The role of mechanics in designing cellular nanocomponents and synthetic cells

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Abstract
Substantial progress has been made in recent times in the design and development of synthetic cell-like compartments using amphiphilic molecules such as lipids, block copolymers, and combinations thereof. The chemistry and self-assembly features of these molecules coupled with advances in precision microfluidics has given us access to shapes beyond spherical vesicles. Furthermore, we are now able to image the dynamic response of these compartments in response to environmental stressors. This leads us then to following question: can we use these data to build a predictive framework of shape, size, and dynamic interactions of these synthetic cells? As it turns out, this problem is fairly complex invoking surface mechanics and interfacial transport. In this talk, I will share some perspectives on how interfacial transport phenomena coupled with surface mechanics can form the foundation of such a predictive framework and identify some challenges associated with the mathematical and computational complexity of such problems. I will also comment on how insights gained from these approaches can be useful for controlling chemical reactions on surfaces, the next big challenge in synthetic cell design.

Short Bio: Padmini Rangamani is an associate professor in Mechanical and Aerospace Engineering at the University of California, San Diego. She joined the department in July 2014. Earlier, she was a UC Berkeley Chancellor's Postdoctoral Fellow, where she worked on lipid bilayer mechanics. She obtained her Ph.D. in biological sciences from the Icahn School of Medicine at Mount Sinai. She received her B.S. and M.S. in Chemical Engineering from Osmania University (Hyderabad, India) and Georgia Institute of Technology respectively. She is the recipient of the ARO, AFOSR, and ONR Young Investigator Awards, and a Sloan Research Fellowship for Computational and Molecular Evolutionary Biology. She is also the lead PI for a MURI award on Bioinspired low energy information processing from the AFOSR.