



DREXEL UNIVERSITY

Mechanical Engineering and Mechanics

College of Engineering



2019

A YEAR IN REVIEW



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WELCOME

When I wrote a few introductory paragraphs to this MEM Year in Review just a few weeks ago, my intent was to share my admiration for the many notable achievements of our students, faculty and alumni. My pride in all of you remains — we have accomplished so much this year. However, we have all been transformed by the COVID-19 pandemic, and I am prouder now of how the MEM community has come together in response to what has swiftly become our strange new normal.

Our faculty, students, and staff have been tireless in moving to remote instruction for the upcoming quarter and in supporting each other through this transition. At a time of great uncertainty, we are writing a new story — of our commitment, innovation, and caring during a worldwide health crisis. I am confident that the compelling stories in this Year in Review will not only give you a fuller picture of the contributions and impact that MEM has on our society but also inspire all of us to continue our good work.

Since starting as interim department head in late 2018, I have witnessed the amazing creativity, work ethic, teamwork, and commitment to social impact that our students display each day. This is nowhere more evident than in the capstone project problems they embrace and the ingenious and entrepreneurial solutions they arrive at. The talents they develop clearly pay off: our recent grads are landing coveted positions at Children’s Hospital of Philadelphia, SpaceX, Google, Tesla, Amazon, and Boston Dynamics, to name a few. They perform service to our country as commissioned officers, pursue graduate and professional studies, and enter prestigious postdoctoral and tenure-track positions. I’m sure you’ll enjoy reading about their experiences and accolades.

I am inspired by the passion of our alumni, whose remarkable achievements bring national and international distinction and honor to both them and their alma mater. I’m humbled by the enduring commitment of our faculty who ensure that our graduates are prepared for wherever their life and career paths may lead.

It’s been a busy time. We’ve welcomed new professional staff and gone through the process of renewal for ABET accreditation. Our work to ensure strong undergraduate enrollment is paying off. Research awards, expenditures, and new proposals are all on the rise. We’ll soon launch a departmental strategic planning process to reimagine MEM’s vision, reaffirm our values, articulate our value proposition, and guide our recruiting and investment in new faculty and the student experience. Under Dean Walker’s leadership, we will soon embark on the most significant transformation of our learning and laboratory spaces in decades.

President Fry, Dean Walker, and others gathered recently to honor and celebrate the many years of service of Drexel faculty and staff. Among them was Professor Harry G. Kwatny, celebrating the extraordinary milestone of fifty years of teaching, mentoring, and research in MEM. Few have guided and made impact on so many generations of students. Still an avid sailor, Professor Kwatny continues to advance understanding of impaired aircraft control, and recently co-authored a new textbook on controls with our colleague, Professor Bor-Chin Chang. Congratulations!

Through individuals and accomplishments like these, MEM confronts the real problems of real people — making life more equitable and meaningful, both in our local Philadelphia neighborhoods and communities around the world.

The story of COVID-19 is still being written. And as it unfolds, it highlights how in times like these our work is more important than ever. With best wishes for your safety, health, and wellbeing in this new season,

Jonathan E. Spanier
 Professor and Head of Mechanical Engineering & Mechanics
 Professor of Materials Science & Engineering
 Professor of Electrical Engineering and Physics (courtesy)

Earth, Wind, Fire, (and Water): Jeff Lyash Faces His Newest Challenge

By almost any metric, Jeffrey Lyash, 57, has led an impressive career. Until recently, the 1984 graduate of the College of Engineering's Department of Mechanical Engineering and Mechanics has served as the president and CEO of Ontario Power Generation, Inc. of Canada, a role that made him the most highly paid public servant in the province. Before that, Lyash's career boasted an impressive array of executive and senior roles in the electrical power industry, including president of CB&I Power, and executive vice president of energy supply for Duke Energy, as well as senior technical and management positions with the US Nuclear Regulatory Commission throughout the northeast United States and Washington, D.C. Now, Lyash is taking on his biggest challenge yet.



This is the most exciting time to be in this business in my career."



Photo courtesy of Tennessee Valley Authority

Last April Lyash was named president and CEO of the Tennessee Valley Authority (TVA), the \$11 billion federal agency formed under Franklin Roosevelt's "New Deal" to help the country recover from the deep 1930s depression. The Authority became the nation's largest electricity supplier in the 1940s. The TVA serves nearly 10 million people in parts of seven southeastern states, receives no taxpayer funding, and derives virtually all of its revenues from sales of electricity. Originally founded with an aggressive hydroelectric program, nuclear generation now represents the largest source of the TVA's electrical power, with coal, natural gas, and renewable resources making up the remainder of its output.

"This is the most exciting time to be in this business in my career," Lyash told members of the press during an interview about challenges faced by the TVA shortly after taking the role. "Is there uncertainty? Yes. Is there risk? Absolutely."

While Lyash may face many challenges in his new role, experts at his alma mater feel he is up to the task. "Drexel MEM's multi-disciplinary education prepares our engineers for a wide variety of different roles," noted Department Head, Jonathan Spanier. "Jeff's newest appointment in the highly complex and evolving energy sector is a stellar example of the kinds of exceptional and nimble leadership that our students can truly admire."

"I am excited about the opportunity to lead TVA, an organization with a great sense of purpose not only to provide reliable, low-cost energy—which is a critical underpinning for how we live— but to improve the lives of people of the Tennessee Valley and the United States through economic development and environmental stewardship," said Lyash.

Lyash, a Pennsylvania native whose grandfather was a coal miner, was inducted into the college Alumni Circle of Distinction in 2009. Lyash also serves on the board of Electric Power Research Institute (EPRI), an international non-profit organization for public interest energy and environmental research.

Lyash now lives in Knoxville with his wife Tracy. They have two married children and nine grandchildren.

RECOGNIZING OUR RECENT ALUMNI



Dr. Han Hu
Assistant Professor
University of Arkansas
Mechanical Engineering



Dr. Min Pack
Assistant Professor
Baylor University
Mechanical Engineering



Dr. Brian Wisner
Assistant Professor
Ohio University
Mechanical Engineering



Photo Credit: Office of the Assistant Secretary of Defense-Public Affairs; U.S. Navy; Sherry Jacob

“I am truly honored and grateful for the recognition. I have mentioned to my colleagues that this award is as much a recognition of their work as it is mine.



