A rare power resides in the gel on these corn roots, and it could help feed the world with far less fertilizer. It’s the latest chapter in a century-long research story.

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On June 25, more than 200 people gathered at Madison's Brittingham Park for a candlelight vigil for Bella Sobah BS'16, who died unexpectedly a week earlier. Sobah chose genetics as her undergraduate major to gain insights into the health issues she faced due to spinal muscular atrophy. She had recently earned her UW law degree and had just joined the Dane County District Attorney's Juvenile Unit. She was known as a tireless advocate for people of color, people with disabilities, immigrants, and the LGBTQ+ community.
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Dean Kate VandenBosch

Toward a Truly Anti-Racist Place

This spring and summer delivered difficulties unlike any we have ever seen. But take a moment. Take a breath. And take solace in the fact that we’ve made it this far, and we can see this through.

Another thing we can take solace in at CALS is the constancy of our purpose. Although more challenges will certainly come our way this year, our mission remains the same: to advance and share knowledge, discover solutions, and promote opportunities in food and agriculture, bioenergy, health, the environment, and human well-being. Through the spirit of cooperation, this work continues. Some of our efforts will help solve the problems caused by this pandemic — and perhaps help prevent the next one. I find comfort and inspiration in that.

But even as we pursue ambitious goals, there are times when external events prompt us to think about how we pursue them. So it was earlier this year with the deaths of George Floyd, Breonna Taylor, Ahmaud Arbery, and, more recently and closer to home, the shooting of Jacob Blake of Kenosha. These events spurred public outrage and a national conversation about addressing racial injustice through anti-racist actions. Like many of you, those of us in higher education are looking for ways to help.

Our campus is guided by an aspirational statement about the value of diversity; and it’s important, as an institution, to state clearly what we stand for. But our campus goals don’t necessarily coincide with what students of color experience when they’re here. This reality is influencing our priorities and actions at CALS, as it is for the whole UW campus. We’re looking to extend beyond a statement about what we value to become a truly anti-racist and inclusive place where all can thrive.

It’s a widely held view in our college that we need to work on both the overall student experience and our recruitment of faculty, staff, and students. One is not more important than the other — we will strive to achieve both together.

First, we need to better understand the obstacles that students with different lived experiences face each day on campus. I am making a point to ask our students and alumni of color about their UW experience, the adequacy of campus spaces for student activities outside the classroom, and what they think was or has been most supportive for them during their time at the university.

These conversations will help us understand where we should invest as a college to better support student success. They will also inform future training to strengthen bystander intervention by instructors and peer mentors when inclusion is lacking. Our faculty and staff will learn how to recognize instances where individual privilege and advantages vary and to assist our students in connecting to community and resources beyond the classroom when needed.

Beyond classroom relationships are a core part of the CALS experience, and we need to help ensure that students of color are forging these relationships successfully. One way to do this is to build on the achievements of QuickStart. Now in its third year, the QuickStart program is designed for incoming first-year students at CALS (see “Off to a QuickStart” in the summer 2019 issue of Grow). In addition to letting students get a jump on their coursework, QuickStart links them to their peers, campus jobs, and campus resources, such as advising and health care, in meaningful ways.

This is a start. But our anti-racism work will continue because it is central to a major part of our mission: the promotion of human well-being. Because our students of color deserve a better campus experience. And because we want to invest in their success and take pride as they make their mark on the world.
Five things everyone should know about . . .
The Economic Impacts of COVID-19

By Tessa Conroy

1. **In a single month, the COVID-19 pandemic erased more than a decade’s-worth of new jobs.** During the Great Recession (2007-09), Wisconsin’s employment level fell to a low of 2.8 million jobs, according to data from the U.S. Bureau of Labor Statistics. This was followed by a period of steady job growth. From January 2010 to January 2020, Wisconsin added close to 203,000 new jobs, reaching a total of just over 3 million. But state residents made significant changes to their spending habits as they adapted to new guidelines and mandates at the onset of the pandemic. From March 2020 to April 2020, this contributed to a loss of nearly 360,000 jobs, which more than eliminated all of the state’s post-Great Recession gains. While some jobs have returned since then, the most recent data (from June 2020) indicate that employment levels in the state are still comparable to those of December 2009, the depth of the Great Recession.

2. **Business owners of color are especially vulnerable to the economic effects of COVID-19.** Some of the most heavily impacted sectors, as measured by unemployment claims, are retail, arts, accommodation and food services, and “other services,” a catchall category that includes pet care, equipment repair, and laundry and dry cleaning, among others. According to the U.S. Census, people of color are more likely than white proprietors to own businesses in these sectors. More than half (54%) of Black- or African American-owned businesses are included in the above categories, as compared to only about one-third (32%) of white-owned businesses. A significant proportion of Asian-owned businesses (49%), American Indian-owned businesses (35%), and Hispanic-owned businesses (36%) are also included in the most vulnerable sectors.

3. **The pandemic has sharpened existing disparities in broadband internet access.** In response to continued efforts to reduce the spread of COVID-19, far more people are working, schooling, and entertaining themselves at home. High-speed internet has become even more important. However, recent data from the UW Division of Extension indicates that more than one-third of households in rural Wisconsin counties do not have broadband access. This service gap makes remote work, virtual education, telehealth, and home entertainment much more difficult for state residents in nonmetropolitan areas.

4. **The economic impacts of the current pandemic are likely to look very different than the fallout of the country’s last major pandemic, and that’s largely due to policy.** This is the nineteenth recession since the flu pandemic of 1918, and the federal response to economic downturns has changed dramatically since then. The Federal Reserve Bank was just five years old in 1918 and had not yet taken an active role in stabilizing downturns. Great Depression era-policies that promoted large government spending (fiscal stimulus) to offset declines in consumer spending had not yet gained traction. And Wisconsin, the first state to pass unemployment insurance into law, didn’t do so until 1932. Today, a breadth of policies has already been deployed. If they work as intended, they will mitigate the negative economic effects of the pandemic and aid a speedy recovery.

5. **The initial federal response to COVID-19 included the largest fiscal stimulus in U.S. history.** Fiscal stimulus has been a common response to economic downturns since the 1930s. In response to the pandemic-induced recession, Congress passed three fiscal stimulus bills to spur demand and stabilize the declining economy. At $2 billion, the Coronavirus Aid, Relief, and Economic Security (CARES) Act of March 2020 is the largest U.S. fiscal stimulus ever passed. A recent study from the Massachusetts Institute of Technology shows that the Paycheck Protection Program, a part of the CARES Act meant to reduce employment loss through relief to businesses, saved between 1.4 million and 3.2 million jobs.

Tessa Conroy is an economic development specialist and assistant professor with the UW-Madison Division of Extension. She teaches courses in the Department of Agricultural and Applied Economics at CALS.
As Milkweed Goes, So Goes the Monarch

A team of entomology students is working to understand the best habitat arrangements for these well-known butterflies to keep them from becoming insects of the past.

Skye Harnsberger, a graduate research assistant in the lab of entomology professor Claudio Gratton, leads research techs Michelle Chung BS’21 and Cheng-kai Guo BS’20 out into a prairie to survey for monarch butterflies, eggs, and caterpillars at Lodi Marsh State Natural Area near Lodi, Wis., in summer 2019.

Right: A monarch caterpillar clings to a milkweed flower at Lodi Marsh State Natural Area.

It’s a sweltering August day in 2019. The sun gilds the flowering prairies of southern Wisconsin. Entomology graduate student Skye Harnsberger and her research team park their pickup truck on the side of a back road, grab their clipboards, and trek into the waist-high grass.

As they tread a predetermined path, the team stays on the lookout for the distinct profile of milkweed plants. When spotted, the milkweed is examined and tallied. They repeat this simple process all summer long. It’s tedious work, but critical, because the data they collect could help save the monarch butterfly.

Milkweed is essential for monarchs. It’s the only plant on which they’ll lay their eggs and the only one that their caterpillars will eat. But in the last two decades, urban development and extensive use of weed killers have depleted this habitat. Today, the number of adult monarchs may be insufficient to ensure that the species persists. And the loss of these butterflies could have implications for many other species.

“Monarchs connect many people to nature, and without these connections, people are less likely to be concerned enough to work to save natural systems,” says Karen Oberhauser, director of the UW Arboretum and a professor of entomology who serves as Harnsberger’s thesis advisor. “They also use habitats that are important to many other plants and animals. So while monarchs may not play a large role in ecosystems, protecting them will lead to increased engagement with natural systems and protected habitat that will benefit many other species.”

This is why Harnsberger is studying how and where to plant milkweed to attract the greatest number of monarchs. Her work is couched in an ongoing debate in conservation circles known as “SLOSS.” It stands for “single large or several small.” The unsettled question: Is it more effective to restore one large habitat or several small ones?

And it’s a crucial question in the context of monarch habitat. In the spring and summer, on their epic northward migrations — the longest of any butterfly species — the monarch seeks out milkweed as repositories for their eggs. What type of habitat configuration are they most likely to use during this critical rest stop?

“You can imagine a large patch with thin milkweed might have different qualities to a monarch flying overhead than a large patch with really dense stands of milkweed or a small patch with lots of stems,” says Harnsberger. “There’s been some modeling on which [type] would be better for the monarch but no real boots-on-the-ground research yet.”

But Harnsberger and her team have put their boots on the prairie. Their study involves 30 sites, and they are categorized into four landscape configuration types with combinations of either large or small milkweed patches and either large or small amounts of surrounding grassland.
That’s how much of the bacteria in your gut could be E. coli. But don’t worry. While a few strains of harmful E. coli can contaminate foods, most strains live peacefully inside your body, and some even produce critical vitamins. You can find more fascinating facts in The E. Coli Chronicles: A Magical Friendship, authored by microbiology Ph.D. student Rachel Salemi and published by JKX Comics. More at go.wisc.edu/ecoli-chronicles.

