

GASEOUS EXCHANGE

Learning outcomes

Students will be able to:

1. differentiate among gaseous exchange, breathing and respiration.
2. describe the process of gaseous exchange in plants by comparing photosynthesis and respiration.
3. identify the different parts of the respiratory system of man.

Gaseous exchange

This is simply the exchange of gases that takes place between the organism and the surrounding environment

Breathing

This is the process that moves the air in and out of the lungs

Respiration

This is the oxidation of food substances with the release of energy in living cells

Gaseous Exchange in Plants

Stomata

The lower epidermis of the leaf contains many minute openings called stomata (singular:stoma). These are more abundant in the lower epidermis of a leaf.

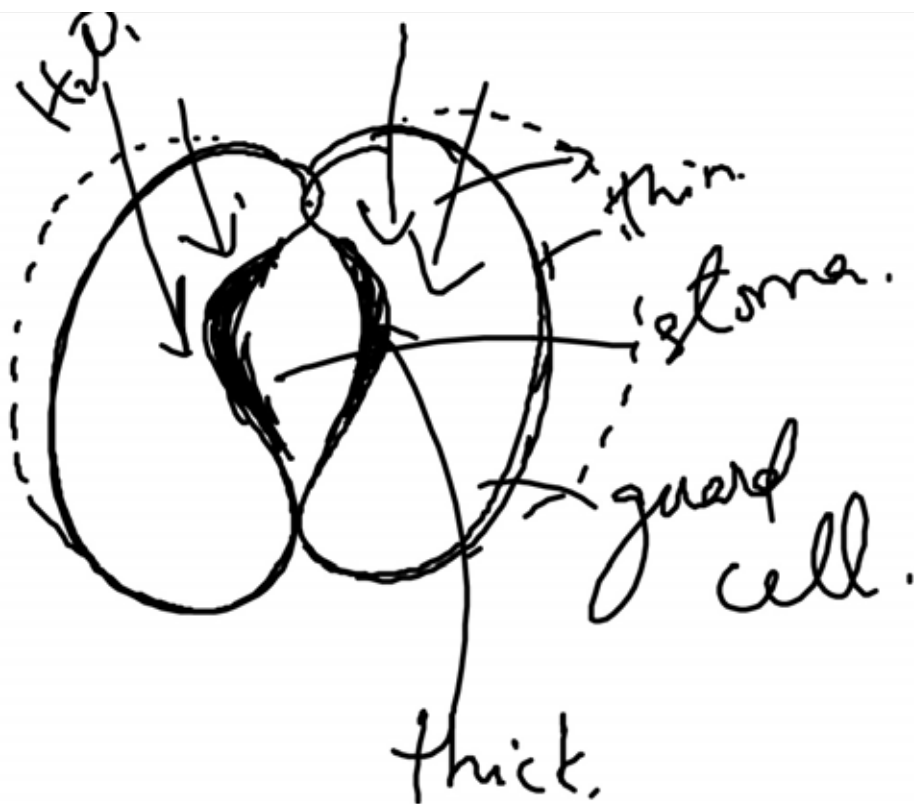
Guard cells

The stomata are bounded by two guard cells which have the following characteristics:

1. They are bean-shaped
2. They contain chloroplasts so they can carry out photosynthesis

3. In sunlight, there is an increase in the **potassium ions** in the guard cells. This, together with the sugars formed as a result of photosynthesis lowers the water potential in the guard cells. As a result, water from other cells enters the guard cells causing them to become turgid and swollen. This causes the stomatal pores to **open**.

At night, the sugars are used up and water leaves the guard cells, so they become flaccid and the stomatal pores **close**. This reduces the amount of water vapour escaping from the leaf.



4. It is through these stomata that gaseous exchange takes place. During the day, carbon dioxide is rapidly used up due to photosynthesis. Therefore carbon dioxide concentration in the leaf becomes lower than in the atmosphere. Therefore, carbon dioxide from the external environment diffuses into the leaf and gets dissolved in the thin film of water surrounding the mesophyll cells.

In leaves and young stems, the exchange of gases takes place through the stomata.

Oxygen from the surrounding air diffuses into the intercellular spaces among the cells of the leaves and the stem. The oxygen dissolves in the moisture on the walls of the cells and then diffuses into the cells. It diffuses from cell to cell to reach those tissues which are not directly connected to the air.

Carbon dioxide produced by respiration diffuses out of the cells through the system of intercellular spaces into the air via the stomata.

Roots get the oxygen from the soil water through the root hairs and carbon dioxide thus produced takes the same route out of the roots.

During photosynthesis oxygen is set free. Some of this oxygen is used for tissue respiration. But during bright sunlight, the rate of photosynthesis is much greater than the rate of respiration. More oxygen is set free than the cells can retain for respiration. As a result, oxygen diffuses out of the leaves through the stomata.

Respiratory System in Man

Multiple Choice Questions

1. The stomata are present more in the

- A. upper epidermis.
- B. lower epidermis.
- C. spongy mesophyll.
- D. palisade mesophyll.

2. The stomata open up during the day due to the building up of

- A. sodium ions.
- B. potassium ions.
- C. chloride ions.
- D. hydrogen ions.

3. The oxygen is set free during photosynthesis. This oxygen

- A. combines with water to form glucose.
- B. is used by the plants for respiration.
- C. is used again for photosynthesis.
- D. is given out at night by plants.

