More than three dozen new faculty, rounded up through an international star search, are taking the College of Biological Sciences to new heights in research and education. See story on page 9.
Less than two years ago I commented in BIO that renewable energy will become a viable option when the cost of biofuel is competitive with the cost of fossil fuel. It seemed like a distant prospect at the time, but the increasing price of oil is bringing this prospect rapidly into focus.

High prices at the pump are giving all of us reason to think about alternatives. Already there are more hybrid cars on the road and long waiting lists to buy them. And, ethanol is getting a lot more respect.

Until recently, enthusiasm about ethanol was tempered by concerns about net energy and environmental benefits. But new research from Argonne National Laboratory shows that ethanol made from corn can achieve moderate reductions in greenhouse gas emissions and that ethanol produced from cellulosic biomass, such as grass and weeds, can achieve even greater energy and greenhouse gas benefits.

That presents a very interesting opportunity, because research conducted by David Tilman, Regents Professor of Ecology, has shown that a plot planted with eight species of native prairie grasses produces nearly three times the biomass as the same plot planted with a single species.

Since agriculture is based on annual monocultures, thinking about biofuel crops has naturally followed suit. But in fact, it might make a lot more sense to plant a variety of perennials. It takes a lot of energy, equipment, and labor to plant, fertilize, and harvest corn. Prairie grasses, on the other hand, are easy and inexpensive to grow. They are perennials so they don’t have to be planted every year. They don’t require much fertilizer. And they have deeper roots, which mitigates soil erosion and runoff of fertilizer into watersheds.

This has big implications for agriculture. Why plant corn when you can plant energy crops that cost less, produce more, and have environmental benefits?

We are exploring the possibility of developing a demonstration field for the St. Paul campus. In essence, the field would be a satellite of Cedar Creek Natural History Area, where David Tilman carries out his biodiversity research. Located near the Cargill Building and the site of the proposed National Center for Biofuels Research, the field would provide research opportunities for faculty and students. It would also be a great educational tool for legislators, donors, media, and the general public.

It’s a visionary plan, but the rapidly changing energy picture makes this the right time to look into the future. And taking bold steps will move the University and Minnesota closer to realizing our goal of being a leader in biofuel production.
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Cover photo by Tim Rummelhoff shows new CBS faculty who work on the St. Paul campus, in the Department of Ecology, Evolution, and Behavior and the Department of Plant Biology. CBS Dean Bob Elde is center; associate deans Robin Wright and Huber Warner are also in the photo.
Renewable energy research surges with $8.5 million in new grants

The Initiative for Renewable Energy and the Environment (IREE) awarded more than $8.5 million to 24 renewable energy projects at the University in August. Projects span bio-energy and bio-products; economic and policy assessments; production and distribution of hydrogen; carbon sequestration; nanotechnology; solar thermal heating systems; and conversion of livestock waste to energy and products. Awards were made to faculty in six schools and colleges, including CBS, where faculty are collaborators on 12 grants.

“The awards, which were aligned with the Minnesota Environment Initiative report on renewable energy research priorities for Minnesota, will position the University to excel in the areas where we have the most potential,” said Dean Elde, who chairs the IREE executive committee.

$2.8 million NSF grant supports interdisciplinary training for ecologists and civil engineers

The National Science Foundation (NSF) has awarded the College of Biological Sciences and Institute of Technology a $2.8 million grant to train graduate students in ecology, civil engineering, and geology to study the combined effects of physical and biological changes on environmental quality. The Mississippi River watershed will be one focus of the study.

Students will develop mathematical tools to evaluate the interaction between physical changes (such as dams and agricultural irrigation) and biological processes, and to address environmental problems, according to principal investigator Claudia Neuhauser, professor and head of ecology, evolution, and behavior. Other leaders are Chris Paola (geology) and Miki Hondzo (civil engineering). More than 20 faculty will be involved.

The National Center for Earth Dynamics in the Institute of Technology and Itasca Biological Station and Laboratories, the CBS research station at Itasca State Park, will serve as key facilities for training and research.

The grant is part of the NSF’s highly competitive Integrative Graduate Education and Research Trainee Program (IGERT). Out of 639 proposals submitted this year, only 20 have been funded to date.

Craig Packer proposes measure to curb lion attacks in Tanzania

Lions have killed 563 Tanzanians since 1990, in part because of an increase in population and a decrease in lion prey outside of protected areas. Not surprisingly, Tanzanians are responding by killing lions, which threatens conservation efforts. In an effort to protect people and lions, a research team led by EEB professor Craig Packer has identified control of bush pigs as the best strategy for curbing attacks. Lions often follow bush pigs, an agricultural pest, into villages and then attack humans who are guarding crops against the pigs. The research was published August 18 in Nature.
Postdoctoral program gets high marks from Science-Next Wave

The Department of Biochemistry, Molecular Biology, and Biophysics (BMBB) was featured in the August issue of Science-Next Wave, an online companion to Science magazine that focuses on early career issues. The article, “Making it Great for Everyone,” details BMBB practices as a model department for postdoctoral education and training. The article, which also discusses future possibilities for innovative reform in national postdoctoral training, was based on an interview with John Lipscomb, director of postdoctoral affairs in BMBB.

GRANTS AND AWARDS

Judy Berman [Genetics, Cell Biology, and Development] received a five-year, $1.8 million grant from the National Institutes of Health (NIH) for “Genome Integrity in Candida albicans.” C. albicans is a type of yeast that can cause serious infections in immuno-compromised patients.

David Kirkpatrick [Genetics, Cell Biology, and Development] has been awarded $1.4 million over five years from the NIH for the grant “Factors Controlling Minisatellite Stability in Yeast.” The grant focuses on repetitive DNA sequences that may be rearranged when reproductive cells are formed and may be linked to breast cancer and other diseases.

Mary Porter [Genetics, Cell Biology, and Development] has received a MERIT (Method to Extend Research in Time) award from the NIH. The award will provide long-term funding for her research on flagella that propel Chlamydomonas, a one-celled algae. The research has implications for human health because the flagella are similar to structures in human and animal cells involved in fertility, vision, hearing, and breathing.

IN PRINT

Joe McFadden [Ecology, Evolution, and Behavior] is coauthor of a paper published in the October 28 issue of Science titled “The Role of Land Surface Change in Arctic Summer Warming.” McFadden and colleagues synthesized a decade of field data from Alaska showing summer warming is occurring primarily on land, where a longer snow-free season and growth of vegetation contribute to atmospheric heating.

Antony Dean [Ecology, Evolution, and Behavior] published a report titled “The Biochemical Architecture of an Ancient Adaptive Landscape” in the October 21 issue of Science. He and his colleagues determined relationships between genotype, phenotype and fitness that provide insights into how natural selection produces adaptations.


Romas Kazlauskas [Biochemistry, Molecular Biology, and Biophysics] wrote a News and Views article for the August 25 issue of Nature. The article describes how the technique of directed evolution creates thousands of mutant enzymes from a single original. A new approach helps to search for variants that have an increased range of substrates and can thus be used for organic synthesis.

Anath Das, Paul Judd, and Renu Kumar [Biochemistry, Molecular Biology, and Biophysics] published an article titled “Spatial Location and Requirements for the Assembly of the Agrobacterium Tumefaciens Type IV Secretion Apparatus” in the August 9 issue of Proceedings of the National Academy of Science.

Judy Berman [Genetics, Cell Biology, and Development] and colleagues published a paper in the August 5 issue of Science titled “Rewiring of the Yeast Transcriptional Network Through the Evolution of Motif Usage.” The discovery grew out of a collaboration with researchers at the Weizman Institute of Science in Israel.

David Zarkower [Genetics, Cell Biology, and Development] and colleagues published a paper in Developmental Cell in June titled “The DM Domain Protein MAB-3 Promotes Sex-Specific Neurogenesis in C. Elegans by Regulating BHLH Proteins.” His coauthors are Jennifer Ross Wolff, Andrea Kalis, and Mark Murphy. The paper shows that MAB-3, a protein involved in regulating sexual development, controls another protein involved in nervous system development. The finding reveals a mechanism by which sex-specific nervous system development can be established.
The architectural firm of Rafferty Tollefson has been selected to design a $7 million expansion of facilities at Cedar Creek Natural History Area that will add 22,300 square feet of research, education, outreach, and housing space to the world-renowned ecology research site.

Established in 1961, the St. Paul firm has received more than 60 awards for design excellence. They specialize in design of educational, civic, and religious structures that “lift the human spirit and respect the natural environment.” Credits include a 63,000-square-foot science building at the University of Minnesota, Morris; Engel Hall and Seton Commons at St. John’s University; the Como Zoo’s large cat exhibit; and the recently completed Visitor’s Center at the University of Minnesota Landscape Arboretum in Chanhassen.

The Cedar Creek project will complement Lawrence Laboratory, which was built in 1957 and is the main existing building at the site. Plans call for converting Lawrence Laboratory into administrative space and adding the following:

- A 12,000-square-foot science and outreach center with laboratories, classrooms, computer rooms, library, auditorium, meeting rooms, and exhibit space.
- 10,300 square feet of new housing for researchers, visiting faculty, and student interns.

For the past 20 years, Cedar Creek has served as a living laboratory for David Tilman, Regents Professor of Ecology, whose long-term ecological experiments at Cedar Creek proved that biodiversity is essential for strong and healthy ecosystems. Tilman, a member of the National Academy of Sciences, is the most cited ecologist in the United States.

Even Mother Nature loves Maroon and Gold.

The University’s 2005 poster and notecards feature Thunbergia mysorensis, a tropical vine that grows in the mountains of southern India and in the College of Biological Sciences greenhouse. The photo was taken in the greenhouse by U photographer Patrick O’Leary. The free poster can be picked up at several University locations or mailed for $5; notecards are $6 for a box of 15. For details, go to http://www1.umn.edu/urelate and open the Quick Link on the right or call 612-624-6868.

Norway’s Crown Prince for endowed chair

Norway’s Crown Prince Haakon brought the College of Biological Sciences a gift when he visited in October in celebration of Norway’s centennial. The prince chose the occasion to announce a $750,000 gift for an endowed faculty position in renewable energy and microbial genomics, called the Norwegian Centennial Interdisciplinary Chair.

The gift stems from several years of collaborative research between the University of Minnesota and the Norwegian University of Life Sciences.

“We have a great working relationship with the Norwegian University of Life Sciences,” said Dean Elde. “The new chair will help us advance research in biofuels, biobased products, and functional genomics.”

