Spring 2024

MESSENGER

MECHANICAL ENGINEERING | UNIVERSITY of WASHINGTON

From clubs to careers, pages 6-7

CHAIR'S MESSAGE

Boundless opportunities

It's wonderful to see that ME's enrollment continues to break records each year. In July, we had our largest-ever Direct to College class, and our junior class this year surpassed 200 for the first time. To support this growth, we're continuing to hire world-class faculty and relentlessly advocating for our labs and classrooms to allow our students to do their best work.

The opportunities for students in ME are boundless. In this issue, we highlight how faculty and students are creating or improving medical devices, developing electric vehicle technologies, working to enhance accessibility for children with disabilities and much more.

Our award-winning student clubs and connections to industry work hand in hand with our faculty and research to attract our students to the UW. We spotlight that connection in our story about how clubs set ME students up for success as future engineering leaders at a variety of companies. We look forward to seeing how this year's graduates will make a difference in the world.

Alberto Aliseda

Mechanical Engineering Chair
PACCAR Endowed Professor

Department highlights

Professor **Ashley Emery**, Professor **Mark Ganter** and Professor **Vipin Kumar** have retired from the UW. We thank them for their contributions to our department and wish them the best of luck in retirement.

Professor **Jonathan Liu** received an R01 grant from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of the National Institutes of Health (NIH) to study computational 3D pathology for Barrett's esophagus risk stratification. The award is $3.65 million over five years.

Feini (Sylvia) Qu, Allan Treuer-Ted Wagner, MD Endowed Chair in Regenerative Spine Surgery in Mechanical Engineering, received the Early Career Achievement in STEM Award from the Seattle chapter of the Association for Women in Science.

A team including Professor **Brian Polagye** and ME alum **Chris Bassett** (M.S. '10, Ph.D. '13), senior mechanical engineer at the Applied Physics Laboratory, received funding from the U.S. Department of Defense's Naval Facilities Engineering and Systems Command (NAVFAC) to advance sensing and power systems for small-scale tidal turbine deployments.

The Meza Lab, led by Assistant Professor **Lucas Meza**, received a National Science Foundation (NSF) Faculty Early Career Development Program (CAREER) Award to study how to create tough, sustainable nanomaterials.

Assistant Professor **Mohammad Malakooti** and Assistant Professor **Krithika Manohar** received an NSF grant to establish a design framework for soft multifunctional composites and investigate their failure under large deformations.

ME student **Carrie Lin** was named one of the Husky 100, which recognizes 100 UW students who are applying what they learn in class to make a difference on campus and in their communities.

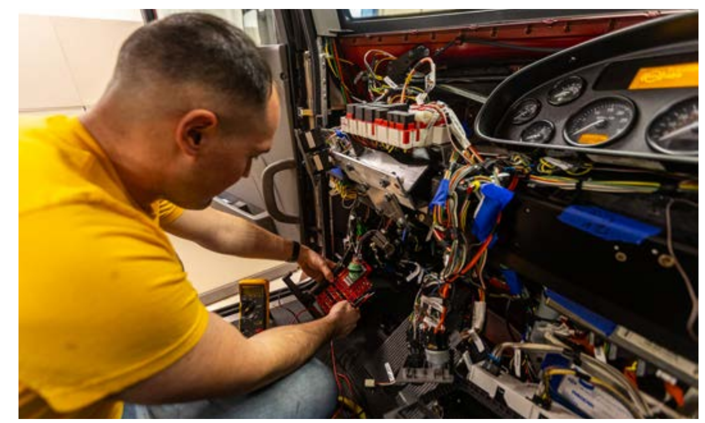
An electrifying experience

A new student club is in charge of transforming a diesel truck into a battery electric vehicle.

ME's newest student club Electric Truck Challenge at UW (E-Truck) is daring to do what many other university students haven't done before: convert a medium-duty diesel truck into a battery electric vehicle. The club has more than 80 members from ME, electrical and computer engineering, civil and environmental engineering, industrial and systems engineering, computer science and aeronautics and astronautics.

"It's an amazing team with a positive atmosphere," says ME senior John Armstrong V, one of the club's co-founders who serves as the team's operational director.

