# Principles of Biochemistry II
# Chemistry 5710 Spring 2019
# TENTATIVE SYLLABUS

Section 1, M W F, 10:30-11:20 AM, ESLC046
Professor Joanie M. Hevel
Widtsoe 235, 797-1622 joanie.hevel@usu.edu

**Office Hours:** Tuesday 1-2; Wednesday 11:30-12:30; other times by appointment.

**Text:** "Lehninger Principles of Biochemistry", Nelson and Cox, 6th 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 reserve materials (class standings, current exam keys, previous exams, problem set solutions, lecture overheads, and other material relevant to the course) will be posted on CANVAS. The reserve materials will be provided to you as downloadable PDF files, which require AcrobatReader, a free program available for both IBM and mac platforms at the Adobe web site. Importantly, *you will take your weekly quizzes using CANVAS.*

**Lecture Overheads** Copies of my lecture overheads will be posted on Canvas. I strongly recommend downloading and printing the appropriate overheads BEFORE lecture and using them to take your notes in class.

**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 in the M W F 10:30 AM class meetings.

**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 **10 minutes to answer 5 questions** (2 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: Trevor Godfrey (trevor.godfrey@aggiemail.usu.edu) and Bradley Richards (bradleyrichards15@gmail.com). UTFs will run a weekly review session if there is interest. Trevor and Bradley are 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 invaluable 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**) 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. Additionally, specific questions will require a grammar-correct, logical narrative, allowing you to practice the skill of scientific writing.

In-class discussions: 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 /Writing 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) **AND** practice at writing. 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. Because you will have a week to complete these, I will expect narratives that show your ability to use correct grammar/spelling. 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. Please be aware that there is a Science Writing Center (https://writing.usu.edu/programs/sci-writing). They will even accept drafts of your narratives prior to meeting in-person with them to help you polish your narrative. 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 during class 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 the limited time frame for an exam, I will not be expecting a complete grammar-correct narrative—your answers do, however, have to be understandable. Make-up exams will **only** be allowed for students that can demonstrate a documented birth or death in the family or a documented illness or presence at a scientific conference or interview. Family vacations do **NOT qualify as a reasonable excuse.** You must contact me **by email one week prior** so I can make arrangements for a make up exam. Bring a calculator-no cell phones allowed.

**Exam Corrections:** I am going to allow you to correct your exams and turn in the corrections for up to 8 additional points on your exam score. To receive the additional points on the exam, you must address ALL of the questions that you did not receive full credit on. If you received full credit on a given question, then obviously you do not need to correct it.

For the corrections, you will need to hand write on a separate piece of paper what the question number is, what you believe the correct answer is, and for the questions that do not have a justification portion "built into the question", you need to provide a short explanation for why the new answer you chose is the correct answer. You will turn in your graded exam with your attached correction pages by the date noted in class at the beginning of class. Late corrections **will not be accepted**. You can turn your corrections in to me earlier if you wish at my office (Widtsoe 235). If I am not available, slide it under my door. If I can't read your writing, I won't be able to grade it.

You are welcomed and encouraged to work in groups and use any resources available to you to make the exam corrections. HOWEVER, your narrative should be your own and not copied verbatim from someone else.

**Assessment** Imbedded questions in the final will be used to address if learning objectives are being met.

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

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|---|---|
| Critical Thinking /Writing 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+ though B- |
| 79.9-70% | C+ through C- | 69.9-60% | D+ through D- |

*In accordance with the Americans with Disabilities Act, reasonable accommodations will be provided for all persons with disabilities in order to ensure equal participation in Chem 5710. In cooperation with the Disability Resource Center, reasonable accommodation will be provided for students with disabilities. Please meet with the instructor during the first week of class to make arrangements. Alternative format print materials, large print, audio, diskette or Braille, will be available through the Disability Resource Center.*

