Spring 2000

University of Minnesota

Frontiers

MAGAZINE OF THE COLLEGE OF BIOLOGICAL SCIENCES

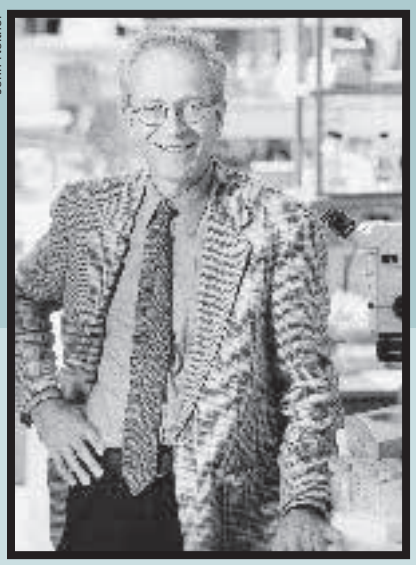
Genomics takes off …

… and controversy escalates. U scientists discuss the issues and the promise of this new science.

Inside

From the dean

John Noltner



Dean Robert Elde

UNTIL RECENTLY, GENOMES HAVE BEEN UNSUNG HEROES, QUIETLY orchestrating life within every living organism. Now that we know a little bit about them, they are the front-page story in the *New York Times,* the object of protests at the state capitol, the subject of a joint press release from Bill Clinton and Tony Blair, the cause of dramatic up- and downturns in the NASDAQ, and the heart and soul of the next few decades of biological research. Why all the clamor?

Part of it is due to misunderstanding. The brand new science of genomics is confused with genetic engineering by many, especially with respect to the plants we consume as food. At the same time, genomics is sure to enhance the field of genetic engineering—and there are many legitimate concerns about the safety and risk/benefit ratio of various genetically modified organisms (GMOs).

A recent *New York Times* article by Andrew Pollack likened the GMO situation to nuclear power. In a sense, the nuclear power industry was its own worst enemy, implementing the technology before adequate safeguards could be employed—hence Three Mile Island and Chernobyl. To date, society has not benefited from the full promise that nuclear power brings in terms of relieving our dependency on fossil fuels. Similarly, regarding the promise of genetically engineered crops, Pollack says, "Science has reached what might be the takeoff stage for a new green revolution. But it may instead go the way of nuclear power—a once-promising technology largely rejected by society."

The lead article in this issue focuses on some of the issues that surround GMOs—and on some of the new research made possible by genomics. Genomics—the curiosity-driven science of finding out what genes make up a genome and how they function together—brings unbridled excitement to the campus. Just yesterday, Professor Jeff Simon of genetics, cell biology, and development blocked my jaywalking on Church Street with his Subaru. He was not making a citizen's arrest, but wanted to relay the excitement of the "fly meeting"—the 41st Annual Drosophila Research Conference—that had just concluded in Pittsburgh. This meeting made the front page of the *Pioneer Press*, the *New York Times*, and *Science* with the news that the fruit fly genome had been completely sequenced.

This *is* rocket science! This is the biological equivalent of landing on the moon. Unfortunately, the general public doesn't understand genomics any more than the science that led to lunar landings. While exploring outer space is viewed as adventurous, exploring the very basis of life—and the power that knowledge lends to modifying living organisms—is often viewed as frightening.

While the concerns about possible applications are valid, I feel it is my responsibility to make sure our faculty are not genomics-less. If the University is to be a top research institution, and if Minnesota is to continue to compete in the global marketplace, we must embrace this basic science. We must give our faculty the tools they need to make discoveries, discoveries that will likely lead to beneficial applications. At the same time, we must draw on all the University's resources in law, public policy, environmental studies, public health, agriculture, medicine, and biology to make sure that we don't rush the technology without adequate safeguards.

The way to ensure the safety of our future is to keep access to discovery of new knowledge where it belongs: in public research institutions that have the public interest as their bottom line.

Robert Elde
Dean, College of Biological Sciences

Contents

Cover: The monarch butterfly is emblematic of the layers of controversy surrounding genomics. Lab research showed that pollen from Bt corn (genetically modified to kill corn borers) can kill monarch larvae, and scientists are working to learn whether monarch larvae regularly encounter Bt corn pollen in nature. In any case, unforeseen environmental results of genetically modified organisms are an issue that must be addressed. Photo by Mike Quinn.

Frontiers
Spring 2000
Volume 2 Number 2

Dean
Robert Elde
Editor
Nancy Rowe
Designer
Elizabeth Longhurst
Advisers
Kathryn Hanna, Associate Dean;
Kathleen Peterson, Director, Office of Student Services;
Paul Germscheid, Alumni Relations Coordinator;
Janene Connelly, Development Director

Frontiers is published three times a year by the University of Minnesota College of Biological Sciences for alumni, faculty, staff, and friends of the college. It is available in alternative formats upon request; please call 612-624-0774 or fax 612-624-2785.

Address correspondence to:
Frontiers Editor
College of Biological Sciences
123 Snyder Hall, 1475 Gortner Ave.
St. Paul, MN 55108
e-mail nrowe@tc.umn.edu

For information on College of Biological Sciences programs and services, visit our Web site at cbs.umn.edu.

Genetics at warp sp

As the new science of genomics comes into its own, controversy about applications is escalating. U researchers discuss the science and the issues.

Georgiana May, associate professor of plant biology

NEARLY 30 YEARS AGO, Rachel Carson ignited a firestorm of controversy with her book *Silent Spring,* in which she documented the poisoning of birds, fish, mammals, and other species from indiscriminate pesticide use. Today a new flame, fueled by the introduction of genetically modified organisms (GMOs), is throwing sparks to the far points of the globe. At the same time, the basic science of genomics is coming into its own. Now scientists and the public must sort out thorny issues surrounding GMOs and their relation to genomics and its sister sciences. It's an arena in which the University of Minnesota, by virtue of its heavy investment in agriculture and life sciences, is stepping into the spotlight.

Last fall the University received a $10 million pledge from Cargill, Inc., to help build a new Microbial and Plant Genomics Center on the St. Paul campus. At this writing, the University is seeking legislative bonding to complete the funding. Far from the legislative halls, however, the battle has already been joined. In January demonstrators from organic farming and environmental organizations protested the University's ties to seed companies in rural Rushford, Minn. And in the wee hours of February 9, vandals from the group Earth Liberation Front trashed a St. Paul campus greenhouse containing genetically engineered oats.

GMOs have become the focal point for a debate over some of society's most basic concerns: the contents of its food supply and who controls it.

GMOs have become the focal point for a debate over some of society's most basic concerns: the contents of its food supply and who controls it. Widespread opposition to GMOs began in Europe; the vehemence of European demands for bans on GMO foods surprised many people in the United States. But, says Donald Wyse, executive director of the University's Minnesota Institute for Sustainable Agriculture, such feelings stem from lack of trust in institutions that have regulated the food system, fueled largely by Britain's experience with mad cow disease.

"The primary issue is the power structure controlling the food system," he says. "While citizens weren't looking, 70 percent of food came to contain GMOs."

A prime question is whether genetic engineering of organisms should be done—and, if so, for what purposes. That raises the question of whether the University should strive to become a leader in genomics, which, though a basic science, can yield information useful in genetic engineering as well as in less controversial applications such as traditional plant breeding or new drug development.

The answer, say many faculty, is yes; a public university offers better hope for the completion of research into ecological or other effects of genetic engineering that may get short shrift in an enterprise primarily concerned with profit.

"Industry is not charging into the problems that will take 10 years to solve," says Georgiana May, an associate professor of plant biology. "Although industry does invest to a significant extent in fundamental

eed

by Deane Morrison

John Noltner

David Somers, professor of agronomy and plant genetics

research, their focus is on the short term. I feel it is the responsibility of university researchers to be thinking about problems on a five- or 10-year horizon so that when the pressing problems of human existence arise, we have some basic biological knowledge about how things work and can solve problems in an objective way."

MUCH DEBATE CENTERS around Bt corn, named for the gene from the bacterium *Bacillus thuringiensis* that produces a potent insecticide. The Bt toxin can be sprayed on plants when corn borers or earworms strike, but that is less effective than putting the Bt gene into corn and letting the plant produce the toxin continuously. Besides the possibility that the toxin, present in Bt corn pollen, will kill monarch butterfly larvae, it is feared that genes like Bt will spread to wild relatives of crops, which will then become "superweeds."

Ecologist David Tilman, director of the College of Biological Sciences' Cedar Creek Natural History Area, says factors that control the function of ecosystems could be greatly changed by novel genes spreading into wild species.

"My experience is that wild legumes are kept in check by the animals and plants that eat or outcompete them," he says. "If certain genes are passed to wild species, that would allow them to spread and dominate in habitats where they wouldn't otherwise."

Also, the potency of the Bt toxin creates a strong evolutionary pressure for insects to develop resistance. The stronger the pressure, the faster the pest will evolve and the sooner the engineered gene will fail.

