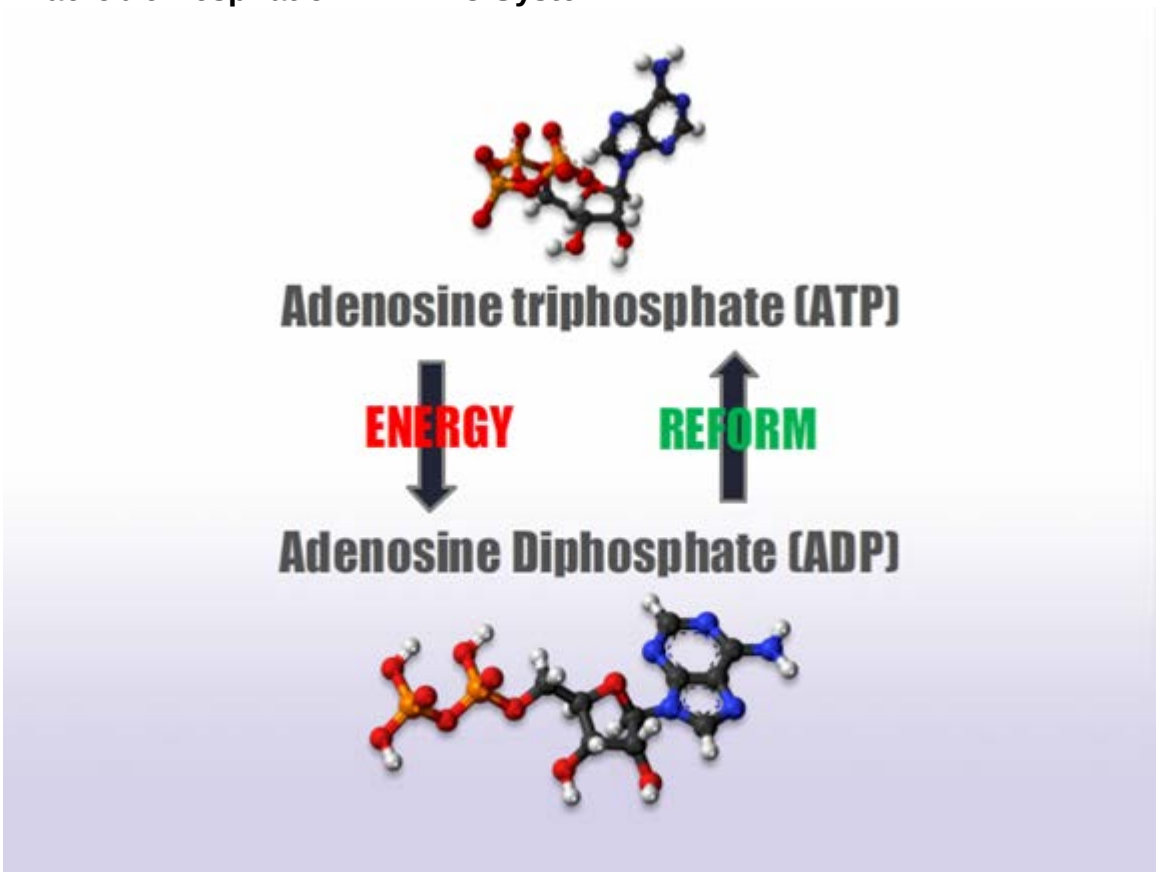
Module 3: High-Performance Machinery
Topic 5 Content: Aerobic and Anaerobic Respiration

Introduction

When you are engaged in exercise, your body must produce energy in order for you to move. There are two ways that your body produces this energy: anaerobic and aerobic respiration systems. Your body's respiratory system determines which type of respiration is utilized, based on the amount of energy needed and the duration of the exercise.

Anaerobic Respiration: ATP-PC System



Anaerobic respiration begins with the ATP-PC system. In anaerobic respiration, no oxygen is used. The first part of the ATP-PC system occurs when ATP breaks down to form ADP. The molecule, adenosine triphosphate (ATP), provides your body with energy. When you begin an activity, your body immediately begins to break down ATP. This process produces a lower-energy molecule known as adenosine diphosphate (ADP). When ATP breaks down to ADP, a large amount of energy is released. ADP will continue to store energy and eventually re-form as ATP. This cycle continuously fuels your cells, thus providing energy to your body.

Click each marker to learn more about ATP and ADP. When you are ready, click ***NEXT*** to continue learning about anaerobic respiration.

