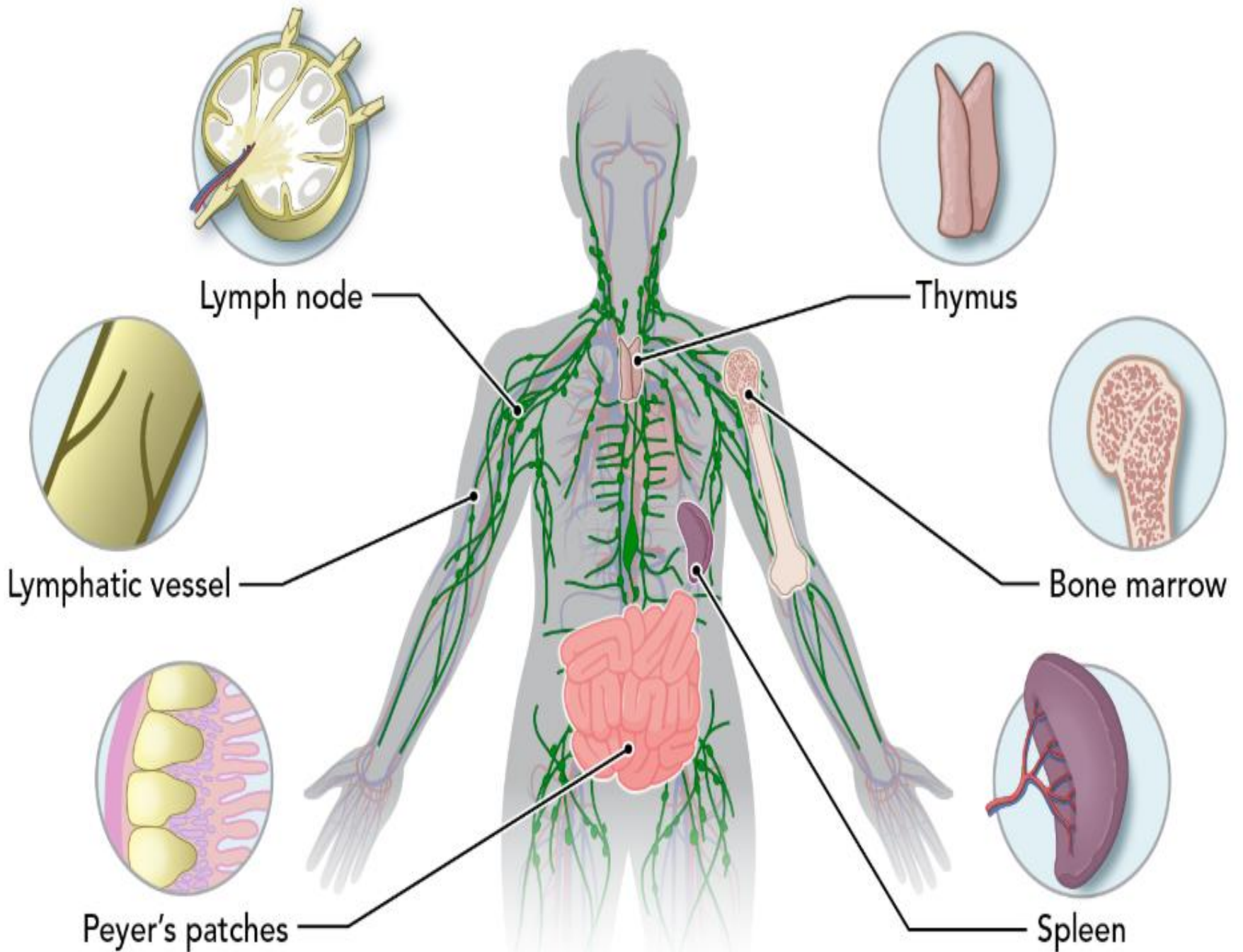


LYMPHOID ORGANS

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The **lymphoid organs** comprise the primary, or generative, lymphoid organs in which lymphocytes arise and mature, and the secondary lymphoid organs in which lymphocytes become activated in response to immune threats. A network of numerous small **lymphatic vessels** collect tissue fluid that surrounds cells, called **lymph**. This lymph drains through lymph nodes, which act as filters, and eventually empties into a larger lymphatic vessel called the **thoracic duct** which returns this fluid and lymphocytes to a large vein in the circulatory system. The lymphoid organs are very important for the development of the immune response and for the normal movements of lymphocytes around the body.



PRIMARY LYMPHOID ORGANS

The **primary** or **generative lymphoid organs** are the bone marrow and the thymus. The **bone marrow** is the site of creation for all lymphocyte progenitors, including those that will become B cells, T cells, and natural killer cells. B cells develop in the bone marrow, then enter the circulation to complete maturation in the secondary lymphoid organs. T cell progenitors are also created in the bone marrow, but these mature into T cells in the **thymus**. If a developing lymphocyte does not create a functional antigen receptor, or if the antigen receptor reacts strongly to self-antigens, the lymphocyte will be induced to die or, in the case of B cells, will change its receptor. Lymphocytes with functional antigen receptors that are not strongly self-reactive develop into naive B and T cells that are activated in the secondary lymphoid organs.

SECONDARY LYMPHOID ORGANS

Secondary lymphoid organs and tissues, such as the **lymph nodes**, **spleen**, and **Peyer's patches** in the intestine, are the sites of B and T cell activation. The spleen is located in the abdomen while there are hundreds of lymph nodes located throughout the body. Lymph nodes commonly occur in clusters in the groin, neck, and axilla (armpit), where they collect lymph from nearby areas. Lymph nodes are supplied by **afferent lymphatic vessels** that bring in lymph, while **efferent lymphatic vessels** take lymph back out into the lymphatic vessels. The spleen has only efferent vessels, as all incoming cells and fluids enter through blood vessels. Additional blood vessels supply all lymphoid organs with blood and provide additional routes for cellular movement. Importantly, naive T and B cells constantly recirculate into and out of secondary lymphoid organs all over the body, in search of antigens they can recognize.

IMMUNE RESPONSE IN LYMPH NODES

T cell responses are initiated when antigen-presenting cells, mainly dendritic cells, collect antigens at the site of tissue injury and move through the afferent lymphatic vessels to the secondary lymphoid organs where they present the antigens to recirculating naive T cells. B cell and antibody responses begin when antigens delivered to the secondary lymphoid organs via the lymph are recognized by recirculating naive B cells. If a naive B or T cell encounters an antigen-presenting cell bearing the antigen its receptor recognizes, and the antigen-presenting cell also expresses other molecules called costimulators that bind to receptors on the naive lymphocyte, the lymphocyte will become activated. An antigen-activated lymphocyte will reproduce rapidly (called clonal expansion) and differentiate into effector cells, thus generating a large number of effector cells that recognize the same antigen. Activated B cells may receive additional signals in the lymph nodes to improve the antibodies they produce, while activated T cells can leave the lymph nodes in order to carry out their function as cytotoxic T lymphocytes or helper T cells.

