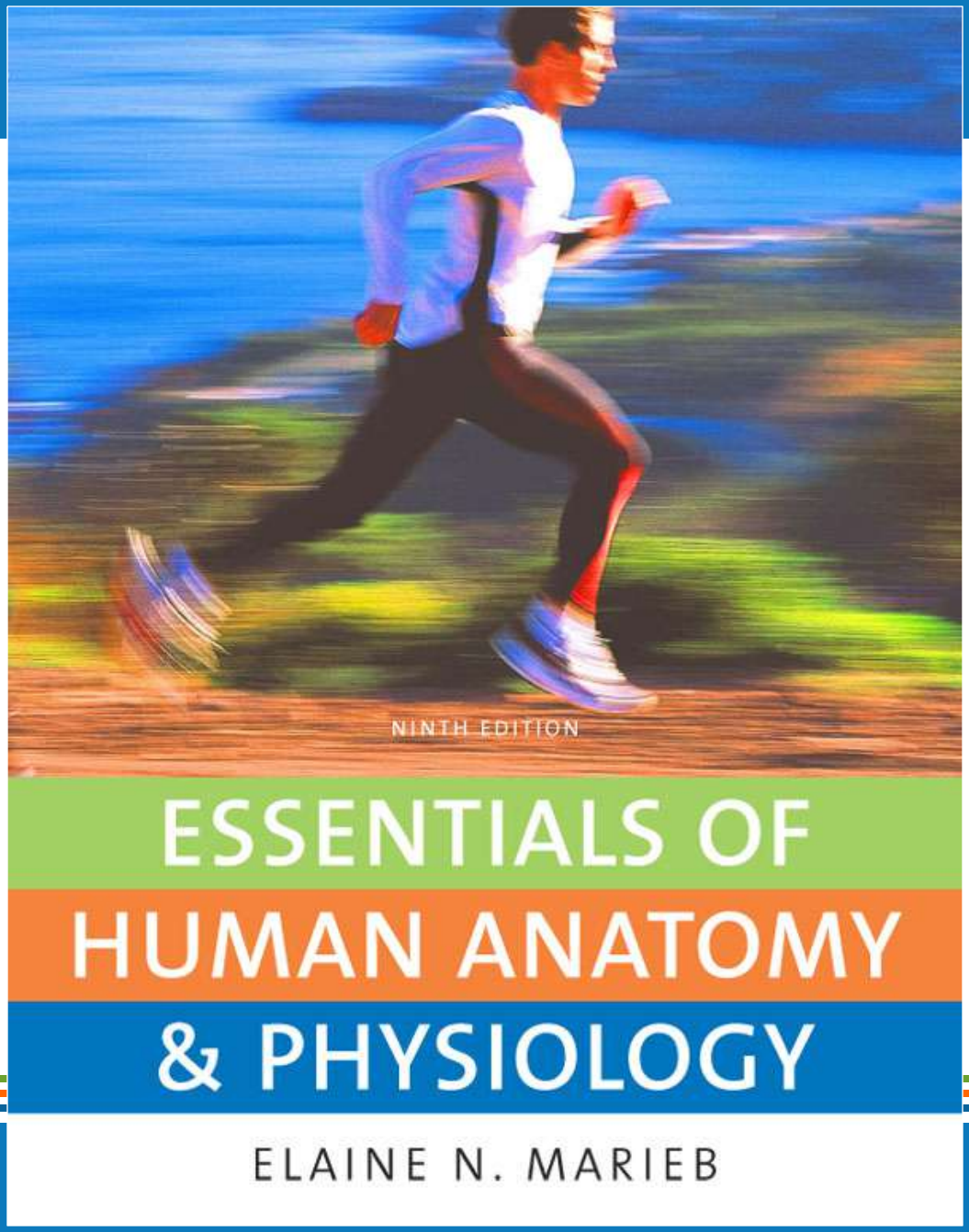


PowerPoint® Lecture Slide Presentation
by Patty Bostwick-Taylor,
Florence-Darlington Technical College

Basic Chemistry

2 PART B

Biochemistry: Essentials for Life

- **Organic compounds**
  - Contain carbon
  - Most are covalently bonded
  - Example: $C_6H_{12}O_6$ (glucose)
- **Inorganic compounds**
  - **Lack carbon**
  - **Tend to be simpler compounds**
  - **Example: H_2O (water)**

Important Inorganic Compounds

- Water
  - Most abundant inorganic compound
  - Vital properties
    - High heat capacity
    - Polarity/solvent properties
    - Chemical reactivity
    - Cushioning

Important Inorganic Compounds

- Salts
  - Easily dissociate into ions in the presence of water
  - Vital to many body functions
  - Include electrolytes which conduct electrical currents

Dissociation of a Salt in Water

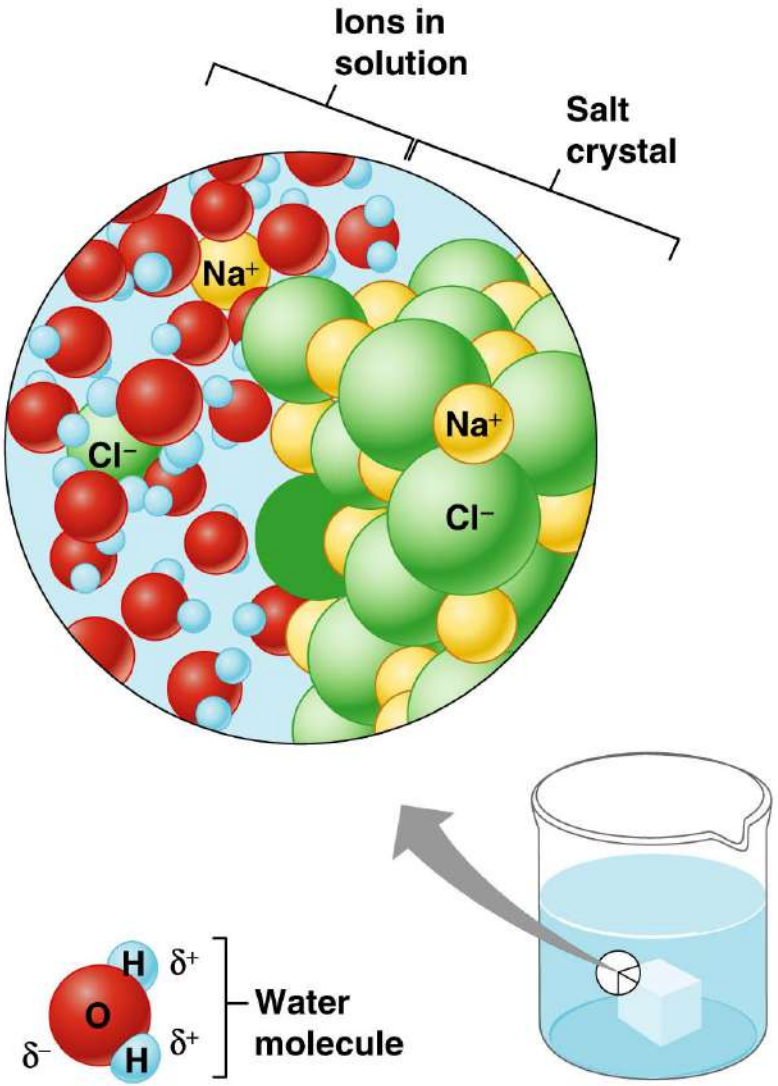


Figure 2.11

Important Inorganic Compounds

- **Acids**
  - Release hydrogen ions (H^+)
  - Are proton donors
- **Bases**
  - **Release hydroxyl ions (OH^-)**
  - **Are proton acceptors**
- **Neutralization reaction**
  - **Acids and bases react to form water and a salt**

pH

- Measures relative concentration of hydrogen ions
  - pH 7 = neutral
  - pH below 7 = acidic
  - pH above 7 = basic
  - Buffers—chemicals that can regulate pH change

