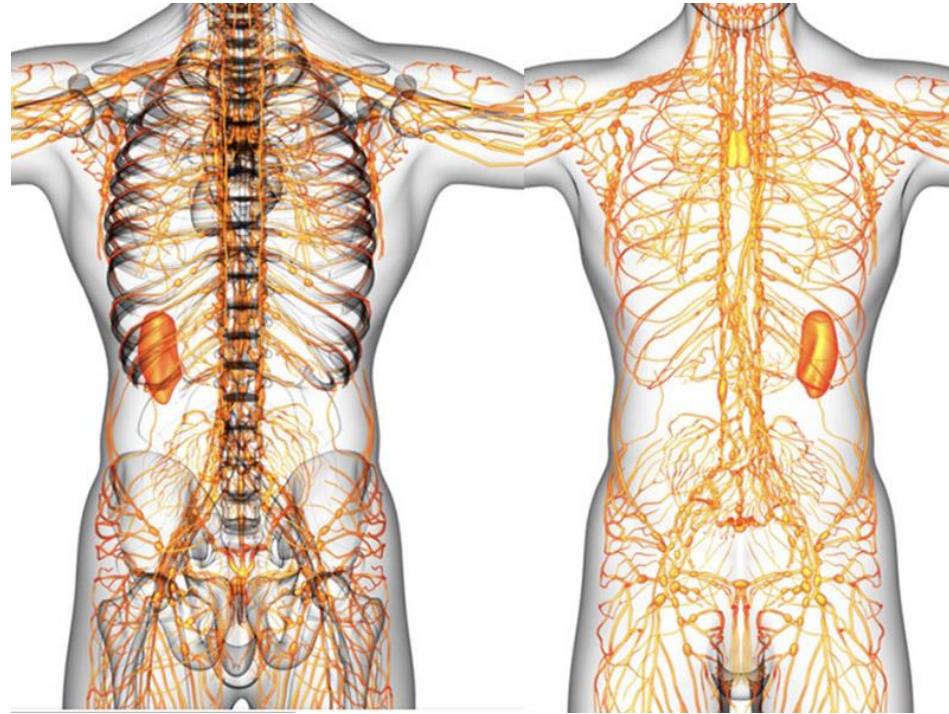


Human Anatomy

Lymphatic System



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Objectives of this lecture

You will be able to describe the following objects:

- ✓ **Functions of lymphatic system**
- ✓ **Types of tissues and organs**
- ✓ **Types of lymphocyte**
- ✓ **Formation and flow of lymph**

The lymph System Functions

- **Drains excess interstitial fluid.** Lymphatic vessels drain excess interstitial fluid from tissue spaces and return it to the blood and maintains fluid homeostasis
- **Transports dietary lipids.** Lymphatic vessels transport lipids and lipid-soluble vitamins (A, D, E, and K) absorbed by the gastrointestinal tract.
- **Carries out immune responses.** Lymphatic tissue initiates highly specific responses directed against particular microbes or abnormal cells.

Introduction to Lymphatic system

- ❑ .The lymphatic system is network of very small tubes(tissues ,vessels ,organs) from all over the body to transport lymph.
- ❑ .There are 500-600 lymph nodes.
- ❑ .Only 10% of reabsorbed by the cell, the rest of 90% of interstitial fluid that is not reabsorbed, is collected by lymph vessels.
- ❑ .Lymphatic comes from the Latin word lymphaticus, meaning “connect to water”.
- ❑ .Lymphatic system is a subsystem of circulatory system.
- ❑ .Lymph can flow only in one direction , that is transported from tissues to heart.

The introduction

- **Lymphatic tissue is a specialized form of reticular connective tissue that contains large numbers of lymphocytes**
- **The lymphatic system assists in circulating body fluids and helps defend the body against disease-causing agents.**
- **most components of blood plasma filter through blood capillary walls to form interstitial fluid.**
- **interstitial fluid passes into lymphatic vessels, it is called lymph (LIMF = clear fluid).**
- **The major difference between interstitial fluid and lymph is location: Interstitial fluid is found between cells, and lymph is located within lymphatic vessels and lymphatic tissue**
- **Lymphatic capillaries have greater permeability than blood capillaries and thus can absorb large molecules such as proteins and lipids.**
- **lymph nodes encapsulated bean shaped organs consist of B cells & T cells masses**

