

grow

Wisconsin's Magazine for the Life Sciences • Fall 2010

food & agriculture • environment • energy • health

What makes the Perfect Cow?

Tradition meets
science in the search
for the dairy ideal



COLLEGE OF AGRICULTURAL & LIFE SCIENCES
University of Wisconsin-Madison





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Wisconsin's Magazine for the Life Sciences

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On the cover: An icon of Wisconsin dairy, the modern Holstein is the product of decades of breeding and selection. *Photo by Wolfgang Hoffmann*

MAKING THE CUT: Dietetics students slice fruit in Babcock Hall's food applications lab, a sparkling new classroom-cum-kitchen that gives students a better feel for large-scale food operations.

Dean Molly Jahn

A New Chapter



Five years ago this past September, I received a call from Chancellor John Wiley offering me the opportunity to lead a great college at a great public university toward its future, strengthening its core commitments and bringing new energy and focus to its missions. In the time I have served as dean, we have made historic progress in many areas. We have modernized operations and improved the efficiency and impact of our work. We have attracted new resources for research, teaching and outreach and recruited more than 50 new professors, enhancing what is already the most productive and excellent faculty in agricultural and life sciences in the world. We have improved our campus facilities and research stations, recommitted to our Farm and Industry Short Course, and strengthened partnerships that are at the core of our missions both within Wisconsin and throughout the world.

Now, recognizing that we have accomplished so much of what I felt I was brought here to do, it's time for a new chapter for me and for CALS. At the end of this year, I will step down as CALS dean to focus on some

I take this step with the confidence that the college is in a very strong position to continue its progress.

issues of special importance to me. Chancellor Biddy Martin has given me a unique opportunity to study our campuswide commitments to sustainability sciences, which will allow me to bring insights from agriculture, environmental and life sciences to help define the research agenda for our university. I'm enthusiastic about taking this challenge, which builds very naturally on my own research interests, my experiences as dean and my recent position with the U.S. Department of Agriculture.

I take this step with the confidence that the college is in a very strong position to continue its progress—with its budget balanced, a dynamic faculty on the rise, growing enrollments and many friends. I am delighted to share that Bill Tracy, current chair of the Department of Agronomy and a veteran of many campus leadership positions, has agreed to serve as interim dean while the chancellor and provost conduct a national search for the next CALS dean. Bill is an exceptional scholar and leader—one who was deeply influential in my decision to come to Wisconsin—and he will represent and direct CALS with grace and vision.

As I make this transition, please know how deeply I appreciate your support and friendship. I know that you, like me, cherish the college and all that it stands for, and together we will continue to add new pages to its illustrious history. Thank you—and On, Wisconsin!

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On Henry Mall

News from around the college

Small Wonder

Should Wisconsin honor its hardest-working bacterium?

Wisconsin has a state dance (the polka), a state fossil (the trilobite), a state beverage (milk, of course) and 18 other official state symbols. But a group of CALS bacteriologists say that honor roll neglects a major player in the Badger state's quality of life: *Lactococcus lactis*.

Not familiar with the name? You probably know the bacterium better by its handiwork—namely, turning milk into Cheddar cheese. Cultures of *Lactococcus lactis* are at work in virtually every dairy plant in the state, driving an industry that contributes some \$18 billion to the state's economy each year.

That kind of impact warrants recognition, argues Rick Gourse, chair of the bacteriology department. Gourse and colleagues are pushing a state bill to designate *Lactococcus* as the official state microbe, which would make Wisconsin the first state to bestow such distinction on a microorganism. Sponsored by Rep. Gary Hebl, the bill passed the State Assembly in the spring but was not considered by the Senate. Hebl is pledging to reintroduce the bill during this fall's legislative session.

"I thought this idea seemed frivolous at first," Gourse admits. "I soon realized that it presents a unique opportunity to raise awareness about the importance of microbiological research for understanding and preventing disease. It also highlights the positive role of microbes in key Wisconsin industries, including cheese, brewing and bioenergy."



ILLUSTRATION BY RENÉE GRAEF

Supporters also hope a state microbe would help counter public fears about germs, which often only get attention as causes of disease or illness. But if the Assembly's first hearings on the bill are any indication, there's still a lot of room for education.

During a presentation [about the bill], someone said, 'I want to wash my hands, thinking about all these germs,' recalls Michelle Rondon, a bacteriology faculty associate involved in the effort. "That's exactly the kind of thinking we are trying to change. The vast majority of microorganisms are either innocuous or beneficial, and *Lactococcus lactis* is an excellent reminder of that fact."

—NICOLE MILLER MS'06

Garden Party

Student-led project inspires a Milwaukee neighborhood.

A community garden is a great place to grow a new generation of neighborhood leaders. That was demonstrated recently in Milwaukee's Lindsay Heights neighborhood, where local teenagers transformed a vacant lot into a vest-pocket park, with help from CALS landscape architecture students.

The project—part of a neighborhood improvement initiative led by Milwaukee's Neu-Life Community Resource Center—put teens in the driver's seat, says graduate student Michelle Bowman. Students in Neu-Life's after-school program planned, designed and raised money for the park, which was constructed during the fall and spring semesters. The job of the UW team, which also included undergrads Dan Schmitt and



PHOTO COURTESY OF MICHELLE BOWMAN

Students at Milwaukee's Neu-Life Community Resource Center dig in to turn a vacant lot into green space.

Danielle Bilot, was to keep the youth focused, spur their creativity and help them transplant their ideas to the garden.

"The first thing we did was ask the kids what they're interested in," Bowman says. "We got everything from a fountain to a boat to a lake to art to purple flowers."

Bowman spread huge rolls of paper and encouraged students to draw and write about their ideas. They took field trips to other community gardens, recording observations in journals. Many of the students' sketches ended up in the final design of the park, Bowman says.

When it came time to turn the design into reality, students recruited neighborhood kids to don gloves and hoist shovels, hauling bucket after bucket of black dirt and manure to transform the hard-packed urban soil into a rich bed for plantings. They chose a name for the park that reflected their pride: "Lot of Respect."

"We talked about names," Bowman recalls, "and one of the boys said, 'I think this is about respect. Instead of people walking over this lot and throwing trash all over the place and using drugs, we're going to give this lot some respect.'"

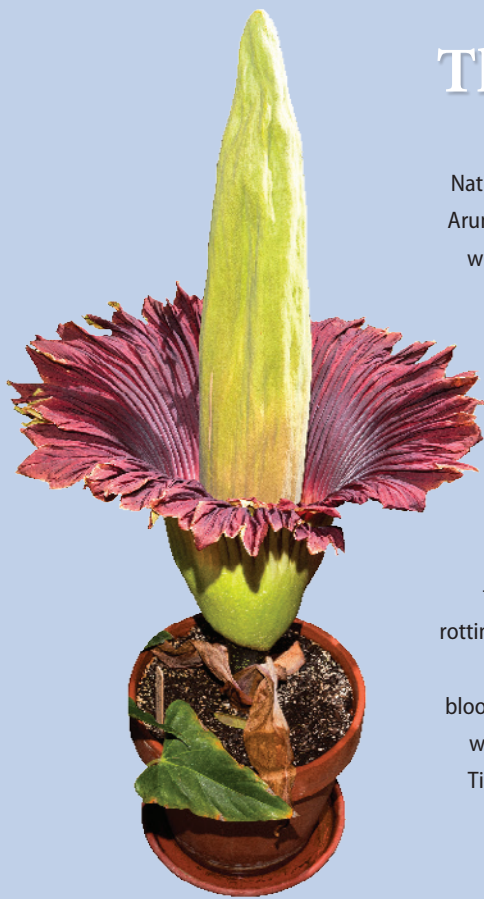
But the Neu-Life kids weren't the only ones who gained from the experience. Sam Dennis, a landscape architecture professor who advised the CALS team, says Bowman and the university students learned the power of community involvement, an important part of what he tries to convey in his design courses.

Bowman saw that "for this to be meaningful for the kids, they had to have total control," Dennis says. "The process of going through all the steps and seeing it to fruition generates respect."

—BOB MITCHELL BS'76

The Big Stink

Native to Sumatra, the towering Titan Arum plant rarely flowers indoors, but when it does, it draws a crowd. That was the case this fall, when 2,000 people visited CALS' D.C. Smith Greenhouse to witness the rare event. In mature bloom, the plant sends up a cone of tiny flowers that can reach 10 feet. But its fame comes from its distinctive foul odor—a stench similar to rotting flesh that earns it the nickname "corpse flower." The four-foot-tall bloom was the first for the CALS plant, which was parented by Big Bucky, a Titan Arum that bloomed in the UW Botany Greenhouse in 2001.



Farm Safe

Program teaches first responders how to handle field accidents.

On a pleasant evening in August, some 40 firefighters and emergency medical technicians converged at Nehls Brothers Farms in Juneau, Wisconsin. But it wasn't an accident that created the commotion. For that, you can thank Cheryl Skjolaas.

A farm safety specialist at the UW-Madison Center for Agricultural Safety and Health, Skjolaas knows all too well the multitude of dangers that exist on the state's farms. Each year in Wisconsin, around 30 people die in farm-related accidents, with causes ranging from tractor rollovers to inhalation of toxic gases inside silos. But Skjolaas says few first responders have experience with modern farms and farm equipment, complicating rescue efforts and costing valuable time.

To compensate, Skjolaas began offering workshops on farm rescue training to firefighters around the state. Her first attempt, in 2007, was little more than a Powerpoint presentation, but now the workshops have evolved into orchestrated, hands-on exercises that teach participants how to respond to farm accidents without putting their own lives in jeopardy. At one workshop, for instance, CALS machinery expert Jeff Nelson, who also serves as a volunteer firefighter, demonstrated how to deploy rescue equipment on heavy-duty farm equipment.

"We're used to grabbing the Jaws of Life and chopping off the door of a wrecked car or using what we call the 'spreaders' and just pulling the door right off," says Nelson. "But because of the strength of the metal [on tractors], that's not possible. You've got to disassemble more. You've got to bend more than cut."

With requests for farm rescue trainings on the rise, Skjolaas is gearing up to start offering annual workshops in each region of the state so that repre-



Cheryl Skjolaas uses "Rescue Randy" to demonstrate safe ways to rescue victims engulfed in grain, which can behave like quicksand. One rescue involves building a dam of plywood around the victim and then using a vacuum to remove excess grain. Jeff Nelson (behind Skjolaas) also led demonstrations that day.

sentatives from all of the state's fire departments can afford to attend.

"We train regularly on ladders, on driving the fire truck, and on farm accidents so we will be ready for when we need that one skill," says Juneau Fire Chief Curtis Ninmann, who attended the exercise at the Nehls farm. "You never know what's going to happen."

—NICOLE MILLER MS'06

Corn's Wow Factor



Bill Tracy knew it was coming. But the burst of sweetness from the ear of corn he'd just bitten into was so swift that he could offer just one word of critique: "Wow!"

That's a common reaction to the new hybrid developed by Tracy's breeding program. Nicknamed Wow corn, its kernels pack a sweet wallop without sacrificing deeper flavors, making it a potentially attractive option for fresh-market growers.

"We're very excited about this corn," says Tracy. "It's a combination of naturally occurring genes that has never existed before, and

it results in a very nice flavor. Literally every person who has ever bitten into it, the first thing they say is, 'Wow!'"

As director of one of the country's only sweet corn breeding programs, Tracy continues to look for ways to improve the popular staple, grown on around 80,000 acres in Wisconsin each year. The new variety, first evaluated in 2008, could be released to growers within two or three years.

Left: Graduate student Hallie Dodson gets a bite of Wow straight from the field.

What Lies Beneath

Long neglected, plant roots are sprouting new interest among scientists.

Patrick Masson likes to confuse plants. In his lab, the CALS professor of genetics grows seedlings of the *Arabidopsis* plant in Petri dishes set at a sharp incline, deliberately jumbling the natural cues plants use to figure out how to grow. The setup causes the plants' roots to skew down the surface of the plate in tiny waves, as if they didn't know which way to turn.

From the plants' confusion, Masson finds clarity. The root growth patterns are helping him study the molecular mechanisms plants use to sense important information about their environment, such as which way is up and the location of rocks or other obtrusions that might hinder root development.

In the process, Masson is contributing to an overlooked field of study that may be poised to revolutionize agriculture. Roots, largely ignored by plant breeders in their attempts to boost crop yields, are gaining attention as a potential target for new efforts to optimize plants.

"Because breeders have not taken full advantage

of root architecture as a way to improve yields, there is a huge genetic potential for improved production through breeding," explains Masson. "Hopefully, these efforts will lead to a new Green Revolution."

