CARBOHYDRATES

LEC.2

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Disaccharides

- Composed of 2 monosaccharides
- cells can make disaccharides by joining two monosaccharides by biosynthesis.

Glucose + fructose = sucrose

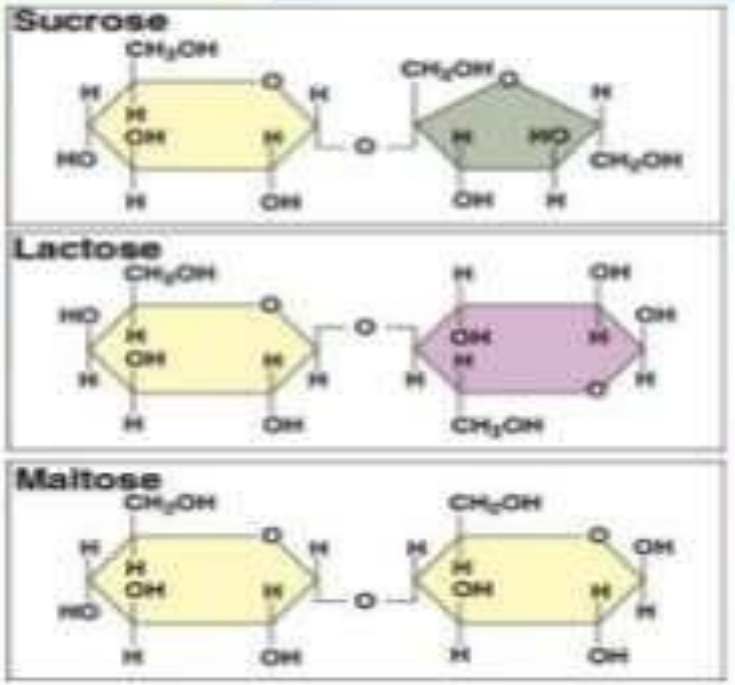
- Table sugar
- Found naturally in plants: sugar cane, sugar beets, honey, maple syrup
- Sucrose may be purified from plant sources into Brown, White and Powdered Sugars.

Glucose + galactose = lactose

- The primary sugar in milk and milk products.
- Many people have problems digesting large amounts of lactose (lactose intolerance)

Glucose + glucose = Maltose

- Produced when starch breaks down.
- Used naturally in fermentation reactions of alcohol and beer manufacturing.



Oligosaccharide is a carbohydrate polymers comprise three to ten monosaccharides, or, simple sugars. They were linked together mostly by **O-glycosidic** bond through **condensation reaction or glycosidic bond** between an anomeric carbon of a monosaccharide and the other after lose molecule of H2O.

Trisaccharides: Carbohydrates that on hydrolysis gives three molecules of monosaccharides, whether same or different. An example is Raffinose.

Tetrasaccharides: carbohydrates that on hydrolysis give four molecules of monosaccharides. Stachyose is an example.

Polysaccharide

They are condensation of polymers of monosaccharides or their derivatives

The general formula of it is $(C_6H_{10}O_5)_n$

Classification :

1. Simple = Homogenous= Homopolysaccharides= Homoglycan

   They are formed from the same type of monosaccharide units and include:

a. hexosans: as fructosans and glucosans.
b. Pentosans: formed of pentos sugar.

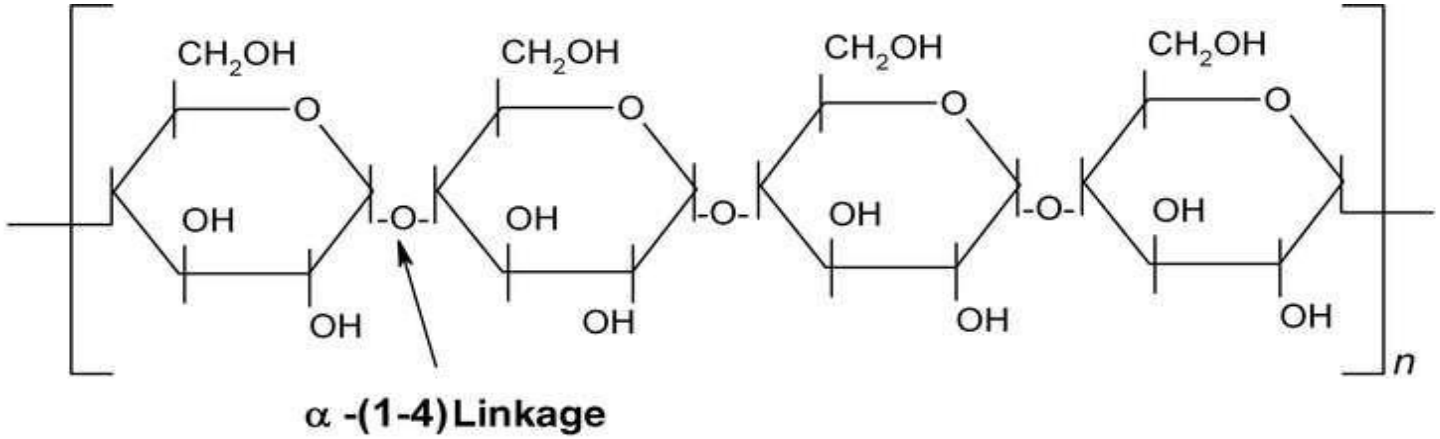
1. Mixed =Heterogenous =Heteropolysaccharides

Are formed from more than one type of monosaccharide as pectin and mucopolysaccharides

Homogenous polysaccharides

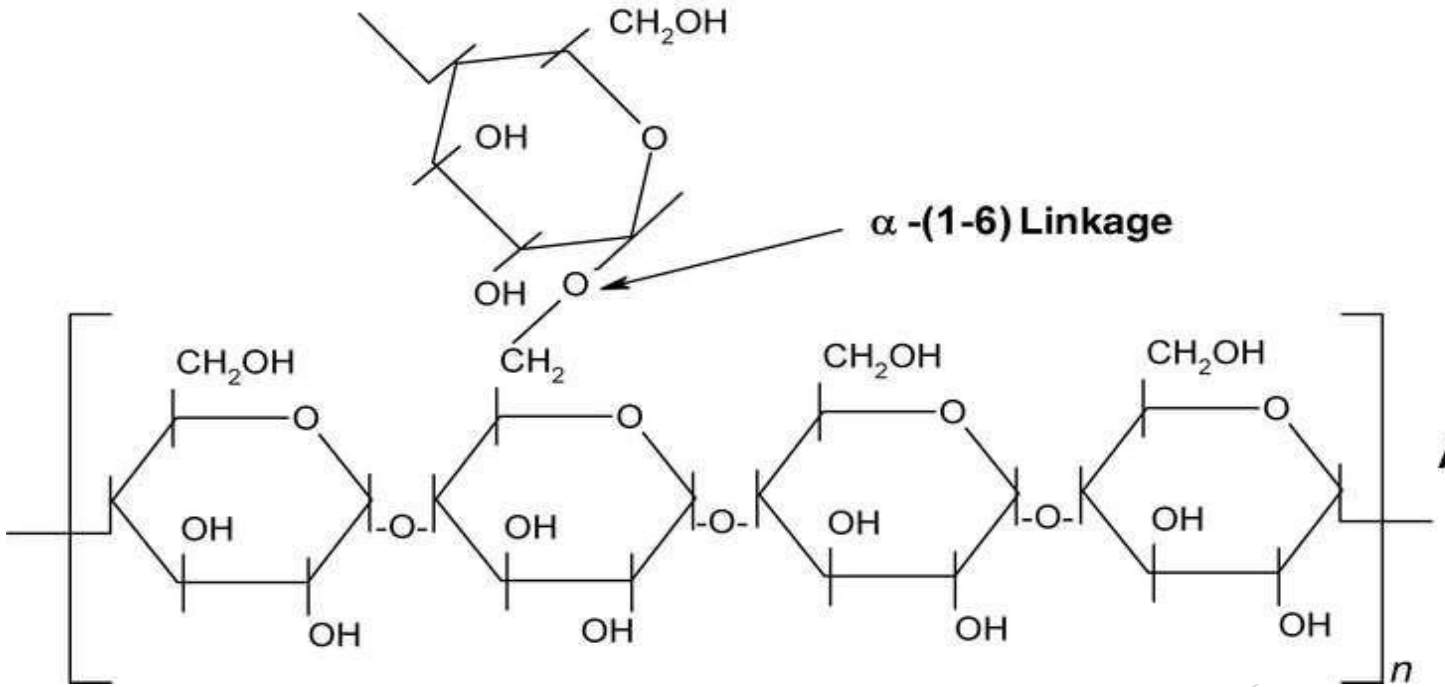
1- Starch :

