



ESM CONNECTIONS

Spring 2021

First at-home COVID-19 test co-developed by engineering science alumnus



John Waldeisen, who earned his bachelor's degree in engineering science (ESC) at Penn State in 2007, had a big year. Lucira Health, the company he co-founded out of

his apartment in 2013 with \$5,000 in savings and a Small Business Innovation Research (SBIR) grant from the National Institutes of Health, received FDA approval for the first at-home COVID-19 test in November of 2020.

It is the first-ever single-use, instrument-free molecular test for at-home use, and it is now available for prescription home-use with self-collected nasal swab samples from individuals aged 14 years and older.

Waldeisen earned his doctoral degree in bioengineering at the University of California, Berkeley, where he met his co-founder Debkishore Mitra. The pair, along with two other classmates—including Benjamin Ross ('06 B.S. ESC, '07 M.S. ESC)—worked on molecular diagnostic technologies for use in resource-limited settings, with funding from the Gates Foundation and Defense Advanced Research Project Agency (DARPA), to develop simple, locally

deployable test kits to detect infectious diseases. After receiving their doctorates in 2012, the graduates launched DiAssess Inc. The company evolved into Lucira Health, where Waldeisen served as chief executive officer until 2019 and remained on the board of directors until November of 2020. The company went public in 2021.

"I am an entrepreneur," said Waldeisen, who noted that he founded Lucira specifically to develop inexpensive diagnostic devices for the early detection of infectious diseases. "My passion lies in team and company building. My interests lie in the development and commercialization of bleeding-edge technologies that will transform the state-of-the-art in biotech and the standard-of-care in health care."

Early on, Waldeisen and his colleagues worked to develop a rapid diagnostic test for influenza. Within months of their product reaching maturity, COVID-19 started to spread. Due to the similarities between influenza and the coronavirus, the test could be quickly redesigned to specifically detect COVID-19.

"The importance of the at-home test kit for COVID-19 cannot be underestimated during the current pandemic," said Akhlesh Lakhtakia,



Evan Pugh University Professor and Charles Godfrey Binder Professor of Engineering Science and Mechanics, who served as Waldeisen's academic adviser. "Even more important, rapid tests on the same platform will be used for other infectious diseases. Imagine the global impact!"

Lakhtakia nominated Waldeisen for the Penn State College of Engineering's inaugural 40 Under 40 Alumni Award cohort. Waldeisen was selected for his significant early career impact, and he is joined by three other ESM alumni: Ross, Jason Ryan ('06 M.S. ESC, '10 Ph.D. MatSE), and Guneet Sethi ('04 M.S. EMCH, '10 Ph.D. ESMCH).

"The wonderful thing about Penn State, and an aspect that is exceedingly different from most other colleges, is that the shared student experience transcends generations," Waldeisen said. "Encounters with alumni, whether 10 years younger or 30 years senior, draw on a wide range of wholesome and visceral conversation topics that bring both parties back to their vivid



PennState
College of Engineering

**ENGINEERING SCIENCE
AND MECHANICS**

In This Issue

- 2 Message from the chair
- 2 Faculty spotlight
- 3 Graduate spotlight
- 3 Undergraduate spotlight
- 3 Alumni news
- 5 Faculty news/honors/awards
- 8 Latest ESM news
- 12 Message from alumni society chair

Innovation lives where disciplines meet.

Message from the chair



Alumni, friends, faculty, and students,

As spring arrives, the flowers bloom, and vaccines become available for all, there is a new wave of optimism in the air. We are looking forward to an in-person May graduation ceremony for the first time in two years. Congratulations to **Olivia**

Cook, our engineering science student marshal, who will be escorted by her faculty adviser, **Andrea Arguelles**, recipient of the 2020-21 Schreyer Honors College Excellence in Teaching Award.

The Penn State Engineering Alumni Society honored three ESM members with 2021 awards. **Wes Blakeslee** ('69 B.S. ESC), former ESM and College of Engineering Industrial and Professional Advisory Committee (IPAC) chair, received the 2021 PSEAS Distinguished Service Award; **Sahin Ozdemir**, associate professor, received the 2021 Outstanding Research Award; and **Saptarshi Das**, assistant professor, received the 2021 Outstanding Teaching Award. Yet more accolades are due to our faculty and staff, who have kept ESM courses, research, and operations running seamlessly in this challenging year. Our faculty received an unprecedented number of external awards and were honored at the Penn State College of Engineering External Awards recognition event—the ceremony video can be viewed online at bit.ly/ae-extawards.

Recruitment is going well, and we are on track to bring in the largest fall graduate class we have seen in many years. We are also recruiting two new faculty member co-hires, together with the Department of Biomedical Engineering—one in biosensing and one in artificial intelligence/machine learning/data sciences related to biomedical applications.

Indeed, brighter times are ahead—I look forward to seeing you all in person soon.

Warm regards,

Judith A. Todd

Judith A. Todd



Olivia Cook



Andrea Arguelles



Wes Blakeslee

First at-home COVID-19 test co-developed (cont.)

years as a Penn State student. As an entrepreneur, I've been fortunate to connect with fellow Penn State entrepreneurs in the early part of my career who guided me when I was still learning the ropes of starting a company."

Waldeisen pays the kindness forward by now advising other newly launched Penn State start-up companies and sharing his experience and lessons learned with students in the Penn State community. Waldeisen most recently spoke about the usefulness of a degree in engineering science and mechanics to a University undergraduate class on April 8.

"My experiences during my time as a student were formative in establishing my work ethic and personal values," Waldeisen said. "The vastly interdisciplinary major of engineering science and mechanics offered a perfectly unique and eclectic exposure of subject areas that continue to be materially useful to me in my everyday life as an entrepreneur."

Faculty spotlight



Joe Cusumano investigates fall risk with grant collaborators

Joe Cusumano, professor of engineering science and mechanics, uses mathematics to understand everyday phenomena. As co-investigator on two National Institute of Aging grants, totaling nearly \$2 million in funding, Cusumano is developing physics-based models that mimic a person's movement while walking.