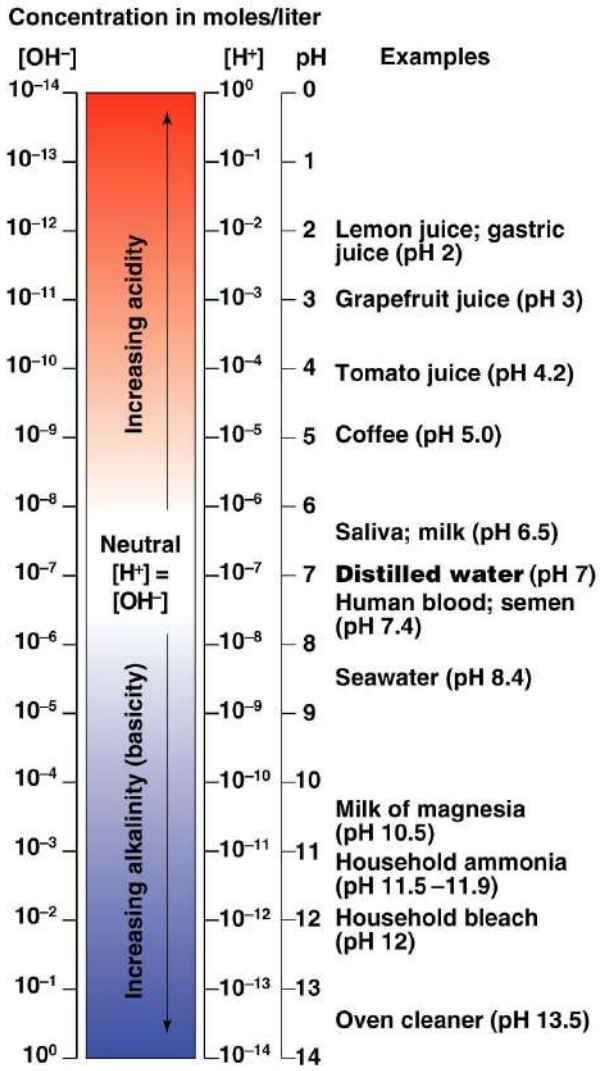
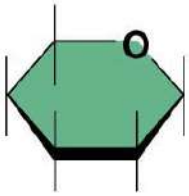


Figure 2.12

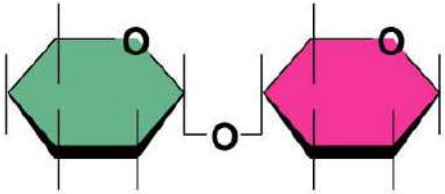
Important Organic Compounds

- Carbohydrates
  - Contain carbon, hydrogen, and oxygen
  - Include sugars and starches
  - Classified according to size
    - Monosaccharides—simple sugars
    - Disaccharides—two simple sugars joined by dehydration synthesis
    - Polysaccharides—long-branching chains of linked simple sugars

Carbohydrates



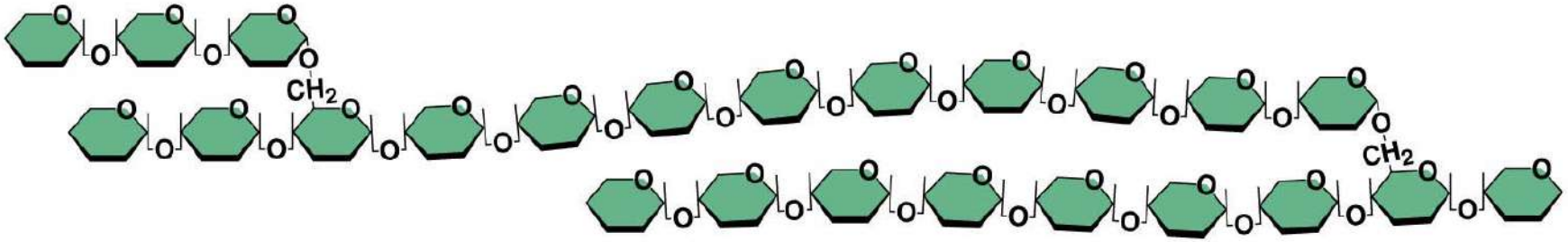
(a) Simple sugar (monosaccharide)



(b) Double sugar (disaccharide)

Figure 2.13a–b

Carbohydrates



(c) Starch (polysaccharide)

Figure 2.13c

Carbohydrates

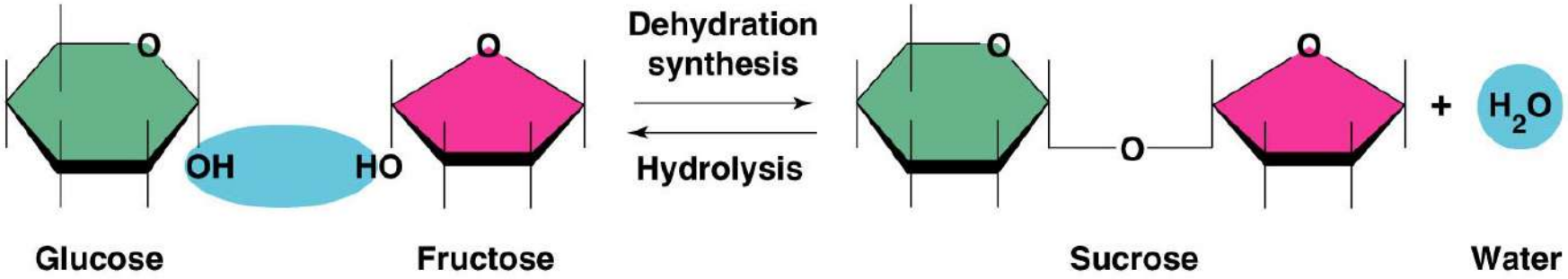


Figure 2.14

Important Organic Compounds

- Lipids
  - Contain carbon, hydrogen, and oxygen
    - Carbon and hydrogen outnumber oxygen
  - Insoluble in water

Lipids

- Common lipids in the human body
  - Neutral fats (triglycerides)
    - Found in fat deposits
    - Composed of fatty acids and glycerol
    - Source of stored energy

