BIOCHEMISTRY (CH 360, BI 360) COURSE
Syllabus and Schedule

FALL SEMESTER 2004

Time Schedule:

Lecture:	MWF 11:00-11:50	H33
Laboratory Group 1:	M 2:00-4:50 pm	H44
Laboratory Group 2:	W 2:00-4:50 pm	H49

Instructor's name, address, phone and email.

G. David Lin Phone: 739 8543	Office: Henry Hall 6 e-Mail: dlin@chaminade.edu

Office Hours:

TR 9:30 – 12:00 am and/or by arrangement.

- Sometimes I will be in the classroom 15 minutes before class and you can ask me questions.
- If I have not another commitment after the lecture, I will stay for your questions until all questions have been answered.

Course Description:

The Biochemistry course (CH 360 or BI 360) enables students to understand biology and life at a chemical level. It provides an overview of general biochemistry with respect to the structure, function, metabolism and mechanism of carbohydrates, lipids, proteins and nucleic acids in biological systems and processes. It also introduces basic techniques in the separation and analysis of these biological molecules, as well as in the characterization of biological processes and their interaction. The course can be used as preparation for specified biochemistry course like medical/clinical/nutritional biochemistry, and analytical/environmental/plant biochemistry, or for related disciplines in forensic science, cellular and molecular biology, pharmacology and toxicology.

Course structure

3 x 1-hour lectures per week (3 credits)
Plus a 3 hr laboratory work per week (see separate Syllabus CH 360L) (1 credit)

Prerequisites: Cellular and Organismic Biology (BI 203/203L and BI 204/204L), and Organic Chemistry (CH 323/323L and CH 324/324L).

Course Objectives:

On the completion of CH 360, the students will be expected to:

1. Describes sub-cellular structures of a living cell with emphasis on their roles in the synthesis, breakdown, transport and storage of biological molecules.
2. Explain the structure, properties, and functions of fundamental building blocks (amino acids, carbohydrates, lipids, and nucleotides), biopolymers (nucleic acids, peptides/ proteins, polysaccharides), membranes, organic and inorganic prosthetic groups.
3. Describe the biosynthesis and catabolism of biological molecules (amino acids, carbohydrates, lipids, nucleic acids, peptides/proteins)
4. Explain the metabolic cycles, biological catalysis and kinetics, mechanisms, organic and inorganic cofactors.
5. Discuss biological equilibria and energetics with reference to pH/buffers, binding/recognition, proton and electron transport, oxidation/reduction, macromolecular conformations and biological interactions that stabilize biomolecules.
6. Discuss biological information flow and control through DNA replication, transcription and translation.

Text Books:

Required:

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

Supplementary:

Holum, J.R. *Fundamentals of General, Organic, and Biological Chemistry*, 6th edition, John Wiley and Sons, Inc. Hoboken, NJ, 1998.

Lehninger, A.L.. Principles of Biochemistry, 4th ed. Worth Publisher, New York.2005.

Gilbert, H.F. Basic Concepts in Biochemistry: a student's survival guide. McGraw-Hill, New York.1992.

Grading Scale:

Poor performance in one exam does not necessarily reflect what you have learned. Your lowest exam of the three term exams will be counted only half as much as the other exams, but the final exam will not be affected. The grading scale will be based on the following:

90-100 %	80-89 %	70-79 %	50-69 %	0-50 %
A	B	C	D	F

Missing an exam can have serious consequences. Do not wait until after the exam is given to try to make up an exam. If you know that you have a scheduling conflict you must make arrangements with the Instructor prior to the exam. In the case of an unexpected illness or problem you must still notify there Instructor before the exam is given and be prepared to present a doctors note or similar evidence to provide a valid excuse. You might not receive full credit for a make-up exam.