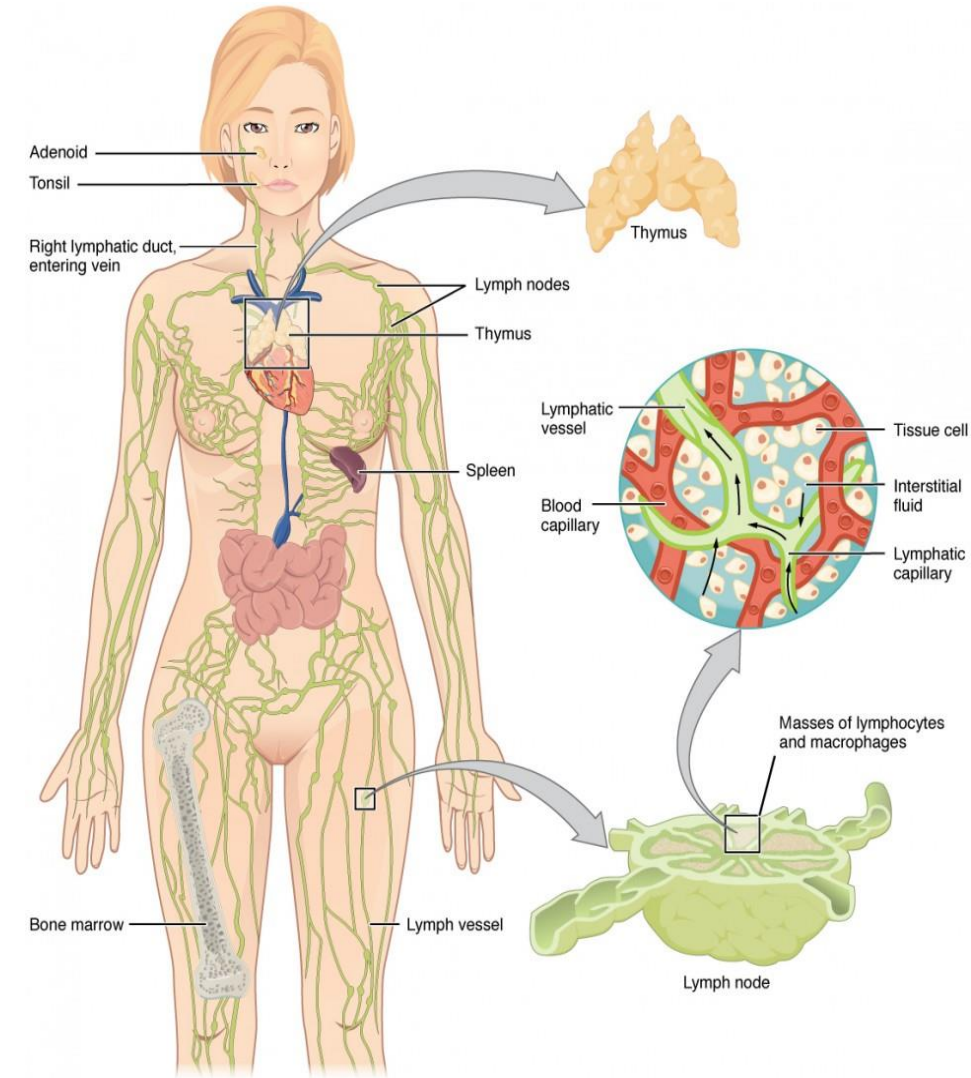
The components of the lymph system

The parts of the **Lymphatic or lymphoid system** consists of system are;

- **A fluid called lymph,**
- **lymphatic vessels that transport the lymph,**
- **A number of lymphatic tissue (lymphocytes within a filtering tissue),**
- **Red bone marrow**

➤ **Lymph**

- ❑ The important function of lymphatic vessels is to return the lost plasma proteins and plasma to the bloodstream.
- ❑ Components of blood plasma, such as nutrients, gases, and hormones, filter freely through the capillary walls to form interstitial fluid, but more fluid filters out of blood capillaries than returns to them by reabsorption
- ❑ The excess filtered fluid about 3 litres per day drains into lymphatic vessels and becomes lymph



Lymphatic vessels Lymph Trunks and Ducts

The principal trunks are the

- lumbar, ➤ **The lumbar trunks** drain lymph from the lower limbs, the wall and viscera of the pelvis, the kidneys, the adrenal glands, and the abdominal wall.

- intestinal, ➤ **The intestinal trunk** drains lymph from the stomach, intestines, pancreas, spleen, and part of the liver.

- bronchomediastinal ➤ **The bronchomediastinal trunks** drain lymph from the thoracic wall, lung, and heart.

