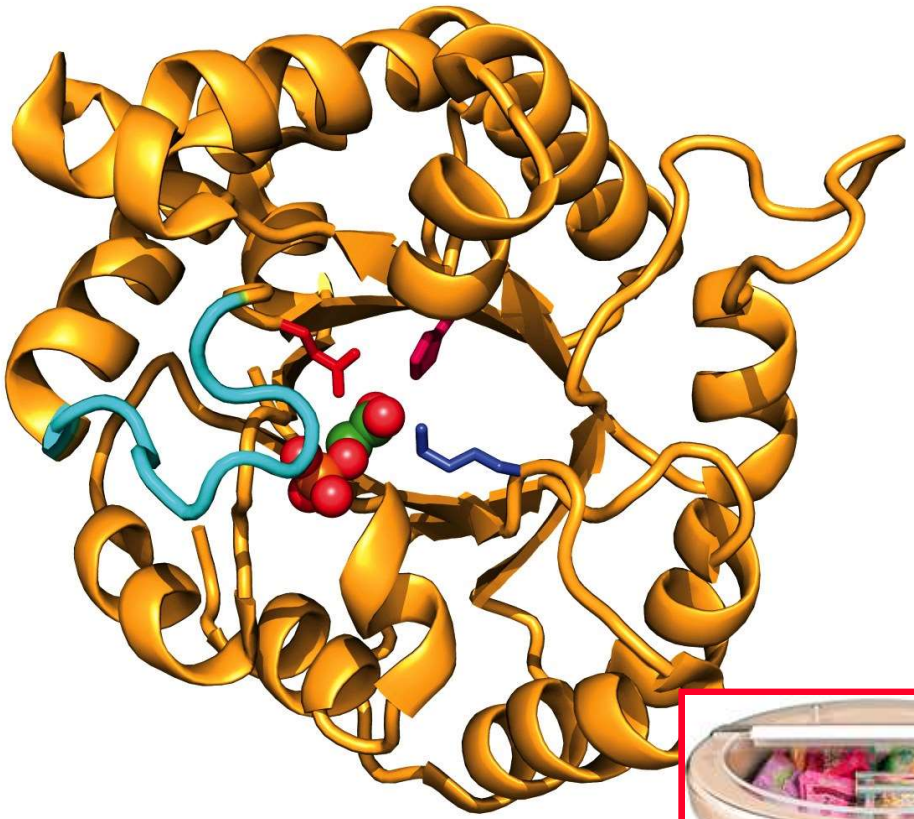
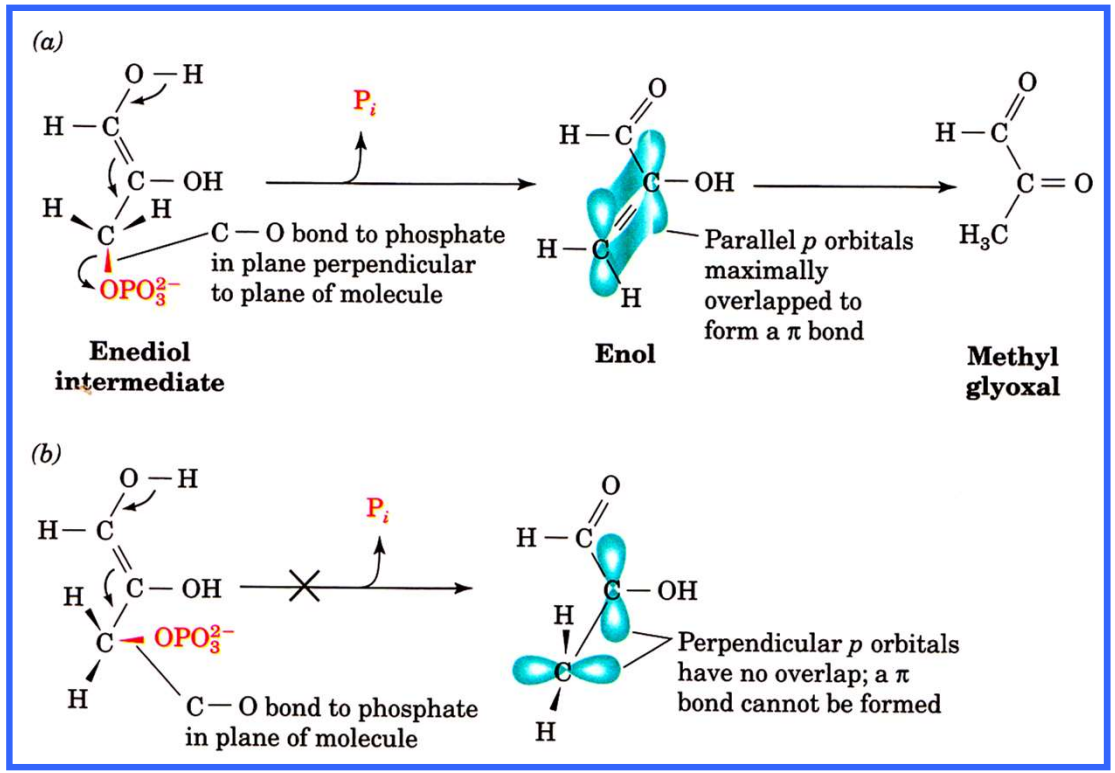
TIM, the perfect (diffusion-controlled, reaction-specific) enzyme

