

1. Lymph and Lymphatic Vessels

a. Write the answers that match the statements in the spaces at the right.

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|---|-------------------------------------|
| 1) Fluid within tissue spaces. | <u>Interstitial fluid</u> |
| 2) Fluid within lymphatic vessels. | <u>Lymph</u> |
| 3) Smallest lymphatic vessels. | <u>Lymphatic capillaries</u> |
| 4) Lymphatic vessels draining large body regions. | <u>Lymphatic trunks</u> |
| 5) Forms wall of lymphatic capillaries. | <u>Endothelium</u> |
| 6) Lymphatic duct draining upper right portion of the body. | <u>Right lymphatic duct</u> |
| 7) Lymphatic duct draining rest of the body. | <u>Thoracic duct</u> |
| 8) Prevent backflow of lymph. | <u>Valves in vessels</u> |
| 9) Provide forces that move lymph. | <u>Skeletal muscle contractions</u> |
| | <u>Respiratory movements</u> |
| 10) Receives lymph from thoracic duct. | <u>Left subclavian vein</u> |
| 11) Empties into right subclavian vein. | <u>Right lymphatic duct</u> |
| 12) Vessels collecting interstitial fluid. | <u>Lymphatic capillaries</u> |
| 13) Source of interstitial fluid. | <u>Blood</u> |

b. Explain the value of the lymphatic system collecting interstitial fluid and returning it to the blood.

Removal of interstitial fluid prevents edema and maintains the normal blood volume. Also, lymph nodes remove pathogens and cellular debris from lymph as it is carried back to the blood.

2. Lymphatic Organs

Write the answers that match the statements in the spaces at the right.

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|--|-------------------------|
| 1) Grouped along larger lymphatic vessels. | <u>Lymph nodes</u> |
| 2) Bilobed gland located above the heart. | <u>Thymus</u> |
| 3) Large lymphatic organ located near stomach. | <u>Spleen</u> |
| 4) Clustered at entrance to pharynx. | <u>Tonsils</u> |
| 5) Organs that filter lymph. | <u>Lymph nodes</u> |
| 6) Lymphatic organ that filters blood. | <u>Spleen</u> |
| 7) Site of T cell differentiation. | <u>Thymus</u> |
| 8) Vessels carrying lymph to lymph node. | <u>Afferent vessels</u> |
| 9) Vessels carrying lymph from lymph node. | <u>Efferent vessels</u> |
| 10) Intercept pathogens entering pharynx. | <u>Tonsils</u> |
| 11) Contains a reserve supply of blood. | <u>Spleen</u> |
| 12) Hormone that promotes T cell maturation. | <u>Thymosin</u> |

3. Nonspecific Resistance Against Disease

Match the type of nonspecific resistance with the statements.

1) Mechanical barriers

3) Phagocytosis

5) Fever

2) Chemicals

4) Inflammation

1 Skin

4 Release of histamine

1 Mucus

5 Abnormally high body temperature

2 Lysozyme

4 Attracts neutrophils and monocytes

1 Mucous membranes

3 Tissue macrophage system

2 Low pH

1 Flow of saliva

2 Gastric juice

3 Granulocytes and macrophages

2 Interferon

4 Increases local blood supply

4 Produces edema

1 Clot seals off pathogens

4 Pus formation

5 Speeds up body processes

1 Flow of tears

3 Pathogens are engulfed and digested

4. Immunity

a. Indicate whether the following statements are true (T) or false (F).

1) Immunity is resistance against specific pathogens.

T

2) Nonspecific resistance is directed against all pathogens.

T

3) Immunity involves granulocytes and macrophages.

F

4) Immunity requires lymphocytes to distinguish between self and nonself molecules.

T

5) Antigens are foreign molecules that cause an immune response.

T

6) Undifferentiated lymphocytes are produced in the spleen.

F

7) All lymphocytes differentiate in the thymus gland.

F

8) The majority of lymphocytes in the blood are T cells.

T

9) Differentiation of lymphocytes occurs throughout life.

F

10) T cells provide cell-mediated immunity.

T

11) B cells provide antibody-mediated immunity.

T

12) Lymphocyte receptors for specific antigens are inherited.

T

13) Lymphocyte receptors are formed by contact with specific antigens.

F

14) There are thousands of different types of B and T cells, and each type responds to a different specific antigen.

T

15) Immunity depends upon lymphocytes whose receptors fit with a specific antigen.

T

16) Immunity involves the interaction of lymphocytes, antigens, and macrophages.

T

17) At any one time, either cell-mediated immunity or antibody-mediated immunity is at work; never both at the same time.

F

18) Reproduction of differentiated lymphocytes occurs in lymphatic organs.

T

- b. Write the words that complete the sentences describing cell-mediated immunity in the spaces at the right.