David Tilman, Regents Professor of Ecology, uses Cedar Creek as a living laboratory for research on biodiversity.
Plants of Itasca State Park are showcased in a new field guide, "Common Plants of Itasca State Park," co-authored by David Biesboer, director of Itasca Biological Station and Laboratories, and Anita Cholewa, professor of plant biology. The guide, published by the Bell Museum of Natural History, is available for purchase at Itasca State Park Visitor Center, at www.bellmuseum.org, or by calling (612) 624-4112.

The University will work with the Norwegian-American community to raise gifts for an endowed Norwegian Centennial Graduate Fellowship to support the exchange of graduate students from the University and cooperating universities in Norway.

University Enterprise Laboratories celebrates grand opening

University Enterprise Laboratories Inc. (UEL), a nonprofit incubator for biotech start-up companies, welcomed new tenants and guests at an October grand opening to celebrate the completion of construction.

Architectural Alliance transformed the 125,000-square-foot building, which had been used for direct mail merchandising, into wet labs for biotech entrepreneurs and offices for related support services. The 21 wet labs overlook an atrium courtyard filled with natural light and featuring a "bioscience garden" of bamboo and other exotic plants. Principal architect was Thomas DeAngelo, who also designed the Cargill Building for Microbial and Plant Genomics on the St. Paul campus.

UEL is a nonprofit, public-private partnership created to provide laboratory space for early-stage bioscience companies and opportunities for faculty and students and to help Minnesota realize economic benefits from advances in biology and biotechnology. Founding partners were the University of Minnesota, the University of Minnesota Foundation, the City of St. Paul, and Xcel Energy. Allina, 3M, Medtronic, Boston Scientific, Dorsey and Whitney, Ecolab, Guidant, Surmodics, and Xcel Energy are corporate sponsors. The University of Minnesota and the City of St. Paul also made financial investments in UEL. Robert Elde, dean of the College of Biological Sciences, is chairman of the board of directors.

UEL is situated on an 11-acre site in the heart of the St. Paul Bioscience Zone and along the bus transit way between the University’s St. Paul and Minneapolis campuses just northwest of University Avenue and Highway 280. For more information about UEL and tenant companies, go to www.uelmn.org.
Through a half-century career, Eville Gorham’s probing curiosity has led to inferences with momentous implications. What might the connection between the atmosphere and lichens imply for Arctic people who eat reindeer? What does the source of nutrients in mosses reveal about the transport of pollutants?

On the basis of such questions and subsequent investigations, Gorham, emeritus professor in the Department of Ecology, Evolution, and Behavior, won the Society of Wetland Scientists 2005 Lifetime Achievement Award—the latest in a string of honors, including membership in the National Academy of Sciences.

G. David Tilman, University Regents Professor and McKnight Presidential Endowed Chair in Ecology, calls Gorham “a true academic,” who is “very curious, very questioning, unfiltered by current dogma.” Says Gorham, “what really motivates me is solving interesting puzzles in the natural world.”

Gorham grew up in Nova Scotia, “shy and introspective,” he once wrote, “a compulsive reader of anything I could lay my hands on.” He attended Dalhousie University in Halifax and earned a doctorate at University College in London, where he studied acidification of woodlands and wetlands in England’s Lake District. He arrived at the University of Minnesota in 1962.

In England, he realized the acidity in bogs was due to acid rain, “which I viewed not as an environmental problem but simply as a fascinating subject for research.” Acid rain was known, but Gorham demonstrated that the atmosphere transported the pollutants much farther than anyone imagined. Gorham also discovered lichens and mosses were concentrating atmospheric radioactive fallout. After reading that reindeer were more radioactive than sheep, Gorham predicted that the people of the Arctic, the Inuit and Sami, would also have high levels of radioactivity because they consumed the reindeer and caribou that ate contaminated lichens. Subsequent research proved him right. That research, says Gorham, was “perhaps the most fascinating work I’ve done.”

Such deductions spring from a wide-ranging mind, says Paul Glaser, senior research associate at the University’s Limnological Research Center, who nominated Gorham for his recent award. “He has always been a Renaissance-type scholar with very keen interests in poetry, literature, history, and the arts as well as the physical and natural sciences.”

Gorham retired in 1998, but he continues to study the atmosphere-wetland relationship. He and Clarence Lehman are estimating the rate and extent that northern peatlands have trapped carbon—an estimated 400 billion tons—since the last ice age. The work has important implications for understanding climate change. Warming might trigger the release of carbon as carbon dioxide, further accelerating the greenhouse effect.

Global warming is the most vexing problem he’s studied, Gorham says, “I don’t think we’re going to control it. I foresee some difficult times for our grandchildren.”

—Greg Breining
Katrina Jones was surprised to learn that a hurricane headed toward New Orleans shared her name. But that, of course, was just the beginning. In the coming days and weeks, she had to get used to hearing or seeing her name every time she tuned into TV and radio news or looked at a newspaper.

Jones, who grew up in North Minneapolis, was beginning her third year at Xavier University in New Orleans when the hurricane struck. She opted to leave the city soon after evacuation was ordered, flying back to Minnesota and returning to her family’s home in North Minneapolis. Within a few days, she realized she couldn’t go back to Xavier, so she enrolled at the College of Biological Sciences. She now plans to apply to the University’s College of Pharmacy after she completes her undergraduate work.

Katrina Jones was one of six students who landed at CBS after Hurricane Katrina closed their schools. A total of 50 New Orleans students are now attending University of Minnesota colleges. The U helped ease their transition with expedited admissions and tuition waivers.

