

Highlights Glycolysis II

1. Reaction #9 is catalyzed by enolase and involves removal of water from 2PG to form PEP, which is a highly energetic compound.
2. Reaction #10 is the "Big Bang" of glycolysis. It is catalyzed by the enzyme pyruvate kinase and in the reaction, a substrate level phosphorylation yields ATP. Note that the ΔG zero prime is very strongly negative, helping to pull all the reactions preceding it to a large extent. The enzyme is allosterically inactivated by ATP and allosterically activated by F1,6BP. The latter activation is an example of "feed forward" activation. Pyruvate kinase is also inactivated by phosphorylation, as will be seen in glycogen metabolism.
3. The phenomenon of redox balancing is important for glycolysis. Redox balancing relates to the relative amount of NAD^+ and NADH in the cell. Remember that reaction 6 is very sensitive to the ratio of NAD^+/NADH .
4. Pyruvate has three separate fates, depending on conditions and the cell type. When oxygen is present, there is plenty of NAD^+ , so aerobic cells convert pyruvate to acetyl-CoA for oxidation in the citric acid cycle. When oxygen is absent, NAD^+ levels can go down, so to prevent that from happening, pyruvate is converted to either lactate (animals) or ethanol (bacteria/yeast). Either of these last two conversions REQUIRES NADH and produces NAD^+ . NAD^+ made in this way can be used to keep reaction 6 of glycolysis going.
5. Anaerobic conversion of NADH to NAD^+ provide MUCH LESS ATP energy to cells than when oxygen is present. Anaerobic metabolism of glucose generates only 2 ATPs per glucose, whereas aerobic metabolism of glucose generates 38 ATPs per glucose.
6. Other sugars than glucose can be metabolized by glycolysis, if they are converted to intermediates of glycolysis.
7. Galactose can enter glycolysis by being converted to galactose-1-phosphate followed by conversion (ultimately) to glucose-1-phosphate and subsequently to glucose-6-phosphate, which is a glycolysis intermediate.
8. Deficiency of galactose conversion enzymes results in accumulation of galactose (from breakdown of lactose). Excess galactose is converted to galactitol (a sugar alcohol). Galactitol in the human eye lens causes it to absorb water and this may be a factor in formation of cataracts.
9. Entry of fructose to the glycolysis cycle may be problematic in some cases. Fructose can be converted to F6P by hexokinase. Fructose can also be converted to fructose-1-phosphate (F1P) by fructokinase. Conversion of F1P to glyceraldehyde and DHAP allows fructose to be metabolized by glycolysis without being controlled by PFK. Ingestion of a lot of fructose (via high fructose corn syrup in many foods) may be a factor in obesity.

