

Medical Biochemistry
BC 362
Fall 2014

Instructor:

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Office hours:

As announced in class each week and also by appointment. Please do not hesitate to make an appointment if you cannot make the scheduled times. Email is also a very convenient way to receive a quick answer to a question.

Text:

Biochemistry: A Short Course, 2nd Edition
by J. L. Tymoczko, J. M. Berg, and L. Stryer (2013); W.H. Freeman and Company.

Course webpage:

<http://www.colby.edu/chemistry/BC362/index.html>

Course overview:

This is an intensive, fast-paced course that provides in-depth exposure to the principles of biochemistry most important to an understanding of health and disease. Major topics include the functions and interactions of the major classes of biomolecules and the transduction and storage of cellular energy (metabolism). This course is designed for students who are more likely to pursue the health professions (e.g., M.D., D.O., D.D.S.) than a research career. The experimental aspects of biochemistry have therefore been de-emphasized, although we will cover many technical chemical concepts that are integral to a firm understanding of biochemistry. Beyond providing a foundational knowledge of the ways in which biochemistry underlies virtually all mechanisms of health and disease, this course will be valuable preparation for entrance exams and for advanced coursework in health professional school.

Course learning goals:

These are the goals that I believe you should strive to achieve in taking this course. I will work hard to enable your success, but remember that the responsibility for learning is ultimately on your shoulders.

1. To develop a solid understanding of the fundamental chemistry and biochemistry of the major classes of biomolecules, including proteins, carbohydrates, and lipids.
2. To gain an appreciation of how basic biochemical principles – including chemical reactivity, thermodynamics, and kinetics - underlie and regulate all biochemical processes that are important for life.
3. To learn how biochemical pathways are interconnected and to see the clear connection between biochemical processes and human biology; to understand how biochemical communication, cooperation, and regulation are critical for the proper control and

execution of processes in health and how defects in these mechanisms can result in disease.

4. To improve your intellectual capacities and thinking skills. Biochemistry is both logical and complex, and its extensively interconnected nature provides a platform for learning how to think both broadly and deeply about various topics, how to see connections between concepts, and how to ask the most important questions about a given problem.

My expectations:

Listed below are the things that I expect from you in progressing through this course:

1. That you keep up-to-date with all of the reading assignments, complete all assigned homework on time, and come to both lecture and discussion sessions prepared and ready to learn.
2. That you bring your energy and enthusiasm about science to class, and that you participate and become engaged in the topics and discussions that we formulate as a group. You should strive for excellence in identifying important questions and in communicating your questions, comments, or responses as clearly as possible.

Lecture topics:

Lectures in this course will be rich in content. The approximate schedule of lecture topics, along with the corresponding textbook chapters, is shown below. We will be covering a large number of topics and will therefore be moving quickly; as a student, you have a significant responsibility to keep up with the material outside of lecture. Some of the material presented in lecture will go much further than is provided in the textbook, while other sections will be more thoroughly covered in the text. You are responsible for learning both the lecture and the reading material.

<u>Dates</u>	<u>Topic</u>	<u>Reading in Text</u>
Sept 4	Introduction, Water, & Buffers	CH 1, 2
Sept 8	Amino Acids, Peptides, and Proteins	CH 3
Sept 9-18	Peptides and Proteins	CH 4, pp 84-87, 9
Sept 23-Sep 30	Enzyme Kinetics and Mechanisms	CH 6, 7, 8
Oct 2	Carbohydrates	CH 10
Oct 9	Lipids and Membranes	CH 11, 12
Oct 16	Introduction to Metabolism	CH 15
Oct 21	Glycolysis	CH 16
Oct 23	TCA	CH 18, 19
Oct 28, 30	Electron Transport Chain/Ox Phos	CH 20, 21
Nov 4, 6	Other Carbohydrate Pathways	CH 17, 24-26
Nov 11, 18	Lipid Metabolism	CH 27, 28
Nov 20	Nitrogen Metabolism	CH 30, 31
Nov 25	Integration of Metabolism	
Dec 2-5	Disorders of Metabolism	

Discussion section:

Good communication, both written and oral, is an essential scientific skill. You will have ample opportunities to communicate your biochemical knowledge both in lecture and in the weekly discussion section. In addition to a quiz, most weeks you will receive a problem set that you are to complete for the Friday meeting, where you will have the opportunity to volunteer to present the questions. Please write out each problem on its own separate page and be prepared to turn in your answers. You should get together with other people in the class to begin working through these problems shortly after they are assigned. The principal goal of these problem sets is to stimulate discussion, not necessarily for you to obtain the “right answers,” so please do not try to “check your answers” with Prof. Millard before discussion section. You will be graded primarily on your effort and your ability to communicate effectively. While there are no excused absences from discussion section, if you know you are going to be absent because of a planned event such as an interview or athletic competition, you must notify Prof. Millard and turn in your entire written problem set *before* discussion.