Jennifer Bosworth, a New Orleans native, was attending the University of New Orleans. She and her roommate left the city on Sunday morning, joining a long line of traffic headed for Texas. After the storm, Jennifer met other family members at her aunt’s house north of Lake Pontchartrain, where they spent nine days without electricity or running water. Her parents’ house, in east New Orleans, survived, but her grandmother’s house was destroyed. Upon learning that her school would be closed indefinitely, Jennifer came to the University of Minnesota with her roommate, who is from Edina. Now living with her roommate’s family, Jennifer hopes to return to New Orleans next year and graduate in spring 2007. After college, she plans to become a marine biologist. She feels very fortunate, but says she is still somewhat in a state of shock. Some of her friends, who are now scattered around the United States, opted to take a semester off rather than resume school elsewhere.

“New Orleans is my home. It was very upsetting to see it destroyed and to think that it might be gone forever,” she says.

Jesse Peterson, a Minnesota native, had just begun a Ph.D. program at Tulane University Medical School when the storm struck. He and his girlfriend headed out of town on Sunday, with Jesse on his motorcycle and his girlfriend driving their car. After hours of grueling traffic and a two-day wait in Texas, they headed back to Minnesota. Jesse drove his motorcycle the entire way. They returned during Hurricane Rita to pick up their belongings.

“It may sound foolish, but there was no traffic whatsoever,” he says.

Jesse says he will miss the weather and culture in New Orleans, but that things are going well for him at the U, where he is now in a Ph.D. program in the Department of Biochemistry, Molecular Biology, and Biophysics.

“The other students welcomed me into the program and have been very friendly.”

—Katrina Jones
New CBS faculty on the Minneapolis campus: Deanna Koepp, Hiroshi Matsuo (front row), Carrie Wilmot, Dave Bernlohr (head of BMBB), Hiroshi Nakato, Duncan Clarke (middle), Reuben Harris, Ross Johnson (head of GCD), Eric Hendrickson (back row).
They have arrived. And with them, so has biology at the University of Minnesota.

Five years ago the University of Minnesota launched a nationwide star search to find talented young biologists working in emerging areas of research. Fortified with cash from the Minnesota Legislature and plans for new research buildings, department heads started making calls to the best university labs in the country.

They were successful. The College of Biological Sciences, the Medical School, and the College of Agricultural, Food, and Environmental Sciences recruited a total of 52 young faculty, primarily to new departments created by the 1997 biological sciences reorganization. More than three dozen have faculty appointments in CBS.

The new faculty arrived between spring 2000 and summer 2005, bringing fresh credentials from institutions such as Harvard, Yale, MIT, Johns Hopkins, CalTech, Duke, Cornell, McGill, the University of Washington, Stanford, UC Berkeley, UCLA, Scripps, Stuttgart University, and the University of Tokyo. They also brought research experience in emerging areas such as biocatalysis, molecular evolution, plant and microbial genomics, proteomics, HIV resistance, renewable energy, and computational biology.

“They share a commitment to be the best in their fields and to use their abilities to improve quality of life and to advance the boundaries of science,” says Robert Elde, dean of the College of Biological Sciences. “In their short time here, they have transformed bioscience research at the University of Minnesota. And they are creating momentum that will have benefits for the University and the state for a long time to come.”

Context for Change

The University of Minnesota’s life sciences programs have produced many research advances and launched thousands of successful careers over the years. But in the 1990s, as the genomics revolution was setting biology ablaze, limited funding and small departments made it tough to bring in new faculty trained in emerging areas.

Recognizing the risk of stagnation, University president Nils Hasselmo enlisted Elde to help reshape biological sciences programs University-wide. Faculty from the Medical School, CBS, and the College of Agricultural, Food, and Environmental Sciences were reconfigured into larger departments with more hiring power: Biochemistry, Molecular Biology, and Biophysics; Genetics, Cell Biology, and Development; Plant Biology; Microbiology; and Neuroscience.

The Department of Ecology, Evolution, and Behavior, which has long had a very strong national reputation, remained intact. Hasselmo made additional investments in this department to maintain its reputation as key senior faculty retired.

The timing couldn’t have been better. In 1997, incoming president Mark Yudof launched his Molecular and Cellular Biology Initiative, aimed at making the University of Minnesota a leader in the fast-growing field. With the new biological sciences structure as a platform for inno-
vation, the Minnesota Legislature supported the initiative by allocating more than $100 million toward new buildings, new technology, and new faculty.

As Dean Elde puts it, "All kinds of things came into alignment." As though planned that way, biological sciences reorganization and the MCB Initiative also align with the University’s new goal to become one of the top public research universities in the world.

"With new research facilities and this group of talented young faculty, we are well on our way to making that a reality in the biological sciences," Elde says.

**Dream Teams**

The initial plan was to recruit established faculty. But an external review committee persuaded the University to hire a larger number of early-career faculty who could bring fresh training and youthful enthusiasm. With funding from the Molecular and Cellular Biology (MCB) Initiative and additional resources from retirements and reallocations, the search began.

The talent pool has allowed the college to create “dream teams” that build on historic strengths.

David Bernlohr, McKnight Professor and head of the Department of Biochemistry, Molecular Biology, and Biophysics (BMBB) says the influx made it possible to organize around research themes. For example, expertise in biocatalysis and biodegradation has been strengthened by the addition of Claudia Schmidt-Dannert, who works on molecular evolution, and Arkady Khodursky, who uses DNA microarray technology to understand how genes work in concert. Schmidt-Dannert was trained at the University of Stuttgart and CalTech. Khodursky came to CBS from the UC Berkeley lab where microarray technology was developed. Other research themes that have been strengthened by new faculty include structural biophysics, cancer biology, and molecular metabolism.

