# SOLUTIONS

SOLUTION ▸ *DRIVEN* SCIENCE™

WINTER 2009

## When Fungi Attack
A fungus could break barriers to cellulosic ethanol

## Warm Front Moving In
Cold-climate research evolves as Earth warms

## Building a Better Potato
Scientists continue a long tradition of CFANS research

## Battle for a Cure
Pigs may hold the key to ending disease

College of Food, Agricultural and Natural Resource Sciences

UNIVERSITY OF MINNESOTA

Photo by Martin Moen

*Solutions* magazine is published three times a year for friends, alumni, faculty, staff and students at the College of Food, Agricultural and Natural Resource Sciences. Like the college, the magazine focuses on how science leads to solutions for today's problems in food and agricultural systems; global climate and environmental change; biodiversity; and bioenergy and bioproducts.

CFANS is composed of six divisions, 13 academic units (two are held jointly), seven research and outreach centers throughout Minnesota, the Bell Museum of Natural History and the Minnesota Landscape Arboretum. The college also participates in many interdisciplinary centers and cooperatives.



**Tell us what you think.**
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# SOLUTIONS

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Photo by Patrick O'Leary

## Welcome to our winter issue of *Solutions*

As we begin a new year and a new semester, we face serious challenges. The state and national economies are struggling, which will almost certainly affect our college's plans for the future. Financial support for scientific research is continuing a 20-year decline, yet problems such as a changing climate, supplies of healthful foods and preserving biodiversity persist.

But we do have reasons to be optimistic, some of which can be found in this issue's stories about the innovative research being done in the College of Food, Agricultural and Natural Resource Sciences. The University of Minnesota remains on track to become one of the best and most productive research universities in the world; scientists in our college are key contributors to those efforts.

Being "the best" yields tangible results that benefit everyone, not just the university. Economists agree that investing in research and education pays big dividends in terms of new jobs and an expanding, innovative economy. As Tom Stinson–Minnesota's chief economist as well as a professor in our applied economics department—has said, "investment in research to maintain the state's competitive position is one of the most critical ingredients to job creation and economic growth."

At CFANS, we are especially conscious of our role as a land-grant university and the accompanying responsibility of sharing our research and expertise with the public. We think it's important for our work to benefit all Minnesotans, and the way to do that is by maintaining our excellence. While we're willing to do our part in solving the state's budget issues, simply reducing the funding that pays for teaching, research and outreach at the university is a short-term, short-sighted answer.

We appreciate all our stakeholders' support as we navigate these turbulent times. We ask that you continue to demonstrate your support for the college and university with our state and national policymakers. On page 24, our alumni and constituent relations director, Mary Buschette, explains specifically what each of us can do to raise awareness of the long-term benefits of a first-class research university.

Thank you for your support. As always, we would love to hear your feedback; write to us at solutions@umn.edu.

Allen S. Levine ('73–M.S., botany; '77–Ph.D., nutrition), Dean

*On the cover: As a brown rot fungus feeds on the sugars in this piece of wood, it bypasses the lignin barrier that has hindered production of cellulosic ethanol.* Photo by Jonathan Schilling.

All photos by David Hansen

# Warm Front

*Editor's note:*
*Because of its location and traditions, some of CFANS' best-known research deals with cold climates. But what happens to that research if, as experts expect, temperatures rise even a few degrees over the next decades? We asked five CFANS scientists to explain how a warmer climate might affect their research.*

**By Becky Beyers**

**Dan Erkkila** ('77–B.S., forest science; '82–M.S., '91–Ph.D., forest management), **head of the North Central Research and Outreach Center in Grand Rapids, which has long been known for its work in breeding cold-hardy fruits, vegetables and wild rice, as well as for its forestry work:**

Over time, NCROC researchers will definitely move their research work in new directions if the climate changes that we are hearing about do occur. Most of our research programs involve, in one way or another, growing agricultural or forest crops in the existing climate of northeast Minnesota. Rising mean temperatures and dewpoints, along with significant long-term changes in precipitation amounts and timing, will directly affect growth.

One of our competitive advantages as a research site has been our traditionally cooler, northern location. Our facility remains the only cold-weather hardiness evaluation site in the lower 48 states for fruit and vegetable crops. If, as a consequence of warming, the USDA plant hardiness zones move north, our ability to study cold-hardiness may cease. On the other hand, warming may produce longer growing seasons, meaning horticultural crops typically requiring warmer, southern locations may find new homes here. For example, northeastern Minnesota sites may be able to support more than cold-climate varieties for Minnesota's growing grape industry.

Warming effects leading to longer growing seasons would likely have a positive effect on commercial wild rice production (California is now the largest producer of commercial

wild rice in the U.S.). But we could also face new or variant diseases arising from moisture and humidity changes, and we would need to breed varieties with the shorter seed dormancy required for the changing dormant/growing seasons.

Forest geneticists and silviculturalists already are looking at how to address new disease and pest issues, as well as the ecologic changes that will alter the landscape. But we don't yet know which species will survive as the coniferous forest biome transitions into a deciduous biome.

**Neil Anderson** ('85–M.S., '89–Ph.D., horticulture), **professor in the Department of Horticultural Science who works in breeding ornamental and flowering plants for cold climates:**

Recent shifts in climate have made breeding and selecting for cold tolerance (winter hardiness) a challenge. Snowfall cover, low soil and air temperatures, soil moisture levels, and frost heaving have varied widely each year since 2000, creating a quandary for focused research. While each winter is highly variable for all of these environmental extremes, the possibility still exists that one winter with a cold temperature dip could kill non-hardy plant materials.

In breeding for winter-hardy herbaceous plants, such as garden mums, lilies or gladioli, the standard procedure has always been to conduct extensive, replicated field testing over years and locations in order to select potential new cultivars with proven hardiness and outstanding garden performance. But with such unpredictable winters, our program has had to modify our selection procedures, expanding beyond field tests to include laboratory freezing tests and nondestructive phenotypic selection of other growth traits.

It may take years before the climatic shifts have adjusted and maintain consistency in summer and winter temperature ranges. Until this happens, however, flower breeding programs must stay vigilant in ensuring that the "winter hardy" selections are widely adaptable to the environmental variations and respond accordingly.

**Patrick Huelman, associate professor in the Department of Bioproducts and Biosystems Engineering, and coordinator of the department's Cold Climate Housing Center:**

The climate would have to change a *lot* to affect what we look at in terms of heating and indoor air quality. But our increasingly warmer and more humid summer weather is creating some new challenges.

In this part of the world we haven't really devoted a great deal of the housing research effort to how houses are affected by air conditioning. People use AC more frequently now, partly because of warm, humid summers but also because they're just used to having it, at work and in their cars. So they're running their home air conditioners more often and for longer stretches of time.

That affects buildings because of how moisture goes in and out through the walls

## CFANS cold-climate research evolves as Earth warms

# Moving In

(or more generically, the "building envelope.") If you're only worried about heating, you'd build the walls so the vapor barriers are on the inside of the walls and the outside part of the walls allows moisture to dissipate. But if you take that same wall with air conditioning on a hot, humid day—you may get moisture condensing on the inner side of the wall. We're starting to see this problem today; as you run air conditioning more, that humidity collects inside the walls, and eventually can lead to problems with mold.

That's the transition we're in—it's not so much because of climate change itself, but because of strong air conditioning use for indoor humidity control or perhaps for other reasons like allergens. We're looking at ways to develop a building envelope that can be more responsive to both heating and cooling needs, and in newer houses there's much more thought being given to how air conditioning is affecting that moisture flow now and in the future.

**Tracy Twine, assistant professor in the Department of Soil, Water and Climate, who studies climate change and ecosystems at the Earth's surface level:**

It's complicated, because the crops that grow in Iowa and places south of here are grown here too—corn and soybeans, for example. It's going to get warmer everywhere, and that may help us because we'll have a longer growing season. Crops like warm weather, so if anything our climate getting a few degrees warmer could benefit corn and soybeans. On the other hand, greater corn yields have been associated with cooler summers. So a warmer spring or fall might be better than a warmer summer.

But you also have to consider precipitation. In the last 20 years or so there's been more precipitation, so if that continues we'd be in good shape. But we don't have a lot of confidence that recent precipitation trends will necessarily continue.

Even predicting what will happen just in Minnesota is difficult—you have to consider the whole planet. We're starting to look at what happens to vegetation as the levels of carbon dioxide and ozone increase at the ground level, and those factors may have just as big an effect on our crops and plants as temperature and precipitation trends.

**Jim Luby** ('82–Ph.D., plant breeding and genetics)**, professor in the Department of Horticultural Science and one of the scientists who developed the Honeycrisp apple and cold-hardy Minnesota wine grapes:**

I guess it will depend on when it gets warmer—in all seasons? More so in winter or summer?—and on how much warmer.

