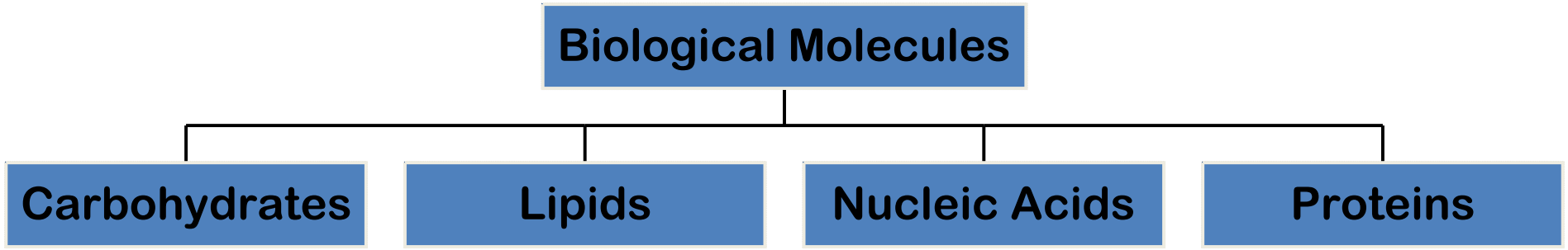
CARBOHYDRATES

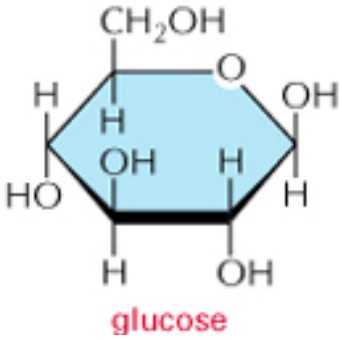

Biological Molecules
Carbohydrates
Lipids
Nucleic Acids
Proteins

Functions

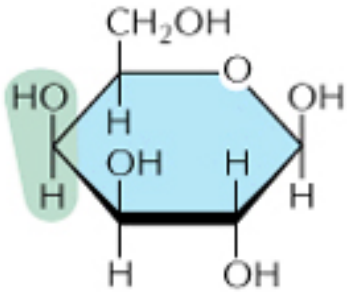
- Quick (or fairly quick) energy
- Energy storage
- Structural support (in plants, insects, and fungi)

Carbohydrates

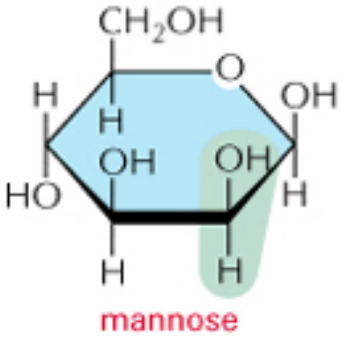
- **Monosaccharides**
- Disaccharides
- Polysaccharides



