College of Environmental Science

Department of Environmental Health

2nd Undergraduate Stage

Third Lecture

Biochemistry

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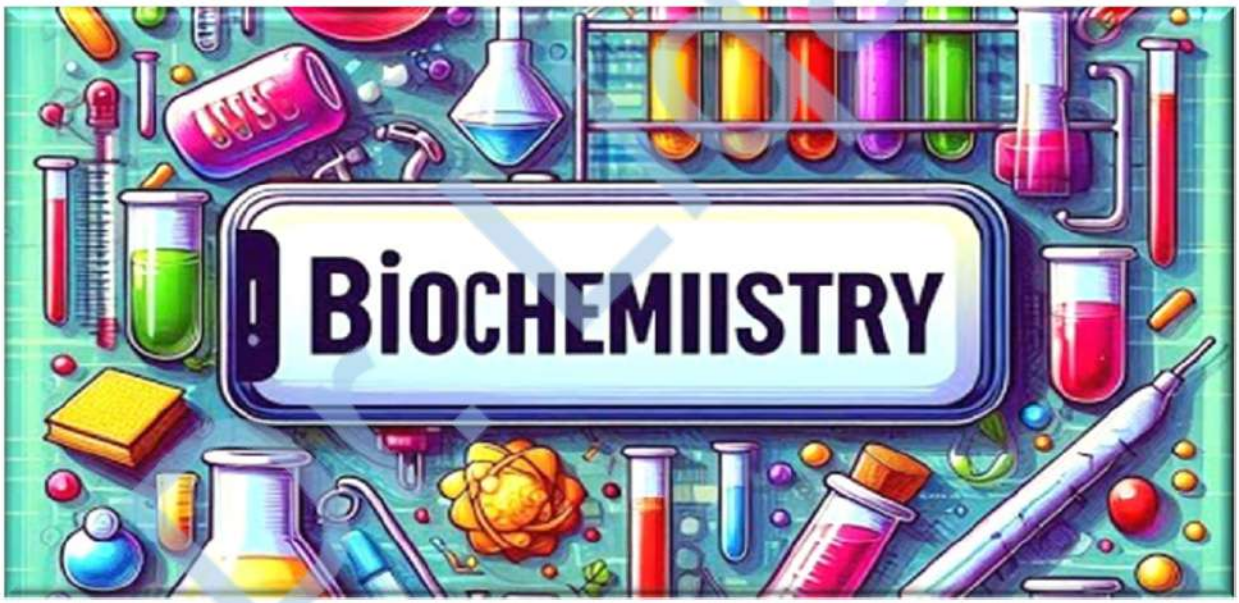
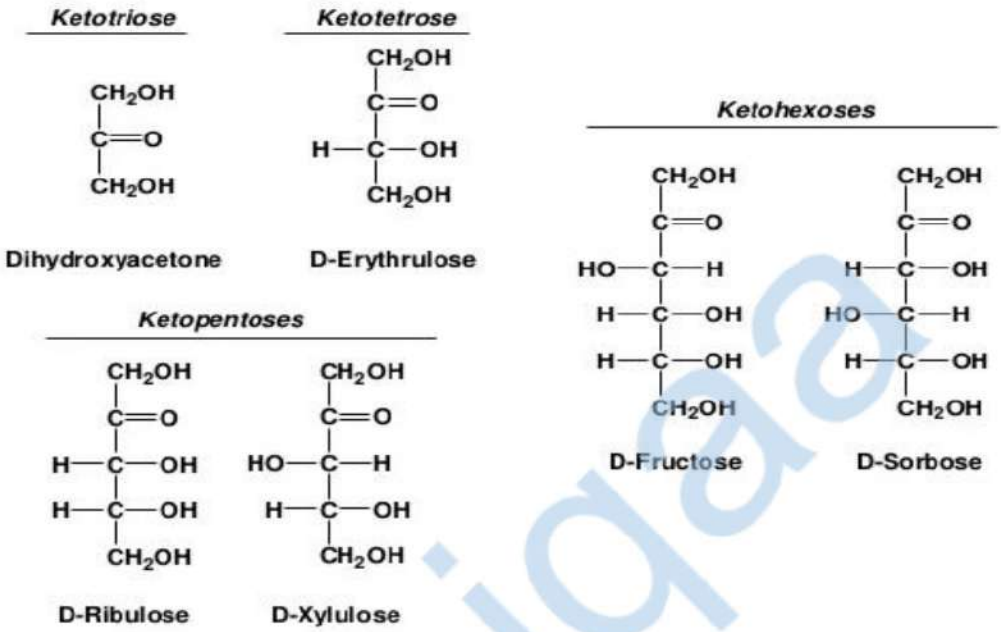


Functions of monosaccharides

Monosaccharides include trioses, tetroses, pentoses, hexoses and heptoses, triose derivatives are formed during the glycolysis process, and triose tetrose, pentose and heptoses sugar derivatives are formed during the breakdown of glucose sugar in the phosphogluconate pathway

Monosaccharides - ketoses



The chemical structures of the aldose are illustrated in (the second lecture Projective formulas of D-aldoses), while the chemical structures of ketoses which are important in metabolism, are shown in the following figure, and monosaccharides important for the human body are pentoses and hexoses.

