BIOL 430 Biological Chemistry

***SUMMER 2016* (05/31/2016 - 07/8/2016)**

This is a 4 credit course designed for Biology BA and MS majors to satisfy upper level elective (4xx) requirements.

Course Description

A lecture and discussion based course that focuses on introductory topics in biochemistry. The course begins with an introduction to biochemical systems (free energy, types of biochemical reactions, biological molecules, macromolecular structure and enzyme kinetics), followed by an overview of major metabolic pathways. An emphasis is placed on the importance of biochemistry in human health and disease, and the importance of modern research on metabolism.

General Course Information

Professor Dr. Mauricio Bustos
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Class will meet MoWeFr 9:00PM-11:50PM (Biological Sciences BS004)
Prerequisites: BIOL 303, or BIOL 302, or CHEM 351, or CHEM 352, or instructor approval

Required textbook: *Fundamentals of Biochemistry*, Donald Voet, Judith Voet, Charlotte Pratt. 3rd or later edition. ISBN 0-471-21495-. *John Wiley & Sons*.

Grading policy:

Midterm Exams (4 exams)	Final Exam (integrative)
35 points each	**35 points**

The grade will be calculated from a cumulative tally of points earned by taking four midterm exams, and a fifth exam which will take place during finals week (5 exams total). Every exam will consist of 35 questions, and every question will be worth 1 point. Exam 5 will be integrative of all the course material but weighted more heavily in favor of the second half of the course.

Scores and letter grades. Letter grades will be assigned according to an absolute scale of the total number of points accumulated over the course of five exams, shown below without "curving":

A: 130 points or more
B: 98 – 129 points
C: 77 – 97 points
D: 63 – 76 points
F: fewer than 63 points

Learning Objectives

At the end of the course students will be expected to:

1. Have accumulated a demonstrable amount of basic knowledge of biochemicals and the general organizational principles that rule metabolic pathways, as well as an operational knowledge of the value and power of biochemical analysis *(--> these integration goals will be supported by lectures, reinforced by mastery quizzes, and evaluated by two traditional-style, in-class tests),*
2. Have gained enough confidence in their own knowledge of biochemistry to interact with a group of peers during open informal debate *(--> this subtle skill will be facilitated by participation in in-class discussions and on line discussion groups),*
3. Have improved self-confidence in biochemistry, which is a subject often shunned by regular biology majors due to the high level of abstraction it requires *(--> self-confidence will arise from the learning plan as a whole).*

Role of the Instructor

Students taking this course should realize that they will have a responsibility for active participation in learning and self-motivation. The role of the instructor in the learning environment will be to:

- Highlight key ideas that are elaborated in greater detail in the course textbook, and present them in a context of everyday utility by citing examples of how biochemistry influences normal human and animal physiology (e.g. what happens to the foods we eat after they enter our bodies), and how it underlies the origin of many diseases and their cures.
- Explain how to interpret abstract definitions and concepts in terms of the behavior of physical entities, such as molecules and enzymes
- Show how rigorous experimentation leads to new knowledge and understanding about physical entities i.e. molecules, that cannot be perceived directly through our senses
- Be available to provide advice and encouragement
- Give honest feedback on performance
- Maintain an appropriate learning environment in class and on line
- Make all supporting learning aids available on time

Syllabus

White background: classroom sessions; Orange background: self-study online
Except for exam dates, other dates are approximate

Class #	Class Date	Topics
1	6/1	Explain class organization and Introduction
1	6/1	Thermodynamics and Bioenergetics
2	6/1	Types of biochemical reactions Weak interactions, binding reactions and Scatchard analysis
3	6/3	Oxidation states of carbon and redox reactions
4	6/3	Water, acid-base reactions, blood pH buffering system
5	6/6	**Online:** Amino acids: chemical and physical properties
6	6/6	**Online:** Practice math-chemistry problems. Online Learning Activity
7	6/8	Protein Structure & function: Cooperativity and allosterism
8	6/8	Review
9	6/10	**Midterm exam 1 (classes 1-7)**
9	6/10	Mechanisms of enzymatic catalysis
10	6/13	Enzyme Kinetics
11	6/15	Enzyme inhibitors
11	6/15	**Online:** Nucleotides: chemical and physical properties
11	6/15	**Online:** Nucleic acid structure and function
12	6/15	Calculating an enzyme's V_{max} and K_M
13	6/17	Review.
14	6/17	**Midterm exam 2 (classes 9-12)**
15		**Online:** Carbohydrates
15	6/20	Introduction to metabolism
16	6/20	Glycolysis and pentose phosphate pathway (shunt)
17	6/20	Glycogen metabolism
17	6/22	Control of glycogen metabolism and gluconeogenesis
18	6/22	Amino acid metabolism
OL4		Lipids
19	6/22	Lipid metabolism
20	6/24	**Online:** Synthesis of purine ribonucleotides

21	6/24	**Online:** Synthesis of pyrimidine ribonucleotides and deoxynucleotides
22	6/24	Synthesis of pyrimidine ribonucleotides and deoxynucleotides
23	6/27	Review
22	6/27	**Midterm exam 3 (classes 15-22)**
24	6/27	Citric acid cycle
25	6/29	Mitochondrial electron transport chain
26	6/29	ATP synthesis by oxidative phosphorylation
27	6/29	Photosynthesis
28	7/1	Integration of mammalian metabolism
29	7/1	Integration of mammalian metabolism
30	7/4	Cancer cell metabolism and the Warburg effect 1
31	7/4	Metabolic engineering: PEPCK supermouse
32	7/6	Review
33	7/8	**Midterm exam 4 (classes 24-29)**
34	7/8	**Midterm exam 5 (classes 24-32)**

Midterm Exams (1-4) and final exam

All exams will be sit-down multiple choice (35 questions). See the Syllabus for exam dates and coverage.

Important information

The principal learning tools for the class will comprise a suite of annotated mini lectures, implemented as Powerpoint presentations and narrated Flash videos, and the course textbook. The course management software Blackboard will be used as central repository for the course, and as a communication platform. Class materials will be found in the Course Documents area of Blackboard. Please notice that this syllabus may undergo multiple revisions even after the first day of class. Changes and amendments to the syllabus will be announced in the Announcements area of Blackboard, in class, and through the on-line Group Discussion Board.

Participation

Participation in class and on-line, through the Discussion Board, is an essential component of the learning experience. While the instructor will encourage students to express their views, the students themselves must make an effort to break the ice. Participation takes place along two equally-weighted dimensions: attendance and awareness. On-line, participation will be judged from the frequency and quality of feedback by each student on the Blackboard Discussion Board, both as questions posted and answers volunteered. In class, attendance will be measured by random roll calls. Awareness will be judged from the willingness to participate in open discussions, also in the form of questions and answers. Although there is no formal grade assigned for participation, a good standing in this category will be rewarded with up to 2.5 % points to help students with borderline scores get a higher final letter grade for the course.