Chemistry 379, MWF 11:50-12:45 SC278

St. Olaf College, Fall 2004 Dr. Gregory W. Muth
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Office hours: M 1:00-3:00 PM, F 2:00-3:00
or by appointment

Text: Lehninger Principles of Biochemistry, 4th ed, Nelson & Cox, 2005

Course description:

There are numerous ways to describe the subject of biochemistry. Some see a comparative perspective looking at the genes and development of many different organisms while others simply see the organic chemistry of really big molecules. Regardless of the definition, biochemistry involves the fundamental chemical reactions that facilitate life. In this course we will begin to explore the relationships between the major classes of biomolecules (amino acids, nucleic acids, lipids and carbohydrates) and how the structure, reactivities, physical properties and transformations of these molecules provide the scaffolding, energy, data storage and communication functions that comprise a biological system.

Course objectives:

Learning biochemistry hopefully will be like looking at familiar things with a new perspective. We will be taking the foundations you have built in other classes and transferring these skills to look at the chemistry of biological reactions and processes.

Some of the skills I would like you to use are:

- Arrow pushing formalism/reaction mechanisms
- Thermodynamic calculations
- Stoichiometry
- Equilibrium calculations
- Acid base chemistry
- Oxidation/reduction chemistry

What I would like you to gain is:

- Knowledge of the building blocks of proteins and nucleic acids and how these blocks form complex molecular machines
- An appreciation of the importance between structure and function
- A working understanding of kinetics
- An appreciation of membranes and homeostasis
- A comprehension of molecular fuel and how this fuel is converted to energy
- An appreciation of organic reaction mechanisms as related to biochemistry
- An appreciation of oxidation/reduction reactions as related to biochemistry
- An ability to critically evaluate the current biochemical models

Class policies and philosophies:

One of the most important aspects of teaching is gathering feedback from students. If I am not communicating effectively, then I am not teaching. Periodically I will be asking for formal feedback from you, but at anytime you feel I am unclear, bring this to my attention. I definitely have the attitude that we can work together as a team to better understand biochemistry. I welcome and encourage participation in and outside of class. Remember the old adage, "you get out of it what you put into it".

I will have an open door policy as much as possible so please drop in. Appointments are also appreciated and can be arranged by e-mail. I will be using the course folders on the server to convey information, post solutions, give hints and tips and provide links to additional resources.

This syllabus will serve as a contract to help avoid misunderstandings as they may arise during the semester. Please check the times and dates carefully and bring to my attention any conflicts immediately.

Grading and Course Requirements

The course will consist of four exams and one comprehensive final exam. The point structure follows:

Exams 4 @ 100 points each	400 points
Final exam	150 points comprehensive
Total	550 points

While each individual exam may be curved based on class performance, final grade will be based on a straight scale. The following percentages are a guideline for grade assignment:

93-100% = A	84-87 = B+	76-79% = B-	68-71% = C	60-63% = D+
88-92% = A-	80-83% = B	72-75% = C+	64-67% = C-	52-59% = D

Please note in order to obtain a passing grade for the semester (regardless of your cumulative point total) you must obtain a passing score (>51.9%) on 2 of the 4 regular exams and the final exam.

Exams:

Each exam during the semester will cover material from lecture, homework and any additional handouts. I strongly encourage class attendance, as some material from primary literature will be presented that is not found in the book. The final exam will be comprehensive. Since each concept builds upon the previous one and so many are integrated, it is important to "live" with biochemistry a little each day. The exams will challenge your mastery of the facts as well as an ability to "think outside the box". Be prepared to derive, synthesize and evaluate new situations. The Honor System will apply during exams. Exam absences due to emergencies or illness will only be excused if the Dean of Students office informs me.

Homework:
Sample problems and solutions are available on the server. I would recommend solving the problems on a weekly basis and having myself or the course grader evaluate the clarity and depth of your answers. Office hours of the course grader will be posted.