"I'm concerned that we're using up a valuable resource—a natural insecticide—by using it too rapidly," says Tilman. "It's just like the case with antibiotics."

John Noltner

"I feel it is the responsibility of university researchers to be thinking about problems on a five- or 10-year horizon so that when the pressing problems of human existence arise, we have some basic biological knowledge about how things work and can solve problems in an objective way." *Georgiana May*

"There are definite issues concerning rapid evolution of pests," says Ron Phillips, Regents Professor of Agronomy. "That's been part and parcel of plant breeding for many years because pests change quickly. Most people think about risk assessment after the fact. But I hope the genomics center will be involved in outreach to ensure that its research is in harmony with the environment. We want strategies to ensure that organisms are environmentally friendly before they're put out."

"If we know all the genes involved on both sides of an interaction between a plant and a pest, could we not do better than a sledgehammer resistance gene?" asks agronomy professor David Somers, who uses genetic engineering as a means to improve crops. "I think we ought to be able to design more rational approaches to pest management using genomics information."

A group of University entomologists—Robert Venette, David Andow, Kenneth Ostlie, and William Hutchison—is monitoring several Bt cornfields, looking for signs of resistance to Bt in European corn borers and earworms each season. The team is also documenting the effects of planting "refuges"—plots of non-Bt corn next to Bt cornfields—in slowing the rise of resistance. The theory behind refuges is that insects raised on non-Bt corn will not develop resistance to the toxin and will contribute their Bt susceptibility to the pest gene pool.

"If 20 percent of a farmer's corn crop is non-Bt corn, that should be adequate to control resistance," says Venette. "In 1999 we noticed an increase in the number of insects on Bt corn over several seasons, but we're not sure if these are early signs of resistance or if the plants are failing to produce the toxin effectively. Overall, though, we still get 99.9 percent control."

"If we know all the genes involved on both sides of an interaction between a plant and a pest, could we not do better than a sledgehammer resistance gene? I think we ought to be able to design more rational approaches to pest management using genomics information." *David Somers*

The rise of GMOs has shifted the balance between the public and private sectors. For example, almost 60 percent of U.S. soybeans carry resistance to the herbicide Roundup™—hence their name, Roundup Ready.™ This allows the herbicide to be used without fear of harming the soybeans. But, says Wyse, the public sector—meaning universities with agricultural experiment stations—had delayed access to the genetics of the Roundup Ready™ trait and so have largely dropped out of the soybean business. Experiment stations are still releasing new crop varieties, but Wyse says the consolidation of seed, chemical, and biotechnology companies works to decrease the total number of crop varieties and consumer choices.

A related issue, the ability of companies to patent crop varieties, remains murky in terms of U.S. law and international agreements. But fears have been raised that patent rights could lead to private control of large segments of the food supply.

Farmers have more immediate concerns. Those who want to plant GMO crops worry that the anti-GMO movement may scare companies into rejecting their crops. Organic farmers object to the widespread use of GMO seed because if pollen from GMO crops should blow or be otherwise transported onto their crops, it could fertilize the plants and disqualify them for the "organic" label. And speaking of labels, many people have called for labeling of foods containing GMO products. Current Food and Drug Administration policy says, in essence, that foods resulting in part from biotechnology will be labeled only if they have been changed in some material way, perhaps in nutritional content or by the introduction of an allergen. The policy is under review by Congress and the FDA.

ALL RIGHT, EVERYBODY TALKS

about GMOs, but what are they? Generally, they are organisms produced by molecular means rather than traditional breeding.

In traditional breeding, new gene combinations occur when whole chromosomes mingle in the fertilized egg. Half the chromosomes come from each parent plant. In genetic engineering, chromosomes don't move into new host plants (or animals). Instead, scientists place only the desired gene—thousands of copies of it—into embryonic cells. Some copies get into the nucleus, and some of those splice themselves into chromosomes. These "transgenes" can end up anywhere, including in the middle of other genes.

Because only one gene is transferred, genetic engineering allows breeders to retain the traits of the recipient plant. In traditional breeding, offspring inherit from both parents equally, and breeding out the undesirable traits from one parent can take many generations.

Another difference: Traditional breeding is limited to sexually compatible varieties or species. But transgenes can be inserted into completely unrelated organisms. Bt (bacteria to corn) is an example. This sort of transfer can happen in nature; viruses are thought to carry genes across huge genetic divides. But genetic engineering has allowed gene transfers at a speed and scale that would never happen in nature, and this fact underlies much of the call to apply the brakes.

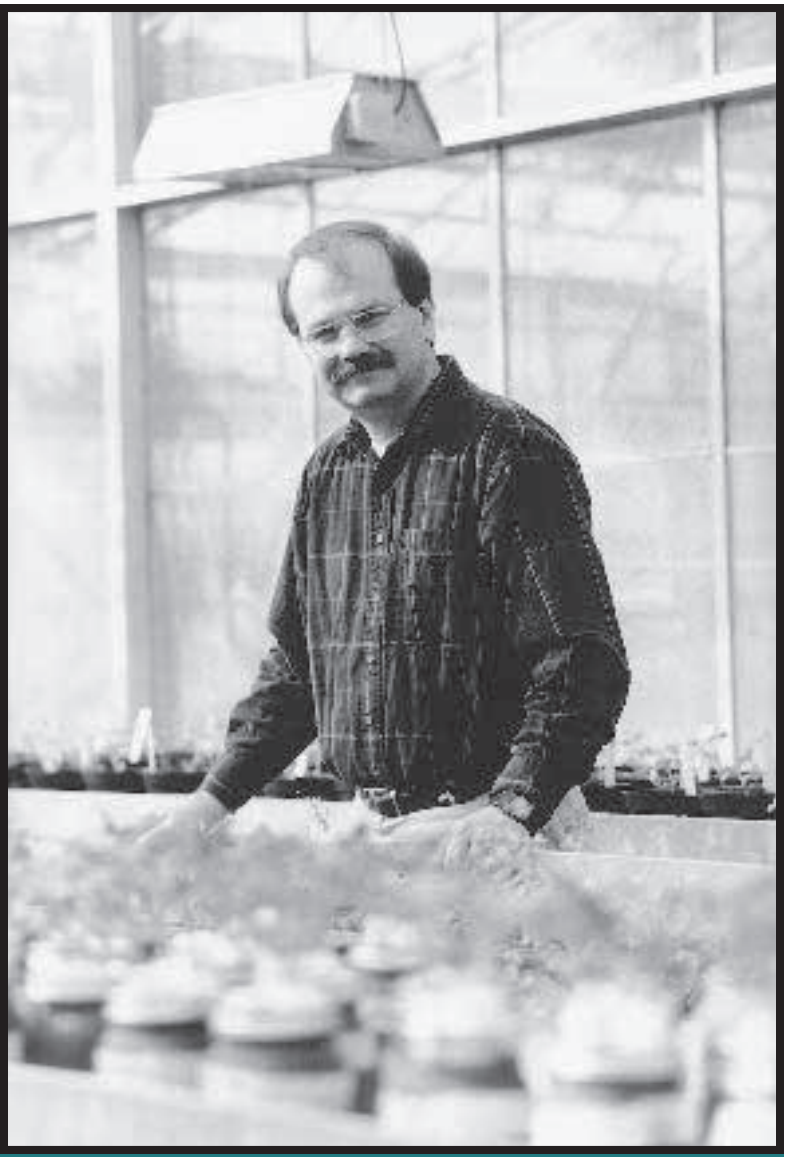
DISTINCT FROM THE APPLIED

science of genetic engineering, the basic science of genomics has now become famous, if not well understood. Where genetics has meant the study of single genes, genomics deals with the sequence and functioning of the entire genome—the complete set of genes in a given organism. One way to do this is with "DNA chips," in which genes and their products are matched. If a match occurs when, say, brain tissue from a 10-day-old chicken embryo is tested, then the gene must be active in the chick brain at that stage of development. If this kind of data is gathered for thousands of genes, it will start to paint a picture of how genes direct development—or how an organism reacts to its environment.

Another aspect of genomics involves bioinformatics, or the science of dealing with huge amounts of information about living systems. Sophisticated computer analysis is needed to spot meaningful patterns in the reams of data on structure and function of genes. Patterns may, for instance, yield clues to evolutionary relationships between species or reveal how two

Those who want to plant GMO crops worry that the anti-GMO movement may scare companies into rejecting their crops. Organic farmers object to the widespread use of GMO seed because if pollen from GMO crops should blow or be otherwise transported onto their crops, it could fertilize the plants and disqualify them for the "organic" label.

John Noltner



Steve Gantt, professor and head of plant biology

patients will respond differently to the same drug.

Many more techniques belong to the realm of genomics; taken together, they add up to the potential to view organisms holistically rather than in the piecemeal fashion of traditional genetics and biochemistry.

