Metabolic Biochemistry
BIBC 102

Winter Quarter 2016

Instructor: Aaron Coleman, Ph.D.
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Office Hours: York Hall room 2300 (ground floor, south end of the building facing the fountain)
Wednesday 9:30 – 10:30 AM and Friday 10:30 – 11:30 AM

Course Text: D.L. Nelson and M.M. Cox, Lehninger-Principles of Biochemistry, 6th Edition Freeman, 2013. The fifth edition of Lehninger is also acceptable; the corresponding reading assignments are given for this edition as well.

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 these pathways are regulated so that metabolism occurs in coordinated fashion.

Discussion Sections: Discussion sections will begin in week 2 of the quarter. Attendance and participation in discussion section activities are required on days where activities are scheduled (see table below). You may only attend the section in which you are enrolled on these days. The IAs will turn away students not on the roster for that section. On days where section activities are not scheduled, attendance is not mandatory and all sections will be open (you may attend any section you wish). Midterm exams will be given back at the section in which you are enrolled. Please note that this is the only place where you can pick up your graded midterm exams.

Discussion Section Activity Schedule				
Week	**Section Days**	**Activity**	**Attendance Pts.**	**Activity Pts.**
2	all	form workgroups; protein structure exercise	4	4
3	all	open (attendance not required)		
4	M, Tu, W	open (attendance not required)	4	4
	Th, F	glycolysis exercise		
5	M, Tu, W	glycolysis exercise		
	Th, F	open (attendance not required)		
6	all	enzyme kinetics exercise	4	4
7	all	open (attendance not required)		
8	all	fermentation exercise	4	4
9	all	oxidative phosphorylation exercise	4	4
10	all	metabolic flux exercise	4	4

Triton Ed: We will be using Triton Ed (https://tritoned.ucsd.edu/webapps/login/) as the course web site. All students will need to be able to access TEd. Once you are enrolled or waitlisted in the class you will have access using your ACS username and password. Be sure to check the TEd frequently for announcements and updates. All of the course materials can be downloaded from TEd.

Exams and Grade Assignments: Your grade will be determined from two midterm exams and the final exam. Each midterm exam has a base point value of 285 points, but the exam on which you receive the higher score will be weighed 50% more heavily from this base value, and the exam on which you receive a lower score will weighed 50% less from the base.

	Point Value
Midterm 1	143 or 428
Midterm 2	143 or 428
Final Exam	380
Section attendance and participation	50
Class Point Total	1000

Make-up exams will not be given, except in case of illness that is documented by a note from a physician. Grades will be based on the following un-curved scale using the adjusted point total from the three exams and section exercises. The grade cutoffs may be adjusted downward at the instructor's discretion.

Grade cutoffs:

905-1000	A	780-789	C+
895-904	A-	695-779	C
885-894	B+	675-694	C-
800-884	B	590-674	D
790-799	B-	0-589	F

Lecture Schedule:

Week		Reading in Lehninger 5th Ed.	6th Ed.	Read on TEd
	Read	1(19-27)	1(20-29)	Chemical reactions
1	Course introduction; Review of protein structure	3(71-77;82-84) 4(113-123)	3(75-81;85-89) 4(115-125)	
	Thermodynamics of enzyme catalysis; Catalytic reaction mechanisms of enzymes	6 (skip box 6-3) (skip 213-219)	6 (skip box 6-3) (skip 221-225)	
2	Michaelis-Menten enzyme kinetics	same	same	Enzyme inhibitors
	Enzyme inhibitors; Regulation of enzyme activity			
3	Metabolism: Coupling of endergonic and exergonic reactions	13 Plus 485-488	13 Plus 501-504	
	Metabolism: Electron carrier cofactors			
4	Glycolysis	14(527-538) (546-551)	14(543-555) (563-568)	
	Fermentation; alternate fates of pyruvate			
5	The pyruvate dehydrogenase complex	16 (skip 638-640)	16 (skip 656-659)	
	Exam 1 in lecture, Thursday, Feb 4th			
6	The citric acid cycle	19 (707-735)	19 (731-762)	
	The mitochondrial electron transport chain			
7	Oxidative phosphorylation and ATP synthase.			
	Gluconeogenesis	14 (551-563)	14 (568-580)	
8	The pentose phosphate pathway; Glycogen metabolism	15 (594-602)	15 (612-620)	Select and read one of two research articles
	Oxidation of fatty acids; Ketone bodies	10(343-348) 17(647-656; 666-668)	10(357-361) 17(667-677; 686-688)	
9	Synthesis of fatty acids; Cholesterol synthesis	21(805-815)	21(833-843)	
	Amino acid metabolism and the urea cycle	18(673-688)	18(695-711)	
	Exam 2; Out of class exam Saturday, March 5th, 10 AM – 12 PM			
10	Regulation of metabolism	15(569-577; 582-590; 602-608)	15(587-595; 601-608; 620-626)	
	Regulation of metabolism, cont.			
	Final Exam Tuesday, March 15th 3 – 6 PM			