

Agricultural & Biological Engineering



INSIDE

Renovation/addition update

Department Head Bernie Engel says the project is on schedule, and he shares a timeline.

Big payoffs: \$15,000 & \$25,000

ABE students past and present star at agBOT Challenge.

Farms, fish, filters

Grace Baldwin has years of on-the-ground experience in Ghana.

A quarter-scale triumph

Purdue has often been a top-five team. This year, no tractor was better.

Treasure in our attic

What was on the 4th floor? Theses, a lot of artwork (pictured), B&W photos, a bowling trophy—and "Joe Kuc sleeps here" written on the ceiling.



ABE eager to embrace changes that the next 3 years will bring

We are well into the fall semester, and a number of great things have happened in ABE since our last newsletter. However, for many of us, nothing has dominated our discussions and efforts more than the ABE building renovation and addition.

The anticipation of a renovated ABE building with a large addition continues to grow. While all in ABE look forward to a fantastic building, we have a great deal to do before moving back in. Here's a brief overview of the project, including recent key events and some milestones ahead.

Whether you graduated 30 years ago or three years ago, you understand the need for a new ABE building. The quality and growth of our program allowed us to make the case for the project and get to the top of the university's priorities. We have consistently been among the very top ABE programs for many years: Undergraduate programs are ranked #1 for the seventh consecutive year (a tie this year). Graduate programs are ranked #2 after eight consecutive years as the top-ranked program. Our programs have grown by most any metric: Undergraduate enrollment reached 424 this fall, graduate student enrollment is at 110, and faculty

total 36, with searches for two additional faculty underway. We have accommodated growth by distributing parts of the program in 11 buildings.

Plans for the renovation of the three-story portion of the ABE building and addition are progressing and are on schedule. Faculty and staff spent a significant amount of time with an architectural team during the spring semester to confirm learning and discovery space requirements and develop conceptual floor plans. Those plans and renderings are accessible at ag.purdue.edu/ABEBuilding. If you haven't seen them, check them out. The floor plans will continue to evolve as we work with the architect.

The three-story portion of the ABE building will be renovated and will house offices for faculty, staff and some graduate students, as well as support spaces for students. The one-story portion of the building will be demolished. In its footprint will rise a building with a basement and four stories (plus mezzanine) above ground. A creative approach that employs a mezzanine will allow direct connections from each floor of the three-story building to the new building. The addition

of approximately 125,000 square feet will provide two classrooms large enough to accommodate our growing undergraduate enrollments, teaching laboratories to support the full range of laboratory experiences needed by our programs, maker spaces to support student discovery and creativity, graduate student offices, and modern laboratories to support research endeavors.

The renovation of the three-story building is extensive enough that everything will need to be removed. Beginning in the spring semester 2017 and continuing into the summer, we got rid of items that are no longer useful. From the attic alone, we removed materials that filled more than four roll-off dumpsters. We had a large garage sale, too. Although we've made a significant dent in reducing what we've collected over 90 years, we have much more to do in that regard before the end of the spring semester.

Planning is continuing for swing space during the period that some of us will be out of the ABE building (see timeline). Because we have laboratories and offices in so many other buildings, only about half of our faculty will have to move to nearby on-campus spaces.

The architectural team and a construction manager are back this fall, engaging faculty and staff in discussions to guide the design. Completion of the detailed design phase of the project is expected in the spring.

In the timeline, I call your attention to April 19, 2018. On that day, I hope you can join us in the ABE building to celebrate our senior design/capstone projects in the afternoon. The event will also give us an opportunity to say farewell to the building you know and love. About two weeks later, we will move into swing space, and the ABE building will no longer be open as the next steps in renovation will begin.

Finally, let me share some great news. We recently passed the halfway mark toward our commitment of \$11M in private support for the building. Thank you to all who have helped us reach this level of support. I would be remiss, however, if I didn't say that we need your help now more than ever. I hope you will join me in being part of this exciting, once-in-a-lifetime opportunity to make a difference for future Boilermakers pursuing a coveted degree in our program!



What's ahead

JANUARY 2018

Detailed design of ABE building renovation and building addition begins

APRIL 2018

Detailed design of the building completed

APRIL 19, 2018

Join us for senior design/capstone poster presentations and a farewell to the current ABE building

APRIL/MAY 2018

Move out of ABE building to swing space by end of 2018 spring semester

NOVEMBER 2020

Move to renovated and new building begins

MARCH/APRIL 2021

Building dedication and ABE Centennial Celebration

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agBOT team meets challenge

ROCKVILLE, Indiana

The second annual agBOT Challenge drew some of the most advanced technologies in the digital agriculture industry to Gerrish Farms in Parke County, about 23 miles north of Terre Haute.

A Purdue team featuring ABE and Mechanical Engineering majors won \$15,000 by finishing second in the weed-and-feed competition on June 23-25.

Cole Mundell of Sharpsville, majoring in Agricultural Systems Management, and Agricultural Engineering majors Ryan Romanowski of Columbia City and Zhihang Song of Zhengzhou, China, represented ABE. Professor Roger Tormoehlen and Richard Fox, computer analyst in Youth Development and Agricultural Education, were the advisors.

The 14 teams in the weed-and-feed competition were from educational and technology companies in the United States and Canada. Prairie Robotics won \$25,000 for finishing first, and third place was worth \$10,000 for Team Gizmoze, led by a 12-year-old Iowa boy. The event also featured a seeding competition,

won by Lairdscape of Rensselaer, Indiana. (Kyler Laird earned an ABE master's degree in 2004.)

"The project highlighted the need for diverse teams that encompass a range of skill sets," Tormoehlen said. "The students' performance is a testament to their skill, their dedication and their ingenuity, as well as the well-rounded education and training they received in Purdue's agricultural and biological engineering and mechanical engineering programs."

The agBOT Challenge is a series of competitions meant to propel innovation in technology and agriculture.

Weed-and-feed teams had to produce an unmanned, robotic device (aka "agBOT") that would:

- Autonomously maneuver two or four 1,000-foot rows at a time and make four 1,000-foot passes at a speed of 3.5 to 10 mph;
- Autonomously observe crop plants and fertilize plants as needed;



- Identify three common weeds within rows and between rows;
- Arrange for the weed to die — chemically or mechanically; and
- Provide real-time observation methods of the plants being fertilized and/or treated.

