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# *INTRODUCTION TO BIOCHEMISTRY*
# CHEM 3653, Spring 2013

## Midterm Study Guide

Chemistry of Life:

- Cell composition: elements, functional groups, macromolecules, organelles
- Stabilizing forces, functional groups
- Phylogenetic tree, organization, principles of evolution

Thermodynamics:

- Driving forces in chemical reactions: Entropy and Enthalpy, predicting entropy and enthalpy change in molecular transformations
- Melting temperature and spontaneity of reactions
- Free energy, equilibrium constant and reaction quotient
- Coupled reactions, control of direction of the reaction
- Biochemical standard state

Water structure and properties

- Hydrophobic and solvation forces
- Membranes and detergents
- Ionization equilibria: weak acids and bases, buffers, titration curves, charge changes vs. pH

DNA structure and central dogma

- DNA/RNA bases and nucleotides
- Watson-Creek base-pairing, complementarity and dsDNA structure
- DNA/RNA melting/reannealing
- Secondary structures in ssDNA/RNA
- Central dogma and flow of genetic information

Protein structure:

- Amino acids, structure, properties, code, unnatural amino acids
- Peptide bonds, structure, formation and cleavage, deducing peptide sequence, sequence alignment, similar and non-similar amino acids, homology, phylogenetic tree

Secondary structure: Ramachadran plot, α-helix, β-sheet, shape and dimensions, coiled coils, topology diagrams, triple helix, crosslinks, hydrogen bonding

Tertiary structure: stabilizing forces, properties of amino acids and probable location within proteins and various interfaces, conservative and non-conservative substitutions, Levinthal paradox, folding pathway, chaperons, human disease

Quaternary interactions: symmetry groups, lingo

Hemoglobin/myoglobin

Structure, function, composition, heme, iron, oxygen binding site, toxins, oxygen binding curves, $K_D$, transport efficiency, Hill coefficient

Bohr effect, BPG, γ-globin, structural basis for cooperativity, Bohr effect etc., titration curves, T- and R- conformations

Hb and human disease

Enzyme catalysis

Properties of enzyme catalysis: rate acceleration, specificity, chirality, cofactors, enzyme classification

Transition state theory and diagrams, binding to transition state

Kinds of catalysis: chemistry and mechanism, examples, possible catalytic groups

Mechanism of lysozyme and serin proteases