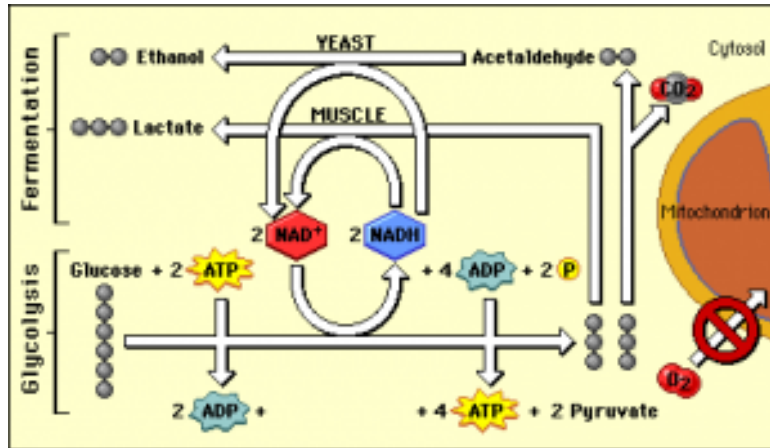


Fermentation Definition

“Fermentation is an anaerobic process in which energy can be released from glucose even if oxygen is not available.”

What is Fermentation?

Fermentation occurs in yeast cells and bacteria and also in the muscles of animals. It is an anaerobic pathway in which glucose is broken down. The processes that use an organic molecule to regenerate NAD^+ and NADH are collectively referred to as fermentation.



The respiration that happens at the minute level in our body, viz., in the cell is called the cellular respiration. It occurs in the presence or absence of oxygen. Any type of cellular respiration begins with glycolysis where a 3-C molecule, pyruvic acid is formed as the end product.

Different cells handle this pyruvate in two major ways, fermentation is one of them. Let us have a detailed look at the fermentation, its types and anaerobic respiration.

Types of Fermentation

There are three different types of fermentation:

Lactic Acid Fermentation

In this, starch or sugar is converted into lactic acid by yeast strains and bacteria. During exercise, energy expenditure is faster than the oxygen supplied to the muscle cells. This results in the formation of lactic acid and painful muscles.

Alcohol Fermentation

Pyruvate, the end product of glycolysis is broken down into alcohol and carbon dioxide. Wine and beer is produced by alcoholic fermentation.

Acetic Acid Fermentation

Starch and sugar present in grains and fruits ferment into vinegar and condiments. For eg., apple cider vinegar.

Fermentation – Anaerobic Respiration

Anaerobic respiration is a type of cellular respiration where respiration takes place in the absence of oxygen. Fermentation is an anaerobic pathway- a common pathway in the majority of prokaryotes and unicellular eukaryotes. During this process, partial oxidation of glucose leads to the formation of acids, gases or alcohol.

In organisms, yeast, for example, the pyruvic acid formed by partial oxidation of glucose is converted to ethanol and carbon dioxide (CO_2). This anaerobic condition is called alcoholic or ethanol fermentation. The whole reaction is

catalyzed by the enzymes, pyruvic acid decarboxylase and alcohol dehydrogenase catalyze. In certain [bacteria](#) and animal muscle cells, under anaerobic conditions, the pyruvic acid is reduced to lactic acid by lactate dehydrogenase. This is called lactic acid fermentation. The end products of these anaerobic pathways make them hazardous processes. For example, a concentration of alcohol above 13 percent produced by yeast cells could kill themselves.

In the alcoholic and lactic acid fermentation, $\text{NADH}+\text{H}^+$ is the reducing agent which is deoxidized to NAD^+ . The energy released in both the processes is not much and the total sum of ATP molecules produced during fermentation is two, which is very less as compared to [aerobic respiration](#). However, this is a commercially employed process in food and beverage industries, and pharmaceutical industries etc.