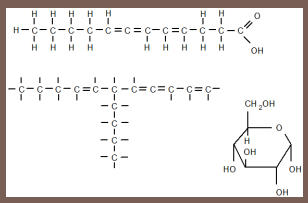
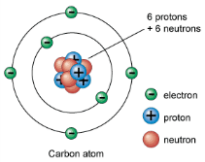
2.3 Carbon Compounds



BIOLOGY
MRS. MICHAELSEN

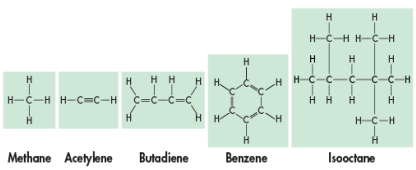
The Chemistry of Carbon

A. Carbon atoms have four valence electrons
   1. Form strong covalent bonds with many other elements: H, O, P, S, N.
   2. Living organisms are made up of carbon and these other elements.



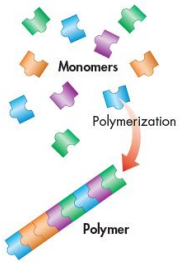
The Chemistry of Carbon

A. Very versatile element.
   1. Carbon-carbon bonds can be single, double, or triple covalent bonds.
   2. Chains of carbon atoms can even close up on themselves to form rings.



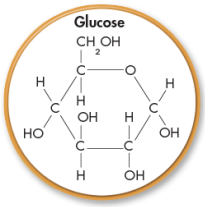
Macromolecules

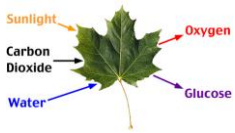
A. Macromolecules:
   1. Means “giant molecules”
   2. Made by a process known as polymerization - large compounds are built by joining smaller ones together.
   3. The smaller units, or **monomers,** join together to form **polymers**.
   4. Four major groups: carbohydrates, lipids, nucleic acids, and proteins.



Carbohydrates

A. **Carbohydrates** are the main source of energy: all life.
   1. Cellular respiration (glucose)
   2. Photosynthesis

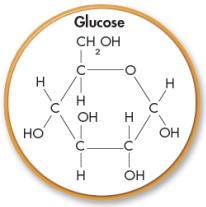




Simple Sugars

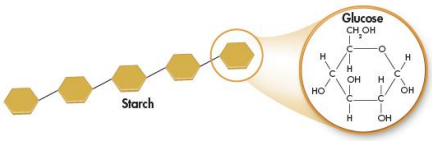
A. Monosaccharide: Single sugar molecule.
   1. Glucose, galactose (milk), and fructose (fruits).

B. Disaccharide: Made by joining glucose and fructose together.
   1. Sucrose (table sugar)



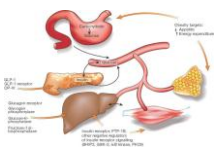
Complex Carbohydrates

A. Polysaccharides: Large macromolecules formed from many monosaccharide's.



Complex Carbohydrates

B. Polysaccharides used for Storage:
   1. Many animals store excess sugar in a polysaccharide called glycogen.
      a. When the level of glucose in your blood runs low, glycogen is broken down into glucose, which is then released into the blood.
   2. Plants use starch to store excess sugar.

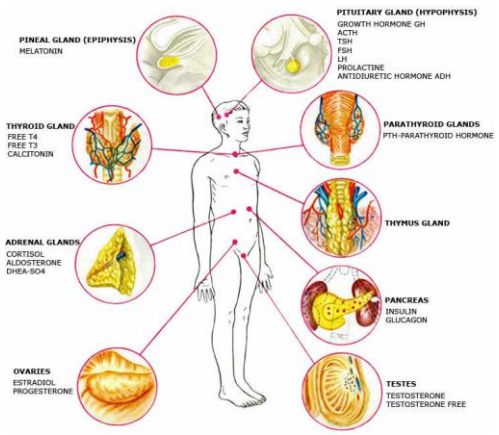


Complex Carbohydrates

C. Polysaccharides used for Structure:
   1. Plants also make another important polysaccharide called cellulose, which gives plants much of their strength and rigidity.
   2. Chitin found in exoskeleton.

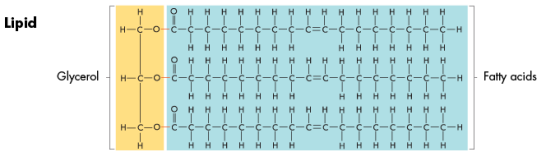
Lipids

A. **Lipids** are fats, oils, waxes and steroids.
B. Lipids can be used to store energy. Some lipids are important parts of biological membranes and waterproof coverings.
C. Steroids synthesized by the body are lipids as well.
   1. Hormones, serve as chemical messengers.



Lipids

E. Structure: **Glycerol** + 3 **fatty acid** chains.



Lipids

F. Carbons joined with single bonds in fatty acid chain: saturated.
   1. Solid at room temperature.
   2. Butter, meat, cheese, coconut oil, palm oil.

Lipids

G. At least one carbon-carbon double bond in a fatty acid: monosaturated (unsaturated).
   1. Tend to be liquid at room temperature.
   2. Olive, peanut, hazelnut, almond oil.

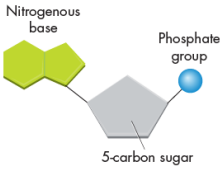
Lipids

H. More than one double bond in fatty acid: polyunsaturated.
   1. Usually liquid at room temperature, but solidify in fridge.
   2. Corn, grape seed, sesame, sunflower oils, wheat germ, fish oil, walnut oil, mixed vegetable oil.

Nucleic Acids

A. DNA and RNA
   1. Store and transmit hereditary, or genetic, information.

B. Assembled from nucleotides.
   2. Consist of a 5-carbon sugar, a phosphate group ($-PO_4$), and a nitrogenous base.



Protein

A. **Proteins** are polymers of molecules called **amino acids**.

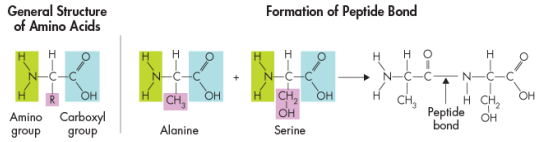
B. Perform many functions:

1. Controls the rate of reactions and
2. Regulates cell processes
3. Forms cellular structures
4. Transports substances into or out of cells
5. Helps to fight disease.

Protein

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

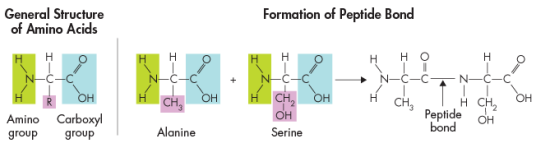
1. Covalent bonds called peptide bonds link amino acids together to form a polypeptide.



Structure and Function

E. Amino acids differ due to side chain: R-group.

1. Gives them different properties.
2. 20 different ones found in nature.
3. Most diverse macromolecules.

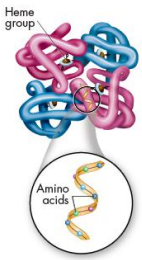


Levels of Organization

A. Proteins have four levels of structure.

B. Primary structure is the sequence of its amino acids.

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



Levels of Organization

D. Tertiary structure is the complete, three-dimensional arrangement.

E. Fourth level of structure - the way in which the different polypeptide chains are arranged with respect to each other.

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