Lipids

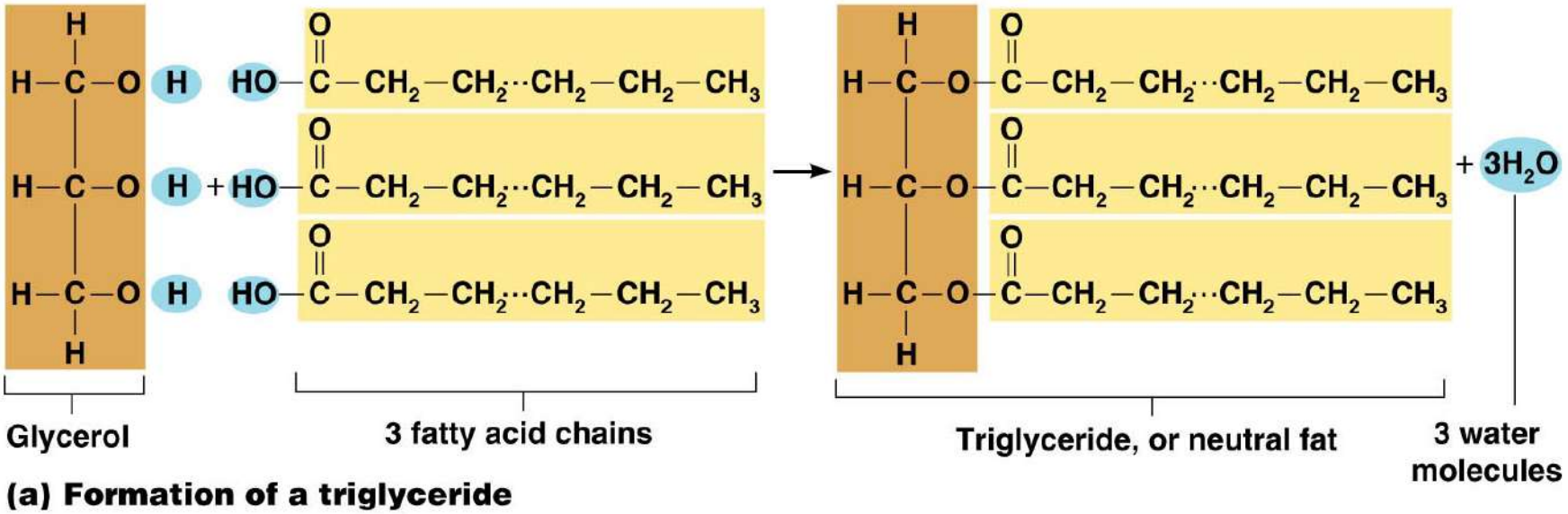
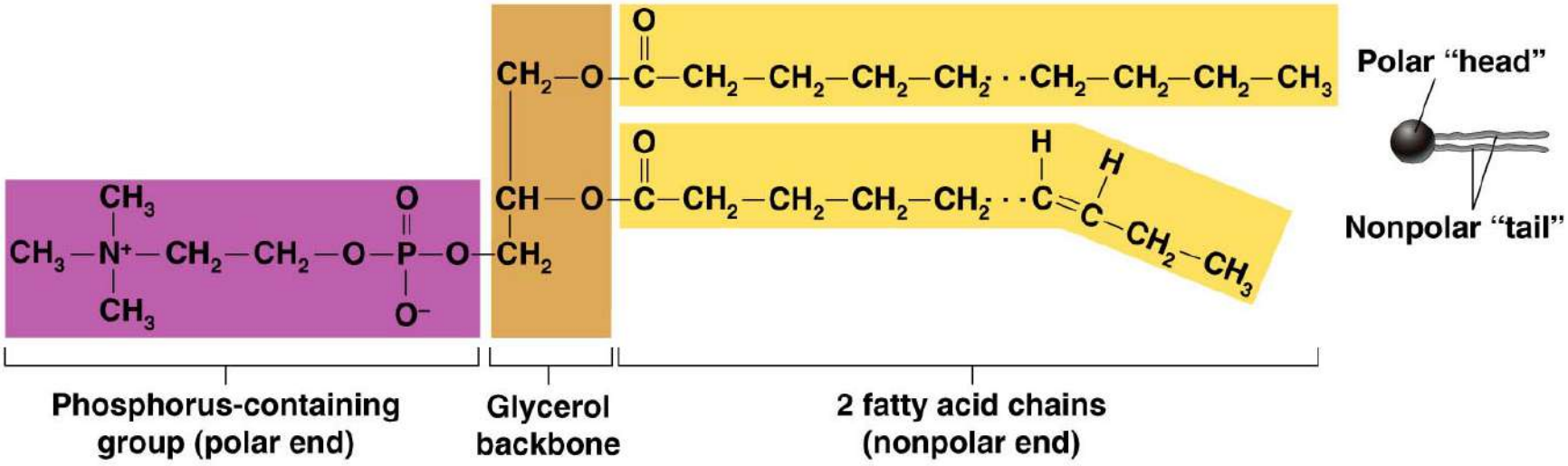


Figure 2.15a

Lipids

- Common lipids in the human body (continued)
  - Phospholipids
    - Form cell membranes
  - Steroids
    - Include cholesterol, bile salts, vitamin D, and some hormones

