Conjugated Oligoelectrolytes for Bioelectrochemical Applications

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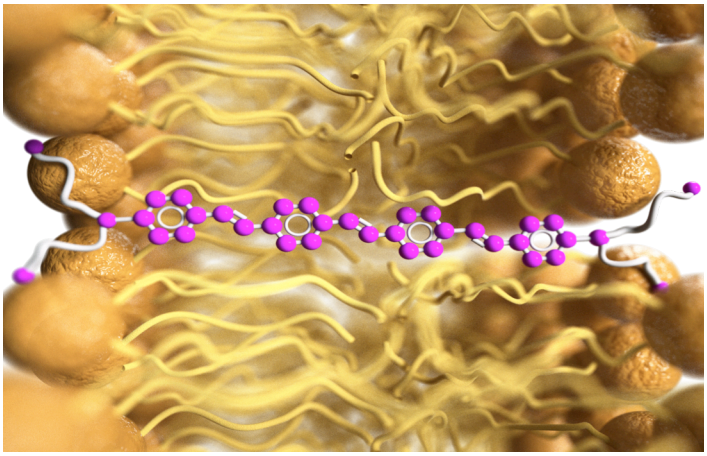
This presentation will center on the design, synthesis and use of conjugated oligoelectrolytes (COEs). These molecules contain a pi-conjugated segment of 2-5 repeat units and terminal ionic functionalities. The distribution of



hydrophobic content and hydrophilic charged groups leads to spontaneous self-assembly within lipid bilayer membranes. When this intercalation occurs within living microorganisms, one finds that it is possible to improve the function of bioelectrochemical devices, such as microbial fuel cells and bioelectrosynthesis platforms. Essentially, charges are more easily injected, or extracted, from microbes. The result is that microbial fuel cells become capable of higher power generation and biological films also become more efficient for wastewater remediation. Membrane modification with COEs leads to additional important changes in microbial behavior and properties. For example, they become more tolerant to stress by bioproduct formation and can become, depending on the molecular structure, more sensitive to the action of antibiotics. Depending on the number of repeat units in the COE, it is possible to increase whole cell catalysis, for example for asymmetric transformations. We will discuss the mechanisms of action by COEs from the point of view of how changes in molecular structure can be used to modify metabolic processes and membrane structural features.

If time permits, we will also discuss how self-doped conjugated *poly*electrolytes can be used as an external matrix that assists in electron extraction from exoelectrogenic bacteria under anaerobic conditions. The overall process mimics the respiration of anaerobic microorganisms onto minerals through extracellular electron transfer. We will examine the importance of molecular structure and how bacteria and synthetic elements come together to define a composite in which one of the elements constitutes a living system.