E-Truck students are advised by ME Professor Per Reinhall and sponsored by the PACCAR Technical Center, which provided the truck as well as ongoing mentorship. ME machine shop lab engineers Eamon McQuaide and Veasna Thon (M.S. '22) also assist the team.



The team has disassembled the truck to understand its components. Photo by Raymond Smith

"The partnership with the PACCAR Technical Center has been outstanding," Reinhall says. "E-Truck's industry mentors have been very generous with their time."

The club has a four-year timeline. By 2027, they plan to transform their vehicle into an all-battery electric truck that meets U.S. Department of Energy (DOE) standards. The truck will run about 200 miles before it needs to be charged, the students estimate.

"We're working on understanding the truck as a system and figuring out the mileage requirements, the motors and which batteries to use," Armstrong says.

According to the DOE, medium- and heavy-duty vehicles generate more than 20% of greenhouse gas emissions from the transportation sector. DOE's recent study showed that by 2030, nearly half of zero-emissions medium- and heavy-duty electric trucks will be cheaper to buy, operate and maintain compared to diesel-powered combustion engine vehicles.

The club's members are passionate about sustainable transportation solutions and interested in applying their knowledge to a large-scale project with the potential to make a positive impact on the environment, says ME senior Max White, E-Truck's co-founder and technical director.

"It's cool to see the excitement students have for the scope of this project," White says. "More than half of the students in the club are first-year students, so they might be able to work on this project from start to finish, from idea to final product."

2024 Hollomon Health Innovation Challenge winners

BioLegacy — a team including ME students and advised by ME faculty and alumni — won the grand prize for its organ cryo-preservation and rewarming innovation.

ShockSafe, including ME students and advised by ME faculty, received the Best Idea for Patient Safety prize for developing an automated external defibrillator (AED) weight-detection accessory that differentiates pediatric and adult patients during cardiac arrest emergencies.

Piezo-Pulse, co-advised by ME faculty, received third place and Best Idea for Patient Safety prizes for increasing the battery life of leadless pacemakers.

A healthy collaboration

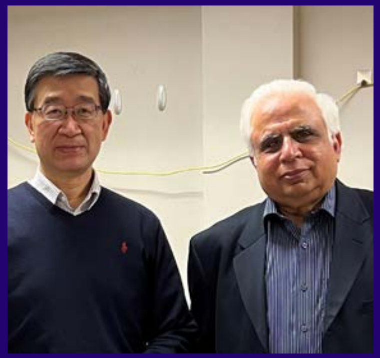
Devices developed by ME and UW Medicine could rescue patients from multi-organ failure and improve catheter safety.

By Lyra Fontaine

AMOR: Treating multiple organ failures

Vital organs can fail during conditions such as sepsis and due to genetic or environmental reasons. If it's not treated quickly, a single-organ failure can trigger dysfunction in other organs. Multi-organ failure is a significant cause of mortality for intensive care patients.

"This urgent medical need is the major driving force for our team to develop a machine that can replace multiple vital organs' functions," says Dayong Gao, Origincell Endowed Professor of Mechanical Engineering, who co-founded the Artificial Multi-Organ Replacement (AMOR) system with Dr. Suhail Ahmad, a UW Medicine professor.



AMOR treats organ failure by removing toxins in patients' blood. If the organs can't be repaired, the system keeps patients alive while they wait for a transplant. AMOR may also be able to help sustain people's lives after transplantation, before the new organ is functional. The machine can be used for both urgent cases and chronic kidney or liver disease.

The automated system supports several organs at the same time. Unlike dialysis machines, AMOR is able to remove sufficient protein-bound toxins, as well as excess fluids from outside the bloodstream that can lead to swelling, pressure on organs and injury. And, Gao says, it's portable, inexpensive and easy to use.

During the design process, Gao's team worked with UW Medicine partners to understand users' needs and parameters that could affect treatment. This included ensuring that there are no air bubbles before recirculating blood to the body.

The machine removes toxins and pumps fluids back into the bloodstream. ME Ph.D. student Shaohang Hao led the development of the automatic control system, which integrates and automates blood pumps and sensors into the machine. The sensors can detect blood leakage, air bubbles, pressure and temperature.

