SPRING 2026

grow

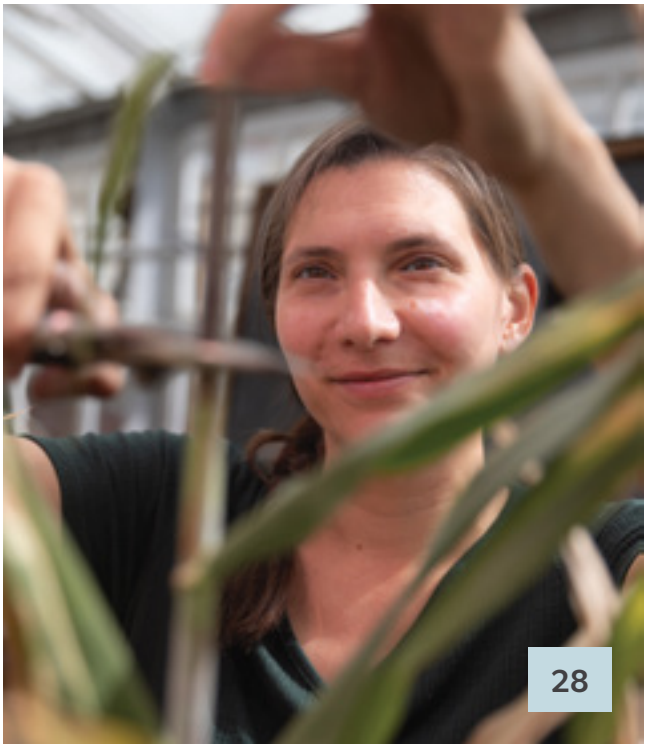
College of Agricultural & Life Sciences
University of Wisconsin–Madison

High-Tech Eyes on Wisconsin Skies

UW's statewide network of weather stations ensures farmers aren't left twisting in the wind.

PAGE 20

A frame filled with honeycomb is removed from a beehive and displayed during Introduction to Honey Bee Medicine, a continuing education course that was taught by Department of Entomology scientist Hannah Gaines Day at UW's Charmany Instructional Facility in Madison, Wis., in August 2025. The course was offered in collaboration with the UW School of Veterinary Medicine, the Wisconsin Honey Producers Association, and the Wisconsin Department of Agriculture, Trade and Consumer Protection. In February 2026, Gaines Day also taught a three-day beekeeping class as part of the UW Farm and Industry Short Course (FISC). The FISC class will be offered again next year. Learn more at **fisc.cals.wisc.edu**. Photo by KEEGAN GERING



Wisconsin's Magazine for the Agricultural and Life Sciences

grow

VOLUME 19, ISSUE 2 | SPRING 2026

FEATURES

DEPARTMENTS

ON THE COVER Wisconet instrumentation engineer Mikaela Martiros bolts a temperature and humidity sensor onto a new weather station near Plymouth, Wis. Read more about UW's statewide weather station network on page 20.

Photo by MICHAEL P. KING

From top: Photo by TAYLOR WOLFRAM, photo by CHELSEA MAMOTT, photo courtesy of BEN JOHNSON

DEAN GLENDA GILLASPY

CALS as a Pipeline to Health Care Careers

Photo by MICHAEL P. KING

Not long ago, I had a meaningful conversation with a friend of CALS, **Susan Crane**. Susan and her husband, **Bob Crane**, raised their children on a Wisconsin dairy farm. Their three sons and two daughters — who are all CALS grads — continue to farm in our state. In addition to her agriculture career, Susan worked as a registered nurse in her rural community, and she also funds a CALS scholarship in memory of her father, **Norbert Kielpinski** FISC'34. Traditionally, the scholarship has been limited to dairy science majors from rural Wisconsin, the original idea being that support for students in production agriculture would be the best way to help enrich rural communities with talent.

Recently, though, after considering further the full scope of how CALS prepares students to contribute to society — including rural communities — Susan had a change of heart about that scholarship. She spoke to me passionately about wanting to support any CALS students who might return to their rural hometowns for a wide variety of jobs in desperate need of skilled, educated workers. So, she opened the scholarship to a greater range of majors.

Here's why I'm sharing this anecdote. At CALS, it's true that we are synonymous with dairy and crops, with fields and fertilizer. We also have a strong reputation for preparing students to do excellent work in agriculture — and in the sciences that make farming more efficient, productive, and sustainable. We are more than fine with this. These activities represent our roots. They're our mission, and they always will be. But other parts of what we do — and the societal contributions that stem from them — are not always readily associated with CALS.

Consider the "life sciences" part of our name. At CALS, we are world leaders (and have been for a long time) in basic research in bacteriology, microbiology, biochemistry, and genetics and genomics — work that has bearing on plants, animals, *and* humans. Those fields cut across most of our academic areas of focus, our 15 departments, 26 majors, and 47 graduate programs that explore biological, environmental, and social sciences.

Exposure to these broad areas preps our students for a wide variety of careers and post-graduate opportunities. One example is health care. Human health may not be top of mind when CALS is mentioned, but our college is a major pipeline to health fields. CALS students who major in many of the fields mentioned earlier, as well as global health, biology, and others, gain a solid health sciences foundation before moving on.

Based on recent data, nearly 20% of our graduates go into health care or public health fields. The top 10 job titles for our grads include medical assistant, clinical lab scientist, clinical research coordinator, and genetic counseling assistant. For those who continue their education, among the top 10 fields of study are nutrition, medicine, public health, dentistry, nursing, genetics, and physician assistant. And what do our rural communities need? More doctors, more nurses, more skilled professionals working on the front lines of human health.

So, it seems "health care" should be just as synonymous with CALS as "cows" or "corn." And we are more than fine with that too.

In this issue, you'll get a close look at some of the exceptional training and experiences our health care-bound students receive. "A Purpose-Driven Path" (p. 8) recounts the personal journey of one undergrad — from eager first-year student to genetics researcher and nursing assistant — who now has her sights set on a career in medicine and health policy. And, in "Wayfinders in the Health Care World" (p. 9), you'll learn how CALS students are helping Madison area residents navigate a complex medical system.

We expect great things from these students in the future, and you get to read about them here first.

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Illustration by JORDYN VOWELS

The Land of Milk *and* Honey

By EMILY SYDOW BSx'28

In a state known for dairy, honey is not the first agricultural product to come to mind. But there's more honey in the Badger State than one might expect, and there's more to learn about this sweet substance than many people realize. Here's a jarful of interesting, helpful, and perhaps unfamiliar honey facts.

1 Wisconsin is one of the nation's top honey-producing states. Typically a first-15 finisher in terms of yield (and as high as 8th in some previous years), Wisconsin came in at 11th in 2024, with an average of 44 pounds of honey per colony. The state's total production in 2024 was 2.51 million pounds, valued at $8.85 million.

2 **Honey production has a long, storied history in Wisconsin.** The state's early Indigenous peoples used the crush and strain method of honey extraction. It's the oldest-known method, and it's still used commonly today. However, this labor-intensive process results in the destruction of honeycomb and places greater stress on bee colonies. Other, less invasive methods came later. Some of these methods were developed and shared through organizations such as the Wisconsin Beekeepers Association (now the Wisconsin Honey Producers Association, or WHPA), which can trace its origins as far back as 1864. The WHPA connects honey producers, and it advocates for the industry. In 1965, the association established the Wisconsin Honey Queen Program, a first-of-its-kind promotion and education program that led to the development of the American Honey Queen Program. With such a strong backing for honey businesses, the industry has thrived for many decades. At the 2025 Wisconsin State Fair, the WHPA celebrated 75 years as a vendor, making it the oldest of the fair's featured Wisconsin commodities.

+ GET THE HONEY BUZZ

Find out more about Wisconsin's honey industry at **wihoney.org**, or find locally produced honey at **honey.com/honey-locator**.

3 **Honey is just flower nectar transformed by bees.** Honeybees visit 50–100 flowers during each flight to gather nectar from flowers and trees. Nectar then travels to their "honey stomachs," which contain enzymes that help break down complex sugars into easily digestible simple sugars. Back at the hive, worker bees deposit the digested nectar into the honeycomb's hexagonal cells. The constant fanning of 60,000–80,000 bees' wings draws moisture from the nectar, transforming it into the sugary, sticky substance that Americans, on average, consume two pounds of each year. Different nectar sources create distinct honey varietals with unique flavor profiles. Wisconsin has more than 30 varietals, including the rare cranberry honey, harvested from the blossoms of a native Wisconsin fruit crop.

4 **Eating honey is associated with many health benefits.** The varietals with the most medicinal properties — buckwheat and star thistle — are used to soothe sore throats and minor burns and wounds. Seasonal allergy sufferers can often alleviate symptoms by eating local honey — it's filled with regional pollen, so it can help build tolerance to area allergens and strengthen immune systems. Daily consumption of honey can improve health by lowering blood pressure, promoting the growth of good gut bacteria, and providing antioxidants that counter the effects of free radicals.

5 **When it comes to cooking, honey has its own rules.** If using honey as a substitute for sugar, it's important to replace 1 cup of sugar with only three-fourths cup of honey. And, when baking with honey, some other adjustments include reducing the recipe's liquid measurements by one-fourth cup and turning the oven down by 25 F. Lighter-colored honeys such as wildflower and clover make great salad dressings and are the most versatile, while darker honeys such as buckwheat are best for marinating meats and producing a stronger taste profile.

Emily Sydow is a sophomore majoring in agricultural and applied economics with a certificate in public policy. She was crowned Wisconsin Honey Queen in January 2025, completed her term in November, and represented Wisconsin at the American Beekeeping Federation Convention in Mobile, Alabama, in January 2026.

A Purpose-Driven Path

Personal experience and a CALS pre-college program guide Naureen Kamal to her own unique mission.

By ELLA GILHOOLY BSx'26

In the aftermath of her grandmother's diagnosis with dementia due to Alzheimer's disease, **Naureen Kamal** BSx'26 developed a keen interest in the life sciences. She perceived these disciplines to be the key to understanding — and perhaps ending — such a devastating condition.

