

Glycogen metabolism

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Glycogen is a storage form of glucose, found in most type of cells. The liver and muscle contain the largest glycogen stores.

- Liver glycogen is a source of blood glucose while muscle glycogen use for its energy needs.

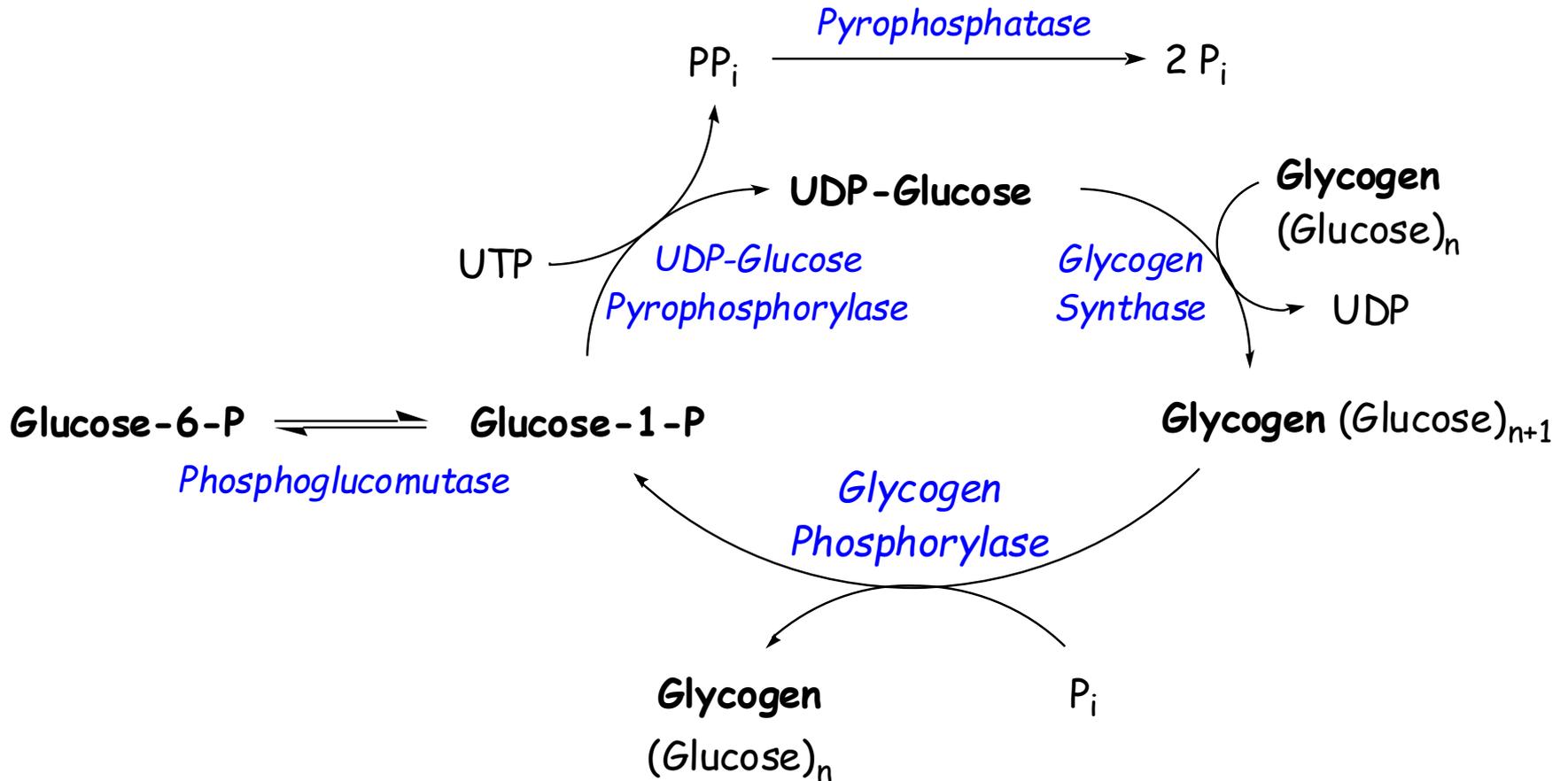
- Glycogenolysis is stimulated by the hormone glucagon, and by catecholamines such as adrenaline (epinephrine).

- Cyclic AMP integrates the regulation of glycogenesis and glycogenolysis by promoting the simultaneous activation of phosphorylase and inhibition of glycogen synthase.

- cAMP is formed from ATP by adenylate cyclase at the inner surface of cell membrane and act as an intracellular second messenger in response to hormones such as glucagon, epinephrine and norepinephrine.

- Duration of liver glycogen storage is about 12 hours (enough for about 12 hours) then gluconeogenesis starts.

Glycogen Metabolism



*Hormones regulated glycogen metabolism:

1 . *Epinephrine*

2 . *Glucagon*

3 . *Insulin*

(the actions of these hormones are indirect) .

* Primary enzymes targets in glycogen metabolism are *glycogen phosphorylase* and *glycogen synthase* .

===== *HORMONES* =====

Glucagon

- A linear polypeptide hormone produced in **α -cells** of the islets of Langerhans of the **pancreas**.
- Acts primarily on **liver** cells .It has no action in muscle .
- Receptors on surface of liver cells.
- Stimulates glycogenolysis and inhibit glycogenesis.
- Glucagon also blocks glycolysis and stimulates gluconeogenesis.

Epinephrine

- Receptors on surface of cells.
- Stimulates glycogenolysis in liver and muscle cells .
- It is secreted by the adrenal medulla in response to hypoglycemia .

Insulin

- *High levels of glucose* induce release of insulin from β -cells of islets of Langerhans in the pancreas.
- Insulin composed of 51 amino acids arranged in two peptide chain linked together by two disulfide bridges .
- Bind to receptors on the cells membrane of liver and muscle cells.
- Increases glycogenesis .
- Active insulin is stored in granules in cytosol . Insulin half life is six minutes. ⁷

(Biosynthesis of insulin)

This involves two inactive precursors :



Preproinsulin is cleaved by proteolysis to form proinsulin which is further cleaved to form active insulin .

Glycogen storage disease



A deficiency of one of the enzymes involved in glycogenesis or glycogenolysis results in the accumulation of normal or abnormal form of glycogen leading to muscle weakness and some glycogen storage diseases result in early death .

In von Gierke's disease , the least rare glycogen storage disorder , there is a deficiency of glucose-6-phosphatase , because this enzyme is essential for the conversion of glucose - 6 - phosphate to glucose , there is fasting hypoglycemia .

Accumulation of glycogen cause hepatomegaly .