James Hing Receives the PECASE

White House Honors Dr. James Hing, '03, '06, '10

As the American Government's highest honor of its type, the Presidential Early Career Award for Scientists and Engineers (PECASE) is one of the most respected awards a young engineer can receive. It is unsurprising then, that when Dr. James Hing, MEM '03, '06, '10 received notice that he had been named as a 2019 PECASE recipient, it took him some time to believe what was happening.

“I was in disbelief at first,” said Hing. “I stared at my name on the White House press release for quite some time, trying to convince myself that it wasn't a typo or mistake. I am truly honored and grateful for the recognition. I have mentioned to my colleagues that this award is as much a recognition of their work as it is mine.”

Hing graduated from CoE with a bachelor's degree in '03; a master's degree in '06; and a PhD in '10 under the advisement of Professor Paul Oh. “I initially started college with the desire to develop robotic prostheses as a mechanical engineer but a course in medical robotics my senior year led me to

pursue a PhD in that field. Unfortunately, half way through my PhD, my advisor decided to leave the university and in order to continue studying robotics at my university, I needed to switch from medical robotics to the field of autonomous vehicles. I have been fascinated with that field ever since the first day in my new laboratory, when I witnessed a driverless ATV navigate around me on its way to a goal.”

Career adjustments like this aren't uncommon, says Dr. Andrei Jablokow, Associate Teaching Professor and Associate Head for Undergraduate Education: “Mechanical engineering is about determination. When you run into an obstacle you have to be able to pick yourself up, assess the situation, and start moving in another direction if necessary.”

Now Strategic Technologies Branch Head at the Naval Air Warfare Center Aircraft Division, Dr. Hing works with perception, advanced control methods, and human machine interactions for autonomous systems operating aboard aircraft carriers.

STUDENT AWARDS & ACCOMPLISHMENTS



Krzysztof Mazur
2019 Graduate College
Research Excellence
Masters Award Recipient



Ebed Jarrell
MEM Junior, named
to the 2018-19
Philadelphia Inquirer
Academic All-Area
Men's At-Large Team



Meet Savanna Michener: The First Peace Engineer

2019 has been a year of firsts for Savanna Michener. Driven to use her education to improve lives, Michener, who started at Drexel in 2014, had thought that pursuing a degree in biomedical engineering was the best route to achieving her goals until an alternative spring break program in Port-au-Prince, Haiti convinced her otherwise.

"Through having conversations with people who were doing humanitarian aid and crisis work, and getting to know their backgrounds and histories in the field, I was exposed to a different kind of work," said Michener. "It led me to understand more about international aid relief: why the earthquake affected them so much, how they were handling the effects, and the role outsiders played. I think it really opened my mind, and I came home and decided I really should do something I'm passionate about."

Now, Michener is Drexel's—and arguably the nation's—first peace engineer. She was enrolled in CoE's 48-credit MS Peace Engineering program, launched last year, and she is now enrolled as a MEM PhD student. "Right now, we're still trying to finalize the details of the coursework since this is the first year the program has been run, and I am working with professors to provide feedback on the core curriculum," Michener said. "I like doing this... I'm used to being a guinea pig."

"I think the engineering field as a whole really needs to reevaluate what we're doing and look at the big picture first and then break it down," said Michener. "Obviously, technical expertise is important in so many situations, and we need more engineers to improve infrastructure. That's our job, right?"

"But we also need engineers who are ethical and competent and want to communicate and want to design holistic solutions. It needs to be a balance between the technical and the contextual."

The Peace Engineering program offers an expansive host of concentrations. Among them are water safety, systems management, data management and data mining, web and mobile development, machine learning and AI, serious gaming, interactivity, and systems analysis. Advisors work closely with program enrollees to ensure a seamless blend of technical and peace-building skills.

Already Michener's education is paying dividends. This summer, as part of her experiential learning requirement, Michener worked with a Water, Sanitation and Health (WASH) organization in a refugee camp in Lesvos, Greece. In October, Michener attended the First International Conference on Environmental Peacebuilding at the University of California, Irvine where Michener presented work on "Strategic entry points for implementation of renewables to improve sustainability and peace outcomes." Later that month she attended PeaceCon 2019 in Washington, DC, and in December attended COP25 in Madrid, Spain.

"I want to add depth to the problems engineers are given..." said Michener. "I think the peace engineering program is a perfect, natural extension of my undergraduate degree."

Interested in pursuing an MS in Peace Engineering? Find out more at drexel.edu/engineering/peace.

MEM PhD Student Honored for Mentorship Excellence

Leading by Example

Each year the Graduate College presents the Outstanding Mentorship Award to up to two graduate students who demonstrate an outstanding commitment to mentoring, developing and supporting undergraduate and/or new or junior graduate students. While mentorship may occur in many settings, the award focuses on mentorship in a research or scholarly setting, such as during the STAR Scholars Program. This year's award was presented to MEM PhD student Reza Pejman. We caught up to Reza to find out what advice he has for students interested in improving their mentorship skill.

Q How did you react when you were told you would be receiving the award? What were your thoughts, actions, or feeling?

A It was a great honor for me to receive this prestigious award. Earning this award has helped me realize that hard work, determination, and believing in yourself are the key components for making a dream come true. I want to thank the graduate college and MEM department for this award, as well as my advisor, Dr. Najafi, for giving me the opportunity to mentor other students in the Multiscale Computational Mechanics and Biomechanics lab.

Q What is your philosophy towards teaching and mentorship? What advice would you give to new TAs to help with their teaching?

A My philosophy toward teaching and mentorship is to be fair and helpful to all students. I always try to help the students in such a way that they can grow and improve educationally and reach their full potential. I believe that one of the key factors in being a successful TA is developing a good

professional relationship with the instructor and the students. Moreover, I think it is quite important that the students have the feeling that the TA cares about their improvement and progress. If the students have that feeling, they will pay more attention to the suggestions and recommendations of the TA.

Q What are your research interests?

A My research interests are nature-inspired design, computational mechanics, thermal science, and biomechanics.

Q What are your hobbies? What do you like to do when you're not in the lab?

A My hobbies are traveling, playing musical instruments, and photography.

Q What are your professional goals?

A My current, short-term goal is to expand my knowledge and skills in my field of expertise and successfully finish my PhD program. After that, I would love to find a job in the R&D section of a tech company.



Check out Senior Design team SafeSense's interview in *Startup Fortune* at StartUpFortune.com/tag/safesense.



