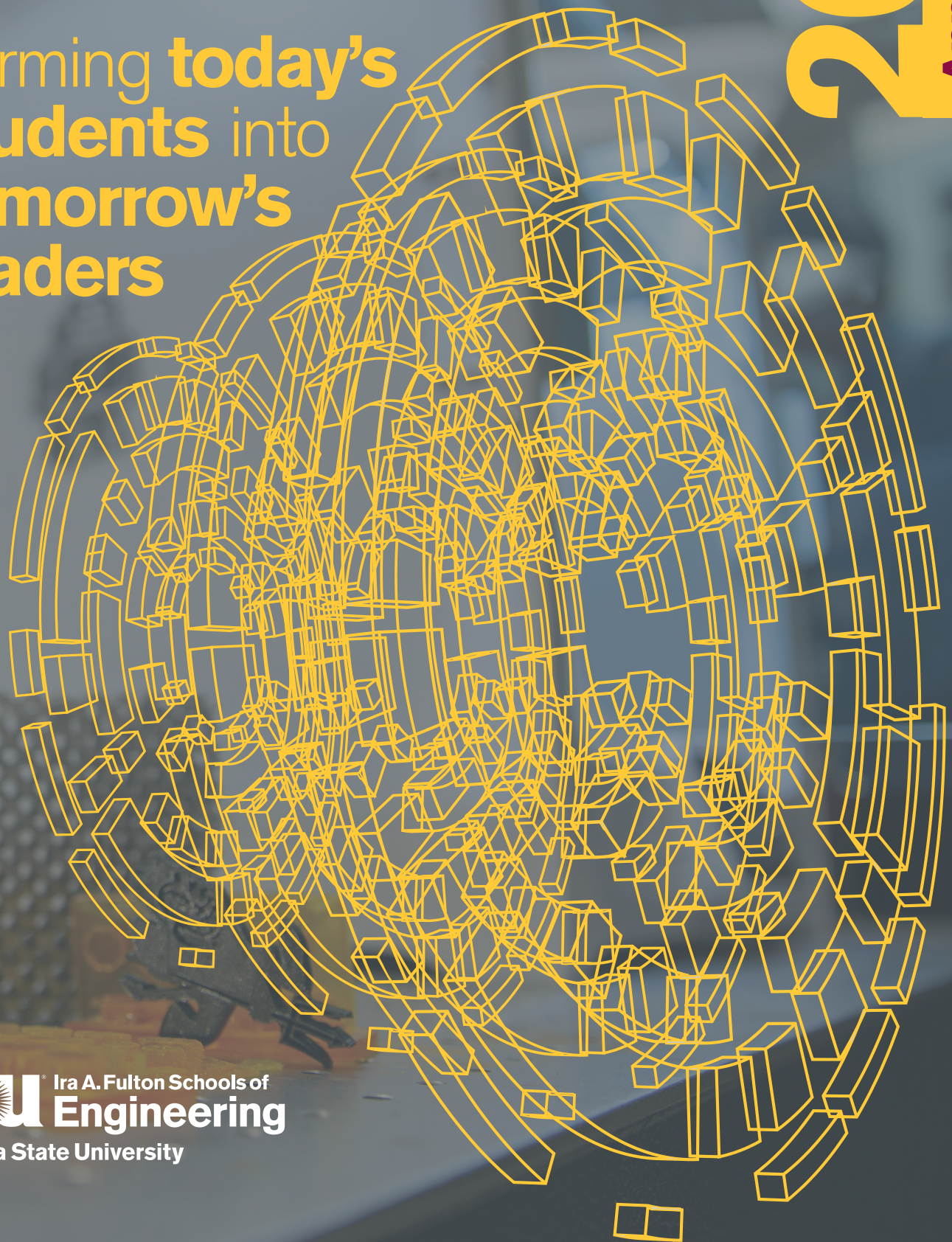
School for Engineering of Matter, Transport and Energy

Forming today's students into tomorrow's leaders

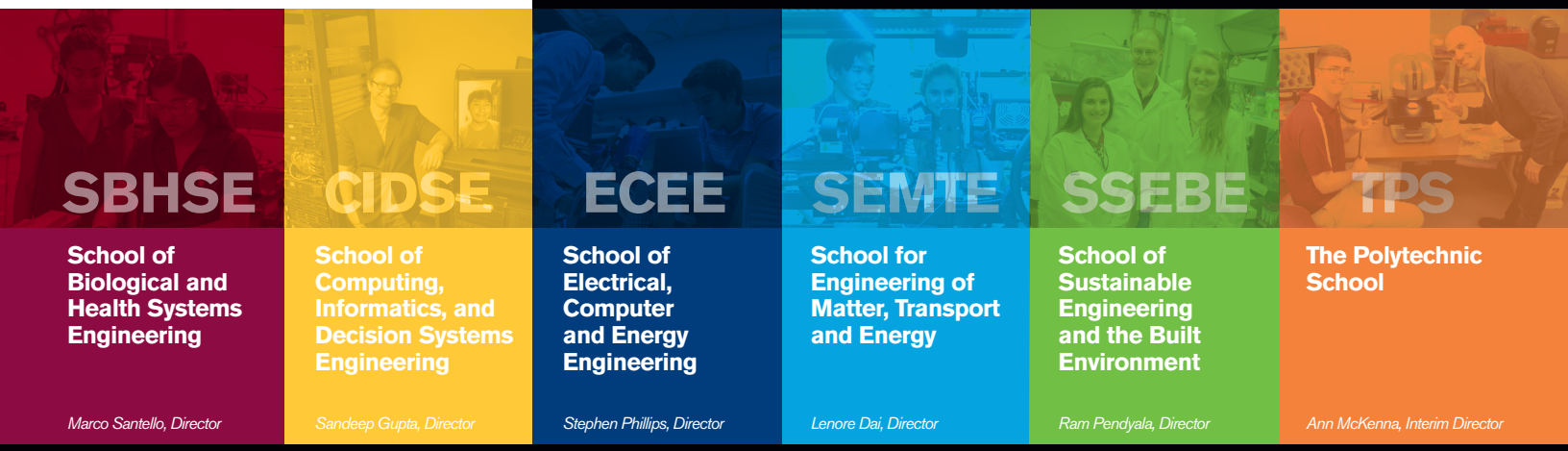
2019 Annual Report



Ira A. Fulton Schools of Engineering
Arizona State University

Ira A. Fulton Schools of Engineering
Arizona State University

The Ira A. Fulton Schools of Engineering at Arizona State University offers **25 undergraduate programs and 46 graduate programs in its six schools:**



SBHSE	CIDSE	ECEE	SEMTE	SSEBE	TPS
School of Biological and Health Systems Engineering	**School of Computing, Informatics, and Decision Systems Engineering**	**School of Electrical, Computer and Energy Engineering**	**School for Engineering of Matter, Transport and Energy**	**School of Sustainable Engineering and the Built Environment**	**The Polytechnic School**
Marco Santello, Director	*Sandeep Gupta, Director*	*Stephen Phillips, Director*	*Lenore Dai, Director*	*Ram Pendyala, Director*	*Ann McKenna, Interim Director*

Innovation at scale

#1 in the U.S. for innovation
ASU ahead of Stanford and MIT
– U.S. News & World Report, 5 years, 2016–2020

BEST COLLEGES U.S.News MOST INNOVATIVE 2020

8 National Academy of Engineering Members

10 American Association for the Advancement of Science Fellows

4 National Academy of Construction Members

11 American Society of Mechanical Engineers Fellows

42 NSF CAREER Awardees in the last five years

38 IEEE Fellows

7 PECASE Awardees

5 National Academy of Inventors Fellows

7 American Society of Civil Engineers Fellows

3 American Institute for Medical and Biological Engineering Fellows

Lead institution on two
National Science Foundation Engineering Research Centers

QESST

CBBG
Center for Bio-mediated & Bio-inspired Geotechnics

Lead institution of the Department of Homeland Security Center of Excellence

CAOE | Center for Accelerating Operational Efficiency
A Department of Homeland Security Center of Excellence

Using today's knowledge to shape tomorrow's engineers

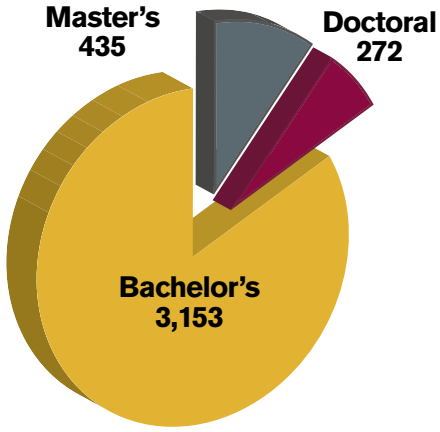
Record setting research

$25M
Awards
$24,626,706

$18M
Research expenditures
$17,868,942

$143M
Proposals
$143,266,577

Continued enrollment increases



Total 3,860

The School for Engineering of Matter, Transport and Energy continues to push the boundaries of innovation and academic excellence at an ever-increasing scale. Through the efforts of our distinguished faculty, exceptional students, tremendous staff and generous donors, our potential is unlimited.

This past year marked a milestone in research awards, with a record $24.6 million in research funding granted to our faculty. This high level of achievement is also reflected in the numerous accolades achieved by our esteemed researchers, particularly the junior professors. Heather Emady, Hyunglae Lee and Matt Green all received NSF CAREER Awards. Green and Sze Zheng Yong also received awards recognizing early career achievements from NASA and DARPA, respectively.

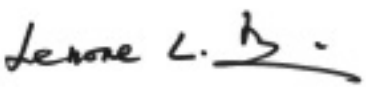
We have happily welcomed 10 new faculty members into our ranks. This constant influx of new experiences and ideas is one of the hallmarks of our success as a school. Two of our new colleagues, George Stephanopoulos, a member of the National Academy of Engineering, and Alexandra Navrotsky, a member of the National Academy of Sciences, share joint appointments with the School of Molecular Sciences. It is through fostering these professional relationships that we strengthen our interdisciplinary skills as engineers in a constantly evolving field. Now more than ever, our engineering graduates are required to possess a wide base of knowledge and skills as they face the world's greatest challenges.

We continue to diligently expand our degree offerings, particularly in response to the 23% increase in enrollment of new graduate students. Of that percentage, a large number have enrolled in our rapidly growing materials science and engineering master's program, which is offered both in person and online. At the forefront of this advancement is materials science researcher and Associate Professor Sefaattin Tongay, who was recently recognized with the Presidential Early Career Award for Scientists and Engineers, and Professor Nate Newman who was inducted as a Fellow into the National Academy of Inventors.

Capitalizing on the opening of academia's largest drone motion capture studio in early 2019, we launched our master's program in robotics and autonomous systems. Students and faculty will have ample space and resources to conduct ground-based and aerial robotics research. We will soon be adding a master's in modern energy production and sustainable use to our curriculum.

Our students rose to ever greater heights, garnering top accolades and honors. Brendon K. Colbert was selected as a National Science Foundation Graduate Research Fellow, and undergraduate student Ava Karanjia won consecutive poster presentations held by The Society of Women Engineers and The American Institute of Chemical Engineers as well as a NSF graduate fellowship. We are particularly proud of our outstanding PhD graduates, five of whom have secured academic positions at universities across the country.

As I reflect on the past year, I am grateful for all of my gifted colleagues in the School for Engineering of Matter, Transport and Energy. My deep gratitude also extends to our generous donors. Without their support, higher education would not have been a viable option for our 100 students who received financial assistance. I am excited as we look to the future and push the boundaries of what it means to truly change the world.



Lenore L. Dai
Professor of chemical engineering
Director of the School for Engineering of Matter, Transport and Energy

SEMTE Report 2019

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American Institute of Chemical Engineers Herb Epstein Award for Technical Programming

The Herb Epstein Award for Technical Programming is awarded by the American Institute of Chemical Engineers to an individual who displays a spirit of volunteerism and dedication to the profession of chemical engineering. Awardees show meritorious contribution to a technical programming event or task that adds value to the institute and its members.

Julianne **Holloway**

Defense Advanced Research Projects Agency Young Faculty Award

The objective of the Defense Advanced Research Projects Agency Young Faculty Award program is to identify and engage rising stars in junior research positions, emphasizing those without prior DARPA funding, and expose them to Department of Defense needs and DARPA's program development process.

Sze Zheng **Yong**

Distinguished Alumni Lecture Award — University of Michigan

The materials science and engineering department Distinguished Alumni Lecture is an award to recognize alumni who have made seminal contributions to materials research, as evident by published scholarship, patents/ technology transfer, mentoring of early career materials researchers and service to the materials profession. The award recipients will be mid-to-late career researchers in academia, government or industrial research and development.

