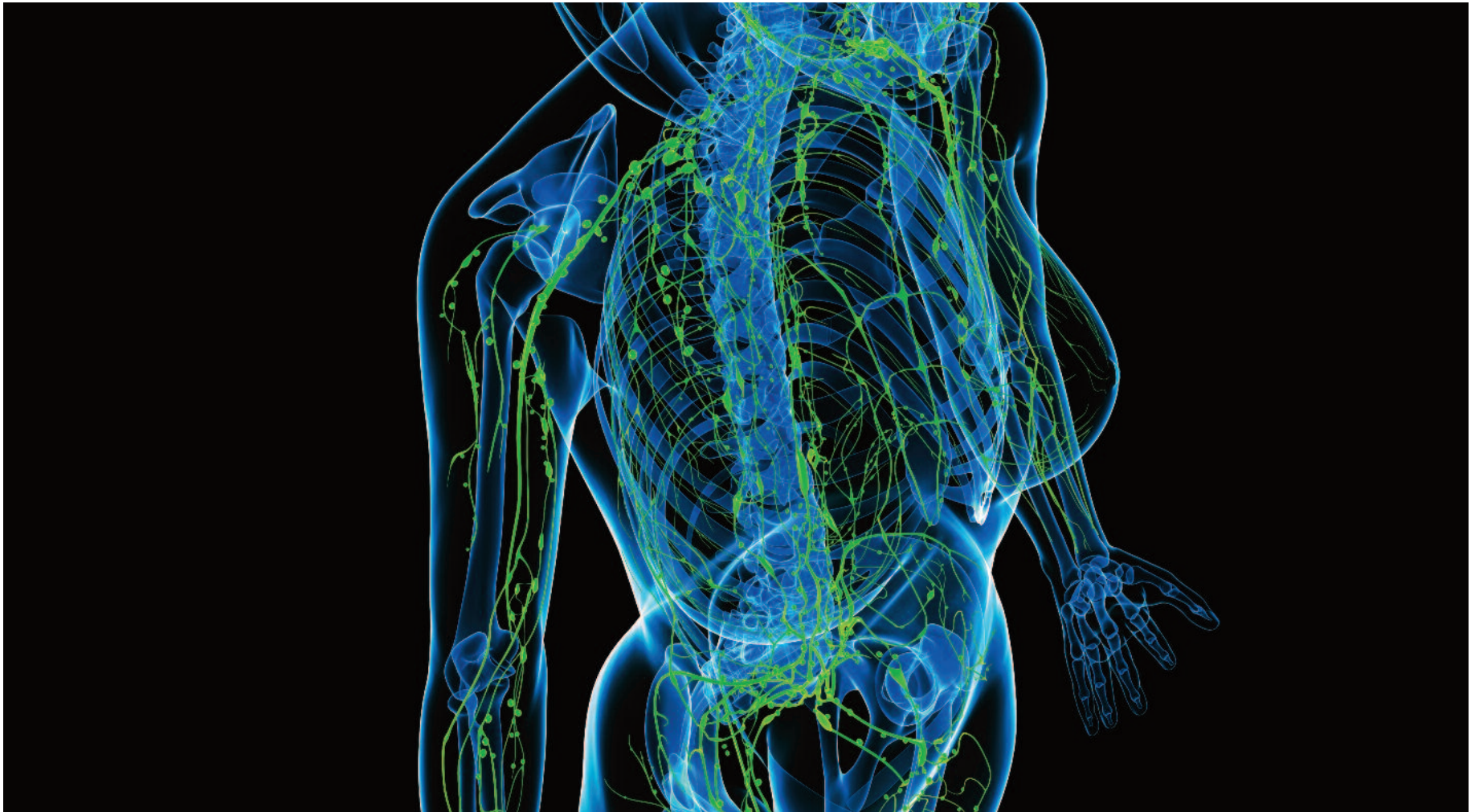




The Lymphatic System

LYMPHATIC SYSTEM

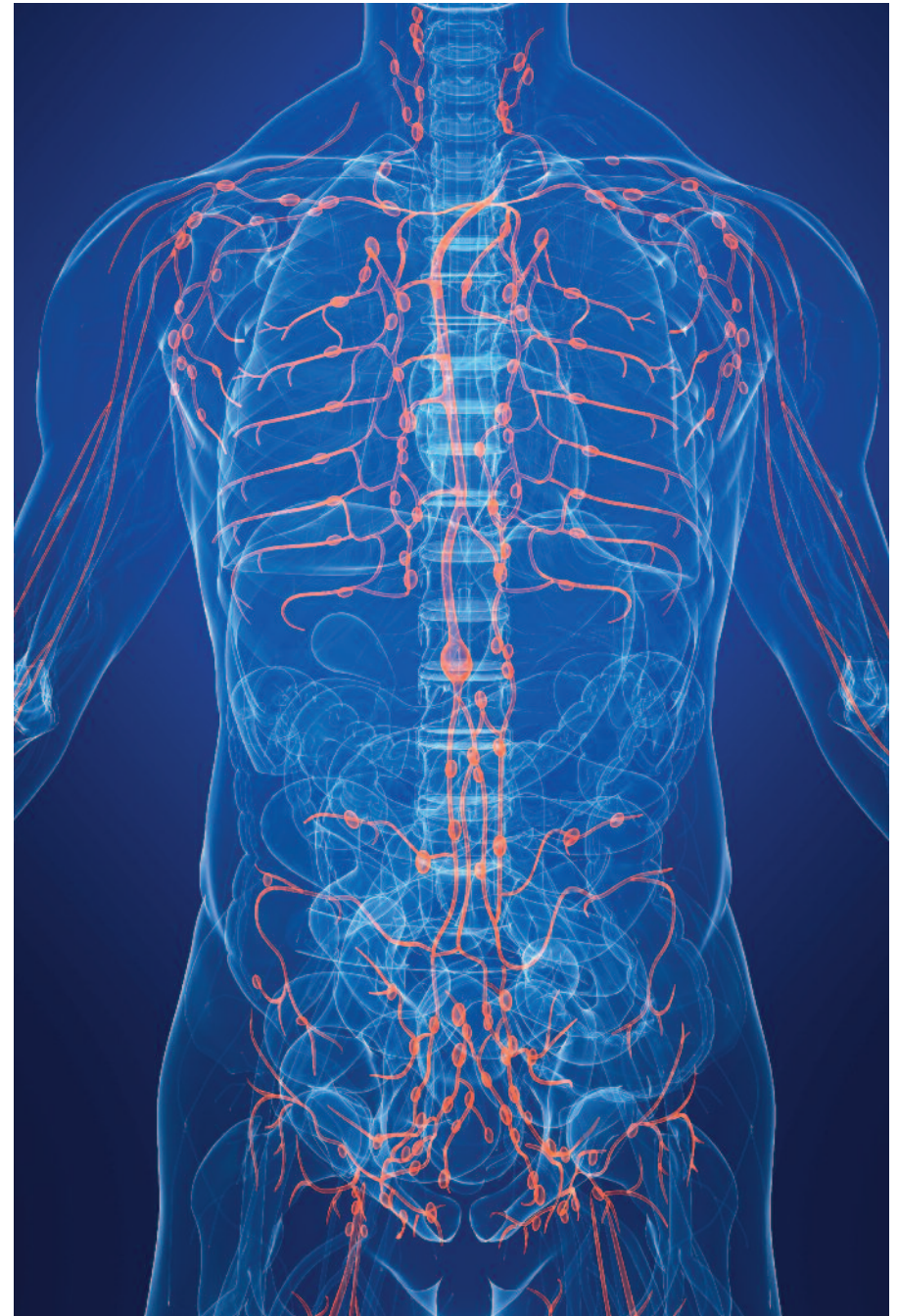
Overview

The lymphatic system is a part of the circulatory system, comprising a network of conduits called lymphatic vessels that carry a clear fluid called lymph unidirectionally towards the heart. The circulatory system processes an average of 20 liters of blood per day through capillary filtration which removes plasma while leaving the blood cells. Roughly 17 liters per day of that gets reabsorbed directly into the blood vessels. The primary function of the lymph system is to provide an accessory route for these excess 3 liters per day to get returned to the blood. Lymph is essentially recycled blood plasma.