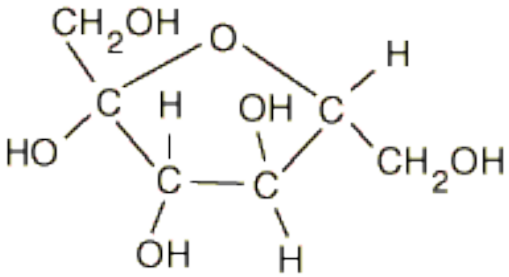
glucose



galactose



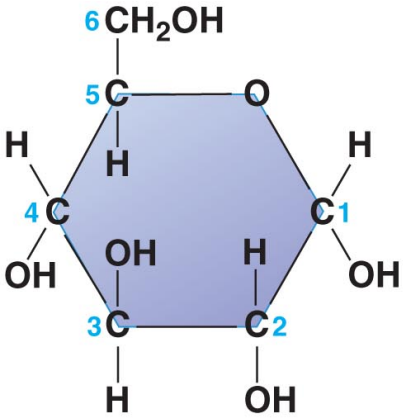
mannose

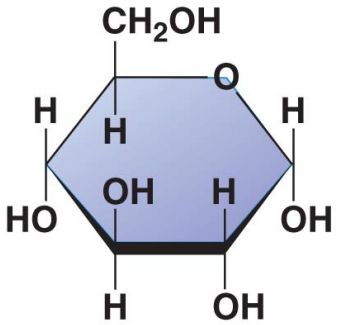


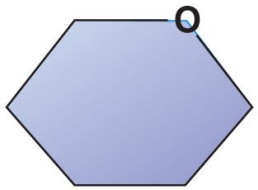
Fructose

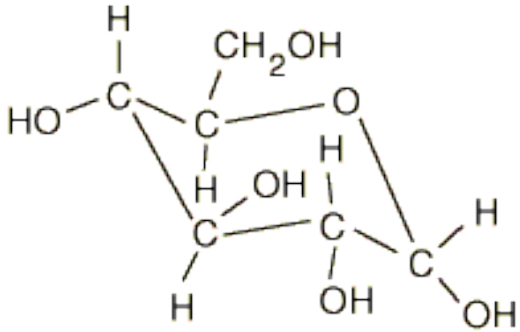
Carbohydrates

- **Monosaccharides**
- Disaccharides
- Polysaccharides



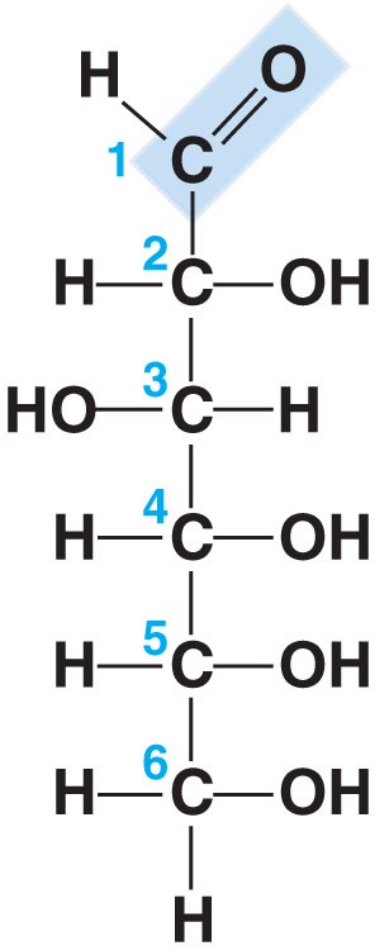




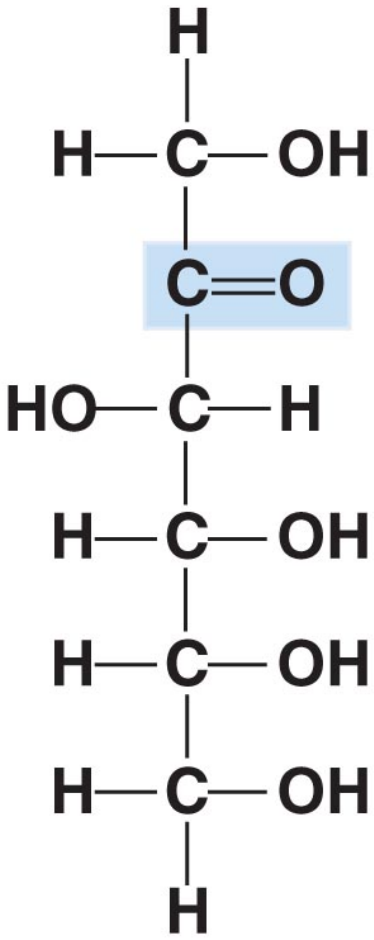


Different ways to draw glucose

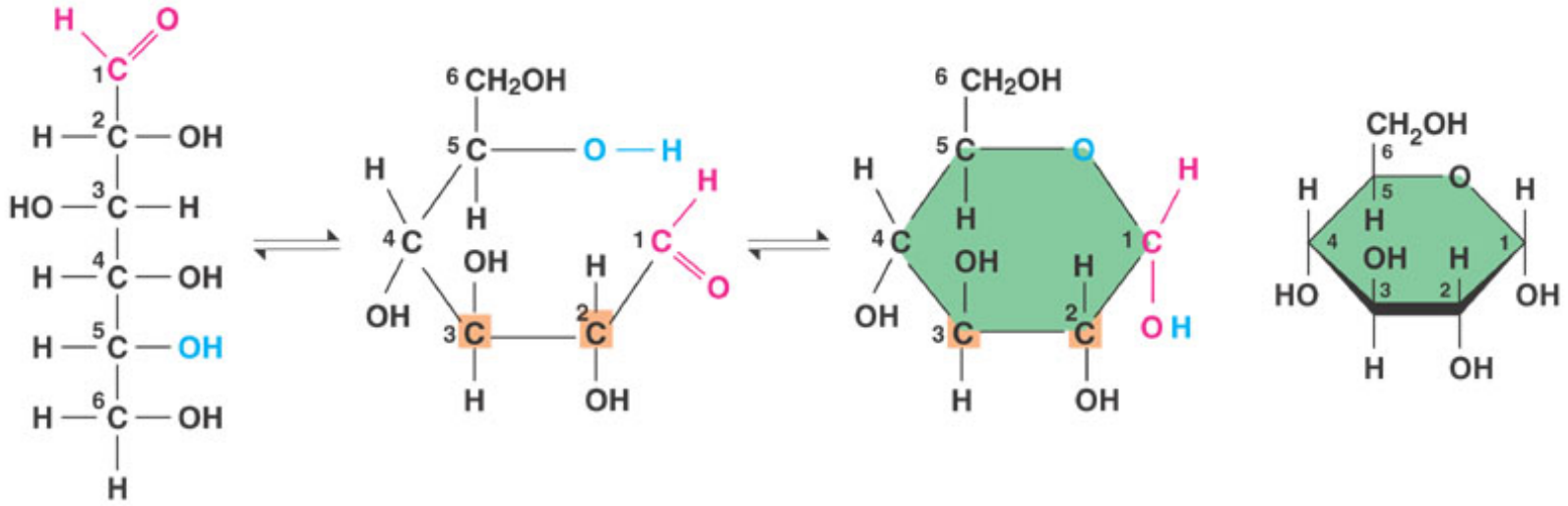
Fig. 3-4b



Glucose
(an aldose)



Fructose
(a ketose)


(a) Linear and ring forms
(b) Abbreviated ring structure

Carbohydrates

- **Monosaccharides**
- Disaccharides
- Polysaccharides

Glucose: A Monosaccharide

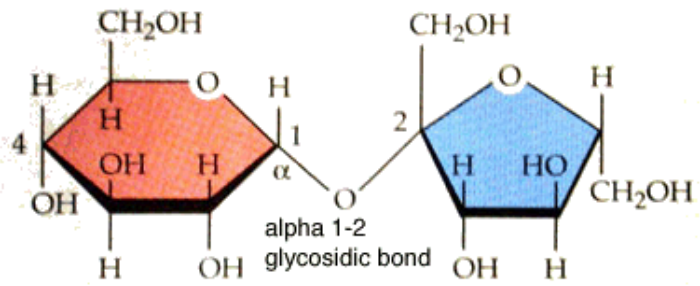
- Glucose is the body's main energy source
- **Cellular respiration** is the process used to convert glucose into energy

glucose + oxygen → carbon dioxide + water

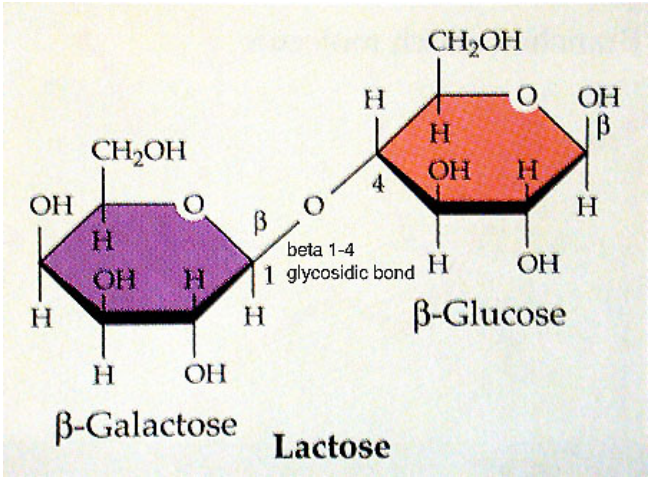
energy

Carbohydrates

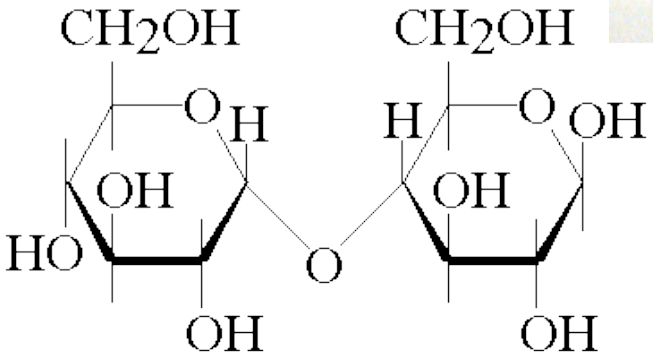
- **Monosaccharides**
- **Disaccharides**
- **Polysaccharides**



