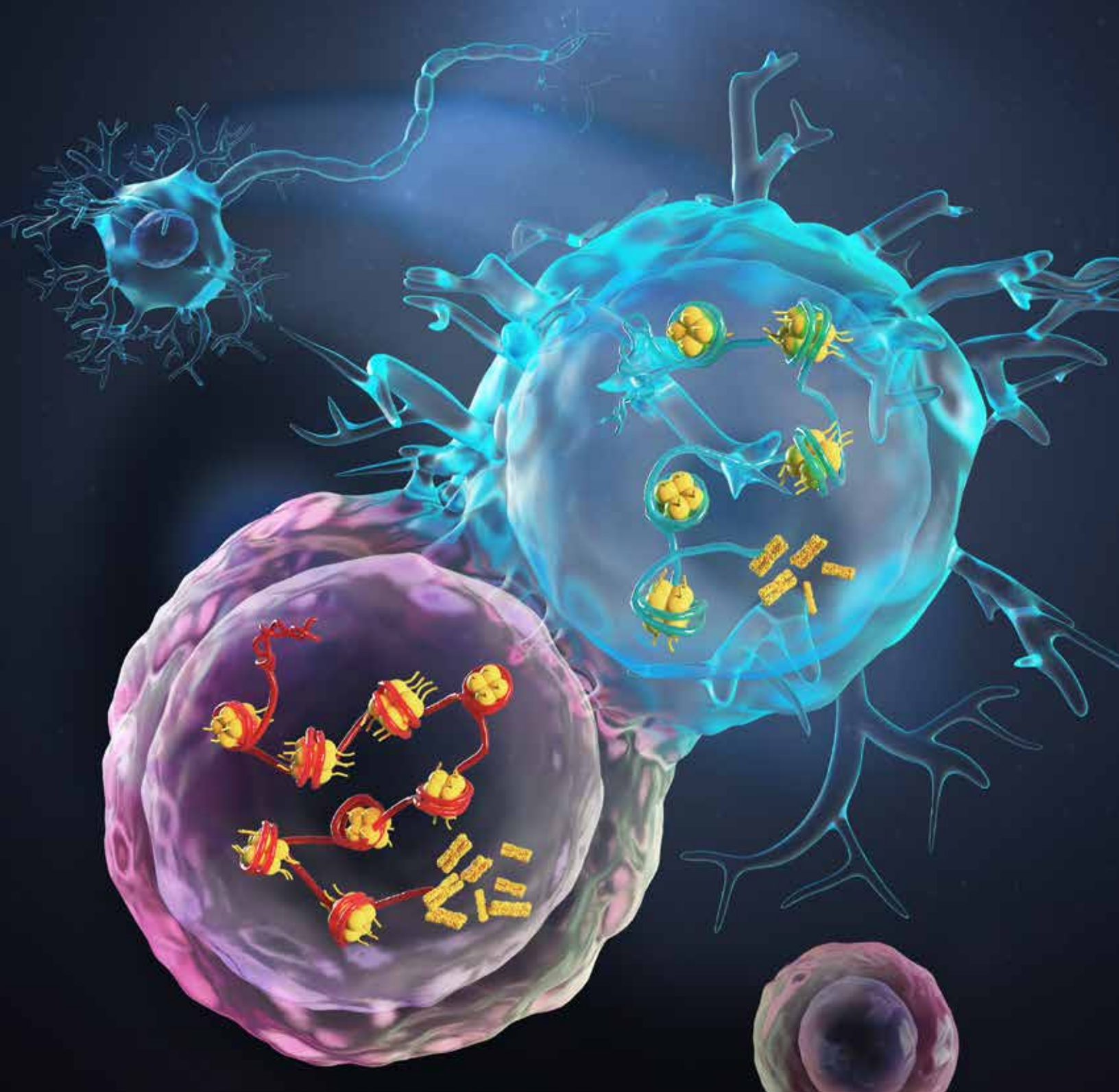# BIOENGINEERING

Performing cutting-edge research that benefits society and training future leaders in the wide range of possible bioengineering careers.

Message from the chair

The pandemic has affected every aspect of our lives. Although we faced many challenges during this pandemic, we continued to advance research frontiers and improve the quality and diversity of our educational programs. With the outstanding multidisciplinary and collaborative environment at UCLA, our bioengineering researchers have developed innovative technologies to fight COVID-19, and performed cutting-edge research in cell engineering, biomaterials, biomedical devices, imaging, and computational biology. Our students and alumni have been recognized with many achievements and awards, and our Industrial Advisory Board has offered excellent advice to our program and students. We will continue to expand our department in the next few years, recruit new talent, and strive for diversity, equity, and inclusion in our working environment. Go Bruins!