In-class presentations:

During the course of the semester, you will have two opportunities to make a short formal presentation. The first is a case study presentation in which you will present the medical history, problems, and treatment of a particular (fictional) patient. Working in a group of three, you will develop a case study and appropriate discussion questions based on the medical literature. You have some flexibility in your choice of a case to present, but it must focus on material covered in the previous week of class. You may choose your group and date (first come, first served; see last page of the syllabus), or you will be assigned a group and date if you have not made your selection by September 13. These presentations will begin in discussion section on Sept 19. Your presentation should be ~15 minutes in length and include a handout that summarizes the case, as well as discussion questions and references. An excellent resource for developing your case is the National Center for Biotechnology Information (NCBI) website “Online Mendelian Inheritance in Man.”

The second presentation will be a ~12-minute Powerpoint presentation on a metabolic disorder during the last week of the semester. Your group is free to choose any metabolic disorder, condition, or disease, but you must satisfy two criteria.

- 1) The topic must be current so that you can review recent primary literature.
- 2) You must explain the disorder on a biochemical level. (e.g., what pathway is affected, and how does this explain the symptoms?)

Assessment and grading:

Your grade for this course will be a composite of several different methods of assessment, as described below:

- Most weeks, a short quiz will be administered at the start of the discussion section. These will be multiple-choice and/or (very) short-answer quizzes designed to be about 10 minutes in duration. ***The quizzes are intended only to encourage “keeping up” and are not representative of the difficulty of the exams.*** There will be no make-up quizzes. In the event of an unplanned, excused absence (such as an illness confirmed by the Health Center), you will not be penalized for the missed quiz. Rarely, you might be permitted to take a quiz

early because of sanctioned college event or the like. Such requests must be made *in writing* at least a week prior to the quiz. **(15% of final grade)**

- There will be two mid-term exams: (1) Tuesday, October 7 and (2) Thursday, November 13. Exam questions will come from all aspects of the course, including reading assignments, lecture material, problem sets, and discussion material. ***The exams will be more difficult than the quizzes!*** There will be no make-up exams. If you miss an exam for a medical reason, you must request communication from your medical professional directly to Prof. Millard. Some students may have approval from the Dean of Students Office for time extensions on exams, in which case appropriate arrangements should be made with the instructor prior to the week of the first exam. **(35% of final grade)**
- The final exam is scheduled for Saturday, December 13. The final exam is *comprehensive*. **(20% of final grade)**
- Discussion and participation will be part of your grade in this course. Attendance at all lectures and discussion sessions is expected. You will be expected to have completed the assigned reading, have completed the problem set, and be otherwise prepared to participate in class discussions. This portion of your grade will be assigned at the professor's discretion. **(20% of final grade)**
- The two in-class presentations described above will account for the remainder of your grade. **(10% of final grade)**

Tips for Success:

One way to succeed in this course is to follow a cycle of Preview-Learn-Review-Study-Assess:¹

- Preview before class by skimming the chapter so that you know what's coming.
- Learn the material by attending class, taking meaningful notes, and asking questions.
- Review after class, reading the chapter and your notes, filling in any gaps, and noting any questions that you have.
- Study, interacting with the material by organizing, making and using flashcards to memorize key facts, solving problems, and re-writing your notes.
- Assess your learning, doing practice problems and on-line sample exam questions without help from the text or your notes and working in study groups to quiz each other.

Intellectual Responsibility:

Any written work submitted in your name is to be your work alone, except for the formal presentations done with a group, which should be equal effort. You are encouraged to discuss material for problem sets with others but merely copying answers is prohibited. Any violation will result in an F in the course.

Cell phones and other portable electronic devices may not be used during quizzes and exams for any reason. A calculator will be provided to you when necessary. Any use of portable electronic devices (for example, leaving the room to make or receive phone calls, sending or reading text messages, or accessing the internet) will be considered a violation of academic honesty. Consequently, the score will be zero, and the violator will be reported to the Dean of Students.

¹ Cook et al. (2013) Effect of Teaching Metacognitive Learning Strategies on Performance in General Chemistry Courses, *J. Chem. Educ.* 90, 961-967.

Special Dates:

There are up to four class periods that may need to be rescheduled because Prof. Millard will be traveling on College business. These dates are as follows. The location for these classes is Keyes 105.

Date	Make-up date and time	Status
Thursday, September 11	Monday, September 8; 6:00 – 7:15 PM	Definite
Friday, September 12	Monday, September 15; 6:00 – 6:50 PM	Definite
Friday, October 31	Monday, November 3; 6:00 – 6:50 PM	Likely
Friday, November 21	Monday, November 24; 6:00 – 6:50 PM	Possible

Dates for case study presentations are as follows: Sept 19, Sept 26, Oct 3, Oct 10, Oct 17, Oct 24, Nov 3 (discussion A only). Discussion A will have two groups of two for the case study presentations. Please email Prof. Millard with your group, preferred dates (in case your first choice is not available), and which discussion section you are in. Note that your partners must be in your discussion section.