

Syllabus

INSTRUCTOR

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COURSE OBJECTIVES

The principal objective of the course is to develop the ability to apply chemical principles to biological phenomena. In addition, you will develop a working knowledge of the structure and functions of the major classes of biological molecules, the principles of bioenergetics and the primary pathways of carbohydrate and fatty acid metabolism.

Biochemistry is very much a work in progress. As much as possible, the course will try to illustrate important principles using examples from recent research. I will also try to point out areas of biochemistry that are poorly understood, since these are the areas in which opportunities for important research are most abundant.

COURSE FORMAT

There will be three lectures (M W F, 10:00 a.m.) per week. In addition, each student has been assigned to one of two recitation sections, M, 1–2 p.m. and T, 11 a.m.–12 noon. These sessions will be used to discuss in more detail material presented in lecture or in readings, to present new material for discussion, and to discuss problem assignments. It is very important that you attend recitation each week.

There will be no laboratory in CHEM 351. An intensive laboratory course in Biochemical Methods (CHEM 358/BIOL 340) will be offered in the spring semester.

READINGS

The textbook for the course is Lehninger *Principles of Biochemistry* by D. L. Nelson and M. M. Cox. In reading the textbook, you should keep in mind that the goal of the course is to develop a conceptual understanding of biochemistry that you will be able to apply to problem solving. Rather than trying to memorize all of the factual details, you should ask yourself whether these details fit into a coherent conceptual framework. When they do not, you should consult the instructor or one of your classmates or raise the point as a question in recitation. Comments on chapters in the textbook will be posted on *Blackboard* to help you focus your reading and thinking on the most important points.

The textbook will be supplemented by readings from the biochemical literature, which will be listed on the weekly course schedule that will be posted on *Blackboard*. Some of these I will expect everyone to read; these will be listed in boldface on the weekly course schedule and will be placed on electronic reserve (ERes; the password for Chem 351 is "helix"). The articles that are not listed in bold serve as a bibliography for the course. You may wish to consult them to clarify points considered in the lectures or to learn about a particular topic in greater depth, either now or in the future.

Some topics will not be covered in class or will only be partially covered in class, and you will be expected to master the topic from reading and doing problems. I will alert you to these topics as the course progresses.



The following three books will be placed on hard-copy reserve in Bertrand Library. You may find them helpful in deepening your understanding of some of the topics covered in the course. I will alert you to relevant sections of these books when we encounter the corresponding topics in class. For those of you who plan to study biochemistry or related fields in graduate school, I recommend these books as excellent additions to your personal library.

- Brandon, C. and Tooze, J. *Introduction to Protein Structure*, 2nd Edition, 1999.
- Fersht, A. *Structure and Mechanism in Protein Science*, 1999.
- Hammes G. *Thermodynamics and Kinetics for The Biological Sciences*, 2000.

PRACTICE PROBLEMS

Since the purpose of the course is to develop a working knowledge of biochemical principles, considerable emphasis is placed on problem solving. Problems will be assigned regularly. Some of these will be from the textbook; others will be in the form of weekly problem sets that will be posted on *Blackboard*. It is recommended that you do them as soon as possible. Most of these assignments will not be collected, but they will be discussed at the recitation sessions. A few problems will be discussed in class; these will be indicated in the weekly course schedule posted on *Blackboard*. Some of the problems will be straightforward; others will challenge you to apply ideas presented in class to topics that have not been covered in class. In some cases problems will be used to introduce new topics. In all cases it is critical that you make a determined effort to solve these problems **before** they are discussed in recitation or class. If you do this, your learning will be active and much more effective than it will be if you simply listen to other people's solutions.

Answers to the problem sets will eventually appear on *Blackboard*. I urge you not to consult these answers until you have worked through the problems thoroughly on your own. If you get stuck on a problem, feel free to contact me, and I will assist you without giving you the answer. Consulting one of your classmates may also be helpful.

GRADED ASSIGNMENTS

There will be about five short written exercises to be turned in. These will be assigned at least one week before the due dates. Some of these graded assignments will require the use of RasMol, a molecular graphics program that will be made available on the university network. Other assignments will require you to interpret results from the biochemical literature.

OFFICE HOURS

Biochemistry is a complex subject, and your goal is to understand it at a conceptual level. If you make a diligent effort to do this, you will have many questions. I encourage you to raise these questions at the recitation sections. In addition, I have set aside the times shown at right as office hours to discuss the course material with students. If these times are not satisfactory, see me after class or send me an e-mail, and we will arrange to meet at another time. You are welcome to stop by my office without an appointment. If I am there and not immersed in another matter, I will be glad to talk with you.

Monday 2–3 p.m.
Tuesday 10–11 a.m.
Friday 11 a.m.–12 noon

OTHER SUGGESTIONS

The amount of material to be covered in the course is considerable, and the pace will therefore be fast. In addition, the course is designed so that topics build on what has been taught earlier. It is important that you make a determined effort to avoid falling behind.

As indicated above, if you study and think about the course material carefully and critically, you are likely to have many questions. An excellent way to clarify your understanding is to discuss these questions with your classmates.

GRADING

There will be three hour exams and a final exam. The hour exams will be given at 10:00 a.m. on the days listed at right:

1. Wednesday, September 21
2. Wednesday, October 26
3. Wednesday, November 30

Grades will be

computed in two ways:	I. Hour exams 52%	II. Two best hour exams..... 35%
	Graded assignments..... 15%	Graded assignments..... 15%
	Final exam 33%	Final exam..... 50%

The higher of the two computed numerical grades will be used in determining your letter grade. No make-up hour exams will be given; students who miss an hour exam will have their grades computed by the second method.

Detailed weekly schedules will be posted on Blackboard

Introduction, cell structure, thermodynamic concepts.....	Ch. 1
Water, aqueous solutions, noncovalent interactions	Ch. 2
Amino acids, covalent structure of proteins, characterization of proteins by mass spectrometry, proteomics	Ch. 3
Three-dimensional structure of proteins.	Ch. 4
Protein Structure and Function: myoglobin, hemoglobin, antibodies.....	Ch. 5
Enzymes: principles of catalysis, kinetics, serine proteases, other classes of proteases, enzyme inhibition, kinetics of enzymes with more than one substrate, kinases, regulation.	Ch. 6.
Carbohydrates.....	Ch. 7
Nucleic Acid Structure.....	Ch. 8
Chemical and enzymatic manipulation of nucleic acids. Applications	Ch. 9
Lipids and Membranes.....	Ch 10, 11
Special topics: Amyloid plaque and its formation, Alzheimer's disease and possible targets for drugs	
Bioenergetics.....	Ch. 13
Glycolysis	Ch. 14
Krebs Cycle	Ch. 16
Oxidative Phosphorylation	Ch. 19
Gluconeogenesis.....	Ch. 14
Fatty acid catabolism.....	Ch. 17