Renewable Energy and the Environment

The University’s new Initiative for Renewable Energy and the Environment, funded with $20 million from the Legislature and Xcel, takes off with a burst of energy. Researchers are developing ways to turn agricultural biomass into fuel and products, use microbes to generate hydrogen and electricity, and increase the use of wind and solar energy. See story on page 9.
It was a big day for CBS when President Bruininks announced his top eight academic priorities at the State of the University address this fall. They are:

- Biosciences and biotechnology
- Environment and renewable energy
- Translational research in human health
- Healthy foods, healthy lives
- Brain development and vitality over the lifespan
- Children, youth, and families
- Arts and humanities
- Law and values in health, environment, and the life sciences

Clearly, CBS will play a leading role in the first two. But we also have parts in many others. There are lots of external factors contributing to our position. Biology’s time has come because of advances in genomics and biotechnology. And the world is looking to biologists to feed the planet’s growing population, find alternatives to fossil fuels, and restore our ecosystems.

But the history goes back much further than that, reflecting decades of work at the University and CBS. In the 1940s Raymond Lindeman published a paper based on research at Cedar Creek Natural History Area that established modern ecosystem ecology. And in the 1950s, Regents Professor Eville Gorham did groundbreaking research on acid rain, chemical pollution of ecosystems, and global warming. David Tilman and others in the Department of Ecology, Evolution, and Behavior carry on their legacy.

Similarly, our strength in microbial biochemistry and biocatalysis dates back to Regents Professor Stanley Dagley, who in the 1970s and 1980s used microbial enzyme pathways to carry out novel chemical reactions. Dagley attracted many talented young biochemists, including Larry Wackett, who is now Distinguished McKnight University Professor and head of the microbial biochemistry division. In turn, Larry attracted other talented young scientists, such as Claudia Schmidt-Dannert. Daniel Bond (see page 9) is the newest rising star to join that group.

The new initiatives are also a continuation of the 1997 Molecular and Cellular Biology Initiative and the reorganization of the biological sciences. Since those events, 41 new faculty have been hired and several facilities have been constructed or renovated.

While it’s an honor for CBS to figure so prominently on the President’s list of academic priorities, it’s also a responsibility. The University and the State are depending on us for leadership in areas that are critically important to the future of Minnesota and the planet. Our goal is to make a difference in how the world deals with challenges presented by a growing population and overextended ecosystems. We’ll do our best to meet those challenges.

Robert Elde, Dean
College of Biological Sciences
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IN THIS ISSUE

IN EVERY ISSUE

2 Abstracts
U to lead sequencing of legume genome...Packer studies human impact on Serengeti...Gombe reunion is a hoot...Cloning marks golden anniversary...

4 College News
CBS launches new Web site...No vacancies in Cargill Building...Nature of Life program...Neuhauser named head of EEB...

15 Alumni News
Mentor Program doubles in size...Class Notes...Join the Legislative Network...Celebrate UMAA’s 100th birthday...

18 Calendar of Events

COVER STORY

9 Renewable Energy and the Environment
The University’s new Initiative for Renewable Energy and the Environment takes off with a burst of energy as researchers explore the ocean depths, fields, forests, lakes, and skies for alternatives to fossil fuels and products.

FEATURES

6 FIELD NOTES — Moving aquatic ecosystems.
7 GENETICS AND CELL BIOLOGY—Yeast cells raise understanding.
13 MICROBIOLOGY — Genomics of mosquitoes and malaria.
14 ALUMNI PROFILE — Erik Pratt, Energy Alley manager and accomplished musician.
16 STUDENT LIFE — Nature of Life program.
17 SCHOLARSHIPS — Needs rise along with tuition.

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**Microbe degrades herbicides in soil**

Lawrence Wackett, professor and head of microbial biochemistry, and Michael Sadowsky, professor of soil, water, and climate, have received a National Science Foundation grant of $700,000 to sequence the genome of *Arthrobacter aurescens*, a soil bacterium that breaks down atrazine and other herbicides.

*Arthrobacter* strains are widespread in soil around the globe and contribute to recycling of organic matter, breaking down environmental pollutants, and transforming heavy metals. They have the ability to degrade herbicides and other organic compounds and to transform toxic heavy metals into nontoxic forms. The researchers hope knowing the sequence will give them new tools—such as genes, enzymes, and other proteins—to clean up the environment.

The project includes collaboration with the Minnesota Science Museum to create hands-on exhibits showing how microbial genomic technologies enhance the environment. Genome sequencing will be done in collaboration with The Institute for Genome Research (TIGR) in Rockville, Md.

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**U wins $10.8 million NSF grant to sequence legume genome**

High nutritional value and the ability to fix nitrogen have won the legume a place of honor in the plant genomics hall of fame. The humble vegetable, a primary source of protein for much of the world’s population, will be the third plant sequenced, following *Arabidopsis*, a model green plant, and rice.

*Medicago truncatula*, the model legume, will share the glory with the University of Minnesota, which was awarded a $10.8 million grant from the National Science Foundation (NSF) to lead the multi-institution effort. Nevin Young, professor of plant biology and plant pathology, is principal investigator of the effort, which is part of the NSF’s plant genome research program.

*Medicago* was selected because it provides an excellent experimental system to study soybeans, mung beans, chickpeas, cowpeas, and lentils, crops that constitute the major source of protein for people throughout the developing world. Alfalfa, also a legume and a major source of protein for foraging cattle, is a close relative of *Medicago truncatula*.

Legumes acquire their high protein content by producing their own fertilizer through a process known as nitrogen fixation. Legumes also produce many compounds with health-promoting properties, such as anti-cancer activity.

"Before fertilizers were commercially produced, agriculture worldwide depended on legumes to supply the nitrogen needed to make protein," Young says.

Young will direct the sequencing project and coordinate its bioinformatics component with Ernest Retzel of Minnesota’s Center for Computational Genomics and Bioinformatics. DNA sequencing will be performed at robotic facilities at the University of Oklahoma Genome Center and The Institute for Genomic Research. The NSF grant adds to more than $5 million in *Medicago* genomics research already underway at Minnesota.

