America’s Next Top Biologists

Quality education, research opportunities and a sense of community are attracting model students to CBS.

*story on page 8*
The best biology program in the U.S.

The College of Biological Sciences is attracting some of the most qualified students at the University of Minnesota. Our “average” freshman graduated in the 95th percentile of his or her high school class and scored 28.6 on the ACT. Many chose CBS over other top schools around the country.

This didn’t happen by accident. Our goal is to provide the best undergraduate biology program in the United States. Over the past decade, we have been working toward that goal by increasing opportunities for student research, strengthening the curriculum, and improving the undergraduate experience with innovative programs. One example is Nature of Life, a three-day summer class at Itasca where freshmen get to know each other, our faculty and our curriculum before stepping into a classroom. Last May, when the first class to go through Nature of Life as freshmen graduated, our four-year graduation rate jumped by 13 percent.

But we are not resting on our laurels. We are continuing to look for innovative ways to make our undergraduate program even better. This year, we launched a new course called Foundations of Biology. In this class, students cover textbook material on their own and work in groups to apply the knowledge to solve real problems such as how to create a vaccine for West Nile virus.

Our next step is to give students more opportunities to participate in international research. We are exploring the possibility of creating a global laboratory using faculty with established research programs in Costa Rica, Papua New Guinea, Tanzania, Norway and the Galapagos Islands. By tapping into this network, students could monitor the effects of climate change and other environmental problems in different parts of the world. Our field stations at Cedar Creek and Itasca would serve as the hub of this network.

Our guiding principle is to question “business as usual” in order to continuously transform our undergraduate program and give our students the best education possible. We know they’re up to the challenge. I encourage you to read about our amazing freshman class in the cover story, which begins on page 8.

Robert Elde, Dean
College of Biological Sciences
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**Cover Story**

**Model Students**

The class of 2011 is the most qualified in CBS’ history. Learn why they chose CBS over other top schools nationwide.

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**Model Students**

The true cost of biofuels

A very useful genome
Research efforts led by the BioTechnology Institute’s Daniel Bond and Jeffrey Gralnick have resulted in a key finding about how bacteria convert organic compounds into electricity. The researchers discovered that riboflavin (commonly known as vitamin B-2) is responsible for much of the energy produced by Shewanella bacteria.

“This is very exciting because it solves a fundamental biological puzzle,” Bond says. “Scientists have known for years that Shewanella produce electricity. Now we know how they do it.”

Shewanella, commonly found in water and soil, can convert simple organic compounds into electricity. The discovery means Shewanella can produce more power simply by increasing riboflavin levels. The finding also opens up multiple possibilities for innovations in renewable energy and environmental clean-up.

The interdisciplinary research team, which included several students, showed that bacteria growing on electrodes naturally produced riboflavin. Because riboflavin was able to carry electrons from the living cells to the electrodes, rates of electricity production increased by 370 percent as riboflavin accumulated.

Scaled-up “microbial fuel cells” using similar bacteria could generate enough electricity to clean up wastewater or power remote sensors on the ocean floor. But more ambitious applications, such as electricity for transportation, homes or businesses, will require further advances in biology and in the cost-effectiveness of fuel cell materials.

“A common bacterium found in soil and water can be used to convert a chemical into nanotubes that conduct electricity and light. The environmentally friendly nanotubes have a variety of potential uses in electronics.

The discovery was made by a multinational team of scientists, including Michael Sadowsky, of the BioTechnology Institute. The bacterium, Shewanella sp. strain HN-41, has the unique ability to convert arsenate into arsenic sulfide nanotubes. This is the first time these specialized nanotubes have been produced by biological rather than chemical means.

“Nanotubes can be used to make fuel cells, batteries, biosensors, and a variety of other devices, such as novel semiconductors that could not be made by other means,” Sadowsky says. “This is a very exciting discovery.”

The study’s lead author, Hor-Gil Hur, from Gwangju Institute of Science and Technology in South Korea, is spending this academic year as a visiting scholar at the University of Minnesota.

“Scientists have known for years that Shewanella produce electricity. Now we know how they do it.”

—Assistant professor Daniel Bond
polysaccharide called succinoglycan, the plant responded by turning off defense genes. This showed that plants sense the presence of succinoglycan, which serves as a pass code to allow these beneficial bacteria to infect the plant.

Menopause unique to human primates
[Current Biology | 12.19.07]
Female chimpanzees and female humans stop reproducing at about the same age, but only human females go through menopause and continue to live for an extended period. Female chimpanzees tend to survive only as long as they are fertile. Only very fit chimpanzees who maintain high birth rates late into life have long lives.

Anne Pusey, director of the University of Minnesota’s Jane Goodall Institute’s Center for Primate Studies, co-authored the study reporting these findings. Melissa Thompson, a former student of Pusey’s now at Harvard University, was lead author.

Human menopause appears to be unique because the reproductive system declines much faster than other systems, leaving an extended post-reproductive period for many women. To gain insights into human menopause, Thompson teamed up with researchers from six chimpanzee research sites across Africa, including Gombe National Park, where Jane Goodall began her pioneering work in 1960.

The group found that chimpanzee and human birth rates show similar patterns of decline after the age of 40, suggesting that the “biological clock” has been relatively conserved over the course of human evolution. Other studies have shown that gorillas and apes do not experience an extended post-reproductive lifespan either. But the adaptive reason for human menopause remains unclear.