Pentoses Sugars

Pentose sugars are very important, as they are included in the chemical structures of nucleotides, nucleic acids and a number of coenzymes, and the following figure shows the importance of these pentoses sugars and their sources

Ribose: it is present in nucleic acid.
Ribulose: it is intermediate product in pentose phosphate pathway.
Arabinose: present in gum Arabic.
Xylose: found in wood gum.
Lyxose: present in heart muscle.
Deoxy ribose: present in nucleic acid.

Hexoses sugars

As for hexoses sugars such as **glucose, galactose, fructose and mannose** is also important sugars for the human body and play a major role in metabolic processes, and their importance is shown in the following:

Glucose sugar: its source: fruit juice, from the hydrolysis of starch, cane sugar sucrose, maltose and lactose sugar. Importance: It is a great source of energy needed by tissues, and a source of fuel for the brain, erythrocytes and skin.

Fructose sugar: its source: fruit juice, honey, hydrolysis of cane sugar, sucrose Importance: it is converted in the liver and intestine into glucose sugar, where the body benefits from it in metabolic processes

Galactose sugar: its source, from the hydrolysis of lactose sugar, Importance: it turns into glucose sugar in the liver for the purpose of benefiting from it in

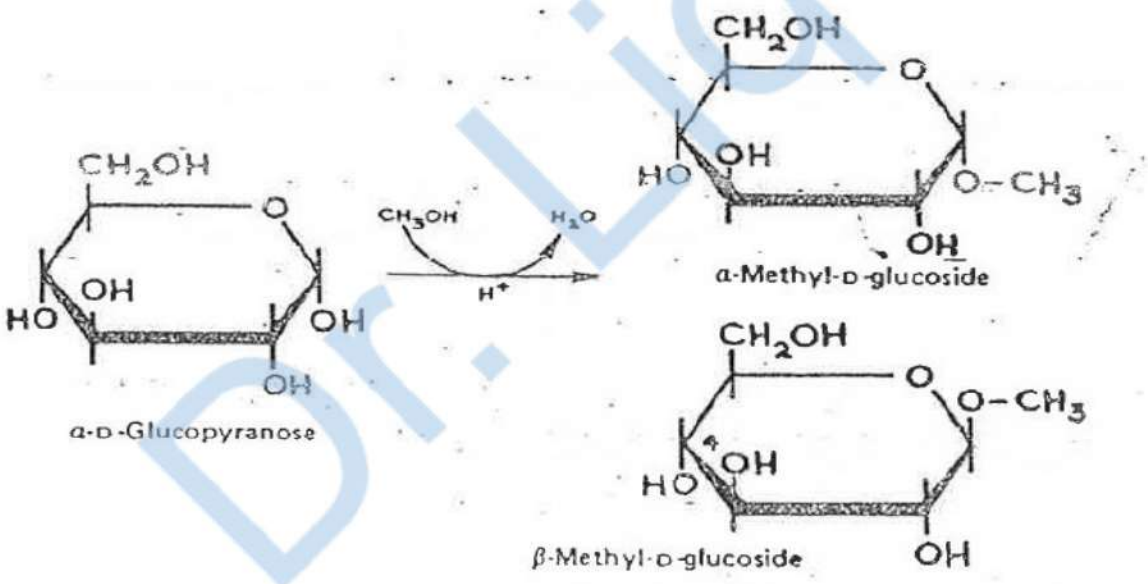
metabolic processes, and is built in the mammary glands to make lactose sugar in milk.

Mannose sugar: its source: from the hydrolysis of maltose sugar, from the gum, and enters the synthesis of polysaccharides

The important reactions of monosaccharides

1.Glycosides formation

Glycosides are compounds resulting from the reaction of monosaccharides with the hydroxyl group of another compound in the presence of a mineral acid as a catalyst. For example, an alpha-D-glucose solution reacts with methyl alcohol at boiling point and in the presence of 0.5% hydrogen chloride as a catalyst to form a mixture of **α-methyl-D-glocoside and β-methyl-D-glucoside**, as shown in the following reaction:

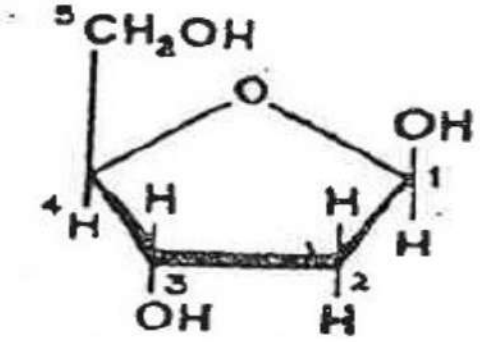


The above reaction is between OH group associated with the anomeric carbon atom 1 in α-D-glucose sugar with OH group in methyl alcohol. Glycosides are involved in the composition of a large number of medical drugs, and they are also present in spices.

2.Deoxy Sugars:

They are those sugars in which the hydroxyl group in the ring is compensated by a hydrogen atom, and one of the most prevalent of these

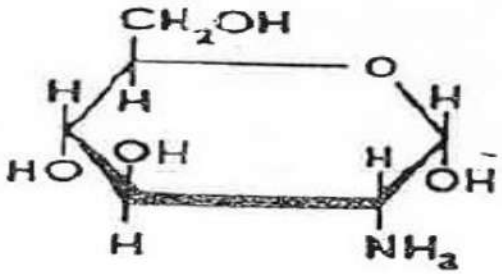
sugars in nature is **2-deoxy-D-ribose sugar**, which is shown in the following figure:



This compound is produced by the acid degradation of deoxyribose DNA.

3. Amino sugars

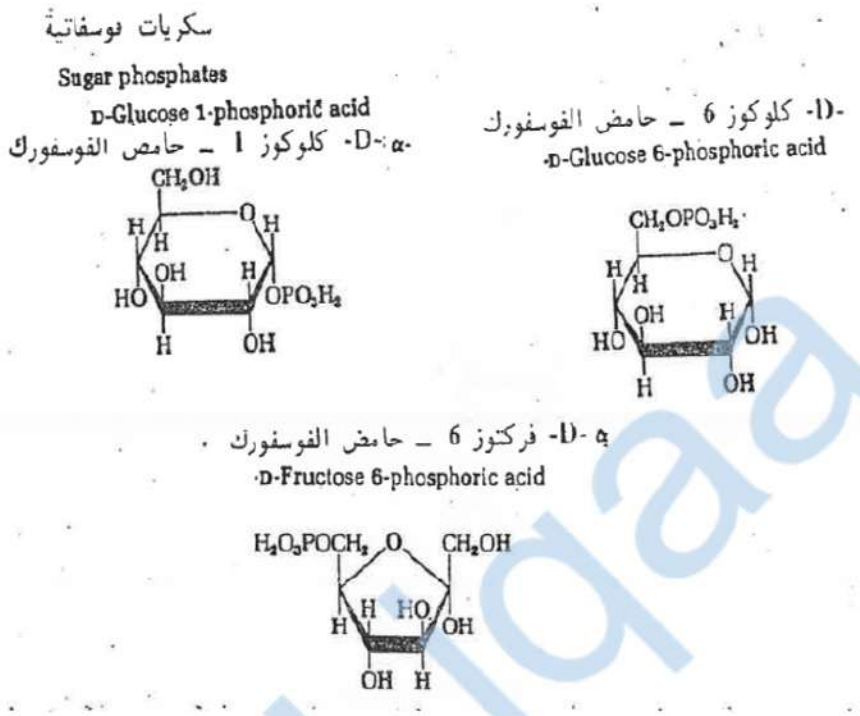
They are sugars containing the amine group that replaced the hydroxyl group, and examples of this are D-glucoseamine, as shown in the following shape, which is one of the main components of chitin, a multiple sugar that enters the composition of the external structure of crustaceans, and the other compound is the galactoseamine, which is one of the main components of multiple sugars found in cartilage, and It is worth noting it is worth, that a number of antibiotics such as erythromycin and carbomycin enter into their composition amino sugars. Where it is believed that the effectiveness of these antibiotics is due to the presence of amino sugar in it.



4. Phosphoric acid esters

There are a number of phosphoric acid esters of monosaccharides and they are important intermediate products during metabolic reactions of

carbohydrates, and the following figure shows examples of some phosphate sugars.



5. Sugar acids

There are a number of sugar acids, the most famous of which are three biologically important acids:

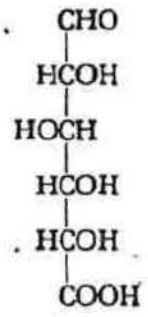
1. **D-Gluconic acid**: It is the acid produced by the oxidation of the aldehyde carbon atom to the carboxyl group. It is an intermediate product during the biological reactions of glucose sugar in some organisms.
2. **D-Glucuronic acid**: This acid results from the oxidation of the hydroxyl group associated with carbon atom No. 6 in D-glucose sugar.
3. **Ascorbic acid, called vitamin C**. It is a non-stable compound that suffers oxidation to dehydroascorbic acid. The vitamin C is found in large quantities in citrus fruits, and a deficiency of this vitamin causes scurvy. The following figure shows the chemical structures of these three sugar acids.

احماض سكرية

D-Gluconic acid

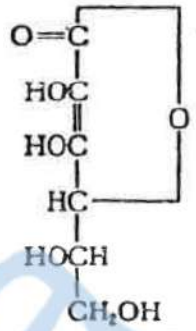
حامض D-كلوكونك

D-Glucuronic acid



حامض D ـ كلوكيورنك

L-Ascorbic acid



حامض L ـ اسكوربك