



Photo credit: Corey Cochran/JPL/  
California Institute of Technology



## Cochran Receives Prestigious NASA JPL Award

ESM alum Corey Cochran's innovative research took shape during his graduate work at Penn State. Now it may revolutionize scientific investigation of planetary bodies.

Corey Cochran ('13 Ph.D. ESMCH, '07 M.S. E E, '04 B.S. E E) received The Edward Stone Award for Outstanding Research Publication from the National Aeronautics and Space Administration Jet Propulsion Laboratory (JPL).

"Being recognized amongst the exceptional JPL researchers is truly an honor, especially because the underlying research idea has roots in the graduate work I performed at Penn State," said Cochran.

Cochran, an instrument developer and investigative scientist for the Europa Clipper mission, won for his paper titled "Vectorized magnetometer for space applications using electrical readout of atomic scale defects in silicon carbide," which was published in *Nature Scientific Reports*. He was cited for a proof-of-concept demonstration of an innovative next-generation solid-state magnetometer.

Magnetometers are essential for scientific investigation of planetary bodies and are ubiquitous on space missions; however, conventional magnetometers may be prone to radiation damage and temperature instabilities. Also, their complexity, size, and cost prevent their applicability in smaller missions involving cubesats.

Cochran's new magnetometer measures magnetic field-induced changes in current



Michael Watkins (left), JPL director, and Mark Simons (right), JPL chief scientist, presenting Cochran (center) with his award. Photo credit: Corey Cochran/JPL/California Institute of Technology.

within a SiC p-n junction caused by the interaction of external magnetic fields with the atomic scale defects intrinsic to the semiconductor.

According to Cochran, if shown to be competitive with heritage space-based magnetometers, the simplicity, small scale, and robustness of the technology could completely revolutionize the way magnetic fields of planetary bodies and their moons are measured in space. The technology would enable missions leveraging swarms of cubesats capable of science returns not possible with a single large-scale satellite and allow for operation in extreme conditions and high radiation environments.

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## Message from the Chair



Fall 2017 was very eventful with the arrival of five new ESM faculty members, including Justin Schwartz, Harold and Inge Marcus Dean of Engineering, who is setting ambitious goals that start with reaching fifty percent undergraduate diversity within six years. Read more about our exciting new hires on page five.

Go to [esm.psu.edu](http://esm.psu.edu) for this year's faculty opening in ultrasonics for structural health monitoring.

In November, the ESM department was reviewed by an external panel, chaired by Ishwar Puri, dean of the College of Engineering at McMaster University, Canada. Over two days, the panel met with deans in the College of Engineering, undergraduate and graduate students, faculty, staff, alumni, and directors from various Penn State research institutes to learn more about our activities. The panel report was highly complimentary regarding the quality of the faculty, students, and programs, and our interdisciplinary research and educational scholarship. The panel highlighted opportunities for differentiating/branding ESM programs and assessing their impact, and made constructive suggestions for enhanced diversity and mentoring initiatives. Congratulations to all for such a positive and constructive review.

On a personal note, I am excited to have just begun a three-year term as a member of the Board of Trustees of ASM International. I look forward to inspiring young members to pursue materials and engineering sciences, and to advancing the materials community.

As the year draws to a close, our students, faculty, and staff thank you for all the support you give to ESM.

Wishing you a very happy holiday season!

*Judith A. Todd*

Judith A. Todd

## Faculty Spotlight

### Drew Receives Multiple Grants for Neuroscience Research

**Patrick Drew**, associate professor of engineering science and mechanics, neurosurgery, and biomedical engineering, is the co-principal investigator (co-PI) on two research projects that received a combined \$6 million. Drew, along with co-PI Nanyin Zhang, professor of biomedical and electrical engineering, was awarded \$3.7 million by the National Institute of Mental Health to investigate which classes of neurons in the brain control spontaneous fluctuations in blood flow. Drew and Zhang also received \$2.3 million from the National Institute of Neurological Disorders and Stroke to study neurovascular coupling, particularly how the communication between neurons and the blood vessels of the brain changes from postnatal development through adulthood. Together, with Professors Francesco Costanzo and Bruce Gluckman, Drew also received \$400,000 from the National Science Foundation to study "Imaging and Modeling Fluid Mechanics of Metabolite Transport in the Brain Interstitium."

In July, Drew was named a Huck Distinguished Associate Professor of Neural Engineering and Neurosurgery.



