CHEM 2360/ MBIO 2360/ CHEM 2860
BIOCHEMISTRY I: BIOMOLECULES AND AN INTRODUCTION TO METABOLIC ENERGY
FALL 2012

Instructors

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Lecture Notes

All course material will be available to registered students through the ANGEL website (https://angel.cc.umanitoba.ca) under the "Lessons" heading. Both lectures sections will be using these notes, but note that revisions may be made during the course***. Material presented in class takes precedence over all other material.***

Textbook
Lehninger *Principles of Biochemistry*, 5th Edition (by Nelson and Cox). The textbook is not required reading, but rather serves as a valuable resource in addition to the lecture notes.

Laboratory
Lab book (2012 Fall edition) is available at the bookstore. Labs begin the week of September 17th, and are held in Parker Building Rooms 406, 416, 422, and 428. Lockers are NOT assigned, but are available on a first come first served basis. Experiments are done is pairs, so students work with whoever is in the locker beside them. Students require a lab coat and USB key to participate in labs.

Evaluation

Laboratory- practical		15%
Laboratory- exam	Monday December 3rd, 7-8pm	10%
Midterm Exam	Monday, October 22nd (7-9pm)	25%
Final Exam		50%

Students must receive a mark of at least 12.5/25 on the laboratory portion of the course (practical + exam) to get credit for the course.

There is no deferred midterm exam. A medical certificate stating the reason for the missed exam must be presented within one week of the missed exam. Upon receipt of the medical certificate the final exam will be pro-rated to 75%. If no medical certificate is provided, the midterm grade will be 0%.

There is no deferred lab exam.

Should major disruptions to University activities occur as a result of a pandemic, the course content, marks breakdown, and other provisions of this document may be adjusted as the circumstances warrant.

Mark Breakdown

A+	90-100%
A	80-89%
B+	75-79%
B	70-74%
C+	65-69%
C	55-64%
D	50-54%
F	0-49%

Academic Dishonesty

In the case of academic dishonesty (cheating, plagiarism, etc.) the exam or paper in question will be given a grade of 0% and the student reported to the appropriate authorities for further punishment. It is up to the student to understand the rules of cheating and plagiarism. Please refer to the University of Manitoba General Academic Regulations and Requirements, Section 7: Academic Integrity: (http://webapps.cc.umanitoba.ca/calendar10/regulations/).

Previous Examinations

Previous midterm and final examinations will be available online. ***No answers will be provided.***

Course Outline

Biochem I is an introductory course dealing with kinds of molecules encountered in biochemistry, and the concept of metabolic energy as a product of catabolism and a requirement for biosynthesis.

1. **Water:** structure of liquid water; hydrogen bonding; electrostatic and van der Waals interactions; the hydrophobic effect; detergents. Ionization of water; strong and weak acids and bases; ionization constants; calculation of pH, and understanding titration curves; Henderson-Hasselbalch equation; buffers.

2. **Amino Acids:** structures of the 20 common amino acids found in proteins; properties and classification of the R-groups; stereochemistry; ionization properties, titration curves, and calculation of pH.

3. **Protein Structure:** the peptide bond; amino acid sequence (primary structure); secondary structure and H-bonding: alpha-helix, beta-sheets; disulfide bonds; tertiary structure and the hydrophobic effect; quaternary structure; folding and denaturation of proteins; prosthetic groups; methods of protein purification.

4. **Enzymes:** catalysis; the enzyme-substrate complex; transition state theory; how enzymes lower the transition state; chiral specificity of enzymes; fundamentals of enzyme kinetics, and the Michaelis-Menten equation; inhibitors and their effects on kinetics; allosteric enzymes.

5. **Carbohydrates:** structures of simple sugars: aldoses and ketoses; naming, and stereochemistry; hemiacetal and acetal chemistry; cyclic forms of monosaccharides, Haworth structures, mutarotation and reducing sugars; sugar derivatives; glycosidic bonds; oligosaccharides; polysaccharides, including their physical properties.

6. **Nucleic Acids:** purines and pyrimidines; structures and naming of nucleosides and nucleotides; the nucleic acids; DNA structure, including the double helix, Watson-Crick base pairs, denaturation; RNA and secondary structure; messenger, transfer and ribosomal RNA; mutations and oxidative damage to DNA.

7. **Lipids and Membranes:** properties of lipids; fatty acids and fats derived from them; storage and membrane lipids; phospholipids; glycolipids, including sphingolipids and gangliosides; steroids and terpenoids; beta-carotene and vision; cholesterol and other steroids; composition of biomembranes; facilitated diffusion and active transport mechanisms.

8. **Bioenergetics:** brief review of thermodynamic concepts; free energy as a means of understanding metabolism; standard free energy change and its measurement from equilibrium constants or cell potentials; redox reactions; biochemical electron carriers; ATP and its central role as storage form and source of free energy.

9. **Glucose metabolism:** glucose oxidation by cells as a source of ATP; detailed description of glycolysis and the tricarboxylic acid cycle; fate of pyruvate under anaerobic conditions; the electron transport chain; mechanism of oxidative phosphorylation; calculations of ATP yield.