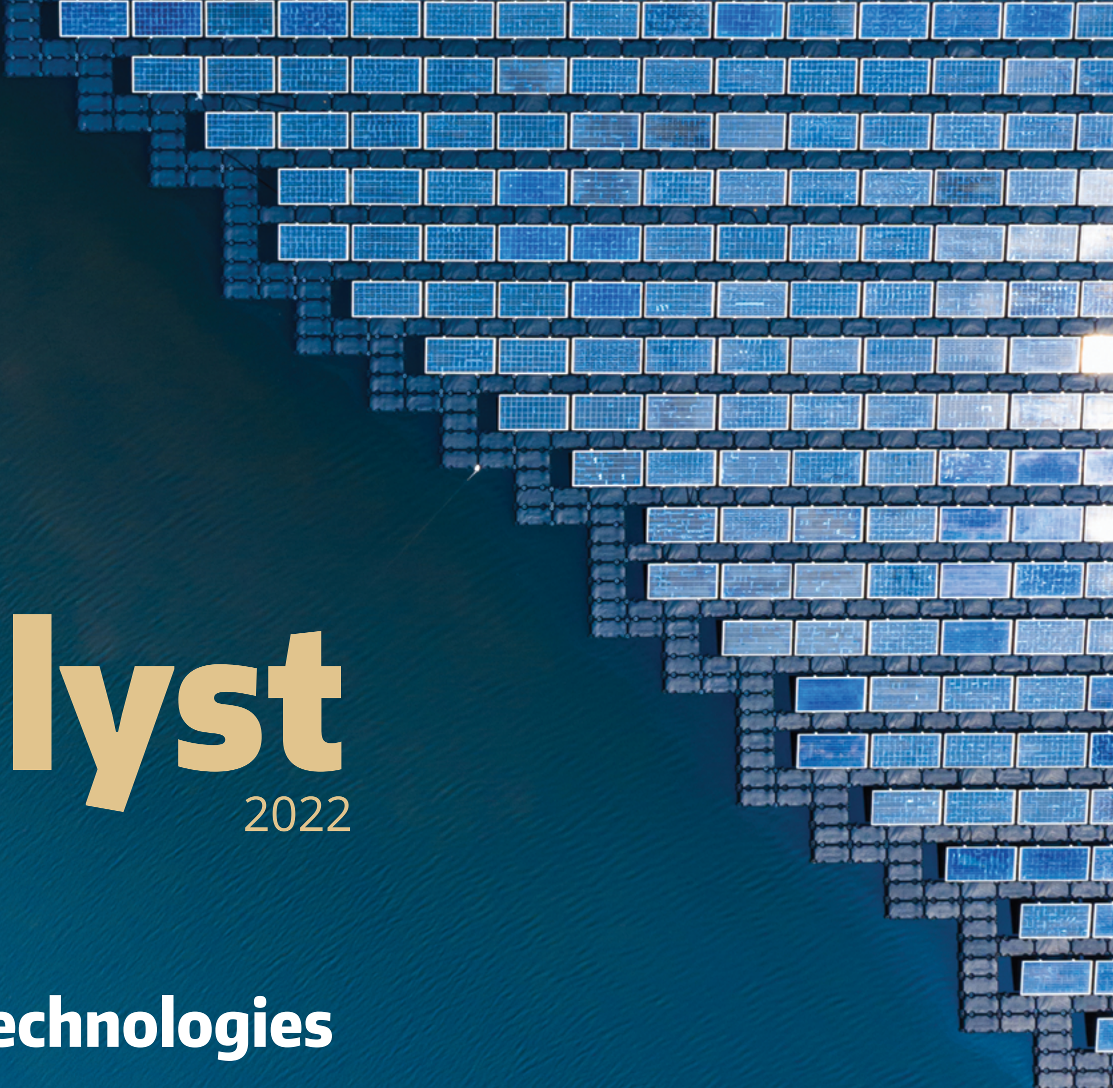


# Catalyst

2022

## Engineering sustainable technologies

Using artificial intelligence to speed energy transitions • Upcycling plastics • Biomanufacturing • Electrifying transit • Improving energy storage

CHEMICAL ENGINEERING
UNIVERSITY *of* WASHINGTON

## FROM THE **CHAIR**

### All of the above

Chemical engineering is undergoing a profound transformation to meet the urgent challenges facing society today. Our field has always been at the vanguard of new science and technology, converting molecules and materials into higher value products. It is no surprise, then, that today's chemical engineers are meeting the moment head on. They're employing their vast array of skills to approach sustainability, climate change and other environmental challenges from all angles.

In this issue of *Catalyst*, we highlight a handful of the innovations that UW ChemE faculty and students are developing to speed us toward a decarbonized economy and a greener future. Some may surprise you. Yes, ChemE's are fine-tuning materials for better batteries and devices for more-efficient renewable energy. But they're also creating cutting-edge biomanufacturing methods and industrial separation processes that stand to slash emissions in carbon-intensive sectors. Even more, they're harnessing the power of AI to speed commercialization of technologies that can really move the needle.

I, for one, couldn't be more excited about where our department's — and our field's — focus is turning. As engineers, we want our work to make marked improvements in people's lives. And as educators, we want to empower the next generation of ChemE's to build on UW's legacy of engineering for the public good.

Reigning in climate change and making our planet a better place to live requires an all-of-the-above approach. What better group to lead the charge than chemical engineers.

**Jim Pfaendtner**
Rogel Endowed Professor
and Department Chair

# Meet our **new faculty**

## Julie Rorrer

**Assistant Professor**

Julie steps into the role of assistant professor in ChemE in January 2023. Her expertise lies in sustainable chemical transformations, and her research will expand the department's work on processes that decrease the carbon intensity of chemical production and mitigate the environmental impacts of waste. Julie earned her Ph.D. in chemical engineering from the University of California, Berkeley and completed a postdoctoral fellowship in the Yuriy Román-Leshkov group at the Massachusetts Institute of Technology.

Julie's research centers on developing more-sustainable catalytic processes to enable chemical upcycling of waste plastics and catalytic upgrading of biomass-derived platform molecules. Traditional plastic recycling is better thought of as "downcycling," she says, resulting in an inferior product and delaying the inevitable of landfill disposal. Her work approaches waste plastics differently and focuses on using milder, lower-energy reaction conditions to upgrade the material into useful chemical feedstock.

In choosing to join UW ChemE, Julie recognized how the department's existing expertise in polymers, advanced materials, and modeling complemented her experimental approach. "More than that," she said, "UW and its inclusive culture really drew me here. The UW values all the facets of my interests across research, teaching, and outreach."

Within ChemE, she will be building out lab capacity to synthesize, characterize, and test catalytic materials in custom-built chemical reactors. In the teaching arena, she will focus on kinetics and catalysis, while keeping an eye on future opportunities to develop science communication training for students.

That's a pursuit she's especially passionate about. Julie is the founder and lead illustrator of the outreach initiative ColorMePhD, a free resource that uses coloring pages to communicate Ph.D.-level STEM research to a broad audience. To date, the pages have featured research from her home institutions as well as work done by underrepresented groups in STEM. She has brought in guest illustrators and translators to expand its scope and reach. Now, at the UW, the Clean Energy Institute will fund a postdoc position to study the project's impact and further increase community engagement.

## Alex Prybutok

**Assistant Teaching Professor**

Alex joined the ChemE faculty in the fall, bringing a wealth of experience in higher ed STEM instruction with a focus on inclusive pedagogy. She earned her Ph.D. in chemical engineering from Northwestern University, where she was co-advised by professors Josh Leonard and Neda Bagheri (now of UW). In her doctoral work, Alex conducted original research both on developing agent-based models of cell-based therapies in solid tumors, as well as on integrating a social justice context into chemical engineering courses.

Alex's passion for teaching extends back to grade school when she volunteered and later became an instructor at summer science camps for kids. Fast forward to her undergraduate studies at the University of Texas at Austin, where her experience with science and engineering prompted her to think about her own and other students' sense of belonging in their fields. She pursued a Ph.D. in order to teach in higher ed and support students from a diversity of backgrounds on their paths to STEM careers.

Over the course of her Ph.D. training, Alex overlaid numerous teaching activities on her chemical engineering research. Increasingly, her pedagogical work focused on themes such as universal design for learning, which focuses on accessibility, and backwards course design, which puts learning objectives first.

Alex created and led a graduate teaching committee in Northwestern's School of Engineering to assess how TAs were being trained and valued, and advised leadership on how to make improvements. Further, she led the development of a workshop to help instructors incorporate anti-racism, diversity, equity, inclusion, and social justice into science and engineering curricula.

At the UW, Alex is teaching courses including the Unit Ops labs and Reactor Design, while working to advance equity in engineering education. "I want to make classes more contextualized," she said. "A lot of chemical engineering problems are very theoretical and detached from reality." To make them more grounded in social justice, for example, one might understand not only a separation and the chemicals involved in it — but also connect it to why doing the separation well and minimizing harmful waste is important if a plant is located near communities that would be affected by its pollution.