## Graduate Spotlight

### Bahari Awarded Fellowship for New Problem-solving Methods

Ph.D. candidate **Fatemeh Bahari** was awarded an Academic Computing Fellowship by the Graduate School to support her research in neural engineering. Her work focuses on understanding how the role of sleep-wake regulation can drastically improve and even change approaches in proposing effective treatments for epilepsy.

Bahari has established a framework which incorporates experimental mechanistic measurements into physiologically-based mathematical models. Her efforts will introduce new avenues in model validation, as well as improved understanding of network interactions in epileptic and healthy brains.



## Undergraduate Spotlight

### Kennedy Receives Diefenderfer Scholarship

Senior **Alayna Kennedy** was the recipient of the College of Engineering's Diefenderfer Scholarship in Engineering. A Schreyer Scholar, Kennedy is completing a thesis titled "Policy Implications of Aligning Human and Machine Values," which focuses on using natural language processing, a form of machine learning, to analyze emotional arcs in text. She is analyzing the policy implications of teaching machines narrative techniques that could lead to mirroring human emotion.

Kennedy is also active outside the classroom. She is a member of the Presidential Leadership Academy, university relations director for Lion Ambassadors, director of career development for Schreyer for Women, and an officer for Nittany Data Labs.

Following graduation in the spring, Kennedy plans to attend graduate school to study technology policy.



## 2017 Golden Decade Reunion

### Five Alumni Honored as Golden Decade Fellows

The annual ESM Golden Decade Reunion was held June 1-2, 2017, at the Penn State Conference Center, in conjunction with Penn State's Alumni Reunion Weekend. Approximately 40 ESM alumni, faculty, staff, and students attended the banquet to recognize ESM alumni who graduated in '67, '72, '77, '87, '97, and 2007. Five individuals were honored as Golden Decade Fellows (50+ years alumni): **John Carpenter** ('57), **Grant Hummer** ('67), **Gordon Marshall** ('67), **Dale Mosier** ('67), and **Sam Zamrik** ('61).



Friday's half-day program consisted of a state of the department address by Judith Todd, department head; a faculty seminar presentation by Assistant Professor Saptarshi Das titled "2D Materials for Ubiquitous Electronics"; a Meet & Greet with ESM students; and a "Meet the Dean" luncheon.

We look forward to seeing you at the 2018 Golden Decade Reunion, May 31-June 1, 2018. For more information or to register, contact Tina Storms, coordinator for alumni, development, and advancement, at 814-867-1569 or [alumnirelations@esm.psu.edu](mailto:alumnirelations@esm.psu.edu).

## Alumni News and Recognition



**Chandra McMahon** ('01 M.Eng. E SC), senior vice president and chief information security officer (CISO) at Verizon Communications, was featured in an SC *Magazine* story titled *Women in IT Security: Power Players*. McMahon was also named to Hot Topic's 2017 list of Top 100 Global CISOs.

### We Want to Hear from You!

Do you have some exciting news you'd like to tell us about? If so, send it our way so we can share it with our community of alumni and peers. Email [alumnirelations@esm.psu.edu](mailto:alumnirelations@esm.psu.edu) and tell us what's been going on with you!

## 2017 Early Career Recognition Award Winners

**Amber Black** ('14 Ph.D. ESMCH) and **Guneet Sethi** ('04 M.S. E MCH, '08 Ph.D. ESMCH) were the 2017 fall and 2018 spring Early Career Recognition Award recipients.



Black is employed as a scientist for the Welding & Joining group of the materials research (Sigma) division of Los Alamos National Laboratory, where she focuses on electron beam and laser welding, as well as additive manufacturing applications. Previously, she was an applications engineer at PTR-Precision Technologies,

Inc., working with customers in the aerospace, automotive, oil and gas, power generation, and medical industries to usher applications from concept through planning and development, to final product production. Her expertise includes electron beam welding, laser welding in vacuum, high-energy metallurgical processing, metallography, and microscopy. In 2015, Black served as an appointed adjunct professor at the University of Connecticut, teaching *Transport Phenomena in Materials*. She is also an active member of the American Welding Society, serving as chair of its AWS C7B Subcommittee on Electron Beam & Allied Processes. Black is chair of ASM International's Women in Materials Engineering

Chapter Focus Subcommittee and past chair of the Emerging Technology Awareness Committee.