MEM Senior Selected for *Forbes* Under 30 Summit

Christopher Lee, a senior in the Department of Mechanical Engineering and Mechanics (MEM), was selected to attend the 2019 “Forbes Under 30 Summit” in Detroit, MI in October as a representative of MEM and Drexel University, one of just 1,000 Forbes Under 30 college scholars nationwide to be so honored.

Lee, a BS/MS student in the College of Engineering and the Pennoni Honors College and current president of Drexel’s Phi Sigma Pi National Honor Fraternity, was chosen after submitting an application, essays, and a resume of leadership skills and career goals.

The four-day conference featured industry leaders like Steve Case of AOL, Yael Aflalo of Reformation, and Jon Oringer of Shutterstock, along with musicians, actors, sports figures, and influencers. Over 9,000 individuals attended the conference, billed as a leading global forum for young leaders, founders, and investors.

As part of his application, Lee emphasized his status as a first-generation Chinese American who was tasked from the time he was a boy to be a role model to four younger siblings. He was raised near Philadelphia in a culture unfamiliar to his parents, who themselves emigrated from Hong Kong decades ago.



As for my leadership philosophy, I believe in a multitude of concepts: leading by example, diversity and inclusion, agreeability and respect.”

“Whenever I discuss leadership skills, I feel compelled to mention my role as a big brother. I was raised to always take care of my siblings, to look out for them, to guide them through life,” said Lee. “That’s why I’ve always tried so hard to thrive academically and professionally; I want to set a good example for them. I try to inspire them with passion and diligence.”

“As for my leadership philosophy, I believe in a multitude of concepts: leading by example, diversity and inclusion, agreeability and respect. You can be the smartest guy in the world, but if you can’t work well with others, you’re setting yourself up for failure. I’ve learned a lot about collaborating and conflict resolution and these skills have developed significantly while I’ve been here at Drexel.”

Lee, who has had three co-ops in dynamic manufacturing industries (chemicals, cosmetics, and pharmaceuticals), plans to investigate the ideas and advances on display from more than 30 fields represented at the conference. Students get to choose from among 20 content tracks like artificial intelligence, fintech and blockchain, and law and policy, that offer themed lectures, demonstrations, and networking opportunities. More than 500 investors attended the event’s industry pitch sessions matching “young founders” with venture capitalists, for which companies pay between \$370 and \$10,000 to access.

“I want to learn more about different industries,” said Lee. “I want to grow myself, see what’s out there, build my resume, make connections. One of the founders of AOL is going to be speaking, so I’m really looking forward to hearing him. And Serena Williams, who is one of the greatest tennis players of all time.”

Interested in applying for next year’s summit? News and pre-registration materials are available through the Forbes Under 30 website at live.forbes.com/under30.



CONGRATULATIONS TO NOELLE KOWNURKO AND RYAN HOSCHAR, MEMBERS OF 2019 DREXEL’ STEEL BRIDGE TEAM AND WINNERS OF THE 2019 AISC STEEL BRIDGE COMPETITION LIGHTNESS CATEGORY.

IN APPRECIATION OF SUPPORT OF SENIOR DESIGN

- ASME Philadelphia Section
- Boeing
- Boston Dynamics
- Bkon
- DePuy Synthes
- Diesel Power Service
- Dorman
- Drs. Lawrence & Horn of Children's Hospital of Philadelphia
- Eaton Corporation
- EFE
- FAA
- L3
- Michael Barthold, Jefferey Darrow & Kory Smith
- NASA
- Quest Therapeutic Services
- Rieker
- Southco
- Tern
- Team Wendy
- The Office of Naval Research
- THRIL
- XDP Diesel Power



SeaVital

Botstiber Senior Design Competition Winner

Now at Incubation Stage

Team SeaVital developed an autonomous drone intended to prevent drowning deaths caused by man-overboard events on cruise ships, commercial tankers, and other waterborne craft. The system is capable of independently locating the "man-overboard" victim and delivering a life jacket or other flotation payload to him or her.

Drexel Dragon Rover

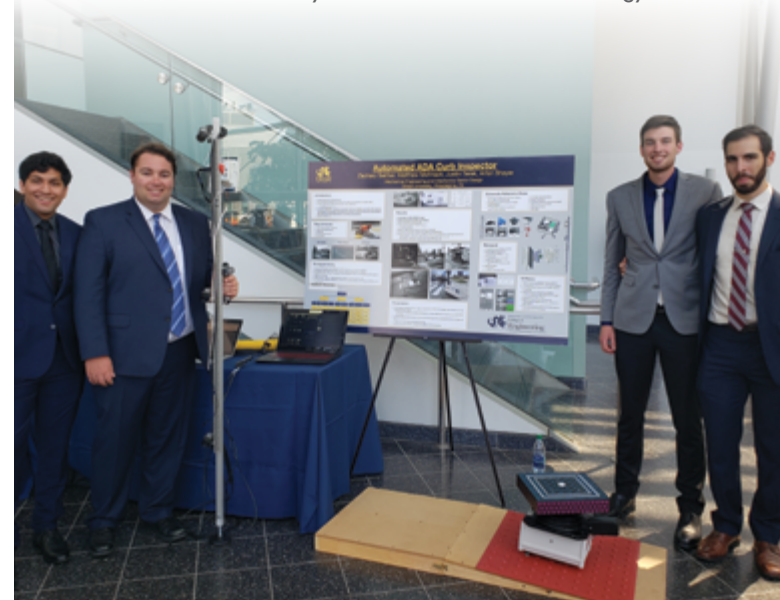
The NASA Human Exploration Rover challenge encourages college and high school students to design, build, and test a lightweight human-powered rover. A requirement of the competition is to develop an innovative wheel design, without the use of existing pneumatic or standard rubber components. In addition, the rover must be able to fit within a 5x5x5 foot volume when folded or unfolded. Team Drexel Dragon Rover designed and fabricated a human-powered rover capable of traversing rough terrain provided by NASA, safely.



