

Biochemistry 482

Spring 2009

Instructor: Dr. Stephen Lodmell

Class time/place: MWF 10:10-11:00am

Office: CHCB 202 Office hours: 11-12 MWF and by appointment

Optional help session: One hour per week, to be arranged

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Text: Garrett and Grisham Biochemistry, 3rd ed. (updated)

Overview: The second semester of biochemistry builds on the foundation laid by BIOC481. In the second semester BIOC482, we turn our attention to the chains of reactions and processes that we call metabolism and the mechanisms by which these reactions occur. We will explore enzyme kinetics and mechanisms, then we will learn about all of the major metabolic pathways that are conserved across the tree of life and study how they integrate in living systems.

Prerequisites: BIOC481 (or equivalent) is the prerequisite for this course. Because biochemistry is a subdiscipline of chemistry, students should have a good working knowledge of inorganic and organic chemistry. We have found in particular that students with weak preparation in organic chemistry have a more difficult time with biochemistry than those with a solid organic background. It is easier to see the logic behind biochemistry if you understand the underlying principles. It is a good idea to review basic organic principles and reactions prior to embarking on the biochemical pathways.

Requirements: Students are expected to study the text carefully and are encouraged to read the text and supplementary materials prior to the corresponding lectures. Questions or problems sets will be assigned for each chapter, but in general they will not be collected or graded. However, similar questions can be expected on quizzes and tests. In addition, there will be writing assignments based on investigations in the current scientific literature, so you will need to become proficient at retrieval of relevant scientific information from the library and electronic sources.

Tests and quizzes: There will be a weekly quiz most Fridays, three midterm exams, and a comprehensive final exam. Each exam counts as 20% of your final grade (your lowest midterm score will be dropped from your final grade calculation). The average of your quizzes will count as one midterm test grade. You may drop your two lowest quiz grades (including any missed quizzes), but makeup quizzes will not be given. The final exam counts the same as a midterm exam. Midterm exams will be held at 7pm on three Wednesday evenings during the semester, as noted below. The midterm exams are scheduled in the evening to allow students more time (two hours) to complete them.

Writing assignments and informational literacy: There will be three writing assignments that combined will constitute 20% of your final grade. These assignments will require research of the scientific literature. You will make extensive use of online resources such as Medline/ PubMed to find appropriate and relevant materials. Although there are many other online resources that are useful to varying degrees, you should use the primary research literature as your principal source of information. Other online sources (notably Wikipedia) are non-refereed and are not reliably accurate

or unbiased. To substantiate arguments and points in your written assignments, you must use and cite the primary research articles that are directly relevant to your topic.

- 1) **Review a current research article** (10%). You will choose a recent (years 2006-2009) research article from the primary research literature that relates to the biochemistry of metabolism in one of the following subject areas: mechanism of action of antibacterial, antifungal or antiviral compounds. You will write a short paper (double spaced, 7-page maximum) centered around this article, stating the problem and relevant background information, the approach/methods, and the results/interpretations in your own words. You must hand in a copy of the research article with your paper. Your paper will be graded and comments and suggestions provided based on both scientific content and appropriate English usage, style, and organization. You will use the comments provided to revise your paper and hand it in for a second assessment. 75% of the grade will come from the first draft, and 25% comes from the revised version.

Some guidelines for writing a review of a research article:

Most important, consider (and be considerate of) your audience/ reader. Who are they? What background are they likely to have? Think about what terms would need to be defined so that the reader has the tools (background and terminology) to understand what you are saying.

- Make the paper user-friendly by defining specialized terms and setting up the subject
- Make the paper able to stand alone, so that someone without further outside reading could understand (almost) all of the points you make in the paper.

A. Introduce the subject (use about one page). Frame the research in ‘big picture’ terms: Why is the subject important and interesting to study? Briefly state what approaches the authors used to address some aspect of the problem at hand.

