

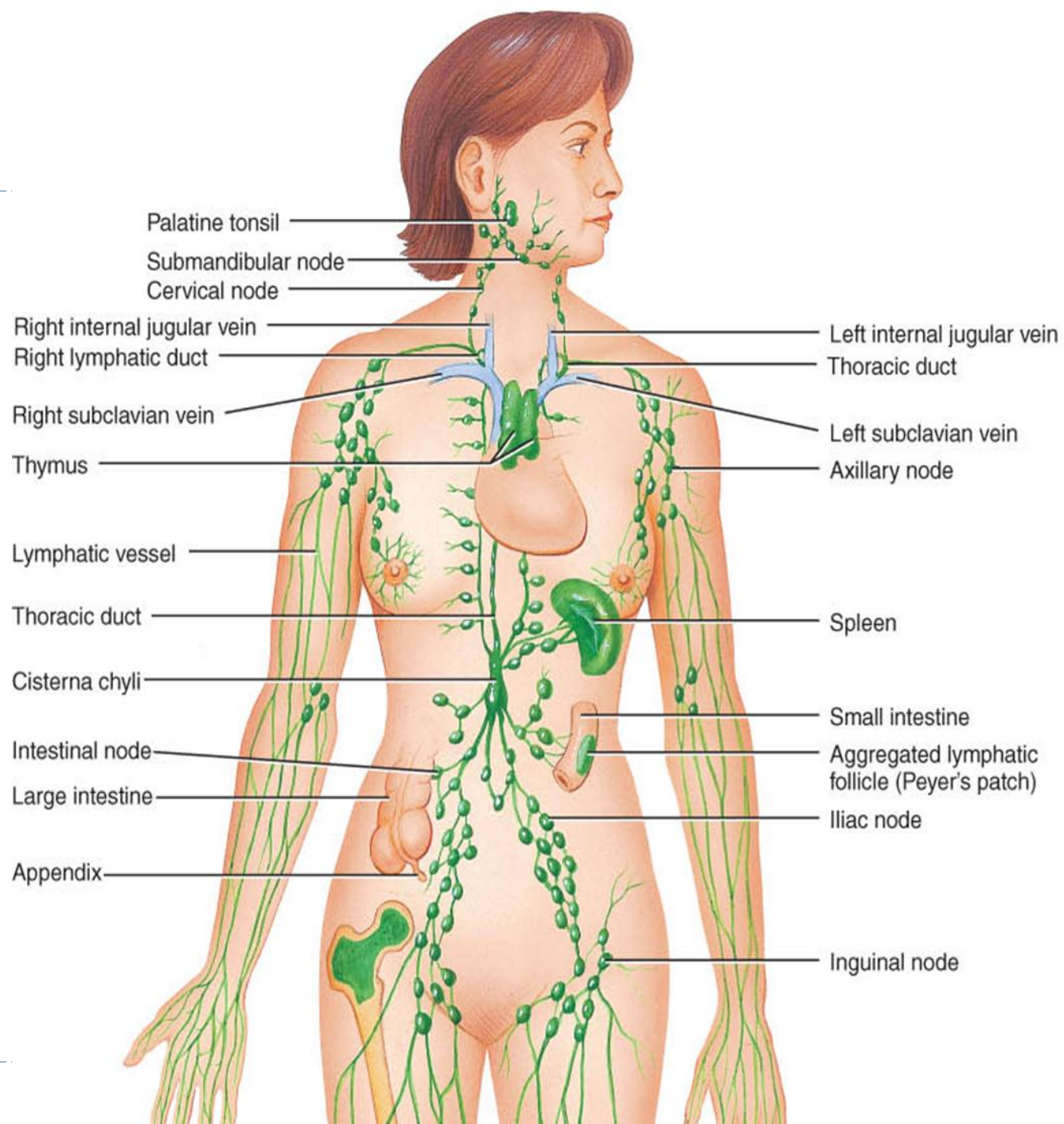
The Lymphatic System

Lymphatic System Function

Lymphatic System which consists of vessels and organs plays **two vital roles in our lives:**

- ▶ **The vessels** essentially maintain interstitial fluid levels by carrying excess fluids as well as any plasma proteins, back into the **CVS**.
- ▶ **The organs**, where critical immune cells such as
 - ▶ lymphocytes which carryout our **body defense**
 - ▶ against infection and disease as well as
 - ▶ offer **ACQUIRED IMMUNITY** .





<http://www.youtube.com/watch?v=Kh-XdNnTZUo&feature=related>



Lymphatic Characteristics

▶ **Properties of lymphatic vessels**

- ▶ One way system toward the heart
- ▶ No pump
- ▶ Lymph moves toward the heart
- ▶ Milking action of skeletal muscle
- ▶ Rhythmic contraction of smooth muscle in vessel walls



Composition of Lymph

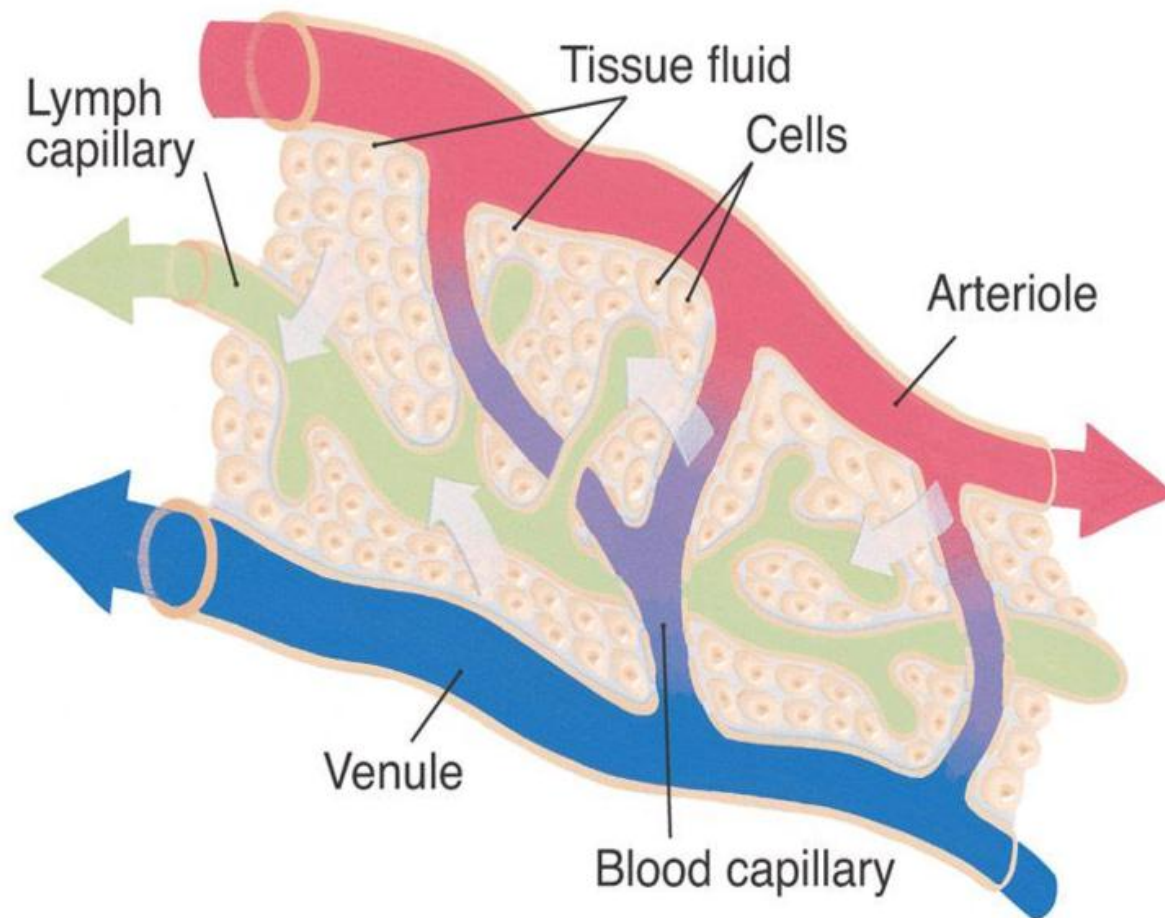
- ▶ Lymph is usually a clear, colorless fluid, similar to blood plasma but low in protein
- ▶ Its composition varies from place to place; after meal, for example, lymph draining from the small intestine, takes on a milky appearance, due to lipid content.
- ▶ Lymph may contain macrophages, viruses, bacteria, cellular debris and even traveling cancer cells.



Lymphatic System Vessels

- ▶ The vessels are called lymphatics.
- ▶ They are thin-walled and are analogous to veins.
- ▶ Small lymphatics are similar to capillaries only more porous;
- ▶ Larger vessels are called collecting vessels: both have valves.
- ▶ 2 large Ducts: **Right Lymphatic duct** and **Thoracic duct** (both empty into the **RT and LT subclavian veins**)
- ▶ Lymph flows only to The Heart (One Way).
- ▶ This is a low-pressure, **pumpless system**. Lymph moves via skeletal muscles and pressure changes in thorax during breathing only.





Lymph Nodes function

- ▶ Lymph Nodes take the germ-filled lymph and
- ▶ Filter lymph before it is returned to the blood
- ▶ **Defense cells within lymph nodes**
 - ▶ Macrophages – engulf and destroy foreign substances
 - ▶ Lymphocytes – provide immune response to antigens



Lymphatic Organs

- ▶ **Lymph Node**- Important lymphocytes of the immune response are matured here.
- ▶ **Spleen**- destroys RBCs and reservoir of blood; **it is the largest** Lymph organ and it filter blood of bacteria and antigen-filled cells.
- ▶ **Thymus Gland**- produces hormone, *thymosin*, *functions in programming lymphocytes T and B cells* also T-cells matured on the Thymus and become part of the immunocompetent



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- ▶ **Tonsils** -Traps bacteria and other microbes in throat.
 - ▶ **Peyer's Patch**- capture and destroy bacteria in intestine, thereby preventing them from penetrating the intestinal wall.



Lymph Node Structure

- ▶ Most are kidney-shaped, less than 1 (one) inch long

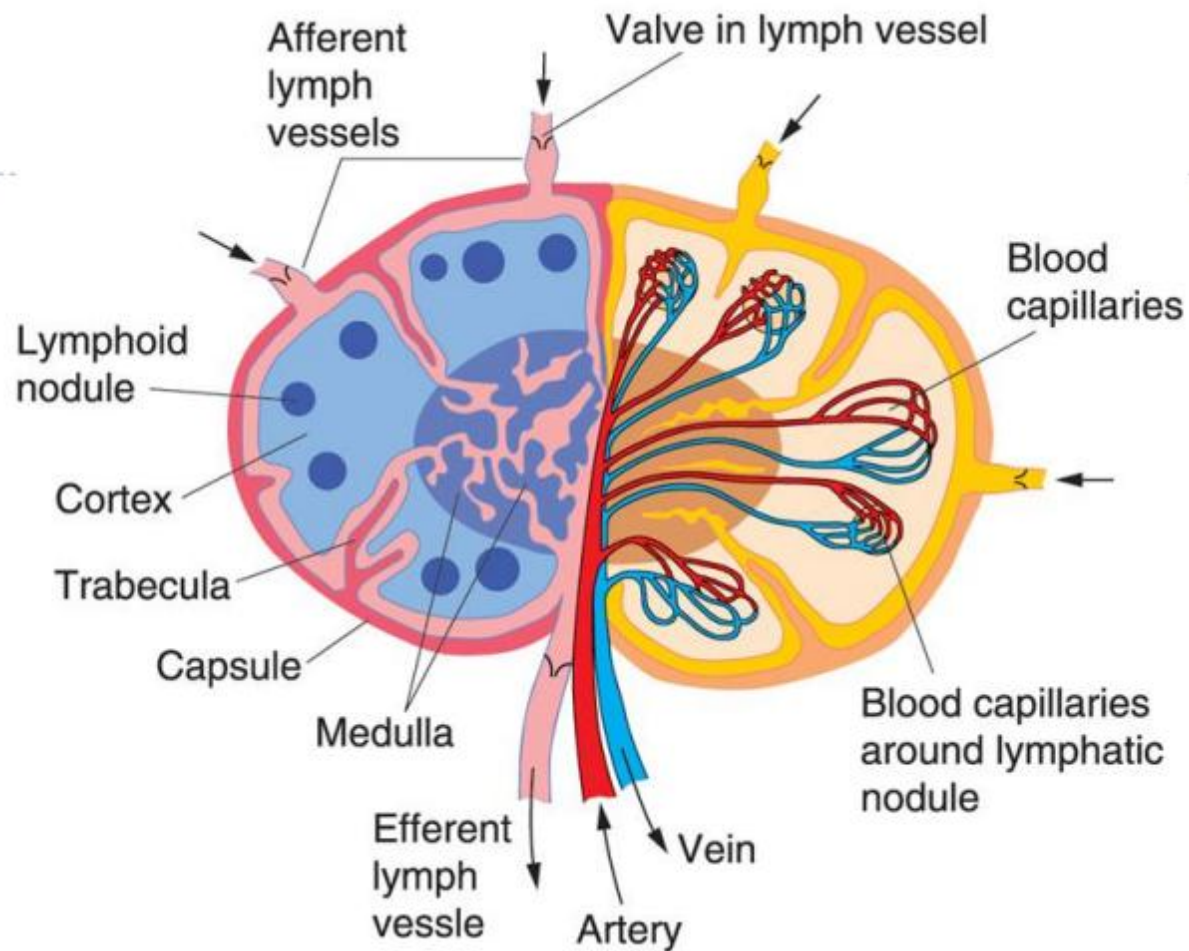
1. Cortex

- ▶ Outer part
- ▶ Contains follicles – collections of lymphocytes

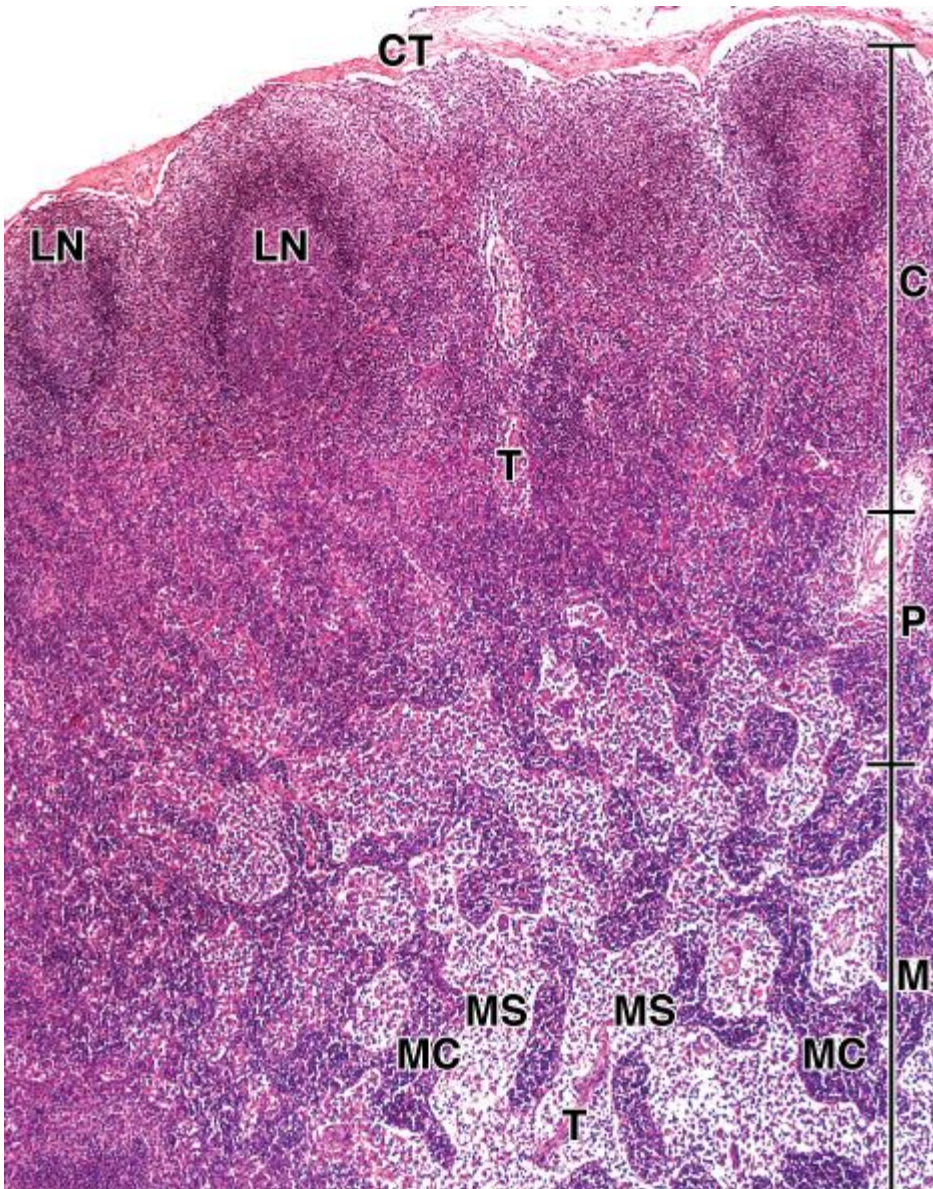
2. Medulla

- ▶ Inner part
- ▶ Contains phagocytic macrophages

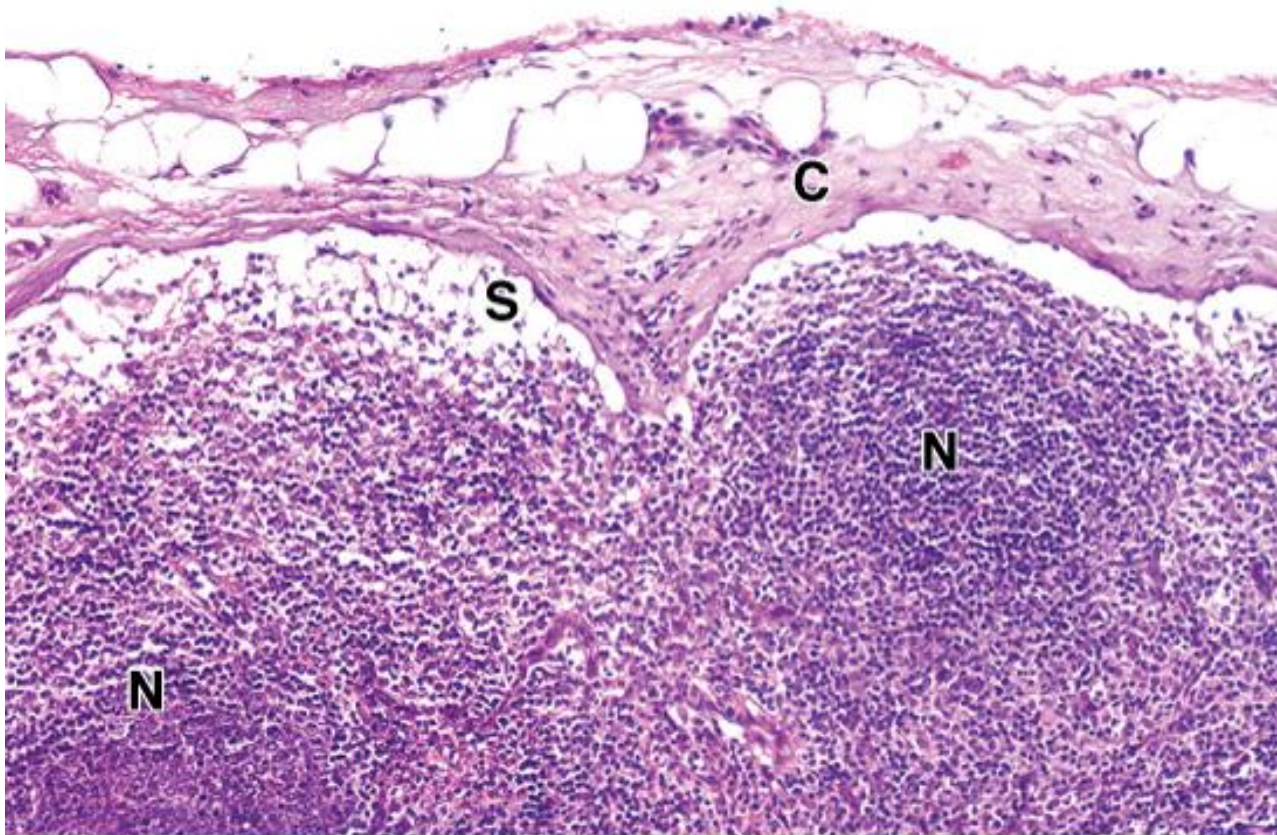




The left half of the figure shows the major regions and structural components of a lymph node and the flow of lymph within these organs, entering via afferent lymphatics on the convex side of the node, passing through unlined sinuses (shown in pink) in the lymphoid tissue, and leaving through an efferent lymphatic at the hilum. Valves in the lymphatic vessels assure the one-way flow of lymph. The right half depicts part of the blood circulation, with a small artery and vein both entering and leaving at the hilum.



A low-magnification section of a lymph node showing the three functional regions: the cortex (C), the paracortex (P), and the medulla (M). Connective tissue of the capsule (CT) completely surrounds each lymph node and extends as several trabeculae (T) throughout the lymphoid tissue. Major spaces for lymph flow are present in this tissue under the capsule and along the trabeculae. A changing population of immune cells is suspended on reticular fibers throughout the cortex, paracortex, and medulla. Lymphoid nodules (LN) are normally restricted to the cortex and the medulla is characterized by sinuses (MS) and cords (MC) of lymphoid tissue. X40. H&E.



Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas*, 12th Edition: <http://www.accessmedicine.com>
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The outer regions on the convex sides of a lymph node include the capsule (C), subcapsular sinuses (S), and diffuse lymphoid tissue with lymphoid nodules (N). Afferent lymphatic vessels (which are only rarely shown well in sections) penetrate this capsule, dumping lymph into the sinus where its contents are processed by lymphocytes and APCs. X140. H&E.

Thymus Gland

- ▶ Histologically, each lobe of the thymus is subdivided by collagenous septa into lobules. Each lobule consists of a
 - ▶ **Peripheral cortex** composed of lymphocytes
 - ▶ **Medulla lacking lymphocytes** but containing glandular tissue.
- ▶ It is the only lymphoid organ lacks the lymphoid **nodules**
- ▶ Various thymic hormones produced by the medulla regulate the differentiation of T lymphocytes, for example, thymosin and thymopoietin.



Spleen

Filters blood of bacteria, viruses and other debris

Destroys worn out blood cells. It then returns (or recycles) some of the breakdown products of RBCs to the liver ..for example Fe, so that more RBCs can be made. The unusable portion of worn-out blood is excreted in bile.

- ▶ Another function: **Stores platelets** and acts as a **blood reservoir**.
- ▶ Lymphocytes are produced; RBCs also made in **fetus only**.



References

<http://www.youtube.com/watch?v=38hwl88Gb44>

[http://www.youtube.com/watch?v=8ngnKlyBA20&feature=r
elmfu](http://www.youtube.com/watch?v=8ngnKlyBA20&feature=r
elmfu)

<http://www.youtube.com/watch?v=KI5L0IBCYYC8>

<http://www.youtube.com/watch?v=FKAfjzjX9Mg>

