

## CHEM 255 BIOCHEMISTRY & NUTRITION

FALL SEMESTER 2009

Prerequisite: CHEM 102, College Chemistry II

Instructor: Dr. Jon Southard      Weyandt 239D      357-2210      southard@iup.edu

Office hours: Monday and Wednesday 10:00 am – 11:00 am, Tuesday 1:00 pm – 2:00 pm  
Thursday 1:00 pm – 3:00 pm (or other hours by appointment). You can also stop by anytime and if possible I will meet with you then.

Required text: *Biochemistry: A Short Course*, Tymoczko, Berg, Stryer, Freeman (2010)

Course website: Accessible via instructor's site ([www.people.iup.edu/southard](http://www.people.iup.edu/southard)). Course materials including syllabus, study guide and previous exams will be made available, also links to relevant sites.

### **COURSE DESCRIPTION AND LEARNING OBJECTIVES**

This course will examine the fundamentals of biochemistry, the molecular interactions of living systems, with an emphasis on molecules and processes relevant to human nutrition and health. While biochemistry is a fact-filled subject area, the emphasis in this course is placed on learning the fundamental concepts of biochemistry and acquiring the ability to 'think biochemically' rather than memorizing many chemical structures and reactions. Still, it will be necessary to understand chemical structures and reactions in order to achieve these goals. After gaining an understanding of the principles of biochemistry and examining the major classes of biomolecules, we will apply this knowledge to the study of metabolism. Through course activities students will gain experience reading and writing about recent scientific research relevant to biochemistry. Successful students will acquire a base of knowledge, concepts and skills that will enable further learning relevant to biochemistry and nutrition.

### **GUIDELINES FOR CLASS PERIODS**

Class time will be used to clarify and expand on topics presented in the text. Based on the nature of the course, regular attendance is expected to be critical for success and is highly recommended. Class attendance will not be recorded. Missing a class period may result in points missed on quizzes. **There are no make-ups for missed quizzes.**

It is expected that students attending class are there to make the best use of this time in learning and understanding the course material and it is the objective of the instructor to facilitate this process. If you do choose to come to class, make every effort to arrive on time. If you are unavoidably delayed try not to disturb your classmates when you enter. **Cell phones must be turned off and put away during the class period.** There should be no food in the classroom. A drink is appropriate. Private conversations can be very distracting to others. Discussions should be limited to course-related matters and any but the briefest exchange should be public so that everyone can benefit. If you find behavior of other students to be distracting, you may discuss the problem confidentially with the instructor.

### **COURSE TEXT AND READINGS**

A list of topics and the corresponding chapters of the text are provided as part of this syllabus. It is expected that students will complete these readings. An initial reading of the appropriate pages of the text prior to presentation of the material in class and second reading afterwards are highly recommended. Detailed guidelines and learning objectives are presented in the CHEM 255 Study Guide.

## PROBLEM-SOLVING

Biochemistry is not a spectator sport. You will need to practice drawing structures, writing reactions, and solving concept-based problems in order to understand the material. Coming to every lecture and taking lots of notes by itself will not help most students very much. THERE IS NO SUBSTITUTE FOR PROBLEM-SOLVING TO LEARN BIOCHEMISTRY. A significant portion of the time you devote to this course should be spent working on problems from the text and old exams (suggested problems are listed in the CHEM 255 Study Guide). Group work on problems is highly encouraged.

Answers for problems are available in the text. It is suggested that while you are working on the problems, you pretend that the answers are not available. Once you have done all that you can on the problems, check the answers in the text. If your answer is different, do not automatically change your answer. Instead, think about how you arrived at your answer and make a note that you did not agree with the text. When we discuss the problems in class, you should ask to take a look at this problem. Together we may be able to agree as to which answer is better. It is much more interesting and useful to understand why you reached a different answer than to get the same answer. Class time will be made available for discussion of the problems.

## GRADING

Course grades will be determined by points earned on exams, quizzes and research reports.

Distribution of points for course grade:	Exams	400
	Quizzes	150
	Research Reports	50
	Total	600

Course letter grades will be assigned based on the percentage of total points earned:  
90-100% = A    80-89% = B    70-79% = C    60-69% = D    <60% = F

Points required to earn each letter grade:

A = 540 points      B = 480 points      C = 420 points      D = 360 points

EXAMS (67% of course grade)

There will be four exams:

Exam	Date*	Topics*
#1	Friday 9/25	Chapters 1-7
#2	Wednesday 10/21	Chapters 8-14
#3	Friday 11/20	Chapters 15-20, 23, 24
Final	Wednesday, 12/16	Chapters 25-29, 31 (50%) Comprehensive (50%)

\*Any changes in dates or topics will be announced in advance in class and/or by email.