- its units are glucose linked by glucosidic bonds.
- It is the storage form of glucose in plants.
- It is a mixture of amylose & amylopectin.
- Amylose is a linear unbranched polymer of glucose linkage together by alpha (1-4) glycosidic bond .
- Amylopectin is a branched polymer of glucose units connective by alpha (1-4), bond with (1-6) , Branch points occur every 25-30 glucose units.



Amylose

α -(1-4) Linkage

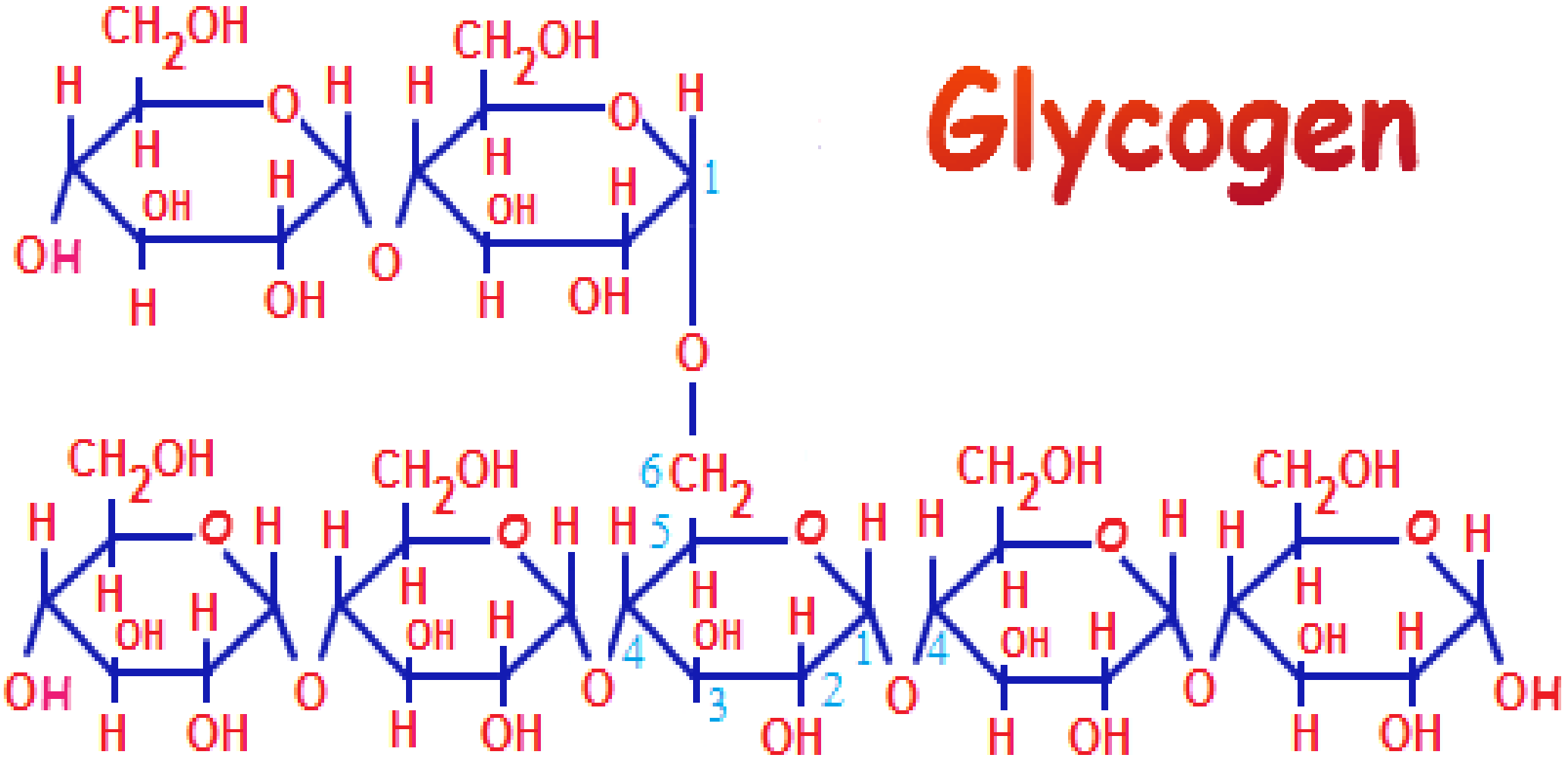


Amylopectin

2-Glycogen:

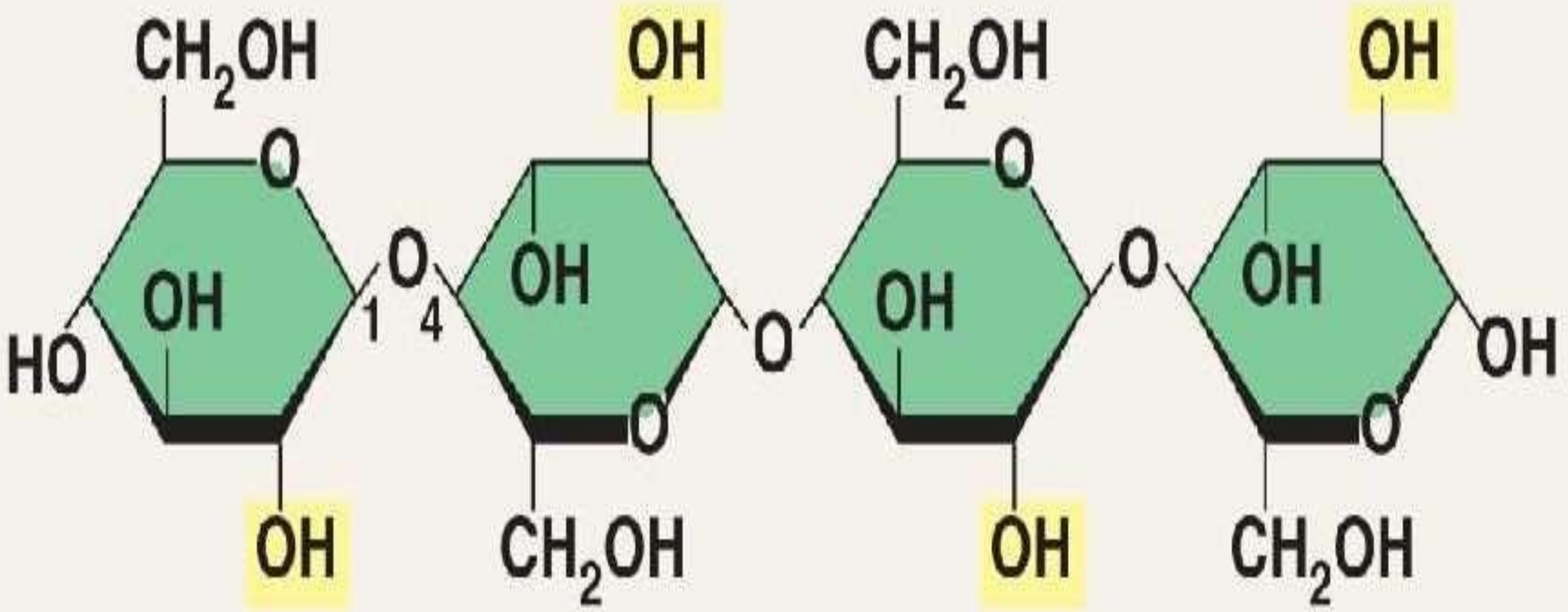
- It is the main storage form of glucose in animals & humans.
- It is mainly found in liver and muscles.
- It is structure similar to amylopectin that is mean containing both alpha (1-4) and (1-6) glycosidic bond ,but it is highly branched from of amylopectin.
- Branch point occur every 8-10 glucose units.