"We as engineers can provide solutions to clinical problems," Hao says. "We were able to design a system that treats multi-organ failure because we know how the mechanisms happen."

ME Ph.D. student Alexander Novokhodko worked to optimize how AMOR purifies blood. The machine diffuses toxins, adds pressure inside the tubes to push toxins out of the bloodstream and absorbs toxins using charcoal and resin.

In a recent clinical trial, AMOR successfully rescued 10 individuals from multiorgan failure, who no longer needed support to breathe and were relisted for transplant. Half the patients eventually had a successful liver transplant or spontaneously recovered, according to results published in the Journal of American Society for Artificial Internal Organs.

UW CoMotion has filed international patents on the AMOR technology. The researchers are now optimizing the machine and participating in the National Science Foundation Innovation Corps program that helps startups commercialize.

"We hope that AMOR can be implemented around the country, including in rural hospitals, in low-resource settings and for military or emergency response," Novokhodko says. ■

Top: From left to right: Graduate student Nanye Du, research engineer Ye Jin, research engineer Ziyuan Wang and Ph.D. student Shaohang Hao working on the AMOR machine, which can treat organ failure by removing toxins in patients' blood. Photo courtesy of Shaohang Hao

Left: AMOR co-founders Dayong Gao, Origincell Endowed Professor of Mechanical Engineering, and Dr. Suhail Ahmad, a UW Medicine professor

CathConnect: Making urinary catheters safer

Nearly one in four hospitalized patients require a urinary catheter, which is a long and flexible tube used to drain urine from the bladder. However, individuals may accidentally pull on and dislodge their own medical equipment. Accidentally removing an indwelling urinary catheter can cause serious complications, including traumatic injury and increased risk of life-threatening infection.

These problems prompted UW Medicine urology resident Dr. Tova Weiss to collaborate with ME students, including then-undergraduate Joelle Tudor and Ph.D. student Michael Malone (B.S. '22), for an Engineering Innovation in Health (EIH) senior capstone project. Together they created a fully functional medical device that serves as an accessory to a catheter. Once installed, the device allows the original catheter tube to safely disconnect when pulled, protecting patients from trauma.

Traditionally, if a patient pulled out a catheter, a balloon that keeps the catheter inside the bladder may cause tissue trauma. However, CathConnect's device allows the tube to disconnect while the balloon remains inflated. It can later be reconnected for continued use. In addition to reducing injury, the innovation aims to ease the burden on caretakers and lower health-care costs.

Having both ME and clinical perspectives were essential for designing the device, which was shared with clinicians to ensure it met specific needs.

"While working with the engineering students, I would come up with an idea that wouldn't work mechanically. Then they would propose a solution that wouldn't work in a hospital setting," Weiss says. "It took both of our perspectives to move forward with a solution."

The students used software to design a prototype, which was brought to life by 3D printing and manually assembling components.

Tudor, who graduated in 2022, now leads the CathConnect spin-off company as full-time CEO. Moving the project through EIH and into a company taught Tudor and Malone important skills in project management, medical device prototyping and commercialization.

"Evaluating the market opportunity for a particular problem, understanding the regulatory and reimbursement hurdles for new medical devices, filing for intellectual property protection and learning how to raise funds to support our commercialization efforts have been critical skills I've developed while working on the project," Malone says.

Next steps include large-scale manufacturing development and initiating the FDA clearance process. CathConnect remains focused on improving the lives of individuals receiving medical treatment and clinicians providing care.

"With ME, there are so many different ways you can apply your degree and make an impact," Tudor says. ■

Above: The CathConnect team with prototypes of the device, which is an accessory to a catheter. From left to right: ME Ph.D. student Michael Malone (B.S. '22), CEO Joelle Tudor (B.S. '22), Manny Pacheco (B.S. '20, M.S. '22), and Chief Medical Officer Tova Weiss, MD, a urology resident physician at UW Medicine. Photo courtesy of Joelle Tudor

FROM CLUBS TO CAREERS

By Lyra Fontaine

The UWPHS team works on their 2024 submarine. Photo by Lyra Fontaine

Participating in a student club can be life-changing for ME students. Whether they build robots, vehicles and submarines or create solutions to accessibility challenges, students form lasting connections and develop hands-on skills that set them up for success in their careers.

As a member of HuskyADAPT, a student organization focused on supporting accessible design and inclusive play technology, Tom Mikolyuk (B.S. '23) learned to create products that center users' needs. He's now a product development engineer at Chiplytics, which develops data-driven inspection technology for microelectronics.

"I've been able to provide more value to the company and grow exponentially as an engineer because my UW experience focused on equal parts technical skills and people skills," Mikolyuk says. "The engineers who are able to understand not just what they're making and how to make it, but why and who they're making it for, are making the biggest impacts on their project, company and industry."

Participating in clubs also enhances students' experiences as they build community, network with alumni and celebrate their accomplishments.

"The pride of having worked together to do something on a national or even global level gives graduates a sense of accomplishment and confidence as they enter the workforce," says Ben Hempstead (B.S. '94), director of technical services at Teague and former member of UW Human Powered Submarine (UWHPS).

Industry leaders — some of whom participated in student clubs themselves — value the unique experiences from extracurriculars that graduates bring to the workplace.

"One of the reasons students with club participation are so sought after is real-world experience that is directly applicable to industry," says Justin Brynestad (B.S. '03), a vice president and program manager at Blue Origin and former UW Formula Motorsports (UWFM) member. "Participating in clubs such as Formula is a great way to develop skills, build a network and make yourself more attractive to employers."

Standout skills

Clubs expand students' knowledge of technical skills such as machining, printed circuit board design and computer-aided design modeling. Students also gain valuable expertise in leadership, communication and collaboration.

UWFM — a team that designs, builds and races an electric formula-style race car — was Brynestad's first experience developing a product in a business-like environment.

"From an engineering perspective, Formula offers members the opportunity to see a product through its entire lifecycle," he says.

As a UWFM member, ME senior Sherveen Mehrvarzan learned about load transfer and electrical design, helped create a new suspension system and integrated team projects into one vehicle. Through UWFM, he says he became a more well-rounded engineer.

"Making sure a part successfully fulfills inter-team goals and incorporates well with other parts of the car gave me more insight into integration engineering," Mehrvarzan says.

While in UWHPS, which designs and manufactures a submarine to compete in international competitions, Hempstead collaborated with and led team members from other disciplines, and interacted with industry supporters.

UWFM members do almost all manufacturing and assembly in-house. Here, ME and MSE students prep the monocoque mold of this year's car before carbon fiber layup. Photo courtesy of UWFM

"A student club is one of the earliest opportunities to really communicate your ideas to others and understand their priorities, which are essential parts of an engineering job," Hempstead says.

Through HuskyADAPT's toy adaptation program, students deconstruct toys and solder in connections to make the toys accessible for local kids with disabilities. Instead of pushing a button to activate a toy, a child might move their finger or tilt their head.

"One of the unique aspects of HuskyADAPT is that they learn fundamentals of accessible and inclusive design," says Kat Steele, the Albert S. Kobayashi Endowed Professor of Mechanical Engineering and ME's HuskyADAPT faculty adviser. "Training future engineers in these principles is critical to support the design of accessible and inclusive products and environments."

In HuskyADAPT, Mikolyuk adapted toys, built sensory toys for children with autism spectrum disorder and revamped the design team program to develop workshops, build industry relationships and organize community events.

"The most important skill I learned was empathy," Mikolyuk says. "I learned how to ask the right questions and use the right methods to understand a customer's pain points and motivations, and how to translate those into sensible design requirements and check my work with the customer at every step."

Set-up for success

At Chiplytics, Mikolyuk's responsibilities include mechanical design and test engineering, technical communication and user feedback gathering.

"My transition from student life to a fast-paced startup environment and a cutting-edge problem space was made so much easier by the fact that we use the same iterative user-centered design process that the HuskyADAPT design teams live and breathe," he says.

After graduating this spring, Mehrvarzan is gearing up to pursue a master's degree in mechanical or electrical engineering. He's applied skills learned in UWFM at internships, including at Tesla's vehicle engineering team.

"The rapid pace of Formula Motorsports translated into the work environment at Tesla, and helped me prepare to think on my feet and design at the rate expected of me," he says.

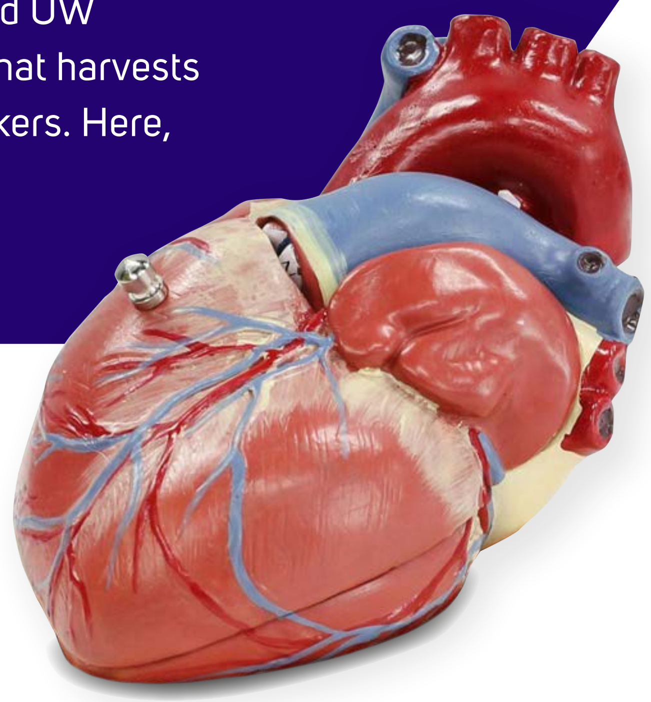
Hempstead, who's worked in engineering for 30 years, credits the technical skills and leadership experience gained from UWHPS with helping him successfully interview for his first job and model how to develop effective teams. He now helps hire recent graduates.

"I enjoy meeting the team captains or other club leaders who have experienced the higher-level challenges of fielding a team," Hempstead says. "Those experiences make them very attractive candidates for the innovative companies of today that expect a lot from UW graduates."

The HuskyADAPT club includes the toy adaptation program, in which students make toys accessible for local children with disabilities. Photo courtesy of HuskyADAPT

HARVESTING HEARTBEAT ENERGY

Assistant Professor Mohammad Malakooti co-leads an interdisciplinary team from ME, bioengineering and UW Medicine that has created a pacemaker "sleeve" that harvests heartbeat energy to extend battery life in pacemakers. Here, he answers a few questions about the new device.



Tell us about the project.

The device is designed to surround a leadless pacemaker, which sits in the heart's right ventricle. The challenge with a leadless pacemaker is that it runs out of battery and it's hard to retrieve. A second device is often implanted without removing the first one. Our innovation involves the use of energy harvesting to extend the leadless pacemaker's battery life. We do this by creating a sleeve for a pacemaker using piezoelectric materials, which generate electricity when mechanical pressure is applied.

In our experiments, we placed the pacemaker with the sleeve inside a machine that simulates blood pressure in the right ventricle. The compressive force from simulated blood pressure causes mechanical deformations in the outer layer of the sleeve, which produces electrical power for every cycle of the heartbeat — enough to increase the battery life by 10 percent.

How did your team come up with the materials and design?

Assistant Professor Mohammad Malakooti

The device is very small, about one-third of an AAA battery. The challenge is to keep its size and shape to maintain the same implantation procedure while making sure it can generate sufficient energy. Our team chose to use piezoelectric polymers because of their stability, biocompatibility and mechanical flexibility.

We selected a polymer called polyvinylidene fluoride (PVDF) for its large piezoelectric response and biocompatibility. The material is rolled into a cylindrical shape that matches the leadless pacemaker, creating a flexible piezoelectric housing. The prototype includes an aluminum rod as a substitute for the actual pacemaker, insulator films and epoxy to encapsulate it. Instead of fixing the PVDF film directly on the pacemaker, our innovative dumbbell-shaped design allows for more deformation under applied pressure, resulting in enhanced energy harvesting.

What's next?

Last year we worked with a talented group of bioengineering students in the Master's of Applied Bioengineering program. I'm excited to co-mentor a new group of students and continue collaborating with Dr. Babak Nazer, associate professor of medicine. We are conducting more research to enhance the energy harvesting performance. We will test our designs with new prototypes and use different materials to make the device more sensitive and responsive to the oscillating blood pressure. Then, Dr. Nazer will do in-vivo validation to confirm safety and efficiency. The goal is to prolong battery life, reduce reimplantation and increase leadless pacemaker candidacy. If there are fewer battery replacements needed, leadless pacemakers could be more accessible for younger patients. ■

Wheels in motion

Research shows the importance of accessible environments for children using assistive technologies.

By Lyra Fontaine

Ride-on cars are miniature toy cars for children with steering wheels and a battery-powered pedal. Adapted ride-on cars are an easy-to-use temporary solution for children with mobility issues. Although wheelchairs have more finite control, insurance typically covers new wheelchairs every five years. Children under age 5 can use adapted ride-on cars to explore their surroundings if they outgrow their wheelchair, or if they aren't able to be in a wheelchair yet.

"Adapted ride-on cars allow children to explore by themselves," says ME Ph.D. candidate Mia Hoffman. "Exploration is critical to language, social and physical development. There are big benefits when a child starts moving."

Recently, UW researchers adapted ride-on cars to make them more accessible. Instead of a foot pedal, children might start the car with a different option that's accessible to them, such as a large button or a pneumatic device that responds to air being blown into it. Researchers added additional structural supports to the device, such as a backrest made out of kickboards or PVC side-supports.

Adapted ride-on cars were provided to 14 families with young children across western Washington. Lead researcher Heather Feldner, an assistant professor of rehabilitation medicine and adjunct assistant professor in ME, trained families on how to use the cars. The families then spent a year playing with the cars. Each car had an integrated data logger that tracked how often the child pressed the switch to move the car, and GPS data indicated how far they traveled.

The study found that most play sessions occurred indoors, underscoring the importance of indoor accessibility for children's mobility technology. However, children used the car longer outdoors, where identifying an accessible route increased the frequency and duration of play sessions.

"Families can sometimes be uncertain about introducing powered mobility for their children in these early stages of development," says Feldner, a co-founder of the UW club HuskyADAPT, which modifies ride-on cars through its Go Baby Go! team. "But ride-on cars and other small devices designed for kids open up so many opportunities — from experiencing the joy of mobility, learning more about the world around them, enjoying social time with family and friends in new environments, and working on developmental skills." ■

For a recent study, adapted ride-on cars were provided to 14 families with young children in locations across western Washington. Photo courtesy of Heather Feldner

Accelerating clean manufacturing research

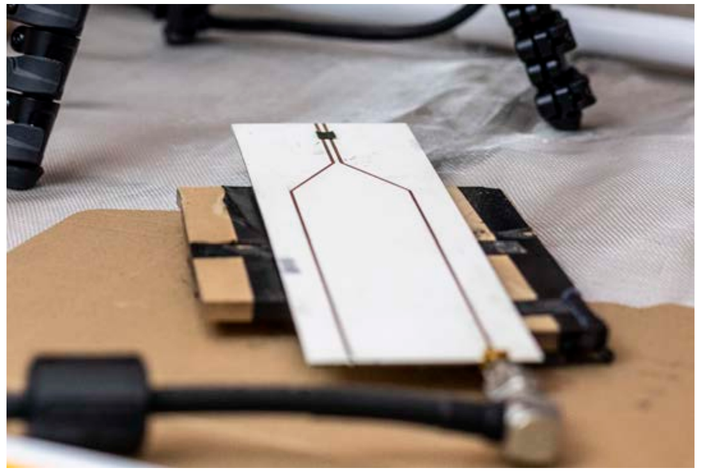
ME researchers are working to accelerate clean energy solutions for manufacturing in the United States through projects supported by the U.S. Department of Energy (DOE)'s Office of Energy Efficiency and Renewable Energy.

By Lyra Fontaine

An energy-efficient way to manufacture composites

Currently, robotic automated fiber placement machines create composites — lightweight, high-performance materials that are used to build aircraft, cars, windmills and more — using an energy-intensive ion lamp that heats carbon fibers and deposits the materials in layers. Assistant Professor Aniruddh Vashisth's vision is to replace the ion bulb in these machines with a radio frequency applicator.

