

# Metabolic Biochemistry

## BIBC 102

Summer Session 2, 2011

**Instructor:** Aaron Coleman, Ph.D.  
York Hall, room 4070A  
abcoleman@ucsd.edu

**Office Hours:** Tues and Weds 12-1 PM

**Course Text:** D.L. Nelson and M.M. Cox Lehninger-Principles of Biochemistry, 5<sup>th</sup> Edition  
Freeman, 2008 (Note that the Lehninger 4<sup>th</sup> edition is also an acceptable text; the  
corresponding page numbers for reading assignments will be posted on WebCT.)

### Course Objectives:

This course will examine the concepts of energy and metabolism, and how they are harnessed and regulated at the cellular and molecular level. We will start by looking in detail at the action of enzymes. We will examine the kinetics of enzyme-catalyzed reactions, the chemical mechanisms through which enzymes produce catalysis, and the regulation of catalytic activity. The remainder of the quarter will focus on metabolism, the various pathways by which biological molecules are broken down to provide energy for the cell, and by which new biological molecules are synthesized. In our study of metabolism we will try to understand how energy flows in the cell, such as in the oxidation of glucose to produce ATP, and how this energy and energy-containing intermediates are utilized to construct new molecules, as in the synthesis of fatty acids from acetyl-CoA. The various biochemical pathways that accomplish this will be examined in detail. We will also look at how the cell manages the free-energy changes that occur in these metabolic pathways, and how these pathways are regulated so that metabolism occurs in coordinated fashion.

**Discussion Sections:** Discussion sections will begin on the Weds of week one. You must sign up for the discussion section you wish to attend using the online Sections Tool at <http://sections.ucsd.edu/> (instructions and an overview of the process are given at <http://sections.ucsd.edu/overview.shtml> ). Online enrollment will begin at 11 PM on the first day of class (8/1/11), and selection of sections is on a first-come, first-serve basis, up to 35 students per section. It is important to attend the discussion section you are signed up for. You will be turning in homework assignments and getting back exams at your designated section. Note that beginning the second week the TAs are required to turn away students who are not on the roster for their section.

**Ted (TritonLink Education):** We will be using Ted (<https://ted.ucsd.edu>) as the course web site. All students will need to be able to access Ted. Once you are enrolled in the class you will have access using your ACS username and password. Be sure to check the course website frequently for announcements and updates on assignments. Many of the materials for the class will be downloaded from here. Use the Discussion Board to ask questions on the course material. The instructor will check the Discussion Board daily to answer questions, but students are encouraged to answer questions as well. This is a handy resource for last minute questions that come up during late night studying for an exam.

**Homework Assignments:** Homework assignments can be downloaded from Ted beginning on the Friday of weeks 1-4, and are then due at the second meeting of your designated discussion section on the following week (*e.g.*, the first homework assignment will be available on Friday of week 1 and will be turned in at your second discussion section of week 2; the second homework assignment will be available on Friday of week 2 and will be turned in at your second discussion section of week 3). Assignments will be collected at the beginning of the section. Homework assignments must be turned into the discussion section for which you are signed up, and will not be accepted at other discussion sections or by the instructor. Late homework assignments will be penalized 5 pts. for each working day that they are late. It is the student's responsibility to coordinate with their TA to turn in a late assignment.

**Exams:** Make-up exams will not be given, except in case of illness that is documented by a note from a physician.

**Grading:**

Homework; 4 assignments at 40 pts. each	160
Midterm Exam	400
Final Exam	440
<b>Total</b>	<b>1000</b>

**Grade cutoffs:** (Grade cutoffs may be lowered at the instructor's discretion.)

905-1000	A	760-779	C+
895-904	A-	695-759	C
880-894	B+	675-694	C-
800-879	B	590-674	D
780-799	B-	0-589	F

## Lecture Schedule:

Week/ Date	Topic	Text Chapters
1 Aug. 1	Course introduction; The structure of Proteins	3 (p. 71-76; 82-84) 4 (p. 113-123)
1 Aug. 2	Chemical reactions and enzyme catalysis	1 (p. 19-27), 6
1 Aug. 3	Catalytic reaction mechanisms of enzymes	6
1 Aug. 4	Michaelis-Menten enzyme kinetics	6
2 Aug. 8	Enzyme inhibitors	
2 Aug. 9	Regulation of enzyme activity	6
2 Aug. 10	Metabolism: Coupling of endergonic and exergonic reactions; Electron carrier cofactors	13 plus p. 485-488
2 Aug. 11	Glycolysis	14 (p. 527-551)
3 Aug. 15	Alternate fates of pyruvate	14 (p. 527-551)
3 Aug. 16	The pyruvate dehydrogenase complex	16
3 Aug. 17	The citric acid cycle <b>Midterm Exam: 2:00-4:50 PM</b>	16
3 Aug. 18	The mitochondrial electron transport chain	19 (p. 707-735)
4 Aug. 22	Oxidative phosphorylation and ATP synthase	19 (p. 707-735) 13 (p. 512-515)
4 Aug. 23	Gluconeogenesis; The pentose phosphate pathway	14 (p. 551-563)
4 Aug. 24	Glycogen metabolism; Regulation of carbohydrate metabolism	15
4 Aug. 25	Oxidation of fatty acids; Ketone bodies	17, 10 (p. 343-348)
5 Aug. 29	Lipid biosynthesis	21
5 Aug. 30	Amino acid metabolism and the urea cycle	18
5 Aug. 31	Photosynthesis, light reactions	19 (p. 742-764)
5 Sept. 1	Photosynthesis, carbon-fixing reactions	20 (p. 773-790)
5 Sept. 2	<b>Final Exam: Friday, Sept. 2; 8:00-11:00 AM</b>	