

grow

Wisconsin's Magazine for the Life Sciences • Spring 2016

food systems • health • bioenergy • environment • climate • communities

Concussion

*Shedding
light on
the inner
workings
of traumatic
brain injury*



College of Agricultural & Life Sciences
UNIVERSITY OF WISCONSIN-MADISON

BIRD ATLAS UPDATED • TRIBAL TEENS TELL THEIR STORIES • A NEW TOOL TO FIGHT CANCER?



Birding with a purpose:
Citizens provide data for Wisconsin's new
Breeding Bird Atlas. Story on page 22.



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Wisconsin's Magazine for the Life Sciences

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Dean Kate VandenBosch

Addressing Our Food Future



In December, I was invited to attend a meeting hosted by the White House's Office of Science and Technology Policy focused on "Raising the Profile of Agriculture." Leaders from across industry, education and government gathered to consider the increased demand for food as earth's changing climate exacerbates constraints imposed by soil loss, pest and pathogen damage, and land and water availability. These are big issues that tax the imagination. It is one thing to say the oft-repeated phrase "feeding nine billion people," but it is another to fully comprehend the many hurdles related to that challenge.

The leaders I spoke with in Washington agreed that meeting this challenge will require creative, environmentally mindful solutions and new agricultural technologies. It is clear that our ability to develop these innovations relies on agricultural research and education and also our ability to recruit science, technology, engineering and math (STEM) graduates into the agricultural workforce.

Pair this with results of a recent public opinion survey conducted by Dominique Brossard and Dietram Scheufele in the Department of Life Sciences Communication that showed Wisconsin residents discuss food and related topics with others more frequently than they discuss public affairs or science topics, and we have an enormous opportunity. If we can leverage public interest in our food future to strengthen emerging collaborations

"Meeting this challenge will require creative, environmentally mindful solutions and new agricultural technologies."

between industry, government agencies and universities, we can develop novel solutions necessary to meet these demands.

The University of Wisconsin–Madison, and our college in particular, are perfectly suited to advance this issue. I am proud to report that a number of UW–Madison colleagues also participated in the White House meeting—Bill Tracy, professor and chair of agronomy, Julie Dawson, assistant professor of horticulture, Ben Miller, director of federal relations, and Heidi Zoerb, associate dean for external relations in CALS. Our alumni also hold significant positions of influence throughout industry and government, including the Office of Science and Technology Policy.

This year, thanks to the generosity of donors to the college's annual fund, we are expanding efforts to interest pre-college students in agriculture-related studies and launching a three-course series for undergraduates on food systems. These are only two of many ways we are working to address these important issues.

The challenges are daunting, but the opportunities are significant. I am excited to see the solutions our students, faculty, staff and graduates develop to meet these demands.

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Editor
Joan Fischer

Writers
Nicole Miller MS'06
Caroline Schneider MS'11

Editorial Assistants
Rebecca Bock, Victoria Khoo, Jacob Knudtson

Design
Diane Doering

Photography/Multimedia
Sevie Kenyon BS'80 MS'06
Uncredited photos are either stock or nonprofessional photography

CALS ADMINISTRATION

Kate VandenBosch, Dean and Director

Richard Straub, Senior Associate Dean

Sarah Pfatteicher, Associate Dean for Academic Affairs

Rick Lindroth, Associate Dean for Research

John Schutske, Associate Dean for Extension and Outreach

Heidi Zoerb, Associate Dean for External Relations and Advancement

INTERACTING WITH CALS Alumni:

Office of External Relations,
1450 Linden Drive, Madison,
WI 53706
Phone: (608) 262-1461
Email: alumni@cals.wisc.edu
www.cals.wisc.edu/alumni/

Prospective students:

Office of Academic Affairs, 1450
Linden Drive, Madison, WI 53706
Phone: (608) 262-3003
Email: undergrads@cals.wisc.edu
www.cals.wisc.edu/students/

Business contacts:

Office of Corporate Relations,
455 Science Drive, Suite 230,
Madison, WI 53711
Phone: (608) 263-2840
Email: inquiries@ocr.wisc.edu
www.ocr.wisc.edu

To make a gift to CALS:

Kate Bahr, UW Foundation,
1848 University Ave., Madison, WI
53726-4090
Phone: (608) 308-5120
Email: kate.bahr@supportuw.org
www.supportuw.org

To contact the magazine:

Grow Editor, 136 Agricultural Hall,
1450 Linden Drive, Madison, WI 53706
Email: grow@cals.wisc.edu
www.grow.cals.wisc.edu



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On Henry Mall

News from around the college

A New Tool to Fight Cancer?

Biochemist Ron Raines and colleagues are developing an enzyme that identifies and destroys cancer cells

A study involving CALS researchers has linked two seemingly unrelated cancer treatments that are both being tested in clinical trials. One treatment is a vaccine that targets a structure on the outside of cancer cells. The other is a slightly altered human enzyme that breaks apart RNA and causes the cell to self-destruct.

The new understanding could help both approaches, says biochemistry professor Ronald Raines, who has long studied ribonucleases—enzymes that break apart RNA, a messenger with multiple roles inside the cell. In 1998, he discovered how to alter one ribonuclease to avoid its deactivation in the body. Soon thereafter, he found that the engineered ribonuclease was more toxic to cancer cells than to others.

Raines patented the advance through the Wisconsin Alumni Research Foundation (WARF) and, with fellow CALS biochemist Laura Kiessling, co-founded Quintessence Biosciences in Madison. They remain shareholders in the firm, which has licensed the patent from WARF and begun early-phase human trials with the ribonuclease at the UW Carbone Cancer Center and MD Anderson Cancer Center in Houston.

The current study began as an effort to figure out why the ribonuclease was selective for cancer cells. To identify which structure on the cell surface helped it enter the cell, Raines screened 264 structures using a specially designed chip. The winner was a carbohydrate called Globo H.

“We were surprised—delighted!—to see that, because we already knew that Globo H is an antigen that is abundant in many tumors,” says Raines. Antigens are molecules with structures that are recognizable to proteins called antibodies. “Globo H is under development as the basis for a vaccine that will teach the immune system to recognize and kill cancer cells,” he says.

Working with Samuel Danishefsky, who solved the difficult problem of synthesizing Globo H at the Memorial Sloan-Kettering Cancer Center in



Biochemistry professor Ron Raines is devising new ways to destroy cancer cells.

New York, Raines found that reducing the Globo H display on their surface made breast cancer cells less vulnerable to ribonucleases like those that Quintessence is testing. “This was exciting, as we now have a much clearer idea of how our drug candidate is working,” says Raines.

CALS biochemistry professor John Markley aided the research with studies of the structure of the molecules in question.

The picture that emerges from their work is of ribonucleases patrolling our bodies, looking for signs of cancer cells, Raines says: “We are working to demonstrate this surveillance more clearly in mice.”

As other scientists test whether using a vaccine will start an immune attack on Globo H, Raines says, “We are probing a different type of immunity. This innate immunity does not involve the immune system. It’s a way for our bodies to fight cancer without using white blood cells or antibodies—just an enzyme and a carbohydrate.”

—DAVID J. TENENBAUM

A Portrait of Hmong in Wisconsin

A report from CALS highlights the status of Hmong in the Badger State—and serves as a valuable resource for communities in which they live

The population of Hmong in Wisconsin is still growing, but more slowly than in the 1990s—and, as of 2010, most Hmong living in Wisconsin were born in the United States. While the 1990s saw a significant reduction in poverty among Hmong, they made fewer gains in this century's first decade. Nearly one in five Hmong remain below the poverty level.

These are some findings recently published in *Hmong in Wisconsin: A Statistical Overview*, a report by the UW–Extension/CALS-based Applied Population Laboratory, drawing upon data from the U.S. Census, the American Community Survey and Wisconsin state health and public instruction agencies.

The report provides valuable information for state and local agencies, educators and other organizations that work with Hmong in Wisconsin, notes Dan Veroff, a UW–Extension demographic specialist and report co-author.

“It provides a broad range of data to both contextualize and understand the assets and needs of Hmong communities,” says Veroff. “Information in the report has been used to design educational programs, improve services for Hmong communities, apply for grants, and set the table for more focused outreach or research.”

One example comes from Yang Sao Xiong, who joined UW–Madison in 2013 as the first tenure-track faculty member in Hmong American Studies. Xiong notes that the high percentage of Hmong K–12 students (including those born in the U.S.) who are classified as limited English proficient, or LEP, is “alarming”: “It is likely that in some Wisconsin counties and school districts, Hmong students are over-identified as LEP students.” Making those circumstances publicly visible in a report is important for encouraging further investigation, he says.

Other findings include:

- The 2010 U.S. Census reported that some 47,000 Hmong live in Wisconsin, the state with the third-largest Hmong population, after California and Minnesota.

- The Hmong population is concentrated in a handful of counties. Milwaukee County has almost twice the Hmong population of the second-highest county, Marathon.

- The percentage of Hmong who speak English at home more than doubled between 2000 and 2010.

- Labor force participation and educational attainment both improved significantly for the Hmong between 2000 and 2006–2010. However, the recession appears to have attenuated some of the potential economic gains that might have occurred otherwise.

—JOAN FISCHER

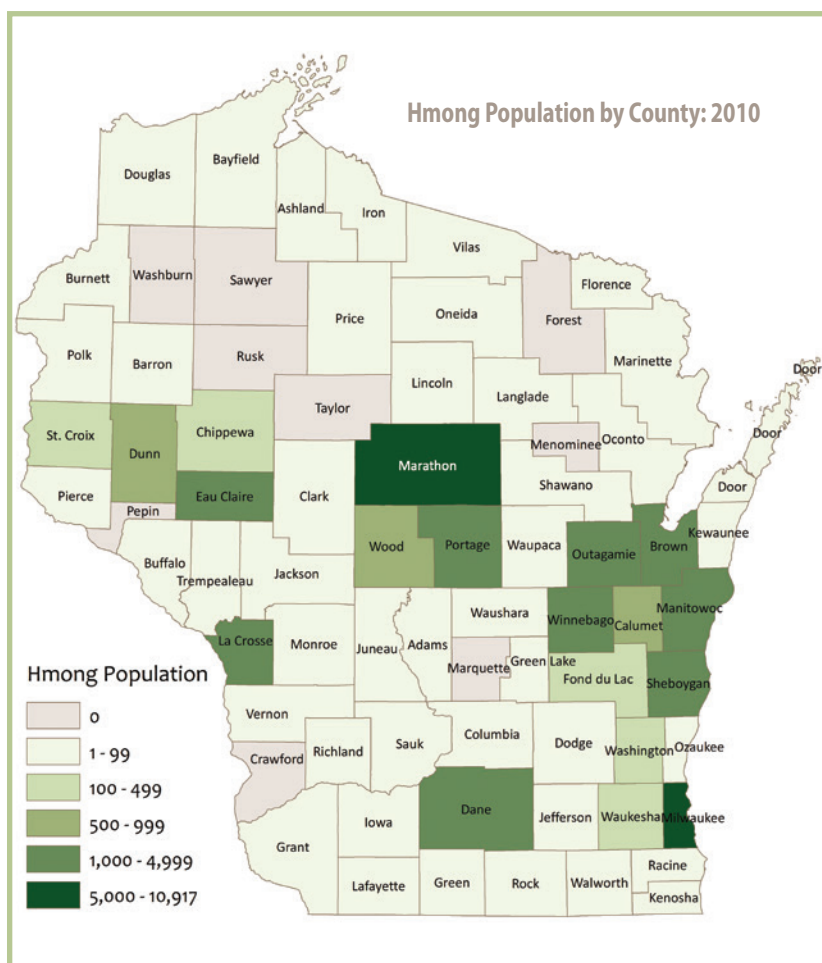


IMAGE PROVIDED BY UW-MADISON APPLIED POPULATION LABORATORY

The report is available for viewing or downloading at http://www.apl.wisc.edu/publications/hmong_chartbook_2010.pdf

New Frontiers for No-Till

A cost-efficient, less environmentally disruptive way of planting is proving effective with the heavy soils of central Wisconsin

When Jason Cavadini, assistant superintendent of the CALS-based Marshfield Agricultural Research Station, first started working at the station in spring 2013, he was told that no-till wouldn't work in the area, with its heavy, poorly drained soils. But he still wanted to give it a try.

"Here in central Wisconsin, a big concern is, what do we do with the water? How do we get it to drain better? If no-till allows the soil to do that naturally, in our opinion it's the best way," says Cavadini. His interest in the method stems from experience on his family's farm near La Crosse, where they have successfully used no-till planting for nearly 20 years.

Conventional tillage often involves turning and pulverizing the soil before planting with multiple passes of a tractor to chisel-plow, disk and smooth out the field. There are many advantages to this approach, including setting back weeds, helping the soil to dry and ensuring good seed-to-soil contact. However, it's also fraught with issues such as soil compaction and erosion.

No-till, on the other hand, involves the use of a planter that seeds directly into the soil without the complete disruption and inversion of the surface. This alternative option, which has been shown to work well in other areas with other soil types, has reduced environmental impacts and helps build long-term soil structure. There's also an economic benefit. "Fewer trips across the field with equipment means less fuel used," notes Cavadini. "We have cut fuel usage and labor associated with spring planting by more than 50 percent since implementing no-till."

Making the switch to no-till, however, involves some trial and error. Cavadini thought, "What better place to give it a try than the Marshfield station?"

"We started a group we're calling Central Wisconsin No-Tillers," Cavadini says. "We set a planter here on the station with different combinations of no-till tools. After we finished planting in the spring of 2014, we invited people to the station and told them what we found with our research planter. About 10 farmers showed up, but it was a

very productive meeting, and we tried to address things that they were questioning."

When Cavadini held a meeting for the group the following year, 46 farmers appeared.

So far, the no-till approach is working well at Marshfield, and the research station has expanded its use to include more crops. Corn was the starting point—"We experienced some of our highest corn yields ever on the station this year in no-till fields," notes Cavadini—and now about 80 percent of the station's plantings are done with no-till, including soybeans, wheat and alfalfa.

"A long-term, no-till soil that is firm at the surface but takes in water readily is what we are really trying to achieve here," Cavadini says. "If we are successful, that will solve a lot of the challenges that central Wisconsin farmers face here every year."