The exams will be comprised of problems (similar in format to the end of chapter problems in the text), short answer, and multiple-choice questions, including fill in the blank, calculations, making or labeling drawings, definitions, writing structures, etc. Exam questions will be drawn from lectures, handouts, and reading assignments given in the syllabus or in class. **Exam grades in this course will not be curved.**

It is expected that an exam will be missed only for a valid reason (illness, personal emergency, or University representation or participation; as described in the IUP catalog). **It is the responsibility of the student to inform the instructor of the reason for missing an exam. This MUST be done in advance (in person, by phone message, or email) unless circumstances CLEARLY do not allow advance notice.** Written documentation (to be kept by the instructor) must be presented no later than one week after the missed exam.

### QUIZZES (25% of course grade)

There will be 11 quizzes during the semester. Dates are listed in the schedule. **Quizzes must be taken during the class period on the day scheduled.** Each quiz will be worth a total of 15 points. One item (worth 5 points) for each quiz will be available in advance on the course website. The 10 highest quiz scores will be used towards the course grade. Thus, any student may miss one quiz without penalty. Beyond this, written documentation (to be kept by the instructor) of a valid excuse due to illness, personal emergency, or University representation or participation (as described in the IUP catalog) must be provided to the instructor within one week of the missed quiz. **There will be no make-ups for missed quizzes.** A missed quiz with a documented excuse will be given a grade based on the average of all completed quizzes.

### RESEARCH REPORTS (8% of course grade)

These will be short (one page maximum), typed, hard-copy (no electronic submissions) reports summarizing and reacting to articles that describe recent scientific research related to biochemistry. The *Science Daily* website ([www.sciencedaily.com](http://www.sciencedaily.com)) is an excellent source of articles, however students may choose other sources such as newspapers, magazines, journals, or other websites. **The article chosen must describe research involving molecules relevant to living systems.** For example, an article on the connection between obesity and diabetes would be appropriate if it describes research on insulin, specific food molecules (trans fats, etc.) or other molecules. However if it was just a study correlating obesity with chance of being diabetic, it would not be appropriate. An article describing the discovery of uranium on Mars would not be appropriate, but one describing the discovery of proteins there would be. A total of 5 reports will be included in the course grade. Due dates are given in the schedule. One late report will be accepted up to the last regular class meeting (Thursday, December 10) without penalty. **Additional late reports will not be accepted.**

Reports must include these elements:

1. Complete source citation (these are given at the bottom of each *Science Daily* article), for example:  
Dana-Farber Cancer Institute (2009, July 30). Scientists Create Energy-burning Brown Fat In Mice. ScienceDaily. Retrieved July 30, 2009, from <http://www.sciencedaily.com/releases/2009/07/090729132109.htm>
2. A summary of the article *in your own words*. This must include a reference to at least one molecule that is mentioned in the article.
3. Your reaction to or opinion on the article. Some suggested questions to consider are:
  - How is the research important, surprising, or disturbing?
  - How does it relate to what you already know?
  - How is it related to anything you have learned in the course?
  - How is it relevant to your intended career?

Reports will be graded for a maximum of 10 points based on this formula:

- 2 pts content of article is appropriate
- 2 pts complete citation is given
- 3 pts quality of summary (is the summary accurate, understandable, and written with correct grammar, spelling and punctuation?)
- 3 pts quality of reaction (are thoughts clearly expressed and written with correct grammar, spelling and punctuation?)

Reports will be carefully monitored for these violations of the IUP Academic Integrity Policy:

Plagiarizing papers, theses, dissertations, essays, reports, speeches and oral presentations, take-home examinations, computer projects, or other academic exercises by misrepresenting or passing off the ideas, words, formulas, or data of another as one's own. Plagiarism is dishonest and illegal. Writers are indebted to authors from whom they borrow exact words, ideas, theories, opinions, statistics, illustrative material, or facts (beyond common knowledge). Writers are also indebted if they summarize or paraphrase in their own words material from sources. All quoted material requires the acknowledgment of the source by the use of quotation marks or indentation (if exact wording is incorporated). In addition, both directly quoted and summarized material must be acknowledged by use of a note or parenthetical citation that indicates the author and/or date of publication and page number or numbers. If the writer indents a quotation, it must be clearly set off from the body of the text and must be documented in the aforesaid manner. To verify the various documentation procedures, writers should consult the style sheet in the particular discipline for which they are preparing the assignment (MLA, APA, Chicago, BC, etc.).

