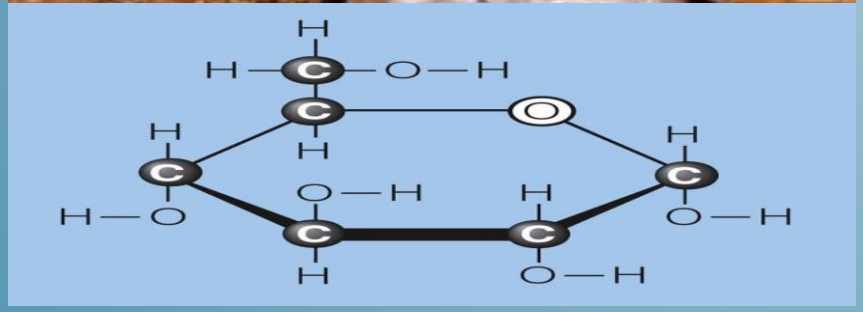
Biochemistry – Year 2



Lecture 3

By

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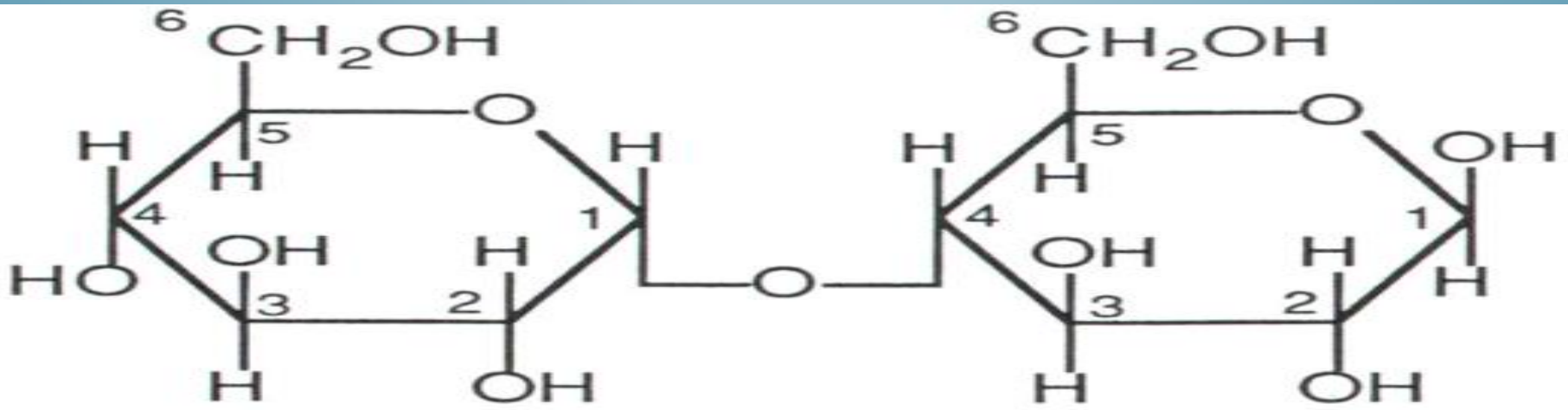
3.Glycosides formation: result from the condensation between the hydroxyl group of anomeric carbon atom of a monosaccharide and another compound (with may not be a monosaccharide).

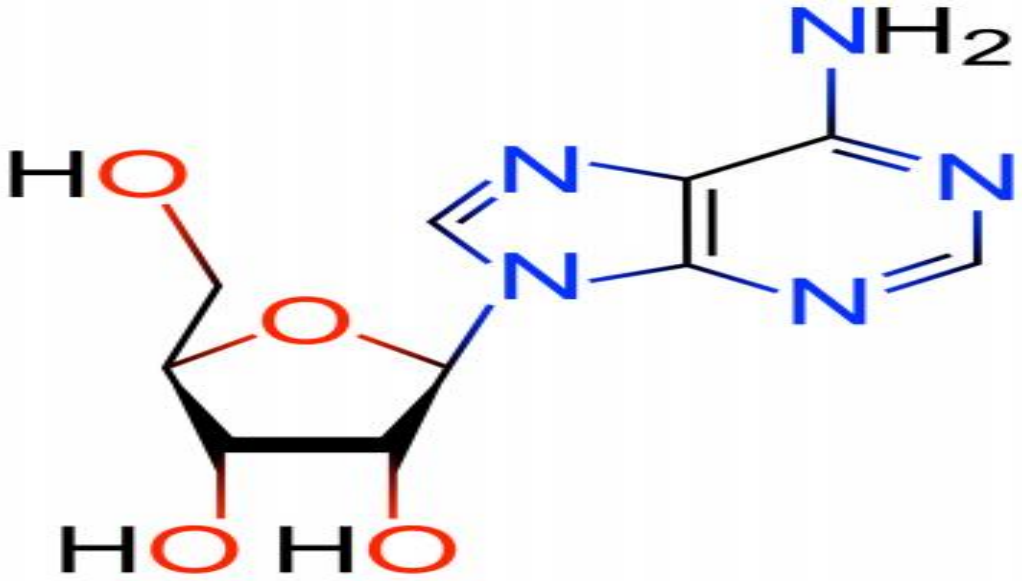
Type of glycosidic bond:

a. O-glycosidic bond : results from the reaction between the hydroxyl group of anomeric carbon atom of a monosaccharide with an alcohol in presence of acid.



Maltose

b. N-glycosidic bond : results from the reaction between the hydroxyl group of anomeric carbon atom of a monosaccharide with an amide group ex: adenosine(with is made from adenine and D-ribose)



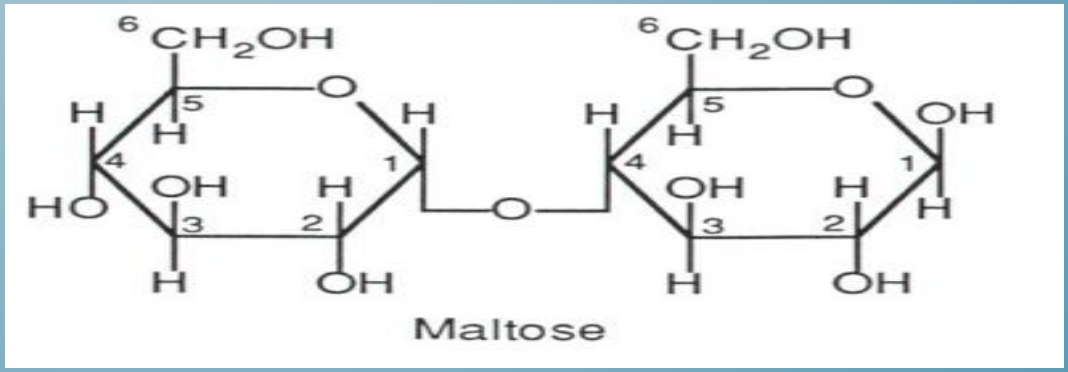
Adenosine

2.Disaccharides

Disaccharide is made up of two molecules of monosaccharides that are the same or different and joined by glycosidic bond. The general molecular formula is $C_{12}H_{22}O_{11}$. Examples are maltose , lactose and sucrose.

1. Maltose:

1. Consists of 2 molecules of Glucose linked by α(1 → 4) glycosidic bond.
2. It is an intermediate in hydrolysis of starch by acid or enzyme (amylase).

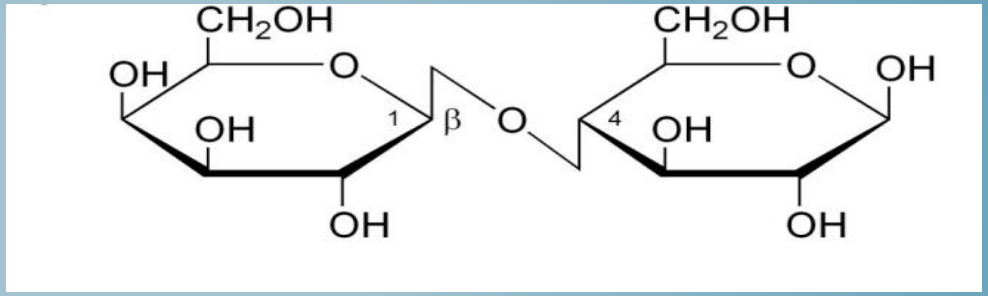


Maltose

2. Lactose:

1.It is made up of one molecule of β-D-Galactose and one molecule of either α or β-D-Glucose linked by β(1→ 4) glycosidic bond.

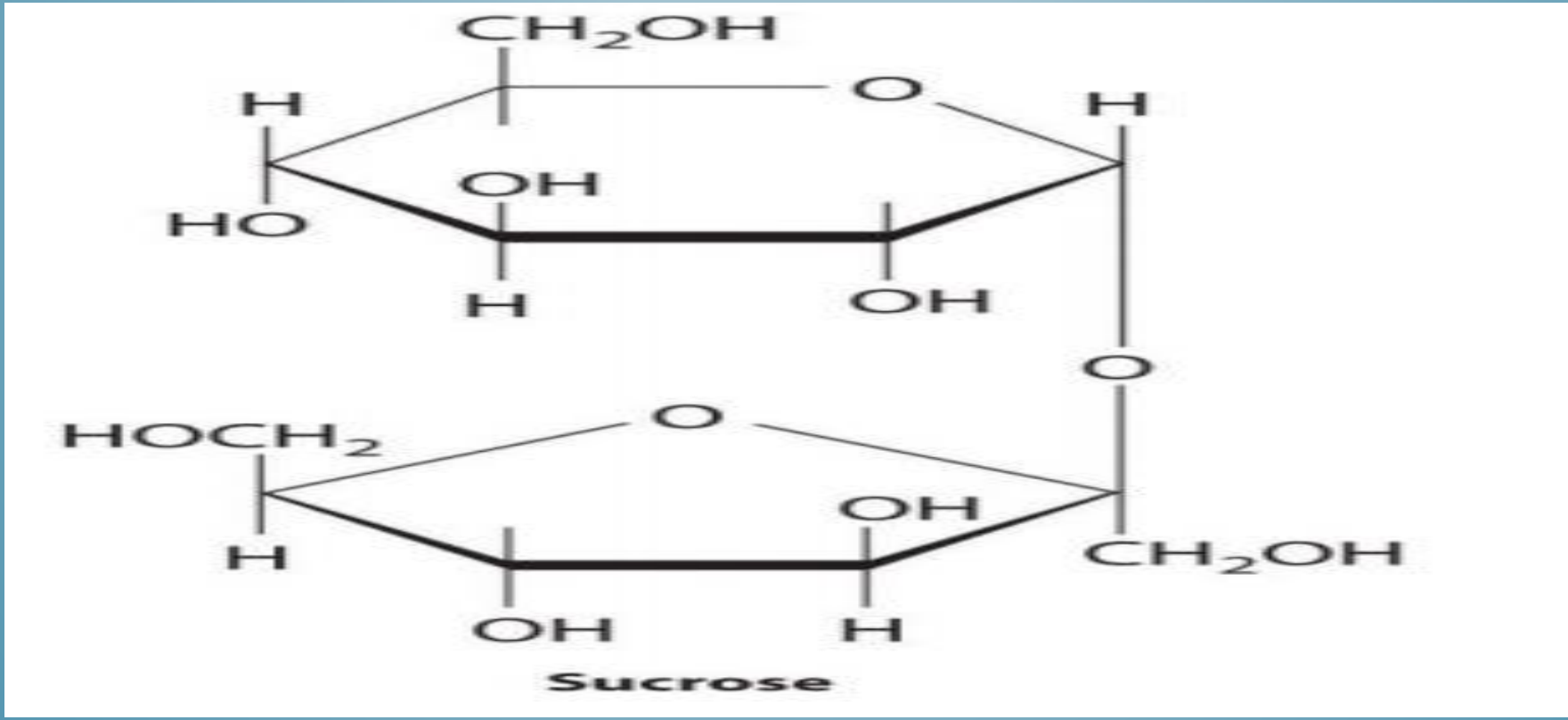
2. It is milk sugar .



3.Sucrose:

1. It is made up of one molecule of α-d-Glucose and one molecule of β-D-fructose linked by (α1→ β2) glycosidic bond .
2. It is called " table sugar" or "cane sugar" . It is synthesized by plant and not by animals.

3.It is used as food preservative because at high concentration it produce high osmotic pressure inhibition the growth of microorganisms.



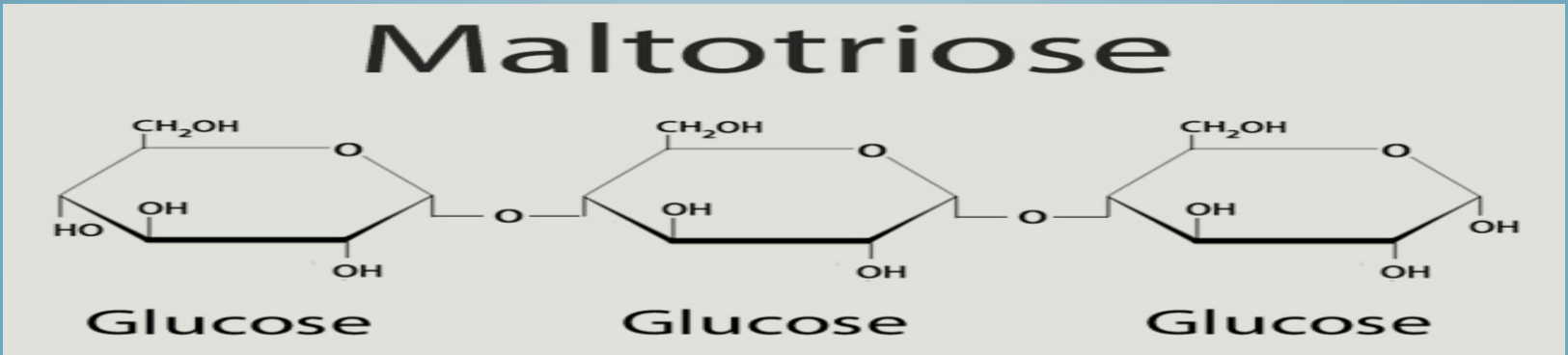
Sucrose

Tests for Carbohydrates:

1. **Molisch's test:** is a sensitive test for the presence of CHO.
2. **Benedict's test:** it is used to detect reducing sugars (whether mono or disaccharide).
3. **Barfoed's test:** it is used to distinguish between reducing monosaccharide from reducing disaccharide.
4. **Bial's test:** it is used to distinguish between pentoses and hexoses.
5. **Seliwanoff's test:** it is used to distinguish between aldoses and ketoses.
6. **Iodine test:** it is used to detect polysaccharides (starch).

3. Oligosaccharides

Are condensation products of three to ten monosaccharides , example is maltotriose that is not a true triose but trisaccharides containing 3 α-glucose residues .

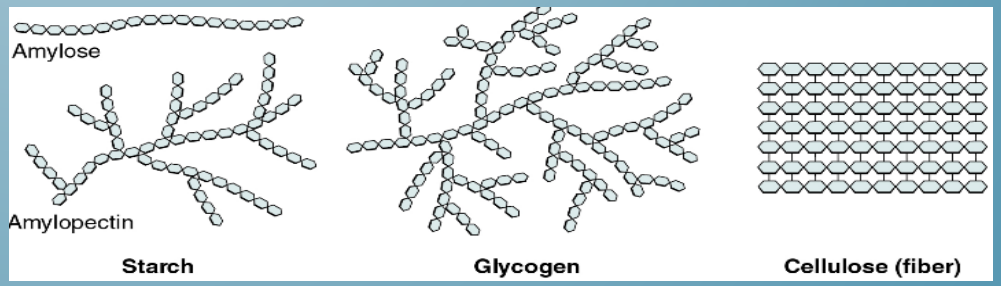


Oligosaccharides are attached covalently to the outer surface of the proteins of the membrane forming (glycoproteins) which act as receptors . Moreover many antibodies coagulation factors contain oligosaccharide unites.

4. Polysaccharides

Are condensation products of ten, hundreds , or even many thousands of monosaccharide linked together by glycoside bonds.

A. Homopolysaccharides: polymer of the same monosaccharides units ex. : starch , glycogen and cellulose.
B. Heteropolysaccharides: polymer of the different monosaccharides units or their derivatives, ex. : Hyaluronic acid and Heparin

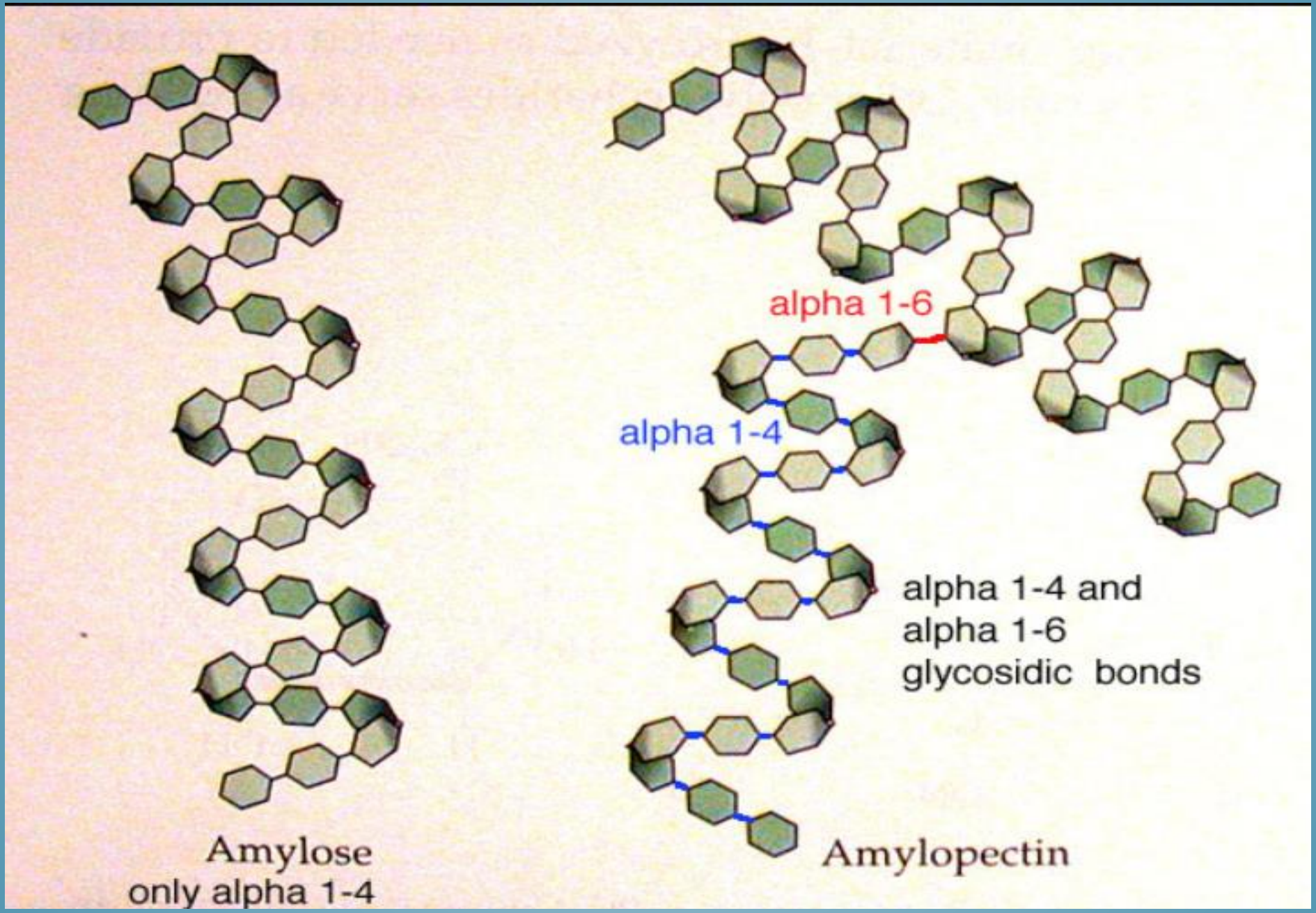


1.Starch:

a. It is a polymer of α-D-glucose.
b. It is the most important dietary carbohydrate in cereals, potatoes and vegetables.
c. It is consist of two types of glucose polymer:

1. **Amylose** (20%) which has a non-branched structure made up entirely of α-D-glucose united by α(1 → 4) glycosidic linkage , so it is a head – to- tail polymer of up to 4000 glucose unites.
2. **Amylopectin** (80%) which is highly branched chains composed of α-D-glucose by α(1 → 4) linkages at branch points are α(1 → 6) linkages . the branched occurs at one in every 20-25 glucose molecules in the chain.

So starch is a heterogeneous homopolysaccharide.


alpha 1-6
alpha 1-4
alpha 1-4 and
alpha 1-6
glycosidic bonds
Amylose
only alpha 1-4
Amylopectin

2.Glycogen:

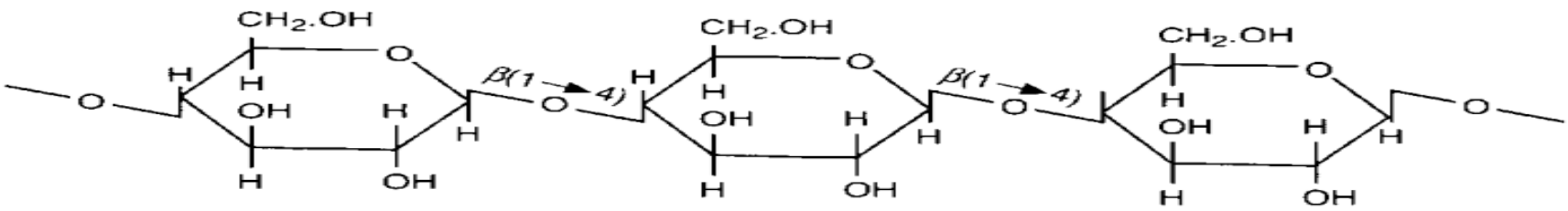
a. It is the storage polysaccharide in animals and is sometimes called animal starch.
b. Like amylopectin, it is highly branched chains composed of α-D-Glucose joined by α(1 → 4) linkages while the linkages at the branch points are α(1 → 6) linkages .
c. It differs from amylopectin that it has more but shorter branches. The branching occur every 12-18 glucose molecules in the chain .
d. During meals, the excess of glucose is stored in the body (liver and muscles) in form of glycogen. Between meals and during fasting, the glycogen is hydrolyzed to glucose to provide the body with its need of glucose.

