GLYCOLYSIS

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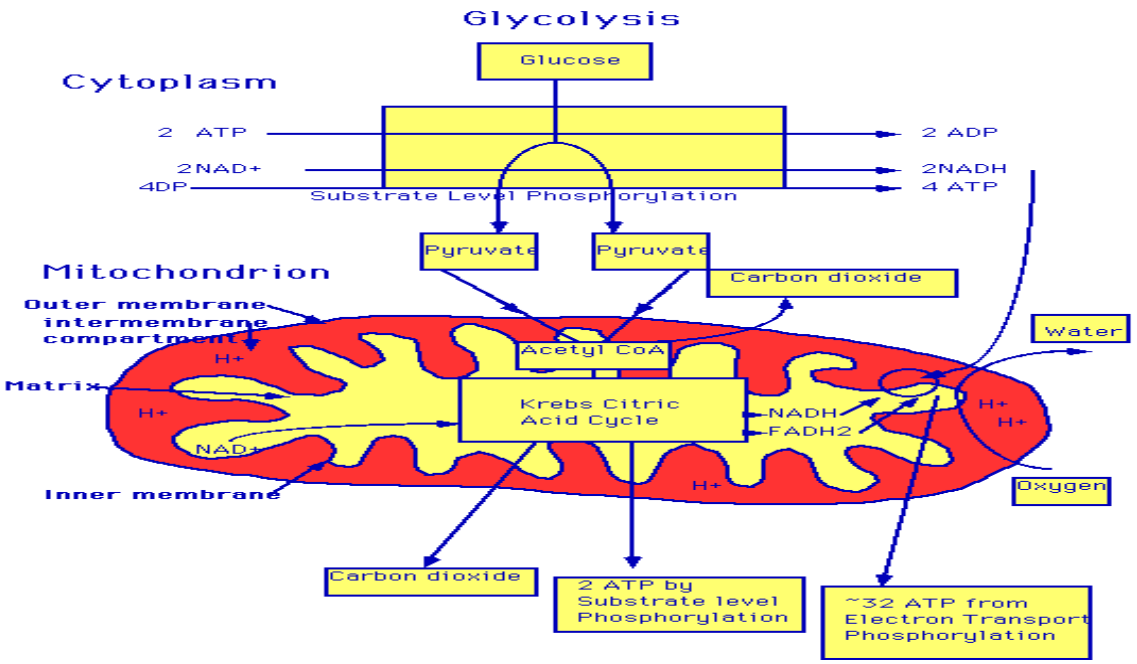
What is Glycolysis?

- Term: from the Greek *glykys,* meaning "sweet," And *lysis,* meaning "splitting"),
- **Glycolysis** (a sweet splitting process) is a central pathway for the catabolism of carbohydrates in which the six-carbon sugars are split to three-carbon compounds with subsequent release of energy used to transform ADP to ATP. **Glycolysis** can proceed under anaerobic (without oxygen) and aerobic conditions.
- Some of the free energy released from glucose is conserved in the form of ATP and NADH.

Glycolisis occur in cytosol in the liver and muscle cells.

ellular Respiration: A Brief Overview:



Two major step of Glycolisis

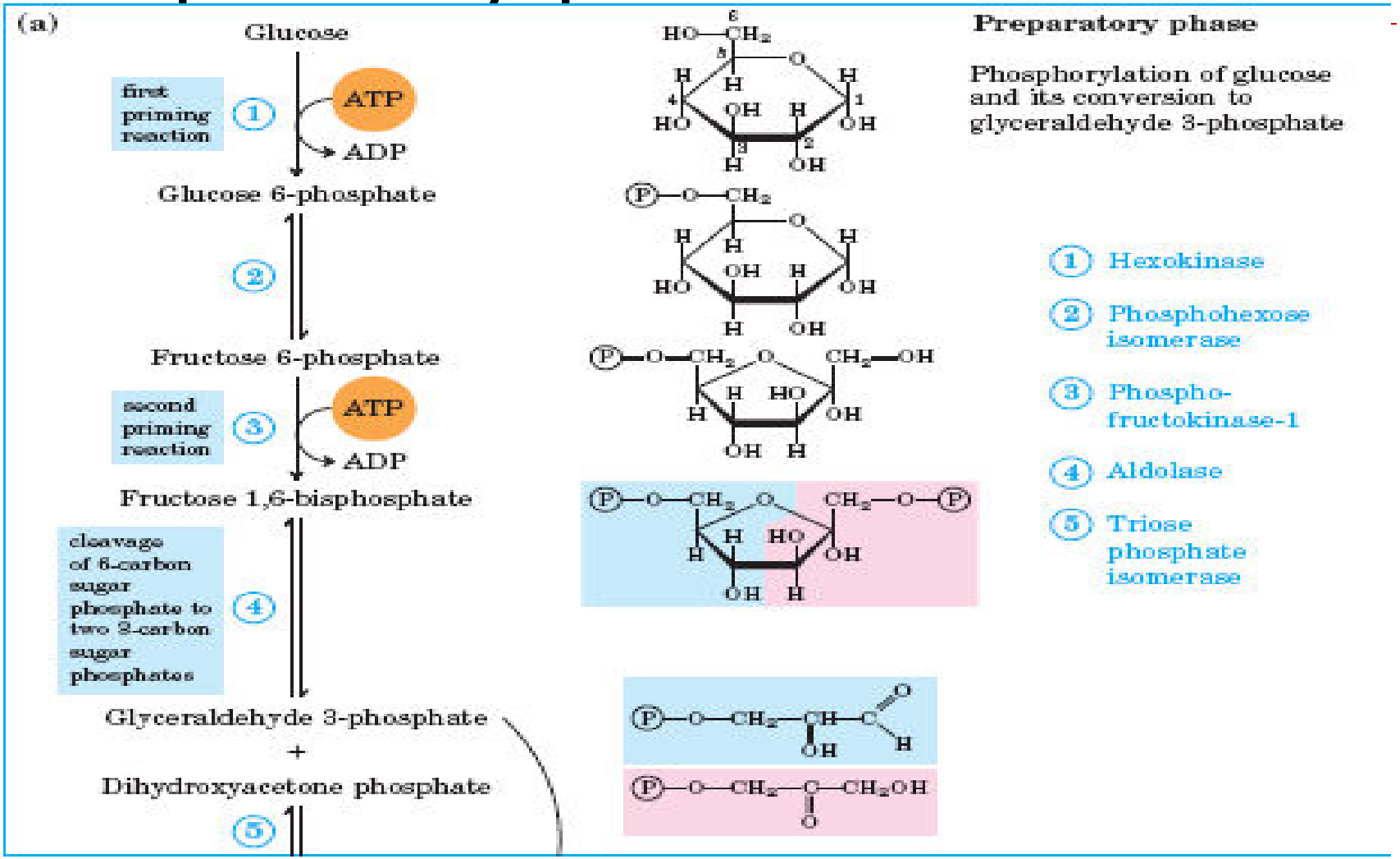
- Preparatory Phases

  Collect all heksose chain converted to two molecule of glyceraldehyde 3-phosphate
- *payoff phase*

  Payback the ATP that consumed in preparatory phase

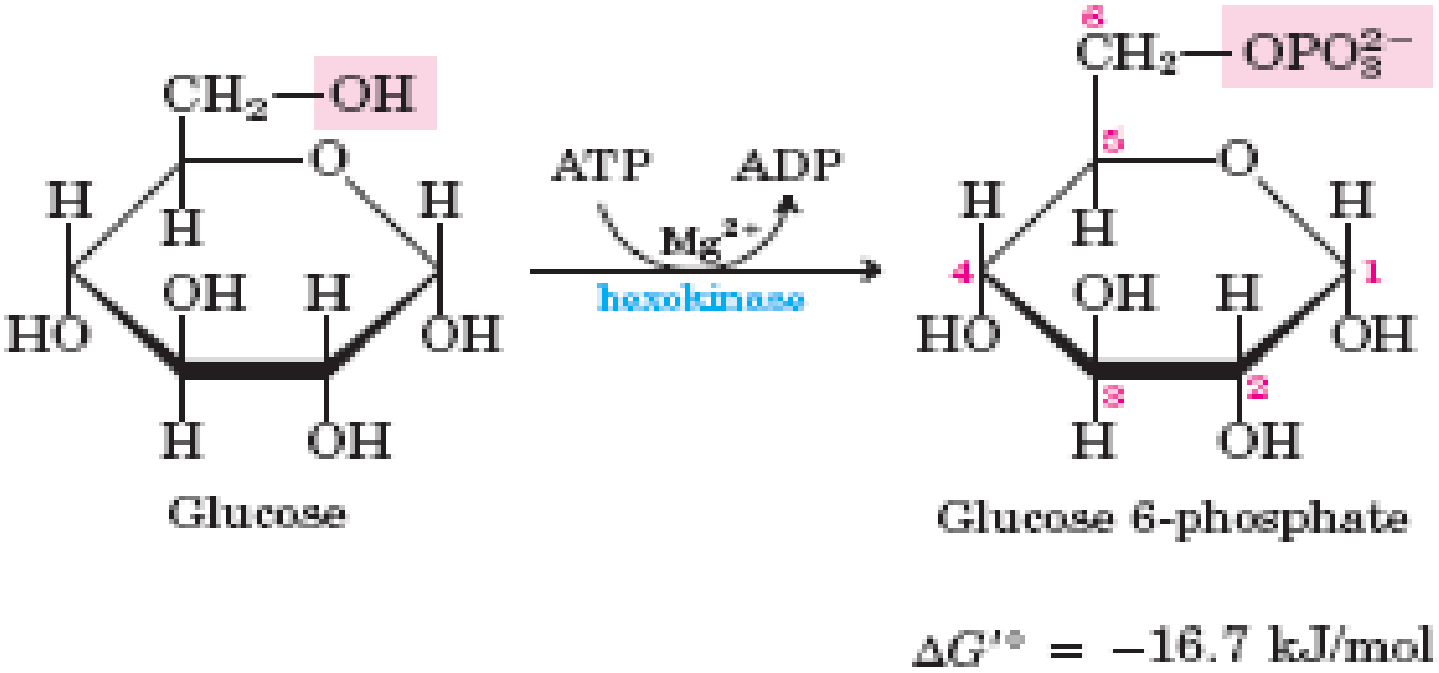
  Glyceraldehyde 3-phosphate-> pyruvate

Preparatory phase



Preparatory Phase

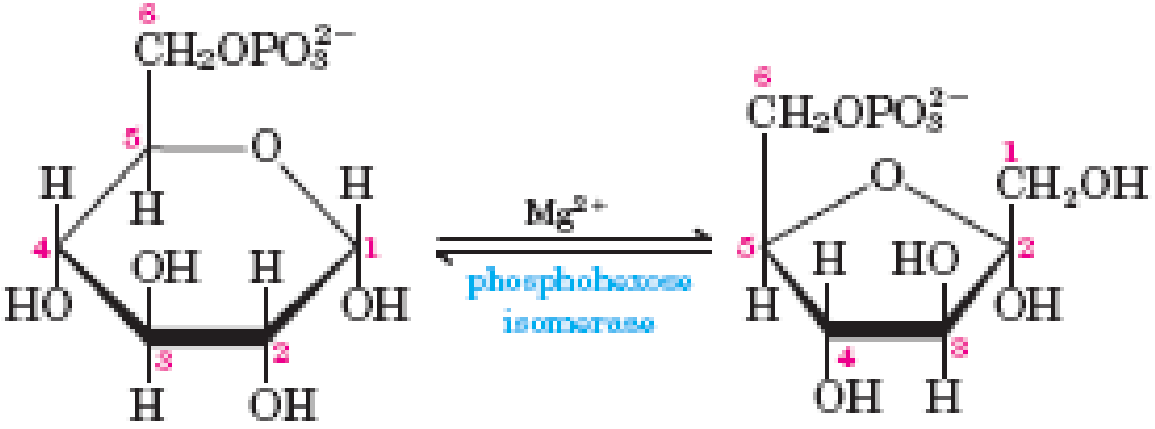
1. *Phosphorylation of Glucose*



$\Delta G'^{\circ} = -16.7$ kJ/mol

Preparatory Phase

- ***Conversion of Glucose 6-Phosphate to Fructose 6-Phosphate***



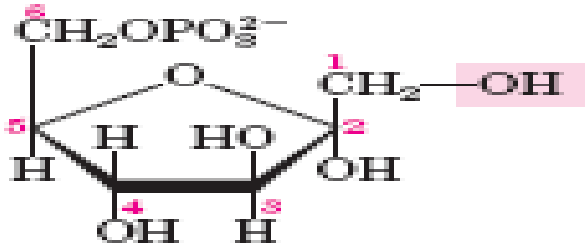
Glucose 6-phosphate

