NEWS BRIEFS

COE MACHINE SHOP MAKEOVER

Thanks to donor support, the College of Engineering (COE) Machine Shop, a source of valuable support to labs, faculty, and students, is undergoing a major renovation that will transform it into a modern design center.

Long the first stop for COE faculty and students needing something built for a lab or an experiment, the shop is also where teams of undergraduate students in mechanical engineering work on their senior capstone projects, making it a critical component of their success both at UCSB and as they prepare to enter the job market.

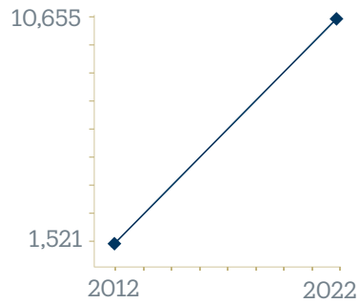
"The newer technology and the other elements of this important renovation will aid students greatly in their capstone projects, allow them to work better as teams in a safe and productive manner, and enhance the College of Engineering's competitiveness with other top institutions," said shop superintendent, **Marty Ramirez.**

The project, which will increase usable space by 35 percent, is being conducted in phases as funds become available, making it a particularly valuable place for donors to direct their philanthropic efforts. Initial gifts, including one from longtime major UCSB contributor **Virgil Elings,** are funding the first phase. The goal is to raise enough funds eventually to establish an endowment to maintain the facility far into the future.

Phase I, which got started last spring, includes the removal of old equipment and the installation of eleven new CNC (computer numerical control) machine tools, 3D printers, a laser cutter, electronics fabrication and testing, pneumatics and hydraulics fabrication and testing, and bench and storage space. Phase II will include enclosing the space with glass garage doors and installing keyless entry for students to access the bench workspace and provide security during extended hours, especially at night.

Such a modern design center, says **Tyler Susko,** the Mechanical Engineering Capstone Instructor, "will introduce students to CNC machining in their freshman year and augment their understanding of those tools in subsequent classes before engaging in the year-long capstone project. We always have safety on our mind, of course, and the new CNC tools are fully enclosed, removing the danger of exposed spinning cutters. I'm looking forward to seeing the growth of our students as they get comfortable with the new tools, which will enable them to create things that were unfeasible in previous years."

BIG NUMBERS FOR COMPUTER SCIENCE



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A Boom in CS Undergraduate Applications

It's no secret that computer science is a sizzling-hot major these days, a fact reflected in the following recent statistics from the College of Engineering's (COE's) own Computer Science (CS) Department. With 1,805 applicants for Fall 2022, the CS graduate program received the most applications of any graduate program in the entire university, and an impressive 19 percent of all graduate applications to UCSB.

- The 10,655 undergraduate applications received represent a seven-fold increase over the past decade, from 1,521 applications in 2012.
- The new undergraduate CS class includes 39 Regents Scholars out of a total of 54 in the COE. Regents' Scholarships are among the UC's highest honors, being awarded to students who have demonstrated academic excellence and leadership and show exceptional promise.

COE machine shop superintendent, Marty Ramirez (left), sets up a new CNC lathe, while semi-retired superintendent Andy Weinberg pauses beside a new CNC milling machine.

BIOENGINEERING WELCOMES FIRST PHD STUDENTS

Professor Beth Pruitt (back row, center) with the first PhD students in biological engineering (clockwise from top left): Zsofia Szegletes, Samuel Feinstein, Gianna Gathman, Lauren Washington, Shaylee Larson, and Elana Muzzy.

This fall marked a big moment for the UC Santa Barbara Biological Engineering program, when it matriculated its first six doctoral students. Five of the six are women. They are: **Gianna Gathman,** who earned her BS in Bioengineering at Santa Clara University, specializing in biodevice engineering; **Shaylee Larson,** who received her BS in Chemical Engineering from the University of Utah; **Elana Muzzy,** who did her undergraduate work in Bioengineering at UC Santa Cruz; **Zsofia Szegletes,** who earned her BS in Biological/Biological Systems Engineering at Cornell University; and

"WE'VE BEEN BUILDING THE CURRICULUM AND ALL THE PIECES FOR YEARS, AND THIS FALL, WE OFFICIALLY START UP!"

