Name _____ Group _____

Date _____ Block _____

Ch 6 Test Review

Directions

Read and highlight the passages on the Immune System and the Cardiovascular (Circulatory) System.

Then answer the questions that follow.

THE BODY'S DEFENSES AGAINST DISEASE

Our bodies are surrounded by microorganisms trying to get into us. Some of them succeed, through the nose, through cuts in our skin, or along with the food we eat. Many of these microorganisms cause serious problems if they survive and reproduce inside us without challenge. Controlling these microscopic invaders is as important to homeostasis as is regulating body temperature and chemistry.

The first line of defense against infection consists of *physical barriers* that block the entry of microorganisms. The skin is the main physical barrier in our body. A second line of defense, called *inflammation*, is present when microorganisms get through our physical barriers. For example, when we get a cut or scrape on the skin, the injured area may become warm, reddened, and perhaps swollen with pus. (See Figure 14-3.) Chemicals released by the damaged tissues are acting like

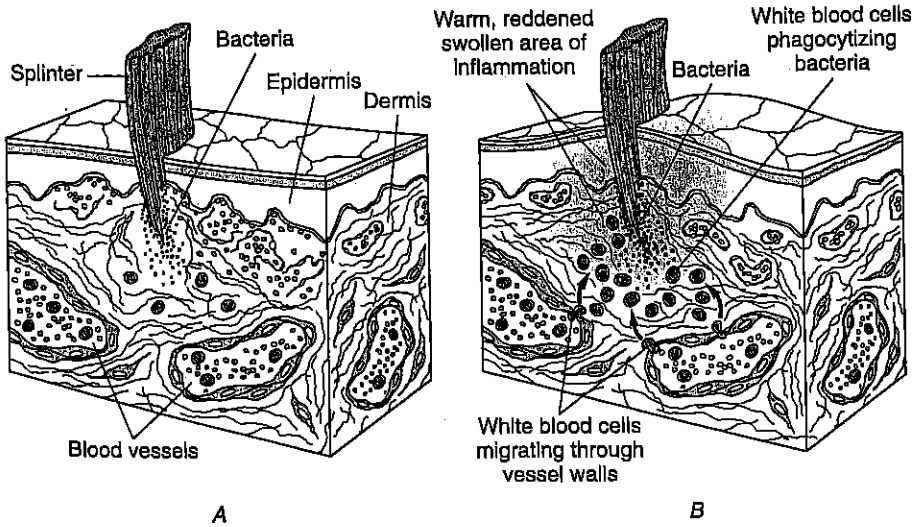

Figure 14-3 Inflammation is the body's second line of defense against infectious bacteria that get through the skin's first defense.

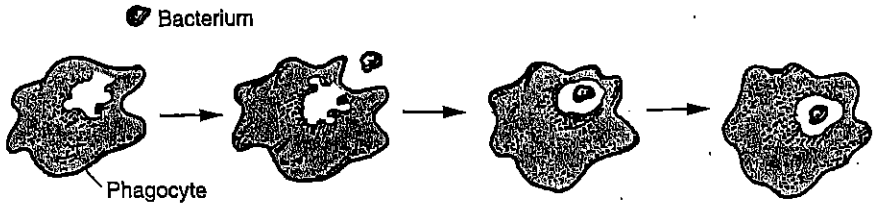

Figure 14-4 During inflammation, the white blood cells engulf and destroy the invading bacteria, which prevents the development of a more serious infection.

an alarm, causing an increase in blood flow to the site of the injury. Special white blood cells that arrive engulf microorganisms, destroying them by ingesting them. All of this activity helps prevent a more serious infection from developing. (See Figure 14-4.)

Vertebrates have evolved a very important system that attacks specific invaders. This is the **immune system**. The immune system recognizes who the "bad guys" are and goes after these invaders to try to keep them from disrupting normal body functions.

THE HUMAN IMMUNE SYSTEM

The immune system defends our bodies against very specific microscopic invaders. Each invader—usually a bacterium or virus—has specific protein molecules attached to its surface. These protein molecules are called **antigens**. It is these molecules that are detected by the body's immune system.