"This project will provide valuable tools for everyone at the University who studies *Medicago,*" says Kate VandenBosch, head of plant biology.
McKinnell marks 50th anniversary of cloning

In 1958, Bob McKinnell jumped at the chance to work with Tom King, a researcher at Fox Chase Cancer Center in Philadelphia who was first to clone an animal [a frog] in 1952. McKinnell, then a graduate student in zoology at the University of Minnesota, met King when he was a visiting professor at the U of M. King used cloning to better understand cancer, and McKinnell was a National Cancer Institute Predoctoral Research Fellow in Zoology. He worked in King’s lab at Fox Chase for three years.

That experience has served McKinnell, now professor emeritus of GCD, well during his career, which has focused on cancer biology. And he remains an authority on cloning technology. In 1978 he wrote the first book on cloning by a scientist, and has authored many articles on the subject. When the film “Jurassic Park” was released in the early 1990s, McKinnell was in demand by the media.

Most recently, McKinnell co-authored “The Golden Anniversary of Cloning: A Celebratory Essay” in the September issue of Differentiation [volume 71, Number 7, Sept. 2003]. He’s proud of that accomplishment, but even more proud of the cover image, which was designed by CBS undergraduate Taryn O. Hall, who is also a staff member in the CBS Imaging Center.

Now retired from research, McKinnell maintains an office in the Biological Sciences Center on the St. Paul campus, where he works on articles and books. He is finishing a revision of “The Biological Basis of Cancer,” published by Cambridge University Press in 1998, and beginning a work on the history and ethics of cloning.

Packer to study human impact on Serengeti

Craig Packer received a $1.7 million grant from the National Science Foundation for “Biocomplexity of the Greater Serengeti: Humans in a Biologically Diverse Ecosystem.” He will use four different models to study the impact of humans on the Serengeti. Packer is Distinguished McKnight University Professor of Ecology, Evolution, and Behavior.

Packer’s research also was featured in the Sunday Express, a British newspaper, in November. The article, “Disney fights to help the lions of Tanzania survive,” focuses on Project Simba, funded by Walt Disney Home Entertainment, which studies the impact of elephant populations on lion populations in Tarangire National Park (Tanzania). The increase of the park’s elephants may disturb mating habits of lions, whose cubs are at risk of being trampled by the elephants.

Goodall’s Gombe Reunion is a real hoot

More than 100 scientists who worked with Jane Goodall at Tanzania’s Gombe National Park over the past 43 years gathered at the University of Minnesota in October for the group’s first formal reunion. The event started with a chimpanzee pant-hoot that was led by Goodall and included professors from Harvard, Stanford, and other distinguished universities. The reunion allowed participants to learn about research at the Center for Primate Studies at CBS and to discuss conservation efforts and future behavior studies.
New Web site

Visit the College of Biological Sciences new Web site at cbs.umn.edu. The site has been redesigned with a fresh new look and reorganized to make it easier for users to find the information they need. Sections for prospective students, current students, faculty and staff, and the biotechnology community are expanded.

Nature of Life program launched in August

Freshman had the opportunity to meet each other and faculty at the Nature of Life program, held at Itasca in August.

Freshmen got their first taste of life at CBS at the Nature of Life program in August at the Itasca Biological Station and Laboratories. Nature of Life is a new program designed to introduce freshmen to each other, faculty, curriculum, research opportunities, and social activities. Nearly all of the 340 members of the freshman class attended the one-credit program. Dean Elde thanks to all of the faculty, staff, and students who helped to get Nature of Life off to a strong start. [See story page 16]

Cargill Building tenants settle in

The Cargill Building for Microbial and Plant Genomics is filling up. Most principal investigators have settled into their offices and labs. They are: Ron Phillips (agronomy and plant genetics, CMPG director); Kenneth Vernick (microbiology); Dan O’Sullivan (food science and nutrition); Sue Gibson (plant biology); Fumi Katagiri (plant biology); Jane Glazebrook (plant biology); Nevin Young (plant pathology); Phillip Pardey (applied economics); Vivek Kapur (microbiology); Sagarika Kanjilal (veterinary pathobiology); Nathan Springer (plant biology); and Jonathan Kahn (law). PI’s are in the process of assembling their research groups. Several bioinformatics faculty and staff are expected to move in soon. There will be 160-200 people working in the building when it is fully occupied.

Claudia Schmidt-Dannert has moved robotic equipment for screening new compounds into the Cargill Building.

Students and donors honored at annual dinner

More than 200 people attended the College’s Recognition and Appreciation Dinner, which was held this fall at the McNamara Alumni Center. The purpose of the annual event is to recognize students who received scholarships and fellowships, to thank donors who provided the funds, and to provide an opportunity for them to meet each other. Alumna Carol Pletcher also received the University’s Outstanding Alumni Achievement award at the dinner. Pletcher, who has a Ph.D. in biochemistry, is now a vice president at Cargill, Inc.
Meet the class of 2007
Welcome to the 327 freshmen who arrived at CBS this semester. Here’s a little bit about them:

- 61 percent are female; 39 percent are male
- 65 percent are MN residents; 25 percent are WI residents
- 34 percent were in the top five percent of their high school class
- 77 were admitted to the honors program

Welcome, new faculty
Welcome to new faculty who have joined the CBS community over the past few months. They are:

BMBB: Timothy Griffin, Reuben Harris, Romas Kauzlauskas
EEB: Jeannine Cavender-Bares and Jacques Finlay
PBIO: Jane Glazebrook, Fumiaki Katagiri, and Nathan Springer
GCD: Robin Wright, Associate Dean
Microbiology: Ken Vernick

Curriculum Task Force
Associate Dean Robin Wright has convened a task force to review the bachelor of science curriculum and make recommendations for improvement. Their goal is to develop an undergraduate program that will move the University of Minnesota to the forefront of biology education. Toward that end, they will review programs at peer institutions, consult with leaders in biology education, refer to scholarly analyses, and seek input from CBS students and faculty as well as people from other colleges and departments and University administrators.

Agendas, minutes, and other information are posted on the CBS Web site at www.cbs.umn.edu/main/ctf.

PEOPLE
Claudia Neuhauser has been named head of the Department of Ecology, Evolution, and Behavior, replacing Robert Sterner, who stepped down to devote full time to research. Neuhauser, who has been interim head since September, brings many strengths to her new role, ranging from expertise in applied mathematics to leadership in education. She serves as EEB’s Director of Graduate Studies and last year received the Stanley Dagley-Samuel Kirkwood Undergraduate Education Award for her course and textbook “Calculus for Biology and Medicine.”

After earning a Ph.D. at Cornell University in 1990, Neuhauser was on the faculty at the University of Southern California and at the University of Wisconsin, Madison. She came to the University of Minnesota in 1996 (initially in the School of Mathematics) and joined EEB fulltime in 2001. She has also held a faculty appointment at the University of California, Davis.

Jean Underwood was named Director of Student Services this summer by Associate Dean Robin Wright. Underwood oversees recruitment, orientation, registration, advising, residence life, career development, and graduation programs. She is also responsible for strengthening collaboration between Student Services and CBS faculty, as well as University of Minnesota offices that serve undergraduates.

Underwood, who has 25 years of experience in student services, has a B.S. in Sociology and an M.S. in Counseling and Guidance for College Student Personnel from Minnesota State University, Mankato. The search committee, chaired by David Bernlohr, included Sehoya Cotner, Stu Goldstein, Jane Phillips, Jerry Reinhart (Carlson School of Management), Sue Wick, and CBS students Cassie Kistler-Anderson and Chuck Herrick.

Elizabeth Wroblewski joined the Dean’s Office as Chief Administrative Officer in October. She came to CBS from the office of Christine Maziar, Provost and Executive Vice President, where she had been chief of staff since 2002, and previously was deputy chief of staff for former President Mark Yudof. Prior to that, Wroblewski was an administrator at the College of St. Catherine for 16 years. Wroblewski brings a variety of skills and experience to her position, including program development, enrollment management, program review, learning assessment, market research, fundraising, and strategic planning. She will serve as the dean’s “right hand” and work with the CBS community to develop and implement the dean’s vision for the College of Biological Sciences. Wroblewski has an M.A. degree from the University and a B.A. degree from Northland College.
When most of us look at a stream, we see rushing water. When Jacques Finlay looks at a stream, he sees a community on the move. Energy, nutrients, and carbon are constantly cascading from one organism to another and through nonliving reservoirs around them.

Finlay, an assistant professor in the Department of Ecology, Evolution, and Behavior, is fascinated by how these ingredients of life flow through aquatic ecosystems. By studying this flow on a variety of scales, from a drop of water to an entire watershed, he hopes to improve understanding of natural aquatic systems; of systems that have been disrupted through human actions, such as the introduction of non-native species; and of systems facing potential future disruption by forces such as global climate change.

Finlay joined the College of Biological Sciences last January. Although his most recent appointment was in Colorado, much of his research has been in the Arctic, focusing on how energy and materials move from one organism to another in cold environments. His most recent studies have focused on the biogeochemistry of rivers in Alaska and Siberia, comparing how the physical settings and living things interact in each environment to create unique systems. The work he’s doing has direct ties to efforts to understand the implications of global climate change.

Arctic stream ecology, he says, is very different from temperate stream ecology because permafrost limits the flow of groundwater into the stream. “We’re trying to predict how the melting of the permafrost might affect nutrient cycles and carbon cycles,” he says.

Just as rivers flow across diverse terrain on their trip to the sea, Finlay’s work touches a wide range of disciplines. Traditionally, ecologists have tended to focus their analyses on a particular type of system—rivers, lakes, forests, tundra. Finlay’s first love is working at the interface. He’s excited about collaborating with other University of Minnesota scientists as he explores connections and interactions—for example, where land and water meet. “There’s a lot of opportunity for that here, a lot of diverse expertise,” he says.

While continuing his Arctic studies, Finlay is also looking forward to exploring the bountiful waterways of Minnesota. He will begin a meta-analysis next spring synthesizing existing data on aquatic food webs, partly in Minnesota. He plans to explore nitrogen cycling in Lake Superior with CBS colleague Robert Sterner, and potential impacts of climate change on the Mississippi River corridor in collaboration with USGS scientists in LaCrosse, Wisconsin. He’s particularly interested in interfacing his specialty—the biology of flowing waters—with the strong limnology program here. “As an aquatic biologist, this is a great place for me to be,” he says.

—Mary K. Hoff
Yeast raises understanding of human biochemistry

Some are our allies, helping us make bread and beer. Others are enemies, invading our bodies. Friend or foe, yeast are highly valued by CBS scientists who use them to explore fundamental biochemical processes.

“You can do really sophisticated genetic experiments with yeast that you really can’t do with other organisms,” says Deanna Koepp. An assistant professor in the Department of Genetics, Cell Biology, and Development (GCD), Koepp is studying the biochemical regulation of cell division.

“Basically, a single cell of yeast does the same sorts of things a single human cell does,” she says, making her experiments “completely applicable” to hot topics such as cancer prevention.

Some of the laboratories studying yeast are focusing on Candida albicans, which infects and sometimes kills humans. GCD professor Pete Magee is mapping the organism’s genome and studying how it gains genetic variability.

Cheryl Gale of GCD and the Department of Pediatrics, Dana Davis of the Department of Microbiology, and Judith Berman, professor of GCD, are studying other aspects of C. albicans in hopes of reducing its impact on humans.

Most of the yeast researchers here, however, work with Saccharomyces cerevisiae, the yeast used in bread-baking and beer-making. S. cerevisiae’s genome was sequenced in 1996, making it possible for researchers to “very quickly home in on genes that might be interesting,” says Duncan Clarke, assistant professor of GCD.

For Clarke that means genes that control chromosomes during cell division, as well as those that keep cells from dividing before their genes are replicated—a control that’s at the crux of much that goes awry in cancers and mutations. For colleague Anja Bielinsky, assistant professor in the Department of Biochemistry, Molecular Biology, and Biophysics (BMBB), the genes of interest are those that regulate replication. Robin Wright, associate dean, focuses on synthesis of endoplasmic reticulum, which plays a role in making proteins and degrading poisons. BMBB professor Dennis Livingston is looking at how cells repair damaged DNA.

