

THE HEALTHY IMMUNE SYSTEM

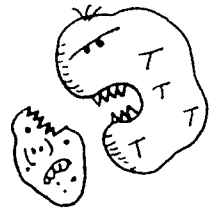
DIRECTIONS: Fill in the blanks using the words below to explain how the healthy immune system functions.

- | | | | |
|------------|-------------|-------------------|------------|
| VIRUS | BACTERIA | ILLNESS | ANTIBODIES |
| NORMAL | ANTIBIOTICS | MULTIPLIES | IMMUNE |
| T-CELLS | B-CELLS | WHITE BLOOD CELLS | |
| CHEMICALLY | PROTOZOAN | FUNGI | |

1. A germ (_____ , _____ , _____ , _____ , _____ , etc.) invades the body and quickly _____ .

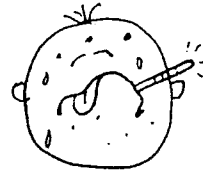
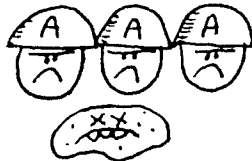
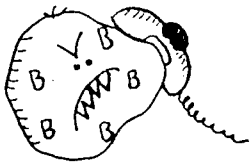


2. The healthy _____ system fights back by sending _____ to destroy the invaders.



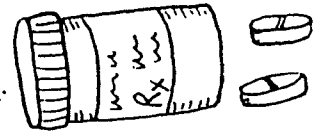
3. First, the _____ surround and "eat" some of the invaders, then _____ notify the

4. _____ which, in turn, produce



5. _____ which destroy the germs.

6. Germs that survive the attack can cause _____ .



7. _____ help to finally destroy all the germs.

8. _____ health is restored.



Active v. Passive “IMMUNITY”

Active Immunity

- As a result of exposure to an infectious agent or one of its products (antigens)
- Antibodies are produced by the host in response to the infectious agent itself (e.g. recovery from the disease), or in response to artificial immunization (vaccination) with some **product derived from the infectious agent** (e.g. toxoid, killed cells, structural components of cells, inactivated virus, etc.).

Passive Immunity

- As a result of the **acquisition of antibodies** which have been produced in another animal (by active means) or derived from cells grown in tissue culture (monoclonal antibodies)
- Injection of immune serum from an individual previously immunized or recovered from disease, e.g. hepatitis; Injection of serum from an animal hyperimmunized with tetanus toxoid; Placental transfer of antibodies from mother to fetus; Transfer of antibodies from mother to infant in milk by nursing.

Directions

- Put an “A” in the box if it is active immunity and a “P” if it is passive immunity.

I was recently vaccinated with a small amount of the polio virus. The injections allowed me to “build-up” some immunity in case of a second exposure.

A cow recently fought off the tetanus bacterium. A serum of its antibodies was injected in me as a vaccine and allowed me to fight off the virus in my body. I stepped on a rusty nail recently.

Memory cells in my body played a large part in allowing me to fight off my second and third exposures to chicken pox

As a developing fetus my mother produced a surplus of antibodies that were successful in fighting influenza in she and I.

24.1 Nonspecific Defenses

Lesson 24.1: True or False

Name _____ Class _____ Date _____

Write true if the statement is true or false if the statement is false.

- _____ 1. The skin is the single most important defense the body has.
- _____ 2. Sneezing removes pathogens from your nose.
- _____ 3. Sweat, mucus, tears, and saliva are all types of mechanical barriers used to protect you.
- _____ 4. The inflammatory response is part of the body's first line of defense.
- _____ 5. Leukocytes are white blood cells that fight infections and get rid of debris.
- _____ 6. Barriers that keep out pathogens are the body's first line of defense.
- _____ 7. The second line of defense attacks pathogens that manage to enter the body.
- _____ 8. The second line of defense includes mechanical, chemical, and biological barriers.
- _____ 9. The first line of defense includes the inflammatory response and phagocytosis.
- _____ 10. A nonspecific defense can be tailored to a particular pathogen.
- _____ 11. The inflammatory response is triggered by chemicals called histamines and cytokines.
- _____ 12. Biological barriers include millions of harmless bacteria live on the human skin.

