Engineering

The Magazine of the Penn State College of Engineering

PENN STATE

Spring/Summer 2019

Power in Partnerships

Engineering solutions through interdisciplinary initiatives

Inspiring Change. Impacting Tomorrow.

Also in this issue:

- Law, Policy, and Engineering initiative holds second symposium
- Earth and Mineral Sciences, Eberly College of Science, and Engineering: Partners for the final frontier
- Cross-campus collaboration: Seed Grant program advances transformative work

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ABOUT THE COVER

During a Maymester trip with the Humanitarian Engineering and Social Entrepreneurship (HESE) program, nuclear engineering student, Misael Carlos Vera, spoke with locals about their health care needs as part of his research for the group venture, MoraSine. This venture is working with health care partners in Kisumu, Kenya, to learn about current processes and availability of blood test results in their effort to improve accessibility and affordability of testing to all. Their proposed device – a smart phone tool that takes a complete blood count – could help rural health care facilities take more preventative medical action when abnormalities appear.

Learn more about HESE on page 31.

BONUS CONTENT

Look out for these icons to access bonus videos and photos as well as links to stories to learn more.

Video Photos Story

To sign up for digital delivery of our magazine, email **communications@engr.psu.edu**.

"Engineering is more than the sum of its parts. In partnership with basic science, art, and more, engineering becomes the means through which ideas become reality."

the **DEAN'S MESSAGE**

Collective voices; Collaborative efforts

We, siloed in our individual disciplines, have looked to the sky and wondered. We could see brilliant, but narrow, patches. Now, by bringing our views together, we can see the whole sky. By bringing our expertise together, we're on the cusp of something spectacular.

Through an infusion of technology into our everyday lives, we expect more than just powerful and fast phones. We expect more than safe and efficient vehicles—soon we will also expect them to drive themselves. Beyond utility, we want our products to be easy to use, while still looking cool.

To make products and processes that benefit all of us, we need all of us. It takes people of every race, of all walks of life, of every sexual orientation, of all abilities, of all experiences to begin to address these technological advancements, as well as the societal pillars underpinning our progress.

Throughout this edition of *Engineering Penn State*, you'll find examples of our collective voices and our collaborative efforts.

From exploring how law, policy, and engineering intersect around privacy protection and biodevices (page 14), to using augmented reality to bring THON to the Penn State Children's Hospital (page 30), to designing sustainable homes that could be built on Mars, Penn State engineers are partnering with their peers from other colleges, across industry, and in government to improve our world and beyond.

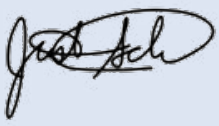
Through our collaborative efforts, we're developing beyond the research to application process; we're solving how society can and should use these applications.

We don't have the answers yet. We don't always know which questions to ask. Interdisciplinary partnerships are so important: to begin to understand how we can work together to decide what we want to know.

With the expertise of faculty from disparate disciplines, we're unifying to train the next generation of engineers who will play a key role in bridging the theory and actual exploration of space; to develop the biodevices that will converge at the crux of law, policy, and engineering to improve the quality of life for millions; and to position Penn State as a leader in these areas.

We're all explorers in our fields. We look to the unknown and, through analysis, we come to understand it. Through engineering, we come to be a part of it.

For the Glory,



Justin Schwartz
Harold and Inge Marcus Dean of Engineering
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Aerospace engineering head appointed to aircraft certification review committee

Amy R. Pritchett, professor and head of aerospace engineering at Penn State, was recently named one of six experts by U.S Transportation Secretary Elaine Chao to serve on a U.S. Department of Transportation (DOT) Special Committee that will review how the Federal Aviation Administration (FAA) certifies aircraft.

The committee, an independent body formed within the structure of the DOT's Safety Oversight and Certification Advisory Committee, was established following the recent crashes of two Boeing 737 Max aircraft. Findings and recommendations by the committee will be presented directly to the secretary and FAA administrator.

The committee will be co-chaired by retired Air Force General Darren McDew, former head of the U.S. Transportation Command, and Lee Moak, former president of the Air Line Pilots Association.

According to the DOT, whose main priority is safety, the committee will be specifically tasked with reviewing the 737 Max 800 certification process from 2012-2017 and recommending improvements to the certification process.

Ribbon cutting dedicates new Chemical and Biomedical Engineering Building

A ribbon-cutting ceremony on April 4 marked the official opening of the new Chemical and Biomedical Engineering (CBE) Building on the Penn State University Park campus. The 109,100-square-foot, six-level facility near the intersection of Shortlidge and Curtin Roads houses the Departments of Chemical Engineering and Biomedical Engineering.

The recently completed $144 million building was designed by architectural firm HOK, and construction was managed by general contracting company Barton Malow. The structure features a variety of laboratories, classrooms, and conference rooms, student common areas, the Dow Chemical Knowledge Commons collaborative student space, and an auditorium for presentations and classes that holds approximately 150 people.

New research shows promise for success of underrepresented scholars in STEM

Penn State's College of Engineering is a key partner in the Millennium Scholars Program, which shows promising early results in expanding diversity and inclusion in STEM, according to a recently published Science study.

"We have so much anecdotal evidence that this program, and programs like it, provide the necessary academic and community support that help prepare students from underrepresented minority groups to succeed in engineering careers," said **Justin Schwartz**, the Harold and Inge Marcus Dean of Engineering. "The hard data collected in this study is invaluable as we continue building and expanding inclusive programs to support all of our students."

Penn State named key partner in Federal Highway Administration project to study truck platooning

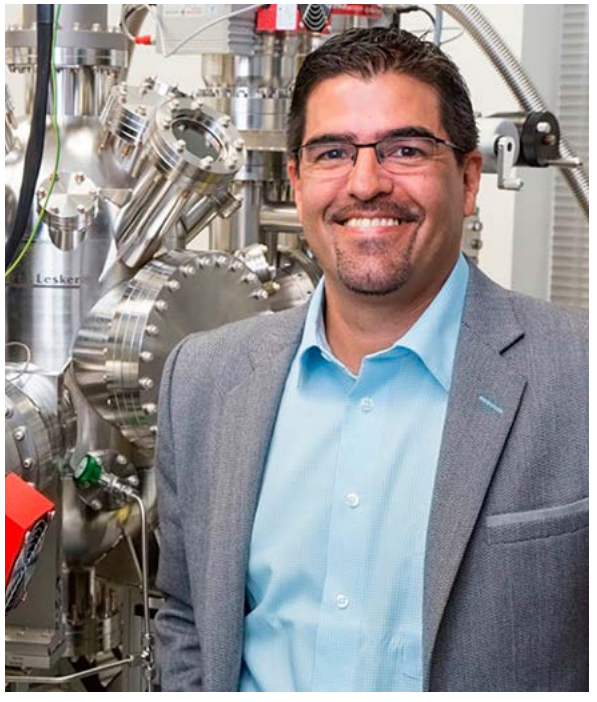
The Thomas D. Larson Pennsylvania Transportation Institute (LTI) is one of seven key partners recently selected to participate in Phase 1 of a Truck Platooning Early Deployment Assessment, part of a recent Broad Agency Announcement (BAA) made by the Federal Highway Administration (FHWA). The $499,878 award will be used to help industry and agency partners understand how truck platoons operate in realistic, operational environments.

The project will be led by Battelle and funded by the Intelligent Transportation Systems Joint Program Office (ITS JPO) in cooperation with the FHWA and Federal Motor Carrier Safety Administration.

Other key team partners include the Center for Automotive Research, SAE International, Saia LTL Freight, Volvo Group, and the University of Michigan Transportation Research Institute. Now through November 2019, the team will perform detailed planning and team building to develop proposals for consideration during Phase 2 of the project.

If awarded to participate in Phase 2 of the project, the team will then execute plans, collect data, and conduct evaluations of truck platoons driven by professional drivers delivering commercial goods.

Head named for Ken and Mary Alice Lindquist Department of Nuclear Engineering



Jean Paul Allain has been named the inaugural head of the recently established Ken and Mary Alice Lindquist Department of Nuclear Engineering at Penn State, effective July 1. He will hold the Lloyd and Dorothy Foehr Huck Chair in Plasma Medicine in the Huck Institutes of the Life Sciences, as well as the positions of an Institute for Cyber Science faculty co-hire, and professor of biomedical engineering by courtesy.

Allain was a professor and the associate head of graduate programs in the Department of Nuclear, Plasma, and Radiological Engineering at the University of Illinois at Urbana-Champaign, where he also led the Radiation Surface Science and Engineering Laboratory. Allain was also professor of Bioengineering, the Micro and Nanotechnology Lab, the Frederick Seitz Materials Research Laboratory, and an affiliate of the Beckman Institute for Advanced Science and Technology at Illinois.

He earned his bachelor's degree in mechanical engineering from California State Polytechnic University, and his master's and doctoral degrees in nuclear engineering from Illinois.

Don't miss a thing...

For the latest news and information from the College of Engineering, including alumni spotlights, research from our faculty and graduate students, and more, visit engr.psu.edu and follow us on social media.

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Engineering Mentoring for Internship Excellence program wins national award

The Women in Engineering ProActive Network (WEPAN) recognized Penn State's Engineering Mentoring for Internship Excellence (EMIX) program with the WEPAN Women in Engineering Initiative Award. The national award was presented at the Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference in Arlington, Virginia, in April.

"The EMIX initiative is designed to prepare women and underrepresented engineering and computer science interns for a seamless transition to the engineering workplace," said **Cheryl Knobloch**, the director of the Women in Engineering Program in the Penn State College of Engineering. Knobloch directs the EMIX initiative, as well. "The overarching goal is to strategically elevate opportunities for industry partners to recruit, retain, and advance diverse technical talent."

In its 13th year, EMIX has engaged more than 250 participants, all of whom have graduated and many of whom ultimately begin their engineering and computer science careers with the company where they interned. EMIX participants have interned in 10 different states with 15 different corporate partners.

Former NASA administrator gives College of Engineering's commencement address

More than 1,400 students received their baccalaureate degrees at the College of Engineering's spring commencement exercises on May 3 at the Bryce Jordan Center.

This year's commencement address, titled "Humanity's Journey of Discovery," was given by Charles F. Bolden Jr., former NASA administrator and current president and chief executive officer of The Bolden Consulting Group LLC.

Bolden received his bachelor's degree in electrical science from the United States Naval Academy and his master's degree in systems management from the University of Southern California.

In 2009, President Barack Obama appointed Bolden to be the 12th National Aeronautics and Space Administration (NASA) administrator, a position Bolden held until 2017.

Bolden had a distinguished 34-year military career, which also included 14 years as a member of NASA's Astronaut Office. After joining the office in 1980 and becoming an astronaut in 1981, he traveled into orbit four times aboard the space shuttle between 1986 and 1994, logging more than 680 hours in space.

He piloted Space Shuttle Columbia in 1986 and Space Shuttle Discovery in 1990—the mission that deployed the Hubble Space Telescope. He also served as mission commander on Space Shuttle Atlantis in 1992 and Space Shuttle Discovery in 1994. Bolden was chief of the Safety and Mission Assurance Office at the Johnson Space Center in the wake of 1986's Space Shuttle Challenger disaster.

Bolden's military and NASA decorations include the Defense Distinguished Service Medal, the Defense Superior Service Medal, the Distinguished Flying Cross, Air Medal, three NASA Exceptional Service Medals, and four NASA Space Flight Medals. He received the Rotary National Space Trophy in 2014 and holds honorary doctoral degrees from numerous institutions of higher education. He was inducted into the U.S. Astronaut Hall of Fame in 2006 and the National Aviation Hall of Fame in 2016.

Korbs establish three Open Doors Scholarships in the College of Engineering

Penn State industrial engineering alumnus **William Korb** and his wife, Wendy, who is also a Penn State graduate, have contributed $100,000 to fund and endow three Open Doors Scholarships in the College of Engineering.

Each gift, matched 2:1 by Penn State for a combined total of $300,000 in new scholarships, will support undergraduate students participating in RaiseMe, the Pathway to Success Summer Start Program (PaSSS), the Student Transitional Experiences Program (STEP), Complete Penn State, or Smart Track to Success.

An Erie native, William Korb attended Penn State Behrend for two years before graduating from University Park with a degree in industrial engineering. He is the retired president and CEO of Gilbarco, the world's leading supplier of fuel dispensers, credit card readers, and point-of-scale devices for gasoline stations.

The Korbs have been long-time supporters of Penn State engineering, both at the Behrend and University Park campuses. In 2002, the Korbs established the Korb Family Trustee Scholarship in Engineering at Behrend, and in 2014 and 2015, they gifted approximately $1.34 million to create the William and Wendy Korb Early Career Professorship in Industrial Engineering and the William and Wendy Korb Early Career Professorship in Biomedical Engineering, designed to support talented engineering faculty at the start of their academic careers.

Huang wins Johnson & Johnson Women in STEM2D Scholars Award

Shengxi Huang, assistant professor of electrical engineering, recently was named a winner of the Johnson & Johnson Women in STEM2D (WiSTEM2D) Scholars Award. She will receive $150,000 in funding and three years of mentorship from Johnson & Johnson toward her research on ubiquitous biosensing platforms.

