Part I. Clinical Applications

1. What is opsonization and how does it help phagocytes? Give an example of a molecule that acts as an opsonin.

2. Under what circumstances might natural killer (NK) cells kill our own cells?

3. What are the cardinal signs of inflammation and what causes them?

4. What triggers the release of histamine from mast cells?

5. What makes HIV particularly hard for the immune system to defeat?

6. Describe the killing mechanism of cytotoxic T cells that involves perforins.
7. Which type of T cell is the most important in both cellular and humoral immunity? Why?

8. Which class of antibody is most abundant in blood? Which is secreted first in a primary immune response? Which is most abundant in secretions?

9. Why is the secondary response to an antigen so much faster than the primary response?

10. How do vaccines protect against common childhood illnesses such as chicken pox, measles, and mumps?

11. Name two different antigen presenting cells (APCs). Which is most important for T lymphocyte activation?

12. In clonal selection, “Who” does the selecting? What is being selected?

13. A common explanation for a sudden or unexplainable pathogenic condition in the body is “It is a viral infection.” Since viruses do not conform to the prokaryotic or eukaryotic plan of organization, how can they be classified as infectious agents?
14. Why are natural killer (NK) cells effective in fighting viral infections?

15. We usually associate a fever with illness or disease. In what ways may a fever be beneficial?

Part I
Using the terms below, complete the following statements. Terms may be used more than once or not at all.

<table>
<thead>
<tr>
<th>A</th>
<th>Complement</th>
<th>Interferons</th>
<th>Stimulate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibody</td>
<td>Contact</td>
<td>Killer</td>
<td>Suppress</td>
</tr>
<tr>
<td>Antibodies</td>
<td>D</td>
<td>lymphokines</td>
<td>Three</td>
</tr>
<tr>
<td>Antigens</td>
<td>E</td>
<td>M</td>
<td>Thymus</td>
</tr>
<tr>
<td>Antigen-antibody</td>
<td>Five</td>
<td>Passive</td>
<td>Transplanted</td>
</tr>
<tr>
<td>B</td>
<td>Heavy</td>
<td>Phagocytes</td>
<td>Variable</td>
</tr>
<tr>
<td>Cell-mediated</td>
<td>Histamine</td>
<td>Quickly</td>
<td></td>
</tr>
<tr>
<td>Chemotaxis</td>
<td>Humoral</td>
<td>Slowly</td>
<td></td>
</tr>
<tr>
<td>Clone</td>
<td>Immunoglobins</td>
<td>Specific antigens</td>
<td></td>
</tr>
</tbody>
</table>

A. Completion
1. Certain pathogens that enter the body are engulfed by _______ in a nonspecific way. Viral infections are often limited by polypeptides called _______, which help protect other cells from subsequent viral infection. _______ immune responses usually begin with large, complex, and foreign molecules called _______ that stimulate _______ lymphocytes to secrete _______ molecules.
2. Since these antibodies are released into the blood, they provide _______ immunity, whereas T lymphocytes require cell contact known as _______ immunity.
3. There are _______ (number) subclasses of antibodies, or _______, which are identified by these capital letters that follow Ig: _______. They differ in the polypeptides that make up the constant region of their _______ chains, whereas the two _______ regions of each antibody combine with specific _______.
4. Opsonization is the process of combining _______ with _______, resulting in phagocytosis.
5. Destruction of foreign cells may also be accomplished by the _______ system of plasma proteins which are activated by _______, _______, _______, and _______.
6. These free-floating proteins promote opsonization and _______, attracting other leukocytes to the area and promoting the release of _______ from mast cells.
7. During the primary immune response, Ig _______ antibodies are produced (quickly/slowly) and the person may get sick. During the secondary response, Ig _______ antibodies are produced _______ (quickly/slowly) by large numbers of identical _______ B/T lymphocytes known as _______, which provides the person with resistance to the pathogen.
8. A person receiving antibody protection made by another organism, such as the antibodies a fetus receives from its mother or a victim receives from antiserum injections, is an example of _______ immunity.
9. T lymphocytes are processed by the _______ gland, which also secretes hormones. There are _______ (number) subtypes of T lymphocytes. The _______ subtype of T lymphocytes requires _______ with the fungus, virus, or certain bacteria to kill these invaders or to reject _______ tissues or organs.
10. Helper T lymphocytes _______ and suppressor T lymphocytes _______ — the function of B lymphocytes and _______ T lymphocytes. Important chemicals secreted by T lymphocytes _______ which participate in the immune response are known as _______, such as interleukin-2.
Part II

**COMPLETION:**

Using the terms below, complete the following statements.

