Analysis of Transcriptional Networks BMB 960/GEN 800/CMB 800 Spring 2006

Gene transcription studies have often focused on individual genes, transcription factors, and cis-regulatory elements. In contrast, traditional genetic analyses have described gene networks, but usually at a qualitative rather than quantitative level. With the advent of genomics, gene arrays and other "-omic" approaches, quantitative system-wide analysis of transcriptional networks is now reshaping the fields of genetic and transcriptional studies. Systems biology may allow us to understand entire genome-wide transcriptional regulatory networks, the evolution of such systems, and how they are perturbed in development and disease.

To help seminar participants understand current cutting-edge studies, the instructors will provide background information on biological and mathematical approaches used in transcriptional systems studies. We will tailor introductory material so that students from both biological and mathematical/statistical areas will profit. The seminar will focus on current examples from the literature of network analysis and modeling in bacterial and eukaryotic systems, presented by students and instructors.

The course will complement a Genetics Symposium to be held in May 2006 on this topic.

Instructors
David Arnosti, Lee Kroos (Biochemistry and Molecular Biology), Chichia Chiu (Mathematics)

Schedule and organization. The two-credit class will meet once a week for two hours (two 50 min sessions plus break). The meeting time will be Wednesday afternoons at 2:30 p.m. Course grade will be based on the student's presentation, as well as written questions derived from weekly reading, and class participation.

1. Overviews and definitions. Course organization, scheduling. (Kroos, Arnosti, Chiu)

2. General approaches.
    a. Methodology for gathering information about transcription (Kroos, Arnosti).
    b. Analysis of systems: dynamic, stochastic, and logic approaches (Chiu)

3. Identification of transcriptional networks (Arnosti, Kroos).

4. Creating transcriptional systems from first principles.

5. Analysis of simple genetic circuitry.

6.–10. Analysis and modeling of networks.

11. –15. Inferring networks from datasets.