As for winter, I think with fruit and any perennial plant we need to remember that we still live in a continental climate with nothing but a couple thousand miles of cold, dark Canadian prairie and taiga between us and the Arctic—nothing to moderate winter temperatures. I am thinking that although climate change may result in warmer average winter temperatures, we will still be subject to occasional very cold Arctic air masses. They may not be as frequent as in years past, but even if one of them comes it could be quite damaging. If we have less persistent snow cover, we may actually see more injury to crowns and roots of perennial fruit plants.

One thing we seem to be seeing already, regardless of global climate change, is a more substantial effect of the Twin Cities heat island. People in Minneapolis-St. Paul and many of the inner ring suburbs are probably seeing a shift of one USDA hardiness zone already from 20 to 25 years ago, compared to the outer suburbs and greater Minnesota.

If we have more summer heat, that could lead to more consistent ripening of grapes and may allow us to grow some different varieties currently grown further south. We may also be able to plant varieties of apples that need a longer season to mature.

But don't plant these just yet—the winter of 2007-08, which was just an average winter, caused extensive damage to these more tender varieties and species. ■

All photos by David Hansen

# Doctor's Orders

## Lake Pepin's decline may force changes in behavior

Our patient is ill and the doctors predict a bad outcome. The cure is within our grasp but it'll be expensive. Should we save the patient?

Our patient is Lake Pepin, a relatively shallow, 40-square-mile body of water within the Mississippi River valley stretching from Red Wing, Minn., to Pepin, Wis. Roughly half of Minnesota's land area and a good portion of Wisconsin—more than 48,000 square miles in all—drains through Lake Pepin. The lake suffers from severe algal blooms, low oxygen levels and a lack of underwater vegetation that would normally cleanse the water and support life.

"But it's more than just Lake Pepin that's at stake," says Faye Sleeper ('90–M.S., geography), co-director of the University of Minnesota Water Resources Center (WRC). "Lake Pepin is an indicator of the health of the waterways that drain into it. Keeping this lake healthy means keeping rivers and lakes in lots of places healthy." The WRC is a collaborative effort of CFANS and University of Minnesota Extension, with funding coming primarily from federal and state government.

Sleeper and other colleagues in the WRC have coordinated the work of a Science Advisory Panel. This team has crafted a proposal for how to cure Lake Pepin. It's the culmination of years of research by scientists from multiple agencies and organizations, including the University of Minnesota. The proposal would shape a prescriptive Total Maximum Daily Load for the lake, or TMDL. Essentially, a TMDL defines how much bad stuff a lake or river can handle and still provide all the benefits—recreation, drinking water, wildlife habitat, and so forth—that we expect.

Lake Pepin primarily suffers from two primary problems: Water entering the lake is carrying too much suspended sediment and too much phosphorus. Years of monitoring the Lake Pepin watershed has revealed where the sediment and phosphorus are coming from. The Minnesota River is the primary source, contributing well over half of the sediment and phosphorus.

One thorny issue confronting the Science Advisory Panel was defining what amount of sedimentation and phosphorus in Lake Pepin is normal. After all, rivers tend to erode their banks and phosphorus is a natural byproduct of decomposing vegetation, so some amount of sediment and phosphorus is expected. How much of Lake Pepin's problems can we affect?

The Science Advisory Panel made numerous recommendations to state pollution control officials on the science and modeling behind a TMDL for Lake Pepin. While not complete, one scenario calls for reducing suspended sediments and phosphorus in the Minnesota and Cannon rivers by one-half, by 20 percent in all other tributaries, and by 70 percent from all wastewater treatment plants in the Lake Pepin watershed. Make no mistake, those are drastic measures.

"The final Lake Pepin TMDL will likely spread the pain around," Sleeper says. "The problems are so severe, there was no way we could single out one or two sources and expect to achieve a cure."

Photo courtesy Faye Sleeper

*Faye Sleeper (right), co-director of the Water Resources Center, holds a sediment core from Lake Pepin. Her work could help save the imperiled lake.*

The Lake Pepin TMDL will be developed by the Minnesota Pollution Control Agency, put out for public review and comment, and then submitted to the federal Environmental Protection Agency for approval. It'll be 2010, at the earliest, before the TMDL is approved.

That gives all of us time to consider how we might change our behavior to cure not only Lake Pepin but all of Minnesota's ailing waters. Sleeper predicts a combination of incentives and voluntary actions to be among the first prescriptions.

"Rain gardens, vegetative buffer strips along shorelines, backyard rain barrels, parking lots made with porous materials, green roofs, and improved agricultural drainage techniques will all become a bigger part of our lives," Sleeper says.

*–Martin Moen*

Photo by David Hansen

All photos by David Hansen

# BUILDING A BETTER P

**by Becky Beyers**

Consider the potato, the *pomme de terre,* the apple of the earth. Even though it's one of the oldest foods known to mankind, it's often been regarded as peasant food, the kind of thing one only consumes if there is no other alternative.

No longer.

In a world where food is increasingly expensive and hard to come by, scientists and humanitarians are taking another look at the potato—the world's number one vegetable crop and its fourth-largest food crop—and recommending it as a way to help end hunger. Citing the potato's high protein and wealth of nutrients, the United Nations Food and Agriculture Organization has called for increased research and development. The FAO saw the need for more potatoes to help feed developing countries as so important that 2008 was designated as the "International Year of the Potato."

At CFANS, plant breeders, biochemists, pathologists, entomologists and soil scientists are continuing a century-old tradition of working with Minnesota's potato farmers and industry to improve the quality, yield and disease resistance of potatoes; some of that work may have implications well beyond the fields of Minnesota and North Dakota.

*Potato researchers harvest large crops each fall to see which cultivars have desirable properties.*

## The versatile vegetable

Potatoes were first cultivated nearly 8,000 years ago in the rugged Andes mountains of Peru; nearly 200 species have been documented, and breeders have used many of those wild species to establish modern varieties. Potatoes are grown in more than 125 countries, often in harsh climate conditions and less-than-ideal soil.

In the Upper Midwest, potatoes are grown in the rich black soil of the Red River Valley, the sandy soils of central and southern Minnesota and the peat of southern Minnesota. Growers raise round red potatoes sold to consumers for boiling and

baking; russets for baking at home and for the French-fry industry; round whites for potato chips; and seed potatoes.

Christian Thill, a professor in the Department of Horticultural Science, works with potato-growing test sites in an area that ranges from western North Dakota to southeastern Minnesota. He says the industry is healthy here, usually ranking in the top five or six states in the nation. Along with the climate, growers here also face the challenge of long distances to bigger markets on the west and east coasts.

A new variety of potato takes about 12 to 15 years to get from inception to market. In a given year, Thill and other potato breeders might test as many as 100,000 new combinations of varieties, weeding out the obvious duds in the first year and narrowing the numbers down to about 15 varieties in their eighth year of testing. Evaluating each variety's resistance to disease, yield and other characteristics takes time and experience, Thill says. "It's a science and it's an art—you have to develop a breeder's eye for the traits that the industry is looking for."

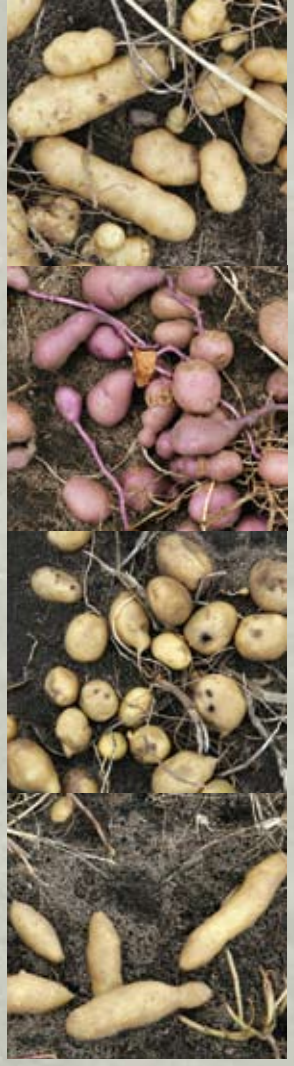
*Horticultural scientist Christian Thill inspects part of the harvest.*

Those traits vary depending on the potato's intended use. For example, a Russet likely will be used to make French fries, so the industry wants a long, oblong-shaped potato that can be cut into strips with little waste, but it also must have the right kind of French fry color and snap and it must not bruise easily. Round whites have to slice evenly into thin, round discs and have skin that peels right off for making potato chips.