“All of us are addressing specific problems in cell biology and cell metabolism using a large variety of methods,” says GCD assistant professor David Kirkpatrick. “They are all different aspects of the basic way a cell grows and lives.”

Yeast researchers have benefited tremendously from the opening last year of the Molecular and Cellular Biology Building on the Minneapolis campus. Seven yeast labs are all housed on one floor.

“It’s really nice,” says BMBB associate professor Paul Siliciano, who is studying how cells dispose of noncoding portions of DNA during the gene-to-protein translation process. “We have a lot more collisions with each other . . . We talk, also, about things we otherwise wouldn’t talk about.”

Kirkpatrick says the setting has done much to encourage collaboration. He and Magee recently submitted a proposal for a project that will bring his basic research on DNA repair in S. cerevisiae to bear on Magee’s C. albicans work—with potentially profound implications for foiling the virulent species’ ability to develop resistance to antifungal agents. “That never would have happened if he hadn’t been two doors down from me,” Kirkpatrick says.

—Mary K. Hoff
Daniel Bond, from the University of Massachusetts, Amherst, helped create a battery that uses common bacteria to turn organic matter from the ocean floor into electricity. In May he will move his laboratory to the University of Minnesota, where he will work with other faculty on renewable energy.
Fill a mason jar with murky sea water, add a dollop of mud, a few inches of wire, and a graphite electrode, and what do you have? A 4th grade science project? A mess for Mom to clean up?

The surprising answer is an experiment conducted by a group of distinguished scientists at the University of Massachusetts, Amherst showing how to make a battery that uses common microbes to transform organic matter from the bottom of the ocean into electrical energy.

The study was published in *Science* in January 2002. And one of those scientists, an assistant professor named Daniel Bond, will soon be packing up his mason jars and heading for the University of Minnesota.

With $20 million from the Legislature for renewable energy, the University of Minnesota is busy making plans to use the state’s biological resources to produce clean energy and environmentally friendly products as well as boost the economy.

Bond is the kind of young scientist who gets competitive offers from universities nationwide. But he chose the University of Minnesota because, he says, the collaborative opportunities and facilities here give him the best opportunity to grow. Bond will be a member of the Department of Microbiology in the Medical School and the Biotechnology Institute, a joint venture of CBS and IT.

Farmers may be the energy producers of the future.
He will set up his lab in CBS’ Gortner Laboratories, where the Biotechnology Institute and the Division of Microbial Biochemistry are located.

“This is a very good sign that we are on the right track,” says Robert Elde, Dean of the College of Biological Sciences and director of the University’s Initiative for Renewable Energy and the Environment (IREE). “The momentum of IREE is building.”

Bond will join faculty from throughout the University linked by the Initiative for Renewable Energy and the Environment, which was funded by the 2003 Legislature with $20 million from money Xcel Energy provides for alternative energy development. The diverse group includes chemists, engineers, ecologists, microbiologists, agronomists, architects, economists, and policy experts with a common interest in finding environmentally and economically friendly alternatives to energy and products made from fossil fuels. Many have been working independently for a number of years on renewable energy projects. Through IREE, they have found each other and are exploring opportunities to share ideas and resources.

Roger Ruan has patented a technique for making liquid “bio crude” from biomass by “cooking” the biomass with water and a chemical catalyst to dissolve it. The simplicity of the process would make it possible for a grower to take biomass to a local biorefinery and have it converted to bio crude, which could then be transported to another site for further processing.

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A growing trend toward renewables

With this initiative the University and the State have stepped up their commitment of financial and human resources to renewable energy and materials. They join a growing national movement toward renewables driven by dwindling fossil fuel reserves, environmental damage from CO₂ and other pollutants, and Middle East politics. Advances in biotechnology make the transition feasible. And potential economic benefits add to the appeal.

The initiative grew out of parallel efforts that began last fall. Edward Garvey, Deputy Commissioner of Commerce, and Dean Elde began discussing a plan to raise the University’s profile in renewable energy while faculty in the College of Agricultural, Food, and Environmental Sciences (COAFES); Al Sullivan, Vice Provost; and Ken Keller of the Humphrey Institute. Richard Hemmingsen, Government Relations, is interim director, Jennifer Kuzma, Humphrey Institute, is interim associate director. The working group consists of Hemmingsen, Kuzma, Phil Larsen, associate dean of COAFES, and Lanny Schmidt, Regents Professor of Chemical Engineering and Materials Science in the Institute of Technology. The committee has designated four research clusters that reflect high potential areas and strengths within and outside of the University.

• Hydrogen
• Bioenergy and Bioproducts
• Policy, Economics, and Ecosystems
• Conservation and Efficient Energy Systems

The focus is balancing short-term and long-term investments, says Hemmingsen. That means finding ways to put wind and solar energy to work now while research on hydrogen and biomass energy continues.

Minnesota is particularly well positioned to benefit because of the state’s agricultural base, the presence of companies such as Cargill, Cargill-Dow, and 3M, and strength of University programs in agriculture, biocatalysis, microbial biochemistry, chemical engineering and materials science, ecology, and other key fields.

The potential economic benefits of renewable energy are enormous because it means the state can produce its own energy rather than paying billions of dollars a year to import fossil fuels. Redirecting that money to Minnesota energy producers would give the state as a whole an economic boost and could revitalize the rural economy.

Organization and goals

IREE is led by an executive committee that is chaired by Dean Elde and includes H. Ted Davis, dean of the Institute of Technology (IT); Charles Muscoplat, dean of the College of Agricultural, Food, and Environmental Sciences (COAFES); Al Sullivan, Vice Provost; and Ken Keller of the Humphrey Institute. Richard Hemmingsen, Government Relations, is interim director, Jennifer Kuzma, Humphrey Institute, is interim associate director. The working group consists of Hemmingsen, Kuzma, Phil Larsen, associate dean of COAFES, Judd Sheridan, associate dean of CBS, and Lanny Schmidt, Regents Professor of Chemical Engineering and Materials Science in the Institute of Technology. The committee has designated four research clusters that reflect high potential areas and strengths within and outside of the University.