Launched in June 2017, the Johnson & Johnson WiSTEM2D Scholars Award aims to fuel development of female STEM2D leaders and feed the STEM2D talent pipeline by awarding and sponsoring women at critical points in their careers in each of the STEM2D disciplines: science, technology, engineering, math, manufacturing, and design. Only six winners were selected from 450 applicants this year, one for each of the disciplines. Huang was the award recipient in the category of technology.

This grant will allow Huang to further her development of ubiquitous biosensing platforms, which can help to diagnose diseases earlier, more accurately and more inexpensively, using a method known as Raman spectroscopy. Watch the winning video submission here.

Lubrizol pledges $100,000 in support of the Engineering Equity Initiative

The Lubrizol Corporation, which owns and operates chemical engineering facilities in 17 countries, has pledged $100,000 over the next five years in support of the College of Engineering's Engineering Equity Initiative.

The initiative aims to increase the number of women completing their engineering degree to 50 percent by 2026, while also growing the number of students from all under-represented groups.

The Lubrizol Fund for the Engineering Equity Initiative in the College of Engineering, as the support is called, will be divided, with 25 percent dedicated to programs that promote equity and inclusion.

The remaining 75 percent will be used to fund scholarships for undergraduate students who are enrolled in the College of Engineering and participating in relevant programs, such as the Women in Engineering Program or the Multicultural Engineering Program. As Lubrizol specializes in chemistry, first preference will be given to students who are majoring or plan to major in chemical engineering.

Penn State is a Google AI Impact Grantee

Penn State is one of 20 organizations that will share $25 million in grants from Google.org, credit and consulting from Google Cloud, and coaching by Google's AI experts as a grantee of the Google AI Impact Challenge.

The Google AI Impact Challenge was an open call to nonprofits, social enterprises, and research institutions from around the world to submit their ideas to use AI to help address societal challenges. More than 2,600 organizations applied.

Landslides, including mud flows and rock avalanches, can mobilize large volumes of geomaterials and are one of the most widespread hazards that face the world. Penn State will receive a $750,000 grant to train deep learning (DL) networks to build a global-scale database of landslide/mudslide occurrences using Google Earth Services. They will then train DL models to predict landslide location, timing, rainfall thresholds, and impacted areas, and provide uncertainty estimates. Lastly, working with Google and the U.S. Geological Survey, they hope to integrate their findings into a warning system.

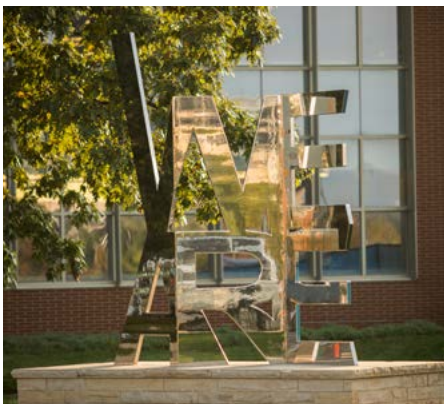
Chaopeng Shen, associate professor of civil engineering and principal investigator of the project, will join **Daniel Kifer**, associate professor of computer science, and **Tong Qiu**, associate professor of civil engineering, on this investigation.

Bus driver seating design improvements get green light

Researchers at Penn State have been awarded $250,000 from the Transportation Research Board to improve bus driver health and safety by transforming operator workstation design, assessment, and ergonomics.

Led by principal investigator (PI) **Matthew Parkinson**, professor of engineering design and mechanical engineering and director of the Bernard M. Learning Factory, the research team will create a design and assessment toolkit that will simultaneously consider how vehicle geometry, driver body type, vision, and posture limitations impact a driver's safety and long-term health. **Andris Freivalds**, Lucas Professor in Industrial Engineering, and **Yiqi Zhang**, assistant professor of industrial engineering, are serving as co-PIs. Heecheon You, professor in the Department of Industrial and Management Engineering at Pohang University of Science and Technology, and **David Klinikowski**, assistant research professor with Penn State's Larson Transportation Institute, are serving as investigators.

"The toolkit we are developing will help manufacturers and other stakeholders to quickly evaluate some aspects of the driver workstation," Parkinson said. "It will provide clear guidance on strengths and weakness of candidate designs and how they can be improved. Since the intention is that it be broadly disseminated, we will not be able to control its implementation. As a result, the toolkit needs to be unambiguous and easy-to-use."

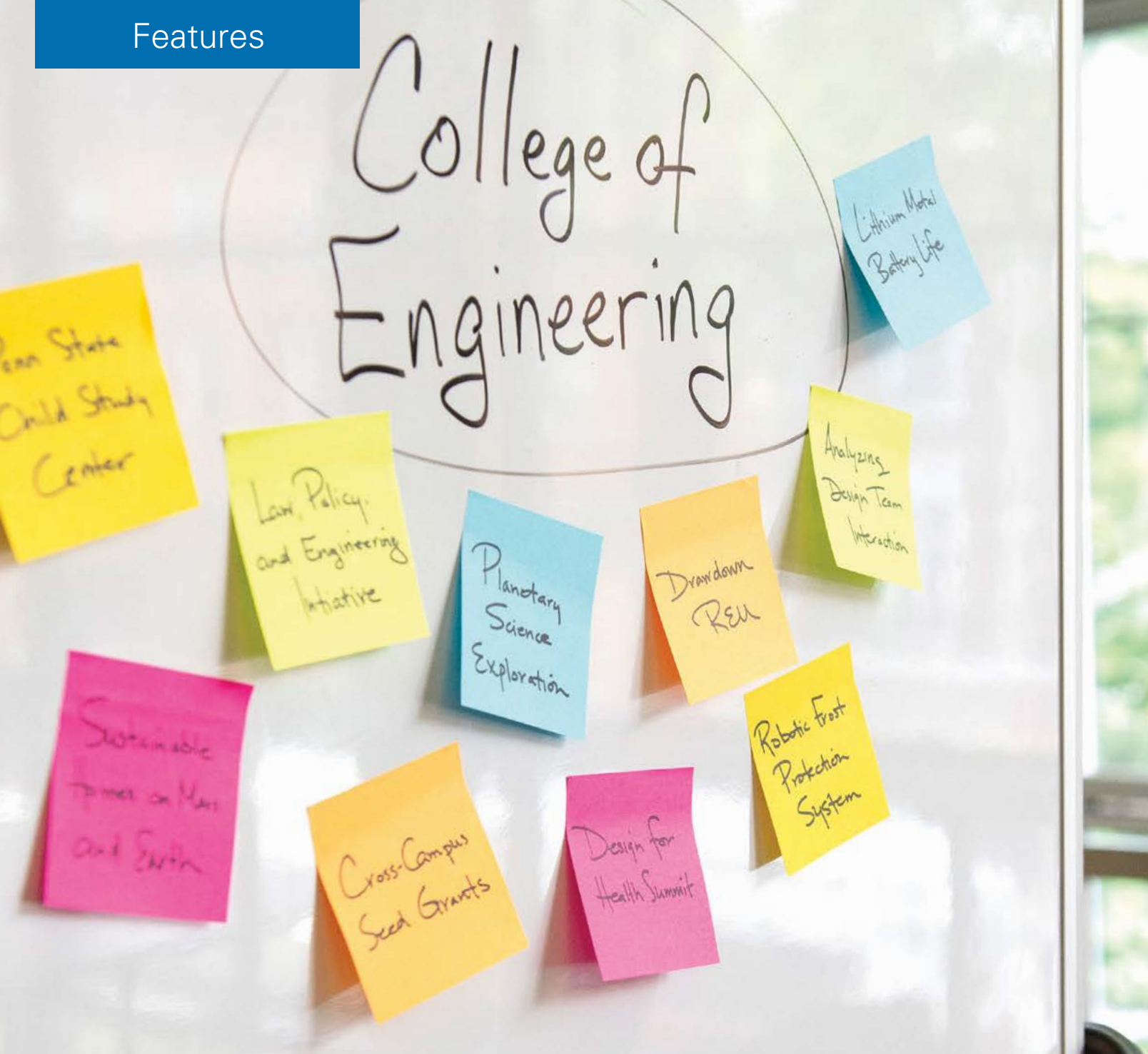


Penn State named latest site for membrane research center

The National Science Foundation (NSF) Industry/University Cooperative Research Center has named Penn State as a new site within the Membrane Science, Engineering and Technology (MAST) Center.

The MAST Center focuses on building industry partnerships to develop advanced membrane technology for separation processes important for water treatment, energy production, pharmaceutical purification, and chemical processing. It also promotes education in membrane science and engineering. The University will join the University of Colorado Boulder, the New Jersey Institute of Technology, and the University of Arkansas as MAST Center sites.

The NSF approved support for the Penn State site in the MAST Center via a five-year, $500,000 grant. Along with **Andrew Zydney**, Bayard D. Kunkle Chair, professor of chemical engineering, and the director of the new Penn State site, the Penn State MAST Center will involve **Manish Kumar**, associate professor of chemical engineering; **Bruce E. Logan**, Evan Pugh Professor and Stan and Flora Kappe Professor of Environmental Engineering; **Enrique D. Gomez**, professor of chemical engineering; **Michael A. Hickner**, professor of materials science and engineering, chemical engineering, and chemistry; and **Xueyi Zhang**, John J. and Jean M. Brennan Clean Energy Early Career Assistant Professor of Chemical Engineering.



Power in Partnerships

Engineering solutions through interdisciplinary initiatives

by Ashley WennersHerron

Across the University

In addition to the 12 departments across the college, Penn State Engineering is also engaged in collaborations with many other Penn State colleges and units.

COLLEGES AND SCHOOLS:
- Agricultural Sciences
- Arts and Architecture
- Donald P. Bellisario College of Communications
- Earth and Mineral Sciences
- Eberly College of Science
- Health and Human Development
- Information Sciences and Technology
- International Affairs
- Liberal Arts
- Medicine
- Penn State Law

UNITS:
- Applied Research Lab
- Center for Science and the Schools
- Edna Bennett Pierce Prevention Research Center
- Institutes of Energy and the Environment
- Materials Research Institute
- Office of Physical Plant
- Penn State Athletics
- Penn State Berkey Creamery
- Huck Institutes of the Life Sciences
- Rock Ethics Institute
- Institute for CyberScience

Engineering Penn State sat down with Dr. Justin Schwartz, the Harold and Inge Marcus Dean of Engineering, to discuss collaborative work within engineering, across Penn State, and with government and industry. This is an area of strategic importance for the College of Engineering, as a multifaceted society requires multi-disciplinary solutions.

Engineering Penn State (EPS): Why are interdisciplinary collaborations important? Is this an area the College of Engineering is championing?

Justin Schwartz (JS): There is almost nothing in our world today that is single-disciplinary driven. This has been the case for decades. When I was a kid, we thought about cars as a mechanical system. By the 1990s, cars were taken over by computers. Cars can fail for electrical and computer reasons, which can be caused by mechanical thermal issues. So, for decades now, almost every new breakthrough is the result of multiple disciplines working together to solve a problem.

In engineering, we like to think that engineering is the discipline, but all of the different programs within engineering would traditionally be their own fields. All the big problems and all of the big challenges cut across boundaries. Big solutions come from multiple views through many lenses. This is a major priority for the College of Engineering as we expand our research portfolio and work toward addressing society's greatest challenges.

EPS: How does engineering evolve with other disciplines?

JS: The step beyond what we've traditionally thought of as being multidisciplinary—the sub-disciplines within the College of Engineering—is to bring in physics, chemistry, biology, mathematics, and the basic sciences. We know it as science, technology, engineering, and math, or STEM. It's this linear pipeline of different fundamental sciences coming together to inform engineering, while engineering translates those basic sciences into a product or system to benefit people.

Going back decades, there wasn't really a big biological engineering presence, and, now, it's ubiquitous. That's only happened over the past 20 years or so. It's a good case study of how engineering's interdisciplinary efforts evolve rather rapidly and significantly.

Another good case study is that of human factors. We used to think of human factors as belonging to psychology, but really, it's the factor of humans within systems. How does the way a person will interact with a system need to influence design methodology and ideology?

The infusion of technology across everyday life has become so profound that interdisciplinarity isn't just science influencing engineering or engineering subdisciplines influencing each other. Now, it also includes people. And it should be people-centric. Humans are now a part of the systems. The more we integrate the human presence, the more impactful all of our efforts will be.

The other piece of this product acceptance is the development of new policies and laws to support or obstruct new technology. Right now, this is a hot topic for autonomous vehicles. What are the regulations in terms of liability and road accessibility? What are the policies for traffic that comprises both computer-driven and human-driven vehicles? What are the rules in terms of order of communication from an electrical system point of view?

There are so many places where we, as people, overlap with technology evolution and emergence.

EPS: There are so many different fields and possible interactions. How do you begin the conversations to prioritize which collaborations should happen now?

JS: Right now, we have several collaborations with other units in the University. One is the Law, Policy, and Engineering (LPE) initiative, which has clear implications for things like autonomous vehicles, nuclear security, cybersecurity, biodevices and the human-technology interface, energy efficient buildings, and so much more. It's at the crux of how to bring law, policy, and technology development together to work hand in hand rather than against one another.

