CHEMICAL ENGINEERING | UNIVERSITY *of* WASHINGTON

Catalyst

2021

mRFP Cherry Blossoms, by Ava Karanjia

New Growth

Record-breaking Ph.D. cohort • New faculty • Diversity, equity and inclusion initiatives • Research funding for sustainable technologies • Benson lobby remodel

FROM THE **CHAIR**

Happy returns

The excitement on campus was palpable this fall. After a year and a half of being strangely quiet, it started buzzing again with students, faculty and staff. In ChemE, many of us saw each other outside of our Zoom boxes for the first time in over a year. Some of our students — who, I might add, had already taken as many as four quarters of ChemE courses remotely — finally set foot in Benson Hall.

It feels great to be back in person again and approaching "normal." Yes, COVID precautions are still part of our daily lives, and holding some meetings and larger gatherings in hybrid format still poses challenges. All in all, though, these are pretty small prices to pay for our students to be here safely in our classrooms and labs.

While everyone was away (not to let a crisis go to waste!), we took the opportunity to upgrade our largest common area, the Benson lobby. The space was showing its age, and we saw the chance to make it more welcoming for studying, collaboration, social gatherings, chats with colleagues and guests, and other elements of being together that we've missed so much in the past year-plus.

We'll no doubt continue to grapple with the pandemic and its aftereffects, but I couldn't be happier with everyone's continuing efforts to get us back — *in person* — to safe, productive teaching and learning.

Jim Pfaendtner
Rogel Endowed Professor
and Department Chair

The 6th Annual **Science & Engineering as Art** Competition

FIRST PLACE

mRFP Cherry Blossoms | By Ava Karanjia

To create this image of a cherry tree in bloom, Ava co-opted the monomeric red fluorescent protein (mRFP) reporter gene that she uses in her synthetic biology research. The mRFP reporter produces a range of pink and red hues based on how strongly a gene is activated.

"The competition was in the middle of cherry blossom season," she said. "It was my first spring in Seattle, so I was obsessed with all of the incredibly pink blooms." To recreate the beauty of the cherry blossoms on a cellular level, Ava streaked cells containing three plasmids — one for the synthetic bacterial transcriptional activator dCas9-AsiA, one for guide RNA, and one for the mRFP reporter — onto an agarose plate with antibiotics. The reporter expressed pink for on-target guide RNA activation and white for off-target guide RNA.

Ava's cherry blossom image demonstrates that the activator dCas9-AsiA has a window of activation based on different guide RNA targets. Achieving this sort of control means that engineers are better equipped to develop synthetic bacterial cellular devices for diagnostics, therapeutics, and more.

Ava is a graduate student co-advised by James Carothers and Jesse Zalatan (professor of chemistry and adjunct professor of ChemE).

