Professor: Alan Moses Office: ESC 4073 Email: alan.moses@utoronto.ca

CSB435H1S: Regulatory Networks and Systems in Molecular Biology

Description
This course will expose students to several of the best-understood regulatory networks in molecular biology, as well as recent technological and methodological developments. Emphasis is on the mechanistic basis for these systems, methods and models for quantitative analysis of regulatory networks, and the biological logic they encode.

Course outline

I. Introduction to regulatory networks and systems biology
    1. Control theory: cells as circuits
    2. High-throughput molecular biology for complex systems
II. Decision-making: the lysis/lysogeny circuit in Lamda phage
    1. Introduction to bacteria and phages – why a switch?
    2. The mechanism of the switch: Cl, Cro and O_{R1-3}
    3. Modeling transcriptional regulation
    4. Stochastcity in gene networks
III. Response to the environment: gal network in budding yeast
    1. Introduction to nutrient sensing – why regulate pathways?
    2. The feedback loops: gal4, gal3 and gal80
    3. Systematic studies and complexity of the gal network
    4. Evolution of the gal network
IV. An intrinsic oscillator: The eukaryotic cell cycle
    1. Overview of the cell cycle
    2. Regulation at the transcription and posttranslational levels
    3. Checkpoints and loss of control: the cell cycle and cancer
    4. Systematic studies and mathematical models of the cell cycle
V. Developmental networks: patterning the fly
    1. Overview of Drosophila development
    2. The AP network
    3. Modeling developmental networks
VI. General principles in regulatory networks?
    1. Systematic data on regulatory networks
    2. Network motifs
    3. Network properties: dynamics, perturbations
    4. Evolution of regulatory networks

Evaluation
Attendance and participation (20%), mid-term exam (25%), paper (25%), final exam (30%)

Textbooks/reading materials
Ptashne M. *A Genetic Switch*, 3rd edition (2004) CSHL Press
Morgan DO, *The Cell Cycle: Principles of Control* New Science Press 2007

Readings from papers will also be assigned.