—SEVIE KENYON BS'80 MS'06

PHOTO BY SEVIE KENYON BS'80 MS'06



Jason Cavadini has had success with no-till on crops at the Marshfield Agricultural Research Station.

Keeping Us Safe

For 70 years, the Food Research Institute has been illuminating and helping eradicate a host of food-borne illnesses

It's hard to believe now, but when the Food Research Institute (FRI) was established in 1946—two years prior to the founding of the World Health Organization—botulism and salmonellosis were poorly understood, and staphylococcal food poisoning was just beginning to be elucidated. Many otherwise well-known diseases were only alleged to be food-borne, and the causes of many known food-borne illnesses had yet to be established.

and the School of Veterinary Medicine.

FRI offers a wealth of educational opportunities to both undergraduate and graduate students. Since 2011, FRI has coordinated its Undergraduate Research Program in Food Safety, which provides students with hands-on experience in basic science and applied investigations of food safety issues. FRI faculty and staff have trained hundreds of undergraduate and graduate students, post-docs, visiting

scientists and research specialists throughout the years, and FRI alumni have gone on to hold positions in industry, government and academia across the country and abroad.

In keeping with the Wisconsin Idea, FRI's reach extends well beyond campus boundaries through industry partnerships, especially with its 40 sponsor companies. The Applied Food Safety Lab and laboratories of FRI faculty collaborate with food processors to identify safe food formulations and processing techniques. The institute also provides outreach and training to both food companies and the greater scientific community through meetings, short courses, conferences and symposia.

"FRI is an outstanding example of how a public-private

partnership can benefit the academic mission of UW–Madison and the needs of the Wisconsin food industry," says FRI director Charles Czuprynski.

During the past 70 years, FRI has made many insights into the causes and transmission of food-borne diseases. Early on, FRI research established methods to identify and detect staphylococcal enterotoxins. Work conducted by FRI scientists pioneered understanding of the molecular mechanisms of botulinum toxin production and led to the harness of the toxin for biomedical uses. FRI faculty are leaders in mycotoxin research and have made important contributions to understanding the shedding of *E. coli* O157 by cattle, survival of *Salmonella* in

PHOTO BY WOLFGANG HOFFMANN BS'75 MS'79



Kathy Glass, associate director of the Food Research Institute, recently worked with animal sciences professor Jeff Sindelar to ensure the safety of organic meats by developing antimicrobials from fruits and vegetables.

Now the oldest U.S. academic program focused on food safety, FRI moved from the University of Chicago to the University of Wisconsin–Madison in 1966 under the leadership of bacteriology professor Edwin “Mike” Foster.

And ever since, FRI has served as a portal to UW–Madison's food safety expertise for food companies in Wisconsin, in the U.S. and around the world. Housed within CALS, the institute is an interdepartmental entity with faculty from bacteriology, animal sciences, food science, plant pathology, medical microbiology and immunology, and pathological sciences, drawing not only from CALS but also from the School of Medicine and Public Health



PHOTO COURTESY OF UW-MADISON/FRI

Lab workers and undergraduates at FRI inoculated apples with *Listeria* in a study that revealed the cause of a *Listeria* outbreak in caramel apples in 2014.

stressful conditions and the role of *Listeria* in food-borne disease. FRI research also identified the health benefits of conjugated linoleic acid in foods of animal origin and conditions that might result in formation of undesirable components in processed foods.

Looking to the future, FRI research is investigating novel mechanisms to prevent food-borne pathogen growth in meat and dairy products, interaction of plant pathogens and pests with human food-borne pathogens, food-animal antibiotic alternatives, and the role of the microbiome in health and disease.

FRI will celebrate its 70th anniversary at its 2016 Spring Meeting May 18–19 at the Fluno Center on the UW–Madison campus. There’s also a reception on May 17 at DeJope Hall, near the grounds of the original FRI building. For more information about FRI and anniversary events, visit fri.wisc.edu.

—LINDSEY JAHN

Cows for Kids

RUTH McNAIR, a senior editor at the CALS-based Center for Integrated Agricultural Systems, recently published a charming children’s book titled *Which Moo Are You?*

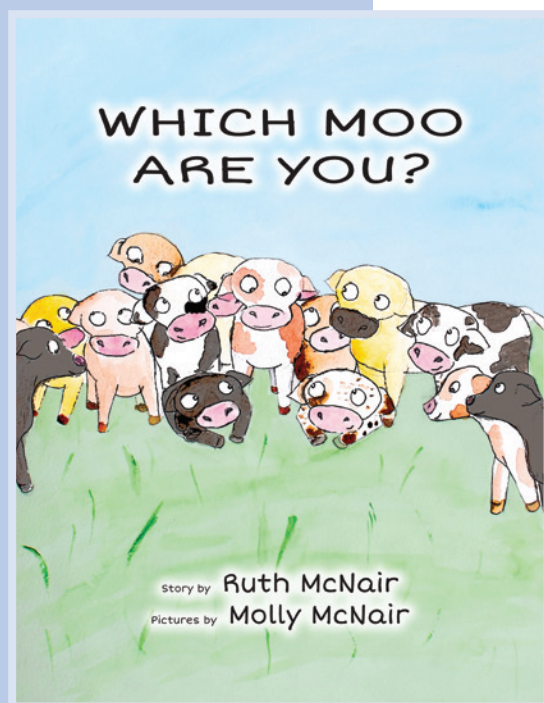
The picture book, illustrated by McNair’s daughter Molly McNair, introduces young readers to a variety of calves, each one distinguished by a key personality trait, as they explore, play, eat and sleep on a farm. Characters include a shy calf, a curious one, a friendly calf and many others. The story ends with a positive message about how we are much more than the labels that others assign to us.

The book, appropriate for ages 2–6, is full of fun rhymes and engaging pencil and watercolor illustrations.

Ruth McNair lives on a farm that hosts grazing dairy heifers during the growing season, and has also been the home of sheep, goats, donkeys, chickens, rabbits and even a llama. Seeing animal-loving kids at farm events inspired her to write the book, she says.

Molly McNair is a costume designer and maker, with a special interest in historical costume. She has a variety of artistic interests and a love of animals.

The book is available for \$16.99 from No Bull Press at nobullpressonline.com.



Milk, Motherhood and the Dairy Cow

A cost-saving technology allows farmers to better synchronize when cows are in heat



PHOTO BY SEVIE KENYON BS'80 MS'06

Dairy scientist Paul Fricke has developed a way to inseminate cows before they show signs of being in heat.

In the 1990s, dairy farmers were seeing a troubling trend in their herds. As cows produced more milk, their reproductive performance declined. This downward slope in reproduction, related to changes in the hormone metabolism of high-producing cows, spurred researchers into action. And CALS scientists found a solution—a reproductive synchronization system that could save Wisconsin dairy farmers more than \$50 million each year.

“The development of these systems has been one of the greatest technological advances in dairy cattle reproduction since artificial insemination,” says Paul Fricke, a CALS professor of dairy science and a UW–Extension specialist. “It is highly, highly significant.”

For the past 20 years, Fricke has been working on the synchronization systems with fellow dairy

science professor Milo Wiltbank. The systems, called Ovsynch, consist of treatments with naturally occurring hormones and are based on Wiltbank’s research into the basic biology of the cow reproductive cycle. The hormonal treatments synchronize the cycles so that farmers know when their cows are most likely to become pregnant.

Pregnancy rates in a herd are a product of two numbers: the service rate (the percentage of eligible cows that are inseminated) and the conception rate (the number of inseminated cows that become pregnant). Historically, farmers relied on visually recognizing when cows were in heat in order to time insemination—a tricky feat that often resulted in missed opportunities and low service rates.

“One of the biggest problems in dairy cattle reproduction is seeing the cows in heat,” says Fricke. “If you can proactively control the reproductive cycle, you can inseminate cows without waiting for them to show heat.”

Synchronization systems take the guesswork out of insemination, increasing service rates and pregnancy rates. Since the technology was first published in the mid-1990s, Fricke, Wiltbank and their colleagues have worked to optimize the systems. Researchers now see conception rates of more than 50 percent, and pregnancy rates of 30 percent or higher. Just 15 years ago, average conception and pregnancy rates were around 35 and 15 percent, respectively. A 30 percent pregnancy rate in herds producing high volumes of milk was unimaginable.

With impressive pregnancy rates and the safety of the system—the natural hormones used are short-lived and do not end up in food products—researchers and farmers alike are excited about further adoption of the technology. The payoff is substantial, considering the costs and benefits of breeding dairy cows, says Kent Weigel, professor and chair of the Department of Dairy Science.

“If we say that this technology will result in a 6 percent improvement in pregnancy rates, and we assume that it costs about \$4 for each extra day that a cow is not pregnant, the technology could save Wisconsin dairy farmers about \$58 million per year with just 50 percent of farmers using it,” explains Weigel. “This is a prime example of basic biology that turned out to have a practical application with huge economic benefits.”

—CAROLINE SCHNEIDER MS'11

Five things everyone should know about . . .

Daylight Saving Time (DST)

By Daniel Phaneuf

1 | A Founding Father was an early advocate. In 1784 Benjamin Franklin observed that during summer months, people slept during the daylight hours of morning and then burned candles at night for illumination. Thus adjusting schedules to begin earlier in the day during summer months would substitute free sunlight for costly wax. Though Franklin advocated changing schedules, he did not propose changing the clock. This idea was first suggested in Britain in 1907, and it was implemented in warring nations in 1916 as an energy-saving measure.

2 | Farmers were not. The notion that farmers pushed for daylight saving time to give them more time in the field is a myth. In fact, farmers consistently came out against a peacetime daylight saving time, which was not implemented in the U.S. until 1966. Losing an hour of morning light meant an early rush to get crops to market. And dairy farmers noted that cows respond poorly to changes in their schedule.

3 | The health effects of DST are a mixed bag. More time spent pursuing outdoor activities and increased exposure to vitamin D can be beneficial. However, studies have found increases in such maladies as workplace accidents, heart attacks, headaches and even suicides at the start and end of daylight saving time, attributable to the negative effects of disrupted sleep rhythms. This is particularly so for people with mental health problems.

4 | It's good for business—except when it's not. Outdoor sports facilities (think golf courses), the grill and charcoal industries and retail groups have long argued that DST is good for business—and for theirs, it is. Less fortunate: airlines that have to scramble to keep international flights running smoothly during the time changes, and television networks that lose prime-time viewers to the extended daylight.

5 | The biggest argument for DST is questionable. The idea that daylight saving time saves energy has been the most formidable argument for its implementation and extension. Most recently, the U.S. Energy Policy Act of 2005 extended DST in 2007 by three weeks in the spring and one week in the fall. But studies by economists in 2008 and 2011 suggest that DST leads to the same amount of electricity use, but shifts it to different parts of the day, or even increases energy use slightly if people engage in additional energy-intensive activities (examples: driving and using air-conditioning).



classAct

Erik Sanson Of Bugs and Humans



PHOTO COURTESY OF ERIK SANSON

Entomology might seem like an unlikely research area for an undergrad whose goal is medical school. But biology major Erik Sanson has clocked in many hours of lab time studying deer ticks—more specifically, *Borrelia burgdorferi*, a bacteria transported by deer ticks—because of its role in causing Lyme disease.

“Entomology sparked

my interest as a young undergraduate because it deals with public health issues throughout the state of Wisconsin,” says Sanson, who works in the lab of entomology professor Susan Paskewitz.

His research on genotypes of *Borrelia burgdorferi* is a good example, he says. “Lyme disease is prevalent in the Midwest, and analyzing possible new strains of the disease can help alert physicians in the area. This would allow them to establish better treatment plans and prevention for their patients.”

Sanson’s been conducting research in medical entomology since his freshman year under the auspices of the Undergraduate Research Scholars (URS) program, which offers research positions to freshmen and sophomores from historically underrepresented groups on campus. Sanson now serves as a URS Fellow, a position in which he mentors a group of URS underclassmen in their projects.

That’s not his only service gig. He’s president of the CALS Student Association, a CALS Student Ambassador, and a mentor with the PEOPLE Program, offering support and guidance to a dozen freshmen throughout the year. Off campus, he has provided in-home patient care as a Certified Nursing Assistant and a Certified Phlebotomy Technician, and he has volunteered at Meriter and William S. Middleton Memorial Veterans hospitals.

Sanson hopes to continue that path of service as a physician.

“I’d like to pursue a career relating to research or public health in urban areas,” he says. “For research, I’m interested in pursuing an MD–Ph.D. dual degree, where I can focus on infectious diseases relating to human illnesses. If I choose the public health route, I’d like to focus on urban areas, working to reduce health disparities and promote health equity to all communities.”

—JOAN FISCHER

AWARDED a Nobel Prize in Physiology or Medicine, **William C. Campbell MS’54 PhD’57**, for his work with co-honoree Satoshi Omura leading to the discovery of the drug avermectin, derivatives of which played an important role in dramatically lowering the incidence of the tropical diseases river blindness and lymphatic filariasis (elephantiasis). Campbell earned his degrees at a time when veterinary medicine was housed in the UW–Madison College of Agriculture.

HONORED with a Veblen–Commons Award, **Daniel W. Bromley**, Anderson-Bascom Professor (Emeritus) in the Department of Agricultural and Applied Economics. The award is given by the Association for Evolutionary Economics to outstanding scholars in that field.

SELECTED to serve on a national committee examining the implications of human genome editing, **Dietram Scheufele**, a professor of life sciences communication. The committee, assembled by the National Academies of Sciences, Engineering and Medicine, will examine the clinical, ethical, legal and social implications of the emerging technology.

LAUNCHED, the *Journal of Undergraduate Science and Technology* (JUST), a new publication to highlight the research of UW–Madison undergraduates. It was founded by CALS genetics major **Eddie Ruiz** and fellow undergraduate **Stephanie Seymour**. JUST will publish peer-reviewed studies whose first authors are UW–Madison undergraduates working in a range of scientific disciplines.

INDUCTED (posthumously) into the Wisconsin 4-H Hall of Fame, **Dennis Buege BS’67 PhD’75**, a professor of animal sciences with CALS and a meat specialist with UW–Extension. Buege was honored for engaging youth across Wisconsin for decades in meat judging and other 4-H activities.

