Macromolecules

Most macromolecules are polymers:

Carbohydrates (C,H,O) = polymer

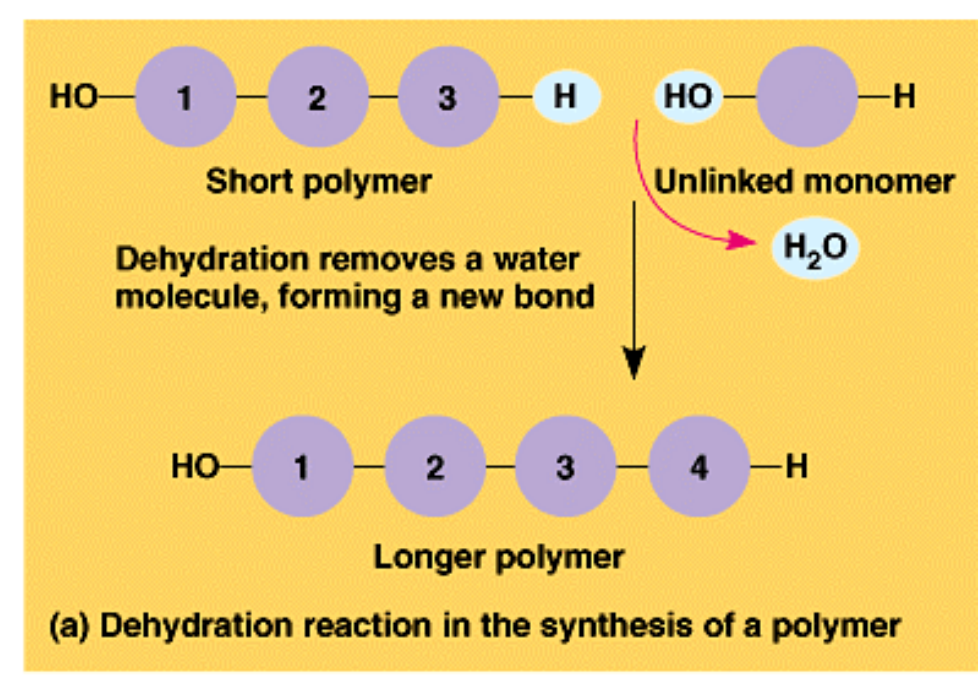
Proteins (C,H,O,N) = polymer

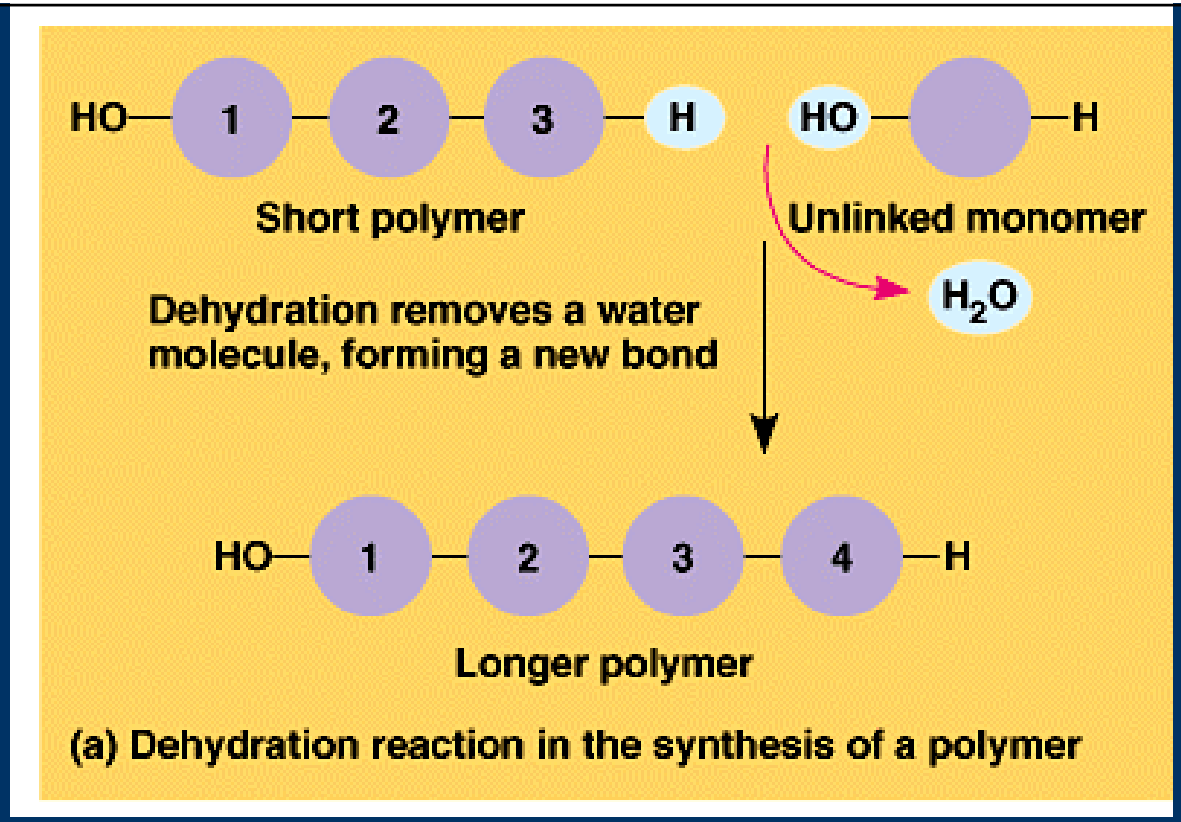
Nucleic acids (C,H,O,N,P) = polymer

Lipids (C,H,O)

A polymer is a long molecule consisting of many similar or identical building blocks linked by covalent bonds.

A repeating units that serve as the building blocks of a polymer are small molecule called monomer

