

READING WARM-UP

Objectives

- Describe the relationship between the lymphatic system and the circulatory system.
- Identify six parts of the lymphatic system, and describe their functions.

Terms to Learn

lymphatic system	thymus
lymph	spleen
lymph node	tonsils

READING STRATEGY

Prediction Guide Before reading this section, write the title of each heading in this section. Next, under each heading, write what you think you will learn.

lymphatic system a collection of organs whose primary function is to collect extracellular fluid and return it to the blood

lymph the fluid that is collected by the lymphatic vessels and nodes

Figure 1 The white arrows show the movement of lymph into lymph capillaries and through lymphatic vessels.

The Lymphatic System

Every time your heart pumps, a little fluid is forced out of the thin walls of the capillaries. Some of this fluid collects in the spaces around your cells. What happens to this fluid?

Most of the fluid is reabsorbed through the capillaries into your blood. But some is not. Your body has a second circulatory system called the lymphatic (lim FAT ik) system.

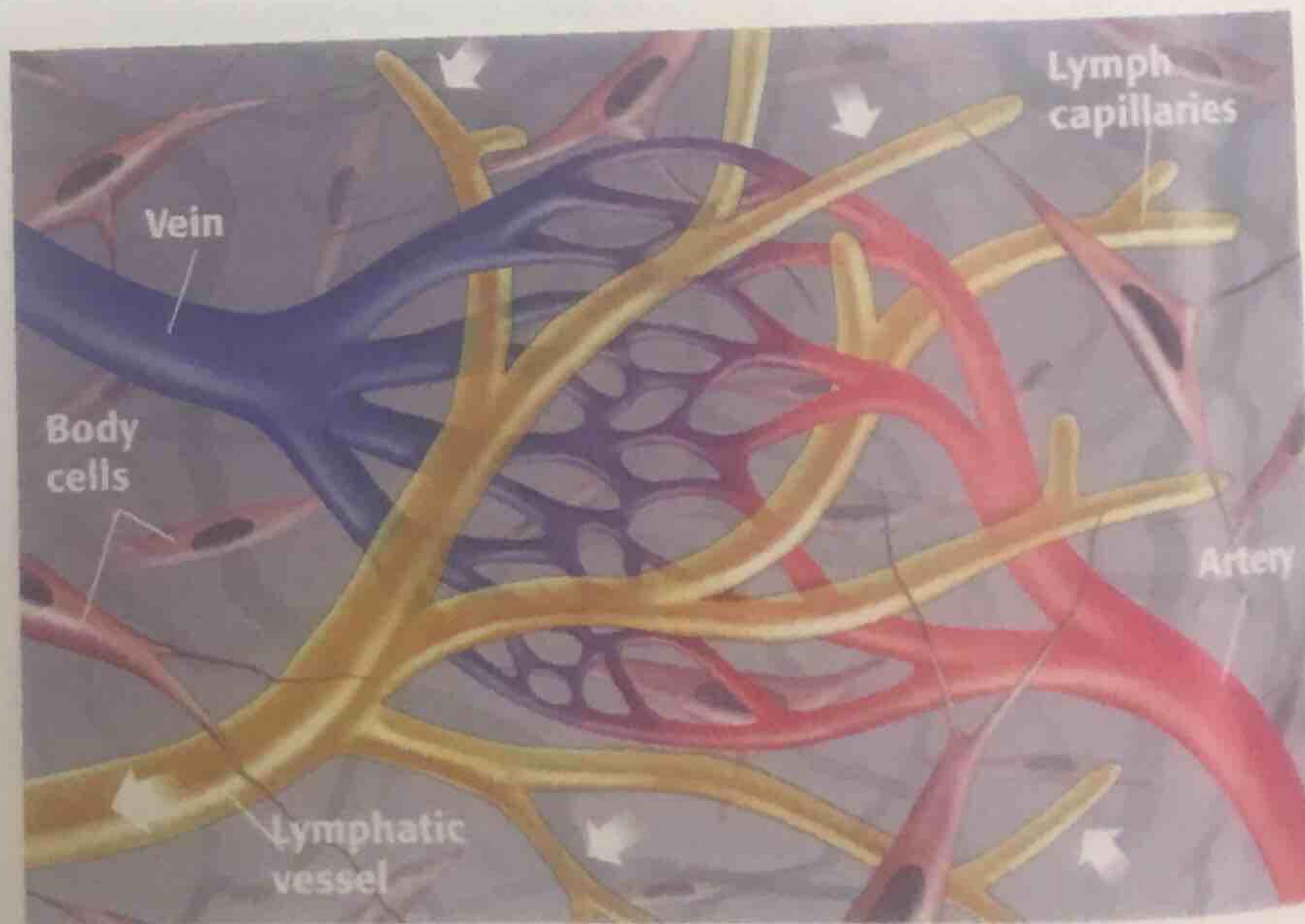
The **lymphatic system** is the group of organs and tissues that collect the excess fluid and return it to your blood. The lymphatic system also helps your body fight pathogens.

