**The Chemistry of Life**

Chemistry 180

Section: D100

Term: 2009 Fall

Instructor: Dr. David Vocadlo

Discussion Topics: 1. To give engineering students who have taken CHEM 121-4 General Chemistry and Laboratory I sufficient background to enter KIN 208-3 Introduction to Physiological Systems.
2. To give science or engineering students who have CHEM 121, but no background in biology, a basic understanding of central concepts of bioorganic chemistry and biochemistry.

Outline: Topics

1. Organic Molecules ( 3 Lectures)
   - Drawing organic molecules
   - Geometry of bonds and bond lengths
   - Hydrogen Bonds
   - Electrostatic interactions
   - Hydrophobic interactions

2. Thermodynamics ( 4 Lectures)
   - Three laws, definitions
   - Entropy
   - Enthalpy
   - Gibbs free energy, spontaneity

2. Chemical Equilibria and Acids/Bases ( 5 Lectures)
   - Le Chatelier’s principle
   - Kw, Keq, pH, pKa
   - Henderson-Hasselbach Equation
   - Titration curves
   - Ionization of amino acid residues

4. Chemical Kinetics ( 5 Lectures)
   - Reaction coordinate diagrams
   - Basic rate equations
   - Reaction order
   - Catalysts (enzymes)

6. Intoduction to Biomolecules ( 5 Lectures)
   - Compartmentalization
   - Functional localization of Biomolecules

7. Central Dogma of Molecular Biology ( 4 Lectures)
   - Structure of cells
   - Flow of information in central dogma
   - Location and significance of molecules
   - Enzymes involved

8. Nervous System ( 9 Lectures) (Integrated Topics)
   - Electrochemistry overview
   - Oxidation and reduction
   - Potential difference / membrane potential
   - Nernst equation
   - Neuron cell structure
   - Synaptic structure
   - Saltatory transmission
   - Action potentials
   - Ion channels
   - Chemical Neurotransmitters (Acetylcholine)
   - Acetylcholinesterase

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- Localization
- Enzyme mechanism
- Enzyme kinetics
- Diffusion limit
- Enzyme inhibition
- Kinesin
  - Microtubules
  - Conformational changes
  - Proteins as machines that perform work

Grading: Problem Sets 25%; Midterm Exam 30%; Final Exam 45%

Required Texts: None

Recommended Texts: Charlotte Pratt and Kathleen Cornely, Essential Biochemistry, Wiley, 2004.
Extended Readings
D. Voet and J.G. Voet, Biochemistry, Wiley, New York, 1990.
B. Alberts et al., The Molecular Biology of the Cell, Garland Pub., New York, 1983.
H. Lodish et al., Molecular Cell Biology, Scientific American Books, 2000.

Materials/Supplies: Calculator.

Prerequisite/Corequisite: Prerequisite/corequisite: prerequisite CHEM 121-4.

Notes: Notes are provided in class.
Lectures allocated to each topic are an estimate and may vary slightly.