Vashisth's lab has discovered that it's possible to rapidly cure and weld carbon fiber composite materials using heat from radio frequency fields. With the help of an automated machine, the researchers move a wand-like radio frequency applicator close to a carbon fiber material to heat it. If it's successful, the new method would lead to 15 percent faster welding and reduced environmental impact, while maintaining or improving the composites' mechanical properties.



Two copper strips on a teflon block are bonded when a radio frequency "wand" is applied in Vashisth's lab. Photo by Dennis Wise

The team will conduct experiments and simulations to investigate how relevant materials respond to radio frequency heating. Then with the expertise of Associate Professor Ashis Banerjee, they will use machine learning to inform optimal processing conditions. Lastly, the team will develop a robotic system that can intelligently and quickly weld thermoplastic composites together, and will scale the technology with Oak Ridge National Laboratory researcher Vipin Kumar.

"This work was accelerated by the UW's location in Washington state, which is a leader in composites," Vashisth says. "It's wonderful to have this project funded and I'm grateful that my colleagues and collaborators believed in the idea."

Better battery performance in electric vehicles

A DOE project led by Pacific Northwest National Laboratory (PNNL), with UW collaborators including Professor John Kramlich, focuses on an innovative approach to manufacturing improved materials for electric vehicle (EV) batteries.

An obstacle to EVs' broader adoption is batteries' limited number of charging cycles. Over time, lithium-ion batteries that are used in EVs can fail and no longer hold a charge. One reason for the batteries' performance loss is due to the current materials used in the cathode, the part of the battery where electrons move to and from. The most common materials are composed of aggregates of small crystals joined at grain boundaries. Most problems with lithium-ion batteries, such as cracking, occur at these grain boundaries.

A promising cathode alternative is nickel-rich transition metal oxides, which could provide a high energy density and a low-cost solution. Because they are made up of a single crystal instead of many crystal grains with grain boundaries, nickel-rich transition metal oxides could improve upon current EV battery performance.

Additionally, PNNL researchers have discovered a simpler way to manufacture single crystals, which will inform the DOE project. The researchers will design a drop-in process in which the new single-crystal manufacturing process can fit into an existing manufacturing facility, which would lower costs.

"This project identifies and addresses the scientific challenges behind scaling up the manufacture of these promising cathode materials," Kramlich says. "We are seeking a cost-effective route that bridges the knowledge gap between academic research and industry manufacturing." ■

Driven to advance vehicle electrification

Engineering research leads the next wave of electric vehicle technologies.

By Brooke Fisher

A research team led by ME Assistant Professor Shijing Sun is working to develop a roadmap for how to best manage and enhance the health of electric vehicle (EV) batteries.

"Battery health is an important concept that relates to the long-term costs of batteries and their safety," explains Sun. "We need to have maintenance plans for the increasing number of EVs on the road."

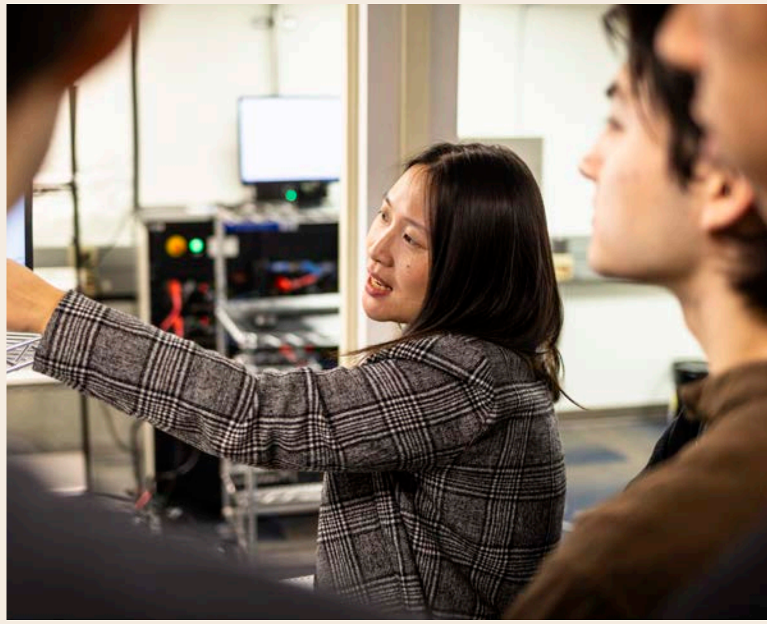
Once batteries are installed in EVs, it's important to have reliable systems in place to monitor battery health, Sun says. In addition to planning ahead for the replacement of aged batteries, managing the overall battery health can also help extend the life of the battery by advising drivers in certain conditions to seek maintenance.

