

Mechanical Engineering Seminar Series

October 28, 2026 11:00AM

Dean's Conference Room, E 203E

Title: Engineering Micro- and Nanofluidic Systems for Diagnostics, Neuromodulation, and Nanobiointerfaces

Dr. Ke Du

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Abstract: Miniaturized micro- and nanofluidic systems, integrated with biochemistry, microscopy, nanomaterials, and computer vision algorithms, provide powerful platforms for diverse biomedical applications, including molecular diagnostics, biophysics, and optogenetics. In this presentation, we introduce a 3D-printed microfluidic system incorporating a rotating magnetic field to enhance target capture, concentration, and detection. The system integrates newly developed, free-standing microvalves for precise reagent handling, with hardware and software control enabled by an AI agent. This integrated platform is designed for the sensitive and specific CRSIPR detection of antimicrobial-resistant bacteria in blood, with the goal of enabling rapid and accessible diagnostics in resource-limited settings. We also highlight our recent advancements in implantable devices for adeno-associated virus (AAV) delivery and the treatment of neurological disorders in mouse models. These devices, fabricated via high-resolution 3D printing, utilize total internal reflection at the liquid–air–microstructure interface to efficiently stimulate neurons. Finally, we integrate experimental approaches with molecular dynamics simulations to study the interactions between arbitrary nanoparticles and living cells—advancing our understanding of nanotoxicity and guiding the design of next-generation drug delivery systems.

Bio: Dr. Ke Du is an Associate Professor in the Department of Chemical and Environmental Engineering at the University of California, Riverside. His research focuses on in vitro molecular diagnostics, in vivo bioimaging, nanotoxicology, and nanomanufacturing. He has received numerous awards and honors, including the EIPBN Inaugural Early Career Award (2024), the NIH Maximizing Investigators' Research Award (MIRA, 2021), and the James H. Potter Award for Outstanding Ph.D. Students (2014). He has also been recognized as an Emerging Investigator by Lab on a Chip (2024) and Nanoscale (2025), and was named a Global Rising Star in Sensing by ACS Sensors. His research has been supported by a broad range of federal agencies and industry partners, including the National Institutes of Health, the National Science Foundation, the U.S. Department of Agriculture, the U.S. Department of Energy, the Burroughs Wellcome Fund (BWF), Mammoth Biosciences, and Biological Mimetics. In addition to his research activities, Dr. Du serves on the Early Career Editorial Advisory Board of *Biomicrofluidics* (AIP Publishing) and as a Special Issue Editor for *Sensors and Actuators Reports* (Elsevier), where he oversees the journal's special issues.