But, as she approached her first semester at UW, she was anxious to get on campus and find her place in a sea of scientific fields. Her decision to join a CALS pre-college program influenced her whole college experience, and it helped her find a life sciences niche where she could contribute to a greater understanding of Alzheimer's.

Kamal stepped onto campus in June 2023 to begin her time with QuickStart, an "early start" program for incoming first-year students at CALS. As she connected with her peers, as well as faculty and staff, she quickly felt her pre-college nerves ease. Not only did Kamal gain early exposure to academic life at UW, she also made close friendships within the CALS community. And she found direction.

"I didn't know what specifically I wanted to study when I started college," Kamal recalls. "QuickStart helped me discover the genetics and genomics major, which aligned well with my interests. The program also allowed me to see that it was feasible to be involved with my passion for studying Alzheimer's disease."

While Kamal's personal connection to Alzheimer's sparked her desire to discover more about the science behind the disease, QuickStart showed her actionable ways to get involved. The program exposed her to the research landscape at UW and helped her identify labs that would be a good fit.

Kamal now conducts research in the lab of **Barbara Bendlin**, a professor of medicine at the UW School of Medicine and Public Health. Bendlin's lab is part of the Wisconsin Alzheimer's Disease Research Center. There, Kamal works on an independent project exploring the effects of appendectomies on individuals at high risk for Alzheimer's disease.

"Genetics plays a big role in Alzheimer's research, but environmental factors can also determine many key components of the disease," says Kamal, who is also pursuing certificates in global health and health policy. "Understanding the pathology of this complex disease is challenging, so I am grateful to work in a positive environment with a collaborative team."

After benefitting so much from QuickStart during her transition to college, Kamal returned to the program as an undergraduate fellow in her sophomore and junior years to serve as a guide for others. She also signed on as a fellow for the Wisconsin Rural Scholars Program (see "A College Try at CALS," *Grow*, fall 2025). She worked with program director **Tanya Cutsforth** BS'08, MS'10 to show students and teachers from all over the state what CALS (and college) is all about.

"Naureen is a true rockstar," Cutsforth says. "A stellar student, engaged in her community, and doing really important work in healthcare to prepare her for the future."

Now a pre-med student with two years of experience as a certified nursing assistant in the UW Health ICU, Kamal is interested in exploring the intersection of public health and policy. She hopes to continue working with complex diseases like Alzheimer's through patient care and research, but also by addressing the broader systems that influence access to treatment and preventative care.

"My grandmother's diagnosis is always in the back of my mind," Kamal says. "Everything I'm working toward goes back to wanting to make a difference for families like mine. I am grateful QuickStart gave me the direction to begin building a career around that mission."

Naureen Kamal, along with other alums of the CALS QuickStart program, speaks during a panel for new program participants in August 2024. Photo by MICHAEL P. KING

Wayfinders in the Health Care World

Undergraduate Amal Vellani stands inside the Center for Patient Partnerships office in Agricultural Hall where she works with the Community Resource Navigator Program.

Through an advocacy program at the Center for Patient Partnerships, students help Madison-area residents traverse a complicated medical system.

Story by CAROLINE SCHNEIDER MS'11 | Photos by KEEGAN GERING

Last fall, **Amal Vellani** BSx'26 found herself serving as a private detective of sorts. As part of the Community Resource Navigator Program (CRNP), Vellani was helping an older woman named "Betty" find her way back to the doctor who had treated her blood clot. Betty and her husband, who both speak little English, had tried without luck to track down the provider. So Vellani started sleuthing. Working through a translator, she and the couple called multiple clinics and kept tabs on responses. After a month of diligence, Vellani was able to find the urgent care clinic Betty had visited and ensure a follow-up appointment with the same doctor.

Vellani's investigation for Betty is just one of many that CRNP undergraduates, called "navigators," have led to help Wisconsin residents negotiate the many facets of health care, from visiting a doctor or finding healthy food to negotiating a stressful financial situation. Launched in 2016, CRNP aims to help residents access a variety of health and community resources. The program also helps undergraduates who are interested in health-related professions learn about the health care system through hands-on work with community members. CRNP is part of the Center for Patient Partnerships (CPP), which moved from another part of campus to CALS and Agricultural Hall last year.

"I came in thinking I was going to be helping clients with very specific resources like medical appointments or food, things like that," says Vellani, a senior majoring in global health and in health promotion and health equity, who is continuing as a navigator this spring. "But it's truly anything from legal information to transportation help or rent assistance. We're trying to make life easier for community members in the Madison area."

Each semester, around 20–25 new navigators take part in a service-learning course with two components: a weekly class and 50 hours of service.

> “We hear from a lot of navigators that it’s not only a great learning environment but also a way to form friendships with people who share their interests and passions.”
>
> – Ashleigh Ross, CRNP instructor

During the class, students meet with instructors **Ashleigh Ross** and **Samantha Russo** and learn how to support patients through phone calls. Ross, the community resource program coordinator, develops the curriculum, while Russo, the bilingual community resource educator, manages interactions between the navigators and their clients. The undergrads also hear from guest speakers, who provide information about resources that are available to patients in the Madison area.

For the service component of the course, students work “call shifts” for four hours each week, where they connect with clients by phone, drawing from a database of around 375 active cases. Students make calls from Agricultural Hall or from the UW South Madison Partnership building on the city’s south side, often working with translators to better communicate with the predominantly Spanish-speaking clientele. Some shifts may be spent leaving voicemails or sending emails to multiple patients. Sometimes a caller may speak to a single client for the entire shift, lending a sympathetic ear to someone who may have few other outlets. CRNP has served more than 700 clients since its launch.

“On the calls, we figure out what we can offer the clients, and then we create resource documents for them,” explains Vellani, who is also pursuing certificates in athletic healthcare and health policy. “We share that document with them, and then we follow up each week or every two weeks. We’re able to really build relationships with clients over time.”

Navigators also connect new patients with the program. Each Saturday, CRNP partners with the UW–Madison School of Medicine and Public Health during a free clinic, called MEDiC, for underinsured and uninsured patients. As the patients wait for their medical appointments to begin, staff and students from CRNP tell them about the program’s services and, if they’re interested, help them fill out an intake form to identify their needs and priorities. Navigators follow up with those clients at a later date.

Student navigators come from many majors. Like Vellani, some are interested in global health, a CALS-based major, while others are pre-med or pre-law or interested in criminal justice or social work. Though their interests vary, Ross says they value exploring the many aspects of wellness, and they appreciate finding common ground with other students.

“A really nice component of the program that’s more informal is the community that’s built among the navigators,” Ross says. “We hear from a lot of navigators that it’s not only a great learning environment but also a way to form friendships with people who share their interests and passions.”

With a sense of purpose and desire to help others, many CRNP undergraduates (usually around 15 per year) choose to continue with the program for more than one semester. Some returning navigators also take on training roles.

“I have realized I really like working in the back end of health care on logistical aspects and connecting with people,” says Vellani, who plans to pursue a master’s in public health after graduation. “I think more than half of our class came back this spring, which really speaks to what a great program it is.”

Returning navigators also conduct research projects that strengthen partnerships throughout the city. This includes work with Covering Wisconsin, an organization that provides insurance navigation, and the Neighborhood House Community Center, where a continuing navigator aims to provide more consistent service this spring. By collecting data and conducting evaluations through these projects, navigators also find ways to improve CRNP.

“What’s really exciting about having the returning navigators is that they’ve spent so much time in the first semester learning about the program and challenges people are facing that they’re able to see the gaps in the resources available and the gaps in the program,” Ross says. “They’re able to provide a lot of feedback and recommendations, and they’re helping to build the internal structure of the program as well as the wealth of knowledge.”

For members of the community, more resources

and knowledge lead to better aid. While navigators sometimes face hang-ups or complaints of wasted time on their calls, the successes shine through, such as Vellani's work to find Betty's doctor. Beyond having access to new resources, patients also report appreciating the navigators' efforts to listen and understand.

As one patient states, "It makes me feel like someone cares, that I have support. It helps me and motivates me to thrive and do better for me and my daughter with the help that I'm provided."

"In general, the feedback is very positive," Russo says. "A lot of our patients are trying to navigate systems that weren't designed for them. There can be a lot of social isolation, and sometimes the navigators are the only people our clients talk to. They tell us they can feel we care and that, in the world today, that's a rare thing."

CPP was founded in 2000 by UW alum and professor emerit of law **Meg Gaines** and her colleagues after she experienced firsthand the struggles of navigating the health care system during her battle with ovarian cancer. The center's focus on partnerships between patients and medical and legal professionals has since become a model for patient advocacy, education, and health justice. CPP is celebrating its 25th anniversary this spring.

"Students learn and serve by providing advocacy and navigation to Wisconsinites, which helps patients access care and community services that support whole health," says CPP director **Sarah Davis**. "The high-impact learning for undergraduate and graduate students in our programs truly embodies the Wisconsin idea."

Opposite page: A student with the Community Resource Navigator Program (CRNP) gathers information for one of the program's clients.

Below: Clockwise from bottom left, undergraduates Hannah Davidson, Michael Howe, and Lahyla Albrecht confer during a call shift with CRNP clients at the Center for Patient Partnerships in Agricultural Hall.

When Entrepreneurial Opportunity Knocks

The unexpected loss of childcare during the COVID-19 pandemic disrupted life at home, which may have prompted working mothers to start their own businesses.

By SILKE SCHMIDT

The COVID-19 pandemic had a silver lining for some: The sudden interruption of daily routines was an opportunity to reconsider life choices. This was perhaps especially true for working mothers who lost their childcare providers, which may have increased the value of work flexibility. For women who had already been pondering self-employment, the pandemic may have been a powerful nudge to join the ranks of entrepreneurs.

Indeed, according to an AARP survey, two-thirds of American women age 40 and older who started a small business between January 2020 and June 2022 named the pandemic as a motivating factor — and 98% considered their business launch the right choice up to two years later.

Such data prompted **Tessa Conroy** to ask a natural follow-up question: Did more women start businesses in counties with mandatory childcare closure policies than those without them? The answer was a clear "yes."