- lymphokines
- helper T
- diapedesis
- lacteals
- precipitation
- lymphatic
- suppressor T
- antibodies
- antigens
- costimulation
- inflammation

1. The ability to resist infection and disease through the activation of specific defenses constitutes ________________.
2. The cells that provide a specific defense known as the immune response are the ________________.
3. The special lymphatic vessels in the lining of the small intestines are the ________________.
4. Lymphocytes that attack foreign cells or body cells infected by viruses are called ________________ cells.
5. Plasma cells are responsible for the production and secretion of ________________.
6. The lymphatic system begins in the tissues as ________________.
7. Cells that represent the “first line” of cellular defense against pathogenic invasion are the ________________.
8. The process during which macrophages move through adjacent endothelial cells of capillary walls is called ________________.
9. The small proteins released by activated lymphocytes and macrophages and by tissue cells infected with viruses are called ________________.
10. An immunization where antibodies are administered to fight infection or prevent disease is ________________.
11. Cytotoxic T cells are responsible for the type of immunity referred to as ________________.
12. Immunity that is present at birth and has no relation to previous exposure to the pathogen involved is ________________.
13. Immunity that appears following exposure to an antigen as a consequence of the immune response is referred to as ________________.
14. The types of cells that inhibit the responses of other T cells and B cells are called ________________ cells.
15. Before B cells can respond to an antigen, they must receive a signal from ________________ cells.
16. When an activated B cell divides, it ultimately produces daughter cells that differentiate into plasma cells and ________________.
17. Antibodies are produced and secreted by ________________.
18. When a direct attack by an antibody covers an antigen, its effect is ________________.
19. The formation of insoluble immune complexes is called ________________.
20. Small organic molecules that are not antigens by themselves are called ________________.
21. The only antibodies that cross the placenta from the maternal bloodstream are ________________ antibodies.
22. When the immune system fails to develop normally or the immune response is blocked in some way, the condition is termed ________________.
23. The system responsible for providing the body with specific defenses against infection is the ________________ system.
Part III

Place the letter corresponding to the correct answer in the space provided.

1. The primary responsibility(-ies) of the lymphocytes in the lymphatic system is(are) to respond to the presence of:
   a. invading pathogens
   b. abnormal body cells
   c. foreign particles
   d. a, b, and c are correct

2. The anatomical barriers and defense mechanisms that cannot distinguish one potential threat from another are called:
   a. the immune response
   b. specific defenses
   c. nonspecific defenses
   d. abnormal nontoxicity

3. The major components of the lymphatic system include:
   a. lymph nodes, lymph, lymphocytes
   b. spleen, thymus, tonsils
   c. thoracic duct, R. lymphatic duct, lymph nodes
   d. lymphatic vessels, lymph, lymphatic organs

4. The primary function of the lymphatic system is:
   a. transporting of nutrients and oxygen to tissues
   b. removal of carbon dioxide and waste products from tissues
   c. regulation of temperature, fluid, electrolytes, and pH balance
   d. production, maintenance, and distribution of lymphocytes

5. Normal lymphocyte populations are maintained through lymphopoiesis in the:
   a. bone marrow and lymphatic tissues
   b. lymph in the lymphatic tissues
   c. blood and the lymph
   d. spleen and liver

6. The largest collection of lymphoid tissue in the body is contained within the:
   a. adult spleen
   b. thymus gland
   c. tonsils
   d. lymphatic nodules

7. Of the following selections, the one that includes only nonspecific defenses is:
   a. T and B-cell activation, complement, inflammation, phagocytosis
   b. hair, skin, mucous membranes, antibodies
   c. hair, skin, complement, inflammation, phagocytosis
   d. antigens, antibodies, complement, macrophages
8. The "first line" of cellular defense against pathogenic invasion is:
   a. interferon
   b. pathogens
   c. phagocytes
   d. complement system

9. A specific defense mechanism is always activated by:
   a. an antigen
   b. an antibody
   c. inflammation
   d. fever

10. When an antigen appears, the immune response begins with:
    a. the presence of immunoglobulins in body fluids
    b. the release of endogenous pyrogens
    c. the activation of the complement system
    d. the activation of specific T cells and B cells

11. T-cell activation leads to the formation of cytotoxic T cells and memory T cells that provide:
    a. humoral immunity
    b. cellular immunity
    c. phagocytosis and immunological surveillance
    d. stimulation of inflammation and fever

