

## Chapter 22: Lymphatic System and Immunity

### I. Lymphatic System

A. Functions of the Lymphatic System - list and describe:

1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

B. Lymphatic Vessels

1. What are lymphatic capillaries? \_\_\_\_\_
2. Lymphatic capillaries differ from blood capillaries in that:
  - a. Lack \_\_\_\_\_
  - b. Cells of the epithelium \_\_\_\_\_ & \_\_\_\_\_
3. Because of the structure of lymphatic capillaries:
  - a. Far more \_\_\_\_\_
  - b. Nothing \_\_\_\_\_
  - c. Epithelium functions as \_\_\_\_\_
4. Lymphatic capillaries join to form larger \_\_\_\_\_
  - a. These resemble \_\_\_\_\_ in structure
5. Lymphatic vessels contain \_\_\_\_\_ similar to those in veins
6. When a lymphatic vessel is compressed \_\_\_\_\_  
as a result the lymph moves \_\_\_\_\_
7. What three factors are responsible for the compression of lymphatic vessels?

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

8. Lymph Nodes

- a. Describe the shape of a lymph node \_\_\_\_\_
- b. Functionally lymph nodes \_\_\_\_\_

9. After passing through the lymph nodes the lymphatic vessels converge to form larger vessels called \_\_\_\_\_

a. Indicate what part of the body is drained by each of the lymphatic trunks:

- 1. Jugular trunks \_\_\_\_\_
- 2. Subclavian trunks \_\_\_\_\_
- 3. Bronchomediastinal trunks \_\_\_\_\_
- 4. Intestinal trunks \_\_\_\_\_
- 5. Lumbar trunks \_\_\_\_\_

b. Lymphatic trunks:

- 1. Connect to \_\_\_\_\_ OR
- 2. Join to form yet larger vessels called \_\_\_\_\_

10. The two major lymphatic ducts are:

a. Right lymphatic duct that is \_\_\_\_\_ in length and drains:

- 1. Right side \_\_\_\_\_
- 2. Right \_\_\_\_\_
- 3. Right \_\_\_\_\_

b. Thoracic duct that is \_\_\_\_\_ in length and drains:

- 1. Right side of the body inferior \_\_\_\_\_
- 2. Entire left \_\_\_\_\_

11. What are cisterna chyli? \_\_\_\_\_

C. Lymphatic Tissues and Organs

1. Lymphatic tissue consists primarily of \_\_\_\_\_ but also includes

\_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_

2. In response to microbes or foreign substances, the lymphocytes:

- a. \_\_\_\_\_

- b. Increase \_\_\_\_\_
  - c. Part of the \_\_\_\_\_
3. What are reticular fibers? \_\_\_\_\_
- a. Lymphocytes and other cells \_\_\_\_\_
  - b. The fiber network \_\_\_\_\_ & \_\_\_\_\_
4. What are mucosa-associated lymphoid tissues (MALT)? \_\_\_\_\_
- \_\_\_\_\_
5. Diffuse Lymphatic Tissue and Lymphatic Nodules
- a. Contains \_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_
  - b. Has no clear \_\_\_\_\_ and \_\_\_\_\_
  - c. It is located:
    - 1. Deep to \_\_\_\_\_
    - 2. Around \_\_\_\_\_
    - 3. Within the \_\_\_\_\_ & \_\_\_\_\_
  - d. What are lymphatic nodules? \_\_\_\_\_
- \_\_\_\_\_
- 1. Where are they numerous? \_\_\_\_\_
  - \_\_\_\_\_
  - 2. What are Peyer's patches? \_\_\_\_\_
  - \_\_\_\_\_
  - 3. What are lymphatic follicles? \_\_\_\_\_
6. Tonsils
- a. What are tonsils? \_\_\_\_\_
  - \_\_\_\_\_
  - b. Tonsils provide protection against \_\_\_\_\_
  - c. Where are the palatine tonsils? \_\_\_\_\_
  - d. Where are the pharyngeal tonsils? \_\_\_\_\_
  - e. Where are the lingual tonsils? \_\_\_\_\_
7. Lymph Nodes
- a. Where are superficial lymph nodes? \_\_\_\_\_
  - b. Where are deep lymph nodes? \_\_\_\_\_

