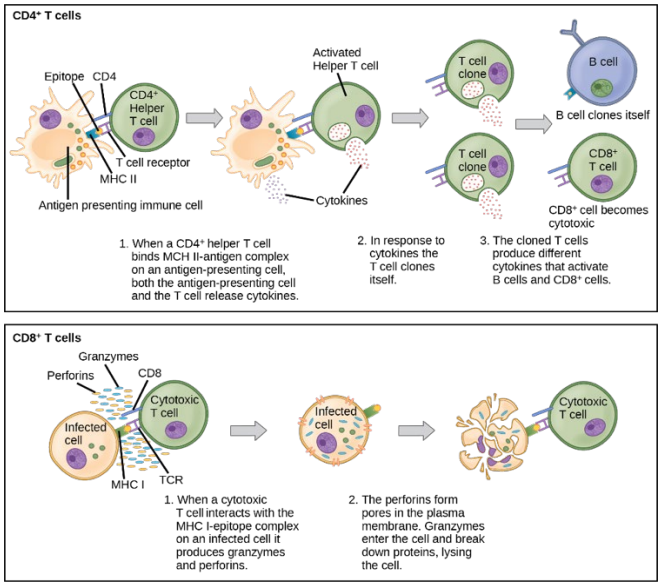
Biology 2e
Unit 7: Animal Structure and Function
Chapter 42: The Immune System

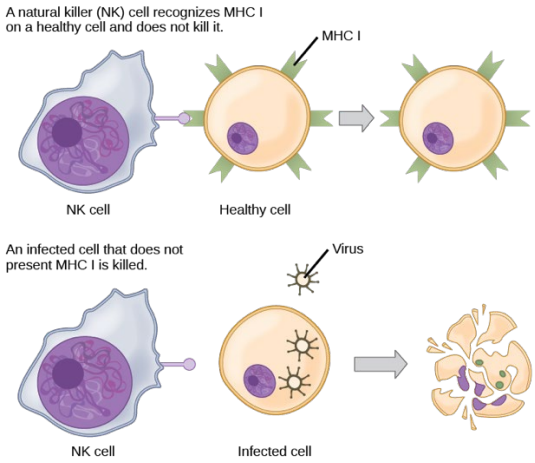
Visual Connection Questions

1. Which of the following statements about T cells is false?



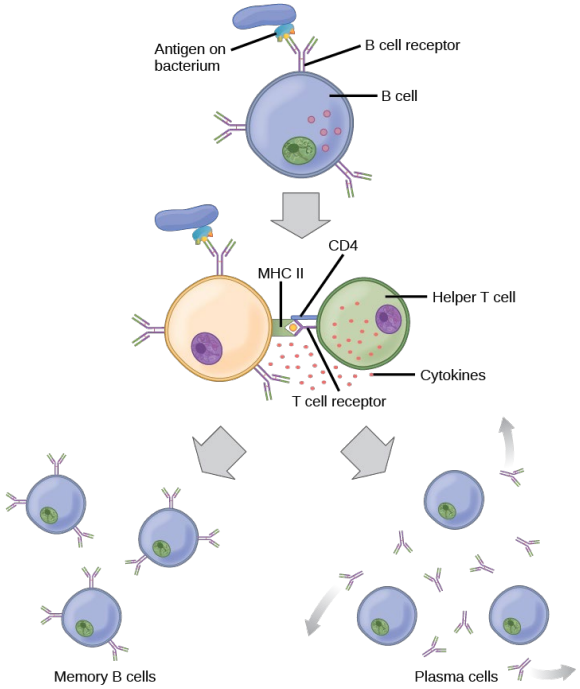
c. MHC II is a receptor found on most body cells, while MHC I is a receptor found on immune cells only

2. Based on what you know about MHC receptors, why do you think an organ transplanted from an incompatible donor to a recipient will be rejected?



MHC receptors differ from person to person. Thus, MHC receptors on an incompatible donor are considered “non-self” and are rejected by the immune system.

3. The Rh antigen is found on Rh-positive red blood cells. An Rh-negative female can usually carry an Rh-positive fetus to term without difficulty. However, if she has a second Rh-positive fetus, her body may launch an immune attack that causes hemolytic disease of the newborn. Why do you think hemolytic disease is only a problem during the second or subsequent pregnancies?



If the blood of the mother and fetus mixes, memory cells that recognize the Rh antigen can form late in the first pregnancy. During subsequent pregnancies, these memory cells launch an immune attack on the fetal blood cells. Injection of anti-Rh antibody during the first pregnancy prevents the immune response from occurring.

