Principles of Biochemistry
Chemistry 5700, Fall 2017

M W F, 10:30-11:20 AM, ESLC-046

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Office Hours: Dr. Dickenson: Wed and Thurs 2:30-3:45 and other times by appointment.
Katie Hull: TBA.
Kara Swenson: TBA

Text: The listed course text is "Lehninger Principles of Biochemistry", Nelson and Cox, 6th ed. The previous (5th) edition or the new (7th) edition will work just fine if you can get a copy. You may have to cross reference the recommended problem sets if you use one of these.

Undergraduate Teaching Fellows: Katie hull and Kara Swenson are the designated undergraduate teaching fellows (UTFs) for this course. They have both taken Chem 5700 recently and performed exceptionally well. They will each have designated duties including attendance of lectures, help with course organization and grading, and they will hold office hours. Katie and Kara are valuable resources for this course that I encourage you to take advantage of and I expect that they be treated with the same respect that you extend to me.

Lecture Overheads Canvas: I will be using Canvas for the management of Chem 5700. Copies of my lecture overheads will be posted on Canvas (https://online.usu.edu/). I strongly recommend that you print the lecture notes BEFORE coming to class and this will be very useful to take notes during the lectures as well.

Prerequisites: A full year of organic chemistry (Chem 2310-2320, or equivalent)

Course Withdrawal: Refer to the current academic year registration calendar for details and deadlines concerning withdrawal conditions and deadlines.

Provisions: The administration of Chem 5700 will adhere strictly to the academic policies outlined in the most recent USU General Catalog, which can be found here: http://catalog.usu.edu/index.php
Per policy, no assignments will be accepted or graded from students not formally enrolled in the course. Students not enrolled in the course may sit in only with instructor approval.

Learning goals and Objectives: Students successfully completing Chem5700 should be able to:

- explain and apply the core concepts underlying the theory of evolution, including the process of natural selection and its molecular basis, and evidence supporting the theory of evolution.

- explain and apply core concepts of matter and energy transformation, including thermodynamics, catalysis, the coupling of exergonic and endergonic processes, and the nature of biological energy.

- explain and apply core concepts of underlying homeostasis, including the need for biological balance, linked steady state processes, quantification of homeostasis, the organization of chemical processes, and control mechanisms.

- explain and apply core concepts of biological information, including the genome, the manner in which the information it contains is encoded and translated, and the mechanisms by which it is transmitted and maintained across generations.

- explain and apply core concepts of macromolecular structure and function, including the nature of biological macromolecules, their interaction with water, the relationship between structure and function, and frequently-encountered mechanisms for regulating their function.

- understand the process of science, including hypothesis generation, experimental design, quantitative analysis, and data interpretation.

Critical Thinking Problem sets: Critical thinking and creative problem solving are invaluable skills for scientists of all fields, including Biochemistry. Chem 5700 is an upper division course designed to arm you with the knowledge necessary to address technically challenging problems. Over the course of the semester, we will work several in class critical thinking problem sets. The tentative dates of some of these assignments are listed in the syllabus, but there will be additional in class activities and the dates are subject to change depending on where we are at with respect to lecture material. These assignments will be collected during class (or the following lecture period) and cannot be made up or turned in late (without an excused absence). So, while attendance is not mandatory, you must be present to have access to these worksheets. In the event of an "excused absence" you must notify the instructor prior to the absence and arrangements will be made. The total points for all of these in-class assignments will be 25 points and will not be tallied until the end of the semester.

Canvas critical thinking short problem sets: These will be much like the problem sets described above but will be administered via Canvas and will be a single question requiring a short answer to complete. Five will be administered over the course of the semester and each will be worth 5 points.

