

UCSD Establishes Graduate Training Program Integrating Biomedical and Physical Sciences with Engineering

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Nine graduate programs and thirteen departments at the University of California, San Diego (UCSD) are collaborating in a new graduate educational program at the increasingly crucial interface of biology, medicine, and physical and engineering sciences. The new curriculum for the Interfaces Training Program will include six new hands-on graduate laboratory courses taught by interdisciplinary teams of faculty members who will introduce students to state-of-the-art techniques studying living systems across physical scales from molecules to the whole organism.

"These challenging problems require a detailed and integrative understanding of biology and life science but they can also benefit enormously from new analytical methods and manipulation tools from chemistry and physics, mathematics, and engineering," said Andrew McCulloch, interim chair of the Jacobs School of Engineering's Department of Bioengineering and director of the Interfaces Training Program at UCSD.

The training program brings together participation from the Schools of Medicine and Engineering and the Divisions of Biological Sciences and Physical Sciences. UCSD students in the program will be matched with dual mentors from two disciplines. Their first year of study will include preparatory lecture courses, and the second year will focus on the six hands-on technology-centered laboratory courses. These labs will introduce students to multi-scale techniques for measuring, imaging, manipulating and analyzing living systems. Trainees will later serve as teaching assistants to help develop and teach the labs and sustain them.

UCSD is one of ten universities that will use \$1 million each provided over three years by the Howard Hughes Medical Institute (HHMI) to initiate the new program. UCSD also has made a significant commitment to underwrite the major costs of leadership and administration for the program. For example, no faculty salaries have been requested because the participating departments value the benefits that the new courses and teaching collaborations will bring to their students and other graduate programs.

The other nine universities funded by HHMI are Brandeis; Carnegie Mellon; Johns Hopkins; New Jersey Institute of Technology/Rutgers-Newark/University of Medicine and Dentistry of New Jersey-New Jersey Medical School; UC Irvine; UC San Francisco; University of Chicago; University of New Mexico; and the University of Pennsylvania. HHMI is partnering with the National Institute of Biomedical Imaging and Bioengineering (NIBIB) to ensure sustaining support for the 10 new programs through peer-reviewed institutional training grants.

At UCSD, McCulloch studies how the molecular and cellular structure of the heart wall gives rise to the integrated electromechanical properties of the whole heart in health and disease. He uses a variety of microscopy, medical imaging, tissue engineering and computational approaches in his research, technologies that students in the Interfaces Training Program will have first-hand experience of using world-class research facilities in the UCSD general campus and School of Medicine.

The three co-program directors at UCSD are:

Mark Ellisman, a professor of neurosciences and bioengineering and director of the Biomedical Informatics Research Network and the National Center for Microscopy and Imaging Research (NCMIR). The center, which

Ellisman established, is at the forefront of designing applications used to study the nervous system and others that integrate tomography and high-performance computing in studies of cell ultrastructure.

Terrence Sejnowski, an HHMI investigator and biology professor at UCSD and the Salk Institute for Biological Studies. He is director of both the Institute for Neural Computation at UCSD and the Computational Neurobiology Training Program, an interdisciplinary Ph.D. training program.

Susan Taylor, an HHMI investigator and professor in UCSD's Department of Chemistry and Biochemistry and the Department of Pharmacology. Taylor studies the structure, function, and dynamics of protein kinases, which are enzymes that dramatically modify the properties of many other cellular proteins by chemically adding phosphate groups to them.

Other leaders of the program at UCSD include:

Vineet Bafna, assistant professor of computer science.

Timothy Baker, professor of chemistry and biochemistry and molecular biology.

Richard Buxton, professor of radiology and director of the Center for Functional MRI.

Anders Dale, professor of neurosciences and radiology.

Jeff Esko, professor of cellular and molecular medicine.

Sylvia Evans, professor of pharmacology.

Lawrence Frank, associate professor of radiology.

Wayne Giles, professor of bioengineering and medicine.

Dorit Hanein, associate professor in the Cell Adhesion and Extracellular Matrix Biology Program at the Burnham Institute and an assistant adjunct professor of pathology at UCSD.

Michael Holst, professor of mathematics.

David Kleinfeld, professor of physics.

Elizabeth Komives, professor of chemistry and biochemistry.

Thomas Liu, associate professor of radiology.

Maryann Martone, adjunct associate professor of neuroscience and co-director of NCMIR.

James Andrew McCammon, professor and the Joseph E. Mayer chair of chemistry and biochemistry.

Sanjay Nigam, professor of medicine in the Department of Pediatrics.

Pavel Pevzner, professor of computer science.

Robert Sah, professor of bioengineering.

Gina Sosinsky, adjunct professor of neuroscience and assistant director of NCMIR.

Jing Wang, professor of neurobiology.

Eric Wong, associate professor of radiology and psychiatry.

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Cardiac Mechanics Research Group

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