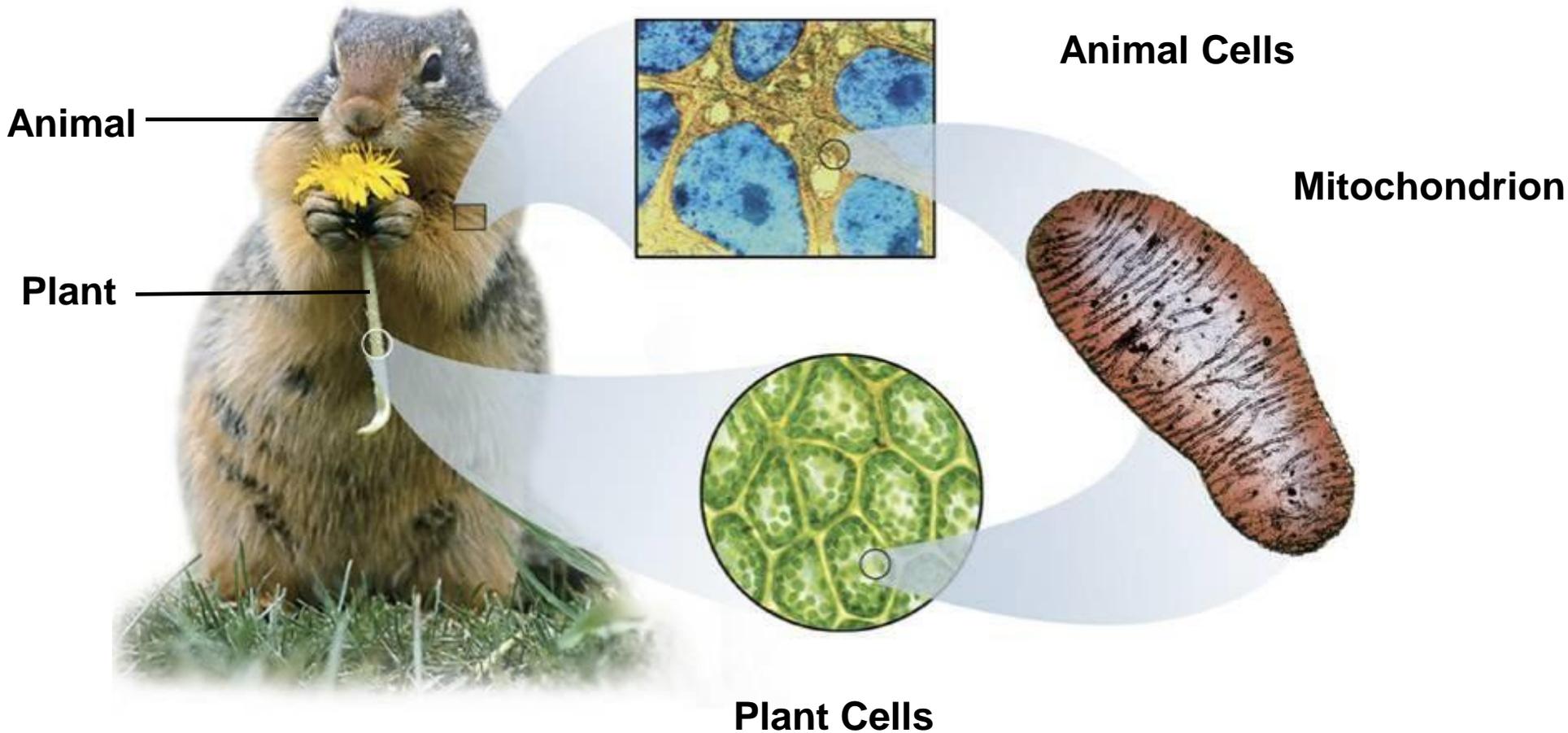
