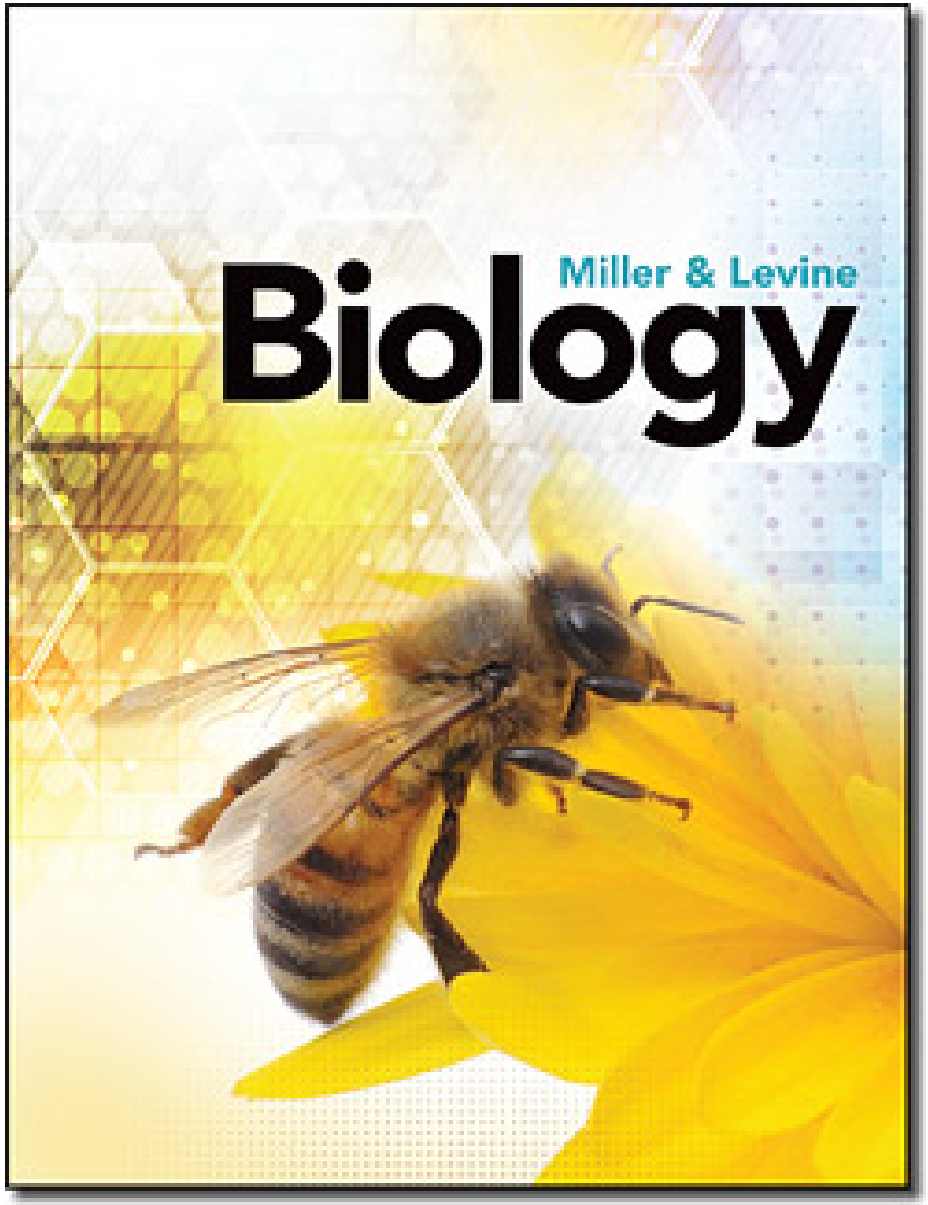



# Lesson Overview
# 2.3

# The Chemistry of Carbon

Carbon atoms can form strong covalent bonds with many other elements.

