



THE TREND IN ENGINEERING

Autumn 2026

SOWING THE BEADS OF LIFE

UW researchers are engineering hydrogels to transform farming, healthcare, wastewater management, biofuels and more

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From the Dean

“We begin the academic year welcoming talented new students, advancing new initiatives and renewing our commitment to providing an exceptional educational experience that prepares graduates to lead, innovate and serve society. At the center of that commitment is continued investment in our students, ensuring they have the opportunities and support to thrive in a rapidly changing world.

This is the final year of Engineering Excellence for the Public Good, the College’s five-year strategic plan. As we close out the plan and look ahead to aligning our work with the UW’s campuswide strategic framework, Built for the Moment - Advancing the Future, it is important to reflect on what we have accomplished and learned through a period of significant transformation and growth. New priorities have emerged in response to a changing world, particularly the rapid expansion of artificial intelligence, which is reshaping engineering education, research and industry.

One example of our commitment to student success is the inaugural Engineering Program Enhancement Fee investment cycle. This year, we will invest nearly \$2 million in projects that improve the student experience, including fabrication and testing tools, instructional equipment, software, computing infrastructure and first-year exploration programs. These investments will expand opportunities for hands-on learning, access to current technologies and professional skill development.

That focus on student learning is reflected in our recent ABET accreditation cycle — the most successful in our



history — including accreditation of our new electrical and computer engineering degree. This achievement reaffirms our commitment to academic excellence, student preparation and program relevance.

With this commitment to quality as a foundation, we will continue investing in the spaces, partnerships and opportunities needed to sustain excellence. This includes pre-design for MEB II, a new mechanical engineering building, and strengthening global engagement through UW Converge Taipei in March.

Thank you for helping advance our work. Together, we are building the future of engineering education and impact.

Nancy Allbritton, M.D., Ph.D.
Frank & Julie Jungers Dean of Engineering



Remembering Suzanne Gage Brainard

Suzanne Gage Brainard, an influential advocate for equity in engineering education who opened doors for generations of engineers, died April 12, 2026. She was 81. Brainard joined the UW in 1988 as director of the Women in Engineering program. Charged with expanding opportunities for students from underrepresented groups, she established tutoring, advising and peer mentoring programs that served more than 1,000 engineering undergraduate and graduate students.

Brainard co-founded WEPAN (Women in Engineering ProActive Network), a national organization supporting efforts to encourage women to pursue engineering. She traveled internationally to advise institutions developing similar programs, extending her influence beyond the UW. Her contributions earned numerous honors, including the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring; the Maria Mitchell Women in Science Award; and fellowships in the American Association for the Advancement of Science and the Association for Women in Science. She retired from the UW in 2015.

Gifts can be made to The Suzanne G. Brainard Endowed Fund for Diversity in STEM

► engr.uw.edu/brainard-endowed-fund

Leadership appointments



**FAISAL HOSSAIN TO LEAD
PROFESSIONAL AND
EXECUTIVE PROGRAMS**

Faisal Hossain, a professor of civil and environmental engineering, has been appointed the College’s assistant dean for professional and executive programs. In this newly created role, Hossain will lead development of a cohesive, financially sustainable portfolio of professional master’s programs, executive and continuing education, certificates and custom industry programs, in partnership with engineering units, UW Continuum College, the Foster School of Business and external collaborators.



**MEHRAN MESBAHI TO
CHAIR AERONAUTICS &
ASTRONAUTICS**

Mehran Mesbahi has been appointed chair of the William E. Boeing Department of Aeronautics & Astronautics. He is the J. Ray Bowen Professor in Innovation in Engineering Education and serves as executive director of the Joint Center for Aerospace Technology Innovation. An expert in autonomous aerospace and robotic systems, Mesbahi is a fellow of the American Institute of Aeronautics and Astronautics and the Institute of Electrical and Electronics Engineers, and has won the NASA Space Act Award and the UW Distinguished Teaching Award.



**JUAN CARLOS IDROBO
TO CHAIR MATERIALS
SCIENCE & ENGINEERING**

Juan Carlos Idrobo has been named chair of the Department of Materials Science & Engineering. Idrobo is internationally recognized for his influential work in electron microscopy and spectroscopy, for which he has been named a fellow of the Microscopy Society of America and a Clarivate Highly Cited Researcher. He holds a joint appointment with Pacific Northwest National Laboratory and formerly served in leadership roles at Oak Ridge National Laboratory.



UW Engineering launches Robotics graduate programs

Washington state has emerged as a major hub for robotics innovation, fueled by advances in artificial intelligence and growing investment in automation across aerospace, manufacturing, logistics, healthcare and autonomous systems. Companies including Amazon, Microsoft, Boeing, NVIDIA and Blue Origin, alongside a rapidly expanding ecosystem of robotics startups, are driving demand for engineers who can work at the intersection of AI, software, sensing and physical systems.

To help meet that need, UW Engineering launched two new graduate offerings this fall: a Master of Science in Robotics and a Graduate Certificate in Applied Robotics. Developed through a collaborative effort spanning ten engineering units and multiple research centers, the new robotics programs harness the UW’s deep expertise in AI, machine learning, autonomous systems, controls, manufacturing and human-centered design, while leveraging longstanding partnerships with industry leaders helping shape the future of robotics.

“Robotics is no longer confined to a single industry or discipline,” says Nancy Allbritton, Frank & Julie Jungers Dean of Engineering. “The next generation of innovation will come from engineers who can integrate AI, software, advanced sensing and physical systems to solve complex real-world problems. These programs bring together the UW’s strengths across engineering and computing to prepare students to lead that future.”



Learn more about Robotics programs

► engr.uw.edu/robotics-programs



Joining the club(s)

Since arriving on campus last summer, UW President Robert J. Jones has fully embraced the Husky experience. That includes joining a wide array of student organizations — including popular engineering clubs Husky Robotics (pictured here) and Formula Motorsports — for an entertaining short video that evoked the droll whimsy of Wes Anderson’s 1998 film, “Rushmore.”

Watch the video:
enr.uw.edu/president-jones-uw-clubs

FDA clears shelf-stable foods processed by microwave

The U.S. Food and Drug Administration (FDA) has accepted the first shelf-stable food commercially processed with the microwave sterilization technology invented by Juming Tang, the Frank Jungers Endowed Chair of Industrial & Systems Engineering.