Lauren Washington, who studied Industrial and Systems Engineering at the University of San Diego. The group also includes UCSB alumnus **Samuel Feinstein,** who earned his undergraduate degree in Biochemistry and Statistical Analysis.

The students will be able to take advantage of a pair of training programs, both of which count as credits toward the PhD — the NIH T32 in Quantitative Mechanobiology program and the NSF Data Driven Biology Predoctoral Training program. Both provide focused coursework and professional development, while supporting students to "undertake research rotations in multiple labs so that they begin right away to build a network and a community," said **Beth Pruitt,** director of UCSB Biological Engineering. "The program is designed around the idea of having the flexibility to explore different labs to help them decide on their PhD paths and projects."

Enrolling PhD students is an important step in the process required for Bioengineering to become a full-fledged department, the seventh in the UCSB College of Engineering. "We are very excited about it," Pruitt said. "We've been building the curriculum and all the pieces for years, and this fall, we officially start up!"

TECHNOLOGY MANAGEMENT HAS A NEW CHAIR AND ITS FIRST PHD GRAD PLACEMENT

The Technology Management (TM) Department in the UC Santa Barbara College of Engineering has a new chair, **Professor Paul Leonardi.** He follows **Professor Kyle Lewis,** who spent five years in the position. Leonardi, who has been with TM since 2014, designed and led the Master of Technology Management program from its beginnings in 2015 through 2019 and has also served recently as PhD director.

"We are well positioned to build on the foundation laid by Kyle and become the preeminent department in the world focusing on the management of technological innovation in its many forms," said Leonardi. "I believe we are building something unique, powerful, and important."

Leonardi also announced that the department had placed its first doctoral graduate, **Virginia Leavell,** who completed her PhD in June and accepted a position as an assistant professor at the University of Cambridge's Judge Business School. Leavell found the TM program (it was not yet a department) while studying for her MA in Sociology at UCSB.

From London in July, she said, "I am so proud to represent Technology Management as its first PhD graduate! I came back to school in search of a place where I could study how technological change affects work. In the TM Department, I found a community of world-class scholars who trained me in research methods and gave me the theoretical foundation to begin to answer the questions about the changing nature of work that keep me up at night. Technology Management is an exciting, rigorous, intellectual, and collegial place to study, and I hope to carry the culture of the department forward with me in my career."

In her research, Leavell employs ethnographic methods and social-network analysis to investigate how ideas about the future influence work and organizing during the lead-up to the implementation of digital technologies, as well as how organizations use digital technologies to make predictions about the future.

"When we launched our PhD program in 2017, our goal was to train students to become leading scholars, researchers, and teachers of technology management at top universities around the world," said Leonardi. "Virginia embodies everything we hoped for in our students: she is whip smart, her dissertation breaks new theoretical ground while also being immensely practical, and she earned a tenure-track job at one of the top business schools in the world. Her placement demonstrates that, even though we are a young program, the strength of our faculty gives even the most storied universities confidence that our students will excel as professors. Virginia is the first in what will undoubtedly be a long string of such students."

At last summer's commencement (right), new Technology Management Department chair, Paul Leonardi congratulates Virginia Leavell, the program's first placed PhD graduate.

CELL CLEANER EXTRAORDINAIRE?

Researchers in UC Santa Barbara neuroscientist **Kenneth S. Kosik**'s lab have discovered a novel organelle that helps to clean up faulty proteins so that cells can function in times of stress. The findings, reported in the June 2 issue of *Nature Communications,* have implications for treating Alzheimer's disease, Parkinson's disease, and other neurodegenerative conditions that result from misfolded proteins.

"People have known for quite a while that there are a few objects floating around in cells that don't have membranes," Kosik said. "Until relatively recently, it has not been clear how they're held together, what they are, or what they're doing."