Prostate cancer and race not linked
[Anticancer Research | 8.21.07]
While prostate cancer appears to be more aggressive in black men than in white men, a study conducted by Akhouri Sinha, professor of genetics, cell biology and development, does not support that notion. In fact, what appears to be greater aggressiveness is likely the result of inferior treatment.

In previous studies, prostate tumors in black patients tended to be larger and more advanced, and black men had higher blood levels of prostate specific antigen (PSA), a substance produced by the prostate that, at high levels, points to the possibility of prostate cancer. But, according to the study, all these criteria are interrelated and could be the result of delayed diagnosis or medical care.

“Our data shows that among patients receiving similar treatment, African-Americans did not follow up with their doctors as consistently as Caucasians,” Sinha says. “In addition, Caucasian patients were four times as likely to receive additional treatment after prostatectomy.”

A new target for cancer treatment
[Molecular Biology of the Cell | 10.07]
CBS researchers have found a new molecular target that has potential for treating cancer.

Assistant Professor Anja-Katrin Bielinsky and graduate student Sharbani Chattopadhyay, both in the Department of Biochemistry, Molecular Biology and Biophysics, have discovered a protein (Mcm10), which regulates a subunit of DNA Polymerase that prevents DNA damage during replication. Depletion of Mcm10 in human tissue culture leads to massive DNA damage and induces apoptosis (cell death).

The researchers believe Mcm10 could be used as a drug target for treating cancer because downregulating production of Mcm10 causes cells to die.

Discovery will advance fight against AIDS
[Nature.com | 2.08]
Hiroshi Matsuo and Reuben Harris, assistant professors in the Department of Biochemistry, Molecular Biology and Biophysics, have determined the molecular structure of APOBEC3G—a protein that inhibits the AIDS virus, HIV. The landmark discovery will help researchers engineer APOBEC3G to develop new treatments for HIV and AIDS.

Low-level nitrogen pollution slowly killing plant species
[Nature | 2.7.08]
The number of plant species worldwide may be dwindling from the effects of chronic low levels of nitrogen on terrestrial ecosystems, according to a study by Christopher Clark, a former graduate student, and David Tilman, Regents Professor of Ecology.

Research was carried out at Cedar Creek Ecosystem Science Reserve. “Even at low levels, comparable to nitrogen deposition over many industrialized nations, we lost about one plant species in six at our test site [17 percent over 23 years],” Clark says. But Clark and Tilman also discovered some good news—that the loss of species can be reversed. Thirteen years after addition of nitrogen was stopped, species numbers had recovered.
Ted Davis tapped to lead the BioTechnology Institute

University of Minnesota Regents Professor Ted Davis has been named director of the BioTechnology Institute (BTI)—a joint effort of the College of Biological Sciences and Institute of Technology.

"With research in biofuels and renewable energy moving to the international forefront, the work done at BTI, especially in the area of biocatalysis, is more critical than ever," says Robert Elde, dean of the College of Biological Sciences. "Ted Davis brings the leadership and expertise needed to create momentum behind the University’s initiatives in these areas of research.”

Davis has been a faculty member in the University’s Department of Chemical Engineering and Materials Science since 1963, serving as department head for 15 years. In 1995, he was named dean of the Institute of Technology and served nine years in that role before leaving the post in 2004. In his new position, Davis will lead efforts to boost interdisciplinary research for new and innovative sources of renewable energy.

New book puts evolution-creationism controversy in context

A new book co-authored by faculty members Mark Decker and Randy Moore traces the history of the evolution-creationism debate back to the mid-19th century. More Than Darwin: An Encyclopedia of the People and Places of the Evolution-Creationism Controversy provides descriptions of significant personalities, places and organizations across the social and scientific spectrum involved in the long history of evolution versus creationism. “When you look at the controversy it pulls from so many areas—age of the earth, free speech, constitutional issues, science issues,” says Moore. “The entries in the book range from theological to political to science, but they are all important.”

CBS student wins recognition for leadership roles

Anh Tran, a senior majoring in neuroscience and psychology, received two awards for her achievements as a student leader: the 2008 President’s Student Leadership Award and the Donald R. Zander Award for Outstanding Student Leadership.

During her tenure as a CBS undergraduate, Tran has been involved in numerous student organizations including the Deans’ Scholars Program, CBS Student Board, Fairview Volunteer Advisory Committee, Vietnamese Student Association and Biology Without Borders, a group she helped organize.

“I have learned that leaders inspire others to step out of their comfort zones,” says Tran, “to become more active members in their communities and take actions that they otherwise would not have.”

Biotechnology leader to speak to class of ’08

Steven Burrill, a leader in the biotechnology industry and CEO of Burrill & Company, a life sciences merchant bank and venture capital firm, will speak at this year’s Commencement ceremony. Burrill has been named a top biotech investment visionary by Scientific American and he serves on numerous biotechnology company boards.
Four CBS faculty named AAAS fellows

Robert Herman, John Lipscomb, Judith Berman and Stephen Polasky were among seven University of Minnesota faculty recently named fellows by the American Association for the Advancement of Science. Berman received the recognition for significant advances in the field of genomics; Herman for developmental genetics; Lipscomb for contributions to metalloenzymology; and Polasky for his work on environmental economics.

