spring 2004

BIO

COLLEGE OF BIOLOGICAL SCIENCES

UNIVERSITY OF MINNESOTA

THE Next Generation OF Biologists

Graduate students are the bioenergy that fuels faculty research labs and the future leaders of Minnesota's bioscience industry. That's why CBS hopes to double the size of graduate programs. See story on page 9.

FIELD NOTES • CSI: MINNESOTA • LIFE AFTER CBS

Robert Elde, Dean

FROM THE DEAN

Investment in graduate education will pay academic and economic dividends

Things have changed just a little since I came to the University of Minnesota as a graduate student in 1969. Shopping for a graduate school was a national phenomenon even then. You didn't just go to the university in your own backyard. You wanted to join a winning team and work with the best faculty. But it was much more low key. Graduate students were more laissez faire about the application process and graduate programs weren't as aggressive about recruiting.

But today it's a different world. Universities use slick Web sites and brochures to sell their programs and fly students in from all over the country for recruitment weekends. That's because they know that the quality and quantity of graduate students can determine the quality of their research programs and the quantity of their funding. And students are much more discriminating about their choices. They have access to lots more information about programs and faculty through the Internet. And they know their decision could make or break their career.

Graduate students are an increasingly important part of the research equation because they determine the volume of work a lab can do and they can take the time to test new ideas. The other parts of the equation are faculty and facilities. The University and the State of Minnesota have invested in those. Thanks to the Molecular and Cellular Biology Initiative, we have 41 new faculty and several new and renovated facilities. But investment in graduate programs hasn't kept pace.

In the past, there was concern about training too many graduate students because there wouldn't be jobs for them. The purpose of graduate programs was to replace retiring faculty. But that's no longer the case. Increasingly, people with graduate degrees in the sciences are going to work for industry and for government. In fact, a graduate degree is becoming a prerequisite for a career just like a bachelor's degree was the ticket 30 years ago.

When a science becomes engineerable, business applications explode. During the 20th century, advances in physics created electrical engineering and advances in chemistry produced chemical engineering. Now it's biology's turn. Advances in molecular biology, biochemistry, and genomics have made it possible to engineer molecules and microbes to create new drugs and renewable fuel, improve crops, and clean up the environment. The potential business applications are unlimited. Bioscience companies in Minnesota are going to need as many people with Ph.D.s as we can provide. If we don't provide the work force, there's a risk that they may go elsewhere.

There's also a risk that if we don't invest in graduate education we could lose our investment in faculty. Faculty rely on graduate students. And if we don't provide them, another university will. It's time for the University and the State to recognize the value of graduate education for research and industry.

Robert Elde, Dean
College of Biological Sciences
belde@cbs.umn.edu

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EDITOR
Peggy Rinard

GRAPHIC DESIGN
Shawn Welch
U of M Printing Services

PHOTOGRAPHY
Tim Rummelhoff

PRINTING
U of M Printing Services

Visit our Web site at www.cbs.umn.edu.
For address changes, please contact Jean Marie Lindquist at jmlindqu@cbs.umn.edu or 612-625-7705.
Address other correspondence to: prinard@cbs.umn.edu

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IREE
Initiative for Renewable Energy and the Environment

IREE leader invents hydrogen reactor that uses renewable fuel


JONATHAN CHAPMAN
Lanny Schmidt

You may soon be able to hold the hydrogen economy in the palm of your hand.

Lanny Schmidt, IREE cluster leader, and colleagues have invented the first reactor capable of efficiently producing hydrogen from a renewable fuel source (ethanol). When coupled with a hydrogen fuel cell, the new device—small enough to hold in your hand—could generate one kilowatt of power, almost enough to supply an average home. The technology provides a practical means of producing hydrogen fuel that moves the hydrogen economy a step closer to reality.

The work, which was featured in the February 13 issue of *Science*, was supported in part by the University of Minnesota's Initiative on Renewable Energy and the Environment. Schmidt, who is Regents Professor of Chemical Engineering in the Institute of Technology, is a co-leader of IREE's Hydrogen Research Cluster. Working with him were scientist Gregg Deluga, first author of the *Science* paper, and graduate student James Salge. All three are in the Institute of Technology's Department of Chemical Engineering and Materials Science. ■

U and Science Museum partner on renewable energy 'Prairie Maze'

To find your way through the Prairie Maze at the Science Museum of Minnesota, you'll have to learn how plants can be used as fuel and how ecosystems provide clean air and water.

The new exhibit, which will open as part of the Science Museum's new Big Backyard exhibit area this summer, is funded in part by a $125,000 grant from the University's Initiative for Renewable Energy and the Environment.

David Tilman, Regents Professor of Ecology, Steve Polasky, ecology, evolution, and behavior, and Don Wyse, agronomy and plant genetics, are working with Patrick Hamilton at the Science Museum to develop the demonstration project. The Prairie Maze will be a working, interactive exhibit that will educate museum visitors about renewable energy and the importance of managing ecosystems. Biomass from the Prairie Maze will be used by an adjacent heat and power plant. The exhibit is scheduled to open in June. ■

IREE awards more than $1 million in research grants

IREE has awarded more than $1 million to faculty who have submitted research proposals for projects ranging from production of biohydrogen to public education on renewable energy and the environment. Following is a breakdown by award category and research cluster.

- $325,000 for support services for the Research Demonstration and Outreach Center at Morris [In addition to $2.5 million committed for the center itself.]
- $75,000 for three seed grants in the Hydrogen Cluster
- $281,585 for 10 seed grants in the Bioenergy and Bioproducts Cluster
- $117,928 for three seed grants in the Conservation and Efficient Energy Systems Cluster
- $88,500 for three seed grants in the Policy, Economics, and Ecosystems Cluster
- $150,000 for two special opportunities grants
- $100,000 for one matching-fund grant

Three additional matching-fund grants totaling $2,175,000 have been approved by the IREE executive committee, pending receipt of matching funds from outside agencies.

To view details of funded proposals, or for information about how to submit a proposal, go to www1.umn.edu/iree/funded_projects.html. ■

IN PRINT

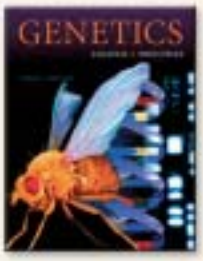
Girl chimps learn faster than boy chimps

Elizabeth Lonsdorf, former graduate student in the Department of Ecology, Evolution, and Behavior, is first author of "Sex Differences in Chimpanzee Learning," published in the April 15 issue of *Nature*. The study shows that female and male chimps both learn from their mothers how to insert sticks into termite mounds and pull out tasty termite snacks, but that females learn earlier. Gender differences in learning this skill compare to differences in human girls and boys acquiring fine motor skills, such as writing.

Nature article on sustainable lion hunting

Karyl Whitman, graduate student in ecology, evolution, and behavior (EEB), is first author on "Sustainable Trophy Hunting of African Lions," which was published in the March 11 issue of *Nature*. Craig Packer and Tony Starfield, professors in EEB are co-authors. Henley Quadling, Peyton West, Meggan Craft, and Bernard Kissui also contributed to the study. The group presents a novel approach for managing hunted lion populations that improves conservation of lions.

Second edition of genetics textbook



The second edition of "Genetics: Analysis and Principles," written by Rob Brooker, professor of genetics, cell biology, and development, was released in January. Publisher is McGraw-Hill.