Tang’s method, developed over the past 25 years, replaces the age-old canning process with finely tuned microwaves that retain the natural nutrients, flavor and texture of foods. So, for instance, a roasted salmon filet can sit in a pantry for three years, without refrigeration or freezing, and still come out of its tray fresh, firm, pink and ready to eat.

With microwave processing cleared for the U.S. grocery stores, Tang is moving to revolutionize our food system by building a network of regional processing hubs that move food from farm to table with fewer steps, fewer miles traveled and less waste.

- Amy Sprague



Engineering Academy opens doors

This summer’s UW Engineering Academy welcomed 49 students from 35 high schools across Washington to the UW campus. The annual program, hosted by the College of Engineering, supports high school students who have limited access to engineering coursework, clubs or competitive teams but are eager to explore engineering pathways, build foundational skills and gain insight into what studying engineering in college could look like.

During the weeklong academy, the visiting students — selected from more than 400 applicants — explored the UW, engineering disciplines and potential careers. They also tackled a team-based engineering challenge to design a robot capable of following a meandering trail.

Food processing innovator Juming Tang. Photo by Amy Sprague



UW Engineering Vice Dean Jihui Yang, UW President Robert J. Jones, Boeing partners Steve Chisholm, '86, and Michelle Carey, '01, and Mechanical Engineering Chair Alberto Aliseda celebrate the BARC's first ten years. Photo by Matt Hagen

Boeing Advanced Research Collaboration redefines industry partnership

Robotic ultrasound technology that detects hidden defects in composite parts. A testbed that measures the dynamics and sensitivities of air flow around wings during stalls. A zipper-like mechanism that wraps high-tech sleeves around the seams where aircraft components meet.

These are just a few of more than 100 innovations developed during the first ten years of the Boeing Advanced Research Collaboration (BARC), a different kind of academic-industry partnership.

Originally established in 2014, BARC is a strategic initiative that pairs Boeing engineers with UW Engineering faculty and students from multiple disciplines to develop a suite of technologies animated by a single, ambitious question: what will the future of flight require?

“BARC is not the typical sponsor-contractor type of relationship,” says Xu Chen, BARC director and associate professor of mechanical engineering. “The technologies we develop together — whether a method, algorithm or system — are often implemented in the factory and create significant impact.”

Applied and foundational research projects focus on a variety of areas, from robotics and automation; to advanced materials, aerodynamics and fluids; to quantum technology, data science and augmented intelligence.

It’s people who set these projects apart, according to BARC co-founder Steve Chisholm, vice president and chief engineer for Boeing Mechanical and Structural Engineering.

“What makes BARC special is the depth of the collaboration,” he says. “This isn’t simply Boeing funding research at a

university. Boeing engineers work alongside UW faculty and students, bringing together different perspectives, expertise and capabilities to address shared technical challenges.”

This creates a unique exchange. “Students and researchers gain exposure to real-world aerospace challenges and experienced Boeing engineers, while our teams benefit from the creativity, research expertise and new ideas coming out of one of the country’s leading engineering institutions,” Chisholm says. “Our proximity helps accelerate research and innovation.”

Chen adds that Boeing’s long-term commitment creates a pipeline of industry-ready students — many BARC alumni are among the 8,000-plus UW grads working at Boeing. And it attracts top-class faculty from multiple disciplines who provide

cutting-edge research expertise and also develop professional education programs, such as the new professional programs in AI and machine learning for engineering and graduate programs in robotics.

As this commitment is renewed for the next ten years, BARC is not only advancing the aerospace industry. It’s also providing a blueprint for strategic collaboration with partners in any industry.

“What began as a bold vision has grown into a model for the College of Engineering,” says Nancy Allbritton, Frank & Julie Jungers Dean of Engineering. “By translating innovations into impact and investing in the next generation of engineers through applied research and workforce development, we are advancing the future of flight. We hope this success inspires similar partnerships with other companies and industries.”

BARC Director Xu Chen speaks at the program’s 10th anniversary celebration. Photo by Matt Hagen



Learn more about BARC

► www.barc.uw.edu

SOWING THE BEADS OF LIFE

By Ed Kromer | Photos by Mark Stone

UW Engineering researchers are adapting hydrogels to catalyze advances in farming, wastewater treatment, healthcare, biofuel and more.



You won't find a more charming spot to host a revolution than the bucolic landscape of 21 Acres farm in Woodinville, Washington.

Amid its colorful plots of flowers and vegetables, UW researchers are field testing a regenerative technology that could transform the way we approach agriculture.

It begins in tidy rows of delicate lettuce and scallion seedlings that Korena Mafune and Renee Davis have bedded with a sprinkling of hydrogel BioBeads formulated in the civil and environmental engineering (CEE) lab of Professor Mari Winkler. These biodegradable bundles, the size of couscous pearls, contain beneficial bacteria, which help plants absorb nitrogen and phosphorus, and mycorrhizal fungi, which extend and strengthen root systems.

The result is higher yields of healthier plants that are more resistant to pests, disease and drought. At scale, it could be a viable alternative to expensive chemical fertilizers that disrupt soil health, says Mafune, '13, '15, '21, a soil ecology expert in the Winkler Lab.

BioBead is, essentially, a probiotic for soil.

"Nature knows how to fix itself," says Davis, a CEE doctoral student and mycologist in the lab. "We're just accelerating the process."

And refining the package. BioBead is one of myriad applications of the hydrogel, a recurring motif in the Winkler Lab, where students and researchers are empowered to explore a range of applications — and take them beyond the academic and into the entrepreneurial.

Hydrogels everywhere

As Mafune describes it, the Winkler Lab is "hydrogels galore."

It didn't start that way. During her doctoral studies at Delft University of Technology in the Netherlands and throughout her early career, Winkler developed new wastewater treatment techniques — and especially the application of Anammox, a breakthrough biological process that uses bacteria to remove nitrogen pollutants from wastewater with minimal energy and chemicals.

A decade ago, she was approached by the U.S. Defense Advanced Research Projects Agency with a project tangentially related to her expertise: to create a wearable system that could collect, sterilize and recycle the urine of soldiers in the field to keep them hydrated and lighten their load.

Winkler saw an intriguing engineering challenge: miniaturizing treatment of a different form of wastewater.



