Anaerobic Respiration

Anaerobic respiration is part of cellular respiration that occurs in the absence of oxygen. It takes place in the cytosol of cells and the primary method of energy generation is substrate-level phosphorylation, which is the formation of ATP by direct transfer of a phosphate group from a phosphate intermediate. The first step is glycolysis, which is the breakdown of a 6-carbon glucose molecule into two 3-carbon pyrvuate molecules. 2 ATP molecules are consumed at the start of glycolysis and 4 are produced, resulting in 2 net ATP. The other product is 2 NADH, formed by reducing 2 NAD+. Because oxygen is absent, the pyruvate cannot enter aerobic respiration and go into the second step of anaerobic respiration, fermentation. The goal of fermentation is to regenerate NAD+ so that the cell replenishes its NAD+ stock to undergo glycolysis again. However, waste byproducts are also formed during fermentation. Depending on the type of cell, either lactic acid (muscle) or alcohol (bacteria) are formed.

PLAY PICMONIC

Cytosol

Side-toe-sail

Anaerobic respiration takes place in the cytosol of the cell.

Glucose

Glue-bottle

Glucose is a 6-carbon carbohydrate that is broken down and released as carbon dioxide in order to generate ATP in the cell.

Glycolysis

Glue-laser

Glycolysis is the process of breaking down glucose into a 3-carbon pyruvate to prepare it for aerobic respiration.

Substrate-level Phosphorylation

Sub-sandwich ATP-batteries

Substrate-level phosphorylation is the production of ATP from ADP by a direct transfer of a high-energy phosphate group from a phosphorylated intermediate metabolic compound in an exergonic catabolic pathway.

2 NADH

(2) Tutu Cigarette-H

The total number of NADH generated in glycolysis is 2. NADH are high energy electron carriers that take electrons from the breakdown of glucose and transport them to the electron transport chain.

2 Net ATP

(2) Tutu ATP-battery in Net

Glycolysis costs 2 ATP in the preparation steps and produces a total of 4 ATP per molecule of glucose, resulting in 2 net ATP.

2 Pyruvate

(2) Tutu Pie-roots

Two pyruvate molecules are formed at the end of glycolysis from the breakdown of glucose. These pyruvate molecules then feed into fermentation in the absence of oxygen and aerobic respiration in the presence of oxygen.

Fermentation

Fern

Fermentation is a metabolic pathway that reduces pyruvate to ethanol or lactic acid in the absence of oxygen.

NAD+ Regeneration

Cigarette (+) Growing

The goal of fermentation is to regenerate NAD+ from the NADH so that glycolysis can continue to occur in the absence of oxygen.

Waste Byproduct

Waste-can

Fermentation produces either alcohol or lactic acid as a waste product.