In addition to teaching, Alex will further support students by taking on mentees and serving as a faculty co-adviser to the UW chapter of Women in Chemical Engineering (WChE).

Professor Julie Rorrer's **ColorMePhD** initiative makes Ph.D.-level STEM research accessible to broad audiences

*colormephd.org*


Jenekhe at the NAE induction ceremony in October 2022

## Samson Jenekhe elected to the National Academy of Engineering

Jenekhe was one of 111 new members in the U.S. in 2022 who were honored for contributions to “engineering research, practice, or education” and to “the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education.” Jenekhe was recognized for his discovery and understanding of conjugated materials for organic light-emitting diodes (OLEDs) widely used in the commercial sector.

## National recognition

**Jim Pfaendtner** was elected to the **Washington State Academy of Sciences.** He also received the **Computational Molecular Science and Engineering Forum Impact Award** from the American Institute of Chemical Engineers.

**Lilo Pozzo** received the **Anne Mayes Award from the Neutron Scattering Society of America,** in recognition of excellent scholarship, service and mentoring. She accepted the award at the International Conference on Neutron Scattering in Buenos Aires, Argentina. It was presented by Katie Weigandt (Ph.D. ’12), her very first student at UW. Weigandt is now a staff research scientist at the NIST Center for Neutron Research.

## Happy retirement

Congratulations to **Mary Lidstrom** on her retirement in June. Lidstrom is now **Professor Emeritus of Chemical Engineering** and continues to mentor trainees in her lab.

ENGINEERING LECTURE SERIES 2022

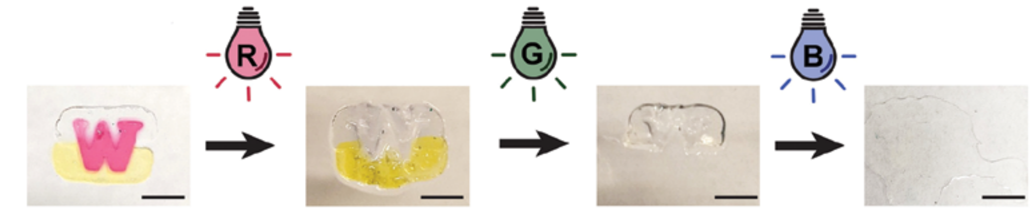
### Engineering Therapies for the Pediatric Brain

Elizabeth Nance presented her nanomedicine research to members of the UW community, the general public and an online audience as part of the UW College of Engineering’s lecture series on engineering health care for the brain.

Watch a recording of the event at engr.washington.edu/events/lectures

HEALTH & BIOTECH

## Light-responsive biomaterials




Photodegradable hydrogels have great potential in targeted drug delivery, regenerative medicine and tissue engineering. However, current photosensitive biomaterials rely on UV light, which has limited utility since it doesn’t penetrate far into tissue. Professor Cole DeForest and Washington Research Foundation Postdoctoral Fellow Teresa Rapp recently reported a family of 3 linkers that cleave rapidly upon exposure to red, green and blue light.

To demonstrate these exact properties, they formulated a multilayered hydrogel composed of patterned regions containing different crosslinkers. When they exposed it sequentially to red, green and blue light, they observed selective degradation of the distinct regions at each step. Further, they measured that the longest-wavelength light (red) cleaved crosslinkers through up to 2 cm of tissue.

ADVANCED MATERIALS

## Researchers create a sea of nano-sized gold stars

Researchers from the Baneyx and Pfaendtner labs in ChemE, along with collaborators at the Pacific Northwest National Laboratory, successfully designed a bio-inspired molecule that can direct gold atoms to form perfect nanoscale stars. The work is an important step toward understanding and controlling metal nanoparticle shape and creating advanced materials with tunable properties.

Metallic nanomaterials are known to have interesting optical properties, and star-shaped ones in particular exhibit unique enhancements that are useful in sensing, detecting pathogenic bacteria, and other national security and health applications.

To create these gold nanostars, the team carefully tuned sequences of peptoids, or programmable protein-like synthetic polymers, to guide small gold particles into this structure. Their synthesis of consistent shapes is an important accomplishment, since more-homogeneous particles translate into more-predictable optical properties. The team’s approach was inspired by nature, where proteins can control the creation of materials with advanced functionalities.

Having assembled a nanoscale constellation, the researchers employed molecular dynamics simulations to illuminate why certain peptoids controlled the formation of perfect stars. Simulations play a critical role in gaining molecular-level understanding of how to design plasmonic nanomaterials that absorb and scatter light in unique ways.

Moving forward, researchers plan to build on this result to be able to predictably use peptoids for making nanomaterials with specific structures and optical properties.

