Lymphoid Organs in Humans

The immune system is found throughout the body and is made up of many different cells, organs, and tissues. The organs and tissues of the system can be classified into two main groups: **(1) primary lymphoid organs,** in which lymphocytes are generated and undergo development and maturation; and **(2) secondary lymphoid organs and tissues,** where mature lymphocytes interact with antigen.

The vessels of the blood and lymphatic systems connect lymphoid organs and tissues and unite them into a functional whole. Leukocytes, or white blood cells, are found within the blood, lymph, and lymphoid tissues and organs. The vertebrate immune system contains many types of leukocytes, but only the lymphocytes have the attributes of receptor diversity, antigen specificity, and self/nonself recognition that are the hallmarks of adaptive immunity.

Lymphatic organs are formed by specialized type of tissue, lymphatic tissue. The tissue consists of lymphatic cells (lymphocytes, their developmental forms and plasmatic cells) and macrophages stored in reticular fibrous tissue (type of specialized loose connective tissue that operates as an architectural framework). The exception is thymus where lymphatic cells are embedded in reticular epithelium, which associates with organ development.

Central lymphoid organs

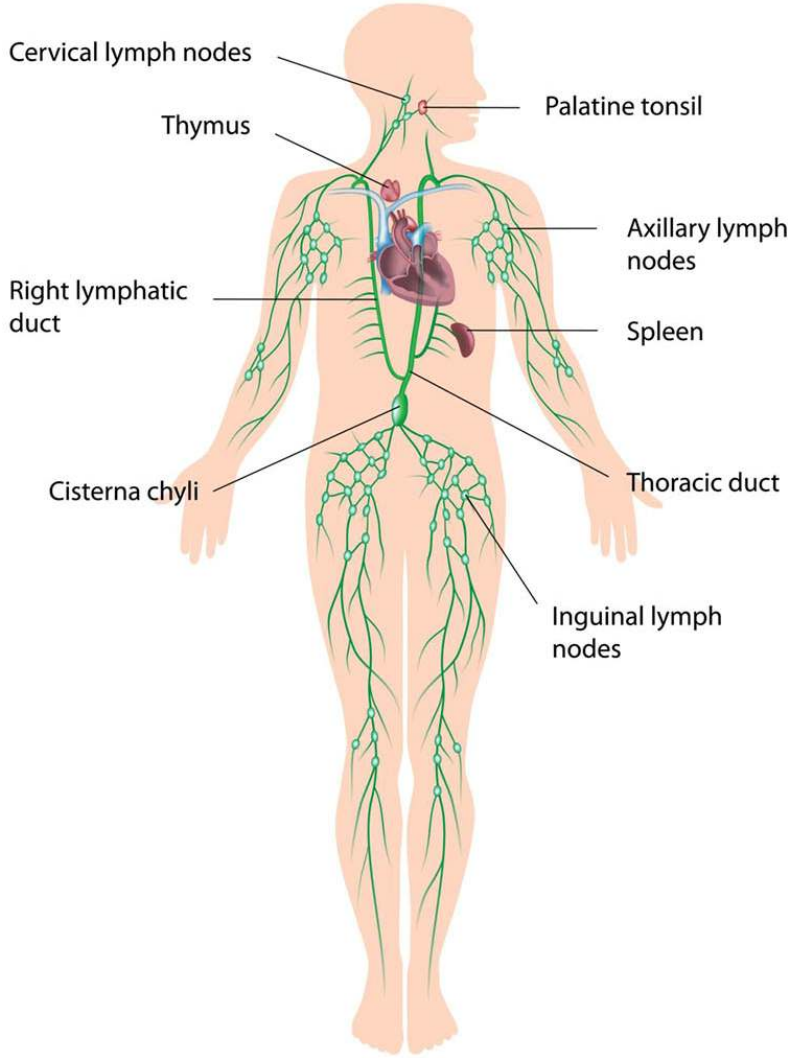
Central lymphoid organs are requisite for the development of the lymphoid and, therefore, the immune system. These include the thymus, bone marrow, and bursa of Fabricus. Central lymphoid organs are **also termed primary lymphoid organs.** They are sites where lymphocytes