Nik **Chawla**

Fulton Exemplar Faculty

Fulton Exemplar Faculty are associate or full professors who have a combination of exemplary research outcomes, excellent teaching, student mentorship and service contributions.

Yongming **Liu**

David **Nielsen**

Fulton Outstanding Assistant Professor

Fulton Outstanding Assistant Professors are those in the middle of their probationary period who are contributing at a high level across all dimensions of teaching, research and service.

Brent **Nannenga**

The Journal of Materials Science Cahn Prize

Each month the editors of the Journal of Materials Science select a paper published in that month's issue via a rigorous nomination and voting procedure. The winning paper is selected from the twelve finalists by a separate panel of distinguished materials scientists.

Kumar **Ankit**

Top 5% Teaching Award

Quality and innovative instruction are top priorities of the Ira A. Fulton Schools of Engineering. Excellence in instruction is recognized by awarding an annual Teaching Excellence Award and through inclusion on the top 5% teachers list. Student nominations and feedback are reviewed by a faculty committee in determining these honors.

Lenore **Dai**

Marcus **Herrmann**

Yang **Jiao**

Gregory **Raupp**

Sefaattin **Tongay**

Qing Hua **Wang**

Sze Zheng **Yong**

Michael Ashby Outstanding Materials Educator Award

The Michael Ashby Outstanding Materials Educator Award recognizes distinguished and exceptional contributions in materials science and engineering education. It is intended to honor an individual with demonstrated notable leadership in the materials education area.

Stephen **Krause**

NASA Early Career Faculty Award

Through the Early Career Faculty solicitation, NASA's space technology research grants program awards grants to accredited U.S. universities on behalf of outstanding faculty researchers early in their careers. The grants sponsor research in specific high-priority areas of interest to America's space program.

Matthew **Green**

National Academy of Inventors Fellowship Induction

The National Academy of Inventors fellows program was established to highlight 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. Induction as a fellow is the highest professional distinction accorded solely to academic inventors.

Nathan **Newman**

National Science Foundation Faculty Early Career Development Program Award

The National Science Foundation grants the Faculty Early Career Development Program Award to early-career faculty members who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization.

Heather **Emady**

Matthew **Green**

Hyunglae **Lee**

Presidential Early Career Award for Scientists and Engineers

Established in 1996, the Presidential Early Career Award for Scientists and Engineers acknowledges the contributions scientists and engineers have made to the advancement of science, technology, education and mathematics education and community service as demonstrated through scientific leadership, public education and community outreach. The White House Office of Science and Technology policy coordinates the award with participating departments and agencies.

Sefaattin **Tongay**

Secretary of the Air Force Distinguished Public Service Award

The Distinguished Public Service Award is awarded to individuals who made a profound contribution to the Air Force on the national level, and facilitate substantial progress to the Air Force mission

Werner J.A. **Dahm**

Faculty acclaim propels success

Our esteemed faculty members are some of our greatest assets. It is through their hard work that we reach new heights. We celebrate their academic accomplishments as they continue to distinguish themselves among their peers.

Kumar **Ankit** received the Cahn Prize for a paper he co-authored, "Measuring solid-liquid interfacial energy fields: diffusion-limited patterns." His findings challenged classical beliefs in the realm of materials science and could have considerable impacts on materials manufacturing. It was selected from 12 finalists at the 2018 Materials Research Society fall meeting and exhibit, a prominent event that draws more than 6,000 attendees from over 55 countries. *Photo courtesy of Kumar Ankit.*

Werner J.A. **Dahm** (left), ASU Foundation Professor, was presented the Secretary of the Air Force Distinguished Public Service Award. He was honored for his leadership in numerous Air Force studies and contributions to technical reviews of the Air Force's $4.3 billion annual research portfolio. The award is the highest recognition given by the Air Force to non-employees. *Photo courtesy of Werner J.A. Dahm.*

Julianne L. **Holloway,** an assistant professor of chemical engineering, is passionate about promoting the development and recognition of women in chemical engineering. Holloway's efforts have been so significant that she was recognized by the American Institute of Chemical Engineers with the Herb Epstein Award for Technical Programming. The award recognizes Holloway's efforts in organizing a symposium to celebrate the 20th anniversary of the institute's women's initiative committee, which has been immensely valuable to many women in chemical engineering.

Sefaattin Tongay

Sefaattin Tongay, associate professor of materials science and engineering, **believes in the power of 2D materials to raise the bar of technological advancement.** Classic 3D materials have enabled some of our most impressive technology but can't meet the demands necessary to reach the next level. 2D crystalline materials, consisting of only single layers of atoms, are poised to drive dramatic progress in computing, communications and more. The key to that will be using quantum bits — the smallest quantities of radiant energy — instead of electrons to go beyond the reach of conventional electronics.

Tongay's research has, in recent years, revealed significantly more evidence about what quantum-grade 2D materials can do to contribute to such innovation. Those discoveries, plus nearly two decades of contributions to his field, earned Tongay the Presidential Early Career Award for Scientists and Engineers in addition to his previous funding awards from the National Science Foundation and the U.S. Department of Defense. ■

PECASE award

Heather Emady

Heather Emady, an assistant professor of chemical engineering, believes that granular particles are often taken for granted. A variety of products and industrial processes are made possible by granular materials, yet they haven't always been given the attention they deserve.

Emady's work focuses on closely **examining the complex chemical and physical interactions of liquids and particulate matter, using high-speed imaging technology.** This reveals the complete internal structure of particles, showing what's happening at the microscopic level as the materials combine with liquids. She received a National Science Foundation Faculty Early Career Award and $424,519 in funding to continue her research.

Her ultimate goal is to explore how granular particles behave in different engineering and manufacturing processes and how they can be employed to make new products or process improvements.

These discoveries will be important for the mining and agricultural industries, the development and manufacturing of pharmaceuticals, numerous consumer products and construction materials — particularly concrete and cement. Her work will also impact relatively new fields, such as biomass conversion to produce renewable energy. ■

NSF CAREER Award

Matthew Green

Assistant professor of chemical engineering Matthew Green received both the National Science Foundation's Faculty Early Career Development Program Award and the NASA Early Career Faculty Award.

Supported by the $519,338, five-year award from the National Science Foundation, Green's focus is on developing a **modular synthetic strategy to reproducibly control the amount and type of charged groups within polyelectrolytes.**

Charged polymers occur all around us in biology and are increasingly used commercially. They require organization and assembly at the nanometer scale and are therefore difficult to predict and control in polyelectrolyte systems. Green is working on a pathway to validate current models and simulations and advance the knowledge in the field of microphase separation of charged block polymers.

Green's NASA award supports his work to develop high-efficiency, low-maintenance carbon dioxide removal systems, which are critical for human space missions beyond low Earth orbit. His methodology utilizes molten salts to remove CO_2 instead of the conventional solid sorbents which are unreliable, high maintenance and potentially dangerous. ■

NSF CAREER Award | **NASA Early Career Faculty Award**

Hyunglae Lee

Hyunglae Lee, an assistant professor of aerospace and mechanical engineering, is developing an innovative framework, called Transparent Robotic-Aided Rehabilitation, known as TRAIN, and utilizing it in **exercise therapy to significantly improve the effectiveness of robot-aided rehabilitation.** The work is supported by a $547,305, five-year National Science Foundation Faculty Early Career Development Program Award.

Stroke is one of the leading causes of long-term disability in the United States, affecting about 6.5 million Americans. With a decrease in stroke mortality and an increasingly aging population, the number of people requiring rehabilitation following stroke is projected to significantly increase.

Lee's framework builds upon enhanced transparency in two distinct aspects. The first is understanding altered biomechanics following a stroke, the second is physical human-robot interaction. Successful application to robotic exercise therapy will directly benefit the overall sensorimotor function in stroke survivors including improved range of motion, strength and stability. ■

NSF CAREER Award

Nate Newman

Nate Newman, the Lamonte H. Lawrence Professor in Solid State Science, was named a Fellow of the National Academy of Inventors. He joins the prestigious ranks of fewer than 1,000 National Academy of Inventor Fellows worldwide. This honor is the highest professional accolade and is reserved solely for academic inventors who have demonstrated the spirit of innovation in creating or facilitating outstanding inventions that have made tangible impacts on the quality of life, economic development and welfare of society.

During his prolific career, Newman has been granted 13 U.S. patents for a wide range of applications, from high-powered electronics to direct nuclear energy generation. He leads a team of about 25 researchers who are working to further solid state electronics and push the performance limits of materials and devices, which are of prime importance to funding agencies such as the Department of Defense and the National Security Agency. ■

National Academy of Inventors Fellow

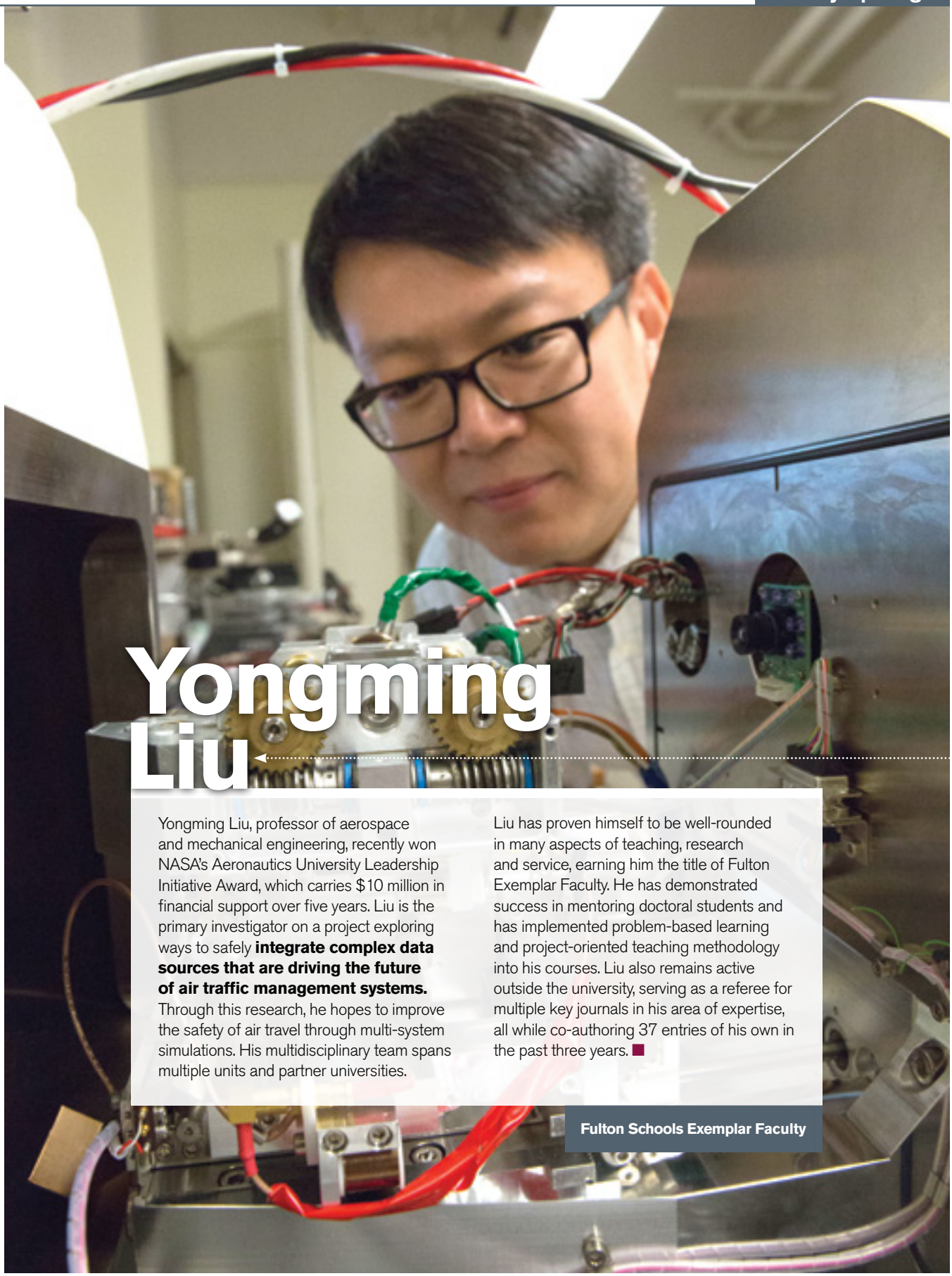
Sze Zheng Yong

Sze Zheng Yong, an assistant professor of aerospace and mechanical engineering, is an expert in system dynamics and control, as well as robotics. His career has revolved around studying the **complex behaviors and interactions within and between various types of autonomous and cyberphysical systems.** Yong's research in control and estimation of complex systems with hybrid dynamics earned him the prestigious Defense Advanced Research Projects Agency Young Faculty Award.

