

INTRODUCTION TO BIOCHEMISTRY
MCB 2000
SPRING 2012

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Text: *Biochemistry A Short Course, 2nd edition*
J.L. Tymoczko, J.M. Berg, L.Stryer
W.H. Freeman and Company, 2013

COURSE AIMS

This course is divided into 2 sections directed toward:

- (1) Defining and identifying chemical interactions important for the structure and function of macromolecules.
- (2) Developing an understanding of chemical and energy transformation reactions---how and why metabolic pathways are regulated.

LEARNING OBJECTIVES

After completing this course, you should be able to:

- (1) Discuss the relationship between structure and function of macromolecules. Why do structure form? How do molecules interact to enable a cell to respond or adapt? Provide examples to illustrate your understanding.
- (2) Identify factors that affect enzyme catalysis *in vivo* and *in vitro*. Define and calculate K_m , V_{max} , and k_{cat} for an enzymatic reaction. Why are enzymes regulated *in vivo*?
- (3) Compare and contrast changes in metabolic pathways in response to different physiological conditions such as fasting, exercise, diet.
- (4) Integrate metabolic pathways with the demand for energy. How does integration occur?
- (5) Acquire and demonstrate basic skills in the laboratory, including the use of instrumentation and biochemical techniques.
- (6) Apply and relate course content to problems in biology and medicine.

Review Sessions from 4-5 PM in TLS 154:

2/7 (Tues), 2/23 (Thurs), 3/20 (Tues), 4/12 (Thurs)

POLICIES FOR MCB 2000

EVALUATION

There will be 4 in-class exams and 1 comprehensive final exam. This results in a total of 5 exam grades. The lowest one of the 4 in-class exams will be dropped and replaced by the final exam score if your score on the final is higher. In this case, your final exam will count twice, as the Final + as the exam replacement. If your final exam score is not higher, the lowest exam grade will not be replaced and the Final will only be counted once.

The lecture portion (600 points) of the course is worth 75% of your grade and will be comprised of the following:

- 4 exams (**400 points total**) approx. 30 multiple choice questions.
- Final exam (**100 points**) 50-60 multiple choice questions (will include material since Exam 4 + **cumulative portion**).
- **Sapling Learning** homework assignments will serve as the equivalent of one exam grade (**100 points**). All of your homework assignment grades will be averaged together to give you a 'homework grade'. See **page 3** below for more information on **Sapling Learning**.

The laboratory portion of the course will comprise 25% of your grade.

Lab policies will be discussed separately in your respective lab sections.

Your final grade will be based on the lecture component and your lab grade.

NOTE: A FAILING GRADE (< 55%) BASED ON EXAM SCORES WILL RESULT IN FAILURE FOR THE COURSE, IRRESPECTIVE OF THE LABORATORY OR HOMEWORK GRADE.

For example, a student's exam average must be 275/500 points or better to pass the course, irrespective of the laboratory or homework grade.

A student's course average (lecture average + lab) will typically be reflected in the following letter grade distribution:

>92	A	76-77	C+	56-61	D- (see Note above)
88-91	A-	72-75	C	< 55	F
86-87	B+	68-71	C-		
82-85	B	66-67	D+		
78-81	B-	62-65	D		

(Grades may shift 1-2 percentage points depending on performance of the class as a whole.)

ABSENCE FROM EXAM

If you miss a single exam for a legitimate reason and you would like to make-up the exam rather than use it as your dropped exam, the exam format will be short answer, short essay. If you have a conflict for any exam arising from a scheduled University event, speak with the faculty as soon as you learn of this conflict. Arrangements for a make-up exam need to be discussed with the instructor. **No exams will be administered prior to the exam dates listed on the syllabus. Make-up exams are to be completed within 1 week of the respective original exam date on the syllabus.**

Rescheduling of the final exam requires the approval of the Office of Student Services and Advocacy.

▪ **Statement from Office of Student Services and Advocacy follows:**

Final exam week for Spring takes place from Monday, April 30th through Saturday, May 5th. Students are required to be available for their exam during the stated time. If you have a conflict with this time you must visit the Office of Student Services and Advocacy to discuss the possibility of rescheduling this exam.

Please note that vacations, previously purchased tickets or reservations, graduations, social events, misreading the exam schedule and over-sleeping are not viable excuses for missing a final exam. If you think that your situation warrants permission to reschedule, please contact the Office of Student Services and Advocacy with any questions. Thank you in advance for your cooperation.

SAPLING LEARNING HOMEWORK ASSIGNMENTS:

1. You must register with Sapling using your UConn email address as your logon during the first week of class; no other email address will be considered valid. Late registration requires permission from the instructor.
2. The homework assignments are intended to give you more practice with problem solving as well as focus on course content; in order to maximize their benefit, they should be completed as we move through the syllabus similar to the reading assignments. The homework will have due dates for this reason; scores will be collected after the respective preset date/time.

TAPING LECTURES AND USE OF COURSE CONTENT:

Lecture content (notes, presentations, recordings) study guides, exam questions are “for your own personal use and no other. You are not authorized to make any commercial use of them without prior permission from me.”

ACADEMIC MISCONDUCT STATEMENT:

“Academic misconduct in any form is in violation of the University of Connecticut Student Conduct Code and will not be tolerated. This includes, but is not limited to: copying or sharing answers on tests or assignments, plagiarism, and having someone else do your academic work. Depending on the act, a student could receive an F grade on the test/assignment, F grade for the course, or could be suspended or expelled.”

DISABILITIES

Any student with disabilities that he/she would like the faculty to be aware of should communicate that information in confidence to the faculty and any issues arising will be addressed in accordance with the policy of the University.