APPOINTED, **Laura Kiessling** (professor of biochemistry) and **Ken Raffa** (professor of entomology), as Vilas Distinguished Achievement Professors and Douglas D. Sorenson Professors. The five-year professorships come with a total of \$75,000 in flexible funds.

Number Crunching 50+ SPECIES OF POLLINATORS—

mostly bees and flies, with some butterflies—were counted in the Lakeshore Nature Preserve on campus last summer by students and other volunteers. The Citizen Science Pollinator Project, held under



the auspices of the Wisconsin Society for Conservation Biology, is developing a baseline database of insect pollinators for use in monitoring and conservation planning.

ECUADOR



Better health through messaging

Some communities in Ecuador face high incidences of water-borne illness because of contaminated water or poor hygiene and sanitation. It's a multipronged problem calling for an interdisciplinary approach combining natural, medical and social sciences. Bret Shaw, a CALS professor of life sciences communication, last year helped implement a social science approach with funding from the UW–Madison Global Health Institute.

"I used a social marketing perspective, which utilizes psychological and communication tools, to try to help villagers make lasting behavior changes in how they interact with water and sanitation," explains Shaw.

Shaw worked with two undergraduates, Lauren Feierstein and Brenna O'Halloran, to create health behavioral prompts—small signs in Spanish left in important areas where a reminder to wash hands is vital, such as in bathrooms, near sinks and on bottles of water. Since many people in the community have limited literacy, it was important for the prompts to use images and very few words.

While the concept can seem intuitive, years of research show that the most effective prompts focus on self-efficacy—showing individuals how easy a behavior is—and making sure that the people in the



PHOTOS COURTESY OF LAUREN FEIERSTEIN

graphic are relatable to the target population. The images and words Shaw's team used were as specific as possible, showing an individual washing his or her hands with just a simple phrase underneath.

"Understanding the perspectives on why someone wouldn't do something such as boil their water or wash their hands was very important," says Feierstein, who also worked with residents on making and distributing organic soap. "Knowing those barriers was crucial to addressing the issue from all angles."

The project was an extension of a course called "Water for Life Sustainability and Health," a partnership between the Madison-based Ceiba Foundation for Tropical Conservation and the Global Health Institute. The course is led by Catherine Woodward, a faculty associate with UW–Madison's Institute for Biology Education and president of the Ceiba Foundation. Shaw was brought in to offer guidance about how social marketing strategies can encourage healthy behavior.

"I'm a biologist and most of the people we work with are biologists, so having a communications person on board was a critical part of getting the message out," says Woodward. "And not just about the message and having people understand why it's a good idea to conserve natural resources—but also to actually get them to change their behavior."

—KAINE KORZEKWA

Undergraduate Lauren Feierstein and a local teacher work with children on "watershed in a box," an activity that helps students make the visual connection between land, water and public health.

(Left)

The health messaging team: Bret Shaw, a CALS professor of life sciences communication, undergraduates Lauren Feierstein and Brenna O'Halloran, and local partner Betsy Vaca.



Bees and Beyond

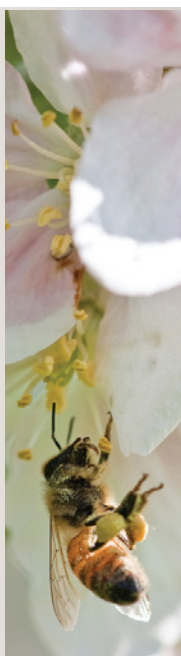
CALS researchers **Claudio Gratton** and **Christina Locke** are providing science-based information and structure to the process as a broad group of stakeholders and citizens create Wisconsin's first Pollinator Protection Plan.

Interview by Nicole Miller MS'06

OVER THE PAST 10 YEARS or so, massive die-offs of the European honeybee—a phenomenon known as colony collapse disorder (CCD)—have sparked increasing concern about the fate of agricultural crops with the loss of these important pollinators. At the federal level, a White House Pollinator Health Task Force was formed and in May 2015 released a national strategy for pollinator protection.

In support of that effort, a number of states are following up with plans of their own. In Wisconsin, professor Claudio Gratton and postdoctoral research associate Christina Locke PhD'14 from the CALS Department of Entomology were invited to partner with the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) in leading a broad array of stakeholders to create a state pollinator protection plan.

The goal of the plan is to provide best management practice recommendations and educational materials for beekeepers, growers, pesticide users, homeowners and landowners who want to improve the health and habitat of managed and wild pollinators. A draft of the plan was open for public review as of this publication's press time in early 2016, with the final report expected soon thereafter.



How bad is the bee situation in our state?

Locke: We have had very few reports in Wisconsin of colony collapse disorder, a phrase I don't like to use because it refers to a collection of symptoms rather than a specific disease. One identifying characteristic of CCD is the disappearance of worker bees. Beekeepers go out to their hives and have a healthy queen and healthy brood cells, but the worker bees have somehow disappeared. That is not happening much in Wisconsin as far as we know.

What we do have are elevated annual losses and overwintering losses in honeybee colonies. Wisconsin beekeepers averaged around a 60 percent colony loss for 2014–15, which is very high. Beekeepers will tell you that a sustainable loss is between 10 and 20 percent every year. These high losses are due to a combination of things. We've had a couple of really hard winters, and the honeybees aren't necessarily adapted to our Wisconsin winters. So there are some efforts to breed queens that are cold-adapted.

The biggest thing that correlates with colony loss in the U.S. overall is the introduction of the Varroa mite in the 1980s. That correlates with steeper declines more than any other single factor we know of. The Varroa mite doesn't just weaken honeybees, it also spreads pathogens that cause diseases. Those pathogens can spread from managed honeybees to wild bees, too, so it's something we're concerned about.

How are our wild pollinators faring?

Gratton: It's really hard to track populations of our wild pollinators. We manage honeybees. We move them around, we keep track of numbers, we can open up the hive and see what's going on. With the native bees, there are more than 500 species in Wisconsin. In any one system like apples or cranberries, we may have 100-plus different species that visit them. But many of them are solitary and sometimes rare. We haven't really been tracking their populations very well. So to know if they are declining, we need a reference point and we don't have one. As a consequence, we actually don't know that much about how populations of the native bees are doing.

The few studies that do exist have looked at historical data and suggest that for the most part, most native bees probably haven't changed that much over time. The few native species that we do have better data on are the bigger, more iconic pollinators like bumble bees. There is some good evidence that these species are declining in North America. And you can point to a couple of species that



PHOTO BY JAMES RUNDE/UW-MADISON WISCONSIN ENERGY INSTITUTE

Entomologist Claudio Gratton and Christina Locke in Gratton's lab, examining part of a vast collection of pollinators. A new state plan they helped create is aimed at better protecting them.

Locke: For example, in the agricultural recommendations there is a range of simple to more difficult practices. You can reconfigure your entire farm and make sure everything is really diverse and use blooming cover crops and all of that—and then at the other end of the spectrum, there are suggestions like leaving woody debris if a tree falls. Leave some wood so that bees can nest. That's an example of a beneficial practice that only requires not doing something.

really have shown dramatic declines compared to midcentury distributions. There may be reasons for those declines—again, having to do with pathogen spread, competitors and declines in flowers in the landscape.

So, is this a crisis for wild pollinators? I think the jury is still out on that. I think there are lots of reasons to be concerned. But I'm not seeing the data out there saying that there is a massive die-off of native bees that we need to be immediately guarding against. This means we may have some time to start helping them out.

We think the way we have approached the plan is helpful because all of the things we talk about in terms of making life better for honeybees are also going to make life better for the native bees. As one example, reduction and judicious use of pesticides.

Also, when you talk to beekeepers and they say, "My bees back in the '50s and '60s used to give me 60 pounds of honey per hive every summer. Now I'm only getting 30"—there is not enough food in the landscape out there for honeybees. Food for honeybees—that is, flowers—is the same as food for the native bees. So all of our discussion about habitat management—getting more flowers out on the landscape, making sure those flowers are blooming throughout the entire summer—those are all things that are going to help native bees as well. I think the plan is going to be able to help a lot of other pollinators that can ride on the coattails of honeybees: bumblebees, butterflies and many of the solitary species that we never pay attention to.

🔗 What are some of the more surprising or important points in the plan thus far?

Gratton: You can do some relatively simple things and potentially have a big impact. It's not like you need to transform the world in order to have an effect. Some really common-sense, small things can go a long way.

🔗 Based on your scientific expertise, what things would help the most?

Locke: For me, it's habitat. We used to have a landscape in the Upper Midwest that was dominated by oak savanna and prairie. Now it's not. That's a lot of acres of habitat to compensate for.

Gratton: And second, as a home gardener or as a farmer, being judicious about killing bees through insecticides. I have to say that most of the farmers that we work with, cranberry and apple farmers, know this. They don't want to kill off their bees. They are very sensitive to that, so they know the things to do to maintain their bee populations. Also, the beekeepers that they've rented bees from would get very mad if you sprayed insecticides during bloom. The farmers, especially of pollinator-dependent crops, know this. They are not necessarily the ones for whom we have to emphasize the importance of not spraying insecticides at especially sensitive times for bees.

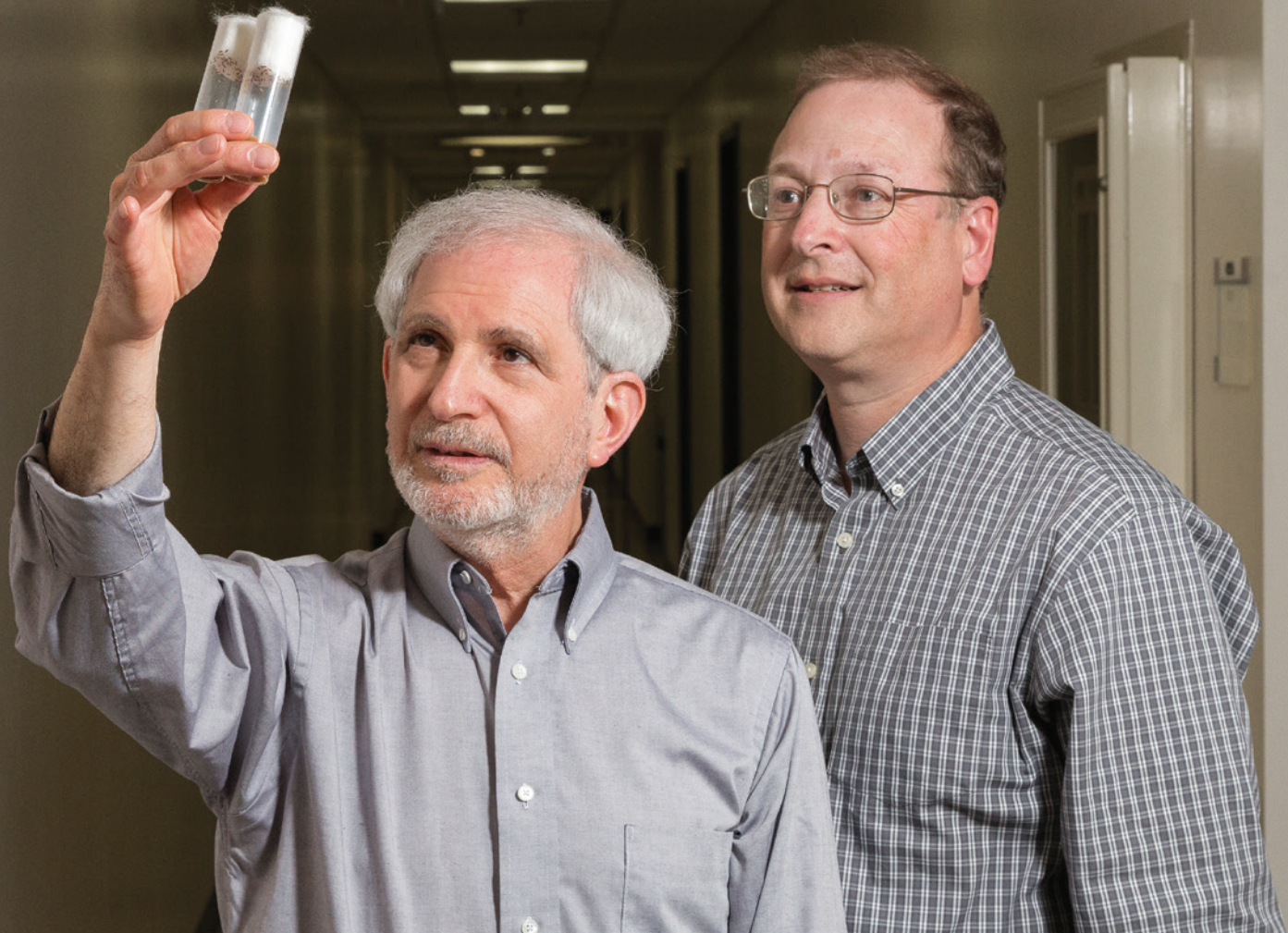
🔗 What's the overall hope in doing this work?

Gratton: I hope that people will read this and recognize that insects—in particular bees, but insects in general—play really important roles in our lives. And that, rather than follow our first instinct to squish them or want them to go away, we appreciate them and try to do things that encourage the beneficial ones in the environment. I hope even in a general sense that anyone can read the plan and say, "Wow, I didn't realize that these little insects, these joint-legged things that fly around, do so much for us that we benefit from. And here are a couple of easy and practical things that I can do to make their lives a little better." That's my immediate goal for the plan. 🔗

You can view the protection plan at <http://go.wisc.edu/pollinator>

A Jolt *to the System*

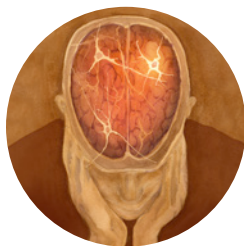
PHOTO BY SEVIE KENTON BS'80 MS'06



For CALS geneticist Barry Ganetzky, insight into the genetic underpinnings of traumatic brain injury began by knocking out fruit flies.

By Nicole Miller MS'06

Working together, geneticists Barry Ganetzky (holding vials containing fruit flies) and David Wassarman have used a fruit fly model to research concussion. The model has revealed key genes involved in the body's response to brain injury and is poised to help unlock medical applications.



As a linebacker for the UW–Madison Badgers, Chris Borland made a name for himself as a hard-hitting tackler. His senior year, he was selected as a first-team All-American as well as the top linebacker and defensive player in the Big Ten Conference.

