3.4 CELLULAR RESPIRATION

Introduction to Cellular Respiration

Cellular respiration is the process through which living cells release energy from food substances. The released energy becomes available for biological activities such as movement, growth, reproduction, and repair.

Importance of Cellular Respiration

Every living organism requires energy for survival. Cellular respiration provides ATP molecules that supply usable energy for metabolism and cellular functions.

Types of Cellular Respiration

Respiration occurs in two major forms: aerobic respiration and anaerobic respiration. Aerobic respiration requires oxygen, whereas anaerobic respiration takes place without oxygen.

Aerobic Respiration

Aerobic respiration completely breaks down glucose in the presence of oxygen. The process releases a large amount of ATP together with carbon dioxide and water.

Anaerobic Respiration

Anaerobic respiration occurs when oxygen is absent or insufficient. Less ATP is produced compared with aerobic respiration. In yeast cells, alcohol and carbon dioxide may form, while muscle cells produce lactic acid.

Energy Currency of Cells

ATP is called the energy currency of the cell because it stores and transfers energy to different cellular activities.

Relationship Between Photosynthesis and Respiration

Photosynthesis stores energy in glucose molecules, while respiration releases that stored energy for biological use. These processes are interconnected in living systems.

Respiration Equation

During aerobic respiration, glucose combines with oxygen to produce carbon dioxide, water, and ATP energy.

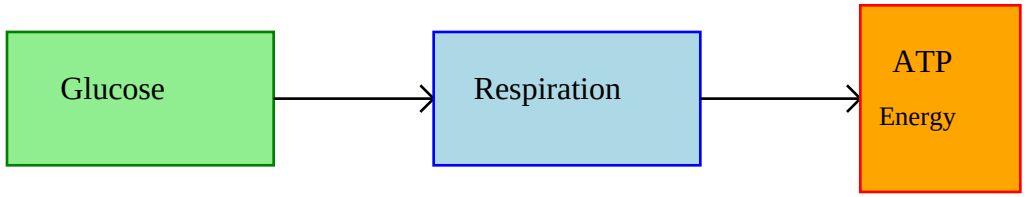
Factors Affecting Respiration

Temperature, oxygen availability, water content, and the amount of glucose influence the rate of cellular respiration.

Importance in Daily Life

Respiration supports heartbeat, brain activity, muscle contraction, active transport, and all metabolic reactions.

Figure: Energy Release During Respiration



Comparison of Aerobic and Anaerobic Respiration

Feature	Aerobic Respiration	Anaerobic Respiration
Oxygen	Required	Not required
ATP Produced	Large amount	Small amount
Products	CO■ and water	Alcohol or lactic acid
Location	Mostly mitochondria	Cytoplasm

Summary

Cellular respiration releases energy stored in food molecules. Aerobic respiration produces large amounts of ATP using oxygen, while anaerobic respiration occurs without oxygen and produces less energy. ATP generated during respiration powers all cellular activities.

Questions and Answers

What is cellular respiration?

It is the process of releasing energy from food molecules.

Why is ATP important?

ATP stores and transfers usable cellular energy.

Which type of respiration requires oxygen?

Aerobic respiration requires oxygen.

What are the products of aerobic respiration?

Carbon dioxide, water, and ATP are produced.

Where does anaerobic respiration occur?

It mainly occurs in the cytoplasm.

Study Notes

- Cellular respiration occurs continuously in living cells.
- Glucose is the main respiratory substrate.
- ATP provides usable energy for cells.
- Oxygen is necessary for aerobic respiration.
- Carbon dioxide forms as a waste product.
- Anaerobic respiration produces less energy.
- Mitochondria are important respiration organelles.
- Respiration supports all life activities.

Respiration in Plants

Plants also perform cellular respiration to release energy from stored food. Respiration occurs day and night in plant cells.

Respiration in Animals

Animal cells continuously require ATP for movement, circulation, digestion, and nervous coordination.

Industrial Importance

Anaerobic respiration in yeast is used in bread making and alcohol production.

Health Importance

Efficient respiration ensures proper functioning of organs and tissues. Disorders affecting respiration reduce energy availability.