LYMPHATIC SYSTEM

SPLEEN, THYMUS GLAND AND LYMPH NODES

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Learning objectives:

After the lecture, students should be able to:

- Describe anatomy of lymphatic system; definitions, end of lymphatic system, and sites of body have not lymph vessels.

-Describe anatomy of the spleen

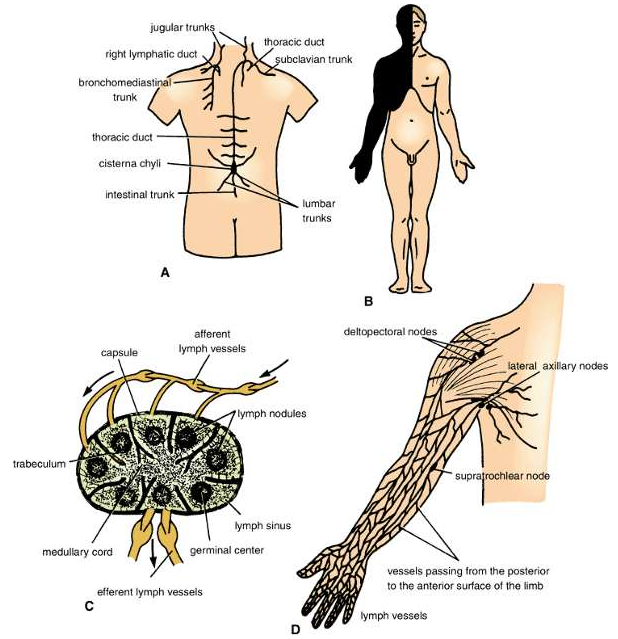
- Describe anatomy of the thymus gland

- Describe anatomy of the lymph nodes

- What is the applied anatomy of the lymph nodes?

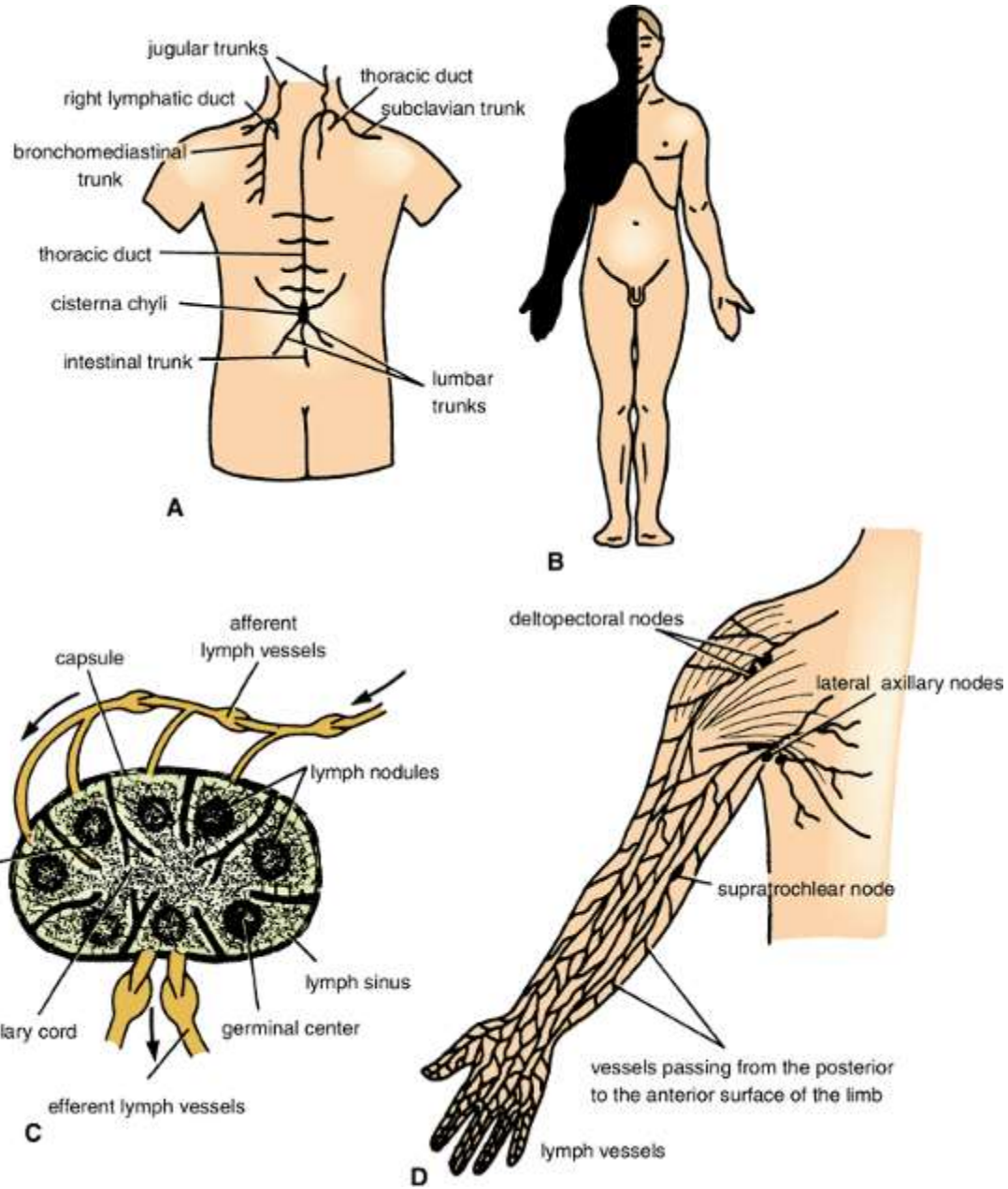
LYMPHATIC SYSTEM

- Essentially a drainage system.
- There is no circulation.
- Essential for immunologic defences of the body against bacteria and viruses, absorption and transport of dietary fat.



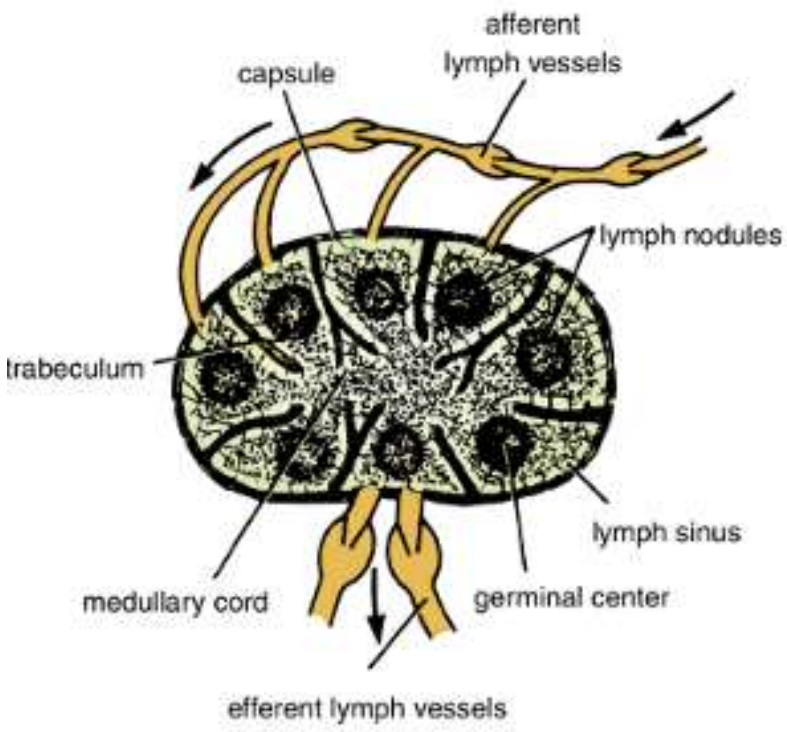
Lymphatic (Lymphoid) Tissues:

- Type of connective tissue that contains large amounts of lymphocytes


jugular trunks
thoracic duct
right lymphatic duct
subclavian trunk
bronchomediastinal trunk
thoracic duct
cisterna chyli
intestinal trunk
lumbar trunks
A
B
afferent lymph vessels
capsule
lymph nodules
trabeculum
lymph sinus
medullary cord
germinal center
efferent lymph vessels
C
deltopectoral nodes
lateral axillary nodes
supratrochlear node
vessels passing from the posterior to the anterior surface of the limb
lymph vessels
D

Sites that produce lymphocytes:

1. Thymus
2. Lymph nodes
3. Spleen
4. Lymphatic nodules aggregated in walls of digestive tract
6. Myeloid tissue in red bone marrow

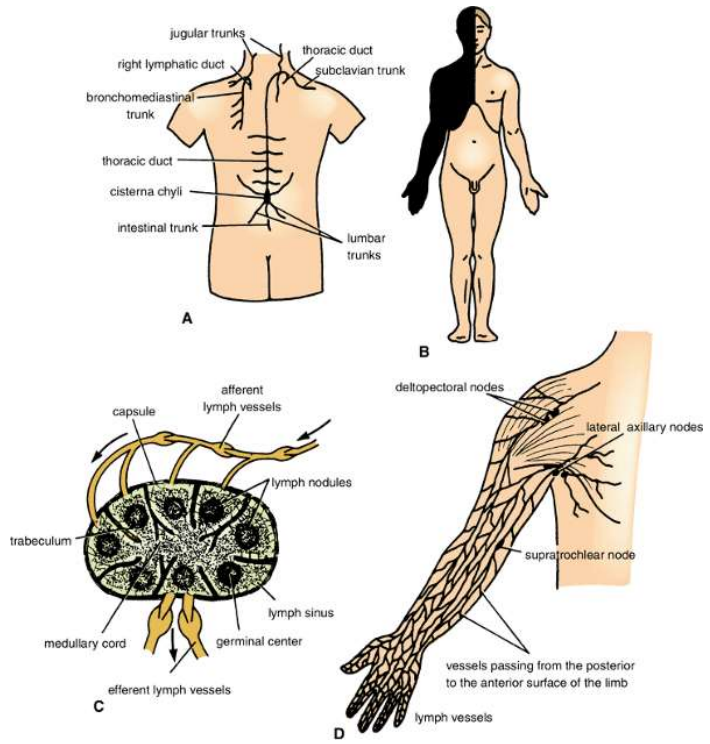


Lymphatic Vessels:

•Tubes that assist cardiovascular system in removal of tissue fluid from tissue spaces of the body then return the fluid to the blood.

They are present in all tissues and organs of the body EXCEPT:

1. Central nervous system
2. Eyeball
3. Internal ear
4. Epidermis of the skin
5. Cartilage
6. Bone

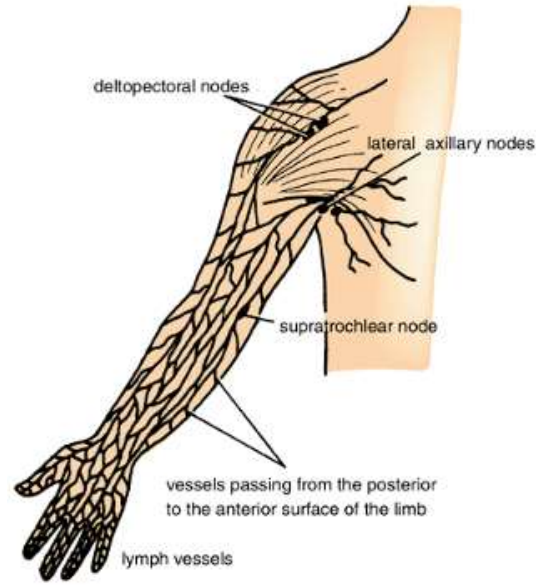


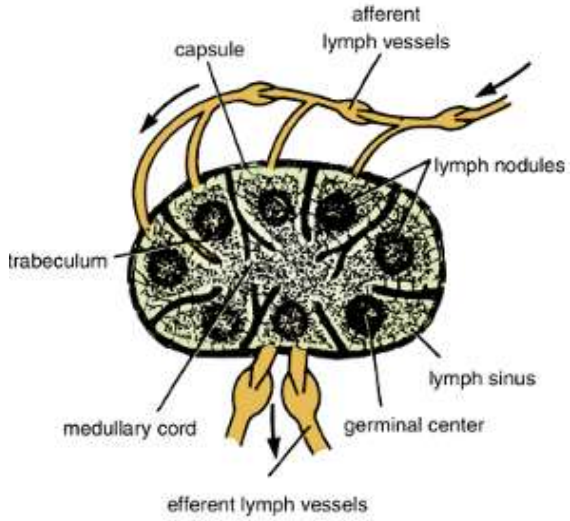
Lymph:

- Tissue fluid once it enters a lymphatic vessel.

Lymph Capillaries:

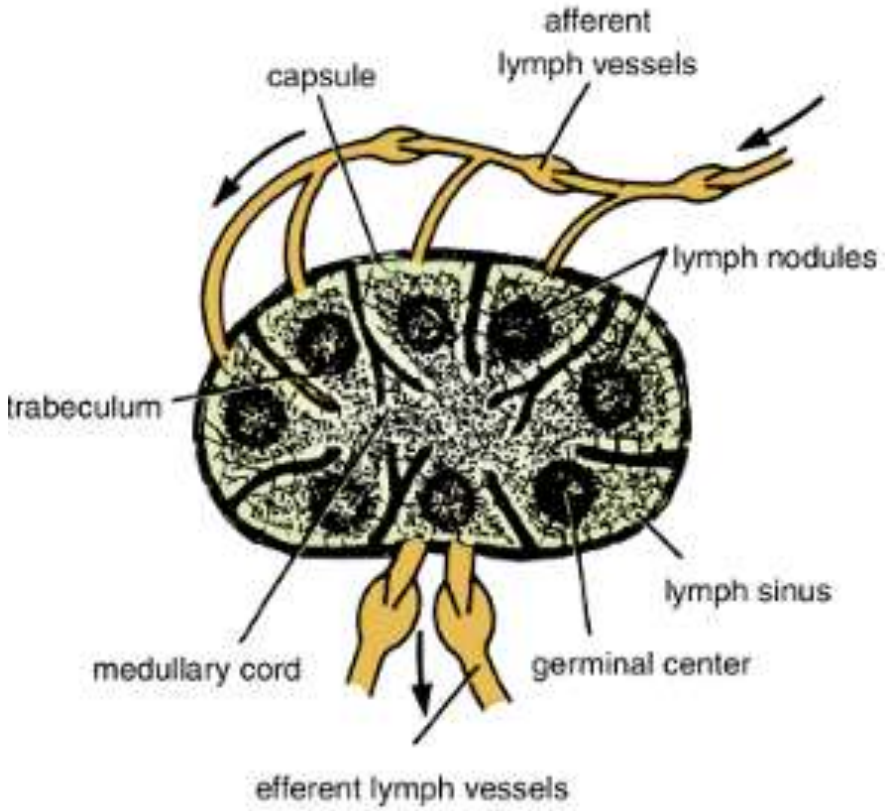
- Network of fine vessels that drain lymph from the tissues
- They are in turn drained by small lymph vessels, which unite to form large lymph vessels.
- The lymph vessels have a ***beaded appearance*** because of the presence of numerous ***valves*** along their course.