RESEARCH GRANTS & AWARDS

Sadowsky awarded $1 million for research on nitrogen-fixing bacterium

Chromosome of the Brj bacterium.

Michael Sadowsky, professor of soil, water, and climate, and member of the Biotechnology Institute, is co-principal investigator on a three-year, $1,028,514 grant from the U.S. Department of Agriculture to construct and evaluate genome-wide microarrays to examine environmentally regulated gene expression in the nitrogen-fixing bacterium *Bradyrhizobium japonicum (Brj)*. This bacterium forms a symbiotic association with soybean plants. David Emerich and Gary Stacey from the University of Missouri-Columbia are co-PIs.

NIH awards Kahlert lab $440,000 for X-ray diffraction equipment

The Kahlert Structural Biology Laboratory, which houses the U's macromolecular X-ray diffraction facility, has been awarded $440,000 by the National Institutes of Health to upgrade the X-ray equipment, with $150,000 in matching funds from CBS, the Medical School, and the Office of the VP for Research. The new equipment will make it possible to collect high quality X-ray data more quickly using smaller crystals of biological molecules. Principal investigator is Carrie Wilmot, assistant professor of biochemistry, molecular biology, and biophysics, director of the lab. The Kahlert lab is located in the Basic Science and Biomedical Engineering Building on the Minneapolis campus. The new equipment is expected to be operational by fall 2004.

Robert Sterner received a $337,076 grant from the National Science Foundation to conduct a study on "Element Linkage and Growth-Competition Tradeoffs in Freshwater Zooplankton."

Robert Sterner and **Jacques Finlay** received a $375,931 National Science Foundation award to study "The Nitrifying of Lake Superior and Its Intersections with the P and Fe Cycles." Sterner is professor of ecology, evolution, and behavior; Finlay is assistant professor.

DAVID HANSEN

Ecology Professor Robert Sterner has received two NSF grants for research involving Lake Superior.

Reuben Harris, assistant professor of biochemistry, molecular biology, and biophysics, has been has been named a 2004-2006 Searle Scholar. The national award program recognizes excellence in biomedical research and selects 15 assistant professors for this honor each year. Harris studies enzymes involved in nucleotide metabolism, specifically the class of proteins that deaminate RNA and DNA, which are involved in a variety of biological processes from RNA editing to immunity.

The Neuroscience Graduate Program is among nine neuroscience programs nationwide selected for the Carnegie Initiative on the Doctorate, a five-year action and research project aimed at improving doctoral education at American universities. The initiative is supported by the Carnegie Foundation for the Advancement of Teaching. For more information, go to http://www.carnegiefoundation.org

Construction on UEL, which will provide lab space for biotech start-up companies, is expected to begin this summer.

University Enterprise Laboratories

Construction on University Enterprise Laboratories (UEL), Inc. a nonprofit incubator for biotech start-up companies, is scheduled to begin this summer. The building, purchased by the City of St. Paul, is situated on an 11-acre site within the St. Paul Bioscience Zone and adjacent to the transitway that connects the University's St. Paul and Minneapolis campuses.

UEL is a nonprofit entity separate from the University created to provide lab space for early stage bioscience companies and opportunities for faculty and students. Robert Elde, Dean of the College of Biological Sciences, is chairman of the board of directors.

The UEL building has 125,000 square feet of existing office and warehouse space. It will be renovated to create a collaborative research center with 50,000 square feet of lab-based incubator space and 75,000 square feet of office/lab space for bioscience and related companies. Founding partners include the University of Minnesota Foundation, the City of St. Paul, Xcel Energy, 3M, Medtronic, Surmodics, Dorsey, Ecolab, and Guidant. ■

Reporters' Guide to CBS biology experts

A guide to faculty with expertise in topics of interest to the media is now posted on the UM News Service Web site at http://www1.umn.edu/urelate/newsservice/expertsbio.html as well as on the CBS Web site under Resources for the Media.

The Reporters' Guide covers hot topics in biology, ranging from renewable energy and materials to bioterrorism. There's also a listing of experts for each department. ■

gene(sis)
Contemporary Art Explores Human Genomics

Weisman exhibit explores genomics and art

Several CBS faculty members contributed to "Gene(sis): Contemporary Art Explores Human Genomics," an exhibit featured at the Weisman Art Museum from January 31 through May 23. Rick Peifer, General Biology Program, provided instruction on genetics for Weisman staff and volunteers. Mark Decker, also in the General Biology Program, developed a kiosk computer program to introduce museum visitors to basic biology behind the art. Philip Regal, professor of ecology, evolution, and behavior, led a series of discussions related to the exhibit titled "Art, Genes, and the Future: The Artistic Challenge in the Age of Biology."

Gene(sis) is organized into four sections representing the following themes:

Sequence: Language and structure of genomic and genetic research.

Specimen: Key issues of DNA ownership, personal privacy, and ethics.

Boundary: Investigations of the newly permeable boundaries between species and the ways in which transgenics has long haunted both Western and Eastern cultural imaginings, including Eduardo Kac's transgenic GFP Bunny aka "Alba," and large-scale, digitally altered photographs by Seattle artist Jaq Chartier.

Subject: Re-imaginings of notions of individual subjectivity, family, and human "nature" in the wake of recent genomic developments. ■

PEOPLE

2004 Distinguished McKnight University Professors

Michael Sadowsky and **Nevin Young** are among five faculty named Distinguished McKnight University Professors for 2004. Sadowsky, professor of soil, water, and climate and Biotechnology Institute member, was chosen for research achievements in environmental microbiology, including genomics of microbial degradation of environmental pollutants, and for contributions to research on nitrogen fixation, microbial ecology of bacteria in soils and water, and understanding how global change influences microbial processes in soil. Young, professor of plant pathology and plant biology, was selected for his achievements in legume genomics and bioinformatics. His research on gene discovery and genome mapping provides useful applications in agriculture by defining genes that affect plant disease resistance, seed quality, and responses to environmental stresses. He is leading the international effort to sequence the first legume genome. Recipients hold the title for as long as they remain at the University of Minnesota and receive $100,000 over five years. Past CBS recipients include David Bernlohr, Larry Wackett, David Tilman, Craig Packer, and Ann Pusey.

Nevin Young and Michael Sadowsky

CBS students win top national scholarships

Maya Babu

Maya Babu, a CBS junior majoring in neuroscience, is one of two University of Minnesota students who received a 2004 Truman Scholarship. An honors student, Maya coordinates the University Promise Alliance, a student-driven organization that aims to mobilize students to work on the needs of children and youth who live near campus. She is involved with many other groups that work with youth and volunteerism, and she plans to pursue medical and law degrees to prepare for a career in mental health policy. Maya will receive $26,000 for her senior year and for her graduate education.

Maralyssa Bann is one of three University of Minnesota students to receive the prestigious Barry M. Goldwater Scholarship. A graduate of Eden Prairie High School, Maralyssa is pursuing a bachelor of science degree in neuroscience and is a sophomore in the CBS honors program. She plans to become a practicing neurologist, combining laboratory and clinical research to develop treatments for Alzheimer's disease. Goldwater Scholars receive up to $7,500 per year for two years.