# Class schedule

| Week | Day | Date | Lecture | Topic | Chapter, Lehninger | Quiz |
|---|---|---|---|---|---|---|
| 1 | M | 1/7 | 1 | Introduction to the course; photosynthesis | 19 | 1 |
| | W | 1/9 | 2 | Photosynthesis | 19 | |
| | F | 1/11 | 3 | Carbohydrate biosynthesis | 20 | |
| 2 | M | 1/14 | 4 | Carbohydrate biosynthesis | 20 | 2 |
| | W | 1/16 | 5 | Carbohydrate biosynthesis/Lipids | 20 | |
| | F | 1/18 | 6 | Lipids | 21 | |
| 3 | M | 1/21 | - | **No classes** MLK Day | - | 3 |
| | W | 1/23 | 7 | Lipids<br>Class Discussion # 1 | 21 | |
| | F | 1/25 | 8 | Lipids / Amino acids | 21/22 | |
| 4 | M | 1/28 | 9 | Amino acids | 22 | 4 |
| | W | 1/30 | 10 | **Critical Problem set #1 DUE**<br>Amino acids | 22 | |
| | F | 2/1 | 11 | catchup | | |
| 5 | M | 2/4 | | **Exam 1: covers Lectures 1-11** | | none |
| | W | 2/6 | 12 | DNA Technologies | 9 | |
| | F | 2/8 | 13 | DNA Technologies | 9 | |
| 6 | M | 2/11 | 14 | DNA Technologies | 9 | 5 |
| | W | 2/13 | 15 | DNA Technologies / Biosignaling | 9/12 | |
| | F | 2/15 | 16 | Biosignaling<br>Class Discussion # 2 | 12 | |
| 7 | M | 2/19 | 17 | **No classes** Presidents Day | - | 6 |
| | W | 2/20 | 18 | Biosignaling | 12 | |
| | F | 2/22 | 19 | Biosignaling | 23 | |
| 8 | M | 2/25 | 20 | Biosignaling<br>Hormonal Regulation<br>**Critical Problem set #2 DUE** | 23 | 7 |
| | W | 2/27 | 21 | Hormonal Regulation | 23 | |
| | F | 3/1 | 22 | catchup | | |
| 9 | M | 3/4 | | **Exam 2: covers Lectures 12-22** | | none |
| | W | 3/6 | 23 | Genes & Chromosomes | 24 | |
| | F | 3/8 | 24 | Genes & Chromosomes | 24 | |
| 10 | M | 3/11 | | SPRING BREAK | | none |
| | W | 3/13 | | SPRING BREAK | | |
| | F | 3/15 | | SPRING BREAK | | |
| 11 | M | 3/18 | 25 | DNA metabolism | 25 | 8 |
| | W | 3/20 | 26 | DNA metabolism | 25 | |
| | F | 3/22 | 27 | DNA metabolism | 25 | |
| 12 | M | 3/25 | 28 | RNA metabolism | 26 | 9 |
| | W | 3/27 | 29 | RNA metabolism | 26 | |
| | F | 3/29 | 30 | RNA metabolism | 26 | |
| 13 | M | 4/1 | 31 | RNA metabolism | 26 | 10 |
| | W | 4/3 | 32 | Protein metabolism | 27 | |

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|---|---|---|---|---|---|---|
| | F | 4/5 | 33 | Protein metabolism<br>Class Discussion # 3 | 27 | |
| **14** | M | 4/8 | 34 | Protein metabolism | 27 | **11** |
| | W | 4/10 | 35 | Protein metabolism | 27 | |
| | F | 4/12 | 36 | Regulation | 28 | |
| **15** | M | 4/15 | | **Exam 3:covers lectures 24-35** | | **none** |
| | W | 4/17 | 37 | Regulation of gene expression | 28 | |
| | F | 4/19 | 38 | Regulation of gene expression | 28 | |
| **16** | M | 4/22 | 39 | Regulation of gene expression<br>**Critical Problem set #3 DUE** | 28 | **none** |
| **FINAL** | **F** | **4/26** | | **Final 9:30-11:20am** | | |

# 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; for this reason I strive to never ask the same question twice. 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)

## MY JOBS

**1) Come to Class Prepared**

a) dissect the chapter and highlight the most important concepts in lectures

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.