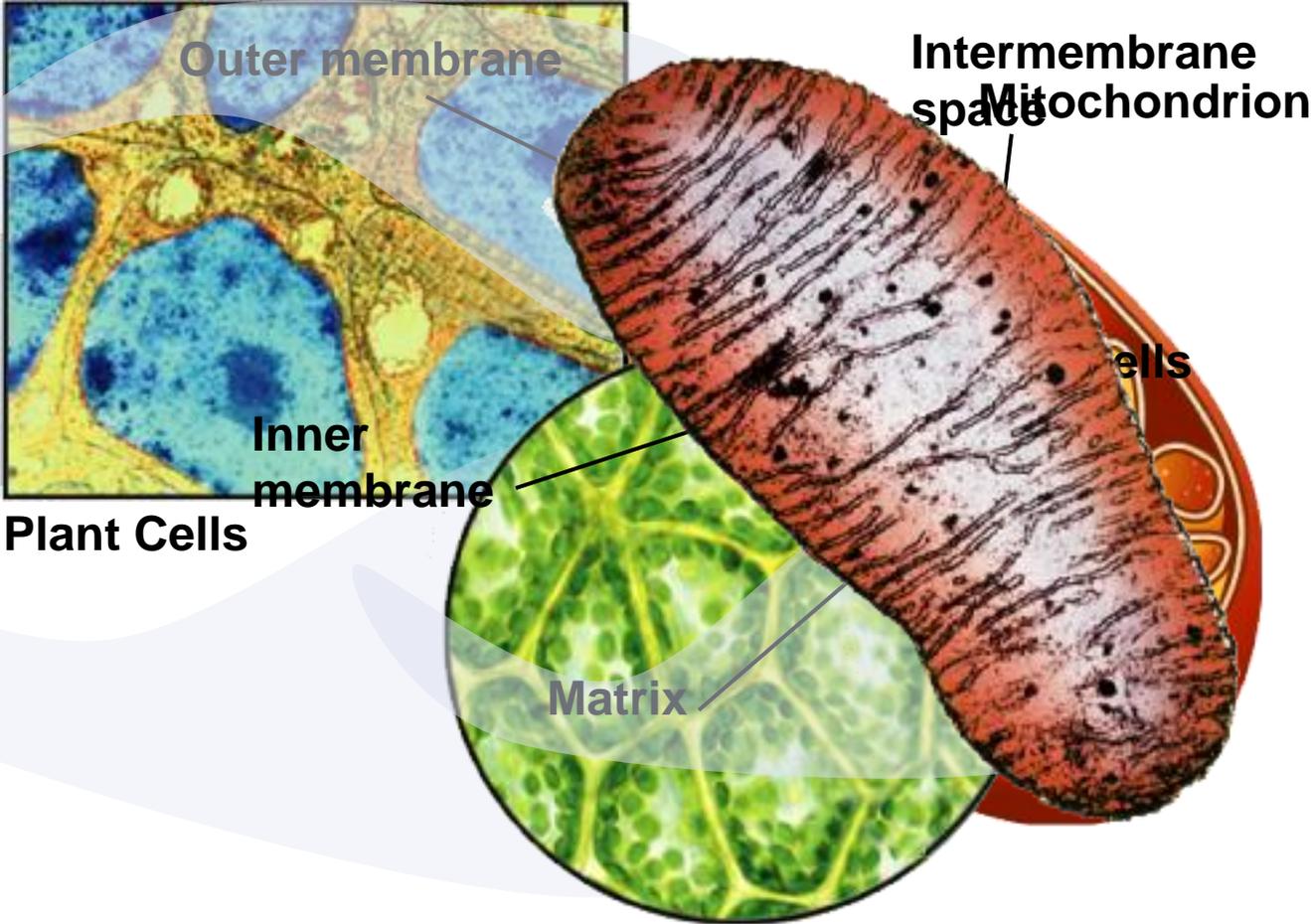