Using advanced imaging techniques, the researchers were able to observe biomolecular *condensates,* which don't have a recognizable cell membrane enclosure but are, instead, separated from the surrounding cytoplasm as the result of a difference in density, similar to how the different densities of oil and water keep them separated. That separation creates a specialized environment for certain functions and reactions, such as those provided by what is called a *stress granule,* a membraneless organelle that appears when the cell is under stress. Its job is to sweep up RNA in the cytoplasm, storing those genetic instructions and pausing their translation into proteins.

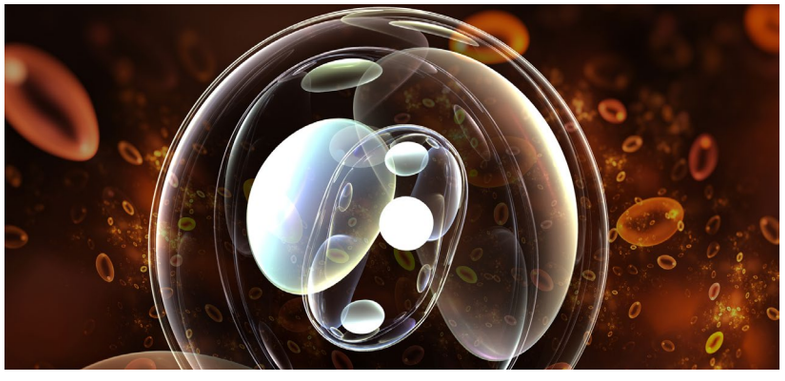
"A cell under stress wants to shut down from making proteins to conserve energy and get past the stress," Kosik explained.

But, what about the proteins that are already in a stressed cell? "If they're under stress, some of them could get damaged and misfold," Kosik says. Misfolds of the tau protein, for example, can become pathological and turn into the neurofibrillary tangles that characterize Alzheimer's disease.

This is where the researchers' newly discovered "BAG2" condensate comes in. Named for the BAG2 protein it contains, the organelle can sweep up these faulty proteins in the cytoplasm and stuff them into a proteasome — the cell's version of a trash can — located in the organelle.

"A few proteins form a little barrel, and as the protein is threaded through that little cylinder, it gets degraded," Kosik said. This inactivates and breaks down the protein. Many proteasomes are present in cells at any given time, he added, but what makes this particular one, labeled 20S, special is that it can accept proteins that are already somewhat misfolded and would not fit in the other cellular trash cans. Kosik suspects that the BAG2 protein may have a role in helping to organize the messy protein before it goes into the 20S proteasome.

"BAG2 is considered a co-chaperone in that it works with molecular chaperones to help proteins fold," he said. In a previous study, researchers in the Kosik Lab demonstrated BAG2's ability to target and clear tangled tau proteins in cell cultures. "The BAG2 condensates seem to actually travel to the damaged tau and gobble it up. It would be nice to figure out how we can shuttle tau into this condensate at the early stages of its damage for the cell to get rid of it before it gets worse."



A GIANT LEAP

A mechanical jumper developed in the lab of UC Santa Barbara engineering professor **Elliot Hawkes** has jumped higher — roughly 100 feet (30 meters) — than any jumper to date, engineered or biological.

"The motivation came from a scientific question," said Hawkes, who as a roboticist seeks to understand the many possible methods for a machine to navigate its environment. "We wanted to understand the limits on engineered jumpers."