Yong is working to understand the intention of autonomous swarms controlled by some other party, such as an enemy. The element of uncertainty surrounding a malicious agent's swarm activities hinders current efforts to model them and the ability to develop mitigating strategies to maintain a strategic advantage and avoid surprises.

Swarm intents differ based on the mission and the objective, and swarm formations differ based on the desired outcome. Yong's project is developing new computational foundations for identification and estimation of swarm intents. In order to understand the behavior of the swarms, the use of classical machine learning methods is no longer sufficient. Classical machine learning methods typically emphasize prediction accuracy over understanding what the obtained models represent. ■

DARPA Young Faculty Award



Yongming Liu

Yongming Liu, professor of aerospace and mechanical engineering, recently won NASA's Aeronautics University Leadership Initiative Award, which carries $10 million in financial support over five years. Liu is the primary investigator on a project exploring ways to safely **integrate complex data sources that are driving the future of air traffic management systems.** Through this research, he hopes to improve the safety of air travel through multi-system simulations. His multidisciplinary team spans multiple units and partner universities.

Liu has proven himself to be well-rounded in many aspects of teaching, research and service, earning him the title of Fulton Exemplar Faculty. He has demonstrated success in mentoring doctoral students and has implemented problem-based learning and project-oriented teaching methodology into his courses. Liu also remains active outside the university, serving as a referee for multiple key journals in his area of expertise, all while co-authoring 37 entries of his own in the past three years. ■

Fulton Schools Exemplar Faculty

David Nielsen

David Nielsen, an associate professor of chemical engineering, is **striving to overcome technological barriers that are limiting the production of bio-derived fuels and chemicals.** Nielsen's research is advancing the engineering of what he calls "microbial chemical factories" to synthesize novel bioproducts. He is also developing strategies for carbon and energy conservation to enhance yields of those products from biomaterials.

Since joining ASU, Nielsen has published 36 refereed journal articles and has been a key investigator on numerous multimillion-dollar research projects. Additionally, he has also been an outstanding mentor to his graduate and undergraduate students, one of whom received the prestigious Fulbright and Goldwater scholarships.

Nielsen has chaired multiple committees both at ASU and externally in his field, including acting as an associate editor of Frontiers in Microbiology and chair of the program committee for the Society of Industrial Microbiology and Biotechnology. His recent successes in teaching and research earned him the Fulton Schools Exemplar Faculty Award. ■

Fulton Schools Exemplar Faculty

Brent Nannenga

Brent Nannenga, assistant professor of chemical engineering, is developing and applying new methods in structural biology, specifically cryo-electron microscopy and electron diffraction.

He is also using protein engineering and structural **biology techniques to understand the mechanisms of how biological molecules interact with inorganic materials.** This research will ultimately help understand how these materials affect biological systems and how scientists can use biology to synthesize materials with new properties under environmentally-friendly conditions.

Nannenga, whose successes in teaching, research and service won him the Fulton Outstanding Assistant Professor Award, gave a keynote lecture at the 31st European Crystallographic Meeting in Oviedo, Spain, in 2018. He also gave two presentations at the 2019 American Crystallographic Association annual meeting in Covington, Kentucky. ■

Fulton Outstanding Assistant Professor

New thought leaders speed the rate of change

For our school to thrive in a rapidly changing academic environment, we must constantly evolve and adapt. Our faculty are at the core of this reinvention. Their new ideas and experience ensure we are always advancing the caliber of our work. Over the course of the past year, we recruited ten new faculty from a variety of research fields to help ensure we are continually improving ourselves as educators.

Abhinav Acharya

Assistant Professor
PhD, University of Florida
Chemical engineering

David Benson

Lecturer Sr.
PhD, Michigan State University
Aerospace and mechanical engineering

Wonmo Kang

Assistant Professor
PhD, University of Illinois at Urbana-Champaign
Aerospace and mechanical engineering

Mohamed Kasbaoui

Assistant Professor
PhD, Cornell University
Aerospace and mechanical engineering

Beomjin Kwon

Assistant Professor
PhD, University of Illinois at Urbana-Champaign
Aerospace and mechanical engineering

Xiangjia (Cindy) Li

Assistant Professor
PhD, University of Southern California
Aerospace and mechanical engineering

Ryan Milcarek

Assistant Professor
PhD, Syracuse University
Aerospace and mechanical engineering

Alexandra Navrotsky*

Professor
PhD, University of Chicago
Chemical engineering, Materials science and engineering

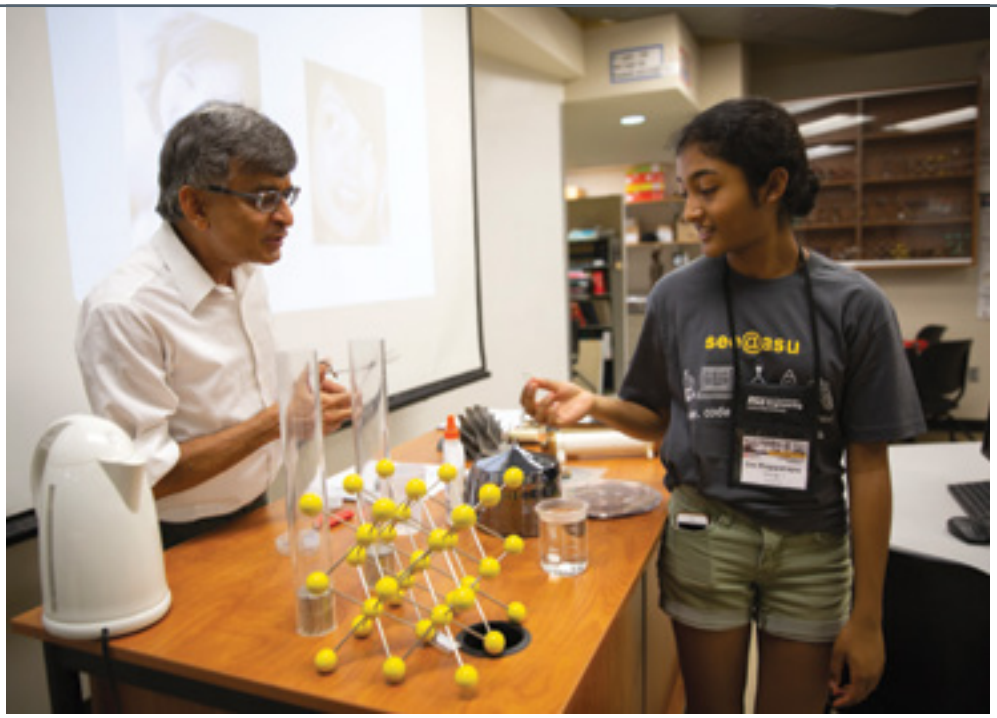
Aikaterini Stefanaki

Lecturer
PhD, The State University of New York at Buffalo
Aerospace and mechanical engineering

George Stephanopoulos*

Professor
PhD, University of Florida
Chemical engineering

**indicates a joint appointment with the School of Molecular Sciences.*



Abhinav **Acharya**
Assistant Professor
PhD, University of Florida
Chemical engineering

James **Adams**
President's Professor, Program Chair of Materials Science and Engineering
PhD, University of Wisconsin–Madison
Materials science and engineering

Ronald **Adrian**
Regents Professor, Ira A. Fulton Professor of Aerospace and Mechanical Engineering, Member of National Academy of Engineering
PhD, University of Cambridge
Aerospace and mechanical engineering

Terry **Alford**
Professor, Associate Director
PhD, Cornell University
Materials science and engineering

Jean **Andino**
Associate Professor
PhD, California Institute of Technology
Chemical engineering

Kumar **Ankit**
Assistant Professor
PhD, Karlsruhe Institute of Technology
Materials science and engineering

David **Benson**
Lecturer Sr.
PhD, Michigan State University
Aerospace and mechanical engineering

Spring **Berman**
Associate Professor
PhD, University of Pennsylvania
Aerospace and mechanical engineering

Luis **Bocanegra**
Professor of Practice
PhD, West Virginia University
Aerospace and mechanical engineering

Ronald **Calhoun**
Associate Professor
PhD, Stanford University
Aerospace and mechanical engineering

Candace **Chan**
Associate Professor
PhD, Stanford University
Materials science and engineering

Aditi **Chattopadhyay**
Regents Professor, Ira A. Fulton Professor of Aerospace and Mechanical Engineering, Director of Adaptive Intelligent Materials and Systems Center
PhD, Georgia Institute of Technology
Aerospace and mechanical engineering

Nikhilesh **Chawla**
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PhD, University of Michigan
Materials science and engineering

Kangping **Chen**
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PhD, University of Minnesota
Aerospace and mechanical engineering

Peter **Crozier**
Professor, Graduate Program Chair of materials science and engineering
PhD, University of Glasgow
Materials science and engineering

Werner **Dahm**
ASU Foundation Professor
PhD, California Institute of Technology
Aerospace and mechanical engineering

Lenore **Dai**
Professor, School Director
PhD, University of Illinois at Urbana-Champaign
Chemical engineering

Shuguang **Deng**
Professor
PhD, University of Cincinnati
Chemical engineering

Sandwip **Dey**
Professor
PhD, Alfred University
Materials science and engineering

Heather **Emady**
Assistant Professor
PhD, Purdue University
Chemical engineering

Masoud Yekani **Fard**
Assistant Research Professor
PhD, Arizona State University
Aerospace and mechanical engineering

Erica **Forzani**
Associate Professor, Fulton Entrepreneurial Professor
PhD, Cordoba National University
Chemical engineering

Cody **Friesen**
Associate Professor, Fulton Professor of Innovation
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Materials science and engineering

Tirupalavanam **Ganesh**
Associate Research Professor
PhD, Arizona State University
Engineering education

Matthew **Green**
Assistant Professor
PhD, Virginia Polytechnic Institute and State University
Chemical engineering

Marcus **Herrmann**
Associate Professor
PhD, University of Technology Aachen
Aerospace and mechanical engineering

Faculty expertise

Julianne **Holloway**
Assistant Professor
PhD, Drexel University
Chemical engineering

Huei-Ping **Huang**
Associate Professor
PhD, University of Illinois at Urbana-Champaign
Aerospace and mechanical engineering

Hanqing **Jiang**
Professor
PhD, Tsinghua University
Aerospace and mechanical engineering

Yang **Jiao**
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Wonmo **Kang**
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Aerospace and mechanical engineering

Jeonglae **Kim**
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Srinivas **Kosaraju**
Lecturer
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PhD, University of Michigan
Materials science and engineering

Beomjin **Kwon**
Assistant Professor
PhD, University of Illinois at Urbana-Champaign
Aerospace and mechanical engineering

Hyunglae **Lee**
Assistant Professor
PhD, Massachusetts Institute of Technology
Aerospace and mechanical engineering

Taewoo **Lee**
Associate Professor
PhD, University of Michigan
Aerospace and mechanical engineering

Jian **Li**
Professor
PhD, University of Southern California
Materials science and engineering

Xiangjia (Cindy) **Li**
Assistant Professor
PhD, University of Southern California
Aerospace and mechanical engineering

Jerry **Lin**
Regents Professor
PhD, Worcester Polytechnic Institute
Chemical engineering

Mary Laura **Lind**
Associate Professor, Graduate Program Chair of chemical engineering
PhD, California Institute of Technology
Chemical engineering

Yongming **Liu**
Professor
PhD, Vanderbilt University
Aerospace and mechanical engineering

Hamid **Marvi**
Assistant Professor
PhD, Georgia Institute of Technology
Aerospace and mechanical engineering

James **Middleton**
Professor
PhD, University of Wisconsin–Madison
Aerospace and mechanical engineering

Marc **Mignolet**
Professor, Graduate Program Chair of aerospace and mechanical engineering
PhD, Rice University
Aerospace and mechanical engineering

Ryan **Milcarek**
Assistant Professor
PhD, Syracuse University
Aerospace and mechanical engineering

Bin **Mu**
Assistant Professor
PhD, Georgia Institute of Technology
Chemical engineering

Christopher **Muhich**
Assistant Professor
PhD, University of Colorado Boulder
Chemical engineering

Raghavendra **Murthy**
Lecturer
PhD, Arizona State University
Aerospace and mechanical engineering

Brent **Nannenga**
Assistant Professor
PhD, University of Washington
Chemical engineering

Alexandra **Navrotsky**
Professor
PhD, University of Chicago
Chemical engineering, Materials science and engineering

Nathan **Newman**
Lamonte H. Lawrence Professor in Solid State Science
PhD, Stanford University
Materials science and engineering

Qiong (Eric) **Nian**
Assistant Professor
PhD, Purdue University
Aerospace and mechanical engineering

David **Nielsen**
Associate Professor, Program Chair of chemical engineering
PhD, Queen's University at Kingston
Chemical engineering

Jay **Oswald**
Associate Professor
PhD, Northwestern University
Aerospace and mechanical engineering

Jay **Patel**
Lecturer
PhD, Arizona State University
Aerospace and mechanical engineering

Matthew **Peet**
Associate Professor
PhD, Stanford University
Aerospace and mechanical engineering

Yulia **Peet**
Assistant Professor
PhD, Stanford University
Aerospace and mechanical engineering

Pedro **Peralta**
Professor
PhD, University of Pennsylvania
Aerospace and mechanical engineering

Patrick **Phelan**
Professor
PhD, University of California, Berkeley
Aerospace and mechanical engineering

In spring of 2019 ASU opened academia's largest indoor motion capture facility for drone research. At 10,000 square feet with a 3D tracking system, the Drone Studio is a premier testbed for drone research, collaboration and learning. Hamid Marvi, Spring Berman, Hyunglae Lee and Sze Zheng Yong are SEMTE faculty leading the way with their robotics research.

