



# Objectives

- ✿ **Explain** the importance of carbon (organic) bonding in biological molecules.
- ✿ **Identify** the functional groups in biological molecules.
- ✿ **Identify** the different types of essential compounds .
- ✿ **Distinguish** between monomers and polymers of the essential compounds.
- ✿ **Describe** the induced fit model of enzyme action.



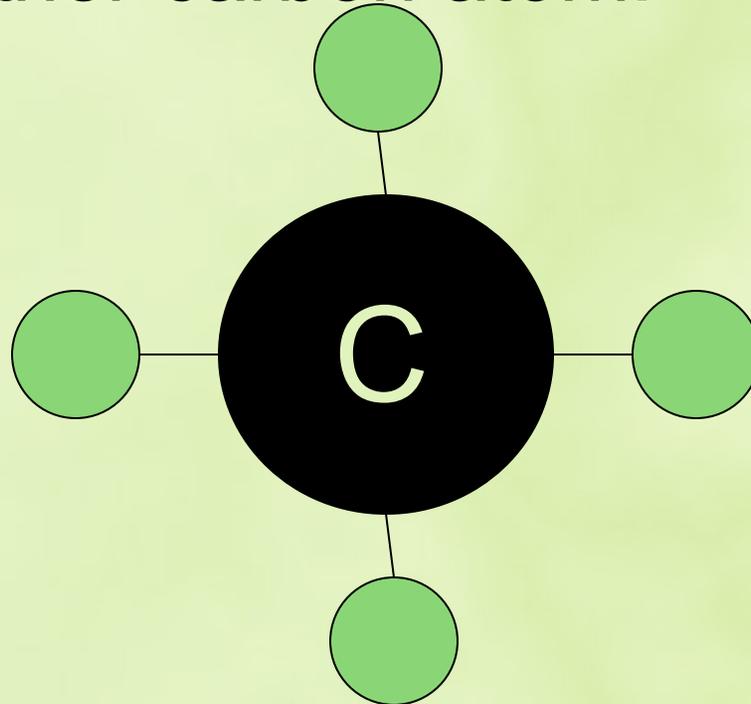
# Organic Compounds

✿ All compounds can be classified into two categories:

- ✿ **Organic Compounds:** These compounds are carbon based.
- ✿ **Inorganic Compounds:** These compounds do not contain carbon (with few exceptions.)

# The Carbon Atom

- ✿ The carbon atom is unique because it can bond with 4 different atoms or even to another carbon atom.



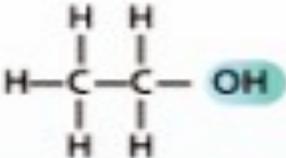
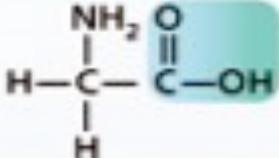
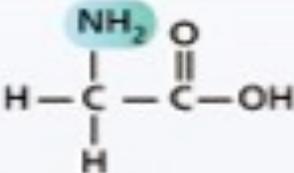
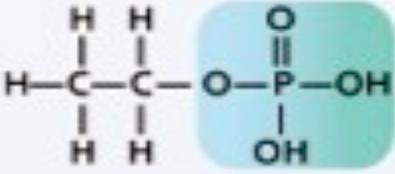


# Functional Groups

- ✿ There are some clusters of atoms that are often used to influence the characteristics of molecules.
- ✿ The presence these **functional groups** determines how and what a molecule does.