It’s not easy bringing people from a half-dozen disciplines together to work on a research problem. But that doesn’t bother Arkady Khodursky. Because he knows it’s the best way to understand the function of an organism’s genome as a whole.

“It’s a different scale of question . . . how do we understand the activities of genomes, not of individual genes,” Khodursky says. "Cells don’t function on the level of individual genes. They function on the level of chromosomes and genomes.”

Khodursky joined the Department of Biochemistry, Molecular Biology, and Biophysics in 2001 after earning a math degree from Moscow State University and a Ph.D. in biophysics from UC Berkeley. He did his postdoctoral research in the lab where microarray technology was developed, and he uses the technology to study gene transcription in bacteria. Khodursky’s ability to apply math to genomics and his expertise with this new technology made him a very sought-after candidate. He chose Minnesota over five other job offers.

Looking at the big picture demands the ability to gather and analyze massive amounts of interrelated data at the molecular scale. Khodursky’s students and colleagues are mathematicians, biostatisticians, computer scientists, physicists, pharmacologists, and chemical engineers as well as biologists.

“Being at a large university is very helpful,” he says. “If I were in a smaller place, I couldn’t have many of these interactions.”

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The Department of Genetics, Cell Biology, and Development (GCD) has been bolstered by the addition of four CBS faculty who are exploring the frontiers of genetics and development using fruit flies and yeast as model organisms. The University’s program in fruit fly genetics produced Nobel Laureate Ed Lewis (B.S. ’39), who joined the faculty of CalTech in the 1940s and won the Nobel Prize in Medicine and Physiology in 1995. Lewis, who died in 2004, helped the University build its genetics program by referring young scientists.

In the Department of Ecology, Evolution, and Behavior (EEB), the new hires have augmented the department’s historic strengths in paleoecology and global ecology, according to department head Claudia Neuhauser. But the department also took the opportunity to strengthen emerging areas such as mechanisms of behavior, community ecology, and evolution.

“Department heads are very well liked because they truly care about building strong departments and helping young faculty develop their careers.”

— Bob Elde

A near doubling of faculty in the Department of Plant Biology created a “remarkable, even breathtaking transformation,” according to an external committee that reviewed the MCB Initiative in 2004. Eight of the eleven new faculty use the genome of the model crop plant Arabidopsis thaliana to advance agriculture and renewable energy as well as the science of plant biology.

Elde credits department heads with the success of the recruitment effort. “They are very well liked because they truly care about building strong departments and helping young faculty develop their careers. We are very fortunate to have a team of department heads who provide strong leadership and keep pace with the cutting edge of their fields. I think that’s very rare.”

Perhaps as valuable as the deluge of new ideas has been the growing culture of collaboration. Senior faculty have become increasingly adept at building bridges...
between departments, disciplines, and the public and private sectors. But the new hires have been in the interdisciplinary mode since their undergraduate days. For them, it’s the way science has always been done.

In EEB, for example, a number of the new faculty are involved in a new $2.8 million National Science Foundation training grant that brings together graduate students in civil engineering, geology, and ecology to cooperatively study the combined impact of biological and physical change on the environment.

In Plant Biology, Fumiaki Katagiri, who came on board two years ago, is on the steering committee for the Consortium for Bioinformatics and Computational Biology, an interdisciplinary research effort involving 10 colleges across the University.

“Everybody’s benefiting from the energy they’re bringing to these kinds of activities.”

The combination of new ideas and enhanced emphasis on interdisciplinary work has helped catalyze a number of new grants, programs, and research initiatives, as well as strengthen existing ones. New faculty have brought in $35 million in research grants and awards.

Several of the recent hires have tied into the Initiative for Renewable Energy and the Environment (IREE), established two years ago by the Minnesota Legislature as a hub for alternative energy research at the U. IREE recently awarded $8.5 million to fund 24 projects. New CBS faculty garnering awards include Daniel Bond, who hopes to develop a fuel cell powered by bacteria; Romas Kazlauskas, who is coaxing yeast to make plastic from renewable materials; and Shinya Sugita, who is studying how wetlands sequester carbon, which slows global warming.

“Everybody’s benefiting from the energy they’re bringing to these kinds of activities.”

—Kate VandenBosch

Nathan Springer began his research on Zea maize genetics early—in middle school—crossing corn plants for a seed company in southern Minnesota research plots. In 2003, after completing his Ph.D here and a postdoc at the University of Wisconsin, he returned to Minnesota to take a faculty position in the Department of Plant Biology.

Springer is up to his ears in an emerging field known as epigenetics, which explores factors outside the genome that affect gene expression. “In some ways it’s a second code on top of the DNA sequence,” he explains. “It determines what’s active and what’s inactive.”

Through his studies, Springer hopes to improve understanding of the role of epigenesis in helping a species survive a changing environment. His research includes work on a major multi-institutional grant with colleagues in Wisconsin, Missouri, Arizona, and Georgia.