Helpful hints regarding the course:

This course can be challenging because of the amount of information that will be covered and there are many interrelationships. Each lecture topic builds from an earlier one. The following are recommended to help you with the course:

1. Review the material on a regular basis—retention is better in smaller, repetitive doses rather than trying to pull an all-nighter. Often students will underestimate the time that they will need to study for an exam. Although, some of the material does require sheer memorization, much of it requires understanding.
2. Skim over the assigned chapters before lecture then read more carefully after lecture as a means of reinforcement. Material not discussed in lecture will not be on an exam, unless specific mention is made.

3. A ***Course Outline*** (this is not the same as the syllabus) has been provided to help you structure your studying—information on the course outline and questions contained therein indicate what you should emphasize. The Course Outline can be used in 2 ways: as a study guide, or as a practice exam for the relevant segments.
4. When reviewing the notes or lecture material, ask yourself the following:
 - What are the main points and important details? Why is this important to know? What practical application does it have?
 - How does it integrate with other parts of the course or courses that you are taking?
5. Be realistic—if you are having a tough time, seek out help—sooner rather than later. Some of you will be better prepared than others based on your previous courses as well as study habits and approaches to learning.

<i>DATE</i>	<i>LECTURE TOPIC</i>	<i>LECTURE NUMBER</i>	<i>READING</i>	<i>LAB (week of)</i>
Jan 18	Unifying principles		Chapt 1	Check-in; Lab Policies
Jan 20	Water & atomic interactions How and why structures form	1	Chapt 2	
Jan 23	Water, acids, bases, and buffers	2	Chapt 2	Biochem Basics
Jan 25	Water, acids, bases, and buffers	3		
Jan 27	Amino acids-properties	4	Chapt 3	
Jan 30	Protein structure, folding, interactions Determining primary structure	5	Chapt 4 Chapt 5: 84-87	Buffers, pH, Titration of Amino Acids
Feb 2	Protein structure, folding, interactions www.nature.com/uidfinder/10.1038/464828a Protein techniques: Ion exchange, 2D-gel electrophoresis	6	See link under lecture topic Chapt 5: 70-74	
Feb 3	Hemoglobin & myoglobin: Structure & function, Intro to Allostery	7	Chapt 9	
Feb 6	Hemoglobin & myoglobin: Structure & function, Intro to Allostery	8	Chapt 9	Ion Exchange Chromatography
Feb 8 (Wed)	EXAM 1	Lectures 1-8		
Feb 10	Basic thermodynamics Introduction to catalysis	9	Chapt 6	
Feb 13	Enzyme kinetics- Michaelis-Menten Eqn	10	Chapt 7: 105-112	Photometry
Feb 15	Enzyme kinetics- Michaelis-Menten Eqn	11		
Feb 17	Enzyme kinetics & Lineweaver –Burk plots	12	Chapt 8: 125-134	
Feb 20	Allosteric enzymes as information sensors	13	Chapt 7: 112-119	Kinetic Studies of Alkaline Phosphatase
Feb 22	Regulation of enzyme activity	14	Lecture notes	
Feb 24 (Fri)	EXAM 2	Lectures 9-14		
Feb 27	Lipids Membrane structure; Transport mechanisms	15	Chapt 11 Chapt 12	Kinetic Studies of Lactate Dehydrogenase
Feb 29	Signal transduction-GPCR	16	Chapt 13: 215-223	
Mar 2	Signal transduction-Receptor Tyrosine Kinases	17	Chapt 13: 223-231	
Mar 5	Introduction to metabolism, Bioenergetics	18	Chapt 14 & 15	Investigation of Protein Folding
Mar 7	Glycolysis	19	Chapt 16	
Mar 9	Glycolysis	20	Chapt 16	
Mar 12-16	SPRING BREAK			
Mar 19	Pyruvate Dehydrogenase Complex	21	Chapt 18	Modulation of Enzymatic Activity-HTPS
Mar 21 (Wed)	EXAM 3	Lectures 15-21		
Mar 23	TCA cycle	22	Chapt 19	
Mar 26	TCA cycle	23	Chapt 19	Separation of Proteins Part I: Chromatography
Mar 28	Electron transport Oxygen metabolism & toxicity	24	Chapt 20	

DATE	LECTURE TOPIC	LECTURE	READING	LAB (week of)
Mar 30	Oxidative phosphorylation	25	Chapt 21	
Apr 2	<u>Anabolic reactions</u> : Glycogen synthesis	26	Chapt 25	Separation of Proteins: Part II: SDS-PAGE
Apr 4	Biosynthesis of fatty acids Effects of ethanol metabolism of fatty acid synthesis Pentose phosphate pathway	27	Chapts 26,28	
Apr 6	Biosynthesis of triglycerides and phospholipids: Esterification	28	Chapt 29: 497-500, 502-503	
Apr 9	Cholesterol & steroid biosynthesis	29	Chapt 29: 503-517	Separation of Proteins: Part III: Western Blot and Protein Assay
Apr 11	<u>Catabolic reactions</u> : Glycogen breakdown	30	Chapt 24	
Apr 13 (Fri)	EXAM 4	Lecture 22-29		
Apr 16	Gluconeogenesis	31	Chapt 17	Anti-oxidants
Apr 18	Gluconeogenesis	32	Chapt 17	
Apr 20	Oxidation of fatty acids,	33	Chapt 27: 465-473	
Apr 23	Ketogenesis	34	Chapt 27: 473-478	LAB PRACTiCAL
Apr 25	Amino acid metabolism: Transamination & Urea cycle	35	Chapt 30	
Apr 27	Course summary	36		
	FINAL EXAM: Preliminary Section 1: Monday April 30 th 10:30 AM-12:30 PM Section 15: Wednesday May 2 nd 8:00-10:00 AM	Lectures 30-36 ; Cumulative		