

UC San Diego

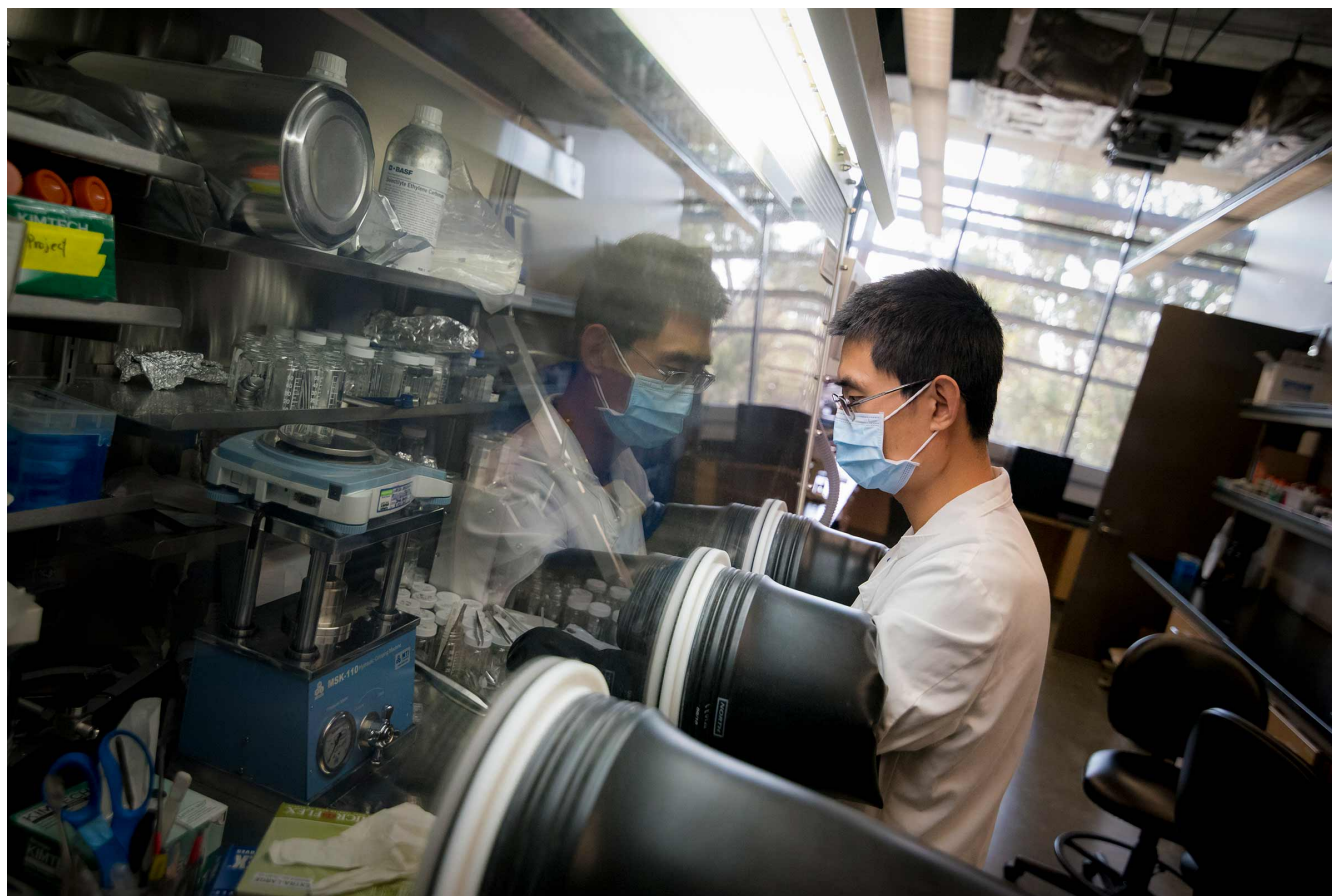
UC San Diego News Center

By Daniel Kane and Cynthia Dillon

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\$18M Boost to Materials Science Research at UC San Diego

Students and faculty will shape the nano- and bio-materials that will make life better, healthier and safer



The UC San Diego MRSEC center provides sustained research and educational opportunities for both graduate and undergraduate students, with a particular focus on transfer students. Photos by Erik Jepsen/University Communications

The National Science Foundation has awarded University of California San Diego researchers a six-year \$18 million grant to fund a new Materials Research Science and Engineering Center (MRSEC).

