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The Right Stuff

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College of Food, Agricultural and Natural Resource Sciences
UNIVERSITY OF MINNESOTA

SOLUTIONS

Solutions magazine is published twice 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.

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College of Food, Agricultural and Natural Resource Sciences
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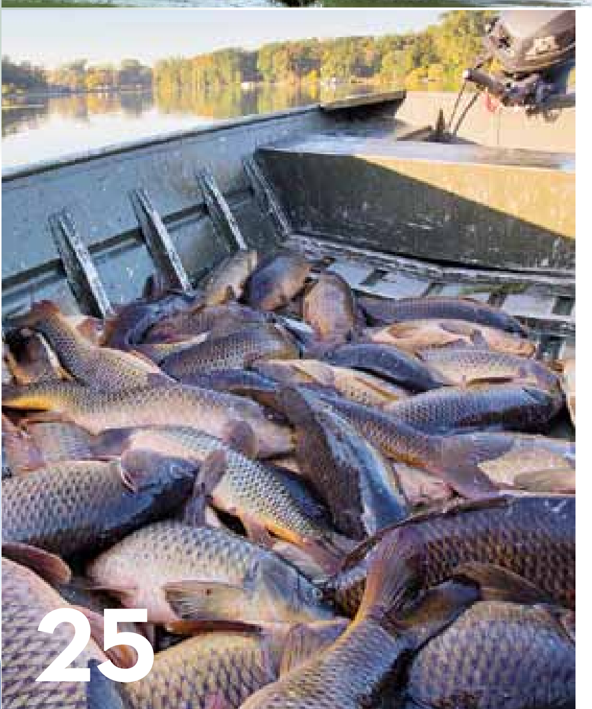


On the Cover: These piglets are among the first offspring of Gopher Nation, a studly boar from the CFANS swine herd. *Photo by David Hansen.*

4, 8, 22, 25: Photos by David Hansen. 12: stock photo; 14: Photo by Jerry Laker; BC: Photo courtesy Peter Sorensen.

THE RIGHT STUFF

Gopher Nation has what it takes to be a stud

BY PATTY MATTERN

On March 10, 2012, a grand sow gave birth to nine piglets inside a barn on the St. Paul campus. All were cute, but the people who operate the U of M Swine Unit recognized something special about one of the newborns.

"When he was a week old, I knew he was something special," said Kyle Rozeboom ('94–B.S., animal and plant systems), the youth leadership/livestock expert who oversees the swine unit.

The piglet stood a little bit bigger, wider and stouter than the others in the litter.

"He was just a really heavy-muscled boar and he's really big boned," said Adam Munsterteiger, a sophomore studying animal science and manager of the swine barn.

"He was just more powerful than the other ones in terms of his looks and the way his body was built," Rozeboom said.

This piglet grew fast, soon bypassing the size of his littermates.

"He was just a very impressive pig to look at," Rozeboom said. "He was kind of the he-man of the litter."

So, when the piglet reached seven days old, Rozeboom and the students made a pivotal decision in the young pig's life. They agreed not to castrate him.

"He was the only male of the litter we kept as a boar," Munsterteiger said.

His brothers met a different—ahem—fate. They became barrows while their brother became the University of Minnesota Swine Herd's first boar stud in 16 years.

He was headed for pig stud stardom. But before placing him into exclusive stud line-up,

Photo by David Hansen

THE STUD

Gopher Nation

they needed a name for him. The students and Rozeboom brainstormed possibilities.

"We kicked around a few different names. We kicked around just calling him Gopher. We thought of calling him Ski-U-Mah, but we figured that would be too hard for people to remember," Rozeboom said.

Then, someone mentioned Gopher Nation. "That name kind of stuck when we threw it out. We all thought it was a good name for him. It's catchy and memorable and it signifies that he is a University of Minnesota Gopher-bred boar," Rozeboom said.

So last fall, Gopher Nation moved to North Iowa Boar Stud (NIBS) in Riceville, Iowa, and resides there with other studs, such as Freak on The Loose, Fast Lane, Maverick and Day Tripper. There, Gopher Nation's semen is collected and sold for $30 a vial or $70 to breed a sow, said Bill Owen, who owns NIBS with his wife, Karen.

Placing a boar to stud marked a resurgence for the U of M swine unit. The unit's barn was built in 1982 and was used mainly for research. At its height, it housed about 100 sows.

It closed in 2008 due to budget cuts. Unit operators dispersed the purebred sows and the swine herd, Rozeboom said. In 2011, Mike White ('80–B.S., wildlife; '86–Ph.D., animal sciences), head of the Department of Animal Science, approached Rozeboom about starting up a production class and the swine unit again. Rozeboom accepted the challenge.

Today, the student-run herd consists of about 30 sows. It houses mainly purebred sows, including Duroc, Hampshire, Landrace, Yorkshire and Chester White, Rozeboom said. The swine unit has shifted its focus to teaching and raising mainly show pigs. U of M students, along with young people involved in 4-H and FFA, learn management, nutrition, welfare, selection and evaluation skills. "We keep pure breeds out there so students see different breeds and learn about their different strengths and weaknesses," Rozeboom said.

It took dedication to begin again. To restart, the unit needed gilts. That's when now-late U of M alumnus Randy Morris ('86–B.S., animal sciences) lent a helping hand. At the time, Morris had one of the most elite swine herds in Minnesota, Rozeboom said.

"He allowed us to go in and pick out a set of replacement gilts. Those gilts became the basis for our replacement of the sow herds."

Tragically, however, Morris was killed in a head-on automobile accident on Dec. 29, 2012.

"He was a good friend to the swine unit who helped us get the U back in the swine business," Rozeboom said.

In fact, one of the best gilts in the litter that came from the Morris herd, Big Mama, Gopher Nation's mother, had the pedigree that helped set Gopher Nation on the path to stud status.

"She's one of our best sows. She's very outstanding to look at and in terms of phenotype," Rozeboom said. Add in a father with an equally impressive pedigree—the sire Stinger—and Gopher Nation's future looked bright.

So Gopher Nation has his parents to thank for his budding stud career. Along with having an outstanding mother and father, what does it take to be a stud in the world of swine breeding? The industry wants pigs that are wide-made or wide-based; possess a high degree of muscle;

THE GRAND SOW

Big Mama

are sound on their feet and legs; travel freely and are good in their structure—taking comfortable strides—and have acceptable leanness, so that the product is ultimately acceptable to the consumer, Rozeboom said. By those standards, Gopher Nation qualifies.

Gopher Nation flourished on regular feed. The four students who operate the swine barn never catered to him with any fancy show rations. He grew up beside his littermates, but at five months they needed to separate him. Yes, there comes a time in a boar's life where he publicly displays his boar status.

"Since he's a boar, he started to ride the other pigs to show off and prove that he was a boar," Rozeboom said.

So he lived separately in the barn for a time. In late summer, Rozeboom contacted Owen at NIBS—the stud house where Gopher Nation's father, Stinger, lives.

Only a small portion of Owen's business deals in collecting semen from cross boars like Gopher Nation to breed show pigs. "My main objective is collecting semen for commercial producers. That's 90 percent of our business," Owen said.

But Owen wanted Gopher Nation, both because of his quality and Owen's desire to honor his late friend, Morris. "I made a commitment to Randy's wife and son that we would like to pay tribute to Randy with the help of Gopher Nation," Owen said. So he and the swine unit agreed that a portion of the proceeds from the sale of Gopher Nation's semen would be set aside for a student scholarship in Randy Morris' name.

Many customers purchased Gopher Nation's semen, and the boar's first offspring already have been born. Customers are pleased with the results, Owen said. "His offspring are going to be extremely competitive at county and state fairs this summer."

Gopher Nation fits right in at his home in Iowa alongside other studs with flashy names and descriptions used to market their semen.

THE TEASE

Whitey

Gopher Nation's been very popular with visitors.

"There are a lot of sows bred to him in Iowa and Minnesota," Owen said. "He has an opportunity to make a name for himself."

While pigs can still mate naturally, the industry has evolved to mainly use artificial insemination (AI) because of AI's advantages, Rozeboom said.

"AI allows you to use the boar more. In a natural mating, a boar may only get to mate one sow a day or two to three sows a week," Rozeboom said. "This way a boar—if he is a boar that produces a high volume of semen—you could breed up to 10 or 12 sows a day in one collection."

The swine unit uses AI for its breeding. There's no natural mating, but one boar does get to hang out near the sows. He helps the swine producers determine which sows are in heat by walking around to see which sows approach. They call him a teaser boar. Sows would rather not have anything to do with boars most of the time, but that changes when they are in heat. The sows amble right up to the teaser boars on the other side of the fence. At that point, producers know when to artificially inseminate the sows. A boar named Frenchy held the heat-checking job until recently when the swine unit replaced him with a new and younger heat-checking boar called Whitey.

On the surface, this might seem like a good gig for the teaser boar, but it's a job that likely results in frustration. "He doesn't get to actually mate them," Rozeboom said. "He has to go back to his pen, poor guy."

Take heart, Whitey. Gopher Nation never gets near the sows either. NIBS staff collects his semen and ships it sometimes hundreds of miles away.

For now, the swine unit is waiting to see what comes of Gopher Nation's offspring.

"We're hoping that he produces good offspring," Rozeboom said. "By summer, we'll know if he bred true." ■

THE NEXT GENERATION

Gopher Nation's offspring

Name That Fungus

'Custingophora blanchettei' honors professor's work in wood-inhabiting fungi

Photo courtesy Robert Blanchette

Some use the word fungus as an insult, but people in plant pathology circles know better.

They recognize that having a fungus named after you ranks as a distinction one must cherish. Few scientists ever get that chance. But Plant Pathology Professor Robert Blanchette recently learned that a new fungus would bear the name *Custingophora blanchettei* in honor of his important contributions to the study of wood-inhabiting fungi.

"It was a great surprise, but, of course, with the naming of various organisms, usually the person is dead before they name something after them," Blanchette said. "It's so much more fun to be alive and have something named after you!"

The story of the newly discovered fungus began in 2012, when Blanchette, along with his former doctoral students Mike Wingfield and Carlos Perez, met in Uruguay to give a training workshop on tree diseases. Wingfield ('83–Ph.D., plant pathology) is director of the Forestry and Agricultural Biotechnology Institute (FABI) at the University of Pretoria and Perez ('05–M.S.; '08–Ph.D., plant pathology) is on the agronomy faculty at the University of the Republic in Uruguay.

After the workshops, Blanchette, Wingfield and Perez went out collecting fungi for a biodiversity study. "We were collecting in a very different forest type where a very unusual tree native to Uruguay grows—the Phytolacca. They're not really woody trees. They're more like herbaceous plants that have gotten tree-size. They get to be huge trees," Blanchette said. "It's an unusual tree and it has unusual fungi."

The three researchers collected specimens there. Wingfield zeroed in on a fungus that causes a stain in wood and collected a sample.

"I remember that Mike was so excited to find this," Blanchette said. "He was looking at it and said, 'This is new! This is new!' "

Blanchette, Wingfield and Perez all left with collections that interested them. That was the last time Blanchette heard anything about the newly found fungus. In the year that followed, Wingfield and Perez investigated the discovery and published the article introducing it to the world in Persoonia, an international mycological journal devoted to the taxonomy of fungi. They wanted to honor Blanchette and surprise him with the naming.

So just what is Custingophora blanchettei?

"We're not quite sure of the biology and ecology of this fungus because it was just collected and was just identified," Blanchette said. "The organism is something like the pathogen that causes Dutch elm disease. It is very aggressive, moved around by insects and colonizes trees quickly."

There's one other species in this genus, he said. In looking at phylogenic analysis, the researchers determined that it's somewhat related to Ceratocystis, a genus of fungi with many different species. One of those Ceratocystis species causes oak wilt.

"So we know it's in this group that's associated with insects and is moved around by insects," Blanchette said. "In Uruguay, where this has been found, we really don't know what its role is in the ecosystem there." Perez will continue working to discover that role.

And, as for the fungi's namesake, Blanchette continues to relish being alive to enjoy the naming honor. "It's so wonderful to have it named after me—and not be dead," he said.
–Patty Mattern

STAR OF THE NORTH

New center's roots in wilderness research run deep

By Becky Beyers

"We have not yet acquired enough basic technical knowledge of wilderness to be able to deal confidently with the many problems of its perpetuation."

–F.B. Hubachek, Sr.,
introduction to the 1950 Quetico-Superior
Wilderness Research Foundation progress report

It was a momentous decision by Chicago attorney Frank Hubachek: to dedicate a portion of his recreational land in far northern Minnesota to natural resources research. He had owned the property, planted trees and encouraged research on it for more than two decades, but in 1948 he created a foundation and hired scientists and workers, put up buildings using timber harvested from the land, and began promoting the concept of restorative wilderness management.

Over the past 60-plus years, CFANS scientists have lived and studied at the site near the Boundary Waters Canoe Area, wilderness co-existing with the Hubachek family's retreat as the area evolved from a heavily logged, touristy vacationland to a quiet preserve where motors are prohibited and scientists can conduct research in an ever-changing forest. Last year, the remaining Hubachek family member with an interest in the property relinquished her rights and the university became the sole owner.

All photos by David Hansen

F.B. (Bill) Hubachek Jr. and Penny Jackson from his law office in Chicago toured the center in 2008 as part of a visit for an annual Wilderness Research Foundation meeting.

The 360-acre site on Fall Lake is being renovated to accommodate larger groups; the renovations include things like bringing septic systems and buildings up to code and expanding kitchen facilities to serve groups of about 20 people. If all goes as planned, the first undergraduate class will study on-site in August, says Linda Nagel, director of the Cloquet Forestry Center, and who oversees operations at the Hubachek Wilderness Research Center (HWRC).

The wilderness forest setting sets the new center apart. At Cloquet, for example, the forest and landscape have been heavily managed for decades. But at the Hubachek center, the trees have not been managed as they typically would for the timber industry, and many of the trees haven't been disturbed at all since Hubachek's workers planted them 80 or 90 years ago. "It's a unique ecosystem, where you can learn about vegetation dynamics without that managed landscape," Nagel says.

Recent research has included studies of how forests recover from fire, and how different kinds of trees and understory are affected by a changing climate. But the center provides the opportunity to do much more, and its capacity to house visiting scientists and students makes it more than just a research site. "There are a lot of research questions to ask in the boreal ecosystem," Nagel says. "But people who do research there will get an experience in addition to knowledge."

The HWRC has a list of mandatory things that have to be done in order to house students and researchers, Nagel says, along with a wish list for future renovations. Many of the buildings were moved to the site from another location, so need repairs. Most are only usable for three seasons, so decisions will have to be made about how best to use or replace them. A to-be-hired research scientist will help build the center's capacity for

Left: *Peter Reich is the F.B. Hubachek senior chair in forest ecology and tree physiology. He's conducted a number of research projects over the years at the center, including the B4Warmed project.*
Right: Research scientist Artur Stefanski manages the operation of the B4Warmed project at the Hubachek and Cloquet research and outreach centers.

Photos by David Hansen

more research, teaching and outreach, Nagel says. For now, the site is not open to the public, but the outreach part of its mission is important; eventually there may be ways to allow visitors on the center's trails, for example.

While most research at the site has been forestry related in recent years, that wasn't always the case and isn't likely to be in the future. Isabel Ahlgren, who with her husband, Cliff, lived and led research at the center until the early 1990s, has written about the history of those years and recalls visiting scholars studying everything from the sociology of canoe country vacationers to mouse habitat to how bees and mosquitoes survived in the far north.

While many topics are ripe for study at the site, water-related research on the area's dozens of lakes seems like a natural possibility, says Carrie Pike ('13–Ph.D., natural resource science), research associate at the Cloquet Forestry Center who's been heavily involved as the center ownership transfers to the university. "If you can portage, you can get to a lot of lakes with potential research topics," she says.

She credits the Ahlgrens—Cliff was hired by Hubachek in 1948 to begin research at the site, and Isabel married and joined him in 1953—with building a tradition of solid scientific research at the center. "They were in the right place at the right time, and they were so motivated," she says. Hubachek "brought in people who were the opposite of lazy, and it was a wonderful confluence of vision and science."

Because of its geography and ecology, the center has hosted scientists and students from all over the world, especially while the Ahlgrens were on site. Now, as part of the college's network of research and outreach centers, it has the potential to thrive again as a hub of natural resources research.

"The wonderful thing about the Hubacheks is they weren't scientists, but Frank realized this was bigger than him. He saw the opportunities for research, and realized it was beyond what he could do on his own," Pike says. "It was incredibly visionary—he could have just turned it into a highfalutin resort. Embracing science like that is just not common these days." ■

What Would Warmer Look Like?

Years—and reams of data—later, B4Warmed is finding answers

They wanted warming, and they got it.

Seven years ago, researchers started the "B4Warmed" project at the Hubachek Wilderness Research Center and the Cloquet Forestry Center. They wanted to simulate the effects of climate change on the boreal forest by artificially warming small plots of trees and understory. Now, with reams of data to tease apart, the project's focus is shifting.

