

Description of the course Math609/BMC609/ Biochem609/BMI609:
Mathematical Methods in Systems Biology
Spring 2016

Instructor: Dr. Gheorghe Craciun, Dept. of Mathematics and Dept. of Biomolecular Chemistry

Intended audience: Students in biochemistry, biology, chemistry, and related disciplines with an interest in quantitative approaches in biology; and students in mathematics, physics, computer science, engineering, and related disciplines with an interest in biology.

Some of the **topics** to be covered are:

- Introduction to mathematical and computational modeling
- Introduction to MATLAB for visualization of biochemical dynamics
- Graphical representations of biochemical systems
- System states and steady states
- The law of mass action and metabolic networks
- Enzymes, substrates and saturating kinetics
- Glycolytic oscillations
- The lac operon in *E. Coli*
- Cell cycle control, budding yeast cell cycle models
- Activator-inhibitor and positive feedback systems
- Understanding large chemical systems based on their network structure
- Robustness and sensitivity analysis

An important part of the **graduate student effort** in this course will be individual projects and collaborative interdisciplinary team projects. The choice of any particular project's topic will be based on student interest, and **could be based on a student's ongoing research interest**. Each project will emphasize a particular biological problem, and may feature the following stages: understanding the biological interaction network involved in the problem, gathering experimental data from literature, setting up a mathematical or computational model, implementing the model using MATLAB or some other software, and comparing the computational and experimental results.