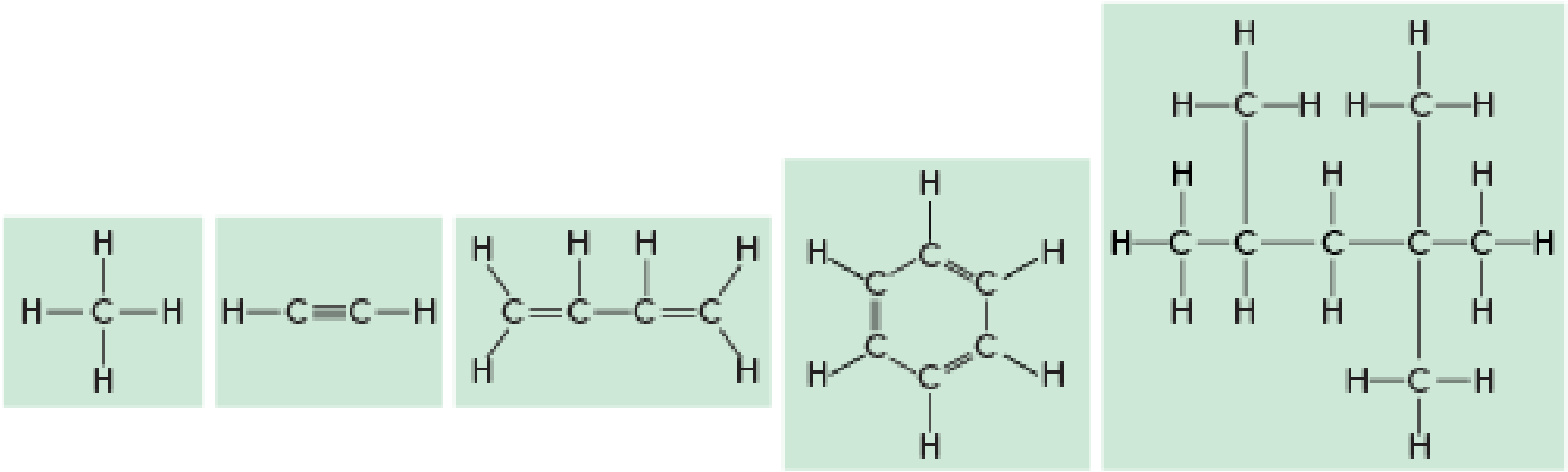
Molecules containing carbon are called organic.

Living organisms are composed of molecules consisting of carbon bonded to other elements.

# The Chemistry of Carbon

Carbon atoms can also bond to each other with single, double, or triple covalent bonds.

carbon atoms can even form rings.

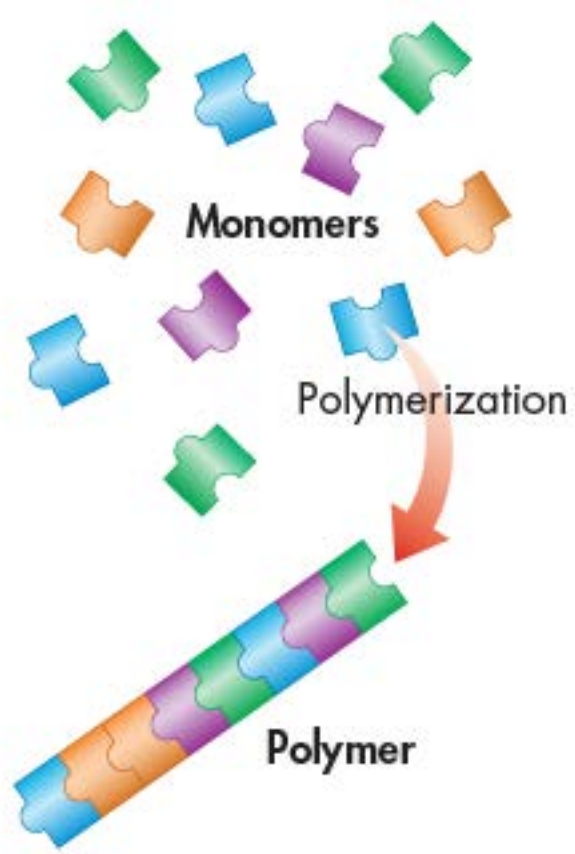


# Macromolecules

Macromolecules are “giant molecules,” made from many smaller molecules.

