

Principles of Biochemistry II

Chemistry 5710 Spring 2022

M W F, 10:30-11:20 AM, WID 007
Dr. Joanie M. Hevel
Widtsoe 235, 797-1622 joanie.hevel@usu.edu

- Office Hours:** **Wednesday 1-2; Thursday 1-2;** other times by appointment.
- Text:** “Lehninger Principles of Biochemistry”, Nelson and Cox, 6th/7th ed. or a comparable two semester text (e.g. Voet and Voet, Garrett & Grisham).
- CANVAS** I will be using CANVAS for the management of Chem 5710. All materials (class standings, exam keys, previous exams, problem set solutions, lecture slides/videos, and other material relevant to the course) will be posted on CANVAS. Importantly, ***you will take your weekly quizzes using CANVAS.***
- Lecture Slides** Copies of my lecture slides will be posted on Canvas. I strongly recommend downloading and printing the appropriate slides BEFORE lecture and using them to take your notes in class. Although I will not record this year’s lectures, last year’s lectures were recorded and are available on the CANVAS site.
- Prerequisites** A full year of organic chemistry (Chem 2310-2320, or equivalent) & Chem 5700 (C-)
- Provisions:** The administration of Chem 5710 will adhere strictly to the regulations outlined in the Spring Semester Schedule of Classes. Per instructions from the Dean’s office, 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.
- Course Content:** Chemistry 5710 is the second of a two semester course sequence in Biochemistry. The intent of this sequence is to provide a thorough and comprehensive survey of biochemistry for science majors (undergraduates and graduates). Chemistry 5710 will focus on anabolism, signaling and information pathways. On the following pages is a tentative outline of the topics to be covered over the semester.
- 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 but should be worked individually (i.e. no help from classmates, etc). The intent of the quizzes is to keep you on top of the course material- i.e. not waiting until exam time to cram. These quizzes will require you to spend time **READING** the text. You will have **20 minutes to answer 10 questions** (1 points for each question). A total of 11 quizzes will be given during the semester. Each student will be allowed to drop the lowest graded quiz. Quizzes will **open up on Thursday 6am and close on Saturday at midnight**. I will not reopen a quiz for anything other than a birth, death, wedding, med school/grad school interview or scientific conference.
- UTFs** There are 2 UTFs for the course: Emma Lindley (emma.lindley@usu.edu) and Nicole Cevering (nicole.cevering@usu.edu). UTFs will run a weekly review session if there is interest. The UTFs are a valuable resources for this course. I expect that they be treated with the same respect that you extend to me. They will not “give you answers”-they have been instructed to help guide you, but to not give you the answers to problem sets. The UTFs also are in charge of the weekly quizzes. **Questions about the quizzes should be directed to them.**

**In-Class
Discussions &
Critical
Thinking
Problem Sets:**

Critical thinking and creative problem solving are valuable skills for students of all fields. Like Chem 5700, Chem 5710 is an upper division course designed to arm you with the knowledge necessary to address technically challenging problems. Over the semester we will have 2 types of activities: 1) in-class group discussions (**not graded, not turned in**) and 2) take-home critical thinking / writing problem sets (**graded**). The goal of these assignments is to promote problem solving that requires you to put together what you have learned in order to effectively address a problem that you have not been directly exposed to previously or to identify deficiencies in your current thought processes.

In-class discussions (not graded, not turned in): Occasionally we will break into groups in class to study a topic related to the current lecture material. They are designed to help you understand the course material from a different perspective. Although I will make any worksheets available to students who are not present in class, it will be difficult to recapitulate the experience on your own so I highly recommend that you attend lectures. These will not be graded and are not turned in. However, if we do not complete everything on the worksheet, the work may become part of the Critical Thinking Problem Set.

Critical Thinking Problem Sets: Some class discussions will segue into a research problem set that will be due approximately one week after the class discussion. The problem sets are meant to give you practice at applying the course information (versus regurgitating it). A significant amount of effort will be required to finish the Research Problems and will likely require you to use on-line databases, read articles from the primary literature, etc. All "data" collected from the internet will need to be properly referenced. **Primary literature (no reviews) from journals having an impact factor of 2 or greater are the only references that should be used.** Critical problem sets MUST BE TYPED. A total of 3 problem sets will be given. Each problem set is worth 50 points. Each day an assignment is late 10 points will be deducted from the total point value.

