

المحاضرة الثالثة

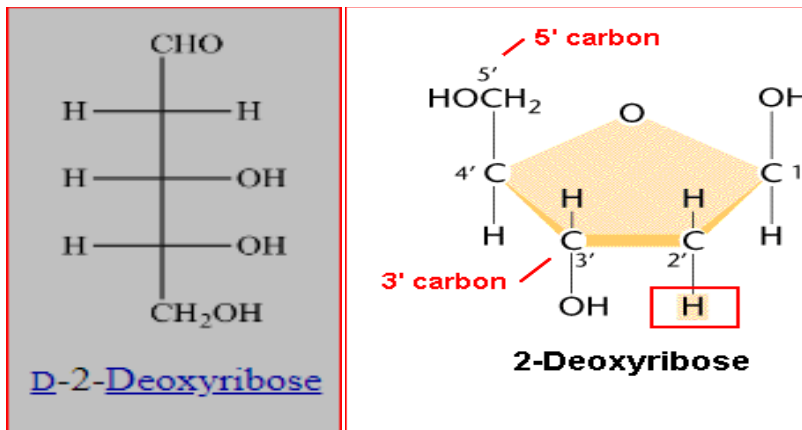
Derivatives of monosaccharides

Derivatives of monosaccharides often means modification of sugar molecules by addition substituent other than hydroxyl group. Amino sugars, acidic sugars, deoxy sugars, sugar alcohols, glycosyl amines, and sugar phosphates are examples of carbohydrate **derivatives**.

- Deoxy sugar

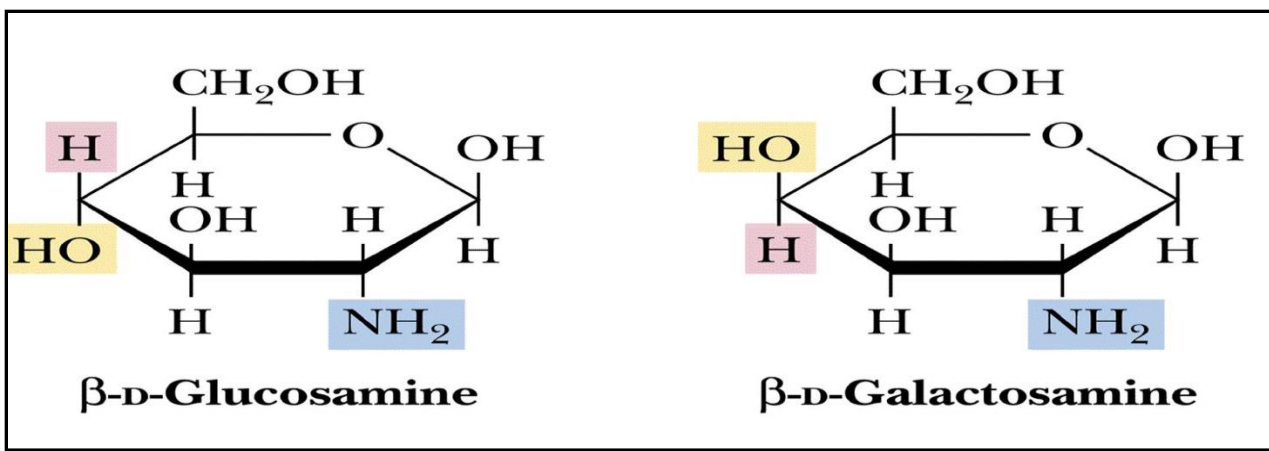
These are monosaccharides which lack one or more hydroxyl groups on the molecule.

One quite widely distributed (ubiquitous) deoxy sugar is 2-deoxy ribose which is the sugar found in DNA.



- Amino sugars

In a number of sugars, an amino group replaces of the hydroxyl groups in the parent monosaccharide.



Disaccharides

Disaccharides consist of two monosaccharides such as.

Monosaccharides.