Fructose 6-phosphate

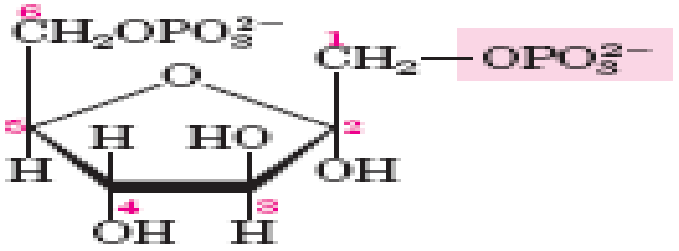
$\Delta G'^{\circ} = 1.7$ kJ/mol

Preparatory Phase

- ***Phosphorylation of Fructose 6-Phosphate to Fructose 1,6-***



Fructose 6-phosphate

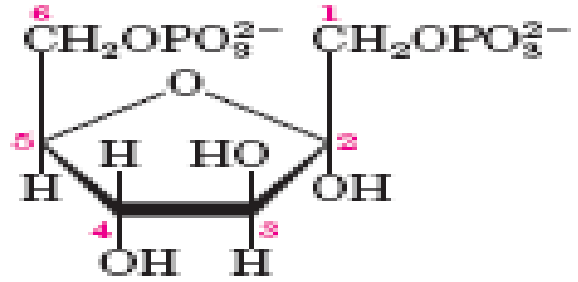


Fructose 1,6-bisphosphate

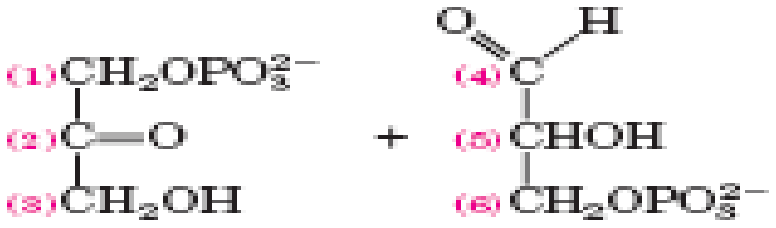
$\Delta G'^{\circ} = -14.2$ kJ/mol

Preparatory Phase

- ***Cleavage of Fructose 1,6-Bisphosphate***