Another is Penn State's partnership with Project Drawdown. We're working with the Penn State Institutes of Energy and the Environment, as well as other colleges, to explore and enhance proposed solutions to reverse global warming. With Drawdown, the goal is to keep ourselves alive as a species. In other collaborations, we're more focused on the evolution of the things we're developing as we're developing them. The outcomes—survival versus improved quality of life via new technologies—are different kinds of motivators.

Solutions for either type of motivation are different, too. Distributed solar power in Kenya won't work the same in Norway. The decision making needs to have a high level of localization. This understanding is also evolving the field of implementation science, which initially emerged in the medical community.

Engineering needs to be interactive not just at the boundary, but also intertwined with our intellectual partners across the University and across the country.

EPS: Once you have the right players in the room, how do you make these conversations into something actionable?

JS: Sometimes that can be difficult, but not always. A lot of it comes down to opportunity space. We don't have legal authority; we don't have the ability to dictate what another country does. We hope that by getting our faculty together to talk from their disparate areas of expertise, we can cultivate an interest around a defined subject that may offer insight. When people from different backgrounds come together with a common purpose, a common "why," and collaborative impediments are removed, great things happen. Human greatness emerges.

We're part of a proposed planetary science collaboration among the College of Engineering, the Eberly College of Science, and the College of Earth and Mineral Sciences to begin to explore how to educate future mission leaders while also positioning Penn State as a leader in this area. A huge amount of science needs to go into the front end of planetary missions. There's also a huge amount of engineering needed to translate the goal of going to another planet or moon into a viable idea. This is big science, with international implications for multi-country collaboration and competition. We need a lot of very different expertise to contribute.

On a topic a little closer to home, we recently hosted a Law, Policy, and Engineering (LPE) symposium on biodevices. We had faculty from the College of Medicine, Penn State Law, the School of International Affairs, the College of Engineering, and Eberly College of Science all together in the same room, along with leaders of industry. We talked about the obstacles to moving these devices forward, and the potential conflicts among social science acceptance, the business model of health care delivery, and the science and technology of developing a device that helps people. We can sometimes see the solution from our own perspective, but we don't understand all the implementation barriers from other disciplines. Working together, and getting together to talk these things through, is so important in technological progression.

EPS: Is there space for Penn State born-and-grown collaborations to position the University as a place where that expertise can inform conversations and decisions on a larger scale?

JS: Absolutely. There is so much going on at Penn State that, when put together, we collectively become one of the dominant forces in planetary science engineering, for example. We welcome in outside expertise not only to learn, but also to better understand who we are and how to contextualize our joint knowledge. There's a huge benefit in the honest assessment of understanding which puzzle pieces we're missing.

Once we know which key pieces we lack, we can find them and make a more holistic picture. That takes us from powerful to dominant, and that's when we go beyond impact.

Justin Schwartz (second from left) speaks with President Eric Barron (left) and David Han (center), the association professor and vice chair of education in the Penn State College of Medicine, and two other attendees at the LPE symposium on biodevices in April.

We're not going it alone, and we wouldn't want to. We position ourselves as leaders in different fields, but we will always go further with important partnerships with other universities, government, and industry. A network of partners means we have a diversity of experiences and a network of sites, and we can reach more communities in different ways with the benefit of having that home influence. One example is our Larson Transportation Institute working with the Pennsylvania Department of Transportation. Professionals in the field come here to provide advanced training in managing accidents and managing traffic, and generally enhancing highway safety, while we have the research direction of understanding these areas to advance autonomous vehicles. It's a highly beneficial relationship for both of us.

EPS: Are there future interdisciplinary collaborations for which you see a current need?

JS: There are a number in the process of emerging and expanding. We're having a lot of good discussions, and there are a lot of people with really good ideas. For example, the College of Engineering will be contributing to the fight against addiction. That doesn't really seem like an obvious fit, addiction isn't an engineering issue, but like so many areas of human need, engineering is part of the solution. There's so much work we can do with analysis and systems-based approaches to mitigate the issue.

For all major societal issues, there's a need for interdisciplinary partnerships to support solving it. There's also a need to educate future generations about this collaborative work. At Penn State, research, teaching, and service are deeply entangled with one another, to the benefit of everyone involved. As we continue to grow, we're building our infrastructure to support these interactions.

The College of Engineering will begin construction on two new research and teaching buildings on West Campus in the next couple of years. The design will be focused specifically on enabling interdisciplinary work in the classroom and in the lab, with hands-on learning space and thematic organization rather than departmental designations.

We're baking collaboration into our infrastructure, which drives our culture. This is the future of engineering, and our partners. ■

Inaugural Drawdown Scholars class arrives at Penn State

Students from across the country will spend eight weeks researching solutions to help reverse global warming

by Ashley WennersHerron

Fifty-five undergraduate students from across the country have arrived at Penn State to take part in the first-ever Drawdown Scholars Research Experience for Undergraduates Program. Dubbed Drawdown Scholars, the students will spend eight weeks embedded in research programs across the University, with the aim of investigating positive solutions-orientated paths to take action on climate change.

The program is the first product of the partnership between Penn State and Project Drawdown, the coalition of researchers who published the 2017 New York Times best-seller, "Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming." The book details 100 solutions that may help achieve drawdown—the point at which greenhouse gases in the atmosphere begin to steadily decline.

"This book is hopeful. We, as a society, are facing a big problem, but there are achievable solutions," said **Justin Schwartz**, the Harold and Inge Marcus Dean of Engineering. "And now, we have 55 bright, optimistic students ready to spend the next two months exploring and enhancing these solutions."

The Drawdown Scholars are paired with faculty mentors from several colleges and campuses at Penn State, including Brandywine, Harrisburg, and University Park. Together, the scholars and faculty will model the solutions, investigate their feasibility, and develop an outreach curriculum to educate others. The scholars will meet with Project Drawdown leaders, including Vice President and Research Director Chad Frischmann (right). They also will participate in weekly professional development courses.

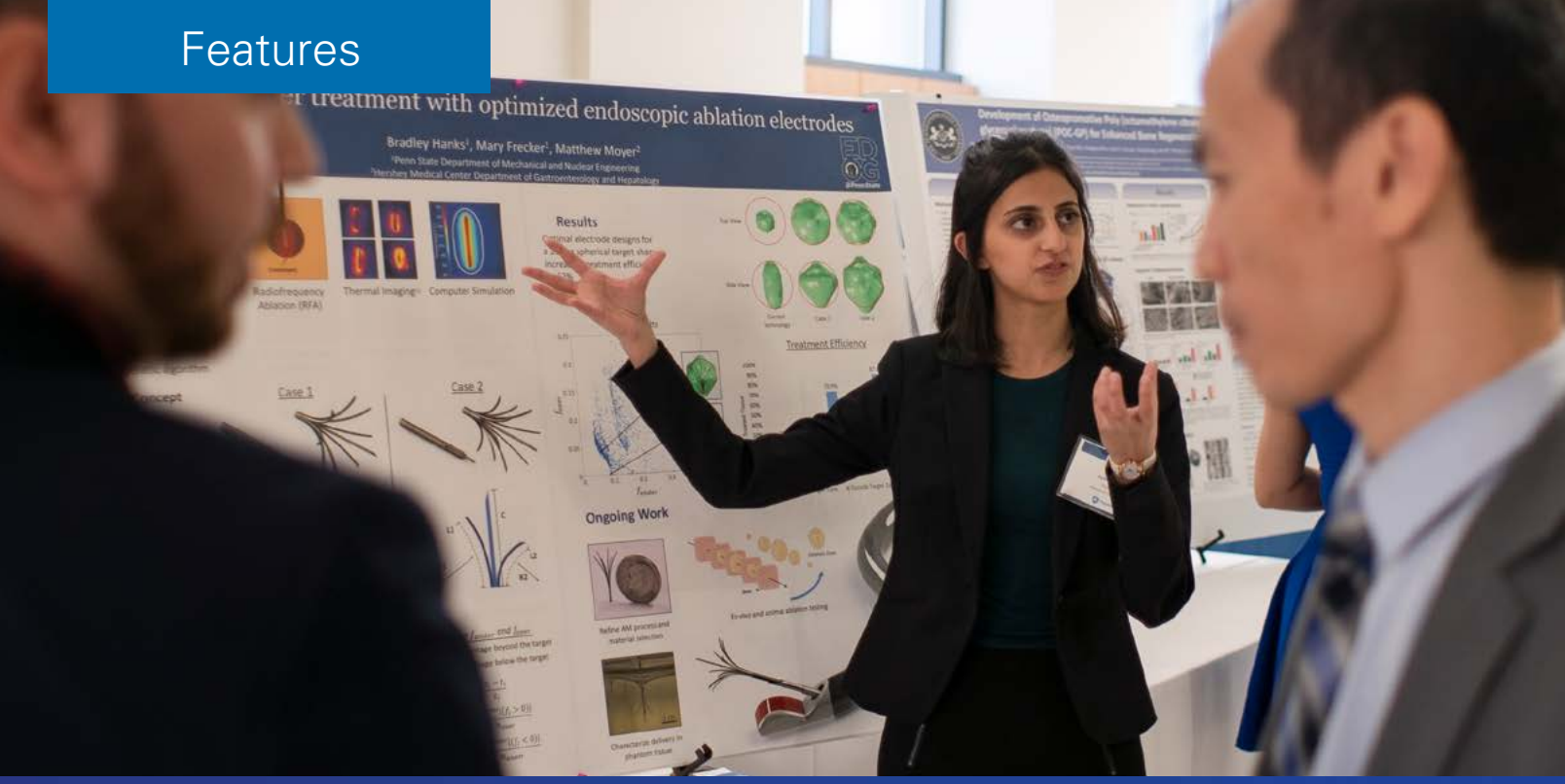
Drawdown Scholars will present the culmination of their work at the Research Experiences for Undergraduates Symposium on July 30. They also will be invited back to Penn State to present their work at the first international conference on drawdown, "Research to Action: The Science of Drawdown," on Sept. 16-18.

Schwartz is co-leading the efforts behind the Drawdown Scholars program and the conference with Tom Richard, professor of agricultural and biological engineering and director of the Penn State Institutes of Energy and the Environment.

The combination of laboratory research and analysis drew in applicants with diverse educational and interdisciplinary backgrounds. Every selected Drawdown Scholar has one important thing in common: a passion for understanding and improving society's relationship with the environment.

"The Drawdown Scholars program appealed to me as the perfect chance to pursue my longtime interest in sustainable urban development and green infrastructure through research," said Selena Tan, a sophomore at Columbia University and a Drawdown Scholar. "Conducting research in a laboratory and utilizing computer software to analyze and interpret data are all very different from anything I have experienced in a classroom or internship setting." ■

Drawdown Vice President and Research Director, Chad Frischmann, speaks to Drawdown Scholars at the REU orientation.



Law, Policy, and Engineering initiative gathers more support with second symposium

by Ashley WennersHerron

Experts from across the United States gathered at Penn State on April 11 to plan for next-generation devices for biotechnology and biomedicine. The second event hosted under the Law, Policy, and Engineering initiative, it was jointly sponsored by the College of Engineering, Penn State Law, and the School of International Affairs.

This symposium, which was also sponsored by the Penn State College of Medicine and chaired by **Andrew Zydney**, the Bayard D. Kunkle Chair and professor of chemical engineering, brought together researchers and members of industry to discuss the potential legal ramifications, policy framework, and technical know-how required to support and guide the accelerated advancement of biodevices.

"It's by bringing together a wide range of expertise and wisdom that we can begin to find a new path forward and most effectively serve the commonwealth and the world," said Penn State President Eric Barron, in his welcoming remarks. He pointed to the breadth and depth of research at Penn State, which has more than $900 million in annual research expenditures. "Given the complexity of the problems our world faces, it's clear that we need collaboration, creativity, innovation, and expertise in many areas. The Law, Policy, and Engineering initiative is one way of bringing the right people together to accomplish this goal."

Humans have used technology interfaces, such as sensors and light signals, for decades. Interfacing has grown to interactions—a person can operate their home's lights from across the world, just by asking their phone. Now, medical biodevices are growing more advanced and, with them, so are the questions surrounding the relationships people have with machines.

"Technology is a part of our lives. More and more, it's becoming a part of us," said **Justin Schwartz**, the Harold and Inge Marcus Dean of Engineering. "Implantable cardio devices help us live longer, artificial hips and knees, and spinal implants help our exoskeleton keep pace with our ever-increasing lifespan. Rapid advances in biotechnology promise to continue to greatly enhance and lengthen our lives, while also challenging what it means to be truly human."

Schwartz cautioned that the work is just beginning, reminding the audience that today's commonplace technology was the stuff of science fiction just a decade ago. In another decade, it'll be rudimentary.