Image courtesy JKX Comics

Awards and Honors

**RECOGNITION FOR FREEDOM FARMERS**


**FELLOW AGRONOMISTS BECOME CSSA FELLOWS**

Two professors of agronomy, Natalia De Leon MS’00, PhD’02 and Molly Jahn, have been selected as Crop Science Society of America Fellows for 2020. They were among a select few recognized this year for their professional achievement and meritorious service.

The surveys Harnsberger completed along with her team of four undergraduates during the summer of 2019 consisted of walking a transect, or survey line, at each site. They followed these lines for equal distances at each location and counted the number of monarch butterflies, monarch caterpillars, and milkweed stems they encountered on either side. Other characteristics the team noted include how many other flowering plants were available for adult monarchs to feed on and the different types of milkweed present (Wisconsin has 12 native species).

The data point to a few landscape preferences among monarchs. First, they seem to prefer fields with higher densities of milkweed and flowering plants. The size of the prairie, however, does not play a significant role in attracting monarchs.

The results also show that monarchs tend to like isolated prairie patches. Harnsberger found this most interesting because it means that patches with less surrounding grassland are more likely to entice monarchs. She describes this as an “if you build it, they will come” scenario for creating and maintaining monarch habitat. Whether a patch is surrounded by farmland, forest, or waterway, the monarchs will make their way to the milkweed.

This research will help land managers configure prairies to be more attractive to monarchs. For assistance, they can turn to the many federal agencies, nonprofits, and private organizations that dedicate funds to monarch habitat restoration designed to increase the butterflies’ declining population.

Harnsberger also points out that anyone, not just land managers, can take small steps to help monarchs. Their population is quickly declining, so any action is better than none at all.

“The number one thing the public can do for monarchs is to plant milkweed,” Harnsberger says. “As much as you can, wherever you can. The more stems, the better for monarchs.”

—Madeline Rastall MS’20
When Elena Haasl BSx’22 came to UW–Madison in fall 2018, she never thought she would end up running her own political campaign. But she did — her very first. And she won. Thanks to her victory this past April, Haasl now represents District 5 on the Dane County Board of Supervisors.

Haasl is a junior majoring in community and environmental sociology (CES) and political science, and she’s earning a certificate in women’s studies. Her interests in environmental and social activism, which she nurtured throughout high school, drove her to take her first CES class. “I really liked the direction of the major and what it covers, and so I was like, ‘I think this is what I want to do. It’s really cool!’”

Given her fascination with politics, Haasl chose to pair CES with political science for a double major. She sees a connection between the two. “Sociology does a great job of outlining disparities when it comes to the environment and things like race or gender, anything like that where I can apply politics and policies in the future,” she says.

Haasl worked on a few political campaigns prior to her own. She most recently assisted with a Madison City Council campaign for Matthew Mitnick, a junior majoring in political science at UW.

“He is one of the most hardworking and dedicated people I know,” Mitnick says.

Mitnick later encouraged Haasl to run her own campaign. When Haasl found out that the previous District 5 supervisor wasn’t seeking reelection, she decided to take the leap.

“Being a woman and being biracial, I thought this would be a good way to amplify marginalized voices in the district,” she says.

District 5 is typically represented by a student — it’s the only district with a student majority — but no students were vying for the seat. This was another aspect of the race that drove Haasl to run.

“It would be silly to not have a student representing the only student district,” Haasl says. “Students have unique needs.”

Haasl says that participating in past campaigns helped her build relationships that contributed to her own campaign’s success. She credits her victory to UW, too. Through courses and interacting with others on campus, she learned how to probe ideas and issues that are important to her.

“It makes me realize that sometimes things aren’t as simple as they seem,” she says. “There’s a lot of history behind certain things, and it’s interesting to see different sides of arguments in my polisci classes and to apply that thinking directly to my job now.”

Mitnick was ecstatic when Haasl won the seat.

“Throughout the entire time I have known her, Elena has put the needs of others above her own,” he says. “When helping Elena out with her campaign, I noticed how easily she was able to connect with constituents and students. This is because her efforts were solely for them — every part of her platform was carefully designed with the community in mind.”

—Jori Skalitzky BSx’22
The Age of Ecological Forecasting

A data revolution is helping scientists predict where and how climate extremes will affect plants and animals — and where to target conservation efforts.

When El Niño approaches, driven by warm Pacific Ocean waters, we’ve come to expect both drenching seasonal rains in the southern United States and drought in the Amazon. Those opposite extremes have huge effects on society and are increasingly predictable thanks to decades of weather data.

Soon, CALS ecologist Ben Zuckerberg thinks we’ll be able to pull off the same forecasting feat for bird migrations and wildlife populations. That’s because just as those recurring changes in climate have expected consequences for humans, they also have predictable effects on plants and animals.

For instance, ecological predictions could aid preparations for diseases in crops or population crashes in endangered species. Good forecasting could explain where conservation measures are needed most in the coming year or decade.

With an interdisciplinary team of scientists, Zuckerberg recently published a paper in the journal *Trends in Ecology and Evolution* describing how species and ecosystems across continents respond to opposite climate extremes induced by patterns such as El Niño. For these large-scale, opposing ecological outcomes, such as famine on one continent and a feast on another, the team coined the term “ecological dipoles.”

“Plant and animal populations respond to climate at continental scales,” says Zuckerberg, an associate professor in the Department of Forest and Wildlife Ecology. “Going forward, we want to know: How do we observe this connection? How do we measure it? How do we track how these dynamics are changing?”

He and his team believe that ongoing fundamental changes in ecological data make this possible. With the rise of citizen science, hundreds of thousands of global volunteers have been collecting quality data about the world around them. And the National Science Foundation has begun setting up ecological stations nationwide that mirror the ubiquitous weather stations we rely on for constant data collection.

“We are beginning that revolution right now in ecology where we are able to collect data at a scale that matches what climatologists have been able to use,” says Zuckerberg. “Having data that’s been collected over continental scales, in real time, and that spans decades is really what you need to analyze the regularity and changes in both climate and ecological dipoles.”

The idea that climate affects ecosystems across big expanses is not entirely new. It’s been clear for decades that plant and animal behavior can be synchronized across a region. One classic example is acorn production. In certain years, all the oak trees in an area will produce huge amounts of acorns, which in turn leads to population booms in squirrels and other animals. Most likely, climate helps organize this collective response. Better data will make it easier to spot these kinds of patterns across the globe.

Understanding this climate-ecology connection is more urgent than ever as Earth rapidly warms and its climate changes, says Zuckerberg. It’s not clear how climate change will affect patterns such as El Niño or the plants and animals that respond to those patterns. Getting a handle on how predictable climate extremes affect ecosystems will help researchers respond to changes as they arise.

For Zuckerberg, the fun comes from wrapping his head around this modern-day butterfly effect.

“Shifts in the climate system that can influence these ecological processes originate halfway across the world,” he says. “And I love thinking about how these connections are going to change over time.”

—Eric Hamilton

One way Ben Zuckerberg and his team are beginning to test their “ecological dipoles” idea is by using citizen science data to track irruptive bird migrations, such as those seen with pine siskins (pictured below), and the boom-and-bust cycle of seed production. Their goal is to identify a link back to climate patterns across the entire continent.

This work was supported by the National Science Foundation Macrosystems Biology and Neon-enabled Science projects 1926428, 1926341, and 1926221 and DEB EAGER project 1745496.
After finishing her work in the Peace Corps, Allendorf enrolled in a Ph.D. program at the University of Minnesota, where she studied local community perceptions of different types of protected areas in Nepal. Since that time, her work with communities across the globe has expanded.

In Chitwan, Nepal, Allendorf, along with the late renowned primatologist Rob Horwich, established a project to manage and monitor Bengal tigers through a Wisconsin organization called Community Conservation (which Horwich founded). Allendorf continues this kind of work today in southeastern Nepal in a project designed to protect wildlife by creating safe animal-use corridors. The aim is to link populations of tigers and elephants from Nepal to India and empower communities to network to create conserved landscapes.

Allendorf also acts as a consultant for projects in other countries, such as Mozambique. She has worked in China, Malaysia, Thailand, Myanmar, Namibia, Tanzania, Guyana, and elsewhere.

“The point of my work, no matter where or which project, has always been to make biologists and ecologists do better with humans,” explains Allendorf. “Social scientists would never claim me, since my degree is in conservation biology, but my whole focus is trying to make biologists think about humans and how they can collaborate with communities to conserve biodiversity.”

One of Allendorf’s priorities is involving more women in community conservation work. She views Nepal as a model for female involvement — its government recommends and aspires to achieve 50% representation of women in all groups. While not all groups reach that milestone, the precedent is set, and it helps communities strive for it.

Allendorf recently took that directive to a project in Sarawak, Malaysia, spearheaded by graduate student Olivia Cosby. The project is an international collaboration between the Smithsonian Conservation Biology Institute, where Cosby is a student fellow, and the Sarawak Forestry Corporation. Cosby has been doing camera trapping — capturing photographs of animals using remotely activated trail cameras — in the Lanjak Entimau Wildlife Sanctuary for the last three years, and she’s made it a goal to include the community in her efforts. Allendorf and Cosby found that the Malaysian women were more than willing to join in.
During the latest trip, they held a training session for the women. They wondered why they hadn’t been asked to be involved sooner, Allendorf says.

“Teri’s advice and oversight have been invaluable,” says Cosby, a master’s student who works in the lab of wildlife ecology professor Timothy Van Deelen. “Much of her time on our last trip was spent talking with the community, particularly the women. She also taught me and two staff members of the Sarawak Forestry Corporation her approach to working with local communities. We spent time gathering information to develop a long-term community wildlife monitoring program that emphasizes peer mentorship.”

Whether in Malaysia, Nepal, or elsewhere, Allendorf finds that local communities are interested in conservation efforts, and that keeps her passionate about her work. Locals are concerned about their crops and livelihoods, but they also understand that the landscape is theirs, and they want to conserve it.