ONE SYSTEM THAT GENOMICS could help illuminate is the symbiotic relationship of legumes and the bacteria that live in nodules in their roots. The bacteria "fix" atmospheric nitrogen into ammonia, a fertilizer component that's expensive in terms of dollars and energy consumption. Steve Gantt, head of the plant biology department, Deborah Samac and Nevin Young of plant pathology, and Carroll Vance of agronomy and plant genetics are examining the bacteria-plant symbiosis in a relative of alfalfa, while soil microbiologist Michael Sadowsky is working on soybeans with colleagues here and at other universities.

With genomics, "we should be able to look at what genes get turned on and where during nodule development," says Gantt. By learning exactly how symbioses come about, says Sadowsky, scientists may soon find a way to make more efficient nitrogen-fixing systems, which could reduce amounts of nitrogen fertilizer required in fields, gardens, and lawns.

Genomics will also help Sadowsky and University colleague Larry Wackett, a biochemist, in their quest to find bacteria that break down organic pollutants. Understanding how a bacterium's genes work—and work together—promises to help the process of choosing, or genetically engineering, bacteria to attack specific pollutants. The scientists may even learn to manipulate bacteria to transform industrial wastes into useful chemicals.

"That type of research isn't likely to occur in industry because it's very long term," Wackett says. "It isn't going to pay off in six months or a year, but in five or 10 years. I think this is the big role of public institutions in doing this type of research."

Other researchers use genetic engineering as a tool to understand how organisms normally function.

"We use transgenic plants to ask basic questions," says plant biologist Neil Olszewski. Working with the mustard plant known as *Arabadopsis,* Olszewski studies gibberellin, a plant growth hormone. His goal is to understand how the hormone signals plant cells what to do. With scientists near to completing the sequence of the *Arabadopsis* genome, Olszewski says a genomics facility could help him and others take advantage of that achievement.

"We need better ways to look at a DNA sequence, figure out if it's a gene or not, and what it does," he says. "I'd like to look at a sequence and say 'Aha! That gene there has a good possibility of being involved in gibberellin signalling.'"

In studying the mechanics of genetic engineering, Somers straddles the line between basic and applied research. Working with oats, he has found that transgenes often insert themselves into chromosomes at locations where a chromosome has broken and exchanged pieces with a different chromosome.

"We don't know for sure if the transgene caused the breakage," says Somers. If transgene insertion does promote chromosome breakage, the implications are not yet clear. Somers says, however, that genomics may help answer such questions, as well as aid the search for better molecular on-off switches to control transgenes.

Many more techniques belong to the realm of genomics; taken together, they add up to the potential to view organisms holistically rather than in the piecemeal fashion of traditional genetics and biochemistry.

Already in the thick of the genomics revolution is Ron Phillips, who gained national recognition for developing a culture system in which corn embryos could be grown. (That system is the basis for much genetic work on corn today, including the production of Bt corn.) Between 1996 and 1998 Phillips chaired a White House commission that devised a national plan for plant genome research. He also has a grant from

the National Science Foundation's Plant Genome Program to develop an efficient way to map genes in corn. He says that, as the DNA sequences of more and more organisms are completed, bioinformatics will be used to extract meaning from the data.

"A computer can spot DNA sequence similarities between and within organisms," says Phillips. "We can learn about common features of genes. For example, plant disease-resistance genes have areas of similarity. We can ask the computer to pull out records of all the genes known with those areas and then ask if those genes are also involved in conferring resistance on the plants in which they're found."

Georgiana May is using maize and the fungus known as corn smut to study how crops and pests coevolve.

"The hypothesis is that agricultural practices—for example, planting crops that are all alike—accelerate the development of pathological strains of any fungus," she says. "We're looking at the genetic variability of corn smut and its ability to spread geographically in cultivated corn and its wild ancestor, teosinte. The surprising thing about this pathogen/plant interaction is that no major epidemics of corn smut have occurred in the last 50 years, even though we might expect that based on information on other plant pathogens. We would like to know why this is so. Why has resistance to corn smut been so durable?"

AS THE UNIVERSITY MOVES CLOSER to building a genomics center, faculty like Tilman and Wyse call for a circumspect approach to planning it.

"I'm personally concerned about the rush to commercialize GMOs, especially by industry," says Tilman. "I think we need to temper the research by getting together teams to consider the drawbacks as well as the benefits. Our goal is not to invent new products that make corporations rich. We're supposed to serve the public by pursuing research in a way that balances costs and benefits."

"I'm personally concerned about the rush to commercialize GMOs, especially by industry. I think we need to temper the research by getting together teams to consider the drawbacks as well as the benefits. Our goal is not to invent new products that make corporations rich. We're supposed to serve the public by pursuing research in a way that balances costs and benefits." *David Tilman*

Sustainable agriculture could become a beneficiary of such research, or it could be adversely affected, says Wyse.

"Land-grant institutions should be creating an environment of education in which genomics knowledge is used to increase the sustainability of agriculture," he says, noting that the University is moving in that direction through its Regional Sustainable Development Partnerships, which were funded in the last two legislative sessions. By March, there will be five partnerships, whose goal is to assess the needs of Minnesotans within each of five regions and bring University resources to bear, based on sustainable development principles. "The genomics center would benefit greatly through its connection to the regional partnerships," says Wyse.

Another way the University is connecting with the community is through public symposia and lectures. Symposia scheduled for this spring address a range of topics including the patentability of genetically engineered organisms; the ethics of genetically modified plants; the ethics, science, and policy of global change; and bioinformatics.

"This land-grant institution needs to develop a system to effectively incorporate concerns of citizens into its work," says Wyse. "I believe the center should have a high citizen input."

For his own part, Wyse sees good outcomes from genomics research.

"We have developed an indigenous legume nursery on the St. Paul campus," he says. "The center may help us investigate potential uses for these plants. I don't want them to be genetically engineered, but I would like to use genomic information to enhance the industrial, medical, or environmental aspects of these plants through classical breeding.

"Genomics can be used to improve plants through venues other than GMOs. If we apply genomics only to GMO technology we may miss some opportunities to achieve results that would be more sustainable and more acceptable to the public."

John Noltner

Neil Olszewski, associate professor of plant biology

Swimming in success

JOHN CAHOY HAS FOUND THE PERFECT CHEMISTRY BETWEEN academic rigor and varsity athletics. Thanks to his formula for success—which calls for 100 percent effort in both areas—both his academic and athletic careers are going swimmingly.

Cahoy, 23, is a senior with a double major in biochemistry and chemistry. His packed schedule includes maintaining a 4.0 grade point average; conducting undergraduate chemistry and biochemistry research that led to an article he recently published in *Inorganic Chemistry*; serving in various positions with student government and other groups; and completing four stellar years with the varsity men's swimming team that included earning All-Big Ten, All-American, and Academic All-American honors.

John Noltner

John Cahoy

A Hudson, Wis., native whose sister Ann swims for the women's team, Cahoy has also garnered an impressive number of scholarships. These include the Michael Loveless Memorial Scholarship and the Caldecott Award, both through the College of Biological Sciences, and two well-regarded national awards: the prestigious Goldwater Scholarship and the highly competitive Beckman Fellowship, named in honor of Arnold Beckman, inventor of the pH meter.

Other students might sink under the weight of all of this responsibility and activity, but Cahoy easily keeps his head above water. "Time management? I don't have time to manage my time, I just do it," he says with a smile.

What Cahoy has found, he says, is that his course work and research, coupled with swimming, makes for "a great combination" of elements. For example, varsity swimming is a "fun" way to take a break from classes and lab research.

Among those impressed by Cahoy's ability to juggle his activities is William Tolman, a chemistry professor who has supervised Cahoy's research and published the recent scientific article with him.

"He's well grounded and has a great future in science," Tolman says. "We're here to teach people and to motivate people to become scientists. John at first knew nothing about research but was very enthusiastic about learning. To see him develop into an independent research scientist is gratifying."

John Lipscomb, professor of biochemistry, molecular biology, and biophysics, agrees. Lipscomb supervises Cahoy's more recent research, which involves examining specific enzyme systems and their biodegradation of aromatic compounds. "A common and important part of the undergraduate experience here is to get students into the laboratory and conducting research problems. The level of success [Cahoy] has had is uncommon. He has brought original solutions … and he's making progress solving this problem that other researchers in other labs have not been able to accomplish."

Cahoy plans more research soon on an especially important subject—his future. He will graduate this spring, and, though he expects to do further graduate work that will likely lead to a Ph.D., for now he's "exploring options." Given Cahoy's simultaneous success at multiple activities, he may decide to choose more than one of those options.

—Angelo Gentile

Science on ice

by Nancy Rowe

U researcher Don Siniff heads south for the winter to study Antarctic pack ice seals.

WHEN THE FIRST DAWN of the new millennium broke, Don Siniff was one of the first people in the world to see it.

That's because Siniff, a professor of ecology, evolution, and behavior, was aboard an ice-breaker ship in the first time zone, about as far south as you can go: He was in the Ross Sea of Antarctica studying pack ice seals and their role in the Antarctic marine ecosystem. He was there as part of the National Science Foundation's Antarctic Pack Ice Seals project (APIS), an international, interdisciplinary research project that started in 1993 to better understand these seals, which account for at least half of the world's seal population.

