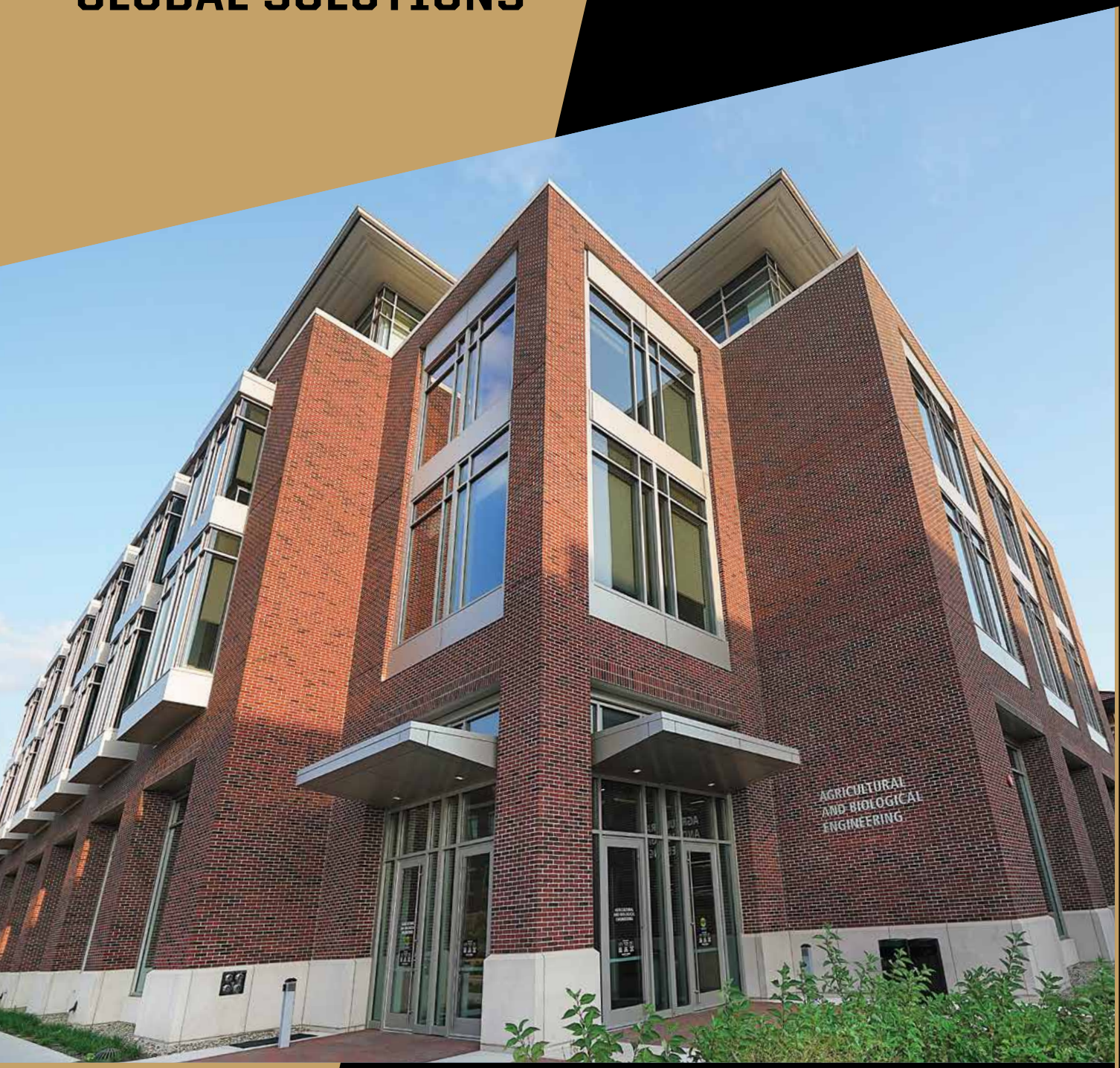
PURSUING
GLOBAL SOLUTIONS



PURDUE UNIVERSITY | Agricultural and Biological Engineering

THE DRIVE [redacted] ACHIEVE

The past year has been one with many things to celebrate. We were very pleased to celebrate the dedication of the new ABE building in September 2021. We were fortunate to be able to welcome back, in person, many friends, alumni, and other visitors to the building and the new spaces and opportunities it provides. Our students have found good uses for the study and collaboration spaces in the building. I see students working together on course projects and homework day and night! Our new research spaces are enabling cutting-edge research spanning from ecological restoration, water modeling, digital applications in agriculture, sensors, automation, bioprocess engineering, and biological engineering. If you are going to be in West Lafayette in the future, please let us know. We'd love to show you around!

We also celebrated our #1 ranking by US News and World Report for our graduate programs for what has been an incredible streak of 13 of the last 14 years in the top slot!

For the first time in the new building, we were able to celebrate our soon-to-be new graduates with their senior capstone poster presentations and other student awards on April 21. A more complete summary of these student accomplishments is included in this issue.