Lesson 24.1: Multiple Choice

Name _____ Class _____ Date _____

Circle the letter of the correct choice.

- Which statement best describes the immune system?
 - The immune system produces gametes.
 - The immune system exchanges gases between the blood and lungs.
 - The immune system protects the body from pathogens.
 - The immune system digests food into usable nutrients.
- The immune system is comprised of _____ lines of defense.
 - two
 - three
 - four
 - five
- Which statement best describes the first line of defense?
 - The first line of defense consists of different types of barriers that keep most pathogens out of the body.
 - The first line of defense includes the inflammatory response.
 - Leukocytes are the cells responsible for the first line of defense.
 - The first line of defense includes the skin, mucous membranes and biological barriers such as white blood cells.
- Which statements are true about mechanical barriers? (1) Mechanical barriers physically block pathogens from entering the body. (2) The skin is the most important mechanical barrier. (3) Mechanical barriers are living organisms that help protect the body. (4) Mechanical barriers destroy pathogens on the outer body surface.
 - 1 and 2
 - 3 and 4
 - 1, 2, and 3
 - 1, 2, 3, and 4
- Which statement describes the second line of defense?
 - The second line of defense includes biological and chemical barriers.
 - The skin is the major organ of the second line of defense.
 - The second line of defense keeps most pathogens out of the body.
 - The second line of defense is encountered by pathogens that enter the body.
- What is the inflammatory response?
 - The inflammatory response begins when cytokines or histamines infect a tissue.
 - The inflammatory response is the first reaction of the body to tissue damage or infection.
 - The inflammatory response is a chemical barrier that destroys pathogens on the body surface.
 - none of the above
- Leukocytes
 - are red blood cells that bring extra oxygen to the site of infection.
 - are biological barriers that help protect the body.
 - are white blood cells that fight infections and get rid of debris.
 - are released by mucous membranes at body openings.

8. Phagocytosis

- (a) is the process in which leukocytes engulf and break down pathogens and debris.
- (b) are chemical barriers destroy pathogens.
- (c) are part of the first line of defense.
- (d) all of the above

Lesson 24.1: Vocabulary I

Name _____ Class _____ Date _____

Match the vocabulary word with the proper definition.

Definitions

- _____ 1. provide a mechanical barrier at body openings
- _____ 2. disease-causing agents
- _____ 3. a type of white blood cell
- _____ 4. living organisms that help protect the body
- _____ 5. the most important mechanical barrier
- _____ 6. a slimy substance that traps pathogens
- _____ 7. the process in which leukocytes engulf pathogens
- _____ 8. destroy pathogens on the outer body surface, at body openings, and on inner body linings
- _____ 9. the first reaction of the body to tissue damage or infection
- _____ 10. physically block pathogens from entering the body
- _____ 11. protects the body from worms, germs, and other agents of harm
- _____ 12. sweep mucus and pathogens toward body openings

Terms

- a. biological barriers
- b. chemical barriers
- c. cilia
- d. immune system
- e. inflammatory response
- f. leukocyte
- g. mechanical barriers
- h. mucous membrane
- i. mucus
- j. pathogens
- k. phagocytosis
- l. skin

Lesson 24.1: Vocabulary II

Name _____ Class _____ Date _____

Fill in the blank with the appropriate term.

1. _____ are disease-causing agents, such as bacteria and viruses.
2. _____ is the process in which cells engulf and break down pathogens and debris.
3. The skin _____ is the single most important defense the body has.
4. The _____ response is the first reaction of the body to tissue damage or infection.
5. _____ membranes secrete mucus, a slimy substance that traps pathogens.
6. _____ barriers destroy pathogens on the outer body surface.
7. Leukocytes are _____ blood cells that fight infections and get rid of debris.
8. A _____ defense is tailored to a particular pathogen.
9. A _____ defense is the same no matter what type of pathogen is involved.
10. Millions of harmless _____ live on the human skin.
11. Mucous membranes provide a _____ barrier at body openings.
12. Sweat, mucus, tears, and saliva all contain _____ that kill pathogens.
13. The _____ line of defense attacks pathogens that manage to enter the body.
14. Barriers that keep out pathogens are the body's _____ line of defense.