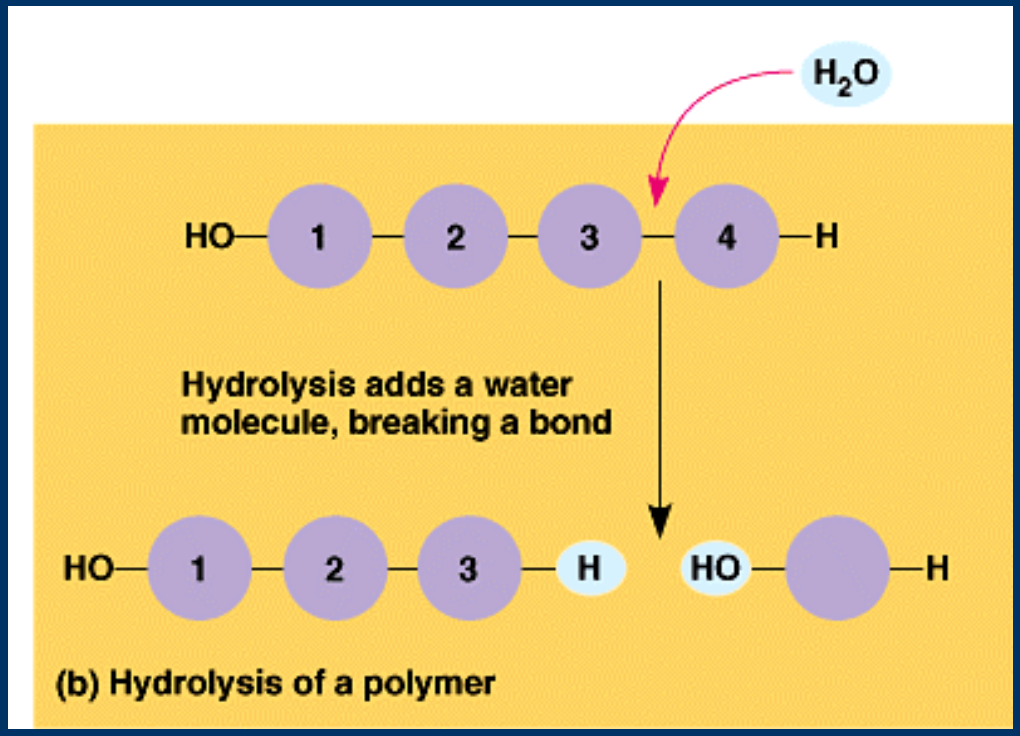




Polymerization reaction is a condensation reaction which 2 monomers are linked by a covalent bond.

1 molecule of water is produced.

This reaction may be called dehydration reaction.



-Polymer are disassembled by hydrolysis or breaking the covalent bond by water. (*hydro* = water, *lysis* = break)

-example = digestion

Carbohydrates

-polymer of monosaccharides

-C : H : O = 1 : 2 : 1

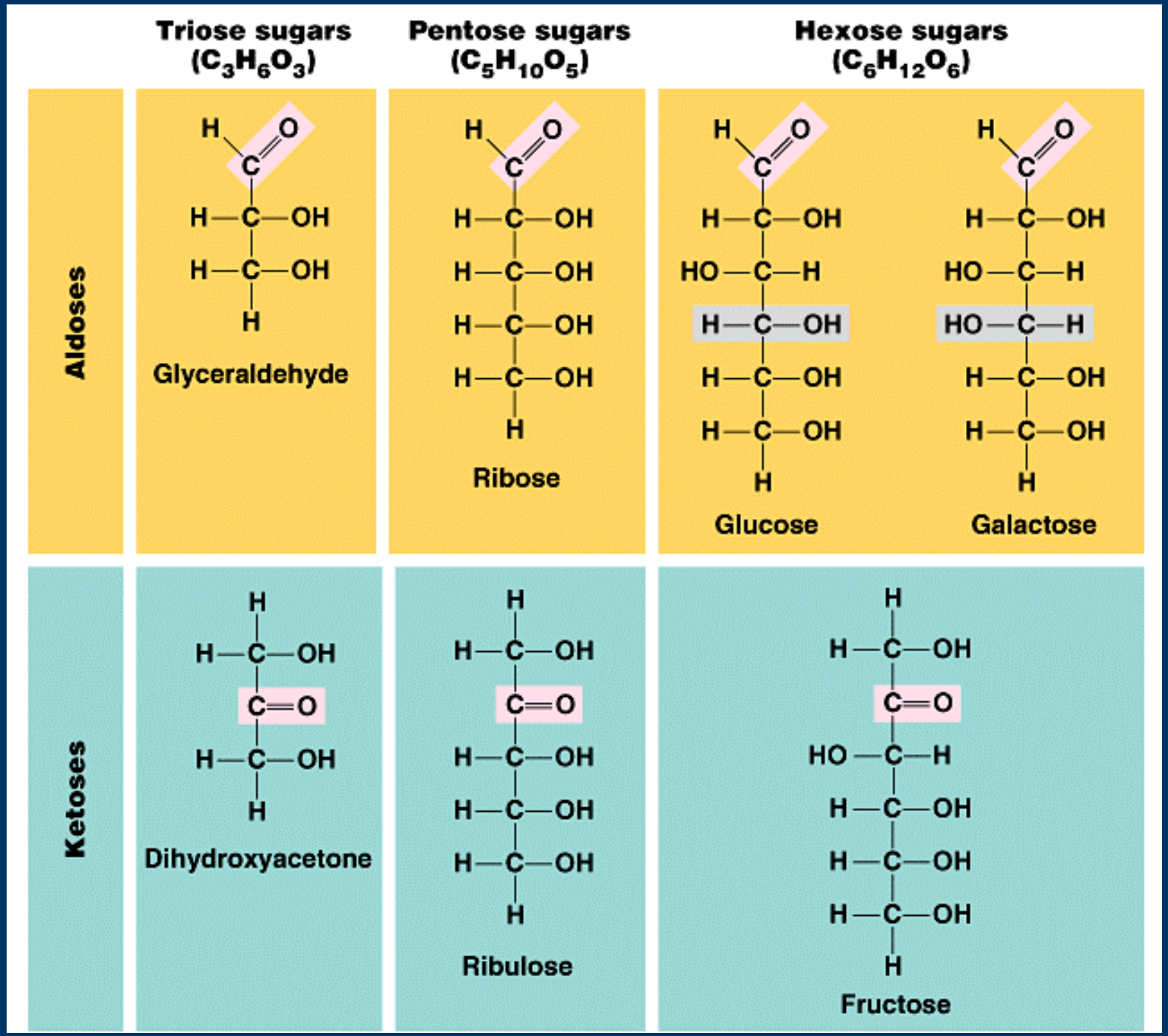
-monosaccharides, disaccharides, polysaccharides

-monosaccharides = $(CH_2O)_n$ n> or = 3

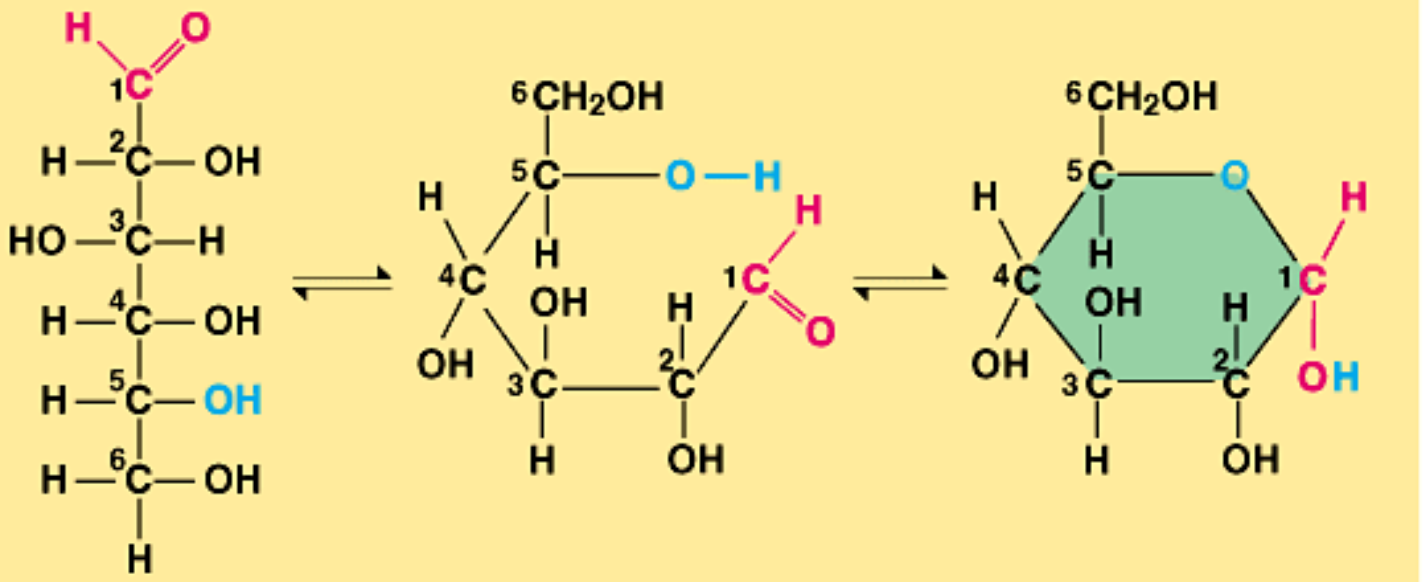
-aldoses

-ketoses

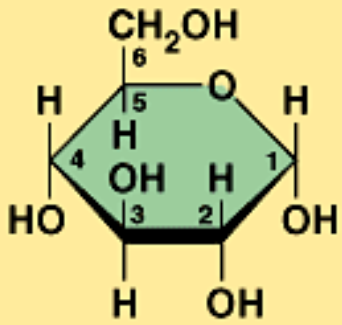
-D isomer glucose : C5 (the chiral carbon most distant from the carbonyl carbon, C1)



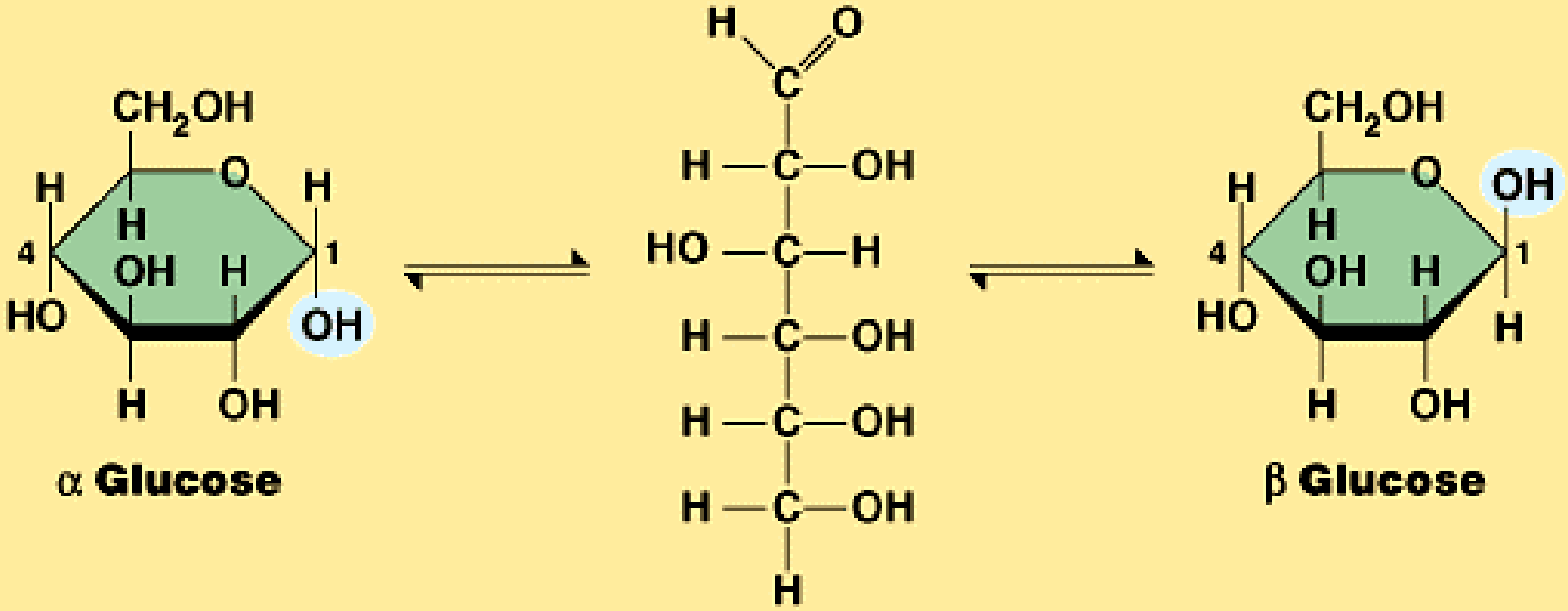
C4 of glucose and galactose = epimers



(a) Linear and ring forms



(b) Abbreviated ring structure

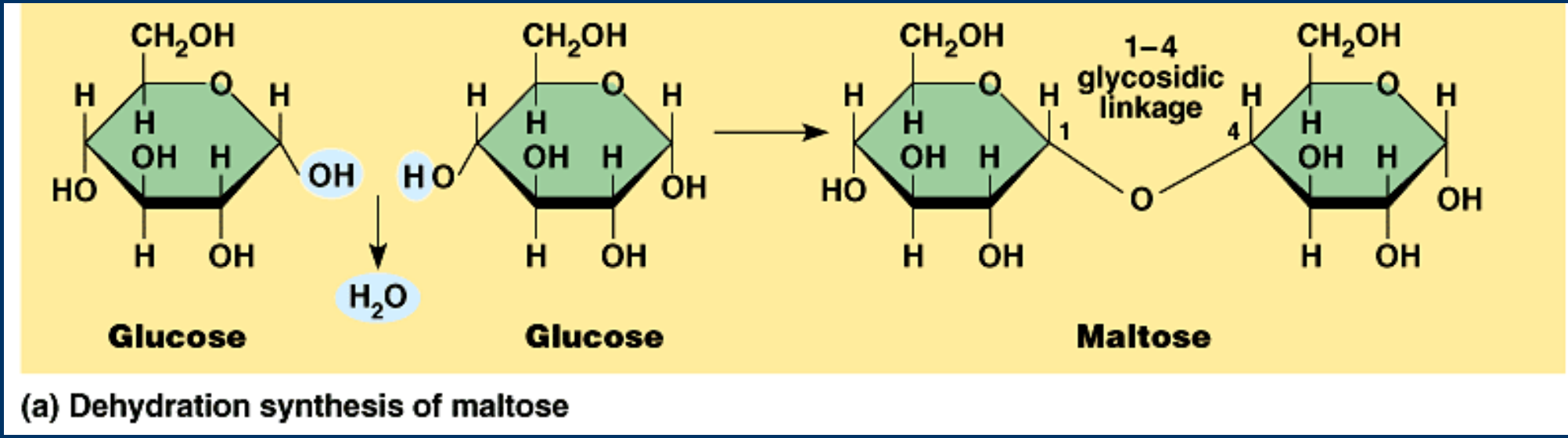


α Glucose

β Glucose

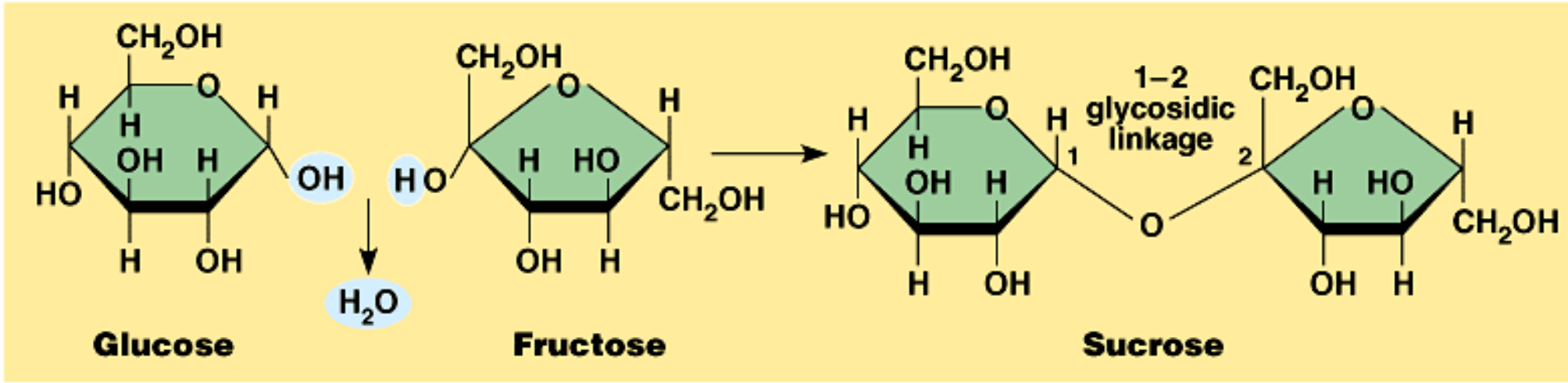
(a) α and β glucose ring structures

Disaccharides = glycosidic linkage between 2 monosaccharides



(a) Dehydration synthesis of maltose

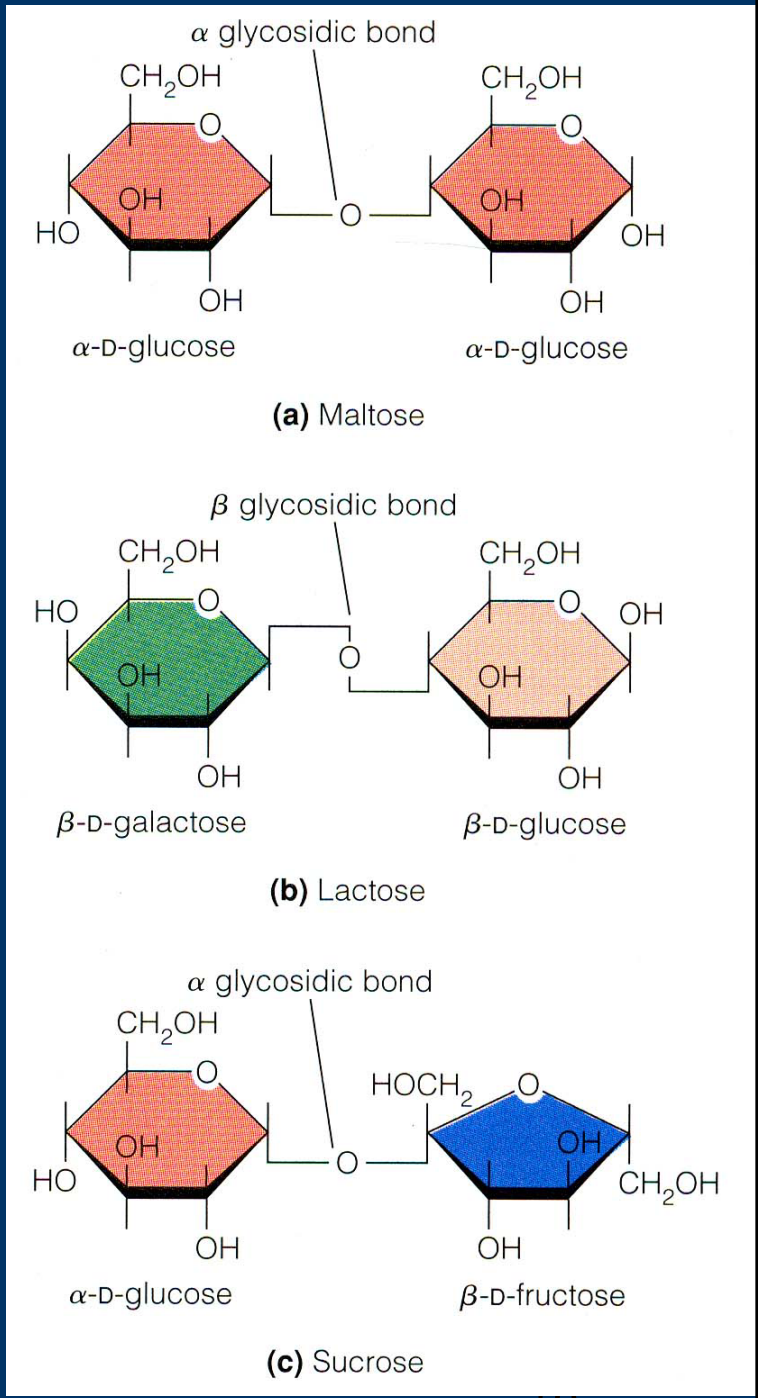
maltose = α (1-4) glycosidic linkage between 2 glucose molecules



(b) Dehydration synthesis of sucrose

sucrose = α (1-2) glycosidic linkage between glucose and fructose

lactose = β (1-4) glycosidic linkage between galactose and glucose



Polysaccharides :

storage and structure

storage polysacchraides:

-starch (in plant)

-glycogen (in animal)

structure polysaccharides:

-cellulose

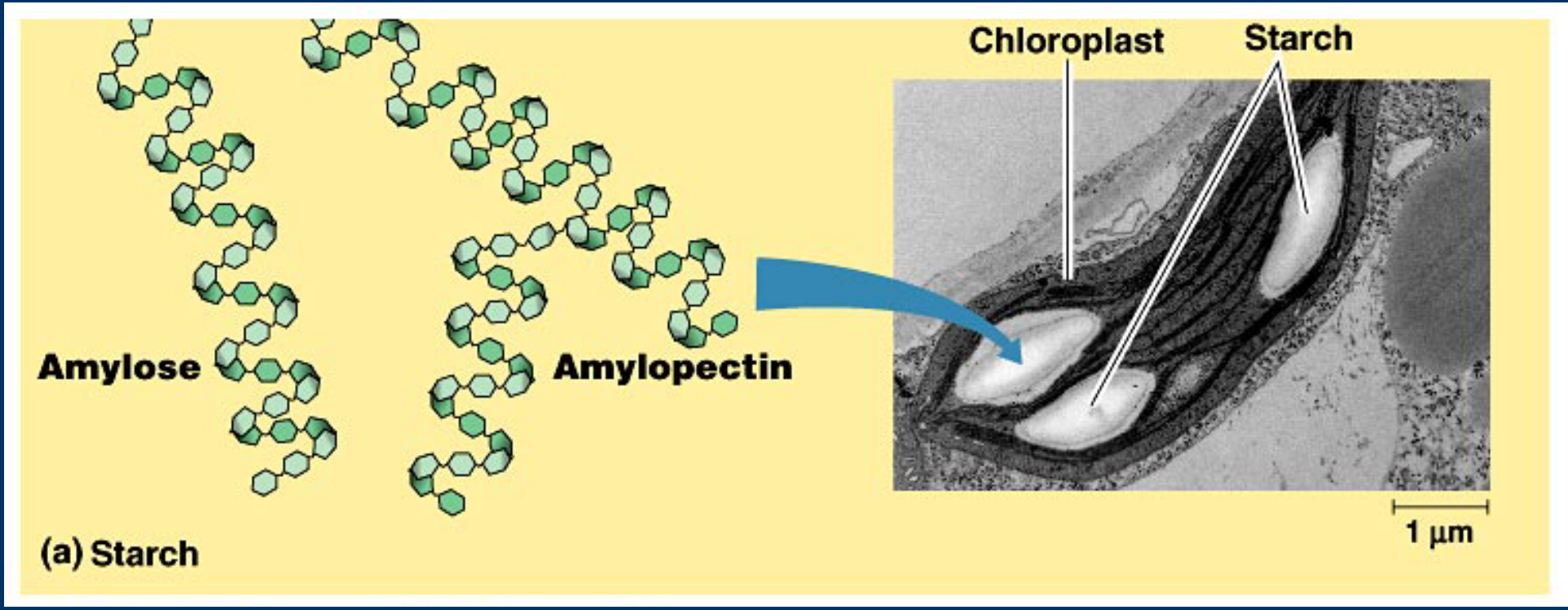
-chitin

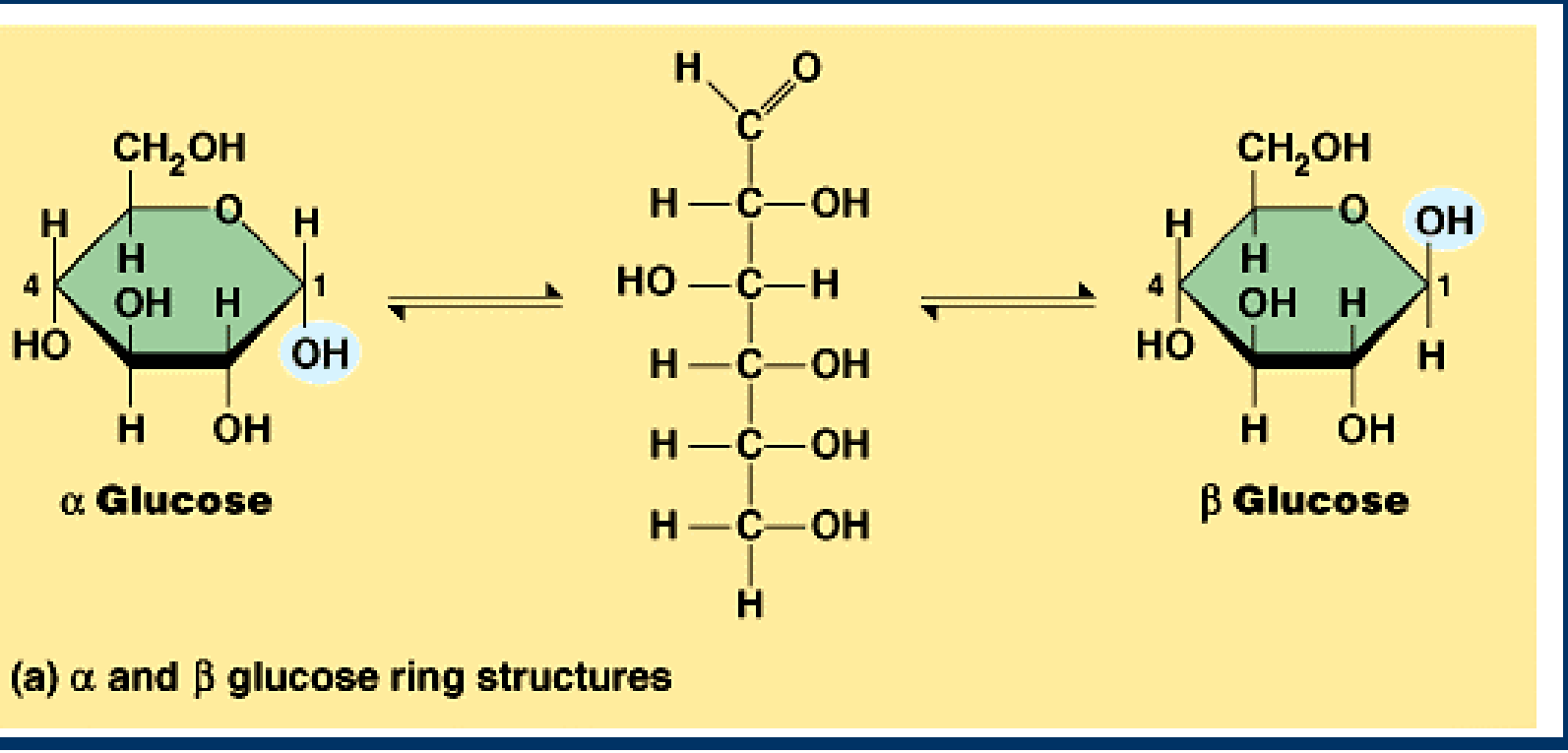
-bacterial cell wall

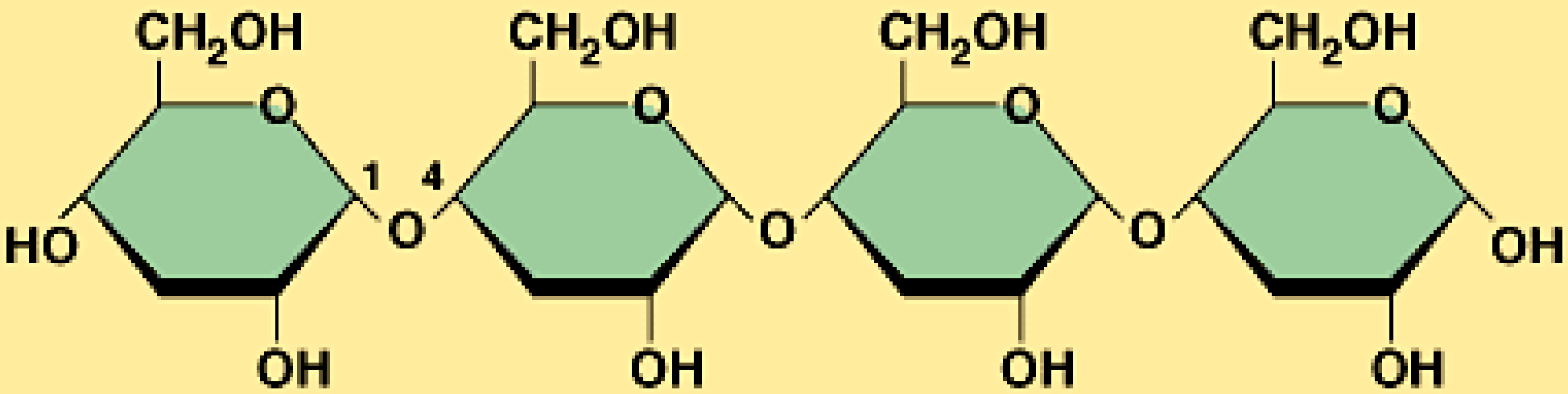
-starch: amylose and amylopectin

amylose = D-glucose linked by a α(1-4) glycosidic linkage