"Our study showed that the number of new women-owned businesses in 2021 was 28% higher in counties with mandatory closures," says Conroy, an associate professor and extension specialist in the Department of Agricultural and Applied Economics. "Although we were unable to identify specific reasons, these closures were likely perceived as an acute life change at home that also caused changes in work preferences."

For Conroy and coauthor **Anil Rupasingha**, a senior research economist with the U.S. Department of Agriculture, the pandemic created a so-called natural experiment, with some areas closing childcare facilities in March and April 2020 and others remaining open. The researchers compared counties in 30 states with closures to "control" counties in 20 states without them, assuming that all 3,108 analyzed counties followed their state's policy.

Most closure durations ranged from 30 to 40 days, with extreme values of eight for Alabama and 98 for New York. Closure details, such as exceptions for essential workers, and limitation details, such as maximum group sizes of supervised children, varied greatly. The duration of limitations exceeded more than six months in 15 states.

Before the pandemic, a typical county saw 20 to 30 new female-owned businesses per year, according to a comprehensive dataset called the National Establishment Time Series. That number range was substantially higher in the approximately 1,100 urban counties (50–90) than it was in the roughly 2,000 rural counties (3–5). Business growth declined rapidly in 2020 followed by a rebound in 2021. The greater increase of new women-owned businesses in counties with mandatory childcare closures was more pronounced in urban (36%) than rural counties (25%).

"This difference makes sense since the margin of adjustment was smaller in rural counties, where women were already used to the scarcity of childcare before the pandemic," Conroy says. "Rural areas also offer fewer market opportunities, an important factor in the decision-making process of potential entrepreneurs."

The greater business growth in counties with closures mostly occurred in the service industry, not in the production or trade sectors. This was evidence against the common belief that women gravitate toward the online retail space for handmade goods; instead, Conroy notes, post-pandemic women-owned businesses appeared to be multifaceted.

In the absence of survey data, the researchers could not distinguish between *opportunity entrepreneurship* and *necessity entrepreneurship*. Opportunity

Illustration by ELENA DELZER

entrepreneurship is driven by innovation or a lucrative market opening; necessity entrepreneurship stems from losing a job or working spouse, difficulty finding a salaried job, or underemployment.

Most entrepreneurial success metrics focus on business survival and economic productivity, such as growth in the founder's income and number of employees. However, a profit-maximizing path may not be a priority for all founders, and researchers have documented a distribution of success for both types of entrepreneurs.

"We don't know a founder's trajectory at the onset, and starting from necessity doesn't mean a business is doomed to fail," Conroy says. "I think success metrics should include the household-level impact of strategies to manage multiple demands and the benefits of flexible work schedules for parents of young children."

The results have a clear policy implication: Offering childcare or flexible work schedules and locations is critical for retaining employees when employers experience labor shortages. Childcare options can also support entrepreneurship — especially when female founders wish to grow their business.

A less obvious but equally important take-home message is this: The reasons for performance differences between male and female founders are complex. Previously reported reasons include men being more likely to start businesses in capital-intensive sectors, such as manufacturing, which often require more employees and produce higher revenue than those in women-dominated service sectors. Differences in risk preferences and educational background, such as differing fields of study, have also been noted.

The new study adds to the evidence for gender differences in founders' intrinsic motivation for launching a business. Yet, regardless of its inspiration, entrepreneurship often produces positive outcomes by multiple metrics, Conroy says.

Last but not least, the study confirms the vital role of childcare for the female labor market and society at large. It supports early childhood development and the ability of parents to provide for their families, in addition to helping employers find the workers they need.

"High-quality childcare is an investment in improved outcomes later in life, such as higher test scores and graduation rates and a lower propensity for crime," Conroy says. "For economists, these 'positive externalities' are a fundamental argument for government support of a public good — in this case, making high-quality childcare both available and affordable."

+ FEDERALLY FUNDED RESEARCH

This study, published in June 2025 in *The Annals of Regional Science*, was supported by USDA-ERS Cooperative Agreement 58-6000-2-0068.

Antibiotics Turned Anti-Amphibian

Pollution from powerful, infection-fighting medications could accelerate amphibian decline by turning a potential solution into a threat.

By CHRIS BARNCARD

Frogs, toads, salamanders, and other amphibians are disappearing as fast as — or faster than — any other class of animals around the world as they succumb to emerging infectious diseases and other threats. Now there's an ironic twist in this tale of survival. A recent CALS study shows that one promising way to protect frogs from a particularly deadly fungal disease may be less useful than previously thought because many waterways are polluted by a common treatment for infections: antibiotic drugs.

The fungus, known as Bd, or *Batrachochytrium dendrobatidis*, is responsible for a skin disease that has contributed to declines in amphibian diversity in many parts of the world. But Bd doesn't have free rein, even in ponds where it causes many infections. The fungus has microscopic enemies — microbes competing hard in their own ecological niches. Scientists have hypothesized that chemical mixtures produced by those microbes could act like a vaccine against Bd.

"In your own microbiota — in your gut, on your skin — you have different species of bacteria living in a particular area," says **Jessica Hua**, a professor of forest and wildlife ecology who studies how ecosystem disturbances such as pollution affect ecology and evolution. "When there's high competition, particular microbial species like these generate compounds that inhibit other bacteria and microorganisms from succeeding."

Those chemical defenses are a reaction to the bacteria's environment. But competition with fungi like Bd is just one aspect of the environment to which microbes need to adapt. Increasingly, bacteria must contend with water contaminated by antibiotic drugs — a pollutant growing more common in waterways affected by runoff from farms, zoos, and wastewater treatment plants.

Hua and her colleagues wanted to find out whether a common bacterium, *Pseudomonas aeruginosa*, retains its Bd-fighting abilities while also fending off assaults from antibiotic pollution.

"Depending on the environment they live in, those bacteria may react by changing that anti-pathogenic cocktail of compounds they produce," Hua says. "If they're really comfortable and stress-free, they might put their resources into growth or some other need. If they have to adapt to a new or unusual problem, like pollutants, that can come at a cost that shifts the cell physiology of the microorganism."

Hua's lab, with collaborators at Binghamton University and New Mexico State University, exposed Bd to two different

+ FEDERALLY FUNDED RESEARCH

This research, published in July 2025 in *Scientific Reports*, was supported in part by grants from the National Science Foundation (2137424 and 2314625).

chemical cocktails: the mix produced by strains of *Pseudomonas* that had adapted to water contaminated by antibiotic drugs and the chemicals made by *Pseudomonas* that hadn't had to figure out how to survive alongside antibiotics. They also raised tadpoles in water with Bd and the chemical cocktail from bacteria that had not been forced to adapt to antibiotics.

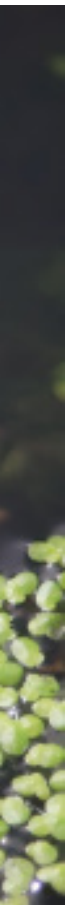
The chemical mix from *Pseudomonas* that hadn't been exposed to antibiotics was indeed bad news for Bd. It reduced the fungi's growth rate significantly in lower concentrations and entirely in large doses. Tadpoles benefited too. They were less likely to be infected with Bd while living in water with the bacteria that hadn't developed tolerance to antibiotics.

However, chemicals from *Pseudomonas* that had adapted to antibiotic pollution actually helped Bd. The troublesome fungi grew faster in water with the products of antibiotic-tolerant *Pseudomonas*; tadpoles in that mix were six times more likely to be infected with Bd than those paired with chemicals from bacteria unbothered by antibiotics.

"This shows us that if we're going to develop some sort of treatment for an emerging disease this way, we have to consider the history of the microbes we're looking at," Hua says. "The traits, the effect on amphibians you're looking for could very easily change — and here we've seen them change from help to harm — especially in light of increasing pollution."

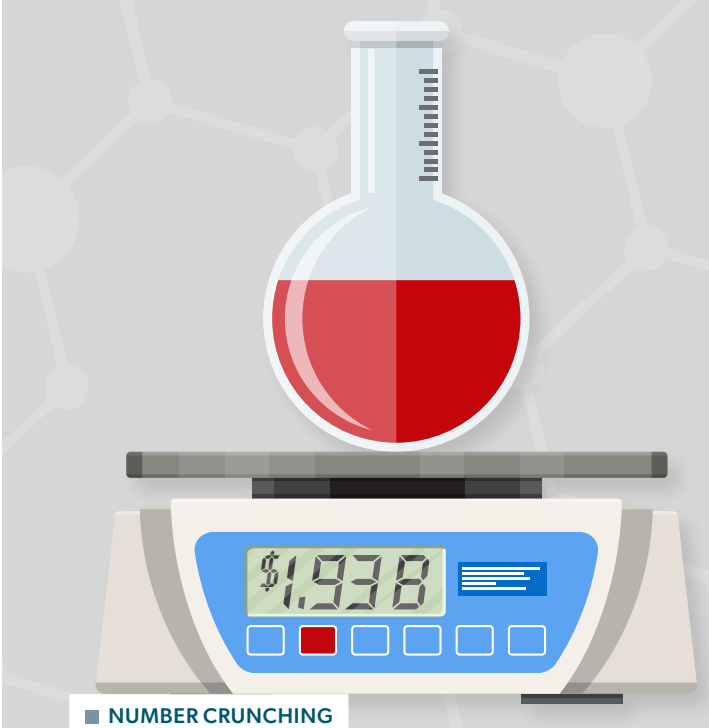
To further complicate matters, the scientists repeated their experiments with strains of *Pseudomonas* that clump together in colonies called biofilms instead of strains that float free in water. The results flipped. The chemical cocktail from biofilm-forming *Pseudomonas* that had not encountered antibiotics was worse for the tadpoles and better for Bd; the antibiotic-tolerant biofilm-forming bacteria inhibited Bd growth and kept tadpoles healthier longer.

"It was surprising to see just how opposite it was with just this change in *Pseudomonas* behavior," Hua says. "There are so many considerations. Ignoring them, we might actually do more harm than good."



Far left: Jessica Hua, a professor of forest and wildlife ecology, studies how ecosystem disturbances such as pollution affect ecology and evolution.
Photo by HILARY DUGAN

Left: Populations of amphibians like this frog are declining around the globe, due in part to a fungus known as Bd. Researchers have found that antibiotic pollution could increase the threat of Bd because it interferes with microbes that could otherwise help the frogs fight off infection.
Photo by iSTOCK.COM/NONO57



■ NUMBER CRUNCHING

RESEARCH HEAVYWEIGHT

UW–Madison now ranks fifth in the U.S. for its investment in research, according to the Higher Education Research and Development Survey, an annual census conducted by the National Science Foundation (NSF).

During fiscal year 2024, UW directed a record-high **$1.93 billion** toward research. Extramural grants secured by CALS scientists are a major part of this figure, which increased by 11.6% over the previous year. The fifth-place ranking (out of 925 institutions) is the university's highest since 2014.

UW receives critical research funding from state and local government, industry, non-profits, foundations, and private philanthropy. But nearly half of UW's total research expenditures come from U.S. federal agencies, such as NSF, the Department of Agriculture, the National Institutes of Health, and the Department of Energy. Recent policy shifts have led to declines in this major source of support, which has caused significant disruptions for research projects and related student jobs.

The rankings highlight the crucial role of the decades-long partnership between universities and the federal government in efforts to tackle society's greatest challenges, to generate discoveries that benefit the state and nation, to fuel the economy, and to prepare students for the workforce.

Illustration by iSTOCK.COM/ABSCENT84, modified by JANELLE JORDAN NAAB

Viral Benefits

In carbon-storing wetlands, viruses help shape (and could be a litmus test for) ecosystem health.

By ELISE MAHON

Some of the peatlands sampled in this study are in Scotland's Flow Country, which is also a UNESCO World Heritage Site. Photo by KARTHIK ANANTHARAMAN

It's well-known among scientists that viruses can alter the makeup and function of ecosystems. For example, they promote microbial diversity by infecting and killing select bacteria, and their impact on microbial communities can influence the global carbon cycle.

But viruses in wetland soil play a more important role than previously understood, and they could even be indicators of ecosystem health, according to a new study by researchers from the Department of Bacteriology. Published in *Nature Microbiology* in December 2025, the study examines viruses in peatlands, which are wetlands that act as vital carbon sinks around the globe.

"We know bacterial processes produce carbon dioxide and methane from this carbon-heavy, peatland soil. But the question is, how do they actually do it, and are there any other components that we have missed out on?" says professor of bacteriology **Karthik Anantharaman**. "That's where viruses come in."

Peatlands, like other kinds of wetlands, are important land types for storing carbon that would otherwise remain in the atmosphere and contribute to global warming. By some estimates, peatlands contain up to one-third of global soil carbon despite covering just 3% of the Earth's surface. However, in a warming world, wetlands are being damaged increasingly, and some are even in danger of contributing carbon to the atmosphere.

With their coauthors from University of Aberdeen and University of Edinburgh, the team analyzed samples taken from seven peatlands across the U.K. The peatlands were categorized as either natural, damaged, or restored. Analysis found that the viral community of each peatland category is made up of different kinds of viruses, revealing patterns between the health of a peatland and which viruses are present.

"Viruses are like a keystone predator in the microbial world," says lead author **James Kosmopoulos**, a Ph.D. student in microbiology who works in

Anantharaman's lab. "Without them, everything in an ecosystem would be out of whack."

In a natural, pristine peatland, viruses are able to infect microbial cells, replicate, and then kill the cells before leaving to infect others. That keeps microbe populations in check and the ecosystem relatively stable. This paper shows that viruses can shift their behavior based on the stability of their ecosystem.

In damaged peatlands, they found that viruses opt to hunker down in infected cells after replicating rather than immediately killing them. The change in viral behavior shifts the dynamics of the soil's microbiome, influencing which bacteria are present and how efficiently bacteria can process and store carbon.

Having identified these patterns, researchers can now determine if a wetland is natural, has been damaged, or if restoration efforts are working just by looking at which viruses are present in a soil sample. The research team believes the patterns they have observed across U.K. peatlands could also be applicable on a global scale.

"Since microbes, including viruses, play a key role in regulating greenhouse gas fluxes, our results suggest that viruses can act as signals of peatland recovery by providing a window into what's happening belowground," says **Ashish Malik**, a coauthor on the paper from the School of GeoSciences at the University of Edinburgh.

In Wisconsin, where 25% of the state is peatland, Kosmopoulos is building a set of long-term data that he hopes can eventually be used to predict wetland health across the state. As this research continues, the team plans to investigate how viruses could be useful tools to influence the restoration of peatlands.

+ FEDERALLY FUNDED RESEARCH

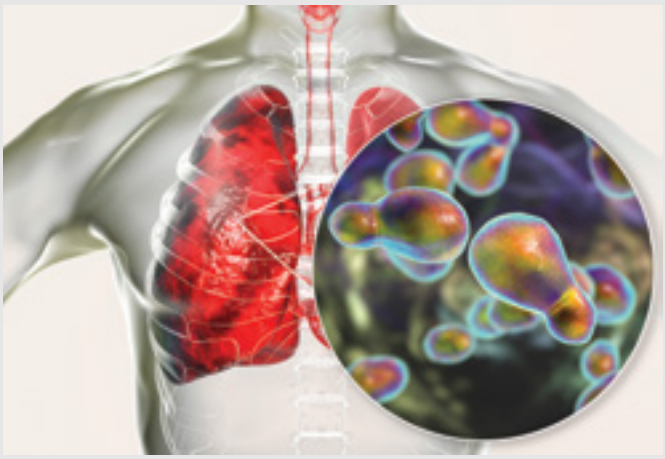
This research was supported by funding from the National Science Foundation (DBI204759), National Science Foundation Graduate Research Fellowship Program (2137424), and Human Frontier Science Program (RGP018/2024). Funding was also provided by UKRI Natural Environment Research Council (NERC), Scottish Universities Partnership for Environmental Research, Doctoral Training Partnership, and the NERC Environmental Omics Facility.

FINDINGS

A NEW WEAPON IN THE ANTIFUNGAL ARSENAL?

Fungal infections can result in serious illnesses, many of them deadly, in immunocompromised people. However, current antifungal medications can be toxic to humans.

A team of researchers from the lab of biochemistry professor **Aaron Hoskins** and the UW Department of Biomolecular Chemistry set out to improve treatment options. Their findings, published in the American Society for Microbiology's *mSphere*, indicate that inhibiting fungal pre-mRNA splicing (an essential step for gene expression) is a promising direction for future antifungal research.



A computer illustration of pulmonary cryptococcosis, an infection that occurs when the yeast fungi *Cryptococcus neoformans* (inset) invades lung tissue. Illustration by iSTOCK.COM/ DR_MICROBE

The study, led by **Sierra Love** MS'21, PhD'25 and **Megan McKeon** MS'20, PhD'24, shows that PladB, a molecule used to inhibit pre-mRNA splicing in human cells, reduces growth and germination in the fungal pathogen *Cryptococcus neoformans*. The experiments also show that PladB is more effective when used in combination with other antifungal drugs.

LIPID-BLASTING ENZYME

When our bodies are put under stress (by nutrient deficiencies or extreme cold, for example), our cells break down energy stores to allow us to survive. The process is tightly regulated and primarily happens in a part of the cell called the lysosome. However, when this process is impaired, BMP lipids, which play an essential role in regulating energy expenditure, can build up in the lysosome. This buildup can lead to metabolic diseases such as cancer, diabetes, and neurodegenerative disorders.

Researchers in the lab of associate professor of biochemistry **Judith Simcox** have identified an enzyme, called Pla2g15, that helps break down BMP lipids. The study, published in *Cell Metabolism*, indicates that Pla2g15 may play an important role in our survival during times of metabolic stress, a function the team is continuing to explore in depth.

—Renata Solan MS'11

What a Wild Bee Wants

Planting more pollinator-friendly flowers can't counteract the negative effects of pesticides on wild bees, a new study says, suggesting that reduced chemical use is more important for conservation efforts than increased habitat.

By TOMAS WEBER

Plant wildflowers, save the bees — or so the thinking goes. Agricultural authorities around the world promote restoring hedgerows and seeding flower strips between fields as pollinator havens. One of the hopes is that creating bee-friendly habitats in agricultural landscapes might offset some of the harm caused by pesticides.

But new research by an international team of scientists, including entomology professor **Claudio Gratton**, reveals a hard truth: While it can help to sow the seeds of beneficial plants such as lavender, iris, sunflowers, and goldenrods in field margins, these flowers don't offset the damage wrought by pesticides.

"People have hypothesized that in areas where there is more natural habitat, where bees can make a home and get food, then the impact of pesticides might be mitigated in some way," Gratton says. "But it turns out that's not really the case."

The surprising results appeared in December 2025 in *Nature Ecology & Evolution*. The authors, which include Gratton, his former graduate student **Rachel Mallinger** MS'09, PhD'15, and dozens of European colleagues, sifted through dozens of studies from around the world, tracking pesticide exposure, surveying bee communities, and mapping habitats around crop fields. Altogether, their analysis covered 910 bee species across 681 fields on three continents. Among the data was a study of Wisconsin's apple orchards (led by Mallinger, now an associate professor at the University of Florida), which shed light on local bee populations.

"We wanted to gather up all the studies on this topic and ask: When people study the things that we think are stressing out wild bees, can we see any general patterns?" Gratton says.

Some of the results were in line with expectations. Pesticides did reduce both bee numbers and species diversity. But restored habitats — although beneficial — could not counteract these chemical effects. "Where there's worse habitat, you get fewer bees. And where there's better habitat, you get more bees. But you don't see a mitigation of the pesticide effect," Gratton says.

The exact reasons for this are not clear. But Gratton has a theory. It's possible, he explains, that the bee populations most heavily impacted by pesticides struggle to travel. "Bees may not be able to venture too far out into the landscapes to benefit from these habitats if they have been exposed to pesticides," Gratton says.

