Lesson 44 Circulatory and Respiratory Systems

Key Words

circulation: movement of blood through the body

atria: upper chambers of the heart that receive blood as it returns to the heart

ventricles: lower chambers of the heart through which blood passes when pumped from the heart

arteries: blood vessels that carry blood away from the heart

capillaries: tiny, thin-walled blood vessels through which the exchange of substances between blood and body cells takes place

veins: blood vessels that carry blood to the heart

plasma: liquid part of blood mostly made of water containing dissolved nutrients, minerals, vitamins, and wastes

respiration: process of taking oxygen in and removing carbon dioxide from the body

diaphragm: large flat muscle at the bottom of the rib cage that assists breathing

KEY IDEAS

Blood moves through the body by a network of blood vessels. The heart pumps blood through this network. The blood vessels and heart make up the circulatory system. As blood flows through vessels in the lungs, oxygen moves into the blood cells. At the same time, carbon dioxide leaves the cells. The respiratory system moves air into and out of the body to ensure the constant exchange of gases.

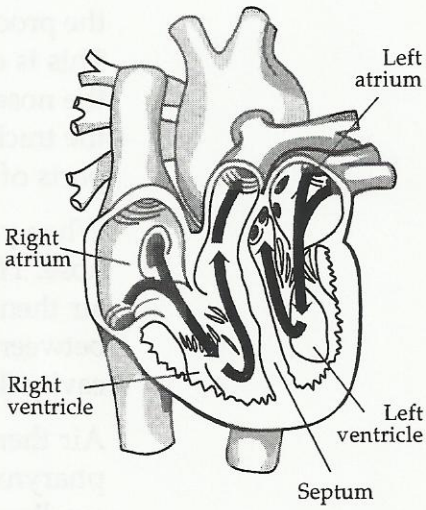
An aerobics instructor shows people how to exercise properly. The instructor designs exercise routines that increase heart and respiratory rates. Aerobic exercise burns calories and strengthens heart muscles. To design helpful and safe aerobic routines, the instructor must be aware of the structure and function of the body's circulatory and respiratory systems.

Circulatory System. The movement of blood through the body is **circulation** (suhr-kyoo-LAY-shun). Materials the body needs must be transported in the blood. The job of the circulatory system is to transport these materials throughout the body. For example, the circulatory system brings food and oxygen to body cells. It also removes waste products, such as carbon dioxide, from body cells.

The Heart. The circulatory system is powered by the heart. The heart is a muscular organ that pumps blood throughout the body. The structure of the heart is like a two-sided pump. A thick wall of muscle divides the heart into two sides. The right side of the heart pumps blood only to the lungs. The blood picks up oxygen in the lungs. The blood then returns to the left side of the heart. The left side pumps the oxygen-rich blood throughout the entire body. When the body has used the blood's oxygen, the blood returns to the right side of the heart.

The heart is divided into four chambers, shown in Fig. 44-1. The two upper chambers are the right atrium and the left atrium (plural, *atria*). These two **atria** (AY-tree-uh) receive blood as it returns to the heart. The two lower chambers are the right ventricle and the left ventricle. Blood is pumped from the heart by the **ventricles** (VEHN-trih-kuhlz).

Fig. 44-1



Between the atrium and ventricle on each side of the heart are valves. The valves are strong flaps of tissue that act like doors. The job of valves is to prevent blood from flowing backward. By opening and closing at certain times, the valves ensure that blood flows in only one direction from the atria to the ventricles.

Blood Vessels. Blood is continuously transported through the body in a closed network of tubes, or blood vessels. Blood vessels are made of muscle tissue. The three kinds of blood vessels are arteries, veins, and capillaries. When the heart muscle contracts, blood is pumped into the arteries. **Arteries** (AHRT-uhr-eez) are muscular blood vessels that carry blood away from the heart.

Arteries are connected to very small, thin-walled blood vessels called **capillaries** (KAP-uh-lehr-eez). The exchange of substances between the blood and body cells takes place through the thin capillary walls. Food and oxygen move from blood into body cells. Carbon dioxide and other waste products move from body cells into the blood. The capillaries that carry away the waste products are connected to veins. **Veins** (vaynz) are blood vessels that carry blood back to the heart. Veins have less muscle in their walls than arteries do.

