

# RESPIRATORY SYSTEM

## Big Picture

The job of the respiratory system is the exchange of gases between the body and the outside air. This process, called respiration, actually consists of two parts. In the first part, oxygen in the air is drawn into the body and carbon dioxide is released from the body through the respiratory tract. In the second part, the circulatory system delivers the oxygen to body cells and picks up carbon dioxide from the cells in return.

## Key Terms

**Respiratory System:** The organ system that brings oxygen into the body and releases carbon dioxide into the atmosphere.

**Respiration:** The exchange of gases between the body and the outside air.

**Lung:** Main organ of the respiratory system.

**Pharynx:** Contains passageways for both food and air.

**Epiglottis:** Covers the opening to the air passage when food is swallowed.

**Larynx:** Contains the vocal cords. Also called the voice box.

**Trachea:** Long tube that leads down to the chest. Also called a windpipe.

**Bronchus (plural, bronchi):** One of two tubes that connects the lungs with the trachea.

**Bronchiole:** Small air passage that branches from the bronchi.

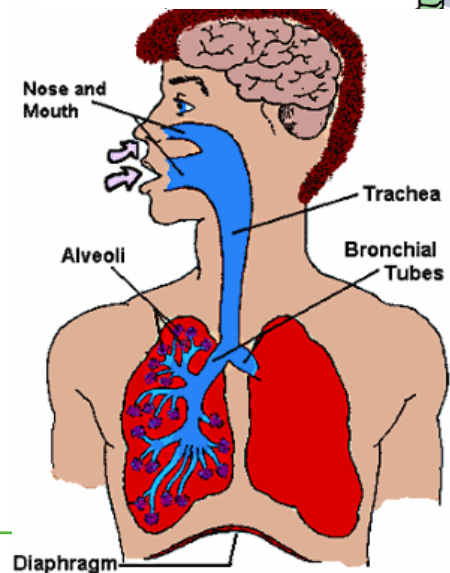
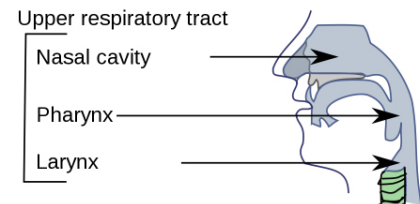
**Alveolus (plural, alveoli):** Tiny air sacs in the lungs where oxygen and carbon dioxide are exchanged.

**Ventilation:** The process of moving air in and out of the lungs.

**Inhalation:** The process of taking air into the lungs.

**Expiration:** The process of releasing air from the lungs.

**Diaphragm:** Muscle that is attached to the lower ribs and is the main muscle in respiration.



## Journey of a Breath of Air

The **respiratory system** is responsible for **gas exchange**.

- The first part of gas exchange involves the diffusion of oxygen into the **lungs** as air is drawn in and the effusion of carbon dioxide out of the lungs as air is pushed out through the respiratory tract.
- The second part of gas exchange is the delivery of oxygen to and the removal of carbon dioxide from the various body cells.

### 1. Ventilation

- Air enters through the nose where dirt and foreign particles are trapped by mucus and nose hairs. The nasal cavity also warms and moistens the air in preparation for its movement into the lungs.
- The air enters the **pharynx**, the **epiglottis**, the **larynx**, the **trachea**, and the left and right **bronchi** of the lungs.
- In the lungs, the air travels into **bronchioles** and finally into **alveoli**.

### 2. Pulmonary Gas Exchange

- In the alveoli of the lungs oxygen and carbon dioxide are exchanged between the air and the blood.
- The relatively high concentration of oxygen in the alveoli causes oxygen to diffuse into the blood capillaries surrounding the alveoli.
- The relatively high carbon dioxide concentration in the blood causes the CO<sub>2</sub> gas to diffuse from the capillaries into the alveoli

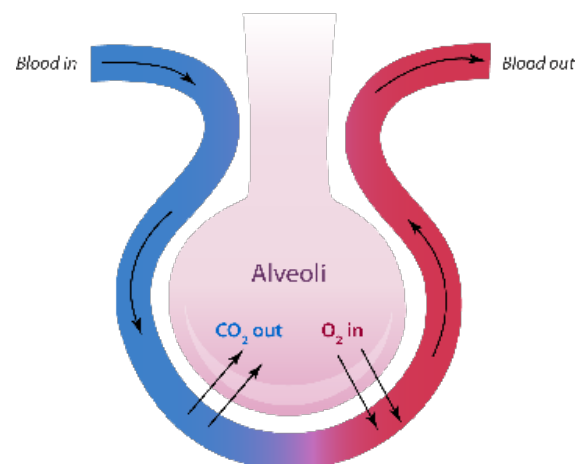


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# RESPIRATORY SYSTEM CONT.

## Journey of a Breath of Air (cont.)

### 3. Gas Transport

- The capillaries carry the oxygen-rich blood back to the heart.
- The heart then pumps the oxygen-rich blood throughout the body.

### 4. Peripheral Gas Exchange

- Oxygen diffuses from the peripheral capillaries into the body cells (which have a lower oxygen concentration than the blood).
- CO<sub>2</sub> gas diffuses from the body cells into the capillaries (which have a lower CO<sub>2</sub> concentration than the body cells).

### 5. Back to the Lungs

- Oxygen-poor and carbon dioxide-rich blood then travels back to the heart through the veins.
- The heart pumps the oxygen-poor blood into the alveoli of the lungs where gas is again exchanged. Carbon dioxide will diffuse into the alveoli and eventually be expelled.

