Department of Chemical Engineering
Distinguished Seminar Speaker

Dr. Steven M. Cramer
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Rensselaer Polytechnic Institute

Host: **Dr. Shashi Murthy**
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"Understanding and Enhancing Selectivity in Multimodal Chromatography"

Friday, February 28
320 Shillman Hall
11:45 a.m. – 1:00 p.m.

Sponsored by the Department of Chemical Engineering

ABSTRACT A detailed investigation into the engineering of multiple weak interactions to create selective multimodal protein separation systems was carried out. This research seeks to determine what conditions are required to achieve selective separations of similar protein variants and to provide fundamental insight into the mechanisms underlying these separations. The retention of protein libraries on several multimodal cation-exchange systems, including Capto MMC and Nuvia cPrime was first examined. While these ligands are constructed from similar functional groups (a phenyl ring and carboxylic acid), the retention of many proteins proved to be sensitive to subtle changes in the ligand chemistry and geometrical presentation. All-atom explicit Molecular Dynamics (MD) simulations were then carried out to shed light on the multiple weak interactions that resulted in the unique selectivities achieved in these multimodal chromatographic systems. Simulations were also performed to evaluate the interactions of fluid phase modifiers with proteins and to study how they enhance/reduce protein-ligand binding. A range of biophysics techniques was also employed to study the energetics, kinetics and thermodynamics of protein binding to self-assembled monolayers (SAMs) of MM ligands. This work provides fundamental understanding of the nature of these interactions at the molecular level and insight into the design of MM ligands, the roles of synergy and the modulation of selectivity using fluid phase modifiers with important implications for addressing challenging problems in downstream bioprocessing.

BIOGRAPHY Dr. Cramer is the William Weightman Walker Professor of Polymer Engineering at Rensselaer Polytechnic Institute. He is currently conducting research on several areas related to protein-surface interactions and molecular bioprocessing. Dr. Cramer is known worldwide for his expertise in separations in general. He is the Editor-in-Chief of the International journal Separation Science and Technology. Dr. Cramer was awarded the Alan S. Michaels Award for the Recovery of Biological Products. He was also awarded Rensselaer's School of Engineering Research Excellence Award, a Presidential Young Investigator award from the National Science Foundation, the Early Career Award from Rensselaer Polytechnic Institute as well as several teaching awards. Dr. Cramer is a fellow of the American Institute of Chemical Engineers, the American Institute for Medical and Biological Engineering and the American Chemical Society. He has chaired several prestigious meetings including several International HIC/RPC Bioseparations Conferences, the ACS Recovery of Biological Products Meeting and the Gordon Conference on Reactive Polymers. Dr. Cramer has published over 150 papers in peer-reviewed journals and has 9 patents. Importantly, he has produced 36 Ph.D. students who have gone on to leadership positions in the biotechnology industry and academia.

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