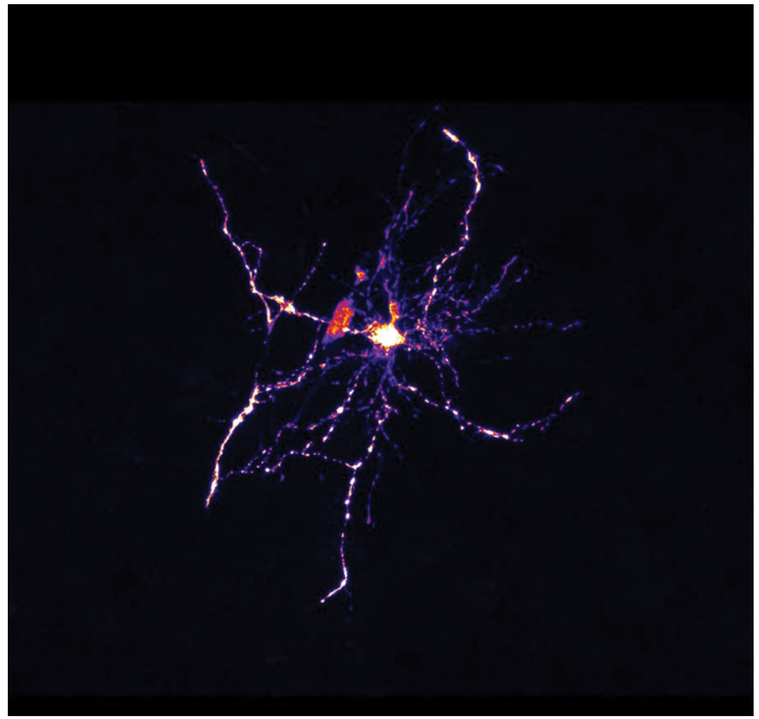
The newly-renovated Benson Hall lobby

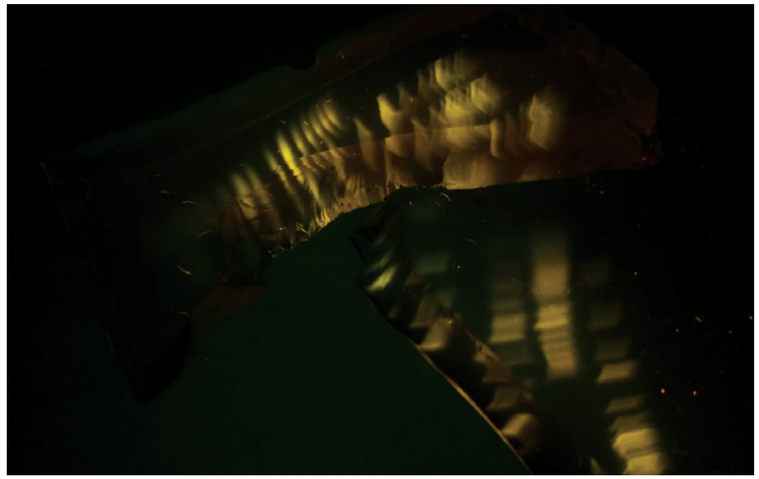
SECOND PLACE

The Stars in Our Cells | By Jeremy Filteau

This confocal microscope image shows a transfected neuron in the cortex of organotypic rat brain tissue. Jeremy acquired the image during experiments in which he was assessing the morphology of neurons. He was drawn to the striking star-like shape of this particular cell and set it against the blackness of outer space.

Jeremy is a graduate student in the labs of Elizabeth Nance and Cole DeForest.





THIRD PLACE

Genetic Cascades | By Diego Alba

This image results from running gel electrophoresis to separate DNA fragments. In his research, Diego employs the process to extract DNA bands to use in the molecular cloning pipeline. But to create the effect shown here, Diego deviated from standard technique. Instead of looking at the gel from above and cutting out the desired band, he ripped the gel and viewed the DNA bands from different angles. "In my mind, they resembled a creek flowing downhill," he said.

Diego is a graduate student in the Carothers lab.

Meet our
new faculty

Jorge Marchand

Assistant Professor of Chemical Engineering

Jorge will join the ChemE faculty as an assistant professor in January 2022. His work utilizes fundamental approaches in synthetic biology, chemical biology, biosynthesis, and biomolecular engineering to expand the building blocks of life. Further, he seeks to use that non-standard biology to produce unique and valuable molecules, such as therapeutics. His approach — coaxing biology to accomplish what's typically done via chemistry — can reduce the use of fossil fuels and toxic solvents in manufacturing processes.

Jorge completed his Ph.D. in Chemical and Biomolecular Engineering at the University of California, Berkeley, and a postdoctoral fellowship in the Department of Genetics at Harvard Medical School.

For his next step, Jorge says he was interested in "finding a place where there's a lot of synergy with others," and UW hit the mark. He discovered that collaboration among synthetic biology researchers was commonplace, not only in ChemE but also across many other departments.

More importantly, he says he was drawn to the mission of the UW and is passionate about teaching and establishing his lab at a public institution. Jorge will introduce students to the important role biology plays in many areas of ChemE in teaching the Biological Frameworks for Engineers class. In the future, he plans to develop more in-depth courses on other topics of interest, such as natural product engineering, which leverages natural biosynthetic pathways to engineer organisms capable of producing next-generation therapeutics, biochemicals, and biomaterials.

Finally, he found alignment with the department's culture and leadership around diversity, equity, and inclusion. As a student, Jorge became involved with affinity groups such as the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS). "That got me thinking about problems with DEI in academia," he says. In his faculty role, he recognizes he'll have opportunities to make STEM higher ed more accessible, and will direct energy toward equitable and inclusive student recruitment, in particular. "We're the jack of all trades as a discipline," he says, and likewise its practitioners should mirror that diversity.

Shachi Mittal

Assistant Professor of Chemical Engineering • Adjunct Assistant Professor of Laboratory Medicine and Pathology, School of Medicine

Shachi joined the ChemE faculty this fall, adding unique expertise in combining advanced imaging with data science for cancer diagnosis. Bridging the gap between engineers and clinicians, she aims to design new technologies that can be rapidly adopted into clinical settings. Before joining UW, she was a Beckman Postdoctoral Fellow at the University of Illinois at Urbana-Champaign.

Shachi's lab employs both experimental and computational methods to investigate the molecular, genomic, and immunological signatures of cancer. Cancers can develop differently in different patient populations. Applying multispectral imaging, which tracks many molecular markers, can point to individualized disease management approaches. And when augmented with artificial intelligence, measurements from diverse patient groups can enable comprehensive characterization of disease and assist in early intervention strategies.

Shachi's journey from childhood in India to a tenure-track faculty position at UW resulted from a series of events that empowered her to dream big. High school teachers went out of their way to encourage her to take the difficult entrance exam for the Indian Institute of Technology Delhi; the selective Khorana Scholars internship program in the U.S. got her hooked on research; and mentors encouraged her to apply to Ph.D. programs.

"My mentors played a critical part in my professional journey," she says. She credits these mentors for recognizing her skills and motivating her to aim for the highest of goals. As a woman of color in academia, she recognizes the importance of equity and inclusion, and believes that mentorship can empower students and position them for success.

Consequently, Shachi is extremely passionate about mentoring, especially women and students from underrepresented communities in STEM. "When I see my mentees succeed, it gives me a lot of happiness and the motivation to go on," she says. She believes strongly that the success of her trainees will define her lab's success.

In Seattle and at UW ChemE, Shachi sees optimal alignment with her interests. When it comes to research, she says, "there are so many opportunities here to combine the engineering and clinical expertise for developing patient-care-driven technologies."

Further, the culture of inclusion in UW ChemE was a big factor in her decision to join. She observed how everyone is valued for what they can bring to the table, that DEI really matters, and that her values mesh with ChemE's. "Not only will the department contribute to my growth, but I can positively contribute to the department," she said. "It's a lock-and-key fit."

Ben Rutz

John C. Berg Endowed Assistant Teaching Professor in Interfacial and Colloid Science

An alumnus of UW ChemE (Ph.D. '14), Ben returned to the department this fall as its first assistant teaching professor. He brings extensive industry experience working on composite materials and polymer chemistry and will bolster ChemE's longstanding strength in surface, interfacial, and colloid sciences.

During his graduate work in professor John Berg's lab, Ben accumulated expertise in polymer matrix composites and surface science. He utilized self-assembled nanomaterials to modify fiber surfaces to improve strength and achieve desired functionality of structural composites.

He went on to work for Toray Composites, starting in Decatur, Alabama, conducting fundamental and product-driven research on carbon fiber surface treatments. Then he transitioned to a role in Tacoma to develop thermosetting composites, and their manufacturing processes, for the next generation of commercial aircraft.

Now at UW, Ben is teaching the lab-intensive interfaces and colloids course, a perennial favorite among students. "To be any good at nanoscience, and to build and manipulate nanomaterials, you need to have that background in interfaces and surfaces," he says. "That's the brilliance of this class." A past winner of the McCarthy Award for Excellence in Chemical Engineering Graduate Student Teaching, he adds that his favorite way to teach is in the laboratory setting, and he's excited to harness students' enthusiasm around the return to in-person learning.

Along with teaching duties, managing ChemE's shared instrument facilities, and advising the student chapter of AIChE, he will also lead the department's growing industry capstone program. Capstone projects are valuable additions to the undergraduate experience, he says, especially given the many reasons it's challenging for students to complete summer internships. These "on-campus internships" impart professional skills such as project management and budgeting, and Ben has the unique experience of having worked with student capstone teams from the industry side.

Sam Jenekhe featured in C&EN's "Trailblazers" issue celebrating Black chemists and chemical engineers

Professor Sam Jenekhe's pioneering work on semiconducting polymers has contributed to the low-power, high-brightness organic light-emitting diodes (OLEDs) now ubiquitous in smartphone and TV screens.

Chemical & Engineering News highlighted some of Jenekhe's key innovations in the field in its February issue. They noted, for example, that in 1994 he helped propel OLEDs out of the lab by figuring out how to make them bright enough to be practically viable.

"Jenekhe showed it was possible to produce light-emitting organic materials with high quantum yields (i.e. brightness) by introducing buffer molecules that prevent the conducting molecules from ordering themselves in a way that quenched their luminescence," they wrote. "That work set a foundation for the development of OLED materials — whether based on polymers or small molecules — with efficiencies suitable for commercial applications."

c&en
CHEMICAL & ENGINEERING NEWS

Mary Lidstrom concludes service as Vice Provost for Research

In August, professor Mary Lidstrom stepped down from her position as UW's third-ever Vice Provost for Research after 15 years in the role. She has returned full time to the faculty in the ChemE and microbiology departments to concentrate on research, and to establish mentoring and DEI programs. Her tenure as VPR came on the heels of a nine-year run as associate dean of new initiatives in the College of Engineering.

In the Office of Research, Lidstrom and her team prioritized helping faculty navigate the bureaucracy, paperwork and regulations that come along with their jobs. "Faculty spend way too much time on administrative issues," she said. "We had a specific initiative to give time back to faculty so that they could do research, mentor trainees, teach and interact with students — all of the things that make the faculty job so amazing and their research so successful."

Under Lidstrom's leadership, the University's research portfolio grew from $996 million when she started as VPR to $1.63 billion in 2020. Over the past decade, the UW has received more externally sponsored research funding than any other U.S. public university. Lidstrom credits the faculty and scholars for those accolades, noting that the depth and breadth of the University's expertise has helped it weather the ebbs and flows of funding in any one area. Further, she prioritized collaborative research, both within the UW and among other organizations; 27% of UW research funding involves partnerships with other entities.

"She has brought strength and stability to our research enterprise during challenging times," said Mark Richards, the UW's provost and executive vice president for academic affairs. "Moreover, Mary's wisdom and savvy about the national and international research landscape have helped keep UW at the forefront of many fields."

Lidstrom said a hallmark of her academic career has been maintaining a tiered mentoring community in which students work in concert with undergraduates, graduate students, and postdoctoral researchers, along with professors. With her renewed ability to focus on mentoring this fall, she has begun hosting monthly professional development workshops for postdocs in ChemE.

This article was adapted from a UW News story by Victor Balta.

UW team's artificial kidney prototype earns major prize

A backpack-size kidney-dialysis device being developed at the UW Center for Dialysis Innovation (CDI) is one of six winners in the international KidneyX competition. KidneyX, a public-private partnership of the American Society of Nephrology and U.S. Department of Health and Human Services, seeks to speed drug and device development to counter the steep global growth of kidney disease. CDI has now won three KidneyX awards.

CDI's prototype artificial kidney is designed to free patients from thrice-weekly, hours-long visits to dialysis centers. Instruments at these centers weigh several hundred pounds, stand 5 feet tall, and use gallons of water for each treatment. Further, outcomes are poor: the onerous regimen typically ends only when the patient receives a kidney transplant or dies.

By contrast, said Buddy Ratner, "a patient with a wearable artificial kidney will get continuous dialysis, which we think will have great health benefits because it more closely emulates the natural organs' filtering function." Ratner, a professor of chemical engineering and bioengineering, co-directs CDI with Dr. Jonathan Himmelfarb, a professor of nephrology at the UW School of Medicine.

CDI's kidney-dialysis device prototype is small, lightweight and untethered

During hemodialysis, blood passes on one side of a semipermeable membrane; on the other side, dialysis fluid circulates, drawing toxins out of the blood. CDI's major advance to allow for portability — and to save water — is a process for recirculating that dialysate. In their closed-loop system, the uremic toxins are removed and transformed into two odorless gases, nitrogen and carbon dioxide, by photo-oxidation.

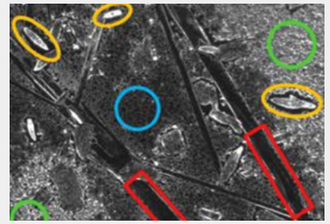
The group aims to have a device ready for clinical trials in two years.

This story has been adapted from an article by Brian Donohue, UW Medicine Newsroom.

FACULTY LEADERSHIP

Lilo Pozzo has been appointed interim chair of the **Department of Materials Science & Engineering.** She began the two-year term in September 2021.

NEW RESEARCH FUNDING



Hugh Hillhouse, David Beck, and colleagues will develop **forecasting models for perovskite photovoltaic performance** using dark-field imaging and machine learning

James Carothers will lead a team developing new scalable, cell-free platforms to enable the capture and **conversion of CO_2 into useful products**

Jim Pfaendtner and collaborators at Washington State University will work on **catalytic processes for more-efficient municipal plastics recycling**

RESEARCH HIGHLIGHT

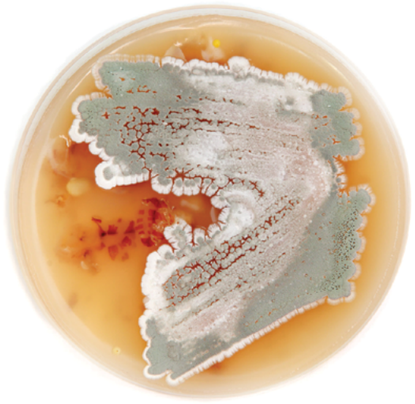
We can make it BETTER

Researchers from across the department are developing and scaling up **advanced manufacturing** technologies to make more sophisticated molecules and materials, more sustainably

Natural product engineering

Jorge Marchand, who is joining the ChemE faculty in January 2022, is looking to soil bacteria for inspiration for ways to make new and improved molecules. Some living organisms — including a number of bacteria, fungi, and plants — naturally produce valuable therapeutic compounds. But they tend to do so in very small quantities. What's more, the true extent of nature's diverse chemistry chest remains unknown.

Marchand is searching for rare and unusual biochemistries that occur naturally in bacteria. Taking cues from their "fringe" biochemistry, he aims to engineer industrial organisms capable of biomanufacturing therapeutic compounds and specialty chemicals in a controllable, scalable way.



