IOWA STATE UNIVERSITY
College of Agriculture and Life Sciences

STORIES

IN AGRICULTURE AND LIFE SCIENCES **VOL.11 NO.2 2017**

SMALL SCIENCE BIG IMPACT

STORIES
IN AGRICULTURE AND LIFE SCIENCES

EDITOR:
Melea Reicks Licht
('00 public service and administration in agriculture, '05 MS agricultural and life sciences education)

WRITERS:
Ed Adcock, Summer Bontrager, Deb Gruca, Darcy Maulsby, Barb McBreen, Brian Meyer, Melea Reicks Licht, Tracy Schlater, Betsy Snow Hickok, Grant Wall, Bill Zahren

DESIGN:
PUSH Branding and Design

College of Agriculture and Life Sciences Administration
Joe Colletti, Interim Endowed Dean, Interim Director, Experiment Station

Ruth MacDonald, Interim Senior Associate Dean, Interim Associate Director, Experiment Station

Jay Harmon, Interim Associate Dean for Extension and Outreach, Interim Director of Agriculture and Natural Resources Extension

David Acker, Associate Dean Academic and Global Programs, Raymond and Mary Baker Chair in Global Agriculture

COLLEGE CONTACTS

To contact the magazine:
STORIES Editor
304 Curtiss Hall
513 Farmhouse Lane
Ames, IA 50011
Phone: (515) 294-5616
E-mail: stories@iastate.edu
www.stories.cals.iastate.edu

For prospective students:
Student Services
20 Curtiss Hall
513 Farmhouse Lane
Ames, IA 50011
Phone: (515) 294-2766
E-mail: calsstudent@iastate.edu
www.students.cals.iastate.edu

To make a gift:
Development Office
310 Curtiss Hall
513 Farmhouse Lane
Ames, IA 50011
Phone: (515) 294-7677
E-mail: agalumni@iastate.edu
www.ag.iastate.edu/agdevelopment

IOWA STATE UNIVERSITY
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Printed with soy inks

MIX Paper from responsible sources FSC® C007419

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SMALL SCIENCE IS FAR FROM INSIGNIFICANT.

It's just the opposite. Our theme for this issue of STORIES refers to the scale in which selected scientific and educational efforts are underway, not the impact the projects are making.

As Basil Nikolau says in his Voices essay on page 14, "Iowa State University researchers are looking for discoveries in small plots, in small organisms or in small molecules, which will uncover advances and provide the foundation for major scientific breakthroughs." Nikolau is the Frances M. Craig Professor of Biochemistry in the Roy J. Carver Department of Biochemistry, Biophysics and Molecular Biology, a department co-administered by our college and the College of Liberal Arts and Sciences. The collaborative nature of Nikolau's work and his explanation of "small science" illustrates three other factors which could have easily been used in the title of this issue: Collaboration. Innovation. Relevance.

Collaboration. The work of Asheesh Singh and Kevin Falk in agronomy focuses on the small but mighty root system of soybeans. It's a great example of the collaborative nature of much of the research featured in this issue. Together with plant pathologists, breeders, geneticists, engineers and computer and data scientists they are gaining better understanding of soybean roots and the important microbial community surrounding them. Their results could help improve profitability.

Innovation. Alumna Diane Young built a hub for the latest testing technology in her corner of rural Iowa. The company attracts top talent to test everything from food products to regulatory water samples to co-products from the ethanol industry.

Relevance. Animal scientist Josh Selsby's research on muscular structure, proteins in muscle and how muscles work may someday help boys with Duchenne muscular dystrophy preserve muscle and live longer. CALS grad Rob Stout's efforts to improve soil health—cover crops, a bioreactor, prairie strips and more—are managing nutrients and reducing run-off in his watershed and downstream.

You'll also read about faculty, students and staff making impacts—big and small—in the lives of students and Iowans and tackling tough issues with global significance.

In closing, I hope you'll make plans to attend the College of Agriculture and Life Sciences celebration at the Cyclone women's basketball game and reception February 10, 2018. We'll be hosting a complimentary pre-game party and will recognize the 2018 CALS Emerging Iowa Leader. Watch STORIES Online for registration details. If you're not receiving your monthly e-news from the college in STORIES Online, e-mail stories@iastate.edu to subscribe.

Kind regards from central campus,

Melea Reicks Licht

Image by Barb McBreen

CONTENTS

ON THE COVER

Asheesh Singh (left), professor of agronomy, and doctoral candidate **Kevin Falk** are part of a research team studying soybean root traits and their microbiome (the tiny community of microbes living on roots). Learn more about what they are uncovering about root genetic diversity on page 26. Image by Christopher Gannon.

When you open this issue of STORIES, I will have spent the first few weeks in my new job as president of the best land-grant university in the country.

Since the October 23 announcement of my selection as the 16th president of Iowa State University, I've received hundreds of messages from alumni and friends. Thank you to those who took the time to send notes of congratulations and best wishes. Your thoughtfulness meant a lot to me.

I will do my very best to make you proud to be alumni of Iowa State University, and of this great College of Agriculture and Life Sciences. I know that Joe Colletti, the interim dean of the college, will continue our momentum into the future and leading into a national search for a new dean.

Since October 23, more than once I've found myself thinking about the "story of two Rogers," a tale that's been told in the College of Agriculture and Life Sciences for over 30 years.

Roger Bruene ('56, agronomy) served as the college's placement officer from 1975 to 1998, and a total of 40 years as a dedicated Iowa State employee. Roger Underwood ('80 agricultural business) was the ringleader of a group of alumni who, over several years, sent Roger Bruene a stream of tributes from around the world. The notes were jotted on postcards, letters, photos, napkins, airsickness bags—any surface that could hold ink. One was even rolled up and put in a wine bottle.

All the notes contained the same message: "I love my job!"

That is the message I want to share with you now. I love my job. I have loved every job I've had at Iowa State University, from working with farmers as an extension integrated pest management specialist to serving as Endowed Dean of one of the very best agricultural colleges in the world.

My next chapter of service to this great university has begun. In every chapter, I have served joyfully and with optimism for what the future holds. Please stay connected. I welcome your input and continued support as we move the university forward.

Wendy Wintersteen
President, Iowa State University
Endowed Dean of Agriculture and Life Sciences 2006-2017

BY THE NUMBERS

CALS STUDENTS

WOMEN 51% + MEN 49%

- **5,333** students, both undergraduate and graduate (62 fewer than Fall 2016)
- **4,603** undergraduates
- **730** graduate students
- **62%** higher than 10 years ago
- **495**—Record number of U.S. multicultural students (self-reported) *187% increase over 10 years ago*

3RD largest undergraduate student body among agricultural colleges in the nation

BUILDING PROFESSIONALS

1,160 bachelor of science degrees awarded last year *(49% more than 5 years ago)*

98% grads placed within 6 months of graduation

STEWARDING SUCCESS

90% PERCENT of new CALS students returned to campus

82% PERCENT stayed in CALS majors

EXTERNAL DOLLARS

$51.5 MILLION brought in by faculty supported by CALS and the Agriculture Experiment Station last year

→ **$271+** MILLION over past 5 years

FOREVER TRUE: INVESTING IN EXCELLENCE

FOREVER TRUE FOR IOWA STATE

- **$30** million raised last year
- **4,500+** alumni, friends and supporters provided gifts
- **$14M** gifts to feed mill and grain science center
  - Kent Corporation, $8 million
  - Iowa Corn Promotion Board, $4 million
  - Sukup Manufacturing Company, $2 million
- **$1M** gift from the Roger and Connie Underwood Family Foundation to support ag entrepreneurship and ag business programs
- Kemin Food Science Laboratory renovation
  - Mary A. Kelleher Nelson and R.W. Nelson
  - Kemin Industries

Image contributed

***Raegan Hoefler**, a senior in genetics, conducted a study on the effects of radiation on corn seedlings. The experiment involved exposing the seedlings to ultraviolet and x-ray irradiation levels similar to what would be found on Mars.*

Story by Summer Bontrager

MAIZE ON MARS

MAKING "THE MARTIAN" A REALITY

Surrounded by a red rocky surface as far as the eye can see, you look up and gaze at the planet Earth in the distance. Your stomach growls and you realize it is time for dinner. Heading back to your colony, you harvest some corn from your garden and prepare it to eat.

Raegan Hoefler, a senior in genetics, from New Vienna, Iowa, conducted a study to see if this garden scenario on Mars is a possibility.

Hoefler received a research grant from the Iowa Space Grant Consortium to conduct an experiment inspired by the movie "The Martian." She worked with Thomas Peterson, professor of genetics, development and cell biology and Pioneer Chair in Maize Molecular Genetics on the project.

Her research efforts also earned her a $5,000 scholarship from the consortium—a part of NASA's National Space Grant College and Fellowship Program.

"I had to design my own research and read a lot of primary literature to find out what has already been done in this field," Hoefler says. "I learned a lot about radiation and space."

Hoefler's research tested the effects of radiation levels on corn, a plant that might one day be grown in a Mars colony. Her project involved exposing corn seedlings to radiation levels similar to what would be found on Mars.

In the movie, based on the book "The Martian," a man is left behind on Mars after a space mission. The only way he can survive is to cultivate potatoes.

"When people think of NASA, I don't think growing food to sustain life on Mars comes to mind," Hoefler says. "It also is interesting that our own ozone is depleting, so Earth may one day become more Martian-like. So we're seeing if plant growth under these conditions is possible."

The corn plants were exposed to both ultraviolet and x-ray irradiation. Hoefler administered UV radiation by using a germicidal lamp in the lab. The X-rays took place at the Mary Greeley Medical Center with a linear accelerator, which is used to provide radiation treatments to cancer patients.

Hoefler determined maize plants are able to survive and reproduce after being irradiated at the tested level.

She also studied irradiation thought to activate transposable elements inside the corn genome. Transposable elements are sections of DNA that have the capability to copy themselves and move around within the genome. Transposable elements are usually kept inactive by the defense mechanisms of the host plant.

In the next step of research, she will conduct bioinformatics analyses to determine if transposable elements are activated in the irradiated plants. If so, the movement of the transposable elements in the genome could cause new mutations and loss of vigor.

After graduation, Hoefler is planning to pursue a doctorate in a field related to genetics or bioinformatics.

MENTORING IN SMALL GROUPS LEADS TO BIG SUCCESS

Story by Barb McBreen
Image by Christopher Gannon

Once you meet Brandon Washington you won't soon forget his smile and caring attitude. That may be why the students he mentors listen when he offers advice on schedules, homework or day-to-day problems.

"I just love to help young people believe in themselves," says Washington, a senior in biology and kinesiology.

Washington grew up in Arlington, Texas—home of the Dallas Cowboys. He thought he'd like to play college football, but the offers he received weren't the right fit for him. He earned academic scholarships to Iowa State University and decided to come to Ames.

"My mom wasn't too thrilled because it's so far from home," Washington says.

Since he arrived at Iowa State he's been exploring different career options. He has the confidence and the grades to become a doctor, but isn't sure that's for him. Instead, he says, he found his calling working with students as a peer mentor.

"He knows the struggles involved in coming to the university setting," says Lauren Westerdale, Biology Education Success Team (BEST) peer mentoring adviser. "He shares those experiences with students and encourages them to persevere and bounce back."

He works with two peer mentoring groups, both in biology and kinesiology. Westerdale says his leadership style attracts students.

"He's a fun, motivated student, and he is sincere and genuine," Westerdale says. "He really connects with students and wants to guide them. He helps them feel at home at Iowa State and become academically successful."

This past summer he interned at the Boys & Girls Club of Ames. With a summer school atmosphere focused on youth development, they offer programs for children ranging in age from six to 18. The experience broadened his idea of what he hopes to do in the future.

"I want to be involved in youth development in some way," Washington says. "I'm hoping to go to graduate school in an area related to student development or student affairs."

He continues to work part time at the Boys & Girls Club as a youth development professional. Kaitlin Binnebose, operations director at the club, says he oversees gym activities and helps students with homework. His work at the club earned him an Employee of the Month award in September.

"He is one of the most respectful, responsible and happiest people I've ever met," Binnebose says. "And the things the kids say about Brandon are inspiring—he makes them feel special."

Jenny Gibbs, the adviser for the kinesiology peer mentor group, says evaluations from his mentees are heartfelt and life-changing.

"His students have said, 'It's because of him I'm still here.' 'Instead of dropping out, he advised me to just drop a class,'" Gibbs says. "He has this special ability to touch people's lives and make a difference. And when he smiles at you, you know your day will be better."

***Brandon Washington** (center), a junior from Arlington, Texas, found his calling working with students as a peer mentor. His mentees say he has a gift for connecting, inspiring and making a difference in the lives of others.*

> ***"He is one of the most respectful, responsible and happiest people I've ever met…the things the kids say about Brandon are inspiring—he makes them feel special."***

STUDENTS

TEAM CODY

EMPOWERING IOWA STATERS

> ***"Iowa State has provided countless opportunities and because of that I'm a well-rounded individual"***

***Cody West** (left) and **Cody Smith** are CALS students serving as president and vice president, respectively, of the Iowa State University Student Government. "Team Cody" worked with Iowa State Interim President **Ben Allen** to address issues such as tuition increases and campus climate.*

Story and image by Barb McBreen

In a small office in the Memorial Union, Cody West and Cody Smith spend more than 20 hours a week together working on issues concerning students. If they aren't in the office or in class they are meeting with students, administrators, legislators or attending the State of Iowa, Board of Regents meetings.

West, a biology senior, is serving as president of the Iowa State University Student Government and Smith, an agricultural and life sciences education and political science senior, is serving as vice president. Together they form "Team Cody." The two received 54 percent of the student vote on March 8.

"One thing we talked about in the campaign is we are genuine people and when we say something we mean it. If we are putting something out there—we wholeheartedly believe it," Smith says.

Smith grew up on a livestock farm in Indiana, and says he's always had a passion for agriculture. He would like to pursue a career in ag policy. Smith has been involved with the Agricultural Education Club, Collegiate FFA Chapter, the Agricultural Communicators of Tomorrow and the College of Agriculture and Life Sciences Ambassadors. He says serving as vice president has introduced him to a broader range of issues.

"This has been great because it has expanded my understanding of issues surrounding healthcare and higher education," Smith says.

The two have been friends since they met in an agricultural education and studies learning community during their first semester on campus.

West, who kept busy applying for medical school and serving on the Iowa State presidential search committee, grew up in Altoona. West says he's been a life-long Cyclone and has family roots in agriculture. He's been involved in freshmen council, pre-med club, Phi Kappa Psi Fraternity, University Honors Program and was a medical research assistant in the College of Veterinary Medicine.

"I was doing practical, relevant research my first year at Iowa State," West says. "That was a great opportunity for me, but as I got involved with student affairs I realized I like connecting with others and that's my calling. I'm hoping to practice medicine and someday return to higher education."

Both West and Smith worked with Iowa State Interim President Ben Allen to address issues such as tuition increases and campus climate. Allen says he's impressed with the student leaders who are effective advocates for students and excellent ambassadors for the university.

"I get my best advice from student leaders because they are there for the students. They are thoughtful, helpful, civil and if they disagree, they do so in a manner that encourages conversation," Allen says. "That's one of the great things about doing this job—I get to interact with students like Smith and West."

As seniors, they both see the need to help undergraduates get more involved in Student Government.

"We're trying to delegate more and give undergraduate students a chance to be involved, so we're more focused on mentoring," Smith says.

Last year both served in Student Government in different capacities. Smith led the public relations committee and West served as vice president. Both realized some of the issues they want to address can't be solved in one year. Their hope is to begin the discussion and address issues such as lease gaps, improved communications, mental health awareness and the need for a more inclusive and diverse campus.

"People don't expect a biology major to be involved in student government," West says. "But for me it's been great to expand on my passion for medicine and focus on areas of student wellness, whether that be physical or mental health."

The two created a new cabinet position to address mental health issues. Nathan Pfister, a senior in industrial engineering, is serving as director of mental health awareness. Pfister, who started a suicide prevention group on campus, welcomed the chance to serve on the Student Government cabinet.

"It's very important to have leaders who help students seek mental health assistance. They've done a great job of bringing up a topic most people shy away from," Pfister says. "They work great as a team and their true goal is to help students. They're always willing to reach out."

The Student Government also is working with the Iowa State Student Affairs Office to sponsor the Green Dot Bystander Intervention program, which is focused on campus safety. West says the purpose of the program is to empower peers with the tools to promote safety.

"Green Dot is a training program, that basically shows students what good and bad interactions may look like in violent situations," West says. "It's a simple way to give students the resources to help their peers."

Smith says working to improve communications with students also is a priority. One tool is the Cyclone 101 class, which teaches basic financial literacy, shares campus resources and discusses diversity and inclusion.

Both agree serving on Student Government allows them to give back to the Iowa State community, and they are thankful for opportunities they've found on campus.

"Iowa State has provided countless opportunities and because of that I'm a well-rounded individual," West says.

"We are surrounded by amazing people," Smith says. "We want to empower other students to find what they are passionate about.

FOOD SCIENCE AND HUMAN NUTRITION ADDS NURSING DEGREE

The Iowa Board of Regents has approved plans for a new bachelor of science in nursing degree in the Department of Food Science and Human Nutrition. The RN-BSN is a continuation program designed for registered nurses—those working in the field as well as recent graduates of approved nursing programs—who want to earn their bachelor's degree. The program will begin in fall 2018.

CANO CAMACHO AWARDED GEORGE WASHINGTON CARVER SPIRIT OF INNOVATION AND SERVICE AWARD

Valeria Cano Camacho, a junior majoring in agronomy and global resource systems, was one of five undergraduate students nationwide to receive the 2017 George Washington Carver Spirit of Innovation and Service Award. This is the second year the award was presented as a tribute to the legacy of Carver. Recipients are first-generation college students pursuing a scientific degree with a high level of involvement in campus activities.

SUCCESS FOR CALS STUDENT TEAMS

- The Agricultural Business Club received the Outstanding Chapter Award at the Agricultural and Applied Economics Association annual meeting. **John Maubach**, senior in agricultural business, placed first in the Earl O. Heady Spreadsheet competition.
- The Dairy Science Club (above left) placed first in overall team judging at the Intercollegiate Dairy Cattle Judging Contest. **Mason Lettinga**, junior in animal science, received first place in the overall individual category and second in the oral reasons competition.
- The Crops Team (above right) earned second place in the Central Regional Crops Contest hosted by Oklahoma State University.
- The Soils Judging Team took third place honors at their regional competition in South Dakota earning them a place a national competition this spring.

Hearty Hellos

- **Leana Bouffard**, professor and chair, sociology
- **Kristen Johansen**, professor and chair, Roy J. Carver Department of Biochemistry, Biophysics and Molecular Biology
- **John Nason**, professor and chair, ecology, evolution and organismal biology
- **Evan Sivesind**, manager, Iowa Pest Resistance Management Plan, entomology
- **Catherine Woteki**, professor, food science and human nutrition

GLOBAL AND NATIONAL LEADERSHIP RECOGNITION FOR FACULTY EXCELLENCE

- **Thomas Baum**, Charles F. Curtiss Distinguished Professor in Agriculture and Life Sciences and chair, plant pathology and microbiology, American Phytopathological Society fellow
- **Matt Darr**, professor, agricultural and biosystems engineering, American Society of Agricultural and Biological Engineers New Holland Young Researcher Award
- **Kathleen Delate**, professor of horticulture and agronomy, Rodale Institute Organic Pioneer Award
- **Cindy Haynes**, professor of horticulture, American Society for Horticulture Science Outstanding Undergraduate Educator Award
- **Maynard Hogberg**, emeritus professor, animal science, Livestock Publications Council Headliner Award
- **Jack Koziel,** associate professor, agricultural and biosystems engineering, won two Publons Peer Review awards, ranked in the top 1 percent of peer reviewers in environmental science
- **Steve Mickelson**, professor and chair, agricultural and biosystems engineering, American Society of Agricultural and Biological Engineers James R. and Karen A. Gilley Academic Leadership Award
- **Manjit Misra**, director, Seed Science Center, professor, agricultural and biosystems engineering, Global Agriculture Leadership Summit Global Agriculture Academic Leadership Award
- **Gary Munkvold**, professor, plant pathology and microbiology, American Phytopathological Society fellow
- **John Patience**, professor, animal science, JBS United 2017 John B. Swisher Leadership Award
- **Stephen Smith**, visiting professor, agronomy, American Seed Trade Association Lifetime Achievement Award
- **Leo Timms**, Morrill professor, animal science, American Dairy Science Association Award of Honor
- **Kan Wang**, professor, agronomy and director of the Plant Transformation Facility, Society for In Vitro Biology Lifetime Achievement Award, Iowa State University Global Professor of Biotechnology

Interim director for Agriculture and Natural Resources Extension and Outreach ***Jay Harmon*** *has built a career helping others and seeking solutions to make agriculture more efficient and sustainable.*

BUILDING PEOPLE

Story by Grant Wall
Image by Christopher Gannon

The value extension provides became apparent to Jay Harmon on day one of his first job.

Hired as a farm structures specialist at Clemson University, Harmon started a week after Hurricane Hugo slammed into the South Carolina coast.

"I figured out pretty quickly that I wasn't working to rebuild barns, I was working to rebuild people," Harmon says. "We spent a lot of time visiting farms that had lost buildings. Many times we were providing more service than education."

That focus on service stuck with Harmon throughout his career. It is still with him as he takes over the role of interim director for Agriculture and Natural Resources Extension and Outreach at Iowa State University.

Harmon succeeds John Lawrence, interim vice president of Iowa State University Extension and Outreach. Prior to moving into this administrative roll, Harmon was a professor of agricultural and biosystems engineering at Iowa State where he specialized in livestock production systems. Harmon holds degrees in agricultural engineering from Purdue University and the University of Minnesota. He earned his doctorate from Virginia Tech University.

"Dr. Harmon has a firm commitment to production agriculture. His leadership and ability to seek solutions make him a highly valued resource for Iowa's pork producers," says Pat McGonegle ('83 animal science), CEO of the Iowa Pork Producers Association. "His research in swine production systems, particularly hog building design and construction, has been invaluable."

Harmon's initial focus since taking over as interim director in April is stewarding the human capital already in place throughout Agriculture and Natural Resources Extension and Outreach.

"What this job comes down to, internally, is taking care of our people from when they start to when they retire," Harmon says.

He also is working to ensure Agriculture and Natural Resources Extension and Outreach is positioned to continue helping people across the state.

"Agriculture must be environmentally sustainable but also grow to help feed the world," Harmon says. "We can impact the lives of Iowans, making them more efficient and agriculture more sustainable. Over the next few years we will be tasked with feeding more people, so we need to remain innovative. We can make life easier by helping Iowans make informed decisions."

Making the lives of Iowans better is at the heart of Iowa State University Extension and Outreach's mission. It's the same mission Harmon has carried with him throughout his career.

"I was a 10-year 4-H'er and had extension experiences through my own county office in Indiana," Harmon says. "I saw the impact that can be made. It's not just that you are doing research and outreach, it's that you are doing something with an immediate impact to help someone."

*It's interaction with her students and advisees that inspires CALS grad **Amy Brandau**, "everyone needs a cheerleader in their corner" says the agricultural business adviser.*

STEERING THE STUDENT EXPERIENCE, LEADING WITH HEART

Story by Deborah Gruca
Image by Christopher Gannon

It was while earning her MBA that Amy Brandau realized the perfect job for herself. She had been working as an academic adviser—and had fallen in love with it.

Brandau ('00 agricultural business, '08 MBA) found her undergraduate degree an ideal combination of her two interests: agriculture, thanks to the family farm where she grew up, and business, because of her mother's bridal shop.

As an adviser in the Department of Economics, she uses her passion for working with college-age students to help economics and agricultural business majors navigate their Iowa State experience.

"I get to work with students the entire time they're here, which is really fun, because I get to watch them mature, grow up and go on to do great things," she says.

Brandau advises 250 sophomores, juniors and seniors—about 80 of them new to her this year.

"It's only overwhelming at registration time, when I meet with students," she says. "I feel strongly about meeting with all of them individually, so I can get to know them and be the best adviser."

Students are required to meet with her once per semester, but at least half will visit with her multiple times.

"I tell my students I'm here so they don't need to panic or lay awake at night and worry. They should stop in and we'll figure out a problem together; sometimes just talking will help solve it."

Conversations take place not only in her office, but also via email, at Agricultural Business Club meetings and even on sidewalks around campus. Questions range from majors and minors, to career paths, internships and graduation tracks.

"She's always willing to meet with me—whether it's about school, jobs or just to catch up," says agricultural business senior Jessica Manthe. "She's made me feel confident in my abilities and has helped calm me down numerous times when things got tough."

Getting Oriented

Brandau teaches an orientation class for students transferring to Iowa State in agricultural business. For one class period, some of the last year's transfers talk to the students about their experiences. Inevitably, they tell the new class how she helped them solve problems or prep for the career fair.

"It's better when the students say it for me," says Brandau. "And it's gratifying when they want to come back and help the next class, which is part of the CALS culture."

Ag business senior Geert Boelen appreciated Brandau's help.

"I had a small case of transfer shock, and being in her Econ 110 class helped me out a lot," he says. "She explained to me a drop in grades was to be expected. That way, I was prepared for it and could adjust accordingly the second semester."

Students who start in spring have a more difficult time adjusting. She started a spring semester orientation class last year to help those students meet others and to learn about Iowa State.

Club Collaboration

Part of Brandau's job includes being an Agricultural Business Club adviser, along with professor Ron Deiter and assistant professor Georgeanne Artz ('05 PhD economics). The award-winning club has monthly meetings, brings in outside speakers and hosts events. The club offers opportunities for leadership development in committees as students run for office, or collaborate on projects and events.

"I always tell people, you're going to have a good degree," says Brandau, "don't worry about that. What Iowa State does well is make sure you're employable with leadership skills, and Ag Bus Club just gives you a way to network and practice those skills."

An annual student favorite is the fall industry tour.

***Brandau** co-led a 10-day Brexit study abroad trip with 20 students to explore the government and history of Great Britain in the wake of Brexit. The group posed outside the Houses of Parliament in Westminster where they toured the Commons Chamber and the Lords Chamber.*

"It's been fun to go on these tours with the students," says Brandau. "The people who are speaking to us are usually my age, so they're people I went to school with. It's neat to reconnect and find out what they're doing now."

Brexit Abroad

Last spring break Brandau co-led a 10-day Brexit study abroad trip with senior lecturer Terry Alexander. Twenty students explored the government and history of Great Britain, specifically England and Scotland. Prior to the trip, students were required to take Economics 496, a three-credit course taught by Brandau and Alexander.

"The Brexit study abroad trip showed me the differences and similarities between the United States and United Kingdom governments," says agricultural business junior Gary Wynne. "I was able to hear people's stories and opinions of current political talking points, both there in the U.K. and in the U.S. These conversations left an impact on the way I think and gave me a new perspective on many topics."

Brandau's passion for her students is reflected in her advising philosophy.

"I have one goal every day when I come to work—how can I interact with students in order to help them have a better experience at Iowa State? While many student meetings begin with developing class schedules and relaying university policies, I find that what students really need are personal connections. It's my belief that everyone needs a cheerleader in their corner while at college," she says.

BACKING UP BAAS

CAREER BUILDER AND STUDENT MENTOR

Story by Barb McBreen
Image by Christopher Gannon

In October 2014 Tom Baas received life changing news.

He was home sick thinking he had the flu, but went to the emergency room and was diagnosed with pneumonia, anemia and Acute Myeloid Leukemia. He was hospitalized immediately and stayed in the hospital for the next four weeks.

"I was sick—really sick. I went through five chemo treatments over the next several months. Those ended in February 2015. I went back to work in April and fulltime that fall," says Baas, an animal science professor, student favorite and swine research extension specialist for more than 20 years.

The Block and Bridle Club came to the support of Baas by organizing a Pie the Professor event. Students raised $612 to toss a pie at Greg Krahn, an animal science lecturer who stepped in to lead Baas' classes when he became ill.

Reciprocal Relationship

Krahn says the way students stepped up to help shows how much they care about Baas.

"If you talk to students in his classes, they would do anything to help him out and I think that shows what kind of person he is and how much people have benefitted from his presence at Iowa State," Krahn says.

"I always told my students they are the best and that's why companies are knocking at the door to be at our career fairs and meet them," Baas says.

Baas knows how to make connections for students and understands the pork industry. He worked in the industry for 22 years before starting in his faculty position at Iowa State in 1994.

"My career has been very rewarding," Baas says. "I brought real-world experiences to the classroom, which helped me prepare students for their careers. I always thought if I helped a student somewhere along the way then I accomplished something."

One of Baas' favorite classes was Pork Fellows, a class that introduced students to opportunities and professionals in the pork industry.

"Students had to convince me they wanted a career in the pork industry to get into the course," Baas says. "Companies were always contacting me and asking if they could meet with students. Students loved it because they could meet with a broad spectrum of professionals."

Called to Be Bald

Unfortunately, Baas' Leukemia returned in December 2015, and he started chemotherapy again. This time, the doctor said his only option was a bone marrow stem cell transplant.

"In May of 2016 I had the stem cell transplant," Baas says. "The transplant was basically a blood transfusion. I don't remember anything for nine days following the procedure. My wife, Cindy, didn't tell me until later, but there were three or four days when they weren't sure if I was going to walk out of there."

He was initially supposed to be in the hospital for 100 days, but was released after 24. For the next six months his immune system was too low to fight infection, so he could only leave his home to go to weekly doctor appointments in Iowa City.

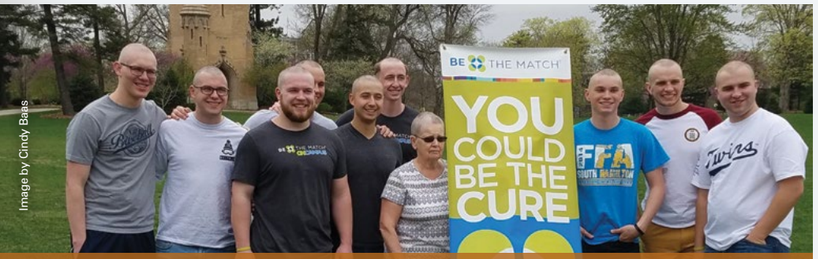


Image by Cindy Baas

*Farmhouse Fraternity hosted a Called to Be Bald event on central campus to raise awareness and funds for bone marrow donation. **Chris Mandt**, a senior in animal science, and **Billy Marshall**, a graduate student in agricultural education and studies, helped organize the event which involved volunteers shaving their head to raise awareness about the ease and importance of donating bone marrow.*

FACULTY + STAFF

*Students, colleagues and alumni offered their support to professor **Tom** and **Cindy Baas** (center) during his battle with Acute Myeloid Leukemia. Lecturer **Greg Krahn** (left), stepped in to lead Baas' classes and students organized awareness and fundraising events. Many even donated bone marrow. **Will Tubbs** (second from left) and **Edan Lambert** (right) are bone marrow donors and grad student **Billy Marshall** (second from right) is a leader in the Be the Match program at Iowa State.*

The same spring Baas was signed up for a stem cell transplant, Chris Mandt, a senior in animal science, started fundraising for Be The Match, a national bone marrow donor registry. He and other members of the Iowa State University Farmhouse Fraternity were planning a Called to Be Bald event to raise awareness about the bone marrow donor program.

"We started planning our Called to be Bald before we found out Dr. Baas had Leukemia," Mandt says. "So, when we found out we decided to raise awareness for him."

That first year the fraternity held a Called to be Bald event to honor Baas the students raised more than $5,000, but more importantly they raised awareness.

"We are trying to change the stigma around bone marrow donations," says Billy Marshall, a graduate student in agricultural education and studies who worked with Mandt to organize the Called to be Bald event.

Marshall says people think of bone marrow transplants as painful and expensive. That may have been true years ago, but today bone marrow donations are similar to blood donations.

"There are two different types of donations. If an adult donates to another adult it's basically pulling stem cells from your blood, so it's similar to a blood donation," Marshall says. "For children, doctors prefer to use bone marrow. The process involves a shot in the hip and anesthesia is administered, similar to pulling a wisdom tooth."

Always a Cyclone

The hardest doctor's order for Baas came after the transplant. He was advised not to return to work. Baas says he will miss teaching, advising and the daily interaction with students.

"My goal was always to make students aware of opportunities and put them in contact with industry people. The fun part of advising was watching students come in as uncertain freshmen and graduate in four years as polished individuals," Baas says.

During the last two years Baas says the Iowa State University community of students, staff and friends have shown their support in numerous ways.

"We used a Caring Bridge site to let folks know what was going on during the hospitalization and the response from students and faculty was great," Baas says. "Students asked me what they could do to help and I told them to donate blood or sign up to be a bone marrow donor."

Krahn says Baas kept his sense of humor through it all. During his visits to the University of Iowa Hospital Baas told him, "Leukemia can do some evil things, but I promise I'll always come back a Cyclone."

BIG ADVANCEMENTS THROUGH SMALL SCIENCE

Story by Basil J. Nikolau
Image by Christopher Gannon

What is "small science"?

The origin of this phrase can be traced to the post-World War II era, as a contrast to "big science." Scientists defined big science as projects such as the Manhattan Project, which ended World War II and launched us into the nuclear age, or the space program that landed humans on the moon.

In contrast, at that time physicists were explaining the evolution and consequence of science, from small to big.

To put it simply, big science projects are built on small science advancements. Take Robert Goddard's invention of liquid propelled rockets—his experiments in physics and aerodynamics as a teenager at home ultimately led to landing on the moon and the exploration of space.

Biology, often described as small science, is launching into an exciting new era. This was largely made possible by applying physics and chemistry to develop new technologies advancing this new type of small science. These technologies sped-up the process and accuracy of determining the structure of biomolecules (specifically, the DNA blueprint of plants and animals), and was the basis for the Human Genome Project. Thus, small science enabled big science.

Translating this biological blueprint will require the science of small things. The coming challenge is to determine the structures of millions of very small biological entities—proteins, RNA molecules, sugars, lipids, small metabolites—and we will need to know where they are within cells and tissues, and how they are affected as time elapses. Although we know many of these small entities, there are many more unknown awaiting discovery. How many are unknown? When will we know we are done? Answering these challenges is big science on a small scale.

This issue of STORIES explores research in the sciences on a small scale. Iowa State University researchers are looking for discoveries in small plots, in small organisms or in small molecules, which will uncover advances and provide the foundation for major scientific breakthroughs.

Analogous to going to the moon—small science deserves the investments of big science. There is a rich harvest of advances to gain from this big science of small things—cures to diseases, overcoming hunger and malnutrition and developing a sustainable economy. S

Basil J. Nikolau is the Frances M. Craig Professor of Biochemistry in the Roy J. Carver Department of Biochemistry, Biophysics and Molecular Biology

LOOKING FOR A CURE

FROM THE INSIDE OUT

Story by Ed Adcock
Image by Christopher Gannon

*By better understanding hyperthermic muscle injury, **Josh Selsby's** research will help decrease human suffering and improve agricultural profitability.*

Extending the life of those afflicted with muscular dystrophy is one of Joshua Selsby's research passions.

Selsby, an associate professor of animal science, has spent his career studying muscle and ways it can be damaged. Since 2006, he's been looking for ways to preserve muscle in boys who suffer from the genetic disease.

Duchenne muscular dystrophy mostly affects boys, with one in 3,500 to 5,000 born with the disease. As preschoolers they begin to experience muscle weakness because an abnormal gene interferes with the production of a protein needed to form healthy muscle. Patients get progressively weaker, and usually by the age of 12 or 13 they will be in wheelchairs. Symptoms can lead to death in their 20s due to respiratory or heart failure, as their diaphragm or heart muscles weaken.

Since 2009, Selsby and collaborator John Quindry at the University of Montana have been looking for a practical way to turn on a pathway thought to have therapeutic potential for those affected by this disease.

After finding no pharmaceuticals available to safely activate this pathway, they turned to the study of a nutraceutical called quercetin. Nutraceuticals are plant-derived supplements that may have physiological impact. Quercetin is derived from many plant sources such as apples, peppers, tomatoes and leafy greens.

Their 10-month study uses multiple pairings of quercetin with other compounds. So far, Selsby says quercetin doesn't provide the "Wow!" he was looking for in skeletal muscles, but there might be some "real promise" for the heart.

In addition to investigating muscular dystrophy, he says he finds the way heat stress affects muscle fascinating.

"I've developed an independent line of research to better understand what heat does to muscle that may cause damage," Selsby says.

The hope is lessons learned in the study of dystrophic skeletal muscle may also apply to heat stressed muscle and may, for example, decrease oxidative stress caused by environmental hyperthermia, says Donald Beermann ('71 animal science), chair of the animal science department.