Song Li, Ph.D.
Chancellor's Professor and Chair

41

Core and joint faculty

6

PECASE and NIH Director's
New Innovator Award
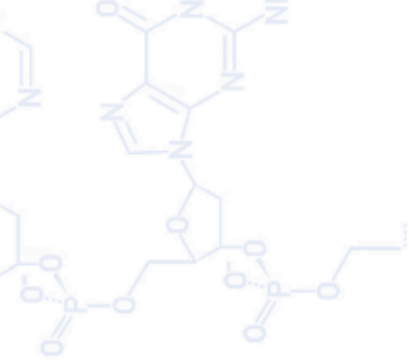
3

National Academy members

197

Graduate students

23

AIMBE members

309

Undergraduate students

THE MISSION OF THE BIOENGINEERING DEPARTMENT at the University of California, Los Angeles is to perform cutting-edge research that benefits society and to train future leaders in the wide range of possible bioengineering careers by producing graduates who are well-grounded in the fundamental sciences, adept at addressing open-ended problems, and highly proficient in rigorous analytical engineering tools necessary for lifelong success.

Over the past few years, our Bioengineering Department has established a vibrant under- graduate degree program and has recruited excellent faculty with diverse backgrounds who are directing innovative research programs. Our bioengineering faculty bring an extensive range of expertise to the department, with specialties including bioengineering, chemistry, materials science, chemical engineering, physics, electrical engineering, and medicine. This broad range of experience has proved to be extremely valuable in preparing and teaching our undergraduate curriculum. Our faculty and students have been recognized by many awards at national and international levels.
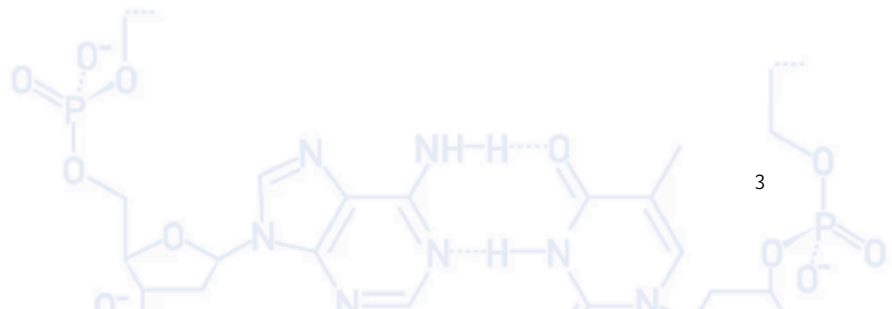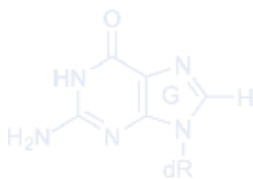
BIOENGINEERING RESEARCH AREAS:

Molecular, Cellular, and Tissue Engineering

Biomedical Devices and Instrumentation

Biomedical Imaging

Biomedical Data Sciences

NeuroEngineering

Jun Chen

Assistant Professor

Research in the Chen Lab is focused on nanotechnology and bioelectronics for energy, sensing, and therapeutic applications in the form of smart textiles, wearables, and body area networks. With a current h-index of 80, Chen Group published 2 books, 200 journal articles and 110 of them are as corresponding contributions in Chemical Reviews, Chemical Society Reviews, Nature Materials, Nature Electronics, Nature Communications, Science Advances, Joule, Matter, Advanced Materials, and many others. The group also filed 14 US patents and licensed 1. The group effort is recently recognized by Vebleo Fellow, 30 Life Sciences Leaders to Watch by Informa, UCLA Society of Hellman Fellows Award, Advanced Materials Rising Star; ACS Nano Rising Stars Lectureship Award; Chemical Society Reviews Emerging Investigators Award and many others Beyond research, he is an associate editor of Biosensors and Bioelectronics.
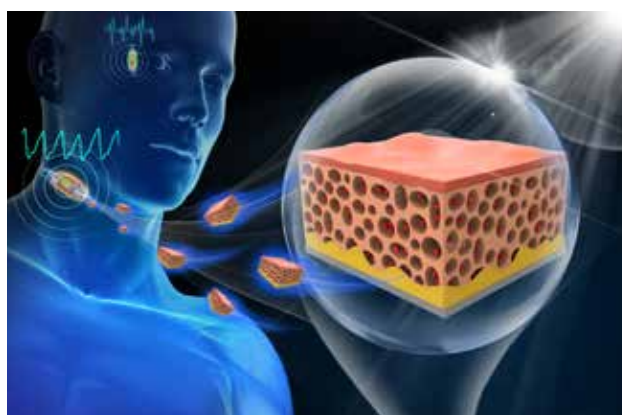
RESEARCH AREA/SPECIALTY:
Bioelectronics, biosensors, smart textiles, nanotechnology, personalized healthcare
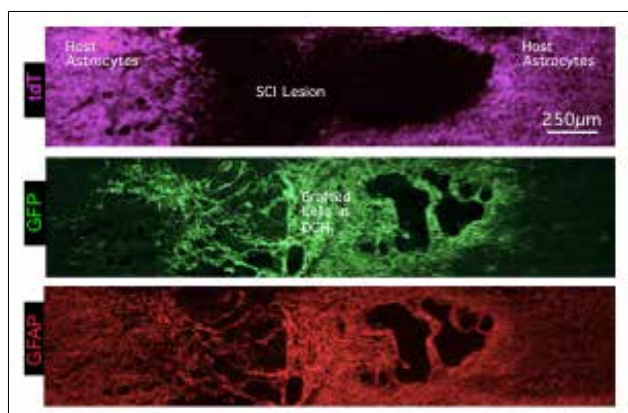
Tim Deming

