

Center for Applied Mathematics and Center for Biocomplexity Colloquium

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***“Graph-theoretic Criteria for Injectivity and Unique
Equilibria in Biochemical Reaction Networks”***

Tuesday November 11, 2008

4:00pm

356 Fitzpatrick Hall

Tea at 3:30pm in 257 Hurley

Biochemical reaction network models give rise to dynamical systems that are usually high dimensional, nonlinear, and have many unknown parameters. Due to the presence of these unknown parameters (such as reaction rate constants) direct numerical simulation of the chemical dynamics is practically impossible. On the other hand, we show that important properties of these systems are determined only by the network structure, and do not depend on the unknown parameters. For example, some reaction networks may give rise to multiple positive equilibria (i.e., they may function as a "biochemical switch") while others cannot exhibit multiple equilibria for any values of the reaction rate parameters. We will point out connections between the capacity of a reaction network to become a biochemical switch, and properties of signed graphs and digraphs that encode the combinatorics of matrix sign patterns of the associated dynamical system. Also, we will point out connections with classical problems in algebraic geometry, such as the real Jacobian conjecture.