A third-round draft pick, Borland seemed destined for a headline career in the National Football League. But during a full-contact practice at the San Francisco 49ers summer training camp in August 2014, Borland got his “bell rung” by a 290-pound fullback during a routine exercise. Though Borland felt dazed, he played through—as he’d done dozens of times before.

Like many football players, Borland had endured his share of hard hits, including two diagnosed concussions. This particular hit, however, got him thinking seriously about the future, and about the negative effects that repeated collisions could have on his long-term physical and cognitive health. Even so, he went on to play a dynamite rookie year.

Then, after the season was over, Borland quit.

The announcement shocked the sports world. Borland was 24 years old and healthy, yet chose to walk away from a \$2.3 million, four-year contract.

“I just honestly want to do what’s best for my health,” Borland explained on ESPN’s *Outside the Lines*. “From what I’ve researched and what I’ve experienced, I don’t think it’s worth the risk.”

With their repeated hits, football players—along with boxers—are at increased risk of developing chronic traumatic encephalopathy (CTE), a degenerative brain disease marked by memory loss, depression, suicidal thoughts, aggression and dementia. Of 91 brains donated to science by former NFL players, 87 have tested positive for CTE. It’s seen as a likely contributing factor to nine suicides by current and retired football players over the past decade.

Borland didn’t want to share that fate.

“To me, Chris Borland is a hero. He walked away before he made the big bucks and he was very explicit about why he quit—that it was not worth it to him,” says CALS genetics professor Barry Ganetzky, whose findings about the central nervous system in fruit flies are shedding light on what hard hits do to humans.

Ganetzky isn’t a sports guy, but he started paying attention to football-related brain injuries after the 2012 suicide of New England Patriots linebacker Junior Seau, intrigued by the biological processes driving this tragic phenomenon.

“I started wondering, what’s the link between a blow to the head and neurodegeneration 10 or 20 years down the line? When I started digging into the scientific literature, it became clear that we know very little,” says Ganetzky, who held the Steenbock Chair for Biological Sciences for 20 years. “And



PHOTO BY BRYCE RICHTER/UW COMMUNICATIONS

my usual response is, well, if we don't understand something about the brain, then we should be studying it in flies."

Fruit flies, officially known as *Drosophila melanogaster*, are a widely studied model organism, with a vast arsenal of genetic and molecular tools available to support that work. Flies reproduce rapidly and are easy to work with, enabling swift research progress. They are well suited for brain research because they have nerve cells, neural circuitry and a hard skull-like cuticle remarkably similar to our own, allowing scientists to conduct probing experiments that would be difficult in rodent models—and impossible in human subjects.

Fly models already exist to study Alzheimer's, Parkinson's and a number of other neurological diseases. Why not concussion? But there wasn't a model available.

Then Ganetzky remembered work he'd done decades earlier.

"It occurred to me that I knew how to make flies have a concussion, and I had done it 40 years ago as a post-doc," says Ganetzky. "I thought, 'That's it!'"

It was a simple thing: As a post-doctoral researcher at the California Institute of Technology, Ganetzky decided to see if any of his flies hap-

pened to be bang-sensitive mutants, flies that display seizures and paralysis after given a high-powered swirl on a vortex machine. But he didn't have a vortex nearby, so he decided to just bang the vials against his hand.

"After a couple of sharp whacks, some of the flies were hanging out at the bottom of the vial, stunned. Others were on their backs, obviously knocked out. And after a few minutes, they all got up and started walking around again," recalls Ganetzky.

He immediately knew the flies weren't bang-sensitive—it's an extremely rare mutation—but Seau's death helped Ganetzky realize they had displayed symptoms "very similar in many respects to the empirical definition of a concussion."

After developing and validating the new fly model, Ganetzky and UW genetics professor David Wassarman have been able to charge forward with brain injury research. The model has already been used to reveal key genes involved in the body's response to brain injury. It's also poised to help unlock medical applications, including a genetic test for high-risk individuals and an assortment of promising drugs and treatments.

In addition to helping athletes in

contact sports, these advances will benefit the millions of Americans each year who experience traumatic brain injury due to falls, car accidents and violent assaults.

"At the most fundamental level, we just want to understand how traumatic brain injury works," explains Ganetzky. "However, this is a major medical problem for which there are not many good—or any good—treatments or therapies or preventives, and so that is part of our motivation. If we can learn the genes and the molecules and the pathways, can we come up with interventions?"

Ganetzky was raised in a working-class neighborhood in Chicago by a candy salesman father and a homemaker mother. Growing up, he had an abundance of natural curiosity and asked a lot of tough questions—and often questioned the answers he received. While this trait caused him some problems as a youth, it came to serve him well in science.

At the University of Illinois in Chicago, he figured he'd become a chemist for the good career prospects. He ended up switching to the biological sciences, however, after a 10-week

Chris Borland, a one-season linebacker with the San Francisco 49ers, retired last year after deciding that his long-term health was more important than his football career. Here he is as a Badger star in 2013 talking with a young fan.

honors biology research experience in a *Drosophila* lab that expanded into a two-year project. From that point forward he stuck with flies, earning his doctoral degree at the University of Washington and then doing his post-doc work at Caltech.

In 1979, Ganetzky joined the University of Wisconsin–Madison, where he chose to focus his research program on exploring temperature-sensitive paralytic mutants, flies that behave normally at room temperature, but then start to tremble and twitch—or pass out—when things heat up. For each mutant he identified, he sought to uncover the faulty gene involved, and thus better understand how brain cells work.

Over the decades, this approach enabled Ganetzky's team to discover a number of critical genes and molecular pathways involved in brain cell signaling, including those required for the release of neurotransmitters. That body of work established Ganetzky as one of the foremost leaders in neurogenetics. Some of his findings shed light on human genetic diseases and led to a test that's now routinely used to assess the safety of new pharmaceutical drugs. For his contributions, Ganetzky was elected in 2006 to the National Academy of Sciences, the nation's preeminent scientific society.

After Ganetzky's "eureka moment" about fly concussions in spring 2012, he immediately reached out to colleague David Wassarman, a genetics professor in the UW–Madison School of Medicine and Public Health. Wassarman, who studies human neuronal disorders using fruit flies, had already been attending Ganetzky's lab meetings for a few years after some of their research findings linking the innate immune response and neurodegeneration dovetailed.

"I did a demonstration of fruit fly concussion for David, and I remember

his response very well," says Ganetzky. "His jaw kind of dropped, and he said, 'If you're not going to study that, then I want to.'"

It was exactly the response that Ganetzky had been hoping for. With retirement looming on the horizon, Ganetzky needed a trusted and enthusiastic collaborator to help pursue the work—someone who would be willing to take on more and more as time went on. Wassarman was game.

"I wanted to put both feet in," says Wassarman. "I said, 'If we're going to do it, let's do it.'"

As a first order of business, Wassarman developed a tool capable of delivering a consistent "dose" of brain injury to flies. The result, known as the High-Impact Trauma (HIT) device, utilizes a metal spring to slam a vial of flies against a firm foam surface. In this setup, it's important to note, the brain injury the flies experience is caused by the rapid acceleration and deceleration of their bodies; it's not necessarily about a direct hit to the head.

"Quite often, as with football players, it can happen because they are running fast and then meet an immovable object. The concussion is caused by a kind of whiplash, where the brain is ricocheting off the inside the skull, and that's what's causing the damage," says Ganetzky. "That's what we're doing here with the flies."

Ganetzky and Wassarman found that flies injured using the HIT device exhibit many of the classic symptoms

Barry Ganetzky in his lab with shelves upon shelves of fruit flies.



PHOTO BY SEVIE KENYON BS'80 MS'06

of traumatic brain injury (TBI) seen in humans. As they reported in the *Proceedings of the National Academies of Science* in 2013, flies show temporary incapacitation and loss of coordination immediately after injury. Those that survive severe injury go on to develop long-term symptoms: activation of the innate immune response, neurodegeneration and early death.

These TBI flies have the potential to reveal much-needed insights—and medical interventions—for the millions of Americans who experience traumatic

brain injury each year. According to the U.S. Centers for Disease Control and Prevention, TBIs cause around 2.5 million emergency room visits, 283,600 hospitalizations and 52,800 deaths each year. Top causes are falls, motor vehicle accidents, and blows or jolts to the head or body, including sports-related concussions. Bomb blasts can cause brain trauma in soldiers in combat zones. Across the country, as many as 6.5 million people are believed to be struggling with the consequences of TBI, and the total economic cost of this health issue is estimated to be \$76 billion per year.

In a demonstration of the power of the TBI model, Rebecca Katzenberger, a senior research specialist in Wassarman's lab, subjected 179 genetically unique strains of flies to four strikes of the HIT device—meant to simulate a series of severe brain injuries—and then monitored them for death at 24 hours post-injury, a data point that serves as an easy-to-measure proxy for the various negative events unfolding inside the body.

The results revealed a huge diversity of responses, underscoring the fact that genotypes matter when it comes to TBI response. Some strains were particularly susceptible to death, losing as many as 57 percent of the flies in those first 24 hours, while others were much more resilient, losing just 7 percent. The team then identified the genes that possibly made a difference, publishing their findings in *eLife* in March 2015.

"Now we have these 100 genes, and scientists can start looking at them in more detail," says Wassarman. "A lot of them are genes that had never really been implicated in traumatic brain injury before. I think this is going to be one of our big contributions."

These findings, the researchers note, may help explain why people respond so differently to similar brain injury events, and may help lead to a genetic test to identify high-risk individuals.

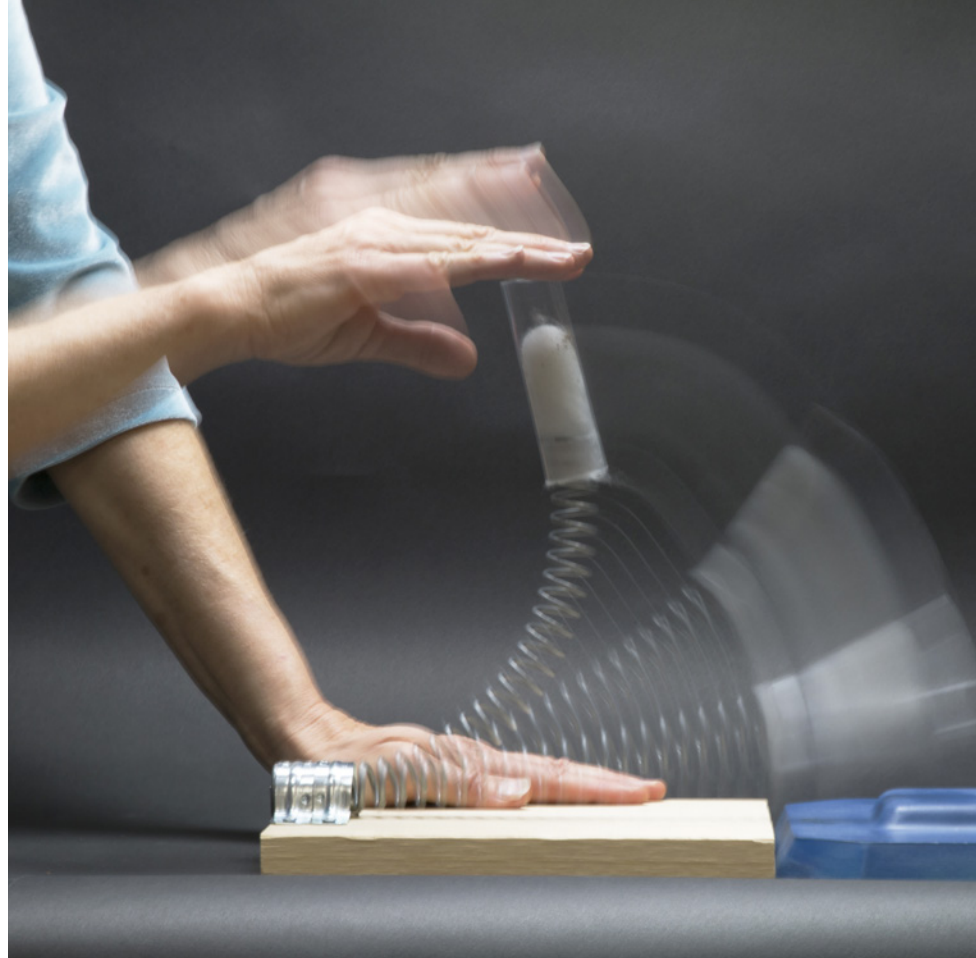


PHOTO BY SEVIE KENTON BS'80 MS'06

"Once we understand those genetic links, we'll be able to test people and tell them, 'Look, you probably shouldn't play football. You should play non-contact sports,'" explains Ganetzky.

After identifying the TBI genes, Ganetzky and Wassarman immediately noticed a handful of genes involved in tissue barrier regulation. Tissue barriers—such as the intestinal barrier and the blood-brain barrier—function as biological blockades keeping "bad" things out while allowing "good" things to pass through.

To explore the connection between brain injury and tissue barriers, the duo had Katzenberger conduct a simple, colorful experiment that involves adding bright blue dye to the flies' food. Under normal conditions, when flies eat the blue-colored food, it stays in the gut, something that is readily observable through the fly exoskeleton. However, after exposure to brain injury—via the HIT device or by having their heads pinched with a forceps—they found that the dye leaks out of the gut and turns the entire body blue, a phenom-

enon called "smurfing" (after the blue Smurf cartoon characters).

Leaky tissue barriers have previously been observed in rodent models of brain injury as well as in human medical cases. "Somehow this injury to the brain is triggering a series of events that leads to the breakdown of the intestinal barrier," notes Ganetzky. "So there's some sort of cross-talk going on between the brain and the intestine, but we don't fully understand it yet."

Upon further exploration, Ganetzky and Wassarman were able to confirm that—along with the blue dye—glucose and bacteria were also crossing the intestinal barrier into the fly's circulatory system, or hemolymph, after brain injury. Homing in on glucose, they found that it plays a causative role in fly death after TBI. "By simply withholding sugar, we were able to keep some of these flies alive, and by a substantial margin," says Wassarman.

If the findings hold up in rodent models and in human trials, he notes, athletes may one day find themselves advised to avoid certain foods after experiencing concussion.

