



ESM CONNECTIONS



Uncomfortably uncertain: Understanding 'and' in COVID-19 research

Engineering science and mechanics alumnus Bill Warren to present on the importance of interfacing in pharmaceutical research

Bill Warren ('86 B.S., '90 Ph.D.), the vice president and leader of a biotech unit embedded within the pharmaceutical company Sanofi, often refers to the 13th century poet Rumi in his work focused on accelerating next-generation influenza vaccine projects.

"Rumi said, 'You think because you understand 'one' that you therefore understand 'two,' because one and one make two. But you forget that you must also understand 'and,'" said Warren, who earned both of his degrees in engineering science and mechanics (ESM). "The way I work on my research, it is important to understand the 'and' via multiple hypotheses. It is also important to ask why am I doing something? Is it for scientific pursuit, or for scientific pursuit that has a positive impact?"

The "and" has become particularly relevant in the current pandemic and political climate, according to Warren. He will address research in this context at Penn State on March 31 in a talk on the ethics in engineering, titled, "What's the 'and' in COVID-19?"

"The case study for the presentation

will be the COVID-19 pandemic in which 'and' is an important word," Warren said. "Is the pandemic real and political? Are there public health and economic devastations? Why are there symptomatic and asymptomatic cases? Will the vaccine be safe and efficacious? Should we innovate vaccines and repurpose drugs?"

The list goes on, but the thread remains the same: In every question, and every answer, multiple realities exist simultaneously. To accurately identify such multiplicity, and to begin to understand the implications of it, diversity is critically needed, according to Warren.

"If you have just one hypothesis, you're starting from a point of bias," Warren said. "The inclusion of diverse ideas and models brings us closer to the objective truth."

Warren credits his ESM education with the training to pursue inclusive research.

"In engineering science and mechanics, we have the 'and' right in the name," Warren said. "We are

trained to be interdisciplinary and learn to appreciate the innovation that stems from collaboration between disciplines. ESM makes T-shaped researchers: broadly aware, with a deep interest in a particular area. ESM set me up for this work."

A reason we need "and" in our research, Warren said, is that the answer is almost never singularly simple.

"In the 13th and 14th centuries, maps of the world showed dragons in the oceans," Warren said. "Maybe the dragons represented a whale, but it was more likely a metaphor for the unknown, for what they could not see. What dragons do we have in front of us? Do we want to be comfortably wrong about what's out there, or uncomfortably uncertain as we pursue a more accurate understanding?"

Judith Todd, P.B. Breneman Chair and department head of ESM, said Warren's talk should resonate not just with those in ESM, but also with individuals across the University.

(continued on next page)

Message from the chair



Alumni, friends, faculty, and students,

I hope you are all staying safe and healthy in these unprecedented COVID-19 times. I have to give many shoutouts to: our staff, who turned on a dime to set up remote operations; our faculty, who developed new teaching methods for remote and in-person courses; our students, who have succeeded in classes and their research despite social distancing and Zoom brain; and especially to our alumni, who provide enduring support. As the festive season of giving approaches, I hope you will find it in your hearts to support the increasing level of need we are seeing among our students and their families.

ESM continues to grow with two new faculty. **Laura Cabrera**, an expert in neural ethics, neural devices, and electrical engineering, will join us on March 1, 2021, as an associate professor of ESM, a core faculty member of the Center for Neural Engineering, a co-funded member of the Rock Ethics Institute, and as the Dorothy Foehr Huck and J. Lloyd Huck Early Career Chair in Neuroethics in the Huck Institutes of the Life Sciences. **Yang Yang**, an expert in advanced electron microscopy techniques, nuclear, materials, and mechanical engineering, will be appointed as assistant professor, co-funded member of the Materials Research Institute, and affiliate faculty member of the Institute for Computational and Data Sciences on June 1, 2021.

In November, ESM welcomed **Lori Rhoades** as our new administrative assistant. Congratulations to Nicole Wolfe, who was promoted to the Office of Engineering Research Administration.