12. Before an antigen can stimulate a lymphocyte, it must first be processed by a:
    a. macrophage
    b. NK cell
    c. cytotoxic T cell
    d. neutrophil

13. The T cells that limit the degree of immune system activation from a single stimulus are:
    a. memory Tc cells
    b. suppressor T cells
    c. cytotoxic T cells
    d. CD4 T cells

14. Since each kind of B cell carries its own particular antibody molecule in its cell membrane, activation can only occur in the presence of a(n):
    a. immunosuppressive drug
    b. cytotoxic T cell
    c. corresponding antigen
    d. CD3 receptor complex

15. Activated B cells produce plasma cells that are specialized because they:
    a. synthesize and secrete antibodies
    b. produce helper T cells
    c. direct a physical and chemical attack
    d. a, b, and c are correct
An active antibody is shaped like a(n):

a. T  
b. A  
c. Y  
d. B

The most important antibody action in the body is:

a. alteration in the cell membrane to increase phagocytosis
b. to attract macrophages and neutrophils to the infected areas
c. activation of the complement systems
d. cell lysis and the cell membrane digestion

Antibodies may promote inflammation through the stimulation of:

a. basophils and mast cells
b. plasma cells and memory B cells
c. suppressor T cells
d. cytotoxic T cells

The antigenic determinant site is the certain portion of the antigen’s exposed surface where:

a. the foreign “body” attacks  
b. phagocytosis occurs  
c. the antibody attacks  
d. the immune surveillance system is activated

Fetal antibody production is uncommon because the developing fetus has:

a. cell-mediated immunity  
b. natural passive immunity  
c. antibody-mediated immunity  
d. endogenous pyrogens

When an immune response mistakenly targets normal body cells and tissues, the result is:

a. immune system failure  
b. the development of an allergy  
c. depression of the inflammatory response  
d. an autoimmune disorder

Depression of the immune system due to chronic stress may cause:

a. depression of the inflammatory response  
b. a reduction in the activities and numbers of phagocytes in peripheral tissues  
c. the inhibition of interleukin secretion  
d. a, b, and c are correct

With advancing age, B cells are less responsive, causing a:

a. decrease in antigen exposure  
b. decreased antibody level after antigen exposure  
c. deactivation of T cell production  
d. a, b, and c are correct
24. B lymphocytes differentiate into:
   a. cytotoxic and suppressor cells
   b. helper and suppressor cells
   c. memory and helper cells
   d. memory and plasma cells

25. ________ cells may activate B cells while ________ cells inhibit the activity of B cells.
   a. memory; plasma
   b. macrophages; microphages
   c. memory; cytotoxic
   d. helper T; suppressor T

26. The primary response of T-cell differentiation in cell-mediated immunity is the production of ________.
   a. helper T
   b. suppressor T
   c. cytotoxic T
   d. memory

27. The vaccination of antigenic materials into the body is called:
   a. naturally acquired active immunity
   b. artificially acquired active immunity
   c. naturally acquired passive immunity
   d. artificially acquired passive immunity

28. In passive immunity ________ are induced into the body by injection.
   a. antibodies
   b. antigens
   c. T and B cells
   d. lymphocytes

29. Which defense mechanism is not in either the external or the internal category of nonspecific immunity?
   a. epithelial membranes (skin) that cover the body surfaces
   b. strong acidity of gastric juice (pH of 1 to 2)
   c. phagocytosis of unwanted substances
   d. activation of lymphocyte cell populations
   e. All of these defense mechanisms are nonspecific.

30. Which cell type does not participate in phagocytosis?
   a. neutrophils within the blood and tissues
   b. monocytes within the blood
   c. macrophages within the connective tissues
   d. Kupffer cells that are “fixed” within the liver
   e. lymphocytes within the blood

31. The highly mobile cells that are the first to arrive at the site of an infection, are the
   a. neutrophils
   b. monocytes
   c. macrophages
   d. basophils
   e. lymphocytes

32. Which organelle contains powerful digestive enzymes and participates directly in the process of phagocytosis?
   a. nucleus
   b. mitochondrion
   c. endoplasmic reticulum
   d. lysosome
   e. Golgi apparatus

33. The thermoregulatory control center or “thermostat” that regulates the body’s response to changes in temperature such as during a fever, is located in the
   a. hypothalamus
   b. pituitary
   c. cerebral cortex
   d. adrenal gland
   e. thyroid gland
34. Populations of lymphocytes known as **B lymphocytes**
   a. secrete antibodies into blood and lymph fluids
   b. are said to provide cell-mediated immunity
   c. attack host cells infected with viruses, fungi, or cancer cells
   d. are originally derived from the thymus gland
   e. must come into close contact with infected cells to destroy them