Automated ADA Curb Inspection

1st place for MEM Senior Design
2nd place for CoE Senior Design Competition

Across the United States, sidewalk ramps are falling apart and are no longer within required specifications set forth by the Americans with Disabilities Act (ADA). Impassible ramps and unsafe curb layouts are a hazard to not only those with disabilities but also to the elderly and to children. Team Automated ADA Curb Inspection, along with the main stakeholder, Rieker Incorporated, created the industry standard for the new generation of measurement and inspection technology. Utilizing photogrammetry techniques and software with a tripod-mounted digital camera, the team is able to reconstruct the entire sidewalk ramp as a virtual 3D model. The model is scaled to fit actual dimensions, and leveled out to a gravity reference. Once this model is obtained, the amount of measurements and observations to be performed on the ramp is limitless. Depth of cracks on the surfaces, placement of the detectable warning strip bumps, obstacles on the sidewalk and changes in height across adjacent surfaces are among the few required measurements that are easily obtained with this methodology.



BOTSTIBER SENIOR DESIGN COMPETITION

The Dietrich W. Botstiber Endowed Fellowship for Inventors and Entrepreneurs generously supports an annual competition for Drexel University senior design students an annual competition for Drexel University senior design students in the college. Each year the competition identifies ten projects that may have commercial potential and provides them with financial support and guidance for incubation options should they choose to pursue commercialization efforts during their senior year and potentially after graduation. This year four teams from MEM were identified as competition winners:

Project S.T.A.R.S.

Developed an instrumented retention system to evaluate the force delivered to a combat helmet's wearer under different tightness settings.

SMARTBike

Developed a semi-autonomous pedal bike that utilizes an electronic drivetrain to autonomously support the rider.

VersaBrush

Designed a home kit which allows users to re-shape worn out brush tips without replacing the entire brush.

SeaVital

See left.



National Leadership

Professor Ying Sun

Dr. Ying Sun, professor in the Department of Mechanical Engineering and Mechanics, headed to the National Science Foundation (NSF) in July to begin a two-year government agency assignment.

She is serving as a program director in the division of Chemical, Bioengineering, Environmental, and Transport Systems (CBET), directing the Thermal Transport Processes program. Sun maintains her schedule of advising and her research lab, the Complex Fluids and Multiphase Transport Lab, at Drexel, dividing her week between DC and Philadelphia in fulfillment of both roles. Her NSF position formally started on July 22.

Sun's Drexel research focuses on multiphase flows and heat/mass transport, multiscale modeling of transport phenomena in energy systems and advanced manufacturing, complex fluids physics, interfacial phenomena, and printable electronics and photovoltaics.

Sun, who applied to the NSF position early in 2019, said one of her driving goals is to participate in discussions about the field's direction and provide a vision for its future.

"The thermal transport field describes how heat, mass, and fluid move from one place to another. It impacts energy, water, infrastructure, automotive, health care, chemical processes, and defense sectors," said Sun. "I will help to define the future of the field by funding innovative ideas, enabling cutting-edge collaborations, and nurturing a new generation of thermal scientists and engineers."

"This is a relatively classic field, but there are a lot of new tools—machine learning and Artificial Intelligence, as well as novel imaging and characterization techniques. I'd like to look at how we can use them to revolutionize the classic problems," she added. "There are new frontiers in robotics, for example, using new materials that have very different thermal properties. So, I will be interested to see how we can contribute to those engineering frontiers, and how we can better understand thermal properties of materials to make them perform more efficiently under extreme conditions."

Part of Sun's role is overseeing the transport program's budget to fund new research. Under that guise, she will determine awards given to early career scientists through the bestowal of prestigious CAREER awards, a significant part of her new role. Sun herself is a CAREER award recipient.

"It is vital that our faculty members have a platform to be leaders in their fields beyond Drexel University," said CoE Dean Sharon L. Walker. "We celebrate Ying's appointment at the NSF, and we are proud and eager to see how she will contribute going forward."

Sun received her bachelor's degree at Tsinghua University in Beijing. She completed her Master's and PhD at the University of Iowa. She joined Drexel's College of Engineering faculty in 2009. She has authored over 65 refereed publications, supervised six PhD dissertations, 12 Master's theses, over 25 undergraduate researchers, and eight post-docs.

I will help to define the future of the field by funding innovative ideas, enabling cutting-edge collaborations, and nurturing a new generation of thermal scientists and engineers."





FORMULA SAE ENTERS NATIONAL COMPETITION

MEM students from Drexel's Formula SAE club competed in the 2019 Formula SAE competition at Lincoln Airpark in Lincoln Nebraska. The team finished 35th out of 80 teams overall, placed 10th for fuel efficiency, and was the only "first year" team to finish without catastrophic failure.

Senior students Nicholas Bilancio, Sean Kennedy, Brandon Pettie, Aimr Daliri Shadbad, and Joshua Welsh began the production of the team's car in late 2017. 2019 was the first year since 2013 that Drexel competed in the event. Faculty advisors Dr. Jennifer Atchison and Scott Eichmann supported the team as advisors during the production process.



MEM Faculty Awarded \$901,458 Grant

The US Department of Education awarded a proposal led by MEM Associate Professor Matthew McCarthy (PI), Professor Ying Sun (co-I), and Associate Professor Antonios Kontsos (co-I) a grant for \$901,458 as part of the Graduate Assistantships in the Areas of National Need (GAANN) program. The MEM GAANN is entitled "Building a Workforce to Address Critical Infrastructure Challenges", and will support doctoral fellows to focus on developing strategies to address shortcomings of the aging US infrastructure. With special emphasis on recruiting students from traditionally underrepresented backgrounds, this fellowship program will address the massive infrastructure challenges facing the United States over the next few decades. Specific areas of emphasis will be placed on:

- 1 Structural Health Monitoring and Materials,
- 2 Energy and Water Infrastructure, and
- 3 Manufacturing and Automation.



MEM Welcomes Dr. Jennifer Atchison

Dr. Jennifer S. Atchison, Assistant Teaching Professor, is our newest addition to the MEM team, and serves as the Senior Design Coordinator. She is a STEM evangelist, an experiential learning devotee and all-around engineering enthusiast. Her research interests are in Engineering Education, specifically looking at how to infuse evidence-based teaching strategies into curriculum reform to make engineering more inclusive. Previously she did her postdoctoral studies at the INM Leibniz Institute for New Materials in Saarbruecken, Germany, where she exercised her entrepreneurial muscles in the INM-Innovation Center leading a small team on a pilot project to scale-up a custom designed needleless electrospinning process for depositing conductive transparent nanofiber webs on roll to roll system. Her work resulted in a patent and was featured at the 2017 Hannover Messe, in Hannover Germany and the 2017 International Exhibition and Conference for the Printed Electronics Industry (LOPEC) in Munich, Germany. Since joining the faculty, she has energized the Senior Design experience by hosting a mid-winter poster session and adding an Instagram channel #MEMsd2020 to heighten awareness of the terrific work the Seniors are doing in their capstone course. Dr. Atchison completed her PhD at Drexel University in Materials Science and Engineering under the supervision of Professor Caroline Schauer. In her free time, Jennifer is an avid hiker and singer.



