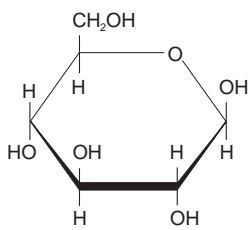


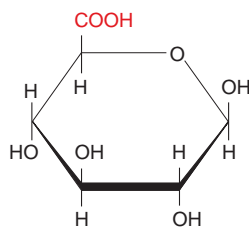
Technical Information - Carbohydrates 1

Monosaccharides

Hexose sugars (containing 6 carbon atoms)

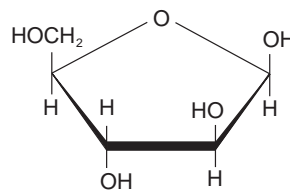


Glucose

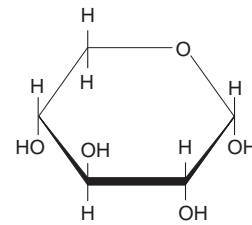


Glucuronic acid

Pentose sugars (containing 5 carbon atoms)



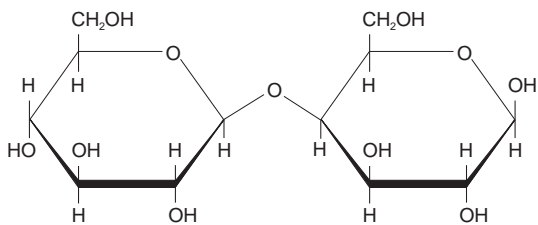
Arabinose



Xylose

Disaccharides

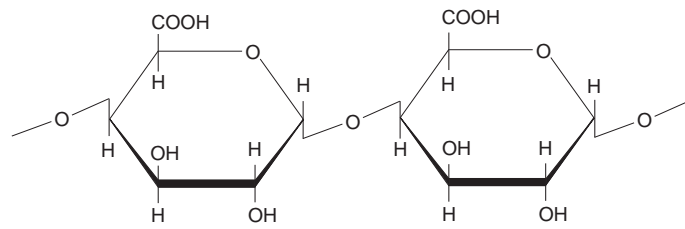
Cellobiose



Glucose

Glucose

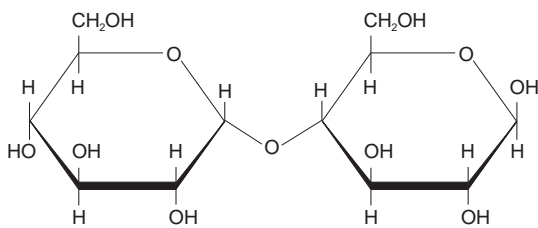
Galacturonic acid residue



Glucuronic acid

Glucuronic acid

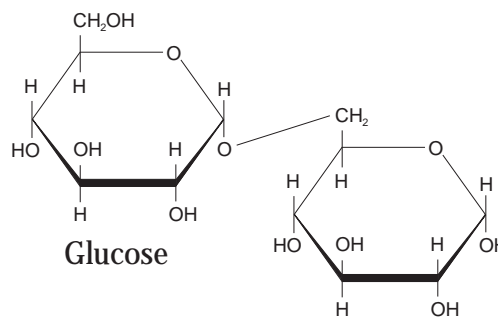
