Al-Mustaqbal University College

Anesthesia Techniques Department

Carbohydrates part 1

Carbohydrates

Definition:-

Carbohydrates may be defined as organic compounds occurring in foods and living tissues and including sugars, starch, and cellulose, composed of the elements C, H, and O.

Carbohydrates are

- A major source of energy from our diet.
- Also called saccharides, which means “sugars.”

The importance Of carbohydrates

Functions of Carbohydrates:

1 - Source of energy for living beings, e.g. glucose

2 - Storage form of energy, e.g. glycogen

3 - Serve as structural component, e.g. glycosaminoglycans in humans

4 - Non-digestable carbohydrates like cellulose, serve as dietary fibers

5 - Constituent of nucleic acids RNA and DNA, e.g. ribose and deoxyribose sugar

6 - Play a role in immunity and also involved in detoxification, e.g. glucuronic acid

Classification of Carbohydrates

Classification:

According to no. of sugar units

Monosaccharaides: 1 sugar unit : glucose, fructose *which present mainly in fruits*, galactose

Disaccharides: 2 sugar units: **lactose** *which known as sugar milk* (galactose + glucose), **maltose**(glucose + glucose)

Oligosaccharides: 3-9 units

Polysaccharides: 10 or more units

The suffix ose indicates that a molecule is a carbohydrate

GLUCOSE

- Physiologically and biomedically , glucose is the most important **monosaccharide**
- It is called blood sugar
- $C_6H_{12}O_6$
- It is source of energy
- It is can be stored in our body in form of glycogen

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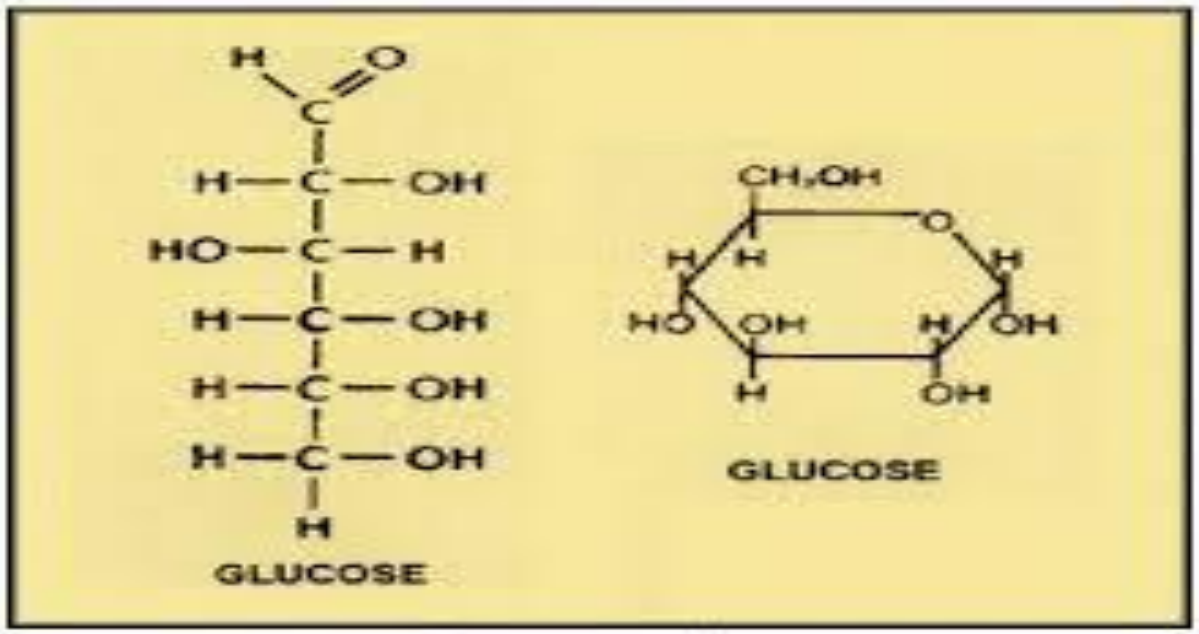