Lymph Nodes:

- Small masses of lymphatic tissue located along course of lymphatic vessels through it lymph is filtered on its way to venous system.



Afferent Lymph Vessels:

- Lymph vessels carry lymph to a lymph node

Efferent Lymph Vessels:

•Lymph vessels that transport lymph away from a lymph node

Right Lymphatic Trunk:

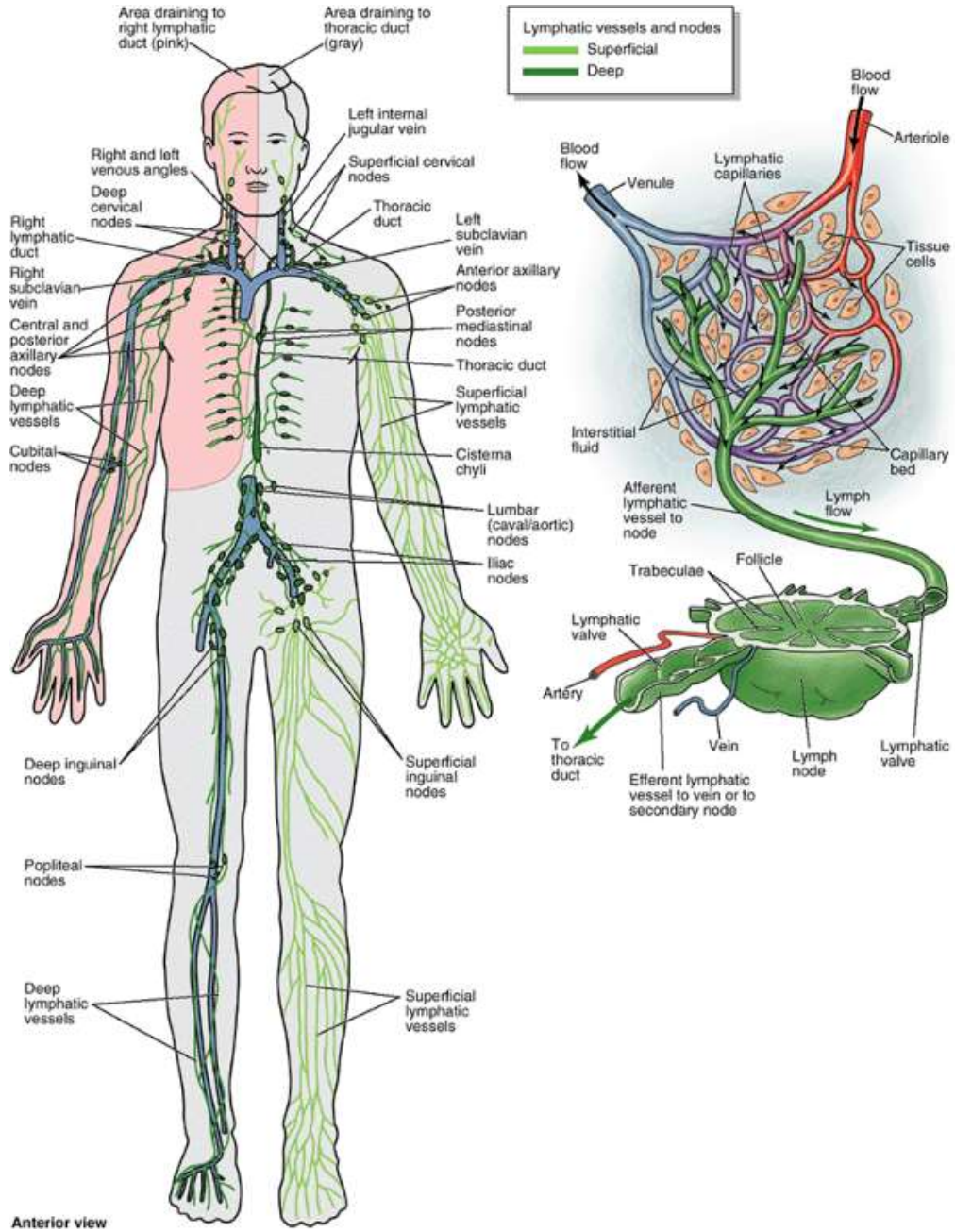
- Ends into junction of right venous angle

•Drains lymph from body's right upper quadrant.

Thoracic Duct:

- Drains lymph from remainder of the body.

•Ends into left venous angle (***angle between left internal jugular vein and left subclavian vein***).