Review Questions

4. Which of the following is a barrier against pathogens provided by the skin?

d. desiccation

5. Although interferons have several effects, they are particularly useful against infections with which type of pathogen?

b. viruses

6. Which organelle do phagocytes use to digest engulfed particles?

a. lysosome

7. Which innate immune system component uses MHC I molecules directly in its defense strategy?

c. NK cells

8. Which of the following is both a phagocyte and an antigen-presenting cell?
d. macrophage

9. Which immune cells bind MHC molecules on APCs via CD8 coreceptors on their cell surfaces?
b. CTLs

10. What "self" pattern is identified by NK cells?
b. missing self

11. The acquired ability to prevent an unnecessary or destructive immune reaction to a harmless foreign particle, such as a food protein, is called _____.
c. immune tolerance

12. Upon reexposure to a pathogen, a memory B cell can differentiate to which cell type?
d. plasma cell

13. Foreign particles circulating in the blood are filtered by the _____.
a. spleen

14. The structure of an antibody is similar to the extracellular component of which receptor?
c. BCR

15. The first antibody class to appear in the serum in response to a newly encountered pathogen is _____.
a. IgM

16. What is the most abundant antibody class detected in the serum upon re-exposure to a pathogen or in reaction to a vaccine?
c. IgG

17. Breastfed infants typically are resistant to disease because of _____.
b. passive immunity

18. Allergy to pollen is classified as:
d. immediate hypersensitivity

19. A potential cause of acquired autoimmunity is _____.
b. molecular mimicry

20. Autoantibodies are probably involved in:
c. systemic lupus erythematosus

21. Which of the following diseases is not due to autoimmunity?
d. HIV/AIDS

Critical Thinking Questions

22. Different MHC I molecules between donor and recipient cells can lead to rejection of a transplanted organ or tissue. Suggest a reason for this.

If the MHC I molecules expressed on donor cells differ from the MHC I molecules expressed on recipient cells, NK cells may identify the donor cells as "non-self" and produce perforin and granzymes to induce the donor cells to undergo apoptosis, which would destroy the transplanted organ.

23. If a series of genetic mutations prevented some, but not all, of the complement proteins from binding antibodies or pathogens, would the entire complement system be compromised?

The entire complement system would probably be affected even when only a few members were mutated such that they could no longer bind. Because the complement involves the binding of activated proteins in a specific sequence, when one or more proteins in the sequence are absent, the subsequent proteins would be incapable of binding to elicit the complement's pathogen-destructive effects.

24. Explain the difference between an epitope and an antigen.

An antigen is a molecule that reacts with some component of the immune response (antibody, B cell receptor, T cell receptor). An epitope is the region on the antigen through which binding with the immune component actually occurs.

25. What is a naïve B or T cell?

A naïve T or B cell is one that has not been activated by binding to the appropriate epitope. Naïve T and B cells cannot produce responses.

26. How does the T_H1 response differ from the T_H2 response?

The T_H1 response involves the secretion of cytokines to stimulate macrophages and CTLs and improve their destruction of intracellular pathogens and tumor cells. It is associated with inflammation. The T_H2 response is involved in the stimulation of B cells into plasma cells that synthesize and secrete antibodies.

27. In mammalian adaptive immune systems, T cell receptors are extraordinarily diverse. What function of the immune system results from this diversity, and how is this diversity achieved?

The diversity of TCRs allows the immune system to have millions of different T cells, and thereby to be specific in distinguishing antigens. This diversity arises from mutation and recombination in the genes that encode the variable regions of TCRs.

28. How do B and T cells differ with respect to antigens that they bind?

T cells bind antigens that have been digested and embedded in MHC molecules by APCs. In contrast, B cells function themselves as APCs to bind intact, unprocessed antigens.

29. Why is the immune response after reinfection much faster than the adaptive immune response after the initial infection?

Upon reinfection, the memory cells will immediately differentiate into plasma cells and CTLs without input from APCs or T_H cells. In contrast, the adaptive immune response to the initial infection requires time for naïve B and T cells with the appropriate antigen specificities to be identified and activated.

30. What are the benefits and costs of antibody cross reactivity?

Cross reactivity of antibodies can be beneficial when it allows an individual's immune system to respond to an array of similar pathogens after being exposed to just one of them. A potential cost of cross reactivity is an antibody response to parts of the body (self) in addition to the appropriate antigen.