AMS 537 / PHY 559 Course outline

Course lecturer: Tom MacCarthy
Room: Laufer Center Seminar Room 101

Topics
Modeling of chemical reaction networks and biochemical kinetics;
Michaelis-Menten Equation, Enzyme reactions, Hill equation
Gene Regulatory Network Models, homodimerizing TFs
Generalized Mass Action and S-system modeling
Dynamics/response time of simple gene regulation
Autoregulation and cooperativity
Local Stability, Limit cycles, bifurcations
Network Motifs, Chemotaxis, Kinetic proof-reading
Self v non-self recognition in immune system
Optimal gene circuit design
Optimal regulation in varying environments,
Glycolysis model and non-dimensionalization
Network theory: centrality measures, diffusion in networks, random walks
Population genetics, Hardy Weinberg law
Irreversible/reversible mutation models
NK Model and neutral networks

Reference Books
Brian Ingalls, Mathematical Modeling in Systems Biology
Uri Alon, An introduction to Systems Biology
M.E.J. Newman, Networks: an introduction
Eberhard Voit, A first course in Systems Biology