Topics for the final exam: Chem142A (Kahn, Fall 2007) Thursday Dec 13, 4 – 7 PM

Large portion of questions on the final will test your understanding of material from all the chapters covered in this course. Below are topics that you should study well in addition to these that were coved in the two midterms.

Chapter 8. You should be familiar with everything that was covered in the lecture. Biochem majors might enjoy reading about DNA sequencing and DNA synthesis. Overall, this is a really important chapter, partially because biochem majors need to know this material for Chem142C. Make sure that you know all about:

- Functions of various nucleotides and nucleic acids
- Structures of ribose and deoxyribose (ring forms)
- Structures and H-bonding properties of five nucleobases: A, C, G, T, and U
- Nomenclature of nucleosides and nucleotides
- Functional significance of minor nucleosides in bacterial and eukaryotic DNA
- Covalent structure of DNA and RNA (e.g. "write complete chemical structure of a messenger RNA that that has the sequence AUGUC")
- Stability and hydrolysis of DNA and RNA
- Structure of DNA base pairs
- Experiments that lead to the identification of DNA as the genetic material
- Interpretation of data that lead to the determination of DNA structure
- Structure and molecular interactions that stabilize the B-form of DNA
- Chemical basis of inheritance: semi-conservative replication of DNA
- Palindromic sequences and hairpin structures
- Biological function of telomeres and of telomerase
- Structural and functional differences between mRNA, tRNA and rRNA
- DNA denaturation and experimental means to study this process
- Application of hybridization phenomenon in molecular biology & forensics
- Mechanisms of mutagenesis

Chapter 9. You need to know the concepts that we covered in the lecture. The textbook is much more detailed and comprehensive than the lecture; biochem majors are encouraged to read this material. The important concepts to understand are:

- What is recombinant DNA, recombinant organism
- DNA Cloning: why and what are the basic steps
- Use of restriction endonucleases in cloning
- Use of antibiotics to select transformed cells
- Characteristics of cloning and expression vectors
- Detection of specific nucleic acid sequences
- Polymerase chain reaction: principles and applications
- How to separate DNA molecules according to their size or shape
- How to clone eukaryotic genes,
- What is cDNA?
- Working principle of DNA microarrays
- Application of DNA microarrays for confirming the presence of specific mRNA-s
- Application of DNA microarrays for comparing mRNA expression levels
- Benefits, drawbacks, and ethical implications of artificially generated organisms

Chapter 10. Be familiar with various functions lipids play in the organism, as well as basic structures of fats and phospholipids. However, we will go light on detailed chemical structures of most lipids. Biochem majors should be well familiar with the material on pages 356-366, but details of these topics will not be tested. So, be prepared to answer questions about:

- Functions of lipids, with examples and explanations
- Physical and chemical properties of fatty acids, fats, and waxes
- General structure of saturated and unsaturated fatty acids
- General structure of cis and trans fatty acids
- Structures of palmitic, stearic, and oleic acid
- Structures of glycerol and triacylgerols
- General structure of glycerophospholipids
- General structure of sphingolipids
- Structural determinants of blood groups
- Structure of cholesterol, general structure of steroids
- Biological function of sterols and steroids

Chapter 11. We focus on the structure, function and main properties of membranes and membrane proteins. Material from pg 392-416 of the textbook (specific transporters) is recommended reading for biochem majors but will not be on the test. Know all about:

- General structure of membranes, vesicles and micelles
- Biological roles of membranes and membrane proteins
- Chemical composition and physical properties of membranes
- Unique features of archeabacterial membranes
- Modulation of membrane rigidity by its composition
- Integral and peripheral membrane proteins
- Anchoring of proteins to the membrane: general principles
- Anchoring of proteins to the cytoplasmic side via C-terminal farnesylation
- Dynamics of lipids in the membrane
- Fluorescence recovery after photobleaching
- Membrane rafts
- Different examples of membrane fusion
- Structure/function of nerve cells
- Protein-mediates membrane fusion during neurotransmitter release
- Simple diffusion vs. facilitated diffusion

Chapter 12. We will make only a brief survey of this chapter with the goal of learning the basics of signal transduction. You need to know the general features of three examples given below but do not need to memorize names and roles of each player in these rather complex cascades. It will be helpful to focus on:

- Common biological signals and responses
- Four main features of signal-transducing systems (specificity, amplification, desensitization, and integration)
- Experimental study of receptor-ligand equilibrium; effect of nonspecific binding
- Signaling via gated ion channels: nicotinic acetylcholine receptor
- Signaling via receptor enzymes: regulation of gene expression by insulin via MAPK cascade (at the level of the general idea, no details)
- Signaling via serpentine receptors: transduction of the epinephrine signal to produce second messenger cAMP (understand the role of G proteins)