We also celebrated a number of our faculty for outstanding research and discovery that is making big impacts in agriculture. Dr. Chaterji, Dr. Verma, and Dr. Singh are all making breakthrough discoveries that are improving the productivity, connectivity, and health of agriculture!

We have much to be thankful for at Purdue ABE, especially the support of our alumni and the impacts they make in food, water, energy, and health. Thank you!

Dr. Nathan Mosier
Department head of Agricultural & Biological Engineering

◀ **From the Cover:** A view of the newly dedicated ABE building.

BY THE *NUMBERS*

#1 UNDERGRADUATE PROGRAM

FOR 11 YEARS RUNNING

US NEWS AND WORLD REPORT

#1 GRADUATE PROGRAM

FOR 13 OF THE LAST 14 YEARS

US NEWS AND WORLD REPORT

$100,000+

SCHOLARSHIPS AWARDED

15 FACULTY & STAFF

IN MILLIONAIRE CLUB

AWARDED MORE THAN
$1 MILLION IN 2021

PART OF 2 NATIONALLY RANKED COLLEGES

#4 IN ENGINEERING AND #4 AGRICULTURE

US NEWS AND WORLD REPORT
QS QUACQUARELLI SYMONDS

95% JOB PLACEMENT

1 YEAR AFTER GRADUATION

SUPPORT ABE TODAY!

OUTSTANDING STUDENTS

ABE recently recognized many of our outstanding students at the 2022 Spring Awards. Alumni, scholarship winners, and exemplary students were acknowledged. Each student was awarded the top departmental prize. We applaud their academic accomplishments as well as their level of engagement in clubs and organizations.

JUSTIN JOHNSON · SENIOR

Justin Johnson is studying Ag Systems Management and Farm Management with a minor in Crop Science and is the son of Brian and Colleen Johnson. Justin was the 2018 Collegiate Farm Bureau Discussion Meet State Winner and the 2021 Indiana Young Farmers and Ag Professionals Discussion Meet State Winner. He works for TTG Equipment as an Integrated Solutions Precision Ag Consultant, and is a part of the Ag Technology and Innovation Community while also being involved as Alpha Mu President, Purdue Ag Ambassadors, and Collegiate Farm Bureau. He's received the Barbara Jennings Memorial Scholarship, Marquardt Farm Scholarship, and Farm Bureau District Scholarship.

HEIDI PHELPS · JUNIOR

Heidi Phelps is double majoring in Agricultural Systems Management and Agribusiness Management. Heidi is the daughter of Craig and Amy Phelps from Groveland, New York. She was the Agricultural Systems Management 2021 Sophomore of the Year, and an Alpha Mu Honors Society Member. Heidi was a farm hand for Edgewood Farms, an Agronomy Intern for Pence Group, an Operations Management Intern for Cargill, and a Student Receptionist at the Purdue Graduate Student Center. She is an ABE Ambassador, ASM Club member, Purdue Western Equestrian Team member, and Ag Tech and Innovation Learning Community Scholar.

NOAH BERNING · SOPHOMORE

Noah Berning is working towards a dual degree in Agricultural Systems Management and Agricultural Economics, with minors in Farm Management, Food and Agribusiness Management, Organizational Leadership, and Data Driven Ag. He is the son of Mark and Pamela Berning and a resident of Monroeville, IN. While at Purdue, Noah has been involved with Ag Ambassadors, Grand Prix Foundation, Farmhouse Fraternity, ASM Club, Agronomy Club, ABE Ambassadors, and undergraduate research with Dr. Dennis Buckmaster and Dr. Shawn Ehlers.

JOSHUA MARIANI · FRESHMAN

A native of Rockville, Maryland, Joshua Mariani is currently pursuing his degree in Pre-Agricultural and Biological Engineering. Joshua is the son of Richard and Tamara Mariani, and a member of the College of Agriculture Dean's Scholars Program, the Honors Queer Community, and the Honors College, as well as the Purdue Student Farming Organization and Environmental Science Club. He was a Purdue Student Government Associate Member and Director of Technology in the fall of 2021 and is currently a PSG College of Agriculture Senator.

CHOOSING TO SERVE

AN ABE GRADUATE STUDENT'S GOAL AS STUDENT TRUSTEE

Written by: Emma Ambrose

"When I started in Purdue Agriculture as a freshman I never imagined I'd be returning to this school, seven years later, as a student trustee," Mark Gee said.

Gee, who is pursuing his master's degree in ABE, was appointed as student member to the Purdue University Board of Trustees in June. In this role, Gee speaks for concerns most pressing to the student body and has an equal vote on all actions taken by the board.

A global pandemic and the largest freshman class ever at Purdue set an interesting stage for Gee's first few months as a trustee. He is working to ensure he has a grasp on current student issues and presents them to the board in ways that effect change and improve student life.

"As an example, I was at a football game and ended up talking to a woman in the ROTC program," Gee said. "The biggest issue for her is access to parking. She's busy, doesn't always have time to hunt for a space and her life would be greatly improved by better access."

