CHEM 115 PO: Biochemistry

Instructor
Prof. Jane M. Liu (SN 216)
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Class
Mon, Wed 11:00 am – 12:15 pm,
SC 103

Office Hours
Whenever my door is open or by appointment

PRE-REQUISITES: CHEM 110A

COURSE OVERVIEW

This upper-level course, for those students with a background in both general chemistry and organic chemistry, will address the following questions:

- **How does the shape, structure and functional groups of macromolecules and metabolites relate to their biological reactivity and function?**
- **How do we isolate, manipulate and study a specific protein of interest from a cell?**
- **How do we study an enzyme's activity?**
- **How do macromolecules functionally interact in a cell?**

The study of biochemistry investigates the interplay between biological macromolecules such as proteins and nucleic acids, and low molecular weight metabolites (such as the products of glucose metabolism). In this course, you will apply your knowledge of intermolecular forces, thermodynamics (when a reaction occurs), chemical kinetics (how fast a reaction occurs), and chemical structure and functionality to understand how biological molecules (and life) work.

COURSE GOALS AND OBJECTIVES (Our Roadmap!)

- Be able to describe/identify the forces that direct/stabilize different levels of protein structure
- Be able to predict how changes in amino acid (or nucleotide) sequence can affect macromolecular structure and function
- Be able to explain how enzymes are able to affect reaction rate enhancement
- Be able to articulate and apply what the enzyme parameters of K_M, V_{max}, k_{cat} and k_{cat}/K_M tell us about an enzyme
- Be able to describe the interactions of biomolecules both quantitatively and qualitatively (in many cases, including mechanistic details)
- Be able to understand the flow of metabolic intermediates through a pathway and communicate information about metabolic pathways using diagrams
- Be able to describe multiple experimental methods used in biochemistry, interpret data from these methods to form conclusions, and develop a testable hypothesis to answer a question
- Be able to summarize and analyze primary literature and data, and apply gathered information to new situations
- Increase **problem solving skills** such as: critical thinking, data analysis, graphical analysis
- Increase **process skills** such as: communication of scientific concepts and experimental results, group dynamics and teamwork, management and self-assessment
- Develop a community of active learners who are intentional about their educational choices

OUTCOMES

For each topic, a list of learning outcomes will be provided to you, so that you can gauge your mastery of the materials and skills covered in CHEM 115.

COURSE MATERIALS

- Nelson DL and MM Cox. *Lehninger Principles of Biochemistry (5th edition).* ("Lehninger")
- Loertscher J and V Minderhout. *Foundations of Biochemistry (3rd edition).* ("FOBC")
- Calculator
- Active email account

COURSE OVERVIEW

Your Tasks

Before class: You will frequently be given initial assignments to work on as an individual before class. These assignments must be ready at the start of class – your preparation will form part of your weekly participation grade.

In class: During our class meeting time, you will frequently function as a member of a Learning Team, developing and examining chemistry concepts as a unit. Your team effort and participation is part of your weekly participation grade. The team responses to a few Key Questions on each in-class activity will be evaluated for strength of concept and effective communication of the concept. The team will also strategize on ways to improve teamwork and team products. These responses will also form part of your weekly participation grade.

After class: Application exercises will be assigned for each activity. Together with problems from the text, they will form your **weekly problem set** that will be collected and graded for each individual. These homework problems and exercises are important to your success in the course. **Actively** working these homework problems is essential for your understanding of the material, as they bring your concept development full circle.

Problem Sets (10 pts/ea): Due in class on Wednesdays at 11:00 am

Recorder Sheets (3 pts/ea): Due by 11:50 pm, day activity is finished (office OR email)

Strategist Sheets (2 pts/ea): Due on Fridays at noon (office OR email)

Performance Evaluations (3 pts/ea): Due on Fridays at noon (office OR email)

Assessments

Final Grade Calculation

Mid-term exams:	32%
Final exam:	18%
Team participation:	10%
Problem Sets/Other:	20%
Laboratory:	20%

Grading Scale

A	93-100	C	73-76
A-	90-92	C-	70-72
B+	87-89	D+	67-69
B	83-86	D	63-66
B-	80-82	D-	60-62
C+	77-79	F	≤59

There is no curve for this course – you need only worry about your own performance. Please note that an "A" grade represents excellent mastery and intelligent discussion of concepts covered in this course.

Exams: The exams will be comprised of short answer and short essay questions. The questions will be drawn from lectures, in-class activities, problem sets and discussions, as well as relevant primary literature that you may not have been previously assigned. No make-up exams will be given. If you know in advance that you will miss an exam, please notify Prof. Liu at least one week ahead of time so that alternative arrangements can be made. If you miss an exam due to a documented health or family-related emergency, your other two exams will each count 25% of your total grade. **The final exam will be cumulative.**

Attendance: Attendance in class is mandatory in an active learning environment. In addition to mastering the material yourself, you are responsible for assisting the other members of your team in their understanding of the material. You must not miss class. Please be respectful of me and your fellow classmates and show up to class on time. You can expect your grade to drop substantially with 3 or more absences. Valid reasons for missing class are serious illness, religious observations or family emergencies. **You are responsible for handing in all assignments on time and obtaining all activities, regardless of missed classes.**

Laboratory: The purpose of *doing* biochemistry is to gain experience in experimental methods that you'll be reading about throughout the semester. Attendance on your scheduled lab day is expected.

Late policy: For all assignments, late work will be accepted. However, for every 24 hours that the assignment is tardy, a 10% deduction will be applied to your grade on that assignment.

Special circumstances: If there are special circumstances, such as illness of other form of emergency, which should be taken into account with regard to any of the stated class policies, please inform me as soon as possible so that alternative arrangements can be made.

Disability Accommodations: If you have a documented disability and wish to discuss academic accommodations, please contact me and/or the Associate Dean of Students Marcelle Holmes (marcelle.holmes@pomona.edu) as soon as possible.

Academic ethics and integrity policy: You are expected to abide by the Pomona College Standards of Academic Integrity. For the official policy go to: http://pomona.catalog.acalog.com/content.php?catoid=4&navoid=102. Plagiarism, whether deliberate or unintentional, and cheating on examinations, are not acceptable.

Schedule (Subject to Change):

Week	Date	Topic	Chapters (Lehninger)
1	9/5	Introduction to Biochemistry	**1 and 2**
2	9/10 9/12	Intermolecular forces and water Amino acids and peptide bonds	**3 and 4**
3	9/17 9/19	Protein folding More protein folding	**3 and 4**
4	9/24 9/26	Working with proteins Working with proteins (continued)	**Primary Lit**

5	10/1 10/3	Enzyme catalysis Enzyme kinetics	**6**
6	10/8 10/10	Enzyme inhibition Hemoglobin	**5**
7	10/15 10/17	**Exam 1** Carbohydrates	**7**
8	10/22 10/24	**Fall Recess** Glycobiology	**7**
9	10/29 10/31	Lipids and membranes Transport across membranes	**10 and 11**
10	11/5 11/7	Signal transduction Metabolism overview	**12 and 13**
11	11/12 11/14	Glycolysis Glycolysis regulation and related pathways	**14**
12	11/19 11/21	Glycogen metabolism and gluconeogenesis Citric Acid Cycle	**15 and 16**
13	11/26 11/28	Electron Transport Chain / Oxidative Phosphorylation **Exam 2**	**19**
14	12/3 12/5	Lipid metabolism Nucleotides and nucleic acids	**17**
15	12/10 12/12	Nucleic acids structure and function/Primary Literature** Primary Literature	**8 and Primary Lit**
	TBA	**Final Exam**	