

Biophysics • BBMB 324

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Office Hours: M 10-12, T9-10,11-12; Th 11-12;
other good times are during Biophysics Labs (Wed & Thurs)

Class Meetings: Sci 376 TWTh(F)
Web Site: All materials will be posted on CLEo (<http://cleo.whitman.edu/>).

Description and purpose:

To learn concepts and techniques connecting biology with physics. We will frequently study and think about simple physical systems, such as Brownian particles and the ideal gas, and then examine how this applies to biology. The course will include a fair amount of mathematical modeling and problem solving requiring independent thinking.

Requirements/Background

I will assume that you can do calculus and that you know general biology. If you are concerned about the former, review differentiation, the chain rule, exponents and logarithms. If you are worried about the latter, I strongly recommend you spend a few hours in the library reading Alberts (see below).

Required Texts (in bookstore and on reserve in library):

1. **Biological Physics** (Nelson, 2004) Overview of how physics can help with the understanding of biology, with emphasis on mathematical modeling and problem solving.
2. **What is Life?** (Schroedinger, 1944) Classic text by the father of quantum mechanics written before the structure determination of DNA that makes arguments for the location of the “seat of life”.

Other texts (on reserve in library):

3. **Essential Cell Biology** (Alberts *et al.*, 2004). A nice overview of cell biology, which will be useful for everyone but especially those without a strong background in biology.
4. **Physical Chemistry. Principles and Applications in Biological Sciences.** (Tinoco *et al.* 2002). Introduction to physical chemistry with emphasis on applications to biology. A good resource for ideas as well as techniques.
5. **Principles of Physical Biochemistry** (van Holde *et al.*, 1998). Very nice resource for techniques in classical biophysics.
6. **Methods in Molecular Biophysics** (Serdyuk *et al.*, 2007). Recent comprehensive text on experimental techniques in biophysics.
7. **Molecular and Cellular Biophysics** (Meyer 2006). Good discussion of many topics in biophysics, assuming previous knowledge of physical chemistry

8. Applied biophysics: a molecular approach for physical scientists (Waigh 2007). A somewhat different approach to biophysics more from the perspective of a physicist or engineer.

Assessment:

- 40% Problem Sets (Due most Wednesdays @ 6 pm in box outside the physics offices.)
- 30% 2 Mid-term Exams (~weeks 5 & 10; see detailed schedule on CLEo for dates)
- 30% Comprehensive Final Exam

Rough Schedule:

Week	Topic	Reading
1 (J15)*	Introduction & Cell Biology	1,2
2 (J22)*	Probability & Ideal Gas Law	3-4
3 (J29)*	Brownian Motion & Diffusion	4
4 (F5)	No Class	Schroedinger What is Life?
5 (F12)*	Life when You're Really Small	5
6 (F19)	Second Law of Thermodynamics	6
7 (F26)	Second Law of Thermodynamics	6
8 (M4)	Osmosis & Entropic Forces	7
9 (M25)	Chemical Potential and Self-Assembly	8
10 (A1)	Cooperativity	9
11 (A8)	Cooperativity	9
12 (A15)* ¹	Molecular Motors	10
13 (A22)	Molecular Motors	10
14 (A29)	Nerve Impulses	11
15 (M6)	Final Exam	

Readings except for week 4 are from Nelson. I will post optional papers on CLEo.

* Class meets on Fridays of these weeks. We likely won't meet on Fridays of the other weeks.

¹ = No class on Tuesday.

A more detailed daily schedule will be posted on CLEo throughout the semester.