

# PRISM

SUMMER 2024

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## The BEAST UNLEASHED

Powerful AI tools are shattering workplace norms. How can we prepare future engineers?



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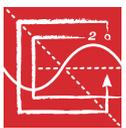
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## HERE TO STAY



Our Summer 2024 cover feature once again spotlights generative artificial intelligence (AI). Proven more than a fast fad, this powerful technology is changing—or will change—almost every aspect of society and how we operate in it.

*Prism* chief correspondent Thomas Grose returns to the topic for this issue. After examining generative AI's implications more abstractly in Summer 2023, he now investigates the ways engineering schools are actively incorporating these tools and preparing their students for workplaces where AI will be ubiquitous.

As National Academy of Engineering Chair Donald C. Winter wrote, the technology has the potential “to precipitate societal changes on the scale of the Industrial Revolution.”

Our second feature is also a repeat—or rather, a yearly tradition, highlighting the history, culture, and attractions of the city in which our Annual Conference takes place. This year, that's Portland, Oregon, from June 23 to 26. There's much to see, do, and eat there—it may be hard not to salivate when you read about food options from countries around the globe. Or from Portland's own Voodoo Donuts (Cap'n Crunch donut, anyone?). Oregon-based writer Korrin Bishop takes you on a virtual tour.

Our ASEE Today section offers highlights so you can start planning your schedule to take advantage of all the Annual Conference offers. Back by popular demand this year: ASEE's Career and Job Fair. Participants will be able to both access educational opportunities and pursue academic and private sector jobs.

Also in ASEE Today, don't miss the Society's 2024 election winners. Congratulations to all of the incoming officers, who start their terms on the last day of the Annual Conference.

We hope to see you in Portland, perhaps at one of Hopscotch's immersive light and sound experiences or browsing the stacks of Powell's, the “world's largest independent bookstore.” Find something great? Tell us about it for an upcoming On My Shelf column, at [prism@asee.org](mailto:prism@asee.org).

Wishing you a summer with just enough—but not too much—sun and lots of fun.

**EVA MILLER**  
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# DIANA CHEN



Photo by Zachary Barron/Harvey Mudd College

*May is Asian American, Native Hawaiian, and Pacific Islander (AAPI) Heritage Month, celebrating the achievements and contributions of individuals from these backgrounds in the United States.*

*Diana Chen is an associate professor at the University of San Diego and founding faculty member in the university's Integrated Engineering program.*

*This interview has been edited for space.*

## **May I ask how you identify in terms of your AAPI background?**

My go-to answer is that I identify as Asian American, for all the political history behind that term and standing in solidarity with all Asians, but my parents are Taiwanese immigrants.

## **How has your identity influenced your journey as an engineering educator?**

Asians may not be underrepresented in engineering, but that doesn't mean we don't experience racism—even if many of us do have privilege in engineering spaces due to historical factors (for example, the 1965 Immigration Act).

The first time I really came to recognize my race in my engineering journey was as an undergrad. I could see who the faculty were [and] who were in the dean positions. I remember not seeing people who looked like me. I remember one case—a visiting professor—where I'd peek into her office all the time, because I was so curious about her story.

My PhD dissertation was interdisciplinary, which is where I started thinking about broadening engineering's boundaries. Over time, it's gotten me to think about how we often leave our identities at the door when doing engineering work. That idea contributed to the creation of Integrated Engineering, where we look at how to broaden the engineering context. We explore how different identities and cultures play a role in what we design, and encourage students [to see] their identities [as] assets, rather than baggage, in engineering spaces.

[That has led to] my research in how engineering culture and spaces are often deeply rooted in systems of oppression.

[In the Co-constructing Faculty Critical Consciousness project] my focus is on faculty. We have so much sway over what students are learning—not only content, but also what it means to be an engineer. If faculty don't understand the importance of their own identity in how they're teaching their students, then it will be really hard to make progress in equity in engineering.

## **Can you talk more about the Integrated Engineering program?**

Engineering is a sociotechnical endeavor. We can't continue to work in silos, where we teach students math and science outside of any context and then expect them to be able to do something out in the world.

Especially with AI on the horizon, will engineers who can only do calculations really be valuable anymore? We need insight into what those calculations mean and why we are using them. What are the assumptions, and how do those get applied to society?

## **How is the curriculum helping students understand the sociotechnical aspects of engineering?**

Our curriculum integrates social concepts even into traditionally technical classes. For example, in Statics, I created a problem that explores using centroids and resultant forces to evaluate whether your hometown has been gerrymandered.

Other courses are designed around the sociotechnical. In User-Centered Design, my final project looks at homelessness in San Diego. We work with a nonprofit to help students understand the causes of homelessness, to have more compassion, and to recognize that not all problems can be solved by engineers alone. Students' final engineering designs consider why their designs matter for people who are experiencing homelessness, and how their designs have transformed due to the broader context.

**ESPECIALLY WITH AI ON THE HORIZON, WILL ENGINEERS WHO CAN ONLY DO CALCULATIONS REALLY BE VALUABLE ANYMORE?**

In the program as a whole, we provide students with a wide breadth of knowledge, and they really start to see connections between all of our classes. Just yesterday in a mechanical-based class, I referenced what students had just seen in their circuits-based class. Students told me what they'd learned, and I connected the dots between the two disciplines for them, emphasizing how real engineering is not siloed. It's because of [these connections] that our students often act as a bridge in senior design between the other engineering majors, because they can speak the vocabulary of all the different disciplines.

## **Anything else you want to add?**

I just want to end on recognizing that not all Asians come from as privileged a background as I do. We are not a monolith. So I want to acknowledge not only that diversity, but also the solidarity that we need to have with other minority groups, [such as] standing up against anti-Blackness.

## BIOMECHANICS

**ANCIENT LESSONS**

Some 450 million years ago, forerunners of sea stars and urchins roamed the ocean. These pleurocystitids—that is, soft robot versions—may soon make a return, thanks to biomimicry in robotics. Biomimicry involves researching biomechanics of animals that have evolved to move efficiently for certain tasks, then building robots that replicate or enhance those movements. In a new twist, mechanical engineers at Carnegie Mellon University are delving into paleobionics, an emerging area aimed at revealing biomechanics of long-extinct creatures. Their research could help reveal the biomechanics that drove evolution and give engineers new inspiration for creating robots with modern applications. As one researcher tells *Discover* magazine, only one percent of all the animals that have existed on Earth are still around, but why not see what can be learned from the other 99 percent? The team analyzed fossil remains, then used computer analyses to determine how pleurocystitids once moved: their long, muscular, segmented stem or tail swept from side to side to propel them forward. Over time the stem evolved for extra length to provide more speed. Researchers say their swimming robotic pleurocystitid, made from silicon and wire, could assist underwater to carry instruments for surveys or tools to fix machines.

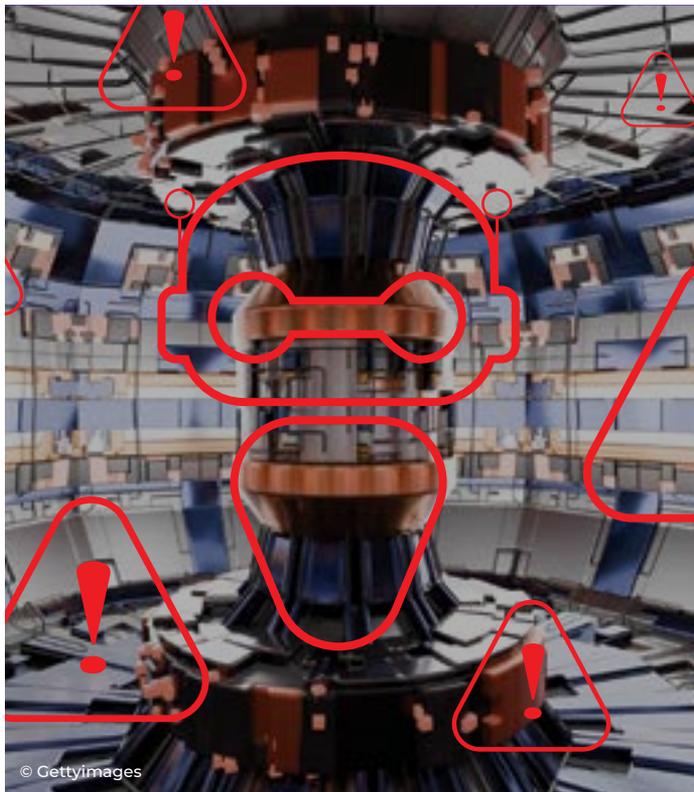
## FIRST LOOK

### ARCHAEO-ENGINEERING

# INTELLIGENT DESIGN

Now extinct, Neanderthals were a hominid species and early ancestors to *Homo sapiens*. With their prominent brow, bulging eyes, and protruding face, Neanderthals are often portrayed as apelike knuckle-draggers. However, recent research casts them in a more positive light, noting they practiced herbal medicine; conducted burial rituals; and produced art, tools, and jewelry. A new discovery indicates they were also engineers who concocted one of the first glues some 40,000 to 60,000 years ago, *Smithsonian* magazine reports. Researchers from Germany's University of Tübingen took a new look at stone artifacts, probably hunting tools, unearthed in 1910 at France's Le Moustier archaeological site. Stored in a Berlin museum since the '60s, the items had never been closely examined. Five turned out to have traces of both ocher, an earth pigment, and bitumen, a petroleum-based hydrocarbon found in soil. When combined, these two substances create a sticky mass that can be molded—for example, into a handle. The investigators believe Neanderthals were clever cave dwellers who chemically engineered the mixture for their tool-holding needs, and likely experimented with ocher-bitumen concentrations until they achieved a blend that worked. Researchers' own experiments showed a 55 percent ocher to 45 percent bitumen mix was the formula that resulted in an easy-to-grasp handle that also left hands and fingers free of sticky residue.