But Siniff started greeting new years in the Antarctic well before APIS was conceived. He's spent most summers (winter in the Northern Hemisphere) there since 1968, when the NSF started funding a seal census in the Antarctic.

"When we started, there was almost nothing known about crabeater seals," he says. That census was the first time that reproduction and family groups of crabeaters were described. But the researchers were less successful with leopard seals, which Siniff describes as "a big predator," less abundant, more solitary, and harder to find.

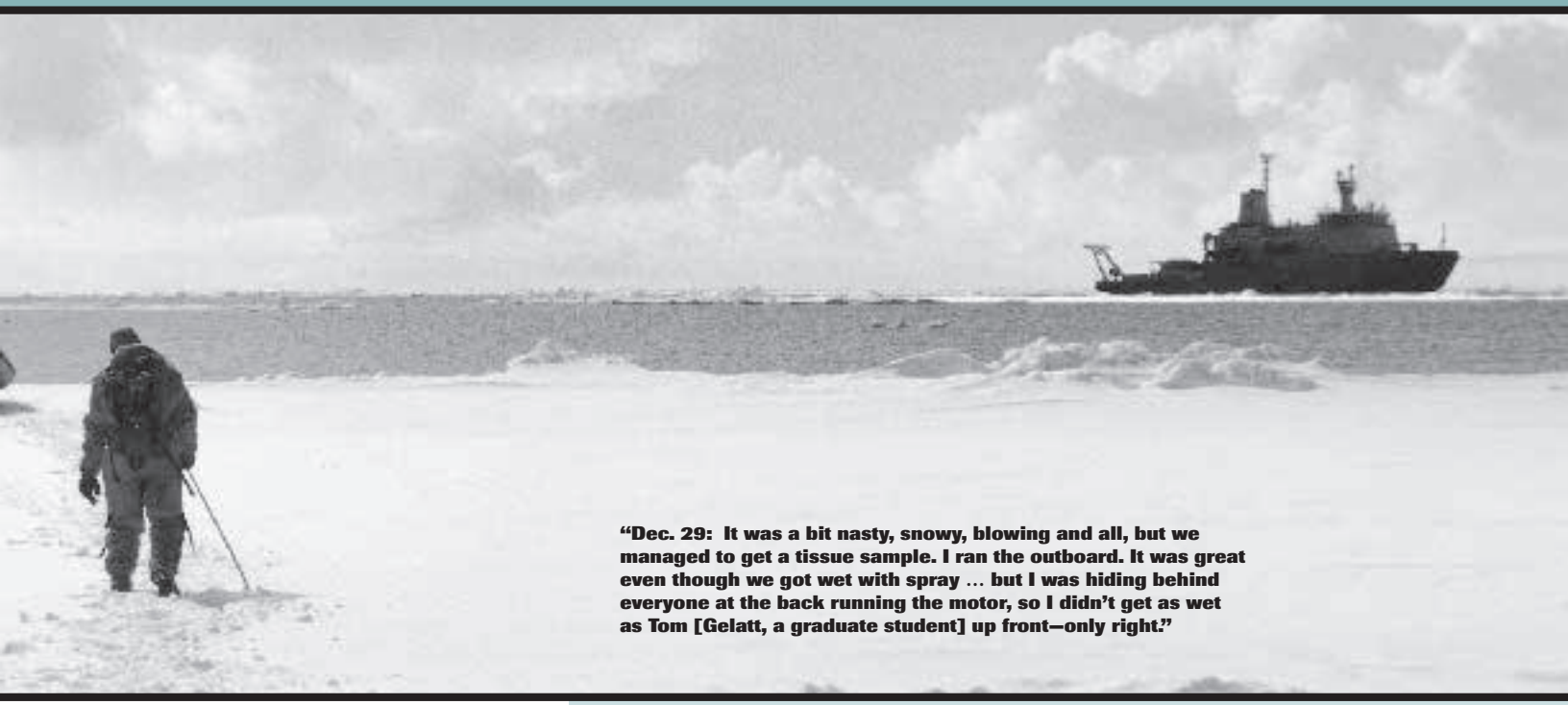
A third species of pack ice seals—that is, seals that bear their pups on floating ice—is the Ross seal, relatively rare in the Antarctic. APIS also studies the Weddell seal, whose females bear their young on fast ice (ice that is stuck fast to the continent rather than the floating pack ice). A large colony of Weddells occupies the region near the McMurdo Station, where Siniff and others have maintained a long-term study. "We have a database of tagged individuals that we've followed for almost 30 years," says Siniff. "We used underwater TV to watch the Weddell seal, did quite a bit of behavior work, mother-pup relationships." Siniff has also done shorter studies on crabeaters and leopard seals, and over the years several graduate students working with him have done their Ph.D. research on various aspects of Antarctic pack ice seals.

As for collecting samples from the predatory leopard seals, "we had a jab pole that we could jab and get a little piece of tissue out of the skin," Siniff says. "You had to be a little careful."

Siniff's latest research is on seal genetics. He and colleague Ian Stirling of the University of Alberta are looking at variation within a species and trying to relate genetic variation to life history patterns. For example, looking at the genetics of two widely separated seal colonies would tell how much interbreeding occurs between the colonies.

Siniff and Stirling are also looking into the origin of Antarctic seals. Fossil material indicates that one seal species immigrated to the Antarctic about 5 million years ago and then the pack ice species (crabeater, leopard, Ross, and Weddell seals) radiated from that one introduction. According to Siniff, it was always thought that southern elephant seals (which are not pack ice seals) were introduced separately, from separate stock. But, he says, that might not be right. It turns out that Ross seals molt in the same way that elephant seals do—by losing some skin along with their hair. "We want to hypothesize that maybe Ross seals are more closely related to elephant seals than

"Jan. 3: It's been a good day for our project. We got eight tissue samples from crabeaters without any sprained body parts. Seems they are just a little more rambunctious than I remember."



"Dec. 29: It was a bit nasty, snowy, blowing and all, but we managed to get a tissue sample. I ran the outboard. It was great even though we got wet with spray … but I was hiding behind everyone at the back running the motor, so I didn't get as wet as Tom [Gelatt, a graduate student] up front—only right."

we previously thought," says Siniff, "so we'll take a look at that [with DNA evidence]."

Collecting the evidence is a challenge. "Basically, you handle [the seals]," says Siniff. "You can put a bag over their head and sort of control them and then take a blood sample, and we'd also take an ear-notcher and take a little piece of tissue out of the rear flipper, and that's all you need for DNA work." On this last trip, Siniff and Stirling collected tissue samples from more than 400 pack ice seals—with help from their graduate students and several other scientists aboard the ship.

As for collecting samples from the predatory leopard seals, "we had a jab pole that we could jab and get a little piece of tissue out of the skin," Siniff says. "You had to be a little careful." Care was also required to get to the seals—motoring from the ship to an ice floe in a rubber boat, or being dropped off by helicopter—not to mention walking around on floating ice. But, says Siniff, the researchers all wore "sponge rubber" suits that float, and he's never seen anyone fall in. "We fall through the ice a little bit, but it's mostly just a leg."

Though the DNA data collected on this trip haven't been analyzed yet, one thing is clear: for Siniff, the fun is in the fieldwork. "I do admit I like this kind of work," he says. "It's good to be in the pack ice."

Diary of a researcher

"Jan. 28: We weighed seven emperor penguins and put satellite tags on two. And had a lot of fresh air and sunshine, along with a little windburn, as we sped along in the zodiac." ***(L to r) Siniff, Jerry Kooyman, and Ian Stirling***

"Jan. 19: Ian and I went with Jerry Kooyman to look for a penguin. … We didn't find the penguin but did find its poop, so now Jerry can be happy trying to figure out what it ate from the leavings, so to speak."

"Jan. 13: We tried to catch a crabeater but he got in the water on us. … I could see he was not going to stop, so dove for cover." ***This crabeater shows old scars from leopard seal attacks and a new scar from a killer whale.***

For more information on APIS, go to www.nsf.gov/cgi-bin/getpub?nsf0030. For more on projects involving Siniff and his graduate students, go to siniff3.ecology.umn.edu.

–Photos and journal entries courtesy of Don Siniff

So you want to be a doctor *and* a

A new program makes it easier to earn law and life sciences degrees simultaneously.

Susan Wolf, law professor and director of the joint degree program

EVERY DAY WE READ OF another instance in which science and law collide. A young man dies following genetic therapy. Environmentalists trying to save salmon battle the hydroelectric industry. A woman fights to make her HMO pay for a bone marrow transplant. NASA astronauts resist having their physical well-being monitored by computer sensors.