**Recommended
problem sets
from the text:**

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. It is highly recommended that all of the students work these problems carefully as many of them will resemble the style of questions on the exams.

Exams: Three hourly exams (100 points each) will be given at the USU Testing Center on the dates indicated on the course schedule. The comprehensive final exam will be worth 150 points. The exam formats (i.e. short answer, short essay, problem solving, matching) will be similar to the exams given in past years with the exception that there will more multiple choice questions on the final. I strongly encourage you to work the past years exams and questions at the end of the chapters in the text as part of your exam preparation. Given that a 2-3 day window will be available for each exam AND you will have a 3-hour block to complete the exams, I do not anticipate needing any make-up exams. 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. If you find yourself in **quarantine, please EMAIL ME IMMEDIATELY** so that we can discuss alternate options for you to take the same exam administered to the rest of the class. Bring a calculator-no cell phones allowed. Exams will be scheduled and taken in the USU Testing Center (<https://www.usu.edu/testing/>). Family vacations do **NOT qualify as a reasonable excuse.**

Assessment Imbedded questions in the final will be used to address if learning objectives are being met and to improve the quality of instruction and proficiency of our students.

Grading: **There will be **NO EXTRA CREDIT** awarded in this class.

Critical Thinking Problem Sets (total of 3 @ 50 pts each)	150 points
On-line quizzes (11, drop lowest)	100 points
Three hourly exams	300 points
Comprehensive Final exam.....	150 points
Total.....	700 points

General breakdown of grading scale is as follows:

100-90%	A through A-	89.9-80%	B+ through B-
79.9-70%	C+ through C-	69.9-60%	D+ through D-

Class schedule

Week	Day	Date	Lecture	Topic	Chapter, Lehninger 6 th ed	Quiz
1	M	1/10	1	Introduction to the course; photosynthesis	19	1
	W	1/12	2	Photosynthesis	19	
	F	1/14	3	Carbohydrate biosynthesis Hevel out of town; view recorded lecture	20	
2	M	1/17	-	No classes MLK Day	--	2
	W	1/19	4	Carbohydrate biosynthesis Hevel out of town; view recorded lecture	20	
	F	1/21	5	Carbohydrate biosynthesis/Lipids	20/21	
3	M	1/24	6	Lipids	21	3
	W	1/26	7	Lipids In-Class Discussion # 1	21	
	F	1/28	8	Lipids / Amino acids	21/22	
4	M	1/31	9	Amino acids	22	4
	W	2/2	10	Critical Problem set #1 DUE Amino acids	22	
	F	2/4	11	Overall metabolism	23	
5	M	2/7	12	DNA Technologies	9	none
	T- Th			Testing Center Exam 1: covers Lectures 1-11 open 2/8-2/10		
	W	2/9	13	DNA Technologies	9	
	F	2/11	14	DNA Technologies	9	
6	M	2/14	14	DNA Technologies	9	5
	W	2/16	15	DNA Technologies / Biosignaling	9/12	
	F	2/18	16	Biosignaling	12	
7	M	2/21	--	No classes Presidents Day	-	6
	W	2/23	17	Biosignaling Class Discussion # 2	12	
	F	2/25	18	Biosignaling Hevel out of town; view recorded lecture	12	
8	M	2/28	19	Biosignaling Critical Problem set #2 DUE	12/23	7
	W	3/2	20	Biosignaling	12/23	
	F	3/4	21	Biosignaling	12/23	
9	M	3/7		SPRING BREAK		
	W	3/9		SPRING BREAK		
	F	3/11		SPRING BREAK		
10	M	3/14	22	Genes & Chromosomes	24	none
	T- Th			Testing Center Exam 2: covers Lectures 12--21 open 3/15-3/17		
	W	3/16	23	Genes & Chromosomes	24	
	F	3/18	24	DNA metabolism	25	
11	M	3/21	25	DNA metabolism	25	8
	W	3/23	26	DNA metabolism	25	