9-1 Chemical Pathways

Food serves as a source of raw materials for the cells in the body and as a source of energy. (pg.221)



Cellular respiration begins in the cytoplasm and ends in the mitochondria. (pg. 221)



Chemical Energy and Food

One gram of glucose ($C_6H_{12}O_6$), when burned in the presence of oxygen, releases 3811 calories of heat energy.

Heat supplies the energy to drive reactions.

A calorie is the amount of energy needed to raise the temperature of 1 gram of water 1 degree Celsius.

Cells don't “burn” glucose.

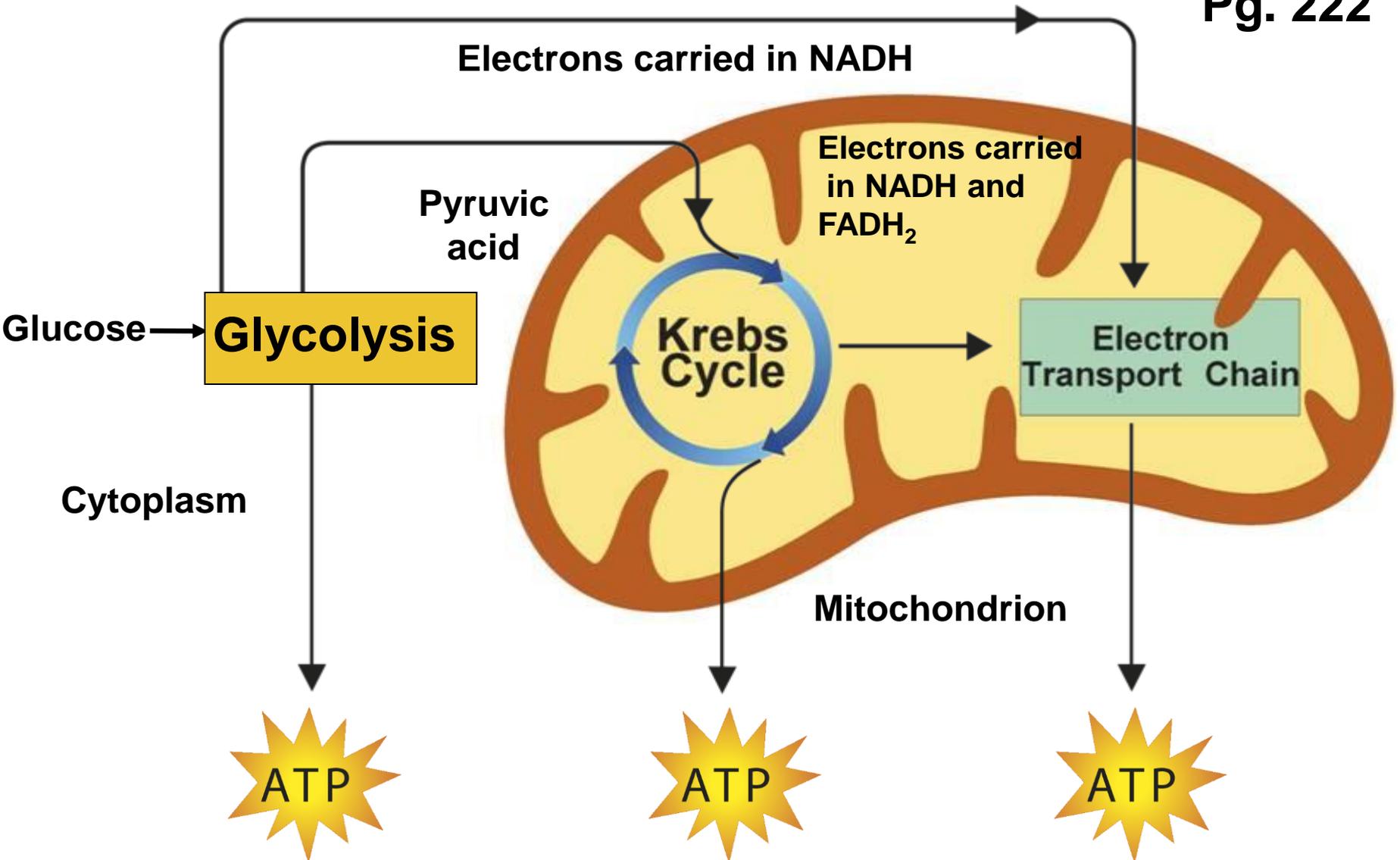
Cells break down glucose through a process called **glycolysis**.

Glycolysis releases a small amount of energy.

What is cellular respiration?

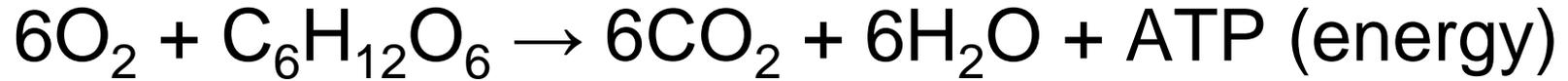
Overview of Cellular Respiration

Pg. 222



Cellular respiration is the process that produces ATP by breaking down glucose and other food molecules in the presence of oxygen.

Equation for cellular respiration is:



oxygen + glucose \rightarrow carbon dioxide + water + Energy

3 Stages of Cellular Respiration

1. Glycolysis

- Takes place in the cytoplasm, anaerobic process

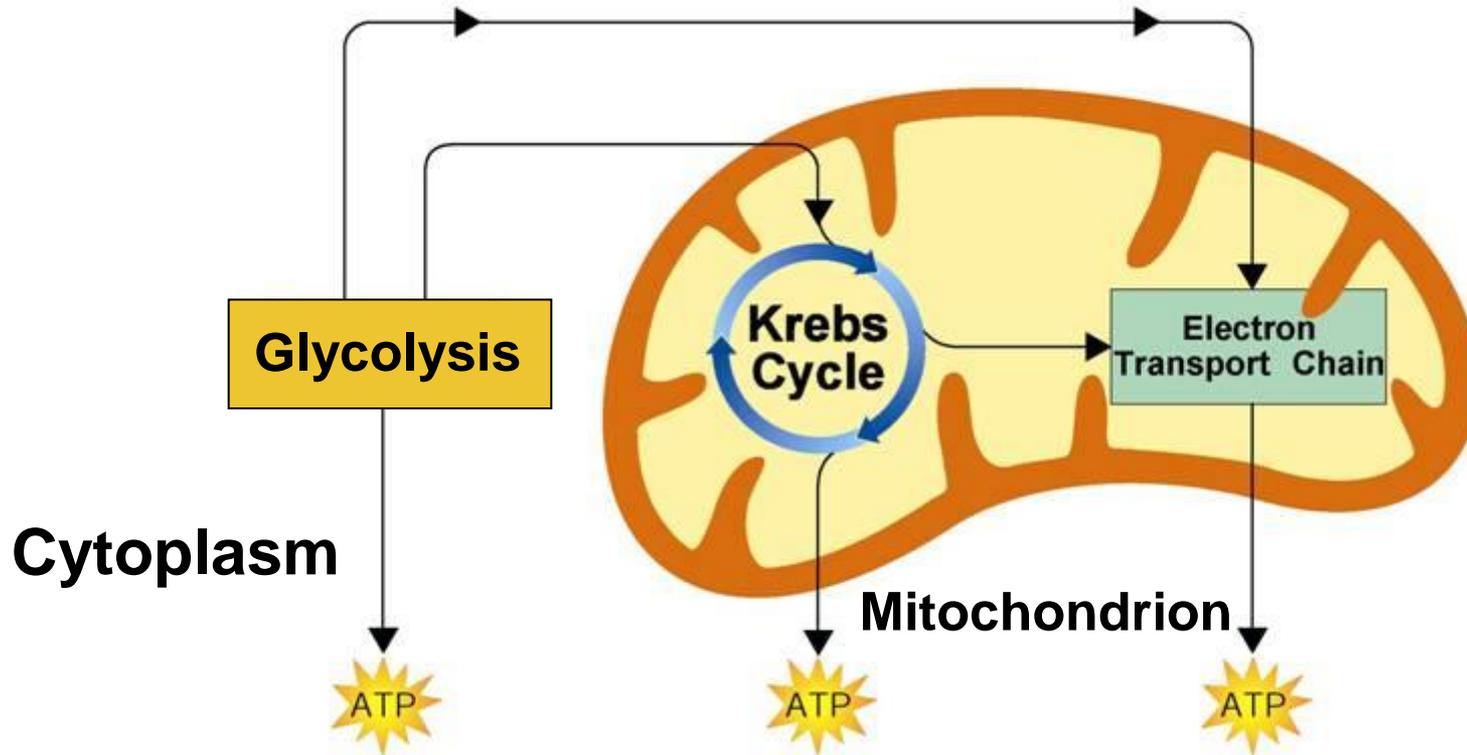
2. Krebs Cycle

- Takes place in the mitochondria, aerobic process

3. Electron Transport Chain

- Takes place in the mitochondria, aerobic process

Cellular Respiration



Glycolysis

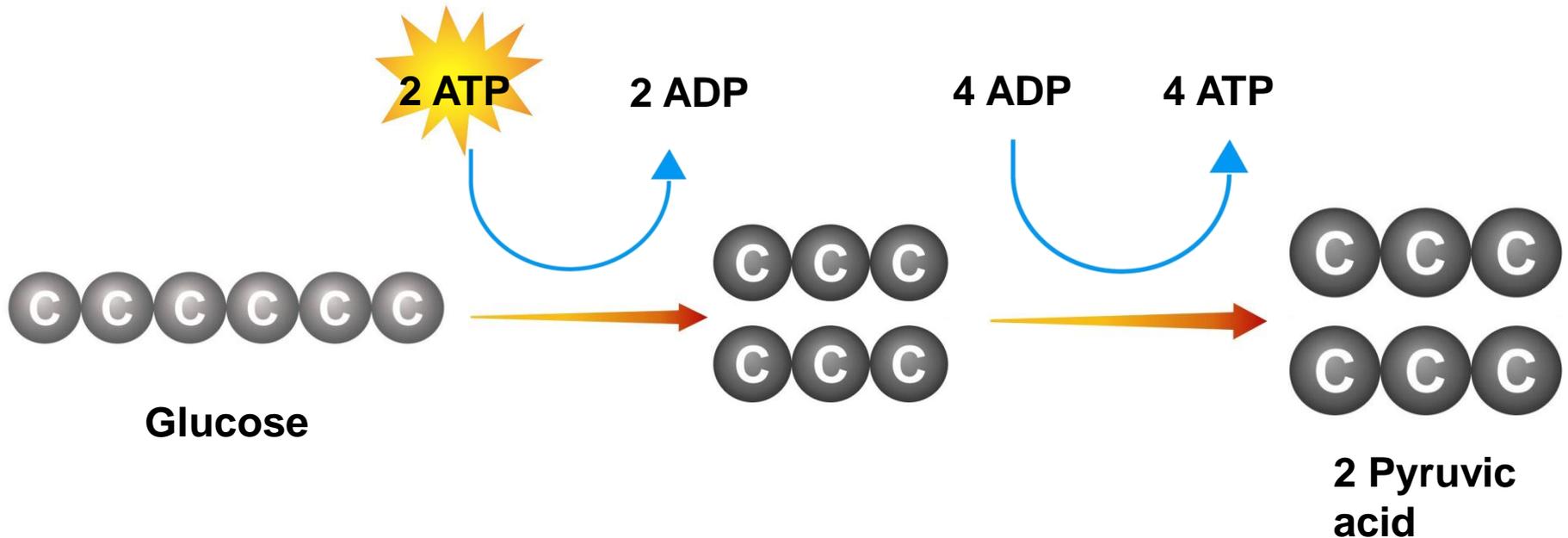
What happens during the process of glycolysis?

Glycolysis

Glycolysis is the process in which one molecule of glucose (6C) produces two molecules of pyruvic acid (3C) and 2 molecules of ATP.