"Law and policy often struggle to appropriately regulate fast-moving science and technology," said Hari Osofsky, dean of Penn State Law and the School of International Affairs. "Next generation devices for biotechnology and biomedicine pose complex technological, ethical, and legal issues and are an important example of why we need collaboration among engineers, lawyers, and industry and public policy leaders. My hope is that today's dialogue is just the beginning of a collaboration on these crucial issues, and I am excited about how we might build from here." ■

LPE

LAW, POLICY, AND ENGINEERING

Allain named inaugural LPE director

The College of Engineering, Penn State Law, and the School of International Affairs have jointly hired **Sandra Allain** as the inaugural director of the Law, Policy, and Engineering initiative. Under Allain's direction, the LPE initiative will advance innovative degree programs and research collaborations that bring together Penn State's expertise in engineering and law and policy to address societal challenges. Allain was most recently an attorney in the Office of University Counsel at the University of Illinois, where she offered legal advice in intellectual property and technology transfer matters. Allain has a broad range of experience in private practice and as in-house counsel, including more than a decade in higher education in various administrative roles. She earned her law degree from Universidad del Rosario Law School in Colombia, and a master's degree in education policy, organization, and leadership from the University of Illinois at Urbana-Champaign. She will join Penn State on September 1.

First Penn State Design for Health Summit held

Faculty from the College of Engineering and the College of Medicine gathered at Penn State Health Milton S. Hershey Medical Center on May 17 for the first Penn State Design for Health Summit. The one-day workshop aimed to design the future of health care by bridging the gap between the Penn State engineering and health communities and to foster new research collaborations.

Co-hosted by **Scarlett Miller** (above right), associate professor of engineering design, and David Han (above left), professor of surgery and radiology, the event began by highlighting an existing interdisciplinary College of Engineering and College of Medicine partnership among Miller, Han, and **Jason Moore**, associate professor of mechanical engineering.

To establish additional collaborative opportunities, summit participants presented on their expertise, experience, ongoing research projects, and areas of interest Pecha Kucha-style. Each attendee submitted up to four slides, which ran for 30 seconds each during fast-pitch presentations. This high-level information was used to set up "matches" between College of Engineering and College of Medicine faculty for three rounds of mini meetings during the afternoon session. These meetings provided faculty members with opportunities to dive deeper into potential research collaborations.

Engineering faculty were invited to tour the College of Medicine's Clinical Simulation Center. The 9,500-square-foot space is home to numerous state-of-the-art simulators including computer-controlled manikins, like the newborn baby seen here.

The summit also included a tour of the College of Medicine's Clinical Simulation Center, a 9,500 square foot dedicated simulation space with state-of-the-art simulators, and presentations on College of Engineering facilities, the Technology Transfer Office, and potential funding opportunities available through the College of Engineering and College of Medicine. ■

Partners for the final frontier

Engineering, Eberly College of Science, Earth and Mineral Sciences join forces to explore planetary science collaboration

by Ashley WennersHerron

External experts and faculty from Penn State's College of Engineering, Eberly College of Science, and College of Earth and Mineral Sciences gathered on April 28–30 to assess capabilities and discuss the goals for academic and research initiatives in planetary sciences.

"We're in the exploration and definition stage of what Penn State can provide to support planetary science missions, as well as what we might need to achieve such goals," said **Sven Bilén**, head of the School of Engineering Design, Technology, and Professional Programs and professor of engineering design, electrical engineering, and aerospace engineering. Bilén is one of the faculty members spearheading the effort.

Penn State's significant expertise in space exploration missions is already being tapped. For example, in collaboration with the Johns Hopkins University Applied Physics Laboratory, Penn State researchers, led by **Jacob Langelaan**, associate professor of aerospace engineering, are contributing to a proposed rotorcraft to explore Titan, Saturn's largest moon. The craft, dubbed **Dragonfly**, is one of two finalists in a NASA-sponsored mission competition. The winner will be announced this summer.

Such a mission requires contributions from multiple disciplines, as well as sub-disciplines within those fields. The engineering aspects, for example, require input from electrical, mechanical, and aerospace engineers. Mathematicians, physicists, geologists, and more contribute from other fields.

Bilén noted that this collaboration—and the understanding of interdisciplinary work—needs to begin early in a student's career. The group is proposing an undergraduate degree in planetary science, with several potential pathways through the program. The program would be housed primarily in the Eberly College of Science, which would manage a science-based track for students interested in graduate studies. Another track on science communication will prepare students for careers in museums and planetariums, science journalism, web development, and education. Engineering will offer a third track in aerospace to prepare students for the space-technology industry.

"These students would be trained in space-mission design and how to apply technology to achieve mission objectives," Bilén said. "We want to educate the next generation of mission leaders."

The working group is currently soliciting input from a broad range of stakeholders as they prepare an informational white paper detailing Penn State's resources and knowledge, as well as a curriculum proposal over the coming months. ■

> "We want to educate the next mission leaders."

Photo credit: Johns Hopkins University Applied Physics Lab

Novel technology aims to improve lithium metal battery life, safety

by Erin Cassidy Hendrick

Rechargeable lithium metal batteries with increased energy density, performance, and safety may be possible with a newly-developed solid-electrolyte interphase (SEI), according to Penn State researchers.

As the demand for higher energy density lithium metal batteries increases—for electric vehicles, smartphones, and drones—stability of the SEI has been a critical issue halting their advancement because a salt layer on the surface of the battery's lithium electrode insulates it and conducts lithium ions.

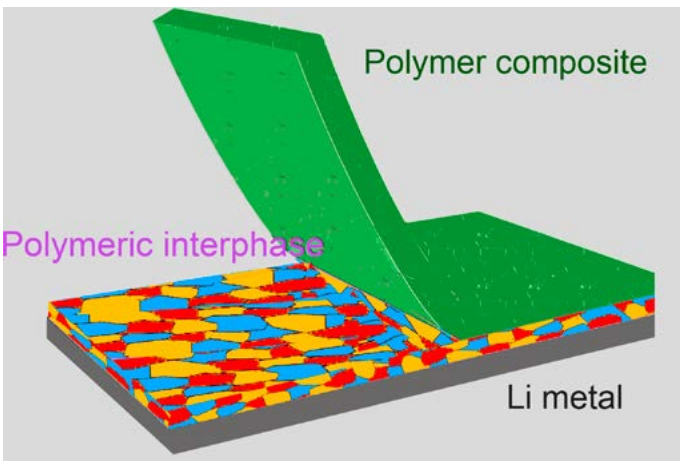
"This layer is very important and is naturally formed by the reaction between the lithium and the electrolyte in the battery," said **Donghai Wang**, professor of mechanical and chemical engineering. "But it doesn't behave very well, which causes a lot of problems."

One of the least understood components of lithium metal batteries, the degradation of the SEI contributes to the development of dendrites, which are needle-like formations that grow from the lithium electrode of the battery and negatively affect performance and safety. The researchers published their approach to this problem in *Nature Materials*.

"This is why lithium metal batteries don't last longer, the interphase grows and it's not stable," Wang said. "In this project, we used a polymer composite to create a much better SEI."

Led by chemistry doctoral student Yue Gao, the enhanced SEI is a reactive polymer composite consisting of polymeric lithium salt, lithium fluoride nanoparticles, and graphene oxide sheets. The novel construction of this battery component has thin layers of these materials, which is where Thomas E. Mallouk, Evan Pugh University Professor of Chemistry, lent his expertise.

"There is a lot of molecular-level control that is needed to achieve a stable lithium interface," Mallouk said. "The polymer



A reactive polymer composite, picturing the electrochemical interface between lithium metal anode and electrolyte, is stabilized by the use of a reactive polymer composite, enabling high-performance rechargeable lithium metal batteries. Credit: Donghai Wang

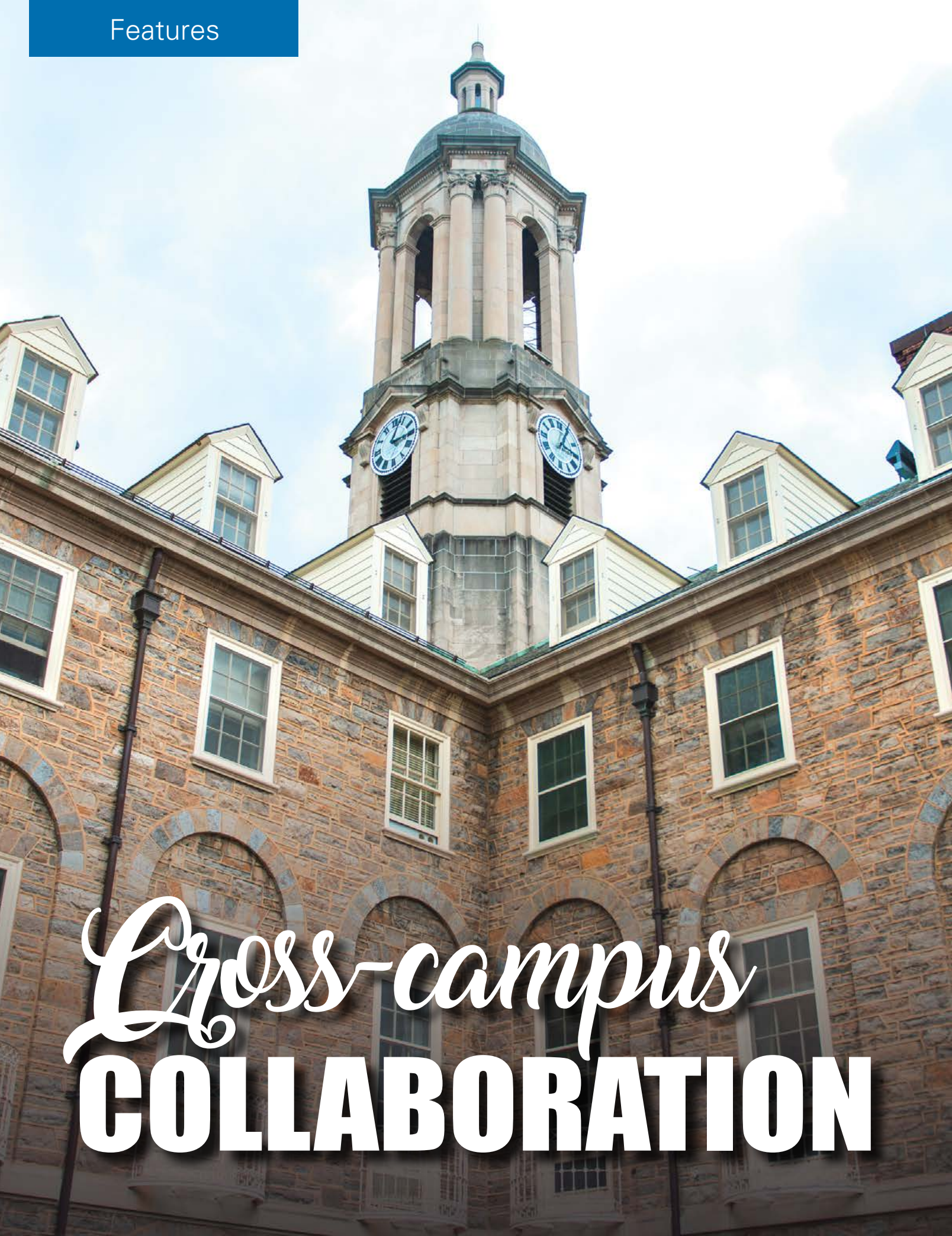
that Yue and Donghai designed reacts to make a claw-like bond to the lithium metal surface. It gives the lithium surface what it wants in a passive way so that it doesn't react with the molecules in the electrolyte. The nanosheets in the composite act as a mechanical barrier to prevent dendrites from forming from the lithium metal."

Using both chemistry and engineering design, the collaboration between fields enabled the technology to control the lithium surface at the atomic scale.

"When we engineer batteries, we don't necessarily think like chemists, all the way down to the molecular level, but that's what we needed to do here," said Mallouk.

The reactive polymer also decreases the weight and manufacturing cost, further enhancing the future of lithium metal batteries.

"With a more stable SEI, it's possible to double the energy density of current batteries, while making them last longer and be safer," Wang said. ■



Cross-campus COLLABORATION

College's Multidisciplinary Research Seed Grant program advances creative, transformative work

The College of Engineering's Multidisciplinary Research Seed Grant program supports research that increases the competitiveness of faculty in attracting high-impact multidisciplinary and center-level research funding from the state and federal government, industry, or foundations. Since the program's inception five years ago, cross-campus collaborations continue to grow.

Using machine learning techniques for geothermal exploration

When **Jing Yang** (above, right), assistant professor of electrical engineering, began looking for practical applications to her machine learning research, partnering with Chris Marone (above, left), professor of geosciences, for his work on safe and efficient geothermal exploration and energy production was a perfect fit.

"Machine learning approaches for safe geothermal exploration" aims to use machine learning to better predict seismic activity during geothermal exploration and to optimize geothermal energy production.

Geothermal systems require the creation of fractures through hydraulic stimulation. This fracture formation and stimulation is associated with microearthquakes (MEQs) that can damage buildings and other surface structures.

"We are very interested in whether certain precursors exist for MEQs so that we can predict when a major seismic activity is going to happen in the near future, upon which some immediate actions can be taken before anything destructive happens," said Yang.

The researchers have had success with gathering data and forecasting seismic activity in the lab, but they need to ensure that they can make these predictions at field scale.

To safely extract the optimal amount of geothermal energy in the hydraulic fracturing process, Yang and Marone will develop a safe reinforcement learning framework by creating scalable algorithms to handle unknown environments.

