Syllabus

Department of Chemistry
FCH 530 – Graduate Studies
Biochemistry 1

Assistant Professor Christopher Nomura
SUNY-ESF
318 Jahn Lab
Syracuse, NY 13210

Phone (315) 470-6854
Fax (315) 470-6856

E-mail: ctnomura@esf.edu
http://www.esf.edu/chemistry/faculty/nomura.asp

COURSE OUTLINE

BIOCHEMISTRY I FCH 530 Fall 2010

Christopher T. Nomura, Ph.D.
(ctnomura@esf.edu) 318 Jahn phone: 470-6854

Website: http://www.esf.edu/chemistry/nomura/fch530/

Room and Time: FCH530 will meet from 8:25AM-9:20AM MWF in room 148 Baker.

General course outline: The first half of the course will be examining amino acids, protein structure and enzyme kinetics. The second half of the course will be an introduction to metabolism.

Textbook: We will be using the textbook **Biochemistry by Voet & Voet (3rd Edition, 2004)** as our text for both semesters. **This is required for the class!!** I do expect that you will read the assigned chapters. WWBH refers to a supplemental book entitled "Biochemistry, A Problems Approach". It is very useful to work the problems. Some of these may be assigned as homework problems but if they are not, I do not collect or grade the supplemental problems. This book will be on reserve in Moon Library.

Grading and Exams: The course will have four exams. All exams are cumulative and consist of multiple-choice, short answer, matching, and other types of questions. Exams will be given in class. In addition several in-class quizzes during the course of the semester that will add another 150 points (perhaps more). The homework assignments will not be collected or graded, but it **highly recommended that you do the homework assignments!** Many of the types of questions on the homework assignments are going to be on exams. Grading will be on a curve average. Graduate students scores do not affect the curve but rather their grade is simply determined by where they fall on the undergraduate average.

Office Hours: Office hours will be on Tues. from 10:35AM – 11:35AM or by appointment only.

Schedule: A **tentative schedule** is included. It is meant to guide you in your readings and studies for the class. We may have some guest lectures throughout the semester to cover for days that I am out of town. Material covered in these lectures is based on my lecture notes and will be included in the exams.

Ch= Voet & Voet, 2004 Biochemistry 3rd Edition
WWBH= Wood, Wilson, Benbow, Hood 1981 [QP518.5 B56]

Aug 30-Sep 3	1:Universal features of cells on Earth, cell types, 2: acid/base chemistry	Ch 1-3, 5 WWBH:1
Sep 6	Labor Day-no class	
Sep 8	3:amino acids	Ch 2-4, 7 *WWBH:2-3*
Sep 10	No class (Eid Ul-Fitr)	
Sep 13,15,17	4:Amino acid chemistry, protein structure, 5:peptide digests, peptide synthesis, 6:protein purification	Ch 2-4, 7 *WWBH:2-3*
Sep 20,22,24	7,8:More protein purification,9:electrophoresis, structure	Ch 6, 8-10 *WWBH:4*
Sep 27, 29, Oct. 1	10,11,12: Protein structure	Ch 8-10 *WWBH:4*
Oct 4	**EXAM 1**	
Oct 6, 8	13,14: Enzymes Kinetics, Michaelis-Menten	Ch 13-15 *WWBH:7-8*
Oct. 11, 13	15, 16: Enzymes Kinetics, Michaelis-Menten	Ch 13-15 *WWBH:7-8*
Oct. 15	Guest lecture from Professor Don Bryant	
Oct 18, 20	17, 18, 19: Michaelis-Menten, Enzyme mechanisms	Ch 13-15
Oct. 22	**EXAM 2**	
Oct. 25, 27, 29	20: Metabolism and Thermodynamics, 21: Glycolysis,	Ch 16, 17 *WWBH:9-10*
Nov 1, 3, 5	22: Glycolysis, 23: Fermentation (anaerobic metabolism), 24: Gluconeogenesis	Ch 23 *WWBH:15*
Nov 8, 10, 12	25: glycogen, pentose phosphate pathway 26,27: citric acid cycle	Ch 23, 21 *WWBH:12*
Nov 15, 17, 21	28, 29, 30: electron transport, oxidative phosphorylation	Ch 22 *WWBH:12,14*
Nov 22	**EXAM 3**	
Nov 24-26	Thanksgiving break	
Nov 29, Dec 1, 3	31,32: Fatty acids/cholesterol, membranes, 33: membranes, beta oxidation	Ch 12, 25 *WWBH:11, 16*
Dec 6, 8	34: more fatty acid breakdown 35: Ketone bodies,	Ch 25
Dec 10	**EXAM 4**	

Graduate course descriptions

FCH530 – Biochemistry I

This course covers the following topics over approximately 15 weeks:
Features of various cell types (bacteria, animal, plant cells). Covers cell architecture similarities and differences, basic chemical building blocks for living cells.

A review of acid-base chemistry including pH and pKa concepts important for determining charge states of amino acids and purification of peptides.

Amino acid chemistry: stereochemistry, peptide bonds, etc. Methods for analysis of protein purification are also covered and include SDS-PAGE, isoelectric focusing, methods for making antibodies, and Western Blot analysis. In addition, reactions for protecting amino and carboxylic acid groups are covered useful for chemical peptide synthesis. A summary of mass spectroscopy techniques used for peptide analysis and the chemical synthesis of polypeptides is covered.

Protein purification: biochemical methods for protein purification including salting in and salting out of proteins, various liquid chromatography techniques (cation and anion exchange chromatography, size exclusion chromatography, hydrophobic interaction chromatography, affinity chromatography, etc.).

Protein structure: covers primary, secondary, tertiary and quaternary structure. Ramachandran charts and their relationship to protein structure are covered. Secondary structure motifs are covered in detail including alpha helices, beta sheets, and omega loops. X-ray diffraction analysis for protein structure is also discussed.

Enzyme kinetics: Michaelis-Menten kinetics are discussed in detail (K_M, k_{cat}, v_{max}). Experimental design for measuring enzymes kinetics and linear conversions of Michaelis-Menten are also covered. These include Eadie-Hofstee and Hanes-Wilkinson plots. In addition, competitive, noncompetitive, and uncompetitive inhibition and derivations are discussed. Allosterism and its relationship to kinetics as well as mechanisms are also discussed.

Metabolism and thermodynamics: a primer on metabolic pathways and regulation, feedforward activation, feedback inhibition, and thermodynamics and difference between steady state and equilibrium in metabolic pathways. We also cover basic metabolic pathways such as glycolysis, fermentation and anaerobic metabolism (lactic acid, ethanol, and mixed acid production), gluconeogenesis, glycogen synthesis, pentose phosphate pathway, citric acid cycle, electron transport, oxidative phosphorylation, fatty acid synthesis, membrane topology, beta oxidation, and ketone bodies. Mechanisms of several enzymes are studied in detail.