BCHM 461: Biochemistry I
Section 0102: MonWed, 4:00-5:15pm, Chemistry 1402
Fall 2019

Professor: David Fushman
Office: Room 1121, Biomolecular Sciences Bldg (#296)
e-mail: fushman@umd.edu (*Please include BCHM461 in the subject line*)
Tel.: 301-405-3461 (Please restrict telephone inquiries to office hour times, except in emergencies)
Office hours: Tuesday 12:30-2:30 pm

Teaching Assistant/Grader: Mr. Steven Bonn
Office: Room 1122, Biomolecular Sciences Bldg (#296), Monday 9:30am-11:00am
e-mail: sbonn@terpmail.umd.edu

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 the four major classes of biological macromolecules: proteins, carbohydrates, lipids, and nucleic acids. The emphasis will be on the chemical properties and three-dimensional structure of these molecules in relationship to their biological function.

Textbooks:
Required: *Lehninger Principles of Biochemistry*, 7th edition, by Nelson and Cox. (Earlier editions: 6th, 5th should be good, too.)
Recommended: *The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry*, 7th 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 in class, and some of these representations may be used on exams. The files will be distributed as PyMol sessions. You can download PyMol visualization software free of charge from here: **http://www.pymol.org/edu/** .

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

where 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 website.

The lecture slides and other electronic material for this course will be made available through ELMS
http://elms.umd.edu

Please note that class lectures and other material are copyrighted and may not be reproduced for anything other than personal use without my written permission.

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.

Homework. Questions and 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, *quizzes* will be handed out regularly. You are expected to hand in your answers before or on the day the quiz is due. All quizzes will contribute 50 points toward your total score.

Exams. There will be two midterm exams. Each of the exams will count for 100 points and will cover material since the previous exam but will inevitably draw on information from earlier in the semester. The final exam will be comprehensive and will count for 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 computation only*.

Examinations will be given on the following dates (all the exams will be in the lecture hall, CHEM 1402)**:**
>   Exam I   Monday, October 7 (tentative)
>   Exam II   Wednesday, November 20 (tentative)
>   Final exam: **Tuesday, December 17, 1:30-3:30 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
Quizzes   …..………..………   50 points total
Final exam ………………..   100 points

Grading. The scores on all three exams and all quizzes will be added, and the final grades will be based on this total (maximum 350 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. 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*. 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. **The will be no make up for missing 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.
All students must take the final exam.

Teaching assistance.   The teaching assistant/grader for this course is *Mr. Steven Bonn*, an advanced graduate student in the Biochemistry program. 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 placed along with lecture notes on the course website. 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 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://shc.umd.edu/SHC/Default.aspx, 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 computation. 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 presentations posted on the web are to help the student in his/her preparation, but they do not include all the materials covered in class. Therefore, attendance to 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** (3 lectures)   Chapter 2
     Non-covalent interactions
     Properties of water
     Acid/base properties, pH buffering capacity

3. **Protein Composition, Structure, and Stability** (10 lectures)   Chapters 3 and 4
     Amino acids – structures, nomenclature, chemistry.
     Primary structure – the peptide bond, sequence homology, and evolution, synthesis.
     Methods for protein purification and analysis.
     Secondary structure – α-helices, β-sheets, turns, Ramachandran plot, structure prediction.
     Tertiary structure, protein motifs & structure classification
     Quarternary structure. Proteins in cellular environment: quinary structure.
     Protein folding and dynamics.
     Methods for protein structure determination.

4. **Protein Function**   (6 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.
     Examples of enzymatic reactions.

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

6. **Nucleotides and Nucleic Acids** (2 lectures)   Chapter 8

7. **Lipids and Membranes** (2 lectures)   Chapters 10 and 11