Northeastern University
College *of* Engineering

Please join us for a

Chemical Engineering Seminar

Wednesday, April 6, 2011
220 Behrakis Building
11:45 a.m. – 1:00 p.m.

"Lipid Layers: From Fundamentals to Biosensor Applications"

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ABSTRACT

The cell membrane is a highly efficient machine that is involved in a variety of cellular processes such as cell adhesion, ion conductivity, and cell signaling to name a few. We can use the fundamental understanding of the complex coupling of interactions between the lipids and proteins that make up the cell membrane to aid us in the rational design of therapeutic and biosensing devices. To that end the thermodynamics of phase separation in mixed lipid-cholesterol bilayers is studied using a highly detailed molecular theory for lipids that explicitly incorporates the conformations of the molecules and all of their relevant intra and intermolecular interactions. The phase diagrams and exact derived expressions are then used to determine the partition coefficients of protein chain anchors into biologically relevant coexisting phases as a function of temperature and degree of saturation of the chain anchors. The predictions are in excellent agreement with experimental observations. The ability of lipid molecules to respond to changes in the environment are then used to study the directionality of nematic ordering in a liquid crystal thin film in contact with a lipid monolayer. Changes in the nematic order induced by the packing of the lipid chains provides a platform for biosensors, as has been mostly developed in the experiments of Professor Nicholas Abbott's research group at the University of Wisconsin Madison. The predictions of the changes in orientation and phase behavior induced by the lipid layer provide for a microscopic understanding of the driving forces of the effects observed in the experimental systems. This theoretical work represents a major step forward in our understanding of the interactions of lipid layers with liquid crystal thin films and the results can be used as a design platform in sensor applications.

Refreshments will be served