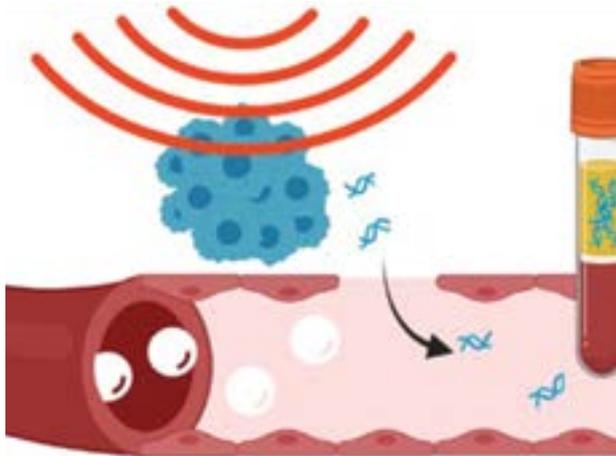
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### ARTIFICIAL INTELLIGENCE

# FUSION FORECASTING

Will artificial intelligence (AI) prove to be more beneficial or destructive for humans? Time will tell. Meanwhile, excitement about an AI warning system for nuclear fusion is heating up. The hope is that AI could help nuclear fusion become the safe, clean, virtually limitless energy source it promises to be. In nuclear fusion, two light hydrogen isotopes are subjected to great pressure and heat by a magnetic field, within a bagel-shaped containment vessel called a tokamak. The resulting ionized cloud, or plasma, forces the isotopes to merge into one heavier helium atom and produces high-energy neutrons. Heat collected from the neutrons can boil water and run a turbine—but plasmas are hard to control. Within a split second they can become unstable, ending the nuclear reaction. One reason is “tearing mode instabilities,” holes that form within the magnetic field and allow a plasma to break free of a tokamak’s control. Researchers at the US Department of Energy’s Princeton Plasma Physics Laboratory have now trained AI, using previous DOE experiment data, to predict when tearing mode instabilities will occur. That lets the system adjust just in time to prevent them. In an actual fusion experiment, the AI predicted tears up to 300 milliseconds in advance—enough time for it to take protective action. More experiments using other tokamaks are in the offing.



## BIOENGINEERING

# SOUND IT OUT

A new technology could help diagnose brain tumors more easily and safely. Surgeons typically biopsy tumors by snipping off bits of tissue for analysis. But with brain tissue, that process can cause dangerous complications. And while tumors shed DNA into the bloodstream, allowing some cancers to be detected from blood samples, the brain has a guardian network of blood vessels that stops most molecules from leaving or entering. Researchers have known for years that focused ultrasound blasts, passed through gas-filled microbubbles, can temporarily disrupt that protective blood-brain barrier—it’s a method they’re working on for drug delivery. Now investigators at Washington University in St. Louis have devised a sonobiopsy device that uses focused ultrasound to let tumor DNA molecules flow out of the brain and enter the bloodstream. The first clinical trial on humans used the technology just before patients’ scheduled brain surgery. Using the tumor tissue as a benchmark, the researchers examined the DNA in the bloodstream. Sonobiopsy “significantly enhanced” tumor DNA detection in three of five test patients, leading the team to predict that sonobiopsy holds the potential to “transform the precision diagnosis of brain tumors.”

## ROBOTICS

# SEEING EYE ... ROBOTS

Guide dogs perform a critical role escorting their visually impaired owners, and the furry, four-legged helpers also serve as a much-loved source of companionship. However, guide dogs are in short supply. There are 43 million blind people worldwide, and another 295 million with vision impaired enough to benefit from canine help. Guide dogs number just 20,000 globally. Breakthroughs in robotics and artificial intelligence (AI) are now developing a new “breed” of guides. While current robotic versions use GPS to navigate and cameras to see, which can limit inside use, researchers at Scotland’s University of Glasgow have prototyped the AI-powered, four-legged RoboGuide specifically for indoor assistance. It uses a sophisticated sensor network to map and assess its surroundings. Software helps the robot learn optimal routes and interpret sensor data in real time, to avoid obstacles such as furniture. RoboGuide also uses large language model generative AI so it can understand a human’s questions and comments, and answer in human language. New Atlas, an online science news site, estimates the robodogs’ cost will fall below \$2,000 each; a trained, live guide dog costs \$50,000. Real dogs also require care and feeding, and their average service lifespan is just 5 to 7 years. Though it won’t be able to provide the affection a real dog can, a robotic dog will last much longer. And if its body needs replacing, the software will ensure it still behaves and sounds as before.

© University of Glasgow



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## MATERIALS SCIENCE

# SOMETHING’S FISHY

Each year, 7 to 12 million tons of fish waste end up in the world’s landfills. But researchers at the National University of Singapore have found a way to divert a lot of that. Their method uses fish scales to produce product-authenticity tags on packaging that would be difficult for counterfeiters to read and extremely challenging to duplicate. Fish scales contain the mineral hydroxyapatite and interlaced chains of collagen. As the team discovered, when these materials are exposed to high temperatures, their molecular structures are altered and they fluoresce as a bright cyan color under ultraviolet light. Heat-treated scales can be arranged into letters, numbers, or symbols and remain camouflaged against a background of untreated scales. Or an ultra-fine laser beam can etch microscopic characters in a tiny section of one scale, which would then require both UV light and a microscope to read. Ultimately, the investigators say, fish-scale product tags should be cheaper, because no special inks are required. While the team tested red tilapia, tags made with other types of fish scales could “tuna” out just as well.

# Women Inventors: Patents Pending

**P**atents support innovation and job growth. However, like many aspects of STEM, they remain male-dominated.

A February 2024 National Science Board report included an analysis of gender in patenting. Since patent applications don't ask for gender, researchers cross-referenced a global gender-name dictionary containing millions of first and middle names with millions of patents completed from 2000 to 2022. According to the report, in 2022 only about 11 percent of all patents were issued to people with names deemed to be women's.

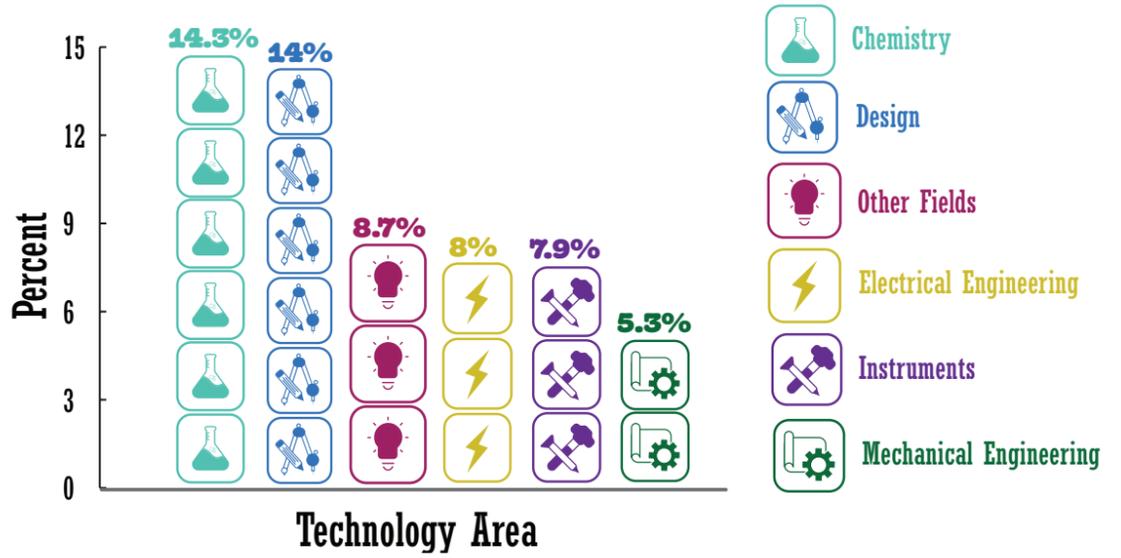
That figure represents incremental growth from 2000, when just over 7 percent of patents were issued to those with women's names.

Over the 22 years examined, the sector with the smallest share of patents awarded to women was mechanical engineering, with 5 percent. Chemistry and design reigned as the areas in which the most patents were awarded to women, although the numbers for each remained well below 20 percent of patents issued. The sector with the most growth was electrical engineering: the percentage of patents gained by women in this area nearly doubled over the two decades, from 5 percent to 10 percent.

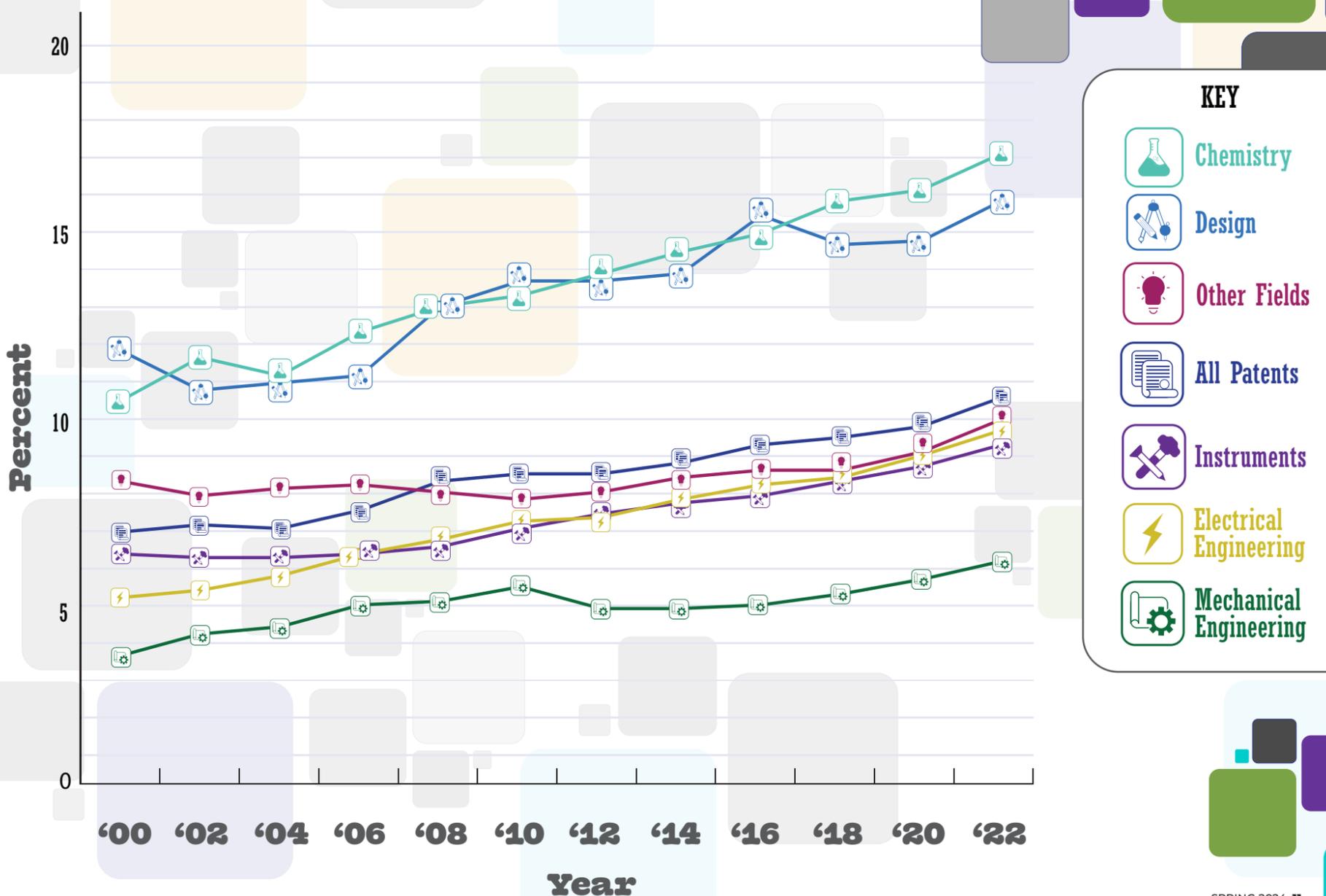
According to the report, one factor that helps increase the numbers of women who are patented inventors is collaboration with advisers in graduate programs, which is "associated with higher rates of first-time patenting by women, identifying a role for mentorship at universities in the invention process."

