BIOCHEMISTRY (CH 360)
COURSE OUTLINE
FALL SEMESTER 2001

Bülent Terem

Required Textbook: Horton, R.H.; Moran, L.A.; Ochs, R.S.; Rawn, J.D.; Scrimgeour, K.G. *Principles of Biochemistry*, 3`° Ed., Prentice-Hall, Inc., Upper Saddle River, NJ, 2002.

Supplementary Books:

Stryer, L. *Biochemistry*, 4`h Ed,; W.H. Freeman, 1995.
Carey, Francis A. *Organic Chemistry*, McGraw-Hill, 4'h Ed., 2000
Bruice, P.Y. Organic *Chemistry*, Prentice-Hall, Inc., 1995.

Exams and Grading: Three 45-minute midterms, quizzes and homework assignments, and a ninety minute comprehensive final.

Course Grade (all grades in percentages)
_ + .26 (average of the three midterms)
+ .26 (average of the two highest midterms)
+ .10 (average of the quizzes and assignments)
+.38 (final)

Office Hours: MWF 10:00 - 11:00 pm and/or by arrangement

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Course Objectives:

This biochemistry course is aimed at students with a solid background in organic chemistry and an interest in molecular aspects of biological processes. Amongst the medley of topics to be discussed three different perspectives are adopted: The course starts with a discussion of familiar topics and principles in a qualitative fashion, emphasizing their applicability to biological systems. What follows is a more descriptive study of well-known metabolic pathways while questioning all possible variations in an attempt to understand each mechanism. The final perspective is in line with the "holistic" nature of biochemistry, where the links and relationships of individual metabolic pathways with one another are elucidated when biosynthetic origins of well-known biological metabolites are investigated. During the semester brief journeys into molecular biology will help to illustrate the enormous potential of the field. Further principles of nucleic acid chemistry will be introduced during the lab course.

Upon completing the course the students should be ready for more specialized courses in clinical biochemistry and molecular biology.

Week	Date	Chapter in Text	Subject
1	8/27	1	Introduction to Biochemistry... Functional groups; Linking metabolites... Biological Polymers... Laws of Thermodynamics (revisited)...
1	8/29	I	Cells... Living organisms, and evolution...
1	8/31	2	Water and non-covalent interactions... Water as a nucleophile: Hydrolysis...
2	9/3		No class: Labor Day
2	9/5	2 3	Ionization of water... Buffers... Amino Acids and the primary structures of proteins... Ionization of amino acids...
2	9/7	3 4	Protein purification techniques... Protein sequencing... Protein Synthesis (review)... Secondary Structure of Proteins... Tertiary Structures...
3	9/10	4	Globular proteins... Oxygen binding: Myoglobin and Hemoglobin...
3	9/12	5	Enzymes: Classification... Enzyme kinetics: The Michaelis-Menten Equation...
3	9/14	5	Reversible and irreversible enzyme inhibition...
4	9/17	5	Allosteric enzymes... Review...
4	9/19		FIRST MIDTERM EXAM
4	9/31	6	General features of enzyme mechanisms... Chemical Catalysis... Proximity Effect...
5	9/24	6	Transition state stabilization... TS analogs as inhibitors...
5	9/36	6	Mechanism of Serine protease activity...
5	9/28	7	Coenzymes: Classifications; NAD", NADH, FAD, FMN, CoA,
6	10/1	7	TPP, Pyridoxal Phosphate, Biotin, Tetrahydrofolate, Cobalamin, Lipoamide,
6	10/3	7	Lipid vitamins, Ubiquinone, Chromones...
6	1015	8	Carbohydrates (review)... Aminosaccharides...
7	10/8		No Class: Discoverer's Day
7	10/10	8	Peptidoglycans... Nucleosides (review)... Penicillin mode of action...
7	10/12	9	Kinase Catalysis ... Lipids: Fatty acid derivatives...
8	10/15	9	Nucleotide derivatives... Nucleotides as regulatory molecules... Phospholipids; Sphingolipids; Steroids... Lipid bilayers...
8	10/17	9	Membrane proteins... Membrane Transport...
8	10/19	9	Transduction of extracellular signals...
9	10/22	9	Review
9	10/24		SECOND MIDTERM EXAM
9	10/26	10	Metabolism: As sum of cellular reactions; as sequence of stepwise reactions; as regulated pathways... Catabolic pathways... "High Energy" metabolites...
10	10/29	10	Free energy change and reduction potential: Electrochemistry of coenzymes...
10	10/31	11	Glycolysis: Mechanism of individual steps...
10	11/2	11	Thermodynamics and Regulation of glycolysis...
11	11/5	12	Citric Acid Cycle: Individual steps, Regulation of the cycle...
11	11/7	12	Entry and exit metabolites... Glyoxylate Cycle...
11	11/9	13	Additional Carbohydrate Pathways: Glycogen Degradation; Gluconeogenesis...
12	11/12		No Class: Veteran's Day
13	11/14	13	Variations in Gluconeogenesis... The Pentose Phosphate Pathway... Interconversions catalyzed by Transketolase and Transaldolase...
13	11/16	14	Oxidative Phosphorylation: The chemiosmotic theory; The protonmotive force; Thermodynamics of electron transport...
13	11/19	14	Cofactors and Complexes in electron transport... Active transport of ATP, ADP, and Pi across the Mitochondrial Membrane... The P:O Ratio...
13	11/21	14 15	Uncouplers... Regulation of Oxidative Phosphorylation... Photosynthesis: Light reactions and dark reactions... Comparisons to oxidative phosphorylation...
13	11/23		No Class: Thanksgiving Break
14	11/26		THIRD MIDTERM EXAM
14	11/28	15	The RPP Cycle... CO_2 Fixation...
14	11/30	16	Lipid Metabolism: Fatty acid oxidation... (3-Oxidation of odd-chain and unsaturated fatty acids...
15	12/3	16	Fatty acid Synthesis...
15	12/5	16	Biosynthesis of other related metabolites...
15	12/7	16	Review...
	12/10		FINAL EXAM (Monday; 8:00)