In one study, Cusumano and his collaborators used a two-dimensional walking model simulation that walks like a human to find the regulation of speed while walking promotes stability. These findings could inform future research on minimizing fall risk. bit.ly/3d-walker



Model that mimics a person's movement

Graduate spotlight



Hemant Gudapati makes new discovery on solid layers on water surface

Hemant Gudapati, ('20 Ph.D. ESMCH), recently published a new discovery in Soft Matter. Along with Ibrahim Ozbolat, Hartz Family Career Development Associate Professor of Engineering Science and Mechanics, Gudapati discovered that fibrous proteins form a solid layer on the surface of water due to aggregation of proteins at the air/water interface. Previously, it was only demonstrated that the other main type of protein, globular proteins, formed these solid layers at the air/water interface. Hemant is now a postdoctoral research associate at Duke University. bit.ly/bio-lead



Bowen Li named Leighton Riess Graduate Fellow

Bowen Li, graduate student in engineering science and mechanics, was selected to receive the Leighton Riess Graduate Fellowship in Engineering. This fellowship is coordinated by the Penn State Center for Biodevices, housed in the College of Engineering. The Leighton Riess Graduate Fellowship in Engineering program supports graduate students in the College of Engineering who are conducting research in biological or biomedical-related topics. These students are recognized for their academic excellence with financial support to help fund their research and tuition. bit.ly/reis-grad

Undergraduate spotlight



Nathan Kizer receives Acoustical Society of America award

Nathan Kizer, an undergraduate senior in engineering science, recently received a \$500 award for his honors thesis project from the Acoustical Society of America. In collaboration with his adviser, Christopher Kube, assistant professor of engineering science and mechanics, the \$500 award will allow Kizer to purchase an ultrasonic transducer and 3D printing filament for his thesis, where he plans to use acoustic waves in additive manufacturing to allow for on-the-fly error detection while 3D printing. bit.ly/ESM-Kizer

Alumni news

Please nominate someone for the Penn State Engineering Science and Mechanics Early Career Recognition Award

The ESM Early Career Recognition Award recognizes alumni who have graduated in the past 10 years who have distinguished themselves in academia, the workplace (e.g., academia, industry, government, military), and/or in their community. Nominations are due on Aug. 15. More information, including the nomination form: bit.ly/esm-earlyaward



One year could change your career

Earn a one-year master's degree from ESM

Graduate Certificate in Laser-Materials Processing and Laser-Based Manufacturing

- Prepares students to integrate laser-materials processing into the concurrent design and manufacturing of multiscale components

M.S. in Engineering at the Nano-scale

- Non-thesis program; 30 credits
- Significant hands-on nanofabrication experiences

M.S. in Engineering Science and Mechanics

- Residence-based program; 32 credits

M.Eng. in Engineering Mechanics

- Professional degree program; 30 credits

Master's Degrees in Additive Manufacturing and Design

- M.S.: Resident program; 30 credits
- M.Eng.: Online program; 30 credits

WE ARE ... HIRING

The ESM department is seeking applicants for postdoctoral and graduate student openings.

Please visit esm.psu.edu/department/job-opportunities.aspx for more information.



Support ESM

Donations to the department allow us to continue our tradition of excellence by supporting current and future world-class engineers, leaders, and innovators who can impact and advance the well-being of global society.

bit.ly/esm-giving



Abby Dodson (third from left) recently gifted \$20,000 to create the Abigail Dodson Excellence Award.

Abby Dodson supports academic excellence through new award

Abby Dodson, a 2012 engineering science major and engineering leadership development minor alumna, recently established a \$20,000 endowment to support undergraduate and graduate students enrolled in the School of Engineering Design, Technology, and Professional Programs, home of the engineering leadership development minor. Entitled the Abigail Dodson Excellence Award, the award will provide financial aid to students who demonstrate leadership, volunteer spirit, and citizenship qualities that positively affect the climate for women in the College of Engineering. bit.ly/ELD-Dodson



What have you been up to?

If you have some exciting news you'd like to tell us about, send it our way so we can share it with our community of alumni and peers: alumrelations@esm.psu.edu

Keep in touch on our LinkedIn group, too! bit.ly/ESMGroup



Krista Heidersbach receives NACE International's 2021 Fellow Award

Krista Heidersbach ('98 Ph.D. ESMCH) has been named a 2021 NACE Fellow. This honor is presented by the Association of Materials Protection and Performance (AMPP)—an organization that focuses on the protection of assets and the performance of industrial and natural materials. Heidersbach is recognized for her leadership with NACE and seminal contributions to the oil and gas community, particularly in microbiologically induced corrosion and pipeline corrosion, according to an AMPP press release. Heidersbach currently works for Phillips 66 as a senior engineer in corrosion and asset integrity. As part of this fellowship, Heidersbach will join a forum of technical and professional leaders who serve as advisers for AMPP. AMPP was formed when NACE International and SSPC: The Society for Protective Coatings combined initiatives to create an overarching organization that supports its industry and individual members worldwide. bit.ly/nace-fellow



Mather family creates new Open Doors scholarship

Patrick Mather ('89 B.S. ESC, '90 M.S. EMCH) and his wife, **Tara Mather**, established the annually funded Mather Family Scholarship to help support ESC students through their undergraduate education. The award consists of \$2,500 per year for five years, with the possibility of expanding to meet more students' needs in the future. The first preference will be given to a first-generation ESC undergraduate student with a demonstrated financial need. This gift will advance "A Greater Penn State for 21st Century Excellence," a focused campaign that seeks to elevate Penn State's position as a leading public university in a world defined by rapid change and global connections. bit.ly/ESM-MatherScholarship

Watch our new engineering science major video

bit.ly/penn-state-esm

Faculty news/honors/awards



Akhlesh Lakhtakia appointed International Chair Professor for National Taipei University of Technology

Akhlesh Lakhtakia, Evan Pugh University Professor and Charles Godfrey Binder Professor of Engineering Science and Mechanics, was recently named International Chair Professor of the National Taipei University of Technology (NTUT) in Taiwan. Lakhtakia was chosen in recognition of

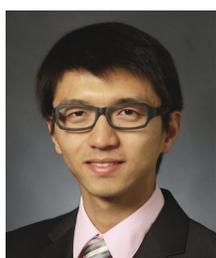
outstanding academic and research activity in the discipline of nanophotonics, according to NTUT. His term will last three years and will conclude in September 2023. As part of his duties for the position, Lakhtakia will spend at least one week per year at NTUT to engage with faculty and graduate students. "I grew up in a social milieu that had declared the entire world a family millennia ago, so I have always sought out international research collaborations," Lakhtakia said. "Taipei Tech faculty are very entrepreneurial, and I hope to think more practically in this new position than I have in the past."



