SYLLABUS for CHEMISTRY 260
ELEMENTARY BIOCHEMISTRY
Spring 2006

INSTRUCTOR

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College of Letters & Science
Department of Chemistry

I. Course Description

A. Biochemistry **(Prerequisites: Chem 220; or 326 and 328)**

Elementary Biochemistry is an introduction to the structures and reactions of the primary molecules of cells. The chemical structures and biological functions of the most common biomolecules, molecular assemblies and polymers of living organisms - including carbohydrates, proteins (enzymes), lipids, nucleic acids, coenzymes, and intermediary metabolites are covered. The reactions and enzyme catalysts of the fundamental metabolic pathways are discussed - including glycolysis, the phosphogluconate pathway, fatty acid catabolism, the citric acid cycle, the electron transport system, oxidative phosphorylation, amino acid catabolism, and the urea cycle. Biological information flow is outlined - including DNA replication; RNA transcription, and protein biosynthesis. The focus of the laboratory portion of the course is on reactions and techniques for analysis of biomolecules.

B. Information for Spring Semester

TIMES:	Lecture 1	M,W,F	12:00 - 12:50	Room Science A109
	Lab 1	T	11:00 - 13:50	Science D118

REQUIRED MATERIALS

TEXTBOOK: Boyer, Rodney *Concepts in Biochemistry*, 2nd ed.; Brooks/Cole: Pacific Grove, CA, 2002.

INSTRUCTORS: Dr. Tom Zamis Office B135 Phone 346-3258 e-mail: tzamis@uwsp.edu
Office Hours: M 1:00, T 9:00, W 1:00, R 9:00, F 10:00.
or other times by appointment.

Laboratory Instructor: Ms. Kathleen Taft Office B118 Phone 346-3706 e-mail:ktaft@uwsp.edu

II. Course Outline

Week #	Dates	Exam #	Topics
1	1/23 - 1/27		Cells, Biomolecules, DNA structure, DNA→protein synthesis
2	1/30 - 2/3		Water, Intermolecular forces, acid/base reactions, buffers
3	2/6 - 2/10		Amino acids, peptides, protein structure
4	2/13 - 2/17	1	Carbohydrate structures
5	2/20 - 2/24		Lipid structures, membranes & transport, lipids in blood
6	2/27 - 3/3		Nucleotides, DNA/RNA structures
7	3/6 - 3/10		PCR, DNA sequencing, DNA fingerprinting
8	3/13 - 3/17	2	Enzymes as catalysts, Molecule binding by Enzymes
	3/20 - 3/24		S p r i n g B r e a k ☺
9	3/27 - 3/31		Enzyme reaction naming, coenzymes
10	4/3 - 4/7		Metabolism introduction, Bioenergetics
11	4/10 - 4/14		Glycolysis, Phosphogluconate pathway
12	4/17 - 4/21	3	Reactions of pyruvate
13	4/24 - 4/28		Citric acid cycle, Oxidative phosphorylation
14	5/1 - 5/5		Fatty acid β-oxidation, hormones and metabolism
15	5/8 - 5/12		Amino acid catabolism, Urea cycle

Exam 4 Tuesday May 16, 12:30 - 2:30

III. Principal Assignments

A. Textbook Reading

Boyer, Rodney *Concepts in Biochemistry*, 2nd ed.; Brooks/Cole: Pacific Grove, CA, 2002.

Topics	Chapter Sections
Cells, Biomolecules, DNA structure, DNA→protein synthesis	1.2 1.3 1.4 2.1 2.2 2.3
Water, Intermolecular forces, acid/base reactions, buffers	3.1 - 3.4
Amino acids, peptides, protein structure	4.1 - 4.5, 5.1 - 5.4
Carbohydrate structures	8.1 - 8.4
Lipid structures, membranes & transport, lipids in blood	9.1 - 9.6, 18.5
Nucleotides, DNA/RNA structures	10.1 10.4
DNA sequencing, PCR, DNA fingerprinting	11.6 13.3
Enzymes as catalysts, Molecule binding by Enzymes	6.1 - 6.4, 7.2 7.3
Enzyme reaction naming, coenzymes	6.1 7.1 14.2
Metabolism introduction, Bioenergetics	14.1 14.3 20.1
Glycolysis, Phosphogluconate pathway	15.1 16.5
Reactions of pyruvate	15.3 16.1
Citric acid cycle, Oxidative phosphorylation	16.2 17.1 17.3
Fatty acid β-oxidation, hormones and metabolism	18.1 18.2 20.3
Amino acid catabolism, Urea cycle	19.3 - 19.5

You are expected to understand all **terminology** listed in the objectives, and information presented as Tables and Figures on the reading assignment pages.

B. Supplementary Material

Handouts of lecture material from your instructor, or the Chem 260 Web page, are provided for easy reference and note-taking in class.

You are allowed to prepare, and bring with you to exams, a one page (8 1/2 x 11) "study sheet". These are prepared by you, and contain handwritten or typed summaries of your notes. **These may not contain any photocopies of handouts or book material.**

Your instructor will also make available, on the Chem 260 Web page, all course materials from lecture and discussion, and locations on the **World Wide Web** that have useful instructional materials.