**Source: Jin, B. et al. Peptoid-Directed Formation of Five-Fold Twinned Au Nanostars through Particle Attachment and Facet Stabilization. *Angewandte Chemie,* 2022.**

Working at the nanoscale up to the systems level, UW chemical engineers are focused on speeding the adoption of renewable power, slashing energy demands of industrial processes, and so much more. **Here's a glimpse into how chemical engineers are leading the charge to a more sustainable future.**

# Champions of Sustainability

BIOMANUFACTURING

## Retooling microbes to upcycle $CO_2$

Artwork © Jennifer Sunami

**About 15 percent of every barrel** of oil goes into making plastics and other ubiquitous products. That means we need new ways to make important products in order to fully give up fossil fuels. Bioproduction holds exciting potential for upcycling materials such as agricultural waste and captured atmospheric $CO_2$ into precursors to plastics and more. New UW-led work could achieve the impressive trifecta of displacing petroleum, sequestering carbon, and making higher-performing products.

The U.S. Department of Energy has awarded a 5-year, $15 million grant to a team of synthetic biologists to engineer microbial genomes that transform $CO_2$ into high-value chemicals. The project, led by professor James Carothers, brings together expertise in CRISPR gene-expression programs, single-cell RNA sequencing, data-driven design, and carbon-conserving pathway engineering. Its aim is to advance fundamental research into large-scale, bio-based chemical production that is not only greener, but also produces better alternatives to petrochemical-based products.

Over the past several years, Carothers and his collaborators have been pioneering CRISPR techniques to control gene expression in cells. So far, they can successfully introduce CRISPR gene expression programs that control 6-7 genes in a cell and direct it to perform different processes. For their current undertaking, however, they figure they'll need to control at least 25 genes to effectively hack the carbon metabolism of microbes.

The researchers will explore how to engineer microbes to use all of its $CO_2$ feedstock, as well as convert that carbon into high-value material. Carbon-metabolizing microbes in the wild can waste up to one-third of the carbon they intake as $CO_2$, and the researchers believe they can improve that efficiency in their DNA redesign.

Machine learning, analysis and modeling expertise from researchers at two national labs and UW's Department of Bioengineering will allow the team to design, build, test, and learn from a large number of iterations. That scale-up in the number of DNA programs to be investigated is crucial to developing fundamental principles, new tools, and design parameters for CRISPR-regulated genomes in all sorts of microbes.

With this concerted effort on basic research, the next generation of bioproduction — carbon-conserving and versatile — doesn't have to be relegated to the distant future.

ENERGY STORAGE

## Battery Data Genome

**An international consortium** of scientists has mapped out a framework for a centralized battery data hub. Invoking the Human Genome Project of the 1990s, the proposed Battery Data Genome is a large-scale undertaking to unify data acquisition and sharing practices across the wide-ranging battery community — and accelerate engineering of the next generation of batteries.

The project architects aim to compile data from all types of batteries across all stages of development and throughout their useful life cycles, from discovery to manufacturing to deployment. They believe that universal data management standards will enable the community to unleash the power of artificial intelligence on the pressing need for better energy storage. Using these data, novel algorithms will be able to uncover possible new battery materials, increase energy storage density and improve cell lifetimes.

A group of 28 scientists, including ChemE professor David Beck and 2022 Ph.D. recipients Erica Eggleton, Victor Hu, and Linette Teo, laid out the idea in a recent paper published in the journal *Joule*. The effort grew out of an Electrochemical Society hack week led by Beck, ChemE professor Dan Schwartz, and Matt Murbach (Ph.D. '18). Eggleton, Hu, Murbach and Teo all completed the Advanced Data Science degree option in ChemE.

Novel algorithms will be able to uncover possible new battery materials, increase energy storage density and improve cell lifetimes

BIG DATA

## Artificial intelligence to improve clean energy

**Some of the most promising** green energy technologies are hindered by their durability. As these technologies are quite new, there is a dearth of research into device failure mechanisms and effective service lifetimes. These unknowns constitute risks to investors and barriers to commercialization.

ChemE's are applying their AI skill set to identify, understand and predict the failure modes of perovskite solar cells and solid oxide fuel cells. New insights may enable those devices to be deployed commercially with predictable warranty models and minimal downtime and revenue loss.

Perovskite solar cells are one of the most rapidly advancing solar technologies: they have power conversion efficiencies on par with silicon solar cells while also being lighter weight and more flexible. They also have shorter energy payback times and lower manufacturing costs. ChemE professors Hugh Hillhouse and David Beck and UW statistics professor Marina Meila are working on a DOE-funded project to understand early indicators and mechanisms of perovskite degradation.