35. Which is not a subclass of **immunoglobulins**?
   a. IgA
   b. IgB
   c. IgD
   d. IgE
   e. IgM

36. Which subclass of immunoglobulin molecules mediates allergic reactions?
   a. IgA
   b. IgB
   c. IgD
   d. IgE
   e. IgM

37. Which substance is released from tissue mast cells and plasma basophils to dilate blood vessels
   and increase capillary permeability?
   a. complements C5 through C9
   b. histamine
   c. IgG
   d. complements C2 through C4
   e. gamma globulin

38. The **clonal selection theory** helps to explain
   a. the primary immune response
   b. the secondary immune response
   c. the secretion of monoclonal antibodies
   d. passive immunity
   e. None of these helps explain the clonal selection theory.

39. A “clone” is best described as a large population of
   a. genetically identical cells
   b. antibody or immunoglobulin molecules belonging to the same subtype
   c. cancer cells growing within a tumor
   d. specific antigen molecules found on the membrane surface of lymphocytes
   e. None of these helps explain the clonal selection theory.

40. Which statement about **passive immunity** is false?
   a. A mother may transfer some IgG antibodies passively through the placenta to the fetus.
   b. A mother may transfer some IgA antibodies passively to the newborn in her first breast milk
      (colostrum).
   c. It can occur when either attenuated pathogens or similar vaccines are injected.
   d. Passive immunity can occur when antiserum or antitoxin preparations are injected.
   e. Passive immunity does not protect the individual against subsequent exposure to the same
      antigen.

41. The gland most responsible for maturation, storage, and formation of T lymphocytes is the
   a. thymus
   b. thyroid
   c. spleen
   d. liver
   e. None of these choices is correct.

42. Which function is not characteristic of T lymphocytes?
   a. attacking virus and fungal infections
   b. stimulating the direct formation of antibodies
   c. carrying out rejection of transplants
   d. patrolling the body as defense against cancer
   e. All of these are T lymphocyte functions.

43. The subpopulation of T lymphocytes that is attacked by the human immunodeficiency virus
   (HIV) in persons with AIDS is the
   a. helper T cells
   b. suppressor T cells
   c. cytotoxic T cells
   d. killer T cells

44. Antibodies made against self-antigens are called
   a. immunoglobulins
   b. autoantibodies
   c. gamma globulins
   d. transplant antigens
The two cell types that are most responsible for engulfing and presenting foreign antigens together with surface histocompatibility antigens on the membrane for the activation of helper T lymphocytes, are macrophages and
a. B lymphocytes
b. dendritic cells
c. platelets
d. neutrophils
e. mast cells

The membrane surface molecules that are carefully matched between a donor and the recipient to avoid organ transplantation rejection, are called
a. histocompatibility antigens
b. lymphokines
c. interleukins
d. interferons
e. antibodies

Which statement about natural killer (NK) cells is false?
- NK cells are not processed (matured) by the thymus gland.
- NK cells can attack and destroy tumor cells.
- NK cells provide a first line of cell-mediated defense, destroying tumors in a nonspecific fashion.
- NK cells must first be activated by macrophages that present foreign tumor antigens.
- NK cells and killer T cells can interact as part of the immune response to the presence of tumors.

Which statement about cancer is false?
- Cancer can be caused by a virus.
- The risk of cancer increases with age as lymphocytes age and thymus hormone production declines.
- Cancer grows faster when corticosteroid hormone levels in the bloodstream are lowered by stressful conditions.
- Cancer normally develops from tumor cells that escape the body’s immunological surveillance system.
- Burkitt’s lymphoma and Kaposi’s sarcoma are examples of cancer.

Which of the following conditions belongs to that form of allergy known as delayed hypersensitivity?
- Allergic rhinitis (runny or stuffy nose)
- Conjunctivitis (red eyes)
- Allergic asthma (difficulty breathing)
- Contact dermatitis (poison ivy)
- Atopic dermatitis (skin hives)

Which immunoglobulin is most responsible for the symptoms of immediate hypersensitivity?
- IgG
- IgE
- IgM
- IgD
- IgA

The chemical released during an immediate hypersensitivity response, such as hay fever, that is most responsible for the itching, sneezing, tearing, and runny nose, is
- Histamine
- Prostaglandins
- Leukotrienes
- Serotonin
- Bradykinin