Fructose 1,6-bisphosphate



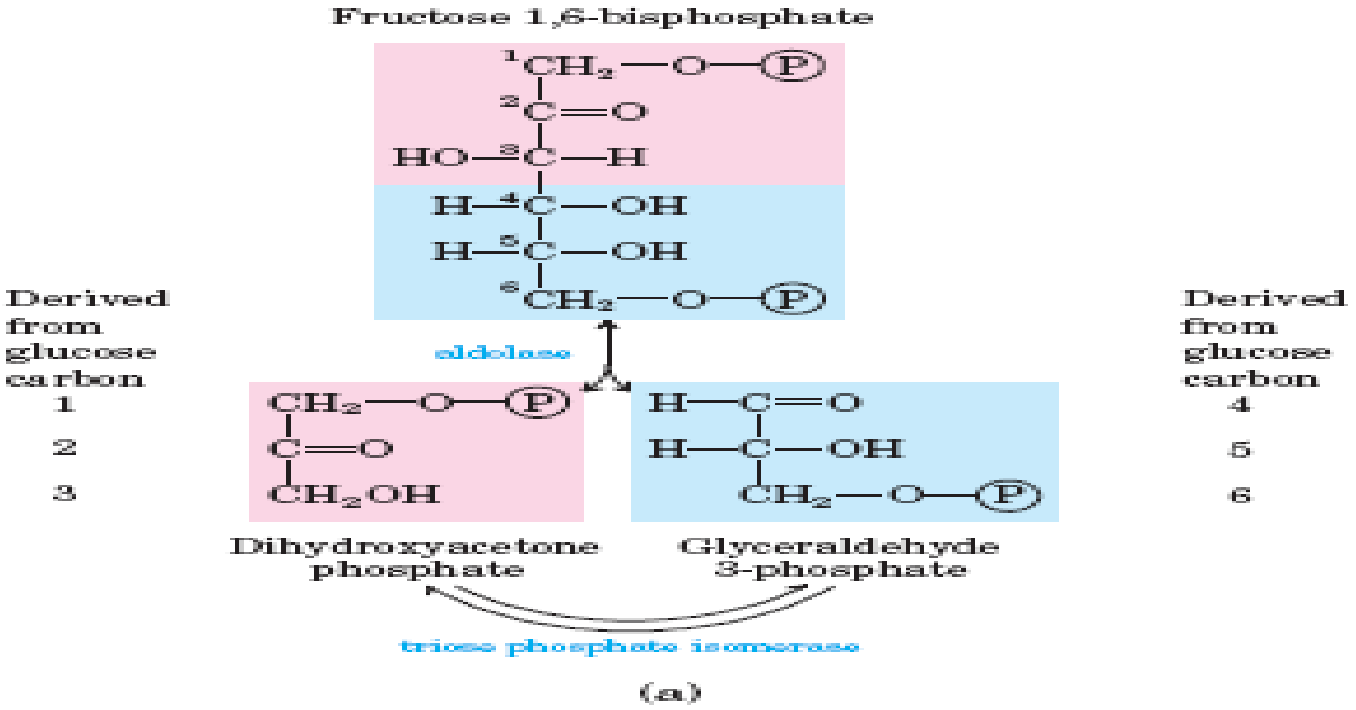
Dihydroxyacetone phosphate

Glyceraldehyde 3-phosphate

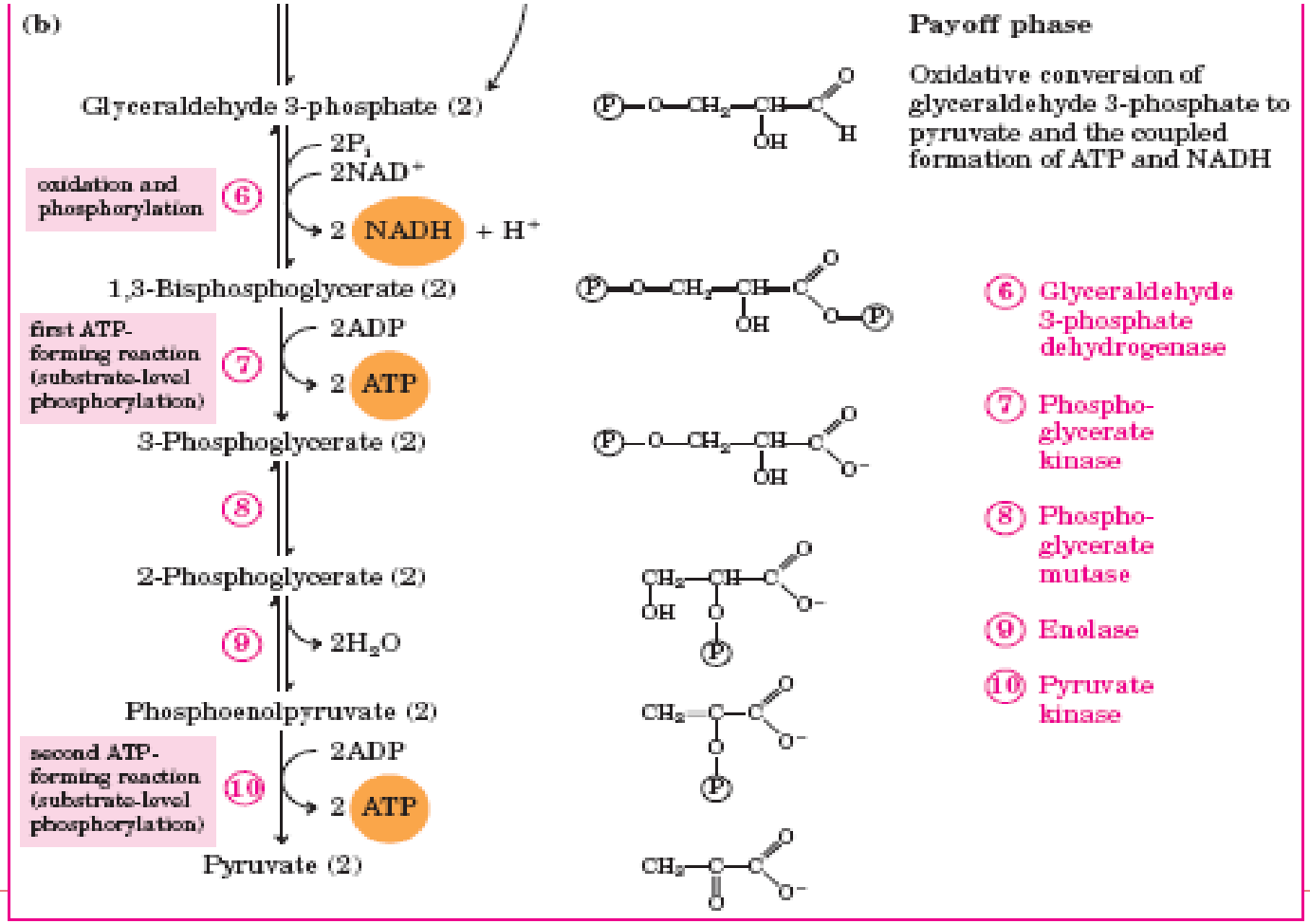
$\Delta G'^{\circ} = 23.8$ kJ/mol

Preparatory Phase

- ***Interconversion of the Triose Phosphates***

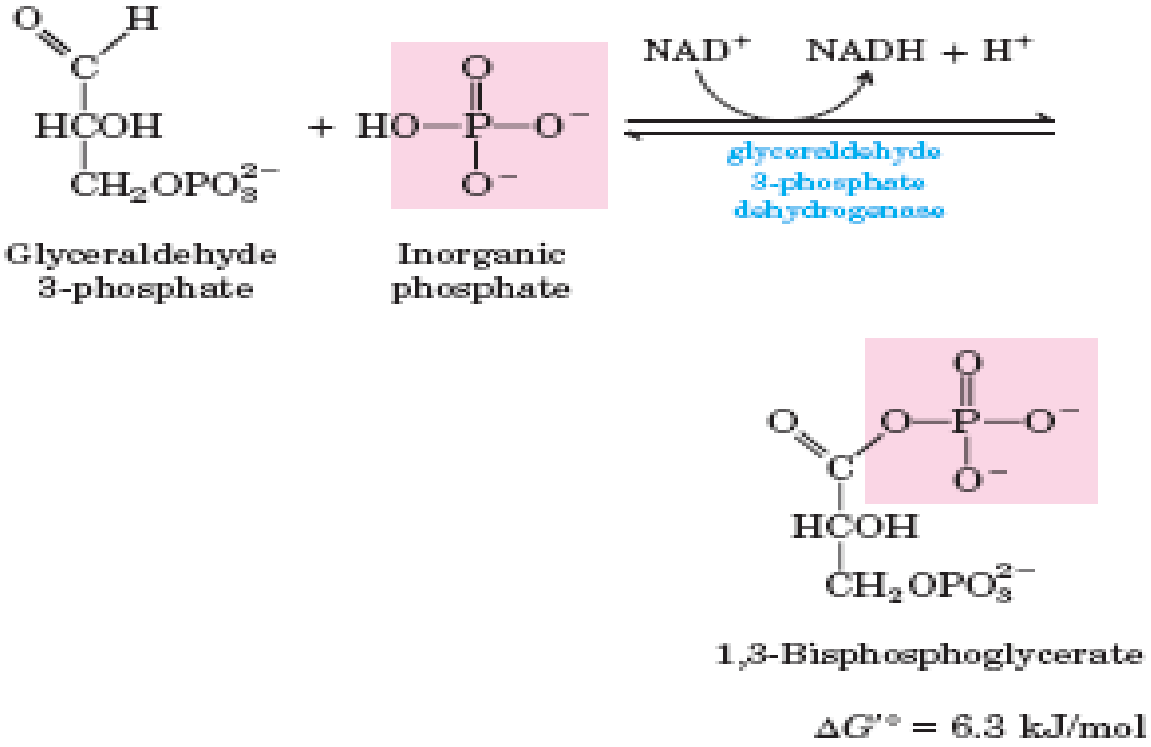


The Payoff Phase



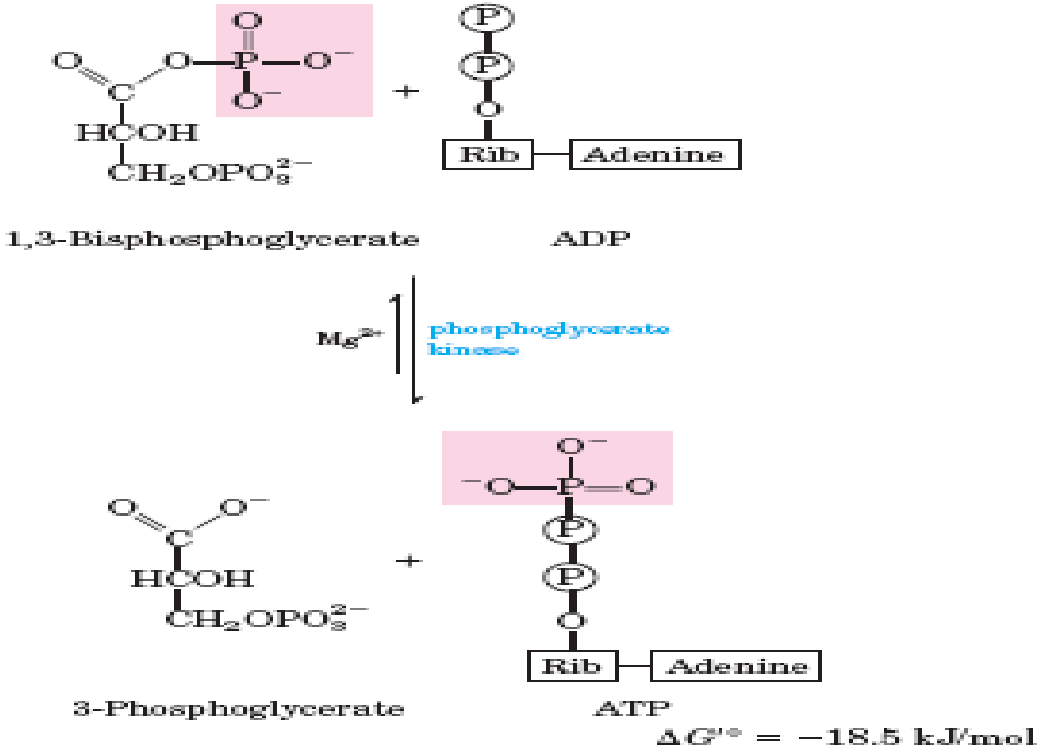
The Payoff Phase of Glycolysis Yields ATP and NADH

- ***Oxidation of Glyceraldehyde 3-Phosphate to 1,3-Bisphosphoglycerate***



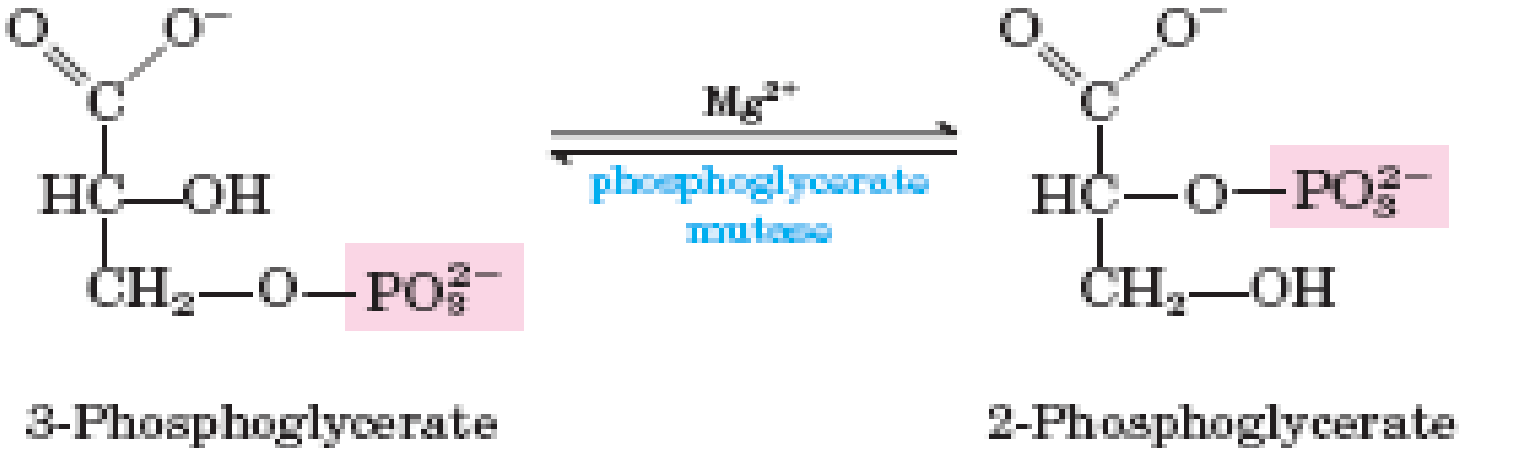
The Payoff Phase

- ***Phosphoryl Transfer from 1,3-Bisphosphoglycerate to ADP***



The Payoff Phase

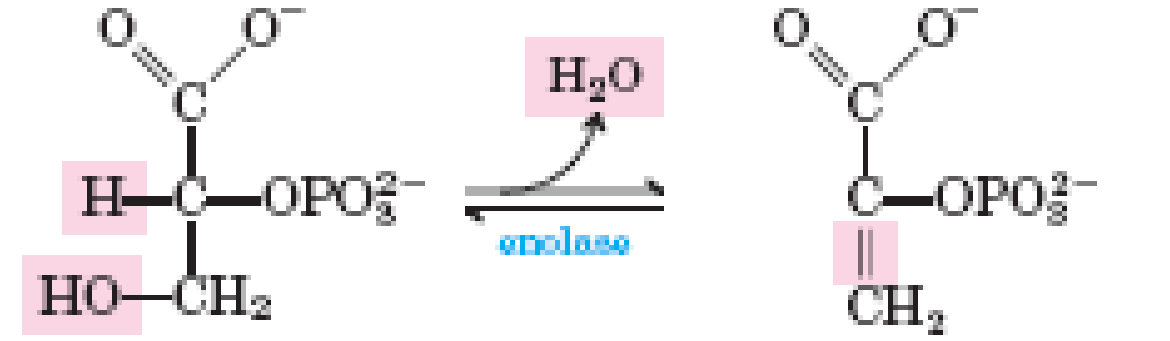
- ***Conversion of 3-Phosphoglycerate to 2-Phosphoglycerate***



$\Delta G'^{\circ} = 4.4$ kJ/mol

The Payoff Phase

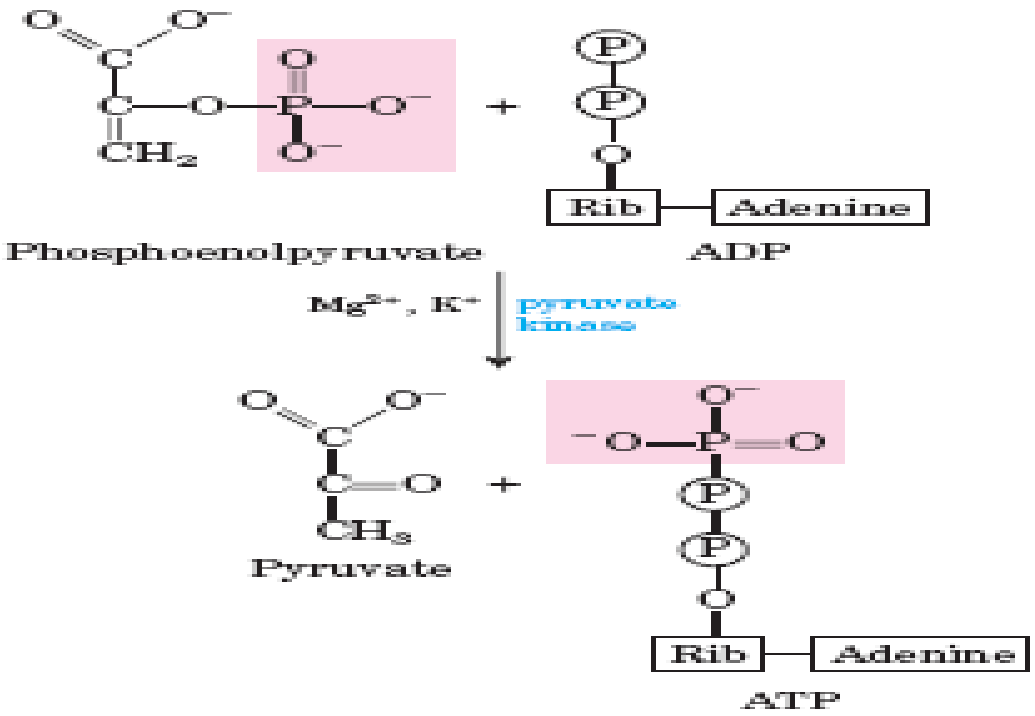
- ***Dehydration of 2-Phosphoglycerate to Phosphoenolpyruvate***



$\Delta G'^{\circ} = 7.5$ kJ/mol

The Payoff Phase

- ***Transfer of the Phosphoryl Group from Phosphoenolpyruvate to ADP***



$\Delta G'^{\circ} = -31.4$ kJ/mol

The Payoff Phase

- **The Overall Balance Sheet Shows a Net Gain of ATP**

$$\text{Glucose} + 2\text{ATP} + 2\text{NAD}^+ + 4\text{ADP} + 2\text{P}_i \longrightarrow$$
$$2\ \text{pyruvate} + 2\text{ADP} + 2\text{NADH} + 2\text{H}^+ + 4\text{ATP} + 2\text{H}_2\text{O}$$

Canceling out both sides equation:

$$\text{Glucose} + 2\text{NAD}^+ + 2\text{ADP} + 2\text{P}_i \longrightarrow$$
$$2\ \text{pyruvate} + 2\text{NADH} + 2\text{H}^+ + 2\text{ATP} + 2\text{H}_2\text{O}$$

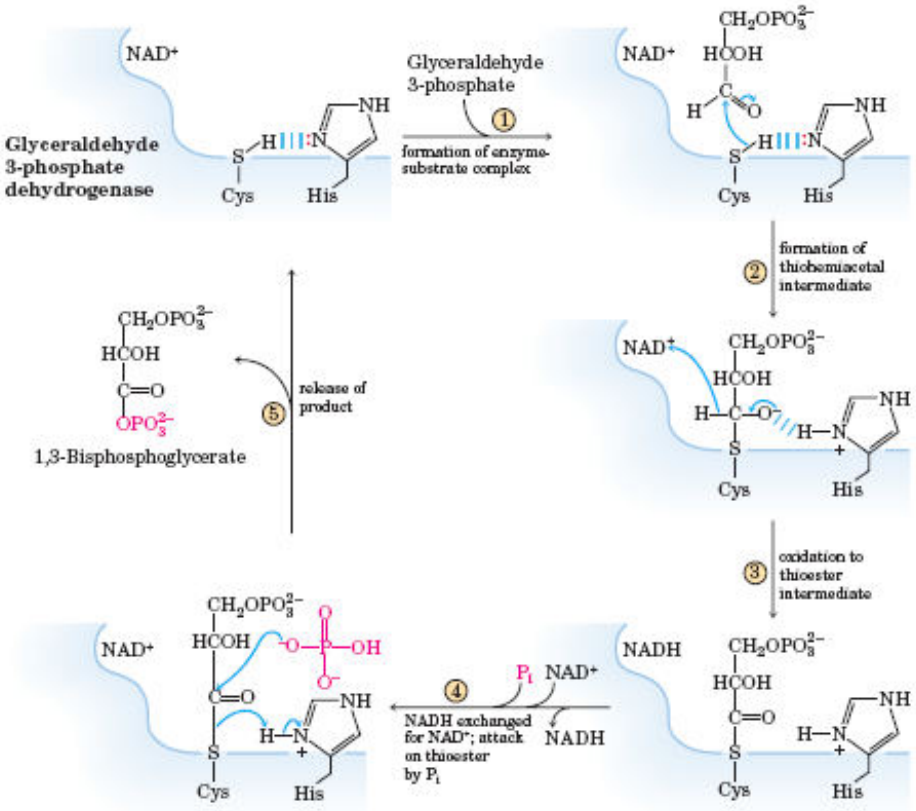
Case

A compound is an inhibitor of glyceraldehyde-3-phosphate.

