

HOPE COLLEGE CHEMISTRY SEMINAR

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Control of Protein Folding and Biomolecular Interactions with Inorganic Complexes

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11:00 am, Science Center Room 3130

Abstract

Small, membrane-associating peptides play a variety of roles in biological systems including cell signaling (hormones) and defense (antibacterial agents). One such peptide is melittin. Melittin is the primary component of bee venom. It takes on an unstructured conformation in solution and forms an alpha helix in cell membranes and membrane mimics. These alpha helices aggregate on the cell surface and form pores causing cellular leakage. Melittin has been the focus of numerous research efforts. Scientists are starting to paint a clearer picture of the thermodynamics of structure formation and membrane association. However, very little is known about the kinetics of folding and binding to membranes. The reason for this is two-fold. First, standard mixing techniques are disrupt membrane mimics and do not permit a rigorously controlled environment for studying kinetics. Second, most mixing techniques cannot achieve the time scales necessary to observe the folding processes (< 1 ms). I am currently developing a generic technique based on inorganic redox chemistry to control protein folding and enable rapid "mixing" of unfolded peptides and cell membrane mimics. Using the ligand exchange properties of Co^{2+} and Co^{3+} (Co^{2+} are substitutionally labile while Co^{3+} complexes are not), I am designing a series of Co^{3+} complexes that can trap proteins in unfolded conformations. Reduction of Co^{3+} to Co^{2+} will release the protein so that it may fold and insert into cell membrane mimics. I will discuss the design strategies, synthetic schemes, and results from this work.

Biography

Matthew went to the University of Dayton for his bachelor's degree. While at Dayton he did an internship at Sandia National Laboratories in Livermore, California and worked on a project designing pollution detection equipment. Matthew then attended Northwestern University for his Ph.D. working for Thomas Meade and Mark Ratner. His Ph.D. focused on designing transition metal-modified binding ligands to study both protein-ligand interactions and better understand fundamental processes in protein electron transfer. Matthew is currently doing a postdoc at the California Institute of Technology with Harry Gray and has been awarded an NIH postdoctoral fellowship. He currently works on a number of problems including: protein-protein interactions in systems involved with electron transfer in respiration, light induced enzyme turnover, and controlling protein-membrane interactions using inorganic chemistry.