Aside from day-to-day issues, Gee said he is providing the student perspective on issues Purdue and most universities are facing in the wake of COVID-19 and remote learning.

"What does education look like going forward from this? How do we build a semester that uses all we learned during the pandemic to give students more flexibility and balance," Gee continued.

Another major topic Gee plans to work on during his three-year term is diversity, how to increase it at Purdue and how to ensure underrepresented students at the university feel supported. He thinks that the College of Agriculture has a lot to contribute in this area.

> **"My goal is to help support the DEI initiative while relying on the life experience and professional expertise of others to lead the way. When I think of Pamala Morris and all the excellent work done by the college's Office of Multicultural Programs, I feel like they can be a shining example for the rest of the university."**
>
> *— Mark Gee, graduate student in ABE*

Serving as a student member allows Gee to give back to the university he feels gave so much to him, as a premier research institution and incubator for innovation.

Outside of the boardroom, Gee is part of some ground-breaking research himself. He works with agronomy professor Mitch Tuinstra and ABE assistant professor Jian Jin on predicting water content in plants using hyperspectral imaging. A major component of this research, Gee added, is building algorithms to analyze all the data that gets collected in a rapid and coherent manner.

"It's like my role as student trustee. I have to try to gather as much information as possible and then condense and analyze in a way where we can draw some conclusions and, hopefully, take meaningful action."

SAVING THE CATTLE INDUSTRY MILLIONS

USING A PEN-SIDE TEST FOR BOVINE RESPIRATORY DISEASE PREVENTION

Written by: Elizabeth Gardner

Sous-vide cooking inspired an idea that took promising technology out of the lab and into the barn. Researchers at Purdue University successfully developed an on-site bovine respiratory disease test that provides results within an hour.

The team of researchers has been steadily advancing the point-of-care technology to address the disease, which is the most common and costly disease affecting cattle in the world.

"We wanted to see if the technology is tough enough for the farm and how messy we could get," said Mohit Verma, assistant professor of agricultural and biological engineering, who led the research. "We weren't overly cautious with cleanliness because we want the test to be easy to use. Respiratory disease can quickly spread from animal to animal, and it can be devastating. Quick diagnosis leads to the proper treatment and reduces unnecessary use of antibiotics."

The team also added an easy-to-read color change from red to yellow to indicate the test results, he said. A paper detailing the work was published in the journal Veterinary Research.

"We've been working to improve our test to get it out of the lab and into the hands of farmers and veterinarians, and it worked very well in the field," Verma said. "One key to achieving this advancement was using a sous-vide water bath to maintain the temperature needed for it to work, around 149 degrees Fahrenheit. My brother was doing sous-vide cooking and the idea just clicked. It is something easy to bring to a farm, fill with water and allow the test to be run."

Bovine respiratory disease, or BRD, is responsible for half of all cattle deaths from disease in North America and costs the beef industry $900 million annually, he said. Several strains of bacteria and viruses can cause the disease, which makes it difficult to effectively treat.

"Some of the bacteria that cause BRD have become resistant to certain antibiotics," Verma said. "Unfortunately, because the standard test can take several days to provide a result, the farmers need to treat the cattle before they know the pathogen responsible. This can lead to use of an ineffective antibiotic or overuse of antibiotics."

The technology created by Verma's team can identify three strains of bacteria among the top four that cause BRD: *Pasteurella multocida*, *Mannheimia haemolytica*, and *Histophilus somni*.

A nasal swab collects the needed sample, and the swab is put into a small vial with corresponding primers and reagents, developed by the team, that serve as biosensors for the bacteria. The vial and its contents, which is called an assay, are heated in the water bath to enable the chemical reactions. If the bacteria for which the test is designed is present, the assay changes color.

The technology tests for DNA from the bacteria and uses a method of nucleic acid amplification called loop-mediated isothermal amplification, or LAMP. When the bacterial DNA is present, LAMP amplifies it. As the level of nucleic acid increases, it changes the pH of the assay, which triggers the color change.

The advantage of LAMP over other methods is that it does not require extraction and processing of the samples, which can be lengthy and expensive, and it produces results in under an hour, Verma

said. Its results matched those from a polymerase chain reaction, or PCR, test 60%-100% of the time.

Verma and his team advanced the technology to this stage through a $1 million USDA-NIFA grant. In a parallel project, Verma is using the same technology for a saliva-based test for COVID-19. The BRD technology is part of his startup company, Krishi Inc. The startup received $100,000 from the Purdue Ag-Celerator fund earlier this year.

> **My brother was doing sous-vide cooking and the idea just clicked. It is something easy to bring to a farm, fill with water and allow the test to be run."**
>
> *—Mohit Verma, assistant professor of Agricultural and Biological Engineering*

The next step in their pursuit of putting the technology into the hands of veterinarians and farmers is to develop paper test strips. These strips could include multiple assays, such that one strip could identify the presence of several different pathogens. They also plan to apply the same approach to tests for other infectious diseases in cows and pigs, and to investigate the potential for detecting food contamination.