Starting with a stock Yamaha all-terrain utility vehicle, the Purdue team built an autonomous propulsion and guidance system that included a sophisticated electronic monitoring package.

“Digital agriculture will enhance our capabilities in the area of precision agriculture, which will be one of the keys as we move to feed a world population projected to reach 9 to 10 billion by 2050,” Tormoehlen said. “It will enable us to increase our production while reducing inputs such as fertilizer and chemicals.”

The students developed communication and collaboration skills that are highly valued by employers in high-tech industries, he added.

Mechanical Engineering majors on the Purdue team were Phillip Bower of West Lafayette; Kyle Scribner of Seattle, Washington; Lexi Wickstrom of Gurnee, Illinois; and Alex Carr, Adam Einck and Melissa Mason of Los Altos, Huntington Beach, and Poway, California, respectively.

Coming up

The 2018 NextGen Expo is set for May 17 at Gerrish Farms, followed by two days of agBOT Challenge events. Weed-and-feed and harvest competitions will be on tap. Visit agbot.ag.

WANT TO KNOW MORE?

www.agriculture.com/video/agbot-challenge-recap

ABE grad makes masterful modifications

RENSELAER — After using it to plant 500 acres of corn at his family’s farm, Kyler Laird took his fourth robotic tractor, the John Deere 6330 he started modifying in December 2016, to the second annual agBOT Challenge in Rockville.

“As it moved across the fields autonomously, the judges were clearly impressed,” said Laurie Bedord, who reported on the June event for Successful Farming at agriculture.com. Laird came home to Lairdscape, a soon-to-be fourth-generation industrial corn and soybean farm operation, as the agBOT seeding competition champion. His one-man band won \$25,000 and bested runner-up Cal Poly and six other teams, including Ohio State and Virginia Tech.

While earning a bachelor’s degree in computer science, then a master’s degree in Ag Systems Management in 2004, the Purdue graduate worked full-time and wasn’t on agBOT-type teams. And now it’s just him ripping out and recreating electrical and hydraulic systems. But he hasn’t forgotten the camaraderie that ABE is so proud of.

“I’m always wishing it was like at Purdue — you walk up to someone and say, ‘How do you do that?’ It’s a benefit I think I squandered sometimes,” he says. His advice: “Find something you love to do and get someone to help you.”

After several years at the University of California Merced, working on the engineering school’s computers, his father’s death in 2010 brought Laird back to Jasper County. The technical ABE classes he took “come in handy all the time,” he says. Knowledge has been on the shelf. “It’s nice to pull it off and do something with it.”

The tractor that wowed the agBOT judges required many hours of contemplation, countless hours of experimentation “and a lot of cold days in the shed,” he says. “I could build it in a few hours now, with the right hardware.”



When profits aren't the point

Brian Wallheimer /Agricultural Communications

Last fall in Ethiopia, David Wilson watched oxen tread a barley crop to separate grain from the stalks.

That method works, to a degree. It has for millennia. But Wilson (BS 2013, MS 2015 Agricultural and Biological Engineering) and the Ethiopian farmers knew the harsh truth: That crop loss is an ever-present concern. That grain dried by the sun, then threshed by beasts of burden, can blow away

or become contaminated by animals, dust, and insects. That taking grain to market often means a long walk, hauling only what can be carried, since rutted and/or muddy roads make vehicle transportation difficult.

The farmers Wilson has met in Ethiopia, Cameroon, Nigeria, and Kenya aren't expecting to see their roads paved anytime soon. Nor are they counting



on expensive, mechanized tools that farmers in more developed countries have used for many decades to plow, harvest, dry and thresh. Many are subsistence farmers, often with little left over to sell.

Affordable, multiuse tools developed by College of Agriculture researchers have the power to improve those farmers' prospects—and quickly. However, sub-Saharan Africa is not a garden spot for investors, especially those seeking abundant returns. Lest their work languish on a shelf, Purdue researchers are taking on the challenges of entrepreneurship.

"To see the farmers actually spending hours and hours manually working on these things, and losing half their yield, showed me the importance of this type of work," Wilson says.

Wilson and several current and former Purdue students founded Mobile Agricultural Power Solutions (MAPS) to produce a three-wheeled, versatile, basic utility vehicle that can haul water and crop inputs, plow fields, and take as much as 1 ton of yield to market on mediocre—or worse—roads.

"When you see men plowing with an ox or women carrying water on their heads, you see a lot of opportunity to change lives in some way," says Wilson, now an ABE undergraduate teaching lab manager.

Wilson said his business idea came directly from work he did as a Purdue student. While in school, he was involved in the Purdue Utility Project (PUP). Wilson was part of a student team that competed to develop a multipurpose, low-cost utility vehicle for farmers



in Cameroon in west-central Africa. PUP vehicles, in service in Africa for about a decade, now even help battle fires.

Wilson credited his continued interest in vehicles to that PUP experience.

"PUP got me really interested in this kind of work that helps people and addresses a real problem," Wilson said. "Now, through my work at Mobile Agricultural Power Solutions, I am able to make a difference for these farmers in Africa, and I find it really rewarding."

His company's AgRover is currently being developed and used in Nigeria and Kenya, but Wilson hopes to expand its reach.

HOW PURDUE SUPPORTS GOOD IDEAS

As Wilson's team steers MAPS into the African agricultural mainstream, Klein Ileleji is harnessing his entrepreneurial skills on behalf of a project that can not only brighten postharvest prospects but improve farmers' home lives, too.

The ABE associate professor has made many research visits to Nigeria and Ghana, and the need for affordable grain-drying technologies was clear, he says. With funding from a U.S. Agency for International Development program, he helped create a solar dehydrator that also acts as a generator, supplying power to homes and small electronic devices while in the field.

Ileleji and his wife, Reiko Habuto Ileleji (MS 2001, PhD 2008 Education), started JUA Technologies

International LLC to further develop and market the multifunctional device. He's well aware of what can happen to a good idea when the market is some of the continent's poorest farmers.

"Companies are not going to go into this market," Ileleji says, "because it is not attractive. You can't convince the large guys since the money is not there to show for it. If you compare what companies in the West invest in developing tech for agriculture versus what is invested in Africa, it's very abysmal."

So Ileleji joined the growing ranks of agricultural entrepreneurs at Purdue. JUA Technologies is scouting opportunities for manufacturing and sales, starting in Nigeria. Small fruit and vegetable farmers in the U.S. who are interested in dehydrating their harvests are another potential market.

JUA Technologies has benefited from Purdue President Mitch Daniels' push for commercialization of Purdue research. Ileleji took advantage of resources at the Purdue Foundry, an entrepreneurship hub developed through the Purdue Research Foundation (PRF) and dedicated to moving student, faculty, and alumni ideas more quickly to the marketplace.

Helping entrepreneurs at nearly every stage of their projects is the reason the Purdue Foundry was established in 2013. Dan Dawes (BS 1980, agricultural economics), an entrepreneur in residence at the Foundry, focuses on mentoring agriculture startups. He says before the Foundry, about eight startup companies were born from Purdue each year. That number has tripled.

"If you look at Purdue's mission, it speaks to serving the citizens of Indiana, the U.S., and the world through discovery—and through the dissemination of knowledge and the preservation of knowledge," Dawes says. "Commercialization of good ideas and technology is the most efficient way for that knowledge to be disseminated."

THE IMPORTANCE OF 'LOCAL'

The MAPS utility vehicle was merely a wooden prototype in 2010. John Lumkes, an ABE professor, led trips to Cameroon over several years, and his team's efforts created seven prototypes in partnership with the African Center for Renewable Energy and Sustainable Technology. ACREST now has vehicles for daily use or to rent to local farmers.

Some farms benefit from subsidized or donated farm machinery. However, Wilson notes, when those vehicles break down, spare parts are costly to import, and farmers don't necessarily have the skills to make repairs.

The AgRover is designed to solve those problems. "It's cheaper than importing a tractor. It's more flexible in its use than trucks that are on the market and imported. Every single part on the vehicle we purchased ... in Lagos," Wilson says, referring to Nigeria's largest city.



More information

- engineering.purdue.edu/pup
- mobileagpower.com
- To learn about PUP vehicles being adapted to help firefighting efforts in Africa, visit the Big Ten Network (btn.com; <https://goo.gl/vbrTM5>)
- JUA Technologies LLC was ranked sixth among the top 10 innovations for the All Africa Postharvest Technologies and Innovation Challenge. The inaugural All Africa Postharvest Congress and Exhibition took place in March in Nairobi, Kenya.
- JUA was highlighted in the May issue of Fast Company, a monthly business magazine. An article titled "Announcing the United States of Innovation" listed the most promising projects, initiatives and companies in each state.
- To learn more about the African Center for Renewable Energy and Sustainable Technology, visit acrest.org.



Ghana keeps calling her

Grace Lynn Baldwin has been knee-deep in Ghana since 2009. She turned 16 as she, her family, and a team from Dayton United Methodist Church were on a mission trip to the nation in western Africa. Now the homeschooled Lafayette native is 24, has an ABE bachelor's degree and is working on a master's. Her senior capstone project was the foundation for her master's work: Development of an Extension demonstration farm in Amakom, Ghana, near Lake Bosomtwe.

The country's lone natural lake is a popular resort area, and a couple dozen villages surround it. Lake Bosomtwe Methodist Clinic has been there since 1972. "The clinic is extremely respected in the area," Baldwin says. Sometimes trust is tangible: Four communities near the clinic donated 50 acres that became the Extension demonstration farm, managed by the Methodist Church in Ghana. The farm "is seen as a place where government and church-appointed agricultural Extension officers can show real-life demonstrations, rather than explaining a concept with no visuals," Baldwin says.

According to the Ghana Statistical Service (2014), nearly all who live near the lake participate in some form of crop farming, but few have much training.

This summer, a survey concluded that the farm has 30 acres of dense bush and 20 acres that can be used immediately for crops. Soil was analyzed at the Kwame Nkrumah University of Science and Technology. (Purdue and KNUST have a long history.)

Baldwin's project used a Service Learning Grant from Purdue's Office of Engagement to buy 950 vetiver plants — similar to elephant grass — a soil auger, a weather station, and additional supplies. A half-acre was planted by hand; plants were purchased from the KNUST horticulture department. Trenches were dug using pickaxes. A second ongoing project is data collection from the weather station, which was installed in March. Every five minutes it records solar radiation, rainfall, wind speed, temperatures, relative humidity, and barometric pressure. The goal, Baldwin says, is to install more weather stations and sell the data, perhaps creating jobs for students with skills sets in information communication technology.



Baldwin first saw Lake Bosomtwe in 2009, before area villagers began transitioning to subsistence farming. Fishing was good enough then that it was a primary source of income and protein for many people. But algae blooms, caused by overuse of fertilizers, and overfishing took a toll. United Nations-sponsored research spotlighted the problem but didn't reach conclusions, says Baldwin, who was tracking the trend from campus. A 2016 visit confirmed the concerns, she says. Her master's degree focus is on establishing improved agricultural practices that will lead to greater fish populations.

That May/June 2016 trip also sparked a water quality project geared primarily for Ghana's arid regions, where service water is in short supply and access to bore holes and wells is limited. Tests are being conducted using low-cost, low-maintenance slow sand water filter technology devised by a Purdue-affiliated startup. Filtered water still requires chlorination — or boiling — to ensure safety.

"This project is not working at Lake Bosomtwe yet," Baldwin says. But early results are positive. "The water used for testing the filter came from the place where people bathe, wash their cows, and collect water for other washing purposes," she says. "The water comes from a pond that has a lovely green film over the top. So, in other words, we obtained the worst water possible and the filter worked wonderfully!"

More information

- Kwame Nkrumah University of Science and Technology: purdue.ag/knust
- The sand filter: purdue.ag/majisafi
- purdue.ag/jafvert
- Grace Baldwin's research is assisted by Global Resource Connections, a nongovernmental organization headed by her father, Alan, that works in Ghana and elsewhere: purdue.ag/cgr



1/4-scale team breaks through

Darrin Pack/Agricultural Communications

Teams from Purdue University have historically done well at the prestigious American Society of Agricultural and Biological Engineers 1/4-Scale Tractor Student Design Competition, but the top prize has proved elusive.

Until this year.

The Purdue team was the overall winner of the competition, held June 1-4 in Peoria, Illinois, earning a \$1,500 cash prize and \$2,000 in scholarships.

The team consisted of seniors Austin Bossaer (Attica), Derek Franke (Monroeville), Austin Franz (Monroeville), Zach Hurd (West Lafayette) and James Marschand (Connersville); junior Joshua Nurrenbern (Haubstadt); and sophomores Julian Halicki (New Castle), Eric Kong (Spencer), William Malecki (LaCrosse), Mitchell Moore (Plymouth) and Brian Sipkema (Fair Oaks).

"We've had multiple top-five finishes over the years but it is

nice to finally be champions," said John Lumkes, professor of agricultural and biological engineering and team advisor.

Thirty-one teams from the United States, Canada and Israel were involved. "We're honored to win this, given the quality of the competition," team member James Marschand said.

The competition, held annually since 1998, is designed to offer engineering students a practical design, manufacturing and sales experience. Each team is provided with a 31-horsepower engine and tires. The members design and build a frame, drivetrain, hitch, clutch, weight brackets and other parts. The entire process takes about nine months. As the competition nears, students spend 20 to 25 hours a week on the project.

A panel of industry experts evaluates entries on innovation, maneuverability, serviceability, safety, sound level and

ergonomics. Teams must submit a written design report and "sell" their design in a formal presentation.

"There is growing concern that students are entering the job market without a lot of practical experience," Lumkes said. "This competition gives students a chance to learn by doing."

Each vehicle is tested in three events designed to measure performance, durability and maneuverability. Purdue took first place in both performance and maneuverability and second in durability.

"It was an impressive performance across the board," Lumkes said. "The students excelled in a number of areas, including communication, teamwork, research and development and time management — skills that are essential for success in the modern engineering job market."

Our back pages

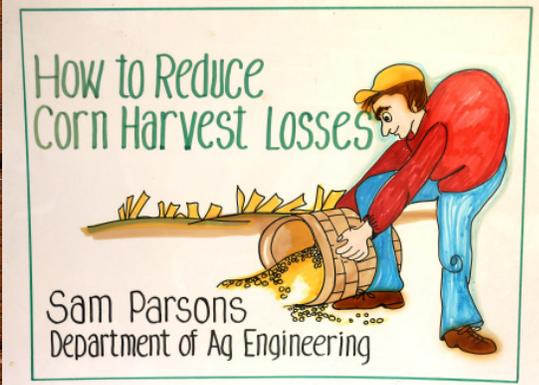
Like many attics, ours was full. We cleaned it out.

That effort started in the spring. "For weeks, all we heard was the steady ka-thunk, ka-thunk, ka-thunk of file cabinets being hauled down the steps," says Carol Weaver, ABE's alumni relations and communications coordinator. A treasure trove of photos, folders and paraphernalia is still being sorted.

Visit the photo gallery at purdueag.exposure.co | New photos by Tom Campbell/Agricultural Communications.









Dear ag industry: Talk up tech

Margaret Hegwood, a junior majoring in Biological Engineering, was one of 20 university students chosen by the Chicago Council on Global Affairs to be a 2017 Next Generation Delegate. This article is taken from a blog series that the delegates contributed to as a run-up to the council's two-day Global Food Security Symposium in March in Washington, D.C.

By Margaret Hegwood (top row, second from left)

Until a year ago, I had never considered a future in the agriculture industry. In fact, having a strong technology-oriented background, I often perceived the industry as “behind the times” — consisting only of traditional farming methods and making little use of today’s modern technology.

In turn, I was unexcited by the idea of working in agriculture because I believed it lacked the engineering innovation that I craved in my education, career, and life. It was only a matter of time before I came to learn the truth about the vital connection between technology and agriculture — and the opportunities that lie at their intersection.

Passionate about engineering technology for the purpose of international development, I became involved with Purdue’s Innovation for International Development (I2D) Lab during my first year of undergraduate studies. Facilitated by Purdue’s Global Engineering Programs, the I2D Lab supports the research of engineering faculty and students by connecting them with partners around the

globe to solve major development challenges. The program also enables a series of experiences for undergraduates in the form of Global Design Teams, which allow students to be involved in research and development projects abroad — in countries such as Cameroon, Tanzania, Jordan, Colombia, and Kenya.

It was through participating in one of these Global Design Teams that I first learned the relevancy of agriculture and food security in international development. In partnership with the St. Luke’s Foundation and the Kilimanjaro School of Pharmacy in Tanzania, I worked to create a universal method for testing the quality of substandard, spurious, fake, falsified, or counterfeit (SSFFC) medicines using High Performance Liquid Chromatography (HPLC). I had begun my research with the intent of learning how to create affordable and accessible medicine in developing countries, but quickly learned that it didn’t matter how exceptional the quality of the medicine I created was if people were still suffering from malnutrition.



The link between food security, nutrition, and medicine was solidified for me last March, at the annual I2D Lab Exposition, where professionals across various fields in international development came together to discuss the world's greatest challenges. It was through Dr. John Lumkes, my university mentor and colleague, that I was exposed to the Land O'Lakes Global Food Challenge — Emerging Leaders for Food Security program, which has allowed me to explore how I can improve food security from the mindset of an engineer.

Since beginning my work with Land O'Lakes, it has become my personal goal to understand how we can not only improve access to food, but also how to provide people everywhere with the proper nutrition to live a healthy life. I work closely with 10 other student interns from diverse backgrounds — including mechanical engineering, agribusiness, economics, and international affairs — to create solutions for improving food security both domestically and abroad. With the support of Land O'Lakes, we have researched topics including genetic modification, the public perception of agriculture, nutrition, food culture, risk assessment, and the relationship of each focus to food security and agricultural development. The knowledge I have gained and the skills I've learned have been invaluable.

Now it's difficult for me to imagine a career outside of agriculture and I find myself asking: How can we engage more young people in this incredible field?

This same question has recently been the focus of the global agriculture industry. Despite the growing global "youth bulge" of 7 billion people under the age of 30, there continues to be little demonstrated youth interest in agriculture. Most interestingly, this lack of interest endures despite chronic youth

unemployment. Global youth unemployment affects nearly 71 million youth worldwide. In the United States alone, 25,000 new jobs in the agriculture industry go unfilled each year.

This is also particularly a concern in regions like sub-Saharan Africa and South Asia, where youth unemployment is 12.9 and 10.1 percent, respectively. As an example, in Mongolia and Vietnam, agriculture comprises nearly a third of the available employment, but the percentage of young people pursuing agriculture-related degrees remains at only 2.35 and 7.99 percent, respectively. And although global opportunities in agriculture are increasing annually, the age of the common farmer continues to rise above 50, with the average age nearing 62 in South Africa, 57.1 in the United States, and 55 in the European Union.