The first Green Revolution, a decades-long period of intense crop breeding that began in the 1940s, led to massive yield increases in the world's key food crops, particularly wheat and rice. But those efforts rarely focused on root systems, which, hidden beneath the soil, proved harder to assess than above-ground traits.

Now, scientists have perfected ways of growing plants in clear, nutrient-rich agar gels, making it easy to monitor root growth in the lab. In Masson's case, he grows *Arabidopsis* seedlings on dense agar that the seedlings' roots can't penetrate, which forces the roots to skew and wave down the agar's surface as if they had encountered a large rock in the soil.

After nearly two decades of growing and studying mutants of *Arabidopsis*, Masson has discovered a

number of genes and proteins that affect root growth, including a gene involved in the transport of an important plant growth regulator. Plant breeders are beginning to target some of these root-forming genes to improve plants' tolerance of drought or acidic soils, says Masson. In one effort, breeders are developing new varieties of wheat for arid climates by crossing popular cultivars with varieties with extra-long roots that can tap into water deep below the earth's surface.

The first agricultural application from Masson's lab, however, may come in the biofuels industry. In a collaborative project led by biochemist Sebastian Bednarek, Masson's team helped discover a gene that regulates the amount of lignin that gets deposited in plant cell walls throughout the entire plant—both below and above ground. With funding from the Great Lakes Bioenergy Research Center, the team is now further assessing this gene.

"To generate better biofuels," Masson says, "breeders would want to decrease the plant's lignin content" by dialing down the gene's activity. The key to making such plant improvements may come from the bottom up.

—NICOLE MILLER MS'06

Forced to grow at a sharp tilt, the roots of *Arabidopsis thaliana* seedlings wave and skew down the surface of a firm agar gel.



The New Masters

Meat crafter program promotes artisanship in meat.

Master Cheesemakers are the rock stars of the dairy industry. They train for years, perfecting one or two cheeses at a time, to earn the right to display the Master's Mark seal on their products.

Now there's a similar path to stardom for the state's artisanal meat makers. This past summer, CALS meat scientists launched the Master Meat Crafter Training Program, a two-year advanced course that covers the principles of meat processing. It's the only program of its kind in the nation.

"Our goal was to create a program that would be recognized and respected around the state, as well as around the country," says CALS meat scientist Jeff Sindelar, the program's director. "It's very intensive. It's designed to make the participants experts in their field."

The program is a key initiative of Wisconsin's Specialty Meat Development Center, a nonprofit resource center formed in 2009 to support artisanal sausage and meat makers in the state. Meat is big business in Wisconsin, contributing \$12.3 billion to the state's economy each year, but many of the state's 475 meat processors are small, with little capacity to grow their businesses. The center's goal is to help these companies develop new products and find new markets.



Moving forward, Sindelar plans to open the Master Meat Crafter Training Program to out-of-state processors. A number have already expressed interest, eager to differentiate their products with the Master Meat Crafter seal.

"When they complete the program, they can say they are Master Meat Crafters," says Sindelar. "They can say their products are of the very highest quality."

—NICOLE MILLER MS'06

In a quest for the perfect steak, researchers note subtle differences in texture and appearance to improve meat-cutting methods.

Thriving While Thirsty



Most plants wither in the arid intensity of a drought. But a few persist, staving off the stresses of heat and dehydration. The roots of that resilience have long been a mystery, one with major implications for improving agriculture in drier climates. But in one recent study, CALS biochemist Michael Sussman unlocked a key piece of the puzzle.

Working with lab plants, Sussman identified a suite of proteins that the hormone abscisic acid acts on to control how plants respond to environmental stresses such as drought, radiation and extreme heat or cold. Knowing the hormone's targets within a cell could help scientists learn how to trigger a plant's natural defenses, such as the ability to go into a dormant phase, enabling it to better

survive drought or other environmental threats.

Breeding plants with better drought resistance could improve agricultural production on marginal lands and expand agriculture into hotter, drier parts of the planet. It's also considered an important route for equipping plants to deal with global climate change, which is already altering patterns of precipitation worldwide.

"If we can figure out how this works with crops and make them able to resist drought, the benefits would be enormous," says Sussman. "These are the first baby steps to understand the effects of dehydration in plants, and it may give us the opportunity to develop crops that can withstand this kind of stress in the field."

classAct

Sarah Jacquart

Staying Fit, Naturally



Like a lot of graduate students, Sarah Jacquart took time this summer to focus on her research. But in her case, that meant spending five mornings each week with a group of excitable middle-schoolers, eating snap peas and exploring the dangers of garlic breath.

Jacquart, a doctoral student in nutritional sciences, leads GardenFit, a program designed to study and promote the health of overweight youth. For eight weeks during the summer, Jacquart convenes students in a local garden, where they learn to grow, prepare and eat healthy fruits and vegetables. The brainchild of Jacquart's advisor, nutritional sciences professor Dale Schoeller, and UW-Madison physician Alexandra Adams, the project is testing gardening as a way to prevent weight gain during the summer, which Jacquart

says is when many children pack on pounds.

"We're not necessarily trying to intervene and cause a lot of weight loss over the summer," explains Jacquart. "We're trying to prevent that three- to six-pound weight gain that other researchers have seen."

When the GardenFit program is in session, Jacquart takes pleasure in the small, day-to-day breakthroughs of introducing kids to new experiences and tastes. She loves seeing the kids eat sugar snap peas fresh off the vine, many for the very first time. She recalls how her group made a pact to try garlic scapes en masse so that they all would end up with stinky breath. Just about everyone liked them, she says.

The experience has taught Jacquart something about her own ambitions, too. After earning her degree, she plans to become a registered dietitian. And while she hasn't settled on where that career path may take her yet, one thing is certain.

"I know I want to work with people," says Jacquart, who grew up in Manitowoc, Wisconsin. "I love being able to talk to people about nutrition and give them advice that could help improve their lives."



CROWNED, as national champions at the 2010 National Collegiate Dairy Judging Contest, the **CALS dairy judging team**. The team, which includes dairy science seniors Kelly Sime, Brian

Coyne, Chelsea Holschbach and Ben Sarbacker, earned the highest combined score during the event at the World Dairy Expo. Coyne recorded the highest individual score in the history of the contest, while Holschbach, who placed second overall, won the "oral reasons" portion of the contest.

RANKED among the best in their fields, **10 CALS doctoral programs**, according to a study by the National Research Council. The report assessed more than 5,000 Ph.D. programs in 60 broad fields on factors such as research productivity, degree completion rates and interdisciplinary connections. CALS programs with average rankings in the top 15 percent of their peer groups included biochemistry, forestry, mass communications, nutritional sciences, and plant breeding and plant genetics. Animal science, dairy science, entomology, food science and microbiology had average rankings that placed them in the top 25 percent.

AWARDED a National Institutes of Health MERIT grant, CALS bacteriologist **Jorge Escalante**. The highly selective award—given in recognition of outstanding and significant accomplishment in NIH-funded work—guarantees Escalante an additional three to five years of support from the agency for his research, which explores the biosynthesis of vitamin B-12.

BESTOWED, for the fifth time, with an honorary doctorate degree, CALS professor **Daniel Gianola**. This time, it was the University of Arhus in Denmark that honored Gianola for his groundbreaking work on quantitative analysis of genetic data, which has fueled improved breeding in livestock throughout the world. Gianola, a professor of animal science and dairy science, has previously won Germany's Alexander von Humboldt Research Award and France's Chaire d'Excellence Pierre de Fermat.

Number Crunching **75** PERCENT OF THE ECONOMIC BENEFIT

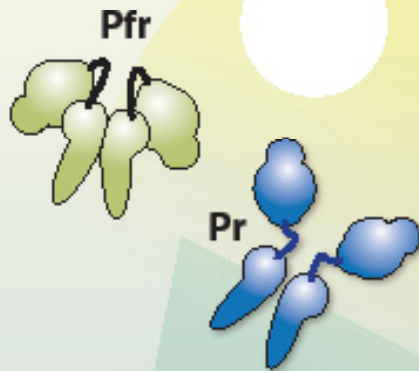
of pest suppression linked to Bt corn in

Wisconsin went to farmers who don't grow the genetically modified crop, according to a study co-authored by CALS agricultural economist Paul Mitchell. The research, the first to estimate the value of area-wide pest suppression from transgenic crops, found that Wisconsin farmers received a \$325 million boost from the use of Bt corn between 1996 and 2009. Non-Bt acres benefitted more because yield gains from reduced pest populations area-wide exceeded the net value of planting the crop, Mitchell says.

how plants tell time

Gardeners often marvel at how plants of the same species tend to flower, fruit and go to seed with remarkable synchronicity, as if on cue. Some flowers even follow a strict daily routine, opening their petals at dawn's light and closing at dusk. How are plants able to keep such rigid schedules? The secret lies in a kind of vegetative internal clock that has fascinated CALS plant scientists for decades. Here's what they've learned about how it works:

1 See the light. The primary component of plants' internal clocks is a light-absorbing molecule known as phytochrome. A turquoise-colored pigment that can exist in two different forms, phytochrome inter-converts between a "Pr" form, which absorbs red light, and a "Pfr" form, which absorbs far-red light.



2 The sun winds the clock.

In full sunlight, plants' leaf cells contain equal amounts of phytochrome's two forms—50 percent Pr and 50 percent Pfr.



3 The clock counts down at night.

When it's dark, some of the phytochrome molecules in the Pfr form break down, while others start converting to Pr at a slow, steady rate. Because this rate is constant, the amount of Pfr remaining in the leaf cells at any given time is a direct reflection of the number of hours a plant has sat in darkness. In this way, plants use phytochrome to count the hours of the night—they don't directly measure day length—and use that information to dictate when to flower and when to shed their leaves at the end of the growing season.

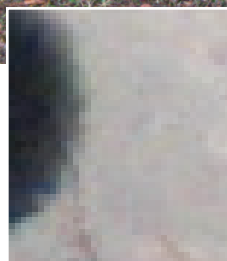
4 Plants got rhythm. The phytochrome clock enables plants to maintain a 24-hour circadian rhythm. For plants that open their flower petals at dawn and close them at dusk, the phytochrome clock allows them to anticipate the sun's rise and set. In fact, when placed in a dark closet, these plants will continue to open and close their flowers right on schedule for a number of days, until the circadian rhythm finally dampens.



CHINA



Following the Trail of Stress in Bears



Karl Malcolm (left) and research associate Wang Daiyong inspect the carcass of a goat killed by a “moon bear” (inset) as part of a study focused on bear-human conflicts and the stress levels of moon bears, which are threatened by declining suitable habitat.

This past September, Karl Malcolm scoured the forested mountaintops of Southwestern China for evidence of Asiatic black bears, hiking with a team of Chinese naturalists and an interpreter through rugged, leech-infested terrain. Because of the noise they made, Malcolm didn't see a single bear, but he did find plenty of the stuff he was looking for: bear poop.

“The locals are always interested to know why someone would come around the world to look for bear feces,” says Malcolm, a doctoral candidate in Tim Van Deelen's lab in the forest and wildlife ecology department.

But the bears' waste reveals much about their living conditions and state of mind. Asiatic black bears, also known as “moon bears” for the white crescent mark on their chests, are in decline in China, confined to small nature reserves that are surrounded by—and sometimes cut through with—human development. The bears are stressed, and they leave signs of it in their feces in the form of stress hormones, which Malcolm extracts in hopes of better understanding the landscape factors that aggravate this sensitive species.

There are plenty, to be sure. The forested reserves where the bears live in Sichuan and Yunnan provinces are located at the tops of mountains, rugged places “too steep to till,” explains Malcolm, so they were never cleared for agriculture. Though the reserves contain preferable habitat, they are ringed, like islands, by villages and crop fields that effectively separate bears from potential mates on other reserves.

At night, bears living along the edges of the reserves sometimes descend from the mountains to feast on corn and goats being raised nearby, inciting villagers to retaliate. There's also an enormous monetary incentive to kill bears. “A single Asiatic black bear, through the sale of its gall bladder, which is a very valuable component in some traditional Chinese medicine treatments, can fetch as much as a year's

salary for a local farmer,” says Malcolm, who has been to China nine times over the past three years for this project, which is run in collaboration with the Smithsonian Institute and Peking University.

By linking data about bears' stress hormone levels to patterns of human development in and around the nature reserves where they live, Malcolm hopes to generate science-based information that the Chinese government can use to identify and protect key pieces of habitat.

“Ideally, we'll come away with some concrete information about the landscape requirements for Asiatic black bears,” he says. “And also some lessons about how nature reserves might be managed to best impact the conservation of this and other sensitive species in China.”

—NICOLE MILLER MS'06

AFRICA



Neighbors Unleash Partnership on Grain

Usually nothing too exciting happens when you're out walking the dog. But for Jeremy Foltz and Sara Patterson, pets spawned a partnership that might help improve incomes and nutrition on the other side of the world.