Hydrogels for many purposes are formulated in the Winkler Lab.

At the time she had begun experimenting with hydrogels — soft, flexible networks of polymer chains that can absorb and retain large volumes of liquid without dissolving. Hydrogels were already being used in drug delivery, tissue engineering, cosmetics and electronics.

Winkler had a novel use in mind.

"We needed to encapsulate bacteria that capture the toxins," she says. "So, we put them into hydrogels."

Wastewater treatment

Removing toxins in a closed space inspired Winkler to think differently about the approach to wastewater treatment that she had studied her entire career.

The problem facing large treatment facilities — especially coastal ones — is one of scale. Growing populations produce more wastewater that needs to be detoxified before it flows back into the ocean. This puts a strain on treatment facilities like Seattle's West Point, which are often tightly wedged into a coastal landscape.

Undergraduate researcher Happy Tju works in the Winkler Lab. Opposite: Researchers and students transplant BioBead-enhanced lettuce at 21 Acres farm.





“There are more people using more water, but the treatment plants don’t have space to expand,” Winkler says. “They need to intensify the space they have.”

Hydrogels can allow this to happen.

Encased in a carrier that won’t degrade, the cargo of wastewater hydrogels is formulated to capture nitrogen and other common toxins, like floating filters that clean water as it passes through. Winkler says they allow space-constrained plants to increase their capacity without expanding their footprint.

“It’s a closed-loop cycle, which makes it so effective,” she adds.

Gut health

In another corner of the Winkler Lab, researchers are applying the same principle to help people with chronic kidney disease, who require dialysis or medications to filter phosphate, urea and other toxins from their bodies.

The team’s solution, Thera-T, is a drinkable hydrogel designed to remove toxins from the gut — think boba tea with medical benefits. Its tiny spheres contain microbes, enzymes and binders that capture and break down toxins before they enter the bloodstream. Once they have done their job, the gels pass naturally through the digestive tract, minimizing the need for dialysis.

“We’re trying to break this vicious cycle at its source: the gut,” says CEE doctoral student Ming-Che Chung.

The researchers believe their drinkable technology, which has shown promise in early testing, could potentially be expanded to remove a range of contaminants from the human body — from microbial toxins to pesticides to microplastics.

Biofuel and biomass

The lab is also exploring new uses for hydrogels in biotechnology and sustainable production through two projects, both of which are in early stages of development.

One creates a bioreactor process that transforms lignin — abundant organic polymers in trees, grasses and flowers that are difficult to break down — into biofuel. Fungal organisms convert lignin into sugars, and microbes convert the sugars into ethanol.

“Imagine converting tree bark to jet fuel,” Winkler says.

Another plan uses hydrogels to grow algae at scale, producing biomass and removing harmful carbon from the atmosphere.

Bao Nguyen Quoc, Ph.D. ‘21, a former doctoral student and postdoc in the lab, explains that only a small fraction of Earth’s surface can support carbon-capturing plants, while vast expanses of ocean remain largely unproductive because they lack nutrients required to grow algae.

Enter SeaO2 Lockers, a plan to encapsulate microalgae seed cells and nitrogen-fixing bacteria in hydrogels, allowing algae to grow in floating farms away from fragile coral reefs and marine habitats. The algae could capture carbon and be harvested for biofuels, pharmaceuticals, food and animal feed.

Entrepreneurial academics

The range of applications reflects the proactive culture Winkler fosters in her lab. She credits her graduate school mentor, Anammox pioneer Mark van Loosdrecht, with empowering independent inquiry and instilling in her a tendency toward research with purpose — to benefit real people in the real world.

Her lab attracts students and researchers with similar passion, and each hydrogel project is being developed with a pathway to the marketplace.

BioBead, incorporated under the name SymbioSoil, won the 2026 Dempsey Startup Competition at the UW and has received commercialization funding from UW CoMotion, Washington Research Foundation and the USDA. Co-founders Mafune and Davis are ramping up field studies and collaborations with farming organizations with an eye to scale manufacturing and pilot a market product next year.

Wastewater treatment technologies are being tested in treatment plants in Seattle, Everett and Edmonds, as well as on the East Coast.

Thera-T, on its journey to commercialization, won second prize at the 2026 UW Hollomon Health Innovation Challenge, received Innovation Gap funding from CoMotion and two awards from the biotech activator Nucleate.

And SeaO2 Lockers continues moving forward, with Quoc returning to the lab as a volunteer in time off from his environmental consulting job.

That’s the point of the lab — and the people who animate it: advancing technology for the common good of people and the planet.

Opposite page: Korena Mafune plants seedlings with BioBeads in the UW Biology Greenhouse. Bottom left: Biodegradable hydrogels carry beneficial bacteria and fungi. Bottom right: The Hollomon Health Innovation Challenge was a launch pad for Thera-T, led by doctoral students Ming-Che Chung (center) and Pei-Hsin Wang (right). Photo courtesy of the UW Buerk Center for Entrepreneurship



“The hydrogel is a carrier that allows different organisms to come together in a closed system. The technological innovation is not only the hydrogel, but what’s in it.”

- Mari Winkler

Davis, who left a corporate job to work on BioBead, sees the shape of a metaphor in so many disparate projects and passionate people revolving around the humble hydrogel.

“Communities of organisms together, combining forces and harnessing their different interactions and synergies, are really inspiring to me,” she says. “There is a core concept to each of these different threads that makes it feel like a community technology. It feels like the future.” ❖



Elevating emerging engineers

By Ed Kromer | Photos by Ryan Hoover

The Industry Capstone Program partners UW Engineering students with sponsor organizations to devise innovative solutions to real-world problems.

An elevator seems like a simple machine: Press a button, step inside. Press another, travel up or down. But behind the control panel of any given unit is a black box of distinct signals that can be difficult to interpret.

Decoding those signals in a systematic way became a most compelling preoccupation for a team of engineering students during their final two quarters at the UW.

They came to this project through the Industry Capstone Program, which challenges graduating seniors to solve real-world engineering challenges posed — and sponsored — by companies, nonprofits and government organizations.

For students, the program represents a comprehensive final exam, requiring them to apply their entire education. But it provides benefits on both sides of the equation.