You are receiving this newsletter in both print and electronic formats—let us know if you have a preference. Wishing you all a joyous holiday season.

Warm regards,

Judith A. Todd

Judith A. Todd

Uncomfortably uncertain (cont.)

"Dr. Warren is a visionary leader with powerful and creative ideas," Todd said. "His ESM journey has taken him along multiple diverse pathways encompassing atomic scale defects in semiconductors; the electronics industry; defense manufacturing and research administration; design of an artificial lymph node; and most recently, to vaccine design. His entrepreneurial spirit has navigated him successfully from invention to startups and industry transitions multiple times. His story is unique and an inspiration to us all."

Warren is a fellow of the American Institute for Medical and Biological Engineering, a professor of biomedical sciences at the University of Central

Florida, and a co-founder of two companies (nScrip and VaxDesign). He has authored over 200 referred publications, including top-cited papers in both the Journal of Applied Physics and Applied Physics Letters, and has over two dozen patents or patent applications. He has received numerous awards and honors, including the Penn State Alumni Fellow Award in 2016, three R&D 100 awards, the 2011 BioFlorida Company of the Year Award, a 2009 Governor's New Product Award, and the Henry Award from the American Ceramic Society.

For more details on Warren's March 31, 2021 talk, including the Zoom link and password, please contact Lisa Spicer at lms8@psu.edu.

Faculty spotlight



Laura Cabrera



Yang Yang



Lori Rhoades

Vijay Varadan, co-founder of Nanowear, announces COVID-19 remote diagnostic research alliance



Vijay Varadan, professor emeritus of engineering science and mechanics, is the co-founder and chief innovation officer of Nanowear—the leading nanotechnology-based connected-care and remote diagnostic platform. In July 2020, Nanowear announced its expansion of a COVID-19 remote diagnostic research alliance with Hackensack Meridian Health Systems, the largest hospital system in New Jersey, and Maimonides Medical Center in Brooklyn, New York. They will focus on remote diagnostic monitoring using Nanowear's patented precision medicine clinical-grade, cloth-based wearable technology— invented by Varadan and other founding engineers. [MORE >>](#)

Graduate spotlight



Jia Zhu earns fellowship to support entrepreneurial spirit

Jia Zhu, a doctoral student in engineering science and mechanics, recently received the Diefenderfer Graduate Fellowship from the Penn State College of Engineering. Zhu investigates flexible medical devices intended to be worn on the body. In collaboration with his adviser, **Huanyu "Larry" Cheng**, Dorothy Quiggle Career Development Professor in the Penn State Department of Engineering Science and Mechanics, Zhu has developed a novel fabrication method to create a low-cost, multifunctional device to monitor human health. [MORE >>](#)

Graduate spotlight (cont.)



Rudy Haluza awarded ASC scholarship

Rudy Haluza, a Penn State engineering science and mechanics doctoral candidate, was awarded a 2020-21 scholarship from the American Society for Composites (ASC). He was honored at the ASC 35th Annual Technical Conference in September. This scholarship is awarded to doctoral students in engineering or science whose dissertation research is focused on composite materials.

[MORE >>](#)

Undergraduate spotlight



Emily Sarah Trageser named student marshal for spring commencement

Emily Sarah Trageser was selected as the student marshal for the engineering science baccalaureate degree program for Penn State's spring commencement ceremony on May 9. Trageser received a bachelor of science in engineering science and a minor in engineering mechanics. Gary Gray, associate professor and undergraduate officer of engineering science and mechanics, was Trageser's faculty marshal. [MORE >>](#)



Keith Griffith named Blue Band drum major

Keith Griffith, senior engineering science student, was named the Penn State Blue Band drum major for the 2020-21 season. Griffith was recently featured on OnwardState.com in a Q&A session that focuses on his new role, what he hopes to achieve, and how he is dealing with the challenges of COVID-19. [MORE >>](#)