amylopectin = branched by a α(1-6) linkage every 12-25 glucose units

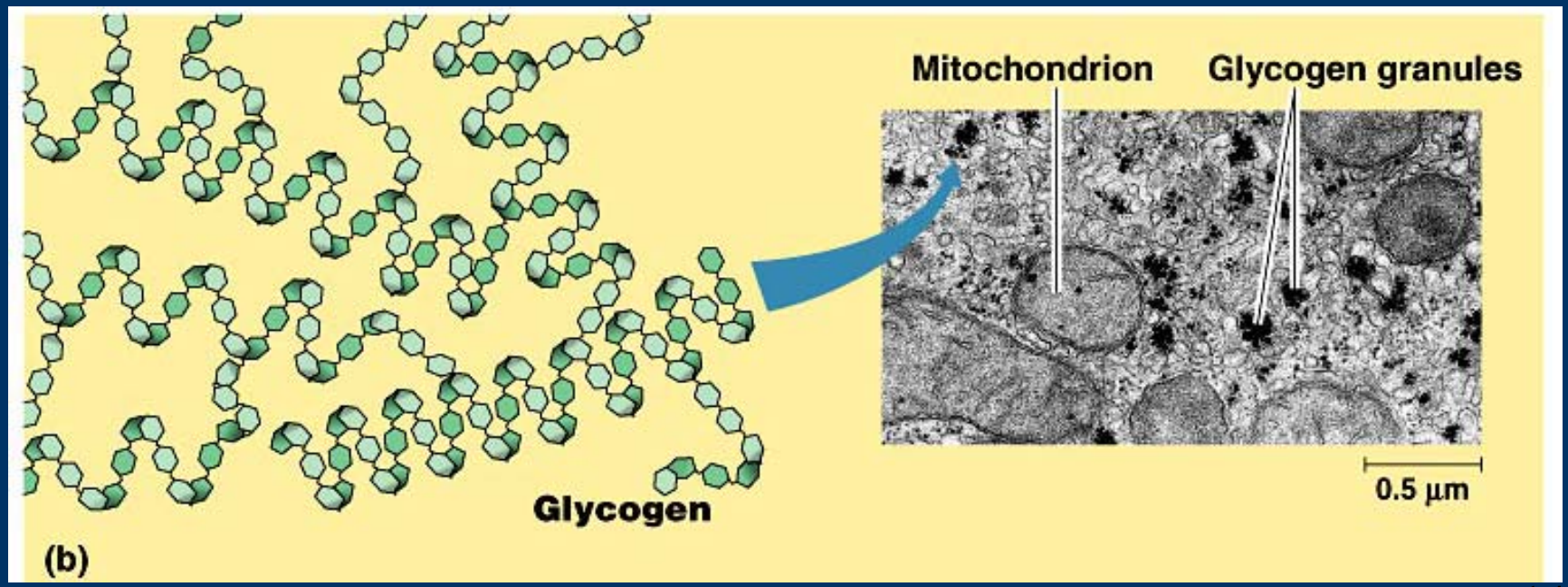



CH2OH
O
H
OH
HO
1
4
α Glucose
β Glucose
(a) α and β glucose ring structures

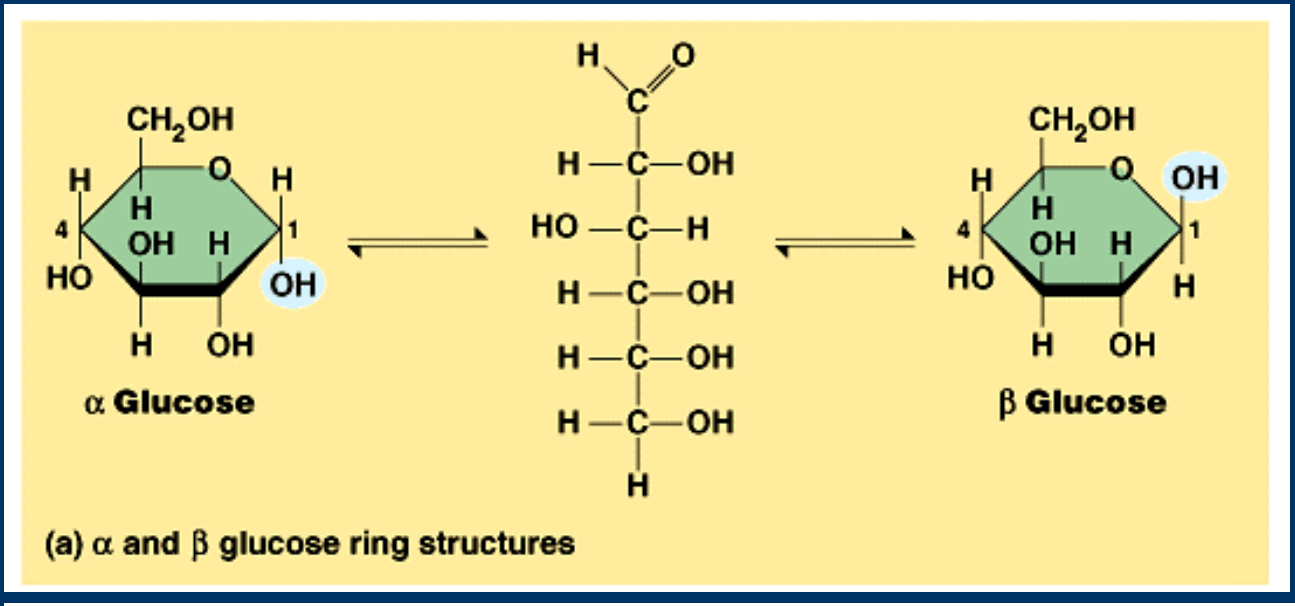

CH2OH
O
HO
OH
1
4
(b) Starch: 1–4 linkage of α glucose monomers