- subclavian, ➤ **The subclavian trunks** drain the upper limbs.

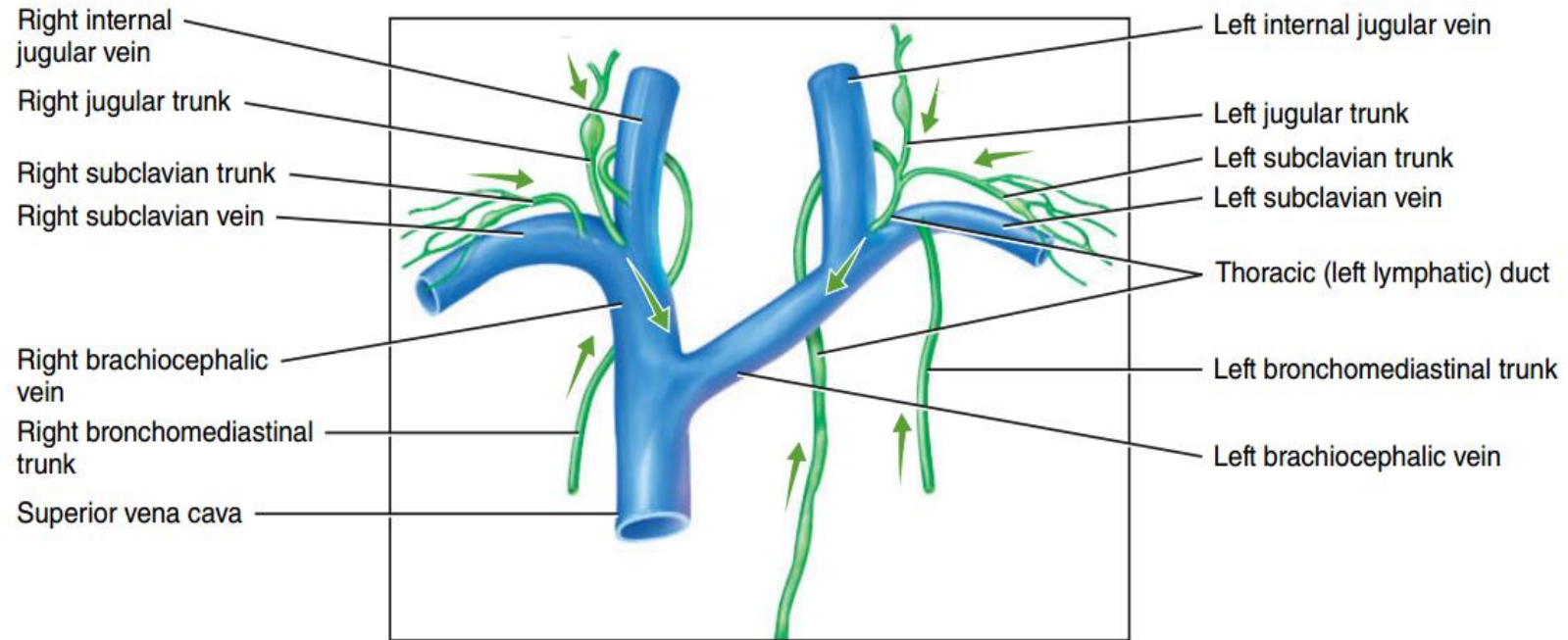
- and jugular trunks ➤ **The jugular trunks** drain the head and neck

Lymph Trunks usually open independently into the venous system on the right side.

The thoracic (left lymphatic) duct forms the largest main lymph vessel or duct that return lymph to the blood on the left side of the body,

The cisterna chyli receives lymph from the right and left lumbar trunks and from the intestinal trunk

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All the lymph from the body returns to the superior vena cava

Types of Lymphatic tissues and organs

Organs and tissues are classified into two groups based on their functions:

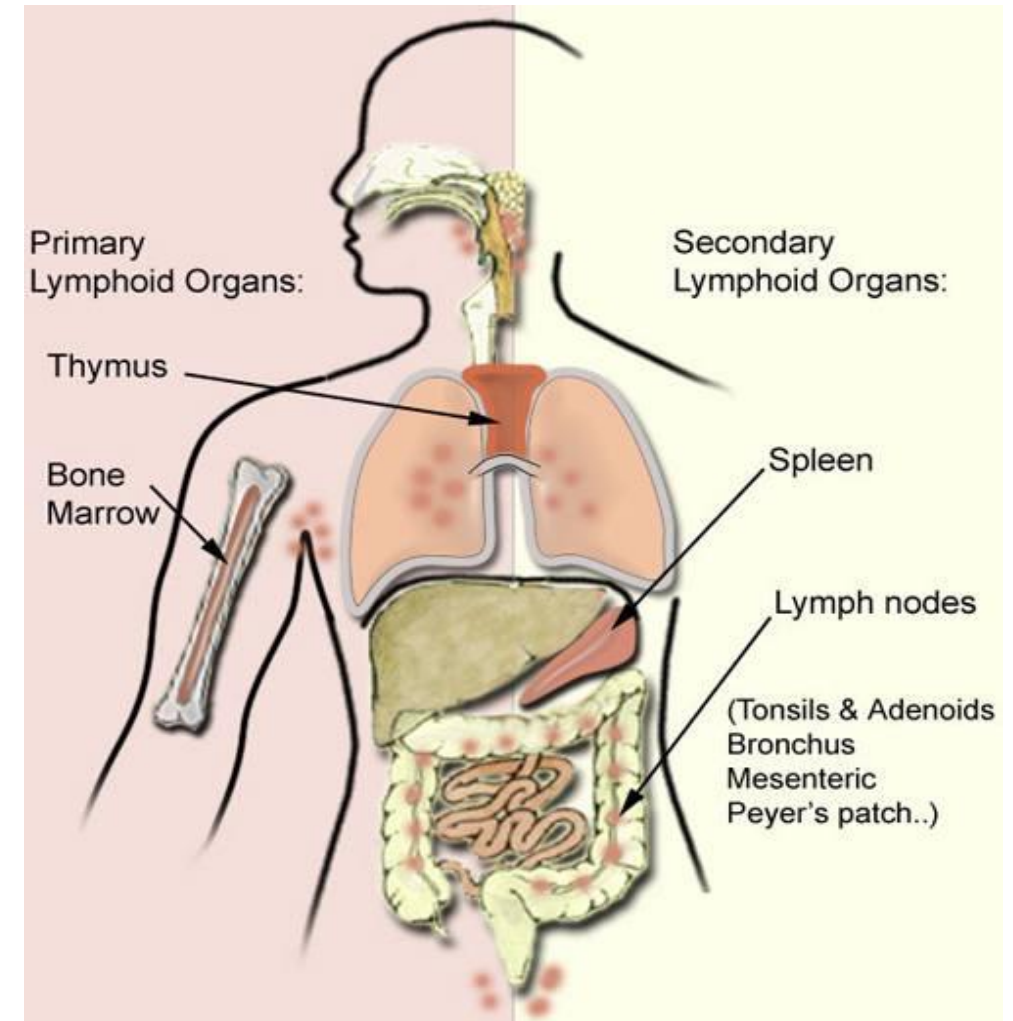
1-Primary lymphatic organs:

are the sites where stem cells divide and become immunocompetent.

The primary lymphatic organs are:

1-Red bone marrow :

It contains stem cells that grow into red blood cells, white blood cells and platelets.

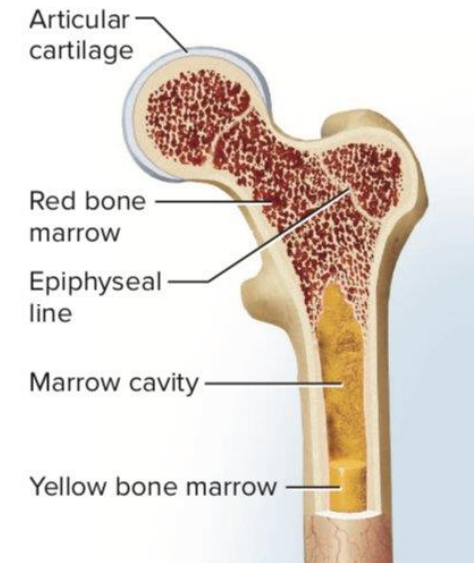


pluripotent stem cells will grow in to (B-cells and pre T-cells)in red bone marrow.

2-Thymus:

is a bilobed organ located in the mediastinum between sternum and the aorta.

The pre T cells will complete their maturation in thymus and become functional T-cells.

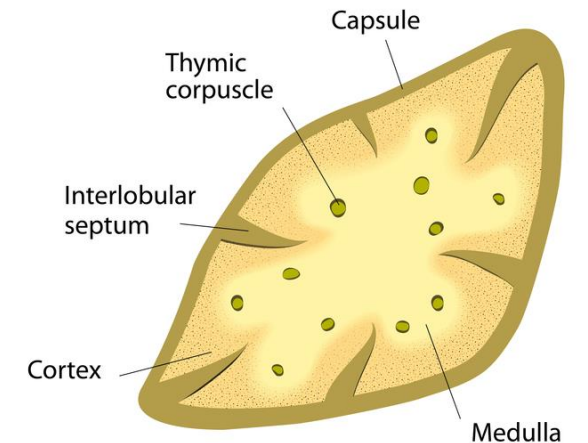


THE THYMUS GLAND

Front view



Structure



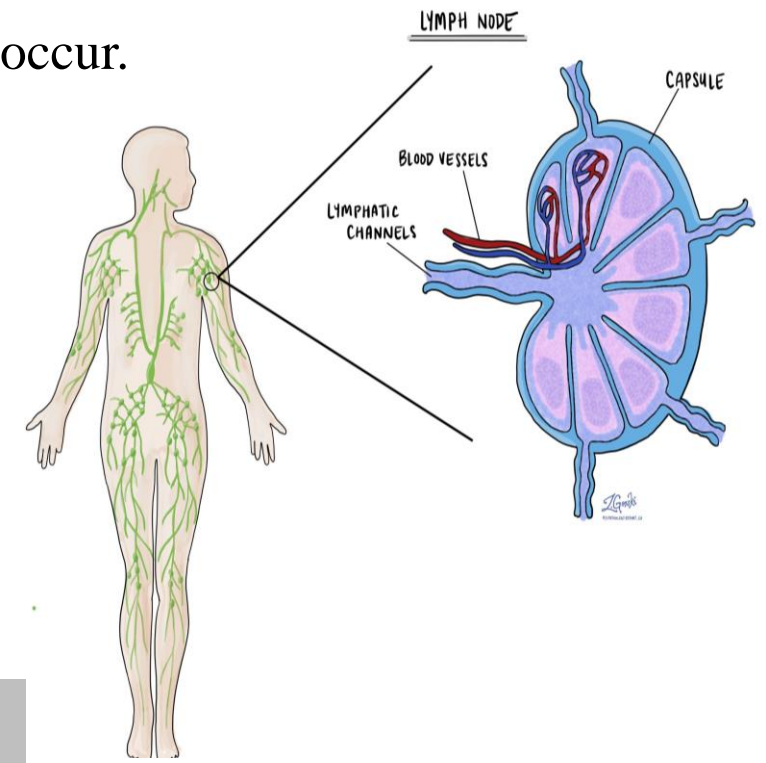
2-Secondary lymphatic organs: are the sites where most immune responses occur.

The secondary lymphatic organs are:

1-Lymph nodes:

are small organs scattered throughout the body, usually occur in groups.

Large groups of lymph nodes are present in mammary glands.



Functions of lymph nodes

.Filter out the lymph by collecting foreign substances and micro molecules in the lymph.

.Lymph nodes also produce and store lymphocytes and other immune system cells that attack and destroy bacteria and harmful substances.

.Lymph nodes inflame during infection by a specific disease, by increasing the number of lymphocytes.