“We're neighbors. We met walking dogs. Zazie and Murphy are now good friends,” explains Foltz. “That's an important part of this collaboration.”

As their dogs got acquainted, so did Foltz and Patterson, who discovered that they both work in CALS. Foltz, an associate professor of agricultural and applied economics, studies adoption of new agricultural technologies. Patterson, an associate professor of horticulture, focuses on plant development and genetics.

Those are seemingly disparate disciplines, but the two scientists found a point of convergence in a grain crop with the odd name of fonio, which Foltz learned about while doing economic development work in Mali, in western Africa.

Subsistence farmers in sub-Saharan Africa have grown fonio for centuries, and for good reason. It's a cousin of crabgrass and just as tenacious, able to grow in arid, nutrient-poor conditions and yield a fine grain that's high in protein, gluten-free and delicious.

“Wealthier people in the city will pay a premium for it, so it's a way to transfer some income to poorer people,” Foltz explains.

Also, very important in famine-prone Africa, fonio is ready for harvest during “the hungry sea-

son”—that uneasy time of year when most crops aren’t yet ripe but most of the previous year’s crop has been consumed.

But fonio’s yields aren’t what they could be, partly because of a trait called early seed shatter, which causes the ripe grain to fall to the ground before it’s harvested. As a result, a third of the potential yield is lost.

When Foltz heard about this, he immediately thought of Patterson, whose lab has researched cell separation processes including early seed shatter.

“Early seed shattering is a problem in many crops,” Patterson explains. “It’s part of the natural developmental process. It helps plants reproduce. Many of the wild progenitors of today’s major grain crops, such as wheat and oats, have the same trait. Early humans selected [varieties] for delayed seed shatter.”

Patterson is now growing fonio on campus, using a combined breeding and molecular approach to find ways to extend the time between full seed development and when the head shatters.

“There has never been a concentrated breeding effort for fonio,” she says. “We think we can select for better varieties.”

—BOB MITCHELL BS’76

ECUADOR



Babcock’s Artisans Spread Cheese Expertise

Anne Topham has been many places to talk about goat milk and cheese, but San Bernardo, Ecuador was different. The air was cold at 10,000 feet when she stepped off the bus after a five-hour ride up from Quito, and the street was dusty from months of drought. The village was practically vertical: simple, small houses and subsistence plots clinging to steep slopes of a deep, narrow mountain valley.

What she had come to talk about, though, was wonderfully familiar. Topham, who raises goats and makes cheese near Ridgeway, Wisconsin, made the journey to give farmers tips about caring for their new goat herds and trade ideas with the operator of the town’s new cheese plant.

“Cheesemakers love to talk to other cheesemakers,” she says.

CALS’ Babcock Institute for International Dairy Research exists to make sure that happens. For the past eight years, the institute has worked with state agencies to send Wisconsin dairy artisans around the globe to swap stories and share best practices. Such exchanges are mutually beneficial, says Babcock



CORBIS IMAGES

director Karen Nielsen.

“We want to help Wisconsin cheesemakers and other dairy product processors gain expertise so that they can compete in an international market,” she says. “And we’re using the same model to share Wisconsin’s dairy expertise to improve the health, nutrition and income of people living in poverty in Latin America.”

Topham was the first Wisconsin cheesemaker to participate in the exchange, traveling to France in 2003, a trip she says profoundly influenced the cheese she sells today. Since then, the program has sent cheesemakers to a dozen countries. Support from the UW Foundation’s Global Outreach Fund is helping extend the program to less-developed countries like Ecuador and Honduras. Babcock brought a group of Honduran cheesemakers to Wisconsin last year, and this year two dairy students from Honduras’ Zamorano Pan-American Agricultural School interned on Wisconsin dairy farms.

Topham’s visit to Ecuador was sparked by two Peace Corps volunteers who had read about the Honduran exchange through the Wisconsin Dairy Business Innovation Center. They convinced the Center to set up an exchange in San Bernardo, where they had recently introduced dairy goats to help local farmers find a more stable income. Topham gave the villagers tips on caring for their goats and showed them how to make ricotta for home use. But she says she learned at least as much from her hosts, noting that the local cheesemaker taught her how to make mozzarella.

“It was a true exchange,” she says.

—BOB MITCHELL BS’76

Virtually unknown here, fonio is a popular grain in sub-Saharan Africa.

On Dairy, He's a Bull

New dairy policy expert **Mark Stephenson** says Wisconsin still earns the title of America's Dairyland by making great milk—and listening to the consumer.

MARK STEPHENSON came to campus in July as the college's new director of dairy policy analysis and director of the Center for Dairy Profitability. In these positions, he will take a leadership role in education and research related to dairy policy and dairy market analysis. He comes here from Cornell University, where he spent 17 years as a dairy economist. Before that he spent three years on the faculty at UW-River Falls.

In the early 1990s a lot of people thought Wisconsin's days as a dairy leader were behind it. You were here then. Did you agree?

Actually, I thought Wisconsin's dairy industry had a bright future, but it wasn't clear to most people back then. That was when California had double-digit growth year after year and surpassed Wisconsin as the No. 1 milk-producing state. It was not obvious at the time that we were going to have the kind of turnaround that we have seen in the last few years in this state.

Why are you bullish about America's Dairyland?

For the same reason that W.D. Hoard was more than a century ago: He looked at the agronomic resources of this area—the climate, the soils, the potential to grow—and recognized that you could grow terrific grass here. You could grow corn. You could grow what you needed to support animal agriculture, and in his mind the best animal agriculture was dairy. It would yield the most and it would give back to the land the animal waste. We still have those resources here today.

How does that help us compete?

Farms here average an acre-and-a-half or two acres per cow. A California farm may have 10 or 12 acres altogether. They buy all of their feed. We buy part of our feed, but we grow an awful lot of it. That means that in times of price volatility we have more stable input costs. With the price swings and downturns in 2009, farms out West got clobbered much worse than farms in the upper Midwest.

How has Wisconsin turned itself around?

For one thing, our processors aren't so commodity-oriented. Twenty years ago, we were making a lot of cheese, a fair amount of butter and some nonfat dry milk, but these weren't highly differentiated products. Today our processors have really brought up the game. They're making a lot of specialty cheese and other products that stand out from the rest of the pack.

What about our farmers?

They looked at what was happening in the West and realized that they could do that too—think about economies of scale and employ a variety of business

models, including smaller, pasture-based systems. They began to remold the dairy industry in this state. Our milk production is showing it today.

Milk prices paid to farmers fell by nearly half last year. Why didn't the price for consumers follow?

There is a strong relationship between retail prices and what farmers receive, but you wouldn't expect them to move in lockstep. Milk may be the major ingredient in dairy products, but it is not the only cost. Other costs—labor in the plants, transporting the milk, the energy used in the plant and the store, everything needed to get it to the checkout counter—haven't changed. The other thing is that consumers do not like prices bouncing around a lot. We all like a sale, but we don't like it to be \$2 a gallon one week and \$4 a gallon the next, so retailers try to buffer those changes. Sometimes their margins shrink, maybe even to negative numbers, and sometimes they grow.

We now have farms milking 5,000 or 6,000 cows. Is this a positive thing for Wisconsin?

I don't think it is a bad thing. I think that the state would do itself wrong to automatically decide not to allow these farms to look for opportunities to lower their costs. I think folks who have a negative connotation about those types of farms should visit one and take a tour. You might see that cows are treated very comfortably and humanely. It is not the case that because these farms are big, they are bad. And it is not the case that because they are big, they aren't family farms.

Will there still be a place for 80- or 100-cow herds in Wisconsin?

There will. Some might need to change their business model, going from a tie-stall barn and selling milk to a co-op to becoming a grazer, perhaps even seasonal grazing. This lower-input approach could be particularly useful for a farm that needs a capital refresh that the operator isn't prepared to make—where the silos and buildings and equipment are too worn out to function. Those who want to milk fewer cows can also consider adding value to their milk—sell it not as milk, but as a finished consumer product. This requires a lot of new skills and homework, but some farms are doing it and doing it well.



Q Can the university help with that?

We can help processors to better understand global markets. The United States has tended to use world markets to sell what we have in surplus—like nonfat dry milk. But the rest of the world isn't used to nonfat dry milk—they are used to skim milk powder. Most of the world wants butter that is 82 percent fat. We produce ours at 80 percent. If we want to sell a commodity around the world, we have to make what the world wants.

“Processors have really brought up their game. They're making products that stand out from the rest of the pack.”

Q But that's not a panacea?

Those approaches work for individual farms, but they can't account for the volume of milk that we produce in Wisconsin. You couldn't have 10,000 small value-added dairy processors. We don't have the consumer market here for that much dairy product, so those folks would have to become much more intelligent marketers and get well outside of their geographic boundaries.

Q So who's going to consume all the additional milk and cheese and yogurt?

If we want to support that growth, we have to look for new markets. We are finding new ways to use milk and entice consumers into using different kinds of dairy products, but a lot of that growth is going to be through export. Other countries have been doing it for a long time, and we need to get better at it. We need to understand our customers better. If we delivered a product that a retailer didn't want in this country, we would take care of that quickly. We've been a bit more relaxed in dealing with export customers. It is harder to service customers overseas, but we need to get them the products and the packaging they want.

Q What counsel can you offer to farmers who have seen their profits evaporate and their net worth plunge in the last couple of years?

I don't anticipate prices having the kind of rebound that will restore all of the lost equity we had over the last year and a half in any short time period. I think it's going to be a crawl back for a lot of people. That's the reality of this. But prices have been stronger here than in the rest of the country, and the costs of producing milk have been relatively lower. So people can look for a better margin of profitability here. They will be restored more quickly than in most places.

Q So there's a good reason that we're America's Dairyland.

Some of the best operations around the country have moved from the West and Southwest to the Midwest because they see this. It's an advantage to be able to grow your own forage base as opposed to buying it. It's an advantage to be in a cooler climate with these high-producing cows. We've also had a lot of growth internally from dairy producers who have realized that a different type of farming system could be even more profitable. They've done it because they recognize that this is a great place to produce milk. **g**

THE THING Que Lan remembers best about the summer of 1973 is the uncontrollable shaking. A stifling blanket of humid air had settled on top of Wuhan, the capital of Hubei province in central China, and it sat on the near 100-degree days like a deflated cloud. It was the time of year when a city collectively dreams of a sudden rain shower or a cool breeze—and yet 13-year-old Lan lay shivering underneath three blankets as her disease dragged her from profuse sweating into debilitating chills. • The diagnosis had surprised Lan. Malaria seemed like a far-off threat, the scourge of rural areas dotted with rice paddies and infested with mosquitoes. But even in the metropolitan climes of central China's biggest city, where government trucks rolled down the avenues dousing neighborhoods with DDT, the threat of the disease was never too distant. As everywhere in the tropical and subtropical regions of Earth—where nearly 50 percent of the world's population now lives—malaria lurks just one fateful bite away. • Lan's illness was one of roughly one-half billion cases of malaria around the world in 1973. Because her family had easy access to medications, she avoided a far more somber statistic: More than a million people die from malaria every year, most of them children. Instead, Lan endured two weeks of shivering, fevers and aches and then recovered, well enough to return to school. Malaria was finished with her. • But Que Lan was not finished with malaria.

THE EXT

By Adam Hinterthuer

Forty years after beating malaria as a child, CALS entomologist Que Lan is still battling the disease. And she's discovered a genetic weakness in malaria-carrying mosquitoes that may finally give us the upper hand.

Entomologist Que Lan at her lab bench, where she studies mosquito larvae to learn more about how to interrupt their development.



ERMINATOR



Now, nearly four decades after the bell first rung in her bout with the disease, Lan is halfway across the world, preparing to land her first solid blow. Malaria has not gone away and is as menacing as ever. While the disease has been pushed out of more temperate (and more prosperous) areas like Europe and the United States, malaria is still present in 108 of the world's 195 countries. In most years, more than 250 million people will get sick with malaria and 1 million—most of them children—will die. Those statistics have led such groups as the Bill and Melinda Gates Foundation to declare all-out war on malaria, making eradication of the disease its No. 1 medical goal. The World Health Organization and National Institutes of Health are equally engaged in the fight. But while these scientists and public health officials struggle to control the disease and its devastating effects, Lan, a CALS associate professor of entomology, is attacking the source—the six-legged pest that malaria uses to get around.

Entomology has come a long way from the days of peering through magni-

fying glasses at anthills. Today, entomologists like Lan peer at bugs from the inside out, scouring their genes for the drivers of their behavior. In her office on the eighth floor of Russell Labs, Lan hunches over her office computer and motions for a colleague to take a look at the bright bands of color on the screen. The bands are genetic code and, from that code, Lan has teased out a single gene essential to mosquito survival. A weakness. A genetic chink in the armor. In a multiyear study funded partly by the U.S. Department of Defense—which hopes to find better mosquito-control methods to protect troops in tropical regions—she's also found a way to prevent that gene from doing its job. This is the target her lab is aiming for, a promising new approach in the fight against malaria. She's out to debug the bug.