B. Go through the experimental data (use about four pages). Describe the actual experiments and data (you should go through the paper essentially figure by figure). What was each experiment designed to show? How was it done (uncommon experimental techniques require more description)? What was the outcome, and how did the data obtained shed light on the overall problem? For each assertion you make, make sure to support it with examples, data, or analogies. Do not leave points that you are trying to make unsubstantiated. A major objective of this assignment is to demonstrate the relationship between actual experimentation and overall conclusions and concepts. Heavy emphasis is placed on your description of the experiments. The data taken from the experiments are subsequently pooled together to make overall conclusions in the next section.

C. Conclusions (about 1 page). What did the experimental results tell us about the research problem at hand? What is the significance of these new results? You may also want to discuss whether the authors conclusions match your own in light of the experimental results presented. Remember that interpretation of experimental results can be subjective. If the authors’ interpretations of the data are different than your own, this is a good place to talk about it.

D. Proofread your paper carefully! This serves two purposes:

- You will locate and correct typographical errors and awkward sentence constructions.

- As you are reading, you should ask yourself: "If I read this paper for the first time, without any additional outside reading, would I be able to understand it? Would I be convinced of points being made in the paper?" If there are places where this is unclear, you should rewrite to clarify and support as necessary.

- 2) **Formulate an opinion about a controversial scientific topic (5%).** Science is not always cut and dry. Experimental results sometimes do not agree with each other or with existing 'accepted' models or paradigms. For example, the prevalence of internal ribosome entry sites (IRESs) in the translation of eukaryotic mRNAs has been hotly debated, as has the prion protein hypothesis, i.e. that prion diseases are caused by protein-only 'pathogens', without any nucleic acid or genome required. Write a short (2-3 page maximum, not including references) paper on one of these topics. Several review articles have been placed on ERES to get you started, but please search the primary literature for more information and the latest results. State the problem, the relative strengths of the arguments on each side of the debate, and finally, using specific examples, make as persuasive a case as you can for one side of the controversy or the other. You will need to say why you believe one side of the controversy and you must state why you (and others) should be willing to dismiss the scientific evidence that supports the other side. This assignment will require reading multiple papers from each side of the controversy. You must cite these papers appropriately in the text and include a complete bibliography. Papers will be graded on persuasiveness, accuracy, solid grammar and style, and appropriate use and citation of sources of information. Remember to use Medline and/or other abstracting services to learn as much about the topic as you can before you arrive at your opinion and write your paper.
- 3) **Summarize a research article or a seminar from the UM IMB or BSD seminar series to be understandable by a non-scientist (5%).** For this assignment, you will attend one (or several) scientific seminars given on campus for the Integrative Microbiology and Biochemistry (IMB) or Biomolecular Structure and Dynamics (BSD) seminar series (every Monday at 4pm in SB117 (IMB) and every Thursday at 4pm in CP212 (BSD)). Your 'role' for this assignment is as a science journalist for a small newspaper. Distill the main points of the seminar, including the problem/background, the approach/methods, and the results/conclusions of the talk in language that a well-educated but non-scientist could understand. Write these up in a concise 2-page paper that may be suitable for publication as a short article in a newspaper, for example. Your paper will be graded for clarity of style, awareness of target audience, and scientific accuracy. You can hand this assignment in at any time during the semester up until the last week.

Student participation: Students are encouraged to participate in classroom discussions and activities.

1) Please ask questions, certainly as they pertain to particular details of the lecture or readings, but also to explore relevance and connections to your own interests with respect to research, health, or other curiosity. 2) The tentative syllabus is adjustable; we can explore special topics in some detail so please feel free to recommend topics for more in-depth study. 3) Student presentations are encouraged. Many students enrolled in this class have some degree of laboratory research experience. It is highly beneficial to all of us to have student presentations during the semester to give others a chance to see what real research is going on presently at The University of Montana and elsewhere.

Graduate credit: If you are taking this course for graduate credit, you are required to do an extra increment of work. To satisfy this increment you will give an oral presentation to the class about your own research, emphasizing connections to material covered in class. Alternatively, you may

present a lecture about a realm of research from the current literature that is relevant to the course content. Please see me to arrange the presentation.