FACULTY & STAFF PROMOTIONS

- ▶ **Christina Giessen**
Assistant Director of Business Affairs
- ▶ **Nathan Schweizer**
Manager, Outreach and Development
- ▶ **Dr. Ying Sun**
Professor
- ▶ **Diane Venti**
Program Manager, Graduate Studies

RECOGNITIONS

- ▶ **Dr. Antonios Kontsos**
Associate Professor, recipient of a Drexel Outstanding Mid-Career Research Achievement Award, and of a Drexel Scholarly Materials and Research Equipment Award for Tenure/Tenure-Track Faculty
- ▶ **Dr. Roger Marino**
Teaching Professor, and recipient of the Drexel Outstanding Teacher Award

"If you want to be a successful engineer you need to understand the core principles of math and physics."

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► Junior Faculty Profile

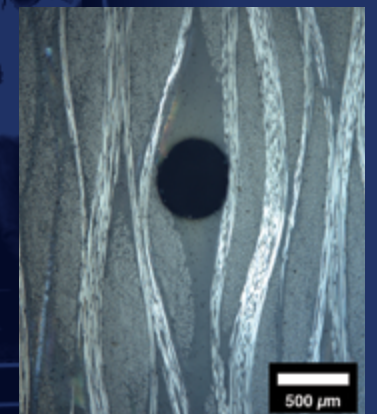
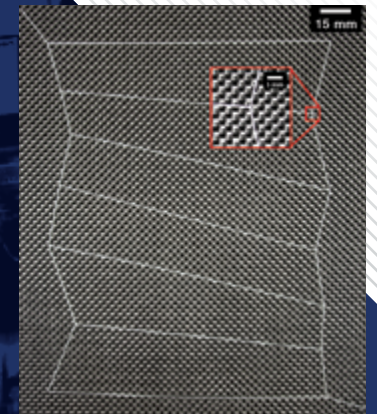
Meet Dr. Ahmad Najafi

Dr. Ahmad Najafi joined the MEM faculty in 2017 following a postdoctoral position at the at the University of Illinois at Urbana-Champaign (UIUC). With PhDs in biomedical engineering and mechanical engineering, Dr. Najafi's work is multidisciplinary and focuses on the intersection between biological systems and mechanics: "On [the] mechanics side I'm interested in design optimization and understanding how material responds to different mechanical situations. On the biological side I liked to understand how biological tissues respond to different situations and behave in different biological situations. Then I used the biological knowledge I had gained for the biological design of material."

Recently, Dr. Najafi, and his faculty collaborator, Dr. Jason Patrick, from North Carolina State University, published a study in the International Journal of Heat and Mass Transfer describing a computational technique they developed which can quickly produce designs for 3D printing carbon-fiber composite materials with an internal vasculature optimized for active cooling inspired by biological systems.

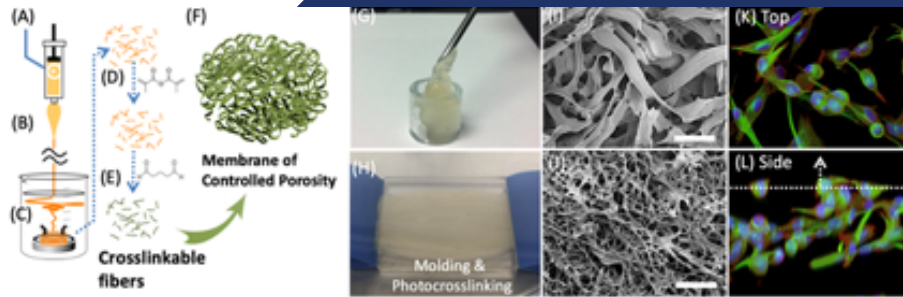
In collaboration with Dr. Antonios Kotsos, Dr. Najafi is also a co-PI of a grant for Design Optimization of Aerospace Parts via Advanced Manufacturing and leads a subaward from the UIUC to investigate the transport of small molecular species across cellular membranes via diffusion through membrane proteins. To students interested in his field he says: "The most important thing I can tell them is focus on the basics of science and engineering like math and physics... If you want to be a successful engineer you need to understand the core principles of math and physics."

Dr. Najafi is a self-described news addict. When not in teaching or in the lab Dr. Najafi enjoys spending time with his wife and two children.



Dr. Najafi's program, hybrid topology/shape optimization (HyTopS) can plot the ideal route of coolant tubes through a material that is designed to dissipate heat.





Manufacturing and application of FiberGel, which consists of light cross-linkable, needle-injectable, and paste-like microfibers that are suitable for implantation, and can help living cells survive and repair damaged tissue: (A)-(F) spinning gelatin into FiberGel, (G) injection of randomized microfibers into an arbitrary defect, (H) applying aligned microfibers to regenerate a linear tissue, (I)-(J) microfiber size can be tuned from sub-cellular to cellular (~20 micrometers), and (K)-(L) cells housed by FiberGel showed strong signs of viability and cell-proliferation. Scale in (I,J) indicates 100 micrometers.



► Junior Faculty Profile Meet Dr. Li-Hsin Han

Dr. Li-Hsin “Leo” Han joined the MEM faculty in 2014 following after completing a postdoctoral position at Stanford University’s School of Medicine under Dr. Fan Yang, focused on tissue engineering. A native of Taiwan, Dr. Han received his BS and MS in Mechanical Engineering from National Taiwan University and his PhD in Mechanical Engineering from UT Austin. Prior to pursuing his PhD, Dr. Han served as a 2nd Lieutenant in the Taiwanese military from 1998–2000 and a patent engineer in industry from 2000–2001.