Sucrose



Lactose



Maltose

Carbohydrates

- **Monosaccharides**
- **Disaccharides**
- **Polysaccharides**

Fig. 3-5-1

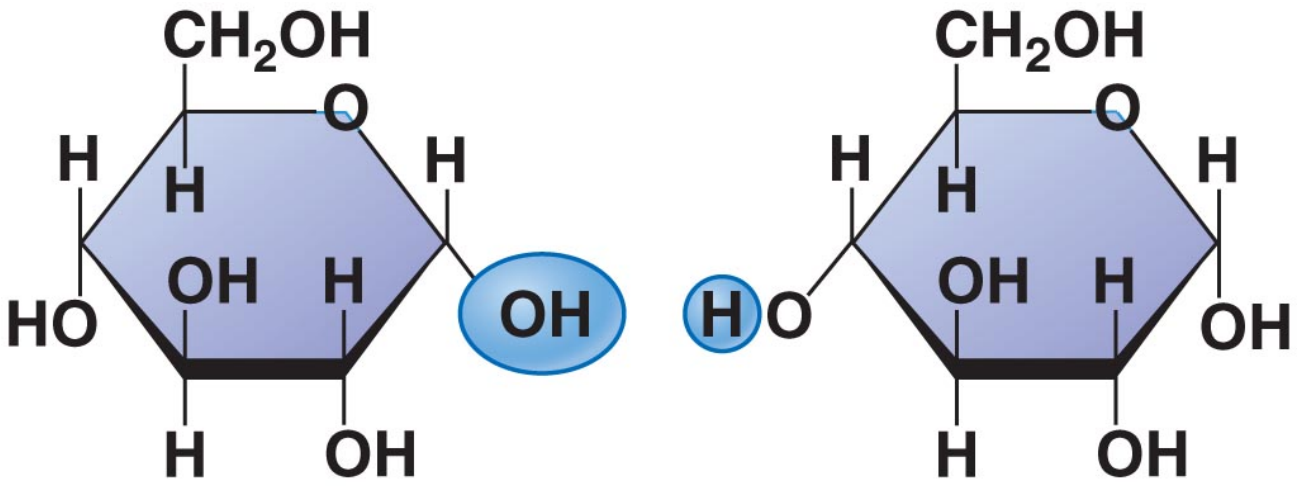
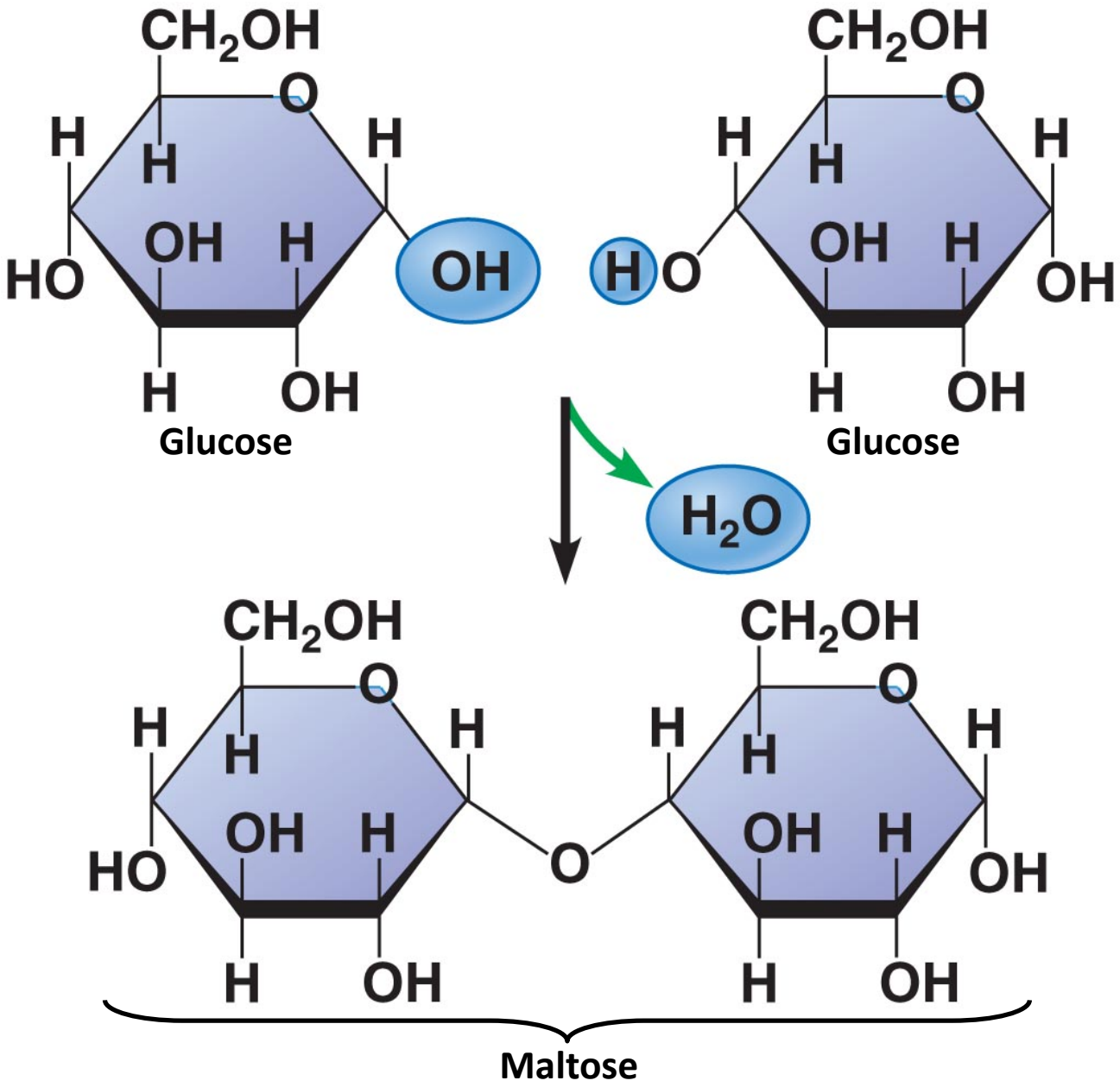
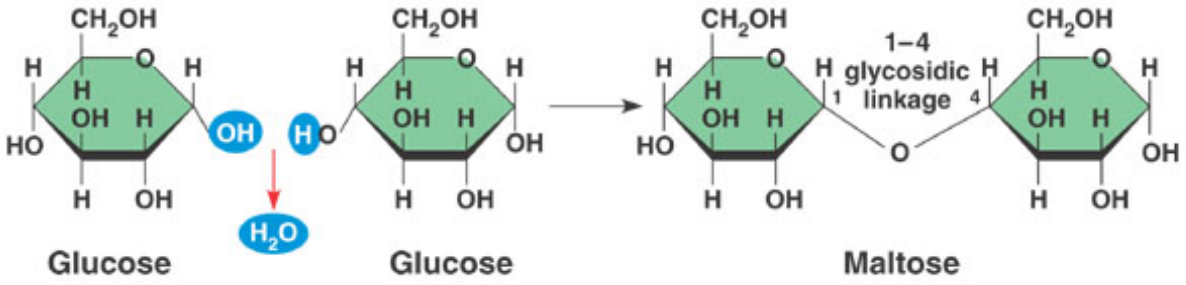


