



DREXEL UNIVERSITY
College of
Engineering



2018
DEAN'S HIGHLIGHTS

THE YEAR IN REVIEW



Dear Friends:

It has been my distinct honor and privilege to have led Drexel's College of Engineering during the past two years as it reinforces its central mission to educate the next generation of engineers. As this report demonstrates, 2018 has been another rewarding year for our students and faculty. We have made great progress enhancing the

student experience and also in our three strategic research areas: advanced manufacturing, cyber and physical infrastructure, and health and medicine. Our students and faculty have animated CoE with ground-breaking research and collaborations. The intellectual vigor fostered at Drexel will continue providing answers to society's greatest challenges.

Herein, we highlight partnerships with industry that investigate the chemical activation powers of plasmas, or enhance predictive safety systems for the petrochemical, nuclear, and aircraft industries; federal and private grants that support the novel research of our outstanding faculty as they create knowledge and apply it; students who participate in co-ops near and far or who have graduated into prestigious careers in industry and academia; and laboratories and collaborations that provide the scaffolding for engineers to usher in new technologies. We want you to be aware of what we are doing in Drexel's College of Engineering because we believe the creativity, innovation, and discoveries manifested here could one day become a part of your life.

As I step down from the position of Interim Dean, it is my pleasure to welcome Dean Sharon Walker. Please join me in wishing her and the entire College of Engineering community great success in the coming year.

Sincerely,

Giuseppe R. Palmese, PhD

Professor and Interim Dean

14%
of Drexel's Undergraduate Engineering Students are
INTERNATIONAL

1ST in the US among private institutions in total number of engineering bachelor's degrees awarded.

6TH in the US among private institutions in total number of engineering bachelor's degrees awarded to women.

13TH in the US among private institutions in the number of engineering master's degrees awarded.

Source: ASEE

DEGREES AWARDED

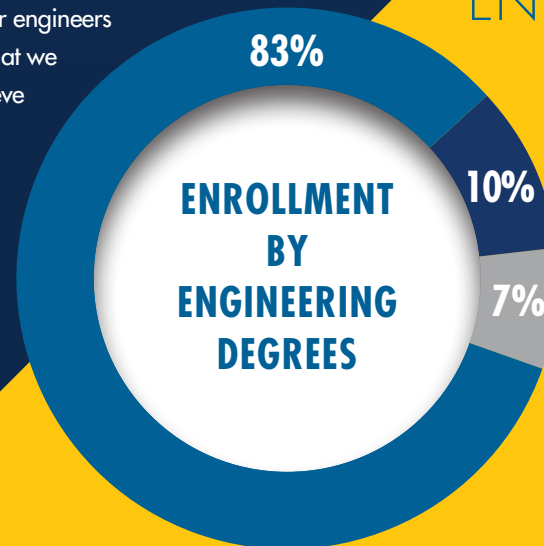
691
BACHELOR

291
MASTERS

48
DOCTORAL



ENROLLMENT BY DEPARTMENT



● BS ● MS ● PhD

	UNDERGRADUATE*	GRADUATE MS	GRADUATE PhD
CBE	423	12	43
CAEE	546	38	58
CEPM&SE	98	107	6
ECE	771	129	76
ET	93	18	-
MSE	130	9	51
MEM	1053	66	53
OTHER	142	-	-
TOTAL	3256	379	287

*Headcount based on Fall 2018 snapshot.

DEPARTMENTS & DEGREES

BS MS PhD

Civil, Architectural and Environmental Engineering (CAEE)

Civil Engineering	✓	✓	✓
Architectural Engineering	✓	✓	✓
Environmental Engineering	✓	✓	✓

Chemical and Biological Engineering (CBE)

Chemical Engineering	✓	✓	✓
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Electrical and Computer Engineering (ECE)

Electrical Engineering	✓	✓	✓
Computer Engineering	✓	✓	✓
Cyber Security		✓	
Telecommunications Engineering		✓	

Construction, Engineering and Project Management and Systems Engineering (CEPM&SE)

Engineering Management		✓	
Construction Management	✓	✓	
Systems Engineering		✓	
Project Management		✓	✓

Engineering Technology (ET)

Engineering Technology	✓	✓	
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Materials Science and Engineering (MSE)

Materials Science and Engineering	✓	✓	✓
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Mechanical Engineering and Mechanics (MEM)

Mechanical Engineering and Mechanics	✓	✓	✓
Peace Engineering		✓	

THE YEARS AHEAD



Dear Friends and Colleagues:

Drexel's College of Engineering offers one of the top STEM educations in the country. Founded as a science and engineering school in 1891, Drexel is dedicated to knowledge that meets the challenges we face as a society and as world citizens. We have a historic priority of translating scholarship and research in the interests of the local community, industry, and the world around us that informs everything we do.