In Nepal, over 19,000 community forest user groups composed of more than 1 million households participate in forest resources management. Given shared interests with those groups, Allendorf offers them technical training in areas such as wildlife monitoring and preservation. She believes that community management and input will propel countries forward in their conservation efforts.

“The story tends to say that local people don’t like protected areas because it takes away their rights and their resources,” Allendorf says. “But in reality, we see that, when you ask them, they appreciate many, many benefits from those areas. If you look at Nepal, they have accomplished so much in 50 years. So I have this dream that new generations will be actively involved in sustainable forest and wildlife management in Nepal — and beyond.”

“The point of my work, no matter where or which project, has always been to make biologists and ecologists do better with humans.”

—Teri Allendorf

Environmental studies master’s student Olivia Cosby teaches women from a community bordering the Lanjak Entimau Wildlife Sanctuary in Sarawak, Malaysia, how to set up camera traps and use GPS devices in January 2020.

“Caroline Schneider MS’11

Environmental studies master’s student Olivia Cosby teaches women from a community bordering the Lanjak Entimau Wildlife Sanctuary in Sarawak, Malaysia, how to set up camera traps and use GPS devices in January 2020.

Photo by Teri Allendorf
What is Known About the Genetic Component of Autism?

The autism research field has known for a long time — since the late ’70s — that genetics are involved in autism. When you look at cohorts of twins, you see that identical or monozygotic twins are much more likely to both have or not have autism. If you look at non-twin siblings, the rate of recurrence is between 10% and 20%. So the more of your genome you share with someone who has autism, the more likely you are to also have autism yourself.

Over the past decade, the field has made remarkable headway in identifying specific genes associated with risk. Scientists have been looking for de novo, or brand-new, mutations. These are not inherited from your mom or dad: They are just DNA replication mistakes that happen when any cell divides. We can find genes that have one of these de novo mutations in affected cases. But we almost never see the mutations in unaffected siblings or in people without autism. So that tells us that this gene is really important for development, and it is specifically associated with risk for autism.

If that gene is mutated, your chances of having autism may be fivefold, tenfold, fifteenfold above the normal expectation. We now have a list of 102 genes that are associated with autism risk.

How Are Sex Differences Between Males and Females Related to Autism?

Autism is among the most sex differentially skewed in terms of its prevalence. It’s four times more common in males than in females. Other conditions show a sex bias as well. Tourette syndrome is very male-biased. ADHD is male-biased. Major depression and generalized anxiety, those are female-skewed. And so, within the realm of neuropsychiatric disorders, there’s some component — I would hypothesize — of sex differential biology contributing to differences in risk.

The goal of my work is, if we can understand what the biological mechanisms are that are leading to these differences in prevalence, we might tap into a very potent pathway for developing treatments. Treatments could mimic or ramp up the biological processes associated with protection in the least affected sex or knock down the pathway that’s associated with risk in the more affected sex.
WHAT MADE YOU WANT TO STUDY THIS FIELD HERE AT CALS AND UW–MADISON?

My Ph.D. is in neuroscience, and then I worked in a psychiatry department, so this is the first time that I’m sitting within a true genetics department and one that is not exclusively focused on human biology but also studies plants, microbes, yeast, and more. So even though that is the focus of my research and will continue to be, it’s exciting to be around labs and other faculty who are using different systems to ask very important questions that I haven’t had the chance to think about in a while.

The other thing that makes coming to the University of Wisconsin so exciting for me, working in this autism research space, is that just down the road is the Waisman Center. Waisman has been so well established in clinically facing research and research of specific neurodevelopmental syndromes related to autism, and autism itself, for a long, long time.

Right now, autism is defined by symptoms in two key domains. One is social communication that encompasses things like verbal language, perceiving facial expressions, and making friendships. The second symptom domain is restricted interests and repetitive behaviors, which can include things such as an intense interest in one topic or a motor movement such as rocking. Every individual has a different constellation of symptoms. We want to focus on these symptoms, and we would like to have some therapeutics to augment the efficacy of behavioral therapy too.

If we have a set of genes that we know are associated with risk for autism, we can use those genes as a place to start in terms of understanding biology. So, we can ask, do these genes carry out similar functions, or do they carry out their major roles within the same cell type or at the same time in development? The hope is that we don’t have to design a drug for each of the 102 different conditions. Ideally, we can group these genes into sets that have similar functions, and then we can design drugs that change those specific pathways or functions. So maybe we don’t need 102 drugs, but five drugs or something to that effect. The major goal of these therapeutics would be to alleviate symptoms for patients seeking treatment and improve quality of life for people with autism and their families.

HOW DOES UNDERSTANDING GENETIC RISK OF AUTISM LEAD TO BETTER TREATMENTS?

Many of the drugs used in the field of psychiatry were discovered by accident or a long time ago, and we’re lucky that they work in the way that they do. Autism has no therapeutics available to target autism-specific symptoms. We can give an antipsychotic to a patient with schizophrenia, and it will probably have effects on their psychosis symptoms. But we don’t have treatments to target the main defining symptoms of autism, specifically.

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I’m excited to be here to bring this human genetics piece to that puzzle and to be complemented by people who are seeing patients day-to-day in the clinic or working on a mouse or cell system to understand biology. Now we can collectively span the range of research from seeing a human patient down to their DNA.
medical student Alice Huang was dutifully taking notes during a lecture at the Mayo Clinic Alix School of Medicine when she snapped to attention. There on the projection screen, next to the title of a cystic fibrosis study, appeared a familiar name.

“That’s my mom!” she gasped to the student beside her. Alice’s mother happens to be Huichuan Lai MS’90, PhD’94, a renowned cystic fibrosis researcher and professor of nutritional sciences at CALS.

A couple of years later, Huichuan Lai’s younger daughter, Leslie Huang, a genetic counseling student, had her turn to beam with pride when her mother’s influential research turned up in her cystic fibrosis training at Mount Sinai in New York. Of all the ways to measure research impact, perhaps the most surreal is learning that your work is being taught to your children in professional training programs across the country.

“That’s when you know your work is being not just viewed but used to educate the next generation,” says Lai, who also has affiliated appointments in the pediatrics and population health sciences departments in the UW School of Medicine and Public Health.

After more than a quarter of a century studying cystic fibrosis (CF) and leading the largest prospective, longitudinal birth cohort study of the condition, Lai has made an undeniable impact on the field. Her work has illuminated the role of nutrition in the disease and its progression, changing the standard of care.

There is still no cure for CF, which afflicts more than 70,000 people worldwide. The complex hereditary disease, which makes it difficult for patients to breathe and absorb nutrients, can lead to deadly malnutrition, infections, diabetes, liver disease, and other complications. And while life expectancy has improved in recent decades, many patients with CF still die before their mid-30s. But earlier screening, new treatments, and research like Lai’s are making it easier to manage the disease and
improve patients’ quality of life.

“Working in the field of cystic fibrosis is very rewarding,” says Lai, whose work is supported by the National Institutes of Health (NIH), the Cystic Fibrosis Foundation, and the Legacy of Angels Foundation. “One reason is that the Cystic Fibrosis Foundation bridges research and clinical practice, and they take the research findings and broadcast them to the community. With diabetes or other diseases, it might take years for new findings to make it into clinics. In CF, it can be within months. It’s very, very fast, and they work very hard to reduce the barrier between research and clinical practice.”

FROM STUDENT TO PROFESSOR AT UW

It was the University of Wisconsin–Madison that sparked Lai’s interest in CF research. After she earned her undergraduate degree in health and nutrition at Taipei Medical College in Taiwan, Lai debated between Rutgers University and UW–Madison for graduate school. Her father, who had lived briefly in New York, lobbied for Rutgers.

But then Lai’s phone rang. It was Denise Ney, Billings-Bascom Professor of Nutritional Sciences, with some questions about Lai’s application. The personal connection made UW even more appealing, and Ney would later become Lai’s Ph.D. mentor.
is the very first question that all CF physicians face in the clinic the first time they see a family with a newly diagnosed infant,” Lai says. “Moms will ask: ‘Can I continue to breastfeed?’ And physicians had no answer.”

That’s because there were no clinical standards for CF nutrition before Lai’s study. “In clinical practice, we typically wait and watch until growth falters,” she says. “But if you wait until growth falters, it’s basically too late.” And so the FIRST (Feeding Infants Right . . . from the STart) study was born.

Breast milk, which has immune-boosting properties, is usually considered the optimal nutrition for healthy babies. But the picture is more complicated for babies with CF, who have increased nutritional needs. Those infants have trouble absorbing breast milk’s essential fatty acids, which are vital for growth. Breast milk is also low in sodium, which can lead to electrolyte imbalance because babies with CF lose so much sodium through their sweat. In severe cases, babies can die because of low blood sodium levels, a condition called hyponatremic dehydration.

But before Lai could even begin recruiting her own research cohort, she needed data. “It wasn’t easy to launch this study,” she notes. She began by conducting a retrospective study using a 10-year cohort (1994-2003) generated from Wisconsin’s CF newborn screening program that was implemented after Farrell’s cohort (1985-1994) demonstrated unequivocal nutritional benefits of early diagnosis through newborn screening. She looked at differences in growth and lung infection rates in babies who were exclusively breastfed versus those who were fed formula.

Lai spent her postdoctoral fellowship in Farrell’s lab and continues to collaborate with him today. “We now always joke that I was on his grant before, and now he’s on my grant,” she says. “It’s a very fruitful collaboration.”

TOWARD PRECISION NUTRITION

Before newborn screening, children with CF were diagnosed at an average age of 9 months — a point when many babies’ nutrition and growth had already suffered, and most mothers had stopped breastfeeding. But by 2011, most babies were diagnosed within the first two months of life, which made it possible to investigate an important question: What’s the best food for those babies? “It is the very first question that all CF physicians face in the clinic the first time they see a family with a newly diagnosed infant,” Lai says. “Moms will ask: ‘Can I continue to breastfeed?’ And physicians had no answer.”