The lymphatic organs also play an important part in the immune system, as the lymph transports antigen-presenting cells to the lymph nodes where and when an immune response is stimulated. Lymph nodes are particularly numerous in the chest, neck, pelvis, axilla (armpit), inguinal (groin) region, and in association with the blood vessels of the intestines.

The study of lymphatic drainage of various organs is important in diagnosis, prognosis, and treatment of cancer. The lymphatic system, because of its physical proximity to many tissues of the body, is responsible for carrying cancerous cells between the various parts of the body in a process called metastasis. The intervening lymph nodes can trap the cancer cells. If they are not successful in destroying the cancer cells the nodes may become sites of secondary tumors.

Lymphedema is the swelling caused by the accumulation of lymph fluid, which may occur if the lymphatic system is damaged or has malformations. It usually affects the limbs, though face, neck and abdomen may also be affected. Some common causes of swollen lymph nodes include infections, infectious mononucleosis, and cancer.



LYMPHATIC SYSTEM DEFINITIONS

Collector Vessels: Fluid flows from pre-collector vessels into valved vessels called collectors.

Initial Lymphatics: Molecules and particles from intercellular spaces too large to enter blood capillaries are absorbed through the walls of the lymphatic capillaries called initial lymphatics.

Lymph: Clear, colorless fluid containing water, protein molecules, cellular components, and fatty acids that need to be transported back into blood circulation.

Lymphangions: Contractile, smooth muscle on the walls of deep collector vessels. They contract in sequence to move lymph fluid along.

Lymphatic Drainage Massage (LDM): Refers to systems of soft tissue manipulations designed to assist the function of the lymphatic system. LDM techniques consist of gentle, slow, repetitive strokes performed in a specific direction and sequence to improve lymph circulation. It is a precise and rhythmic massage used for general wellness, to enhance healing and treat lymphedema.

Lymphatic System Vessels: Responsible for the absorption, collection, and transport of lymph fluid.