Dr. Han’s research focusses on micro/ nano-fabrication, biomaterial design, tissue engineering, rapid prototyping, free-form fabrication, polymer microactuators and photonics. His lab developed FiberGel, a gel made of microfibers formed by a novel method that utilizes repeated stretching and folding similar to the process used to make taffy candy. These fibers can then be applied to damaged tissue to act as a scaffold for stem cells to grow on to repair that damage, dramatically improving the performance of stem cell treatments. FiberGel can be tuned for different tissue types by controlling the diameter, stiffness, and alignment of the microfibers, and its “tuning” can be used to control the final shape of the stem cells that accompany it, making possible its use across a range of tissue types.

Presently, Dr. Han is also leading a large-animal study of FiberGel’s use in cartilage repair funded by a \$256,000 grant from the Coulter Wallace Foundation. Dr. Han has received a \$389,992 grant from the NIH to

investigate the use of cell-sized, cross-linkable micro ribbons developed at Stanford for the repair of meniscus damage. He is also co-PI of a \$460,016 grant for the development of an artery-on-a-chip system in collaboration with Dr. Alisa Clyne (University of Maryland) that utilizes perivascular adipose tissue (PVAT) to enable vascular contractility measurements in response to various stimuli, thereby aiming to expand our understanding of the impact of inflammation and obesity on top vessel health.

When in the classroom Dr. Han likes to emphasize creativity and creative learning. “I want to teach my students to perform intellectual activities that cannot (cannot yet) be replaced by machine; namely, creativity. I start to do so perhaps by adding a little bit of art components into my class, such as in the design project in the in MEM 423 Mechanics of Vibration. After all, in the age of Leonardo Da Vinci, science, engineering and art were all from the same family; this might be the time for these fields to get back together again.”

Unleash Your Innovation and Make an Impact

In August 2019, Drexel’s Office of Corporate Relations and Economic Development, Office of Technology Commercialization and Drexel Ventures merged into a brand-new organization called the Office of Applied Innovation. Reporting to the Executive Vice Provost for Research and Innovation Dr. Aleister Saunders, Applied Innovation provides technology licensing, industry-sponsored research development and entrepreneurial support services to support the creative and impact endeavors of Drexel faculty, postdocs, professional staff and graduate students.

Applied Innovation’s vision statement is “re-imagine academic transfer, enabling creativity and impact”. “We want to remove barriers for Drexel innovators and help them do what they do best – innovate”, says Shintaro Kaido, Vice Provost for Innovation and Commercialization and Executive Director, Office of Applied Innovation. For example, Kaido’s team is working on a streamlined licensing model for Drexel startups developing through Drexel’s venture support and gap funding programs. In October 2017, the Association of Public & Land-grant Universities (APLU) Commission on Innovation, Competitiveness and Economic Prosperity (CICEP) consisting of 27 institutions released a statement that “universities must streamline the licensing process for university startups, aligning these processes with the needs and capacities (of startups)”. As a co-founder of a university spinout himself, Kaido understands this issue deeply; “We want to be ahead of the curve in developing an innovative model to empower Drexel’s entrepreneurial talents”.

During the past several years, Drexel has developed resources to support entrepreneurial researchers. Drexel ran a very successful pilot of the NSF I-Corps program in 2019, which pairs a PI with developing entrepreneurial talent (most often postdocs, PhD and masters students) to take them through “customer discovery” or the process of understanding

given an innovation, who might care most, why and how much. Launched in 2011, the NSF I-Corps have funded over 1500 teams which resulted in 790 startup companies raising \$456M in capital with 4 exits. Recently, Dr. Kelvin Droegemeier, Director of the Office of Science & Technology Policy acknowledged I-Corps has the best program to stimulate university-industry relationships. The 2019 Drexel pilot worked with 14 teams with 4 teams getting accepted into the national cohort and receiving \$50K per team in funding from the NSF.

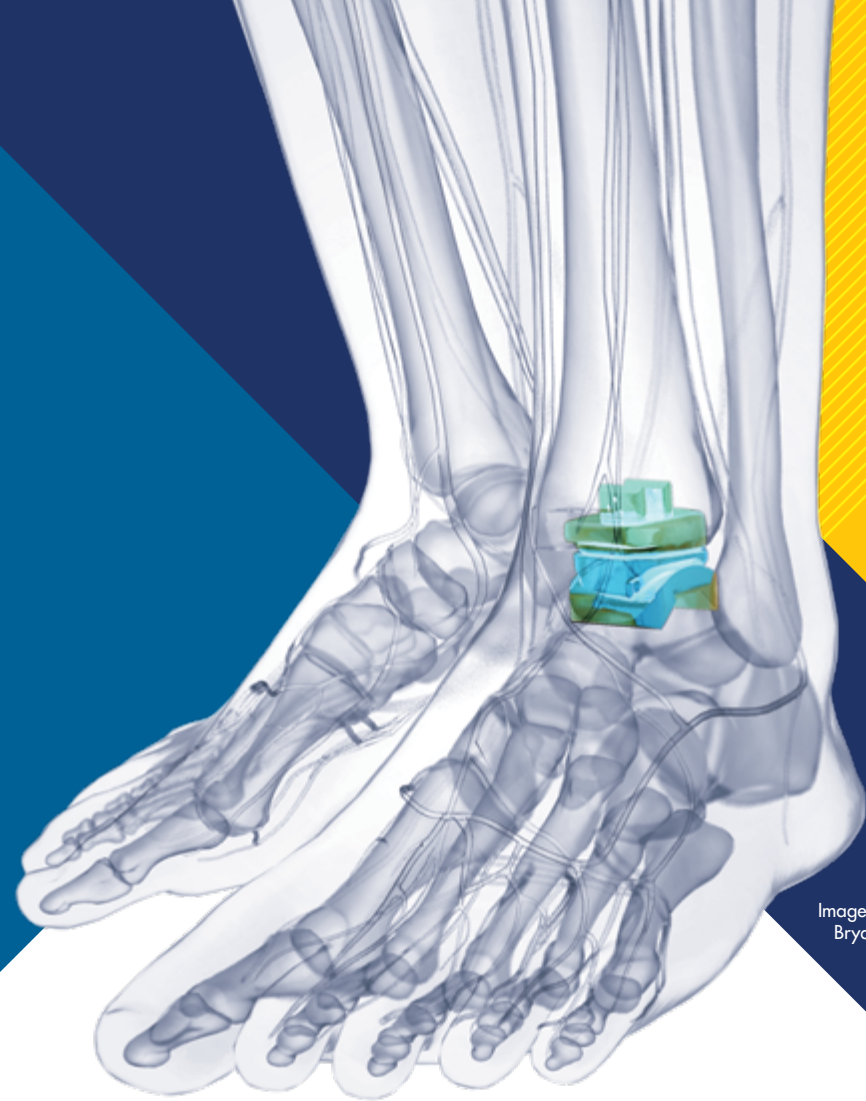
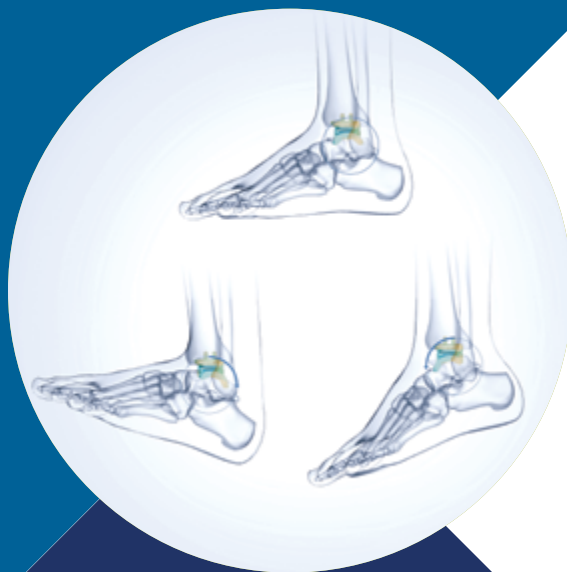


