

Chemical Basis of Metabolism
CH 368
Spring 2012

Instructor: Julie T. Millard, Dorros Professor of Life Sciences
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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: Nelson and Cox (2008) Lehninger's Principles of Biochemistry; 5th Edition

Course Webpage: <http://www.colby.edu/chemistry/BC368/368index.html>

Course Overview and Goals:

This course is a continuation of BC 367. That course concentrated on protein structure, enzyme kinetics and mechanisms, and the structure and function of lipids, carbohydrates, and nucleic acids. This course will focus on the deployment and use of these biomolecules throughout the cell. Chemical signaling, membrane phenomena, metabolism, bioenergetics, and regulatory processes will be of particular interest. We will examine individual reactions and metabolic pathways while investigating how cells and organisms integrate and regulate these reactions and pathways to accomplish specific tasks. While we will focus on human examples, other animals and plants will also be considered. Topics include the generation and use of metabolic energy, the integrated control of cellular functions, mechanisms of transport, and special subjects of particular interest to biochemists with a chemical background. Learning goals include the development of problem-solving, critical-thinking, and communication skills in both the lecture and optional laboratory. 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. The laboratory will employ a collaborative case study approach, applying biochemical tools to real-world problems.

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 for each week, along with the corresponding textbook readings, is shown below. We will be covering a great deal of material 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>Topic</u>	<u>Date(s)</u>	<u>Relevant Reading</u>
DNA Fingerprinting	Feb 1	Box 9-1
Membranes and Transport	Feb 7-14	CH 11
Biosignaling	Feb 16-23	CH 12
Principles of Bioenergetics	Feb 28	preface to Part II, CH 13
Glycolysis, Pentose Phosphate	Mar 1, 6	CH 14 (pp 527-551; 558-end)
Citric Acid Cycle	Mar 8, 13	CH 16
Oxidative Phosphorylation	Mar 15-29	CH 19 (pp. 707-742)
Photosynthesis	Apr 3, 5	CH 19 (pp. 742-end), CH 20
Other Carbohydrate Biosynthesis	Apr 10, 12	CH 14 (pp. 551-558), CH 15
Fatty Acid Oxidation & Synthesis	Apr 17-24	CH 17, 21
Nitrogen Metabolism	Apr 26, May 1	CH 18, 22
Integration of Metabolism	May 3	CH 23

Exams:

Exams will be given according to the following tentative schedule:

- Exam 1 –Wednesday, March 7 through Friday, March 9.
- Exam 2 – Monday, April 16 through Wednesday, April 18.

Exam questions will come from all aspects of the course, including reading assignments, lecture material, problem sets, and discussion material. The format of these exams will be discussed in class and will follow the Biochemistry Honor System. Please plan accordingly, as there are 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. The final exam will be given at the time designated by the Registrar.

Some students may have approval from the Dean of Students Office for time extensions on exams. Please have Dean Moore contact Prof. Millard to discuss an appropriate time extension prior to the first exam.

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 class and in the weekly discussion section. Most weeks, you will receive a problem set that you are to complete for the Friday meeting. Please neatly write or type out each problem separately on its own sheet of paper: most weeks you will be asked to turn in

one or more problems, so you should always be prepared for this possibility. 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. Participation includes presenting a problem, asking questions, providing additional details to a problem, and contributing a slightly different viewpoint on a problem. Merely sitting in class is not enough for the top discussion grades. 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 turn in the entire written problem set *before* discussion section. Your grade for discussion will be assigned at Prof. Millard’s discretion.

In-Class Presentation:

You will obtain additional practice with scientific communication by making a short formal presentation to the class during discussion section. Working with a partner, you have two options for this presentation:

- a) A case study presentation in which you will present the medical history, problems, and treatment of a particular (fictional) patient. You will develop your case study with appropriate discussion questions based on the medical literature.
- b) A problem-solving presentation in which you will present the background and results of a particular biochemical experiment. You will use data and develop appropriate discussion questions based on the biochemical literature.

You have some flexibility in your choice of a topic to present, but it must focus on material covered since the previous presentation. You may choose your partner and date (first come, first served), or you will be assigned a group and date if you have not made your selection by Feb 17. Your presentation should be ~15 minutes in length and include a handout that summarizes the case or problem, as well as discussion questions and references. An excellent resource for developing medical cases is the National Center for Biotechnology Information (NCBI) resource “Online Mendelian Inheritance in Man.” Available dates for these presentations are Feb 24, Mar 2, Mar 16, Mar 30, Apr 13, and Apr 27.

Class Participation and Intellectual Responsibility:

You are expected to come to class each period prepared to participate. You are responsible for all material presented in each class meeting, as well as all assigned readings, which should be done before the relevant class. This includes problem sets, in-class problems, and discussion section. Attendance is expected; unexcused absences will be penalized at Prof. Millard’s discretion.

Any written work submitted in your name is to be your work alone, except for the formal presentations done with a partner, 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.

Portable Electronic Devices:

Cell phones and other portable electronic devices may not be used during exams for any reason. The only exception is a non-programmable calculator; if you do not have one, you may borrow one from Prof. Millard. Any use of portable electronic devices (for example, making or receiving phone calls, sending or reading text messages, or accessing the internet) will be considered a violation of academic honesty.

Assessment and Grading:

	with laboratory	without laboratory
Hour Exams	35%	50%
Discussion & Participation	20%	20%
Final Exam	20%	25%
Presentation	5%	5%
Laboratory	20%	---