An α/β barrel with lid

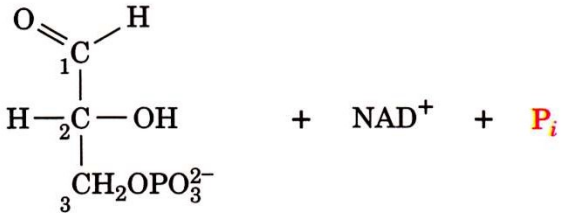




➢ **K = [GAP]/[DHAP] = 4.7×10^{-2} is maintained, feeding the next step**

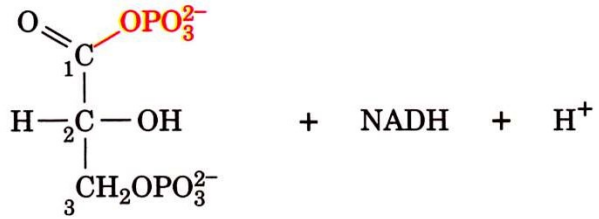
Step 6: Glyceraldehyde-3-phosphate dehydrogenase (GAPDH)

Goal:



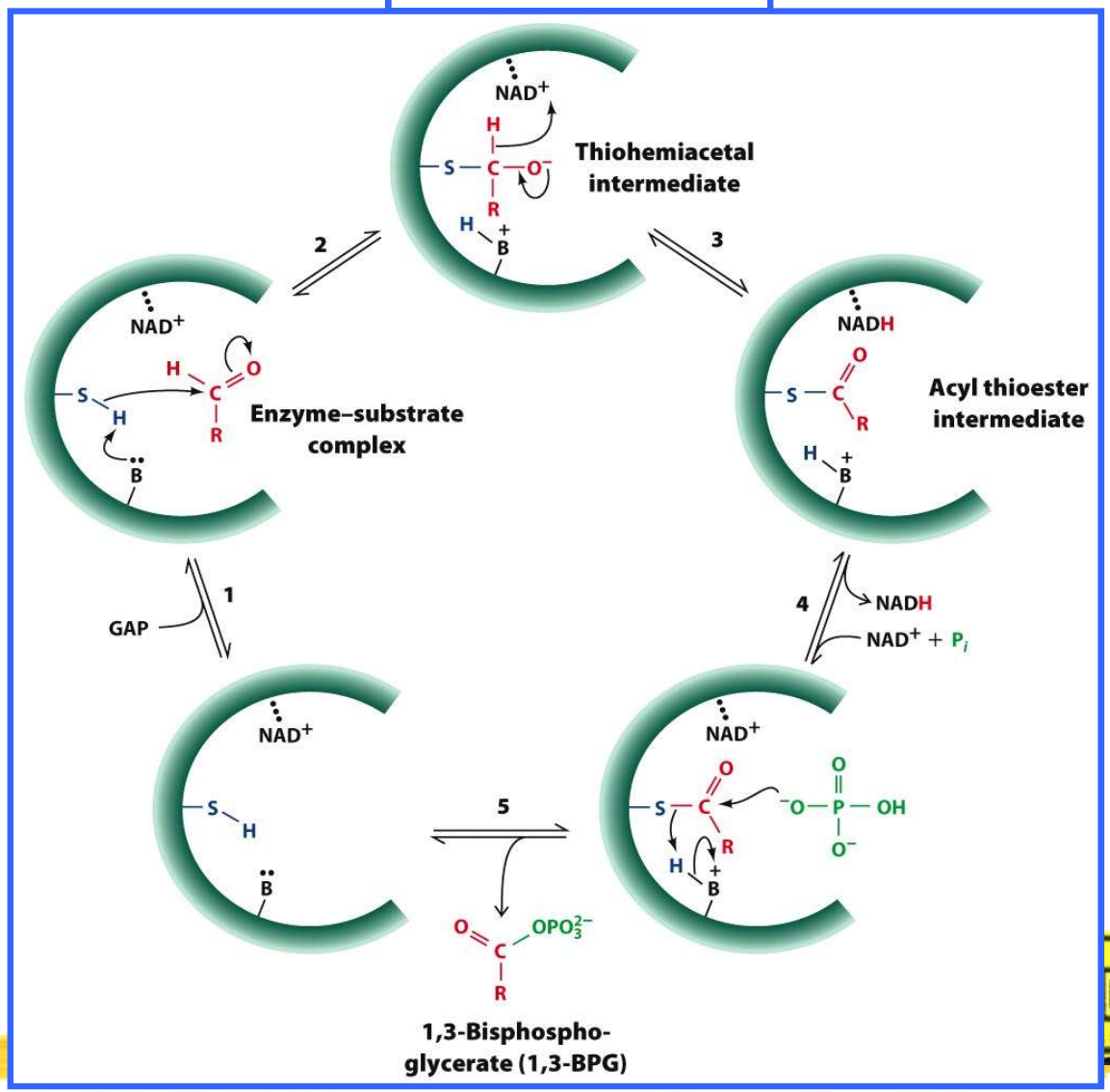
Glyceraldehyde-3-phosphate (GAP)

