Lymph Nodes and Other Lymphoid Organs

4. Match the terms in Column B with the appropriate descriptions in Column A. More than one choice may apply in some cases.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The largest lymphatic organ; a blood reservoir</td>
<td>A. Lymph nodes</td>
</tr>
<tr>
<td>2. Filter lymph</td>
<td>B. Peyer's patches</td>
</tr>
<tr>
<td>3. Particularly large and important during youth; produces hormones that help to program the immune system</td>
<td>C. Spleen</td>
</tr>
<tr>
<td>4. Collectively called MALT</td>
<td>D. Thymus</td>
</tr>
<tr>
<td>5. Removes aged and defective red blood cells</td>
<td>E. Tonsils</td>
</tr>
<tr>
<td>6. Prevents bacteria from breaching the intestinal wall</td>
<td></td>
</tr>
</tbody>
</table>

5. Figure 12–2 depicts several different lymphoid organs. Label all lymphoid organs indicated by a leader line and add labels as necessary to identify the sites where the axillary, cervical, and inguinal lymph nodes would be located. Color the lymphoid organs as you like, and then shade in light green the portion of the body that is drained by the right lymphatic duct.

Figure 12–2
BODY DEFENSES

Nonspecific (Innate) Body Defenses

7. The three major elements of the body's nonspecific defense system are: the
   (1) __________________ , consisting of the skin and __________________ ;
   defensive cells, such as (2) __________________ and phagocytes; and a whole
   deluge of (3) __________________ .

8. Indicate the sites of activity or the secretions of the nonspecific defenses by
   writing the correct terms in the answer blanks.
   1. Lysozyme is found in the body secretions called ______________ and ______________.
   2. Fluids with an acid pH are found in the ______________ and ______________.
   3. Sebum is a product of the ______________ glands and acts at the surface
      of the ______________.
   4. Mucus is produced by mucus-secreting glands found in the respiratory and
      ______________ system mucosae.

9. Figure 12–4 diagrams the events involved in the inflammatory response.
   Assume the following events have already occurred: tissue injury and
   invasion of microbes, and release of inflammatory chemicals by mast cells.
   Each subsequent event is represented by a square with one or more arrows.
   From the list below, write the correct number in each event square in the
   figure. Then, color-code and color the structures that appear below the
   numbered list.
   1. WBCs are drawn to the injured area by the release of inflammatory chemicals.
   2. Tissue repair occurs.
   3. Local blood vessels dilate, and the capillaries become engorged with blood.
   4. Phagocytosis of microbes occurs.
   5. Fluid containing clotting proteins is lost from the bloodstream and enters
      the injured tissue area.
   6. Margination and diapedesis occur.
      ○ Monocyte ○ Neutrophil(s) ○ Endothelium of capillary
      ○ Epithelium ○ Macrophage ○ Microorganisms
      ○ Erythrocyte(s) ○ Subcutaneous tissue ○ Fibrous repair tissue
10. Circle the term that does not belong in each of the following groupings.

1. Redness  Pain  Swelling  Itching  Heat
2. Neutrophils  Macrophages  Phagocytes  Natural killer cells
3. Inflammatory chemicals  Histamine  Kinins  Interferon
4. Intact skin  Intact mucosae  Inflammation  First line of defense
5. Interferons  Antiviral  Antibacterial  Proteins

11. Match the terms in Column B with the descriptions of the nonspecific defenses of the body in Column A. More than one choice may apply.

**Column A**

- 1. Have antimicrobial activity
- 2. Provide mechanical barriers
- 3. Provide chemical barriers
- 4. Entraps microorganisms entering the respiratory passages
- 5. Part of the first line of defense

**Column B**

- A. Acids
- B. Lysozyme
- C. Mucosae
- D. Mucus
- E. Protein-digesting enzymes
- F. Sebum
- G. Skin
Cells of the Immune System: An Overview

19. Using the key choices, select the term that correctly completes each statement. Insert the appropriate term or letter in the answer blanks.