Additive manufacturing

Teams of undergraduate students will get hands-on experience in this burgeoning field by way of two Boeing-sponsored capstone projects. The aerospace industry, among many others, is increasingly using additive manufacturing to fabricate complex components and one-off replacement parts. With mentorship of Boeing engineers and ChemE faculty, students will work on various aspects of optimizing 3D-printed parts for aerospace applications.

Membrane manufacturing upgrade

Professor David Bergsman's lab is using vapor phase infiltration to take membranes where they've never gone before. Their technique involves diffusing reactive agents into polymers to impart them with new, desired properties.

The impact of the resulting souped-up membranes is potentially huge: they might remake certain industrial processes to have a much smaller environmental footprint. "We're particularly interested in trying to get these membranes into high-energy separation spaces, such as petrochemical and air separations, where energy-intensive thermal distillation has historically been used," he says. Polymer membranes will dissolve in oil, for example, but with the right infiltration reactions, he says, they could be modified to withstand the conditions.

The key to realizing such impacts will be to make manufacturing the new membranes straightforward. That's why Bergsman's group is developing vapor phase infiltration as a "drop-in" step to existing processes. It's costly for membrane manufacturers to change their polymer formulations, but much less so to add just one step.

The high throughput deposition reactor in the Bergsman lab

Cell-free synthetic biology

Microbial cells have proven to be workhorses for producing many important chemicals, from biofuels to personal care product ingredients. However, while cells are versatile as "factories," they require a lot of care and feeding. And all the energy input equates to a lot of overhead, says professor James Carothers.

To sidestep the inefficiencies, he's going cell-free. His group is building systems from the bottom up to contain only the cell components needed to perform biocatalysis. "Anything you can do in a cell you can do cell-free, but with a smaller footprint," both physical and environmental, he says. When you're only feeding cytoplasm and not entire cells, you don't need large fermenter tanks and hefty energy inputs to drive reactions.

Cell-free systems are already part of the biomanufacturing mix, but at present they can only perform relatively simple reactions at scale. The Carothers lab is working on how to scale up multi-step enzymatic processes to expand the range of products that can be manufactured in this way. In a new project, his group is developing systems that can use CO_2 as an input to produce industrial chemicals.

Synthesizing nanowires using light

Professor Vincent Holmberg and his collaborators have patented a new process for manufacturing colloidal semiconductor nanowires using lasers. Nanowires have a wide range of applications, including in optoelectronics, sensing, energy conversion, energy storage, and quantum technologies. In a first-ever demonstration, Holmberg showed that semiconductor nanowires can be grown by simply irradiating a solution containing colloidal nanocrystals and molecular precursors with a laser. The beauty of the approach lies in its simplicity and flexibility. It is compatible with a wide range of materials systems; can be carried out on demand, on the benchtop in simple glassware under ordinary conditions; and requires no specialty reactors or expensive pressure control systems.

Image: Nanocrystal-seeded semiconductor nanowires

Tech transfer

The Bioindustrial Manufacturing And Design Ecosystem, or BioMADE, is a Department of Defense-funded consortium of industry, academic, non-profit, and U.S. government members that is enriching bioindustrial manufacturing capabilities domestically.

The UW is a member institution of BioMADE, with activities centered in the ChemE and electrical & computer engineering departments. Membership also allows UW researchers access to specialized testing facilities. The University's involvement represents one vehicle for getting technology out of the lab and into the industrial sector.

BioMADE™

First Nations Launch

2021 graduate Chyson Acoba (far left) took part in the NASA-sponsored First Nations Launch high-power rocketry competition in the spring. The multidisciplinary UW team was drawn from the campus chapter of the American Indian Science & Engineering Society, and Chyson was the team lead and the airframe & simulations lead. The team took second place.

68 undergraduate students participated in **ChemE's inaugural hackathon** in January 2021. Over the course of two weeks, they learned Python coding and teamed up to tackle a real-world chemical production problem. Learn more at **www.c-hack.org**

Graduate student accolades

Sarah Alamdari received the American Chemical Society's **Chemical Computing Group Excellence Award**

Akshay Subramaniam earned the **H. H. Dow Memorial Student Achievement Award** from the Industrial Electrochemistry and Electrochemical Engineering Division of the Electrochemical Society

Duyen Tran participated in the **Excellence in Graduate Polymer Research Symposium** sponsored by the American Chemical Society's Division of Polymer Chemistry

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Ph.D. students joined the department in Fall 2021. The cohort is the largest in UW ChemE history.

