

# ANSWERS TO CHAPTER 14

## CONTENT LEARNING ACTIVITY

### Lymphatic Vessels

1. Lymphatic capillaries; 2. Lymphatic vessels; 3. Thoracic duct

### Lymphatic Organs

1. Red bone marrow; 2. Lymphatic organs; 3. Thymus; 4. Spleen; 5. Tonsils; 6. Lymph nodes

### Tonsils

1. Palatine tonsils; 2. Pharyngeal tonsils; 3. Lingual tonsils
1. Pharyngeal tonsil; 2. Palatine tonsil; 3. Lingual tonsil

### Lymph nodes

1. Lymph nodules; 2. Lymph sinus; 3. Germinal centers
1. Inguinal; 2. Axillary; 3. Cervical

### Spleen

1. Blood; 2. White pulp; 3. Red pulp; 4. Foreign substances; 5. Erythrocytes; 6. Blood; 7. Lymphocytes; 8. Macrophages

### Thymus

1. Decreases; 2. Lymphocytes; 3. Degenerate; 4. Foreign substances; 5. Blood; 6. Thymic tissues

### Immunity

1. Innate immunity; 2. Adaptive immunity; 3. Adaptive immunity

### Innate immunity

1. Mechanical mechanisms; 2. Cell surface chemicals; 3. Inflammatory chemicals; 4. Inflammatory chemicals; 5. Complement; 6. Viral protection chemical
1. Phagocytes; 2. Neutrophils; 3. Macrophages; 4. Mononuclear phagocytic system
1. Basophils and mast cells; 2. Eosinophils; 3. Natural killer cells

### Inflammatory Response

1. Chemical mediators; 2. Vasodilation; 3. Chemotactic; 4. Vascular permeability; 5. Fibrin; 6. Complement

1. Local inflammation; 2. Systemic inflammation; 3. Neutrophils; 4. Pyrogens; 5. Vascular permeability

### Adaptive immunity

1. Antigens; 2. Foreign antigens; 3. Allergic reactions; 4. Self antigens
1. B cells; 2. T cells; 3. Antibody-mediated immunity

### Origin and Development of Lymphocytes

1. Stem cells; 2. Red bone marrow; 3. Thymus; 4. Clones

### Activation and Multiplication of Lymphocytes

1. Antigen-binding receptors; 2. Clone; 3. Endocytosis; 4. Major histocompatibility complex (MHC) proteins; 5. Helper T cell; 6. Costimulation; 7. Cytokines; 8. Interleukin-1; 9. Interleukin-2; 10. B or T cells
1. Helper T cells; 2. Antigen; 3. MHC molecule; 4. Interleukins; 5. Antibodies; 6. Antigen

### Antibody-Mediated Immunity

1. Variable region; 2. Constant region; 3. Immunoglobulins or gamma globulins
1. Antigen-binding site; 2. Variable region; 3. Constant region

### Effects of Antibodies

1. Direct effects; 2. Indirect effects

### Antibody Production

1. Primary response; 2. Plasma cells; 3. Memory B cells; 4. Secondary, or memory, response

### Cell-Mediated Immunity

1. Cytotoxic (cytolytic) T cells; 2. Cytokines; 3. Memory T cells

### Immunotherapy

1. Cytokines; 2. Autoimmune; 3. Myelin; 4. MHC molecules; 5. Monoclonal antibodies; 6. Antigen; 7. Neuroendocrine

### Acquired Immunity

1. Active natural immunity; 2. Active artificial immunity; 3. Passive natural immunity; 4. Passive artificial immunity; 5. Antiserum

## QUICK RECALL

1. Maintains fluid balance in the tissues, absorbs fats and other substances from the digestive tract, and defends against microorganisms and other foreign substances
2. Contraction of surrounding skeletal muscles, contraction of smooth muscle in lymphatic vessels, and pressure changes in the thorax during respiration
3. Lymph nodes: filter lymph and remove substances by phagocytosis, stimulate and release lymphocytes. Spleen: lymphocytes stimulated in white pulp, foreign substances phagocytized in red pulp, blood reservoir, destruction of worn out erythrocytes. Thymus: site for production and maturation of lymphocytes
4. Neutrophils and macrophages
5. B cells produce antibodies, T cells produce cytokines
6. Antibody-mediated immunity: direct effects include inactivating antigen or binding antigens together; indirect effects include activating complement or increasing inflammation by attaching to other cells; Cell-mediated immunity: T cells lyse cells and produce cytokines