They are formed by polymerization.

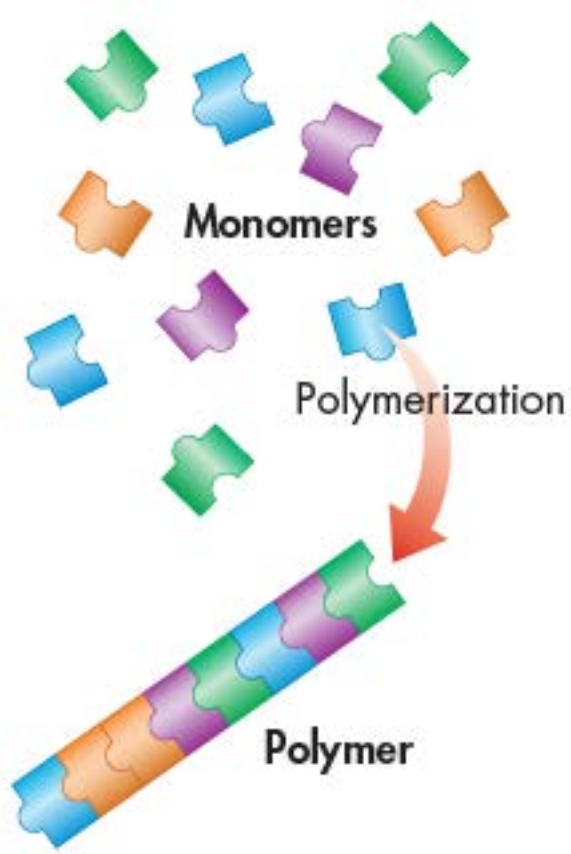
Polymerization - large compounds built by joining many smaller ones together.



# Macromolecules

The smaller units, or **monomers,** join together to form **polymers**.

The monomers in a polymer may be identical or different.



# Macromolecules

four major groups of macromolecules in living things

1. carbohydrates
2. lipids
3. nucleic acids
4. proteins

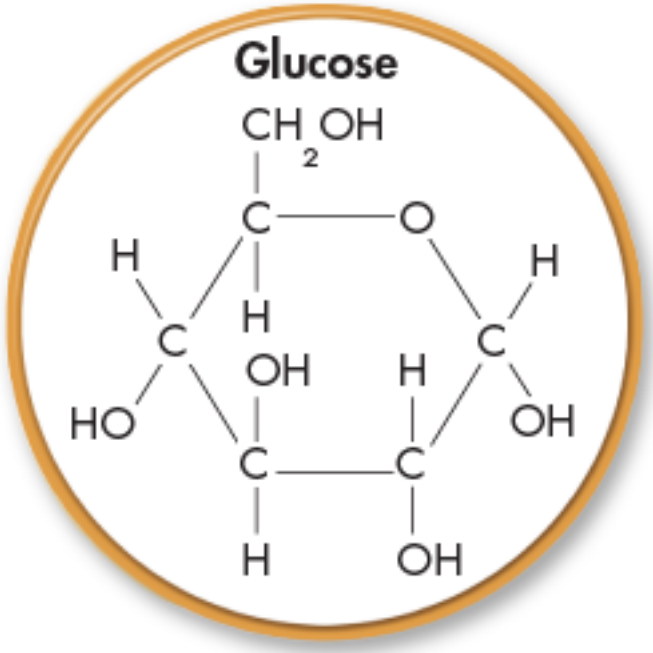
# Carbohydrates

**Carbohydrates -** compounds made of carbon, hydrogen, and oxygen atoms, usually in a ratio of 1 : 2 : 1.

Living things use carbohydrates as their main source of energy.