Key Choices

A. Antigen(s)  D. Cellular immunity  G. Lymph nodes
B. B cells  E. Humoral immunity  H. Macrophages
C. Blood  F. Lymph  I. T cells

1. Immunity is resistance to disease resulting from the presence of foreign substances or ______ in the body. When this resistance is provided by antibodies released to body fluids, the immunity is called ______. When living cells provide the protection, the immunity is referred to as ______. The major actors in the immune response are two lymphocyte populations, the ______ and the ______. Phagocytic cells that act as accessory cells in the immune response are the ______.

2. Because pathogens are likely to use both ______ and ______ as a means of getting around the body, ______ and other lymphatic tissues (which house the immune cells) are in an excellent position to detect their presence.

20. A schematic of the life cycle of the lymphocytes involved in immunity is shown in Figure 12-5. First, select different colors for the areas listed below and use them to color the coding circles and the corresponding regions in the figure. If there is overlap, use stripes of a second color to indicate the second identification. Then respond to the statements following the figure, which relate to the two-phase differentiation process of B and T cells.

- Area where immature lymphocytes arise
- Area seeded by immunocompetent B and T cells
- Area where T cells become immunocompetent
- Area where the antigen challenge and clonal selection are likely to occur
- Area where B cells become immunocompetent
1. What signifies that a lymphocyte has become immunocompetent?

2. During what period of life does immunocompetence develop?

3. What determines which antigen a particular T or B cell will be able to recognize?
   A. its genes or B. "its" antigen

4. What triggers the process of clonal selection in a T or B cell?
   A. its genes or B. binding to "its" antigen

5. During development of immunocompetence, the ability to tolerate ________________ must also occur if the immune system is to function normally.
21. T cells and B cells exhibit certain similarities and differences. Check (√) the appropriate spaces in the table below to indicate the lymphocyte type that exhibits each characteristic.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>T cell</th>
<th>B cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Originates in bone marrow from stem cells called hemocytoblasts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progeny are plasma cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progeny include regulatory, helper, and cytotoxic cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progeny include memory cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is responsible for directly attacking foreign cells or virus-infected cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Produces antibodies that are released to body fluids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bears a cell-surface receptor capable of recognizing a specific antigen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forms clones upon stimulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts for most of the lymphocytes in the circulation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

22. Circle the term that does not belong in each of the following groupings.

1. Antibodies       Gamma globulin       Cytokines       Immunoglobulins
2. Protein          Complete antigen     Nucleic acid     Hapten
3. Lymph nodes      Liver              Spleen            Thymus       Bone marrow

**Humoral (Antibody-Mediated) Immune Response**

23. The basic structure of an antibody molecule is diagrammed in Figure 12–6. Select different colors, and color in the coding circles below and the corresponding areas on the diagram.

- heavy chains
- light chains

Add labels to the diagram to correctly identify the type of bonds holding the polypeptide chains together. Also label the constant (C) and variable (V) regions of the antibody, and add “polka dots” to the variable portions. Then, answer the two questions following the figure.
1. Which portion of the antibody—V or C—is its antigen-binding site?

2. Which portion acts to determine antibody class and specific function?

24. Match the antibody classes in Column B to their descriptions in Column A. Place the correct term(s) or letter response(s) in the answer blanks.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bound to the surface of a B cell</td>
<td>A. IgA</td>
</tr>
<tr>
<td>2. Crosses the placenta</td>
<td>B. IgD</td>
</tr>
<tr>
<td>3. The first antibody released during the primary response</td>
<td>C. IgE</td>
</tr>
<tr>
<td>4. Fixes complement (two classes)</td>
<td>D. IgG</td>
</tr>
<tr>
<td>5. Is a pentamer</td>
<td>E. IgM</td>
</tr>
<tr>
<td>6. The most abundant antibody found in blood plasma and the chief antibody released during secondary responses</td>
<td></td>
</tr>
<tr>
<td>7. Binds to the surface of mast cells and mediates an allergic response</td>
<td></td>
</tr>
<tr>
<td>8. Predominant antibody found in mucus, saliva, and tears</td>
<td></td>
</tr>
</tbody>
</table>
Cellular (Cell-Mediated) Immune Response

