


grow

Wisconsin's Magazine for the Life Sciences • Summer 2010

food & agriculture • environment • energy • health



**Are
troubled
waters
making
fish unsafe
to eat?**

Swimming Upstream



College of Agricultural & Life Sciences
University of Wisconsin-Madison

HOW FAIR IS FAIR TRADE? • METABOLOMICS AND YOUR HEALTH • PLIGHT OF THE GREEN POTATO



Graduate student Jenna Eun leads lab-coated third-graders on a tour of CALS biochemistry professor Doug Weibel's lab as part of Micro-Explorers, an after-school science outreach program that allows kids to explore the microscopic world. Photo by Jeff Miller



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Wisconsin's Magazine for the Life Sciences

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Wisconsin's innovative Healthy Grown Potato has been a success with growers, researchers, environmentalists and the World Wildlife Fund. So why aren't consumers buying it?

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On the cover: One of the most popular game fish in Wisconsin, rainbow trout accumulate PCBs and other toxins in their bodies. *Photo by Wolfgang Hoffmann*

Dean Molly Jahn

Home Again



As this issue arrives, I am delighted to be returning to CALS after a short-term tour of duty in Washington, D.C. Nine months ago, I was honored to be called to provide interim leadership for several key research agencies in the U.S. Department of Agriculture. Now, after a truly remarkable experience with the agency, I am even more honored to be returning home.

The USDA was founded in the same year as our land-grant system of higher education, and the opportunity to work as part of the agency's leadership team has given me a new perspective on our national research, education and extension system. My assignment was profoundly enlightening, and I return with new insights and new friends that will help me be a better dean—and help CALS become even more effective in carrying out its missions.

I want to thank everyone in the university and the community who helped me take on this challenging role. I can't say enough about the outstanding leadership that Irwin Goldman provided as interim dean. Under his steady guidance, and with the talents of his excellent team, CALS has not

I believe we have so much to celebrate, and yet there is so much more that we can do.

missed a beat. Indeed, we're coming off a year of historic accomplishment. Our community championed a landmark reform to our degree requirements and began a self-study that will shape the future of our academic affairs. Our faculty, staff and students continued to find new ways to build partnerships with the communities we serve and improve our economic and social well-being. And our alumni have responded with heartwarming strength to our call to help maintain the affordability of a UW-Madison education through gifts to the Wisconsin Rural Youth Scholarship Fund and other need-based scholarships.

As I return and begin my fifth year of service to CALS, I believe we have so much to celebrate, and yet there is so much more that we can do. In Washington I saw both the impact of our land-grant system and the great challenge in maintaining its resources. But I am proud to be leading a college that has always responded to such challenges with innovation, information and inspiration.

grow

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On Henry Mall

News from around the college

Out on a Limb

Horticulture students get a lesson in career climbing.

You'd have to say Lizzi Lathers looked a little anxious, as students often do when taking on a new lesson.

But most lessons don't come while suspended 15 feet in the air.

That's where the CALS junior found herself one day in April, clinging to a rope lassoed high among the branches of the swamp white oak tree in front of the Microbial Sciences Building. As she dangled, Sean Gere, the professional arborist who coaxed her up there, offered encouragement.

"Just trust the rope," he called out. "The loop will hold your weight."

"Really?" Lathers asked, peering at the harness suspiciously. "Promise?"

Climbing a tree safely and confidently is a matter of experience and preparation. In Horticulture 375, CALS' course on arboriculture and landscape maintenance, students get a unique opportunity to gain their footing by spending one class session literally learning the ropes. Organized by associate professor Laura Jull, the demonstration is intended to show students the equipment and techniques professional arborists use when pruning or treating trees.

"It can take months or even years to really become a good climber," says Jull. "So obviously, we just give them a taste of it. But it's an important skill to master if you're interested in arboriculture."

So, too, are tree biology, pest management, and



disease treatment and prevention, all subjects Jull explores in depth as part of the class. But none of those topics elicit quite the same response as strapping into a harness and heading up into the branches.

"I'm not a huge risk-taker, but I couldn't resist the chance to surround myself in that beautiful tree," says Lathers, a horticulture major. "Horticulture is best learned hands-on, and this class has capitalized on that."

—MICHAEL PENN

Students dangle amid the branches of a swamp white oak tree as part of a class demonstration of safe climbing techniques.

The Pathogen Path

Scientist tracks how bacteria hitch a ride on plants to get to humans.

To dine with Jeri Barak is to take a lesson in applied food safety. Barak, an assistant professor of plant pathology, begins by sorting through her salad, plucking out any greens that appear dark and wet and moving them to another plate. It's not the appearance that bothers her—it's the small, but deadly, chance that those leaves host colonies of *Salmonella enterica*.

Why would salmonella, bacteria that thrive in the warm-blooded environs of an animal, hang out in a pile of lettuce? That's what Barak would like to know. For the past 10 years, she's been studying how the bacteria use plants as a mode of transportation to arrive at a more favorable destination.

Given the choice between alighting upon a plant or an animal, salmonella cells would pick an animal every time, Barak explains. Animals provide just the right milieu for the bacteria to grow and reproduce. By comparison, plants are inhospitable wastelands. But Barak has found that when salmonella cells wind up on a tomato or cauliflower plant, they are capable of hunkering down and waiting for something better to come along. "They want to get to an animal host, so why not get onto the food that your host eats?" Barak says. "It's a smart strategy."

That strategy is abetted by Americans buying more fresh produce. In the past, most families boiled vegetables like spinach, helping kill off pathogens. But as more veggies are eaten raw, foodborne illnesses from contaminated produce have increased significantly. Over the past 40 years, the incidence of produce-related outbreaks has grown from less than 1 percent to more than 12 percent of reported cases. "There is even some evidence that the number of



CALS plant pathologist Jeri Barak scrutinizes produce at the Dane County Farmers' Market for signs of disease, one step consumers can take to guard against food pathogens.

salmonellosis outbreaks caused by people eating produce is now higher than those caused by eating eggs, chicken and other animal products," says Barak.

Barak was among the first handful of researchers to start studying human pathogens in the context of plant systems. She was just launching her research career in 1996, when a major *E. coli* outbreak in Japan caused 17 deaths and more than 6,000 illnesses. The source in that case was sprouts, and it motivated the U.S. government to fund research on pathogens in produce.

In the lab, Barak has been working to identify the genes that enable salmonella to hang on for the ride, with the long-term goal of using this knowledge to improve food safety. So far she has pinpointed more than a dozen key genes involved in attaching and adhering to plants. She is also exploring a number of important extrinsic factors. She discovered, for instance, that salmonella thrives when tomato plants are infected with *Xanthomonas vesicatoria*, a common plant pathogen. "During disease," she explains, "there are nutrients leaking out, so there's a lot of stuff for salmonella to eat and everything just grows." On the positive side, Barak has found a number of heirloom tomato varieties that salmonella can't attach to. She is in the process of figuring out what makes these plants impervious to the bacterium, which could help speed the breeding of salmonella-free tomato varieties down the line.

In the meantime, Barak has no plans to swear off her vegetarian diet and hopes no one else will either. "That would be the worst thing that could happen," she says. Just watch out for the slimy lettuce.

—NICOLE MILLER MS'06

Skin Deep Exposing Skin's Role in Fat Burning

Most people think of skin only as a cover that shields the body from germs. But CALS biochemist James Ntambi has discovered that our largest organ plays a major role in energy metabolism by releasing a chemical signal that tells the body when to burn dietary fats. Ntambi's lab is now working to identify the factor in skin tissue and pinpoint its place in the body's metabolic processes. "We have an idea what the factor is, but we still need to show that it gets secreted into the blood to prove that it's the one," he says. If he's successful, the work could open the door to new kinds of weight-loss drugs that would mimic or boost the signal coming from the skin, triggering our metabolism to burn off excess fat.



Going to the Source

Buffer project takes on runoff one field at a time.

Who put the P in the Pecatonica? Just a handful of people, it turns out. A large share of the phosphorus that's contaminating this picturesque southwestern Wisconsin stream is likely coming from a relatively small number of farm fields, a recent analysis finds.

A study of one sub-watershed suggests that about 60 percent of the phosphorus flowing into the river comes from just 12 percent of the surrounding farmland. Ten of the area's 61 farms account for most of the problem spots, leading researchers to think that changing practices in a small number of places could make a big difference in water quality.

That approach is being put to the test in the Pecatonica by a partnership that includes university researchers, public agencies, farm groups and The Nature Conservancy. The strategy was outlined in a 2005 report by a policy advisory group called the Wisconsin Buffer Initiative, which advised using UW-Madison-derived models to identify areas that had the greatest likelihood of nutrient runoff—and the best chance of fixing the problem.

"We're testing the idea that if you go into a watershed, identify the high phosphorus-loss fields and change management on those fields, you can decrease phosphorus at the mouth of the watershed," says Laura Good, a CALS soil scientist who rated fields for their potential to shed nutrients into the river.

With the problem fields identified, a team of

farm-management specialists and conservationists is beginning to work with farmers to modify cropping practices. "We're trying to bring a whole-farm management perspective, looking at the impact of implementing these best management practices and trying to work it all the way through," says Tom Cox, a professor of agricultural and applied economics.

These farmers aren't bad actors, says Pete Nowak, a professor in UW-Madison's Nelson Institute for Environmental Studies who directs the buffer initiative. In most cases they are already employing many sound conservation practices, but the choices aren't always appropriate on vulnerable fields, he says.

"The traditional approach is to come in with a technical manual and say you have to do this," says Nowak. "Our approach is to ask, 'Why are you doing this?' and then work with them."

Usually the reasons farmers cite for particular practices are economic. A farmer might grow corn silage, a crop that leaves the field bare at harvest, because it's needed for dairy rations.

"We're looking for the win-win in terms of environmental and economic performance," says Cox. "We think it's possible, but it's not a cookie-cutter solution. This won't work without working through the potential spillover aspects of the change onto the whole farm operation."

—BOB MITCHELL BS'76



PAT SUTTER / DANE COUNTY DEPT. OF LAND AND WATER RESOURCES

Phosphorus runoff from a small number of farms clouds streams in the picturesque Pecatonica watershed.

classAct



Christian Truong

Riding the Long Road

When Christian Truong arrived at UW-Madison as a freshman in the fall of 2001, he never imagined nearly a decade later, he'd still working toward his degree. But life has had a way of throwing obstacles in Truong's path.

The first disruption came in 2004, when Truong, an army enlistee trained in emergency medicine, was deployed to Iraq. He spent a year serving as a medic for an infantry unit stationed north of Baghdad, an experience that taught him life is fleeting. "Seeing what the soldiers were fighting for ... makes you realize how fortunate you are," says Truong, a native of France who moved to the United States at age eight. "It really invigorated this drive to make the most of my life."

By the time he returned to campus in 2006, Truong no longer felt inspired majoring in biomedical engineering. He took a botany class, which awakened his interest in the environment and eventually led him to a new field—biological systems engineering.

Then, another hurdle. After failing to finish nearly half of the problems on a routine midterm, Truong discovered he had a learning disability that hampered his ability to complete timed tests. Ever indefatigable, he learned to manage the issue. "I thought, after all I had been through, with moving to this country, learning a new language and going to war, this was easy. I just took it one step at a time," he says.

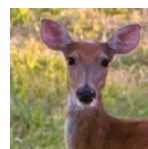
Now, with a December graduation finally in sight, Truong has a summer internship lined up with ConAgra, which he hopes will lead to a job as a food process engineer. He's also training with UW-Madison's cycling team, where he's had a couple of top-10 finishes in collegiate road races. And that should come as no surprise: He's gotten pretty good at long, uphill climbs.

ADOPTED, by a rare all-faculty vote, a unified **CALS bachelor's of science degree**. The single degree replaces four separate degree paths—a frequent source of confusion for students, parents, advisors and employers—and creates a uniform set of academic requirements across the college. CALS' four professional-certification degrees will remain unchanged.



INDUCTED into the Wisconsin Meat Industry Hall of Fame: baseball radio announcer and sausage enthusiast **Bob Uecker**. The voice of the Milwaukee Brewers was elected to the hall, which is housed in the UW Meat Sciences

Building, for his unfailing on-air advocacy of Wisconsin's finest meat products. His picture now joins more than 50 other barons of bologna on the hall's wall of fame.

