CHEM 3054 **Biochemistry Syllabus** **Fall 2009**

Instructor Dr. Nathan J. Malmberg

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Textbook Leninger Principles of Biochemistry, Fifth Edition by David L. Nelson and Michael M. Cox ISBN: 0-7167-7108-X

Lab Text Modern Experimental Biochemistry, Third Edition by Rodney Boyer ISBN: 0-8053-3111-5

Also Required Lab goggles and a TI-34 calculator.

Course Meets MWF at 11:00-11:50 AM in Wood 201A

Lab Meets M 1-5 PM in Wood 209

Description The structural and functional properties of proteins, carbohydrates, lipids and nucleic acids are studied to reveal the molecular basis of membrane composition and dynamics, bioenergetics, enzyme kinetics and regulation, and the transmission and expression of genetic information in prokaryotes and eukaryotes.

Goals We will be looking at the basis for function of several different types of biological macromolecules. By understanding these fundamental principles, we will gain insight into the remarkable similarities (both qualitative and quantitative) of such diverse biomolecules such as proteins, phospholipids, sugars and DNA. As your experience broadens beyond this course, you will find that these fundamentals apply well in other areas of biosciences, as well.

Further Information about disabilities, incomplete grades, inclement weather schedules, final exams, etc. can be found in the university-wide syllabus attachment at http://www.okbu.edu/academics/forms/Syllabus_Attachment_Fall09.pdf.

Academic Dishonesty will not be tolerated. Offenses will result in a zero for the assignment, and may result in disciplinary action by the University. Academic dishonesty may include, but is not limited to:

- Copying from another student's exam or quiz.
- Sharing data analysis with your lab partner or other students.
- Insufficient rewording of material derived from another source.
- Hiring another individual or company to perform experiments, write papers, etc.

Integration of Faith and Learning Biochemistry stands at the heart of several issues which are having pronounced influences on Christianity. During the course of the semester, we will attempt to address some of these issues, and explore how a Christian worldview influences the way we understand biochemical systems.

Attendance Attendance will not be taken in this course. However, you are responsible for the information presented in class. In addition, your participation in class will not only help yourself, it also helps me identify that you are putting in a significant effort in the class.

Grades The value of each assignment for the semester is listed below:

Midterm Exams	400 pts
Final Exam	100 pts
Quizzes	100 pts
Lab	200 pts
Molecular Visualization Paper	50 pts
Molecular Visualization Presentation	50 pts
Total	900 pts

Grading Scale Grades will tentatively be assigned according to the following scale: 85-100%–A, 70-84%–B, 55-69%–C, 40-54%–D, below 40%–F. These scales may be adjusted downward, but don't count on it.

Exams Midterm exams will be held during normal class periods on Wednesdays on *September 23, October 7, November 4 and November 18.* Each exam will be worth 100 points, and will test the material covered in lecture from each section of the course. The final exam will be held at the exam time specified by the university (currently Tuesday, December 15 at 3:15 PM), will be worth 100 points, and will cover material from the entire semester (comprehensive).

Quizzes There will be a quiz almost every Wednesday testing your comprehension of the material covered since the previous week. The major exceptions to this quiz rule will be on Wednesdays of an exam.

Paper Each of you will write a paper about your analysis of a protein structure using a freely available molecular visualization software tool. More details will be given as the semester progresses. The paper will be due on *Wednesday, October 28 in class.*

Presentation You will be required to give a 10-15 minute presentation about the protein structure you studied using the molecular visualization software tool mentioned above. The presentation will be given during the last lab period of the semester. The slides for your presentation should be in OpenDocument Presentation format (.odp) or Microsoft PowerPoint format, and should be given to Dr. Malmberg by noon of that day. Be aware that this presentation will be given to *two* of the chemistry faculty, so I will not be the only one evaluating your presentation.

Late Policy Exams and quizzes must be completed on the days on which they are given. Failure to take an exam or quiz in the alloted time will result in a zero for that exam or quiz. Exceptions will be made for exams which are missed because of:

- University-sponsored activities. You must make alternative arrangements with me at least a week in advance.
- Documented medical absence.
- Death in the family.