"The research tools Dr. Selsby uses to study muscular dystrophy are also used to investigate and understand the inflammatory signaling pathways and changes in energy, metabolism and mitochondria function in skeletal muscle associated with heat stress," says Beermann.

Heat stress represents a significant human health concern as well as recurrent burden that detracts from growth efficiency in animal production. By better understanding hyperthermic muscle injury, there is the possibility this research will serve the dual purpose of decreasing human suffering as well as improving agricultural profitability and ensuring food security.

Selsby joined the department in 2008. He teaches graduate-level physiology and muscle biology courses and advises undergraduate students.

He plans to continue both lines of research with the hope of improving lives through decreased disease burden and improved food security and agricultural profitability. S

*Researcher **Marshall McDaniel** is brewing up a new way to test for soil health by examining soil's ability to decompose tea bags. Farmer collaborators find the method easy to use and interpret.*

TEA TIME FOR SOIL HEALTH

Story by Tracy Schlater
Image by Christopher Gannon

The system of microorganisms and enzymes in soil are a key factor in how plants take up nutrients for growth. It's a complex system. Marshall McDaniel's research in the Department of Agronomy is trying to uncover a simple way to gauge soil health—soil's decomposition ability.

"The faster soil can decompose material, the faster it can make those nutrients available to the plants," says McDaniel. "Our goal is to give farmers an easy, inexpensive way to gauge how well their soil breaks down plant matter."

How? Bury tea bags.

Standard brewed tea bags are readily available, inexpensive and typically weigh the same regardless of name brand. A high-quality tea serves as a control since almost any soil system will be able to successfully decompose its perfect combination of carbon and nitrogen. However, the ratio of carbon and nitrogen in poor-quality tea is less than ideal. This imbalance tests the ability of soil microorganisms because poor-quality tea requires more inputs, like carbon, from the soil to breakdown.

McDaniel, an assistant professor, is studying soil's decomposition ability in traditional cropping rotations and those with the addition of cover crops. He partnered with Practical Farmers of Iowa and has nine sites on privately owned farms and one site on Iowa State University land. The project is funded by The Leopold Center for Sustainable Agriculture.

"We haven't done a deep analysis of the data yet, but early results show soil microbes improve even after just one year of a cover crop," says McDaniel. "If the critical analysis confirms it, our next question will be, 'why?'"

McDaniel wanted to get farmers involved by testing something they were curious about on their own farms. The project involves seven farmers burying and collecting tea bags themselves, as citizen scientists. One of these farmers is Nathan Anderson ('10 agronomy).

"I was immediately intrigued," says Anderson. "There are a lot of soil tests advertised, but this was low cost and the method was simple, straightforward and easy to implement."

On Anderson's farm, they are running five trials in the same type of soil. Three row-cropped fields have very different yield productivity. The two additional sites are in a rotationally grazed pasture and established alfalfa field.

"I wanted to see what else might be going on from a biological standpoint that could be contributing to the differences we're seeing," says Anderson.

A simple soil test like the one McDaniel has created can help farmers set soil health goals and gauge their progress. As a farmer, Anderson says one of the most beneficial aspects of the tea bag test is the timeliness.

"It's going to give us a quicker report card for some of the tools we're using for soil health, like cover crops," says Anderson. "It has the potential to be a game changer in terms of measuring progress."

SMALL PRAIRIES OFFER ABUNDANT INSIGHTS

Story by Ed Adcock
Image by Christopher Gannon

When Benjamin Gue viewed the site for Iowa State University in 1858 it was mostly tallgrass prairie, as was about 80 percent of the state. The farmer and legislator who proposed the bill that established the State Agricultural College and Model Farm commented on the 648-acre location:

"… the great monotonous plain of waving grass only broken here and there by scattered groves … Standing on the eminence where the college now looms, we could only see one of the most beautiful landscapes in the west … "

The grassland gave way to the campus, but there are still patches of prairie at Iowa State used for teaching, research and extension. There are about a dozen plots in Story and Boone counties ranging from 3 to 70 acres.

"In one way these patches are a good reminder of our heritage," says Mark Honeyman, associate dean of operations for the College of Agriculture and Life Sciences, which includes its research and demonstration farms.

Although small in size, these plots are rich with opportunities to discover.

Between Science Hall and Science Hall II is a third-of-an-acre prairie plot. Mary Harris, an adjunct assistant professor in natural resource ecology and management, uses the prairie for the pollination biology course she teaches.

"I take the class there three times early in fall semester to get hands-on experience estimating plant diversity and observing how different pollinators interact with the variety of blooming prairie plants. Students love this experience and it is great to have this outdoor classroom just outside the building; it means we can meet and conduct class within the allotted 50 minutes," she says.

The newest patch is a 10-acre prairie at the Horticulture Research Station near Gilbert. It was planted in 2015.

"Pollinators benefit from a diverse, perennial plant environment, like prairie. That was a driver for establishing prairie at the Hort Station because every apple, every squash, every tomato has to be pollinated," Honeyman says.

That prairie also was part of the Monarch butterfly habitat project and surrounds a 300-year-old burr oak, which is the 14th largest in the state of Iowa. Prairie plots also are labor-savers.

"If it's a well-established prairie, we don't have to mow it or control weeds, and we only need to burn it every few years," Honeyman says.

In addition to the restored prairies, there is a 3-acre patch of native prairie (original to pre-tillage times) at the university dairy farm. Two acres of restored prairie were added and it was named for Marvin Anderson, a former dean of extension, who did graduate work there, and Robert Dyas, a landscape architecture professor who was an expert on prairie.

These small research venues offer great insight. Proximity and access benefit students and faculty alike.

***Mary Harris** (left), adjunct assistant professor, and **Amanda Kindred**, a senior in animal ecology, examine a bee trap located in the prairie plot on Iowa State's campus between Science I and Science II. Faculty in natural resource ecology and management; entomology; and ecology, evolution and organismal biology frequent the small plot for research and class activities.*

TINY AMBASSADORS FOR SCIENCE

Story by Summer Bontrager
Image by Christopher Gannon

SMALL SCIENCE, BIG IMPACT

***Joshua Byrne** gets acquainted with two new species added to the Insect Zoo's collection of 100 species last year: The Malaysian giant walking stick (far left) and the Hercules beetle. The Insect Zoo is celebrating its 20th anniversary of providing youth outreach activities.*

Ginny Mitchell has a fondness for something that may make other people's skin crawl. She loves insects, and has made a career out of it.

Mitchell has worked for Iowa State for five years in the Department of Entomology, running the Insect Zoo. She takes the Insect Zoo around Iowa providing educational programs and exhibits.

Two new species were added to the Insect Zoo's collection of 100 species last year—the Malaysian giant walking stick and the Hercules beetle. The Insect Zoo purchased a male and female of both species, although the female Hercules beetle did not survive the import process from Taiwan.

The Malaysian giant walking stick is the third largest insect in the world, behind two other species of walking sticks. It can detach its legs when it feels threatened, and then can grow them back.

The male Hercules beetle has long horn-like pincers extending from its head. It could make short work of cracking open a nut because the pincers can grow up to two to three inches long. The pincers are used in mating rituals and fighting over food.

20 years of engaging, educating

This year, the Insect Zoo is celebrating its 20th anniversary. In 1997, it began as an entomology outreach program to engage kids in the life of insects, using a hands-on approach.

"Our mission is to introduce children to arthropods," Mitchell says. "This includes insects, spiders, tarantulas, millipedes, centipedes and scorpions. We want to teach them their biology and importance to our environment. People may think cockroaches are disgusting, but really they are the garbage collectors of our planet. We couldn't live without them. We also want to give people an appreciation for an animal that is usually stepped on."

Mitchell created a course based on the state's core curriculum so science teachers can bring the zoo into classrooms. The zoo meets the requirements for teaching about metamorphosis, insect defenses and their roles.

"Insects are essential to Iowa. Without ants to till the soil, cockroaches and beetles to break down dead animals and plants, bees and flies to pollinate plants and mayflies and caddisflies to keep the waterways clean, none of our ecosystems could function," says Joshua Byrne ('17 animal ecology) who worked with Mitchell as an undergraduate. Byrne is currently employed at the Little Rock Zoo in Arkansas, and is a classroom teaching assistant at Pediatrics Plus Developmental Preschool.

The Insect Zoo's goal is to present many different species to spread knowledge.

"Diversity is key. Arthropods are the most diverse animal on this earth. There are more arthropods than any other animal combined," Mitchell says. "If we can display the diversity within this group of animals, then people will be even more amazed and appreciative."

Have bugs, will travel

The Insect Zoo obtains species from different institutions that import the insects. Mitchell also travels to Arizona to gather insects from the desert.

At an Insect Zoo event, Mitchell will bring five to 100 species. She chooses insects based on their ability to adapt to diverse situations and their hardiness. Mitchell carefully watches over and protects them during handling.

Mitchell's favorite memory is from one school demonstration. A second grader ran up afterwards and handed her a drawing of the two of them. The little girl wrote: "I want to be like you when I grow up."

The Insect Zoo has been growing in popularity. In 2016, Mitchell presented more programs than in the entire 20-year history. It was featured at 355 events at schools, birthday parties, nursing homes, daycares and fairs. In 2016, the zoo reached more than 34,000 Iowans. S

*Left: **Hannah Guyer** (left), a graduate student in agricultural and biosystems engineering, works with assistant professor **Adina Howe** to screen manure for antibiotic resistant genes. Right: Associate professor **Michelle Soupir** (left) and undergraduate **Alexis Slade** prepare agar for phenotypic analysis of resistant bacteria. Far right: **Dan Andersen** and fellow researchers are finding each tested method of swine manure treatment and storage shows potential for reducing antibiotic-resistant bacteria.*

SMALL SCIENCE, BIG IMPACT

TAKING ON ANTIMICROBIAL RESISTANCE

Story by Brian Meyer and Melea Reicks Licht
Images by Rachel Kennedy

The development of antibiotics is one of the greatest discoveries of humankind, resulting in countless lives saved from the devastation of infectious diseases.

Antimicrobials are important for modern animal agriculture and have been widely used for the prevention and control of animal diseases. Recently, the value of these "wonder drugs" has diminished due to the drastic increase in antimicrobial resistance, threatening public health and raising the specter of multibillion dollar medical costs and economic losses.

Antimicrobial resistance also is an ecosystem problem impacting the health of humans, animals and the environment.

Antibiotic-resistant bacteria can develop in the digestive system of humans and livestock receiving antibiotics. There also is concern humans may be exposed to the resistant bacteria from livestock through food, the environment (water, soil, air) or by direct human-animal contact.

To address the challenge, in 2014 the White House issued the "National Strategy for Combating Antibiotic-Resistant Bacteria," which calls for national efforts to combat antimicrobial resistance pathogens. In 2015, the World Health Organization endorsed a global action plan to mitigate the problem.

Collaborating to combat resistance

Iowa State University has a group of diverse, highly experienced scientists working on a broad range of topics related to antimicrobial resistance. In 2015, a university-wide antimicrobial resistance initiative was established involving approximately 60 faculty members across several colleges and USDA National Center for Animal Health scientists.

Additional researchers and health professionals from several other Midwest institutions joined the effort and are helping to develop new interdisciplinary research projects. There are now more than 100 researchers involved in addition to Iowa State University faculty and staff.

"We want to continue to expand our initiative into a larger regional and national consortium, which we propose to call the Antimicrobial Resistance Consortium," says Paul Plummer, associate professor of veterinary diagnostics and production animal medicine. "The initiative will take a systems-oriented approach so the biology and ecology of organisms are understood within the context of crop and livestock production and social, economic, environmental and other factors."

Hongwei Xin, assistant dean for research in the College of Agriculture and Life Sciences, says stakeholders must work together to ensure guidelines are followed and emergence of resistance is monitored.

"Antibiotics contribute to antimicrobial resistance and impact people, animals and the environment. Trying to fix the blame for the global antibiotic resistance pandemic on a single source or use is contrary to the broad, systems approach required to make progress," says Xin. "Critical research is needed on transmission of antimicrobial-resistant organisms through the environment, contact and food."

Multi-pronged approach to mitigation

Interdisciplinary teams of researchers have numerous projects underway providing valuable information on the transport of antibiotics, antibiotic-resistant bacteria and antibiotic resistance genes in the livestock food chain and the effect of manure application timing and management on the presence of antibiotic-resistant bacteria.

In one such project, researchers received a nearly $1 million grant from the U.S. Department of Agriculture's National Institute of Food and Agriculture (USDA-NIFA) to advance the technological tools used to detect antimicrobial resistance and form strategies to slow its spread.

Led by Adina Howe, an assistant professor of agricultural and biosystems engineering, the three-year project brings together researchers from Iowa State University, the USDA and Grinnell College. The team will improve a new technology called DARTE-QM, which it designed to efficiently sequence the genes of microbes.

They will gather manure, soil and water samples from swine operations and use DARTE-QM to sequence genes associated with resistance in the samples. The team will determine which genes may allow antimicrobial resistance to develop and persist in the environment. The researchers also will look at what production practices and environmental factors, such as drought or flooding, contribute to the propagation of resistant genes.

"We want to identify control points where we see reservoirs of resistance," says Michelle Soupir, an associate professor of agricultural and biosystems engineering and a contributor to the project. "Once we do that, we can help determine mitigation efforts."

Reducing resistance on farm

Members of the DARTE-QM research team, including Soupir, Howe and Thomas Moorman, scientist at the USDA National Laboratory for Agriculture and the Environment and affiliate associate professor of agronomy, are working with Dan Andersen to consider practical mitigation efforts for reducing the spread of resistance in agricultural environments. Andersen is an assistant professor of agricultural and biosystems engineering. In addition to the USDA-NIFA grant, much of their work is funded by National Pork Checkoff dollars.

They're comparing effects of alternative swine manure treatment and storage.

"Manure is a great fertilizer resource on a farm. Livestock production is a critical component of sustainability as the majority of nitrogen, phosphorus and potassium we feed ends up in manure and needs to be recycled," says Andersen. "Managing microbes for soil health, including the presence of antibiotic-resistant bacteria, is an evolving science."

Andersen says each method under consideration in their collaborative research shows potential for reducing antibiotic-resistant bacteria in swine manure.

Mitigation efforts under consideration include:

- Anaerobic digestion—This system could include capturing the resulting natural gas for energy.
- Two-phase manure storage—Holding manure longer in two different basins allows the natural microbial community more time to reduce the presence of antibiotic-resistant bacteria.
- Addition of Ionophore—Narasin (a brand of the antibacterial agent Ionophore) is an approved feed additive designed to reduce methane in swine manure, and it may hold potential for reducing the presence of resistant bacteria as well.
- Centrifugation—Separating liquid manure from solid has shown antibiotic-resistant bacteria tend to stay in the solids.
- Separating solid manure from liquid as manure is removed from facilities—This is planned for inclusion at Iowa State University's proposed new facilities.

"Preliminary results show two-phase storage reduces the presence of antibiotic-resistant bacteria, and centrifugation can remove as much as 100 percent under high speeds for an extended time," Soupir says.

Andersen says some of the strategies are showing promise for an additional benefit: the reduction of odor by 10-15 percent.

Key Points from ISU Experts on

ANTIBIOTIC RESISTANCE IN LIVESTOCK

Iowa State University faculty have broad expertise and experience in the area of antibiotic use and antibiotic resistance in livestock and poultry, and work closely with stakeholders on addressing these issues. The following are key points to consider from the perspective of Iowa State researchers, veterinarians and extension specialists.

- The U.S. meat supply is safe. The USDA Food Safety Inspection Service oversees the safety of meat.
- Veterinarians and livestock producers strive for prudent, judicious use of antibiotics and have established guidelines and training materials to help ensure antimicrobials are only used when necessary and are administered appropriately.
- Antibiotic use remains an important option for reducing animal suffering. Veterinarians carry out proper treatment plans for animal health and animal welfare, including the use of antibiotics to reduce suffering and death from treatable illnesses.
- Approximately 30 percent of animal antibiotics are not used in human medicine. This class of drugs, called ionophores, is used to prevent and control coccidia, a family of disease-causing parasites. Ionophores are not associated with the development of antibiotic resistance that would impact human health.
- Comparing livestock antibiotic use to humans can be misleading. The statement "80 percent of antibiotics are used in animals" often is a common claim cited in news media and by some organizations. That statistic lacks context, and the FDA has cautioned against comparing human and animal numbers. Differences in scale exist between livestock and people in terms of dosing and volume used.
- Antibiotics that are deemed medically important for humans have been restricted for use in animals to treat, prevent or control disease. In 2013, the FDA called on animal drug manufacturers to stop labeling their products for promotion of animal growth and to change the labeling to require veterinary oversight when they are used for therapeutic purposes. No antibiotics that are defined as medically important for use in humans are used for growth promotion; their use is limited to treatment, prevention and control of animal disease under the direct supervision and monitoring of veterinarians.
- The FDA rigorously evaluates new livestock antibiotics. Before final approval, the FDA is required to assess the safety of animal drugs to ensure low risk for antimicrobial resistance transmission to humans. This measure also ensures the continued safety of meat products.
- U.S. poultry farms have monitored antimicrobial resistance since 2014. The poultry industry, in collaboration with the USDA National Antimicrobial Resistance Monitoring System, began collecting on-farm bacteria samples to monitor antimicrobial resistance. The goal of this ongoing study is to monitor antimicrobial use and resistance over time.
- New, research-based alternatives to antibiotics exist. The implementation of research-based technologies—including improvements in the engineering of animal housing, the use of effective vaccinations, improved nutrition and genetic selection—is allowing the livestock and poultry industries to emphasize alternative approaches to improving efficiency that replace the use of antibiotics for growth promotion.

Paul Plummer, associate professor, veterinary diagnostics and production animal medicine; Qijing Zhang, associate dean for research and graduate studies, College of Veterinary Medicine; Hongwei Xin, assistant dean for research, College of Agriculture and Life Sciences; Donald Beermann, chair, animal science

STORIES EXTRA: www.stories.cals.iastate.edu

Visit STORIES online for links to the Iowa State University Antimicrobial Resistance Consortium, the American Veterinary Medical Association Resources on Antibiotic Use and Antimicrobial Resistance and Food and Drug Administration Guidance Documents.

*Agronomy professor **Antonio Mallarino** led a team of scientists from across the Midwest to better understand how micronutrients in soil aid growth and development of soybeans.*

MICRONUTRIENTS, MACRO-IMPACT ON PLANT HEALTH

Story by Tracy Schlater
Image by Christopher Gannon

Just like people, plants need nutrients to help them grow. Antonio Mallarino, professor of agronomy, has put together a team of scientists from across the Midwest to better understand how micronutrients aid growth and development of soybeans.

"Micronutrients are nutrients that are essential for crops but are only needed in very small amounts," says Mallarino. "Those most commonly thought about by farmers are boron, copper, iron, manganese, molybdenum and zinc."

Mallarino led a team of researchers and extension specialists from five universities in reviewing micronutrient research on soybeans in the North Central region. This included over 200 field trials conducted in five states since 2012.

"Growers often receive mixed messages about soybean micronutrient needs," says collaborator Carrie Laboski, professor and extension soil scientist, University of Wisconsin-Madison. "To address this confusion, Mallarino assembled and led a team of North Central region colleagues who have conducted micronutrient field trials. The result of this collaboration is a useful, research-based reference soybean growers can use to help improve their profitability."

The team revealed some specific soil types and plant growing conditions that result in micronutrient deficiencies, which could impact how soybeans develop. They also assessed the value of soil and tissue testing. The team combined the information and prepared a regional publication to help farmers across the Midwest understand the value of micronutrients and make them aware of potential problems with the interpretation of soil and tissue test results.

"Micronutrients for Soybean Production in the North Central Region" (CROP 3135) is available through the Iowa State University Extension Store.

"We try to watch our soils and fertility and feed the crop with just what it needs to be as efficient as possible," says Pete Bardole, farmer in Greene County, Iowa, and host of one of Mallarino's test plots. "If we don't apply things we don't need, that adds to our bottom line and saves us money."

Mallarino says additional research is needed from a regional perspective.

In Iowa, his research shows necessary micronutrients for soybeans are present in adequate amounts across most of the state. "Farmers can spend less time and money treating the soil," says Mallarino.

However, northern and western Iowa have iron deficient soils due to high levels of calcium carbonate which cause chlorosis in soybeans. Thanks to the regional collaboration of this project, Mallarino learned of new research in Kansas and Minnesota showing that a new fertilizer seems to have potential to make soybeans grown in iron deficient soils be more productive.

Yandeau-Nelson's *research passion is corn. She studies genetic networks of plant cuticle lipids (the waxy substance on the surface of plant leaves and corn silk) and their protective properties against environmental stresses.*

STRANDS OF CORN SILK AND DNA

Story by Bill Zahren
Images by Christopher Gannon

Marna Yandeau-Nelson *and* ***Scott Nelson*** *say combining genetic and biochemical science at work with a home life raising two kids isn't much different from other two-professional households, except for the occasional grant review over dinner. Off campus they enjoy experiencing steam engines with their children Ian and Ada.*

Image contributed

Scott Nelson and Marna Yandeau-Nelson combine genetic and biochemical science at work with a home life of raising a garden, two kids, a dog and batches of beer.

She's from upstate New York, came to Iowa to be a pharmacist, fell in love with corn, a guy who helped her unload her car and "field days."

He's from near Fargo, North Dakota, grew up loving science fiction, enjoys tinkering with antique engines, studying double-strand DNA breaks and sharing grant proposal drafts with his special someone.

The two conduct research that could some day—albeit years from now—take a bite out of cancer and dramatically boost crop yields.

Coulomb's Law

Say hello to Scott Nelson and Marna Yandeau-Nelson, a physical example of Coulomb's Law, something very few people can name, but everyone knows about.

"We're very much an opposites-attract couple," says Yandeau-Nelson, assistant professor of genetics, development and cell biology. French physicist Charles-Augustin de Coulomb proved the physics law of opposites attract and likes repel in the world of electromagnetism in 1784. William Shakespeare chronicled it as a romantic truth 200 years earlier.

"He's a very even-keeled kind of guy," says Yandeau-Nelson. "Things don't upset Scott or get him excited much. I'm more of an emoter, I guess," she says, with a laugh. The two met in Ames in 1998 while both were in grad school at Iowa State.

After enrolling in the Drake University pharmacy program, a summer job at Pioneer introduced Yandeau-Nelson ('05 PhD genetics) to the love of her professional life: *Zea mays*, aka corn.

"I think corn is such a beautiful, clever plant," she says. "When you drive by the corn fields of Iowa, diversity's not the word you think about. That's because the plants have all been bred to be hybrids that give you reliable yield. But if you look at all the different varieties of corn, it's like walking through a plant zoo. They're different shapes and sizes and colors; it is just a beautiful plant."

Nelson ('02 PhD biochemistry) was drawn to science by his childhood love for science fiction, along with his father's work as an agricultural economics professor at North Dakota State University.

Nelson *(right), associate professor of biochemistry, biophysics and molecular biology, focuses his research on how the body repairs severe double-strand breaks in DNA and seeks to understand enzyme functions that could lead to pharmaceutical advancements to prevent malaria. He also teaches an undergraduate course on the biochemistry of beer.*

A matchmaking mutual friend was the catalyst for their personal chemistry. It led to their wedding in 2004 in the midst of a long-distance relationship while she earned her doctorate at Iowa State and he served as a post-doc at Penn State.

Five years later, they found two positions at their alma mater. Although both work in departments shared between the College of Agriculture and Life Sciences and the College of Liberal Arts and Sciences, they don't work in the same research lab or building.

The Tale of Two Strands

Yandeau-Nelson studies genetic networks of plant cuticle lipids and their protective properties against environmental stresses. Cuticle lipids make up the waxy substance on the surface of plant leaves and corn silk. Understanding how these chemicals are produced could lead to advances in crop protection, including drought-resistant corn. Since these waxes are chemically similar to components of petroleum, the research could have biofuel applications as well.

Nelson is an associate professor of biochemistry, biophysics and molecular biology. He focuses on what's been called the "keystone complex" of DNA repair, specifically related to double-strand breaks. Understanding how the body repairs severe double-strand breaks could lead to pharmaceutical breakthroughs.

He also studies enzyme functions that could lead to advances in drugs to treat and prevent malaria and malaria-like diseases in humans and animals.

Although only about 25 percent of their time is focused on teaching with the rest on research, both list interacting with students as a highlight of their jobs.

"I like the fact we can teach and train and learn from doing those things, but we can do it in many different ways at different levels. It keeps things fresh," says Yandeau-Nelson, who keeps her hands-on science game up via visits to her research cornfield.

Not only is Iowa State their beloved alma mater, but Nelson says the professional support is exceptional. "The biochemistry department is extremely close-knit, very collegial and the atmosphere is right."

A Two-Scientist Home

If regimented order, neatness, scientific method and well-scrubbed stainless-steel rule a scientist's workplace, does that carry through to a scientist's home?

Not in this case, Yandeau-Nelson admits. Their home goes through the same cycles of tidy and disorganized as every home.

"Sometimes the neat scientists come home and they want to be the opposite of neat," explains Nelson.

There is some shop talk, though. "If you ask our kids (Ada, 10, and Ian, 7) they feel we talk about it way too often, but I feel like we don't," says Nelson.

"If there are issues in either of our labs we look to each other," Yandeau-Nelson adds, "not specifics, but questions of styles, how to run a lab and things like that."

"We cover for each other at home when someone is working long hours, but if Marna was a lawyer working late it would be the same thing," says Scott. "There's nothing intrinsic about the fact that we're both professors on-campus that causes any problems. I think it's only positives, really." S

STUDYING THE GENETIC DIVERSITY THAT LIES BENEATH

Story by Tracy Schlater
Image by Christopher Gannon

DNA is everywhere, including the root system of plants. Up until now few have studied the genetic basis of root structure because it's difficult to observe how roots grow underground.

Asheesh Singh, professor of agronomy, and his doctorate student Kevin Falk are two of the few doing it with help from Baskar Ganapathysubramanian, professor of mechanical engineering, and Gwyn Beattie, professor of plant pathology. The idea to focus on researching root traits and their microbiome (the tiny community of microbes living on roots) came directly from a brainstorming session with farmers and Iowa State researchers at a workshop conducted by the Iowa Soybean Research Center.

"The lack of information about the genetics of root systems is limiting given how important they are to the health of the plant," says Singh. "We want to understand the root genetic diversity in soybeans and hopefully link the information we get with what we know is happening above ground."

Digging deep for data

Singh and Falk assembled 300 different types of soybeans from 19 different countries. They grew them in controlled environments and in Iowa farm fields. Then, they started digging.

"You can imagine the difficulty of digging up more than 1,000 samples by hand and carefully cleaning off soil and debris," says Singh. "We take photos of each root system."

It's a team effort. There are 12 undergraduate employees, nine graduate students, four staff members and two postdoctoral researchers working on the project. Working in teams of eight to 10 people, it took hundreds of hours to dig up the root systems and properly clean them.

"I consider myself more of an archeologist than a ditch-digger," says Falk. "Taking our time to extract the root in the best possible condition for high-quality data is difficult."

Over 100,000 images will be taken in the team's custom-designed photo booth using studio lighting and multiple cameras while rotating the root to different positions for multiple angles. Photos are uploaded into software created by Ganapathysubramanian's team to analyze the architectural structure of the root system.

Tight research and microbial communities

"It is a challenging research topic, and we have a very vibrant collaboration between breeders, geneticists, engineers and computer and data scientists allowing us to work in this area," says Singh. "We try to ask questions relating to real life applications and usefulness to farmers to improve their profitability."

"The collaboration has allowed us agronomists to build technical skills including digital image processing, high-throughput pipeline development and data management," says Falk.

In addition to the genetic traits, Gwyn Beattie, professor of plant pathology, is looking at the community of microbes found on and within the roots. "The roots are covered with diverse communities of microbes, which are influencing the plant in ways most people didn't expect," says Beattie.

These microscopic organisms are a city of activity within and along the root systems, affecting the plant in multiple ways. Combining that information with what's happening above ground will give them a better understanding of how soybeans respond and why.

"Microbes tend to hang out together, like neighborhoods," says Beattie. "Some are always together and others never hang out. If you take away one, does the whole neighborhood fall apart? We're trying to find the organisms that are key to the structure of these communities and their ability to affect plant roots."

Mapping roots' microbiome

Up until recently the tools to take apart a microbial community didn't exist. The DNA of these microbes, however, provides nametags to identify which ones and how many are there. With these nametags, Beattie can quantify and locate microbes on and within the root system as the roots grow through soil.

Creating a map of the microbiome on the different parts of a soybean root system, and seeing how this map changes as the plant grows, has not been done before. It is an important step toward identifying how microbes promote root growth, and therefore plant growth.

"We want to know which microbes are most useful for making soybeans tolerate things like low phosphorus, drought, high temperature stress," says Beattie. "If we understand why things work the way they do, we can make them work better."

The Singh research team will dig and photograph all of the root systems by the end of the year. In the following year, these photos will be analyzed using the software Ganapathysubramanian created, and Beattie and Amy Welty-Bernard, a postdoc driving the microbiome project, will draw the initial maps of the root microbes.

What they've found so far is exciting.

"We see tremendous diversity for root traits, which is very encouraging," says Singh. "Once we are able to connect root related traits with above ground traits we will be able to take the next steps in breeding and science for soybeans."

Combining the genetics of the root systems with the microbial influences could provide tremendous opportunity for new varieties of soybeans. Developers could be able to strategically select genes for root features the way they select for growth above ground.

The project is funded by the Iowa Soybean Research Center, the Raymond F. Baker Center for Plant Breeding and the Monsanto Chair in Soybean Breeding.

Far left: ***Kevin Falk,*** *doctoral student in agronomy, helps lead the research team working to better understand the genetics of root systems and their microbial influences. Left: Over 100,000 images will be taken in the team's custom-designed photo booth at different positions and multiple angles. Right: Researchers are comparing the root systems and microbiomes of 300 different types of soybeans from 19 different countries.*

ALUMNI

FULL STEAM AHEAD

***Diane Young** emphasizes the importance of careers in science, technology, engineering, math and communication for rural Iowa. She creates such opportunities at Foundation Analytical Laboratory in Cherokee and promotes STE(A)M careers at local schools.*

4 LAB-TESTED TIPS FOR ENTREPRENEURIAL SUCCESS

Story by Darcy Maulsby
Images contributed

While Diane (Ducommun) Young loved growing up on a farm near Larrabee and working for local veterinarians during high school, the odds of her returning to rural Iowa for a career weren't good.

"In the 1980s Farm Crisis, you were encouraged to avoid a career in agriculture," says Young ('91 animal science, ag microbiology).

As her career in foodservice quality assurance and purchasing took her across the nation, away from her husband and young son for days at a time, a career staying in rural Iowa began to look more attractive. Young left the corporate world and launched Foundation Analytical Laboratory in Cherokee in 2009.

Today, the 20 full-time employees and two part-time employees at Foundation Analytical Laboratory test everything from food products to regulatory water samples to co-products from the ethanol industry. This isn't your typical testing lab, says Young, whose team serves more than 800 customers, including 80 ethanol plants nationwide.

"The science of chemical and microbiological analysis is the backbone of Foundation Analytical Laboratory, but the art of human relationships is our lifeblood," says Young, who is passionate about providing high-quality, science-based jobs in rural Iowa.

Four keys to success

Not only does Young encourage students to pursue careers in science, technology, engineering and math (STEM), but she emphasizes the "art of communication" (verbal and written) must be part of STEM to provide the STEAM for business success.

This philosophy grew out of Young's frustrations when she was a customer of various contract labs. "I had to follow up for results, and sometimes I wasn't even sure the lab was providing good quality data," she says.

Young vowed to do things differently and embraces four success strategies:

1. Every customer is gold. One of Young's first jobs as a crop scout taught her to provide high-quality, consistent service, no matter the size of the client's operation.
2. Think creatively. When a client asked Foundation Analytical Laboratory to test many samples for a certain time-consuming test and provide same-day results, Young agreed—and had to find a way to make it happen. Instead of using the standard blender system for sample preparation, Young purchased a paint shaker. The machine allowed the lab to handle 67 samples rather than six samples per day. "It's essential to embrace the lost art of customer service," she says.
3. Don't be afraid to be different. When Young worked in quality assurance for a foodservice company, Boston-based consultants advised her employer to get out of rural markets. This assessment, along with the consultants' idea to compete mainly on price, didn't sit well with Young. She says, "if you're no different from the competition, why should anyone do business with you?"
4. Focus on the triple bottom line. The three benzene rings in Foundation Analytical Laboratory's logo represent the interconnections between feed, food and the environment, as well as the triple bottom line. "We strive to be the laboratory provider of choice, the employer of choice and the investment of choice," Young says. "We're a highly-educated group of hard-working, Iowa farm kids who do what it takes to get the job done."

Inspiring the next generation

Many of these success strategies took root during Young's years at Iowa State University, where professors including John Holt, Elsa Murano, Doug Kenealy and Bill Wunder influenced her career path.

"I absolutely loved my time at ISU," says Young, whose husband Nate ('91 fisheries and wildlife biology) also is an Iowa State graduate. "It was challenging and taught me how to succeed wherever you are." The Youngs are proud their son, Zane, will earn his mechanical engineering degree from their alma mater in the spring of 2018.

"ISU gives you a lifetime of memories," Young says. "Some of my favorites are my Rodeo Club and Block and Bridle activities, football and basketball games and developing lifelong friendships."

Young introduces local students to Iowa State University degree programs that lead to STEM careers. She offers tours of Foundation Analytical Laboratory and has hosted titrating contests, pipetting contests and other hands-on learning opportunities for chemistry students from Ridge View High School in Holstein.

She also is teaming up with the Cherokee school district to work with local fourth grade students. "I want to help get more kids excited about science," says Young, a 2016 Women of Innovation finalist honored by The Technology Association of Iowa.

"As our business grows, I'm proud to offer internships to fellow Iowa Staters," she says. "It's even more exciting to offer competitive positions for people interested in living and working in our great state."

ALUMNI

*The list of conservation practices on the Stout farm runs the gamut, and **Rob Stout** says these wiggly inhabitants are a good indicator of soil health.*

*The bioreactor **Stout** installed in 2014 has dramatically decreased the amount of nitrogen leaving his farm, sometimes by as much as 99 percent. A bonus: The prairie strip he installed atop the bioreactor builds plant and wildlife diversity.*

FARMER-SCIENTIST

FOCUSED ON SOIL HEALTH

Story and images by Melea Reicks Licht

Rob Stout has been described a number of ways. Master farmer. Award-winning conservationist. Community volunteer. Good neighbor. Farmer-scientist.

Evidence of these roles can be found in the fields surrounding his home near Washington, Iowa.

Orange flags dot the landscape marking data collection points for Iowa State University research. At any given point Stout has numerous collaborative research projects underway, "I've never stopped to count them," he says. A recent conversation revealed at least six ongoing studies.

"I just love that stuff. I geek out when it comes to research," Stout says. "Working with Iowa State gives me the best of both worlds (farming and research). I can't wait to get the results and think of ways to implement them into our farm."

The flags in fields closest to his home mark the location of buried tea bags. The decomposition of the tea bags will help Iowa State researchers better understand factors affecting soil health—a topic close to his heart (read more about the project on page 16).

Stout ('78 farm operations) worked as an undergraduate research assistant for Walter Fehr ('67 PhD agronomy), Charles F. Curtiss Distinguished Professor in Agriculture, and was advised by Maynard Hogberg ('66 ag and life sciences education, '72 MS animal science, '76 PhD) during his time at Iowa State. Both professors tried to recruit him to pursue graduate school in their programs.

But, opportunity knocked when a neighbor of the Stout family invited him to meet around their kitchen table during his senior year at Iowa State. The neighbor had a few hundred acres of tillable ground available for rent. Stout's course was set.

His drive to learn and discover deepened throughout his farming career. So did his kitchen-table collaborations. He gathered friends and neighbors together to create the West Fork Crooked Creek Watershed Improvement Project.

Joining them at the table was Jamie Benning ('01 agronomy, MS '03 soil science) water quality program manager for Iowa State University Extension and Outreach.

"There are several characteristics we look for when identifying farmers to lead water quality efforts including experience in agricultural, conservation and community organizations. Another characteristic is their drive to collect data and evaluate new practices. Rob is a great example of this type of scientist-farmer," Benning says. "He is a great collaborator in on-farm research and demonstration projects."

Due in part to their leadership efforts, West Fork Crooked Creek Watershed and two neighboring watersheds received funding from the Iowa Department of Agriculture and Land Stewardship Water Quality Initiative to support conservation and water quality practice implementation. The watershed was able to install two bioreactors and cover crop adoption has grown to over 15 percent of corn and soybean acres compared to the statewide average of 2-3 percent.

"It's our duty as farmers to be good stewards of the land and leave our water quality better than we found it," Stout says. "Everything we do impacts our watershed. I'm surrounded by a lot of good farmers and neighbors who also care about their ground and how we leave it for future generations."