If this compound were added into liver cells where D-glucose
was only substrate, what is the effect of the additional of this compound
for the step of glycolisys?

- In this case, glyceraldehyde-3-phosphate have to continue to the reaction of payoff phase.
- glyceraldehyde-3-phosphate will converted to 1,3-biphosphoglycerate as the first compound that produce in the payoff phase
- If the enzyme glyceraldehyde 3-phosphate dehydrogenase that has play role in the converting reaction is inhibited, the and the production of 4 molecule of ATP and 2 molecule of NADH will be decrease and the concentration of pyruvate become lower.
- Because the decreasing concentration of pyruvate, the reaction cannot continue to the next step:cytric acid cycle»electron transport chain=the lack of ATP.

Mechanism of reaction to form glyceraldehyde-3-phosphate to 1,3-biphosphoglycerate

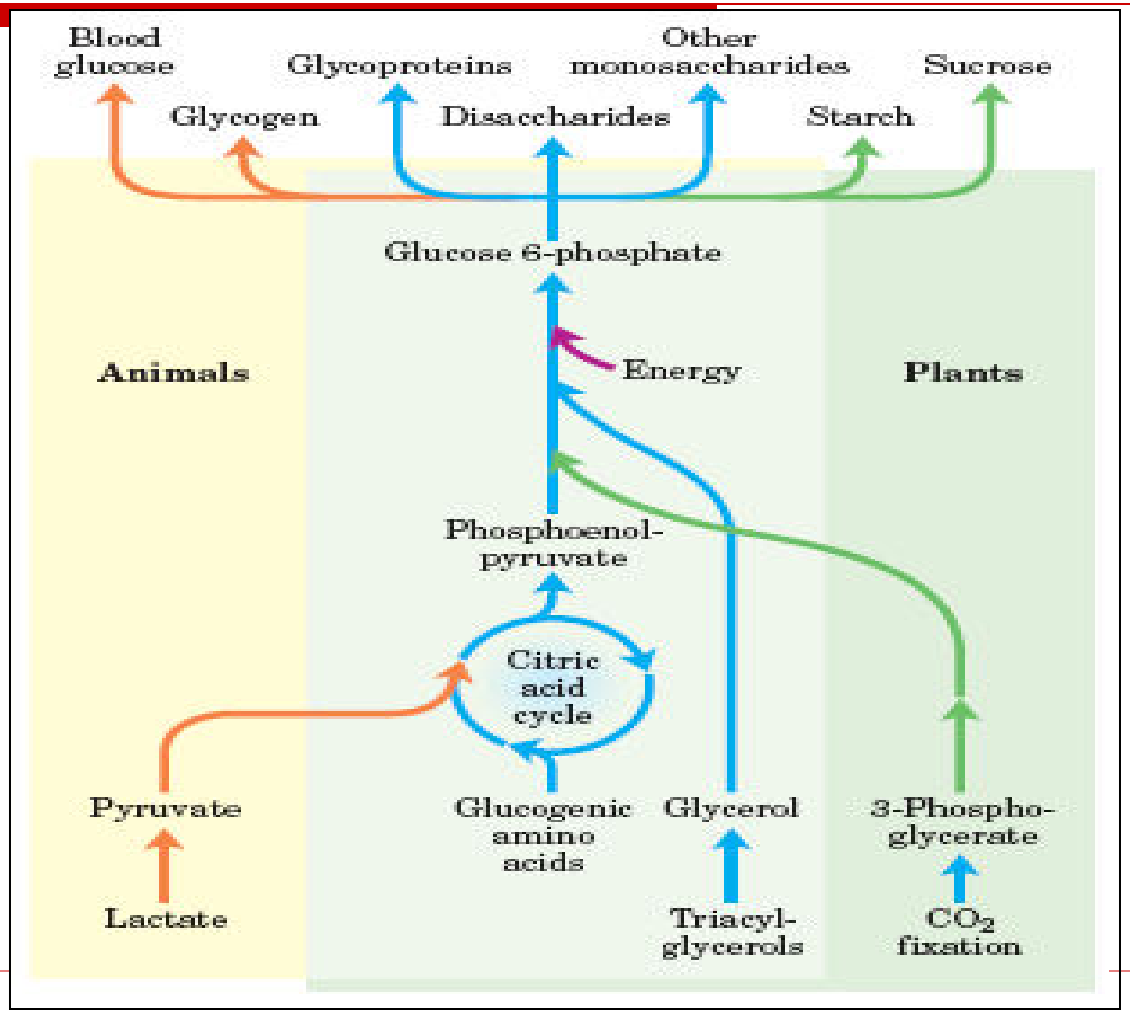


- Case 2

  If the substance were L-lactate, what is the effect of the additional of this compound for the step of glycolisys?

L-lactate is usually produced by anaerobic Glycolysis in skeletal muscle return to the liver and converted to glucose, which move back to muscle and converted to glycogen- a circuit called the Cory Cycle.

Diagram of melabolism



- According to that picture we can see that, L-Lactate can directly converted to pyruvate and going to the next step»citric acid cycle.
- So, the inhibitor of glyceraldehyde 3-phosphate do not have an essential effect to the next regulation from glycolysis.

Referensi

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Thank you for your attention