جلوكوز - سكر العنب

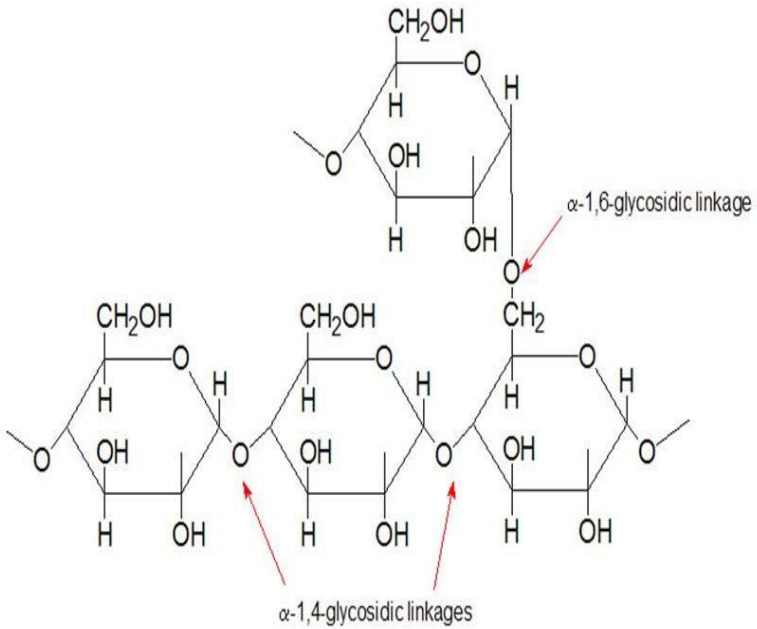
GLYCOGEN METABOLISM

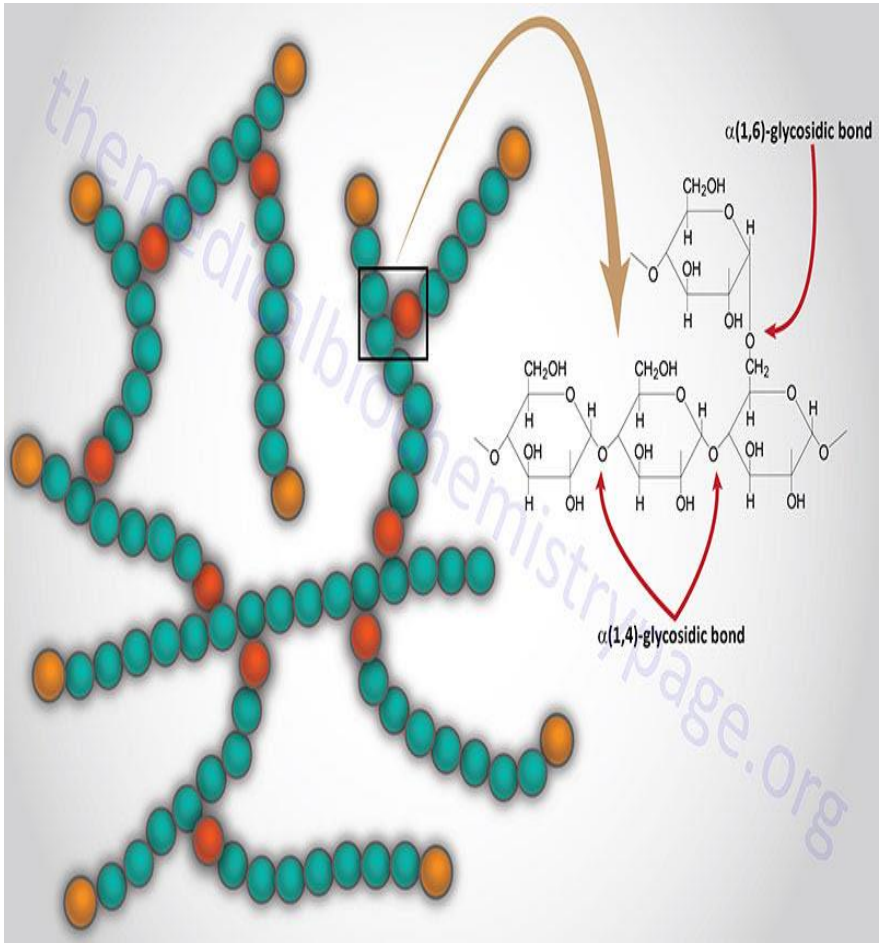
• Glycogen is the major storage form of glucose mainly in the liver and muscle.

• The concentration of liver glycogen (up to 6%) is greater than in muscle tissues (1%).

• The synthesis(glycogenesis) and degradation(glycogenolysis) occur via different pathways. Glycogenesis and glycogenolysis are both cytosolic processes

Glycogen structure





Glycogenesis

Glycogenesis is the pathway for the formation of glycogen from glucose. This process requires energy, supplied by ATP and uridine triphosphate (UTP). It occurs in muscle and liver.

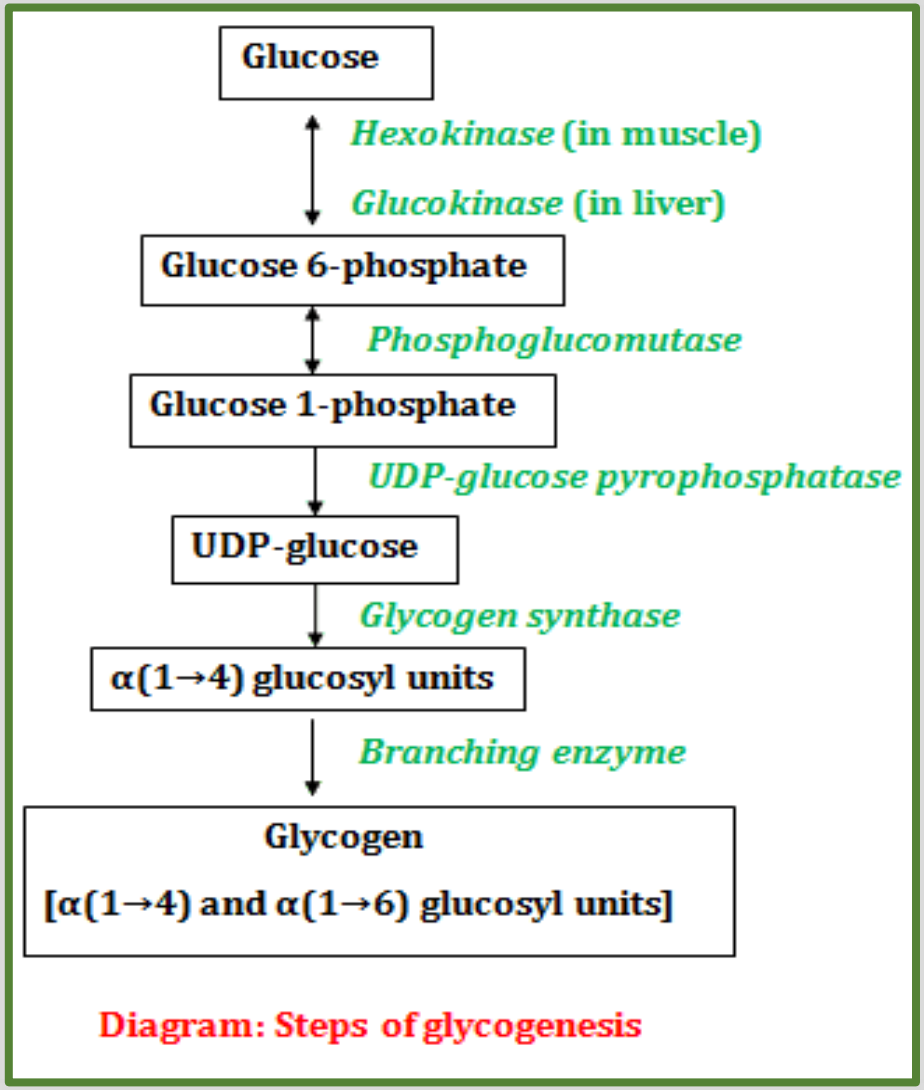


Diagram: Steps of glycogenesis

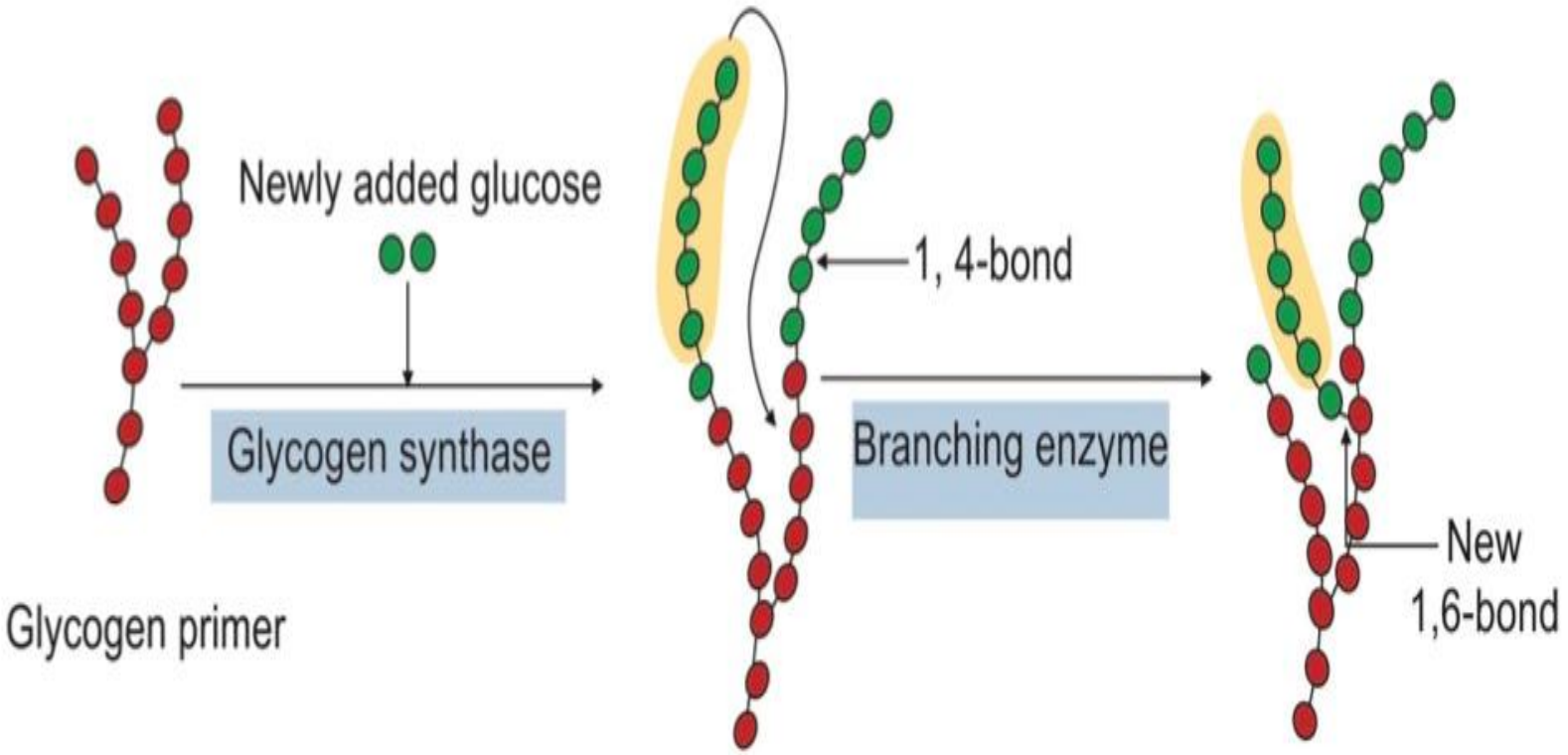
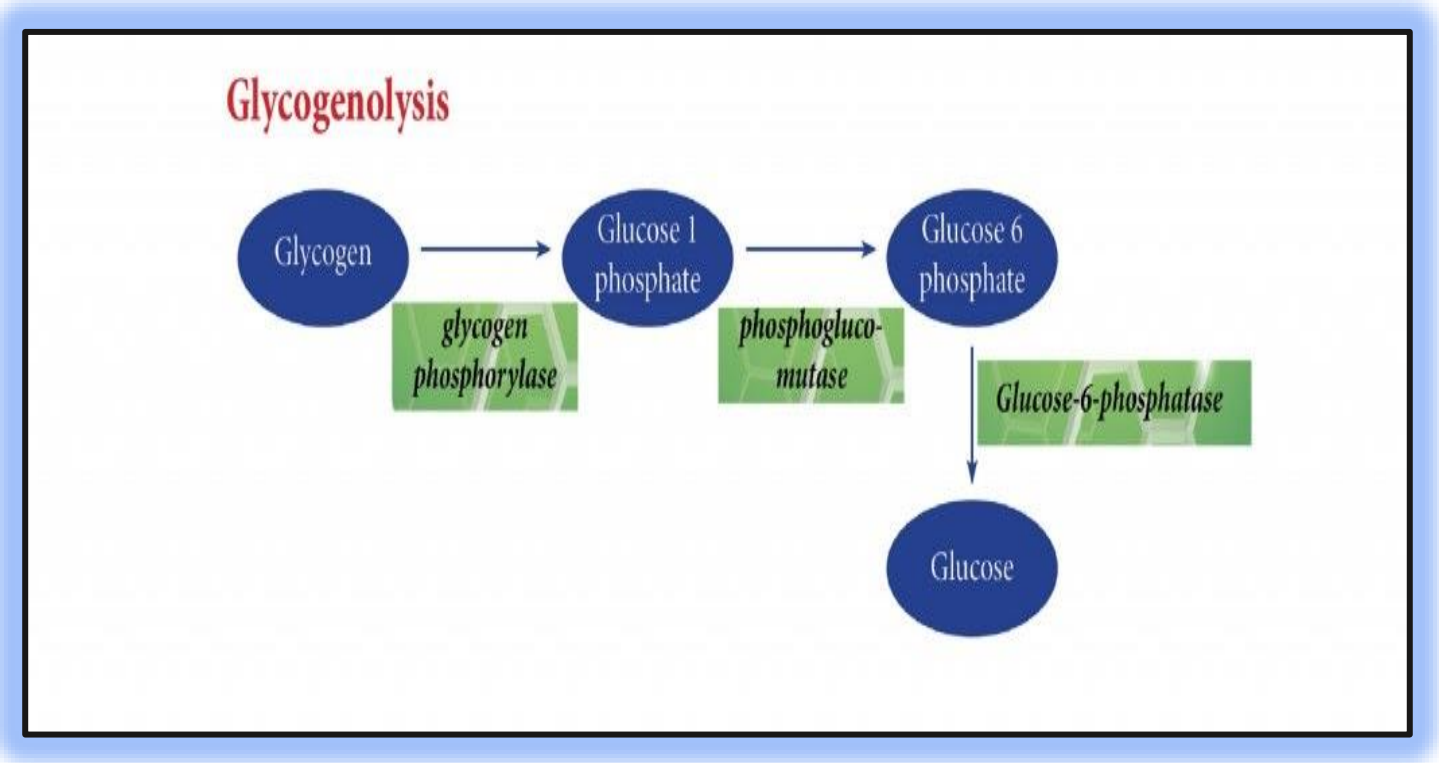