Jagannathan **Rajagopalan**
Associate Professor
PhD, University of Illinois at Urbana-Champaign
Aerospace and mechanical engineering

Gregory **Raupp**
ASU Foundation Professor, Director of MacroTechnology Works
PhD, University of Wisconsin–Madison
Chemical engineering

Kaushal **Rege**
Professor
PhD, Rensselaer Polytechnic Institute
Chemical engineering

Yi **Ren**
Assistant Professor
PhD, University of Michigan
Aerospace and mechanical engineering

Daniel **Rivera**
Professor
PhD, California Institute of Technology
Chemical engineering

Ronald **Roedel**
Professor Emeritus
PhD, University of California, Los Angeles
Solar energy engineering and commercialization

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New grant to help power US energy grid for DAYS

The U.S. Department of Energy's Advanced Research Projects Agency-Energy has selected 10 projects to be a part of the Duration Addition of electricitY Storage program, known as DAYS.

A $2 million award to help develop the next generation of designs for long-duration storage on the U.S. power grid was granted to ASU and partners at Michigan State University, Dresser-Rand and Saudi Aramco Energy Ventures.

Christopher Muhich, a chemical engineering assistant professor, is one of three primary co-investigators on the project. The project is called Scalable Thermochemical Option for Renewable Energy Storage, or STORES.

"It is very exciting to be working on the DAYS project with MSU and ARPA-E," says Muhich. "The long-term electrical energy storage solutions that we are working on through DAYS are going to be critical as the nation and the world integrate ever more renewable energy into the electric grid. By storing the electrical energy as heat, we can achieve relatively low-cost storage over long periods. In addition to directly contributing to the engineering of energy storage systems, there are many interesting fundamental chemical and materials engineering questions that we will get to tackle."

Muhich will work with the team to develop a modular thermal storage system that uses electricity from sources such as wind and solar to heat up a bed of magnesium manganese oxide particles to high temperatures. Once heated, the particle bed will release oxygen and store the heat energy in the form of chemical energy. The system is designed to pass air over the particle bed to start a chemical reaction that releases heat to drive a gas turbine generator.

Each of the 10 projects selected for ARPA-E's DAYS program has a goal to develop its own energy storage system that provides power to the electric grid for durations of 10 to approximately 100 hours. The systems will be deployable in almost any location and can charge and discharge electricity at a target fixed cost per cycle.

These projects will allow for new opportunities to increase grid resilience and performance as the extended discharge times of these projects enables a new set of applications for grid storage, including long-lasting backup power and greater integration of intermittent, renewable energy resources. ■

Associate Professors Erica Forzani (left) and Mary Laura Lind.

Continued partnerships with Mayo Clinic

Being able to partner with one of the world's most prestigious medical centers provides invaluable opportunities for researchers in the school.

For one group of professors, teaming with the renowned Mayo Clinic has created a number of collaborations in recent years that are transforming health care.

Researchers and medical experts are combining forces to find solutions for a variety of health care needs, aiming to alleviate or cure medical issues that have plagued the health care community for decades.

In 2018, associate professors of chemical engineering Mary Laura Lind and Erica Forzani, along with Mayo Clinic adjunct faculty member Leslie Thomas, embarked on a project to find a new way of looking at acute kidney injuries. In particular, the researchers wanted to look at how the injury is diagnosed since the ailment is typically not found quickly in patients.

The group was awarded a $900,000 team science grant from the Mayo Clinic and ASU Alliance for Health Care, allowing them to spend three years developing a device that can help doctors make speedier diagnoses.

The results could be highly beneficial for the thousands of people diagnosed with acute kidney injuries each year. By providing a novel method to make earlier diagnoses, there is potential to both decrease the chances of irreversible kidney damage while also minimizing the need for long-term dialysis.

The school has collaborated with the Mayo Clinic in other projects as well. In 2018, a neurologist from the Mayo Clinic worked with chemical engineering Professor Michael Sierks to take a new look at Parkinson's disease. Together they are working to find blood-based biomarkers that can be screened for an earlier diagnosis, help track the disease's progression and potentially create new methods for treatment.

In another recent project, Forzani teamed up with a Mayo Clinic investigator to look at how to improve quality of life and prevent brain damage in newborns, children and adults who suffer from urea cycle and liver disorders. Additionally, chemical engineering Assistant Professor Matthew Green is working with a Mayo researcher to evaluate pancreatic triglyceride lipase and its inhibitors.

And aerospace and mechanical engineering Assistant Professor Yulia Peet was selected as an Alliance Fellow as part of an interdisciplinary program that paired ASU and Mayo Clinic investigators.

Ultimately, the school's connections with the Mayo Clinic continue to create integral partnerships of all kinds, allowing ASU engineering faculty members to explore critical issues alongside some of the world's most preeminent medical researchers. ■

Materials science researcher earns NSF support

Qing Hua Wang, an assistant professor of materials science and engineering, has received two awards from the National Science Foundation to explore the potential for nanomaterials in various applications and to bring together researchers on quantum materials.

One continuing grant is from the NSF's Division of Materials Research. For this project, Wang will be working with metal oxides, which have a variety of uses, but mostly exist as bulk crystals. This structure makes it difficult for them to be formed into nanosheets. To attempt to fix this issue, Wang will investigate a novel plasma-based synthesis method that aims to convert atomically thin metal sulfides and selenides into metal oxide nanosheets and nanoscrolls.

"The DMR award will allow us and our collaborators to pursue new ways to experimentally synthesize and computationally predict atomically thin metal oxides, which will have potential uses in electronics and energy application," says Wang.

Wang was also part of a group of professors awarded a Conceptualization Grant from the NSF's Quantum Leap Challenge Institutes. The award supports activities to build capacity among teams planning for large-scale, interdisciplinary Challenge Institute projects. These activities aim to advance the frontiers of quantum information science and engineering, which includes working with quantum computation, quantum sensing, quantum simulation and quantum communication.

"The award will support a wider effort at ASU involving multiple research groups to build a quantum materials institute, which will also bring other researchers across the country together with new ideas," says Wang.

As part of both grants, Wang will be working to engage in activities with underrepresented high school, undergraduate and graduate students to increase their levels of scientific engagement.

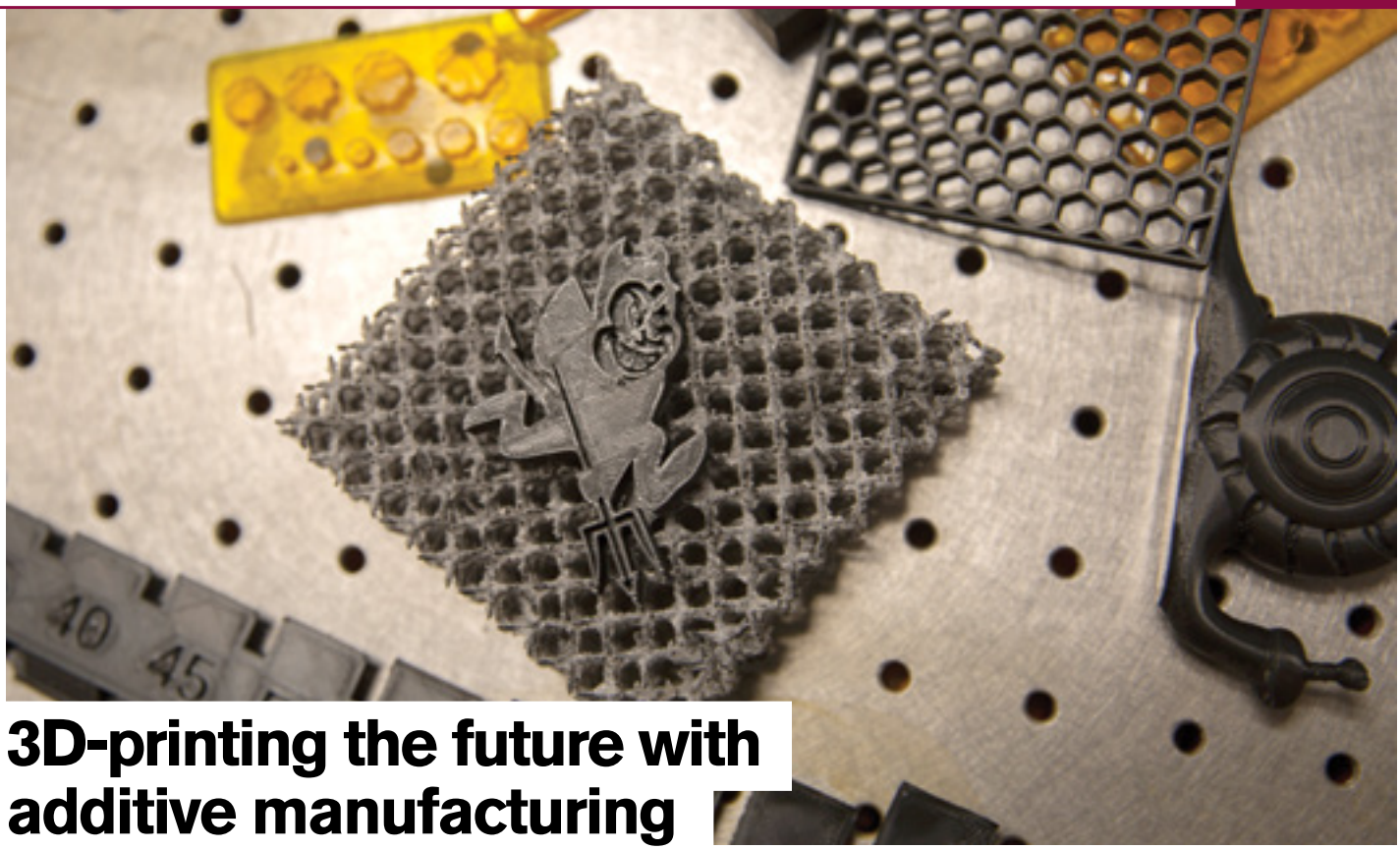
"Both these awards will also help us to increase our educational and outreach efforts," says Wang. ■

Illustration by Charles Shockley.

Electronic pill to monitor health

Winner of the Skysong Innovations faculty startup competition, Vantronics was launched by Professor Hanqing Jiang.

Jiang and his colleagues have developed an edible electronic device that can monitor gastric pH levels. This information can be important to patients with disorders such as acid reflux. Currently available techniques for monitoring gastric pH levels are invasive, uncomfortable and require administration by a health professional. Vantronics' edible electronics are the size of a typical pill, so patients can easily swallow them. Built-in communication systems within the pill allow the device to communicate with outside devices (such as a cellphone) to provide real-time gastric pH levels. All of the materials in the pill eventually dissolve inside the body. ■



3D-printing the future with additive manufacturing

Additive manufacturing is fast becoming one of the most important manufacturing techniques utilized today.

It has created new opportunities for manipulating and fabricating multi-scale, multi-material and multi-functional structures.

The growing need for expertise and innovation in the field has led to a new research area emphasis for the School for Engineering of Matter, Transport and Energy.

"ASU has been one of the major research and education institutes in the state of Arizona and United States," says Qiong (Eric) Nian, an assistant professor of aerospace and mechanical engineering. "In this respect, the school has the responsibility to advance this research area and train the next generation manufacturing engineers."

