Carnegie Mellon
Materials Science and Engineering Seminar Series

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"Self-assembly in biological systems: From cytoskeletal proteins to curvature stabilizing lipids"

Friday,April 11, 2008
11:30 A.M. Seminar in Baker Hall A51

In this post-genomics proteomics era there is renewed interest in elucidating collective interactions between cellular proteins and associated biomolecules leading to supramolecular structures, with the ultimate goal of relating structure to function. The talk will show examples of our research consisting of learning from, and building upon, the many illuminating examples of (out-of-equilibrium) assembly occurring *in vivo*. For example, the nerve cell cytoskeleton provides a rich variety of highly ordered bundles and networks of interacting neurofilaments, microtubules (MT), and filamentous actin, where the nature of the interactions, structures, and structure-function correlations remain poorly understood. In recent work in far simpler reconstituted protein systems in the presence of counter-ions, using a combination of synchrotron x-ray diffraction, electron microscopy, and optical imaging, we have demonstrated how 3D MT bundles and 2D network-like bundles may be assembled *in vitro* revealing unexpected structures not predicted by current electrostatic theories of polyelectrolyte bundling. In another set of experiments we will describe recent work on lipid-protein and lipid nanotubes through membrane shape evolution processes involving protein templates and curvature stabilizing lipids. Indeed, similar membrane shape changes, occurring in vivo for the purpose of specific cellular functions, are often induced by protein scaffold recruitment through interactions between membranes and proteins.

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Cyrus Safinya is a Professor in the Materials, Physics, and Molecular, Cellular, and Developmental Biology Departments at the University of California at Santa Barbara. He received a B.S. in Physics and Mathematics from Bates College and Ph.D. in Physics from the Massachusetts Institute of Technology. Before joining the faculty of the University of California at Santa Barbara, he was a research physicist at Exxon Research and Engineering Company in New Jersey and conducted research on the structure of complex fluids and biological membranes. Current research is centered on the elucidation of key parameters, which control the interactions between proteins derived from the eukaryotic nerve cell cytoskeleton and lead to hierarchical structures, with the ultimate goal of relating structure to function, and developing synthetic carriers of genes and short-interfering RNA for gene delivery and silencing applications. He was a Henri De Rothschild Foundation Fellow, awarded by the Curie Institute, in 1994. He is a fellow of the American Physical Society and the American Association for the Advancement of Science.