Joseph Foley is one of eight students in the United States to receive a Summer Undergraduate Research Fellowship from the American Society of Plant Biologists. Joe is a graduate of Mounds View High School and, as a freshman in the CBS Honors Program, is carrying out a research project in Carolyn Silflow's laboratory in the Department of Plant Biology. The fellowship provides a stipend of $3,000 plus supplies and a travel grant that allows participants to present their research at the annual ASPB meeting.

Claudia Neuhauser is among six University faculty who received the 2004 Horace T. Morse—University of Minnesota Alumni Award for Outstanding Contributions to Undergraduate Education. Neuhauser is professor and head of ecology, evolution, and behavior.

Leslie Schiff, director of undergraduate studies for microbiology, will receive the Carski Award at the general meeting of the American Society for Microbiology in New Orleans on May 24. The Carski award is the highest honor given for teaching microbiology to undergraduate students.

Willard Koukkari, professor of plant biology retired in January. During almost four decades of service to the University, Will devoted himself to helping undergraduates find the key to knowledge within themselves, artfully encouraging them as they learn, not just facts, but also how to learn and perhaps even more important, how to enjoy learning so that it becomes a lifelong pursuit. Will is also known for his research in the field of chronobiology, or biological rhythms.

Barbara Theno joined CBS as Director of Human Resources in March. Theno comes to the University from Great River Energy in Elk River, where she worked for nine years and helped arrange a successful merger. She brings a great deal of professional experience in organizational development, performance management, conflict resolution, contract negotiation, legal compliance, and policy development.

Jen White, EEB graduate student, was awarded a Torske Klubben Fellowship for 2004-05. The Torske Klubben, founded in 1933, awards fellowships to Minnesota resident graduate students who are interested in connections with Norway and its culture.

Biochemist coaxes enzymes
to make new biological drugs

TIM RUMMELHOFF

Romas Kazlauskas, new faculty member in the Department of Biochemistry, Molecular Biology, and Biophysics, induces the evolution of enzymes to find new medicines.

The experience sparked a lifelong interest in catalysts and how they can be harnessed for new jobs.

Believe it or not, a young man once got turned on to an exciting career by watching paint dry.

As a student at Cleveland State in the mid-70s, Romas Kazlauskas worked for a company that made the lead compounds that catalyzed the drying process, speeding it up. The experience sparked a lifelong interest in catalysts and how they can be harnessed for new jobs. Now an associate professor of biochemistry, molecular biology, and biophysics, Kazlauskas is a chemical architect, building both new drugs and new drug-synthesizing enzymes. His goal is more efficient and greener (less polluting) routes to the next generation of drugs.

"We're trying to evolve enzymes to synthesize new drugs, and we're also evolving small molecules and screening them for their potential as drug precursors," Kazlauskas says.

Raised in Cleveland by Lithuanian immigrant parents, Kazlauskas left his home town for graduate school at MIT in Cambridge, Mass. After receiving his Ph.D. in 1982, he moved a stone's throw up the Charles River to Harvard for a three-year postdoctoral position.

"It was an exciting place to be," he recalls. "You could feel the energy everywhere."

Some of that energy came from series of developments in chemistry. Kazlauskas and his contemporaries discovered how to tap the powers of natural enzymes for everything from cleaning fabrics to making new drugs. He took that knowledge to a job at General Electric in Schenectady, N.Y., where he studied the biodegradation of PCBs. After three years at G.E., he joined the faculty of McGill University in Montreal, where he spent the next 15 years.

A big hurdle in the manufacture of drugs is getting around the fact that many drugs are like gloves—they come in left- and right-handed forms. Usually, only one form is useful. The trick is to make sure that in each chain of chemical reactions leading to synthesis of a drug, only chemicals of the correct "handedness" are formed.

To that end, Kazlauskas is mutating genes for enzymes that catalyze such reactions, aiming to produce new enzymes that will lead to new drugs without producing byproducts of the wrong handedness. He also uses traditional chemical means to generate novel molecules, which he then tests for drug-like activity. In short, he is advancing the search for new drugs by evolving both new enzymes and new molecules with potential as drugs. Also, some of his new enzymes may find uses in industry as replacements for chemical processes that produce environmental pollutants.

A globetrotter, Kazlauskas collaborates with scientists in Montreal and Sweden. Four years ago, he visited his ancestral country for the first time when he attended a conference in Vilnius, Lithuania. As a fluent speaker of Lithuanian, he got around just fine.

Back home, Kazlauskas keeps physically active by running the three miles from Gortner Lab to his home, which he shares with his wife and three children.

—Deane Morrison

One-celled algae provide food for fish and food for thought

In a pond, one-celled algae known as *Chlamydomonas* provide food for fish, waterbugs, and other creatures. In Carolyn Silflow's lab, the microscopic green creatures are providing food for thought as Silflow works to understand a type of subcellular structure that not only helps *Chlamydomonas* move, but also plays a part in a spectrum of biological functions, from reproduction in primitive plants to hearing in humans.

A professor of plant biology, Silflow studies *Chlamydomonas'* flagella, two whiplike appendages that beat in a breast-stroke pattern to propel it through its watery world. In particular, she's got her eye on the root of the matter—subcellular structures called basal bodies from which flagella arise. By learning the role various genes play in the construction and function of basal bodies, Silflow hopes to shed light on how flagella and their close relatives, cilia, work—and why they don't when they don't.

To learn about basal bodies, Silflow is using a process called gene discovery. First, she creates mutations that affect the number, position, and movement of flagella. She then looks at the genetic material of the mutants to find out which gene has been altered. Once she knows the gene, she can identify the corresponding protein. Finally, she can figure out the protein's function based on what she knows about what's awry with the mutant. So far she's made seven kinds of mutants and has identified the genes and proteins associated with four of them.

The biochemical pathways Silflow is exploring as she works to learn how flagella work are fascinating for their own sake. But her research is drawing attention for other reasons, too. It turns out an amazing array of structures in people and other animals—tails of sperm, the ciliated cells that clear airways, light-sensing structures in eyes, sound-sensing cells in inner ears, cells that usher eggs from ovary to fallopian tube, kidney cells that help cleanse blood—all contain structures remarkably similar to flagella. As a result, information on how *Chlamydomonas* flagella work is providing valuable insights into a spectrum of human ailments, including some forms of infertility, vision problems, and kidney disorders.

"My motivation is not working on a particular disease; I get a lot of satisfaction just from the very basic work of trying to understand the molecular mechanisms," Silflow says. "But because these are highly conserved organelles I know that what I learn is important in the bigger picture."

In addition to looking at specific mutations, Silflow has been working with Paul Lefebvre, another professor of plant biology who is using gene discovery to explore flagellar mutations, to create a molecular map of the *Chlamydomonas* genome. The map will improve researchers' ability to use gene discovery to identify and characterize genes that control various aspects of *Chlamydomonas* structure and function.

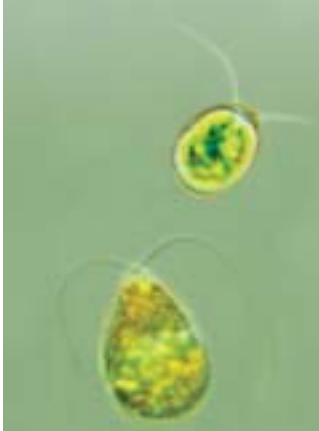
"It allows you to go from a phenotype to then clone the gene that is mutated to give you that phenotype," Silflow says. "So if you map the mutation genetically you can go into that region of the genome and clone the gene."

