

Catalyst

2024

Bridging the gap

Accelerating research • Broadening
professional ChemE education • Full-scale
battery labs • AI/ML for chemical processes

CHEMICAL ENGINEERING
UNIVERSITY *of* WASHINGTON

W

FROM THE INTERIM CHAIR

Up to speed

For UW ChemE, 2024 was an exciting year of expansion and growth. Despite the decline of chemical engineering applications on a national level, our department continues to flourish. This year we welcomed our largest cohort of incoming undergraduate students in decades, with 99 students enrolled in the ChemE introductory course. I believe this to be a direct reflection of our department's continued efforts to make ChemE an exciting place to be for aspiring engineers.

This issue of Catalyst outlines new initiatives we have taken to develop professional learning programs for working engineers. Whether it's making a career shift into clean energy and battery engineering, or adopting data science practices, artificial intelligence and machine learning into chemical processes in order to accelerate advances across industries, UW ChemE is working hard to broaden the educational landscape.

Chemical engineers are well positioned to be world-class innovators in the new and growing industries of clean energy, artificial intelligence and biotechnology, and we always look forward to seeing how our students — past, present and future — will make a positive impact.

James Carothers

Interim Department Chair and
Charles W.H. Matthaei Endowed
Professor



discovering CHEME

The University of Washington College of Engineering hosted the first Engineering Discovery Days event since 2019. UW ChemE facilitated two days of fun scientific demonstrations for visiting 4th through 8th grade students at Benson Hall.

Electrochemical Engin-earring

ChemE Ph.D. student Rose Lee and Clean Energy Institute postdoctoral researcher Rebecca Vincent led a demonstration to show electrochemistry can transform the color of titanium metal. Participants created their own jewelry while learning about clean energy applications of electrochemistry.



Students engaged in live electrochemistry experiments. Photo by Mark Stone

“Super Cool” Fun with Liquid Nitrogen

Members of the Bergsman Research Group demonstrated how liquid nitrogen slows down molecules, changing the form and function of items such as rubber bands, flowers, chips and more.

This experiment was supported by ChemE graduate students Joelle Scott, Jane Keth, Seancarlos Gonzalez and Claire Benstead, as well as undergraduate students Alyssa Hicks and Cecilia Osburn.



Chemical engineering assistant professor David Bergsman leads “super cool” experiments at the 2024 Engineering Discovery Days. Photo by Matt Hagan

Unpoppable Bubbles

ChemE undergraduate students Lauren Ellis and Stella Anastasakis led an engaging, hands-on experiment in chemistry and surface tension for visiting students, where they created unpoppable bubbles.



Discovery Days participants create unpoppable bubbles. Photo by Lola Reinhardt

Walk on Water!

Adventurous Discovery Days participants took their chance to stride across a pool of oobleck, a non-Newtonian fluid that can behave like both a liquid and a solid, simulating the ability to nearly walk on water. This crowd-pleasing demonstration was hosted by graduate students and Z Lab members Ayca Ersoy, Haoqing Zhang, Rishabh Sanghavi and Kenny Lam



A participant “walks on water” while supervised by ChemE undergraduate student Sarina Vafa (B.S. '24). Photo by Mark Stone

Other ChemE Discovery Day demos included:

Brains, Engineers and Medicine, Oh My! The Nance Lab

Exploring Conductive Inks The Jenekhe Lab

Hydrogen, from Water!

Instant Snow from Super-Absorbent Polymers

Microscopic Marvels & Pioneering Minds

Rob-Ross The Pozzo Research Group

2024 Fellowships

Lilo Pozzo was named a **2024 NSSA Fellow** for her development of in situ neutron scattering measurements to show soft matter structure-function relationships, and for her advocacy and service in the greater neutron user community. Pozzo was nominated by Katie Weigandt, a UW ChemE alumna and former member of the Pozzo Research Group.



Elizabeth Nance was named among the **2024 Controlled Release Society College of Fellows**. Nance's research has helped fill critical knowledge gaps in neonatal brain disease and drug delivery. Her lab currently has four provisional patents on nanotherapeutic platforms to facilitate translation of these technologies into the clinical setting.