Laura Cabrera joins engineering science and mechanics as associate professor

Laura Cabrera, a researcher in neuroethics and neurotechnologies, joined the Department of Engineering Science and Mechanics as an associate professor on March 1. Cabrera's appointment includes serving as a research associate in the Rock Ethics

Institute, the Dorothy Foehr Huck and J. Lloyd Huck Early Career Chair in Neuroethics in the Huck Institutes of the Life Sciences, a core faculty member in the Center for Neural Engineering, and an affiliate associate professor of bioethics and philosophy in Penn State's College of the Liberal Arts. As part of numerous units at Penn State, Cabrera plans to develop graduate and undergraduate courses that focus on ethics and collaborate with her colleagues to integrate neuroethical considerations into their work. Cabrera's vision is to create a center for neuroethics that is housed in the College of Engineering and promotes multidisciplinary work across numerous units at Penn State. bit.ly/neuro-prof

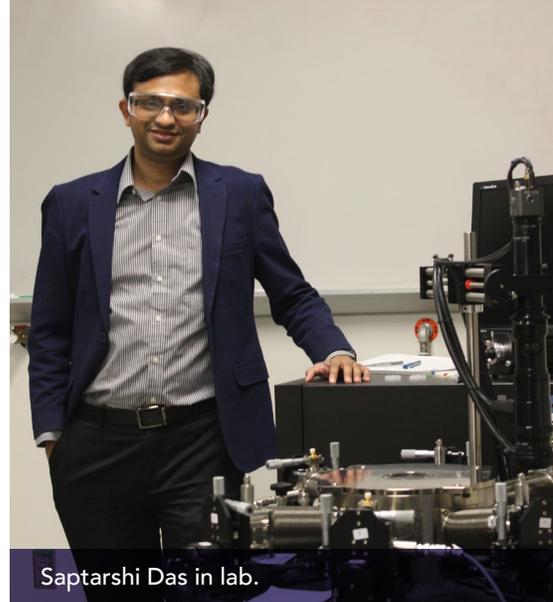


Huanyu Cheng receives three honors

Huanyu "Larry" Cheng, Dorothy Quiggle Career Development Professor in the Department of Engineering Science and Mechanics, has been named a 2021 Scialog Fellow by the Research Corporation for Science Advancement. bit.ly/prof-scialog

In addition, a paper authored by Cheng and colleagues in China was selected for an online collection to mark the Lunar New Year. Curated by the Royal Society of Chemistry, the collection specifically highlights popular articles from Asia that were published in the Journal of Materials Chemistry A. The paper, titled, "Novel gas sensing platform based on a stretchable laser-induced graphene pattern with self-heating capabilities," describes a wearable gas sensor that monitors environmental and human health with a self-heating mechanism that increases sensitivity compared to already existing sensors. bit.ly/novel-gas

Cheng was also selected as a panel fellow for the inaugural cohort of the National Science Foundation (NSF) Division of Civil, Manufacturing, and Mechanical Innovation's Game Changer Academy for Advancing Research Innovation. Selected fellows will meet 13 times over the year to build on NSF's robust agenda for investing in transformative innovation and discovery.



Saptarshi Das in lab.

Saptarshi Das receives NSF CAREER Award

Saptarshi Das, assistant professor of engineering science and mechanics, received a five-year, \$500,000 National Science Foundation CAREER Award to develop a new low-power straintronic computing component. Straintronics is a relatively new research area focusing on the enhancement of electronic devices by introducing forces that cause a resulting displacement, or strain, on materials and influence their electrical properties. Das's straintronic device consists of a transistor stacked on top of an actuator. When electricity is applied to the actuator, it will expand upward, compressing the transistor. According to Das, this push will change the conductivity of the transistor, making it effective in switching current on and off. Das and his team will compare the efficiency of the straintronic device to traditional and alternative components currently being researched. The researchers' long-term goal for this fundamental research is to create ultra-low-power computing tools that can serve as the building blocks for architectures of everyday computing devices or communications technology in remote locations. bit.ly/career-award



Army grant could advance high-grade steel 3D printing

Researchers recently received \$434,000 from the United States Army to develop 3D printing techniques for high strength steels and

alloys. High-grade steel is well suited for use in defense-relevant applications like personal armor and armored vehicles, but the material is difficult to manufacture traditionally. Researchers, including **Todd Palmer**, professor of engineering science and mechanics and materials science and engineering, will use computer modeling to test and refine the parameters of the printing process. They also plan to manufacture large-scale structures to provide experimental data to the Army. bit.ly/3dsteelprint



An illustration of military vehicle and ammunition technology printed with 3D printer.

Three Penn State researchers win 2020 Rustum and Della Roy Awards



The Penn State Materials Research Institute recently announced

the three winners of the 2020 Rustum and Della Roy Innovation in Materials Research Award.

The award recognizes interdisciplinary materials research at Penn State which yields innovative and unexpected results and is given annually to two graduate students and one postdoctoral researcher or junior faculty member. Among this year's winners is **Saptarshi Das**, assistant professor of engineering science and mechanics, who specializes in design and experimental demonstration of novel nanodevices based on 2D materials. bit.ly/psu-draward



Vijay Varadan receives patent and founding chair award

Vijay Varadan, distinguished professor emeritus of engineering science and mechanics, recently received a U.S. patent for his work on smart textiles. Varadan integrated electronic and optical sensor technologies into clothing, bed sheets, and pillowcases. Meant to replace hospital stays with in-home monitoring, the textile sensors can be used by patients with neurological, cardiac, and pulmonary conditions.