Quizzes: Quizzes will cover material presented in the previous week's lecture **OR** in the reading material. The quizzes are to be taken on-line using Canvas. The quizzes are open book/open note but <u>MUST</u> be worked individually. The intent of the quizzes is to keep you on top of the course material- i.e. not waiting until exam time to cram. You will have 30 minutes to complete the quiz once it is initiated. A total of 11 quizzes worth

10 points each will be given during the semester. Each student will be allowed to drop the lowest one graded quiz. The quizzes are due by 8AM MST on the day listed in the syllabus for each quiz. You are allowed to drop your lowest quiz grade and for this reason, **I will not re-open a quiz after the cutoff time under any circumstance.**

Exams: Three hourly exams (100 points each) will be given during class on the dates indicated on the course schedule. The comprehensive final exam will be worth 150 points. The first three exams will consist primarily of short answer, essay, and problem solving similar to the exams given in previous years. The comprehensive final exam will be primarily multiple choice and matching format, similar to the online quizzes. I strongly encourage you to work the past years exams as part of your exam preparation. Make-up exams will **only** be allowed for students that can demonstrate a documented birth or death in the family, a documented illness, or presence at a scientific conference or interview. Family vacations do **NOT** qualify as a reasonable excuse**.**

Recommended Problem sets: Recommended problem sets from the text book will be provided periodically for the students. Participation is 100% voluntary and the problems will not be graded.

Course Assessment: Students in this class are expected to develop proficiency in the principles listed on the class schedule and the attached "Learning Objectives" list. Questions provided on midterms, quizzes, and your analysis of the problem sets will be used to assess your understanding of these principles. The formats to be used for assessment will include instructor-designed questions (essay, short answer, problem solving, multiple choice) and will cover material that is expected to be mastered by students taking the first semester of a two semester upper division biochemistry class. Please note that assessment is a tool used by the Department of Chemistry and Biochemistry to improve the quality of instruction and proficiency of our students. Your grade will be based on your performance on the assignments indicated above, some of which will be used for course assessment.

Grading:

Canvas short critical thinking problem sets..…….....25 points
In-class critical thinking worksheets…….....50 points
On-line quizzes (1, drop lowest)……..……..100 points
Three hourly exams .....300 points
Comprehensive Final exam .....125 points
Total .....600 points

In terms of final assignment of grades, you are guaranteed the following grades if your final class percentage lies within the indicated ranges.

100-90%	A through A-	89.9-78%	B+ though B-
77.9-68%	C+ through C-	67.9-59%	D+ through D-

Based on the overall class average at the END of the semester, the percentage cutoffs may be adjusted to be lower than those above at the instructor's discretion. They will never, however, shift higher.

Tentative Class schedule (Subject to change)

Day	Date	Lecture	Topic	Chapter, Lehninger (6th ED)	Quiz
M	8/28	1	Introduction to the course	1	**#1** Due 9/6
W	8/30	2	Water: properties, ionization, hydrophobic effects	2	
F	9/1	3	Amino acids, peptides, and proteins	3	
M	9/4		Labor Day (No Class)		
W	9/6	4	Protein Structure	3	**#2** Due 9/18
F	9/8	5	Protein Structural Tools	3	
M	9/11	6	Protein 2˚ Structure	4	
W	9/13	7	Protein 3˚ and 4˚ Structure	4	
F	9/15	8	Protein Structure Determination, Folding and Prion Diseases	4	**#3** Due 9/25
M	9/18	9	Protein function: ligand binding; allostery; regulation	5	
W	**9/20**		**In Class Critical Thinking Set #1**		
F	9/22	10	Protein function: molecular motors	5	
M	**9/25**		**Exam 1 in class: covers Lectures 1-10**		
W	9/27	11	Enzyme Function	6	**#4** Due 10/2
F	9/29	12	Enzyme Kinetics - I	6	
M	10/2	13	Enzyme Kinetics - II	6	**#5** Due 10/9
W	10/4	14	Regulatory Enzymes	6	
F	10/6	15	Carbohydrates	7	
M	10/9	16	Polysaccharides	7	**#6** Due 10/16
W	10/11	17	Nucleic Acids: DNA	8	
F	10/13	18	Nucleic Acids: RNA	8	
M	10/16	19	Lipids	10	**#7**

