AUTUMN 2018

MESSENGER

MECHANICAL ENGINEERING | UNIVERSITY *of* WASHINGTON

How mechanical engineers are shaping the future of data science *Pages 4-5*

Shaping the future through ME

Mechanical engineering is an ever-evolving discipline, and I'm thrilled to share with you in this issue some exciting new projects our faculty and students are pursuing. Whether they're developing algorithms to improve airplane design, investigating new materials to advance clean energy, or creating technologies to better treat cancer, our researchers are truly shaping the future.

Today's ME students are tomorrow's engineering leaders, and UW ME is committed to preparing them to tackle our world's grand challenges. Through education, research and innovation across fields as diverse as data science, health care, alternative energy and manufacturing, we strive to make the world a better place. I hope you enjoy reading about some of our recent endeavors in the following pages.

Per Reinhall
Mechanical Engineering Chair

FACULTY NEWS

New faculty, recent promotions and retirements

Lucas Meza Ph.D., California Institute of Technology, joins us from the University of Cambridge where he was a research associate studying the micromechanical behavior of 3D woven fiber composites. Previously, he was at the California Institute of Technology, where he worked on ultralight, hierarchical metamaterials composed of nanoscale ceramics. As an ME assistant professor, he will investigate the connection between small-scale material phenomena and large-scale mechanical properties in natural and engineered materials to develop new materials with novel mechanical properties.

Jeffrey Lipton Ph.D., Cornell University, is completing a postdoctoral fellowship at the Massachusetts Institute of Technology and will join our faculty as an assistant professor in Summer 2019. In his research, he uses robots to create novel materials and manufacturing methods with the capacity to expand robotic capabilities. At Cornell, Lipton led the Fab@Home Lab, which makes open-source 3D printer kits for bio-research labs. He co-founded two companies: GEMS Boxes, a platform for distributing opioid antidotes, and Seraph Robotics, which commercialized Fab@Home technology.

Soyoung Kang Ph.D., University of Washington, joins us as a lecturer for Engineering Innovation in Health, ME's program that promotes collaboration between engineering and the health sciences to develop solutions to pressing health challenges. An ME alumna, Kang's research focuses on developing an optical molecular imaging system to enable early cancer detection and guide the surgical resection of tumors. She has worked for several European health-care institutes, including Philips Research in The Netherlands and IMTEK and IBA in Germany.

We are also pleased to announce **Alberto Aliseda's** promotion to full professor from associate professor and **Steve Brunton's** and **Kat Steele's** promotions to associate professors from assistant professors.

Finally, join us in congratulating professors **Martin Berg, James Riley** and **Mark Tuttle** on their retirement this year. Professors Riley and Tuttle will continue their research in the department.

ELEMENTARY ENGINEERS

Fifth graders from Marysville, Washington, started this school year as engineers, thanks to ME professor Brian Fabien and his students.

For a week in September, the UW campus buzzed with the energy of 55 fifth grade mechanical engineers, data engineers and materials engineers. The students, from the Marysville Cooperative Education Partnership at Marshall Elementary, worked in small teams to design, build and test gravity cars — hand-built cruisers that use weight and gravity to move.

The fifth graders were at the UW as part of Engineering Week, a K-12 teacher-training program that helps teachers learn how to introduce engineering into their classes.

"Although engineering is a key part of K-12 STEM (science, technology, engineering and math) requirements, in Washington state there aren't many opportunities for teachers to learn how to teach it," said College of Engineering associate dean for academic affairs and ME professor Brian Fabien. Fabien developed the program three years ago with support from the National Science Foundation.

At first, the program invited only teachers to campus. But after discussions with participants, Fabien decided to invite students and parents so the UW could model how to introduce basic engineering principles to kids. It also presented an opportunity to acquaint students and their parents with the university environment.The fifth graders spent the week learning about engineering and living in UW residence halls. In the mornings, they explored basic engineering concepts through activities related to their gravity cars. In the afternoons, they toured engineering labs and met with engineering student clubs. To help facilitate the activities, Fabien enlisted ME students and members of the UW's EcoCAR team.

"Gravity cars are a great tool to introduce engineering concepts and processes," said ME sophomore Livia Anderson, who serves as the propulsion systems integration lead this year for EcoCAR. "They are small cruisers that involve simple machines that are relatively easy to explain and play with. The fun starts when you put them together — things can get pretty complex."

ME junior Nikolas Johnson appreciated the opportunity to practice teaching basic engineering skills through Engineering Week.

"It challenged us engineering students to pare down the technical details related to engineering and make them accessible and engaging," he said. "You might think you understand a concept like acceleration, or know how to run a 3D printer, but then you have to explain it at a level that fifth graders will understand."

