CHEM 514
BIOCHEMISTRY
LIFE - It's Biological diversity and Chemical Unity
FALL 2012
Thursday - 7:00 to 9:30 PM

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Course Instructor

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CHEM 514 Biochemistry Hours: 3

R 7:00p-9:30 p Location: STC127

Meets 8/27/2012 through 12/14/2012

COURSE DESCRIPTION
This introductory course in biochemistry is intended to provide undergraduate and graduate students with a foundation and in depth knowledge of biochemistry. This course will be covering many aspects of biochemistry, including: biomolecules and metabolism. The course consists of lectures sessions and the topic covered will be given in details in the course schedule.

COURSE GOALS
Students who successfully complete this course will be able to:

The main objectives of this course are to provide a basic foundation and understanding of the principles of modern biochemistry necessary for further work in the biochemical/biomedical areas. Unlike much earlier chemistry the material is often conceptually complex and not yet amenable to straightforward mathematical interpretation. Accordingly, the students may find the material more heavily descriptive than in their earlier chemical studies. By the end of this course the students will have a better understanding of the structure and function of the biological macromolecules its metabolism and biosynthesis.

REQUIRED TEXTBOOK (S)

Required Text Book: BIOCHEMISTRY by Berg, Jeremy M.; Tymoczko, John L.; and Stryer, Lubert. New York: W. H. Freeman and Co: 7th edition

REQUIRED JOURNAL ARTICLE (S)
Lectures and other supplementary materials (Journal articles, case study material and assignments and quizzes) will be email to the students before the session.

RECOMMENDED TEXTBOOK (S)/READING (S)
Recommended for additional reading
Lehninger, Principles of Biochemistry, Fourth Edition
Biochemistry by Garrett and Grisham.
Biochemistry by Mathews and Van Holde

EXAMS

There will be three equally weighted exams given, two during the course and the third at the final exam time. The Students will be expected to be available and prepared for the exams at the specified times. ***Missing an exam will result in a 0 score for that exam unless due to illness as documented by a doctor's note and the student notifies the instructor of the illness before the exam (e-mail, phone message, etc.).*** Make-up exams will not be given ordinarily. The exams will contain a mix of multiple choice questions, long (explanation) questions, short (formulas and definitions) questions and graphical/diagrammatic questions.

COURSE GRADING

Grading: Your final grade is based on the performance in two intermediate exams (20% each), homework/quizzes (20%) , Problem based learning (PBL) (20%) and the final exam (20%)

Grading will be based on a standard percentage scale: 100-90 = A; 89-80 = B; 79-70 = C; 69-60 = D; 59-below = F. Dishonest scholarship will earn an automatic zero (0) and initiate prosecution to the fullest extent. Incomplete grades may be given only if the student has a current average ³70% and is precluded from completion of the course by a documented illness or family crisis.

The last drop date for the course is _____

SECURE TEST ITEM POLICY

Students are expected to adhere to the Texas A&M University, Commerce policy on conduct during the course and the examination sessions. Cheating on an examination will not be tolerated. A report of any cheating will be made in accordance with the policies of the University effective at the time of the occurrence.

POLICY ON LATE SUBMISSION

Your assignment needs to be submitted on time. Late submission of the assignments will result in deduction of 5%/day for that assignment unless the student have a valid reason like due to illness as documented by a doctor's note and the student notifies the instructor of the illness before the exam (e-mail, phone message, etc.).

POLICY ON ATTENDANCE

Students are expected to attend all the class. Students may miss a required session only with an excused absence from the Course Instructor. Please notify the instructor about your excused absence as soon as possible in order to schedule a makeup in another laboratory session. Exams and/or tests missed due to unexcused absences will be given a grade of zero. Exams or quizzes missed because of excused absences will be made up during another laboratory period.

IMPORTANT NOTICE

The provisions contained in this syllabus do not constitute a contract between the student and the University. These provisions may be changed at any time for any reason at the discretion of the Course Instructor and Texas A&M University, Commerce Campus. When necessary, appropriate notice of such changes will be made available to the students. Please refer to the Texas A&M University, Commerce Campus students Hand BOOK for General policies and guidelines.

COURSE SCHEDULE

lecture	Day	Date	Course Session Topic	Assigned Readings: Chapter in 7th edition
1	Thur	8/30	Introduction to Biochemistry Structure and function of Major compounds in your body	1
2	Thur	8\30	*Water an excellent solvent, buffering against pH changes in biological system, bicarbonate buffer system*	Reading material and review material will be provided practice problems
3	Thur	9/6	Amino acids and Proteins, *composition and Structure*	2