When the immune system detects an antigen, it produces **antibodies**, molecules that bind to that antigen. Once the antibodies bind to the antigen, the invader can be destroyed by the body. (See Figure 14-5.) **Vaccinations** use weakened **microbes** (microorganisms), or parts of them, to stimulate the immune system to react by recognizing specific antigens. This reaction provides the body with **immunity**—the ability to resist an infection—by preparing it to fight subsequent invasions by the same microbes (by producing the appropriate antibodies). Vaccines offer protection against a number of diseases. People are now given harmless antigens in a vaccine, which cause the body to produce antibodies.

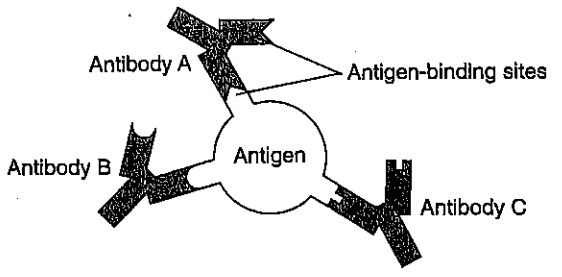

Figure 14-5 Antibodies, produced by the immune system, bind to antigens, which are specific protein molecules on an invading microbe's surface.

B CELLS AND T CELLS

The immune system also includes B cells and T cells, special kinds of *white blood cells* that are produced in bone marrow, the thymus gland, the spleen, the lymph nodes, and the tonsils. (See Figure 14-6.) *B cells* are the ones

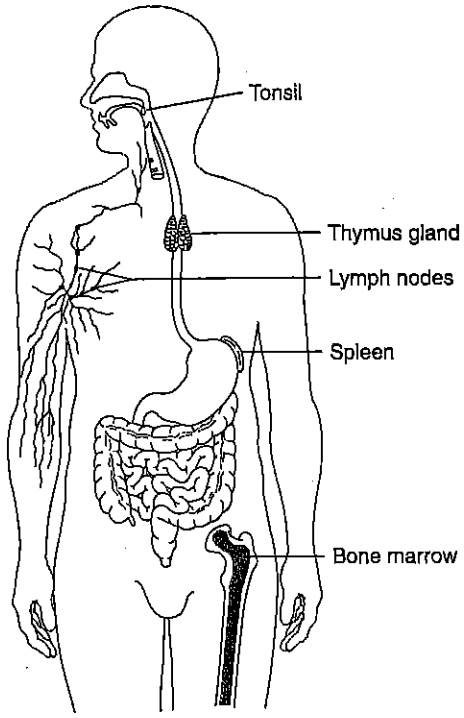

Figure 14-6 Special white blood cells, called B cells and T cells, are produced in the tonsils, thymus gland, lymph nodes, spleen, and bone marrow.

that respond to specific antigens by beginning to produce antibody proteins that will bind only with that antigen.

As time goes on, the body comes to have many different types of B cells, each producing antibodies for one specific antigen. After having been invaded once by an antigen, some special B cells that recognize that antigen remain in the body for the rest of one's life. These are called memory B cells. Because they are already present in the body, you instantly start making antibodies the moment you encounter the same invading microorganisms again. That is why individuals usually do not get measles or chicken pox a second time. The immune system remembers the first exposure to the disease and is ready to defend the body. (See Figure 14-7.)

One type of T cell is called *killer T cells*. Through protein receptors on their surface, they can recognize cells in the body that have been infected with invading microorganisms. The killer T cells punch holes in the membranes of the infected cells, sometimes injecting poison into them. (See Figure 14-8.) Another important type of T cell, called *helper T cells*, assists both B cells and killer T cells. Without helper T cells, the other members of the immune system cannot do their job. Just how important helper T cells are, is shown by the fact that they are the cells that are destroyed by the *h*uman *i*mmunodeficiency *v*irus (HIV), which results in the disease called AIDS.