The researchers conducted high-throughput measurements of optoelectronic characteristics of perovskite films and devices under various environmental conditions. Analysis of the resulting dataset revealed critical physical processes limiting performance, including one that was previously unknown and uncharacterized.

From there, they developed machine learning models to make accurate predictions of cells' service lifetimes based on composition and environmental conditions. They made their models, along with data acquisition and analysis methods, available as open science for others to use and further develop. The team believes their results can facilitate device design by reducing the need for expensive and time-consuming lifetime tests.

Elsewhere in ChemE, professor Stu Adler's group is developing machine learning models to identify and pre-emptively predict the failure of solid-oxide fuel cells (SOFCs). SOFCs are more efficient, cheaper and easier to maintain than conventional batteries.

Fuel cell batteries are scalable by bundling individual cells into stacks. However, there's a lack of diagnostic tools to detect and predict cell-level failures ahead of entire stack or system failures. To approach the problem, Adler's group simulated the electrochemical impedance spectroscopy response of healthy and failing SOFC stacks and trained a machine learning model on the data. The model was able to detect and differentiate failure modes, as well as distinguish them from degradation due to long-term use. The results are an encouraging step toward making combustion-free power viable on a large scale.

CARBON SEQUESTRATION

## Mimicking nature to store carbon dioxide in minerals

**Reaching carbon-negative goals,** like the Department of Energy's Carbon Negative Earthshot, requires finding new ways to capture carbon from the environment and store it. One approach is to convert carbon dioxide gas into stable solids.

A newly funded project based at the Pacific Northwest National Laboratory (PNNL) draws inspiration from nature to turn $CO_2$ into minerals. Proteins within small living creatures can take $CO_2$ and transform it into the minerals that make up seashells, or carbonates.

Led by ChemE affiliate professor and UW-PNNL Faculty Fellow Chun-Long Chen, researchers will develop new molecules, called peptoids, that can mimic the natural function of carbon-capture proteins. These molecules are highly stable, tunable, and cheap to synthesize.

The new project will focus on mimicking marine environments where $CO_2$ conversion naturally occurs. Peptoids will convert $CO_2$ and metal ions dissolved in water into solid carbonate materials. The team will use state-of-the-art imaging techniques, coupled with theoretical simulations, to watch the solids form and understand how the peptoids promote $CO_2$ hydration and conversion into minerals.

The fundamental science produced in this project can lead to design principles for molecules that promote efficient conversion of $CO_2$ into useful carbonate materials, and can provide key information to help develop stable and scalable systems for removing $CO_2$ from the atmosphere.

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This article was adapted from a story by Beth Mundy, published by PNNL

Proteins within small living creatures can take $CO_2$ and transform it into minerals that make up seashells. Researchers are developing new molecules that can mimic the natural function of carbon-capture proteins.

TRANSIT ELECTRIFICATION

## route_dynamics

**It's one thing to build** an electric bus. It's quite another to optimize a whole metropolitan area's electric transit fleet. How do you set up routes to get the most out of a charge? How much do factors such as weather, hills, and frequent stops impact battery performance?

Erica Eggleton (Ph.D. '22) tackled these questions and more for her dissertation work in professor Dan Schwartz's lab. The work combined Schwartz group expertise in physics-based battery modeling with a systems-level approach to battery efficiency. She created an open-source Python software package called route_dynamics that uses geographical information, ridership numbers, and vehicle acceleration data to model how batteries perform over different bus routes.

This work began as an industry capstone project at the intersection of data science and clean energy. Partnering with King County Metro, a national leader in transitioning to a fully electrified bus fleet, Erica expanded the scope and functionality of the software, with the aim of helping vehicle fleet managers better plan routes based on battery health and longevity. Ultimately, she had the opportunity to present her work to Washington Governor Jay Inslee during a visit to the Clean Energy Institute.

Since graduating in June 2022, Erica has continued to work on smoothing the transition to greener transit. She has established a consulting business that specializes in energy storage systems and electrified transportation, and offers technical insights and analysis to clients such as electric vehicle start-ups, vehicle manufacturers and transit agencies.

DISTILLATIONS

## Decarbonizing industrial chemistry

**Industrial separations** and distillations rely heavily on heat-driven processes. As a result, they account for 10-15% of global energy use, by some estimates. A recent Department of Energy report calculates a potential to save 100 million tonnes of $CO_2$ emissions and $4 billion in energy costs annually if more-efficient purification methods were used in the U.S. petroleum, chemical and paper manufacturing sectors alone.

