Biological Engineering and Small-scale Technologies

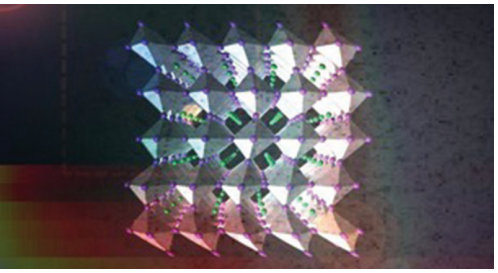
GRADUATE STUDIES AT UNIVERSITY OF CALIFORNIA, MERCED (M.S., Ph.D.)

The Biological Engineering and Small-scale Technologies [BEST] graduate group offers a multidisciplinary research and training program for master-level and doctoral students who want to be at the forefront of the modern revolutions in materials science, biological materials, nanotechnology and bioengineering.

BEST training incorporates elements from engineering, physics, chemistry, and biology, and students can choose from two tracks, both of which include the implementation of innovative materials for applications in human health, green energy, artificial intelligence, and sensing:

- **BIOENGINEERING EMPHASIS:** discover and formulate design principles behind the structures and modes of operation of living matter at various length scales, ranging from biomolecules and cells to full organisms
- **MATERIALS SCIENCE AND ENGINEERING EMPHASIS:** use new innovations in materials and nanotechnology to create transformative materials with exciting new properties

- tissue engineering
- new biomaterials
- advanced imaging
- microfluidics
- materials synthesis and manipulation
- electrochemical, electronic and optical
- characterization
- structural analysis and imaging
- nano-manufacturing
- computational modeling and simulation



CORE FACULTY MEMBERS

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VALERIE LEPPERT, Professor, Materials Science and Engineering

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YUE (JESSICA) WANG, Assistant Professor, Materials Science and Engineering

CONTACT

For more information regarding the BEST graduate emphasis, faculty members and the admissions process, please visit our website at **best.ucmerced.edu**. General information on applying to graduate school at UC Merced can be found online at **graduatedivision.ucmerced.edu**.

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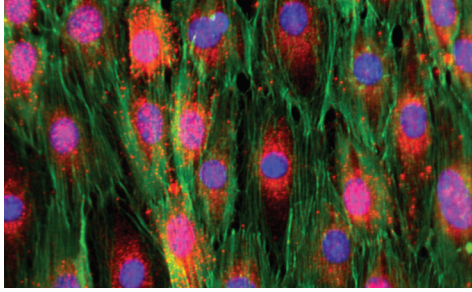
Research Areas

BIOLOGICAL ENGINEERING AND SMALL-SCALE TECHNOLOGIES



BIOMOLECULAR SCIENCE AND ENGINEERING focuses on the structural, quantitative and functional characterization of biomolecules, including proteins, nucleic acids, and lipids, as well as the design of custom biomolecules, assemblies and devices with applications in biomedical research, drug design, sustainable energy production, bioremediation, and environment. Current research interests include protein folding, engineering and design, controlled macromolecular self-assembly, molecular motors and actuators, electrophysiology, recombinant and hybrid biosensors, lipid membranes, semi-synthetic cells, and biologically-inspired engineered materials (biomimicry).

INVOLVED FACULTY INCLUDE: *Chin, Escobar, Filipp, Gopinath, Gopinathan, Hirst, Muñoz, Nobile, Subramainam, Viney, Xu and Ye*

TISSUE ENGINEERING is the combined application of engineering principles and methods from the life sciences towards the design, development, and maintenance of artificial biological products capable of repairing, improving, or restoring tissue and/or organ function. Current interests span stem cell plasticity and differentiation, development of vascular and cardiovascular tissue products, biomaterial scaffold development, biodegradable materials and their properties for bioengineering applications.

INVOLVED FACULTY INCLUDE: *Chin, McCloskey, Sun and Xu*

BIOLOGICAL IMAGING AND SPECTROSCOPY utilizes advanced technologies to obtain, analyze and display images and structural information of biological systems at the molecular, cellular, tissue, and organ levels. The BEST biological imaging and spectroscopy area emphasizes instrument and algorithm development for cancer and cardiovascular imaging and diagnosis, electrophysiology and biophysical applications, in addition to the synthesis of biomedical biomarkers and development of light-based biosensors.

INVOLVED FACULTY INCLUDE: *Escobar, Gopinath, Hirst, Li, Muñoz, Sharping, Spencer and Wolf*

BIOLOGICAL MODELING AND CONTROL involves the development and application of mathematical models, computational methods and simulations to describe complex biological phenomena with the goals of understanding the dynamics of biological systems and harnessing the capability of designing and controlling them. Current interests within BEST include protein structure and folding simulation, cardiac muscle modeling, transport processes in biological systems, molecular motors, liquid crystals and colloids and synthetic biology.