But the engineer of the 21st century needs to do more. So, our curriculum focuses on skills in leadership, critical thinking, and collaboration — intangibles that ensure we are graduating versatile, adaptable engineers into a rapidly changing world. Talent is essential here at Drexel because engineering is hard. So, our administration, faculty members, and staffers are dedicated to the success of each student who crosses our threshold. Since one out of every 100 engineers working in the United States today holds an undergraduate degree from Drexel, we believe that dedication meets its mark.

I am delighted to be the chief advocate for the College's diverse, dynamic, empowered and empowering body of scholars, and I look forward to my task in the years ahead.

I hope you enjoy reading about our achievements in this latest edition of *Dean's Highlights* as much as I enjoy watching them unfold.

Sincerely,

Sharon L. Walker, PhD

Distinguished Professor and Dean





In Partnership with Industry

► **FUN WITH PLASMAS** | CoE's **Alexander Fridman (MEM)**, Gregory Fridman (BioMed) and the Nyheim Plasma Institute Team are spearheading Drexel's new partnership in a National Science Foundation Industry/University Cooperative Research Center to investigate and leverage the chemical activation power of Low Temperature Plasmas (LTPs) to new industries. The incipient Center for High Pressure Plasma Energy, Agriculture and Biomedical Technologies (C-PEAB) will explore the fundamental scientific basis of LTP-generated chemical reactivity at atmospheric and higher pressures, opening new opportunities for industry to improve the efficiency of processing or to create new processes. These fundamentals will be translated into improving the food-water-energy nexus and to improve human health in industries like food processing, agriculture, fuel conversion, medical and water treatment, and pharmaceuticals. Other universities in the partnership include The University of Michigan and George Washington University.

► **PREDICTIVE SAFETY SYSTEMS** | Existing safety systems activate an alarm when an individual variable exceeds a threshold. Consequently, their alarm signals are reactive and do not account for interactions among process variables. To address these problems, **Masoud Soroush's** group (CBE) introduced the novel concept of model-predictive safety (MPS) systems that generate predictive alarm signals, allowing for predictive detection and proactive mitigation of process hazards in processes. The group, in collaboration with the Air Liquide Corporation and colleagues at the University of Pennsylvania, was awarded an NSF grant for "GOALI: Collaborative Research: Model-Predictive Safety Systems for Predictive Detection of Operation Hazards." The MPS systems can benefit many industries such as the chemical, petrochemical, food, nuclear, aircraft, and petroleum. Deployment of the MPS systems will result in saving lives, reducing workplace injuries, and spurring economic benefits.

GRANT HIGHLIGHTS

► **BIOMECHANICS OF BLOOD FLOW** | **Alisa Morss Clyne (MEM)** was awarded a five-year, \$1.9M National Institute of Health Research Project Grant, the oldest mechanism for investigator-initiated grants funded by the NIH. Clyne will pursue research on the effect of laminar and disturbed flow on endothelial glucose metabolism.

► **JUST KEEP SWIMMING** | **James Tangorra (MEM)** received a \$1.4M grant from the Office of Naval Research to uncover sensorimotor principles by which fish control and modulate median fin and axial body movements, and to develop a freely swimming vehicle that adopts biological principles of multi-fin gaits for maneuvering. Dr. Tangorra's research is in collaboration with Harvard University and the University of Chicago.

► **INTER-INSTITUTIONAL COLLABORATIONS** | **Jason Baxter (CBE)** received a \$216K NSF grant for directing charge and energy flow in discrete nanocrystal-dendrimer hybrids and in their assemblies, in collaboration with Christopher Murray of the University of Pennsylvania; **Christopher Li (MSE)** received a \$225K NSF grant to research polymer single crystal-assisted "Grafting From," in collaboration with Bin Zhao of the University of Tennessee Knoxville; and **Jonathan Spanier (MSE)** received a \$299K NSF Israel-Binational Science Foundation grant for the processing of polar absorbers to enable hot-carrier all-oxide transparent solar cells, in collaboration with Ilya Grinberg at Bar-Ilan University.

► **INTRA-CoE COLLABORATIONS** | **Michel Barsoum (MSE)** and **Yury Gogotsi (MSE)** received a \$491K NSF grant for the fundamental study of ordered MXenes and their defects; **Jason Baxter (CBE)**, **Sabrina Spatari (CAEE)** and **Aaron Fafarman (CBE)** received a \$208K NSF grant to research the environmental sustainability of lead trihalide perovskite solar cells; **Kapil Dandekar (ECE)**, **Baris Taskin (ECE)**, **Steven Weber (ECE)** and Geoffrey Mainland (CCI) received a \$949K NSF grant to develop a scalable software defined radio network testbed for hybrid measurement and emulation; and **Ying Sun (MEM)** and **Vibha Kalra (CBE)** received a \$449K NSF grant to research the effects of electrode microstructure and Li_2O_2 growth on Li-air battery performance.