Lipids

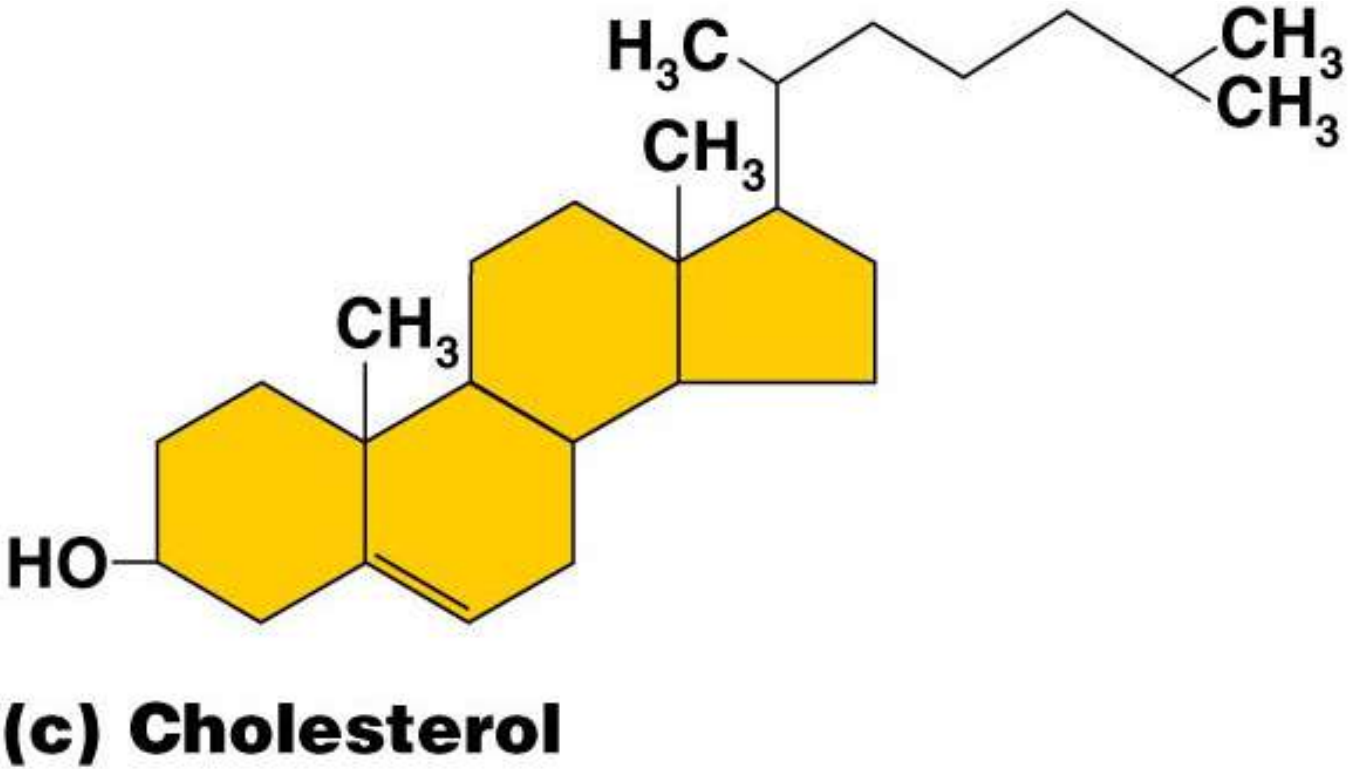


(b) Phospholipid molecule (phosphatidylcholine)

Figure 2.15b

Lipids

- Cholesterol
  - The basis for all steroids made in the body

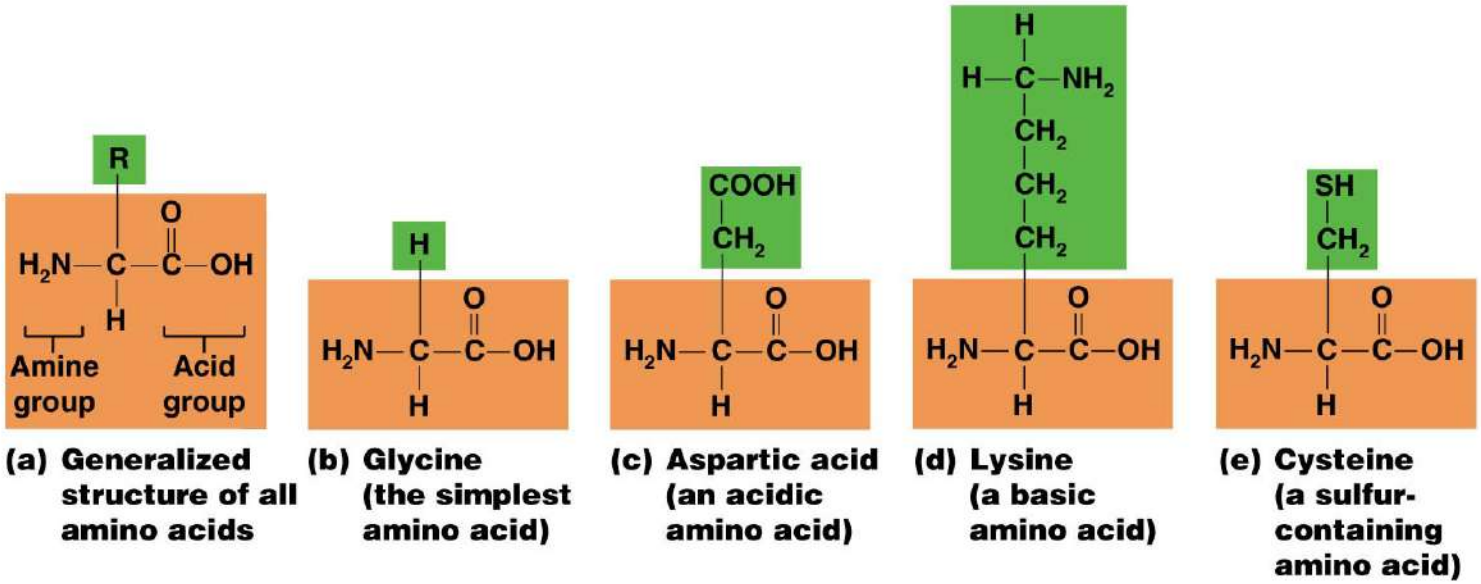


(c) Cholesterol

Figure 2.15c

Important Organic Compounds

- Proteins
  - Made of amino acids
    - Contain carbon, oxygen, hydrogen, nitrogen, and sometimes sulfur



(a) Generalized structure of all amino acids

(b) Glycine (the simplest amino acid)

(c) Aspartic acid (an acidic amino acid)

(d) Lysine (a basic amino acid)

(e) Cysteine (a sulfur-containing amino acid)

Figure 2.16

Proteins

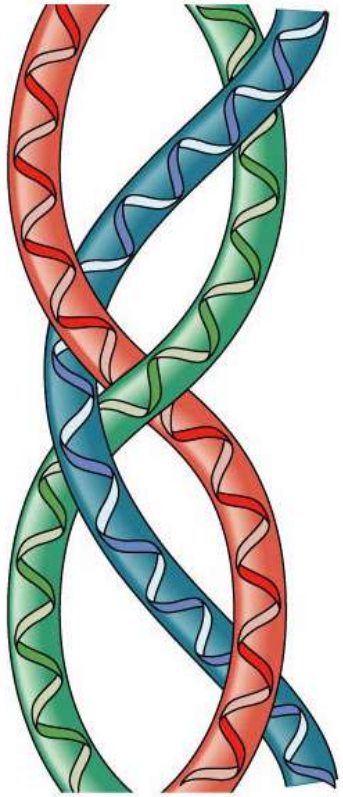
- **Account for over half of the body's organic matter**
  - Provide for construction materials for body tissues
  - Play a vital role in cell function
- **Act as enzymes, hormones, and antibodies**

Proteins

- Amino acid structure
  - Contain an amine group (NH_2)
  - Contain an acid group (COOH)
  - Vary only by R groups

Proteins

- Fibrous proteins
  - Also known as structural proteins
  - Appear in body structures
  - Examples include collagen and keratin
  - Stable

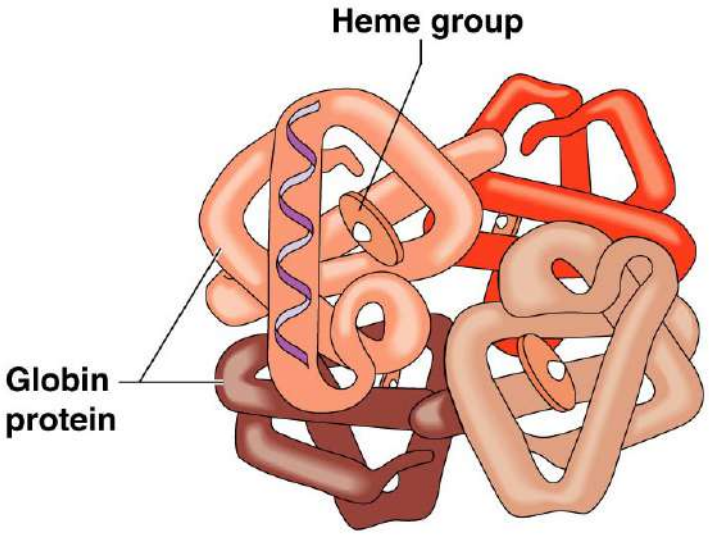


(a) Triple helix of collagen (a fibrous or structural protein).

