# Respiration in Humans

## Introduction

Respiration is a vital biological process in which oxygen is taken into the body, used for energy production, and carbon dioxide is expelled. Human respiration involves the coordinated functioning of various organs, primarily the lungs.

## Why Do We Breathe Faster During Exercise?

- During exercise, muscles require more oxygen to produce energy rapidly.
- To meet this increased demand, breathing rate rises, allowing more oxygen intake.
- The extra carbon dioxide produced as a byproduct is removed through exhalation.
- This ensures a proper balance of oxygen and carbon dioxide in the body.

## Breathing Process

- Breathing involves inhalation (taking in oxygen-rich air) and exhalation (expelling carbon dioxide-rich air).
- The lungs are the primary organs responsible for breathing.
- Air is usually taken in through the nose, sometimes through the mouth.
- If nostrils and mouth are tightly closed, breathing becomes impossible, causing discomfort.
- The process of breathing is continuous and essential for life.
- Mountaineers carry oxygen cylinders as oxygen levels are lower at high altitudes.

## Breathing Rate

- A breath consists of one inhalation and one exhalation.
- The number of breaths per minute is called the breathing rate.
- An average adult at rest breathes 15–18 times per minute.
- During sleep, breathing rate is slower as the body requires less energy.
- Physical activities like exercise, running, and weightlifting increase breathing rate.
- During heavy exercise, breathing rate can rise to 25 breaths per minute or more.

## Mechanism of Breathing

### i. Inhalation (Inspiration):

- Ribs move upwards and outwards.
- The diaphragm moves downward, increasing the volume of the thoracic cavity.
- This creates lower pressure inside the lungs, drawing air in.

### ii. Exhalation (Expiration):

- Ribs move downward and inward.
- The diaphragm moves up, reducing thoracic cavity volume.
- Air pressure inside the lungs increases, forcing air out.

### Observations:

- The reaction produces carbon dioxide gas.
- Carbon dioxide turns lime water milky due to the formation of calcium carbonate.
- This reaction confirms the presence of carbon dioxide.

**Activity to Demonstrate Breathing Mechanism**

**Materials:**

- Transparent plastic bottle
- Y-shaped tube
- Balloons
- Rubber sheet
- Rubber band

**Method:**

- Cut the bottom of the plastic bottle.
- Make a hole in the cap and insert the Y-shaped tube with balloons attached.
- Seal the cap with plasticine.
- Attach a thin rubber sheet to the bottom opening.
- Pulling the rubber sheet down inflates the balloons (inhalation).

Pushing the rubber sheet up deflates the balloons (exhalation).

**Conclusion:** The rubber sheet mimics the diaphragm, demonstrating the breathing process.

## Gaseous Exchange in Lungs

- Lungs contain bronchi that branch into bronchioles ending in alveoli.
- Alveoli have thin walls surrounded by capillaries where gas exchange occurs.
- Oxygen diffuses from alveoli into the blood.
- Carbon dioxide diffuses from blood into alveoli to be exhaled.
- Red Blood Cells (RBCs) contain hemoglobin, which binds with oxygen and transports it to body cells.

## Composition of Inhaled and Exhaled Air

| Gas | Inhaled Air | Exhaled Air |
|---|---|---|
| Oxygen | 21% | 16.4% |
| Carbon Dioxide | 0.04% | 4.4% |
| Water Vapor | Little | A lot |

**Activity to Show Carbon Dioxide Production**

**Materials:**

- Glass/plastic bottle
- Straw
- Lime water

**Method:**

- Pour lime water into the bottle.
- Insert a straw and blow air into the lime water.
- Lime water turns milky, proving the presence of carbon dioxide in exhaled air.

## Human Respiratory System Components

### i. Nose:

- Contains a nasal cavity with fine hairs and mucus to trap dust and microbes.
- Mucus moistens and filters the air.

### ii. Pharynx:

- The passage connecting the nasal cavity to the trachea.
- The opening into the trachea is called the glottis.

### iii. Trachea (Windpipe):

- A cylindrical tube supported by cartilaginous rings to prevent collapse.

### iv. Bronchi

- The trachea splits into two bronchi, each leading to a lung.
- Inside the lungs, bronchi branch into smaller bronchioles.

### v. Lungs:

- Contain alveoli where oxygen is absorbed into the blood, and carbon dioxide is expelled.

### Sneezing

- Air contains dust, pollen, and smoke particles.
- These irritants can bypass nasal hair and reach the nasal passage.
- The body expels them through sneezing, a reflex action.

### Conclusion

Respiration in humans is a complex yet essential process that ensures oxygen supply for energy production and the removal of carbon dioxide. The lungs, diaphragm, and respiratory passages work together to maintain efficient gas exchange, supporting overall health and bodily functions.