Springer says his department has changed dramatically since he was a grad student here. Most obvious is the size of the faculty, which has doubled in the past five years. “There are a lot of very good things about that, in terms of the excitement level and having other people at the same stage of their careers,” he says.
REAL-WORLD REVOLUTION

As a result of the influx of new faculty, CBS is rapidly establishing a new place among research universities. The plant biology department is becoming one of the top in the country. And research programs in structural biology, microbial biochemistry, global ecology, and developmental biology are positioned to become leaders among their peers.

“These new people are the future of the college,” says Huber Warner, associate dean for research. “I’m very optimistic about the prospects for all our departments.”

The state’s investment in the Molecular and Cellular Biology Initiative will also pay off for Minnesota.

“This is not about adding more ivory to the ivory tower,” Elde says. The focus is on meeting human needs in Minnesota and around the world. Research, teaching, and outreach efforts by new faculty have real-world implications for renewable energy production, agriculture, medicine, environmental protection, and more. They are helping reduce human suffering from disease. They are finding new and better ways to repair and even prevent damage to ecosystems caused by fossil fuels and nitrogen fertilizers. They are finding ways to improve crop production. And they are creating both new opportunities for economic growth and new graduates to fill the jobs those opportunities provide.

The infusion of new blood into the U’s biosciences programs has also strengthened undergraduate education. At the undergraduate level, junior faculty have developed new class offerings in a variety of specialized subjects related to their expertise, including ecophysiology (the study of how an organism’s function relates to its environment), bioinformatics, and diversity of flowering plants. They also provide increased opportunities for undergraduates to participate in research.

After earning his Ph.D. from the University of Tokyo, Hiroshi Nakato was doing postdoctoral research at the University of Arizona, Tucson, when the call came from Minnesota. He says it has been a very good move for him, despite exchanging year-round sunshine for Minnesota’s seasons.

Nakato is interested in how cells communicate during development. Using the fruit fly Drosophila as a model, he studies how molecules called heparan sulfate proteoglycans (HSPGs) guide cells as they develop into different tissues. HSPGs are known to play a role in growth factor signaling, cell adhesion, wound healing, and tumor metastasis.

The Minnesota advantage is the community of scientists, he says. “The strength is science and people. Not just science, and not just people,” he says. “This is a great environment to work in.”

NEXT STEPS

The MCB Initiative provided funding for superb new facilities and superb new faculty. More graduate students are needed to complete the picture.

“We’ve set some really good things in motion,” Elde says. But, he adds, for the investments so far to pay off, attention must now turn to recruiting more and better-qualified graduate students, who are an equally important component of a successful research and teaching enterprise. Graduate students provide the people power that faculty need to maximize productivity in the lab. And they serve as teachers and mentors for undergrads. Many peer institutions average three grad students per faculty member. At CBS, the ratio is closer to one to one.

Bringing enthusiastic young faculty with exciting research programs on board is certainly helping recruitment efforts. But to really make a difference, the college needs funding to increase stipends and to support more graduate students.
Stephen Ekker has seen the future, and it is small. Smaller than your cells—even smaller than some of the structures within your cells.

An associate professor in the Department of Genetics, Cell Biology, and Development, Ekker is leading a University-wide effort to use nanotechnology to prevent, treat, and cure disease.

One of the fastest growing fields in science today, nanotechnology is the design and development of minute devices—devices with dimensions on the order of one ten-thousandth of a millimeter—to address human needs.

Applications range from improving computer chips and solar energy use to building better golf clubs.

Although nanotechnology has been part of the world of physics for some time, only recently has it begun to build momentum in the biological sciences.

Last year Ekker, who has a background in both engineering and biology, established a working group that brings together dozens of researchers in an array of departments—from the College of Biological Sciences, Institute of Technology, College of Pharmacy, Medical School, and Cancer Center—to collaboratively apply their expertise to solving biological problems using nanotechnology.

“Nationally, the field of nanobiotechnology is exploding,” Ekker says. “I only hope we can keep up with the ever-expanding wave of scientific possibilities.”

Drawing on the expertise of the working group, Ekker has organized a Minnesota Cancer Nanotherapy Center. He proposes eight projects to bring a variety of nanotechnologies—seven of which were developed at the University of Minnesota—to bear on cancer diagnosis and treatment. Proposed projects include developing magnetic nanoparticles to treat lung and breast cancer; creating anti-tumor antibody nanorings; developing nanoengineered silicon-based scaffolds for new cancer vaccines; using silicon nanoparticles for cancer imaging and treatment; using nanoparticles to modify genes for cancer therapy; using nano-sized electrospray to treat lung cancer; and evaluating the safety and toxicology of the base nanomaterials that underlie each core project.

Ekker says the University of Minnesota is just the place for conducting such research. Close to 50 IT faculty are already involved in nanotechnology research. The Cancer Center, College of Pharmacy, and Medical School provide a wealth of expertise in linking basic science with clinical application. And the clustering of Academic Health Center, biological sciences, and engineering facilities along Washington Avenue creates unparalleled opportunity for interaction. “This kind of interdisciplinary science is our future,” he says. “The University of Minnesota is one of few places in the world that can do it at one major location.”

Although there are some institutional barriers yet to overcome, Ekker thinks it’s well worth the effort. “If we really put the right people together, an interdisciplinary approach should be able to solve problems that have been very difficult to tackle in the past,” he says.

—Mary Hoff
“Want to say one word to you. Just one word...Plastics”

When Dustin Hoffman’s character, Benjamin Braddock, received that famous career tip in the 1967 movie The Graduate, the world of petrochemical plastics was in its heyday. “Space-age” plastics turned up in everything from automobiles to shiny vinyl clothing. Now, in a world of diminishing oil reserves and burgeoning plastics that don’t decompose, biologically-derived polymers hold even greater promise.