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The executive committee is also looking at how to work with external partners to leverage resources throughout the state to best advantage.

**Hydrogen**

Hydrogen, the simplest and most abundant element in the universe, makes an ideal fuel because it doesn’t produce emissions and is renewable. But it rarely exists alone in nature, so scientists have to find creative ways to separate it from other elements or to produce pure hydrogen.

Hydrogen Cluster co-leader Lanny Schmidt, Institute of Technology, and colleagues in his group are exploring several different approaches. Schmidt is developing chemical methods to turn fossil and renewable fuels into hydrogen while Jane Davidson, also in IT, is using solar energy. Michael Flickinger, a CBS faculty member on sabbatical at Cargill, Inc., is experimenting with phototrophic bacteria encapsulated in latex film. The cells produce hydrogen when they are exposed to light.

Another key issue is developing hydrogen fuel cells. Like a battery, a fuel cell converts energy from a chemical reaction into electricity. Unlike a battery, however, a fuel cell never needs recharging because it has an external fuel source — e.g. hydrogen. Fuel cells will need to be created for a variety of uses, from laptops to cars to buildings. Schmidt hopes that IREE funds also will attract U faculty interested in hydrogen storage and transportation.

**Bioenergy and Bioproducts**

The Bioenergy and Bioproducts Cluster focuses on converting biomass such as corn stover, wood chips, alternative crops, perennials, and organic refuse into fuel and products such as plastics and fibers.

Biomass energy has the potential to greatly reduce greenhouse gases, which cause global warming. Biomass generates about the same amount of carbon dioxide as fossil fuels, but every time a new plant grows, carbon dioxide is actually removed from the atmosphere. The net emission of carbon dioxide will be zero as long as plants continue to be replenished for biomass energy purposes. Growing energy crops would also benefit the state’s agricultural industry.

Cluster leaders are Larry Wackett, College of Biological Sciences; Roger Ruan and Don Wyse, College of Agricultural, Food, and Environmental Sciences; David Kittelson, Institute of Technology; and Donald Fosnacht, UMD. Wackett, head of microbial biochemistry in CBS, has expertise in using microbes, enzymes, and other eco-friendly catalysts to turn biomass into fuel and products. Ruan, who heads the Center for Biorefining, has patented a simple technique for making liquid “biocrude” (biopolylol) from biomass and is developing methods for turning the liquefied biomass into industrial and consumer products such as biodiesel fuel and biodegradable polymers. Kittelson directs the Center for Biodiesel Research. Wyse, former director of the Minnesota Institute for Sustainable Agriculture, looks at developing crops specifically to provide energy. Fosnacht, who is associated with the Natural Resources Research Institute at UM Duluth, works on using forest residue and products as biomass.

**Policy, Economics, and Ecosystems**

David Tilman, Regents Professor of Ecology and a co-leader of the Policy, Economics, and Ecosystems Cluster, calls it the conscience of the initiative.

“We will look at all the costs, including unseen environmental costs; to figure out what’s best for society,” Tilman says. As an example, Tilman points to environmental costs of using nitrogen fertilizers to grow energy crops, such as corn to make ethanol. Nitrogen fertilizers are the main source of groundwater pollution along the Mississippi and responsible for ecosystem damage in the Gulf of Mexico. Corn requires lots of nitrogen.

“There’s lots of potential, but lots of issues. What’s the net gain when costs are weighed against benefits? I haven’t yet seen an example where all costs and benefits were fully considered in the same analysis. That’s where our focus will be.”

Tilman adds that the timing for this effort is good because he believes society wants to make wise choices about energy. And IREE provides an opportunity for engineers, agronomists, ecologists, economists, and policy makers to work together at the beginning of the process.

Other co-leaders are Ken Keller, Hubert Humphrey Institute, and Steve Polasky, College of Agricultural, Food, and Environmental Sciences.
Conservation and Efficient Energy Systems

Greg Cuomo, co-leader of Conservation and Efficient Energy Systems, jokes that this cluster includes “everything else that’s left over from the other three.” For the most part, that means conservation of energy and the integration of all forms of energy into efficient systems for use in buildings, industry, and transportation. The cluster also serves a demonstration role to show how renewable energy can be put to use.

An associate professor of agronomy and plant genetics in the College of Agricultural, Food, and Environmental Sciences, Cuomo heads COAFES’ West Central Research and Outreach Center in Morris. He has a long-standing interest in the potential of renewable energy to revitalize the rural economy. Cuomo planned the new Renewable Energy Research and Demonstration Center at Morris, which was funded with $4 million from the IREE legislation.

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“Conservation and Efficient Energy Systems

Greg Cuomo, co-leader of Conservation and Efficient Energy Systems, jokes that this cluster includes “everything else that’s left over from the other three.” For the most part, that means conservation of energy and the integration of all forms of energy into efficient systems for use in buildings, industry, and transportation. The cluster also serves a demonstration role to show how renewable energy can be put to use.

An associate professor of agronomy and plant genetics in the College of Agricultural, Food, and Environmental Sciences, Cuomo heads COAFES’ West Central Research and Outreach Center in Morris. He has a long-standing interest in the potential of renewable energy to revitalize the rural economy. Cuomo planned the new Renewable Energy Research and Demonstration Center at Morris, which was funded with $4 million from the IREE legislation.

“The purpose of the center is to show what rural Minnesota can do for renewable energy and vice versa.”

—Greg Cuomo

Jane Davidson, professor of mechanical engineering in the Institute of Technology, another co-leader, focuses on solar applications to buildings, and Ned Mohan, professor of electrical engineering, is leading wind research activities in the cluster.

Next steps

IREE is still getting up and running, so examples in each cluster provide only a glimpse of what might ultimately take shape or the source of the energy, from the ocean depths—such as Daniel Bond’s sediment battery—to fields and forests, to the sky.