The big interdisciplinary questions—Should we allow genetically modified organisms into our food system? How can we safeguard genetic privacy as we map and sequence the human genome? How can we assure access to affordable health care?—can't be answered by specialists in either law or science. Instead, a new breed of professional has become increasingly necessary, a person who represents a hybrid of these two professions. A professional who understands both areas well enough to tackle what University of Minnesota law professor Susan Wolf calls "the really big 21st century questions."

It was the growing need for this kind of cross-training that led Wolf, together with Law School dean Tom Sullivan and College of Biological Sciences (CBS) dean Bob Elde, to propose creation of a unique joint degree program in law, health, and the life sciences. Approved by the University's Board of Regents last summer, the program is the only one of its kind in the country. It's geared to students interested in combining a law degree with a master's or doctorate in molecular, cellular, developmental biology and genetics; pharmacology; health services research, policy, and administration; environmental health; ecology; conservation biology; or science, technology, and environmental policy.

Completing the program will lead graduates to jobs in law, government, and business, where they will specialize in such fields as biotechnology and genetics; drug development and regulation; science and health policy; and environmental policy and law.

The University was a natural place to found such a joint program, says Wolf, the program's director, because of the "enormous number of faculty members here who do biology and because of our great strengths in both the Law School and the Center for Bioethics."

The goal of the program, currently in its first recruiting cycle, is to "attract excellent students and train them in such a way as to really equip them to address these interdisciplinary questions," says Wolf.

The need for cross-trained professionals was becoming increasingly obvious in recent years, according to Elde, with the demand coming from both students and employers. Student interest was made manifest in a survey of biology graduate students done three years ago, in which 20 percent of respondents expressed an interest in combining their science expertise with law or business training. "It's important that we take the needs and desires of our students to heart and deliver what they think they need," Elde says. "The faculty, too, has realized that the stuff we're doing has big implications for society." First-year law students showed equally strong interest in the joint program when they too were polled, says Wolf.

As for employer interest, that started to become clear through both the numbers of students doing two degrees on their own, and the anecdotal evidence of law firms hiring people away from lab benches and sending them to law school. Elde also learned in meetings with Law School dean Sullivan that intellectual property law in general and biotechnology law in particular are the fastest growing areas of law. "There is a tremendous market for these people," confirms Wolf, who is herself a patent lawyer focus-

John Noltner

By Lynette Lamb

lawyer

John Noltner

The big interdisciplinary questions—Should we allow genetically modified organisms into our food system? How can we safeguard genetic privacy as we map and sequence the human genome? How can we assure access to affordable health care?—can't be answered by specialists in either law or science. Instead, a new breed of professional has become increasingly necessary, a person who represents a hybrid of these two professions.

ing on genetics. "And this stuff is so complicated," adds Elde, "you can't just go to law school and hope to understand it."

One CBS graduate thankful for his cross-training—which he managed on his own, albeit in a time-intensive, cumbersome fashion—is Paul Savereide (Ph.D., J.D. 1991). Now a Cargill attorney specializing in intellectual property law, he decided to earn both degrees to give himself "more control over my career options and to allow me to stay in the Twin Cities." A friend in patent law assured him of the burgeoning job market in the science/law area, so after six years in graduate school, Savereide began work on his law degree in 1988. Ultimately he took his law school finals in December 1991 and defended his Ph.D. dissertation in cell biology the very next week.

In a true masterpiece of Minnesota understatement, Savereide concedes that the month of December 1991 was "intense." He never could have done it, he insists, without the patience and support of his adviser, Pete Lefebvre, professor of genetics, cell biology, and development, as well as the flexibility of the Law School faculty.

The new joint program is designed to streamline the process that Savereide went through, says Wolf, thus making for a more economical curriculum. Organizers expect it will take most students four years to complete a joint master's and law degree, and somewhat longer to complete the Ph.D. and law combination ("The research side of it is very unpredictable," Elde says. "We can't ever guarantee how fast that will go.")

Program enrollees will also enjoy the benefits of some new classes being created for them (which will also enrich the curricula of traditional law and biology students), as well as a proseminar designed to be, as Wolf puts it, "the center of a kind of intellectual life at the University."

Wolf also hopes the program will lead to more joint grant proposals and collaborations among diverse University faculty, as well as to a greater intersection of the University with the law and business communities.

As for Jeannine Thiele, the single student in the fledgling program this year, she's just hoping to find a job she loves. Thiele started her master's degree in molecular biology and genetics in fall 1998, and had already applied to law school when she heard about the new joint program. She became its guinea pig last September when she entered law school. Like the students who will follow her, Thiele is devoting her second year strictly to law school, but will combine coursework in both disciplines during her third and fourth years in the program.

"I wasn't entirely happy working in a lab, but I still love science," says the 29-year-old Thiele, who expects to someday work as a patent attorney. "The joint program has given me a way to work in science without staying in a lab. It feels very right for me."

Now she just needs a few fellow students. "I'm thrilled to be getting some colleagues next fall," she says. "It will be really nice to be around other people doing the same thing."

J.D./Ph.D. student Jeannine Thiele

CBS News

Kudos

David Bernlohr, professor of biochemistry, molecular biology, and biophysics (BMBB), is a recipient of the 2000 Distinguished McKnight University Professorship, which recognizes and rewards the University's most outstanding midcareer faculty.

Eville Gorham, Regents Professor Emeritus of Ecology, Evolution, and Behavior (EEB), will receive the 2000 Benjamin Franklin Medal in Earth Science from the Franklin Institute in Philadelphia April 27. The award is for his "seminal contributions in understanding the ways plants interact with their environment, and the use of this knowledge to measure the source of the contents of air, and the effects of air contents on plants and the environment in general."

Assistant professors **Sarah Hobbie** of EEB and **David Largaespada** of genetics, cell biology, and development (GCD) have been awarded McKnight Land-Grant Professorships for 2000-02. They are two of 12 University faculty in the early stages of their careers to receive this award this year.

GCD professor emeritus **Robert McKinnell** served on the 20-member Board of Advisors for the Millennium Edition of "Who's Who in America."®

BMBB professor **David Thomas** is one of eight recipients of this year's University of Minnesota Award for Outstanding Contributions to Postbaccalaureate, Graduate, and Professional Education.

UGather™ and UPresent™ made a successful appearance at MacWorld Expo in January, and since then have enjoyed nearly 9,000 downloads from all over the world. This organization and presentation software, created by Rick Peifer and Kyle Hammond of the General Biology Program, is available free at upresent.umn.edu.

Transitions

Janene Connelly joined CBS in February as director of development and external relations. Formerly the executive director of development and director of corporate and foundation relations for the University of St. Thomas, she has a B.S. from the University of Minnesota and a master's degree in philanthropy and development from St. Mary's University of Minnesota. She is in charge of major gifts to the college, including corporate and foundation giving and planned giving (wills, bequests, trusts, annuities, etc.); is responsible for long-range collegiate development planning as well as CBS' capital campaign; and will manage volunteer fundraising initiatives. She can be reached at 612-624-7496 or connelly@cbs.umn.edu.

Assistant Professors **Lincoln Potter** and **Claudia Schmidt-Dannert** are new additions to BMBB. Potter joined the department's Regulatory Biochemistry Division in September and Schmidt-Dannert joined the Microbial Biochemistry and Biotechnology Division in March.

Ernst Abbe, c. 1942

Ernst Abbe, professor emeritus of botany, died March 15 at the Wilder Center in St. Paul. He was 95. An accomplished scholar in morphology, cytology, genetics, and phytogeography, he came to the University as a botany instructor in 1935 and by 1945 was a full professor. He chaired the botany department from 1944 to 1947 and from 1962 to 1967, and was instrumental in moving the Botany Department and Herbarium to St. Paul, where they took up residence in the new Biological Sciences Center in 1973. He retired in 1974. Abbe spent a great deal of effort revitalizing the Minnesota Academy of Science and served as its vice president in 1951-52 and president in 1952-53. In 1980, Abbe and his wife, Lucy, were honored for their important contributions to the activities of the Minnesota Academy of Science over a 30-year period. Abbe and his wife were a team in all respects and participated together in a number of expeditions, including Hudson Bay, Southeast Asia, Borneo, and Malaysia. Abbe is survived by two sons, six grandchildren and eight great-grandchildren. The family asks that memorials be sent to CBS' Ernst C. and Lucy B. Abbe Scholarship.

Nelson Goldberg, professor emeritus of biochemistry, died December 19 at Methodist Hospital HealthSystem Minnesota of heart failure connected to spinal surgery. He was 68. Goldberg was on the Medical School faculty for 35 years, first in pharmacology and later in biochemistry. His discovery of the cell signaling substance cyclic GMP made him world renowned. His work describing how signals are transmitted and modulated in cells by cyclic GMP was the basis of many subsequent discoveries, including the role of nitric oxide in signal transmission, which led to the 1998 Nobel Prize in Medicine and development of the drug Viagra. He retired in May 1999. The University of Minnesota will award him a posthumous honorary Doctor of Science degree and BMBB has established the Nelson D. Goldberg Memorial Lectureship in his honor. He is survived by his wife, Marjorie, two sons, and one grandson.

John Noltner

News

CBS, EEB, and the University's Ethics and Public Policy Initiative will present the symposium "Global Change: Ethics, Science, and Policy," April 27 in the Cowles Auditorium of the Hubert H. Humphrey Center on the west bank of the Minneapolis campus. The symposium will initiate a dialog among ethicists, scientists, and policy makers and will feature several nationally known speakers. It is free and open to the public and starts at noon. For more information, go to biosci.cbs.umn.edu/eeb/GlobalChangeWorkshop/index.html or call 612-624-4238.

History under the microscope

Mark Sanders, Imaging Center director

ON THE OTHER SIDE OF THE WORLD, UNIVERSITY OF Minnesota scientists and students are piecing together the remains of an ancient city. And in the process, they're verifying a Biblical story about that city, which existed 2,200 years ago.

The city is Kedesh in northern Israel, and the story is about its inhabitants, the Phoenicians, who fled in a hurry as a Maccabean army approached. They left all their belongings behind, creating a ghost town and generating a host of questions.

That story is told in the Book of Maccabees, but little is known about the Phoenicians' quick exodus and how they lived their daily lives, which is why the University's archaeological dig is so important. The findings could fill gaping holes in what historians know about these people and the Maccabean war.

But the study is important for another reason, as well: It's the first time the College of Biological Sciences' Imaging Center has supported an archaeological dig. Although the collaboration has resulted in some notable archaeological findings, it's also showcased a polarity in research methods: high-resolution, high-powered computerized microscopes versus slow, laborious, hands-on archaeological methods.

For Imaging Center director Mark Sanders, it's an entertaining contrast. "An archaeologist uses a hammer to bust open a jar to see what it contained," he says. "We use microscopes and computer software."

Using the center's high-tech equipment, Sanders has been examining two of the clay artifacts that were brought back to the University from the Kedesh site last fall by Andrea Berlin, the dig's co-director and an assistant professor of classical and Near Eastern studies. At the site, Berlin had discovered a roomful of intact and broken-in-place containers and wanted to find out what had been stored inside them. She e-mailed Marty Dworkin, microbiology professor emeritus, who told her not to wash them, but to bring them to the University for analysis. She brought back two intact juglets, one broken bottle, and the bottoms of two large jars. For help with microscopic analysis, Dworkin referred Berlin to the president of the Minnesota Microscopy Society—Sanders. The rest, you might say, is history.

"The exciting thing is that you never would have known that there was anything to gain by looking inside of an empty jug," Berlin says. "It was a shot in the dark."

Using electron microscopes, Sanders magnified the residue on shards from the bottoms of the jugs by 50 to 200 times (the microscopes are actually capable of 100,000 times magnification) and discovered starch granules from wheat. Others using different methods confirmed wheat on separate shards, and found that the juglets contained an oil-based liquid.

To examine the artifacts, Sanders also used laser scanning confocal microscopy, whereby the computer pieces together a series of high-resolution, high-magnification images of a very small area on an artifact to create a 3-D image that's easy for scientists to examine and study.

That technique is a tremendous departure from methods Berlin has been using since her first archaeological dig in the early 1970s. She says she has never been in the position of having scientists, like Sanders, who can help her.

"My eyes have been opened to the variety of analytical techniques that can be used in archaeology," Berlin says. "We've been overlooking these findings for years. Now we've come up with an inexpensive and relatively quick way to look at microscopic residue on artifacts, and that's really cool."

Sanders is equally excited. He always welcomes new uses for Imaging Center equipment, which is used predominately by cellular and molecular biologists. He looks forward to more non-traditional collaborations in the future, especially if they have the historical significance of Kedesh. "I'm just excited about putting my hands on these artifacts from antiquity," he says.

—Geoff Gorvin

AlumNews

From the president

Nancy Rowe

Lisa Weik

THE BIOLOGICAL SCIENCES Alumni Society (BSAS) Board of Directors formed a consensus Point of View (POV) this year. It reads: "Develop an active and informed biological sciences community of alumni." Heavy emphasis is on "active," "informed," and "community." As the year has progressed, we have strived to use this POV to evaluate all projects and activities that BSAS will undertake. Here are highlights of our year so far; you decide if we are hitting our mark within the spirit of our POV.

BSAS co-sponsored the annual fall Itasca weekend, which featured a wide selection of outdoor nature programs and indoor talks for both adults and kids, to allow everyone to have fun learning about biology in the spectacular setting of CBS' Lake Itasca Forestry and Biological Station in Itasca State Park. The social events, including a banquet and 90th birthday party with cake, helped foster community.

To help alumni who are thinking about career transitions, BSAS took an active role in the April 6 CBS Career and Internship Fair. CBS expanded the scope of the fair this year to include more networking opportunities and job fair options for alumni. As part of the fair, BSAS cosponsored "Changing Careers in Science," an event featuring keynote speaker Amy Lindgren, weekly employment columnist for the *St. Paul Pioneer Press* and author of several books and articles on job searches and career transitions. The event also included a panel discussion with CBS alumni who have changed careers or developed unique career paths, and a reception to help participants network with colleagues.

For our 1999-2000 Mentoring Program wrap-up dinner April 27, we will join forces with the alumni mentoring program of the College of Agricultural, Food, and Environmental Sciences to create a fun ending to an exciting year. Our fall kickoff exceeded expectations, with 59 student/mentor matches (double last year) coupled with our earliest match-up event ever—before Thanksgiving.

Our February board meeting at the Science Museum of Minnesota inspired a new idea: BSAS Family Day at the Science Museum. We'll hold the first one next spring.

Finally, the BSAS board is seeking additional members to bring their talents, vitality, and place in the community to our alumni society. Please consider visiting one of our meetings and joining us for a light supper; we would be happy to meet you.

I hope you have concluded that BSAS is hitting the mark in "developing an active and informed biological sciences community of alumni." I think we are on the right track.

Warmest regards,

Lisa A. Weik
President, Biological Sciences Alumni Society

CALENDAR OF EVENTS

2000

Thursday, April 27	"Global Change: Ethics, Science, and Policy," Cowles Auditorium, Hubert H. Humphrey Center, noon
Tuesday, May 2	BSAS board meeting, 406A Biological Sciences Center, 5:30–7:30 p.m.
Saturday, May 13	CBS Commencement, Northrop Auditorium, 7:30 p.m.
Wednesday, June 7	BSAS board meeting, time and Minneapolis campus location TBA
	UMAA 2000 Annual Meeting and Celebration, McNamara Alumni Center and Williams Arena (For more information go to www.umaa.umn.edu or call 612-624-2323.)
September 29–October 1	Itasca Weekend, Lake Itasca Forestry and Biological Station

For the complete college calendar, go to cbs.umn.edu/cgi-bin/calendar/calendar.pl.
For the U of M events calendar, go to events.tc.umn.edu.
For a list of biological seminars at the U of M, go to cbs.umn.edu/college_info/seminar.html.

Matalin and Carville to speak

Two of the most fascinating personalities in 1990s political campaigning will headline the University of Minnesota Alumni Association's 2000 Annual Meeting and Celebration. Democratic consultant James Carville and Republican strategist Mary Matalin will present a point-counterpoint discussion on current partisan politics Wednesday evening, June 7, just as the presidential campaign gets into full swing. Matalin and Carville rose to national prominence when they helped run opposite sides of the 1992 presidential campaign. They later married and co-wrote the bestseller *All's Fair: Love, War, and Running for President,* which is also the title of their presentation. Both continue to be active and outspoken for their respective parties. For information on time, location, and ticket prices and availability, go to www.umaa.umn.edu or call 612-624-2323.

Class notes

New Gateway opens

The McNamara Alumni Center, University of Minnesota Gateway, officially opened with a celebration February 11–13. This new "front door" to the University contains the original Memorial Stadium Arch and a heritage gallery. It also houses the University of Minnesota Alumni Association, Foundation, Board of Regents, Medical Foundation, and other units.

Be an alumni mentor

Mentoring gives you the opportunity to share your profession in a very personal and lasting way. If you're interested in signing up, please complete the enclosed envelope and let us know! All CBS alumni and friends are welcome.

BSAS scholarships awarded

Five BSAS freshman scholarships of $1,000 have been awarded for fall 2000, two single-year and three multi-year. Thanks to all who contributed.

Mark your calendars

The first-ever BSAS Family Day at the Science Museum of Minnesota will be held Saturday, March 3, 2001. Stay tuned for details.

BSAS Board of Directors—Officers

President: Lisa Weik
President-elect: Jerald Barnard
Past President: Tom Skalbeck
National Board Representative: Carol Pletcher
Chair, Alumni Relations and Events Committee: Dick Osgood
Chair, Student Services Committee: Deanna Croes

Be sure to visit the CBS Alumni & Friends Web pages at cbs.umn.edu/7alumni/7alumni.html.

