The Respiratory System

BIO 105
Chapter 14

Functions of the Respiratory System

1. Air distribution
2. Filters, warms, and humidifies air
3. Gas exchange
4. Speech/sound production
5. Olfaction
Nose
Functions:
1. Olfaction
2. Filtration and cleaning
3. Conditioning the air

Sinuses
Functions:
1. Lighten weight of bones
2. Condition air
3. Resonating chambers
Pharynx (throat)

Functions:
1. Serves as a passageway for air and food
2. Tonsils are found here
3. Auditory tube connects

Larynx

Functions:
1. Entrance to the lower respiratory tract
Larynx

Functions:

2. Voice production

During quiet breathing, the vocal cords are near the sides of the larynx, and the glottis is open.

During speech, the vocal cords are stretched over the glottis and vibrate as air passes through them, producing the voice.

Trachea

• Also known as the “windpipe”
Bronchial Tree

Bronchi
Bronchioles

Alveoli

(a) Each alveolus is a cup-shaped chamber. In this section, areas of the alveoli have been cut open and you can see into them.

(b) Much of the surface of each alveolus is covered with capillaries. The interface provides a vast surface area for the exchange of gases between the alveoli and the blood.

Newborn Respiratory Distress Syndrome
Alveoli

Function:
Gas-exchanging portion of the respiratory tract

Steps to respiration

- Ventilation
- External respiration
- Gas transport
- Internal respiration
Dalton’s Law

- The total pressure exerted by a mixture of gases is the sum of the pressures exerted by the individual gases.

- The pressure of a single gas in a mixture is known as its partial pressure.

Boyle’s Law: $P_1V_1 = P_2V_2$

Decreasing volume increases collisions and increases pressure.

$V_1 = 1.0 \text{ L}$
$P_1 = 100 \text{ mm Hg}$

$V_2 = 0.5 \text{ L}$
$P_2 = 200 \text{ mm Hg}$
A spirometer is used to measure air volumes entering and leaving lungs.

**Spirometer**

Spirometry measures how fast and how much air you breathe out.

**External Respiration**

External respiration is the exchange of oxygen and carbon dioxide between the lungs and the body tissues.

Gas transport means oxygen and carbon dioxide between the lungs and the body tissues.

Breathing means air in and out of the lungs.

Gas diffusion means oxygen and carbon dioxide between the blood and the body tissues.

Carbon dioxide transport means oxygen and carbon dioxide between blood and the body tissues.

Lungs Gas diffusion Oxygen transport
Gas Transport

Once gas exchange occurs at the level of the alveoli, how is it transported in the blood?

Internal Respiration

Breathing moves air in and out of the lungs. Internal respiration is the exchange of oxygen and carbon dioxide between the lungs and the blood. Gas transport moves oxygen and carbon dioxide between the lungs and the body tissues. Internal respiration is the exchange of oxygen and carbon dioxide between blood and the body tissues.
How is ventilation rate controlled?

**NEURAL CONTROLS**
- Cerebral cortex: Increases central nervous system control of breathing.
- Medulla oblongata: Breathing center.

**CHEMICAL CONTROLS**
- Medulla oblongata: Chemoreceptors respond to rising blood levels of carbon dioxide.
- Cortical centers: Chemoreceptors respond to rising blood levels of oxygen.

Increased blood level of carbon dioxide (increased acidity, $[H^+]$):
- Increased carbon dioxide level (increased acidity, $[H^+]$) in cerebral spinal fluid.
- Sensed by chemoreceptors in medulla.
- Sensed by peripheral chemoreceptors in aortic and carotid bodies.
- Breathing control center in medulla stimulated.
- Breathing rate increased (more carbon dioxide exhaled).
- Carbon dioxide level in blood returns to normal.