BCHM 461: Biochemistry I
Section 0103: Tue/Thu, 12:30-1:45pm, Chemistry 1402
Fall 2024

Professor: David Fushman
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Office hours: Wednesdays 4:00-5:30 pm via zoom **https://umd.zoom.us/j/8653743671**

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Course Description

Biochemistry is the study of the molecular basis of life. Biochemistry 461 is an introductory course that will introduce you to basic concepts in biochemistry and will provide the vocabulary and grammar needed to pursue further course work and research in this field. We will cover proteins as a major class of biological macromolecules and, if time permits, carbohydrates. The emphasis will be on the composition, chemical properties, and three-dimensional structure of these molecules in relationship to their biological function.

Textbooks:
Required: *Lehninger Principles of Biochemistry*, 8th edition, by Nelson and Cox. (Earlier editions: 7th, 6th, 5th should be good, too.)
Recommended: *The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry*, 6th edition, by Osgood and Ocorr.
Additional recommended reading: *Biochemistry*, by Voet and Voet.

Software tools. I will use molecular visualization tools to help describe various structural aspects of biological macromolecules in class, and some of these representations may be used on exams. You can download PyMol visualization software free of charge from here: **http://www.pymol.org/edu/** .

Course Web Site:
http://terpconnect.umd.edu/~fushman/

Here you will find a copy of the syllabus, regular reading and homework assignments, quizzes, exam solutions and statistics, study hints and extra material. The website will be updated and the material will be posted as we proceed with the course. You are welcome to email me your questions and comments. I do not guarantee individual responses, but errors or common points of confusion will be addressed in class and/or in the Q&A section on the course website.

Copies of the lecture slides and other electronic material for this course will be made available through ELMS

http://elms.umd.edu

Class format. ***Lecture attendance is important and expected.*** The lectures will not replace the textbook but rather supplement it with new material, emphasize important conceptual and technical issues, and clarify tricky points. You are responsible for *both* the material covered in the lectures and the assigned reading. **Please ask questions in lecture if something is not clear!**

If you believe a mistake has been made in lecture (it's likely to happen), please speak up or inform me afterward. Cellular phones should be OFF at any time during lectures and exams.

Office hours will be held online via zoom. If you can't connect during the allocated time but want to speak with me, I will be happy to arrange a zoom meeting at a different day/time. My goal is to accommodate as many of your requests as possible.

You must fully comply with the COVID-19 related campus policies and rules for in-person teaching. There will be zero tolerance for any violations of these policies and rules. If we transition to online education, lectures will be delivered synchronously (via zoom) or asynchronously (as prerecorded videos). They will be recorded (using zoom) and made available via ELMS.

Homework. Questions and end-of-chapter problems will be given as homework regularly: they are designed to encourage your regular reading of the material, and completing them will help you prepare for the exams.
In addition, **graded** take-home ***quizzes*** will be given regularly. They will be emailed to you and posted on the course website, and you are expected to submit your answers via ELMS before the specified deadline. All quizzes together will contribute up to 100 points toward your total score.

Exams. There will be two midterm exams. Each of the exams will count for up to 100 points and will cover material since the previous exam but will inevitably draw on the information from earlier in the semester. The final exam will be cumulative and will count for up to 100 pts. The exams will include material covered in the lectures and in the corresponding sections of the textbook. You will be allowed to use calculators on the exams *for computations only*.
All students must take the final exam.

Examinations will be given on the following dates (all the exams will be in the lecture hall, CHEM 1402)**:**

Exam I	Tuesday, October 8 (tentative)
Exam II	Thursday, November 21 (tentative)
Final exam:	**Monday, December 16, 4:00-6:00 pm (**This exam date is firm)

Review Sessions: Typically there will be a review session in the late afternoon or evening a few days before an exam.

Grading Policy.

Midterm Exams …….….	100 points each
Graded Quizzes …..……....	100 points total
Final Exam …….	100 points

Grading. The scores on all three exams and all graded quizzes will be added, and the final grades will be based on this total (maximum 400 points). Grading will be done on a *curve* based on the overall distribution of the *class scores*. Final grading will be done using the "plus/minus" grading system.

Re-grading. If you think a mistake has been made in grading your work, you must submit it to me for re-grading no later than one week after the date on which the work was returned to the class, with a *written* explanation of your reason for desiring a re-grade. Be aware that the entire exam will be subject to re-grading, which often might decrease the total score. If you used a pencil on the exam, your work will not be eligible for re-grading. After that, the grade will be considered final. Arithmetic errors in the grading can be corrected without re-grading.