“Capstone sponsors partner on exploratory or innovation-focused work while mentoring emerging engineering students,” says program director Jill Kaatz. “Many companies also use the program to tackle smaller-scale projects that benefit from fresh perspectives. And our students get an invaluable hands-on, practical experience to kickstart their careers.”

In last year’s Industry Capstone Program, 600 students from nine different engineering disciplines tackled 116 different

projects created and sponsored by 79 partner organizations, including Amazon, Blue Origin, WSDOT, PACCAR, Boeing — and, for the first time, the Otis Elevator Company.

Out of comfort, in good company

The students working with Otis did not initially expect the inner workings of elevators to present such a fascinating challenge. They were tasked with developing an AI-powered framework to automate the software protocols in an elevator control system.

“Any student who starts this project is likely to think: it’s an elevator — how difficult could it be?” says the team’s faculty mentor Mahmood Hameed, an associate teaching professor in electrical and computer engineering (ECE). “But the students figured out very quickly that elevator controls are not at all simple. They operate in an enormous sea of signals. Navigating this required a steep learning curve for everyone.”

Especially since those signals often speak in different languages.

Beside Hameed and teaching assistant Zach Hao, the students received mentoring for this decoding project from a veteran team of Otis engineers. They also worked with a technician who helped them operate an elevator system simulator that Otis provided — a blue box, the size of a mini fridge, equipped

with all the controls, sensors and actuators that drive the real thing.

“Getting to interact with people who are so knowledgeable and passionate about this project was incredibly helpful,” says team lead Aakash Namboodiri, ‘26.

A journey as vital as its destination

The team had to quickly learn how to work together. “None of us knew each other before,” says team member Kuhu Nain, ‘26. “So open communication was most important.”

They practiced this constantly, through daily meetings and chats among the team and weekly check-ins with their Otis and UW mentors. Hameed encouraged them to ask questions, no matter how simple, and to take nothing for granted. “This is a learning experience,” he says, “not a time to be timid.”

That advice was especially relevant in the disorienting first weeks of the project. “I saw ‘AI framework’ and ‘reverse engineering’ in the project description and thought that sounded cool,” Nain says. “But once we actually got into it, it took us a month just to understand what we were actually doing.”

Once they did, the project took off. The team’s elegant AI solution impressed their sponsor and tied for first prize at ECE’s ENGINE capstone showcase.

What’s in it for Otis

The Industry Capstone Program offers participating organizations many benefits, from low-cost innovation to engagement with talented students to non-exclusive commercial licensing of any intellectual property developed.

For Otis, perhaps the greatest value has come from observing the process the students took to solve an ambiguous and expensive problem.

“Reverse engineering an elevator manually is kind of a brute-force process,” says Sally Mahoney, a longtime Otis engineer who worked with the team. “So, we were excited to watch the process taken to crack the code by this team of young, smart engineers who have all the latest training and tools — but

Students show off their work at the ENGINE capstone showcase.



The team used an elevator system simulator to test its models.

didn’t know anything about elevators. What they brought to this problem was what we wanted to see: fresh eyes.”

And curious minds.

That was the hope when Joseph Armas, ‘98, president of Otis Americas, first proposed this project. “Partnering with UW’s Industry Capstone Program allows us to engage directly with emerging engineering talent while advancing real-world challenges in our industry,” says Armas, a UW graduate with a degree in aeronautics and astronautics. “It’s a true two-way exchange: Students gain hands-on experience in a critical industry, and we benefit from fresh thinking and new perspectives. Their first-place finish is a great example of what that collaboration can achieve.”

Going up

For students, the Industry Capstone Program is “the bridge between the classroom and the world they’re going into,” says Hameed. “Not only do they draw on things they’ve learned, but also on some things that they need to learn but haven’t yet, which is cool.”

Cool, yes. But also calculated. The challenge presented to the Otis team could be seen as a microcosm of what lies ahead in their careers — a black box of signals that will need to be decoded.

“When students graduate and go into industry, they are often presented with work that someone else has done and left them to understand,” Hameed adds. “These capstone projects are exactly like that: reverse engineering legacy processes to understand how technologies could be improved.”

Through a wider lens, the experience delivers a message of empowerment to the next generation of engineers.

“We live in a time when things are constantly changing,” says Nain. “And if we have the skills and tools to affect change, why wouldn’t we?” ❖



Learn more about the Industry Capstone Program

► enr.uw.edu/industry-capstone

Keeping watch on a one-of-a-kind bridge

The I-90 Homer M. Hadley Memorial Bridge is, in a sense, a boat. Its concrete pontoons float on Lake Washington between Seattle and Mercer Island, rising and falling with the seasons, drifting with wind and water, expanding and contracting with temperature.

For 35 years, people crossing the twin I-90 spires have traveled by car, bus or truck. But in March, Sound Transit’s light rail extension began carrying passengers across the Homer Hadley — the first time light rail has ever operated on a floating bridge.

As trains began crossing the lake, a team of UW researchers had already been at work on another first: a digital twin — a virtual replica — of the bridge built specifically to inform operations, maintenance and asset management.

The project, led by civil and environmental engineering faculty members Travis Thornstad and Michael Motley in collaboration with the UW Mobility Innovation Center, connects sensors placed inside the floating pontoons to a computer model that pulls in weather data, GPS positions, anchor cable tension readings and other measurements. The information travels to the cloud, where maintenance



A light rail train crosses the I-90 floating bridge. Photo by Sound Transit

staff can review a 3D model of the bridge, click on a sensor location and see real-time conditions at that spot.

“The most surprising thing for me has been learning how the bridge behaves on a day-to-day basis at the level of precision that we were never able to before,” Thornstad says.

That baseline understanding is the foundation for what comes next: anomaly detection and physics-based models that can forecast the bridge’s future condition. Think of it as a weather forecast for infrastructure.

- Julia Davis

Tracking your tears

Eyes may be the windows to the soul. But tears, it turns out, have their own story to tell.

“We tear all the time, not just when we cry, and our tears are actually very similar to blood,” says Tueng Shen, a UW Medicine eye surgeon and UW Engineering’s associate dean for medical technology innovation.

Like saliva and sweat, tears carry biomarkers that reveal what’s happening inside the body.

Shen is helping design a microscopic wireless biosensor that could sit in a tear duct and monitor fluid for signs of disease. The proof-of-concept device will measure inflammation and blood sugar to help researchers track conditions such as dry eye disease and diabetes without repeated blood draws.

