



**Immune System and Disease Worksheets**

**Nonspecific Defenses: True or False**

Name \_\_\_\_\_ Date \_\_\_\_\_

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





- \_\_\_\_\_ 1. Pathogens are physically forced out of the respiratory tract when a person coughs.
- \_\_\_\_\_ 2. In a healthy human, the skin's surface contains no bacteria.
- \_\_\_\_\_ 3. Pathogen is a technical term for germ.
- \_\_\_\_\_ 4. All immune system responses are specific; there are no nonspecific defenses.
- \_\_\_\_\_ 5. The common cold is caused by a bacterium.
- \_\_\_\_\_ 6. Strep throat is caused by a virus.
- \_\_\_\_\_ 7. Athlete's foot is caused by a fungus.
- \_\_\_\_\_ 8. Tuberculosis is caused by a bacterium.
- \_\_\_\_\_ 9. Cold sores are caused by a fungus.
- \_\_\_\_\_ 10. Some mushrooms contain chemicals harmful to humans.
- \_\_\_\_\_ 11. Mucus made by the respiratory system is one kind of immune system defense.
- \_\_\_\_\_ 12. Cilia move pathogens into the bloodstream.
- \_\_\_\_\_ 13. The main function of red blood cells is to make antibodies.
- \_\_\_\_\_ 14. Histamines reduce inflammation.
- \_\_\_\_\_ 15. Some types of white blood cells secrete histamines.

## Lesson 1: Critical Reading

Read this passage from the lesson and answer the following questions.

### First Line of Defense

The immune system has three lines of defense. The first line of defense includes a variety of barriers against pathogens that keep most pathogens out of the body. Pathogens are disease-causing agents, such as bacteria and viruses. Defenses in the first line are the same regardless of the type of pathogen. This is why they are called nonspecific defenses. Several types of pathogens that are common causes of human disease can be seen in the Figure below.

Type of pathogen	Description	Human Disease caused by pathogens of that type
Bacteria Escherichia coli	 Single-celled organisms without a nucleus	Strep throat, staph infections, tuberculosis, food poisoning, tetanus, pneumonia, syphilis
Viruses Herpes simplex	 Non-living particles that reproduce by taking over living cells	Common cold, flu, genital herpes, cold sores, measles, AIDS, genital warts, chicken pox, small pox
Fungi Death Cap mushroom	 Simple organisms, including mushrooms and yeasts, that grow as single cells or thread-like filaments	Ringworm, athlete's foot, tinea, candidiasis, histoplasmosis, mushroom poisoning
Giardia Lamblia	 Single-celled organism with a nucleus	Malaria, "traveler's diarrhea", giardiasis, typhoid, relapsing fever ("sleeping sickness")

### Mechanical Barriers

Mechanical barriers physically block pathogens from entering the body. The skin is the most important mechanical barrier. In fact, it is the single most important defense of the body against pathogens. It forms a physical barrier between the body and the outside world. The outer layer of the skin is a tough, nearly water-proof coating that is very difficult for pathogens to penetrate.

At body openings, such as the mouth and nose, the body has a different mechanical barrier. Instead of skin, mucous membranes line these and other organs that are exposed to the outside environment. They include the organs of the respiratory, gastrointestinal, and urinary tracts. Mucous membranes secrete mucus, a slimy substance that coats the membranes and traps pathogens. Mucous membranes also have cilia, which are tiny projections that have wavelike motions. The movements of cilia sweep mucus and trapped pathogens toward body openings to be removed from the body.

Pathogens are removed from the respiratory tract when you sneeze or cough. In addition, tears wash pathogens from the eyes, and urine flushes pathogens out of the urinary tract. Chemical Barriers

Chemical barriers are proteins that destroy pathogens at the body's surface. The skin and mucous membranes secrete proteins that kill many of the pathogens with which they come into contact. For example, enzymes called lysozymes—which are found in sweat, mucus, tears, and saliva—kill pathogens by breaking open their cell walls. Urine and vaginal secretions are too acidic for many pathogens, and semen contains zinc, which most pathogens cannot tolerate. Hydrochloric acid secreted by mucous membranes lining the stomach kills pathogens that enter the stomach in food or water.

