

The Chemicals of Life

Properties of Organic Compounds

- Organic compounds consist of carbon and one or more additional elements covalently bonded
- Some biologically important organic molecules are: carbohydrates (glucose), lipids (glycerol), proteins (insulin) and nucleic acids (DNA)
- A carbon atom can form up to four stable covalent bonds with other atoms and can form links in chains and rings
- It is capable of rotating freely, however double covalent bonds restricts rotation
- Differ structurally from each other by the length of the chain and the functional groups

Hydrocarbons

- The simplest organic molecules consist of a chain of carbon atoms, with each carbon atom filling the rest of its bonding sites with hydrogen atoms
- If the carbon atoms are only connected with single bonds the molecule is called an alkane
- Alkanes are named with prefix system and always end in "ane"
- A prefix is assigned to indicate the number of carbons in the longest chain of the carbohydrate

Multiple Bonds

- A carbon chain that contains one or more double bonds is called an alkene and the names end in "ene" and use a number to specify where the double bond is located, like 1-butene
- A carbon chain that contains one or more triple bonds is called an alkyne and the names end in "yne", like 2-pentyne

Functional Groups

- Are other atoms that are covalently bonded to the carbon backbone
- the reactive sites are unstable due to either:
 - a) the polar character of the bond involved
 - b) the presence of multiple bonds

Hydroxyl Group

- Consists of an oxygen atom bonded to a hydrogen atom
- It has a high electronegativity, so it pulls electrons away from the carbon atom
- It is important in carbohydrates, pyruvic acid (used in respiration), glycerol (a component of fats), and alcohols
- Alcohols are compounds that contain a hydroxyl group (OH^-) attached to the carbon, and can easily dissolve in water because water molecules form H-bonds with OH groups
- Their names end in "ol" and use a number to identify the location of the hydroxyl group, like 3-pentanol

Carbonyl or Keto Group

- Consists of a carbon atom double bonded to an oxygen atom
- The carbon has two more sites for covalent bonding

- If the group is on the end of the molecule it is called an aldehyde
- Aldehydes end in "al", like hexanal
- If it is bonded to an interior carbon it is a ketone
- Ketones end in "one" like propanone
- Important in nitrogenous bases, carbohydrates and pyruvic acid

Carboxyl Group

- Consists of a carbon atom double bonded to an oxygen atom and single bonded to a hydroxyl group
- Important in fatty acids, citric acid, and pyruvic acids
- They can only be located at the end of a molecule and their names end in "oic acid", like ethanoic acid

Amine Group

- Consists of a nitrogen atom attached to the backbone (nitrogen is also bonded to hydrogen atoms)
- Amines end in "amine"
- Important in amino acids, urea, proteins, nitrogenous bases and nucleic acids (necessary for amide bonds)

Sulfhydryl Group

- Consists of a sulfur atom bonded to a hydrogen atom
- Important in proteins (maintains its shape)

Phosphate Group

- Consists of an oxygen which is single bonded to a phosphorus atom, which in turn is double bonded to an oxygen atom and single bonded to two oxygen ions
- Important in glycolysis, ATP and ADP, nucleotides, nucleic acids and phospholipids