- c. A capsule composed of \_\_\_\_\_ surrounds a lymph node
  - d. What are trabeculae? \_\_\_\_\_
  - e. Reticular fibers \_\_\_\_\_
  - f. What are lymphatic sinuses? \_\_\_\_\_
  - g. Describe the cortex of a lymph node: \_\_\_\_\_  
\_\_\_\_\_
  - h. Describe the medulla of a lymph node: \_\_\_\_\_  
\_\_\_\_\_
  - i. Afferent lymphatic vessels carry \_\_\_\_\_
  - j. Efferent lymphatic vessels carry \_\_\_\_\_
  - k. What do macrophages do to lymph? \_\_\_\_\_  
\_\_\_\_\_
  - l. What happens at a germinal center? \_\_\_\_\_  
\_\_\_\_\_
8. Spleen
- a. Roughly the size of \_\_\_\_\_
  - b. The outer capsule is composed of \_\_\_\_\_
  - c. Trabeculae are composed of \_\_\_\_\_
  - d. Trabeculae subdivide the spleen into \_\_\_\_\_
  - e. White pulp is associated with \_\_\_\_\_
  - f. Red pulp is associated with \_\_\_\_\_
  - g. What is the periarterial lymphatic sheath? \_\_\_\_\_  
\_\_\_\_\_
  - h. What are the splenic cords? \_\_\_\_\_
  - i. What are the venous sinuses? \_\_\_\_\_
  - j. Blood flows through the spleen at \_\_\_\_\_
  - k. Functionally the spleen:
    - 1. Destroys defective \_\_\_\_\_
      - a. Old red blood cells can rupture \_\_\_\_\_  
\_\_\_\_\_

- b. Splenic macrophages \_\_\_\_\_
  - 2. Detects and responds to \_\_\_\_\_
    - a. Stimulate an \_\_\_\_\_ because of specialized lymphocytes in the \_\_\_\_\_
    - b. High concentrations of T cells in \_\_\_\_\_
    - c. High concentrations of B cells in \_\_\_\_\_
  - 3. Acts as a blood \_\_\_\_\_
    - a. During exercise splenic volume \_\_\_\_\_
    - b. Increase in circulating red blood cells can promote \_\_\_\_\_ to \_\_\_\_\_ during \_\_\_\_\_ or \_\_\_\_\_
9. Thymus
- a. Where is the thymus located \_\_\_\_\_
  - b. The thymus is a \_\_\_\_\_ gland
  - c. The thymus is surrounded by a thin \_\_\_\_\_
  - d. Lobules are formed by \_\_\_\_\_ that extend \_\_\_\_\_
  - e. The framework of the thymus consists of \_\_\_\_\_
    - 1. The cells are joined by \_\_\_\_\_
    - 2. Form small, \_\_\_\_\_ filled with \_\_\_\_\_
  - f. Describe the cortex: \_\_\_\_\_
  - g. Describe the medulla: \_\_\_\_\_
  - h. What are thymic corpuscles? \_\_\_\_\_
  - i. The thymus is the site of maturation for \_\_\_\_\_
  - j. Large numbers \_\_\_\_\_ but most \_\_\_\_\_
  - k. The lymphocytes that survive maturation are capable of:
    - 1. Reacting \_\_\_\_\_
    - 2. Normally they do not \_\_\_\_\_

## II. Immunity

- A. What is immunity? \_\_\_\_\_
  - 1. Innate immunity is also called \_\_\_\_\_
  - 2. Adaptive immunity is also called \_\_\_\_\_
  - 3. Specificity and memory are characteristics of \_\_\_\_\_

4. What is specificity? \_\_\_\_\_
5. What is memory? \_\_\_\_\_
6. In innate immunity:
  - a. Each time \_\_\_\_\_
  - b. The response is \_\_\_\_\_
  - c. Because \_\_\_\_\_
7. In adaptive immunity:
  - a. Response during the second exposure is \_\_\_\_\_ than  
\_\_\_\_\_
  - b. Because the immune system \_\_\_\_\_