Using the same paper or work more than once without authorization of the faculty member to whom the work is being submitted.

### BONUS POINTS

In order to account for extenuating circumstances that may occur over the course of a semester, one quiz may be missed without penalty and one research report may be turned in anytime up to the last regular class meeting (Thursday, December 10) without penalty.

In order to encourage diligence in meeting course requirements, the following bonus points will be available:

- A student who takes 10 quizzes in class on the scheduled day shall receive 10 bonus points.
  - A student who satisfactorily (grades of 7 or above) completes all research reports by the scheduled due dates shall receive 10 bonus points.
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**REVISED TENTATIVE\* SCHEDULE FOR CHEM 255, FALL 2009**

<b>Class meeting</b>	<b>Topic/Activity</b>	<b>Reading</b>	<b>Quiz</b>	<b>Report</b>
1 Monday 8/31	Introduction to course	Syllabus	Quiz 1	
2 Wednesday 9/2	Introduction to biochemistry, Water	Chapters 1 & 2		
3 Friday 9/4	Weak interactions, Acids & bases	Chapter 2		
Monday 9/7	<i>NO CLASS – Labor Day Holiday</i>			
4 Wednesday 9/9	Amino acids	Chapter 3	Quiz 2	
5 Friday 9/11	Protein structure	Chapter 4		#1 due
6 Monday 9/14	Enzymes as catalysts, Free energy of reactions	Chapter 5		
7 Wednesday 9/16	Enzyme kinetics	Chapter 6	Quiz 3	
8 Friday 9/18	Allosteric enzymes	Chapter 6		
9 Monday 9/21	Catalytic mechanisms, Enzyme inhibitors	Chapter 7		
10 Wednesday 9/23	Problem/review session		Quiz 4	
<b>11 Friday 9/25</b>	<b>Exam #1</b>			
12 Monday 9/28	Ligand binding by proteins	Chapter 8		
13 Wednesday 9/30	Carbohydrates	Chapter 9		#2 due
14 Friday 10/2	Carbohydrates	Chapter 9		
15 Monday 10/5	Lipids	Chapter 10	Quiz 5	
16 Wednesday 10/7	Membranes	Chapters 11-12		
17 Friday 10/9	Introduction to metabolism	Chapter 13		
18 Monday 10/12	Digestion	Chapter 13		
19 Wednesday 10/14	Metabolic concepts and design	Chapter 14	Quiz 6	
20 Friday 10/16	Metabolic concepts and design	Chapter 14		#3 due
21 Monday 10/19	Problem/review session		Quiz 7	
<b>22 Wednesday 10/21</b>	<b>Exam #2</b>			
23 Friday 10/23	Glycolysis	Chapter 15		
24 Monday 10/26	Glycolysis	Chapter 15		
25 Wednesday 10/28	Gluconeogenesis	Chapter 16		
26 Friday 10/30	Gluconeogenesis	Chapter 16		
27 Monday 11/2	Preparation for citric acid cycle	Chapter 17	Quiz 8	
28 Wednesday 11/4	Citric acid cycle	Chapter 18		
29 Friday 11/6	Citric acid cycle	Chapter 18		
30 Monday 11/9	The electron-transport chain	Chapter 19		#4 due
31 Wednesday 11/11	The proton-motive force and ATP synthase	Chapter 20	Quiz 9	
32 Friday 11/13	Glycogen degradation	Chapter 23		
33 Monday 11/16	Glycogen synthesis	Chapter 24		
34 Wednesday 11/18	Problem/review session		Quiz 10	
<b>35 Friday 11/20</b>	<b>Exam #3</b>			
11/23 to 11/27	<i>NO CLASS –Thanksgiving Break</i>			
36 Monday 11/30	Pentose phosphate path	Chapter 25		
37 Wednesday 12/2	Fatty acid degradation	Chapter 26		
38 Friday 12/4	Fatty acid synthesis,	Chapter 27		#5 due
39 Monday 12/7	Cholesterol metabolism	Chapter 28		
40 Wednesday 12/9	Amino acid metabolism	Chapters 29 & 31	Quiz 11	
41 Friday 12/11	Metabolism in fasting and diabetes			
42 Monday 12/14	Problem/review session			
<b>43 Wednesday, 12/16</b>	<b>Final Exam (10:15am - 12:15pm)</b>			

**\*Any changes will be announced in class and/or by email**