New undergraduate course: Introduction to Mathematical Biology MA463, Spring 2008

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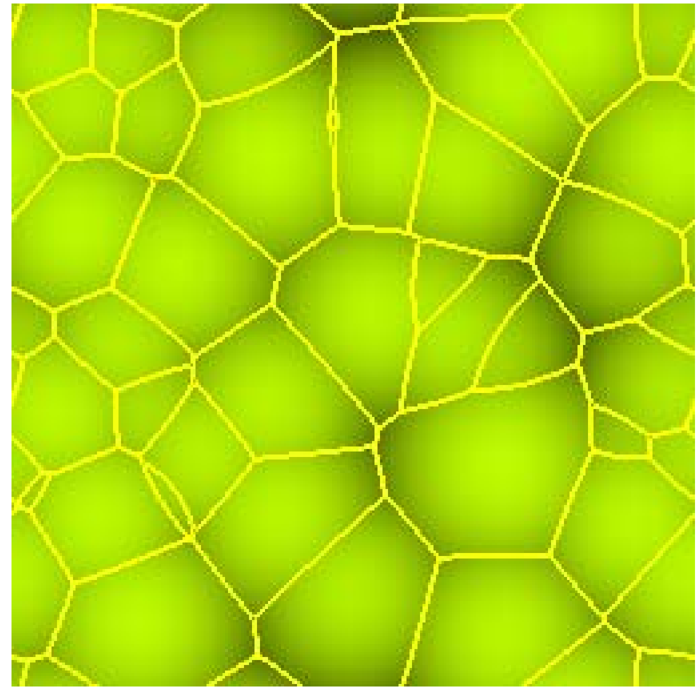
Course webpage: http://personal.stevens.edu/~nstrigul/MA463/index_IMB.html



Course description

The goal of this course is to give students an understanding of the biological-mathematical interface, and how mathematics contributes to the study of biological phenomena. To apply modeling (both mathematical and experimental models) to a natural system, we always simplify it by making both implicit and explicit assumptions. This course teaches students to see the hidden assumptions and understand their role in the results of model applications. Specific examples include: dynamics of infectious diseases (flu epidemics and AIDS), natural recourse management (fisheries), forest dynamics, interacting species (resource competition, predator-prey, and host-parasite models), spatial models, enzyme kinetics, chemostat theory, and bioremediation. In this course biology students will learn to formulate their specific questions in a mathematical way, while mathematics students will learn what constitutes biologically relevant questions, and how to accept the high level of uncertainty that exists in biological research. A substantial part of the course will use analytical methods in concert with computer simulations using the Mathematica software.

Course program

Biological systems as complex adaptive systems. Discrete and continuous single species models. Age- and size- structured populations. Natural resource management, fisheries. Enzyme kinetic. Microbiological models: biodegradation and chemostat theory. Multi-species communities: 1) Competition models, coexistence, 2) Predator-prey models. Optimal foraging, 3) Host-parasite dynamics. Infectious diseases: 1) SIR models, 2) Flu epidemics, AIDS. Forest modeling. Spatially-distributed models: 1) Conservation equation, 2) Random walk and diffusion. Fick's laws. Fitting models to data. Optimal experimental designs.

Prerequisites: calculus, differential equations and linear algebra.