Primary and Secondary Immune Response Worksheet

Part A: Memory Response

Law enforcement agents use a database of “mug shots” to help identify previous lawbreakers. The mug shots comprise a photo library of individuals who were arrested for criminal acts. Like these agents, some cells of your immune system also maintain a record of previous intruders. This recall is the basis of the memory response.

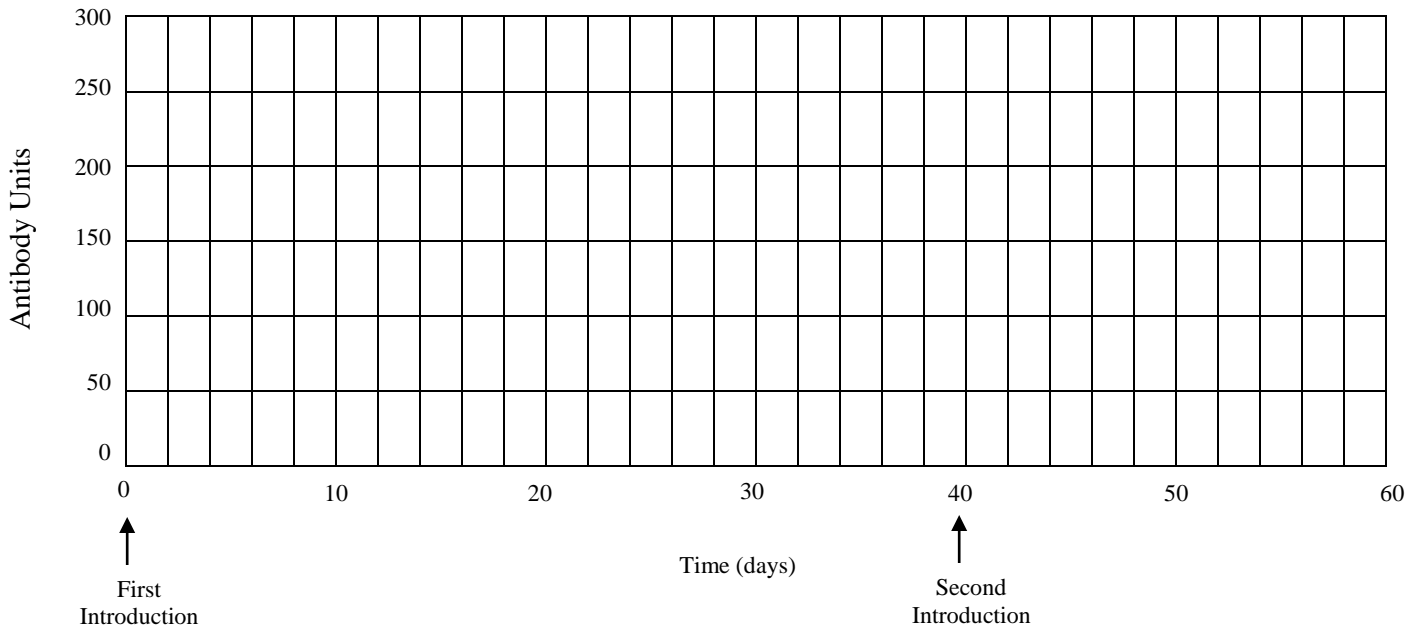
The first appearance of an infectious agent stimulates the primary immune response. During this response, the intruder is identified and eliminated. As part of this process, T_H cells activate antigen-specific T and B memory cells. A memory cell is dedicated to recalling only one type of antigen. Since your body encounters thousands of antigens, its mug shot portfolio must contain an equal number of different memory cell types.

If an antigen appears, the specific memory cells act quickly. Memory cells act quickly. Memory T cells become active T cells. They produce a secondary immune response. Plasma cells produce higher levels of antibodies in a short period. In addition, this second release of antibodies tends to be more effective in binding and deactivating the antigen.

Graphing Data

Graph the following data on the axis provided below. Assume that the antigen was first introduced at time 0 and later reintroduced on day 40.

