Chemistry of life

Chemical composition of living things

- 98% H,O,C,N **(bioelements)**
- ~2% S, P, Na, Cl, Ca, K, Mg, Fe **(macroelements)**
- ~0.02% I, F, Co, Mn, Mo, B, Zn **(microelements)**
- In very small amounts Ag, Se, Hg**(ultramicroelements)**

Chemical reactions

- A compound is formed when molecules are rearranged or bonds form between atoms. The formation of bonds is termed a chemical reaction

Types of reaction

- Oxidation - reduction (redox) reactions
- Anabolic - catabolic reactions
- Hydrolysis - dehydration synthesis

Oxidation - reduction (redox) reactions

- A chemical reaction involves physical changes to all the reactants involved. For example, a compound may **receive** or **donate** electrons. Such reactions are known as **oxidation-reduction** reactions or redox reactions. The compound donating electrons is said to be *oxidised* while the compound accepting electrons is said to be *reduced*.
- Ex:
- $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ + Energy (Oxidation of glucose)

Anabolic - Catabolic Reactions

- **Catabolic Reactions**
- Organic compounds are broken down to their monomers by catabolic reactions, most of which result in energy release.
- EX: $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ + Energy (38 ATP/686 Kcal/mol)
- **Anabolic Reactions**
- All reactions in a cell that build new molecules are known as anabolic reactions.
- EX:
- $6CO_2 + 6H_2O$ + Light energy (686 Kcal/mol) $\longrightarrow C_6H_{12}O_6 + 6O_2$

Hydrolysis - Dehydration Synthesis

- Chemical reactions can also be categorised according to the behaviour of **water** in the reaction. For example in catabolic reactions, water is split by hydrolytic enzymes and its components are added to the bonds that are to be broken. This is known as hydrolysis
- EX: $C_{12}H_{22}O_{11} + H_2O \longrightarrow 2\ C_6H_{12}O_6$ (hydrolysis)
- Anabolic reactions, the condensation of two amino acids or carbohydrates for example, involves the formation of new bonds and the formation and release of water. This is known as dehydration synthesis
- EX:aa1 + aa2 $\longrightarrow$ dipeptide + H_2O (dehydration)