Faculty news/honors/awards

Judith Todd elected vice president of ASM International

Judith Todd was elected vice president of ASM International at the society's annual meeting on Sept. 14. Todd has served as a fellow of ASM International since 1997 and as a member of the board of trustees since 2017. During her time as a member of the board of trustees, Todd served as a liaison to the Women in Materials Engineering Committee, a liaison to the Thermal Spray Society, and the chair of a task force that focuses on diversity, equity, and inclusion. In these roles, she helped promote the visibility, recognition, and engagement of the organization's increasingly diverse members. "As vice president, my highest priorities are membership growth, technical excellence encompassing new materials frontiers, and digital content and knowledge dissemination," Todd said. "I envision ASM becoming a role model for diversity, equity, inclusion, and engagement across the member spectrum." [MORE >>](#)



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- Residence-based program; 32 credits

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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. Please remember ESM this holiday season.

bit.ly/esm-giving



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: alumnirelations@esm.psu.edu

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



Watch our new engineering science major video

bit.ly/penn-state-esm

Faculty news/honors/awards (cont.)



Andrea Arguelles and Christian Peco receive NSF grant

Andrea Arguelles, assistant professor of engineering science and mechanics, and **Christian Peco**, assistant professor of engineering science and mechanics, received a \$500,000 National Science Foundation grant to advance quality control methods for parts produced through additive manufacturing. The grant will support three years of experimental research and model development. [MORE >>](#)



Charles Bakis honored by two national societies

Charles Bakis, distinguished professor of engineering science and mechanics and director of the Penn State Composite Materials Laboratory, was selected for the 2020 Wayne W. Stinchcomb Memorial Lecture and Award by the American Society for Testing and Materials Committee D30 on Composite Materials. He received the award and presented the named lecture at the 2020 American Society for Composites conference. [MORE >>](#)

Alumni news



Dennis Newton receives Outstanding Engineering Alumni Award

Dennis Newton ('63 B.S. ESC) was named the recipient of the 2020 Outstanding Engineering Alumni (OEA) Award. This award recognizes alumni of the Penn State College of Engineering who have reached exceptional levels of professional achievement. Established in 1966, the OEA Award is the highest honor bestowed by the College of Engineering. Newton served as chief engineering test pilot for LearFan Limited and a flight test pilot for the Federal Aviation Administration. In 1987, he began working for The Boeing Company as an instructor pilot. He spent 14 years at Boeing, holding numerous positions—production flight test captain, designating engineering representative flight test pilot, and assistant chief pilot—before retiring in 2003.



Feng Guo receives NIH Director's New Innovator Award

Feng Guo ('15 Ph.D. ESMCH), recently received the 2020 National Institutes of Health (NIH) Director's New Innovator Award for his research in the development of bioengineering technologies for emerging translational applications in neural disorders and cancer. Using the funds from this award, Guo and his research team will specifically focus on a project titled, "An acoustofluidic avidity cytometer for massive parallel profiling single autoreactive T cell in autoimmune disease." Guo is currently an assistant professor of intelligent systems engineering at Indiana University Bloomington. While earning his doctorate degree from Penn State, Guo developed 3D acoustic tweezer and acoustofluidics technologies for single cell manipulation and analysis.



Muhammad Faryad receives Early Career Recognition Award

The Department of Engineering Science and Mechanics has named Muhammad Faryad ('12 Ph.D. ESMCH) the recipient of the 2020 Early Career Recognition Award. The award is intended to recognize alumni who have graduated in the last 10 years and have distinguished themselves in academia, industry,

government, or the military. The involvement of alumni in their communities can also be considered. Individuals can nominate others or themselves for the award. Faryad, a doctoral alumnus, currently serves as chair and assistant professor of the Department of Physics at Lahore University of Management Sciences (LUMS) in Pakistan. His research focuses on optics, with applications in optical sensors, solar cells, and photonic crystals for controlling the movement of light. He joined the LUMS faculty in 2014 after a two-year postdoctoral appointment within ESM. [MORE >>](#)

