SEMESTER VI -BIOCHEMISTRY

POLYSACCHARIDES

JASMINE MARIYA A J
ASSISTANT PROFESSOR ON CONTRACT
LITTLE FLOWER COLLEGE ,GURUVAYUR

POLYSACCHARIDES

- They are polymerised products of many monosaccharide units
- Also known as glycans
- Empirical formula $(C_6H_{10}O_5)_n$
- They are commonly made up of more than 10 monosaccharide units
- More than 4 different kinds of monosaccharide units seldom occur in a polysaccharide
- All the glycosidic linkages of a polysaccharide may not be the same

Polysaccharides

Homo and Heteropolysaccharides

Homo-polysaccharides contain only a single type of monomeric units.
Hetero-polysaccharides contain two or more different kinds of monomeric units.

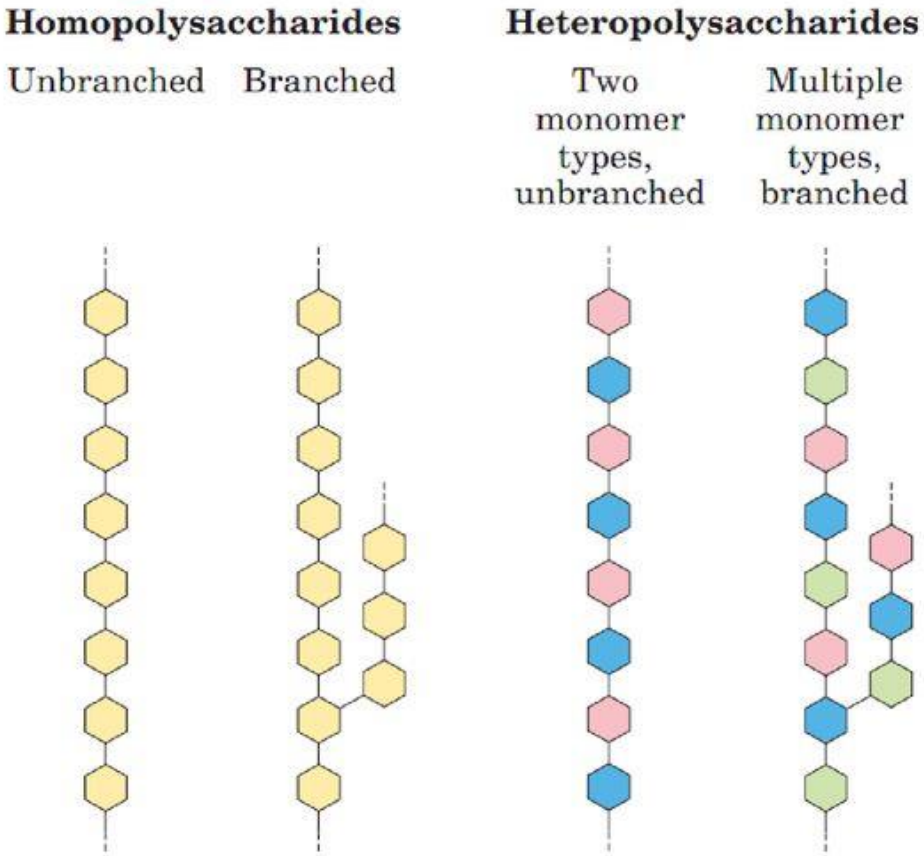


FIGURE 7–13 Homo- and heteropolysaccharides. Polysaccharides may be composed of one, two, or several different monosaccharides, in straight or branched chains of varying length.

Examples of Homo-polysaccharides: glycogen in animals; starch and cellulose in plants.
Starch and glycogen serve as stored forms of fuel. Cellulose serves structural roles.

Example of Hetero-polysaccharides: peptidoglycan of bacterial cell wall.

Q1. What are homo- and heteropolysaccharides? Give examples.

HOMOPOLYSACCHARIDES

- Made up of single kind of monosaccharides
- Four kinds :

1.Glucans – polymer of glucose units eg: starch,Glycogen

2.Fructans : polymer of fructose

Eg: Inulin

3.Mannans : Polymer of mannose

4.Xylans :polymer of xylose

Starch

- Storage form of plant polysaccharide also known as reserve carbohydrate of plant kingdom
- Sources : Potatoes ,Tapioca ,Cereals (rice,wheat) and other food grains
- Composed of two types of glucose polymers, Amylose and Amylopectin

Amylose : Composed of 10-20%

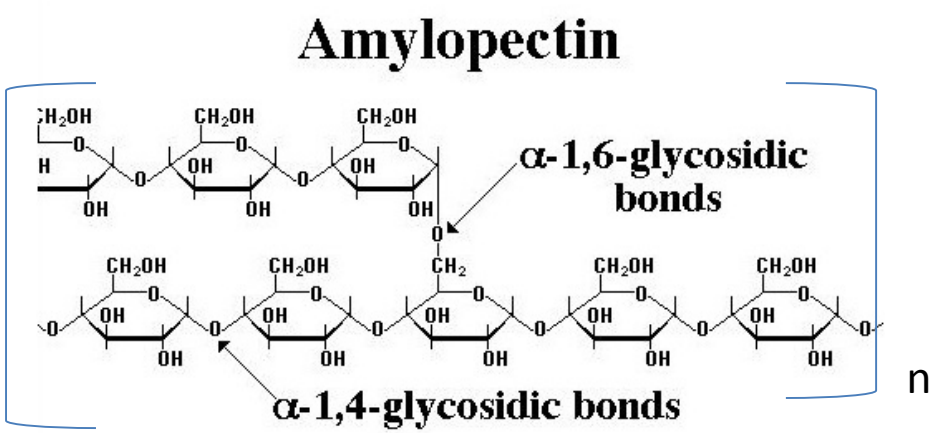
Made up of glucose units with α1→4 glycosidic linkage

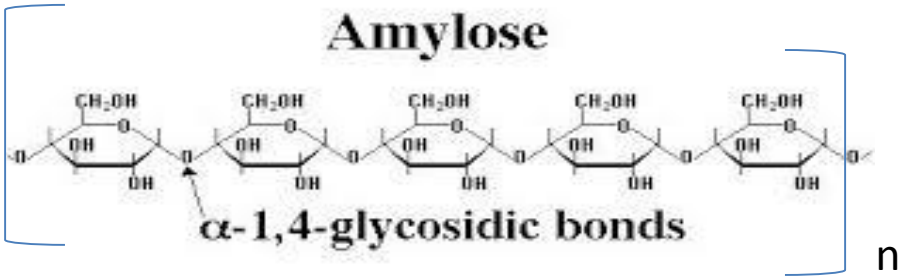
Unbranched long chain

Amylopectin : Composed of 80-90%

Made up of glucose units with with α1→4 and with α1→6 glycosidic linkages

Highly branched,branch points are made by α1→6 glycosidic linkage

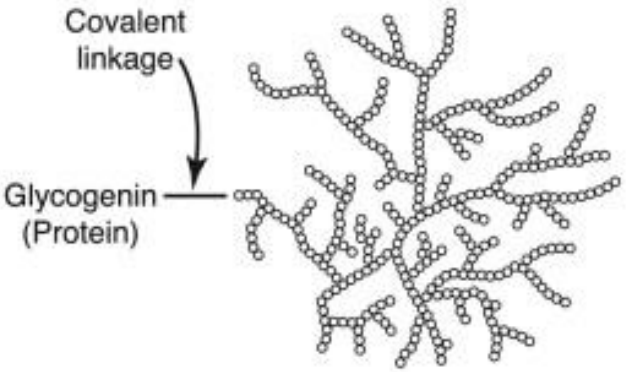




Glycogen

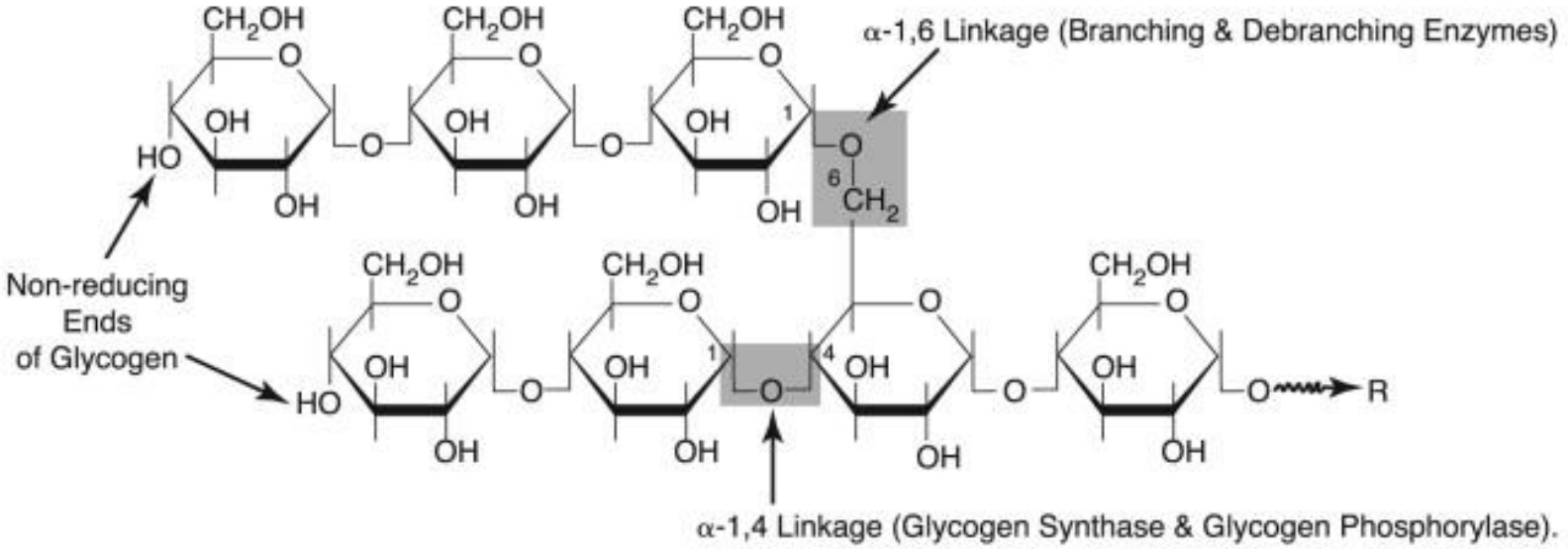
- Reserve carbohydrate in animals
- It is stored in liver and muscle
- Glycogen is composed of glucose units made up of α1→4 links in straight chain and α1→6 linkages in branching points
- Glycogen is more branched and more compact than amylopectin

Structure



Glycogen

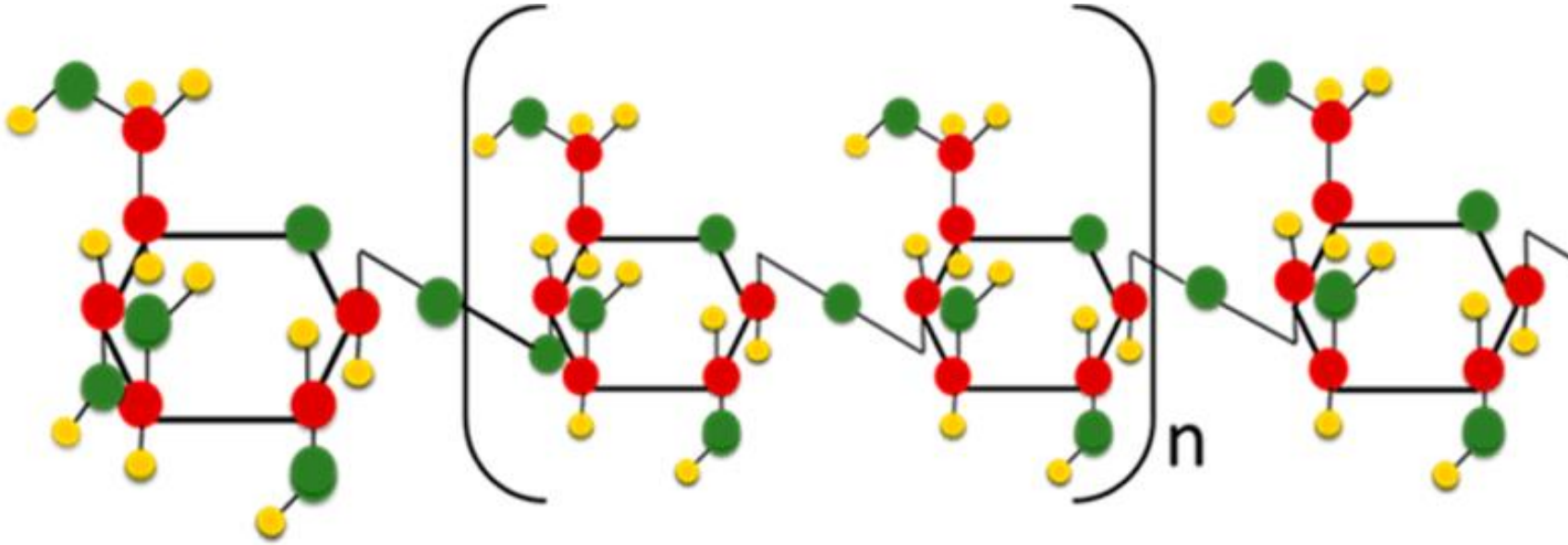
The α-1,6 glycosidic bonds in glycogen are produced by the non-regulatory brancing enzyme (and broken by debranching enzyme), while α-1,4 glycosidic bonds in glycogen are produced by the regulatory glycogen synthase (and broken by glycogen phosphorylase).