Figure 2.17a

Proteins

- Globular proteins
  - Also known as functional proteins
  - Function as antibodies or enzymes
  - Can be denatured



(b) Hemoglobin molecule composed of the protein globin and attached heme groups. (Globin is a globular or functional protein.)

Figure 2.17b

Enzymes

- Act as biological catalysts
- Increase the rate of chemical reactions

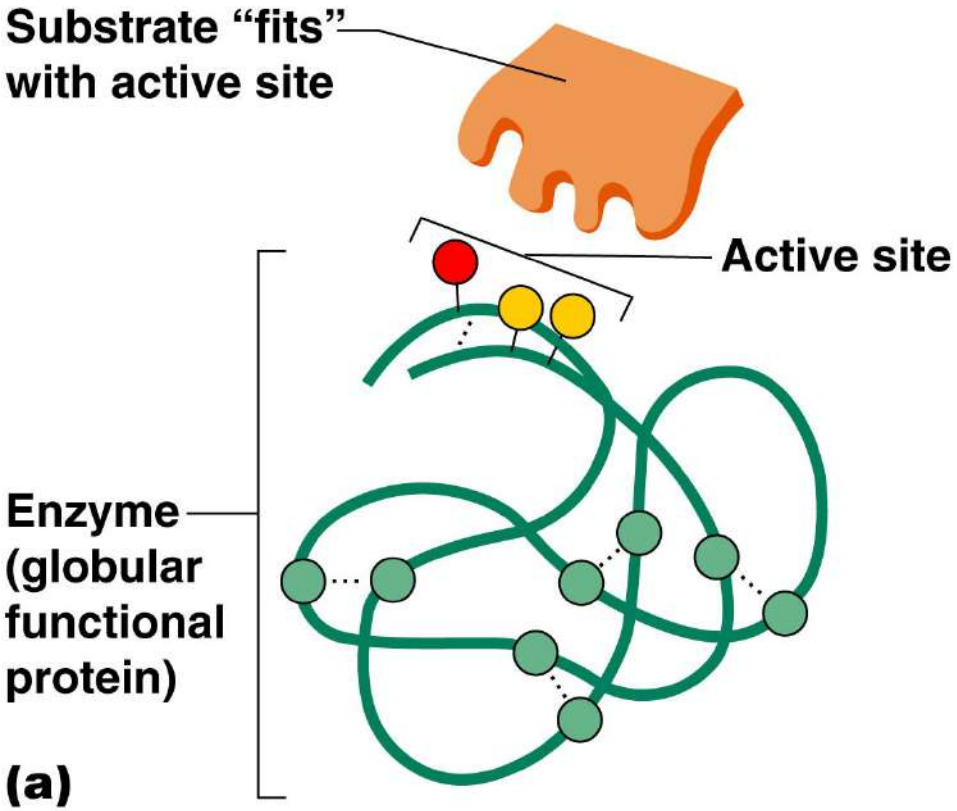


Figure 2.18a

Enzymes

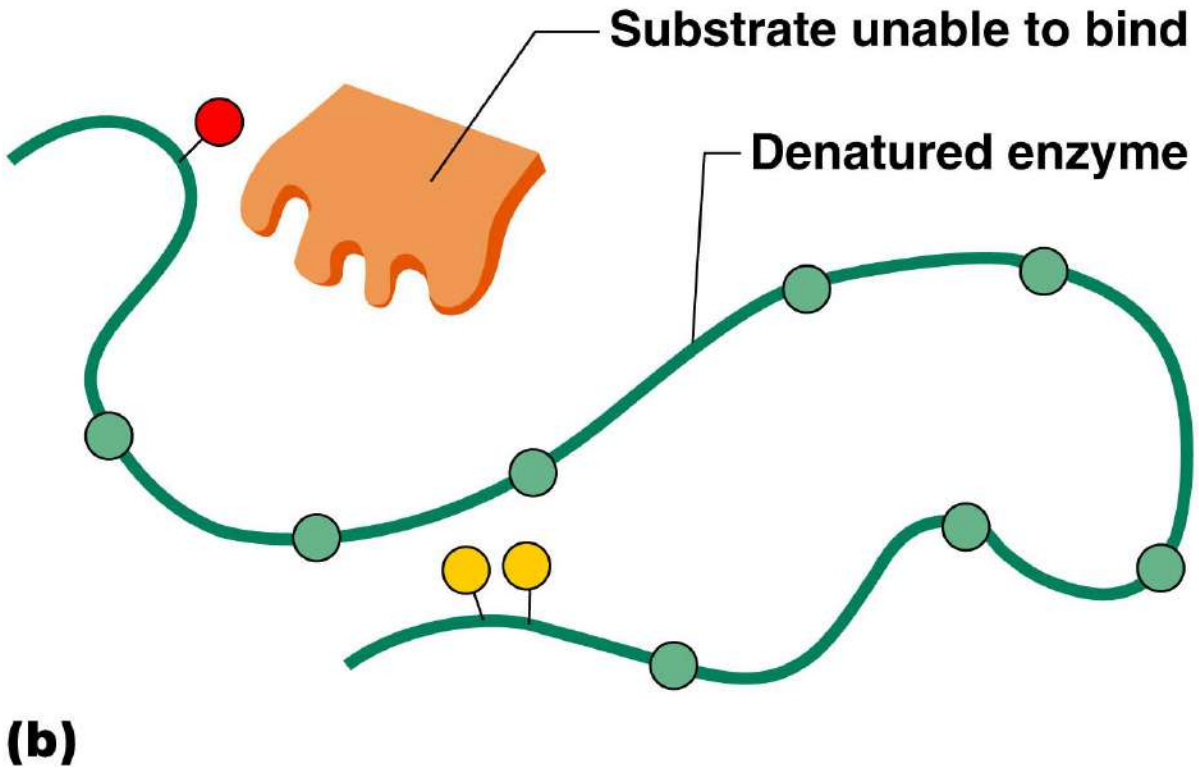
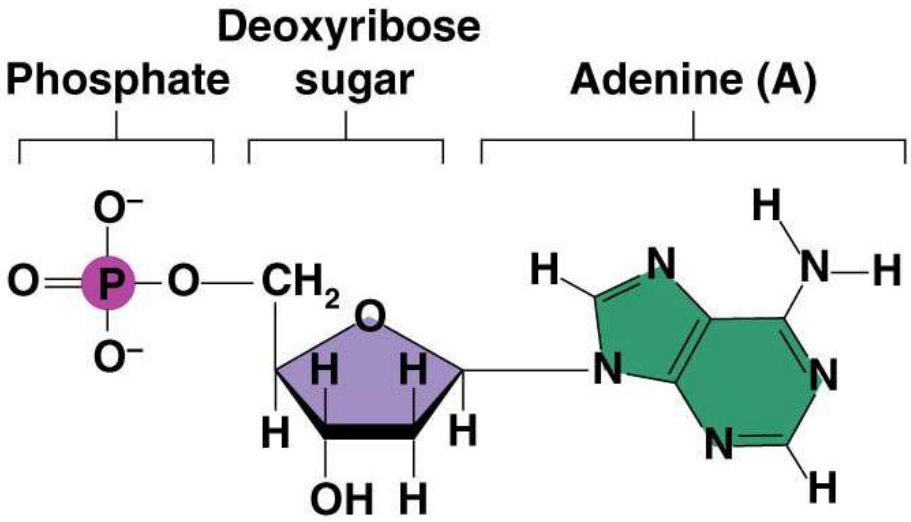