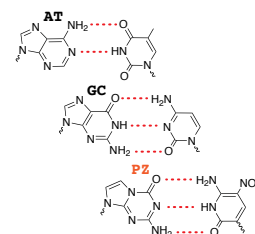
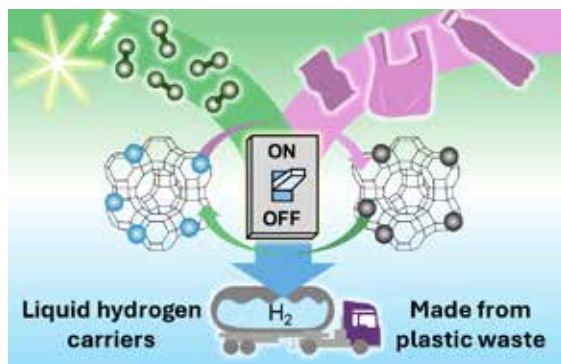
Early innovators at UW ChemE

Julie Rorrer received a \$500,000 grant from a new program by the Advanced Research Projects Agency-Energy (ARPA-E). The **Inspiring Generations of New Innovators to Impact Technologies in Energy 2024 (IGNIITE 2024)** program funds early-career innovators to advance energy-focused research projects. The Rorrer Lab will use the funds to develop a catalytic reactor that can adapt to the intermittent nature of renewable hydrogen availability, and also provide a cheaper and cleaner way to store green hydrogen using waste plastics.



David Bergsman received the **2024 Paul H. Holloway Young Investigator Award** from the American Vacuum Society (AVS) for his outstanding theoretical and experimental contributions to thin film science and technology.

Jorge Marchand received \$1.1 million in funding over a three-year period from the **Systems and Synthetic Biology cluster of the National Science Foundation (NSF) Division of Molecular and Cellular Biosciences**. This grant will help Marchand lead a cross-institutional collaborative research project to develop model systems for expanding the genetic lexicon. The hope is that these findings could be used to develop new biotherapeutics and a deeper understanding of molecular biology.



materials discovery ACCELERATORS

RESEARCH HIGHLIGHTS

Modular, open-source robot propels lab automation

The Pozzo Research Group is working to speed up the process of discovering and optimizing materials that have applications in clean energy, medicine, nanotechnology and more. To do this, researchers used a series of commercially available equipment to conduct experiments through machine learning, high-throughput analysis, and advanced characterization through neutron and X-ray scattering. The Pozzo Research Group partnered with the UW Department of Human Centered Design and Engineering (HCDE) to create a platform that would be completely customizable to their specific experimentation needs. With open-source hardware design provided by Machine Agency, the lab of HCDE professor Nadya Peek, ChemE researchers built their own multi-functional robot with automated and autonomous experimentation for materials discovery in mind.

This multi-process machine, called “Jubilee,” was built from open-hardware components and is capable of the same liquid handling of off-the-shelf tools and more. With the open-hardware framework, Jubilee is designed to be a completely modular robot with customizable functionality that brings capabilities of multiple lab machines into one.

*A demonstration of Jubilee's liquid handling capabilities.
Photo provided by the Pozzo Research Group*



Multi-chamber reactor for rapid thin film experimentation

Finding new photoresist materials that work well with extreme ultraviolet light (EUV) will allow for the development of smaller transistors and more powerful computers. ChemE Ph.D. students and Bergsman Research Group members Duncan Reece and Yuri Choe outlined their process to build a new reactor made up of six independent vacuum chambers in a recent publication, which was selected for the 2024 JVST A Best ALD Paper Award. This project was funded by the Semiconductor Research Corporation, a collaboration of scientists and engineers across academic institutions, government agencies and technology companies focused on advancing critical technologies for the betterment of economic growth and national security.

The Bergsman Group's reactor is capable of using shared materials sources for atomic layer deposition (ALD) and molecular layer deposition (MLD) processes so that six different experiments can run simultaneously without cross-contamination. A series of pipes and tubing connects each chamber to shared pieces of equipment and chemical sources. A computer then runs a program that controls which chamber each reactant vapor is sent to, and for how long. Employing this reactor will allow for accelerated experimentation of new thin film materials with applications in the rapidly advancing field of microelectronics.

ChemE Ph.D. candidate Duncan Reece examines the reactor. Photo provided by David Bergsman.



Header and cover image courtesy of Umberto, Unsplash



Bridging the gap

Professional learning programs designed
for working chemical engineers

Photo by Dennis Wise

UW ChemE has taken on the task of developing new professional certificate programs that will help working engineers fill critical knowledge gaps amidst new emerging industries and accelerating technologies.

