Contact Information:
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Meeting Times:
Lecture: 8:30-9:40 am MWF YC 115  
Office Hours: 10-11 am M, 1:30-3 pm Th  
Web: Moodle (Physics 570)

Course Outline and Goals:
This course is guided by the mantra, “Quantitative data require quantitative models.” Biological physics is a rapidly progressing field - we will not be recapitulating ideas developed a century ago (see E&M, Quantum Mechanics, Thermal Physics, etc.). As a result, this course asks something completely new: building models of poorly defined systems. Your goal will be to start with estimates, limits, spherical cows to build some intuition and models (the physics in biological physics). Only after you have built a model do you get the reward of working out the math.

Required Text:

Course Philosophy:
Your instructor has fixated on the idea that the text - and particular, reading the text before each class - is an integral part of learning. The class sessions will be devoted to working out interesting ideas, building models, and understanding the science. If this is to be successful, you must complete the assigned reading ahead of time, not after the fact.

Assignments:
Homework will be assigned each week, collected on Friday. Collaboration, properly acknowledged, is encouraged. However, you are responsible for ensuring that you, individually, understand each problem. You must hand in your own solutions in your own handwriting, unless the instructor determines that it is illegible. You will then be required to type solutions.

In-class problems presented individually will give you a chance to explore ideas beyond the basics of the text. There are plenty of exciting ideas left for the problems - we will devote several class sections over the term to exploring these ideas with you in the lead. These problems must be presented using PowerPoint; solutions will be posted on Moodle.

During the final week of the course, working in a small group (2-3), you will teach the class a topic of your choice using an extended presentation (40-45 minutes). Possible topics can come from areas of the text we don’t cover or recent research (Science, Nature and Proceedings of the National Academy of Sciences are good sources). I will meet with each group to approve your choice of topic and to review your presentation.

Grades for the presentation will be given on a group and individual basis.
Grading Formula:
Weekly homework: 20%
Problems: 10%
Exam: 20%
Presentation: 30%
Comprehensive Final: 20%

Honor Code:
No Lawrence student will unfairly advance his or her own academic performance or in any way limit or impede the academic pursuits of other students of the Lawrence community. Honor the honor code. Collaboration on the homework is encouraged; however, solutions must be written up individually. Acknowledge any collaborators.
<table>
<thead>
<tr>
<th>Week beginning:</th>
<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>Mar. 21</td>
<td>Spring Break</td>
<td>Overview of the course Why Biological Physics? Ch. 1, particularly pp 3-14, 19-22.</td>
<td>What and Where E. Coli Ch 2.1 (esp 29-34), and viruses 2.2.3 and 2.2.4 (esp 54-57).</td>
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<td>Mar. 28</td>
<td>When: 3.1 (p75-80, 87-89), 3.2 (p90-93), 3.3.3 (97 and 102-104)</td>
<td>Who: Read enough to figure out Figures 4.7, 4.8, 4.10, 4.16, 4.25.</td>
<td>In Class Problems Energy scales: Ch 5.1-5.3</td>
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<td>Apr. 4</td>
<td>Energy minimization Ch 5.5</td>
<td>Entropy and transcription: Chapter 6.1</td>
<td>Entropy can do work Ch. 6.2-6.4</td>
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<td>Apr. 11</td>
<td>Chemotaxis – an equilibrium perspective Ch 19.4</td>
<td>DNA structure at equilibrium Ch 8.2-8.3</td>
<td>In Class Problems Testing the DNA model Ch 8.4</td>
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<td>Apr. 18</td>
<td>Beam Theory and DNA Bending Ch 10.1-2</td>
<td>WLC model 10.3</td>
<td>DNA packaging 10.4</td>
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<td>Apr. 25</td>
<td>Navier-Stokes in a day 12.1-2</td>
<td>Midterm exam</td>
<td>NO CLASS: Reading period</td>
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<td>May 2</td>
<td>Low Reynolds Number World Ch. 12.4</td>
<td>Microscopic Diffusion 13.2, 13.4</td>
<td>In Class Problems Diffusion in cells 13.3</td>
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<td>May 9</td>
<td>Rates and Speeds 15.1-15.2</td>
<td>Cytoskeleton from a rate eq. perspective Ch. 10.5, 14.1, 15.3</td>
<td>In Class Problems Motors and beating diffusion Ch 16.1-2 Presentation PowerPoint due</td>
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<td>May 16</td>
<td>Ion Channels and Neurophysiology Ch.17.1-3</td>
<td>Cell networks and the Repressilator</td>
<td>In Class Problems Repressilator revisited.</td>
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**Final Exam:** Wednesday, June 1 at 3 pm.