glyceraldehyde-3-phosphate dehydrogenase (GAPDH)

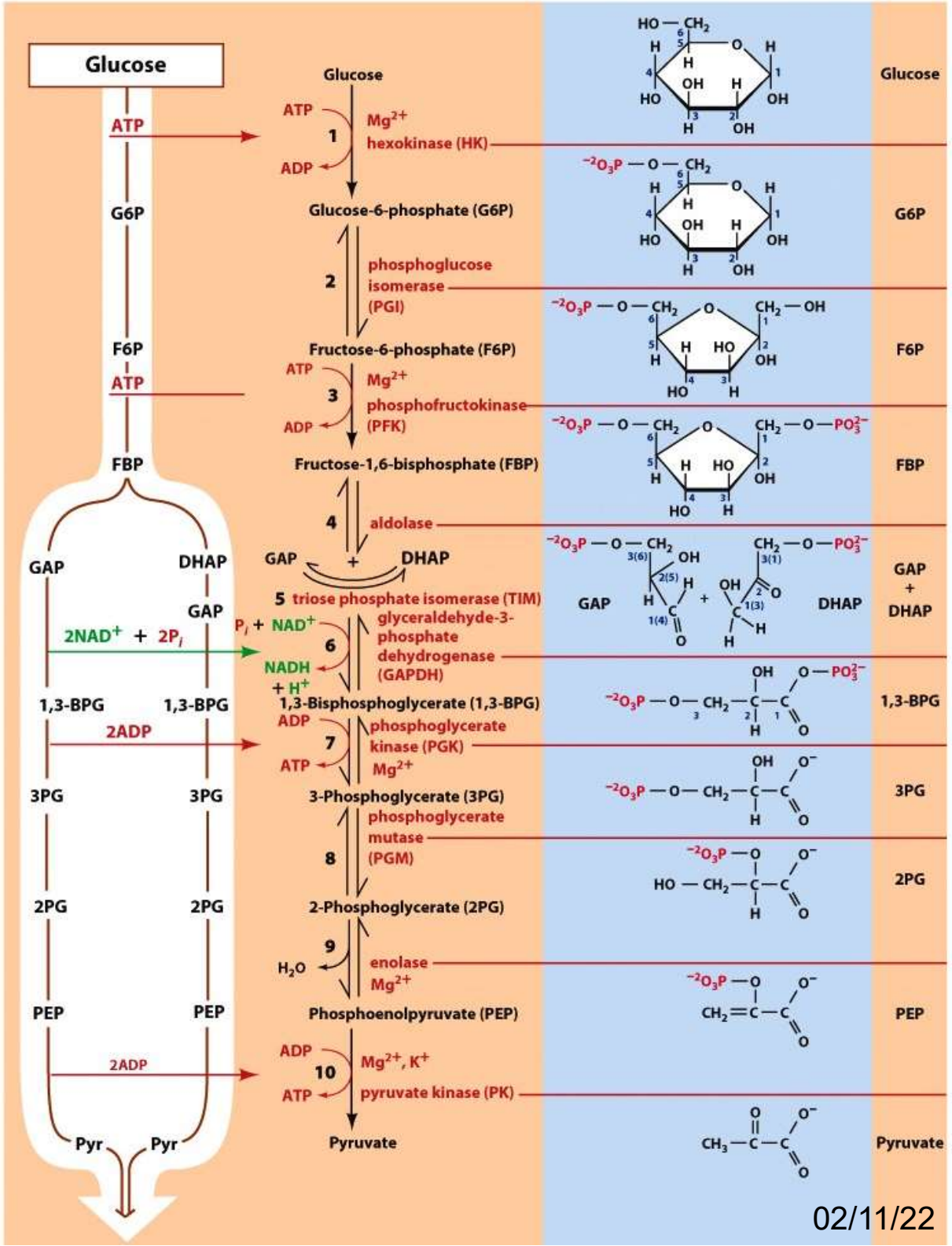


1,3-Bisphosphoglycerate (1,3-BPG)