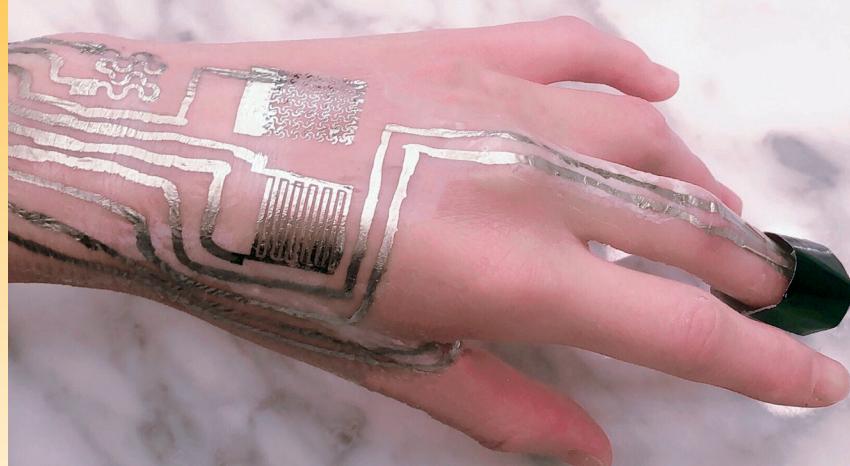
The latest ESM news

Engineers print wearable sensors directly on skin without heat

An international team of researchers developed a novel technique to produce precise, high-performing biometric sensors

Wearable sensors are evolving from watches and electrodes to bendable devices that provide far more precise biometric measurements and comfort for users. Now, an international team of researchers has taken the evolution one step further by printing sensors directly on human skin without the use of heat. Led by **Huanyu "Larry" Cheng**, Dorothy Quiggle Career Development Professor in the Penn State Department of Engineering Science and Mechanics, the team published their results in ACS Applied Materials & Interfaces.

Cheng and his colleagues previously developed flexible printed circuit boards for use in wearable sensors, but printing directly on skin has been hindered by the bonding process for the metallic components in the sensor. Called sintering, this process typically requires temperatures of around 572 degrees Fahrenheit (300 degrees Celsius) to bond the sensor's silver nanoparticles together. The



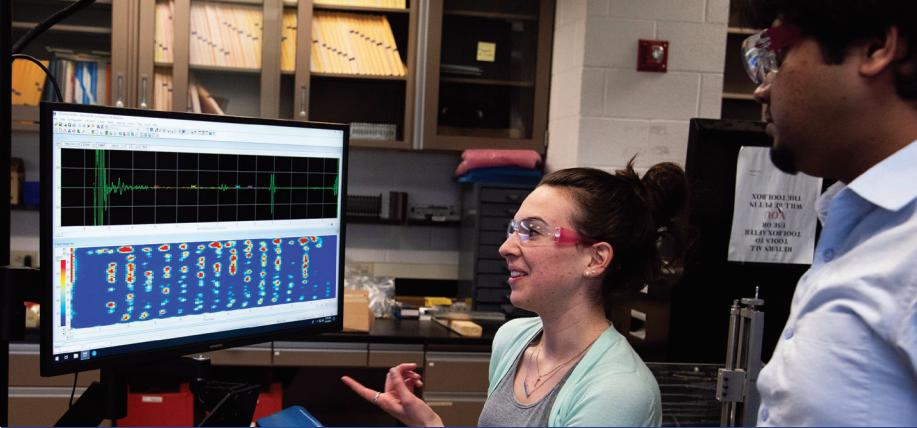
researchers changed the formula of the aid layer and the printing material and found that they could sinter at room temperature.