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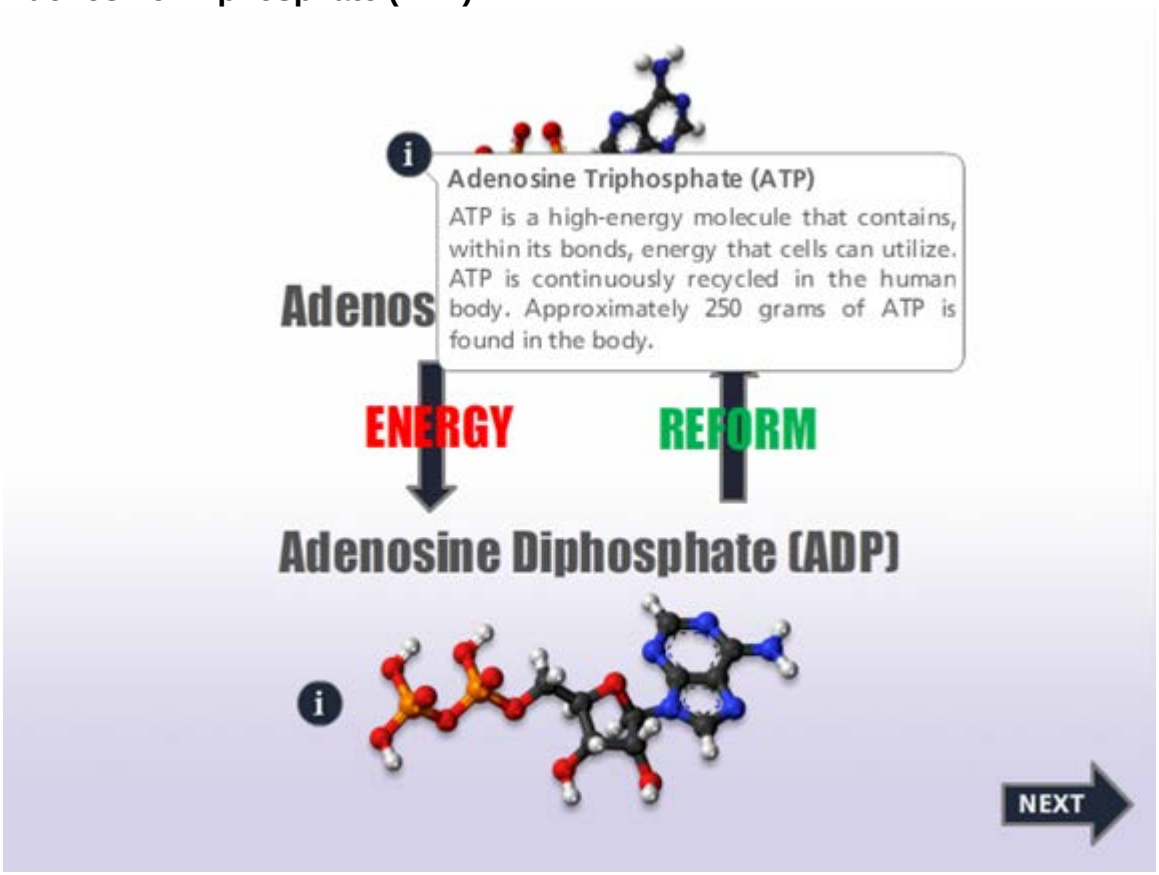
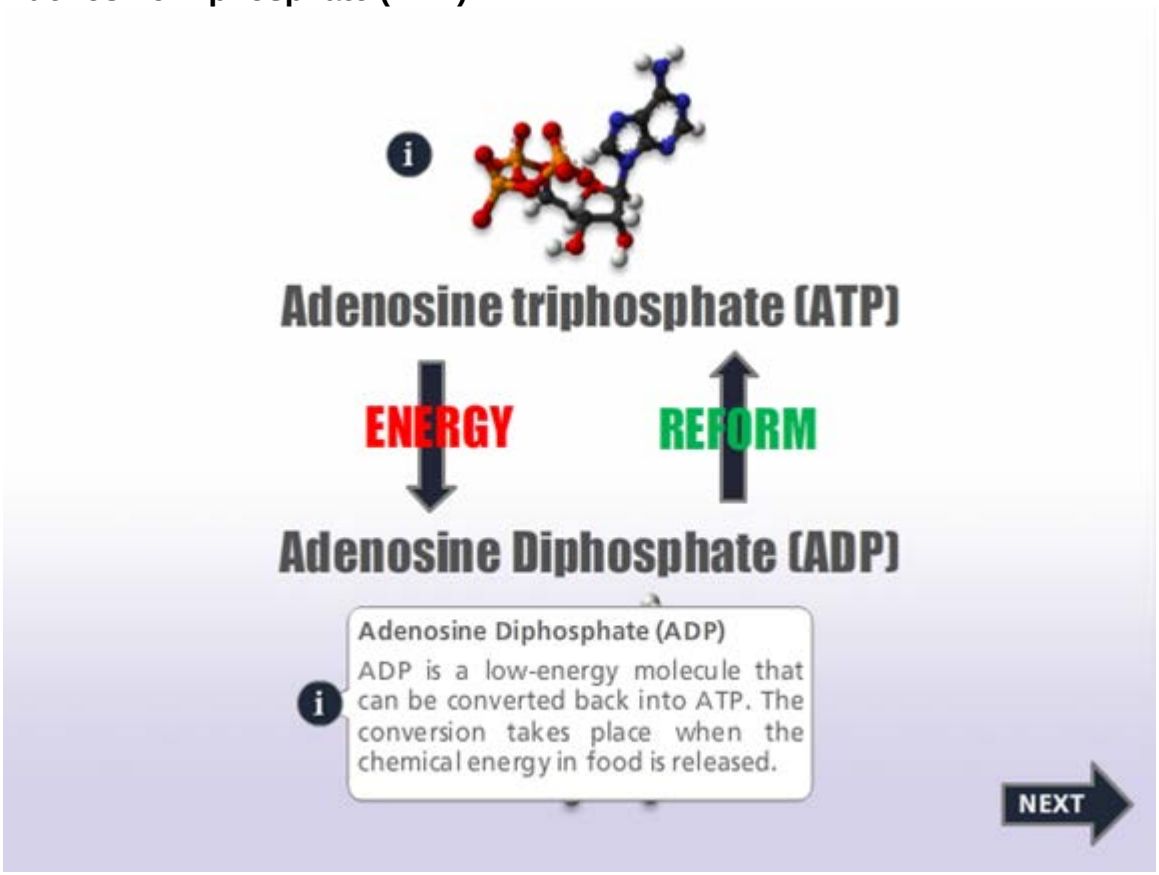
Adenosine Triphosphate (ATP)



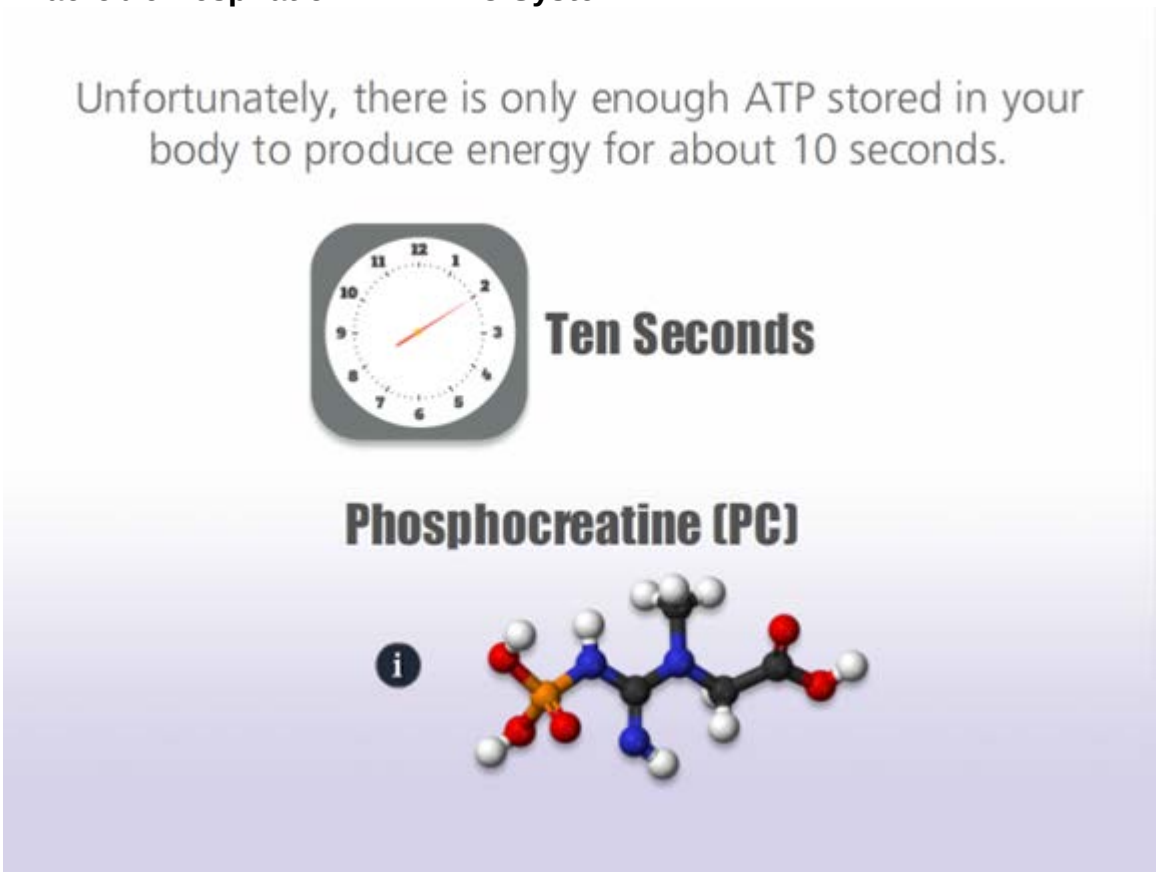
ATP is a high-energy molecule that contains, within its bonds, energy that cells can utilize. ATP is continuously recycled in the human body. Approximately 250 grams of ATP is found in the body.

Adenosine Diphosphate (ADP)



ADP is a low-energy molecule that can be converted back into ATP. The conversion takes place when the chemical energy in food is released.

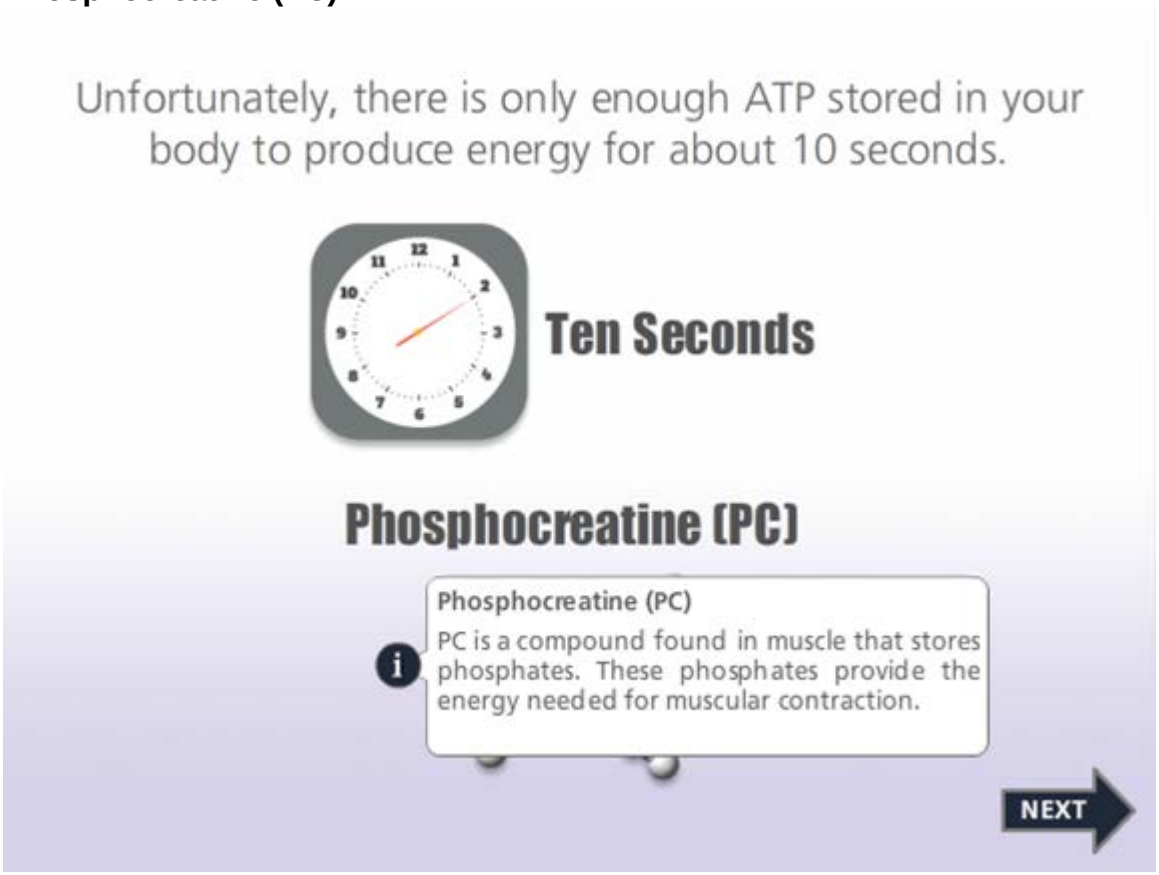
Anaerobic Respiration: ATP - PC System



Unfortunately, there is only enough ATP stored in your body to produce energy for about 10 seconds. As ATP begins to decline, your body begins to use another energy source, known as phosphocreatine (PC). However, this can only provide, approximately another 10 seconds of energy.

Click the marker to learn more about PC. When you are ready, click ***NEXT*** to continue learning about anaerobic respiration.

Phosphocreatine (PC)



PC is a compound found in muscle that stores phosphates. These phosphates provide the energy needed for muscular contraction.

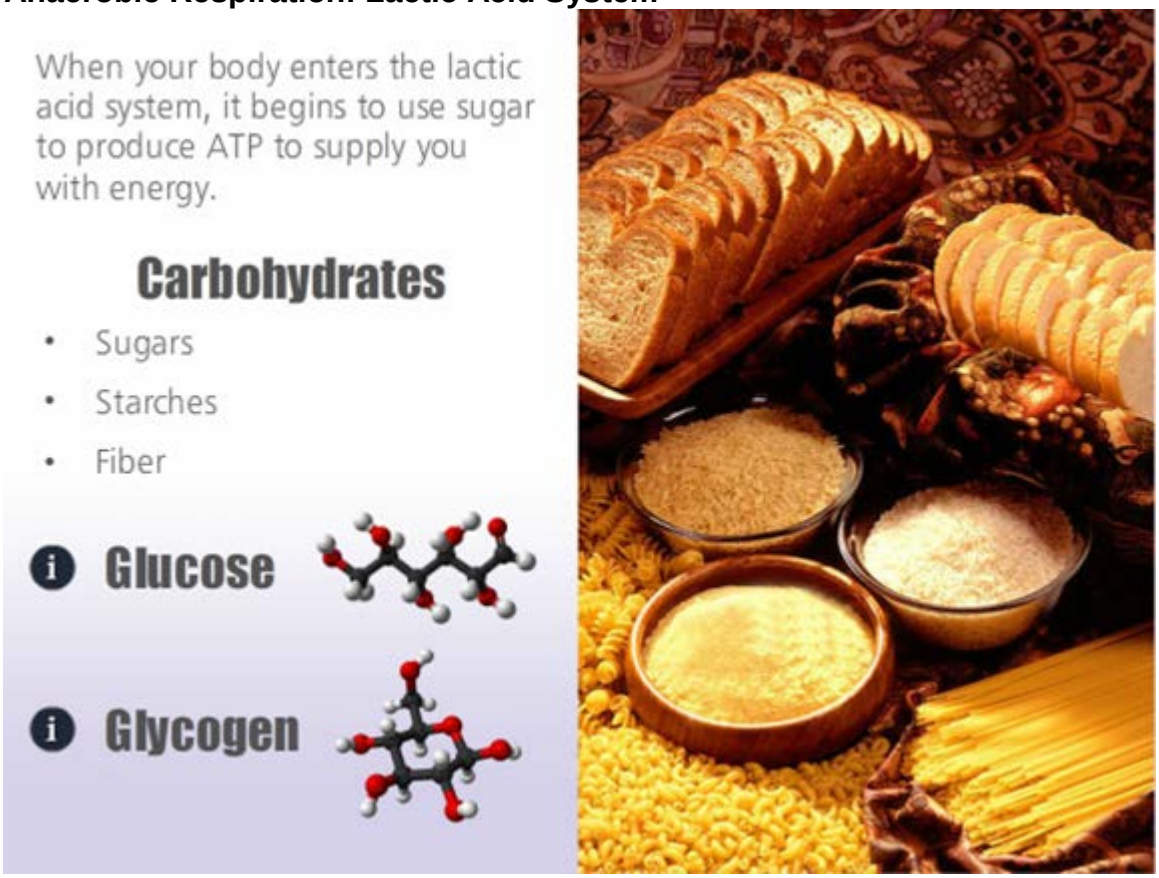
Anaerobic Respiration: ATP - PC System

The ATP-PC system, also known as the phosphagen system, is only able to produce energy for a short amount of time. It is most effective when you engage in activities that require a burst of energy for a short period of time, such as sprinting, swinging a bat in a softball game, shooting a basketball, or pitching a baseball. Click ***NEXT*** to continue learning about anaerobic respiration.

Fast Twitch Muscle Fibers

Two types of muscle fibers exist that contract in particular ways to support physical activity. These include fast twitch muscle fibers and slow twitch muscle fibers. Fast twitch muscle fibers help with anaerobic activities like sprinting, because they create fuel through short bursts, and quickly produce a lot of strength. However, fast twitch muscle fibers tire easily, prompting your body to require rest.

Anaerobic Respiration: Lactic Acid System



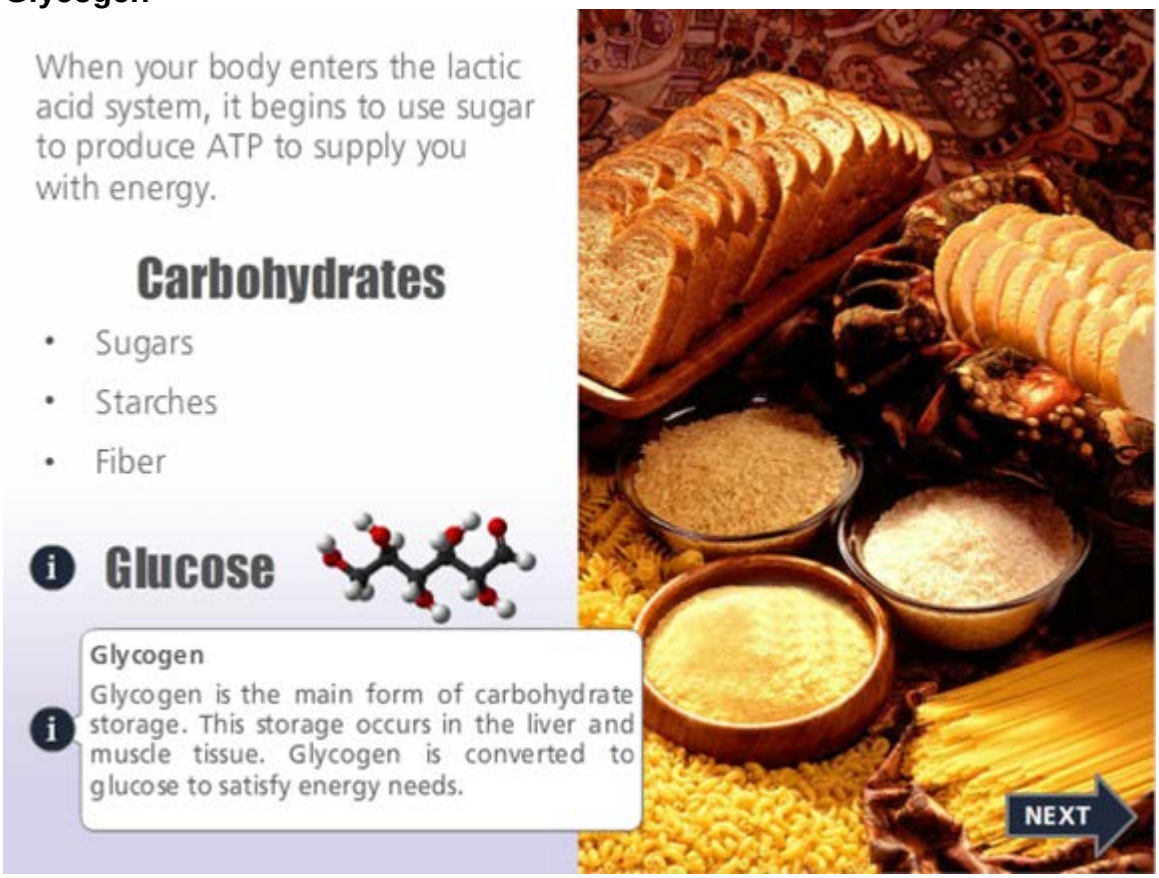
When your body enters the lactic acid system, it begins to use sugar to produce ATP to supply you with energy. Sugars, starches, and fiber are the three main types of carbohydrates. When you eat, your body breaks these carbohydrates down, with the exception of fiber, to sugar. Some of the sugar circulates in your blood, and is known as glucose. The remaining sugar is stored in your body and is known as glycogen.

Click each marker to learn more about glucose and glycogen. When you are ready, click ***NEXT*** to continue learning about anaerobic respiration and the lactic acid system.

Glucose

Glucose is a simple sugar that serves as the main source of food for our cells.

Glycogen



Glycogen is the main form of carbohydrate storage. This storage occurs in the liver and muscle tissue. Glycogen is converted to glucose to satisfy energy needs.

Anaerobic Respiration: Lactic Acid System

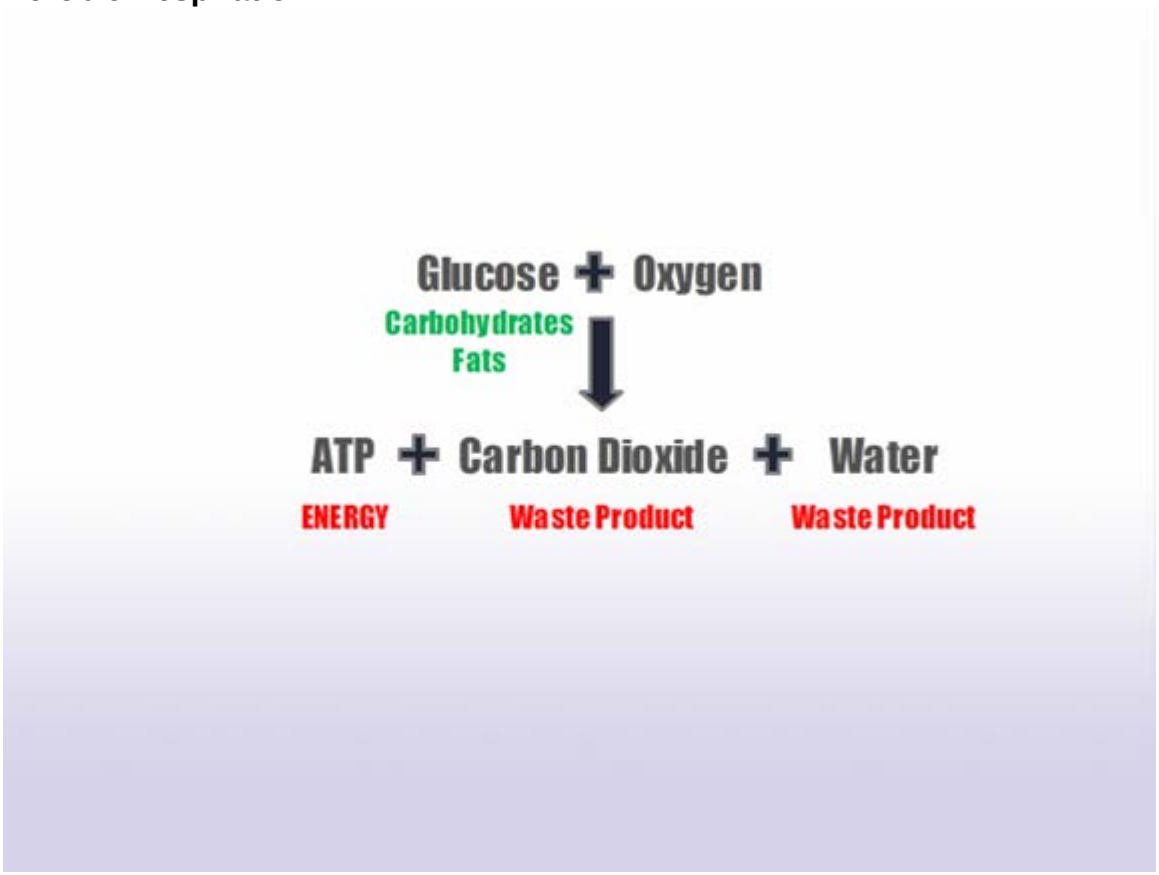
Have you ever gotten a cramp while exercising? The reason for your cramp can be explained by the lactic acid system. When glycogen is broken down into glucose during the lactic acid system, lactic acid builds up in your muscles. This causes muscles to feel tired and sore during and after intense exercise. Lactic acid build-up is the reason your muscles cramp.

Click the marker to learn more about lactic acid. When you are ready, click ***NEXT*** to continue.

Lactic Acid

Lactic acid is an organic acid that forms in the muscle tissue during exercise. As lactic acid builds up, it can cause the muscles to cramp.

Aerobic Respiration



When you begin exercising, your respiratory system has yet to deliver an adequate amount of oxygen to your cells. As a result, your body begins to use anaerobic respiration to produce energy. After receiving an increase in oxygen, the cells in your body combine glucose and oxygen to produce energy, in the form of ATP. The waste products in this process are carbon dioxide and water.

The glucose used in aerobic respiration is provided by the burning of carbohydrates and fat. Your body first breaks down carbohydrates into glucose. Once all of the available carbohydrates are used, the body turns to fat for a supply of glucose.

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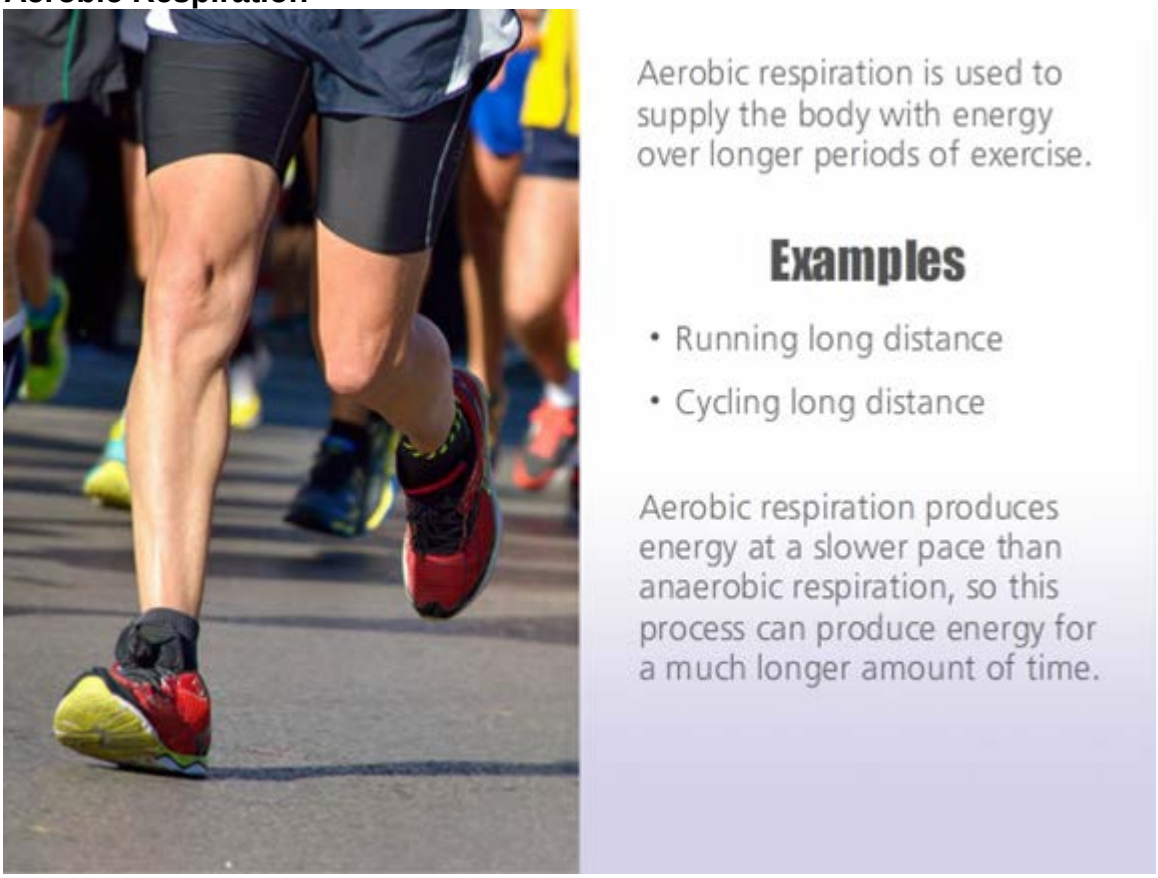
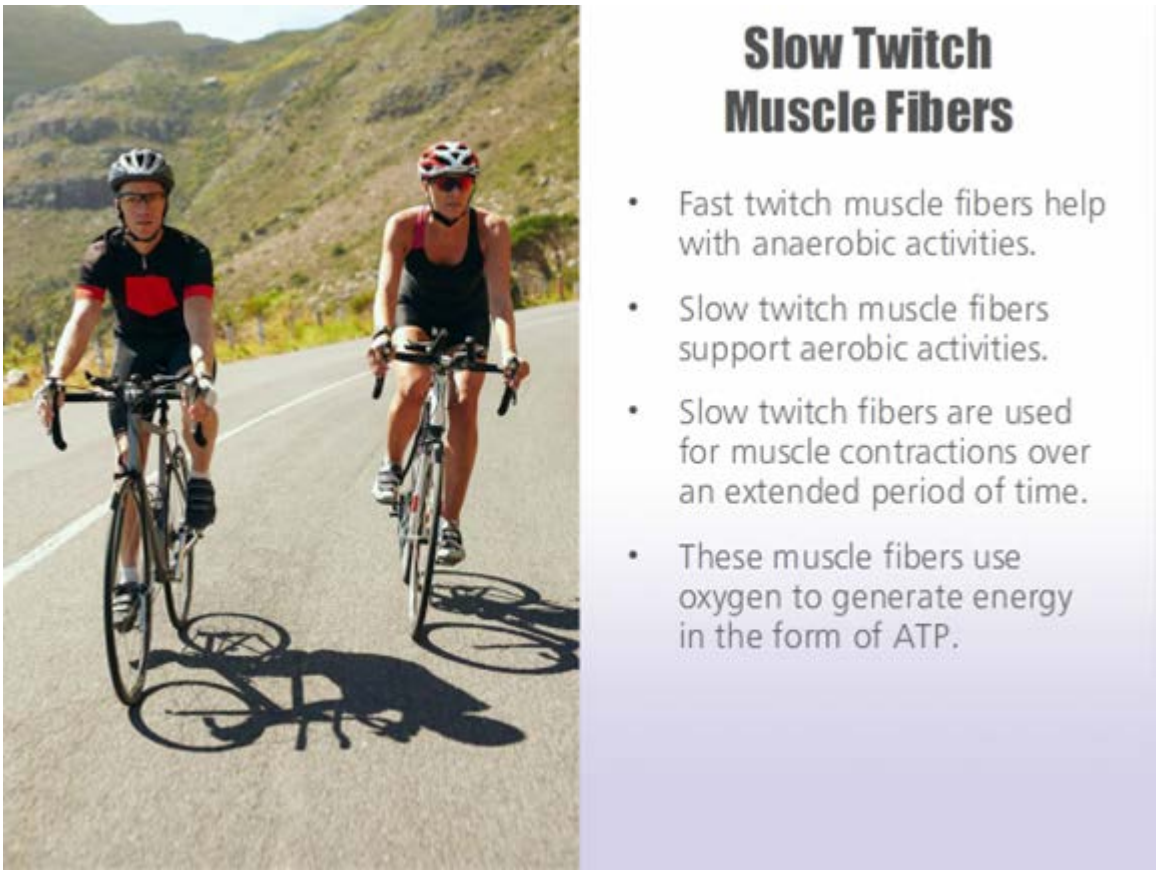
Aerobic Respiration



Aerobic respiration is used to supply the body with energy over longer periods of exercise. For example, if you ran for three miles or rode a bike for five miles, your body would need a continuous supply of energy. Aerobic respiration produces energy at a slower pace than anaerobic respiration, so this process can produce energy for a much longer amount of time.

Slow Twitch Muscle Fibers



Fast twitch muscle fibers help with anaerobic activities. Slow twitch muscle fibers support aerobic activities that need to use muscle contractions over an extended period of time, as when a cyclist rides a bike for hours. Specifically, slow twitch muscle fibers effectively use oxygen to generate energy in the form of ATP.

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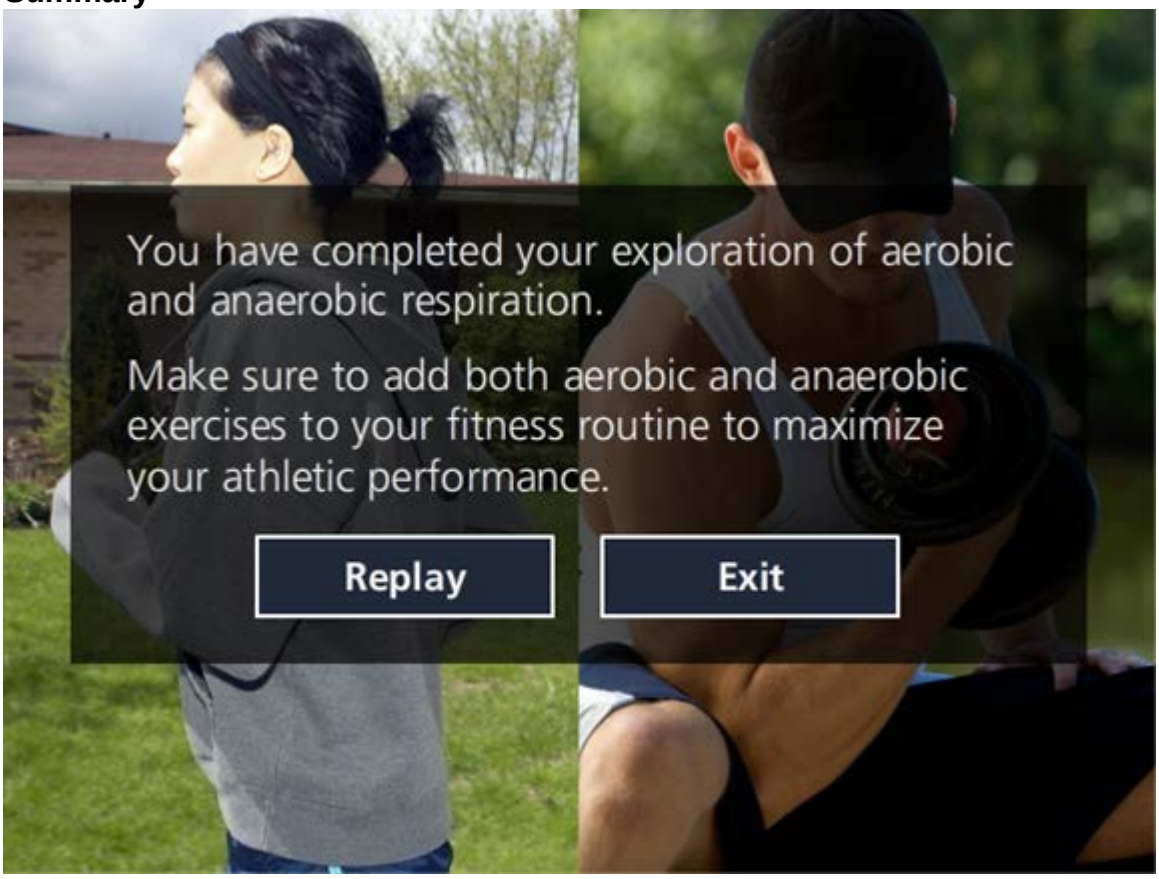
Summary



You have completed your exploration of aerobic and anaerobic respiration.

Make sure to add both aerobic and anaerobic exercises to your fitness routine to maximize your athletic performance.

If you wish to view any of the information again click ***Replay***. Click ***Exit*** to close the interactivity.