## Gas Exchange and Homeostasis

The rate of breathing must be regulated in order to maintain the proper concentration of carbon dioxide in the blood and thus also to maintain the proper blood pH.

- Some carbon dioxide dissolves in the blood to form carbonic acid. If the blood contains too little carbon dioxide, the blood is too basic. If the blood contains too much carbon dioxide, it becomes too acidic.

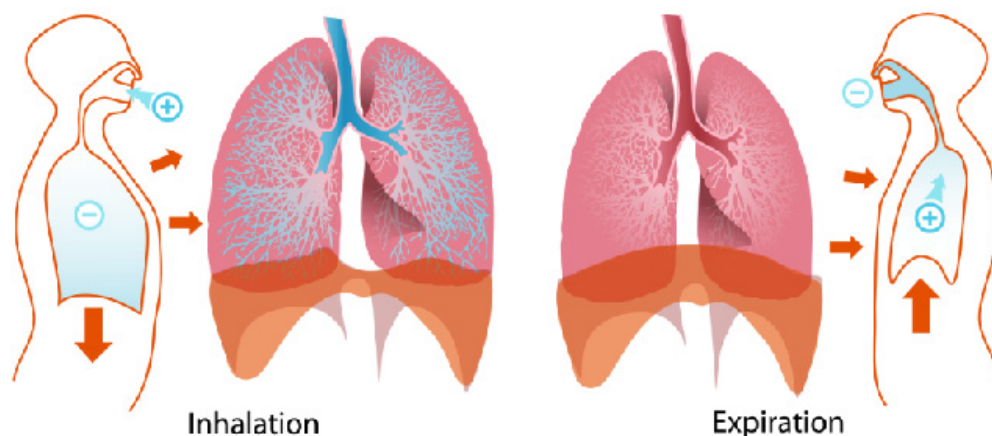
## Regulation of Breathing

### How Breathing Occurs

**Inhalation** and **exhalation** result from the contraction of the **diaphragm**.

- When the diaphragm contracts during inhalation, the lungs have a larger volume, decreasing air pressure in the lungs. Air will then move from the outside, where the air pressure is higher, into the lungs.
- When the diaphragm relaxes during expiration, the lungs have a smaller volume, increasing air pressure in the lungs. Air will then move out of the lungs.

Image Credit: Mariana Ruiz Villarreal (LadyofHats), Public Domain



*Breathing and respiration are not the same! Breathing is the physical process of bringing oxygen into the lungs (as well as expelling carbon dioxide), while respiration is the process of bringing oxygen to the cells.*

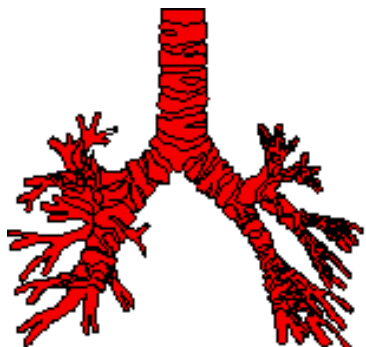
### Control of Breathing

- Nerve pulses from the brain stem control the unconscious contraction and relaxation of the diaphragm.
- The brain stem also monitors carbon dioxide concentrations in the blood, stimulating the diaphragm to contract more or less frequently.

## Main Parts of the Respiratory system

### TRACHEA

- Your trachea is the tube that connects your mouth and nose to your lungs.
- Only air goes into your trachea.
- Your epiglottis (flap of skin) covers the trachea when you're eating or drinking. This little flap makes sure none of your food gets into your lungs.



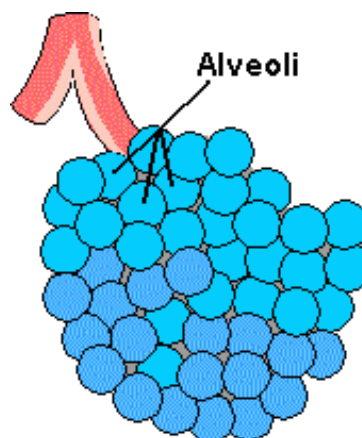
### BRONCHIAL TUBES

When the air you breathe in goes down your trachea, it comes to a fork in the road. These are the bronchial tubes. One tube goes into your right lung, and the other goes into your left lung. The bronchial tubes go into your lungs and keep branching off into smaller and smaller tubes until the sacs at the end called alveoli are reached.

They help clean your lungs. They are covered with mucus, which sticks to dirt and germs that get into your lungs. Next, millions of tiny hairs called cilia act like tiny brooms to sweep out the bad stuff caught in the mucus. Each cilium sweeps back and forth about ten times every second! That's 36,000 every hour, 24 hours a day! They do this to keep your lungs clean.

### ALVEOLI

When air enters your lungs, it goes through a maze of smaller and smaller tubes until it reaches tiny sacs called alveoli. The sacs look like bunches of grapes at the end of the bronchial tubes. The alveoli are where the oxygen from the air enters your blood, and the carbon dioxide from your body goes into the air. Alveoli are very tiny, but you have a lot of them in your lungs. In fact, you have 300,000,000 alveoli in each lung.



### DIAPHRAGM

The diaphragm is a big sheet-like muscle that's at the bottom of your chest cavity. The diaphragm helps you get air in and out of your lungs by moving up and down. When your diaphragm moves down, you breathe in. When your diaphragm moves up, you breathe out!