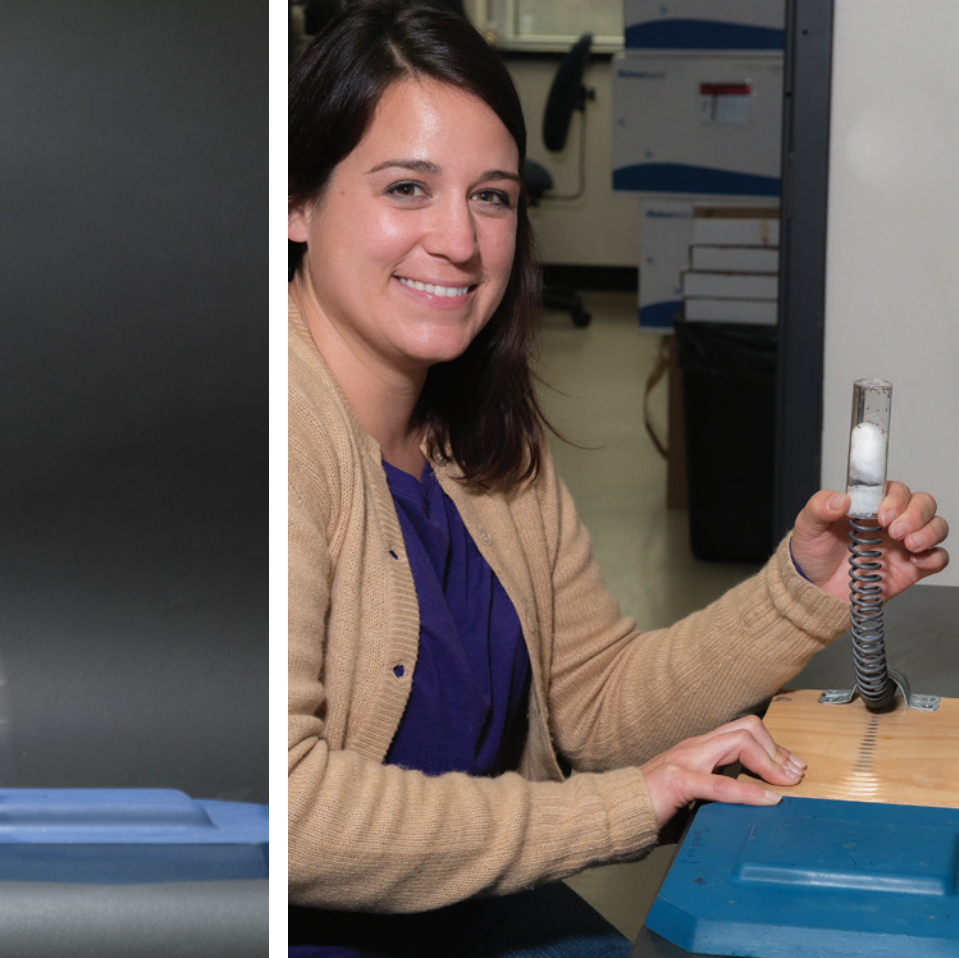


PHOTO BY SEVIE KENYON BS'80 MS'06

How to concuss a fruit fly: The HIT device in action and on display with researcher Rebecca Katzenberger.

The bacteria that cross the intestinal barrier appear to be playing more of a long game. Ganetzky and Wassarman believe they are the culprits triggering the innate immune response observed in TBI flies. The innate immune response, also known as the inflammatory response, is the body's natural reaction to microbial invasion and other stressors. If properly controlled—turned on and off at the right time—it protects the body. If left on, however, it can cause collateral damage throughout the body, including damaging brain cells.

“Here’s what we think is happening: Traumatic brain injury is causing increased intestinal permeability. That causes the bacteria to leak out, which turns on the innate immune response, and that is possibly leading to neurodegeneration down the line,” explains Wassarman.

Ganetzky and Wassarman are intrigued by a concept that is emerging from their work and related studies: that TBI accelerates aging. Some of the key physical outcomes of brain injury—problems with tissue barriers and increased inflammation—are also hallmarks of the natural aging process.

More support for this idea came in summer 2015, with the release of a report describing signs of early aging in the brains of war veterans exposed to bomb blasts in Iraq and Afghanistan.

“Somehow a blow to the head is activating all of these pathways related to aging and speeding them all up. Biologically, I think that this is maybe one of the most fascinating things about the whole project,” says Ganetzky, noting that TBI flies are a great model for further exploration.

Even at this early stage, without fully understanding the basic scientific mechanisms involved, the model is already revealing some promising medical applications. As soon as Ganetzky and Wassarman realized that the inflammatory response might lead to neurodegeneration, a treatment suggested itself: Could a simple anti-inflammatory help? They tried giving TBI-injured flies some aspirin mixed in their food. It helped.

“Our studies show that there appears to be a window of time after brain injury when the flies are particularly susceptible to dying. And if we can prevent certain events from happening

during this time, then we can prevent death,” says Wassarman. “That’s what we think aspirin is doing—by lowering the innate immune response.”


The next step is to look for drug candidates that work even better than aspirin. Ganetzky and Wassarman are in the process of screening a set of 2,400 compounds, and they’ve already found a handful of very promising ones that can now be tested in rodent models and, ultimately, in human clinical trials.

“It would be wonderful if someday it were possible to offer a simple intervention beyond surgery to help individuals who have suffered a severe traumatic brain injury,” says Wassarman.

There’s a lot left to learn, and Ganetzky and Wassarman are eager to pursue all that the model can tell them. With Ganetzky’s retirement set for early 2016, the work of securing the project’s first federal grant and conducting experiments will largely fall to Wassarman.

But Ganetzky won’t be out of the picture. He continues to keep up on brain injury medical cases and scientific discoveries, and is encouraged by the national conversation about sports and brain injuries that’s starting to gain traction—and by the NFL’s commitment to scientific research in this area.

Some of these advances can be attributed, in part, to Chris Borland, whose post-NFL journey has led him deeper into the world of sports-related brain injury. Borland has submitted to numerous brain scans to support research, and has also become a sought-after speaker, touring the country to raise awareness about the risks of concussion.

It’s that kind of dedication to public service on the part of Borland and many other athletes, along with the excitement of discovery, that’s keeping Ganetzky in the game. Despite his retirement, Ganetzky plans to keep a scaled-back version of his lab running for at least a few more years. 



Jim Berkelman out birding
on behalf of the Atlas.



for the birds

A new version of the Wisconsin Breeding Bird Atlas draws on the increasing power of citizen science

By Terry Devitt

Photography by Wolfgang Hoffmann BS'75 MS'79

Slipping into a patch

of woods in western Dane

County, Jim Berkelman ignores the swarming mosquitoes and strains to sort through the early-morning chatter of warblers, robins and vireos and the nearby drum of a pileated woodpecker. “I’m hearing something I wouldn’t expect to hear,” says Berkelman, a lecturer in the Department of Forest and Wildlife Ecology at CALS and a volunteer contributor to the Wisconsin Breeding Bird Atlas II, a comprehensive, volunteer-powered survey of birds that nest in Wisconsin.

Experienced birders use their ears as much as their eyes to identify species, and Berkelman thinks he hears a northern parula, a small warbler that doesn’t typically nest this far south. Finding a bird, Berkelman explains, is only the start. The point of the Atlas, he notes, is to identify and map where birds in Wisconsin are courting, nesting, breeding and raising their broods.



To be sure of that, “atlasers,” as volunteer observers like Berkelman are called, must find tangible evidence that a species has actually taken up residence. A nest, of course, is the most obvious clue. But most birds are assiduously covert in their nesting and only conspicuous players like robins, herons, orioles, house wrens and bluebirds construct their nests in ways that make them easy to find and identify.

Other definitive hallmarks of breeding birds include observations of birds carrying nesting material or food for nestlings; distraction displays where

birds seek to draw animals, other birds or humans away from a nest; and, of course, fledglings. Some bird species are fastidious as well and carry fecal matter away from occupied nests. Such an observation is also a telltale sign of breeding and can be used by an atlaser to confirm breeding activity and provide a new data point that science can ultimately draw on.

Following a rising wooded path to the top of a hill, Berkelman’s rounds on this warm June day encompass two different types of ecosystems: forest, and open fields and prairie. His block is

designated as a “priority block,” a specified block within a six-block “quad” on a grid of more than 7,000 three-mile-by-three-mile blocks that covers Wisconsin. Within that grid are 1,175 priority blocks, each of which requires at least a year’s documentation of breeding birds within a five-year period to ensure that the state is uniformly surveyed for the new Atlas. In addition, there are 153 “specialty blocks” that have unique habitat, are of high conservation value or are of particular interest to ornithologists.

Today, Berkelman is recording his data the old-fashioned way: with pen and notebook. Later, he can plug his observations into Atlas eBird, an online checklist program that is a direct conduit to the database that is the bedrock of the Wisconsin Breeding Bird Atlas.

Data, of course, are the raw material of science. Astronomers gather it by measuring and parsing starlight. Molecular biologists get data by plumbing the sequence of the chemical base pairs that make up a gene or genome. Meteorologists numerically dissect the many variables of weather—temperature, precipitation, wind, clouds.

To be sure, most data collection is a laborious and numbing process—the antithesis of the eureka moment. Harvesting data can be very expensive, too, as the tools of modern science have become bigger, more complex and more powerful in their ability to see farther or smaller, drill deeper, or accelerate particles to higher energies. Indeed, much of what we hear about modern scientific discovery rests on the pillars of sophisticated technology. Think of the Hubble Space Telescope, the Large Hadron Collider, the IceCube Neutrino Observatory and the Human Genome Project as just a few examples.

But while technology is taking science to new heights, it’s also giving



(Opposite, standing) Ben Zuckerberg, a professor of forest and wildlife ecology, has been working with Atlas coordinators. Here he assists doctoral student Christopher Latimer in a field project on wintering birds. They capture birds, take measurements, and mark each bird with a band and a device called a passive integrated transponder to track movements and feeding behavior.

a boost to the age-old methods of data gathering like the ones Berkelman uses in his efforts to document the presence of breeding birds. The Internet and personal computing technology are being used like never before to crowd-source traditional observational data collected by a growing cadre of citizen scientists. Groups of people or individuals armed with laptops and app-laden smartphones are collectively logging everything from trash in the ocean and flying ants to cosmic rays and precipitation, giving working scientists access to oceans of new data and the revelations that come from subsequent analysis and interpretation.

In the realm of ecology, citizen science has gained a new standing as researchers have tapped into the potential of an interested public. Citizen science projects, mapping things like the presence and behaviors of bumblebees, manta rays, butterflies and bats, have fueled dozens of published studies.

It's proven to be a powerful resource for Ben Zuckerberg, a professor

of forest and wildlife ecology at CALS. North American birds and their distribution on a changing landscape are a primary focus of his research, a significant portion of which depends on data gathered by volunteer observers.

For instance, Zuckerberg and post-doctoral fellow Karine Princé drew on citizen science data to tell us that the cast of characters we see at our bird feeders in

the winter is shifting, most likely due to climate change. Their study of wintering songbirds shows that some species, once rare during the Wisconsin winter, are shifting their ranges north, remaking the resident communities of birds that visit our backyard feeders.

The conclusions of the study rested on two decades of data gathered by thousands of citizen scientists through the Cornell University Laboratory of Ornithology's Project Feederwatch.

"Birds have always been important environmental indicators," Zuckerberg explains. Rapidly declining songbird populations in the 1950s and 1960s, he notes, were used to help ascertain the

consequences of widespread use of the chemical insecticide DDT, which was subsequently banned, first in Wisconsin and then nationally.

The DDT story was famously informed by the unintended involvement of ordinary citizens who gathered baseline data in the form of bird eggs. In the 19th century, collecting bird eggs was a widespread hobby, an artifact of the Victorian obsession with the natural world. Many collections ended up in museums where, decades later, CALS ornithologist Joseph Hickey and his students used them to document the thinning of eggshells subsequent to the widespread introduction of DDT into the environment in the 1940s and '50s.

Today the contributions of citizen scientists tend to be more directed, and the advent of personal computers and smartphones, in particular, are making participation easier, more immediate and more effective. And a prime example of that trend is the Wisconsin Breeding Bird Atlas, a collaborative project by the Wisconsin Department of Natural Resources (DNR), the Wisconsin Society for Ornithology, the Wisconsin Bird Conservation Initiative and the Western Great Lakes Bird and Bat Observatory. This year, the group launched a second iteration of the Atlas. Zuckerberg and other scientists are working with Atlas coordinators and waiting in anticipation of a flood of new

data from the project, which recruits volunteers statewide to survey thousands of designated blocks over a five-year period for evidence of breeding birds.

The first Wisconsin Breeding Bird Atlas featured data collected by nearly 1,600 volunteers between 1995





A beautiful find:
American robin eggs.

and 2000. As its name implies, the Atlas is a survey that documents the distribution and abundance of birds breeding in Wisconsin. It provides critical baseline information about bird species that live in our state and is an important benchmark in terms of assessing potential changes in bird populations over time due to things like habitat loss and climate change. It also helps document avian diversity, the state of endangered and rare bird species, and habitat needs in Wisconsin.

Such data, explains Zuckerberg, help scientists make sense of a world that involves players ranging from microbes to plants and animals, including birds. There are so many moving parts that capturing a wide snapshot of what exists where at a given point in time can give scientists insightful information about the dynamics, nuances and health of an ecosystem.

“Ecology is necessarily a messy endeavor,” Zuckerberg observes. “But at certain scales, it all becomes very clear.”

Drawing on things like Breeding Bird Atlas data, Zuckerberg and other scientists can get at the scales that matter: geography and time. As the Wisconsin Breeding Bird Atlas II effort gets under way, ecologists are laying the groundwork for analyzing the data by formulating hypotheses and ideas about what the data might show and how it will compare to data in the first iteration of the Atlas, which, according to the Wisconsin Society of Ornithology, “represented the largest coordinated field effort in the history of Wisconsin ornithology.”

Data collection for the Wisconsin Breeding Bird Atlas II began in 2015 and runs through 2019. In September the DNR released findings for the first Atlas season. Volunteers submitted nearly 24,000 checklists documenting the location and breeding activity of 229 species of birds. These early data show that wild turkeys are on the move, now populating nearly every corner of our state. And eight species of birds new to the Wisconsin breeding landscape since the last survey—including the iconic whooping crane—have cropped up in the new Atlas data.