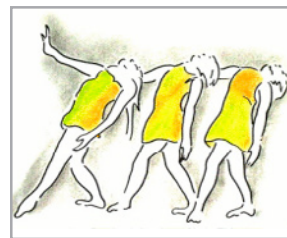


SIGNED, an agreement between CALS and the **Wisconsin Department of Natural Resources** to launch new research on the state's deer herd. The DNR will support several CALS projects to

more accurately measure the number of deer in the state and their impact on the environment as part of an effort to refine the agency's strategies for managing the herd.

HONORED, by the American Chemical Society, life sciences communication lecturer **Ron Seely**. A veteran science journalist for the Wisconsin State Journal, Seely won the Grady-Stack award for his coverage of science and environment.

DANCED, more than a dozen UW-Madison students and scientists who responded to a unique invitation to interpret their research in movement. Organized by visiting science writer **John Bohannon**, who is leading a national



"Dance Your Ph.D." contest for the journal Science, the students attempted to interpret moving molecules and other scientific phenomena in creative dance. No word yet if Broadway is interested.

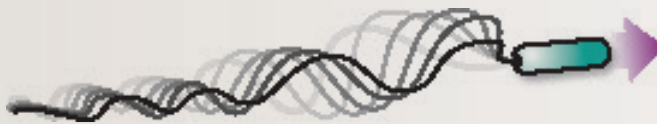
Number
Crunching **51** **PERCENT OF THE WISCONSIN CORN**
crop planted by the beginning of May,

the earliest date to reach the halfway mark since the USDA began tracking crop planting in 1979. A warm spring brought relief for farmers who endured a cold, wet fall, which wreaked havoc on harvest and fieldwork. Joe Lauer, CALS' extension specialist for corn, says some farmers started planting this year's corn crop before they were done harvesting last year's.

how bacteria move

FOR SUCH TINY ORGANISMS, BACTERIA lay a big footprint on our lives. And one reason why is that they can really get around. Most bacteria are able to navigate nimbly in a host of environments—including our bodies—to find food or a host, and the results can be both helpful (such as when bacteria boost our immune system or aid with digestion) or terribly destructive. But how does a brainless, single-celled organism plan its peregrinations? Doug Weibel, assistant professor of biochemistry, explains:

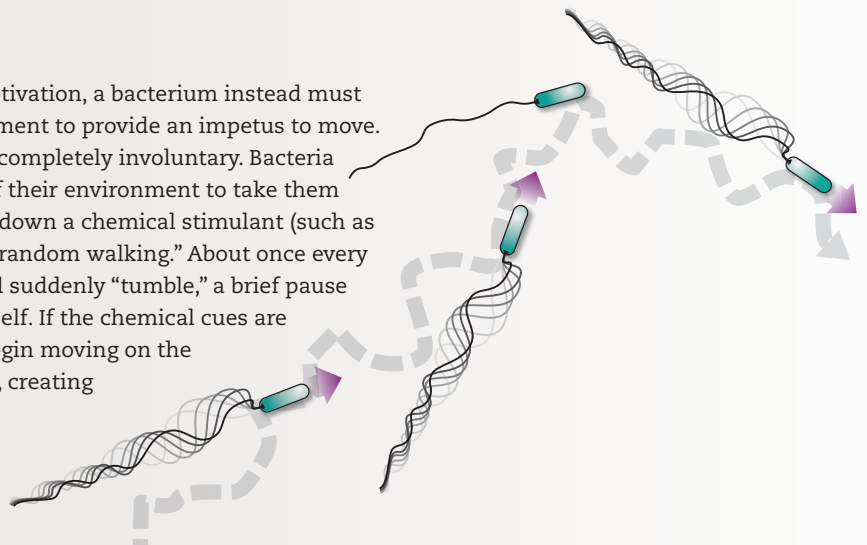
Whip it: One of the most common methods of transport for bacteria is with the aid of flagella, thin, whip-like structures that extend from the cell walls of many kinds of bacteria. Some bacteria have a single, tail-like flagellum or a small cluster of flagella, which rotate in coordinated fashion, much like the propeller on a boat engine, to push the organism forward.



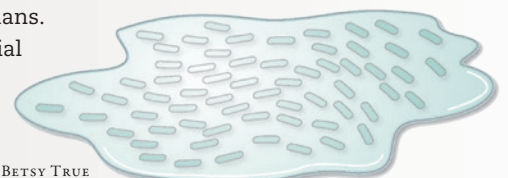
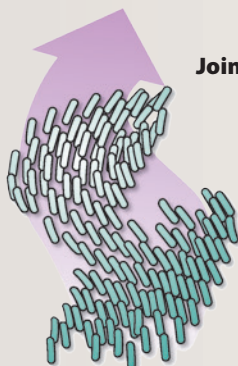
The hook: Many bacteria also use appendages called pili to move along a surface. These pili, which can cover the surface of a bacterium like tiny hairs, bind receptors and pull a bacterium forward when retracted. Pathogenic bacteria such as *Salmonella* deploy this method of mobility when moving along the surface of a human cell in search of a place to dig in.



Getting warmer: With no brain to supply motivation, a bacterium instead must rely on chemical cues from its environment to provide an impetus to move. This process, known as chemotaxis, is completely involuntary. Bacteria simply respond to the tugs and pulls of their environment to take them to useful places. A bacterium tracking down a chemical stimulant (such as a nutrient) moves in a way known as “random walking.” About once every three seconds, a moving bacterium will suddenly “tumble,” a brief pause that allows the organism to reorient itself. If the chemical cues are right to continue, the bacterium will begin moving on the same path. If not, it will change course, creating a jagged path toward its destination.



Joining the crowd: Some bacteria don't just seek out nutrients—they also seek out each other. Like dancers in a performance, these strains cluster together to create swirling patterns of coordinated motion. Congregating bacteria also can join to form a biofilm—a thin matrix of bacteria stuck together on a surface. Bacterial cells in a biofilm can have characteristics that aren't present when they develop on their own, and it's believed that biofilm formation may play a role in many bacterial infections that affect humans. The discovery and exploration of these forms of bacterial collaboration has changed how scientists regard these organisms, which the more we learn about them seem anything but simple.



ILLUSTRATIONS BY BETSY TRUE

COSTA RICA



Twin Gardens Teach About Local Food

Costa Rica attracts tourists who think green—visitors who want to enjoy tropical beaches, rainforests and wildlife in a sustainable way. And they carry that attitude to the table. They want to eat organic food.

The nation's hospitality industry is eager to oblige.

"Costa Rica's hotels want to provide organic vegetables to their clients. It's a huge niche market that people can make money in so there are a lot of entrepreneurs," says Jim Nienhuis, a CALS horticulture professor who regularly teaches and conducts field research in the Central American country.

To help Costa Rican farmers fill that desire, Nienhuis recently hosted seven students from the Instituto Tecnológico de Costa Rica in Wisconsin, where they visited organic farms, research stations, botanical displays and urban gardens. This spring, a group of UW-Madison students will do the same thing in Costa Rica.

Growing organic food in the tropics is tough, Nienhuis says. There are more insects and diseases,

and no winter to kill them. And growers make things harder for themselves in their eagerness to please visitors' palates.

"They try to grow varieties that are familiar to American or European tourists. Those varieties are almost always poorly adapted to the tropics so the growers always have to pile on the pesticides," he says.

A key goal of the exchange program is

help the students see how plants grow differently at different latitudes. Nienhuis and his Costa Rican colleagues planted identical vegetable gardens—each with 28 varieties—in Madison and San Carlos so students could observe differences.

"We have a real strength in vegetable variety development; they don't have that there. I want to get them to see that they can develop their own varieties," says Nienhuis. "The garden is a way of demystifying the process of variety development."

—BOB MITCHELL BS'76



OSCAR GUTIERREZ

In Costa Rica, tourists like foods like mangoes to be fresh—and green.



JEREMY WEBER

PERU



Is All Really Fair with Fair-Trade Coffee?

When you buy a cup of coffee that has been certified as Fair Trade, Organic or another "socially responsible" label, do you know what you are really getting?

"I think most consumers would be surprised to learn who really benefits from certification," says Jeremy Weber MA'08, a Ph.D. candidate in agricultural and applied economics.

Weber has spent much of the past five years studying the impact of certification on coffee growers in Peru and Mexico, and he says the small, family-operated farms often portrayed in fair-trade promotions are among the least likely to benefit directly from consumers' purchases. Often the price premiums growers receive for certified beans are too small to cover the costs of becoming certified. The fees and coordination involved with gaining various certifications favor growers who are organized and aware enough to take advantage, Weber says.

Weber became interested in the coffee trade after spending a year in Peru on a Fulbright fellowship. During that time, he followed a growers' cooperative as it became certified as Fair Trade, a standard that signifies adherence to sustainable development and fair-labor practices. For his doctoral research, he examined the experience of growers in three such standards—Fair Trade, Organic and Rainforest Alliance. He found that growers do often benefit—but not for the reasons consumers might assume.



CALS Professor Brad Barham visits with a Peruvian farmer who participates in a local fair-trade coffee cooperative.

“They received more money for their coffee, but the key was increased productivity from their plants,” he explains.

Growers working toward Rainforest Alliance certification, for example, received technical assistance from a nongovernmental organization, something that local governments rarely provide. Weber says farmers who implemented pruning techniques recommended by the NGO doubled yields in four years, although he says sustaining those yields will depend on how well they replenish soils.

Coffee drinkers also might not expect that certification can benefit public-works projects. NGOs working with certification agencies have helped bring running water and latrines into growers’ communities. One Peruvian farmer told Weber proudly: “Our town used to be seen as a backward place, where people were thought of as lazy and incompetent. Now, even though we are just small farmers, we are seen as just as good as other coffee growers from the outside. Farmers from other places are coming to see my crop and how I manage it.”

Still, Weber feels fair-trade and organic certification has a long way to go before it can live up to the claims it makes. “Certification too often can become a once-a-year visit to fill out a checklist, not a holistic view focused on outcomes that consumers are expecting,” he says. More evaluations by third-party organizations and academic researchers are needed to fully understand whether certifications are delivering on their lofty promises.

—THERESA LINS BS’92

RUSSIA



Sausage Makers Find Spice in New Business

Before Larry Borchert BS’62 MS’64 PhD’67, there was no beef jerky in Russia. At least none where he visited.

“I found out on my first trip to Russia that they didn’t know what jerky was,” says Borchert, an adjunct professor in the animal science department. “And once I made it, they really fell in love with it.”

Borchert, who spent 30 years in research and development for Oscar Mayer, traveled six times to Russia between 2000 and 2007, visiting small meat processing plants that were struggling with the transition to capitalism. Under the Soviet regime, meat processing facilities were state-owned and operated, he explains. “Then, all of the sudden, they became privatized. Through all sorts of different mechanisms, people acquired private sausage companies, and in many cases they didn’t know what they were doing.”

As a volunteer for the U.S. Agency for International Development, Borchert worked with eight plants to develop new products and improve safety processes. “My role was to help in whatever way I could,” he says. In the western Russian city of Smolensk, for instance, that meant teaching workers a better way to cut up a pork carcass. In a Siberian plant, he demonstrated smokehouse cooking to workers who were losing sausages—and wages—when casings fell apart during boiling. He also visited three colleges, where he described modern American sausage-making techniques to students who in one case were learning from a textbook printed in 1964.

Not all of his ideas went over well. When he cooked bacon for his host in a small Siberian village, she didn’t like the fried meat, saying she’d rather eat it raw, with a swig of vodka.

But when it came to jerky, everyone wanted a bite. “I think every place where I taught them how to make jerky, they commercialized it and are still making and selling it today,” he says.

—NICOLE MILLER MS’06



American meat processing is bringing new flavor to the Russian market.

Nutrition for Life

When scientists feared thousands of kids with cystic fibrosis were going malnourished, **HuiChuan Lai** went to the data for answers.