ATP Production

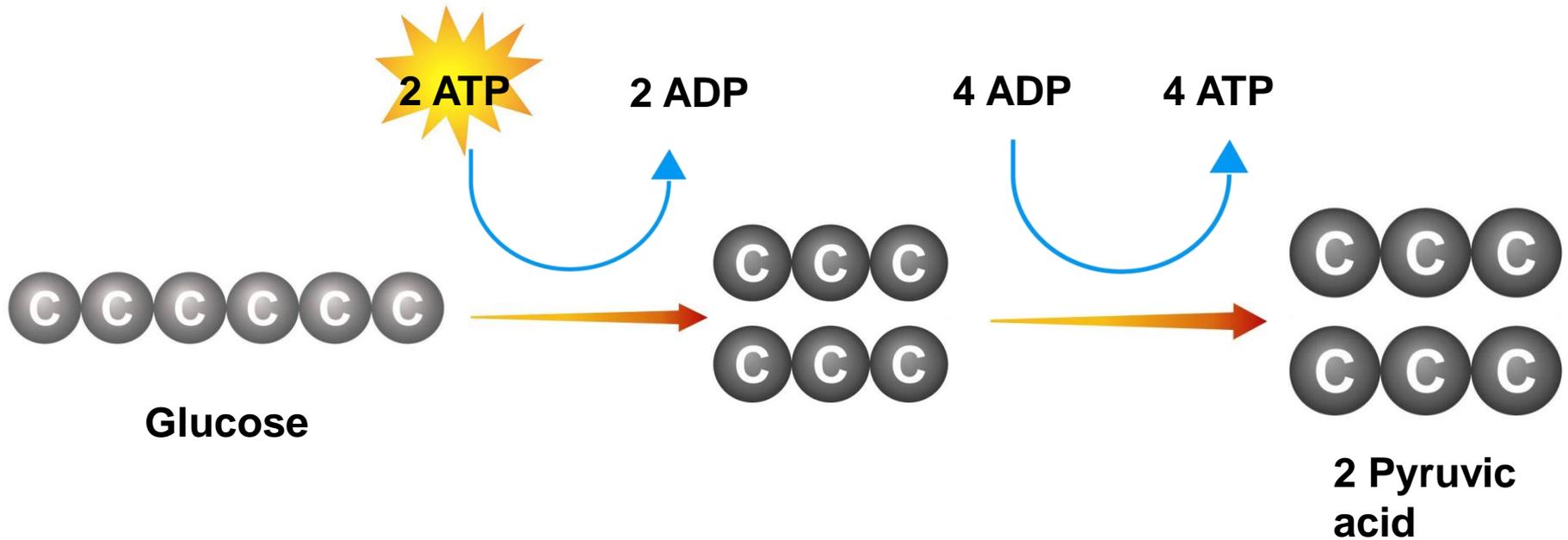
At the beginning of glycolysis, the cell uses up 2 molecules of ATP to start the reaction.



Glycolysis

When glycolysis is complete, 4 ATP molecules have been produced.

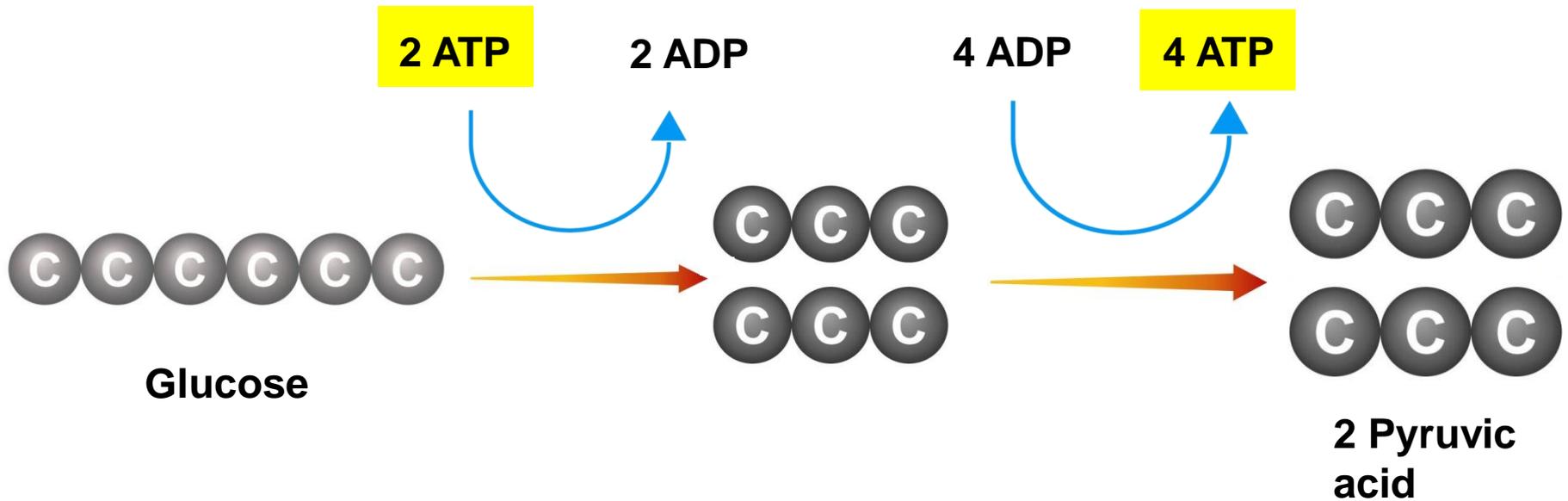
Pg. 223



Glycolysis

This gives the cell a net gain of 2 ATP molecules.