# Functional Groups

**TABLE 3-1** Common Functional Groups

Functional group	Structural formula	Example
Hydroxyl	$\text{—OH}$	 $\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H—C—C—OH} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$
Carboxyl	$\begin{array}{c} \text{O} \\    \\ \text{—C—OH} \end{array}$	 $\begin{array}{c} \text{NH}_2 \quad \text{O} \\   \quad    \\ \text{H—C—C—OH} \\   \\ \text{H} \end{array}$
Amino	$\begin{array}{c} \text{H} \\   \\ \text{—N—H} \end{array}$	 $\begin{array}{c} \text{NH}_2 \quad \text{O} \\   \quad    \\ \text{H—C—C—OH} \\   \\ \text{H} \end{array}$
Phosphate	$\begin{array}{c} \text{O} \\    \\ \text{—O—P—OH} \\   \\ \text{OH} \end{array}$	 $\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H—C—C—O—P—OH} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{OH} \end{array}$



# Monomers & Polymers

- ✿ Many carbon compounds are built from **Monomers**, which are simple carbon based molecules that can serve as building blocks for more complex molecules.
- ✿ Monomers combine to form **polymers**.
- ✿ Large polymers can also be called **macromolecules**.

A little *Greek*:

*mono* = single, *poly* = many, *micro* = small, *macro* = large

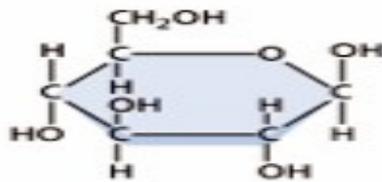


# Molecules of Life

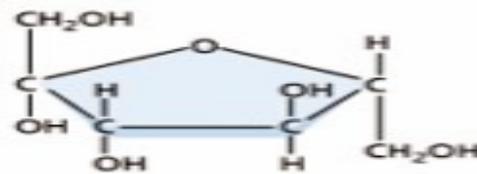
- ✿ There are four essential macromolecules for life and each plays a specific role in the chemistry of the specific organism.
- ✿ They are:
  - ✿ Carbohydrates
  - ✿ Proteins
  - ✿ Lipids
  - ✿ Nucleic Acids

# Carbohydrates

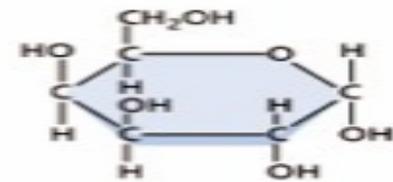
- ✿ **Monomer:** Monosaccharide (Glucose, Fructose, Galactose)
- ✿ **General Formula:**  $\text{CH}_2\text{O}$  (1:2:1 Ratio)
- ✿ **Polymer:** Disaccharide and Polysaccharide.
- ✿ **Primary Use:** Energy use and/or storage.



