Polysaccharides

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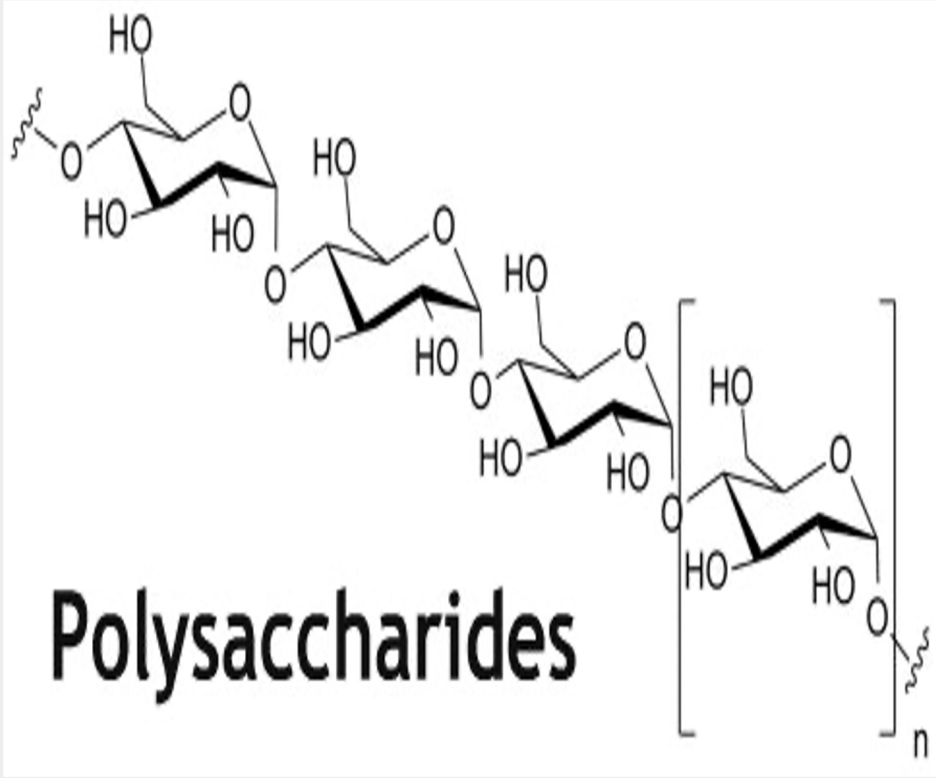
What is polysaccharides?

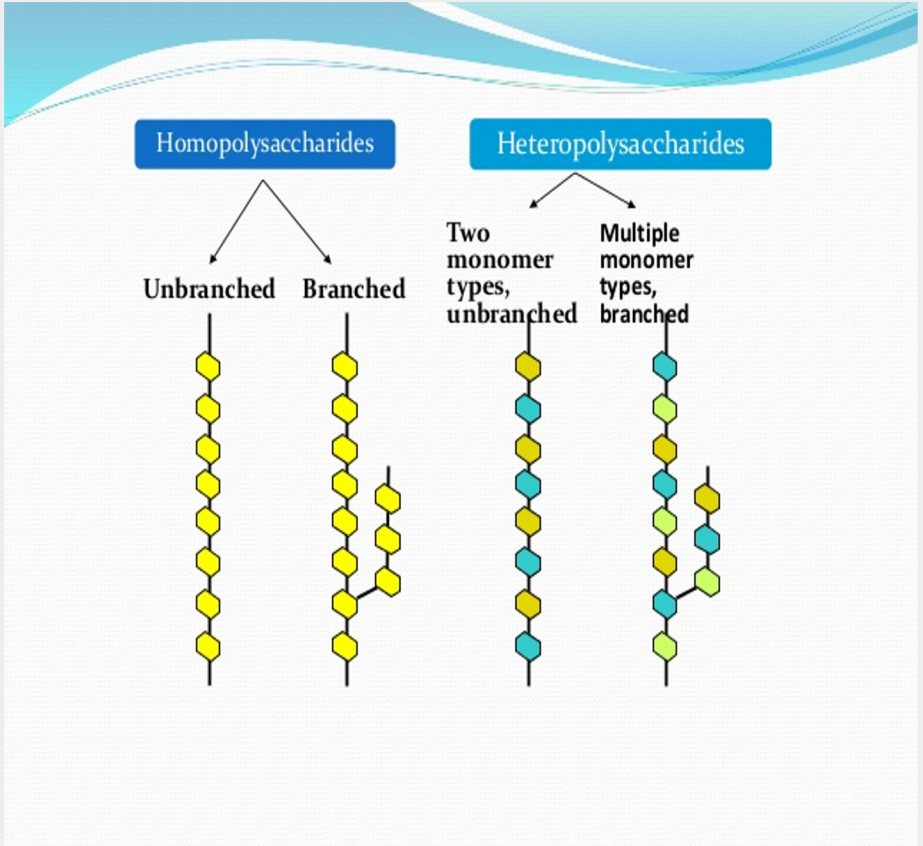
Polysaccharides are long-chain complex carbohydrate molecules made up of multiple monosaccharides linked by glycosidic bonds. They can range from being structurally branched to linear, but most-simply they are large carbohydrate molecules. Starch, glycogen and cellulose are all examples of polysaccharides.



Two types of Polysaccharides:

a.**Homopolysacccharide** are made up of a single monosaccharide

b.**Heteropolysaccharide** composed of two or more different monosaccharide



Starch is known to be the storage polysaccharide of many plants as well as being a homopolysaccharide of glucose containing 20% **Amylose** and 80% **Amylopectin.** It is a digestible complex carbohydrate. Amylose usually is a helical configuration with 6 glucose units. Amylopectin with branches of about 20-25 glucose units.

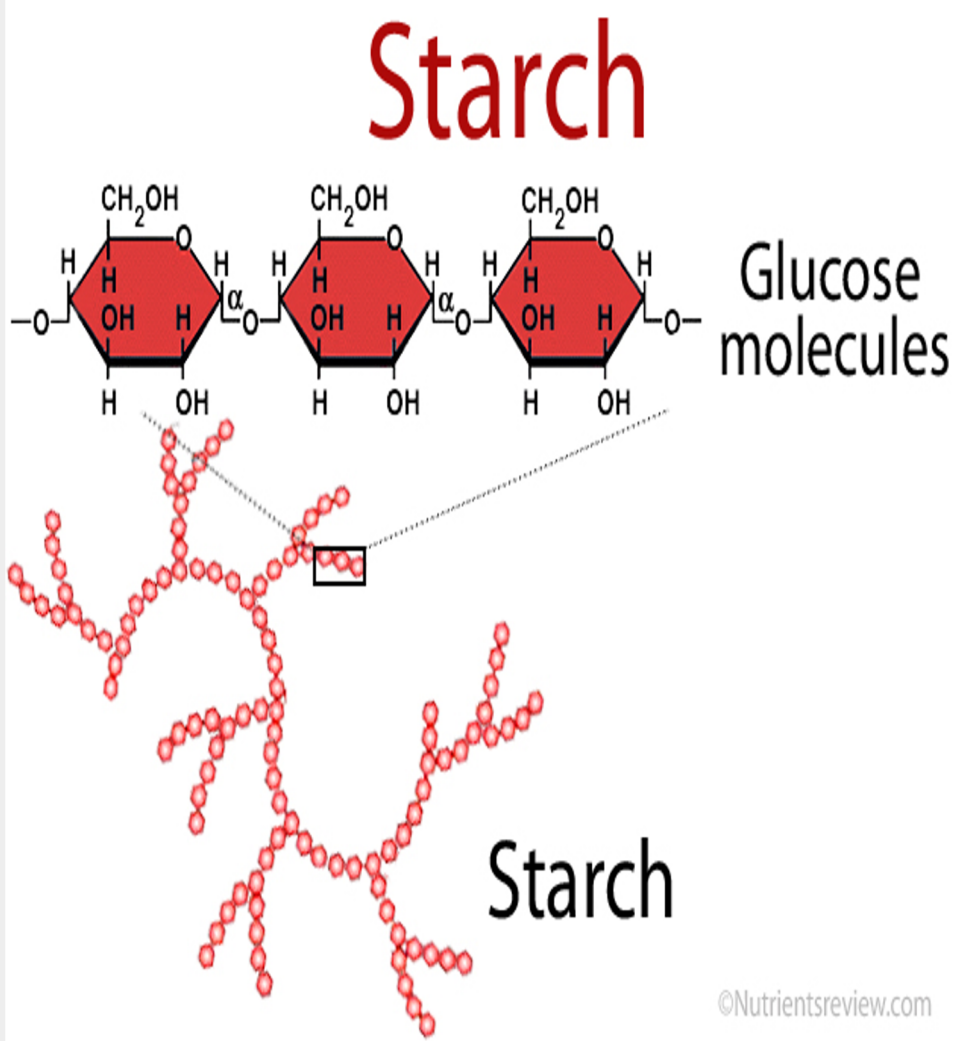
FUNCTIONS:

- Energy. Starch provides carbon atoms of 4.2 calories per gram
- Starch provides carbon atoms for synthesis of other substances in the body

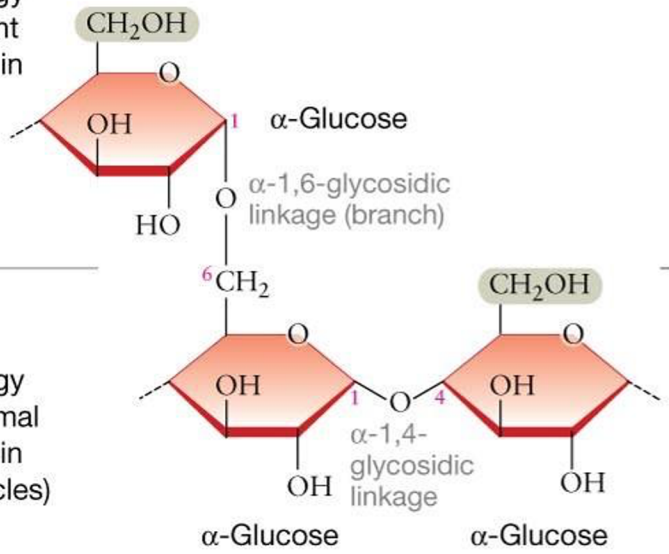
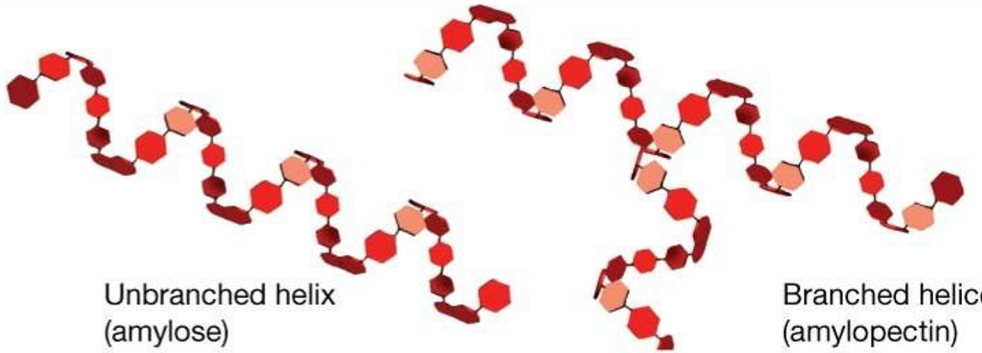
Starch naturally occurs only in plant foods.

Starch Formula: $C_6H_{10}O_5$

Some starchy foods are bread, cereal, pasta, rice, potatoes and beans.



SUMMARY TABLE 5.1 Polysaccharides Differ in Structure (Part 1)

Polysaccharide	Chemical Structure	Three-dimensional Structure
Starch Used for energy storage in plant cells (such as in potatoes) 		
Glycogen Used for energy storage in animal cells (such as in liver and muscles) 		

Glycogen

Formula: $C_{24}H_{42}O_{21}$

Glycogen is the medium- term storage polysaccharides for animals (never found in plants).

In humans, glycogen is made and stored in the cells of the liver and muscles. It acts as an energy reserve carbohydrate for animals.

Glycogen is a homopolymer that consists of glucose monosaccharides.It is insoluable in water.

Glycogen consists of glucose monomers linked by (1-4) glycosidic bonds in a helical fashion.The helical chain in branched into 10 or so units by alpha (1-6) glycosidic bond.This makes glycogen a highly branched polysaccharide.

A glycosidic linkage is a type of covalent bond that joins a carbohydrate (sugar) molecule to another group .

