Introduction to Life Sciences (tentative)

05-08-16

Introduction. Humans have wondered about the physical, chemical and biological basis of life for centuries. Although the picture is far from complete, a framework now exists to understand life in terms of Biology, Chemistry and Physics. This course will begin to tell this story beginning with the basics of chemistry and culminating in several human diseases whose atomic basis is now beginning to be understood.

Professor: David Jeruzalmi (dj@ccny.cuny.edu), CDI 1316
Office Hours: by appointment.

Class meetings: TBD

Course website: TBD

Grading: TBD

Overview*.The first ~25% of the course will be devoted to review of chemistry with a focus on those aspects of relevance to the life sciences. Topics will include the basics of chemistry, atoms and bonds, intermolecular forces, thermodynamics, chemical equilibrium, acid-base chemistry and kinetics. The second ~25% of the course will pivot to the various molecules associated with life: amino acids, proteins, protein folding, membranes, membrane proteins, DNA, RNA. The third ~25% of the course will deal with how to understand the chemical basis of information transfer in biology: DNA replication, Transcription, Protein synthesis, cell signaling. The final component of the course will focus on the contributions of basic understanding of biology to medicine.
* to be finalized

Format. This course is a hybrid online course, and will meet 1 time per week. Prior to each class meeting (see below), students will read from the assigned readings (described below) and/or listed to a 30-40 min podcast prepared by the instructor, and may include available online content (e.g. Henry Stewart talks). Students will be quizzed (online) on this material. Class time itself will be used to 1) present a short summary of the lecture, 2) answer questions by class (Prof will have some to prime discussion), and 3) go over quizzes, problems sets, exams. As the semester proceeds, class meetings will (later in the semester) include student-presentations and discussion of selected reviews or primary literature. Students will be asked to write/draw a short summary of what was learned during each class meeting. Students will be assigned weekly problem sets. 2-3 exams will be used to further evaluate the students.

E-coursepack. This is still in the planning stage. Considering a custom coursepack from http://www.academicpub.com. Content from various text books (mash-ups in principle possible per publisher): 1) Fundamentals of General Organic & Biological Chemistry by McMurray et al, and 2) Molecular Biology of the Cell by Alberts et al, primary literature, original content from the instructor.

Other ideas include an ebook or Apple iBook (which would require a Mac or iDevice). In future instances of the course, students will assist in revising the course-pack.

Academic Objectives of the Course. Students will be trained in this class to be able to understand (tentative):

1. the basics of chemistry, atoms, bonds.
2. the basics of thermodynamics in a biochemical context
3. the basics of chemical equilibrium
4. the basics of acid base chemistry
5. the basics of kinetics
6. the basics of protein and nucleic acid structure
7. the basics of membrane structure
8. the basics of DNA replication, RNA and Protein synthesis
9. the basics of enzyme catalysis
10. the basics of cell signaling
11. basic aspects of the connection between basic biochemistry and disease.

Assessment. The Professor will develop a biochemistry assessment test along the lines of Force Concept Inventory used to assess instruction-promoted understanding of physics concepts. Assessment will be given before the course starts and after it ends.

A tentative mapping of topics to weeks/dates appears below.

Week		
1		Intro to course, basics of chemistry, atoms, bonds
2		Thermodynamics
3		Chemical equilibrium, acid base chemistry
4		Kinetics, reaction rate
5		Intro to protein structure
6		Transport of ions across a membrane, membrane potential
7		Midterm
8		Intro to nucleic acids, DNA, RNA
9		DNA Replication
10		RNA synthesis, splicing
11		Protein synthesis
12		Control of gene expression
13		Enzyme catalysis
14		Cell signaling
15		Applications to Medicine
		Final