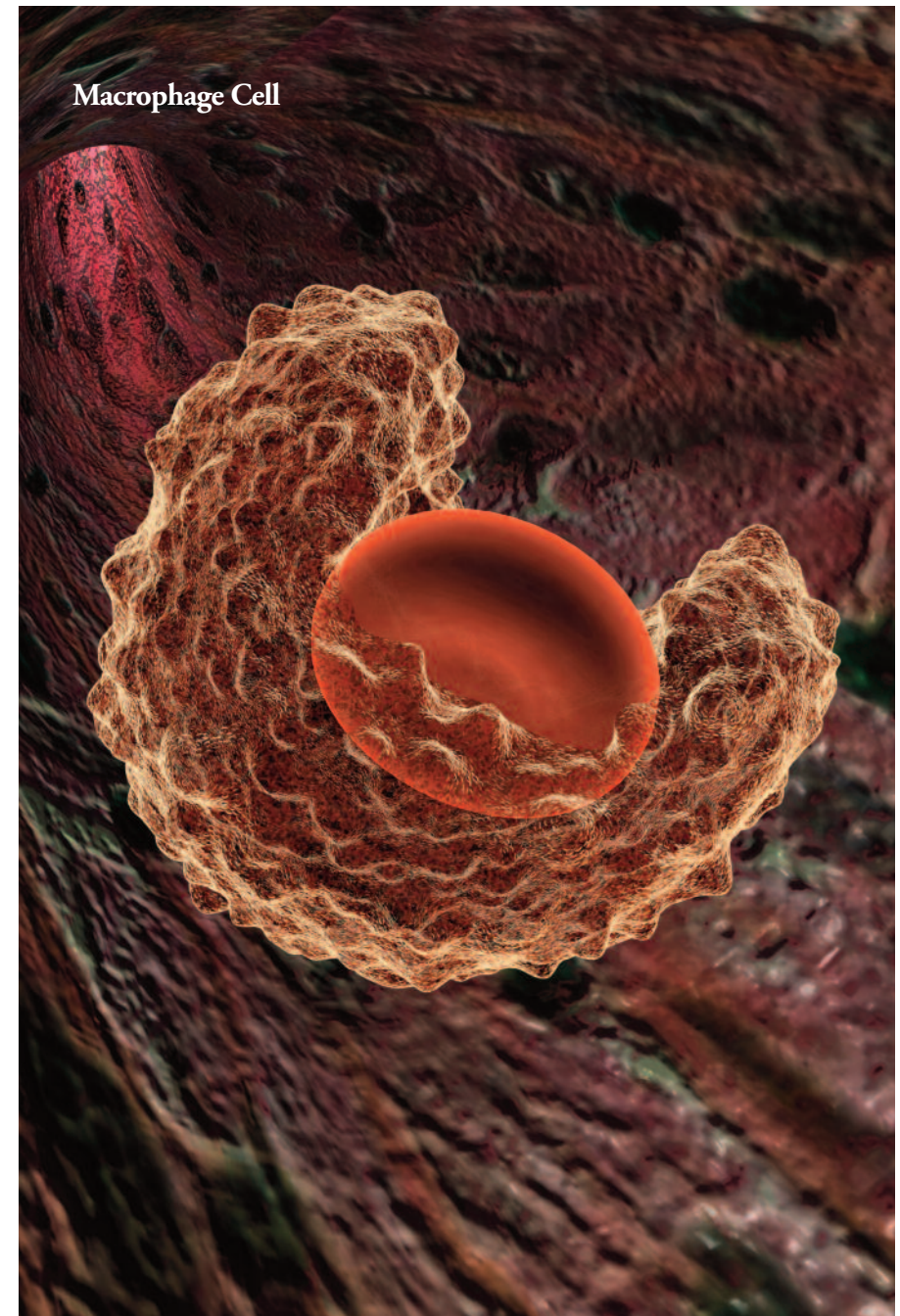
Lymphedema: Characterized by an abnormal accumulation of lymph fluid in tissues of an arm, leg or other body region.

Lymph Nodes: Facilitate the immune response helping to protect the body from infection and disease. Lymph passes through the nodes as it circulates.

Pre-collector Vessels: Fluid from the initial lymphatics flows into these vessels.

Macrophages: Act as a waste disposal site by removing bacteria, cell debris and foreign material.

Lymphocytes: Produced in nodes and released to process infectious material.