Professor

Research in the Deming Lab is focused on synthesis, processing, character-ization and evaluation of biological and biomimetic materials based on polypep-tides. These materials are being studied since they can be prepared from renewable resources, they can be biocompatible and biodegradable, and possess unique self-assem-bling properties. We utilize innovative chemistry techniques to synthesize materials with properties that rival the complexity found in biological systems. The polymers are then processed into ordered assemblies, which are characterized for both nanoscale structure as well as biological function. Current efforts are focused on commer-cialization of polypeptide hydrogels for treatment and prevention of infection, and for cosmetic applications.

Dino DiCarlo

Armond and Elena Hairapetian Chair in Engineering & Medicine

The Di Carlo Lab works at the intersection of micro-, nano- and information technology and biology – spanning fundamental investigations in fluid flow and single-cell behavior to clinical and industrial applications. Prof. Di Carlo has been pioneering the field of "Inertial Microfluidics." The group has used inertial fluid dynamic effects to manipulate particles, cells, and fluids in precise ways, enabling the isolation and preparation of samples of blood and other fluids, and performing single-cell analysis. His group also pioneered new approaches to quantify single-cell mechanical properties at high rates.
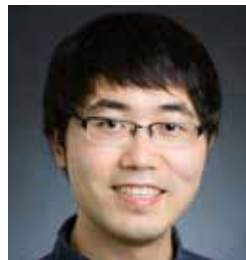

RESEARCH AREA/SPECIALTY:
Bioinspired materials, polymers, functional polypeptides
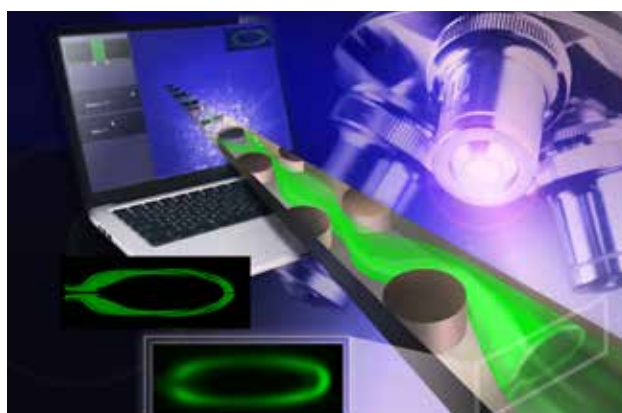
RESEARCH AREA/SPECIALTY:
Lab on a particle, Smart Biomaterials, Microfluidics

Liang Gao

Assistant Professor

The Gao Lab specializes in developing novel optical imaging technologies to improve our fundamental understanding of cell and tissue biology and to directly impact disease diagnosis. His current research interests encompass multidimensional optical imaging, computational optical imaging, ultrafast imaging, and biomedical optics. His lab holds the world record for fastest 2D and 3D imaging.

RESEARCH AREA/SPECIALTY:
**Biophotonics, Biomedical imaging instrumentation, Computational optical imaging**

Daniel Kamei

Professor

Professor Kamei's research is in the area of colloid and interface science, focusing on the application of nanoparticles as well as surfactant and polymer systems. His research group was the first to demonstrate that an aqueous two-phase system (ATPS) could be used to concentrate a target biomarker into a smaller volume before application to a lateral-flow immunoassay (LFA) strip. The Kamei Laboratory also became the first to recognize that paper could accelerate the macroscopic ATPS phase separation process, thereby significantly decreasing user interaction and assay time. They recently expanded upon this discovery by pioneering the automation of biomarker concentration, capture, and signal enhancement on a paper-based device. His research group has continued to develop innovative point-of-care devices and also maintains its efforts in using their expertise in colloid and interface science for designing novel drug delivery systems.
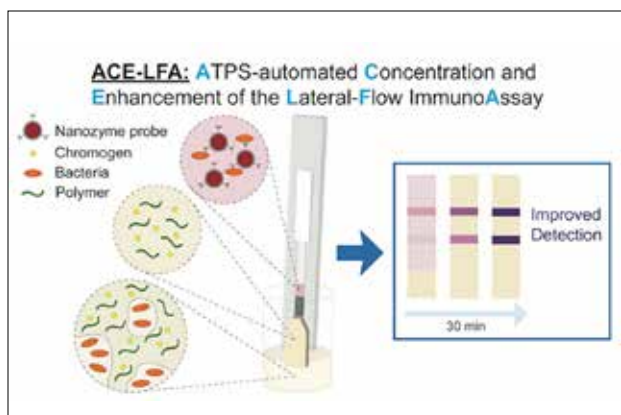
RESEARCH AREA/SPECIALTY:
Colloid and interface science; aqueous two-phase systems; point-of-care diagnostics; drug delivery