Maltose



Glucose

Glucose

Isomaltose

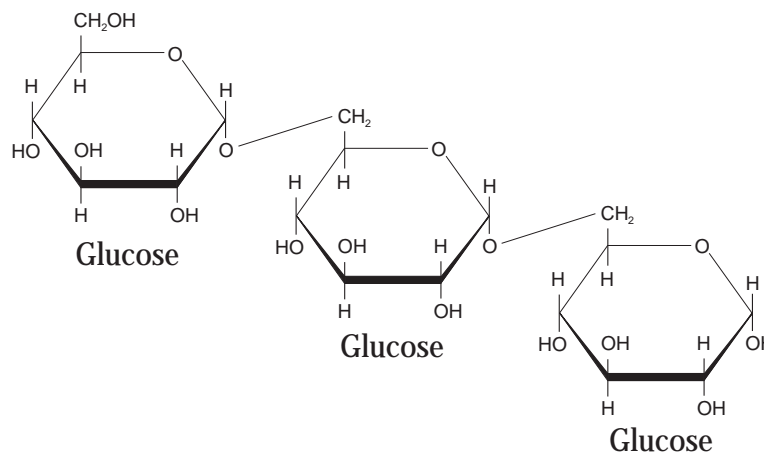


Glucose

Glucose

Trisaccharides

Isomaltotriose



Glucose

Glucose

Glucose

Technical Information - Carbohydrates 2

Polysaccharides

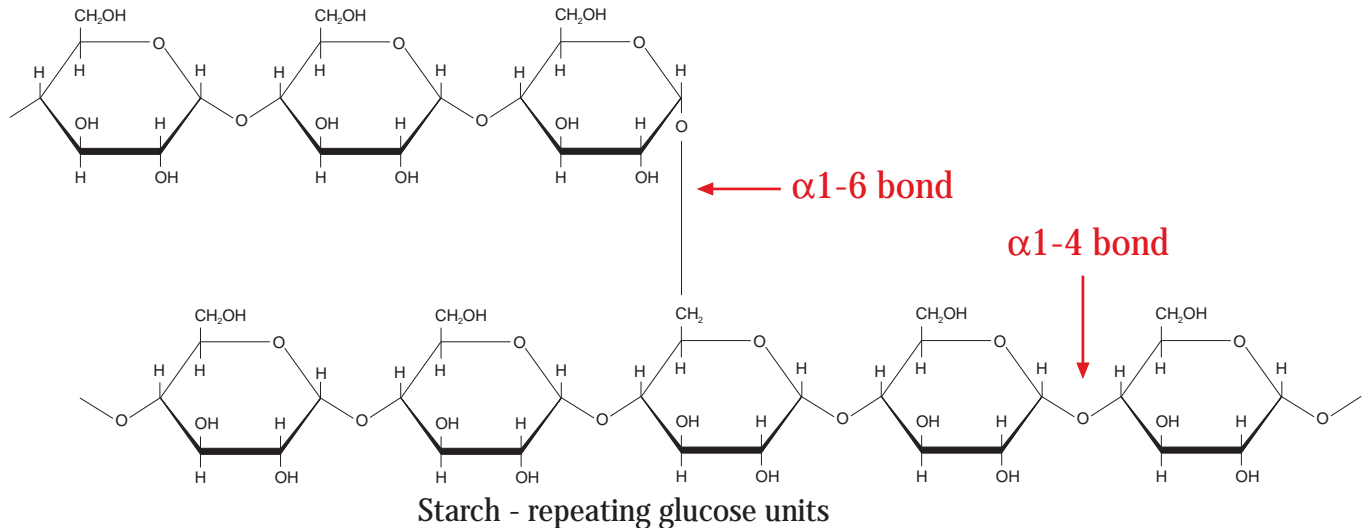
Starch

Naturally occurring starch is a polymer of glucose arranged in one of two ways:

Amylose an unbranched chain of glucose units usually 200-20,000 units long.

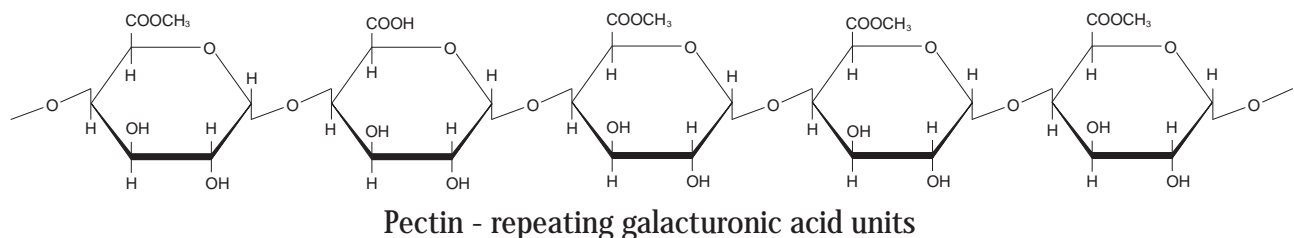
Amylopectin a branched form of amylose (shown below). Short chains of about 30 glucose units are attached to the amylose molecule every 20-30 units along the chain.