Time (Days)	Antibody Units
0	0
2	0
4	10
6	30
8	70
10	120
12	120
14	100
16	80
18	50
20	20
22	15
24	10
26	5
28	0
30	0
32	0
34	0
36	0
38	0
40	0
42	10
44	40
46	90
48	150
50	250
52	300
54	280
56	260
58	230
60	200



Answer the questions on the back

1. Describe the primary and secondary immune response in terms of:

(a) speed

(b) number of antibodies produced.

2. Which immune cells contribute to the difference in response?

The Body's Defenses

Nonspecific Defenses

Directions: *Read the passage below. Answer the questions that follow.*

When the body is invaded, four important nonspecific defenses take action: the inflammatory response; the temperature response; proteins that kill or inhibit pathogens; and white blood cells, which attack and kill pathogens.

Inflammatory Response: Injury or local infection, such as a cut or a scrape, causes an inflammatory response. An inflammatory response is a series of events that suppress infection and speed recovery. Imagine that a splinter has punctured your finger, creating an entrance for pathogens. Infected or injured cells in your finger release chemicals, including histamine. Histamine causes local blood vessels to dilate, increasing blood flow to the area. Increased blood flow brings white blood cells to the infection site, where they can attack pathogens. The increased blood flow also causes swelling and redness in the infected area. The whitish liquid, or pus, associated with some infections contains white blood cells, dead cells and dead pathogens.

Temperature Response: When the body begins its fight against pathogens, body temperature increases several degrees above the normal value of about 37°C (99°F). This higher temperature is called a fever, and it is a common symptom of illness that shows the body is responding to an infection. Fever is helpful because many disease-causing bacteria do not grow well at high temperatures.

Directions: *Read each question and write your answer in the space provided.*

1. What four nonspecific defenses are caused by pathogens invading the body?

2. What is an inflammatory response?

Immune Response

Directions: *Read the passage below. Answer the questions that follow.*

White blood cells are produced in bone marrow and circulate in blood and lymph. Of the 100 trillion cells in your body, about 2 trillion are white blood cells. Four main kinds of white blood cells participate in the immune response: macrophages, cytotoxic T cells, B cells and helper T cells. Each kind of cell has a different function. Macrophages consume pathogens and infected cells. Cytotoxic T cells attack and kill infected cells. B cells label invaders for later destruction by macrophages. Helper T cells activate both cytotoxic T cells and B cells. These four kinds of white blood cells interact to remove pathogens from the body.

1. **Write the type of white blood cell described by the phrase.**

- a. _____ label invaders for later destruction
- b. _____ consume pathogens
- c. _____ kill infected cells
- d. _____ activate B cells
- e. _____ consume infected cells
- f. _____ activate cytotoxic T cells

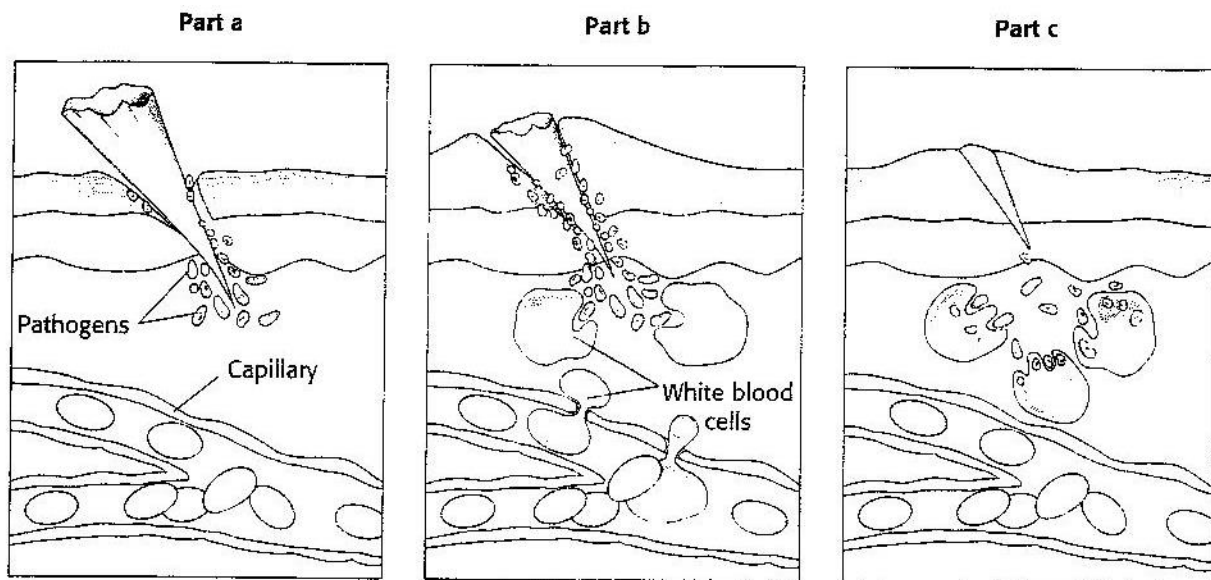
2. A ration of white blood cells to body cells shows one white blood cell to