## Biological Barriers

Biological barriers involve living organisms that compete with pathogens. Human skin is covered by millions of bacteria. Millions more colonize the gastrointestinal, urinary, and genital tracts. Most of these bacteria are helpful or at least not harmful. They are important in defense because they help prevent harmful bacteria from becoming established in or on the body. They do this by competing with harmful bacterial for food and space. Helpful bacteria may also change pH or other factors and make conditions less suitable for harmful bacteria.

## Questions

1. Name and briefly describe the immune system's first line of defense.

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2. How can the skin be considered part of the immune system?

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3. What are mucous membranes? Where are they found?

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4. Are all bacteria that live in the human body harmful? Why or why not?

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5. What is the purpose of the cilia of the cells that line the respiratory lining?

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## Multiple Choice

Circle the letter of the correct choice.

1. A component of the immune system's first line of defense is

- a. the spine.
- b. the skin.
- c. antibodies.
- d. cytokines.

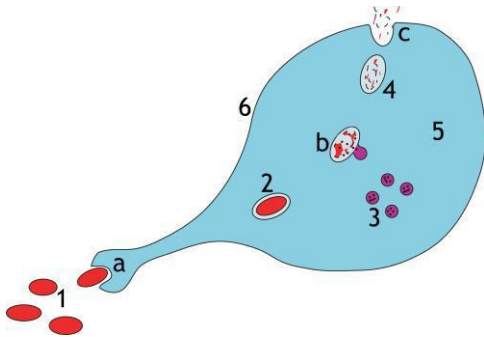
2. Lysozymes

- a. produce acid from protein.
- b. are antibodies that bind to red blood cells.
- c. are enzymes that break down bacterial cell walls.
- d. are enzymes that break down histamines.

3. Mucus is produced by

- a. none of the above
- b. by the respiratory tract, but not by the intestinal tract.
- c. by healthy tissues, including the respiratory tract and intestinal tract.
- d. only damaged respiratory passages.

4. The diagram below shows the process of



- a. phagocytosis.
- b. pinocytosis.
- c. cilia action.
- d. skin cell production.

5. When bacteria enter the body through a cut in the skin

- a. the immune system shuts down.
- b. the third line of defense of the immune system is activated within seconds.
- c. the first line of defense of the immune system has succeeded.
- d. the second line of defense of the immune system is activated.

6. A chemical that is produced as a part of the inflammatory response is

- a. flagella.
- b. cilia.
- c. monoamine.
- d. histamine.

7. A type of human immune system cell that ingests pathogens by phagocytosis is

- a. neuron.
- b. macrophage.
- c. muscle cell.
- d. bacteria.

## Vocabulary

*Match the vocabulary term with the correct definition.*

### Term

- |                           |                               |                             |
|---------------------------|-------------------------------|-----------------------------|
| ____ 1. pathogens         | ____ 5. white blood cells     | ____ 8. histamines          |
| ____ 2. lysozymes         | ____ 6. nonspecific defenses  | ____ 9. biological barriers |
| ____ 3. cytokines         | ____ 7. inflammatory response | ____ 10. phagocytosis       |
| ____ 4. chemical barriers |                               |                             |

### Definition

- a. Defenses that are the same regardless of the type of pathogen; found in the first and second line of defense.
- b. Living organisms that compete with pathogens; help prevent harmful bacteria from becoming established in or on the body.
- c. Disease-causing agents, such as bacteria and viruses.
- d. Enzymes that kill pathogens by breaking open their cell walls; found in sweat, mucus, tears, and saliva.
- e. leukocytes
- f. Chemicals that destroy pathogens at the body's surface.
- g. Proteins that act as chemical signals used to communicate between cells.
- h. A complex biological reaction to tissue damage; one of the first responses of the immune system to infection or injury; triggered by chemicals called cytokines and histamines.
- i. The process of engulfing and breaking down pathogens and other unwanted substances.
- j. chemicals that cause inflammation

