Chemistry 491/591
Biochemistry
Winter 2014

Meeting Time:  MWF, 11:30 -12:35 PM, Cramer 53
Instructor: Dr John Perona
Office: SRTC 414
Office Hrs: W 10-11:30 AM

Tutor room biochemistry expertise: Emil Nilsson, Mon 10-12; Wed 4 -6


Exams and Grading: There will be 2 closed-book midterm exams worth 25% each and a closed-book, comprehensive final exam worth 50% of the grade. Exam questions will focus primarily on material covered in the lectures. There will be no make-up exams given for the midterms. Missing a midterm exam with giving of appropriate notice (physician’s note or serious close family emergency) will result in proportionately greater weight placed on the final examination. Each exam is preceded by a review session with no new material presented.

Studying: Most students find this to be a challenging course, and the material forms a critical part of your professional education in Biochemistry. Keeping up with the reading is essential. Additional suggested strategies: (i) read the relevant textbook material BEFORE the lecture is given; (ii) print out the annotated transparencies available on-line, and use them in note-taking during class; (iii) make use of my office hours and the tutoring hours; (iv) synthesize your own ongoing outline of the material based on your personal class notes, transparencies presented in class, and the textbook – and use this outline to study from; (v) practice writing structures and pathways until they are routine.

Suggested problems are recommended as they can provide a different perspective on the material. Answers to suggested problems will be posted on line before each exam.

Learning Aids: bcs.whfreeman.com/lehninger6e/ Midterms and final exam from an earlier version of this class, including answers, will be available on line.

Required background: 491 builds on the information base presented in 490. It is expected that you know structures of all the amino acids, the common protein structure motifs, the structures of the building blocks of nucleic acids, simple and complex carbohydrates, and lipids, and some elementary aspects of biosignaling. Good knowledge of chemical kinetics and thermodynamics (Freshman Chemistry level), and some aspects of organic mechanisms, are also presumed.


Graduate Students: For those enrolled in 591, there will be additional readings from the literature and three short written papers due based on these research papers.
Syllabus

Part I. Enzymes, bioenergetics, and metabolic principles.
January 6 Introduction to enzymes and catalytic power. Reading: pp 189-200, 219-220
January 8 Enzyme kinetics. Reading: pp 200-213
January 10 Regulatory control; classes of reactions Reading: pp 226-236; 511-517
January 13 Enzyme mechanisms. Reading: pp 213-220
January 15 Bioenergetics: Free-energies, phosphoryl transfer. Reading: pp 501-511; 517-524
January 20 MLK Holiday – no class

Part II. Metabolic pathways and regulation
January 22 Pathway of glycolysis. Reading: pp 543-558
January 24 Glycolysis: Feeder pathways. Anaerobic fermentation. Reading: pp 558-568
January 27 Review for Midterm I
January 29 Midterm I: Chapters 6 and 13; Chapter 14 (glycolysis only)
Suggested problems for midterm I: Chapter 6: 2, 5, 6, 8, 11, 13, 15;
Chapter 13: 2, 3, 5, 11, 13, 23, 24; Chapter 14: 1, 2, 6, 11

January 31 Pentose phosphate pathway. PDH. Reading: pp 575-580; 633-638
February 3 Citric acid cycle. Reading: pp 638-653
February 5 Gluconeogenesis and glycogen metabolism. Reading: pp 568-575; 612-620
February 7 Principles of metabolic regulation. Reading: pp 587-601
February 10 Regulation of glycolytic flux. Reading: pp 601-612; review 433-453; 453-458
February 12 Regulation of glycogen storage and breakdown. Reading: pp 620-627; 460-463
February 14 Regulation of citric acid cycle; glyoxylate cycle. Reading: pp 653-659
February 17 Integration of nitrogen and carbon metabolism. Reading: pp. 695-709
February 19 Fat mobilization and fatty acid oxidation. Reading: pp. 667-679
February 21 Aspects of lipid biosynthesis. Reading: pp 833-848; 859-864
February 24 Review for Midterm II
February 26 Midterm II: Chapters 14 (all), 15, 16, 17, 18, 21
Suggested problems for midterm II: Chapter 14: 20, 26; Chapter 15: 1, 2, 4; Chapter 16: 1, 2, 3, 5, 10, 18; Chapter 17: 3, 10, 22; Chapter 18: 1, 3, 5, 15 Chapter 21: 2, 3

Part III. Nitrogen cycle, oxidative phosphorylation and photosynthesis.
March 1 Nitrogen cycle and overview of nitrogen metabolism. Reading: pp. 881-891
March 3 Electron transfer and generation of H⁺ gradient. Reading: pp 731-747
March 5 ATP synthesis and regulation. Reading: pp 747-762
March 7 Photosynthesis – light reactions Reading: pp 769-776
March 10 Light reactions (continued). Photophosphorylation. Reading: pp 776-791
March 12 Carbon fixation and photorespiration. Reading: pp 799-818
March 14 Completion and review for final exam
Suggested problems: Chapter 19: 1, 3, 10; Chapter 20: 7; Chapter 22: 2,9