

MOLECULAR CELL PHYSIOLOGY - Biological molecules

- I. Types of biological molecules
  - A. Inorganic - cofactors, catalysts, equilibria, etc., many participate as part of or with organic molecules
  - B. Organic - carbohydrates, lipids, proteins, nucleic acids, porphyrins, and secondary products
- II. Classification, structure, and function of major biological molecules
  - A. Carbohydrates
    - 1. Sugars and related compounds - ENERGY
      - a) Glucose & fructose
        - 1) Hexoses of central importance in cell metabolism
        - 2) Glucose is most commonly found in the dextrorotatory (D) form, as is the case with most other sugars except for fructose, which is often found as L-fructose
      - b) Sucrose - a disaccharide composed of glucose and fructose - major translocated carbohydrate in plants
      - c) Polysaccharides
        - 1) Starch - branched polymer of glucose
          - a) Amylose - linear polymer ( $\alpha$ -1,4)
          - b) Amylopectin - branched polymer ( $\alpha$ -1,6)
          - c) Easily hydrolyzed to glucose
          - d) Major storage carbohydrate
        - 2) Cellulose - linear polymer of glucose
          - a) Glucose units connected differently ( $\beta$ -1,4)
          - b) Difficult to hydrolyze
          - c) Structural carbohydrate (along with hemicellulose, {xylose, arabinose}, lignin {coniferyl, coumaryl, synapyl alcohols}, and pectin {galactose})
  - B. Lipids
    - 1. Glycerol and related compounds - FAT STORAGE, COATING, & MEMBRANES
      - a) Triglycerides (fat) - linoleic and linolenic acid
      - b) Coating (wax, cutin) - ester (RCOOR) of above with 20 - 28 carbons
      - c) Membranes (phospholipids) - fatty acid replaced by phosphate (hydrophilic & hydrophobic) membrane fluidity
      - d) Non-covalent bonds are critical in stabilizing biomembranes
      - e) Interspersion of cholesterol provides rigidity
  - C. Proteins
    - 1. Enzymes - CATALYZE REACTIONS; METABOLISM
      - a) Amino acids - from translation of RNA
      - b) All amino acids in nature are usually found in the levorotatory (L) form
      - c) Peptide bonds for peptides and eventually, proteins
  - D. Nucleic acids - GENETIC INFORMATION
    - 1. DNA: Adenine, guanine (purines), thymine, & cytosine (pyrimidines)
    - 2. RNA: Adenine, guanine (purines), uracil, & cytosine (pyrimidines)
  - E. Porphyrins
    - 1. Chlorophyll - PHOTOSYNTHESIS
      - a) absorb photons
      - b) transfer electron to acceptor - then photolysis to replace it
  - F. Secondary products
    - 1. Phenolics [free phenolics, flavonoids (including anthocyanins), tannins] - PIGMENTATION, RESISTANCE
    - 2. Steroids & terpenoids - SCENTS, RESISTANCE, (used by man for RUBBER)
    - 3. Alkaloids - RESISTANCE (used by man for DRUGS such as COCAINE, MORPHINE, etc.)