Source: "Counting Women as Patented Inventors," in *Invention, Knowledge Transfer, and Innovation, a report drawn from Science and Engineering Indicators 2024*. National Science Board, National Science Foundation. Access the section at <https://bit.ly/4cyoSly>.

## Inventors with Female Names, 2000–2022



## Inventors with Female Names, by Year



# MAGIC TOUCH

With 106 patents (and counting), this Imagineer is being inducted into the National Inventors Hall of Fame.



©Disney

Lanny Smoot remembers his father walking into their Brooklyn, New York, apartment with an electric bell, a light bulb, and batteries. Intrigued, he watched as his jack-of-all-trades dad wired the pieces together so that the bell rang and the bulb glowed.

“I was stunned,” recalls Smoot, who was five years old at the time. “I could not take my eyes off [the contraption]. That lit up my entire career.”

For 25 years, Smoot has worked at Walt Disney Imagineering Research & Development, making similar magic happen for other people. He is Disney’s most prolific inventor.

Among the Imagineer’s creations are special effects for some of the first interactive scavenger hunts at Disney Parks. For example, for a game based on the *Kim Possible* show, an old-fashioned tripod camera superimposed clues on the view just for guests who were playing.

Currently under development is the HoloTile floor—which acts like a treadmill for multiple people, allowing them to twist, turn, and walk an unlimited distance

in any direction at the same time. One potential application: shared virtual reality experiences. The invention also enables moving inanimate objects through remote control. *Star Trek* fans may notice a similarity to the show’s holodeck—and yes, Smoot was a huge fan of the series in his teens. Disney notes that the HoloTile floor “can allow stage performers to move and dance in new ways, or stage props and structures to move around or appear to set themselves up.”

The inventor explains about his designs, “I wish for something, then push for it to happen in the real world. It’s my curiosity that sparks the imagination, and it’s my imagination that supports the curiosity.”

This process has earned him a place in the National Inventors Hall of Fame. Smoot will be inducted in May and is only the second person at The Walt Disney Company to receive the honor. Finding out that the first person was Walt Disney himself was “an emotional point in my life,” says the Imagineer. “I think I went blank.”

Smoot earned bachelor’s and master’s degrees in electrical engineering from

Columbia University, but never saw a Black engineer until shortly before he became one. He knows not everyone has been, as he puts it, gifted with a “fortunate series of events,” including being raised by supportive parents and receiving scholarships to attend college.

That’s why he feels compelled to engage Black students and other students of color in STEM areas such as inventing and engineering. Smoot has served as a judge for the Disney on the Yard Innovation Challenge, an annual design competition for students attending historically Black colleges and universities, and participates in Career STEAMposium, an event in Pasadena, California, each year that exposes middle school through college students to working professionals in science, technology, engineering, arts, and mathematics.

“I don’t think a person’s life should be based on luck,” Smoot says. “A number of things happened to break just right for me to be successful, and I don’t want that to be necessary [for others]. It shouldn’t be extraordinary that a person does what I do. It should be ordinary.”

Smoot has been working to connect others with opportunities since he started his career at Bell Labs, where he invented some of the first fiber-optic transmission technologies used widely in the Bell Telephone system. After only a year there, he created the Collective Effort Management Development Program, in which young employees of color, a minority in the engineering divisions, shared technical information about their specialties with each other weekly.

Now, the 68-year-old says he’s nowhere near ready to stop pushing boundaries in theatrical technologies and special effects. Smoot still has a few patents awaiting approval and a few others in development.

“As long as I’m around,” he says, “I’m going to be thinking and using my imagination.”

*Robin L. Flanigan is a freelance journalist and author based in Rochester, New York.*

# CHANGE OF PLANS

It's time to rethink the research-focused PhD.

If the STEM PhD were a product sold in stores, customers would have long ago called for a redesign. The National Academies, Council of Graduate Schools, and *Nature* have all rightly advocated for reforms to PhD training. They've echoed calls from industry and society for researchers to be more responsive and more quickly generate innovative solutions to pressing problems.

Still, in the United States, most STEM-related doctoral training continues to follow a post-World War II framework for curiosity-driven academic research (see, for example, the development of the atomic bomb). But today's grand challenges in such areas as climate change, energy, and health care require a more directed, use-inspired approach.

For decades, the scientific community has wrestled with the research paradigm. Gradually, support has grown for research focused on pre-identified problems. Yet, little has changed in training students.

The effects of this mismatch are heightened by employment trends. The US is producing more PhD graduates, but fewer are finding academic jobs. According to a recent survey from the National Center for Science and Engineering Statistics, about 90% of engineering PhDs will work outside academia or continue as postdocs; 79% will be tasked with solving problems and creating competitive advantages for their industry employers.

The time for debate is over. We must move forward in a collaborative effort among academic, industrial, and governmental stakeholders to redesign graduate engineering education to center student experience and use-inspired research.

Implementing such broad-scale cultural change is daunting, but some big thinkers are leading the way. In 2021, university, industry, and funding agency leaders joined together at a National Workshop on Industry-University Partnership for Doctoral Education. The result was an engineering change order of sorts, emphasizing the need for graduate training to embrace a problem-solving approach. A collective solution—developed by consortia of

universities and private corporations, national labs, defense organizations, and health-care institutes—is required.

One initial effort is Lehigh University's Pasteur Partners PhD (P3) program. Our initiative promotes comprehensive change through four pillars:

- An optional preprogram internship, offering potential research ideas drawn from existing projects at companies;
- Co-advising by a faculty member and an industry researcher;
- Required one-credit courses on skills such as effective communication, teamwork, and independent thinking;
- A one- or two-semester residency to complete part of the dissertation in the industrial environment.

A handful of other universities have taken steps toward reform. For example, the Accelerate to Industry program at North Carolina State University provides graduate students and postdocs with company visits, team practicums, and internships.

But few broad-scale efforts exist, due to various challenges. In our P3 experience, we have faced many. For example, the current academic structure prioritizes research output, such as grants and publications, over training researchers to find realistic, economically viable solutions to real-world problems.

In addition, a natural tension exists between the traditionally open knowledge environment of research universities and companies' interest in protecting intellectual property from competitors.

Stakeholders are also understandably wary about supporting a new program for which ROI will be unknown for years. (Agencies focused on developing a competitive US workforce, such as the National Science Foundation, can help with targeted funding.)

Despite these challenges, early evaluations of P3 suggest success. Industry advisers have acknowledged students' growth in professional, technical, and soft skills. And interns have added staffing capacity needed

at companies for previously underresourced projects. Students report benefiting from practical experience, professional connections, a deepened understanding of work in industrial labs, and increased confidence in their career prospects.

These early results are more than encouraging. We believe they represent a viable and replicable set of practices that can revolutionize graduate education in STEM.

Importantly, we must reject the premise that changes to PhD training will undermine its quality. Rather, we believe the universal advantages of a problem-solving mindset will produce better industrial researchers and academicians.

Systemic change will hinge on fundamentally reframing the way PhDs

**WE ENCOURAGE  
OUR FELLOW  
ENGINEERING  
EDUCATORS TO  
JOIN WITH US  
IN REIMAGINING  
GRADUATE  
EDUCATION.**

are trained to think about problems, with the support of committed partners in industry and government. To succeed, all stakeholders must share in both the benefits and necessary commitments to create better-trained researchers.

We encourage our fellow engineering educators to join with us in reimagining graduate education through P3 consortia or by driving similar innovation at their institutions.

*Himanshu Jain has a distinguished chair in engineering and applied science at Lehigh University. Nathan Urban is Lehigh's provost. Gary Calabrese is a recently retired senior vice president at Corning.*

*Learn more about the P3 program at <https://go.lehigh.edu/p3>.*



# TAMING the TIGER

Engineering schools, eyeing AI's overwhelming potential, look for ways to make it work for them and their students.

By THOMAS K. GROSE

**C**hatGPT and its progeny are quickly changing the world, including the way engineers work. That's a huge new challenge for engineering schools.

The large language model (LLM) chatbot, which uses a type of generative artificial intelligence (AI) to gobble up massive amounts of online data and spit out content, was publicly released November 30, 2022, about a year and a half ago. Already, a host of other commercially available generative AI platforms have launched in its wake—all of them capable of producing a wide range of content, including text, software coding, images, animation, and 3D models. Many experts, including economists and technologists, say these generative AI platforms will spawn new industries and remake existing ones, kill some jobs while creating others, and boost productivity and economic growth. No technology is risk-free, of course, and the problems AI could unleash range from mass joblessness to an epidemic of disinformation. But the technology's likely upsides are immense: breakthrough discoveries in medicine, development of useful new materials, and improved management of renewable energy sources. The technology has the potential, writes National Academy of Engineering Chair Donald C. Winter, "to precipitate societal changes on the scale of the Industrial Revolution."

The good news for engineers is that their jobs look secure. They'll be needed to work with AI to bring to fruition all of its possible benefits. Indeed, the emergence of generative AI (as well as other forms of artificial intelligence) is already affecting how they perform their

“It’s not going to be acceptable for engineers to graduate from engineering school, go into the world of work, and have no clue how to utilize these platforms.”

