Glycolysis

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Glycolysis

- Summarize glycolysis.
- List the products of glycolysis.



How do you slice a molecule of glucose in half?

With sharp knives? Not really. But you lyse it through glycolysis. This is an extremely important part of cellular respiration. It happens all the time, both with and without oxygen. And in the process, transfers some energy to ATP.

Cellular Respiration Stage I: Glycolysis

The first stage of cellular respiration is **glycolysis**. It does not require oxygen, and it does not take place in the mitochondrion - it takes place in the cytosol of the cytoplasm.

When was the last time you enjoyed yogurt on your breakfast cereal, or had a tetanus shot? These experiences may appear unconnected, but both relate to bacteria which do not use oxygen to make ATP. In fact, tetanus bacteria cannot survive if oxygen is present. However, *Lactobacillus acidophilus* (bacteria which make yogurt) and *Clostridium tetani* (bacteria which cause tetanus or lockjaw) share with nearly all organisms the first stage of cellular respiration, glycolysis. Because glycolysis is universal, whereas **aerobic** (oxygen-requiring) cellular respiration is not, most biologists consider it to be the most fundamental and primitive pathway for making ATP.

Splitting Glucose

The word *glycolysis* means "glucose splitting," which is exactly what happens in this stage. Enzymes split a molecule of glucose into two molecules of **pyruvate** (also known as pyruvic acid). This occurs in several steps, as shown in **Figure** 1.1. You can watch an animation of the steps of glycolysis at this link: http://www.youtube.com/watch?v=6 JGXayUyNVw .



FIGURE 1.1

In glycolysis, glucose (C6) is split into two 3-carbon (C3) pyruvate molecules. This releases energy, which is transferred to ATP. How many ATP molecules are made during this stage of cellular respiration?

Results of Glycolysis

Energy is needed at the start of glycolysis to split the glucose molecule into two pyruvate molecules. These two molecules go on to stage II of cellular respiration. The energy to split glucose is provided by two molecules of ATP. As glycolysis proceeds, energy is released, and the energy is used to make four molecules of ATP. As a result, there is a net gain of two ATP molecules during glycolysis. During this stage, high-energy electrons are also transferred to molecules of NAD⁺ to produce two molecules of **NADH**, another energy-carrying molecule. NADH is used in stage III of cellular respiration to make more ATP.

Summary

- The first stage of cellular respiration is glycolysis. It does not require oxygen.
- During glycolysis, one glucose molecule is split into two pyruvate molecules, using 2 ATP while producing 4 ATP and 2 NADH molecules.

References

1. Hana Zavadska. Steps of glycolysis. CC BY-NC 3.0