"This platform is very versatile," Verma said. "We just need to change the matrix we are using – develop new primers and assays – for different pathogens. We are working to apply our technology to address other health issues, and we believe it has potential for quick detection of new viruses to help prevent global pandemics."

SPOTLIGHT

UNDERGRAD STUDENT

HEIDI PHELPS · JUNIOR

Major: Agricultural Systems Management Major

Graduation: Class of 2023

Hometown: Groveland, New York

Heidi Phelps, a junior in Agricultural Systems Management (ASM), grew up on a farm in an agricultural community in New York. As she was deciding what to study, she could not imagine her life without agriculture. She chose ASM as a major because she loves the constant change and innovation in agricultural technology. Heidi visited several of the top agricultural universities in the Midwest and on the east coast, but ultimately chose Purdue because she felt at home when visiting and the opportunities at Purdue seemed endless.

The transition to Purdue University from her small town in New York has been one of the biggest changes and best experiences thus far. That journey began when she participated in Boiler Gold Rush orientation. Once classes started, she discovered the Purdue Western Equestrian Team, which allowed her to continue enjoying one of her passions and find friends who shared her love of horses.

Heidi spent this spring semester studying at University College Dublin. She has been able to see and experience both Irish culture and the cultures of her international classmates.

"I am so thankful for all these experiences I have had at Purdue. With every step I take out of my comfort zone, whether it be an internship, a club or activity, or studying abroad, I am rewarded with great friends and expanding my knowledge of the world.

"The most important part of your transition to college is to allow yourself to grow. Step out of your comfort zone and meet new people. Choose a university where you can see yourself as a student, imagine yourself studying in a café or taking courses. And if it feels right, go for it and give it your all. Make the most of the opportunities available and be true to yourself."

Great advice for any college student.

THE FUTURE OF MEDICINE

FROM SOIL-DWELLING BACTERIOPHAGES TO PRESIDENT MITCH DANIELS

AT PURDUE UNIVERSITY, UNDERGRADUATES GET TO GET THEIR HANDS DIRTY IN THE LAB. METAPHORICALLY, OF COURSE — THEIR HANDS AND LABS ARE CLEAN, BUT THEIR UNDERSTANDING OF THE IN-DEPTH COMPLEXITIES OF THE RESEARCH PROCESS AS AN ORGANIC AND OPPORTUNISTIC PROCESS IS RICHLY ROOTED IN LIVED EXPERIENCE.

During the pandemic, students and their professors adapted to ensure that students continued to get hands-on practice, discovering new, potentially therapeutic viruses – including one lightheartedly named for President Mitch Daniels.

Undergraduate courses ABE 226 Biotechnology Laboratory I and ABE 227 Biotechnology Laboratory II typify that learning experience.

"Without this course, I would have never been able to fully understand the vast effort behind making scientific discoveries," said course graduate Ekta Singh.

The courses are designed for undergraduate students of any major who want research experience. Students work with mycobacteriophages. Also called "bacteriophages," or simply "phages," they are types of viruses that destroy bacteria cells by infecting them and reproducing inside them. Selected and wielded

One lab group honored its Boilermaker pride by naming its bacteriophage after a Purdue pillar. The bacteriophage's colloquial nickname, "DaddyDaniels," is an homage to "Daddy Warbucks" of "Annie" fame and a salute to Daniels for 11 years of frozen tuition. The lab group formally presented their research to Daniels in person.

strategically, bacteriophages can help treat bacterial infections in humans that have become resistant to antibiotics. Students in the class recently named one of their bacteriophages for President Mitch Daniels.

During the fall of 2020, professors weren't even sure if the class would be possible while keeping everyone safe. Student leaders within the class stepped forward to work out ways for lab partners to cooperate safely on studying bacteriophages.

One lab group honored its Boilermaker pride by naming its bacteriophage after a Purdue pillar. The bacteriophage's colloquial nickname, "DaddyDaniels," is an homage to "Daddy Warbucks" of "Annie" fame and a salute to Daniels for 11 years of frozen tuition. The lab group formally presented their research to Daniels in person.

The research course begins by having students sample their environments – everywhere they can think of, but primarily places with soil – to find bacteriophages that have adapted to attack one of their target viruses. The phage that became known as the DaddyDaniels phage was found in a raised mulch bed outside of an apartment building off campus. Students then isolate, study and catalog the bacteriophages including mapping their genetic code.

The professor emphasized that the trial-and-error nature of research is both a vital part of the process as well as an important lesson the students learn: Not every experiment comes out "right" the first time.

"This course is an excellent way to engage students in what we know from the literature and to help them learn these kind of skills and capabilities from an authentic science perspective," said Kari Clase, a professor of agricultural and biological engineering and one of the course instructors. "It's an opportunity to practice and explore where it's safe to fail. We teach them that failure is part of the process and how to learn from it and thrive."