- a. 10 body cells.
- b. 50 body cells.
- c. 1,000 body cells.
- d. 5,000,000 body cells.

3. What three effects does increased blood flow have on an infection site?

4. What effect does fever have on many disease-causing bacteria?

5. The figure illustrates the inflammatory response. In the space on the next page describe what is occurring in each part of the figure.



Part a:

Part b:

Part c:

6. Release of the chemical histamine causes
- the production of white blood cells.
 - a decrease in blood flow.
 - A decrease in body temperature.
 - blood vessels to dilate.

Disease Transmission and Prevention

Directions: Read the passage below. Answer the questions that follow.

The German physician Robert Koch (1843-1910) established a procedure for diagnosing causes of infection. In his research with anthrax, Koch developed the following four-step procedure, known as Koch's postulates, as a guide for identifying specific pathogens. Biologists have used Koch's postulates to identify many pathogens

- The pathogen must be found in an animal with the disease and not in a healthy animal.
- The pathogen must be isolated from the sick animal and grown in a laboratory culture.
- When the isolated pathogen is injected into a healthy animal, the animal must develop the disease.
- The pathogen should be taken from the second animal and grown in laboratory culture. The pathogen should be the same as the original pathogen.

1. What is indicated when, in spite of being injected with a pathogen isolated from a sick animal, another animal remains healthy?

2. According to Koch's postulates, a pathogen can be considered to cause a particular disease if the pathogen is

- a. found in an animal with the disease.
- b. lacking in healthy animals.
- c. found in all members of the same species.
- d. Both (a) and (b).

Disorders of the Immune System

Directions: *Read the passage below. Answer the questions that follow.*

You can become infected with HIV if you receive HIV-infected white blood cells, which are present in many body fluids. The most common method of HIV transmission is through sexual contact. Because semen, vaginal fluid and mucous membranes may contain HIV, both males and females can become infected with HIV during vaginal, anal or oral intercourse. Use of a latex condom during intercourse reduces but does not eliminate the risk of getting or spreading HIV.

HIV can be passed between drug users who share a hypodermic needle if HIV-infected blood remains in the needle or syringe. In the late 1970s and early 1980s, many people became infected with HIV after receiving transfusions of HIV-contaminated blood. This is very unlikely now because blood made available for transfusion is tested for HIV. In addition, pregnant or nursing mothers can pass HIV to their infants through breast milk and blood.

HIV is not transmitted through the air, by toilet seats, by kissing or handshaking, or by any other medium where HIV-infected white blood cells could not survive. Although HIV has been found in tears, saliva and urine, these body fluids usually contain too few HIV particles to cause an infection. Insects such as mosquitoes and ticks do not transmit HIV because they do not carry infected white blood cells.