Stout has been farming for 35 years, and his farm has been in their family since 1926. Stout farms 1,100 acres and manages a hog operation of 9,000 head. His stepson, Alex, works with him handling facility management and partners in conservation efforts to encourage wildlife and plant diversity.

No-till, terraces, grass waterways, prairie strips—the list of conservation practices on the Stout farm runs the full gamut. They inject manure from their hog operation into the fields to target nutrients and reduce run-off. And, he's seen a dramatic decrease in the amount of nitrates leaving his farm thanks to the bioreactor installed in 2014.

"The bioreactor has lowered nitrate levels in the tile water by nearly 70 percent over three years, and other practices have reduced nitrates by 30-45 percent," Stout says. "I've noticed a decrease in nitrogen exiting the bioreactor as high as 99 percent in late summer and early fall. The average during spring rain events ranges from 40-60 percent reduction in nitrogen."

Stout has been an active participant in Iowa Learning Farms and Practical Farmers of Iowa cover crop projects. He started by planting 10 acres of cover crops in 2009 and is now managing all 1,100 acres using cover crops. Since adopting cover crops he's noticed improved soil health and a small yield bump, around five percent in soybean yields.

"I could tell the cover crops were helping to prevent erosion and build soil organic matter almost immediately. I can pull up a spade full of soil anywhere in the field and find earthworms. That's a good sign of soil health," he says.

The Stout family's commitment to conservation is clear and award-winning.

Their family was one of the first to receive the Iowa Farm Environmental Leader Award from Gov. Terry Branstad at the 2012 Iowa State Fair. Stout has been named the Iowa Soybean Association Environmental Leader of 2016 and the 2017 Gary Wergin Good Farm Neighbor Award Winner.

Stout loves to share his enthusiasm and experience with other farmers. His ability to connect and lead earned Stout leadership positions in the Iowa Farm Bureau, Iowa Corn Growers Association, Iowa Soybean Association, Iowa Pork Producers Association and as a trustee for his church. He's also a member of the Timely Tips panel of experts in Wallaces Farmer and hosts field days and members of the media throughout the year.

"Meetings. I go to a lot of meetings," Stout jokes. His wife Jean agrees. "But he loves it," she adds with a smile. S

STORIES EXTRA: www.stories.cals.iastate.edu

Learn more about Rob Stout and his commitment to conservation online in this video by the Coalition to Support Iowa Farmers and Iowa Learning Farm's Conservation Chat.

DRIVEN TO EXPLORE AND EXPRESS

Story by Melea Reicks Licht
Image by Beck's Hybrids

Natalina Sents knew early she wasn't interested in a "regular" job following graduation.

"My definition of success has always been different from my classmates. Get an internship, get a full-time offer, rise up the corporate ladder...that's a great American dream. It's awesome. It's just not mine," she says.

For Sents ('16 agricultural business) her lightbulb moment came while listening to a speaker from Beck's Hybrids during an Agricultural Business Club meeting at Iowa State.

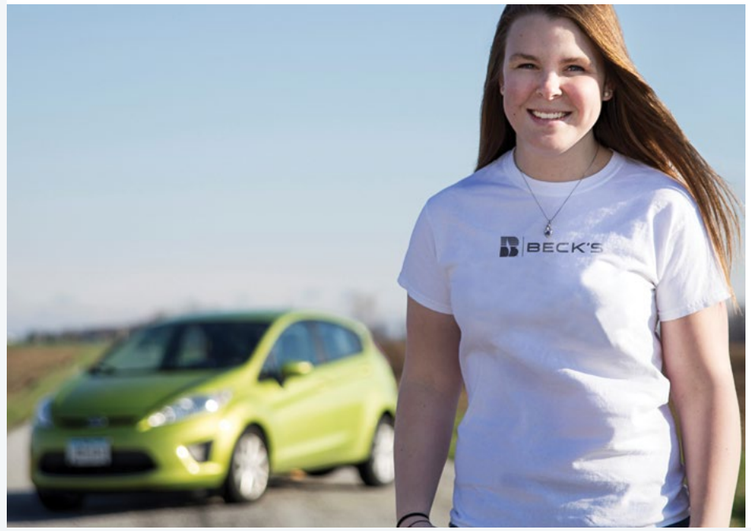
"I was moved to tears by the video Craig Spray showed of farmers describing why they choose to farm. It made such an impression," Sents says. "I just couldn't forget it. I knew this was something I had to be a part of."

She approached Beck's at the College of Agriculture and Life Sciences Career Day later that semester. They turned her down for an internship and encouraged her to get more experience. She started blogging and took to social media to build her network. Then, she went back to Beck's the following year.

> ***"I had made up my mind to travel all 50 states in one year to tell farmers' stories"***

"I approached them at the next CALS Career Day, and said, 'I want this internship.'"

Her persistence and the quality of her writing samples got her the job. She attended video shoots and interviewed farmers for the company's Why I Farm campaign.



"I knew I was home," she says.

Following the internship, she stayed involved with the Agricultural Entrepreneurship Initiative (AgEI). As graduation neared and she was searching for her next move, her mind churned.

She had always wanted to travel to all 50 states. She was a seasoned road-tripper thanks to years of visiting family scattered around the Midwest. She had an undeniable passion for helping farmers tell their stories.

With the encouragement of mentors from AgEI, she pitched a "crazy idea" to her former supervisors at Beck's.

"I had made up my mind to travel all 50 states in one year to tell farmers' stories," she says. "I asked them if they wanted to be a part of my journey."

A week after graduation she hit the road.

In partnership with Beck's she traveled over 100,000 miles, interviewed more than 100 farm families and hit her goal of reaching all 50 states in one year. While she learned a great deal about American agriculture along the way, she says some of the greatest lessons were about connecting with people.

"I noticed a butterfly effect throughout the year," she says. "Stories told by one farmer would illustrate how others have impacted their life and how they've impacted the lives of others. This interconnected impact of people on one other was a common theme among my visits."

Sents is still carving out her version of the American dream. She's busy speaking with groups about her experiences and recently became a digital content editor for *Successful Farming*.

WHY I FARM ROADTRIP: ERIN BRENNEMAN ('04 ANIMAL SCIENCE)

Story and image by Natalina Sents

Erin (Churan) Brenneman had no idea her Iowa State adventure would transform her from a Chicago city girl to a sow momma in southeast Iowa. That's where she met Tim. The more time she spent on Tim's farm, the more she fell in love with it—and Tim. After graduation, Tim and Erin got married, and started their life together in Southeast Iowa.

With her mother-in-law's guidance, Erin learned to manage what she calls the "maternity ward for pigs." In the farrowing barn, she hand-dries each baby pig and keeps an eye out for sows that need help giving birth. It's important to keep each piglet warm, dry and full of milk.

Like their parents, her sons love life on the farm. The boys look forward to coming to the farm when they have a day off of school. As a family, they cherish the time they can spend working side by side with the pigs. "I didn't grow up this way, but now it's really important to me that my kids get to grow up this way. I think that's some of what keeps me going. They understand what I do and why I do it."

Before college, Erin never would have imagined this life for herself. Now, she wouldn't have it any other way.

That's why Erin Brenneman farms.

WHY I FARM ROADTRIP: BRANDON WONG

Story and image by Natalina Sents

Kalo is the Hawaiian word for taro, a starchy vegetable root that has been grown on the islands for centuries. Different parts of the taro plant are used to make important cultural dishes including poi, lau lau and taro chips. The root and leaves must be thoroughly steamed or cooked to eliminate calcium oxalate.

Growing up, Brandon learned to replant taro stems in neat rows on his grandparents' farm. "They've been doing this 72 years." He smiles. He's proud to be building upon the knowledge his family has been passing down by going to college.

"…The reason I love to do it is because it's hard work. I love working hard. I think that's the motivation, being active. It's satisfying to be tired at the end of the day. I pull 25 bags of this a week and they're almost 80 pounds each. I think if you can do this, you can pretty much do anything. Construction was easy. Wildlife work was easy. I like the challenge of this."

That's why Brandon Wong farms.

STORIES EXTRA: www.stories.cals.iastate.edu

Read more about Natalina Sents' Why I Farm road trip online and find more of her stories including the full articles excerpted above.

PENCHANT FOR PROTOCOLS

Story by Melea Reicks Licht
Images contributed

*From her time as nuclear electronics technician in the US Navy, to studying corn diseases on the Iowa State campus, **Jacqueline McGrew** honed her abilities in metrics, quality control and systems management. She recently shared her experiences with interns at Iowa State.*

When she joined the crew of the USS Enterprise (CVN-65) Jacqueline McGrew became the first woman to operate the world's first nuclear-powered aircraft carrier.

McGrew ('11 biology) landed the gig as a nuclear electronics technician in the US Navy after failing out of the University of South Florida. A military brat herself, she'd traveled the world as her father served in the US Air Force. She says her assignment was the result of aptitude and coincidence.

"The recruiter got a bonus for placing a female and minority in the nuclear program. I went to the Air Force recruiter first, but he was out to lunch and the navy recruiter was there. After I completed my first test his eyes lit up, and he asked if I had ever thought of the nuclear program," she says. "He drove me to another recruiter so I could take another math test. From that moment, we never talked about any other job."

She gained incredible experience in reporting, metrics, quality control and systems management in the Navy. Through her service she also met her husband Joshua, an Iowa native, and they made plans to attend Iowa State University together.

Her interest in science led her to major in biology at Iowa State. An internship with Charles Block, a USDA-ARS collaborator in plant pathology and microbiology inspired her interest in plants. She helped Block study corn diseases by setting up experiments, collecting samples and tracking data. Combined with her skills earned in the Navy, McGrew uncovered her penchant for scientific protocols.

As a quality systems specialist at Catalent Pharma Solutions, in Kansas City, Missouri, she is responsible for the management and quality assurance of systems used to develop and manufacture pharmaceuticals.

"Jacqueline's position was created to allow us to stay on the forefront of FDA's regulatory agenda. She's the first in Catalent to fill this role, and one of the few in the company involved with metric reporting. She does a lot of data mining," says Joel Scheiferstein, quality systems manager. "She's built upon her natural ability through proactive training and continuing education."

One of their drugs was recently fast-tracked by the FDA to fight leukemia without the adverse side-effects of other chemotherapy drugs.

McGrew shared her experiences with the college's George Washington Carver interns this summer after answering a call for volunteers in the alumni e-newsletter STORIES *Online*.

"The students really like to hear that if you fail it's not the end of the world. You have to move on. At Iowa State I took on too much – a huge course load and worked two jobs. I went in for academic assistance and student services helped me cut back on my course load and finish," McGrew says. "The support I received at Iowa State gives me reason to come back and hopefully inspire others."

*Pictured from left, **Todd Hall**, **Catherine Woteki**, **Wendy Wintersteen**, **Claire Masker**, **Dawn Refsell** and **Gerald Klonglan**.*

CALS ALUMNI, FRIENDS HONORED BY COLLEGE, ALUMNI ASSOCIATION

CALS graduates were honored by Iowa State for service to the college and agricultural and life sciences industries during Homecoming events in October.

CALS Awardees

Floyd Andre Award:
Todd B. Hall ('82 animal science), executive vice president, Cargill

George Washington Carver Distinguished Service Award:
Gerald E. Klonglan ('58 rural sociology, '62 MS, '63 PhD), emeritus professor, Iowa State University Department of Sociology; retired associate dean for national programs, Iowa State University College of Agriculture and Life Sciences; retired assistant director, Iowa Agriculture and Home Economics Experiment Station.

Henry A. Wallace Award:
Catherine E. Woteki, professor, Iowa State University Department of Food Science and Human Nutrition; former chief scientist and undersecretary, U.S. Department of Agriculture; former CALS dean.

Outstanding Young Professional Award:
Dawn E. Refsell ('01 agronomy, '03 MS crop production and physiology), manager, Midwest field development, Valent U.S.A.

Alumni Association Awards

James A. Hopson Alumni Volunteer Service Award:
Kyle S. Flander ('03 industrial technology), process improvement engineer, Entrematic/Amarr

Claire E. Masker ('05 animal science, agricultural and life sciences education, '08 MS agricultural and life sciences education), director of public relations, National Pork Board

KERNS PRESENTS DEAL LECTURE

Joe Kerns ('86 agricultural business), risk management consultant and president of Kerns and Associates in Ames, Iowa, presented the 2017 William K. Deal Endowed Leadership Lecture, Oct. 5 at Iowa State. Kerns' presentation, "Suddenly, suddenly, then all of the sudden: A tale of resiliency, entrepreneurship and the value of mentors," is available online at www.stories.cals.iastate.edu.