Notes and ERES: Class notes will be posted on the electronic reserve system (ERES) from the Mansfield Library. To access this, go to the Mansfield Library home page, then follow the link for ERES. You can access the course using either our names or the course number. A password will be required, which will be provided to you in class. Remember that these notes are what we use as an *outline* for class preparation. They are not intended to be used as a substitute for coming to class or for doing the readings.

General Policies

University policies on drops, adds, changes of grade option, or change to audit status will be strictly enforced in this course. These policies are described in the 2008-2009 catalog. Students should specifically note that after the 30th day of the semester, such changes are NOT automatically approved. They may be requested by petition, but the petition MUST be accompanied by documentation of extenuating circumstances. Requests to drop a course or change the grade basis to benefit a student's grade point average will not be approved.

Note:

- A recent change in university policy states that a “P” grade is given in lieu of A, B, or C grade; an “F” grade is given in lieu of a D or F grade.
- After the 15th day of classes, students will not be able to change from a grade to audit status, under any circumstances.

In working through homework assignments, students are encouraged to work together to solve problems, to share information or resources, and to test each other's understanding of the material. Those are all acceptable forms of collaboration. However, the written work that each student turns in must be his or her own. Only in this way can faculty judge individual understanding of concepts or information. A good rule of thumb for students to follow is to work together up to the point of committing words to paper. At that stage, each student must work independently. A second key guideline is that once a student has written an out-of-class assignment, it must not be shown to another student in the course. Assignments from two or more students that have significant overlap, in the professional judgment of the faculty member, will be regarded as reflecting a violation of the expectation that students turn in independent assignments. Please note that direct copying of sentences from any published without proper citation is considered plagiarism. **THIS INCLUDES THE INTERNET.** Be sure to put the information in your own words and be aware that the instructor will check literary and Internet resources. Violations will be dealt with according to the Student Conduct Code.

All exams and quizzes are ‘closed book’, that is, you may not use any notes in print, audio, or electronic form. Please turn off your cell phones, MP3 players and all electronic devices prior to the start of exams and quizzes.

Special accommodations: If you are registered with Disability Student Services and require special accommodations, please contact instructor to make arrangements.

Tentative class topics schedule:

Jan 26-Jan 30	<i>Translation/Protein synthesis (Ch 30)</i>
Jan 2- Feb 6	<i>Enzyme specificity and kinetics (Ch 13)</i>
Feb 9- Feb 13	<i>Enzyme mechanism (Ch 14)</i>
(Feb 16- President's Day- no class)	
Feb 18-Feb 20	<i>Enzyme regulation (Ch 15)</i>

- **Feb 18 (Wednesday)- First midterm exam 7-9 pm HS411**

Feb 23- Feb 27	<i>Overview of metabolism (Ch 17)</i>
Mar 2- Mar 6	<i>Glycolysis (Ch 18)</i>

Note: March 9 is last day to drop w/o petition

- **March 4 (Wednesday)- First draft of written assignment #1 due**

Mar 9- Mar 13	<i>Tricarboxylic Acid cycle (Ch 19)</i>
Mar 16- Mar 20	<i>Electron Transport (Ch 20)</i>

- **March 18 (Wednesday)- Second midterm exam 7-9pm HS411**

Mar 23- Mar 27	<i>Electron Transport and Photosynthesis (Ch 20-21)</i>
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- **March 25 (Wednesday) Final draft of written assignment #1 due**

March 30-April 3 – No class- Spring break

Apr 6 – Apr 10	<i>Gluconeogenesis, glycogen metab, PPP (Ch 22)</i>
Apr 13 – Apr 17	<i>Fatty Acid catabolism (Ch 23)</i>

- **April 15 (Wednesday) Written assignment #2 due**

Apr 20 – Apr 24	<i>Lipid biosynth, amino acid metabolism (Ch 24)</i>
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- **April 22 (Wednesday) – Third midterm exam 7- 9pm HS411**

Apr 27 – May 1	<i>Metabolic integration (Ch 27)</i>
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- **April 29 (Wednesday) Final draft of assignment #2 due**

May 4- May 8	<i>Signal transduction (Ch 32)</i>
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- **May 6: Assignment #3 is due if you have not already handed it in!**

- **Wednesday May 13 Final examination (cumulative) 10:10-12noon F305**