-glycogen -D-glucose linked by α (1-4) glycosidic linkage

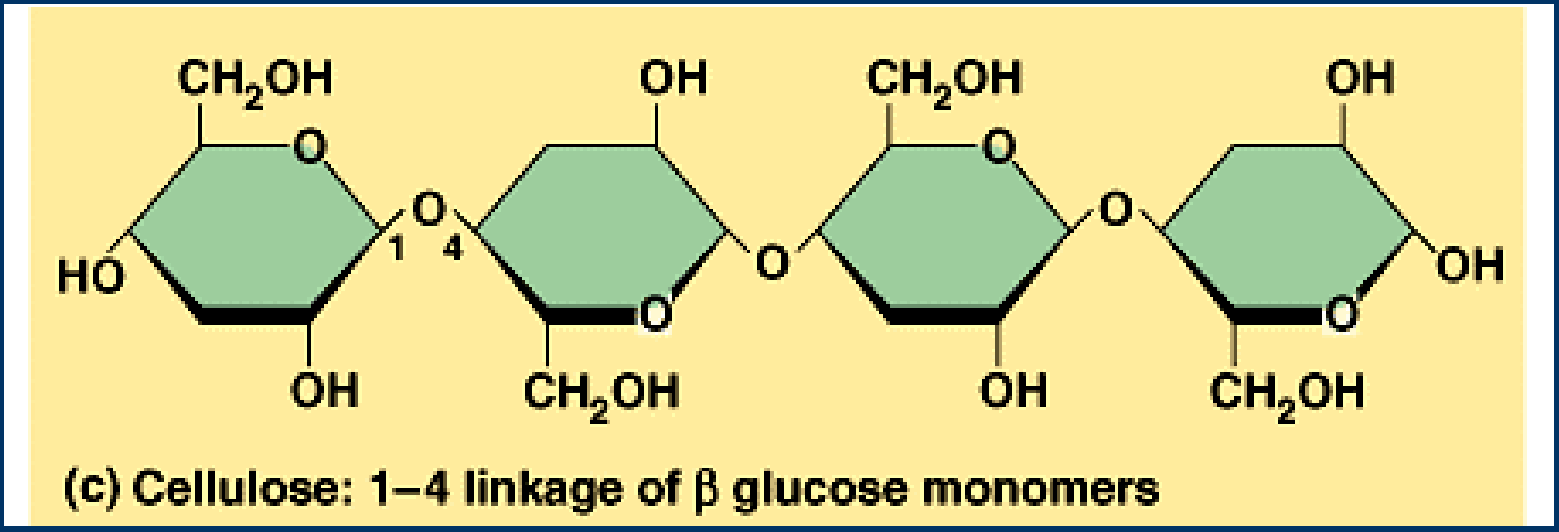
-branched by α (1-6) glycosidic linkage at every 8-12 glucose units



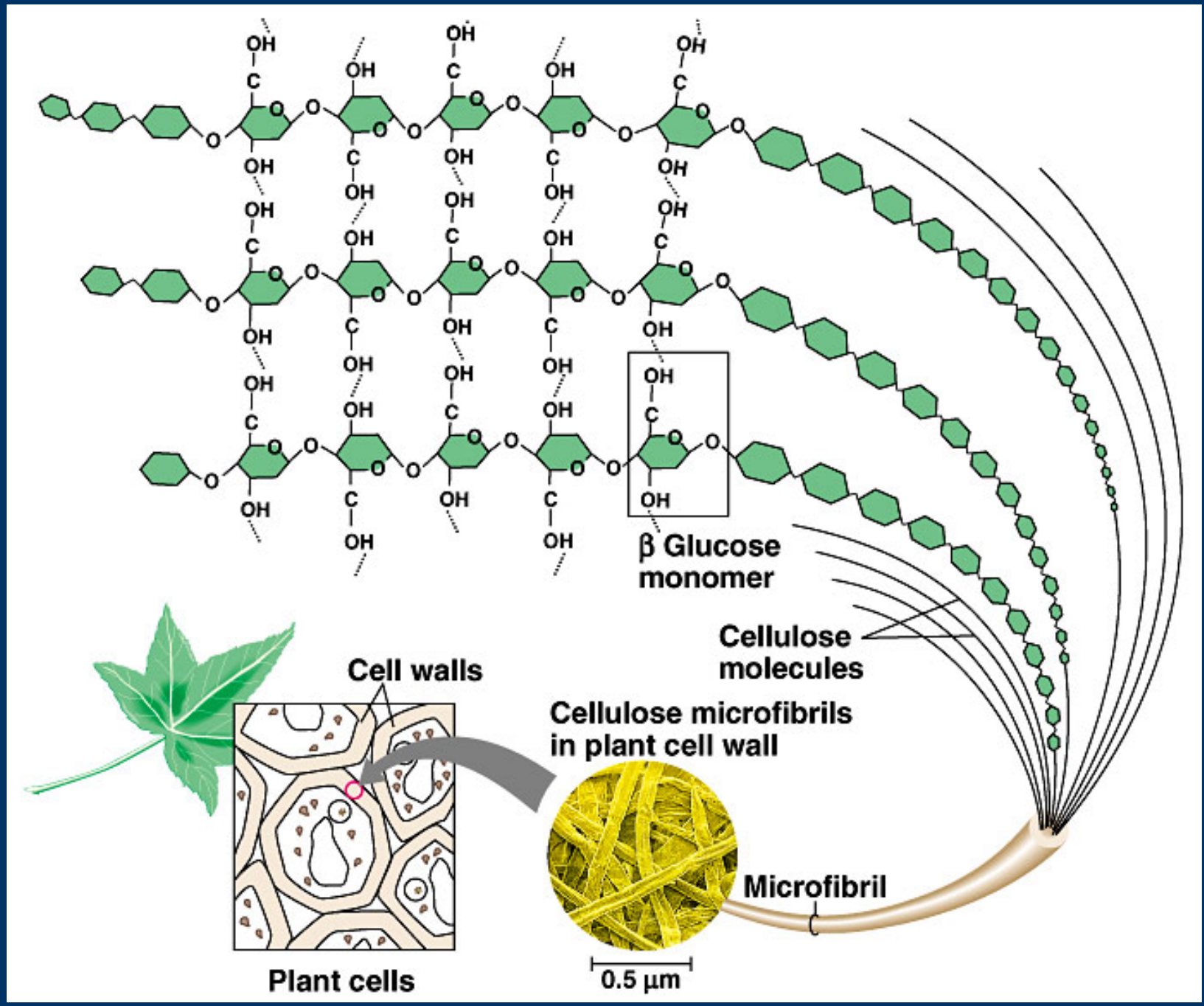
Structural polysaccharides: cellulose β(1-4) glycosidic linkage of D-glucose