Disaccharide

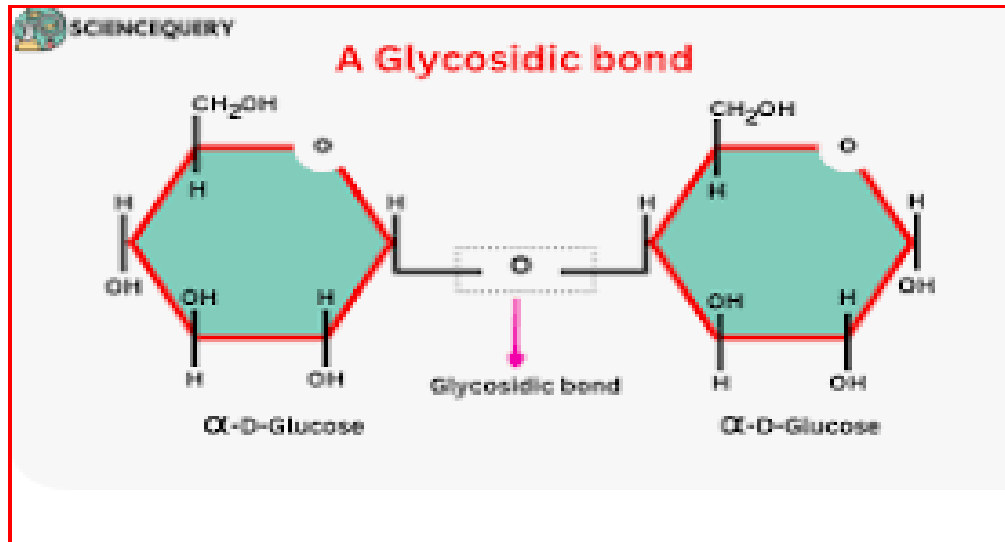
Glucose + glucose \longrightarrow maltose + H₂O

Glucose + galactose \longrightarrow Lactose + H₂O

Glucose + fructose \longrightarrow Sucrose + H₂O

Glycosidic bond.

Is the primary structural linkage in all polymers of monosaccharides. A glycosidic bond is an acetal linkage in which the anomeric carbon of a sugar is condensed with an alcohol, an amine or thiol. Compound containing glycosidic bonds are called glycosides. The glycosides include disaccharides, polysaccharides and some carbohydrate derivatives.



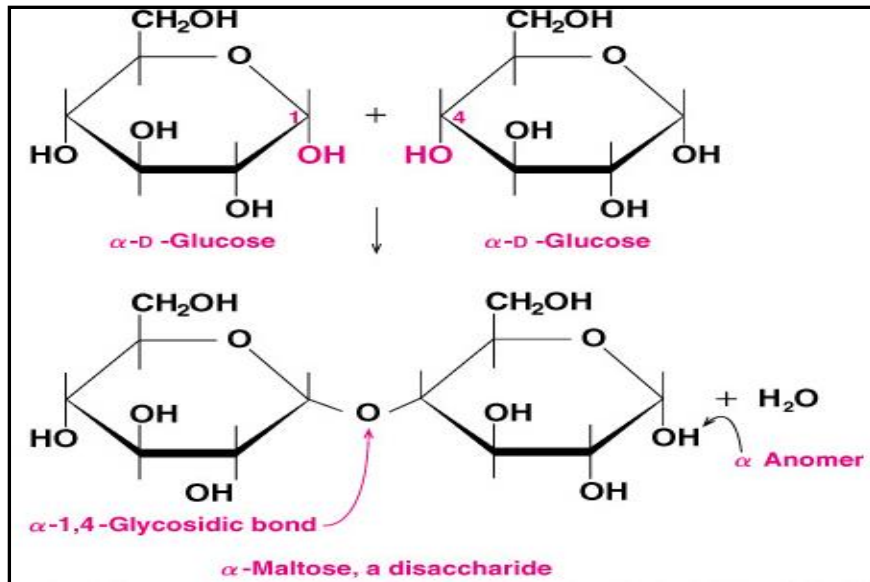
Note: An anomeric carbon is a hemiacetal or hemiketal carbon of a cyclic sugar. It is the carbon at which the alpha anomer or beta anomer is formed.

Disaccharides

1-Maltose

- A disaccharide also known as malt sugar.
- Composed of two D-glucose molecules.
- Obtained from the hydrolysis of starch.

