

PHCY 421 - Biochemistry I

Course Syllabus, Fall 2013

Chapel Hill Section:	001	
Asheville Section:	961A	
Credit Hours:	3	
Course Coordinator:	Dr. Andrew Lee	(Rm. 201A Beard Hall, 966-7821)
Course Instructors:	Dr. Andrew Lee	drewlee@unc.edu
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Required Textbook:	<i>Biochemistry: A Short Course, 2nd Edition.</i> Authors: Tymoczko, Berg, and Stryer.	

Introduction to Course and Broad Learning Objectives. All living organisms do what they do because of a multitude of chemical processes that occur within (as well as in-between) cells. Take as a single motivating example the simple fact that we must breathe to stay alive. Why is this so critical? What ultimate purpose does oxygen (O₂) ultimately serve? How does oxygen penetrate into bodily tissues? What delivers it there and what use is made of oxygen? This course will address this group of questions by focusing on proteins that transport and regulate oxygen levels. It will also focus on systems of enzymes that provide molecular energy to cells through the metabolism of energy-rich matter such as carbohydrates and fats. For that matter, what *are* proteins and what do they look like? How do they interact with chemicals, drugs, and other proteins? How do such simply conceived entities drive an astonishingly wide range of chemical transformations? These very questions apply to many other aspects of basic cell function and drug treatments. Biochemistry is the study of these molecular processes. Detailed learning objectives for the course will be included in powerpoint slides for each lecture.

Drugs work by altering these biochemical processes. This course will therefore also be concerned with basic properties of drugs and the fundamental mechanism of drug action: binding. While examples of drugs will be covered, the overall emphasis will be with understanding fundamentals of metabolic pathways, mechanisms of enzyme function, and the basic thermodynamics underlying these processes.

Summary. *The course covers basic principles of protein function, metabolism, and an introduction to molecular mechanisms of drug action.*

Topics include: Review of key concepts in general and organic chemistry, properties of drugs, amino acid and protein structure, structure/function relationships in proteins, enzyme function (catalysis), protein receptor-drug interactions, carbohydrates and their metabolism, electron transport, lipids and their metabolism, amino acid metabolism, and some regulatory mechanisms. Human disease states, their biochemical origins, and pharmaceutical treatment are discussed in relation to all of the above, when appropriate.

Course co-requisite: Concurrent enrollment in PHCY 401.

This course assumes knowledge of basic general and organic chemistry.

Course components (lecture, pre-class questions, recitations, and exams)

Lecture: "Lectures" will be held Mon/Wed from 9:30 - 10:50 am, in Kerr 1001 (Chapel Hill students) and Karpen 011 (Asheville students). Some classes will contain active learning sessions, mixed in with formal lecture. Lecture slides will be posted by the instructor, 3 days prior to lecture, on Sakai. Recorded lectures will be made available to all students.

Pre-class questions: The day before some lectures (this year, a subset of Dr. Lee's), you will need to complete a short series of questions that will be posted online on Sakai. These are designed to be simple and to encourage learning of some of the basic/introductory material so that more advanced learning can occur in class the next day. You will be notified when the questions are available. Completion (not performance) of these questions will be factored into your grade (see below) to encourage utilization of this method to better prepare you for class.

Open recitations: There will be a total of 10 graded problem sets during the semester. The problem set due dates are coordinated with two separate "open recitations" on Friday afternoons (see below for session times and place). These provide an opportunity to enhance and apply your knowledge gained from lecture and the textbook. Problem sets will be posted electronically on Sakai, with answer keys posted on the due date. You are advised to work the problem sets by yourself. However, working together with one or two classmates is only recommended *after attempting to work all problems by yourself*. *For problem sets that are graded, if extreme copying is found (such as the majority of problems having identical wording between two or more students), points will be deducted.*

- Problem sets will only be included in computation of final grade (10%, see below) if your overall score is higher than your exam score average. In other words, graded problem sets cannot hurt your grade.
- The overall problem set score will be computed from all 10 sets.
- Problem sets will only be graded if they are turned in within 24 hours of being due. Otherwise, they will be given a score of 0.
- Points will be deducted if they are handed in late, but within 24 hours of the due time.

*It is advisable to have your problem set graded because self-grading can sometimes allow you to think you provided the correct answer, when in fact there may be some details wrong.

All problem sets are due Friday morning at 10:00 AM in the Biochemistry homework drop box at the front of PCL lab, Beard 204 (it is to the left after you enter the lab, look for a gray box hanging on a divider). ****Write your name and section number on your stapled problem set that you hand in!****

Friday afternoon “open recitations”:

<u>Time</u>	<u>Location</u>
Friday 1:00-1:50	Kerr 1001 (Chapel Hill), Karpén 011 (Asheville)
Friday 2:00-2:50	Kerr 1001 (Chapel Hill), Karpén 011 (Asheville)

These recitations are “open” because you are free to attend either session. Attendance is optional.