3 types:

1. monosaccharides
2. disaccharides
3. polysaccharides

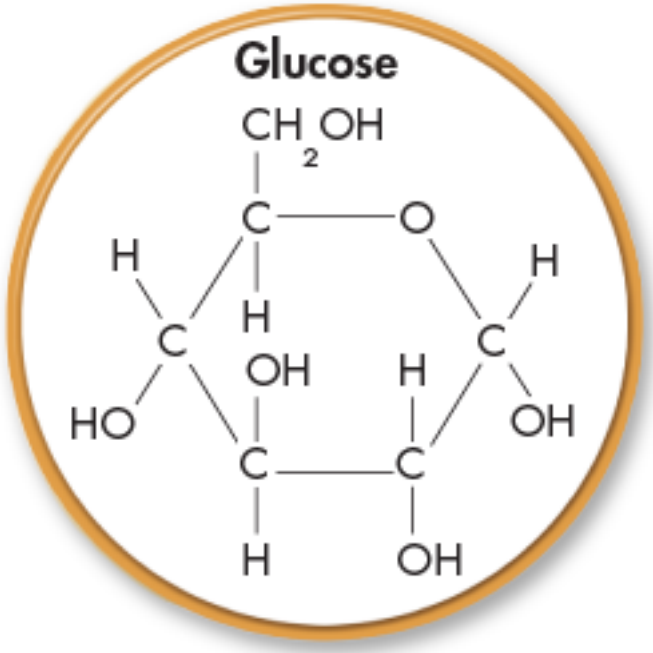


# Simple Sugars

Single sugar molecules are **monosaccharides.**

examples: glucose - cell's favorite food,
galactose -found in milk
fructose - in fruits.

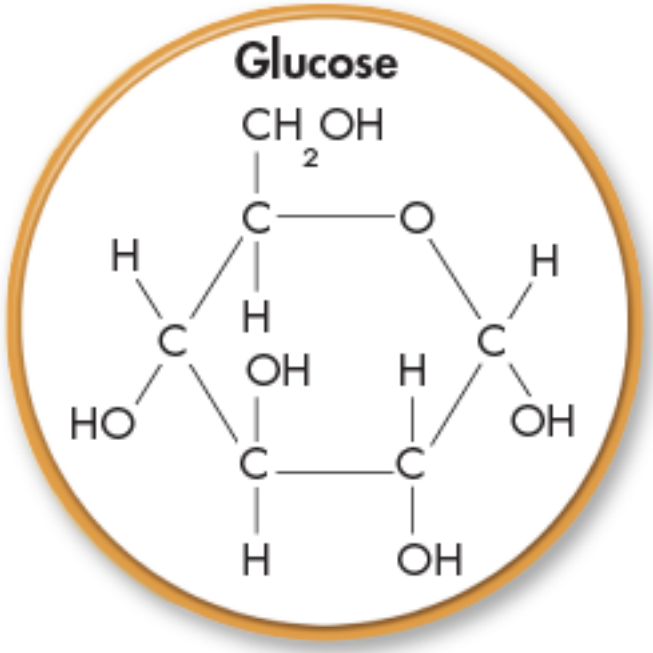
Ordinary table sugar, sucrose, is a disaccharide, a compound made by joining glucose and fructose together.



