



## What Is This Module About?

Every day, you are in contact with your environment. You use your body to do a lot of things. You touch and hold objects and shake hands with other people and pat your pet animals. In activities like these, your body makes contact with other people, animals and objects in your surroundings. However, your environment is not perfect. It contains many organisms and substances that can harm your body. Nevertheless, you can carry out your everyday activities without any grave danger to your health. This is because of a special group of organs in your body that protect you from danger. Your body's ability to ward off harmful organisms is called **immunity**. Maintaining this ability is the function of your lymphatic system. Do you ever wonder how your lymphatic system carries out this function?

Without your being aware of it, a war rages on inside your body every day. This is a war between harmful organisms and your lymphatic system. When your lymphatic system wins, you stay healthy. When it loses the fight, you get sick.

In this module, you will learn about the parts and functions of the lymphatic system. You will also find out about some injuries and diseases that can affect the lymphatic system and the ways by which you can take care of it.

This module is divided into three lessons. These are:

Lesson 1 — *The Parts and Functions of the Lymphatic System*

Lesson 2 — *Diseases That Can Affect the Lymphatic System*

Lesson 3 — *Taking Care of the Lymphatic System*



## What Will You Learn From This Module?

After studying this module, you should to be able to:

- ◆ describe the parts of the lymphatic system of the human body;
- ◆ state the functions of the lymphatic system;
- ◆ identify and describe diseases that can affect the lymphatic system; and
- ◆ demonstrate how to take proper care of the lymphatic system.



## Let's See What You Already Know

To find out how much you already know the topic to be discussed in this module, take the following test. Write your answers on the lines .

1. Enumerate the parts of the lymphatic system.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
2. State two functions of the lymphatic system.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
3. Identify two diseases associated with the lymphatic system.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
4. State four ways of taking care of the lymphatic system.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  - d. \_\_\_\_\_
5. Name two organisms that can trigger an immune reaction from the body.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on page 25.

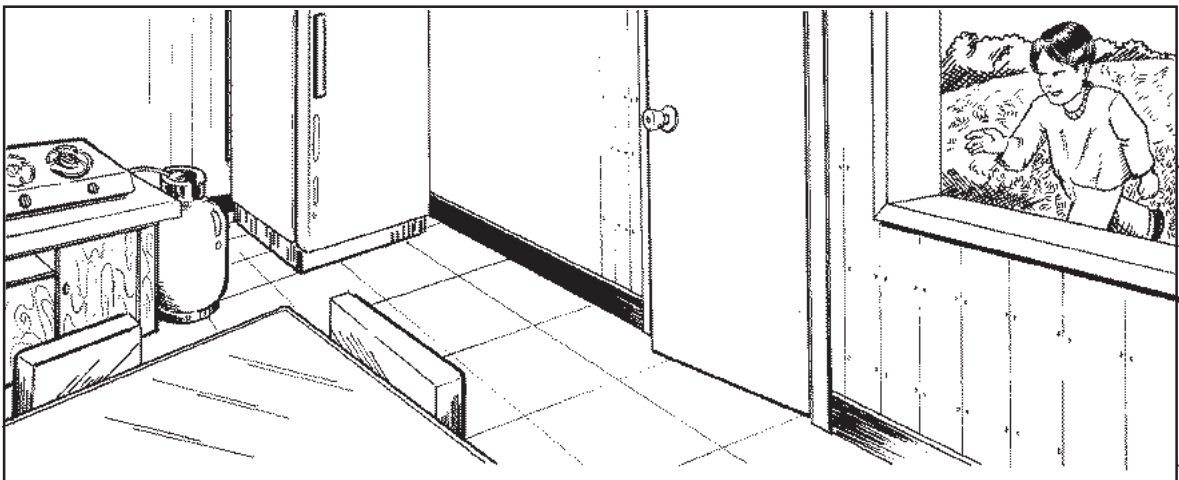
If all your answers are correct, very good! This shows that you already know much about the topic. You may still study the module to review what you already know. Who knows, you might learn some more new things.

If you got a low score, don't feel bad. This module is for you and it will help you to understand some important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin lesson 1.

# The Parts and Functions of the Lymphatic System

If you're the last person to leave your house, what are the things you do? Do you lock the doors? Do you check if the windows are closed, the lights are turned off and the gas tank is sealed? These habits manifest your need for security. If you accidentally leave your door unlocked, what could possibly happen?



Life nowadays is full of uncertainties. Every day, you face danger from sickness, accidents and other events that threaten your well-being and health. You know how important security is in your life. You lock the doors of your house before you leave because you don't want intruders to get in. There are always bad people who can harm your family and damage your property.

You are fortunate to have a built-in security system inside your body. This is the **immune** or **lymphatic system**, which maintains the immunity of your body. The lymphatic system keeps you safe from harmful organisms that can make you sick. It works as your own "army" to defend your body from harm. But do you know what exactly make up your lymphatic system and how it works?

In this lesson, you will be introduced to the parts and functions of the lymphatic system. The lymphatic system keeps the body immune to infections, enabling it to fight off organisms that can harm the body. Indeed, the lymphatic system is a very important part of the body. Without it, staying healthy would not be possible.

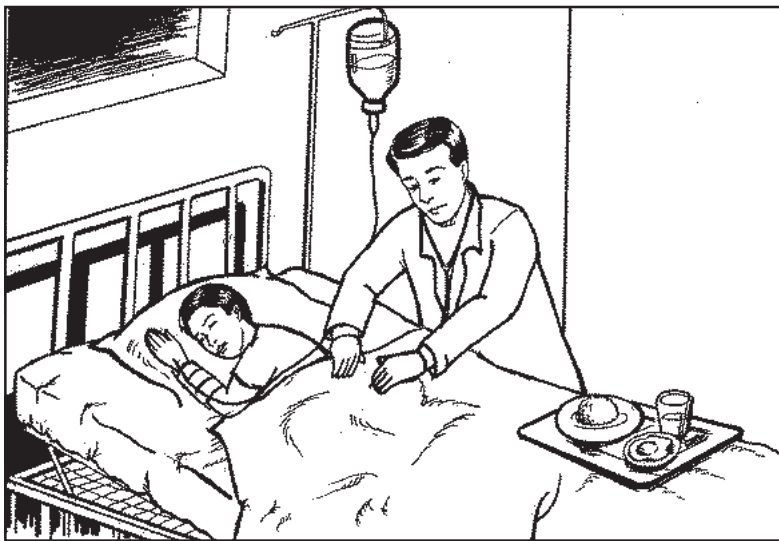


## Let's Read

Recall a time when you got sick and had to stay in bed for some time. How did it feel to be sick? What did you do in order to get well?