healthy lymph nodes are not visible



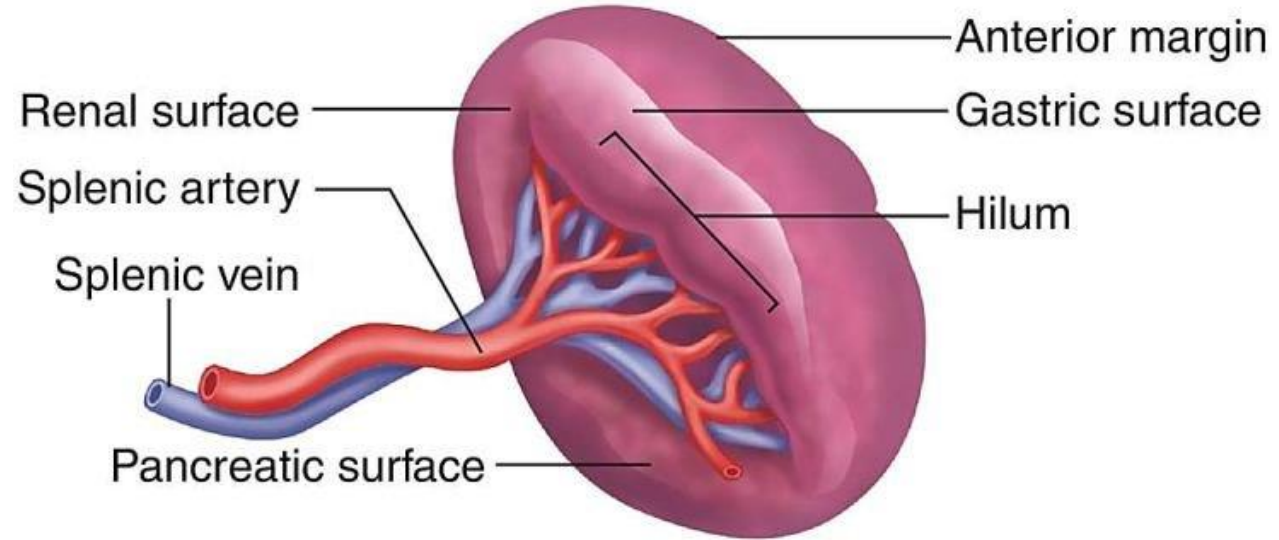
inflammation of the lymph nodes

2-Spleen:

Is a soft , encapsulated organ which is the **largest** single mass of lymphatic tissue in the body.

The main functions of spleen are:

- .Filter blood by removing cellular waste and getting ride of old or damaged red blood cells.
- .Makes white blood cells and antibodies that help you fight infection.
- .Collect the substances in blood that cause disease and lymphocytes attack them.



3-Lymphatic Nodules:

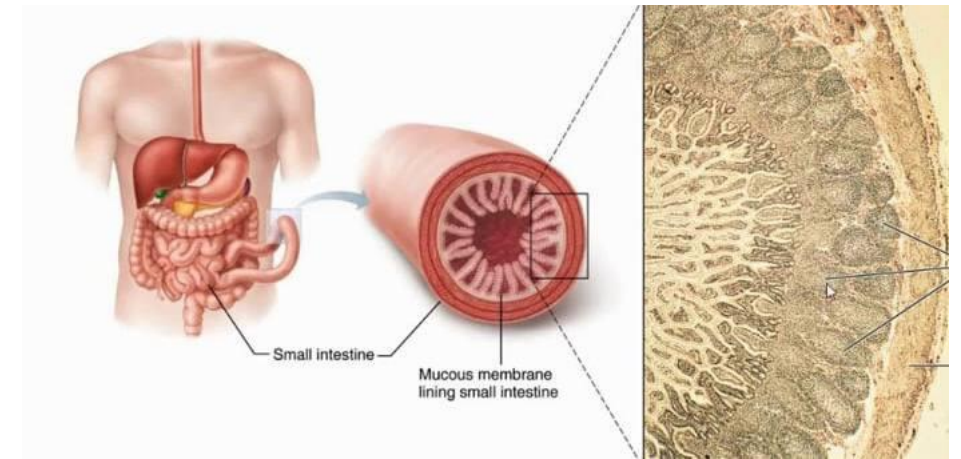
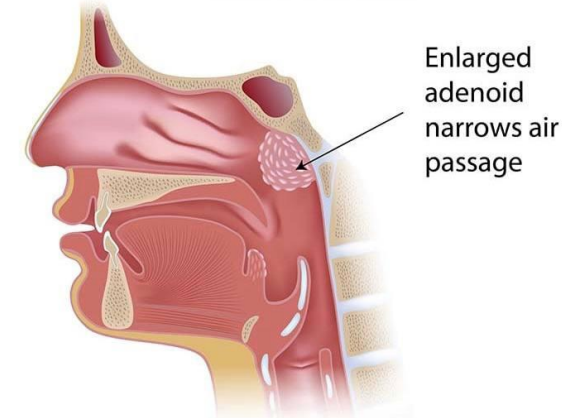
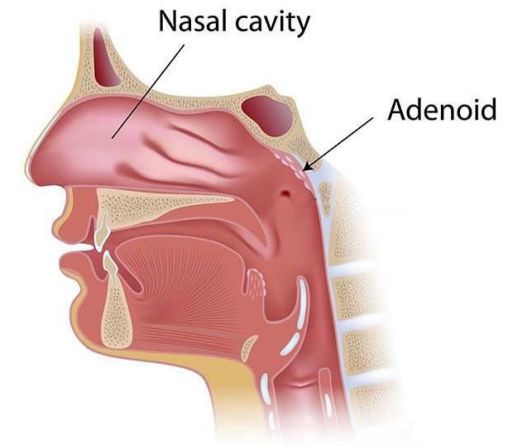
are small, localized collection of lymphoid tissue, located in the loose connective tissue beneath epithelial membranes.

