

BIOL/CHEM 328: Biochemistry II
Spring Semester, 2008
~ Syllabus ~



Instructor: Dr. Diane Husic **E-mail address:** dhusic@moravian.edu

Office: 311 Collier Hall of Science

Office hours: Mondays 9:00 – 10:00 a.m. Tuesdays 9:00 – 10:00 a.m.
Wednesdays 2:00 – 3:00 p.m. Thursdays 9:00 – 10:00 a.m.

** I can meet with you at other times, but please schedule these appointments with me ahead of time.*

Class Times: Lecture: Tuesdays/Thursdays 10:20 - 11:30 a.m. in PPHAC 116
Lab: Mondays @ 12:45 - 3:45 p.m. in 301 Collier HOS

Course Prerequisites: BIOL/CHEM 327 (Biochemistry I); and therefore also BIOL 265 & CHEM 212
OR permission of instructor

Course "support": There will be a Blackboard shell for this course; please check this site for announcements and updated postings on a regular basis

Website associated with textbook: <http://bcs.whfreeman.com/lehninger/>

Course text: Lehninger Principles of Biochemistry, 4th ed., (D.L. Nelson and M.M. Cox) W. H. Freeman & Co. (NY, 2005)

Course objectives/introductory comments: This course is designed to expand a student's background and understanding of the discipline of biochemistry. A variety of advanced topics will be discussed including:



Examples of key metabolic pathways and strategies



Integration and regulation of metabolism



Membrane transport mechanisms



Mechanisms of catalysis and design of active sites of enzymes/enzyme kinetics



Bioenergetics



Signal transduction and the hormonal control of cellular metabolism and gene expression



Aberrations in gene expression/cellular signaling in human disease



An introduction to the biochemistry of cancer and AIDS

As time permits, I like to incorporate discussions of topics that are currently "hot" in the field of

biochemistry, relevant issues that appear in the media during the semester, and/or topics which are of particular interest to students enrolled in the course. Seeing how the concepts learned in class relate to current research in the field and understanding the social implications of the advancements in biochemistry are important. Please let me know if there are any relevant subjects that you are particularly interested in.

Approximately weekly, I will prepare a detailed lecture outline that will be posted on BlackBoard and will include a list of required and recommended readings from the text, journals or books in the library collection, or articles that can be found via the internet. In addition, I will list suggested study problems from the text. **Please note that I will occasionally update this lecture outline throughout the week, and I use Blackboard to post announcements to the class, so you should get into the habit of checking this course resource on a regular basis.**

Since this is an upper-level course, I have high expectations for each of you. Much of the material discussed goes beyond the scope of a textbook and exams will certainly involve more than simple memorization and "regurgitation" of the material discussed in lecture. A large amount of material will be covered in this course; biochemistry has never been considered an easy subject! I will expect you to understand concepts and be able to relate them to new situations. You will also use the background material from class as a basis for interpretation and critique of current journal articles. It is my hope that this course will serve as a bridge between a classical undergraduate science course and the field of biochemistry in the "real world" of the research laboratory in industry or academe. Thus, I include readings from journals, the writing of a grant proposal, and other assignments and test questions that are designed to inspire critical scientific thinking and evaluation.

Biochemistry Course "Survival Techniques"

1. *Make use of the lecture outlines to keep on track.* As noted above, I will provide an outline of topics covered in lecture each week. These outlines also include a listing of corresponding pages from the text to be read and suggested study problems.
2. *Come to class.* In an upper level course like this, I typically don't have attendance problems. I don't formally take attendance everyday, but this is a small group and I do know who shows up both physically and mentally! I don't lecture straight out of the text. If attendance ever does become a problem in one of my classes, I have been known to give *impromptu* in-class assignments due at the end of the class period; these can significantly benefit those who do show up to class.
3. *Read assigned material before coming to class.* This helps to facilitate discussions, allows you to better follow material covered in lectures and puts you in a better position to ask good questions during class.
4. *Work on the study problems listed in the lecture outlines.* I select questions from the text or elsewhere that are designed to help reinforce concepts presented in the lecture and readings. I do not routinely collect or grade these; they are, instead, are for "practice". **Don't** wait to work on these problems until right before the exam. You need to ensure that you understand the concepts as we are covering them since the topics in this course tend to build on one another. Also, don't be surprised if some of these problems end up on the exams! Additional problem sets may be distributed periodically and the solutions will be posted and/or discussed in class.
5. *Get help.* If you get stuck on a problem, or don't understand something from lecture, come to see me in a timely fashion. I have consistently observed that those students who come to my office with questions on a regular basis do the best in this course. Besides taking advantage of my office hours, feel free to contact me via e-mail with questions that arise as you are studying or working on practice problems. There are also numerous internet resources that can serve as tutorials or provide additional information on any course topic that might intrigue you.
6. *In general -- continue to refine and use good study habits.* Students who wait until the last minute to