### III. Innate Immunity

#### A. Mechanical Mechanisms

1. Form barriers that prevent \_\_\_\_\_
  - a. Such as the \_\_\_\_\_ & \_\_\_\_\_
2. Remove \_\_\_\_\_ & \_\_\_\_\_ from the surface
  - a. Washed from the eyes by \_\_\_\_\_
  - b. Washed from the mouth by \_\_\_\_\_
  - c. Washed from the urinary tract by \_\_\_\_\_
  - d. Ciliated mucous membranes \_\_\_\_\_ to the  
\_\_\_\_\_ where they \_\_\_\_\_
  - e. Microbes are also removed from the respiratory tract by \_\_\_\_\_  
& \_\_\_\_\_

#### B. Chemical Mediators

1. Some found on the surface of cells kill \_\_\_\_\_
2. Other chemical mediators promote inflammation by
  - a. Causing \_\_\_\_\_
  - b. Increasing \_\_\_\_\_
  - c. Attracting \_\_\_\_\_
  - d. Stimulating \_\_\_\_\_

### 3. Complement

- a. Complement is a group of \_\_\_\_\_
- b. What is the complement cascade? \_\_\_\_\_
- c. The alternative pathway is part of \_\_\_\_\_
  1. Initiated when \_\_\_\_\_
  2. If activated C3 combines with \_\_\_\_\_ it becomes \_\_\_\_\_ and activates \_\_\_\_\_
- d. What is a membrane attack complex (MAC)? \_\_\_\_\_  
\_\_\_\_\_
  1. What happens because of the hole? \_\_\_\_\_  
\_\_\_\_\_
  2. What does lysozyme do in conjunction with MAC? \_\_\_\_\_  
\_\_\_\_\_
- e. Complement proteins can attach to bacteria and stimulate \_\_\_\_\_
- f. Complement proteins also:
  1. Attract \_\_\_\_\_
  2. Promote \_\_\_\_\_

### 4. Interferons

- a. Interferons are proteins that \_\_\_\_\_
- b. Viruses stimulate an infected cell to \_\_\_\_\_
- c. Interferons bind to the \_\_\_\_\_
  1. This stimulates the neighboring cells to produce \_\_\_\_\_
  2. This stops viral reproduction by \_\_\_\_\_
- d. Interferons act against \_\_\_\_\_
- e. Interferons also play a role in \_\_\_\_\_

### C. Cells

1. White blood cells are the most important \_\_\_\_\_
2. What are chemotactic factors? \_\_\_\_\_  
\_\_\_\_\_
  - a. Important examples include:
    1. \_\_\_\_\_

2. \_\_\_\_\_
  3. \_\_\_\_\_
  4. \_\_\_\_\_
3. How are chemotactic factors spread? \_\_\_\_\_
  4. White blood cells follow chemotactic factors by moving from areas of \_\_\_\_\_ concentration to areas of \_\_\_\_\_ concentration
    - a. This ability is called \_\_\_\_\_
  5. Describe the ameboid movement of white blood cells: \_\_\_\_\_  
\_\_\_\_\_
  6. What happens in phagocytosis? \_\_\_\_\_  
\_\_\_\_\_
  7. Neutrophils
    - a. Neutrophils are \_\_\_\_\_
    - b. Neutrophils are usually the \_\_\_\_\_ and they often \_\_\_\_\_
    - c. Neutrophils also release \_\_\_\_\_ that
      1. Kill \_\_\_\_\_
      2. Cause \_\_\_\_\_ damage
      3. Cause \_\_\_\_\_
    - d. Pus is an accumulation of \_\_\_\_\_  
\_\_\_\_\_
  8. Macrophages
    - a. Macrophages are \_\_\_\_\_ that leave blood, enter \_\_\_\_\_ enlarge \_\_\_\_\_, & increase \_\_\_\_\_
    - b. Macrophages are \_\_\_\_\_ phagocytic cells that
      1. Outlive \_\_\_\_\_
      2. Ingest \_\_\_\_\_ & \_\_\_\_\_
    - c. Usually accumulate in tissue \_\_\_\_\_
    - d. Responsible for \_\_\_\_\_
    - e. Macrophages enhance the immune response by producing a variety of chemicals such as: \_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_