One of the big changes over the project was that researchers began simulating the effects of drought via a system that diverts 40 to 45 percent of seasonal rainfall off some of the research plots and into rain barrels, says Artur Stefanski ('09–M.S., integrated biosciences), the research fellow who's managed the B4Warmed project since it began. The project is led by Department of Forest Resources Regent's Professor Peter Reich, with co-investigators Rebecca Montgomery and Sarah Hobbie, from the forest resources and ecology, evolution and behavior departments respectively, and researchers Jacek Oleksyn and Roy Rich.

Originally, the project included 96 plots, each 10 feet in diameter; in 2011, the 24 control plots that weren't being artificially warmed were dropped from the project, Stefanski says. The remaining plots are either heated via underground cables or infrared lamps, to either 1.7 or 3.4 degrees warmer than the ambient temperature. Half of each plot is planted as if trees had been clear cut, and half includes understory. The heat is turned on for eight or nine months a year, usually from March or April until November.

Along with the overall growth and performance of the transplanted seedlings and volunteer herbaceous plants, researchers also are looking at how seeds establish themselves in warmer, drier conditions, Stefanski says. An insect component also has been added that compares the phenology of insects to that of the plants at the site. In the future, the plots could be used for other research on the effects of climate change, he adds. "Our invention works pretty well. Looking at things on this scale can change our understanding of how things work."

So what have researchers learned? A lot, with more to come, Stefanski says. The biggest difference for the trees and plants is in the spring and from late summer into fall; in the spring, a warmer climate is beneficial because the plants grow faster. But in the fall, the warmer air becomes a negative because the plants lose moisture more quickly. The good news, however, may be that plants are showing their adaptability even in just a few years of simulated warmer and drier air. "They're already adjusting," he says, "just like athletes adapt to warmer temperatures."

–Becky Beyers

Photo by David Hansen

Now You See

by Sara Specht

People like to say that you are what you eat.

Some university researchers are hoping the same could be said for moose—because what moose are is disappearing in record numbers in northern Minnesota. CFANS ecologist James Forester is hoping the reasons for it can be found by looking at what, when and where moose eat.

Vanishing act

The recent dwindling of the moose population in Minnesota has been dramatic. Since a 1990s study estimated 4,000 moose in the western part of the state, those animals have virtually vanished—a recent count found only about 100.

The focus now has turned to moose in northeastern Minnesota, where a similar decline has begun. In the past eight years, the moose population in the arrowhead region has dropped 52 percent—from 8,800 to about 4,300. That makes the yearly mortality rate more than double the historical average of 12 percent per year in the same region.

With numbers like that, several groups are coming together to gather data on moose survival in the northeast. Forester, an assistant professor in the Department of Fisheries, Wildlife and Conservation Biology, has teamed up with the Minnesota Department of Natural Resources (DNR) and the Grand Portage Band of the Lake Superior Chippewa to collar more than 130 moose in the area over the past year.

The radio collars track the movement of the individual moose across the landscape, sending regular location emails, including mortality notifications. DNR and Grand Portage Band representatives in the area collect the fallen animals to perform necropsies to determine cause of death.

Photos by Pete Takash, MN DNR

Photo by Pete Takash, MN DNR

Main: The helicopter carrying the moose capture crew follows a darted cow and her calf at a safe height and distance as they wait for the tranquilizer to take effect.
Top: Once the capture crew has collected all necessary samples and attached a collar, a quick injection delivers a reversal drug that takes almost immediate effect, allowing the moose to stand up and return to the woods.
Bottom: This successfully collared cow moose turns back toward the capture crew before ambling off into the thicket to be reunited with her calf.

Them

Tracking diet through time and space may reveal the secret of Minnesota's vanishing moose

The DNR's goal is to identify specific causes of death—like predation from wolves or health threats from parasites like brain worms. Forester plans to take a step back to look at changes in the moose's food supply that might prove to be a larger source of troubles—and maybe reveal some steps land managers can take to save Minnesota's moose.

"In order to survive and reproduce, an animal has to avoid predation, avoid heat stress in summer and wintertime, find enough energy in the summer and carry it through winter when food quality is low, and it has to avoid parasites," Forester says. "All of that can be affected by its diet and the quality and composition of the forage. What we expect to find is that the distribution of resources in the landscape will be important in predicting how likely animals are to survive to the next year."

Finding forage

The first task is to find out what food is available and what exactly the collared moose choose to eat. In the past such determinations have mostly been done by sight—walk into moose habitat and note which plants had been browsed at about moose-height. While this can be useful for population-wide estimates, Forester says, it doesn't identify individual animal behaviors.

"If we look at areas where known animals live and measure the composition of the forage that's available to them, we can relate what they chose to eat to what they could have eaten," Forester says. "Until we know what food is available to them on the ground, it's hard for us to identify any kind of preference."

To document the moose's menu, Forester sent graduate student John Berini ('07–B.S., fisheries and wildlife) into the woods with a team of students to collect plant samples. Those samples will be subjected to a stable isotope analysis in paleontologist David Fox's lab. The isotopic composition will vary depending on a variety of environmental factors to map a plant's individual signature, Fox says.

To find out what each moose eats, Fox and Berini apply the same analysis to hairs collected from the collared animal at capture. Each spring, moose shed their hair and regrow a new coat by fall. So a long hair collected from the shoulders in early winter will hold a record of the previous year's diet.

Photo by David Hansen

James Forester's team tracks diets in an effort to find out why so many moose are dying.

"You are what you eat," Fox says. "If you section off the hair and compare the isotopic traits there to the signature of plants in localized parts of the landscape, you can trace when and where the moose is foraging. That isotope analysis is a tracer that links movement to how the moose is using the landscape."

The team also is analyzing the chemical composition of the plant samples, based on the ground temperature where it was harvested. As a plant grows, it develops plant secondary metabolites (PSMs) as defense against being eaten. As the climate warms and extends the growing season, some plants develop more or more concentrated PSMs.

"Maybe there's some effect of temperature that's playing a role in this arms race with herbivores," Forester says. "Maybe the quality of

the forage is changing and some of these protective secondary compounds are making plants taste bad or become harder to digest."

The team distributed temperature loggers across the region, and also is taking advantage of CFANS' B4Warmed project, where forest researchers are maintaining forest plots at warmer temperatures. Using clippings from the B4Warmed plots of paper birch and balsam fir—common moose foods—analysis shows that as the temperature increased, more PSMs were created in the plants.

Now the team must identify the implications of those new compounds in a moose's diet and expand the sample pool as other plant foods are identified.

"Things are definitely changing in the stuff that moose eat," Forester says. "So we'll have to look at how the production of these PSMs change across the landscape. Do we see a change in selection, based on their hair, that reflects the change in the biochemistry in the plants, and how does it affect an animal's survival?"

A changing landscape

If the plants may be benefiting from warmer temperatures, the moose decidedly are not. They are well adapted to cold temperatures, and they have to expel substantial amounts of energy to cool off. This, too, can have an effect on their diet and the landscapes they inhabit.

Using hourly location signals from the collars, Forester is tracking the moose through space over the course of days and seasons, looking at the different land cover types the animals choose. For instance, when the temperature rises, a moose will look for cover or for wetlands to keep cool. But old forests with a lot of cover may not have as much low-slung forage as a younger forest.

Forester will use the tracking data to show whether moose respond to a landscape by changing their behavior so they can get all the things they need—food, cover and protection from predators. He hopes that if landscape patterns and plant composition can be linked to how a moose can survive, changes in land management practices could have a positive impact on moose survival.

"It may be that we can't control what's causing the decline in moose, that moose are going to leave Minnesota," Forester says. "As an outdoorsman, that would be tragic to me. I wonder if my daughter and son will ever float the Boundary Waters with me and experience that connection with the wilderness, and I hope that we can figure out some management tools that will ensure that they'll be able to make that trip and see a moose in the wild." ■

Secrets of the Kodkod

Tiny and rare cat might have an important role in rainforest habitat

Smaller than a house cat and shrouded in mystery, it individually roams the temperate rainforest sustaining itself on rodents and birds. This felid faces two threats: an endangered habitat and humans.

The Kodkod cat—the smallest wild cat known in the Americas—piqued the interest of Rodrigo Castro Bustamante and Stephania Galuppo Gaete when they set out to get their master's degrees in conservation biology. The married Chilean couple wanted to study something few had studied before.

"We were looking for a species that is really important but one that you don't know too much about," Castro Bustamante said. The Kodkod is smaller than a domestic cat, weighing just 2.4 kg or a little over 5 pounds—and that's one of the larger ones.

The Kodkod has a small head and its base coat color can range from grey to brown with small dark spots. Its tail has darker rings and an M marking on its forehead. Few have seen it. Most Chilean people learn of it only in stories, just as the researchers did before their study.

"It's a very secretive cat," Galuppo Gaete says. "In almost all of Chilean territory, they call it a *güiña*. If someone says 'there is a *güiña*,' that means you stole something. It's a reference to this cat."