FREESE NAMED AMONG TOP WOMEN IN MEDIA

Betsy Freese ('84 agricultural journalism), executive editor for Meredith Agrimedia's Living the Country Life and Successful Farming, was named to the 2017 class of Top Women in Media by Folio, an organization providing magazine publishing professionals with news, insights and best practices. Freese also was awarded the Agricultural Communicators of Tomorrow Honored Professional Award at the 2017 Agriculture Media Summit.

CALS ALUMNI EARN TOP NATIONAL HONORS

Greg Nickerson ('81 ag journalism), chief executive officer of Bader Rutter, National Agri-Marketing Association Marketer of the Year Award

Paul Queck ('70 animal science), freelance writer and photographer and former editor for Farm Progress publications, American Agricultural Editors' Association Lifetime Achievement Award

Kelly Schwalbe ('82 ag journalism), partner and public relations director for Sage, National Agri-Marketing Association Professional Development Award

Charles Sukup ('76 ag engineering, '82 MS), president of Sukup Manufacturing Company, Tau Beta Pi Distinguished Alumni Award

TEAMING UP TO BATTLE PALMER AMARANTH

Story by Grant Wall
Images by Christopher Gannon

*Iowa State University Extension and Outreach's **Bob Hartzler** and **Meaghan Anderson** have joined with industry and government partners to raise awareness of the dangers of Palmer amaranth and the importance of management to slow its spread.*

Waterhemp is one of the worst weeds Iowa farmers face. It produces a large number of seed and germinates late in the summer so it is not controlled by early season herbicide applications. It has incredible genetic diversity, which allows for increased herbicide resistance.

Multiply its growing power and resistance, and the result is its genetic cousin—Palmer amaranth.

Palmer amaranth is a pigweed species not native to Iowa. Since moving into the state from the south in 2013, it has been found in 50 counties. With no easy treatment options, Iowa State University is working with farmers, industry specialists and state agencies to slow its spread.

"Be constantly alert," says Bob Hartzler, agronomy professor and weed specialist with Iowa State University Extension and Outreach. "The majority of Iowa's fields have waterhemp, so it's so easy to get complacent when encountering pigweeds."

Hartzler ('78 agronomy, '87 PhD) teamed up with the Iowa State University Extension and Outreach crops team including Meaghan Anderson, extension field agronomist. Together they raise awareness of the dangers of the weed and the importance of vigilance and management.

"We want farmers to be able to identify Palmer amaranth in fields and understand how important it is to manage it quickly and properly," says Anderson ('12 agronomy, '14 MS crop production and physiology).

They work with industry and government partners to offer statewide meetings, media campaigns and extension publications to help curtail its spread.

"Working with Iowa State University Extension and Outreach is important because they are an unbiased party giving farmers direction," says Dean Grossnickle ('95 agricultural business), field agronomist with Syngenta. "They've done a very good job of raising awareness. They aren't crying wolf—it's a very bad weed. By being proactive we still have a chance to manage it."

While widespread crop losses have not been reported in Iowa fields, an increased need for herbicides is cutting into profit margins. The cost of herbicides for soybean has more than doubled in the last three years, almost entirely because of herbicide-resistant waterhemp. If Palmer amaranth is allowed to spread, those costs will continue to rise.

Anderson recommends farmers plant and harvest fields containing Palmer amaranth last in order to avoid spreading its seed. Soybean fields are key to scout late in the season, as Palmer amaranth will be easier to find above this crop than in corn.

"The Palmer amaranth we are seeing now is not reaching its full potential," Hartzler says. "Weeds need a period of time to adapt to new environments. There is no doubt Palmer amaranth will adapt to live in Iowa, so now is the time to go after it. We have the chance to eradicate it from most fields where it has been found, and greatly reduce the rate it spreads in the state. It would be a huge mistake to miss this opportunity."

GREENHORN GRAZING

BUILDING KNOWLEDGE AND COMRADERY

***Justin Rowe** (second from left) has completed the Greenhorn Grazing program offered by Iowa State University Extension and Outreach and now hosts participants on his own farm. The class helps create community among producers as they learn from each others mistakes and successes. Far Left: Extension livestock specialist **Joe Sellers** helped create the Greenhorn Grazing program seven years ago. He says the class isn't just for beginners. It is open to any beef producer looking to network and upgrade management skills.*

Story by Grant Wall
Images by Christopher Gannon

With nearly 20 producers surveying his land, Justin Rowe explains how he organized his newest pasture.

He points out where he's constructed a fence around a pond, individual paddocks and shade for his 100 cows.

Rowe is a graduate of the Greenhorn Grazing program offered by Iowa State University Extension and Outreach. He is now helping to instruct, provide information and networking opportunities to livestock producers across the state. This group is meeting in Madison County while another meets in Crawford County in western Iowa.

"I enjoyed my experience in the class and picked up ideas that have been helpful in my operation," Rowe says. "In agriculture we need to help others, and share what worked and what didn't work."

Extension livestock specialist Joe Sellers ('76 animal science, '91 MS agricultural education and studies) was part of the group that designed the program and leads the group Rowe is addressing.

"We call it Greenhorn Grazing, but this class isn't just for beginners," Seller says. "It's for anyone who wants to upgrade their management skills."

Greenhorn Grazing classes started in 2010 as a way to combine pasture walks and other meetings into a structured program. Since then, 12 courses have been held with over 260 attendees.

"You can show pictures in meetings, but then to go out into the field and see someone actually doing it. That makes it a completely different kind of experience," says Brian Peterson, a retired state grassland conservationist with the Natural Resources Conservation Service and current president of the Southern Iowa Forage and Livestock Committee. "You can ask questions in this type of small group and get specific answers that pertain to your operation."

Two or three classes are held each year around the state, combining the expertise of ISU Extension and Outreach specialists, producers and professionals from the agriculture industry and state agencies.

Those partnerships are what makes the class so valuable to producers says Peterson ('71 farm operations) who helps Sellers teach portions of the class.

"These partnerships help us tell the same story and work together toward the same goal, using our diverse expertise to mold the program into one great package," says Peterson.

Partnering with outside groups also helps Iowa State University Extension and Outreach specialists.

"There are areas where new research is needed, like fencing systems or weed and brush control," Sellers says. "When we don't have resources at Iowa State working on those issues sometimes industry does. The combination of experts adds a lot of value to our participants."

The class helps foster community among producers as they learn from both the mistakes and successes of their peers.

"Producers have different approaches to management and those interactions are important," Sellers says. "A lot of comradery is being built. Many attendees have created informal networks to stay in contact after the class has ended."

***Julie** and **Jay Jacobi** (left, second from left) review travel photos and share stories with students who received scholarships thanks to their gift to Iowa State University. **Anne Dinges** (center), **Jeremy Schuster** and **Kaysha Rodriguez-Avila** (right) are among more than 30 students who have traveled abroad with financial assistance from the Jacobis.*

LEARNING

BEYOND BORDERS

Story by Betsy Snow Hickok
Image by Bob Elbert

"Agriculture is tasked with feeding a growing population worldwide," says Chris Cornelius. "As the world feels smaller, we depend on each other across borders and continents."

Cornelius ('83 agricultural journalism) has seen the changing face of agriculture first-hand; she and her husband, Chuck ('83 agronomy), are the fourth generation to run Cornelius Seed in Bellevue, Iowa.

Fortunately, the College of Agriculture and Life Sciences has long emphasized the important role of global learning—whether students plan to return to the family farm or help feed developing communities halfway around the world. The college is known for one of the strongest international programs at any university.

"Seeing processes and the culture of a country can be life-changing, not only for the students, but for the people they work with," says Cornelius. To facilitate the development of new study abroad initiatives, the couple established the Charles and Christine Cornelius Global Endowment for Faculty Support.

"Faculty need to travel to conduct site visits to plan safe and successful study abroad programs, especially in developing countries," says Julie Blanchong, associate professor in the department of natural resource ecology and management.

An interest in education and international study runs in the Cornelius family.

Chuck's sister, Julie ('88 agricultural business) Jacobi, and her husband, Jay ('89 agricultural business), created the Jay and Julie Cornelius Jacobi Scholarship for Agricultural Study Abroad, which has been awarded to more than 30 students.

"We didn't get to study abroad as undergraduates, but we've come to appreciate the value of international experiences," says Julie. "We hope our recipients will one day have the desire and ability to help future students."

"The Jacobi Scholarship allowed me to study in Antarctica, where I observed penguins, seals, whales and birds in their natural habitats," says recipient Taylor Berkshire, a senior in agronomy. "I learned about the impact our actions, even in Iowa, have on that environment. I am still in complete awe that I had this opportunity, which would not have been possible without the Jacobis' support."

While the majority of incoming students express an interest in studying abroad, only 25 percent do so—mainly due to the expense. By raising funds for global scholarships, faculty support and programs during the *Forever True* campaign, the college has a goal to increase the participation rate to 50 percent.

"Opportunities for students abound in the global agriculture sector," says Cornelius. "It will be a great outcome if we can build on the college's strengths, and educate even more leaders ready to help solve the challenges our world will face."

From faculty-student trivia nights to entrepreneurial brainstorming sessions, faculty find fun and meaningful ways to engage students in hands-on learning in agricultural business.

Image contributed

Story by Betsy Snow Hickok
Image by Christopher Gannon

CULTIVATING THE BEST IN AGRICULTURAL BUSINESS

The agricultural business program at Iowa State is recognized nationally for combining an exceptional education in business, management and economics with a range of hands-on learning experiences—from industry visits and internships to participation in study abroad and student activities like the number-one-ranked Agricultural Business Club in the nation.

Support for agricultural business during the *Forever True* campaign will strengthen the following areas:

Faculty support

Named faculty positions attract excellent faculty, keep their teaching on the leading edge, and provide time to serve as effective mentors for individuals and student groups.

"Establishing named faculty positions in strategic areas is essential to attracting faculty who will engage students' curiosity, intellect and passion," says Pete ('74 agricultural business) and Dana ('87 home economics education) Wenstrand, who established the Peter J. and Dana M. Wenstrand Harvest Fund to support the agricultural business program. "These educators will play a critical role in increasing the profile of the program, and in preparing future business owners, managers and leaders for the increasingly dynamic marketplace."

Student scholarships

Expanding support for scholarships and fellowships will keep an agricultural business education within reach and help recruit exceptional undergraduate and graduate students.

"Thanks to scholarships, I've participated in eight student organizations, experiences that have helped me make connections and strengthen my leadership skills," says Catherine Isley, senior in agricultural business. "I've chosen internships and jobs for the quality of the experience, not just because a position pays well. I've also taken two study abroad trips. Scholarships have been one of the biggest contributors to my success."

Sustaining leading-edge curriculum

From technology to international trade, agricultural business is constantly evolving; the program must continuously develop cutting-edge capstone courses and other curricula.

Capstone courses provide critical integrative learning experiences, and new funding will expand topics into areas such as business analytics, food market analysis, agribusiness management, international/global agribusiness and trade, agricultural policy, agricultural finance and farm management. Funding will also help develop new courses and curricula in emerging areas of expertise.

Growing the Agricultural Entrepreneurship Initiative

The Agricultural Entrepreneurship Initiative provides practical business development experiences that teach students to think entrepreneurially.

A gift from Keith ('59 animal science, '63 PhD) and Virginia ('60 child development) Smith supports the Student Incubator Program, a key aspect of the Agricultural Entrepreneurship Initiative. Last year's 14 participants developed a range of innovative ideas, from a solar-powered food dehydrator, to a real estate data management system, to a specialty beef business.

"Iowa State's Agricultural Entrepreneurship Initiative is recognized as one of the best in the country. This is the Age of the Entrepreneur; students should know from their first day on the Iowa State campus that they can one day work for themselves," says Roger C. Underwood ('80 agricultural business). S

Iowa State University's comprehensive *Forever True, For Iowa State* campaign promises true transformation for the College of Agriculture and Life Sciences. The college's goal to raise $200 million will help grow six key areas: global agriculture, agricultural business and entrepreneurship, student and faculty enrichment, biosciences, sustainability and new innovative facilities for animal agriculture teaching and research. In strengthening these areas, the campaign will ensure the college continues to provide a world-class education that meets the needs of tomorrow's students.

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