1. What is the most common method of HIV transmission?

The Body's Defenses

Directions: *In the blank's provided, fill in the letters of the term or phrase being described.*

1. a disease-causing agent A - - - - -
2. layers of epithelial tissue M - - - - - M - - - - -
that serve as barriers to
pathogens and produce
chemical defense
3. a series of events that - - - L - - - - - - - - - - E - - - - -
suppress infection
4. chemical that causes local - - - I - - - - -
blood vessels to dilate
5. a defense mechanism with - - - - - M - - - - - Y - - - - -
20 different proteins
6. a protein released by cells - - - - - E - - - - -
infected with viruses
7. a white blood cell that N - - - - -
releases chemicals that kill
pathogens
8. a white blood cell that - - - R - - - - -
ingests and kills pathogens
9. destroys an infected cell by N - - - - - - - - - - L - - - - - L
puncturing its membrane

Directions: *Use the terms from the list below to fill in the blanks in the following passage.*

- | | | |
|------------|-------------------|----------------|
| antibodies | B cells | helper T cells |
| antigens | cytotoxic T cells | plasma cells |

White blood cells are produced in bone marrow and circulate in blood and lymph. Four main kinds of white blood cells are involved in the immune response. Macrophages consume pathogens and infected cells.

(10) _____ attack and kill infected cells. (11) _____ label invaders for later destruction by macrophages. (12) _____ activate both cytotoxic T cells and B cells. An infected body cell will display _____ of an invader on its surface. These are substances that trigger an immune response. In an immune response, B cells divide and develop into (14) _____, which release special defensive proteins into the blood. These special proteins are called (15) _____.

Directions: *In the space provided, write the letter of the description that best matches the term or phrase.*

- | | |
|------------------------------|--|
| _____ 16. Koch's postulates | a. body's overreaction to a normally harmless antigen |
| _____ 17. immunity | b. when the body launches an immune response against its own cells |
| _____ 18. vaccination | c. a medical procedure used to produce resistance |
| _____ 19. vaccine | d. the virus that causes AIDS |
| _____ 20. antigen shifting | e. a guide for identifying specific pathogens |
| _____ 21. autoimmune disease | f. resistance to a particular disease |
| _____ 22. AIDS | g. a solution that contains a dead or modified pathogen that can no longer cause disease |
| _____ 23. HIV | h. acquired immunodeficiency syndrome |
| _____ 24. allergy | i. when a pathogen produces a new antigen that the immune system does not recognize |
| _____ 25. CD4 | j. receptor protein recognized by HIV |

Organ Systems Overview

A. Use the key below to indicate the body systems that perform the following functions for the body:

a. cardiovascular
b. digestive
c. endocrine

d. integumentary
e. lymphatic/immune
f. muscular

g. nervous
h. reproductive
i. respiratory

j. skeletal
k. urinary

- _____ 1. rids the body of nitrogen-containing wastes
_____ 2. is affected by removal of the thyroid gland
_____ 3. provides support and levers on which the muscular system acts
_____ 4. includes the heart
_____ 5. causes the onset of the menstrual cycle
_____ 6. protects underlying organs from drying out and from mechanical damage
_____ 7. protects the body; destroys bacteria and tumor cells
_____ 8. breaks down ingested food into its building blocks
_____ 9. removes carbon dioxide from the blood
_____ 10. delivers oxygen and nutrients to the tissues
_____ 11. moves the limbs; facilitates facial expression
_____ 12. conserves body water or eliminates excesses
_____ and _____ 13. facilitate conception and childbearing
_____ 14. controls the body by means of chemical molecules called hormones.
_____ 15. is damaged when you cut your finger or get a severe sunburn

B. Use the above key, choose the *organ system* to which each of the following sets of organs or body structures belong:

- _____ 1. thymus, spleen, lymphatic vessels
_____ 2. bones, cartilages, tendons
_____ 3. pancreas, pituitary, adrenals
_____ 4. trachea, bronchi, alveoli
_____ 5. kidneys, bladder, ureters
_____ 6. testis, vas deferens, urethra
_____ 7. esophagus, large intestine, rectum
_____ 8. arteries, veins, heart

C. The levels of organization of a living body are chemical, _____, _____, _____, and organism.

D. Define organ: _____

E. Using the terms provided, correctly identify all of the body organs provided with leader lines in the drawings shown below. The name the organ systems by entering the name of each on the answer blank below each drawing.

Blood vessels
Brain

Heart
Kidney

Nerves
Sensory receptor

Spinal cord
Ureter

Urethra
Urinary bladder