Main **function** of lymphatic nodules is protecting pharynx from infection.

Types of lymphatic nodules:

- Tonsils : under the mucous membrane
- Adenoids : upper part of back of nasal cavity
- Peyer's patches : ileum of small intestine

All types are clusters of lymphatic nodules.



Lymphoid Tissue

.Lymphatic tissue : a part of body's immune system that helps protect it from bacteria and other foreign substances.

.It consists of connective tissues formed of reticular fibers, with various types of leukocytes.

.Diffuse lymphatic tissue is non-encapsulated lymphatic tissue that found in respiratory tract.

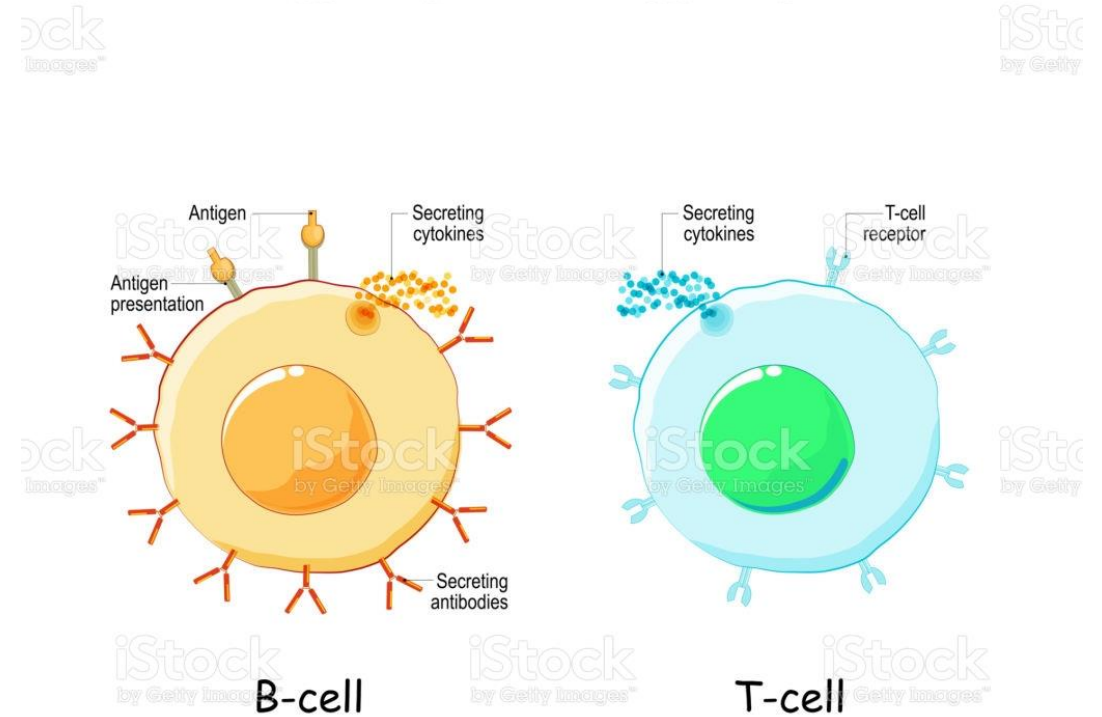
Lymphocytes

Lymphocyte: is a type of white blood cell that is a part of the immune system.

There are two main types of lymphocytes:

1-B-cells: produce antibody molecules that can latch on and destroy invading viruses or bacteria.