By Ro Stastny

As a discipline, chemical engineering has valuable applications across every major impact area in science and technology. But with a world where new industries like clean energy, biotechnology and artificial intelligence are becoming central to making continued advancements, some working professionals may find it challenging to adapt in their career if they earned a chemical engineering degree more than a decade ago.

Unlike traditional graduate degrees, these new programs are designed to be structured for a working engineer and are laser-focused on industry-specific applications, allowing professionals to build a highly customized set of skills aligned with their individual goals. These certificates are part of a broader collection of professional development programs created by the University of Washington College of Engineering, giving participants the flexibility to earn credentials necessary to advance or change careers while maintaining a full-time work schedule.

"Our faculty are excited to help participants learn to solve problems with tools and technologies that barely even existed five to 10 years ago, let alone when most working engineers were last in a classroom."

James Carothers, ChemE professor and interim chair



A battery electrode coater is one of the machines used in the Washington Clean Energy Testbeds, where professional program students will complete their culminating capstone for the Graduate Certificate in Battery Engineering, Materials and Manufacturing.

Photo by Matt Hagan

CONTINUED ON NEXT PAGE

At the Washington Clean Energy Testbeds, student researchers develop coin cell batteries using novel materials and test their performance.

Coin cells are often used in the early stages of battery research to test the efficacy and performance of new battery materials and architectures. The small size allows for the determination of cell performance metrics such as cell capacity, voltage or maximum current, enabling researchers to compare cells made of new materials with batteries currently being manufactured.

With successful test results, researchers can quickly scale these novel material cells to larger formats.

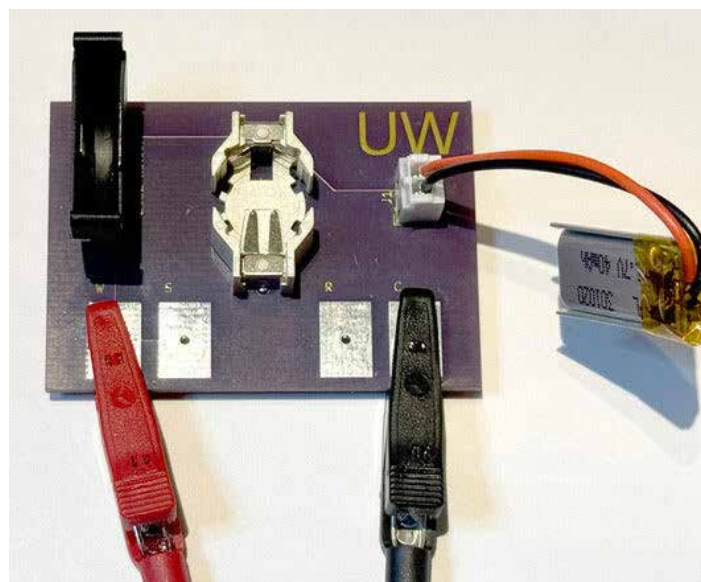


Photo by Matt Hagan

Fully charged

In 2024, chemical engineering professors Stu Adler and Eric Stuve piloted new battery courses for a professional program designed to fill critical skill and knowledge gaps as the battery industry booms and more workers are needed to meet demand. A survey of industry engineers conducted by NAATBatt in 2021 found that most participants lacked necessary skills in electrochemistry and manufacturing of battery materials. Additionally, surveyed engineers expressed their desire for more hands-on training opportunities in the area of battery engineering.

The University of Washington is well positioned to help fill this gap through collaborations between UW ChemE and the Washington Clean Energy Testbeds. Using the data they collected from industry outreach and surveys, Adler and Stuve have developed a Graduate Certificate in Battery Engineering, Materials and Manufacturing, which is set to welcome its first cohort in 2025. This one-



The interface board (above) designed by Adler, to be used with the PalmSens EMStat4S (pictured bottom left) as part of the at-home lab equipment that students will use during the course. This offers remote learners an easy way to perform hands-on tests with various kinds of batteries. Images provided by Stu Adler.

year program specifically addresses the areas of battery knowledge most lacking among chemical engineers, starting with fundamentals of battery electrochemistry and design and leading up to full-scale battery manufacturing. ChemE faculty have also brought hands-on training components into an online, remote learning environment by assembling at-home lab equipment for students to use throughout their courses.