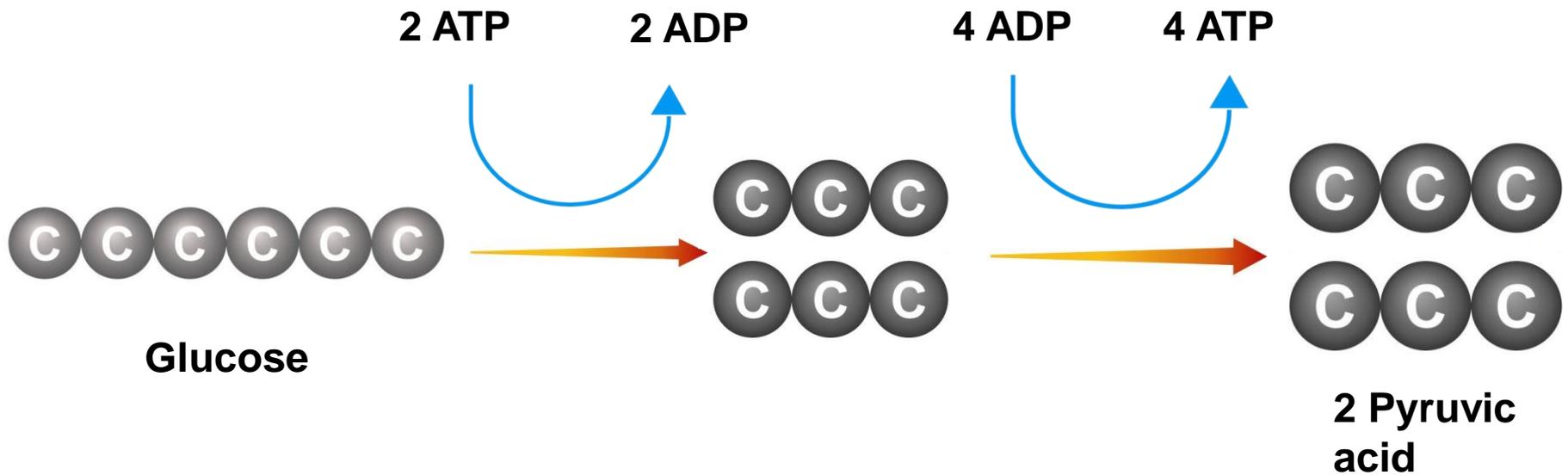
Pg. 223



Glycolysis

Also produced are 2 molecules of pyruvic acid.

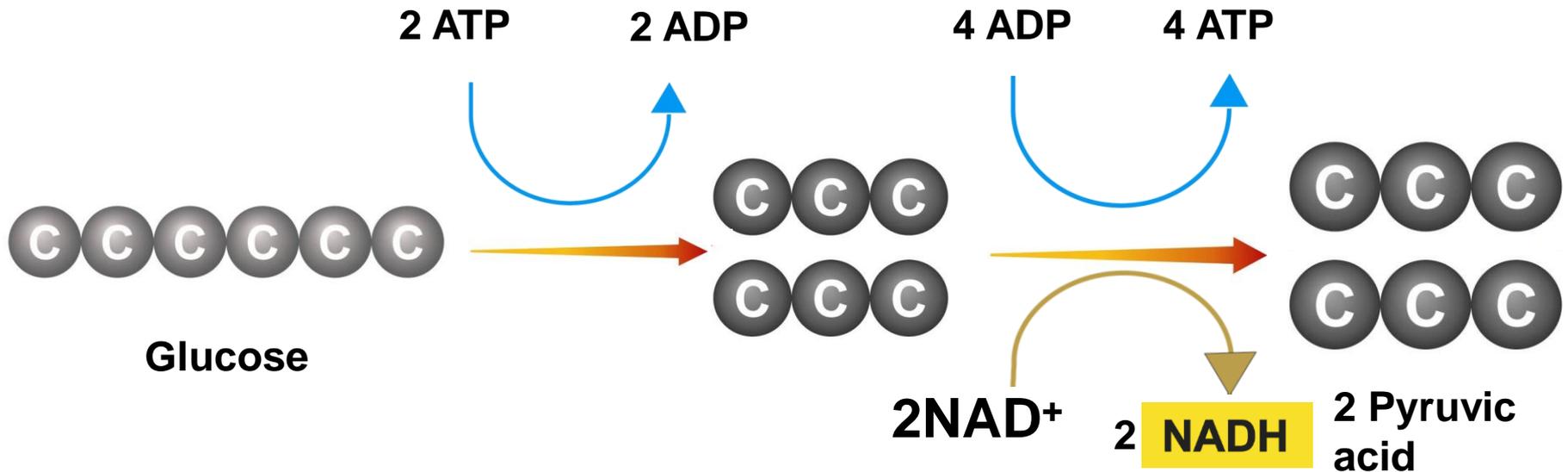
Pg. 223



NADH Production

- 4 high-energy electrons are passed on to an electron carrier called **NAD⁺**.
- Each NAD⁺ accepts a pair of high-energy electrons and becomes an NADH molecule.