Two members of the Class of 2021 represent ChemE in this year's Husky 100 cohort

The Husky 100 is a tri-campus award recognizing 100 students who are making the most of their Husky experience

In her time at UW, **Denise Beebout** served as president of the UW chapter of the Society of Women Engineers, completed an internship at Boeing, and conducted research in the Washington Nanofabrication Facility and in Elizabeth Nance's lab. "As a first-generation college student and parent of two, I hope to inspire others to know it's never too late to return to school and accomplish what may seem impossible," she said. "I've discovered my passion for helping other underrepresented students in STEM find the support and resources to succeed."

As an undergraduate in ChemE, **Michael Chungyoun** worked in Elizabeth Nance's lab on optimizing polymeric nanoparticles for neurological drug delivery. "The UW has provided me the opportunity to understand my family's health complications through drug delivery research," he said. "The lens I have developed as a Husky has shown me that being relentless in my pursuits will allow me to become a leader in my research and minority communities." Michael is now a Ph.D. student in the Department of Chemical and Biomolecular Engineering at Johns Hopkins University.

ChemE IDEA Projects

With the support of an endowed fund established by a donor in 2020, ChemE students, faculty and staff are developing and implementing inclusion, diversity, equity and anti-racism (IDEA) initiatives in our community.

The first round of funding is supporting:

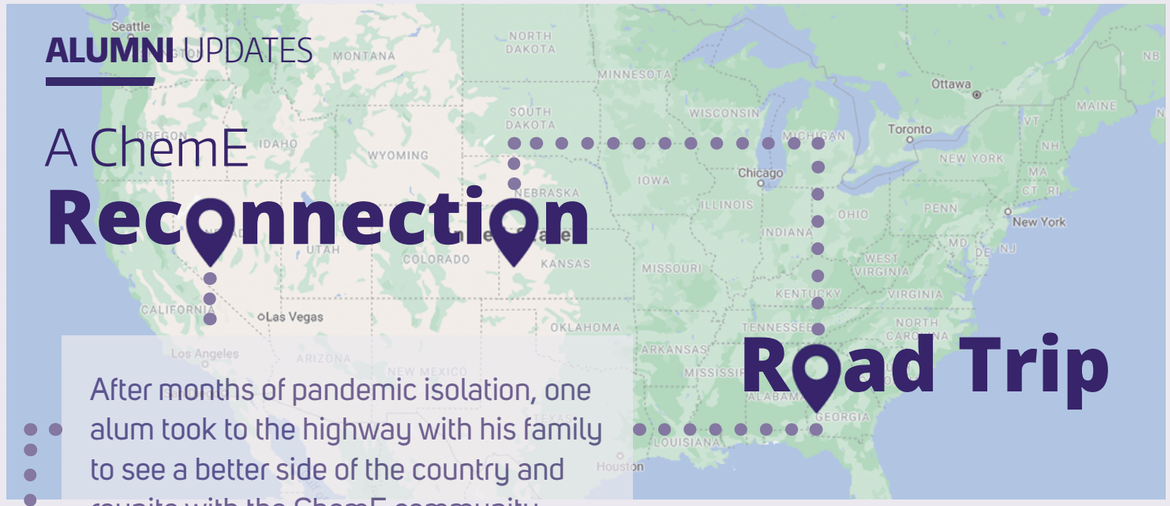
The "ChemE Declassified" panel and seminar series. Run by graduate students for undergraduates, the series helps students explore and prepare for graduate school as a next step. This represents one approach to plugging the "leaky pipeline" of STEM majors from underrepresented groups to academic positions.

A K–12 STEM outreach course: "DNA Origami for Drug Delivery Systems." Conducted virtually in Spring 2021 at a Seattle high school, the course reached a diverse student population and helped prepare participants for higher education in STEM. Undergraduates from the ChemE, BioE, and biology departments taught students about DNA origami drug delivery technology using paper origami.

A new "Ethics and DEI for Chemical Engineers" seminar. The course trains students to be ethically-responsible and socially-aware engineers. It consists of guest speakers from the UW and other institutions covering topics such as workplace discrimination and implicit bias, along with case studies that highlight medical, environmental, and other ethical issues.

Learn more about existing and planned DEI initiatives in ChemE at **www.cheme.washington.edu/diversity-equity-inclusion.**

A ChemE Reconnection Road Trip



After months of pandemic isolation, one alum took to the highway with his family to see a better side of the country and reunite with the ChemE community

When he got to California, the fatigue really started to set in. Ikechukwu Nwaneshiudu (Ph.D. '13), who goes by EK, had just driven with his wife and 6-month-old daughter across the country from Philadelphia. And it was a long way back.