IV. Conduct and Evaluation Procedures

A. Attendance

Attendance is not required for lecture, however the majority of the material that you will be responsible for is presented in lecture. Be sure to obtain notes from your peers on those rare occasions that you miss lecture.

Attendance is required for examinations and laboratory. An *excused absence* requires that **verifiable** arrangements be made with your instructor **in advance** for things like off-campus trips or personal appointments; or following an emergency or illness, a written note from a physician or university administrator is presented upon returning.

B. Student Conduct

The following are from the University publication "Community Rights and Responsibilities". The full document is available from the UWSP Web Page under Student Life.

Nearly 10,000 students, staff, faculty and visitors descend on our one square mile campus each day of the academic year. It is apparent that as a learning community, we need standards or codes of conduct which clarify the behavioral expectations for our academic and nonacademic environments. The policies and procedures spelled out in our Community Rights and Responsibilities publication provide for a sense of order for all while respecting the dignity and rights of individuals. Through these policies, civility within our learning community is affirmed, diversity is pursued, the importance of each person is honored and well defined procedures guide behavior for the common good.

UWSP 14.01 STATEMENT OF PRINCIPLES. The board of regents, administrators, faculty, academic staff and students of the University of Wisconsin system believe that academic honesty and integrity are fundamental to the mission of higher education and of the University of Wisconsin system. The university has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonesty. Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others' academic endeavors. Students who violate these standards must be confronted and must accept the consequences of their actions.

See Section, UWSP 14.03 ACADEMIC MISCONDUCT SUBJECT TO DISCIPLINARY ACTION, for specific examples of academic standard violations.

C. Grading Policy

Exams will be held **Fridays** and will last from 12:00 until 1:00 PM. If you have a conflict with the scheduled exam time, please make arrangements with me for a makeup in advance. A makeup exam will be arranged for any **excused** absences. Your final grade will be based on the total points earned out of 1000. The distribution of points is as follows:

Hour Exams (4 @ 175 pts)	700 points
Lab Work	250 points
Deportment/Instructor	50 points

The tentative levels of achievement required for letter grades are:

"A, A-" 900 points "B+, B, B-" 800 points "C+, C, C-" 700 points "D" 600 points.

These levels will not be raised.

V. Course Objectives

A. Philosophy

First, one must master the fundamentals. Precise, biochemical definitions for terminology, and biomolecule names and Lewis structures must be learned. Biomolecules (which include proteins, carbohydrates, nucleic acids and lipids) are polyfunctional, organic molecules in aqueous solution. To understand biochemical structures, you must learn which organic functional groups are important in the structures of each category of biomolecules, and how these functional groups interact with water.

Enzymes are the biomolecules that control all of the reactions occurring in cells. You should understand how enzymes act as catalysts, how they bind to reactant and regulatory molecules, and how they are named. This will allow you to understand biochemical reactions.

Finally, the first two components are brought together to understand the basic biochemical pathways of intermediary metabolism. My hope is that you will achieve a sufficient understanding of these fundamental principles, and be able to explore and comprehend the latest developments in genetics, medicine, biochemistry and molecular biology.

It is <u>your</u> responsibility to learn the material that I have selected as objectives for the course. <u>I</u> will lead you through the sequence of topics that serve as a general introduction to biochemistry. I will present the material through interactive lectures that incorporate computer graphics, videos, Internet resources, current articles, real-world applications, and handouts I will give you individual help and guidance when you ask me to - and please feel free to ask me when you need it! Your learning will be evaluated by examinations that will cover <u>only</u> the material listed in the objectives. There will be four comprehensive hour exams. The exams will focus on the understanding of terminology, structures, enzyme names and biochemical reactions. Each exam will contain approximately 35 short answer questions.

B. General Objectives

Biomolecule Structures

1) You should be able to recognize the names, abbreviations, functional groups and complete Lewis structures of biomolecules listed in the objectives.
2) You should know which organic functional groups are important in the structures of each category of biomolecules.
3) Understand how these functional groups relate to different molecular forms (reduced or oxidized, ionic form at a pH, ring vs. chain form, resonance forms), interactions (hydrogen bonding, ionic bonding, van der Waals forces, or hydrophobic effect), and general organic reaction types.

Metabolism

For the pathways discussed in class, you should be able to:

1) Recognize the structures and names, of substrates and products, in the enzyme catalyzed reactions listed in the objectives.
2) Know the names of the enzymes, and their cofactors, for the enzyme catalyzed reactions listed in the objectives.
3) Understand the overall reactions, the free energy considerations (production and use of ATP) and oxidation-reduction considerations (production and use of redox coenzymes) for each pathway.

Biological Information Flow

You should understand the structural relationships between deoxyribonucleic acids and ribonucleic acids in the processes of replication, transcription and translation. Understand electrophoresis, DNA sequencing, PCR, and DNA fingerprinting.

Laboratory

You should understand the general principles behind each experiment as described in each lab experiment handout. You should be able to solve qualitative and quantitative problems based on results obtained in the laboratory.