—Mary K. Hoff

TIM RUMMELHOFF

Carolyn Silflow and Paul Lefebvre conduct genetic research on *Chlamydomonas*, a one-celled algae, that is providing insights into a variety of human ailments.

Information on how Chlamydomonas flagella work is providing valuable insights into a spectrum of human ailments.



Erin Marasco

Erin Marasco (left), a graduate student in the lab of Claudia Schmidt-Dannert (right), uses directed evolution and metabolic pathway engineering to create new biological compounds. She puts in 50 to 60 hours a week and receives a stipend of $22,000 a year. Marasco considers herself lucky because funding for her position is secure.

TIM RUMMELHOFF

THE NEXT Generation of BIOLOGISTS

CBS graduate students are the bioenergy that fuels the academic research enterprise and the future leaders of bioscience education programs, government agencies, and biotech companies. But funding for graduate education doesn't reflect the value of these students to the University, the state, and the biotechnology industry. To realize investments in faculty and facilities, Minnesota needs to step up its commitment to graduate education.

Something smells good in Claudia Schmidt-Dannert's lab. Mmmm. It looks good, too. And it probably even tastes good, says grad student Erin Marasco. But it's not ready for a taste test just yet. Most experiments graduate students perform are by nature exploratory. And results are at least as likely to end up down the drain as featured in a scientific journal or as biology's latest product. That's one of the many reasons graduate students are valuable. They can try out lots of creative ideas to find the ones that merit development.

Marasco helps Schmidt-Dannert shuffle genes for carotenoids (pigments found in carrots, and other fruits and vegetables) to create metabolic pathways that are inserted into bacteria to make new biological compounds. The compounds have a variety of applications, from natural colors, flavors, and aromas in foods to anticancer drugs.

Microbial biotechnology is a form of green chemistry, Marasco explains. Biological compounds are healthier than chemical compounds and don't generate as much waste. The technique can produce more complex compounds. And it's actually more efficient than chemical synthesis.

Marasco is one of about 270 graduate students who work in faculty research labs throughout the College of Biological Sciences. They are the bioenergy that fuels the academic research enterprise and the glue that holds it together. Faculty rely on them to carry out research and test new ideas. Departments rely on them to teach introductory courses and labs. And undergraduates look up to them.

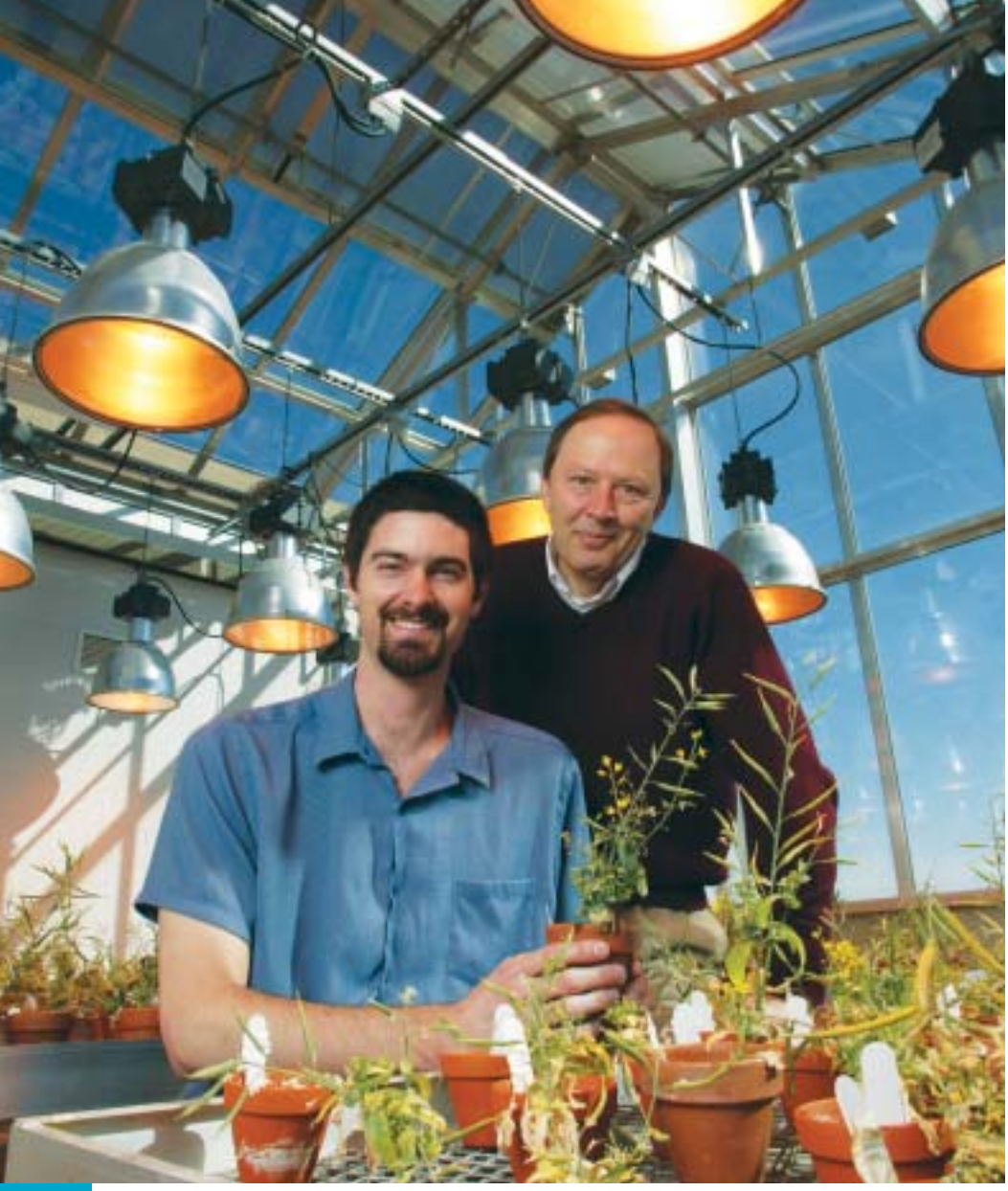
No stable funding for graduate education

Yet for all the work they do and respect they earn, CBS graduate students occupy a precarious position because funding is increasingly patched together from a variety of sources that can shift or disappear at any time.

Graduate students are paid a stipend to cover living expenses. At CBS, that ranges from $14,000 to $22,000 per year depending on the department and length of the term. They also receive tuition and fringe benefits, which can add more than $10,000 per student.

During the first year most students take courses and rotate through research labs before committing to one, where they work for the next two to four years. During their last year, they focus on completing their research and dissertation. Faculty use their research grants to pay the stipend, tuition, and benefits while students work in their labs. Many students also receive part of their support as teaching assistants.

First and last-year support is more challenging. First-year students don't have time to work because of classes and lab rotations. Fifth-year students in some programs require separate funds while they devote full-time to their dissertation. The Graduate School provides only 110 first-year and dissertation fellowships University-wide each year. The coveted awards are divvied up among programs. Federal agencies, such as



TIM RUMMELHOFF

Joe Fargione

Joe Fargione (left), born and raised in Minneapolis, earned his bachelor's degree from Hampshire College in Massachusetts, but returned to Minnesota to work with David Tilman, Regents Professor of Ecology (right). His research focuses on the consequences of biodiversity loss in prairies, which results from runoff of nitrogen fertilizers. After he graduates in June, Joe will go to the University of New Mexico for a postdoctoral fellowship. His career goal is to study how plant communities, and the ecosystem services they provide to humans, are affected by changes in global ecosystems. While at the University of Minnesota, he has been supported by fellowships and teaching. And he has authored or co-authored nine journal articles. "I have been very fortunate," Joe says. "But I worry that younger colleagues who don't get as much support can't be as productive."

the National Institutes of Health, National Science Foundation, and U.S. Department of Agriculture, provide some fellowship support. The 3M Graduate Fellowship Fund, the University's 21st Century Fellowship Fund, and individual fellowships also support a number of CBS graduate students.

But the combined resources fall short of the $8.1 million it takes to support the 270 CBS graduate students each year. The burden for the remainder falls on departments, which rely on soft money from unfilled faculty positions and other sources. And recent budget cuts have made soft money harder to come by. Some departments are actually going into the red to cover the costs. Ironically, departments don't always benefit directly. Many students now work with faculty members outside of their program's home department because of the multi-departmental and even multi-college composition of the program's graduate faculty. Program leaders are forced to "Go hat in hand from

THE NEXT GE

place to place asking for money," says Meg Titus, Director of Graduate Studies for the Department of Genetics, Cell Biology, and Development.

"We are supporting graduate students on a hope and a prayer," adds David Bernlohr, Head of the Department of Biochemistry, Molecular Biology, and Biophysics.

"We need twice as many students to support faculty research and to be competitive with other universities. At this point the formula for that is two times a hope and a prayer."

A wake-up call from external review committee

To complicate matters further, demand for graduate students has never been greater. Departments are scrambling to provide students for 41 faculty hired through the Molecular and Cellular Biology Initiative, which did not provide funds for graduate students.

A recent external review observed that the graduate programs in the Department of Biochemistry, Molecular Biology, and Biophysics and the Department of Genetics, Cell Biology, and Development are not nearly large enough to support faculty research. They noted that the ratio of grad students to faculty is 3:1 at competitor institutions while it's only 1:1 on average in these programs, a ratio that's comparable to other CBS programs.

Reviewers state that "Graduate student productivity is the engine that drives research progress, award of grant dollars, and resulting indirect costs to the University. It is in the University's best interests to facilitate the accommodation of as many qualified students as can be attracted the program." However, the reviewers also note that "Costs are a disincentive for faculty to take more students, even if more were available," mainly because of the high fringe rate at the University of Minnesota. On the plus side, reviewers were very positive about improvements made in faculty and facilities through the Molecular and Cellular Biology Initiative. They commented on the

NERATION OF BIOLOGISTS

number of talented young faculty and the amount and quality of research space. But they said graduate programs are as important as faculty and facilities, and warned that the University is in jeopardy of losing its investment if it doesn't make a similar investment to grow graduate programs.

The need to pay higher fringe costs makes it difficult for other programs to offer competitive stipends, which affects the University's ability to recruit top students. Claudia Neuhauser, head of the Department of Ecology, Evolution, and Behavior and Director of Graduate Studies reports that the University of Michigan and Northwestern University offer ecology graduate students $20,000 over 12 months, while she can offer only $14,000 for nine months. While her program's reputation continues to attract top students, this is increasingly difficult because of funding. She is also deeply concerned that she can not guarantee students funding for five years, which is standard among many competitors.

"We can say that they will probably have the financial support they need to complete the program, but we can't promise," Neuhauser says. Her department encourages students to pursue independent research rather than exclusively support faculty research, so faculty research grants don't cover as much of the costs. She relies more heavily on Teaching Assistantships, funding from the Graduate School, and fellowships provided by federal agencies and individuals. But as the number of graduate students in the program has grown, the number of teaching assistantships and fellowships has not kept pace.

"We know there aren't any pots of money lying around," Neuhauser says. "It's a matter of the state and the University setting priorities."

Carolyn Silflow, Associate Director of Graduate Studies for the Plant Biological Sciences Graduate Program, says she is concerned about stipends keeping pace

Jennifer Ross Wolff

After earning a B.S. in biology from Millikin University in Illinois and an M.S. in cell biology from Vanderbilt University, Jennifer Ross Wolff came to the University of Minnesota to work in David Zarkower's lab while her husband earned a master's degree in music composition, and later entered the Ph.D. program. She shares Zarkower's interest in using the model organism *C.elegans* to understand what genes determine gender. Jennifer is supported by a fellowship from the National Institutes of Mental Health to study how the male nervous system differs from the female and what genes regulate those differences. She has authored several journal articles. When she graduates in about a year, Jennifer hopes to teach in a small liberal arts college in Minnesota or elsewhere in the Midwest.

TIM RUMMELHOFF

The value of graduate education for Minnesota

Carol Pletcher, Ph.D. in biochemistry, Vice President, Cargill, Inc.

Carol Pletcher knows something about the value of graduate education. After earning a Ph.D. in biochemistry at the College of Biological Sciences in the late 1970s, she was hired as a staff scientist in product development and has worked her way up to Vice President. Pletcher received a fellowship from the American Association of University Women that enabled her to complete her doctoral degree. She and her husband, Wayne, recently established a fellowship fund of their own to provide the same kind of support for other young women. Cargill matched the gift and Wayne's employer, 3M, did the same. The amount was also matched by the University of Minnesota 21st Century Graduate Fellowship Fund.

Here are some other examples of former graduate students who are making a difference in Minnesota.

Brian Brazeau, Ph.D. in biochemistry, Biotechnology TDC, Cargill, Inc.

Karl Clark, Ph.D. in genetics, scientist at Discovery Genomics in Minneapolis.

Mervyn DeSousa, Ph.D. in microbial engineering, principal scientist in the Biotechnology Development Center, Cargill, Inc.

Bo Hedlund, Ph.D. in biochemistry, President and CEO of Biomedical Frontiers, Inc.

Julie Kirihara, Ph.D., in biochemistry, founder and president of ATG Laboratories, past-president of MNBIO.

Gordon MacFarlane, Ph.D. in biochemistry, Director of Research and Development at Diasorin, Inc.

Franklyn Prendergast, Ph.D. in biochemistry, Director of the Mayo Clinic Cancer Center.

Ruth Shuman, Ph.D. in genetics, founder and president of Gentra Systems, Inc.

Paul Savereide, Ph.D. in genetics and J.D., intellectual property attorney for Cargill, Inc.

Joel Tallaksen, Ph.D in plant biology, EMSL Analytical, an environmental consulting firm.

Kipling Thacker, Ph.D. in microbiology, co-founder and Director of New Business and Development for Lifecore, Inc.

Mark Tomai, Ph.D. in microbiology, 3M Pharmaceuticals.

with the cost of living, particularly housing, in the Twin Cities. Meanwhile stipends at other Universities are climbing as programs get more competitive.

TIM RUMMELHOFF

Adam Huang

Adam Huang is a second-year student who works with plant biologist Sue Gibson. Gibson's lab, located in the Cargill Building for Microbial and Plant Genomics, explores the role of sugar in regulating plant gene expression and development. In plants, sugars are similar to hormones because they affect flowering, early seedling development, and other processes. In addition to addressing scientific questions, a long-term goal of the research is to engineer more productive plants by altering the way that plants respond to sugar. Huang earned a B.S. in biotechnology and M.S. in plant biology in China before coming to the University of Minnesota.

"The University of Texas offers students a signing bonus and a computer," she says. "We just can't compete with that."

Graduate program rankings reflect research quality

The National Research Council (NRC) ranks graduate programs about once every 10 years. Faculty, students, and even funding agencies tend to use the rankings to judge overall quality of a research program. Consequently, rankings influence a program's ability to attract top faculty, students, and funds.

"For the most part, the rankings are highly correlated with program size," says Judd Sheridan, CBS Associate Dean for Research. Sheridan says that bigger programs are better known and attract more national attention, largely because faculty labs with more graduate students are more productive and bring in more federal grants. Moreover, more students graduate and move on to postdoctoral positions, further enhancing the reputation of the program.

In the last NRC survey of biological science graduate programs, which was released in 1995, most of the University's programs ranked between 34th and 39th. (The exception, Ecology, was ranked 15th) That's one reason the University decided to reorganize and consolidate basic sciences programs in CBS, the Medical School, and the College of Agriculture, Food, and Environmental Sciences several years ago. The new departments are larger and stronger. The Molecular and Cellular Biology Initiative, launched in 1997, gave biology another boost with funds to hire 41 new faculty and to construct or renovate research facilities.

The NRC has not released rankings since 1995, but the external group that reviewed the joint MCDGB program said that it was "probably not in the top 20, but definitely in the top 40. In 2002, *U.S. News & World Report* ranked University of Minnesota biological sciences graduate programs 29th among about 140 institutions.

Erin Marasco says the student perception is that Minnesota is "middle of the pack" while the University of Wisconsin, Madison, the University of Michigan, Washington University in St. Louis, and the University of Washington, Seattle are in the top 10.

"Most people come here because of geography," says Marasco, who chose the U because of the microbial biochemistry group's reputation and because her husband got a job as an engineer for General Mills. She says students are generally satisfied, but some worry about getting the financial support they need to complete their Ph.D. and how the University's national reputation will affect their job search after graduation.

Graduate programs support the growth of biotechnology

Increasing the size of graduate programs is also good for Minnesota's economy. About half of the people who earn Ph.D.s in the Department of Biochemistry, Molecular Biology, and Biophysics go into industry rather than academia. And the external review noted that graduates are remaining in Minnesota.

They join the state's "creative class," says Dean Robert Elde. "These are the people who come up with the ideas for new technologies, start companies, and create jobs in biotechnology."

Sheridan says that other states have found ways to support graduate education because they recognize its importance. In Minnesota, as elsewhere, the solution will need to come from everyone who benefits from graduate education.

"Faculty are willing to step up and write more grants. The University needs to recognize that the quality and quantity of students determines our national reputation as a research institution and influences our ability to recruit faculty and receive federal grants. The state needs to help because biotechnology industry won't relocate or grow here unless the workforce is here. Companies who hire graduates will benefit from investing in graduate fellowships. "

There's a growing awareness within the University that this is an important issue, Elde says. He is hopeful it will be brought to the Legislature's attention during the 2005 session.

"This is really finishing the work Mark Yudof started several years ago with the reorganization of the biological sciences and the Molecular and Cellular Biology Initiative," Elde says. "It's also very compatible with the Governor Pawlenty's goals and interests."

—Peggy Rinard

Ancient pollen shed light on current environmental issues

When Shinya Sugita needs to unwind, he goes to his laboratory, flips on a microscope, positions a slide on the viewing stage, and starts to tally what he sees. Basswood . . . American elm . . . another elm . . . red maple. . .

"I love counting pollen," says Sugita, assistant professor in the Department of Ecology, Evolution, and Behavior. "It's very relaxing."

Sugita is a palynologist—a scientist who studies ancient pollen grains and other microfossils found in sediment beneath lakes and bogs. Based on their observations, palynologists can paint a portrait of the vegetation at various times and places of our planet's past. They can then correlate those changes with known changes in other variables such as climate and the presence of humans to create a clearer picture of how external forces shape ecosystems.

Sugita got into this field in the late 1970s as a way to combine two big interests of his—history and ecology. At the time it seemed to be basic science at its best—knowledge for the sake of knowledge. But as global climate change began to attract attention, so did palynology. Because the fossil pollen record shows how vegetation changes as climate changes, it's useful for testing models attempting to predict how future climate might affect future vegetation. "Over the last 10 to 15 years paleorecords have become more important as people try to understand change in the environment," Sugita says.

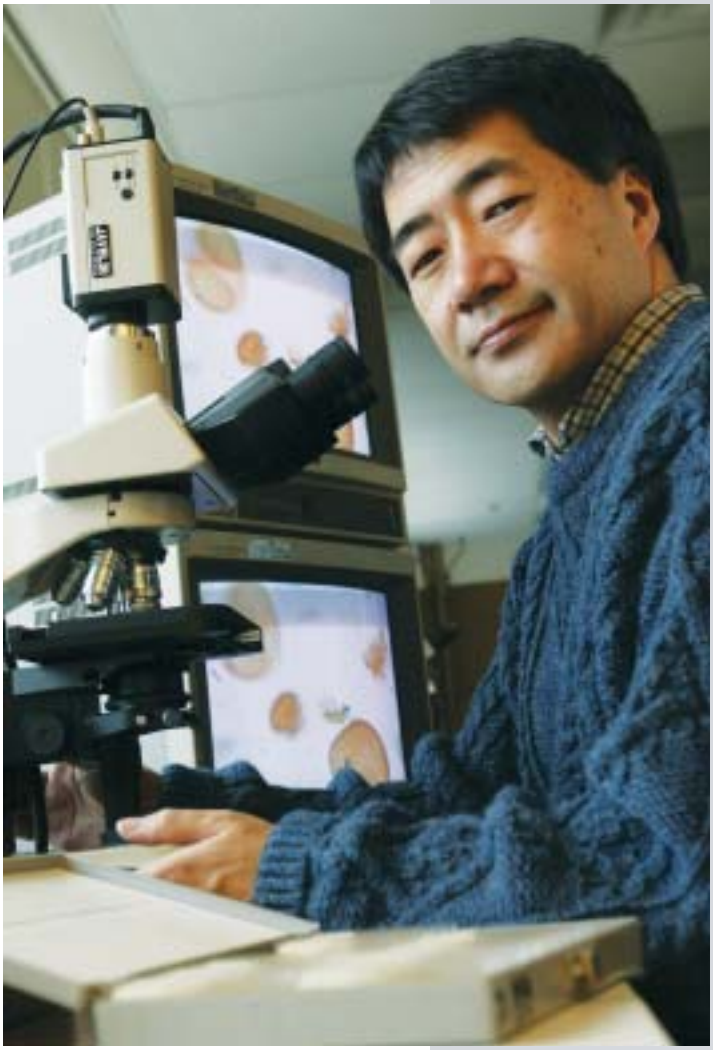
Results from palynological studies are also drawing interest from the emerging field of conservation biology, which seeks to preserve or recreate aspects of nature in their natural state. "Paleodata help tell us what to conserve," Sugita says. "In Europe, Japan, this country, people are interested in what were the natural conditions before."