Adler and Stuve have outlined a culminating two-week intensive lab experience for the curriculum, hosted at the Washington Clean Energy Testbeds in Seattle. This capstone brings the advanced



battery course topics to life with an on-site, full-scale battery manufacturing project.

Harnessing the power of data

Artificial intelligence (AI) and machine learning (ML) are helping engineers make critical advances in the clean energy, chemical, semiconductor and biomanufacturing industries. With the growing abundance of data generated by automation, engineers can incorporate these new predictive tools to aid in data interpretation and decision making at scale.

UW ChemE's industry partners are seeking these new data science skills and expertise and see them as essential for professional engineers to remain competitive in the workforce. ChemE currently offers data science degree options for M.S. and Ph.D. students, which enable students pursuing advanced degrees in chemical engineering to add a credential that explicitly acknowledges their expertise and research

experiences in the chemical sciences through the application of data science methods including AI and ML, data visualization, statistics, data management, and software engineering.

Over the last year, chemical engineering professor David Beck has led the development of a new graduate certificate to expand access of this data science curriculum to working chemical engineers. The Graduate Certificate in AI/ML-driven Molecular and Processing Engineering will cover applications of artificial intelligence and machine learning to molecular and process systems in a remote, project-based setting using the language of chemical engineers.

"Engineers will practice the concepts of research, software design and engineering, and human centered design so that software tools built using AI and ML to support research are sustainable, reproducible and user-centered," said Beck.

This professional certificate will be opening applications in Spring 2025.

A new avenue for learning

With these two professional certificates underway and ideas for more in the pipeline, the leading ChemE faculty are committed to keeping course materials current by incorporating methods from their active research programs.

This level of access will enable professional learners to engage in, and stay on top of, advancing industry challenges and solutions in a rapidly changing world.

Photo courtesy of UW Hyak

THE STUDENT EXPERIENCE

Undergraduate achievements



ChemE junior **Annabella Li** was awarded the **Barry M. Goldwater Scholarship**. Li is a double major in chemical engineering and biochemistry, and a member of the DeForest Research Group. Her research focuses on designing, producing and testing protein-based systems for use in controlled drug delivery and tissue modeling.

Kristin Bennett received the **Mary Gates Leadership Scholarship** from the Mary Gates Endowment for Students for her project titled "Providing Curricular-Based Professional Development in Identifying Accessibility Challenges in the Workplace and Building Communication and Support Skills for Disability in the Workplace."



Award-winning patient care device

Sarina Vafa (B.S. '24) participated in the Hollomon Health Innovation Challenge as a member of a multidisciplinary team, ShockSafe, that won the Jim & Timmie Hollomon Best Idea for Patient Safety Prize.

ShockSafe's AED weight-detection accessory aimed to distinguish between pediatric and adult patients during cardiac arrest emergencies. Their technology-enabled solution aimed to improve patient safety through error and complication reductions in patient care.

Sarina Vafa (center) and the members of the ShockSafe team at 2024 the Hollomon Health Innovation Challenge

Graduate student highlights



Maria Politi (Ph.D. '24) won the **Clean Energy Scientific Achievement Award** from the Clean Energy Institute, for her leadership in accelerating the adoption of automation and AI for the discovery and optimization of clean energy materials.



HUSKY 100

Nada Naser (Ph.D. '24)

ChemE Ph.D. candidate **Karen Li** was one of eight doctoral students nationally to be awarded by the **U.S. Department of Energy (DOE)'s Office of Science Graduate Student Research (SCGSR) program**. Li was invited to conduct thesis research in the Nanoscience and Technology division at the Argonne National Laboratory under mentor and award-winning scientist Jie Xu.

ChemE Ph.D. candidate **Sydney Floryanzia** received the **2024 HHMI Gilliam Fellowship**, a program that recognizes student-adviser pairs committed to fostering equity and inclusion in science. Floryanzia and her adviser, Elizabeth Nance, will receive an annual award of \$53,000 for up to three years.

UW ChemE brings home win for classroom accessibility publication

A publication co-authored by students, faculty and staff from the UW chemical engineering department's Diversity, Equity, Inclusion and Accessibility (DEIA) committee received two awards at the 2024 American Society of Engineering Education (ASEE) Annual Conference this summer.