Mechanism

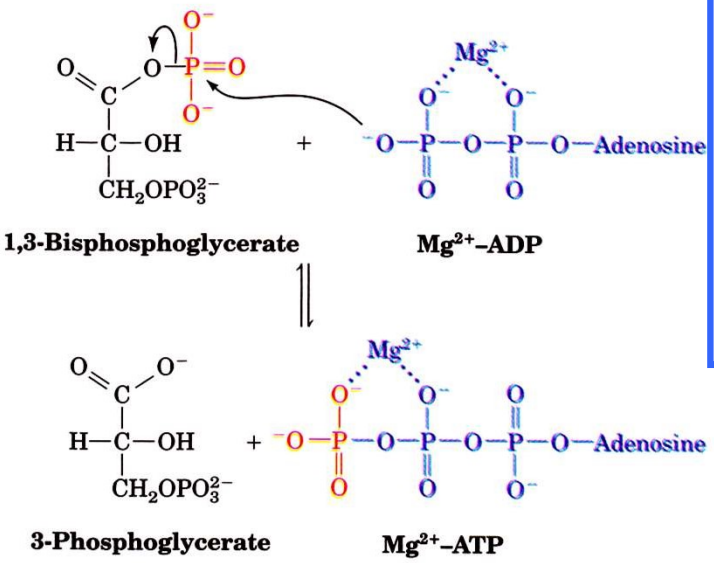


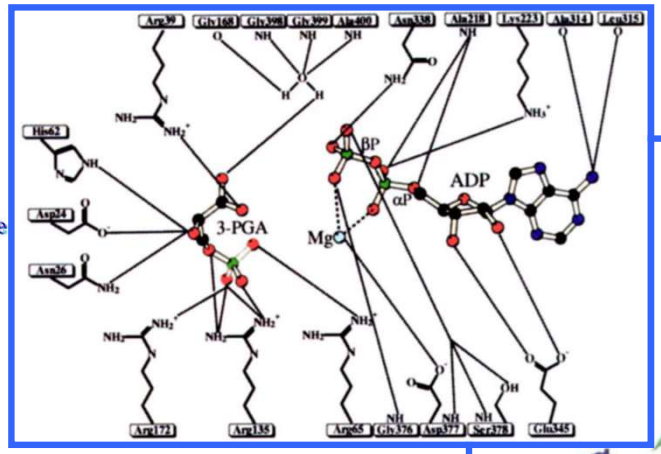
Shock and awe resolved



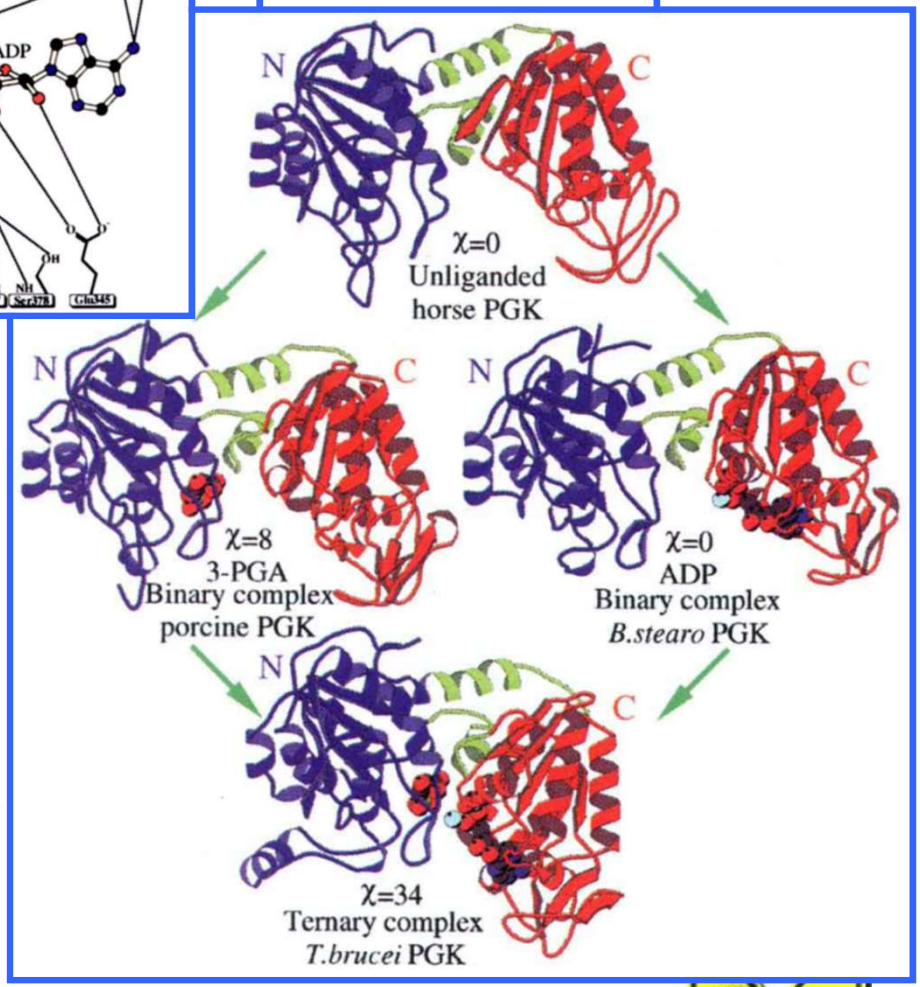
Step 7: Phosphoglycerate kinase harvests the 1st ATP

