UC San Diego
JACOBS SCHOOL OF ENGINEERING
Aiiso Yufeng Li Family Department of Chemical and Nano Engineering

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DEPARTMENT SEMINAR

Wednesday, April 16th, 2025
11:00 AM - 12:00 PM
SME 248

Dr. Ritu Raman, PhD

"4D Neuromuscular Tissue Engineering for Regenerative Medicine and Robotics"

Eugene Bell Career Development Assistant Professor
Department of Mechanical Engineering
Massachusetts Institute of Technology

Abstract: Human beings and other biological creatures navigate unpredictable and dynamic environments by combining compliant mechanical actuators (skeletal muscle) with neural control and sensory feedback. Disease or damage that impacts neuromuscular tissues thus has a severe negative impact on health, mobility, and quality-of-life, motivating the development of tissue engineered multicellular models of the motor control system. We have engineered optogenetic skeletal muscle actuators and shown that light can be used to non-invasively and precisely control muscle contraction, and moreover, that repeated light stimulation "exercise" can program tissue strength, endurance, and regeneration after trauma in vitro and in vivo. Leveraging these tissues, we have interrogated how exercise programs crosstalk between muscle and other surrounding cells, such as peripheral nerves and vasculature, to better understand how mechanical and biochemical signaling can be manipulated in physiological and pathological states. In addition to applications of this work in disease modeling and regenerative medicine, we will also discuss how we use engineered muscle to power adaptive biohybrid robots that demonstrate a range of functional behaviors such as walking and gripping. This talk will cover the advantages, challenges, and future directions of using tissue engineered models to understand and manipulate the mechanics of biological motor control systems.

Bio: Ritu Raman, PhD is the Eugene Bell Career Development Assistant Professor of Mechanical Engineering at MIT. Her lab is centered on 4D tissue engineering of biological actuators for applications in medicine and machines. Ritu's research has received several recognitions including the PECASE, the NSF CAREER Award, the Army Research Office YIP Award, and the Office of Naval Research YIP Award, as well as Rising Star Junior Faculty Awards from the Biomedical Engineering Society and the American Society of Mechanical Engineers. She is also the recipient of the Spira Award for Excellence in Teaching at MIT and the author of the MIT Press book *Biofabrication.* Ritu received her BS from Cornell University and her PhD as an NSF Fellow with Prof. Rashid Bashir at the University of Illinois at Urbana-Champaign. She completed her postdoctoral research as a L'Oréal For Women in Science Fellow and NASEM Ford Foundation Fellow with Prof. Robert Langer at MIT. RamanLab.mit.edu

Seminar Host: Zeinab Jahed