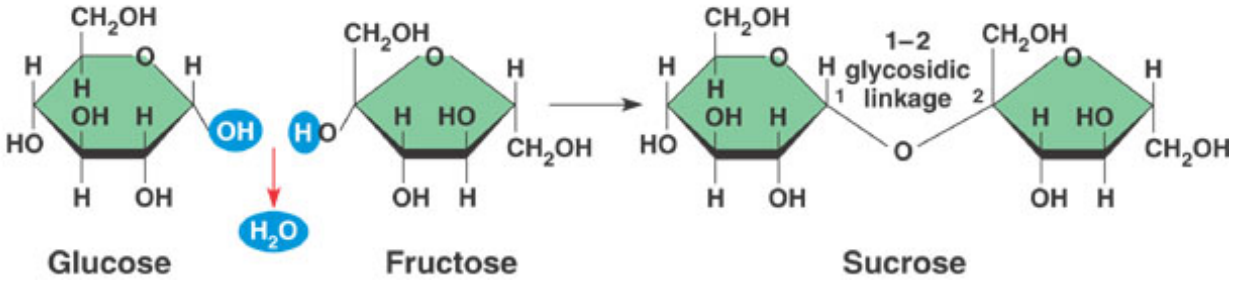
Fig. 3-5-2

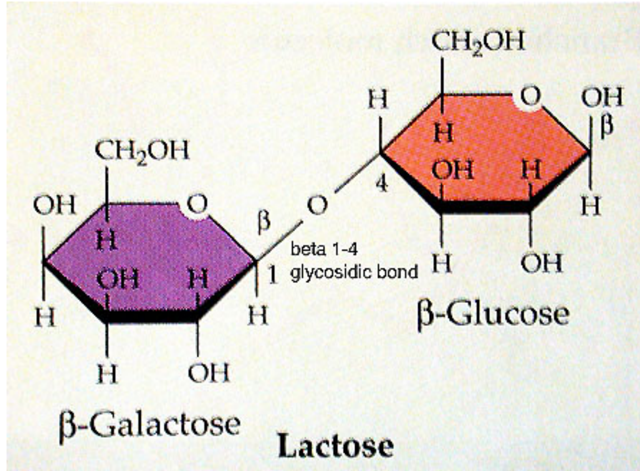


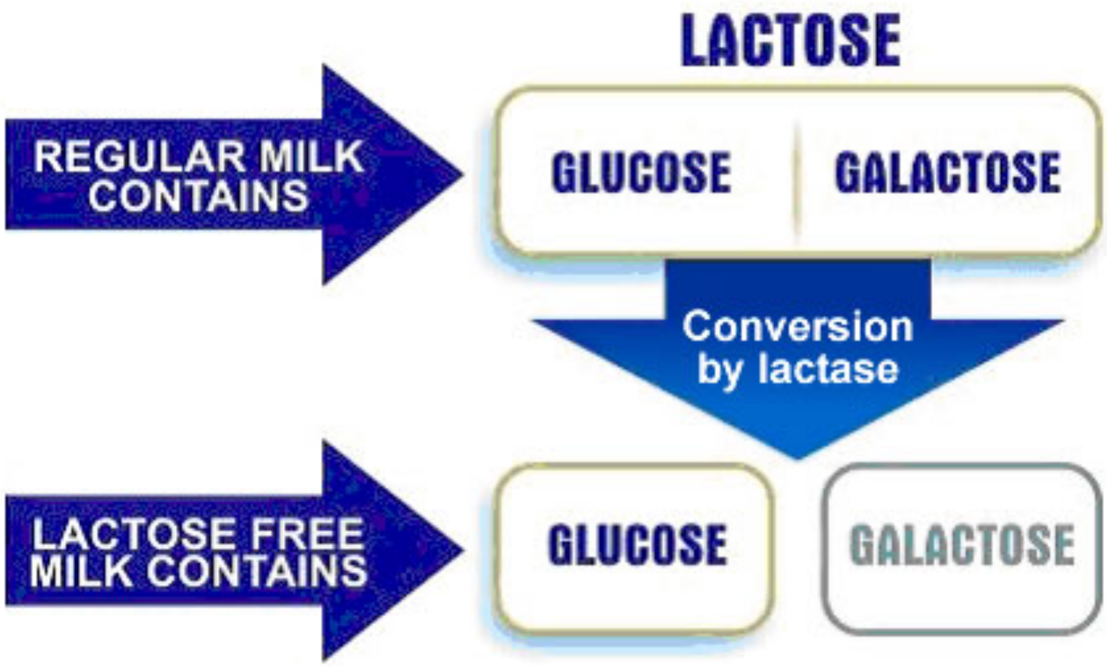
(a) Dehydration reaction in the synthesis of maltose



