

BIOCHEMISTRY AND MOLECULAR BIOLOGY 452W
BIOCHEMISTRY II
SPRING SEMESTER 2006
PF 210
M, W, F 9:00-9:50 A.M.

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Text: Biochemistry, 5th Ed.
Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer
Freeman, 2002, ISBN 0-471-15451-2

Text (Lab): Protein Methods, 2nd Ed.
Bollag, Rozycki, and Edelstein
Wiley-Liss, 1996, ISBN 0-7167-3051-0
And Supplemental Papers and Descriptions

Course Description: Biochemistry. Biology and chemistry. Chemistry and biology. The chemistry of biological systems. The biology of chemical reactions. This is a field that takes the best of both. It examines reactions in the cell. Chemical reactions. But, these are not the typical chemical reactions because they are done (most of the time in the cell) in aqueous solvent and they can't use strong bases or acids in many cases. Water slows (or stops) many of the synthetic reactions of carbon containing compounds that we use in the lab (think of how many times in organic lab you used water as a solvent for a reaction). The removal of strong bases and acids would cripple us as chemists in the lab. Yet, cells do quite well. They typically produce compounds as needed in high yield *and* stereochemically pure. How do they do this? These reactions are the point of this class really.

Biochemistry is an already broad field that is ever increasing in scope and depth. Look at any biochemistry textbook from the early 1980's and your current one and you will likely be amazed at the changes. Biochemistry is a relatively young field that is currently enjoying a rapid expansion of knowledge. Part of the reason for this expansion is its relationship to organic chemistry. Biochemistry, as a field, has evolved to the point where molecular mechanisms are becoming known. Not surprisingly, these mechanisms are based on the organic chemistry you have learned and the application of the knowledge of organic chemistry to biochemistry fuels the expansion of both fields. One need only look at classic cellular cycles like the Krebs Cycle to see Aldol condensation, oxidation, decarboxylation, dehydrogenation, and hydration reactions!!! Or, take a look at protein synthesis and realize how cells use esters (amino acyl tRNA's!!) instead of free acid amino acids partly because of the inherent lack of carbonyl reactivity of free acids!!! Another reason for this expansion is the development of techniques that allow us to better

observe what happens in the cell. These techniques will be a focus of the laboratory portion of this course. Additional information about how cells do these amazing reactions has come from pharmaceutical research and research into other foreign compounds administered to cells or organisms. We will thus explore some of what we have learned through the accidental or purposeful development of pharmaceuticals.

This course is designed to expose you to many (but certainly not all) of the fundamental concepts of biochemistry. This second semester course will focus more upon genetic material, namely DNA and RNA and some cell cycles. This will include the DNA and RNA structure, how they are made, how they replicate, etc. It will look at the reactions of certain cycles and certain biosynthetic pathways. It will, of course, involve proteins as these are intimately involved in many of the processes we will look at. So, first semester material cannot "go away"!

This course is also likely to be somewhat different than many you have taken here at Ursinus. We will use the chapters of the text as overall guiding structures (more at first and less later is the goal), but I hope that this class will be far more based in the primary literature related to these chapters. Additionally, I will resist lecturing in this course as much as possible. What does this mean? This means that you will have a significant role in this course. You will discuss, you will present, you will ask questions, you will answer questions, you will not be able to put this class off for a few days! You will be expected to contribute *everyday* to the success (or failure!!!) of this class. You will be graded on these presentations, your constructive involvement in the course on a regular basis, and your questions! In trade for this, I am making less of the points of the course dependent upon exams (which will mean there will only be a mid term and a final exam)! I am hopeful that this type of format will allow you to learn more than you ever could in other formats. I am hopeful that it will inspire you to *want* to learn more than you ever have.

A final note. I have not taught this course before and I have not tried this format (because I have never had the *luxury* at Ursinus of having only 10 students in one of my courses!) here at Ursinus. There are likely to be bumps in the road and things that don't work well (and hopefully more that do work well). I ask you, no, *I plead with you*, to always offer your opinion on what works and what doesn't for you *and* to offer alternatives for things that do not work well when you can. I am open to altering things throughout the course to make it more valuable to all of you. I don't have all of the answers or even pretend to, so I simply ask that your increased involvement include never being afraid to offer your opinion. Rest assured that you can make a comment to me and this will never enter into a grading decision. If you don't believe that, you can always slip notes anonymously under my door!

