

RESPIRATION

Introduction

Respiration refers to the **process by which organisms exchange gases**, typically oxygen (O_2) and carbon dioxide (CO_2), with their environment. This process is vital for the survival of most aerobic organisms, including humans.

Types:

- **External Respiration**
- **Internal Respiration**

External Respiration:

This is the process of exchanging gases between an organism and its external environment.

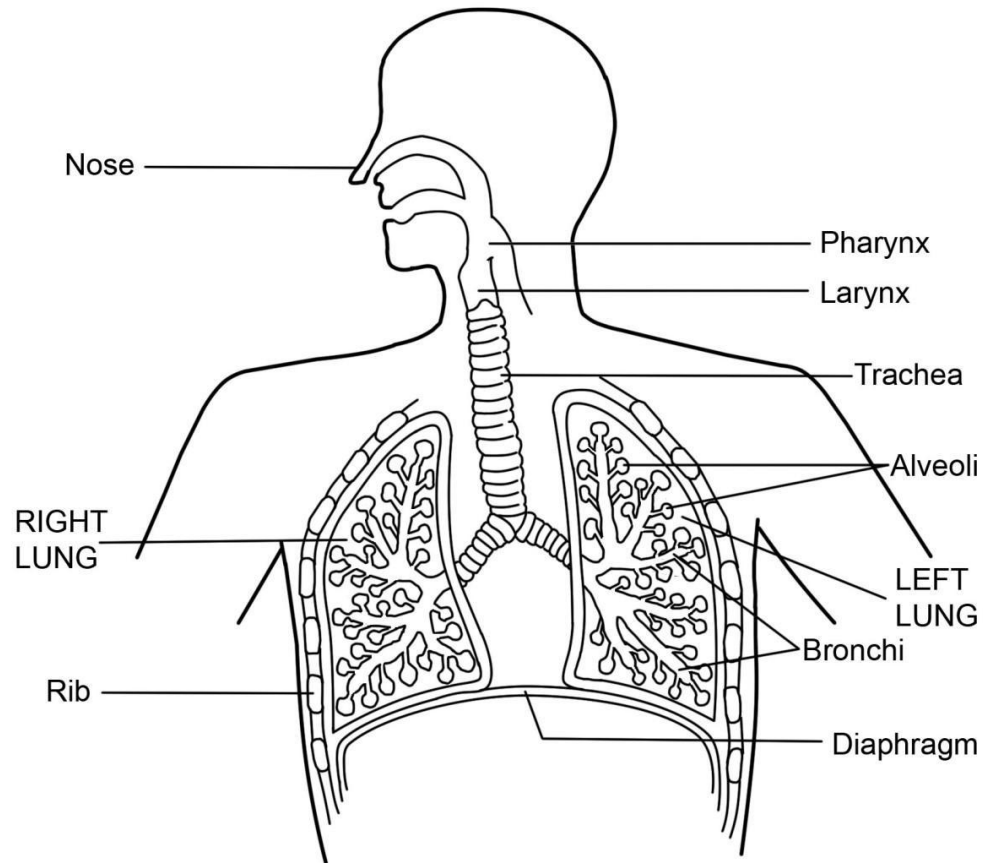
In humans and many animals, external respiration occurs in the respiratory system, primarily in the lungs.

Internal Respiration:

Internal respiration, also known as cellular respiration, occurs within the cells of an organism.

This process involves the utilization of oxygen to produce energy.

Humans respiratory system



In humans, the respiratory system includes organs such as the nose, mouth, trachea, bronchi, and lungs.

Functions of respiratory system's

Inhalation: The process of breathing in air, which brings oxygen into the body.

Exhalation: The process of breathing out air, which removes carbon dioxide from the body.

Gas Exchange: Oxygen in the inhaled air diffuses into the bloodstream, while carbon dioxide from the blood diffuses into the lungs to be exhaled.

Maintaining Acid-Base Balance: The respiratory system helps regulate the body's pH by controlling the elimination of carbon dioxide, which can influence blood acidity.

Ventilator

A ventilator, also known as a mechanical ventilator or a respirator, is a medical device that assists individuals with breathing when they are unable to do so adequately on their own.

Ventilators are commonly used in critical care settings, such as intensive care units (ICUs), during surgery and in emergency medicine.

They can provide mechanical ventilation to support a patient's respiratory function.

Types of ventilators

- Face mask ventilators
- Mechanical ventilators
- Manual resuscitator bags
- Tracheostomy ventilators
- Intermittent Positive Pressure Ventilation (IPPV)

The choice of ventilator type and mode depends on the patient's condition, their lung mechanics, and the specific goals of ventilation therapy.