Glucose

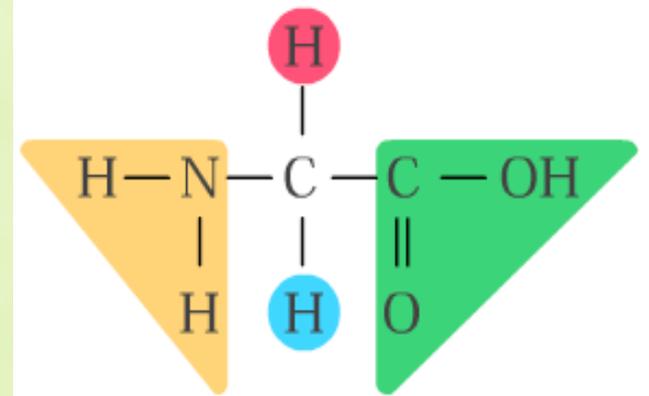


Fructose



Galactose

# Proteins

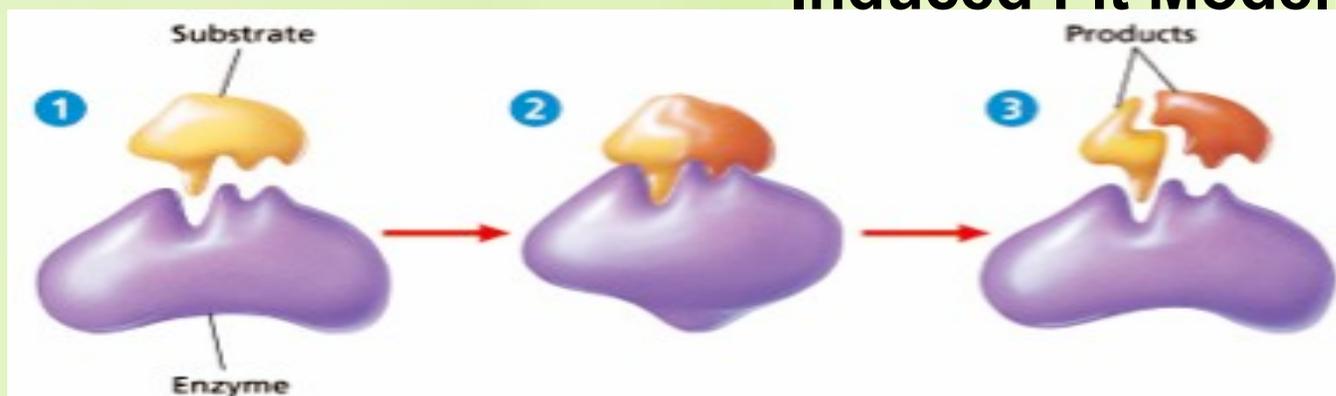


- ✿ **Monomer:** Amino Acids
- ✿ **General Formula:** Carbon bonded to 1 Hydrogen, 1 carboxyl Group, 1 amino group, and a “R” group.
- ✿ **Polymer:** Dipeptide and/or Polypeptide.
- ✿ **Primary Use:** Hair, horns, skin, muscle, and many biological catalysts.

# Enzymes (Proteins)

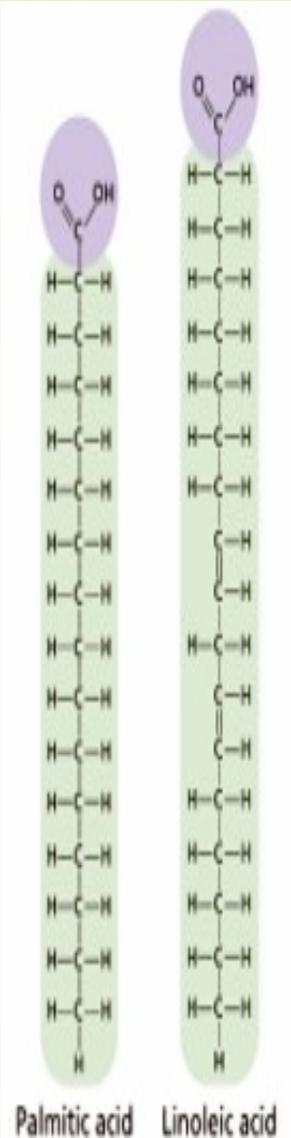
- ✿ Enzymes are a specific type of protein that act as a catalyst to breakdown certain substances (**substrate**).
- ✿ Once a substrate comes in contact with the **active site** of an enzyme, it is broken down.

Induced Fit Model:



# Lipids

- ✿ **Monomer:** Fatty Acids
- ✿ **General Formula:** Long Carbon chain with carboxyl group on one end and an “X” group.
- ✿ **Polymer:** Triglycerides (X=alcohol), phospholipids (X=phosphate), waxes (X=Alcohol chain).
- ✿ **Primary Use:** Energy storage, membranes.
- ✿ **NOTE:** The carboxyl end of a lipid is **hydrophilic** (attracted to water) and the other end is often **hydrophobic** (water fearing.)