— Kadri Parris, a senior lecturer in engineering education at Ohio State University



jobs, and will continue to do so. Many rote tasks that engineers now do themselves will be automated, including computer-aided design, simulations, diagnostics, data analysis, and coding. Ideally, this shift should allow engineers to spend most of their time on the more creative and critical facets of their work.

But the sea change in how engineers ply their trade is forcing engineering schools to figure out how to overhaul their courses and curricula so that their students are conversant with these powerful new tools when they enter a workforce being reshaped by self-thinking algorithms.

## A WORK IN PROGRESS

“This is going to have a lot of impact on how everyone does a lot of things in life, but I think engineers in particular are going to be impacted first, and among the most heavily,” says Robert Ghrist, associate dean for undergraduate education at the University of Pennsylvania’s engineering school. “Much of what we do . . . AI seems to be getting really good at.” Kadri Parris, a senior lecturer in engineering education at Ohio State University, adds that these technologies will allow companies to do in hours tasks that once took days or weeks. “It’s not going to be acceptable for engineers to graduate from engineering school, go into the world of work, and have no clue how to utilize these platforms.”

So far, it appears that many schools are looking for ways to insert AI technologies into existing courses. They’re encouraging faculty teams to brainstorm, and piloting new course content. “We are trying to understand the impact, and based on assessing this impact, trying to move it into the classroom, into the way we design our content and our curricula,” says Ovidiu Daescu, computer science department head at the University of Texas–Dallas. But this is very much a work in

progress, points out Mary Besterfield-Sacre, senior associate dean of engineering at the University of Pittsburgh. “From what I’ve seen, it’s all kind of piecemeal,” she says. “Everybody’s doing it right now kind of in their own little way, and we need to start creating best practices.” The kinds of questions that need answers, Besterfield-Sacre says, are: Where in the curriculum do you start—first year, second year? Which classes are most conducive to incorporating AI? How will the process differ for the various disciplines?

In the meantime, at least two engineering schools have answered the challenge by creating degrees in AI engineering, essentially calling it a new discipline. Penn will roll out a BS in AI engineering this fall, while Carnegie Mellon University is in its second year of offering a master’s. CMU has also begun offering online courses geared toward working engineers who want to earn certificates remotely in AI engineering.

## THE RIGHT QUESTIONS

One key skill that students need to master is crafting carefully worded queries to produce the best responses from AI and to do so efficiently. So-called “prompt engineering” is a type of expertise that may be evolving into a new discipline. “Asking the right questions to get the right answers should be part of the training,” Daescu says. This is no simple task, because the English language can be ambiguous. For example, explains Ella Atkins, head of the department of aerospace and ocean engineering at Virginia Tech, say you want an airplane design that offers good performance at high angles of attack. “What does that mean? What does performance mean? Is it fuel? Is it time? Is it maximum speed or average speed? So there’s a lot of questions about how the back-and-forth conversation [with an algorithm] might go so that the interpretation is clear.”

Another possible issue, Besterfield-Sacre says, is the need to protect an employer's intellectual property (IP). "We need to definitely be teaching our students this. An innocent inquiry used to gather more information can lead to things going out into the cloud that should never be going out." Another IP concern, says Krista Kecskemety, an associate professor of practice in engineering education at Ohio State, is when an engineer gets "some kind of output [from AI]. Who owns that output?" Should the engineer be using it and presenting it?

Additionally, Daescu says, students need to be taught to be critical thinkers: "They need to learn to recognize when an answer might not be correct." Indeed, all of the academics interviewed for this story agreed that while AI will take over many rote tasks, engineers still need to be trained in fundamental skills so they can look critically at AI-produced content. Many tasks will become automated by AI, Parris says, but "the elements of thinking through the design process and making certain decisions will still rest with the engineer."

Students already have tools like Excel and MATLAB to help them with problem-solving, Kecskemety says, but AI could perform that task for them. "I think it's really important for us to figure out which ways we plug [AI] into that ... process, so it is helping support the problem-solving, not circumventing it. We still want our students to have those critical-thinking skills to be able to work through a problem." Sami Khorbotly, a professor of electrical and computer engineering at Valparaiso University, says his students still "have to learn how to write a code," but if several assignments later they figure out they can use ChatGPT to create a piece of code for them, "then I expect them to make sure that they ask it all the right questions and then look at the output to make sure it's the right thing."

## TECHNICAL ETHICS

Ethics is, of course, always an important part of engineering education. However, AI or machine learning (ML) technologies add complications. When the technologies first came into use, faculty spotted student papers that were AI-generated in whole or in part, and worked to nip the trend in the bud (*Prism*, Summer 2023). But the problem isn't limited to cheating. As Ghrist explains, there's the pure ethics side: How do we decide what uses of AI are OK, and when? "There is a technical side as well," he adds. "Is it possible for an algorithm to be biased [due to distortions in data used to train the AI]? Is it possible to write an algorithm that does not have bias in it? How do you check? Those are the technical issues, really interesting ones. So we hope to be able to train our students broadly."

Muhsin Menekse, an associate professor of engineering education at Purdue University, says the need for students to understand how to use AI responsibly will require "course curriculums to be updated, including cases, examples, that show students the misuses of AI tools." Ultimately, AI needs to be employed to aid and not harm humanity. There's always a 5 to 10 percent chance that an ML or AI system will give an incorrect result, Khorbotly says. If it's being used to recommend a movie, that's not such a big deal. "But if you are creating your AI system to drop bombs out of an airplane, are you OK with that?"

Penn's new BS degree will be offered to existing students when it launches this fall. Ghrist is not sure how big the first cohort will be but says that, based on inquiries he's getting, "the demand is going to be substantial." The degree will package together many AI and ML courses created by electrical and systems engineering departments over the last five to 10 years, Ghrist says. A few new courses are in the works, too, including a linear algebra class that's more focused on data and applications. One of the ethics courses will deal with technology and law and be taught by law school instructors.

Not all engineering academics are convinced there's a need for an undergraduate degree in AI engineering, because many schools will cover the same material within existing courses and disciplines. Khorbotly says, "I think at this point, it's still most likely buzzwords and marketing strategies."

## 'HUGE DEMAND'

Among interviewees, there was more support for offering master's degrees, as CMU is doing. There, the same core set of courses—including classes in AI, ML, and deep learning—is offered within seven engineering disciplines, but each is tweaked to accommodate a particular discipline's needs. Jonathan Cagan, head of the mechanical engineering department, thinks the master's degree will appeal mostly to people who are still early in their careers. Even engineers who graduated just five years ago probably didn't get much, if any, AI training, he says. "It's pretty recent in terms of impact." While the school initially decided to cap enrollment at around 100, "there's a huge demand, so we may have to rethink that," Cagan says.

Alternatively, schools can offer certification programs for working engineers who want to update their skills. "I think this is an opportunity," Parris says. "Some universities are already putting out short [training] courses." His own school, Ohio State, for instance, offers an online "AI Boot Camp" that students anywhere can complete part-time over 24 weeks. CMU allows people who earn two certificates remotely to then spend a semester on campus taking classes to earn a master's.

There was agreement among the engineers interviewed that their profession is not at risk from AI. "I don't think we are ready to kick out the engineers," Virginia Tech's Atkins says. "There's no threat to jobs because those engineers are going to be needed to see that [AI] output and ask questions: Does this matter, does this make sense?" Cagan agrees: "Look, engineers are solving hard problems and they're very complicated, so I don't think we're close to replacing engineers. My own research is looking at how AI and humans collaborate. To me, that's the future."

For engineering schools that are revamping their courses and curricula, it's bound to be of some comfort that their students will work alongside AI and not be replaced by it.

*Thomas K. Grose is Prism's chief correspondent. He is based in the United Kingdom.*

# Portland City Rhythms

## Explore Portland's stunning scenery and quirky culture while attending ASEE's 2024 Annual Conference.

The Willamette River snakes through Portland, Oregon, dividing the city into eclectic neighborhoods to the east and west before meeting the Columbia River and the Washington State border. Tree-lined paths weave through the verdant metropolis, cross-genre art adorns the city's plazas, and international flavors stew in downtown restaurants.

Portland is known for a progressive mindset, but the river town has a problematic history. From 1840 to 1880, the region's prosperous fur trade motivated colonizers to forcibly remove indigenous people, stealing 2.5 million acres of tribal land. Local areas reflect the names of displaced tribes—for example, Multnomah, Clackamas, Cayuse, and Walla Walla.

In the 19th century, Portland transformed into a bustling shipping town; the development of railroads sped the growth of the logging and mining industries. These opportunities attracted Japanese and Cantonese Chinese immigrants who established a Chinatown and two Japantowns. Meanwhile, a majority Black neighborhood grew in North Portland with resident-owned diners, shops, and clubs. However, a series of state laws focused on expelling and excluding Black residents. The last was repealed in 1926, but racial references persisted in the Oregon constitution until 2002. Today, art exhibits, cultural gardens, and educational opportunities seek to acknowledge and repair Portland's troubled past.

### BEVY OF BRIDGES

Twelve bridges crisscross the Willamette River to connect Portland's east and west sides. The most accessible to conference-goers, mere blocks from the Oregon Convention Center, is the Steel Bridge, built in 1912. Its double-decker construction invites walkers, bikers, and light rail riders to spectacular structural and river views.

Other ogle-worthy bridges include the Burlington Northern Railroad Bridge (1908), a vertical lift truss bridge exclusively for

locomotives; the Hawthorne Bridge (1910), the oldest vertical lift bridge still operating in the US; and the Burnside Bridge (1926), with its iconic Italian Renaissance-style towers.

For best viewing, book a ticket on the 150-foot *Portland Spirit* yacht to cruise the Willamette River from downtown Portland to the historic Milwaukie (Oregon) waterfront. During this two-hour float, you'll pass under eight bridges. Select the lunch or dinner option to dine with live piano music or opt for the budget-friendly sightseeing-only ticket to relax on the outer deck with a recorded narration on the city's history and culture.

Finally, trek the Tilikum Crossing, named for the Chinook word for people. Completed in 2015, this bridge is open only to public transit, bicyclists, and pedestrians. Its modernist cable-stayed construction mimics the snow-capped Mount Hood towering to its east. On its west side, hop the Portland Aerial Tram for an exhilarating vantage point and panoramic views of the river. On the bridge's other end, visit the free-entry Oregon Rail Heritage Center to view three massive steam locomotives—one dating back to 1905 and another stretching 120 feet long.