It's a critical finding. Pollinators — which include bees, butterflies, moths, beetles, and even certain birds — play an essential role in food security. Thirty-five percent of the world's crops depend on pollinators. These plants, such as apples and almonds, provide most of the nutrients that humans consume.

But bees are in serious trouble. Global populations are declining. Along with habitat loss and disease, pesticides are a major factor. The chemicals make bees sluggish, interfere with reproduction, and can even cause paralysis.

It's not just the number of bees that matters. Species diversity is also crucial. Over the course of a multi-year study, Mallinger discovered that 90 different species of bees visit Wisconsin apple orchards. That diversity buffers the risk. "It you only have just one pollinator species that's doing everything for you, and for whatever reason you have a bad year, you're done," Gratton says.

So what can farmers who want to build pollinator resilience do? The key is to minimize pesticide use. That might seem daunting to some growers; but, says Gratton, the benefits of pesticides tend to be overstated.

For some vegetable crops, yield gains achieved via pesticide use are "very small, if they even exist at all," he says. And for pollinator-dependent crops, insecticides can reduce yields because they kill the very creatures the plants need to survive. "You tend to get a negative effect on yield. You're throwing money away," Gratton says.

Still, Gratton sees reasons for optimism. Since joining CALS in 2003, he has noticed a shift in the conversation. The farmers he speaks with across the Midwest increasingly recognize the threats pollinators face.

"That awareness was not around when I first started at UW," he says. "Increasingly, people know that pesticides kill bees, and that we need to be as targeted and judicious about their use as we can be."

Opposite page, left: A wild bee gathers nectar from a meadow sage flower.
Photo by NIK HAWKINS

Opposite page, right: A tractor sprays insecticide in an apple orchard.
Photo by iSTOCK.COM/FOTOKOSTIC

FOLLOW-UP

MARINE PROTECTED AREA SUCCESS IS NO FISH STORY

In "Win-Win-Win in Hawaii" (*Grow*, spring 2023), **Elise Mahon** highlighted a study of the ecological, economic, and cultural benefits of the Papahānaumokuākea Marine National Monument, the world's largest marine protected area (MPA).

The study, coauthored by assistant professor of forest and wildlife ecology **Jennifer Raynor**, showcased the concept of "spillover" from MPAs. MPAs restrict where fishing is allowed. Raynor's study found that these protected waters give fish species a chance to flourish, causing an increase in overall population that can spill over beyond the MPA and increase fisher's catch rates and profits. The monument also preserves important cultural sites for Native Hawaiians.

Raynor has since followed up with research that supports these findings in a global context. Her recent work shows that artificial intelligence methods applied to satellite data provide a powerful new way to assess industrial fishing activity in MPAs and eliminate blind spots in current monitoring methods. The first-of-its-kind study, published in July 2025 in the journal *Science*, found that the world's most strongly protected MPAs experience little-to-no industrial fishing activity. The results bolster the idea that, by helping the ocean recover from fishing pressure, MPAs boost biodiversity inside their boundaries but also replenish fish populations in surrounding areas.

"We found that MPAs with strict legal fishing bans work better than critics claim," Raynor explains. "MPAs can help to regenerate fish populations, which creates strong incentives for illegal fishing — and yet, that activity was mostly absent. This is good news for marine conservation."

—By Silke Schmidt and Nik Hawkins

This study was funded by National Geographic Pristine Seas

Above: A school of triggerfish swims at Flores Island (west of Portugal), a biosphere preserve with a marine zone.
Photo by MANU SAN FELIX, NATIONAL GEOGRAPHIC PRISTINE SEAS

High-Tech Eyes on Fields and Skies

UW's statewide network of hyper-local weather stations gives Wisconsin farmers a powerful tool to reduce costs and improve yields.

CLOCKWISE FROM LEFT:

Wisconet instrumentation engineer Caitlin Wienkes installs a new weather station near Plymouth, Wis.

An aerial photo of Hillside Apples, an orchard in Casco, Wis., that hosts a Wisconet station.

David Bartling, co-owner of Bartling's Manitowish Cranberry Co. in Manitowish Waters, Wis., views data using the Wisconet website on his phone.

Cranberries float in the bed after being removed from the vines at Bartling's Manitowish Cranberry Co.

PHOTOS BY MICHAEL P. KING, TAYLOR WOLFRAM, AND ALTHEA DOTZOUR (2)

STORY BY **Chris Barncard**

PHOTOS BY **Althea Dotzour**, **Michael P. King**, AND **Taylor Wolfram**

If you closed your eyes — and maybe if David Bartling BS'13 wasn't trying to shout over the roar of harvesting machinery — you might guess he was talking about his software business or a chemistry lab. Not the weather on the farm.

"The more data, the better," says Bartling, co-owner of Bartling's Manitowish Cranberry Co. in Vilas County. "I have an engineering background, and an engineer likes data."

Over the nearly 80 years and three generations the Bartling family has been growing cranberries in Wisconsin's Northwoods, plenty has changed about the way farmers approach their work. In particular, understanding the growing environment — temperature and moisture, above ground and below, past and present and future — has taken on a decidedly modern edge.

CLOCKWISE FROM TOP LEFT:

Co-owner David Bartling gathers a handful of cranberries at Bartling's Manitowish Cranberry Co. in Manitowish Waters, Wis.

General manager Michael O'Brien poses for a portrait at Vilas Cranberry Company in Manitowish Waters, Wis.

A Wisconet station, which provides localized weather data for crop decisions, installed at Vilas Cranberry Company.

Workers monitor the flow of floating cranberries as they are sucked out of the cranberry bed by a berry pump at Bartling's Manitowish Cranberry Co.

PHOTOS BY ALTHEA DOTZOUR

Precise Weather Data for Precision Agriculture

"When you dial down and focus on ways to support the farmers in our very diversified agricultural economy in Wisconsin, what they require feels familiar to a scientist," says Chris Kucharik, a professor of plant and agroecosystem sciences at CALS. "It's detailed information, different types of support tools, data-based models to help them guide their decision-making."

Kucharik is the director of a team of meteorologists, engineers, web developers, and technicians building out Wisconet, a statewide network of high-quality weather stations that provide valuable, local data to farmers.

In Bartling's case, it couldn't be more local. In 2024, he and Michael O'Brien, a neighbor and general manager of Vilas Cranberry Company, agreed to allow Wisconet to install a station on a shared berm between their farms. Now, every few minutes, research-grade instruments take new measurements of air and soil temperature, humidity, precipitation, wind, and more within yards of their plants.

"When you're applying fertilizer or treating for pests, to be able to do that according to data coming from right down the road from your own beds, that benefit is awesome," says Bartling, who earned his CALS degree in biological systems engineering. "The rain gauge we had for 40 years was probably $5 down at the hardware store. But if I forgot to drive by it and empty it after the last rain, well, Wisconet is a little more reliable."

And, because each Wisconet site has a page on the network's website reporting the latest (and historical) data, Bartling can check on his farm while he's dropping his daughter at daycare in the morning or making a run to the supply store.

It's not easy for owners of small farms to invest in data and analysis, according to O'Brien, which makes Wisconet an important resource — even to farms that don't host a Wisconet station.

"You'd be surprised how many farmers don't have access to that kind of information. The equipment and expertise is expensive," he says. "To my knowledge, all the growers around here use it. And we can look at surrounding stations to see what's coming toward us or whether something is starting to move off."

Better Decision-Making with On-Farm Data

Timely access is important to Bill Roethle, owner of Hillside Apples in Casco, just east of Green Bay. He jumped at the opportunity to relocate a Wisconet station from a nearby farm when its owner decided to retire. Roethle used to get his farm-relevant weather information by calling a recorded service in Sturgeon Bay, about 20 miles up the Lake Michigan shore.

"Sometimes, they'd have the same message on there for a week or so," Roethle says. "Now, I can pull out my phone and look at it myself. Better decisions can be made because it's right here, and it's up-to-the-minute data."

OPPOSITE PAGE: A Wisconet station at Hillside Apples in Casco, Wis.

BELOW: Bill Roethle, owner of Hillside Apples, inspects an apple tree for insect damage in his family-owned orchard.

PHOTOS BY TAYLOR WOLFRAM

"Better decisions can be made because it's right here, and it's up-to-the-minute data."

– Bill Roethle, Hillside Apples

> "Having specific and timely knowledge about their own area is a real economic advantage for Wisconsin farmers."
>
> – Chris Kucharik, Wisconet director and CALS professor

A Statewide Network for Farms, Forests, and Cities

With support from the Wisconsin Alumni Research Foundation, Wisconet has grown from 14 stations to nearly 80 since 2023. The pins marking stations on the state map in Chris Vagasky's office have quickly accumulated, multiplying Wisconet's benefits and making empty territory disappear.

"They're in a really diverse range of locations, including farms, forests, and built-up areas," says Vagasky, a meteorologist and Wisconet program manager. "So, the data from these stations can be used at different scales — locally, regionally, or as a networked representation of the whole state — in ways that are useful for agriculture, for emergency management and research applications."

Wisconet also shares its stations' data with the National Oceanic and Atmospheric Administration, contributing to services such as national severe weather forecasting and drought monitoring. Also, because the data is available to the public on Wisconet's website, anyone can find the closest station — or one in another corner of the state — to check current conditions or recent trends and even tools that map heat risk and storm severity.

Many other states have weather station networks, called mesonets, referring to observations taken on the mesoscale (around 1 mile to 150 miles in size). But Wisconet (Wisconsin Environmental Mesonet) stations go above and beyond for farmers by adding extra sensors to the typical mesonet station's array of equipment — including sensors that track soil moisture at intervals down several feet into the ground.

Funding from the U.S. Department of Agriculture-supported Wisconsin Rural Partnerships Institute has helped Wisconet developers turn the stream of data from the stations into tools specific to different types of crops grown around the state.

Explore Wisconet Online

The digital edition of this issue of *Grow* includes two videos that showcase the staff behind Wisconet, the farmers who use and benefit from the network, and the Wisconet dashboard in action. View them at **go.wisc.edu/grow-wisconet**.

Access Wisconet for highly localized weather and soil measurement data at **wisconet.wisc.edu**.

