

**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 protolysis 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.)**