

1-2010

## BIOC 482.01: Biochemistry

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# Biochemistry 482

## Spring 2010

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, 3<sup>rd</sup> 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 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 2007-2010) 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) **Summarize a research 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 approximately every other 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. The tentative schedule for IMB seminars is shown below.
- 3) **Attend, summarize, and critique at least two NCUR presentations (April 15-16, 2010)** (5%). The University of Montana is hosting the National Conference on Undergraduate Research (NCUR) in April. There will be hundreds of talks and poster presentations on campus over these days. You are required to attend at least two of these presentations of your choice (as long as they are in the fields of Molecular Biology, Biochemistry, or related). In this

assignment, you will articulate a scientific summary of an oral presentation, and you will separately discuss the *content* and *delivery* in a 1-2 page summary and critique of each talk. For each presentation, state the title, the name of the speaker, the room number and time of the presentation, and the name of the session moderator (the 'emcee' of the session). Give enough background information to make clear the significance and rationale for the work, the hypotheses, and goals, and summarize the findings and interpretations. Then, give a brief critique of the delivery of the talk according to the rubric devised by Profs. Brewer and Ebert-May attached to this syllabus. **It would be useful to review the rubric before you attend the talks, and to bring the rubric with you to give you some basis to judge, compare, and critique the presentations.**

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 and powerpoint presentations 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 studying the text; both of these activities are required for success in the course.

#### General University 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 2009-2010 catalog. Briefly:

After registering and through the **first fifteen (15) instructional days of the semester**, students may use Cyberbear to drop and add courses or change sections and credits. Fees are reassessed on the sixteenth day of the term. Added courses and credits may result in additional fees. For courses dropped by the fifteenth instructional day, no fees are charged and courses are not recorded. (For deadlines and refund policy for withdrawal from all courses, see the Withdrawal sections of the catalog.)

After adding a course, the credit/no credit grading option or auditor status may be elected on the internet or on a form available at the Registration Counter in Griz Central in the Lommasson Center. These options are not allowed for some courses as identified in the Class Schedule. Change of grading option to audit is not allowed after the 15 instructional day.

**Beginning the sixteenth (16<sup>th</sup>) instructional day of the semester through the forty-fifth (45<sup>th</sup>) instructional day**, students use paper forms to drop, add and make changes of section, grading option, or credit. The drop/add form must be signed by the instructor of the course and the student's advisor. The signed drop/add form must be returned to the Registration Counter (or the Registrar's Office at the College of Technology) no later than the **forty-fifth** instructional day. A \$10.00 processing fee is charged for each drop/add form. Added courses and credits may result in additional fees. There are no refunds or reductions of fees for courses dropped and grades of W (withdrew) are recorded.

**Beginning the forty-sixth (46<sup>th</sup>) instructional day of the semester through the last day of instruction before scheduled final examinations, students must petition to drop.**

The petition form must be signed by the instructor of the course and the student's advisor and, the dean of the student's major. A \$10.00 processing fee is charged for each petition. There are no refunds or reductions of fees for courses dropped, and the instructor assigns a grade of WP (withdrew/passing) if the student's course work has been passing or a WF (withdrew/failing) if the course work has been failing. These grades do not affect grade averages but they are recorded on students' transcripts.

Documented justification is required for dropping courses by petition. Some examples of documented circumstances that may merit approval are: accident or illness, family emergency, or other circumstances beyond the student's control.

The opportunity to drop a course for the current term for such a course ends on the last day of instruction before scheduled final exams. Dropping a course taken in a previous term or altering grading option or audit status for such a course is not allowed. The only exceptions are for students who have received a grade of NF (never attended).

Note:

- A recent change in university policy states that a "CR" grade is given in lieu of A, B, or C grade; an "NC" 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.

Academic honesty

In working through homework and writing 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 cell phones, calculators, MP3 players and all other electronic devices prior to the start of exams and quizzes.

Special accommodations: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students (DSS). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with DSS, please contact DSS in Lommasson 154. I will work with you and DSS to provide an appropriate accommodation.