In May 2021, COVID vaccines were becoming readily available, and the family sorely needed a change of scenery. EK's wife, Anna, is a recent immigrant from Nigeria; she moved to the United States in the latter part of 2019. The couple got married and enjoyed trips to Disneyland and Las Vegas. Not too long after that, though, the pandemic halted their plans to do things like go to basketball games and concerts, or even just discover their favorite neighborhood hangouts. Instead, EK said, "She got a horrible image of what the United States was."

He was confident he could turn those impressions around. They had some time, so how about a road trip to explore the cities and culture in different regions of the country? They could make their way down to Laredo, Texas, to see one of EK's sisters. Then, if they were going that far, they could continue on and visit another sister in San Francisco. At some point, EK realized he knew a lot more people along the way. "How many ChemE's can we see on the way to San Francisco?" he mused.

By the time their 30-day, 11,500-mile round trip journey through 25 states was complete, they had visited eight friends from EK's grad school days.

That included his Ph.D. adviser, Dan Schwartz. In Schwartz's group, EK worked on tailoring polymer phases to enhance Raman spectroscopy. He now works for Merck in Philadelphia, where he uses his Raman expertise in process analytical technologies to aid in the development of vaccines, anticancer therapeutics, and more.

"When told the reason for this epic trip," said Schwartz, "I was proud to be part of the ChemE community that EK felt showed off the positive character of regular Americans (in contrast to those making news or visible on social media)." Schwartz hosted EK and family for lunch at his home on Vashon Island.

Leave it to a ChemE to pull off this kind of trip: it took testing and optimization to figure out how to spend so much time on the move with a 6-month-old. EK and Anna experimented in advance to see how long Kaira could tolerate being in the car. They nailed down the right timing for waking up, feeding, car-loading, and playing and napping in transit.

The established routine paid off. Along with seeing family and friends, they got a flavor for many regions of the country. They checked out a lot of big cities (some favorites: Houston and Omaha). They also found adventure in some wilder places (turned around by blizzard conditions in Yellowstone). And in all those miles, EK points out, they were fortunate to have no major incidents or car trouble.

"The trip did the job" for seeing the states in a much better light, he said. "We made it to California and it wasn't burning!" And as a nice bonus, he was able to introduce Anna to people who made his time in UW ChemE the positive experience it was. When all was said and done, they concluded, "the United States is actually pretty cool."

EK, Kaira and Anna

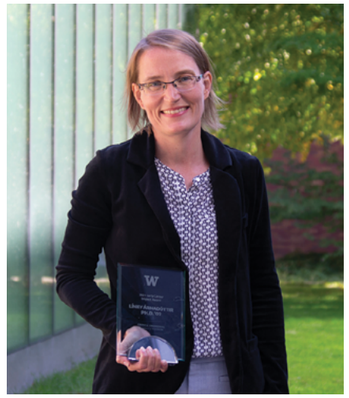
2021 UW Chemical Engineering

Early Career Impact Award

Líney Árnadóttir (M.S. '03, Ph.D. '07)

Associate Professor of Chemical Engineering, Oregon State University

This year, UW ChemE was proud to present its first Early Career Impact Award. The award recognizes 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. Our first honoree, Líney Árnadóttir, accepted the award at ChemE's annual Graduate Student Symposium on September 23, 2021.



Líney's research probes the mechanics of surface reactions at the molecular level, with applications in energy and material stability. She and her group primarily use computational approaches such as kinetic modeling and density functional theory to study surface chemistry, and they complement those methods with experimental surface science tools. She uses this distinctive hybrid approach to guide catalyst design and development for fuel cells and more-efficient industrial-scale processes, and to study the degradation mechanism of oxides for improved durability of catalysts and alloys, among other applications.

In addition to innovative research, Líney has held leadership positions in the catalysis and surface science communities. These have included chair and vice chair of the Pacific Coast Catalysis Society and executive board member of the AVS Surface Science Division. She is currently a member of the Advanced Light Source Proposal Study Panel, a co-program chair for the AVS Heterogeneous Catalysis Focus Topic, and a counselor for the ACS Division of Catalysis Science and Technology.

Líney is passionate about mentoring, and she recently received OSU's College of Engineering Graduate Mentoring Award and its Margaret and Thomas Meehan Honors College Eminent Mentor award. "I love working with students," she says. "It's a lot of fun to see them grow and share thoughts and ideas about research."

Before joining OSU, Líney earned her B.S. in chemistry from the University of Iceland, and M.S. and Ph.D. in ChemE from UW. In her time in Seattle — as a student, postdoc, and on sabbatical — she worked in the labs of Eric Stuve and David Castner in ChemE, Lara Gamble in bioengineering, and Charles Campbell in chemistry.

Startup News

This spring, ChemE spinoff company **BlueDot Photonics** announced it had raised $1 million in its Series Seed financing round. BlueDot is developing a quantum-cutting technology aimed at increasing the efficiency of solar panels, lowering the cost of solar power, and accelerating its widespread adoption.