Some enzymes are capable of breaking the bonds forming the branches (α 1-6 bonds) while some enzymes break the bonds connecting glucose units within the amylose chain (α 1-4 bonds).



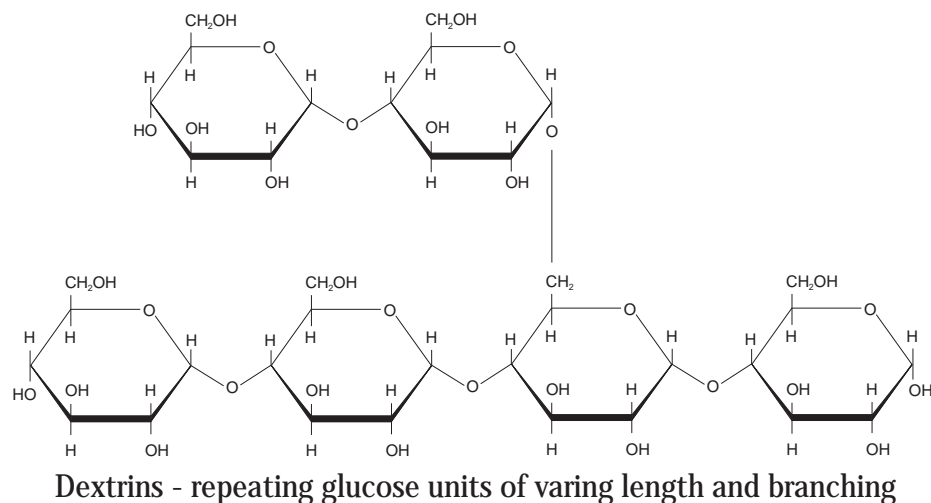
Pectin

Pectin is a mixed group of polysaccharides. Each polysaccharide consists mainly of galacturonic acid units. The -COOH group in a variable number of the units is altered (to a methyl ester) to form the pectin molecule.



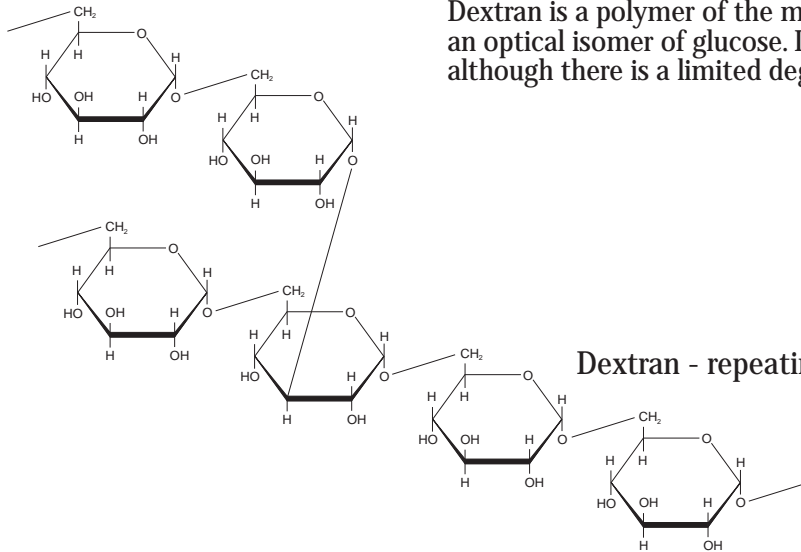
Dextrins

Dextrins are polysaccharides formed by the incomplete breakdown of amylose and amylopectin of starch. The resulting dextrin may or may not be branched, depending on the site of cleavage.