# Disaccharides

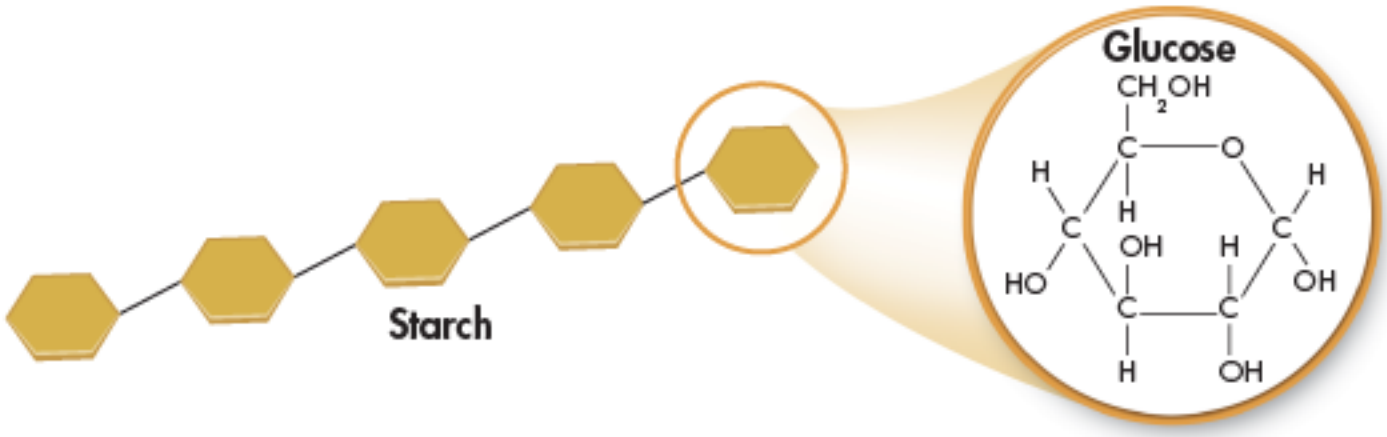
**disaccharides -** sugars made by joining two monosaccharides together

example: sucrose - table sugar, made by joining glucose and fructose together.



# Complex Carbohydrates

**polysaccharides** - sugars formed by joining many monosaccharides together.



# Complex Carbohydrates

examples: glycogen - excess sugar storage in animals

starch - excess sugar storage in plants

cellulose - plant cell wall rigidity

# Lipids

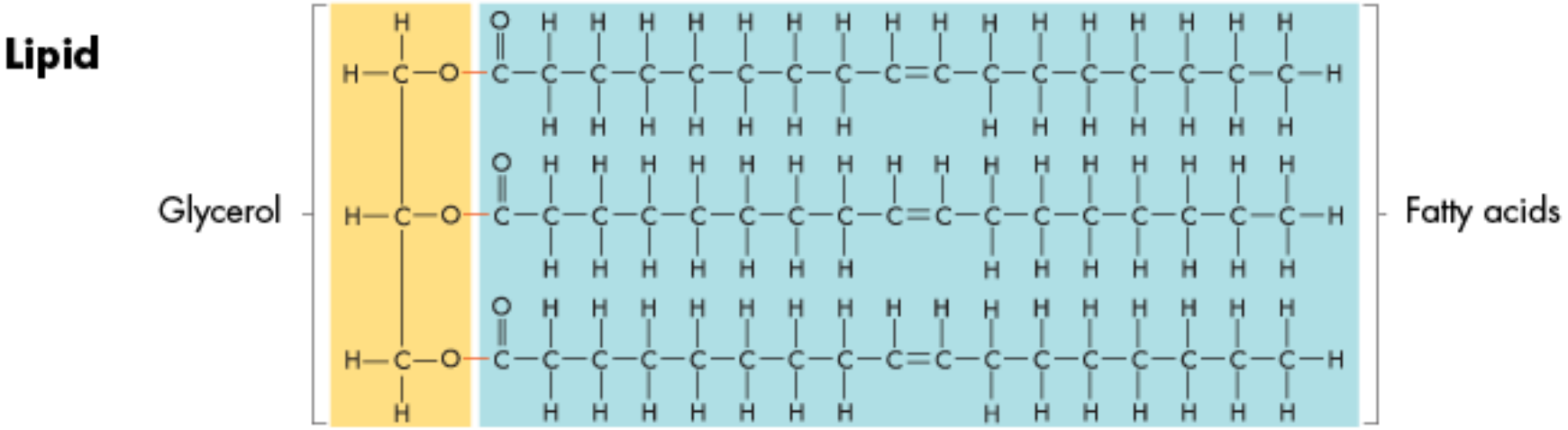
**Lipids -** made mostly from carbon, hydrogen, and oxygen
- generally not soluble in water.

categories of lipids:

1. fats
2. oils
3. waxes

# Lipids

Many lipids formed by glycerol molecule combining with fatty acids.