Andrea Kasko

Professor

The Kasko Lab's research is centered on developing polymeric materials for bioengineering applications. The group is specifically interested in designing stimuli-responsive biomaterials for applications in drug delivery and tissue engineering, and in making biomimetic materials that recapture biological function. The Kasko research group focuses on the synthesis of new complex polymeric biomaterials. Their goals are to develop materials that can be manipulated spatially and dynamically in a predictable manner using different (chemical) mechanisms, and to incorporate increasing levels of biomimicry into synthetic materials for use as biomaterials and/or as wholly synthetic therapeutics. Within these themes, they have three separate projects – dynamically responsive biomaterials, novel antimicrobials and new glycomimetics.
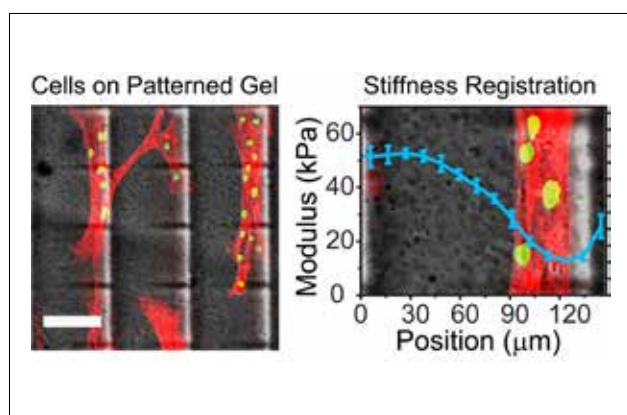
RESEARCH AREA/SPECIALTY:
**Developing polymeric materials for bioengineering applications**

Song Li

Chancellor Professor and Chair of Bioengineering

The Li Lab is focused on cell engineering, mechnobiology, biomaterials and tissue engineering. Stem cells and reprogrammed cells have broad applications in regenerative medicine, disease modeling, and drug screening. We integrate bioengineering technologies and molecular analysis to study how biophysical factors, such as mechanical cues and the micro/nano structure of biomaterials, regulate cell fate determination and epigenetic changes, with the goal of translating fundamental findings into cell engineering technologies. At tissue level, the regeneration process requires the coordination of immune cells, stem cells, and resident cells in the microenvironment. We investigate the mechanisms of tissue remodeling, and develop multidisciplinary approaches to engineer cells, biomaterials, drug delivery systems, and biophysical factors to promote the regeneration of functional tissues.
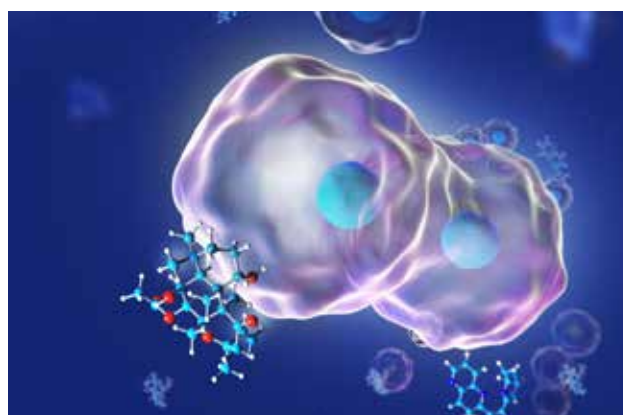
RESEARCH AREA/SPECIALTY:
Cell Engineering, Mechanobiology, Biomaterials

Wentai Liu

Professor

The Liu Lab (Biomimetic Research Laboratory (BRL)) engages in interdisciplinary research of bionic engineering and neural prosthesis. The integration of science, engineering, and technology supports the aims of 1) regaining eyesight for the blind; restoring motor function for the paralyzed; 3) replenishing the cognition impaired; 4) reanimating automatic nerves; 5) brain-to-brain communication. Since the early stages of retinal prosthesis in 1988, BRL has led the engineering efforts for vision restoration in blind patients. Notably, BRL has the unique credential of retinal prosthesis development from conception to the final implant. These efforts led to successful commercial implants (code name Argus-II by Second Sight) for blind patients, receiving both CE Mark in 2011 and US FDA approval in 2013.