Technical Information - Carbohydrates 3

Dextran

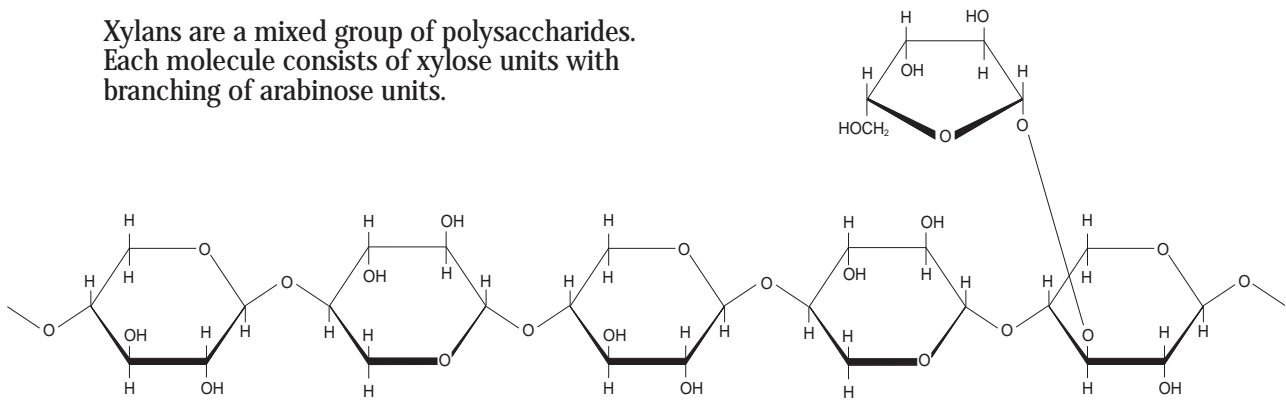


Dextran is a polymer of the monosaccharide dextrose, an optical isomer of glucose. It is a largely linear molecule, although there is a limited degree of branching.

Dextran - repeating glucose (dextrose) units

Xylans

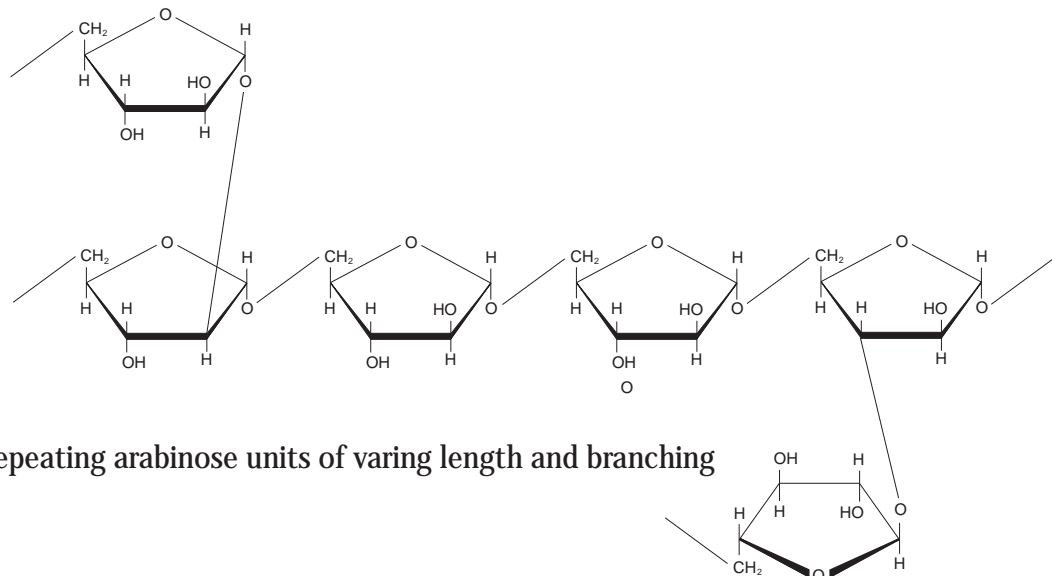
Xylans are a mixed group of polysaccharides. Each molecule consists of xylose units with branching of arabinose units.



Xylans - repeating xylose units with branching of arabinose side chains

Arabinans

Arabinans are a mixed group of polysaccharides. Each molecule consists mainly of arabinose units which can be branched to varying degrees in one of two positions from the arabinose unit.

