# Respiration of Organisms

## Introduction

All living things need air (Oxygen) for their survival. Plants and animals need oxygen to release energy from their food. The energy stored in food molecules is released by their oxidation.

- The process which breaks down the food to release energy in the presence of oxygen and enzymes is called **respiration**.
- **Breathing or external respiration:** It is the process of inhaling fresh air ($O_2$) and exhaling used air ($CO_2$). It's a mechanical process which involves pumping air in and out of the lungs.
- **Cellular respiration:** It is the chemical breakdown of glucose inside the cells.
- **Aerobic Respiration:** It is the process which involves the breakdown of glucose into $CO_2$ and water inside the body cells in the presence of oxygen.

$$\text{Glucose} \xrightarrow{\text{Presence of } O_2} \text{Water} + CO_2 + \text{Energy}$$

- **Anaerobic Respiration:** It is the process which involves the breakdown of glucose into $CO_2$ and ethyl alcohol in the absence of oxygen.

$$\text{Glucose} \xrightarrow{\text{Absence of } O_2} \text{Ethyl Alcohol} + CO_2 + \text{Energy}$$

**Differences between Aerobic and Anaerobic Respiration :**

| Aerobic Respiration | Anaerobic Respiration |
|---|---|
| 1. It occurs in the presence of oxygen | 1. It occurs in the absence of oxygen |
| 2. Glucose is oxidised completely | 2. Glucose is oxidised incompletely |
| 3. End products are $CO_2$, water and energy | 3. End products are ethyl alcohol and $CO_2$ and energy |
| 4. More energy is produced (38 ATP from one gram mole of glucose) | 4. Very little energy is produced (2 ATP from one gram mole of glucose) |
| 5. Occurs in most of the plants and animals | 5. Occurs in few organisms like yeast, bacteria and some parasitic worms |

## Respiration in Humans

Human respiratory tract involves the following :

- **External nostrils:** First part of respiratory system. It opens into nasal cavity and is meant for inhalation of air from outside.
- **Nasal cavity:** This cavity is separated from oral cavity by means of a hard and bony palate. It is lined by ciliated columnar epithelial cells that are rich in mucus, it brings about warmth, moistening and sterilization of air It contains hair and mucus which entrap the dust particles. Nasal cavity opens into it and it leads to pharynx.

- **Pharynx:** It is a common part between both alimentary canal and respiratory system.
- **Larynx:** It is an enlarged part of trachea which is also called as `voice box'. It produces voice by passage of air between vocal cords. It contains four different types of cartilages among them a 'C' shaped thyroid cartilage protruding out in neck region is called Adam's apple.
- **Trachea:** It is also called as wind pipe and is 10-12 cm long tube. Its walls are supported by cartilaginous rings which prevents them to collapse when air is absent in them.
- **Bronchi:** Trachea is branched into two bronchi left and right each of which enters into the lungs.
- **Lungs:** These are two light weight spongy pouches covered by a membrane called Pleura. Bronchi are further branched into several bronchioles, at the end of bronchioles alveolar sacs or alveoli are present which are rich in blood capillaries and are thin walled.
- **Diaphragm:** It is a sheet of muscles that lies below the lungs and separates thoracic cavity from abdominal cavity.

- **Inhalation Process**

  During inhalation, the ribs move upwards and outwards and the diaphragm moves down. This increases the volume of thoracic cavity. The lungs being elastic also increases in size and the air pressure in the
  lung decreases. Air from the atmosphere having higher pressure rushes into the lungs through nostrils and air passages and the lungs filled with fresh air or one can say that during inhalation, ribs move up and outwards and diaphragm moves down. This movement increases space in our chest cavity and air rushes into the lungs. The lungs get filled with air.

- **Exhalation Process**

  During inhalation, the ribs move downwards and inwards and the diaphragm moves up. When the ribs and diaphragm return to their original position, the volume of thoracic cavity decreases along with the lungs. This increases the air pressure inside the lungs and the air from the lungs is pushed out. Also one can say that during exhalation, ribs move down and inwards, while diaphragm moves up to its former position. This reduces the size of the chest cavity and air is pushed out of the lungs. These movements in our body can be felt.

## Respiration in other animals

- **Respiration in Fishes (Aquatic Respiration):** In Fishes exchange of gases occurs through gills (gills have fine blood capillaries). During breathing, fish takes in water through its mouth and pass it over the gills, the oxygen present in water is extracted by gills and water is removed out through gill slits. This oxygen is now absorbed by blood and is carried to all parts of the body and at the same time carbon dioxide rich blood from body tissues is sent back to the gills and is expelled out into the surrounding water.

- **Respiration in Earthworm (Cutaneous Respiration):** In organisms like earthworm and leech exchange of gases occurs through their skin as their skin is very thin and moist. It is rich in blood supply so the oxygen is absorbed by moist skin of earthworm and is transported to all the cells of body through blood. The carbon dioxide from body cells diffuses into the blood and expelled out through skin.