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That gave her enough data to design a longitudinal observational study, which earned NIH funding, for a new birth cohort (2012-17) that continues a decade later. While it’s not a randomized clinical trial, the observations of nearly 200 families who have chosen to breastfeed, use formula, or do a combination of both have led to interesting insights.

Lai had to wait until her youngest subject turned 2 in December 2019 to complete the data analysis from the primary end point of 2 years of age, and she plans to share her results at the North American Cystic Fibrosis Conference in October 2020. But her preliminary data show that babies
who were exclusively breastfed for the first six months did not grow as well during their first year as babies who were exclusively formula-fed or who received a combination of the two. Lai found that babies who were exclusively breastfed were also deficient in iron, essential fatty acids, and vitamin D.

The impact on infection rates is less clear: She found no difference between the babies who were exclusively breastfed and those who were exclusively formula-fed, but babies who had both feeding types had higher rates of infection in the first year of life. “So that’s a puzzle,” she notes.

Because of poor growth, two-thirds of infants with CF are prescribed fortified, calorie-dense formula by six months of age, “and then they start to catch up,” Lai says. So Lai wondered whether she could predict which babies will need fortified feedings and which won’t. Babies typically grow rapidly during their first month of life, but Lai found that babies who lose more weight shortly after birth tend to have more severe CF symptoms. She believes those babies are the ones who would benefit most from earlier fortified feedings.

“Nutritional status and pulmonary status are so closely related,” she explains. “The better the nutritional status, the better the lung status.”

A DEDICATED TEAM

To recruit patients, Lai’s lab works with pediatric CF centers in Madison, Milwaukee, Chicago, Indianapolis, Boston, and Salt Lake City. Recruitment is challenging because families must enroll within a baby’s first two months of life, and the study requires ongoing questionnaires, food diaries, and blood and fecal samples as a child grows.

While a high attrition rate is common for such studies, more than 90% of Lai’s patients have stuck with it. “We understand the burden of data collection on families, but we have a lot of families who are so dedicated,” says Lai, who keeps a photo collage of smiling kids and parents from the FIRST cohort on her computer.

Those families spur her relentless search for answers. For at least a decade, she regularly clocked 80-hour workweeks. “The complexity of a longitudinal study like this is that I can’t wait because these kids are growing,” she explains.
learn about the study and about the disease, and they learn how these big studies are handled. It’s a great mentoring experience for them.”

QUESTIONS BEGET QUESTIONS

The first phase of the study focused on nutrition, growth, and lung disease outcomes over a baby’s first two years of life. Phase II extended the study to follow the children until age 6 and expanded to include more sensitive outcome measures, such as lung clearance index and chest CT.

And new research questions have emerged along the way. For example: Are there microbiome differences in children with CF, and could their mix of gut bacteria affect the relationship between breastfeeding and growth and immunity? To find answers, Lai added a gut microbiome substudy to compare children with CF with their siblings without the disease and found distinct differences in the bacterial mix between the two.

For another substudy, she examined how probiotics changed the microbiome profile and the effect on gastrointestinal symptoms and antibiotic therapy. She continues to study the effect of repeated antibiotic therapies on gut microbiome because children with CF have more infections that require antibiotics.

The CF field has also evolved over the life of the FIRST study. There are now four drugs, known as CFTR modulator therapies, which target the gene involved with the disease. Since 2012, the percentage of patients who are eligible for those therapies has grown from 5% to 90%, Lai notes.

CF symptoms stem from a malfunction in a protein that controls the movement of chloride throughout the body. When chloride gets trapped in cells, it leads to the production of sticky mucus that can hinder gastrointestinal and lung functions and trap bacteria, causing malnutrition and recurring respiratory infections. CFTR modulator therapies can lower a child’s abnormally high sweat chloride levels, reduce pancreatic insufficiency (low digestive enzymes), and preserve their respiratory functions. After treatment, patients may be able to reduce the dosage of pancreatic enzyme supplements that are needed to increase digestion and nutrient absorption.

The FIRST study will continue until at least 2025, but with new aims. “We want to study the postmodulator era — do those kids have better growth and disease outcomes?” Lai says. Treatment effectiveness varies, so she wants to see if there are patterns in the children who respond better to treatment. “The advantage of our study is that we have all that life history,” she explains. “I think
this will be the most completely studied pediatric cohort in the history of CF.”

And it’s possible that Lai’s team will continue to follow these children into adolescence. “Phase III would be fascinating because they’re entering puberty, and that’s when many start to go into decline and when some start to develop CF-related diabetes,” Lai notes. There are many more questions to explore, “and a lot of the CF clinicians want to find out the answers,” she says.

**RESEARCH FOR BETTER LIVES**

Lai is delighted that her work has gone beyond peer-reviewed journals to influence clinical practice. “I am most proud of bringing people from different disciplines together — dietitians and nutritionists, biostatisticians, and traditional medical clinicians,” she says. “I have elevated the status of dietitians and nutritionists in CF care because my research points out the importance of nutritional management, and you can only achieve good nutritional management if you have expert clinical dietitians and nutritionists on your team. And I have actually changed how providers monitor nutritional status. Now BMI [body mass index] and weight-for-length at the 50th percentile is universally used as a benchmark in the care of CF patients, and that was all because of my studies.”

Then there are the families at the heart of her work. Parents will email Lai after discovering her research online or come up to her at conferences to tell her how much her work has meant to them. “Your findings answered my question about why this is happening to my baby,” one mom told her.

Among the grateful families are the Kibbels of Waupun, Wisconsin. This is the first time the family has participated in a research study, but they didn’t hesitate to sign up after their son, Easton, was diagnosed with CF in 2014.

Thankfully, 5-year-old Easton is doing well, especially since he started one of the newer CF medications in 2017. “He’s super healthy. He’s pancreatic sufficient [produces enough digestive enzymes], so that makes it easier,” says Easton’s mom, Dana Kibbel. “His pulmonary function has significantly increased, and it’s a progressive disease, so for that number to increase every time we go to the clinic is pretty amazing.”

The Kibbels’ oldest son, Cooper, who does not have CF, participated in the sibling study. “He thinks it’s cool to be involved, too,” Kibbel says. And most recently, their newborn, Krew, was also diagnosed with CF, giving them yet another reason to support research like Lai’s.

“How far they’ve come with CF research doesn’t come from researching normal kids — it’s because these CF patients and families are stepping forward and wanting to be part of this,” Kibbel says. “So we decided that this is what we want to do for the future of CF.”
Three key players in ongoing nitrogen fixation research at CALS — from left, agronomy professor Natalia de Leon, horticulture faculty associate Claudia Calderón, and bacteriology researcher Valentina Infante — are pictured (standing six feet apart) in an experimental corn plot at West Madison Agricultural Research Station.

Photo by Michael P. King
It’s a decades-long story — the quest to understand how certain plants form a fertilization partnership with bacteria. If harnessed correctly in cereal crops, this natural power can help feed a growing population without harming the environment. Critical chapters of the story have taken place at UW–Madison. Its principal characters have walked the halls of CALS. And the compelling tale is still unfolding.

By Eric Hamilton
But instead of high-pressure tanks of super-heated natural gas, they turned to nature’s chemical factories: plants. Scientists had recently discovered that legumes — peas, beans, alfalfa — partner with bacteria to fix nitrogen in their roots. This discovery set off a decades-long race to understand this vital alchemy and harness it to feed a growing population.

For more than a century, CALS scientists have played the parts of bacterial purveyors and biochemical sleuths, of mutant wranglers and slime whisperers, to unlock the secrets of nitrogen fixation. Today, UW remains a leader in understanding, applying, and expanding the potential for nitrogen fixation to improve agriculture worldwide.

In 1909, the German chemist Fritz Haber sparked an agricultural revolution. Using enormous pressures and high temperatures, he had learned how to efficiently transform nitrogen, so abundant in the air, into ammonia. Artificial fertilizer was born.

By converting atmospheric nitrogen into a form plants can use — a process known as “fixation” — Haber helped farmers make their fields vastly more productive. He was lauded for conjuring “bread from air.” Today, artificial fertilizers and their fixed nitrogen feed half the world’s population.

At the time of Haber’s invention, UW scientists were establishing the university as an epicenter of nitrogen-fixation research.
Future Crop

As you follow the curving road of the West Madison Agricultural Research Station toward the experimental plots, the corn catches your gaze. It looms several feet above the familiar, Midwestern corn planted nearby. Even though it’s October, this corn remains green while the other varieties have turned to yellow husks.

On closer inspection, the corn sports dense arrays of thick, red roots on its stalks, set at regular intervals above the ground. Clinging to these roots is a viscous, slime-like gel. This gel is the reason the corn is here in Madison, thousands of miles from its native Mexico.

“These aerial roots produce an insane amount of gel,” says Jean-Michel Ané, a professor of agronomy and bacteriology who has studied the special corn for years. “What we found is that gel is a good environment for nitrogen-fixing bacteria.”

In 2018, Ané and his partners at the University of California, Davis and Mars, Inc. announced that special varieties of corn from central Mexico can use this gel to fix nitrogen. The corn can acquire 30% to 80% of its nitrogen from bacteria in the gel. It was the first time that a grain crop — not a legume — was discovered that could acquire a significant amount of nitrogen from the air by partnering with bacteria.

At the West Madison research station, Ané and professor of agronomy Natalia de Leon MS’00, PhD’02 are testing dozens of varieties of this tropical corn to funnel into breeding programs. Their goal is to cross this nitrogen-fixation trait into elite varieties of corn adapted to different regions around the world. If high-yielding varieties of corn could produce even a fraction of their own nitrogen, it would have global benefits.