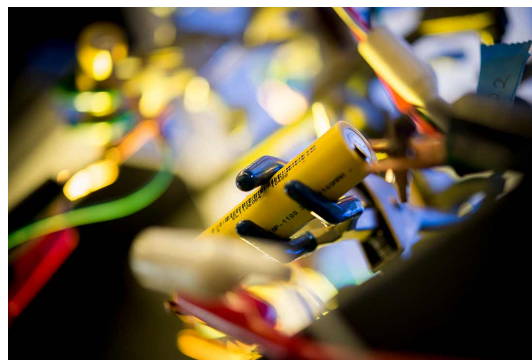
These research centers are transformative for the schools that earn them, putting their materials science research efforts into the global spotlight. In addition to research and facilities funding, MRSEC centers provide sustained research opportunities for both graduate and undergraduate students, and resources to focus on diversifying the pool of students studying materials science.

The UC San Diego labs funded by this new MRSEC will focus on two important, emerging approaches to build new materials aimed at improving human lives.

The first research theme is all about developing new ways to control the properties of materials during their synthesis by controlling how they transition, from the smallest atomic building blocks to materials that are large enough to see with the human eye.

The second research theme is focused on creating hybrid materials that incorporate living substances—microbes and plant cells—in order to create materials with new properties.

The new materials developed at UC San Diego will be used to improve the speed and accuracy of medical diagnostic tests, enable more effective therapeutics for disease treatment, quickly and efficiently decontaminate chemical or biological hazards, improve batteries, and reduce the cost of key industrial processes.



Improved materials for batteries and other technologies that help societies increase renewable energy use will emerge from UC San Diego MRSEC center projects.

"This MRSEC grant is a wonderful affirmation of what we've known all along—that UC San Diego is a world-class research and education powerhouse in materials science. This grant is going to enable researchers and students from different disciplines to work together and chart the course for important new avenues for innovation in materials science," said UC San Diego Chancellor Pradeep K. Khosla.

At the heart of the new MRSEC are student programs designed to diversify materials science and a strong partnership with the educational arm of San Diego's Fleet Science Center.

The team weaves 19 UC San Diego faculty members and their labs from the Division of Physical Sciences, the Jacobs School of Engineering and the Division of Biological Sciences into a large community of computational and materials science researchers.

A true UC San Diego collaboration

“Our MRSEC capitalizes on three specific strengths at UC San Diego—our leadership in materials science, our leadership in the life sciences and our position as a national resource in high performance computing,” said Michael Sailor, professor of chemistry and biochemistry at UC San Diego and the leader of the center. “We are weaving the life sciences and high performance computing into materials science. That really makes our center unique.”

The MRSEC is the first big win for the UC San Diego Institute for Materials Discovery and Design (IMDD), which focuses on bridging the gap between physical scientists and engineers on the campus to enable cross-disciplinary research.



The UC San Diego professors who make up the leadership team of the UC San Diego MRSEC center are, left to right: Tod Pascal, Andrea Tao, Jon Pokorski, Nicole Steinmetz, Michael Sailor, Shirley Meng and Stacey Brydges.

"Many of tomorrow's life-changing discoveries will happen at the intersection of engineering, physical sciences and biological sciences. This is why we pursue such interdisciplinarity here at UC San Diego, and this MRSEC is a tangible result of that effort. It is a tribute to the vision of Mike Sailor, Shirley Meng, Andrea Tao and Jon Pokorski to make the connections necessary to build this world-class team across such varied disciplines," said Albert P. Pisano, dean of the UC San Diego Jacobs School of Engineering.

This world-class research will directly serve UC San Diego graduate and undergraduate students, including transfer students. According to Sailor, one of the unique challenges for transfer students is that they often do not have the time or the training to participate in the rich research enterprise at UC San Diego.