Medical professionals, such as respiratory therapists and intensivists, determine the most appropriate type and settings for each patient to optimize their respiratory support while minimizing complications.

Types of ventilators

Face mask ventilators

- A face mask ventilator is a noninvasive method of supporting a person's breathing and oxygen levels.
- To use one, a person wears a mask that fits over the nose and mouth while air blows into their airways and lungs.

Mechanical ventilators

- Mechanical ventilators are machines that take over the breathing process entirely.
- Doctors use these when a person cannot breathe on their own.

Types of ventilators

Manual resuscitator bags

Manual resuscitator bags are pieces of equipment that allow people to control the airflow of their ventilator with their hands.

These devices consist of an empty bag, or “bladder,” that a person squeezes to pump air into the lungs.

Tracheostomy ventilators

A tracheostomy is a procedure where a doctor creates an opening in the windpipe and inserts a tube, which allows air to flow in and out.

This enables a person to breathe without using their nose or mouth.

Types of ventilators

Intermittent Positive Pressure Ventilation (IPPV)

- IPPV is a traditional mechanical ventilation mode in which the ventilator delivers breaths to the patient at regular intervals.
- These breaths are delivered as positive pressure, meaning the ventilator forces air into the patient's lungs to inflate them.

Within IPPV, there are various modes and types of ventilators:

- Volume-Cycled Ventilators
- Pressure-Cycled Ventilators
- Time-Cycled Ventilators
- Volume-Assured/Pressure-Controlled Ventilators
- Bilevel Positive Airway Pressure (BiPAP) Machines
- Adaptive Support Ventilation (ASV)

Risks of using ventilators

- [atelectasis](#), which occurs when the lungs do not expand fully, reducing the amount of oxygen that enters the bloodstream
- [aspiration](#), or breathing objects or fluids, such as saliva, into the airways
- lung damage, which can result from high air pressure or high oxygen levels
- [pulmonary edema](#), which occurs when fluid builds up inside the air sacs in the lungs
- [pneumothorax](#), which occurs when air is leaking from the lungs into the space just outside of them, causing [pain](#), [shortness of breath](#), and — in some cases — complete lung collapse
- [infections](#), which can include [sinus infections](#)
- airway obstruction
- long-term vocal cord damage as a result of intubation
- [blood clots](#) or [bedsores](#) as a result of lying in one position for long periods
- [muscle weakness](#), if a person stays on a ventilator for a long time
- [delirium](#), which can lead to [psychological trauma](#) or [post-traumatic stress disorder](#)

Intermittent Positive Pressure Breathing (IPPB)

- IPPB is a respiratory therapy technique that assists individuals in breathing by delivering intermittent pulses of air at a controlled pressure.

(who have difficulty breathing on their own)

- While traditional IPPB units have been used in the past, modern respiratory care has evolved significantly, and electronic devices with advanced monitoring capabilities have become more common.

Overview of how IPPB works

Purpose: IPPB is used to improve lung function, oxygenation, and ventilation in patients

Mechanism: By delivering a controlled volume or pressure of air into the lungs during inspiration.

Components: generates the pressure, a circuit or tubing that delivers the pressurized air to the patient, and a mask or mouthpiece through which the patient breathes.

Settings: The settings on an IPPB machine can be adjusted based on the patient's needs. This includes the inspiratory pressure, inspiratory time, and respiratory rate.

Delivery: The machine delivers a preset volume or pressure of air for a specified duration, followed by a period of exhalation.

Monitoring: During IPPB treatment, the patient's vital signs, oxygen saturation, and respiratory effort are monitored closely.

Any signs of distress or discomfort are noted, and adjustments to the settings may be made as needed.

Electronic IPPB

An electronic IPPB unit with monitoring for all respiratory parameters would be a **sophisticated device designed to deliver assisted breaths to patients while monitoring various respiratory parameters.**

An electronic IPPB unit with monitoring for all respiratory parameters

- **Pressure Control**
- **Volume Control**
- **Inspiratory Time Control**
- **Respiratory Rate Control**
- **Monitoring**
- **Oxygen Saturation (SpO₂):** Measures the oxygen level in the blood.
- **End-Tidal CO₂ (ETCO₂):** Measures the level of carbon dioxide at the end of exhalation
- **Respiratory Rate:** Measures the number of breaths per minute.
- **Tidal Volume:** Measures the volume of air moved in and out of the lungs with each breath.
- **Peak Inspiratory Pressure (PIP):** Measures the maximum pressure applied to the airways during inspiration.
- **Alarms:** high or low oxygen saturation, high or low respiratory rate, or high peak inspiratory pressure.
- **Data Recording**