(b) Dehydration reaction in the synthesis of sucrose

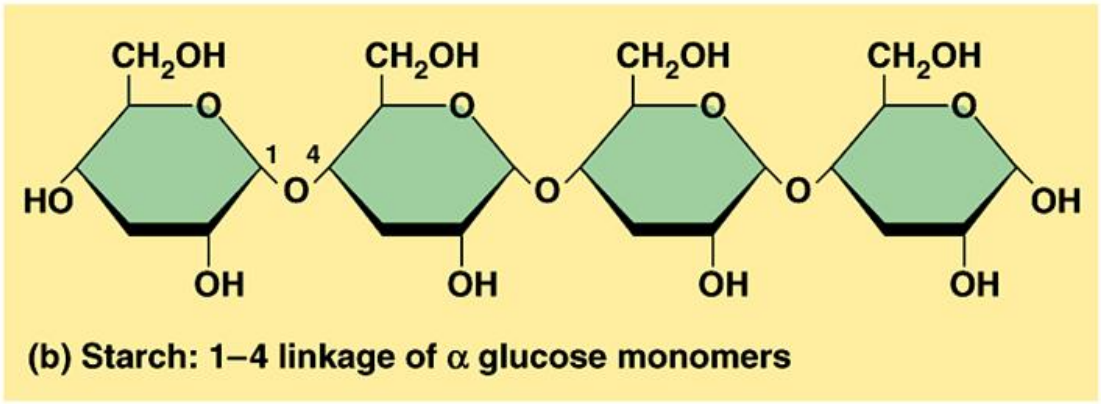



CH2OH
OH
O
β
O
4
CH2OH
H
O
OH
β
H
OH
H
H
OH
H
beta 1-4
glycosidic bond
1
H
H
OH
H
β-Glucose
H
OH
β-Galactose
Lactose


LACTOSE
REGULAR MILK CONTAINS
GLUCOSE
GALACTOSE
Conversion by lactase
LACTOSE FREE MILK CONTAINS
GLUCOSE
GALACTOSE

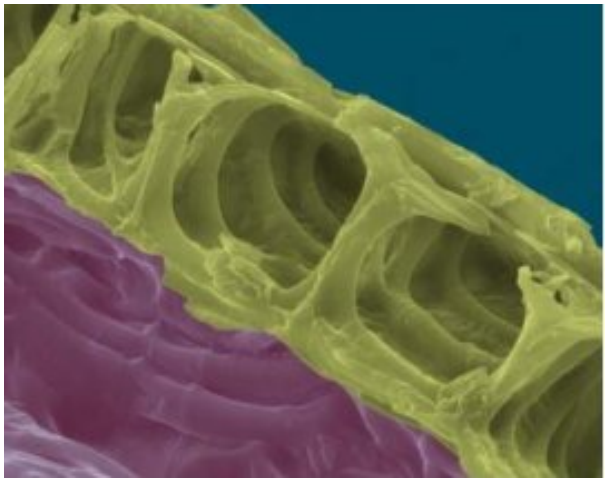
Carbohydrates

- **Monosaccharides**
- **Disaccharides**
- **Polysaccharides**



Carbohydrates

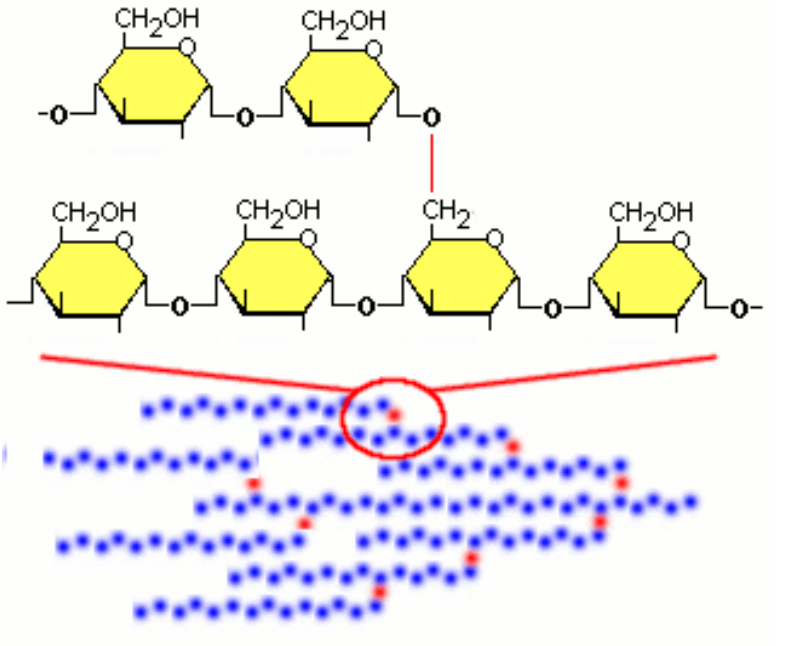
- Monosaccharides
- Disaccharides
- Polysaccharides



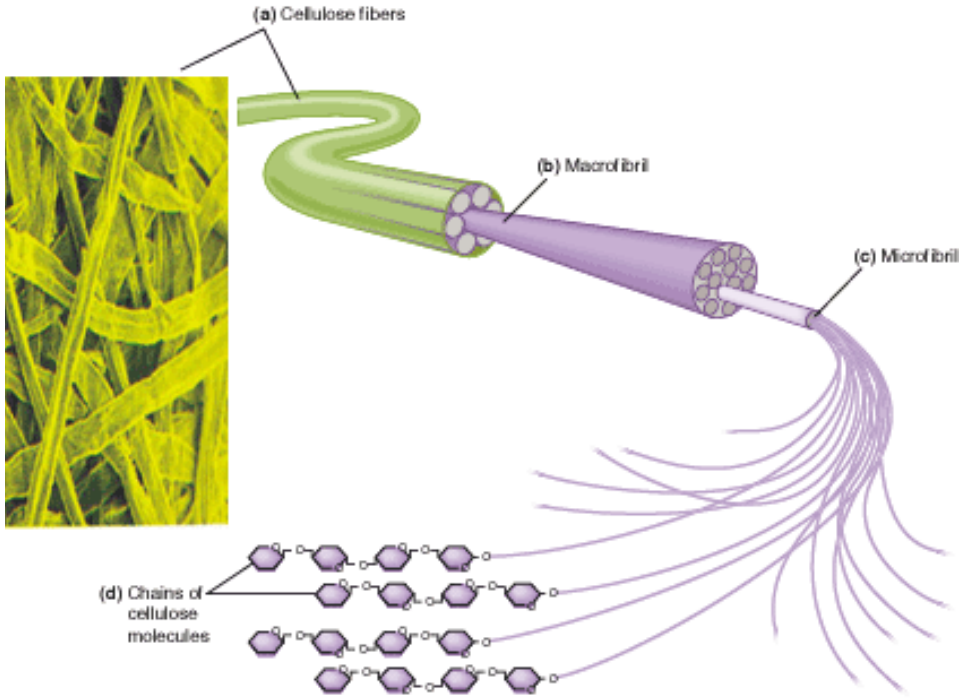
Plant Polysaccharides

- **Starch**
  - **Structure: Branched***
  - **Function: Energy storage**

***Some forms**



- **Cellulose ("fiber")**
  - **Structure: Straight chain**
  - **Function: Structural support**