HUMANS have been swatting at mosquitoes for millennia. And mosquitoes have returned the favor, injecting us with all sorts of diseases, from dengue fever to lymphatic filariasis to West Nile virus. But malaria is king of them all, a

harbinger of death and disease throughout the ages. Descriptions of malaria symptoms can be found in ancient Chinese medical writings dating back to 2700 B.C. and are scattered throughout Greek and Roman texts. The disease has claimed millions upon millions of lives, including those of several popes, the Italian poet Dante, and, some scholars believe, Alexander the Great. Outbreaks of malaria have sent famous explorers far off course and swung the outcomes of wars by incapacitating entire armies.

As is to be expected with such a devastating disease, we've spent centuries battling back. In ancient China, a remedy for malaria's intense fevers was made from dried wormwood leaves. In the 17th century, it was bark from the *Cinchona calisaya* tree that grew high in the Peruvian Andes. The active ingredients from both remedies are still used today in some malaria drugs. Other anti-malarial drugs were developed during both World War II and the Vietnam War as prosperous nations searched for ways to minimize the effects of malaria on their forces. Today, travelers to malaria-afflicted regions can take any of

While male mosquitoes drink only plant nectar, the females of most mosquito species need a blood meal to lay their eggs. In the lab, female *Aedes aegypti* drink a concoction of warmed rabbit blood and sugar water, offered through a layer of gauze.

a half-dozen drugs to prevent infection and treat symptoms. But the development of new drugs has slowed dramatically, and the old ones are growing less effective as the disease gains resistance to them.

When a mosquito infects a person with malaria, they are actually injecting the plasmodium parasite into the bloodstream. Plasmodium heads for the liver where it begins to reproduce. It eventually builds an army of parasites that swarm into the bloodstream where they kill red blood cells and, sometimes, their host. During this stage of the disease, a single person can have millions upon millions of plasmodium parasites reproducing in their body. Multiply that single infection with hundreds of millions of people also carrying hundreds of millions of plasmodium parasites, and resistance to commonly used drugs is an inescapable result. To stay ahead of malaria means keeping it on its toes. Researchers know that the war will not be won with World War II-era weapons. It will take a modern, multifaceted arsenal to keep pace.

This is a lesson that the World Health Organization learned the hard way. In 1955, the WHO announced its Global Malaria Eradication Programme, aiming to rid the world of the disease with the help of newly developed weapons—including anti-malarial drugs developed during World War II and the insecticide DDT—and some it hoped were on the way. Medical science believed a vaccine to ward off malarial infection was close at hand, and buoyed by that optimism, the WHO boldly predicted the tropics could be soon free from the grip of the disease. But while the campaign did push malaria out of temperate regions of the United States and Europe, the disease proved intractable in other areas. A vaccine did not emerge, and the parasite quickly evolved resistance to many of the new drugs. But the WHO's biggest shortcoming

was underestimating the complexity of eradicating such a disease. That kind of bold aim necessitates more than good medicine.

"With malaria, we have pretty good drugs," says Bruce Christensen, a parasitologist in the UW School of Veterinary Medicine. "The problem is you don't have a very good infrastructure for health facilities [in developing nations]. It's really hard for people to even get medical care. So even if you have good drugs, you probably don't have them in the areas where you need them."

At every turn, the WHO's efforts were thwarted by the realities of human nature. People didn't use the bed nets that were handed out in villages to prevent mosquito bites because the nets were stifling to sleep under and were handy as fishing nets. A campaign to spray the walls of houses with DDT met with a similarly unexpected failure. "One of the big problems they had with their workers was they would leave one wall unsprayed," says Christensen. "And the reason they did that is because if they sprayed all the walls and killed all the mosquitoes, then they were out of a job and this was the best job they'd ever had."

DDT presented other problems as well. The insecticide had been the go-to weapon for mosquito control since 1948, when Paul Mueller won a Nobel Prize for demonstrating its lethal power over insects. By the 1960s, however, the pesticide once hailed as a miracle was looking more like an environmental monster, laying waste to birds, frogs and other animals. Facing mounting criticism from conservationists, the U.S. Environmental Protection Agency banned its use in 1972. With no U.S. market to serve, many companies stopped manufacturing DDT, making it scarcer and more expensive for widespread applications in the tropics. Plus, after three decades of near-exclusive use, it, too, was losing its potency.

In 1973—the same year that Que Lan was shivering under her blankets and unknowingly preparing for a career doing battle with malaria—the WHO threw in the towel. Malaria, the organization admitted, was hopelessly entrenched in certain parts of the globe.

The failure of eradication triggered a shift in thinking about malaria control. Many scientists and public health officials realized that malaria and mosquitoes went hand in hand. You could never kill the disease without also going after its carrier. In his 2010 letter to Gates Foundation supporters, Bill Gates even acknowledges that modern medicine isn't ready to eliminate malaria. A vaccine, he says, is at least 10 years away. We have to get better at killing mosquitoes.

The approach, called vector control, sounds hopeless at first. Places where malaria is endemic are home to multiple millions of mosquitoes that thrive year-round. No method of insect control could possibly eliminate that kind of population. Papua New Guinea is a perfect example, says Bruce Christensen. Mosquitoes there often lay their eggs in puddles of rainwater that collect in cattle hoofprints. Multiply a hundred eggs by a million hoofprints and the numbers quickly become incomprehensible. "What do you do?" Christensen asks. "Do you try to put [pesticide] everywhere? Because there are breeding sites everywhere." The best that can be hoped for is to knock mosquito populations back, especially around areas more densely populated with people.

The authors of a new report on malaria control say such modest efforts may actually produce major results. Published in the August issue of *PLoS Medicine*, the article points out that in parts of sub-Saharan Africa, a person can receive up to 1,000 infectious bites from a malaria-carrying mosquito each year. Those mosquitoes aren't just injecting that person with the disease, they are often also picking up a new batch of the

To ensure a steady supply of mosquitoes for experiments, the Lan lab runs an incubator devoted to rearing mosquito larvae, which thrive on fish food.

parasite to carry to someone else. That means that, even if a massive campaign of drug delivery pushed malaria to the brink of regional extinction, a single infected person moving into the area could give rise to thousands of new infections and quickly re-establish the disease.

Controlling mosquitoes, on the other hand, makes it more difficult for the disease to rebound from successful anti-malaria campaigns. Reduce the number of mosquitoes in a malaria-infected environment by just half, and the instances of multiple infections and transmissions can drop by entire orders of magnitude. You simply can't overestimate the role mosquitoes play, the authors conclude. And that means that, to wage a truly effective campaign against malaria, you need more than a doctor. You need an exterminator.

AFTER her bout with malaria, Que Lan went on to study the sciences. She studied microbiology at Wuhan University in China and earned a master's degree at Brock University in St. Catharines, Ontario. But it took one intriguing offer—an invitation to complete her doctoral work at the University of Minnesota in noted entomologist Ann Fallon's mosquito lab—for Lan to realize that the mosquito that bit her in 1973 was still buzzing around in the back of her head. It seemed like a crazy idea, the bravado of young ambition, but Que Lan wanted to bite back. "I thought maybe someday I can do something about this," says Lan, laughing at the audacity of her younger self. "It was just this kind of remote idea that maybe someday I can do something [to help]."

Under Fallon's tutelage, Lan learned molecular biology, which she says "was really nothing to do with killing mosquitoes." Her research had more to do with what makes them thrive. But after joining the UW-Madison faculty in

2000, she set out to turn that knowledge into better weapons for mosquito control.

"The key," she says, "is to really understand the biology of your target insect and develop specific components that just target that."

Lan knew from her Ph.D. work that mosquitoes, like all arthropods, don't make their own steroids or cholesterol. Both substances are essential for survival, and insects must get them from their food sources. So when Lan discovered that a gene called sterol carrier protein-2 is active in the gut during feeding, she knew she had found an essential link in a mosquito's ability to live. "That's the Achilles' heel," she thought. "If I can destroy this pathway, they may not survive."

She and her lab researchers turned their focus exclusively on the gene. They solved the three-dimensional structure of the protein, deciphered how it interacts with other molecules, and studied when and where it was switched on. They studied the function of the gene during the mosquito's various development stages, which led to a critical discovery: If the gene was not allowed to activate inside a female mosquito, the developing larva would not get the cholesterol it needed and the egg would not hatch. In other words, silence the gene and you silence the bug.

In itself, the finding was a career-defining achievement. Researchers often only get this far—learning something new that hasn't been known before. But Lan wanted more. She knew the finding represented an exploitable weakness, one that could be developed into a method of control. Imagine, for example, dropping a pellet into a pool of standing water, where mosquitoes lay their eggs, that would deliver a knockout blow to the larvae's cholesterol-uptake capacity. Although her focus had been on mosquitoes of the species *Aedes aegypti*, which carry yellow fever, Lan was

confident it would work for malaria- and West Nile-transmitting mosquitoes as well. The idea of those little pellets preventing a disease-carrying swarm from hatching, Lan says, "is really satisfying."

But what would flip the switch? Lan needed a chemical that could knock the gene out of order. And that chemical needed to pose as little threat to humans, animals or the environment as possible. The last thing she wanted was to create another DDT. To avoid this, she took a trip to see a few robots on the west side of campus.

HOUSED in the Paul P. Carbone Comprehensive Cancer Center at the UW-Madison School of Medicine and Public Health, the Small Molecule Screening Facility allows researchers to conduct thousands of experiments simultaneously. The facility boasts three robots that store tens of thousands of chemicals. Introduce those robots to a cell line or protein, and they'll introduce it to a few molecules of every chemical at their disposal. Advanced and sensitive instruments monitor each experiment and alert researchers when there's a "hit," or, rather, when one chemical has achieved its desired results. And that's what happened when Lan's lab took sterol carrier protein-2 for a run through the robot gauntlet: Out of tens of thousands of chemicals, they found a dozen that worked. And they all worked in much the same way. Like a game of molecular musical chairs, these synthetic chemicals competed with cholesterol for a seat on sterol carrier protein-2. For every molecule of the chemical that bound to the protein, a cholesterol molecule was out of luck. Lan left the facility with a plan—introduce enough molecules of the chemical to the game, and developing mosquitoes don't get enough cholesterol to ever hatch from their eggs.

The trouble with synthetic chemi-



cals, though, is that they hang around in the ecosystem long after they've been applied. If Lan's chemical tools were going to see wide use, a better alternative would be to employ a natural chemical to muck with the bug's genes. So Lan again turned to the library to find a natural chemical that mimicked the activity of the synthetics.

The source was unexpected—an Asian fruit called mangosteen, which contains a chemical that turns out to be a dead ringer for the best-performing of the synthetic chemicals Lan tested. Touted for the rejuvenating power of its juice, mangosteen is called “queen of the fruit” in parts of Southeast Asia. The fact that a malaria-infested country could harbor a promising new natural agent against the disease is a delicious irony, Lan finds.

“We’re pretty sure this quality is one of [mangosteen’s] main evolutionary traits. It’s a naturally occurring defense compound,” she says. “We would never have imagined to use [mangosteen extract] on insects. Not in a million years if we didn’t get it from our library screening.”

Susan Paskewitz, a CALS entomolo-

gy professor who also works on mosquito-borne disease, thinks there’s great promise in this new way of methodically developing insecticides. “In the old days we might have started with something that from lab experiments was known to kill agricultural pests and then tested it on mosquitoes,” she says. The power of genetics is to look at species-specific approaches, which could mean fewer unintended consequences.

And that seems true for Lan’s genetic attack strategy. Since the chemical approach employs a different mode of action than traditional pesticides, it promises to be effective against species that have grown resistant to those applications. There’s also little danger of the chemical affecting humans or other animals since chemicals bind differently in our protein. And even if some of the chemicals bound and prevented uptake of cholesterol, it wouldn’t matter much since vertebrates make their own cholesterol.

