Northeastern University
College *of* Engineering

Please join us for a
Special Chemical Engineering & Bioengineering Seminar

Wednesday, April 3, 2013
108 West Village H
11:45 a.m. – 1:00 p.m.

"Biomimetic Surfaces for Probing Virus-cell Interactions and Viral Entry Kinetics"

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ABSTRACT

Class I membrane-enveloped viruses, such as influenza, infect host cells through the endocytotic pathway. For this class of viruses, one essential viral coat protein is responsible for both the attachment of the virus to the host cell (binding) and the fusion of the viral membrane with the host membrane. Because one protein controls both processes, it is challenging to obtain entry kinetics with traditional ensemble assays. To differentiate these processes, we use single virion imaging techniques to quantify virus-host interactions in a biomimetic system that captures many features of the natural infection process. In nature, influenza virus binds to a glycolipid containing sialic acid groups present on the surface of epithelial cells in the respiratory system. This event initiates its uptake into an endosome. Once inside the endosome, the viral membrane must fuse the endosomal membrane in order to delivery its genetic material to the cytosol for replication. Viral fusion to the endosomal membrane is initiated by a conformational change in hemagglutinin, triggered by acidification of the endosome.

Different strains and serotypes of virus can have markedly different binding and fusion characteristics and characterizing this behavior is important for basic biological studies of virus entry, identifying new anti-viral drugs that target viral entry processes, and creating new diagnostic tools for differentiating virus types. The development of such platforms requires an appropriate mimic for the host cell surface that presents the receptors for viral interaction and a strategy to acidify the system to mimic the drop in pH inside the endosomal compartment to initiate membrane fusion. We developed an in vitro method for assaying binding and fusion of a single virion particle using an individual virion imaging technique and analysis of stochastic data. In this work, we mimic the host membrane chemistry in a supported bilayer coating the walls of a microfluidic device. The physico-chemical properties of the bilayer can be controlled to present different receptors and surface features to modify virus-host interactions. Recently, we developed a method to create supported bilayers from cell plasma membranes, allowing us to expand this technique to viruses that rely on proteinaceous receptors as well. I will present recent results on entry kinetics of coronavirus, a class I virus responsible for SARS outbreak in 2002.

BIOGRAPHY: Professor Susan Daniel is an assistant professor of chemical and biomolecular engineering at Cornell University. She obtained her B.S., M.S., and Ph.D. (2005) from Lehigh University in chemical engineering. In her graduate work, Susan pioneered systems to manage digital droplet fluidics using interfacial surface chemistry and drop shape fluctuation to actuate motion. Following her graduate work with Manoj Chaudhury, Susan joined Paul Cremer's research group in chemistry at Texas A&M University. There she applied her knowledge of interfacial chemistry to biological membranes and developed novel biosensing and biomimetic membrane assays. She was a post-doctoral associate with Paul for 2.5 years until she joined Cornell in 2007. Susan is the recipient of an NSF CAREER award in 2011 and the Denice Denton Emerging Leader Award in 2012. She is also the faculty advisor for the CBE graduate women's group, which serves to provide professional development and leadership opportunities to graduate students to complement their graduate education.

Refreshments will be served.