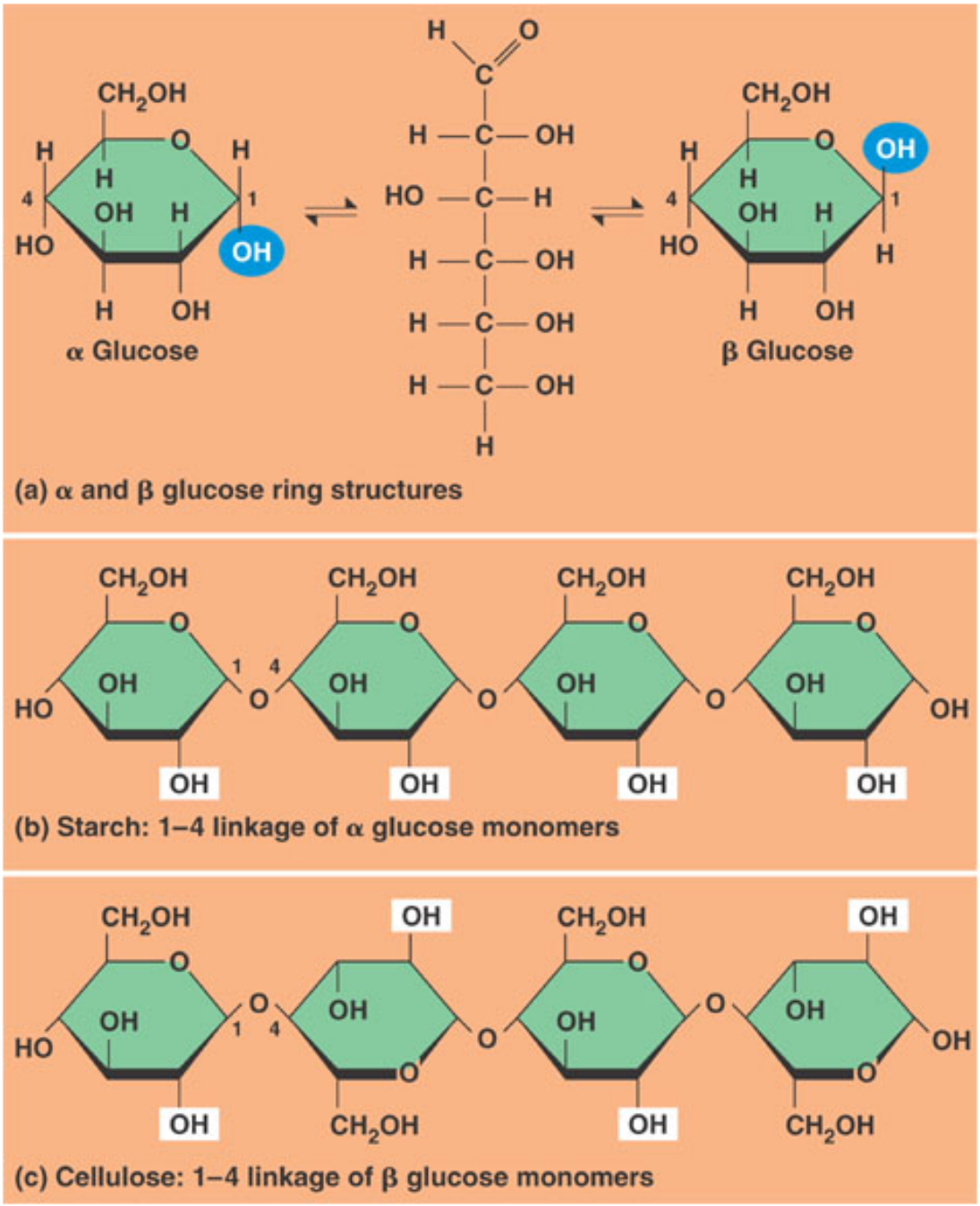
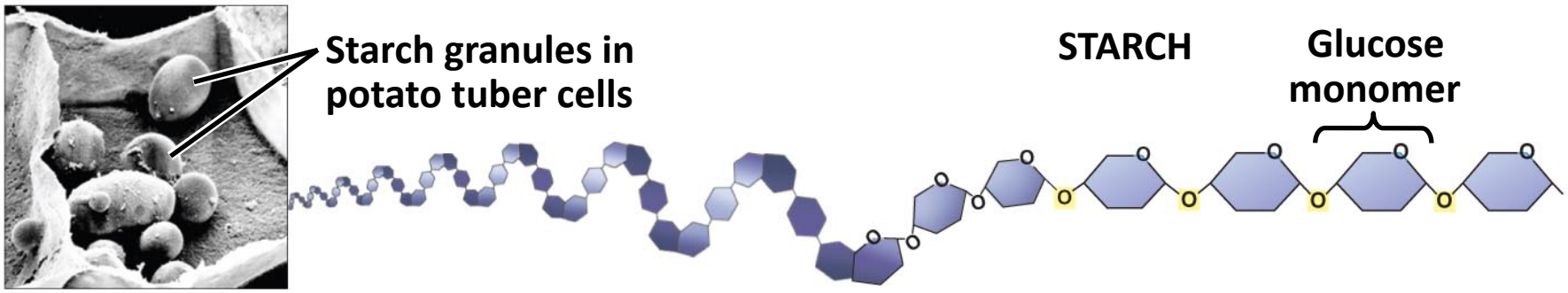

α Glucose
β Glucose
(a) α and β glucose ring structures
(b) Starch: 1–4 linkage of α glucose monomers
(c) Cellulose: 1–4 linkage of β glucose monomers