WHAT IS THE SECRET FOR ENGAGING YOUTH IN AGRICULTURE?

The answer is found in my own story: technology. Just as I became involved in agriculture through engineering innovation, so too can we educate young people about opportunities in agriculture through technology and science. Agriculture goes beyond the stereotype of farming to include food science, biotechnology, machine systems, resource management, and genetics research. Positive efforts to educate at all levels of education, including primary, secondary, and higher-level education, are key in bringing this idea to light in the minds of young people around the globe.

Through investing to link technology and youth, we can ensure both the future of the agriculture industry and the success of future generations. And, with their creativity and mind-power, young people can also aid in leading us toward a more food secure future for the entire world.



‘Tracer’ scratches title itch

Hydraulics usually power giant machines. Can hydraulics power a bicycle? That’s the idea behind the Fluid Power Vehicle Challenge, a national contest run by the National Fluid Power Association. Students build a chainless bicycle, powered solely by hydraulic pumps and motors.

Three ABE students—seniors Yizhou Mao and Zhengpu Chen, and junior Chenxi Li—were members of the Purdue team that won the April contest in Ames, Iowa. The Boilermakers designed a custom bike frame that doubles as the hydraulic oil reservoir, and a smartphone app to monitor telemetry.

“The idea behind the competition is to use fluid power technology in new ways,” said Andrea Vacca, associate professor of both Agricultural and Biological Engineering and Mechanical Engineering, which joined forces on the project. “It’s a real challenge, because a bicycle is small and light-duty. Most teams take an existing bicycle and modify it, but this year our team started from scratch.”

Students designed and built a two-wheeled aluminum frame that balanced the needs of the hydraulic systems with the feel of a “normal” bicycle. “It’s very easy to ride,” said Gianluca Marinaro, an ABE visiting scholar who built most of the frame and rode the bicycle for the competition. “When you pedal, you generate hydraulic flow, which allows the motors to drive the rear wheel. And we built the hydraulic reservoir into the frame of the bicycle, so it has the same balance as a normal bike.”

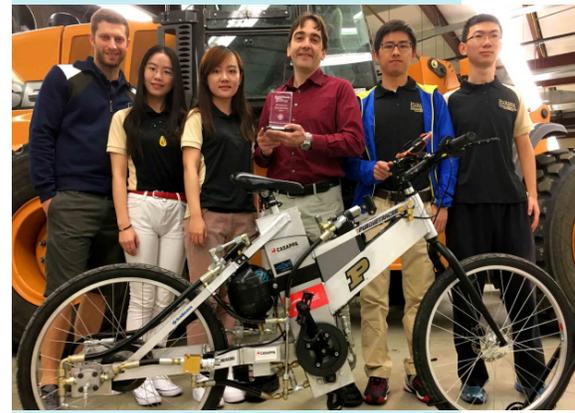
Nicknamed “Purdue Tracer,” the bicycle has other tricks up its sleeve. Zhuangying Xu developed the smartphone app to be “completely integrated with the bicycle. You can see how much pressure is in the hydraulic lines, how fast you’re pedaling, and even your heart rate. We’ve also integrated things like weather and geolocation, so it is a very intelligent bicycle.”

Another feature is the accumulator, which featured prominently in the 2017 competition. “One of the contests was to power the bike without pedaling,” he said. “With our hydraulic system, we could attach a lever and hand-pump the accumulator beforehand, which gave us about 500 meters of travel without pedaling.”

Vacca’s students have entered similar contests for six years, but this is the first time they’ve come out on top. “It’s not so much about the bicycle as it is about using fluid power in unique ways,” Vacca said. “We’re very lucky at Purdue to have the Maha Fluid Power Research Center, which is the largest academic hydraulics lab in the country. Our students have the ability to tackle any problem, big or small.”

Xu called the team a “perfect mix of electrical, mechanical, and hydraulic students. We’ve really enjoyed this process.”

**Jared Pike, Communication Specialist,
School of Mechanical Engineering**



Adds up to 1st place

Purdue’s results at the 2017 Fluid Power Vehicle Challenge. Thirteen college teams participated in the contest organized by the National Fluid Power Association and held in April in Ames, Iowa.

- **1st Place:** Overall champion
- **1st Place:** Efficiency challenge
- **1st Place:** Best design
- **1st Place:** Reliability and safety
- **2nd Place:** Best paper/presentation
- **2nd Place:** Reliability/durability challenge
- **3rd Place:** Sprint race
- **3rd Place:** Workmanship

Want to see it?

To view the bike in action and see the members of the national championship team, visit youtu.be/f1_l87GAcT8.

New Faculty



Dr. Mohit Verma

Dr. Mohit Verma begins his Purdue career in January as an Assistant Professor in the Department of Agricultural and Biological Engineering. He completed a Banting Postdoctoral Fellowship (2015-2017) at Professor George Whitesides' laboratory in Harvard University. He received his PhD (as a Vanier Canada Graduate Scholar) in Chemical Engineering (Nanotechnology) from the University of Waterloo under the supervision of Professor Frank Gu in 2015. He completed his Bachelor's of Applied Science in Nanotechnology Engineering at the University of Waterloo in 2012.

During his undergraduate and doctorate work, Dr. Verma utilized nanotechnology to develop solutions for problems in drug delivery, biosensors, and agriculture. As a postdoctoral fellow, he broadened his research to the fields of low-cost diagnostics, soft robotics, and the gut microbiome. As a faculty member, his goal is to engineer human microbiomes for improving health. For more, visit vermalab.com.

Faculty Awards

Jenna Rickus

Promotion to associate vice provost for teaching and learning

Team Award, College of Engineering, Faculty Awards of Excellence: "Implantable Networks of Wireless Nanoelectronic Nodes"

Michael Ladisch

Elected Fellow of the American Institute of Chemical Engineers

Purdue Agriculture 2017 TEAM Award. "Together everyone achieves more."