Make-up exam policy. ***Do not miss any of the exams or graded quizzes***. If you miss an exam, **you will have a score of "0" on the exam until it is made up.** Only students with **legitimate excuses** as determined by the University policy will be given a make-up exam. For a make-up exam you will need a written documentation of the emergency or illness. A missed quiz will also be assigned a zero score. There will be no make-ups for missed quizzes.

It is your responsibility to contact me promptly to schedule a make-up exam. In any case, YOU MUST CONTACT ME WITHIN 24 HOURS OF MISSING AN EXAM, and your written documentation must be provided within a week of missing the exam.

Teaching assistance. The teaching assistant/grader for this course is *Mr. Reid Peterson*, an advanced graduate student in the Biochemistry program. There will also be Guided Study Sessions led by Mr. Jacob Svoysky, a senior undergraduate student. We will be happy to help you with the material during office hours. If necessary, we will arrange other times to meet.

Video Lectures. In the case of illness or travel on my part, lectures will be recorded (audio and video) and posted along with lecture notes on ELMS. You will be responsible for this material. Additional time will be made during review sessions or office hours to ask questions about any material covered in a video lecture.

The University course-related policies and resources can be found at:
http://www.ugst.umd.edu/courserelatedpolicies.html .

Academic integrity. Students are expected to observe the University's *Code of Academic Integrity* (**http://www.president.umd.edu/policies/iii100a.html**). Students are responsible for knowing, understanding and behave accordingly to the content of the Code. Cheating on the exams or problem sets is not acceptable and will be met with zero tolerance. Specific guidelines relevant to this course include:

1. All work that you submit for grading in this course must be the original work of the student whose name is on the work.

2. You may use a **standalone** calculator (not on your **Smartphone**) for the exams, but **only** for computations. Any other use is a violation of the University's *Code of Academic Integrity*.

3. Other actions such as falsification of excuses for missed exams or submission of an altered, graded examination for re-grading, etc., are violations of the *Code of Academic Integrity* or the *Code of Student Conduct.*

Honor Pledge. Students will be required to write and sign on the front cover of each exam the Honor Pledge: "I pledge on my honor that I have not given or received any unauthorized assistance on this examination". More information on the Honor Pledge can be found on the University website **http://www.ugst.umd.edu/courserelatedpolicies.html**.

Religious observance. It is the student's responsibility to inform me in advance of any intended absences for religious observances. Notice should be provided as soon as possible but no later than the end of the schedule adjustment period (September 9th).

Students with disabilities. If you have a documented disability and wish to discuss academic accommodations with me, please contact me as soon as possible.

Course Outline

The book, lecture notes, and any Power Point/PDF presentations posted on the web are to help you in learning and preparation for the exams, but they do not include all the material covered in class. Therefore, attendance in class is highly recommended.
You are supposed to know ALL chemical structures and ALL mechanisms described in class unless otherwise mentioned in class.

The exact order of topics and the number of lectures on each may change.

1. **Principles of Biochemistry** (2 lectures) Chapters 1 and 13
   The Foundations of Biochemistry
   Energy and principles of bioenergetics

2. **Water, the Solvent of Life** (3 lectures) Chapter 2
   Non-covalent interactions
   Properties of water
   Acid/base properties, pH buffering capacity

3. **Protein Composition, Structure, and Stability** (13 lectures) Chapters 3 and 4
   Amino acids – structures, nomenclature, chemistry.
   Primary structure – the peptide bond, sequence homology, and evolution, synthesis.
   Working with proteins – methods for protein purification and analysis.
   Secondary structure – α-helices, β-sheets, turns, Ramachandran plot, structure prediction.
   Tertiary structure, protein motifs & structure classification
   Quaternary structure. Proteins in cellular environment: quinary structure.
   Protein folding and dynamics.
   Methods for protein structure determination.

4. **Protein Function** (7 lectures) Chapters 5 and 6
   Protein-ligand interactions. Oxygen-binding proteins.
   Quantitative analysis of protein-ligand interactions.
   Cooperativity, allostery.
   Enzymes -- how they work.
   Enzyme kinetics – Michaelis-Menten equation, Lineweaver-Burke plots etc.
   Enzyme inhibition – mechanisms.
   Specific examples of enzymatic reactions.

5. **Carbohydrates and Glycobiology** (2 lectures) Chapter 7