Biophysics • BBMB 324 • Spring 2013

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Office Hours: Check http://www.whitman.edu/~juersdh/Schedule.htm. Also by appointment or if my office door is open; other good times may be during biophysics labs (Mon&Tues)

Class Meetings: Sci 111 TWTh(F)

Web Site: All materials will be posted on CLEo (http://cleo.whitman.edu/).

Description and purpose:

To learn how concepts and techniques from physics can improve understanding of biological systems. 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 including the chain rule, integration and also 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 Text (in bookstore):

1. **Physical Biology of the Cell** (Phillips *et al*., 2009) New text describing how physics can help with the understanding of biology. The emphasis of the book deals with applying simple physical models to specific interesting biological systems.

Other texts (on reserve in library):

2. **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.
3. **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.
4. **Principles of Physical Biochemistry** (van Holde *et al.,* 1998*).* Very nice resource for techniques in classical biophysics.
5. **Methods in Molecular Biophysics** (Serdyuk *et al*., 2007). Recent comprehensive text on experimental techniques in biophysics.
6. **Molecular and Cellular Biophysics** (Meyer 2006). Good discussion of many topics in biophysics, assuming previous knowledge of physical chemistry
7. **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.

8. **Biological Physics** (Nelson, 2004) Very nice overview of how physics can help with the understanding of biology, with emphasis on mathematical modeling and problem solving.
9. **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".

Assessment:

30%	Problem Sets. Due most Fridays @ 6 pm in box outside the physics offices. Most problem sets will be 6-7 problems and I will grade 2-3 of them.
40%	3 Mid-term Exams (~weeks 4, 7 & 12; see detailed schedule on CLEo for dates)
30%	Comprehensive Final Exam

Schedule – Rough and Subject to Change

Week	Topic	Text
1 (J14)	Introduction. Random Walks	1-4, 13
2 (J21)	Diffusion	13
3 (J28)	Hydrodynamics	12
4 (F4)	Equilibrium & Thermodynamics	5
5 (F11)	Statistical Mechanics - Entropy	6
6 (F18)	Statistical Mechanics - Free Energy	6
7 (F25)	Entropic Forces	6
8 (M3)	Solution Electrostatics	9
9 (M24)	Solution Electrostatics	9
10 (M31)	Architecture with Macromolecules	10
11 (A7)	Physical Properties of Membranes	11
12 (A14)	Molecular Motors	16
13 (A21)	Molecular Motors	16
14 (A28)	Nerve Impulses	17
15 (M5)	Final Exam (May 12)	

Readings are from Phillips. I will post optional papers on CLEo.

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