LYMPHATIC NODES

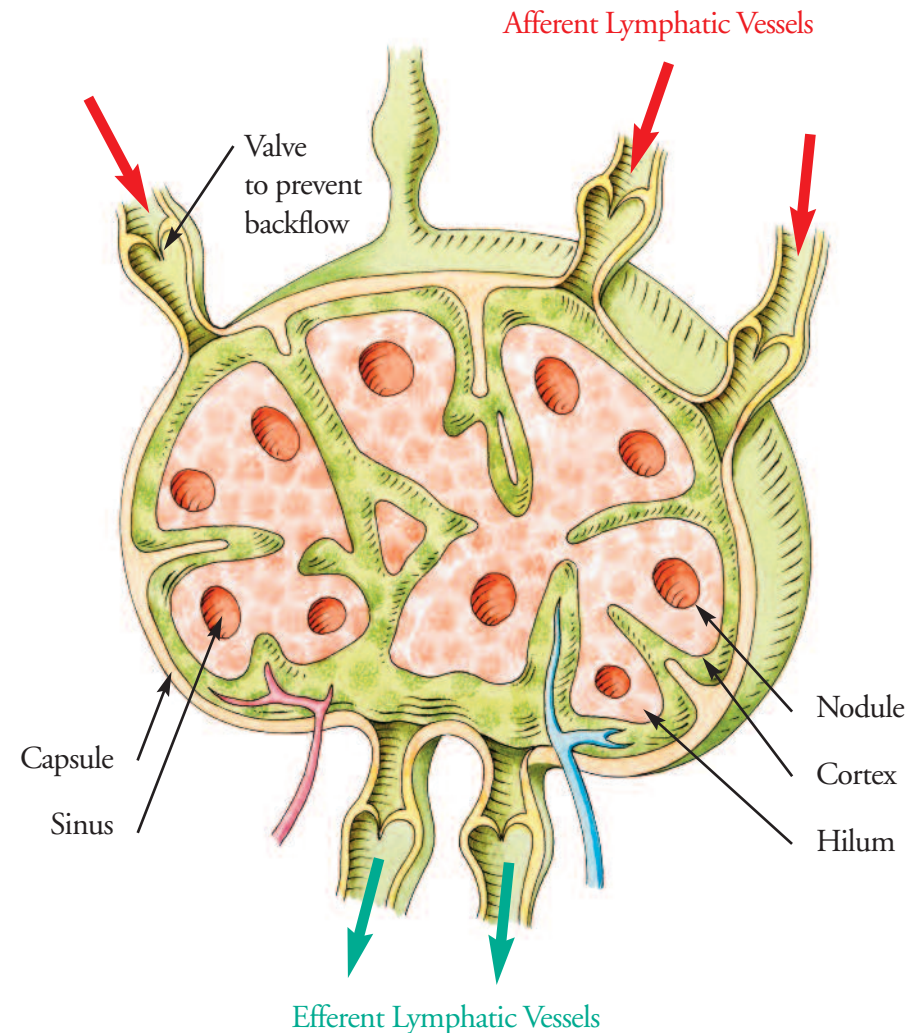
Overview

The lymph node is an oval-shaped organ of the immune system, distributed widely throughout the body including the armpit and stomach and linked by lymphatic vessels. Lymph nodes act as filters or traps for foreign particles and are important in the proper functioning of the immune system. They are packed tightly with the white blood cells called lymphocytes and macrophages.