OPPOSITE PAGE: Wisconet instrumentation engineers Mikaela Martiros (background) and Caitlin Wienkes set up a new weather station near Plymouth, Wis. Wienkes connects to the control board as Martiros digs a hole for soil sensors.

BELOW: Chris Kucharik, professor of plant and agroecosystem sciences and Wisconet director, presents about the UW-managed mesonet at the 2025 Farm and Industry Short Course's AgForward program on the UW–Madison campus.

BELOW RIGHT: The top portion of a Wisconet station at Vilas Cranberry Co.

PHOTOS BY MICHAEL P. KING (2) AND ALTHEA DOTZOUR

"We can translate the stations' reports into alerts when the conditions are just right for a particular disease to spread through cherry trees or when it's almost been warm and wet enough for a pest that eats corn roots to emerge," Kucharik says. "Having specific and timely knowledge about their own area is a real economic advantage for Wisconsin farmers."

Many farmers fully understand the advantages Wisconet has over older methods of reading the weather to determine the best timing for certain practices. So, they're using it frequently, and they're spreading the word about its benefits.

Kevin Koepsel, whose Blind Cow Dairy covers about 97 acres near Kewaskum, spent decades relying on what he called "a not exactly scientific" way to kick off planting. "We've got a field-stone basement, and when the field stone warmed up to 50 degrees, we knew the rest of the soil was 50 degrees. That's when we started planting corn and soybeans," he says. "Eventually, I thought there's got to be a better way."

That arrived in 2024 with a Wisconet station. "I'm glued to it," Koepsel says. "I talk about it everywhere I go, point people to the website."

That's important to the network, according to Kucharik, which requires ongoing support.

"If we just talk about agriculture, and if that data and those decision-support tools go away, our farmers suddenly become less competitive with our neighboring states," he says.

"It was a learning experience for me," says Phil Mueller, general manager of Star Valley Flowers near Soldiers Grove, which is also home to a Wisconet station. "I'd keep an eye on it after rain fell and watch that moisture move down 4 and 8 and 20 inches."

And Star Valley's station has all kinds of fans.

"It wasn't long before we noticed a hole right next to the station," Mueller says. "It turned out to be a badger. That seems like a pretty good endorsement."

Lighter Fare *for* Cattle *and* Microbes

STORY BY
Chris Hubbuch

PHOTOS BY
Chelsea Mamott

Rebecca Smith uses genetic tools to develop plants that can be digested more easily. The outcomes could be greater efficiency for biofuel production and lower methane emissions from dairy cows.

In the King Hall greenhouse on the UW campus, Rebecca Smith stands amid a potted jungle of sorghum, clipping stalk segments into a plastic bin to be weighed and cataloged. Seeds, bagged and labeled, are stacked to the side. Tissue samples have been flash-frozen in liquid nitrogen for chemical and genetic analysis.

The plants have an extra piece of DNA that increases their production of a chemical that weakens bonds in the cell walls. The walls are like bank vaults full of carbohydrates; the goal is to make it a little easier to break in and turn those sugars into energy.

With more than 50 plants, it's tedious but necessary work to figure out which specimens perform best depending on where the extra gene landed and how active it is. "Best" in this case means the plant cell walls are easiest to break down after harvest, but the plants otherwise grow like native sorghum, a hardy crop that withstands arid conditions and produces a lot of organic material, Smith says.

An assistant professor in the Department of Plant and Agroecosystem Sciences at CALS, Smith investigates how forage and bioenergy crops develop at the cellular level. She uses her unique combination of skills to engineer new varieties to help solve some of humanity's biggest challenges.

OPPOSITE PAGE, CLOCKWISE FROM TOP:

Rebecca Smith, assistant professor in the plant and agroecosystems department, harvests sorghum plants in the King Hall greenhouse on the UW campus as part of a study to identify genetic modifications that make the plants easier to digest.

Closeup of a cut sorghum stem.

Sorghum seeds like these are used for human food and animal fodder.

Sorghum seeds are collected and bagged for growing the next generation of plants.

As a scientist with the Great Lakes Bioenergy Research Center (GLBRC), Smith spent the past decade researching ways to grow non-food plants as feedstocks for fuels and chemicals traditionally derived from petroleum. Now, as a new member of the Dairy Innovation Hub, she is working to grow crops that are easier for cows to eat. Both projects aim to make farming more sustainable, bolster rural economies, and ultimately reduce greenhouse gas emissions.

"The goal is to improve digestibility," Smith says. "There are synergies in what makes a good plant for biofuel and for feed."

The Problem with Lignin

Underpinning Smith's research is a basic problem: With the exception of fruits and grains, plants store chemical energy in the form of carbohydrates that are hard to access.

Plants evolved to grow and survive often hostile conditions — gravity, wind, and predators, to name a few — and create their own food by using sunlight to combine carbon dioxide from the air with water from the earth. A key part of that survival strategy is

lignin, a chain of molecules (or polymer) bound to the sugars in the cell wall that helps ward off pests, repel water, and provide structural support.

Just as it protects plants in the field, lignin acts as a barrier to the energy stores — whether in a biorefinery or a cow's gut. As a result, lignin is one of the biggest obstacles to producing cost-effective advanced biofuels, which are made from plant fiber rather than corn kernels or soybeans. And it's hard for cows to digest, which means they get less energy from their feed, and they burp more methane, a potent greenhouse gas.

The challenge is to grow plants with less lignin, or lignin that's easier to remove, without affecting overall growth and development.

"We have to use what we know about cell biology so that we can manipulate lignin in specific cell types rather than in the entire plant," Smith says. "No farmer wants to grow a plant that is going to fall over or is going to be ridiculously short."

Plant Chemistry

The daughter of a musician and an English professor, Smith grew up in Winnipeg, a city of about 843,000 people situated 135 miles north of Grand Forks, North Dakota, in the Canadian province of Manitoba. Drawn to science from an early age, Smith initially wanted to be a veterinarian, but she changed her mind after a job shadowing experience.

"I only needed to see one dog get neutered," she says.

Her "ah-ha" moment came while studying for a high school biology exam amid her mother's house plants.

"Things just started clicking in my brain," Smith says. "It was just that concept of plants taking in carbon dioxide and turning that into energy, and then they're releasing oxygen, and they're supporting our life on Earth."

In college she discovered what would become her core research interest: secondary (or specialized) metabolites, chemicals that perform helpful functions, such as protecting the plant or sending signals, but often aren't essential for survival.

"Plants are producing these ridiculously complicated molecules, and we understand a lot of times what their use is for us but have very little understanding of why the plant is putting so much energy into making them," Smith says. "It was just absolutely fascinating."

After her initial plans for graduate school fell through, Smith contacted Lacey Samuels, a professor at the University of British Columbia, who invited her to work on a project investigating how plants form lignin.

"I'd learned about lignin," Smith says. "But I'd not really thought about lignin very much."

Plants typically use enzymes that hook molecules together into polymers. But lignin is pure chemistry; it forms when unpaired electrons cause individual molecules (or monomers) to link together in unpredictable ways.

"You can't really predict how those monomers are going to come together, what bonds are going to form between them, because it all depends on chemistry," Smith says. "It looks different from one cell to another, even if the cells are right next to each other."

Lignin also happens to be a rich source of ring-shaped molecules known as aromatics, which are found in petroleum and used to make plastics, adhesives, lubricants, and medicines, though the complex structure makes it hard to break them apart into useful components.

Smith decided that to really understand lignin she needed to learn more about chemistry and the techniques used to analyze it. So, in 2013, her final year of graduate school, she visited the lab of John Ralph, an internationally recognized expert on lignin known for his pioneering work in structural analysis. At the time, he was a biochemistry professor at CALS.

Realizing Smith had much-needed expertise in plant physiology, Ralph hired her the next year as a postdoctoral fellow with GLBRC, a federally funded research center based at UW that works to enable the cost-effective production of biofuels and chemicals from non-food plants.

Smith was later promoted to staff scientist and eventually established her own lab, contributing to dozens of studies identifying ways to reduce lignin content, make it easier to break apart, or incorporate more valuable compounds.

Easier Digestion

Bioenergy crops — including grasses and trees — pull carbon from the air and can be grown on land unsuitable for food production, so they could be renewable sources of transportation fuels and petroleum-derived products, such as plastics.

Microbes can ferment the plant sugars into alcohols and convert lignin components into valuable chemicals, but only after the biomass is broken down, which requires a lot of energy and chemicals that can inhibit fermentation.

Cattle and other ruminants break down feed with the help of microbes in the rumen, the first in a series of stomachs. The amount and structure of lignin in the plant determines how much time and energy it takes to free up the carbohydrates. And the longer it takes to digest, the more methane a cow produces.

To confront these challenges, Smith uses multiple methods, including gene editing tools such as CRISPR, to identify the genes involved in lignin formation and dial them up or down to modify the lignin content and structure. In the case of biofuels, that translates to more efficient refining and, ultimately, products that can compete with fossil fuels on price.

"We're making it easier to get to the products," Smith says. "The less chemicals and energy we have to put into breaking apart the plant, the easier it is to bring the cost down."

For cattle, it means better health and fewer burps, which Smith says could make the dairy industry "a little more sustainable."

Global Problems, Cellular Solutions

As a graduate student, Smith had assumed she would spend her career studying the basic biology of plants. But after coming to GLBRC in 2014, she realized her skills could help solve bigger

problems in keeping with the Wisconsin Idea that university research should serve the public good.

"I always envisioned I'd be doing pretty basic research," she says. "I've become more and more excited over time to do research that will make the world better."

In 2024, Smith received a faculty appointment at CALS, where she teaches plant science and conducts research for the Dairy Innovation Hub, which was established by the Wisconsin Legislature in 2019 to drive research and development in support of the state's dairy industry.

Smith is also part of a precision agriculture project that integrates plant genetics, animal nutrition, microbiome physiology, and artificial intelligence. The project's goals are to develop plants that improve feed efficiency, reduce methane emissions from dairy cows, and require less fertilizer.

With $7.8 million in annual state funding, the Dairy Innovation Hub has supported more than 260 research projects and 23 faculty positions at UW–Madison, UW–Platteville, and UW–River Falls working in four research areas: land and water; animal health; human health and nutrition; and farm business and community.