The increase in additive manufacturing research can provide students more opportunities to get related skills and access to cutting-edge technologies.

"Additive manufacturing is a promising new technology that provides a tool for solving the manufacturing challenges of design with advanced material in various areas," says Xiangjia (Cindy) Li, assistant professor of aerospace and mechanical engineering. "The research of additive manufacturing will enable us to extend some of the current research at ASU and to facilitate more applications than ever before."

The additive manufacturing industry is currently seeing extensive growth driven by key factors such as the internet of things, more 3D printer equipment options, material options and design software tools as well as the development of the workforce and the industry's body of knowledge.

The direction of that growth is something that the school hopes to help guide.

"According to industry reports, more than half of the additive manufacturing applications are still for prototyping and proof-of-concepts, with less than 25 percent for production parts," says Nian. "As we go into the future, I expect we will witness the faster transition of the additive manufacturing process for production applications in various industries ranging from aerospace to automotive, medical and consumer industries."

With the growing possibilities for production and prototyping, additive manufacturing has the ability to be a game changer.

Additive manufacturing could scale up from prototyping to production, reorganize the supply chain, offer greater flexibility and more customized designs, adopt more materials and advanced composites, and create a more sustainable society with less manufacturing waste.

With its ability to allow fabrication of different types of product designs using a single machine, additive manufacturing is cost effective for small batches of customized products. Still, the cost is the key issue in expanding its usage.

Additive manufacturing is introducing a paradigm shift from geometry-centered prototypes to function-focused applications. The future will see the evolution of such ideas as smart, biomimetic and green additive manufacturing.

Advances in this research can be accelerated by identifying the needs, challenges and opportunities of industry. The objective of growth of additive manufacturing research at ASU is to construct a new industrial ecosystem for further facilitating the development of manufacturing and activating more innovations in Arizona. ■

A bonding experience: Repairing wounds with gold, silk and lasers

A dermal regenerator was the medical tool used to repair spaceship crew members' wounds on the science fiction TV show "Star Trek."

Another kind of tissue-repair technique emerging from Kaushal Rege's research has been compared to the fictional device that healed damaged flesh by simply being passed over a wounded body part.

The comparison is a bit of a stretch, says Rege, a chemical engineering professor, but he and his research collaborators are excited about their new tissue-bonding method utilizing the restorative capabilities of nanomaterials.

The team in Rege's Molecular and Nanoscale Bioengineering Lab has been experimenting with this laser-activated process that promises to be effective as a reinforcement for conventional stitches used to seal wounds and surgical incisions, and in some cases provide a safer, more resilient alternative.

The biggest advance in the project, which has funding from the Mayo Clinic and the National Institute of Biomedical Imaging and Bioengineering, is the discovery of a powerful combination of two long-treasured materials that make this nanomaterial-welding an effective tissue sealant — silk and gold.

Using silk produced by silkworms and tiny gold nanorods (roughly 10,000 times smaller in diameter than a single human hair), researchers zap the nanorods with laser light, causing electrons in the gold to oscillate.

"Those oscillations produce a rise in temperature caused by the release of energy from the gold nanorods as they convert the laser light into heat," Rege says.

That heat can then produce changes in the material properties of the silk and collagen, the main structural protein found in skin and other connective tissues.

When the heat dissipates, the tissue molecules and the silk molecules "interdigitize," Rege says. "They essentially interlace," creating "bioactive sealing." The heated laser light essentially welds together silk molecules and tissue molecules to close an open wound or incision.

Rege points out that the method is working on skin, but his team is still exploring its use when applied to the tissues of internal organs.

"The materials have to withstand the kinds of the biomechanical stresses that occur in delicate places in the body, such as in colorectal tissue," Rege says. The bonding materials also have to be tested to prove they can be both nontoxic and biodegradable in all applications.

"The main thing is that the sealing has enough mechanical strength so that leaks, separations and infections don't happen and the body's natural healing processes have time to take over," he says.

Rege's key collaborators are Professor Jeff Yarger and his research group in ASU's School of Molecular Sciences, whose expertise is in silk and related biopolymers, and Jacquelyn Kilbourne, assistant director of the Department of Animal Care and Technologies at ASU. Their contributions are paving the way for safe clinical testing of new tissue-repair materials and methods.

Rege says he's confident the technique will prove valuable in multiple biomedical applications, including nerve and cardiovascular surgery and repair. ■

Microscopic views of dancing atoms can reveal paths to progress

An important part of Peter Crozier's job involves watching dances. He views these intricate performances through state-of-the-art, high-powered microscopes because the dancers are atoms. Crozier is a materials scientist who studies how the underlying principles of nature can be applied to pursuits in materials science and engineering.

To do that, he examines the choreographed ways in which materials form at the atomic level and how those materials develop various functionalities. "Think of graphite and diamonds, two very different materials. Diamonds are hard and transparent. Graphite is soft and black. Yet they are both pure carbon," says Crozier. "The only difference between diamonds and graphite is the way their atoms are arranged in their most basic structures," he says.

Deeper understanding of the ways atoms assemble and bond in materials promises to provide insights into a vast array of chemical and biological systems, energy engineering and environmental sciences.

Progress toward that goal has earned Crozier and his colleagues a National Science Foundation Major Research Instrumentation Award. It provides more than $1.8 million to fund the acquisition of a direct electron detector, a piece of technology that will boost the team's work in advanced transmission electron microscopy.

The new equipment will give researchers a sharper view of "atomic positions and dynamics," Crozier says. The detector will enable researchers to examine advanced real-time, atomic-level identification and characterization of the structures of soft and hard materials in situ, or in their natural working environments.

In situ studies also allow a closer look at how materials at the atomic level perform as catalysts, or substances that can trigger and speed up chemical reactions. This is important because catalytic materials are used to manufacture about 80% of the world's industrial products, including pharmaceuticals, agricultural materials and chemical-based commercial products.

These processes are at the core of the investigations of the Crozier Research Group @ ASU, which focuses on microscopy to help reveal how catalysts can be used to develop more sustainable, renewable clean-energy technologies. ■

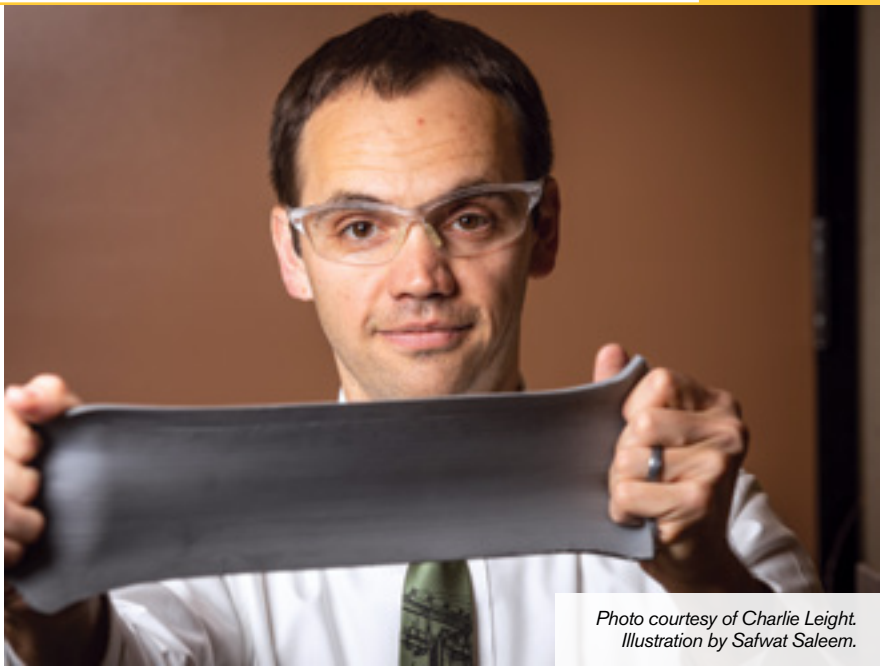


Photo courtesy of Charlie Leight. Illustration by Safwat Saleem.

Cool fashions for a hot planet

In the classic science fiction novel "Dune," much of the story takes place on the harsh desert planet Arrakis. With no natural precipitation, native inhabitants wear suits that capture all the moisture from their bodies and recycle it into drinking water.

Here on Earth, the last four years have been the hottest on record. By the year 2100, about half of the world's population is predicted to be exposed to climatic conditions exceeding deadly temperature thresholds for at least three weeks per year.

Assistant Professor Konrad Rykaczewski has been working on the fashions and fabrics for a hot planet.

"Right now we make clothes to look pretty," said Rykaczewski, "[but] cooling will become one of the key functions of clothing."

Initially, Rykaczewski imagines cooling components will be concealed under clothes that look similar to what we wear now. But he is looking at ways to reengineer historic styles that feature large exterior surface areas into novel cooling garments that store and evaporate water.

Metamaterial film that reflects visible light but emits highly in infrared could also be incorporated into designs. Condenser tubes could provide the support for a future hoopskirt, bustle or crinoline that would provide large heat rejection area.

Rykaczewski is not only thinking about fashion for a hot world. He has also been designing materials for them. As a thermal engineer, for the last few years he has worked on thermal management of electronics, putting partially liquid, partially solid particles of gallium-based liquid metal into silicone.

His temperature-regulating fabric is made from the material and embedded with tubes that can be filled with circulating liquid. A roughly 4 inch by 10 inch sample contains about 15 feet of tubing.

Rykaczewski's designs have lots of cool potential. ■

ASU and Mitsubishi initiate one-of-a-kind Global KAITEKI Center

Professor George Stephanopoulos has been committed to furthering ASU and the Fulton Schools' efforts to develop a sustainable future.

One of his most significant contributions has been founding The Global KAITEKI Center, which is funded by The KAITEKI Institute of the Mitsubishi Chemical Holdings Company of Japan.

The goal is to help global businesses make decisions, innovate products and services and undertake future development using sustainability, health and well-being as an integrated strategic-success platform.

The center's roots began nearly two decades ago when Stephanopoulos was both a professor at the Massachusetts Institute of Technology and the chief technology officer at Mitsubishi Chemical.

Since arriving at ASU in 2018, Stephanopoulos, who holds a joint appointment in the School of Molecular Sciences, came to better understand the sustainability-leadership opportunities at ASU. He helped facilitate a partnership focused around the company's concept of KAITEKI, which means "the sustainable well-being of people, society and our planet Earth."

Today The Global KAITEKI Center is an integral part of ASU's Global Institute of Sustainability and Global Futures Laboratory. It has become the model of the type of partnership between academia and industry in designing and creating a future where Earth thrives.

Through a broad interdisciplinary scope, Stephanopoulos is leading The Global KAITEKI Center's efforts to integrate science, engineering, social and economic dimensions to deliver specific solutions that sustain and improve the physical ecosystem, human health and quality of life, communities and societies at large. ■

Sub-zero sustainability

Associate Professors Robert Wang and Kristen Parrish are leading a team of ASU researchers on a quest for well-preserved, quality ice cream.

Associate Professor Robert Wang (left) and an ASU engineering team are working on a thermal energy system to reduce the costs and the amount of electrical power needed to keep large food storage facilities refrigerated at sub-zero temperatures. Also pictured (left to right), doctoral students Prathamesh Vartak and Neda Askari and Associate Professor Kristen Parrish.

While delicious treats are always a priority, their research is valuable to the large-scale food storage facilities that must keep food stores frozen under precise technical specifications for optimal enjoyment.

The associate professors are working with Arizona's Salt River Project water and power utility, Viking Cold Solutions and the Bashas' Family of Stores grocery chain to test a new thermal energy system in Bashas' 10,400-square-foot ice cream freezer in Chandler, Arizona. "Ice packs" of food-safe phase change materials that transform repeatedly from liquid to solid and back to liquid are placed on racks of shelving throughout the storage facility. As the phase change material transitions, the system absorbs or releases large amounts of energy while maintaining a stable temperature.

The project provides Wang the opportunity to apply his varied expertise in thermal science and phase change materials to the energy sector. "Keeping a space cold is essentially a process of removing heat," he explains. In this system, as the phase change material encased in the plastic melts, "it absorbs the surrounding heat and keeps the freezer cold."

The passive energy process means no electricity is needed to drive the melting process of the phase change material. This means not only improved energy efficiency for SRP and Bashas', but significant costs savings. Bashas' can reduce how long it runs the facility's conventional electrical refrigeration system during expensive peak load hours when customer demand for energy is highest for SRP.

Ultimately, the results of the project will help assess whether users' electric bills can be adequately reduced to offset the installation costs of the thermal energy storage systems. ■

New alloys with superhero-like strength

The work of Professor Pedro Peralta has the potential to change how conflict plays out on the battlefield.