“The stories that come out of the data are so robust,” Zuckerberg says. “We go in with our ideas of what we’re going to uncover, and some of the patterns just jump out at us.”

The major advantage of the Wisconsin Breeding Bird Atlas, according to noted ornithologist Stan Temple, a CALS emeritus professor in forest and wildlife ecology, is that it documents the relationship between birds and the places they require to successfully reproduce. “Habitat affinity is where the Atlas works best,” Temple explains.

Temple cites other long-standing citizen science efforts to document birds. The North American Breeding Bird Survey was officially launched in 1966. Conducted during the breeding season, volunteers traverse by car more than 3,700 randomly selected 24.5-mile road transects in the United States and Canada. Stopping every half-mile, volunteers document every bird seen

or heard in a three-minute span before moving to the next observing station. The North American Breeding Bird Survey, Temple argues, is the gold standard for measuring population trends among birds.

A more recent citizen science effort—one that capitalizes on personal computing technology and helps inform the Wisconsin Breeding Bird Atlas—is the aforementioned eBird. Taking old-fashioned pen and paper checklists into the digital age, eBird is an online checklist linked to a central database. Used by amateur and professional birders, eBird logs millions of bird observations worldwide in any given month through a simple and intuitive web interface. The Wisconsin Breeding Bird Atlas II is the first state Atlas effort to employ it.

“We’re in the information age now,” explains Nick Anich, the Wisconsin DNR Breeding Bird Atlas coordinator. “We have eBird. We’re excited to use this new system. The developers have put an awful lot of effort into the checklist input, and they just launched the maps function. And the data update at least every 24 hours, so we can see things in real time.”

But can the information gathered by armies of citizen scientists be trusted? Can it help researchers predict the future of Wisconsin’s environment? How is it validated? Can scientists get over any qualms they might have about data collected beyond the strict parameters of controlled experiments and expert observation?

Zuckerberg, who has published on the use and value of crowd-sourced data, believes that many scientists are coming around to the idea that the data indeed represent an accurate picture of the natural world. “There has always been some skepticism about it in ecology. But studies show it is valuable data that are relatively accurate for picking up ecological patterns and processes,” Zuckerberg says.

Eyes and ears alert: Jim Berkelman scanning the field and trees for movement.



“There are entire subfields of ecology dependent on these data. Theories in macroecology and how species respond to widespread environmental changes, such as pollution or climate change, for example,” Zuckerberg observes, referencing the study of relationships between living organisms and their environments at large spatial scales. “We wouldn’t be able to do anything like that without citizen science.”

That kind of insight is essential, Zuckerberg stresses, as broad-scale environmental change due to pollution, deforestation, reforestation and climate change will have significant and possibly lasting effects on birds in many different types of ecosystems.

According to Temple, the power of citizen science lies in the sheer numbers of observers. As a new CALS faculty member in 1976, Temple launched the Wisconsin Checklist Project. “The Wisconsin Checklist Project did in the predigital age what eBird does now,”

Temple explains. “It is a rigorous way of engaging lots of bird-watchers in a very systematic way.”

For the most part, Temple says, the data are trustworthy. “Bird-watchers are used to keeping records, so you’re not asking them to do anything that already isn’t part of the culture. Mistakes in observing and recording happen, but it is safe to say those few errors become insignificant noise in comparison to the strength of the signal: the overwhelming number of accurate observations.”


For atlasers like Florence Edwards-Miller, a 31-year-old communications specialist from Madison, the chance to go into the field and gather data blends neatly with her deep-felt appreciation of the natural world.

Trekking through the prime birding habitat of Madison’s Nine Springs E-way on a rainy midsummer morning, Edwards-Miller is on a mission. An experienced birder, she knows she can

confirm any number of breeding birds that use the settling ponds of Madison’s Metropolitan Sewerage District to raise their broods. And she is eager to contribute those little bits of data to the Wisconsin Breeding Bird Atlas effort.

“You can’t make good decisions unless you know what’s out there,” says Edwards-Miller. “I believe in science. I believe in the importance of the data.”

In a little more than an hour, she confirms the presence of breeding mallards, Canada geese and red-winged blackbirds—all pedestrian wetland species—by noting offspring and, in the case of the blackbirds, a cantankerous distraction display.

It takes a little longer to find the killdeer fledglings, but at the end of our circuit around the pond, there they are: little puffballs on stilts trailing behind their foraging parents. It’s a beautiful sight. And another valuable data point for the Wisconsin Breeding Bird Atlas. 

Age-Old

PHOTOS BY RICK OLIVO



Life sciences communication professor
Patty Loew fosters intercultural learning
with workshops that help tribal teens tell
their stories in a digital world.



Traditions, New Media

By Ron Seely



Live from the lake: Patty Loew (inset, reaching down) brings UW global health students and Bad River Ojibwe teens together to learn from each other and create digital stories about tribal life and concerns.

There is no better place to begin this story than on an August morning in the remote reaches of the Bad River Ojibwe Reservation, afloat on Lake Superior's shining Chequamegon Bay beneath an expansive, cloud-filled sky.

Several flat-bottomed boats are lined up gunwale-to-gunwale, bobbing in the gentle waves. They're filled with students—a mix of UW–Madison undergraduates and tribal youth—on a field project run through UW–Madison's Global Health Institute. They are listening to Dana Jackson and Edith Leoso, Bad River tribal members and elders, talk about wild rice and the windswept, watery landscape around them, the sloughs and the tamarack stands, the distant islands and the shimmering headlands.

It is all ancestral home to the Ojibwe, and Jackson and Leoso bring it to life with their words. They tell the Ojibwe creation story of how their tribal forebears came to the land so many years ago from the east, seeking, as they had been told in visions, a place where “the food grows on top of the water.” They speak of the chiefs who signed treaties to protect this homeland and of the warriors who fought to protect it and of the threats that come with modern times.

The students, armed with video cameras and recorders, soak it all up. The land seems to take on new depth and meaning, peopled now with the ghosts and the place names and shrouded in the mystery and the magic of the old stories.

It's an ideal classroom for the CALS professor who is the guiding hand behind this floating, open-air lecture session.

Patty Loew, a professor of life sciences communication, has brought these students here to share with them the lives and the culture of a people she knows well.

Loew is a tribal member of the Bad River Ojibwe. She can trace her family back to ancestors who were among the tribal leaders signing the tribe's historic treaties in the 1800s. When she looks out upon the waters of Lake Superior and the winding sloughs of the reservation, she sees her own family's history. These places are as special to her as to any other member of the Bad River community.

Two years ago, in a column in the *Wisconsin State Journal* about the importance of this place to the Ojibwe, Loew wrote, “You won't see any stained glass or church spires in the Bad River or Kakagon Sloughs, but those wetlands are as holy to us as any temple or cathedral.”

A noted television journalist and the author of several acclaimed books on

Wisconsin's Native Americans as well as an accomplished scholar, Loew could easily be resting on her many successes.

Instead, she is deeply involved in a number of teaching and media projects that are not only bringing the stories of Wisconsin's Native Americans to life, but also are providing new ways for those stories to be shared by tribal members themselves. Since 2007, she has led efforts to teach tribal teenagers digital storytelling and technology skills. Working with colleagues as well as tribal leaders, she has helped young people create documentaries sharing Native American issues and culture. In a 2012 project, for example, eight St. Croix Ojibwe students created a tribal history told through the life stories of five St. Croix elders.



In this work Loew has also partnered with the UW–Madison Global Health Institute. She's currently in the midst of a project—the one that has us floating on Chequamegon Bay—in which global health students from a wide range of majors work alongside tribal youth to bring the power of digital media to bear on reservation health issues such as nutrition and childhood obesity. The Bad River Reservation has some of the highest diabetes and cardiovascular disease rates in the United States, according to a 2008 Wisconsin Nutrition and Growth Study.

Loew's projects can already boast some impressive successes. In 2013, three 14-year-old Bad River participants in her tribal youth media workshops produced a documentary, *Protect Our Future*, that detailed the potential environmental threats posed by a proposed iron mine in the Penokee Range above the Bad River reservation.

The video was an award-winning hit. It played to large audiences at film festivals throughout the Great Lakes region and was screened at the Arizona State University Human Rights Festival. The teens were on hand to introduce

their film, which they also shared at the nearby Salt River Tribal High School.

The project followed a unique blueprint developed by Loew that melds traditional knowledge from tribal elders and leaders with the use of digital media skills now being deployed by tribal youth.

It is, in effect, an artful and sensitive blending of the old and new. Loew, not one to think small, says she sees the work in the context of a larger and more powerful dream. Oblivious to the breeze and splashing water from Lake Superior, she speaks from her seat in one of the boats as it motors through the reservation's famed Kakagon Sloughs. In between her answers to questions, she patiently works with students as they learn how to use video cameras. She helps one of them frame a shot and assists another who is figuring out how to program a video card.

"My ultimate goal," Loew says as she works, "is to help Bad River become the media center for Indian Country. We want to combine really strong media skills with a really strong sense of culture."

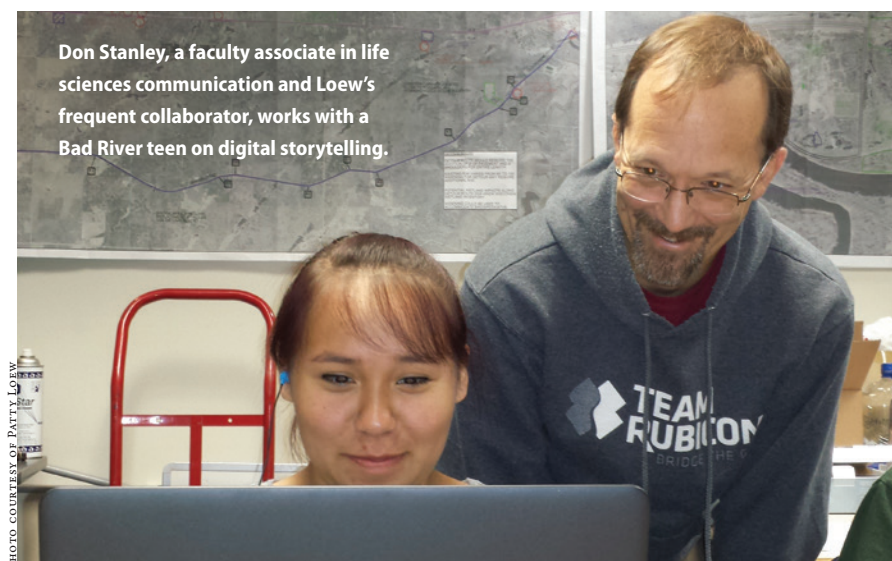
Loew's work has drawn praise from many quarters, from tribal leaders to academic colleagues.

Joe Rose is an elder with the Bad River Ojibwe and has watched young tribal members embrace Loew's teachings. He describes the pride that the video *Protect Our Future* brought to the reservation.

"We were fighting against the mine then," Rose recalls. "That was a very serious threat to us. We were very concerned about our wild rice. That was exceptional work that Patty did with the young people. She taught them how to use the media, how to do the photography and the interviewing. They even did the music. And it was all done by students, only 14 or 15 years old."

Don Stanley, a CALS faculty associate in the Department of Life Sciences Communication who specializes in social media, has worked alongside Loew on the reservation, served as her co-investigator, and, Loew says, sparked the original idea for much of their tribal youth media work.

There are few better examples of the Wisconsin Idea in action, Stanley says,



Don Stanley, a faculty associate in life sciences communication and Loew's frequent collaborator, works with a Bad River teen on digital storytelling.

PHOTO COURTESY OF PATTY LOEW

when it comes to sharing the department's communication expertise and scholarship with a broader audience.

And, in this case, that sharing is with a community that few can reach as effectively as Loew. Loew has the ability to connect in a special way, Stanley notes, because of her deep tribal roots and connections. People know her and see her knowledge and respect for tribal life and culture. That understanding and empathy is not always common among academics.

"A lot of time in academia, we don't understand that," Stanley says. "Researchers come in, extract what they want and leave. But people you are working with relate on a scale that is much more real and visceral when they're dealing with somebody who gets it."

And Loew gets it.

"She's got incredible street cred," Stanley says of Loew's work on the reservation. "It's a blast traveling with her up there. Everybody is a family member. Everybody is 'Hey, Patty!' and big hugs. I also think that because she doesn't take herself so seriously, she's really approachable."

Indeed, Loew is quick to laugh, and a talker. She will enthuse equally about her work or a Green Bay Packer game (she is a devoted fan). She evokes laughter from her students when, passing by a reservation boat flying a Packer pennant, she says, casually, "Oh, look. The tribal flag!"

Loew is quick to point out an important caveat when it comes to her work with the Bad River community as

it relates to the Wisconsin Idea. This is not about just transferring knowledge from the campus to the reservation, she says. In fact, she prefers the phrase "knowledge exchange."

The tribes, Loew says, are a rich and unrecognized source of information about the natural world. The elders and others on the reservation have much to share, and that traditional knowledge can inform and extend science and natural resource management in the non-Indian world, notes Loew.

In the Ojibwe, Loew sees a people who have valuable lessons for us in how to combine culture with a respect for the natural workings of the planet.

"Over the past 25 years, I've seen a real need for scientific information that has cultural relevance," Loew says. "Native communities may be poor in an economic sense but they are rich in natural resources. And the culture is attached to those resources in a way that can't be separated."

"So it's a two-way street," Loew continues. "We don't necessarily have the scientific capacity. But what we do have is storytellers and people who know and embrace the culture."

Loew did not come to these understandings suddenly. They are the result of a slow and gradual awakening on her part to her own Native American heritage and a lifetime spent learning the communication skills that would one day allow her to bring the power of story to bear on sharing the history and culture and struggles of not only the Ojibwe but all of Wisconsin's tribes.

Loew's path has led her to a very

(Opposite) Patty Loew (wearing white sweater vest) talks about cultural history and digital storytelling with high school students from the Ho-Chunk Nation during a recent visit on campus. They are gathered near a Native American effigy mound and the Tree of Peace on Observatory Hill.

professorial office in Hiram Smith Hall on the UW-Madison campus, home to the Department of Life Sciences Communication (LSC) and just a stone's skip from Lake Mendota.