The *güiña* earned a bad reputation when it preyed on poultry, so farmers shot and killed them. Today, reports of Kodkods preying on poultry are rare, but the negative perception remains, Castro Bustamante said.

The couple's research is focused on Kodkods living between two national parks and one national reserve in the Chilean temperate rainforest, a geographic region where the indigenous people—the Mapuche—live.

Photo by Jerry Laker

Castro Bustamante wants to determine the connectivity of *guiñas* among natural parks and reserves, and the crucial fragments and corridors which would allow *güiña* dispersal in a landscape matrix of forest fragments, agriculture and human presence in the pre-Andean zone of the Araucanía region of southern Chile.

Galuppo Gaete is researching the Kodkod's basic ecology. "I'm examining its activity patterns. I'm also looking at its dietary preferences," she said. "Is the Kodkod a specialist or an opportunist?"

Recent studies suggest that the Kodkod increases its activity during dawn and dusk and becomes most active at night and decreases activity during the day, she said.

No one possesses an accurate estimate of the Kodkod population.

"The Kodkod is considered vulnerable because it occupies a narrow strip of geography between Argentina and Chile," Galuppo Gaete said. "It's endangered because the native forests are endangered and lately because of the human-carnivore conflict."

Beginning in December 2010, the couple spent about eight months in the field over three years researching the Kodkod. They captured Kodkods, anesthetized them and collected blood and hair samples. They recorded the sex, weight and the cats' measurements and marked the cats with a subcutaneous microchip before setting them free. Some samples were for a colleague's work and not for use in their research.

Galuppo Gaete collected and analyzed Kodkod scat, which indicates the cat eats mostly rodents, rabbits and birds.

The researchers still are analyzing data and are beginning to write about it. They want their research to contribute to the conservation of the Kodkod, which in 2002 was listed as vulnerable by the Convention on International Trade in Endangered Species and protected.

Conserving the Kodkod is important, they said. The cat aids in controlling pests (rodents), which helps diminish the spread of lethal diseases such as the Hantavirus.

"All animals are important and have their own intrinsic value and role," Galuppo Gaete said. "The *güiña*, as carnivore, is at the top of the trophic chain holding off their prey's populations and also, thousands of ecological interactions which we as human beings ignore, but are essential for the maintenance of the ecosystems."
–Patty Mattern

Photos courtesy Rodrigo Castro Bustamante and Stephania Galuppo Gaete

Stephania Galuppo Gaete and Rodrigo Castro Bustamante wanted to study something few had researched before when they were beginning their master's degrees in conservation biology. They chose the rare kodkod cat that lives in their native Chile.

SOLUTIONS **IN**BRIEF

Ever wondered what the St. Paul campus looked like in 1890? A new Campus History web application from the U of M libraries lets you travel back in time. The app is a collaboration between the John R. Borchert Map Library and the University of Minnesota Archives. Using the application's transparency slider, you can compare historical maps to current satellite imagery, or compare historical aerial imagery across time. Watch at **www.lib.umn.edu/campushistory/about**.

Senior **Kirsten Pagel**, an Agriculture and Food Business Management major from Fulda, Minn., was crowned University of Minnesota homecoming queen in September.

OVER**HEARD**

"This is Groundhog Day. We woke up, and there's the same song on the radio. If we don't get the new farm bill, we'll get an extension."

—**Marin Bozic**, assistant professor of applied economics, in a *Time* magazine story about the U.S. farm bill.

37

Percentage of students on the U's Twin Cities campus who earned their undergraduate degrees with no debt.

$33,938

Average total debt of students who did have debt to repay after graduation.

34°

The temperature **Ted Labuza** recommends refrigerators be kept at to prevent food spoilage. He was a collaborator on a report from Harvard Law School and the Natural Resources Defense Council about the confusion caused by 'sell by' dates.

1945

Photo courtesy University Minnesota China Center

The year when 10 students sponsored by the Chinese government arrived at the University of Minnesota. **Zou Bingwen**, who was a China representative at the Food and Agriculture Organization, proposed the program. After receiving master of science degrees in agricultural engineering and completing a one-year farm internship, the students returned to China in 1948 and became the first generation of agricultural engineering scientists in the People's Republic of China.

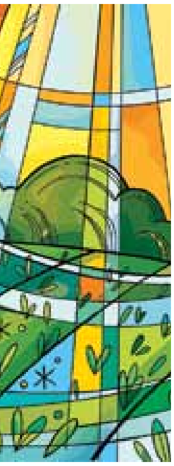
—*From* ***China 100****, a yearlong celebration honoring the first University of Minnesota students from China and the wealth of connections that have come since.*

"But if everybody would just plant flowers, as many as you can, just grow organic bee food, every bit would help. A little pot of flowers on your doorstep is not enough to support a whole colony of bees, but a whole neighborhood filled with pots might be. If everybody does a little, collectively, it would be a big help. We need to stop thinking of ourselves at every turn."

—**Marla Spivak,** Department of Entomology professor, in a *Minneapolis-St. Paul* magazine story about disappearing pollinators.

"It's not just about cows, sows and plows anymore."

—Agricultural Education professor **Brad Greiman**, in a *Minneapolis Star Tribune* story about the boom in agricultural education at Minnesota's K–12 schools.



Star power

You might have seen a CFANS project on TV, in print or even at the Twin Cities airport in the last few months: The university's "Driven to Discover" 2013–2014 advertising campaign features the Flavor Research and Education Center, the Minnesota Aquatic Invasive Species Research Center and renewable energy work at the West Central Research and Outreach Center. The advertising campaign resumes this spring. Or you can check them out at **discover.umn.edu**.

The CFANS Undergraduate Community by Major

Agricultural Education 65; **Agricultural and Food Business Management** 32; **Agricultural Industries and Marketing** 28; **Animal Science** 402; **Applied Economics** 161; **Applied Plant Science** 24; **Fisheries, Wildlife and Conservation Biology** 128; **Environmental Sciences, Policy and Management** 260; **Food Systems** 22; **Food Science** 110; **Plant Science** 28; **Pre-agricultural and Food Business** 47; **Forest and Natural Resource Management** 46; **Nutrition** 304; **Horticultural Science** 49; **Pre-bioproducts and Biosystems Engineering** 46; **Bioproducts and Biosystems Engineering** 39; **Recreation Resource Management** 7. **TOTAL: 1,864**

Colleges won't merge

CFANS and the College of Biological Sciences will not merge, University of Minnesota provost Karen Hanson announced in early February. A 19-member faculty and student task force was charged in September 2013 with examining the question of whether a merger would be beneficial to the colleges and help the university keep pace with trends in research and higher education in agriculture, biological and natural resource sciences. After researching the question throughout fall semester, the task force unanimously recommended against a merger.

Task force members did, however, encourage further collaborations in research and education, and the provost noted in her announcement that the specific recommendations will be considered as part of the university's strategic planning efforts.

Legislative session includes St. Paul projects

This year's Minnesota legislative session will include discussion of several projects important to CFANS and the St. Paul campus: improvements to the Bee Lab, Minnesota Aquatic Invasive Species Research Center and campus greenhouses as well as a new building for microbial research. The university is also seeking funding for HEAPR (Higher Education Asset Preservation and Replacement) that could help pay for repairs at Alderman Hall and the Andrew Boss Laboratory. A new Bell Museum on the St. Paul campus, while not part of the university's official request, also is expected to be part of the legislative debate.

Classes Without Quizzes: Learning without the stress of tests and assignments

Food labels, extreme weather, Minnesota's disappearing moose population and renewable energy are among the featured topics at this year's "Classes Without Quizzes" on Saturday, April 5, at the University of Minnesota's St. Paul campus.

Experts from CFANS will present mini-seminars designed for the general public, including students of all ages. The event will be from 8 a.m. to 1:30 p.m. and includes kids-only sessions focused on hands-on science. Ted Labuza, professor in the Department of Food Science and Nutrition, will present the keynote address, "Making Sense of Food Labels."

Other topics to be covered in the eight mini-sessions include extending the cold-climate fruit-growing season; Minnesota's recovering economy; and why genetic diversity is important to the world's food supply. Kids' sessions will include hands-on science and a trip to the university's Raptor Center.

To register for Classes Without Quizzes, go to z.umn.edu/cwq. Registration cost is: $35 for the general public; $30 for members of the U of M Alumni Association; $20 for youth K–6 and $10 for youth in seventh through 12th grade and U of M students.

Photo ©Benjamin Victor Studios

Honoring agriculture's greatest contributors

This seven-foot bronze sculpture of Nobel Peace Prize laureate and CFANS alumnus **Norman Borlaug** will grace the northern end of the St. Paul campus later this year, the first step in what eventually will become a Siehl Prize for Excellence in Agriculture walkway honoring contributions to agriculture. The sculpture shows Borlaug as he looked working in research fields in Mexico, where he developed the varieties of wheat that are credited with saving millions of people from starvation.