Nest installed on CBS building to lure fairgrounds falcons

Professor Emeritus Harrison “Bud” Tordoff, who taught in the Department of Ecology, Evolution and Behavior for nearly 20 years before retiring in 1988, led a recent effort to install a nest box on top of the Biological Sciences Center on the U’s St. Paul campus. His goal: to lure a pair of peregrine falcons from their current roost in the Minnesota State Fairgrounds.

“A pair of falcons has nested on the Space Tower at the fairgrounds for years with no success in fledging any young,” says Tordoff. “Peregrines like high places. So we thought a box on top of the Biological Sciences building would give them another maybe better option.”

Tordoff and others have been watching the local peregrine population closely during its slow recovery from the DDT era. With assistance from the Bell Museum and University facilities staff, the new nest box was installed this spring. While the peregrines in question have yet to relocate, the benefits of having the falcons literally on-site are considerable. Says Tordoff: “We see a nesting pair there as a huge asset for classes and research projects.”

CBS senior wins Fulbright to Finland

Plant biology major Brian Arnold has been awarded a Fulbright Grant to Finland for 2008-09. Arnold will spend the year at the University of Oulu working in the laboratory of Outi Savolainen, a renowned plant genetics researcher who is studying the genetic basis for adaptation in flowering time in the plant Arabidopsis lyrata.

Judith Berman receives U distinction

Judith Berman, in the Department of Genetics, Cell Biology and Development, has been named a 2008-10 Distinguished McKnight University Professor in recognition of her outstanding contributions as a researcher and teacher. Berman is a leader in the study of yeasts. Her work spans genetics, cell biology, genomics, microbiology and systems biology. Among her accomplishments, Berman has identified a major new mechanism of resistance to antifungal drugs and is using that breakthrough to develop new tools for preventing of this important clinical problem.

McKnight Land Grant awards go to assistant professors Bee and Wilson

Mark Bee and Michael Wilson, both assistant professors in the Department of Ecology, Evolution and Behavior, have been named McKnight Land Grant Professors. The award, which goes to promising junior faculty, includes a research grant and the option of a year’s leave to pursue research.

Bee’s research draws on mechanistic and evolutionary studies to answer fundamental questions about animal communication. Wilson, who has a joint appointment in the Department of Anthropology, uses data collected over four decades to better understand intergroup aggression and vocal communication in chimpanzees.
Running up the carbon debt

Turning pristine land into biofuel farms could make global warming worse

Swiching from fossil fuels to renewable biofuels is supposed to mitigate global warming, not make it worse.

Yet that’s what happens when native ecosystems are converted into “farms” for biofuel crops, according to a study by the University of Minnesota and the Nature Conservancy published online in Science on February 7. The researchers document how clearing rainforests, peatlands, savannas or grasslands to make way for biofuel-yielding croplands emits large amounts of carbon that add to the atmosphere’s already heavy burden of greenhouse gases.

The work shows that biofuels produced this way can cause more emissions than gasoline.

In places like Brazil, Southeast Asia and the United States, pristine land is being cleared and planted with corn or sugarcane to produce ethanol, or with palm trees or soybeans to produce biodiesel. The carbon, stored in the original plants and soil, is released as carbon dioxide when that organic matter decays, which can take 50 years or longer.

The land conversions pump out 17 to 423 times more carbon than the annual savings from replacing fossil fuels with biofuels. This constitutes a “carbon debt” that the biofuels produced on the land must pay off before they can begin to cut greenhouse gas emissions.

In the worst case the researchers examined, converting peatland rainforests in Indonesia into palm oil plantations ran up a carbon debt that would take 423 years to pay off. The next worst was soybeans in the Amazon, which wouldn’t “pay for themselves” in renewable soy biodiesel for 319 years. The conversion of U.S. grasslands for corn ethanol and Indonesian rainforests for palm biodiesel also ran up big carbon debts.

“The research examines the conversion of land for biofuels and asks the question, ‘Is it worth it?’” says lead author Joe Fargione, a scientist for the Nature Conservancy. “Surprisingly, the answer is no.” Fargione began the work as a University postdoctoral researcher with Stephen Polasky, applied economics professor, and David Tilman, Regents Professor of Ecology; both are co-authors of the paper.

A better alternative, the researchers say, is making biofuels from waste plant material such as corn stover or from native grasses and woody plants grown on marginal lands unsuitable for crops.

“Biofuels made from perennial crops grown on degraded land that is no longer useful for growing food crops may actually help us fight global warming,” says co-author Jason Hill, a research associate in the Department of Applied Economics. “One example is ethanol made from diverse mixtures of native prairie plants. Minnesota is well poised in this respect.”

Tilman adds that “biofuels made from waste biomass or from biomass grown on abandoned agricultural lands planted with perennials incur little or no carbon debt and offer immediate and sustained greenhouse gas advantages.”

Co-author Peter Hawthorne located numbers used in the calculations, conducted a statistical analysis, and linked the research to global and regional patterns of land use and availability. — Deane Morrison
Imagine a one-celled organism that behaves like an animal, but photosynthesizes like a plant. A treasure trove of evolutionary insight? A valuable tool for studying fundamental characteristics of multicellular plants and animals? Yes, and yes. But no need to imagine. This amazing creature really exists—in the form of Chlamydomonas reinhardtii, a microscopic alga that informs research in everything from understanding kidney disease to reducing the threat of global warming.

