

UNIVERSITY OF CALIFORNIA, IRVINE

THE DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

Is Proud to Host a Seminar by:

**PROFESSOR  
DARREN J. LIPOMI**

Department of NanoEngineering  
Associate Dean for Students and  
Faculty Director of IDEA Engineering Student Center  
University of California, San Diego



***ORGANIC HAPTICS: STRUCTURED POLYMERS  
FOR TWO-WAY COMMUNICATION WITH  
BIOLOGICAL SYSTEMS***

DATE:

Thursday, October 26, 2023

TIME:

2:00 - 3:20 PM

LOCATION:

McDonnell Douglas Engineering Auditorium

**Abstract:** Mechanical deformability underpins many of the advantages of semiconducting and stimuli-responsive polymers in applications from flexible solar cells to wearable devices for healthcare and virtual touch. In this talk, I will present my group's work at the intersection between the science of soft materials and the science of touch. This field, which we have named "organic haptics," combines active polymers, contact mechanics, and psychophysics. We are beginning to understand the ways in which stick slip friction, adhesion, and capillary forces between planar surfaces and human skin affect the ways materials produce tactile objects in consciousness as mediated by the sense of touch. This work, which combines human subject experiments, laboratory mockups of human skin, and analytical models accounting for friction, has led to several important observations. In particular, we have elucidated the mechanism by which humans can differentiate hydrophilic from hydrophobic surfaces when bulk parameters such as hardness, roughness, and thermal conductivity are held constant, and have also taken steps to understand the perception of softness of surfaces bearing microscopic relief structures. We have taken the insights from these psychophysical experiments to design new electroactive and ionically conductive materials to produce haptic biomaterials whose goal is to produce realistic sensations for applications in tactile therapy, instrumented prostheses, education and training, and virtual and augmented reality.

**Bio:** Darren J. Lipomi is a Professor of nanoengineering, chemical engineering, and materials Science at UC San Diego. He is also the Associate Dean for Students and the Faculty Director of the IDEA Engineering Student Center at the Jacobs School of Engineering at UCSD. Lipomi earned his bachelor's degree in chemistry with a minor in physics as a Beckman Scholar at Boston University in 2005, and his PhD in chemistry at Harvard University in 2010, with Prof. George M. Whitesides. From 2010 – 2012, he was an Intelligence Community Postdoctoral Fellow in the laboratory of Prof. Zhenan Bao at Stanford University, and arrived at UCSD in 2012. His research interests include the chemistry of organic materials, especially the mechanical properties of semiconducting polymers for flexible solar cells, biomechanical sensors, and phenomena that occur at the intersection of materials chemistry with human perception and cognition. He is the recipient of the AFOSR Young Investigator award, the NIH Director's New Innovator Award, the Presidential Early Career Award for Scientists and Engineers (PECASE), and the NSF BRITE-Pivot award. He hosts a podcast, "Molecular Podcasting with Darren Lipomi" and associated YouTube channel (Darren\_Lipomi) that together have >14,000 subscribers. These venues serve as a resource to students, postdocs, and other early-career researchers. His research website is [lipomigroup.org](http://lipomigroup.org).

