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Six UCSB junior faculty members selected for 2026 NSF CAREER awards

Some of the most essential functions of the human body are performed by tiny subcellular structures called peroxisomes. These membrane-bound organelles are instrumental in a range of metabolic functions, including breaking down fatty acids, creating specialized fat molecules for nerves and brain cells, and neutralizing reactive oxygen species, with results that have effects across many bodily systems.

For UC Santa Barbara biologist Brooke Gardner, peroxisomes — more specifically their membranes — are a source of fascination and of mystery. The organelles act like little labs, creating specialized environments within the cytoplasm, and can contain more than 50 types of enzymes in order to carry out a variety of specialized reactions.

“The membrane, which creates the barrier between the enzymes and toxic metabolites, and the rest of the cell, has to be selectively permeable so that the enzymes can enter, while the toxic byproducts don’t escape,”

she said. “This permeability is controlled by membrane proteins, which sit in the barrier. Making those membrane proteins is a challenge for the cell and the peroxisome has a unique mechanism for their biogenesis that we don’t fully

understand.”

However, with support from the National Science Foundation (NSF), Gardner, an associate professor in the Department of Molecular, Cellular and Developmental Biology can take us closer to understanding these sophisticated structures. As a 2026 NSF CAREER Award fellow, she will have the ability to not just support her lab’s work, but also to pursue the research where it takes her.

“I am so thrilled to receive the NSF CAREER, which both supports our research and our broader goals of increasing participation in our science,” she said, crediting her lab members, particularly graduate students Nikki Jacobsen and Soham Chowdhury and undergraduate researcher Sambhav Jain. The early career award will enable the researchers to test new ideas experimentally, and allow them to increase transfer student participation, giving incoming students an opportunity for hands-on research. The transfer student pipeline is incredibly strong at the UCs, Gardner said, but the transfer process can make it hard for students to tap into opportunities like summer research. “I am hoping this grant will help us make the path into a lab or summer research experience a little easier.”

Gardner is one of several junior faculty at UCSB to be selected this year for the NSF CAREER program, one of NSF’s most prestigious awards, given “in support of early-career faculty who have the potential to serve as academic role models in research and education.” She joins five others in receiving the awards: computer scientist Yuheng Bu, earth scientist Gen Li, bioengineer Marley Dewey, mechanical engineer Emilie Dressaire and environmental scientist Grace Wu.

Read about Yuheng Bu’s CAREER Award to ensure the trustworthiness of AI-generated text

Gen Li: How earthquakes continue to shape the Earth years after the ground stops shaking

For Gen Li, an assistant professor in the Department of Earth Science, the support from his CAREER Award will enable him to study the “long-tail” effects of earthquakes — the continuing repercussions of massive, sudden and often catastrophic earth movements.

“My research focuses on understanding how earthquake-induced slope failures, or landslides, can cause natural hazards, influence landscapes and impact the transport of Earth materials and chemicals,” he said. Recently, he and his collaborators showed how earthquake-induced landslides can indeed have far-reaching effects, showing that the sediment and coarser material (gravel, rocks and boulders) can fill up rivers, contributing to flooding and reshaping the rivers themselves, with consequences that can affect infrastructure, water quality and community safety downstream of the landslide.

Using the Himalayan mountains as a natural laboratory, Li and his research group will study some of the lesser-known but crucial and fundamental aspects of earthquake-induced landslides, such as their frequency and the organic carbon transport involved. With the data they gather, the team will develop landslide inventories and models to estimate long-term seismic landslide fluxes; measure field samples to quantify organic carbon mobilized by landslides; and use geochemical analyses to determine the reactivity and fate of mobilized carbon, in an effort to “advance understanding of interactions among tectonics, surface processes and the carbon cycle.” The insights gained from the work can also be applied to the reduction of disaster risks elsewhere in the world, while also improving hazard assessment and infrastructure resilience in places in the United States where similar processes occur, such as Alaska, California and the Pacific Northwest.

“The award would enable me to establish a research program that advances a fundamental understanding of how earthquakes shape the surface environment both today and in Earth’s history,” he said. “It would also provide the resources and opportunities to train students and integrate cutting-edge research in earth sciences into university education,” added Li, who said he is grateful to NSF for the award, and to his department, colleagues, and research group members for their support of his research program.

Read about Marley Dewey’s CAREER Award to restore coral reefs

Emilie Dressaire: Creating cell culture environments for better biotech and medicine

A deep knowledge of how cells work is fundamental to both our basic understanding of cell biology as well as its applied aspects, including biotechnology and pharmaceuticals. We have the time-honored approaches, such as in vitro cultures in petri dishes that allow important but somewhat limited insights, and in vivo testing in animal models, which are more difficult, expensive and complex systems to access. But what if there was an alternative, a system that can mimic the three-dimensional environment of living cells, but also is easier to access and has tunable properties?

That’s the focus of mechanical engineering assistant professor Emilie Dressaire’s work. Microgels — grain-sized clusters of soft slippery particles — provide just the right consistency for cells to grow, organize and divide, making them ideal for studying cells. “This is particularly useful to study cell aggregates, such as organoids or tumoroids,” she said.

However, microgels currently inhibit the transport of oxygen and nutrients to the cells, which limits long-term cell studies. Supported by her CAREER award, Dressaire and her lab will dive into the transport properties of these microgels, which

resemble tiny, squishy ball pits, with particles that stick to each other but also create spaces in between.

“My research looks into transport in those microgels, how fluid flows through the void spaces and how molecules and other particles move through and around the microgel particles,” she said. “The goal is to control and enhance transport in microgels so cells can experience molecular exchanges, analogous to those they experience in the body. This is really important to better understand how cells and cell aggregates respond to signals from their environments and drugs.”

The work, which involves computer modeling and millifluidic experiments, will interrogate fundamental questions of fluid flow and transport of solutes and particles across microgels; how pressure may influence flow and transport; and if granular microgels can be engineered to enhance transport and support cell growth and assembly.

“I am incredibly grateful for this CAREER award,” said Dressaire, adding that the support will enable a new course on biological flows and several outreach initiatives

in the Santa Barbara area. It will also support the work of graduate and undergraduate researchers, a couple of whom are already working on fabricating microgels in order to grow and study breast cancer cells. “The knowledge that we gain is essential to engineer advanced culture media that support rapid drug screening for patient-specific treatment,” she said. “This award is a first step toward engineering cell culture environments that offer a practical alternative to in-vivo culture.”

Grace Wu: Renewable energy systems to boost the resilience of agriculture

Agrivoltaic systems — systems that use the same land for both renewable energy generation and farming — are emerging as potential solutions to the competition for the limited land area needed for both food and solar energy production. There are benefits to co-locating crops and photovoltaic panels, according to Grace Wu, an assistant professor at UC Santa Barbara’s Environmental Studies Program.

“In some cases, the partial shade from solar panels can help crops and forage adapt to hotter and drier climate conditions,” she said. By reducing evapotranspiration, the shade from panels can also increase water use efficiency, and they could be a worthy investment for farmers looking to diversify their income.

However, agrivoltaics are not a one-size-fits-all solution. There are potential tradeoffs, with the shade and changes to the microclimate possibly affecting yield and conditions for crop and forage growth, among other factors.

“Understanding where, how, and for which crops and livestock management systems these agrivoltaic projects are viable remains a major scientific gap,” Wu said.

Now, with the support from her CAREER award, Wu is poised to close that gap. “The CAREER award will allow my lab to pursue some of the big questions that motivated me to work on agrivoltaics in the first place: how we can design and site renewable energy systems that work with and increase the resilience of, rather than simply compete with, agriculture, and to bring students into that research along the way,” she said.

To address these big questions, Wu and her team will be creating a framework to systematically assess agrivoltaic feasibility across diverse climates, agricultural systems and solar array designs in the United States. The work, she said, will merge solar design engineering and economics, agronomy and spatial science methods to identify the best solution depending on the crop, management system, climate and array design. The result? A clearer picture that will help reduce uncertainty for farmers, solar developers and policymakers as they seek to adapt food and forage production while also meeting the growing demand for clean, renewable energy, all with an eye toward potentially large-scale agrivoltaic operations in the U.S.

“I’m excited to see this work make its way into research and practitioner communities to help shape our understanding of the possibilities for agrivoltaics in the U.S.,” she said. “I’m honored to have this opportunity to advance the knowledge and tools for scaling up agrivoltaics in the U.S. and to train students in this emerging area of research.”

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