“It’s like Al Capp’s Shmoo,” says Pete Lefebvre, professor of plant biology and an internationally renowned expert in Chlamydomonas genetics. “Its whole purpose was to be useful. A Shmoo could transform itself into anything its human wished for. Chlamydomonas has that kind of versatility for researchers.” [For those not familiar with L’il Abner, Al Capp’s Shmoo was a popular character during the 1950s in the long-running comic strip.]

Chlamydomonas’ value as a research subject took a giant leap forward last fall with the publication in the October 12 Science of the alga’s DNA sequence by an international team of researchers. Lefebvre and two other CBS faculty played key roles: Lefebvre isolated the DNA used for the sequencing effort. Anton Sanderfoot, assistant professor of plant biology, helped figure out the function of hundreds of the 15,256 genes identified through the effort. Carolyn Silflow, professor of plant biology, developed links between the Chlamydomonas genetic map and the genome sequence.

The genetic sequencing of the Chlamydomonas genome is particularly exciting because the alga is pertinent to so many areas of investigation. Chlamydomonas sits at the point in the evolutionary tree of life where green algae and land plants diverged, so the sequencing “provides a nice bridge between unicellular and multicellular plants, plus a connection to the rest of things that aren’t plants,” Sanderfoot says. Because it has a chloroplast, is single-celled, and is easy to grow and maintain, the alga is a superb subject for exploring plant biochemistry. The parts that propel it—a pair of flagella sprouting out its front end like little wiggly legs—are virtually identical to cilia that are movers and shakers in many mammalian organs, so it also makes a great model for studying various human diseases that arise from faulty functioning of such structures. In recent times, Chlamydomonas’ photosynthetic and hydrogen-producing capabilities have earned it a top spot in research aimed at producing renewable fuels and mitigating global warming as well.

Knowing the DNA sequence, Silflow says, makes it possible for researchers to adopt new and productive approaches to advancing these diverse lines of inquiry. “It allows us to interpret our research and plan our experiments in a much different way,” she says.

Lefebvre and other scientists around the world, for example, are delving into the DNA database using a computer tool called a BLAST search to look for genes found in both Chlamydomonas and other organisms. These genes can be studied to inform our understanding of—and potentially ability to repair or improve—the function they facilitate.

“At the same time [the genome] is useful in and of itself,” Sanderfoot adds. “It tells you a lot about how things came to be.” —Mary Hoff
“If you put students first everything else falls into place.”
—Dean Robert Elde
With a perfect score on his ACT, freshman Alex Yeh, from Neenah, Wisconsin could have chosen almost any college or university in the United States. But it was the College of Biological Sciences at the University of Minnesota that ultimately won him over.

Alex was drawn to the University of Minnesota by its urban environment and research opportunities. After visiting the College of Biological Sciences, he liked its small size and friendliness.

Since he arrived at CBS this fall, Alex has appreciated the effort the college makes to engage him and other students in activities and events.

"The faculty and staff at CBS really go out of their way to treat students as individuals rather than a group," he says.

Alex is one of 325 students in the College of Biological Sciences 2007-08 freshman class. Like Alex, they all have impressive academic credentials. Their average high school rank was 95.3 percent (the highest average rank of any U of M freshman-admitting college this fall) and their average ACT score was 28.6. That puts CBS at the head of the University of Minnesota's freshman class this year. And this isn’t just any year. The 5,280 freshman who entered the University this fall are the most academically prepared in its history. Moreover, with 21 percent students of color, the CBS freshman class is very diverse.

It’s no accident that CBS is gaining a reputation in the Midwest and beyond as the place to go for biology. It’s one of only a few colleges in the United States devoted exclusively to biology. It spans all areas of biology, from molecules to ecosystems. As a small college within a big public research university, it offers the best of both worlds. And a series of innovative programs launched over the past decade have dramatically enhanced the quality of the undergraduate experience.

CBS’s growing reputation resulted in 3,800 applicants last year and more than 4,300 this year—a record number.

"The numbers confirm that we made the right choices for our students," says Robert Elde, dean of the college. "I can’t tell you how gratifying that is."

"There’s a lot of interest in CBS among high school students," says admissions counselor Leah Brus. "Its reputation is attracting students from across the United States as well as Minnesota and Wisconsin.

"A lot of good students who are from Minnesota don’t want to leave the state," says Brus. "They may apply and get accepted to Ivy League schools but ultimately decide on the University of Minnesota because they can get an affordable, high-quality education close to home. At CBS, they know they will be challenged and be among their peers."

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Sanyu Janardan

Sanyu Janardan has always been interested in science. But her personal experience with cancer while a junior at Wayzata High School drew her towards a career in medicine. Now she wants to be a pediatric oncologist. Although she missed 75 days of school during cancer treatment, Sanyu completed the work at home and graduated near the top of her class. She is in the CBS Honors Program.

Other schools she applied to: Duke University, Washington University in St. Louis, University of Wisconsin, Madison.

Why she chose CBS: Lots of research opportunities. It’s a small community within a large university.

“CBS students come from a wide variety of backgrounds and diverse experiences. I think it’s really awesome that so many of us are working towards the same ultimate goal of attending medical school.”

Ryan Wynn

A football scholarship brought Ryan Wynn, a graduate of Maple Grove High School, to the University of Minnesota. But he chose CBS because of the college’s reputation and selectivity. And he enjoyed the opportunity to make new friends through the Nature of Life program. Ryan was selected to give the speech for the incoming freshman class at Convocation this fall. He is majoring in neuroscience and Italian and plans a career in medicine. He was inspired to become a doctor after saving a man from drowning while he was on vacation in Hawaii.

