

Chemistry C484: Biomolecules and Catabolism (3 cr.)

Spring Semester 2009
MWF 11:15 a.m. – 12:05 p.m.

Professor Martha G. Oakley
Chemistry 122

This course is the first of a two semester sequence of biochemistry courses for undergraduates (C484 and C485). Its prerequisites are 11 hours of chemistry courses including **C341 and C342**. Students should also have completed a survey course in biology (Biol L104, L112, or equivalent). *This is a difficult course that will require you to apply concepts in organic chemistry, thermodynamics, and biology to the study of the chemistry of living systems.*

Should I take C484 or C483?

Both C483 and C484 are offered in the spring of 2009. If you are a biochemistry major, you must of course take C484 and C485. Many of you, however, are not in that position and have a choice. You may find the following guidelines to be useful.

- 1) C484 and C485 are taught in much greater chemical detail than C483. If you are concerned that your background in organic chemistry is weak, C483 is a better option.
- 2) If you are a chemistry major who plans to take only a single term of biochemistry, you are probably better off taking C483. This course introduces students to the topics covered in both C484 and C485 in less detail and is an excellent survey course. This course does not cover gene expression and many other topics that are important in modern biochemistry.
- 3) If you are a biology student, missing C485 may not be as much of an issue, as you will have seen the gene expression material in your biology classes. Students who have told me they are glad they took C484 include:
 - a. Students bound for graduate school in molecular or cell biology or microbiology. Having struggled through this material can make the killer biochemistry courses in the first year of grad school a lot easier.
 - b. Students preparing for the MCATs or the equivalent exams for other professional school in the Health Sciences. Many of these students have found that this course also helps them to review organic chemistry.
 - c. Students who plan to attend medical, dental, or optometry school who wish to have time to understand biochemistry at a deeper level than it is generally covered in these professional schools. Understanding the chemical logic can make the memorization you must do much, much easier. I recommend that students in this situation also take C485 if possible.
- 4) If you are a spring-term senior, don't forget that this will be a very busy semester for you as you arrange your life after college. Don't underestimate the time and effort this pursuit will require, and be sure that you have the time to complete successfully a difficult course like C484.

INSTRUCTOR: Professor Martha Oakley, Simon Hall, 320C
Office hours to be announced.
oakley@indiana.edu

ASSOCIATE INSTRUCTORS:
To be announced

TEXTBOOK: Berg, Tymoczko, and Stryer, Biochemistry, (6th Edition), 2006

In addition, the following textbooks will be on reserve in the Chemistry Library and should be used if you would like additional perspectives on a particular subject:

Voet & Voet, Biochemistry, (3rd Edition), 2004

Matthews, van Holde and Ahern, Biochemistry, (3rd Edition), 2000

Lehninger, Principles of Biochemistry, (4th Edition), 2005

Voet, Voet, & Pratt, Fundamentals of Biochemistry, (2nd Edition), 2006

Garrett & Grisham, Biochemistry, (3rd Edition) 2005

WEBSITE: Lecture notes will be posted on Oncourse, <https://oncourse.iu.edu/portal>. *Students are responsible for printing their own lecture notes.* Every effort will be made to post the lecture notes in a timely fashion. Other important information will be posted in the chemistry department's course website: <http://courses.chem.indiana.edu/c484/default.asp>

QUIZZES: Three quizzes, worth 15 points each, will be given in class. The dates are listed below:

Quiz 1: Friday, January 23

Quiz 2: Friday, February 6

Quiz 3: Wednesday, February 11

There will be no make-up quizzes. Under a limited set of circumstances, you may make arrangements to take a quiz early (e.g., documented medical school or graduate school interview, sporting event for which you are on the IU team). Excused absences will be granted only in case of genuine and documented emergencies.

PROBLEM SETS: 6 Problem sets worth a total of 155 pts. will be handed out during the semester to help aid in the learning of the course material. The AIs will go over problem sets during office hours and review sessions. If you take the problem sets seriously, many of the questions on the exams should look familiar. Note: approximately one third of the problems for each problem set will be graded. A complete answer key will be provided so that you may check your work on the other problems.

Due Dates (always at the beginning of class):

Problem Set 1 Monday, February 2

Problem Set 2 Friday, February 13

Problem Set 3 Friday, February 27

Problem Set 4 Monday, March 9

Problem Set 5 Wednesday, April 1

Problem Set 6 Wednesday, April 15

EXAMS: There will be three evening mid-term exams and a comprehensive 2-hour final examination according to the following schedule.

Exam 1: Thursday, February 19 7:00 p.m. – 9:00 p.m.

Exam 2:	Thursday, March 12	7:00 p.m. – 9:00 p.m.
Exam 3:	Thursday, April 23	7:00 p.m. – 9:00 p.m.
Final Exam:	Wednesday, May 6	5:00 p.m. – 7:00 p.m.

There will be no make-up examinations. Under a limited set of circumstances, you may make arrangements to take an exam early (e.g., documented medical school or graduate school interview, sporting event for which you are on the IU team). You drop one exam from your final grade to accommodate emergency absences from class.

REGRADES are discouraged. It is your job to make your work clear and legible so we can read and score it properly the first time through. All regrade requests, including fixing math errors on our part, *must* be made **in writing** no later than the class period following the class at which the exam was returned. *Please be sure to consult the answer key before you request a regrade.* Many regrade requests are the result of an incomplete understanding of the material. The entire paper may be regarded, so do not submit trivial regrade requests.

ACADEMIC MISCONDUCT: Cheating will not be tolerated. The instructor takes seriously her obligation to protect the majority of honest students by vigorously prosecuting those who are dishonest about learning. The **minimum** penalty sought will be failure in the course.