In addition to helping teachers, Fabien hopes that the experience encourages the fifth graders to envision themselves as future engineers.

"I look forward to seeing them on the UW campus one day soon, in our classrooms and makerspaces, and leading our student clubs," he said.

During Engineering Week, fifth graders designed and constructed gravity cars — hand-built cruisers that use weight and gravity to move.

DATA DRIVEN

ME associate professor Steve Brunton discusses his dynamical systems research and the crucial role that mechanical engineers play in shaping the future of data science.

Data science offers a new frontier of exploration, and with decades of experience in systems, sensors, controls and fluids research, mechanical engineers are helping to shape the field's future.

ME associate professor Steve Brunton is one of these leading researchers. Currently a data science fellow at the UW's eScience Institute, he is involved in cutting-edge work that applies data science, machine learning and dynamical systems to classical engineering problems in fluid mechanics and airplane design. We recently sat down with Brunton to examine data science through a mechanical engineering lens and discuss his research, including an unexpected creature at the center of it: the moth.

How are data science and big data related?

Data science is an umbrella term for acquiring, managing, cleaning, formatting, storing and interpreting data. Data scientists extract information and reveal patterns. Science has always been driven by data; however, data science has become more popular due in part to the rapid growth of "big data" — complex data too large to be easily stored or analyzed in traditional systems. It's all around us; sources include email, social media posts, digital media files, mobile phones, medical records, financial records and increasingly engineering systems, such as aircraft and factories. We use data science as a tool to manage and assess it.

How so?

Mostly through machine learning and data analysis. Once a complex data set is collected, we apply machine learning, which refers to the process of building models to manage and describe data and automate its analysis. We develop and use algorithms to identify patterns and insights. Then we extract information, form conclusions and consider future applications.

Why are mechanical engineers important to data science?

Machine learning relies on computer science, statistics and applied mathematics. Because of their diverse background, mechanical engineers work effectively across these areas. The future of machine learning — and data science — will involve a deeper connection with physics; the more we want to apply machine learning to real-world problems, the more we need people who know how to work with nonlinear and dynamical systems, who can work in chaotic environments with ever-changing factors. For example, how do we account for turbulence in airplane design? How do we better manage the impact of injury in a human body? How do we collect and convert energy from dynamic sources like the sun, wind and waves? Mechanical engineers have long been working in such areas; because of our experience with systems, sensors, controls and fluids, we have much to offer.

How did you become interested in data science?

My background is in fluid mechanics and dynamics, and I'm particularly interested in deepening the relationship between physics and machine learning. There has been a bit of a divide between the computer science and statistics elements of machine learning, but as the technology grows, so does the need to unite them. Especially if we want to apply machine learning to systems that aren't linear, clean or predictable — most real-world systems. To advance machine learning, we will need a "new physics" for such systems, and that's exciting.

Currently, we can look to nature to know that this is possible. Biological systems often don't operate under the assumptions required for big data or deep learning; they work with limited and incomplete data. For example, a moth flies without velocity field measurements, a Ph.D. in fluid mechanics or knowledge of governing equations. Instead, it relies on a few well-placed sensors and a robust neural control system. This system provides proof-by-existence in advanced capabilities based on limited data.

You mentioned a moth. How has it informed your research?

I explore ways to better incorporate sensor placement to improve aircraft manufacturing — not just what a sensor can measure and how it works, but where and how it should be affixed. Moths provide a great example of biological sensor placement; they have a series of biosensors within their wings that inform flight actions.

In complex neural systems, there are many biosensor patterns but only a few that dominate. My collaborators Bing Brunton, Nathan Kutz, Tom Daniel, Josh Proctor and I have created algorithms based on the moth's sparse sensing. Tom got us interested in the moth, and Nathan introduced us to sparse sensing. Krithika Manohar, a former Ph.D. student of Nathan and mine, translated these algorithms to The Boeing Company to improve assembly rates on several aircraft lines.

Which industries are interested in data science?

Steve Brunton

Any industry that has lots of data! The tech and biomedical industries are at the forefront of this field. And the marketing and retail industries have long been key players. Manufacturing is increasing its investment in data science, too. Companies like Boeing and GE are leading efforts on this front.

For data to be valuable, it needs to be collected and analyzed. Companies that are making the biggest strides are those that are willing to invest in analytics. Over the years many have put resources toward data collection and storage, but few have invested in analyzing it. Data doesn't do much good if there's no means of interpreting and learning from it.

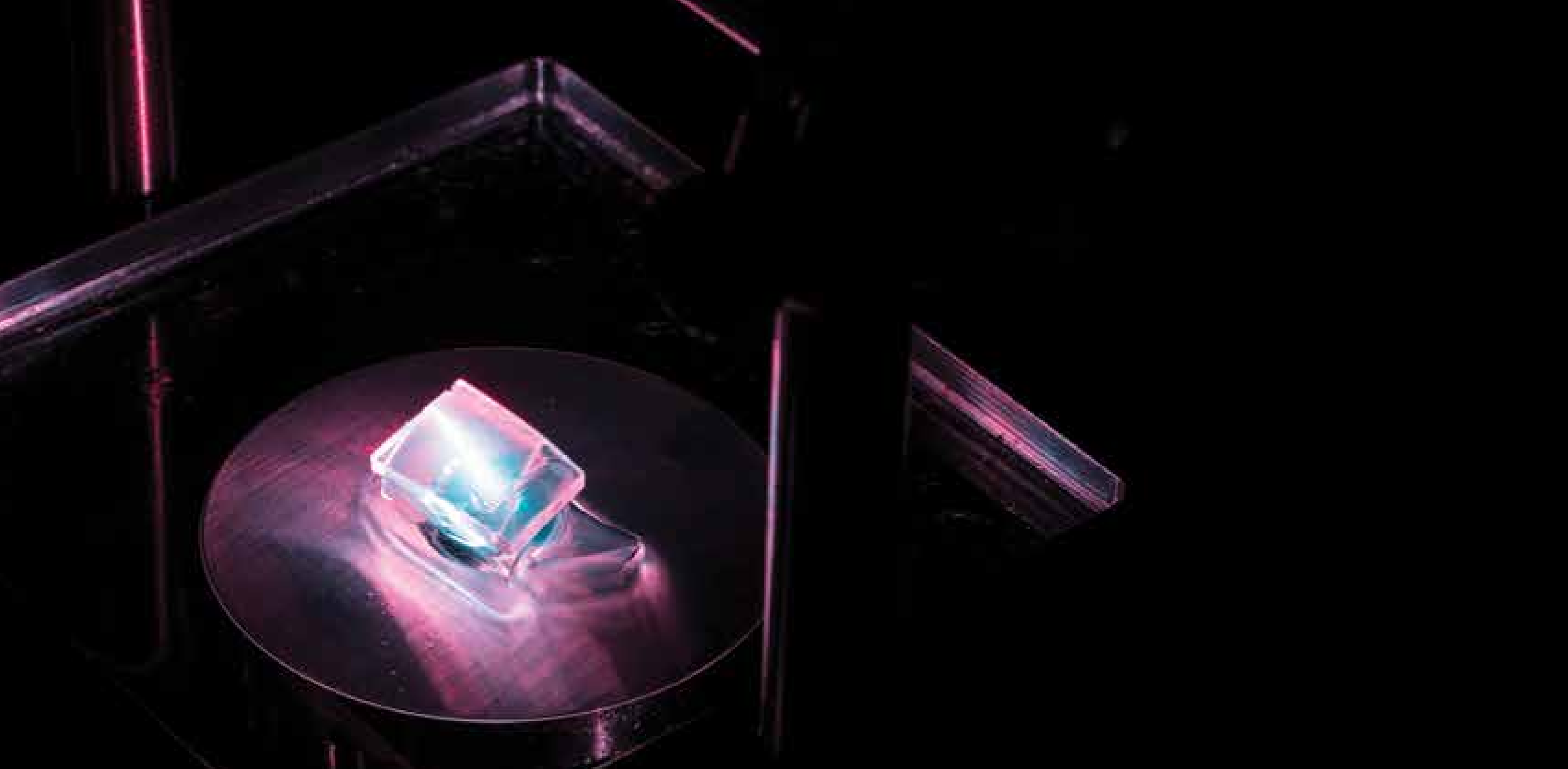
What advice do you have for ME students interested in data science?

Learn a programming language, become really good at math, and find a data project that you can delve into, apply your skills and get a sense of the research. It's important to learn machine learning algorithms, but it's just as important to dive in and experiment with data.

"My background is in fluid mechanics and dynamics, and I'm particularly interested in deepening the relationship between physics and machine learning."

- Steve Brunton
ME associate professor

Keep up with Brunton and his team at eigensteve.com.



FIGHTING CANCER WITH MECHANICAL ENGINEERING

ME faculty are developing devices and technologies to better detect and treat cancer.

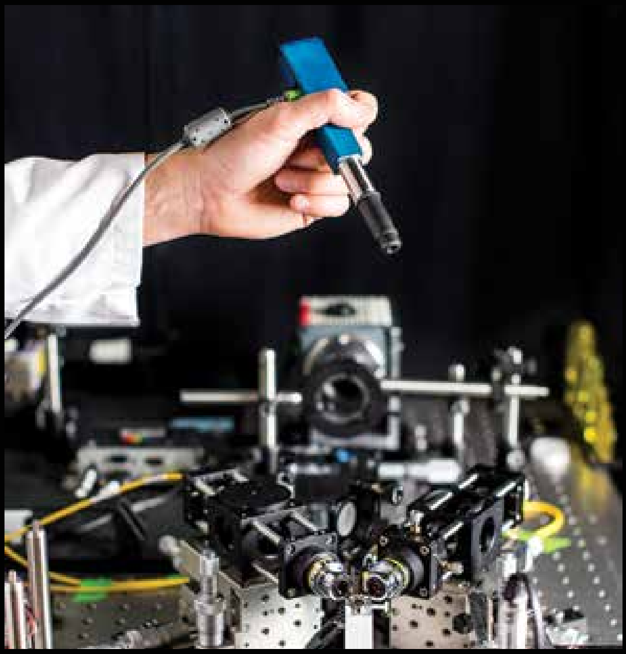
Cancer affects millions of people and is among the leading causes of death worldwide. There are about 15.5 million cancer survivors in the U.S. today, and an estimated 1,735,350 new cases of cancer will be diagnosed in the U.S. this year, according to the National Cancer Institute.

From advancements in imaging technologies to innovations in cell therapy and nanorobotics, our faculty are creating better means of understanding, detecting and treating the disease.

Improving microscope technologies

Pathologists play a critical role in diagnosing and treating cancer patients by imaging biopsies and surgical excisions at the microscopic scale. Unfortunately, the process of imaging tissues under a microscope — known as histology — is based on technologies that are slow and outdated, which can lead to non-optimal treatment of cancer patients.

Rather than cutting tissues into thin 2D sections that are laboriously mounted on glass slides and imaged with analog microscopes over the course of hours or days, ME associate professor Jonathan Liu is developing both miniature handheld microscopes that can zoom in on a patient's cells non-invasively in real time — for example, to



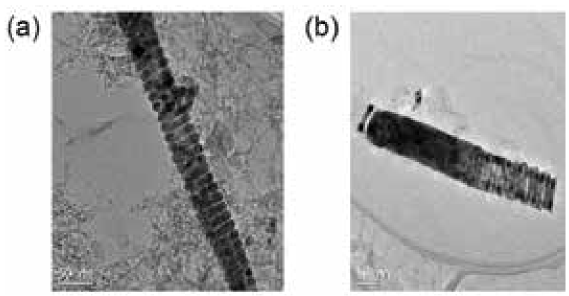
To create a handheld microscope, Jonathan Liu's team miniaturized the larger microscope prototype seen on the table into a device roughly the size of a pen.

guide a tumor-resection procedure. He's also developing benchtop microscopes that can image surgical specimens and biopsies comprehensively in 3D without having to cut tissues. This latter technology, known as "open-top light-sheet microscopy," has the potential to usher histology into the big-data digital era, much like how digital CT X-ray and MRI have revolutionized the field of radiology.

Liu and his pathology collaborators are starting a company to commercialize this technology and are refining these techniques and demonstrating their clinical value through studies funded by the National Institutes of Health and the U.S. Department of Defense.

Applying nanorobotics to cancer diagnosis and treatment

Working closely with researchers in radiology and electrical and computer engineering, Nabtesco Endowed Professor Minoru Taya is investigating ways to synthesize mechanically flexible nanohelices — key building blocks for biological materials, such as proteins and DNA — for cancer diagnosis and treatment. The team is creating these synthetic structures with magnetically active material and combining them with nanorods and nanohelices to form nanorobots.

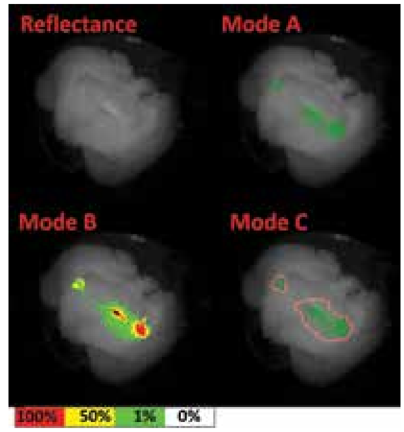


A nanohelix (left) is combined with a nanorod to create nanorobot (right).

Once these nanorobots are deployed in the body and guided to a cancer site via a magnetic field within an MRI chamber, another magnetic field can be applied to cause them to vibrate. The team hopes that this mechanical stress will damage the surrounding cancerous cells to the point of apoptosis or necrosis — cell death. This technology could prove especially beneficial in fighting difficult-to-treat cancers. Taya's group will work with UW Medicine in a clinical trial to test the efficacy of nanorobots in treatment. His work is supported by a $1.5 million National Robotics Initiative grant from the National Science Foundation.

Innovating imaging for early detection

Early detection is critical for turning cancer into a curable disease. Before the cancer has time to grow into a tumor, cancer cells express molecular markers that can be labeled with fluorescence. Optical imaging is the one non-invasive medical imaging method that can detect at the cellular level, but it is restricted in penetration depth in tissue. ME research professor Eric Seibel and bioengineering doctoral student Yang Jiang have developed the smallest optical endoscope that can image the fluorescent-dyed cancer cells as well as healthy tissue in reflectance. This multimodal (reflectance/florescence) scanning fiber endoscope has a tip the size of a grain of rice and a long flexible shaft that can be wrapped around a finger.



A conceptual scanning fiber endoscope clinical interface with two displays. The top right is a full-color reflectance image shown in grayscale. A, B and C are modes that highlight cancer cells.

The many advantages of this device are being validated in research funded by the National Institutes of Health in clinical trials. Invented and developed at the UW, this endoscope technology promises great potential and is highly desirable for applications ranging from image-guided biopsies for cancer diagnosis to guiding the removal of tumor cells during surgery.

The UW ME Human Photonics Lab, which Seibel directs, is partnering with leaders in cancer therapy, including the Fred Hutchinson Cancer Research Center, the University of Michigan, Stanford University and the Barrow Neurological Institute. A Seattle-based medical device start-up, VerAvanti, Inc., has licensed this technology.

Cryopreservation for stem cell transplantation and therapy

Stem cell transplant procedures can restore blood-forming stem cells in patients who have had theirs damaged or destroyed by high doses of radiation or chemotherapy. Through a process known as cryopreservation, living blood cells and platelets are frozen and stored in cell banks until they are needed for transplants. At that time, they are thawed and re-introduced to the body.

In the fight against cancer, cryopreservation promises many opportunities for advancements in stem cell transplantation and therapy. However, one of the biggest challenges this process currently faces is cryoinjury — damaging or killing the cells while storing them at low temperatures.

Origincell Endowed Professor Dayong Gao and his team are investigating the underlying physical and biological mechanisms related to cell injury. Their research shows that the challenge to cells during cryopreservation is not their ability to endure storage at low temperatures (-196° C in liquid nitrogen) as has been widely thought; rather, it is the lethality of an intermediate temperature zone (−15 to −60°C) that cells must be exposed to twice — once during cooling and once during warming. Based on these findings, Gao's team is developing optimal methods, devices and technologies for specific cell types to prevent cryoinjury, achieve long-term cryopreservation, and allow for more cancer treatment options.


Gaurav Mukherjee, left, fits a motorized orthotic device on CNT volunteer Eric Rea's hand.

RESEARCH + OUTREACH

At the intersection of biomechanics and neural engineering, Ph.D. student Gaurav Mukherjee is exploring how to develop machines that improve the quality of human life while also making time for K–12 STEM outreach.

Why do we perceive our limbs as our own? For individuals who use prostheses and orthoses, how can engineers develop more natural devices that better align with the user's sense of body?

ME doctoral student Gaurav Mukherjee believes that augmented and virtual environments provide opportunities to investigate these questions. Through collaborating with UW mechanical and neural engineering researchers and interning at the Facebook Reality Labs, he has been exploring the relationship between the human body and AR/VR technologies.

When he's not steeped in research, Mukherjee is pursuing his other passion: introducing science and engineering to young people. We recently talked with Mukherjee about his path to ME, current research and why he makes time for outreach.

Why did you decide to study ME at the UW?

While working on my master's degree at the University of Cincinnati, I learned about Kat Steele's research, which spans user-centered design to computational modeling. I wanted to understand the interface between wearable robots and the human body, so I looked into ME's Ph.D. program.

When I visited Seattle, I reached out to Eric Chudler, the executive director and education director at the Center for Neurotechnology (CNT) and an advocate for K-12 science outreach. When I realized that I could work with researchers at the forefront of biomechanics and neural engineering like Professors Steele and Chudler, I decided that the UW was the place for me.

Tell us about your research.

I'm interested in the elegant complexity of human hands: their structure and how they function. Understanding the biomechanics of our hands helps us design better prosthetic and orthotic devices to enhance motor and sensory function and sensation. I first worked in Professor Steele's Ability & Innovation Lab, thanks to a fellowship from the UW Institute for Neural Engineering (UWIN), and focused on the biomechanics of the hand. I studied the challenges associated with function after injury to the central nervous system, such as in the case of cerebral palsy and spinal cord injury. The multifaceted nature of these problems helped me develop a diverse skillset in biomechanical and electrophysiological data acquisition and analysis, computational modeling, mechanical design and controls.