"It's all industry-driven and consumer-driven," Thill says. "If a potato variety has strong disease resistance but not the right fry color, it's no good. When you go to the store to buy potatoes for boiling or mashing, you want a nice red skin that stays on until you peel it."

Those kinds of characteristics might someday lead to development of a potato with high name recognition and the ability to command premium prices, sort of the 'Honeycrisp' apple of potatoes.

"We're not there yet, but it could happen," Thill says. "We haven't specifically bred for taste and texture—people like to bite into the 'Honeycrisp' because of how it tastes and the crispness, but



*Different uses call for different potato shapes, sizes and colors.*

we don't have a potato yet like that. Up until now, we've concentrated on breeding potatoes for a specific use. But there's a way to get there eventually."

## Future threats

Late blight, the disease responsible for the Irish potato famine of the 1840s, still poses the biggest threat to non-seed potato growers, says Jim Bradeen, a professor in the Department of Plant Pathology who specializes in potato disease. Part of late blight's potency comes from how quickly it can kill a crop; within a week to 10 days, an entire field can be wiped out, he says. Most U.S.-grown varieties are susceptible, particularly in years with cool, wet conditions. Fungicides work on some pathogen strains, but because the disease is so fast-acting, farmers have to spray the fungicides before the disease strikes—an expensive and less-than-environmentally friendly solution.

Bradeen's lab concentrates on using the disease resistance genes found in wild species of potato to breed new varieties with other desirable traits. Because molecular tools and technology are advancing so quickly, scientists are close to having a pyramid of disease-resistant genes that can work together against ever-changing diseases.

"Historically, we thought of improving the plant as the primary defense against disease," he says. "But the pathogens also are changing. We have to find not just what works now, but what will work in the future."

Seed-potato growers in Minnesota and North Dakota benefit from nearly ideal conditions for growing seed potatoes—long, cold winters that kill off most diseases and pests followed by hot summer days with cool nights. Still, they face threats, both environmental and financial.

Photos by David Hansen

*About 200 different species of potato can be found around the world.*

Viral diseases pose the greatest dangers to seed-potato production. A serious outbreak of PVY—Potato Virus Y—in the early 1990s led to major losses in Minnesota. The disease, which is transmitted by aphids, stunts growth, reduces yield and kills the potato plants. Scientists in CFANS have experimented with integrated pest management solutions to the problem, but it hasn't yet been resolved.

Because seed potatoes must be certified and inspected before they can be sold, PVY creates an economic problem as well, Thill says. Establishing a seed-potato operation takes about five years. A beginning grower often can pay about $30 per pound for the mini-tubers needed to get started, and most assume they'll pay that off in about three years. But if PVY invades and prevents certification after two years, the new farmers can't afford to stay in business.

## Feeding the world

Still, the outlook for potatoes remains strong both in Minnesota and worldwide. Production more than doubled in developing countries around the world between 1991 and 2007; China and India are now the top and second-place producers of potatoes. Because the population of those countries is expanding so rapidly and so much food is needed, potatoes likely will become a staple food in parts of the world where it hadn't been seen much until recently.

Thill also sees the potential for new niche markets in Minnesota, whether it's in novelty potatoes—he has a 'Golden Gopher' variety with maroon skin and gold insides, for example—or in emphasizing that potatoes can be locally grown. "We're innovators," he says. "We can always make it even better." ■

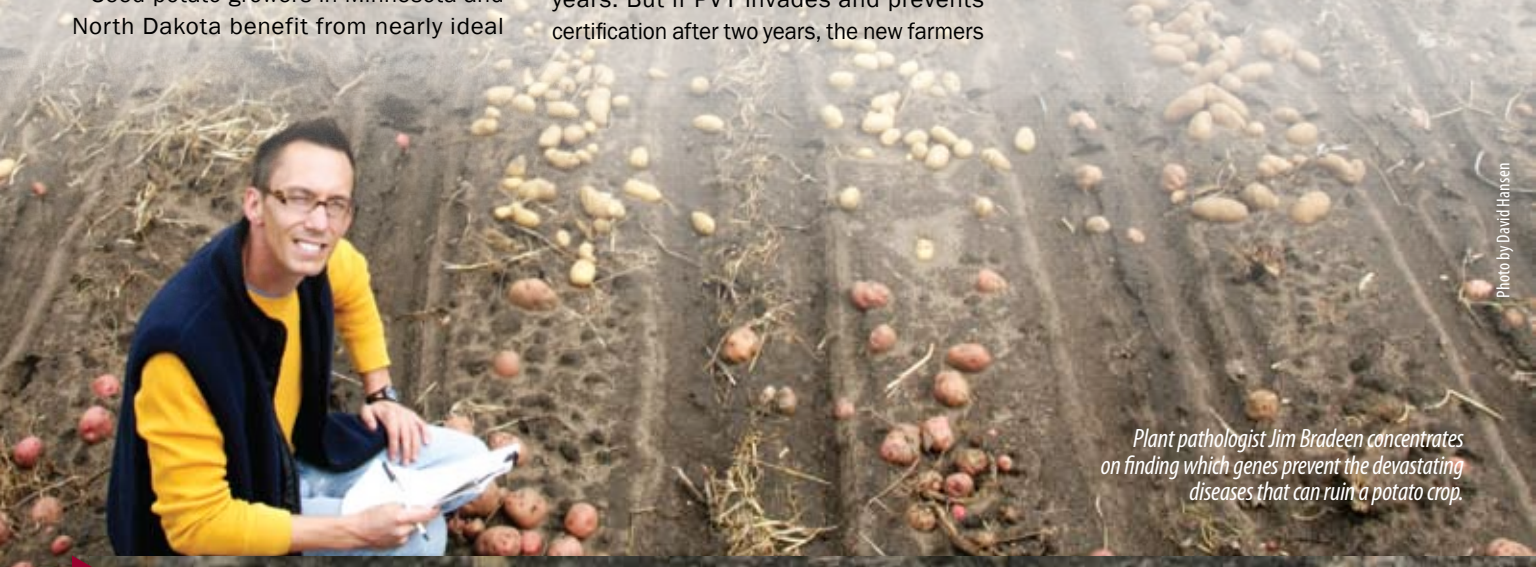


Photo by David Hansen

*Plant pathologist Jim Bradeen concentrates on finding which genes prevent the devastating diseases that can ruin a potato crop.*

# Coming Clean on Organics

## Natural sanitizers may be best for organic food production



Photos by David Hansen

*Joellen Feirtag (above) brings a more natural sanitizer into organic food processing plants, while Francisco Diez (right) begins research on a new technique in his lab.*

Pure, natural, untreated. None of these labels can sell in an American grocery store like the word "organic" does, at an average price 50 percent higher than conventional foods.

Responding to the wave of demand for food with minimal exposure to chemicals, the U.S. Department of Agriculture sets strict guidelines to certify food as organic. Organic regulations limit outside chemicals in all stages of production—from feed and fertilizer to commercial processing. But food safety protocols demand a compromise: there are currently no truly organic sanitizers on the market. So organic food processing plants still use chemical sanitizers on their equipment, while some producers use nothing at all because there is no disinfectant approved for use directly on produce.

Two professors in the Department of Food Science and Nutrition have been awarded a USDA grant to find more natural solutions to organic sterilization. In his lab, Francisco Diez is turning to nature's answer to infection. Just as *Salmonella* and *Escherichia coli* on food transmit disease to humans, bacteriophages are naturally occurring organisms that infect and kill the bacteria themselves.

The idea of using a bacteriophage, or phage, to combat infection is not new, but this is the first time phages have been suggested for wide use in food processing, and Diez is starting from scratch. While phages do not infect humans, the individual strains that affect the most common food-borne bacteria have yet to be identified.

"Once we're 100 percent sure the genome for a standard phage is safe, then we can start applying those mixtures of phages on the target bacteria," Diez says. "The first stage is to get at least ten very effective strains isolated for use on vegetables or equipment surfaces."

While Diez researches new ideas in the lab, Joellen Feirtag ('87–M.S., '90–Ph.D., food science) is trying to bring an established process onto the market. Her goal is to put electrochemically activated (ECA) water into food processing plants and onto the USDA National Organic Program's radar. The ECA process passes simple salt water through an electric charge that produces two streams of water: oxidized water at pH 7.0 that can be used as a disinfectant and anti-oxidant water that works as a detergent.

ECA water is used extensively throughout Europe for a variety of anti-bacterial and water treatment purposes. It can be used directly on food as well as on equipment, and research has even shown that including ECA in feed results in healthier animals without the use of antibiotics. Feirtag's goal is to help spread the technology in the U.S. and, with this grant, prove to the USDA that it's a more natural sanitizer for organic processing.