- f. Macrophages are located just beneath the free surfaces of the body to provide \_\_\_\_\_
  - g. Macrophages are also located within \_\_\_\_\_ called \_\_\_\_\_
    - 1. These macrophages are now called the:
      - \_\_\_\_\_
9. Basophils, Mast Cells, and Eosinophils
- a. Basophils are motile white blood cells that \_\_\_\_\_
  - b. Mast cells are non-motile cells in \_\_\_\_\_
    - 1. Located at potential \_\_\_\_\_
  - c. When activated basophils and mast cells:
    - 1. Release \_\_\_\_\_ such as \_\_\_\_\_ & \_\_\_\_\_
      - a. Produce \_\_\_\_\_
      - b. Activate \_\_\_\_\_
  - d. Eosinophils
    - 1. Eosinophils release enzymes that \_\_\_\_\_
    - 2. Mechanism to contain and \_\_\_\_\_
    - 3. Eosinophil numbers greatly increase in patients with \_\_\_\_\_
    - \_\_\_\_\_
    - 4. Eosinophils also secrete enzymes that \_\_\_\_\_
10. Natural Killer (NK) Cells
- a. Natural killer cells are a type of \_\_\_\_\_
  - b. The attack classes of cells such as \_\_\_\_\_ & \_\_\_\_\_
  - c. NK cells kill their target cells by using \_\_\_\_\_
- D. Inflammatory Response
- 1. What is the inflammatory response? \_\_\_\_\_
  - \_\_\_\_\_
  - 2. Damage to tissues cause the release or activation of \_\_\_\_\_ such as:
    - a. \_\_\_\_\_
    - b. \_\_\_\_\_
    - c. \_\_\_\_\_
    - d. \_\_\_\_\_

- e. \_\_\_\_\_ & others
- 3. What effects are produced by the chemical mediators?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
- 4. How is the infected area walled off? \_\_\_\_\_
- 5. Complement:
  - a. Further \_\_\_\_\_
  - b. Attracts \_\_\_\_\_
- 6. The process continues until \_\_\_\_\_
- 7. Finally phagocytes \_\_\_\_\_ and the tissue \_\_\_\_\_
- 8. What is local inflammation? \_\_\_\_\_
  - a. Symptoms of local inflammation include: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_
- 9. What is systemic inflammation? \_\_\_\_\_
  - a. Three additional features of systemic inflammation are:
    - 1. Red bone marrow \_\_\_\_\_
    - 2. Pyrogens are released by \_\_\_\_\_
      - a. Pyrogens stimulate \_\_\_\_\_
    - 3. Large amounts of fluid \_\_\_\_\_
      - a. Decreased blood volume can cause \_\_\_\_\_ & \_\_\_\_\_

#### IV. Adaptive Immunity

##### A. General

- 1. Adaptive immunity involves \_\_\_\_\_  
\_\_\_\_\_
- 2. What are antigens? \_\_\_\_\_
- 3. What are haptens? \_\_\_\_\_
- 4. Foreign Antigens
  - a. Antigens not produced by the body but \_\_\_\_\_