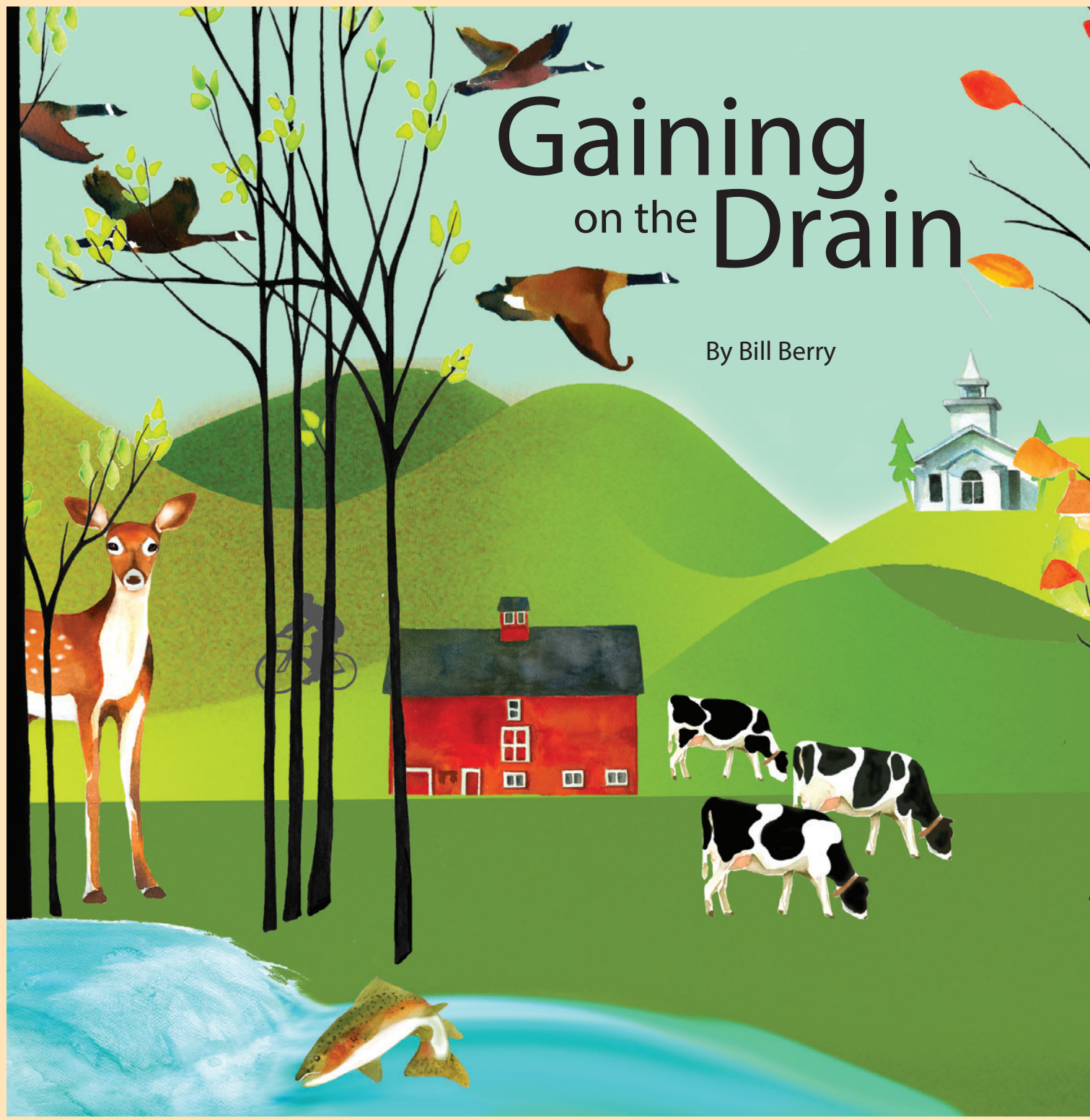
Lan has taken this particular avenue of research as far as she can as a researcher. Her naturally derived cholesterol inhibitor has been submitted for a patent, and she’s now waiting to hear if

industry will license the technology and develop a commercial product from it. She knows her find is not “the answer” to the malaria question. But she is convinced it will be a welcome addition to the fight.

“The toolbox is almost empty,” she says. “We’re just putting more tools into the toolbox.”

Of course, Lan knows her new tool won’t last forever. Someday the compound will grow obsolete as mosquitoes slowly evolve resistance. But she is confident science will uncover new weaknesses in mosquitoes’ makeup and reveal new routes of attack.

“You’re never going to win,” she says. “Mosquitoes have been around for millions of years, and they’re going to be around for another million years. We just try to avoid their contact [with humans] in high-density populations. That’s all we can do.” But mosquitoes, beware. Just because she knows she can’t win doesn’t mean Lan isn’t going to fight. As long as little girls shiver under heavy blankets in the sweltering heat, she won’t give up. What that mosquito started back in 1973, Lan will never finish. [g](#)



Gaining on the Drain

By Bill Berry

Attracted by amenities, young professionals are moving back to parts of rural Wisconsin in the



It's no surprise to Lily Palmer BS'02 and Tom Bergman that they landed in Iron County, near the northern tip of Wisconsin. Stretching along the border of the Upper Peninsula and dotted by the hills of the Gogebic Range, the county's natural amenities—including waterfalls, trout streams, more than 400 inland lakes and miles of trails for hiking and biking—offered plenty of enticement for the couple. And the 200 inches of annual snowfall? Not a problem for the self-proclaimed “snow people,” who met at a ski resort in Washington state.

About the only thing Iron County didn't seem to offer was a promising career path. With just 7,000 year-round residents and a per capita income less than 70 percent of the national average, the county ranks among the poorest in Wisconsin. Despite a colorful history tied to the iron mining boom in the late 19th and early 20th centuries, when such cities as Hurley and Ironwood, Michigan, developed almost overnight, the region today is marked by high unemployment, declining manufacturing and a rapidly winnowing population. It's the kind of place that young, college-educated professionals tend to leave, not seek out.

Except that's exactly what Bergman and Palmer did. After spending a winter working on a vacation home for Palmer's parents, the couple decided to relocate to Hurley in 2005.

athave seendecades of population decline.

Will jobs follow?

They bought a home and put down roots. Bergman, a geologist by training, took a job at a ski shop, but eventually both found professional jobs. Bergman became Iron County's zoning administrator, and Palmer works as a soil scientist with Coleman Engineering, just across the border in Michigan.

Young, educated and actively engaged in their community, the couple fits the profile of the kind of people rural communities across the Upper Midwest have spent decades trying to attract, often without success. Between 1990 and 2000, more than half of the rural counties in Midwestern states lost population, continuing a generations-long exodus of young people to other parts of the country. The phenomenon, known as "brain drain," is a much-belabored issue for such states as Wisconsin, which invests significant resources toward educating its citizens only to see many of them move elsewhere. According to one study by the publication *Postsecondary Education Opportunity*, Wisconsin colleges and universities handed out 505,767 bachelor's degrees between 1989 and 2007, but the number of college-educated people living in the state increased by only 377,275 during that time. The net loss of more than 125,000 college graduates ranked Wisconsin among the bottom 10 states in terms of retaining college graduates.

In such places as Iron County—which lost 35 percent of its residents aged 20 to 24 during the 1990s—those data feed fears about sustaining rural economic vitality and quality of life. The county is one of 10 in Wisconsin where more people died between 2000 and 2008 than were born, and many longtime residents worry that the community services they depend on, namely medical care, will disappear with the aging population. As Bob Jacquart, owner of an Ironwood fabric products business, points out, "We have five dentists in the area, and they all graduated from high



school in 1968."

But there is hope in the presence of people like Palmer and Bergman—and perhaps a lesson. To date, much of the discussion around Wisconsin's brain drain problem has revolved around the need for economic development, with state and business leaders calling for

The factors most important to new grads were scenic beauty, safe streets, affordability, a place to raise a family and good schools. "If that doesn't describe our area, I don't know what does," says Andresen.

more incentives to spark job creation. And while jobs undoubtedly are an important part of attracting and retaining young, educated workers, employment prospects didn't weigh heavily on Bergman's or Palmer's mind when deciding to settle down in Iron County. The choice was more about a way of life.

Two hundred miles south of Iron County, CALS demographer Richelle Winkler has been studying the factors behind worker migration, and she says something unique is happening in rural Wisconsin. "It's a complicated story," she warns, but one not entirely devoid of promising signs.

For one thing, Wisconsin's rural counties are "doing much better than non-metropolitan counties in the U.S. overall," says Winkler, an associate researcher in the Applied Population Laboratory, part of the Department of Community and Environmental Sociology. While census figures show that the 47 counties in Wisconsin defined as non-metropolitan lost about 35,000 people aged 20 to 29 between 1990 and 2000, they actually gained college-educated residents. And while that's true for the country's rural areas as a whole, the rate at which college grads are moving into rural areas in Wisconsin is above

the national average, Winkler says.

One possible explanation is Wisconsin's relative economic diversity. Out-migration of college-educated people tends to be most pronounced in counties that lean heavily on mining or farming, which is why such states as Pennsylvania, Illinois, Iowa and North Dakota struggle with chronic brain drain. Wisconsin has no mining-dependent counties, and despite the importance of agriculture to the state's economy, only two—Lafayette and Clark—are considered farming-dependent by the U.S. Department of Agriculture, which factors only on-farm employment in making the designation.

But Winkler is interested to learn if another factor is driving in-migration in places like Iron County. For her doctoral thesis, she studied 14 Wisconsin counties defined as "amenity destinations" for their natural or recreational appeal. Those counties may have an advantage closing the brain drain by playing to young professionals' interest in quality of life factors, she says.

"Some of my research focuses on how being a destination county impacts community well-being: How does migration impact human and social capital, educational attainment, labor force data, age and income levels?" she says.

Winkler's research echoes a growing number of academics and consultants who are saying that amenities play a critical role in a community's ability to attract and retain an educated workforce. In his 2002 book *The Rise of the Creative Class*, Richard Florida described a modern breed of intellectual professionals who seek out communities that fulfill their desire for creativity and diversity. Rebecca Ryan, author of the book *Live First, Work Second*, proclaims that young people put more emphasis on the right place than the right job.

But those arguments would seem to favor cities like Seattle and Austin, which have won legions of young talent by fostering rich cultural offerings

spanning food, music and the arts. Can small-town Wisconsin compete?

Will Andresen thinks so. A UW-Extension community resource development agent in Iron County, Andresen is spearheading an effort called the Gogebic Range Next Generation Initiative, which is trying to attract young professionals by highlighting the region's attractions and quality of life. He notes that when the state of Michigan surveyed 13,500 college graduates about what they wanted in a place to live, 38 percent said they wanted to live in a small town and 36 percent said they preferred a rural area. The factors the new grads judged as most important were scenic beauty, safe streets, affordability, a place to raise a family and good schools. "If this doesn't describe our area, I don't know what does," says Andresen.

When Andresen gave the same survey to 668 high school and college students and young professionals in northern Wisconsin, the same top priorities emerged (in slightly different order). The results also confirmed one of Ryan's main arguments, with three in four respondents saying they would choose a place to live before seeking a job.

Drive an hour up Highway 2 and you'll find a stark contrast to the sunny hopes of the Gogebic Range Next Generation Initiative. Bayfield County, a Northwoods jewel of forests, fruit orchards and Lake Superior shoreline, is hardly short on amenities. But natural beauty hasn't helped stem the tide of young people leaving: In the 1990s, the county lost a stunning 56 percent of its 20- to 24-year-olds, the worst out-migration in the state.

"It's not because they don't want to be here. They just don't have a choice," says Billie Hoopman, Bayfield's city clerk. Hoopman is an exception. After

earning a degree at UW-Eau Claire, she returned home and married a local man whose family operates a Lake Superior commercial fishing business. But she can't think of many childhood friends who are still around. "There are a lot who try to stay, but they give up."

The reason? Jobs. A lack of employment opportunity, combined with high property values, helps send young people scurrying.

"Jobs in rural areas are paying a lot less than in urban areas, and that trend on wages has been downward," says Gary Green, a CALS professor of community and environmental sociology who studies rural labor markets. "People in rural areas make about 60 cents on the dollar that people in urban areas make."

That disparity in career opportunity makes it difficult for many students from rural backgrounds to imagine moving back home after graduation. CALS student Kelly Neis, for example, hails from Benton, a tiny village of 1,000 in southwestern Wisconsin. Her education is being supported in part by a Wisconsin Rural Youth Scholarship, a need-based aid program created by CALS to ease the cost of college for rural families and help attract more rural students to the university. But she acknowledges that her likely career path won't take her back to the rolling hills of the Driftless region.