Glycogen



3-Cellulose :

- The most abundant carbohydrate found in nature
- It is simple straight chain polysaccharide formed of beta glucose units linked by beta (1-4) glucosidic linkage
- No digested in humans due to lack of enzyme that hydrolyses beta (1-4) glucosidic linkage.
- Its function in diet to increase stool bulk that stimulate intestinal peristalsis and prevent constipation



Cellulose: 1–4 linkage of β glucose monomers

4- Chitin : composed of repeated unit of N-acetylglucosamine

5- Dextrin: It is derived from the partial hydrolysis of starch, consisting of glucose unit

Heteropolysaccharides

Mucopolysaccharides = glycosaminoglycans

1. Hyaluronic acid : repeated units of β glucuronic acid and N-acetyl glucosamine .
2. Hyaluronic acid found between joints acts as synovial fluid and provides frictionless movement and it is also found in loose connective tissue and cartilage.
2. Chondroitine 4 or 6 sulfate : repeated units of glucuronic acid and N- acetylgalactoseamine with sulfate at C-4 or C-6 .
   Found in cartilage , tendons and ligaments.

3-Heparin : sulfated glucosamine and sulfated iduronic acid

It is intracellular component while other glycosaminoglycans are extracellular..

It is a medically important polysaccharide because it prevents clotting in the blood stream, that is mean It serve as anticoagulant.

4-Heparan sulphate

5- Keratan sulphate. does not contain uronic acid

6-Dermatan sulphate

7- Agar

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glycoproteins

They are proteins attached to oligosaccharides .

Examples:

1. IgG
2. Mucine found in mucous secretions .
3. Membrane-bound glycoproteins.
4. Plasma transport proteins.
5. Structural proteins as collagen

Clinical importance of some carbohydrates

Inulin : –

It is a polysaccharide (containing fructose) which can be used in determination of glomerular filtration rate (GFR).

Cardiac glycosides :

Sugars can react with alcohols forming acetals known as glycosides . examples , cardiac glycosides as digitalis which is used in treatment of heart failure

Ouabain :

-Inhibitor of Na-K ATPase of cell membrane.