Sethi is senior manager, hardware reliability engineering at Amazon Lab126 and leads the product reliability team for Amazon hardware products such as Kindle, Fire Tablet, Echo, and Fire TV family. Sethi is a pioneer in developing new technologies such as Amazon PagePress®, waterproofing, novel display, and composite enclosures

for Amazon hardware products. His leadership and materials expertise has enabled Amazon to develop robust and yet low-priced consumer electronic products. Sethi has written more than 35 publications including a book titled "Thin Films for High Energy Density Capacitors," holds four patents, and has received multiple trade secret awards. He is currently the chair of IEEE Santa Clara Valley Reliability Chapter and actively contributes to the scientific community as a journal editor, peer reviewer, and session chair for IEEE and SAE conferences.

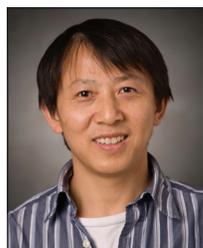
The ESM Early Career Recognition Award recognizes alumni who graduated in the past 10 years and have distinguished themselves at work and/or in their community.

## 2017 PSEAS Award Winners

On October 25, the College of Engineering, in conjunction with the Penn State Engineering Alumni Society (PSEAS), held its annual PSEAS Awards reception to honor faculty, staff, and alumni for their outstanding teaching, research, advising, and service.

The ESM department was extremely proud to, once again, have four recipients among this year's winners: **Charles Bakis**, Distinguished Professor of Engineering Science and Mechanics, Premier Research Award; **Gary Gray**, associate professor of engineering science and mechanics, Outstanding Advising Award; **Melissa Fink**, department head staff assistant, Outstanding Staff Award; and **Abby Dodson** ('12 E SC), product engineer at Lear Corporation, Young Alumni Achievement Award.

## Faculty Honors/Awards



### Zhang, multidisciplinary research team receive seed grant

A multidisciplinary team of researchers, led by **Sulin Zhang**, principal investigator and professor of engineering science and mechanics, received a \$25,000 seed grant from the Penn State Institute

for CyberScience to develop a modeling platform to predict the deformability and morphological changes of diseased and aged red blood cells (RBC). The one-year project titled "Understanding the Molecular Origins of Impaired Deformability and Shape in Diseased and Aged Red Blood Cells through Multiscale Modeling" will offer key molecular insight into the principles underlying RBC deformability and provide rational guidance to the development of novel diagnostic sensors, anti-malaria therapies, and new protocols for blood storage.



### CNEU receives NSF funding to develop nanotechnology workforce

With two grants awarded by the National Science Foundation (NSF), the Penn State Center for Nanotechnology Education and Utilization (CNEU), led by **Osama Awadelkarim**, professor of engineering science and mechanics

and CNEU director, will develop a Nanotechnology Professional Development Partnership to continue providing leading-edge nanotechnology education to post-secondary educators and students to address the growing national need for a skilled nanotechnology workforce.

Totaling more than \$2.5 million, the awards, administered through the NSF's Advanced Technological Education



## Students + Industry = the Right Mix

On September 13, ESM held its annual Recruitment by Industry Mixer in conjunction with Penn State's Fall Career Days. Held in the Earth and Engineering Sciences Building, the event gave more than 50 ESM students the opportunity to meet and talk with a diverse group of companies and organizations including PWC, American International Group, the National Reconnaissance Office, MPR Associates, and the Naval Nuclear Laboratory. Students put their best feet forward to secure interviews at Career Days for internships and co-op opportunities. If your company is interested in participating in the 2018 fall mixer, please contact Tina Storms, coordinator for alumni, development, and advancement, at 814-867-1569 or [alumnirelations@esm.psu.edu](mailto:alumnirelations@esm.psu.edu).

(ATE) program, will provide funding through August 2020. This financial support will allow CNEU to offer new, more affordable, and accessible training to a much larger and diverse nanotechnology audience through its Nanotechnology Applications and Career Knowledge (NACK) Network, which recently became an ATE support center.



### Masters receives ASEE Mechanics Division James L. Meriam Service Award

**Christine Masters**, assistant dean for academic support and global programs in the College of Engineering and associate professor of engineering science and mechanics, received the 2017 ASEE Mechanics Division James L. Meriam Service Award. The award recognizes significant service to the ASEE Mechanics Division as characterized by notable leadership, significant contributions, and prolonged and dedicated service.

# ESM Frontiers

## A High Five to the Future of ESM

### ESM welcomes five new faculty members for 2017-2018

The future of the department is looking even brighter with the addition of five new faculty members:

**Şahin K. Özdemir, Todd Palmer, Christian Peco, Slava V. Rotkin, and Justin Schwartz.**



Özdemir was hired as an associate professor. He comes to Penn State from Washington University in St. Louis, where he was a research

associate professor in the Department of Electrical and Systems Engineering. He is also a specially appointed professor in the Graduate School of Engineering Science at Osaka University (Japan), and has a close research collaboration with RIKEN, Japan's largest comprehensive research institution.