# Lipids

**saturated fat** - fatty acid chain contains all single bonds
- tend to be solids
- also called “animal fats”

**unsaturated fat** - fatty acid chain contains at least one double bond

**polyunsaturated fat** - fatty acid chain contains many double bonds

Unsaturated fats tend to be liquids, and are also called “plant fats”.

# Lipids

Lipids used to store energy.

Some are parts of biological membranes and waterproof coverings.

Many steroids, such as hormones, are lipids and serve as chemical messengers.

# Nucleic Acids

Nucleic acids store and transmit hereditary, or genetic, information.

**Nucleic acids** - made of hydrogen, oxygen, nitrogen, carbon, and phosphorus.

Nucleic acids are polymers made from monomers called nucleotides.

# Nucleic Acids

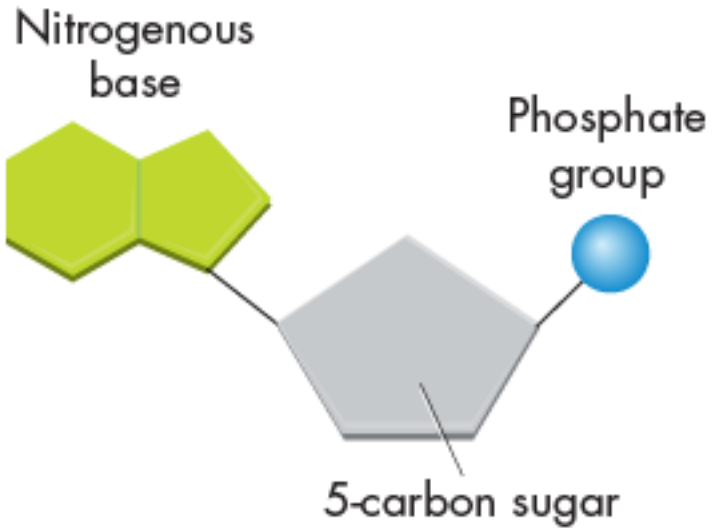
**Nucleotides** consist of three parts:

5-carbon sugar,

phosphate group ($–PO_4$)

nitrogenous base.

One nucleotide, adenosine triphosphate (ATP), captures and transfers chemical energy.



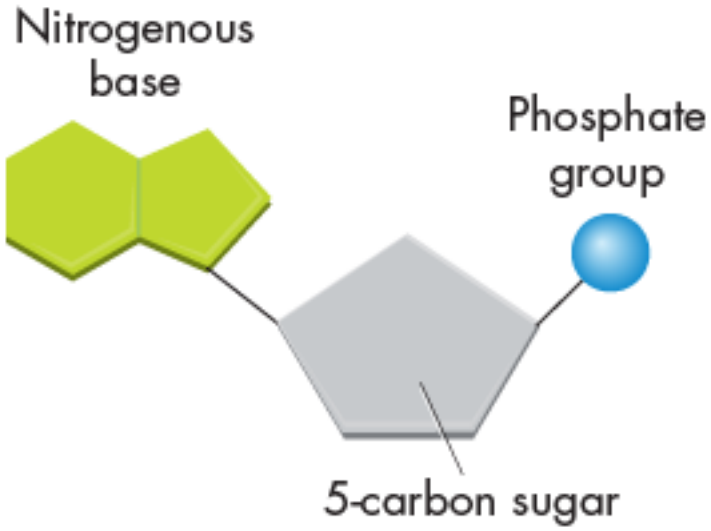
# Nucleic Acids

Nucleotides join to form nucleic acids.

two kinds of nucleic acids:

1. ribonucleic acid (RNA)
   - contains the sugar ribose

2. deoxyribonucleic acid (DNA)
   - contains the sugar deoxyribose.



# Protein

**Proteins** - made of nitrogen, carbon, hydrogen, and oxygen.

Proteins are polymers made of monomers called amino acids.

Proteins perform many varied functions, such as controlling the rate of reactions and regulating cell processes, forming cellular structures, transporting substances into or out of cells, and helping to fight disease.