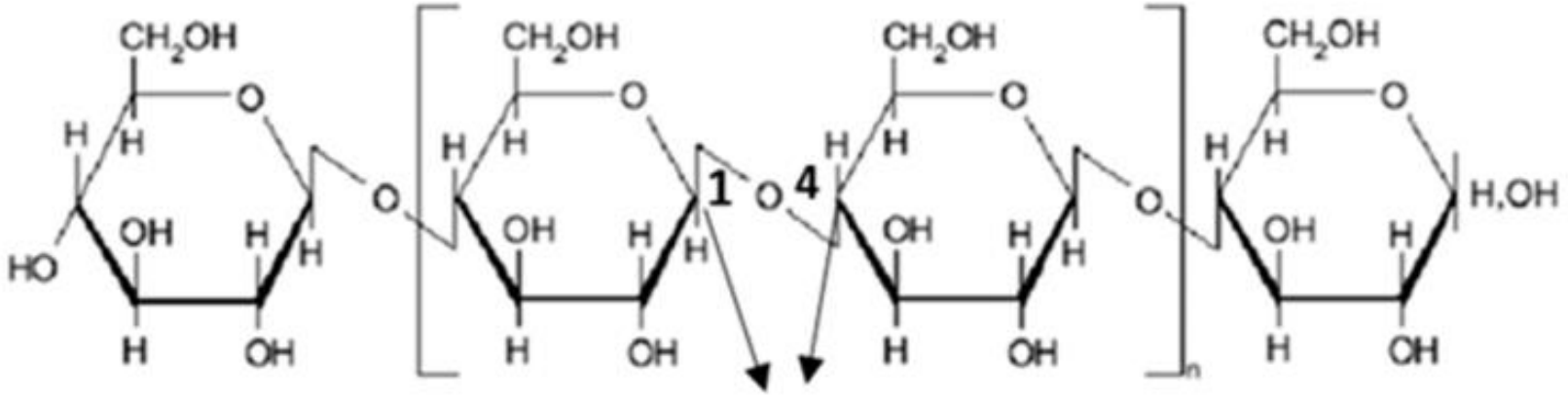
Cellulose

- Supporting tissues of plants
- Most abundant organic material in nature
- It is mage up of glucose units linked through beta 1→4 linkages.
- It has a straight line structure with no branching points
- Beta 1→4 linkages are digested by cellobiase enzyme (also cellulase) but this enzyme is absent in animals and human digestive tracts .Hence cellulose cannot be digested

a)



b)



Non-reducing end

β 1-4 Glucosidic bond

reducing end

Other important homopolysaccharides

- Chitin – found in exoskeleton of insects
- Callose –found in plants in response to wounds
- Inulin – fructan starch ,found in tubers of the family asteraceae

HETROPOLYSACCHARIDES

- Polysaccharides composed of more than one monosaccharide units
- Eg: agar ,mucopolysaccharides

Agar

- It is prepared from sea weeds (Gelidium,gracilaria etc.)
- It contains agarose and agaropectin and it contains mainly galactose sulphate,galacturonic acid ,and sulphuric acid esters
- It is dissolved in water at 100˚C ,which upon cooling forms a gel
- It cannot be digested by bacteria hence used as a supporting agent fr bacterial culture

MUCOPOLYSCCHARIDES

- Also kown as glycosamino glycans (GAG ‘s)
- They are hetero polysaccharides made up of uronic acid and amino sugars
- Since they contain charged groups ,they can attract water molecules and form viscous solutions
- Common mucopolysaccharides are ,Hyluronic acid, Chondrotin sulphate ,heparin sulpate keratan sulphate etc.

Some common mucopolysaccharides (glycosaminoglycans – GAG)			
Mucopolysaccharide	*Composition*	*Distribution*	*Functions*
Hyaluronic acid	D-glucuromic acid, N-acetylglucosamine	Connective tissue, synovial fluid, vitreous humour.	Serves as a lubricanf and shorck-absorber. Promotes wound healing.
Chondroitin sulphate	D-glucuronic acid, N-acetylgalactosamine sulphate.	Skin, cartilage, bone, walls of blood vessels.	Maintains the shape and structure of tissues.
Heparin	D-glucoronate sulphate, N-sulphoglucosamine sulphate.	Blood, lungs, liver kidneys, spleen.	Acts as an anti-coagulant.
Dermatan sulphate	L-iduronic acid, N-acetylglucosamine sulphate.	Skin, heart valves, valves of blood vessels.	Maintains the shape of tissues.
Keratan sulphate	D-galactose, N-acetylglucosamine sulphate	Cartilage, connective tissues cornea.	Makes the corne a transparent.