

BCH 4053—Spring 2001—Chapter 1 Lecture Notes

Slide
1

Syllabus Information

- Course Description
- Prerequisites
- Grading
 - Three hour tests
 - Final exam
 - Optional web tests
 - Group problems
- Email communication
- Class Web Page
- Study Suggestions

Slide
2

Review

- Organic Functional Groups
- General Chemistry Concepts and Calculations
 - Stoichiometry
 - Acid-Base, pH
 - Thermodynamics; Free Energy and Entropy
- Biology
 - Cell Structure

Slide
3

Biochemistry

- Explain Life with chemical and physical principles
 - composition
 - reactions
 - interactions and regulation
 - energy flow
 - information flow
 - NO VITAL FORCE
 - Unity principle

Slide
4

Biochemistry

- 20TH Century Science
 - 1894 Emil Fisher—Enzymes
 - 1897 Buchner Brothers—Zymase
 - 1926 Sumner crystallization of urease identifying enzymes as proteins
 - First half of century—structure and reactions
 - isolation and structure of cellular constituents
 - vitamins
 - major metabolic pathways

Slide
5

Biochemistry, con't.

- Middle of century merging with genetics
 - Garrod—alkaptonuria—inherited diseases
 - Beadle and Tatum—mutations = loss of enzyme
 - Ingram 1956 showed sickle cell Hemoglobin was different by only 1 AA
 - Identification of DNA as genetic material (Watson and Crick)

Slide
6

Biochemistry, con't

- Latter part of century—technology developments
 - Development of x-ray crystallography, and structure determination of macromolecules
 - Sequencing proteins and nucleic acids
 - Recombinant DNA technology

Slide
7

Chapter One Topics to Review

Slide
8

Properties of Living Systems

- complicated and highly organized
- functional role of biological structures
- energy flow through living systems
 - order at the expense of energy—steady state
- self replication through structural complementarity

Slide
9

Biomolecules

- Elemental composition
- Versatility of Carbon
- Biomolecular Hierarchy
 - monomer→polymer→supramolecular structure
 - directional sense of building blocks
- Molecular and Cellular Dimensions
 - Table 1.2
 - Figure 1.8
- Membranes

Slide
10

Weak Chemical Forces non covalent bonds

- Van der Waals forces (0.4-4 kJ/mol)
 - dipole-dipole ($1/r^3$ dependance of energy)
 - dipole-induced dipole ($1/r^5$ dependance of energy)
 - induced dipole-induced dipole (dispersion) ($1/r^6$ dependance of energy)
 - repulsive forces at close distance ($1/r^{12}$ dependance of energy) (see Figure 1.13)

Slide
11

Weak Chemical Forces non covalent bonds con't.

- Hydrogen bonds (12-30 kJ/mol)
 - Between F, O, and N (see Figure 1.14)
- Ionic (coulombic) interaction (20 kJ/mol)
 - $F = q_1 q_2 / Dr^2$, where D is dielectric constant
 - Energy falls off as $1/r$
- Hydrophobic interactions (<40 kJ/mol)

Slide
12

Biomolecular Interactions and Recognition

- Sum of many weak interactions
- Complementarity of interacting structures
- Narrow range of environmental conditions

Slide
13

Metabolism

- Totality of chemical reactions occurring in the cell
- Reactions catalyzed by enzymes
 - Recent exception—RNA catalyzed reactions

Slide
14

Organization and Structure of Cells

- Prokaryotic cell (eubacteria, archaebacteria)
(Fig. 1.21)
- Eukaryotic cells
 - Animal cell (Fig. 1.22)
 - Plant cell (Fig. 1.23)
- Viruses (Fig. 1.25)