## Immune Response: True or False

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

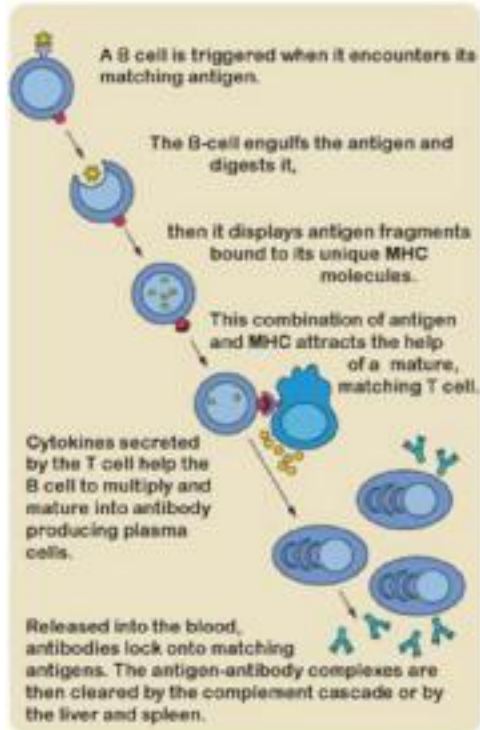
- \_\_\_\_\_ 1. The third line of defense is nonspecific.
- \_\_\_\_\_ 2. The lymphatic system is not part of the immune system.
- \_\_\_\_\_ 3. The lymphatic system transports fatty acids out of the bloodstream.
- \_\_\_\_\_ 4. The lymphatic system produces white blood cells.
- \_\_\_\_\_ 5. Another name for white blood cell is leukocyte.
- \_\_\_\_\_ 6. The red bone marrow is part of the lymphatic system.
- \_\_\_\_\_ 7. T cells mature in the thymus.
- \_\_\_\_\_ 8. The spleen makes new red blood cells.
- \_\_\_\_\_ 9. Humans cannot survive without tonsils.
- \_\_\_\_\_ 10. Lymph is pumped through the lymphatic vessels by the lymphatic pumping organ.
- \_\_\_\_\_ 11. B cells mature in the thymus.
- \_\_\_\_\_ 12. A major function of the humoral immune system is to destroy proteins that are nonself.
- \_\_\_\_\_ 13. Both T cells and B cells have receptors that bind specifically to a particular antigen.
- \_\_\_\_\_ 14. Helper T cell cytokines stimulate the development of B cells into mature antibody-producing cells.
- \_\_\_\_\_ 15. The base of a Y-shaped antibody is the part of the protein that binds specifically to an antigen.

## Lesson: 2 Critical Reading

Read this passage from the lesson and answer the questions that follow.

### B Cell Activation

Naïve B cells are activated by an antigen in the sequence of events shown in Figure below. A B cell encounters its matching antigen and engulfs it. The B cell then displays fragments of the antigen on its surface. This attracts a helper T cell (which you will read about below). The helper T cell binds to the B cell at the antigen site and releases cytokines. As you read in Lesson 1, cytokines are chemical signals used to communicate between cells. Cytokines from the helper T cell stimulate the B cell to develop into plasma cells or memory cells.



### | Questions

1. What is the first step in the activation of a naïve B cell?
2. What is the second step in the activation process?
3. Define antigen display as illustrated in the above figure.
4. Describe the basis of the T cell binding to the B cell in the above figure.
5. What stimulates the maturation of B cells? What do mature B cells produce?

## Multiple Choice

*Circle the letter of the correct choice.*

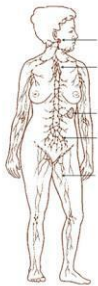
1. Transport of fatty acids occurs from the \_\_\_\_\_ into the \_\_\_\_\_.
  1. small intestine, lymphatic system
  2. blood, small intestine
  3. skeletal muscle cells, small intestine
  4. urinary tract, antigen
2. From the choices below, one possible cause of localized fluid accumulation in the tissues is
  1. too rapid transport of fatty acids from the intestine into the lymph.
  2. too rapid transport of fatty acids from the blood to the intestine.
  3. drinking more than 8 glasses of water in one day.
  4. damage to the lymph vessels such that they do not take up excess body fluids from the tissues.
3. Located behind the breast bone, this gland functions to mature T cells of the immune system
  1. spleen.
  2. thymus.
  3. heart.
  4. gall bladder.
4. Lymph drains into the bloodstream from the
  1. intestine.
  2. lymphatic ducts in the chest.
  3. tonsils.
  4. spleen.
5. Cells that display parts of a pathogen's proteins on their surface are called
  1. red blood cells.
  2. regulatory T cells.
  3. antigen-presenting cells.
  4. helper T cells.
6. Helper T cells
  1. destroy pathogens.
  2. make antibodies.
  3. kill cancerous cells.
  4. none of the above