“Our MRSEC summer schools have a specific focus on bringing transfer students into the materials science research community—the intensive workshops are intended to bring them up to speed so that they can seamlessly enter a research lab. Exposure of undergraduates to cutting-edge research is one of the most important activities of the MRSEC, because fluency in research concepts, tools, and techniques is a key element of a well-trained STEM workforce,” said Steven Boggs, dean of the Division of Physical Sciences at UC San Diego.

Research thrust: predictive assembly

The "predictive assembly" research team is working to bring the computational and predictive tools that the pharmaceutical industry has used successfully to design "small molecule" drugs with particular properties and behaviors into the realm of materials science. The team is led by UC San Diego nanoengineering professors Andrea Tao and Tod Pascal.

Learn more about the [predictive assembly project](#).

Research thrust: living materials

The second UC San Diego team is using the tools of the biotechnology revolution—in particular, genetic engineering and synthetic biology—to build new classes of materials with new kinds of abilities. Materials that can repair themselves are just one example. The team's big idea is to incorporate living organisms, either from plants or microbes, into their new materials. UC San Diego nanoengineering professor Jonathan Pokorski co-leads this research team, along with co-leader Nicole Steinmetz, also a UC San Diego nanoengineering professor.



The living materials research team is using the tools of biotechnology to build new classes of materials that help make people healthier and safer.

Learn more about the [living materials project](#).

Diversifying the materials science education pipeline

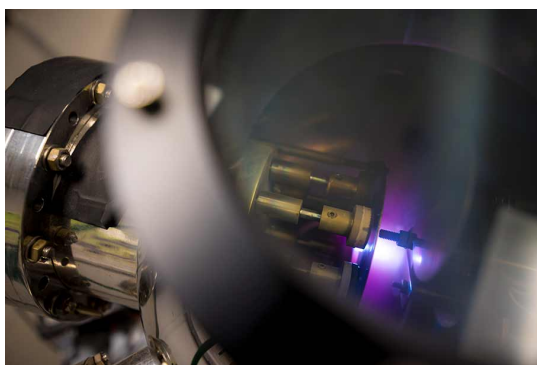
As part of its core educational mission, the UC San Diego MRSEC team is developing a suite of education programs aimed at growing and diversifying the pipeline for materials scientists in the United States. Summer school workshops, for example, are designed to provide trainees with immersive experience in laboratory procedures, advanced instrumentation and computational methods, explained Stacey Brydges, a professor in the Department of Chemistry & Biochemistry at UC San Diego who oversees the educational elements of the MRSEC.

"We view the summer schools as a transformative mechanism to enhance the training of participants from a broad range of educational levels—from high school to post-graduate," said Brydges. "We will offer high school and undergraduate students, with particular opportunities for our transfer students, their first introduction to research. The programs will also give incoming graduate students a quick start on their thesis projects."

Programs will also provide established industrial and international scientists with an update on the “hot topics” by engaging UC San Diego MRSEC researchers.

MRSEC facilities

One of the most important drivers of success in materials research today is the availability of cutting-edge instrumentation. The UC San Diego MRSEC will bring two new, exciting elements to the campus' research-facilities ecosystem: the Engineered Living Materials Foundry and the MesoMaterials Design Facility.



The predictive assembly research team is weaving computational and predictive tools into the realm of materials science in order to create materials with new, useful properties.

“High-end computation and synthetic biology are both under-represented in the materials science field, and these are areas where we see our MRSEC facilities poised to make a big impact,” said UC San Diego nanoengineering professor Shirley Meng.

She leads the facilities thrust of the MRSEC and is also director of the IMDD. “A major task for our MRSEC is not just to build out the facilities ecosystem but also to train scientists and engineers on how to deploy these tools to enable their research.”

Public outreach

To reach out to the public in new ways, the UC San Diego MRSEC team partnered with San Diego's Fleet Science Center.

“The goals of many of our community programs and initiatives dovetail nicely with the MRSEC goals,” said Kris Mooney, director of education at the Fleet Science Center.

The MRSEC leverages the Fleet Science Center's community engagement model, which relies on local community-articulated needs to guide the design and delivery of educational programming.

"When we were setting up the MRSEC, we paid close attention to the diversity of our program at all levels," said Sailor. "We are particularly focused on diversifying the pipeline for materials science. This is a field that touches the lives of everyone. It's critical that the people developing the future of materials science reflect society at large."