Vessels of the Lymphatic System

The fluid collected by the lymphatic system is carried through vessels. The smallest vessels of the lymphatic system are *lymph capillaries*. Lymph capillaries absorb some of the fluid and particles from between the cells. These particles are too large to enter blood capillaries. Some of these particles are dead cells or pathogens. The fluid and particles absorbed into lymph capillaries are called **lymph**.

As shown in **Figure 1**, lymph capillaries carry lymph into larger vessels called *lymphatic vessels*. Skeletal muscles squeeze these vessels to force lymph through the lymphatic system. Valves inside lymphatic vessels stop backflow. Lymph drains into the large neck veins of the cardiovascular system.

Reading Check How is the lymphatic system related to the cardiovascular system? (See the Appendix for answers to Reading Checks.)



Other Parts of the Lymphatic System

In addition to vessels and capillaries, several organs and tissues are part of the lymphatic system. These organs and tissues are shown in **Figure 2**. Bone marrow plays an important role in your lymphatic system. The other parts of the lymphatic system are the lymph nodes, the thymus gland, the spleen, and the tonsils.

Bone Marrow

Bones—part of your skeletal system—are very important to your lymphatic system. *Bone marrow* is the soft tissue inside of bones. Bone marrow is where most red and white blood cells, including lymphocytes (LIM foh SIETS), are produced. *Lymphocytes* are a type of white blood cell that helps your body fight pathogens.

Lymph Nodes

As lymph travels through lymphatic vessels, it passes through lymph nodes. **Lymph nodes** are small, bean-shaped masses of tissue that remove pathogens and dead cells from the lymph. Lymph nodes are concentrated in the armpits, neck, and groin.

Lymph nodes contain lymphocytes. Some lymphocytes—called *killer T cells*—surround and destroy pathogens. Other lymphocytes—called *B cells*—produce antibodies that attach to pathogens. These marked pathogens clump together and are then destroyed by other cells.

When bacteria or other pathogens cause an infection, WBCs may multiply greatly. The lymph nodes fill with WBCs that are fighting the infection. As a result, some lymph nodes may become swollen and painful. Your doctor may feel these swollen lymph nodes to see if you have an infection. In fact, if your lymph nodes are swollen and sore, you or your parent can feel them, too. Swollen lymph nodes are sometimes an early clue that you have an infection.