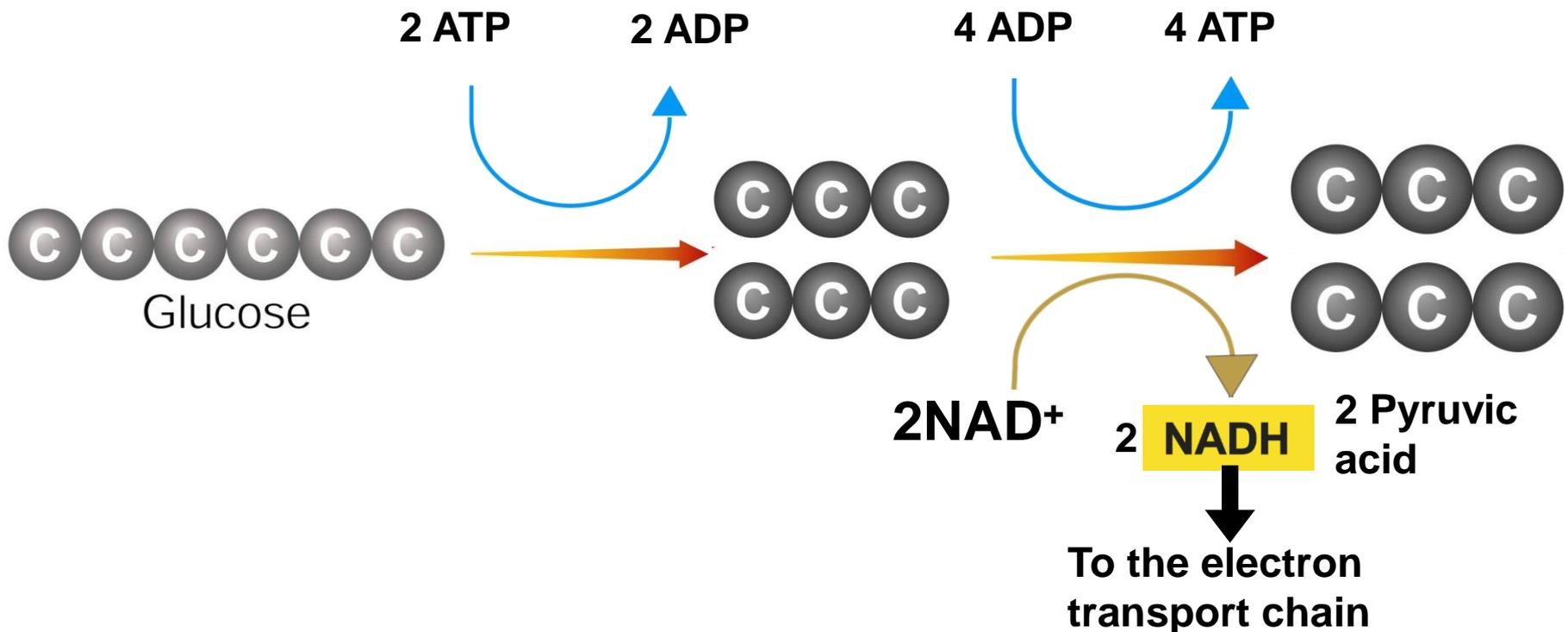
Pg. 223



Glycolysis

The NADH molecule holds the electrons and high energy until they can be transferred to the electron transport chain.

Pg. 223



The Advantages of Glycolysis

- Fast process
- Cells can produce thousands of ATP molecules in a few milliseconds.
- Glycolysis does not require oxygen.

Fermentation

A combined process of glycolysis and a different pathway in the absence of oxygen (**anaerobic**).

Fermentation produces ATP in the absence of oxygen.

What are the two main types of fermentation?

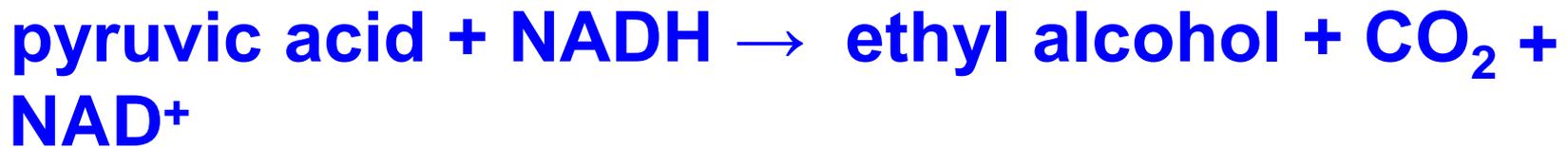


The two main types of fermentation are lactic acid fermentation and alcoholic fermentation.