4	Thur	9/6	*A portrait of protein in action - Hemoglobin*	7
5	Thur	9/13	*Exploring proteins and proteomes Protein, purification, characterization, immunological techniques, Mass spectrometry*	3 publication on protein purification
6	Thur	9\20	*PBL -1 Small team based activity – A research problem will be given to the students and the students work as a team to come up with the research proposal with specific aims and experimental design followed by discussion (material covered will be lecture 1-5)*	Material will be provided
7	Thur	9\27	*Enzymes – Biological catalysts- enzyme kinetics, enzyme inhibitors- Targeting enzyme inhibitors in drug discovery.*	8 review paper will be provided and discussed
8	Thur	9\27	*Enzyme - Catalytic strategies and regulatory strategies*	9
9	Thur	10/4	*Nucleic acids structure and function- DNA, RNA and the flow of information*	4
	Thur	**10\11**	***Exam -1(Based on lecture topic (1-9)***	
10	Thur	10\18	*Carbohydrate structure and function*	11
11	Thur	10\25	*Lipids composition, structure and function Lipoprotein transport- lipoproteins and liposomes in targeted drug delivery*	12 review paper will be provided
12	Thur	11\1	*Cell membrane and Bio signaling – membrane channels and pump*	13.14
13	Thur	11\8	*PBL -2 - Small team based activity – A research problem will be given to the students and the students work as a team to come up with the research proposal with specific aims and experimental design (material covered will be lecture 9-12)*	Material will be provided
14	Thur	11\15	Overview of metabolism – function of major macromolecules – major metabolic pathways	15,27
15	Thur	11\22	*Thanks Giving Holiday*	
	Thur	**12\6**	***Exam -2 (Based on lecture topic 10 -15)***	
	Thur	**12\12**	***Final Exam (Lecture 1-15)***	

Introduction to Biochemistry
Student Learning Objectives

After you have studied the lecture and reading materials, you should be able to:

Introduction to Biochemistry Structure of Major Components in Your Body

1. List the characteristics of living organisms
2. Understand the nature of molecules of life
3. Describe the levels of organization of life
4. Explain how the electronic structure of water accounts for its unique properties
5. Explain the importance of hydrogen bonding to biomolecular structure and function.
6. What are the types of non-covalent, reversible interactions and why are they important in biochemistry?

Nucleic acids Structure and Function

1. Recognize the chemical structures of purine and pyrimidine nucleotides
2. Understand the structural organization of RNA and DNA
3. Define the role of hydrogen bonds in 3-D structures of nucleic acids
4. List the differences between DNA and RNA
5. Describe the double helical structure of DNA
6. Identify the various kinds of RNA and their biological functions

Amino Acids and Proteins

1. Describe the general properties of amino acids
2. Describe their classification, based on their side chain composition.
3. List the non-protein amino acids
4. Understand the acid-base properties of amino acids
5. Describe the formation of peptides.
6. List the biologically important peptides and their functions.
7. Define primary, secondary, tertiary and quaternary structures of proteins

Structure and Functional Relationships of Protein

1. Explain the factors affecting protein structural stability
2. Understand the structural basis of protein denaturation.
3. List the properties of the oxygen binding proteins: hemoglobin and myoglobin and describe the regulation of oxygen transport.
4. Understand why myoglobin is a storage protein while hemoglobin is a transport protein.

Enzyme Kinetics

Understand the relation between enzyme catalyzed reaction and transition state of the reaction and enzyme inhibitors.

Describe the unique hallmarks of enzyme catalysis.

2. List the 6 basic types of enzyme reactions
3. List the coenzymes; know from which vitamins they are derived and their general type of catalytic functions.

4. Describe how enzymes increase the rate of catalysis
5. Explain the fundamental nature of the catalytic center of enzymes.
6. List the factors that affect the rate of enzyme catalysis
7. Use the Michaelis-Menton equation in describing how enzymes work
8. Describe the physiological signature of K_m & V_{max}
9. Explain the double reciprocal method of determining K_m and V_{max}.
10. Describe the effect of activators and inhibitors on enzymes
11. Distinguish between reversible and irreversible inhibitors and list the types of reversible inhibitors

Carbohydrates

Structure and function of monosaccharides and polysaccharides.

1. Understand the chemical nature of carbohydrates
2. Describe how carbohydrates are classified
3. Understand the stereoisomerism of carbohydrates and explain their existence as (i) D & L-isomers, (ii) Anomeric forms, and (iii) Chair and boat conformations
4. Recognize the structures of simple sugars and complex carbohydrates.
5. Understand the chemical nature of blood group antigens

Structure and function of major lipids and lipoproteins

1. List the biological functions of lipids
2. Describe how lipids are classified
3. Explain the basic structure of triglycerides and their hydrolytic products
4. Describe the different types of phospholipids and their functions
5. Recognize the structure of cholesterol and its biological function

Cell membrane Biosignaling

1. Describe the '**lipid bilayer'** and '**fluidic mosaic**' models of membrane structure
2. Explain the composition of the biological membrane
3. List the functions of the biological membrane
4. List the kinds of biological transporters and understand their mechanisms
5. Distinguish among uniport, symport, and antiport systems
6. Explain the mechanism of 'bio-signalling' (signal transduction)

Overview of Metabolism

1. Explain the role of catabolic and anabolic pathways in cell metabolism
2. Distinguish between kinetic and potential energy
3. Distinguish between open and closed systems
4. Explain the role of ATP in the cell
5. Describe ATP's composition and how it performs cellular work
6. Understand the energy profile of a reaction including: activation energy, free energy change, & transition state
7. Describe the role and mechanisms of enzymes
8. Glucose as a major energy source
9. Explain how metabolic pathways are inter-linked.
10. Explain how acetyl-Co-A serves as a key intermediate
11. List examples of diseases resulting from defects in metabolism

Team Based Learning Activity - Biochemistry and its relationship to other disciplines

Will provide an opportunity to the students to interact and work as a team to to apply their knowledge in basic biochemistry to practical scenarios.

How to identify a research problem in the biochemistry field.

How to apply the basic biochemistry knowledge to design a research project/ scientific publications and submit the findings

How will you apply your biochemistry knowledge in the field of diagnosis and treatment of patients.