### **IMB Seminar schedule, Spring 2010**

Jan 25 - OPEN DATE

Feb 1 - Joachim Schultz, Universitaüt Tübingen (Co-Sponsored with CBSD)

Fen 8 - Janet Jansson, Lawrence Berkley National Laboratory

Feb 15 - Holiday

Feb 22 - OPEN DATE

Mar 1 - Kevan Roberts, UM BMED and CEHS

Mar 8 - Timothy James, University of Michigan

Mar 15 - Brent Ryckman, UM DBS

Mar 22 - Klara Brinkarova, UM Chemistry Department

Apr 5 - Stephanie Lathrop, Washington University in St. Louis

Apr 12 - Frank Rosenzweig, UM DBS

Apr 19 - Alan Wolfe, Loyola University Stritch School of Medicine

Apr 26 - Vanessa Ezenwa, UM DBS

May 3 - Sarah Certel, UM DBS

## Tentative class topics schedule:

Jan 25-Jan 29	<i>Enzyme specificity and kinetics (Ch 13)</i>
Feb 1- Feb 5	<i>Enzyme mechanism (Ch 14)</i>
Feb 8- Feb 12	<i>Enzyme regulation (Ch 15)</i>
(Feb 15- President's Day- no class)	
Feb 17-Feb 19	<i>Molecular Motors (Ch 16)</i>

- **Feb 17 (Wednesday)- First midterm exam 7-9 pm Room TBA**

Feb 22- Feb 26	<i>Overview of metabolism (Ch 17)</i>
Mar 1- Mar 5	<i>Glycolysis (Ch 18)</i>

- **March 3 (Wednesday)- First draft of written assignment #1 due**

Mar 8- Mar 12	<i>Tricarboxylic Acid cycle (Ch 19)</i>
Mar 15- Mar 19	<i>Electron Transport (Ch 20)</i>

- **March 17 (Wednesday)- Second midterm exam 7-9pm Room TBA**

Mar 22- Mar 26	<i>Electron Transport and Photosynthesis (Ch 20-21)</i>
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- **March 24 (Wednesday) Final draft of written assignment #1 due**

March 29-April 2 – No class- Spring break!

Apr 5 – Apr 9	<i>Gluconeogenesis, glycogen metab, PPP (Ch 22)</i>
Apr 12 – Apr 14	<i>Fatty Acid catabolism (Ch 23)</i>

- **April 15-16 (Thursday, Friday) NCUR – You must attend at least one hour session of Biochemistry-related oral and/or poster presentations. Also note that writing assignment #3 is based on NCUR presentations.**

Apr 19 – Apr 23	<i>Lipid biosynth, amino acid metabolism (Ch 24)</i>
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- **April 21 (Wednesday) – Third midterm exam 7- 9pm Room TBA**

Apr 26 – Apr 30	<i>Metabolic integration (Ch 27)</i>
May 3- May 7	<i>Signal transduction (Ch 32)</i>

- **May 5: Assignments #2 and 3 are due if you have not already handed both in!**
- **Monday May 10 Final examination (cumulative) 8:10-10:00am Room F305**



**Scoring Rubric for Oral Presentation/Written Summary of Scientific Research Papers (for written omit Style/Delivery column)**

*Adapted from Brewer, C.A., and D. Ebert-May. 1998. Hearing the case for genetic engineering: breaking down the barriers of anonymity through student hearings in the large lecture hall. Journal of College Science Teaching 28 (2): 97-101.*

Level of Achievement	Clarity	Content	Style/Delivery	Use of Visual Aids	Integration of Knowledge	Ability to Answer Questions
<b>Excellent 25 points</b>	<ul style="list-style-type: none"> <li>Well thought out</li> <li>Use of proper language</li> <li>Significance clearly stated</li> <li>Previous work sets the stage for this study</li> <li>Handout and bibliography provided for audience</li> </ul>	<ul style="list-style-type: none"> <li>Identifies the research question or work</li> <li>Has advanced understanding of the experimental approach and significance</li> <li>Critically evaluates results, methodology and/or conclusions</li> <li>Scientifically rigorous and well researched</li> </ul>	<ul style="list-style-type: none"> <li>Uses time wisely</li> <li>Logical progression</li> <li>Speaks with good pacing</li> <li>Makes eye contact and does not read information</li> <li>Uses engaging tone and vocabulary</li> </ul>	<ul style="list-style-type: none"> <li>Well placed images</li> <li>Charts summarize data and/or conclusions</li> <li>Size and labels are clear</li> <li>Very little text</li> <li>Figures and images explained and described well</li> <li>AV set up properly</li> </ul>	<ul style="list-style-type: none"> <li>Integrates research findings to broader context</li> <li>Understands implication of data or method</li> <li>Identifies future avenues of investigation</li> <li>Supports arguments or explanation with references</li> </ul>	<ul style="list-style-type: none"> <li>Anticipates audience questions</li> <li>Understands audience questions</li> <li>Can integrate knowledge to answer questions</li> <li>Thoroughly responds to questions</li> </ul>
<b>Good 20 points</b>	<ul style="list-style-type: none"> <li>Well thought out</li> <li>Use of proper language</li> <li>Significance clearly stated</li> <li>Handout and bibliography provided for audience</li> </ul>	<ul style="list-style-type: none"> <li>Identifies the research question or work</li> <li>Has basic understanding of the experimental approach and significance</li> <li>Critically evaluates results, methodology and/or conclusions</li> <li>Well researched</li> </ul>	<ul style="list-style-type: none"> <li>Spends too much time on introduction</li> <li>Speaks well, but often back tracks</li> <li>Makes good eye contact and looks at notes occasionally</li> <li>Uses good vocabulary and tone</li> </ul>	<ul style="list-style-type: none"> <li>Excellent images but not always well placed</li> <li>Size and labels are clear</li> <li>Very little text</li> <li>Figures and charts are explained well</li> <li>AV mishaps resolved</li> </ul>	<ul style="list-style-type: none"> <li>Minimally integrates research findings to broader context</li> <li>Has some understanding of the implications of data or method</li> <li>Identifies some future avenues of investigation</li> <li>Supports arguments or explanation with references</li> </ul>	<ul style="list-style-type: none"> <li>Does not anticipate audience questions</li> <li>Understands the audience questions</li> <li>Can integrate knowledge to answer the question</li> <li>Thoroughly responds to most questions</li> </ul>
<b>Adequate 15 point</b>	<ul style="list-style-type: none"> <li>Talk a bit disorganized</li> <li>Shows some effort to use proper language</li> <li>Significance a bit unclear</li> <li>Handout and bibliography are not well formatted</li> </ul>	<ul style="list-style-type: none"> <li>Research question a bit unclear</li> <li>Description of experimental approach a bit confusing</li> <li>Results and conclusions stated but not critically evaluated</li> <li>No use of outside readings</li> </ul>	<ul style="list-style-type: none"> <li>Presentation poorly timed</li> <li>Presentation jumping from different topics</li> <li>Some hesitation and uncertainty are apparent</li> <li>Makes little eye contact</li> <li>Monotone and non-engaging delivery</li> </ul>	<ul style="list-style-type: none"> <li>Labels and legends are a bit unclear</li> <li>Size might be a bit too small</li> <li>Too much detail</li> <li>Blocks of text on handouts or slides</li> <li>Figures are explained well</li> <li>AV mishaps resolved</li> </ul>	<ul style="list-style-type: none"> <li>Does not integrate the work or method into the broader context</li> <li>Supports argument or explanation with few references</li> <li>Makes some errors in interpretation and application of data or method</li> <li>Makes few connections between data, method, and conclusions</li> </ul>	<ul style="list-style-type: none"> <li>Does not anticipate audience questions</li> <li>Makes an effort to address question</li> <li>Can address some questions</li> <li>Overlooks obvious questions</li> <li>Often responds poorly to questions</li> </ul>
<b>Inadequate 10 points</b>	<ul style="list-style-type: none"> <li>Talk difficult to follow</li> <li>Unclear language</li> <li>Does not understand significance of paper</li> <li>No handout or bibliography</li> </ul>	<ul style="list-style-type: none"> <li>Does not understand research or work</li> <li>Does not understand experimental approach</li> <li>Does not understand conclusions or recognize implications for future work</li> </ul>	<ul style="list-style-type: none"> <li>Presentation poorly timed</li> <li>Jumbled with no logical progression</li> <li>Makes no eye contact and reads from notes</li> <li>Hesitation and uncertainty are apparent</li> </ul>	<ul style="list-style-type: none"> <li>Labeling is not clear</li> <li>Too small to see</li> <li>No logical placement</li> <li>Mostly text and very few images</li> <li>Figures are not explained</li> <li>AV mishaps unresolved</li> </ul>	<ul style="list-style-type: none"> <li>Does not integrate the work or method into the broader context</li> <li>Makes little effort to use data to support arguments</li> <li>Misinterprets information</li> <li>Makes no connections between data, method, and conclusions</li> <li>Lacks logic</li> </ul>	<ul style="list-style-type: none"> <li>Either makes no effort to respond to questions or does so poorly</li> </ul>
<b>No effort 0 points</b>						