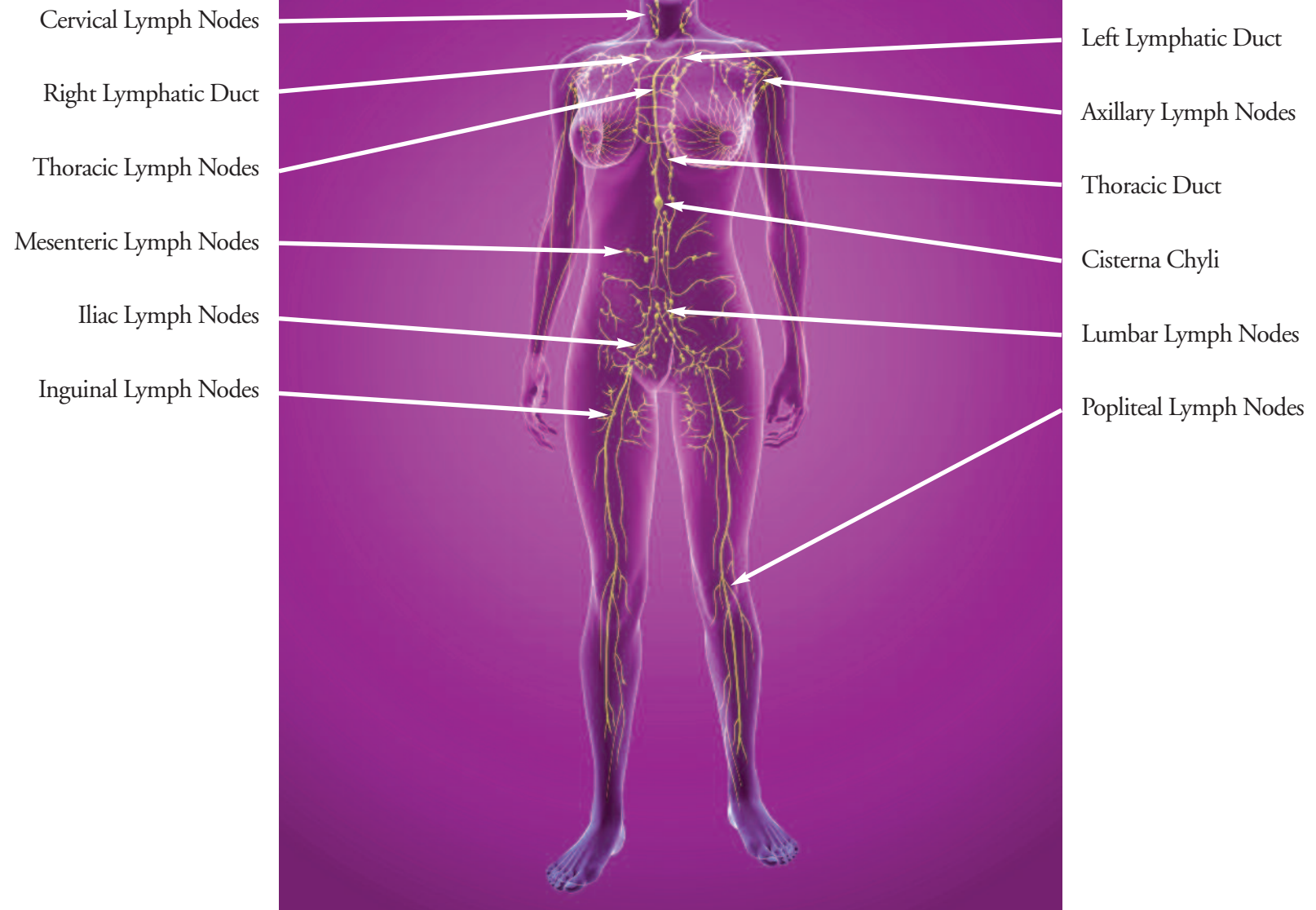
Lymph nodes also have clinical significance. They become inflamed or enlarged in various conditions, which may range from trivial, such as a throat infection, to life-threatening such as cancers. In the latter, the condition of lymph nodes is so significant that it is used for cancer staging, which decides the treatment to be employed, and for determining the prognosis.

The lymph fluid inside of the lymph nodes contains lymphocytes, a type of white blood cell, which are continuously recirculated through the lymph nodes and the bloodstream. Molecules found on bacteria cell walls or chemical substances secreted from bacteria, called antigens, may be taken up by dedicated antigen presenting cells such as dendritic cells into the lymph system and then into lymph nodes. In response to the antigens, the lymphocytes in the lymph node make an antibody which will go out of the lymph node into circulation, seek, and target the pathogen producing the antigen by targeting it for destruction by other cells and complement. Other immune system cells will be made to fight the infection and “sent” to the lymph nodes. The increased numbers of immune system cells fighting the infection will make the node expand and become “swollen.”

Humans have approximately 500-600 lymph nodes distributed throughout the body, with clusters found in the underarms, groin, neck, chest, and abdomen. The spleen and tonsils are large lymphoid organs that serve similar functions to lymph nodes, though the spleen filters blood cells rather than lymph.