William Field, Salah Issa, Charlene Cheng, Steven Wettschurack, Michael Manning, Denise Heath (ABE); Donald Haberlin, Ivy Tech; Brandy Miller, Dirk Maier, Iowa State; Brian French, Washington State. April 2017

Klein Ileleji

Solar Dehydrator among top-10 innovations at All-African Post-Harvest Congress and Exhibit, March 28-31, 2017, Nairobi, Kenya.

The Andersons Cereal and Oilseeds Awards of Excellence

Nadia Gkritza

Leadership Award, 15th Annual Engineering Faculty Awards of Excellence, February 16-17, 2017

Monika Ivantysynova

Honorary doctorate from Lappeenranta University of Technology, February 13, 2017

Indrajeet Chaubey

Named Associate Dean and Director of International Programs in Agriculture, January 25, 2017

Named ASABE Fellow

Dennis Buckmaster

2016-2017 Learning Community Student Impact Award

Appointed as a Dean's Fellow for Digital Agriculture, College of Agriculture

Margaret Gitau

2017 College of Engineering's Graduate Mentor Award for ABE

Distinguished Ag Alumni

The Purdue Distinguished Agricultural Alumni Award is presented by the College of Agriculture to mid-career Purdue Agriculture graduates who have made significant contributions to their profession, or society in general. ABE is proud to have a number of awardees. For a full listing, visit ag.purdue.edu/agalumni and click on Alumni Awards.

JANE L. LAVEY

The 1992 Purdue graduate joined Eli Lilly as a technical services representative, then moved to Quality Assurance. She was promoted to the Elanco Animal Health and Bulk Pharmaceutical Manufacturing group and became a senior quality standards associate, then an associate consultant in Clinical Trial Supply Operations. In 2010, she joined Fisher Clinical, where she created quality system documentation for Drug Product Trial Support; that earned her the Product R&D Operations Group Achievement Award, and she was promoted to quality assurance representative. Since August 2012, Ms. Lavey has been a food safety and compliance specialist with Nestle USA. She manages the quality training programs and investigates consumer complaints.



Outstanding Alumni

Each spring, the ABE Department presents the Outstanding ABE Alumnus Award to select alumni. The award is based on significant contributions or marked success in their chosen career field and is typically given mid-career. This year's honorees:



RICHARD W. DEAN II, BS AE 1981

After 35 years of engineering expertise in the armed forces, federal and private sectors, the retired U.S. Army Reserve Command colonel is the director of engineering at National Defense University in Washington, D.C. He was responsible for the construction of the Korean War Veterans Memorial on the National Mall and renovation projects at the Kennedy Center for the Performing Arts. He was key in the design and construction of Camps Gjilane and Bondsteel in Kosovo. For more than 25 years Mr. Dean has led semiannual construction projects at a Boy Scouts camp at Goshen, Virginia.



DALE A. GICK, BS AE 1993

Since July 2012, the Fowler, Indiana, native has been director of the Division of Engineering for the Indiana Department of Natural Resources. He returned to Indiana in 2008 after stints with the Illinois State Water Survey and EDS in Pennsylvania. Mr. Gick has been an IDNR engineer and manager for more than 20 years. He earned his PE designation in 2001. A recipient of the 2011 Governor's Public Service Achievement Team Award, he's an active volunteer with his sons' Boy Scout troop. He married Erin in 1994, and they have two sons.



ANNA HAYES, BS BFPE 2007, MS ABE 2008

A second-generation Boilermaker from southern Indiana, she had internships with Kellogg and General Mills' research and development units. At General Mills, her efforts resulted in \$3 million of productivity and trans-fat removal from Totino's™ products, and she was promoted to Manufacturing Reliability. Her passion for experimentation led her back to R&D, and she was the lead developer for the national launches of Nature Valley Nut Clusters and Chex Chips. She has been with Mead Johnson Nutrition since late 2017 and earned a Lean Six Sigma Green Belt in 2016. Anna and her husband, Garth, have two children.



DAVID J. (DAVE) KOELLISCH, BS AE 1994

The New Jersey native has been with Parker Hannifin since 2006, first as an automation territory manager, now as a cylinder application engineer for the Ohio Valley region. His duties include training distributors in the proper implementation of hydraulic and pneumatic cylinders. Previously, he was with TRW, and he was awarded five patents for truck steering components. Mr. Koellisch is a Six Sigma Green Belt and was awarded the Automation Group's Diamond Team Award for leadership and sales growth. He and his wife, Meredith, have two children. He's an Eagle Scout and a Scoutmaster.



TED S. MACY, BS AE 1976, MS AE 1980

His years at Purdue whetted his interest in computers and programming, and he has long been an advocate of open sharing of agricultural data. By 1991, he had written software to develop and apply variable-rate fertilizer, lime, and seeding prescriptions on a 2,000-acre farm. He started Applications Mapping to develop the popular AgLink software, then merged with AGRIS Corp. He went on to form MapShots, developing EasiSuite software and the current AgStudio product and the Pioneer HiBred Field360 Studio. In 2009, he and his wife, Nancy, sold MapShots to DuPont Pioneer, where he remains a key architect.



JOHN M. SHUTSKE, BS 1983, MS 1984, PHD 1988, ALL ASM

He was chosen as the Outstanding Graduate Instructor while pursuing his first two Purdue degrees. He landed at the University of Minnesota and UM Extension, where he was an agricultural public health and safety engineering specialist and professor. Mr. Shutske has been a project director for the National AgrAbility program, which helps farmers with disabilities. Since 2008 he has been with the University of Wisconsin College of Agricultural and Life Sciences and the UW Cooperative Extension Service, including eight years as associate dean for Extension and Outreach and an 11-month stint as the interim provost.

Help us choose more Outstanding Alumni

We invite your nominations for future honorees. Visit purdue.ag/abe-outstanding-alumni or contact Carol Weaver cmweaver@purdue.edu for additional information.

Outstanding Students 2016-2017



ANDERSON SMITH

In the classroom: Senior; Agricultural Engineering, with focus on Environmental and Natural Resource Engineering; minor in Global Engineering; certificate in Entrepreneurship and Innovation.

On/off campus: Two years as president of the ABE Ambassadors; member of ASABE chapter and Alpha Epsilon Club. With the GEARE Cohort (Global Engineering Alliance for Research and Education); in 2016, spent seven months in Colombia piloting a study abroad program at the Universidad del Norte and working as an industrial engineering intern at Ensacar S.A. Was on the senior design team that won Indiana Soybean Alliance's Soybean Product Innovation Competition; received provisional patent for a soy-based air filter.