Figure 2.18b

Important Organic Compounds

- Nucleic Acids
  - Provide blueprint of life
  - Nucleotide bases
    - A = Adenine
    - G = Guanine
    - C = Cytosine
    - T = Thymine
    - U = Uracil
  - Make DNA and RNA

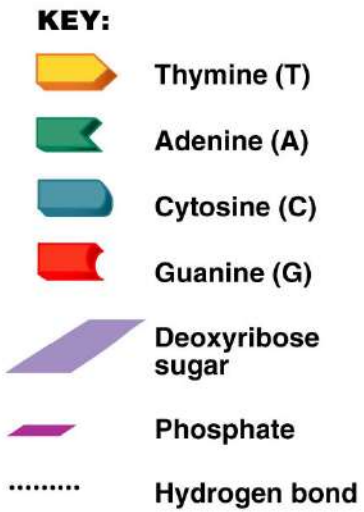


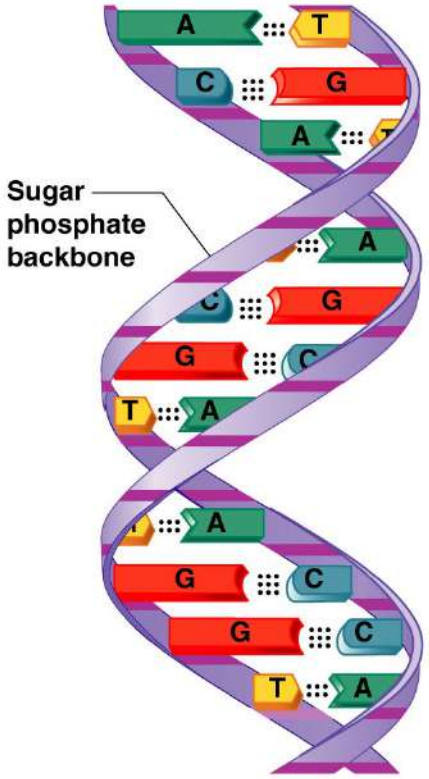
(a) Adenine nucleotide
(Chemical structure)

Figure 2.19a

Nucleic Acids

- Deoxyribonucleic acid (DNA)
  - Organized by complimentary bases to form double helix
  - Replicates before cell division
  - Provides instructions for every protein in the body





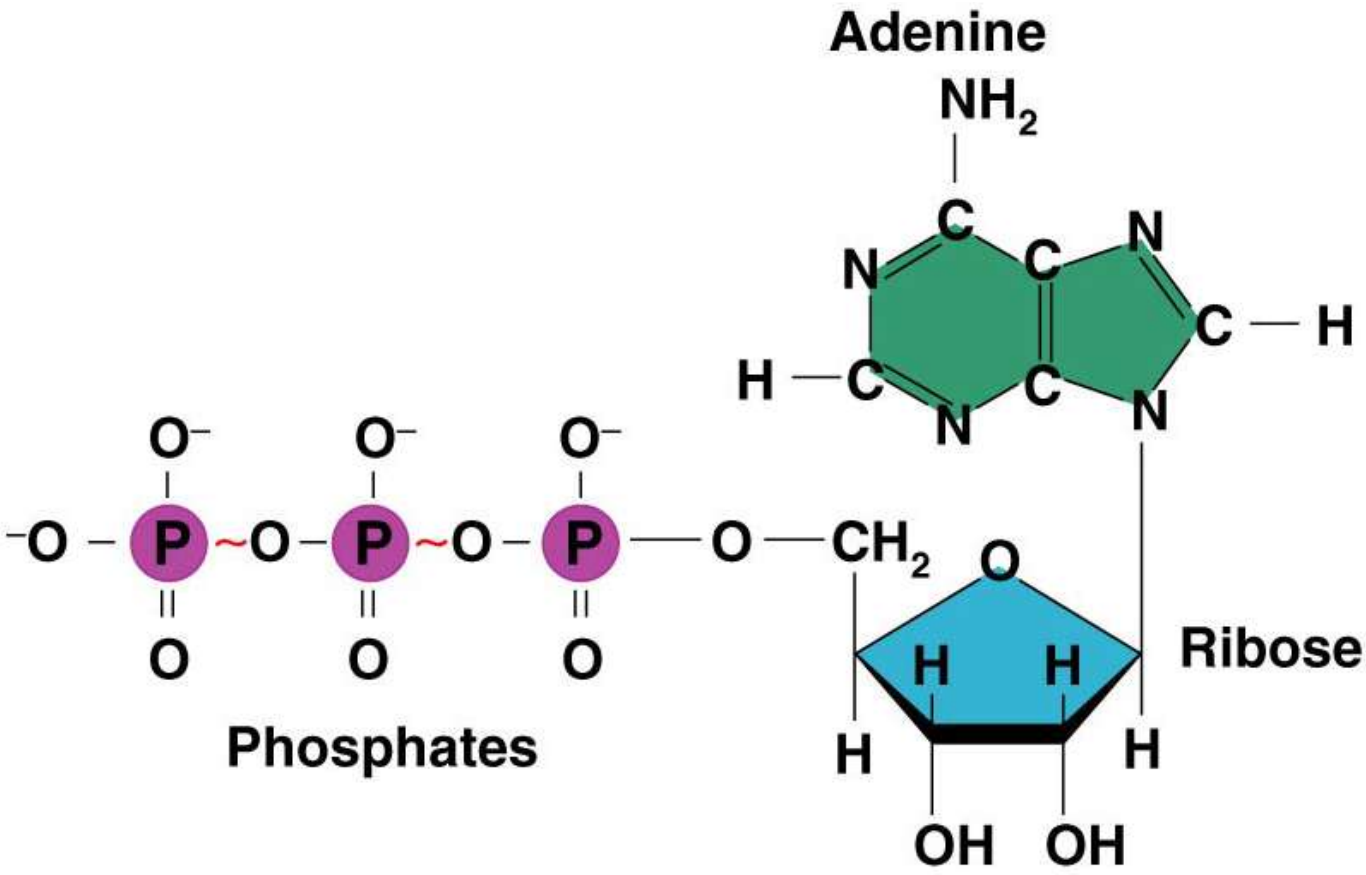
(c) DNA molecule

Figure 2.19c

Important Organic Compounds

- Adenosine triphosphate (ATP)
  - Chemical energy used by all cells
  - Energy is released by breaking high energy phosphate bond
  - ATP is replenished by oxidation of food fuels

Adenosine Triphosphate (ATP)



(a) Adenosine triphosphate (ATP)