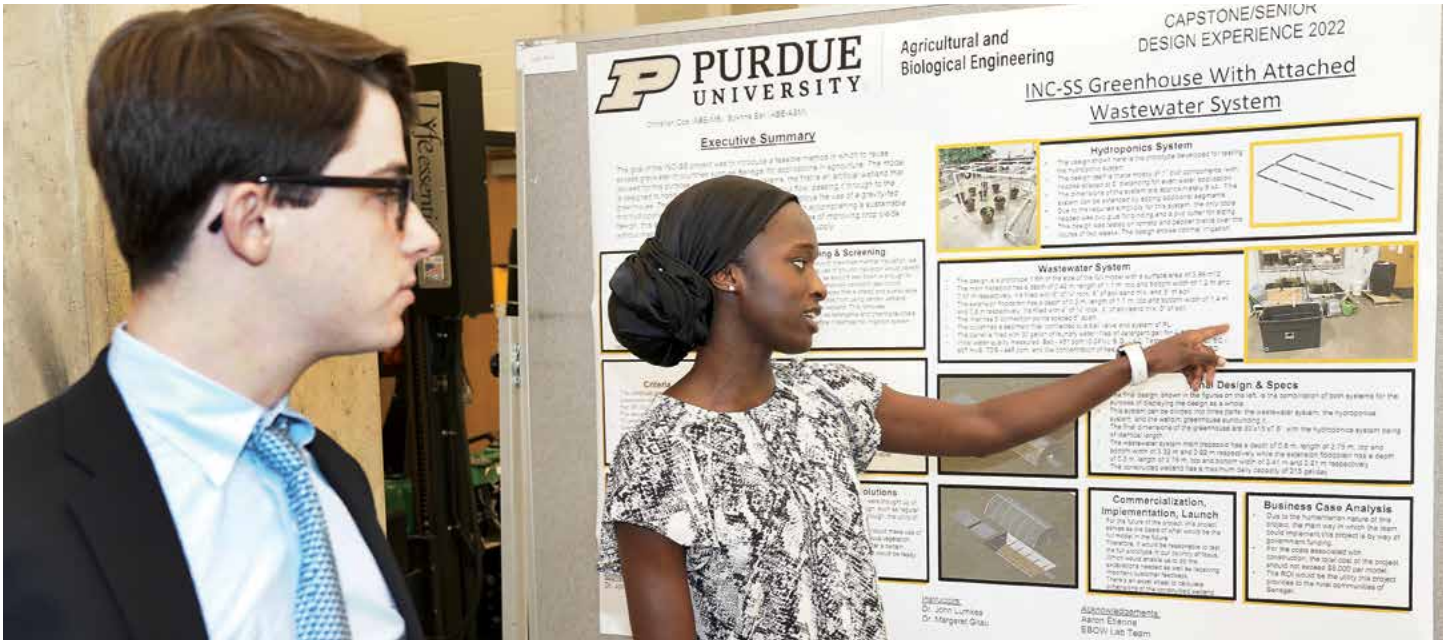
The research started in this class can also directly affect students' careers and futures. Many alumni credit the course with enabling them to pursue internships and careers in the pharmaceutical field. For those who don't pursue a research field, the experience enriches their outlook and offers them insight as they pursue careers as engineers, doctors, health professionals and more.

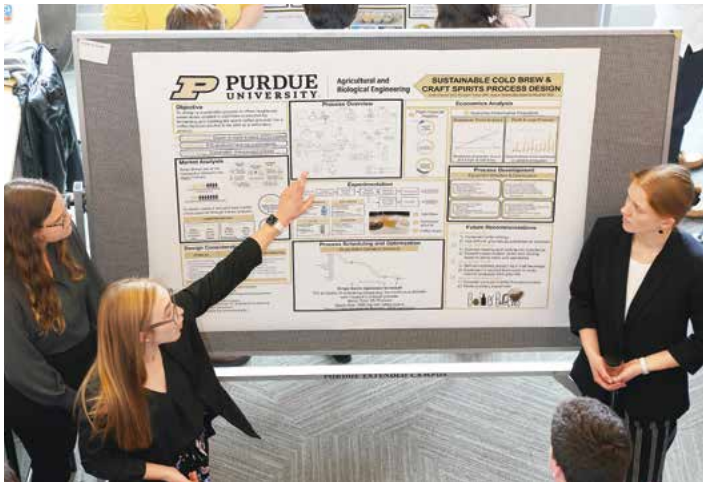
The discovery and the naming of the DaddyDaniels bacteriophage drew accolades from both Boilermaker students and parents, especially given that it happened in the heart of the pandemic, when Purdue was working tirelessly to promote learning in innovative ways while protecting the health of Purdue's people and community.

"The ABE 226 and 227 courses gave me a supportive space to explore all and any of my academic curiosities," said former course student Rebecca Slaughter. "Because of my research and teaching roles in the course, I was able to conduct research in other Purdue laboratories, gain technical laboratory and computational skills and learn how to effectively share my knowledge with my peers. From these courses, I was able to obtain two research-based internships in the biopharmaceutical industry and multiple job offers. I am forever grateful for the experiences I was able to gain from this course."