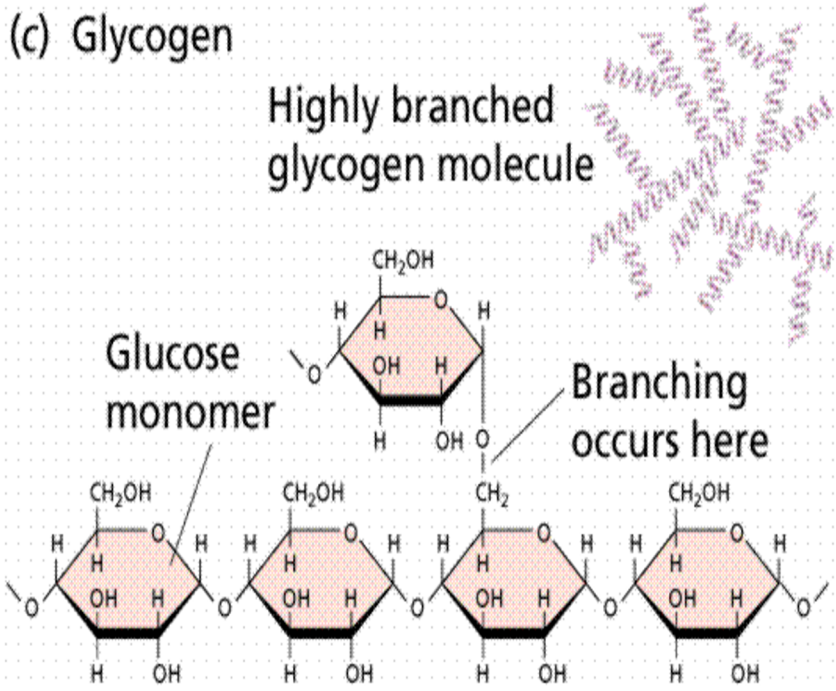


Figure 3.12 (3)

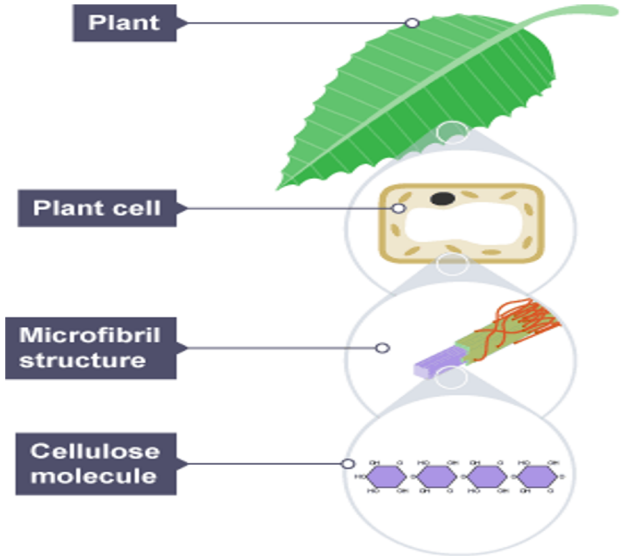
Cellulose plays a structural role in plants.

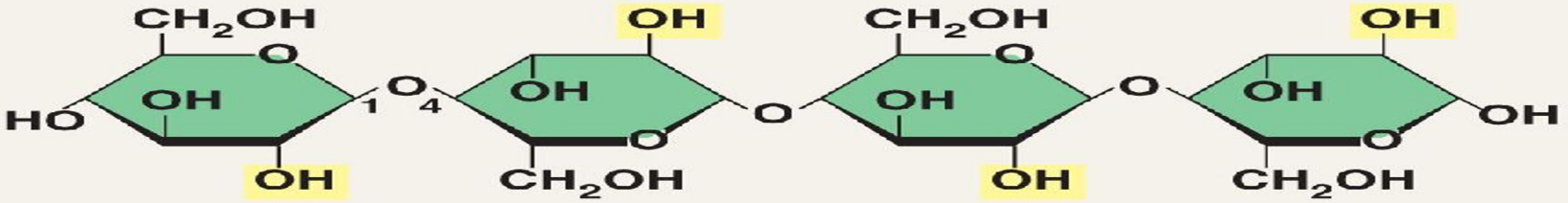
Cellulose is completely different from starch and glycogen. It is the structural (not storing anything) polysaccharide found in plants.

It is formed by hydrolysis of beta glucose rather than alpha glucose .Glucose monomers are linked together by B 1,4-bond glycosidic bonds.It does not have any branches.

The B 1,4 linkages allows the cellulose to form very long ,linear fibers. The fibers can stack on top of each other by hydrogen bonds.This makes cellulose optimal for providing structure ,protection and support for plants.

Formula: $(C_6H_{10}O_5)_n$





Cellulose: 1—4 linkage of β glucose monomers

Q & A - Chapter 16 - Polysaccharides Overview

1.What is a Polymer?

A very large molecule formed by the combination of many small molecules,called monomers.

2.What form of sugar is used as the major transport sugar in a plant ? Sucrose

3.What is the major structural form of sugar in a plant?

Carbohydrates have the general molecular **formula** CH_2O

4.What is the major physiological purpose of glycogen ?

Glycogen serves as a storage molecule for glucose.

5.Where are a-amylase and b-amylase produced ?

Salivary gland and pancreas.