In wealthy countries, farmers can afford to apply large amounts of fertilizers to maximize their crop yields. But excess nutrients spill into waterways and promote the growth of algae that deplete oxygen in the water and kill animal life. As the Mississippi River funnels nitrogen from Midwestern corn fields every summer, it creates a low-oxygen “dead zone” in the Gulf of Mexico more than 7,000 square miles across.

In developing countries, access to fertilizers can be limited by either supply or price. The lack of fertilizer suppresses yield and hobbles profits. And the world spends about 1% of its total energy use — and creates an equal proportion of its greenhouse gases — just to produce nitrogen fertilizers using Haber’s original method.

“The benefits of nitrogen fixation [in corn] for developed countries, it’s really to develop an agriculture that’s more sustainable and less damaging to the environment,” says Ané. “And for developing countries, it’s a matter of increasing yield, because when they cannot have access to fertilizers, [a lack of] nitrogen is limiting their yield.”

Ané’s corn seed came from CIMMYT, a globally renowned plant breeding nonprofit based in Mexico that is dedicated to improving corn and wheat. CIMMYT and organizations like it source thousands of unique, local varieties of crops that can contribute new traits, such as pest or drought resistance, to high-yielding lines. Ané’s goal is to make his research — and any new seeds — widely available to improve agriculture broadly.

“I want to make sure everything I do is publicly accessible,” he says.

At the start of his career, Ané couldn’t have foreseen working with this unique corn. Like many nitrogen-fixation researchers over the decades, Ané hoped to engineer non-legumes to partner with nitrogen-fixing bacteria — the field’s holy grail. And he’s continued probing the genes that could make that possible, with some promise.

The century-long story of nitrogen-fixation research at UW–Madison and CALS includes a large cast of characters, many of whom are shown in a rough chronology of their contributions beginning here and continuing through p. 27.
But in other ways, his tenure on campus has followed a well-worn path. With one foot in bacteriology and another in agronomy, and his work with agronomist de Leon and others, Ané exemplifies perhaps the defining feature of nitrogen-fixation research at UW–Madison: cooperation.

**Fixated on Nitrogen Fixation**

“In this long history of nitrogen fixation here, there have been strong collaborations,” says Gary Roberts, professor emeritus of bacteriology, as he sits in the light-filled atrium of UW’s Microbial Sciences Building.

He would know. As one in a long line of researchers at CALS who probed the legume-bacteria partnership at the heart of nitrogen fixation, Roberts himself had strong collaborations, especially with biochemists.

That has been a common link. In CALS, the close association between the bacteriology and biochemistry departments — down the block from UW faculty members attend the groundbreaking of the Bacteriology Building for the College of Agriculture on July 27, 1953. Pictured are E. B. Fred, Elizabeth McCoy, H. L. Russell, E. M. Foster, O. N. Allen, J. L. Baldwin, W. D. Stoval, R. K. Froker, W. D. Frost, W. C. Frazier, K. B. Raper, C. A. Elvehjem, J. B. Wilson, P. W. Wilson, S. G. Knight, W. B. Sarles, and Noble Clark.

one another — drove the research forward faster than either department could have accomplished alone.

Much of that work began with Perry Wilson BS’28, PhD’32. Hired as an assistant professor in the Department of Agricultural Bacteriology in 1932, Wilson became an early pioneer in the biochemistry of nitrogen fixation, in part because of access to stable external grants before such funding was common. In his greenhouse attached to King Hall, Wilson investigated how different gases affect nitrogen fixation. He showed that carbon dioxide provides critical support for photosynthesis and that hydrogen gas inhibits the process.

Wilson went on to train Bob Burris MS’38, PhD’40, who earned a faculty appointment in biochemistry. By using a stable isotope of nitrogen to follow the process, Burris established that the Rhizobia bacteria behind fixation turned nitrogen in the air into ammonia — precisely the product of Haber’s industrial reaction that so electrified the world. Burris went on to isolate and probe the proteins at the heart of the bacteria’s nitrogen-fixing reactions.

“Almost every important biochemical advance [in nitrogen fixation] for 20 years, Burris’s lab either did it first or second,” says Roberts.

Those proteins that Burris studied collectively make up the heart of nitrogen fixation: nitrogenase. The enzyme used by bacteria to convert atmospheric nitrogen into ammonia, nitrogenase is the only known example in the biological world where inert nitrogen gas is converted into a form that plants can use. It’s a mercurial enzyme, requiring strict conditions and enormous sums of energy to function — a feature that led to winding but productive research careers.

Next door to Wilson’s lab, Winston Brill set up shop as a professor of bacteriology in 1968. Working in the evenings next to Wilson’s student, Bob Fisher MS’67, PhD’69, Brill pitched in by helping to isolate a mutant strain of bacteria that couldn’t fix nitrogen, which helped Fisher explore the biochemistry of the process.

“That’s how I sneaked up on the field,” says Brill, now a retired creativity consultant living in Washington state. “From then on, I think almost all of my research had to do with nitrogen fixation.”

Mutant bacteria became the Brill lab’s go-to method for piecing together the genes required for nitrogen fixation. With CALS bacteriologist Vinod Shah, Brill identified the active site of nitrogenase — where the alchemy takes place. Some of his other collaborations included faculty from the agronomy and entomology departments.

At one point, Brill’s lab isolated a mutant of Azotobacter. Another
nitrogen-fixing group, that excreted ammonia. They decided to test whether the mutant could provide enough nitrogen to help plants grow and settled on corn for their experiment.

The corn grew taller in the lab. “Under sterile conditions, it looked pretty neat. But we knew from working with Rhizobia that working in the soil is very different from working in a sterile flask,” says Brill. In field conditions, the growth gains vanished, which Brill says they expected.

Brill even looked at indigenous corn varieties, spotting one from Ecuador that looked to be incorporating fixed nitrogen. But when they didn’t see any improvement in growth in a lab experiment, they dropped the project. When Ané published his findings about nitrogen-fixing corn, Brill was floored, and he quickly offered his congratulations.

When Roberts secured his faculty appointment, he collaborated with biochemist Paul Ludden PhD’77 to study the active site of nitrogenase. They worked out how the metal-rich enzyme core was put together. And they studied how bacteria regulate nitrogen fixation, an energy-intensive process. “It’s so slow, and so expensive, that you don’t do it unless you really, really need to,” says Roberts.

Burris and Brill long ran a Monday journal club on nitrogen fixation that attracted campus researchers from bacteriology, biochemistry, horticulture, botany, and agronomy, furthering the kinds of collaborations that spurred the research along in CALS.

“[The seminar] was one of the highlights of my postdoctoral experience because we had expertise in all of these different aspects of symbiosis on campus,” says CALS Dean Kate VandenBosch, who trained in nitrogen fixation at UW–Madison as a postdoctoral researcher in the 1980s with Elden Newcomb. “It got me out of my silo and pushed me to understand other aspects of the science that had not been part of my training.”

With Newcomb, a professor of botany, VandenBosch researched the enzymes found within the nodules that nitrogen-fixing bacteria form on plant roots. They pioneered new ways to see specific proteins using high-powered microscopy, which provided a greater understanding of how the plant cooperates with bacteria to establish the partnership.

“Nitrogen fixation is a field that was very intellectually stimulating and brought a lot of people into the field for a variety of reasons,” says VandenBosch. “It’s the interplay of the compatibility interactions between Rhizobium and the plant and how they influence each other’s development to create this stable, beneficial interaction that is of economic significance.”

But with much of the key biochemistry and bacteriology worked out, and practical advances in agriculture hard to come by, much of the nitrogen fixation work shifted to investigating how plant genes govern the partnership between bacteria and host plant. As the 20th century closed, emphasis on plant genomic analysis increased, and research on nitrogen fixation and its potential to improve agriculture moved to other institutions.

That is, until Ané joined the university in 2004. The inclusion of nitrogen-fixing corn has further reinvigorated the line of research, enticed new researchers to the field, and reignited hopes for developing practical applications. A century ago, even before Perry Wilson began his work, that same spirit of optimism and practicality permeated the UW’s approach to nitrogen fixation.
Research Rooted in Helping Farmers

As knowledge of legumes’ useful partnership with microbes spread around the country at the turn of the 20th century, so did the need for the particular bacteria that make the partnership possible. While these microbes are widespread where beans or alfalfa have long been grown, they can be absent in other soils. Enter the inoculating culture.

At the end of the 19th century, companies began bottling and selling nitrogen-fixing bacteria to farmers to spread on their fields or coat their seeds. But poor understanding of microbial growth, confusion over the appropriate strains, and shoddy quality control often combined to make the effectiveness of these cultures suspect.

So in 1916, CALS scientists started growing cultures and supplying them, at cost, to farmers around the state. By 1925, UW was supplying more than 100,000 cultures a year, principally to alfalfa farmers. Private companies, weary of competing with the university, lobbied the state legislature to halt the university’s practice.

But a December 1924 article in The Capital Times reported that the university had persuaded legislators that their efforts to distribute high-quality cultures benefited the state’s farmers. “There were a lot of farmers that were pretty insistent that [the university] stay in it because they were confident in the UW product,” recalls Burris in an oral history.

By 1930, the U.S. Department of Agriculture valued all the country’s cultures, commercial and not-for-profit, at $1 million, equivalent to $15 million in 2020. Today, seed companies continue to provide inoculated seed to ensure robust crops of soybeans, alfalfa, and other legumes.

E. B. Fred led the charge to perfect and distribute inoculating cultures. As one of the first bacteriology professors on campus and dean of the College of Agriculture at the time (and eventually university president), Fred set the tone for the university’s century-long commitment to nitrogen fixation research.

In addition to his work advancing inoculating cultures, Fred turned his attention to organizing the ballooning field. He partnered with Ira Baldwin PhD’26, his successor as College of Agriculture dean, and bacteriologist Elizabeth McCoy BS’25, MS’26, PhD’29 to publish a mighty tome — 343 pages long — organizing all existing knowledge of nitrogen fixation in 1934, starting with the use of legume crop rotation in classical antiquity and ending with the latest advances in bacteriology and biochemistry.