Özdemir's research lies at the interface of engineering, physics, nanotechnology, and materials science. His highly interdisciplinary work includes experimental and theoretical studies in photonics, optomechanics, parity-time symmetric systems, single particle/molecule detection, quantum sensors and plasmonics. Özdemir has published more than 120 peer-reviewed journal articles, with more than 5,800 citations.



Formerly senior research associate at the Applied Research Laboratory, Palmer joins ESM as professor and director of

the Center for Innovative Sintered Products, and affiliated professor of materials science and engineering.

His research interests involve electron beam and laser processing and joining of advanced materials, development of process-structure-property relationships in additive manufacturing of metals, synchrotron-based in situ X-ray diffraction techniques, physical metallurgy of gears and bearings, and economics and business development in materials and manufacturing industries.



Peco comes to Penn State as an assistant professor, having previously been a postdoctoral research associate in the Pratt School of Engineering at

Duke University. He is also a research collaborator at the Information Initiative at Duke, Idaho National Laboratory, and the Okinawa Institute of Technology (Japan).

His interdisciplinary research explores problems in biomechanics and materials science with the long-term objective placed on the active control of soft materials, such as lipid bilayers, to create bioinspired soft nanomachinery.



Rotkin has been hired as a College of Engineering Frontier Professor with tenure home in ESM, following 13 years at Lehigh University where

he was most recently professor in the physics and materials science and engineering departments. He has more than 3,500 total citations and 78 peer-reviewed journal articles.

Rotkin is an expert in the field of applied and device physics of semiconductor nanostructures and nanomaterials with a focus on nanocarbons and 2D materials—particularly on biosensing applications of nanocarbon materials and their compounds, nanoscale and near-field optics characterization and quantum optics and nanophotonics of low-dimensional systems.



Schwartz, who was named the new Harold and Inge Marcus Dean in the College of Engineering, is also tenured in ESM. He has held

positions as the Kobe Distinguished Professor and Department Head of Materials Science and Engineering at North Carolina State University (2009-2017), and the Jack E. Crow Professor of Engineering (2005-2009) and senior research adviser to the vice president for research (2001-2002) at Florida State University.

Schwartz's research interests include processing-structure-property relationships and failure mechanisms in superconducting materials and systems, multiferroic and magnetic thin films and devices, and optical fiber-based sensors. He focuses on the scientific challenges in transitioning new materials into technologically functional materials.



## Message from Your Alumni Society Chair

During our fall 2017 meeting, the ESM Alumni Society selected winners for the fall 2017 and spring 2018 Early Career Recognition Award. After considering several very qualified candidates, Amber Black was selected to receive the fall 2017 award and Guneet Sethi was selected to receive the spring 2018 award.

The highlight of the fall meeting was the official launching of the ESM Mentoring program. The kickoff occurred at a special barbeque luncheon with opening remarks by Dr. Judith Todd. Approximately 35 students attended the luncheon. Board members also participated in a question and answer session with the students regarding the mentoring program. To date, 27 students, both graduate and undergraduate, have signed up for the program, with 16 alumni who have come forward to serve as

mentors. Unfortunately, we have not been able to match all of the students with mentors, in part, due to citizenry requirements for some of the mentors. If you would like to volunteer as a mentor, please contact Tina Storms, ESM coordinator for alumni, development, and advancement at 814-867-1569.

The ESM Alumni Society is comprised of 15-20 alumni who have a broad range of backgrounds and careers. The society meets twice a year to see how we can best enrich the department and be of assistance to students. If you would like to be a part of the ESM Alumni Society, again, please contact Tina Storms in the ESM office.

Rich Smith ('73 E MCH)



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- Significant hands-on nanofabrication experiences

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##### M.Eng. in Engineering Mechanics

- Professional degree program; 30 credits

ESM is also participating in a new M.S. in Additive Manufacturing and Design degree offered through Penn State World Campus. Learn more at [amdprogram.psu.edu](http://amdprogram.psu.edu).

## WE ARE...HIRING!



### Tenure-track Assistant Professor

The ESM department currently has an opening for an assistant professor in ultrasonics for structural health monitoring, though exceptional faculty at higher ranks may be considered. Learn more at [esm.psu.edu/department/job-opportunities.aspx](http://esm.psu.edu/department/job-opportunities.aspx).

## 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.

[esm.psu.edu](http://esm.psu.edu)



## Contact ESM and Stay in Touch

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