The hub's faculty director, professor and soil extension specialist Matt Ruark, says crop development has emerged as "a huge need" that Smith has filled.

"We had focused a lot of stuff on the land and water side that was more about soil and crop management versus plant development," Ruark says. "It was a missing piece."

Ruark says Smith's research addresses two key metrics for dairy farmers: quantity and quality. And while the hub primarily supports applied research to improve productivity on the farm, Ruark says it's critical to have scientists like Smith whose scope is cellular.

"Now we have this nice spectrum of scientists working across these scales," Ruark says. "There's nothing to take to the field unless she's doing work at her level."

Ralph, now retired, says Smith has had a positive impact on GLBRC, and her unusual combination of skills makes her a valuable member of the university faculty.

"I was so glad we could retain her on this campus," Ralph says. "There are very few that can do good analytics as well as good plant characterization and transformation work. She's a superstar. She has really good ideas — excellent, researchable ideas — and knows how to go about them and knows the pieces she needs to make a good story." g

CLOCKWISE FROM LEFT:

Rebecca Smith cuts a sorghum plant for sampling as part of an experiment using technology (developed by the Great Lakes Bioenergy Research Center) that makes it easier to break apart lignin, a part of the cell wall that provides structure.

Samuel Chagas, a postdoctoral researcher in Smith's lab, prepares samples for analysis.

Chagas peels back a section of sorghum stem.

A SPECIAL **OFFSHOOTS** FEATURE

A Grower's Vision, a Dentist's Brew, and a Farm's Revival

With a green thumb and beermaking prowess — and a little help from their hardworking family — two alums have created a thriving, sustainable agribusiness.

By **Susan Lampert Smith BS'82**

Ben and Laura (Duesterbeck) Johnson in the taproom at Duesterbeck's Brewing Company near Elkhorn, Wis. PHOTO BY MICHAEL P. KING

OPPOSITE PAGE: *(Top)* Hops grow on vines near a barn at Duesterbeck's Brewing Company. *(Bottom)* The brewing company entrance. PHOTOS COURTESY OF BEN JOHNSON

Laura Duesterbeck Johnson BS'03 always felt the pressure of succession when she was growing up on a farm in Walworth County. The property had been with the family since 1861, so her father, **Dennis Duesterbeck** FISC'67, kept a close eye on the future of the operation. And Laura, one of three sisters, had the keenest interest in agriculture. She raised pigs to show at the county fair, participated in 4H and FFA, and loved to garden.

"I think this is an issue on every small family farm: Who's going to take over in the next generation?" Laura says. "And my dad was always scouting for that. He'd ask, 'What are you going to do with the farm?' And I didn't know. I wanted to be a stay-at-home mom. So that was my goal — to be a farmer's wife."

When she enrolled as a horticulture major at CALS in 1999, Laura joked that she was looking for her "Mrs. degree." She did in fact fall in love with fellow CALS student **Ben Johnson** BS'04, and they married the summer after graduation. But Ben, a bacteriology major, planned to go to dental school and didn't have the slightest interest in farming. He did, however, really enjoy brewing beer. And, eventually, kegs of Duesterbeck's Crop Duester Cream Ale and Barn Quilt Blondie would provide the yeasty breath of fresh air that revived the old family farmstead.

Ben and Laura knew each other at Delavan-Darien High School, where they graduated a year apart. They started dating when both lived in Witte Hall. Ben, who had many bacteriology classes in the old Fred Hall (where the Microbial Sciences Building now stands), would bring his lunch across the street to the D.C. Smith Greenhouse, where Laura worked for former greenhouse manager **John Mather** MS'76. They'd eat together most days in the conservancy. Laura loved taking classes with horticulture professors **Dennis Stimart** and **Jim Nienhuis** PhD'82. Nienhuis, she recalls, would issue a friendly challenge to students: If they made a green salsa better than his, he'd give them an A. "I don't think he ever gave us the recipe, either," she says.

Duesterbeck's Brewing Company hosts live music on an outdoor stage Memorial Day weekend through September. PHOTO COURTESY OF BEN JOHNSON

Ben's interest in fermentation was more than academic. He began brewing beer in his apartment, and he founded a home brewing club for students. Ben was interested in the scientific aspects of brewing and says that a bacteriology degree also fulfilled the requirements for applying to dental school. While an undergraduate, he did research in the lab of famed virologist **Ann Palmenberg** and took honors biology classes through the Biocore honors program.

"It was extremely competitive and really helped me stand out as a candidate when applying to dental school," Ben says.

After graduation and their wedding, the couple headed to Minnesota for Ben's dental schooling. They had two children while there and came back to Delavan, where Ben started work in a dental practice that he later purchased.

Out on the farm, the clock was ticking. Laura's dad was in poor health after a heart attack and eventual heart transplant at UW Health. Even before COVID made them commonplace, Dennis wore an N95 mask to protect against the germs and dust of farm life that could be fatal to him. Meanwhile, the Johnson family grew to include six children, and Ben kept brewing beer.

"I built a pretty sophisticated brewery in our basement, here in Delavan, that was kind of pro level," Ben recalls. "That's where I was really able to start perfecting my recipes and techniques."

One day, Ben told Laura he wanted to open a taproom in downtown Delavan.

"And I said 'no,' " she recalls. "If you're going to do it, you're doing it on my family farm."

Laura finally had the answer to her father's worry about the future of the farm, albeit one that would take a lot of labor and investment. The farmstead had several dilapidated buildings filled with generations of farm junk. The Johnsons set to work cleaning and having the property rezoned. They razed the old dairy barn and reused the original beams and barn siding to create a tasting room. The old pig shed became a music hall; the grain bin, an outdoor bar; and the grainery, a gift shop. Today the farm's green-roofed red buildings look like a toy manufacturer's version of an ideal Wisconsin farm (but decorated with beer-themed barn quilts created by Laura).

Duesterbeck's Brewing Company opened in fall 2019 and shut down the following spring during the COVID pandemic. Laura and Ben used the time to create a new patio, and they were so busy when they reopened for outdoor service on Memorial Day weekend 2020 that they ran out of beer. They have since expanded to a 20-barrel brewing operation with a full-time brewmaster.

Despite Ben's worries that no one would find a brewery "in the middle of nowhere," the place is rocking on summer weekends, when they host outdoor music events. Laura estimates that 70% of their warm-weather customers are vacationers from the

nearby Lake Geneva, Delavan Lake, and Lauderdale Lakes resort areas.

The Duesterbecks extend their community beyond the farm by creating beer for events at Old World Wisconsin in Eagle and the Yerkes Observatory in Williams Bay. They feature local products, too, including the honey for the Bees Be Crazy Hefeweizen Ale, grown by CALS alum and Duesterbeck's bartender **Rick Henningfeld** BS'05. One of Rick's brothers, **Frank Henningfeld**, runs the family dairy farm while another, **Ron Henningfeld** BS'07, turns the milk into Hill Valley Dairy's cheese curds, also for sale at the brewery. They use apples from the Apple Barn orchard up the road to make hard cider seltzer, and Laura grows hops and jalapeños that flavor their beers.

People who want a snack with their beer can opt for pretzels from the local German bakery or Blue Farm tortilla chips grown near Janesville. In the summer months, Laura buys plants from her horticulture classmate **Nick Pesche** BS'02, whose family operates a greenhouse near Lake Geneva.

Beyond supporting local products, the Johnsons are also proud of their commitment to sustainability.

"We're the largest production brewery on a farm in Wisconsin, and we're the only brewery I know of that reuses 100% of its water." Ben says. The brewery's well water goes through a reverse osmosis system. It's filtered and then has salts added back into the water in quantities appropriate for the style of beer being made. The wastewater is collected, put into holding tanks, and eventually spread on crop land. The spent brewers' grains are fed to cattle on a nearby farm.

The Johnson children, representatives of the farm's seventh generation, are finding their role in the brewery operation. Eldest Makai, a graphic design student at UW–Whitewater, creates all the colorful labels, with many of the beers honoring family members: The Pig Farmer Pale Ale is a tribute to Dennis Duesterbeck, who passed away in 2017, while The Old Girl's Sticky Buns, a stout flavored with vanilla and maple, is a nod to grandma Cathy's famous breakfast rolls.

The next oldest, Grace, is a UW–Madison human ecology major who manages the farm's social media accounts and has owned her own coffee truck at the brewery since she was 15. Son Trae fixes everything on the farm and 3D prints any parts he can't find. He also runs the sound and drone camera during the summer music events. The younger children, Amari, Boden, and Rosealee, are still growing up and figuring out how they fit into the family business.

By reviving the farm, the Johnsons aim to keep it as a viable business for the next generation.

"It's teaching them all a good work ethic," Ben says. "We're hoping to build something so they will want to stay in the area when they get older — or to give them a reason to come back." g

CLOCKWISE FROM TOP LEFT: Tanks, kegs, and cans in the brewery at Duesterbeck's Brewing Company.

An assortment of canned beer at Duesterbeck's Brewing Company, adorned with colorful art designed by daughter Makai Johnson. PHOTOS BY MICHAEL P. KING (2)

Ben and Laura Johnson's son, Trae, operates the sound board during an outdoor concert. PHOTO COURTESY OF BEN JOHNSON

From a Rural Perspective

Rooted in the farm life of her youth, sociologist Loka Ashwood works with rural residents to reveal the reasons and solutions for challenges in their communities.

Interview by NIK HAWKINS

Photo courtesy of THE JOHN D. AND CATHERINE T. MACARTHUR FOUNDATION

Loka Ashwood PhD'15 was born and raised in a rural community, and rural America is where her heart remains. Her research has settled there with her.

To get a sense of the questions Ashwood tries to answer, look no further than the hardships faced by communities like her home county of McDonough in west-central Illinois — places that often seem underserved or disregarded by the government. Places that endure environmental and health injustices, often tied to unwarranted challenges to land ownership and access at the hands of corporations or extractive industries. She hopes to help rural Americans answer this overarching question: Who benefits from the exploitation of their communities? The truth can often be difficult to discern. And perhaps an even more important question: What can be done about it?