Marone and Yang plan to use results from this preliminary effort to develop a larger funded project and to extend this work beyond geothermal energy production into other areas. //

Joining forces to understand cancer progression

Collaborative research led by **Aida Ebrahimi** (above, right), assistant professor of electrical engineering, along with **Esther Gomez**, assistant professor of chemical engineering and biomedical engineering, and **Mehdi Kiani**, Dorothy Quiggle Assistant Professor of Electrical Engineering, will advance our understanding of the development and progression of cancer and other diseases.

"eROS: In situ Mapping of Reactive Oxygen Species Produced by Cancer Cells using Integrated Sensor Arrays" was spawn from previous research that Ebrahimi conducted on the effect of oxidative stress in bacteria cells. Ebrahimi knew that a healthy human body generates reactive oxygen species (ROS) to help fight off pathogens, such as bacteria. She then began learning about how radical species, including ROS, play a role in the progression of other biology-relevant issues, including cancer, infectious diseases, Alzheimer's, and Parkinson's.

Ebrahimi sought out Gomez, who is an expert on cancer research and is studying the effect of chemical and mechanical cues on cellular signaling mechanisms, and Kiani, who is an expert on integrated circuit (IC) technology.

"We wanted to enable mapping of the release and progression of ROS from cancer cells and normal cells and monitor the production of these species as a function of time over different locations to achieve the spatiotemporally resolved analysis. We wanted to achieve this by combining a sensor array based on specifically designed nanomaterials with IC technology," said Ebrahimi.

Achieving this goal would be extremely valuable cancer research and also for the understanding and treatment of other diseases involving ROS.

"If we can come up with these sensory arrays that can map the production and progress of these ROS and how they affect neighboring cells, it could be implemented in studying the role of ROS in pathogenesis of bacterial biofilms, which are a huge problem in hospitals, medical implants, post-surgical complications, and other health issues," said Ebrahimi. //

Driver behavior and autonomous vehicle technology

While many believe commuters may start to favor longer commute distances in exchange for lower cost homes if they are able to be productive during their commute, a key missing factor in predicting whether this is true is better understanding the effects of Connected and Autonomous Vehicle (CAV) technology on drivers' acceptance of longer travel time and changes in commuting behavior.

Ilgin Guler, assistant professor of civil engineering, along with **Sean Brennan**, professor of mechanical engineering, and **Yiqi Zhang**, assistant professor of industrial engineering, plan to develop a driver-in-the-loop simulator tool that allows drivers to experience dynamic traffic flow simulations. This will help the researchers understand the effects of CAV technology on commuting behavior.

The team will first integrate a microscopic traffic simulator with a driving simulator to recreate traffic conditions in State College, Pennsylvania. This will involve developing the necessary software that will allow the driving simulator to interact seamlessly with a microscopic traffic simulator. The driving simulator will allow a human to drive a traditional vehicle, semi-autonomous, or autonomous vehicle, and the exact behavior of the car will be provided to the microscopic simulator.

The researchers will then examine the driving simulator validity. For this step, human experiments will be conducted to collect and compare driving performance data in the developed driving simulator and the real roadway. These tests will be used to generate baseline data for general driving behavior such as speed control, lateral control, and responses to traffic lights and signs.

Finally, the research team will conduct human experiments to investigate the impact of CAVs on driver behavior and drivers' acceptance of CAV technologies. The experiment will include Level 4 and Level 5 CAV technology, some with internet access and some without internet access. The automation level and CAV's connectivity will be combined to yield four experimental conditions, which will be investigated for the change in drivers' acceptance of longer travel times.

In the end, the team hopes to have a much better understanding of the impacts of CAV technology on changes in driver behaviors at a community level and, eventually, how city structure will change if people move further away from urban centers. ■

$1.2 million NSF grant funds interdisciplinary Child Study Center project

by Susan Burlingame, Samantha Chavanic

Though it is known that preschool play helps build foundational skills that support thinking and reasoning, currently, there is little focus on STEM (science, technology, engineering, and mathematics) education in early childhood. Traditional STEM toys for young children most often target boys and an individualized play focus, furthering the recognized gender gap in STEM and limiting parent-child interactive experiences.

"This is a problem from a developmental standpoint. Parents play the role of instructor in these activities, directing children in finding the correct solution," Karen Bierman, Evan Pugh University Professor and director of the Penn State Child Study Center, said. "We believe that supporting child skills like reasoning, joyful problem-solving, creativity, and collaboration are just as important."

An interdisciplinary Penn State research team was recently awarded $1.2 million from the National Science Foundation (NSF) for "Designing Innovative Guided Play Experiences to Empower Parents and Engage Preschool-Age Children in STEM Learning." Led by principal investigator (PI) Bierman, the project will explore how to enrich informal learning opportunities for parents and children in under-resourced communities. Co-PIs on the project include **Jessica Menold**, assistant professor of engineering design and mechanical engineering; **Scarlett Miller**, associate professor of engineering design and industrial engineering; and Meg Small, assistant research professor and director for social innovation at the Edna Bennett Pierce Prevention Research Center. Jennifer Connell, family social worker in the Child Study Center, serves as the project coordinator.

The team will investigate how parents and preschoolers play together using build kits specifically designed to develop both STEM and social-emotional skills.

Menold, build kit design and production lead, said the goal of the kits is to support active and engaging parent-child play experiences.

"Building STEM skills early is critical for building the next generation of creative engineers and scientists," she said. "I see this as an opportunity to engage underrepresented groups in engineering and science early and start cultivating a passion for STEM through hands-on parent-child activities and imaginative play."

The three-year project began in fall 2018 with initial build kit prototyping and testing. The project's second year will include refining play guides and piloting at Discovery Space, a children's science museum and learning center in State College. During the final year of the project, the interdisciplinary team will test the impact the materials have on child skill development.

"Interdisciplinary efforts are the hallmark of Penn State's research enterprise, and we are thrilled the NSF is funding such an important project, which combines the efforts of faculty members in three different colleges," said Neil Sharkey, vice president for research. "The Child Study Center's groundbreaking work on understanding and promoting STEM skill development in preschool children will help us in building the workforce of the future." ■

"When participants had open-ended materials to play with, there was a lot more language used back and forth, as compared with when they used finished products," said Meg Small, director of social innovation for the Edna Bennett Pierce Prevention Research Center. Photo credit: Sara Brennan

(Top) Project team, from left: Jessica Menold, Meg Small, Sabrina Voltaire, Jennifer Connell, Karen Bierman, Lynn Liben, and Phoebe Bridy. (Team member Scarlett Miller is missing from the picture). Voltaire is a graduate student in Human Development and Family Studies, and Bridy is an undergraduate student studying engineering design. Photo credit: Sara Brennan

Designing Sustainable Homes on Mars and Earth

by Leon Valsechi

Above: Maryam Hojati, Colleges of Engineering and Arts and Architecture; Nate Watson, College of Engineering; Shadi Nazarian, College of Arts and Architecture; Jose Duarte, College of Arts and Architecture; and Negar Ashrafi, College of Arts and Architecture

Penn State researchers are developing 3D-printed building technology that could be used for NASA's space exploration projects and impact the future of housing on Earth.

Almost 34 million miles from Earth, Mars exists as the solar system's next frontier for human space exploration. A team of Penn State researchers has accepted NASA's challenge of designing an autonomous system capable of creating a human shelter on the red planet using 3D-printing technology. With the focus of the project on Mars, perhaps the most profound application of their work is on Earth.

Consisting of students and faculty representing the Colleges of Arts and Architecture, Engineering, Agricultural Sciences, and the Materials Research Institute, the team's breakthroughs have opened the possibility to applying the technology to create sustainable housing options that could revolutionize the construction industry and address larger societal issues such as homelessness.

Building Tomorrow, Layer by Layer

For nearly two years, the team has been competing in NASA's 3D-Printed Habitat Challenge, a Centennial Challenges competition. The four-phase competition requires entrants to develop advanced 3D-printing technology to produce a structurally sound habitat that can be 3D-printed by NASA's space explorers on Mars and beyond.

The internal success enjoyed by the team has led to a second place finish in phase two, and second and third place finishes in construction levels one and two of phase three of the competition, which has generated nearly $300,000 in prize money. That funding, along with a grant from Penn State and in-kind contributions of materials and consultation from Autodesk, Gulf Concrete Technologies, and Tilcon, has helped the team navigate numerous challenges.

One of the early design challenges the team faced was addressing the atmospheric pressure difference between the two planets. Earth's atmospheric pressure is nearly 15 pounds per square inch and Mars has an atmospheric pressure of well less than one pound per square inch. The dramatic difference informed a dome design that allows the walls of the structure to withstand the pressurization necessary to provide human explorers with an atmospheric habitat similar to Earth's.

Applying Penn State Expertise

Over the last decade, Penn State has been a leader in additive manufacturing research, with 3D printing labs on campus that offer a glimpse of the technology being explored by the team.

After a digital scanning process, a computer-guided robotic arm controls a nozzle that discharges a paste-like printing compound, made from various materials and filaments, that rapidly hardens to form the desired object. As research has progressed, the concept of 3D-printed buildings has emerged in the industry as an alternative to conventional building methods.

Printing tests to model material deformation during printing, from the work of architectural Ph.D. candidate Negar Ashrafi.

Advancements in printing concrete structures has led to researchers gaining a firm grasp on how materials behave on Earth but applying the same techniques on Mars was uncharted territory.

Aleksandra Radlińska, assistant professor of civil engineering, brought to the team a wealth of research knowledge in the field of cement and concrete behavior and sustainability. She also brought the idea of shipping concrete samples to the International Space Station for a round of experiments and the industry connections to make it happen.

Twice in 2018, a rocket launched from NASA's Wallops Island in Virginia carrying sealed packets prepared at Penn State. The packets, about the size of a plastic sandwich bag, have two sides—one containing water and the other containing the team's 3D-printing cement mixture. The space station crew member slowly squeezed and agitated each packet until the two sides mixed and then more than 100 samples were sent back to Happy Valley.

Complex, textured part from the work of Professional Master of Architecture student Drew Marshall.

The results of the experiments have provided the team with a better understanding of how the materials might react on Mars, but to have a full understanding, the team is in the early stages of building a small-scale machine that will be sent to the space station to conduct live printing experiments.

Additional components of the competition from the College of Engineering includes structural analysis by **Ali Memari**, professor and Bernard and Henrietta Hankin Chair in Residential Building Construction; robotics and systems design by **Sven Bilén**, head of the School of Engineering Design, Technology, and Professional Programs and professor of engineering design, aerospace engineering, and electrical engineering; and 3D printing expertise from **Nick Meisel**, assistant professor of engineering design and mechanical engineering, and **Randall Bock**, research assistant in agricultural and biological engineering.

"… The challenges we have faced have revealed the strength of our team, which is the diversity of ideas and disciplines," José Duarte, Stuckeman Chair in Design Innovation Director, Stuckeman Center for Design Computing, College of Arts and Architecture, said. "We don't view success individually. These are the team's successes. These are Penn State's successes."

After 30 hours of 3D printing over May 1-4 of head-to-head competition, the Penn State team won second place and $200,000 in the fourth phase of the competition. ■

DEVELOPING A SYSTEM OF ROBOTIC FROST PROTECTION IN ORCHARDS

by Chuck Gill

The National Science Foundation's Cyber-Physical Systems program awarded more than $843,000 to a team led by **Daeun Dana Choi**, assistant professor of agricultural and biological engineering, to develop a system that helps tree-fruit growers avoid frost damage to their crops by using unmanned aerial vehicles (UAVs) and ground-based robots.

Every year, the United States produces an average of 15 million tons of deciduous fruit. However, unpredictable frost and freeze events can damage crops significantly and cause substantial economic losses.

Methods commonly used by growers to avoid frost damage include sprinkler systems that form ice on the trees to trap the plants' heat; heaters to warm the orchard; and fans to mix colder air at ground level during a temperature inversion with warmer air higher in the atmosphere. These methods are resource-intensive and can be inefficient and impractical.

Choi explained that this three-year project is aimed at reducing the risk of crop damage by using UAVs to monitor air temperatures on nights when there is frost and sending commands to ground robots with heaters mounted on them. In this way, growers can target only those areas most at risk and ensure that all parts of the orchard are protected, while minimizing energy use.

"The project will integrate autonomous vehicles, real-time data analytics, decision-making, and Internet of Things (IoT) communications to significantly reduce the cost, and increase the precision, of frost protection of fruit trees," she said.

The team, which includes horticulturists and agricultural and mechanical engineers, first will develop UAV-based sensing systems to monitor air temperature of an apple orchard in real time and evaluate developmental stages of blossoms in the field. The researchers then will use this information as inputs to the decision-making and mission-planning process for an autonomous, mobile heating unit. Finally, they will integrate and evaluate communication and cooperative control of the multivehicle system in field tests.

"Frost protection using a novel combination of multivehicle systems for sensing, mission planning, and control in real time is a unique application that has never been tested in orchard conditions," Choi said. "Successful completion of this project will provide an effective way to maintain crop yield and increase economic profits."

"The project will integrate autonomous vehicles, real-time data analytics, decision-making, and Internet of Things (IoT) communications to significantly reduce the cost, and increase the precision, of frost protection of fruit trees."