Exams: Exams will constitute a significant portion of your grade in this class. More importantly, you should use them as an indicator of what areas you are still having difficulties with. You should seek prompt assistance after an exam. Don't let a problem get worse by not attending to it.

An important set of policies applies to examinations. Please read these policies carefully and if you don't understand any aspect of each policy, please see me now!

- 1) Exams are to be taken on the day and time that is specified in this syllabus. If you know in advance that you have to miss an exam, you must talk to me in advance of

the exam day and get approval to miss the exam. If you have a legitimate need to be off-campus on the exam day, I will of course work with you to find an alternate, *earlier* time for you to take the exam. If you suddenly become *seriously* ill or have another *serious*, unanticipated emergency and **must** miss the exam (and you could not arrange to see me in advance), you **MUST** contact me as soon as the situation permits (preferably prior to exam time) to explain the situation. If I am not in my office, please leave a message explaining your situation and a number where you can be reached. *Please note: multiple other exams the same day, etc. is not a serious, unanticipated emergency and I will expect you to plan ahead and take the exam on time. Failure to adhere to this policy will result in the score of 0 (ZERO) being recorded for the exam!*

- 2) Exams begin promptly at 8:35 a.m. and end promptly at 9:50 a.m., even if you arrive late. If somebody has left the exam by the time you arrive late, you will not be allowed to sit for the exam and a score of 0 (zero) will be recorded.

Academic Dishonesty: Each of you will be asked abide by the college's policy on academic dishonesty. If you are not aware of this policy, please talk with me as soon as possible. If you breach the college's policy (even "unknowingly" or through ignorance of the policy), **I will fail you in the course**, no matter how "trivial" you view the breach. I strongly believe that any academic dishonesty threatens the very integrity of the learning process and undermines our reason for being here. As such, there is no "trivial" breach and each will be treated with the most severe response allowed to me under the policy. Typically for a "first" documented offense at the college, that is failure for the course, *not just the assignment*. If you have committed academic dishonesty previously at Ursinus and the Dean of the college has this on record, she has moved aggressively for expulsion from the college, which is within the college's rights under the policy. I also note here that *failure to report cases of academic dishonesty that you witness is also considered academic dishonesty*. Please see me if you are not clear about this policy.

Projects: There will be a couple of projects throughout the course of the semester that are designed to give you more intimate knowledge in an area as well as giving some variety to how your ultimate grade is determined. You will work in small groups on the projects. The group you work in for each project **will** change. Group size will be limited to a minimum of two people and a maximum of three people for the group projects. I urge you to carefully choose who you want to work with for the one group project where you are allowed to choose your group, remembering that a constructive working relationship is far more important than working with a friend. If your group experiences difficulties working together, I urge you to contact me as soon as possible for help in resolving the conflict. The second group project will be done by groups whose members will be assigned by me (I know, I know, you hate this...).

Paper 1: I will ask you to write a paper about something that interests you in terms of how modern genetics answer a question. For example, how is genetic analysis used in criminal proceedings? Or, how is genetic analysis used in studying evolution? Or, how

could gene therapy be used to treat medical ailments? Or, how are organisms manipulated genetically and for what reason or benefit? Or, how could cloning be used to treat a disease? In this paper, I want you to choose a topic that truly interests you (but it cannot involve human cloning, see below) and then learn everything you can about it from the literature (primary, peer reviewed literature is greatly preferred over websites). You then will write a paper detailing what the (major) genetic technique(s) that is (are) used in your area, how this analysis is done, the data that is obtained from these analyses, and how this data is analyzed. I would also like you to discuss, where appropriate, this method's relationship to other established methods and benefits and risks of the genetic method versus these other methods. Your paper will be due at 9:00 a.m. on Friday, February 17, 2006. **Late papers will result in the paper being marked down 10 points per hour (or portion thereof).** The paper will be graded on its effectiveness at delivering accurate, relevant information in a concise fashion, the ability to captivate the reader, the creativity of your presentation, as well as general attributes such as spelling, grammar, punctuation, etc.