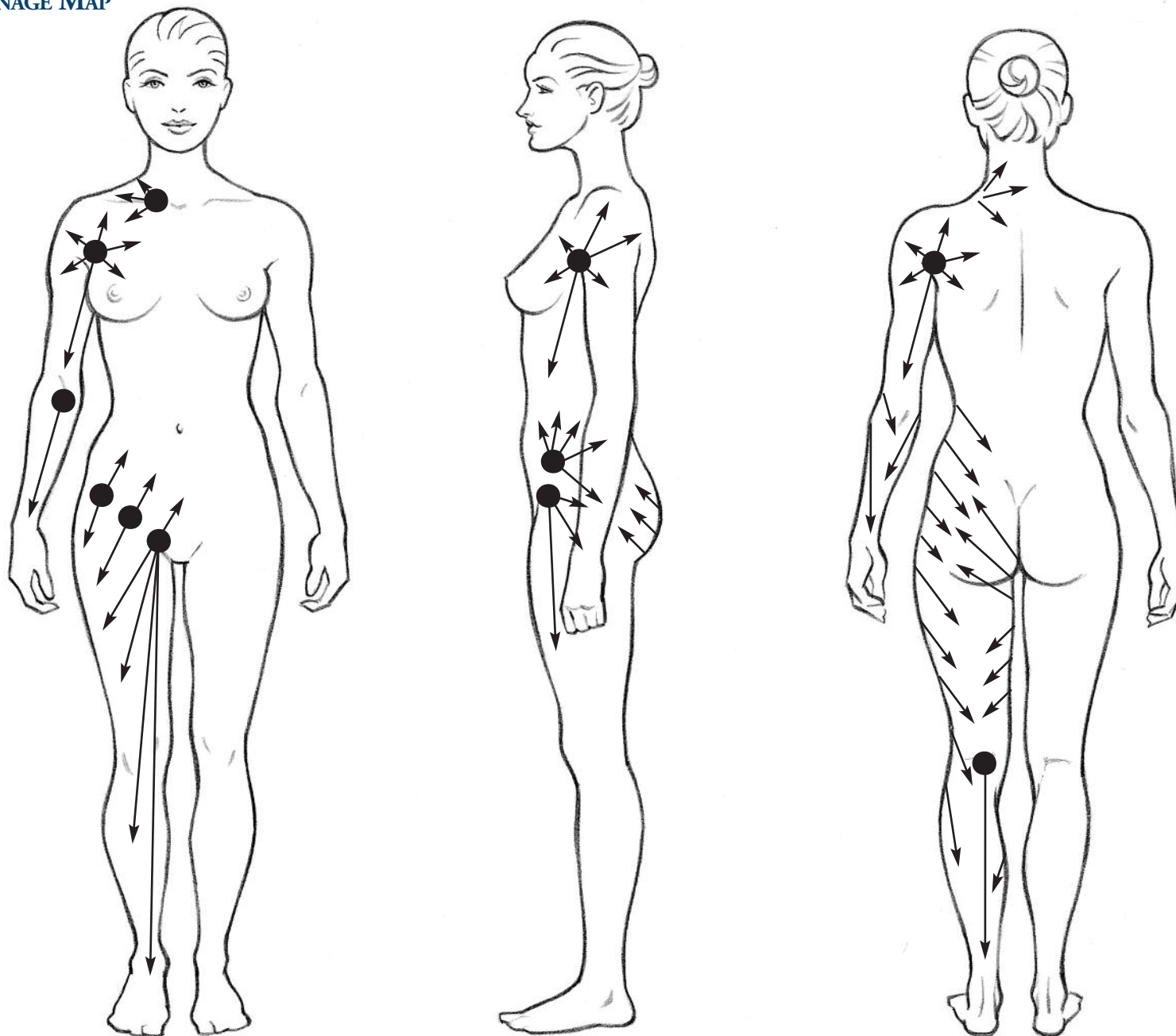
LYMPHATIC SYSTEM



LYMPHATIC NODES

Name	Position	Flow	Name	Position	Flow
Temporalis	Temple	Drain or move lymph towards the thoracic and axillary nodes.	Cisterna Chyli	Lower abdomen	Drain or move lymph towards external iliac nodes located on the left and right side.
Retroauricular	Ear area	Same as above.	Common Iliac	Upper groin	Drain to superficial inguinal nodes.
Occiput	Behind head	Same as above.	Cubital	Inner elbow	Lymph is drained to this area.
Angulus	Below ear	Same as above.	Palmar Plexus	Hand	Drain to cubital nodes.
Profundus	Side of neck	Same as above.	Dorsal Plexus	Hand	Drain to cubital nodes.
Parotid	Ear area	Same as above.	External Iliac	Groin	Drain to superficial inguinal nodes.
Buccal	Cheek area	Same as above.	Internal Iliac	Groin	Drain to superficial inguinal nodes.
Cervical	Neck	Same as above.	Superficial Inguinal	Inner thigh	Lymph is drained to this area.
Terminus	Neck	Same as above.	Popliteal	Behind knee	Lymph is drained to this area.
Axillary	Underarm	Drain lymph to this area	Plantar/Dorsal Plexus	Foot	Drain to popliteal nodes.
Thoracic	Chest	Same as above.			
Parasternal	Chest	Drain or move lymph towards the thoracic and axillary nodes.			
Intercostal	Upper abdomen	Drain or move lymph towards the axillary nodes located in the underarms.			

LYMPH DRAINAGE MAP



LYMPH AND THE IMMUNE SYSTEM

The immune system is a system of biological structures and processes within an organism that protects against disease. To function properly, an immune system must detect a wide variety of agents, from viruses to parasitic worms, and distinguish them from the organism's own healthy tissue.

The immune system protects organisms from infection with layered defenses of increasing specificity. In simple terms, **physical barriers** (such as your skin) prevent pathogens such as bacteria and viruses from entering the organism. If a pathogen breaches these barriers, the **innate immune system** provides an immediate, but non-specific response. If pathogens successfully evade the innate response, humans possess a third layer of protection, the **adaptive immune system**, which is activated by the innate response. Here, the immune system adapts its response during an infection to improve its recognition of the pathogen. The cells of the adaptive immune system are special types of leukocytes, called lymphocytes. B cells and T cells are the major types of lymphocytes and are derived from stem cells in the bone marrow. When B cells and T cells are activated and begin to replicate, some of their offspring become long-lived memory cells. Throughout your lifetime, these adaptive memory cells remember each specific pathogen encountered and can mount a stronger response if the pathogen is detected again.