The U.S. Department of Agriculture's National Institute of Food and Agriculture is a co-sponsor of the project. Other members of the research team are Paul Heinemann, professor and head of agricultural and biological engineering; Long He, assistant professor of agricultural and biological engineering; Rob Crassweller, professor of horticulture and extension tree-fruit specialist; David James Lyons, assistant research professor, Applied Research Laboratory; Joseph Sommer, professor of mechanical engineering; and James Schupp, professor of pomology. ■

Kathryn Jablokow, front; Susan Mohammed, middle; and Scarlett Miller, back, discuss a recent study where students were asked to fill out a series of surveys throughout the design process of a class project to provide team interaction data.

Analyzing design team interaction

by Samantha Chavanic

Imagine being on a team that works seamlessly, easily completing the assigned project. Now, imagine being part of a team that struggles to work together and meet deadlines. How do these teams differ? What can be done to ensure effective teaming happens?

To answer these questions, an interdisciplinary team of Penn State researchers will study how engineering team design performance is impacted by team interactions.

Led by principal investigator (PI) **Scarlett Miller**, associate professor of engineering design and industrial engineering, the team has been awarded $349,792 from the National Science Foundation for "Longitudinal Exploration of Engineering Design Team Performance in Relation to Team Composition, Climate, and Communication Patterns." The project will investigate team structure, and how it and communication capabilities impact psychological safety, a shared belief that a team is safe for interpersonal risk-taking. **Kathryn Jablokow**, professor of engineering design and mechanical engineering, and Susan Mohammed, professor of psychology, serve as co-PIs.

Research results will be used to develop a model showcasing interpersonal risk-taking's influence on teams during the design process.

In a psychologically safe climate, teams are comfortable sharing ideas because mistakes are treated with understanding and failures are learning tools. Current research on team communication and psychological safety focuses on a single design stage. Researchers will expand on this by exploring how psychological safety develops and how it is either maintained or decreased during an engineering team's lifetime.

"Establishing a psychologically safe climate is important because it has been shown to positively predict key team outcomes, including task performance, creativity, information sharing, learning, work engagement, and satisfaction," Mohammed said. "It has been a consistent, generalizable, and multilevel predictor of numerous outcomes important to individuals, teams, and organizations."

Engineering organizations are becoming more team-based, as it is believed teams generate better solutions to complex problems, Miller said. Because of this, engineering is increasingly being taught as a team process. However, little is known about how to teach teaming effectively.

"This lack of understanding is problematic because teams are dynamic entities by nature; when we represent teams as static entities, we cannot effectively train engineers to work in team environments," she said. "Think peer reviews that often occur at the end of a project. While these 'snapshot' methods allow us to understand what went well or didn't go well, it does not allow us to identify when to intervene or what type of intervention would be beneficial."

Researchers will also explore team training execution and effectiveness. Findings will be shared as a free collection of activities.

"Solving complex engineering problems requires collaboration," Jablokow said. "When you improve team performance, you make the process of problem-solving more effective and more efficient, which translates to less time, lower costs, and better solutions." ■

Making an Impact

Interdepartmental seminar on X-ray micro-CT imaging bit.ly/2WzQ46y

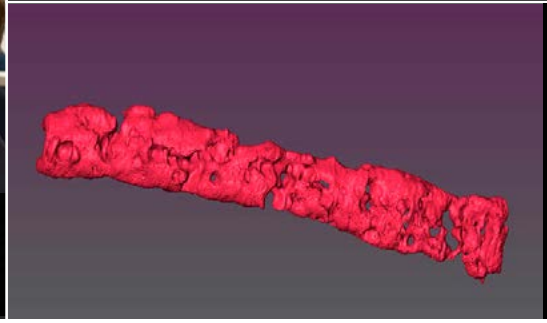
KidWind Challenge 2019
bit.ly/2MEnjB7

Students code inventive solution at HackPSU 2019
bit.ly/2MG7Pwg

The Power of Internships
bit.ly/2R5kLKQ

Two new scholarships support LGBTQA+ community in engineering and the arts
bit.ly/2XBRcCV

Industryxchange 2019
bit.ly/2ZzUck4

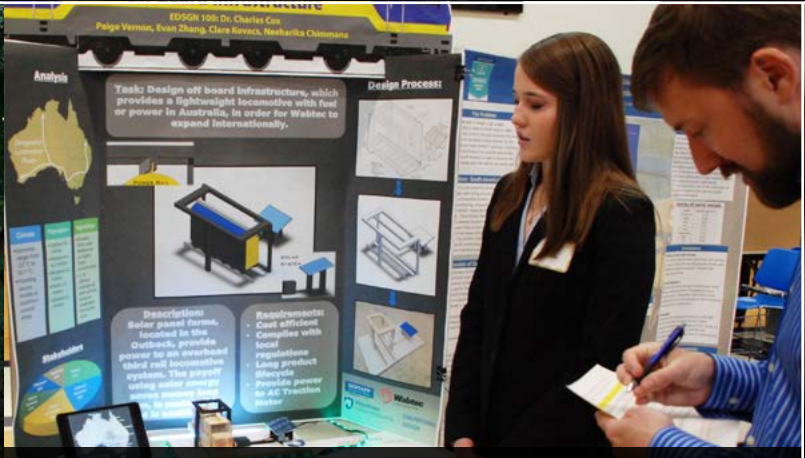


Micropores let oxygen and nutrients inside biofabricated tissues
bit.ly/2Wycss6

Penn State Service Enterprise Engineering Initiative
bit.ly/2EYmRaD

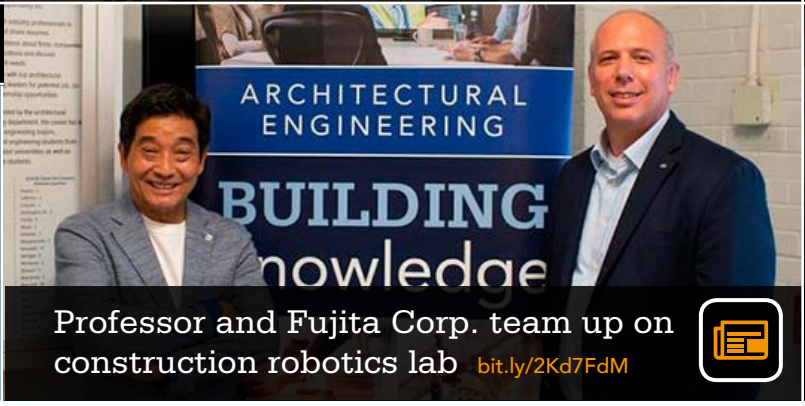
ChE students tell environmental stories with digital media
bit.ly/2I94uSr

We Are Inspired
bit.ly/2F2pNCU

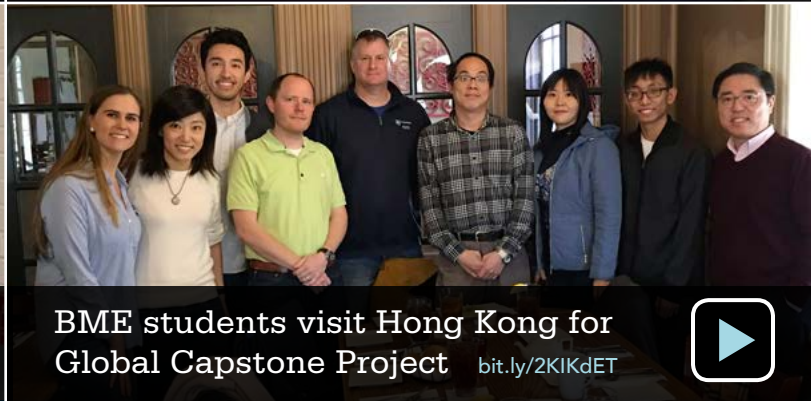


Capstone Design Showcase
bit.ly/2MF5xO8 // bit.ly/2wLGNsz

Center for Engineering Outreach and Inclusion Allies Event bit.ly/2IAIL4M



Professor and Fujita Corp. team up on construction robotics lab bit.ly/2Kd7FdM



BME students visit Hong Kong for Global Capstone Project bit.ly/2KIKdET

Student-engineered rocket creates LAUNCHPAD FOR EXPERIENCE

by Erin Cassidy Hendrick

After 18 months of painstaking design and construction, a team of engineers witnessed equipment they built take to the skies, attached to a rocket launched in Norway. But they weren't NASA scientists—they were undergraduate students in the Penn State College of Engineering.

As members of the Student Space Laboratory Program (SSPL), a student-run organization, they were a part of a NASA-sponsored project, the RockSat-XN program, created through the government entity's Grand Challenge Initiative. One of the seven rockets launched that day was designated exclusively for student experimentation and design. After months of hard work, the students created measurement devices to accompany that rocket, launched in the Arctic Circle.

Specific to the rocket's location, it is also the site of the much-beloved aurora borealis.

The structural team, one of many student groups on the project, comprised of mechanical engineering majors **Carl Smeltz**, **Sasha Yaskolko**, and **Cole Karschner**, electrical engineering major **Erica Venkatesulu**, and aerospace major **Vignesh Rathnakumar**, aimed to glean new information about this phenomena with their payload design.

The G-Chaser Rockets' overall mission was to better understand the ionosphere, a unique layer of the atmosphere.

"We wanted to map electron winds in that area—that's what causes the aurora borealis. These electron winds haven't really been mapped before, because satellites are too high to see it and hot air balloons are too low," Smeltz said. "So with this rocket, we wanted to learn something new that no one has ever done before."

When the rocket returned, the team was able to extract some new data about the conditions in the ionosphere. "It wasn't perfect data, but we got some new information! It was an accomplishment for us," Smeltz said.

But beyond the scientific knowledge gained during this journey,

The Penn State Student Space Laboratory Program structural team. Top: Alvaro Guerra, Sergio Gallucci, Matthew Miller, Carl Smeltz, Ryan Krebs, Robert Martin, and Joshua Davidson. Bottom: Professor Timothy Wheeler, Erica Venkatesulu, and Steven Krupa.

Smeltz and the team believe their cultural and professional skills reached new heights. With students hailing from Japan, Norway, and the United States, their project gave them hands-on experience working internationally.

"Since all our payloads were going on the same rocket, we really had to work together to make sure everyone's designs and experiments meshed," he said. "If our instruments were too close together, they could interfere, so we made some design changes or recommended ones for other teams so we could all be happy with our experiments."

Smeltz is quick to reiterate the impact of cross-discipline work in this area. He said, "One engineer can't make a rocket on their own. There's mechanical structures, electrical parts, analyzing the data using computer science. I have a big sense of accomplishment on this project, because my part helped the whole team create something we were really proud of." ■

Penn State team earns top spot in international Kaggle hackathon

Students from four colleges blend interdisciplinary backgrounds and shared skills to claim first place

by Kylee McGuigan

In December 2018, a team of five Penn State students from four separate colleges earned the top spot in the international Kaggle University Hackathon, the first-ever university hackathon of its kind.

Suraj Dalsania (information sciences and technology, College of Information Sciences and Technology (IST)), **Neil Ashtekar** (computer science, College of Engineering), Izzi Oakes (integrative arts, College of Arts and Architecture), Will Wright (mathematics, Eberly College of Science), and **Ming-Ju Li** (electrical engineering, College of Engineering) joined to compete for Penn State. They are all members of Nittany Data Labs (NDL), a College of IST student organization aimed at preparing students to become leading data scientists in a number of fields.

At the hackathon, teams were given a data set of medical drug reviews and ratings, indicating whether or not people found them helpful. Team NDL set off to address a set of problems, such as creating a way for people to find the best medication for their illness and determining which machine models work best for predicting a drug's rating based on consumer reviews.

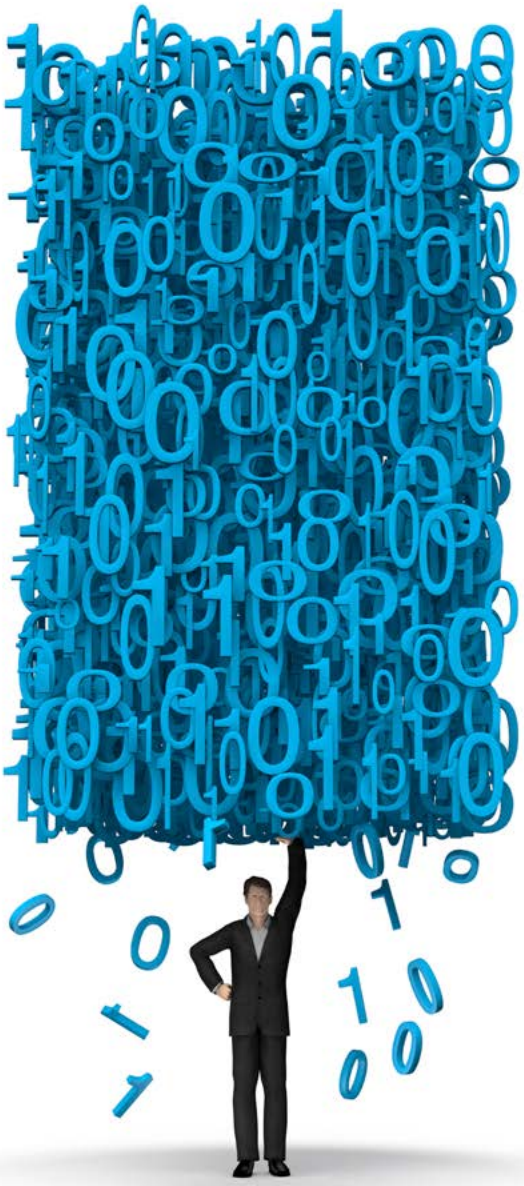
Their final submission was in the form of a code that used sentiment analysis to explore how it affected user ratings, the perceived usefulness of ratings, and which machine learning models could best predict the sentiment or rating based on the user review, among many other factors. To accomplish their task, the team members worked individually at first, but then combined their data together. They credit their interdisciplinary approach and the foundation they've built through classes and NDL with advancing the project.

