

**BIOCHEMISTRY
CHEMISTRY 471A
SYLLABUS - FALL 2005**

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Office Hours:
Tuesday 2:00 - 4:00 PM
Wednesday 9:30 - 11:00 AM
Friday 10:00 - 11:30 AM

Text: **Biochemistry** by Jeremy Berg, John Tymoczko, and Lubert Stryer

This course is designed to introduce you to the molecular basis of life. This semester, we will be focusing on two of the major classes of bio-molecules, namely proteins and carbohydrates.

We will cover chapters 1, 3-5, 7-10, and 27-29, though not necessarily in numerical order. There will be three exams during the semester and a final exam at the end of the semester. The exams will cover the material presented in lecture and on the homework assignments. Homework will be assigned and you will work in assigned groups. Group work, when properly done, enhances the learning amongst everyone. This means that you should attempt the homework problems on your own before coming to the group meeting. Discussion should take place between group members about each question. One set of answers is then turned in for each group. The exams will be given on the following dates:

EXAM 1	FRIDAY, OCTOBER 7
EXAM 2	MONDAY, NOVEMBER 7
EXAM 3	MONDAY, DECEMBER 5
FINAL EXAM	TUESDAY, DECEMBER 13 10:30 AM – 12:30 PM

Biochemistry is an exciting field because new discoveries are changing the way we understand living systems. As a result, you will be given an assignment that requires you to read the current literature. This assignment is in the form of a major paper entitled "Adopt a Protein". See page 3 for further details on the assignment. Finally, you will be required to attend one-two seminars this semester.

SCHEDULE

<u>date</u>	<u>topic</u>	<u>chapter</u>
9/9	Introduction	1
9/12-9/16	Protein Structure	3
9/19-9/26	Protein Function: Myoglobin and Hemoglobin	10.2, Readings on reserve

9/28-9/30	Exploring Proteins	4
10/3-10/5	Bioinformatics	7
10/7	Exam 1	1, 3, 4, 7, 10.2
10/10-10/12	Enzyme Kinetics	8
10/14	Mid-Semester Break	
10/17-10/24	Enzyme Kinetics	8
10/26-10/28	Enzyme Mechanism	9
10/31-11/4	Enzyme Regulation	10.1, 10.3–10.5
11/7	Exam 2	8, 9, 10.1.3.4.5
11/9-11/18	DNA structure and Replication	5 and 27
11/21	Adopt a Protein paper due	
11/21-11/23	Protein Synthesis	28 and 29
11/24	Thanksgiving!	
11/28-12/2	Protein Synthesis and Targeting	29
12/5	Exam 3	5, 27, 28, 29
12/7	Special Topics	
12/9	Review for Final Exam	
12/13	FINAL Exam (10:30 AM-12:30PM)	everything

GRADING

EXAMS	17% each	51%
FINAL EXAM		24%
ADOPT A PROTEIN PAPER		15%
HOMEWORK		10%

Learning biochemistry involves keeping up with the material and not waiting until the night before the exam to cram. Cramming is the least effective way to learn. To be successful, read the text before coming to class so that you will have an idea of what is being discussed. Read the text after coming to class to clarify concepts. If you are having trouble understanding the concepts after this, there are a number of options that you can pursue including the following.

- Come talk to me
- Read other biochemistry texts that might explain the concepts in slightly different ways - resources on reserve include
 - Concepts in Biochemistry by Boyer (easiest)
 - Biochemistry by Mathews, Van Holde, and Ahern
 - Also check biochemistry texts in the stacks on Waldo
- Check the internet for other resources

Adopt A Protein

The purpose of this assignment is to write a paper on the structure and function of a protein of interest. In doing so, you will learn how to do a scientific literature review and you will learn how to use WEB resources to download protein structures. Thus, you must include a computer generated picture of your protein in the paper.