In the biological world, the maximum achievable jump is limited by the amount of energy the system can give to pushing the body off the ground. In engineered jumpers, however, motors that ratchet or rotate can be used to multiply the amount of energy a jumper can store in its spring, an ability known as *work multiplication.*

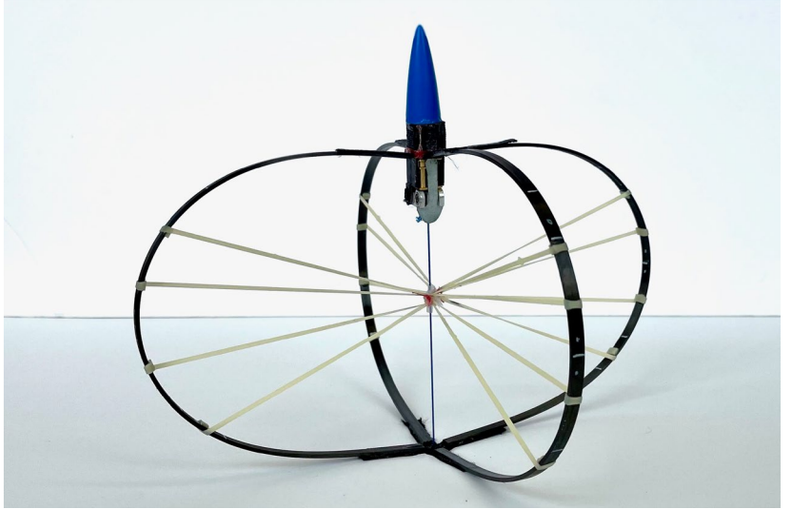
"This difference between energy production in biological versus engineered jumpers means that the two should have very different designs to maximize height," said **Charles Xaio,** a PhD candidate in the Hawkes lab.

Animals should have a small spring — only enough to store the relatively small amount of energy produced by their single muscle stroke — and a large muscle mass. "In contrast, engineered jumpers should have a spring that is as large as possible and a tiny motor," Xaio said.

The team designed a 30-centimeter-tall jumper in which the spring, relative to its motor, is nearly one hundred times greater than what is found in animals. In their spring, carbon-fiber compression bows (the four black curved elements shown below) are squashed while rubber bands (the white elements) are stretched by a line wrapped around a motor-driven spindle.

The mechanical jumper can accelerate from 0 to 60 mph in 9 milliseconds — an acceleration force of 315 g. (NASA astronauts experience up to about 6 g.) The 100-foot height it reached is, the study reads, "near the feasible limit of jump height with currently available materials."

The jumping ability of this design sets the stage for reimagining jumping as an efficient form of machine locomotion, with jumping robots able to go where, currently, only flying robots can. The team calculated that, in a low-gravity environment, such as the Moon's, the jumper should be able to reach 125 meters in height while achieving a kilometer of forward motion. That, Hawkes could not resist suggesting, à la first man on the moon, Neil Armstrong, "would be one giant leap for engineered jumpers."



Ready for launch (above): The jumper built in Elliot Hawkes's lab set a record for a jumping robot; (left): differences in density prevent water and oil from mixing; molecular condensates behave in a similar way, providing a favorable environment for stress granules.

UCSB HOSTS SYSTEM-WIDE BIOENGINEERING EVENT

More than three hundred people attended the 22nd annual University of California Systemwide Symposium on Bioengineering and Biotechnology Showcase, known as BIC, held August 8-10 at UC Santa Barbara. The three-day event, which had been on hold during two years of the COVID pandemic, featured diverse opportunities for graduate students to interact closely with industry representatives and like-minded graduate students from all ten UC campuses, and to learn about diverse paths to success in the industry.

Students from all ten UC campuses participated in a poster session at BIC.

"The industry component made this event much more than an academic conference," said **Ryan Stowers,** assistant professor of biological engineering and mechanical engineering and an organizer of the event. "This is a huge draw for the students who are more on the industrial track, giving them the opportunity to meet people and see what's new in the field. And beyond the science, the speakers offered remarks about how they transitioned from grad school and how they got to their positions now. The students saw that there's not just one route to a position and gathered insight into how some successful people navigated the professional terrain."

The event included many invited speakers presenting on a wide range of topics, a poster session, a panel of professionals who took questions about pathways to biotech careers, and a kind of "speed dating" analog in which students paired with industry experts for ten minutes of rapid-fire exchange before switching to a different expert.