Advanced polymer membranes can slash emissions in desalination, carbon capture and separations processes

Professor David Bergsman is working on membrane-based technologies that can eat away at that big chunk of the emissions pie. His group uses a technique called vapor phase infiltration to diffuse reactive agents into polymer membranes and impart them with new, desired properties. For example, he's working on modifying membranes that would ordinarily dissolve in oil to be able to withstand the conditions of petrochemical separations — and replace much higher energy processes. Going even further, the lab is developing vapor phase infiltration as a "drop-in" step to fit within conventional membrane manufacturing operations. Advanced membranes also have the potential to slash emissions in carbon capture and water desalination processes.

## Graduate student accolades

**Sydney Floryanzia,** Ph.D. student in Elizabeth Nance's lab, is the 2022 recipient of the **Poddar Award for Rising Chemical Engineers** from the American Institute of Chemical Engineers (AIChE). The award honors one recent bachelor's degree recipient for their contributions to AIChE, chemical engineering and society, and who shows potential for future growth and leadership. Sydney was also featured in the April 2022 issue of AIChE's *CEP* magazine for her research into the mechanics of the blood-brain barrier to enable better treatment of brain disease.

Ph.D. student **Maria Politi** was a **poster prize recipient at the Acceleration Consortium's annual conference.** The event explored leading-edge methods, applications and research related to materials and molecular discovery. Maria's poster was entitled "Open-Hardware Materials Acceleration Platforms for Accessible and Democratized Materials Discovery."

Maria Politi presents at the Accelerate Conference, University of Toronto, 2022. Photo by Clifton Li © Acceleration Consortium

**Renyu Zheng** was one of three recipients of an **Outstanding Oral Presentation award at the 11th Annual Peptoid Summit**. Renyu is a graduate student mentored by UW ChemE affiliate professor and PNNL senior research scientist Chun-Long Chen. He was the only non-faculty member to receive the award. Renyu reported on the design of a simple peptoid capable of self-assembly into highly ordered helical fibers.



### 2022 College of Engineering Dean's Medalist

## Isaiah Lemmon

As a double major in chemical engineering and computer science, Isaiah blended molecular science and software engineering, and worked in Jim Pfaendtner's lab on catalysis, interfacial phenomena and molecular dynamics. He received some of the highest grades in complex technical courses, and on a project on datacenter systems, he was credited with one of the most ambitious and interesting projects in a class of undergraduate and graduate students.

Isaiah's research talents and passion for discovery caught the notice of faculty members, who recruited him for projects working alongside graduate students and postdocs. As a junior, he rewrote a complex piece of reaction engineering software in Python which transformed the program into a robust and reusable application that has improved research outcomes in labs across engineering. After graduating in December 2021, Isaiah joined Amazon Web Services as a software engineer.

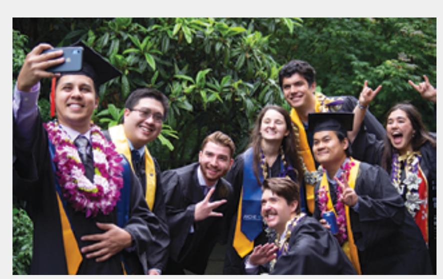

### Award-winning health care advance

**2022 graduates Jimmy Ye and Evan Ross were part of the entrepreneurial design team, inSTENT Connection, that won the $15,000 grand prize in UW's Hollomon Health Innovation Challenge. The interdisciplinary team developed a new kind of biodegradable GI stent that can decrease complications from surgery. The team formed through the Engineering Innovation in Health program, which promotes collaboration between engineering and the health sciences to develop technical solutions to pressing health care challenges.**

Photo by Matt Hagen/UW Buerk Center for Entrepreneurship

# Building Community

After a long stretch of pandemic isolation, ChemE students and faculty are finding ways to get back together, create a sense of belonging in the department, and support each other. Here's just a taste of ChemE extracurricular life in 2022.




**From left to right**

Elizabeth Nance and members of her lab gather for happy hour in February to support a graduate's successful launch into industry (top), and to celebrate Pride Month in June (bottom).

Shachi Mittal and her group welcomed spring by participating in the Cherry Blossom 5K and picnicking amongst the blooms on the Quad.

The UW and the department celebrated graduation in person for the first time since 2019. A group of undergrads snaps a selfie at ChemE's reception at Benson Hall (top), and Dan Schwartz gathers with the newly minted PhDs from his group (bottom).

Jim Pfaendtner and group members embark on a summer hike to Snow Lake.

