

Gluconeogenesis

Regulation of Glycolysis & Gluconeogenesis

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biochemistry

Gluconeogenesis is the process by which glucose is synthesized from non carbohydrate precursors , occurs Mainly in the liver under fasting condition .

Synthesis of glucose from pyruvate utilizes many of the same enzymes as **Glycolysis**.

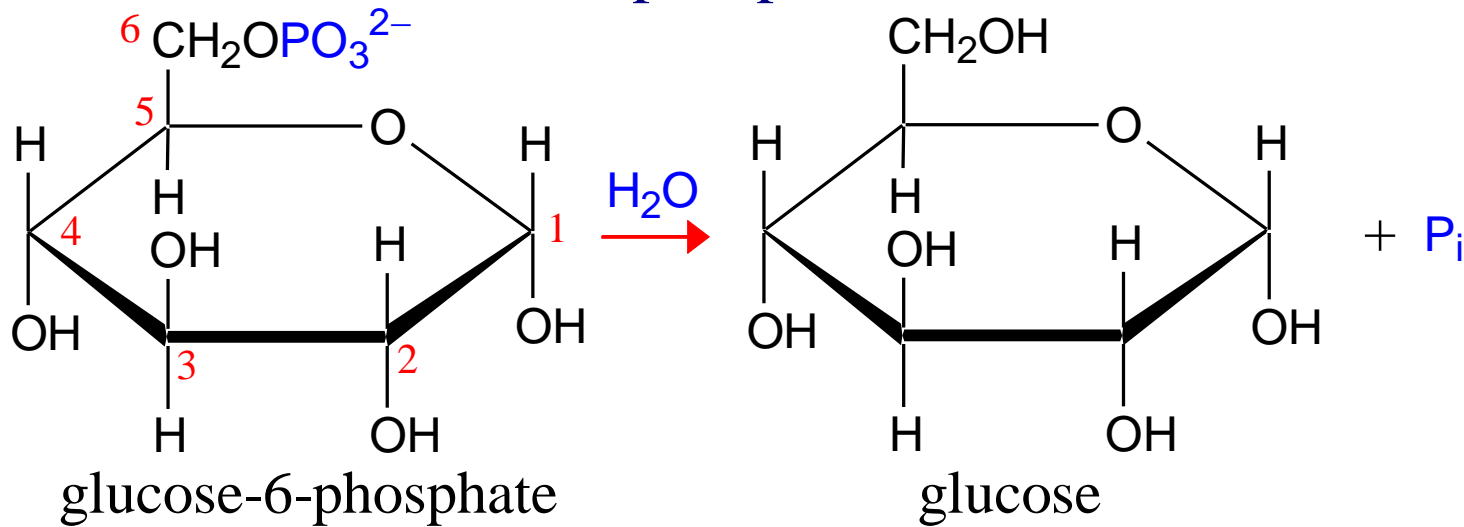
Three Glycolysis reactions have such a large negative ΔG that they are essentially **irreversible**.

- ◆ **Hexokinase** (or Glucokinase)
- ◆ **Phosphofructokinase**
- ◆ **Pyruvate Kinase.**

These steps must be **bypassed** in gluconeogenesis.

Two of the bypass reactions involve simple **hydrolysis** reactions.

Glucose-6-phosphatase

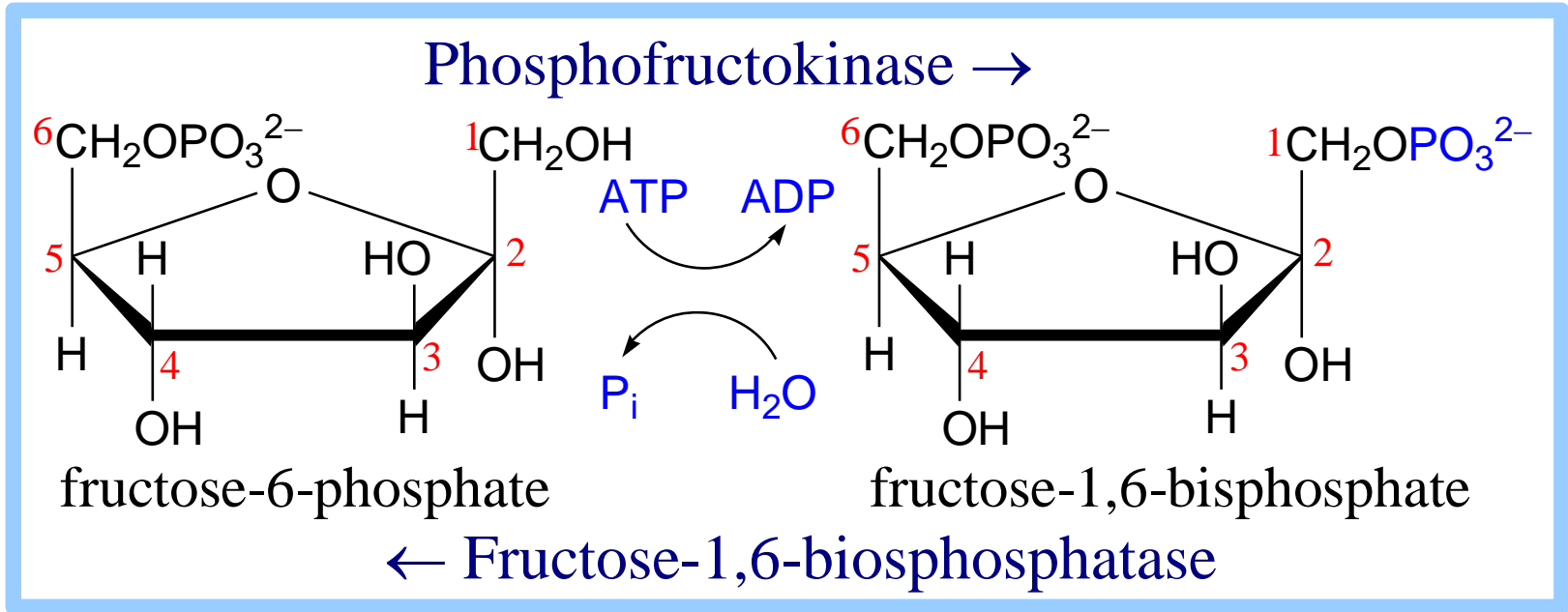


Hexokinase or **Glucokinase** (Glycolysis) catalyzes:



Glucose-6-Phosphatase (Gluconeogenesis) catalyzes:



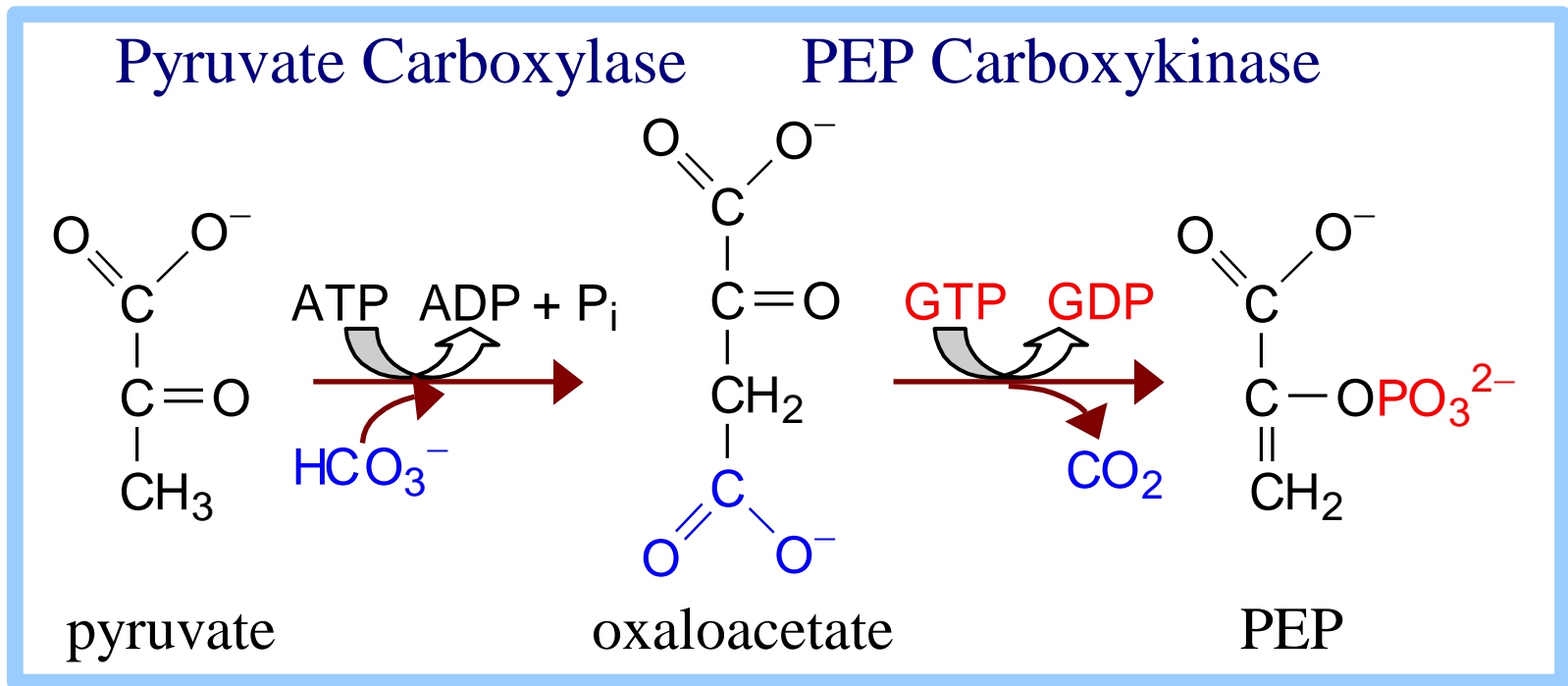


Phosphofructokinase (Glycolysis) catalyzes:



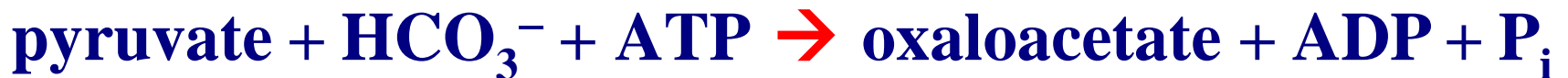
Fructose-1,6-bisphosphatase (Gluconeogenesis) catalyzes:





Bypass of Pyruvate Kinase (2 enzymes):

Pyruvate Carboxylase (Gluconeogenesis) catalyzes:



PEP Carboxykinase (Gluconeogenesis) catalyzes:



Gluconeogenesis take place :

- 1 . During fasting or starvation or when the level of liver glycogen is low . Gluconeogenesis is important in keeping the blood glucose conc.**
- 2 . During long exercise, lactate is used as precursor.**
- 3 . When ATP is available in the cell (or we need minimum energy requirement) .**

Gluconeogenesis occurs under conditions in which pyruvate dehydrogenase , pyruvate kinase , PFK and (GK or HK) are relatively inactive .

Regulation of gluconeogenesis

- 1 . Under fasting conditions , glucagon is elevated and stimulates gluconeogenesis .**
- 2 . Gluconeogenesis is inhibited by insulin and after CHO feeding .**
- 3 . Gluconeogenesis is stimulate in starvation .**
- 4 . Glucocorticoids are steroid hormones stimulates gluconeogenesis .**

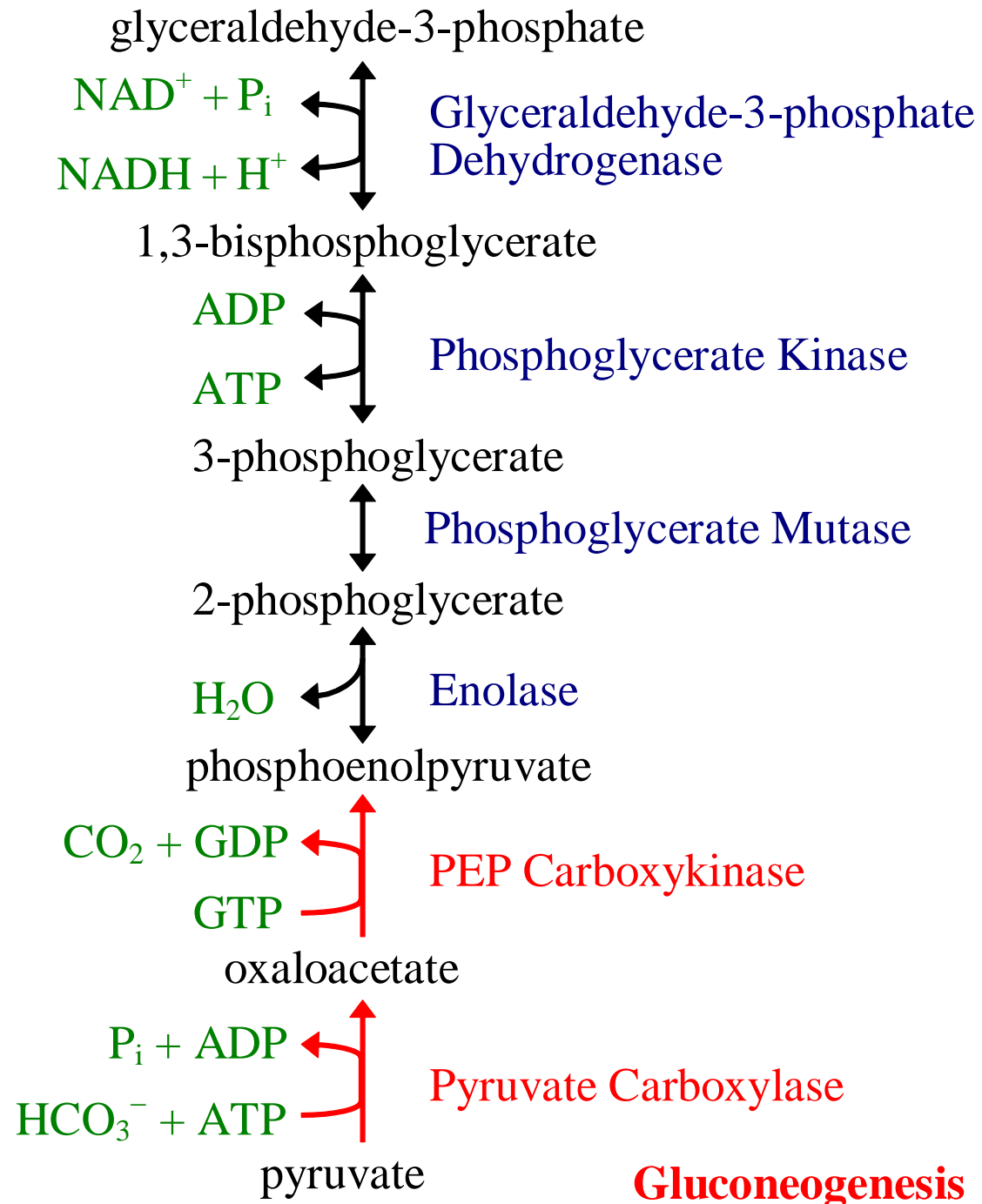
The major substrates of gluconeogenesis are lactate , glycerol , propionate and glucogenic amino acids .

Glucogenic amino acids (Amino acids are derived from the dietary proteins , tissues proteins or from the breakdown of skeletal muscle proteins during starvation)

After deamination or transamination , glucogenic amino acids yield either pyruvate or intermediates of the TCA cycle . Amino acids that are degraded to acetyl CoA or acetoacetyl CoA are termed ketogenic amino acids because they can give rise to ketone bodies .

The hydrolysis of triacylglycerols in fat cells yield glycerol and fatty acids . Glycerol may enter glycolytic pathway at dihydroxy acetone phosphate .

Summary of Gluconeogenesis Pathway



Gluconeogenesis

