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Carbohydrates

Structure and properties of cellulose,starch and glycogen

Starch:

Structure	Properties
Made up of many alpha glucose monomers joined by alpha (1,4) glycosidic bonds and coiled to form helices resulting in compactness in amylose and in amylopectin it additionally has alpha (1,6) glycosidic bonds at branch points	Compact structure enables many alpha glucose to be packed per unit volume
Most hydroxyl groups of alpha glucose monomers are projected into the helix and are involved in intramolecular hydrogen bonding within the helix	Resulting in insolubility ensures that starch does not affect water potential of cells, able to stores as much as starch
Amylopectin has many branch points bonds formed by alpha 1,6 glycosidic bonds	Multiple branch sites allow release of more glucose per unit time

Cellulose:

Structure	Properties
Each cellulose molecule consists of alternate beta glucose monomers rotated 180 degrees with respect to each other linked by beta-1,4 glycosidic bond resulting in a linear and unbranched cellulose chain. The hydroxyl groups project outwards from each linear cellulose molecules allows extensive hydrogen bonds to form between neighbouring parallel chains,	Extensive cross-linking by hydrogen bonding imparts high tensile strength and rigidity allowing cell to develop turgor pressure when placed in solution with higher-water potential ,providing mechanical strength to plant cells/ prevents osmotic lysis when placing in solutions of higher water potential;

Structure	Properties
forming microfibrils which will bundle together to form macro fibrils which in turn associate e together to form cellulose fibres giving rise to high tensile strength	
Since the hydroxyl groups are involved in cross-linking between the cellulose chains, the -OH groups are not free to form hydrogen bonds with water,	insoluble in water allowing cell walls to provide structural support as they will not dissolve
Criss crossing of many microfibrils creates a meshwork, resulting in a porous structures that allows the passage of water and solute molecules, permeable to water and solutes	Enabling permeability to important substances and does not hinder transport
Meshwork of interwoven cellulose fibres form the cell wall of plant cells which helps to distribute-stress in all directions	Ability to distribute stress in all directions prevents plant cells from bursting under turgor pressure;

Glycogen:

Structure	Function
Large long chain, insoluble in water due to hydrogen bonds in the OH groups being involved in intermolecular hydrogen bonding, hence unable to interact with water	Can be stored in large quantities and Does not affect water potential of cells
Alpha (1,4) glycosidic Bond links glucose monomers forming a Helical molecule glucose forming a large yet compact structure for storage	More glucose units per volume can be stored

Structure	Function
Extensively branched with many ends for hydrolysis of glycosidic bonds	Releases more glucose molecules per unit time

Advantage of starch

- Large amount of glucose can be stored without affecting the water potential of the cell
- Compact and more glucose can be stored within a given space
- Large amount of glucose can be released as substrate for respiration
- Alpha 1-6 glycosidic bond provides free end that can be hydrolysed easily

Compare amylose and amylopectin

- Both are composed of alpha glucose monomers
- Both contain alpha (1,4) glycosidic bonds between monomers

Amylose	Amylopectin
Only contains alpha (1,4) glycosidic bonds	Contains alpha (1,4) glycosidic bonds and alpha (1,6) glycosidic bonds at branch points
Unbranched	Branched molecule

Describe formation of glycosidic bonds

- state name of bond
  - Beta (1-4) glycosidic bond
- Glycosidic bond forms between Carbon number _ of one beta glucose monomer and carbon number Y of another beta glucose monimer

- Via a condensation reaction joining the two monomers together with removal of one water
- Reaction is catalysed by enzymes