She is also experimenting with an alternate salt-and-water combination to replicate common ECA's results with an even more environmentally neutral result. If standard sodium chloride could be replaced with sodium bicarbonate, it could create a chlorine-free sanitizer found abundantly in nature. Her preliminary results are promising.

"It's almost too good to be true," Feirtag says. "I call it magic water, and people say it doesn't sound scientific. But it can be used in any type of food processing. This could be the truly organic way to do it." *–Sara Specht*

# College recognized for outstanding diversity work


CFANS is the 2008 winner of the University of Minnesota's Office for Equity and Diversity's Outstanding Unit Award. The award was announced Nov. 20 and cites the college's "transformative work that is well-resourced, linked to its collegiate mission and strategic planning and connected to every part of its operation."

The award was announced at the university's first Equity and Diversity Breakfast, which also included presentation of the 2008 Scholarly Excellence in Equity and Diversity (SEED) awards to 11 undergraduate and two graduate students. The new SEED Award program is designed to honor high-achieving diverse students at the University of Minnesota.

CFANS' unit award was made because of the college's strong pursuit of its diversity goals, development of partnerships with diverse groups on campus and other internal college initiatives.

## Hoover will lead Department of Horticultural Science

Emily Hoover, a member of the faculty in the Department of Horticultural Science since 1983, has been named head of the department. In addition to her department role, Hoover has been director of education/associate director at the Minnesota Landscape Arboretum since 1999. She has been a leader in faculty initiatives and this year is chair of the university's Faculty Consultative Committee.

Her research on integrated fruit-crop management also has been widely recognized; in 2007 she was named a fellow of the American Society for Horticultural Science, the organization's highest honor. She earned her bachelor's, master's and Ph.D. degrees in the department.

## Weller named to lead Bell Museum

Susan Weller, professor in the Department of Entomology and interim director of the Bell Museum of Natural History, is the museum's new director. Weller, the first female director in the museum's 136-year history is internationally recognized for her research on the evolution of butterflies and moths and will be one of only three women researchers leading U.S. university-based natural history museums.

## Composition highlights Food Prize ceremony

The 2008 World Food Prize ceremony in Des Moines, Iowa, had a strong CFANS connection. The featured music for the evening was the debut of a musical tribute to WFP founder Norman Borlaug called "All Growing Borlaug Wheat," which used spoken word and music to trace Borlaug's career. The tribute, with music by CFANS dean Allen Levine and Paul Johnson and narration written by Andrea Gilats, includes three of Borlaug's favorite songs: "Iowa Corn Song"; the hymn of the University of Minnesota; and a Mexican harvest song, which was a tribute to Borlaug's many years of work in that country.

*Above: CFANS student David Johnson (left) was a Borlaug-Ruan intern in the Philippines as part of the global Youth Institute. Left: Norman Borlaug and Allen Levine at the 2008 World Food Prize ceremony.*

# Global Youth Institute provides opportunities for young scholars

If young people have the opportunity to learn about food issues, they may go on to do great things.

The World Food Prize's Global Youth Institute aims to give them that opportunity. Last fall five Minnesota high-school students and their teachers attended the Institute, which is part of the annual three-day World Food Prize colloquium in Des Moines, Iowa. Next year, organizers in CFANS hope to foster even more interest in the program.

"Norman Borlaug believed in supporting young people, and after the World Food Prize was established, he wanted to create this Youth Institute," says Ron Phillips, a Regents professor in the Department of Agronomy and Plant Genetics. The program, which started in 1994, initially included only Iowa students but now has been expanded to include Minnesota students.

Participants are chosen after they write an essay on critical food issues and go through an interview process. Up to six Minnesota students will be selected for the all-expenses paid trip to attend the lectures and ceremonies of the World Food Prize; they also prepare discussion papers and present them during a day-long seminar before a panel of agricultural and food experts. After attending the Youth Institute, students may apply for the Borlaug-Ruan Internship program, an eight-week hands-on experience at an international agricultural research center.

CFANS organizers hope to create an event each October in St. Paul that combines the interview and selection process for students with a lecture by a renowned food-issues expert and other events as a way to mark the state's official Norman Borlaug Day.

"Our challenge is to capture the interest of potential students," Phillips says. "This can be a life-changing experience for them."

# Three from CFANS named AAAS Fellows


Photo by Patrick O'Leary


Photo by David Hansen


Photo by David Hansen

*From top: Allen S. Levine, Michael J. Sadowsky, Deon D. Stuthman*

Three faculty members from CFANS have been awarded the distinction of Fellow of the American Association for the Advancement of Science for 2009. Fellows earn their ranking because of their efforts toward advancing science applications that are deemed scientifically or socially distinguished.

The three are:

Allen S. Levine, dean of the college and director of the Minnesota Obesity Center: For distinguished scholarly contributions to the fields of nutrition and neuroscience, particularly for neuropeptidergic intake and for leadership in the prevention of obesity.

Michael J. Sadowsky, professor in the Department of Soil, Water and Climate: For distinguished contributions to the field of environmental microbiology, with respect to molecular plant-microbe interactions, biodegradation of chlorinated herbicides and determining sources of fecal bacteria.

Deon D. Stuthman, professor in the Department of Agronomy and Plant Genetics: For distinguished contributions to the fields of plant breeding and genetics, emphasizing grain quality and disease resistance, with emphasis on both American continents.

Seven other current CFANS faculty members and five faculty emeriti also are current Fellows. The new Fellows will be presented with an official certificate and a gold rosette pin on Feb. 14 during the 2009 AAAS Annual Meeting in Chicago.

## Swackhamer to head EPA science board

Deb Swackhamer, co-director of the Water Resources Center and a professor of environmental health sciences, has been appointed chair of the Environmental Protection Agency's Science Advisory Board (SAB).

The board is an independently chartered Federal Advisory Committee composed of external scientists and engineers. Its principal mission includes reviewing the quality and relevance of the scientific and technical information being used or proposed as the basis for EPA regulations. Swackhamer's term as chair runs until October 2010.

Swackhamer, an internationally recognized expert on toxic chemicals in freshwater lakes and rivers, has extensive experience applying science to environmental protection

More information about the SAB can be found at www.epa.gov/sab.

# TELL US WHAT YOU THINK OF SOLUTIONS

This is our sixth issue of *Solutions*, and we'd like to hear from readers about what they like and would like to change about the magazine. So here's your chance to give us compliments, constructive criticism, even story ideas.

We've set up an online survey for *Solutions* readers that you can access from the CFANS home page at www.cfans.umn.edu. Simply log on to the site, answer the few short questions and hit "send."

Of course, we always welcome phone calls, emails and letters about *Solutions* too. We'll use the information to guide planning for future issues. If you prefer a paper copy, call Holly at 612-624-0822 to request it. Thanks for your help, and for reading.

**WWW.CFANS.UMN.EDU**

## NextGen Energy awards grants to CFANS projects

Three projects involving CFANS scientists will receive a total of $250,000 in new funding from the state's Next Generation Energy Board, Gov. Tim Pawlenty announced. The grants were part of a $3 million award to eight projects statewide. The CFANS projects include:

"Sustainable Forest Biomass Production: Comparing Physical, Economic and Social Availability," led by Dennis Becker, assistant professor, Department of Forest Resources; "Dedicated Energy Crop Production," led by professors Craig Sheaffer and Don Wyse, Department of Agronomy and Plant Genetics in cooperation with colleagues from Central Lakes College and the Natural Resources Conservation Service; "Modeling Biomass Fuel Servicing Enterprises," led by Michael Reese, director of renewable energy, West Central Research and Outreach Center and William Lazarus, professor, Department of Applied Economics.


*Participants in the agricultural engineering department's junior rope short course in 1927 posed for a photograph.*

## BBE to celebrate department centennial

The Department of Bioproducts and Biosystems Engineering is celebrating 100 years of research, teaching and extension this spring with a series of six seminars capped off by an open house, reception and keynote seminar in March. The seminars begin on Jan. 26 and cover a range of topics, including renewable energy, water management issues and agriculture in the 21st century. On March 26, the department will welcome the public and alumni back for tours of BBE labs, a historic commemoration and lectures. For details, visit the BBE website at www.bbe.umn.edu.

The department was established as "the Division of Agricultural Engineering" on July 1, 1909, bringing together curriculum in farm structures, farm mechanics and agricultural physics that had existed on the St. Paul campus since the late 1800s. Over time, the department's name and focus changed; today the department aims to be a global leader in the discovery, development and application of renewable resources and sustainable technologies.

## Bell Museum design work nearly complete

The campaign for a new facility on the St. Paul campus for the Bell Museum of Natural History is picking up where it left off in 2008. University of Minnesota officials and advocates are gearing up for another try at securing $26.3 million in state-backed bonds to build a facility with flexible space for exhibits, classrooms, and laboratories where visitors can interact with scientists. A year ago, the request was supported by the state legislature but vetoed by Minnesota Governor Tim Pawlenty.