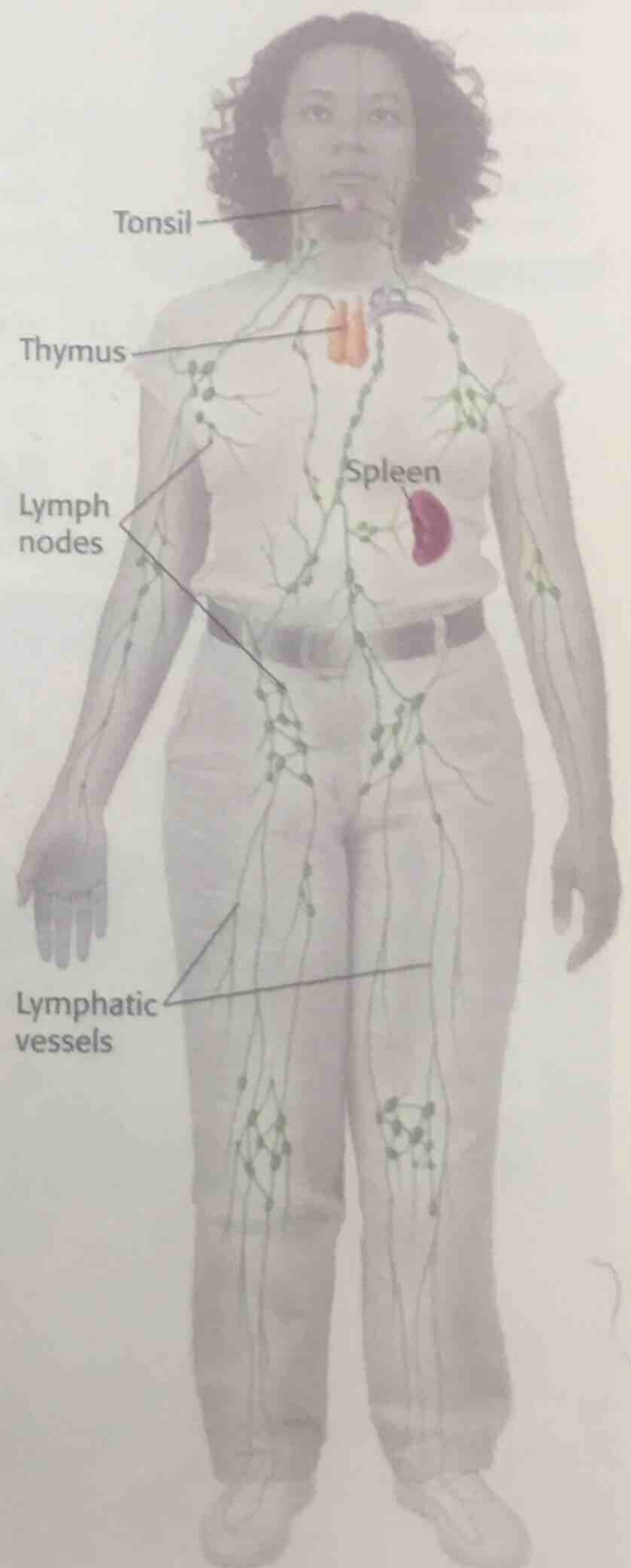
Thymus

T cells develop from immature lymphocytes produced in the bone marrow. Before these cells are ready to fight infections, they develop further in the thymus. The **thymus** is the gland that produces T cells that are ready to fight infection. The thymus is located behind the breastbone, just above the heart. Mature lymphocytes from the thymus travel through the lymphatic system to other areas of your body.

lymph node an organ that filters lymph and that is found along the lymphatic vessels

thymus the main gland of the lymphatic system; it produces mature T lymphocytes

Figure 2 The Lymphatic System



spleen the largest lymphatic organ in the body

