Fall 2019 Chemistry Seminar Speaker

Jeffrey Halpern

University of New Hampshire December 5, 2019 1:10-3:00 pm Agriculture Building Rm. 41

"Reusable and Reproducible Polymer-Modified Electrochemical Surfaces to Detect of Bioanalytes"

Abstract: The SEEDS (Surface Enhanced Electrochemical Diagnostic Sensors) laboratory is actively looking at novel ways to develop point-of-need sensors to diagnose diseases and evaluate patient health. Electrochemical biosensors are typically limited in selectivity or sensitivity due to inadequate surface interactions between the analyte and sensor. Surface modifications have the ability to recruit biomolecules to the surface increasing sensitivity; however, stability and reproducibility are often a concern.

One paradigm that will be presented is a reusable cyclodextrin-mediated sensor surface to detect hydrophobic molecules. A gold electrode surface was modified with polyethylene glycol (PEG)-SH via thiol chemistry. The surface PEG brushes were then complexed with α -cyclodextrin. The CD-PEG surface was exposed to different concentrations of resveratrol (0.5-20 nm). We monitored the double layer capacitance, which was proportional to the release of CD from the PEG surface to form a CD:Res complex. Compared to the bare surface, the sensitivity was improved. To check the reusability of the surface, after the first two serial dilutions the surface was reloaded with CD and then the third serial dilution was performed. It was found that CD was successfully reloaded on the PEG brushes. Surface analysis confirmed the impedance results both for initial surface modification and cyclodextrin reloading.

While not fully developed, another paradigm that will be presented is using Elastin-Like Polymers as a surface-bound stimuli sensor. We will report our progress towards using this surface, reproducible modification protocols, and the electrochemical response of the stimulus behavior. The reusability of the surface will also be explained.

Bio: Prof. Halpern earned his PhD in Chemical Engineering in 2010 at Case Western Reserve University in Chemical Engineering. His first postdoc (2011-2012) was funded through an NIH NRSA fellowship at Case Western Reserve University in Biomedical Engineering. Prof. Halpern's second postdoc was funded through Fulbright and Lady Davis Fellowships (2013-2014) to work in Israel at the Technion in the Department of Chemical Engineering. He joined the Department of Chemical Engineering at the University of New Hampshire in 2014 and currently heads the SEEDS Lab. Dr. Halpern prides himself on his student mentoring, and has mentored 17 undergraduates, 2 summer interns, 5 graduate students, and 2 post doctorates. As part of these efforts, he was recently awarded the Educator's Award from LEAP for Education.