Design work has continued and is now nearing completion. The designs illustrate how the new building and its surrounding grounds will immerse visitors in scientific exploration and discovery. The proposed indoor galleries and outdoor areas will be quite a change from the traditional natural history museum.

"We are especially good at sparking excitement for environmental science in children," says Susan Weller, director of the Bell Museum. "The new building will allow us to enhance that fun experience and expand to reach people of all ages."

All pre-design work on the new facility has been funded by approximately $5.9 million in private funds. The project would create more than 210 full-time equivalent design and construction jobs.

All photos by Jonathan Schilling

## Scientists try using nature's approach to break down biomass for cellulosic ethanol

# When Fungi ATTACK

By Sara Specht

**It looks like a chunk of wood.**

**It looks like a small piece of a big tree, something you might grab two-handed to toss into the campfire. Pick it up, and it feels like florist's foam. It's light as a dry sponge and flakes away under the weight of your fingers.**

**What it is is the skeleton of a tree branch: a framework of lignin picked clean of its cellulose mass. The rotted wood is a builder's nightmare.**

It also is a biorefiner's dream. The sugar compounds that comprise the bulk of all plant tissue, cellulose and hemicellulose, are the building blocks for cellulosic ethanol, a potentially sustainable alternative to fossil-based fuels The challenge is freeing those carbohydrates, unharmed, from the lignin glue that protects it. So far the world has failed to find a way to do it effectively or affordably.

And yet, that perfectly hollowed lignin shell sitting in Jonathan Schilling's office keeps hope alive that we'll find a way. Schilling is a professor in the Department of Bioproducts and Biosystems Engineering, and studies the brown rot wood-degrading fungi that made

*Brown rot fungi attack a piece of biomass in Jonathan Schilling's lab.*

*As brown rot progresses, wood retains its shape, but as the cellulose is removed the lignin shell loses strength and mass.*

the shell, pests that weaken the wood in decks and buildings.

With a new three-year grant from the U.S. Department of Energy and U.S, Department of Agriculture, Schilling and a team of CFANS researchers hope to discover how these fungi so completely bypass the lignin barrier in plant tissue. They hope to mimic that process to extract the cellulose from wood and other plants for commercial cellulosic ethanol production.

## No silver bullet

Found in plant cell walls, cellulose is the most abundant organic compound on Earth, a potentially boundless source of energy. The idea is simple—take a plant, extract the cellulose and ferment it into ethanol or other biofuels—and you have a plentiful source of fuel. But the solution—getting past the lignin that hinders the extraction of cellulose—is complex.

Lignin fills the spaces in a plant cell wall between the carbohydrate components, and it's the glue gives a plant structure. It also protects the plant from attack from many fungi and bacteria. Lignin itself can be burned for fuel or converted into commercial products, though its potential hasn't been fully explored. Many paper manufacturers, which break down lignin during the pulping process, burn the lignin byproduct to power the mill.

But until now, scientists have been more interested in getting through it to the cellulose. Cellulosic ethanol processing plants currently use a multistep process that includes a chemical pretreatment to open up or break down the lignin structure, followed by extraction and hydrolysis of the released sugars and fermentation into alcohol for fuel. The process, particularly the pretreatment, is expensive and only partially successful.

"On a good day, getting 80 percent of the cellulose out of the biomass is a success," says Schilling. "So you're still leaving 20 grams in 100 on this stubborn plant. There have been a lot of attempts to squeeze out a little extra efficiency, but we're still not there to commercialization."

A main focus of research to increase efficiency has been to modify the pretreatment step to neutralize the lignin. Recent studies have concentrated on white rot fungi, which feed on lignin and leave cellulose behind. Others are looking for new chemicals or enzymes that might increase the current system's effectiveness.

But in the nuisance of brown rot, Schilling saw an extraction process that worked with complete efficiency without damaging a potential value-added lignin component. And brown rot does it without a key enzyme considered critical to the current process. Brown rot performs a pretreatment that allows it to get into a wood's lignin matrix and sets its own enzymes up for success.

"Many research groups around the world are migrating toward what I call silver bullet enzymes, looking for some enzyme that's going to perform better than what they already have in hand," Schilling says. "We're looking instead at a process. The answer is not that brown rot fungi have a silver bullet enzyme but that they are able to utilize a whole system that allows them complete efficiency."

## In fungi's footprints

Understanding what brown rot fungi do is easy: step onto an infected log and see it crumble. The fungus saps a tree's strength long before the mushroom forms. However, understanding exactly how it happens is the challenge.

"There are some key things we need to find out: how does the system function; can we find the mechanism; and can we mimic it to get the cellulose out for biofuels," says Robert Blanchette, who studies forest pathology and wood degradation in the Department of Plant Pathology.

*Brown rot fungi weaken a tree until it crumbles, leaving only lignin behind.*

While Schilling infects wood and plant tissues with three varieties of brown rot to figure out what components are involved in the pretreatment, Blanchette will take a closer look to try to visualize the process and understand the interaction between fungus and biomass on a cellular level. A particular goal is to map out the timing of brown rot's procedure—the steps and the pieces required have never been defined.

"The odd thing is that lignin seems to trigger this system," says Blanchette. "You have to have lignin present: the lignin seems to be a triggering mechanism to get everything rolling."

To test specifically how brown rot's pretreatment process enhances its own enzymes and affects the different elements of plant tissue, Schilling's team enlisted the expertise of Timothy Filley at his Purdue Stable Isotope Laboratory. Filley's diagnostic techniques will use isotopes to identify what and how chemical changes occur during the course of deterioration.

"The idea is looking at wood degradation as a system and giving the fungus some respect," Schilling says. "Hopefully we can replicate what it does and create a process that mimics nature, in a basic sense."

## Refining the system

Ulrike Tschirner is a lignin chemist in the Department of Bioproducts and Biosystems Engineering. She works with the paper industry, breaking down wood fiber for pulp, but the recent demand for biofuels has brought her onto the project to study how brown rot fungi modifies lignin and the possible applications of that system.

Photo by Jonathan Schilling

*By the time this brown rot mushroom formed, the wood had already been sapped of strength.*

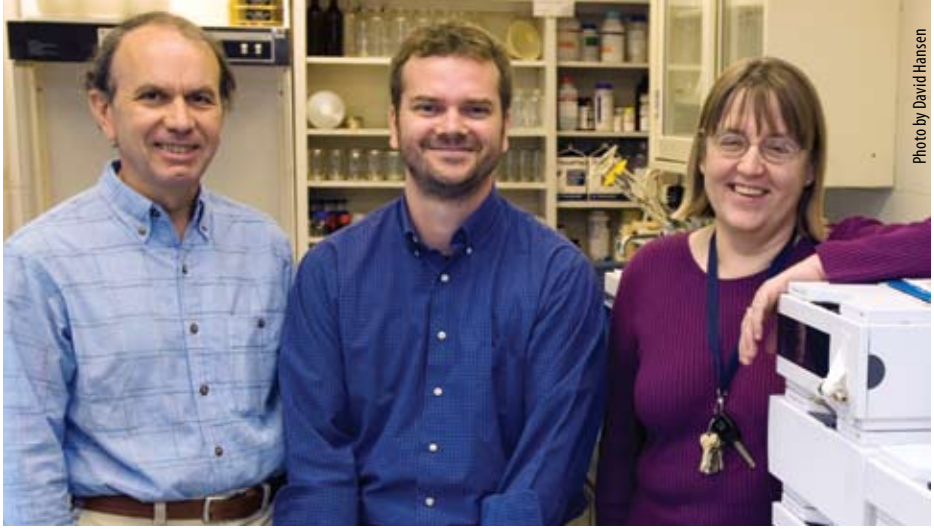


Photo by David Hansen

*Robert Blanchette, Jonathan Schilling and Ulrike Tschirner hope to make plant lignin a benefit to cellulosic ethanol production, rather than a barrier.*

To her, the idea of a biorefinery means using a whole material, not just part of it. And to be economically feasible, she argues, at some point commercial biorefineries will be forced to.

"It's been really hard to get lignin out of wood without having a byproduct in it," Tschirner says. "With most pulping you have a sulfur compound, so what you end up with is a material that smells like skunk at the end, which limits its applications. But this is something to get excited about. There are much higher value products that could be made from lignin."

Right now the bioprocessing pretreatment of cellulosic plant material works to open up the lignin matrix as much as possible, which sacrifices some of the lignin that might be marketed. If the early stages of research are successful and the team is able not only to identify brown rot's plant degradation mechanism but to mimic it, the changes to current biorefining processes would likely be dramatic. Brown rot seems actually to use fewer steps to bypass lignin than commercial processes. Refineries also tend to keep the costly pretreatment step separate from the later processing.