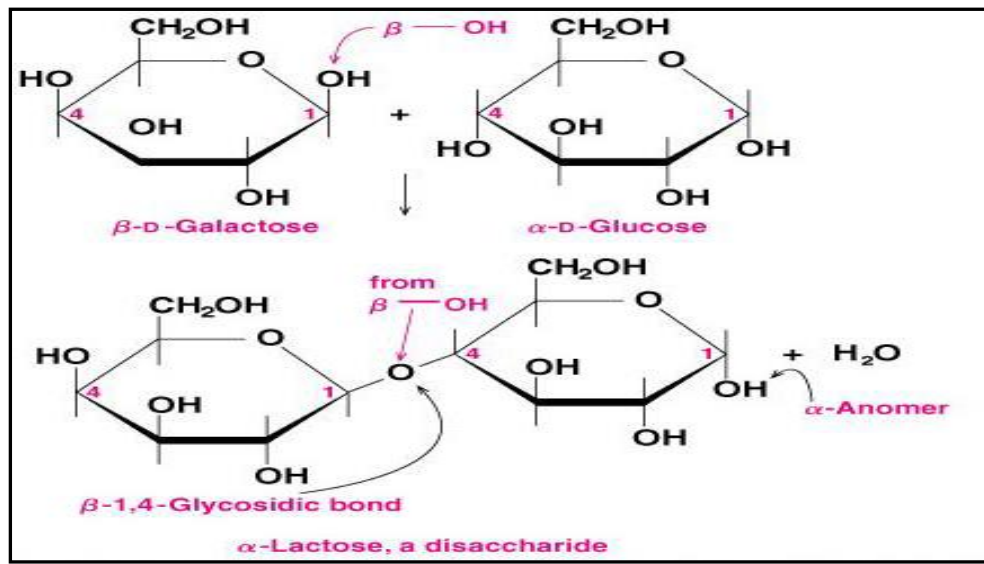
- Linked by an α 1,4-glycosidic bond formed from α OH on C₁ of the first glucose and - OH on C4 of the second glucose.
- Used in Cereals, Candies and Brewing.



Maltose structure

2-Lactose

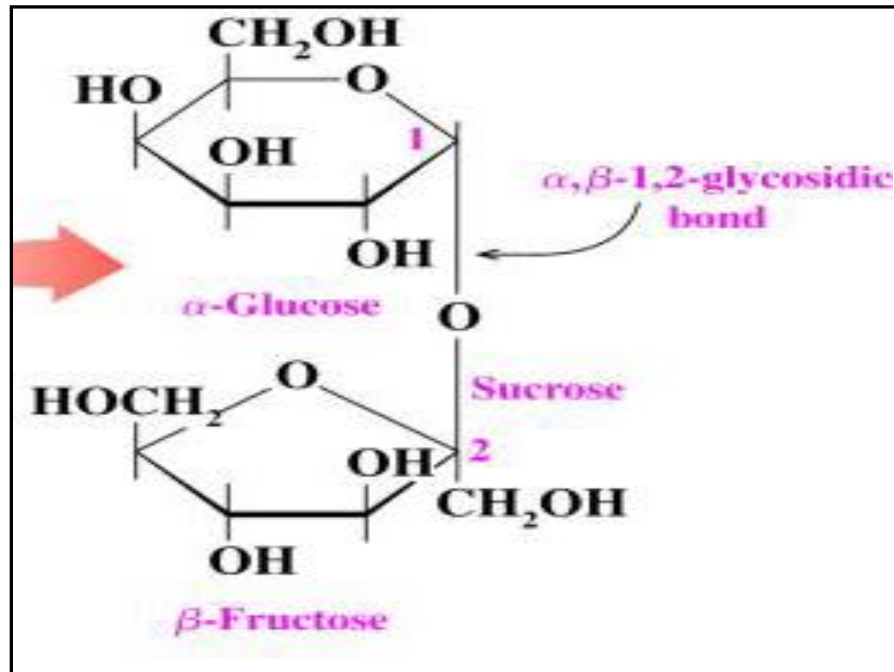
- Is a disaccharide of β -D-galactose and α or β -D-glucose
- Contains a β -1, 4glycosidic bond.
- Is found in milk and milk products.



Lactose structure

3.Sucrose or table sugar.

- As obtained from Sugar cane and Sugar beets.
- Consist of α -D-glucose and β -D-fructose.
- Has an α , β -1,2 glycosidic bond.