What's ahead: After graduation, two years in the Orr Fellowship, a developmental program; will be full-time employee at KSM Consulting, a strategic business consulting firm in Indianapolis. Then, a master's degree in engineering, and an MBA.



AUSTIN BITTING

In the classroom: Senior; Agricultural Systems Management; minors in Farm Management and Crop Science.

On/off campus: Involved with ASM Club, Purdue Diesel Club, Purdue Quality Deer Management Association club,

Alpha Mu Honor Society, Alpha Zeta Honor Society. Interned at Kingdom Ag Concepts Inc., of Bremen, Indiana, during the summer after his junior year; worked with an engineer building and testing a new design of stalk rolls for combine corn heads.

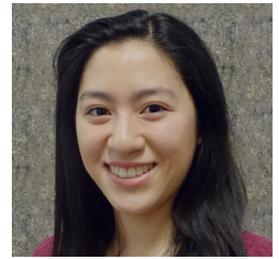
What's ahead: After graduation, joined Kingdom Ag Concepts as a product development specialist.

HANNA TSO

In the classroom: Senior; Biological Engineering; on pre-med track.

On/off campus: Active in Beerling Scholars Student Association, Mortar Board, and club tennis. Conducted research as an intern at the National Institutes of Health for the past few summers. Co-authored a paper in the Journal of Clinical Microbiology. Worked last summer on a retinal tissue engineering project as an intern at the National Eye Institute.

What's ahead: Now attending the Indiana University School of Medicine at the West Lafayette campus.



JARED BEDEL

In the classroom: Junior; Agricultural Systems Management; minors in Crop Science and Farm Management.

On/off campus: Member of Alpha Mu Honor Society; Ag Council representative for the ASM Club.

What's ahead: After graduation, will pursue a career in ag retail or ag equipment industry.



MARK GEE

In the classroom: Junior; triple major in Biological Engineering, Biochemistry, and Agronomy; his biological engineering focus is biomolecular and cellular engineering.

On/off campus: Iowa native has hands-on growing experience; interned at international ag research stations in Mexico and India for seven months before starting college. At Purdue, he has been involved with research projects studying plant epigenetics and advanced phenotyping. Last summer, he interned at DuPont Pioneer for the fourth time (maize pollinator in the field; entomology; company's Government Affairs office in Washington, D.C.; in engineering group for automated phenotyping.)

What's ahead: Goal is to become an expert in plant biochemistry and help improve crop options, optimize biological systems, and implement sustainable practices in agriculture.





PETER RUSCHE

In the classroom: Junior; Agricultural Engineering, with a focus on Environmental and Natural Resources Engineering.

On/off campus: Vice president of agricultural engineering for the ABE Ambassadors. Executive director of

men’s recruitment for Purdue Cooperative Council. Member of Fairway Cooperative. For two summers, worked for Hancock County Surveyor’s Office. Last summer, worked for Dr. Keith Cherkauer at Purdue.



KATIE CARNAHAN

In the classroom: Sophomore; Agricultural Systems Management.

On/off campus: Member of ABE Ambassadors, Alpha Mu Honor Society, and secretary of the ASM Club. Interned last summer at

Helena Chemical Co. (was returning Intern of the Year.)

What’s ahead: After graduation, a career in precision agricultural sales.



MARGARET HEGWOOD

In the classroom: Sophomore; Biological Engineering, with a focus on Cellular and Biomolecular Engineering, minor in Biotechnology.

On/off campus: Member of Society of Women Engineers

and National Society for Collegiate Scholars. For Purdue’s Global Engineering Programs, is office assistant and undergraduate course assistant to the Global Engineering Cultures and Practice Learning Community. With the Innovation for International Development (I2D) Lab, volunteers with the Mandela Washington Fellowship’s Young African Leaders Initiative. Conducts personal research with a Global Design Team for Quality Medicine Testing in partnership with the Kilimanjaro School of Pharmacy in Tanzania. In fall 2016, was one of 11 Emerging Leader Interns to work for the Land O’Lakes Inc. Global Food Challenge Program; in March 2017, represented Land O’Lakes and Purdue as a Next Generation Delegate for the Chicago Council’s Annual Global Food Security Symposium in Washington, D.C. Last summer worked with Land O’Lakes in Arden Hills, Minnesota. There’s more: Read her story on Page 16.

ZANE GOTTSCHALK

In the classroom: Sophomore; Agricultural Engineering, with a concentration in Machine Systems.

On/off campus: Involved with the Alpha Zeta Honor Society, the American Society of Agricultural and Biological Engineers, the Purdue Society of Professional Engineers, and Alpha Gamma Rho fraternity. Works for Caterpillar in its Lafayette plant through a parallel co-op program.

What’s ahead: After graduation, a career in the agricultural industry, designing and manufacturing advanced equipment.



JONATHAN NEFF

In the classroom: Freshman; Agricultural Systems Management.

On/off campus: ASM Club, Purdue Diesel Club; member of the Agricultural Technology and Innovation Learning Community. Runs his own small engine repair business.



ADAM HEMMELGARN

In the classroom: Freshman; Agricultural Engineering, with a concentration in Machine Systems. Working toward earning a Certificate of Entrepreneurship and Innovation through the Krannert School of Business.

On/off campus: With Wesley Foundation, is service chair on the student leadership board. Plays in the Purdue Collegiate Band. Attends ASABE Club meetings.

What’s ahead: After graduation, a design job with an agricultural equipment manufacturer.



Student Awards

Margaret Hegwood

Land O'Lakes 3rd Cohort of the Global Food Challenge
— Emerging Leaders for Food Security program

Anderson Smith

Orr Fellowship from KSM Consulting

Riccardo Bianchi

2016 SAE Excellence in Oral Presentation Award
from the Commercial Vehicle Engineering Congress

**Jake Feller, Ryan Fletcher, Candace Popp,
Alex Reutmann, Dustin Stevenson**

1/4-Scale Maneuverability Award

Suraj Mohan

iGEM Giant Jamboree Silver Medal

**Will Field, Zane Gottschalk, Brady Need,
Jacob Tyler, Katie Carnahan, Kolt Kinsler**

FFA American Degrees

**Barbara McAnulty, Kathryn Atherton,
Madalyn Alm**

1st place, Undergraduate Research and Poster
Symposium Awards, College of Agriculture

**Andrew Huang, Sushant Mehan,
Samaneh Saadat, Anderson Smith**

Winning team, Indiana Soybean Alliance Student
Soybean Innovation Competition, for FiltraSoy (air
filter media)

Yi Li, Stuart Smith

Magoon Award

Julie Burchell

College of Engineering, Outstanding Service
Scholarship

Ning Xiang

College of Engineering, Outstanding Researcher
Award

Jessica Zuponic

ABE Outstanding MS Student

Pushpak Bhandari

ABE Outstanding PhD Student

Patents

Dr. Jenna Rickus. June 13, 2017: Patent No. 9,677,065. Cell-Mediated Silica Sol-Gel Encapsulation of Living Cells and Tissues.