As interest in their field has grown, palynologists have faced a bit of a challenge. Traditionally they have been a qualitative bunch, observing but not applying a whole lot of mechanistic thinking to their observations. Consequently, the discipline was short on the quantitative rigor public policymakers need to extrapolate from a picture of what was to predict what might be.

Fortunately, Sugita was a bit of a renegade in this regard. As a postdoctoral student working with now-professor emeritus Margaret Davis in the 1990s, he developed an elaborate computer model that takes the many variables involved in pollen distribution, from pollen weight and shape to prevailing winds and topography, and creates from them a corrective lens that transforms historical pollen data into a comparatively clear picture of the past.

In 1997 Sugita took his model to Sweden to evaluate, "the history and impact of human activities on vegetation over the last 5,000 to 7,000 years." As part of that effort he and his European colleagues obtained funding from the Nordic Research Council in Norway to enhance the user-friendliness of his computer program and train Ph.D. students from 10 European countries to use it.

—Mary K. Hoff



TIM RUMMELHOFF

Shinya Sugita uses fossil records of pollen to study the history of vegetation and climate.

ALUMNI PROFILE

CSI: MINNESOTA

CBS alumni at the scene of the crime

TIM RUMMELHOFF

CBS alumni who are now forensic scientists at the St. Paul Bureau of Criminal Apprehension (BCA). From front to back are Myha Le, B.S. in Biochemistry, 2000; Amy Tierney, B.S. in Genetics, '97; Staci Bennett, B.S. in Biology, '91; Jim Liberty, B.S. in Microbiology, '87; Drake Holter, B.S. in Biology, '94. Not pictured are Jay Wenner and Delores Schoenbauer.

Exquisite Corpse

To their left is the "Exquisite Corpse," stained glass art created for the Bureau's new building. It represents cross sections of the corpse of a convicted felon, considered to be anatomically perfect. He donated his body for forensics research and education.

Week in and week out, sometimes up to four times a week, TV viewers are entertained—if not dazzled—by the science-citing sleuths of "CSI: Crime Scene Investigation" and its several spinoffs.

A Johnny-come-lately to the phenomenon sat down recently for an inaugural viewing of CSI: Miami. First, our smooth-talking (and incredibly intuitive) prime-time forensic scientists targeted a man who manufactured fiberglass surfboards when traces of fiberglass resin were found on a crime-scene ski mask. Later, the killer was fingered because the vise he used to make a piece of jewelry for the victim's wife left the exact same microscopic imprint on the shotgun he sawed off to commit the murder.

As investigative work goes, that's sexy stuff. Kinda makes you want to find a job in forensic science. A number of CBS grads have done just that, and are working at places like the Minnesota Bureau of Criminal Apprehension (BCA) and the Armed Forces' DNA identification lab near Washington, D.C.

Kathryn Hanna, faculty adviser for the CBS Forensics Club, has witnessed an explosion of students interested in forensic science following the popularity of the CSI shows. In the spring of 2002, the club had about a dozen interested students. Now, two years later, there are more than 200 names on the club's e-mail list.

There is no formal degree program in forensic science in the Upper Midwest, but that does not and should not curtail CBS students' interest in the field. Any training in the basic sciences is good background.

Jennifer Zimdars' ('99, genetics and cell biology) decided to pursue an advanced degree, and attended graduate school at George Washington University in Washington, D.C., for forensic science. After an internship, she

TIM RUMMELHOFF

Bloody shoe

Staci Bennett and Amy Tierney, who work in the pare to analyze DNA of blood splattered on a shoe dence in a homicide case. Tierney specializes in sexual assaults, homicides, and other crimes.

landed a position at the American Registry of Pathology's DNA identification lab in Rockville, Maryland.

Working under the Office of the Armed Forces Medical Examiner, the lab's primary charge is "to identify all fallen soldiers" of the U.S. armed forces, Zimdars says. This includes a growing effort to confirm the identities of soldiers from previous wars, including Vietnam and Korea.

A BCA mascot

"Over the years, we've identified many fallen [soldier] remains, including the Tomb of the Unknown Soldier," says Zimdars.

Her office has also handled some extremely high-profile work—most notably the recent DNA analysis of Saddam Hussein as well as his two sons, Uday and Qusay, who were killed by coalition forces in Iraq. Samples were compared using Y chromosomal STR (short tandem repeat) DNA analysis.

"Uday and Qusay and Saddam all had the exact same profile, and also the bodyguard [who was killed with the sons]," says Zimdars. "It probably means that the bodyguard is a close relative somewhere in the paternal line."


BCA's biology section, pre- that was submitted as evi- analyzing DNA samples from Bennett is section supervisor.

Zimdars says there's no doubt that the CSI shows have spawned a dramatic increase in interest in forensic science. Over the past few years, Zimdars says, applications to George Washington "have probably more than quadrupled." "We're getting thousands of applications for about 200 spaces," she says.

Another CBS alum's entry into forensic science predates the debut of CSI by many years; in fact, it even precedes the extensive use of DNA testing. When Jim Dougherty ('89, microbiology) was hired by the Minnesota BCA in 1990, the lab was still doing serological testing of samples based on proteins in the blood.

"I was hired with a number of other scientists to start forensic DNA analysis, and by 1991 I was doing case work in DNA analysis," Dougherty says. He continued that work throughout the '90s and went on to become a crime scene team leader, processing two of the scenes in the Katie Poirer abduction case. In 2001, Dougherty moved to the BCA's new office in Bemidji, Minn.—a satellite lab for the St. Paul headquarters—where he is assistant lab director.

Dougherty says that the BCA typically hires students who have a degree in a science. "They're in the program they need to be in if they're in the College of Biological Sciences," he says. "If you want to work in the field of DNA analysis, you need to have biochemistry, genetics, molecular biology, and some kind of a statistics class." There are currently seven CBS alums working in the BCA's St. Paul office, and an eighth will soon join them.

As for the merits of "CSI: Crime Scene Investigation," "CSI: Miami," and other highly rated dramas capturing the fancies of armchair detectives just about every weekday evening?

Dougherty says that the shows have changed the lives of forensic scientists, sometimes for the better and sometimes for the worse. While there is increased interest from students and a lot more requests for tours of the BCA facilities, he says there is a definite downside. In some cases, the DNA analysis that some jurors expect to occur may not be necessary or, for that matter, even possible. "It makes

"There's no doubt that the CSI shows have spawned a dramatic increase in interest in forensic science."
—Jennifer Zimdars

juries expect a lot," he says. "They think they know how we do our jobs because of what they see on TV."

What does Zimdars think of the shows?

The science can actually be very accurate, she says. "What isn't realistic is the turnaround time," she says. "And of course the drama associated with it. I don't really watch them anymore, because I know the daily routine, and the amount of grunt work, are so different."

—Rick Moore


TIM RUMMELHOFF

Drug bust
Myha Le confirms that packets of white powder taken in a drug bust are heroin. The BCA's chemistry section, where Le works, primarily identifies drugs. Meth amphetamine is the most common drug that comes through this lab.

The Class of 2003 reports back on life after CBS

James Ross says his CBS education prepared him well for Harvard Medical School.

When Jim Ross was deciding where to apply for medical school, he took to heart some advice from David Bernlohr, head of the biochemistry department at the University of Minnesota. Bernlohr, Ross says, told him "to decide on a couple of schools I really, really wanted to go to... and apply."