"In addition to consolidating steps, you also have the potential to save one of your pieces as a value-added product," says Schilling. "The potential here for a synergy between pretreatment and the enzyme treatments offers a great cost benefit to these companies by doing something that would be truly consolidated bioprocessing."

## Perennial power

Along a road in rural Minnesota, fields stretch into the horizon. Green and maroon and gold sway in a breeze all around the car motoring down the lane. On the left, a neat pattern of lines and curves hypnotizes the eye. To the right is a rolling prairie, flowing in waves to meet the shore of a rich forest.

Imagine you are in that car, and you might be in almost any corner of the state. Now imagine that the power that carries you through that vista is growing all around you.

Economically feasible cellulosic ethanol might be the next step to making this scene a reality: conventional farmers could sell plant byproducts for fuel, and perennial, fast-growing plants might become a high-value agricultural opportunity.

The options presented by cellulosic ethanol seem endless, and Schilling thinks part of the solution might be found by imitating a pest that is just as happy extracting cellulose from alfalfa and corn stover as from spruce and birch. And his grant might be only the first step to driving a plant-powered car.

"Solutions involve multiple approaches," Schilling says. "And cellulosic ethanol and corn-based ethanol, they're part of a big blanket. They're all part of a portfolio of solutions to our problems. That's the right answer." ■

# The Whole Kernel

## Building a market for a byproduct of corn-based ethanol

The success of Minnesota's ethanol industry has linked the state's rural economy to the boom and bust of global energy markets like never before. A strategy for stabilizing the ethanol-fueled rural economy lies in what might seem an unlikely place: animal nutrition.

Corn-based ethanol plants produce large amounts of wet and dried distillers grains for use in livestock and poultry feeds. Dried distillers grains with solubles, or DDGS, is the predominant type of distillers grain used by U.S. livestock producers. Developing a strong market for DDGS helps ethanol producers ride out the ups and downs of the energy market, and gives livestock producers an alternative feed source.

Research led by professor Jerry Shurson ('81–B.S., animal science) in the Department of Animal Science has helped create that market. The sale of DDGS now contributes an estimated 20 percent of an ethanol plant's revenue stream, more than double what it contributed 10 years ago. The growth in DDGS sales is the product of investments in Shurson's research by numerous agricultural interests, which totals nearly $1.4 million. The funding and the results of more than 50 research projects have made Shurson an internationally respected expert on the nutritional value and feeding applications of distillers grains.

Shurson's work couldn't have come at a better time. Record high corn and feed prices have challenged livestock producers to find economically viable options. For every bushel of corn used to produce ethanol, about one-third of it comes out of the milling process as DDGS. Shurson says, "What's often forgotten in the food versus fuel debate is that ethanol plants are producing an excellent, and often lower cost, partial replacement for corn and other ingredients in livestock and poultry feeds."

"We now have a very good understanding of the optimal quantities of DDGS to add to livestock and poultry diets," Shurson says. "We also understand the impacts of DDGS on meat quality, manure management, the volume of manure produced and odor control." The work is summarized on a website he manages, www.ddgs.umn.edu.

Shurson's research team also has documented potential benefits of DDGS for the animals that eat it. In swine, they've found evidence of lower mortality rates and less incidence of the intestinal disease ileitis. The potential for some compounds found in distillers' by-products to improve human cardiovascular health is one of several subjects of future research.

The past decade has been fun and a fantastic experience for the Adams, Minn. native who grew up on a hog, dairy and crop farm before earning degrees at the University of Minnesota and Michigan State University.

"I still run into producers who aren't aware of the economic and nutritional benefits of adding DDGS to their livestock diets," Shurson says. "So that keeps me motivated and focused."

And while Shurson's team has greatly expanded farmers' and scientists' knowledge of the role of DDGS in livestock diets, there is more to be discovered. Shurson's team is investigating the use of enzymes to increase the energy value of DDGS, determining the nutritional value of new by-products from fractionation processes being used in some ethanol plants, as well as researching the potential for feeding liquid by-products (thin stillage and syrup) to swine.


*Jerry Shurson's work has helped create a stronger market for dried distillers grains with solubles, which corn-based ethanol plants produce in great quantity.*

Shurson's also helping the industry develop a quality assurance program to document the nutrient value and variability of DDGS from different sources. The results could help ethanol producers differentiate their DDGS products.

"These research questions and opportunities to share new knowledge will keep us busy for many years to come," Shurson says. "It's a great example of how a land-grant university can serve the state and have a positive impact on its key agricultural industries." *–Martin Moen*

# BATTLE

Photo by David Hansen

**By Becky Beyers**

They may not be able to fly, but pigs can do amazing things.

Recent advancements in genome engineering are helping scientists develop a new kind of pig, one that can model and test treatments for human diseases such as diabetes, cystic fibrosis, muscular dystrophy and heart disease.

Genetically modified pigs are anticipated to help on two critical fronts; modeling disease and therapy, and providing tissues and organs for therapy. Scott Fahrenkrug, an associate professor in the Department of Animal Science, sees this next generation of biomedical pigs as a logical step in the longstanding partnership between pigs and human health.

## Why pigs?

Scientists have long used animal models, usually mice, to simulate the effects of disease on humans and to test possible cures; the problem is that mice don't always show the same symptoms or react to treatment as humans would.

Pigs much more closely resemble humans in size and physiology, and already are major contributors to human health: their heart valves are used in transplants, their skin is grafted onto severe burns and their byproducts contribute to dozens of pharmaceuticals.

Pigs have also provided treatments for Type 1 diabetes, the sixth-leading cause of death in the United States. Diabetic patients can't produce their own insulin, the hormone that regulates blood glucose, and until synthetic substitutes were developed in the 1970s, pig insulin was used to treat human patients. Researchers now eventually hope to transplant islet tissue—the tissue that produces insulin—from pigs into Type 1 diabetes patients.

For Fahrenkrug and others, effective treatments for other human diseases also may lie in the pig. Recent sequencing of the pig genome, and newly developed tools for genome engineering set the stage to model congenital diseases in pigs, which provides the opportunity to study diseases and develop therapies in a large animal. "Pigs are excellent models, much better than rodents," Fahrenkrug says, because they are so similar to humans and because size does matter. A six-month-old pig weighs about the same as a human teenager, with similar-sized organs, he says. "We need size-appropriate models for studying drug, stem-cell and gene therapies so we can move the science from the bench to the bedside."

Fahrenkrug has initiated not-for-profit efforts focused on developing pigs that will make such procedures more effective and safe. "The not-for-profit approach may seem counterintuitive for a market anticipated to approach $10 billion a year, but we want to keep the ultimate cost of treating patients as low as possible," Fahrenkrug says. Because diabetes has caused heartbreak in his own family, he says he's "downright stubborn

*Scott Fahrenkrug, associate professor in the Department of Animal Science, is leading efforts to develop pigs for biomedical uses.*

# Pigs may hold the key to ending disease

# for a Cure

on this point. Every dollar donated now will save thousands at the point of care, clearing the path to the treatment of many more patients."

Traditionally, genetic modification takes place by injecting DNA into an embryo, resulting in a transgenic animal. The problem with that process and pigs, Fahrenkrug says, is that it works only about 1 percent of the time. Using transposon—mobile DNA—technology developed at the university, Fahrenkrug's lab can insert DNA sequences encoding a particular disease into the pig's genome with up to 90 percent success. In cases where a normal gene needs to be broken, a genetically modified pig cell can be cloned and grown into a pig. "It really is amazing how far we've come," he says. "Now, we need to marshal the resources to deliver these animals to the disease specialists."

*Fahrenkrug's lab uses transposon tools, a way of moving genes around to create the desired effect on an organism.*

Photo by David Hansen

## The economics of biomedical animals

Making the pigs is only one part of the puzzle. Pigs used in biomedical research have to be cared for just like any animal, except that they require much more expensive and painstaking care. Even healthy biomedical-use pigs eat special food, drink disinfected water, need space and breathe filtered air.

Federal regulations are stringent about the pigs' care. Pigs with congenital diseases will need to be treated like patients while scientists pursue therapies that might work on humans. "You have to be willing to make the investment; these are sick animals and they have to be shown the same care and nurturing as their human counterparts," he says. Caring for pigs that have such diseases could cost as much as $50 per pig, per day.