7. Cells infected with a virus are
1. stimulated to divide by helper T cells.
  2. making antibodies.
  3. destroyed by cytotoxic T cells.
  4. none of the above

## Vocabulary

*Labeling a Diagram: In the diagram of the human lymphatic system, label the five structures to which arrows point.*



**Immune System Diseases: True or False: Write true if the statement is true or false if the statement is false.**

- \_\_\_\_\_ 1. Inflammation of the skin can result from a bee sting.
- \_\_\_\_\_ 2. An allergen is any antigen that causes an allergic reaction in a sensitive person.
- \_\_\_\_\_ 3. A person is either allergic to many antigens, or to none.
- \_\_\_\_\_ 4. All allergies are severe.
- \_\_\_\_\_ 5. Histamines stimulate inflammation.
- \_\_\_\_\_ 6. One symptom of an allergy can be itchy eyes.
- \_\_\_\_\_ 7. Anaphylaxis is the most severe response to an allergen, and is potentially fatal.
- \_\_\_\_\_ 8. An antidote to anaphylaxis is immediate injection of epinephrine.
- \_\_\_\_\_ 9. HIV is an example of an autoimmune disease.
- \_\_\_\_\_ 10. Multiple sclerosis is an example of an autoimmune disease.
- \_\_\_\_\_ 11. Joint inflammation is a typical symptom of both Type I diabetes and multiple sclerosis.

- \_\_\_\_\_ 12. Congenital immunodeficiency is usually caused by a mutation.
- \_\_\_\_\_ 13. The absence of a thymus (thymic aplasia) results from a genetic defect.
- \_\_\_\_\_ 14. People who have received an organ transplant often are treated with drugs that suppress their immune system.
- \_\_\_\_\_ 15. People who have AIDS are susceptible to certain types of pathogens that don't often infect healthy people.

## Lesson 3: Critical Reading

*Read this passage and answer the questions that follow.*

### Contact with Poison Ivy: A Classic Example of a Delayed Hypersensitivity Response



Have you every heard the saying “Leaves of three, let them be?” That admonition refers to poison ivy. Poison Ivy grows in the 48 contiguous states of the United States. Depending upon the particular variety and its environment, poison ivy can be a fuzzy, climbing vine, a short, trailside plant, or shrub-like. Leaves are arranged in groups of three. The exact shape and color of the leaves can vary (they can be green, green with a reddish tinge, shiny, or not). The variation in appearance is probably one reason why so many people brush against poison ivy without knowing. They then suffer from an intensely itchy red rash that results from contact with poison ivy’s leaves or stems. Such a rash is a classic example of a delayed hypersensitivity response. This response is also a form of allergic contact dermatitis.

You may be wondering, what is it in poison ivy that causes the rash? Is poison ivy contagious? The answer to the first question is: urushiol, an oil that the plant makes, causes the angry red rash. People get the rash when they touch or brush up against part of the plant, and some of the urushiol gets transferred to their skin. Urushiol can also be transferred to garden tools, clothes, and pet fur. It can be inactivated with lots of soap and water. However, if you touch poison ivy you must wash it off immediately, since the hypersensitivity response begins in as little as a few minutes after exposure.

Now let’s answer to the second question: is poison ivy contagious? If you touch someone who still has urushiol on their skin or clothes, or a pet who has urushiol on its fur, then yes, you can contract the poison ivy rash this way. However, if you touch a poison ivy rash on someone else, you will not get a rash.