## 2022 R. Wells Moulton

# Distinguished Alumnus in Industry

## Kirk A. Nass (Ph.D. '89)

**Technical Team Leader: Dispersants, Inhibitors, and Fuel Additives (ret.), Chevron Oronite Company LLC**

Kirk A. Nass is a polymer science expert and 31-year veteran of Chevron. Over the span of his career at the company's Richmond Technology Center in the San Francisco Bay Area, he worked as a polymer R&D engineer; managed technical teams supporting performance additives for lubricating oils and gasoline; and advanced equity and inclusion for LGBTQ engineers. Nass earned a B.S. in chemical engineering from the University of Illinois at Urbana-Champaign in 1983 and a Ph.D. in ChemE from the UW in 1989.

For much of his career, Nass worked on or supported widely-used products, including PARATONE®, a motor oil viscosity modifier used in about one-third of automobiles worldwide, and TECHRON®, Chevron's proprietary gasoline additive. He supported customers of these products globally, and was issued several U.S. and international patents related to polymers that modify oil viscosity. In addition, he earned two company Presidential awards for significant contributions to the company: one for designing and executing the testing plan for a new product rollout, and another for successfully pitching a product which helped Chevron win a competitive bid to supply additives to a major global motor oil company.

From his first day at Chevron, Nass took steps to improve diversity, equity, and inclusion in corporate culture. He started with a seemingly small action: placing a photo of his boyfriend (now husband) on his desk on his first day of work in 1989. Ensuing conversations and connections seeded something much larger — the formation and growth of the Chevron Lesbian and Gay Employees Association, now known as Chevron PRIDE. Nass served as a founding board member of the organization and held various board positions, including Chair, for 10 years. During that time, Chevron added sexual orientation to its non-discrimination and non-harassment policies, extended domestic partner benefits to all employees, and officially recognized employee diversity networks.

Since his retirement in 2020, Nass has turned his focus to service and to guiding ChemE trainees in their professional development. He has spoken to ChemE classes at UW on multiple occasions about his career, and he now serves on the department's External Advisory Board. In his address at the 2022 ChemE department graduation celebration, he encouraged graduates to be their authentic selves and "hold the door open" to make things easier for other people. In that spirit, Nass and his husband, Michael E. Gillespie, have established scholarships intended for LGBTQ engineering undergraduates at both the University of Illinois and the University of Washington to continue supporting diverse STEM talent.

Kirk Nass delivers an address at the 2022 ChemE graduation ceremony

## 2022 UW Chemical Engineering

# Early Career Impact Award

## Brent Nannenga (Ph.D. '11)

**Associate Professor of Chemical Engineering**
**School for Engineering of Matter, Transport and Energy**
**Arizona State University**

Brent Nannenga is an emerging leader in the fields of protein engineering and structural biology, and an expert in cutting-edge crystallography and cryo-electron microscopy techniques. His work centers on understanding the structure of proteins and small molecules with the aim of engineering improved materials.

Nannenga has been instrumental in developing a technique called microcrystal electron diffraction, or MicroED, which bypasses a technical hurdle in the structural analysis of crystals. For decades, X-ray crystallography depended on the often-difficult task of growing sufficiently large crystals of a purified protein sample. MicroED allows researchers to directly analyze microcrystals, instead of continuing to experiment with conditions that might yield larger ones. Nannenga's group receives requests to process samples from labs around the world.

Additionally, he has earned national recognition from peers for his work. In 2020, he won the Microscopy Society of America's Burton Medal, for young researchers in the field of microscopy and microanalysis. He also received the American Crystallographic Association's Etter Award, an early-career award for crystallographic research. He is an NSF CAREER Award recipient and was named Fulton Outstanding Assistant Professor in Arizona State University's engineering school in 2018.

Before joining the ASU faculty in 2015, Nannenga earned his B.S. and M.S. in chemical engineering at that institution. He then went on to earn a Ph.D. at UW, working on protein engineering in the lab of François Baneyx, and to work as a postdoctoral associate at Howard Hughes Medical Institute.

"I found that the environment of the UW was very formative," says Nannenga. "I had a lot of really good mentors." He says Baneyx was a huge influence on how he approaches both research problems and mentoring. And he credits UW ChemE's positive mentoring environment with setting him on the path to professional success. "I definitely would not be where I am now without the many faculty who helped me in different ways," he says.

Nannenga visited the department in November to accept his award. He shared insights from his research and career with ChemE students at the annual Graduate Awards Day.