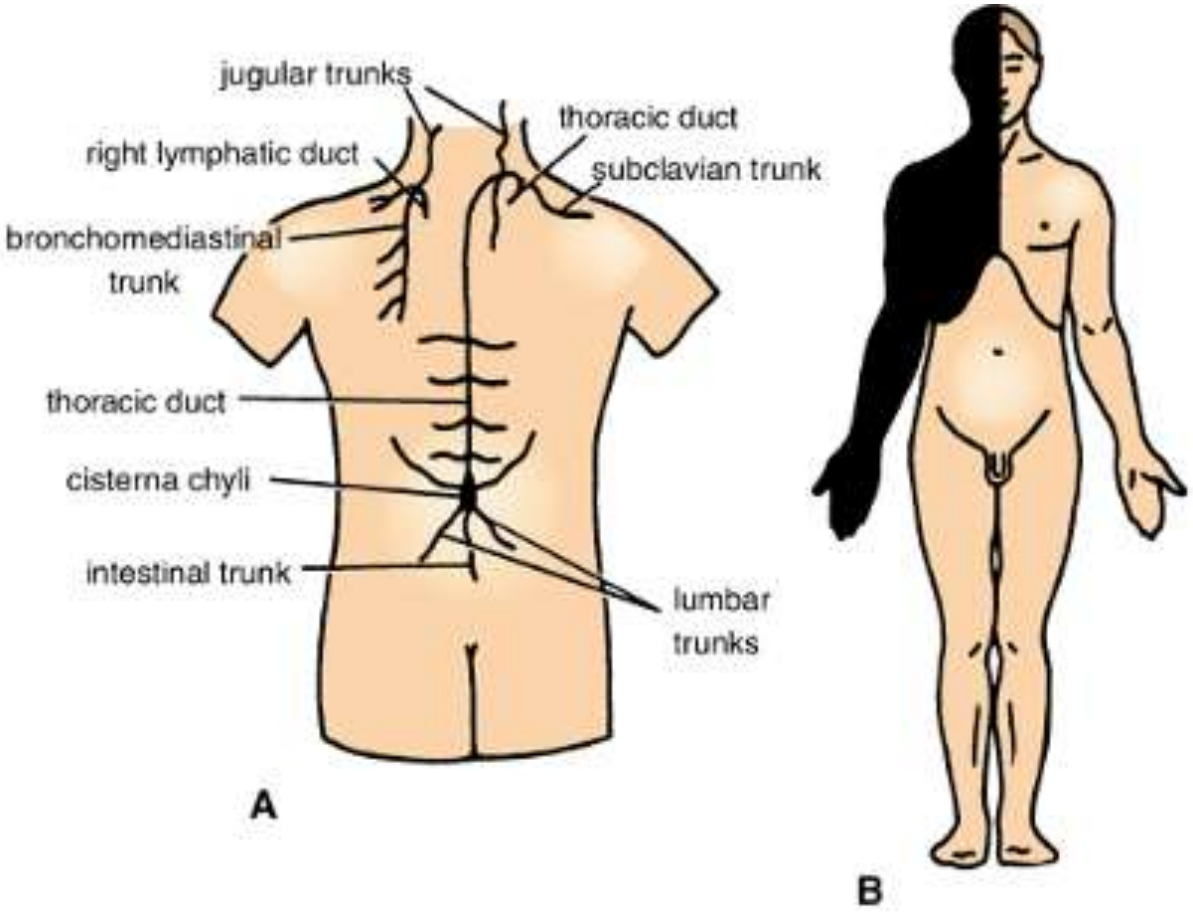

Area draining to right lymphatic duct (pink)
Area draining to thoracic duct (gray)
Lymphatic vessels and nodes
Superficial
Deep
Left internal jugular vein
Right and left venous angles
Superficial cervical nodes
Deep cervical nodes
Thoracic duct
Right lymphatic duct
Left subclavian vein
Right subclavian vein
Anterior axillary nodes
Central and posterior axillary nodes
Posterior mediastinal nodes
Thoracic duct
Deep lymphatic vessels
Superficial lymphatic vessels
Cubital nodes
Cisterna chyli
Lumbar (caval/aortic) nodes
Iliac nodes
Deep inguinal nodes
Superficial inguinal nodes
Popliteal nodes
Deep lymphatic vessels
Superficial lymphatic vessels
Anterior view
Blood flow
Arteriole
Blood flow
Venule
Lymphatic capillaries
Tissue cells
Interstitial fluid
Capillary bed
Afferent lymphatic vessel to node
Lymph flow
Trabeculae
Follicle
Lymphatic valve
Artery
To thoracic duct
Vein
Lymph node
Lymphatic valve
Efferent lymphatic vessel to vein or to secondary node

THORACIC DUCT

- About 45 Cm long
- Has many valves and beaded appearance
- Main lymphatic duct in the body

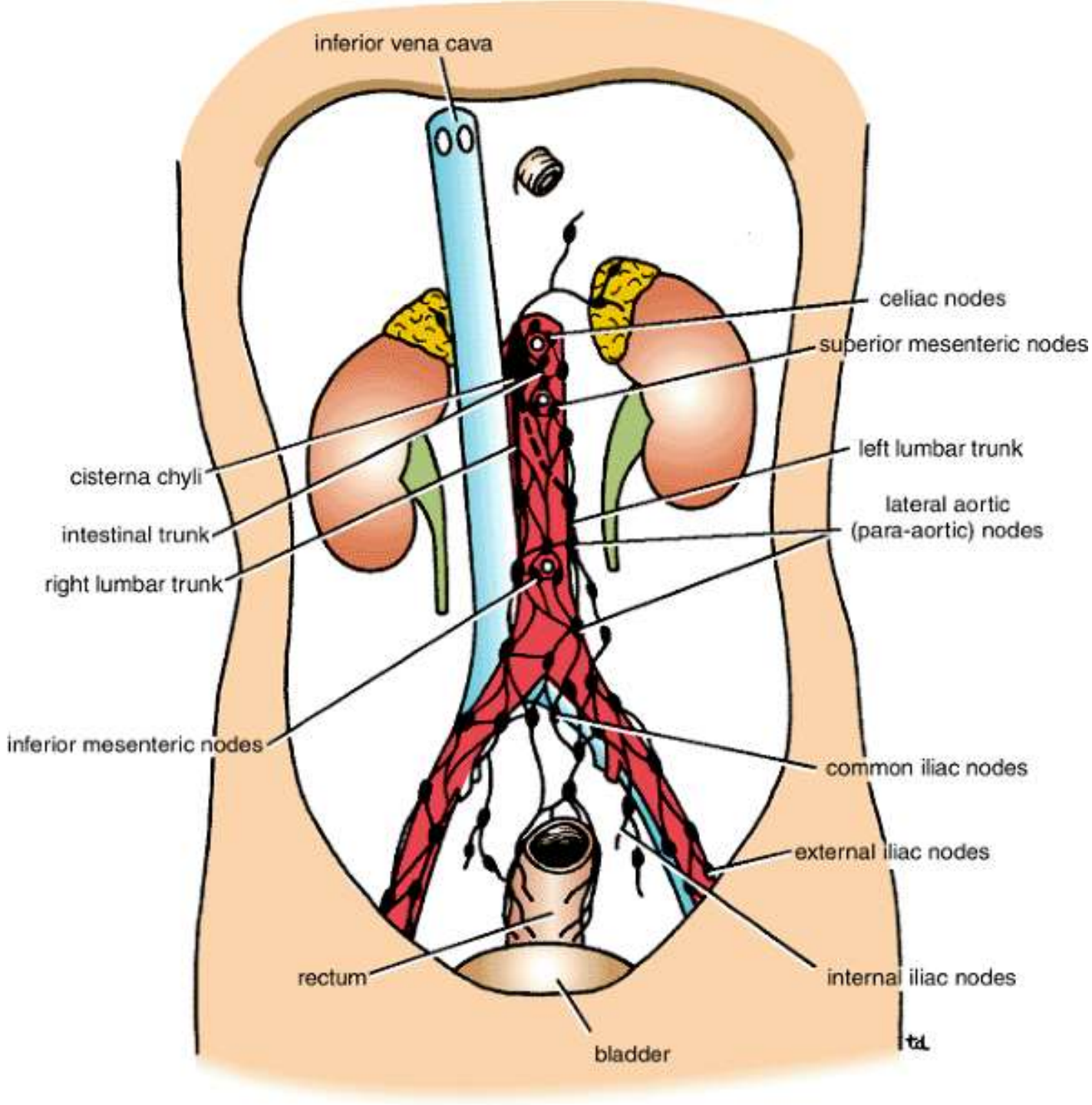
Drains lymph vessels from all the body except:

1) Right side of head and neck
2) Right upper limb
3) Right side of chest
4) Upper surface of right lobe of the liver



Beginning:

- In the abdomen
- Behind right crus of diaphragm
- As dilated sac; cisterna chyli
- At level of L1, 2


inferior vena cava
celiac nodes
superior mesenteric nodes
left lumbar trunk
lateral aortic
(para-aortic) nodes
cisterna chyli
intestinal trunk
right lumbar trunk
inferior mesenteric nodes
common iliac nodes
external iliac nodes
internal iliac nodes
rectum
bladder

Course and relations of thoracic duct:

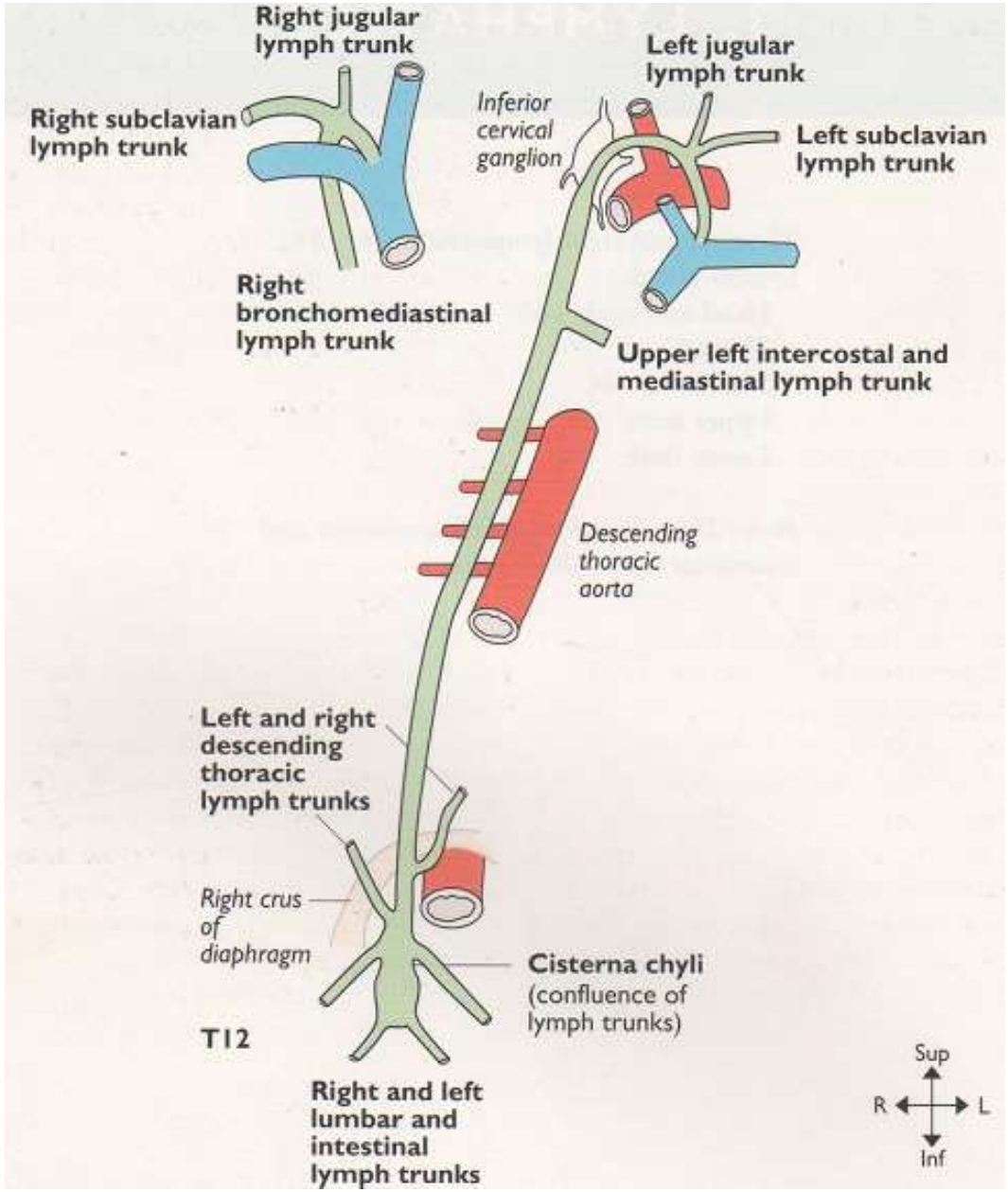
- Ascends through aortic opening of diaphragm, on right side of descending thoracic aorta
- Crosses median plane behind oesophagus to reach its left border

At lower border of body of 4th thoracic vertebra (sternal angle)

- Runs upward along left edge of oesophagus to enter root of neck
- Bends laterally behind carotid sheath and in front vertebral vessels

At level of 7th cervical vertebra

- Turns downward in front of phrenic nerve
- Crosses 1st part of left subclavian artery



End of thoracic duct:

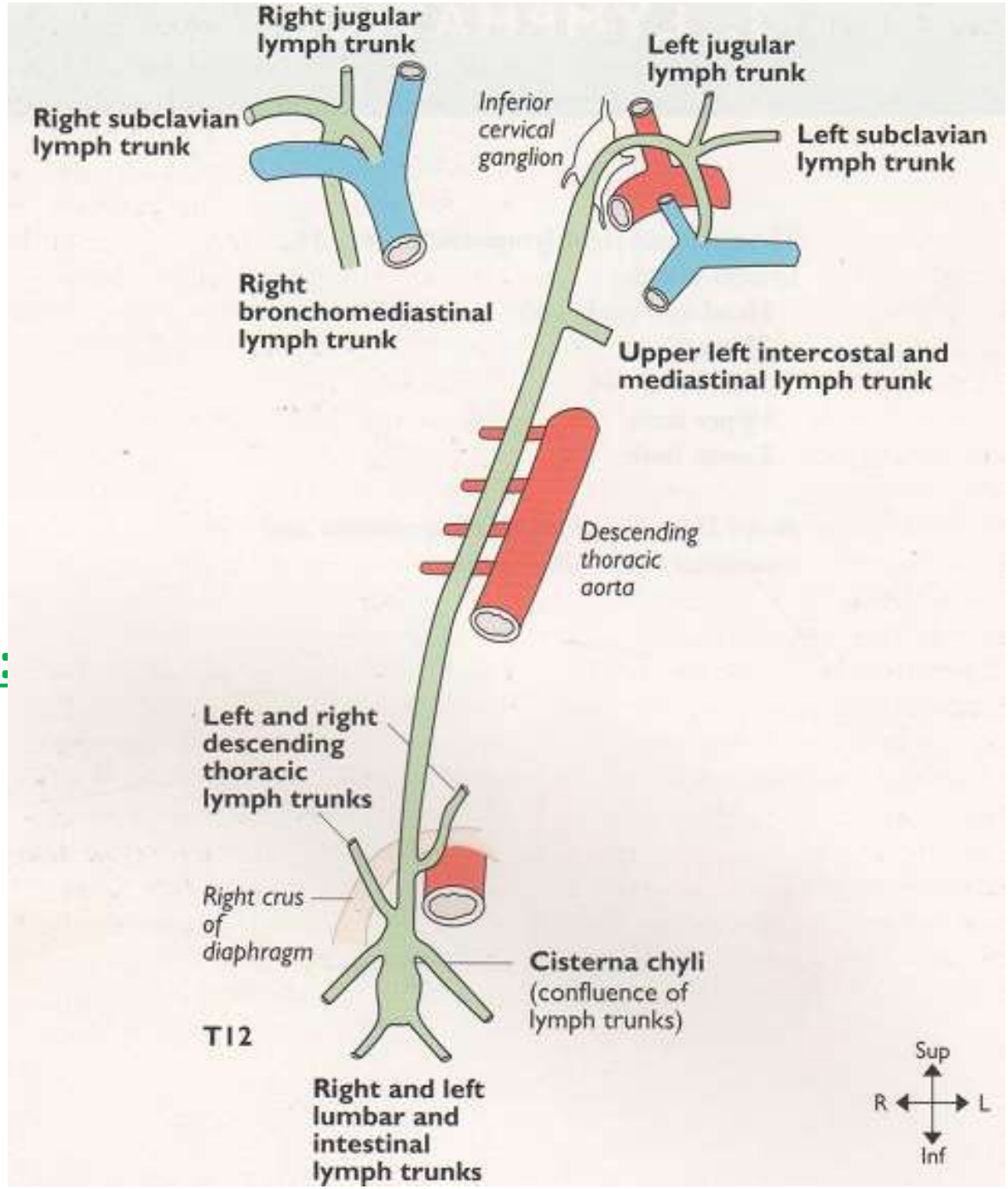
- In the neck
- Beginning of left brachiocephalic vein