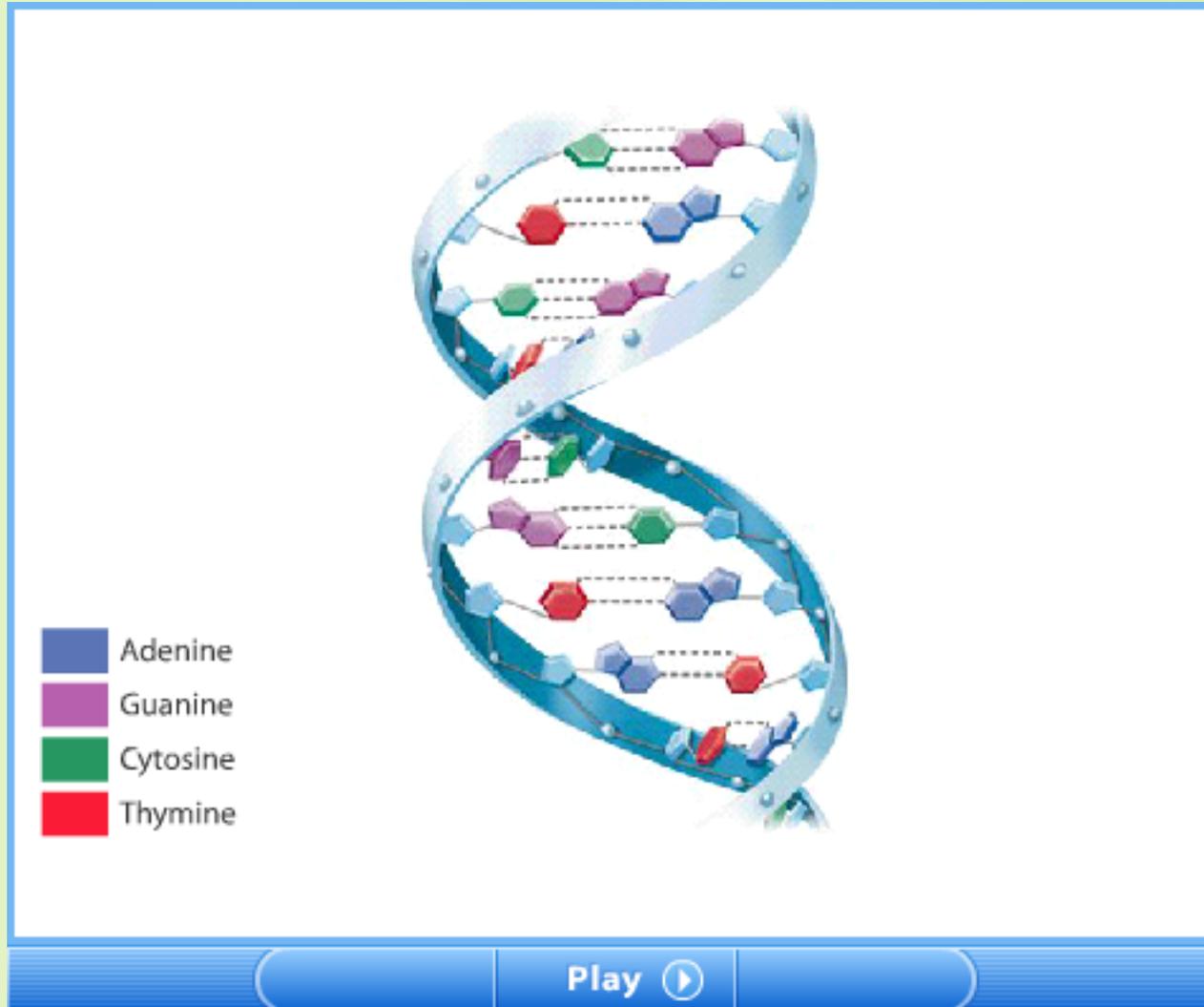




# Nucleic Acids

- ✿ **Monomer:** Nucleotide
- ✿ **General Formula:** Phosphate group, a Carbon sugar, & Ring-shaped nitrogenous base.
- ✿ **Polymer:** Deoxyribonucleic Acid (DNA) & Ribonucleic Acid (RNA).
- ✿ **Primary Use:** Storing and transferring information in cells.

# Nucleic Acids (Cont...)





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