The sensors are capable of precisely and continuously capturing temperature, humidity, blood oxygen levels, and heart performance signals, according to Cheng. The researchers also linked the on-body sensors into a network with wireless transmission capabilities to monitor the combination of signals as they progress. Next, the researchers plan to alter the technology to target specific applications as needed, such as a precise on-body sensor network placed to monitor the particular symptoms associated with COVID-19. [MORE >>](#)

Big Ten Academic Alliance Academic Leadership Program inducts six new fellows

The Big Ten Academic Alliance (BTAA) Academic Leadership Program (ALP) in 2020-21 will include six new fellows from Penn State. **Francesco Costanzo**, associate department head of engineering science and mechanics, and professor of engineering science and mechanics, mathematics, mechanical engineering, and biomedical engineering, was named a fellow. [MORE >>](#)



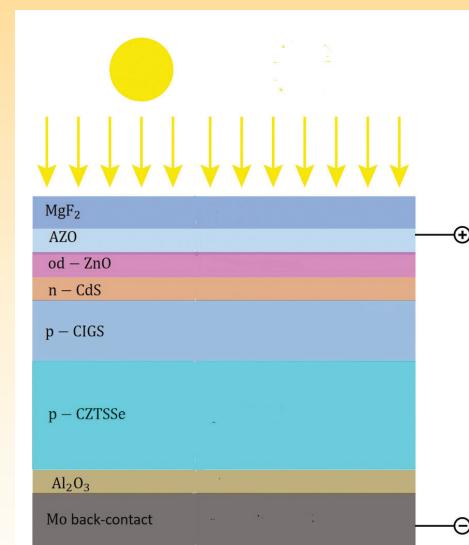


Engineers investigate additive manufacturing quality control with grant from 3M

An interdisciplinary team of researchers in Penn State's College of Earth and Mineral Sciences and College of Engineering was awarded a \$180,000 grant to investigate comprehensive quality control methods for additive manufacturing (AM), or 3D printing, of metals. The grant is renewable for up to three years, for a total of \$540,000, as part of a Penn State agreement with 3M. Using nondestructive evaluation, a method for examining or testing a part or system without causing harm, the researchers will assess 3D printed parts. They are specifically investigating binder jetting, an AM process involving the repeated layering of powder particles and an adhesive. Co-principal investigators **Andrea Arguelles**, assistant professor of engineering science and mechanics, and **Christopher Kube**, assistant professor of engineering science and mechanics, will contribute their expertise of ultrasonic measurement and computational analysis to the research. [MORE >>](#)

Theoretically, two layers are better than one for solar-cell efficiency

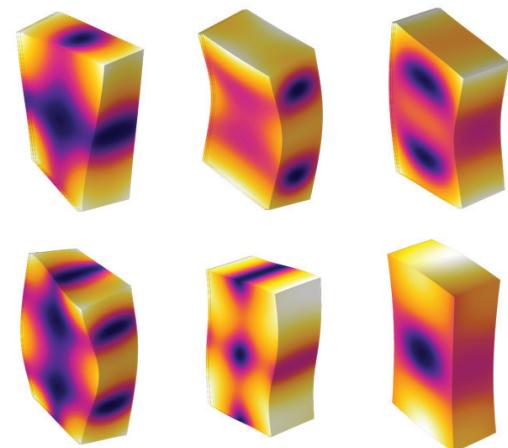
Solar cells have come a long way, but inexpensive, thin film solar cells are still far behind more expensive, crystalline solar cells in efficiency. Now, a team of researchers suggests that using two thin films of different materials may be the way to go to create affordable, thin film cells with about 34% efficiency. **Akhlesh Lakhtakia**, Evan Pugh University Professor and Charles Godfrey Binder Professor of Engineering Science and Mechanics, and his research team that includes **Faiz Ahmad**, doctoral student in engineering science and mechanics, and Peter B. Monk, Unidel Professor of Mathematical Sciences at the University of Delaware, are investigating the use of CIGS—copper indium gallium (di) selenide—and CZTSSe—copper zinc tin sulfur selenide as solar cell materials to increase the efficiency of the thin film cells. [MORE >>](#)



Schematic of a double thin film layered solar cell. The sun enters at the top and reaches the CIGS and CZTSSe layers that absorb the light and create positive and negative particles that travel to the top and bottom contact layers, producing electricity.