One junior faculty member from each of the ten UC campuses competed for the prestigious Shu Chien Early Career Lecturer Award, which went to UC San Diego assistant professor Daniela Valdez-Jasso, with Jury Awards going to UCSB assistant professor **Siddarth Day** and UC Davis assistant professor Randy Carney.

MAJOR AWARDS FOR CHEM-E CHAIR

Over the course of a few days last spring, UC Santa Barbara chemical engineering professor and department chair, **Rachel Segalman,** won two of chemical engineering's most prestigious awards. The first was the 2021 Ernest Orlando Lawrence Award in Condensed Matter and Materials Science, the U.S. Department of Energy's highest scientific honor. The second was the American Institute of Chemical Engineers' (AIChE) Andreas Acrivos Award for Professional Progress in Chemical Engineering. Then, in September, a third honor followed when Segalman was elected a fellow of the AIChE. And finally, in October, she was elected a fellow of the Royal Society of Chemistry, the oldest chemical society in the world.

Segalman received news of the first award by way of a phone call from the Secretary of Energy herself, Jennifer Granholm. "All I could think about during the call was how this was the award that many of the all-around scientists and leaders that I looked up to as a young scientist had won," said Segalman. "The attribute common to all of the prior recipients is that they are great scientists who had a significant impact in identifying and solving basic, fundamental scientific problems of critical energy consequence. They are also generous, insightful mentors and educators. For me, receiving this honor comes with a huge sense of accomplishment and responsibility.

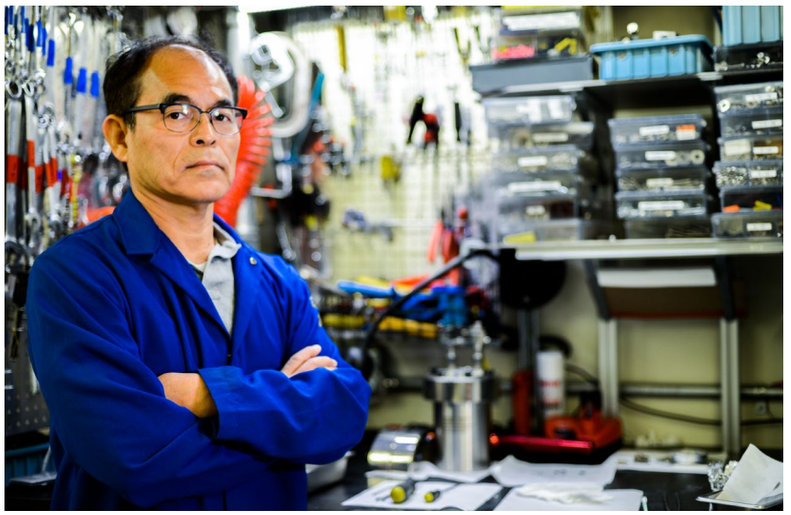
"Much like the Lawrence Award, the Acrivos Professional Progress Award is special because some of my personal heroes have won it," Segalman said of the second award, referencing Frances Arnold (2004) and former UCSB College of Engineering dean **Matthew Tirrell** (1998). "While the Lawrence Award is special because of its stature in the U.S. government, the Acrivos Professional Progress is a recognition from my peers!"

"Rachel Segalman has been at the forefront in materials and chemical engineering, making major contributions to our general knowledge of block polymers and hybrid thermoelectric materials," said **Tresa Pollock,** the UCSB College of Engineering's interim dean and Alcoa Distinguished Professor of Materials. "We are extremely proud that the Department of Energy has recognized the impact and significance of her research, and we are thrilled to extend to her our deepest congratulations."

Segalman's research is focused on controlling self-assembly, structure, and properties in functional polymers, work that paves the way for the development of sophisticated materials for such energy applications as photovoltaics, fuel cells, and thermoelectrics.

Rachel Segalman receives the Lawrence Award from (left) Dr. Asmeret Berhe, director of the DOE's Office of Science, and Frank Rose, principal deputy administrator of the National Nuclear Security Administration, at DOE headquarters in Washington, D.C.

