

Physics 7097
Biological Physics – Fall 2005
Physics Department, University of Florida

Instructor

Prof. Steve Hagen
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Class meetings

Tuesdays / Thursdays, 10:40 - 11:55 am
Room 2260 NPB (CME conference room)

Course Description and Goals

This course aims to introduce the physical science graduate student to the rapidly expanding field of biological physics, where physical arguments and reasoning can provide significant insight into the design and function of biological systems. We will introduce major themes in biological physics, with an emphasis on the statistical physics of biological systems at the microscopic or molecular level. Relevant concepts in biology and chemistry are introduced as needed: the course requires no detailed knowledge of biology or chemistry beyond the basic, high-school level. The course does not however replace a standard introductory biology course.

Textbook

Biological Physics: Energy, Information, Life
by Philip Nelson (2004)
ISBN 0 7167 4372 8

This is a physics textbook, but it is more readable and less mathematical than many other physics texts. The book operates on two parallel tracks: Track I is aimed at undergraduate students, while Track II is aimed at senior undergraduates and graduate students. We intend to emphasize Track II.

Schedule of Topics

We are using *Nelson* as the basic structure, so we will start by following his textbook closely (see below). We will not follow slavishly to the end, however. Especially towards the end of the semester, we will probably expand on some topics and introduce some other new ones. Depending on the interests of the class, these may include (1) Noise in gene expression, (2) Information theory in molecular biology, (3) Virus capsid structure and stability, (4) Mechanical stretching and irreversibility in biomacromolecules, etc. Below is the outline for *Nelson*:

Chapter 1	(Review)	Energy & free energy
Chapter 2		
Chapter 3	(Review)	Probabilities and distributions
Chapter 4		Random walks, dissipation, and diffusion
Chapter 5		Dynamics at low Reynolds number

Chapter 6	(Review)	Entropy, temperature, and free energy
Chapter 7		Entropic forces in biology
Chapter 8		Chemical forces & self-assembly
Chapter 9		Cooperative transitions, folding
Chapter 10		Enzymes and molecular machines
Chapter 11		Membranes and channels
Chapter 12		Nerve impulses

Graded Assignments

In-class writing: It is very important to keep up with the class and the readings. I will regularly give short in-class writing assignments (10-15 minutes) to verify that people are staying current.

Problem sets: I will assign occasional homework based on the Track I and Track II problems in *Nelson*. Since there is no grader for this course, there will not be very many of these assignments.

Presentation: To encourage you to read and discover some interesting biological physics on your own, I would like you to give an in-class presentation on a topic of your choice. The presentation will be reasonably short (~30 minutes) and can cover any topic at the interface of biology and physics. You'll need to discuss your topic with me in advance.

Final examination: I do not intend to give a final examination in Fall 2005.

Attendance

Students should plan to attend class consistently. Students who need to miss class occasionally may ask (in advance) for a make-up of missed work. Students who frequently miss class will not be granted make-ups and should anticipate receiving a poor course grade.

Incomplete Grades:

Under UF policy, a student who requests an incomplete grade must (1) be prevented by a severe and unusual situation from completing the course, AND (2) have notified the lecture instructors in a prompt and timely manner of that situation, AND (3) be earning a passing grade at the time the request is made. A lack of diligence in contacting the instructor will surely lead to denial of the request.

Students with disabilities

Students occasionally request special accommodations for disabilities or severe medical situations. Such students must first contact the Dean of Students Office. That office will provide documentation, which the student must bring to the instructor. Under no circumstances will any special accommodations be provided to students who lack proper UF documentation of a disability.

Academic Honesty

I expect students will hold themselves to a high standard of academic honesty. Violations of academic honesty, including plagiarism and related crimes, will result in a failing grade.