Goal:



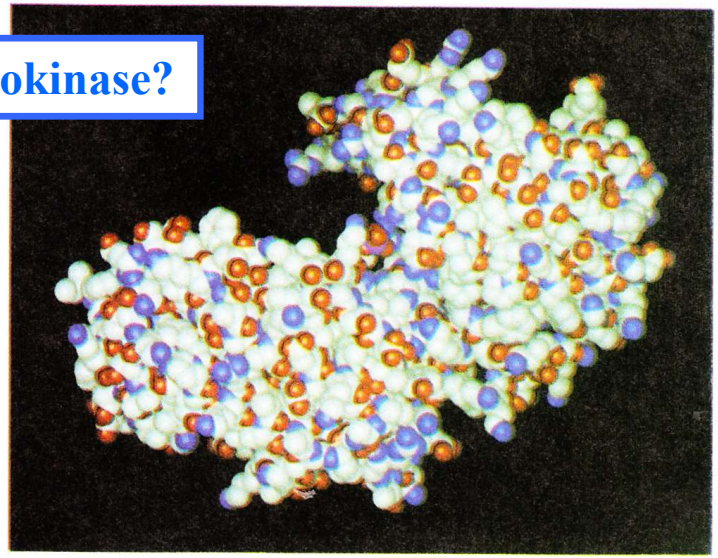


Mechanism



Structure:

- Remember hexokinase?



Bradley E. Bernstein*, Paul A. M. Michels† & Wim G. J. Hol*

Steps 6 & 7 together: How does this work, energetically?

$$\text{GAP} + P_i + \text{NAD}^+ \rightarrow \text{1,3-BPG} + \text{NADH}$$

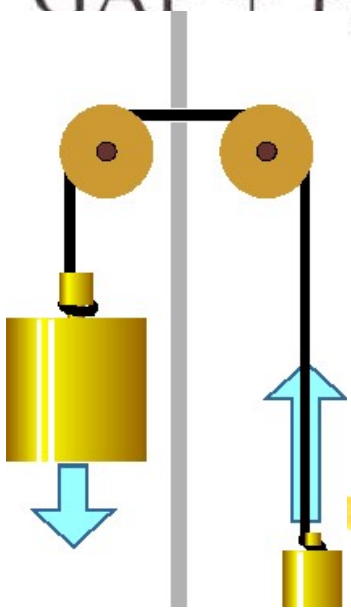
$$\Delta G^{\circ\prime} = +6.7 \text{ kJ} \cdot \text{mol}^{-1}$$

$$\text{1,3-BPG} + \text{ADP} \rightarrow \text{3PG} + \text{ATP}$$

$$\Delta G^{\circ\prime} = -18.8 \text{ kJ} \cdot \text{mol}^{-1}$$

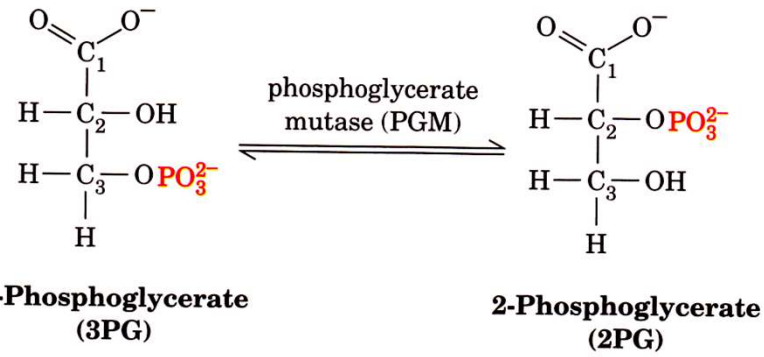
$$\text{GAP} + P_i + \text{NAD}^+ + \text{ADP} \rightarrow \text{3PG} + \text{NADH} + \text{ATP}$$