read the text, review the lecture notes, or study for an exam will quickly realize that the amount of material can be overwhelming. You should expect to study a **minimum of 6 hours per week for this course**. As noted above, **reading the assigned material prior** to attending the lectures is useful. IN OTHER WORDS, COME TO CLASS PREPARED AND DON'T PROCRASTINATE IN YOUR STUDIES!

ACADEMIC INTEGRITY: In my opinion, academic integrity is of utmost importance and cheating will not be tolerated. Please read the Academic Honesty Policy that I distribute and sign and return the cover page.



Tests/Assignments/Grading:

I do look at trends in grades over the semester; improvement in test grades over the duration of the course will be favorably noticed! Participation in class discussions, review periods, etc. is expected and will be a factor in the determination of final grades.

The lecture portion of the course will count as 75% of your total course grade. The lecture grade will be determined as follows:

	<u>% of final grade</u>
Tests ¹	55
Assignments, Quizzes and Class Participation ²	25
Grant Proposal ³	20
	<hr/>
	100 %

¹**Tests:** Tests will be based on lecture material and assigned readings from both the text and journal articles. **No make-up exams** will be administered without an official medical or registrar's excuse.

Tentative test dates:

Test #1 (15% of grade):	Thursday, February 14 th
Test #2 (20% of grade):	Thursday, March 27 th
Test #3 (20% of grade):	During finals weeks (April 28 th to May 3 rd ; exact date and time TBD)

²**Assignments and quizzes:** Quizzes or assignments will be given to encourage you to keep up with the course material. Many of the assignments will involve the use of research articles from primary journals and/or the internet. I expect each of you to actively participate in class discussions and to complete all assignments in a timely and professional manner. There will be no make-ups for assignments or quizzes and **late work will not be accepted.**

³ **Grant Proposal:**

Each person enrolled in this course will be expected to write a research grant proposal. This is not a typical literature search type of term paper; rather, you will be expected to read up on a biochemical topic of personal interest and then propose experiments to address new, unanswered questions related to the topic. Development of project proposals and grant writing are an integral part of working in biochemistry and related fields, and the funding of such proposals by granting agencies is crucial for the continuation of research (and, often your job). Please start thinking about this assignment early in the semester.

Proposals will be graded on the basis of four main criteria:

1. Scientific content:

- Are the questions being asked logical and thought provoking?
- Would the proposed experiments answer the questions being asked?
- Is the proposal written at a level expected from a student in a 400-500 level biochemistry course?

2. Justifications for the proposed study:

- Has the project been well thought-out?
- Are the justifications logical and convincing to the reader? (i.e. Have you convinced me why I should fund your project over that of J. Doe, Ph.D.?!)

3. Format of the proposal:

- Is the style, grammar, level of "professionalism", etc. appropriate for a scientific grant proposal?
- Are all components of a typical grant proposal included?
- Have primary references been used and properly cited?

4. Creativity/Originality of proposal:

- Have original, unanswered questions been asked?
- What extent of effort was put into this assignment?
- Is the proposal just a rehashing of material found in articles or other sources? (It better not be - this would be a form of plagiarism.)

I have a collection of materials regarding grant writing that I will provide later in the semester. I also have some samples of previous students' proposals on file. I prefer that each of you select your own topic, based on a personal interest, rather than coming to me for an idea. However, I do want to approval all topics before you actually start writing the grant.