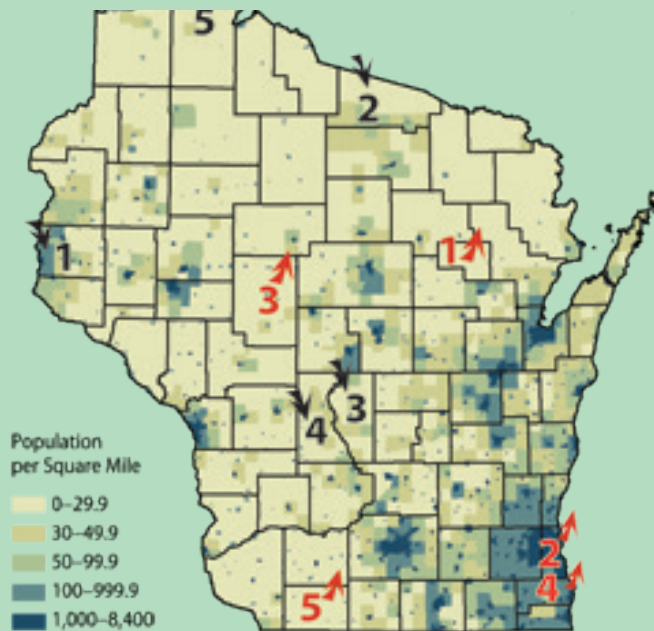
"For me, the main factor that will have the most pull on where I live is a job opportunity," she says. "My ideal career is in the field of physical therapy or athletic training, so I would go where jobs are available."

Fellow Rural Youth Scholar Ian Begeman, a genetics major from Chasburg, Wisconsin, has similar doubts about heading back to his hometown. "I like the small-town feel," he says. "Unfortunately, there's not a whole lot in my field in the area."

Many rural leaders expect the job outlook to improve as emerging agricul-

Badgers on the Move

The graphic below maps Wisconsin's municipalities by population density, according to U.S. Census statistics for 2009. The five Wisconsin counties with the highest rates of out-migration (population loss due to natives moving elsewhere) are highlighted in red, while counties with the highest rates of in-migration (population gain from new residents moving in) are noted in black.



Filling In

1. St. Croix County
2000 population: 63,155
2010 estimate: 79,919
Gain from in-migration: 16.9%

2. Vilas County
2000 population: 21,033
2010 estimate: 23,422
Gain from in-migration: 15.0%

3. Adams County
2000 population: 19,920
2010 estimate: 22,213
Gain from in-migration: 14.4%

4. Juneau County
2000 population: 24,316
2010 estimate: 27,760
Gain from in-migration: 13.9%

5. Bayfield County
2000 population: 15,013
2010 estimate: 16,674
Gain from in-migration: 12.3%

Emptying Out

1. Menominee County
2000 population: 4,562
2010 estimate: 4,656
Loss from out-migration: -12.1%

2. Milwaukee County
2000 population: 940,164
2010 estimate: 928,449
Loss from out-migration: -8.0%

3. Clark County
2000 population: 33,557
2010 estimate: 34,950
Loss from out-migration: -2.3%

4. Racine County
2000 population: 188,831
2010 estimate: 196,456
Loss from out-migration: -1.4%

5. Lafayette County
2000 population: 16,137
2010 estimate: 16,556
Loss from out-migration: -1.0%

Data prepared by
Applied Population
Laboratory, UW-
Madison/Extension.
Sources: U.S. Census
Bureau; Wisconsin
Department of
Administration,
Demographic Services
Center.

tural and environmental industries such as bioenergy develop. More investment in renewable energy is likely to bring new generating facilities and jobs to rural areas rich in potential sources of energy such as cropland, wood and paper waste, wind, sun and water. That could bode well for places like Bayfield. "The green economy is going to happen faster than we thought," says Larry MacDonald, Bayfield's mayor. "I don't think initially the incomes are going to be real high, but I think they'll be at least market rate here. In the long run, that's going to be a way of life."

Health care also promises to be a growth industry in rural areas. Amenity destinations like Iron and Bayfield counties tend to draw a lot of retirees, and rural populations almost everywhere else are aging. The need is already so critical that the UW School of Medicine and Public Health has put in place a program to give preferred admission to students who commit to practicing in rural areas. Other states are banding together to take a regional approach to addressing rural health care needs.

"A fundamental issue related to rural brain drain is about people who can deliver vital services and contribute to the community," says CALS sociologist Leann Tigges, who studies work and gender roles in rural America. "Medical areas are incredibly important."

But Tigges' research on manufacturing and labor needs has uncovered another key concern in counties of all sizes, and certainly in rural counties losing their young. "We talk a lot about 'college-educated.' The notion of skills needs to be expanded," she says. "Society's emphasis is on college education, yet there's an absence of work that requires a college education." She says instead rural communities should think about what kinds of jobs people in the community need to be able to stay. "You have to think about jobs for women as well as men. You have to think about



how to be a good employer.”

That thinking is echoed by sociologists Maria Kefalas and Patrick Carr, authors of the 2009 book, *Hollowing Out the Middle*. While researching the book, the authors spent six months in a 2,000-resident town in northeastern Iowa locked in a seemingly endless struggle with brain drain and waning community vitality. Kefalas and Carr concluded that cultivating young people’s connection to the community’s assets is a good start. But they also recommend rural communities do more to train “stayers”—the long-term residents who choose not to leave—with skills that benefit both them and the community, such as computer technology, health care, sustainable agriculture and green energy. Neglecting these critical community needs, they argue, puts young people on an inevitable path toward leaving.

“What happens at the level of the small town is mirrored and magnified and spreads. The chain of events set in motion reverberates and has conse-

quences for the state and the Midwest as a whole,” they write. “Simply put, if you start preparing people to leave when they are in their teens, should you be surprised when many of them migrate away from their home states once they finish college?”


Back in Iron County, Palmer and Bergman feel no such despair for their chosen home. In fact, they’re brimming with optimism, fueled by the community spirit surrounding the Gogebic Range Next Generation Initiative. Will Andresen invited Rebecca Ryan to come speak, and 250 people attended her talk. Their enthusiasm has spilled over into a full-throttle community campaign, with four committees now working on ways to enhance and promote the region’s amenities. One group is mapping out a regional bike trail, which would link five cities on either side of the border and better connect their professional and cultural resources. Another committee is

Hoopman can’t think of many childhood friends who are still around. “There are a lot who try to stay, but they give up.”

building a website called “The Beautiful Northwoods Adventure,” with the goal of luring more people like Palmer and Bergman to move to the area.

Even longtime residents like Bob Jacquart, who has seen generations come and go through the region, are excited. He already employs 160 people at his business, which makes Stormy Kromer winter hats and other fabric products, but now plans to expand. “To grow, you have to know your potential. We had a job fair to know what is out there, and 70 people said they would work at our business,” he says.

“If we can make this place friendly to young professionals, they will come, and then maybe their spouses will be entrepreneurs,” Palmer says, her pride for her adopted home flowing. “We’ve got this wonderful place, and we could [just] leave, or we could try to attract young people and make it like Jackson Hole or Bozeman.”

Meanwhile, students like Kelly Neis and Ian Begeman are nearing graduation and the fateful choices that follow. Will they embrace the familiar affinity for open spaces and pastoral beauty? Or will the lure of jobs win out? “The biggest thing is just having a job I’m satisfied with and enjoy doing,” says Begeman. “Then, if I could also live in a nice environment, I’d probably live in the country.” The real challenge for rural Wisconsin may not be choosing between developing jobs or amenities. It will be figuring out how to do both at the same time. 

Finding a Cow's Inner Dairyness

The dairy industry has spent a century searching for the perfect traits in a milk cow. Advances in genetics are getting us closer than ever—and changing our idea of perfect in the process.

by Bob Mitchell BS'76

A champion cow at the World Dairy Expo displays the long, lean look of today's supermodel show cows, a shape defined by years of breeding for high milk production.







A cow that makes milk for Muenster? It's possible, says dairy scientist Kent Weigel. Genomic testing could allow breeders to identify cows that produce milk with a protein ratio that matches the needs of a specific cheese plant.

a sweeping slant to ribs, overall angularity and length of neck," explains CALS dairy science instructor Ted Halbach, who coaches the students on the UW-Madison dairy judging team. "It means she looks like she's giving a lot of milk." These are traits Halbach knows well. In his dozen years as coach, the UW judging team has won three national championships, including one

in 2010. He won the contest himself as part of Wisconsin's 1980 team, and he's the son of a winner. His father competed and won as a UW senior in 1939.

But a lot has changed in the 90 years since the national judging contest began. These days, farmers use more than their eyes to tell them about a cow's milk-making potential. They rely on extensive data about her pedigree and the performance of her mother and aunts and sisters. And now the sequencing of the cow genome—completed in 2009 by a team of 300 scientists from 25 countries—has opened a vault of new data and new possibilities.

That was demonstrated during one of Expo's biggest events, the Friday night Holstein sale, when auctioneer Tom Morris brought down his gavel to sell a four-month-old calf for \$87,000—the highest price paid all week. Two weeks before the auction, that calf had topped a ranking of Holstein heifers by the Genomic Total Performance Index, a prediction of her future performance gleaned by scanning her chromosomes. The calf would have brought a good price without that—she comes from a long line of top performers—but her outstanding genomic report card definitely helped fuel the bidding.

When the University of Wisconsin proposed to set up a genetics department in 1910, it had the enthusiastic backing of W.D. Hoard, publisher of the influential *Hoard's Dairyman*

The cardinal rule in dairy judging is that if you're in doubt, you pick the cow with the best udder. Few people know that better than Brian Coyne, who grew up on a dairy farm near Eau Claire and began judging dairy cows when he was 10. Yet in the biggest contest of his life, he was about to throw that maxim out the window.

Coyne, a CALS senior majoring in dairy science, was getting his first look at a group of Milking Shorthorns—four of the 48 cows he evaluated during the National Intercollegiate Dairy Judging Contest at the 2010 World Dairy Expo—and the first one in line really caught his eye. He liked every part of her, save one: She clearly had the worst udder of the group.

"She was huge," Coyne recalled later. "She was really clean-cut. She had a big, sharp front end on her." Despite her mammary shortcomings, she had what Coyne looks for in a great cow: "She was really *dairy*."

"Dairy" is a compliment paid often around venues like the World Dairy Expo. You hear it from judges at the event's seven major breed shows, from onlookers at the big-money cattle sales held each night, and from the visitors who stream through the barns that house nearly 2,500 of the world's best show cows. The term is a bit of industry shorthand, usually uttered in awestruck

tones to explain what separates an outstanding cow from one that's merely good: "*She is just so dairy!*"

To be successful in the milk production business, you have to be able to recognize a good cow. Dairy judging contests teach one of the oldest ways of doing that: giving her a good long look, from muzzle to hip bones and rump to hooves, to see how closely she conforms to "true type," the hypothetical perfect cow. In the most practical sense, being dairy means that a cow has a body that promises great things in the milking parlor.

"We're talking about openness to rib,

magazine. But he wanted a different name. “Genetics,” he said, was a technical term that the state’s dairy farmers wouldn’t understand.

It didn’t take them long to catch on. Through genetic selection, the dairy industry has been able to achieve astounding gains in the quality and quantity of milk that cows make. Since 1939, the nation’s dairy herd has shrunk by 60 percent, but it produces 20 percent more milk because the average cow’s production has more than quadrupled.

Those increases were accomplished through the development of a gene pool that is not only deep, but also extremely well cataloged. By the late 1800s, newly established breed associations were keeping herd books to track the pedigrees of high-performing animals. Soon after, the emergence of the Dairy Herd Improvement record system created a standardized way to compare various bulls and cows by keeping tabs on how much milk their offspring produced. Today the industry collects data on nearly half of the nation’s 9 million dairy cattle, recording not just milk yield, fat and protein, but also data related to things like health, fertility and milk quality. International producers have adopted the same framework, creating a vast database of cow performance that spans the globe.

For Kent Weigel, a CALS dairy scientist whose work focuses on genetic selection, the records offer a trove of data that can be mined to optimize breeding. “We can statistically analyze those data and figure out which are the best families to select as parents of the next generation,” he says. The standard way of doing that is for breeding companies to collect and sift data on the progeny of their breeding bulls. It’s dependable, says Weigel, but slow, because you have to wait for bulls to grow up and start producing daughters. “It’s at least five years before you get any information and can decide if it’s a good bull you want to

keep or a bad bull that you want to get rid of.” In contrast, genomic screening offers immediate feedback. Technicians can take a sample of blood or hair from a newborn calf, extract the DNA, and have an almost instant prediction of how she’ll perform in the herd. This is done by scanning the calf’s genetic code for the presence of certain markers, snips of DNA that are associated with various important traits. Roughly \$150 will pay for a scan of 50,000 genetic markers. A new, slightly more expensive version will look at almost 800,000 markers.

“It’s not as accurate [as progeny testing]—not yet,” says Weigel. “We’re in this transition period, starting to move away from the progeny testing to the DNA testing. But decisions based on the DNA test results are taking a greater and greater role.”