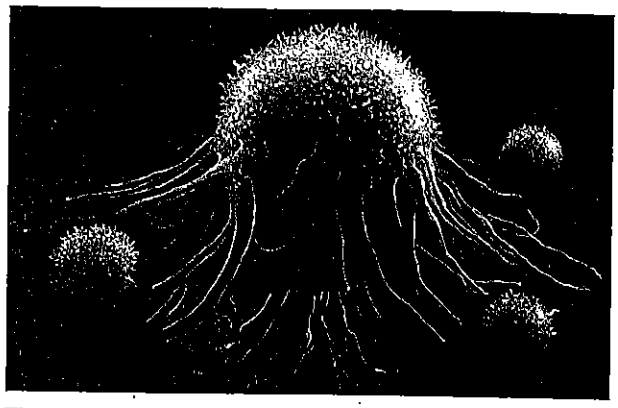

Figure 14-8 Killer T cells can recognize cells in the body that have been infected by invading microorganisms. Here, some killer T cells are shown attacking an infected body cell.

WHEN THINGS GO WRONG: DISEASES OF THE IMMUNE SYSTEM

The immune system helps maintain the internal dynamic equilibrium necessary for life. However, the immune system can become out of balance. It can be overactive or underactive, and in either case the body's equilibrium is upset.

Allergic reactions result from overactivity of the immune system. The body responds inappropriately to common substances such as dust, mold, pollen, or certain foods. The immune system begins making a special type of antibody to these substances, which normally

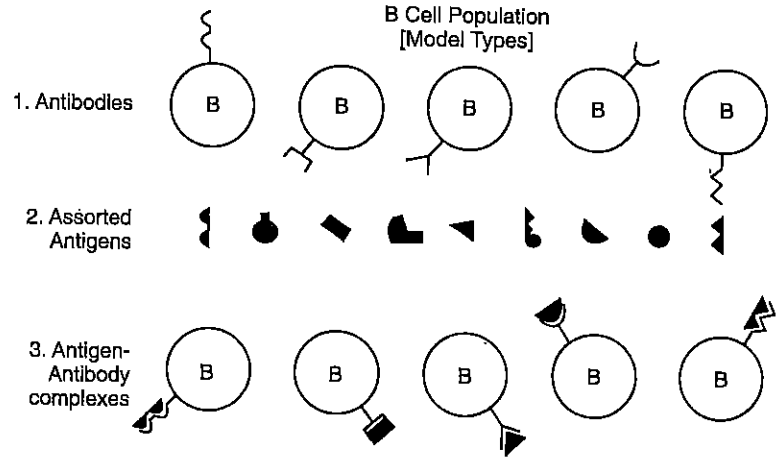

Figure 14-7 Over time, a person's body comes to have many different B cells. The memory B cells, which remain in the body after their first exposure to an antigen, can instantly make antibodies when they encounter the same antigen again.

would not stimulate it. These antibodies cause cells in the body to release substances, including *histamines*, which cause many allergic symptoms, such as extra fluid in the nasal pathways, difficulty breathing, or hives. The allergies are often treated with *antihistamines*, drugs that stop the release of histamines.

Sometimes an overactive immune system begins to attack its own normal body tissues. These are called *autoimmune diseases* and they are very serious. They include rheumatoid arthritis and lupus erythematosus. In all autoimmune diseases, the body is literally rejecting its own tissues. The immune system may also attack transplanted organs; medications are then taken to try to prevent organ rejection.

Also inflammation, which protects us when we are young, may actually be contributing to crippling diseases when we get older. For example, researchers now suspect that many heart attacks occur when a rupture develops in the wall of an artery, brought on by overactive immune system cells causing inflammation.

The condition known as **AIDS** (*a*cquired *i*mmuno*d*eficiency *s*yndrome) is a type of *immunodeficiency disease*, which means that the body's immune system is underactive because it is weakened, in this case by HIV, the human immunodeficiency virus. As a result, the body cannot protect itself from other diseases (such as pneumonia, tuberculosis, and cancer) that may attack it—a condition that is usually fatal.

THE HUMAN CIRCULATORY SYSTEM

The heart is the pump that moves blood through the body. In mammals, the heart has four separate chambers. Our circulatory system has the same layout as that of all other mammals and is highly efficient at the job it does.

The circulatory system accomplishes the vital task of transport through the many thousands of kilometers of *blood vessels* in the body. (See Figure 9-4.) Blood from the lungs enters the left atrium of the heart, then passes to the left ventricle. This oxygen-rich blood then begins its journey throughout the body by passing through the aorta (the body's largest artery) to the other arteries.

The *arteries* are vessels that have thick, muscular walls. They are very elastic, expanding and contracting as blood from the heart is pumped through them in pulses—one pulse for every heartbeat. The elasticity of the arteries' walls exerts pressure against the blood inside. This pressure is measured as your *blood pressure*.

The arteries become smaller and smaller as their distance away from the heart increases. Eventually the blood enters *capillaries*, the smallest vessels. Capillaries are close to every body cell. It is at the capillaries that the exchange of nutrients and gases between the blood and the cells takes place. After moving through capillaries, blood returns through the thin-walled *veins*, which get larger and larger

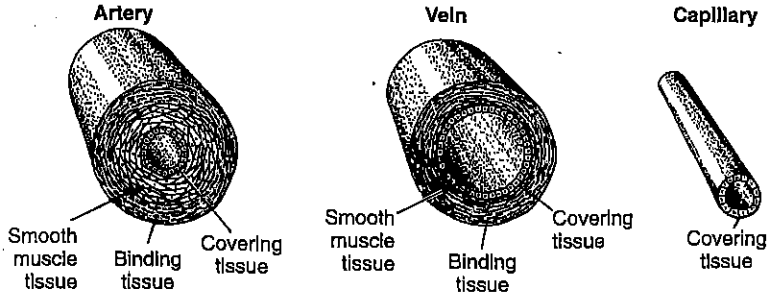

Figure 9-4 Cross sections of the three kinds of blood vessels in humans.

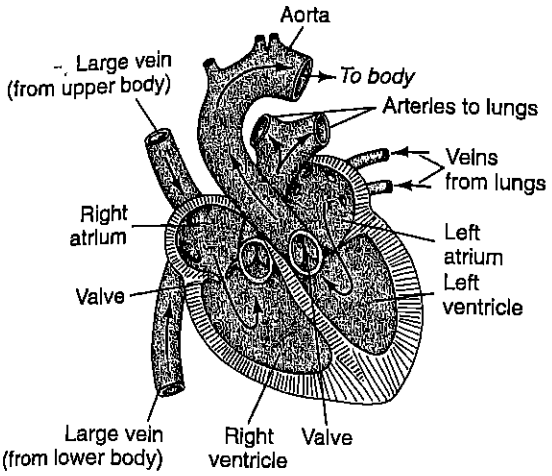

Figure 9-5 All mammals, including humans, have an efficient four-chambered heart to pump blood through the body.

closer to the heart. Unlike the walls of arteries, the walls of veins have little elasticity; blood is under low pressure in them. It would be very easy for blood to flow backward in the veins of the legs. To prevent the blood from moving backward, one-way valves work to trap it. The blood remains stationary in the veins until the beating of the heart and other muscular activities, such as leg muscle contractions, force the blood back up toward the heart.

The oxygen-poor blood from the body enters the right atrium of the heart, passes through the right ventricle, and then enters the arteries that take it to the lungs. After the exchange of gases that occurs in the lungs, oxygen-rich blood once again returns by veins to the left atrium of the heart. (See Figure 9-5.)

BLOOD TISSUE AND BLOOD FLOW

The entire purpose of the transport system is to move materials to and from cells. A capillary is so small that red blood cells must travel through it in single file. Molecules, including water, diffuse through the capillary walls and enter the spaces around body cells. These intercellular spaces are filled with a fluid that surrounds all cells. Molecules diffuse between this *intercellular fluid* (ICF) and the body cells. (See Figure 9-6.)

Blood itself is a tissue. But unlike any other tissue in the body, blood is a liquid. Blood is made up of cells, cell parts, and a clear, light-yellow-colored liquid called *plasma*. The plasma is 90 percent water, plus many important proteins, salts, vitamins, hormones, gases, sugars, and other nutrients. One of the proteins, *fibrinogen*, helps in the clotting process that stops bleeding caused by an injury. (See Figure 9-7.)

