



Principles of Biochemistry Chemistry 5700, Fall 2021

Face-to-Face course. Lecture time/location: MWF 10:30-11:20 ESLC 007
Dr. Nicholas Dickenson, Chemistry and Biochemistry
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- Office Hours:** Dr. Dickenson: Fri 3:00-3:50PM and other times by appointment. Zoom link available in Canvas.
Emma Lindley (emma.lindley@usu.edu): TBA.
Porter Ellis (pkreyellis@aggiemail.usu.edu): TBA
- Text:** The listed course text is “Lehninger Principles of Biochemistry”, Nelson and Cox, 6th ed. There is a new 7th edition, but you can buy the 6th edition used for well under \$100 online, so I would recommend that.
- Undergraduate Teaching Fellows:** Emma is the designated undergraduate teaching fellow (UTF) for this course. She has taken Chem 5700, 5710, and 5720 last year and performed exceptionally well in each. She will have designated duties including viewing online lecture materials, participating in office hours, helping with course organization and grading, and will hold office hours. Emma is an extremely valuable resource for this course that I encourage you to take advantage of her knowledge. I expect that she 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 are posted on Canvas (<https://online.usu.edu/>). I strongly recommend that you print and/or download the lecture slides BEFORE viewing online lectures as this will be very useful to take notes during the lectures.
- Prerequisites:** A full year of organic chemistry (C- or better in 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 during the assigned lecture period. These assignments will be collected at the end of the class. These exercises cannot be made up or turned in late (without an excused absence). In the event of an approved 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. Several will be administered over the course of the semester and will be worth 25 points total.

Quizzes:

Quizzes will cover material presented in the previous weeks' lectures **AND/OR** in the associated reading material. The quizzes are to be taken on-line using Canvas. The quizzes are open book/open note but MUST 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 20 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 drop

one quiz score (the lowest 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.**

Exams: Three hourly exams (100 points each) and a comprehensive final exam (125 points) will be given throughout the semester. 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. If an exam is unable to be completed due to an appropriate circumstance excused by the instructor, then the percentage earned on the cumulative final exam will be used for both the final exam score and the missed exam. Should a student miss more than one exam, they will need to work directly with the instructor to determine an appropriate course of action (potentially including withdrawal from the course or taking an incomplete. Examples of circumstances that can be excused include a documented birth or death in the immediate family, a documented illness, or presence at a scientific conference or job interview. Family vacations do **NOT** qualify as a reasonable excuse. If you have been asked to quarantine by your physician or the USU Covid Cares team due to exposure to Covid-19, notify me as soon as possible so that we can discuss alternate options for you to take the same exam administered to the rest of the class.

Recommended Problem sets: Recommended problem sets from the text book are provided for each chapter. Participation is 100% voluntary and the problems will not be graded, but my experience is that students who work these problems consistently do better in the course than those who do not.

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.....	20 points
In-class critical thinking worksheets.....	30 points
On-line quizzes (11, drop lowest).....	100 points
Three hourly exams	300 points
Comprehensive Final exam	125 points
Total	575 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 - 90.0% A through A-	< 90.0 - 80% B+ through B-
< 80.0 - 70% C+ through C-	< 70.0 - 60% D+ through D

< 60% F

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). Lecture and quiz schedules are subject to change based on the rate at which we are able to cover the material and this may affect quiz due dates as well. Refer to due dates in Canvas for the most accurate reflection of assignments for the course and when they are due.

Day	Date	Lecture	Topic	Chapter, Lehninger (6 th ED)	Quiz
M	8/30	1	Introduction to the course	1	#1 Due 9/8
W	9/1	2	Water: properties, ionization, hydrophobic effects	2	
F	9/3	3	Amino acids, peptides, and proteins	3	
M	9/6		Labor Day (No Class)		
W	9/8	4	Protein Structure	3	#2 Due 9/20
F	9/10	5	Protein Structural Tools	3	
M	9/13	6	Protein 2° Structure	4	
W	9/15	7	Protein 3° and 4° Structure	4	
F	9/17	8	Protein Structure Determination, Folding and Prion Diseases	4	#3 Due 9/27
M	9/20	9	Protein function: ligand binding; allostery; regulation	5	
W	9/22		In Class Critical Thinking Set #1		
F	9/24	10	Protein function: molecular motors	5	
M	9/27		Exam 1: covers Lectures 1-10		
W	9/29	11	Enzyme Function	6	#4 Due 10/8
F	10/1	12	Enzyme Kinetics - I	6	
M	10/4	13	Enzyme Kinetics - II	6	
W	10/6	14	Regulatory Enzymes	6	#5 Due 10/13
F	10/8	15	Carbohydrates	7	