Engineering professor uses AFRL fellowship to research additive manufacturing

For 12 weeks over the summer, **Christopher Kube**, assistant professor of engineering science and mechanics, conducted research as part of the 2020 U.S. Air Force Research Lab (AFRL) Summer Faculty Fellowship Program at AFRL-Materials and Manufacturing. Kube collaborated with **Jared Gillespie**, graduate student in engineering science and mechanics, to conduct research that was focused on the influence of texture and residual stress on the measurement of vibrational resonances of metallic additively manufactured parts. [MORE >>](#)



Christopher Kube and Jared Gillespie conducted research that focused on the influence of texture and residual stress on the measurement of vibrational resonances of metallic additively manufactured parts. The simulated natural vibrational modes seen here give important insight into the properties of additively manufactured parts. IMAGE: MATTHEW CHERRY, AFRL

Penn State team recently won the top prize in the Ben Franklin (BF) TechCelerator @ State College program.

A team of four College of Engineering students, one College of Earth and Mineral Sciences student, and one engineering faculty member recently won the top prize in the Ben Franklin (BF) TechCelerator @ State College program. **Jia Zhu**, graduate student in engineering science and mechanics; **Michael Dexheimer**, graduate student in engineering science and mechanics; **Shangbin Liu**, undergraduate student in mechanical engineering; **Kairui Tang**, undergraduate student in mechanical engineering; **Ning Yi**, graduate student in materials science and engineering; and **Huanyu "Larry" Cheng**, Dorothy Quiggle Career Development Professor in the Penn State Department of Engineering Science and Mechanics, were awarded first place for their flex heal product—a stretchable bandage for advanced wound healing and health monitoring. [MORE >>](#)

Engineering professor named editor-in-chief of nondestructive evaluation journal



Parisa Shokouhi, associate professor of engineering science and mechanics and acoustics, was named editor-in-chief of Research in Nondestructive Evaluation (RNDE), the research journal of the American Society for Nondestructive Testing (ASNT). [MORE >>](#)

Jian Hsu named director of Joint Innovation Partnership in Penn State SIRO

Jian Hsu, professor of engineering science and mechanics, was recently named director of the Joint Innovation Partnership (JIP) in the Penn State Strategic Interdisciplinary Research Office (SIRO), which reports to the senior vice president for research. In this position, he will manage existing relationships with SIRO partners in joint innovation centers at various locations around the world and seek funding opportunities that promote joint research projects, faculty exchange, and graduate student training.



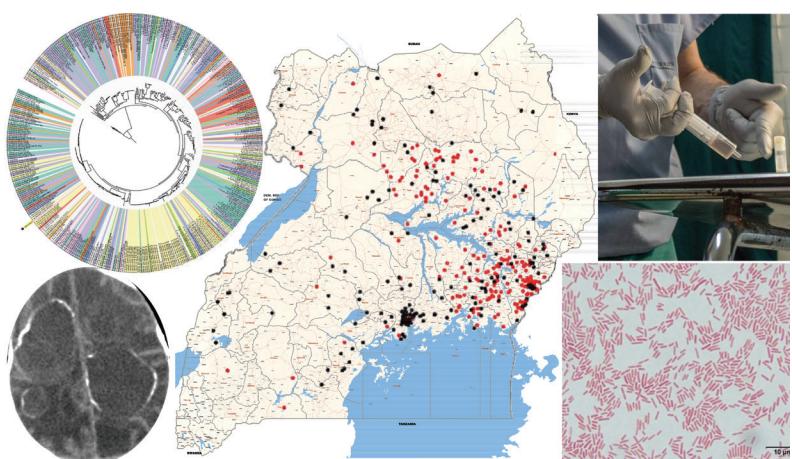
Imitating the brain to make computers more efficient