Fig. 3-7a



wood is mostly cellulose

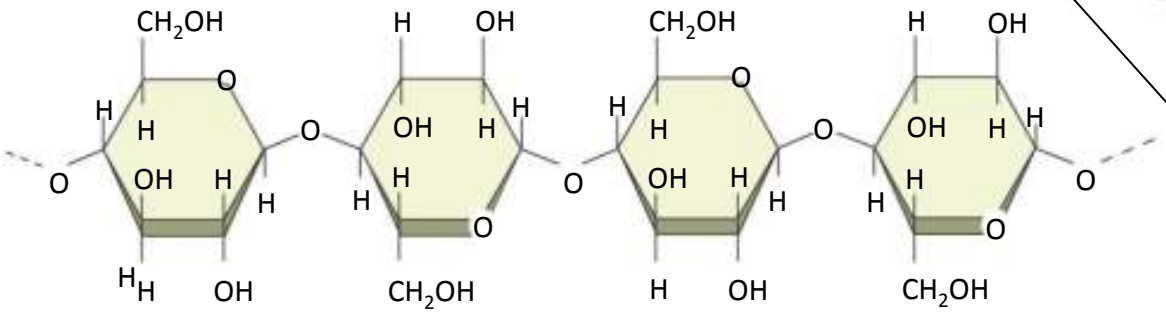
plant cell with cell wall

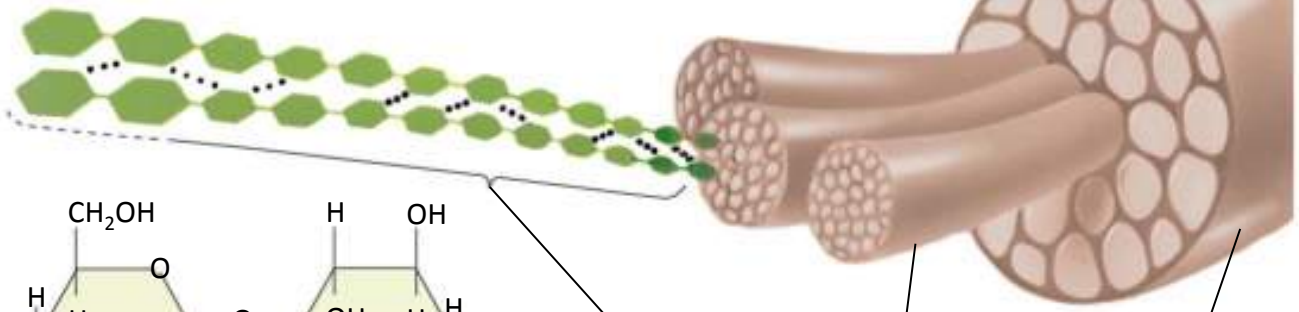
1 micrometer

close-up of cell wall

1 micrometer

Cellulose



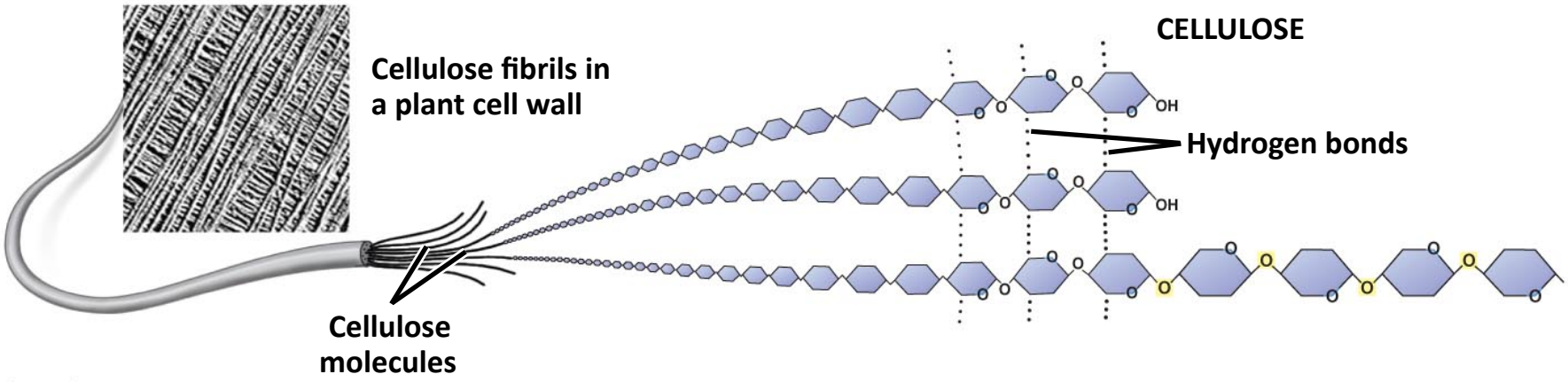


individual cellulose molecules

bundle of cellulose molecules

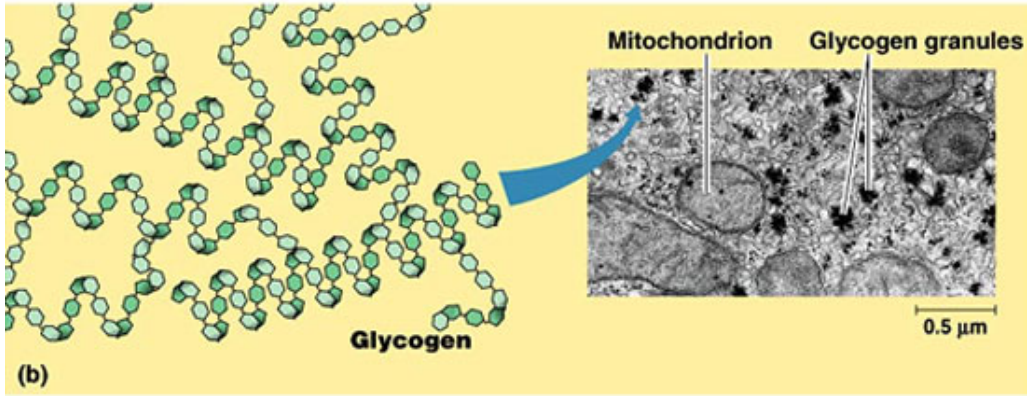
cellulose fiber

Fig. 3-7c

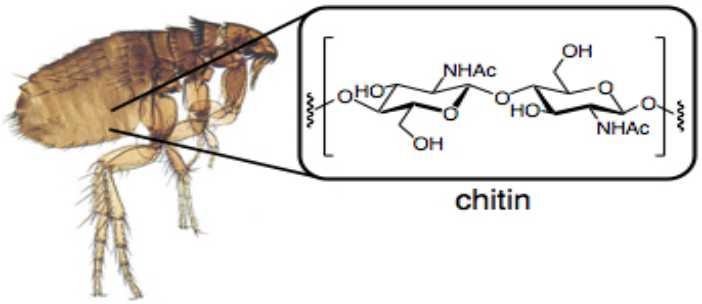


Animal Polysaccharides

- **Glycogen**
  - **Structure: Branched**
  - **Function: E storage**

