UC DAVIS
MATERIALS SCIENCE AND ENGINEERING

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Interfacial and Bulk Molecular Phenomena in Mussel Adhesive Proteins and Their Synthetic Polymer Mimics

Phenols are important components of biological tissues where they perform a variety of biological functions, including wet bioadhesion, pigmentation, infection prevention, metal binding and antioxidant properties. Phenols are broadly distributed in both plant and animal tissues. One of the most notable examples can be found in mussels, where proteins found in the mussel byssus, attachment organ of the mussel, contain high levels of the phenolic amino acid 3,4-dihydroxy-L-alanine (DOPA). DOPA contributes to both the interfacial and bulk mechanical performance of the tissue via a range of unique chemical interactions. In this talk, I will introduce DOPA and its function in the mussel byssus, with an emphasis on the interfacial and bulk molecular mechanics of DOPA. There is a growing recognition that phenols and polyphenols are useful building blocks for advanced functional materials, and I will provide a few selected examples of how we can exploit these molecules as building blocks for synthetic bioinspired adhesives, hydrogels and coatings.

Bio: 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.