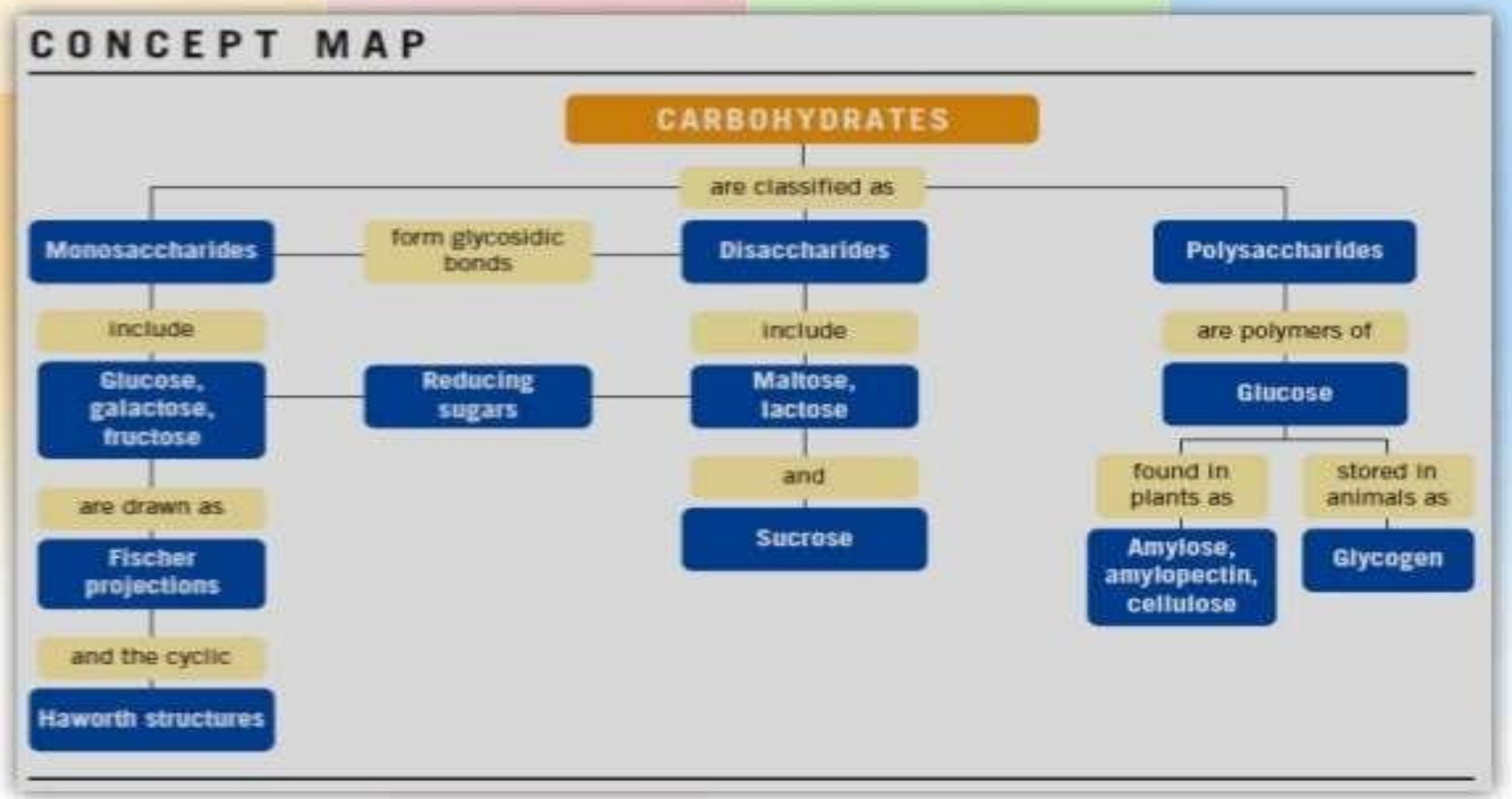
-Called a cardiac glycoside

-Lower doses can be used medically to treat hypotension and some arrhythmias.

Streptomycin:

It is an antibiotic.

CONCEPT MAP


CARBOHYDRATES
are classified as
Monosaccharides
form glycosidic bonds
Disaccharides
Polysaccharides
include
include
are polymers of
Glucose, galactose, fructose
Reducing sugars
Maltose, lactose
Glucose
are drawn as
and
found in plants as
stored in animals as
Fischer projections
Sucrose
Amylose, amylopectin, cellulose
Glycogen
and the cyclic
Haworth structures


THANK
YOU!