ASSOCIATE PROFESSOR HUICHUAN LAI MS'90 PhD'94 began exploring the link between nutrition and cystic fibrosis in 1994, when she spent a year working in UW-Madison's pediatric pulmonary center. A registered dietitian trained in biostatistics, she has spent much of her career scouring epidemiological data for trends that explain how diet affects the health and longevity of children with the genetic disorder. Her work led the national Cystic Fibrosis Foundation in 2005 to rewrite its nutritional guidelines, a move that is contributing to a heartening trend toward better nutrition and increased life expectancy among CF patients.

What causes cystic fibrosis?

The basic defect is in the gene that encodes a transport protein for chloride. It affects almost all organs in the body, but the clinical manifestation is primarily in the lungs and in the digestive system. The classic presentation for undiagnosed CF is failure to thrive, meaning that kids don't grow as they normally would. Because of the problem in the digestive system, they can't absorb fat, and fat contains a lot of energy. The lung involvement does not manifest until a little bit later in life, and most patients end up dying from respiratory complications.

What can doctors do?

Because the lung disease is what causes mortality, the treatment now is really focused on that part of it. But there are many anecdotal observations, small studies, that show that if patients preserve good nutritional status the lung disease will progress more slowly. Over the last 10 years more and more emphasis has been placed on treating malnutrition, with the hope that you can slow down lung disease. And nutrition treatments have lengthened survival dramatically. The median age of survival is beyond 40 now. Three decades ago it used to be less than 10.

How is nutritional status measured in these patients?

It's important to define optimal nutritional status in CF patients because nutrition has such a big impact on lung disease, quality of life and survival, and that's what my research focuses on.

So the Cystic Fibrosis Foundation publishes clinical practice guidelines—the first one was done in 1992, and then it was updated in 2002 and again in 2005. The guidelines traditionally have been based on how close a patient's weight is to an ideal standard. So when a patient comes to the clinic, doctors will try to calculate the patient's ideal weight, and then they will take their actual weight as a percentage of ideal weight. If the result is above 90 percent, they say, "That's fine. Let's keep watching." If it's below 90 percent, they do something about it. One of my major contributions to the field is that I proved this percentage of ideal body weight guideline is faulty. It's only correct for children of average stature.

What was wrong with it?

At the extremes (of height), the ideal body weights are wrong. If the patient is short, for instance, the ideal weight is underestimated. So when you do the calculation for a short child, a doctor is more likely to think a child is fine, when in fact he is too thin.

How did you figure this out?

I didn't just discover it. I was motivated by questions coming from the clinic. I work with dietitians and pulmonologists a lot, and this question was brought by a dietitian who was using this index in the clinic. She had calculated the ideal weight for a child who was particularly short, and it just didn't seem right to her. She said, "This child is not supposed to be at this weight. It would be too low."

I also heard about problems with tall patients, where the dietitian would say, "I can't increase his weight to that level, I think it's way too high. Why is that the standard?" It's not only frustrating. It doesn't make sense to them.

So these comments motivated me to look into whether there was anything wrong with the definition of this parameter. That is how I got started.

What happened after you found the flaw?

When I first presented it at the annual CFF meeting, people were really skeptical because that parameter had been used for decades. I was trying to prove my point, but explaining my statistical methods to the clinical community was really difficult because my proof involved really complex mathematics. Some of them got it and believed it, but some of them really didn't. After this, I realized I needed to give practical examples, specific patient examples, to help convince people.

Eventually, the CFF convened a consensus com-





mittee to revise the guideline. I was on that committee. So we dropped that (faulty) parameter in 2005, and CF centers started using the new guideline, which is based on body mass index, after that.

📍 What are some of the outcomes of adopting this new guideline?

There are 115 Cystic Fibrosis Centers around the nation, and each year the CFF publishes annual reports where they rank CF centers in terms of key parameters. In these reports they calculate the percentage of patients that are in nutritional failure, and so clinics do their best to improve patients' nutritional status so that they won't be counted as nutritional failures. After the CFF adopted the new guideline, one-third of the centers ended up changing their rankings on this parameter. Originally the UW's Cystic Fibrosis Center was in the middle, but with the new guideline we moved to the top quartile, something that affirms

the benefits of the newborn screening for CF that we do here.

More recently, I've been working on the CFF's height parameter in the guidelines. I came up with a new method that is more accurate. It's a little bit more complicated than the original CFF method, but it's simple enough for use in the clinic. It'll be interesting to see if this parameter gets adopted what kind of impact it will have on rankings.

“Nutrition treatments have lengthened survival dramatically. The median age of survival is beyond 40 now.”

📍 Does the CFF ever see you as a troublemaker, looking for problems with their guidelines the way you do?

Sometimes they do, I think. But it's important to work within the system because the CFF facilitates so much in terms of translating research into care. If an individual researcher is promoting their findings to the clinical community, it is not very effective in my experience. It's better when the CFF acts as a liaison to get the word out and uses research findings to update clinical guidelines.

📍 What's next for you? Another guideline to debunk?

We are developing a separate set of nutritional status parameters for adolescents. Right now, the child guidelines are supposed to cover them, but adolescent growth is so different from pre-adolescent because they go through growth spurts, where they'll grow four centimeters a year for two years in a row. So the classical growth charts do not apply during that time. This is also the period when patient lung function declines the most, and there has got to be some relationship between nutrition, growth and lung function that is unique to this period. That's what I'm working on now. 📍



Wisconsin growers may have the greenest potato on the planet.
It's complicated.

STALKING the SUSTAINABLE MARKET

BY ERIK NESS

So why can't you get it at your supermarket?

WHEN THE IOWA-BASED grocery chain Hy-Vee opened a new store in Madison last October, everything was rolled out with a fresh coat of green. There was sustainable seafood at the fish counter and organic produce in the aisles. The chain gave thoughtful attention to details such as reducing food waste and increasing recycling. Even the building itself was partly recycled, an old K-Mart folded into the design of the new building, making it one of the first certified green buildings in the area.

As in many grocery stores, the produce section is the gateway. And on opening day there was Nick Somers, a dean of potato production in Wisconsin, standing next to bins of his spuds. If he looked a little stiff—well, a cardboard facsimile often has that effect. Somers was busy battenning down his farm for winter, but he happily lent his face to Hy-Vee's efforts to push local produce.

But six months later, Somers' photo is gone. And if his potatoes are here, you can't tell. There are more than a dozen options on display, of various types and quantities and price points. One bag makes claims of being local and sustainable but offers no real information as to how and why, beyond some green lettering and a windmill in the logo. Across the aisle are two organic potato options, at more than double the price.

There is a frustrating irony here for growers like Somers. Wisconsin has pioneered environmentally friendly potato production with a unique collaboration among University of Wisconsin researchers, the Wisconsin Potato and Vegetable Growers Association, and environmental groups such as World

Wildlife Fund and the International Crane Foundation. A compelling argument can be made that these potatoes—branded Healthy Grown—are environmentally superior to organic. But while sales of organic produce grow steadily, Healthy Grown toils in retail anonymity.

"We all thought we were going to put this WWF logo on our bags, and they would fly off the shelf, right? It didn't work quite like that," says Somers, somewhat ruefully. "Getting it to the supermarket and telling the story? It's a long story. It's something you can't tell in one word like organic. Everyone thinks, 'Oh, organic is fresh, it tastes better.' We don't have a word like that. Healthy Grown means what?"

POTATOES MAY NOT HAVE THE PROFILE of cheese or corn in Wisconsin, but they are still important players in the state's agricultural economy. Wisconsin is the nation's third-largest grower of potatoes, with nearly 40,000 acres grown for produce markets—that's fresh market in industry jargon—and another 30,000 acres feeding the processing industry. Good years see farmers harvest more than 25 billion pounds of potatoes.

The state's prominence in the potato industry stretches back to the 1920s, when it led the nation in potato production. The epic drought of the 1930s collapsed production, and it's been a slow process of recovery since. The post-World War II expansion of irrigation helped revitalize the crop, especially in the fine soils of the central sands region, where the state's potato farms are concentrated. So did the introduction of varieties such as Russet Burbank, which was adapted for Wisconsin by scientists

at the Hancock Agricultural Research Station in the 1950s.

The ubiquitous Russet Burbank is the king of potatoes in America, thanks in large part to the fact that it is the primary potato used to make McDonald's French fries. But while it may produce the perfect fry—and boasts a superb shelf life—the Russet Burbank is also greedy, requiring lots of water and fertilizer. Though originally bred for resistance to late blight, the fungal disease that caused the Irish potato famine, in production-scale agriculture it's susceptible to early blight, late blight and the Colorado potato beetle. It's virtually impossible to produce in quantity without herbicides, insecticides and fungicides. The rebirth of Wisconsin's potato industry coincided with the growing use of these agricultural chemicals in commercial agriculture after World War II.

At first this was considered progress. But perceptions of pesticides began to shift in 1962 with the publication of Rachel Carson's exposé of DDT, *Silent Spring*. Environmental concerns mounted every time a new substance—aldrin, aldicarb, atrazine—made headlines.

That was the terrain in 1979 when Walt Stevenson PhD'73, now an emeritus plant pathologist, arrived back in Madison to assume the chair of his Ph.D. mentor. That year an epidemic of late blight had farmers spraying potato fields relentlessly, 12 to 16 times a year, sometimes as soon as the plants broke the ground. And understandably so: When late blight surfaced it cost producers \$12 million, out-of-pocket. "When you have late blight in the area, you just don't sleep when you're a grower," says Stevenson.

But for all the cost and potential health risk, growers weren't necessarily spraying scientifically. They followed

Left: Seed potatoes tumble out of a planter at Coloma Farms in Coloma, Wisconsin.

product labels and their instincts. But these chemical tools are not one-size-fits-all, and CALS researchers began working with growers on a more scientific, interactive approach. Scientists closely studied environmental conditions to identify when blight emerged, while scouts scoured fields, reporting back on pest and crop conditions. Researchers crunched the numbers to determine whether the risk of blight was high, alerting farmers to spray only when the situation merited.

The project focused on late blight first, and the forecasting soon reached the point of preventing from two to four chemical treatments. The real surprise came from Steve Diercks, a potato grower in Coloma, Wisconsin, who had volunteered a field where Stevenson and his students were testing their early blight forecasting techniques. Not only had Diercks sprayed the test plot only when told to, he revealed at the end of the year that he had scaled up the experiment, running his entire operation on the recommendations: “He followed the science and he believed in the science,” says Stevenson, still flattered and a little flabbergasted.

The success of disease forecasting meant farmers could reliably reduce the number of fungicide applications and still get good—or maybe even better—disease management. The technique gained power when other inputs were added. For example, using monitoring to inform irrigation cut back on water use, which in turn reduced the leaching of pesticides and fertilizers into the water. This meant more nitrogen available to the plant, making it more resistant to early blight, and less pollution.

This ecologically informed technique is at the heart of integrated pest management, or IPM. It’s adaptive, science-based and sometimes downright clever. In the case of the Colorado potato beetle, for instance, simple science deduced at which point in development

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the beetle was most vulnerable to insecticide. But it was a stroke of ingenuity to plant a “trap crop” bordering the field to attract the beetles. The innovation allowed farmers to get more mileage out of using less pesticide.

IPM engages a farmer’s stewardship and entrepreneurial instincts. For example, while Diercks was using the early blight forecasting, he realized he was just three weeks from harvest and still hadn’t sprayed. He wondered: How much damage could early blight do in those three weeks? Could he avoid spraying altogether?

“He never would have asked that question if he hadn’t already eliminated the first four sprays,” says Stevenson. “He wasn’t doing this blindly. He was looking at the environmental data, he was plugging this into the software, he was walking the field. He was making an informed decision and asking what I think were the right questions.”

IN 1996 NICK SOMERS TOOK WISCONSIN’S innovative disease forecasting software to a national growers meeting. Also sharing the podium that day was a representative from the World Wildlife Fund, and afterwards the two got to talking. They clicked, deciding on the spot that their two organizations should find a way to work together. The result was a partnership between WWF and WPVGA to experiment with reducing the use of high-risk pesticides and expanding the implementation of IPM in Wisconsin’s potato fields. In 1999 the UW IPM team officially joined in, and by 2001 the Healthy Grown standard was launched.