The statue was to be shown March 27 as part of events on campus and around the nation held in honor of the 100th anniversary of Borlaug's birth. The U of M statue is a direct casting of the sculpture placed in the U.S. Capitol's Statuary Hall by the state of Iowa; it was created by South Dakota sculptor Benjamin Victor.

Siehl Prize for Excellence in Agriculture 2014 laureates announced

One of Minnesota's best-known climatologists, the CEO of a large agricultural products company and a farmer who has played a key role in the state's turfgrass industry are this year's recipients of the prestigious Siehl Prize in Agriculture.

The prize is awarded annually by CFANS. Recipients are chosen in three categories: knowledge (teaching, research and outreach); agribusiness; and production agriculture. This year's winners are:

Mark Seeley (knowledge): Since the late 1970s, Mark Seeley has been the go-to source for information about Minnesota's weather and climate. As a professor in the university's Department of Soil, Water and Climate, he has led numerous research projects, mentored and advised students, and is perhaps best known for his Extension and outreach work: he's a frequent guest on local and national media and makes many public appearances each year.

Tom Rosen (agribusiness): As CEO of Rosen's Diversified Inc., he leads a multi-faceted, international agricultural products company best known for its meat processing, agricultural chemicals and companion animal products. Rosen's Diversified, a family-owned, privately held company, is headquartered in Fairmont, Minn., where Tom Rosen lives. He's held volunteer leadership roles in the Minnesota Business Partnership, the Minnesota Chamber of Commerce, Southern Minnesota Initiative Foundation and Minnesota Agri-Growth.

Richard Magnusson (production agriculture): The Magnusson family farm produces grain crops such as soybeans, sunflowers, corn, wheat and specialty seed crops on about 10,000 acres in northwestern Minnesota. The family has been instrumental in the success of the grass seed industry not only by its production, but also by donating 40 acres of land to the University of Minnesota to establish a research farm for northern crops with an emphasis on grass and legume seed production and turfgrass breeding. He led efforts to create a farmer-owned cooperative that works with the university to sell new crop varieties, and has been active in local, state and national agriculture and civic groups, including the Minnesota Crop Improvement Association and the National Wheat Growers Association.

The 2014 Siehl Prize laureates will be honored at a ceremony in McNamara Alumni Center on Thursday, May 22.

CFANS IN THE SUMMER

Siehl Prize for Excellence in Agriculture

May 22 at McNamara Alumni Center

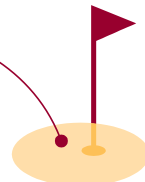
www.cfans.umn.edu/siehlprize

Northern Spark

June 14 at the Bell Museum of Natural History

Stay up all night with us as we participate in this city-wide arts extravaganza!

northernspark.org



Golf Scramble for Scholarships

July 11 at Les Bolstad Golf Course

www.cfans.umn.edu/siehlprize

Horticulture Night in Morris

July 24 at the West Central ROC

wcroc.cfans.umn.edu

University on the Prairie

July 29–31 at the Southwest ROC in Lamberton

swroc.cfans.umn.edu

2014 Minnesota FarmFest

August 5–7 in Redwood County, MN

www.ideaggroup.com/farmfest

2014 Minnesota State Fair

August 21–September 1

Visit us in the CFANS wing of the Ag-Hort Building.

The Taste of Summer

All photos by Chanbin Chen

Minnesotans could have fresh, homegrown tomatoes... just in time for the holidays

Nothing evokes summer more than the taste of a fresh tomato still warm from the sun. Maybe we in the Upper Midwest enjoy tomatoes so much because the short growing season means that we have just a few weeks each year to enjoy the sweet vine-ripe fruit.

But what if that short season could be overcome by a fast-growing, high-yield, easily harvested breed that, by the way, tastes great? And what if that tomato not only could be grown all summer long but also as an edible decoration for your holiday table?

An enthusiastic backyard gardener rather than a professional plant breeder, Assistant Professor Changbin Chen set his sights on building a better tomato about five years ago. In addition to fast growth and high yield, Chen aimed for a dwarf plant that wouldn't need to be staked so that the fruit could be machine harvested on large-scale farming operations, as well as hand-picked from small container gardens.

The long-term goal of Chen's research in the Department of Horticultural Science is to make stable aneuploidy tomato seed stock through chromosome rearrangement. "Most plants cells are diploids, meaning that they have two sets of chromosomes, one set from the mother and one set from the father," Chen explains. "We wanted to rearrange the chromosome patterns and to create plants with aneuploidy cells, that is cells with additional chromosomes added to the two sets of chromosomes. That's how you can get a high level of diversity in a short time."

In order to generate desired traits as starting tomato varieties for building stable aneuploidy tomato seeds stock, Chen and his students started with two very different tomato varieties, which offered a large number of chromosome combinations and possible recombination. They crossed a bush variety with a stable inbred line screened from a hybrid variety called Big Zack, a flavorful tomato that produces fruit along long vines. Using tweezers, students painstakingly removed anther cones—which hold the pollen—from the flowers of one plant to prevent self-pollination, and then pollinated those flowers over successive days with the pollen of the other tomato variety.

By screening these crosses, Chen's research team developed seven varieties of dwarf tomatoes with fruit of different colors, sizes and shapes. "If you have a good phenotype—like disease resistance or high yield—you want to keep it," says Chen. In this case, it took five generations to create the desired varieties to be used for future breeding of stable aneuploidy seed stock.

Chen is concentrating on three lines, one of which has heart-shaped fruit and the other two oblong, pointed fruit that resemble holiday lights. The plants, which grow from 8 to 14 inches tall, are easy to grow in Zone 2 and grow so quickly that two crops can be grown in a single season

Left: The novel tomato varieties are bred to grow fruit in a range of colors and shapes. Below: Chen's process of chromosome rearrangement produces more consistent results than traditional tomato breeding methods.

in Zones 4 and 5. The bushes produce 80 to 120 medium-sized tomatoes per plant, with a potential yield of 60,000 pounds of fruit per acre per crop. This compares with other high-yield varieties that average 46,000 pounds per acre. Because of the plants' compact size, an acre of land can host up to 40,000 plants.

In addition to traditional markets, such as fresh food stores and tomato processing plants, Chen thinks that the dwarf tomato plants have great potential for the live potted plant market. "You could go to the farmers market and not only buy tomatoes but bring home the whole plant," he says.

The Green Barn Garden Center and Farm in Isanti, Minn., has offered an acre of land for a large-scale farm test this spring. The growers also will try raising the novel varieties in the greenhouse, with the goal of producing fruit-filled potted plants in time for the 2014 holiday season.

Chen is working with the university's Office of Technology Commercialization to license the new tomato varieties, where they will join the many cold-hardy varieties of apples, grapes, mums, azaleas and other plants that the university has patented over the years. The new tomatoes, which have not yet been named, should be available in 2015 or 2016.

In the meantime, Chen and his students will work on developing a strain with even sweeter fruit, increasing the sugar concentration in these tomatoes from an average of 3.5 percent to 6 percent or higher. "We will do this by prolonging leaf growth and life," Chen explains. "The longer the leaves live, the more photosynthesis occurs and the more sugar that is produced. In rice, just two additional days of sunshine can increase the amount of sugar and starch by 15 percent. We want to do that with tomatoes." *–Julie C. Lund*

THREE QUESTIONS WITH CANDICE HIRSCH

One of the 19 new faculty members joining the college this year


Photo by David Hansen

What surprised you the most about your first semester as a faculty member?

As an undergraduate student you have a perception of what your professors do. Then as a graduate student you begin to learn a bit more through interactions with your adviser. Finally, as a post-doc you have likely done a significant amount of research, been involved in teaching and gone through the process of writing grants, and you naively think you understand what being a faculty member entails. For the most part this is true, but for me, it has been all of the little things that I was unaware of that come up in my daily activities that has surprised me the most.

What's been the most fun?

As with all new faculty, my first semester on campus has been somewhat of a whirlwind, with setting up my research program, identifying teaching opportunities and many other responsibilities. Within all of that, working through the process of developing my own research program has been challenging, but also incredibly fun. The process of generating ideas, hiring my first research assistants and initiating the first experiments has been an enjoyable and educational experience. It is fun to think about the exciting work in corn genetics and genomics that my group is working on. I also have the pleasure of working with great people in the Department of Agronomy and Plant Genetics and at the University of Minnesota as a whole, which makes coming to work every day fun.

Why corn?

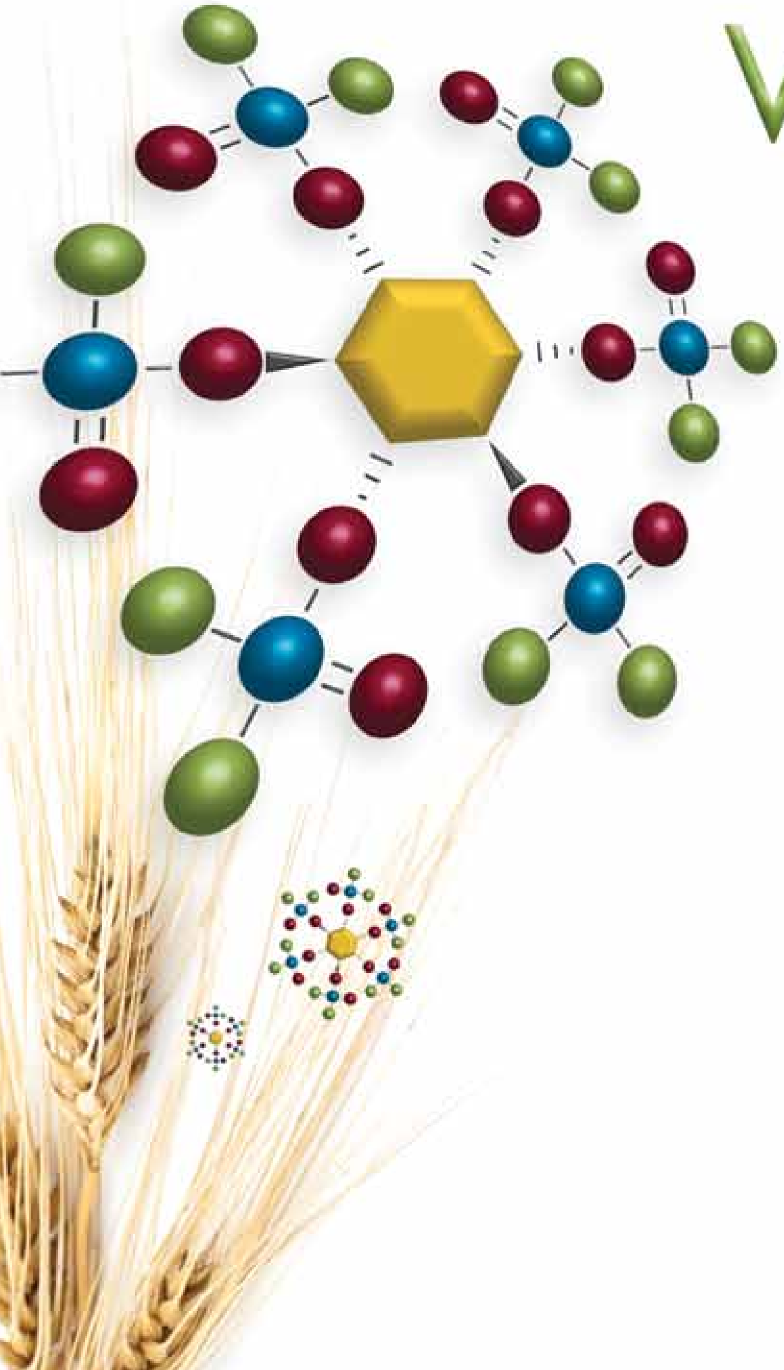
My path to working on corn was somewhat indirect. When I arrived at the University of Wisconsin–Madison as an undergraduate student I had spent a lot of timing volunteering at hospitals and intended to continue on to medical school. Shortly after arriving on campus I sat down with a wise mentor who suggested that I consider working in a plant lab to expand my experiences before deciding on a career path. Shortly after that conversation, I started working in a corn genetics lab on campus and developed a passion for research that I have carried with me since. Corn is a unique plant to work on. It serves as a model system for genetic studies in plants, and has been used in numerous important scientific findings such as discoveries like Barbara McClintock's "jumping genes," but at the same time it is also a very important crop plant. I think this unique aspect of corn is part of what makes the corn research community such a great group of scientists to work with. On top of all of that, we get to spend the majority of our summers working outside, walking fields, pollinating corn and enjoying beautiful weather!

BONUS QUESTION:
Did you know what you were getting into with a Minnesota winter?

I have lived in the Midwest for the majority of my life. I lived in Madison, Wis., for almost 20 years, and then lived in East Lansing, Mich., for a few years prior to moving to Minnesota. With all of that experience in cold weather climates I thought I was prepared for my first Minnesota winter. It turns out, nothing can prepare you for temperatures that are colder than Mars.

What's Cooking?

By Julie C. Lund



Engineers test techniques for making food fresher, safer and more nutritious

American consumers are tough customers. Not only do we want our food healthy and safe but we want it to be minimally processed as well as long-lasting. It can be difficult to achieve the twin goals of food stability and freshness but faculty members in the Department of Bioproducts and Biosystems Engineering are engaged in several projects to make food safer and more nutritious.

Now you see it

Although neither magnetic resonance imaging (MRI) nor nuclear magnetic resonance (NMR) technology were developed for food applications, they have great potential for the food industry, says Professor Roger Ruan. "What makes these methods unique is that they are non-destructive, non-invasive and fast, compared with conventional methods of determining food stability."

As a Ph.D. student at the University of Illinois at Urbana–Champaign, Ruan studied with Paul C. Lauterbur, who was recognized with the Nobel Prize in Physiology or Medicine in 2003 for developing magnetic resonance imaging as a diagnostic tool. Just as MRI scanners can be used to "see" inside the body, they can reveal the internal composition of food, such as temperature and water distribution and the presence of microbes or other foreign materials.

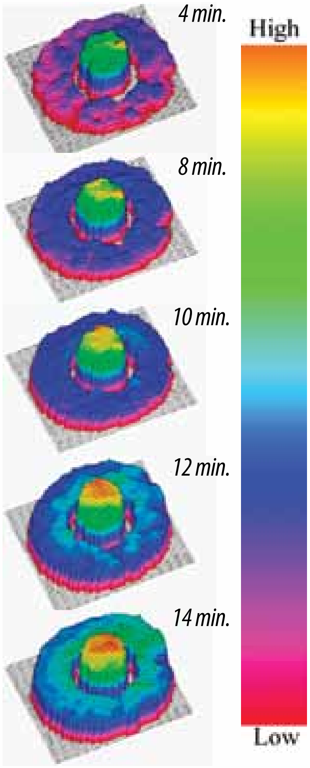
For example, MRI and NMR technologies can be used to measure and monitor water mobility in food products to determine how stable they are, explains Associate Research Professor Paul Chen. If the water molecules are mobile within the food product, they are vulnerable to chemical and biological reactions that can affect stability and shelf life.

The process is non-destructive and non-invasive. “You don’t need to take samples or cut into the food. You just put it in the [MRI] chamber. And the measurements are very quick—they take just a fraction of a second,” says Chen.

To model what happens during food processing requires making many assumptions, says Ruan, and modeling is not easy because many foods have complex chemical structures. “With this technology, you can use data to test the assumptions. I actually can map out the temperature distribution, the movement of moisture, the internal composition. And I can monitor it during the whole production process.”

In fact, the MRI and NMR technologies can be used at several points in the production process. A producer of nutrition bars screens ingredients to see which best hold water to prevent the bars from hardening. A dry soup company uses the technique to see which components of the recipe are cake-resistant and less likely to cause lumps. The technique also can be used for quality assurance on the production line or during storage to assure that there are no foreign materials in the product or packaging.

Chen and Ruan have conducted several research projects for the U.S. Army to help create MREs (Meals, Ready to Eat) that have a long shelf life. Although not yet widely used by commercial food manufacturers, as the cost for the MRI and NMR technologies come down, Chen and Ruan anticipate broader adoption by the food processing industry.

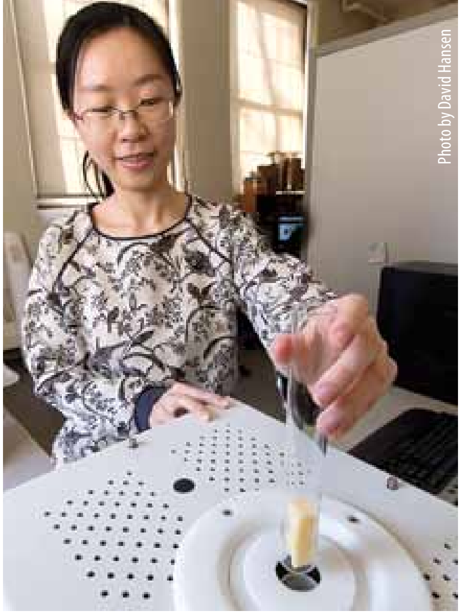


Left: A temperature map of ohmically heated whey and liquid produced by MRI imaging. Below: Roger Ruan poses with a prototype of a Concentrated High Intensity Electric Field (CHIEF) reactor that can more effectively and cost-efficiently destroy pathogens in food without altering its essential characteristics.