The ASEE Annual Conference brings together engineering educators to learn and share innovative approaches to improve learning outcomes for their students. ChemE DEIA committee members attended the conference in Portland this past June, where undergraduate student Kristin Bennett formally presented key data points from the committee team's collaborative paper on class recordings and accessibility.

The publication received the Professional Interest Council (PIC) I Best Paper award over all 11 divisions within that council. It also received the 2025 Joseph J. Martin Award, an honor for the most outstanding paper presented within the Chemical Engineering division.

In their paper, the authors address the impact of lecture recording in classrooms on student learning outcomes. This has been a topic of contention among educators and disability advocates that has become broadly debated in the wake of the COVID-19 pandemic, and with rising technology integrations in learning. The authors document the process that the department used to identify the need for better access to department courses. They cite multiple sources to support their consensus that lecture recordings as a supplemental learning material are beneficial for all students regardless of disability status, and do not correlate with course performance or a lack of class engagement.

Co-authors

Stuart Adler ChemE associate professor

Kristin Bennett ChemE undergraduate student (B.S. '25)

David Bergsman ChemE assistant professor

Emily Risë Crum ChemE alumna (B.S. '23)

Nicole Minkoff ChemE undergraduate adviser

Alex Prybutok ChemE assistant teaching professor



(From left) Alex Prybutok, Nicole Minkoff and Kristin Bennett at the ASEE conference in Portland, Oregon



ChemE undergraduate student Kristin Bennett presents the DEIA committee team's paper at the ASEE conference

To Record or Not to Record? Collaborating through Conflict
Read the paper at peer.asee.org

2024 R. Wells Moulton

Distinguished Alumnus in Industry

Camillo Cheng (B.S. '76)

Co-Owner,
Savr, LLC dba Tsue Chong Company

Camillo Cheng grew up in Malaysia, and came to the United States in the 1970s to attend college. His decision to pursue a degree in chemical engineering stemmed from his general interest in science and chemistry.

Cheng graduated with a bachelor's degree in chemical engineering in 1976. He then continued his education at UW and earned a MBA in 1978.

For the first few years of his career, Cheng worked in chemical sales with companies that ranged in size from small, privately owned firms to multinational corporations. With a particular interest in business leadership, Cheng then took an opportunity to help run a local chemical company. Over the next several years he rose from president to CEO, ultimately becoming minority partner before helping to sell the company in 1998.

At that point Cheng set his sights in a new direction and became the owner of Golden Pheasant Foods, a family-owned Asian food manufacturer in Seattle. Cheng and his wife ran and successfully grew the business together before selling it in 2012.

In 2019, still not quite ready to fully retire, he partnered with his son Isaac and together they purchased Tsue Chong Company, a long-standing Asian food manufacturer that has been in operation for over 100 years. Cheng still helps run the company today.

Outside of work, Camillo has demonstrated a commitment to giving back, and has been a generous alumni volunteer with UW ChemE, having served as an informal mentor to students.

"Over the years I have learned that business really is my hobby," said Cheng, "I enjoy being an entrepreneur and taking risks, and making sure things all work out. I also really enjoy the 'people' part of it, and being able to see others grow in their own success."



Camillo Cheng speaks at the ceremony for the ChemE graduating class of 2024



ChemE department interim chair James Carothers and Camillo Cheng celebrate his award

2024 UW Chemical Engineering

Early Career Impact Award

Felix Sunjoo Kim (Ph.D. '12)

Professor and Department Chair, Chung-Ang University
Seoul, Korea

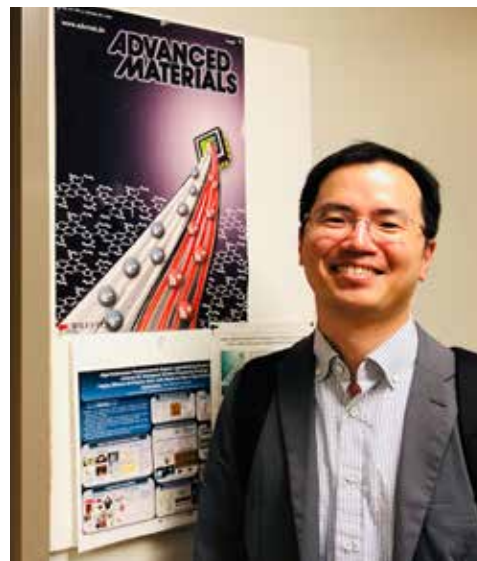
Felix Kim earned his Ph.D. in chemical engineering from the University of Washington in 2012, advised by ChemE professor Samson Jenekhe. In reflecting on his experience as a student, Kim commended UW ChemE for fostering a creative and collaborative learning environment, with accessible faculty who were always willing to provide guidance and expert advice to support him through his research and career development.