1. How are arteries and veins alike? How are they different?

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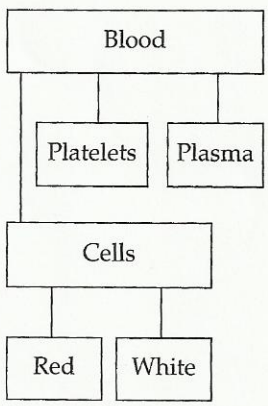
Fig. 44-2



Blood. Blood is a type of tissue that is a mixture of plasma, red blood cells, white blood cells, and platelets. Fig. 44-2 shows the four components of blood. **Plasma** (PLAZ-muh) is the liquid part of blood. It is mostly water. Dissolved in this water are nutrients, minerals, vitamins, and wastes. Red blood cells carry oxygen throughout the body. A red protein called hemoglobin is contained in red blood cells. Hemoglobin is the part of the cell that holds the oxygen. It also gives the cell its red color.

White blood cells protect the body against infection. Some white blood cells actually digest disease-causing cells. Other white blood cells release chemicals that help the body fight disease.

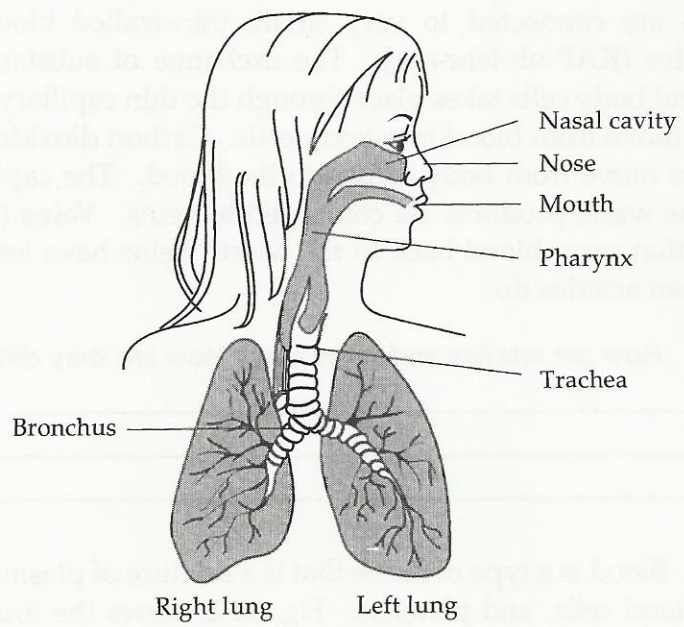
Pieces of cells called platelets are also contained in blood. Platelets work to stop the flow of blood from a wound. If a blood vessel is cut, platelets rush to the wound. The platelets help form a substance that plugs the wound. The plug, or clot, stops the flow of blood from the vessel.

Respiratory System. One of the main functions of the circulatory system is to carry oxygen throughout the body. **Respiration** (rehs-per-AY-shun) is the process of taking oxygen in and removing carbon dioxide from the body. This is done by the respiratory system. The respiratory system consists of the nose, nasal cavity, pharynx, airways, and lungs. The airways consist of the trachea, the bronchi, and passages within the lungs. Fig. 44-3 shows the parts of the respiratory system.

When you breath in, or inhale, air enters the respiratory system through the nose. Hairs in the nose trap particles of dirt and dust contained in the air. The air then moves into the nasal cavity. The nasal cavity is a hollow opening between the nose and throat. A sticky substance called mucus lines the nasal cavity. The solid particles left in the air stick to the mucus.

Air then moves into the pharynx, or throat. Food also passes through the pharynx. The bottom of the pharynx connects to two tubes. When you swallow, food goes down one of the tubes. Air goes down the other tube called the trachea, or windpipe. The walls of the trachea are lined with mucus. Once again, particles in the air stick to the mucus lining.

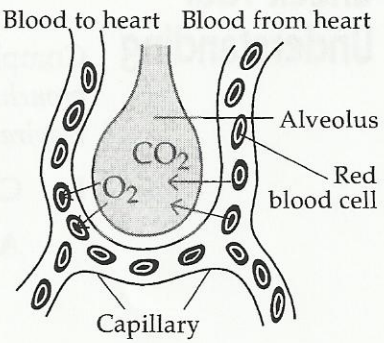
Fig. 44-3



The Lungs. At the end of the trachea lie two smaller tubes called bronchi (sing. *bronchus*). Each bronchus leads to a lung. The lungs are the main organs of the respiratory system. The exchange of gases occurs within the lungs.

In the lungs are clusters of tiny air sacs called alveoli (sing. *alveolus*). Surrounding the alveoli is a network of capillaries. The very thin walls of the alveoli and capillaries permit the passage of oxygen and carbon dioxide. Fig. 44-4 shows the exchange of gases at an alveolus. Oxygen moves from the alveolus into the blood in the capillaries. At the same time, carbon dioxide moves from the blood in the capillaries into the alveolus. The oxygen-rich blood then returns to the heart. The heart pumps this oxygen-rich blood to the cells of the body. Carbon dioxide is released from the body when you exhale, or breath out.

Fig. 44-4

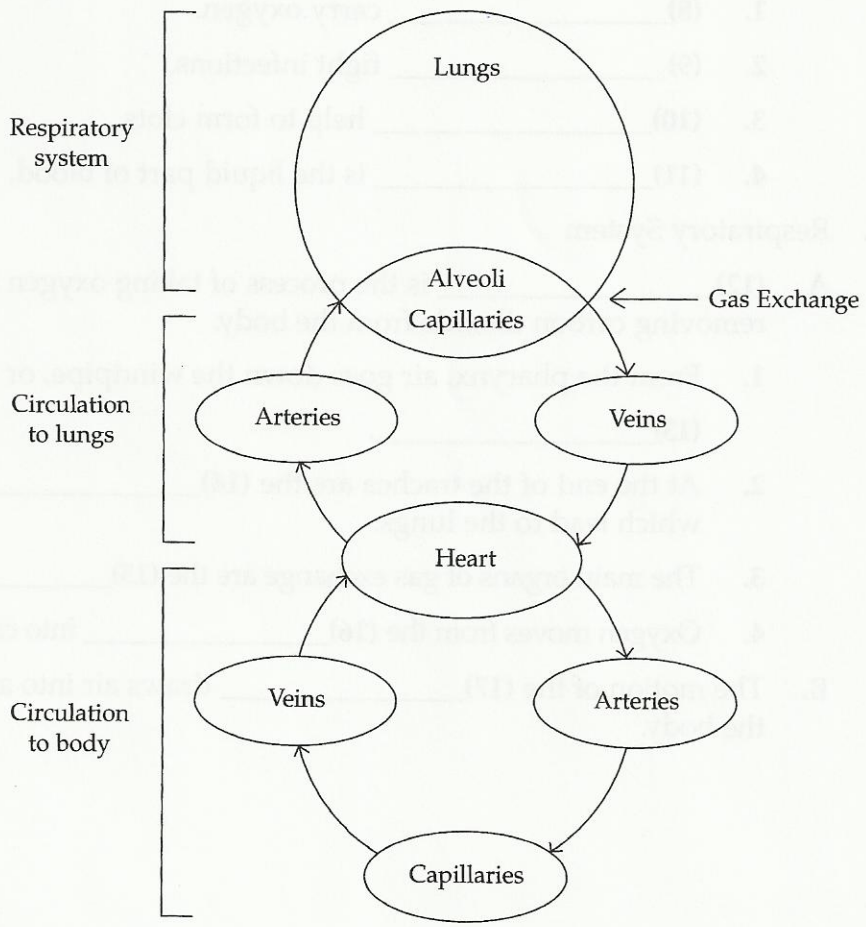


Breathing draws air into and out of the body. A muscle called the diaphragm assists breathing. The **diaphragm** (DY-uh-fram) is a large, flat muscle that lies at the bottom of the rib cage. When the diaphragm contracts, air is drawn into the lungs. When the diaphragm relaxes, air is pushed out of the lungs.

Fig. 44-5 summarizes the relationship among the circulatory and the respiratory systems.

TAKE ANOTHER LOOK

Fig. 44-5



Check Your Understanding

Complete the outline using the following words: *alveoli, arteries, atria, bronchi, capillaries, diaphragm, lungs, plasma, platelets, pump, red blood cells, respiration, trachea, veins, ventricles, white blood cells*

I. Circulatory System

A. Heart

1. The heart is a two-sided **(2)**_____.
2. Right and left **(3)**_____ receive blood.
3. Blood leaves through right and left **(4)**_____.

B. Blood Vessels

1. **(5)**_____ carry blood away from the heart.
2. **(6)**_____ carry blood to the heart.
3. Oxygen enters blood by passing through the thin walls of the **(7)**_____.

C. Blood

1. **(8)**_____ carry oxygen.
2. **(9)**_____ fight infections.
3. **(10)**_____ help to form clots.
4. **(11)**_____ is the liquid part of blood.

II. Respiratory System

A. **(12)**_____ is the process of taking oxygen in and removing carbon dioxide from the body.

1. From the pharynx, air goes down the windpipe, or **(13)**_____.
2. At the end of the trachea are the **(14)**_____, which lead to the lungs.
3. The main organs of gas exchange are the **(15)**_____.
4. Oxygen moves from the **(16)**_____ into capillaries.

B. The motion of the **(17)**_____ draws air into and out of the body.

18. Why is the heart described as a two-sided pump?

19. What do valves in the heart do? _____

20. What are the three types of blood vessels? What does each one do?

21. How do the functions of red blood cells and white blood cells differ?