Much of the industry’s excitement about genomic screening has focused on having a faster way to spot the same traits measured by progeny testing—like a cow’s potential for producing milk, butterfat and protein. But genomics promises a much richer lode of data. Over time, it will make it possible to predict traits that are too difficult or expensive to measure on the thousands of commercial farms that supply data to the progeny testing system, such as genetic predisposition to infertility (*see related story*), or resistance to disease, or how efficiently a cow converts feed into milk.

“To measure feed intake on an individual animal basis you need a lot of labor and specialized equipment. We couldn’t measure it on hundreds of thousands of animals. It would be prohibitively expensive,” says Weigel. “But you can do it on a few thousand cows in research herds and then DNA-test those animals. If it works as we hope, we’d be able to take specialized traits and put them in a national breeding program.”

Genetic Counseling for Cows

Professor explores why the best milking cows are often the hardest to impregnate.

When UW-Madison hired Hasan Khatib as an assistant professor in 2002, his colleagues knew not to expect a typical dairy scientist. A student of human genetics, Khatib had spent three years after earning his doctorate counseling couples about their chances of passing on inherited disorders.

These days, he’s working with a different species—but he’s still doing essentially the same thing.

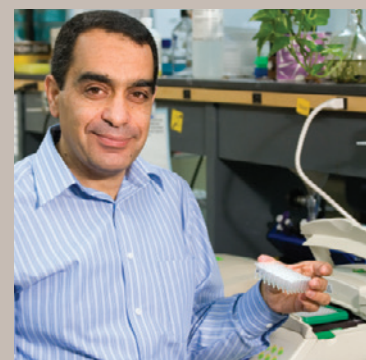
In his lab, Khatib studies the genes of newly fertilized cow embryos to understand the connections among traits passed down from their parents. For the past several years, he’s been focused on a major frustration for the dairy industry—the fact that today’s super-producing milk cows often have trouble getting pregnant. In fact, during the past 20 years, as milk yields have gone up, pregnancy rates have headed in the other direction, falling by 20 percent.

“A large portion of infertility is because embryos die early, in the first few days of pregnancy,” says Khatib. “That’s why we are focused on this stage of development, where we can identify genetic factors leading to better survivability of embryos, hence increasing fertility of cows.”

Khatib has discovered one reason why increased milk production and infertility go hand-in-hand. He located a gene variant that, when present in homozygous form—two copies, one from each parent—the embryo dies soon after conception. But in heterozygous form, where the cow carries one lethal and one non-lethal variant, the gene is associated with increased milk production.

Because breeders select for higher milk production, Khatib’s data suggests that 65 to 70 percent of Holsteins have that genotype. Breeding heterozygous bulls with heterozygous cows, however, increases the chance of passing on the lethal combination of genes. To avoid that situation, Khatib developed a set of markers that indicate the presence of the gene, which he has patented and licensed to a breeding firm.

“This is like genetic counseling for bulls,” he says. “It’s the same principle: How to use your genetic markers to improve the trait that you’re looking at.”



Khatib: A common cause of infertility in cows stems from a lethal combination of genes.



The World Dairy Expo offers a stage for students to learn the technique of judging cows, a 90-year-old tradition that trains them to recognize dairy potential.

Identifying specialized traits could lead to specialized cows. For example, producers who feed their cattle on pasture might be able to select cows that are really good at converting grass to milk. “In the past all you could do is try to select different sire families whose daughters seem to have done better on grass than on total mixed rations,” says Weigel. “You didn’t really know what you were selecting. But now you could test individual animals and target them for grazing, target them for confinement, target them for producing cheese, or for a certain kind of cheese.”

“It’s far-fetched today,” says Weigel. “But not that far-fetched. We can imagine being able to do it.”

Back at the World Dairy Expo show ring, it doesn’t take any data mining to see the cumulative effect that a century of breeding has had on dairy

cows. Compared to the squat, rounded cows Ted Halbach’s father judged 70 years ago, today’s cows are bovine super-models—longer, taller and svelter. This form has followed function: The industry has selected for cows that put energy into making milk rather than meat.

In recent years, however, it’s become apparent that such cows may not have the resilience to thrive in the larger herds that are becoming the norm in the industry. “This cow has to be able to function in the housing environment. She has to have the physical attributes that sustain and support her production,” explains Halbach. “You can have an animal with great production potential, but if she doesn’t have the physical attributes to reach that potential, she won’t. It’s as simple as that.”

Concerned that cows were becoming too frail, the Purebred Cattle Association asked Halbach in 2007 to lead an effort to revise its unified scorecard—the standard for that hypothetical perfect cow. Halbach turned to research conducted by Weigel, who had analyzed a dozen years of data on Holsteins and Jerseys to find links between a cow’s

physical characteristics and how long she survived in the herd.

“There was a perception that what makes a good dairy cow was her ability to milk herself—to take all this body tissue, mobilize it, make all this milk from it and not have any extra fat on her,” says Weigel. “Well, she also has to do other things, like get pregnant and not get sick and so on. It became fairly clear that that was a trait where we’ve maybe gone too far.”

The revised standards emphasize more balance between strength and dairy character. “We’ve started to get people to think again that, yes, we want cows that produce a lot of milk, but we also want them to not kill themselves doing it,” Weigel says. “We want them to be able to maintain good health.”

Still, the ideal cow epitomized in the revised standards and in the show ring is geared toward a particular kind of dairying, in which cows live in large, open-stall barns and are fed a mixed ration that includes grain, forage, protein and mineral supplements. This is the dominant milk production system in the United States today, but plenty of cows

across the nation and around the world live a different kind of life.

“Those cows are Ferraris,” says dairy farmer and UW-Extension agent Vance Haugen, describing the show cows at World Dairy Expo. “That’s wonderful, but I’m not going drive a Ferrari on my back forty. I’d rather be driving my Jeep.” Haugen, who operates a pasture-based dairy farm, says he prefers cows with “a little more girth, maybe a wider muzzle so she can graze a little bit better. And smaller.”

Smaller is also better in Central America, says Ysidro Matamoros, an animal scientist from Honduras who brought a group of students to Dairy Expo. In his country, the average dairy herd has about nine cows that subsist on low-quality pasture and endure a brutally hot and humid climate. “She has to be smaller, because she has to dissipate a lot of heat,” he says. She also has to have some meat on her bones, literally. In Honduras—as in many countries—much of the milk comes from cows raised for both milk and meat.

In some parts of the world, farmers rely on indigenous breeds of cattle that are better tailored to handle the rigors of the environment. The tradeoff is that they don’t produce much milk. UW dairy geneticist Hasan Khatib thinks genomics can speed efforts to coax more production out of these breeds without sacrificing their native toughness. He is collaborating with scientists in Pakistan to compare the genome of Cholistani, a desert breed used for milk, meat and pulling carts, to that of Holsteins and Jerseys.

“It’s interesting for us to compare a breed that wasn’t under selection to some that were under intense selection for milk production,” he says. “This will allow us to identify genes that cause these trait differences, which could help us identify cows that will be better for this use and maybe apply that to other situations.”

What this means is that in an increasingly diverse global dairy industry, there is no ideal. One herd’s perfect cow might be a cull cow in a herd on the other side of the world.

The ability to find genetic markers for hundreds of discrete traits will continue to refine our ability to define perfection on a case-by-case basis. “The idea in the past was to look at what people thought the cow should look like intuitively. What they favored. What they liked to look at,” says Weigel. “Now you’ve got the data telling you what the cow should look like.”

But perfection will always be in the eye of the beholder. Brian Coyne says he will never forget that great Milking Shorthorn with the subpar udder that caught his eye during the national dairy judging contest. Nor will he forget his conversation with the Shorthorn judge in the final portion of the competition, in which contestants give their reasons for ranking the cows the way they did. Coyne dug deep into dairy-judging

lexicon to explain why he picked that cow. He talked about her “decided advantage in dairyness, longer and cleaner head and neck and sharply chiseled top line.” But the judge wasn’t buying it. She pressed Coyne, asking how he would have rated the cows on udders alone. By that standard, he admitted, his first-place cow would have gone last.

“The judge gave me this funny look, and I was like, ‘Yeah, I started with my worst-uddered cow,’ and thinking, ‘I screwed this up really badly.’”

Actually, he didn’t mess up much at all. He won the contest with the highest score in event history, and he did okay with the Shorthorns. The one he ranked first belonged in second place. She may not have been the perfect dairy cow, but she was very dairy. 🐄

With genetic testing offering more insight into a cow’s potential, the next generation of dairy farmers will look at cows differently than their grandparents did—from the inside and out.



The Grow Dozen



Marshall Ernst



Jane Hillstrom



Barbara Jesse



Mark Kreul



James Lochner



Kathleen Pearce

Marshall Ernst BS'74 Meat and Animal Science • Ernst's resume includes some of the meat industry's most noted names, including Smithfield Foods, Johnsonville Sausage, Sara Lee Meat Group and Swift and Co., where he was vice president of operations. Now he owns Ernst Herefords in Windsor, Colorado, and has just taken a position as livestock manager of the National Western Stock Show. "A lot of people in the livestock industry got their start exhibiting meat animals, and that early experience led them to work in production agriculture or agribusiness careers," he says. "To be part of that and to work for the granddaddy of all livestock shows will be very rewarding."

Jane Hillstrom BS'80 Meat and Animal Science • Hillstrom spent nearly 10 years as executive director of the Wisconsin Beef Council. During her tenure she advocated for funding for UW meat science research and partnered with UW-Extension on public education. After leaving the council she started her own business, Hillstrom Communications, where meat and dairy producers form the bulk of her clients. "My passion for the beef industry began on my grandfather's farm and in 4-H showing Herefords at the local county fair," she says. "I have always loved working with cattle and the people who raise them."

Barbara Jesse BS'78 Meat and Animal Science • Jesse is a swine consultant and owner of Swine Data Management, an Iowa-based records service bureau providing production records and consulting

to pork producers to help them manage their herd and improve the profitability of their business. She is also on the software development team of Agritech Software, a Spanish company that develops livestock management software used by some of the largest swine production companies around the world. "I love using data to help pork producers solve problems and make decisions," she says.

Mark Kreul BS'85 Meat and Animal Science • Kreul is manager of food safety and technical services for In-N-Out Burger, a chain that rests its success on doing a few items exceptionally well. The key to the chain's faithful following is that simplicity, says Kreul—and the fresh, high-quality beef. Kreul was raised on a purebred Angus farm in a family that's been in the beef business since 1896. Shortly after he arrived at CALS, the meat science and muscle biology faculty swept him up with their "contagious pursuit of knowledge and application," Kreul says. "The meat industry has been my passion ever since."

James Lochner BS'74 MS'76, Meat and Animal Science • In November 2009, Lochner was appointed chief operating officer of Tyson Foods—and by August 2010, the meat processing giant was posting record third-quarter earnings and sales. He and CEO Donnie Smith, who came into the top leadership positions at the same time, are widely credited in the industry as a winning team. Lochner began his corporate career with Oscar Mayer Foods in 1976, but he kept a foot in academia with an appointment to

the CALS faculty two years later. In 1983 he joined the meat processor IBP, Inc. and kept rising through the ranks after Tyson Foods acquired it in 2001, serving as senior group vice president of fresh meats and margin optimization prior to his latest appointment. As chief operating officer, he aims to increase efficiency in all aspects of operations, he says.

Kathleen Pearce BS'80 Meat and Animal Science • Shortly after graduating, Pearce and fellow CALS alum Christopher Kuehnle (BS'77, Agricultural Business Management) founded New Age Computer Systems, which patented an integrated program for computerizing meat processing plants. A few years later they launched The Meat Handler Company, which designs and creates meat software systems and provides turnkey systems with on-site installation and training. In 2003, Pearce "switched species," as she puts it, and became a registered nurse and nutritionist. Her hobbies include playing upright bass in a vintage cowboy band.

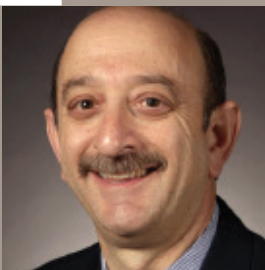
Terry Quam BS'78 Meat and Animal Science • Quam and his family own Marda Angus Farms, an operation that includes 125 registered Angus cows, 720 acres of crops, and a custom feeding program for 150 locally owned Jersey heifers. Quam has been an instructor in the CALS School for Beginning Dairy and Livestock Farmers; growing future farmers is something he takes seriously. "I'm a young pup in farming, and I'm 55 years old," Quam says. "If we don't encourage the next generation to come along, it's

12

Alumni who are making a difference in the meat industry



Terry Quam



Max Rothschild



Christopher Salm



Cindy Schweitzer



Fritz Usinger



Steven Van Lannen

not going to be a pretty sight for agriculture.” Quam heads the Lodi Agricultural Fair board and serves as Wisconsin’s representative with the National Cattle-men’s Beef Association.

