The Center for Control, Dynamical Systems, and Computation
University of California at Santa Barbara
Spring 2008 Systems Biology
Seminar Series Presents

Systems biology of information processing in biological networks

Ilya Nemenman
Los Alamos National Laboratory

Tuesday, April 1, 2008 11:00am-12:00pm ESB 1001

Abstract:

In the recent years, biology has been shifting its focus from studies of molecular components of organisms to attempting to understand entire biological systems as a whole. This has opened up new opportunities for the physical way of thinking in biology, and it allowed us to wonder if there exists a biological systems theory as general as, say, the Landau theory in physics, and thus capable of "explaining" many diverse biological implementations of the same physical phenomenon at once. In this talk, I will describe a very small corner of systems biophysics, where the first steps toward a general understanding may have already been made. Here, using the tools of information theory and statistical physics, we have been able to make small steps toward formulation of and answers to questions like: What are the signal processing capabilities of biological networks? Which functions can they perform? How important is stochasticity? How can we understand network macroscopic dynamics without microscopic data? How can the networks be coarse-grained? Interestingly, very similar questions and tools can be used in the domain of cellular regulatory networks and systems neuroscience, and the talk will emphasize the similarity.

About the Speaker:

Ilya Nemenman is a Technical Staff Member at the Los Alamos National Laboratory and Adjunct Assistant Professor in the Department of Physics, University of New Mexico, Albuquerque, NM. He received his MS in Physics from San Francisco State University in 1997 and PhD in Physics from Princeton University in 2000. His research interests include using methods of theoretical physics and machine learning to develop functional, coarse-grained models of information processing in systems biology. This includes, in particular, reverse-engineering cellular networks and creation of efficient tools for their modeling and analysis.