Yet, for the bioplastic industry to thrive, it must overcome two obstacles: cost and versatility. If bioplastics cost more than their petroleum-based counterparts, no one will use them, even if they’re better for the environment. And these new bioplastics must offer an array of properties—strength, pliability, transparency, and formability, for example—to match petro-plastics.

Some bio-based polymers are already on the market. Cargill Dow’s NatureWorks products, for example, are used in packaging, blankets, and wipes. Cargill Dow turns unrefined dextrose from corn into lactic acid from which a polymer is formed. These types of plastics have their limitations, however, such as intolerance to heat.

In contrast, polyhydroxyalkanoates (PHAs), a family of biodegradable polymers naturally synthesized by bacteria as carbon and energy reserve materials, offers promise. Friedrich Srienc, a native of Austria who came to the University of Minnesota in 1985, works with PHAs. He and a cadre of other researchers in the Biotechnology Institute are tackling the issues of cost and versatility in biopolymer production. They have received IREE grants for two major projects. The first is a $270,000 three-year grant with which Srienc and Romas Kazlauskas, an associate professor in the Department of Biochemistry, Molecular Biology and Biophysics, seek to develop new yeast strains capable of synthesizing polymers under anaerobic conditions. Anaerobic (in absence of oxygen) processing requires less energy, which reduces the cost. Srienc maintains that coupling PHA production with ethanol production (using the same biological raw materials) will improve the economic viability of both biopolymer and ethanol production.

The second is a three-year, $429,000 grant funding work in which Srienc is collaborating with Kazlauskas and Claudia Schmidt-Dannert, associate professor in the Department of Biochemistry, Molecular Biology, and Biophysics. Combining their expertise in enzyme-catalyzed synthesis, biosynthetic pathway engineering, and metabolic network engineering, they are working to develop a new class of polymers with electrical conducting properties, or electronic plastics. Such plastics are currently synthesized from petroleum and are used in lasers, ultra-fast image processors, thin-film transistors, highly sensitive plastic photodiodes, and integrated circuits.

So, Benjamin Braddock might receive the same advice today as he did in the ’60s. But if Srienc and company achieve their goals, the word will be... bioplastics.

—Terri Peterson Smith
An advocate for science
Adapting to the political ecosystem of Washington, D.C.

At the risk of being called an advocate, David Blockstein does just that—advocates that scientists dive into the political process to ensure that science informs debate, especially about the environment.

Blockstein, Ph.D. graduate of the College of Biological Sciences, is a senior scientist (and former executive director) for the National Council for Science and the Environment in Washington, D.C., a nonprofit, nonpartisan group of scientists and policymakers working to ensure scientists have a say in the supercharged atmosphere of national politics.

“Every day we see the consequences of decisions made without great understanding or appreciation for the use of science.”

—David Blockstein

Blockstein grew up in Madison, Wisconsin, where bird-watching field trips led by his fifth-grade teacher triggered his “innate biophilia,” he recalls. “I was absolutely hooked.”

He earned a B.S. in wildlife ecology from the University of Wisconsin and traveled to Minnesota to study under an “exceptional flock” of ornithology professors.

Blockstein also had an early interest in politics, beginning with his mother’s campaigns for county commissioner. From 1987 to 1988, he worked with the House of Representatives Environment Subcommittee on national biodiversity legislation. “To work with [Congress] and provide some education to people in that political system, you have to operate within the rules of that system,” he says. “You have to learn to adapt to that ecosystem.”

Blockstein sees what he calls a “schizophrenic perspective” toward science. “On the one hand, science is one of the few things that everybody will agree is a good thing. On the other hand, science is increasingly used as a political football. It’s abused by the left and abused by the right. I don’t think anybody is really innocent when it comes to the misuse of scientific information.”

Many scientists avoid the political fracas, afraid that political involvement will brand them advocates and cost them credibility, Blockstein says. Nonetheless, they can bring unique qualities to the public debate, including information, knowledge, and critical thinking. To avoid the appearance of bias, Blockstein says, “in everything you do, you need to obey the rules of science.”

Among his recent projects is the Council of Environmental Deans and Directors, representing about 120 colleges of environment and natural resources and institutes for environmental studies (including the U of M). Representatives strive to improve environmental programs. “Without education, everything else is temporary,” Blockstein says.

Blockstein, who studied and taught at Itasca, laments the “tremendous decline in the study of natural history. We have wonderful ways of simulating nature, but we’re missing the opportunities to experience nature.” University programs emphasize molecular biology and theoretical work at the expense of fieldwork, he says. He worries students will miss the chance he had, as a young birdwatcher, to link science with nature.

“There is no substitute,” he says, “for being out in the field.”

—Greg Breining
In memoriom

Ornithologist Dwain Warner dies at 88

Dwain Warner, a longtime faculty member at the College of Biological Sciences, died in St. Paul on September 30. He was 88.

Born in Stanchfield, Minnesota, Warner earned a B.S. degree in botany at Carleton College and Ph.D. in ornithology at Cornell University. He came to the University of Minnesota in 1947, after serving in the South Pacific during World War II. During nearly 40 years at the U, he was a profes sor of ecology and behavior and curator of birds at the Bell Museum of Natural History. He retired in the mid 1980s.