(a) α and β glucose ring structures



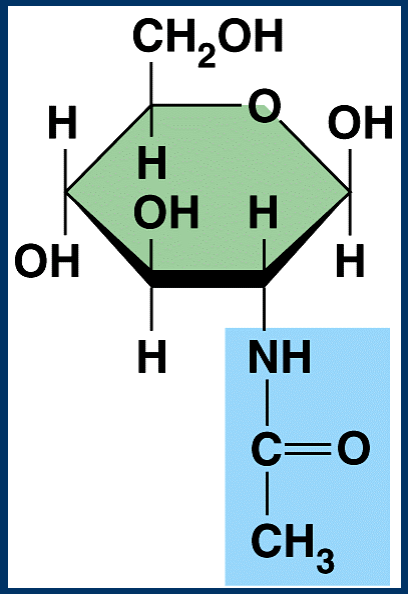
(c) Cellulose: 1–4 linkage of β glucose monomers

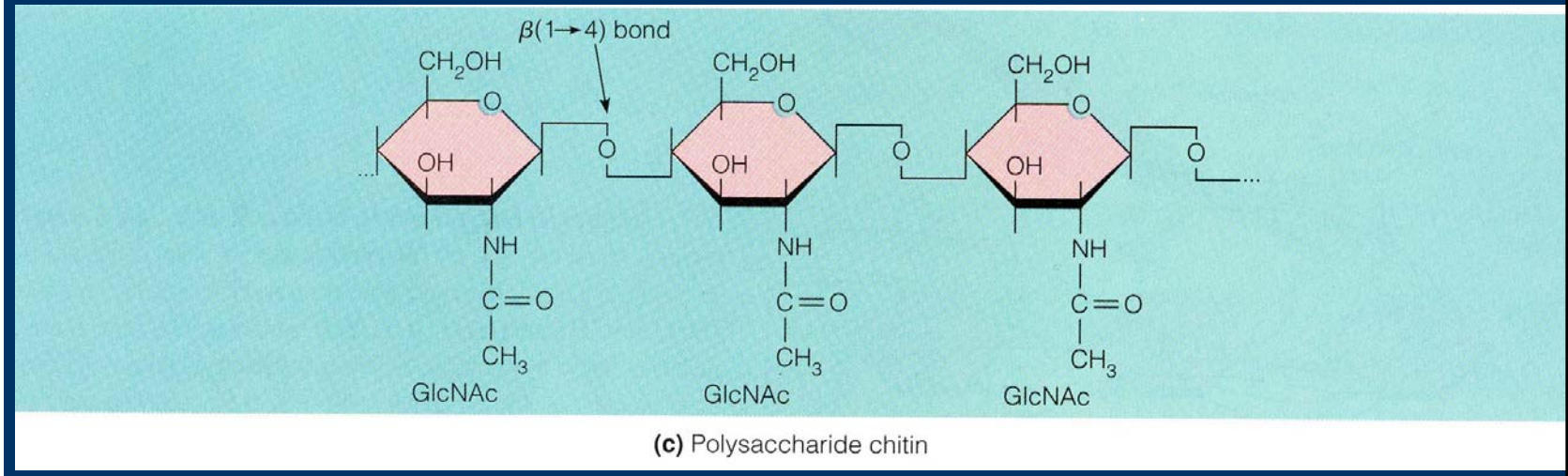


The arrangement of cellulose in plant cell wall

-chitin in insect exoskeletons and crustacean shells

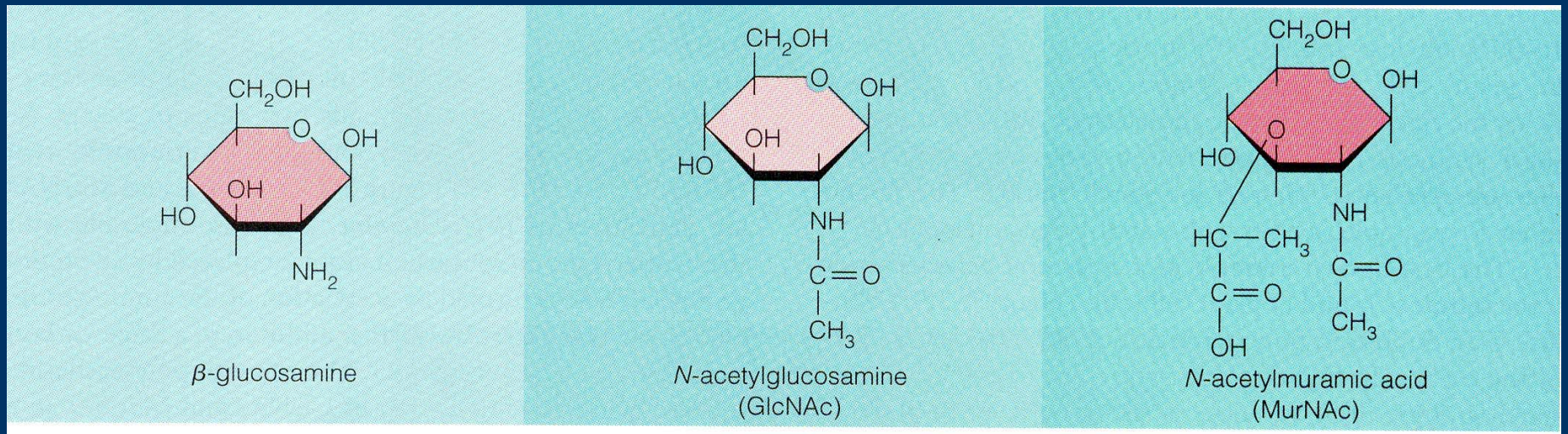
=β(1-4) glycosidic linakge of N-acetylglucosamine





Chitin from insect can be used to make a strong and flexible surgical thread that decomposes after the wound or incision heals.

-bacterial cell wall = β(1-4) glycosidic linkage between N-acetyl glucosamine and N-acetylmuramic acid



Functions of Carbohydrates:

1. An energy storage: plants convert light energy into monosaccharides and starch which animals can use as energy source.
2. Structure of organism: cellulose, chitin and bacterial cell wall.
3. Component of nucleic acid: ribose and deoxyribose.
4. Glycoprotein and glycolipid are composition of cell membrane or recognition molecule.

หน้าที่ของคาร์โบไฮเดรต

1.พลังงานสะสม พืชเก็บพลังงานจากแสงอาทิตย์ในรูปของน้ำตาลโมเลกุลเดี่ยว และแป้ง สัตว์เก็บพลังงานที่เหลือจากการเผาผลาญน้ำตาลในรูปของไกลโคเจน

2.เป็นโครงสร้างของสิ่งมีชีวิต (เซลลูโลส ไคติน ผนังเซลล์ของแบคทีเรีย)

3.เป็นองค์ประกอบของกรดนิวคลีอิก น้ำตาลไรโบส และดีออกซีไรโบส

4.รวมกับโปรตีน หรือลิพิด เป็นไกลโคโปรตีน หรือไกลโค-ลิพิด ซึ่งเป็นเยื่อหุ้มเซลล์ และเป็นโมเลกุลที่ถูกจดจำ (recognition)โดยโปรตีนอื่นๆ