28. Several populations of T cells exist. Match the terms in Column B to the descriptions in Column A. Place the correct term or letter response in the answer blanks.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Binds with and releases chemicals that activate B cells, T cells, and macrophages</td>
<td>A. Helper T cell</td>
</tr>
<tr>
<td>2. Activated by recognizing both its antigen and a self-protein presented on the surface of a macrophage</td>
<td>B. Cytotoxic T cell</td>
</tr>
<tr>
<td>3. Turns off the immune response when the “enemy” has been routed</td>
<td>C. Regulatory T cell</td>
</tr>
<tr>
<td>4. Directly attacks and lyses cellular pathogens</td>
<td>D. Memory T cell</td>
</tr>
<tr>
<td>5. Initiates secondary response to a recognized antigen</td>
<td></td>
</tr>
</tbody>
</table>

29. Using the key choices, select the terms that correspond to the descriptions of substances or events by inserting the appropriate term or letter in the answer blanks.

Key Choices

A. Anaphylactic shock        D. Complement          F. Inflammation
B. Antibodies                E. Cytokines           G. Interferon
C. Chemotaxis factors

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A protein released by macrophages and activated T cells that helps to protect other body cells from viral multiplication</td>
<td>1. A protein released by macrophages and activated T cells that helps to protect other body cells from viral multiplication</td>
</tr>
<tr>
<td>2. Any types of molecules that attract neutrophils and other protective cells into a region where an immune response is ongoing</td>
<td>2. Any types of molecules that attract neutrophils and other protective cells into a region where an immune response is ongoing</td>
</tr>
<tr>
<td>3. Proteins released by plasma cells that mark antigens for destruction by phagocytes or complement</td>
<td>3. Proteins released by plasma cells that mark antigens for destruction by phagocytes or complement</td>
</tr>
<tr>
<td>4. A consequence of the release of histamine and of complement activation</td>
<td>4. A consequence of the release of histamine and of complement activation</td>
</tr>
<tr>
<td>5. C and G are examples of this class of molecules</td>
<td>5. C and G are examples of this class of molecules</td>
</tr>
<tr>
<td>6. A group of plasma proteins that amplifies the immune response by causing lysis of cellular pathogens once it has been “fixed” to their surface</td>
<td>6. A group of plasma proteins that amplifies the immune response by causing lysis of cellular pathogens once it has been “fixed” to their surface</td>
</tr>
<tr>
<td>7. Class of chemicals released by macrophages</td>
<td>7. Class of chemicals released by macrophages</td>
</tr>
</tbody>
</table>
30. Organ transplants are often unsuccessful because self-proteins vary in different individuals. However, chances of success increase if certain important procedures are followed. The following questions refer to this important area of clinical medicine.

1. Assuming that autografts and isografts are not possible, what is the next most successful graft type and what is its source?

2. What two cell types are important in rejection phenomena?

3. Why are immunosuppressive drugs (or therapy) provided after transplant surgery, and what is the major shortcoming of this therapy?

31. Figure 12-7 is a flowchart of the immune response that tests your understanding of the interrelationships of that process. Several terms have been omitted from this schematic. First, complete the figure by inserting appropriate terms from the key choices below. (Note that oval blanks indicate that the required term identifies a cell type, and rectangular blanks represent the names of chemical molecules. Also note that solid lines represent stimulatory or enhancing effects, whereas broken lines indicate inhibition.) Then color the coding circles and the corresponding ovals, indicating the cell types identified.

**Key Choices**

**Cell types:**
- B cell
- Helper T cell
- Cytotoxic T cell
- Macrophage
- Memory B cell
- Memory T cell
- Neutrophils
- Plasma cell
- Regulatory T cell

**Molecules:**
- Antibodies
- Chemotactic factors
- Complement
- Cytokines
- Interferon
- Perforin
- Suppressor factors
Antigen invades
Engulfed by

Processes and presents antigen to

Secretes

Activate

Released

Stimulate

Interacts with and stimulates cloning of

Some
activate

Some
become

Secretes

Some
stimulate

Some
stimulate

Secretes

Some
attract

Directly attacks the cellular antigen causing its lysis

Enhance the inflammatory response

Inhibits

Upon later stimulation, clone to form

Some
become

Most differentiate further to become

Secretes

Figure 12-7