At first, Healthy Grown focused on IPM and the adoption of best management practices for fertilizer application and soil erosion. The team also developed a ranking system for pesticide toxicity, giving the growers a simple tool allowing them to compare their options and make less toxic choices. Growers could no longer use the full arsenal of legal agents. The most toxic and problematic were put on a do-not-use list, while others were limited. In 2006 ecological restoration of non-cropped farmland was added to the standard, and organizers began to try to measure more challenging things such as biodiversity. In 2009 social components such as hiring practices and on-farm energy use were incorporated. Farmers fill out a lengthy questionnaire and are subjected to annual audits. Nearly a quarter of fields that apply for certification don’t achieve it.

The evolution of the Healthy Grown standard coincided with market trends—even as organic was raising the bar for food production, consumers and activists wanted more. We wanted our coffee bird-friendly, our chocolate grown without child labor and our eggs laid by happy chickens. Standards promoting various social and environmental goals have proliferated. Even retail giant



Once the nation's leader in potato production, Wisconsin still farms nearly 40,000 acres of the crop. Farmers hoped Healthy Grown would give the state a unique brand to claim back some of its market dominance.

Wal-Mart is rolling out a mission to define the sustainability of its products.

To the disappointment of Healthy Grown's farmers, however, this wave of green marketing has not swept up Wisconsin's eco-potatoes. Growers had hoped that consumers would be willing to pay a premium for the Healthy Grown brand to help compensate for the extra cost of IPM and certification. A market survey conducted by the WPVGA in the brand's infancy gave them reason to hope. After hearing the brand's story, 70 percent of consumers surveyed said they would have interest in buying Healthy Grown potatoes, and 88 percent of those said they would pay 25 cents more per bag to get them. But that hasn't happened. In most years fewer than 5 percent of potatoes certified under the program have been sold under the Healthy Grown label. The rest get bulked with other fresh-market orders, earning growers nothing for their extra effort.

Part of the problem is low visibility.

Even around Madison, with its eager market for environmentally friendly products, Healthy Grown potatoes are hard to track down. An informal survey of produce buyers for the city's main groceries yielded only passing familiarity with the brand. One buyer for Cub Foods recalled stocking the brand in the past but said it was dropped because consumers weren't willing to pay the higher cost.

At the Madison Hy-Vee, it's clear that produce marketing is a work in progress. The picture of Somers and another local onion grower were too big, and so they went into storage. Ryan Lindner, the store's produce buyer, says they've moved away from bins as well. "We want to bring a more on-the-table look," he says. He'd like more marketing material, and he notes that Hy-Vee is working on new signage highlighting local produce that should be rolled out soon.

"Sometimes what consumers say and what produce buyers do are not the same thing," says Tim Feit, marketing manager for the WPVGA. "It is so hard to get these buyers off of price. Even if consumers would be willing to pay more, that's not necessarily what the buyer will pay for the product."

Despite the disappointing sales, the growers have largely kept the faith. The number of acres enrolled in the program remains steady at around 5,000, and while a few growers have dropped out, others have stepped in or stepped up their acreage. Without a price premium to pay the bills, it helps that the WPVGA underwrites audit costs and grants support conservation work.

And Feit says the brand's story can win over consumers, if only it could be heard above the din. This spring the WPVGA is testing some new point of purchase marketing tools in cooperation with grocery chain Piggly Wiggly. "The key is to educate the consumer that these potatoes are raised differently," he says. "And while the WPVGA has put money into marketing Healthy Grown, it's a miniscule amount compared to the amount that gets thrown at new consumer products."

Feit points out that even some in the WPVGA don't fully understand what Healthy Grown represents. "To try to communicate that to a consumer with a 30-second commercial or a poster?" he asks. "Without a big marketing budget, it's hard to explain that complex message. Even if we spent our entire promotions budget, it wouldn't be enough."



One of the first potato farms to adopt IPM, Steve Diercks' Coloma Farms plants more than 300 acres of Healthy Grown potatoes, but these days Diercks is driven more by the environmental benefits than the market.

A SUSTAINABLE POTATO CAN BE A HARD

thing to love. To begin with, consumers don't tend to fuss over potatoes in the same way they do apples or other produce. Botanically there are scores of different options for both plants. But while most people can wax on the relative merits of a Fuji or a Cortland, potatoes don't engender such opinions. There are exceptions, of course, but for many shoppers, a bag of potatoes is still predominantly a bag of starch.

But most of the confusion seems to come from the concept of sustainability itself. One reason organic has become the gold standard for consumers is a relatively simple definition—food grown with no synthetic materials—that most people can grasp. At its root is a rejection of pesticides for personal and environmental health reasons. While there has been continual skirmishing over control of the details, there is a strong alternative production base along with a watchdog core of educated consumers.

Sustainability, on the other hand, is

a murkier ideal. The general principle—that your methods of production can be maintained over time—seems simple enough, but it has become a gathering point for debate. There are numerous existing and ongoing efforts to define the term for trade. Just one example: The Leonardo Academy, based in Madison, is developing a scientifically measured sustainability standard under the auspices of the American National Standards Institute. ANSI standards help regulate everything from paper size to eye protection. But when Leonardo introduced its draft standard in 2007, a firestorm ensued, leading the committee to scrap its work and start from scratch. The group has six task forces still working out just how to define sustainability. Then they'll have to figure out how to measure and monitor that definition. Similar discussions are taking place around other proposed standards, including the Stewardship Index for Specialty Crops and the Field to Market program of the Keystone Alliance for Sustainable Agriculture.

"Sustainability has become a buzzword," says Jed Colquhoun, a CALS associate professor of horticulture who works with Healthy Grown. But despite his association with the Wisconsin Institute for Sustainable Agriculture, he won't offer up a quick definition. "We're coming up with a new name that doesn't involve sustainability, because it's such a nebulous and difficult term," he says. "It depends on who you ask and which value filter you run that through."

For example, while most consumers regard organic as meeting the standards of sustainability, the bigger picture isn't so clear. Is the price premium on organic produce sustainable with 20 percent of U.S. families struggling to put food on the table? Is the production capacity of organic systems sustainable enough to meet the demands of feeding more and more people using less and less land? The truth is the challenges facing agriculture and the environment may be bigger than organic alone can handle.

"Organic isn't the solution," argues Jeb Barzen, of the International Crane

**“The market
doesn’t like
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Foundation, one of the organizations supporting the Healthy Grown program. It’s a lesson he learned from a soybean farmer in western Minnesota. The farmer cultivates organic fields, but he also grows soybeans using a ridge-tilling technique that leaves the valleys between rows untouched by the cultivator. Plant matter accumulates and non-crop species take root, making the ridge-till fields less prone to soil erosion. The catch: The ridge-till fields do require some pesticide use.

So which soybean crop is more “sustainable”? The organic field produces healthy food, but perhaps at a greater expense to the land and surrounding water. The ridge-till field requires accepting some chemical use in exchange for other benefits, including clean water and nesting for upland sandpipers, which won’t take up residence in the organic field.

“Healthy Grown is an attempt to look at all of those resources coming off the land at the same time—habitat for cranes, habitat for lots of other species, productive agricultural fields—because these fields need to be productive in order for people to retain them. And they also need to produce clean water, healthy soil, rural aesthetics, possibly carbon sequestration and so on,” says Barzen. “The real challenge is figuring out how to fit this into a market system that, especially for commodities, likes sound bites. It doesn’t like complication, and that’s essentially what we’re selling.”

Those complications have kept Healthy Grown from finding a foothold in markets such as Whole Foods, says Deana Knuteson, a CALS researcher who has been coordinating the Healthy Grown program since before it came to market in 2001. She says the chain ultimately decided not to highlight the fact that not all of its produce is organic. “It was a marketing thing,” she sighs. The experience leaves her wondering whether the market will allow a niche for agriculture that is both progressive

and production-scale. “How can we develop an ecologically sound production model for large-scale agriculture that fits a need and helps the landscape without having to transition all the way to organic?” she asks.

The answer could well hang on the emerging definition of sustainability in the marketplace. Will the playing field be set by corporations large and small as they jockey for the marketing advantage that sustainability might confer? Or will more rigorous standards, monitored by independent observers, gain momentum and market share?

NOT EVERYONE THINKS NATIONAL standards will be helpful. “I don’t have a lot of confidence that you can create a national standard that would be worth a grain of salt,” says Barzen. He’s been helping quantify the biodiversity element of Healthy Grown potatoes, and like most scientists he has a hard time imagining how we’ll ever be able to develop meaningful comparisons between regions as different as Idaho and Wisconsin. “By working at such a broad scale you have to water it down,

and it really doesn’t mean much.”

But if anything, says Barzen, Healthy Grown is feeling the double-edged sword of the market. “I do know we have really got to sell some potatoes under Healthy Grown to make this work. If we were selling a lot of these potatoes, we’d have the whole Wisconsin potato industry following us. If that were working, we could influence Idaho and Washington and other potato producing regions.”

If anything, Healthy Grown may not survive a shift to national standards. “People want to differentiate themselves,” explains Colquhoun. “I think one of the risks is that we raise the bar across the board so that there isn’t a market advantage to doing it, so that there isn’t a grower advantage in terms of price received and such. We’ve just increased the price of doing business.”

That would put a decade of research and several million dollars worth of taxpayer and grower investment on the shelf. “We’ve shown it can be done. It’s been through this development phase that other groups are just starting. It’s science-based. It’s research-based, which is unique. It’s third-party certified,” says Knuteson, ticking off the selling points. The bottom line, as far as she can see: “Grocery stores want to be green, but don’t want to be paying more.”

The sustaining grace here is the growers, who despite the setbacks are even considering expanding the Healthy Grown concept to other vegetable crops. “They were looking for a different way to grow because they wanted to do the right thing for the land,” says Knuteson. “With the economy the way it is, industry is still doing it, and that tells you it’s real. It’s actually going to be beneficial and save money in the end.”

“It’s been a struggle,” admits Somers. And while Healthy Grown doesn’t help his bottom line, “we feel it is the right thing to do,” he says. “We just keep going at it, and we feel that one day



The Catch

By Madeline Fisher

*Fish are good for you—
except when they're bad.*

*How a legacy of environmental
contamination continues to haunt
one of our healthiest foods,
and what we can do to fix it.*



If every writer has a muse, then

Nancy Langston's is surely Lake Superior. An environmental historian who has written three books about people's connection to natural places, Langston fell in love with the lake's shimmering blue expanse while house-sitting for a colleague several summers ago. Within a month she'd begun looking for her own lakeside retreat, and soon found it in a 10- by 20-foot shed, to which she and her husband added insulation and a floor. Here she has spent every summer since, drawing inspiration from the rare beauty of her surroundings: the vast, unbroken forests, the beaches of polished stones, the serenity of her kayak slicing through the waves. And, of course, the fish—succulent, fresh-caught lake trout so alive with flavor they could be a muse all on their own. Her days often ended with a trip to the market for a few fresh fillets to cook for dinner.

But Langston doesn't eat lake trout nearly as often anymore. Despite its divine flavor and undeniable health benefits—including a wallop of omega-3 fatty acids—she fears that her habit of eating trout three or four times a week was doing harm to her body. One concern is toxaphene, a pesticide sprayed extensively on cotton fields in the 1960s and '70s that has found its way into Lake Superior waters. A member of the infamous "dirty dozen" organic chemicals outlawed in 2004 by the international Stockholm Convention—along with PCBs, DDT and dioxins—toxaphene has been linked to kidney and liver problems and increased risk of cancer. Still more troubling is how toxaphene levels have risen over time in large, predatory Lake Superior fish such as lake trout, even as traces of other banned chemicals have declined.

Langston, a professor with UW's Nelson Institute for Environmental Studies and CALS' Department of Forest and Wildlife Ecology, had

never heard of toxaphene before reading chemist Melvin Visser's 2007 book *Cold, Clear and Deadly*, which chronicled the history of the pollutant in the Great Lakes. Visser's tale put an abrupt end to her love affair with lake trout.

"Now I know enough that I mostly eat whitefish," she says. "It's lower on the food chain so it's less high in contaminants. But it's also less abundant in healthy fats. And it just doesn't taste as good."

