

Metabolic Pathways Involved in Cellular Respiration

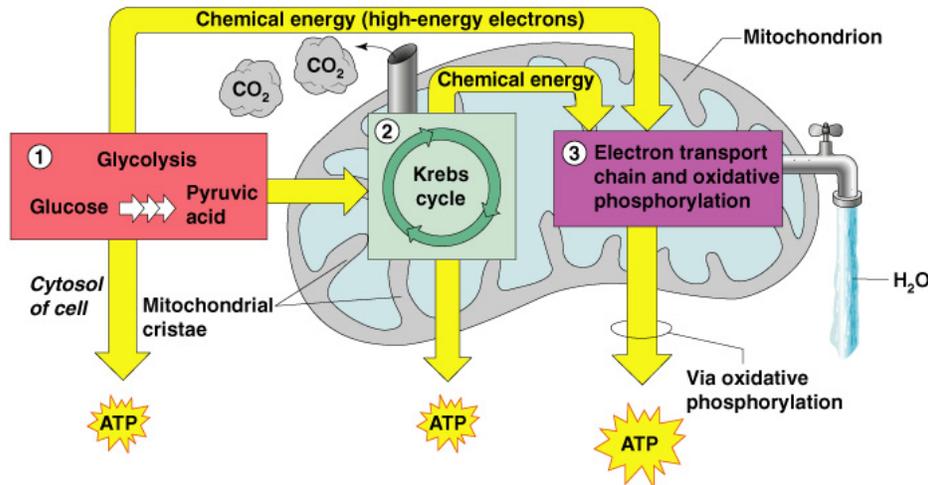


Figure 14.18

Key Ideas:

1. This illustration describes the two “metabolic pathways” found in the cytoplasm of cells.
2. Glycolysis is a metabolic pathway (ie group of enzymes that converts glucose into pyruvic acid). This occurs within the “gel” of the cytoplasm and glycolysis does not require oxygen. Glycolysis produces only a small amount of ATP. If oxygen is not available then pyruvic acid is converted to lactate and leaves the cell. The lactate is transported to the liver where the lactate is converted into glucose (ie two 3-carbon lactate molecules are used to make 1-6carbon glucose molecule). If oxygen is available then pyruvic acid is converted to acetyl-CoA, enters the mitochondria, and the net result is the production of significantly more ATP and “reduced” NADH and FADH.
3. The Krebs cycle (also called the Citric Acid Cycle) occurs inside the mitochondria. This is a cellular organelle surrounded by “two membranes”. If oxygen is available then acetyl-CoA is able to enter the mitochondria. Once inside, the acetyl-CoA is “fed” into the Krebs Cycle which produces more ATP and reduces FAD and NAD to form FADH and NADH (ie adding H⁺ to FAD and NAD make them “high energy” molecules).
4. Reduced FADH and NADH are energized co-enzymes. Within the mitochondria, FADH and NADH are passed down an electron transport chain and more ATP is formed. When all the energy associated with the H⁺ that were attached to the NAD and FAD are exhausted, spent (H⁺)s are attached to an oxygen atom to make water (H₂O). This is called “metabolic” water because it is made in the process of carbohydrate catabolism!
5. The four carbon atoms which moved across the double membrane to enter the mitochondria (ie two – two carbon acetyl-CoA molecules) are then “fed into” the Krebs Cycle. These “four carbons” are transformed into carbon dioxide as they travel around the Krebs Cycle. CO₂ is a poison and it is transported to and excreted by the respiratory system.
6. See “Carbohydrate Handout” to follow the actual ATP “count” as the glucose molecule is catabolism.