Paper 2: The second paper is going to be a twist of sorts. It will be a paper that will make an argument (either for or against) human cloning. This paper will first detail what cloning is (scientifically) and its potential uses. You should examine whether there are effective ways of doing things without the use of human cloning. You should then examine some of the ethical issues surrounding cloning and present an argument, based upon your analysis above, of whether the United States should ban human cloning, regulate its use (and how), or allow it unrestricted. You will *not* be graded on your position (for or against), you will be graded upon your presentation of the relevant facts and the foundation they lay for your position. The more effectively you present a foundation, the more persuasive the paper is likely to be. The paper will be graded on its effectiveness at delivering accurate, relevant information in a concise fashion, the foundational information you provide to support your argument, the effectiveness of your overall argument, ***the thoughtfulness and commentary you make on the paper you are assigned to peer review (see below)***, as well as general attributes such as spelling, grammar, punctuation, etc. This paper will be due on Monday, April 3, 2006. It will be peer reviewed by a member of the class (assigned by me) and returned to you by Monday, April 10, 2006. You will revise it and then submit it again, with revisions and the original paper, to me on Monday, April 17, 2006.

Presentations: A significant part of your overall grade will come from participation and presentations in class. These presentations will include "routine" stuff, where you are asked to present material from the text; to less "routine" ones where you are asked to guide a discussion about a literature article. The "routine" presentations will be done with only a couple days notice at most; the less "routine" ones will be done with more notice to you (hopefully at least a week). Two hundred points (of 1200 overall) come from all of these. The presentations will be graded on your accuracy and ability to effectively communicate the information and to answer questions about the material. Presentations will be assigned in class, so if you miss class, you better check to see if you were assigned one in your absence (highly likely!!).

Participation (in class): One hundred points overall will be designated to your everyday readiness and willingness to participate in class. If you come everyday having studied the material, are ready to be involved in the discussion, ready to ask questions, ready to answer questions, etc., then you will get 100 points at the end. If you don't keep up with the material, sit silently in class, offer nothing valuable to discussions, don't have questions, etc., you will get somewhere close to 0 points, if not 0 points. Around the midpoint of the class, I will furnish to you what percentage of the points I would assign at that point if the class ended then and try to offer some points for improvement where necessary. You will have to earn these points; they are not CIE participation points where if you are alive in the room, you'll get them. Your chair will get no in class participation points...if you act like your chair, you'll get the same! One final point here...I don't care whether you are always right or wrong, just whether you offered prepared, thoughtful engagement in the course.

Lab: The lab for this course is on Wednesday from 1:30-4:20 p.m. **The lab will not meet the first week, January 18, 2006!!!** No work will be typically (with the exception of changes of water baths, etc.) permitted outside of your assigned section, including clean up! As such, you must come prepared to do the lab for that day and work efficiently. Part of your participation grade for the lab will be based on your ability to arrive on time and start working quickly and efficiently. Additionally, part of this grade will reflect how clean you keep the lab on a week-to-week basis.

There will be a **mandatory** lab clean up of the lab at the end of the course. More information will follow. *In order to receive the participation points tentatively assigned to you thus far, you must participate in this clean up.*

The participation points for lab will be based upon (in random order):

- 1) Cleanliness of the lab and your area week to week.
- 2) Promptness and efficiency of your work in lab.
- 3) Your lab notebook, which will be collected at the end of the course.
- 4) Your group's assessment of your contributions.
- 5) My assessment of your contributions.
- 6) Your readiness for the experiment each week (did you do what you need to do to step into lab and get started right away?).

The lab will be graded on the basis of laboratory reports that your group submits. Your group will write up complete journal-style lab reports for 4 labs (with due dates listed below). The grade will be shared by all group members signing the report. Reports are due at 1:30 p.m. (in lab on Wednesday) and each hour late (or portion thereof), the report loses 5 points. Each report should consist of (in order): title page, abstract, introduction, materials and methods, results, discussion, references.

In order to ensure that your group doesn't save all work until the end of the course, the following report deadlines will be observed:

Lab Report Due Dates:

1 Report in by: February 22, 2006

2 Reports in by: March 29, 2006

3 Reports in by: April 12, 2006

4 Reports in by: April 26, 2006

What this means is that by February 22, you must have handed in at least one report. By March 29, your group will have handed in at least two reports, etc. Students may choose to not write about a particular experiment, but then this may limit their choice in the future in order to meet the above deadlines for the number of reports handed in. **Please note that each report can only be handed in the week following the completion of the experimental work in lab!!** Translation: When an experiment is completed in lab, your group has until the following week to hand it in. After that, a report will *not* be accepted for that experiment, so you'll have to choose another experiment to write about.

