

## The Immune System: Innate Host Defenses

- Name the two major categories of innate (nonspecific) defenses:
  - \_\_\_\_\_
  - \_\_\_\_\_
- Surface barriers include the \_\_\_\_\_ and \_\_\_\_\_ of the respiratory, gastrointestinal and genitourinary tracts.
- List the three properties of skin that help it resist invasion:
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
- The mucus membranes not only provide a barrier, but they also produce a variety of protective chemicals. For example, the stomach secretes \_\_\_\_\_ enzymes and has a very \_\_\_\_\_ pH. The respiratory and digestive tracts are lined with \_\_\_\_\_ that traps pathogens.
- Once the surface barrier has been broken, the second line of defense, the innate internal defense system (nonspecific defense system), attempts to limit the spread of pathogens. Name the 5 components of the innate internal defense system:
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
- Neutrophils and monocytes/macrophages (monocytes develop into macrophages in the tissue) are the two types of phagocytes discussed. Answer the following questions by circling the correct answer.

|  |                          |
|--|--------------------------|
| Which phagocyte is most abundant?          | Neutrophil or Monocyte   |
| Which phagocytizes more pathogens?         | Neutrophil or Macrophage |
| Which cell is not found in healthy tissue? | Neutrophil or Macrophage |

7. A phagocyte recognizes and binds to molecules found on pathogens using special membrane receptors, such as the \_\_\_\_\_ receptor and the \_\_\_\_\_ (\_\_\_\_) receptor.
8. At least 10 different TLRs have been identified on human phagocytes. Two reactions are triggered when TLRs recognize a pathogen:
- \_\_\_\_\_
  - \_\_\_\_\_
9. A phagocyte engulfs a pathogen and brings it inside the phagocyte in a vesicle called a \_\_\_\_\_, which later fuses with a lysosome and is then called a \_\_\_\_\_.
10. Name three ways the pathogen is destroyed:
- \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
11. Many pathogens have evolved strategies to avoid being killed by phagocytes. For example, some bacteria enclose themselves in capsules. \_\_\_\_\_ is a process of coating bacteria to enhance phagocytosis by a macrophage. Phagocytes have receptors that can attach to opsonins on the bacteria. Two factors can act as opsonins:
- \_\_\_\_\_
  - \_\_\_\_\_
12. Certain \_\_\_\_\_ (from the adaptive defense system) can enhance the killing process within a macrophage. This happens when the macrophage presents antigens from the bacteria to this cell. This is an example of the interaction between the innate and adaptive defense systems.
13. \_\_\_\_\_ cells are a type of lymphocyte, but, unlike the B and T cells, they are not specific. However, they can still recognize abnormal cells. T cells look for the presence of abnormal antigens on the cell surface, while these cells look for the \_\_\_\_\_ of normally occurring self-proteins.

14. NK cells kill like \_\_\_\_\_ T cells; direct contact with a target cell causes it to undergo \_\_\_\_\_, a form of cellular suicide.
15. Name the two types of antimicrobial proteins:
- \_\_\_\_\_
  - \_\_\_\_\_
16. Interferons are cytokines that do the following three things:
- \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
17. What causes a cell to secrete interferons? \_\_\_\_\_
18. The interferons secreted by this cell bind to receptors on nearby cells, causing these nearby cells to produce proteins that \_\_\_\_\_ by degrading \_\_\_\_\_ and preventing synthesis of \_\_\_\_\_.
19. The complement system is a cascade of interdependent proteins which enhance both the innate and adaptive defenses. When activated, these proteins can:
- \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
20. Both adaptive and innate defense systems can activate this cascade via several pathways. For example:
- \_\_\_\_\_ on cells activate the cascade via the classical pathway.
  - \_\_\_\_\_ bind to sugars on the surface of bacteria (\_\_\_\_\_ pathway).
  - A lack of \_\_\_\_\_ proteins on body cells active the alternative pathway.
21. All three pathways cause activation of the C3 protein, which splits into two fragments, C3b and C3a. What do these fragments do?
- C3a causes \_\_\_\_\_.
  - C3b causes \_\_\_\_\_.

22. C3b cleaves C5 into two parts:
- C5a causes \_\_\_\_\_.
  - C5b combines with other complement proteins to form the \_\_\_\_\_ (\_\_\_\_), which causes the cell to lyse.
23. Name the four cardinal signs of inflammation:
- \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
24. The purpose of inflammation is to bring \_\_\_\_\_ and \_\_\_\_\_ into an injured area. This action accomplishes three things:
- Prevents \_\_\_\_\_
  - Disposes of \_\_\_\_\_
  - Sets the stage for \_\_\_\_\_
25. When tissues are injured, macrophages release chemical mediators, called inflammatory mediators. These chemical mediators cause two key effects:
- \_\_\_\_\_, which causes redness and heat
  - \_\_\_\_\_, which causes swelling and, thus, pain
26. These chemical mediators activate cell adhesion molecules on endothelial cells. \_\_\_\_\_ is the process where neutrophils and monocytes bind to these cell adhesion molecules. When neutrophils bind to these molecules, they are activated and leave the blood vessel by a process called \_\_\_\_\_. Once in the tissue, the neutrophils follow a chemical trail to the site of infection. This process is called \_\_\_\_\_.
27. The leakiness of the capillaries allows plasma and proteins to leak into the injured area. What three important classes of proteins enter the affected area?
- \_\_\_\_\_

- \_\_\_\_\_

- \_\_\_\_\_

28. In addition to the complement system, other chemicals act as inflammatory mediators:

- \_\_\_\_\_

- \_\_\_\_\_

- \_\_\_\_\_

29. Bacterial components and cytokines act as \_\_\_\_\_, which cause the body's thermostat to set its temperature higher, thus causing a \_\_\_\_\_. This elevated body temperature is advantageous to our defense system because:

- \_\_\_\_\_

- \_\_\_\_\_

- \_\_\_\_\_