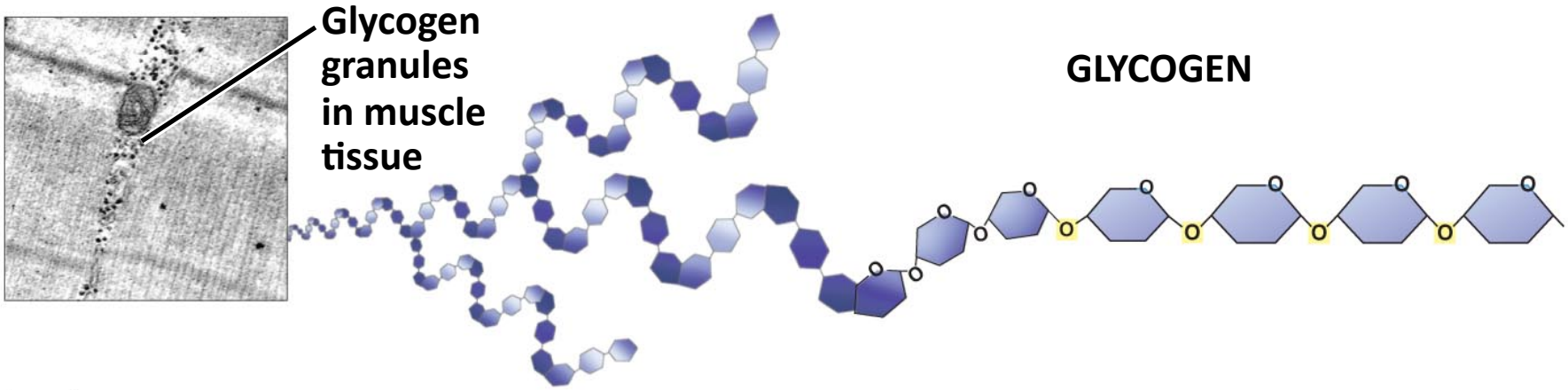


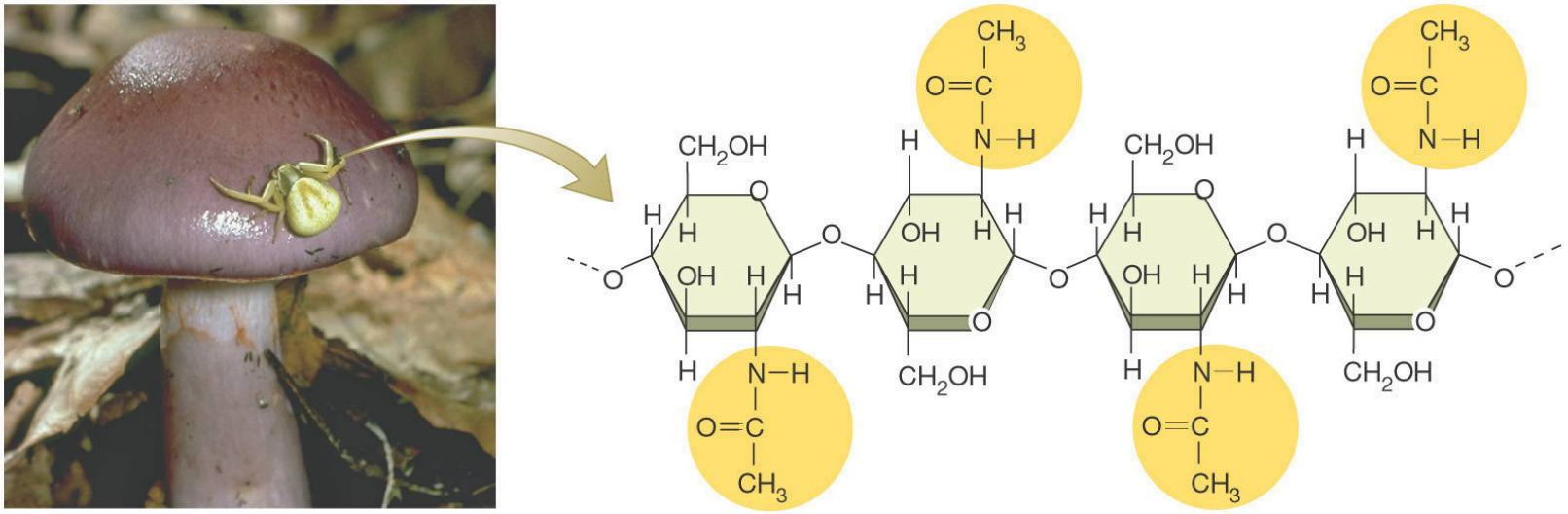
- **Chitin**
  - **Structure: Straight chain**
  - **Function: Structural support (in arthropods and fungi)**



flea

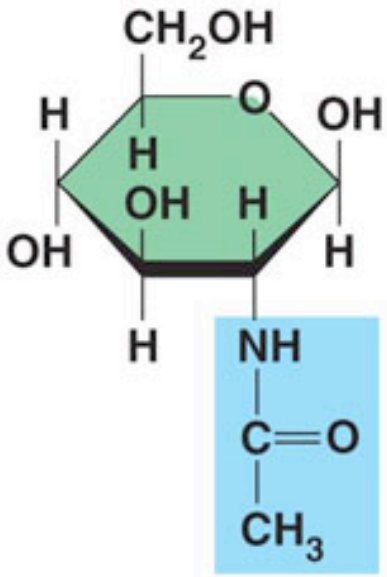
Fig. 3-7b





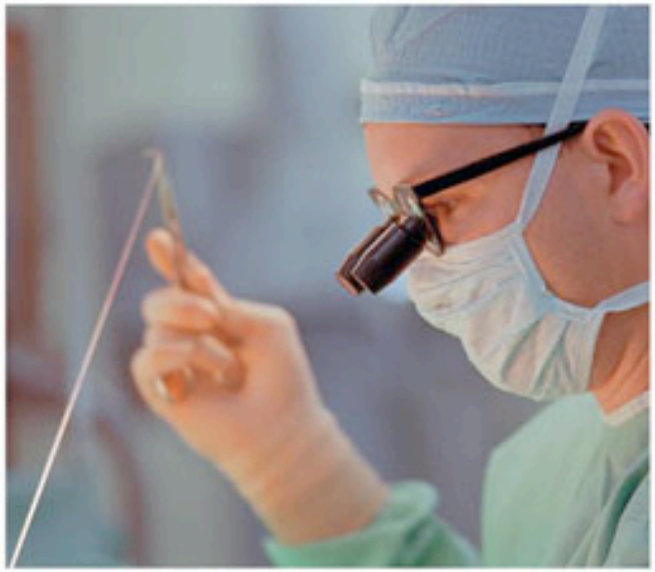
CHITIN

Fig. 3-7



(a) The structure of the chitin monomer.

(b) Chitin forms the exoskeleton of arthropods.



(c) Chitin is used to make a strong and flexible surgical thread.

Fig. 3-7

Chitin also makes up the cell walls of fungi.

Fig. 3-7