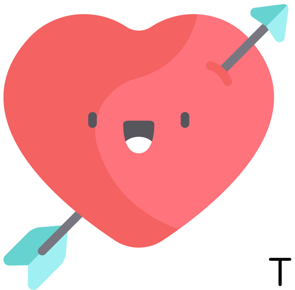


MCB 150

The Molecular and Cellular Basis of Life

Lecture 12: Fermentation and Regulation of Metabolism

Today's Learning Catalytics Session ID is:
38147346

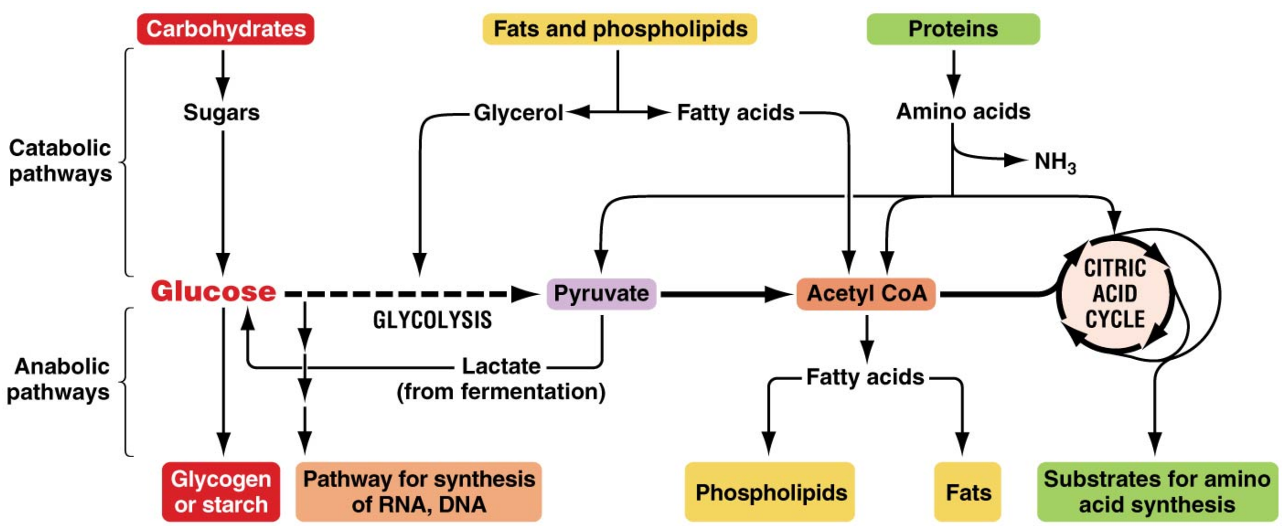
We followed the path of the C and H in glucose to complete oxidation in the presence of O_2:

- Glycolysis first (1 glucose to 2 pyruvate)
- Krebs Cycle next (carbons released as CO_2)
- ETC and Oxidative Phosphorylation last (hydrogens combine with oxygen to form water)

More importantly, we followed the path of the energy in glucose (as electrons) to make ATP:

- Some ATP generated by SLP in both glycolysis and Krebs
- Most electrons transferred to cofactors which carry them to the ETC, which uses them to create a proton gradient, which in turn powers ATP synthase

What about low-carb diets? If you don't eat carbs, how do you make ATP?