FACULTY HIGHLIGHTS

In FY18 Drexel faculty published peer-reviewed work in *Nature*, *Nature Communications*, *Science Advances*, *Nature Nanotechnology*, and *Nature Energy*.



2017-2018
FACULTY

- 107 TENURE TRACK
- 28 TEACHING FACULTY
- 6 RESEARCH FACULTY



RESEARCH EXPENDITURES

\$19,923,769 2017

\$20,081,937 2018

Selected Faculty Achievements

Four CoE faculty members won 2018 National Science Foundation Faculty Early Career Development (CAREER) awards, among the most prestigious science awards in support of early-career research: **Leslie Lamberson (MEM)**; **Ekaterina Pomerantseva (MSE)**; **Ioannis Savidis (ECE)**; and **Maureen Tang (CBE)**. In addition, **Shannon Capps (CAEE)** received a three-year, \$269K grant through the NASA (Early Career) Investigator Program in Earth Science.

Yury Gogotsi (MSE) has received an h-index value of 100 from Google Scholar and other citation databases — the highest ever received by a professor within the College of Engineering. The h-index classifies scholars according to the number of extant papers cited by other scientists and publications.

Simi Hoque (CAEE) was honored at the annual “Girls Inc. 2018 Strong, Smart, and Bold” ceremony in recognition of her STEM University for Girls summer program, held annually at Drexel. Under Hoque’s leadership and with volunteer CoE faculty and students, STEM University provides underrepresented middle school girls from Philadelphia with a week-long series of classes in STEM topics, including mentoring.

Charles Haas (CAEE) received the A.P. Black Award at the Annual Conference and Exposition of the American Water Works Association held in Las Vegas, NV, in June. The award is given for outstanding research contributions to water science and water supply. As part of the ceremony, Haas presented a keynote address on “Quantitative Microbial Risk Assessment in Drinking Water: Lessons Learned and Paths Forward.”

Franco Montalto (CAEE) is collaborating with colleagues from the United Nations Green Climate Fund, which channels funding for environmental projects to developing countries, on a climate adaptation plan for the Caribbean island of Grenada. The plan is the first of its kind in this hemisphere. It has received funding for a pre-feasibility program that includes workshops on infrastructure like wastewater treatment plants and coastal roads threatened by climate change.

Aaron Fafarman (CBE) won this year’s American Institute of Chemical Engineers/Delaware Valley Section Outstanding Faculty Award. The award recognizes a regional faculty member who has contributed to the profession through publications and presentations in the field, has a strong record of service, and has demonstrated commitment to teaching and students.

Richard Chiou (ET) received the David Wells Service Award of the American Society for Engineering Education (ASEE) Manufacturing Division in June for his outstanding service to the field.

The Institute of Electrical and Electronics Engineers (IEEE) awarded Drexel this year’s Outstanding Chapter Award. Drexel’s Beta Alpha was commended for its professional development, scholarship, and public service activities under the faculty advising of **Tim Kurzweg (ECE)**. IEEE is the premier professional organization for electrical and computer engineers, and is tasked with fostering the highest level of academic and professional excellence. The chapter award was formally presented at the annual conference in Monterey, CA this spring.

Strategic Research Areas



Drexel Engineering contributes solutions to some of the most pressing societal and global challenges, generating advancements in translational, use-inspired research in **health and medicine**, **advanced manufacturing**, and **cyber and physical infrastructure**. Here are some examples:

HEALTH & MEDICINE

- ▶ **Eugenia Ellis (CAEE)** and the dLUX Drexel Light Lab investigate how light in the built environment affects human health, from circadian rhythmicity and visual perception and acuity to cognitive function. Among other outcomes, research generated by dLUX assists human services organizations in creating indoor environments for special needs populations, such as children with autism and older adults with dementia.
- ▶ Technology invented and developed by **Wei-Heng Shih (MSE)** and Wan Shih (BioMed) that facilitates iBreastExam™ — a portable, hand-held sensor used to detect clinically significant lesions that could indicate the early stages of breast cancer — received international attention this summer through an Op-Ed in *The New York Times*. The piece discussed how iBreast's battery-operated, radiation-free, low-cost examination option is making breast cancer screenings available to millions of poor women in India and other countries.

