Amgen Seminar Series in Chemical Engineering

in

Cherry Auditorium, Kirk Hall, 1 PM

Presents on April 3, 2008

Multifunctional Nanoparticle/Lipid Self-Assemblies

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Lipid bilayer membranes provide the physical barriers that define the structure, function, and stability of living cells. Specifically, they play a key role in governing molecular and phase toxicity, anesthetic action, the bioaccumulation of hydrophobic or amphiphatic pollutants, and cell-surface interactions. In addition to their ubiquity in nature, vesicles (or liposomes) self-assembled from synthetic lipid bilayers provide a biologically inspired route for the design of, for example, drug delivery systems, nanostructured materials and devices, and biosensors. We currently have two research thrusts in our laboratory related to lipid assemblies: (1) Utilizing synthetic lipid bilayers as model cell membranes to study nanomaterial and biomolecular interactions and (2) designing new multifunctional hybrid lipid assemblies for therapeutic applications. In this seminar, I will describe the techniques we use to design these systems, to evaluate their thermodynamic and transport properties (e.g. within lipid bilayers), which are governed by intermolecular and surface interactions, and to impart function. Specific projects that will be discussed include gauging nanoparticle toxicity, elucidating peptide-membrane interaction mechanisms for drug delivery, and creating inorganic nanoparticle/lipid assemblies.

This seminar series is at the University of Rhode Island is made possible through the generosity of Amgen, West Greenwich, R.I.