Week 4: Lymphatic System

The lymphatic system is a multifaceted system consisting of lymphatic vessels, organs, and tissues that penetrate almost every body tissue. The different organs include the thymus, tonsils, red bone marrow, spleen, and lymph nodes. These organs are densely populated with lymphocytes that will fight against pathogens and activate an immune response. Recall that lymphocytes are produced in red bone marrow.

Overview of the Lymphatic System

Before we dive into the specific components, it is essential to be familiar with the primary roles of this body system. The lymphatic system has three functions:

- fluid recovery
- immunity
- lipid absorption.

Fluid Recovery

Recall that fluid is continually filtered from blood capillaries into tissues. The blood capillaries will reabsorb about 85% of this interstitial fluid and put it back into venous circulation. The remaining 15% remains in the tissues, accounting for 2-4 liters of water and 25% plasma proteins. Returning the remaining fluid and proteins to blood is essential to ensure fluid homeostasis. Vessels of the lymphatic system are responsible for reabsorbing this excess fluid called **lymph**. Failure to return lymph could result in edema or circulatory failure.

Immunity

Along with the excess tissue fluid that is recovered, the lymphatic system will also pick up any chemicals or foreign cells from tissues. The lymph (recovered fluid) will pass through lymphatic vessels and lymph nodes containing immune cells like lymphocytes that seek out and destroy pathogens, abnormal cells, or potentially harmful foreign substances. This ensures that the lymphatic fluid that enters the bloodstream is free of pathogens that could spread throughout the body,

Lipid Absorption

The lymphatic system absorbs dietary fats and fat-soluble vitamins from the digestive system. The small intestine contains special lymphatic vessels called **lacteals** that absorb these nutrients and transport them to the bloodstream via lymph. Dietary lipids are too large to be transported through blood capillaries and enter the lacteals.

Lymph

Lymph is a colorless, clear fluid similar to blood plasma but with lower protein concentration. This fluid is the recovered excess fluid from tissues essential to ensure fluid balance. The composition of this fluid is different from place to place in the body. Lymph also contains bacteria, viruses, cellular debris, hormones, and other substances that are absorbed from tissues. This lymph is filtered as it passes through lymph nodes enroute to the bloodstream.

Lymphatic Vessels

The lymphatic vessels lack a pump, such as the heart, and rely on the stretching of the vessels due to an increase of lymph to open valves that allow unidirectional flow for the lymph. Much like venous return, lymphatic flow can be produced by skeletal muscle pumps, and due to their proximity to many arteries, the pressure within those arteries can drive lymph circulation.

The lymphatic vessels are similar to blood vessels except that they are closed at one end and provide a one-directional flow for fluid, and their cells are not joined by tight junctions. These vessels penetrate nearly every body tissue except for bone, bone marrow, cartilage, and the cornea.

Lymphatic vessels contain thin endothelial cells overlapping like the shingles of a roof that act as open and close valves. When pressure in the tissue is high, it pushes the valve-like structure and fluid flows inward. When pressure is higher in the lymphatic vessel than in the tissue, the valves are closed.