Warner is remembered for his role in developing radio telemetry for tracking animals at Cedar Creek Natural History Area. Inspired by Soviet scientists who monitored the behavior of a dog launched into space in 1957, Warner recognized that telemetry could be used to study the movement of animals through their environment. Telemetry has since become a standard used worldwide for tracking animals. Warner is also known for his research on seasonal migration of birds.

Colleagues, friends, and students remember Warner’s infectious enthusiasm about ornithology. Bob Zink, who is now curator of birds at the Bell Museum, recalls how Warner encouraged his interest in birds.

“Sharing his enthusiasm for ornithology was a hallmark of his character,” Zink says.

Warner is survived by his wife, Marie Ward; sons Bill, Richard, and David; daughters Betsy Hoppe and Bonnie Alexander; 11 grandchildren; and 15 grandchildren. His first wife, Dorothy, died in 1965 and their son Robert died in 2003.

Class Notes

Steven Kirkhorn (B.S. in Zoology, 1973) is medical director of the Marshfield Clinic National Farm Medicine Center and National Children’s Center for Rural and Agricultural Health and Safety at Marshfield, Wisconsin. His current research involves assessing early-life farm exposure and the development of childhood asthma, and the role of the “hygiene hypothesis” and asthma. He is on the USDA’s Agricultural Air Quality Task Force and a clinical faculty member of the University of Minnesota and University of Wisconsin-Madison Medical Schools lecturing and developing curriculum in rural occupational, environmental, and agricultural medicine.

William E. Hobbs (B.S. in Genetics and Cell Biology, 1993) is currently a fellow in hematology/oncology at the University of Washington. He received his Ph.D. in 2000 from the University of Pittsburgh’s molecular virology and microbiology program. He completed his M.D. in 2002, going on to an internal medicine residency at the University of Washington, Seattle. After completing his clinical duties, he plans to go back to the lab and start an academic career.

Dan Liedt (B.S. in Genetics and Cell Biology, 1996) is serving in the 3rd Armored Cavalry Regiment Medical Troop, the largest deployable medical unit in the U.S. Army located near Tall Afar, Iraq, west of Mosul. He is commander for the medical troop responsible for health care and treatment of casualties for more than 5,200 regimental soldiers, Coalition Forces, Iraqi Army soldiers, Iraqi police, civilians, and detained persons.

Julie Constable (Ph.D. in Ecology, 2000) accepted a new position last March as wildlife ecologist with the Endangered Species Recovery Program, Central Valley, California.

Rebecca Marrs Eide (B.S. in Biochemistry, 2001) has joined Protein Design Labs in the Quality Assurance department.


Minali Gala (B.S. in Genetics and Cell Biology, 2005) is working at Protein Design Labs in Brooklyn Park as a quality control analyst in the lab’s QC Chemistry Department.

Melinda Hanson (B.S. in Biology, 2005) moved to Santa Barbara after graduation and works at URS Corporation. She also serves as an attached medic at a U.S. Army rigging unit in Santa Barbara.

Rebecca E. Long (B.S. in Genetics and Cell Biology, 2005) has accepted a position with Beckman Coulter in Chaska.

Class Notes Needed

If you have an update that you would like to share with your classmates, send an e-mail to john5091@umn.edu.

We’re also looking for stories from alumni who have met their match while studying at the Itasca Lab’s QC Chemistry Department.

Barbara.

R. M. Beckman Coulter in Chaska.

Assurance department.

with the Endangered Species Recovery Program, Central Valley, California.

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Commencement 2005
Habitat for Biologists at Itasca Biological Station

Student biologists at Itasca Biological Station got a new habitat this summer, thanks to alumni and friends who contributed funds for materials and volunteers who helped build it.

The cabin, which replaced one demolished last fall, launched a campaign, dubbed “Habitat for Biologists,” to replace, renovate, and restore facilities throughout the field station, many of which were built in the 1940s and ‘50s.

“Nature continuously restores habitats for wildlife at Itasca but hasn’t been as kind to human habitats,” says Dean Elde.

CBS, which operates the field station, raised $50,000 from alumni and friends to build the cabin. A professional crew laid the foundation, installed utilities, and constructed the frame and roof, and volunteer crews raised the walls and shingled the roof.

John Tester, professor emeritus of ecology, is leading a campaign to raise $150,000 to restore a three-bedroom log cabin built in 1911. There are 34 cabins and 12 laboratories and classrooms at the field station, many of which need work.

Dean Elde hopes Habitat for Biologists will raise awareness about the value of Itasca.

“The Itasca Biological Station is an exquisitely beautiful living laboratory and classroom that showcases Minnesota’s best natural features,” he said. “It is truly one of the University’s hidden treasures.”

Dean Elde with President Robert Bruininks at the Habitat for Biologists construction site.

Volunteers raise a wall for the new cabin for women students.

The cabin will be ready for students in spring field biology classes.

The field station is currently used in the summer for field biology classes, faculty research, Nature of Life [an orientation program for freshmen], orientations for graduate programs, and the Science Education Program for Greater Minnesota, which is funded by the Howard Hughes Institute to recruit, train and retain science teachers for regional school districts.

Ultimately, Elde hopes to raise funds to build a new complex with an auditorium, meeting rooms, and state of the art laboratories.

“Other universities operate field stations such as this on a much larger scale, using them for a broad spectrum of research, education, outreach, and professional development programs,” said Elde. “Itasca has the potential to be that kind of a resource for the University.”