Kim is now a professor of chemical engineering at Chung-Ang University in Seoul, Korea and currently serves as the department chair. His research focuses on sustainable electronics and neuromorphic computing systems enabled by chemical engineering. Semiconductors and microchips have fundamentally changed the way that people live, and artificial intelligence (AI) is now accelerating that change. However, the current technology used to run AI is inefficient and requires too much energy to run. If there is no intervention, overlooking the sustainability of these systems will very quickly pose great energy challenges.

To address this, Kim is working on finding a solution to the increased energy demands of running artificial intelligence on high-power devices. He is working to develop electronic systems based on nature-derived materials and bio-inspired spiking neural networks to mimic the human brain, among other strategies to tackle the AI energy challenge. Kim has published over 100 research articles in peer-reviewed journals, and he currently holds eight patents. He has won several research and teaching awards, including the American Chemical Society National Award for Outstanding Graduate Research in Polymer Chemistry (2014) and the Chung-Ang University Excellent Young Faculty Grant (2018).

In October of this year Kim traveled from Seoul, Korea to receive his award in person, presented to him by Jenekhe. While visiting campus, Kim also gave a special seminar on polymer blends for electrochemical transistors and neuromorphic devices.

Chemical engineering professor Samson Jenekhe (right) presents the 2024 Early Career Impact Award to Kim during his visit to UW campus on October 8, 2024.



Felix Kim stands next to a poster that hangs in Benson Hall, depicting research that he worked on as a Ph.D. student



UW ChemE established the Early Career Impact Award in 2021 to recognize a graduate within 15 years of receiving their degree who has made significant contributions to engineering in industry, academia, government, or public or volunteer service.

DONOR SPOTLIGHT

New undergraduate research fund honors John Berg

The Gregory and Kimberly Ogden Endowment Fund in Undergraduate Research will support new opportunities for ChemE undergraduate students to work in labs and gain invaluable experience in chemical engineering research.

University of Washington Chemical Engineering alumnus Greg Ogden (B.S. '86) knew that he wanted to be a chemical engineer ever since he was very young. Pursuing his acceptance to UW was, for Greg, an obvious choice in moving toward his ideal future career.

In his first year as a UW student, Greg got a summer job with the football stadium crew where he worked painting Husky helmets and sanding the bleachers. It was a fun job to have as a student, but Greg yearned for a job with an engineering focus that aligned with his ChemE education.

The following year, Greg was offered an opportunity to work as an undergraduate researcher in the Surface and Colloids Lab under ChemE professor John Berg. He worked alongside Berg and ChemE graduate students conducting experiments in surface tension for the remaining three years of his undergraduate degree.

After graduating from UW, Greg earned a master's in chemical engineering from the University of Colorado Boulder in 1988. He worked in industry for several years in air pollution control and nuclear waste remediation and earned a Ph.D. in chemical engineering from the University of Arizona in 2002. Greg is currently a research professor in the UA Department of Chemical and Environmental Engineering, where he has been a faculty member for over 20 years. His wife Kimberly Ogden is also a professor in the same department.

Greg credits the early research experience he had and being supported by John Berg and other ChemE faculty as invaluable to his subsequent career success. The Gregory and Kimberly Ogden Endowment Fund in Chemical Engineering was started to honor the impact that Berg had on Greg's ChemE experience and continue incentivizing undergraduate chemical engineering students to engage in hands-on research.

"Dr. Berg continually encouraged me to try different procedures and understand the basic phenomena in question. During my undergraduate years at UW, he nurtured my interest in and love of hands-on research that has continued to this day."