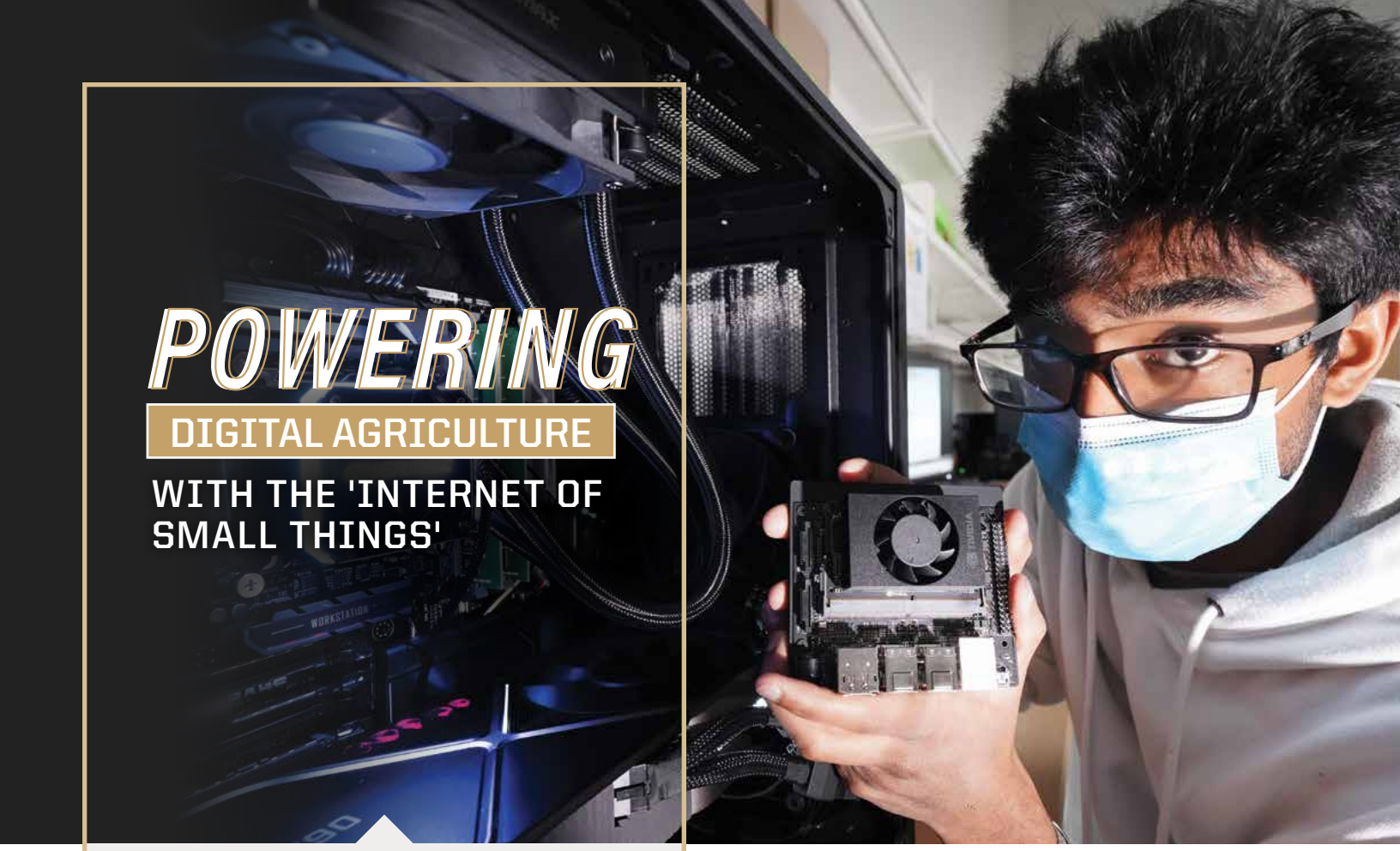
ABE CAPSTONE PROJECT

PREPARATION FOR THE NEXT GIANT LEAP





THE AGRICULTURAL AND BIOLOGICAL ENGINEERING ACADEMIC CAREER CULMINATES IN THE CAPSTONE PROJECT. WE'RE GRATEFUL TO THE ALUMNI WHO RETURN TO HELP JUDGE THOSE PROJECTS. THE ENGAGEMENT BETWEEN THE ALUMNI AND GRADUATING SENIORS IS INVALUABLE. THANKS TO ALL OF OUR ALUMNI FOR BEING THERE AS OUR STUDENTS PREPARE FOR THEIR NEXT GIANT LEAP!



POWERING DIGITAL AGRICULTURE WITH THE 'INTERNET OF SMALL THINGS'

ROVERS PATROL ROWS OF CROPS AND DRONES MONITOR FROM ABOVE ON FARMS ACROSS THE U.S. BUT TO REALIZE THE FULL POTENTIAL OF DIGITAL AGRICULTURE, THESE SYSTEMS NEED TO BECOME MUCH MORE EFFICIENT, SCALABLE, AND RESILIENT.