To develop highly predictive models, Sun's research employs artificial intelligence to process large and complex datasets. Together with her students, she conducts tests at the Washington Clean Energy Testbeds, part of the Clean Energy Institute. They analyze battery charge and discharge behavior to investigate factors that affect performance, such as the frequency of charging and the environment — for example, a battery in Arizona would perform differently than one in Alaska. Human behavior is also a factor, as aggressive driving and rapid braking can drain the battery.

"Better understanding how the battery behaves today and identifying limitations will also guide us to explore new ideas for the next generation of batteries," Sun says.

In addition, UW engineering faculty are working toward developing the next generation of EV battery materials and technologies. Other projects aim to reduce costs, extend the lifespan of EV batteries and create an EV battery that needs to be charged much less frequently than stopping at a gas station.

ME Professor Corie Cobb and Jun Liu, a professor of materials science and engineering and of chemical engineering, are investigating how to extend the cycle life of lithium-ion batteries used in EVs. The cycle life is the number of times a battery can be charged and discharged before it begins to degrade, and the researchers — both Washington Research Foundation Innovation Professors in Clean Energy — are working with PNNL's Cathode-Electrolyte Interphase Consortium, supported by the DOE's Vehicle Technologies Office. ■



At the Washington Clean Energy Testbeds, ME Assistant Professor Shijing Sun and her students review data pertaining to battery cycling tests. Photo by Dennis Wise

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2024 GRADUATION

This year, ME awarded 198 bachelor's, 131 master's and 26 doctoral degrees degrees to the class of 2024. The department appreciates the friends and family who came together to celebrate their achievement.

A special thank you to this year's graduation speaker, **Anders Brown** ('92 BSME, '94 MSME), an experienced executive and business operator, having built and scaled businesses at the intersection of software, hardware and new markets. He has a broad range of sales, marketing, engineering and operational experience across the U.S., Asia and Europe, including a wide range of work with corporate financings such as acquisitions, joint ventures and IPOs.

Currently, Brown is an Operating Partner with GLP Capital Partners (GCP), where he oversees certain venture and private equity investments in their U.S. portfolio. Additionally, Brown is Chairman of the Board at Woodland Park Zoo, as well as a member of the UW College of Engineering Advisory Board. He has two ME degrees and is a lifelong Husky fan.

Thank you, speakers

Chair's Distinguished Industry Lecture Series:

Tim Chung, Microsoft; Jocelyne Mekontso, Philips

Leadership Seminar Series:

Dan Ervin (BSME '80), Varius; Krithika Manohar (UW Applied Mathematics Ph.D. '18), UW ME; Derek Wallin (MSME '17), Meta; Rae Anne Rushing (BSME '88), Rushing; Anders Brown (BSME '92, MSME '94), GLP Capital Partners; Julia Doerner (BSME '13), McKinstry; Mike Machinski (BSME '91), Corbin Engineering; Marco Micheletti (BSME '97), Fresh Consulting; Taylor Barclay (MSME '12), Clēnera

Department Seminar Series:

Ross Ethier, Georgia Tech; Pablo Zavattieri, Purdue; Albert Shih, University of Michigan; Mjaye Mazwi, Seattle Children's; Kevin Turner, University of Pennsylvania; Ed Habtour, UW Aeronautics & Astronautics; Brody Foy, UW Medicine; Zhangli Peng, University of Illinois Chicago; Ximin He, UCLA; Changliu Liu, Carnegie Mellon University