CONNECTION TO Social Studies

WRITING SKILL Vent Your Spleen

Why do we say that someone is "venting his spleen"? What does it mean? Conduct library or Internet research about this phrase. Write a report on what you have learned.

Spleen

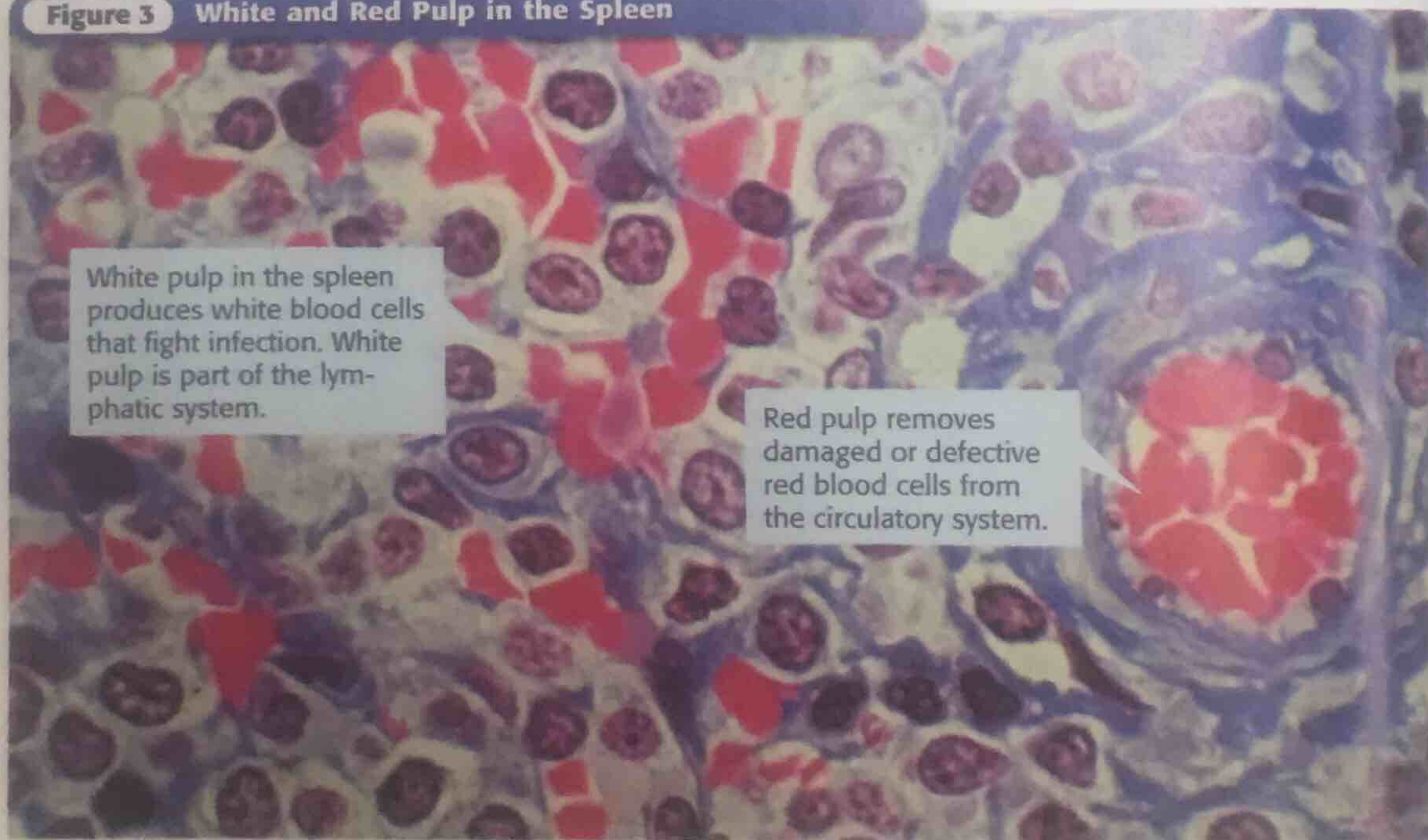
Your spleen is the largest lymphatic organ. The **spleen** stores and produces lymphocytes. It is a purplish organ about the size of your fist. Your spleen is soft and spongy. It is located in the upper left side of your abdomen. As blood flows through the spleen, lymphocytes attack or mark pathogens in the blood. If pathogens cause an infection, the spleen may also release lymphocytes into the bloodstream.

