

## Math 49S, Spring 2005

### Applications of Mathematics to Physiology and Medicine

**Instructor:** Professor Michael C. Reed

**Time:** MWF 10:20-11:10

**Prerequisites:** Math 32 or 32L or the equivalent, high school biology, and an interest in human physiology.

**Curriculum 2000 requirements:** Math 49S fulfills M, QID, R, W, NS.

This seminar, open only to freshmen, will be offered in Spring 2005. Topics usually include: the heart and circulation, heat and temperature regulation, oxygen uptake in the lungs, the immune system and infectious diseases, nephrons and the kidney, ovulation number in mammals, chemistry and cell metabolism, sensory neurobiology. Other topics may be substituted depending on the interests of the students enrolled.

The structure of the course will be as follows. During the first half the instructor will lecture and students will do background reading and work in groups on problem sets, often presenting their group work to the class. Before Spring Break, each student will choose a research project from a list of about 30 possible projects presented by the instructor or create a project based on their own interests (with the approval of the instructor). During the second half of the semester, each student gives two 25 minute lectures to the seminar on his or her research project and writes a 20 page paper. There is no midterm. The final exam covers the problem sets from the first half of the semester.

Recent student research topics were: "Mathematical Models of the Control of Ovulation," "Mathematics and Physiology of the Human Eye," "The Vestibular System: the Center of All Balance," "Mechanical Heart Valves and Models of Stenosis," "Mathematical Epidemic Models," "Diabetes and a Mathematical Model of the Oral Glucose Tolerance Test," "Information Theory and Molecular Biology," "A Biological and Mathematical Analysis of HIV," "Mathematical Modeling of Muscle Crossbridge Dynamics," "Information Theory and Molecular Biology," "Two-step Chemotherapy, a Mathematical Model," "Increased Intracranial Pressure: A Biological Investigation and a Mathematical Model," "The Immune System: a Biological and Mathematical Explanation," "Applications of Mathematics to Animal Scaling," "DNA Sequence Analysis and Pairwise Alignment."