

Review I (Biochemistry I, January 29, 2010)

Chapter 1. Introduction to Biochemistry

Central Dogma and chemical bonds in Biochemistry

Thermodynamics

Henderson-Hasselbalch equation ($\text{pH} = \text{pK}_a + \log\frac{[\text{B}^-]}{[\text{HB}]}$)

Chapter 2. Protein structures and Functions

A). 20 amino acids (chemical structures and properties)

B). Beer's law

C). Protein primary structure

Definition, peptide bond, and other properties

D). Protein secondary structure

Definition, Peptide bonds; Ramachandran diagram; the alpha helix; the beta sheet; reverse turns and loops

E). Protein tertiary structure

Definition, properties & domains

F). Protein Quaternary structure

Definition and properties

G). Protein folding (Anfinsen's experiment; prion protein; Alzheimer disease)

4. Exploring proteins

Protein purification (salt out, dialysis, liquid chromatography (ion exchange, gel filtration, affinity, HPLC, and more)

SDS-polyacrylamide Gel electrophoresis

Ultracentrifugation

Determination of amino acid composition and sequence

Solid phase protein synthesis

Antibodies as an important tool in biochemistry (ELISA and Western blotting)

NMR spectroscopy and X-ray diffraction to determine the 3-D structures of proteins.

5. Nucleic Acids

Compositions of nucleic acids: DNA vs. RNA

Ribose vs. deoxyribose; bases; nucleoside and nucleotide; double stand vs. single strand; chemical structures.

Structure of double stranded DNA structure; properties of A, B. and Z-form DNA.

DNA semiconservative replication: Meselson & Stahl Experiment; chemical reaction

RNA: mRNA, tRNA, & rRNA; properties; RNA synthesis; promoters; terminators;

Genetic codon: properties & open reading frame

Intron vs exon: definition and properties.

6. Exploring gene

Restriction enzymes: definition and properties

Agarose gel electrophoresis

DNA sequencing: Sanger dideoxy method

Automated solid-phase DNA synthesis

Polymerase chain reaction (PCR): principle, components and applications

Recombinant DNA technology: ligation reaction, plasmid, lambda phage, genomic library, yeast artificial chromosome, transgenic mice, and more

Site-directed mutagenesis