The reports should always contain background information that you have obtained from the literature. Remember that information from *peer-reviewed* journals should be the most reliable. Information obtained from internet sources should also be treated with suspicion and will be given less value than peer reviewed journals. Analysis of your data may also require that you report on similar experiments from the literature or other groups. When you include any work that is not your own, make sure to properly cite the work. The failure to properly cite original work is academic dishonesty and is grounds for failing the course! Data should be reported efficiently and in a manner that aids in communication of the science. These reports will be graded on background information, completeness, accuracy, analysis of the data, presentation, grammar, punctuation, spelling, and discussion of results.

Participation Grade: It is expected that all good citizens will get the vast majority, if not all, of these points. Do not count on these points to "raise your grade", count on them to *only* lower your grade if you have not been a good citizen!!

Grading: The final grades for the course will be determined from the following (this may be adjusted if time constraints prevent some assignments from being completed):

In Class Exams (1x100 points)	100 points
Class Presentations ("routine" and not)	200 points
Participation (in class)	100 points
Paper 1	100 points
Paper 2	100 points
Lab Participation, readiness	200 points
Lab reports (4 x 50 points)	200 points
Final Exam	<u>200 points</u>
TOTAL	1200 points

Tentative Course Schedule

The material covered is approximate. The dates for the exam and the final exam are NOT, meaning the coverage of material on the mid term exam will be adjusted based on what is covered in class but you can depend on the exam date. The final exam date is set by the college and will include everything in the course!

<u>DATE</u>	<u>CHAPTER</u>	<u>TENTATIVE MATERIAL COVERED</u>
Jan 16	Syllabus, etc.	Introduction
Jan 18	17	The Citric Acid Cycle
Jan 20	17	The Citric Acid Cycle
Jan 23	17	The Citric Acid Cycle
Jan 25	17	The Citric Acid Cycle
Jan 27	16	Glycolysis and Gluconeogenesis
Jan 30	16	Glycolysis and Gluconeogenesis
Feb 1	16	Glycolysis and Gluconeogenesis
Feb 3	16	Glycolysis and Gluconeogenesis
Feb 6	5	RNA, DNA, and the Flow of Genetic Information
Feb 8	5	RNA, DNA, and the Flow of Genetic Information
Feb 10	5	RNA, DNA, and the Flow of Genetic Information
Feb 13	6	Exploring Genes
Feb 15	6	Exploring Genes
Feb 17	6	Exploring Genes
Feb 20	25	Nucleotide Biosynthesis
Feb 22	25	Nucleotide Biosynthesis
Feb 24	25	Nucleotide Biosynthesis
Feb 27	25	Nucleotide Biosynthesis
Mar 1	27	DNA Replication, Recombination, etc.
Mar 3	27	DNA Replication, Recombination, etc.
Mar 6	27	DNA Replication, Recombination, etc.
Mar 8	27	DNA Replication, Recombination, etc.
Mar 10	MIDTERM EXAM (Tentative Coverage Chaps 17, 16, 5, 6, 25, 27)	
Mar 11 (Saturday)-Mar 19 (Sunday)	SPRING BREAK!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!	
Mar 20	27	DNA Replication, Recombination, etc.
Mar 22	27	DNA Replication, Recombination, etc.
Mar 24	27	DNA Replication, Recombination, etc.
Mar 27	28	RNA Synthesis and Splicing
Mar 29	28	RNA Synthesis and Splicing
Mar 31	28	RNA Synthesis and Splicing
Apr 3	28	RNA Synthesis and Splicing
Apr 3	28	RNA Synthesis and Splicing
Apr 5	31	The Control of Gene Expression
Apr 7	31	The Control of Gene Expression
Apr 10	31	The Control of Gene Expression
Apr 12	31	The Control of Gene Expression
Apr 14	31	The Control of Gene Expression
Apr 17	31	The Control of Gene Expression
Apr 19	7	Exploring Evolution
Apr 21	7	Exploring Evolution
Apr 24	7	Exploring Evolution
Apr 26	7	Exploring Evolution
Apr 28	7	Exploring Evolution
May 3	FINAL EXAM 9 A.M.-12 P.M. PFAHLER HALL 107	