THE RIGHT APPROACH, NOT THE POPULAR ONE



UCSB materials professor and Nobel laureate Shuji Nakamura tenaciously pursued his vision of a GaN LED, despite prevailing opinion suggesting he was wrong.

At the Japan Society of Applied Physics conference in 1992, approximately five hundred individuals attended the zinc selenide sessions [related to using the compound to create a blue LED), but only about five people attended the gallium nitride (GaN) sessions.

"Not only was zinc selenide more popular at the time [as a likely candidate for creating the then-elusive blue LED], but gallium nitride was actively discouraged, with researchers stating, 'Gallium nitride has no future,' and 'Gallium nitride people have to move to zinc selenide.'"

One year later, **Shuji Nakamura,** a dedicated "gallium nitride person," would use his GaN platform to invent the blue LED, which would revolutionaize lighting and earn him the 2014 Nobel Prize in physics.

From a September 8 article on forbes.com about the importance of challenging conventional wisdom to achieve great things.

NEW STRATEGIC DEVELOPMENT LEADER

The UC Santa Barbara College of Engineering (COE) has hired **Meredith Murr** as the new Director of Strategic Programs and Corporate Development, a position crucial to securing important industry partnerships that support faculty research at the leading edge of discovery.

"I'm really excited," said Murr, who started her new position in August. "I have spent a large portion of my life at UCSB. I started my PhD here in 2001, and I was on campus straight through 2018, either with graduate school or various jobs. It definitely feels like coming home."

Murr earned her PhD in UCSB's Department of Molecular, Cellular, and Developmental Biology in 2006. She spent the next twelve years working at the university, including nine years with the Office of Research, where she rose to become the assistant vice chancellor of research development and strategic planning. In that position, she worked with the vice chancellor and academic deans to match strategic research goals with funding opportunities. She left UCSB in 2018 to launch a consulting business, where she advised academic institutions and national laboratories on strategic planning and proposal development.

"We are thrilled to welcome Meredith to the college," said **Tresa Pollock,** interim dean of the College of Engineering and Alcoa Distinguished Professor of Materials. "She is familiar with the college and our faculty, and she knows the importance of engaging industry partners in pioneering research. I am confident that her abundance of relevant experience and her clear strategic vision for advancing interdisciplinary research and enhancing external support will allow her to make a significant impact."

Murr's responsibilities in the position include two major components: working to interest industry partners in funding research, and meeting directly with faculty to brainstorm about the next grand challenges in their fields and how to solve them in ways that play to UCSB's strengths. Once faculty-driven ideas are established, Murr's team will present them to members of industry and collaborate with the Office of Development and the Office of Research to pursue private or federal funding to establish research centers on campus. The overarching theme of her director position, Murr says, "is to do the groundwork to help raise funds that enable college faculty to expand the frontiers of their research."

"My scientific background and my work experience will allow me to speak with potential funders in a way that combines a compelling scientific story informed by a firm understanding of the scientific details," said Murr, who did quite a bit of strategic planning as a consultant. "I also know how to bring people together and build consensus by ensuring that people feel heard and excited about moving forward."

Murr will also oversee the Corporate Affiliates Program, which is designed to facilitate the interactions of corporate members with faculty, students, and other campus stakeholders. When it comes to industry partnerships, she says, "The college has a huge potential for growth."

"In the departments that are really growing — computer science, biological engineering, and technology management, for instance — there are tremendous opportunities to develop new partnerships," said Murr. "There's also a lot to build on with the already-excellent industry relations that are in place in the Chemical Engineering, Materials, Mechanical Engineering, and Electrical and Computer Engineering Departments."

Murr encourages industry representatives to contact her to learn more about the college's many areas of expertise, the diverse investigations being undertaken with them, and the state-of-the-art facilities that enable UCSB's world-class research enterprise.

"Our office serves as a gateway for industry partners," she says. "Once we understand what they are looking for, we can identify the key researchers and resources available within the college to explore prospective research collaborations and accelerate innovation."

Meredith Murr (left), new director of COE strategic programs and corporate development.