"When it came to the predictive modeling part, we started working together and it was more organized," added Oakes.

Teamwork is something that the team can credit to learning at Penn State, as that is one skill that has been taught through their courses and other experiences.

"In my time [at Penn State], I have developed beneficial skills in the art of networking and professional development," said Dalsania. "Being in the College of IST, as well as a part of NDL, has taught me real world lessons on how to interact with business professionals, how to work together on group projects, and how to become a better leader."

In the hackathon, Team NDL scored highest out of the 18 participating teams among universities around the globe. Owned by Google LLC, Kaggle is an online community of more than 1 million data scientists and machine learners that offers a collaborative space and hosts competitions to solve data science challenges. ■



Team Nittany Data Labs, winners of the Kaggle University Club Hackathon, competed against 17 other collegiate teams to earn top spot in the international competition. Pictured, left to right, are Neil Ashtekar, Izzi Oakes, Suraj Dalsania, Will Wright, and Ming-Ju Li.

Augmented reality brings THON to Children's Hospital

by Steve Sampsell

What can a few people do to make a difference for many others?

When those people are Penn State students, it's a lot. Katherine Finneran added her name to the seemingly ever-growing list of community-minded and motivated Penn State students with an idea she formed last summer and made a reality in recent months.

Finneran, a senior public relations major who completed a summer internship with Showtime Networks, noted the company's use of augmented reality (AR) in some cases and wondered about its possible implementation in conjunction with the Penn State Dance Marathon.

A media relations captain for THON this year, Finneran thought AR might be a way to bring THON to the children battling pediatric cancer at the Penn State Children's Hospital who are unable to attend the event Feb. 15-17 at the Bryce Jordan Center (BJC). She previously served on the donor/alumni relations and dancer relations committees for the student-led philanthropic event.

"Pairing technology with the largest student-run philanthropy in the world?" Finneran asked. "It seemed like a perfect combination."

Finneran's THON co-captain, Anne Papandreas, a sophomore biobehavioral health major, teamed up with Finneran to lead the project. Papandreas opened the door to six talented students from the College of Engineering and the College of Information Sciences and Technology who had AR experience.

"They were excited about taking on the project," Finneran said. "They're full-time students just like me, but they were more than willing to help and jumped on the idea. I have so much respect for people who could create something like this and bring it to the children who are unable to attend. All these people, coming together? It's exciting and special."

Team members include students from three different colleges on campus. Front row (from left): Tyler Spagnolo, Zack Deible, and Sydney Wehn. Back row (from left): Isabelle Biase, Ruchi Patel, Anne Papandreas, Katherine Finneran, and Kevin Gardner.

The six students who designed the effort were: senior **Ruchi Patel** (industrial engineering), junior **Tyler Spagnolo** (computer science), sophomore **Isabelle Biase** (computer science), sophomore **Zack Deible** (data science), sophomore **Kevin Gardner** (computer science), and sophomore Sydney Wehn (applied data sciences).

Biase and Spagnolo were first inspired to assist others with technology when they created a tool using artificial intelligence to help Penn State students find a potential path to their dream job as part of the Nittany AI Challenge. Their team, Aspire, went on to finish as one of the top three teams for 2018.

> *"My biggest motivation for pursuing a career in computer science is to create technology that empowers people."*

"My biggest motivation for pursuing a career in computer science is to create technology that empowers people," Biase said. "With this AR application for THON, I also hope to make an impact by using technology to support THON's mission."

Spagnolo said the Nittany AI Challenge led him to take on projects with a powerful mission like the AR application for THON.

"The experience inspired me to want to make a difference in the lives of others and instilled in me the self-belief that's necessary to do it," Spagnolo said. "I had always felt like there were so many amazing and impactful things going on here at the University, but the challenge was the first thing that turned that thought into a reality."

After months of development, the overall AR group brought its efforts to fruition in February, including posters on the walls of Penn State Children's Hospital, voice recognition technology, and more. Specifically, when a user pointed an iPad at the posters, it brought to life aspects of THON that other children enjoy in person, including blowing bubbles on the floor of the Bryce Jordan Center and learning the line dance.

"It's sometimes hard for people to understand the magic of THON if they've never experienced it at the BJC," Finneran said. "However, this augmented reality app helps change that by giving the patients and their families an opportunity to feel the energy that comes alive during the 46-hour dance marathon." ■

Student diversity strengthens program's impact and reach

by Courtney Allen

"I think that when we say, 'we should appoint more female leaders,' we have to give data as to why. Not just because they are women, but because the research shows it actually works for the benefit of the ventures." – **Daniela Staicu, visiting Fulbright scholar**

As part of the HESE venture Produce Solutions, Megan Ellery (right) and Greg Schweiker (left), talk to vendors in the early morning hours at Kibuye Market—one of the largest open-air markets in eastern Africa—to learn about problems in the Kenyan produce supply chain that affect food quality and profit.

Jessica Novis (left) and Zaid Hmoud (center) of Inakua, meet with a village community to learn more about farming habits in their efforts to develop small scale aquaponics systems that would free subsistence farmers from the fluctuations caused by climate change as well as the risk and time involved in traditional farming.

Through its unique opportunities focused on social entrepreneurship and humanitarian technology development, the Humanitarian Engineering and Social Entrepreneurship (HESE) program attracts a diverse group of Penn State students wanting to inspire change. Together, these students help to solve problems using technology-based sustainable approaches that impact millions of lives around the world.

Recent research conducted by the program finds that diversity among HESE's engineering students is also growing, with more than half being female students. This statistic, coupled with the program's focus on cultivating multi-semester leadership growth, has led to most HESE ventures transitioning to being women-led or co-led.

Daniela Staicu, HESE's visiting Fulbright scholar studying leadership in social ventures, said this approach was established as a result of a HESE study developed as part of her Fulbright research, including "guided student reflections on the process of achieving their goals in the HESE program." Among other research areas, Staicu studied women who transitioned from a team member position to a leadership role and how this change led to more effective team results and personal development opportunities for the women involved.

"In the fall, we gathered input from all 49 students taking the first HESE course [ENGR 451] and we were able to implement changes right away, in the spring course [EDSGN 452/453]," she said. "This led to an environment even more conducive to successful, diverse teaming. I think that when we say, 'we should appoint more female leaders,' we have to give data as to why. Not just because they are women, but because the research shows it actually works for the benefit of the ventures."

Amanda Bailey, a senior chemical engineering student, said this is one of the most unique components of HESE.

"It shows that not only are we developing more leadership skills, but we're also developing management skills [through collaborative, interdisciplinary teams]," said Bailey. "We're also fostering that as an opportunity for women to get more into leadership. That's something unique that allows for building women leaders and giving women opportunities which other classes might not."

HESE's diversity allows for fluidity in projects, explained **Jack Iffert**, a civil engineering student.

"When we think about HESE, and the social and political value, each of us as problem solvers will bring a perspective. Having a diverse range of people is productive. It's not just five civil engineers; it's all different people who are able to provide their expertise in the area they're most comfortable with, which makes a more holistic product," he said.

Iffert said that while working on a semester-long project, his teammates ranged from engineering and architecture students to international affairs majors. Thanks to his team's diverse background, Iffert was able to grow his blueprint skillset with help from an architecture student teammate.

"I was able to put things in a visual marketplace and I learned a lot about applying a blueprint to real life. Good ideas are not limited to technical expertise," he explained. "Sometimes engineers put all their ideas in a box, and that's tunnel vision. So, you're able to be pushed out of that box, and out of the limitations we [engineers] create, ultimately limiting our creativity."

Staicu explained why she thinks HESE is more popular among women engineering students.

"They are eager to be in this program because they get to develop technology to impact communities that are disenfranchised. The social role is very important to them," she said. "They are interested in acquiring skills that are related to business, an area where they may have less of a background. It's about an interest in making the transition from the traditional role of engineer to a modern role where they have business skills to develop a technology-business model with care for the people and the environment at the same time."

As a technology development program predominately composed of female students, HESE differs greatly from the traditionally male-dominated field of engineering, generating curiosity about what makes HESE more attractive to women.

"Research shows that it is the impact of the program. I think that students, and particularly millennials, are becoming more empathetic. Empathy is the foundation of our program and what we are seeing in the HESE classes," said **John Gershenson**, director of HESE and research professor.

Because a specific goal of HESE is to create innovative change within developing communities, students are placed in teams where they actively work to frame and solve issues in these communities. Students explained that it is HESE's team structure and community engagement that contributes to its appeal and success.

"Through interacting and forming relationships with local communities we are able to learn about the market supply chain to see the problems farmers and wholesalers encounter daily," Lakshmi Hirpara, an energy business and finance student, said. "Having a relationship with our local contact, Caroline, has helped us surge forward immensely by allowing us to immerse in the culture of the market and gain insights about these problems people are facing every day."

Without the team structure, Bailey described how she would not have been able to reach her goals as easily, notably being named the first runner-up of the Joelle Award for Women in Engineering Leadership. This award aims to highlight female students who are brandishing a path of leadership and service and who provide a positive environment for women within the College of Engineering.

"I think I wouldn't have even been close to achieving it [Joelle Award runner-up] without my HESE experience. I think with HESE it's so important to encourage women, and the best way HESE does that is working in groups. We don't exclude," she said.

Daniela Staicu with the Produce Solutions team at their final presentations before the Maymester research trip to Kenya. From left, Yash Makhecha, Greg Schweiker, Megan Ellery, Daniela Staicu, Lakshmi Hirpara, Ebenezer Akande, and Krina Patel.

Students

Daniel Kats, a biomedical engineering major who has worked on HESE projects in Kenya, said being on diverse teams makes working on the ventures much more real.

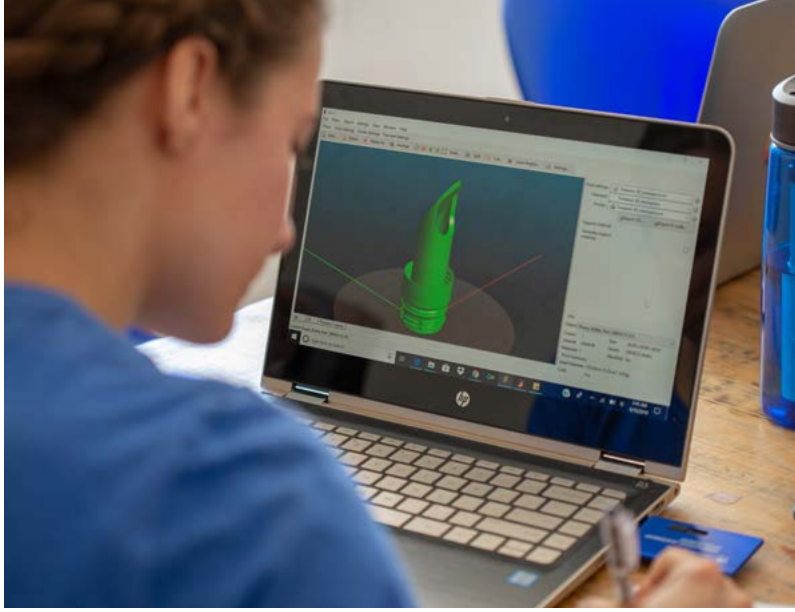
"This is real stuff with real people. You don't just forget about it when the semester ends," he said. "This is a significant part of our life. We see the change we are making and it's more satisfying than just writing a report."

Lucy Spicer, a biomedical and mechanical engineering double-major sophomore, said the environment of equity in HESE is what helps establish its uniqueness.

"HESE is one of those programs that is so different from everything else in the College of Engineering. It has the deeply rooted technical aspects, but you get to see the business, supply chain, and other fields as well," she said.

When explaining the humanitarian aspects of HESE, Gershenson explained that it wasn't simply that women were more interested in impact, but perhaps that women were "ahead of the game."

After hearing about HESE at a Women in Engineering Program, **Kayli Rentzel**, mechanical engineering student, said she instantly became interested in inspiring change and impacting millions.



Magdalia Campobasso, as part of the Kijenzi team in Kisumu, Kenya, works on 3D printing a medical replacement part for a nearby hospital.

"I thought it was cool that we weren't making a hypothetical business; this is going to produce something," she said. "Yeah, we're students, but we are making a difference. It's more worthwhile to work on something that will change the world." ■

HESE director, John Gershenson, talks about project collaboration:

"HESE thrives on this idea of having multidisciplinary students because all projects ARE multidisciplinary. It's not special to HESE. All good product and service development thrives on vastly different perspectives and vastly different backgrounds. HESE, at the heart of it, requires a piece of technology which is why it is half engineering and half other disciplines. We're working with other colleges in order to make HESE part of their curriculum, too. All good design happens this way. "

Jack Iffert and his team, Chirp Alert, speak to leaders of a community about early warning systems and their efforts to respond to border violence.

