

BIOL/MATH 320 – Biomathematics Spring 2004

The course focuses on developing quantification skills for biomathematics- the discipline that uses mathematical models to help understand phenomena in biology and related sciences through analysis and interpretation of experimental data. The skills developed in the course include the ability to look at an unfamiliar problem, analyze it to determine the type of data necessary to address the problem, select the appropriate mathematical tools to be applied to the available data sets, and draw conclusions on the adequacy of the results. This course will include presentations by and laboratory sessions with faculty of the University of Virginia School of Medicine.

Class meeting times: Lectures: Mondays, Wednesdays, Fridays, 9:30-10:20 AM, Guion A 201
Laboratory: Thursdays, 2:45-5:30 PM, Guion A 201 and A205

Instructors:	Dr. Raina Robeva	Dr. Robin Lee Davies
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Office hours:	1:30-2:20 PM Wednesdays	10:30-11:20 AM Mondays
	9:20-10:20 AM Tuesdays & Thursdays	11:30-12:20 AM Fridays

Assignments and Grading: You will be required to keep a **laboratory journal**, in which you record your thoughts and ideas regarding possible solutions to the data analysis and modeling problems that we explore during the course of the semester. For the duration of the course, there will be several **small project assignments** and one **large project assignment**. Some of the work on these projects will be accomplished during class time. The projects will require written and oral reports and will be graded based on the quality of results as well as with respect to writing style and quality of presentations. The large project will require a substantial written report (“research” paper) and a 30 to 40 minute oral presentation (scheduled for Thursday, April 22, during our last lab period). Teamwork will be emphasized throughout the course. Because of the nature of the course, there will be no mid-term or final exam.

In determining your final grade for the course, your scores on the individual items will be weighted as follows:

Small projects:	35%
Large project:	35%
Journal:	20%
Attendance and Participation:	10%

Attendance: Because of the collaborative nature of Biomathematics, which will be reflected in this course, it is essential that each member of the team be present for each class meeting. If you must be absent for any reason, please notify the instructors and whichever of your classmates is acting as your partner or team members. Also, many of the kinds of problems we will be

addressing may not have a single obvious solution. When faced with such situations, biomathematicians will discuss the problem among themselves and with the clinicians or other scientists with whom they may be working, or others with relevant experience. Such "brainstorming" can be very valuable, and solutions are often discovered as a result of the free exchange of ideas. Therefore, participation in class discussions will be expected.

Tentative Weekly Schedule

Week of	Topic
January 12	Introduction, Population models, Types of models
January 19	Biology of populations; Analysis of bacterial population data; Discrete and Continuous models – Differences, similarities, relations
January 26	Randomness, Gaussian and Non-Gaussian distributions; Goodness of fit; The nature of data, when to use nonlinear least squares, bootstrapping
February 2	Goodness of fit II; Interacting Populations
February 9	Interacting Populations II; Infections, Epidemics, and Epidemiology
February 16	Epidemiology II
February 23	Genetics and selection, Non-Hardy-Weinberg
March 1	Spring break
March 8	Quantitative genetics
March 15	Endocrinology and hormone pulsatility
March 22	Modeling of Hormone Feedback Networks; Circadian rhythms and periodicity
March 29	DNA chips; Rhythm analysis of gene array experiments
April 5	Quantitative Questions & Issues of Irregularity; Analysis of Neonatal Heart Rate Time Series
April 12	Diabetes and Control of blood glucose levels; Risk analysis of blood glucose data
April 19	Ligand-Binding Problems; Student presentations, reports, discussions

Collaborating Biomathematicians:

Dr. Michael Johnson is a Professor of Pharmacology and Internal Medicine (Endocrine Division), has a Ph.D. in biophysics with a specialty in mathematical modeling of biological processes, and 30 years experience in biomathematical technology. His post-doctoral fellowship was in the Clinical Endocrinology Branch at the National Institutes of Health. Dr. Johnson has written more than 280 publications and edited 8 books. The majority of these involve mathematical modeling of various biological processes.

Dr. Boris Kovatchev is an Associate Professor in Psychiatric Medicine and Health Evaluation Sciences has a Ph.D. in Mathematics with a specialty in probability and statistics, and ten years experience in biomathematical technology. Dr. Kovatchev has authored many publications and two of his inventions, filed with the UVA Patent Foundation, have attracted interest and research support from Lifescan, Inc. and Roche Diagnostics. In addition to his own original research, Dr. Kovatchev provides support to a wide variety of projects in behavioral medicine, pediatrics, rehabilitation medicine, and cardiology.

Dr. Martin Straume is an Associate Professor of Research in the Division of Endocrinology and Metabolism in the Department of Internal Medicine of UVA's Health System. Dr. Straume has a Ph.D. in biochemistry and specializes in computer-based algorithm development and implementation for custom data modeling and analysis of biological systems, and human diseases and disorders. Dr. Straume has numerous publications in biomathematics and is currently the biomathematician of the National Science Foundation Center for Biological Timing at UVA.