Amerman Active-Learning Workbook: Chapter 20 Answers

Key Concept: Why does severe swelling result when lymphatic vessels are blocked or damaged?
Lymphatic vessels perform the function of picking up excess interstitial fluid and bringing it back to the cardiovascular system. That swelling, or lymphedema, occurs when lymphatic vessels are prevented from transporting excess interstitial fluid back to the cardiovascular system, and it accumulates in the tissues.

Key Concept: Why do lymph nodes get swollen when you are sick?
Lymph nodes act as filters that trap pathogens that have entered the lymphatic circulation. When large numbers of pathogens become trapped in a lymph node, they may trigger a response that causes the lymph node to enlarge or swell.

Key Concept: When you cut your finger, which line of defense is compromised? Why do we cover a wound with a bandage?
The first line of defense, which includes surface barriers such as the cutaneous membrane, is compromised. The bandage temporarily takes the place of the breached surface barrier and acts to help block the entry of pathogens into the body.

Complete It: Overview of Immunity

Fill in the blanks to complete the following paragraphs that describe the basic principles of the immune system.
The first line of defense consists of surface barriers that prevent the entry of pathogens into the body. Certain surface barriers secrete substances that deter the growth of, kill, or trap pathogens, such as keratin in the skin, mucus in mucous membranes, and acid in the stomach.
The second line of defense is also known as innate immunity and the third line as adaptive immunity. The main cells of both lines are leukocytes. Many cells of the second line ingest pathogens or damaged cells by the process of phagocytosis. The other component of both lines are proteins, such as antibodies, complement system, and cytokines.

Key Concept: Why does a problem with the lymphatic system potentially lead to a problem with the immune system?
Lymphatic system tissues and organs do three critical things for the immune system. They hold a large proportion of immune system cells, trap pathogens for the immune system, and help

activate cells of the immune system. Without these critical functions, the immune system is less effective.

Key Concept: What often causes "flu-like" symptoms when one is infected with a pathogen?
Many cytokines (and interferons to a lesser extent) induce "flu-like" symptoms, including fever, chills, and aches due to in part to stimulation of inflammation.

Key Concept: What causes a fever?
Fever is initiated by chemicals called pyrogens which are released from damaged cells or certain bacteria. Pyrogens act on the hypothalamus, causing the hypothalamic thermostat to reset to a higher range.

Key Concept: Your classmate insists that since your patient has a fever, she must have an infection because the elevated temperature of fever kills the bacteria. Explain to your classmate why this is wrong.
A body temperature high enough to kill bacterial cells would probably kill most body cells too, and fever can occur independently of bacterial infection. Fever's more likely contribution is that phagocytes function more efficiently at a slightly higher body temperature.

Key Concept: What is a T cell clone? How is each T cell clone genetically unique? Which clones are destroyed in the thymus, and why?
A T cell clone is a population of T cells that can respond to a specific antigen. All the cells of this clone have a unique T cell receptor (coded in its DNA) that binds to a specific antigenic determinant. The thymus destroys clones that cannot recognize antigens as well as self-reactive T cells which would attack the body's own cells.

Complete It: T Cells and MHC Molecules

Fill in the blanks to complete the following paragraph that describes the properties of MHC molecules and their relationship to cytotoxic and helper T cells.
The T cell receptor can only bind to portions of antigen bound to major histocompatibility complexes on the surface of cells. Nearly all cells have class I MHC molecules on their cell surface that display endogenous antigens. Class II MHC molecules are found only on antigen-presenting cells and display exogenous antigens. T_H cells bind to class II MHC molecules only, whereas TC cells bind to class I MHC.

Key Concept: Why are both class I and class II MHC molecules needed?

T_C cells generally interact only with class I MHC molecules found on the surface of nearly all nucleated cells. Class II MHC molecules are found only on the surfaces of antigen-presenting cells like dendritic cells and present exogenous antigens taken in by phagocytosis. This allows a T_C cell to be activated by and destroy a diseased cell and not destroy dendritic cells.

Key Concept: Why does so much of the immune system malfunction if T_H cells are not working properly?

T_H cells secrete cytokines that activate and enhance various components of the immune response. These cytokines stimulate macrophages, activate T_C cells, and stimulate B cells. Therefore T_H cells are needed for normal function of all main components of the immune system.

Key Concept: Where do B cells mature? Why do only about 10% of the cells complete their maturation process?

B cells mature in bone marrow. Only about 10% of the B cells complete their maturation process because clones that recognize self-antigens (self-reactive B cells) are destroyed. This prevents the development of autoimmunity, in which B cells recognize self-antigens and produce autoantibodies that bind self-antigens.

Key Concept: How do plasma cells and memory B cells differ?

Plasma cells secrete antibodies, while memory B cells are long-lived cells that do not secrete antibodies. Instead, memory B cells remain dormant and respond to antigens upon a secondary exposure.

Key Concept: You have just been envenomated by a spider and the physician gives you pre-formed antibodies to the venom. Is this active or passive immunity? Six months later, you find that your antibody titer to the venom is still high. Is this due to active or passive immunity? Explain.

The first case is passive immunity, in which preformed antibodies are passed from another organism to you. It lasts only the amount of time that the antibodies stay in the bloodstream. The second case is active immunity in which you have produced antibodies from your own B cells due to exposure to the venom.

Key Concept: Your friend insists that she gets the flu every time she gets a flu shot. However, the flu vaccine contains killed viruses. What do you tell her?

Killed flu viruses in the flu shot are not capable of reproducing in the body and cannot cause the flu. A person experiencing flulike symptoms after receiving the vaccine may have been exposed to a different virus or a mutated strain of the virus. Sometimes, if this occurs shortly after receiving the shot, it is likely that there was not enough time for the immune system to mount a primary response and develop immunity.

Key Concept: How does the response to a bacterial infection differ from the response to a viral infection?

In bacterial infection, damaged cells release chemicals that attract and activate macrophages, neutrophils, T_H and B cells (but generally not T_C cells). In viral infections, infected cells release inflammatory chemicals and interferons, which induce a lymphocyte-dominant response in which B cells and T_C cells destroy the infected cells.

Key Concept: How does the response to cancer cells differ from the responses to most infectious pathogens?

Natural Killer cells play a large role in the response to cancer cells, as they help destroy the cancer cells and secrete certain interferons, which also induce cancer cell death. Also dendritic cells and T_H cells play a role in activating T_C cells to attack cancer cells.

Key Concept: Why is a type I hypersensitivity reaction much more severe upon a second exposure to the allergen?

A first exposure is required to sensitize histamine-producing cells (e.g. mast cells). An allergen must first bind to a B cell, and the B cell then differentiates into plasma cells that begin to secrete IgE antibodies. Once the IgE antibodies are attached to the histamine-producing cells, a second exposure can directly (and immediately) trigger histamine release from these cells.

Key Concept: Why does the loss of functional T_H cells in HIV/AIDS cause problems for the entire immune system?

Since T_H cells secrete cytokines that activate and enhance various components of the immune response, T_H cells are required for almost all parts of the innate and adaptive immune responses to function properly. For this reason, the loss of T_H cells causes failure of almost the entire adaptive immune response, as well as some aspects of the innate response.