ADVANCED MANUFACTURING

- ▶ Under the leadership of **Richard Chiou (ET)**, Engineering Technology hosted an open workshop addressing the transformation of industrial manufacturing in the 21st century and the impact of new technologies that herald innovative productivity solutions. The workshop offered lectures on electronics manufacturing, design solutions for the aircraft industry, robotics, the evolution of urban manufacturing, food production, and aquaculture/algae for biofuels.
- ▶ Functional fabrics are enabling exciting new application domains in smart homes and wearable health systems. The use of Passive Radio Frequency Identification (PRFI) enables technology for high-density deployments, since fabric devices would not require a battery or transceiver electronics. In light of this, the NSF has awarded **Kapil Dandekar (ECE)** and **Steven Weber (ECE)** a \$500K grant to develop architectures for PRFI-based functional fabrics and associated sensor solutions.

CYBER & PHYSICAL INFRASTRUCTURE

- ▶ The NSF awarded Co-Principal Investigators **Jin Wen (CAEE)** and **Simi Hoque (CAEE)** a \$60K grant to host an international conference, "Connecting Women Faculty in Sustainable Building Research," held in China this July. A gender gap in the growth in sustainable building research has left women in the field with diminished networking opportunities. The well-attended conference addressed these and other issues by providing a multinational, multidisciplinary platform for collaboration among women faculty in the field. The conference also emphasized career paths for those at the beginning of their academic careers, thus broadening the contributions to sustainable building research and to society at large.

College of Engineering GRADUATES SOAR



- ▶ Alumna **Prineha Narang (MSE '11)**, now an assistant professor of Materials Science at Harvard University, was selected as one of

Forbes' "30 Under 30," and as one of the *MIT Technology Review's* "35 Under 35" for her advances with materials at the nanoscale.

- ▶ Alumnus **Ciira Maina (ECE '11)** is a senior lecturer in the Department of Electrical and Electronic Engineering at Dedan Kimathi University of Technology in Nyeri, Kenya. He delivered the plenary at the inaugural "Black in AI" workshop as part of this year's Neural Information Processing Systems conference.

- ▶ Alumnus **Tirthak Saha (ECE '16)**, was selected as one of *Forbes'* "30 Under 30" for his work in grid modernization. Saha implements Smart Grid projects for American Electric Power, and won the company's "Spark Tank Innovation Challenge" with a design that will improve energy delivery across nine mid-western states.

LIVING IN A MATERIALS WORLD

In an investment that could facilitate development of advanced batteries and supercapacitors, improve water purification methods, and yield new discoveries about the wondrous two-dimensional materials called MXene, Drexel is building a new \$5M laboratory on third-floor Bossone for the A.J. Drexel Nanomaterials Institute (DNI) and affiliated faculty. Construction began in June on the 7,400-square-foot lab to accommodate the more than 50 researchers working on MXenes at Drexel. The atomically-thin MXenes could be the key to building smaller, faster electronics; improving energy storage devices; adding durability to a wide range of consumer products; and providing advances in electromagnetic interference shielding and antennas for wearable electronics and the Internet of Things.

Under the leadership of **Yury Gogotsi** and **Ekaterina Pomerantseva (MSE)**, the new DNI laboratory will have several features to foster the start-from-scratch development of MXenes. Carbon and oxide materials will be explored as well. The highly sophisticated equipment for synthesis, characterization, and electrochemical testing of materials will be available for the first time in one lab: four large, sealed glove boxes for handling air-sensitive materials like lithium; new high-temperature furnaces that reach 3,000 degrees Fahrenheit; advanced spectrometers and battery testing equipment; three times the number of chemical fume hoods in the former Gogotsi lab; and convenient working space for CoE faculty and students.

INNOVATION

SPOTLIGHT

A Palette of Building Blocks for Thermosets



Two new patents awarded to **Giuseppe R. Palmese (CBE)** in the Polymers & Composites Lab this year will advance the transition of research discoveries on thermosets, a class of polymers that form a crosslink network of molecules to yield stronger, stiffer, more heat-resistant properties. Because they do not melt, thermosets have exciting applications in the aerospace, automobile, infrastructure, and energy industries. Palmese's group designs new molecules and seeks to understand the physical and chemical processes that convert monomers into polymers to investigate whether end-product characteristics can be designed to meet the needs of specific applications. The research drawing the greatest industry attention uses monomers derived from natural sources, or bio-based, like cellulose, plant oils, or lignin. Providing an alternative to petroleum-derived polymers, Palmese's research uses the palette of new naturally derived chemical building blocks to obtain thermosets. The lab has enjoyed success so far with methacrylated fatty acids MFA, used to improve the safety characteristics of certain resins and as adhesives; bio-rubbers that serve as toughening agents; and isosorbide methacrylate, which could play a role in thermoset additive manufacturing technologies requiring high-temperature performance characteristics.