“It was the most powerful feeling I’ve ever had,” Ryan recalls. “It made me feel like I want to save peoples’ lives every day.”

Ryan plans to volunteer at University of Minnesota-Fairview Children’s Hospital.

Nikki Weisenburger

Nikki Weisenburger became hooked on medicine through health journalism books like Hot Zone, about the Ebola virus. But she didn’t see herself as a doctor. She learned about public health through her father, Joe Weisenburger, who is CFO for the University’s School of Public Health (SPH). And she volunteered for SPH faculty Mary Story and Mary Smyth the summer after 10th grade. Then, through the University’s Post Secondary Education Program, she took history of medicine classes while a senior at Hopkins High School. Nikki knew she had found a match for her interests in public health. To prepare for her future, she is completing a B.S. degree in biology with a minor in the history of medicine. She plans on graduate school at the U’s School of Public Health and a career as an epidemiologist or health journalist.
Other schools she applied to: Wesleyan, William and Mary, Northwestern University, Tufts.

Why she chose CBS: “I love Minnesota. I can’t imagine living anywhere else. CBS appealed to me because it’s a small school in a gigantic university. There are a variety of research opportunities and classes. It’s less expensive than private schools, so I can study abroad in Italy.”

Megan Neumann Sleeper

Megan Neumann Sleeper’s parents—Michael Sleeper and Shannon Neumann—both earned degrees in agriculture at the University of Minnesota. And while Megan, who is from Wisconsin, didn’t grow up on a farm, animals have always been an important part of her family’s life. That’s why she decided to focus her education and career on zoology. She plans to work at a zoo or study animals that live in the Amazon Rainforest. “There are so many animals in the Amazon that haven’t been studied,” she says. She is also completing a minor in art, to leave a door open in case she decides to combine her biology and art interests as an illustrator.

What she likes about CBS: “All of the extracurricular programs, clubs and research opportunities.” Megan belongs to the CBS Biology Hoopla Club, the Ecology, Evolution and Behavior Club, and has attended “Caffeine with the Dean”—an opportunity for small groups of students to share coffee and conversation with the dean—twice. “Dean Elde is very open and interesting to talk to. He really listens to students and takes notes.” Megan is also a member of Deans’ Scholars, a leadership development program, and a member of the U’s Kappa Alpha Theta sorority.

“The Nature of Life Program was amazing,” she says, because she made lots of new friends and learned so much about CBS and the U.

“CBS appealed to me because it’s a small school in a gigantic university.”
Brus says that the day before May 1, 2007—the national deadline for confirming admission to colleges—she got phone calls all day long from students who still hadn’t decided between CBS and Michigan, Johns Hopkins, Cal Tech or Yale. Many of those students are now members of the CBS freshman class.

When Elde became dean 12 years ago, he read a book titled Academic Duty by Don Kennedy, former president of Stanford University. He was struck by Kennedy’s philosophy: “If you put students first, everything else falls into place almost naturally.”

“It’s been my mantra ever since, and it has never steered me wrong,” Elde says.

Creating a stronger sense of community for students was one of Elde’s top priorities. Early on, he gained approval for CBS to admit biology majors as freshmen rather than as juniors. He also created Biology House, a designated wing of Pioneer Hall, where new biology students could get acquainted and form study groups.

The college got a big boost from the 1998 University-wide reorganization of the biological sciences (led by Elde) which consolidated and strengthened biology departments on the Minneapolis and St. Paul campuses. At about the same time, the Molecular and Cellular Biology Initiative provided state funds for the $88 million Molecular and Cellular Biology Building, where most undergraduate classes are now held, and for 41 new faculty. Providing opportunities for students to gain research experience in faculty labs became a key part of the undergraduate experience.

Nature of Life, a freshman orientation program held at Itasca Biological Station and Laboratories, was created in 2003. Students spend three days at the field station in small groups to get to know each other and the faculty, and to learn how to make the most of their CBS experience. The program, a big success with students, has become a signature of the college. Last spring, when the first Nature of Life group graduated, the CBS four-year graduation rate jumped by 13 percent.

“We believe this was due in part to Nature of Life, which creates a bond among students and faculty, but it also reflects the quality of our students, who just keep getting better every year,” says Robin Wright, associate dean for academic and faculty affairs.

The latest addition to the lineup is Foundations of Biology, a new introductory course for biology majors that focuses on applying knowledge to solve problems rather than memorizing facts. Students are responsible for learning the textbook material on their own. There are no lectures. Instead, students work in teams to develop concepts. Projects in the new course, launched in the fall, include developing a treatment strategy for antibiotic-resistant tuberculosis and creating a DNA vaccine for West Nile virus. It’s the only class of its kind in the United States.

“The creativity of the students is astonishing,” says Wright, who worked with a team of faculty to design the course, which replaces a large “Biology 101” lecture class. “They came up with some very clever ideas for treating drug-resistant tuberculosis. And they seem to be having fun.”

“It’s more difficult than a lecture class, but more stimulating and rewarding, too,” said one student.

Wright’s goal is to develop and deliver the best undergraduate biology curriculum in the United States. That’s difficult to measure because biology programs aren’t ranked. But Wright and other faculty are very active in national organizations that connect them with faculty from other colleges who are also on the cutting edge of science education. So they are constantly comparing CBS to other top schools and developing more effective ways to help students learn.