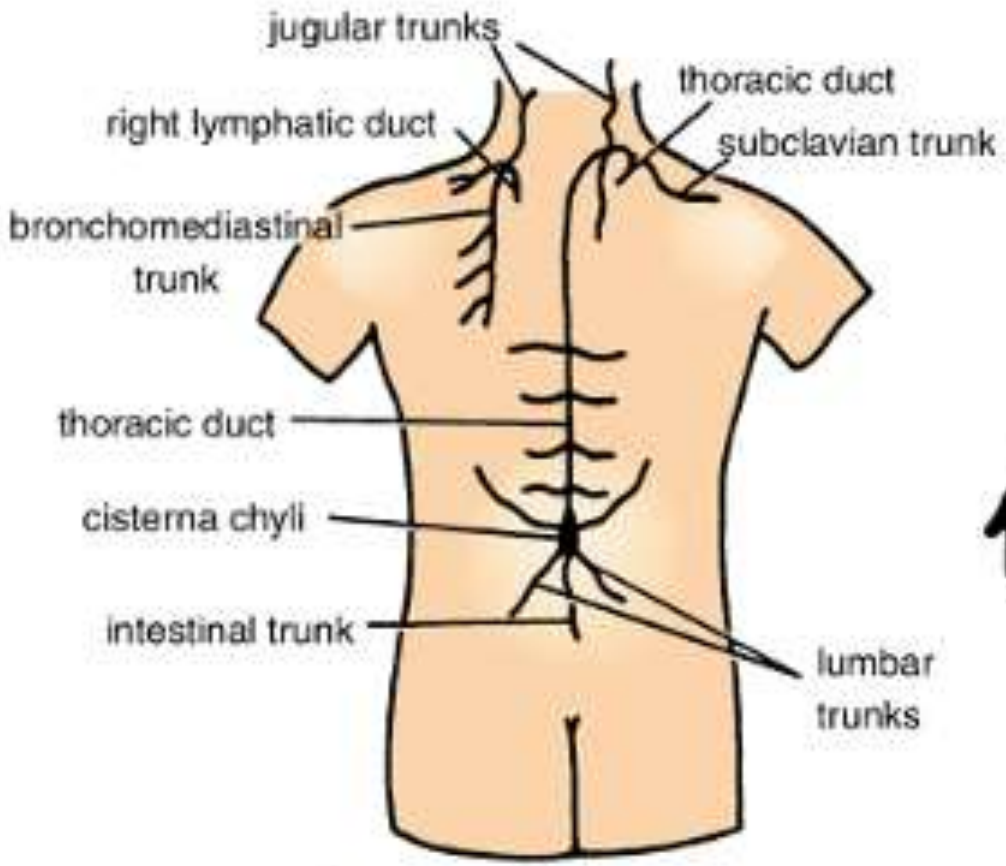
Thoracic duct at root of the neck receives:

1. Left jugular lymph trunk
2. Left subclavian lymph trunk
3. Left bronchomediastinal lymph trunk

Thoracic duct conveys to blood lymph from:

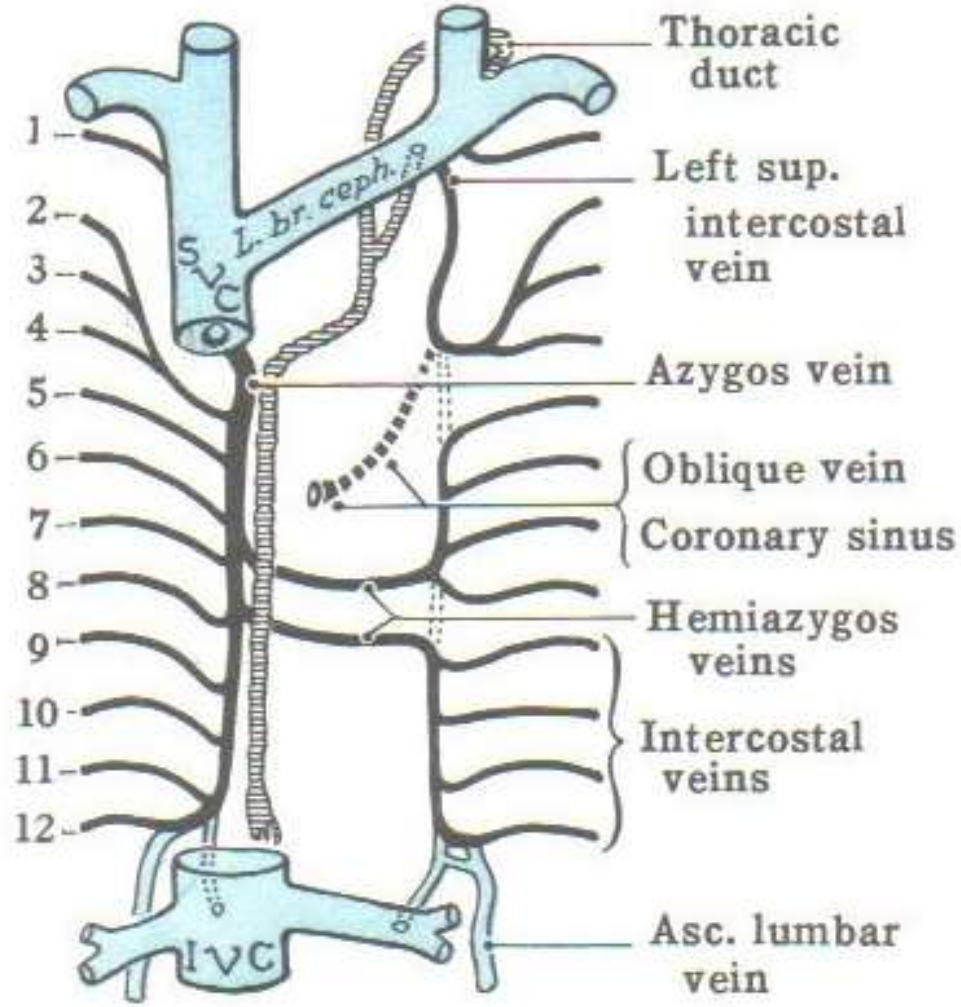
1. Lower limbs
2. Pelvic cavity
3. Abdominal cavity
4. Left side of thorax
5. Left side of head and neck
6. Left upper limb