“The role of cluster leaders is to draw people to this work who have interests beyond their own,” Hemmingsen says.

Toward that end, IREE is soliciting proposals. Grants are available to support cluster activities, new research, matching funds for special opportunities, and educational programs.

A key goal is to leverage funds to attract additional support from state and federal government as well as from industry. While $20 million is “enough to make a difference,” Elde says. “Many states are committing much more, and the reality is that we are competing with them to establish our niche in the renewable energy economy.”

Just when that economy will arrive will likely depend on when energy producers will be able to offer bio-based fuel and products to consumers at prices that are competitive with petroleum products.

“Ultimately, consumers will decide,” says Elde. “Meanwhile, we are preparing for that inevitability.”

—Peggy Rinard

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—Peggy Rinard
Infected with an interest in mosquito-borne diseases

It’s a typical rainy season morning in the West African country of Mali and Kenneth Vernick is intently stalking *Anopheles gambiae*, the mosquito that transmits malaria. He finds a blood-bloated female hiding behind a rafter and stows it away. Later he will take his quarry to a facility where he’ll raise its offspring and screen them for resistance to the parasite that causes malaria. Vernick is determined to find out how resistant mosquitoes kill the parasite.

When the rainy season is over in Mali, Vernick usually returns to his laboratory at New York University. But this year he settled into the Cargill Building for Microbial and Plant Genomics at the University of Minnesota, where he and his research group are continuing their efforts to prevent malaria, which ranks with HIV and tuberculosis as one of the world’s top three infectious diseases. Vernick holds an appointment in the Department of Microbiology and is a member of the Center for Microbial and Plant Genomics (CMPG).

“We accepted the invitation because the University of Minnesota has expanded capabilities in genomics,” Vernick says. “We can accomplish more faster with technology and expertise here.”

Vernick came by his interest in malaria the hard way. Working between college (University of Maryland) and graduate school (National Institutes of Health) as a biologist in the Everglades, he contracted a mosquito-transmitted virus and became as sick as he had ever been in his life. The experience left him with sympathy for people who suffer from such diseases and an awareness of the amount of work needed to prevent them.

The malarial parasite, which kills mostly children in developing countries, lives in a cycle of transmission between humans and mosquitoes. Scientists have recently sequenced the genomes of all three: human, mosquito, and parasite. By identifying two mosquito genes that confer resistance to the parasite, Vernick and his team played an important part in that work. (See “Genetic Loci Affecting Resistance to Human Malaria Parasites in a West African Mosquito Vector Population,” Oct. 4, 2002 issue, *Science*.) Now they are ready to use the power of genomics, proteomics, and computational biology to find all the natural resistance genes and learn how they enable mosquitoes to kill the parasite.

Training Malian scientists is integral to the effort. Vernick works closely with colleagues at the University of Mali and travels there during the rainy season, when mosquitoes breed and malaria is transmitted. During the dry season, Malian scientists come to the United States. His work could contribute to the eradication of malaria by one or more of three routes: 1) creating resistant mosquitoes in the wild, rendering them unable to trans-
If you could capture Erik Pratt’s energy, it just might make a promising source of renewable fuel.

By day, Pratt (B.S. Ecology, ’97) is manager of Energy Alley, a program of the non-profit Minnesota Environmental Initiative, but evenings and weekends he leads an equally full life as a musician. He plays piano professionally, studies piano with local jazz artist Nachito Herrera, is a singer at St. Paul’s Cathedral, and is an active member of the Twin Cities ballroom dancing scene.

“I like to be out every night,” says Pratt, who began his academic career with a bachelor’s degree in piano performance from Westminster Choir College (Princeton, New Jersey). “If for some reason I find myself home for an evening, I get restless and just want to get out and enjoy life.”

Erik grew up in New Brighton, Minnesota. From an early age he aspired to a career in music, but in his early 20s his growing awareness of environmental issues led him back to Minnesota and to the College of Biological Sciences as an ecology major. [Coincidentally, Erik’s uncle, Douglas Pratt, is professor emeritus of plant biology in the College of Biological Sciences.] At CBS, Erik was particularly influenced by John Tester’s course on Minnesota ecology.

“Tester’s book, Minnesota’s Natural Heritage, strongly resonated with me because I was already used to understanding my interests in terms of heritage, such as musical heritages from around the world and the Scandinavian traditions I grew up with. There are challenges to understanding both cultural heritage and natural heritage in the context of modern life. These challenges interest me very much.”

Following CBS, he received an M.S. degree from the University of Wisconsin, Madison, with a focus on energy policy and analysis. “Energy is one of the strongest links between modern life and our natural heritage. The use of energy defines our modern living standard, yet it has a major impact on the environment.”

Since 2001, Erik has been manager of Energy Alley, one of five programs of the Minnesota Environmental Initiative (MEI), a non-profit organization dedicated to providing solutions to environmental problems by building partnerships among business, non-profit advocates, and government.

Energy Alley uses MEI’s partnership approach to promote development of clean and efficient energy technology in Minnesota. “Environmental problems are increasingly complex and the solutions are often elusive,” Pratt says. “The partnership model is the only way to move forward for some problems.”

Erik is currently building a partnership among research institutions, businesses, government, and non-profits to prioritize energy research in Minnesota. The University’s new Initiative for Renewable Energy and the Environment, with leadership from Dean Elde—who also serves as an Energy Alley board member—is helping to create the partnership.

“Solutions to our energy issues require new technologies. The University of Minnesota is providing leadership by connecting biotechnology, engineering, ecology and public policy together to develop these solutions.” Pratt says.

Erik hopes that some day he can look back and see that his work in energy has had a role in bridging the gap between our natural heritage and our modern lives. That would really be something to sing about.

—Peggy Rinard
Mentor Program doubles

Each year the College of Biological Sciences enlists alumni and friends as mentors to help students prepare for life after graduation. This year, the Mentor Program matched more than 140 students with mentors; a 100 percent increase over 2002. CBS would like to thank everyone who shared their time and experience with CBS undergraduate students this year.