	F	3/25	27	RNA metabolism	26	
12	M	3/28	28	RNA metabolism	26	9
	W	3/30	29	RNA metabolism	26	
	F	4/1	30	RNA metabolism	26	
	M	4/4	31	Protein metabolism	27	
13	W	4/6	32	Protein metabolism In-Class Discussion # 3	27	10
	F	4/8	33	Protein metabolism	27	
	M	4/11	34	Protein metabolism	27	
14	W	4/13	35	Regulation of gene expression Critical Problem set #3 DUE	28	11
	F	4/15	36	Regulation of gene expression	28	
	M	4/18		No class		
15	M-T			Testing Center Exam 3: covers lectures 22-36 open 4/18-4/19 NOTE-exam is only open for 2 days		none
	W	4/20	37	Regulation of gene expression/review	28	
	F	4/22	38	review		
	M	4/25	39	review		
16	M	4/25	39	review		none
FINAL	F	4/29		WID 007 Final 9:30-11:20 am		

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>.

EXPECTATIONS

Much of the raw information in this class you may have seen before, perhaps in another class. However, this is a 5000 level class, which means that you should begin to apply raw information to solve problems.

YOUR JOBS

1) Come to Class Prepared

- a) download notes and look them over BEFORE class
- b) read the text before or very near lecture time—if time is limited at least look at the subheadings in the chapter and the summarized notes throughout each chapter

2) Understand I am Trying to Prepare You for the Real World

it is unlikely that you will have to solve a problem in the real world that is directly out of my lectures or the text. My goals for you are that you are able to intelligently talk about concepts and apply facts/concepts to solve problems.

3) Study Consistently-Don't Cram

- a) your objective is not to perform a “data dump” at the end of each exam
- b) read the chapter to fill-in/supplement my lectures to provide yourself with a comprehensive view of the material
- c) as we move through chapters, **do the suggested questions at the end of the chapter**; answers are at the back
- d) as the semester goes along, homework sets and in-class discussions will become more comprehensive—life's problems are not compartmentalized in chapters
- e) practice being engaged in class—think about the material we are discussing, ask questions (if you are prepared for class this will be much easier)
- f) use the 2021 recorded lectures to review and fill in gaps in your understanding

MY JOBS

1) Come to Class Prepared

- a) dissect the chapter and highlight the most important concepts in lectures using concise, accurate material.
- b) question the class in ways that help students think about concepts specifically (current lecture material) and broadly (over multiple chapter material)
- c) inject lectures with examples of how the information is relevant to your careers/lives

2) Provide You with Problems that Develop Your Critical Thinking and Problem Solving Skills

- a) make you think within the limits of a technique or concept
- b) test your ability to apply the information, not just regurgitate the information
- c) show you the relevance of such skills using real-world problems

3) Encourage You to Study Consistently

- a) provide weekly quizzes as a way to evaluate your learning
- b) provide in-class discussions and research problem sets throughout the semester to evaluate your learning between exams

OBJECTIVES

Using the new IDEA evaluation system, 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 how these objectives apply to material throughout the semester:

A. Describe the fundamental components and biochemical reactions that allow an organism to convert light energy into chemical energy **(1,2,3)**

Be able to apply the chemical principles that are the basis for photosynthesis.

Identify the inputs and outputs of the light-dependent and carbon-assimilation pathways.

Know how photosynthetic processes can be regulated and why.

Know the fundamental architecture of carbohydrate-based biomolecules and their role in biology.

B. Describe the biochemical basis for, lipid, nucleic acid, and protein synthesis: cellular location, functions of enzymes, regulation, and function of products **(1,2,3)**

Describe the flux of carbon and nitrogen in living organisms. What are the important enzymes or enzyme complexes?

C. Explain the use of DNA technologies in the research laboratory, the clinic and in industry. Be able to apply molecular biology techniques to solve hypothetical research or human health problems. **(1,2,3)**

D. Develop a comprehensive view of how higher organisms receive and respond to external stimuli at the biochemical level. **(1,2,3)**

Be able to hypothesize how and where a signal is received and what type of biochemical circuitry is used to deliver the message.

E. Describe how mammalian metabolism is integrated as demonstrated by hormonal regulation. **(1,2,3)**

F. Describe the structure and topology of chromosomes and genes and how they are packaged and how this relates to gene expression **(1,2,3)**

Explain how the expression of genetic information is regulated

G. Describe the structure and processes related to DNA, RNA, and protein. **(1,2,3)**

Explain how replication, transcription, translation, and protein processing occur and how they may be regulated.