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

# A passion for engineering excellence and opportunity is all in the family

## Dahlgren father and son alumni establish new endowment in chemical engineering

The University of Washington plays a prominent role in the Dahlgren family story. Family members spanning multiple generations have earned UW degrees ranging from building construction to education (in those cases: Scott Dahlgren '84 and Helen Dahlgren '60, respectively). But the chemical engineering department had a particular draw. Daniel L. (B.S. '60), his brother Edwin (B.S. '56) and son Daniel T. (B.S. '82) all chose the ChemE path at UW.

Professor John Berg, Daniel L. Dahlgren, Daniel T. Dahlgren and department chair Jim Pfaendtner at a donor appreciation luncheon in spring 2022. Berg was the younger Daniel's ChemE adviser.

Now, Daniel L. and Daniel T. — father and son — have established the Dahlgren Family Endowed Faculty Fellowship in Chemical Engineering. "We want to recognize the impact UW Chemical Engineering has had on our family," said the younger Dan, "and we hope this will help ensure the same opportunity for future generations."

The endowment will support efforts to continue recruiting and retaining top faculty in ChemE, which is critical to sustaining a strong department. People make the difference, and attracting top tier faculty in turn draws in talented students and raises the bar on the quality of teaching and research. UW's ChemE department is not the biggest, but the Dahlgrens believe it will continue to punch above its weight.

They were inspired to establish this endowment to give back to the university, college and department that shaped their lives and opened doors for career and personal success. Daniel T. combined his ChemE degree with a Harvard MBA and worked in marketing and managerial roles for 33 years at The Clorox Company. He retired in July 2022 as Vice President – Strategy and Planning. He was the recipient of ChemE's 2019 Moulton Distinguished Alumnus Award and has stayed closely connected to the department, serving on its External Advisory Board for many years.

Daniel L. enjoyed a nearly 30-year career with the pulp and paper company, Georgia-Pacific. He served in many technical and leadership positions, ultimately becoming general manager of the company's sizable Bellingham, Washington, operations. Edwin (deceased) joined the engineering staff of Georgia-Pacific after serving as a pilot in the Air Force. He worked as a manager of engineering services and an environmental director until his retirement in 1991, then shifted to consulting.

The Dahlgrens are committed to ensuring that a UW chemical engineering degree is a springboard to a fulfilling career, as it was for them. With their support, the department is better positioned to attract and retain researchers and educators passionate about advancing knowledge and developing leaders in the field.

WOMEN IN CHEMICAL ENGINEERING

# 6th Annual Industry Event

Alumni panelists at the WChE Industry Event

The ChemE student organization Women in Chemical Engineering (WChE) returned, after a pandemic-induced hiatus, to hosting an in-person gathering for their 6th Annual Industry Event in November 2022. Eleven department alumni, now working in a variety of fields at different stages of their careers, participated as panelists. They shared with current students valuable insights into preparing for and navigating the many career paths available to ChemE's.

The evening kicked off with a keynote talk by Amanda Levenson (B.S. '18), Manufacturing Business Manager at the electric vehicle company Lucid Motors. Amanda explained how her career path took several unexpected turns, from her initial interest in medical diagnostic devices to working in semiconductor wafer fabrication at Intel and eventually to her current position at Lucid. Along the way, she realized the value in "planning to not have a plan" and keeping her eyes open to new opportunities.

Following the keynote, the 115 attendees chose among four Q&A panels focused on professional development. Moderated by WChE officers, they addressed topics such as work-life balance, keys to success in a first job, and moving into leadership roles.

WChE faculty adviser Elizabeth Nance and student organizers, led by graduate student and WChE President Ruby Jin, are grateful to the alumni panelists as well as the sponsors who made the evening possible. Corporate, individual and organizational sponsors contributed a total of more than $10,000 in support of the event. For more information about WChE and the Industry Event, visit *wcheuw.com*.

## Chemical Engineering **Leadership Seminar Series**

Now in its 16th year, 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.

### 2022 SPEAKERS

**David Gasperino (B.S. '03)**
Principal Research Scientist, Amazon

**Michael Bechtol (B.S. '91)**
Health Safety and Environmental Manager, Phillips 66

**Megan McClure (B.S. '03)**
Principal Scientist, Just-Evotec Biologics

**Warren Wilder (B.S. '79)**
Director, Petronas Chemicals

**Scott Roberts (Ph.D. '74)**
Retired, Shell

**Laura Foster (B.S. '10)**
Materials and Process Engineer, Boeing

**Laura Cladas (B.S. '11)**
Greenhouse Gas Emissions Specialist, WA Department of Ecology

**Erika Johnston (Ph.D. '97)**
Consultant

## 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 chair Jim Pfaendtner at *chechair@uw.edu* if you're interested in getting involved and would like to learn more.

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