Less heat, more taste and nutrition

As well as products that stay fresh on the shelf, shoppers want assurance that the foods they buy are safe and free from bacteria, microbes or other unwanted micro-organisms. Irradiation, ultrafiltration, ozonation and ultra-high temperature processing are among several methods that the food industry uses to kill pathogens. Unfortunately, these technologies have limitations, as they are either extremely expensive or affect the product’s flavor, color or nutrient content. Non-thermal pasteurization, on the other hand, offers the possibility of producing safe, fresh-like, minimally processed foods without degrading or damaging the food’s taste or nutritional value.

The use of electrical fields to purify products is relatively new in the food industry. Pulsed electric field (PEF) pasteurization was first used commercially in the United States in 2005 on apple cider products. PEF involves applying a high-voltage electric field to a liquid or semi-solid food placed between two electrodes. But, while PEF is quite successful at inactivating micro-organisms, the use of DC (rather than AC) current makes it quite expensive.



Postdoctoral research associate Yun Li prepares to place a piece of cheese in an MRI scanner to look at lipid distribution.

"There also is the problem of electrode contamination," Chen says. The electrodes must make direct contact with the food. As the electrodes erode, they can contaminate the food."

Chen and Ruan's process uses novel reactors to generate high-intensity electric fields or non-thermal plasma to kill micro-organisms. Between the electrodes, they use dielectric barriers to separate and protect the food from the electrodes, eliminating possible contamination. The reactors use less expensive AC current, making them cheaper and more efficient to operate. Chen and Ruan recently built a prototype Concentrated High Intensity Electric Field (CHIEF) reactor that concentrates electrical energy, effectively destroying pathogens with very low voltage but without destroying the food or liquid's physical or chemical properties.

Plasma is the fourth state of matter, explains Chen (the others are solid, liquid and gas). It is essentially ionized gas created by applying enough voltage to release the electrons from the atoms. Positively charged nuclei swim in a "sea" of freely moving disassociated electrons, which allows the plasma state to conduct electricity. These "energetic particles" can bombard other particles they come in contact with, such as bacteria, viruses and fungi.

Thus far, most of the research has been done on milk, orange juice and whey products. "Our system is small, and there is room for improvement," Chen says. "But it holds enormous potential."

Pop goes the wheat bran

Changes in consumer attitudes and behavior have contributed to a growth in the consumption of "healthy" foods, as well as a growth in the demand for minimally processed foods. The increase in consumption of healthy food is associated with an abundance of scientific evidence regarding linkages between diet and good health.

The benefits of a diet rich in fruits, vegetables and whole grains is well documented. These foods contain many phytochemicals—beneficial chemical compounds found in plants (phyto is Greek for "plant"), such as antioxidants, that may contribute to health but are not considered essential nutrients, like vitamins and minerals. Examples include the carotene that makes carrots orange or the flavonoids that give grapes and blueberries their purple and blue pigments.

Unfortunately, many phytochemicals cannot be digested in their natural form; they simply pass through the human body unabsorbed. "A lot of good things—especially antioxidants—are hidden in cells that are very rigid and hard to break, so we don't have access to all of the nutrients in the food we eat," explains Chen.

As an example, 80 percent of the phenolic antioxidants in wheat bran—the "good stuff" in the wheat kernel—are structurally bound and insoluble. And, while wheat bran contains 43 percent dietary fiber, 40 percent is insoluble fiber, which is much less useful to the body than soluble fiber.

Chen and Ruan have explored several ways to improve the bioavailability or absorption rate of fiber and phytochemicals in whole grain foods, including enzyme and chemical treatments and a physical process called high-pressure pasteurization (HPH).

"It's relatively simple," Ruan says. "We use high pressure, and then suddenly release the pressure. The sudden change in pressure explodes the cell structure, releasing the micro-nutrients."

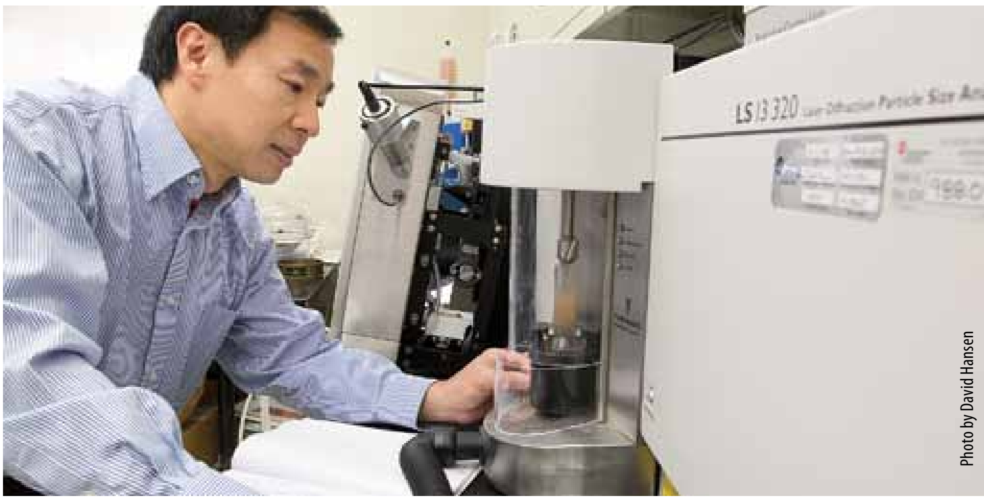
In an air puffing system, such as those used to make "puffed" breakfast cereals, the difference in pressure is only a few hundred pounds per square inch (psi), Ruan explains. "But we use very high pressure, with a difference in pressure of tens of thousands of psi."

Ruan and Chen's recent research showed that optimal HPH processing resulted in wheat bran ingredients with nearly 500 percent more soluble dietary fiber and a three-hundred-fold increase in free, unbound phenolics.

An added benefit is that HPH can be done with little or no change in temperature. High-temperature pasteurization can cause chemicals to oxidize, destroying some of the food's antioxidant properties.

"The sudden change in pressure also helps to deactivate some kinds of bacteria, so it's a non-thermal pasteurization technique, too," says Ruan. "In the end, you have a functional, nutritious product that is safe to eat." ■

Paul Chen uses a laser defraction particle size analyzer as part of the quality assurance process.



TOOLS OF THE TRADE

Aquatic Invasive Species Research Center Carp Program


All photos by David Hansen

Common Carp were introduced in the United States in the late 1800s at the behest of European immigrants who missed what they considered to be a tasty food. The U.S. Commission on Fish and Fisheries (the precursor to the U.S. Fish and Wildlife Service) purchased carp from Germany and spread them across the country by rail car. Carp, the commission believed, would serve as an inexpensive source of protein for the benefit of all Americans. Minnesota lakes were stocked with carp as early as 1882 and the fish flourished.

Once a highly desired import, Common Carp are now considered among the most problematic fish species. Not only are Common Carp not native to this area but they also are invasive, proliferating quickly and dominating the ecosystem. Common Carp have a disproportionately large impact on the environment because they dig deeply into the lake bottom when feeding, disturbing plant roots and stirring up sediment. “Instead of a nice clear lake with healthy vegetation, you get a turbid one devoid of most plants, which is not ideal for our native fishes or waterfowl,” says graduate student Justine Koch.

Carp have become the dominant species in the Twin Cities area and southern Minnesota. Researchers are trying to learn as much as possible about the Common Carp in Ramsey County’s Phalen chain of lakes and other watersheds, including how many live there, where they aggregate and reproduce and their seasonal movements, to develop plans to better manage and eradicate the species.

Here are some of the tools of their trade:

A box net: Poles are staked in a 70-foot by 70-foot square, with the netting lying on the lake floor. The area is baited with hundreds of pounds of corn for seven to 10 days to attract carp. Researchers arrive before sunrise to raise the mesh via pulleys, trapping the fish in a contained space.

An electrofishing boat sends pulses of DC current into the water, which temporarily stuns the fish so that researchers can net them. Fish are measured, sexed and checked for fin markings or tags. A dip net with an insulated handle prevents the team members from being electrocuted.

A PIT tag reader scans the Passive Integrated Transponder (PIT) tag inside the fish. Each tag contains a unique 12-digit number, which is logged into a database with information on sex, length, location at capture and other details about the individual carp. PIT tags use the same technology as that of chips inserted into pet dogs and cats.

A measuring board with a metal ruler along the bottom is used to determine the fish’s length and is a convenient place to verify its sex (this is a male judging by the sperm or milt in its abdomen).

Justine Koch, graduate student in conservation biology, Reid Swanson, junior scientist; Peter Sorensen, scientific director of the Minnesota Aquatic Invasive Species Research Center and faculty member.