But Loew, as her colleagues will point out, seems to have trouble staying in that comfortable office. Everyone who works with her in Hiram Smith Hall has had the pleasant experience of meeting a wide-eyed Loew in the hallway and being greeted by the phrase "Hey! I have an idea I wanted to try out on you."

It is more than a charming aspect of her character. It is how she works, bringing to life the cherished Wisconsin ideal of "sifting and winnowing."

Loew is an idea factory. In recent months, her friends and co-workers have listened and watched as Loew has worried about the many employees who will be out of work when Oscar Mayer's Madison factory closes. Perhaps, she muses as she talks with her colleagues, there is a way one of her video classes can help provide video resumes.

More often than not, those ideas become reality.

"She's phenomenal at taking ideas and making them come to fruition," says Stanley.

Professor and LSC department chair Dominique Brossard says Loew heightens the department's effectiveness at giving students a more global perspective on the intersections of culture and science in the natural world. Her courses in ethnic studies and Native American issues and the media are very popular, she notes.

And with her extensive background in television and video production, Loew is a key player in achieving another of the department's goals—providing foundational communication skills to students.

"She's uniquely positioned to do this kind of thing," Brossard says.



A storied broadcasting career: Loew, pictured here during her days as an anchor with WKOW-TV, imparts valuable journalistic and technical skills to her students.

Loew has traveled a long road to reach this stage in her career. She grew up on Milwaukee's north side, little aware of her Native American background and the important role it would play as her life unfolded.

"I didn't know I was Indian until I was 13," Loew recalls. "I was just a kid growing up in a housing project in Milwaukee."

Looking back, Loew believes her mother, who was born on a reservation, and her grandfather, who lived with the family, were trying to shield her from the discrimination frequently faced by Native Americans. Her grandfather, Edward DeNomie, was raised in the Tomah Indian Boarding School. Life in such schools was harsh, and children were often punished severely for speaking their native language or clinging to other aspects of their culture.

Even so, Loew heard and relished the stories of her ancestors. And by the late 1960s, she had become well aware not only of her rich cultural heritage but also the ugliness of racial prejudice. She recalls a growing sense of outrage, especially in the 1970s as Native American rights became a prominent news story.

Loew pursued a career in broadcast journalism. She earned a degree from UW-La Crosse and started her broadcasting career working in the city as a TV and radio reporter.

Eventually Loew moved to Madison, where she worked her way up to the anchor's desk at the ABC affiliate, WKOW-TV. Her awareness of Native American culture and her desire to tell

the stories of Wisconsin's tribes grew. In the 1980s, she earned awards and gained respect throughout the state for her coverage of the fierce legal battle and sometimes ugly boat-landing confrontations as the Ojibwe fought to reestablish off-reservation hunting and fishing rights that had been included in the treaties.

Loew would go on to make dozens of documentaries telling the stories and covering the struggles of Wisconsin's Native American communities. After moving on to Wisconsin Public Television, she made reporting on the tribes a regular part of her job as host of the show *Weekend*.

In a 2006 interview in the magazine *Diverse: Issues in Higher Education*, Loew described the important connection between her rediscovered culture and her professional life.

"As a journalist, a researcher, you have questions," Loew said. "You realize you are struggling for answers about yourself. So you want to be open, to make connections to people. You find yourself being very relational, and that's very Native."

That willingness to be up-front about her debt to her past, and to be outspoken about the indignities that Native Americans have had to endure, have sometimes landed her in interesting, if not difficult, positions.

After she gave a talk about some of the more unpleasant truths of the first Thanksgiving, she earned the ire of none other than radio talk show host Rush Limbaugh. He accused Loew of being part of a "multicultural curriculum which is designed to get as many little kids as possible to question the decency and goodness of their own country."

Few of Loew's documentaries received more attention than *Way of the Warrior*, an exploration of the role of Native American soldiers in the U.S. military that aired on PBS in 2007. During her research, she stumbled across

a film about her grandfather's World War I outfit. Her quiet Ojibwe grandfather, it turned out, had fought in seven of WWI's major battles as part of the 32nd Red Arrow Division.

Later, in another serendipitous discovery, she would find his diary. She describes how touched she was and how she is still so taken by the idea of Edward DeNomie raising his hand to take the oath and enlist in the U.S. Army—even though he had been denied citizenship in the country for which he was willing to give his life. Native Americans were not granted citizenship in the United States until 1924.

The popular, eye-opening documentary told the stories of many such Native American soldiers. And, later, after earning her master's and doctoral degrees in journalism and joining the Department of Life Sciences Communication, Loew would continue telling the stories of Wisconsin's tribes and of her own people at Bad River. She's written several popular books, including *Indian Nations of Wisconsin: Histories of Endurance and Renewal*—which has been adapted for children and is now widely used in public schools—and, most recently, *Seventh Generation Earth Ethics*, a collection of biographies about 12 Native Americans who were key figures in environmental and cultural sustainability.

Sitting in the stern of one of the boats winding through the reservation sloughs, Loew reflects on her storytelling past and connects it with the ancient tradition of the Ojibwe and other native cultures.

"We are oral storytellers," Loew says. But she is lending a new twist to the revered tradition. By adapting digital media to the old stories, the power of their message is amplified and made more accessible, especially important when it comes to lessons regarding



Capturing their stories: By creating videos, teens behind the camera learn from and give voice to members of the tribal community.

nutrition and health among tribal members.

For example, some of the young tribal videographers have scoured the reservation collecting information from elders about age-old gardening and cooking skills. They hope to use that information at some point, Loew explains, to create “teen cuisine” cooking shows focused on healthy eating.

It makes so much sense to combine the old and the new, Loew says. After all, she adds, by the year 2020, 80 percent of content on the World Wide Web is expected to be video.

“These are new tools to help us be who we are, to help us capture the essence of who we are,” says Loew. “It’s a way to preserve our stories and a really unique approach to documenting life on the reservation at this particular time in history.”

Students from the Global Health Institute class, traveling with Loew on weeklong field trips, have worked side by side with tribal youth to gather information for the health and nutrition project and to create videos.

Cali McAtee, a CALS biology major who went with Loew to Bad River in August, wrote in her journal about not only establishing close relationships with tribal young people, but also of gaining valuable insight into another culture. She recalls in her writings the feeling of traveling through a sea of rice at the edge of Lake Superior.

“I have seen a lot of wild rice in my life, but from far away. I probably assumed it was a field because you can’t really see the water in between,” wrote McAtee. “I liked hearing about the importance of rice to the Ojibwe because I don’t think I necessarily have anything as important or meaningful in my life as rice is to theirs.”

Loew has felt the power of story in her own life and in her own search for connections. Researching one of her books, Loew found herself reading the classic book *Kitchi-Gami: Life Among the Lake Superior Ojibway*, by Johann Georg Kohl. In the book she came across a story in which Kohl brings to life a meeting he had with a tribal elder.

That elder was none other than Loew’s great-great-grandfather, Loon’s Foot. Kohl wrote how, during his conversation with the old man, Loon’s Foot stepped back into his lodge and came out with a smoky, stained birch-bark scroll. Unrolling it and speaking in French, Loon’s Foot showed Kohl the story of his family told on the scroll and the dots and lines that denoted the passing years and decades. The story reached back to the year 1142.

“Here I was just reading Kohl, and then holy smokes!” Loew recalls. “Not bad for an oral culture.”

Loew firmly believes it is possible to capture that same kind of magic today with new approaches to traditional storytelling.

Don Stanley has watched as Loew has found a way to navigate between two worlds—the quickly receding years of the elders and the fast-paced, media-rich present of the tribal young—to create a new way to tell and preserve story and tradition, and then apply their lessons to modern-day problems.

As an example, Stanley describes how, as part of the nutrition project, he has seen Loew work with Native middle school

students, teaching them how to videotape an elder speaking about traditional foods and health. While Loew is helping the teens develop communication skills, she knows full well that she is also preserving the knowledge of that tribal elder for future generations.

No less an expert on Ojibwe tradition than tribal elder Joe Rose admires and respects Loew’s ability to bridge old and new worlds. He says that with the passing of the generation that experienced the assimilation policies of the boarding schools, it’s important that the young be able to hear the elders’ voices—to see their faces, lined and carrying the weight of the years, but still alive with the resilience and strength and wisdom of their ancient heritage.

“It is very important, since we do come from an oral culture,” Rose says of Loew’s task. “But you’ve heard the expression that a picture is worth a thousand words? Well, there’s truth in that, too.”

As for Loew, she says that the girl growing up in the Milwaukee projects has found her place.

“I’m doing what I was supposed to do,” Loew says. “I’m incredibly grateful that Don and I have found such a dedicated, caring community—our students, our volunteers, the Bad River kids and their families—with whom to pursue this work. They’re the ones who make it possible.” 

in the field



Kweku Brewoo



Abby Kinchy



Jill Lucht



Max Pfeffer



Tim Slack

Kweku Brewoo BS'14 • Kweku Brewoo was drawn to pursue CES and International Studies degrees by his desire to someday work for the United Nations. At CALS he was nurtured by inspiring professors who served as both teachers and mentors, he says, taking the time to talk about his goals and share stories of their own career paths. Upon graduating, Brewoo took part in a study abroad program in China. He then worked as a financial specialist with the UW–Madison College of Letters and Science, hoping to develop skills and understanding of financial components that could one day serve him at the United Nations. He recently accepted a position with the Department of Educational Psychology in the School of Education and plans to earn a master's degree in public health. Brewoo wants to have a positive influence on people and communities in the same way he was inspired and mentored at CALS.

Abby Kinchy PhD'07 • “I feel so fortunate to be able to teach about the topics I feel passionate about—and to have colleagues who really support me in pursuing research that doesn't always fit neatly into one disciplinary category,” says Abby Kinchy of her work in the interdisciplinary Science and Technology Studies (STS) department at the Rensselaer Polytechnic Institute in Troy, New York. As an associate professor, Kinchy directs the graduate program in STS, teaches a variety of undergraduate courses, advises many “fascinating and brilliant students,” and does research on important public issues such as hydraulic fracturing and genetic engineering. Her research examines the

unequal distribution of the negative consequences of agricultural and energy systems as well as the varying capacity of communities and social movements to participate in making decisions about technological change.

Jill Lucht BS'00 • Growing up on a dairy farm in northern Wisconsin shaped Jill Lucht's passion for sustainable agriculture. At CALS, she took advantage of opportunities to study and work with people from all around the world, traveling to Trinidad twice through UW programs. After obtaining her master's degree from the University of Missouri, Lucht took a position there as a policy analyst on agricultural, food and rural policy, developing her ability to communicate between researchers, technical data analysts and the general public. In her current position with the University of Missouri's Center for Health Policy, Lucht directs a project that utilizes Missouri's Medicaid claims data to evaluate health care innovations and population health for the state and the academic research community. The data are used for everything from helping children and their families better manage asthma to evaluating the use of telemedicine in rural Missouri.

Max Pfeffer MS'79 • Max Pfeffer is a senior associate dean and an international professor of development sociology with Cornell University's College of Agriculture and Life Sciences. His interest in community and environmental sociology was fueled by a personal experience. His parents were farmers in Germany, and when they immigrated to the

United States after World War II, they continued farming in their adopted home amid the fluctuation of agriculture and the broader economy of the post-war period. His studies at CALS eventually allowed him to examine those changes from a scholarly perspective. His CALS experience also gave him the perspective and confidence to go into the world and make meaningful contributions through his work, he says. That work includes teaching environmental sociology and sociological theory as well as researching rural labor markets, international migration, land use and environmental planning. Pfeffer, who earned his Ph.D. in sociology at UW–Madison, has published a wide range of scholarly articles and has written or co-edited four books. In his spare time, he enjoys gardening and hiking with his wife, Pilar Parra PhD'89, who is also a CALS alum.

Tim Slack BS'98 • Having grown up in a small town, Tim Slack has always been interested in how often rural places are overlooked in discussions about social and political issues. That interest drew him to community and environmental sociology at CALS. Slack appreciates the opportunity he had at CALS to learn from and work with excellent faculty who are leaders in their field and who challenged him intellectually, an experience that helped him see the important role that the social sciences have to play in the land grant mission, something that remains important to him to this day. Slack is an associate professor and director of undergraduate studies in the Department of Sociology

Improving the world through Community and Environmental Sociology(CES)

formerly Rural Sociology

by Kara Luedtke



Lisa Wilson-Wright

Kimberlee Wright

David Zoerb

at Louisiana State University, where he teaches a variety of courses ranging from introductory sociology to a specialized graduate seminar on the sociology of poverty. His research focuses on questions related to social and economic inequality, including the issues of underemployment and poverty.

Lisa Wilson-Wright PhD'01 • As a director at the Massachusetts-based NMR Group, Inc., Lisa Wilson-Wright leads studies that evaluate energy efficiency and renewable energy programs. She has extensive experience in the use of quantitative and qualitative research techniques to help inform energy efficiency, clean energy and environmental policy. Clients of NMR include electric and gas utilities, energy regulators and nonprofits. "I find it extremely fulfilling to see firsthand how clients use the results of our studies to improve programs, thereby saving energy, reducing customers' bills and limiting greenhouse gas emissions," she says. Working at NMR, Wilson-Wright finds the skills developed in CALS useful on a daily basis in developing surveys, analyzing data, authoring reports, presenting findings—and, ultimately, in asking difficult questions and delving deeper into the data to find answers. Wilson-Wright also serves on the board of the Farm Direct Coop, a nonprofit member organization that distributes locally grown organic food.

Kimberlee Wright BS'85 • Kimberlee Wright was born and raised in central Illinois. Living where Abraham Lincoln

first practiced law inspired her to value and strive for social justice, she says. Her love of the natural world was inspired by her grandmother, a master gardener and naturalist. Earning a bachelor's degree in community and environmental sociology at CALS, followed by a JD from the UW-Madison School of Law, allowed her to combine those two passions—a course she has continued pursuing throughout her career. Wright serves as executive director of Midwest Environmental Advocates, a nonprofit environmental law center that strives to protect and improve the health of water, land and air throughout the state. Previously she served as the director of conservation programs for The Nature Conservancy and as the executive director for Domestic Abuse Intervention Services. "More than anything, my education at CALS connected me to the families of rural Wisconsin and their love of place," says Wright. "It's such a privilege to be working with people who stand up for the rights of future generations to clean water, air and land. Our conservation ethic in Wisconsin is second to none."

