

Course and Section: 462:201
Course Title: Projects in Mathematical Biology
Day and Time: MWF 2.00PM-3.00PM
Instructor: Somdatta Sinha
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Topics

This course aims to expose students to different modeling methods to describe and study a variety of biological systems/processes. Different mathematical approaches will be introduced and the biological processes that can be modeled using these methods will be discussed. Experience and familiarity with any programming language and tools like MATLAB, XPP, etc. will be useful for students, but not essential.

We will introduce/recapitulate the mathematical methods to study dynamic processes (temporal, spatial and spatiotemporal) using discrete and continuous models (deterministic and stochastic formalisms), individual-based modeling techniques, static descriptions using networks/graphs, and basic regression-based statistical models to analyze time series data.

Few representative biological topics on which mathematical models will be discussed are - ecology (population dynamics), epidemiology (disease dynamics), pattern formation and collective behavior in tissues, biochemical pathways and networks.

Students will:

- learn how to look at a biological problem from modeling perspective;
- be exposed to different techniques for effective modeling of biological systems;
- become comfortable with reading primary biological modeling literature and presentation;
- complete a final project on a topic of their choice, including oral and written presentation

Activities

Final grades will be assigned as follows:

Homework and written work 20%, class presentations 20%, Project (including final report and presentation) 60%.

Each of the mathematical approaches will be discussed in the initial part of the course. Examples of biological problems that can be modeled using the approach will be presented. Relevant papers from the literature will be assigned for study. The papers will be discussed in class in brief. A summary of each of these papers (not more than 2 pages) has to be submitted as written (typed) work by all, and class presentations will be made by students during which in-depth discussions will be done. Assignment of papers to students will be done randomly, and submissions must be done by the due date.

A final project will be proposed by students (if necessary in groups) by the end of the first month based on their interest. Projects can be method-based or biological problem-based. A complete report in the form of a journal paper will be written up, and presented in the class. Full details for the final projects will be discussed in class.

There will not be a final exam.

Reading list will be given in the class based on topics.