Image Credit:
Bryan Christie Design

Every startup needs 3 things, according to Kaido — Access to smart, connected capital, access to customers and access to talent. ic@3401 is the largest community of funded startups in the Greater Philadelphia region; since 2016, member startups have raised over \$70M with 2 exits to publicly traded companies. “Unlike other university incubators with a long list of mentors, ic@3401 offers real-time help for Drexel innovators” says Eamon Gallagher, ic@3401 Director and also the director of Drexel Law’s Entrepreneurial Law Clinic.

Currently there are 24 inventions designed by MEM faculty and students available for license through Drexel’s tech commercialization team, as well as three companies that have partnered with MEM faculty or students for research or

commercialization. One of them, Kinos Medical founded by MEM alumnus Brian Garvey, and funded in part by the Coulter Foundation, is working with MEM’s Dr. Soren Siegler to bring to market a revolutionary new form of ankle replacement device.

MEM senior design students can also take advantage of the Botstiber Senior Design Entrepreneurship Competition, which offers up to \$2,000 for supplies to up to ten teams from the College of Engineering with the purpose of educating students on the principles of entrepreneurship as well as to identify design projects that may have commercial potential and assist them with entry into the incubation process should they choose to pursue commercialization efforts during their senior year and after graduation.

Dr. Cho Named NAI Fellow

Professor Young I. Cho was inducted as a Fellow at the National Academy of Inventors at a ceremony held April 2019 at Space Center Houston in Houston, TX, for his work developing non-chemical water treatment technologies, a blood viscometer for clinical settings, and applications of low-temperature plasma technology to solving mineral and bio fouling problems caused by hard water. Founded in 2010, the National Academy of Inventors inducts Fellows on an annual basis to recognize academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society. Currently the NAI has 1,229 Fellows worldwide representing more than 250 prestigious universities, governmental and non-profit research institutes. Collectively, the Fellows hold more than 38,000 issued U.S. patents, which have generated over 11,000 licensed technologies and companies, and created more than 36 million jobs. In addition, over \$1.6 trillion in revenue has been generated based on NAI Fellow discoveries. Election to NAI Fellow status is the highest professional distinction accorded solely to academic inventors.

Dr. Cho's induction cites his development of a blood viscometer for clinical settings. Blood viscosity is an important parameter of cardiovascular health and keeping it in the correct range is vital for balancing the prevention of stroke and heart attack with avoiding internal bleeding. Dr. Cho's inventions allow this indicator to be tested easily at the point-of-care setting. Cho's

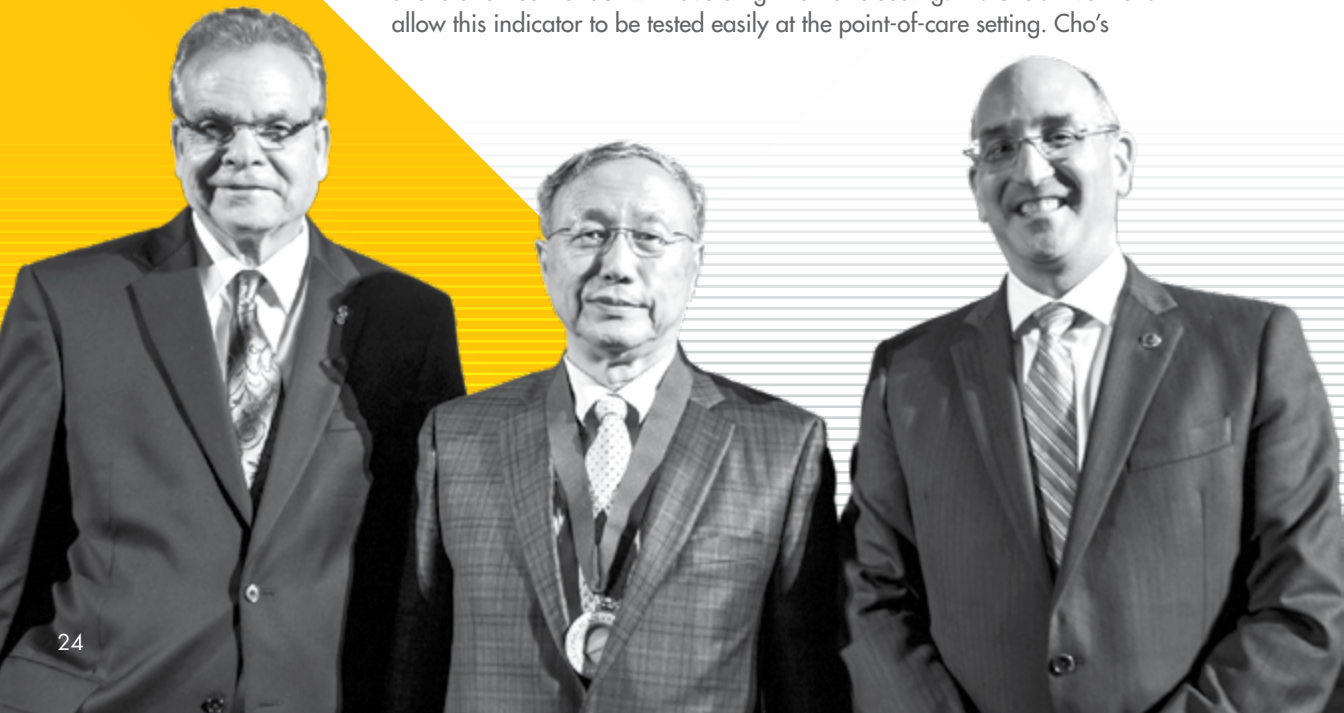
induction also cites the contribution of Cho's inventions to the reduction of water use in cooling towers. Consumption of water for industrial and large residential cooling is second only to agricultural irrigation and exceeds 35% of the total U.S. water consumption. Circulating water in cooling towers increases its hardness and must be replenished with fresh water to avoid clogging heat exchanges. Cho's inventions reduce water hardness using electromagnetic means, thus reduces cooling tower's consumption of fresh water, eventually lowering the cost of living for tens of millions of Americans.