Greg and Kimberly Ogden on vacation at Denali National Park

If you are interested in making an impact through philanthropy at the UW, please contact Emily Thurston, Assistant Director of Advancement, at ethurs@uw.edu

**Stay
connected
with ChemE**

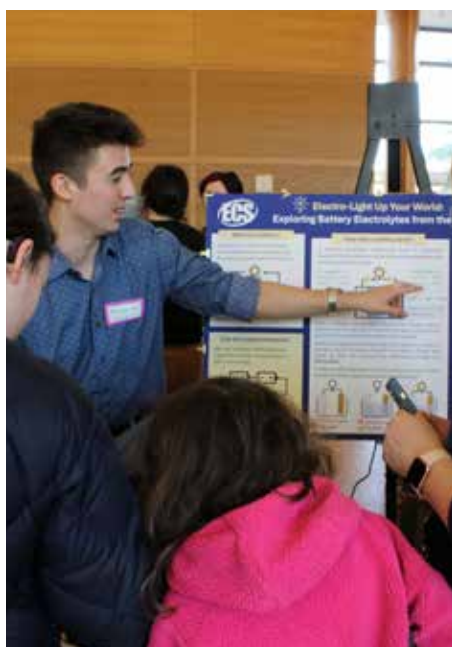
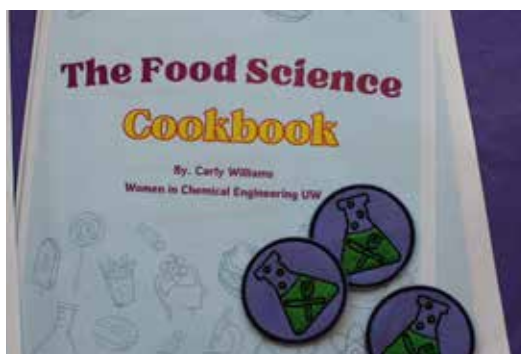
We have opportunities for alumni at all stages of their careers to support and interact with the department. Whether it's giving a guest lecture, sponsoring a capstone project, or participating in a networking event, alumni enrich department life and add value to the student experience.

Please contact department interim chair James Carothers at chechair@uw.edu if you're interested in getting involved and would like to learn more.

WOMEN IN CHEMICAL ENGINEERING

Introduce a Girl to Food Science

UW Women in Chemical Engineering (WChE) hosted their 8th annual "Introduce a Girl" event, offering an engaging and interactive afternoon of STEM demonstrations for young girls and gender-expansive individuals. This event was sponsored by WChE, the Clean Energy Institute, the HUB, and the UW Alumni Association.



Photos by Ro Stastny. Washington State law does not allow faces of minors to be shown without their express written permission. All participants shown signed a consent form prior to the event.

Chemical Engineering Leadership Seminar Series

This series explores a breadth of career paths and connects students with alumni who are leaders in a range of industries and sectors. Reflecting upon their careers, speakers offer students valuable insights, lessons learned, and advice for succeeding in today's professional work environment.

2024 SPEAKERS

Lindsey Boles (B.S. '11)

Chief Product Officer, Zeno Power

Kovas Palunas (B.S. '16)

Software Engineer, Google

Tae Han (B.S. '98)

President and COO, ProfoundBio

Erin Hollinger (B.S. '07)

Director of Engineering, Intel

Jade Hudson (B.S. '87)

Director of Production Engineering, Blue Origin

Brooke Raleigh (B.S. '06)

Senior Process Engineer, Envoy Development

Kurt Ilgenfritz (B.S. '81)

Retired, ExxonMobil

Marc Levin (B.S. '80)

Reactive Hazards & Safety Engineer, Shell Oil Company

Greg Ogden (B.S. '86)

Research Professor, University of Arizona



Never miss
an update.
Follow us on
social media!



University of Washington
Chemical Engineering



@UWChemE



@uwcheme

Benson Hall 105, Box 351750
Seattle, WA 98195-1750



RETURN SERVICE REQUESTED

James Carothers

Interim Department Chair and
Charles W.H. Matthaei Endowed Professor

Ro Stastny

ChemE Communications Manager,
Catalyst editor and designer

Kaitlin Colleary

Director of Advancement, College of Engineering

Emily Thurston

Assistant Director of Advancement, College of
Engineering

Send comments and address corrections to
chenews@uw.edu or to the return address above



The Future is Bright

Support the next
generation of leaders
with a gift to ChemE.

Discover all the ways to make an impact: cheme.uw.edu/give