M	10/11	16	Polysaccharides	7	
W	10/13	17	In Class Critical Thinking Set #2 AND Nucleic Acids: DNA	8	#6 Due 10/20
F	10/15		No Class – Fall Break		
M	10/18	18	Nucleic Acids: RNA	8	
W	10/20	19	Lipids	10	#7 Due 10/27
F	10/22	20	Lipids and Metabolism	10	
M	10/25		Exam 2: covers Lectures 11-20		
W	10/27	21	Biological Membranes	11	#8 Due 11/8
F	10/29	22	Membrane Transport – Ion Channels	11	
M	11/1	23	Bioenergetics - I	13	
W	11/3	24	Bioenergetics - II	13	
F	11/5	25	Glycolysis	14	#9 Due 11/17
M	11/8	26	Metabolic Disorders	14	
W	11/10	27	Metabolic Regulation - I	15	
F	11/12	28	Metabolic Regulation - II	15	
M	11/15		Critical Thinking Problem Set #3		
W	11/17		Exam 3: covers lectures 21-28		
F	11/19	29	Citric Acid Cycle	16	#10 Due 12/1
M	11/22	30	Citric Acid Cycle and Physiology	16	
W	11/24		Thanksgiving Break No Class		
F	11/26		Thanksgiving Break No Class		
M	11/29	31	Fatty Acids	17	#11 Due 12/10
W	12/1	32	Nitrogen Excretion	18	

F	12/3	33	Urea Cycle/Amino Acid Oxidation	18	
M	12/6	35	Mitochondrial electron transfer and oxidative phosphorylation	19	NO Quiz
W	12/8	36	Mitochondrial electron transfer and oxidative phosphorylation (Cont)	19	
F	12/17	Final Exam (All Lectures) 9:30-11:20AM			

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

Be Prepared for Class

- Download notes and look them over BEFORE attending lectures
- Be punctual, attend all classes, and finish the quizzes/problem sets on time.
- Participate in office hour discussions and exercises.
- Read all the assigned material in the book and any additional information/papers provided to you.
- 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

Be Prepared for Class

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

OBJECTIVES

In planning this course, I have identified three main course objectives:

- Gaining factual knowledge (terminology, classifications, methods, trends)*
- Learning fundamental principles, generalizations, or theories*
- 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)**.

Students with disabilities statement: USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn # 101, 435-797-2444, drc@usu.edu). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.

Plagiarism Policy: Plagiarism includes knowingly "representing by paraphrase or direct quotation, the published or unpublished work of another person as one's own in any academic exercise or activity without full and clear acknowledgment. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials." The penalties for plagiarism are severe. They include warning or reprimand, grade adjustment, probation, suspension, expulsion, withholding of transcripts, denial or revocation of degrees, and referral to psychological counseling.

COVID-19 Classroom Safety Protocols: While not mandated at the time that this syllabus was published, USU encourages and welcomes the wearing of masks in all university building, especially within 6 feet of others. Furthermore, it is strongly encouraged to take measures to mitigate risk as recommended by federal and state public health officials. These measures include getting fully vaccinated, staying home if you are sick (even with mild symptoms), and maintaining good hygiene including frequent hand washing. Testing will be provided, without charge, throughout the semester and the [USU COVID Webpage](#) will provide up-to-date information. Please remember; COVID can have significant impact on the health and safety of those around you so remain vigilant and respectful.

For details concerning additional USU academic definitions and requirements including Academic Freedom and Professional Responsibilities, Academic Integrity - "The Honor System", Grievance Process, Sexual Harassment, Withdrawal Policy, "I" Grade Policy and Dropping Courses, No-Test Days Policy, Assumption of Risk, and Mental Health, please visit the Office of the Executive Vice President & Provost's webpage at <https://www.usu.edu/provost/faculty-life/syllabus>.