In addition to being part of the lymphatic system, the spleen produces, monitors, stores, and destroys blood cells. When red blood cells (RBCs) are squeezed through the spleen's capillaries, the older and more fragile cells burst. These damaged RBCs are then taken apart by some of the cells in the spleen. Some parts of these RBCs may be reused. For this reason, you can think of the spleen as the red-blood-cell recycling center.

The spleen has two important functions. The *white pulp*, shown in **Figure 3**, is part of the lymphatic system. It helps to fight infections. The *red pulp*, also shown in **Figure 3**, removes unwanted material, such as defective red blood cells, from the blood. However, it is possible to lead a healthy life without your spleen. If the spleen is damaged or removed, other organs in the body take over many of its functions.

Reading Check What are two important functions of the spleen?

Figure 3 White and Red Pulp in the Spleen



White pulp in the spleen produces white blood cells that fight infection. White pulp is part of the lymphatic system.

Red pulp removes damaged or defective red blood cells from the circulatory system.

Tonsils

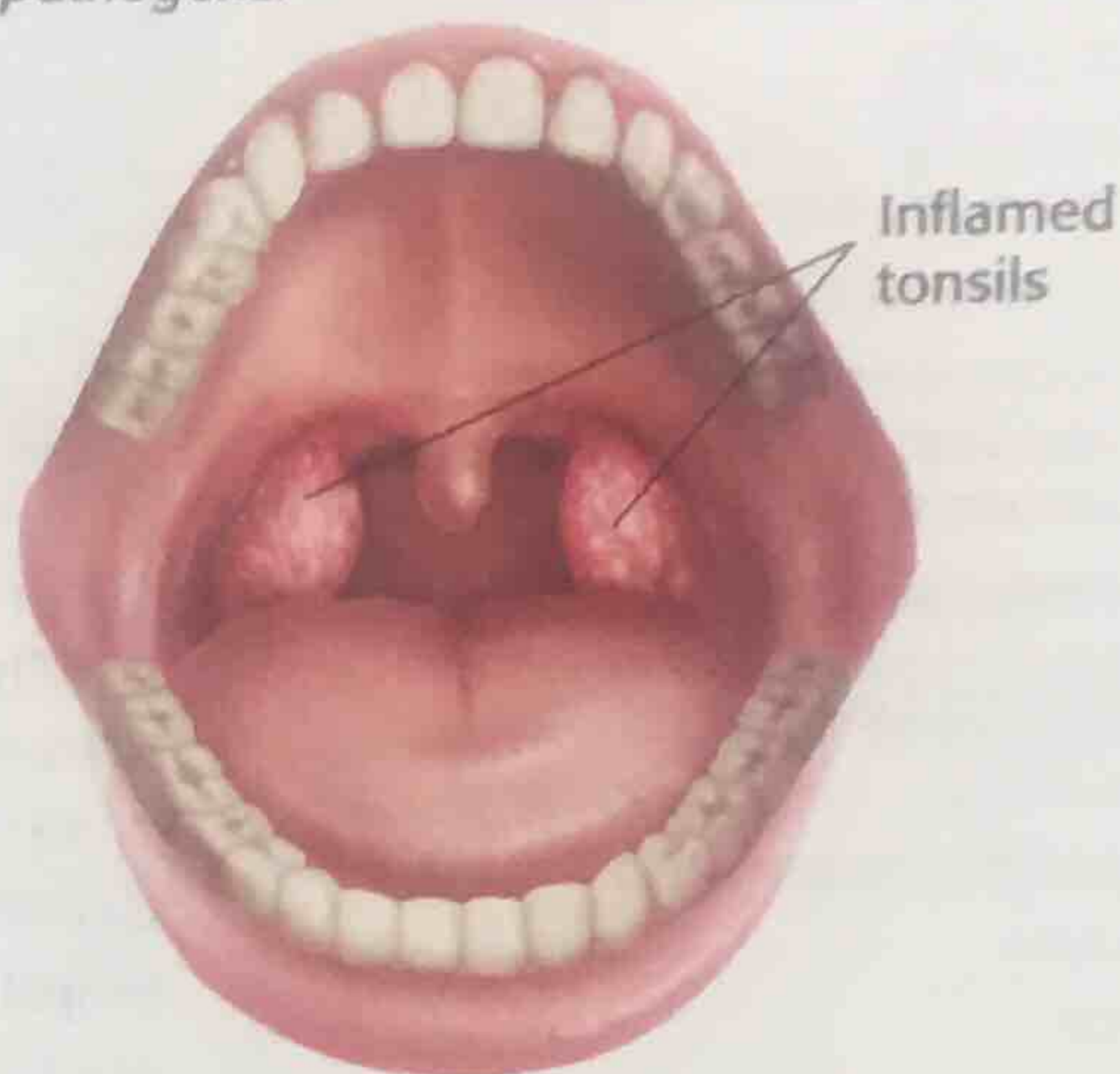
The lymphatic system includes your tonsils. **Tonsils** are lymphatic tissue in the nasal cavity and at the back of the mouth on either side of the tongue. Each tonsil is about the size of a large olive.

Tonsils help defend the body against infection. Lymphocytes in the tonsils trap pathogens that enter the throat. Sometimes, tonsils become infected and are red, swollen, and very sore. Severely infected tonsils may be covered with patches of white, infected tissue. Sore, swollen tonsils, such as those in **Figure 4**, make swallowing difficult.

Sometimes, a doctor will suggest surgery to remove the tonsils. In the past, this surgery was frequently done in childhood. It is less common today. Surgery is now done only if a child has frequent, severe tonsil infections or if a child's tonsils are so enlarged that breathing is difficult.

tonsils small, rounded masses of lymphatic tissue located in the pharynx and in the passage from the mouth to the pharynx

Figure 4 Tonsils help protect your throat and lungs from infection by trapping pathogens.



SECTION Review

Summary

- The lymphatic system collects fluid from between the cells and returns it to the blood.
- The lymphatic system contains cells that help the body fight disease.
- The lymphatic system consists of lymphatic vessels, lymph, and tissues and organs throughout the body.
- The thymus, spleen, and tonsils contain lymphocytes that help fight pathogens.

Using Key Terms

1. Use each of the following terms in a separate sentence: *lymph nodes*, *spleen*, and *tonsils*.

Understanding Key Ideas

2. Lymph
 - a. is the same as blood.
 - b. is fluid in the cells.
 - c. drains into your muscles.
 - d. is fluid collected by lymphatic vessels.
3. Name six parts of the lymphatic system. Tell what each part does.
4. How are your cardiovascular and lymphatic systems related?

Math Skills

5. One cubic millimeter of blood contains 5 million RBCs and 10,000 WBCs. How many times more RBCs are there than WBCs?

Critical Thinking

6. **Expressing Opinions** Some people have frequent, severe tonsil infections. These infections can be treated with medicine, and the infections usually go away after a few days. Do you think removing tonsils in such a case is a good idea? Explain.
7. **Analyzing Ideas** Why is it important that lymphatic tissue is spread throughout the body?

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Topic: The Lymphatic System
SciLinks code: HSM0891