- b. Examples of foreign antigens include: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
  - c. What is an allergic reaction? \_\_\_\_\_
  - d. Foreign antigens in transplanted tissues and organs result in  
 \_\_\_\_\_
  - 5. Self-antigens
    - a. Molecules produced by the body that stimulate \_\_\_\_\_
    - b. What is an autoimmune disease? \_\_\_\_\_
  - 6. Antibody-Mediated Immunity (formerly Humoral Immunity)
    - a. B cells give rise to \_\_\_\_\_ that produce \_\_\_\_\_ found in  
 \_\_\_\_\_
  - 7. Cell-Mediated Immunity
    - a. Different subpopulations of T cells are responsible for particular aspects:
      - 1. Effector T cells such as:
        - a. \_\_\_\_\_
        - b. \_\_\_\_\_
          - 1. Responsible for producing \_\_\_\_\_
      - 2. Regulatory T cells such as:
        - a. \_\_\_\_\_
        - b. \_\_\_\_\_
          - 1. Can promote or inhibit \_\_\_\_\_
- B. Origin and Development of Lymphocytes
  - 1. In the red bone marrow:
    - a. Some stem cells give rise to pre-T cells
      - 1. Pre-T cells migrate \_\_\_\_\_
      - 2. The pre-T cells divide and \_\_\_\_\_
        - a. What is the function of thymosin? \_\_\_\_\_
    - b. Other stem cells produce \_\_\_\_\_
      - 1. Processed in the red bone marrow into \_\_\_\_\_

2. What happens in the positive selection process? \_\_\_\_\_  
\_\_\_\_\_
3. What is a clone of lymphocytes? \_\_\_\_\_  
\_\_\_\_\_
  - a. Each clone can respond only to a \_\_\_\_\_
4. What happens in the negative selection process? \_\_\_\_\_  
\_\_\_\_\_
5. T cells and B cells continually circulate between the \_\_\_\_\_ &  
\_\_\_\_\_
6. The primary lymphatic organs are the sites where \_\_\_\_\_
  - a. These organs are the \_\_\_\_\_ & \_\_\_\_\_
7. The secondary lymphatic organs and tissues are the sites where \_\_\_\_\_  
\_\_\_\_\_
  - a. These include the \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_

### C. Activation of Lymphocytes

1. The two general principles of lymphocyte activation are:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
2. Antigenic Determinants and Antigen Receptors
  - a. What must happen for an adaptive immune response to occur?  
\_\_\_\_\_
  - b. The portion of an antigen recognized by a lymphocyte is called:  
\_\_\_\_\_ or \_\_\_\_\_
  - c. The portion of a lymphocyte that reacts with the antigen is called:  
\_\_\_\_\_
    1. The T cell receptor consists of 2 \_\_\_\_\_ subdivided  
into a \_\_\_\_\_ & a \_\_\_\_\_ region
      - a. Which part binds to the antigen? \_\_\_\_\_
    2. The B-cell receptor consists of 4 \_\_\_\_\_  
with 2 \_\_\_\_\_ regions

### 3. Major Histocompatibility Complex Molecules

- a. Most lymphocyte activation involves glycoproteins on the surfaces of cells called \_\_\_\_\_
  - b. MHC molecules have a variable region that can bind to \_\_\_\_\_
  - c. MHC Class I Molecules
    1. Are found on nucleated cells and function to \_\_\_\_\_  
\_\_\_\_\_
    2. MHC class I/antigen complexes on the surface of cells can:
      - a. Bind to \_\_\_\_\_
      - b. This combination \_\_\_\_\_
      - c. Activated T cells can \_\_\_\_\_
      - d. Effectively stopping \_\_\_\_\_
    3. What does MHC-restricted mean? \_\_\_\_\_  
\_\_\_\_\_
  - d. MHC Class II Molecules
    1. Are found on \_\_\_\_\_ which include:
      - a. \_\_\_\_\_
      - b. \_\_\_\_\_
      - c. \_\_\_\_\_
      - d. \_\_\_\_\_
    2. What are dendritic cells? \_\_\_\_\_
    3. Antigen-presenting cells are specialized to:
      - a. Take \_\_\_\_\_
      - b. Process \_\_\_\_\_
      - c. Use \_\_\_\_\_
      - d. To display \_\_\_\_\_
        1. MHC class II/antigen complex can \_\_\_\_\_
      - e. The displaying cell \_\_\_\_\_ destroyed
      - f. Stimulates other immune cells \_\_\_\_\_
- ### 4. Costimulation
- a. Needed to \_\_\_\_\_ in B cells and T cells

b. Costimulation is accomplished by:

1. \_\_\_\_\_
2. \_\_\_\_\_

c. What are cytokines? \_\_\_\_\_  
\_\_\_\_\_

d. Certain pairs of molecules can also be involved in costimulation:

1. When the surface molecule on one cell combines with \_\_\_\_\_  
\_\_\_\_\_
2. The combination can act as:
  - a. Signal \_\_\_\_\_
  - b. Can hold \_\_\_\_\_

#### 5. Lymphocyte Proliferation

a. Proliferation of Helper T cells

1. How is the antigen presented? \_\_\_\_\_
2. What helper T cells can respond to this presentation? \_\_\_\_\_
3. How do the helper T cells respond to activation? \_\_\_\_\_

b. Proliferation and Activation of B or Effector T cells

1. B cells present processed antigen on surface with \_\_\_\_\_
2. What responds to this presentation? \_\_\_\_\_
3. These cells then stimulate the B cells to \_\_\_\_\_

#### D. Inhibition of Lymphocytes

1. What is tolerance? \_\_\_\_\_
2. The most important function of tolerance is \_\_\_\_\_  
\_\_\_\_\_

3. List and describe three ways tolerance can be induced:

- a. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- b. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

c. \_\_\_\_\_  
\_\_\_\_\_

## E. Antibody-Mediated Immunity

1. Effective against \_\_\_\_\_

2. Antibodies

a. Antibodies are \_\_\_\_\_

b. Antibodies are what portion of plasma proteins? \_\_\_\_\_

c. Antibodies are also known as \_\_\_\_\_

d. Each antibody is composed of \_\_\_\_\_

1. Two \_\_\_\_\_ and

2. Two \_\_\_\_\_

e. Where is the variable region? \_\_\_\_\_

f. The variable region is responsible for? \_\_\_\_\_

g. What is the constant region responsible for? \_\_\_\_\_  
\_\_\_\_\_

3. Effects of Antibodies

a. Antibodies can directly affect antigens in two ways:

1. Can bind to \_\_\_\_\_

2. Can combine with \_\_\_\_\_

b. Antibodies can indirectly affect antigens by:

1. Activate the \_\_\_\_\_

2. Initiate an \_\_\_\_\_

3. Act as an opsonin by:

a. Connecting to \_\_\_\_\_

b. Connect to a macrophage \_\_\_\_\_

c. Then the macrophage \_\_\_\_\_

4. Antibody Production

a. Primary Response

1. Response to the \_\_\_\_\_ exposure to a specific antigen

2. Antigen binds to B cell receptors on \_\_\_\_\_

3. Activation causes the small lymphocyte B cell to undergo \_\_\_\_\_

- 
4. Some of the cells become:
    - a. Plasma cells that \_\_\_\_\_
    - b. Others revert back \_\_\_\_\_ & become \_\_\_\_\_
  5. How long does it take to produce enough antibodies to be effective against the antigen? \_\_\_\_\_
  6. Disease symptoms develop because \_\_\_\_\_
- b. Secondary or Memory Response
1. Occurs when \_\_\_\_\_
  2. Results from \_\_\_\_\_ which
    - a. Rapidly \_\_\_\_\_ and
    - b. Large amounts of \_\_\_\_\_
  3. Provides better protection for two reasons:
    - a. Time required \_\_\_\_\_
    - b. Amount of \_\_\_\_\_
  4. Antigen is quickly destroyed, \_\_\_\_\_, &  
\_\_\_\_\_
  5. The memory response also forms \_\_\_\_\_

#### F. Cell-Mediated Immunity

1. Function of T cells and is most effective against \_\_\_\_\_
2. Activation of T cells is regulated by:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
3. Once activated T cells go through a series of divisions and produce:
  - a. \_\_\_\_\_ such as \_\_\_\_\_
  - b. \_\_\_\_\_
4. Functionally effector T cells are responsible for \_\_\_\_\_
5. Functionally memory T cells are responsible for \_\_\_\_\_
6. Cytotoxic T Cells
  - a. Contact antigens on the surface of a cell:
    1. \_\_\_\_\_ on virus-infected cells