COURSE GRADES: Course grades will be based on a total score of 600 points, as outlined in the tables below from quizzes, problem sets, and examinations. All three of your quiz scores will count toward the **quiz score**, and the combined grades from the six problem sets will count as your **problem set score**. Three evening Midterm exams worth 100 points each and one Final exam worth 200 points will be given during the semester. The lowest exam score, or ½ the final exam score, whichever is lower, will be dropped before calculating the total **exam score**. The instructor does not grade on a curve. Final letter grades will be assigned on the basis of the following definitions: (A) an A student not only understands the material well but can apply it creatively to new situations. (B) A B student has a good, solid understanding of the material but has trouble applying that knowledge to new situations. (C) A C student has major gaps in understanding. Still larger gaps lead to a D or F in the course. The instructor will list the grade ranges for each exam as they are returned. Point totals for the course will be available on Oncourse.

Exam I	100	Quizzes:	15 x 3	45
Exam II	100	Problem Sets	(6; variable credit)	155
Exam III	100			
Final	200	Quiz/Problem Set Score:		200
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	500	Quiz/Problem Set Score:		200
drop 1 exam or ½ the final:	-100	Exam score:		400
Exam score:	400	Total points possible		600

Tentative Schedule of Lectures

Lecture No.	Date		Subject	Reading
Part One: The Structure and Function of Molecules Required for Life				
1	12-Jan	M	Introduction to Biochemistry	Ch. 1
2	14-Jan	W	Introduction to Biochemistry	Ch. 1
3	16-Jan	F	Protein Structure	Ch. 2.1
	19-Jan	M	No Class: Martin Luther King Day	
4	21-Jan	W	Protein Structure	Ch. 2.2, 3.2, 3.5
5	23-Jan	F	Protein Structure	Ch. 2.3, 2.4, 2.5
Quiz 1 in class: Amino Acid Structures				
6	26-Jan	M	Protein Structure	Ch. 3.6
7	28-Jan	W	Protein Structure	Ch. 2.6
8	30-Jan	F	Hemoglobin	Ch. 7
9	2-Feb	M	Review of Organic Chemistry	Ch 15.4
Problem Set 1 Due at the beginning of class				
10	4-Feb	W	DNA, RNA and Genetic Information	Ch. 4
11	6-Feb	F	Carbohydrates	Ch. 11.1, 11.2
Quiz 2 in class: Organic Mechanisms and Arrow-Pushing				
12	9-Feb	M	Carbohydrates	Ch. 11.3
13	11-Feb	W	Membranes	Ch. 12.1-12.3
Quiz 3 in class: Nucleic Acids & Sugars				
14	13-Feb	F	Membranes	Ch. 12.4-12.6
Problem Set 2 Due at the beginning of class				
Part Two: Biological Catalysis and Methods for Studying Enzymes				
15	16-Feb	M	Protein Purification and Synthesis	Ch. 3.1
16	18-Feb	W	Review: Part I	
19-Feb Th Exam 1				
17	20-Feb	F	Protein Purification and Synthesis	Ch. 3.3 & 3.4
18	23-Feb	M	Genes & Genomes	Ch. 5
19	25-Feb	W	Evolution & Bioinformatics	Ch. 6
20	27-Feb	F	Enzymes and Enzyme Kinetics	Ch. 8.1-8.3
Problem Set 3 Due at the beginning of class				
21	2-Mar	M	Enzymes and Enzyme Kinetics	Ch. 8.4
22	4-Mar	W	Enzymes and Enzyme Kinetics	Ch. 8.5
23	6-Mar	F	Enzymes and Enzyme Kinetics	Catch up
24	9-Mar	M	Catalytic Strategies	Ch. 9.1
Problem Set 4 Due at the beginning of class				
25	11-Mar	W	Review Through Chapter 8	
12-Mar Th Exam 2				

	13-Mar	F	No class	
	16-Mar	M		
	18-Mar	W	Spring Break, no classes	
	20-Mar	F		
26	23-Mar	M	Catalytic Strategies	Ch. 9.2
27	25-Mar	W	Catalytic Strategies	Ch. 9.3,9.4
28	27-Mar	F	Regulatory Mechanisms	Ch. 10
29	30-Mar	M	Regulatory Mechanisms	Ch. 10
Part Three: Catabolic Metabolism				
30	1-Apr	W	Metabolism: Basics	Ch. 15.1-15.3
Problem Set 5 Due at the beginning of class				
31	3-Apr	F	Glycolysis and Gluconeogenesis	Ch. 16.1
32	6-Apr	M	Glycolysis and Gluconeogenesis	Ch. 16.2
33	8-Apr	W	Glycolysis and Gluconeogenesis	Ch. 16.3
34	10-Apr	F	Glycolysis and Gluconeogenesis	Ch. 16.4
35	13-Apr	M	Citric Acid Cycle	Ch. 17.1
36	15-Apr	W	Citric Acid Cycle	Ch. 17.2
Problem Set 6 Due at the beginning of class				
37	17-Apr	F	Citric Acid Cycle	Ch. 17.3-17.5
38	20-Apr	M	Oxidative Phosphorylation	Ch. 18.1-18.2
39	22-Apr	W	Review through Chapter 17	Ch. 18.3
23- Th Exam 3				
Apr				
40	24-Apr	F	Oxidative Phosphorylation	Ch. 18.4
41	27-Apr		Oxidative Phosphorylation	Ch. 18.5
42	29-Apr		Oxidative Phosphorylation	Ch. 18.6
43	1-May		Review	
FINAL EXAM Wednesday May 6, 5:00 pm -7:00 pm				

This schedule is to be considered an outline. While assignment dates will not change, we may move through material more quickly or slowly than is indicated here. Changes will be announced during class. Students are responsible for getting the material from a classmate if they are not present in class, for whatever reason.