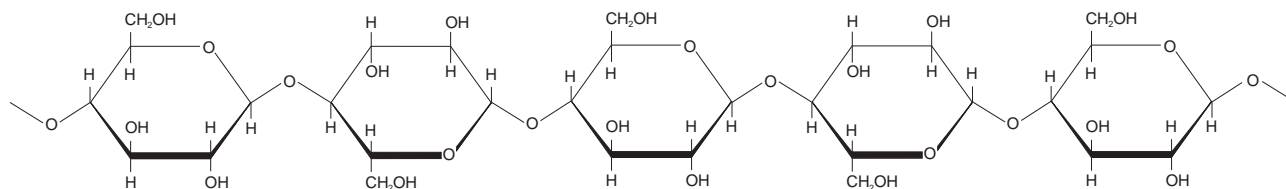


Arabinans - repeating arabinose units of varying length and branching

Technical Information - Carbohydrates 4

Cellulose

Cellulose is a polymer of glucose but unlike starch, it is not branched. Also, the -CH₂OH groups of the glucose units alternate above and below the plane of the molecule. The lack of branching allows the long chains to lie close together to form rigid structures.



Cellulose - repeating glucose units

Hemicellulose

Hemicellulose is a polysaccharide made up of many different monosaccharide units. In contrast to cellulose, hemicellulose has a random structure with little strength.

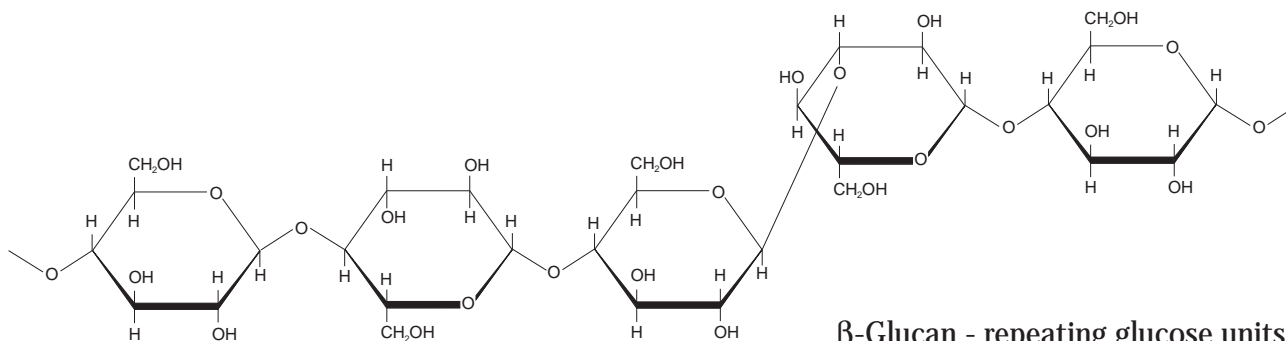
Monosaccharides that make up hemicellulose include:

Hexose sugars: glucose, galactose, mannose
Pentose sugars: arabinose and xylose

Of these, xylose is present in the largest amount.

β-Glucans

β-glucans consist of repeating glucose units, up to 250,000 units long. Like cellulose, the molecule is not branched. Unlike cellulose, however, where bonding of each glucose unit occurs at the same position, every three to four units the next glucose is attached at a different position.



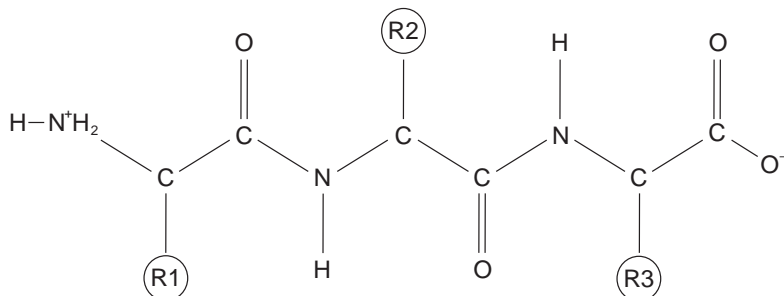
β-Glucan - repeating glucose units

Technical Information - Proteins

Proteins

Proteins are composed of amino acid units. There are 20 different amino acids that occur most commonly in proteins. Peptide bonds link amino acids to form peptide chains. When the peptide chain is longer than 10 amino acids, the structure is termed a polypeptide. Proteins are considerably larger and can be 20,000 amino acids in length.

A tripeptide is shown below. The R-group is different depending on the amino acid.



Peptides - repeating amino acid units