Recently I've been working with Eric Rombokas and Patrick Aubin at the VA Puget Sound Center for Limb Loss and Mobility. I'm still focused on the human hand and have expanded my research in biomechanics to explore questions related to perception and sensation — specifically, how do people perceive ownership over their own hands? We use our body's and brain's abilities to create sensorimotor illusions to answer questions like this in the hope that we can eventually engineer a feeling of ownership over artificial limbs, both in the real world as well as in virtual reality.

You've been involved in engineering outreach since you arrived on campus. Tell us about your experiences.

I've been fortunate to work with many UW faculty who support K-12 and community outreach. I helped ME professor Brian Fabien develop a middle school robotics curriculum, which was very rewarding. Through the Washington Alliance for Better Schools, I've introduced STEM activities to high school teachers and co-taught an introductory neural engineering high school class. Last year, as a research assistant with the Northwest Earth and Space Sciences Pipeline, I taught robotics, circuits and rocketry in underserved schools across the Pacific Northwest.

Professor Steele instilled in me the importance of including the community's perspectives when designing solutions. With her, I organized Seattle's first-ever "Handathon," a 24-hour hackathon-style challenge that brought together students, faculty and clinicians to build better 3D-printed prosthetic hands. I've especially enjoyed taking part in Engineering Discovery Days, where I get to share the "robo gripper" with students — it's a robotic device powered by muscle nerve signals, and it's a lot of fun.

Why do you make time for outreach?

Learning how to do good research is key to being an effective scientist and engineer, but it's equally important to be able to communicate research findings and their impact to the public. Outreach allows me to practice this skill. Witnessing the enthusiasm and joy that a moving robot creates in an audience of middle schoolers infects me with similar curiosity and wonder. Trust me, you need a lot of that in grad school! Through outreach I try to encourage young people to see themselves as future scientists and engineers.

What do you like best about being part of UW's neural engineering community?

Neural engineering is a rapidly evolving field, and it can be overwhelming to figure out how to get involved. Centers and institutes like the CNT and UWIN provide opportunities for researchers from a variety of fields — engineering, medicine, ethics, education — to collaborate and exchange ideas. The UW neural engineering community values the end user's input and experience. This runs through much of the research that's happening across the UW, and it's great.

How do mechanical engineers add value to neural engineering?

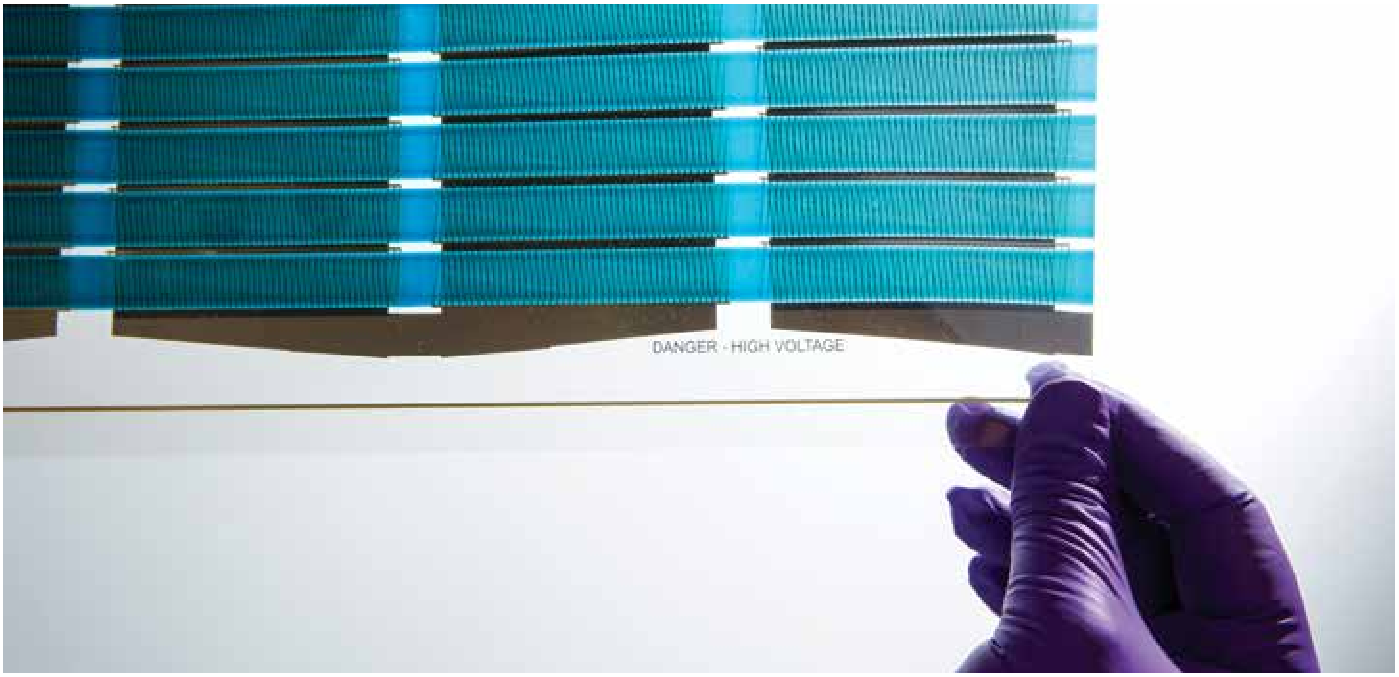
Mechanical engineers transform ideas into physical forms, working prototypes and mechanisms. Many aspects of neural engineering can benefit from this kind of translation and problem solving. Mechanical engineering is an incredibly diverse field, so those of us who study it are well-positioned to work across disciplines.