A

B



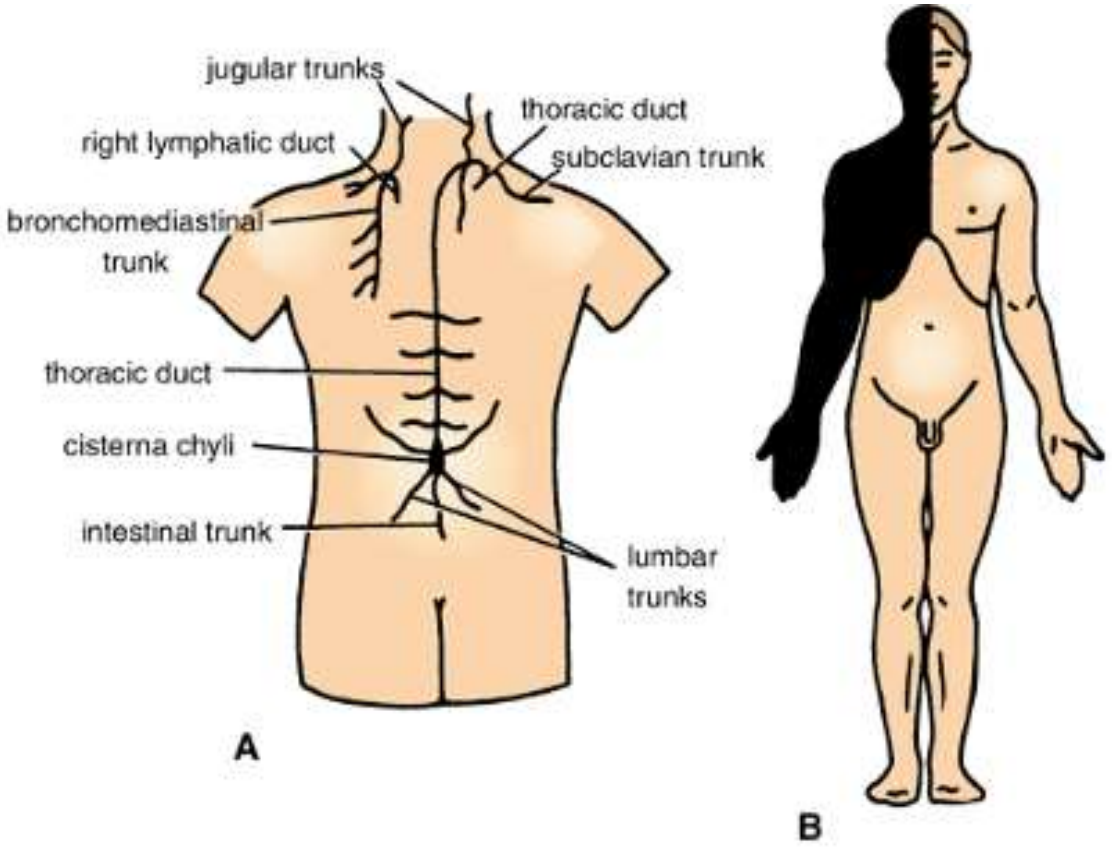
AZYGOS SYSTEM

RIGHT LYMPHATIC TRUNK

- About ½ inch (1.25 Cm) long

Formed by union of:

1. Right jugular lymph trunk
2. Right subclavian lymph trunk
3. Right bronchomediastinal lymph trunk



Drains:

1. Right side of head and neck
2. Right upper limb
3. Right side of thorax

End:

- Beginning of right brachiocephalic vein

SPLEEN

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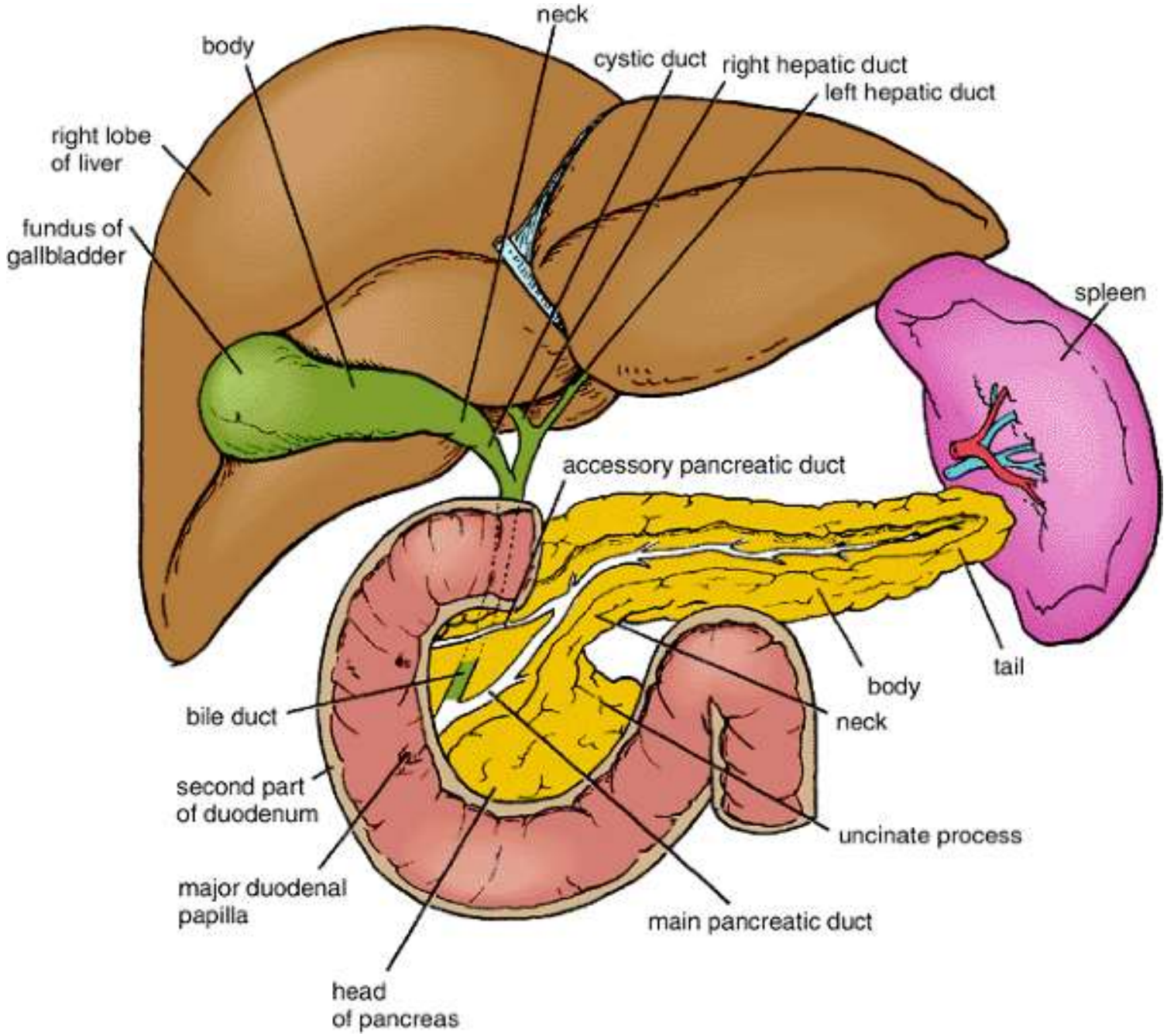
SPLEEN