Susan Berget (Ph.D. '74) is a biochemistry professor and director of the Cell and Molecular Biology Graduate Program at Baylor College of Medicine.

Dick Osgood (B.S. '77, M.S. '79) co-organized a session on cumulative impacts of development on lakes with Pat Brezonik, director of the University of Minnesota Water Resources Center, for the annual meeting of the North American Lake Management Society in Reno, Nev., in November. Dick, who presented a paper in the session, is the owner of Ecosystem Strategies, a consulting business emphasizing water resources planning and management.

Mark Tuszynski (B.S. '79) is an associate professor of neurosciences and director of the Center for Neural Repair at the University of California, San Diego. He is senior author of a study on how the brain ages, which appeared in the September 14, 1999, Proceedings of the National Academy of Sciences and which was written up in the *Star Tribune*.

David Largaespada (B.S. '82), assistant professor of genetics, cell biology, and development at the University of Minnesota, has been named a McKnight Land-Grant Professor for 2000-02. Besides the title, winners receive a $25,000 research grant in each of two years and a research leave in the second year.

Loren Miller (B.S. '86) finished his Ph.D. in fisheries and wildlife in 1996 at the University and is now working with Anne Kapuscinski, director of the University's Institute for Social, Economic, and Ecological Sustainability.

John Pukite (B.S. '87), who published *A Field Guide to Cows* in 1998, has now published *A Field Guide to Pigs*, which includes tips on proper clothing and equipment for pig viewing, techniques for sneaking up to pigs, rules of pig etiquette, illustrated pig facts, and a checklist of breeds. Read more about it at webpages.mr.net/pukite/pig/guide.html.

Mary Jo Lockbaum (B.S. '90), past BSAS president, received her MBA in 1998 from the University of St. Thomas and as of December 1999 became operations manager of the Loyalty Division of Carlson Marketing Group in Plymouth, Minn. The division runs loyalty programs such as gold points cards and frequent flyer programs for businesses.

Olaf Olson (B.S. '94) received a Ph.D. from Lehigh University in environmental science and recently completed a postdoctoral fellowship in Regina, Saskatchewan.

Andrea Rahn (B.S. '94) attended medical school at the University of North Dakota in Grand Forks and graduated in 1998, then completed a transitional internship at Gundersen Lutheran Hospital in La Crosse, Wis. She is now on active duty for the U.S. Navy, serving as a General Medical Officer in Athens, Ga., where she is stationed at a primary care/family practice clinic.

Cindy Campbell Lashley (B.S. '95) received a master's degree in genetic counseling from the University of Minnesota in 1998 and just published the book *Genetics: Visual Aids for Health Care Professionals*. For more information, go to www.cclbooks.com.

Steve Lund (Ph.D. '95) is a plant physiologist and pathologist for Genesis R&D, the first privately owned biotechnology company in New Zealand. Steve works on gene discovery in plants with a particular emphasis on forest tree species, with the aim of genetically improving pine and eucalyptus varieties for tree farming.

Kate Howe (M.S. '98) is a graduate student in the Department of Zoology at the University of Washington.

Mollie Mallinger (B.S. '99) is a biomedical technologist at the Jackson Laboratory of Bar Harbor, Maine, the world's number-one producer of transgenic mice. Mollie is in charge of all the polymerase chain reaction (PCR) testing for the Diagnostic Laboratory. She designs PCR tests and primers and is doing research.

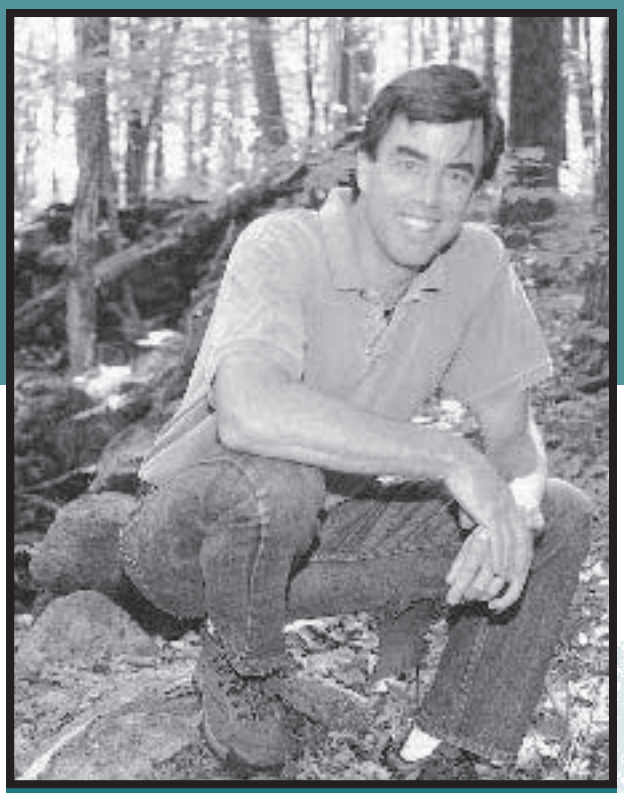
Jennifer Schmitz (B.S. '99) spent last summer working on a limnological research project on Lake Tanganyika in Tanzania. She is now on temporary assignment as a student support services assistant in CBS Student Services.

The January issue of *Mpls.St.Paul* magazine featured a physician survey of premier medical specialists in the Twin Cities. The list included:
Susan Mahle (M.S. '72), pediatrics
Richard Stanek (B.S. '75), cataract surgery, lens implants, refractive surgery
Steven Inman (B.S. '78), pediatric services
David Thorson (B.S. '79), MinnHealth Family Physicians
M. Gene Parrish (B.S. '80), mood disorders, geriatric, postpartum depression
Rochelle Taube (B.S. '83), sports medicine

Three CBS alumni are among the preceptors for students in the University of Minnesota Rural Physicians Associate Program. They are:
P. Andy Ruth (B.S. '74)
Kurt Angstman (B.S. '81)
Diane Kennedy (B.S. '86)

ALUMS ONLINE

Stan Tekiela (B.S. '94), author of *Birds of Minnesota Field Guide* and *Wildflowers of Minnesota Field Guide,* has a Web site that includes reviews of his books, links to his syndicated "NatureSmart" newspaper columns, and an online "ask the naturalist" Q&A forum. Go to www.Naturesmart.com.



Jim Gipe

David Foster

Fostering a forest

by Jennifer Amie

Time spent in Thoreau's country shows a CBS grad the impact of human history on the natural landscape.

IN THE SOLITUDE OF THE NEW England woods, crumbling stone walls wind through stands of maple and spruce. Collapsed field-stone cellar holes nestle amid moss and ferns. Remnants of a bustling agricultural community, these relics have—over the last century—been absorbed by a fast-growing forest of sugar maple, beech, and yellow birch. It was to such a forest that David Foster retreated in the summer of 1977 to build a log cabin during a break between college and graduate school. Anticipating an isolated summer, he brought a literary companion into the woods—Henry David Thoreau.

"I spent a year living by myself and it was very lonely," Foster says. "I took Thoreau's journals with me. But 100 years after Thoreau recorded his observations of the New England landscape, I found that his journals bore no relation to life in the big woods. I was terribly disappointed." Thoreau's woods, says Foster, were occupied by farmers, woodcutters, and young children exploring. During Foster's stay, however, the sole sign of human activity was the distant ringing of a church bell.

Thoreau's landscape was, to a large extent, agricultural—a climate that declined at the end of his lifetime. "Farming moved to the Midwest, and people moved to the cities with industrialization," Foster explains. "As people abandoned agricultural land, it came back quite quickly and naturally to forest." It was in this newer, abandoned forest that Foster lived.

Once he realized the tremendous impact of human history on the natural landscape, Foster began to look at ecology in different terms. "As soon as you recognize that humans have shaped nature for a long time, it changes your understanding of nature," he says. "We have to take a broad view of understanding the environment." Foster realized that to understand any ecological process, he needed to know its history. This concept would inform Foster's thought throughout his studies and career, and forms the basis for his recent book, *Thoreau's Country: A Journey Through a Transformed Landscape* (Harvard University Press, 1999). In it, Foster chronicles New England's natural history in light of his own experiences and using Thoreau's writings as a window to the past.

Today, Foster lives in Massachusetts with his wife and two children and is a member of the faculty at Harvard University. He supervises a 35-member research staff as director of the Harvard Forest, a 3,000-acre research site. Like the College of Biological Sciences' Cedar Creek Natural History Area, Harvard Forest is, essentially, an outdoor lab and classroom used for long-term ecological studies. Foster researches human and environmental factors that have affected the landscape over time—a quest with roots in his graduate studies at the University of Minnesota, where he earned an M.S. and Ph.D. in ecology, studying the role of lightning fires in the wilderness of Labrador, Canada. "I was absolutely inspired by graduate school at the U of M—especially working with a phenomenally good research group run by Herb Wright," says Foster.