Additional support:
Any student with a documented intellectual, physical or emotional disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities must also contact Ruth Bolstad (bolstadr@stolaf.edu), Student Disability Services Specialist in the Academic Support Center (x3288) located in Room 1 of Old Main Annex.

Biochemistry I Course Overview (lecture schedule subject to change)

Month	Date	Day	Title	Topic	Assignment	Reading*
Sept	10	F	Lecture 1	Introduction, bonding, water		Chapter 1 p. 12-28, Chapter 2 p. 69-70
	13	M	Lecture 2	Thermodynamics, equilibrium, acid-base concepts		Chapter 2 p. 45-68
	15	W	Lecture 3	Amino acids		Chapter 3 p. 75-85
	17	F	Lecture 4	Peptides, primary structure	1	Chapter 3 p. 85-104
	20	M	Lecture 5	Protein structure		Chapter 4 p. 116-146
	22	W	Lecture 6	Protein structure		
	24	F	Lecture 7	Practical proteins	2	
	27	**M**	**Exam 1**			
	29	W	Lecture 8	Enzymes-basic concepts		Chapter 6 p. 190-200
Oct	1	F	Lecture 9	Enzymes-kinetics	3	Chapter 6 p. 202-209
	4	M	Lecture 10	Enzymes-kinetics		
	6	W	Lecture 11	Enzymes-inhibition		Chapter 6 p. 209-213
	8	F	Lecture 12	Catalytic strategies	4	Chapter 6 p. 200-202, 213-218
	11	M	Lecture 13	Catalytic strategies		Chapter 6 p. 218-220
	13	W	Lecture 14	Regulatory strategies		Chapter 6 p. 225-234
	15	F	Lecture 15	Regulatory strategies	5	Chapter 5 p. 157-174
	18	**M**	**Exam 2**			
	20	W	Lecture 16	Fatty acids, lipids		Chapter 10 p. 343-357
	22	F	Lecture 17	Lipids, membranes	6	Chapter 10 p. 357-363 Chapter 11 p. 369-380
	25	**M**	**Fall break**			
	27	W	Lecture 18	Transport across membranes		Chapter 11 p. 389-398
	29	F	Lecture 19	Carbohydrate structure	7	Chapter 7 p. 238-252
Nov	1	M	Lecture 20	DNA structure, biosynthesis		Chapter 22 p. 862-868 Chapter 8 p. 273-283
	3	W	Lecture 21	RNA structure		Chapter 8 p. 284-291
	5	F	Lecture 22	Functional RNA	8	Chapter 26 p. 1007-1011
	8	M	Lecture 23	Protein synthesis		Chapter 27 p. 1044-1067
	10	**W**	**Exam 3**			
	12	F	Lecture 24	Design of metabolism	9	Chapter 13 p. 481-506
	15	M	Lecture 25	Design of metabolism		Chapter 13 p. 506-517
	17	W	Lecture 26	Glycolysis		Chapter 14 p. 521-534
	19	F	Lecture 27	Glycolysis	10	Chapter 14 p. 543-549
	22	M	Lecture 28	Regulation of glycolysis		Chapter 15 p. 571-583, Chapter 14 p. 538-543
	24	**W**	**Thanksgiving**			
	26	**F**	**Thanksgiving**			
	29	M	Lecture 29	Citric acid cycle		Chapter 16 p. 601-608
Dec	1	W	Lecture 30	Citric acid cycle	11	Chapter 16 p. 608-620
	3	F	Lecture 31	Oxidative phosphorylation		Chapter 19 p. 690-716
	6	M	Lecture 32	Oxidative phosphorylation		
	8	W	Lecture 33	Oxidative phosphorylation	12	
	10	**F**	**Exam 4**			
	13	M	Review			
	16	**Th**	**Final Exam**	9:00-11:00 am		

* Additional readings may be assigned as the topic material warrants