Written by: Elizabeth Gardner

Data engineering expert Somali Chaterji *(left)* is pursuing these advances with support from a National Science Foundation Computer and Information Science and Engineering Directorate (CISE) CAREER Award.

Chaterji, assistant professor of agricultural and biological engineering, earned the $550,000 award for her proposal titled "Robust and Adaptive Streaming Analytics for Sensorized Farms: Internet of Small Things to the Rescue." She named the project Sirius, after the brightest star visible from Earth at night.

"I want this project to shine a light on cyber-physical systems and make them more capable," said Chaterji, who is a member of Purdue's Center for Resilient Infrastructures, Systems, and Processes (CRISP) and

The Open Ag Technology and Systems Center (OATS). "By 2025, there will be 38.6 billion connected devices worldwide – held in the palm of our hand, flying in the air, roving on the ground, or embedded in the soil. We want to make these devices not just data collectors, but intelligent devices performing their own data analysis and making quick, local, and efficient decisions."

Chaterji's goal is to create what she calls "The Internet of Small Things," a network of small devices to make data collection, analysis, and actuation more sustainable, she said. To achieve that goal, Chaterji is working to incorporate machine learning applications and on-device computation into a variety of devices used in computer vision with applications in agriculture, surveillance, and automation.

For example, through Sirius technology, drones will determine their own optimal trajectories, reducing wasted battery power and recharge time; and rovers moving around a field sensing soil and plant conditions will be able to determine and apply the precise amount of water and nutrients needed.

Perhaps most importantly, Sirius will enable the devices and network to refine and reduce data transmission, which accounts for the bulk of energy consumption by networked devices, through on-device intelligence, she said.

"Our innovation distributes the computation and each device can decide to transmit only the useful quanta of data instead of a giant data deluge," she said. "Improved efficiencies like these will benefit the farmers and the environment by reducing the frequency of charging these devices and decreasing the reliance on cloud computation and data centers."

Chaterji also is director of the Innovatory for Cells and Neural Machines (ICAN) at Purdue and is on the leadership team for the Wabash Heartland Innovation Network (WHIN).

"Drones and static and mobile sensors gathering data about moisture, temperature, carbon and pH levels, and plant health are out there on the farms," she said. "This technology will bring them together as a network and optimize the data analysis and use of computational resources. Multiple farms could be linked to share data as well, while preserving privacy, leveraging decentralized learning on mobile devices."

Chaterji said the big question she wants to answer is: As these devices become smaller and multipurpose, can I approximate the heavyweight data analysis algorithms so that they fit the devices?

"These small devices don't have the memory or computing power of a data center. Instead of up-sizing the devices, let's right size the algorithms," she said. "This approach will be faster and will decongest the network channels, which is increasingly a problem with the ubiquity of mobile sensing devices. The network can adaptively decide how much to compute on the sensor, how much on the edge devices, and how much on the cloud."

The Sirius project also aims to create a network that can monitor its own devices. Using the cyber fingerprint of each device, the system can determine if a device is failing or is compromised.

"This was an idea raised by Microsoft, and my collaboration with Microsoft Azure exposes me to the latest in anomaly detection software, as well as to edge computing infrastructure," she said.

Ranveer Chandra, managing director at Microsoft Research, praised the Sirius project in a press release, saying, "This work is innovative as well as timely. Somali is in a unique position to bring together her insight in IoT and federated data analytics to the application domains of drone surveillance and sustainable agriculture."

Chaterji working with her graduate students.

MAPPING

THE RELATIONSHIP BETWEEN

INDUSTRY AND THE ENVIRONMENT

Written by: Elizabeth Gardner

A new tool finds hidden connections across industrial sectors and identifies opportunities to reduce waste and lower carbon emissions by mapping the physical economy for a region.

"The climate and the economy are too important for us to make mistakes," said Shweta Singh, the interdisciplinary scientist at Purdue University who developed the tool. "This tool provides a big-picture view and allows policymakers and industry to plug in a potential change and see the results. Those involved can virtually test different options before making a decision."

Past zero-waste and low-carbon efforts focused on one portion of industrial flow, for example, reducing energy use in a single production process. However, a view of the whole system is needed to make the best choices and most effective investments in emerging technology for overall improvement, she said.

"The approach is like the human genome project, but for the physical economy – mapping the relationship between industry and the environment," said Singh, who holds appointments as an assistant professor of agricultural and biological engineering in the College of Agriculture and environmental and ecological engineering in the College of Engineering. "It allows us to find and understand connections within the whole system. We needed the human genome project – the complete map – to begin to identify the genes key to disease or health, and we need a complete map of the physical economy to identify what changes are key to achieving sustainability."

The theory behind the model is detailed in a paper in the journal Energy & Environmental Science of The Royal Society of Chemistry. A paper focused on the cloud platform tool will be published in the Journal of Industrial Ecology.

