Name: _____ Date: _____ Block: ____

9-2 The Krebs Cycle and Electron Transport WORKSHEET #2

Bang! The starter's pistol goes off, and the runners push off their starting blocks and sprint down the track. The initial burns of energy soon fades, and the runners settle down to a steady pace. After the runners hit the finish line, they walk around slowly and breathe deeply to catch their breath.

Let's look at what happens at each stage of the race in terms of the pathways the body uses to release energy. To obtain energy, the body uses ATP already in muscles and new ATP made by lactic acid fermentation and cellular respiration. At the beginning of a race, the body uses all three ATP sources, but stored ATP and lactic acid fermentation can only supply energy for a limited time.

Quick Energy

What happens when your body needs lots of energy in a hurry? In response to sudden danger, quick actions might make the difference between life and death. To an athlete, a sudden burst of speed might win a race.

Cells normally contain small amounts of ATP produced during glycolysis and cellular respiration. When the starting gun goes off in a footrace, the muscles of the runners contain only enough of this ATP for a few seconds of intense activity. Before most of the runners have passed the 50-meter mark, that store of ATP is nearly gone. At this point, their muscle cells are producing most of their ATP by lactic acid fermentation. These sources can usually supply enough ATP to last about 90 seconds. In a 200- or 300-meter sprint, this may be just enough to reach the finish line.

Fermentation produces lactic acid as a byproduct. When the race is over, the only way to get rid of lactic acid is in a chemical pathway that requires extra oxygen. For that reason, you can think of a quick sprint building up an oxygen debt that a runner has to repay after the race with plenty of heavy breathing.

Long-Term Energy

What happens if a race is longer? How does your body generate the ATP it needs to run 2 kilometers or more, or to play in a soccer game that lasts more than an hour? For exercise longer than about 90 seconds, cellular respiration is the only way to generate a continuing supply of ATO. Cellular respiration releases energy more slowly than fermentation, which is why even well-conditioned athletes have to pace themselves during a long race or over the course of a game. Your body stores energy in muscle and other tissues in the form of the carbohydrate glycogen. These stores of glycogen are usually enough to last for 15 or 20 minutes of activity. After that, you body begins to break down other stored molecules, including fats, for energy. This is one reason why aerobic forms of exercise such as running, dancing, and swimming are so beneficial for weight control.