2. \_\_\_\_\_ on tumor cells
  3. \_\_\_\_\_ on transplanted tissues
- b. When the cytotoxic T cell binds with its target cell:
1. Releases chemicals that \_\_\_\_\_
    - a. How does perforin work? \_\_\_\_\_  
\_\_\_\_\_
  2. Can also release cytokines that \_\_\_\_\_
7. Delayed Hypersensitivity T Cells
- a. Respond to antigens by \_\_\_\_\_
    1. Promote \_\_\_\_\_ &
    2. \_\_\_\_\_ especially in \_\_\_\_\_

## V. Immunotherapy

A. Immunotherapy treats disease by \_\_\_\_\_ or

1. Some approaches attempt \_\_\_\_\_
2. Sometimes inhibiting \_\_\_\_\_

B. Monoclonal Antibodies

1. Producing monoclonal antibodies may result in \_\_\_\_\_  
\_\_\_\_\_
2. What is the major problem with monoclonal antibodies? \_\_\_\_\_  
\_\_\_\_\_
3. What is humanization? \_\_\_\_\_
  - a. What is its purpose? \_\_\_\_\_

## VI. Acquired Immunity

A. Terminology

1. List the four ways of acquiring adaptive immunity:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_

- d. \_\_\_\_\_
2. What does the term natural imply? \_\_\_\_\_
  3. What does the term artificial imply? \_\_\_\_\_
  4. What does active immunity mean? \_\_\_\_\_
  5. What does passive immunity mean? \_\_\_\_\_
  6. Which is longer lasting immunity, active or passive? \_\_\_\_\_
- B. Active Natural Immunity
1. Is the result of natural \_\_\_\_\_
  2. The first exposure usually causes \_\_\_\_\_
- C. Active Artificial Immunity
1. An antigen is deliberately \_\_\_\_\_
    - a. The process is called \_\_\_\_\_
    - b. The introduced antigen is called a \_\_\_\_\_
  2. The vaccine usually contains:
    - a. Some part \_\_\_\_\_
    - b. Dead \_\_\_\_\_ or a live, \_\_\_\_\_
  3. The vaccine is designed to stimulate an immune response but \_\_\_\_\_  
\_\_\_\_\_
  4. Why is this a preferred method of acquiring adaptive immunity? \_\_\_\_\_  
\_\_\_\_\_
- D. Passive Natural Immunity
1. Results from the transfer of \_\_\_\_\_  
\_\_\_\_\_
  2. Antibodies can also be transferred to the newborn in the \_\_\_\_\_
- E. Passive Artificial Immunity
1. Begins with vaccinating an \_\_\_\_\_
  2. Antibodies are then removed \_\_\_\_\_  
\_\_\_\_\_
  3. Sometimes a human who has developed \_\_\_\_\_  
\_\_\_\_\_
  4. Provides immediate \_\_\_\_\_ but is only \_\_\_\_\_

5. What is antiserum? \_\_\_\_\_  
\_\_\_\_\_

### VIII. Effects of Aging on the Lymphatic System and Immunity

A. What effect does aging have on the lymphatic system? \_\_\_\_\_  
\_\_\_\_\_

B. What effect does aging have on helper T cells? \_\_\_\_\_  
\_\_\_\_\_

#### C. Antibody Responses

1. Primary and secondary responses \_\_\_\_\_

2. \_\_\_\_\_ is needed to produce a response

3. Response is \_\_\_\_\_

4. Less \_\_\_\_\_

5. Fewer \_\_\_\_\_

6. So the ability to resist infections \_\_\_\_\_

#### D. Cell-Mediated Immunity

1. The ability to resist intracellular pathogens \_\_\_\_\_

2. Pathogens not eliminated from the body can be reactivated when \_\_\_\_\_  
\_\_\_\_\_

a. A common example is chicken pox appearing later as \_\_\_\_\_

E. Are new autoimmune diseases common in the elderly? \_\_\_\_\_

1. Increased incidence of cancer in the elderly is assumed \_\_\_\_\_  
\_\_\_\_\_