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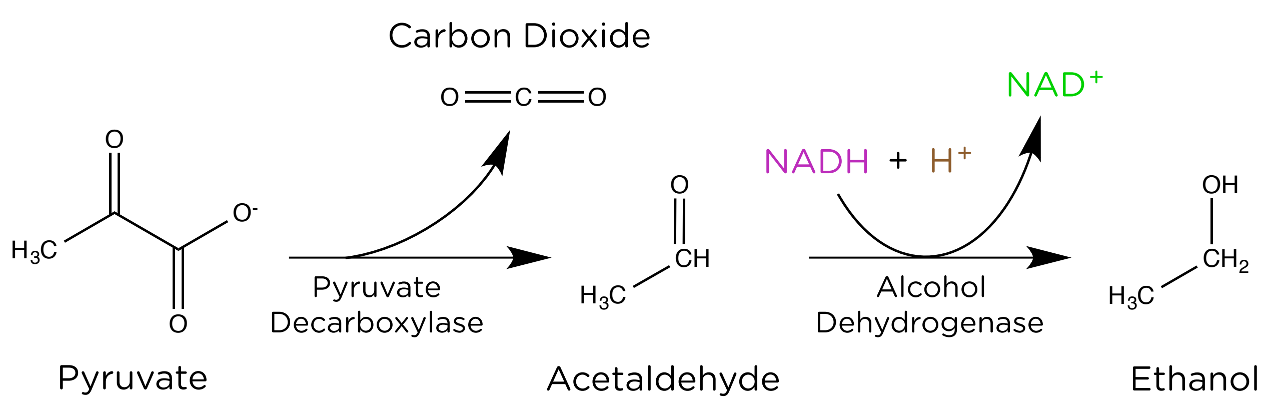
What happens to aerobically-respiring cells under anaerobic conditions?

- These cells can perform glycolysis, but no Krebs cycle or oxidative phosphorylation—all ATP comes from glycolysis
- The pyruvate undergoes a process called **Fermentation**:
  - Serves to regenerate the NAD^+ which was reduced to NADH in glycolysis
  - No additional energy is released per molecule of glucose (because glucose is not completely oxidized), but the rate of glycolysis is increased to compensate for loss of oxidative phosphorylation
  - Fermentation products accumulate

Fermentation in yeast:



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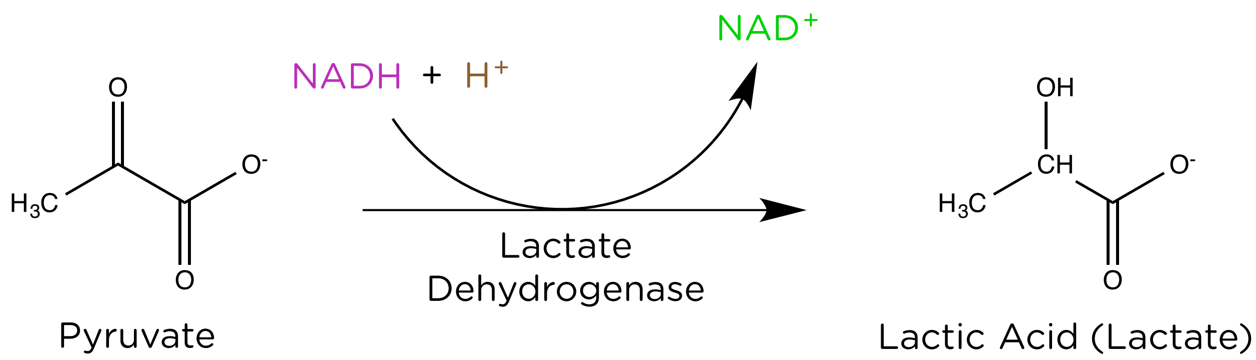
Fermentation in muscle cells and many bacteria:



Catabolic and biosynthetic pathways are regulated and coordinated

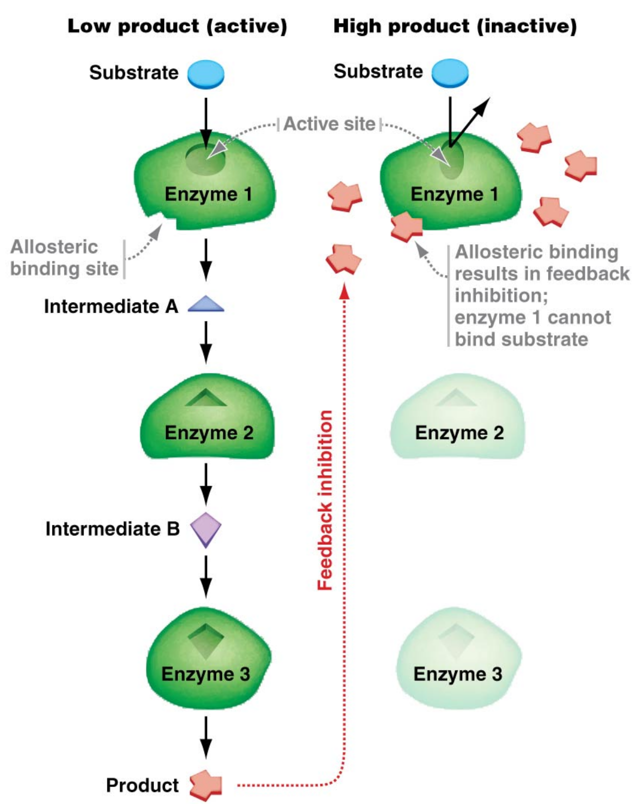
- Don't use any more energy than necessary
- Coordination comes from two primary sources:
  - Amount of enzyme
  - Activity of **allosterically-regulated** enzyme