The cells in the blood include *red blood cells*, which contain the oxygen-carrying protein hemoglobin, and *white blood cells*. There are five types of white blood cells, all of which are involved in protecting the body from disease-causing foreign substances. Blood also contains *platelets*—fragments of cells that plug "leaks" wherever an injury occurs. Platelets also begin the complex chemical process that results in production of a clot. A blood clot stops the flow of blood out of a damaged blood vessel. (See Figure 9-8.)

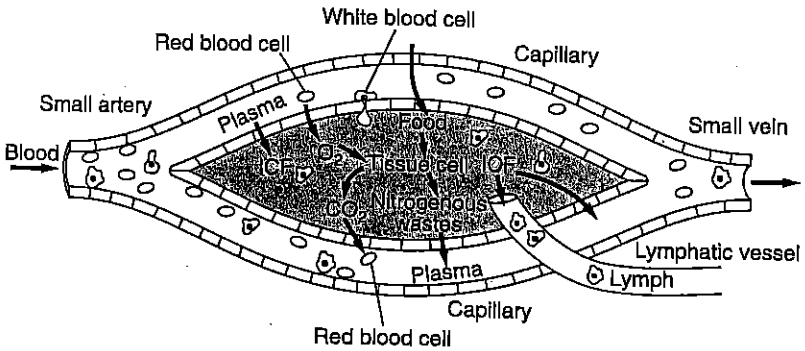

Figure 9-6 Molecules diffuse between the capillaries, ICF, and body cells.

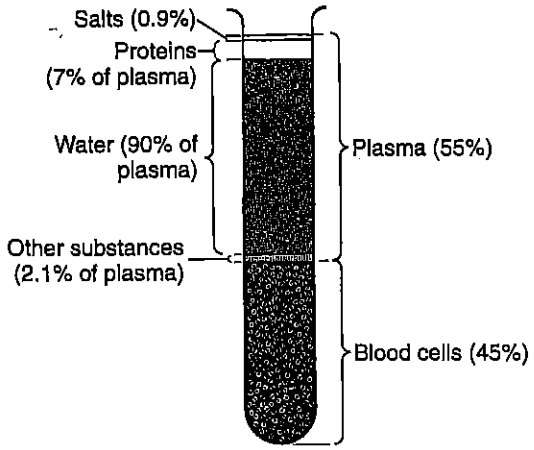

Figure 9-7 Blood is a tissue that is made up of plasma and blood cells.

WHEN THINGS GO WRONG: CARDIOVASCULAR DISEASE

The human transport system is called the *cardio-* (heart) *vascular* (vessels) *system*. Cardiovascular disease includes several important, and potentially fatal, conditions. A *heart attack* occurs when the vessels that bring blood to the heart get blocked and the heart tissue beyond that point is not supplied with blood. The muscle tissue in that area of the heart then dies.

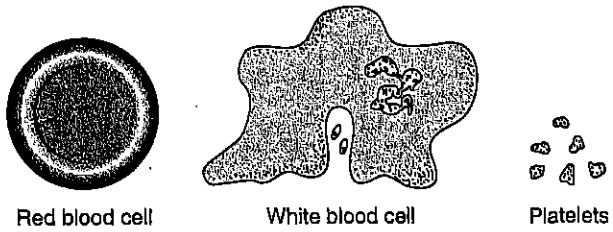

Figure 9-8 Red blood cells carry oxygen, white blood cells protect us from disease, and platelets begin the clotting process.

Unlike a heart attack, which often occurs suddenly, some forms of cardiovascular disease develop slowly over a long period of time. Clogged arteries result from the gradual buildup of layers of fatty deposits inside the arteries. Cardiovascular disease also includes strokes that may block an artery in the brain. Depending on what area of the brain is affected, strokes can damage a person's ability to feel things or to speak and move. Scientists think that both diet and heredity play a part in the development of cardiovascular disease.