Since Harvard Medical School was on that list for Ross, a 2003 CBS graduate (B.S., biochemistry), he gave it a shot. Although he wasn't certain of his academic pedigree while being interviewed with peers from Stanford, Harvard, and Yale, he soon found out he was more than qualified with his background at CBS.

"I realized how good my undergraduate education was compared to the background of other students," Ross says. "At times I thought I was actually more prepared than some of my classmates."

Ross is now keeping up with the rigors of medical school at Harvard and the accelerated pace of the Boston area ("Everyone seems like they're on the run," he says) with a hectic schedule of his own. He's in the Big Brothers program, tutors students in grades 9-12 who may be heading into medicine, and recently started coaching Little League baseball. In addition to his academic background at CBS, there's one other thing that being from Minnesota prepared him well for: Ross says he's the "only Minnesota kid" playing hockey for the Harvard Medical School club team.

Ross is one of 273 students who graduated last year from CBS with majors spanning biology, biochemistry, ecology, genetics, microbiology, and neuroscience. More than 50 graduated with honors. Their paths since graduation are as divergent as their fields of interest, from medical school to research in labs on campus. According to a 2003 exit survey of CBS graduates, approximately one-third were preparing to begin graduate or professional programs last fall, and 48.6 percent planned to enter a graduate or professional program at some point in the future. Nearly 26 percent were entering the workforce and another 39 percent were still looking for jobs.

Imee Cambronero's path took her to Washington, D.C., as an intern for Minnesota Congresswoman Betty McCollum. While working on Spring Jam last year, the December grad (B.S., biology) researched and wrote about alcohol policy. Her newfound interests in policy and health led her to take a public-health class in the fall, and when she heard of an internship opportunity in McCollum's office, she thought, "This really aligns well."

Cambronero's future may entail graduate school—either in public health or public policy—but for now she's happy in D.C., and was recently promoted to staff assistant. "I feel very comfortable out here," says Cambronero. "I'll probably stay here on the Hill for a while, or I might

Imee Cambronero works in the office of Congresswoman Betty McCollum in Washington, D.C.

TIM RUMMELHOFF

Cara White will head to Texas this summer to teach Hispanic students in a low-income school district.

look at the National Institutes of Health or other contract agencies that deal with public health, or nonprofits. There are definitely opportunities out here."

Cara White (B.S., biology) is continuing her work of three years in the veterinary pathobiology department at the University. Part lab manager and part technician, she studies the immune system response to SIV (simian immunodeficiency virus). "We use tissues from SIV-infected monkeys as a model system for HIV to study the immune system response," White says.

This summer, she'll be joining Teach for America, a program that places recent college graduates in low-income school districts around the country. Her two-year assignment will take her to the Rio Grande Valley in Texas. As she works toward teaching certification, she'll be able to gauge her interest in an education-related career.

"It's an opportunity to work where the need is the greatest," White says. "If I'm going to be teaching, I'd like to be able to make a difference."

—Rick Moore

St. Paul Saints Game

Join CBS for the Third Annual CBS Alumni Day at the June 25th St. Paul Saints game. Enjoy baseball outside on a warm summer night with fellow CBS alumni. We'll be grilling and tailgating prior to the game, then joining the other Saints fans in reserved bleacher seats while we cheer on the hometown team as they take on the Sioux City Explorers.

Tickets are $16 per person, which includes reserved bleacher seating, grilled items, chips, potato salad, baked beans, and soda.

Last year we had more than 150 CBS alumni and friends join us, so be sure to get your tickets early to reserve your space. Visit www.cbs.umn.edu/alumnievents to register. Family and friends are welcome.

Fall Fest 2004: Connecting U

On Sunday, October 17, the Biological Sciences Alumni Society will host *Fall Fest 2004: Connecting U.* Join CBS alumni, students, parents, faculty, and staff as we explore CBS research, tour facilities on the St. Paul campus, and learn how CBS, along with the College of Agricultural, Food, and Environmental Sciences, the College of Veterinary Medicine, and the College of Human Ecology are working to support President Bruininks' initiatives for 2004.

You can participate in one of four presidential initiative education tracks. Bioscience and Biotechnology; Healthy Foods, Healthy Lives; Environment and Renewable Energy; and Children, Youth, and Families. Or take a tour of St. Paul campus facilities including the new Cargill Building for Microbial and Plant Genomics, the Raptor Center, small and large animal hospitals at the College of Veterinary Medicine, or one of the many greenhouses. In addition to the education tracks, we'll also have activities and tours for families and children.

Mark October 17 on your calendar to attend *Fall Fest 2004: Connecting U* and watch your mail this summer for more information.

Class Notes

J.P. Houchins (B.S. in Biochemisty, 1975) is a scientist and manager at R&D Systems in Minneapolis. J.P. is also a member of the CBS Alumni Speakers Bureau.

Vicki Schuman (B.S. in Microbiology, 1979) is the owner of Schuman & Associates, a technical writing agency. Schuman & Associates is located in Plymouth.

Thomas Blanck (B.S. in Microbiology, 1984) recently started his own business, Packaging Solutions Group. PSG is a package engineering and development firm that helps companies create a competitive advantage in the marketplace. PSG is located in Minneapolis.

John Richards (B.S. in Biochemistry, 1985) is the owner of Croix Computing Corporation. Established in 2000, Croix helps small businesses take advantage of advances in computer technology.

Andrew Snyder (B.S. in Microbiology, 1993) is director of clinical research for St. Paul Heart Clinic. Andrew also volunteers for CBS through the Mentor Program and the Alumni Speakers Bureau.

Luca Gunther (B.S. in Genetics, Cell Biology, and Development, 1999) recently joined the Carlson School of Management after working for a commercial lab and doing basic research at the U. He hopes to obtain his MBA through CSOM.

Send your news to Emily Johnston, ejohnsto@cbs.umn.edu.

—Emily Johnston

CBS Calendar

Commencement
May 15, 7 p.m.
Northrop Auditorium

St. Paul Saints Game
June 25
6 p.m. Picnic
7 p.m. First pitch
Midway Stadium, St. Paul

CBS Community Day
TBD

Awards & Recognition Dinner
October 7
5:30 - 8:30 p.m.
McNamara Alumni Center, Minneapolis

Fall Fest 2004: Connecting U
October 17
11 a.m. - 5 p.m.
St. Paul Campus

Homecoming Tailgating & Football
October 23
Time TBD

Contact Emily Johnston at alumni@cbs.umn.edu or (612) 624-4770 for more information about any of the events listed above.

A Perfect Match

Doubling the impact of endowed scholarships

$16,000 a year. That's the average annual cost of tuition, fees, room and board for a U of M undergraduate, this year, but costs are expected to rise. And while that $16,000 is a bargain relative to many other colleges and universities, the price is still steep, and many struggle to pay it.

To help students and their families meet the costs of higher education, the U has set a priority on increasing the number of scholarships it can offer. And, to encourage new gifts for scholarships, the U recently launched a program that will double the impact of any gift of $25,000 or more for endowed scholarships.

Matching gifts from employers can be used to meet the $25,000 minimum, and gifts may be paid over five years, making it even easier to take part in this program, and still double the impact of your gift. For more information, call the University of Minnesota Foundation at 612-624-3333 and ask to talk to Bob Burgett.

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