CHEM 4603 **Advanced Biochemistry** **Spring 2009**
Syllabus

Instructor Dr. Nathan J. Malmberg

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Textbook Lehninger Principles of Biochemistry, Fifth Edition by David L. Nelson and Michael M. Cox, W. H. Freeman and Company, 2005. ISBN: 0-7167-7108-X

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

Description Metabolic and biosynthetic pathways will be emphasized and the biochemical description of immunology will be introduced. Prerequisite: Grade of C or better in CHEM 305, concurrent enrollment in CHEM 465.

Goals We will be constructing a detailed description of the metabolic pathways of the cell. You will be tested not only on your ability to recall this description, but also on your ability to apply it to different circumstances, ie metabolic requirements, vitamin deficiencies, genetic disorders, etc. We will attempt to elucidate why biochemical reactions occur as they do, and what happens when they don't work correctly. Our goal is not so much to prepare you for working with these pathways on a regular basis, but to prepare you to think about these reactions in a holistic way.

For metabolic pathways, you will be expected to know starting and ending molecules, intermediates formed in the pathway, the names of enzymes that catalyze the pathway, the cofactors used or formed along the path, and the mechanisms of the reactions that are well-characterized. For information metabolism, you will be expected to know the structures of the proteins and nucleic acids involved, the enzymes that catalyze important reactions in that metabolism, and the steps involved in each metabolic process.

Additional Info regarding disabilities, attendance, academic dishonesty, inclement weather, important semester deadlines, etc. are available in the university wide syllabus attachment available at http://www.okbu.edu/academics/forms/Syllabus_Attachment_Spring09.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.

See the online syllabus attachment for further details about academic dishonesty.

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	600 pts
Final Exam	200 pts
Quizzes	100 pts
Molecule Paper	50 pts
Molecule Presentation	50 pts
Total	1000 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 consist of two parts, an in-class component to be held during normal class periods on Wednesdays on *March 4, April 1, and April 29,* and a take-home component to be turned in at the beginning of class the following Monday. Each exam will be worth 200 points, and will test the material covered in lecture from each section of the course. The final exam will be held at the time appointed by the university, will be worth 200 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 a compound or element which influences biochemical pathways in an unusual way. Details about the paper, together with assignment of the compound, will follow later in the semester. The paper will be due on *Wednesday, April 15 in class.* A rough draft of the paper may be turned in for comments and suggestions no later than Friday, April 10 at 3:00 PM.

Presentation You will be required to give a 10-15 minute presentation about the compound that was the topic of your paper. The presentation will be given during class on *Wednesday, May 13 or Friday, May 15.* You may prepare slides to project from Dr. Malmberg's computer or from a laptop you bring to class. The presentation should be at a level that your classmates, having learned from this course, will be able to understand.

Late Policy Exams and quizzes must be completed on the days on which they are given. Take-home exams must be turned in on the designated completion date. 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.

Papers that are turned in late will be subject to the following penalties:

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

Tentative Lecture Schedule Spring 2009

Week	M	W	F	Topic
2/2–2/6	Chap. 3, 7	8, 10	6, 11	Biochem Review
2/9–2/13	13	13	14	Bioenergetics
2/16–2/20	14	14	14	Glycolysis, Gluconeogenesis, Pentose Phosphate
2/23–2/27	20.1	15	15	Glycogen and Regulation of Sugars
3/2–3/6	16	Exam I	16	Citric Acid Cycle
3/9–3/13	16	16	19	Oxidative Phosphorylation
3/16–3/20	Spring Break			
3/23–3/27	19	19	19	Photosynthesis
3/30–4/3	17	Exam II	17	Fatty Acid Metabolism
4/6–4/10	21	21	18	Fatty Acid Biosynthesis
4/13–4/17	18	18	22	Amino Acid Catabolism
4/20–4/24	22	Quiz	24	DNA and Genes
4/27–5/1	25	Exam III	25	DNA Metabolism
5/4–5/8	26	26	27	RNA Metabolism
5/11–5/15	27	Presentations	Presentations, Review	Protein Synthesis

Topics by Chapter Lehninger's Principles of Biochemistry

Chapter 3 Amino Acid Structure, Acid-Base Properties of Amino Acids, Peptide Bonds

Chapter 7 Carbohydrate Classification, Carbohydrate Stereochemistry, Epimers, Anomers, Glycosidic Bonds, Aldonic Acids

Chapter 8 Purine and Pyrimidine Structure, Nucleotide Structure, Nucleic Acid Polymers, Base-Pairing, Helical Structure of DNA

Chapter 6 Enzyme Thermodynamics, Mechanisms of Enzyme Catalysis, Classification of Enzymes, Enzyme Cofactors, Regulation of Enzymes

Chapter 11 Thermodynamics of Membrane Transport, Chemical and Potential Gradients Across a Membrane

Chapter 13 Equilibrium and Free Energy, Standard, Actual and Transformed Free Energy, Phosphoryl Group Transfers, Free Energy of Hydrolysis, Oxidation and Reduction, Redox Half-Reactions, Reduction Potentials and Free Energy, Redox Coenzymes

Chapter 14 Glycolysis, Gluconeogenesis, Fates of Pyruvate, Pentose Phosphate Pathway, Feeder Pathways for Glycolysis

Chapter 15 Catabolism of Glycogen, Glycogen Synthesis, Metabolic Regulation, Coordinated Regulation of Glycolysis and Gluconeogenesis

Chapter 16 Production of Acetyl-CoA, Reactions of the Citric Acid Cycle, Regulation of the Citric Acid Cycle, Glyoxalate Cycle

Chapter 17 Hydrolysis of Fats, Fate of Glycerol, β-Oxidation of Fatty Acids, Regulation of Fatty Acid Metabolism, Ketone Bodies

Chapter 18 Hydrolysis of Peptides, Fates of Amino Groups, Urea Cycle, Pathways of Amino Acid Degradation

Chapter 19 Electron Transport in Mitochondria, ATP Synthesis, Regulation Oxidative Phosphorylation, Photophosphorylation, Light Absorption, Light-Driven Electron Flow, ATP Synthesis by Photophosphorylation

Chapter 20 Photosynthetic Carbohydrate Synthesis

Chapter 21 Biosynthesis of Fatty Acids, Biosynthesis of Triacylglycerols, Biosynthesis of Membrane Phospholipids, Biosynthesis of Cholesterol and Isoprenoids

Chapter 22 Biosynthesis of Amino Acids, Molecules Derived From Amino Acids

Chapter 24 Chromosomal Elements, DNA Supercoiling, Structure of Chromosomes

Chapter 25 DNA Replication, DNA Repair, DNA Recombination

Chapter 26 DNA-Dependent Synthesis of RNA, RNA Processing, Reverse Transcription, Telomerase

Chapter 27 The Genetic Code, Protein Synthesis, Protein Targeting and Degradation