$$\Delta G^{\circ\prime} = -12.1 \text{ kJ} \cdot \text{mol}^{-1}$$



Step 8: Phosphoglycerate mutase reshuffles the substrate in preparation…

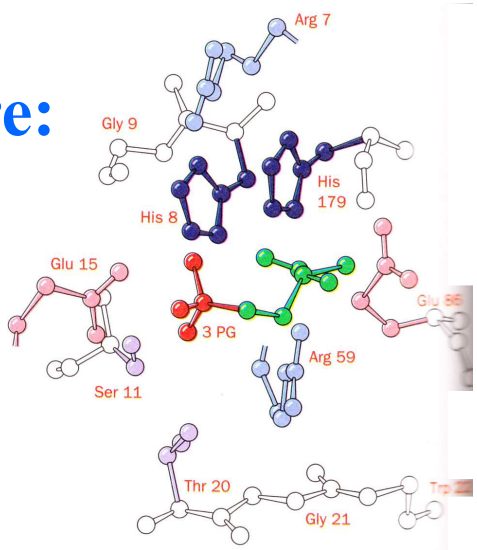
Goal:



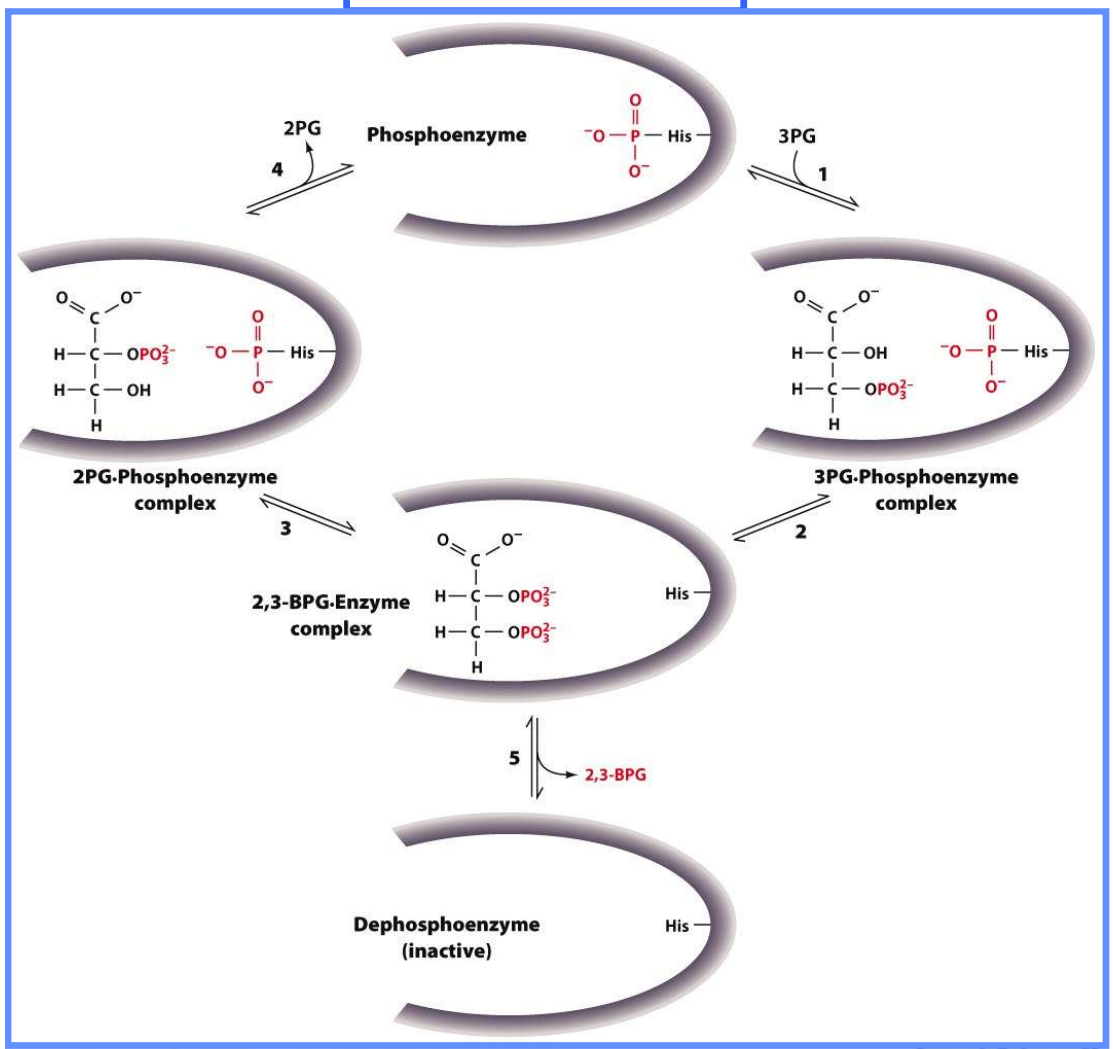
3-Phosphoglycerate (3PG)

