I. Organic Molecules
   1) Carbohydrates
   2) Lipids
   3) Proteins
   4) Nucleic Acids

II. Bonding Behavior of Carbon Atoms
   • Outer shell of carbon has 4 electrons, but can hold 8 electrons
   • Each carbon atom can form covalent bonds:

III. Bonding Arrangements
   • Chains of carbon atoms form a linear or branched carbon backbone
   • Carbon Rings

IV. Hydrogen bonds can form
   • between atoms on different large molecules
   • between atoms within the same large molecule

V. Functional Groups
   •Atoms or clusters of atoms that are covalently bonded to carbon backbone
   •Give organic compounds their distinct properties

VI. Types of Reactions
   Functional group transfer
   Electron transfer
   Rearrangement
   Condensation
   Cleavage (e.g., hydrolysis)

VII. Carbohydrates
   CHO = 1:2:1 ratio
   Monosaccharides (simple sugars, monomer)
   Oligosaccharides (short-chain polymers)
   Polysaccharides (complex carbohydrates, long chain polymers)

VIII. Monosaccharides
   • Simplest carbohydrates (one unit = monomer)
   • Linear or ring form
   • Most are sweet tasting and water soluble

IX. Disaccharides
X. Polysaccharides
   • Straight or branched chains of sugar monomers
   • Most common forms are composed entirely of glucose: Cellulose, starch, glycogen

XI. Cellulose                Starch

XII. Glycogen
   • Sugar storage form in animals
   • Large stores in muscle and liver cells
   • When blood sugar decreases, enzymes in liver cells degrade glycogen, releasing glucose

XIII. Lipids
   • Most lipids include one or more fatty acids. These are:
     • Sterols and their derivatives have no fatty acids
     • Tend to be insoluble in water because they are hydrophobic.

XIV. Fatty Acids

XV. Fats

XVI. Phospholipids

XVII. Sterols and their Derivatives

XVIII. Waxes

XIX. Proteins

XX. Polypeptides
   • A polymer of amino acids linked by peptide bonds
   • Peptide bond:

XXI. Primary Structure of Proteins
   • Defined by amino acid sequence
   • Unique for each protein
   • Dipeptide = Two linked amino acids
   • Polypeptide = Three or more

XXII. Secondary Structure
XXIII. Tertiary Structure

XXIV. Quaternary Structure

XXV. Protein Shapes
  • Fibrous proteins
    – Polypeptide chains arranged as strands or sheets (e.g., Keratin, elastin, collagen, actin, myosin)
  • Globular proteins
    – Polypeptide chains folded into compact shapes (e.g., hemoglobin, enzymes, hormones)

XXVI. Polypeptides With Attached Organic Compounds
  • Lipoproteins: Proteins combined with cholesterol, triglycerides, phospholipid
  • Glycoproteins: Proteins combined with oligosaccharides

XXVII. Protein Denaturation
  • Disruption of three-dimensional shape
  • Causes of denaturation:
    • Destroying protein shape disrupts protein function

XXVIII. Nucleotides
  Composed of:

XXIX. Adenosine Triphosphate (ATP): A Nucleotide

XXX. Nucleotide Functions
  • Energy carriers (e.g., ATP, NADH, NADPH)
  • Coenzymes (e.g., Coenzyme A)
  • Chemical messengers (e.g., cAMP)
  • Building blocks for polymers (e.g., DNA, RNA)

XXXI. Four Nucleotides Are Found in DNA
  1.
  2.
  3.
  4.

XXXII. DNA
  • Deoxyribonucleic acid (deoxyribose = sugar in backbone)
  • Double-stranded twisted into a double helix
  • Nucleotide bases form hydrogen bonds between the two strands:
  • Serves as template for synthesis of proteins

XXXIII. RNA
  • Ribonucleic acid (ribose = sugar in backbone)
  • Usually occurs as a single strand
  • Four types of nitrogenous bases:
  • Three types of RNA are key players in protein synthesis: