Chapter 7 Anaerobic Exercise

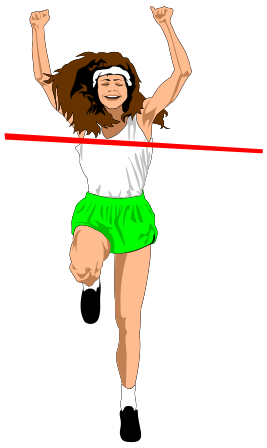
Hand in Hand

Nutrition and **physical activity** go **hand in hand**. The working body demands **energy-yielding nutrients** to fuel activity. And, it needs **protein** plus supporting nutrients in order to build **lean tissue.**

Exercise requires the body to dip into its **stores of fuel** - namely, **fat** and **glycogen** (sugar). By using up fat and building lean tissue, **exercise pushes body-composition toward lean** and thus, **raises** the body's rate of energy expenditure (metabolism).

To the contrary, a lack of exercise, or an **"exercise deficiency"** can lead to accelerated development of the diseases associated with sedentary life - **cardiovascular disease, obesity, intestinal disorders, apathy, insomnia, accelerated bone loss**, etc.

Want Good Looks? Get Metabolism



For the person seeking health or wellness, **physical activity** is as important as **nutrition** or **sleep.** It promotes fitness. And, since a fit body looks healthy and attractive, it **enhances appearance.**

To understand **exercise** we must first refer back to **metabolism**. The term metabolism refers to **chemical reactions** that take place within the body. As explained earlier, **metabolism is the sum energy expenditure of all bodily functions**. It is the amount of energy our bodies require and burn during one day.

Aerobic metabolism refers to a series of chemical reactions that **requires the presence of oxygen.** In contrast, **anaerobic metabolism** means just the opposite - a series of chemical reactions that **does not require the presence of oxygen.**

Energy is described as the capacity or ability to perform work. The most common unit of measure is the **calorie**.

To understand **how** the body fulfills the caloric energy demand during exercise **without** the presence of oxygen we must discuss your body's **complex** fuel systems.

ATP - Adenosine Triphosphate

The energy source - **Adenosine Triphosphate** (ATP) is the **most immediate source of chemical energy for muscular activity**. If you suddenly jumped two feet into the air from a standing start, the energy source would be ATP.

The energy available from ATP is very limited. If you ran 100 meters as fast as you could, you'd exhaust all of your ATP.

The usefulness of the ATP system lies in the **rapid availability** of **energy** -- rather than quantity. Only about **30 seconds** of ATP is stored in the body.

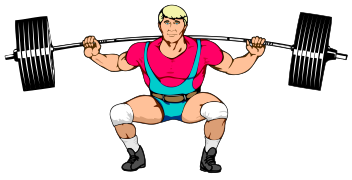
ATP is stored in most cells, but, particularly in muscle cells. It is the most important **anaerobic fuel source** available. In fact, other forms of chemical energy, available from foods, must be transformed into ATP before they can be used by the muscle cells. ATP is the only source of fuel or energy the body accepts. Therefore, it is important to understand that all remaining fuel systems are simply resynthesizing and rebuilding ATP. There are two ways the body restores energy to ATP without the presence of oxygen.

Anaerobic Pathways

1. The first anaerobic method of ATP resynthesis comes from a chemical compound called **phosphocreatine (PC).** Phosphocreatine is an energy-rich compound similar to ATP. It is **stored in the muscle**. However, we're more concerned with the other anaerobic system -- Lactic Acid.

2. The **Lactic Acid System** is the second method used to replenish ATP during exercise.

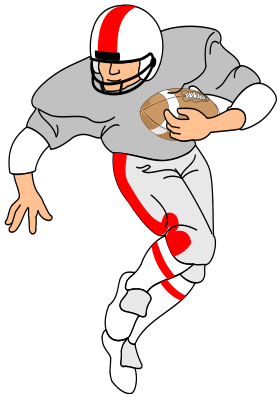
The Lactic Acid System



After the allocated supply of stored ATP is exhausted, the body must find **another fuel source** in order for activity to continue. After the first 30 seconds the next available fuel source will come from the **lactic acid system**.

Technically, the lactic acid system, is known as **anaerobic glycolysis**. While **glycolysis** refers to the **breakdown of sugar** (carbohydrate), **anaerobic glycolysis** is the breakdown of (sugar) carbohydrate **without oxygen**.

In this system the breakdown of sugar supplies the necessary energy required to resynthesize ATP. However, when **carbohydrate** is only partially broken down, one of the end products is **lactic acid**. (Hence the name lactic acid system).



When a high level of lactic acid accumulates in the muscle and blood the result is temporary muscular fatigue and soreness.

You have probably experienced this. It often occurs after extended anaerobic exercise. Activities such as **weight lifting, tennis, basketball, football**, etc. draw energy from sugar in the blood and muscles (glucose) to rebuild and resynthesize ATP.

The lactic acid system, like the ATP system, is extremely important because it provides a **rapid supply** of rebuilt ATP energy. Exercises that are performed at maximum rates between 1 and 3 minutes depend heavily upon the Lactic Acid System for ATP energy.

Performance Time

It is important to understand that even though activities such as **weight lifting, football, basketball, volleyball, baseball, tennis**, **alpine skiing,** etc. may be played for several hours, the **actual performance time** of the activities generally falls within this period. When there's a break in the action, between plays, between sets, etc. the activity or performance stops and **the body will begin to recover.**

The rate of recovery is so rapid that half of the ATP used is resynthesized **within 30 seconds.** Ninety-eight percent (98%) of ATP is rebuilt within the first 3 minutes of rest. Therefore, when the action is stopped the body will start to rebuild and reuse ATP for fuel through its anaerobic pathways. **This reduces the body's need to burn fat**.

Time, therefore is the **common denominator** for distinguishing between **sugar-burning** (anaerobic) and **fat-burning** (aerobic) exercises. Intermittent activities that last less than three minutes in **continuous** duration will always use **ATP** or **Glucose** as the primary fuel source.

A Two-System Party

We have discussed the two primary anaerobic fuel systems: 1) The ATP system and 2) the lactic acid system (Anaerobic). The difference between these anaerobic fuel systems and the aerobic fuel systems is **duration**.

Any activity that occurs in **less than 30 seconds** will rely heavily upon the ATP system. After 30 seconds and **up to 3 minutes** the body will use the anaerobic lactic acid system to resynthesize ATP so the activity can continue.