Celebrating Norman Borlaug

Alumni and Constituent Relations Director Mary Buschette

1914 was a good year. The U of M celebrated our first homecoming, the American Phytopathological Society was founded in Minnesota, and Norman Ernest Borlaug was born in Cresco, Iowa. This year we will recognize all of these milestones at the University of Minnesota.

Norman Borlaug has been an inspiration to me ever since I was a CFANS student and first learned about him and his impact in my classes in the early 1980s. During that time Borlaug Hall was a new building just opening on campus. Several years later, shortly after I began my role in alumni relations, I had the opportunity to meet Borlaug during one of his visits to campus. It was exciting to meet the man whose passion and dedication to fighting hunger I admired so much. However, I wasn't really sure what to say to him. When I had the opportunity, I asked him, "What is your advice if you really want to make a difference in the world?" He looked at me and simply said, "Just do it!"

Three simple words. If you look at his life, Borlaug really did live out his own advice. He let nothing stand in his way, even though he encountered many obstacles. When his job at the U.S. Forestry Service fell through due to the Great Depression, he turned to his alma mater and connected with Professor of Plant Pathology E.C. Stakman. After hearing a lecture regarding wheat rust, Borlaug found a new passion in plant pathology. When he was making a good living at a job with Dupont he was offered a job by the Rockefeller Foundation to help Mexico with wheat breeding issues. Rather than remaining where he was comfortable, Borlaug took the offer and began a new career abroad.

Through the application of breeding techniques that he had learned from Stakman, Borlaug developed new varieties of high-yielding semi-dwarf wheat. Borlaug understood that these new varieties of wheat had the potential to dramatically reduce global food shortages, and he set out to introduce them to such countries as India and Pakistan. When he encountered barriers to export seed to Asia, he was not deterred but instead found ways to make connections with people who could help him overcome these obstacles, and made it happen. Instead of becoming discouraged—he just did it!

As a result of his work, Mexico became a net exporter of wheat by 1963. Between 1965 and 1970, wheat yields nearly doubled in Pakistan and India, greatly improving the food security in those nations. In December 1970, Borlaug was awarded the Nobel Peace Prize for his recognition of his contributions to world peace through increasing food supply.

This year, the University of Minnesota celebrates the 100th anniversary of Borlaug's birth. A weeklong celebration in March included his daughter, Jeanie Borlaug Laube, and his biographer, Noel Vietmayer, and there is much more to come.

As members of the University of Minnesota community, we should be proud of the remarkable and inspiring legacy of our alumnus, Norman Borlaug, and of the university's role in continuing to develop future hunger fighters. I hope you will join us in the celebration.

Learn more at borlaug.cfans.umn.edu.

Picture This

A passion for photography leads to a career in images from space

Mangroves are a unique coastal ecosystem.

Maybe it's because she is the mother of a 1-year-old and a 3-year-old, but children's book metaphors come easily to Jennifer Murphy Corcoran. Corcoran, who is a post-doc at the NASA Jet Propulsion Laboratory in Pasadena, Calif., uses data from satellites and other remote sensing equipment to map mangrove forests throughout the Americas.

"Mangroves are a coastal ecosystem, unique in that they are on the boundary of salt and fresh water," Corcoran explains. "They act as buffers during severe weather events, such as hurricanes and storm surges. It's like the three little pigs—you want a good barrier between you and that big bad wolf."

Corcoran currently is taking existing maps and data sets and trying to improve them to learn more about the factors that affect mangrove forests. To do so she is developing a "bald Earth" map—a map of the ground's surface without vegetation bias.

"Satellite images show everything on the surface—trees, buildings, urban areas. I am looking for holes in the canopy and other data points that I can interpolate, so that the maps will be more accurate," Corcoran says. The goal is to better understand the vulnerability of these coastal ecosystems and identify which need conservation or restoration.

Corcoran's introduction to photogrammetry (the process of taking measurements or making maps or scale drawings from photographs), remote sensing and geospatial analysis came in an unusual place—a dumpster.

Corcoran took some time to work between high school and college, applying her love of photography at Lifetouch National School Studios, a large commercial photography company. While visiting a company warehouse, the Rosemount, Minn., native noticed a neighboring refuse bin behind a publishing house filled with text books.

"I had a field day pulling out books on subjects I knew nothing about," she remembers. One of those books was "Interpretation of Aerial Photographs" by Thomas Avery and Graydon Berlin, a text she would later use in one of her graduate courses at the University of Minnesota.

"That book really opened my eyes to the concept of remote sensing," Corcoran says. "It seemed to take my passion for photography and throw it up in the air for a greater perspective."

Corcoran decided to study environmental science at Evergreen State College in Olympia, Wash. She returned to Minnesota to earn

Photo by David Moyle

a Master of Science degree in soil science with a minor in Geographic Information Systems from the College of Food, Agricultural and Natural Resource Sciences in 2009, followed by a Ph.D. in natural resources science and management with a minor in water resources in 2013.

Her doctoral dissertation—"Integrating Data from Several Remotely Sensed Platforms to Accurately Map Wetlands"—sums up her interest in bringing technology and photography to bear on environmental science and was the perfect starting point for her current research at NASA.

Corcoran is glad to have a broad background and an abundance of interests to draw on as she looks forward to her career after her post-doc. "Your passion and your skill set are not always the same thing," she says. "The challenge is to marry the two, either in a single career or in conjunction with collaborators who complement you and your abilities."

She counsels current students to explore as much as possible. As young people, it's easy to "feel like we should go into the areas where we get good grades," Corcoran says, but she thinks that sometimes it is the subjects that are the most challenging—"that we struggle with"—that are the most rewarding.

"I was a terrible math student," Corcoran confesses. "But I really loved it and kept going. I'm glad I did."

Just like the little engine that could. *–Julie C. Lund*

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Planting the Seed

New gift supports internships for horticulture students

George and Mary Lou Klacan's love of gardens and the Arboretum inspired them to endow a summer internship program.

George Klacan's love of gardens and gardening was planted early as he tended vegetables and flowers with his mother in their backyard in Kenosha, Wis. He kept his hands in the dirt, earning undergraduate, graduate and doctoral degrees in soil science at the University of Wisconsin–Madison.

After a short stint at the experiment station at Colorado State University, Green Giant offered Klacan a position with its agricultural research division in Le Sueur, Minn., where he worked from 1965 to 1995 in plant nutrition and pest management.

It was in 1965 that Klacan and his wife, Mary Lou, were first introduced to the Minnesota Landscape Arboretum by a friend. At that time, seven years after its establishment, the arboretum was "just 160 acres and an outhouse," says Mary Lou Klacan. They began to visit often, making it an annual tradition to picnic with their four children on Mother's Day when the crabapple trees were in bloom.

The Klacans moved to Minnetonka in 2007, which made it easier for them both to volunteer at the arboretum. Mary Lou helps with the annual book sale and George has spent several years working closely with Dan Miller, an integrative pest management specialist at the arboretum.

"[Director of operations and research] Peter Moe knew what I did for a living so he steered me toward Dan," George Klacan says.

For the last several years, George Klacan has worked with Miller and a series of summer interns scouting for pests, assessing damage and inventorying the arboretum's pine, ash and birch collections.

"George has a great spirit," says Miller. "He really enjoys the interns and is a great mentor to them."

One of those interns was Jennie Sirota. "During the internship I learned about a variety of plant pests, plant diseases, and how best to treat these problems. Almost every day of the summer, something different arose, making it a worthwhile learning experience," Sirota says.

Getting to know Jennie and the other interns inspired the Klacans to endow a summer internship program at the arboretum for horticulture students with an interest in integrative pest management.

"We want to encourage more young people to go into agriculture and horticulture," Mary Lou says of their gift. "Not everyone can work on a computer. Not all of the answers are on that iPad."

"We can't fund a whole building or contribute $1 million, but at least we can kick off one or two students," George adds.

"It's like stone soup," Mary Lou explains. "If you put a little something in the pot and someone else puts a little something in the pot, pretty soon you've got something." *–Julie C. Lund*

Anita Rieder contributed to this story.

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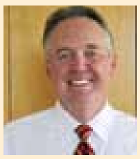

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DISCOVER CFANS

Few dwellers of the deep incite as much fear and curiosity as the shark. CFANS students who participate in the August "Tropical Marine Biology and Shark Ecology" study abroad program learn hands-on (or is that fins-on?) about the many shark species—as well as several marine ecosystems (mangroves, coral reefs, sandy and rocky inter-tidal zones)—at a biological field station on the island of South Bimini, the Bahamas. Along with understanding marine habitats from seeing them close up, students learn about the organisms that live underwater and the policy issues that affect the Caribbean and its inhabitants.

Photo courtesy Peter Sorensen