Now a professor of community and environmental sociology at CALS, Ashwood has worked in rural areas in Alabama, Georgia, Kentucky, Illinois, and Wisconsin, and she's expanding her scope to national and international scales.

You were raised on your family's farm in rural Illinois. How does your upbringing motivate and inform your work?

It's superimposed over everything I do, for better or for worse. I grew up between the towns of Vermont and Industry in Illinois. And then I went to Northwestern University, just outside of Chicago, as an undergraduate. That was such a shocking experience, to be in an urban context, and I've never forgotten that. It felt so lonely. So I had this incredible access to the university but also this feeling of isolation. Having experienced that, it influences my approach to students in my classroom, particularly to those who come from rural areas and perhaps don't feel like they belong.

Also, seeing the decline of the area where I grew up had a huge impact on me. The rise of poverty there, and crime, issues that I first explored in the Deep South and now in the Midwest. I experience all of this so personally. Fortunately, as a rural and environmental sociologist, I get to work with rural people to answer questions that concern them and their communities. And given that the topics I work on are derived from relationships with communities, I aim to be translational with my work — writing and delivering findings in a way that anyone can understand and access, sharing what's usable and helpful.

Can you describe a research project along these lines that you're working on now?

I'm conducting oral history interviews that help map the locations of former rural homesteads. It's well-documented that the number of farms in the U.S. is in decline, but we don't really pay much attention to rural homes, and they are of such historical significance. For example, where I grew up, many farmhouses were bulldozed or burned and now live only in memory. They're just being erased. People in rural areas often haven't had a chance to mourn these losses.

So, to enliven those memories and help record this vital history, I am working with [state cartographer] **Howard Veregin** and [geospatial outreach specialist] **Mike Hasinoff** at the Wisconsin State Cartographer's Office to create an online, interactive

map where the public can access the platform and indicate where they know rural houses and related farm structures once stood. It's a public service, and it's participatory. Wisconsin's going to be the focus, but we're also including Illinois and Kentucky. The results will help us see trends. When we know the areas where the most homesteads have disappeared, we can contextualize that with U.S. Department of Agriculture and voting data and start to understand the political and economic reality in rural places and help support change by dignifying the past.

This will also be an opportunity for UW students. I'll be teaching a course, Community and Environmental Sociology (CES) 499: Independent Study in Engaged Sociology, where students can work with the state cartographer's office and me to learn how to mix oral histories with GIS [geographic information system] mapping. They'll be able to help document these important rural histories while learning new skills — how to map and conduct effective interviews to create data that can make change.

How can people get involved in this project?

They can visit **go.wisc.edu/lost-rural-homes** and directly map lost rural homesteads at this very moment. If they would also like to be interviewed to record their story, they can get in touch with me directly at ashwood@wisc.edu or 608-262-4239.

What other research projects are you working on at the moment?

Another ongoing project is a continuation of some intensive, qualitative, community-based research. I have examined corporate ownership of land and also industrial animal facilities. In both areas of work, we found emerging models where absentee and sometimes foreign-owned entities use limited liability companies to mask their identities. In the hog industry, we found 18,000-head hog gestation sites were being proposed in rural areas, and the names associated with them just had an LLC at the end, so people didn't know who or what was behind it. It wasn't the local hog producer they knew from years ago because that industry collapsed in the 90s.

My dissertation had a similar focus. In rural Georgia, LLCs were being used to take land through eminent domain or to exploit "heirs' property" (family-owned land passed down informally through generations), which is very traditional among Black farmers in the Deep South. Again, they didn't know anything about these LLCs that were proposing to take their land.

Where did you take it from there?

I started to branch out with great, smart people, like [UW sociology graduate student] **John Canfield**, and, at the University of Kentucky, [communication professor] **Andy Pilny** and [sociology graduate student] **Mohammad Khalilian**. We started to work our way up, asking questions. Is this LLC a subsidiary of another company? Who are its investors? Are they absentee owned, meaning from outside of the county, state, or the country?

The answers motivated us to look globally across nine agricultural sectors using big data. We started with the largest agribusiness powerhouses to see if they're intertwined through LLCs or their equivalents in other countries, to see how much anti-competitive activity is going on. And we've been looking at leaders at these companies who own the most shares and firms that own shares in each other, or subsidiaries of one another, and are the ultimate beneficiaries.

Now we have a dataset with more than 20,000 relationships and 16,000 entities — firms or people that are the predominant actors among what we often consider to be only 47 entities — and I am working with **Caitlin Bourbeau** and undergraduate **Nadia Choi** at the UW Applied Population Laboratory in my department to make it public at **acre.wisc.edu**. It will be an interactive database, so people can click through and find for themselves which people or firms are the most interconnected.

How would you like to see this database get used?

I hope it's empowering. One of the main groups I thought of as users of this is farmers who are trying to understand why their input costs keep going up. It might help them feel less self-blame if they understand the larger context of what's going on with corporate consolidation in agriculture.

For students, it's helpful to move past the grocery store shelves and understand the companies involved in agriculture. And for rural people in general who may be dealing with injustices related to this concentration or a proposed facility, they can figure out more easily who makes money off these efforts that are not necessarily good for rural communities.

The database unveils a vast social network and shows that much of the power in the world is based on relationships. But if we understand that our relationships are also a form of power, I think we can take on consolidation and antitrust in better ways.

For a bonus question and answer about a new course Ashwood created, visit **grow.cals.wisc.edu**.

MORE ABOUT LOKA ASHWOOD

Ashwood was named a MacArthur Fellow in 2024. Her published books include *For-Profit Democracy: Why the Government is Losing the Trust of Rural America* (Yale University Press, 2018) and *Empty Fields, Empty Promises: A State-by-State Guide to Understanding and Transforming the Right to Farm* (The University of North Carolina Press, 2023), which is available for free online at **library.oapen.org**.

Photos courtesy of YALE UNIVERSITY PRESS and THE UNIVERSITY OF NORTH CAROLINA PRESS

That Extra Mile for Students

An award that honors two exceptional CALS mentors of the past recognizes those who exceed expectations in serving students today.

By NIK HAWKINS

At the annual CALS Awards event, held each spring to celebrate some of the key people behind the college's accomplishments, one moment of recognition tends to be a little more boisterous than others.

The **Arthur J.** and **Ellen A. Maurer** Extra Mile Award is given to someone who has provided above-and-beyond service to undergrads or grad students. Its conferral always attracts a band of students who rush in from classes to get loud for their favorite instructor, advisor, or mentor.

"It definitely has its own cheering section," says **Minda Maurer** who, along with her brother **Brant Maurer**, serves as liaison for the award to the college. Minda and Brant are the children of the late Ellen and Arthur.

Ellen MS'81 established the award in 1999 with a gift in memory of Arthur (Art), a CALS poultry and food science professor known for his remarkable dedication to students. It has since been renamed to also honor Ellen, who enjoyed a prolific career at CALS as a teacher, science communicator, and photographer. The award includes a monetary stipend, and its nominations come directly from students.

"Our dad did tons of research for the university and received lots of grants," Brant says. "But what he enjoyed the most was advising — working with the students and helping them do great things. Both of our parents loved opportunities for one-on-one mentoring, to shape individuals who can make change. And that's why, for this award, students get to decide who had the biggest impact on them."

The 2025 recipient was **Eric Ronk** BS'11, a member of the teaching faculty in the Department of Animal and Dairy Sciences. Ronk teaches critical intro courses and labs as well as dairy herd management classes. He also advises the Badger Dairy Club and coaches the CALS team for the Dairy Challenge, a competition where students tour and analyze a real-world dairy operation and then develop and present recommendations for improvement.

Ronk says the most enjoyable part of his work is guiding students through a transformative time, from fledgling first-years to budding professionals, and helping them achieve their goals. This makes the student nominations for the Extra Mile Award —which cited Ronk's mentorship, teaching, dedication, time commitment, and encouraging nature — particularly significant to him.

"It's the most meaningful award I've received in my career," Ronk says. "Sometimes life is so busy that you don't always see the impact you're making, and this feels like real appreciation for hard work and extra effort."

Brant and Minda have seen firsthand what their parents well knew: The true value recipients get from being recognized is knowing they've contributed to the success of CALS students. It's part of the sense of community they feel at the college, which is somewhat of a second home for them.

"We grew up there," Minda says, and both she and Brant remember their parents' students and colleagues from all over the world becoming a part of their family. They were regulars at the Thanksgiving table, people they made a point to visit when traveling the globe. And many of those friends and family have since contributed to the Extra Mile Award fund. That "family feel" keeps the Maurers coming back to attend the award event whenever possible.

"And," Minda says, "it really does feel wonderful and good that we can help someone help someone else."

Eric Ronk, recent recipient of the Arthur J. and Ellen A. Maurer Extra Mile Award, shows students how to handle a Holstein cow during an introductory animal and dairy sciences course. Photo by MICHAEL P. KING

$ SUPPORT THE STUDENT SUPPORTERS

To contribute to the Arthur J. and Ellen A. Maurer Extra Mile Award fund, contact Jodi Wickham at jodi.wickham@supportuw.org or 608-206-6058.

Here's to 75 more years of dairy-inspired hangouts

To help the store celebrate 75 years as a gathering place for dairy lovers, this issue's **Final Exam** is a dairy-themed delight! Ace it, and you could win a gift box of Babcock cheese. Test your dairy knowledge at **grow.cals.wisc.edu**.

Built in 1951, the Babcock Dairy Store and its house-made goods have enticed patrons from across campus (and beyond) for decades.

TOP: Students drink malts at Babcock Hall in March 1952. **Photo courtesy of the UW–Madison Archives**

BOTTOM: On a warm September day, students enjoy ice cream and sandwiches on the steps to the Babcock Dairy Store. **Photo by Ben Vincent**

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Jeremy Menchik digs into an ice cream cone at the Babcock Dairy Store in July 1981.

To celebrate the store's 75th anniversary, take a special dairy-themed Final Exam on page 39. Photo by **NORMAN LENBURG**