Metabolic Biochemistry
BIBC 102

Fall Quarter 2022

Instructor: Aaron Coleman, Ph.D.
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Office Hours
In-Person: Tuesday 3 – 4 pm in York Hall 3080A (my office—check here first) and York 2300 (conference room); we will move to the conference room to accommodate larger numbers.
Zoom: Thursday 10 – 11 am (beginning Sept. 30th)

Required Text: D.L. Nelson and M.M. Cox, Lehninger-Principles of Biochemistry, 6th or 7th Edition (Freeman).

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). Your midterm exams will be returned to you in your enrolled section.

Discussion Section Activity Schedule				
Week	**Section Days**	**Activity**	**Attendance and participation points**	**Submitted work**
2	Mon, Fri	form workgroups; biological oxidation reactions	10	
3	Th, F	enzyme kinetics	10	10
4	Mon	open (attendance not required)		
	Fri	glycolysis exercise	10	15
5	Mon	glycolysis exercise		
	Fri	open (attendance not required)		
6	all	fermentation	10	
7	all	open (attendance not required)		
8	all	oxidative phosphorylation	10	15
9	all	open (attendance not required)		
10	all	metabolic flux card game	10	5

Exams and Grade Assignments: Your grade will be determined by the following. There will be two midterm exams and a final exam. All the exams are in-person at the times and locations given in the schedule of classes. 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. The pre-midterm quizzes are designed to help you prepare for the exam. They will be asynchronous and taken on Canvas. You will have a 3-day window prior to each exam in which to complete the quiz.

	Point Value
Midterm 1	143 or 428
Midterm 2	143 or 428
Final Exam	285
Pre-Midterm Quizzes (20 pts. each)	40
Discussion Section	105
Class Point Total	1000

No makeup exams will be given. If you miss an exam due to a documented illness, the points for that exam will be dropped from your point total for the class and your grade will be based on the other two exams, and quiz and section points.

Grades will be based on the following un-curved scale. 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 chapter (pages)		Read on Canvas
	*Indicates bring PowerPoint figure for that lecture (available on Canvas).	7th ed.	6th ed.	
0	Course introduction			Chemical reactions
1	Review of protein structure Thermodynamics of chemical reactions and enzyme catalysis	1(21-29) 13(495-501) 3(75-81;85-88) Review if necessary	1(20-29) 13(505-511) 3(75-81;85-89) Review if necessary	
2	Michaelis-Menten enzyme kinetics Enzyme inhibitors; Regulation of enzyme activity	6(187-213; 225-231)	6(189-213; 226-232)	Enzyme inhibitors; The Meaning of K_M and K_D
3	Metabolism: Coupling of endergonic and exergonic reactions; Electron carrier cofactors	13(491-494; 507-524)	13(501-504; 510-511; 517-534)	
4	Glycolysis Fermentation; alternate fates of pyruvate; alcohol metabolism in animals	14(533-545; 553-557)	14(543-555; 563-568)	
5	The pyruvate dehydrogenase complex* The citric acid cycle*	16 (all)	16 (skip 655-659)	
	Exam 1: Thursday, Oct 27th, 8 – 9 pm in Peterson 108			
6	The mitochondrial electron transport chain; the Q cycle*			
7	Oxidative phosphorylation and ATP synthase; the malate-aspartate shuttle*	19(711-741)	19(731-762)	
8	Gluconeogenesis*; the pentose phosphate pathway; glycogen metabolism	14(558-569) 15(601-608)	14(568-580) 15(612-620)	
9	Oxidation of fatty acids; ketone bodies*;	10(361-366) 17(649-657; 668-670)	10(357-361) 17(667-675; 686-688)	
	Exam 2: Saturday, Nov 26th, 10 am – 12 noon in Peterson 108			
10	Synthesis of fatty acids; Cholesterol synthesis*; Amino acid metabolism and the urea cycle	21(811-819) 18(675-691)	21(833-841) 18(695-711)	
	Final Exam Friday, Dec 9th, 7 – 10 pm			