

# ELEN E6950 Topics in ECE

## Mathematical Modeling of Gene Regulatory Networks

**Lecturer:**

Prof. Predrag Jelenkovic  
Office hours: Wed. 4-5pm  
Office: 812 Schapiro Research Bldg.  
Phone: (212) 854-8174  
Email: predrag@ee.columbia.edu  
URL: <http://www.comet.columbia.edu/~predrag>

**TA/Grader:** TBA**Day, time and place:** Tue, 4:10-6:40pm, 424 Pupin (likely to be changed to Tue 5:30-8pm, to avoid conflict with another related course)**Credits:** 3**Prerequisites:** Some knowledge of molecular biology and mathematical sophistication is desirable (e.g. E4060 and E6711).**Description:** Recent successes in describing genomes of humans and model organisms raise a new set of challenges aimed at describing the complex dynamical mechanisms of gene regulation and protein interactions. Some of the fundamental features of these complex and large-scale systems include: nonlinearity, transport delay, stochastic phenomena, and intricate feedback mechanisms. The course provides an overview of recently proposed models that include “logical” or “Boolean networks”, nonlinear differential and stochastic equations as well as the hybrid approaches. Special emphasis will be given to applying models of computer networks to gene regulation.**Project(s):** small numerical or simulation problems will be assigned**Required text:** lecture notes and research papers will be used. In addition, the following textbook is recommended:

- [1] Computational Modeling of Genetic and Biochemical Networks (Computational Molecular Biology) by James M. Bower (Editor), Hamid Bolouri (Editor), MIT Press 2001, ISBN 0262024810.

**Homework:** weekly assigned.**Grading:** Hwk (20%) + Midterm (35%) + Final (45%); depending on the number of student, the final is likely to consist of a project and a written paper.**Software requirements:** Quantitative homework assignments may require the use of mathematical software packages MATHEMATICA or MATLAB.