FERMENTATION, REGULATION

10/30/91, rvsd 11/3/93, 11/8/94, 5 Nov 99, 6 Nov 00, 5 Nov 01, 7 Nov 03, 5 Nov 04, 27Oct08
BKH: pp. 382-401, BKH 5th: 378-393, bkhb 7TH: PP229-246

NAD^+ required for glycolysis, must regenerate from accumulated NADH:

pyruvate can accept H, produce lactate. Lactate can be carried to liver, gluconeogenesis

Microorganisms alternative: Ethanol formed by decarboxylation, reduction

ATP from glycolysis only traps about 7% of energy in glucose

STARCH CATABOLISM: Phosphorolysis of starch produces G-1-PO_4, phosphoglucomutase changes to G-6-PO_4

Regulation of Glycolysis: THREE intrinsic mechanisms:

1. G6P inhibits **hexokinase**
2. ATP allosterically inhibits **phosphofructokinase** (also a substrate). p 250: forms *sigmoidal* curve enzyme conc vs reaction velocity (active site has higher affinity for ATP than allosteric site.) (Show rate vs [F-6-PO_4] at low vs high ATP.) (P 250) also inhibited by citrate and by fatty acids
3. ATP and acetyl coenzyme A inhibit **pyruvate kinase**.

A second phosphofructokinase synthesizes in the unphosphorylated state

HORMONAL REGULATION of glycolysis versus gluconeogenesis by glucagon: (p 245)

Fructose-2,6-bisphosphate activation of phosphofructokinase: stimulates glycolysis *vs* inhibits gluconeogenesis

1) Glucagon triggers cAMP production in the cytoplasm
2) cAMP activates a kinase which phosphorylates PFK-2.
   a) unphosphorylated, PFK-2 makes **Fructose-2,6-bisphosphate which activates phosphofructokinase**, and stimulates **glycolysis**. (F 2,6 bisPO_4 also inhibits fructose-1,6-bisPase
   b) when phosphorylated, PFK-2 acts as a **phosphatase**. Removing the 2 PO4 from F2,6 bisPO_4 which inhibits phosphofructokinase (and glycolysis), stimulates **gluconeogenesis**.