Regulation of Glycolysis

Reaction 1 – The amount of glucose entering the glycolysis pathway decreases when high levels of glucose-6-phosphate are present in the cell.

Reaction 3 – The enzyme here is inhibited by high levels of ATP (when ATP is plentiful) and activated by high levels of ADP and AMP (the cell has used up much of its ATP).

Reaction 10 – High levels of ATP and acetyl CoA inhibit this enzyme.

Glycogen Metabolism

When we eat and we have plenty of ATP as well as glucose in our system, we use the excess to replenish our energy reserves.

Glycogenesis:
It is the synthesis of glycogen from glucose molecules. It happens when we have high levels of glucose. Glycogen is stored in limited amounts in our skeletal muscle and liver.

Glycogenolysis:
When the concentration of blood glucose drops, glycogen is broken down to glucose.

We need to regulate the concentration of glucose due to the fact that the brain, skeletal muscles, and red blood cells require glucose to function properly.

When [glucose] is high (after eating)
Insulin (produced in the pancreas) is released into the bloodstream. It signals cells to synthesize glycogen (glycogenesis), accelerates glycolysis and inhibits glucose synthesis.

If we have enough glycogen, the extra glucose is converted to fat.

When [glucose] is low
Glucagon (produced in the pancreas) is secreted into the bloodstream. In the liver, it accelerates the rate of Glycogenolysis (which increases the concentration of glucose), and inhibits glycogenesis (the synthesis of glycogen).

Epinephrine (adrenaline) is released from the adrenal glands when we need a "burst of energy" (the "fight or flight" mode) to signal for glycogenolysis.

Gluconeogenesis:
We have enough glycogen for ≈ one day. When we need glucose, it can be synthesized from noncarbohydrate compounds (amino acids, glycogen, fats). Most glucose is synthesized in the cytosol of liver cells.

With the exception of reactions 1,3 and 10, this pathway is the reverse of glycolysis. It starts with pyruvate.