Varadan also recently received the Founding Chair Award from the Society of Photo-Optical Instrumentation Engineers (SPIE), an international society for optics and photonics scholars. The award recognizes his contributions and leadership in establishing the smart structures and materials division at the SPIE conference in 1993. bit.ly/spie21



Parisa Shokouhi and Jacques Riviere awarded Department of Energy grant

Department of Engineering Science and Mechanics faculty recently received a U.S. Department of Energy grant for their proposal on the interactions among thermal, hydrological, mechanical and chemical effects in an integrated laboratory and modeling study. **Parisa Shokouhi**, associate professor of ESM and acoustics, and **Jacques Rivière**, assistant professor of ESM and acoustics, are currently in negotiations for final funding that could total up to \$11 million over three years as part of the DOE's Frontier Observatory for Research in Geothermal Energy Initiative at the University of Utah. "This grant will further the development of renewable, clean energy," said Pennsylvania Senator Bob Casey in a news release. "Penn State continues to be at the forefront of research into 21st century challenges. I applaud the students and researchers at Penn State for their work to receive this grant." bit.ly/energy-gov





Sushi-like rolled 2D heterostructures may lead to new miniaturized electronics

Researchers' recent synthesis of one-dimensional van der Waals heterostructures, a type of heterostructure made by layering

two-dimensional materials that are one atom thick, may lead to new, miniaturized electronics that are currently not possible, according to **Slava V. Rotkin**, Penn State Frontier Professor of Engineering Science and Mechanics.

The team's research, published in *ACS Nano*, suggests that all 2D materials could be rolled into one-dimensional heterostructure cylinders, known as hetero-nanotubes, that resemble hot dog or sushi rolls. University of Tokyo researchers, who partnered with Penn State on the grant, fabricated electrodes on a hetero-nanotube and demonstrated that it can work as an extremely small diode with high performance despite its size. bit.ly/sushi-2d

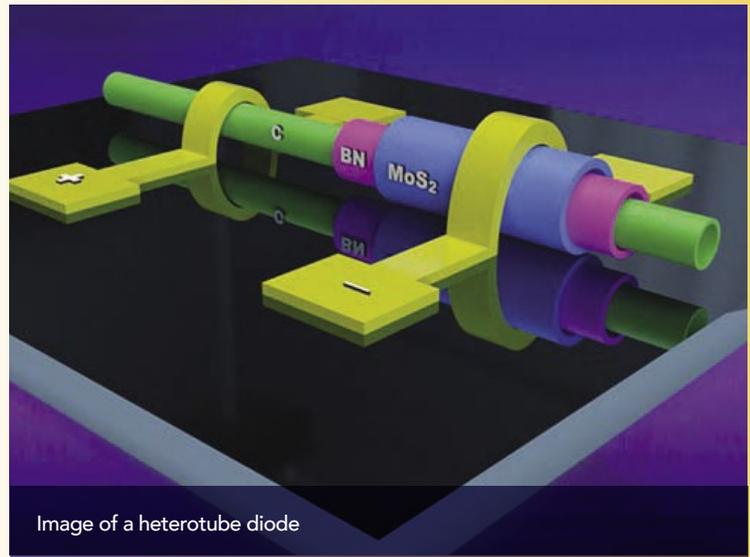


Image of a heterotube diode



Penn State to lead \$7.5M physics research program

Sahin K. Özdemir, associate professor, is leading a newly funded Department of Defense Multidisciplinary University Research Initiative in partnership with the University of Central Florida, Michigan Technological University, Yale University, University of Southern California, Washington University in St. Louis, and University of California, Berkeley.

The \$7.5 million project will allow researchers to investigate the mechanisms underpinning quantum systems with the goal of controlling their unique properties and applying them to highly precise and sensitive devices for use in sensing. Titled "Non-Hermitian Programmable Materials at Exceptional Points," the project will also serve as a research launch pad for graduate students and begin to establish a dedicated quantum physics research program at Penn State.



Three individuals honored with Penn State Engineering Alumni Society Awards

This year, three members of Penn State's Department of Engineering Science and Mechanics (ESM) received Penn State Engineering Alumni Society Awards. The awards recognize outstanding teaching, research, advising,

and service among the faculty, staff, and alumni of the College of Engineering. **Sahin Özdemir**, associate professor of ESM, received the Outstanding Research Award; **Saptarshi Das**, assistant professor of ESM, received the Outstanding Teaching Award; and **Wesley Blakeslee**, a 1969 alumnus of ESM and computer science, received the Distinguished Service Award. bit.ly/coe-honors

In Memoriam:



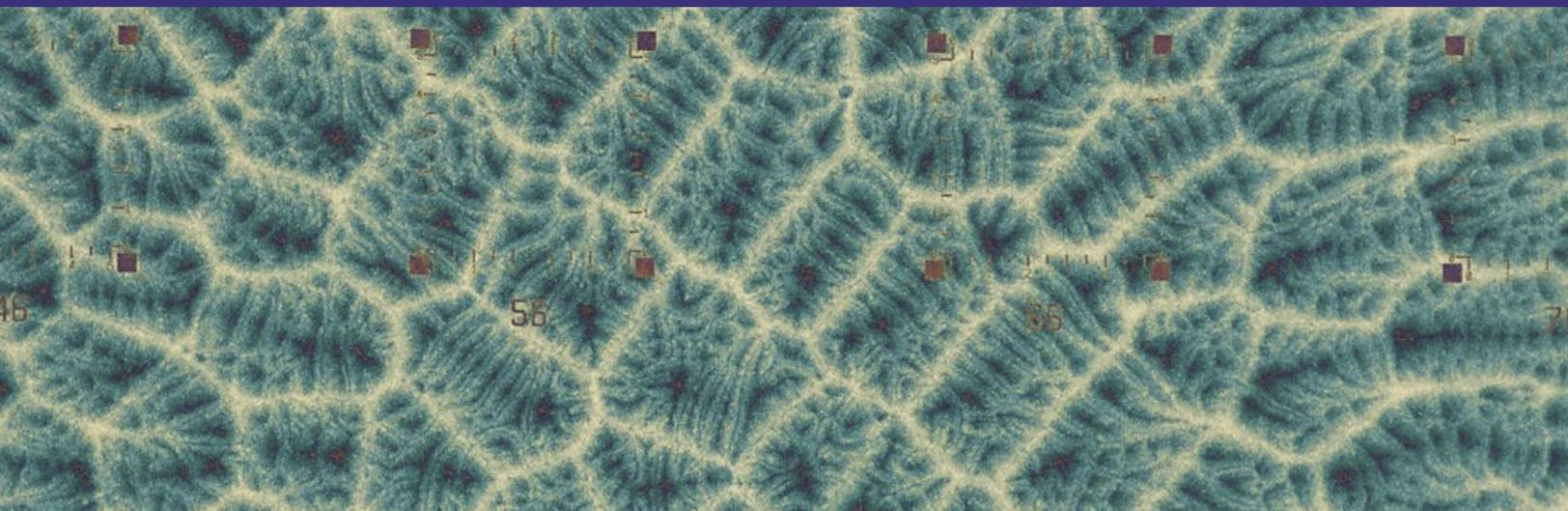
John "Jack" Carpenter, who received his bachelor of science in engineering science in 1957, died on

March 10, 2020, at the age of 84. He earned his master of science and doctorate at the University of Michigan in 1958 and 1963. At the time of his death, he was an emeritus distinguished scientist at Argonne National Laboratory, and lived in nearby Lisle, Illinois, with his wife Rhonda. Read more about his life and career.

bit.ly/mem-jcarpenter

"Jack embodied the spirit and accomplishments of our ESM graduates, and we will miss him very much,"

said Judy Todd, department head, professor of ESM, and P.B. Breneman Chair.



Third-place winner in the Art in Science competition captures the liquid-phase exfoliation of MoS₂, a transitional metal. Credit: Amritanand Sebastian

ESM Today 2021

The 18th annual ESM Today research symposium was held on Feb. 27, 2021. This event, organized by the ESM Graduate Student Council, gives undergraduate and graduate students the opportunity to showcase their research through oral and poster presentations to peers, colleagues, and faculty. This year, the event was held via Gathertown, a virtual collaborative platform. Andrew “Mike” Erdman ('69 ESC), retired adjunct professor of practice in the Penn State School of Engineering Design, Technology, and Professional Programs and the Department of Engineering Science and Mechanics, presented the keynote that focused on exploration of professional paths and options for current graduate students.

Here is a list of ESM students who received prizes for their work:

Oral presentation competition

(held across three virtual rooms)

First place

Prabhakaran Manogharan, advised by Parisa Shokouhi, associate professor of engineering science and mechanics: “Nonlinear Resonance Ultrasonic Spectroscopy for In-process Monitoring of Additively Manufactured Parts”

Rahul Pendurthi, advised by Saptarshi Das, assistant professor of engineering science and mechanics: “A Synergistic Hardware Neural Network with Enhanced Learning and Accurate Inference Enabled by Programmable and Complementary 2D FETs”

Avery Brown, advised by Charles Bakis, distinguished professor of engineering science and mechanics: “Improved Damping by Tailoring the Bond Strength of Carbon Nanotubes in Carbon/Epoxy Composites”

Second place

Akhil Dodda, advised by Saptarshi Das: “A Low-Power Biomimetic Crypto Engine for All-In-One IoT based on Programmable and Multifunctional MoS₂ FETs”

Lalith Sai Srinivas Pillarisetti, advised by Clifford Lissenden, professor of engineering science and mechanics, and Parisa Shokouhi: “Control of Surface Wave Propagation Through Imposing Midline Boundary Conditions on the Surface”

Colin Williams, advised by Parisa Shokouhi: “An Experimental Approach to Understanding Correlations Between Ultrasonic Nonlinearity Parameters and Fracture Toughness in Steel Samples”

Third place

Daniel Giraldo-Guzman, advised by Clifford Lissenden, Parisa Shokouhi, and Mary Frecker, Riess Chair of Engineering, director of the Penn State Center for Biodevices, and professor of mechanical and biomedical engineering: “Topology Optimization Design of Metamaterials to Control Lamb Wave Propagation”

Linying Gao, advised by Jacques Rivière, assistant professor of engineering science and mechanics: “Nonlinear Elasticity of a Glass Bead Pack: Effect of Relative Humidity”

Ferris Arnous, advised by Ram Narayanan, professor of electrical engineering, and Michael Lanagan, professor of engineering science and mechanics: “Multidomain Machine Learning Based Feature Analysis Algorithms for Engineering System Diagnostics”

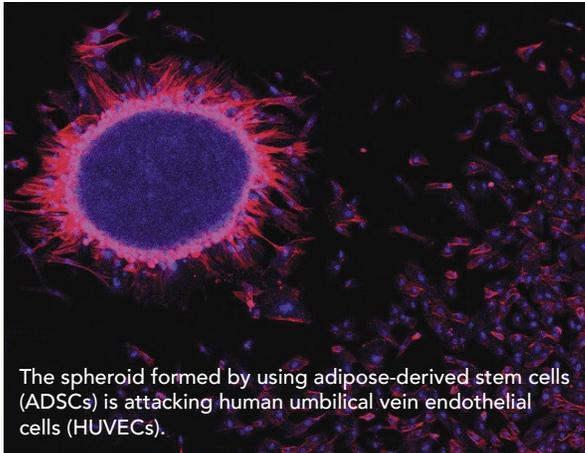
Poster competition

First place

Nazmiye Celik, advised by Ibrahim Ozbolat, Hartz Family Career Development Associate Professor of Engineering Science and Mechanics: “Tissue Spheroids into In-Vitro Planet Cells”



The spheroids formed by using human umbilical vein endothelial cells (HUVECs) is discovering on the planet of Adipose-derived stem cells (ADSCs).



The spheroid formed by using adipose-derived stem cells (ADSCs) is attacking human umbilical vein endothelial cells (HUVECs).

Poster by first-place winner, Nazmiye Celik.

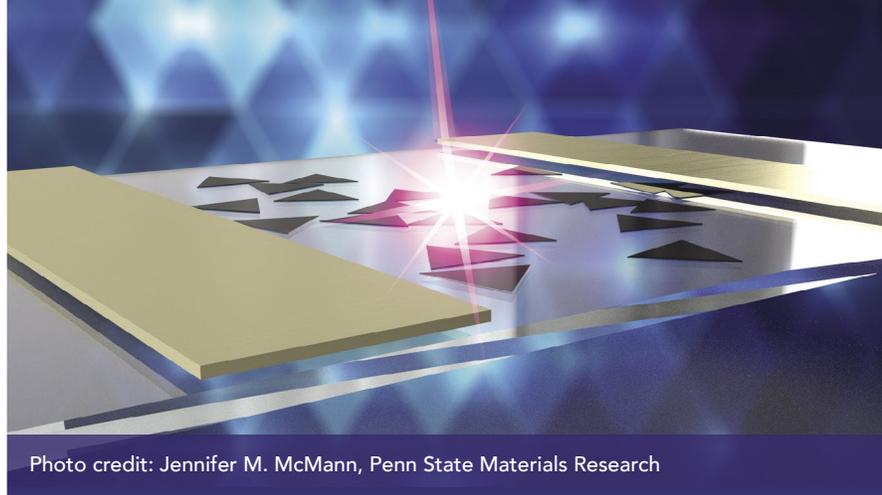


Photo credit: Jennifer M. McMann, Penn State Materials Research

Research lays groundwork for ultra-thin, energy efficient photodetector on glass

Photodetectors convert light energy into electrical signals to complete everyday tasks like opening automatic sliding doors and automatically adjusting a cell phone's screen brightness in different lighting conditions.

Integrating photodetectors with durable Gorilla glass, the material used for smart phone screens manufactured by Corning Incorporated, could advance photodetectors' uses, according to Saptarshi Das, assistant professor of engineering science and mechanics, in a new ACS Nano paper.

When integrated with Gorilla glass, photodetectors could lead to the commercial development of "smart glass," or glass equipped with automatic sensing properties. Smart glass has a number of applications ranging from imaging to advanced robotics, according to the researchers. bit.ly/thin-energy

Second place

Arnab Chatterjee, advised by Reginald Hamilton, associate professor of engineering science and mechanics: "Characterizing LDED Based AM Ti Rich Near Net Build"

Third place

Robert F. Brown, advised by Timothy Eden, research professor of engineering science and mechanics: "Parameter Development via In Situ Residual Stress Measurement and Postdeposition Analysis of Cold Spray CuNi Coatings"

Art in Science competition

First place

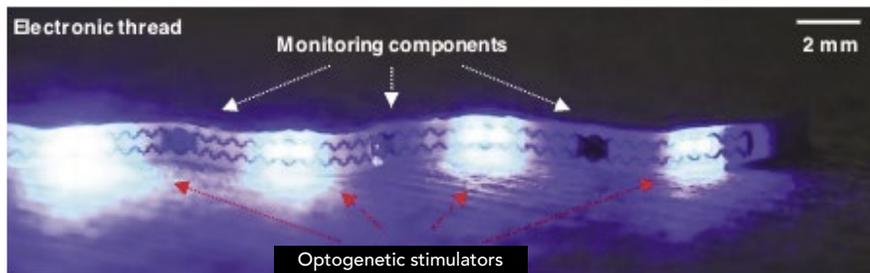
Nazmiye Celik, advised by Ibrahim Ozbolat: "Tissue Spheroids into In-Vitro Planet Cells"

Second place

Madhuri Dey, advised by Ibrahim Ozbolat: "Bioprinting the Tumor Microenvironment"

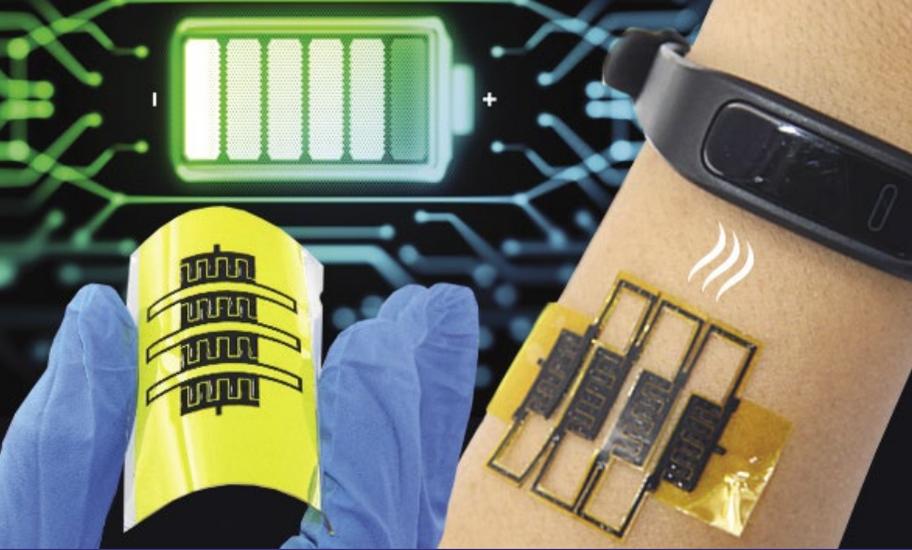
Third place

Amritanand Sebastian, advised by Saptarshi Das: "Liquid-phase Exfoliated MoS₂"