## Multiple Choice

*Circle the letter of the correct choice.*

- Allergic symptoms of sneezing and itchy, watery eyes can often be treated effectively with
  - histamines.
  - antihistamines.
  - antibiotics.
  - aspirin.
- In one type of immunotherapy used to treat allergic symptoms,
  - the allergen is removed from a person's system.
  - a person is injected repeatedly over time with an allergen to which they are sensitive, with the goal of reducing the person's sensitivity to that allergen.
  - all T cells are inactivated.
  - the antigen is removed from the person's environment.
- Pollen from the ragweed plant
  - most often causes joint pain.
  - causes allergic rhinitis in sensitive individuals.
  - causes HIV.
  - acts as an antihistamine.
- Painful joints, caused by inflammation of the joints resulting from an immune system attack against the joint tissues typifies \_\_\_\_\_.
  - rheumatoid arthritis.
  - type I diabetes.
  - delayed hypersensitivity response.
  - AIDS.
- The autoimmune disease that results from the body attacking tissues such as the heart or lungs is called
  - systemic lupus erythematosus.
  - multiple sclerosis.
  - type I diabetes.
  - rheumatoid arthritis.
- Treatment for type I diabetes includes
  - avoidance of exercise.
  - insulin, delivered as injections or through a pump.
  - a diet high in sugar.
  - elevation of the heart.

7. HIV results from

- d. all of the above
- c. a bacterium found in contaminated water.
- b. an overactive immune system that persists for years.
- a. destruction of helper T cells because of infection by the human immunodeficiency virus.

## Vocabulary

*Match the vocabulary term with the correct definition.*

<b>Term</b>	_____ 4. immunodeficiency	_____ 7. AIDS
_____ 1. opportunistic diseases	_____ 5. allergic rhinitis	_____ 8. antihistamines
_____ 2. epinephrine	_____ 6. acquired immunodeficiency	_____ 9. autoimmunity
_____ 3. HIV		_____ 10. anaphylaxis

## Definition

- a. Acquired immune deficiency syndrome; a late stage in the progression of an HIV infection.
- b. Diseases that occur when the immune system fails to recognize the body's own molecules as self and attacks the body's cells as though they were foreign invaders.
- c. An allergic response in which there is a sudden, massive release of histamines throughout the body.
- d. Drugs that reduce or eliminate the effects of histamines.
- e. The "fight-or-flight" hormone that your adrenal glands normally produce when you are in danger.
- f. A common immediate hypersensitivity reaction; affects mainly mucous membranes lining the nose; often called hay fever.
- g. Infections and tumors rare in people with a healthy immune system but common in immunodeficient people.
- h. Occurs when one or more components of the immune system are not working normally.
- i. Immunodeficiency that occurs when immune function declines in a person who was born with a normal immune system.
- j. The human immunodeficiency virus, the virus that causes AIDS.

## Environmental Problems and Human Health: True or False

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

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

- \_\_\_\_\_ 1. Chemicals in the environment are one cause of some cancers.
- \_\_\_\_\_ 2. There is no link between air pollution and asthma.
- \_\_\_\_\_ 3. Mutations in some genes can contribute to the development of cancer.
- \_\_\_\_\_ 4. Since it is present in sunlight, ultraviolet radiation is not considered a carcinogen.
- \_\_\_\_\_ 5. All viruses cause the same cancer.
- \_\_\_\_\_ 6. Non-cancerous cells have lost the ability to regulate their cell cycles.
- \_\_\_\_\_ 7. Damaged DNA can be repaired by the gene products of tumor-suppressor genes.
- \_\_\_\_\_ 8. Oncogenes are mutated genes that have lost their normal, regulated function.
- \_\_\_\_\_ 9. All tumors are cancerous.
- \_\_\_\_\_ 10. Tumor removal by surgery is one strategy used to treat some cancers.
- \_\_\_\_\_ 11. The Air Quality Index can vary between different geographical locations.
- \_\_\_\_\_ 12. Ozone is a gas that can be hazardous to human health.
- \_\_\_\_\_ 13. Some people are allergic to mold.
- \_\_\_\_\_ 14. All agents of bioterrorism are spread through the air.
- \_\_\_\_\_ 15. As of 2009, there have not yet been any acts of bioterrorism in the US.