Around the same time, Ethel Allen MS’30 trained with Fred, Baldwin, and Wilson as a research fellow in nitrogen fixation. Later, in the 1940s, she and her husband, O. N. Allen, joined the bacteriology department, where they published dozens of articles on nitrogen fixation. After her husband’s death in 1976, Ethel completed their magnum opus, an 830-page encyclopedic description of legumes and their partnership with nitrogen-fixing bacteria, published in 1981.

As women working in male-dominated fields, McCoy and Ethel Allen rarely received the attention that Fred did as future university president. Ethel spent much of her career working in her husband’s lab without pay, while McCoy received belittling news coverage despite achieving full professorship in 1942. But by their own accounts, both women felt welcome and accepted by their colleagues at UW. And McCoy advanced much of the early nitrogen-fixation bacteriology at UW. “[McCoy] just had an amazingly broad spread of information in all kinds of areas,” Burris recalls in an oral history. “She was a bacteriologist’s bacteriologist.” (For more about McCoy, see “The Sweeping Landscape of Her Work” in the spring 2020 issue of Grow.)
Fred went on to train Wilson, who continued UW’s line of nitrogen fixation research forward to today.

**A Corn (and Sorghum) Collaboration**

Out at the West Madison research fields, Natalia de Leon is in her second year supervising the breeding program with the nitrogen-fixing corn varieties from CIMMYT. Hints that cereal crops such as corn might be able to incorporate fixed nitrogen had swirled around her during her scientific career. But Ané’s confirmation that indigenous varieties exhibited robust fixation opened her eyes to new possibilities.

“I was shocked when I saw the numbers showing the amount of nitrogen that they were able to incorporate when the right conditions were provided,” says de Leon. “If this is something that can be consistently done, it could have a big impact.”

That impact could be even greater. Since demonstrating nitrogen fixation in corn, Ané has since spotted it in sorghum as well. A specialty crop in North America, sorghum is a foundational grain in the tropical world.

“These sorghum accessions also get a large amount of nitrogen from the air by the same mechanisms; and so, at this point, it’s not unique to corn,” says Ané, who recently received a $5.8 million grant from the Department of Energy to study sorghum nitrogen fixation along with Ophelia Venturelli, professor of biochemistry; Sushmita Roy, professor of biostatistics and medical informatics in the UW School of Medicine and Public Health; and Wilfred Vermerris, professor of microbiology and cell science at the University of Florida.

For the corn project, de Leon worked with horticulture faculty associate Claudia Calderón MS’09, PhD’10, researcher Valentina Infante, professor of agronomy Shawn Kaeppler BS’87, and other breeders to help Ané select new lines to test and to develop the breeding program at West Madison. In these early stages, the researchers are linking physical characteristics such as aerial roots to nitrogen fixation so they can track the trait during crosses.

For de Leon, this collaboration has generated fresh ideas for her existing projects and provided new opportunities to pursue. Producing the gel that fixes nitrogen requires wet conditions, which gives the staff in de Leon’s lab a new trait to study as they focus on environmental responses in corn. For this project, the group is concentrating heavily on corn germplasm from outside North America. If the breeding program could imbue these lines with the nitrogen-fixation trait, it would have a tremendous benefit for farmers in developing countries, says de Leon.

But perhaps the defining feature is the collaboration itself. “It goes all the way from very foundational biology to the very practical, like how do we find varieties of corn that express these traits the best, and how can we deploy them to places where it’d have a real impact on farmers’ fields,” says de Leon.

That means bringing bacteriologists and agronomists together. “We’re each learning to speak a different language,” says de Leon. “That has made it so much more enjoyable and meaningful.”
In late 2018, Ralph and Beth Aschenbrenner started hearing a lot of good things about growing industrial hemp. Hemp is an incredibly versatile plant, known for its strong fiber and nutrient-rich grain. It’s used in textiles, ropes, and building materials. It can be found in cooking oil, protein bars, and hemp milk. It’s also added to lotions and cosmetics.

But most of the buzz the Aschenbrenners heard centered on a more lucrative component of the crop: cannabidiol (CBD), a compound being marketed as a health-promoting nutraceutical for a wide range of medical conditions. CBD was the new “it” item, found in an expanding assortment of tinctures, lotions, and other products. And although they weren’t farmers, by early 2019, the Aschenbrenners were excited about giving hemp a go.

CALS and Extension experts are helping farmers find the best ways to grow and market a trendy crop as the industry makes its shaky but hopeful resurgence in Wisconsin.

By Nicole Miller MS’06

Above: Destined for research fields, young industrial hemp plants grow at the Wisconsin Crop Innovation Center in Middleton, Wis. Right: A combine harvests a field of industrial hemp at Arlington Agricultural Research Station in Arlington, Wis.
rope for the war effort. Market shifts largely halted hemp production in the 1950s. In 1970, the crop ended up listed as a Schedule I drug — alongside marijuana — in the federal Controlled Substances Act, even though hemp has very low levels (less than 0.3%) of tetrahydrocannabinol (THC), the psychoactive compound found in its cannabis cousin. In late 2017, after key changes to federal and state legislation, it once again became legal to grow industrial hemp in Wisconsin.

In 2018, around 135 growers gave it a try. In 2019, that number shot up to around 850, with the Aschenbrenners among the many hundreds of first-timers that year. The vast majority planned to grow CBD hemp, with their sights set on producing fields of female plants with high levels of CBD in their unpollinated flowers, where the non-psychoactive compound concentrates.

The Aschenbrenners applied for a grower’s license through the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) Industrial Hemp Research Pilot Program. Their plan was to grow CBD hemp and sell it to a CBD processor. They would grow hemp in Hobart for one year and then hand over the operation to their daughter to continue in the Madison area. Next came seed acquisitions and investments in new equipment to help them plant, harvest, and process their crop. They jumped right in. It was an invigorating time.

“I applied for a license about two weeks before the permit period ended,” recalls Ralph. “Then I talked to my daughter, Mary. She always likes to try new things, and she’s big into organic farming. [Eventually] she said, ‘Yeah, let’s do it.’”

The Aschenbrenners live on two-and-a-half acres in Hobart, Wisconsin, and they decided to expand their sizable vegetable garden to accommodate one-third of an acre of hemp. Mary, who lives in Madison, would drive up and help on weekends. They were excited to be marching in the new vanguard of Wisconsin hemp farmers. The crop had recently been legalized, a change in status that returned the state to its nearly forgotten agricultural roots.

Wisconsin’s first hemp crop was planted in 1908, and the state was a leading producer during World War II, when the plant’s fibers were used to make
rebuilding the state’s knowledge base of hemp agronomics and genetics, to better understand the crop’s modern market potential, and to share everything learned with growers.

“Our goal, as always, is to provide accurate advice on the best agricultural practices for Wisconsin’s hemp growers, with solid science behind our recommendations,” says project leader Rodrigo Werle, assistant professor and extension specialist in the Department of Agronomy.

The Aschenbrenners, along with hundreds of others, turned out for the program’s webinars, field days, and growers’ meetings. Each event drew huge crowds, and excitement thrummed through researchers and growers alike. It felt like the start of a grand adventure, a time to try new things and learn new things — and, for growers, to face the risks and rewards of entering a developing market.

Ultimately, it turned out to be a rough experience for many.

“It’s been exciting to work on a new crop,” says Werle. “However, it’s a challenging spot to be in right now, especially because a lot of people grew the crop thinking they were going to be able to sell it, and many couldn’t.”

A Necessary Network

Like the state’s hemp growers, UW–Madison experts jumped right in.

“We started with nothing in the spring of 2019,” says horticulture assistant professor Shelby Ellison BS’06, who manages the UW hemp program’s CBD hemp efforts. “None of us had any formal training in hemp or cannabis. It’s crazy how many connections we developed and how much we learned in such a short period of time.”

The UW’s hemp program includes more than a dozen CALS faculty members with joint appointments in Extension — from agronomy, horticulture, soil science, plant pathology, biological systems engineering, and agricultural and applied economics — as well as Extension educators in three counties. Together, they set out to explore a long list of questions related to hemp grown for CBD, grain, and fiber in the context of conventional and organic systems. The overall effort involves research and outreach as well as a new UW undergraduate course on hemp.

At the outset, however, the fledgling program needed the help of others. The Wisconsin Idea thrives on partnerships, support from committed
stakeholders, and a two-way flow of information, and this was a situation where outside expertise and support made all the difference.

Early on, the program was bolstered by a gift from Tim Erdman, of Erdman Factory and Farms, which provided additional support for research, outreach, and program staffing. At the time, Erdman was preparing for his first foray into the field to grow CBD hemp, and he was interested in exploring how to apply his resources to further the budding industry in Wisconsin.

“I would like Wisconsin to be a leader in hemp again, as we were in the past,” says Erdman, whose hemp business now focuses on seed improvement and production. “After meeting with the folks at the Wisconsin Crop Innovation Center and talking with Dean Kate VandenBosch, I was impressed enough with the college’s unique capabilities to decide to contribute to the efforts.”

Throughout the 2019 season, but especially early on, the UW team relied on professors and hemp growers from other states as well as Wisconsin’s own 2018 hemp growers to serve as expert panelists at their outreach events and to help guide the development of their first-year field trials. One of them was Brian Parr, an agronomist at Legacy Hemp, LLC.

“Brian Parr experimented with the crop for a year before we started,” says Werle, who oversees the program’s fiber- and grain-focused efforts. “I think we would have made a lot of mistakes if we didn’t have recommendations from him.”

Due to some language in Wisconsin’s hemp law, known as Act 100, the UW’s hemp outreach events turned out to be critical networking opportunities. They provided one of the only ways for hemp growers and processors to find each other.