Gary Krutz, Brittany Newell. May 31, 2017. Patent No. 9,683,663. Electroactive actuators, systems equipped.

(Alva Peled), Bernard Tao, (Samia Mohtar.) November 22, 2016. Patent No. 9,499,444. Alkyl ester polystyrene blends for use in concrete.

Michael Ladisch, (Ximenes Eduardo.) May 16, 2017. Patent No. 9,651,551. Methods and systems useful for foodborne pathogen detection.

ASABE Awards

Annual international meeting, summer 2017

Al Heber

Superior Paper: "Odor and Odorous Chemical Emissions from Animal Buildings: Part 3, Chemical Emissions," Transactions of the ASABE 58(5): 1333-1347

Natalie Carroll

Blue Ribbon for Comprehensive Publication, "Soil and Water Science"

Femeena Pandara Valappil

Ethics Video Challenge winner

Kingsly Ambrose

Educational Aids Blue Ribbon Award, "Training on Prevention of Grain Dust Explosions"

Dharmendra Saraswat

Educational Aids Blue Ribbon Award, "SWAT Tools"

Amber Wolfe, William Field, Paul Jones, Stephen Swain, Jon Smith, Dawn Minns

Educational Aids Blue Ribbon Award, "Arthritis and Gardening: A Guide for Home Gardeners and Small-Scale Producers"

Clifford Racz, Paul Jones, William Field, Dawn Minns

Educational Aids Blue Ribbon Award, www.agrability.org

Garett Pignotti

Outstanding NRES Oral Presentation

Help us remember

Since the 1930s, the ABE building has been home to students, faculty, and staff as they teach, learn, conduct research, and solve problems. Though we are not saying goodbye to our building, we are preparing for demolition and renovation. When we return, only the outside appearance will be unchanged.

What is your favorite memory of the ABE building? Did you have a favorite place to study, to gather, to sleep? There is a lot of history here—your history—and we don't want to lose it. Drop us a line, give us a call, send us pictures. We want to tell your story—major events and everyday life, too.

Go to purdue.edu/ABE and click on "Building History," or send an email to cmweaver@purdue.edu.



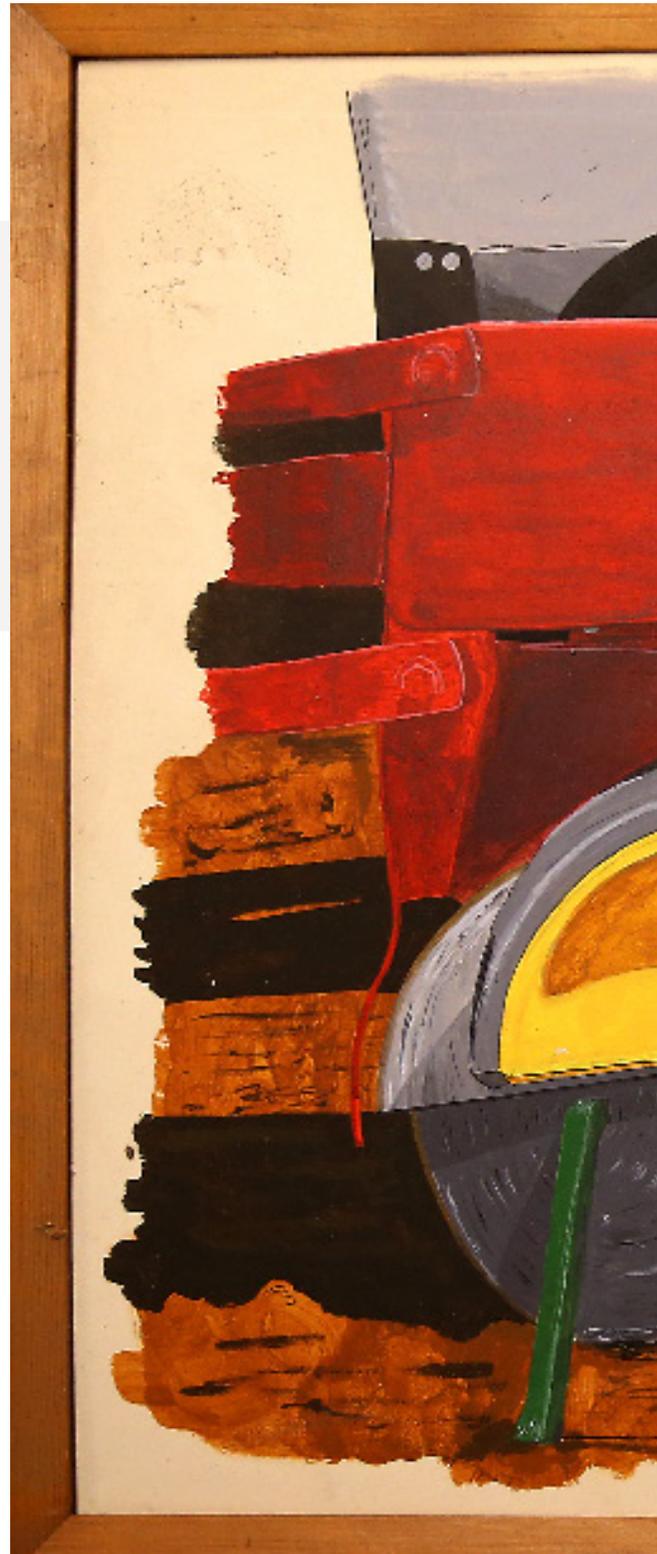
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Stay in touch

We are always looking for news about our alumni and friends.
Please send updates and news items to Carol Weaver,