Figure 2.20a

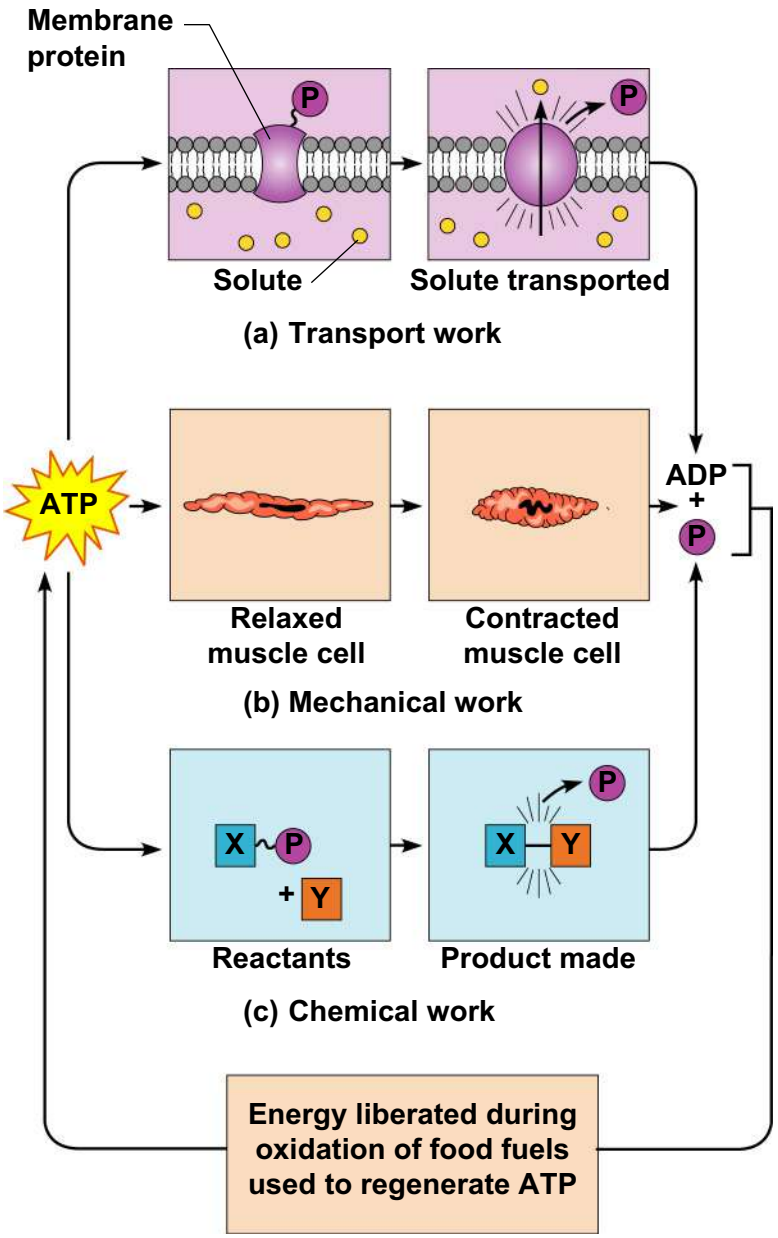


Figure 2.21

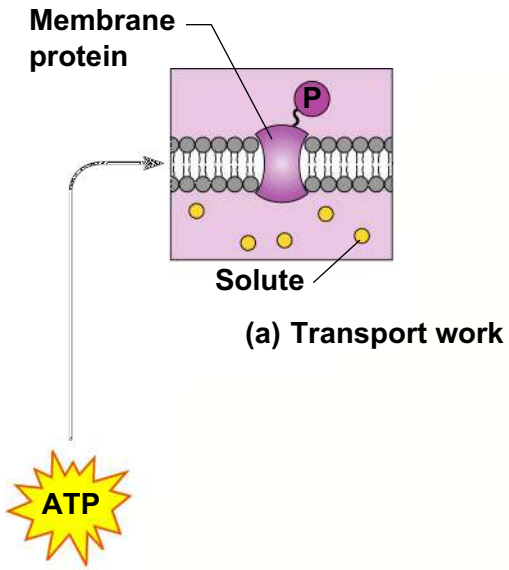


Figure 2.21, step 1

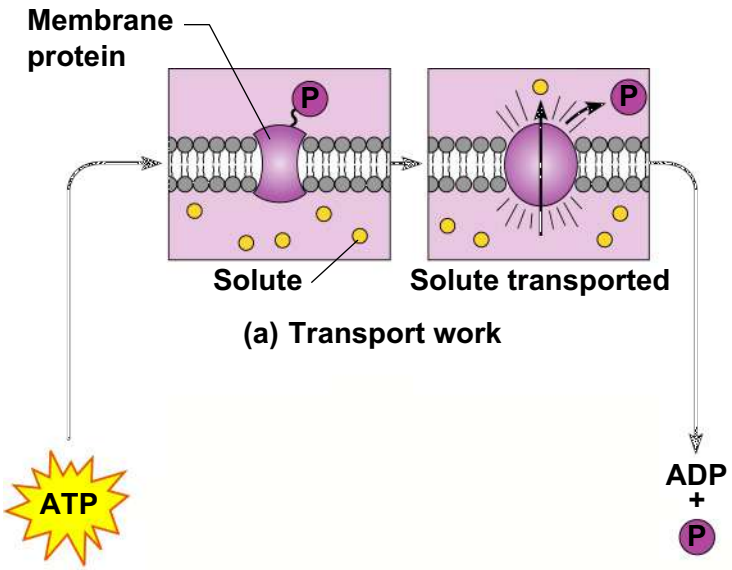
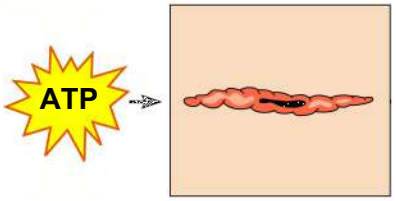