To keep everyone on tract on this grant project, I have listed a series of deadlines. There will be **no extensions** for these due dates.

Topic decision date:

An abstract describing the proposal topic:

Proposal due:

Proposal presentations (oral) to class
"review panel":

February 21st

March 11th

April 18th

To be presented in class the last week of the semester

BIOL/CHEM 328: Biochemistry II

Laboratory Syllabus

~ Spring Semester, 2008 ~

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Course Prerequisites: BIOL/CHEM 327 (Biochemistry I); and therefore also BIOL 265 & CHEM 212
OR permission of instructor

Course text: There is no separate text for laboratory. Information regarding specific laboratory exercises will be provided either as handouts or as documents posted on the BlackBoard site for the course.

The lecture text (Lehninger Principles of Biochemistry, 4th ed.) may serve as a resource for some of the laboratory exercises.

Required supplies: A laboratory notebook is required and is available in the bookstore. The notebook is to have numbered and bound pages and grids (for graphing).

Safety goggles - Please bring these to lab each week.

Course objectives/introductory comments:

The points listed below provide both a description of the goals of the laboratory portion of this course and a sense of my expectations.

- You will conduct experiments that will continue to expose you to techniques and laboratory principles used for studies of biological molecules and processes. Besides relating to principles discussed in class and in the text, we will delve into other areas important to the field such as bioinformatics, the use of genomic databases and understanding biochemical primary literature. It is important to recognize that *in silico* approaches are critical for much of what biochemists now do.
- I emphasize experimental design, methodology, the further development of good laboratory practices (including safety), and data analysis. Acquisition of reliable and meaningful data is important; however, if the experiment does not go as planned, it is also important for you to determine whether there were flaws in experimental design, technical problems, or “operator error”! Troubleshooting is an important component of scientific research in both academia and industry.

- For each new experiment (or other lab exercise), I intend to distribute materials (typically via BlackBoard) ahead of time that introduce the experimental theory and procedures. **It is expected that you read this material before the start of the laboratory period.** You should outline the experimental procedure in your own words in your laboratory notebook and list the equipment and supplies that you will need for the experiment. Experiments run smoother and quicker if you are organized and prepared before coming to lab.
- Given the importance of good record keeping and communications skills in any science-related job, you will be expected to maintain thorough and accurate records in laboratory notebooks, and write concise, detailed reports using scientific journal article format. You may also be asked to orally defend your data and explain the significance of your results. Thus, a good understanding of the biochemical concepts *and* effective oral and written communication skills are expected of all students enrolled in this course.
- In general, experiments are more complex than lower level courses and several of the experiments will be investigative or "research-oriented". In some cases, you will be designing your own procedures utilizing primary literature resources to guide you. Some of the experiments have not been done before -- so we can only predict the results. (In other words, we may not know what the "right answer is".) This will not be a cookbook lab course; rather, the course is designed to give you a better idea of what a scientist actually does.
- Sometimes, we will spend time having a "lab meeting" or "journal club" since that is also an important part of what "doing science" involves when you are a part of a research team.
- My expectations for each of you are high. You will need to work hard, think hard, and be independent and self-confident with your ideas and lab technique. I will, of course, be available to help you along the way. I will introduce the new techniques and methodologies as needed.
- Attendance is crucial for the laboratory sessions, and due to the complex nature of many of the experiments, make-ups are not possible.
- There will be times when portions of an experiment can not be completed during the regularly scheduled times; research is not done in neat little 3-hour blocks. Coming to lab prepared helps you to make efficient use of your time, but there may be times when you have to come in to lab outside of the scheduled lab time to work on some aspect of the experiment. Team-work (division of labor) typically works well in this course, since many of the experiments will be conducted in pairs or small groups.
- Participation and cooperation by each group member is essential to complete the experiments on time. Group members must be able to work together and communicate with each other. You may meet with others in the group or with other class members to discuss the experiment and interpret the results, but your assignments and lab reports must be individually prepared. It is your responsibility to obtain all of the necessary data and enter it into your notebook before leaving the lab for the day.
- At the end of each lab, I expect students to clean up the benches, the hoods, instrument areas, etc. This has been a problem in the past, but clean, organized lab spaces are part of good laboratory technique.

