Carbohydrates

* Carbohydrates are used for:
    * sources of energy
    * building materials
    * cell surface markers

* Carbohydrates contain:
    * Carbon
    * Hydrogen
    * Oxygen

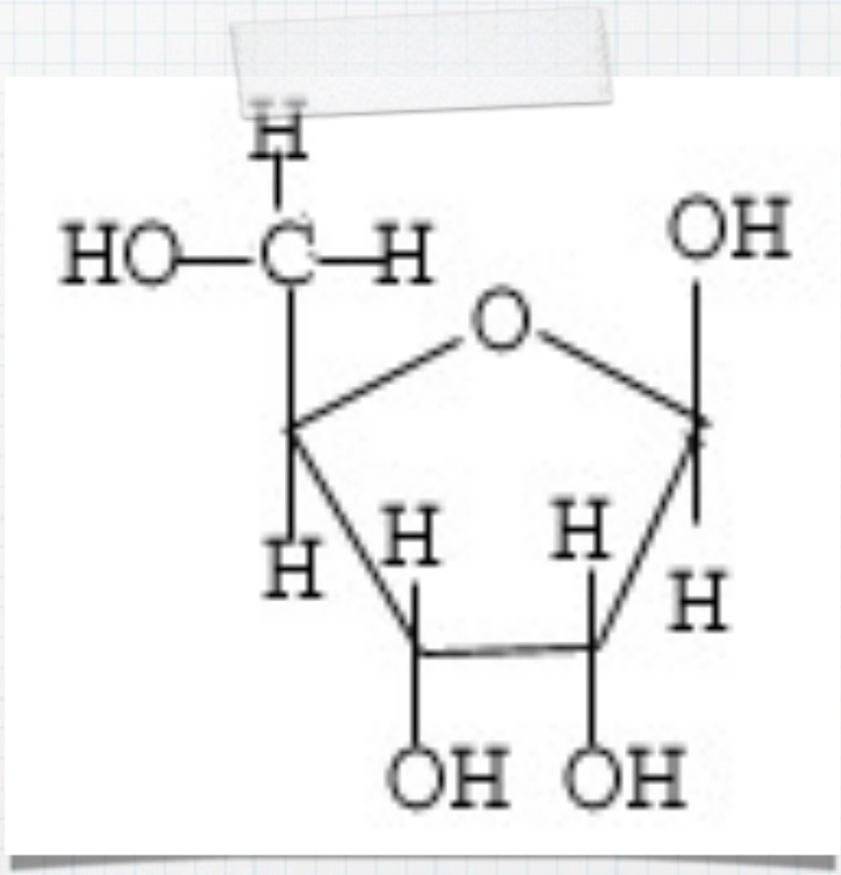
* There are three types of carbohydrates
  * Monosaccharides
  * Disaccharides
  * Polysaccharides

Monosaccharides

* Building blocks of carbohydrates.
* Contain either 5 or 6 carbons
* Monosaccharides exist in two forms
  * Dry state: Straight Chain
  * Dissolved in water: Ring form

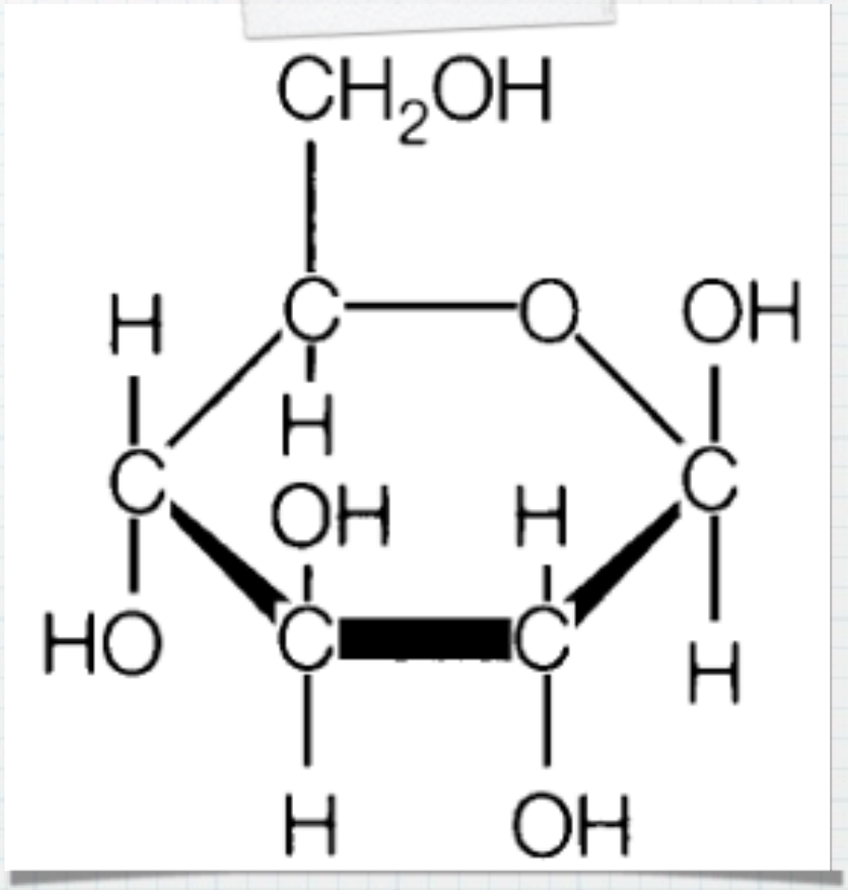
Example

* Ribose
    * $C_5H_{10}O_5$



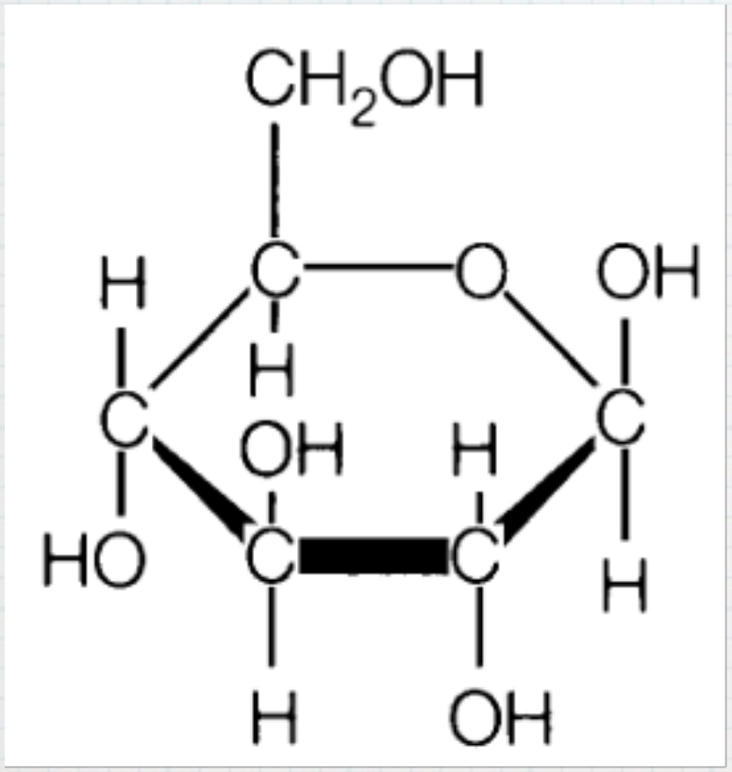
Example

* Glucose
  * $C_6H_{12}O_6$

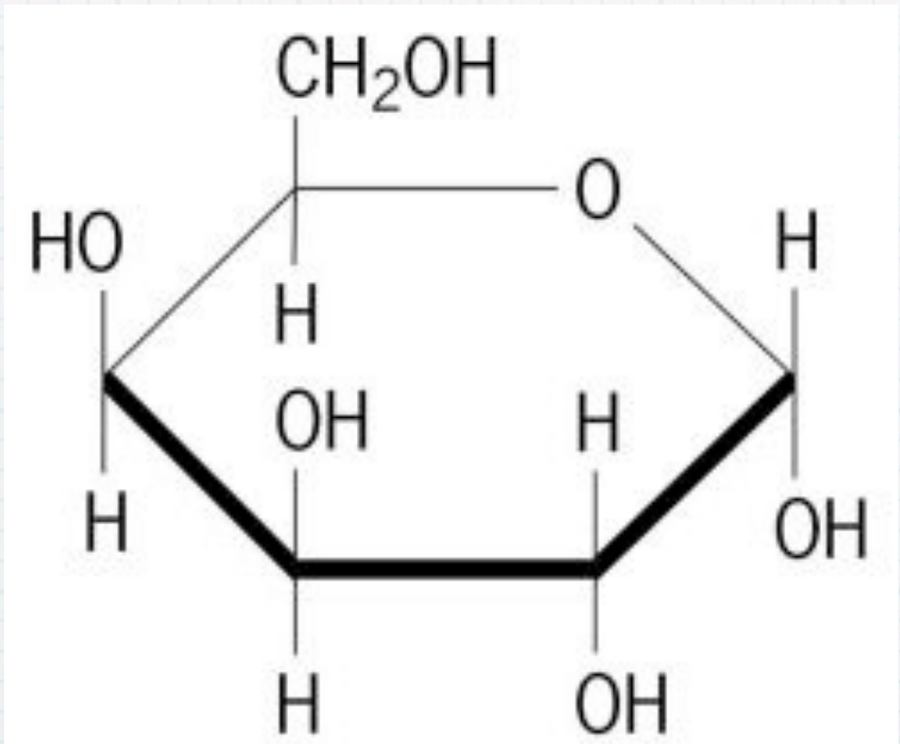


* Isomers: same number and type of atoms, different arrangement.

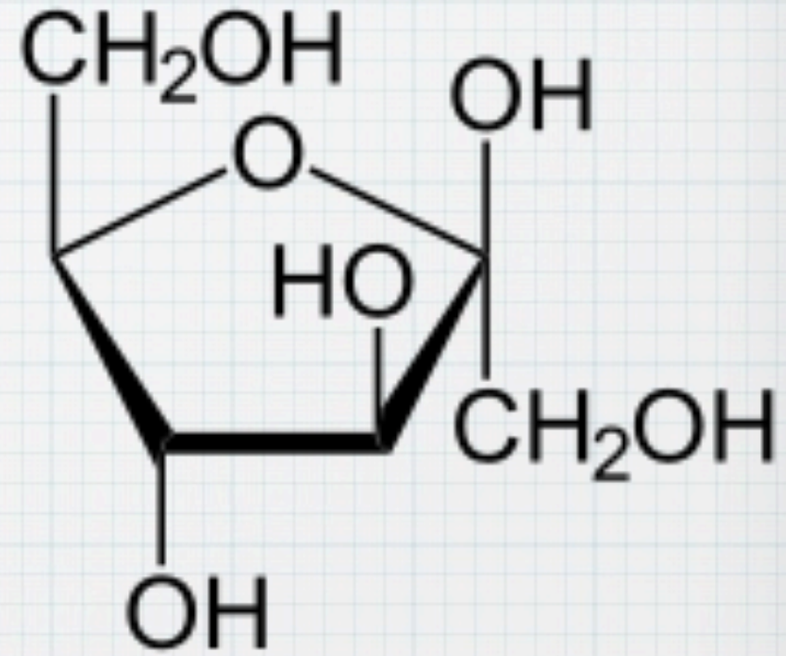
Glucose



Galactose

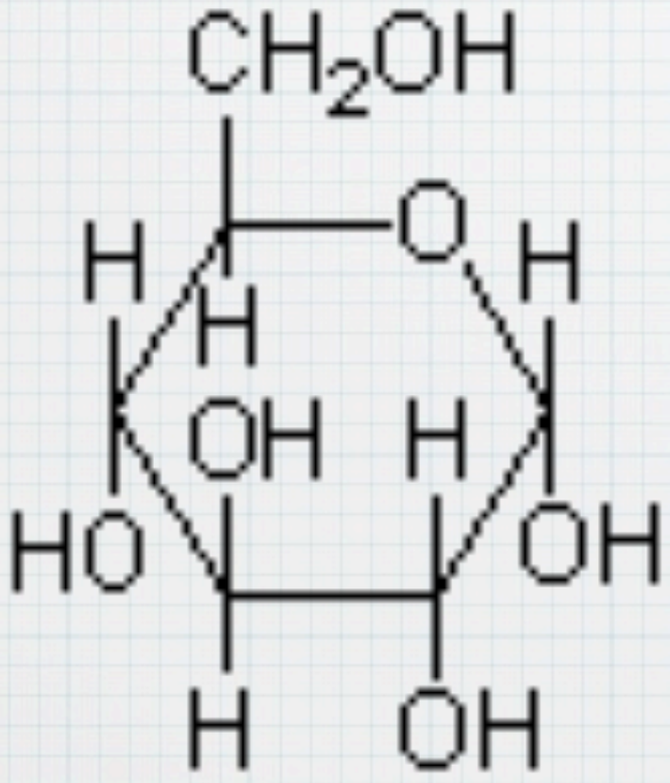


Fructose

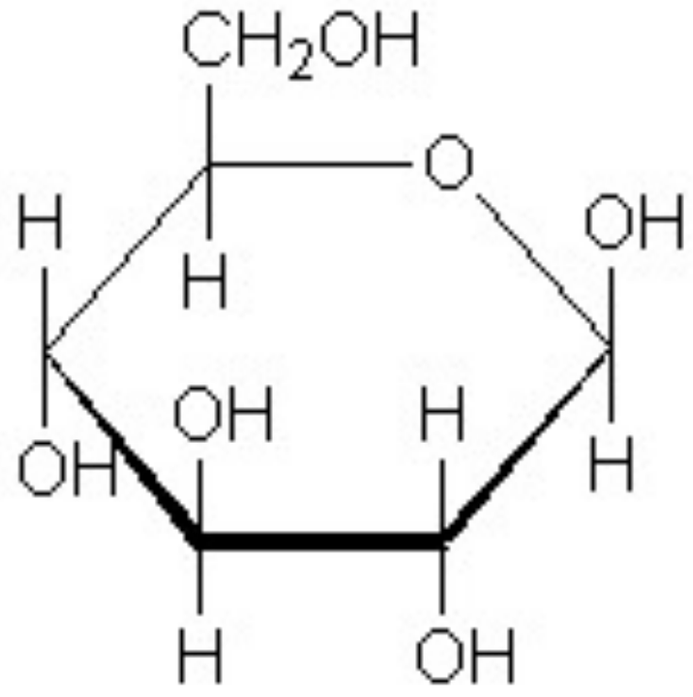


* You can also have isomers of the same macromolecule

α-Glucose

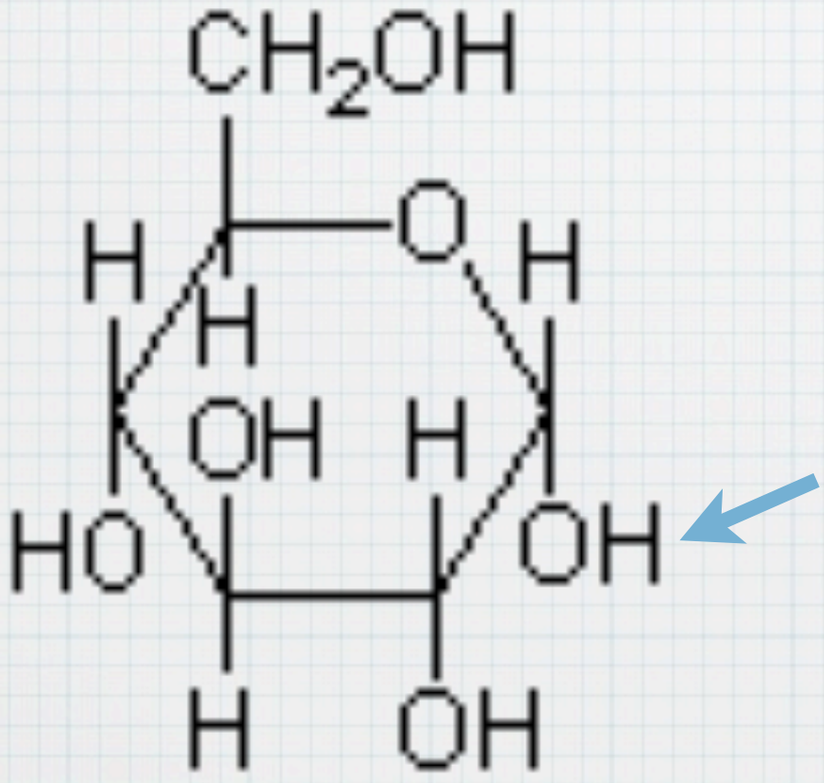


β-Glucose

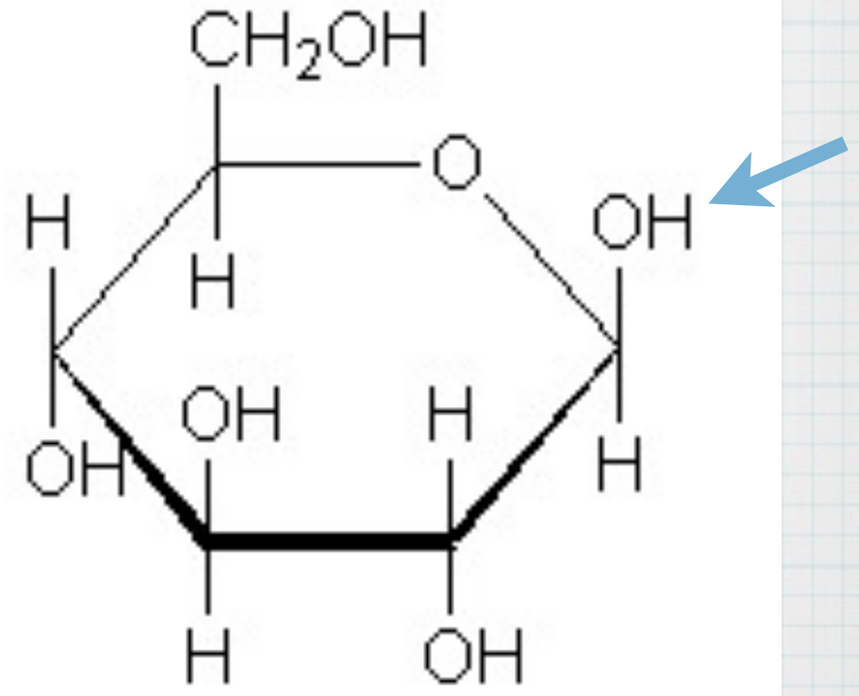


* You can also have isomers of the same macromolecule

α-Glucose



β-Glucose

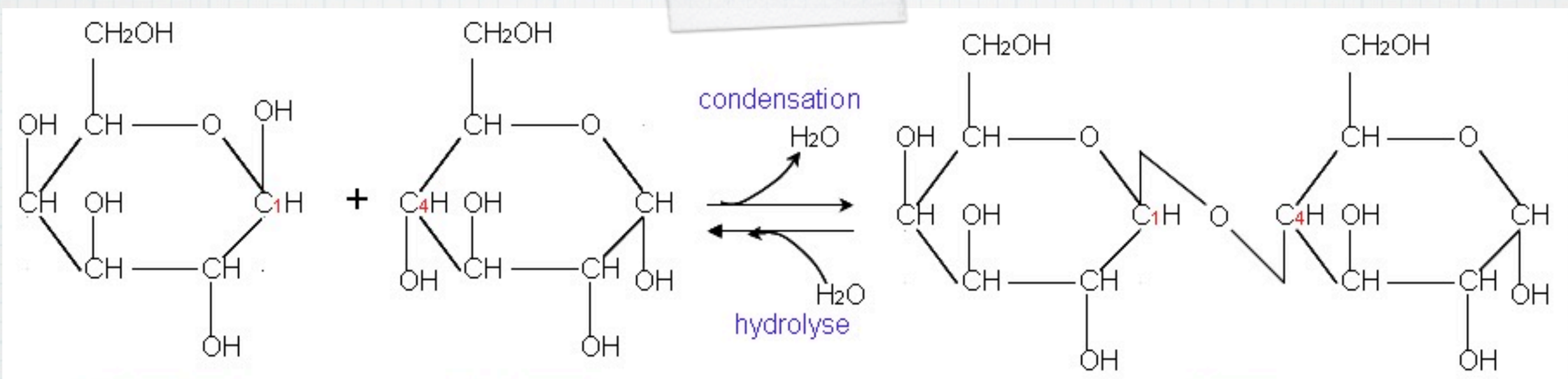


Disaccharides

* two monosaccharides joined by dehydration synthesis

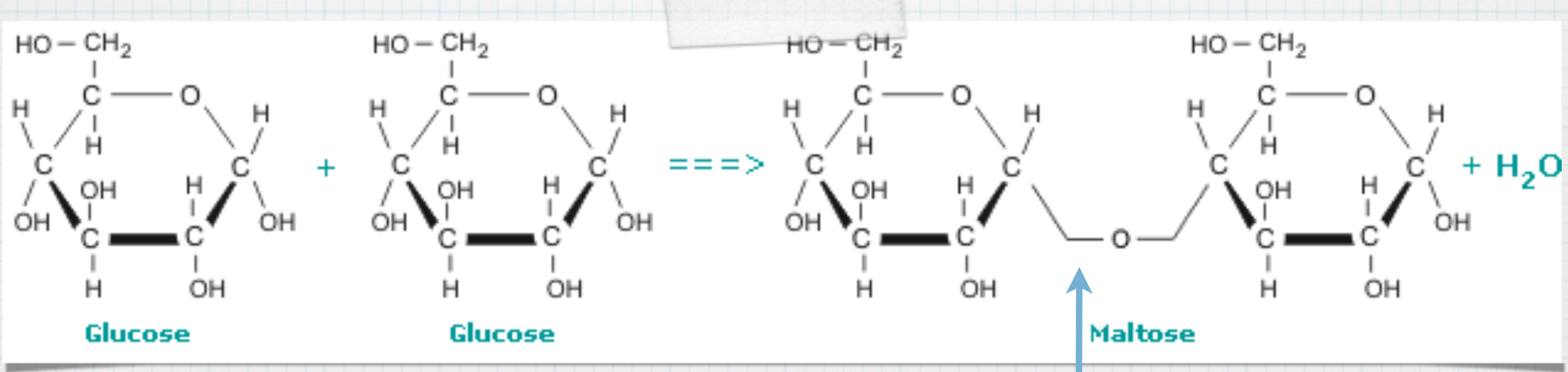
Example

* Lactose
  * Formed by glucose + galactose



Example

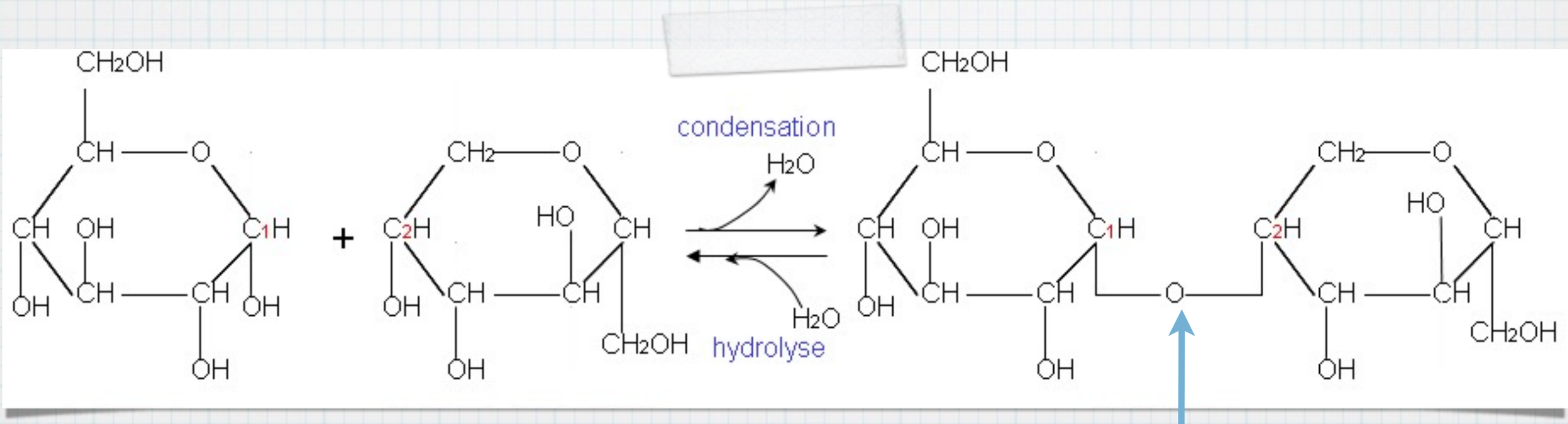
* Maltose
  * Formed by glucose + glucose



α 1-4 glycosidic linkages

Example

* Sucrose
  * Formed by glucose + fructose

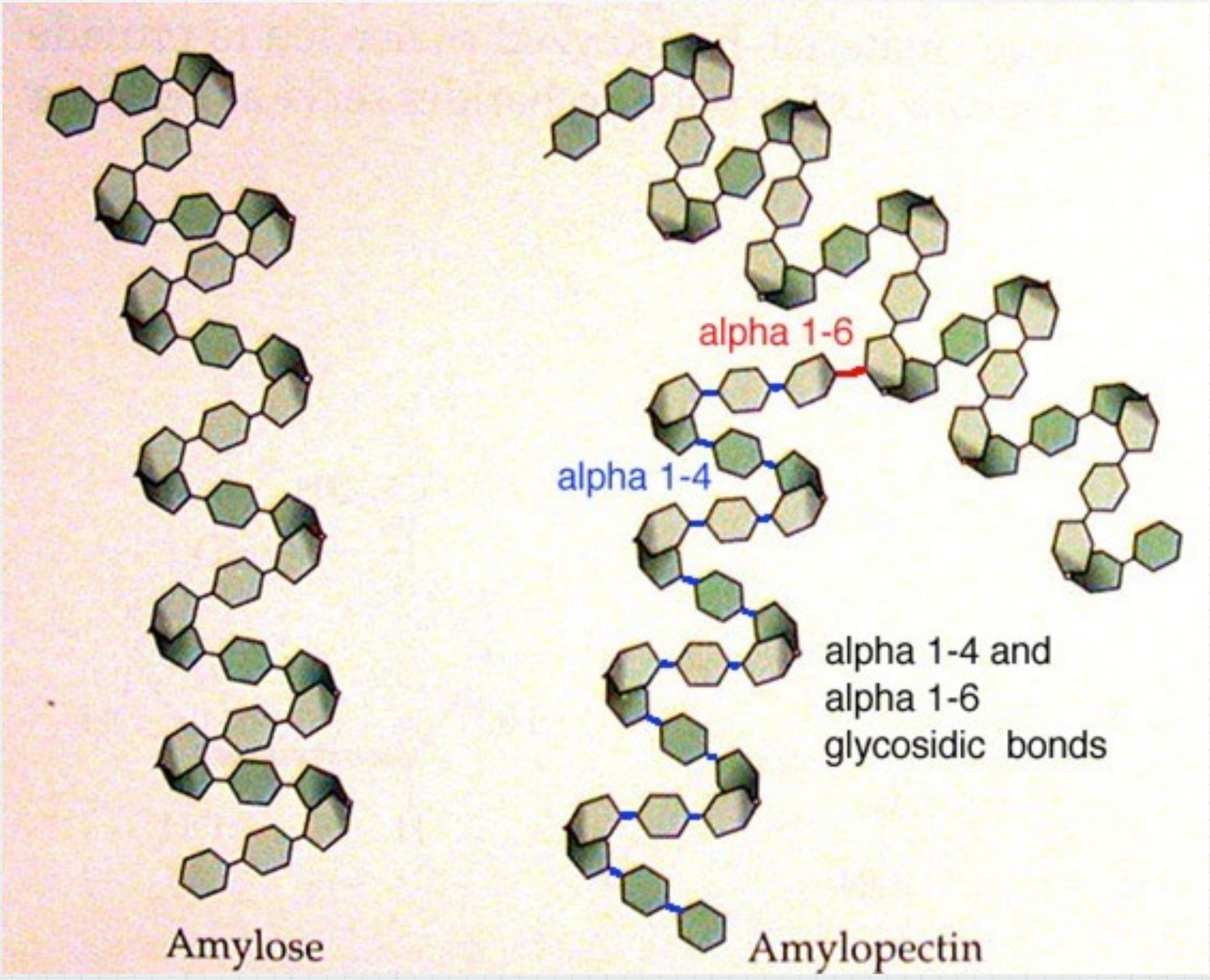


α 1-4 glycosidic linkages

Polysaccharides

* composed of several monosaccharide polymers
* some are straight chains, while others are branched
* act as either energy storage or structural support

* Energy Storage:
* Plants: store in the form of starch either as amylose (1000 glucose units) or amylopectin (1000 - 6000