“I see my role as an architect,” Wright says. “I design experiences that will help students learn and use materials in creative ways.” —Peggy Rinard
November 27 brought the season’s first single-digit temperatures, but more than 450 people still made their way to the University of Minnesota’s Coffman Student Union for E3 2007. Throughout the day-long conference on renewable energy, the economy and the environment, experts traded notes on green plastics, next-generation feed stocks and everything in between. During lunch, friendly debates over algae-to-fuel conversion replaced the usual table talk.

Hosted annually by the University of Minnesota’s Initiative for Renewable Energy and the Environment (IREE), the E3 conference is a telling example of how IREE is mobilizing scientists, movers and shakers, and policymakers to build a more sustainable future for Minnesota.

Since 2003, IREE has supported nearly 400 University researchers from seven colleges and four campuses working on more than 130 renewable energy projects. The initiative has also collaborated with external partners, including local heavyweights like Xcel Energy, 3M and the Metropolitan Council.

“Most University researchers are thinking about breakthroughs in science, not in the marketplace,” says Dick Hemmingsen, IREE’s director. “Our role is to pull and push those breakthroughs toward application, and partnerships are the way to do it.”

The facts and figures speak for themselves. In the past four years, the University has received 34 disclosures in the renewable energy area, 14 of which resulted from IREE-funded projects. Several of those projects are currently under review for commercial development, including Lanny Schmidt’s hydrogen fuel technologies and Roger Ruan’s method for ammonia production.

Most IREE projects involve faculty from at least two colleges or departments. Although the professors might work in adjacent buildings, it often takes IREE funding to bring them together.

“Through IREE, Paul Lefebvre and I became connected with Michael Flickinger’s group [in the BioTechnology Institute],” says Carolyn Silflow, professor of plant biology. “We began a research collaboration that wouldn’t have started without IREE support.”

Right now, Silflow’s team is using IREE funds to characterize and improve the production of hydrogen through a single-celled green alga known as *Chlamydomonas reinhardtii*. While not a likely source for biofuels, the lessons learned from its genome sequence can be applied to more ideal species.

In the process of connecting colleagues, Silflow says IREE has also motivated the most single-minded of scientists to think outside the lab.

“My research is in basic cell and molecular biology, but I’m interested in contributing my expertise to solve real-world problems. IREE provides a link between basic and applied research, and both are important for long-term solutions to the energy crisis.”

This past year, the state legislature established long-term funding for the initiative. As the state looks to the University to help reach its goal of producing 25 percent of energy from renewable sources by 2025, IREE is prepared to lead the way. — Eve Daniels
Not Business as Usual

CBS alum makes the leap from Harvard researcher to business owner

Steve Braun’s biography reads like the perfect progression from biology undergrad to successful researcher and contented family man. He graduated from the College of Biological Sciences in 1987 and went on to earn a Ph.D. in genetics in 1993 before beginning a career as a researcher at Indiana University. While there, he met his wife Caterina, a fellow researcher. The couple moved to Boston, bought a house and started a family. But Braun will soon be returning to his Midwest roots and revising his resume to include his next title: business owner.

Braun currently leads a team of researchers in the Division of Immunology at the New England Primate Research Center at Harvard Medical School. It’s a career path rooted in his undergraduate experience as a CBS student. “One of the things that I liked best about the University of Minnesota was the emphasis on research starting at the undergraduate level,” says Braun. “Even in the classroom, the focus of the material was the experimental results.”

Braun’s work in translational medicine bridges basic and applied science. “We take basic findings and develop their therapeutic potential,” he says. The research he conducts at Harvard could one day lead to stem cell gene therapies for AIDS. “By putting the inhibitor gene into hematopoietic stem cells, we are hoping to protect all the cells in the blood including the CD4+ T cells which get infected by HIV-1,” says Braun. “Interestingly, we are using a modified version of HIV-1 itself to carry the inhibitor gene into the cells.”

Making the leap from basic science to a viable therapy involves loads of challenges even for researchers at top institutions. “In my work in the primate model, we encounter similar problems that doctors have had in scaling up clinical gene therapy trials ... Many times, we don’t have the necessary data to make a decision and we cannot do a controlled experiment due to a lack of time, money or both.” Often, says Braun, researchers are left with gap in knowledge that closes gradually as new information becomes available.

But as engaging and challenging as his work as a researcher is, Braun’s story doesn’t begin and end in the lab. An entrepreneurial tendency runs in the family. He’s planning a move into the world of business ownership, another of his passions—and his science background provides a strong foundation. “I will go from research to solving business problems, which turns out to be very similar.”

The new venture will entail a move back to the Twin Cities. The company will specialize in self-sealing waterproofing for houses and buildings. “I’ve been reviewing my organic chemistry,” says Braun. “The advantage of having studied biology is that I had built on the foundations of chemistry, physics and math. Now, I am going back to the basics.”

Once the business is up and running, Braun will be able to put his lab experience to work in a new arena—product research and development. In the meantime, he’s brushing up on his business knowledge learning everything from sales and marketing to inventory and accounting.

“The part of science I’ve always enjoyed is the mental challenge,” Braun says. “Starting a new company, especially developing new products, will be very similar to the applied biomedical science in which I have been involved.”

