Biological Molecules

Three of the Four Major Molecules That Cells Use in Their Everyday Existence

Review

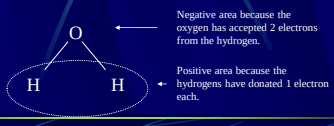
- Matter
- Electrons
- Protons
- Neutrons
- Atoms
- Orbits/shells

Review

- Ions
- Ionic bonds
- Covalent bonds
- Periodic table
- Acids and bases

Water

- Inorganic
  - Contains no carbon
- Polar
  - Has an negative area and a positive area



Water

- Strong surface tension
  - Due to adhesion between the water molecules and the surface around the water
    - The result is capillary action
      - An example is a straw in a soda cup, the soda is just a little higher in the straw than in the soda

Water

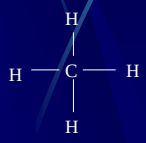
- Water has a very strong attraction between each molecule.
  - This also results in strong surface tension.
  - The attraction between the molecules is called **cohesion.**
  - This is the reason that water heats up and cools down so slowly.

Organic Molecules

- All organic molecules contain at least one carbon atom.

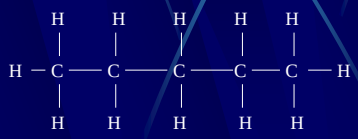
Organic Molecules

- Carbon is able to form four bonds with other atoms.



Organic Molecules

- The four bonding sites allow carbon to form chains:

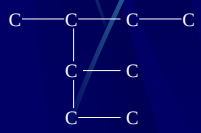


Organic Molecules

- They can also form rings:

Organic Molecules

- Or they can form branched chains:



Mono Vs. Poly

- A monomer is a single unit of a type of molecule.
  - This could be a ring or chain.
- A polymer is more than one unit of the same molecule.
  - This would be a series of rings or chains.

Carbohydrates

- All carbohydrates have a chemical formula ratio of one part carbon, to two parts hydrogen, to one part oxygen.
  - $C_6H_{12}O_6$ = glucose
- Each unit of CHO is a saccharide.
- Can exist as monsaccharides, disaccharides, and polysaccharides.

Carbohydrates

- Monosaccharides are the simplest form of carbohydrates.
  - Glucose is the monosaccharide formed by plants that we use as our form of energy.

Carbohydrates

- Fructose is the monosaccharide that is the sweetest and is found in fruits.

Carbohydrates

- Galactose is found in milk and is usually combined with one of the earlier mentioned monosaccharides

Carbohydrates

- All of the above have the same formula - $C_6H_{12}O_6$.
- They have the same formula but different structures.
  - This is known as an isomer.

Carbohydrates

- Disaccharides
  - Two saccharides bonded together through dehydration synthesis.
  - Sucrose = glucose and fructose
    - Found in sugar cane and sugar beets
    - Table sugar
  - Lactose = galactose and glucose
    - Found in milk

Carbohydrates

- Polysaccharides
  - More than two saccharides bound together through dehydration synthesis.
  - Glycogen = used to store glucose in animals
    - Glucose stored in branched chains.
      - Harder to burn
  - Starch = used to store glucose in plants.
  - Cellulose = used to give strength in plants.
    - Glucose in very long chains.

Lipids

- Fats, oils, and waxes

Lipids

- Large number of carbon and hydrogen atoms, small number of oxygen atoms.

Lipids

- Do not dissolve in water.
- The cell membrane is composed of lipids due to their insolubility properties.

Lipids

- Lipids are made of monomers called **fatty acids.**

Lipids

- Fatty acids consist of two ends
  - A carboxyl end which is hydrophilic (water loving)
  - A hydrocarbon chain which is hydrophobic (water fearing)
- This structure gives lipids it's characteristic behavior in water.

Lipids

- Types of lipids
  - Triglycerides
  - Waxes
  - Steroids

Lipids

- Triglycerides
  - 3 fatty acids joined at one glycerol
  - Two types
    - Oils
    - Fats

Lipids

- Triglycerides
  - Oils
    - Liquid at room temperature
    - Usually found in plants
    - Unsaturated – does not have hydrogen attached to every carbon

Lipids

- Triglycerides
  - Fats
    - Solid at room temperature
    - Usually found in animals
    - Saturated – has hydrogen attached to every carbon

Lipids

- Waxes
  - Consist of long fatty acid attached to an alcohol chain
  - This makes waxes waterproof
    - Found in plants to protect leaves from dehydration
    - Found in ears to form a protective barrier against microorganisms

Steroids

- Composed of four carbon rings
- Found in substances such as hormones, nerve tissue, venoms, and plant poisons

Proteins

- Consist of hydrogen, oxygen, carbon, and nitrogen

Proteins

- Formed from the linked monomers of amino acids

Proteins

- 20 different types of amino acids
  - Each consist of a central carbon atom with a hydrogen atom, an amine group, a carboxyl group, and an “R” group attached
  - The difference between each amino acid is the “R” group

Proteins

- Two amino acids bond together to form a dipeptide
  - The bonding is done by dehydration synthesis

Proteins

- A long chain of amino acids is called a polypeptide.

Proteins

- One type of protein is an enzyme

Proteins

- Enzymes act as a catalyst
  - A substance that speeds up a reaction, by lowering the activation energy, but does not get used up in the process
  - The substance that the enzyme acts on the the substrate.
    - The result are the products.

Nucleic Acids

- Complex organic molecules that store information in the cell.

Nucleic Acids

- Composed of monomers called nucleotides
  - Each nucleotide is composed of a phosphate group, a five carbon sugar, and a ring shaped nitrogen base.

Nucleic Acids

- There are two types of nucleic acids
  - DNA – Deoxyribonucleic acid
  - RNA – Ribonucleic acid
- We will learn more about nucleic acids in future units.