Some enzymes have binding sites other than the active site to which regulatory molecules (**allosteric regulators**) bind

- Change conformation of active site
- Can either Increase or Decrease activity of enzyme:
  - Called **Positive Regulator** if it *increases* activity
  - Called **Negative Regulator** if it *decreases* activity

Sometimes, the allosteric regulator is a product of a later reaction in that pathway

- Called **feedback inhibition**



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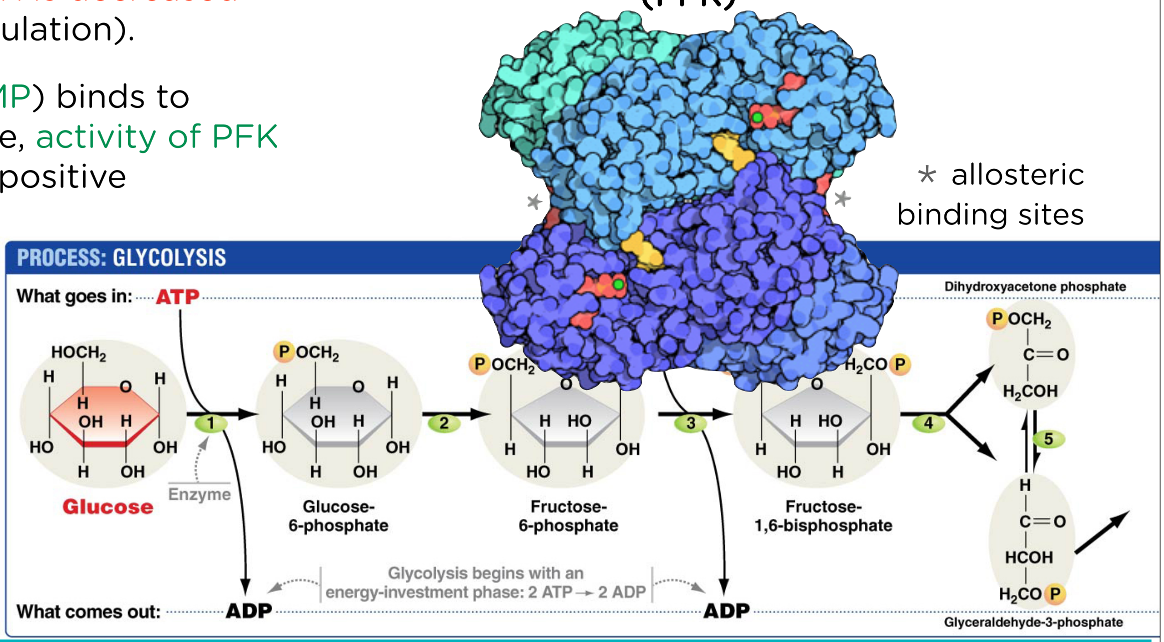
Example: Feedback inhibition of glycolysis by ATP:

If ATP binds to regulatory site, activity of PFK is decreased (negative regulation).

If ADP (or AMP) binds to regulatory site, activity of PFK is increased (positive regulation).

Phosphofructokinase (PFK)



Some allosteric regulators can turn “up” one reaction and turn “down” a different reaction