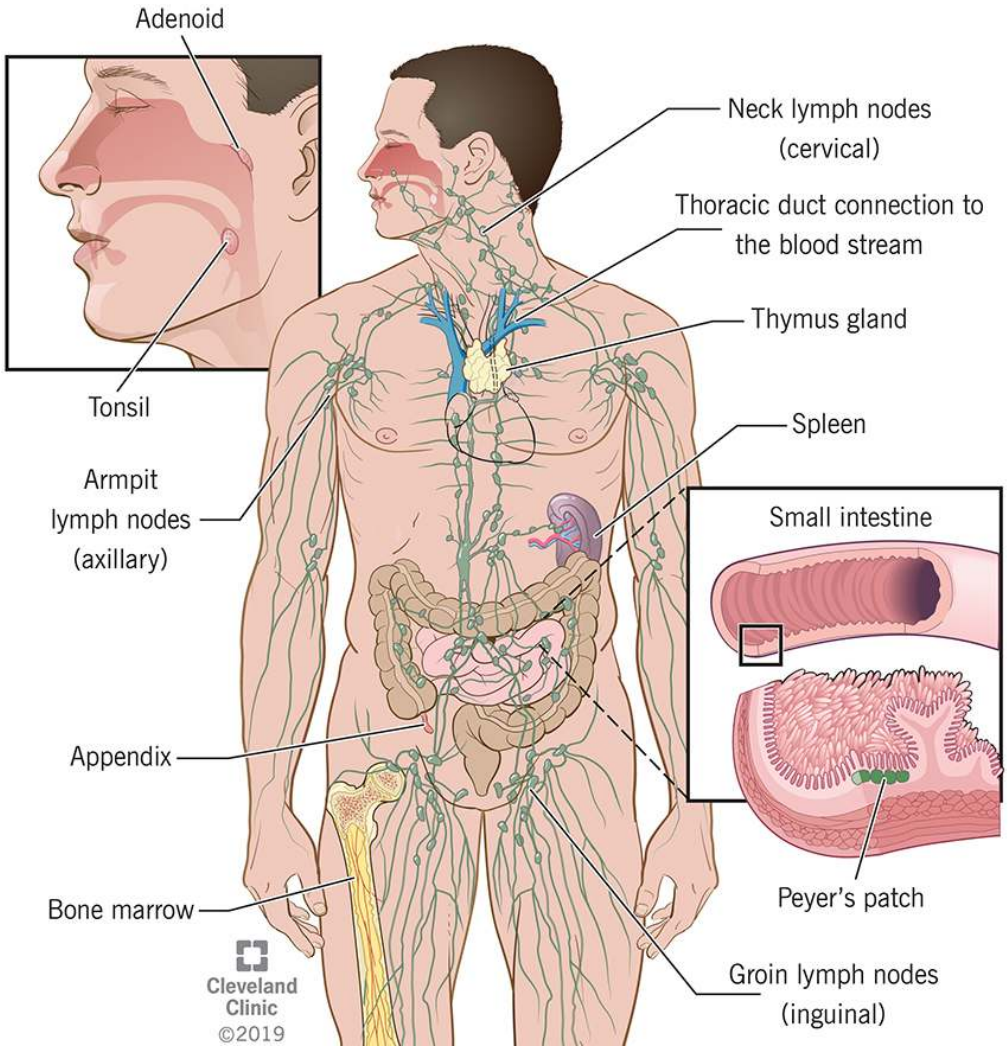
	Primary lymphoid organs	Secondary lymphoid organs
Component	Bone marrow, fetal liver, thymus	Spleen, lymph nodes, and mucosa-associated lymphoid tissue (MALT) including tonsils, adenoids, respiratory, genitourinary, and gastrointestinal tracts
Proliferation and differentiation	Antigen-independent	Antigen-dependent
Product	Immunocompetent cells (B cells and T cells)	Effector cells (antibody-secreting plasma cells for humoral immune response and T helper and T cytotoxic cells for cell-mediated immune response)
Event	Development and maturation of B and T cells	Induction of immune response: encounter of antigens and antigen-presenting cells (APC) with mature B and T cells, generation of effector cells, and memory cells

are generated. Both T and B cells originate in the bone marrow but only B cells mature there. Human T cells mature in the thymus

Peripheral lymphoid organs

Peripheral lymphoid organs are not required for ontogeny of the immune response. They are sites where adaptive immune responses are initiated and where lymphocytes are maintained. Peripheral lymphoid organs are also termed **secondary lymphoid organs.** They include the lymph nodes, spleen, tonsils, and mucosal-associated lymphoid tissues in which immune responses are induced.




Adenoid
Neck lymph nodes
(cervical)
Thoracic duct connection to
the blood stream
Thymus gland
Tonsil
Spleen
Armpit
lymph nodes
(axillary)
Small intestine
Appendix
Bone marrow
Peyer's patch
Groin lymph nodes
(inguinal)
Cleveland
Clinic
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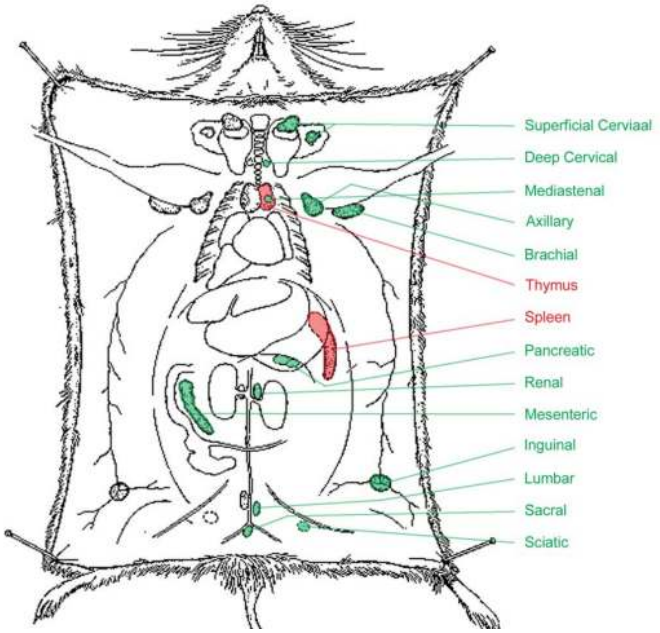
Lymphoid Organs in Mouse



The diagram below shows the locations of various lymphoid tissues in the mouse. Thymus and spleen are represented in red, while lymph nodes are color coded in green. The spleen sits in the peritoneal cavity on high under the rib cage on the left side. It is prominent and dark red in color. The thymus sits over the heart in the midline of the thoracic cavity. It is milky white and has two lobes, one of either side of the midline. It is large in young mice, but may be difficult to find in older animals. Lymph nodes are somewhat more difficult to find. They are generally "pearly white" and/or translucent in color and can blend in with surrounding fat. The easiest nodes to find are the mesenteric, brachial and inguinal nodes. The other nodes are generally much smaller and more difficult to find.