



## Department of Chemical Engineering Seminar Series

Tuesday, November 3, 2009

Presentation: 1:30 p.m., 1017 H.H. Dow

Refreshments to Follow: 3158 H.H. Dow (Pod Room)

### Arup K. Chakraborty

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*Understanding adaptive immunity: A crossroad of the physical, life, and engineering sciences*

Complex organisms, like humans, have an adaptive immune system that enables them to combat diverse pathogens. This flexible system can also go awry, and many diseases are the direct consequence of the adaptive immune system failing to discriminate between markers of self and non-self. In spite of major discoveries regarding how the adaptive immune system is regulated, an understanding of the principles that govern how an immune or autoimmune response emerges has been elusive. This missing basic knowledge hinders our ability to develop therapeutics. An important barrier to developing the mechanistic principles that govern adaptive immunity is that the pertinent processes involve cooperative dynamic events with many participating components that must act collectively for a phenomenon to emerge. Moreover, these processes span a spectrum of scales, ranging from molecules to tissues to the entire organism. This hierarchically organized cooperativity with feedback between the scales makes it difficult to intuit underlying principles from experimental observations. Stochastic effects further confound intuition. I will describe work which brings together approaches rooted in statistical physics with experiments (carried out by key collaborators) to shed light on a problem that begins with molecular considerations and closes with implications for humans infected with HIV.

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