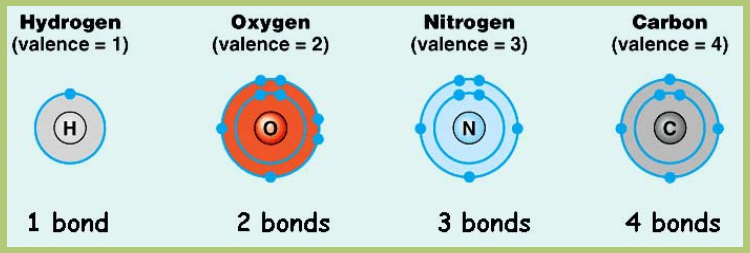
Carbon Compounds (Section 2.3)

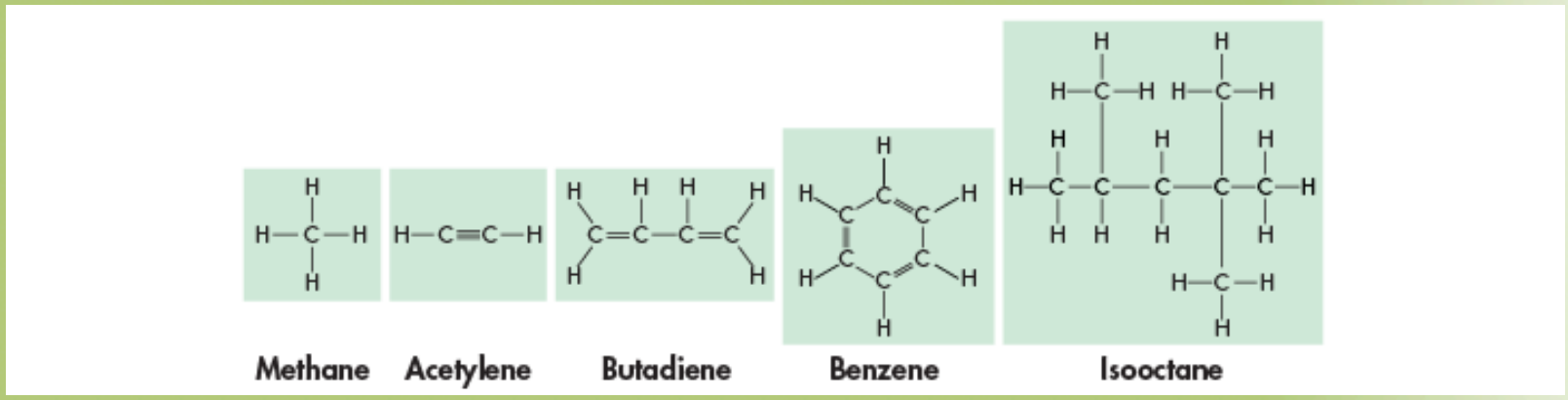
The Chemistry of Carbon (Organic Chemistry)

Carbon atoms have ***four*** valence electrons, allowing them to form strong covalent bonds with many other elements. ***(see examples below)***



Such as: hydrogen, oxygen, phosphorus, sulfur, and nitrogen

Carbon-carbon bonds can be **single**, **double**, or **triple** covalent bonds.