RESEARCH AREA/SPECIALTY:
**Neuroengineering, neural prosthesis**

Aaron Meyer

Assistant Professor

The Meyer lab integrates machine learning and experiments to study cell-to-cell communication and signal transduction. They are interested in how extracellular cues operate alone and in combination to influence cell behavior. In cancer, cells often use parallel signaling pathways to evade therapy. Conversely, the immune system uses combinations of signals to direct its responses to cancer and infection. Both situations have created similar challenges in the design of biotherapeutics. The group operates from the perspective that we need better tools to measure, model, and manipulate these processes most effectively. The lab has led the development of multi-modal analysis tools to study antibody responses, proteomics, and data integration.
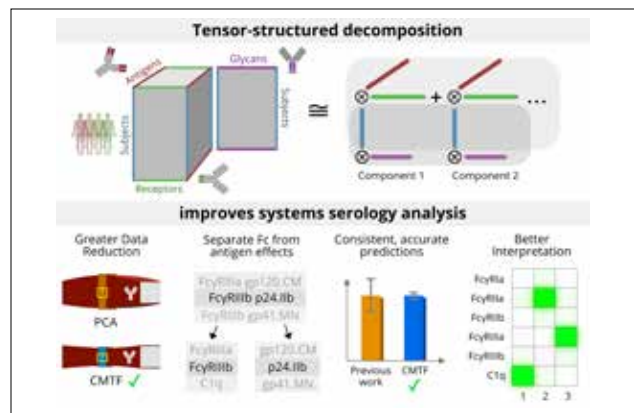
RESEARCH AREA/SPECIALTY:
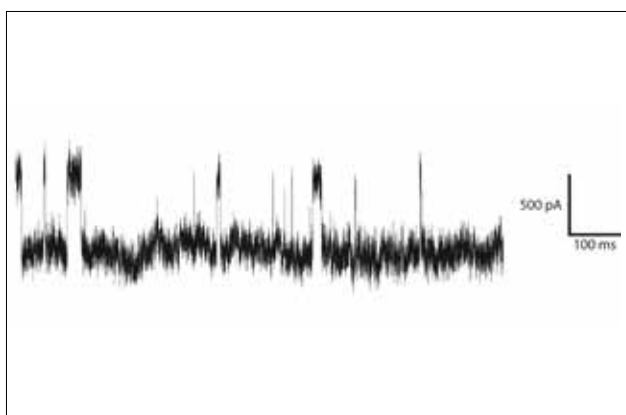**Immune engineering, systems biology, machine learning**

Jacob Schmidt

Undergraduate Vice Chair and Professor

The Schmidt lab has a device-centered focus, primarily covering sensor and instrumentation development. The group has studied the use of protein and inorganic nanopores for single specifically sensing of nucleic acids and proteins. In these measurements, changes in the electrical conductance of an electrolyte-filled nanopore are monitored to detect individual molecules and other small objects entering or occluding the pore. The size, shape, and identity of these molecules can be inferred from analysis of the measured conductance signals. Detecting single molecules enables use of very small analyte volumes—a long term goal is single cell protein characterization.

Jennifer Wilson

Assistant Professor

The Lab for the Understanding of Network Effects (LUNE), studies how proteins downstream of drug targets affect drug-induced phenotypes – the ability to mitigate disease or cause side effects. Drugs are traditionally developed to alter the function of proteins within cells – usually proteins that are malfunctioning and have causal relationships to disease. However, proteins in the cell exist in large, complex networks – they interact with each other and rarely exist in isolation. Even well designed drugs that alter the function of a target protein have ripple effects through protein networks. It's widely appreciated that drug effects propagate through protein networks, but the downstream effects are not routinely considered during target protein selection. We aim to design models that anticipate downstream drug effects during initial therapeutic design.

RESEARCH AREA/SPECIALTY:
Sensor and instrumentation development
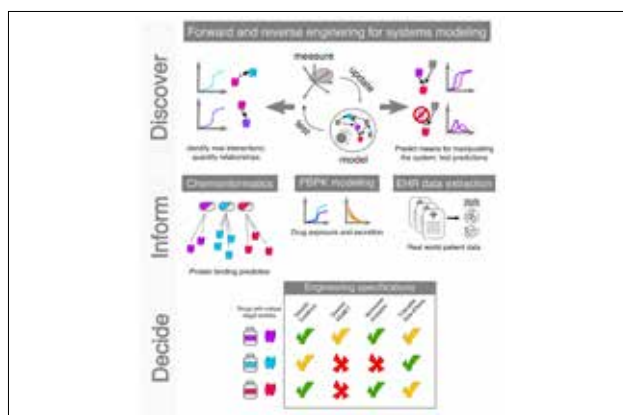
RESEARCH AREA/SPECIALTY:
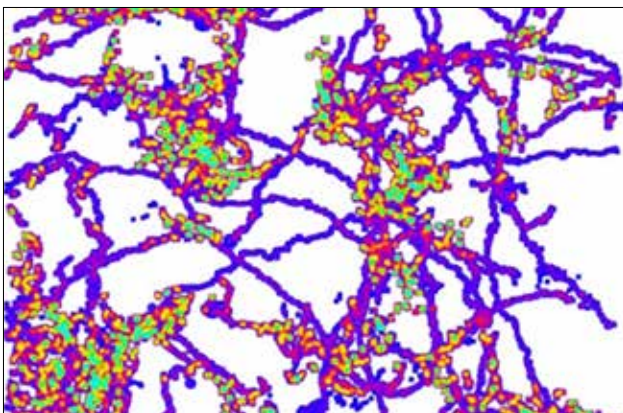**Protein interaction networks, drug pathways, computational models**

Gerard Wong
Professor

The Wong Lab uses multidisciplinary approaches to solve problems in infectious diseases, auto-immune disorders and inflammations, with implications for respiratory diseases, heart disease, and cancer. Wong's honors include: the Beckman Young Investigator Award, Alfred P Sloan Fellowship, and Sackler Distinguished Speaker. He is a Fellow of the American Physical Society, a Fellow of the American Academy of Microbiology, and a Fellow of the American Institute for Medical and Biological Engineering. His group has produced 11 professors since 2006. The lab's interests include Bacterial biofilm communities, innate immunity, autoimmune diseases, antibiotic design, machine learning, neurodegenerative diseases, viral replication, programmed cell death, and immunotherapy of cancer.