Read the following story:

Ben was a twelve-year old boy who liked to play a lot. He loved to roll in the mud with his playmates and he often swam in the river that ran through his town. One day, he felt sick. He was running a high fever and he could hardly move. His mother took him to a doctor who said that he should be confined in a hospital. In the hospital, a doctor gave Ben some medicine to make him well.



After a few days, Ben was up and about again. When his doctor saw him, the doctor smiled and said, "It's a good thing Ben's immune system is strong. He would have been worse if his immune system didn't help him fight the disease."



## Let's Think About This

Answer the following questions:

1. Why do you think Ben got sick?

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2. How do you think Ben was able to recover from his illness?

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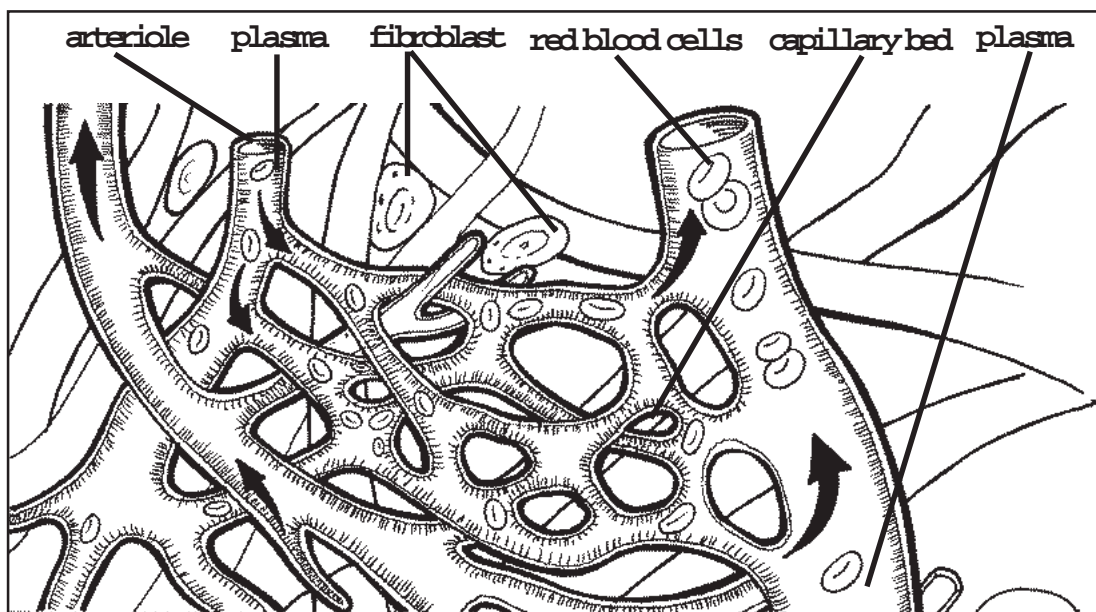
Check your answers in the *Answer Key* on page 25.



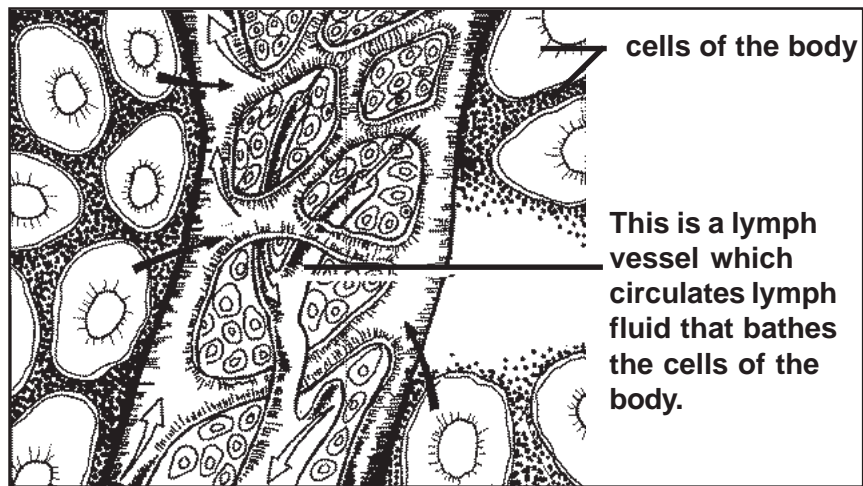
## Let's Learn

In the previous section, you read the story of Ben and how he got sick and recovered from his illness. Ben was able to get well because, as his doctor said, his immune or lymphatic system helped him.

The lymphatic system is a network of vessels whose primary function is to assist in circulating body fluids. These vessels transport excess fluid away from the interstitial spaces (spaces between cells in body tissues) and return it to the bloodstream. This prevents tissues from swelling up. The lymphatic system also filters out disease-causing organisms, produces a type of white blood cells and generates antibodies.

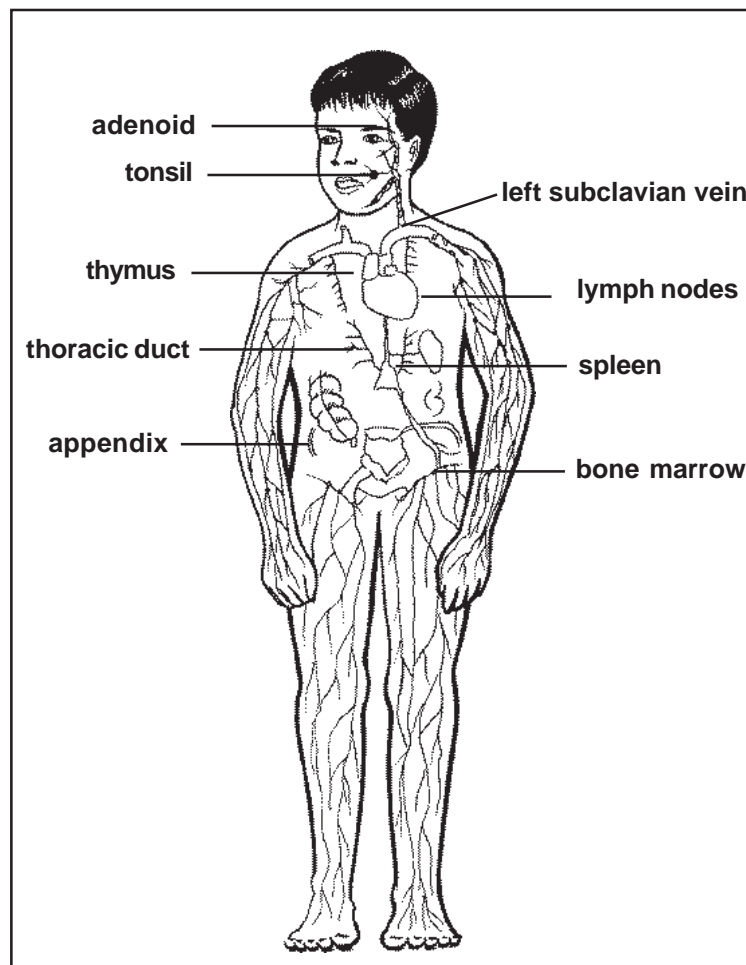


The picture above shows a capillary network through which blood passes and reaches the cells of the body. When blood reaches the cells, exchange of food, oxygen and nutrients takes place. As this occurs, a little liquid from the plasma (the liquid part of blood) leaks out of the capillary wall. This liquid reaches the spaces between the body cells (interstitial spaces) and is collected by and stored in tubes called **lymphatic vessels**. Once inside the lymphatic vessel, the liquid is called **lymph**. Lymph is a milky fluid that continuously bathes the cells of the body. Wherever there are cells, lymph is also found. It needs to be circulated like blood in order to remove excess fluid and harmful materials from interstitial spaces.



Lymph is found all over the body except the central nervous system, eyeballs, inner ear, cartilage and the epidermis of the skin. The walls of lymph vessels are lined with a single layer of **endothelium** which permits fluid and large particles, such as plasma proteins and foreign substances, to enter.

Lymph has components similar to those of blood, except that it has no red blood cells and platelets. It has a type of white blood cells called **lymphocytes** as well as cells that engulf foreign materials, which are called **macrophages**.



The Lymphatic System of the Human Body

The lymphatic system is made up of the following parts:

1. **Lymphatic vessels** – As was mentioned earlier, the lymphatic vessels are tubes through which lymph passes as it circulates the body. They return the lymph to the blood through veins near the heart.

There are two major lymphatic vessels. These are the **thoracic duct** and **right lymph duct**. All the lymph collected from the left side of the body, the digestive tract and the right side of the lower part of the body flows into the thoracic duct. The thoracic duct then empties the lymph into the **left subclavian vein**, which then brings the lymph to the heart. On the other hand, all the lymph from the right side of the head, neck and chest go to the right lymph duct which then deposits it into the **right subclavian vein**.

2. **Lymph nodes** – These are clumps of tissue that are found mainly in the neck, groin and armpits. However, they are found all over the lymphatic vessels. Lymph passes through the lymph nodes before it returns to the blood. The primary function of the lymph nodes is to produce lymphocytes.

3. **Lymphoid organs** – These are organs that contain a large amount of lymphocytes. Among these are the:

- ◆ **Spleen** – a soft, purplish organ lying high above the abdomen. This organ receives blood from an artery that branches off to the aorta, the largest artery in the body. The blood vessels of the spleen are surrounded by lymphocytes and macrophages. The macrophages remove harmful microorganisms from the blood and destroy them by phagocytosis.
- ◆ **Tonsils** – masses of tissue located in a protective ring under mucous membranes in the mouth and back of the throat. These help protect the body against bacteria that invade tissues around the openings of the mouth and nose.
- ◆ **Thymus** – a soft, flattened, pinkish-gray organ located in the upper chest under the breastbone. The thymus serves as a site for the development of lymphocytes in the fetus. Soon after birth, the thymus begins secreting a group of hormones that enable lymphocytes to develop into **T cells**, groups of cells that protect the body against invasions by foreign organisms. If the thymus fails to develop, the immune system cannot develop completely as well.





## Let's Review

It is said that the circulatory and lymphatic systems are similar. Can you identify the similarities and differences between these two organ systems? List them in the table below.

Similarities	Differences

Compare your answers with those in the *Answer Key* on page 26.



## Let's Learn

Now let us discuss the functions of the lymphatic system. The lymphatic system has two main functions: maintaining fluid balance in the body and immunity.

Maintaining fluid balance in the body is accomplished by the lymphatic vessels, which collect lymph from the interstitial spaces and return it to the blood. Drainage of the lymph is important, because if the fluid accumulates in the interstitial spaces over a period of time, the tissues would swell up. This could lead to the destruction of the tissues.

Immunity or the ability of the body to fight off infection is accomplished by the lymphatic system through the actions of its components. The lymph nodes filter the air that passes through the mouth and the spleen filters the blood that passes through it.

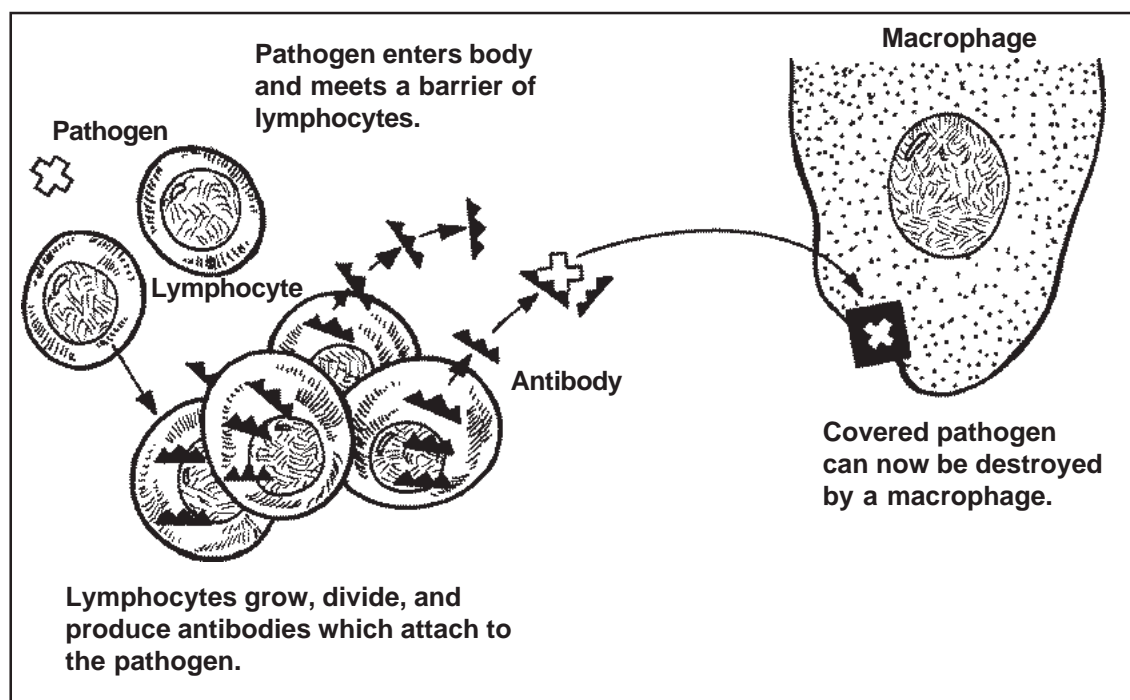
The lymph nodes, tonsils and spleen accomplish their tasks by trapping and destroying antigens in the lymph, air and blood, respectively. **Antigens** are molecules that cause the body to produce antibodies, which are proteins. Bacteria, viruses, malignant (cancer-causing) cells and foreign tissues are examples of antigens.



Destruction of antigens is carried out by the lymphocytes. If you recall, lymphocytes are a group of white blood cells. There are two types of lymphocytes that are active in the immunity function of the lymphatic system. These are the T lymphocytes (T cells) and B lymphocytes (B cells).

**B lymphocytes** produce antibodies. Antibodies are able to recognize specific antigens and attach themselves to these antigens. This action causes the antigens to become inactive and prevents them from harming the cells of the body.

**T lymphocytes** are further divided into groups, each having a specific function. When these cells recognize foreign antigens on the surface of a body, they change into active cells that attack the infected cells directly. Some T cells also release chemicals that draw the macrophages, which then engulf and absorb the infected cells.





## Let's Try This

Palpate for your lymph nodes. Feel the lymph nodes in your body by gently pressing your hand against your armpits, groin or neck.



If you weren't able to feel any tiny lumps, that means you are not suffering from any infection. You can actually see your lymphatic system at work when you are sick. When you are sick, you will notice that you have some lumps in your neck. These lumps are swollen lymph nodes that are helping you get well. Your lymph nodes swell because your lymphatic vessels are carrying the infection there so that your lymphocytes can act on it immediately.



## Let's See What You Have Learned

Match the items in Column A with those in Column B.

A	B
____ 1. lymphatic system	a. the organ where T lymphocytes develop
____ 2. immunity	b. molecules that cause the body to produce antibodies
____ 3. spleen	c. interstitial fluid
____ 4. lymphocyte	d. destroys antigens in the air that enters the body

- |                        |  |
|------------------------|--|
| _____ 5. antigens      | e. network of vessels that circulate lymph                       |
| _____ 6. thymus        | f. swells during infections                                      |
| _____ 7. B lymphocytes | g. a type of white blood cell that maintains the body's immunity |
| _____ 8. lymph node    | h. ability of the body to fight off infections                   |
| _____ 9. lymph         | i. lymphocytes that produce antibodies                           |
| _____ 10. tonsils      | j. a lymphoid organ  |

Compare your answers with those in the *Answer Key* on page 26. If your score is 6 or higher, congratulations. You did great! You have learned a lot about the parts and functions of the lymphatic system. Review the parts you missed then proceed to the next lesson.



## Let's Remember

- ◆ The lymphatic system is a network of organs and vessels that collect excess fluid from the interstitial spaces and return it to the bloodstream. Its primary functions are maintenance of fluid balance in the body and immunity.
- ◆ Lymph is a milky fluid that continuously bathes the cells of the body, and is circulated around the body in order to remove excess fluid and harmful materials from interstitial spaces.
- ◆ Lymph contains a type of white blood cells called lymphocytes as well as macrophages, cells that eat foreign materials in the body.
- ◆ The lymphatic system is composed of lymphatic vessels, lymph nodes and lymphoid organs such as the spleen, tonsils and thymus.
- ◆ The lymph nodes and lymphoid organs play an important role in immunity. They contain lymphocytes that destroy antigens.
- ◆ The two types of lymphocytes that are active in maintaining the immunity of the body are the T lymphocytes or T cells and B lymphocytes or B cells. B lymphocytes produce antibodies that attach themselves to antigens, while T lymphocytes attack infected cells directly.

# Diseases That Can Affect the Lymphatic System

In the previous lesson, you learned about the parts and functions of the lymphatic system. You also discovered the role of your lymphatic system in keeping you healthy by preventing bacteria and other foreign materials from harming your body. The lymphatic system does its work so well that you are able to avoid infectious diseases.

In this lesson, you will learn about some diseases that can affect the lymphatic system. Ironical as it may seem, the primary organ system that defends the body from harm is also prone to diseases. Hence, it is important to know what these diseases are.



## Let's Try This

As of 1999, there were already 23,000 Filipinos 15 to 49 years old who were infected with HIV. Still, a lot of us remain ignorant of the causes and effects of this virus and the disease it brings—AIDS. The following are a list of statements about AIDS and HIV. Some of them are correct, others are not. Can you distinguish the correct statements from the incorrect ones? Put their numbers in the appropriate boxes on the next page.

1. You can get HIV in swimming pools.
2. If you are infected with HIV, you will surely get sick with AIDS.
3. HIV-positive women can infect their babies through breastfeeding.
4. If you hug someone who has HIV or AIDS, you will also get infected.
5. You can get HIV from mosquito and animal bites.
6. AIDS is a disease that attacks the immune system.
7. So far, no cure for AIDS has been discovered.
8. AIDS stands for acquired immune deficiency syndrome.
9. You can get infected with HIV through unprotected sex, sharing needles and blood transfusion.
10. You can get infected with HIV if you share food and personal things with an HIV-infected person.

**Correct Statement**

**Incorrect Statement**

Compare your answers with those in the *Answer Key* on page 26.



## **Let's Learn**

### **Acquired Immune Deficiency Syndrome (AIDS)**

Let us now learn about what medical experts call the “health threat of the century.” AIDS is a specific group of diseases that result from the reduction of the immunity of the body. This means that it attacks the lymphatic system, specifically, the T lymphocytes or T cells. This is brought on by a virus called **human immunodeficiency virus (HIV)**.

HIV is transmitted through the following means:

- ◆ unprotected sex with an infected person
- ◆ sharing needles or syringes for drug injection with someone who is infected with the virus
- ◆ transfusion of infected blood

The three modes of transmission listed above are the only means by which one can get infected with HIV. You can't get infected through mosquito and animal bites, because the virus lives only in humans. You can't also get the virus by hugging an infected person or by sharing his or her food and personal things. Nor can you get it in swimming pools—the chemicals in pools are strong enough to kill the virus.

However, women infected with HIV can pass on the virus to their unborn children. They can also transmit the virus to their babies through breastfeeding. Hence, if a woman is HIV-positive (infected with HIV), she is discouraged from getting pregnant.

If a person is infected with HIV, this does not mean that he or she will develop AIDS, but it is highly probable that he or she will. Some HIV-positive people can go for more than ten years without developing AIDS. However, once their T cell count becomes lower than 200 cells per cubic milliliter of blood and they develop an infection, they are considered to have AIDS already.

AIDS causes death because as HIV multiplies inside the body, it attacks and kills the T cells. This slows down the ability of the body to fight infection caused by bacteria, viruses and other foreign materials. Thus, the patient becomes prone to all sorts of infections, and these infections are the ones that eventually lead to the patient's death. Among these infections are pneumonia, Kaposi's sarcoma (a type of skin cancer), and meningitis (an infection of the fluids in the brain). Without the T cells to fight the organisms that cause the infection, the infection worsens until the patient dies.



## Let's Review

Let's see if you now have a clearer understanding of AIDS. Answer the following:

1. Tell the difference between AIDS and HIV.

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2. Name the ways by which HIV is transmitted.

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Compare your answers with those in the *Answer Key* on page 27.

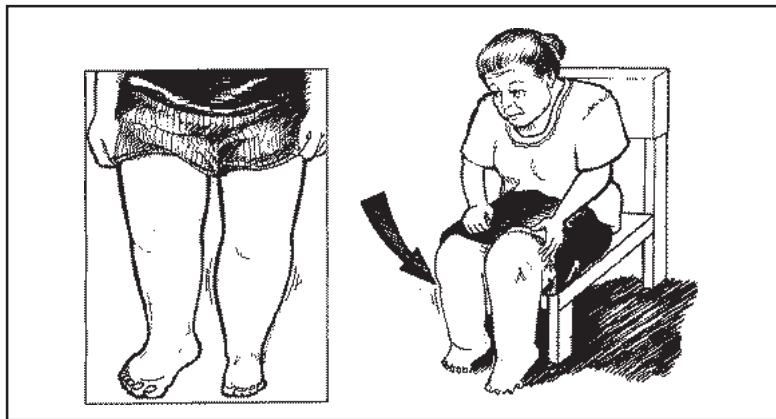


## Let's Learn

Here are some more diseases and disorders that affect the lymphatic system.

### Edema

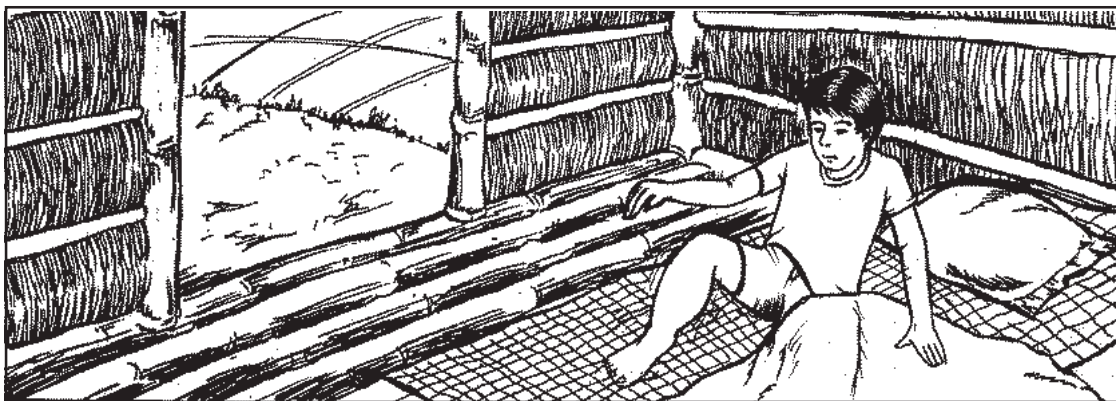
Mrs. Castro was a 56-year-old teacher. She had been having heart problems for a long time. One day, she noticed that both of her legs were swollen and heavy. She went to the doctor, who told her that she was suffering from heart failure. Her legs swelled because of edema, a symptom of heart failure. She was given medicine to relieve the swelling in her legs and to improve her blood circulation.



***Edema** is a swelling on the body caused by the accumulation of fluid in the body tissues. It results from the inability of the lymphatic system to perform the task of draining the body's fluids. It can also be brought on by various diseases and disorders, such as heart failure, kidney malfunction and varicose veins.*

### Lymphangitis and Lymphadenitis

Carlo, a 16-year-old boy, woke up one day to find that his legs were painfully swollen. He remembered that he stepped on a sharp object a week before, but did not do anything about it. Afterwards he developed a fever which lasted for days. He was brought to a hospital, where he was diagnosed to have lymphangitis.



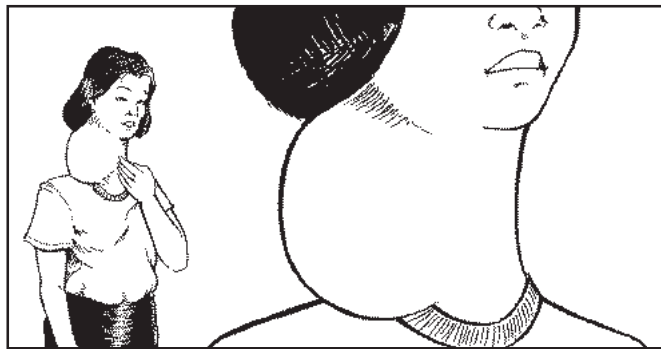
Lymphangitis and lymphadenitis are complications that result from infections caused by bacteria.



**Lymphangitis** is the inflammation of the lymphatic vessels that results from infection by streptococci and staphylococci, two common bacteria. These bacteria are usually transmitted through insect or animal bites. **Lymphadenitis**, on the other hand, involves inflammation of the lymph nodes. This may occur if the nodes are overwhelmed by bacteria, viruses, fungi or other organisms, infection then develops within the nodes. Both lymphangitis and lymphadenitis should be treated immediately (usually with antibiotics). Otherwise, the infection could spread to the bloodstream and cause death.

## **Lymphoma**

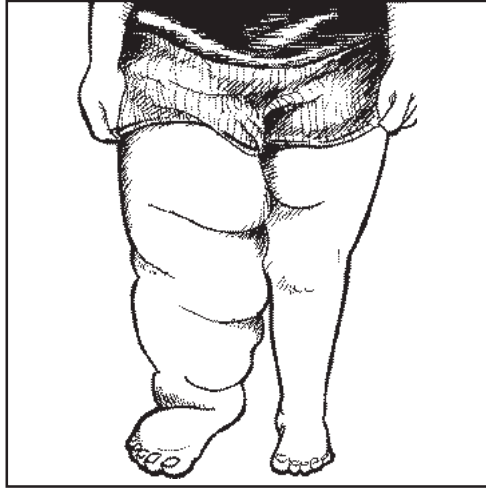
Alice was a 35-year-old housewife. One day, she noticed that there was a lump on the left side of her neck. She dismissed it as a swollen lymph node and hoped it would disappear on its own. However, the node kept on growing. She also began to feel constantly tired and started losing weight. She consulted a doctor, who told her to undergo a biopsy. **Biopsy** involves getting a tissue sample and studying it under a microscope. The result of the biopsy revealed something Alice did not expect: She had lymphoma.



**Lymphoma** is a cancer of the lymphatic system. The most common type of lymphoma is **non-Hodgkins lymphoma**. In this type of disease, cells in the lymphatic system become abnormal. They divide and grow without any order or control. This disease can start anywhere in the body. Its most common symptom is a painless swelling of the lymph nodes in the neck, under arm or groin. Lymphoma patients usually undergo chemotherapy and radiation therapy. Some even have to undergo surgery.

## Elephantiasis

Juan is an abaca farmer, who often wades in dirty water because of his work. One day, he noticed that his left leg was swollen. The swelling got worse until his entire lower left extremity swelled. He was diagnosed to be suffering from elephantiasis.



**Elephantiasis** is an abnormal enlargement of any part of the body caused by the obstruction of the lymphatic vessels in the affected area. This disease commonly affects the leg and scrotum.

In tropical countries like ours, elephantiasis is normally caused by filariasis, an infestation of certain parasitic round worms called **Wuchereria bancrofti**. These tiny worms are introduced into the body by many types of mosquitoes. These parasites search out the lymph nodes and lymph vessels, where they absorb nutrients. Abaca plantations are often infested with these parasites, hence workers are advised to wear boots and protective clothing. Recovery from filariasis is possible, but elephantiasis itself cannot be cured.



## Let's See What You Have Learned

Answer the following:

1. Differentiate lymphadenitis from lymphangitis.

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2. What is AIDS?

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Compare your answers with those in the *Answer Key* on page 27. If you answered both questions correctly, good work! You have learned a lot about the diseases that affect the lymphatic system.

If you were not able to answer both questions correctly you should study the lesson again. Review them and try to answer the questions again. Afterwards, you may proceed to the next lesson.



## Let's Remember

- ◆ The lymphatic system is prone to many kinds of diseases. Among these are AIDS, edema, lymphangitis, lymphadenitis, lymphoma and elephantiasis.
- ◆ AIDS is a group of infections that occur due to the reduction of the body's immunity. It is caused by HIV, a virus that attacks the lymphatic system, specifically the T cells.
- ◆ Edema is a swelling in the body caused by a buildup of fluid in the body tissues.
- ◆ Lymphangitis is an inflammation of the lymphatic vessels that results from infection by streptococci and staphylococci.
- ◆ Lymphadenitis is an inflammation of the lymph nodes that occurs if the nodes are overwhelmed by bacteria and other organisms.
- ◆ Lymphoma is a cancer of the lymphatic system, the most common type of which is non-Hodgkin's lymphoma.
- ◆ Elephantiasis is an abnormal enlargement of any part of the body caused by the obstruction of the lymphatic vessels. It is usually caused by the infestation of roundworms that are transmitted through mosquito bites.

## **Taking Care of the Lymphatic System**

In the previous lesson, you learned about some diseases that can affect your lymphatic system. To prevent these diseases from occurring, it is very important for you to learn how to take care of your lymphatic system.

In this lesson, you will learn how to take good care of the lymphatic system.



### **Let's Try This**

How well do you take care of your lymphatic system? Find out by answering the set of questions below.

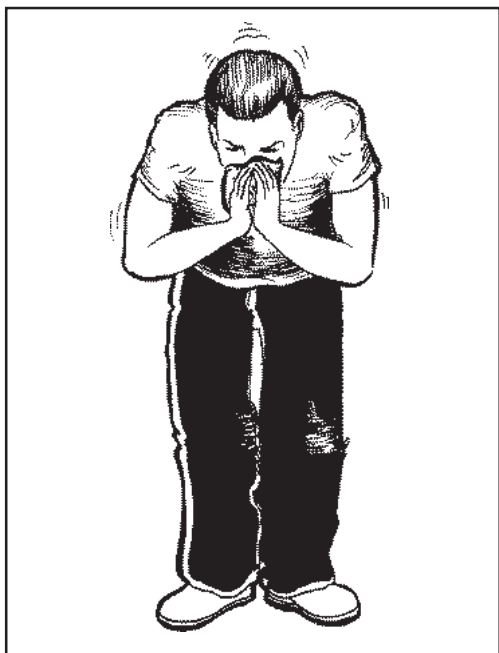
1. Do you have a well-balanced diet, that is, do you eat plenty of fruits and vegetables and less high-fat foods such as meat, eggs and butter? Yes No
2. Do you avoid a lot of salty foods? Yes No
3. Do you try to maintain your normal weight? Yes No
4. Do you clean your wounds and scratches with soap and water? Yes No
5. Do you go to the doctor regularly for a checkup? Yes No
6. Do you exercise regularly? Yes No
7. Do you get enough sleep and rest? Yes No
8. Do you protect yourself from mosquito and animal bites? Yes No
9. Do you practice safe sex? Yes No

Did you answer Yes to all of the questions? If you did, that means that you are taking care of your lymphatic system very well. If you answered No to some of the questions, that means you need a change of habits. Read on to find out how you can take care of your lymphatic system and prevent yourself from getting sick.

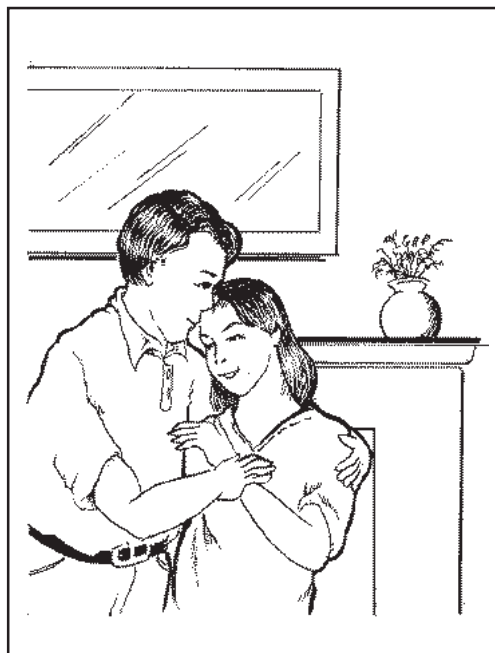


## Let's Learn

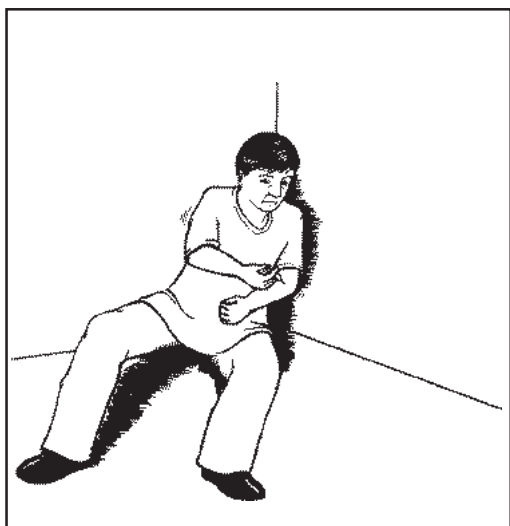
There are some ways by which you can take care of your lymphatic system.



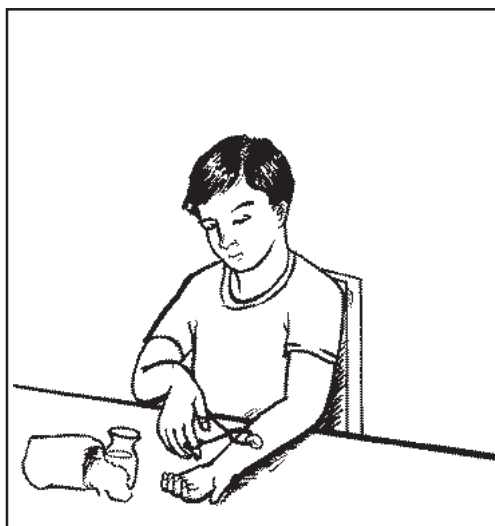
Avoid acquiring and spreading infections. Cover your nose when you sneeze and your mouth when you cough.



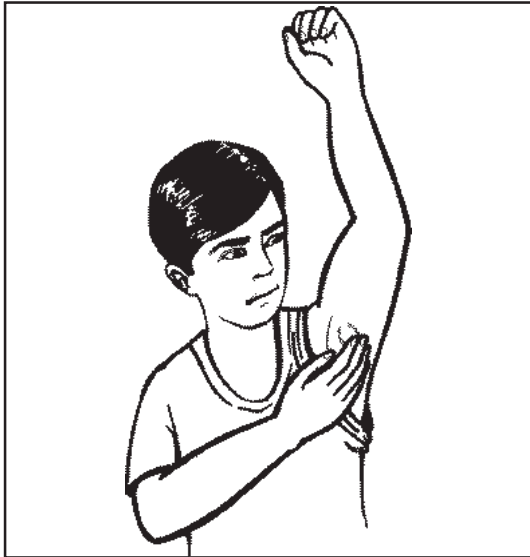
Practice safe sex in order to prevent AIDS. Be faithful to your partner to spare yourselves the danger of getting infected with HIV.



Avoid illegal drugs. Drug dependents, especially those who share needles, tend to get infected with HIV.



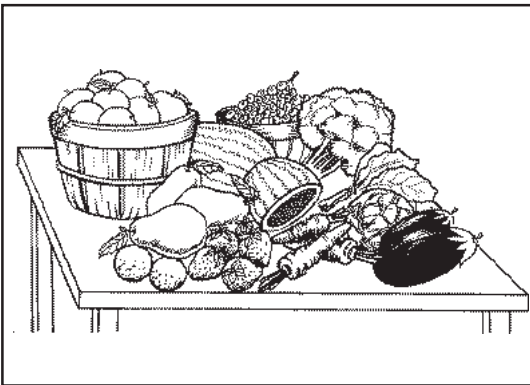
Avoid infection. Clean your wounds and scratches thoroughly to prevent inflammation of the lymphatic vessels.



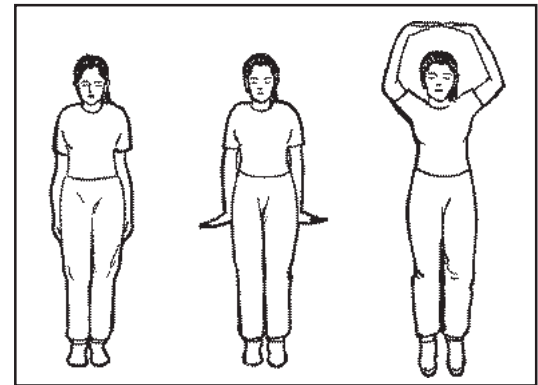
Check regularly for any lump in your armpit, on your neck and around your groin. Seek medical attention immediately if you detect any lump.



Avoid prolonged standing and other activities that can impede lymph drainage.



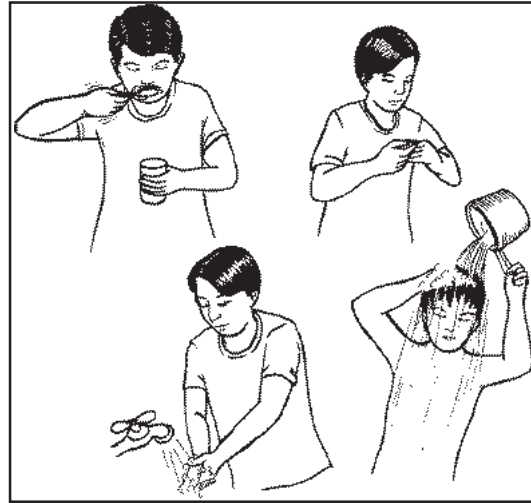
Eat nutritious foods such as fruits and vegetables to keep your lymphatic system healthy. Avoid eating salty foods because having too much salt in the body can cause you to retain fluids in your tissues.



Exercise regularly to keep your lymphatic system healthy. Make sure also that you get enough sleep and rest.



Wear rubber boots and protective clothing when working in farms to avoid contact with filariasis-causing organisms.



Maintain proper hygiene.



## Let's Think About This

After studying some of the guidelines on how to take care of the lymphatic system, examine yourself. Are you observing the proper habits and methods to protect your lymphatic system? Remember, protect your lymphatic system and it will protect you.



## Let's See What You Have Learned

Which of the following practices are good for your lymphatic system? Put a check on the line before the number of the correct practice.

- ☐ 1. eating junk foods
- ☐ 2. taking a bath regularly
- ☐ 3. covering the nose and mouth when sneezing
- ☐ 4. having multiple sexual partners
- ☐ 5. exercising regularly
- ☐ 6. eating plenty of salted nuts, *daing* and *tinapa*
- ☐ 7. cleaning wounds and scratches thoroughly
- ☐ 8. going to the doctor regularly for a checkup



- \_\_\_\_\_ 9. ignoring painless lumps on the neck, armpits and groin
- \_\_\_\_\_ 10. protecting oneself from mosquito and animal bites

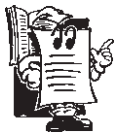
Compare your answers with those in the *Answer Key* on page 27.



## Let's Remember

- ◆ There are many ways by which you can take care of your lymphatic system. Among these are: avoiding catching and spreading infections, practicing safe sex, avoiding illegal drugs, cleaning wounds and scratches thoroughly, checking regularly for lumps in the armpits, neck and groin, avoiding activities that can impede lymph drainage, eating nutritious foods, avoiding salty foods, exercising regularly, protecting yourself from mosquito bites and maintaining proper hygiene.

You have now reached the end of the module. Congratulations! Did you enjoy studying this module? Did you learn a lot from it? The following is a summary of its main points to help you remember them better.



## Let's Sum Up

- ◆ The lymphatic system serves to maintain fluid balance in the body and fight off infections.
- ◆ The lymphatic system is composed of the lymphatic vessels, lymph nodes and lymphoid organs. The infection-fighting components of this organ system are the lymphocytes, specifically the T lymphocytes and B lymphocytes.
- ◆ Many diseases and disorders can affect the lymphatic system. Among these are AIDS, edema, lymphangitis, lymphadenitis, lymphoma and elephantiasis.
- ◆ You can take care of your lymphatic system by observing proper hygiene, protecting yourself against infection and eating nutritious foods.



## What Have You Learned?

Fill in the blanks.

1. Once the fluid in the interstitial spaces enters the lymphatic vessels, it is called \_\_\_\_\_.
2. \_\_\_\_\_ become swollen when there is an infection in the body.
3. The \_\_\_\_\_ is an organ where lymphocytes mature and develop into T lymphocytes.
4. The three parts of the lymphatic system are the \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
5. The most common type of lymphoma is \_\_\_\_\_.
6. \_\_\_\_\_ may be brought on by such diseases as heart failure.
7. AIDS stands for \_\_\_\_\_.
8. \_\_\_\_\_ foods can cause the body tissues to retain more fluid.
9. Lymphangitis and lymphadenitis are two diseases that result from infections caused by \_\_\_\_\_.
10. B lymphocytes produce \_\_\_\_\_ that attach themselves to antigens.

Compare your answers with those in the *Answer Key* on page 27.

If your score is:

- |   |   |    |   |
|---|---|----|---|
| 8 | – | 10 | Well done! You learned a lot from this module. Keep up the good work. |
| 4 | – | 7  | Good! You only need to review the parts you missed.                   |
| 0 | – | 3  | You should study the module again.                                    |



## Answer Key

### A. Let's See What You Already Know (*page 2*)

1.
  - a. lymphatic vessels
  - b. lymph nodes
  - c. lymphoid organs
2.
  - a. maintains fluid balance in the body
  - b. maintains immunity
3.
  - a. lymphangitis
  - b. lymphadenitis

(Other possible answers: AIDS, lymphoma, elephantiasis, edema)
4.
  - a. Proper hygiene
  - b. Avoiding infections
  - c. Regular consultation with the doctor
  - d. Checking regularly for palpable masses in the body
5.
  - a. bacteria
  - b. viruses

(Other possible answers: parasites such as tiny worms, fungi)

### B. Lesson 1

*Let's Think About This (page 4 )*

(Answers will depend on the learner's perception. The following are the expected answers, however.)

1. Ben got sick because he probably got infected by bacteria or viruses in the mud and river he played in.
2. Ben got well because his immune system fought the microorganisms that caused the infection in his body.

*Let's Review ( page 8)*

Similarities	Differences
They both circulate fluids throughout the body.	The circulatory system circulates blood while the lymphatic system circulates lymph.  Blood circulates through the pumping action of the heart; lymph circulates without any organ to pump it.
Both circulating fluids pass through a series of tubes.	Blood passes through veins, arteries, and capillaries; lymph passes through lymphatic vessels.

*Let's See What You Have Learned (pages 10-11)*

- |      |       |
|------|-------|
| 1. e | 6. a  |
| 2. h | 7. i  |
| 3. j | 8. f  |
| 4. g | 9. c  |
| 5. b | 10. d |

**C. Lesson 2**

*Let's Try This (page 13)*

Correct Statement	Incorrect Statement
3	1
6	2
7	4
8	5
9	10

*Let's Review (page 14)*

1. AIDS is a group of diseases that result from the reduced immunity of the body; HIV is the virus that causes AIDS.
2. HIV is transmitted through (a) unprotected sex, (b) sharing needles in injecting drugs and (c) blood transfusion.

*Let's See What You Have Learned (pages 17-18)*

1. Lymphadenitis refers to the inflammation of the lymph node, while lymphangitis refers to the inflammation of lymph vessels.
2. AIDS stands for Acquired Immune Deficiency Syndrome. It is caused by HIV, a virus that attacks the T cells of the lymphatic system and causes immunity to fail. This leads to many infectious and diseases.

**D. Lesson 3**

*Let's See What You Have Learned (pages 22-23)*

The following numbers should be checked: 2, 3, 5, 7, 8, 10.

**E. What Have You Learned (page 24)**

1. lymph
2. Lymph nodes
3. thymus
4. lymphatic vessels; lymph nodes; lymphoid organs
5. non-Hodgkin's lymphoma
6. Edema
7. acquired immune deficiency syndrome
8. Salty
9. bacteria
10. antibodies



## Glossary

**AIDS** Stands for acquired immune deficiency syndrome; a group of infections that attack the body as a result of the reduction of the body's immunity.

**Biopsy** A test conducted on whether a patient has cancer or not by taking a sample of the body tissues and studying it.

**Edema** A swelling in the body caused by the accumulation of fluid in the body tissues.

**Elephantiasis** An abnormal enlargement of any part of the body caused by the obstruction of the lymphatic vessels.

**Immunity** The ability of the body to fight off infections.

**Infection** The presence of harmful microorganisms and other foreign materials in the body.

**Inflammation** A condition characterized by redness, heat, swelling and pain; a reaction of the body to the presence of infection.

**Interstitial spaces** The spaces between cells in the tissues of the body.

**Lymphadenitis** An inflammation of the lymph nodes.

**Lymphangitis** An inflammation of lymphatic vessels.

**Lymph nodes** Part of the lymphatic system that filter lymph as it passes before it returns to the bloodstream.

**Lymphoma** A cancer of the lymphatic system.

**Lymphocyte** A type of white blood cell found in the lymph and the parts of the lymphatic system.

**Spleen** A lymphoid organ; filters the blood that passes through it.

**Thymus** An organ found high above the abdomen; where lymphocytes mature and develop.



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