'Smart Wrap' implant may help people better control their bladders

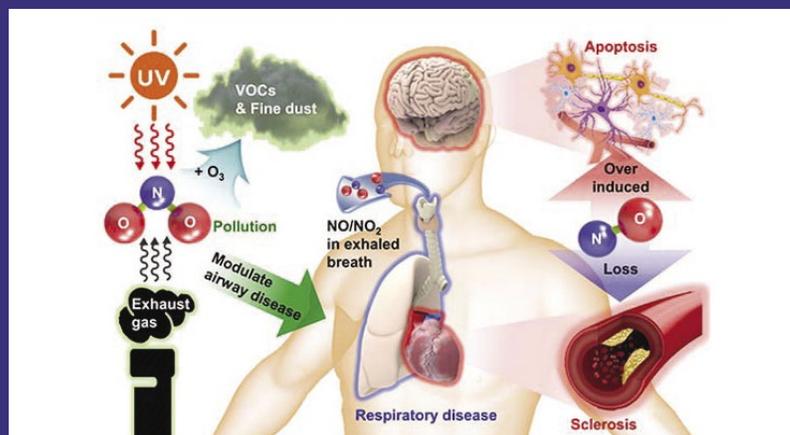
An implantable smart wrap that fits safely and securely around the bladder may one day help people who have under-active bladders, according to an international team of researchers including **Larry Cheng**, Dorothy Quiggle Career Development Professor in the Department of Engineering Science and Mechanics. The device, which was tested on mice, uses a serpentine-shaped polymer wrap as well as sensors to enable precise, real-time monitoring of the bladder. The implant first detects when the bladder needs to be completely emptied and then sends a signal to a polymer web with an electronic thread that expands or contracts with the bladder. After the bladder is emptied, the band returns to its initial formation. bit.ly/smart-wrap



Latest news: Larry Cheng sensor research stories

Huanyu "Larry" Cheng, Dorothy Quiggle Career Development Professor in the Department of Engineering Science and Mechanics, has recently published several papers on his work developing stretchable sensors capable of harvesting and transmitting energy wirelessly. Here are the stories written about his work:

- **Journal: Trends in Analytical Chemistry**
Researchers develop sensors that detect human biomarkers and toxic gas. bit.ly/sensors-bio
- **Journal: Nano Energy**
Stretchable micro-supercapacitors to self-power wearable devices. bit.ly/wear-dev
- **Journal: NPG Asia Materials**
Implantable sensor could measure bodily functions—and then safely biodegrade. bit.ly/implant-sensor
- **Journal: Microsystems & Nanoengineering**
Wearable sensor monitors health, administers drugs using saliva and tears. bit.ly/tears-monitor
- **Journal of Materials Chemistry A: 2020 Most Popular Articles**
Novel gas sensing platform based on a stretchable laser-induced graphene pattern with self-heating capabilities. bit.ly/novel-gas
- **Journal of Materials Chemistry A**
Inexpensive tin packs a big punch for the future of supercapacitors. bit.ly/super-capac

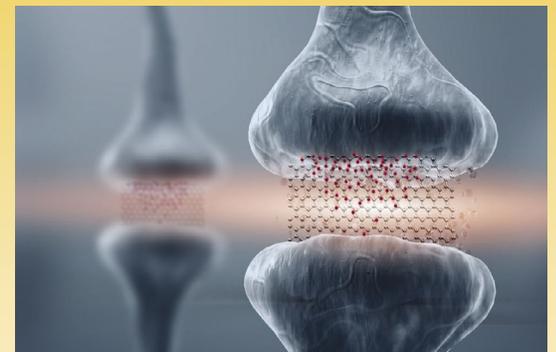


Latest ESM news (cont.)



Shokouhi receives NSF funding to study wave mitigation

Parisa Shokouhi, principal investigator and associate professor of engineering science and mechanics and acoustics, received a \$641,162 National Science Foundation grant to explore the possibilities of controlling waves that move along the border between two differing media. With co-principal investigators **Cliff Lissenden**, professor of engineering science and mechanics and acoustics, and **Mary Frecker**, professor of mechanical engineering and biomedical engineering, Shokouhi is investigating a surface that could have future applications in seismic wave control. bit.ly/nsfw-wave



Graphene-based memory resistors show promise for brain-based computing

A team of Penn State engineers is attempting to pioneer a type of computing that mimics the efficiency of the brain's neural networks while exploiting the brain's analog nature. Artificial neural networks can be reconfigured by applying a brief electric field to a sheet of graphene, the one-atomic-thick layer of carbon atoms, according to Principal Investigator **Saptarshi Das**, assistant professor of engineering science and mechanics. Essentially, the team can control a large number of memory states with precision using simple graphene field effect transistors. bit.ly/graphene-mem

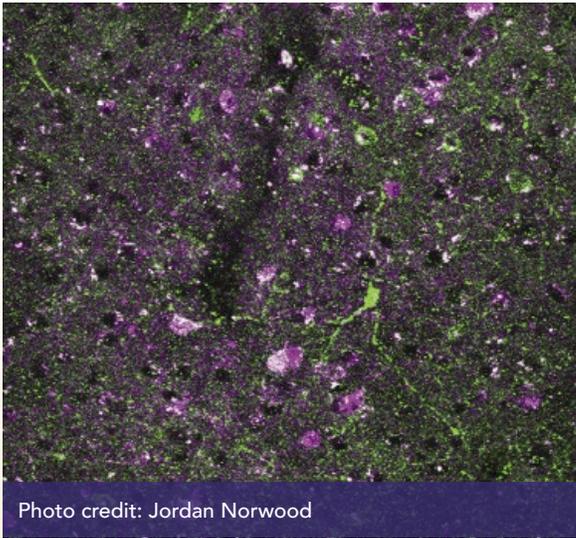
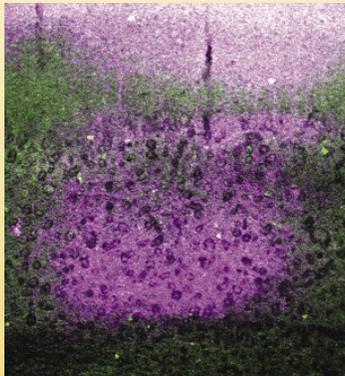


Photo credit: Jordan Norwood

Some neurons target tiny cerebral blood vessel dilation

Neurons control blood flow in tiny vessels in the brain, but researchers know little about this relationship. **Patrick Drew**, Huck Distinguished Associate Professor

of Engineering Science and Mechanics, Neurosurgery, and Biomedical Engineering, has found a connection between nitric oxide-expressing neurons and changes in arterial diameters in mice, which may shed light on brain function and aging. Drew and his team showed that with an increase or decrease of the nitric oxide enzyme, there was a change in dilation without a change in electrical activity. bit.ly/tiny-vess



Blood flow and neural activity greatly increase during both non-rapid eye movement sleep and rapid eye movement sleep stages.