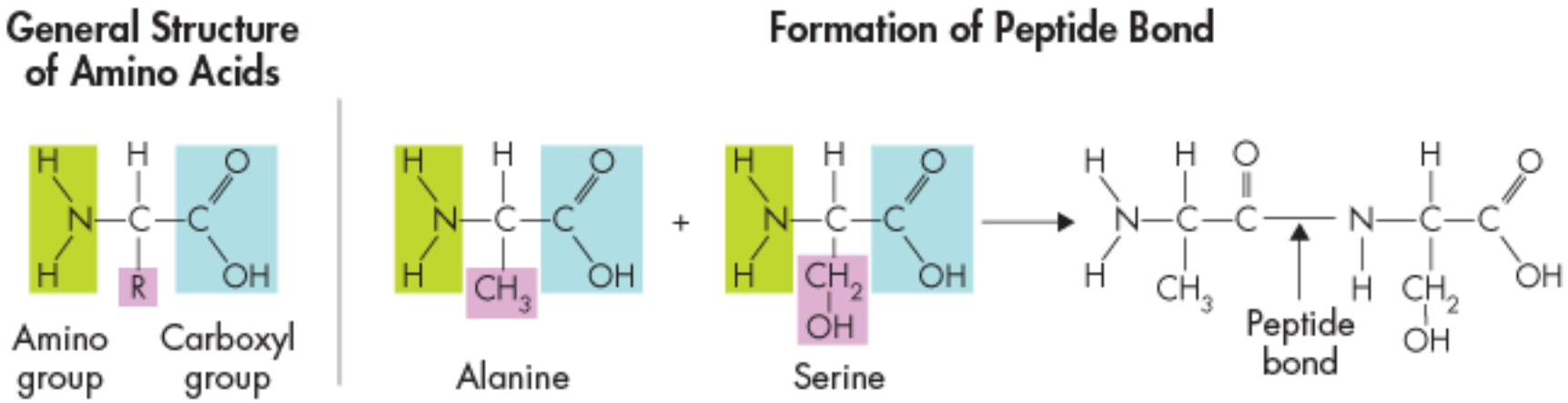
# Protein

**Amino acids** - compounds with amino group ($–NH_2$) on one end and carboxyl group (–COOH) on the other end.

- More than 20 different amino acids are found in nature

Peptide bonds link amino acids together to form a polypeptide.

Protein - functional molecule built from one or more polypeptides.

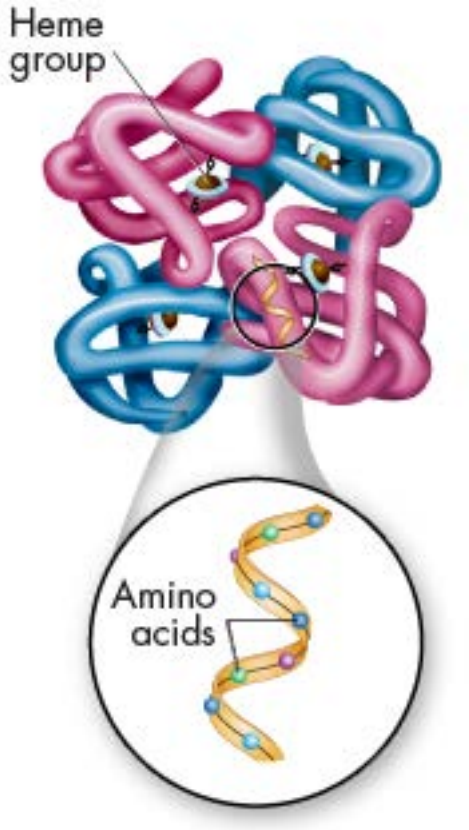


# Levels of Organization

Proteins have four levels of structure.

1. Primary structure - the sequence of amino acids.

2. Secondary structure - folding or coiling of the polypeptide chain.



# Levels of Organization

3. Tertiary structure - complete 3D arrangement of a polypeptide chain.

4. Quaternary structure - the way the different polypeptide chains are arranged with respect to each other.

For example, the protein shown, hemoglobin, consists of four subunits.