When you get a cut, all sorts of bacteria and viruses enter your body through the break in the skin. Your immune system responds and eliminates the invaders while the skin heals itself and seals the puncture. In rare cases the immune system misses something and the cut gets infected. It gets inflamed and will often fill with pus. Inflammation and pus are both side-effects of the immune system doing its job.

There are human ailments that are caused by the immune system working in unexpected or incorrect ways that cause problems. For example,

some people have allergies. Allergies are really just the immune system overreacting to certain stimuli that other people don't react to at all.

The major components of the immune system are: Thymus, Spleen, **Lymph system**, Bone marrow, White blood cells, Antibodies, Complement system and Hormones.

The lymph system is most familiar to people because doctors often check for “swollen lymph nodes” in the neck. The lymphatic system extends throughout your body in much the same way your blood vessels do. The main difference between the blood flowing in the circulatory system and the lymph flowing in the lymph system is that blood is pressurized by the heart, while the lymph system is passive. Fluids ooze into the lymph system and get pushed by normal body and muscle motion to the lymph nodes.

Lymph is a clearish liquid that bathes the cells with water and nutrients. Lymph is blood plasma—the liquid that makes up blood minus the red and white cells. Think about it, each cell does not have its own private blood vessel feeding it, yet it has to get food, water, and oxygen to survive. Blood transfers these materials to the lymph through the capillary walls, and lymph carries it to the cells. The cells also produce proteins and waste products and the lymph absorbs these products and carries them away. Any random bacteria that enter the body also find their way into this inter-cell fluid. One job of the lymph system is to drain and filter these fluids to detect and remove the bacteria. Small lymph

vessels collect the liquid and move it toward larger vessels so that the fluid finally arrives at the lymph nodes for processing. Lymph nodes contain filtering tissue and a large number of lymph cells. When fighting certain bacterial infections, the lymph nodes swell with bacteria and the cells fighting the bacteria, to the point where you can actually feel them. Swollen lymph nodes are an indication that you have an infection.