Exams: There will be 3 exams plus a final exam, according to the schedule below. Each exam will be 80 minutes and cover the material before it, ~6 lectures worth, as described below. The “final exam” is not cumulative and covers the material corresponding to lectures 10/28 – 11/25 only. Exams may be subjected to normalization on a per exam basis; in that case, students will receive the “raw” and normalized scores.

Calculator policy: Calculators may be used for exams requiring numerical computation. Graphing calculators are not allowed; the only equation that may be programmed into your calculator is the quadratic equation.

Missed exam policy: Exams may be taken later than the scheduled time in extreme cases (e.g. severe health issues or death in the family) and will be considered on an individual basis. Holiday travel is not a valid excuse for missing an exam. Contact Dr. Lee regarding circumstances that may make it difficult to be present for any exam.

Office hours: You should seek help from the course professors, TAs, and other students. Professors and TAs will post their open office hours on Sakai.

Sakai Course Site: Check “Sakai” (sakai.unc.edu) for course announcements, updates, recitation problem sets and answer keys, and other posted materials.

Grades: *Each exam will be worth 24.5% of your final grade, for a total of 98%. If graded recitations increase your overall score, they will be worth 10% of the final grade and exams will each be worth 22.0%. The remaining 2% of your final grade will come from completion (not performance) of pre-class questions. Final grades will be assigned as A,B,C or F, corresponding to overall scores of ≥89, 78-88.9, 67-77.9, and <67, respectively. Each exam will be graded as soon as possible and your grade and a distribution graph will be posted on Sakai. Contact Dr. Lee to discuss any special issues regarding grades.*

Remediation policy: At the end of the course, students who do not have enough points to pass (C or higher) will have the opportunity to remediate by taking a “remediation exam” that covers the same topics as the exam for which they scored lowest (out of the four exams taken during the semester). The score of this exam will then be averaged 50/50 with the original exam on that subject area, and this average score will replace the original exam score. The remediation exam will not necessarily be multiple choice and will be given during the first week of the spring semester. Using this procedure, only students who have the potential to increase their point total above the minimum for passing the course will be allowed this opportunity to remediate. Students who plan to remediate should contact Dr. Lee by December 6 so that they may be given an incomplete grade.

HONOR CODE: The UNC Honor Code policies are applicable to all work in PHCY 421, including the problem sets.

The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct at the University as they have during the long life of this institution. Your acceptance of enrollment in the University presupposes a commitment to the principles embodied in the Code of Student Conduct and a respect for this most significant Carolina tradition. Your participation in this course comes with the expectation that your work will be completed in full observance of the Honor Code. Academic dishonesty in any form is unacceptable. If a violation is suspected, it may be reported to the Student Attorney General’s Office. If you have any questions about your responsibility or the responsibility of faculty members under the Honor Code, please visit the Office of Student Conduct web site (<http://studentconduct.unc.edu>), consult the Graduate and Professional Student Attorney General (gpsag@unc.edu), or contact a representative within the UNC Eshelman School of Pharmacy.

Students with Disabilities Statement Recommended wording for all Pharmacy courses:

The UNC Eshelman School of Pharmacy is committed to providing reasonable accommodations for all persons with documented disabilities or accessibility concerns in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. If you have a medical condition, disability, or accessibility concern that may impact your ability to meet the academic demands or requirements of the course, please contact the appropriate office on your campus. Students are required to self identify for disability/accessibility support.

Chapel Hill based students, contact Accessibility Resources and Services in person at the Student and Academic Services Building (SASB) Suite 2126, by email at accessibility@unc.edu or via the web site at <http://accessibility.unc.edu>.

Asheville based students, please contact Disability Services in person at 258 Brown Hall, by phone at (828) 232-5050, or by email at disabilityservices@unca.edu.

Course Evaluation Statement Recommended wording for all Pharmacy courses:

Students are **required** to complete the course evaluation. ***Those not completing the evaluation will receive an “incomplete” grade for the course, and the “incomplete” grade must be resolved directly with the Executive Associate Dean for Professional Education.*** This is a course requirement and a responsibility of all students completing a course. Student feedback is essential and highly valued in the School’s efforts to continually improve the quality of courses and the effectiveness of our faculty as educators. As a faculty, we can assure you that your feedback is reviewed in detail. The evaluations are taken very seriously by course directors, individual instructors, and the School. In 2011, the School implemented new policies and procedures for course evaluations, which include specific guidance on how the findings are used by the School as a means of continued quality improvement. More information about the policy and insight into how we use your feedback, can be found here: <http://pharmacy.unc.edu/about-us/school-organization/office-of-strategic-planning-and-assessment/course-evaluations>.