“To protect the identities and field locations of growers against potential theft, there was a confidentiality clause in Act 100 that prevented DATCP from sharing information about the state’s growers and processors,” says Rob Richard, president of the Wisconsin Hemp Alliance. “Because of that, the UW has been a key clearinghouse to connect growers with each other.”

Not surprisingly, in-person events drew significant crowds, between 300 and 400 for the big field days and grower meetings. And similar numbers participated in the early-season webinars.

“It’s really remarkable how many people participated in our programming,” recalls Ellison. “It was thousands and thousands of people through all of the events that we did.”

First Field Trials

As data from the UW’s various field trials came in, hemp program researchers started sharing their initial results. A major concern of CBD hemp growers in Wisconsin — and across the nation — has to do with THC levels. If the THC concentration of a hemp plant rises above the legal limit of 0.3% dry weight — in other words, if the plant “goes hot” — federal law says a grower’s entire field must be destroyed. Understandably, growers want to know: What varieties tend to go hot? What management practices contribute to this? At the start of the season, there was particular suspicion that nitrogen fertilizer could drive up THC levels.

To that end, Ellison conducted a CBD hemp variety trial, looking at three nitrogen application levels. Plant samples were analyzed at the Wisconsin Crop Innovation Center (WCIC) on a high-performance liquid chromatography system, a machine that Erdman donated to the college — in addition to his general program gift — to help facilitate testing of THC, CBD, and other cannabinoids.

Some of the UW research plants tested hot, and THC remained a problem for Wisconsin growers. Across the state, around 15% of the crop had to be destroyed. (Other states fared worse: In Arizona, around 40% of the crop was destroyed.)

UW researchers found that nitrogen didn’t seem to cause problems. Instead, going hot was more about the variety — the specific genetics — of the plant.

“There are very clear differences on what performs well in the Midwest,” says Ellison. “I only ran six varieties [in 2019] but I also have this big network of people that I know. So I have information about
what grows well, more or less, as well as what grows poorly or is very likely to go hot.”

On the fiber and grain side of things, where THC is less of a concern, Werle’s team — in collaboration with teams led by agronomy professor Shawn Conley BS’96, MS’99, PhD’01 and soil science professor Carrie Laboski — conducted an agronomic study assessing planting densities and fertilizer rates using varieties known as X-59 and CRS-1. They were also involved in a multi-state trial of 15 varieties from Europe and Canada, running the trial at two locations in the state with support from Extension educators on the hemp team and Arlington Agricultural Research Station staff.

“The goal was to see how well they do in different environments,” says Haleigh Ortmeier-Clarke, an agronomy graduate student in both Werle’s and Conley’s labs. “There’s a lot of variation in our data, which we kind of expected. Some varieties are going to do well in the Wisconsin climate, and some aren’t.”

The UW hemp team produced many other helpful initial findings related to weed and pest management options, mechanical harvest technology, and how hemp fits into organic grain production systems. These efforts set the stage for ongoing research in 2020 and beyond.

**Feral and Red Fluorescent**

The U.S. hemp industry is looking for a permanent solution to the THC problem. Many of the crops that go hot are just barely over the THC limit. There’s a widespread push to ask the federal government to increase the current THC maximum level of 0.3% — which many see as arbitrary and unnecessarily low — up to 1%. But no one is holding their breath for that. At the same time, the industry is asking for improved varieties that reliably stay under the THC threshold.

“Exceeding the THC limit is a major risk factor for growers,” says Doug Reinemann BS’80, MS’83, associate dean for outreach and extension for CALS. “The biggest need — the place where the UW can make a significant contribution — is the plant genetics, the plant breeding to develop certified seed stock that is going to perform reliably.”

To that end, Ellison spent some of her time during 2019 gathering “feral hemp” from Wisconsin’s roadsides and field edges. These are wild survivors from back when hemp was widely grown in the state, plants that have survived unintended for decades and are adapted to Wisconsin’s climate and soil types. Ellison plans to share seeds from these plants with the new hemp seed bank being established by the USDA, and they will be a part of the UW’s program to support traditional plant breeding efforts to improve hemp for Wisconsin and the Midwest.
Another group of CALS researchers is making swift progress trying a different tack — genetic engineering — to improve hemp. Last year, CALS researchers at the WCIC inserted the gene for red fluorescent protein (RFP) into a hemp plant’s genome. The resultant plants, when viewed through a green filter, glow a striking poinsettia red.

The WCIC team believes this proof-of-concept experiment was the first successful genetic engineering of hemp. The hemp cells transformed at WCIC grew into fully fertile plants that were able to pass along the RFP gene to their progeny. At the time, other scientific teams had only been able to coax their transformed cells to grow into roots or clumps of cells.

“I scoured the literature — public universities and private companies — and can’t find evidence that anyone has done what WCIC has done,” says Mike Petersen BS’87, WCIC’s associate director.

WCIC staff have filed a patent for the technology through the Wisconsin Alumni Research Foundation, and they are eager to work with researchers from public and private institutions on projects to improve hemp through genetic engineering and gene editing.

“Subsequent efforts would create plants with traits that could be of value to Wisconsin’s farmers, such as THC-free hemp, high-CBD hemp, better disease resistance, better fiber, and more,” says Petersen. To explore these and other traits and engineer improvements in hemp, the WCIC was recently awarded a grant from the Wisconsin Alumni Research Foundation Accelerator Program.

**An Uncertain Market Forecast**

Despite various challenges, many Wisconsin growers who planted CBD hemp managed to produce a beautiful crop. But that didn’t guarantee financial success; unfortunately, the vast majority couldn’t find a buyer.

Compared to other states, Wisconsin’s market is still in its infancy, so there aren’t many processors or businesses buying hemp or hemp products. That infrastructure is being developed on the fly.

“Wisconsin is behind, way behind,” says Paul Mitchell, professor and extension specialist in the Department of Agricultural and Applied Economics.

“There are at least 14 states that have more years of experience than us in hemp production.”

As part of the UW hemp team, Mitchell’s role is to assess the economic and market potential of hemp for Wisconsin and share that information widely with the state’s growers, processors, lenders, and businesses. His goal is to paint an accurate economic picture of what people can expect in the
short-term as well as factors that may influence long-term profitability.

It’s not a pretty picture right now.

Over the course of the 2019 growing season, the price for CBD hemp (raw biomass) dropped by around 70%. This was caused by a huge shift in the supply-and-demand equation that year. As Mitchell explains it, the value of the current CBD market in the United States is around $4 billion per year. At that level, only 20,000 acres of CBD hemp are needed. In 2019, however, U.S. growers planted around 115,000 acres, saturating the market.

There are some notes of optimism for the future, however, for those who can take the long view. In particular, there are some if-then scenarios that could lead to more hemp being grown on the landscape — in Wisconsin and around the nation. Two big ones are predicated on changes to current federal regulations.

Right now, hemp grain cannot be used as animal feed. If the U.S. Department of Agriculture were to OK this use, the market for grain would expand significantly.

Along the same lines, it’s currently illegal to add CBD to food products; it must be treated as an unregulated supplement. If the U.S. Food and Drug Administration (FDA) were to give CBD official “generally recognized as safe,” or GRAS, status, it could lead to a huge surge in consumer food and beverage products that feature CBD.

“Coca-Cola isn’t going to release a CBD product until the FDA gives them the OK to do so,” says Ellison. “[If they do], that will drastically affect the market.”

In the meantime, Wisconsin has a number of comparative advantages that should help bolster the state’s burgeoning hemp market. The state is a leading producer of numerous specialty crops, such as potato, cranberry, sweet corn, green beans, and ginseng. It’s also strong in food processing and a leader in organics. All of these things give Wisconsin an edge.

“I know we can catch up if we want to,” says Mitchell. “We can add hemp to our list of specialty crops. We’re going to see small companies developing successful products for local and regional markets. But we’ve got a lot of work to do yet. This isn’t going to happen without a lot of people putting in a lot of work.”

**Hemp Hope Sprouts Eternal**

In spring 2019, the Aschenbrenners started with 600 CBD hemp plants. After a relentlessly wet spring, they planted at the earliest opportunity. It turned out to be an unseasonably hot and dry weekend, and the plants struggled. The 500 or so survivors were later laid flat by a massive windstorm. Ralph and Beth meticulously worked their way through the field, loosening the soil around the roots and righting each plant, one by one.

Later in the season, two different fungi attacked the crop.

To help them contend with these and other issues, the Aschenbrenners attended a handful of UW hemp events over the course of the season. They also utilized the recommendations and services of a private agronomics company.

“There were times when I thought it wasn’t doing very well, but the crop actually turned out pretty decent at the very end,” says Ralph Aschenbrenner.
At harvest time, they hired a few locals through Craigslist to help bring in their crop of 450 plants, and various family members worked side by side to destem, trim, and start drying the hemp flowers. They ended up with a fabulous haul — 257 pounds of dried hemp flowers with an impressive 11.8% CBD, ready for processing. But no buyer.

“We couldn’t find a processor,” says Beth Aschenbrenner. “Those that would take it were charging so much, and then they’d give [the hemp oil or purified CBD extract] back to you, and you’d have to sell it yourself.”

In December, Beth and Ralph attended a UW-hosted hemp growers meeting to assess their options. They ended up buying a press from the Oil Press Company of Mondovia, Wisconsin, after meeting the company’s owners at the event.

And they kept moving forward with their plan. In spring 2020, Mary took the equipment and planted 800 CBD hemp plants near Madison. At the same time, she also took possession of the previous year’s Hobart harvest to press, package, and market. They plan to sell bottles of hemp oil to family and friends and go from there.

“There are a lot of people that are stepping out of the farming industry. Mary wants to get in, and we want to help and support her as much as we can,” says Ralph. “We want to ensure she has a whole wealth of knowledge of how things work, in case she ever wants to scale up. Hopefully, one day, she can start her own little organic farm of some sort. Maybe it’s not all hemp. Maybe it’s a mix of things.”