Of key importance in the lab:

1. Safety
2. A thorough understanding of the principles underlying the experiments
3. Coming to lab prepared
4. Attendance and participation
5. Asking questions
6. Good laboratory technique

Grading and evaluation for the laboratory portion of BIOL/CHEM 328:

The laboratory portion of the course will count as 25% of your total course grade. This grade will be determined as follows:

	<u>% Total Laboratory Grade</u>
<i>Laboratory exercises</i>	50
- Experimental design	
- Lab reports ¹ and other forms of data presentation	
- Participation in lab discussions	
- Miscellaneous assignments	
<i>Laboratory technique</i> , including participation and contributions to lab team, laboratory notebook ²	35
<i>Laboratory final (April 21st)</i>	15
	<hr/> 100%

¹Regarding lab reports: Lab reports should be written as though there were to be submitted for publication (i.e. clear, concise, factual, and complete). It is useful to browse through biochemical journals to see appropriate formats for scientific reports, tables, figures, legends, references, etc. Reports will not be done for all experiments; sometimes we will have "lab meetings" to discuss results and our conclusions or there will be exercises designed to reinforce key points from the lab. Specific details will be given with each experiment. More details about format are provided below.

²Regarding lab notebooks: You are expected to keep a detailed laboratory notebook throughout the semester. Everything should go into your notebook: references, notes and plans for experiments, calculations, summaries, and, of course, all data. All entries are to be in **ink** (no white-out, erasures, etc.) and notebook pages are bound so that pages can't be ripped out or added. Do not write data on loose scraps of paper with the intention of entering the information into your notebook later. It is too easy to lose critical information this way.

ALTERATION OF EXPERIMENTAL DATA WILL ABSOLUTELY NOT BE TOLERATED.

The elimination of any data from a table or graph must be noted and fully justified (typically by statistical means). The discussion of the data and the explanation of data which does not correlated with the expected results are more important than having the "right answer".

Highly recommended suggestions for notebook/laboratory record keeping:

- Include a table of contents;
- Number pages and date all entries;
- Use one side of notebook for calculations, scribbling, etc. and use other side for entries (makes it easier to find things);
- You should prepare for each lab ahead of time; include an objective, procedural outline or flow chart and relevant references in notebook prior to coming to lab. You can often set up data tables in your notebook ahead of time as well.

Laboratory report format:

A written formal laboratory report for an experiment will be due on an assigned date, typically one week following the completion of an experiment. **LATE LAB REPORTS WILL NOT BE ACCEPTED.**

All reports must be typed using proper grammar, complete sentences and paragraphs. Tables and graphs must be in ink also. Do not use pages from your laboratory notebook for your reports. Reports will be evaluated for their accuracy, completeness, format and quality (including neatness and professional looking graphs and tables). Reports that are written incorrectly or that are incomplete will be returned ungraded. In these cases, you may have the opportunity to redo the report after discussing the problems with me.

Manuscripts in biochemical journals (not review articles) provide examples of format and content. I highly suggest that you browse through some journals in the library to see what scientific reports are like. Specific guidelines will be given for individual reports, but a general format for your reports follows on the next page.

Do not wait until the last minute to write up a lab report. It is easier to start when the procedure and data are still fresh in your memory. That way, if you have questions, you will also have more time to ask me questions. For certain experiments, I will hold a help session to go through calculations, concepts, etc. prior to the due date for the report.

Specific guidelines will be given for individual reports, but a general format is presented below:

Title Page

- Include experimental title, date, lab section, and name(s) of experimenter(s).

Introduction

- The introduction should be a brief explanation of the experimental objectives and the general approach used to address the scientific question. Some theory underlying the experiment should also be included.

Methods

- The details of the methods should be described in complete sentences (not a list of tasks performed) only as they differ from the methods listed in the text, handout or other references used. The source of the complete procedure should be formally referenced in the bibliography at the end of the report.
- The methods section, as well as others, are written in the past tense (what was done). Also avoid "first person" usage ("I treated the samples with..."); rather, write using a passive voice ("The samples were treated with.....").