## WORD PARTS

1. antigen
2. phagocyte; phagocytosis; phagocytic; macrophage
3. macrophage
4. inflammatory; inflammation
5. immune; immunity; immunodeficiency; autoimmunity
6. autoimmunity

## MASTERY LEARNING ACTIVITY

1. D. The lymphatic system is involved in tissue fluid balance, fat absorption, and defense against microorganisms and other foreign substances.
2. B. Most lymphatic vessels pass through a lymph node. Lymphatic vessels have valves that ensure one-way flow, and lymph vessels from the right upper limb, right thorax, and right side of the head and neck join the right lymphatic duct. Lymphatic vessels from the rest of the body empty into the thoracic duct.
3. C. Lymph is moved by contraction of surrounding skeletal muscle, contraction of smooth muscle in lymphatic vessels, and increased thoracic pressure during respiration.
4. A. There are three groups of tonsils: palatine, pharyngeal, and lingual. The tonsils decrease in size in adults, and form a protective ring of lymphatic tissue between the mouth, nose, and pharynx that helps to prevent damage from foreign substances.
5. D. Lymph nodes contain a network of fibers. Within lymph sinuses the fiber network and macrophages filter the lymph to remove microorganisms and other foreign substances. Within the lymphatic tissue of the lymph node, lymphocytes are produced in germinal centers.
6. A. The spleen detects and responds to foreign substances in the blood, destroys worn erythrocytes, and acts as a reservoir for blood.
7. B. The thymus produces lymphocytes that move to other lymphatic tissue. With increasing age in the adult, the thymus decreases in size.
8. C. The series of reactions produces activated complement, which promotes inflammation and phagocytosis, and can lyse bacterial cells.
9. A. Interferon does not protect the cell producing the interferon, but does enter other cells and prevents viral replication.
10. B. Neutrophils are phagocytic cells that are usually the first cell type to enter infected tissues. They account for most of the dead cells in pus. Macrophages appear in infected tissue after neutrophils and are responsible for the cleanup of dead neutrophils and other cellular debris.
11. D. Mast cells are cells found in connective tissue that release inflammatory chemicals. Like macrophages, mast cells are located where microorganisms are likely to enter the body.
12. E. Damage to tissue causes the release of histamine and other chemical mediators that cause vasodilation, attract phagocytes (chemotaxis), and increase vascular permeability (allowing the entry of fibrinogen, which can be converted to fibrin and walls off infected areas).
13. D. Antigens are substances that stimulate a specific immune system response. They can be foreign substances (foreign antigens) or molecules produced by the body (self antigens).
14. B. B cells originate and are processed in the red bone marrow. T cells originate in red bone marrow and are processed in the thymus. Once B and T cells are released into the blood, they circulate between the blood and lymphatic tissues.
15. D. Helper T cells are a special kind of T cell responsible for regulating the immune system. Helper T cells release interleukin 2, which stimulates the helper T cells to divide. This increases the number of helper T cells, which increases the effectiveness of the immune system.
16. A. The variable region makes the antibody specific for a given antigen. The constant region is involved with the activation of complement and enables the antibody to attach to various cells.
17. B. Antibodies promote phagocytosis, activate complement, stimulate inflammation, and bind antigens together.
18. C. The secondary response is more rapid and produces more antibodies than the primary response. Thus the secondary response effectively destroys the antigen and prevents the appearance of disease symptoms.
19. A. During the primary response memory cells are formed. They are responsible for the secondary response.
20. C. Active artificial immunity occurs when an antigen is deliberately introduced into an individual to stimulate his immune system. The introduced antigen is called a vaccine. Active natural immunity occurs when an individual is naturally exposed to an antigen that causes the individual's immune system to respond. Passive natural immunity occurs when antibodies pass through the placenta from mother to child, and passive artificial immunity occurs when antibodies (in antiserum) from a human or another animal are injected into the individual requiring immunity.



## FINAL CHALLENGES



1. Because the brain, spinal cord, and bone marrow are encased by bone, the bone prevents the tissues from swelling.
2. Blockage of the lymphatic vessels produces edema, and the lower limbs can eventually swell to several times their normal size. This condition is called elephantiasis.
3. The ointment was a good idea for the poison ivy, which caused a delayed hypersensitivity reaction, e.g., too much inflammation. For the scrape it is a bad idea, because a normal amount of inflammation is beneficial and helps to fight infection in the scrape.
4. Because antibodies and cytokines both produce inflammation, the fact that the metal in the jewelry resulted in inflammation is not enough information to answer the question. However, the fact that it took most of the day (many hours) to develop the reaction indicates a delayed hypersensitivity reaction and therefore cytokines.