Chapter 21 Study Guide

Lymphatic System

1. What are the main functions of the Lymphatic system?
    1. 1. Fluid recovery- fluid continuously filters from the blood capillaries into the tissue spaces
    2. 2. Immunity- excess filtered fluid picks up foreign cells and chemicals from the tissues
    3. 3. Lipid Absorption- lacteals in small intestine absorb dietary lipids that are not absorbed by the blood capillaries
2. Components of the Lymphatic System
    1. 1. Lymph fluid- similar to blood plasma, but LOW in protein content
    2. 2. Lymphatic vessels
    3. 3. Lymphoid tissues and organs
3. What is the primary function of lymphatic vessels (related to interstitial fluid and capillary beds)?
    - Fluid is forced out of blood at the arterial end of capillary bed and are reabsorbed at the venous end
    - The "leaked fluid" (interstitial fluid) has to be returned to blood to maintain proper blood volume
    - **Lymphatic vessels collect interstitial fluid**

4. Which circulatory vessels are lymphatic capillaries closely associated with? Why do you think this is the case?
    - Lymphatic capillaries are associated with capillary beds and loose connective tissue of the body
5. In which direction does lymph flow?
    - Lymph flows in one direction; towards the heart
6. How do the minivalves of lymphatic capillaries work?
    - Endothelial cells overlap forming minivalves
    - Increases in interstitial fluid volume causes minivalves to open, fluid enters
    - Decreases in interstitial fluid volume close minivalves, prevents backflow
7. How are lymphatic collecting vessels similar to veins?
    - Lymphatic vessels for in the embryp by budding from the veins, so they have similar histology. (tunica interna- endothelium and valves, media- elastic fibers and smooth muscle, and externa-thin)
    - Their walls are thinner and their valves are closer together than those of veins
8. Can you outline the sequence of structures through which lymph flows (from lymphatic capillaries to the heart)?
    - Lymphatic capillaries → lymphatic collecting vessels (internal valves prevent backflow) → lymph nodes (fluid detox, destruction of bacteria, viruses, cancer cells) →Lymphatic trunks (where collecting vessels unite)

→ Lymphatic ducts (right lymphatic duct which goes to the right upper arm and the ride side of head and thorax) (thoracic duct goes to the rest of the body)

9. What are the main two lymphatic ducts, and which areas of the body do they service?
    - Right lymphatic duct which goes to the right upper arm and the ride side of head and thorax
    - Thoracic duct goes to the rest of the body
10. What is the cisterna chyli?
    - Gateway to the thoracic duct
    - Merger of two lumbar trunks+ intestinal trunk
11. Which mechanisms facilitate the transport of lymph from body tissues to the heart? Which of these are similar to the mechanisms used by veins?
    - Flow of lymph relies on:
        - Skeletal muscle "milking"
        - Respiratory pumps (changes in pressure of thoracic cavity- breathing)
        - Valves to prevent backflow
        - Close association with arteries (arterial pulses promote lymph transport)
        - Smooth muscle in lymphatic trunks and thoracic duct
        - Activity level speed transport
    - Very similar to venous return of blood to the heart; except the lymphatic system has no pump like the heart and lymph flows at even lower pressure and speed than venous blood
12. Which types of cells (4 main types) reside in the lymphoid tissue? What are the functions of these cells?
    - Lymphocytes- arise in the red bone marrow; natural killer (NK) cells destroy bacteria and infected host cells → mature into T lymphocytes which direct attack on infected cells or invaders → mature into B lymphocytes which produce plasma cells that secrete antibodies against foreign substances (antigens)
    - Macrophages- phagocytize foreign substances and activate T lymphocytes
    - Dendrite Cells- capture antigens, transport to lymph nodes; activate T lymphocytes
    - Reticular Cells- produce stroma =fibrous network that supports other lymphoid cells
13. What is the primary function of lymphoid tissue?
    - Lymphatic tissue is critical for proper functioning of the immune system
        - It is the site proliferation of lymphocytes
        - Fibrous network provides good surveillance points for immune cells (lymphocytes)
14. What is the difference between diffuse lymphatic tissue and lymphoid follicles?
    - Lymphatic follicles(nodules)- concentrations of lymphoid tissue that form larger lymphoid organs like lymph nodes

15. What is the germinal center within a lymphoid follicle?
    - Germinal centers provide proliferation grounds for dendritic cells and B lymphocytes
16. What are lymph nodes? What are their primary functions? Where are they located?
    - "rest stops" for lymph where fluid filtration occurs; secondary organs of the lymphatic system; they are clustered around lymphatic vessels and embedded in connective tissue of the body
    - Functions:
        - 1) Filtration of microorganisms and debris from loose connective tissue by macrophages (prevents delivery to blood and other body parts)
        - 2) Immune system activation; when antigens are detected by resident lymphocytes, attack is initiated
17. Which layer is the cortex (inside or outside)? The medulla?
    - Cortex- outer layer of the lymph node
    - Medulla- inner layer of the lymph node
18. Which structures compose the cortex of a lymph node? And, which types of cells would you find there?
    - The cortex contains densely packed follicles with germinal centers
    - Germinal centers house proliferating B cells, dendritic cells, and active T cells (surveillance)
19. Which structures compose the medulla of a lymph node? And, which types of cells would you find in the medulla that are not found in the cortex?
    - Medullary cords are thin inward extensions from the cortex; contain B and T lymphocytes + **PLASMA CELLS**
20. **Where do macrophages reside within the lymph node medulla?**
    1. **In the medullary cords**
21. Can you track the flow of lymph within a lymph node?
    - Lymph enters the lymph node through the afferent lymphatic vessels → subcapsular sinus → medullary sinus → hilum → efferent lymphatic vessels: filtered lymph exits lymph node
22. What is the advantage of having fewer efferent than afferent vessels?

23. What are buboes? How does this relate to the Bubonic Plague?
    - Buboes: swollen lymph nodes cause by tremendous #'s of bacteria trapped in a lymph node (immune system can't keep up) and inflammation!