

# The Lymphatic System and Lymphoid Organs and Tissues

## Outline

- 20.1 The lymphatic system includes lymphatic vessels, lymph, and lymph nodes (pp. 758–760; Figs. 20.1–20.3)
- A. The fluid that does not circulate back into the blood from the interstitial fluid is collected by the lymphatic vessels. (p. 758)
  - B. The lymphatic vessels form a one-way system in which lymph flows only toward the heart. (p. 759–760; Figs. 20.1–20.2)
    - 1. The lymphatic transport system starts with the highly permeable lymphatic capillaries, found between the tissue cells and blood capillaries, in the loose connective tissue.
      - a. Large molecules, such as proteins, that are too large to enter blood capillaries can easily pass into lymphatic capillaries.
    - 2. The lymph capillaries flow into the collecting lymphatic vessels and carry the lymph to the lymphatic trunks.
    - 3. The lymphatic trunks drain fairly large areas of the body and eventually empty the lymph back into the circulatory system via the thoracic duct or the right lymphatic duct.
  - C. Lymphatic vessels are low-pressure vessels that use the same mechanisms as veins to return the lymph to the circulatory system—skeletal muscle compression, pressure changes during breathing, and valves to prevent back-flow. (p. 760)
- 20.2 Lymphoid cells and tissues are found in lymphoid organs and in connective tissue of other organs (pp. 761–762; Fig. 20.4)
- A. Lymphoid Cells (p. 761–762; Fig. 20.4)
    - 1. Lymphocytes arise in the red bone marrow and mature into one of two lymphocytes: T cells, or B cells.
    - 2. Macrophages play an important role in body protection by acting as phagocytes and in activating T lymphocytes.
    - 3. Dendritic cells, found in lymphoid tissue, also play a role in T lymphocyte activation.
    - 4. Reticular cells produce the stroma, which is the network that supports the other cell types in the lymphoid tissue.
  - B. Lymphoid tissues house and provide a proliferation site for lymphocytes and furnish an ideal surveillance site for lymphocytes and macrophages. (p. 762; Fig. 20.4)
    - 1. Lymphoid tissues may be diffuse lymphoid tissues, found in nearly every body organ, or lymphoid follicles, which may form part of larger lymphoid organs or be found as aggregations, such as the Peyer's patches in the intestinal wall.
- 20.3 Lymph nodes filter lymph and house lymphocytes (pp. 762–763; Fig. 20.5)
- A. The principal lymphoid organs in the body are the lymph nodes, which act as filters to remove and destroy microorganisms and other debris for the lymph before it is transported back to the bloodstream. (p. 762)

- B. Each lymph node is surrounded by a dense fibrous capsule with an internal framework, or stroma, of reticular fibers that supports the lymphocytes. (pp. 762–763; Fig. 20.5)
  - C. Lymph enters the convex side of a lymph node through afferent lymphatic vessels and exits via fewer efferent vessels, after passing through several sinuses. (p. 763; Fig. 20.5)
    - 1. There are more afferent vessels than efferent vessels, so that the lymph gets backed up slightly in the lymph node, giving the lymphocytes and macrophages time to perform their defensive functions.
- 20.4 The spleen removes bloodborne pathogens and aged red blood cells (pp. 764–765; Fig. 20.6)
- A. The spleen is the largest lymphoid organ, located in the left side of the abdominal cavity directly below the diaphragm. (pp. 764–765; Fig. 20.6)
    - 1. The spleen's main function is to remove old and defective RBCs and platelets as well as foreign matter and debris from the blood. It also provides a site for lymphocyte proliferation and immune surveillance.
    - 2. The spleen is surrounded by a fibrous capsule and contains both lymphocytes found in white pulp and macrophages found in red pulp.
- 20.5 MALT guards the body's entryways against pathogens (pp. 765–766; Figs. 20.7–20.8)
- A. Mucosa-associated lymphoid tissues, MALT, are a set of lymphoid tissues located in mucous membranes throughout the body. (pp. 765–766; Figs. 20.7–20.8)
    - 1. Tonsils are the simplest lymphoid organs—forming a ring of lymphoid tissue around the opening to the pharynx—which serve to gather and remove many of the pathogens entering the pharynx in food or inhaled air.
    - 2. Clusters of aggregated lymphoid nodules, the Peyer's patches, are found in the wall of the distal portion of the small intestine.
    - 3. The appendix is located off the first part of the large intestine and contains large numbers of lymphoid follicles.
- 20.6 T lymphocytes mature in the thymus (pp. 766–767; Fig. 20.9)
- A. The thymus secretes hormones that cause T lymphocytes to become immuno-competent. (pp. 766–767; Fig. 20.9)
    - 1. The thymus is made up of thymic lobules containing an outer cortex and an inner medulla.
    - 2. The thymus differs from other lymphoid organs in that it has no B cells and, therefore, no follicles, it is not directly involved in fighting antigens, and the stroma of the thymus consists of epithelial cells, not reticular fibers.

#### Developmental Aspects of the Lymphatic System and Lymphoid Organs and Tissues (p. 767)

- A. By the fifth week of embryonic development, the beginnings of the lymphatic vessels and the main clusters of lymph nodes are apparent, forming from the budding of lymph sacs from the developing veins. (p. 767)
- B. The thymus is an endodermal derivative, while the rest of the lymphoid organs derive from the mesenchyme. (p. 767)