



Department of Chemical Engineering Special Guest Seminar



Neha Kamat

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Host: Thomas J Webster
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**“Towards the
Construction of
Protocells:
Designing Optically
Responsive
Membranes”**

Wednesday, July 23
325 Shillman Hall
11:45 a.m. – 1:00 p.m.

*Refreshments will be
served*

ABSTRACT Single cells coordinate simple physical and chemical processes to yield complex behaviors, like movement, membrane deformation, and spatially organized chemical reactions. The construction of minimal systems, or synthetic cells, achieves two main purposes: It creates a tool for recreating and studying basic physical cellular processes, and it defines a new class of biomaterials, that could be used as sensory and therapeutic particles. My work has focused on the design of two major components of cells, the membrane and the genetic polymer, by using a mixture of biotic and abiotic materials to build cell-like systems through their co-assembly. I will describe the design of bilayer membranes made from diblock copolymers to which we can impart photoresponsive properties to induce light-triggered vesicle rupture and create optically active mechanical stress sensors. I will describe how we can use microfluidic and soft lithography techniques to precisely control the size, internal solute loading, and spatial position of vesicles to control vesicle architecture and aid the design of sensory arrays. I will also discuss recent work exploring how RNA oligomers can be coupled to bilayer membranes and how the membranes' surface can be used as scaffolding to improve the rate and efficiency of non-enzymatic RNA replication chemistries. Designing bilayer-based assemblies with controlled physical and chemical properties will aid the design

of cellular-mimetic systems to study biophysical processes involved in membrane deformation and transport. In addition, these assemblies will create a new class of biomaterial interfaces, able to use membrane components, genetic polymers, and non-biological materials to communicate with cellular systems.

BIOGRAPHY Dr. Neha Kamat is currently a NASA Postdoctoral Fellow working in Prof. Jack Szostak's laboratory at Harvard University and Massachusetts General Hospital, joining the laboratory's efforts to develop a simple, artificial cell. She received her undergraduate degree in Bioengineering from Rice University, where she worked with Prof. Jennifer West on gold nanoshell-mediated cancer therapy. She received her Ph.D. in Bioengineering from the University of Pennsylvania where she worked with Prof. Daniel Hammer and was a NSF Graduate Research Fellowship recipient. As a graduate student, she worked on designing photoresponsive polymer vesicles and using microfluidic techniques for vesicle construction. Her research interests are in the areas of diblock copolymer membranes, microfluidic techniques for vesicle assembly, membrane stress sensors, and bottom-up construction of cellular mimetic systems.