Benjamin Wu
Professor

The Wu Lab uses cutting-edge bioengineering strategies to address unmet needs and open-ended problems. His group has extensively analyzed the effects of processing parameters on the formation of biomimetic apatites and this fundamental understanding has led to applications in the areas of art conservation, drug delivery, separations, and biosensors. Additionally, his group has also shed light on the interplay between orthobiologic growth factors and adult stem cells in the area of bone repair. The group has developed practical methods to effectively deliver the bone-forming molecule, NELL-1, for bone and cartilage repair. Systemic delivery of NELL-1 is currently being studied in zero-G environment on the International Space Station as a potential strategy to slow and/or reverse bone loss during spaceflight.

RESEARCH AREA/SPECIALTY:
Immunity and antimicrobials, biofilms, fundamental science
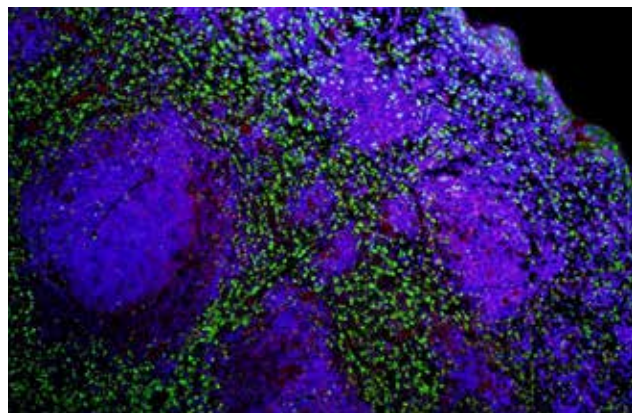
RESEARCH AREA/SPECIALTY:
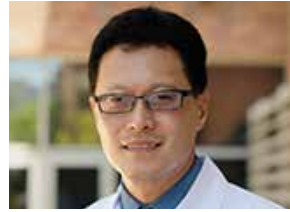**Advanced manufacturing, orthobiologics, biomaterials**

Mark Cohen
Professor, Psychiatry and Biobehavioral Sciences

Weizhe Hong
Professor, Biological Chemistry

Tzung Hsiai
Professor, Department of Medicine

Pirouz Kavehpour
Professor, Mechanical and Aerospace Engineering

Corey Arnold
Professor, Radiological Sciences

Linda Demer, MD PhD
Professor and Executive Vice Chair, Departments of Medicine

William Hsu
Associate Professor, Radiological Sciences

Chang-Jin "CJ" Kim
Distinguished Professor, Mechanical and Aerospace Engineering

Pei-Yu "Eric" Chiou
Professor and Vice Chair, Mechanical and Aerospace Engineering

Elisa Franco
Associate Professor, Mechanical and Aerospace Engineering

Debiao Li
Professor, Department of Medicine

Neil Lin
Mechanical and Aerospace Engineering Bioengineering

Tyler Clites
Assistant Professor, Mechanical and Aerospace Engineering

Chih-Ming Ho
Distinguished Professor Emeritus, Mechanical and Aerospace Engineering

Shantanu H. Joshi
Associate Professor, Neurology

Arash Naeim
Professor, Department of Medicine

OUR JOINT FACULTY

Aydogan Ozcan
Chancellor's Professor,
Electrical & Computer
Engineering

Sophia Sangiorgio
Professor, Orthopaedic
Surgery

Yi Tang
Professor, Chemical and
Biomolecular Engineering

Paul Weiss
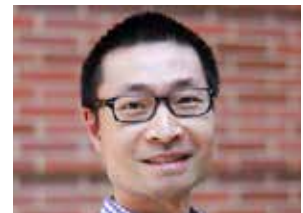Distinguished Professor,
Chemistry and
Biochemistry

Jacob Rosen
Professor, Mechanical and
Aerospace Engineering

Kalyanam Shivkumar
Professor, Department of
Medicine

Michael Teitell
Professor, Pathology and
Laboratory Medicine

Holden Wu
Associate Professor,
Department of Radiology
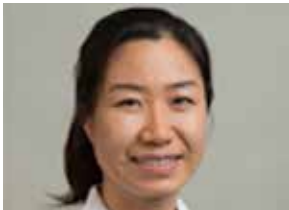
Dan Ruan
Associate Professor,
Radiation Oncology

Maie St. John
Professor and Chair,
Department of Head and
Neck Surgery

Cun Yu Wang
Chair and No-Hee Park-
Endowed Professor,
Division of Oral Biology and
Medicine