Figure 12.11: Schematic representation of glycogenesis (mechanism of branching)

Glycogenolysis

Glycogenolysis is the degradation of glycogen to glucose-6-phosphate and glucose in muscle and liver respectively. Glycogenolysis is not the reverse of glycogenesis but is a separate pathway.



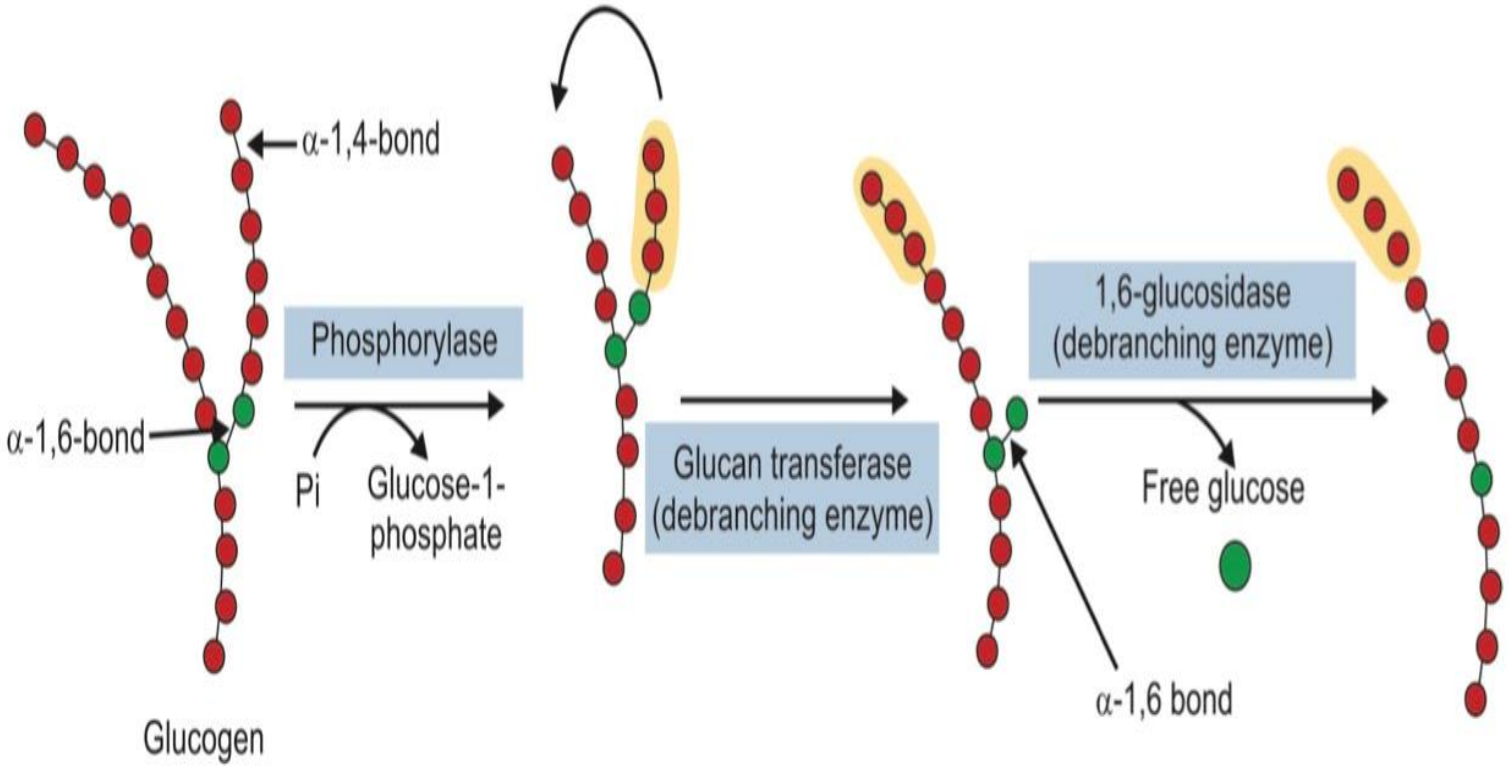


Figure 12.12: Schematic representation of glycogenolysis (mechanism of debranching)

Significance of Glycogenolysis and Glycogenesis

In liver

Following a meal, excess glucose is removed from the portal circulation and stored as glycogen by glycogenesis. Conversely, during fasting, blood glucose levels are maintained within the normal range by release of glucose from liver glycogen by glycogenolysis.

In muscle

The function of muscle glycogen is to act as a readily available source of glucose within the muscle itself during muscle contraction. The muscle cannot release glucose into the blood, because of the absence of glucose-6-phosphatase that hydrolyzes glucose 6-phosphate to glucose. Therefore, muscle glycogen stores are used exclusively by muscle.

GOOD LUCK