**Fermentation**

**Definition:**
Fermentation is the chemical decomposition of a complex substance, especially a carbohydrate, into simpler chemical products, brought about by the action of enzymes, bacteria, yeasts, or molds, generally in the absence of oxygen. It may be a natural process, or one brought about or enhanced technically to produce a desired end product; e.g., the fermentation of grape juice to make wine or of corn products to produce ethanol fuel.

**Process by which the living cell is able to obtain energy through the breakdown of glucose and other simple sugar molecules without requiring oxygen.**

Fermentation is achieved by somewhat different chemical sequences in different species of organisms. Two closely related paths of fermentation predominate for glucose. When muscle tissue receives sufficient oxygen supply, it fully metabolizes its fuel glucose to water and carbon dioxide. However, at times of strenuous activity, muscle tissue uses oxygen faster than the blood can supply it. During this anaerobic condition, the six-carbon glucose molecule is only partly broken down to two molecules of the three-carbon sugar called lactic acid. This process, called lactic acid fermentation, also occurs in many microorganisms and in the cells of most higher animals. In alcoholic fermentation, such as occurs in brewer's yeast and some bacteria, the production of lactic acid is bypassed, and the glucose molecule is degraded to two molecules of the two-carbon alcohol, ethanol, and to two molecules of carbon dioxide. Many of the enzymes of lactic acid and alcoholic fermentation are identical to the enzymes that bring about the metabolic conversion known as glycolysis. Alcoholic fermentation is a process that was known to antiquity. Before 2000 B.C. the Egyptians apparently knew that crushed fruits stored in a warm place would produce a substance with a pleasant intoxicating power. By 1500 B.C. the production of beer from germinating cereals (malt) and the preparation of wines from crushed grapes were established arts in most of the Middle East. Aristotle believed that grape juice was an infantile form of wine and that fermentation was, therefore, the maturation of the grape extract. Interest in the process of fermentation has continued through the ages, and much of modern biochemistry, especially enzyme studies, has emerged directly from early studies on the fermentation process. One of the earliest laboratories established for the study of biological chemistry was that founded in Copenhagen in 1875 and financed by the brewing family of Jacob Christian Jacobsen.

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