

HOPE COLLEGE CHEMISTRY SEMINAR

Charge Transfer Properties of Immobilized Biomolecules: Small Steps Toward New Molecular Devices

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Friday, September 18, 2009 4:00 pm, Schaap 1000

Abstract

Proteins and peptides are desirable components for a rapidly developing class of biodevices and molecular electronics because of their molecular recognition capabilities and well-defined structures. Cytochrome *c*, a small redox-active protein, is a convenient model system for exploring the relationship between protein structure, motion, and charge transfer properties. We have used cyclic voltammetry to determine the electrochemical electron transfer rate constant (k^0) for cytochrome *c* covalently bound to mixed hydroxyl-/carboxylic acid-terminated self-assembled monolayers (SAMs) of alkanethiols to elucidate facets of the electron transfer process. In order to best incorporate proteins and peptides into molecular devices, scaffolds with good charge transport properties must also be developed. Peptide Nucleic Acid (PNA) is a synthetic analogue of DNA that has promise in this area. Its neutral, peptide-based backbone makes it particularly attractive for applications that require surface assembly. We have characterized features of charge transport through PNA by forming SAMs on gold via a cysteine moiety and assessing k^0 via the cyclic voltammetric response of a ferrocene reporter group. Theoretical and experimental (STM) studies of single-molecule PNA conductance were also performed.

Biography

Kathy (Ewing) Davis received her B.A. in German and B.S. in Chemistry (Magna Cum Laude) from Hope in 2005. She is very grateful for her time at Hope, where she not only got a terrific education, but she was able (and encouraged by her professors) to be involved in a little bit of everything, from Chem Club to study abroad (Vienna, Austria) to jazz band! She performed research with Dr. Brown for 2½ years (and had a wonderful time!), using an electrochemical quartz crystal microbalance to study the electropolymerization of tetraaminophthalocyanine for the development of a glucose biosensor. It's also where a very nice chemistry alumnus (Matt Davis '04), proposed to her after her last college final. They were married in Holland in 2006.

*Kathy has been a graduate student at the University of Pittsburgh since 2005, where she is an analytical chemist working on a physical chemistry project in the lab of Professor David Waldeck. In Dave's group, Kathy uses cyclic voltammetry to study the charge transfer properties of immobilized biomolecules, working first on cytochrome *c* as a model protein system and now on peptide nucleic acid. She has been fortunate to receive several fellowships and awards during her time at Pitt, her favorite being an invitation and sponsorship by the NSF to attend the 57th Meeting of Nobel Laureates in Lindau, Germany.*