2-Phosphoglycerate (2PG)

Structure:

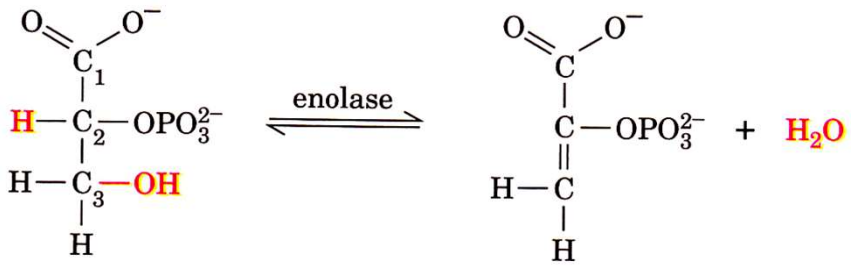


Mechanism



Step 9: …For dehydration by enolase

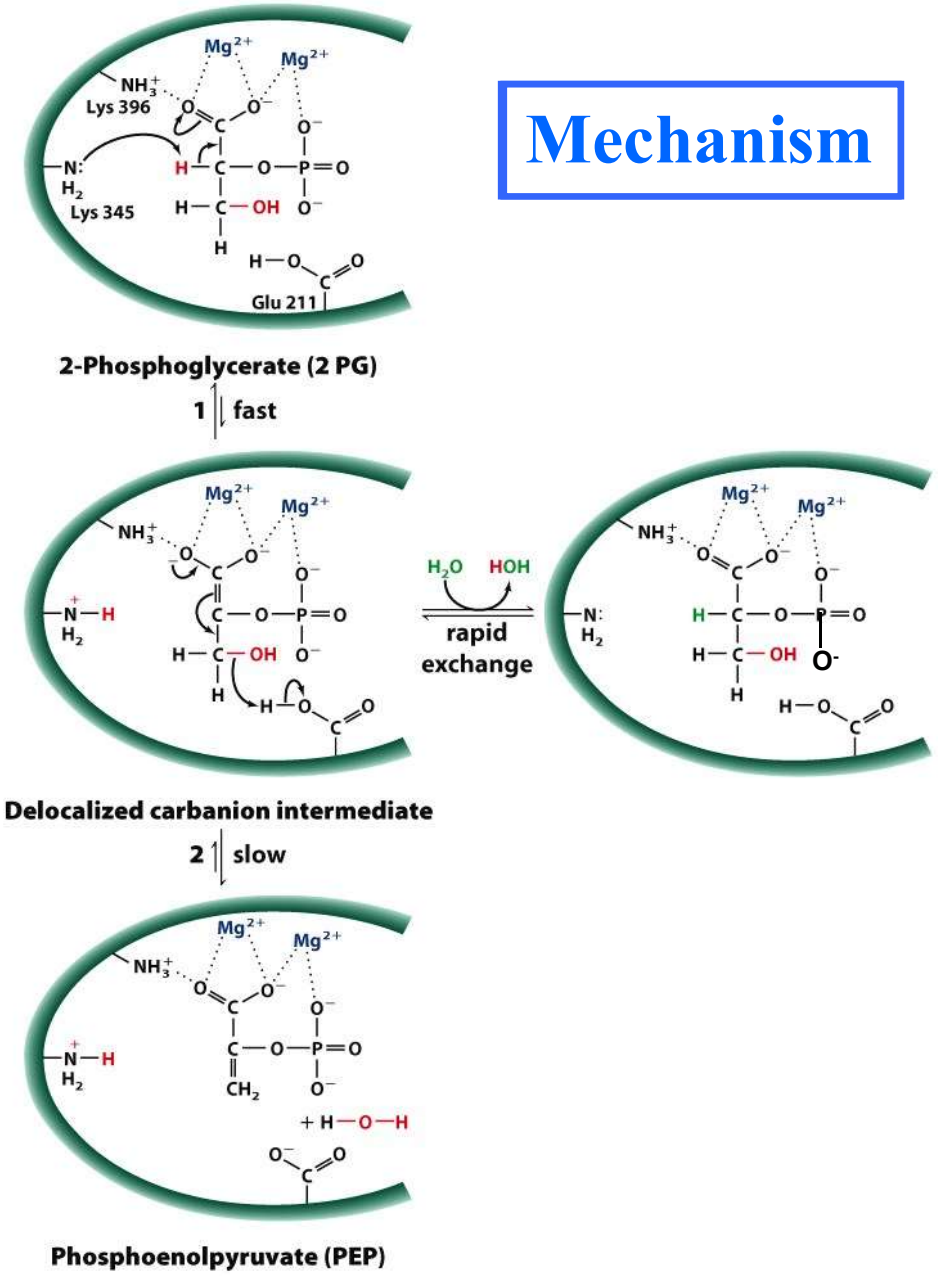
Goal:



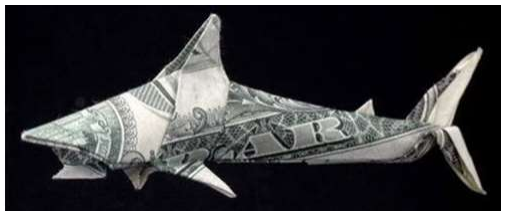
2-Phosphoglycerate (2PG) ⇌ **Phosphoenolpyruvate (PEP)**

The ultimate energy source

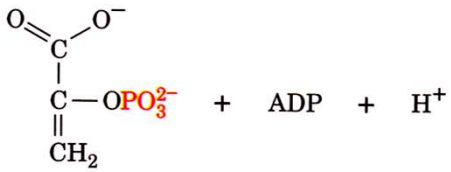
Mechanism



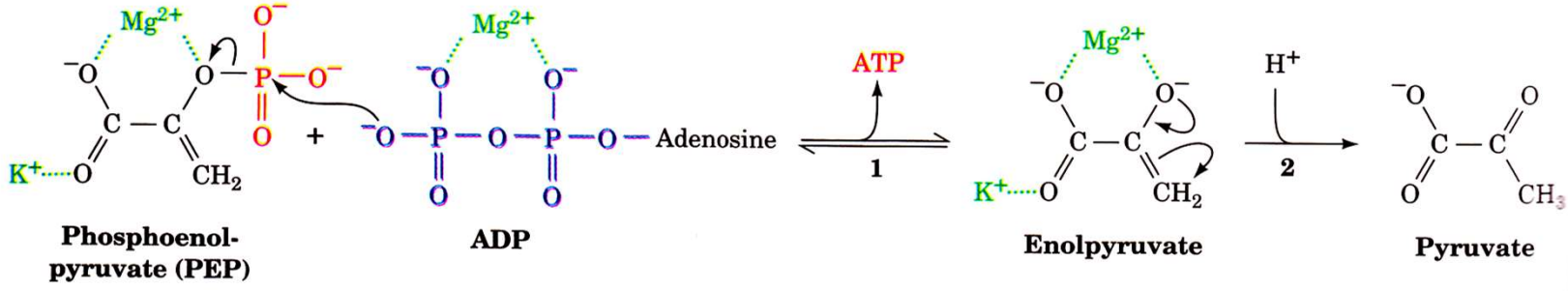
Step 10: Cashing in – the ultimate gain through pyruvate kinase



Goal:

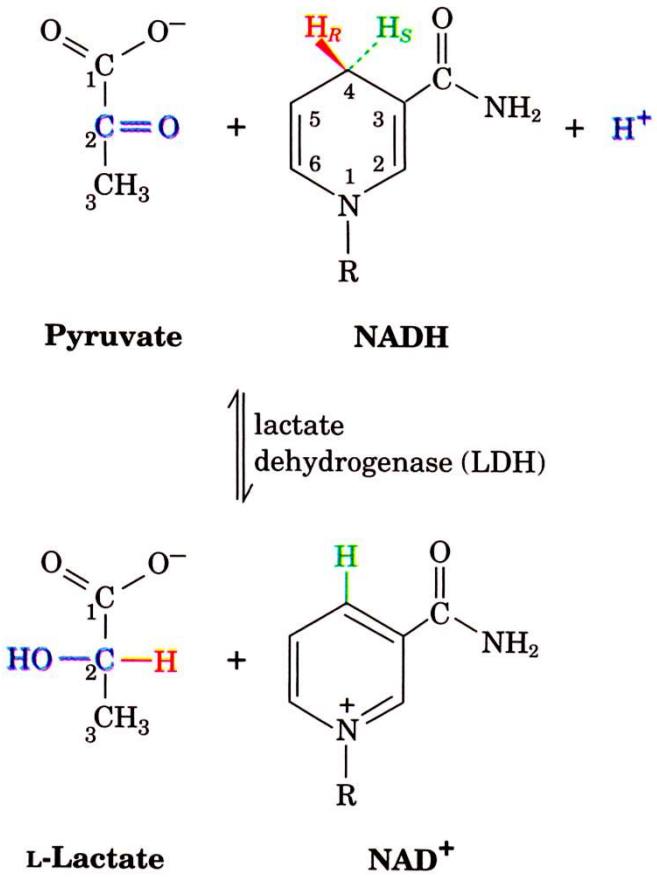


Mechanism



Muscles upon oxygen depletion: Homolactic fermentation

Goal: Getting rid of NADH



Mechanism