CH360 Tentative Lecture Schedules

Week	Date	Chapter in Text	*Contents*
1	8/23		Welcome… Pre-test.
1	8/25	1, 2	Pre-test feedback… Biochemistry, Organic Chemistry, General Chemistry, and their links… Living organisms, dynamic processes, cells, biological molecules, biopolymers, and their interactions… The amazing water.
1	8/27		**No Class:** Spiritual Convocation,
2	8/30	3	Structures and properties of amino acids…. Peptides, primary structures of proteins, protein purification and sequencing techniques.
2	9/1	4	Secondary, tertiary and quaternary structures of proteins… Protein folding and stability
2	9/3	4	Globular, fibrous and membrane proteins… Hemoglobin, myoglobin, collagen, antibodies… Biological function of proteins
3	9/6		**No class:** Labor Day
3	9/8	5	Properties of enzymes: Classification and nomenclature, Catalytic efficiency and specificity, Kinetics, Inhibition
3	9/10	6	Mechanisms of enzyme: acid-base catalysis, covalent catalysis, proximity and transition state, Key-lock model, induced fit concept, kinase, lysozyme, and proteases.
4	9/13	7	Enzyme cofactors: Essential inorganic ions (K, Mg, Ca, Zn, Fe), Group-transferring coenzymes (NAD^+, $NADP^+$, FAD, FMN). Review so far
4	9/15		*FIRST MIDTERM EXAM*
4	9/17	7	Group-transferring coenzymes (CoA, vitamins, biotin, ubiquinone, lipoamide, cytochromes and some proteins). Regulation of enzyme…
5	9/20	8	Carbohydrates overview… Aminosaccharides… Glycans, proteoglycans, cartilage… Peptidoglycans, cell wall, penicillin mode of action … Glycoproteins…
5	9/22	9	Structure and property of lipids: Fatty acids, triacylglycerols (fats and oils), glycerophospholipids (in cell membrane), sphingolipids, eicosanoids, steroids, and terpenes, waxes.
5	9/24	9	Cell membrane: lipid bilayers, membrane proteins, active and passive transport, signal transduction (G proteins and protein kinases)
6	9/27	10	Metabolism: Metabolic pathways, catabolic and anabolic reactions, thermodynamics and free energy changes, Energy-rich molecules
6	9/29	11	Glycosis: A ubiquitous ten step pathway, a 4-step regulation
6	10/1	12	The citric acid cycle: The cross road in the aerobic catabolism of carbohydrates, lipids and amino acids. The eight enzyme-catalyzed reaction

7	10/4	13	Additional Pathways in Carbohydrate Metabolism: Glycogen degradation; Gluconeogenesis, Pentose phosphate pathway, Inter-conversions between a ketose and an aldose phosphates.
7	10/6	14	Oxidative phosphorylation: The mitochondrion, the respiratory electron transport chain, the proton concentration gradient, the coupling
7	10/8	14	The chemiosmotic theory, the protonmotive force
8	10/11		**No Class:** Discoverer's Day
8	10/13	14	Electrochemistry of coenzymes, the P/O ratio, uncouplers, regulation of oxidative phosphorylation
8	10/15	15	Photosynthesis: Chloroplasts, chlorophylls, the light reaction, the dark reaction, CO_2 fixation by the RPP Cycle, Comparisons to oxidative phosphorylation
9	10/18	16	Lipid Metabolism: Absorption, storage and degradation of fatty acid, β-Oxidation of odd-chain and unsaturated fatty acids
9	10/20		*SECOND MIDTERM EXAM*
9	10/22	16	Lipid metabolism: Fatty acid Synthesis, cholesterol synthesis
10	10/25	16	Lipid Metabolism: Eicosanoids, triacylglycerols, glycerophospholipids
10	10/27	17	Nitrogen metabolism: sources of nitrogen
10	10/29	17	Nitrogen metabolism: synthesis of amino acids
11	11/1	17	Nitrogen metabolism: degradation of amino acids
11	11/3	18	Nitrogen metabolism: Nucleotide, alkaloids
11	11/5	19	Nucleic acids: Nucleotides, DNA, the double helical structure, RNA
12	11/8	19	Nucleic acids: Histones, chromatins, chromosomes, hydrolysis of DNA by restriction endonucleases
12	11/10	20	DNA replication: The central dogma, DNA polymerases, the replicsome, the replication fork.
12	11/12	20	DNA replication: regulations, DNA sequencing, DNA repair and recombination
13	11/15	21	Transcription: DNA-directed RNA synthesis, basic steps
13	11/17	21	Transcription: regulation and RNA processing:
13	11/19		*THIRD MIDTERM EXAM*
14	11/22	22	Protein synthesis: Codons, tRNA, aminoacyl-tRNA synthetases, ribosomes
14	11/24	22	Translation: From mRNA to protein, basic steps and regulations
14	11/26		**No Class:** Thanksgiving Break
15	11/29	23	Recombinant DNA Technology: The basic steps, PCR amplication of specific DNA, site directed mutagenesis.
15	12/1		Review
15	12/3		Post-test
	12/6-9		**FINAL EXAM** (specific date and time to be advised)