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.

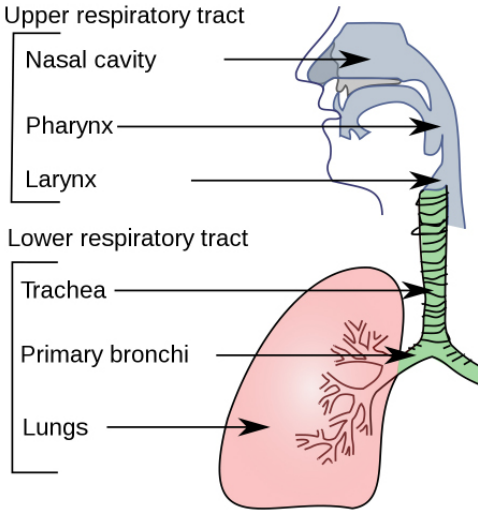
Alveolus (plural, **alveoli):** Tiny air sacs in the lungs where oxygen and carbon dioxide are exchanged.

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.



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Journey of a Breath of Air

The **respiratory system** is responsible for **respiration**.

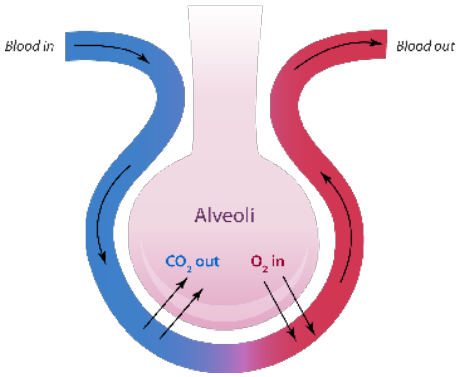
- The first part of respiration involves the diffusion of oxygen into the **lungs** as air is drawn in and the effusion of carbon dioxide out of the lungs as air is pushed out through the respiratory tract.
- The second part of respiration is the delivery of oxygen to and the removal of carbon dioxide 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 then enters the **pharynx** and goes past the **epiglottis** into the **larynx**.
- The air enters the **trachea** and the trachea divides as it meets the lungs, providing air to the left and right **bronchi**.
- In the lungs, the air travels into **bronchioles** and finally into **alveoli**.

2. Pulmonary Gas Exchange

- Gas is exchanged between the air and the blood in the alveoli of the lungs.
- The relatively high oxygen concentration in the alveoli from the inhaled air causes oxygen to diffuse into the pulmonary capillaries that surround the alveoli.
- The relatively high carbon dioxide concentration in the blood causes carbon dioxide to diffuse into the alveoli and will eventually be expelled by the body when the lungs expire.



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Respiratory System cont.

Journey of a Breath of Air (cont.)

3. Gas Transport

- The pulmonary capillaries carry the oxygen-rich blood back to the heart.
- The heart then pumps the oxygen-rich blood throughout the body.
- The oxygen-rich blood eventually reaches the peripheral capillaries in the body's tissues.

4. Peripheral Gas Exchange

- Oxygen diffuses across the peripheral capillaries into the body cells, which have a lower oxygen concentration than the blood.
- Carbon dioxide, a waste produced by cellular respiration, diffuses into the capillaries, which have a lower carbon dioxide 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.

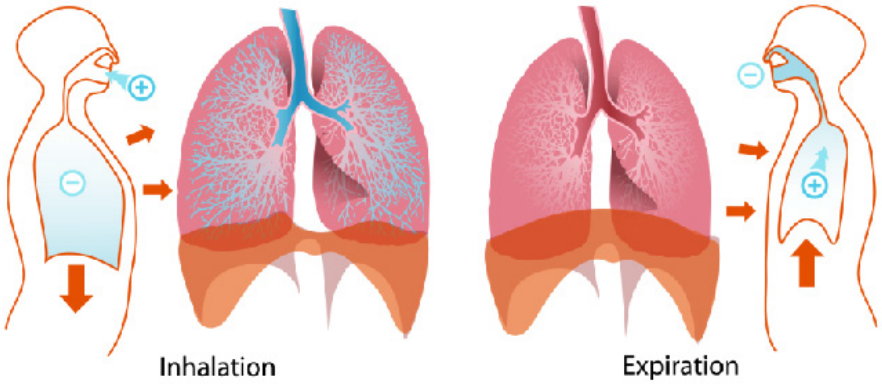
Regulation of Breathing

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.

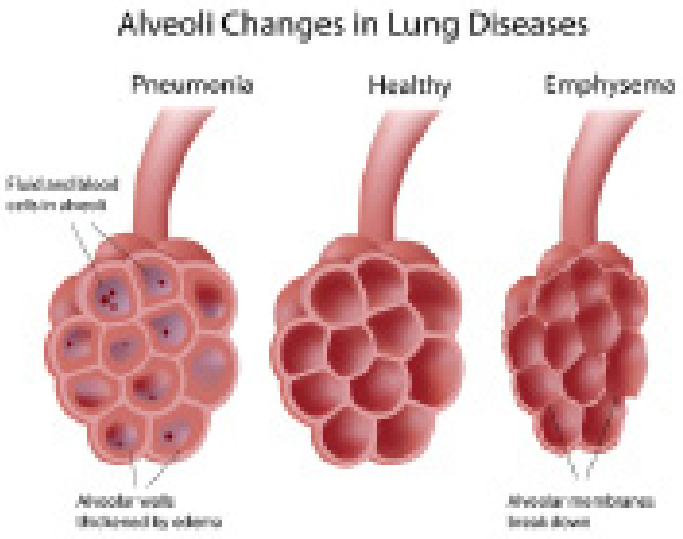
Control of Breathing

- 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.

Respiratory System cont.

Respiratory System Diseases

- Asthma: Periodic and chronic inflammation of the airways that causes difficulty in breathing. An asthma attack can be caused by a number of factors including allergens and stress.
- Pneumonia: Inflammation of the lungs and the entrance of fluid into alveoli. Pneumonia reduces the efficiency of gas exchange and is characterized by difficulty in breathing. Pneumonia can be brought on by a number of factors including infection.
- Emphysema: Deterioration of the alveoli walls, leading to difficulty breathing. Emphysema is usually a direct result of smoking.
- Smoking: While not technically a disease, smoking can lead to impaired respiratory system function by damaging the lungs.



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