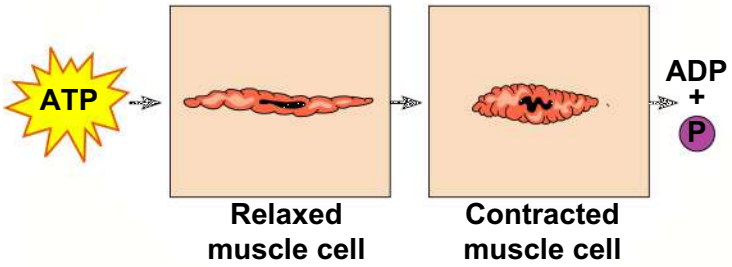
Figure 2.21, step 2



Relaxed
muscle cell

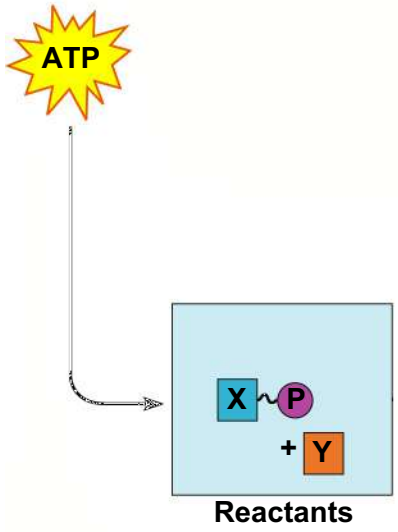
(b) Mechanical work

Figure 2.21, step 3



(b) Mechanical work

Figure 2.21, step 4



(c) Chemical work

Figure 2.21, step 5

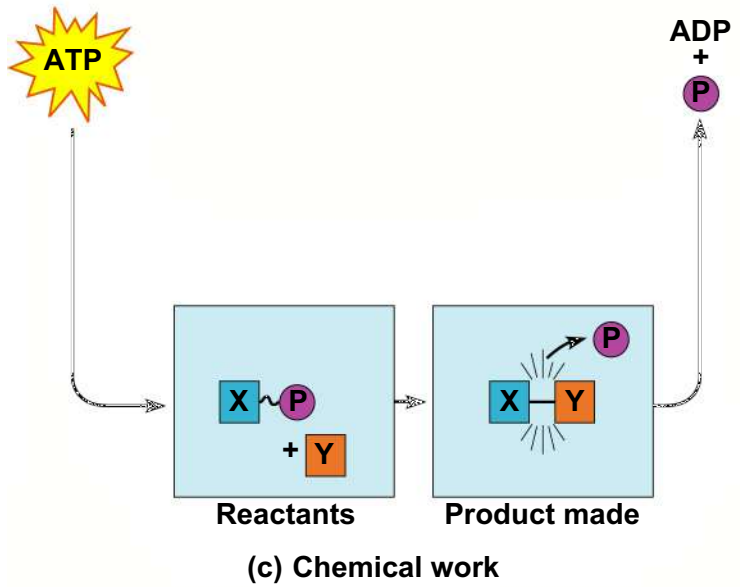


Figure 2.21, step 6

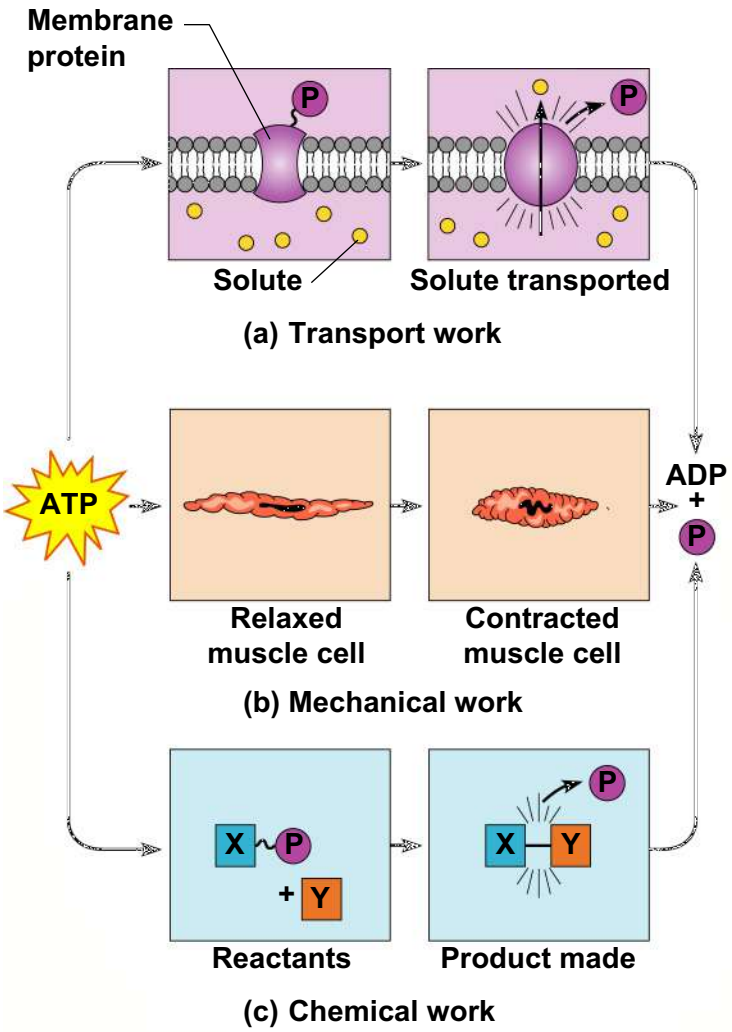


Figure 2.21, step 7

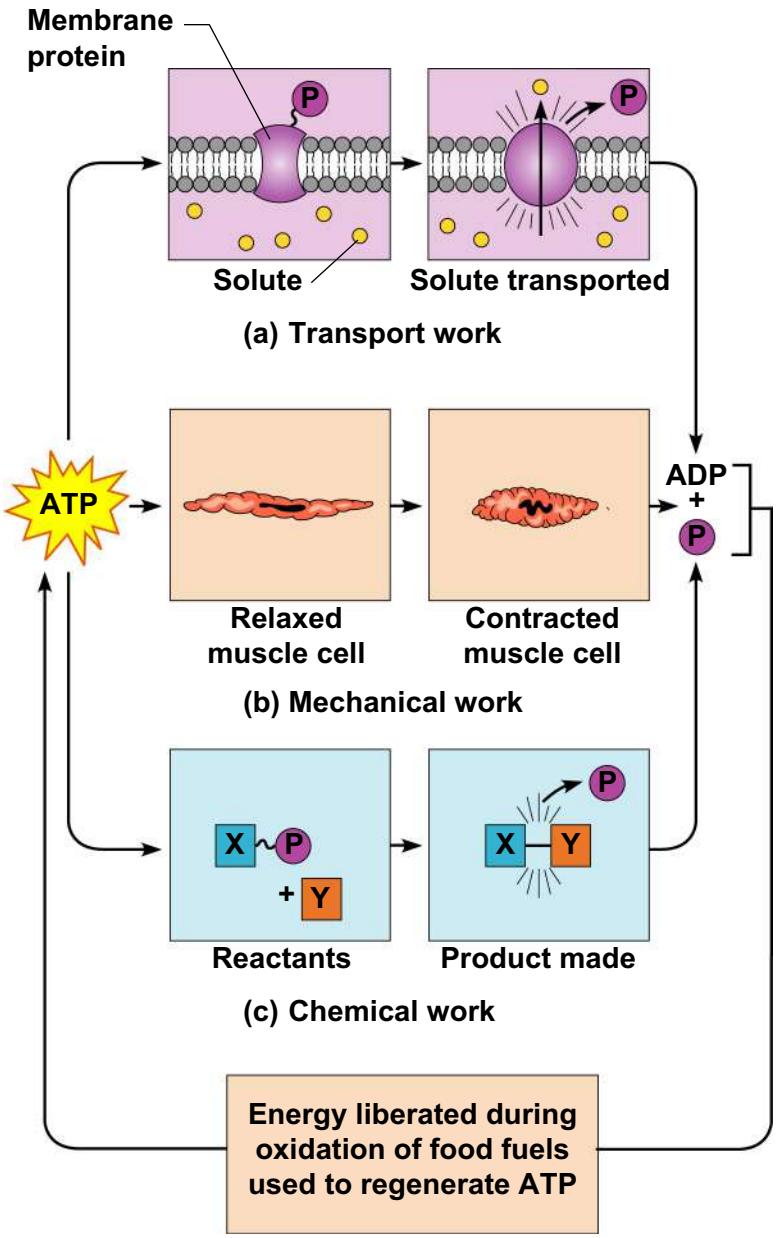


Figure 2.21, step 8