In her dilemma over fish, Langston is hardly alone. Consumers are told repeatedly that fish is among the healthiest sources of protein in our diets. Eating fish twice a week can help stave off heart attacks and lower cholesterol. Doctors encourage women to eat more fish during pregnancy to prevent early delivery and foster fetal brain development. But looming over these benefits is a dark warning about toxic chemicals with the potential to cause cancer, neurological problems and reproductive dysfunction. Worse still, the dangers are rarely clear,



Nancy Langston still loves to eat fish, but these days she's more careful about her choices.

varying greatly among fish species and location, making it tough for consumers to know how to protect themselves.

"It's a real quandary for anybody: Can you eat the fish? Is it healthy to eat fish?" says Marty Kanarek, an environmental epidemiologist in the UW-Madison School of Medicine and Public Health who has studied contaminants in fish and their impacts on people. "You know, when you go to the grocery store, the price per unit (on foods) is marked carefully, the calories are labeled, all kinds of ingredients are labeled. But the labels don't tell you which fish is safe and which isn't."

How did we reach this place, where one of our healthiest foods has grown so complicated? As is true of many contemporary questions, the answers lie in the past, Langston says. In her latest book, *Toxic Bodies*, she delves into a 70-year history of industrialization and environmental pollution that begins to explain why we're facing a problem with fish. But the story is much more than

that. Mostly, it's about us—us and the unbreakable tie to the world around us, a connection that is at once obvious and easy to forget.

It was not a fish,

but an endangered bird, that first drew Langston's attention to the influence of humans in ecosystems. As a graduate student pursuing her Ph.D. in ecology, she traveled to Zimbabwe to observe bird populations in a national park, but she quickly found herself more interested in an unfolding human story. A flood of refugees from neighboring Zambia had stirred fears about poaching, leading park officials to warn that any African caught inside the park would be shot on sight. At the same time, Zimbabwe's own agricultural lands were shifting heavily toward commodity crops such as sugarcane, creating pressure to open parklands to settlement and farming. Langston soon became convinced that the real driving factor in environmental change was human culture. Understanding and reversing environmental decline, she realized, required watching more than birds. It meant observing people.

After returning home, she refocused her research on environmental history, the study of the shared history of people and the land. Her first book, published in 1995, explored the root causes of the failing health of forests in the western United States. She followed with an examination of riparian zones, showing how scientific and cultural ideas about nature triggered often-contentious disagreements about how to manage these areas.

Her interest in environmental pollutants was sparked by conversations with one of her graduate students, a native of Wisconsin named Maria. Growing up on the shores of the Fox River, Maria spent her summers swimming in the Green Bay waters where the Fox River empties. Friday feasts of local fish were a

family tradition. Only years later did she realize the river was choked with PCBs, released over decades by paper mills lining its banks. The Fox River became a Superfund site, and Maria became an environmental scientist. She became keenly aware of the dangers of PCBs, which can collect in the body, causing cancer and disturbing hormonal activity.

By 2000, Maria confronted a difficult choice. Pregnant with her first child, she worried about whether to

those legacies.”

In her research for *Toxic Bodies*, Langston went back to the days just after World War II, when advances in the manufacture of synthetic chemicals spawned an array of new industries. In the decades since, synthetic fertilizers, pesticides and pharmaceuticals have flooded the U.S. consumer market, bringing with them scores of benefits. The products have boosted yields of the nation's most important food crops,



breastfeed her baby, knowing that the PCBs she'd accumulated during her childhood could flow into her baby with breast milk. At the same time, how could she not breastfeed her baby, considering all the benefits it provided?

Maria's dilemma haunted Langston. It also left her curious. What in our history could explain why such painful decisions were necessary, and how might our past end up shaping the future?

“Part of what interests me is that we eat fish in the here-and-now, but fish have the traces, the legacies, of the past five decades of industrialization,” says Langston. “And our children and grandchildren will continue to bear

A display of fresh fish at a Madison grocery offers an array of options, but few clues about the waters in which they lived.

kept pests at bay and ushered in an age of better living through chemistry. But we know now that many of these wonder chemicals have a dark side: Their use can exact a devastating toll on the environment and the health of people and animals. And as Langston argues, we often continue to feel the impact of chemicals even decades after they were used.

The focus of her book is diethylstilbestrol, or DES, a hormone-mimicking chemical approved by the then fledgling

Food and Drug Administration in 1941. A potent form of synthetic estrogen, DES was shown in early tests to cause cancer and disrupt sexual development in laboratory animals. Nevertheless, the FDA first sanctioned it as a hormone replacement for women during menopause and later as a treatment for pregnant women to prevent miscarriage. DES found further use in the livestock industry, which deployed it to increase meat in chickens, turkeys and cattle without increasing feed. Millions of women were prescribed DES, and millions more were exposed to residues of the chemical through meat and polluted runoff from farms. Yet the FDA didn't fully ban the chemical until the early 1970s.

Why the agency approved DES and then failed to restrict it for so long is central both to Langston's book and to the situation we face with many other contaminants. Langston explains that since the 1920s, debate has raged over whether chemicals should be regulated

based on their potential to cause harm or evidence of actual harm. In many instances through history, the latter argument won out: Regulators agreed to approve use of chemicals where the effects on humans were unknown or unclear.

And there's the rub. Demonstrating that chemicals will harm us is tough because such lab tests can't be carried out on people. Typically, the best evidence of a chemical's effects come from studies on lab animals, but scientists are far from unanimous about how well those studies predict what might happen in human populations. Even extrapolating lab studies to wild animals is tricky. For one, environmental levels of toxins are typically much lower than the doses employed in toxicology tests, says Bill Karasov, a colleague of Langston's in forest and wildlife ecology who has studied the effects of contaminants on fish-eating birds, including loons and bald eagles. Animals also vary tremendously in their vulnerability to different toxins. Some species may be worse than others at clearing a chemical once they consume it, for example, or they may harbor especially sensitive target sites in the body.

Nothing, therefore, is assumed. Along with laboratory experiments, regulatory agencies usually require proof of harm from both studies of wildlife and epidemiological research on people—where exposure to a contaminant is correlated to health problems—before banning or restricting a chemical.

"Our society demands a lot of evidence before we take policy actions," says Karasov, "and that goes for protecting human life and wildlife."

But others worry that the level of certainty required to ban a chemical creates a wedge for manufacturers, who can argue that the clear economic and social benefits of using chemicals outweigh the potential threats. "It's precautionary to assume that if a

chemical causes harm to other animals then it could be harmful to people," says Langston. "But each time there's political pressure, that caution gets eroded."

One chemical whose toxic effects are undisputed is mercury. In its silvery, elemental form, mercury is relatively harmless. But the metal can also take an organic form, called methylmercury, that can accumulate in tiny organisms and the larger animals who eat them, sometimes with tragic results.

That is what happened in the 1950s in the Japanese town of Minimata, where a factory had begun dumping mercury-laden wastewater into a nearby bay. Unbeknownst to the company or townspeople, the waste mercury wasn't washing out to sea, but was instead accumulating as methylmercury inside bay fish, a chief source of food in the local diet. The result was a public health disaster.

"Babies were born with a terrible cerebral palsy-type condition where they were virtually helpless, and they had all kinds of neurological problems," says Kanarek, who has studied mercury exposure in Wisconsin communities that depend on fishing. Children and adults in Minimata lost the ability to walk or speak. Some shook violently. The strange ailment afflicted entire families, and it soon was dubbed Minimata disease.

Thinking the condition was contagious, the community isolated the victims and disinfected their homes. But people eventually suspected a different cause. Cats were behaving strangely after eating fish tossed from boats returning from the bay. "The cats would do this dance in the air and then drop dead," says Kanarek. "That's when people first began realizing that maybe fish were causing the problem."

Although concentrated sources of mercury pollution are virtually nonexistent today, methylmercury in fish remains a public health threat in many



Flames curl around baskets of whitefish during a community fish boil, one of many Wisconsin traditions that tie to fish.

Grow Fish

If wild fish turn unhealthy, can farmed stocks swim to the rescue?

With many wild fish stocks in decline from overfishing and other threats, aquaculture—the managed cultivation of fish—has taken on a larger role in feeding the nation's growing appetite for seafood. But are farmed fish really any freer from contamination than wild ones?

That all depends, says Jeff Malison, director of the CALS aquaculture program in the Department of Animal Sciences.

"No fish is going to be pollutant-free," he says. "But yes, farmed fish can have much lower levels (of contaminants) than wild fish—at least they have that potential."

Because farmed fish accumulate toxins from the environment and their food just like wild fish do, the key to producing a "clean animal" is to grow it in fresh, unpolluted water and feed it a diet free of toxic ingredients, Malison says. But farmed fish also have a fin up on their wild kin: They grow much faster, which means they have considerably less time to collect pollutants during their short lives. Pond-raised rainbow trout, for example, are usually big enough for the dinner plate by one year old, whereas wild trout of the same size might be three to four years old.

Wisconsin happens to be among the top 10 producers of farmed rainbow trout in the country. But before consumers rush out to buy farm-raised filets of other popular Midwest fish, such as yellow perch and walleye, they should know that fish farming is hardly routine. Malison points out that we raise only about six to 10 bird and mammal species for meat, but we eat around 200 species of fish, each with its own set of environmental needs and tolerances. And with the exception of a few species, most fish have yet to be bred for captivity.

"Even though it was practiced in China 4,000 to 5,000 years ago," says Malison, "aquaculture is still relatively young as a technological industry."

The aquaculture program has been working since the 1970s to improve two critical factors that limit the production of fish: reproduction in captivity and the costs of raising juveniles. The diminutive yellow perch is a prime example. Because it takes many perch to make a meal, farmers need to grow lots of them. "And when you need



Fish raised in a controlled environment can be cleaner than wild ones, says UW aquaculture specialist Jeff Malison. But that doesn't mean they always are.

lots of them you've got to make sure the cost of the babies is really, really low to develop a profitable industry," says Malison. "So we've been doing a lot of research on reproduction to try to reduce the cost of fingerling production."

CALS researchers have also studied walleye, but for a very different reason. Carnivorous and aggressive, "it's really kind of a rascal in captivity," Malison says, noting that farmed walleye have a tendency to attack their own mates. To solve this problem, his group is now using Wisconsin Department of Agriculture, Trade and Consumer Protection funds to breed the brutish walleye with a closely related fish, called the sauger. The result is a much more docile fish that also grows faster.

The success of these projects will surely expand the choices consumers have at the grocery store. But another goal is to expand the state's aquaculture industry, which also encompasses bait fish and fish for stocking lakes and rivers. And as Malison notes, Wisconsin has plenty to bring to the table—water resources, farming expertise and, of course, the market. Fish fry, anyone?

parts of the world, including Wisconsin. Released into the atmosphere primarily through coal burning and small gold-mining operations, mercury can travel anywhere from a few miles to halfway around the globe before falling to earth. When it reaches lakes and oceans, microorganisms convert it into methyl form, which then gets stuck in small organisms like plankton. Plankton is eaten by fish, which in turn are eaten by larger fish, passing mercury contamination up the food chain. As a result, “tiny quantities in water end up being hundreds of thousands of times more concentrated in fish,” says Henry Anderson, the State of Wisconsin’s chief medical officer for environmental and occupational health. “Then we’re at the top of the chain, so it accumulates in people.” The same mechanism explains how toxins such as PCBs and toxaphene reach unsafe levels.

It’s the job of Anderson’s department to help people reduce their exposure, which it does first by monitoring a host of contaminants in fish—everything from older banned chemicals, like DDT, to newer ones, such as flame retardants. The group then issues consumption guidelines for fish caught in Wisconsin lakes and sold in grocery stores.

But the advice grows quickly complicated. For one, species from the same lake often contain different amounts of toxins; a walleye, for example, typically has four times the methylmercury of a bluegill. This means that warnings to merely stay away from certain lakes are too simple.

There are other complexities, as well. Methylmercury does slowly leave the body, for instance. So if a woman wants to get pregnant, she can reduce her mercury level by half if she stops eating contaminated fish for two months. PCBs are another story. “You just accumulate them over your lifetime,” Anderson says. At the same time, since PCBs build up exclusively in fat, a diner can cut exposure to PCBs by as

much as half simply by trimming away a fish’s skin and belly fat. The same trick does nothing to lower methylmercury, however, which settles in muscle tissue throughout the body.