The Seattle startup **Membrion,** founded by Greg Newbloom (Ph.D. '14), reported in September that it added $3 million to an earlier Series A funding round. The company, whose membranes can remove salt and heavy metals from wastewater, plans to double the size of its manufacturing facility and ramp up hiring.

Sironix Renewables, co-founded by Christoph Krumm (B.S. '11), unveiled its expanded development facility in Seattle this summer. The new 3,700-square-foot facility houses the production and testing equipment that Sironix uses to develop non-toxic, sustainably-sourced ingredients for the cleaning product and personal care industries.

2021 R. Wells Moulton

Distinguished Alumni Awards

Since 1993, the Moulton Awards have recognized department alumni who have made exceptional contributions in industry, academia, government, or public service

DISTINGUISHED ALUMNUS IN INDUSTRY

Mark Lawrence (B.S. '94)

Managing Director, BlackRock

Mark Lawrence is a portfolio manager for the Opportunistic Credit Investment Team at BlackRock, focusing on public and private credit investments in special situations, direct lending, and secondary markets. Mark has extensive experience investing in companies across geographies, industries, and growth stages.

Prior to joining BlackRock in 2016, Mark had been a portfolio strategist for the Opportunistic Credit Team at Apollo Global Management, and a senior analyst at Solus Alternative Asset Management. There he identified, analyzed, and valued investments in a variety of industrial and basic materials sectors.

When Mark was at the UW, the entrepreneurial opportunities available to today's engineering students did not exist. His interest in business and finance was piqued soon after graduating, when he worked for a company run by a UW ChemE.

"It was interesting to see, when you combined a ChemE degree with a business degree, how much more you could do," he said. In fact, he considers business a pretty natural step for ChemE's because design in chemical engineering tends to go beyond feasibility to encompass economics.

Subsequently, Mark earned an MBA from the University of Notre Dame and embarked on a career in business finance. He quickly learned that his ChemE background uniquely suited him for certain challenging tasks. For example, while advising companies in bankruptcy for PricewaterhouseCoopers, one of his first deals was identifying a buyer for a business paper machine company. He was the one with the skills to go to the plant, talk to the engineers, understand how the operation worked, and relate it all to the company's financial viability.

Mark has a long track record of service as a UW alumnus. He is currently a member of the UW College of Engineering Visiting Committee and has previously served on the UW ChemE Advisory Board. In 2011, Mark and his wife, Nicole, established the Lawrence Family Endowed Fund for Chemical Engineering to support graduate students and innovation in research.

Mark underscored his focus on philanthropy in his address at the 2021 ChemE virtual graduation ceremony. "Give some back," he encouraged graduates. "Help the next student get to where you got."

DISTINGUISHED ALUMNUS IN ACADEMIA

Hugh Hillhouse (M.S. '96)

Rehnberg Chair Professor of Chemical Engineering, University of Washington

Hugh's research addresses fundamental science and engineering challenges that may help mitigate the climate and environmental impacts of human activity. For the better part of his academic career, he and his team have worked to reveal a deeper understanding of chalcogenide and perovskite semiconductor photovoltaics and to develop roll-to-roll printing methods for solar cells based on these materials.

Highlights from his research include the development of colloidal nanocrystal ink methods that enable the printing of high efficiency chalcogenide solar cells; photoluminescence methods to rapidly assess photovoltaic materials; high-throughput methods for solution-processed semiconductor deposition; and new perovskite solar cell architectures. At various times, his group and collaborators have held world records for performance of high-bandgap perovskite solar cells and all-perovskite tandem solar cells. Most recently, his group has focused on understanding the stability of perovskite semiconductors and solar cells.

In another area of research inspired by his love for the natural world and marine environments, his group has been exploring ways to electrochemically degrade pharmaceutical compounds in human waste. Pharmaceutical pollution in aquatic environments is pervasive, with profound effects on ecosystems.

Prior to joining the UW ChemE faculty in 2010, he was an associate professor of chemical engineering at Purdue University. He earned his undergraduate degree at Clemson University; his M.S. at UW, studying colloidal phenomena with John Berg; and his Ph.D. at the University of Massachusetts at Amherst, working on the self-assembly of nanostructured thin films with Michael Tsapatsis.

Hugh has published more than 100 peer-reviewed research articles that have been cited by more than 11,000 other publications. In 2016, he was selected by the U.S. Department of Energy to host a visit by Secretary of Energy Ernest Moniz to showcase advances in solution processed photovoltaics. He has also won the NSF CAREER Award and the Purdue University Early Career Research Excellence Award. In addition to his research and teaching roles, he consults for companies and vets technology for investors in the nanotech and cleantech sectors.

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Now in its 15th 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.

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