Alcoholic Fermentation

Yeasts and a few other microorganisms use alcoholic fermentation

Equation for Alcoholic Fermentation:



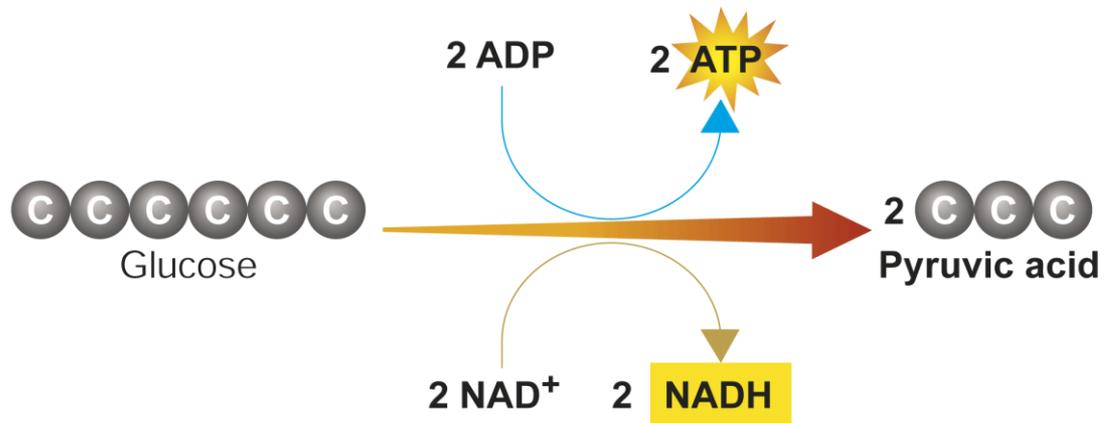
Lactic Acid Fermentation

In many cells, pyruvic acid that accumulates as a result of glycolysis can be converted to lactic acid.

Lactic acid build up in muscle causes pain.

Fermentation

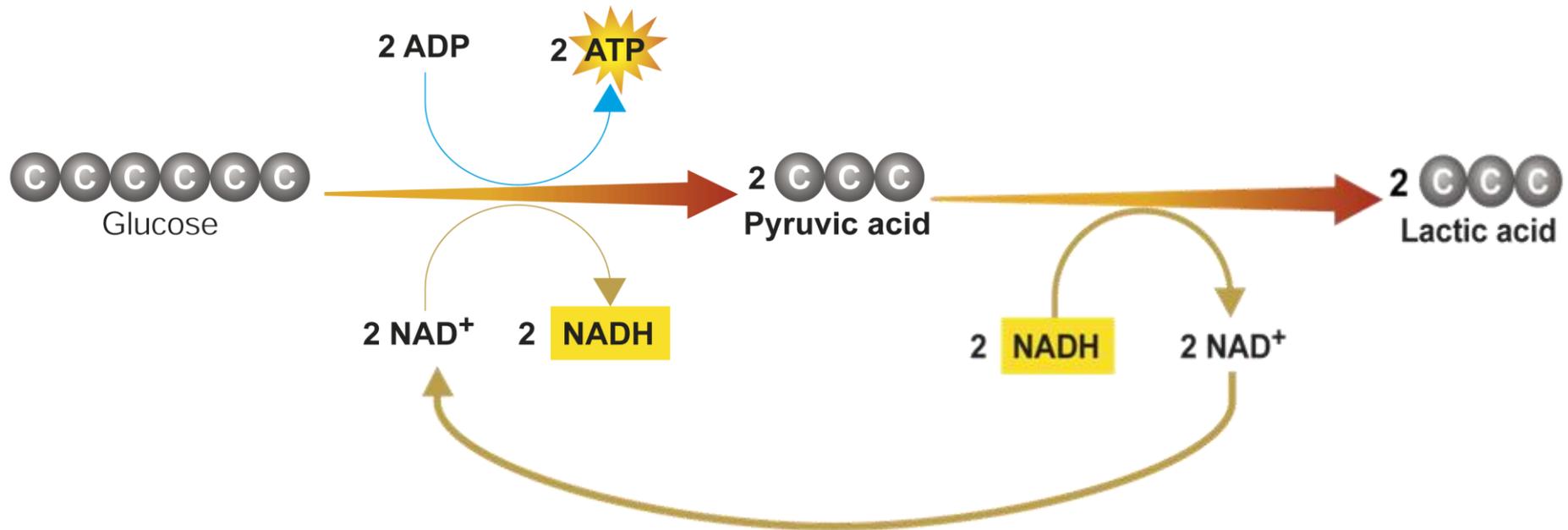
The first part of the equation is glycolysis.



Fermentation

The second part shows the conversion of pyruvic acid to lactic acid.

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Fermentation

Equation for lactic acid fermentation:

