

35.2 Defenses Against Infection

Lesson Objectives

- Describe the body's nonspecific defenses against invading pathogens.
- Describe the function of the immune system's specific defenses.
- List the body's specific defenses against pathogens.

Lesson Summary

Nonspecific Defenses The body has many nonspecific defenses, which defend against a wide range of pathogens.

- ▶ The first line of defense is skin. Skin keeps pathogens out of the body by forming a barrier that few pathogens can get through. Mucus, saliva, and tears contain an enzyme that can kill bacteria. Mucus can also trap pathogens.
- ▶ When pathogens do enter the body, the second line of defense goes to work. These nonspecific defenses include:
 - the **inflammatory response**, in which chemicals called **histamines** cause blood vessels near a wound to expand and phagocytes to move into the tissue to fight infection.
 - the production of proteins called **interferons**, which help block the replication of viruses.
 - the release of chemicals that produce a **fever**, an increase in normal body temperature, which may slow the growth of pathogens and speed up immune response.

Specific Defenses: The Immune System The function of the immune system is to fight infection by inactivating foreign substances or cells that have entered the body. The specific immune response works in several ways, including:

- ▶ recognizing "self," including cells and proteins that belong to the body.
- ▶ recognizing "nonself", or **antigens**, molecules found on foreign substances. Antigens stimulate the immune system to produce cells called lymphocytes that recognize, attack, destroy, and "remember" specific pathogens.
- ▶ producing specific lymphocytes that recognize specific antigens. They work by attacking infected cells or producing **antibodies**, proteins which tag antigens for destruction by immune cells.

The Immune System in Action The immune response works in two ways.

- ▶ In **humoral immunity**, white blood cells, called B lymphocytes (B cells), make antibodies that attack pathogens in the blood.
- ▶ In **cell-mediated immunity** white blood cells, called T lymphocytes (T cells), find and destroy abnormal or infected cells.
- ▶ After a pathogen is destroyed, memory B cells and memory T cells stay in the body. These cells help create a faster immune response if the same pathogen enters the body again.

Nonspecific Defenses

For Questions 1–8, write the letter of the definition that best matches each term.

Term

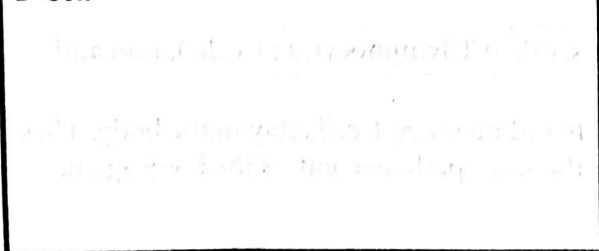
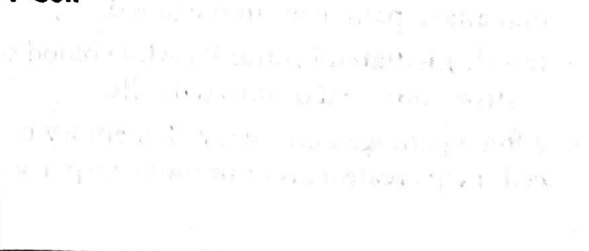
Definition

- | | |
|--------------------------------|--|
| _____ 1. skin | A. An increase in body temperature, which slows or stops pathogens |
| _____ 2. lysozyme | B. A secretion of the nose and throat that traps pathogens |
| _____ 3. inflammatory response | C. An enzyme found in tears and saliva that breaks down bacterial cell walls |
| _____ 4. histamines | D. Chemicals that increase blood flow to tissues |
| _____ 5. interferons | E. Combination of physical and chemical barriers that defend against pathogens |
| _____ 6. fever | F. Redness, pain, and swelling at the site of an injury |
| _____ 7. mucus | G. Proteins that fight viral growth |
| _____ 8. nonspecific defenses | H. The body's most important nonspecific defense |

Specific Defenses: The Immune System

For Questions 9–14, complete each statement by writing the correct word or words.

9. The _____ response is the body's response to specific invaders.
10. A substance that triggers the immune response is known as a (n) _____.
11. The main role of _____ is to tag _____ for destruction by immune-system cells.
12. The main working cells of the immune system are two types of _____. Their specific types are determined by a person's _____.
13. _____ discover antigens in body fluids.
14. _____ defend the body against pathogens that have infected body cells.
15. **THINK VISUALLY** In the space provided, draw an example of each type of lymphocyte indicated to show a basic difference between the two types of cells.

B Cell	T Cell
	

The Immune System in Action

For Questions 16–22, write True or False on the line provided.

- _____ 16. Humoral immunity is a response to pathogens in blood and lymph.
- _____ 17. The first response of humoral immunity to infection is much faster than the second response.
- _____ 18. Plasma cells are specialized B cells.
- _____ 19. Cell-mediated immunity involves antibodies.
- _____ 20. Cell-mediated immunity causes infected body cells to die.
- _____ 21. Cell-mediated immunity only works on viral diseases.
- _____ 22. Cytotoxic T cells are a cause of rejection of transplanted organs.

23. Complete the table to compare how humoral and cell-mediated immunity work after a virus invades the body for the first and second times.

Action of Humoral Immunity	Action of Cell-Mediated Immunity
Primary response:	Primary response:
	Macrophages consume viruses and display their antigens on the cell surface. Helper T cells are activated.
Activated B cells grow and divide rapidly.	
	Helper T cells activate B cells and cytotoxic T cells and produce memory cells.
Plasma cells release antibodies that capture antigens and mark them for destruction.	
Secondary response:	Secondary response:

Apply the Big Idea

24. A runny nose is a symptom of a cold. How is this evidence that the body's immune defenses are working?

35.3 Fighting Infectious Disease

Lesson Objectives

- ☞ Distinguish between active immunity and passive immunity.
- ☞ Describe how public health measures and medications fight disease.
- ☞ Describe why patterns of infectious disease have changed.

Lesson Summary

Acquired Immunity You can acquire immunity without having a disease.

- ▶ **Vaccination** is the injection of a weakened or mild form of a pathogen to cause immunity.
- ▶ **Active immunity** results from vaccines or natural exposure to an antigen.
- ▶ **Passive immunity** forms when antibodies are introduced into the body. It lasts only until the immune system destroys the foreign antibodies.

Public Health and Medications In 2005, less than 5 percent of human deaths were caused by infectious diseases. This statistic is the result of two major factors.

- ▶ The field of public health provides services that help monitor food and water supplies and promote vaccinations and healthy behavior.
- ▶ The development and use of many new medications, particularly antibiotics and antiviral drugs, has saved many lives by helping to cure infectious diseases.

New and Re-Emerging Diseases Since 1980, many new diseases have appeared and several diseases once thought to have been eradicated have recurred. There are two main reasons for these changes.

- ▶ Interactions with exotic animals have increased.
- ▶ The misuse of medications has caused diseases that were once under control, such as tuberculosis and malaria, to evolve resistance to many antibiotics.

Acquired Immunity

1. What was the origin of the term *vaccination*? Explain why this name was given.

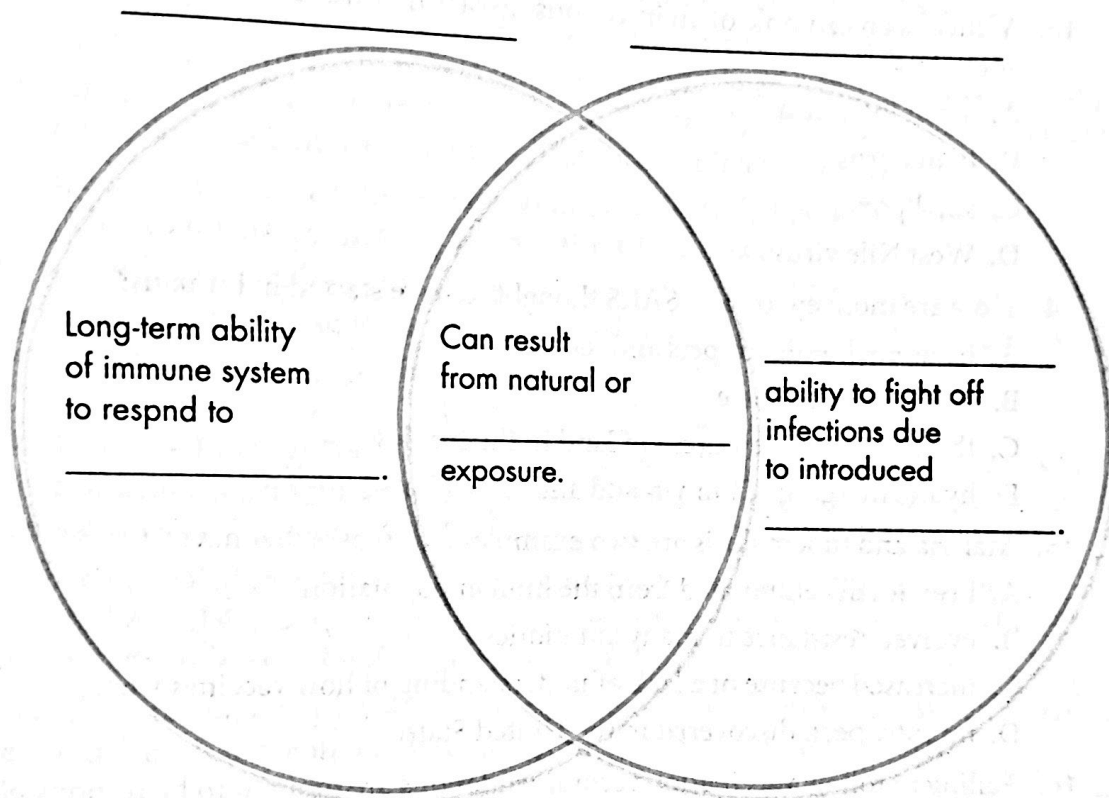
2. How does a vaccine work?

3. What type of immunity do vaccinations produce?

4. What type of immunity does a mother pass on to her infant while breastfeeding?

5. Why is passive immunity only temporary?

6. Complete the Venn diagram comparing the two types of immunity and writing the correct word or words on the lines provided.



Public Health and Medications

For Questions 7–11, complete each statement by writing the correct word or words.

7. Promoting childhood _____ and providing clean drinking water are two _____ activities that have greatly reduced the spread of many infectious diseases.
8. Compounds that kill bacteria without harming the host cells are called _____.
9. The first antibiotic to be discovered was _____.
10. _____ drugs inhibit the ability of viruses to invade cells or multiply within cells.
11. How did Alexander Fleming discover the first antibiotic?

New and Re-Emerging Diseases

For Questions 12–16, write the letter of the correct answer on the line at the left.

- _____ 12. Which of the following is NOT considered to be a major cause of new or re-emerging diseases?
- A. misuse of medications
 - B. merging of human and animal habitats
 - C. vaccination
 - D. trade in exotic animals
- _____ 13. Which is an example of an infectious disease that was eliminated by public health measures?
- A. avian influenza
 - B. hantavirus
 - C. smallpox
 - D. West Nile virus
- _____ 14. How are monkeypox and SARS thought to have started in humans?
- A. by animal trade for pets and food
 - B. antibiotic resistance
 - C. the clearing of new areas of land in the tropics
 - D. by the merging of human and animal habitats
- _____ 15. Malaria and tuberculosis are two examples of diseases that have
- A. been totally eliminated from the human population.
 - B. evolved resistance to many antibiotics.
 - C. increased because of a lack of understanding of how vaccines work.
 - D. recently been discovered in the United States.
- _____ 16. Failing to follow vaccination recommendations are thought to be responsible for the comeback of
- A. Ebola.
 - B. influenza.
 - C. Lyme disease.
 - D. measles.

Apply the Big Idea

17. After being vaccinated, many children are treated for fever. This is not considered a danger or problem. Why might this happen?