"Through outreach I try to encourage young people to see themselves as future scientists and engineers," Mukherjee says.

Mukherjee leads an Engineering Discovery Days demo with ME affiliate assistant professor Eric Rombokas.

MATERIAL **IMPACT**

ME faculty are helping set the course toward a smarter, more sustainable future through new materials research.



Working in conjunction with the UW Clean Energy Institute (CEI) and Washington Research Foundation, ME faculty are helping to advance clean energy by developing next-generation solar energy and battery storage materials, devices and systems. Whether they are investigating how to build high-efficiency, low-cost solar cells or are pushing the envelope on batteries that can store more energy and perform better than current technology allows, our faculty are at the leading edge of sustainability research.

Advancing solar energy and electronics at the Washington Clean Energy Testbeds

ME MSE associate professor Devin MacKenzie is a Washington Research Foundation Innovation Professor of Clean Energy, member faculty of the CEI, and technical director of the Washington Clean Energy Testbeds (WCET), a laboratory and workspace that provides industrial, government and academic users access to world-class fabrication tools, analysis instruments and professional staff.

His research team, the Scalable Printed Electronics and Energy Devices (SPEED) group, is exploring more sustainable ways to make electronic and energy devices. Much of their research focuses on printed and roll-to-roll processed large area solar cells and involves perovskite, a new material with a unique crystal composition that allows it to be printed on flexible materials. It may offer an alternative to silicon solar cells, thus making solar energy more accessible and affordable.

The team is also investigating new ways to fabricate flexible electronics and sensors through low-carbon footprint additive printing. Flexible electronics represent a new class of electronics; lightweight, bendable, stretchable and robust, they have the potential to shape manufacturing and energy sectors on a global scale. Additionally, SPEED is researching photonic film nanomanufacturing to improve the efficiency of solar modules and smart windows. The team is also working with new energy-dense, low environmental-impact batteries for a variety of applications, including storage, body sensors, wearable electronics and electronics for extreme environments.

Much of Devin MacKenzie's research at WCET focuses on printed and roll-to-roll processed large area solar cells.

Creating better lithium-ion batteries

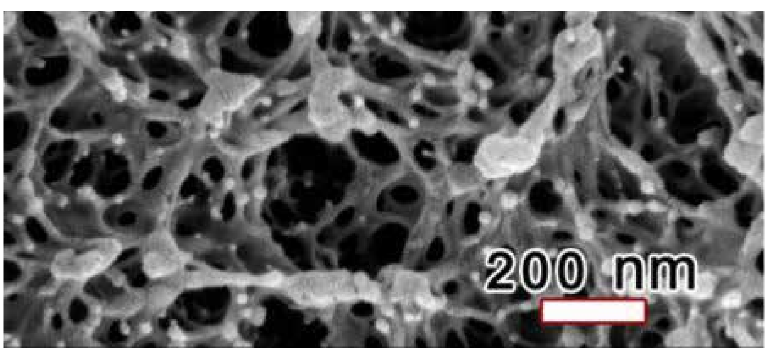
ME associate professor Corie Cobb is a Washington Research Foundation Innovation Professor of Clean Energy and member faculty of the CEI and Molecular Engineering & Sciences Institute. She is investigating new additive manufacturing and computational design methods to revolutionize energy storage and other complex engineered material systems.

Cobb's research centers on lithium-ion batteries — rechargeable batteries that have high energy density and are used in smartphones and other consumer electronics with potential extensions to electric vehicles and aerospace industry applications. In particular, her work focuses on new design and manufacturing processes for better-performing lithium-ion batteries, beginning with the materials out of which they are made.