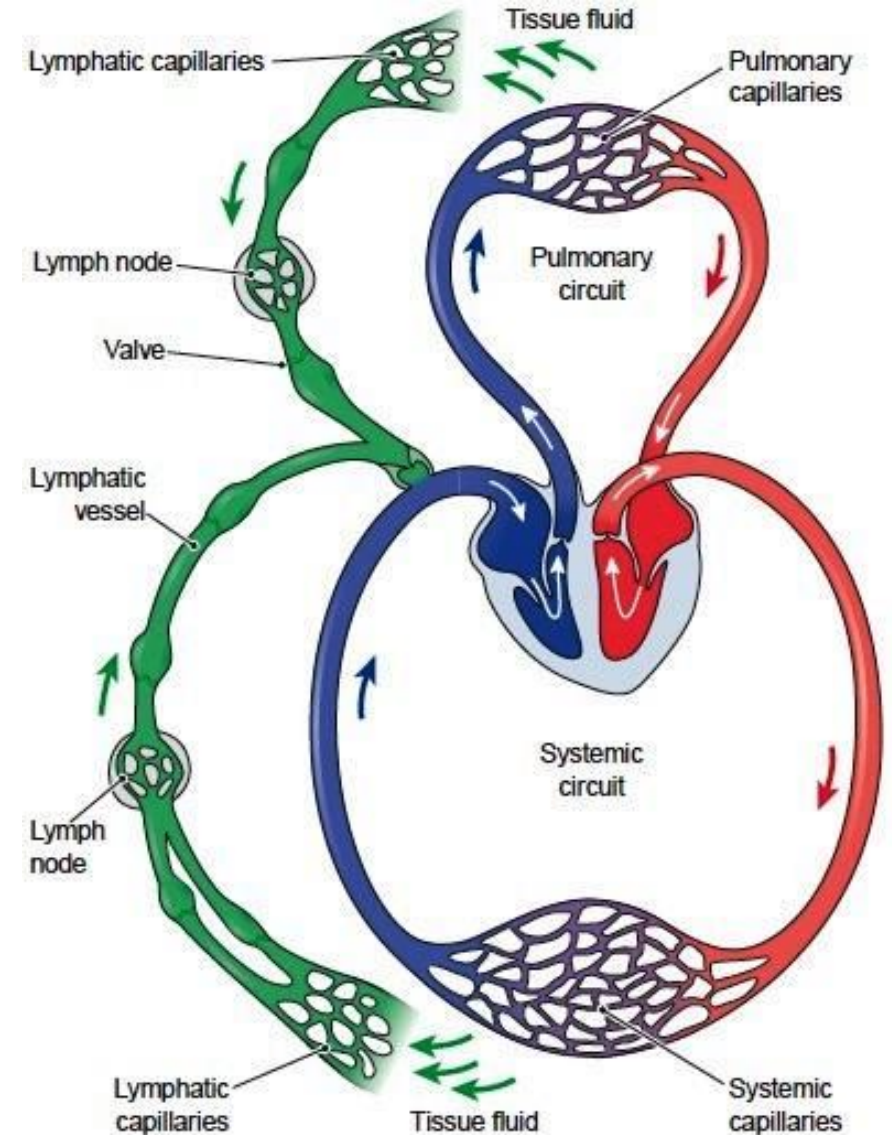
2-T-cells: are direct fighters of foreign invaders and also produce cytokines (substance that help in activating other parts of immune system).



Formation and flow of lymph

Formation of lymph : it is formed when the interstitial fluid is collected through tiny lymph capillaries which are located throughout the body, then transported through lymph vessels to lymph nodes, which clean and filter it.

The excess filtered fluid from blood capillaries about 3-liters per day drains into lymphatic vessels And becomes lymph.



There are two types of pumps that maintain the flow of lymph:

1-Respiratory pump: lymph flow is maintained by pressure changes that occur during inhalation and exhalation.

Lymph flow during inhalation from the abdominal region, where the pressure is higher toward the thoracic region, where it is lower.

During exhalation lymphatic vessels distend, the smooth muscle in its wall will contract, that help in moving lymph from one segment to another in a vessel.

2. Skeletal muscle pump : skeletal muscle contractions compresses lymphatic vessels (as well as veins) and forces lymph toward the junction of the internal jugular and subclavian veins.

Definitions

Lymphatic system : is a network of tissues, vessels and organs that work together to move a colorless, watery fluid called lymph back into your circulatory system.

Fluid homeostasis: is the term for the way the body keeps the osmolality of the body fluids within a very narrow range, all the time (amount of water in organism needs to be controlled via osmoregulation).

Lymph nodes : a small bean-shaped structure that is part of the body's immune system.

Lymph Nodules : small, localized collection of lymphoid tissue.

Interstitial fluid : is the body fluid between blood vessels and cells.

Lymph : a colourless fluid containing white blood cells, which bathes the tissues and drains through the lymphatic system into the bloodstream.

Q&A

- .What are the main functions of lymphatic tissue?
- .What does lymphatic system consist of?
- .In which lymphatic organs stem cells divide?
- .Which type of lymphocyte completes its maturation in thymus?
- .Enumerate the secondary lymphatic organs.
- .What are the types of lymphocytes?
- .Where does the flow of lymph start?
- .How Respiratory system and lymphatic system are connected together, explain?

References

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