Costs and the market for biomedical pigs mean that


Photo by David Hansen

*Pigs are good models for simulating disease because of their similarities to humans.*

developing and raising the pigs likely will involve private industry as well as research institutions like the University of Minnesota. Funding may not be available from traditional scientific research sources, because the work overlaps areas covered by the National Institutes of Health and the U.S. Department of Agriculture but doesn't fall neatly into either one.

At Exemplar Genetics, a company based in Sioux City, Iowa, that's also working on developing pigs for medical research, scientists from academia and the private sector both are contributing to progress in the field, says John Swart, company president. "They share the same vision and passion to pursue cures for a number of different disease complexes, and their roles are complementary." He expects that the market for transgenic pigs like Fahrenkrug's will be fully developed in five to 10 years.

While developing biomedical pigs may seem like a shift from traditional animal science, it's really just part of the overall goal of improving human health, says Abel Ponce de Leon, CFANS associate dean for research. "When we develop animal models, when we work with multifunctional landscapes, when we study ecosystems and clean water—it all relates to human health, if you look at it from the overall perspective."

## Saving humans with animals

Researchers realize that this kind of work may generate controversy, especially among animal-rights advocates. Fahrenkrug says he welcomes the discussion and doesn't dismiss the concerns. "Animal welfare has to be paramount in our research, but compromises are both possible, and necessary. As we move forward with this research I relish the opportunity to speak with both patient and animal advocates, so we can work toward accommodating all concerns.

"We are no longer in the realm of science fiction; we and others are developing the capability to modify the genome in previously unimaginable ways. We need to overcome the fear of this power, and instead focus our efforts on deciding how to humanely, safely and effectively use it for the betterment of mankind."



Want to get involved in the campaign for safe pigs to cure diabetes? Go to www.thepoint.com/campaigns/safe-pigs-to-cure-diabetes.

# Everybody Loves Butterflies

## Karen Oberhauser's work shows why monarchs are important

In the world of butterflies, the monarch rules.

The orange-and-black beauties are the state butterfly or insect in seven U.S. states, the insect emblem of Quebec, and the representative insect of the Mexican state of Michoacan. Countless children have been wowed by its metamorphosis from caterpillar to winged beauty.

Its unique migratory pattern intrigues scientists, both professionals and the thousands of citizen scientists who volunteer to record monarch sightings as the butterflies go back and forth to central Mexico each winter.

Because of that long migration—some butterflies travel from southern Canada, more than 1,000 miles—monarchs depend on a wide variety of habitats as they move back and forth. While the monarchs themselves aren't endangered, some of their habitat is, thanks to deforestation, development of agricultural land and other environmental issues.

That's why scientists from the U.S., Canada and Mexico put together the North American Monarch Conservation Plan and published it last summer. Karen Oberhauser ('89–Ph.D., ecology and genetics), an associate professor in the Department of Fisheries, Wildlife, and Conservation Biology, was the report's lead author and project coordinator.

The report calls for increased enforcement of environmental laws, better monitoring of monarch population and migration, and providing incentives for conservation practices, among other things. Oberhauser says the plan came about after the trilateral Commission for Environmental Cooperation enlisted nine scientists—three from each country—to pull together a report and recommendations. All three governments have accepted the report, and some of its ideas already are being put in place. Oberhauser recently conducted training sessions in Mexico on how to monitor the butterflies, for example.

Writing a cooperative report with the oversight of government agencies was a new experience for a scientist used to working more independently, she says, but learning how each country deals with environmental policy, and the differences in those policies, was fascinating.

In the U.S., that means more interest in conservation policy overall, Oberhauser says. "Right now I'm teaching a conservation biology course; this subject wasn't even a recognized field when I was a student. Working on this plan, developing the course, and engaging in research with a very applied conservation focus have all come together in an active learning experience for me, as well as for my students."

While Oberhauser has spent much of her career studying monarchs and their habitats, one of the report's surprises was the sheer magnitude of how much habitat is being lost all across North America. "It really reminded me of the importance of volunteer monitors keeping track of what's going on with monarchs," she says. "Citizen science is going to be very important as we move forward." *–Becky Beyers*

Photo by David Hansen

*Karen Oberhauser led the team that developed a North American plan for preserving monarch butterflies.*

# Alumni Update

## A message from CFANS Alumni Relations director Mary Buschette

Photo by Tom Foley

Would you like to positively influence outcomes that can affect people's lives? Want to be an advocate for the University of Minnesota and the College of Food, Agricultural and Natural Resource Sciences? Joining the U of M's Legislative Network is a great and easy way to help the U and feel good about it. Founded by the University of Minnesota Alumni Association more than 15 years ago, the Legislative Network is a coalition of alumni, students, faculty, staff and community who share a commitment to higher education and to the University of Minnesota. Members receive timely updates on U legislative news, as well as action alerts that members can use to contact their elected officials.

There has never been a more crucial time to join the Legislative Network. With Minnesota facing a $4.8 billion deficit for the next two years, the university is preparing for a challenging 2009 legislative session. The U draws one-fourth of its revenue from the state, and budget cuts will be an unavoidable part of the statewide solution. Whether the U sustains cuts that, in the words of President Bruininks, "erode the quality of the education our students receive and slow the creation of jobs and economic growth for the state by shutting off our human capital and innovation pipelines" is up to us as citizens and U advocates.

To learn more or to join the network, visit www.supporttheu.umn.edu.

## SAVE THE DATE!

**January 24, 2009**
UMAA's Florida Minne-College: Naples, Fla.

**March 7, 2009**
UMAA's Arizona Minne-College: Scottsdale, Ariz.

**April 4, 2009**
Classes Without Quizzes: St. Paul Campus

**June 25, 2009**
St. Paul Campus Reunion:
Minnesota Landscape Arboretum, Chaska

**July 10, 2009:**
Golf Scramble for Scholarships:
Les Bolstad Golf Course

**July 20-25, 2009:**
Cloquet Centennial Celebration &
Alumni & Friends Reunion: Cloquet, Minn.

**October 10, 2009:**
Homecoming 2009—the first in the new TCF Stadium

# Can You Identify this Photo?



Please tell us who these people are and what they're doing. Everyone who sends in the correct answer will be entered in a drawing for a CFANS coffee mug. Send your answers to bbeyers@umn.edu.

## Last issue's answer

Just a handful of readers guessed the correct year and circumstances of this photo; it was Colleen Traxler, Larry Pfarr, Nancy Neil, Mike Tentis and Gary Sloan, working on a float for Homecoming 1984. The Gophers lost that year to Northwestern, 28-31. Roger Chamberlain recognized his college buddies and wins the mug.

# Art Imitates Life

## Sara Stack's passion for painting connects her to nature

Sara Stack is always collecting ideas for her art.

It could be a snapshot of a particular kind of sunlight, or an animal's tracks in the snow, but the 2006 forest resources graduate finds inspiration for her wildlife paintings everywhere, she says.

"There are just so many ideas and so little time," she says. Her job as a forester with the Minnesota Department of Natural Resources area office in Orr, Minn., gets her out in the woods frequently, but leaves little time for painting.

Still, she found time to create the winning design for the 2007 Minnesota waterfowl stamp design contest, a painting of Ross's geese. The stamps—which are required for all waterfowl hunters between ages 18 and 64—raise money for habitat improvements. The DNR holds similar contests for walleye, trout, pheasant and turkey stamps.

Stack's first wildlife art contest win came when she was still in high school, when one of her paintings won the national junior-level waterfowl contest. "I had always drawn things, but I really started to focus on it in middle school and high school, and started to have some success then," she says. After high school, she worked for a few years and took a few art classes, but didn't find her niche until she talked with a career counselor in the then-College of Natural Resources.

"I knew I liked wildlife, but I found that the best career prospects were in forestry, so I went with that major," she says. "I was so happy with the program and it's worked out so well." Her job includes assessing forests for potential timber sales as well as fighting fires, so she spends a fair amount of time outdoors.

What she sees out there can be the inspiration for another painting. Stack keeps a digital camera with her and says she's got removable disk drives filled with shots that might be part of a painting someday. Each creation starts with a rough sketch, "a tiny little idea," she says. Once the sketch is finalized, she scans it into a computer and enlarges it, then uses transfer paper to get the drawing onto masonite. Then she begins the painting process, which can take a few months to a year or more.

Her winning waterfowl painting drew attention from unexpected audiences, including a collector who drove up to the remote Orr site in order to have her sign his stamp. "He has the artist sign every one," Stack said. "This kind of art has a big audience in Minnesota."

The DNR's rules prohibit stamp-contest winners from entering the same contest for two years, but she can enter paintings for its other contests or for waterfowl contests in other states. This winter, she's working on entries for North Carolina, Colorado and Wyoming contests.

