

## Chapter 6

## Carbohydrates

# Running Out of Energy

**Directions:** Read the following selection. Then answer the questions under *Thinking Critically*, and complete the activities as directed by your teacher.

His energy depleted, Pheidippides ran on sheer determination. After finishing his 36.2-kilometer run from the site of the battle of Marathon to Athens, he announced the Greek victory to the Athenians. Then, according to legend, he died. The 42.19-kilometer race called the marathon is named for Pheidippides' legendary feat in 490 B.C.

Today, long-distance runners rarely die. However, during the last few miles of a race, many of them understand how Pheidippides may have felt during his last hour. Perhaps you have seen long-distance runners gasp their way toward the finish line, cross it, collapse, and flop to the ground like stranded fish. Others stagger in, barely able to move their bodies over the finish line. These runners have run out of energy.

"Hitting the wall" refers to a point in a run at which energy and performance drop suddenly. Moving the body takes extraordinary effort because the runner's legs often feel heavy and leaden. Light-headedness is common, as is cold, clammy perspiration. Some runners can "hit the wall" within a single mile. Others have been known to run for more than forty miles without experiencing this sudden drop.

What causes runners to "hit the wall"? As you learned in Chapter 5, energy is produced by the oxidation of glucose. Because long-distance runners need so much energy during extended periods without food, most of the glucose they use during the run comes from glycogen. Although glycogen is stored in muscle tissue and the liver, the body can store only limited amounts. Therefore, long-distance runners often run out of stored glycogen before they finish the run.

At this point, the body begins to metabolize fat for energy. However, metabolizing fat requires a two-step process: the conversion of fat to glucose and the oxidation of glucose. Meanwhile, the runner uses energy faster than the body can produce it by this two-step process.

Many strategies are used in an attempt to avoid or delay "hitting the wall." For example, a runner might follow a routine of very light training and a high-carbohydrate diet for a few days before the race to increase glycogen stores. Training can increase the body's ability to metabolize fat.

An even greater concern for long-distance runners is water loss. Because vast quantities of water are lost as the body tries to cool itself through perspiration, dehydration poses a lethal threat. Long-distance runners need to replace not only the lost water but the water-soluble nutrients that are washed out of the body. In order to replace nutrients such as potassium, sodium, and chloride, runners will often drink electrolyte-replacement solutions before, during, or after a run.

Had Pheidippides known what marathon runners know today, perhaps he could have saved his own life. Fortunately, today's long-distance runners appreciate the importance of replenishing water, energy stores, and nutrients.

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## Thinking Critically

1. What activities, other than running, could deplete glycogen stores?

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2. If Pheidippides had known about the effects of long-distance running on the body's nutrient requirements, how could he have used this knowledge to save his life?

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3. Assume a long-distance runner has trained for a year to win an important medal. Four miles before the finish line, she "hits the wall." She is far ahead of the other runners. Do you think she should continue? Why or why not?

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## For Further Study

- ◆ Conduct research on the strategies runners use to delay "hitting the wall." What are their drawbacks, limitations, and hazards? Write a summary about your findings and submit it to your teacher.
- ◆ Conduct research about water-soluble nutrients. Name ten water-soluble nutrients, and describe the deficiency symptoms for each. How can an athlete who perspires heavily use this information? Share your findings with the class.