Joanna Abrams
Mary Ahrens
Jeremy Alley
Michael Ameli
Peter Anderson
Michelle Arnhold
Monica Arroyo
Sheryl Aurandt
Carolyn Bagne
Lana Barkawi
Roxann Barnes
Kyle Baron
Jennifer Blair
Susan Block
Christine Boryczka
Leslie Brandt
Lillian Burke
Laura Bursch
Dawn Cameron
Jeff Carpenter
Kent Cavender-Bares
Marlene Cepeda
Goodwin
Timothy Conner
Meggan Craft
Deanna Croes
Jolene Dalton
Steve Debol
Melissa Deeg
Tony Dodge
Earl Dunham
Ray Dybzinski
Stephen England
Kathy Ensrud
Gunnar Erickson
Matthew Finke
Carolyn Fletcher
Joseph Fong
Allen Frechette
Zachary German
Brian Golob
Amy Groszbach
Shawn Groth
Keli Hadsall
Deb Heim
Curt Henry
Amy Hentges
Katherine Himes
Nathan Hoffman
Laura Huseby
Carleen Jogodka
Jane Johnson
Mary Kemen
David Kettner
Alexander Khoruts
Amy Kizer
Jennifer Klein
Rebecca Krenz
Mark Labenski
Kathleen Lacasse
Phil Lawonn
Bonnie LeRoy
Vanessa Lopes
Michael Loushin
Dawn Lowe
Lisa Lund
Nathan Magarvey
Sam Martin
Michael Martinez
Maureen McDonnell
Dale McHugh
Leila Midefort
Jim Moldenhauer
Kristen Mueller
David Nascene
Jessie Nelson
Pamela Nelson
Cheryl Neudauer
Bryan Nikolai
Tamara Nissen
Lance Olson
Connie Osbeck
Nancy Ott-Pinckaers
Rich Peter
Laura Phillips
Douglas Pratt
Jon Rechtiene
Kent Reed
Karen Reese
Ryan Ritchie
Lowell Rushmeyer
Shari Rybak
Amy Schmidt
John Schnickel
Chris Schoonover
Lisa Schweizer
Paul Score
Jennifer Seffernick
Stephanie Seliga
John Severson
Kevin Silverstein
Bobbi Sisco
Alicia Sivitz
Pam Skinner
Jennifer Smith
Tanya Smutka
Andrew Snyder
Tim Starr
Jelena Svircev
Joseph Thurn
Amy Timmers
John Twomey
Katy Van Patten
Angie Vasquez
Sarah Wanner
Marc Weber
Fred Wesely
Marie Wheeler
Kyle Whitingham
Elizabeth Williams
Bruce Withuhn
Jennifer Zimdars

Class Notes

David Ditcher [M.S. in Botany, 1960] presented a keynote address at the annual meeting of the German Botanical Society, held in September 2003 in Frankfurt, Germany. The talk, entitled “Searching for the First Flower in the World,” focused on ancient flowers in Northeast China and reproductive biology of flowering plants.

Roy Hammerstedt [Ph.D in Biochemistry, 1968] is president of a new company called ADP Life Sciences. ADP’s vision is to accelerate the market readiness of proprietary life science technologies that improve quality of life and health. Located in Pennsylvania, ADP was founded in 2003.

Shelley Steva [B.S. in Zoology, 1975] is in her fourth year of teaching science at Red Lake County Central School in Plummer, Minnesota. She is happy that her daughter is a freshman at the University of Minnesota majoring in environmental science.

Huan Ngo [B.S. in Microbiology, 1986] is a science teacher at Sheridan Communications and Technology Middle School in New Haven, Connecticut. He is equipping the school’s lab for biomedical science and biotechnology in order to introduce students to leading-edge science in these fields.

David Blehert [B.S. in Biology, 1993] recently completed a postdoctoral research fellowship at the National Institutes of Health in Bethesda, Maryland. He is relocating to Madison, Wisconsin to manage the diagnostic bacteriology laboratory at the National Wildlife Health Center, which is part of the United States Geological Survey. David, his wife, Regina, and their daughter, Mirra, are excited to be moving back to the Midwest.

Charles Johnson [B.S. in Microbiology, 1996] moved to Ames, Iowa this winter to start a combined residency and Ph.D. program in veterinary pathology at the Iowa State University Veterinary College.

Mark Schoenbeck [Ph.D. in Plant Biological Sciences, 1997] was appointed assistant professor in the biology department at the University of Nebraska, Omaha. Mark teaches biology, writing, and plant physiology at the undergraduate and graduate levels.

James Ross [B.S. in Biochemistry, 2003] is pursuing an M.D. at Harvard Medical School.

Have news to share with fellow alumni? Send by e-mail to Emily Johnston, ejohnsto@cbs.umn.edu.

Join the UM Legislative Network

The Legislative Network is a coalition of volunteers who are committed to educating elected officials about the importance of the University of Minnesota to the state.

After a long history of alumni involvement in legislative advocacy on behalf of the U, the University of Minnesota Alumni Association created the Legislative Network more than 15 years ago. The Network has worked to keep alumni, students, faculty, staff, and community involved in important University initiatives at the Legislature.

To get involved, visit the new Legislative Network Web site, www.supporttheumn.edu.

UMAA plans 100th birthday bash

Join CBS alumni and the University community as we celebrate the University of Minnesota Alumni Association’s 100th birthday on January 30, 2004. Mark your calendars today.

Your membership makes a difference. UMAA and the Biological Sciences Alumni Society are your lifelong connection to the University of Minnesota and the College of Biological Sciences. You can join by visiting www.alumni.umn.edu/society-cbs, or by calling Emily Johnston at 612-624-4770.

—Emily Johnston
Nature of Life program introduces freshman to CBS

Freshman Aaron Charlson grew up in Mitchell, South Dakota, home of the self-proclaimed “world’s largest” Corn Palace. (You may have seen the corny billboards along the interstate: “Ear-chitecture,” “You’ll be a-maized,” “Ears to you.”) While he may not brag about this most kitschy of tourist traps, growing up in Mitchell did have its advantages, like an inherent sense of comfort and a history with friends.

