

UC San Diego

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

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Chemical and Nano Engineering
EARLY CAREER SPOTLIGHT SEMINAR

Wednesday, February 5th, 2025

11:00 AM - 12:00 PM

SME 248



Dr. Rachel Blau, PhD

“Bioinspired multifunctional materials for precise and long-term communication with neurons”

Postdoctoral Scholar

Lipomi Research Group

Aiiso Yufeng Li Family Department of Chemical and Nano Engineering
University of California, San Diego

Abstract: The realistic transmission of the sense of touch has transformative implications for biomedical technologies, including surgical procedures, prosthetics, rehabilitation, AR/VR teleoperation, and more. Unlike technologies that transmit audio and visual cues, creating remote, realistic tactile sensations remains a major challenge. However, this capability holds the potential to transform human life as profoundly as the advent of computers and the internet. Current haptic devices and motors are bulky, expensive, and occasionally painful, with a limited range of sensations. Recent advances in materials science have enabled the development of miniaturized electrodes capable of transmitting electrical stimuli that are perceived as mechanical sensations, a phenomenon known as the electro-tactile effect. Yet, this method is hindered by inconsistencies, galvanic reactions, pain, desensitization, and unintended stimulation of non-tactile nerves.

My research addresses these challenges by designing molecularly tailored conductive polymers to meet critical needs in touch transmission, sensory enhancement, and neural recording technologies—key components of the sense of touch. In the first part of my presentation, I will introduce the development and synthesis of a stable conductive coating optimized for long-term neural recording. Next, I will discuss the design, synthesis, and scalable fabrication of conformal conductive electrodes capable of transmitting a broader spectrum of tactile sensations with enhanced accuracy and ultra-low currents. These advancements are crucial for decoding neural activity and expanding the range of touch transmission in haptic technologies that replicate tactile experiences. Throughout the talk, I will demonstrate how the molecular design of conductive materials enhances skin conformability, improves charge transport efficiency, and ensures durability. I will also highlight how integrating organic chemistry and engineering approaches enables precise control over the mechanical, electrochemical, and functional properties of conductive coatings. Finally, I will conclude with a forward looking perspective on the field and outline the next steps for advancing this research.

Bio: Rachel Blau is a postdoctoral scholar in the laboratory of Prof. Darren Lipomi, within the Aiiso Yufeng Li Family Department of Chemical and Nano Engineering. She received the prestigious Marie Skłodowska-Curie Actions Postdoctoral Fellowship. Her research is centered on the design and synthesis of advanced conductive and stretchable polymers capable of transmitting tactile feedback, known as haptics, for human-machine interfaces. These materials serve as tools for wearable or implantable sensors to analyze neuronal activity with high precision. With wide-ranging applications in the biomedical field, they hold potential for medical training, remote patient visits, physical therapy, robotic-assisted surgery, and prosthetic design.

Rachel obtained her B.Sc. in Chemistry from Bar-Ilan University, her Pharmacy (B.Pharm) degree from The Hebrew University of Jerusalem, and pursued her M.Sc. and Ph.D. in Medical Sciences at the laboratory of Prof. Ronit Satchi-Fainaro within the Department of Physiology and Pharmacology at the Sackler Faculty of Medicine, Tel Aviv University, Israel. During her time there, her research focused on developing smart polymeric probes for companion diagnostics and precise tumor excision during image-guided surgery.

Seminar Host: Zeinab Jahed