Yang Yang
Professor, Materials Science
and Engineering

OUR STAFF

Lili Bulhoes
Graduate Student
Affairs Officer

Cindy Dang
Fund Manager

Daphne-Jane Dizon
Management Services
Officer

Janet Lin
Senior Fund
Manager

Sarah Matautia
Purchasing
Coordinator

Emilia Rodriguez-Vera
Administrative Specialist

AWARDS AND RECOGNITION (2020-2021)

2020

- Edward K. Rice Outstanding Doctoral Student Award (2020): **Parinaz Abiri**, PhD '19, MD '21
- Northrop Grumman Excellence in Teaching Award (2020): **Stephanie Seidlits**
- Society for Laboratory Automation and Screening Innovation Award (2020): **Joseph de Rutte**
- IEEE Fellow (2020): **Paul Weiss**
- BMES Fellow (2020): **Tzung Hsiai**, **Walt Baxter**
- UCLA-CalTech integrated Cardiovascular Medicine for Bioengineers (iCMB) and Caltech/UCLA individulaized Theranostic Engineering to Advance Metabolic System (iTEAM): (PD: **Tzung Hsiai**, Co-PD: **Song Li**, **Dino Di Carlo**, **Paivi Pajukanta**, **Zhaoping Li**, **Y. C Tai**)
- National Defense Science and Engineering Graduate Fellowship (2020): **Trinny Tat**
- Shu Chien Early Career Award (2020): **Stephanie Seidlits**
- National Academy of Inventors (2020): **Bahram Jalali**
- Web of Sciences 2020 Highly cited Researchers: **Jun Chen**, **Aydogan Ozcan**, **Yang Yang**

2020 Commencement Awards

- School-Wide Outstanding Bachelor of Science Award: **Mariam Sheyda Carson**
- Chancellor's Service Award: **Nicole Marie Kuntjoro**, **Savannah Sealy-Anna Shumock**
- Engineering Achievement Award in Student Welfare: **Mariam Sheyda Carson**, **Jessica "Jessii" Morgan Chun**, **Nicole Marie Kuntjoro**, **LeeAnn Kai-Yin Li**, **Kajal Maran**, **Izabella Krystyna Samuel**
- Bioengineering Outstanding Students: **Joseph de Rutte** (Ph.D.), **Michael Chen** (MS), **Mariam Sheyda Carson** (B.S.)

2021

- Northrop Grumman Excellence in Teaching Award (2021): **Aaron Meyer**
- UC Big Ideas Winners (2021): **Xuexiang Zhang**, **Crystal Xiao**, **Mahdi Hasani**
- ACS Nano Rising Stars (2021): **Jun Chen**
- Shu Chien Early Career Award (2021 Finalist): **Liang Gao**
- 30 Life Sciences Leaders To Watch by In Vivo (2021): **Jun Chen**
- 2nd Influential Researcher globally in the field of Nanogenerator (2021): **Jun Chen**
- BMES Outstanding Outreach Award (2021): **UCLA BMES Student Chapter**
- International Academy of Medical and Biological Engineering Fellow (2021): **Zhen Gu**
- Lab on a Chip Widmer Poster Award @ MicroTAS 2021 (2021); **Sohyung Lee**
- Biomicrofluidics Best Paper Award @ MicroTAS 2021 (2021): **Doyeon Koo**
- James Willerson Lectureship Award (2021) **Linda Demer**

2021 Commencement Awards

- Engineering Achievement Award in Student Welfare (2021): **Linnet Y Chang**, **Griffith Collwyn Hesketh Hughes**, **Sami Rafeedie**, **Nina Angelique Tittensor**, **Yilian Wang**
- Bioengineering Outstanding Students: **Reyhaneh Nazarian** (Ph.D.), **Cole David Benyshek** (M.S.), **Mayilone Sathialingam** (B.S.)
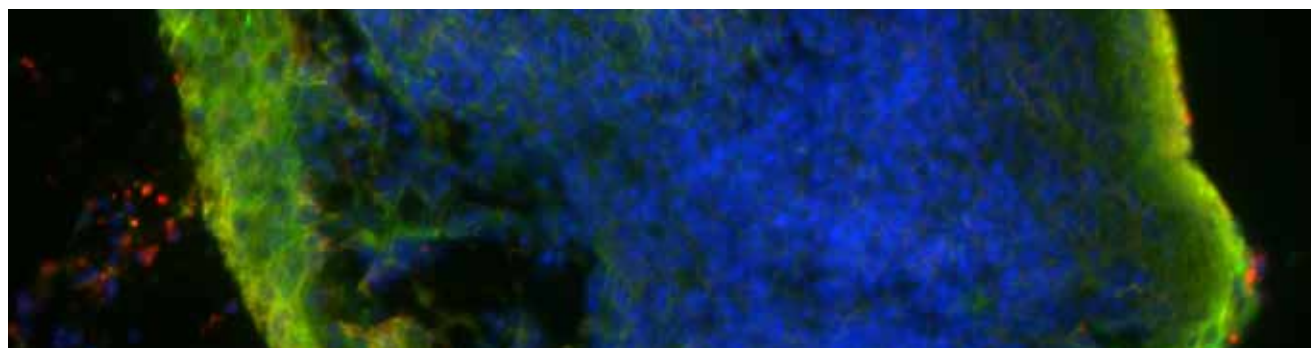
UCLA Bioengineering
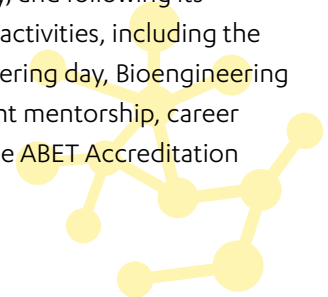# Alumni Advisory Board (AAB)