Results

Data:

- Tables and graphs of the raw data collected are included in the Results section of a report. Typically raw data is used to construct preliminary tables and graphs that would not be included in a formal publication, but I would like these included in your reports so that it is easier for me to find errors should they exist.

- Tables and figures should contain legends, should be neat and in ink, and should be titled, numbered, and clearly labeled (including units). Someone unfamiliar with the data and experiment should be able to remove a figure or table from a report and be able to determine the meaning and significance of the information within it without having to refer to the text of the report.

Calculations:

- Always include a sample calculation for all mathematical data manipulations so that I can check them for accuracy.

Text:

- Sometimes short explanations or descriptions of the data are included in the Results section, but detailed analyses or interpretation of the data is often found in the Discussion section of a research manuscript (or lab report).

Discussion

- This section is a summary and explanation of the results in terms of the principles to be learned. Relate the results back to the objective(s) stated in the Introduction. You should explain how the data demonstrates what was predicted or why the data deviates from the expected or literature values. "Experimental error" is not a specific enough explanation, but one that I commonly encounter when grading.

- Any questions asked in the lab handouts should be addressed in the Discussion section of the report by incorporating the answers into the text of the discussion.

References

- All reports should include a list of citations used for the methods, literature values, and theory or analysis included.

Laboratory rules and policies:

Below is a list of rules and procedures that we all must follow for safety, efficiency, good laboratory technique and courtesy to your lab mates.

General:

1. Safety glasses must be brought to each class and worn while in the lab when working with chemicals.
2. Bench space in the laboratory is for doing science. Do not put coats, backpacks, or other personal belongings on the benches or pieces of equipment.
3. No food or drink is permitted in the lab.
4. Be aware of the location of all safety equipment in the laboratory. Any chemical spill or personal

injury, regardless of severity, must be immediately reported to the instructor.

5. Please be considerate and clean up your work areas completely at the end of the class. Return chemicals, glassware and equipment to their initial location. Do not disturb items in the laboratory that you are not using; remember that the lab space is used by others for classes and research. Remember that 30% of your grade is related to lab technique of which neatness and clean-up are a part.

Glassware:

1. For the most part, you will be sharing glassware with students from other courses and who are doing research. Cleanliness is essential since glassware contaminants can destroy many biomolecules and interfere with experimental assays. Glassware that has contained protein solutions, organic chemicals or unknown solutions should be thoroughly washed with detergent and rinsed with excessive amounts of water. Detergents themselves will denature most enzymes, so it is essential that the glassware be well rinsed. Rinse glassware with distilled water after rinsing well with tap water. In the case of glassware that has only contained water-soluble salt or buffer solutions, just rinse well; it is not necessary to use detergent as this is often more difficult to rinse than the original solution. If using a detergent, use only the dilute detergent solutions which I provide.
2. Clean your own dirty glassware each lab period and return it to the appropriate place when you are finished using it.
3. Used pipettes should be placed tip up into the pipette holder immediately after use -- before materials can dry on the glass. Pipettes used for protein solutions, organic chemicals or caustic solvents should be rinsed with water first before placing them in this pipette holder. I will clean a batch of the pipettes when necessary. Please do not use any more pipettes than is necessary as the cleaning process is time consuming.

Chemicals, Storage, and Solution Preparation:

1. Some of the chemicals and stock solutions that you will need will be prepared for you ahead of time. Please be sure that you know what you are doing before you begin to use these solutions, and if you are in doubt, ask me. Most biochemicals are very expensive and I only prepare enough of the reagent to complete the experiment a single time.
2. Always store a reagent as recommended in the procedure or on the bottle. Chemicals that are stored in the refrigerator or freezer must be warmed to room temperature before opening the desiccator and/or bottle to avoid condensation which may accelerate the degradation of the chemical or hydrate it so that estimation of the amount of the reagent by weight measurement becomes impossible.
3. When you are responsible for preparing solutions, be sure to prepare all solutions with deionized water unless otherwise directed.
4. Label all solutions using labeling tape and markers provided. Include the contents, your initials, the class and the date when the solution was prepared.
5. If you will no longer need a solution, check with your lab partners and me before disposing of it. Some chemicals will require special disposal methods of which you will be informed.

