



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

Using Control Theory to Study Biological Systems: Perfect Adaptation in the Osmo-Response Signaling Network of *S. Cerevisiae*

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Friday, January 18, 2008 3:00-4:00pm Harold Frank Hall 1104

Abstract:

Yeast cells must carefully regulate their internal osmolyte concentrations, particularly in response to osmotic changes in their environment. The protein Hog1, embedded in a well-characterized signaling network, is an important mediator of this osmo-response. We measure Hog1 dynamics in response to hyper osmotic shocks at the single cell level, and find that the steady-state level of Hog1 activity in response to a step input is identical to its pre-stimulus level, a behavior termed perfect adaptation. We use simple control theory ideas to guide our experiments and find the biological process responsible for the perfect adaptation: osmolyte production providing integral feedback. Furthermore, we show that while the gene expression response mediated by Hog1 is not required for the perfect adaptation, Hog1's ability to interact with other proteins (through its kinase activity) is essential.

About the Speaker:

Carlos A Gómez-Uribe has been at MIT since 1998, where he is currently working toward a PhD in Medical Engineering at the Harvard-MIT Division of Health Sciences and Technology. Before enrolling in this program, he became a PhD candidate in Electrical Engineering from MIT, in the area of control, signal processing and estimation. He holds a masters degree in Electrical Engineering and Computer Science (EECS), and undergraduate degrees in EECS and Mathematics, all from MIT. His current research has been focused on biological networks, where he has been involved in largely experimental projects, as well as in developing model reduction tools for stochastic models of chemical kinetics.