The tool uses physical principles and mechanistic models from physics, engineering and biological sciences to automate mapping of the physical economy, and it is much faster than the standard methods, Singh said.

"With this modeling tool, we can do in one day what would have taken 100 days," she said. "The existing mapping methods were tedious and time consuming. By looking at each economic sector as a process – taking resources through physical changes to create a product – we can use existing mechanistic models to map a multiscale view of the physical economy. With that in place we can make changes and see the cascade of events from the process to sector to whole economy."

Singh used the tool to map the physical economy of Illinois for 10 agro-based sectors from farming to downstream processing of products. The model found connections and highlighted opportunities for large-scale recycling to reduce waste. The results showed that the adoption of technologies for industrial wastewater and hog manure recycling would have the highest impact by reducing more than 62% of hog waste outputs, 96% of dry corn milling waste, and 99% of soybean hull waste.

"We also found indirect connections, for example recycling hog farm waste led to reduced emissions down the line in manufacturing," Singh said. "In the supply chain, experts talk about first, second- and third-order impacts. Third-order impacts may not be obvious, but they can really have an impact. Here it becomes transparent, and we can identify that third-order impact very quickly."

Singh credits a diverse academic background in sparking the idea for the model.

"I always had an interest in various disciplines," she said. "My friends joked I had taken a class in every building on campus. I actually began my studies in chemical engineering, which takes a very close look at the flow of a chemical reaction and the byproducts created. Then, while studying sustainability assessment for industrial systems, I broadened my scope to macroeconomic

framework. It led me to wonder why there wasn't more communication and crossover between the disciplines. In this model, I try to bring all of these things together, connecting process engineering with economic modeling."

From left are Shweta Singh, assistant professor of agricultural and biological engineering at Purdue University, and graduate students Venkata Sai Gargeya Vunnava and Jaewoo Shin.

Singh also credits the interdisciplinary background of Venkata Sai Gargeya Vunnava, the graduate student who collaborated on the project. "Thinking about the challenge without being mentally stuck in a single academic discipline led to this innovation," Singh said. "We must be open to learning anything from anywhere."

Singh disclosed the modeling tool to the Purdue Research Foundation Office of Technology Commercialization, which has applied for patent protection on the intellectual property. The Office of Technology Commercialization is currently looking for partners to help commercialize this technology.

The National Science Foundation (CBET- 1805741) funded Singh's work. A U.S. patent is pending on the cloud platform implementing the methodology for automation, with potential for commercialization as technology.

SPOTLIGHT

GRADUATE STUDENT RESEARCH

HASSAN ASSAF'S RESEARCH INTEGRATES ADVANCED FLUID POWER CONCEPTS AND INNOVATION

"I was the kid who opened things up and looked inside," said Hassan Assaf, recalling his childhood in Beirut, Lebanon. His curiosity later evolved into an interest in designing new products.

Assaf enrolled at the Polytechnic University of Turin in Italy, where he earned a bachelor's degree in mechanical engineering and a master's degree in mechatronic engineering.

While working on his master's thesis in 2018, Assaf traveled to Purdue as a visiting scholar under the guidance of Andrea Vacca, professor of agricultural and biological engineering (ABE) and mechanical engineering. Vacca leads Purdue's Maha Fluid Power Research Center, which is the largest academic hydraulics lab in the United States.

Assaf's interest in fluid power technology and access to such resources influenced his return to Purdue for doctoral study in 2019. "I got to know the lab and could do my own research on different problems and challenges," said Assaf.

In the first two years of his program, Assaf designed novel hydraulic trainers that integrate advanced electro-hydraulic components, data acquisition systems and visual aids. The trainers are now used at the Fluid Power and Motion Control Lab of Purdue's new ABE building. There, they expose students to advanced fluid power concepts through hands-on experiences.

Assaf also helped address increased demand for online education by developing a virtual reality application to replicate the physical trainers for remote lab experiences.

Assaf is currently designing an electrohydraulic battery-powered system to replace the internal combustion engine in a hydraulic system. The work is part of a broader effort to address global warming by reducing CO2 emissions. "I can design the electric motor and cylinders for an integrated system," he explained. "The goal is to fabricate a working prototype."

After completing his PhD, Assaf plans to work in industry, at least for a few years. "I want to know how the industry works," he explained. "Then maybe go back home and join academia."

INNOVATING WITH SOYBEANS

The 28th Student Soybean Innovation competition, sponsored by the Indiana Soybean Alliance, brought out the creativity in multiple student teams. Winning the $20,000 grand prize was "Team Smulch" which created a soy-based substitute for mulch and rubber playground turf. Congratulations to all the participants!

From left: Zuhal Cakir, Elizabeth Plassard and Ethan Miller of "Team Smulch" are presented with the grand prize check from Jim Douglas, Indiana Soybean Alliance chairman and farmer from Flat Rock, IN.

BOILER UP!

SUMMER 2022

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