

Respiratory system

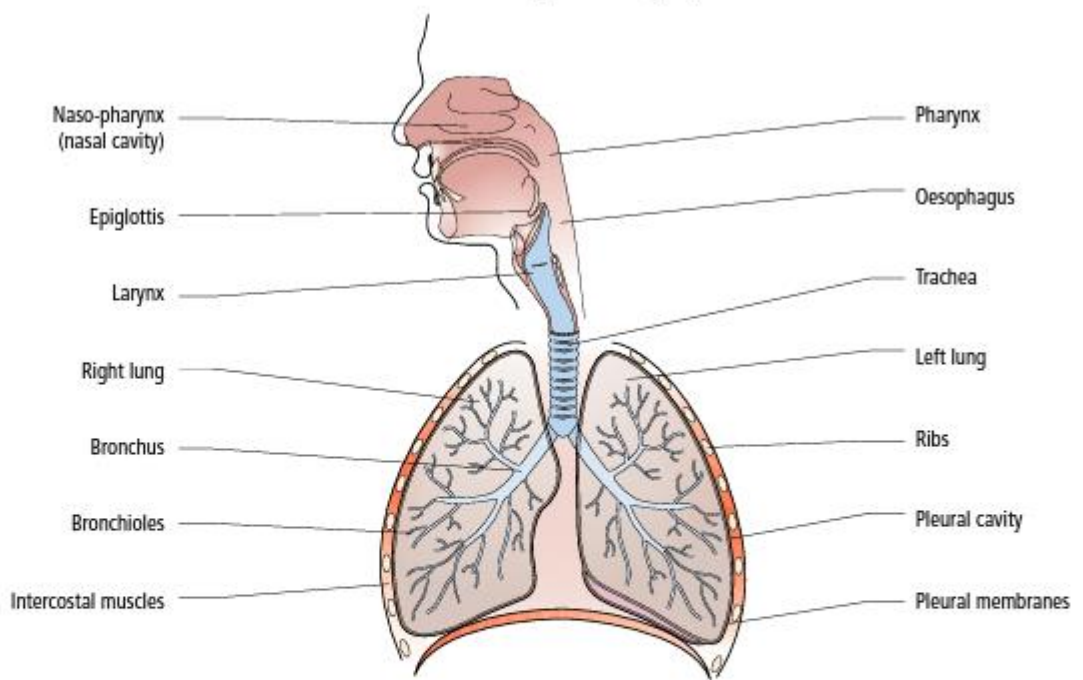
The respiratory system is responsible for the process by which vital oxygen is extracted from the air and made available for use by every cell of the human body. The air that we breathe contains only 21 per cent oxygen and of that, only 4 per cent is utilised by the respiratory system. Without oxygen the body's cells die within two or three minutes, with the brain cells being most sensitive to a lack of oxygen resulting in brain damage.

The respiratory system is the most important excretory system in the human body as it removes the waste product produced by this process – carbon dioxide – and expels it into the external environment. If carbon dioxide is allowed to accumulate in the body, it becomes poisonous and therefore dangerous.

Most of the organs of the respiratory system lie within the thoracic cavity (chest) of the body, with the openings of the mouth and nose providing the link to the external environment.

The rates at which oxygen is inhaled and carbon dioxide exhaled are determined within the respiratory centre situated in the medulla oblongata of the brain stem.

Structures of the respiratory system



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- Nose: consists of two nasal cavities; moistens, warms and filters air.
- Pharynx: two distinct areas – the back of the nose and back of the throat. The air continues to be warmed in the pharynx.
- Larynx (voice box): when air passes over the vocal chords the voice is created; during swallowing the larynx is closed off by the epiglottis.

- Trachea: the main airway from the nose and mouth to the lungs. Rings of cartilage hold the trachea open during breathing.
- Bronchi: two tubes derived from the trachea, one into each lung.
- Bronchioles: smaller tubes which branch from the bronchi within the lung tissue and divide into even smaller tubes that lead to the alveoli. There are no cartilage rings present.
- Alveoli: small sacs where gaseous exchange takes place (external respiration). Surrounded by numerous blood capillaries.
- Lungs: two lungs that lie in the thoracic cavity.
- Pleura: a membrane that lines the outer surface of each lung and the inside of the thoracic cavity; between is a space called the pleura cavity.
- Diaphragm: a thin sheet of muscle that separates the thoracic and abdominal cavities; when it lowers it increases the chest cavity and causes air to be drawn into the lungs.

Stages of respiration

There are two stages of respiration that deliver vital oxygen and remove carbon dioxide from the tissues:

- external respiration: the exchange of oxygen and carbon dioxide with the external environment, the air.
- internal respiration: the exchange between the internal environment at the tissues known as gaseous exchange.

External respiration

The thoracic cavity exists within a 'vacuum' and when the volume of this cavity increases by the lowering of the diaphragm and the raising of the ribs, the lungs inflate and air is drawn into the body (as long as either the nose or mouth is open).

The oxygen in the air diffuses through the wall of the alveoli into the blood and carbon dioxide diffuses from the blood through the wall into the alveoli.

Internal respiration

This is the diffusion of oxygen from the blood into any of the tissues for use by the body's cells and the waste product carbon dioxide produced by the cells during metabolism into the blood.

Principles of gaseous exchange

Internal and external respiration relies on the process of diffusion, which is defined as:

'Gases diffuse from a higher pressure to a lower pressure until equal pressure is achieved.'

Disorders of the respiratory system

Disease/disorder	Cause	Description
Asthma	Allergen/antigen such as a micro-organism or cold air	Lining of the airway becomes inflamed and swells and the muscles within the walls of the airway tighten; together there is a narrowing of the airway and the person has difficulty breathing, as well as coughing, wheezing and a tight feeling in the chest
Hay fever	Allergen is usually pollen or spores from plants	When the pollen enters the airway the linings release histamine, which brings about the allergic reaction of sneezing, runny nose, watery and itchy eyes
Bronchitis	Acute bronchitis is caused by a respiratory viral infection, e.g. cold or flu	Structures of the respiratory system become inflamed, starting with the nose, sinuses and throat and spreading to the lungs. Symptoms are chest pain, cough with mucous, wheezing, shortness of breath and fatigue
Pneumonia	Infection of the lungs caused by viruses, bacteria or fungi	Susceptible people are the young and the elderly where there is a chance of death if left untreated. Other risk factors are smoking, recent cold or flu, heart disease. Symptoms include cough, fever, shortness of breath, sharp or stabbing chest pain
Pleurisy	Pneumonia or other chest infections can lead to pleurisy	Inflammation of the lining of the lungs, leading to sharp chest pain during breathing and coughing
Emphysema	Prolonged bouts of other respiratory conditions such as bronchitis. Caused by smoking or exposure to gases and smoke, e.g. while at work	Destruction of the lung tissue, resulting in permanent narrowing of the airways leading to breathing difficulties
Sinusitis	Inflammation of the linings of the sinuses caused by a bacterial or viral infection	Symptoms are runny or blocked nose, pain or tenderness in the face, headache, pressure problems with the ears and loss of taste and smell
Rhinitis	Can be caused by a viral infection such as a cold but also as a response to an allergen such as smoke, perfumes, paint fumes, etc.	Inflammation of the lining of the nose temporarily giving rise to cold-like symptoms