Sucrose structure

Types of Poly saccharides

Polysaccharides are frequently divided into two broad classes:

A. Homopolysaccharides (Homoglycans): Are polymers containing only one type of monosaccharides residue).

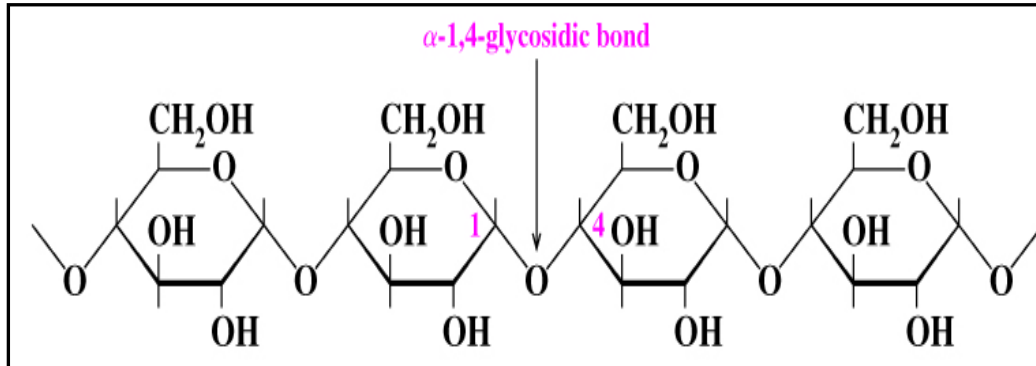
- Are Polymers of D-glucose
- Include starches (amylose and amylopectin), which is made of α -D-glucose
- Include glycogen (animal starch in muscle), which is made of α -D-glucose.
- Include cellulose (plants and wood), which is made of β -D-glucose.

A. Starch

Starch consist of:

-Amylose

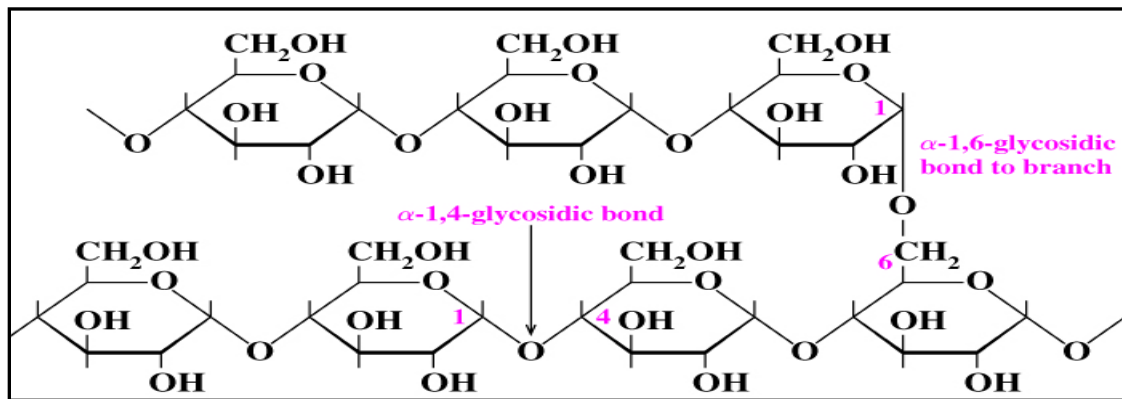
In plant cells, starch is present as a mixture of amylose and amylopectin. Is a polymer of α -D-glucose molecules linked by α -1-4 glycosidic bonds. Amylose unbranched Polymer chained.



Amylose structure

- Amylopectin

Is a branched-chain polysaccharides and a polymer of α -D-glucose molecules. Amylopectin has α -1, 4 glycosidic bonds between the glucose units and α -1, 6 bonds to branches.



Amylopectin structure

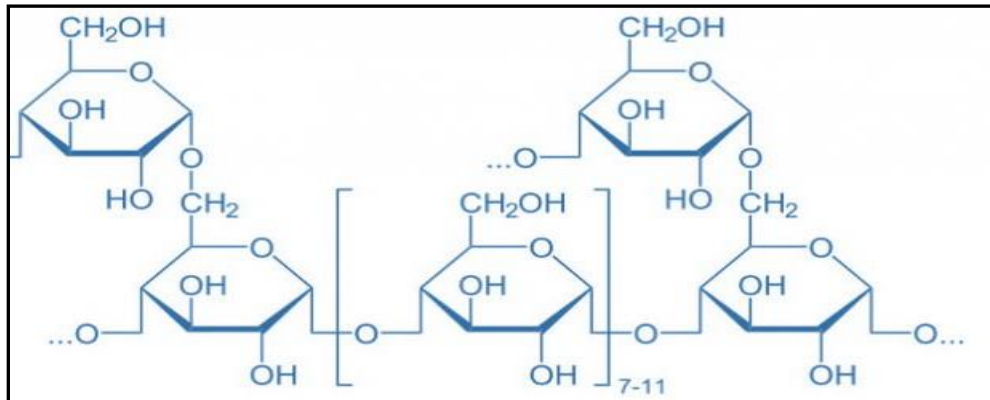
Main features of starch

- 1- Used as energy storage, in plants.
- 2- found in all plant seeds and tubers.
- 3- Mostly containing (20-25%) amylose and (70-80%) amylopectin
- 4- Both amylose and amylopectin are completely hydrolyzed to produce D-glucose.

B. Glycogen

Glycogen, a storage Polysaccharide found in animal and bacteria and stores α -D- glucose in muscle. It's similar to amylopectin, but is more highly branched.

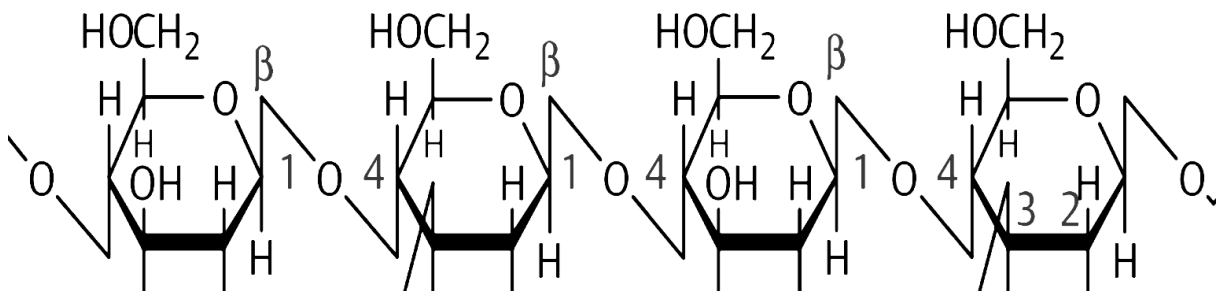
Glycogen bind α -1,6 and α - 1,4.



Glycogen structure

C. Cellulose

Is a polysaccharide of glucose units in unbranched chains. The glucose residues are joined by β -1,4 glycosidic bonds. Cellulose cannot be digested by humans because humans cannot break down β -1,4 glycosidic bonds.



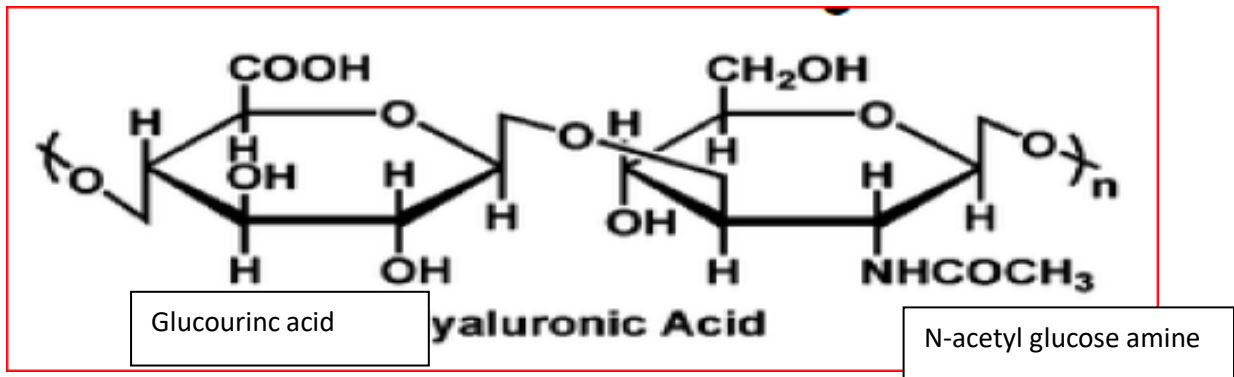
Cellulose structure

B- Heteropolysaccharides

Heteropolysaccharides : Are polysaccharides that contain multiple monosaccharide units.

- Mucopolysaccharides

These materials provides a thin, viscous, jelly- like coating to cells. The most abundant form is hyaluronic acid, which consist of **glucouronic acid** unit joined with N-acetyl glucose amine unit.



Hyaluronic acid structure