SELECTED CENTERS & INSTITUTES

- ▶ A.J. Drexel Institute of Energy and the Environment (ExE)
- ▶ A.J. Drexel Nanomaterials Institute (DNI)
- ▶ C. & J. Nyheim Plasma Institute
- ▶ Center for Electric Power Engineering
- ▶ DHS Center for Academic Excellence
- ▶ Expressive and Creative Interaction Technologies (ExCITe)
- ▶ Isaac L. Auerbach Cybersecurity Institute
- ▶ Materials Center of Excellence

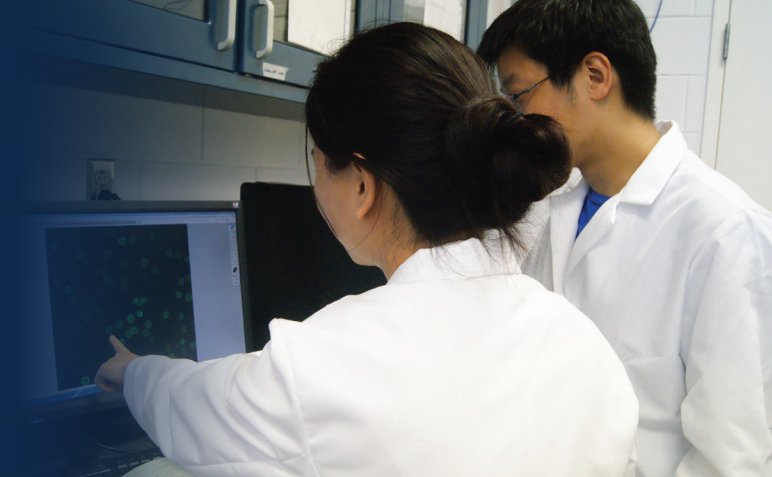


STACKING 2D MATERIALS

► **Ekaterina Pomerantseva** and **Yury Gogotsi (MSE)** published in *Nature Energy* on advantages gained by stacking different two-dimensional (2D) materials into heterostructured architectures.

TARGETED DRUG DELIVERY

► **Hao Cheng** and **Christopher Li (MSE)** published in *Nature Communications* on developing a durable, long-lasting polymer crystal casing — crystalsomes — for intravenous drug delivery.

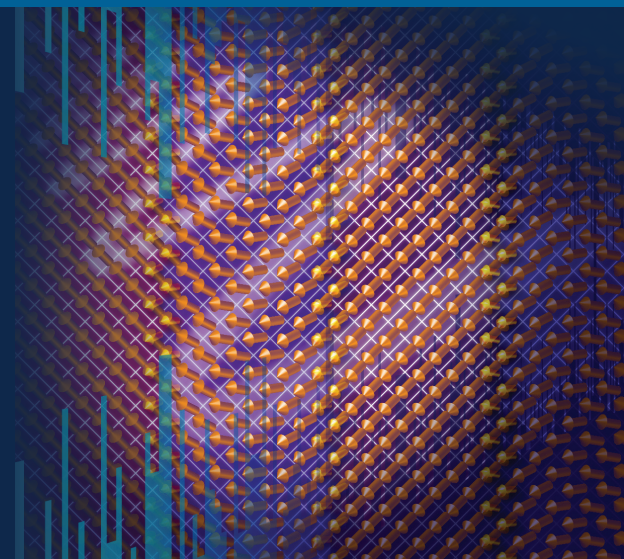


FACULTY RESEARCH MAKING HEADLINES



THIRD-HAND SMOKE

► An article on third-hand smoke and particle uptake by **Peter DeCarlo (CAEE)** and **Michael Waring (CAEE)** was published in *Science Advances*, showing how the chemical residue from cigarette smoke outside can be readily transported indoors.



FERROELECTRIC MATERIALS

► **Jon Spanier (MSE)** and collaborators published a study in *Nature* showing how two-dimensional defects can resonate and can be used to tune and transmit microwaves with a much higher fidelity.

Deploying Technology

► INNOVATING TOWARD SOLUTIONS

Proprietary technology designed by **Michele Marcolongo (MSE)** is driving a new startup, InvisALERT, that develops compliance-based patient safety solutions and resolves costly non-compliance issues in the acute health-care, corrections, drug delivery, long-term care, youth and special education markets. Solutions are tailored to meet the demanding requirements of complex workflows and critical communications needs. Marcolongo is co-founder of the company. InvisALERT's first product, ObservSMART, is a wristband and software-based check tracker that replaces paper-based forms in charged situations like psychiatric settings and emergency rooms.

Through his research in the field of multimedia forensics, **Matt Stamm (ECE)** has received funding from the National Science Foundation, the Defense Advanced Research Projects Agency, the Army Research Office, and the Defense Forensics & Biometrics Agency as he seeks to deliver software prototypes that determine when images are real, when they have been digitally enhanced, and even how they have been digitally enhanced. Stamm's MISL lab has already delivered one prototype for photographic images, and plans to deliver another for videos within two years.

Patents

Drexel continues to soar in rankings by the National Academy of Inventors and Intellectual Property Owners Association, moving up 18 spots this year to 54 in the world's top 100 universities for patents granted by the US. More than 60% of patents submitted since 2012 involve CoE research, including 37 patents awarded to **Wei-Heng Shih (MSE)** for technologies ranging from ceramic materials to medical device applications. Four of his technologies have been licensed to address pressing issues in healthcare and energy.

	2016	2017
PATENT APPLICATIONS	114	129
INVENTION DISCLOSURES	58	63
PATENTS ISSUED	39	41

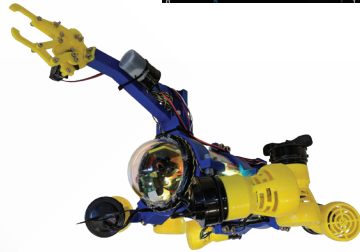
STUDENT FELLOWSHIPS

Valerie Niemann, (BS Chemical Engineering '18) was awarded a Fulbright US Student Program Grant for 2018-2019 for her research on topics in renewable energy and power generation. Her grant will take her to Switzerland. She plans to pursue a PhD in chemical engineering, researching renewable chemical processes for energy applications. Under this flagship international educational exchange program sponsored by the US government, Fulbrighters address critical global challenges while building relationships, knowledge, and leadership in support of long-term US interests.

2012 to 2018

- 10 CoE Fulbright Scholars
- 8 CoE Goldwater Scholars
- 20 CoE National Science Foundation Graduate Research Fellows
- 5 CoE National Defense Science & Engineering Graduate Fellows

THE DREXEL DRAGONS COMPETE



The **Drexel CyberDragons** reached finals at the national Collegiate Cyber Defense Competition (CCDC) in 2018, the team's first year as a competitive unit. At CCDC, Drexel "inherited" a small corporate network and defended it from an active team of professional hackers. The CyberDragons receive support both internally and from seasoned professionals with Susquehanna International Group and with Security Risk Advisors, both Philadelphia-based companies. The team has 40 active members and 10 officers working with the latest tools and techniques in the realm of cybersecurity.

Drexel's re-booted **Robotics Club** qualified for a spot representing the United States at the 2018 MATE International ROV competition in Washington after its underwater vehicle, "ADAM," won six awards at a regional competition, including Best Overall Entry. The 15 Drexel team members faced 30 of the world's premiere collegiate underwater robotics teams in a competition that drew entries from all over the US, as well as Turkey, Egypt, Russia, and India.

A team of MEM undergraduates took third place out of 54 teams at the **American Society of Mechanical Engineers (ASME)** E-fest East 2018 Student Design Competition, held at Penn State in April. The team's stackable omni-wheeled robot, "Thor," featured a lightweight acrylic platform, lasers, an Arduino-based Teensy board, and firing mechanisms tucked into a robust device that deployed tennis balls at 20 mph and played soccer based on contest specs. Thor was principally designed by **Frederick Wachter, Sergio Machaca, and Matthew Wiese (all MEM '18)**.

Members of the **National Society of Black Engineers/Drexel chapter** attended the 44th Annual National NSBE Convention in Pittsburgh, competing in a Google-sponsored hack-a-thon writing code for 30 straight hours. They took second place. The 200-strong chapter also runs extensive community outreach programs, networking events, and professional development workshops through the academic year.

Once again this year, the **Drexel Space Systems Laboratory** sent a team to the finals of **NASA's RASC-AL Forum**, a university-level aerospace architecture designs competition held in Cocoa Beach, FL. The Drexel team's contest specs involved designing a scalable tele-operated robotic architecture to enable returns from the moon's polar regions of a two-meter-long rod of pristine sample. Drexel's team collaborated with the University of Pennsylvania as well as teams from Korea, Hong Kong, and Australia.



MOLLY CUKA '19

Mechanical Engineering and Mechanics (MEM)

Like so many students who participate in co-op, Molly Cuka found her calling working as a reliability and maintainability engineer for The Boeing Company on the V-22 Osprey program. There, she met regularly with suppliers to track testing, manufacturing, and general updates on parts and products that support Boeing's Osprey tiltrotor combat aircraft.

"I really loved my co-op for three reasons," said Cuka, who is also pursuing a business minor. "One, I got to apply stuff I had already learned in school. Two, I got to learn stuff I'd never learn in school. Three, I figured out that I definitely want to work in this field. It was nice to get that kind of confirmation after wandering around in majors for a while. I cannot even express how great the co-op program is."



ISAIAH SAUVAGEAU '20

Civil, Architectural and Environmental Engineering (CAEE)

Isaiah Sauvageau represents a new generation of sustainability engineers. His co-op for AgroCycle, a research project based at University College Dublin, targeted "valorization" efforts for the forestry and poultry industries — efforts that increase the value of byproducts typically sent to landfills, like woodchips and poultry litter. Sauvageau toured facilities, analyzed trends and stats, and produced reports on the generation of bio-gas for the School of Biosystems and Food Engineering.

"The most useful sources of information for compiling reports were government-reported statistics. I enjoyed digging through the numbers despite the task's tedious nature because it made my work credible," said Sauvageau. "We must find value in the byproducts of our processes. I am proud to contribute to the effort of making a more sustainable society."



MARIA LEFCHAK '19

Materials Science and Engineering (MSE)

For Maria Lefchak, a good thing just kept getting better with her three co-ops at Johnson & Johnson. She held a research and design position in the company's Raw Material Center; a post in Oral Care Product Development formulating Listerine products; and, most recently, an internship at the company's center in France as the only foreign intern. It is all of a piece for Lefchak, who hopes one day to work as a cosmetic formulator and who began her career in materials science out of a love for self-care products.

"Not only did I learn ways to apply classroom theories to real-world situations, but I also learned what it means to be in a professional environment," said Lefchak. "I was treated not like a second set of hands, but budding talent. It is thanks to Drexel, where co-ops are a seamless part of one's education."

THE CO-OP

EXPERIENCE

DREXEL CELEBRATES 100 YEARS OF COOPERATIVE EDUCATION, A PROUD MILESTONE FOR EXPERIENTIAL LEARNING AND GENERATIONS OF STUDENTS.



DOUGLAS FORBES '19

Engineering Technology (ET)

At Apple Inc., in Cupertino, CA, Douglas Forbes worked as an iOS Accessories quality assurance engineer for CarPlay, Apple's in-car user interface. Forbes oversaw third-party certifications, worked with automakers to test their CarPlay integrations, and provided feedback. As part of his co-op, Forbes learned hardware integration like USB and wireless standards, which could prove beneficial to his career.

"The most valuable piece of my co-op was being able to work on a team and understanding your role. Any job you get will teach you the specific skill set you need to be good at your job, but the ability to work as a team is something that this co-op has well prepared me for," said Forbes. "Being a good teammate has also enhanced my ability to communicate with clients and other companies, which is not something you can get without experience."



KATERYNA SHEVCHUK '20

Chemical and Biological Engineering (CBE)

During her co-op at KAIST University, the leading technological university in South Korea, Kateryna Shevchuk worked on nanomaterials research within the National Nanofabrication Center. Her project focused on the application of MXenes (two-dimensional transition metal carbides discovered at Drexel) in gas sensors to detect volatile organic compounds. She focused on synthesizing the material, depositing it on gas sensors, and conducting gas sensing tests.

"Adjusting to a completely different culture from both a personal and professional standpoint is a great challenge but an incredible opportunity to grow as a person, engineer, and leader," said Shevchuk. "I have made valuable connections that will help me in attaining my career goals. I think that being able to broaden your horizons and get out of your comfort zone is an exceptional experience for all aspiring professionals. And it truly was for me."



NICHOLAS HOOD '20

Electrical and Computer Engineering (ECE)

In the spring of 2018, Nicholas Hood worked as a research assistant with Comcast, one of CoE's largest post-graduation employers. He had an opportunity to contribute through querying a database in SQL programming language and working on software development methodologies with a Comcast team. His biggest project was piloting a new end-to-end sales quoting, order manager, and billing system for business-class customers, during which he worked with skilled engineers from all over the world.

"This is the first time I have worked at such a large company," said Hood. "With the amount of exposure I am getting to different projects, I feel like I've learned more in these six months than I could have going to classes alone. Between what I learned in class and the experience I am getting on co-op, I feel well prepared for my future."



99% OF ENGINEERING UNDERGRADS
ARE EMPLOYED IN CO-OPS



\$18,000 AVERAGE EARNINGS
PER CO-OP CYCLE



CoE's FabLab: INNOVATION STUDIO

Since Innovation Studio opened three years ago to great excitement among design and Maker Space enthusiasts, the 20,000-square-foot “flow through” area has lived up to its promise with a host of creative projects generated by Drexel engineers: animatronics with Arduino-based technology for haunted house displays; mini-steel bridges; an underwater robot; water filtration experiments based on apocalyptic scenarios — tsunami, nuclear war, zombie invasion — in which dirty drinking water was filtered using “found” materials; a Formula SAE car gearing up for its first competition in six years; and dLab — an open invitation for the Drexel community to design and build supervised, individual projects. The Studio is equipped with twelve 3D printers, each with a 10x10x10 print build; a wet lab with six fume hoods; laser cutters and other heavy machinery for advanced manufacturing; a classroom/teaching space; and woodworking equipment. Also heavily used by Freshman and Senior Design courses, the Studio continues to underscore Drexel's commitment to experiential learning.



Promoting Urban Green Infrastructure



Leena Shevade
(PhD candidate,
CAEE) researches
ways to improve
the management of
urban storm water, a
pressing concern in

cities where impervious surfaces can lead to massive flooding. With advisor **Franco Montalto (CAEE)**, Shevade studies root zone configuration, ponding, inflow depths on the infiltration performance, and soil conductivity — small-scale factors that impact the effectiveness of urban green infrastructure systems.

“I grew up in India, so I know why proper catchments are needed,” she says. “That’s why I thought, this is the area where I should do my research. Because it’s what’s needed right now.”



CIVIC ENGAGEMENT

► **Philly Materials Science and Engineering Day** was held on campus in February for the eighth year. Students of all ages enjoyed drop-in demonstrations and workshops on the materials, or “stuff,” around us — from ice cream to glass bending to water safety, and took in a performance mixing hip hop and materials science.

► Together with the City of Philadelphia, Drexel hosted a one-day **Philly in Flight** learning and networking event in March that explored with civic, institutional, corporate, and academic stakeholders how to leverage unmanned aircraft systems (UAS) technology in innovative and meaningful ways and how to address FAA priorities for drone deployment.

► The **25th Annual Junior Solar Sprint** in May hosted 200 middle school students on campus to race the solar-powered cars they designed and built, providing hands-on STEM experience. The event was co-sponsored with the Philadelphia Solar Energy Association and was organized by CoE faculty and students.

► Drexel **STEM University for Girls** held its second annual summer session in July, with faculty and graduate students from Civil, Architectural, and Environmental Engineering, Electrical Engineering, Engineering Technology, Chemistry, and Construction Management teaching hands-on workshops to middle school girls from greater Philadelphia.

ACADEMIC DIVISIONS – 7%

\$501,309

FACILITIES – 5%

\$398,692

FACULTY SUPPORT – 35%

\$2,500,000

OTHER – 2%

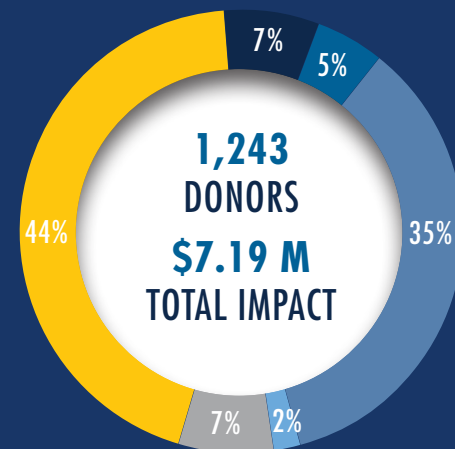
\$139,095

RESEARCH – 7%

\$506,964

STUDENT AID – 44%

\$3,145,645



Over 125 years ago, Anthony J. Drexel foresaw the need for an institution that would prepare his beloved Philadelphia for the challenges and opportunities of the Industrial Revolution. Boldly, yet without fanfare, he stepped into this void with a disruptive notion that higher education should be open to all, advancing the ideals of a just and diverse society.

Since then, Drexel University College of Engineering has relied on alumni, faculty, staff, and Drexel parents and friends to sustain our founder's vision, support our students and programs, and take the College in a dynamic new direction.

In fiscal year 2018, 1,243 donors gave to the College of Engineering for a total impact of over \$7.1M. We are immensely grateful to all who contributed.

THANK YOU FOR YOUR SUPPORT!

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PUBLICATION CREDIT

- **WRITING:** Wendy Plump, Jon Spanier, and the College of Engineering Communications Team
- **GRAPHIC DESIGN:** Trissy Laurito '09

Drexel University
College of Engineering
3141 Chestnut Street
Philadelphia, PA 19104

215.895.2210
drexel.edu/engineering



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