By integrating design theory, computation, manufacturing and materials science, Cobb studies the formulation and processing of new 3D material architectures to better understand how materials can be controlled and engineered. She hopes to develop new additive manufacturing processes for fabricating and enhancing batteries that will improve the overall performance quality, accessibility, cost and efficiency of lithium-ion batteries.

Bringing battery innovation to market

ME professor Vipin Kumar and ME alumnus Krishna Nadella, MS '02, Ph.D. '09, are developing nanostructured thin films for lithium-ion batteries at WCET thanks to $225,000 in Small Business Technology Transfer funding. Their research is taking place through their startup company Vesicus, which is creating and commercializing novel cellular materials.

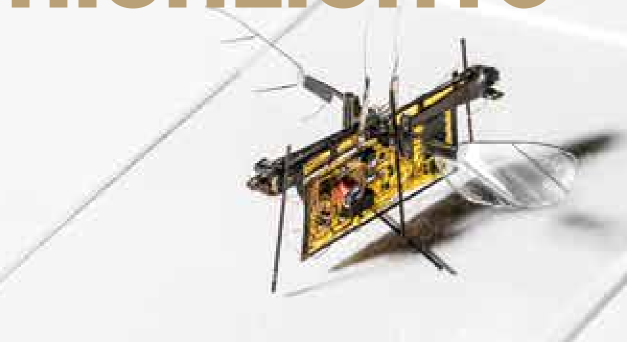


Vesicus' nanoporous polymer thin film.

The team is exploring how to apply a nanoporous polymer thin film as an ion-exchange membrane in lithium-ion batteries. The film will have a higher porosity and thermal stability than the membranes used in existing batteries. Compared to the current multi-step process for fabricating battery membranes, Vesicus hopes its continuous process will result in higher productivity.

Vesicus is using the Testbeds' roll-to-roll printer and characterization tools for this work. Along with lithium-ion batteries, other applications of these films include substrates for flexible electronic circuits, separators for the oil and gas industries, and filter membranes for biological technology.

RESEARCH HIGHLIGHTS



Read more research news at me.uw.edu/news

Insect-sized robot takes flight

RoboFly, the first wireless flying robot insect, has taken off, thanks to a research team including ME assistant professor Sawyer Fuller. Slightly heavier than a toothpick and powered by a laser beam, RoboFly soars by fluttering tiny wings. Future versions may graduate from the laser and use batteries or harvest energy from radio frequency signals. Someday, the team hopes, RoboFly will help perform jobs like sniffing out gas leaks and slipping into tight places too small for drones.

Building better turbines

ME graduate student Ben Strom, undergraduate Noah Johnson and associate professor Brian Polagye have determined that the way cross-flow turbine blades are mounted can significantly impact a turbine's performance. Using a recirculating water flume, they measured how the efficiency of a two-bladed turbine varied with ten different mounting structures. Unexpectedly, a commonly-used configuration performs the worst. The results should help to build more efficient turbines for power generation from wind and water.

Improving treatment for brain aneurysms

Endovascular methods may show more promise for treating brain aneurysms. Because they are used inside blood vessels, these methods are less invasive than techniques that require partial skull removal. But they are not well-understood. Thanks to research conducted by Michael Barbour (Ph.D. '18), who investigated the effect of such treatments inside an aneurysm, clinicians are closer to maximizing the likelihood of success. Barbour received the UW Graduate School's 2018 Distinguished Dissertation Award for his work.

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Celebrating student success

Join us in congratulating our student teams on this year's wins!

Formula Motorsports placed third overall at the 2018 Society of Automotive Engineers competition. The team also placed first in endurance, second in engineering design and third in business presentation, and was the runner-up for the Cummins Innovative Design Award. This was the first year the team focused solely on developing an electric vehicle.

This summer, **UW Hyperloop** placed among the top four teams at SpaceX's Hyperloop competition. First, second and third place all went to European teams, making UW Hyperloop the top team from the United States. The team also received an innovation award for using cold gas thrusters to propel their pod.

UW Formula Motorsports team.

The **UW Human Powered Submarine** team won its category of two-person piloted submarines and received third place in design this year in the 2018 European International Sub Races. It was the first team to have two female pilots in the two-person sub complete the course.

Husky Robotics placed fourth at this year's Canadian International Rover Challenge. For this space robotics competition, teams compete prototype rovers across a range of tasks to simulate how rovers might function on an extraterrestrial planet.

HuskyADAPT won a 2018 Ford College Community Challenge award. In partnership with the UW Taskar Center for Accessible Technology and Provail Therapy Center, the group will use the $25,000 award to develop an adapted toy lending library in Seattle to give families and caregivers of children with disabilities access to modified toys.