Increased blood flow during sleep tied to critical brain function

Our brains experience significant changes in blood flow and neural activity during sleep, according to **Patrick Drew**, Huck Distinguished Associate Professor of Engineering Science and Mechanics, Neurosurgery, and Biomedical Engineering. Such changes may help to clean out metabolic brain waste that builds up during the day.

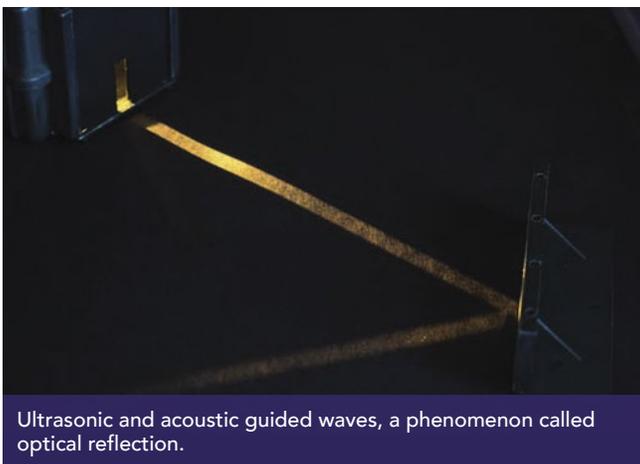
In a study published in *eLife* and supported by the National Institutes of Health, researchers studied the sleep patterns and alertness states of mice, and collected data on their neural activity, blood vessel dilation, electromyography activity, and whisker and body movements.

The researchers found that brain arterioles, or small branches of arteries, were much more dilated when the mice were in non-rapid eye movement sleep than when they were awake, and the dilation was even larger during REM sleep.

The dilated blood vessels and increased blood flow may help the brain move waste products out of the brain, according to Drew. That could be why disrupted sleep is associated with diseases that afflict the brain, such as Alzheimer's and dementia. bit.ly/sleep-crit

Penn State researchers receive patent for light-altering acoustic technology

From navigating ships and submarines using sonar to imaging organs in the human body using ultrasound technology, scientists and engineers have studied the numerous applications of sound waves for decades. Now, researchers at Penn State have found a way to use ultrasonic and acoustic guided waves to alter how light bounces off objects, a phenomenon called optical reflection. Inventors **Akhlesh Lakhtakia**, Evan Pugh University Professor and Charles Godfrey Binder Professor of Engineering Science and Mechanics, and **Joseph Rose**, Paul Morrow Professor Emeritus in Engineering Design and Manufacturing, received a patent on Feb. 2. bit.ly/acou-tech



Ultrasonic and acoustic guided waves, a phenomenon called optical reflection.

Message from your alumni society chair



Circa 1961



2020

Did you know that there was once a railroad track running along the north side of College Avenue? It was very short, as tracks go—only the length of Hammond Building. What rode those rails was the first vertical tower crane I had ever seen. Because it could travel, that crane could reach and help construct every part of that long building. The College of Engineering is celebrating 125 years of existence. At roughly half that age, Hammond Building is scheduled for demolition. On the other side of Atherton Street, new engineering buildings are rising where the last freshman-sophomore tug-of-war was held in 1957 (but that's another story).

The new construction includes a major facility where students can build projects using modern subtractive and additive technologies along with electronics and microcomputers. There was no such opportunity during my college days, but high schools had shop classes, and cars were simple enough that teens could work on them. Now potential engineers can reach college age without ever disassembling anything.

Facilities change greatly over the years, as does education itself. The Accreditation Board for

Engineering and Technology (ABET) is an organization that evaluates and accredits engineering and engineering technology programs. A team of volunteers from education and industry visits every six years to assess whether graduates have the skills necessary to enter the engineering workforce. Thirty years ago, this was almost a checklist of topics covered, faculty counts, and facilities available. Now, it is more process-oriented. A program must define what it is doing, do it, assess it, and improve it. The evaluators often find things that need to be improved. Sometimes, the identified problem(s) are easily corrected misperceptions, or quickly addressed with minor adjustments. In more extreme cases, a program is reassessed after two years of corrective action, and, at worst, a program can lose accreditation. The engineering science major in the Department of Engineering Science and Mechanics has been accredited by ABET since 1959.

Change is a constant. Engineers must be adaptable. We invite you to recognize the early career engineers who adapt well and have distinguished themselves in academia, the workplace, and/or in their community in the 10 years since they graduated. Nominations are due Aug. 15. More information is available here: bit.ly/esm-ecaward

Chuck Gaston ('61 ESC)

Contact ESM and stay in touch

Judith A. Todd
Department Head and
P. B. Breneman Chair
814-863-0771 • jtodd@psu.edu

Chuck Gaston
Alumni Society Chair
717-468-5935 • cgaston@aol.com

Lisa Spicer
Alumni, Development, and Advancement
814-867-1569 • lms8@psu.edu

ESM website: esm.psu.edu
PESMAS website: esm.psu.edu/alumni
PESMAS operations: alumnirelations@esm.psu.edu
Digital newsletter: bit.ly/esm-connections2021



PennState
College of Engineering

**ENGINEERING SCIENCE
AND MECHANICS**