If it can be engineered to draw power from the body and send data wirelessly for at least six months, the sensor, the size of a grain of rice, could one day become a broad health-monitoring platform.

The project has been developed through the UW’s new Kren Engineering-based Medicine Initiative.

- Brian Donohue



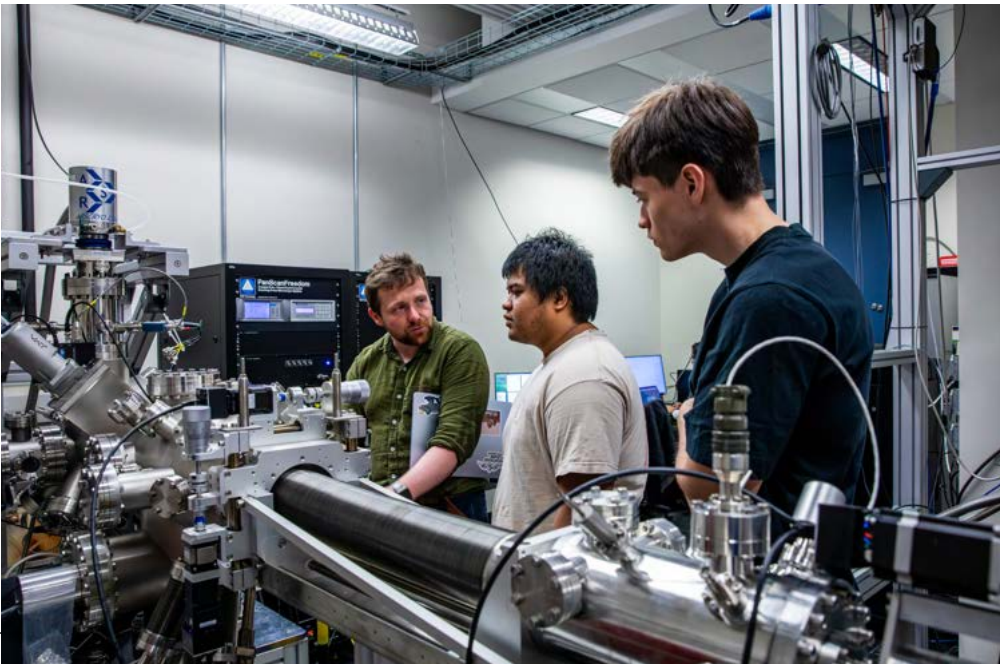
Probing the mysteries of quantum phenomena

The new Quantum Technologies Training and Testbeds lab (QT3), a unique resource for quantum researchers and educators, is packed with extraordinary machinery.

The dilution fridge can cool a small chamber close to the coldest possible temperature in the universe, creating an optimal environment to study and manipulate a material’s quantum properties. The photon qubit tabletop lab can demonstrate the phenomenon of quantum entanglement, where two particles appear to communicate instantaneously with each other despite being physically apart. The scanning tunneling microscope can image individual atoms within a solid material, allowing researchers to study the structure of materials at the smallest scales. And an ion-trapping machine can suspend charged particles, such as grains of pollen, in midair using electrical fields, a technique that can also be used to trap single atoms and manipulate their quantum properties.

“The idea of QT3 is to improve access to quantum hardware,” says Max Parsons, an

Max Parsons and students in the QT3 lab experiment with a scanning tunneling microscope. Erhong Gao / University of Washington



assistant professor of electrical and computer engineering. “We’re inviting researchers, initially from across campus, but also from other universities and from industry, to come and test their ideas. This can be a hub for quantum experts to share their ideas and collaborate.”

- William Poor

Estimating the carbon footprint of electronic devices

Google Flights can quickly compare carbon emissions for different itineraries, but shopping for a laptop offers no such sustainability data.

UW researchers have developed a system that estimates the environmental impacts of making electronic devices by using

AI agents to comb through public data and conduct life cycle assessments. The system achieves an average error rate of 5%-19%, similar to expert assessments.

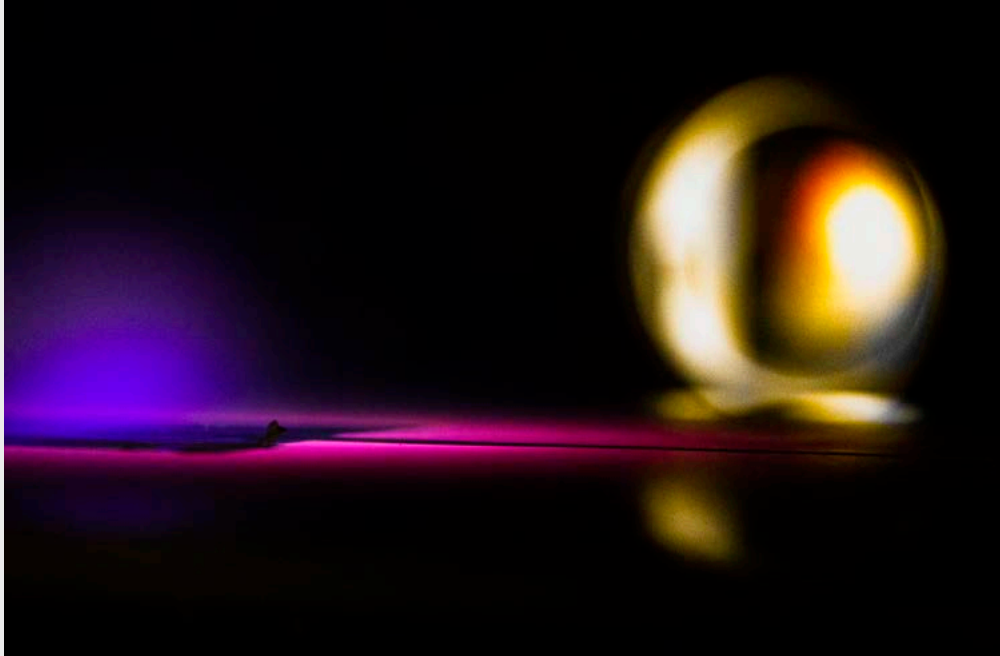
Vikram Iyer, an assistant professor in the Paul G. Allen School of Computer Science & Engineering and project lead, says there is growing demand for this information, but human experts can spend days or months gathering data. The system does it in about a minute.

One AI agent defines what information is needed and checks accuracy, while another scrapes product descriptions, images, spreadsheets and databases. The team also developed a “nearest-neighbors” method to estimate footprints for devices and materials with missing data.

Iyer hopes this automation will help companies spend less time hunting for stats and more time reducing product carbon footprints overall.

- Stefan Milne





Researchers in the SPACE Lab are creating physical models of lunar magnetic anomalies.
Mark Stone / University of Washington

Harnessing the moon's natural power supply

On the airless surface of the moon, a bombardment of solar wind threatens future exploration. But the moon also hides a natural defense: anomalies called mini-magnetospheres, localized regions of magnetism that can shield the surface from solar radiation.

Justin Little, an associate professor in aeronautics and astronautics, is leading development of experimental and

computational tools to investigate whether these anomalies could not only protect lunar research bases, but also power them.

The concept centers on the polarized electric field that forms around a mini-magnetosphere as solar wind passes through it. The separation of charges creates a natural voltage difference, like a battery. The challenge is that the solar wind is very low density, so the system has

voltage but not enough current. To address that, researchers inject electrons into the magnetic bubble, creating a virtual electrode that spreads current over a larger area.

Ph.D. students Patrick Rae and Arvinth Sharma are testing the idea through lab experiments and 3D simulations.

“This research,” Little says, “will allow us to not only advance our understanding of the natural phenomena present at lunar magnetic anomalies, but also how we might leverage these phenomena to support the long-term growth of human operations on the moon.”

- Amy Sprague

Some AI browsers come with major cybersecurity risks

AI-powered browsers can help you plan trips, book reservations and manage calendars. But UW research finds they also can create serious cybersecurity risks. A team from the Allen School studied seven popular AI browsers and found that four could allow malicious actors to bypass the “same-origin policy,” a key protection that keeps websites open in a browser from accessing one another’s information.

The researchers demonstrated a successful proof-of-concept attack on ChatGPT Atlas, showing how one website could steal information from another embedded in it. They also found similar attack conditions in Chrome with Gemini, Claude for Chrome and Perplexity Comet. In general, browsers that gave agents fewer permissions were safer.

“Browser agents aren’t ready for the public,” says David Kohlbrenner, an assistant professor in the Allen School. “Even if you’re a relatively savvy user, if these agents have access to a browser that contains your credentials — your email, your

bank account, whatever it is — you should not trust that these systems are ready to truly protect your information. They may get there in time, but they’re not there yet.”

- Stefan Milne



A 2007 landslide caused damage along Washington State Route 6.
Washington State Department of Transportation

New database maps landslide risk across the U.S.

Landslides cause an estimated \$3 billion to \$6 billion in damage and multiple fatalities every year in the United States, and the risk is likely to grow as development expands into landslide-prone areas and severe weather drives more intense rainfall. Now, UW researchers have created the first national database to map building-level landslide exposure across the U.S.

The Landslide Exposure Database rates 128 million buildings by landslide susceptibility and combines that information with socioeconomic data to show which residents are most vulnerable to landslide hazards and disruptions. The analysis found that about 6.5 million people live in landslide-prone regions, with the greatest concentrations in Appalachia and along the West Coast. Urban residents in at-risk areas tended to be more affluent and resilient, while rural residents were often less resourced and more vulnerable to the impacts of a landslide.

Joseph Wartman, a professor of civil and environmental engineering and co-creator of the database, says the work adds a human dimension to a field that has long focused on physical geography.

“This effort was much more than just merging massive datasets,” adds doctoral student Daniel Acosta-Reyes. “The real work was the careful curation required to turn the incredibly rich data available in the U.S. into an accurate, usable tool for everyone from decision makers to the public.”

- William Poor

RESEARCH NEWS

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Lab notes

Advancing materials with AI and quantum

Materials science and engineering researchers are advancing discovery of quantum materials with unusual properties like superconductivity and entanglement. One study used AI to simulate large stacks of atomic sheets, while another used a quantum computer to create a self-improving design loop by discovering new materials that could themselves be components of future quantum computers. These tools could help design future materials for quantum computing and energy-efficient electronics.

Making research papers accessible with AI

A human centered design and engineering team has built an AI tool called PaperTok that helps academic researchers turn their papers into short videos. The tool allows iterative editing of the transcript and video clip, facilitating an alternative to the social media trend of AI-generated science videos produced by non-scientists.

Accelerating discovery of new materials

Mechanical engineering researchers have developed an inverse design framework that speeds discovery of flexible composite materials — essential for wearables, stretchable electronics and soft robotic systems — by working backward from desired properties. Using physics-based modeling and machine learning, the method identified a material with 60% higher thermal conductivity and 10% lower cost than previous materials, promising faster, less wasteful design.

Decoding cells’ protein stockpiles

A study led by Paul Wiggins, an associate professor of physics and of bioengineering, found that the bacterium *Acinetobacter baylyi* makes large surpluses of many essential proteins, rather than producing only what it needs. This overabundance likely acts as a hedge against the imprecision of protein production, ensuring cells don’t run out of critical components — and challenging the idea that cells always optimize for efficiency.

- William Poor and Stefan Milne



CHIPS2FUTURE

By Ed Kromer

A summer immersion in the epicenter of the modern semiconductor industry – Taiwan – was the experience of a lifetime for UW Engineering students.

In 1976, the Taiwanese government sent a small group of promising young engineers to the United States to learn how to make computer microchips, seeding Taiwan's rise to global superpower status in the modern semiconductor industry.

In 2026, the University of Washington sent a small group of promising young engineering students to Taiwan to learn how they did it — and continue to do it.

The inaugural Chips2Future summer engineering immersion, piloted and led by UW electrical and computer engineering (ECE) faculty, offered undergraduate students an intensive primer in semiconductor design and production, hands-on practice in world-class facilities and visits to many of the companies that now produce 90 percent of the world's advanced microchips.

"Chips2Future was much more than just learning theory in a classroom," says ECE Professor Jenq-Neng Hwang, who developed and directed the program. "It was about opening students' eyes to see how the Taiwanese semiconductor industry was created and how the infrastructure of its ecosystem works."

What they did last summer

The students, representing electrical and computer engineering, computer science and engineering, and industrial

and systems engineering, were based at at Hwang's alma mater, National Taiwan University (NTU) in Taipei.

In week one, ECE Professor Anant Anantram provided an intensive introduction to semiconductor devices. Postdoctoral scholar William Livernois, '22, '25, delivered the second week's deep dive into CMOS circuits, the core technology used to construct chips, microprocessors and memory.

In week three, the students tested these advanced semiconductor concepts on real hardware at the state-of-the-art Taiwan Semiconductor Research Institute (TSRI).

The final week featured visits to many of the nation's leading semiconductor companies and organizations, including MediaTek, Global Unichip, Winbond and Taiwan Semiconductor Manufacturing Company (TSMC). The group also toured the Institute of Pioneer Semiconductor Innovation



at National Yang Ming Chiao Tung University and its innovative industry training collaboration.

In the margins of Chips2Future, the students visited Taiwan's cultural sites and museums, traversed its efficient transit system, sampled its culinary mosaic and famed night markets — and beat the summer heat with lots and lots of boba tea (invented in Taiwan).

Eye-opening experience

Though not a personal fan of boba, ECE senior Akash Savitala found lots to love about the experience. Highlights, for him, were touring the iconic TSMC facility, watching the Wall-E-style robots delivering silicon wafers through the production process at Winbond, visiting museums and temples, and meeting students in the NTU maker space. But the real value was a comprehensive understanding of the semiconductor industry, from concept to manufacture at mass scale.

"That combination," Savitala says, "helped me connect what I've learned in the classroom to the bigger picture of semiconductor development and gave me a much clearer sense of the directions I'd like to explore moving forward."

In his case, it means shifting from a software path toward quantum computing and the physical concepts behind it.

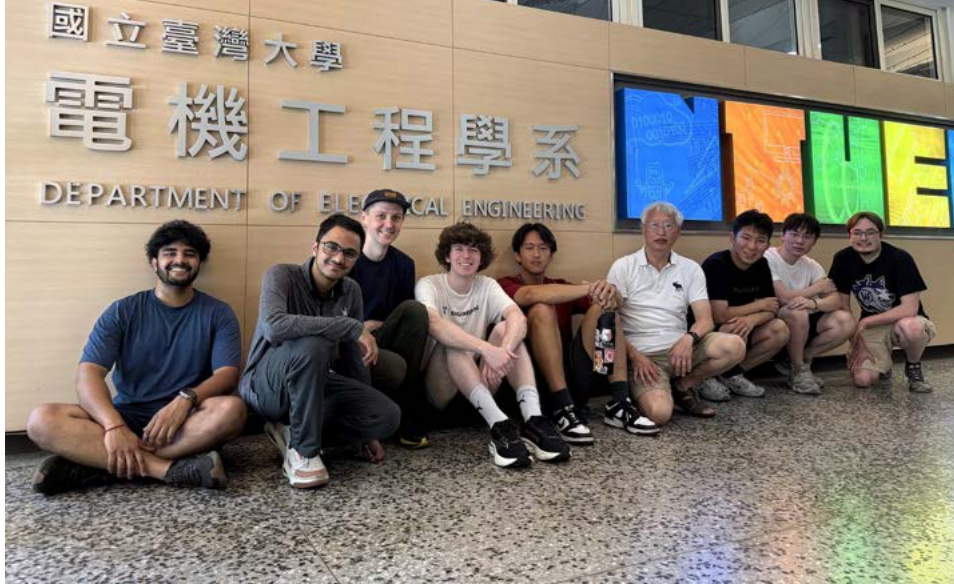
Thinking bigger

"Chips2Future is experiential learning at its best," says Jihui Yang, vice dean of the College of Engineering. "The pilot program demonstrated the power of bringing students, universities and industry together — and laid the groundwork for even stronger partnerships between the UW and Taiwan in the years ahead. I'm grateful to ECE Chair Eric Klavins for supporting the launch of this valuable initiative."

Future iterations could deepen the student experience by drawing on NTU's academic programs and faculty expertise, creating more opportunities for students from both institutions to work together and, eventually, bringing NTU students to the UW.

For Hwang, who served as a guide throughout the visit to his native Taiwan, the goal of Chips2Future was to provide undergraduates a rare opportunity to experience a critical global industry at its epicenter. Its broader purpose is to build on the academic and industry relationships that have helped Taiwan's semiconductor sector thrive.

Many of Hwang's classmates at NTU in the early 1980s went on to graduate studies in the U.S. and then returned to help take Taiwan's semiconductor industry from promising to preeminent in the ensuing decades. He knows the power of cultural and technological exchange.



UW Engineering students and faculty take a break at National Taiwan University. Opposite page: A chip fabricated in Chris Rudell's ECE lab. Photo by Ryan Hoover

"Many of those original engineers who were sent to the U.S. in the 1970s came back and launched companies that built the industry in Taiwan," Hwang says. "That's what I'm hoping the students will take away from this experience. In the beginning, they were skeptical about my suggestion. But gradually, it got some of the students thinking bigger — about what they can learn and what their careers could possibly be." ❖



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Students work on circuits at Taiwan Semiconductor Research Institute.

ENGINEERING THE FUTURE

By Malavika Jagannathan

Recent grad Gizem Gökçe-Alpkılıç is using AI-powered tools to create proteins and solve global challenges, like drug-resistant infection.

As a child, Gizem Gökçe-Alpkılıç asked her parents for a microscope so she could dissect the world around her. She's still looking at life's smallest parts today at the UW's Institute for Protein Design (IPD) — just with more sophisticated tools.

Led by Nobel Prize winner David Baker, the IPD is an interdisciplinary research center harnessing AI to design proteins that could shape the future of medicine and beyond. The impact of this cutting-edge research is what brought Gökçe-Alpkılıç, '26, from Ankara, Turkey, to the UW for a doctorate in molecular engineering — and is keeping her at the IPD as a postdoctoral researcher.

Gökçe-Alpkılıç's work could help scientists solve persistent global challenges, like infections from bacteria or viruses that have adapted to medicine. "We need new countermeasures and we need to be fast," she says, "so AI models will be helpful in that part."

Her Husky journey began in 2015, when, as an undergraduate in Turkey studying biomedical engineering, she spent four months at the UW through the Visiting International Student Internship & Training program. Working in Chemical Engineering Professor François Baneyx's lab gave her a firsthand experience with research — and a sense for her future as a scientist.

Later, with a scholarship from the Turkish Fulbright Education Commission, she returned to the UW. What initially drew

her to the University — the resources, community and interdisciplinary collaboration — brought her to the IPD.

She couldn't have predicted how quickly AI would transform the field, allowing scientists to test hundreds of designs and create proteins that don't exist in nature.

Gökçe-Alpkılıç and her IPD colleagues move between computers and white coats and goggles, using deep-learning tools to model and generate protein designs, then testing them in the lab. "It's really important to use experimental data and feed it back to the AI computational models to improve it further," she says.

Gökçe-Alpkılıç has tested the capabilities of peptides, tiny molecules that can target proteins associated with diseases like cancer or antibiotic-resistant bacteria. She compares proteins to locks and peptides to keys: "You basically know the structure of your lock and are trying to make the key to fit into that." Her goal is to find the key that both fits and stays in the lock, helping pave the way for more highly targeted drugs.

Much of her research focuses on a particular protein in *Francisella tularensis*, the bacterium that causes tularemia. With no licensed vaccine available and the bacterium classified as a potential bioterrorism agent, Gökçe-Alpkılıç is designing peptide and mini-protein binders to disrupt its key function.

She believes the UW is the perfect place for this exploratory research and is excited to see where her research could go next — far beyond anything she'd imagined as a child with a brand-new microscope. ❖

Built to play

The project began with a simple question: How could a two-year-old with cerebral palsy play alongside her older sibling?

That question led Mia Hoffman, '26, to develop the Switch Kit, an adaptable play and communication system that helps children with motor disabilities engage more fully in play.

For her work — and for an academic career defined by community-engaged research — Hoffman received the UW Graduate School Medal last spring. The award recognizes a UW doctoral candidate whose academic expertise and social awareness are integrated in ways that demonstrate civic engagement and a capacity to promote social change.

Using inexpensive materials and customizable switches, the Switch Kit allows children with disabilities to engage with digital play environments in developmentally meaningful ways. Hoffman has open-sourced the designs, partnered with community organizations to distribute them and, through her leadership in HuskyADAPT — a student organization dedicated

to supporting accessible design and inclusive play technology — helped make adapted toys available to families throughout Washington.

"We wanted families to see these designs and think bigger," she explains. "Here's a starting point, but you can make it your own."

Now, after completing her doctorate in mechanical engineering, she is embarking on the next chapter: as a postdoctoral researcher at The Ohio State University, where she will continue developing assistive technologies for children.

- Tatiana Rodriguez

(Not so) ordinary days

Human centered design and engineering (HCDE) master's student Selah Key recently presented her independent research project, Ordinary Days, at the United Nations' AI for Good Global Summit in Geneva, where it received a Best Use Case award through the International Telecommunication Union's Innovate for Impact initiative.

Ordinary Days is a context-aware, multimodal AI system designed to help people better understand and respond to chronic stress. By combining user input, digital behaviors and privacy-preserving methods, it aims to recognize individual stress patterns and deliver personalized, evidence-based interventions while preserving user agency.

"My goal has always been to create human-centered technology that helps people live happier, more authentic lives," Key says. "HCDE gave me the flexibility to combine human-computer interaction, AI, clinical neuroscience and design research into one project."

- Leah Pistorius

Cheers to engineers!

The Chemical Engineering Brew Club, a student organization exploring the art and science of brewing and distilling, teamed up with Seattle-based Fremont Brewing over the summer. Their creation, Dawg Water, was a limited-release hazy beer with notes of bread dough, stone fruit, florals and fresh grass.

The beer was so well received that Fremont Brewing sold out in just a few weeks. But don't worry if you missed it: the club is planning another collaboration with Fremont Brewing this academic year and are in talks with other Seattle-area breweries, too.

- Tess Wroblewski



Students in the Chemical Engineering Brew Club formulate their proprietary beer at Fremont Brewing.





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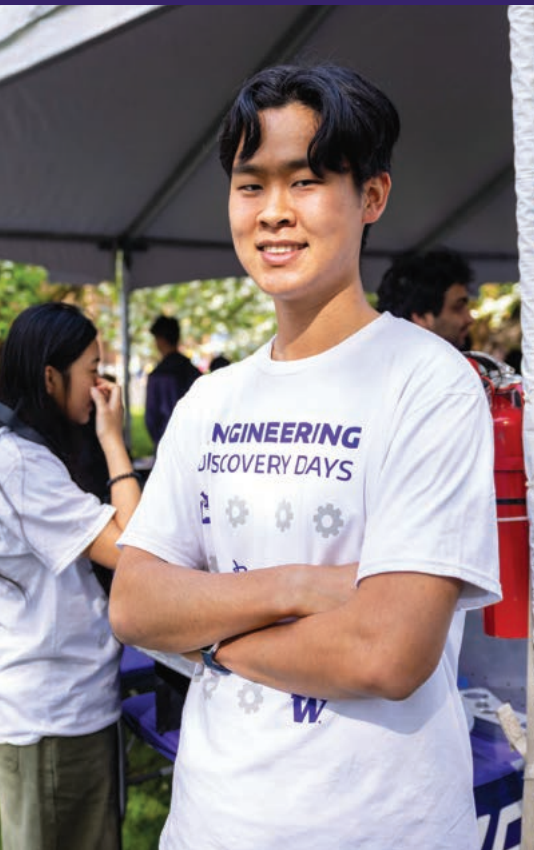
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The power of curiosity

Curiosity has the power to change lives. For thousands of K-12 students each year, it begins at Discovery Days, where hands-on activities and conversations with UW Engineering students reveal how engineering improves lives, strengthens communities and helps solve the world's biggest challenges.

Discovery Days also transforms UW student volunteers, who develop communication and problem-solving skills and earn confidence to lead.

"What stuck with me most was the curiosity and feeling that I could build something amazing one day," says mechanical engineering senior Andy Yang, whose own middle school visit to Discovery Days inspired his path to UW Engineering. As a student presenter, he is now sparking that same curiosity in others.

Programs like Discovery Days are possible through the Engineering Dean's Fund for Excellence, which provides flexible support for opportunities that prepare students to lead while inspiring the next generation of engineers.

Your support helps ensure more students can discover what's possible — and imagine where curiosity might lead them.

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