

**SECTION REVIEW**

How is energy obtained from glucose when oxygen is not present? In this section you discovered the answer to this question as you were introduced to the process of fermentation. Fermentation is an anaerobic process that enables cells to carry out energy production in the absence of oxygen. The combination of glycolysis, which is also anaerobic, and fermentation produces 2 molecules of ATP from a molecule of glucose.

Recall that glycolysis produces 2 molecules of pyruvic acid, 2 molecules of NADH, and a total of 2 molecules of ATP. In order for glycolysis to continue, the NADH must be converted back to NAD<sup>+</sup>. In fermentation, electrons from

NADH are transferred to an organic molecule such as pyruvic acid. This converts the NADH to NAD<sup>+</sup>, which can then be used in glycolysis.

In this section you learned that most eukaryotic cells use one of two fermentation pathways: lactic acid fermentation or alcoholic fermentation. In cells that undergo lactic acid fermentation—human muscle cells, for example—electrons from NADH are added to pyruvic acid, transforming it into lactic acid. In cells that undergo alcoholic fermentation—yeast cells, for example—electrons from NADH are added to pyruvic acid, changing it into alcohol and carbon dioxide.

**Defining Terms: Building Vocabulary Skills**

In your own words, define each of the following terms.

1. Anaerobic: \_\_\_\_\_  
\_\_\_\_\_
2. Aerobic: \_\_\_\_\_  
\_\_\_\_\_
3. Fermentation: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Lactic acid fermentation: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. Alcoholic fermentation: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. Pyruvic acid: \_\_\_\_\_  
\_\_\_\_\_

**Matching Up: Using the Main Ideas**

In the space provided, write the term from the following word bank that best fits the description. Some terms are used more than once.

| Word Bank   |                          |
|-------------|--------------------------|
| Respiration | Lactic acid fermentation |
| Glycolysis  | Alcoholic fermentation   |

1. Important to bakers and brewers: \_\_\_\_\_
2. A great deal of energy is extracted from glucose: \_\_\_\_\_
3. Causes a painful, burning sensation in muscles: \_\_\_\_\_
4. Produces 2 ATP molecules and pyruvic acid: \_\_\_\_\_
5. Associated with rapid exercise: \_\_\_\_\_
6. Fermentation that occurs in yeast cells: \_\_\_\_\_
7. Requires oxygen: \_\_\_\_\_
8. Fermentation that occurs in muscle cells that do not have sufficient oxygen:  
\_\_\_\_\_
9. Alcohol is a by-product: \_\_\_\_\_
10. Pyruvic acid is the final electron acceptor (2 answers): \_\_\_\_\_  
\_\_\_\_\_

**Concept Mapping**

The construction of and theory behind concept mapping are discussed on pages vii–ix in the front of this Study Guide. Read those pages carefully. Then consider the concepts presented in Section 6–4 and how you would organize them into a concept map. Now look at the concept map for Chapter 6 on page 66. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 6–4. When you have finished the chapter, you will have a completed concept map.