Peralta, who studies mechanical, aerospace and materials science engineering, and his research group have been working to understand the mechanical behavior of both metals and polymers when very large forces are applied very quickly. This includes ballistic impacts and explosions.

The team focuses their projects on the plastic response of these materials, such as how resistant they are to permanent deformations, as well as their resistance to failure.

"Our approach is to build an understanding of the fundamental mechanisms, which is centered on the relationship between properties and material structure," says Peralta, who is also a visiting scientist in the Materials Science and Technology Division at Los Alamos National Laboratory.

When working with metals, Peralta's group changes their structure using thermomechanical treatments, altering the grain size and performing impact testing at different velocities. In their research of polymers, the team is developing techniques to use laser-based diagnostics to measure materials' resistance to deformation at large levels of stress, among other projects.

They have also performed experiments using synchrotron X-ray sources to measure the structure of polymers as a function of applied pressure and temperature.

The research of Peralta's group can have important implications for military applications, allowing for safety improvements and enhanced weaponry. For instance, the aerospace industry benefits from this work in that they are able to improve objects' crashworthiness, while the Department of Defense can rely on these efforts to improve the design and reliability of nuclear weapons.

"The work we do has direct impact on programmatic needs to Department of Defense efforts to create better protection systems for soldiers," explains Peralta, "and for vehicles using polymer coatings, to the design of metallic armor." ■

Illustration courtesy of Purdue University.

Turning borderlands into an energy-water innovation zone

A bold proposal for the future of most of the nearly 2,000-mile stretch of land along the United States-Mexico border has been drawing attention.

The ambitious plan, called the Future Energy, Water, Industry and Education Park initiative, details concepts for developing the borderlands by bringing energy and water resources, farming, business opportunities and jobs to the region.

This innovation zone would consist of a series of industrial parks, focusing on the infrastructure development to support the testing, production and deployment of technologies and systems to meet growing needs for energy, water and food in both Mexico and the U.S.

The idea comes from an informal consortium of about 30 engineers and scientists that includes Regents Professor Ronald Adrian, a professor of mechanical and aerospace engineering who discussed the growing interest in the plan and the outlook for moving it forward.

Question: What is the primary mission of the project?

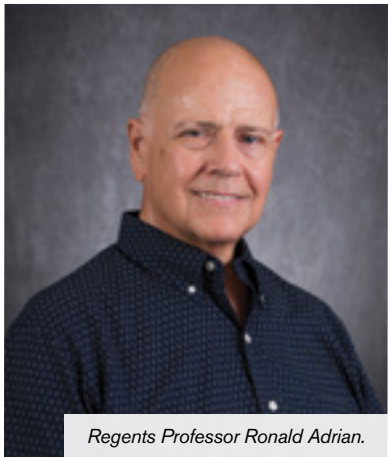
Answer: To see the U.S.-Mexico border turned into a corridor that is rich in energy and water, which will attract businesses, investment and jobs and greatly expand agricultural opportunities in the region.

Q: How could your research expertise be applied?

My major area of research is turbulent flow. Among its many facets, turbulence increases resistance to the flow of fluids through pipes. And when pumping across distances approaching 1,000 miles, the cost of overcoming the flow resistance is very high. There are a number of methods for reducing the resistance, like drag reduction, and that's where my research could help.

Q: Why focus a plan for economic growth in the border region on energy development?

A: The solar irradiance and windy conditions there provide some of the best sites in the world for producing solar energy and wind energy. Extracting energy from these sources and converting it into electricity is the modern equivalent of mining wealth out of the earth, except this wealth will not run out. ■



Regents Professor Ronald Adrian.

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Mechanical engineering
Charles Lemon Memorial Scholarship
Sun Angel Funk Scholarship

Megan **Dieu**
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Kerrigan Humanitarian Engineering Scholarship

Keith **Dixon**
Mechanical engineering
New Engineering Futures Scholarship

Kolbe **Dumas**
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Tempe Union High School District Scholarship

Justin **Edberg**
Aerospace engineering (aeronautics)
ASAP-METS Scholarship

Alan **Escobar**
Mechanical engineering
New Engineering Futures Scholarship (fall '18)

Curren **Fasching**
Mechanical engineering
New Engineering Futures Scholarship

Alexandra **Fernandez**
Mechanical engineering (energy and environment)
Michael J. Konen Engineering Scholarship

Maria **Flores**
Mechanical engineering
New Engineering Futures Scholarship

Tayler **Garcia**
Mechanical engineering
Peter Stein Measurement Engineering Scholarship

Jessica **Garcia**
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Tempe Union High School District Scholarship

Whitney **Geren**
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Stephanie A. Lahti Memorial Scholarship in Chemical Engineering

Braxton **Gibson**
Mechanical engineering
New Engineering Futures Scholarship

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Mechanical engineering
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Tempe Union High School District Scholarship

Alyson **Neaves**
Mechanical engineering
New Engineering Futures Scholarship

Parker **Olszak**
Chemical engineering
Charles Lemon Memorial Scholarship

Enoch **O'Neal**
Aerospace engineering (astronautics)
ASAP-METS Scholarship

Jerry **Orozco**
Aerospace engineering (astronautics)
ASAP-METS Scholarship

Dylan **Ottney**
Chemical engineering
Dr. Lee P. Thompson Memorial Scholarship

Molly **Pavey**
Mechanical engineering (energy and environment)
Michael J. Konen Engineering Scholarship

Andrew **Peavler**
Mechanical engineering
SMECA Scholarship

Sarah **Peterson**
Mechanical engineering
Tempe Union High School District Scholarship

Camden **Peterson**
Mechanical engineering
Tom and JoAnn Prescott New American University Scholarship

Madasyn **Pettersen**
Mechanical engineering
New Engineering Futures Scholarship

David **Phelps**
Aerospace engineering, MS
ASAP-METS Scholarship

James **Pillar**
Mechanical engineering
New Engineering Futures Scholarship

Adam **Powers**
Aerospace engineering (astronautics)
ASAP-METS Scholarship

Amos Ramirez
Mechanical engineering
SMECA Scholarship

Wei Wei **Robinson**
Aerospace engineering (aeronautics)
ASAP-METS Scholarship

Edwin **Rodriguez**
Mechanical engineering
New Engineering Futures Scholarship

Xochitl **Roman**
Mechanical engineering
New Engineering Futures Scholarship

Javier **Romero**
Mechanical engineering
Tempe Union High School District Scholarship

Alissa **Royle**
Mechanical engineering
Samuel E. Craig Memorial Scholarship

Christian **Salgado**
Mechanical engineering
New Engineering Futures Scholarship (fall '18)

Vinicio **Sanudo**
Chemical engineering
Dr. James W. Turnbow Memorial Scholarship

Alexandra **Schwindt**
Mechanical engineering
Srinivasan Iyer Family New American University Scholarship

Pearson **Schwisow**
Mechanical engineering
SMECA Scholarship and Tempe Union High School District Scholarship

Shane **Skinner**
Aerospace engineering (astronautics)
ASAP-METS Scholarship

Jacob **Smith**
Chemical engineering
DASH Scholars

Aldo **Soberon**
Aerospace engineering (aeronautics)
ASAP-METS Scholarship

Cameron **Starostecki**
Mechanical engineering (computational mechanics)
Marilyn and James A. Schmidlin New American University Scholarship

Devin **Stealy**
Mechanical engineering
New Engineering Futures Scholarship (fall '18)

Serita **Sulzman**
Chemical engineering
Materials science and engineering
Craig and Barbara Barrett Scholarship
Excellence in Engineering Leadership Scholarship

Alexandra **Talbot**
Mechanical engineering
New Engineering Futures Scholarship

Doni **Tapederi**
Mechanical engineering
Scholarship for Merit in Mechanical and Aerospace

Anfernee **Tsaipi**
Mechanical engineering
New Engineering Futures Scholarship

Matan **Utschen**
Mechanical engineering
New Engineering Futures Scholarship (fall '18)

Andres **Valenzuela**
Aerospace engineering (aeronautics)
ASAP-METS Scholarship

Bryan **Vo**
Chemical engineering
Boeing Scholarship
Dr. Lee P. Thompson Memorial Scholarship

Alicia **Vozza**
Chemical engineering
DASH Scholars

Kane **Wiley**
Chemical engineering
ASAP-METS Scholarship

Nathanael **Zuniga**
Aerospace engineering (astronautics)
ASAP-METS Scholarship

Surprise gift establishes fellowship for mechanical and aerospace students

Thanks to a recent $25,000 endowment by an anonymous Fulton Schools alum, a new fellowship has been established for mechanical and aerospace engineering students pursuing a bachelor's and master's degree in a Fulton Schools accelerated 4+1 program. Generous gifts such as these are an opportunity to give back and help students fulfill their dreams. Please consider donating to such a worthy cause.

Photo courtesy of Brigham Young University.

Photo courtesy of The University of Maryland.

PhD grads find success in academia

For many doctoral graduates of the School for Engineering of Matter, Transport and Energy, ASU is not their last academic institution. In fact, many PhD graduates have gone on to other universities to become professors and continue their research.

Each student carves their own unique path to academia.

For Stella Nickerson '16, the realization that she wanted to become a professor occurred just before she began exploring her keen interest in chemical engineering.

"I went into chemical engineering as an 18-year-old because I loved math, physics and chemistry and wanted to use these subjects together to understand the world better and to make useful things," says Nickerson, who has been a chemical engineering faculty member at Brigham Young University's Ira A. Fulton College of Engineering since 2016.

Nickerson used her time at the Fulton Schools to prepare her for the next step in her career. She focused her research on ionic liquids — room-temperature liquids made entirely of ions.

According to Nickerson, her graduate advisor and school director, Lenore Dai, played an influential role in her doctoral studies and career. "Her support and encouragement helped keep me motivated as I learned how to conduct independent research," says Nickerson.

More students decide to pursue teaching and academic research after graduation. That was the case with Joe Huang '12, who has been an assistant professor of bioengineering at the University of Maryland since 2018..

"I decided to pursue a career in academia during my PhD training after I had the opportunity to mentor several undergraduate students in the Rege Lab," says Huang. While his focus was on biochemical engineering he transitioned his research to be centered around photobiology in medicine.

Huang says that his time in the Fulton Schools allowed him to get crucial practical experience while also working in a team-based setting, something which he says has aided him in his teaching career. ■

Outstanding graduates

Spring 2018

Outstanding graduates

Hassan **Almousa**
BSE, Materials science and engineering

Jack **Miller**
BSE, Aerospace engineering

Jordan **Patterson**
BSE, Mechanical engineering

Frederick **Rivers**
BSE, Chemical engineering

Impact awards

Erin **Huber**
BSE, Materials science and engineering

Outstanding and distinguished graduates

Fall 2018

Outstanding graduates

Eric **Mannix**
BSE, Chemical engineering

Philip **Sitterle**
BSE, Chemical engineering

Philip **Thomas**
BSE, Aerospace engineering

Impact awards

Francisco **Brown-Muñoz**
MS, Chemical engineering

Katelyn **Kline**
MS, Materials science and engineering

Nathanael **Zuniga**
BSE, Mechanical engineering

Dean's Dissertation Award

Karthik **Subramaniam Pushpavanam**
PhD, Chemical engineering

Spring 2019

Outstanding graduates

Marielle **Debeurre**
BSE, Mechanical engineering

Michaela Lynn **Dye**
BSE, Mechanical engineering

Dylan **Ottney**
BSE, Aerospace engineering

Benjamin **Shindel**
BSE, Materials science and engineering

Zachary **Tronstad**
BSE, Chemical engineering

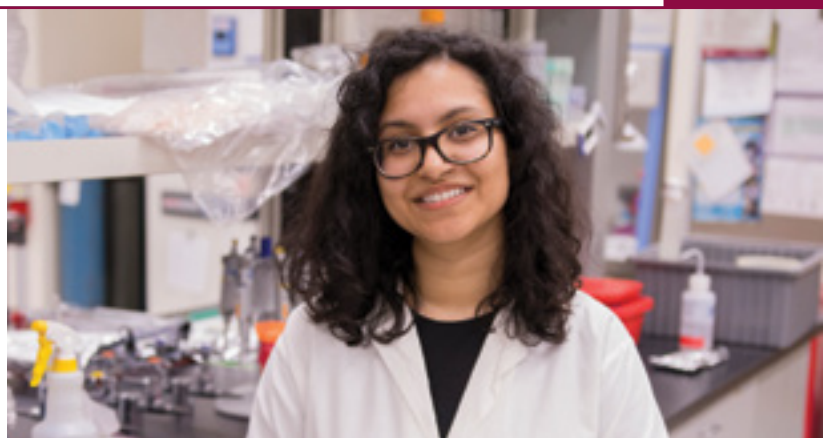
Impact awards

Claire **Jordan**
BSE, Mechanical engineering

Philip **Mulford**
BSE, Aerospace engineering

Emily Rose **Nugent**
BSE, Chemical engineering

Multidisciplinary student researcher aspires to solve health challenges



Ava Karanjia was eight years old when she was diagnosed with an unknown illness and spent countless hours in doctors' offices being handed from one specialist to another.