—Stephanie Xenos
Dr. Ray Anderson’s biography runs parallel to some of the most important medical and scientific developments of the last century. He spent his career at the first hospital devoted to caring for heart conditions and worked in a milieu that produced groundbreaking research that altered medicine forever. “Everything just happened to me,” says the Duluth native and son of Swedish immigrants.

As a freshman at Gustavus Adolphus College, Anderson got a job in the biology department paying 25 cents an hour. His undergraduate mentor and professor Dr. J. Alfred Elson helped him obtain a teaching assistant position at the University of Minnesota in the lab of Dr. C.P. Oliver, a leading geneticist. (Nobel Laureate Edward Lewis also studied with Oliver.) Anderson went on to complete his Ph.D. in Zoology (Genetics). Oliver encouraged him to apply to medical school to study the burgeoning field of medical genetics.

While still an undergraduate, Anderson spent the summer of 1942 working for the State Conservation Department. In his spare time, he collected fruit fly specimens, which he and fellow graduate student Melvin Green sent to Dr. J.T. Patterson at the University of Texas, an authority on fruit fly speciation. One of the specimens proved to be a new species. Patterson named it Drosophila lacicola and wrote two papers about it. Though he noted the contribution made by Anderson and Green, the students weren’t given credit as co-authors.

After graduating first in his class from the University of Minnesota Medical School, Anderson interned at the University of Michigan Hospital in Ann Arbor and completed his residency in pediatrics at the University of Minnesota Hospital. Anderson also spent 1947-49 in Japan organizing the Atomic Bomb Casualty Commission’s genetic research program. On returning to the states, he rejoined the pediatrics staff and embarked on a career punctuated by brushes with history: he was the first pediatric intern-resident at the first heart hospital and one of his patients was the first to undergo open-heart surgery using the cross-circulation technique.

Anderson spent three decades as a member of the pediatrics faculty and a practicing pediatric cardiologist at the University of Minnesota Medical School where he worked closely with open-heart surgery pioneers Drs. C. Walton Lillehei and Richard Varco. He retired as emeritus professor of pediatrics in 1980.

But for Anderson, who has given generously in support of pediatric cardiology research at the U, it was one his formative experiences as a biology grad student that inspired his latest gift: $250,000 to establish the Ray C. Anderson Fellowship in Zoology and Genetics. Anderson received the Alexander Anderson Fellowship in Zoology as a graduate student in 1941, which provided much needed support during that period. Says Anderson: “I always felt that I owed a little bit to the U for helping me.” —Stephanie Xenos
As the University of Minnesota’s reputation as a top public research university continues to grow, an odd sort of paradox has developed. As more highly qualified students apply to the University, and to the College of Biological Sciences in particular, the college struggles to offer competitive packages. Increasingly, we face the real possibility that top students who would choose CBS are going to go elsewhere simply because other institutions are able to offer more attractive scholarships, an understandable move given the rising cost of tuition.

CBS offers a handful of scholarships specifically to freshmen. While these scholarships fill a critical need, they only cover a tiny portion of the 300+ incoming class. The college depends on donors like Kien Nguyen and Julie Warren, Venkateswarlu Pothapragada, Denny and Joan Dvergsten, Clare and Jerome Ritter, and others who have provided much needed funding for freshman scholarships to help us attract the best and brightest. Through their incredible generosity, we have been able to support students who, without it, may have gone elsewhere. It is just the tip of the iceberg, though.

This year, CBS has received a record number of applications from the most qualified students in the college’s history. But an application is only a first step. Part of getting those students to actually enroll is offering them help financing their education. We need your help to make that happen. Consider supporting an existing scholarship or starting one of your own. It’s easier than you think and more important than you’ll ever know.

—Laurie Hennen, Director of Development
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Four Questions for Mike Thompson

Supporting undergraduate scholarships is more important than ever

Mike Thompson graduated from the College of Biological Sciences in 1993 with a Ph.D. in botany.

Your most memorable CBS moment?
Steve Gantt (my Ph.D. adviser) and I presented at a NATO-sponsored conference on chloroplast molecular biology in Grenoble, France at a castle called the Chateau de Sassenage. The science discussion, the food, the side trips and the people made this a spectacular experience.

What do you do now?
I run the DNA technologies area of BioDiagnostics Inc., a private seed-testing company with customers worldwide. I got into seed testing at Monsanto where I was the lead on a project. I left Monsanto to be in closer proximity to family. I knew the owner of BioDiagnostics through my work at Monsanto, and he needed someone to run his DNA testing area. The rest is history.

Why did you get involved in the BSAS?
My personal goal is to sustain and improve our world. I saw involvement with BSAS as one avenue to that end. I also wanted to reconnect with friends in the college, and BSAS was a good place to start.

What are your goals for the BSAS board?
1] Motivate our board and membership to make a meaningful difference. 2] Bring about greater visibility to the BSAS and engage our membership. 3] Build the future by supporting and engaging students.

Interested in participating in BSAS? Contact Rebecca Brzezinski, alumni relations coordinator, at rlb@umn.edu.

Back to Basics

—Laurie Hennen, Director of Development
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After graduating two years ago, Shireen de Sam Lazaro (B.S. Genetics, Cell Biology and Development and B.S. in Microbiology ’06) worked as a research scientist for R&D Systems. She left the company in June to travel to Bolivia and Peru where she visited Machu Picchu. Shireen started medical school at the University of Minnesota this fall.

