

Most of the substances present in the human body and in other living organisms, animals and plants, are **polyfunctional organic compounds**, i.e. compounds that have two or more different functional groups in their molecules.

Hydroxy acids, keto acids and amino acids are important polyfunctional compounds:

- *hydroxy acids* contain both the hydroxyl and the carboxyl functional groups;
- *keto acids* are compounds that contain both the carboxyl and the ketone groups;
- *amino acids* contain both the amino and the carboxyl groups.

Triglycerides are lipids that are obtained by means of the *esterification reaction* between glycerol and fatty acids and form the fatty tissues of animals and plants. Triglycerides may be saturated or unsaturated depending on whether the hydrocarbon chains of the fatty acids contain double bonds or not. The esterification reaction occurs between the functional group —OH of the fatty acid and the hydrogen atom of the hydroxyl group of glycerol. The *hydrolysis reaction* of triglycerides always produces a molecule of glycerol and three fatty acid molecules.

Carbohydrates (also called *glucides*) are ternary compounds (C, H and O) and are particularly important biologically for both their function in providing chemical energy and as they constitute the structural components of many vegetables. They can be classified into simple carbohydrates (monosaccharides and disaccharides) and macromolecular carbohydrates (polysaccharides).

Polyhydroxyaldehydes and polyhydroxyketones are *monosaccharides* whose molecules are made up of five or six carbon atoms and are therefore also called pentose and hexose respectively. Biologically, ribose (an aldopentose), glucose (an aldohexose) and fructose (a ketohexose) are among the most important monosaccharides.

Disaccharides are compounds formed by two monosaccharide molecules joined by a *glycosidic bond*. This bond is formed as a result of the condensation reaction between the —OH group of a monosaccharide and the OH— group of another monosaccharide: it forms an oxygen bridge between two atoms of carbon. Sucrose and lactose are two examples of disaccharides.

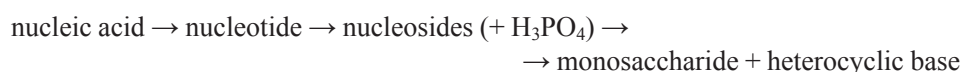
The *polysaccharides* (starch, cellulose, glycogen) are macromolecular compounds, that are formed by a large number of monosaccharides molecules linked together in a chain, always with a glycosidic bond. The reaction that allows you to break the glycosidic bond is termed *carbohydrate hydrolysis*.

The *peptide bond*, that joins two amino acids, binds the carbon atom of a molecule with the nitrogen atom of the other molecule: it is formed by the condensation reaction between the carboxylic acid —OH group and the hydrogen atom of the amino group.

Proteins are macromolecules composed of amino acid molecules bound together in chains by means of the peptide bond. The *protein hydrolysis* reaction can break the peptide bond and thereby liberate its constituent amino acid molecules.

DNA (deoxyribonucleic acid) is a macromolecule composed of thousands of nucleotides linked together in chains. It is this sequence of nucleotides that carries genetic code.

The sequence of decomposition of a nucleic acid is as follows:



Nucleotides are compounds that are formed by the esterification reaction between a nucleoside and a phosphoric acid molecule.

The condensation reaction between deoxyribose and one of four heterocyclic bases (cytosine, adenine, thymine, and guanine) present in DNA gives rise to a *nucleoside*.