The UCLA Bioengineering Alumni Advisory Board's mission is to promote the communication, growth, and shared activities of the UCLA Bioengineering alumni, faculty, and students.

The AAB members offer unique inputs to help the Department understand the needs of industry, academia, and the medical professions, insights into how well the department is meeting the bioengineering needs of the future, and knowledge of current trends in the industry, including suggestions for keeping the curriculum and degree programs current. They also provide input to academics, research, outreach, advocacy, and development.

The members represent a cross-section of the alumni of the Department, and of the major areas of the bioengineering field.

The AAB meets annually, and following its mission, is involved in several activities, including the annual Discover UCLA Engineering day, Bioengineering Research Day, ongoing student mentorship, career development advising, and the ABET Accreditation process every six years.

BME Industrial Advisory Board

The Bioengineering department is supported by the industrial advisory board. This board has diverse representation from career paths that need bioengineering graduates, including Biotech (Amgen and Genentech), Medtech (Edwards and Medtronics), entrepreneurs, patent attorneys, etc. Many of the members are UC alums as well!

The goal of the IAB is to increase interactions between industry and students and faculty. This includes participating in department events, providing input for curriculum development, mentoring students, providing opportunities for students to obtain industrial experience, and establishing collaborations with faculty.

Bioengineering Graduate Association (BGA)

The Bioengineering Graduate Association (BGA) at UCLA was established to facilitate communication between graduate students and department faculty, encourage the involvement of students in the graduate community, and establish platforms for the academic and professional development of its members.

BGA coordinates with the department to provide resources of outreach for graduate students, including arranging lunch with the guest faculty who present at our department's weekly seminar series, organize the department's annual recruiting event and research showcase, BE Research Day, and provide other opportunities for student involvement. BGA also works to enrich the life of graduate students and form close bonds within the department.

In addition to promoting academic success, BGA facilities opportunities to network with industry professionals through special seminars and alumni panel events. These quarterly events provide BE graduate students with opportunities to learn about careers in industry and network with industry professionals from a wide variety of companies.

As BGA looks towards the 2021 – 2022 academic year, we are excited to help welcome a new cohort of graduate students to our department and will continue to facilitate connections between our students and academic and career opportunities.

BGA hosted the Bioengineering Symposium in February 2020.

BGA leadership team at Bioengineering Research Day in February 2020.

Biomedical Engineering Society (BMES)

The Biomedical Engineering Society (BMES) at UCLA aims to connect students interested in Bioengineering and support them through professional, outreach, technical, and social opportunities and events.

The professional aspect encompasses academic guidance opportunities, through class planning workshops and career exploration panels, as well as connections to industry, via biotechnology-focused career fairs, industry information sessions, and resume building workshops.

BMES provides outreach opportunities through our recently established Reaching and Inspiring Students in Engineering (RISE) program and annual fundraisers to local food banks. RISE connects volunteers with middle and high school students from Title I schools to introduce and teach concepts such as circuits, Adruino coding, and Computer Aided Design (CAD). Recently, BMES at UCLA was also nationally recognized and awarded the Outstanding Outreach Award for our efforts in giving back to the community.

Students may also choose to expand their technical knowledge by joining one of our project teams. These teams focus on a variety of skills: from learning wet lab techniques to applying their knowledge towards a specific medical or engineering problem. To complement these projects, BMES plans to incorporate a new workshop series next year to introduce technical skills without the commitment of a yearlong project.

In addition to promoting professional and academic success, BMES facilitates bonding through mentorship activities and social events. These include game nights and study nights through the mentorship

(*top*) BMES Cell Team presents their research during poster presentations at the annual Spring Banquet (2019).

(*bottom*) BMES Board for the 2019-2020 academic year.

family system as well as quarterly club-wide events such as BMES Banquet and Fall BBQ.

As BMES looks towards the 2021-2022 academic year, our organization hopes to achieve several goals. We want to further incorporate mental health within the diversity & inclusion conversation, increase accessibility to our technical skills workshops, and encourage more interpersonal connections between students and leaders in Industry.

Producing graduates who are well-grounded in the fundamental sciences, adept at addressing open-ended problems, and highly proficient in rigorous analytical engineering tools necessary for lifelong success.

UCLA Samueli
Bioengineering

Department of Bioengineering

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University of California
Los Angeles, CA 90095-1600

www.bioeng.ucla.edu