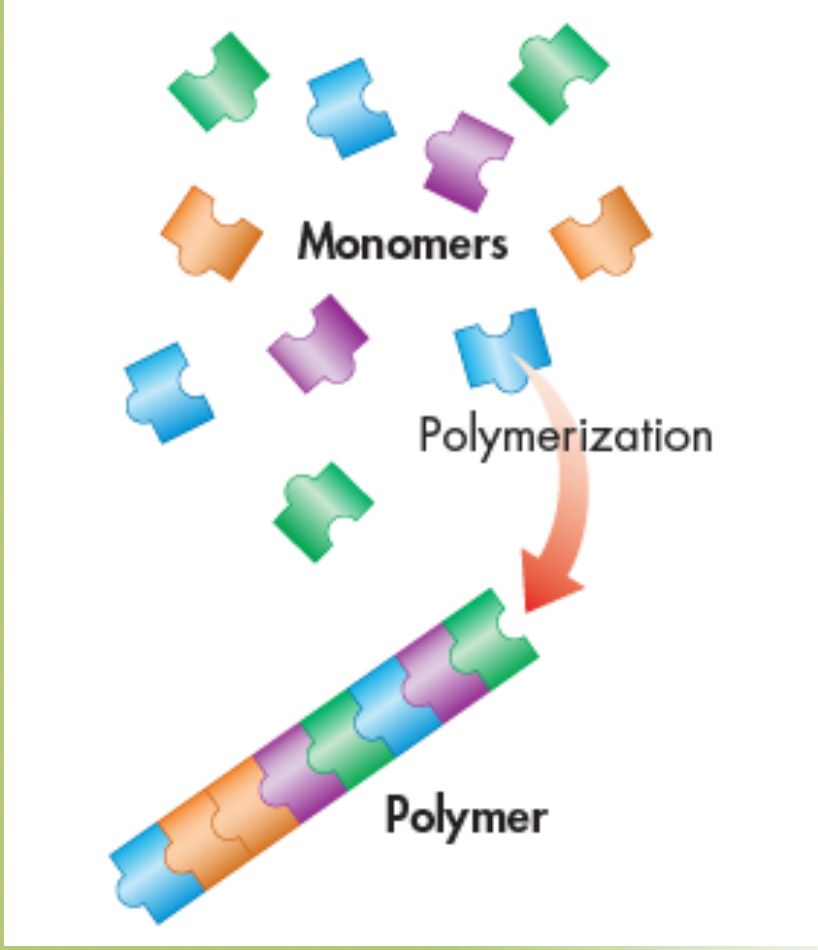


Macromolecules

Many of the organic compounds in living cells are **macromolecules**, or **"giant molecules,"** made from thousands or even hundreds of thousands of smaller molecules.

Most macromolecules are formed by a process known as **polymerization**, in which large compounds are built by joining smaller ones together.

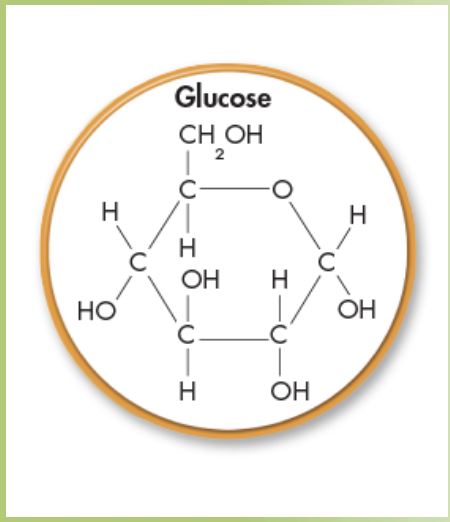
The smaller units, or **monomers,** join together to form **polymers**.



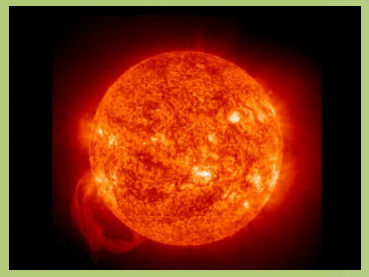
Macromolecules

Carbs, Lipids, Nucleic Acids, Proteins

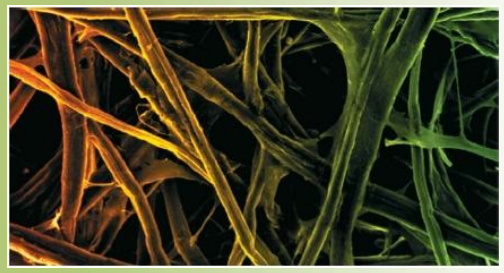
Carbohydrates are compounds made up of carbon, hydrogen, and oxygen atoms, usually in a ratio of 1 : 2 : 1. ($C_6H_{12}O_6$)



Living things use carbohydrates as their **main source of energy**. The breakdown of sugars, such as glucose, supplies immediate energy for cell activities.



Plants, some animals, and other organisms also use carbohydrates for structural purposes.



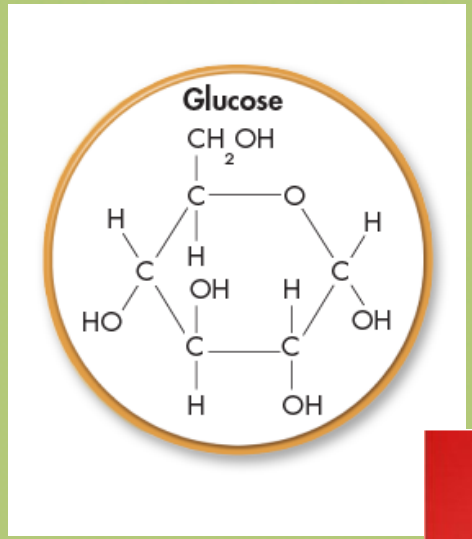
Types of Carbohydrates

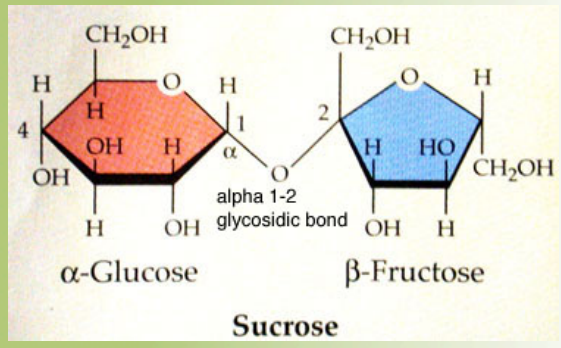
Simple Sugars

Single sugar molecules are also known as ***monosaccharides*.**

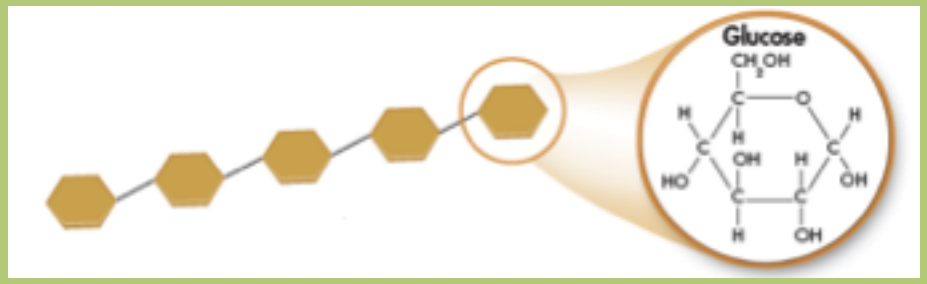
Besides **glucose**, monosaccharides include **galactose**, which is a component of milk, and **fructose**, which is found in many fruits.

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





Complex Carbohydrates (Polysaccharides)



Glycogen: stores excess sugar in animals and is broken down when your blood glucose runs low.

The glycogen stored in your muscles supplies the energy for muscle contraction.

Starch: stores excess sugar in plants.

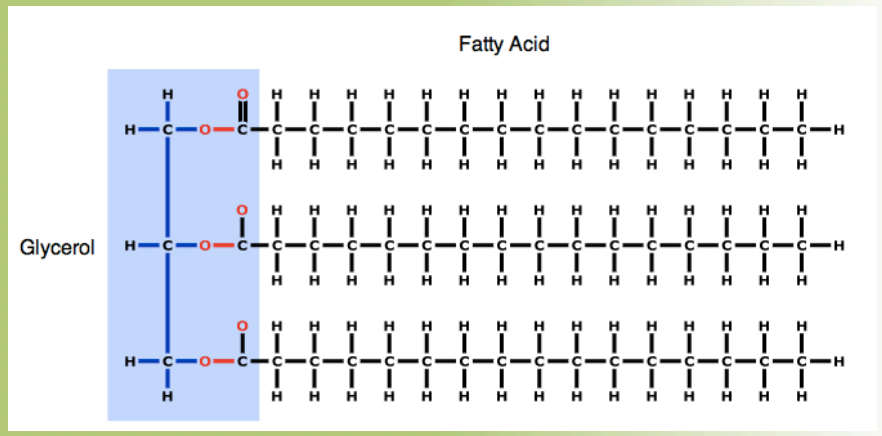
Cellulose: which gives plants much of their strength and rigidity.

Lipids

Lipids are made mostly from carbon and hydrogen atoms and are generally <u>not soluble in water.</u>

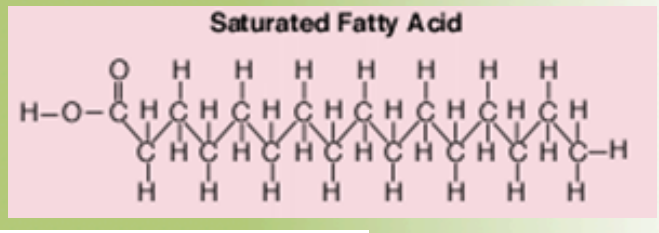
TYPES OF LIPIDS

Lipids can be used to store energy, create biological membranes and waterproof coverings or act as chemical messengers **(ex. Steroids)**



Lipids form when a **glycerol** molecule combines with compounds called **fatty acids**.

Distinguishing Lipids (FATS)



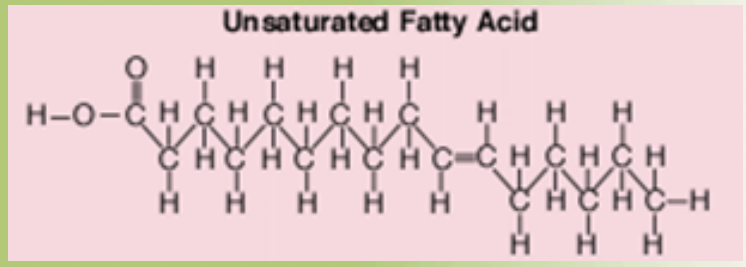
Saturated: carbon to carbon single bonds ONLY!!!

solid at room temperature

tend to raise bad (HDL)cholesterol

Unsaturated: at least **ONE** carbon to carbon double bond.

liquid and tend to lower (HDL) bad cholesterol

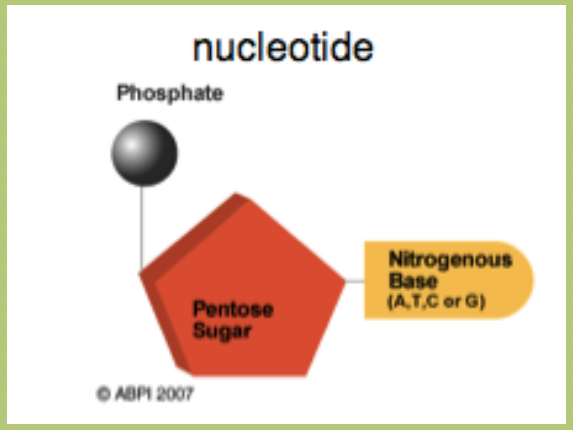


Polyunsaturated: more than one carbon to carbon double bond.

liquid and also lower (HDL) bad cholesterol.

Nucleic Acids

Nucleic acids are information carrying polymers containing hydrogen, oxygen, nitrogen, carbon, and phosphorus.

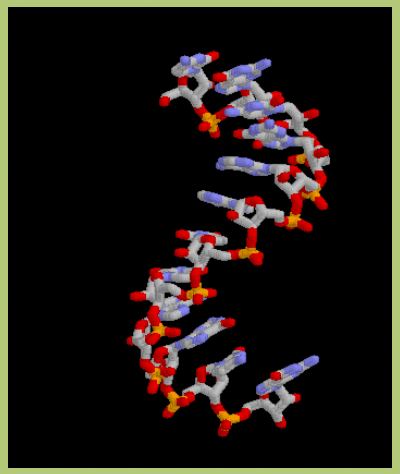


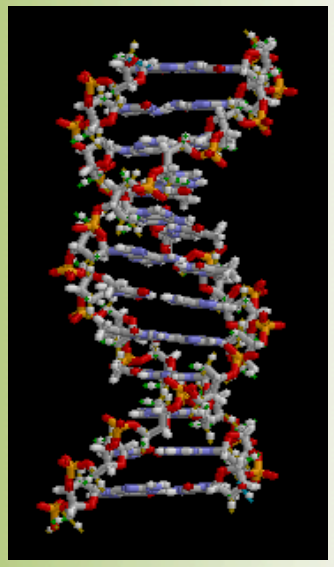
Monomer = nucleotide

Types:

***Ribonucleic acid (RNA)*:** contain the sugar ribose

***Deoxyribonucleic acid (DNA)*:** contains the sugar deoxyribose.





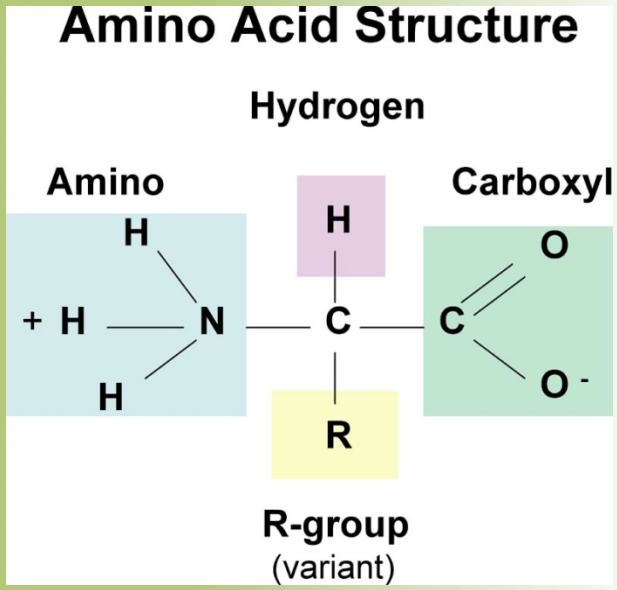
Protein

Proteins are macromolecules that contain nitrogen as well as carbon, hydrogen, and oxygen.