3. Cellulose or dietary fibers:

a. It is a structural polysaccharide. It is the main constituent of cell wall of plants.

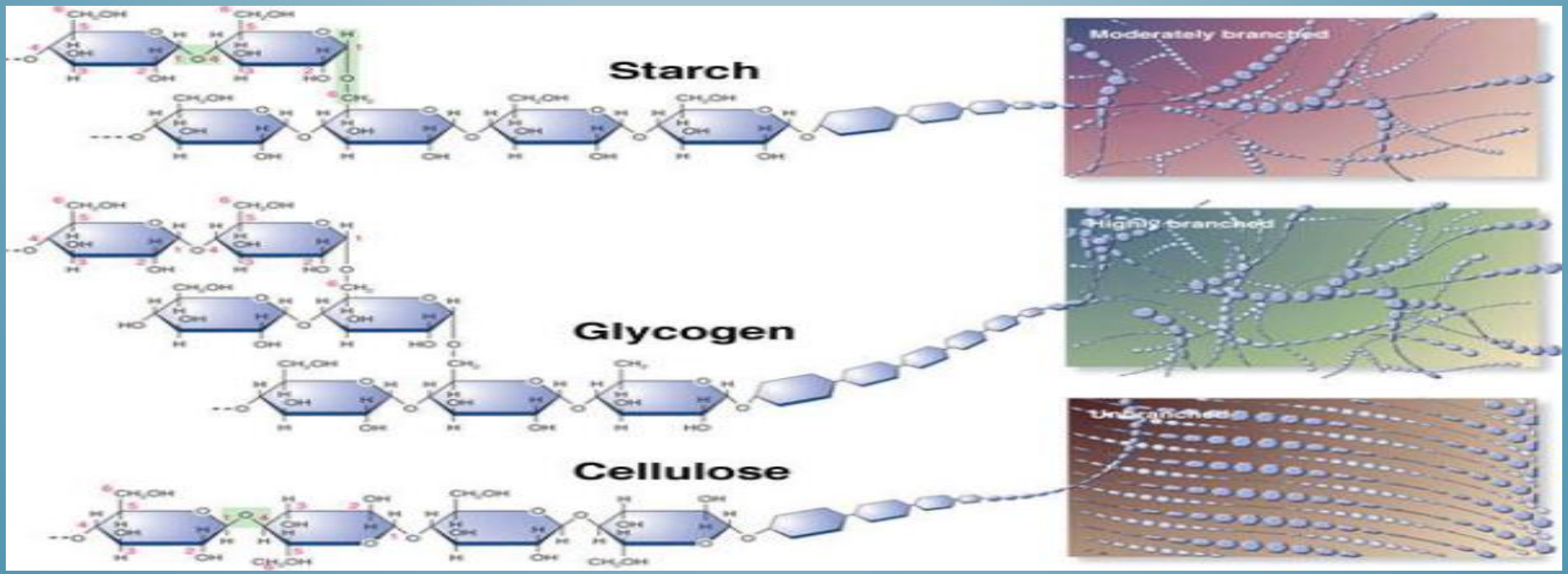
b. It is an unbranched homopolysaccharide of β-D-Glucose joined by β(1 → 4) linkages to form long , straight chains. They are strengthened by crosslinking hydrogen bonds forming long chains of parallel cellulose molecules called fibrils.

c. It has no dietary importance in human because human gut not release the enzyme responsible for hydrolysis of β(1 → 4) linkages so he cant digest cellulose.



Soluble fibers : can be digested by intestinal becteria (this property is also known as fermentability). These fibers are found in fruits and vegetables.

Insoluble fibers : can not be digested by intestinal becteria .These fibers are found in whole grains and vegetables.



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