Though the disease directly affected her, Karanjia also saw the indirect effects it had on her family. And as she grew older, she came to understand how illness can affect entire communities.

Karanjia's experience inspired her to pursue a career where she could help communities overcome health challenges by tackling them at the molecular level. Taking a multidisciplinary approach, she is double-majoring in chemical engineering and molecular biosciences and biotechnology. She believes her majors have helped her see how her chemical engineering courses apply to biology, particularly disease-causing microbes.

"Engineering provides you with problem-solving abilities and the engineering mindset that helps you go through things very methodically," she explains.

Karanjia has quickly distinguished herself as a budding researcher. In two consecutive weekends of her junior year, she presented her research in poster presentation competitions at the Society of Women Engineers WE18 Conference and the American Institute of Chemical Engineers Annual Student Conference. To her surprise, she won first-place prizes in both competitions. Karanjia will go on to pursue her doctorate in chemical engineering as a National Science Foundation Research Fellow.

Along with being an accomplished researcher, Karanjia takes many opportunities to help her peers be successful. She has led K-12 outreach efforts with Fulton Ambassadors, a group that shows prospective students around the Fulton Schools and gives classroom presentations. She also welcomes first-year students each summer at the E2 welcome event as a camp counselor. At the Tooker House residence hall, Karanjia serves as a peer mentor helping connect students with faculty members to take advantage of research opportunities. ■

NSF Graduate Research Fellow combats cancer with math

Brendon K. Colbert has been interested in the human immune system ever since his youngest brother was diagnosed with multiple food allergies. That fueled his desire to study the intersection of biological sciences and control systems engineering.

As one of 2,000 students selected as a National Science Foundation Graduate Research Fellow in 2018, Colbert is continuing his research as a doctoral student in mechanical engineering at ASU. He'll explore how to model and control dynamic systems to behave in medically beneficial ways.

The main focus of his research is to mathematically determine how the immune system interacts with cancer, and develop a treatment strategy to deliver the appropriate medications to patients so their immune systems can kill cancer cells.

"The innovative part of this research is we're trying to develop treatment protocols based upon the state of the patient's own immune system," said Colbert.

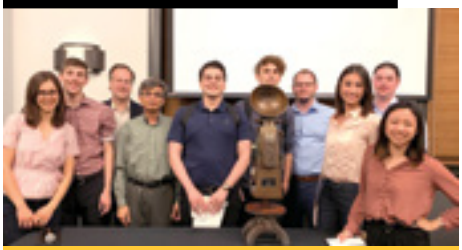
Being awarded the NSF fellowship means a great deal to Colbert. The funding it provides will allow him to focus exclusively on his research for the next three years.

His research proposal likely stood out among more than 12,000 fellowship applicants because it demonstrated the potential of his work to advance knowledge at the intersection of biology and control systems engineering.

"I'm honored to have received the award," said Colbert. "I'm also proud of how I've grown as a researcher these past few years and that I was able to put together a proposal that was accepted."

After completing his doctoral studies, Colbert intends to remain in academia or a related field of research with the long-term goal of becoming a professor. ■

ASU sweeps the podium at 2019 Materials Bowl



Members of the winning teams and mentors (from left to right) Pranvera Kolari, Benjamin Shindel, President's Professor James Adams, Senior Research Specialist Shahriar Anwar, Austin Bennett, Brandon Houck, Andrew Black, Samantha Hom, Devin Hardy and Ariana Tse pose with the Materials Territorial Trophy after winning the three top prizes at the 2019 Materials Bowl. Photograph courtesy of Shahriar Anwar.

Ten Fulton Schools teams competed in the 16th annual Materials Bowl in Tempe, Arizona. The Materials Bowl is a senior capstone project and poster competition for Arizona materials science and engineering students sponsored by the ASM International Phoenix Chapter. A jury of four industry professionals award the three top-ranked projects, with the winning team receiving the Materials Territorial Trophy.

This year, ASU teams took all three winning prizes. The first place winning team included Andrew Black, Devin Hardy, Samantha Hom and Ariana Tse. They took home the top prize of $1,000 and claimed the Materials Territorial Trophy for their project.

In the project, mentored by Honeywell, the team designed a heat treatment for additively manufactured AM355 stainless steel — a staple in the aerospace industry. They reduced processing time and costs while maintaining the material's desired properties.

The team of Austin Bennett and Brandon Houck earned the second-place prize of $700 with their project, "Design and Process Development of Natural Fiber Reinforced Bio-Composites."

The duo developed a method of generating and testing a microbial harvested biocomposite that could be used as a replacement for natural leather made from animal hide.

The third place team featured Pranvera Kolari and Benjamin Shindel, who won a $300 prize for their project, "ConCreate: Design of an Additively Manufacturable and Sustainable Concrete Mix."

The team produced additively manufactured concrete that incorporated waste glass. They claimed that their product would reduce both global carbon dioxide emissions and improve glass recycling while speeding up building construction using additive manufacturing techniques. ■

Members of team ASU: Don Wood, Nick Kolesov, Evan Draganchuk, Dan Kosednar and Luke Burgett prepare for competition. Photo courtesy of Timothy Takashi.

ASU students take their aircraft design skills to the sky

The 38th American Institute of Aeronautics and Astronautics Design/Build/Fly Competition Flyoff challenged 785 students from six continents to perform aircraft carrier operations in the desert.

In the competition, undergraduate and graduate aerospace engineering students create small unmanned, electric, radio-controlled aircraft that meet strict requirements, develop a report about their design and complete flight missions on a new theme each year.

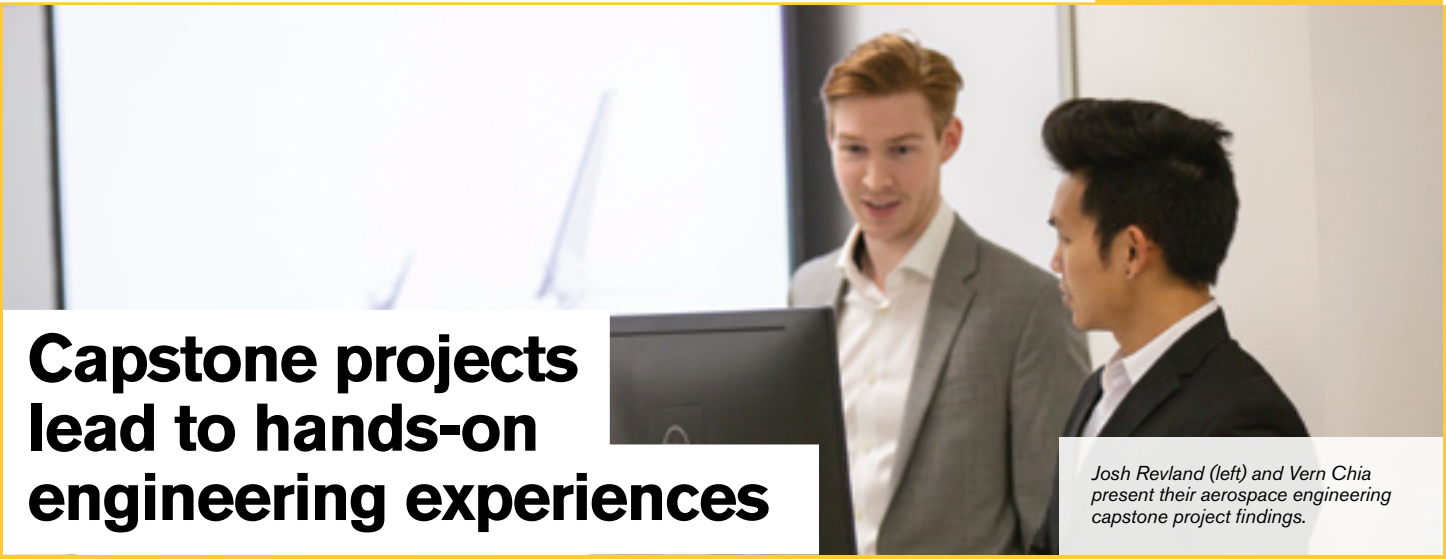
A team of ASU engineering students was one of 77 teams out of 142 total entries that participated in the final flyoff round of the competition.

The team, led by undergraduate aerospace engineering student Nikolay Kolesov along with undergraduate aeronautical management technology student Evan Draganchuk and undergraduate aerospace engineering student Daniel Kosednar, successfully completed four simulated aircraft carrier ground and flight activities and placed 17th overall.

Kolesov, Draganchuk and Kosednar developed the aircraft with other members of the Air Devils student organization under advisor Timothy Takahashi, an aerospace engineering professor of practice.

"AIAA Design/Build/Fly is a great experience because students have to learn how to design and fabricate hardware that works in the real world," Takahashi says, "which means it has to reliably fly in real weather."

Landing among the top 20 teams was an accomplishment, but next year, the team will aim to earn a top 10 spot for the first time. ■



Capstone projects lead to hands-on engineering experiences

Josh Revland (left) and Vern Chia present their aerospace engineering capstone project findings.

For students gearing up for the next step in their careers, the School for Engineering of Matter, Transport and Energy offers the opportunity to get invaluable practical experience before graduation. Students can work on capstone projects that allow them to spend their last year gaining hands-on experience as engineers.

Whether students are designing and developing a portable power generation device or spending their semester building a corrosion detecting robot, the capstone program gives these students both a chance to gain real world experience and work on solutions that can potentially benefit the world.

"For students who are at the end of college, the capstone is a combination of both skill and what they have studied. It is their first step to act as an engineer," says Professor of Practice Abdelrahman N. Shuaib, who serves as the main faculty advisor for the school's capstone program.

Capstone participants work in teams of six or seven as they try to address a specific need in the world and conceptualize an invention to fix that problem.

An integral part of the program is that students follow the integrated product development system approach when working on their projects. This structure allows the students to use a real-world approach to product design — from selecting a concept to understanding the customer needs to conceiving a design and ultimately developing a product.

According to Shuaib, the capstone program also tries to emphasize other components of what students can expect as they transition into their professional careers.

"We want them to have a designer's mindset and think about cost, sustainability, assembly and liability, because for engineers, we are liable for anything we make," says Shuaib, who noted that there were approximately 200 participants in the capstone program during the 2018-2019 academic year.

One of the more unique aspects of the capstone program is that it allows students to potentially team up with an outside business or organization, providing a collaboration that gives unparalleled guidance and the opportunity for additional funding.

In 2018, Phoenix Children's Hospital partnered with two different capstone teams on projects developed to help countless people. In one project, students set out to find a way to help children with traumatic brain injuries who, because they are often bedridden, are prone to developing pressure ulcers. To assuage this issue, the students conceived a pressure redistribution bed. The bed is designed to measure pressure and then redistribute that pressure in order to minimize the risk of developing these ulcers.

In another project with the hospital, a team focused its efforts on improving the rehabilitation of children with traumatic brain injuries. To do this, they created what they called the VR 360 rehabilitation platform.

Since virtual reality games can distract patients from the pain of physical therapy, the students' invention simulates a walking motion while providing a controller to incorporate virtual reality games. This allows patients to move their limbs as they recover, while engaging in games to help them not focus on their pain.

The hospital wasn't the only external collaborator partner for students. Students in the program also worked with the city of Chandler, Cummins Jamestown Heavy Duty Engineering and Northrop Grumman, one of the world's largest defense technology companies.