Currently, he is involved in a long-term study examining human impact on environments in Puerto Rico, the Yucatan, and Harvard's forest—areas that have been abandoned by settlers. "We're looking at what happened since the Mayan culture crashed 1,000 years ago, since people moved off the land in Puerto Rico in the late 19th century, and at the legacy of human activity in New England," Foster says. "We hope to show the commonality of landscapes people view as very, very different. Remarkable chunks of the world have had greater human activity in the past. We're learning about the restoration of such ecosystems—and what we learn from these landscapes might help us when we want to restore land intentionally."

"As soon as you recognize that humans have shaped nature for a long time, it changes your understanding of nature. We have to take a broad view of understanding the environment."

David Foster

Thank you for your support

The University of Minnesota and the College of Biological Sciences recognize donors through various gift clubs. We are pleased to announce two new annual University giving clubs and two new lifetime clubs. The two new annual clubs are the Maroon Club, which recognizes donors who contribute $1,000 or more, and the Gold Club, for those who contribute $2,500 or more each year. The two new lifetime giving societies are the Chancellors Society, for lifetime gifts of $50,000 or more, and the Regents Society, for lifetime giving of $500,000 to $999,999. Thank you for your support. Your gifts make a difference!

Annual Giving Clubs

College of Biological Sciences Programs

DEAN'S CIRCLE 1999

The essential, distinguishing feature of the Dean's Circle is its members' pledge and commitment to sustained, annual support. Members make annual gifts of $100 to a special project of priority chosen by the dean.

+ LaVonne Batalden (10)
+ David Bernlohr (11)
+ David Biesboer (2)
• William Buhi
+ Lillian P. Burke (3)
+ Michael Carey (1)
+ Jacquelyn DeGuise (8)
+ Gary Dillehay (7)
+ Dr. & Mrs. Bruce Dumke (7)
+ Denneth Dvergsten (11)
+ Gunnar Erickson (10)
+ David & Elizabeth Fesler (10)
+ Eville Gorham (9)
+ Mary Grula (6)
+ Perry Hackett (9)
+ Myrna Halbach (10)
+ Kathryn Hanna (5)
+ William Harrison (4)
+ Dr. John Hiemenz (3)
+ Robert C. Hodson (5)
+ Scot W. Hutton (11)
+ Heather Almquist Jacobson (7)
+ Sally & Charles Jorgensen (4)
+ Mark R. Kaster (7)
+ Kristine Kirkeby (9)
+ James Langland (3)
+ Mara M. LaRock (1)
+ Irvin Liener (11)
+ Rex Lovrien (9)
+ Patricia Lowell-Hammarback (4)
+ Steven C. Matson (1)
+ James K. McCormack (1)
+ Richard Meyer (9)
+ Barbara Bailey Miller (9)
+ Brad Narr (11)
+ Nancy Ott-Pinckaers (5)
• Kathleen Parson
+ Jeff Pearce (10)
+ Bernard Phinney (11)
+ Christina Pieper-Bigelow (3)
+ Marco Rabinovitz (1)
+ Nancy Rowe (1)
+ Doris Rubenstein (11)
+ Gary Silberstein (5)
+ Andrew Streifel (8)
+ Melvin Stulberg (2)
+ Kipling Thacker (11)
+ Steven Thompson (3)
+ Robert Valente (2)
+ Cheryl Vergin (9)
+ Joyce S. Warkentien (5)
+ Tom & Eileen Welna (6)
+ J. Michael Zylka (2)

DOUBLE HELIX SOCIETY 1999

The Double Helix Society comprises individuals donating $1,000 over a two-year period on a sustained basis for a program of their choice and institutions contributing a minimum of $2,000 for the same period. Society members are permanently recognized on the Double Helix board in the Gallery in Snyder Hall.

+ American Cancer Society
+ Norma Allewell
+ Franklin Barnwell
+ Beckman Instruments
+ Robert Brambl
+ P. Patrick Cleary
+ Kendall Corbin
• Mrs. P.A. Dagley*
+ Dagley Family
+ DiaSorin, Inc.
+ Therese Francis/Crossquarter Breeze
+ James P. Grover
+ Wesley & Ida Hackett
+ LaVell Henderson*
+ Claude H. Hills
+ Darrin P. Johnson
+ Herb Jonas
+ Mary C. Kemen
+ Beatrice K. Klein
+ Max A. Lauffer
+ Edward & Pamela Lewis
• Johng K. Lim
+ David & Mary Loveless
• David J. & Esther G. McLaughlin
+ Robert & Roberta Megard
+ Patrice Morrow
• Gary Nelsestuen
+ Edgar Painter
• Irwin Rubenstein
+ ViroMed Laboratories
+ Clare Woodward
+ Zumbro/IFP

University of Minnesota Programs

MAROON CLUB (annual gifts of $1,000 or more)

Donald N. Alstad
Brian J. Brogmus
Drs. John E. & Ting C. Carlson
Thomas R. & Doris Clevenger
Gregory L. Cowan
Andrew M. & Kaari B. Davies
Ecotrust
John E. Gander
Claude H. Hills
Thomas R. Jacques
Darrin P. Johnson & Charla R. Bunton-Johnson
Claire E. Kotts
Dr. Max A. & Ericka E. Lauffer
Dr. Arnold Lindall
David J. & Esther G. McLaughlin
Benjamin S. Oehler
Dr. James B. & Joan C. Peter
James R. & Patricia M. Pray
Marco Rabinovitz
Dr. James B. & Patricia Swan
Ben & Louise Thoma
Dr. James S. Vinson

GOLD CLUB (annual gifts of $2,500 or more)

Robert O. & Roberta A. Megard
David J. & Donna Milller
Dr. Jack E. Richman
Palmer Rogers

• Charter member + Sustaining member ( ) Indicates number of years of membership *in memory

Thank you for your support

University of Minnesota Lifetime Giving Clubs

PRESIDENTS CLUB—$10,000 ($25,000 after 7/1/98)

Rose Marie Abbott
C. Robert Binger
Walter & Dorothy Breckenridge
Paul Boyer
Richard & Lucille Caldecott
Sarah Nelson Cook
Bruce & Lisa Dumke
Robert Elde
Albert Frenkel
J. Stephen Gantt & Jocelyn Shaw
Donald & Nancy Gilbertson
Richard & Kathryn* Gray, Sr.
Norman & Linda Harris
LaVell Henderson*
Otto J. Hill*
Anne Hopkins
Richard & Judi Huempfner
Andrew & Bess* Justus
Mary Kemen
Paul LeFebvre
Edward Lewis
David & Mary Loveless
Gladys F. Markley
Barbara B. Miller
Patrice Morrow
Gary & Mary Nelsestuen
Alonzo Newby
Edgar Painter
David* & Jean Parmelee
Bernard & Jean Phinney
Kevyn Riley
William Shepherd
Carolyn Silflow
Michael J. Simmons
Duane & Carmel Skar
D. Peter Snustad
Kipling Thacker
Harrison & Jean Tordoff
Robert J. Wilkie
Windibrow Foundation

FOUNDERS SOCIETY—$25,000

Victor Bloomfield
Charles & Sally Jorgensen
Paul & Beatrice Magee
Henrietta & Philip Miller
Margaret Snyder

CHANCELLORS SOCIETY—$50,000

Margaret Davis
J. Emory Morris
Russell Rothman

TRUSTEES SOCIETY—$100,000

Elmer L. Andersen
Elwood Caldwell
Wallace & Mary Lee Dayton
Barbara & Morris Friedell
Dr. & Mrs. Arnold Johnson*
Donald* & Elizabeth Lawrence
R & D Systems, Inc.
Rhone-Poulenc Ag. Co.
Nathan Sperber
Wilkie Bros. Foundation

REGENTS SOCIETY—$500,000

Abbott Laboratories Fund
Dow Chemical Co.

BUILDERS SOCIETY—$1,000,000

James Ford Bell Foundation
Ciba Geigy
Ecolab Foundation
E.I. DuPont de Nemours & Co.
David & Elizabeth Fesler
Freshwater Foundation
Charles M. Goethe Estate
Donald & Louise Gabbert
General Mills Foundation
Medtronic Foundation
Merck & Company
Monsanto Co.
John & Margaret Ordway, Jr.
Pillsbury Co. Foundation
Pioneer Hi-Bred, International, Inc.
Rosemount Inc.
3M Co. & Foundation

HERITAGE SOCIETY—planned gifts or bequests

Elwood Caldwell
Sarah Nelson Cook
Denneth & Joan Dvergsten
David & Elizabeth Fesler
Otto J. Hill*
Theodora Johnson*
Jack Lynch*
Jean McIntosh
Henrietta & Philip Miller
Darby & Geraldine Nelson
Max Schultze*
William Sheperd
Nathan Sperber
Sandra Ann Stoller

*in memory

College of Biological Sciences
University of Minnesota
123 Snyder Hall
1475 Gortner Avenue
St. Paul, MN 55108

Nonprofit
Organization
U.S. Postage
PAID
Permit No. 155
Minneapolis,
Minnesota