When a macrophage engulfs an antigen, part of it is carried to the cell surface and displayed. If a ____ 1 ____ cell's ____ 2 ____ can bind with the pre-sented antigen, it does so and becomes activated. Activated ____ 3 ____ cells divide, rapidly forming a ____ 4 ____ of T cell subtypes that have the same antigen receptor. ____ 5 ____ secrete cytotoxins that rupture antigen-bearing plasma membranes and substances that recruit additional lymphocytes and ____ 6 ____ . ____ 7 ____ secrete chemicals that help activate B cells and stimulate ____ 8 ____ by macrophages. When the pathogens have been destroyed, ____ 9 ____ secrete chemicals to slow and stop the immune response. The dormant ____ 1_0 ____ remain to recognize and start an immune response if the same ____ 1_1 ____ should ever reenter the body.

- 1) Helper T
- 2) Receptor
- 3) Helper T
- 4) Clone
- 5) Killer T cells
- 6) Macrophages
- 7) Helper T cells
- 8) Phagocytosis
- 9) Suppressor T cells
- 10) Memory T cells
- 11) Antigen

- c. Write the words that complete the sentences describing antibody-related immunity in the spaces at the right.

B cells are activated when their antigen receptors bind to an ____ 1 ____ . Activated B cells are stimulated to divide rapidly by ____ 2 ____ , chemicals released from activated ____ 3 ____ cells that have receptors that can bind to the same antigen. The expanding B cell population is called a ____ 4 ____ , which consists of ____ 5 ____ cells that produce antibodies and ____ 6 ____ cells that remain dormant. Once the pathogen has been eliminated, ____ 7 ____ slow and stop the immune response. If the same antigen later reenters the body, ____ 8 ____ start a rapid and intense ____ 9 ____ response.

- 1) Antigen
- 2) Cytokines
- 3) Helper T
- 4) Clone
- 5) Plasma
- 6) Memory B
- 7) Suppressor T cells
- 8) Memory B cells
- 9) Secondary immune

- d. Match the antibodies with the statements. More than one answer may apply.

IgA

IgD

IgE

IgG

IgM

- 1) Most abundant antibody in the blood.
- 2) Fixes complement to antigens.
- 3) Serves as receptors on B cells.
- 4) Involved in allergic reactions.
- 5) Transferred to child via mother's milk.
- 6) Transferred to fetus via placenta.
- 7) Binds with antigens.
- 8) Protects mucous membranes.
- 9) Neutralizes toxins.

- 1) IgG
- 2) IgG, IgM
- 3) IgD, IgM
- 4) IgE
- 5) IgA
- 6) IgG
- 7) IgM
- 8) IgA
- 9) IgG

5. Immune Responses

- a. Match the immune responses with the statements.
- | | |
|--|------------------------------|
| 1) Primary immune response | 2) Secondary immune response |
| <u>1</u> Occurs when an antigen is encountered for the first time. | |
| <u>2</u> Occurs in subsequent encounters with same antigen. | |
| <u>2</u> Results from activation of memory cells. | |
| <u>2</u> The more rapid and intense response. | |
- b. Match the types of immunity with the statements.
- | | |
|--|----------------------------------|
| 1) Naturally acquired active | 3) Naturally acquired passive |
| 2) Artificially acquired active | 4) Artificially acquired passive |
| <u>3</u> Immunity from antibodies received in mother's milk. | |
| <u>2</u> Immunity from a vaccine of dead pathogens. | |
| <u>1</u> Immunity after having the disease and recovering. | |
| <u>4</u> Immunity from injected antibodies. | |
| <u>2</u> Immunity from DPT injections. | |
| <u>4</u> Immunity from monoclonal antibodies. | |

6. Disorders of the Lymphatic and Immune Systems

Write the answers that match the statements in the spaces at the right.

- | | |
|--|---------------------------|
| 1) Microscopic worms plug lymphatic vessels. | <u>Elephantiasis</u> |
| 2) An abnormally intense immune reaction. | <u>Allergy</u> |
| 3) HIV destroys helper T cells. | <u>AIDS</u> |
| 4) A tumor of lymphatic tissue. | <u>Lymphoma</u> |
| 5) Inflammation of the tonsils. | <u>Tonsillitis</u> |
| 6) Lymphocytes attack own body tissues. | <u>Autoimmune disease</u> |
| 7) Allergy attack that involves entire body. | <u>Anaphylaxis</u> |
| 8) Transmitted via blood exchanges and sexual intercourse. | <u>AIDS</u> |

7. Clinical Applications



- a. Mary is a grocery checker with no evidence of heart disease. She complains that when she comes home from work, her feet and legs are swollen and sometimes painful. In the morning, the swelling is gone. How do you explain this? **Standing for long hours causes interstitial fluid to pool in the legs and feet because, without muscle contractions, the lymphatic system cannot remove the excess fluid against the force of gravity. When lying down at night, the force of gravity is minimized enabling the removal of excess fluid.**
- b. The AIDS virus attacks helper T cells. Explain how this, in time, causes immunodeficiency. **Immunity is gradually diminished as more and more helper T cells are destroyed since helper T cells are the only cells that can start an immune response.**
- c. Infants typically receive a series of three DPT injections (vaccinations) followed by a booster shot at four to six years of age. Explain the value of the booster shot. **A booster shot tricks the immune system into "thinking" that an invasion of the pathogen has begun. Therefore, it triggers a powerful secondary immune response raising to new heights the level of protective antibodies in the blood.**