Max Rothschild MS’75 Meat and Animal Science • Rothschild had a strong interest in genetics even as a child, but he didn’t become truly hooked until he worked with legendary UW professor A.B. “Chappie” Chapman. “My work at UW was pivotal to how I approach science and, to a great extent, life,” he says. Now a distinguished professor of agricultural and life sciences at Iowa State University, Rothschild directs the Center for Integrated Animal Genomics, where he is seeking to understand the genetic control of traits in dogs, sheep, shrimp and pigs. Considered a world leader in pig genetics, he serves as the USDA Pig Genome Coordinator.

Christopher Salm BS’76 Meat and Animal Science • If you’re a smoked sausage fan, you’ve probably eaten Salm Partners products without knowing it. The company, founded by CEO Salm and three brothers, produces hot dogs and sausages that are then sold by brand marketers and private label retailers. The company is an industry leader in devel-

oping and implementing new technology systems for processing those meats. Throughout a career that’s included Oscar Mayer, Johnsonville Sausage, and ConAgra, Salm’s focus has been on “finding and proving new technologies and processes to better feed the world,” he says. He chairs the advisory board to the meats group in the animal science department at CALS and is helping lead an industry-focused capital campaign to build a new meats lab on campus.

Cindy Schweitzer Ashton BS’78 Food Science • As director of research and technical information with the National Cattlemen’s Beef Association in Chicago, Schweitzer networked with researchers around the country to promote red meat based on their scientific findings. As manager of global nutrition at McDonald’s Corp., she contributed to improving the quality of McDonald’s nutritional information reporting around the world. Now, as technical director at Global Dairy Platform, her attention has switched from beef to dairy—a reasonable career move for someone who grew up on a dairy farm appreciating all aspects of the cow.

Frederick “Fritz” Usinger IV BS’80 Meat and Animal Science • It’s the Old World

recipes, it’s the 70-plus kinds of sausage, it’s the signature elves. Usinger’s Famous Sausage is a Milwaukee institution, founded in 1880 by the first Fred Usinger, a German immigrant who had \$400 on arrival. In 1988, at age 30, great grandson Frederick “Fritz” Usinger IV became the company’s president, taking over from his father, a member of the Wisconsin Meat Industry Hall of Fame. Innovations under Fritz’s leadership include introducing chicken link sausage and such zippy ingredients as tomato, mozzarella, cilantro and onion. Usinger’s also was the official supplier of frankfurters to the 2002 Winter Olympics in Salt Lake City.

Steven Van Lannen BS’91 Agricultural Journalism • As executive vice president of American Foods Group, Van Lannen works with his team to manage cattle procurement, food safety, human resources, worker safety and environmental compliance. American Foods helps put the “packer” in Green Bay—the company’s main plant there processes nearly 2,000 head of cattle each day and produces some four million pounds of ground beef each week. Van Lannen serves on the board of directors with the National Meat Association and the Wisconsin Beef Council.

About the Dozen

These 12 alumni represent the depth and breadth of CALS graduates’ accomplishments. Selections for the list are made by the Grow staff and are intended to reflect a sample of alumni stories. It is not a ranking or a comprehensive list. To read more about CALS alumni, go to www.cals.wisc.edu/alumni/

Next issue: Forestry

Know someone who should be in the Grow Dozen? Email us at grow@cals.wisc.edu

Catch up with ...

Sarah Mattison BS'05 Nutritional Sciences

IN THE BATTLE AGAINST EXCESS BODY FAT, Sarah Mattison poses a double threat. She and husband Ryan Berndt own Hybrid Fitness and Fit Fresh Cuisine, two businesses that work in tandem to help clients get in shape. Located under the same roof in Fitchburg, Wis., Hybrid and Fit Fresh combine a workout gym with a restaurant offering locally grown, nutritionally balanced food including counter service, delivery, and calorically controlled carry-out meal plans. A registered dietitian and a certified personal trainer, Mattison opened Hybrid/Fit Fresh in 2009 after a stint as a dietitian for UW athletic teams. A second restaurant, sans gym, opened earlier this year.

● **How did you arrive at your profession?**

I've always loved science, animals and the environment. I've also always been really active and enjoyed sports. When I entered UW, zoology seemed the obvious choice, and during that time I studied marine biology on a semester abroad in Australia. But after graduation I felt that marine biology was a better hobby than a career. During a lunch with my sister she casually said, "You've always loved cooking and food—why don't you go into nutrition?" After giving it some thought I realized she was right—I had always been experimenting with food, cooking and nutrition.

● **How did you hit upon the nexus of fitness and healthy food? Most businesses seem to do one or the other.**

An all-inclusive approach to health makes sense. My husband, Ryan, is a master-level personal trainer. Clients get expert advice from him on their exercise and learn cutting-edge techniques to improve their fitness. As a registered dietician, I provide reputable individualized nutrition information. The meal plan service takes it a step further by making healthy eating convenient. We're a one-stop shop for expert fitness and health enhancement. As entrepreneurs, we saw an opportunity to combine our skills to offer something unique.

● **What's the most rewarding thing about your work?**

Helping people make positive changes toward their health. It fuels me to work harder as more people I work with make changes and are so grateful for my help. I also value that I can be creative daily through exercise, cooking and motivational techniques.



● **What's your best advice for people who want to lead more healthful lives?**

Define what "healthy" is to you and create a plan to make changes weekly. Also, when it comes to weight loss there is a science to work with, so seek professional advice and help where necessary so your efforts pay off.

● **Does being an entrepreneur have its scary moments?**

Yes, but that fear becomes a fuel, a drive to work harder and smarter.



My Barn in Winter, a painting by Jack Dennis, is one of eight new works of rural art in Ag Hall.

VISIT Agricultural Hall to see the newest works from the **Wisconsin Regional Art Program**. It's the Year of the Arts on UW-Madison's campus, and CALS is helping mark the occasion by featuring eight new prints and paintings in the lobby of Ag Hall. The college began showcasing rural-themed artworks in its flagship building last year.

CHECK OUT the birth of the **Wisconsin Institutes of Discovery** during its grand opening Dec. 2-11. The week's events include tours of the extraordinary new facility, which will support innovative research projects in the biological sciences, as well as public programs to learn more about scientific research. Go to www.discovery.wisc.edu for more details.

HEAR expert opinions on the state of farming at the **Wisconsin Agricultural Economic Outlook Forum** on Jan. 19. Sponsored by CALS and UW-Extension, the fourth annual forum brings together some of the nation's top economists and commodity specialists to analyze the dynamics affecting the state's agricultural industries and share their views on the future direction of the farm sector.

EXPLORE cool science at UW-Madison's weekly **Wednesday Nite @ the Lab** series. The free, on-campus lectures showcase the latest discoveries from UW researchers, spanning topics from astrology to zoology. Can't make it to campus? No problem—the series is shown live on the web. Check out www.uw.alumni.com/wednitelab/ for more information.

JOIN CALS alumni in the Kohl Center Nicholas Suite on March 5 for the **Badger men's hockey match** against Colorado College. Sponsored by the Wisconsin Agricultural and Life Sciences Alumni Association (WALSAA), the event includes food and a silent auction. Visit www.walsaa.org for more details.

LIKE us on **Facebook**. CALS recently launched a page on the social networking site to give students, faculty and alumni a place to connect and exchange ideas. Join the community by visiting the page and sharing it with others.



For links to more information, go to www.cals.wisc.edu/grow/

CREEPY CRAWLERS

Nothing perks up a classroom like the presence of a Madagascar hissing cockroach.

Just ask Erinn Powell, who has introduced dozens of them to squealing schoolchildren as an Insect Ambassador. The CALS entomology program sends undergrads and graduate students on show-and-tell missions to area schools, clubs and organizations to teach audiences about where insects live, how they survive and the positive things they do for our environment.

The encounters are transformational, says Powell—especially when it comes to scary-looking creatures like the cockroaches. “I love the moment when at first a child is stiffly holding the cockroach with her eyes closed,” she says, “and then suddenly she loosens up and smiles when she realizes that its exoskeleton is really very smooth and interesting to look at. Her friends gather around and they take turns petting the cockroach.”



Other favorites include Goliath and Hercules beetles, walking sticks, butterflies and hornworms. All insects are reared in the lab, ensuring cleanliness, and none can sting, bite or transmit disease. Private gifts help the Ambassadors maintain the insects and pay for supplies.

A bright blue hornworm brings delight (and a little fright) to audiences of the Insect Ambassadors.

The UW Foundation maintains more than 6,000 gift funds that provide critical resources for the educational activities of the college. To help support the Charles F. and Patricia R. Koval Insect Ambassadors Program, visit: <http://www.supportuw.org/giving?seq=2410>

Five things everyone should know about . . .

Urban Chickens

By Ron Kean



1 | Chickens are definitely going mainstream. Whether it's due to the interest in locally produced foods or simply a desire for a natural hobby, a growing number of urban and suburban residents are raising chickens. It's now legal to keep chickens as pets (under certain conditions) in many cities, including Madison, Chicago, New York, Seattle and St. Louis, and several others are considering allowing the practice. There's no good data on how many people are taking up backyard chicken farming, but Backyard Poultry, a magazine published in Wisconsin, sells about 95,000 copies each issue.

2 | Buy the bird, get the eggs for free. Madison's backyard chicken networking group, Mad City Chickens, champions the hen as a "pet with benefits." Not only do they come in many shapes, sizes and colors, but they provide eggs, consume kitchen waste and produce fertilizer for gardens. They're also relatively inexpensive and can live comfortably in urban-sized yards. On top of that, they're just interesting—chickens have social behaviors that make them fascinating companions for children and adults alike. With some handling and treats, they can become very tame around people.

3 | And we're talking about a lot of eggs. It takes a hen about 24 to 26 hours to make one egg. A hen bred for commercial production can

lay about 300 eggs per year in her prime. Breeds that have been selected for other traits, such as color or pattern, will generally lay fewer, as will older hens. But a good estimate for a backyard coop with four hens is about 70 to 80 dozen eggs each year—likely plenty for a family, and the neighbors, too.

4 | No boys allowed. Most cities permit residents to keep only hens, fearing that roosters' crowing will create disturbance for those living nearby. And that's probably a good idea. Some people don't realize that roosters don't crow only at sunrise—they crow often throughout the day, which can put a strain on neighborly relations. And unless you're looking to hatch eggs, roosters aren't needed for egg production, anyway.

5 | And no hormones, either. A common misconception is that poultry producers use hormones to boost egg production in their hens. Not only is hormone use illegal in the United States, it's unnecessary. Those phenomenal production levels are the result of years of careful genetic selection, nutritionally balanced rations and good flock management.

Ron Kean is the extension poultry specialist for CALS and UW-Extension. In addition to teaching courses on the biology and management of poultry for the Department of Animal Science and leading workshops for professionals and hobbyists around the state, he is a regular columnist for Backyard Poultry magazine, where he answers questions about everything from predator prevention to proper care of chick feet.

Take the Final Exam!

Fill out your answers online. Ace our quiz and we'll enter you in a drawing for a gift box of Babcock Hall cheese. Go to www.cals.wisc.edu/grow/ for more details.

Entomology

1. Why has dengue fever become a serious public health threat in recent years?

- a. The environmental movement to use less powerful pesticides has allowed the mosquito population to grow
- b. Increased insecticide resistance of mosquitoes
- c. Genetic mutation of the dengue fever virus
- d. Weather warming patterns have extended the mosquito breeding season
- e. All of the above

Dairy Science

2. Which breed of dairy cattle is known for high concentrations of fat and protein in milk and, therefore, good cheesemaking properties?

- a. Ayrshire
- b. Jersey
- c. Holstein
- d. Guernsey

Community Sociology

3. The average resident of rural Wisconsin is 41.7 years, which is ____ than the average resident of urban counties and ____ than the average resident of farm-dependent counties.

- a. younger, younger
- b. younger, older
- c. older, younger
- d. older, older

Nutritional Sciences

4. A staple food of traditional hunting and gathering cultures in Wisconsin was:

- a. barley
- b. millet
- c. wild rye
- d. wild rice

Horticulture

5. Which cucurbita species make the best pumpkin pie?

- a. Cucurbita moschata
- b. Cucurbita mixta
- c. Cucurbita pepo
- d. Cucurbita maxima

LAST ISSUE: Answers were 1: A, B and D, 2: A, 3: C, 4: A, 5: A or C. Congratulations to Tricia Brein of Shevlin, Minn., who was randomly selected from the nine people who aced our Final Exam. She wins a gift certificate to Babcock Hall.

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HAIR APPARENT

The surface of a mustard plant leaf looks like an alien landscape when seen with the aid of an electron microscope. The hair-like structures, known as trichomes, give leaves their fuzzy texture. For more cool science, visit us online at www.cals.wisc.edu/grow/.

