DRAFT Biology S105: Biochemistry, Biophysics, and Cell Biology

Note: S105 is co-taught, and divided into two parts. Each will count as 50% of your grade.
Part I, which corresponds to the half-semester course Biology 101 in fall and spring semesters, will be taught by Dr. Robert Collins. Part II will be taught by Dr. Mark Mooseker, and correlates to Biology 102. Please read the entire syllabus. This syllabus is a general guide, and subject to change if necessary.

Part I Biochemistry/Biophysics

Dr. Robert Collins  
Office Hours: Following class, and by appointment  
Lecture: M-F 10.30-12.15  
Location: TBD

GOALS: Part I of Biology S105 will introduce the common macromolecules of life and their function. In short, we will investigate life at the molecular level. Experimental methods and rationales will be introduced. Students will be asked to interpret data and understand related research and its impact on society.

TEXTS: Life: The Science of Biology, 11th edition, By Sadava et al. Sinauer/ WH Freeman, publishers. The 9th or 10th editions are acceptable, and I will list readings for all three versions. All PowerPoints will be posted before the lecture, and all additional assigned readings can be downloaded via the course website.

Optional reading: The Double Helix: A Personal Account of the Discovery of the Structure of DNA, James Watson 1968

Other optional readings and videos will be posted online.

ASSESSMENT for PART 1 (50% of overall grade):
Weekly Quizzes: Three lecture periods will end with a 15-minute quiz focused on material presented during the previous lectures. No information in the assigned readings that is not discussed in lectures will be on the quizzes or exam. You are responsible for information in lectures that is not covered in the textbook. The quizzes make up 25% of your grade.

Homework: Posted on the course web site during the week, submit your work via the site by class time on the due date. The homework assignments make up 25% of your grade. You may discuss the assigned exercises with classmates but must compose and write the answers independently.

Midterm Exam: Held during normal class hours on June 11, and will count for 35% of your grade.

Participation: You will receive a score worth 15% of your grade for participation in exercises and activities done in class, so come prepared and participate. Supplemental readings will be posted online and announced in class. Read the participation grading rubric provided.
**Academic Dishonesty:**

Students are expected to read and understand “Appendix A” as outlined in the Yale Summer Session Handbook.

NOTE: A student violating the terms outline Appendix A of the Yale summer session handbook in any assignment, test, or examination in this class will receive a minimum penalty of a zero (0) for that exam, quiz or assignment, and may receive a grade of "F" for the course at the discretion of the instructors.

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<th>Date</th>
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<th>Topic</th>
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<td>1</td>
<td>May 27</td>
<td>M</td>
<td>Introduction/What is Biochemistry?</td>
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<td>2</td>
<td>May 28</td>
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<td>Proteins</td>
<td>Design Activity</td>
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<td>3</td>
<td>May 29</td>
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<td>Protein Function and Folding</td>
<td>Discuss HW1 Due 9am Fold-it</td>
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<td>May 30</td>
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<td>Carbohydrates, Lipids, Membranes and Thermodynamics of Life</td>
<td>Quiz 1 over lectures 1-3</td>
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<td>5</td>
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<td>Enzymes</td>
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<td>Review HW2 (due 9 AM)</td>
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<td>DNA Structure and Replication</td>
<td>Quiz 2 over lectures 4-6</td>
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<td>Read Watson and Crick, Nature 1953</td>
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<td>Transcription and Translation</td>
<td>Review HW3 (due 9 AM)</td>
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<td>10</td>
<td>June 7</td>
<td>F</td>
<td>Genomics and other -omics</td>
<td>Quiz 3 over lectures 7-9</td>
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<td>Read NYT article re: Dr. Wartman</td>
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<td>11</td>
<td>June 10</td>
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<td>Special Topic: HIV</td>
<td>Discuss Merluzzi, et al 1990</td>
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<td>12</td>
<td>June 11</td>
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<td>Midterm in Class</td>
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COURSE DESCRIPTION:

Biology 105B (6/12/19-6/28/19): Cell Biology and Membrane Physiology

Content, course philosophy and outcome goals:

This module will cover a number of central topics (as detailed below) in cell biology but will not focus on comprehensive coverage of all areas of cell biology and membrane physiology. Most lectures will highlight experimental examples from which the "facts" about a given topic were derived. There will also be discussion of key experimental methods and rationales. The lectures will be a mix of conventional lecture presentation and a variety of in-class discussions and problem solving sessions.

For each topic, there will be a detailed outline of content, but the rate and depth at which topics are discussed will be gauged by my "real time" assessment of understanding based on the in-class problem solving sessions and performance on problem sets. That is, no attempt will be made to cover a set amount of material/lecture. Rather, it is likely that only a subset of topics listed in the syllabus below will be discussed. While increasing your knowledge base of cell biology is a critical goal of the course, equally important will be developing an enhanced skill set in understanding experimental rationales and interpretation of experimental data sets. These critical thinking skills are broadly applicable and are at the core of the skills expected of incoming medical school students (as detailed in the Howard Hughes Medical Institute/American Association of Medical Colleges revised guidelines for medical school education. In addition to lectures, we will also discuss, in round table fashion, a series (4-5) of a classic research paper. The methods and each data figure will be discussed in order.

Modes of assessment:

1. There will be several problem sets. Each will be due at the next class session. These will be in the form of typical exam questions, similar to those that will comprise most of the content of the mid-module and final exams. You may collaborate with others on these problems but your responses should be your own. Problem sets will be graded and will constitute 25% of the final grade.

2. There will be a mid-module exam after the first six lectures. This exam will consist of two parts, an overnight take home exam composed of problem set type questions. The second part will be a short in class exam on 6/21 consisting of questions about the discussion papers read thus far. Lecture will follow this in class exam.

3. There will be a second exam primarily covering material covered in lectures 7-12, although some questions may integrate information/strategies discussed during the first half of the course. This exam will be given in class on 6/28/18. The second exam will be similar in format to the midmodule exam except it will not be given in two parts. You will be given the full 10:30-12:15 time period to take this exam. In contrast to the problem sets, you are not permitted to collaborate on the take home exam. The standard Yale College penalties for violating this will be applied.
Both exams will consist largely of experimental analyses and not “facts”, and both will also include at least one question based directly on data from one or more of the papers read in Discussion section. Each exam will constitute 30% of the final grade.

4. Preparation for and participation in the paper discussions, as well as participation the in-class exercises will evaluated and will constitute 15% of your grade.

**Lecture Topics:**

Note that detailed lecture outlines and reading assignments will be posted at the beginning of Biology 105. In addition, most lectures in the first half of the module will include a discussion of relevant experimental methods (e.g. light and electron microscopy, cell fractionation, use of antibodies for immunolocalization and immunochemical analysis, pulse chase labeling). Based on lecture pace in Biol. 102 the following topics will be covered.

1. Structural and functional properties of biological membranes
2. Membrane transport
3. Biosynthesis of secretory and membrane proteins; sorting signals and vesicular traffic
4. Endocytosis
5. The cytoskeleton
6. Cell division

If time permits (I cannot predict the pace of coverage in our small class format) we may also discuss signal transduction and/or intercellular junctions. If so, additional lecture outlines will be posted, with reading assignments

**Reading:**

The primary reading will be assigned from the text, *Cell and Molecular Biology by Karp* (or Karp et al. Wiley Press). I will list assigned reading for the 6th, 7th and 8th editions. I will place copies of Karp on reserve at Bass. A custom version of the 8th edition is available through the Yale Bookstore. Please use the lecture outlines and lecture content to provide the framework for what is important to think about and understand. There will be no questions on the problem sets or exam on content not explicitly discussed in class.