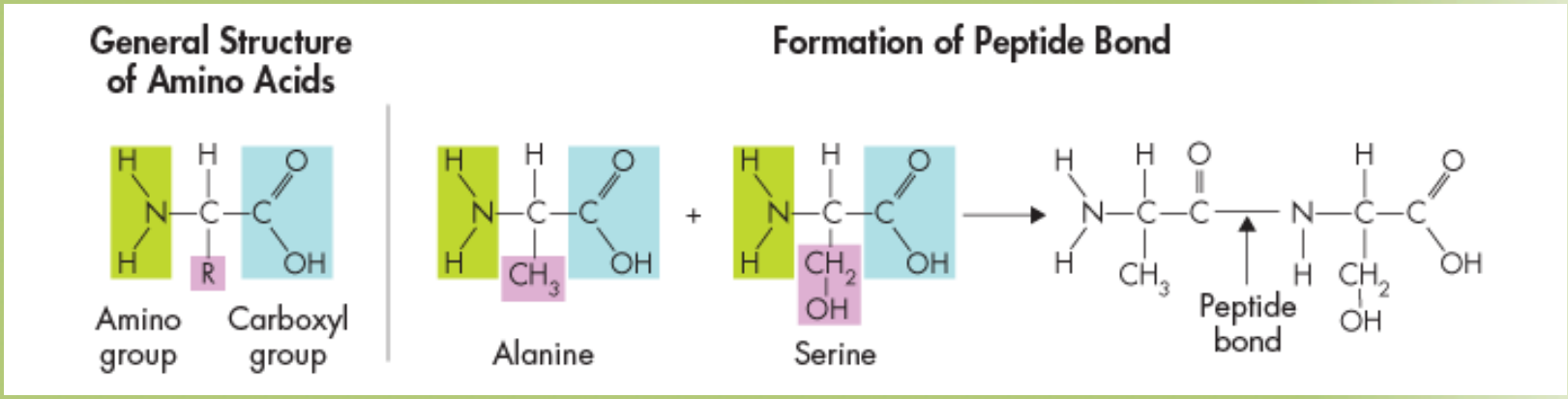
Monomer = amino acid

Function of Proteins:

1. control the rate of reactions (enzymes)
2. regulating cell processes
3. forming cellular structures
4. transporting substances into or out of cells
5. helping to fight disease.



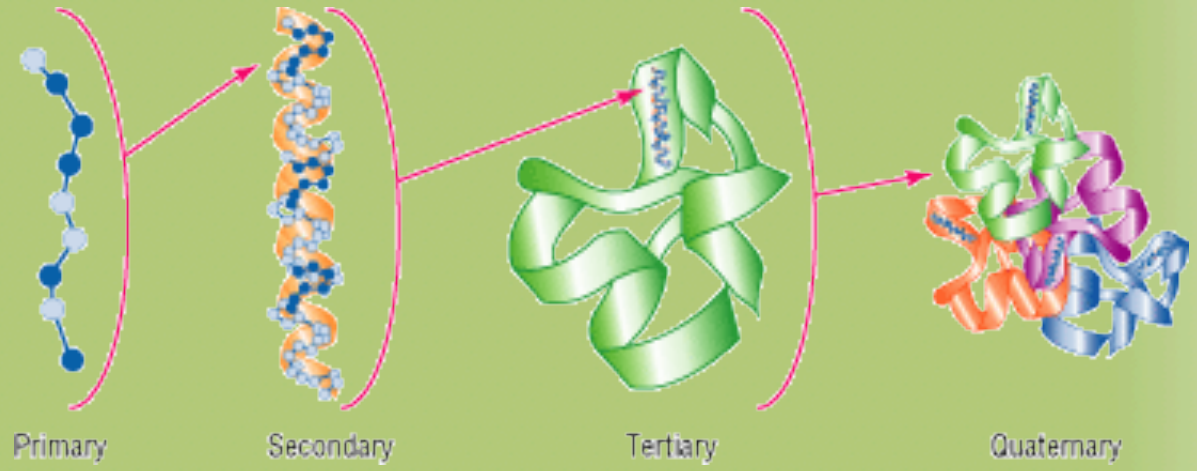
Peptide bonds



Amino acids differ from each other in a side chain called the **R-group**, which have a range of different properties.

More than 20 different amino acids are found in nature.

Levels of Organization in Proteins



Primary structure is the sequence of its amino acids.

Secondary structure is the folding or coiling of the polypeptide chain.

Tertiary structure is the complete, three-dimensional arrangement of a polypeptide chain.

A **fourth (Quatenary)** level of structure would include proteins with more than one chain and how they are arranged with respect to each other.