The first step in this assignment is to decide on a protein that you would like to investigate in detail. There are several ways of doing this. You can look through your textbook or any other biochemistry textbook in the library to find a protein of interest. You may also come and talk to me for any suggestions. I would recommend picking several proteins to begin with. You cannot do proteins that we have discussed in depth in the class which include myoglobin, hemoglobin, collagen, chymotrypsin, carbonic anhydrase, and aspartate transcarbamoylase. Once you have picked a protein, you will want to immediately determine if the three-dimensional structure of the protein has been determined and if it has been entered into the protein database. This is important for downloading a picture of your protein as well as indicating that there is probably enough information known about the protein to write your paper. In other words, if your protein does not have a structure in the protein database, there is probably not much known about the protein itself. You will want to use Protein Explorer to download the protein structure. (See below for using Protein Explorer) Once you have determined that the structure is available, you will want to do a literature search on the protein to gather information on the structure and the function of the protein. You may utilize several databases in searching for information. The most commonly used searches are through Basic Biosis or

Medline, which are available on line through our library, or Pub Med or Scholar Google, which is available on the internet. These can be accessed at any time. You can also search through STN. This is available from the chemistry department after 5:00 PM.

Paper length: 5 – 6 pages (not including references, figures, or drawings)

Due Date: Monday - November 21, 2004

Minimum number of references: 6 total references and 3 of the 6 references must come from research articles found in standard scientific/biochemistry journals such as Journal of Biological Chemistry, Biochemistry, Science, Nature, Cell, Proceedings of the National Academy of Sciences, etc...

Using Protein Explorer

1. You may use Internet Explorer or Netscape Communicator (Navigator) to gain access to this program. Internet Explorer will not work. In addition, your computer must have Chime downloaded and integrated into Internet Explorer or Netscape Communicator. The computers in the chemistry lounge (Science 302A) and one in the instrument room (for the microplate reader) are equipped to use protein explorer with Chime.
2. In the appropriate internet browser go to www.proteinexplorer.org
3. Go to the middle of the page and you will see Find the molecule's PDB (protein database) ID number. Click on this to find the ID number for the protein(s) you want to see.
4. In the PDB, click on PDB lite
5. In PDB lite, click on USA
6. In this page, enter the name of the protein you would like to see and hit enter.
8. You will see the number of different structures for the protein. Click on retrieve released data matching your query.
9. You will see different types of structures for the protein depending on the species and the laboratory the protein was crystallized in. Highlight the protein structure you would like to view.
10. Click on view the macromolecule. This will give you some initial information on the protein taken from x-ray crystallography and other sources. The code in the upper left corner is your protein's PDB ID code. (If this does not work, then copy the PDB ID code in the left hand column and to the protein explorer home page to enter the PDB ID code directly).
11. Close or hide the window.
12. The protein explorer window should now be showing. If it is not showing, then go to the website.
13. Enter the PDB Identification Code in the box in the center column and click Go.
14. Once the structure of your protein has appeared (it may take a few minutes), there are a number of options in viewing your proteins. Look through

the different options. You may hide the water molecules and stop the spinning at any point.

15. You can view different parts of the structure in different ways under Explore More. You will want to print a structure of your protein that highlights the following:

Select 1 - helices and strands

Display 2 - cartoon

Display 3 –choose a color for the helices and another color for the strands

Because the computers in the student room are not hooked to a printer, you can e-mail the file to me and I can print them from my computer.

16. Click on PE Site Map (Beyond Quick Views) and you will be able to pull up an amino acid sequence. You can also click on specific amino acids to see where they appear in the 3D structure. Find the amine and carboxyl termini.

Using Basic Biosis or Medline

1. Go to Whittier College website
2. Click on Academic Resources
3. Click on Library Resources
4. Click on Electronic Resources
5. Click on First Search
6. Pull down the specific search engine - either Basic Biosis or Medline
7. Enter the name of your protein as a key word in the title
8. You may want to limit your search to structure and function as key words as well.
9. You can e-mail the results to yourself and then look up articles.
10. It is likely that the initial papers from your search may not give you the background information or other information that you need to do your paper. You will need to look up the references cited by some of the papers to discover other papers that will give you the needed information. For example, the introduction in many papers will cite other articles that give some of the basic information that you will need for the protein or topic of interest.

In your paper, discuss why your protein is of interest, which includes information on how the protein functions. Then discuss the structure and tie the information on structure to how the protein functions. Conclude with what is unknown about the protein and what further research needs to be done.