Online course evaluations will be available for students beginning the last week of the course. Students will receive an email message directing them to a website where they can complete their course evaluations. The course evaluation must be completed by midnight **December 11, 2013** to receive a final grade in a course. Those not completing the evaluation will receive an “incomplete” grade for the course. All course evaluations are confidential and anonymous.

Syllabus Changes Statement Recommended wording for all Pharmacy courses:

The course director reserves the right to make changes to the syllabus, including project due dates and test dates, when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.

PHCY 421 Lecture Schedule (Fall, 2013)

25 lectures, 4 exams

Section 1

- 8/14 Introduction to course (Lee). The drug scene: factors important for drug function, bonds within molecules (Kohn).
- 8/19 Organic/medicinal functional groups. (Kohn)
- 8/21 Stereochemistry in drugs and biology: why it is important. (Kohn)
- 8/26 Medicinal/biological reactions; Solubility and drug function. (Kohn)
- 8/28 Acids & bases, pH, and pK_a . (Lee)
- 9/2 *Labor Day Holiday*
- 9/4 Polypeptides and proteins, protein structure. (Lee)

Section 2

9/9 Exam 1: lectures 8/14 - 9/4

- 9/11 Protein structure, folding and misfolding. (Lee)
- 9/16 Myoglobin function and protein-ligand (drug) binding equilibria. (Lee)
- 9/18 Hemoglobin function and oxygen transport, intro to enzymes (Lee)
- 9/23 Enzymes: function, mechanism, and kinetics (Lee)
- 9/25 Enzyme cofactor structure and function, enzyme inhibitors. (Lee)

Section 3

- 9/30 Antibody structure, proteins as drug receptors: enzymes, membrane proteins, etc. (Lee)

10/2 Exam 2: lectures 9/11 - 9/25

- 10/7 Structures of carbohydrates, glycoproteins, glucosamines, etc.. (Liu)
- 10/9 Intro to metabolism, glycolysis. (Liu)
- 10/14 Krebs cycle, pentose phosphate shunt. (Liu)
- 10/16 *no class*



Fall Break

- 10/21 ATP generation: Electron transport, oxidative phosphorylation, cytochrome P450. (Lee)
- 10/23 Carbohydrate biosynthesis, regulation of glucose levels. (Lee)

Section 4

- 10/28 Nitrogen metabolism: Amino acid metabolism, heme metabolism. (Lee)
- #### **10/30 Exam 3: lectures 9/30 - 10/23**
- 11/4 Signal transduction overview. (Jarstfer)
 - 11/6 Structures and function of lipids: fatty acids, triacylglycerides, sphingolipids, etc. (Jarstfer)
 - 11/11 Membrane transport and membrane receptors. (Jarstfer)
 - 11/13 Membrane transport, membrane receptors, and lipid transport. (Jarstfer)
 - 11/18 Fatty acid metabolism. (Jarstfer)
 - 11/20 Triacylglyceride and phospholipid metabolism. (Jarstfer)
 - 11/25 Triacylglyceride and phospholipid metabolism. (Jarstfer)



- 11/27 *Thanksgiving Holiday*

PHCY 421 Open Recitations - Fall, 2013

	Aug 16	<i>no recitation</i>
1	Aug 23	chemical structures and bonding (HK)
2	Aug 30	stereochemistry, reactions, and solubility (HK)
3	Sept 6	pH, pK _a , amino acids, polypeptides (AL)
	Sept 13	<i>no recitation</i> , [‡] self-graded problems: protein structure and folding (AL)
4	Sept 20	myoglobin and hemoglobin function, protein-ligand interactions (AL)
5	Sept 27	enzyme function, mechanism, kinetics, and inhibition (AL)
	Oct 4	<i>no recitation</i>
6	Oct 11	carbohydrates, glycolysis (JL)
	<i>Fall Break</i>	<i>no recitation on Oct 18</i> , [‡] self-graded problems: Krebs cycle, pentose phosphate shunt (JL)
7	Oct 25	ATP generation, carbohydrate biosynthesis (AL)
	Nov 1	<i>no recitation</i> , [‡] self-graded problems: nitrogen metabolism (AL)
8	Nov 8	signal transduction (MJ)
9	Nov 15	membranes and membrane transport (MJ)
10	Nov 22	phospholipid and steroid metabolism (MJ)
	<i>Thanksgiving Break</i>	<i>no recitation on Nov 29</i>

Problem sets that are handed in will be collectively worth up to 10% of the students' final grades (see policy above). Problem sets will be graded by TA's.

[‡] Problem set is self-graded and will not count towards "recitation points".