David Zoerb BS'68 • David Zoerb's path from community and environmental sociology at CALS led to a successful career in marketing. Zoerb's interest in the intersection of cultural, social and political dynamics was nurtured via practical, hands-on opportunities at CALS, providing a framework to create and implement strategies and programs that were successful for a wide spectrum of social and marketing challenges. Zoerb relishes finding creative approaches to

About *In the Field*

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

Know a CALS grad whose work should be highlighted in *Grow*?
E-mail us at: grow@cals.wisc.edu

solving marketing problems, and he approached his career with an open mind and an eye for new opportunities. Now enjoying retirement, he volunteers in the MERLIN Network at UW Research Park, working with other volunteers to help new entrepreneurs and startups in their business efforts. He has also served on several local and regional planning and economic development committees and commissions. As a third-generation CALS alumnus whose two daughters are also UW graduates, Zoerb has UW roots that run deep. Over the years, he has been involved in leadership roles for the Wisconsin Alumni Association, Badger Action Network and UW Athletics. When it comes time for his twin granddaughters to consider college, Zoerb hopes they become the family's fifth generation of UW students.

Catch up with ...

Gary Brown BS'84 Landscape Architecture

A

As director of Campus Planning & Landscape Architecture at UW–Madison, Gary Brown BS'84 is in charge of places that hold cherished memories for just about every Badger alum. In addition to overseeing campus

master planning activities on the 936-acre campus, Brown serves as director of the 300-acre Lakeshore Nature Preserve. Brown, a Fellow of the American Society of Landscape Architects, also serves as the chair of the UW–Madison Landscape Architecture Alumni Advisory Board.

Currently Brown is spearheading the latest Campus Master Plan, a vision for the physical campus that is updated every 10 years.



● **Is there an overarching goal you're aiming for in this iteration of the Campus Master Plan?**

This time around, rather than focus on the building capacity of the land, we are specifically looking at the spaces in between our buildings—the campus landscape. As a landscape architect, I find these spaces as important to me as the buildings, and in some cases, more so.

When we ask alumni about their favorite places on campus, they often mention Bascom Hill, the view from Observatory Hill out over Lake Mendota (and “traying” down that hill in the winter!), or the Memorial Union Terrace, some of our most iconic landscapes. We want to make sure all of our campus landscapes support the mission of the university and provide respite, rejuvenation and places for faculty, staff and students to gather outside in the warmer months. In winter, views out to great landscapes can help promote the wellness of our staff and the learn-

ing potential of our students. Landscapes and views to them are inherently important for our long-term health and well-being.

● **Can you offer any specifics yet?**

The plan includes adding new courtyards and open spaces as redevelopment occurs in the south campus, south of University Avenue. We are also looking at significant changes to the area between North Charter Street and Henry Mall, north of University Avenue, as that area redevelops over time.

● **Where do you find inspiration for a task like this?**

I rely on my landscape architecture colleagues around the country who provide inspiration in their work on campus landscapes. Some say the physical campus soon won't be needed, with the expansion of online learning. I disagree. The physical campus and all that it stands for—the life of the campus, the heart and soul of the great universities—are in their campus landscapes. It's what makes each university unique, offering a “sense of place” created by the university's own history and its part of the world.

● **What's the hardest thing about your job?**

Getting people involved and excited. Facilities planning can be pretty dull for some people. I want people to feel free to share their ideas and concepts about how the campus should look, feel and function in 20 years. It's nice to stop and gaze into the crystal ball every now and then to predict the future. You never know what actually can come true. Look at Alumni Park, the East Campus Mall, a reinvigorated Memorial Union Terrace and the new State Street Mall—all great examples of amazing ideas and visions for our campus landscape that have been, and will prove to be, iconic for years to come.

—JOAN FISCHER

For more information and to share your ideas, please visit www.masterplan.wisc.edu

A Fitting Tribute

How best to honor a towering eminence in one's field?



The late James F. Crow—an outstanding scientist, statesman, public servant and teacher—would surely have been happy with the solution arrived at by his colleagues and friends: a professorship named in his honor to ensure that great work in genetics continues.

The James F. Crow Professorship in Genetics will be made available to attract a world-class scientist to join the faculty in genetics. Endowment earnings will be made available to support the recipient's research.

The professor who bears the title will build on the legacy of a giant. Crow was a pioneer in genetics. He measured the consequences of mutations—essentially, mistakes in DNA—for humans and other organisms, and he invented models that explain the pattern of DNA differences between individuals.

Crow's discoveries made many of today's genetic technologies possible, including commercial services that use DNA to reveal personal genealogy, the criminal justice system's application of DNA evidence, and public health models that reveal why some diseases are common and others are rare. His work helped establish the University of Wisconsin–Madison as an international leader in genetics.

“Legions of the world's most renowned geneticists trekked to Madison to visit Jim and meet with the broader community of geneticists on campus,” says John Doebley, genetics professor and chair of the UW–Madison Laboratory of Genetics.

Crow, an active member of the Laboratory of Genetics from 1948 to 2012, seamlessly integrated research with outstanding teaching and a passion for public service. One of his greatest gifts was his enthusiasm and ability to clearly explain genetic concepts to a wide range of audiences. He spoke to people he met in the community with the same admiration and excitement with which he greeted his scientific colleagues.

The professorship will honor Crow's legacy by ensuring the continuation of discoveries with high societal relevance, notes Doebley. “Jim's interests spanned the entire range of the field of genetics, but with a penchant for honing in on the most interesting and fundamental questions. As such, we can best honor his memory by following his instincts in this regard.”

—JOAN FISCHER

You can make a gift to the James F. Crow Professorship in Genetics fund at <http://supportuw.org/giveto/CrowProfessorship> or contact Kate Bahr at the UW Foundation (tel. 608-308-5120, kate.bahr@supportuw.org).

A fundraising event for the named professorship will be held on **Friday, September 23, 1–9 p.m.** More info available soon at <http://www.genetics.wisc.edu/CrowProfessorship.htm>.

SCIENCE FUN ON CAMPUS—Visitors of all ages are welcome to **Science Expeditions, April 1–3**, a cost-free event at various venues across campus. CALS faculty offer hands-on “Exploration Stations” at the Wisconsin Institutes for Discovery and lead activities at other campus locations as well. More info at science.wisc.edu/events-science-expeditions.

UP YOUR GARDENING GAME—Learn what makes a garden especially beautiful from a nationally renowned panel of experts at **The Artful Garden Symposium on Saturday, April 2** at Allen Centennial Garden on the UW–Madison campus. This ticketed event includes morning refreshments and lunch. More info at allencentennialgardens.org.

MEET YOUNG SCIENTISTS—This year's **Undergraduate Research Symposium** takes place **Thursday, April 14** at Union South (Varsity Hall). The symposium showcases undergraduate research from all across campus, including CALS. More info at ugradsymposium.wisc.edu.

TINY ORGANISMS, BIG MEANING—Learn more about the role of the microbiome in research at **Exploring Microbiome Opportunities in Agricultural and Life Sciences**, a symposium presented by CALS on **Wednesday, April 20, 8:30 a.m. to 4:30 p.m.**, in the Microbial Sciences Building (Ebling Auditorium). Speakers include **Jo Handelsman PhD'84**, associate director for science at the White House Office of Science and Technology Policy; **James Prosser**, professor and chair of molecular and cell biology at the University of Aberdeen; and **Federico Rey**, a professor in the Department of Bacteriology at CALS. More info at cals.wisc.edu/microbiome.

EAT A FARM-STYLE BREAKFAST ON CAMPUS at **Breakfast on the Farm on Sunday, May 1, 8 a.m.–12 p.m.** at the Stock Pavilion. The event benefits the Association of Women in Agriculture. More info at: awamadison.org/breakfast_on_the_farm.php.

BIKE FOR A CAUSE with Ride to Farm, a 50-mile bike ride in southern Wisconsin to benefit the Wisconsin School for Beginning Dairy and Livestock Farmers. The ride takes place on **Saturday, June 4**. Even if you don't bike, you can pledge a rider. More information at ridetofarm.dojiggy.com.

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

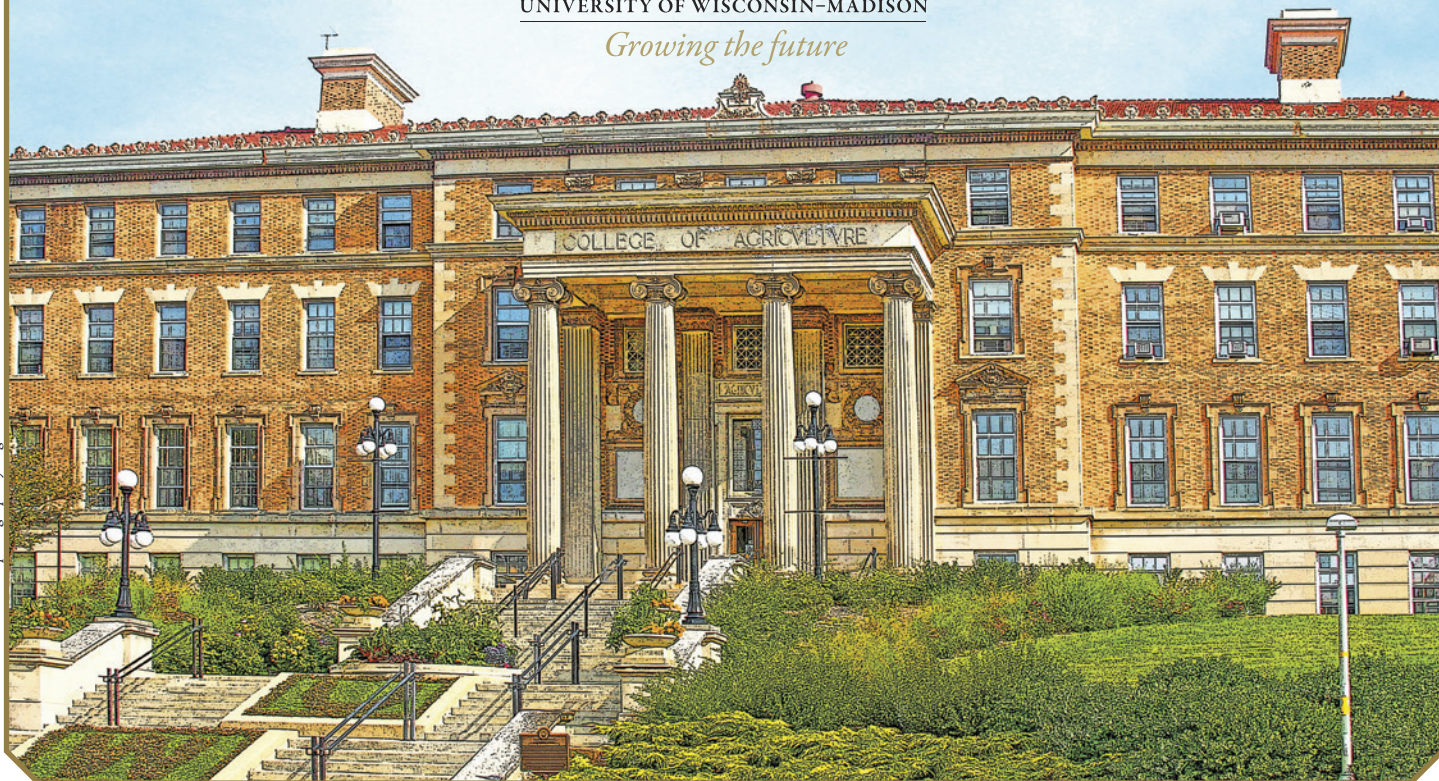




College of
Agricultural & Life Sciences
UNIVERSITY OF WISCONSIN-MADISON

Growing the future

Photo-illustration based on a photograph by Roger Schmidt.



Thank you for helping us grow our future

PLATINUM

COVANCE

GOLD



BRONZE

kikkoman



Dow AgroSciences

Over the past year our college made great strides in discovery and innovation in our core areas: food systems, health, bionergy, the environment and communities. These advancements would not have been possible without the generous support of our sponsors. We thank them for helping CALS grow the future.

THANK YOU AND ON, WISCONSIN!

Take the FINAL EXAM!

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

Agronomy

1) Which of the following statements about intensive rotational grazing is true?

- a) Animals are allowed to graze on all of the pasture plants for as long as they want.
- b) Pasture plants don't have adequate time to regrow before they are grazed again.
- c) Grazing animals are allowed on each pasture section for indefinite periods of time.
- d) Pastures are divided into smaller sections called paddocks.

Agricultural and Applied Economics

2) Which is true of policy relating to climate change?

- a) Adaptation increases the need to mitigate, and mitigation increases the need to adapt.
- b) Adaptation increases the need to mitigate, and mitigation reduces the need to adapt.
- c) Adaptation reduces the need to mitigate, and mitigation increases the need to adapt.
- d) Adaptation reduces the need to mitigate, and mitigation reduces the need to adapt.

Global Health

3) What disease is also known as "breakbone" fever?

- a) Beriberi
- b) Rickets
- c) Dengue fever
- d) Yellow fever

Animal Sciences

4) If you are a vegan, which of the following should you be most concerned about getting?

- a) Vitamin A
- b) Vitamin C
- c) Vitamin B₁₂
- d) Vitamin D
- e) Vitamin E

Entomology

5) What percentage of all native plants in the world require pollination by an animal (most often an insect)?

- a) one-third
- b) one-half
- c) two-thirds
- d) three-fourths

Last issue: Answers were 1:C; 2:B; 3:C; 4:D; 5:E. Congratulations to Amanda Ritzman BS'15, who was randomly selected from 8 people who correctly answered all questions. She wins a Babcock Hall cheese box.

College of Agricultural and Life Sciences
University of Wisconsin–Madison
136 Agricultural Hall, 1450 Linden Drive
Madison, WI 53706

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PHOTO BY SEVIE KENTON BS'80 MS'06



Baa-dorable! Lambing season at the
CALS-based Arlington Agricultural Research
Station. Learn more about activities there at
<http://arlington.ars.wisc.edu>.