BIOLOGY 5910
MATHEMATICAL MODELING IN BIOLOGY
Spring Semester, 2020 Syllabus

Time and Place:	Monday and Wednesday 1:25–2:45, LS 111
Instructor:	Fred Adler
Offices:	304 LCB and 319 South Biology
Office Hour:	TBA
Optional text:	F. R. Adler, *Modeling the Dynamics of Life*
Supp. texts:	E. S. Allman and J. A. Rhodes, *Mathematical Models in Biology*
	L. Edelstein-Keshet *Mathematical Models in Biology*
	S. P. Otto and T. Day, *A Biologist's Guide to Mathematical Modeling*
	G. Ledder, *Differential Equations, A Modeling Approach*

The Course: Biology 5910 is designed for life scientists with a likely rusty background in calculus who wish to become comfortable with the mathematical techniques used to study biological systems. The project is central to this course, and the course material is designed to help get results that are genuinely useful.

Expected Learning Outcomes: Ability to write down simple mathematical models of fundamental biological processes, to understand their consequences through simulation and mathematical analysis, and to apply these skills to a problem from your own research. Also, to be able to critically evaluate the assumptions and structure of mathematical models in papers and talks.

Homework: Written homework will be handed out on Tuesdays and due the next Tuesday.

Computation: Simulating on a computer is nearly essential for studying any mathematical model. I use R for everything, and have put the link to download this free software on the website. There will be component of computer simulation in much of the homework, based on computer programs presented in class and available on the web site.

Exams: There will be one mid-term, and a take-home final.

Projects: By the fifth week of the semester, I will have met with each student to discuss a project, ideally generated from your own research or interests, that is interesting, worthwhile and feasible. Within these limits, almost any topic is fair game, but some connection to the course material would be gratifying.

Grading: Grades will be weighted according to the following scheme.

Midterm	20%
Take-home final	20%
Written homework	20%
Project	40%

TENTATIVE COURSE SCHEDULE
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Week of	Topic	Relevant book sections
Jan 06	Modeling, calculus and optimization	Chapters 2 and 4, Sect. 3.3
Jan 13	Discrete-time dynamical systems	Chapter 1, Sect 3.1-2
Jan 20	Meet the matrix	Supplementary material
Jan 27	Differential equations	Chapters 4 and 5.1–5.3
Feb 03	Systems of differential equations	Sections 5.4–5.7
Feb 10	Modeling infectious diseases	Chapters 4 and 5
Feb 17	Review and midterm	Chapters 1-5
Feb 24	Project ideas presented	Chapters 1-8
Mar 02	Probability theory and stochastic models	Chapter 6-7
Mar 16	Random walks and diffusion	
Mar 23	Statistics	Chapter 8
Mar 30	Project progress reports	Chapters 1-8
Apr 06	Special topic	
Apr 13	Finish projects	
Apr 20	Project presentations	

ADA statement: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

Accommodations policy: The instructor does not grant content accommodation requests as the course content fulfills legitimate pedagogical goals.

Academic Misconduct: Academic misconduct includes, but is not limited to, cheating, misrepresenting one's work, inappropriately collaborating, plagiarism, and fabrication or falsification of information. It also includes facilitating academic misconduct by intentionally helping or attempting to help another to commit an act of academic misconduct. Any assignment or test associated with academic misconduct will receive no credit, and may lead to a failing grade and reporting to the higher administration.