W	10/18	20	Lipids and Metabolism	10	Due 10/23
R	**10/19**		**Critical Thinking Problem Set #2** *Note Thursday Class		
F	**10/20**		No Class Fall Break (Meet Thursday)		
M	**10/23**		**Exam 2 in class: covers Lectures 11-20**		
W	10/25	21	Biological Membranes	11	
F	10/27	22	Membrane Transport – Ion Channels	11	**#8** Due 11/6
M	10/30	23	Bioenergetics - I	13	
W	11/1	24	Bioenergetics - II	13	
F	11/3	25	Glycolysis	14	
M	11/6	26	Metabolic Disorders	14	**#9** Due 11/13
W	11/8	27	Metabolic Regulation - I	15	
F	11/10	28	Metabolic Regulation - II	15	
M	**11/13**		**Critical Thinking Problem Set #3**		**#10** Due 11/20
W	11/15	29	Citric Acid Cycle	16	
F	11/17	30	Citric Acid Cycle and Physiology	16	
M	11/20		**Exam 3 in class: covers lectures 21-30**		
W	11/22		Thanksgiving Break No Class		
F	11/24		Thanksgiving Break No Class		
M	11/27	31	Fatty Acids	17	
W	11/29	32	Nitrogen Excretion	18	**#11** Due 12/4
F	12/1	33	Urea Cycle	18	
M	12/4	34	Amino Acid Oxidation	18	
W	12/6	35	Mitochondrial electron transfer and oxidative phosphorylation	19	
F	12/8	36	Mitochondrial electron transfer and oxidative phosphorylation (Cont)	19	
F	12/15		**Final Exam(All Lectures) 9:30-11:20AM ESLC 046**		

EXPECTATIONS

This is a 5000 level class and I thoroughly expect you not just to memorize the information, but be able to interpret and apply it to specific tasks that will be presented to you throughout the course (research problem sets). At the end of the course, my expectation is that you are aware of the connection between the subject material to your everyday lives.

YOUR RESPONSIBILITIES

Come to Class Prepared

a) Download notes and look them over BEFORE class
b) Be punctual, attend all classes, and finish the quizzes/problem sets on time.
c) Read all the assigned material in the book and any additional information/papers handed to you.
d) Think about the material learnt and apply it to real-life scenarios. This would be a perfect way to study for your exams.

MY JOBS

Come to Class Prepared

a) Be precise and systematic with presentation of the lecture material.
b) Be clear and fair about expectations.
c) Provide you with ample material to best understand the concept being taught.
d) Enable you to critically think and apply the concepts.

OBJECTIVES

In planning this course, I have identified three main course objectives:
1. Gaining factual knowledge (terminology, classifications, methods, trends)
2. Learning fundamental principles, generalizations, or theories
3. Learning to apply course materials (to improve rational thinking, problem solving and decisions)

Below is a list of examples of how these objectives apply to material throughout the semester:

A. Teach the fundamentals of biochemistry including the connection between chemistry, math, and biology and how it pertains to a quantitative description of life. Present the information about the building blocks of life - protein, DNA, RNA. Teach the students how these molecules are synthesized, regulated, and specifically highlight how these processes are interconnected **(1,2,3).**

B. Describe the concept of enzymes; including how they are made, how they function and the biological and biophysical processes that define their activity and function. Help the students connect the dots between how mutations in the DNA lead to defective enzymes and their disease phenotypes **(1,2,3).**

C. Describe to students the connection between how the findings were uncovered, what is their historical context and where they encounter such information in their lives (diagnostic tests, etc.). **(1,2,3).**

D. Teach how humans makes and use energy. What are the by-products of energy metabolism and how does the body secrete the waste. **(1,2,3).**