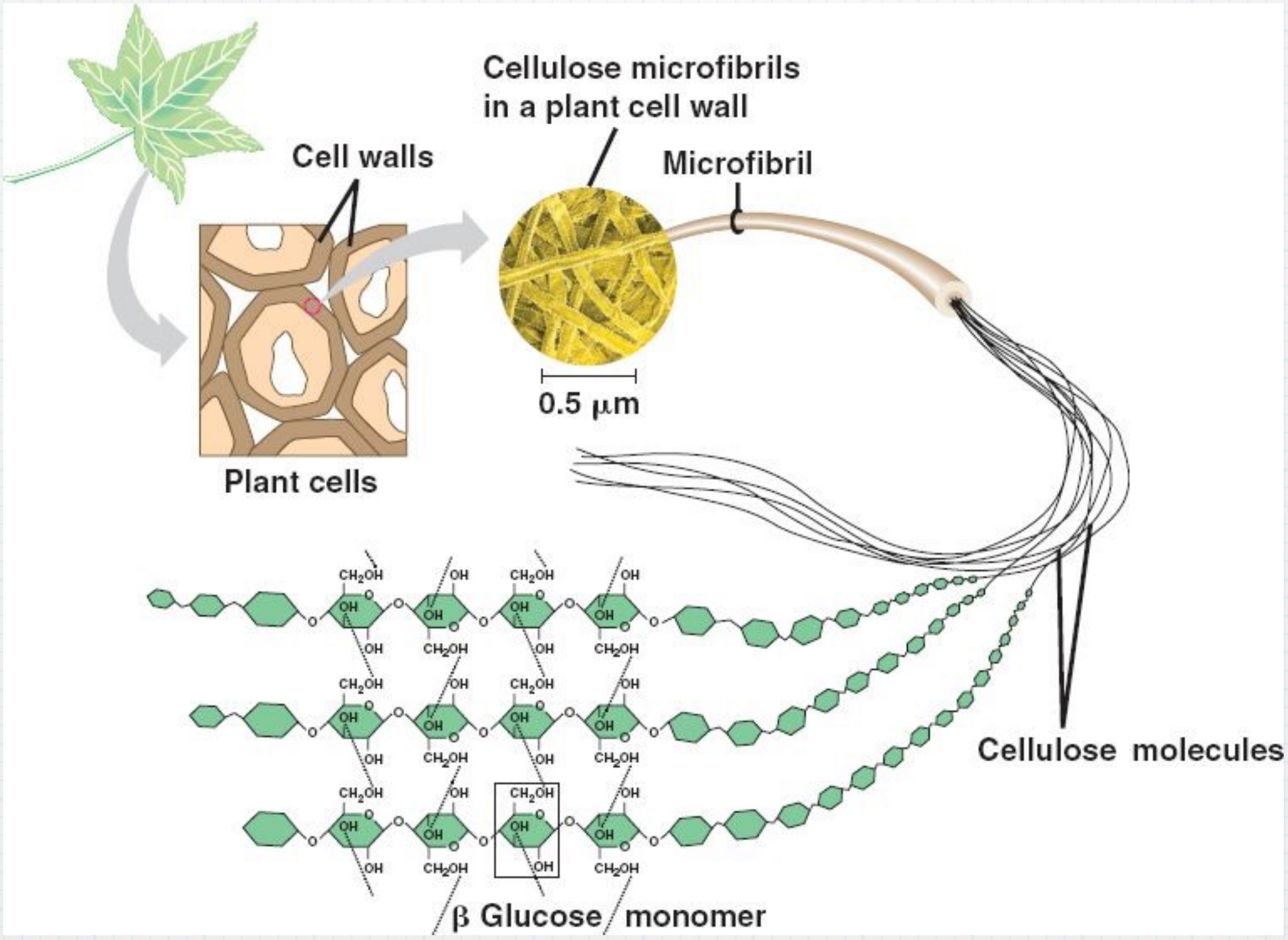

alpha 1-6
alpha 1-4
alpha 1-4 and
alpha 1-6
glycosidic bonds
Amylose
Amylopectin

* Energy Storage:

* Animals: store in the form of glucose units in branches of 24 - 26 units)

* Structural Support:

* Plant: uses celluloses for support - a straight structure within the cell wall of plants


Cellulose microfibrils
in a plant cell wall
Cell walls
Microfibril
0.5 μm
Plant cells
Cellulose molecules
β Glucose monomer

* Structural Support:

* Animal: uses chitin - a polysaccharide that contains nitrogen

  * found in exoskeleton of crustaceans


cuticle made
of chitin