Members of GreenBriq carbonize dried water hyacinth, an invasive species on Lake Victoria, in the process of making briquettes for use as a sustainable fuel in cook stoves in the local village.

Penn State startup wins $367K in pitch competition

by Erin Cassidy Hendrick

spotLESS Materials LLC, a startup company developed from research conducted in the Penn State Department of Mechanical Engineering, won third place and $367,500 at the 2019 Rice Business Plan Competition (RBPC) on April 6.

Birgitt Boschitsch, mechanical engineering alumna and spotLESS CEO; **Jing Wang**, Ph.D. graduate and technical adviser; **Nan Sun**, current Ph.D. student researcher; and **Tak-Sing Wong**, the Wormley Early Career Professor and chief technology officer, participated in the RBPC to market their innovative liquid-entrenched smooth surface (LESS) coating, a spray-able, anti-fouling coating that can address sticky problems across industries. For example, it can be applied to toilet and sanitation facilities.

Developed by Wang, the technical lead of the project, it dramatically decreases the amount of water needed when flushing a toilet, by more than 90 percent.

In their RBPC pitch, the team wrote, "We have developed a robust bio-inspired, liquid-, sludge-, and bacteria-repellent coating that can be applied in minutes in ambient conditions. This coating can transform sticky surfaces into self-cleaning ones."

By creating self-cleaning surfaces, this impactful tech could mitigate hazards and costs associated with maintaining surfaces prone to contamination. It could even be adopted to save millions of gallons of water every day that can be directed toward other important activities or to drought-stricken areas or to regions experiencing chronic water scarcity. Even in communities with access to clean water, the use of this product would conserve precious resources and provide cost savings.

The team started in sanitation, but noted these problems are ubiquitous and have consequences across industries, from automotive to marine and beyond.

They added, "Our goal is to leverage our team's materials expertise to solve 'sticky problems' across various industries."

Birgitt Boschitsch, Nan Sun, Tak-Sing Wong, and Jing Wang receive their funding from the Rice Business Plan Competition.

While it wasn't their first big win, taking third place at the RBPC, one of the world's largest student pitch competitions, represents a critical turning point for the startup.

Boschitsch said, "This financial investment will help us fund business development activities key to acquiring our first paying customers. In addition to the funding, this win gives us credibility that can help us attract business talent, strategic partners, etc."

As a participants in the National Science Foundation (NSF) I-Corps National Team in the past and as current recipients of an NSF SBIR Phase I grant, the researchers receive additional support in the form of entrepreneurial education, mentoring, and funding to accelerate the translation of knowledge derived from fundamental research into emerging products and services that can attract subsequent third-party funding.

"All the teams participating in the Rice Business Plan Competition were impressive, so getting third place was both exciting and humbling," Boschitsch said. "I was so proud of our team, so grateful for the mentors who helped equip us, and so overwhelmed by the support." ■

Ned Brokloff named defense research liaison for Engineering

An '82 graduate of the College of Engineering, **Ned Brokloff** has spent the past 36 years at the Johns Hopkins University Applied Physics Laboratory, connecting researchers with engineers to translate science from theory to practice for the U.S. Department of Defense. Now, he'll do similar work as the defense-related research liaison for the College of Engineering and the Applied Research Laboratory.

Brokloff's main objective is to match the capabilities in Engineering with opportunities across laboratories and agencies that support federal government research, specifically for defense. He's working to connect engineering faculty with ARL faculty and engineers. He's also matching current research in engineering with current sponsored programs in ARL, as well as making connections between current research in engineering and potential applications ARL may be able to develop in a decade.

While Brokloff is just now returning to Penn State for work, he has been deeply involved with the Penn State community for the last decade. An active member of the alumni association, Brokloff is also a passionate donor and mentor for the students producing THON, the student-run philanthropic 46-hour dance marathon that raises awareness and millions of dollars to benefit those affected by childhood cancer.

OUTSTANDING ENGINEERING ALUMNI

Alumni honored with college's most prestigious award

In April, twelve engineering graduates were honored with the 2019 Outstanding Engineering Alumni Award. Established in 1966, the Outstanding Engineering Alumni Award is the highest honor bestowed by the College of Engineering and recognizes graduates who have reached exceptional levels of professional achievement.

Back row, from left: **Jiayu Chen**, electrical engineering, Ph.D. 1993; **Fred McLaren**, civil engineering, B.S. 1962, sanitary engineering, B.S. 1962; **John O'Keefe**, architectural engineering, B.S. 1987; **Tim Kowalski**, computer science, B.S. 1982; **Justin Schwartz**, Harold and Inge Marcus Dean of Engineering

Front row, from left: **Gary Butler**, industrial engineering, B.S. 1971; **Tim Davis**, engineering science and mechanics, B.S. 1986; **Terri Ruch**, agricultural engineering, B.S. 1987; **Jack Shearer Brenizer**, nuclear engineering, Ph.D. 1981; **Brian Olsavsky**, mechanical engineering, B.S. 1985; **Joel Madison**, aerospace engineering, M.S. 1988

Not pictured: **Eric Schnur**, chemical engineering, B.S. 1989; **Alan Snyder**, engineering science, B.S. 1978, bioengineering, Ph.D. 1987

Read full bios of our outstanding alumni.
bit.ly/2Zacfx7

Photo Credit: Willy Sanjuan-Invision-AP Images

Electrical engineering alumna wins Engineering Emmy Award

This fall, millions of viewers tuned in to watch television's biggest stars receive recognition during the 70th Annual Primetime Emmy Awards. But it wasn't just celebrities whose work was recognized; **Diane Miller**, Penn State electrical engineering alumna and senior embedded firmware engineer at Production Resource Group, received an Engineering Emmy Award for her work on the GroundControl project at Production Resource Group.

According to the Emmy Awards website, an Engineering Emmy Award "is bestowed upon an individual, company, or organization for developments in engineering that are either so extensive an improvement on existing methods, or so innovative in nature, that they materially affect the transmission, recording, or reception of television."

Miller and her team at Production Resource Group received the Emmy for their project GroundControl, which allows a followspot operator, who usually works suspended from a truss above the stage or audience, to work from the ground and control the followspot remotely.

Miller credits her Penn State education as laying the foundation for her professional success. "My time at Penn State was instrumental in teaching me how to think like an engineer, to creatively but logically solve problems. The coursework I completed at Penn State gave me the knowledge and skills I need to excel in my field."

Spotlight

SUSAN FULLERTON, assistant professor of chemical and petroleum engineering at the University of Pittsburgh's Swanson School of Engineering, earned her bachelor of science and Ph.D. degrees in chemical engineering at Penn State (2002 and 2009, respectively).

What is your area of expertise?

My research group, the Nanoionics and Electronics Lab, studies the interplay between ions and two-dimensional (2D) materials to engineer low-power, next-generation electronics. The continuous miniaturization of electronics allows us to pack more computing power into our handheld devices, but we need new materials and device concepts to make the components even smaller.

One such material is 2D material—a sheet-like material that is only a single molecule thick. My Ph.D. training at Penn State focused on ion transport, and ions do a good job of controlling charge transport through the 2D sheets—a function that is critical for electronic devices.

What do you like the most about your job?

I love working at the boundary of what is known and what is unknown. Every research project moves that boundary to some extent, and watching my group move that boundary is quite thrilling. In teaching, I really enjoy watching students grasp the tough concepts and make connections between my course and other courses. To avoid the "curse of knowledge," I try to put myself in their place and consider my level of understanding when I was sitting in the classrooms at Penn State.

Speaking of teaching, in December you won your department's teaching award.

This is the 2018 James Pommersheim Award for Excellence in Teaching in Chemical and Petroleum Engineering.

Pommersheim is a Pitt alum with a highly respected teaching career at Bucknell University, and he presented the award. The award recognizes excellence in teaching in our department, which for the past several years has earned the highest teaching record of any department in our school of engineering. With so many deserving faculty, it was quite an honor to win.

You are also the recipient of the 2019 AAAS Marion Milligan Mason Award for Women in the Chemical Sciences. Talk a bit about what the award means to you.

I am honored to be a recipient of this award, which was made possible by Dr. Milligan Mason, a chemist who was deeply committed to higher education for women. I'm eager to be a champion and ambassador for women in the chemical sciences. This, and my recent NSF CAREER Award, will open new doors for my research lab.

How did your Penn State chemical engineering education prepare you for your career in academia?

Above all, the Ph.D. provided me with a toolkit for tackling problems—even those outside my discipline. Some of the most exciting discoveries are happening at the intersection of multiple disciplines, and my training at Penn State enables me to be responsive to these opportunities. ■

FROM YOUR PRESIDENT

Multiple backgrounds, one goal: Build an active, engaged community of engineering alumni

Just like the College of Engineering, the Penn State Engineering Alumni Society (PSEAS) is an interdisciplinary group. Our current board members represent diversity in career backgrounds, degrees, graduation years, and gender, coming together and connecting as volunteers who support and lead alumni to engage in College of Engineering programs and events.

We are all proud and passionate Penn State engineering alumni and members of the Penn State Alumni Association. Did you know that if you are a member of the Penn State Alumni Association, you are automatically a member of PSEAS? No extra dues or fees are required.

A great opportunity to get to know more about PSEAS and have a ton of fun in the process is to come to our College of Engineering Alumni Tailgate held on September 7, from 4:00 – 6:30 p.m. at the Bryce Jordan Center's Founders Lounge. All proceeds from the tailgate, including registration and the Silent Auction, directly benefit the Penn State Engineering Alumni Society Endowed Scholarship Fund, which provides scholarship support to engineering students who demonstrate promise of academic success. For more information on the tailgate, and to register, visit bit.ly/CoEtailgate19. We would love to see you there! Please RSVP by August 23, as space is filling up fast.

In addition, every October, PSEAS sponsors annual awards that are given to engineering faculty, staff, and alumni at a ceremony held in the Hintz Family Alumni Center on the Penn State University Park Campus. Nominated by their respective departments, honorees are selected by their peers along with members of the PSEAS Board of Directors. Stay tuned to find out this year's recipients!

For more information on how to get involved with PSEAS, contact the College of Engineering Alumni Relations Office at alumni@engr.psu.edu.

We are PSEAS and we are 100,000 strong. Join us as we inspire change and impact tomorrow.

For the Glory,

Jane Hrehocik Clampitt

Jane Hrehocik Clampitt, '79 BS ChE
President, Penn State Engineering Alumni Society
clampittjh@verizon.net

THE PENN STATE ENGINEERING ALUMNI SOCIETY

Building an active, engaged community of engineering alumni since 1959

The alumni society provides:

- Membership in a worldwide network of 100,000 engineering alumni.
- Fellowship among engineering alumni, faculty, staff, and students.
- Volunteer and service opportunities on campus and in your own community.

We want to hear from you! **Visit PSEAS** on the web to submit your latest news and to learn more about becoming a member.

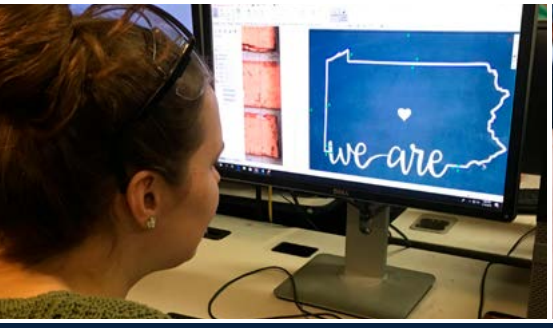
FOR MORE INFORMATION, CONTACT:

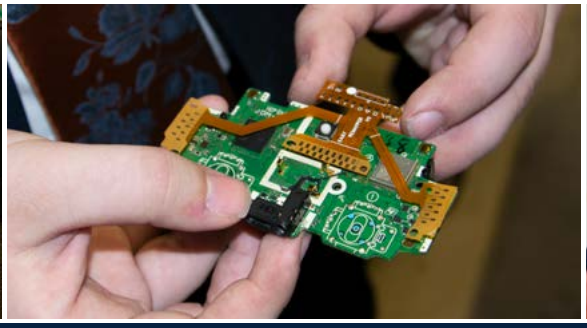
Erin Tench, Director of Alumni Relations,
Events and Volunteer Engagement
101 Hammond, University Park, PA 16802
814-863-3384 | ext120@engr.psu.edu

PennState
College of Engineering

The Pennsylvania State University
101 Hammond Building
University Park, PA 16802-1400

Calendar of Events





Aug. 10	Summer Commencement
Aug. 26	Fall Semester Begins
Sept. 6	Penn State Engineering Alumni Society Board Meeting
Sept. 7	Penn State Engineering Alumni Society Alumni Tailgate (Penn State vs. Buffalo)
Sept. 17-20	Fall Career Days
Sept. 24	Architectural Engineering Career Fair
Sept. 28 – Oct. 5	Homecoming
Oct. 11-13	Parents and Families Weekend
Nov. 16	Military Appreciation Day
Dec. 12	College of Engineering Design Showcase
Dec. 21	Fall Commencement