PHYSIOLOGY

LYMPHATIC SYSTEM

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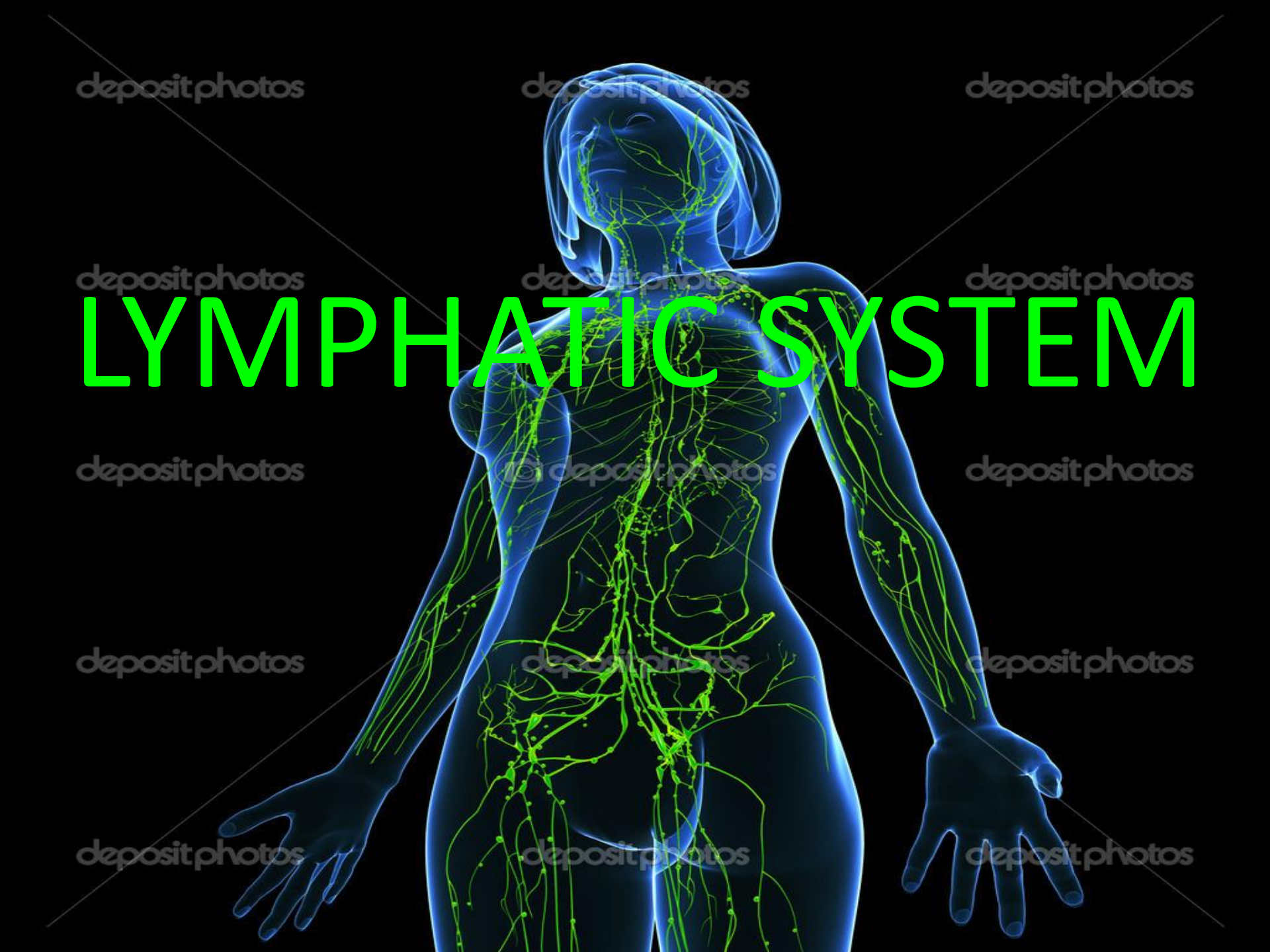
LYMPHATIC SYSTEM



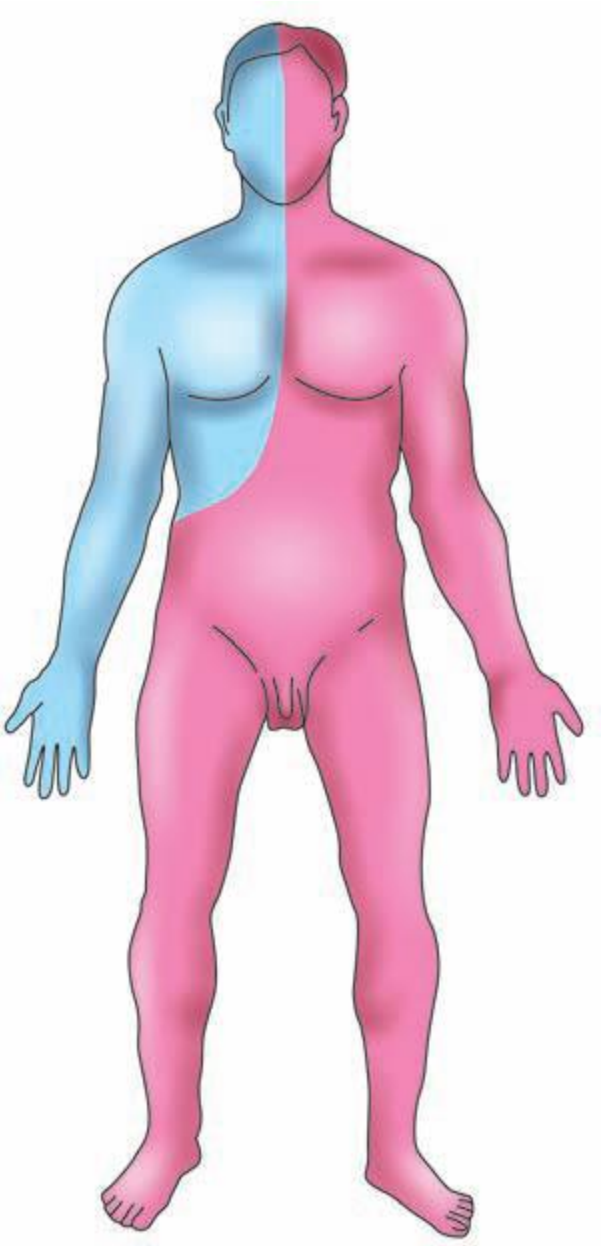
- **LYMPHATIC SYSTEM**
- Lymphatic system is a closed system of lymph channels or lymph vessels, through which lymph flows. It is a **one-way system and allows the lymph flow from tissue** spaces toward the blood

- **ORGANIZATION OF LYMPHATIC SYSTEM**
- Lymphatic system arises from tissue spaces as a meshwork of delicate vessels. These vessels are called **lymph capillaries.**
- Lymph capillaries start from tissue spaces as enlarged blind-ended terminals called **capillary bulbs.**
- These bulbs contain valves, which allow flow of lymph in only one direction. There are some muscle fibers around these bulbs. These muscle fibers cause contraction of bulbs so that, lymph is pushed through the vessels.

- Lymph capillaries are lined by endothelial cells.
- Capillaries unite to form large lymphatic vessels.
- Lymphatic vessels become larger and larger because of the joining of many tributaries along their course.
- The structure of lymph capillaries is slightly different from that of the blood capillaries. Lymph capillaries are more porous and the cells lie overlapping on one another.
- This allows the fluid to move into the lymph capillaries and not in the opposite direction.

DRAINAGE OF LYMPHATIC SYSTEM

- Larger lymph vessels ultimately form the **right lymphatic duct and thoracic duct.**
- **Right lymphatic duct opens into** right subclavian vein and the thoracic duct opens into left subclavian vein. Thoracic duct drains the lymph from more than two third of the tissue spaces in the body



Lymph drainage. Blue area = Drained by right lymphatic duct; Pink area = Drained by thoracic duct.

SITUATION OF LYMPH VESSELS

- Lymph vessels are situated in the following regions:

1. Deeper layers of skin
2. Subcutaneous tissues
3. Diaphragm
4. Wall of abdominal cavity
5. Omentum
6. Linings of respiratory tract except alveoli
7. Linings of digestive tract
8. Linings of urinary tract

9. Linings of genital tract
10. Liver
11. Heart.

Lymph vessels are not present in the following structures:

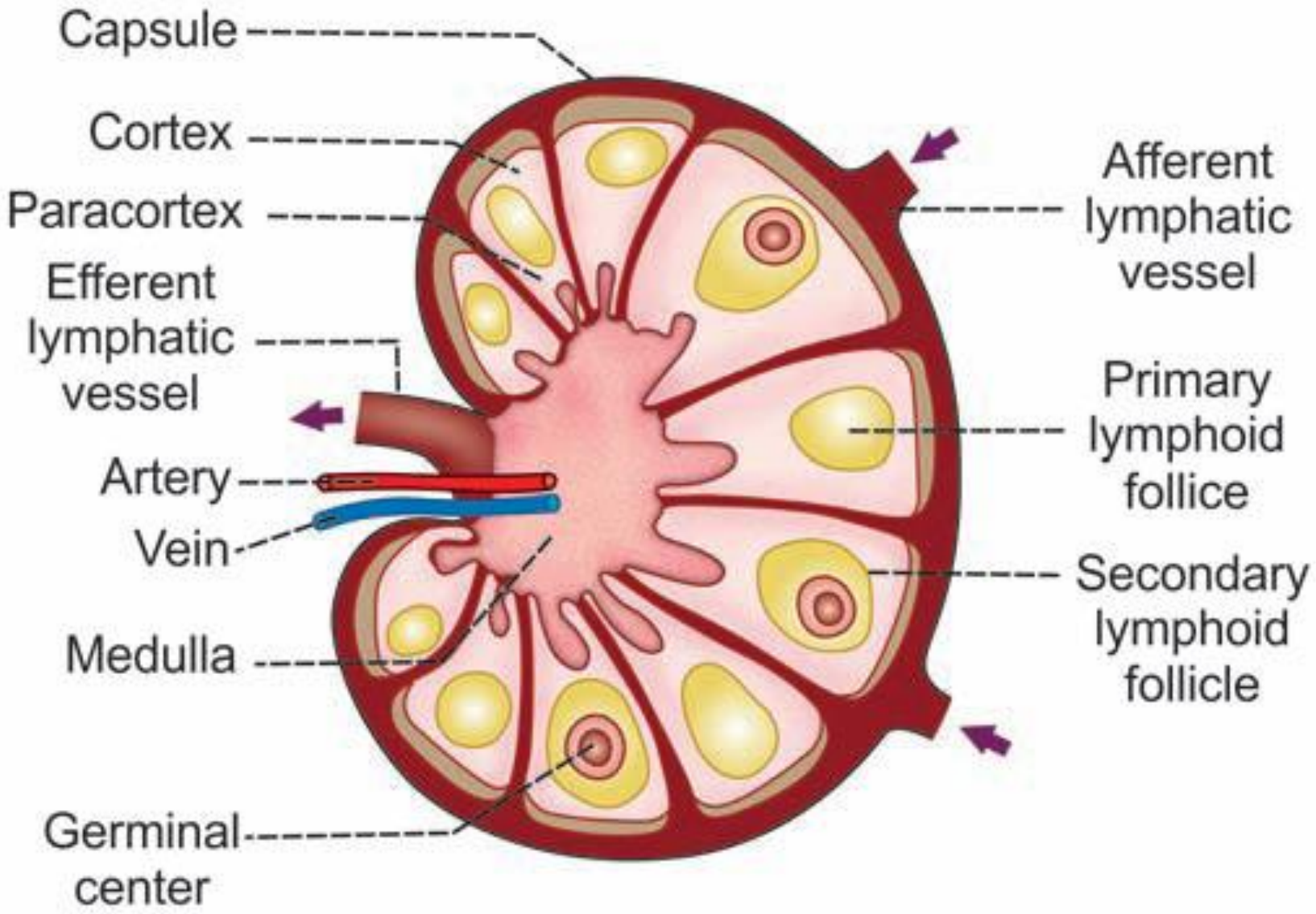
1. Superficial layers of skin
2. Central nervous system
3. Cornea
4. Bones
5. Alveoli of lungs.

LYMPH NODES

- Lymph nodes are small glandular structures located in the course of lymph vessels. The lymph nodes are also called lymph glands or lymphatic nodes.

STRUCTUTRE OF LYMPH NODES

- Each lymph node constitutes masses of lymphatic tissue, covered by a dense connective tissue capsule.
- The structures are arranged in three layers namely cortex, paracortex and medulla


Capsule
Cortex
Paracortex
Efferent lymphatic vessel
Artery
Vein
Medulla
Germinal center
Afferent lymphatic vessel
Primary lymphoid follice
Secondary lymphoid follicle

- ***Cortex***
- Cortex of lymph node consists of primary and secondary **lymphoid follicles. Primary follicle develops first. When** some antigens enter the body and reach the lymph nodes, the cells of primary follicle proliferate.
- The active proliferation of the cells occurs in a particular area of the follicle called the germinal center. After proliferation of cells, the primary follicles become the secondary follicle.
- Cortex also contains some B lymphocytes, which are usually aggregated into the primary follicles. Macrophages are also found in the cortex.

Paracortex

- Paracortex is in between the cortex and medulla.
- Paracortex contains T lymphocytes.

Medulla

- Medulla contains B and T lymphocytes and macrophages.
- Blood vessels of lymph node pass through medulla

Lymphatic Vessels to Lymph Node

- Lymph node receives lymph by one or two lymphaticvessels called **afferent vessels. Afferent vessels divide** into small channels. Lymph passes through afferent vessels and small channels and reaches the cortex.
- It circulates through cortex, paracortex and medulla of the lymph node. From medulla, the lymph leaves the node via one or two **efferent vessels.**

Distribution of Lymph Nodes

- Lymph nodes are present along the course of lymphatic vessels in elbow, axilla, knee and groin. Lymph nodes are also present in certain points in abdomen, thorax and neck, where many lymph vessels join.

FUNCTIONS OF LYMPH NODES

Lymph nodes serve as filters which filter bacteria and toxic substances from the lymph.

- Functions of the lymph nodes are:

1. When lymph passes through the lymph nodes, it is filtered, i.e. the water and electrolytes are removed.But, the proteins and lipids are retained in the lymph.
2. Bacteria and other toxic substances are destroyed by macrophages of lymph nodes. Because of this, lymph nodes are called defense barriers.

LYMPH

FORMATION OF LYMPH

- Lymph is formed from interstitial fluid, due to the permeability of lymph capillaries. When blood passes via blood capillaries in the tissues, 9/10th of fluid passes into venous end of capillaries from the arterial end.
- And, the remaining 1/10th of the fluid passes into lymph capillaries, which have more permeability than blood capillaries.

- So, when lymph passes through lymph capillaries, the composition of lymph is more or less similar to that of interstitial fluid including protein content.
- Proteins present in the interstitial fluid cannot enter the blood capillaries because of their larger size. So, these proteins enter lymph vessels, which are permeable to large particles also.

- **RATE OF LYMPH FLOW**
- About 120 mL of lymph flows into blood per hour. Out of this, about 100 mL/hour flows through thoracic duct and 20 mL/ hour flows through the right lymphatic duct.
- ***Factors Increasing the Flow of Lymph***

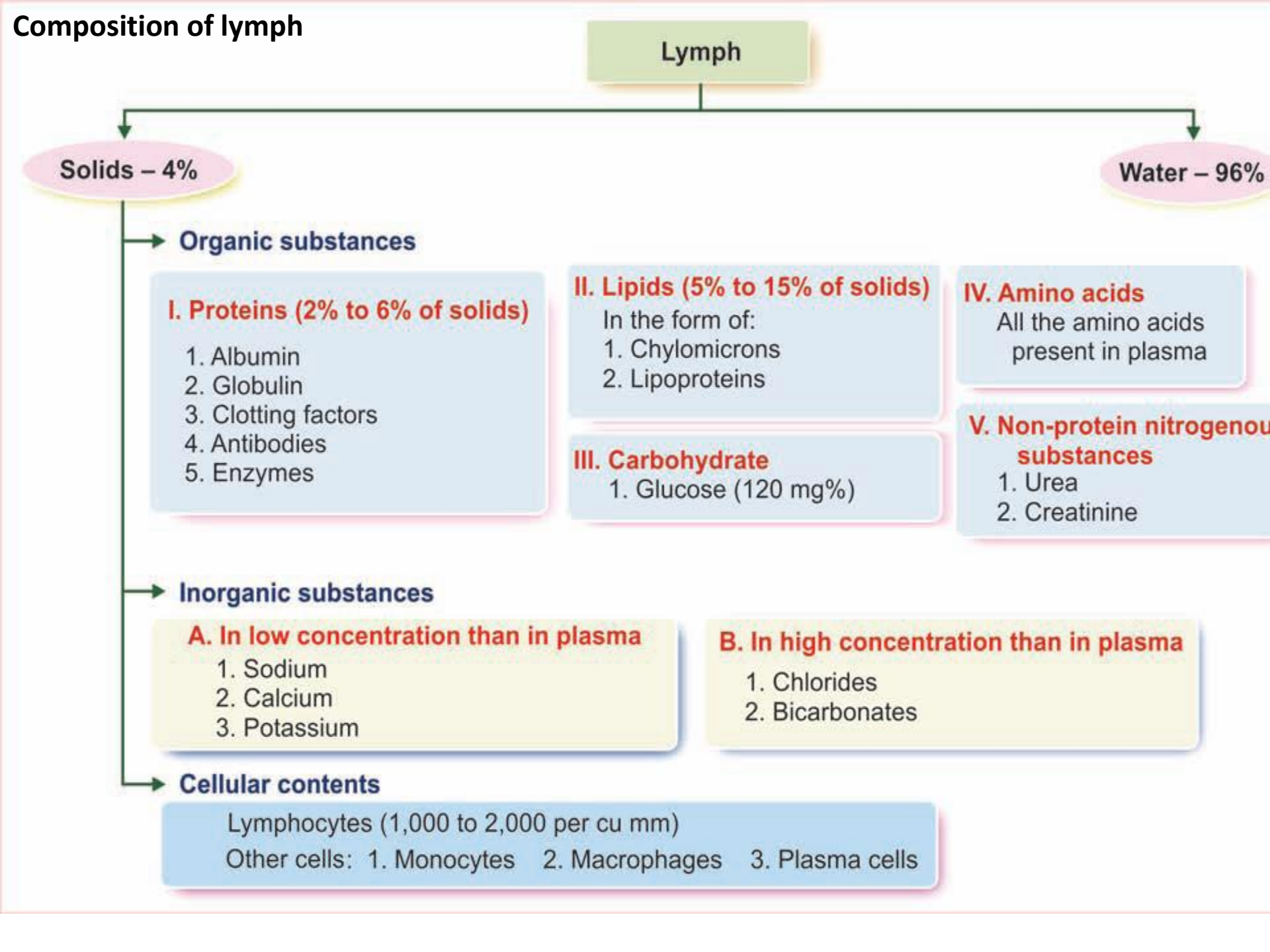
Flow of lymph is promoted by the increase in:

1. Interstitial fluid pressure.
2. Blood capillary pressure.
3. Surface area of lymph capillary by means of dilatation.
4. Permeability of lymph capillaries.
5. Functional activities of tissues

COMPOSITION OF LYMPH

- Usually, lymph is a clear and colorless fluid. It is formed by 96% water and 4% solids. Some blood cells are also present in lymph

Composition of lymph



- **FUNCTIONS OF LYMPH**

1. Important function of lymph is to return the proteins from tissue spaces into blood.
2. It is responsible for redistribution of fluid in the body.
3. Bacteria, toxins and other foreign bodies are removed from tissues via lymph.
4. Lymph flow is responsible for the maintenance of structural and functional integrity of tissue. Obstruction to lymph flow affects various tissues, particularly myocardium, nephrons and hepatic cells.

5. Lymph flow serves as an important route for intestinal fat absorption. This is why lymph appears milky after a fatty meal.
6. It plays an important role in immunity by transport of lymphocytes.