Those are two of the benefits Charlson gained from The Nature of Life, the College of Biological Sciences’ new summer introductory program. The program offers incoming freshmen the chance to live, study, and socialize in small groups with faculty and student peers for three days at the Itasca Biological Station and Laboratories.

For Charlson, it helped soothe his apprehension over moving to the big city and entering a large university. “It was comforting to come from a small town to a large school and feel like I was a name and not just a number,” Charlson says. “I still keep in contact with a lot of people I met there. Those are my friends.”

“Nature of Life provided the opportunity to meet people that you have class with, so when I go to a biology lecture, I can sit next to friends,” he adds.

The program helps students form relationships with their peers and with faculty. It also provides an intensive introduction to biology. Hands-on, small-group seminars explore various aspects of the biological sciences including field biology, molecular and cellular biology, and genetics and cell biology.

Those touch on the nature of life. Other sessions, led by peer mentors, address U of M traditions and the nature of college life, covering topics such as survival skills, curriculum planning, and research opportunities in biology. Once school starts in the fall, students complete their one-credit Nature of Life experience with follow-up assignments like interviewing a faculty member, attending various events, reflective essays, and writing an academic plan.

“It was a pleasure to meet each batch of students on the first evening and watch them open up to each other as they became part of the CBS community over the next three days,” says John S. Anderson, former interim dean, who was involved in developing the pilot for Nature of Life. “I expect that the college will see benefits from NOL far into the future in terms of improved retention and graduation rates, heightened identification with CBS, and ultimately dedicated alumni.”

For students, the program goes a long way toward delving into new friendships. “It was amazing how many people I recognized the first week of school, and I’ve heard a lot of people say the same thing,” says Madeline Teisberg, a first-year student from Inver Grove Heights, Minnesota. “I was nervous because I didn’t know anybody, going into it.”

According to Sarah Endrizzi, the coordinator of Nature of Life, the transformation from nervousness to comfort is clearly expressed on the bus rides to and from Lake Itasca. Says Endrizzi: “The first 10 minutes of that bus ride are pretty quiet, and then the students gradually get to know each other, they form friendships, and by the end of the third day, you come home on the bus and you can’t get them to stop talking.”

—Rick Moore
Tuition hikes increase scholarship needs

Campaign Minnesota raised $1.65 billion, which is the second highest amount ever raised by a public research university. But it didn’t solve all of the University’s financial problems.

As private contributions [which are designated for specific purposes] increased over the seven years of the Campaign, state support decreased. This is not unique to Minnesota. Public universities across the country are seeing support from state governments dwindle. All are forced to raise tuition and to knock harder on doors of corporations, foundations, and individuals to maintain the quality and affordability of a public university education.

The University of Minnesota has been forced to make double digit increases in tuition for the past four years. Tuition is now $6,562 a year. Add room, board, and books and the real cost is more than double. An undergraduate would have to work 55 hours a week at minimum wage to pay their way through college. And tuition is expected to continue increasing.

At the same time, CBS is getting more applicants with higher qualifications than ever before. One third of the freshman class graduated in the top five percent of their high school class. Many students interested in CBS get offers from other schools that have more scholarship resources.

“To continue attracting top students, we need to give our students more financial support,” says Dean Robert Elde. “That means we need to renew our commitment to increase our scholarship endowment. Because we are a young college, that endowment is relatively low – only $2 million. To remain competitive with other schools, we need to raise that to at least $10 million.”

Campaign Minnesota may be over, but CBS’ campaign to provide the best education we can—and to make it affordable to the best and brightest students—continues.

James Ross, who received the Stanley Dagley Undergraduate Scholarship, is now a first-year student at Harvard Medical School.

An undergraduate would have to work 55 hours a week at minimum wage to pay their way through college.

Tuition Facts

Tuition Increases:
- Fall 2001, 11 percent
- Fall 2002, 13 percent
- Fall 2003, 15 percent.

Tuition: Resident undergraduates pay approximately $6,562 a year. Non-Residents pay approximately $18,193 a year.

Corporate Support:
Companies often ask about participation rates from alumni and friends. They use these numbers to determine their level of support to the University. Even modest support from alumni and friends can lead to millions of dollars in corporate support.

State Support: Support from the State of Minnesota is rapidly on the decline. Currently the U receives approximately 30 percent of its budget from the state.

Working Students:
According to the Minnesota Student Survey (Spring 2001), approximately 76 percent of Twin Cities respondents work while attending college.

Paying for Tuition: An undergraduate student would have to work 55 hours per week at minimum wage to pay the cost of attending college.
CBS Calendar

UMAA’s 100th Birthday Party
Friday, January 30, time TBD
McNamara Alumni Center
www.alumni.umn.edu

Alumni Brewery Tour
Saturday, February 21, 1–3 p.m.
Summit Brewing Company
$10 per person
For more information or to register, go to cbs.umn.edu and click on Alumni and Friends.

CBS Career & Internship Fair
Friday, February 27, 11–3 p.m.
McNamara Alumni Center
http://www.cbs.umn.edu/main/careerfair/

Mentor Program Reception
Tuesday, April 13, 5:30–7:00 p.m.
McNamara Alumni Center

CBS Year-End Picnic
Friday, May 7, 12 noon–2 p.m.
Snyder Hall Lawn

Commencement
Saturday, May 15, 7 p.m.
Northrop Auditorium

St. Paul Saints Game & Tailgating
Day and time TBD
Midway Stadium

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

Construction on UEL incubator begins in February, 2004

University Enterprise Laboratories (UEL) has raised $6.75 million of $9 million needed to begin renovation of the building purchased by the City of St. Paul to serve as an incubator for start-up biotech companies. Contributors are Xcel, the City of St. Paul, 3M, Medtronic, and the University. The $9 million is needed as a down payment to secure additional loans for the $19 million project. Architects are planning the renovation, which is scheduled to start in February. Construction will be completed in late summer. The building is located on the transitway between the St. Paul and Minneapolis campuses. UEL is a nonprofit entity separate from the University. Robert Elde, CBS Dean, is chairman of the board.