"My work is really representational," she says. "A lot of artists are trying to make some kind of a statement with their work, but that's not me. I'm into simple realism." *–Becky Beyers*

Photos courtesy Sara Stack

*Department of Forest Resources graduate Sara Stack finds inspiration for her art in nature.*

# Alums earn Outstanding Achievement Awards

Two CFANS graduates received the University of Minnesota's Outstanding Achievement Award this fall. The award is conferred on alumni or former students who have attained unusual distinction in their profession or in public service and who have demonstrated outstanding achievement and leadership.

Agribusiness innovator **Dean Oestreich,** chairman of Pioneer Hi-Bred, a DuPont business, has worked for just one company—Pioneer—since graduating from the university in 1974 with a bachelor's degree from the Department of Agronomy and Plant Genetics. He started his career as an assistant research station manager for the Iowa-based seed and genetics company. From there he worked his way up through positions in Pioneer's research, information technology, supply management, and international business divisions. He was responsible for seed supplies around the world and later for all North American operations before becoming the company's 10th president in January 2004. In November 2007, he was named chairman of Pioneer and vice president of its parent company, DuPont.

Under Oestreich's leadership, Pioneer became the first company to launch a corn genomics project and to have seed sales outside of North America totaling more than $1 billion. His Outstanding Achievement Award was presented on Sept. 18.

Nationally known public gardens expert **Robert E. Lyons** earned his master's degree in 1979 and Ph.D. in 1981 from the Department of Horticultural Science, and is currently a professor and program director at the University of Delaware and Longwood Gardens graduate program in public horticulture. In that role, he helps develop leaders in the field of public horticulture at Longwood Gardens, which is considered the premier botanical garden of its type in the nation.

He is one of only two people in the history of the American Society of Horticultural Sciences to receive both its educator award and its research award.

Before his work at Delaware, Lyons spent five years as professor and director at the J.C. Raulston Arboretum at North Carolina State University, where he was responsible for the fund-raising and construction of a new $4 million education center. Prior to that, he was a professor at Virginia Tech, where he helped develop that university's horticulture gardens and ultimately became director of the gardens. He also has earned several teaching awards during his career. His Outstanding Achievement Award was presented Sept. 3.

Photos by Martin Moen

*Top: Fellow CFANS graduate Chuck Walters congratulates Pioneer Hi-Bred chairman Dean Oestreich on his outstanding achievement award. Bottom: Public gardens expert and OAA recipient Robert Lyons greeted retired U of M gardening guru Deb Brown.*

# UMAA honors CFANS volunteers

CFANS was well-represented at the University of Minnesota Alumni Association's annual national awards ceremony during Homecoming week in late October. Top honors went to:

CFANS Alumni Society, program extraordinaire award, "Classes Without Quizzes"; judges noted that the program gives alumni and friends a reason to come back to campus, participate in a lifelong learning program and strengthen their connection to the CFANS community and the University of Minnesota.

Dana Souther of the Department of Animal Science, staff volunteer award; her award recognizes her role in creating the CFANS Departmental Council on Alumni Relations, a group of departmental representatives from the college that meets every month to plan programs and events to involve alumni and friends in the college, as well as her contributions to the Alumni Society's holiday gathering and professional meetings.

CFANS student Megan Hines, student volunteer award; her award recognizes her service on the CFANS Student Board and Alumni Society Board and contributions to CFANS activities and events.

*CFANS volunteers had a strong showing at the annual awards ceremony.*

Alumnus Scott Manwarren, alumni service award; in the four years since the Golf Scramble for Scholarships tournament began, he has recognized an opportunity to reconnect with fellow alumni while helping to enhance the student experience at the college, and has enthusiastically progressed from player to committee member to chair of the tournament. In the process, he has helped raise more than $50,000 for scholarships.

# CFANS Alumni Society
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# BY THE NUMBERS CFANS class of 2012

**27** Percentage who are from Wisconsin

**105** (34.5%) MALES

**25.8** Mean ACT score for new freshmen (maximum is 36)

**9.9** PERCENTAGE WHO ARE STUDENTS OF COLOR

**1.6** percentage who are international students

**199** (65.5%) FEMALES

**304** TOTAL NUMBER OF NEW FIRST-YEAR STUDENTS

**28** Percentage who are from other parts of Minnesota

**37** PERCENTAGE WHO ARE FROM THE TWIN CITIES METRO AREA

*Source: University of Minnesota Office of Institutional Research*

# Horticultural Marketing Grows

## Chengyan Yue helps green industry stay on top of trends


*Assistant Professor Chengyan Yue is the first holder of the Todd and Barbara Bachman Endowed Chair in Horticultural Science.*

Flowers and plants are like fashion: what's on every consumer's must-have list this year might be out of style and consigned to the clearance shelf by next season.

That's one reason Chengyan Yue finds horticultural marketing so fascinating. As the first holder of the Todd and Barbara Bachman Endowed Chair in Horticultural Science, she provides a unique combination of expertise in both horticultural science and marketing. The chair, established in 2000, is one of only a few of its kind in the United States.

Yue says her interest in the horticulture industry evolved while she was a Ph.D. student in economics at Iowa State University, when she was asked to participate in a research project dealing with colleagues in horticultural science.

"This is a really intriguing industry," she says. "It's big—floriculture alone is $20 billion a year, and the nursery/greenhouse segment is our third largest crop. In recent years it's become far more sophisticated, but there's still not enough work being done on the marketing side to build consumers' awareness."

The horticulture industry is different for several reasons, Yue says: its products are living, perishable material, and what's available to consumers is strongly influenced by seasonal and geographic variables.

In Minnesota, for example, cut flowers generally come from other countries, where production costs are low enough to make up for the cost of transporting them. While some locally grown products are sold, Yue says, climate is a huge factor for the state's industry, because only certain flowers and plants can be grown here.

In a tough economy, consumers might be less likely to buy horticultural products or may cut back on their spending, Yue says. "These aren't staples like bread or milk. But one advantage is the huge variety of horticultural products. If you don't want to pay for one, maybe there's another that appeals to you more."

Bachman's CEO Todd Bachman, who died last summer, felt deeply that his industry needs marketing expertise like what Yue provides, says Paul Bachman, president of the family floral, garden and home business. "Especially on the floral side, we've seen that plants and flower sales are favorably impacted when there is good marketing."

Todd and Barbara Bachman established the chair because they wanted to provide the University of Minnesota with a way to devote resources to horticultural marketing, Paul Bachman said. The couple's close connections to the university—both graduated from the university, Barbara's father was a longtime professor of horticultural science and Paul's father was on the advisory council for the agriculture college—meant "the U was near and dear to them," Paul Bachman said.

Yue says the unusual combination of disciplines is a great opportunity. She looks forward to helping growers and sellers develop niche markets, perhaps in specialty flowers or locally grown fruits and vegetables. "It's a good thing that we're looking at these issues and trying to find ways to compete. That's very promising." *–Becky Beyers*

This photo, taken by Changbin Chen, research assistant professor in the Department of Horticultural Science, won an international photo contest and was selected as the cover photo for the December issue of *European Molecular Biology Organization Journal*.

Chen, who trained at the New York Institute of Photography, has more than 50,000 flower photos covering thousands of species. This photo shows the megasporophyte leaf of Cycas. During the pollination season, the ovules growing on the edges of megasporophyte leaves secrete pollination droplets that facilitate the pollination. Sometimes, as in this photograph, the pollination droplets attract bugs that are believed to be associated with Cycas pollination process.

College of Food, Agricultural and Natural Resource Sciences
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# CFANS 2009 CALENDAR OF SPRING EVENTS

These are some of the many events supported by the College of Food, Agricultural and Natural Resource Sciences. All are open to the public; some may require a registration or fee to attend. Visit www.cfans.umn.edu/Events2.html or contact Honey VanderVenter at 612-625-6710 or hvander@umn.edu for more information.

**March 10**
"New frontiers in plant health: Will climate change tip the balance toward disease?" Solution-Driven Science Symposium
Northstar Ballroom, St. Paul Campus

**March 18**
2009 Siehl Prize winners announced
Minnesota State Capitol

**March 26**
Open house, symposium and historic commemoration in honor of Department of Bioproducts and Biosystems Engineering centennial
St. Paul Campus

**April 1**
"How Safe is Our Food Supply? Expectations, Technology and Regulation" The Food Industry Center spring symposium
Coffman Union, University of Minnesota East Bank

**April 4**
Classes Without Quizzes
St. Paul Campus

**May 10**
Commencement 2009

**June 25**
St. Paul Campus Reunion
Minnesota Landscape Arboretum, Chaska

**July 10**
Golf Scramble for Scholarships
Les Bolstad Golf Course, University of Minnesota

**July 20-25**
Cloquet Forestry Center Centennial Celebration
Cloquet, Minn.