Department of Chemical Engineering Seminar Series

Getting through the gatekeepers: changing the selectivity of semi-permeable cellular membranes

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Abstract

The phospholipid bilayer has long been described as the cellular gatekeeper, preventing the passive transport of proteins, small molecules, and even ions. It was recently discovered that some bacteria use compartmental systems as well, contrary to the long-held belief that bacteria lack such organization, but the bacterial compartment membranes are made entirely of proteins. We explore the gatekeeping functions of each of these distinct types of membranes, studying protein and small molecule transport and sequestration in each case. Using various synthetic biology approaches, we are also engineering the protein-based parts of these systems in order to 1) sequester metabolic pathway enzymes and intermediates in the protein compartments and 2) gain control and alter the specificity of lipid membrane transporters for small molecules and proteins. In this talk, I will discuss our recent progress and provide examples of how this work will lead to advances for bioenergy and chemical production.

Speaker Biography

Danielle Tullman-Ercek is an assistant professor in the Department of Chemical and Biomolecular Engineering at the University of California Berkeley. Danielle received her B.S. in Chemical Engineering at Illinois Institute of Technology in Chicago, and her Ph.D. in Chemical Engineering from the University of Texas at Austin. She carried out her postdoctoral research at UCSF and the Joint Bioenergy Institute prior to joining Cal in 2009. Her research focuses on building protein-based devices for applications in bioenergy and drug delivery. She is particularly interested in engineering multi-protein complexes, such as the machines that transport proteins and small molecules across cellular membranes. She is a member of the Berkeley Synthetic Biology Institute and the Synthetic Biology Engineering Research Center, and was recently awarded an NSF CAREER award for her work on the construction of bacterial organelles using protein membranes.