### GATHERING STEAM

Bridges and railroad history are just two aspects of Portland that engineers might appreciate. The Oregon Museum of Science and Industry (OMSI) offers interactive exhibits and guided play on STEM topics for both kids and adults. OMSI features chemistry and physics labs, a natural history wing, and interactive displays on topics from urban earthquake resilience to walking with tyrannosaurs. Visitors can also tour the USS *Blueback*—the Navy's last active-duty diesel-electric submarine, decommissioned in 1990—which is docked outside.

Less than two miles from OMSI is Hopscotch, an electrified experience merging art and engineering. The gallery's 14 immersive installations combine light, sound, and technology for mind-bending experiences.

"We challenge visitors to engage with art in unconventional ways, which fosters curiosity and sparks dialogue," says Gabe Martin, experience manager at Hopscotch. "The 'anti-art' visitor is my favorite type of guest because they believe they don't enjoy art. Our experience allows them to connect holistically with artists to broaden their perspectives ... beyond traditional art spaces."

At Hopscotch, jump into the Quantum Trampoline—a bouncy floor surrounded on three sides by large-scale video projections of abstract images that change color, shape, and velocity in sync with your movements. Or enter the world of Chromesthesia in small rooms with saturated color fields and curated soundtracks. In the Laser Graffiti room, use digital spray cans to paint a communal canvas, or maneuver Unknown Atmospheres as 40,000 light-emitting diodes release color waves through 150,000 translucent orbs.

By Korrin Bishop

## GET WEIRD

Portland has an offbeat reputation, and it's worth leaning into. Start at the original Voodoo Doughnut in Old Town Portland for a cereal-coated or bacon-topped treat. While there, you may catch an unexpected union: "We perform both legal and non-legal wedding ceremonies at all of our brick-and-mortar locations," the confectioner's website declares. The shop is hard to miss with its bright pink and purple exterior across from a giant black-and-yellow "Keep Portland Weird" sign.

Next, walk to Pioneer Square. Come noon, "Fanfare for the Common Man" blasts from loudspeakers and the janky-yet-dramatic Weather Machine begins its announcement of what the day's weather ... well, already is. The spinning metal orb sprays a fine mist as light bulbs dance along its pole and then reveals which of its three weather predictions best suits the day: a golden sun if it's clear, a blue heron if it's cloudy, or a dragon if it's stormy.

Watch from the square's miniature amphitheater to sample its acoustical wonders. Stand on the granite disk, speak toward the steps, and your voice echoes back at the same volume. Sit on opposite sides of the semicircle with a friend and whisper to find that you can still hear one another perfectly.

Above nearby Southpark Seafood restaurant, find "Transcendence" by Keith Jellum, an 11-foot hand-forged bronze salmon swimming through the brickwork. Four streets over, glimpse the namesake of popular sketch-comedy show *Portlandia*, a nearly 45-foot-tall, 7-ton copper woman holding a trident, perched on the entrance to a municipal office building. Artist Raymond Kaskey's sculpture is the second-largest copper repoussé statue in the United States, after the Statue of Liberty. What makes the behemoth even weirder: It stands in a sterile business district opposite a complex aptly named Standard Plaza.

## PARKS AND GARDENS

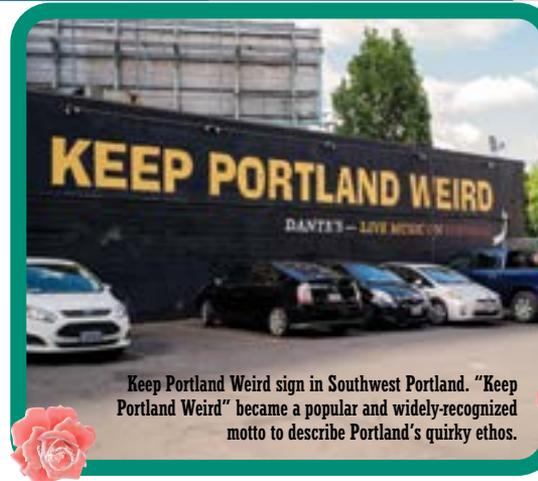
In a city with an average 222 overcast days annually, when the sun appears in Portland, residents flock outside. Join the celebration at Tom McCall Waterfront Park, a nearly 37-acre green space on the Willamette River. Adjacent, at the SW Taylor Street stoplight, find Mill Ends Park in the median strip of SW Naito Parkway. This one-tree nook measures a mere 452 square inches, setting the record for the world's smallest park.

During Portland's summer, roses burst into bloom—their preponderance results from an effort to line 20 miles of streets with flowers before the 1905 Lewis and Clark Centennial Exposition. With the addition of the International Rose Test Garden in 1917—which houses more than 10,000 bushes of 610 different varieties—the town duly earned its nickname as the City of Roses. The annual Rose Festival will have wrapped by conference time, but plenty will still be present.

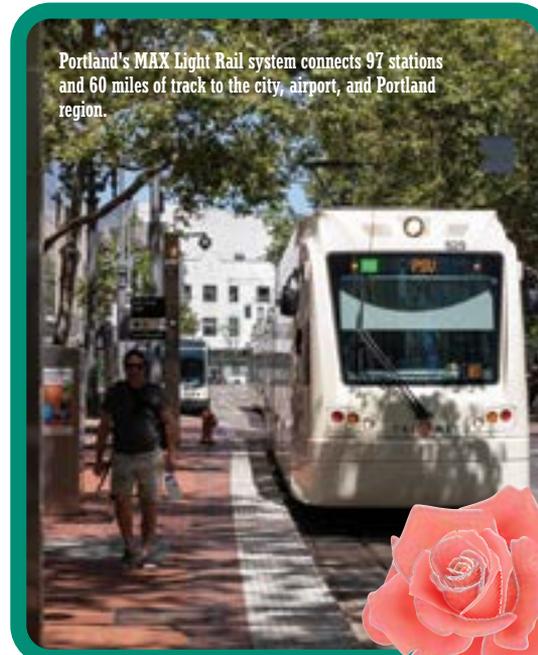
Visit these roses and more in Washington Park—a nearly 460-acre greenspace with diverse destinations, such as the Oregon Zoo, a children's playground, and the World Forestry Center Discovery Museum. Its Portland Japanese Garden has been deemed the most authentic of its type outside of Japan. It was founded in 1963 as a place for cross-cultural understanding following World War II.

"Every single view has been considered and intentionally designed," says Will Lerner, the garden's communications specialist. Unlike Western spaces emphasizing colorful flowers, the Japanese Garden is nearly 75 percent green. The hue creates a calming atmosphere, Lerner explains, in combination with audio texture from water features.

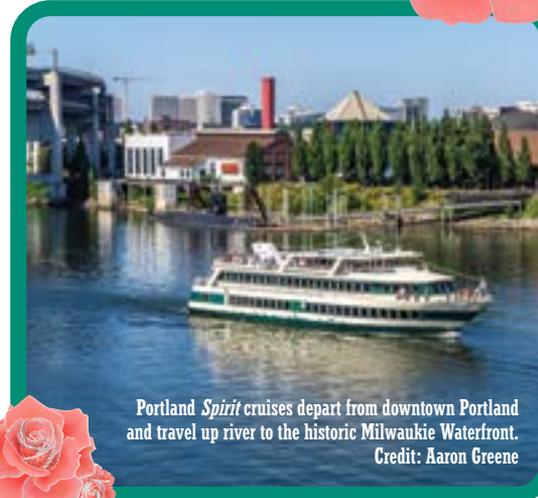
The garden's teahouse was built in Japan and then deconstructed and shipped to Portland. Other LEED-certified garden buildings were designed by acclaimed architect Kengo Kuma and evoke his "anti-object" approach to remove barriers between humans and nature—for instance, in living roofs made of sedum plants.



Keep Portland Weird sign in Southwest Portland. "Keep Portland Weird" became a popular and widely-recognized motto to describe Portland's quirky ethos.



Portland's MAX Light Rail system connects 97 stations and 60 miles of track to the city, airport, and Portland region.



Portland Spirit cruises depart from downtown Portland and travel up river to the historic Milwaukie Waterfront. Credit: Aaron Greene



Portland's International Rose Test Garden is the oldest official continuously operated public rose test garden in the United States. The garden's views and more than 10,000 bushes make it one of the city's most notable landmarks. The best rose-viewing months are May through September.



## EAT AND SHOP LOCAL

After working up an appetite sightseeing, you can find a range of dining choices in historic North Portland, a quick ride from the convention center. North Mississippi and North Williams avenues offer dishes for all budgets—from award-winning Thai barbecue to authentic German food. Downtown's ample options are also a 10-minute taxi or public transit trip. At food cart pods such as Lil' America or Hawthorne Asylum, you can sample such offerings as Southern seafood boils and vegan Egyptian.

For brunch, Pine State Biscuits, concocting towering Southern-style sandwiches, is a 15-minute walk north of the convention center. Broder Café serves Norwegian potato crepes and Danish pancakes with lemon curd and lingonberry jam, as well as a stunning array of craft aquavit cocktails.

At dinnertime, check out Sousòl by James Beard award-winner Gregory Gourdet. Named for the Haitian Creole word for “basement,” this lamp-lit pan-Caribbean lounge takes you underground for a speakeasy ambiance boasting sylvan wallpaper and magenta upholstery. Savor small plates like saltfish fritters with fermented pepper remoulade alongside thoughtful full-spirit and zero-proof mixed drinks.

Across from the convention center is Hotel Eastlund's rooftop Metropolitan Tavern. Expect contemporary Pacific Northwest cuisine and happy hours with a scenic view. Try the local steelhead du jour.

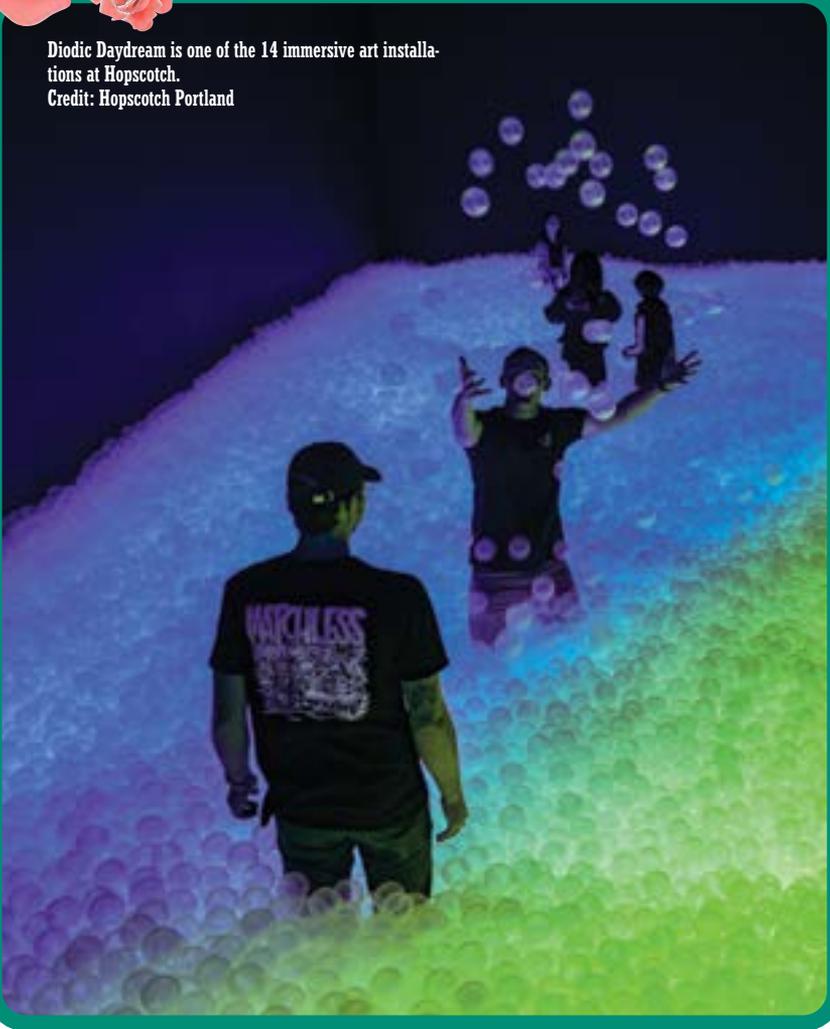
After enjoying Portland's cuisine, stroll SW 10th Avenue for souvenirs. Start at Powell's City of Books, a multilevel maze of new, used, and rare volumes and gifts that comprises an entire city block. From there, find made-in-Oregon merch at Crafty Wonderland, Tender Loving Empire, and Hello From Portland.

## GET AROUND

Portland's neighborhoods are highly walkable. To reach them, use ride-sharing or public transit. There's a MAX light rail stop across from the convention center, where you can buy a day pass. The westbound red, blue, and green trains go to downtown's Pioneer Square, where all lines intersect. The blue and red lines continue to Washington Park.

To fully embrace Portland, try all modes of moving around the city. Go by water, bus, and bridge. Hop a taxi. Take the tram. Discover peculiar Portland.

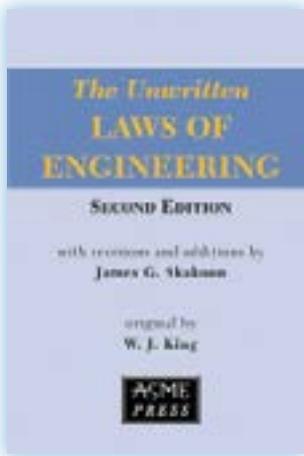
*Korin Bishop is a freelance writer and editor based in Oregon.*



Diodic Daydream is one of the 14 immersive art installations at Hopscotch.  
Credit: Hopscotch Portland

# LAWS, HEAT, MEANING, MANAGEMENT

Years ago, when I was teaching at West Virginia University, several students asked for book recommendations that could help them develop as humans, not just as engineers. I started generating a list. Today, I still refer to it often.



## **The Unwritten Laws of Engineering**

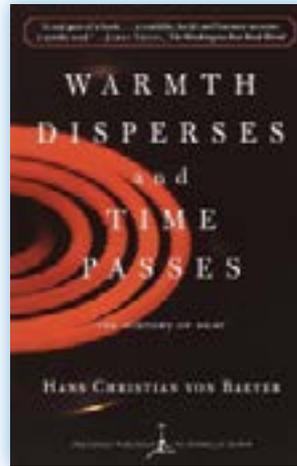
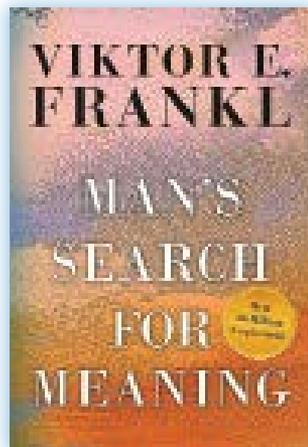
By W.J. King & James Skakoon  
ASME Press, 2019 (second edition)

The unwritten laws were first published in 1944 as three articles in *Mechanical Engineering* magazine and quickly became a classic of engineering literature. The premise: the chief obstacles to the success of engineers and engineering students are of a personal and administrative nature rather than a technical one.

## **Man's Search for Meaning**

By Viktor Frankl  
Beacon Press, 2006 edition

This text is based on psychiatrist Viktor Frankl's experience in Nazi concentration camps. Frankl argues that we cannot avoid suffering but we can choose how to cope with it, find meaning in it, and move forward with renewed purpose. He concludes that what humans actually need is not a tensionless state but rather the striving and struggling for a worthwhile goal, the call of a potential meaning waiting to be fulfilled.



## **Warmth Disperses and Time Passes: The History of Heat**

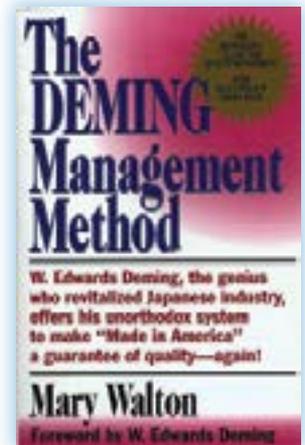
By Hans Christian von Baeyer  
Random House, 1999

This text provides background on our modern understanding of heat energy as well as its transfer and dispersion throughout our environment. The author walks us through the evolution of our scientific understanding of thermodynamics, stopping to dwell on the intellectual and societal framework that allowed the physicists of the time to make their respective scientific leaps.

## **The Deming Management Method**

By Mary Walton  
Perigee Trade, 1986

This was required reading during my time in graduate school. How fortunate I was to find it and be able to implement the concept of quality within my work and life. I will argue that W. Edwards Deming has had more impact on business and industry than any other engineer in history, worldwide. I encourage you to also take a look at other Deming-related titles; you will not be disappointed.



Braxton V. Lewis  
Sustainable Technologies Manager  
Noblis  
Morgantown, West Virginia

*Editor's note: These reviews are a sampling from Lewis's list, and have been edited for space. Access his full post at <https://bit.ly/3VadwnM>.*

Have a good book to recommend? Email [prism@asee.org](mailto:prism@asee.org) with a brief writeup of a mainstream read (not textbook) that would be useful, interesting, or enlightening to fellow engineering educators. Please include why you recommend it. Wildcard submissions are also welcome (a non-job-related book that you think others should read, such as a poetry compilation, humor collection, or novel). We will run a selection of submissions in Prism. Writeups may be edited for length and clarity. Looking forward to your recommendations!

## GETTING ACTIVE

Professional development can help faculty implement active learning.



Active learning centers students, with instructors leading them in interactive activities, group work, and self-guided learning. Research has demonstrated that active learning can improve student comprehension and retention in educational programs. Nonetheless, within engineering, lectures remain the dominant form of teaching. Faculty members may lack awareness of active learning's benefits, knowledge of how to implement the strategy, or time to plan.

Our study described best practices from a large-scale, multiyear professional development program promoting active learning to engineering faculty. Just-in-Time Teaching with Two-Way Formative Feedback for Disciplinary Faculty (JTTFD) involved more than 80 faculty members across engineering disciplines at a large engineering college. The study describes a model and evaluation framework for JTTFD, which could be adopted in other professional development (PD) programs.

Throughout the fall semester, faculty attended eight one-hour workshops. The sessions included a mini-lecture on a topic followed by facilitated group activities to demonstrate active learning practices.

Workshop topics included an introduction to active learning; Bloom's taxonomy; student engagement; and inclusive classroom practices.

In the spring semester, faculty participated in communities of practice (CoPs) to further connect with colleagues. These CoP sessions comprised a brief refresher presentation on a topic and facilitated conversation. Faculty members deemed the sessions useful and requested CoPs continue the following year.

JTTFD employed a comprehensive evaluation strategy to understand changes in faculty members' awareness of, attitudes towards, and use of active learning. We also examined shifts in student achievement. We developed two novel survey instruments: one to capture baseline data on faculty knowledge of various instructional practices, and one to measure faculty dispositions toward and use of specific teaching strategies.

The research team also conducted extensive classroom observations before, during, and after faculty participation in JTTFD to characterize adjustments in teaching practices, focusing on implementation of active learning in the classroom. Lastly, we collected achievement data for students enrolled in participating faculty members'

classes before and after the instructors finished the program.

Results showed that faculty awareness of active learning increased significantly after completing JTTFD. Faculty also rated the value of active learning more highly. Classroom observations revealed a moderate average increase in the use of active learning practices. Watching how faculty *actually* conducted classes was a critical component of our evaluation because we could see real-time changes in instructional practices as opposed to potentially biased self-reports.

Student achievement shifts were less pronounced. We noted a small decrease in the percentage of students receiving a "C" or withdrawing from the course after faculty participated in JTTFD. It may take time for faculty to incorporate active learning practices into their classrooms fully; therefore, more substantial changes in student achievement may only occur after a few years. Based on our experience, we encourage all future professional development evaluations to incorporate long-term assessment of student achievement.

We also advocate for alternative measures of student outcomes, because course grades might not best measure student achievement or learning. Instead, we encourage measures of achievement focused on active learning tenets, such as class observations.

We urge all future professional development program evaluations to focus on innovative ways to understand changes in student achievement, motivation, and other outcomes. While this study was focused particularly on a PD program for undergraduate engineering faculty, the evaluation model could easily be adapted to other contexts.

*Lydia Ross is an assistant professor in the Mary Lou Fulton Teachers College at Arizona State University (ASU). Her research centers on student access and inclusion in STEM. Stephen Krause is a professor in the materials science program at ASU's Ira A. Fulton Schools of Engineering with research interests in engineering education.*

*Read more about the study in Advances in Engineering Education (Volume 12, Issue 1), <https://advances.asee.org>.*



## BUILDING COMMUNITIES

Developing opportunities for peer learning, collaboration, and networking is a primary way ASEE provides value.

By Jacqueline El-Sayed

Greetings! This is an exciting year for me as I begin my second decade with the ASEE community. I first became a member in 2004 as a junior engineering professor. Having started my career as a truck engineer in the transportation sector, ASEE connected me with a strong community of practice also passionate about engineering education. I was elected to my first ASEE volunteer leadership role in 2009. As treasurer of the Women in Engineering Division (WIED), I worked closely with a cohort of other division executive officers on WIED's strategic planning, conference program, and infrastructure. As I grew professionally, so did my ASEE community of practice, expanding in 2012 to the members of the Engineering Deans Council (EDC) and the EDC committees I served on and led. In 2019, after a national search, I joined ASEE headquarters as the Chief Academic Officer responsible for professional services. In 2022, I was honored to be appointed as ASEE's Executive Director and Chief Executive Officer—the first woman in our Society's 131-year history to hold those positions. Throughout the last two decades, ASEE's community has been instrumental for me.

In 2023, ASEE launched our Listening Tour (LT) to hear from members, staff, and stakeholders. Thank you to all who have taken the time to fill out the LT survey and attend the LT virtual sessions. Your valuable insights will inform ASEE's strategy, goals, and 2024–2027 strategic plan. One of the central themes from your feedback so far is that the Society is also an important community of practice for you. Our members value the support they receive from ASEE when they are students, as they become entry-level professionals, and while they grow in their careers. Our members also appreciate the strong

partnerships we form—with government agencies and corporate members, and across higher education—to advance ASEE's vision of education that empowers students and engineering professionals to help create a better world.

ASEE's unique membership is central to why our communities of practice (CoPs) are so engaging and supportive. The Society spans the breadth and depth of the engineering education community. Members come from all engineering disciplines and affinity groups and include those working at all levels of education, industry, and government. ASEE represents the intersection of a Venn diagram of those who impact future engineers.

ASEE's divisions, sectors, zones, councils, and governance provide our CoPs with their network-connecting infrastructure. The Society's many conferences, courses and webinars, and externally funded programs provide CoPs with meaningful events and shared professional development experiences.

Together across ASEE and with our partners, we are building on our strong CoPs to create knowledge and provide thought leadership on the future of engineering and how to educate its workforce. We are working together to develop resources and influence public policy that will move our nation forward.

We anticipate another year of powerful impact. Our 2024 Public Policy Colloquium and Research Leadership Institute boasted strong attendance, programming, and engagement, and our 2024 Engineering Deans Institute and Annual Conference are meeting metrics for outstanding attendance. ASEE Learning Services continues to provide in-person and virtual courses, workshops, and webinars—serving more than 2,700 participants since its inception in 2020. In addition, the Society continues to provide externally funded initiatives for professional development, mentorship, and thought leadership.

For example:

- The Engineering for One Planet Mini-Grant Program (EOP-MG), funded by The Lemelson Foundation, assists faculty in integrating sustainability into their curriculum. The program has supported three cohort CoPs since its inception and is still going strong!
- The Capacity Building for Research at Minority-Serving Institutions program (CyBR-MSI), focused on building capacity of core engineering research and funded by the National Science Foundation's Computer and Information Science and Engineering (CISE) directorate, has attracted more than 400 MSI faculty attendees from over 160 institutions. Three CoP cohorts of attendees have gone on to submit successful research proposals, and ASEE will hold the first PI meeting this year to bring three years of awardees together into a new PI CoP to identify and share lessons learned.
- The Archival Publication Authors workshops for engineering educators (APA-ENG), funded by the Kern Family Foundation, provide professional development opportunities for two CoP cohorts of faculty to understand the scholarship of teaching and learning and to integrate the entrepreneurial mindset into manuscripts. The programming developed via this grant will now be integrated into two new ASEE Learning Services courses.

## ASEE REPRESENTS THE INTERSECTION OF A VENN DIAGRAM: THOSE WHO IMPACT FUTURE ENGINEERS.

- The Minority Mentoring Program (MMP) funded by Chevron connects women faculty of color with experienced ASEE mentors, a cohort with facilitated peer mentoring, and a facilitated CoP with regular meetings.
- ASEE's three postdoctoral fellowship programs continue to provide new engineering PhDs with opportunities for placement at 1) university campuses across the country (E-Fellows, funded by the National Science Foundation); 2) government labs (NRL Fellows, funded by the Office of Naval Research); 3) start-ups (IPERF Fellows, funded by the National Science Foundation).

- ASEE continues to provide leadership for national positive change through the ASEE Diversity Recognition Program (ADRP) and the NSF Engineering PLUS INCLUDES Alliance, as well as national thought leadership via the work of the Engineering Societies Education Roundtable (ESER) and the NSF Engineering Research Visioning Alliance (ERVA).

Your responses via our Listening Tour and our many engaging events, opportunities, and CoPs convey to us at ASEE HQ that the Society provides our members and the engineering community with strong value and a lifetime of support.

On behalf of ASEE HQ, I invite you to peruse *Prism's* spectacular articles, which continue to document the impact of our engineering education community. As a longtime ASEE member myself, I feel confident that, like me, you will enjoy reading our award-winning *Prism* magazine and reflect upon how *Prism*, like ASEE's many communities of practice and our shared ASEE mission, connects us as individuals into a supportive network so that collectively we move ourselves, our institutions, and our nation forward.

*Jacqueline El-Sayed is CEO and Executive Director of ASEE.*

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# WELCOME TO THE 2024 ANNUAL CONFERENCE AND EXPOSITION!

June 23–26 • Oregon Convention Center • Portland, OR

Join us at the nation's premier engineering education conference promoting research, education, collaboration, and networking.

ASEE's 2024 conference features more than 400 technical sessions and thousands of authors and speakers, with peer-reviewed papers spanning all disciplines of engineering education. Join the engineering education community at this milestone event!

And don't miss *Prism's* preview of what to see and do in host city Portland, pp. 18–21.

Schedule subject to change. Get the latest information and details about all sessions at [www.asee.org/osl](http://www.asee.org/osl).

## CONFERENCE HIGHLIGHTS

### SUNDAY, JUNE 23

#### Back by Popular Demand! ASEE Annual Conference Job Fair

10:00 am to noon

Oregon Ballroom Foyer/Plaza, Convention Center

#### ASEE Division Mixer

3:30 pm to 5:00 pm

Oregon Ballroom 201–204, Convention Center

#### Focus on Exhibits: Welcome Reception and Taste of the Town

5:00 pm to 7:00 pm

Exhibit Hall B, C, D, Convention Center

### MONDAY, JUNE 24

#### Monday Plenary and Keynote Speaker

8:00 am to 9:00 am

Portland Ballroom A, Convention Center

#### Keynote Speaker:

**Jayathi Y. Murthy, P.E.** President, *Oregon State University*

#### Exhibit Hall and Poster Board Viewing Open

9:00 am to 6:00 pm

Exhibit Hall B, C, D, Convention Center

#### ASEE Bistro

9:00 am to 6:00 pm

Exhibit Hall B, C, D, Convention Center

#### Two-Year College Model Design Competition

9:15 am to 10:45 am

Exhibit Hall B, C, D, Convention Center

#### Focus on Exhibits: Networking Break and ASEE Division Poster Session

9:15 am to 10:45 am

Exhibit Hall B, C, D, Convention Center

#### ASEE General Body Meeting and Finances Town Hall

11:00 am to 12:30 pm

Portland Ballroom B – SGS, Convention Center

#### Greet the Stars! ASEE New Members and First-Timers Orientation

1:30 pm to 3:00 pm

Portland Ballroom B – SGS, Convention Center

#### Interdivisional Town Hall Meeting

3:15 pm to 4:45 pm

Portland Ballroom B – SGS, Convention Center

#### Focus on Exhibits: Summertime Social

5:00 pm to 6:00 pm

Exhibit Hall B, C, D, Convention Center

## Campus Representative Member Recruitment Awards Reception

7:00 pm to 9:00 pm

Deshauts Ballroom A, Hyatt Portland (HQ Hotel)

Free ticketed event

## TUESDAY, JUNE 25

### Tuesday Plenary—Best Overall Papers and Corporate Member Council Keynote Speaker

8:00 am to 9:00 am

Portland Ballroom A, Convention Center

#### Speaker:

**Sri Yash Tadimalla**, *PhD student in computer science and sociology, UNC Charlotte; and Technology Focal Point for the United Nations MGCY Science–Policy Interface and the incumbent General Secretary of the World Student Platform for Engineering Education Development (SPEED)*

### Exhibit Hall and Poster Board Viewing Open

12:30 pm to 6:00 pm

Exhibit Hall B, C, D, Convention Center

### Focus on Exhibits: Networking Break

5:00 pm to 6:00 pm

Exhibit Hall B, C, D, Convention Center

## WEDNESDAY, JUNE 26

### Exhibit Hall and Poster Board Viewing Open

9:00 am to noon

Exhibit Hall B, C, D, Convention Center

### Focus on Exhibits: Networking Break & NSF Grantees Poster Session

9:45 am to 10:45 am

Exhibit Hall B, C, D, Convention Center

### ASEE Awards Lunch

11:00 am to 12:30 pm

Portland Ballroom B – SGS, Convention Center

### 2024 Program Chair & Co-Chair Appreciation Celebration

5:30 pm to 6:30 pm

Skyview Terrace, Convention Center

### ASEE President's Farewell Reception

6:30 pm to 8:00 pm

Portland Ballroom A, Convention Center

# 2024 ASEE ELECTION RESULTS

ASEE members chose a new President-Elect and three new Board members in this year's election. In addition, they approved changes to the ASEE Constitution.

Congratulations to the new slate of ASEE volunteer leaders.

## PRESIDENT-ELECT

### Christi Patton Luks

Missouri University of Science and Technology

Term: 2024–2027

## VICE PRESIDENT OF MEMBER AFFAIRS

### John Brocato

University of Georgia

Term: 2024–2026

## ZONE II CHAIR

### Todd Schweisinger

Clemson University

Term: 2024–2027

## ZONE IV CHAIR

### Jessica Perez

California State Polytechnic University, Pomona

Term: 2024–2027

There were 924 voters out of 8,406 members; 11% of the membership participated in the election.

Terms begin on June 26, 2024.

## LEARN MORE

Go to <https://bit.ly/47GTcxL> to read about the new officers and view the approved changes to the constitution.

*In this issue's Heritage Month Q+A, University of San Diego associate professor Diana Chen discussed the importance of sociotechnical context in engineering education. In 2021, a Last Word article by the University of Michigan's Erin Cech and Cindy Finelli highlighted engineers' responsibility to the public welfare. They recently published a paper about their research in the Journal of Engineering Education (<https://bit.ly/4atWKVK>). A key finding: public welfare responsibilities should be taught as part of the core engineering curriculum.*

# TRAINING WATCHDOG ENGINEERS

Engineers are obligated to protect the public. Their institutions should help.

It has never been more important for engineers to attend to the impact of technology on public safety, health, and welfare. Recent reports of algorithmic bias, drone-based surveillance, and emissions falsification (among other issues) underscore the potential harms of the socio-technical systems that engineers help to create and maintain, even while those systems offer crucial solutions. As technologies grow in complexity, laypeople are less and less able to understand, manipulate, and opt out of them. As a result, members of the public are increasingly reliant on engineers to serve as vigilant watchdogs who intervene when companies, governments, or social institutions design and use technologies in ways that endanger the public.

However, engineers may not take this responsibility seriously, know how to intervene when necessary, and be willing to act when circumstances warrant. Our National Science Foundation-funded research studies these watchdog commitments, asking whether engineering professionals and students recognize their public welfare responsibilities, are aware of strategies for intervening, and are willing to act when they see public welfare endangerments. We examine how the structure and culture of both the engineering profession and engineering education support or undermine these three steps.

Although past research suggests that engineers may distance themselves from public welfare responsibilities and that institutional spaces like engineering education tend to de-emphasize such obligations, little empirical investigation has focused on engineers' public welfare responsibilities. Our multimethod study considers factors that impact watchdog commitments across three levels: professional culture, institutional contexts, and professional identities. We are conducting both a representative survey of US engineers and a series of longitudinal interviews that follow a cohort of electrical and computer engineering [ECE] master's students into

the workforce. Using insights from these data, we will design and assess a novel graduate seminar course to train engineers in their public welfare responsibilities. The efforts not only attend to engineers' abstract perceptions of such responsibilities but also investigate their recognition of how these duties play out in their daily work, awareness of intervention strategies, and intended and actual interventions.

We are in the early stages of this research, but already the need for it has become clear. In our pilot survey of employed engineers in the US, for example, half of the respondents agreed that "raising concerns about diversity undermines one's credibility as an engineer," and 72 percent agreed that "technical skills are more valuable in STEM than social skills." Less than a quarter of employed engineers who completed our survey had received training on ethical and professional responsibilities to public welfare in their engineering education, and only 28 percent had received training on the policy implications of engineering design in either their workplace or their professional societies.

Early interviews with engineering master's students show similarly worrying trends in recognition of, and willingness to engage with, public welfare responsibilities. For example, when asked whether it is engineers' responsibility to consider social inequalities in their work, a 24-year-old ECE master's student replied that engineering is "neutral" and does not "necessarily have anything to do with the evolution of society."

He added, "It's how humans use technology that matters. [It] is not about the technology itself as inherently maybe racist or sexist."

Engineers have a responsibility to actively consider how the socio-technical systems in their purview may negatively or unequally impact the public. Our project is developing a theoretical framework to understand how engineers recognize, strategize, and act as public welfare watchdogs, and we are working to identify factors that shape these

outcomes. This research will help engineering educators and leaders revise training efforts and accountability infrastructures to equip engineers to be more effective public welfare watchdogs. In turn, research-informed engineering courses can enhance professional responsibility training among students. Beyond engineering education, employers and professional societies need to promote public welfare responsibilities and provide opportunities for engineers to come together for collective statements or actions in the interest of protecting the public good.

**LESS THAN A QUARTER OF EMPLOYED ENGINEERS HAD RECEIVED TRAINING ON ETHICAL AND PROFESSIONAL RESPONSIBILITIES TO PUBLIC WELFARE IN THEIR ENGINEERING EDUCATION.**

The role of engineers as public welfare watchdogs lies at the heart of their ethical responsibilities as professionals. Engineering education, the engineering workforce, and engineering professional societies must take seriously the training of engineers not only to recognize these responsibilities in the abstract but also to act on them when necessary.

*Erin Cech is an associate professor of sociology and (by courtesy) mechanical engineering at the University of Michigan. She is the author of *The Trouble with Passion: How Searching for Fulfillment at Work Fosters Inequality (2021)* and *Misconceiving Merit: Paradoxes of Excellence and Devotion in Academic Science and Engineering (forthcoming 2022, with Mary Blair-Loy)*.*

*Cindy Finelli is a professor of electrical engineering and computer science and (by courtesy) higher education at the University of Michigan, where she also is director of the engineering education research program. She is an ASEE Fellow.*

# CONGRATULATIONS TO THE 2023 ASEE HALL OF FAME INDUCTEES!

For more than a century, ASEE has been proud to support the engineering educators whose work has modernized society.

In celebration of the Society's 130th year, ASEE requested nominations for its 2023 Hall of Fame. This designation honors the engineering and engineering technology education standouts whose work has made a significant impact. The selected inductees were announced at the Society's 130th Gala on October 10, 2023.

The inductees' areas of influence are broad, with expertise in pedagogy, broadening participation, research, leadership and service, entrepreneurship, and more.

## Congratulations to these nominees!

### Howard G. Adams

Founder and CEO of H.G. Adams & Associates, Inc.; Executive Director, National Consortium for Graduate Degrees for Minorities in Engineering and Science, *University of Notre Dame*

### Bernard Amadei

Distinguished Professor and Professor of Civil Engineering, *University of Colorado, Boulder*

### Jenna P. Carpenter

Dean and Professor of Engineering, *Campbell University*

### Marjan J. Eggermont

Teaching Professor, *University of Calgary*

### Jacqueline El-Sayed

Chief Executive Officer and Executive Director, *American Society for Engineering Education*

### Stephanie Farrell

Experiential Engineering Education Professor and Founding Department Head, *Rowan University*

### Richard M. Felder

Hoechst Celanese Professor Emeritus of Chemical Engineering, *North Carolina State University*

### Leah H. Jamieson

Ransburg Distinguished Professor of Electrical and Computer Engineering, *Purdue University at West Lafayette*

### Julie P. Martin

Director, Engineering Education Transformations Institute, *University of Georgia College of Engineering*

### Adrienne R. Minerick

Professor of Chemical Engineering & Affiliated Professor of Biomedical Engineering, *Michigan Technological University*

### William C. Oakes

Assistant Dean for Experiential Learning, 150th Anniversary Professor, Professor of Engineering Education, Director of the EPICS Program, *Purdue University at West Lafayette*

### Matthew W. Ohland

Dale & Suzi Gallagher Professor, Associate Head of Engineering Education, *Purdue University at West Lafayette*

### Joseph J. Rencis

Interim Department Head of Mechanical Engineering, *The University of Texas Dallas*

### Stephen J. Ressler

Professor Emeritus, *United States Military Academy*

### Larry Richards

Professor Emeritus, Department of Mechanical and Aerospace Engineering, *University of Virginia*

### Donna M. Riley

Jim and Ellen King Dean of Engineering and Computing, *University of New Mexico*

### Karl A. Smith

Emeritus Professor of Civil, Environmental, and Geo-Engineering, Morse-Alumni Distinguished University Teaching Professor, and Faculty Member, Technological Leadership Institute, *University of Minnesota - Twin Cities*

### Ruth A. Streveler

Professor Emeritus, *Purdue University at West Lafayette*

### Douglas Tougaw

Dean, College of Engineering, and Professor of Electrical and Computer Engineering, *Valparaiso University*

### Phillip Wankat

Clifton L. Lovell Distinguished Professor Emeritus of Chemical Engineering and Professor Emeritus of Engineering Education, *Purdue University at West Lafayette*

### Bevlee A. Watford

Professor, Associate Dean for Equity and Advancement, and Executive Director, Center for the Enhancement of Engineering Diversity, *Virginia Polytechnic Institute and State University*

### Julia M. Williams

Professor of English, *Rose-Hulman Institute of Technology*

### Team - Katy Colbry and Dirk Colbry

*Michigan State University*

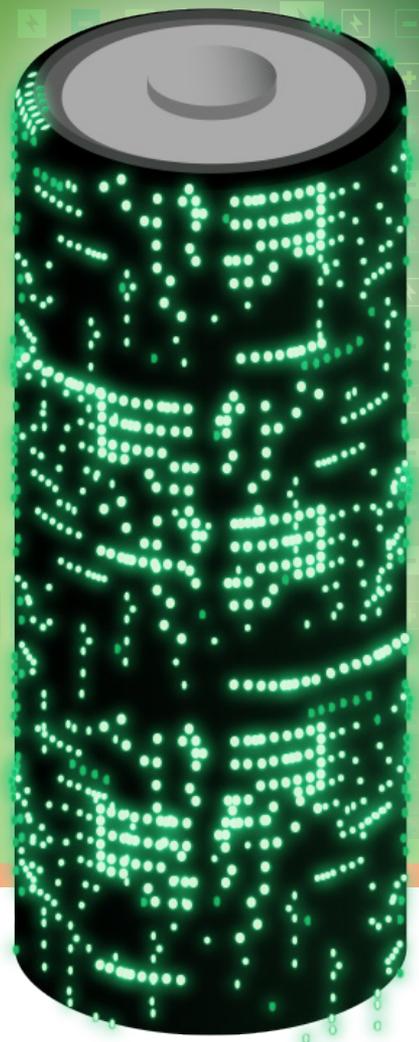
### Team - Jon Leydens and Juan Lucena

*Colorado School of Mines*

### Team - K-12 STEM Center at the University of Southern California's Viterbi School of Engineering

*University of Southern California*

# A Beacon for Battery Advancement



Interdisciplinary Jonsson School researchers land a \$30 million award from the U.S. Department of Defense to boost battery research and leverage over \$200 million in private capital. As part of the initiative, the Batteries and Energy to Advance Commercialization and National Security (BEACONS) center at UT Dallas partners with other universities and industry experts toward new battery technologies. The center answers a national call by the Federal Consortium for Advanced Batteries to secure a domestic supply of lithium-ion batteries and ensure U.S. battery technology leadership.

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