Homework and lab reports that are turned in late will be subject to the following penalties:

1 day	10 %
2 days	30 %
3 days	60 %
4 days	100 %

Exceptions will be made as for exams and quizzes.

Tentative Lecture Schedule Fall 2009

Week	M	W	F	Topic
8/26–8/28		Chap.1	1	Background to Biochem
8/31–9/4	2	2	3	Water
9/7–9/11	Labor Day	3	3	Protein Primary Structure
9/14–9/18	4	4	4	Protein Secondary and Tertiary Structure
9/21–9/25	5	Exam 1	5	Protein Function
9/28–10/2	5	6	6	Enzymes
10/5–10/9	6	Exam 2	7	Carbohydrates
10/12–10/16	7	7	Free Days	Nucleotides
10/19–10/23	8	8	8	Nucleic Acids
10/26–10/30	9	9	9	DNA-based Technology
11/2–11/6	10	Exam 3	10	Lipids
11/9–11/13	11	11	12	Membranes
11/16–11/20	12	Exam 4	13	Biosignaling
11/23–11/27	13	Thanksgiving Holiday		Principles of Metabolism
11/30–12/4	13	14	14	Glycolysis
12/7–12/11	14	16	16	Citric Acid Cycle

Topics by Chapter we will cover in this course:

Chap. 1 Cell structure, organic review, thermodynamics and kinetics, theories of origins

Chap. 2 Properties of water and the hydrophobic effect, ionization constants and the Henderson-Hasselbalch equation, buffers, water in chemical reactions.

Chap. 3 Amino acid structure(s), ionization of amino acids, polypeptides and the peptide bond, protein primary structure, chromatography (ion-exchange, size-exclusion and affinity), isoelectric point, electrophoresis (SDS and isoelectric focusing), methods of sequence determination, sequence math

Chap. 4 Protein secondary, tertiary and quaternary structure, x-ray diffraction and NMR, protein folds and folding motifs, protein folding and denaturation

Chap. 5 Ligand binding site, binding equilibria and association/dissociation constants, Hill plots, cooperativity and allostery

Chap. 6 Enzyme composition, active sites and substrates, thermodynamics and kinetics of enzyme-catalyzed reactions, enzymes and transition states, mechanisms of enzyme catalysis, derivation and use of Michaelis-Menton equation, interpretation of kinetic parameters, inhibitors (competitive, uncompetitive, noncompetitive, irreversible), regulation of enzymes

Chap. 7 Monosaccharides, oligosaccharides, polysaccharides, aldoses and ketoses, stereochemistry of sugars, epimers, cyclic structures, acid derivatives, glycosidic bonds, glycoconjugates

Chap. 8 Nucleotide structure, phosphodiester bonds and polynucleotides, base pairs, helical structure of DNA, denaturation and hybridization, sequence determination of nucleic acids, functions of nucleotides

Chap. 9 DNA cloning and recombinant DNA, restriction endonucleases, plasmids, transformation, vector gene expression, site-directed mutagenesis, fusion proteins, PCR, DNA libraries, DNA fingerprinting, DNA chips and microarrays, yeast two-hybrid selections

Chap. 10 Fatty acid structure, triacylglycerols, glycerophospholipids, steroids, eicosanoids, isoprenoids

Chap. 11 Lipid bilayer, micelles, integral and peripheral membrane proteins, hydropathy plots and membrane topology, membrane phases, transverse and lateral diffusion, passive and active transport, carriers and channels, symport and antiport, free energy of transport

Chap. 12 General features of signal transduction, G protein-coupled receptors and second messengers

Chap. 13 Standard and actual free energy changes, transformed constants, free energy of hydrolysis, "high-energy" bonds, oxidation-reduction reactions, reduction potentials and free energy, cofactors in metabolism

Chap. 14 Reactions and enzymes of glycolysis, feeder pathways for glycolysis, fates of pyruvate, gluconeogenesis

Chap. 16 Production of acetyl-CoA, Reactions and Enzymes of the Citric Acid Cycle