## Lesson 4: Critical Reading

*Read this passage from the lesson and answer the questions that follow.*

### Cancer Treatment and Prevention

Most cancers can be treated and some can be cured. The general goal of treatment is to remove the tumor without damaging the rest of the body. Cancer may be treated with a combination of surgery, chemotherapy, and/or radiation. In the past, chemotherapy drugs caused serious side effects. Many of today's chemotherapy drugs target specific molecules in tumors. This reduces damage to normal body cells and causes fewer side effects.

The outcome of cancer treatment depends on factors such as the type of cancer and its stage. The stage of cancer refers to the extent to which the cancer has developed. Generally, early diagnosis and treatment lead to the best chances of survival. That's why it's important for people to be aware of the following warning signs of cancer:

- A change in bowel or bladder habits
- A sore that does not heal
- Unusual bleeding or discharge from any place
- A lump in the breast or other parts of the body
- Chronic indigestion or difficulty in swallowing
- Obvious changes in a wart or mole
- Persistent coughing or hoarseness

Having warning signs of cancer does not mean that you have cancer, but you should see a doctor to be sure. Getting recommended tests for particular cancers, such as colonoscopies for colon cancer, can also help detect cancers early, when chances of a cure are greatest.

Many cancers can be prevented, or at least their risk can be reduced. You can help reduce your risk of cancer by avoiding specific carcinogens and maintaining a healthy lifestyle. Carcinogens you can avoid or limit your exposure to include tobacco smoke, sexually transmitted viruses, improperly cooked foods, and UV radiation. Other lifestyle choices you can make to reduce your risk of cancer include being physically active, eating a low-fat diet, and maintaining a normal weight.

### Questions

1. What are three standard types of cancer treatment?
2. What is meant by a stage of cancer?
3. How does early diagnosis aid survival?
4. Name 3 symptoms that may indicate cancer.

5. How can you reduce your risk of developing cancer?

## Multiple Choice

*Circle the letter of the correct choice.*

1. Which of the following is a potential carcinogen?
  1. radon
  2. hepatitis B virus
  3. ultraviolet radiation
  4. asbestos
  5. all of the above
2. Carcinogens cause cancer by
  1. inducing mutations that cause unregulated cell division of cells.
  2. repairing mutations in DNA.
  3. suppressing the division of cells that have damaged DNA.
  4. none of the above
3. A tumor of connective tissues is classified as a
  1. carcinoma.
  2. sarcoma.
  3. neuroma.
  4. lymphoma.
4. The most common type of infant cancer is
  1. colorectal cancer.
  2. lung cancer.
  3. leukemia.
  4. bladder cancer.
5. \_\_\_\_\_ air pollution is a human health problem
  1. No
  2. Outdoor
  3. Indoor
  4. Indoor and outdoor
6. One of the most dangerous bio-terrorism agents is



1. cholera.
2. brucellosis.
3. ricin.
4. smallpox.

7. \_\_\_\_\_ is a pathogen that has been used in a documented incident of bioterrorism in the US.

1. Smallpox
2. Cholera
3. Anthrax
4. Brucellosis

## Vocabulary

*Match the vocabulary term with the correct definition.*

### Term

- |                                |                         |                      |
|--------------------------------|-------------------------|----------------------|
| ____ 1. tumor-suppressor genes | ____ 5. oncogene        | ____ 9. bioterrorism |
| ____ 2. proto-oncogenes        | ____ 6. ozone           | ____ 10. carcinoma   |
| ____ 3. lymphoma               | ____ 7. carbon monoxide |                      |
| ____ 4. tumor                  | ____ 8. Sarcoma         |                      |

### Definition

- a. A gas that forms close to the ground when high concentrations of air pollutants are heated by sunlight.
- b. A tumor of connective tissues, such as bone.
- c. An abnormal mass of tissue.
- d. A tumor of epithelial tissues, such as lung tissue.
- e. A gas produced by cars, furnaces, and other devices that burn fuel; replaces oxygen in the blood and quickly leads to death.
- f. Genes that normally repair damaged DNA or prevent cells with badly damaged DNA from dividing.
- g. Terrorism by intentional release or spread of pathogens.
- h. A tumor of lymphatic cells, such as T cells.

- i. Genes that normally help regulate cell division.
- j. A gene that, when mutated or expressed at high levels, helps turn a normal cell into a cancer cell.