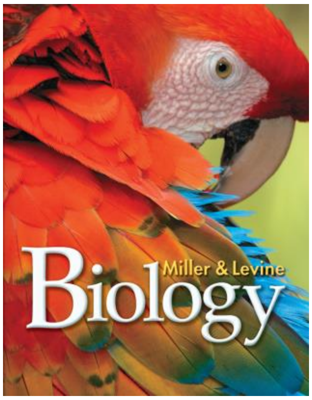


Lesson Overview

9.3 Fermentation

Lesson Overview Fermentation

THINK ABOUT IT

We use oxygen to release chemical energy from the food we eat, but what if oxygen is not around?

Is there a pathway that allows cells to extract energy from food in the absence of oxygen?

Lesson Overview Fermentation

Bell-Ringer:

- How do organisms generate energy when oxygen is not available?

Lesson Overview Fermentation

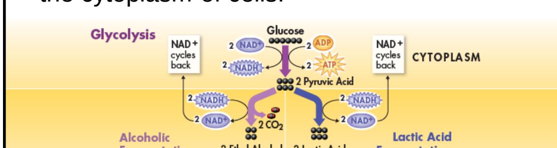
Fermenation

- How do organisms generate energy when oxygen is not available?
- In the absence of oxygen, fermentation releases energy from food molecules by producing ATP.

Lesson Overview Fermentation

Fermentation

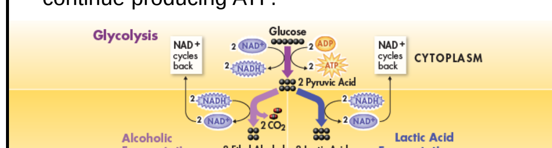
Fermentation is a process by which energy can be released from food molecules in the absence of oxygen. Fermentation occurs in the cytoplasm of cells.



Lesson Overview Fermentation

Fermentation

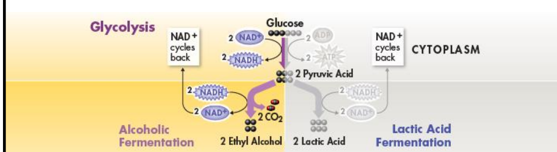
Under **anaerobic** conditions, fermentation follows glycolysis. During fermentation, cells convert NADH produced by glycolysis back into the electron carrier NAD^+, which allows glycolysis to continue producing ATP.



Alcoholic Fermentation

Yeast and a few other microorganisms use alcoholic fermentation that produces ethyl alcohol and carbon dioxide.

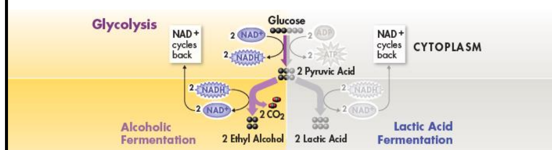
This process is used to produce alcoholic beverages and causes bread dough to rise.



Alcoholic Fermentation

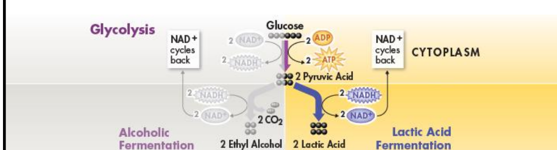
Chemical equation:

Pyruvic acid + NADH → Alcohol + CO_2 + NAD^+



Lactic Acid Fermentation

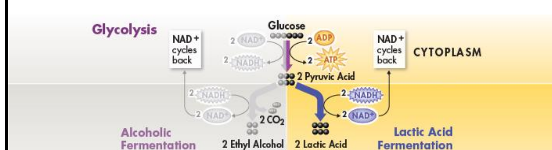
Most organisms, including humans, carry out fermentation using a chemical reaction that converts pyruvic acid to lactic acid.



Lactic Acid Fermentation

Chemical equation:

Pyruvic acid + NADH → Lactic acid + NAD^+



Energy and Exercise

- How does the body produce ATP during different stages of exercise?

Energy and Exercise

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- For short, quick bursts of energy, the body uses ATP already in muscles as well as ATP made by lactic acid fermentation.

For exercise longer than about 90 seconds, cellular respiration is the only way to continue generating a supply of ATP.

Energy and Exercise

- How does the body produce ATP during different stages of exercise?
- For short, quick bursts of energy, the body uses ATP already in muscles as well as ATP made by lactic acid fermentation.
- For exercise longer than about 90 seconds, cellular respiration is the only way to continue generating a supply of ATP.

Quick Energy

Cells normally contain small amounts of ATP produced during cellular respiration, enough for a few seconds of intense activity.

Quick Energy

Lactic acid fermentation can supply enough ATP to last about 90 seconds. However, extra oxygen is required to get rid of the lactic acid produced. Following intense exercise, a person will huff and puff for several minutes in order to pay back the built-up "oxygen debt" and clear the lactic acid from the body.

Long-Term Energy

For intense exercise lasting longer than 90 seconds, cellular respiration is required to continue production of ATP.

Cellular respiration releases energy more slowly than fermentation does.

The body stores energy in the form of the carbohydrate glycogen. These glycogen stores are enough to last for 15 to 20 minutes of activity. After that, the body begins to break down other stored molecules, including fats, for energy.

Long-Term Energy

Hibernating animals like this brown bear rely on stored fat for energy when they sleep through the winter.