UCLA Engineering
HENRY SAMUELI SCHOOL OF ENGINEERING AND APPLIED SCIENCE

# BIOENGINEERING

PRESENTS

**Adhesive Hydrogels and Coatings Inspired by Biological Polyphenols**

THURSDAY, OCTOBER 27, 2016
1:00 – 2:00 PM
2101 ENGINEERING V


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### ABSTRACT:


Polyphenols are a large class of natural biomolecules that have functions including structural support, pigmentation, anti-oxidation, anti-inflammation and radiation protection. The phenolic functional group lends unique properties to these biomolecules, among the most prominent being strong interactions at solid-liquid interfaces. In this talk I will focus on a few examples of our research work on biological polyphenols that are interfacially active, where we seek to better understand their fundamental structure-property relationships on a molecular level, and exploit this information for the design of simple polymer mimics of biological polyphenols for a number of practical applications. In the area of wet adhesion, good biological models to study are the adhesive secretions that marine organisms rely on for attachment to substrates in wet, turbulent environments. In the case of mussels, adhesion is mediated by the byssus- a remarkably strong and tough tissue comprised of a collection of collagenous protein threads terminally anchored by an adhesive pad. Proteins found near the byssus-substrate interface are enriched in the phenolic amino acid 3,4-dihydroxy-L-alanine (DOPA), where it is capable of interacting strongly with organic and inorganic substrates. DOPA is present in lower concentrations away from the interface, where it forms a covalent network that is reinforced with noncovalent coordination bonds with transition metals (e.g. Fe, Zn and Cu). In the first part of this talk I will provide an overview of molecular aspects of mussel adhesion, with an emphasis on the interfacial interactions of DOPA and the mechanically active DOPA-metal interactions. Our experiments provide insights into key mechanisms of wet biological adhesion, and also inform the design of synthetic mimics of these proteins. In the second half of this talk I will describe some of our translational efforts, which include the development of biomimetic surgical adhesives, and coatings for a variety of uses. Finally, I will briefly introduce our related work with polyphenols found in tea, chocolate and red wine. Plant polyphenols are chemically similar to DOPA, and therefore can be exploited in similar ways.


### BIOGRAPHY:

**Dr. Phillip B. Messersmith** is the Class of 1941 Professor in the Departments of Bioengineering and Materials Science and Engineering at UC-Berkeley. He earned his B.S. degree in life sciences in 1985 from the University of Illinois at Urbana, M.S degree in bioengineering from Clemson University, and his Ph.D. degree in materials science and engineering in 1993 from the University of Illinois at Urbana. Previously, Dr. Messersmith was a postdoctoral fellow at Cornell University (1993-1994), and a faculty member at the University of Illinois at Chicago (1994-1997) and Northwestern University (1997-2014). His awards and honors include a MERIT award from the National Institutes of Health, the Langmuir Lecture Award from the American Chemical Society, and the 2013 Clemson Award for Basic Research from the Society for Biomaterials. Dr. Messersmith is a fellow of the American Institute for Medical and Biological Engineering, the Royal Society of Chemistry, and the International Union of Societies of Biomaterials Science and Engineering. The Messersmith research group is interested in understanding structure-processing-property relationships of materials in biological systems, and in using this information to inform the design, synthesis and application of biologically inspired synthetic materials used in a variety of practical applications.