It’s enough to make one swear off eating seafood altogether. But Anderson contends that being informed about fish isn’t different from learning how to limit our intake of saturated fat or salt. The basic guidelines are simple, he suggests: Know where your fish come from, and eat a variety of types, especially smaller, short-lived species low on the food chain, such as bluegills, yellow perch and small rainbow trout. And most Wisconsinites consume fish once a week or less, hardly enough to worry about.

“Most people don’t eat that much fish,” he says. “They could probably stand to eat more.”

This may be true for

many Wisconsin families, but it’s hardly the case for Mic Isham. A leader of the Lac Courte Oreilles band of Ojibwe in northern Wisconsin, Isham and his family follow a traditional lifestyle that revolves around Ojibwe customs, encompassing language, culture and spirituality. Tribal members gather and hunt indigenous foods such as wild rice, berries, venison and fish, which form a significant portion of their diets. The serving of these traditional foods is also required at feasts, funerals and other tribal ceremonies. And in northern Wisconsin, any traditional feast is bound to include plenty of walleye—*ogaa* in Ojibwe. This means that when the *ogaa* spawn in the spring waters around Lac Courte Oreilles, the Ojibwe fish. And fish. And fish.

“We *harvest* them,” says Isham. “We get 300 fish, we put them in the freezer, and we’re eating a lot of meals a week with our children and our families.”

The Lac Courte Oreilles alone take

between 1,900 and 2,500 fish during spring spear-fishing season, says Isham, who helps manage the annual harvest for his band. Yet cherished as the tradition may be, it too has been touched by modern day concerns about chemicals. When Isham chooses the 15 or so lakes where the band will spear, for example, he takes a step his ancestors never did: He consults a set of maps issued by the Great Lakes Indian Fish and Wildlife Commission, detailing which lakes carry the highest risk of methylmercury exposure. At the same time, tribal members are encouraged to catch and eat mostly smaller fish, both during the spear-fishing season and throughout the year. Because families freeze so many fish to eat later, they’re also taught to label each bag with the weight and species of fish, along with where it was caught, to help them monitor their families’ exposure to methylmercury and other contaminants.

But these are far from the most significant changes the tribe has seen. “Cleaning up certain things, like mercury in a lake, is really, really hard. The obvious way to go is to prevent any further contamination,” says Isham. “So now we’re really environmentally active.” The Ojibwe have been vocal in calling for regulation of mercury emissions from coal-burning plants, for example. But they work on many other issues, as well, including mining, shoreline development, forestry practices and dealing with invasive species.

Why cast such a wide net when the target is contaminated fish?

“It’s all connected,” Isham says. “That’s how we try to educate our youth, so that the next generation is smarter than we are when it comes to contaminants and other things.” He explains how the tribe understands that activities far outside their community affect the health of fisheries and forests, just as the actions on their reservation spill over to the lands outside. Likewise, the philosophy with chemicals, he says,



is to understand that by using them in the wider world “basically you’re putting them into your own body.”

This is the ultimate message of Langston’s work, and it leaves us with an ultimate choice. Are we satisfied with making personal decisions about which fish to eat and how often? Or do we want to work toward a future where such decisions aren’t required anymore? Because the way the world is now wasn’t inevitable, says Langston. It, too, was


built of choices.

“For me, that’s one of the most valuable lessons about history,” she says. “We’re not constrained by the way the present looks today. There were other paths we could have taken (in the past) and that means there are other choices we can make here and now.”

As we consider this, we may want to remember the Ojibwe, who not only believe the health of people and the water are inextricably linked, but that

During spring spear-fishing season, Ojibwe fishermen spear hundreds of walleye, but the generations-old tradition now carries a modern concern about exposure to chemicals.

each is also the caretaker of the other. Thus, they say that when human life is sick, the water will flush it away.

And when the water is sick, it is up to us to flush it away. 



Telltale Chemistry

By Nicole Miller MS'06

Photographs by C&N Photography, Inc.

For a woman with polycystic ovary syndrome, life is full of unwelcome surprises. Starting at puberty, her body, surging with an unnatural burst of testosterone, will grow hair where it shouldn't and produce acne and sweat. She may gain weight, often hurtling toward obesity despite her most fanatical efforts to shed pounds. She may become prone to diabetes and heart disease. But that's not the worst of it. The cruelest blow is that all of this may happen without her knowing why. Though PCOS is the most common hormonal disorder

But what if we knew what our bodies know? "Your body is very smart," says Fariba Assadi-Porter PhD'94, an associate scientist in the CALS Department of Biochemistry. "It does really clever chemistry when it confronts disease. Before any physical signs show, your body is already adjusting its chemistry to defend itself." Like sentinels prepared for combat, our body's defenses react to conditions that we aren't able to perceive. What we really need is news from the front—an alert that the enemies are massing at the gate.

promise of metabolomics, an exploding area of science that focuses on our chemical makeup at the most basic level. Smaller than cells, genes and proteins, metabolites are essentially the chopped-up products and by-products of our cells' energy functions. Metabolic processes such as digestion create tiny fragments of foods and drugs, which float around as sugars or fatty acids inside us. Our bodies harbor at least 3,000 different types of metabolites, and their quantities are constantly changing, depending on factors such as diet, exercise and viral or

The earliest signs of illness and disease show up in your body's metabolites. Now scientists are figuring out how to track these molecules—and they're changing medicine in the process.

among women of reproductive age, affecting as many as one in 10 women, it's a tricky one for doctors to detect because its symptoms mimic many other ailments. Many women don't discover they have PCOS until they try to get pregnant, their struggles to conceive only heightening their creeping doubt that something inside is wrong.

Short of a cure, what many women with PCOS hope for is a warning—a test that could alert future patients to the presence of the syndrome, giving them the head start they need to keep their symptoms in check. But no such test exists. PCOS involves multiple genes and an assortment of hormones that act on several different organs in the body. The best doctors can do now is diagnose PCOS by exclusion, ruling out other possible explanations in a process that can take months of testing.

Assadi-Porter is among a growing community of scientists who argue those alerts are all around us—in our blood, sweat, urine, tears and literally every breath we take. Those bodily fluids contain thousands of tiny molecules called metabolites, which are created when we digest foods, drugs or pollutants from the environment. By studying the profile of those metabolites, Assadi-Porter and other researchers hope to identify signals in the body's internal chemistry that can help doctors diagnose hard-to-catch diseases like PCOS. Currently she is scouring blood, urine, sweat and breath samples from dozens of women with PCOS to look for metabolite profiles that are consistent with the syndrome. Once found, those telltale molecules could become the basis for a simple, noninvasive diagnostic test.

The project is a prime example of the

bacterial infections.

Assadi-Porter says that shifting profile makes the metabolome—the term researchers use to describe the whole picture of our metabolites at any given moment—a compelling place to look for evidence of something new arising in our bodies. Her PCOS experiments—which won one of the first grants awarded by the university's new research incubator, the Wisconsin Institutes of Discovery—are just the beginning. She predicts that within a decade a comprehensive screen of a patient's metabolome will become a routine part of a trip to the doctor.

"This is very important for personalized medicine, to monitor peoples' health status," she says "With current technology we're going to be able to do that. In the next ten years, we're going to be there for sure."

The idea behind metabolomics isn't a new one. People have long understood that states of health and disease are somehow reflected in the concentrations of molecules inside our bodies. Physicians in ancient China used to set bowls of urine near colonies of ants to see if the insects swarmed. If they did, it meant the sample was full of sugar, confirming diabetes. Today doctors still look at sugar to diagnose the disease, measuring patients' blood glucose levels. In the same way, they test cholesterol

early as 2003, scientists have had few resources to make sense of metabolites. The equipment necessary to measure and analyze them is large and expensive, and the resulting data streams can overwhelm even the best-equipped lab. Only in the past five years have scientists begun to piece together a roadmap, assembling databases of known metabolites to aid researchers in making sense of their data.

One of first researchers to join in that quest was John Markley, a bio-

than 700 pure metabolites through its machines, compiling the data in a free, online database. Scientists are beginning to use the data—and NMRFAM's technology—for a range of applications that extend well beyond human health. The aim of one of the facility's projects is to compile a database of all the molecular constituents found in the plant cell wall, to aid researchers trying to unlock new forms of renewable energy from plants.

"Our major emphasis has been to get the technology in hand and get our database set up," says Markley. "What excites me now is being able to apply the technology that we've developed to studies that are well-defined, and where we can use this approach to get solid information."

Assadi-Porter's PCOS project is the second such study to emerge from Markley's lab. She first explored the power of metabolomics to monitor the progression of sepsis, a type of bacterial infection that sparks a dangerous, whole-body inflammatory response. She chose sepsis because the current testing technology is woefully inadequate. "By the time a doctor determines a person has sepsis," she explains, "they are on the knife's edge."

With animal sciences professor Mark Cook and zoologist Warren Porter, Assadi-Porter began analyzing metabolites in the breath associated with sepsis. In experiments with mice, the team was able to detect sepsis two hours after the onset of infection, hours earlier than previously possible. They later found the same results in rats and chickens. The team patented its "breathalyzer" technology and then founded a medical devices company to develop it into a viable product for at-risk patients.

Fariba Assadi-Porter prepares tubes of bodily fluids for analysis in a nuclear magnetic resonance machine (background), which reveals the identity and concentration of individual molecules in the samples.

Your body is very smart. Before any physical signs (of disease) show, it's already **adjusting its chemistry to defend itself.**

to monitor heart disease and urea and creatinine for kidney problems. Metabolomics is different mostly because of its scale: Instead of looking at the quantities of one or two isolated metabolites, it involves taking a broad view of scores or even hundreds of metabolites at once.

This expansion has been made possible by major advances in the field's two workhorse technologies: nuclear magnetic resonance, or NMR, and mass spectrometry. Both techniques can reveal information about the mass and structure of individual molecules, as well as the composition of complex molecular mixtures. Over the past couple decades, these machines have become significantly more powerful, capable of detecting more metabolites in a sample, while requiring smaller sample volumes.

But the human metabolome has remained a relative scientific frontier. Unlike in genetics, where efforts such as the Human Genome Project led to vast libraries of freely accessible data as

chemistry professor and director of the Nuclear Magnetic Resonance Facility at Madison (NMRFAM). Housed in the basement of the Biochemistry Addition, NMRFAM looks like a set from a James Bond movie, a vast, hangar-like room lined with gleaming domed machines. That equipment offers researchers the power and sensitivity to break a sample of blood or urine down into a roster of metabolites. Recognizing this unique capacity, Markley applied in 2004 for funding from a special National Institutes of Health Roadmap initiative called Metabolomics Technology Development to begin building tools to advance the field.

"We proposed that one of the major roadblocks in the field was the lack of a database containing data about pure, bona fide metabolites, as well as a lack of methods to rapidly collect and analyze data," says Markley. "So that's what we've been doing ever since."

NMRFAM has now run more





Assadi-Porter's sepsis project highlights one of the main advantages of metabolomics: its acute sensitivity to what's happening inside the body at a given moment. And that plasticity has some scientists saying that metabolomics could turn out to be the missing link in delivering on the promise of personalized medicine.

The idea at the root of personalized medicine is that every body functions a little differently, and what works for one may not at all work for another. Many people believed that the sequencing of the human genome would unlock this great vault of individuality, yielding a master guide that would tell us how to diagnose conditions and prescribe therapies that optimally fit each person's unique genetic makeup. But while genes reveal a surfeit of information about inherited conditions—such as a patient's predisposition to breast or colon cancer—most of our day-to-day maladies are not hard-wired into our genetic code. To get a complete understanding of the processes that govern our bodies, we need to look not just at our genome, but at the other *-omes*: the transcriptome, which describes all of the

protein-encoding RNA molecules in our cells; the proteome, our complete set of proteins; and the metabolome.

"The exciting part is not the metabolome, not the transcriptome and not the proteome," says Mike Sussman, a biochemist and director of UW-Madison Biotechnology Center. "It's the integration of them all."

Figuring out how these four systems work together is one of the most pressing problems in systems biology, and billions of dollars are being invested to learn how their interconnection affects our health. One notable example comes from Sussman's own lab, which is studying a special breed of rat to try to find the biochemical signals associated with colon cancer. Developed by UW-Madison oncologist William Dove, the rats have a genetic mutation that causes them to develop a rat form of the cancer. Scientists already know this mutation has a human analog, and patients who are missing the gene are more likely to develop colon cancer. But they can't predict when in someone's life that might happen. Sussman's project is part of a larger effort to follow the chain from gene to RNA to protein to metabolite,

Using mass spectrometry, researcher Amy Harms is searching for a chemical signature in body tissue that could alert doctors to the onset of colon cancer.

which scientists hope will lead them to key signals that can sound the alarm when the cancer starts growing.

"Using metabolomics, we are trying to find a small molecule whose concentration precedes and predicts colon cancer," he says. And success in this case would have a result that everyone over the age of 50 could appreciate. "People won't have to get colonoscopies," he says.

Unfortunately, the story for PCOS isn't so simple. Despite exhaustive searches, scientists have yet to find a cause for the syndrome, which seems to arise from multiple layers of dysfunction. Current thinking is that the path to PCOS starts in the womb, when a fetus is exposed to a blast of testosterone—or possibly some other chemical signal—that permanently reprograms the genes her body will start expressing at puberty. But what causes this blast in the first place? Because PCOS cases tend to cluster in families, signs point

to some kind of heritable genetic factor, possibly a large group of problem genes that add up to initiate the syndrome. But very little is known about how this might work.

"PCOS behaves like it's caused by a dominant gene that doesn't always express itself, and that's just baffled people for a long time," says endocrinologist Dave Abbott, a professor of obstetrics and gynecology at the UW-Madison who has spent 18 years trying to understand the *in utero* conditions that trigger PCOS.

When Abbott heard about Assadi-Porter's PCOS project, he jumped at the chance to join the team, eager to approach the disease from a new angle. "The metabolome approach allows us to go from just having a diagnostic test to being a mechanistic cause investigation," he says. "It may allow us to figure out what's causing the metabolic [part of the] syndrome and lead to new therapeutic approaches that haven't been applied because the knowledge isn't there."

But the clearest and most devastating calls for answers have come from patients themselves. From the moment

"The exciting part is not the metabolome, not the transcriptome and not the proteome. **It's the integration of them all.**"

the project was announced, Assadi-Porter says she has received numerous emails from women with PCOS, asking how they could participate in the search for a diagnostic test. And while the test wouldn't help these women directly, they were eager to participate in something that could help future generations catch the disease early enough to intervene and keep the syndrome's symptoms under control.

"These women were in the later stages and had so many symptoms," says Assadi-Porter. "They were sending me their blood chemistry and asking, 'Can we help you in any way? It's so terrible to have this disease.' They didn't want their daughters to have to go through what they went through, should they have it."

Each volunteer spent 12 hours

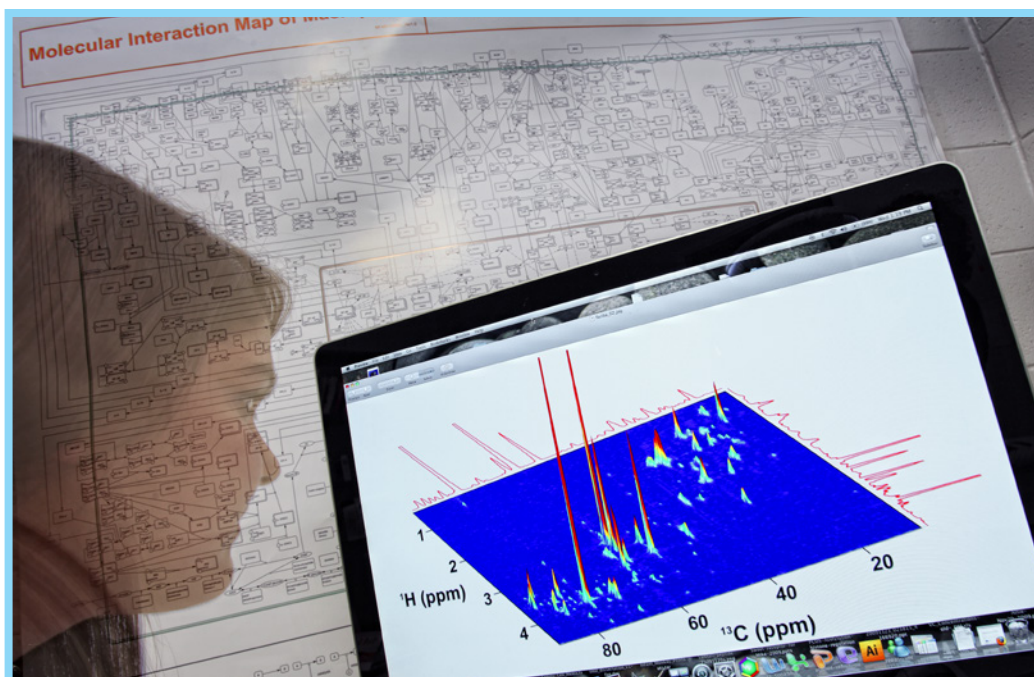
inside a metabolic chamber at the UW Hospital, where they ate a prescribed dinner, ran on a treadmill and slept, all while machines recorded their breathing. Along the way, they gave samples of blood, urine and saliva that were later packaged and sent to Assadi-Porter at the NMRFAM for analysis.

From the vast pool of metabolites in these samples, Assadi-Porter has found a handful that rise to the surface as indicators of PCOS. If all goes well, this suite of metabolites will enable the creation of the medical community's first-ever diagnostic test for the syndrome, which Assadi-Porter plans to undertake next.

The test would not merely save time, although that's an important outcome for women who endure the guesswork currently involved in diagnosing PCOS.

An immediate answer would eliminate misdiagnosis, a common problem, and get women on therapies faster, before symptoms become severe. But mostly, an immediate answer would be just that: an answer. A way for a woman to know what her body is up against, deal with it and move on with her life. [g](#)

Peaks on a graphic display of data tell scientists which molecules are present in a sample, offering a clue to what diseases look like on a molecular level.



The Grow Dozen



Peter Aggen

Allison Cabalka

Stephanie Lutter Fritz

Elizabeth Kearney

Michael Meyer

Steve Peterson

Peter Aggen BS'02 Biology • As a physical therapist at Sister Kenny Sports and Physical Therapy in St. Paul, Minnesota, Aggen helps patients return to an active lifestyle without pain. A board certified specialist in sports therapy, his own active lifestyle and love of sports helps him better understand the issues his patients face and helps apply this learning to teaching. He is also a member of the staff running program, which performs outreach to running groups and at local races.

Allison Cabalka BS'82 Biochemistry • As a pediatric cardiologist with the Mayo Clinic in Rochester, Minnesota, Cabalka performs some of the most delicate procedures in medicine—repairing heart defects in newborns and young children. Cabalka's interventions include surgically placing devices to close holes in the heart and balloons to open stenotic heart valves, as well as the use of echocardiograms to diagnose congenital heart defects. She is also active in international medical aid, making regular trips to treat children in Mongolia, Nepal and the Kurdistan region of northern Iraq. In 2006 the Minnesota Chapter of the American College of Cardiology recognized her for outstanding contributions to international pediatric cardiology and outreach to underserved populations.

Stephanie Lutter Fritz BS'97 Bacteriology • After completing medical school, Lutter Fritz moved to Washington University in St. Louis to accept a fellowship in pediatric infectious diseases, earning a master's degree in clinical investigation. She is now an instruc-

tor and researcher in the university's Patient-Oriented Research Unit, where she studies the epidemiology and virulence of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA), one of the so-called superbugs that cause severe and sometimes fatal infections among patients. For her research ambitions she was awarded the Infectious Diseases Society of America/ National Foundation for Infectious Diseases Pfizer Fellowship in Clinical Disease. Fritz doesn't just battle bacteria in the lab: She also treats pediatrics patients at St. Louis Children's Hospital and performs investigations in community settings.

Elizabeth Kearney BS'95 Genetics • As a clinician in genetic counseling for seven years, Kearney was able to practice in a variety of settings, including a diagnostic laboratory, a general genetics department, specialty clinics and prenatal diagnosis centers. Most recently, Kearney has been elected as president to the National Society of Genetic Counselors, where she leads the association and serves as chief spokesperson. She also works as an independent marketing consultant for genetics companies in the San Francisco Bay area.

Michael Meyer BS'91 Bacteriology • When Meyer returned to Wisconsin in 2008 to become an assistant professor of pediatrics at the Medical College of Wisconsin, he brought a wealth of experience that has given him a unique perspective on his specialty of critical care. Serving 13 years in the U.S. Air Force, Meyer rose to the rank of lieutenant col-

onel and saw duty at Bagram Air Force Base in Afghanistan as a critical-care medical consultant. He then led a critical-care air transport team that assisted in the evacuation of critically ill patients from New Orleans following Hurricane Katrina. These days he pursues research on transport medicine while treating patients in critical condition at the Children's Hospital of Wisconsin.

Steve Peterson BS'83 Bacteriology • Originally a veterinarian, Peterson returned to medical school to become a specialist on conditions affecting the ear, nose and throat. Now with the Tri Cities Skin and Cancer facility in Johnson City, Tennessee, he specializes in Mohs surgery, a technique developed at UW-Madison to remove cancers from skin. Peterson says he enjoys working in an outpatient environment and finds it especially rewarding to help patients through the process of reconstructive surgery following cancer removal.

Benjamin Reineking BS'05 Bacteriology • Reineking is the owner of Reinkeking Chiropractic in Appleton, where he treats a variety of conditions through physical adjustments and rehabilitation exercises. Being a chiropractor allows him to spend more time with patients and help them with issues that lie beyond physical pain, he says. He is currently working to become certified to work with children through the International Chiropractic Pediatric Association.

Manuel Roman BS'82 Wildlife Ecology • Roman is an emergency-medicine physician and president of Suburban

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Alumni who are making a difference in medicine



Benjamin Reineking



Manuel Roman



Ann Schmidt



Kathy Selvaggi



Christine Sinsky



Jerome Siy

Emergency Associates, a physicians group that provides clinical services for hospitals in the Twin Cities area. When Roman began his residency, emergency medicine was a relatively new specialty. He helped establish the emergency medicine group for the St. Francis Regional Medical Center in Shakopee, Minnesota, which honored him with the hospital's first-ever new physician leadership award. Roman also has headed emergency departments in Edina, Minnesota, and Palm Springs, California.

Ann Schmidt BS'83 Nutritional Sciences • A physician in UW Health's internal-medicine clinic, Schmidt has recently been named a fellow with the American College of Physicians for her scholarship, clinical practice, teaching and administrative work. She also serves as service chief for the Department of General Internal Medicine at the UW Medical Foundation and holds a faculty position in the UW School of Medicine and Public Health. Schmidt says her degree in nutritional sciences gives her a strong basis for talking to patients about the steps they can take to prevent heart disease and other chronic diseases, a subject she gives special attention in her clinical care.

Kathy Selvaggi BS'79 MS'81 Bacteriology • After training in internal medicine and hematology/oncology, Selvaggi became interested in palliative care, which focuses on relieving the pain and stress of patients who suffer from serious illnesses. In 2006 she completed a fellowship in palliative medicine at the Dana-Farber Cancer Institute in Boston. She then became chief of palliative medicine for the West Penn Allegheny Health System, where she was voted one of Pittsburgh's top doctors and won the American Cancer Society's Lane Adams Award, honoring medical professionals who promote the quality of life for cancer patients and their families. Recently she accepted a position that will take her back to Boston as co-director of the inpatient palliative care unit at the prestigious Dana-Farber/Brigham and Women's Cancer Center.

Christine Sinsky BS'77 Biochemistry • Sinsky practices internal medicine at Medical Associates Clinic and Health Plans, Iowa's oldest multi-specialty group-practice medical clinic. She has served on numerous professional panels and committees, including the Society of Internal Medicine's Blue Ribbon Panel on the Future of General Internal Medicine, the American College of Physicians

and the National Committee for Quality Assurance. She is a fellow of the American College of Physicians and a director on the American Board of Internal Medicine. She has also given regional and national workshops on improving office practice and has been a consultant to several academic medical centers regarding improving ambulatory practice.

Jerome Siy BS'93 Biochemistry • Currently head of hospital medicine for Health Partners Medical Group and division head of primary care at Regions Hospital in St. Paul, Minnesota, Siy is one of the nation's pre-eminent hospitalists, a specialty that focuses on improving the quality and efficiency of hospital care. Among his accomplishments, Siy coordinated collaborations among Regions' hospital medicine, emergency and behavioral health departments to better address patients' mental health needs as they entered hospital care, which has helped reduce wait times and streamlined care. Thanks to such efforts, Siy was named to the *Minneapolis/St. Paul Business Journal's* "40 under 40" in 2007 and tabbed by the Society of Hospital Medicine for its 2009 award for clinical excellence.

About the Dozen

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

Next issue: Meat

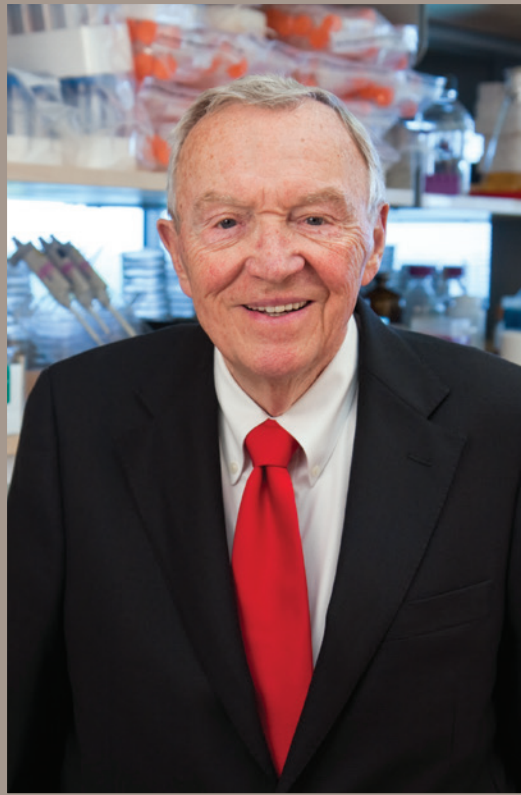
Know someone who should be in the Grow Dozen? Email us at: grow@cals.wisc.edu

Catch up with ...

Bob Bush BS'50 Food Science

SIXTY YEARS after earning his first degree from UW-Madison, Bob Bush was back on campus in May to pick up another one, this time an honorary doctorate in food science. The longtime president (1978-1985) and chair (1985-1999) of Green Bay-based Schreiber Foods was one of five

people to receive the honor during commencement; fellow CALS grad Milton Friend, emeritus scientist with the U.S. Geological Survey, National Wildlife Health Center, was also bestowed. We caught up with Bush to talk about what it was like to run the second-largest cheese company in the world and his not-so-quiet life in retirement.



● **How did it feel to be back on campus to receive an honorary degree?**

It's awesome. I'm humbled, thrilled. When Chancellor Martin called to tell me, I was truly speechless. I never expected I'd become "Dr. Bush."

● **You've stayed connected over the years with the college—can you tell us how that relationship started?**

Not too long after I graduated, the Food Research Institute saved Schreiber Foods from certain bankruptcy. I got a phone call from a customer saying that our cheese had made him sick. Soon I got two more calls. Naturally, we were extremely concerned. We recalled the cheese, but it came from a 40 million pound lot. Health officials said we would have to throw it all away, which would have meant everyone at the company would be out looking for another job. FRI helped us devise a test to determine which cheese from the lot was affected. Ultimately, we figured out that only 1 percent of the lot had been contaminated. I was so grateful that FRI was here and could provide us with the technical expertise we needed.

● **What was Schreiber like back then?**

Well, Mr. Schreiber asked my father to help him start a cheese company in 1945, and I joined him after I finished up at UW. When I started, Schreiber had one plant and fewer than 50 employees in Green Bay. I worked almost everywhere in the company. Now we have plants throughout Wisconsin and the world. If you order a cheeseburger at a restaurant, there is a 90 percent chance that the cheese on it is a Schreiber product.

● **Was it difficult to lead the company through such a growth spurt?**

I had a great team. They told me their ideas, and I told them to go do it.

● **Even in your retirement, you're involved with multiple organizations and causes in the Green Bay area. Aren't you tempted to slow down?**

When I see a not-for-profit struggling, I can't seem to resist stepping in to help. Often I end up as chairman of a board or committee, and we get to work.

● **The same way you "ended up" as CEO of Schreiber?**

Yep.



CALS' Kemp Natural Resources Station turns 50 in August.

CELEBRATE 50 years of environmental research and education at the **Kemp Natural Resources Station**. Created in 1960 when Susan Small and Sally Greenleaf donated the land and buildings along Tomahawk Lake in Wisconsin's Northwoods, the station's rare beauty and unique features have made it a beloved part of the CALS landscape. Kemp will mark its birthday with an open house and reunion on Aug. 21. 📱

CHEW on the science of food during **"Food Science for a Healthier You,"** part of the UW Division of Continuing Studies' University Summer Forum. Coordinated by CALS senior lecturer Monica Theis, the twice-weekly evening seminar will explore how food science creates and informs healthier choices in our diet. Classes meet

July 13-August 5 in the Microbial Sciences Building. 📱

HEAD UP to Pierce County for this year's **Farm Technology Days**, July 20-22. A number of CALS and UW-Extension experts will be on hand to show off the latest in agricultural knowhow during the three-day event, which is expected to draw some 60,000 visitors. 📱

WELCOME Dean Molly Jahn back to Wisconsin at a special dinner for the dean on September 24. The event, to be held at Madison's Monona Terrace Convention Center, will be an opportunity to hear about Jahn's experiences as deputy undersecretary for the U.S. Department of Agriculture. Contact Brian Hettiger at the UW Foundation for more information (see page 4 for contact information).



ASK your grocery store to stock **Healthy Grown** potatoes (see story, page 14). Grown under a unique partnership including the Wisconsin Potato and Vegetable Growers Association, the World Wildlife Fund, the International Crane Foundation and CALS researchers, the potatoes are good for you and for the environment.

FOLLOW CALS on **Twitter**. The fast-growing social networking site is now the place to find up-to-the-minute scoops on college news and activities, as well as links to the most interesting Tweets from our partners in agriculture and the life sciences. 📱 Search for "UWMadisonCALS."

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

COURTESY OF MICHAEL LEE

somethingHappeningHere

Kohler, Wisconsin. The return to Wisconsin of the PGA Championship, which runs August 9-15 at Kohler's Whistling Straits golf course, offers more than a chance to see the world's best golfers tee it up in the Dairy State. The event will shine an international spotlight on the landscape artistry of CALS alum **Michael Lee BS'87**.

As manager of the Whistling Straits course, Lee is responsible for maintaining the course's undulating fairways, roughs and greens, which make it one of the most unique golf venues in the country. Hugging the shores of Lake Michigan,



the Pete Dye-designed course was built to evoke the windswept Scottish courses where the game was born. The course first hosted the PGA Championships in 2004 and will do so again in 2015.

Lee has been preparing the turf for the

Lee at Whistling Straits: Gearing up for an onslaught of fans—and volunteers.

past two years and is now assembling a small army of volunteers—including fellow superintendents from as far away as New Zealand—to keep the course in top playing shape. "On a typical summer day we might have 40 people working on course. During the tournament we'll probably have 125, because we'll have twice the work and half the time to do it," says Lee.

After that, you can probably catch Lee on the beach: An inveterate surfer, he hits the waves near Sheboygan every fall.

Know a CALS alum doing good things in your neighborhood? Send it to grow@cals.wisc.edu.

Five things everyone should know about . . .

Raw Milk

By Scott Rankin

- 1 | Wisconsin is not alone in its interest in raw milk.** In May Wisconsin Gov. Jim Doyle vetoed a bill that would have allowed farmers to sell unpasteurized milk to consumers on a limited basis. But this is likely not the last we will hear about raw milk. Nationally consumer interest in raw milk is peaking, and 28 states now allow raw milk to be sold either directly to consumers or through retail outlets. Raw milk is also used in some forms of cheese, such as Parmesan or Cheddar, that are aged over long periods of time.
- 2 | The risks associated with drinking raw milk are real.** The federal government and public health agencies oppose consumption of raw milk because it can harbor pathogens such as *Salmonella*, *Listeria*, *Campylobacter* and toxic strains of *E. coli*, which can cause serious and sometimes fatal illnesses. More than 100 years of scientific study bear these risks out. Moreover, no farming practice can completely eliminate the presence of these pathogens. Only pasteurization, the process of heating milk to rid it of dangerous microbes, has proved effective.
- 3 | The risks are also relatively small.** Multiple surveys have shown that between 1 and 10 percent of raw milk samples are likely to contain pathogenic bacteria. It's estimated that at least half of Wisconsin's 13,000 dairy farm families consume raw milk, and we have not seen catastrophic consequences from this consumption. Farmers argue there is a bigger risk of getting hurt driving to a farm than there is from drinking raw milk, and that may well be true. But the reality of that risk remains.
- 4 | Paradoxically, some people drink it for health reasons.** Michael Bell, a CALS professor of community and environmental sociology, has done survey research to investigate why consumers drink raw milk despite its health risks. Many of the consumers in his study reported that raw milk helps them deal with personal or family health issues, including psoriasis, allergies, intestinal diseases, digestive problems and nervous system diseases. The root causes of these health problems are uncertain, and this is partly why sufferers seek alternative treatments. Although almost no reputable research has been done to test these potential health benefits, clearly many consumers have deeply held beliefs that drinking raw milk is worth the risk.
- 5 | Food is usually presumed guilty until proven innocent.** In this country, most regulatory systems put the burden on food manufacturers to prove their products are safe. There are clearly public safety reasons for that bias, but business interests also play a significant role. Food suppliers and their insurance companies don't want to risk being liable in incidents of food contamination, and so they have a powerful incentive to err on the side of safety. The national chain Whole Foods, for example, has decided not to sell raw milk because of the high cost of potential liability.

Scott Rankin is an associate professor and current chair of the CALS Department of Food Science. An expert on the characterization of dairy food flavors, he studies the chemical reactions and compounds that create the unique flavors of cheese and other dairy products. He works closely with dairy processors throughout Wisconsin to solve flavor problems and improve techniques for making dairy products.

Take the Final Exam!

QUESTIONS FROM ACTUAL CALS EXAMS

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.

Aquaculture

1. Pollutants that are harmful or toxic to humans are likely to be found in what types of fish? (Circle all answers that apply.)

- a. Fatty
- b. Old, big
- c. Small, fast, young
- d. Top chain predators
- e. All the above

From Meat and Animal Science 305: Introduction to Meat Science and Technology, taught by Jeff Malison:

Agronomy

2. Improving human nutrition by increasing the concentration of minerals and vitamins in crop plants is referred to as:

- a. Biofortification
- b. Diet diversification
- c. Epistasis
- d. Immunization

From Agronomy/Horticulture 338: Plant Breeding and Biotechnology, taught by Shawn Kaeppler

Economics

3. The economic term for the sacrifice of not doing something else is:

- a. Cost of doing business
- b. Marginal cost
- c. Opportunity cost
- d. None of the above

From Agricultural and Applied Economics 215: Introduction to Agricultural and Applied Economics, taught by Bruce Jones

Animal Sciences

4. Which of the following countries has the highest per capita meat consumption (kg/person/day)?

- a. United States
- b. Brazil
- c. China
- d. Japan
- e. Mexico

From Animal Science 101: Livestock Production, taught by David Combs and Mark Cook

Plant Pathology

5. What practices can a farmer institute to reduce pesticide use while still successfully controlling pests? (Circle all answers that apply.)

- a. Use pest- and/or disease-resistant plant varieties
- b. Maintain a low genetic diversity of the crop
- c. Rotate crops
- d. All the above

From Plant Pathology 123: Plants, Parasites and People taught by Andrew Bent

LAST ISSUE: Answers were 1: E, 2: D, 3: C, 4: C, 5: B. Congratulations to Shana Lavin PhD'07, of Chicago, who was randomly selected from the nine people who aced our Final Exam and wins a gift certificate to Babcock Hall.

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WE ALL SCREAM

Just in time for National Ice Cream Month in July, a tempting pink ribbon of freshly made strawberry ice cream pours into a carton at the Babcock Hall dairy plant. For more cool science, visit us online at www.cals.wisc.edu/grow/.