Margaret Nordlie Gibson (M.S. Genetics ‘87) teaches in the biology department at the University of Mary in Bismarck, North Dakota. She was promoted to full professor last year and married Allen Gibson, a physician assistant, in July.

Capping more than a decade in the pharmaceutical business, Priso Horace (B.S. Biology ‘82 and M.S. Microbiology ‘89) was recently promoted to associate director of worldwide regulatory affairs and quality assurance for Pfizer New York. Focus areas include drug registration issues, labeling, product development initiatives, product defense and commercial program support.

Christine Goetz (B.S. Biochemistry ‘00) started post-doctoral cancer research at the University of North Carolina Chapel Hill in 2005. Her research, currently funded through the Cancer Research Institute, focuses on the role of a specific signaling pathway in modulating p53 protein during germlinal center reaction. Christine and her husband, Mark, recently welcomed a baby boy, Micah, born in June.

Todd Lemke (B.S. Genetics and Cell Biology ’92) is the director of pharmacy at Paynesville Area Healthcare System, a rural hospital in central Minnesota. He, his wife, Ann, and his children, George, Greta and Henry, live on a hobby farm in Forest Prairie Township.

Luke Robinson (B.S. Biochemistry ’06) is wrapping up his second year in MIT’s Ph.D. program in biological engineering. He is exploring how changes in sugar modifications of proteins and other cellular molecules can contribute to cancer progression. Luke hopes to engineer a drug delivery system to more effectively transport anti-cancer agents to tumors. In his free time, he enjoys running along the Charles River and hiking the White Mountains of New Hampshire with friends and lab mates.

Mabina Kiawu (B.S. Biochemistry ’06) works as a forensic scientist with the Wisconsin Department of Justice in the Madison Crime Laboratory. She is considering returning to school to pursue an advanced degree in pharmacetics.

After graduating, Cole Greves (B.S. Genetics and Cell Biology ’98) attended medical school at the University of North Dakota and completed a four-year residency in obstetrics and gynecology in Orlando, Florida. He is currently working on a three-year fellowship in maternal-fetal medicine at the University of Rochester in New York. Cole’s research interests include management of diabetes in pregnancy and prenatal ultrasonographic diagnosis.

Michael Jensen (B.S. Biology ’06) recently completed the initial licensure program at the University of Minnesota, which allows him to teach high school life science and middle school general science. Michael is close to completing his M.Ed in science education and was recently hired at Waconia High School.

Troy Hansen (B.S. Biology ’91) completed medical school in 1996. He recently returned to the University of Minnesota to complete a Master’s of Public Health in maternal and child health. In addition, Troy is a member of the Minnesota State Advisory Council on Mental Health. He continues to work as an emergency physician in south central and south metro Minnesota. Troy is married with three children ages 15, 8 and 4.

Samuel Bircher (B.S. Ecology, Evolution and Behavior ’07) teaches and conducts research at a university in Beijing, China. He plans to apply to graduate school and study phytoremediation, which looks at ways to use plants and trees to absorb or break down pollutants in soil and water.

Kristin Herman (B.S. Biology ’02) recently moved to New Zealand to pursue her doctorate at the University of Otago. She is studying the host life cycle of a parasitic worm species.

Last year, Gail Buhl (B.S. Biology ’87) joined the University of Minnesota Raptor Center as education program manager after stints at the Wolf Ridge Education and Learning Center and the Minnesota Zoo.

Keep us updated about what’s going on in your life. Send an email to Rebecca Brzezinski, alumni relations coordinator, at rlb@umn.edu
In the first case, chlorofluorcarbons (CFCs) were found to be destroying the atmospheric ozone layer, which protects plants, animals, and people from the effects of harmful UV radiation. Scientists were alarmed to discover an “ozone hole” over Antarctica in the early 1980s. To address this problem an international treaty, the Montreal Protocol, was signed in 1987 to phase out the production and consumption of all CFCs by the middle of this century. It has since been ratified by 180 nations.

In the second case, the amount of carbon dioxide in the atmosphere has been increasing since the industrial revolution. Carbon dioxide is a greenhouse gas that causes global warming and other climate changes. Human activities affect the amount of carbon dioxide released into the atmosphere, mostly through the use of fossil fuels. However, thus far, international efforts to regulate the amount of carbon dioxide released have not been successful.

So, it is possible to repair some of the major types of damage human activities have done to global ecosystems, but past experience shows that it requires all nations of the world to work together, and that the longer we wait to act, the more difficult it will be.

Reducing greenhouse gases is the key to lowering the Earth’s thermostat, which is now turned higher than it has ever been since humans have inhabited the Earth. A variety of known practices and technologies can control greenhouse gases and eventually stop a global rise in temperatures. The first and easiest part of the solution is to reduce present inefficiencies in burning fossil fuels. Avoiding fossil fuels by applying technologies to capture solar power, wind, hydro, geothermal, and related sources of energy, is second. Removing greenhouse gases is third—combining biofuels with emerging technologies for carbon capture and storage could eventually help scrub the twentieth century’s fossil carbon from the biosphere while producing perpetually renewable energy. By the end of this century, the world needs to be totally converted to energy that does not release carbon dioxide. The natural systems of the Earth will then have a chance to absorb excess greenhouse gases, as they have done for ages, and finally bring the Earth’s thermostat back down.

The University of Minnesota’s Driven to Discover campaign has generated dozens of biology-related questions. To find Q&As featuring CBS faculty, go to www.discover.umn.edu.