The Aschenbrenners aren’t the only folks who didn’t give up on hemp. In 2020, DATCP received 1,510 applications for grower licenses, virtually the same number as in 2019. Around half were for repeat growers and half for first-timers. Given the difficult market situation, it shows a surprising level of continued interest and commitment.

“The folks I talked with this year, they are planting hemp because they feel they can do a better job, have a higher-quality product, and use less labor,” says Ellison. “They want to continue to get skills and experiences growing hemp. And folks this year are planting at a much smaller scale, so there’s not as much risk.”

The UW hemp program is also marching forward while following new safety guidelines in response to the coronavirus pandemic. The team has created online resources and digital materials for outreach (visit go.wisc.edu/hemp), and they’ve repeated many of the program’s field studies — with physical distancing. Ellison’s CBD hemp variety trial expanded to 44 varieties, so there will be more information to share in the near future.

“There will be a lot of resources that will come out of what we are doing this summer,” says Ellison. “All of our recommendations will carry more weight after a second year of data collection.”

As the hemp industry develops in Wisconsin, the UW hemp program will continue its work and keep adapting to the interests and needs of the state’s growers.

“For now, I would recommend people plant very small acreage,” Ellison says. “Just focus on learning how to grow it until the FDA and USDA decide what’s going to happen.”

And Werle suggests avoiding costly errors by leaving the experimentation to UW. “Let us make the mistakes in the research plots,” he suggests. “Let us learn what works, and what doesn’t, in our environment.”

Wisconsin’s hopeful and persistent hemp growers can take it from there.
At the Center of the COVID-19 Response

As a CDC scientist, Christina Carlson uses her cellular and molecular biology expertise to help manage the coronavirus pandemic.

While most of us have been doing our best to avoid contact with the novel coronavirus, Christina Carlson MS’08, PhD’13 has been in the thick of it. As a Laboratory Leadership Service (LLS) fellow for the Centers for Disease Control and Prevention (CDC), she’s been working on the front lines of the COVID-19 pandemic.

Carlson grew up in Balsam Lake, Wisconsin, and those small-town, rural roots influenced her interest in science. “I spent a lot of time outdoors and developed an early and lasting fascination with nearly every aspect of the natural world,” she says.

As an undergraduate, Carlson attended the University of Wisconsin–Stevens Point, where she discovered her true passion: cellular and molecular biology. She continued exploring the field with master’s and doctoral degrees from CALS and a UW master’s degree in public health.

It was during her time at UW that Carlson first encountered the CDC program she would eventually join. She was captivated by the work they performed — from emergency outbreak response and surveillance to technical assistance and support.

“I couldn’t help but imagine how rewarding it might be to someday apply my scientific knowledge and skills to positively impact human health on a population-wide level, within and beyond the laboratory,” Carlson says. Fittingly, that is exactly what she’s up to now.

Carlson began her tenure as an LLS fellow in 2018 at the Malaria Laboratory Research and Development Unit at CDC headquarters in Atlanta, Georgia. When the COVID-19 pandemic reached the United States, her focus switched to the coronavirus. She was deployed three times — to California, Illinois, and Washington State — to provide laboratory operations and overall support during the missions.

“I served as the laboratory team lead,” Carlson says. “While the title remained the same, the missions and responsibilities were different for each deployment.”

In California, Carlson worked with around 200 individuals who arrived from Wuhan, China, at the end of January. She helped coordinate the collection, transport, processing, shipping, and testing of specimens they provided. While she was there, the U.S. Department of Health and Human Services ordered the first mandatory federal quarantine on U.S. soil in more than 50 years.

In March, the CDC sent Carlson to Chicago, where she and her team performed contact tracing in response to COVID-19 cases associated with travel. She conducted risk assessments for health care workers and made recommendations about work restrictions. After only four days — the COVID-19 situation was constantly in flux — they headed to Washington state, where cases were on the rise. There, through the end of March, they provided field epidemiology and laboratory support for the Seattle & King County and Washington State departments of health as they investigated COVID-19 outbreaks in nursing and long-term care facilities.

“I found outbreak response work to be simultaneously the most rewarding, frustrating, and humbling work I’ve ever tackled,” Carlson says. “Response work sometimes feels small and minimally impactful. But those small improvements can build incrementally into greater public health impacts over time.”

Carlson recalls lessons from her time as a student at CALS that still influence her today. For instance, her Ph.D. thesis advisor, soil science professor Joel Pedersen, regularly pushed her to think beyond sometimes rigid biological perspectives, she says. This helped her learn how to adapt to unfamiliar and complex situations — a skill she put to good use during her COVID-19 deployments.

“Christina was an exceptional student — highly motivated, articulate, intelligent, and conscientious,” Pedersen says. “She exercised good judgment in the interpretation of her results, and in evaluating the work of others.”

Carlson plans to stay with the CDC to support the COVID-19 response. And when her work there is done, she hopes to continue as a public health laboratory scientist, in part due to the inspiration of her recent experiences.

“As much as my COVID-19 deployment experiences have forced me to face difficult truths and tragedies,” Carlson says, “they have also left me with an unexpected sense of optimism about the world around me.”

—Jori Skalitzky BSx’22

Left: Christina Carlson at the World Health Organization headquarters in Geneva, Switzerland, where she spent two months consulting as part of her Centers for Disease Control and Prevention fellowship.
When the coronavirus pandemic started disrupting the nation’s meat supply chains in spring, UW–Madison’s swine program soon found itself among the affected operations. With roughly 1,500 pigs housed at Arlington Agricultural Research Station, the swine program conducts nutritional studies that support the hog industry in Wisconsin and the Midwest. When the pigs reach market weight, they are typically sent to harvest at the Tyson Fresh Meats plant in Waterloo, Iowa. But the coronavirus quickly changed all that.

The Tyson plant, dealing with worker shortages and a shutdown due to COVID-19 infections, couldn’t take the university’s hogs. Meanwhile, the demand for meat products at grocery stores and food pantries was rising.

“I made the case that we have animal processing capability and cooler space at the Meat Science and Muscle Biology Laboratory,” explains Jamie Reichert, manager at Arlington station’s swine facility. “So let’s process our pigs that have nowhere to go and help supply meat to our community. Let’s be part of the solution here.”

And a great solution did arise — through a bit of serendipity and a key partnership.

During a virtual meeting about the upcoming opening of the new Meat Science and Animal Biologics Discovery Building on campus, Jeff Sindelar, professor and extension meat specialist in the Department of Animal and Dairy Sciences, happened to mention the university’s surplus hog situation. Also on the call was Al Gunderson BS’77, MS’79, vice president of Vita Plus, a Madison-based animal feed and technology company.

“After the call, Al independently reached out to us,” says Sindelar. “He said, ‘Hey, we’ve got this new Vita Plus Serving Customers and Rural Communities Project, and I think it may have good alignment [with your goals].’”

The purpose of the Vita Plus project, launched in April with a $100,000 commitment, is to purchase dairy, beef, and pork products directly from producers and contribute them to local food pantries, school programs, and other local food security efforts.

Not long after the meeting, a partnership began, and a process was put in place to have Reichert and animal and dairy sciences department staff safely harvest surplus hogs at the Meat Science and Muscle Biology Laboratory. Gunderson recruited Jerry Stoddard of Stoddard’s Meat Market in Cottage Grove to pick up the carcasses and turn them into familiar cuts, such as chops, roasts, ribs, brats, and sausage. Vita Plus employees drove the finished frozen pork products to area food banks, and the company’s Serving Customers and Rural Communities Project helped cover the costs of the meat and processing.

“It’s wonderful to have this pork that was in jeopardy of not being utilized go to people who need it and help the community,” says Gunderson, a graduate of the university’s meat and animal science program and a recipient of one of the 2020 CALS Honorary Recognition Awards.

The department provided around 8,700 pounds of meat to more than a dozen area food banks through the Vita Plus partnership. For the pantries receiving the pork, it was a welcome gift.

“We serve the elderly, young families, the sick, people who’ve experienced some kind of crisis — anybody,” says Ruth Ann Waugh, volunteer coordinator of the Poynette Area Community Food Pantry.

“Many people do receive some kind of [government] assistance, but we are that fill-in. When their shelves get low, we’re right there to help. And pork is something we don’t always have, so this was an awesome donation.”

—Nicole Miller MS’06

Using the advanced facilities and equipment at the new Meat Science and Animal Biologics Discovery Building, faculty and staff will train current and future meat industry leaders and find ways to enhance animal and human health. To support these programs with a gift, visit supportuw.org/giveto/meatsciencebuilding or contact Henry Lagrimini at henry.lagrimini@supportuw.org or 608-308-5375.

nextSteps

SAVE THE DATE for the next CALS Honorary Recognition Banquet and Ceremony. To protect the health and safety of the CALS community during the coronavirus pandemic, the 2020 ceremony has been postponed. But award winners will still receive the pomp and circumstance they deserve on the rescheduled date of Thursday, Oct. 21, 2021. See you there!
Cheese is good.

Free cheese is even better. Ace our Final Exam, and you could win a whole box of it! Test your knowledge at grow.cals.wisc.edu.
We are so proud … to call you our alumni. Last spring, we saw firsthand how you take on a challenge. You face it. You adapt. You persevere. We thank you, CALS 2020 grads, for your flexibility, your fortitude, and your grace under pressure. Nothing can stop you now. 
ONE FIELD, MANY FACES

The Department of Entomology recently unveiled a series of posters, on display in Russell Laboratories, that highlights a diverse array of scientists from throughout the department’s history. The project was spearheaded by graduate students Skye Harnsberger, Jade Kochanski BS’16, MS’20, Liz Kozik (who provided the illustrations), Taylor Tai, and Jacki Whisenant. View all of the posters at go.wisc.edu/diverse-entomology.