Computers can perform operations much faster than the human brain and store more information. Despite these disadvantages, the human brain is a more efficient computer than the most sophisticated supercomputers—by a factor of a million, according to Saptarshi Das, assistant professor of engineering science and mechanics. This efficiency gap is a result of differences in energy consumption, volume and complexity of computing, according to Das. With a \$690,000 grant from the U.S. Army Research Office (ARO), Das plans to target each of those areas to start closing that efficiency gap. [MORE >>](#)



Bacteria virus combo in severe neonatal brain infections in Uganda

A newly identified bacteria and a common virus may be the underlying cause of infection-induced hydrocephalus in Uganda, according to an international team of researchers. Steven J. Schiff, Brush Chair Professor of Engineering and professor of engineering science and mechanics, neurosurgery, and physics, and his research team have studied this problem for more than 10 years, but in the last five years, they took a different approach, using DNA and RNA sequencing techniques to identify the causative agents. The researchers found the bacteria was a previously unidentified strain of *Paenibacillus thiaminolyticus*, now named Mbale after the city where the CURE Children's Hospital is located. While the researchers believe they have found the source of the infections that cause the high prevalence of hydrocephalus, they have not yet found where the babies encounter the new bacteria. The researchers are creating predictive models that, coupled with data they are now analyzing from thousands of infants and satellite-acquired rainfall, can predict optimal treatment for individual locations. [MORE >>](#)



Fluid from the brain taken at surgery led to the recovery of a novel strain of a highly virulent bacteria, shown on the tree of life of related organisms. These infection cases, shown as red dots on the map, are concentrated within a region in Eastern Uganda characterized by wetlands and swamps on the north and south banks of Lake Kyoga into and out of which the Nile river flows. CREDIT: SCHIFF LAB/Penn State

Message from your alumni society chair



Circa 1961

Do you ever get lost in the alphabet soup? Since you are reading this, it is very unlikely that "PSU" makes you think of the state universities of Portland, Oregon; Plymouth, New Hampshire; or Pittsburg, Kansas, yet all of those also use "PSU"—my dad went to the school in Pittsburg long before it became a state university.



2020

Furthermore, you probably know that ESM stands for engineering science and mechanics, and the separate programs are designated "E SC," "E MCH," and "ESMCH"—although, when I was an undergraduate, "ENG SCI" was the less obscure abbreviation. But what about PSESMAS? With a little

effort and using the previous context clues, it can be interpreted as Penn State Engineering Science and Mechanics Alumni Society.

PSESMAS is a group of diverse, passionate alumni who endeavor to be catalysts to motivate many other alumni to interact with the ESM department, its students, and other alumni. The goal is to promote lifelong, mutually beneficial relationships that improve the quality of the department and the education it provides to both undergraduate and graduate students.

To help facilitate those connections, every year an alumnus makes a presentation to current students on what the degree has meant in his or her career. PSESMAS works to provide ESM students with valuable mentorships—offering mock interviews, group discussions, and informal lunch discussions for current students. These activities are hosted primarily, but not exclusively, by members of the PSESMAS Advisory Board, who meet twice a year.

PSESMAS also sponsors an Early Career Recognition Award. From a field of very strong applicants, this year's recipient is Muhammad Faryad ('12 Ph.D. ESMCH). Among many other accomplishments, Muhammad heads the Physics Department at Lahore University in Pakistan, is a fellow in SPIE—more alphabet soup—and has established two SPIE student chapters. Congratulations to our 2020 winner!

If you would like to be a part of the PSESMAS, or nominate someone (or yourself) for the Early Career Recognition Award, please contact Lisa Spicer, coordinator for alumni, development, and advancement, at 814-867-1569 or lms8@psu.edu.

Chuck Gaston ('61 ENG SCI)

Contact ESM and stay in touch

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