INVOLVED FACULTY INCLUDE: *Chin, Escobar, Filipp, Gopinath, Gopinathan, Hirst, Liu, McCloskey, Muñoz, Nobile, Wolf and Xu*

FUNCTIONAL NANOMATERIALS is an area that recognizes the possibility of obtaining materials with unprecedented properties via quantum confinement and rational amalgamation of nanoscale building blocks. Current interests combine molecular design, nanoscale self-assembling strategies and innovative green nano-manufacturing routes towards developing new functional nanocomposites for a wide range of applications such as optics, electronics and medicine. Additional interests aim at creating material platforms with hierarchical functionalities for energy harvesting (photovoltaics, batteries and fuel cells), sensing (environmental monitoring and accurate early disease diagnosis) and nature-inspired materials for drug delivery.

INVOLVED FACULTY INCLUDE: *Davila, Ghosh, Hwan, Leppert, Lu, McCloskey, Tung, Subramaniam, Wang and Ye*

RESPONSIVE POLYMERS provide a means for developing new low-energy-driven sub-molecular switches as nanodevice building blocks. Current efforts involve the synthesis of oligomers and polymers that offer giant thermal contraction to be used in devices with tailored (including zero) thermal expansion, molecular actuators, machine intelligence, thermal energy conversion, and the ability to control stem cell differentiation.

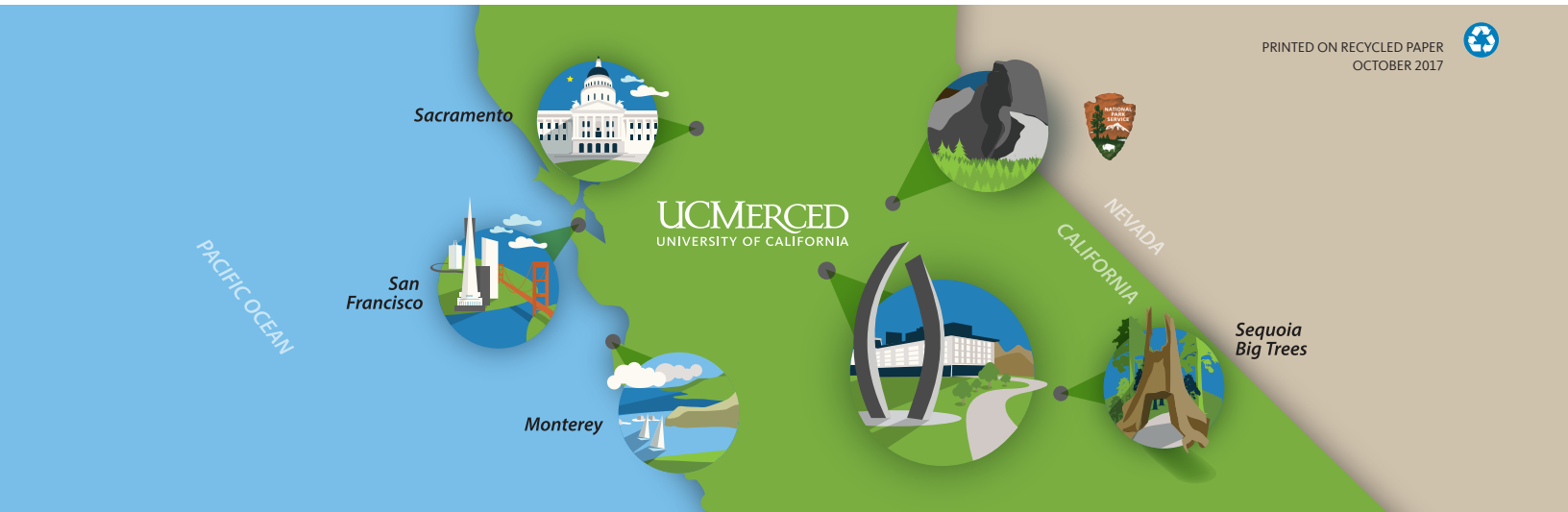
INVOLVED FACULTY INCLUDE: *Lu, Wang and Viney*

MATERIALS SIMULATION, VISUALIZATION AND BIO-INSPIRED DESIGN accelerates innovative research by the integration of experimentation, theory and simulation. This requires researchers to work in new ways that rely on advances in technology and communication. Presently, the focus is on investigating the properties and transformations of nature-inspired materials and related structures for applications including sensors and drug delivery, and the design of man-made materials. Cutting-edge high-performance computing, 3D visualization and prototyping make the toolset.

INVOLVED FACULTY INCLUDE: *Davila, Gopinath, Kurtz and Viney*

NANOMATERIALS IN THE ENVIRONMENT research examines the impact of natural and engineered nanoscale materials on the environment and human health, as well as how nanomaterials may be exploited to benefit both. Topics include the nature and role of airborne geologic and anthropogenic nanoparticulate matter in lung inflammatory disease, effect of waterborne engineered nanoparticles on aquatic organisms, respiratory toxicity of mesoporous silica nanoparticles for drug delivery, and the use of nanoparticles for promoting stem cell differentiation.

INVOLVED FACULTY INCLUDE: *Davila, Kurtz, Leppert and Chin*



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