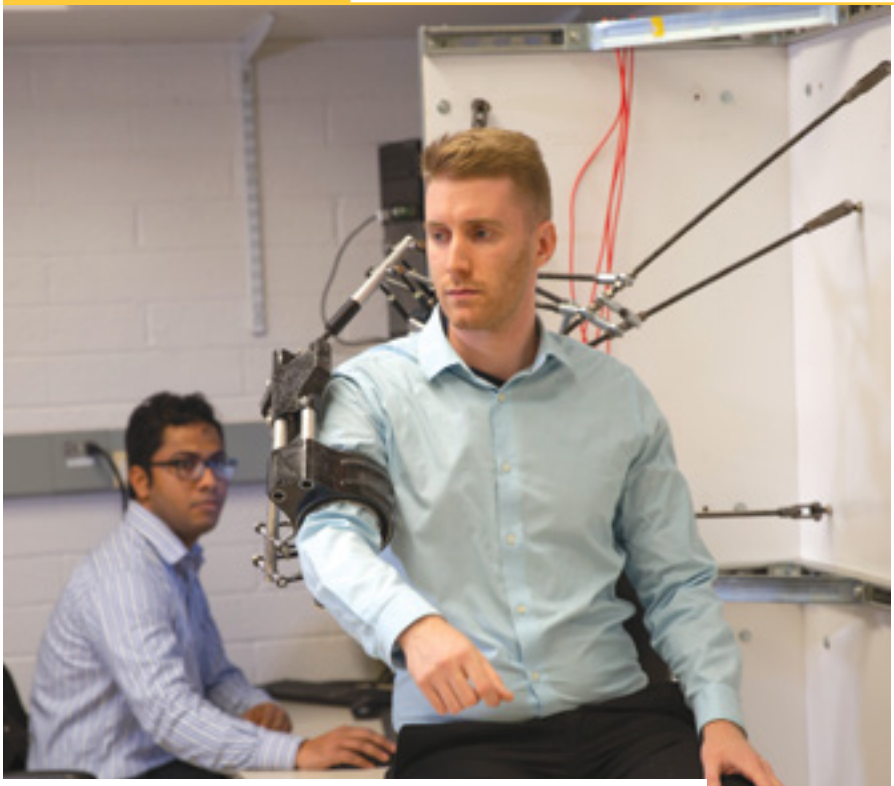
Last year, a student team working with Northrop Grumman received a $5,000 budget from the company, along with additional funding from the school to complete their capstone project. Their project involved both designing and manufacturing a cart that was specifically designed to rotate a production rocket module around x, y and z axes. Then Northrop Grumman tested the capabilities of the sensors on the module to detect rotational displacement.

When the team designed their invention, they were aiming to create something that was both mobile and lightweight. To achieve this goal, they used extruded aluminum for the frame and 6061-T6 aluminum plates for other parts of the cart. Once complete, the cart that was able to support up to 400 pounds. The team then manufactured, tested and developed a scaled-down prototype that was validated against the voice of customer requirements.

Over the years, students in the capstone program have been able to work with some of the leading companies and organizations in their respective industries, including Raytheon, Bing Golf and Southwest Solar Technology.

Shuaib says these diverse partnerships provide an additional benefit to students as they prepare them for the next step in their engineering careers.

"They help them identify the scope of issues and it gives them a real-life situation to work with," he says. ■



New master's program focuses on robotics, autonomous systems

The age of robotics and autonomous systems has arrived.

These emerging technologies have the potential to increase the efficiency, productivity and safety of humans through manufacturing, transportation, aerospace, defense, health care and many other critical fields.

Within the last five years, these fields have seen tremendous growth. Despite the expansion, industry and academia are greatly in need of qualified personnel to continue pursuing advancements in robotics and autonomous systems.

As a result, the School for Engineering of Matter, Transport and Energy, in collaboration with three other Fulton Schools, have formed a new master's program in robotics and autonomous systems designed to train the next generation of robotics researchers with multidisciplinary knowledge in artificial intelligence, computer science, machine learning and a variety of other advanced topics.

PhD students Justin Hunt (right) and Varun Nalam conduct research in Assistant Professor Hyunglae Lee's Neuromuscular Control and Human Robotics Laboratory.

The program, launched in early 2019, is among fewer than 10 in the country specializing in the field of robotics and autonomous systems. Students gain in-depth theoretical knowledge and practical experience working across engineering specialties to develop and control robotic platforms and autonomous systems.

Students also have the opportunity to work with leading researchers in more than 25 world-class robotics labs in areas fit for their unique research interests, such as autonomous vehicles, biologically inspired mechatronic technologies, household robotics, multi-agent systems and more. Many of the robotics labs also have strong ties to industry partners and collaborators, which enable graduate students to interact with and present their ideas to industry representatives. ■

Coming Soon: Master of Science in modern energy production and sustainable use

At a time of increased urban development and expansion, the needs of modern cities are vastly different than they were five or even ten years ago.

Today's engineers are already forced to re-visualize cityscapes — tomorrow's engineers will require a highly nuanced set of interdisciplinary skills that touch a greater variety of industries and methodologies. In order to generate the human capital needed to solve the grand challenges surrounding the future of energy production, storage and sustainability, new educational opportunities must be created.

Enter the Master of Science in modern energy production and sustainable use. The program will combine technical knowledge in science and engineering with interdisciplinary thinking, giving students real-world knowledge of complex energy systems and their applications. Special emphasis will be given to rethinking how energy and manufactured products are created and consumed.

Students will be able to optionally use six credits to explore non-technical topics, such as energy policy and energy management. Graduates of the program will be able to demonstrate their deep understanding of renewable energy production and storage, efficient manufacturing techniques and sustainable transportation, and can expect to find employment in environmental, chemical, mechanical and materials science engineering. ■

Degree programs

Aerospace engineering

Degrees offered: BSE, MS, PhD

The aerospace engineering curriculum focuses on technological areas critical to the design and development of aerospace vehicles and systems. The aeronautics concentration emphasizes engineering and the design of aircraft, helicopters, missiles and other vehicles that fly through the atmosphere.

Chemical engineering

Degrees offered: BSE, MS, PhD

The undergraduate and graduate programs in chemical engineering focus on the study of matter and energy and their transformation into forms useful for society. Chemical engineers use chemistry, physics, mathematics and engineering to convert raw materials or chemicals into more useful or valuable forms. They develop and produce a diverse range of products, including high-performance materials for aerospace, automotive, biomedical, electronic and environmental applications.

Materials science and engineering

Degrees offered: BSE, MS, PhD

The Master of Science in materials science and engineering is available on the Tempe campus or online through ASU Online.

Materials science and engineering mixes chemistry and physics to understand the structure and properties of materials that comprise the world. Materials engineers are responsible for designing and developing advanced materials for a wide variety of engineering applications. Students learn about the design of materials and how to process them to improve their structure, properties and performance.

Mechanical engineering

Degrees offered: BSE, MS, PhD

Mechanical engineering encompasses a vast multitude of applications from the efficient conversion and transmission of energy and power to the design and implementation of nanoscale devices. Mechanical engineers design and develop products in all sectors of society, and they collaborate with other engineers and designers to produce systems and components for a large variety of applications.

Solar energy engineering and commercialization

Degrees offered: PSM

The professional science master's program in solar energy engineering and commercialization is a relatively new type of graduate program aimed at students who desire both technical and nontechnical aspects to their graduate education. The program offers advanced, interdisciplinary education in solar energy technologies along with the business/policy/nontechnical aspects necessary for successful development and commercialization.

ASU professor modernizes lectures with formative feedback

Stephen Krause has spent nearly 20 years tailoring his teaching style to fit his students' needs.

In 2018, the materials science and engineering professor was awarded the Michael Ashby Outstanding Materials Educator Award by the Materials Division of American Society of Engineering Education for his impact in shaping how students are taught.

It all began more than 20 years ago when Krause began collecting short, written comments from his students at the end of every class responding to the questions, "What was the muddiest point of the lecture today?" and "What was the most interesting thing you learned today?" The results surprised him. Armed with this information, he discovered students' misconceptions as well as his own instructor "blind spots," what he refers to as faulty assumptions about students' difficulties.

The students' retention and grades improved as his teaching evolved and he continued incorporating formative feedback. He then added engagement activities to his class time for added participation.

From there, Krause shared this teaching method on a broader scale beyond materials science, first to a few faculty members at other universities, then with his colleagues at ASU. Between 2007 and 2015, the National Science Foundation has awarded three grants for projects Krause led to expand the engagement and feedback system. The third grant awarded, worth $1.5 million, allowed him to expand the methodology across disciplines.

The Michael Ashby Outstanding Materials Educator Award recognizes not only Krause's research publications and conference contributions within the materials science community but also his transdisciplinary collaboration to shape the way students are taught. At the American Society of Engineering Education conference, he presented a talk about his research and experience with formative feedback. ■

Thank you for being the foundation of all of our success.

Shahriar **Anwar**
Research Specialist

Ebony **Baker**
Academic Success Specialist

Susan **Baldi**
Business Operations Specialist Senior
IMPACT Award nominee '18 '19

Robert **Booher**
Manager of IT and Infrastructure

Andrea **Brown**
Academic Success Specialist

Leonard **Bucholz**
Shop Manager

Hannah **Carter**
Academic Success Specialist

Jessica **Caruthers**
Academic Success Coordinator
IMPACT Award winner '19

Alejandro **Chiquete**
System Support Analyst

Danielle **Daley**
Research Advancement Administrator
IMPACT Award nominee '19

Mark **Frazier**
Systems Support Specialist

Greg **Grassl**
Business Operations Specialist

Kelley **Hall**
Research Advancement Manager
IMPACT Award nominee '19

Geoffrey **Hamilton**
Academic Success Specialist
IMPACT Award nominee '19

David **Jackson**
Academic Success Specialist

Jarrett **Johnson**
Business Operations Specialist
IMPACT Award nominee '18

Mike **Joslin**
Research Advancement Administrator Senior

Stephanie **Kennedy**
Administrative Assistant

Dallas **Kingsbury**
Laboratory Manager

Jonathan **Kirkland**
Systems Support Analyst Senior

Miriah **Kleijn**
Research Advancement Administrator
IMPACT Award nominee '19

Cynthia **Kowite**
Academic Success Specialist

Mia **Kroeger**
Assistant Director Academic Services

Tiffany **Le**
Student Services Coordinator Associate
IMPACT Award nominee '19

Gayla **Livengood**
Department Human Resources Specialist

Andre **Magdelano**
Machinist Senior

Miranda **Milovich**
Academic Success Specialist
IMPACT Award nominee '19

Amy **Newberg**
Academic Success Specialist

Tae **O'Connor**
Business Operations Specialist

Mariah **Pacey**
Business Operations Manager Senior
IMPACT Award nominee '18
IMPACT Award winner '19

Fred **Pena**
Laboratory Manager

Shannon **Pete**
Business Operations Specialist Senior

Lacy **Quail**
Academic Success Specialist

Christine **Quintero**
Academic Success Specialist

Samantha **Ramirez**
Department Human Resources Specialist Senior
IMPACT Award nominee '19

Shabnam **Rezai**
Academic Success Specialist

Cara **Rickard**
Executive Administrative Support Specialist

Bruce **Steele**
Laboratory Manager

Molly **Swindler**
Research Advancement Specialist
IMPACT Award nominee '19

Albert **Thompson III**
Systems Support Analyst Senior
IMPACT Award nominee '18

Farah **Usman**
Business Operations Specialist

Dave **Vega**
Academic Success Specialist

Sarah **Wentz**
Academic Success Specialist

Tiffany **Wingerson**
Manager-Graduate Advising
IMPACT Award nominee '19

Jessica Caruthers honored for mentoring achievements

Jessica Caruthers, an academic success coordinator, received a 2019 Impact Award for her achievement in SEMTE, specifically for her commitment to the undergraduate advising team. Caruthers demonstrated her aptitude for mentorship by immediately jumping in to support advising staff in the midst of a busy orientation season. This was after having recently returned from maternity leave. Her leadership contributed significantly to the 100% staff retention rate that year. She demonstrated high achievement outside SEMTE as well, receiving multiple professional certifications and engaging within the ASU network. ■

Mariah Pacey recognized for staffing innovations

In her role as Business Operations Manager Senior, **Mariah Pacey** often deals with complex issues within SEMTE. Pacey constantly strives to find new and improved ways to solve problems, which is a cornerstone of innovation. For this reason she received the 2019 Impact Award for innovation.

Under her direction, SEMTE has successfully implemented a staff satisfaction survey, flexible schedule program and introduced a one-day-per-week telecommuting option. Additionally, she augmented onboarding practices for new staff members, which involve direct interviews with school leadership following the new employee's initial adjustment period. ■

SEMTE staff awards

Every year, SEMTE recognizes the outstanding individuals who ensure the advancement of our school. It is through their valuable efforts that we achieve new heights.

Staff Excellence Award

Danielle Daley '19
Jarrett Johnson '19
Tiffany Le '18
Andre Magdelano '18
Fred Pena '18
Cara Rickard '18

Staff Rising Star Award

Alejandro Chiquete '19

Ira A. Fulton Schools of Engineering
Arizona State University

School for Engineering of Matter, Transport and Energy
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semte.engineering.asu.edu