With his induction of in 2018 class, Dr. Cho joins a group that boasts more than 125 presidents and senior leaders of research universities and non-profit research institutes, 502 members of the National Academies of Sciences, Engineering, and Medicine, 40 inductees of the National Inventors Hall of Fame, 57 recipients of the U.S. National Medal of Technology and Innovation and U.S. National Medal of Science, 34 Nobel Laureates, 3 Queen Elizabeth Prize for Engineering recipients, 304 AAAS Fellows, 200 IEEE Fellows, and 164 Fellows of the American Academy of Arts & Sciences. Dr. Cho is also a recipient of the NSF Presidential Young Investigator Award, the Lindback Award and the Research Professor of the Year Award at Drexel University, and two NASA Space Act Tech Brief Awards. He has submitted 34 invention disclosures to Drexel University and holds 27 U.S. patents and 2 pending patent applications, seven of which have been licensed. Cho is an editor for Handbook of Heat Transfer (McGraw Hill, 3rd ed.) and Heat Transfer-Asian Research (Wiley), and the Advances in Heat Transfer (Academic Press), a reviewer for ASME Applied Mechanics Reviews, J. of Heat Transfer, International Journal of the Heat and Mass Transfer, AIChE Journal, J. of Biomechanics, J. of Biomechanical Engineering., AIAA, and Chemical Engineering Communications. He has authored about 150 peer-reviewed papers.



CELEBRATING DR. KWATNY'S 55TH YEAR AT DREXEL

Harry G. Kwatny, the S. Herbert Raynes Professor of Mechanical Engineering in the College of Engineering, celebrated 55 years of working at Drexel in 2018. That comes over 60 years after he first came to the University (which was then called the Drexel Institute of Technology) as a freshman in February of 1957. He has published three books, authored over 200 papers and created software and a consulting company that provides research services and expertise in various industries.



MEM Professor Receives Plasma's Highest Honor

We caught up with Dr. Alexander Fridman to hear about his trip to Naples, Italy to receive the 2019 Plasma Chemistry Award.

Q Can you give me a few highlights of your trip to Naples? How did it feel to receive the award?

A Sure! I was very excited to receive the award in Naples from the President of International Plasma Chemistry Society in the presence of the world's greatest plasma scientists and engineers. After my Award lecture, there were a lot of questions about my old and new research work in plasma and nuclear science and engineering, including work I did on the Chernobyl nuclear reactor after the severe accident, and my relationships with academician Valery Legasov shown recently on TV in the film series "Chernobyl".

Q How would you characterize the state of plasma chemistry today? What are its greatest challenges and opportunities?

A Plasma science and engineering, as well as plasma chemistry, today are in the focus of development of the most modern technologies, especially those related to microelectronics, the hardware required to build new computers, cellphones, etc. In addition to plasma microelectronics and plasma material processing, plasma sciences have begun making significant contributions to environmental protection, agriculture and food processing, and especially to medicine. Plasma medicine is the newest branch of plasma science and engineering and has grown from its beginning at Drexel University 16 years ago to a global discipline with research and application in centers and hospitals worldwide.

Q What advice do you have for Drexel students interested in plasma chemistry?

A Drexel students and alumni are strongly positioned today in plasma science and engineering; they work in famous plasma and microelectronic companies, including those in Silicon Valley and in national labs, and they become leading professors in prestigious universities in the USA and abroad. I would recommend that students who are still taking classes at Drexel classes and are interested in plasma spend more effort on fundamentals in physics, chemistry, biology, and engineering. Modern plasma is very multidisciplinary. Then visit the Nyheim Plasma Institute!

Q What are your plans for the future?

A My future plans are to focus on novel plasma applications in biology, environmental control, and making novel materials. We have a good team, good equipment, and good traditions to meet new challenges. New students are very welcome!

Q What do you feel has been your greatest legacy in the field?

A Most of people relate my legacy in the plasma field to the creation of Plasma Medicine. Together with colleagues and friends from Drexel COE, CoM, and CoAS, we started plasma medicine in 2003, and today a significant number of successful plasma surgeries and procedures are performed all over the world, treating diseases including cancer and chronic wounds not successfully treated before. This is a big deal! Thank you, Drexel!

“

...today a significant number of successful plasma surgeries and procedures are performed all over the world, treating multiple diseases including cancer and chronic wounds not successfully treated before.”



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MEM at a Glance



27th in the *U.S. News & World Report* rankings among undergraduate ME programs that offer the doctorate



16th among M.S. programs in ME in the 2020 Best Colleges list based on median early-career salary from the U.S. Dept. of Education

972
Undergraduate Students – 2019

\$2.13m
FY20 Q1 & Q2 New Research Grants & Contract Awards[†]

89
Graduate Students – 2019

20
Active Federal & Industry Grants & Contracts – 2019

25
Full-time Faculty

4
NSF CAREER Award Recipients among Current Faculty

17
Mentees of MEM faculty who started faculty careers (since 2010)

\$3.84m
FY2019 Research Expenditures[†]

\$19/hr
Median Co-op Salary

[†]including A.J. Drexel Plasma Institute

The Drexel College of Engineering is in the midst of the most comprehensive and transformative fundraising campaign in our history. To learn more about our progress and success, and to make your gift today, please visit us at: drexel.edu/engineering/alumni/make-a-gift



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