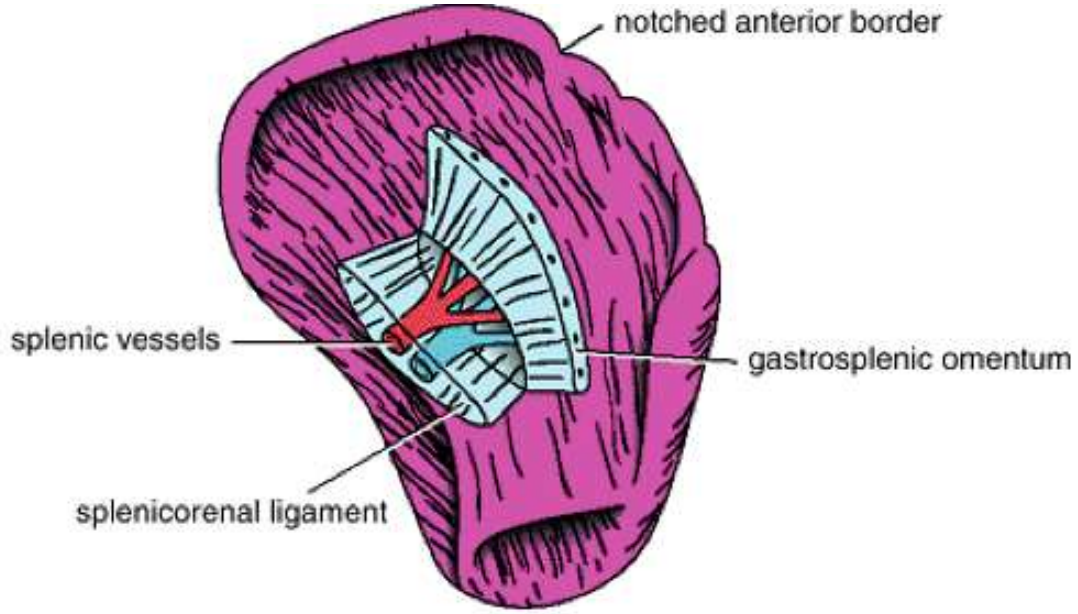
1, 3, 5, 7, 9, 11

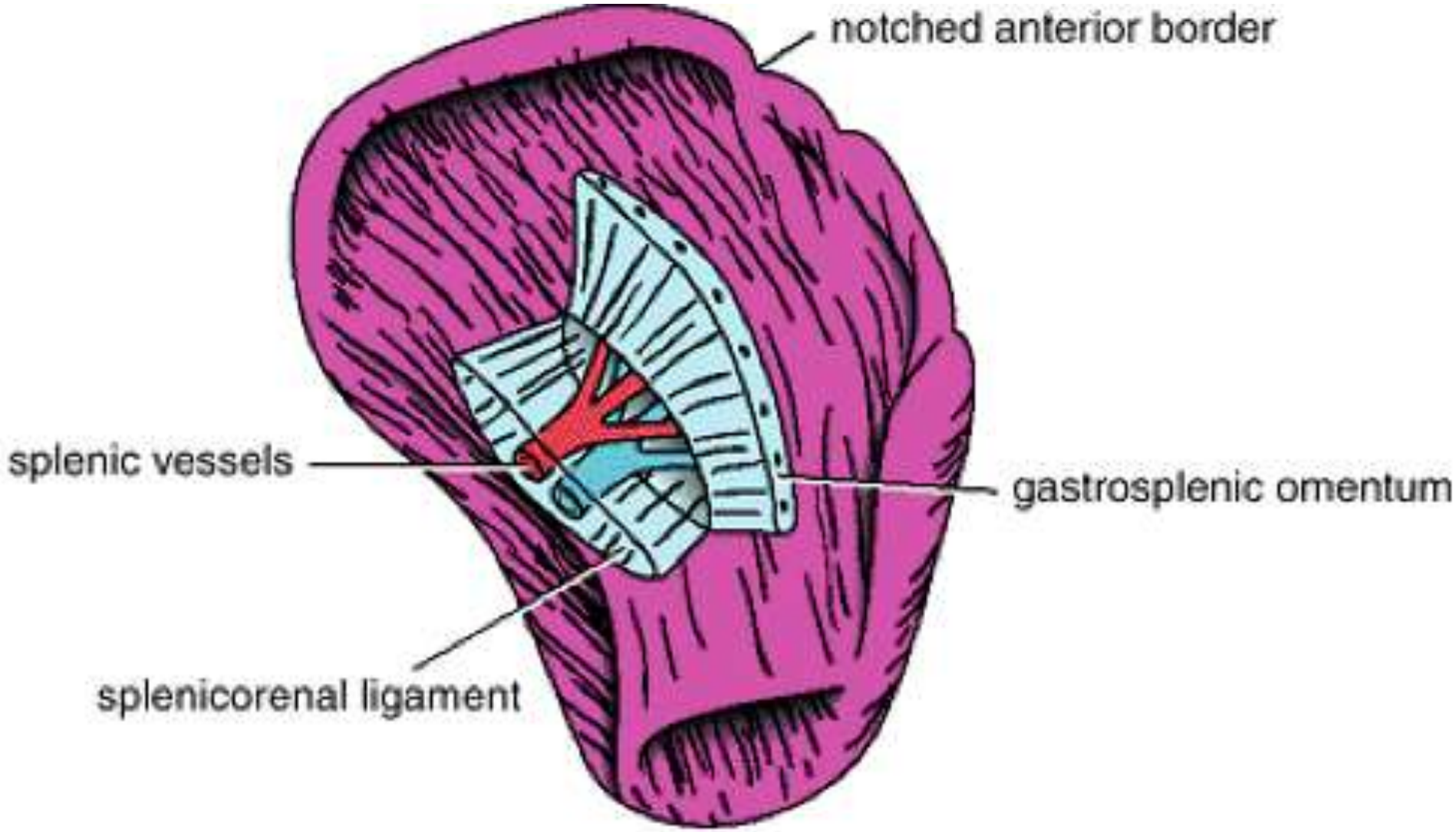
- 1 inch thick, 3 inches wide, 5 inches long, 7 ounces weight and 9-11 ribs relation
- Reddish in colour
- The largest single mass of lymphoid tissue in the body
- Oval in shape
- Lies just below left half of diaphragm close to 9^{th}, 10^{th} and 11^{th} ribs
- The long axis: Lies along shaft of 10^{th} rib
- Its lower pole extends forward only as far as mid-axillary line
- Can not be palpated on clinical examination
- Has notched anterior border


neck
body
cystic duct
right hepatic duct
left hepatic duct
right lobe of liver
fundus of gallbladder
spleen
accessory pancreatic duct
tail
body
neck
bile duct
second part of duodenum
uncinate process
major duodenal papilla
main pancreatic duct
head of pancreas

- **Surrounded by peritoneum: Passes from its hilum as gastrosplenic ligament to greater curvature of the stomach (carrying short gastric and left gastroepiploic vessels)**

- **Peritoneum also passes to left kidney as lienorenal ligament (carrying splenic vessels and tail of pancreas)**

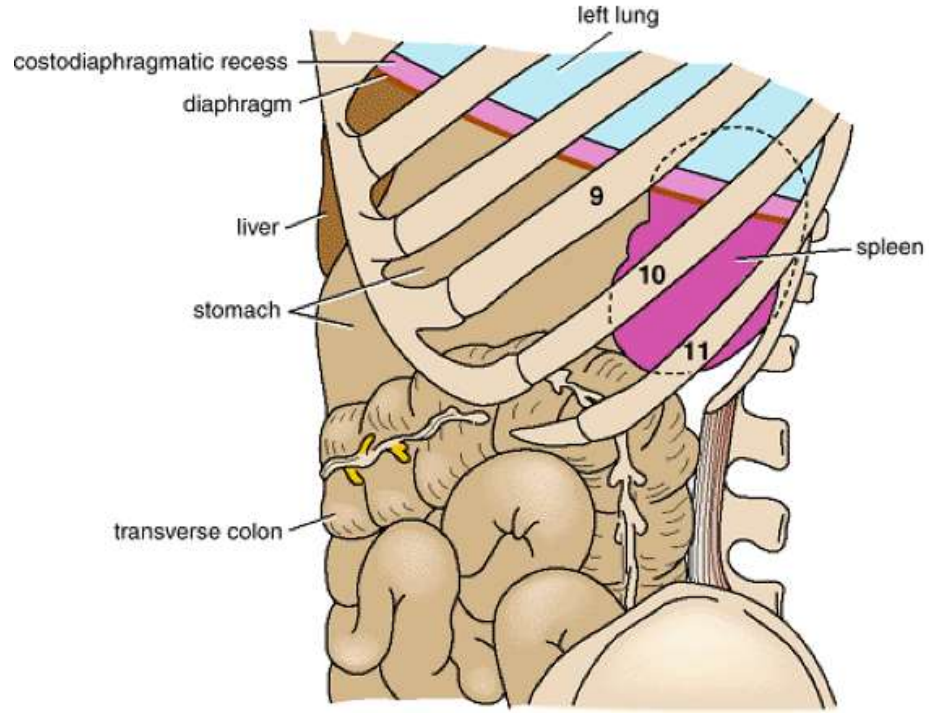



notched anterior border
splenic vessels
gastrosplenic omentum
splenicorenal ligament

RELATIONS OF SPLEEN:

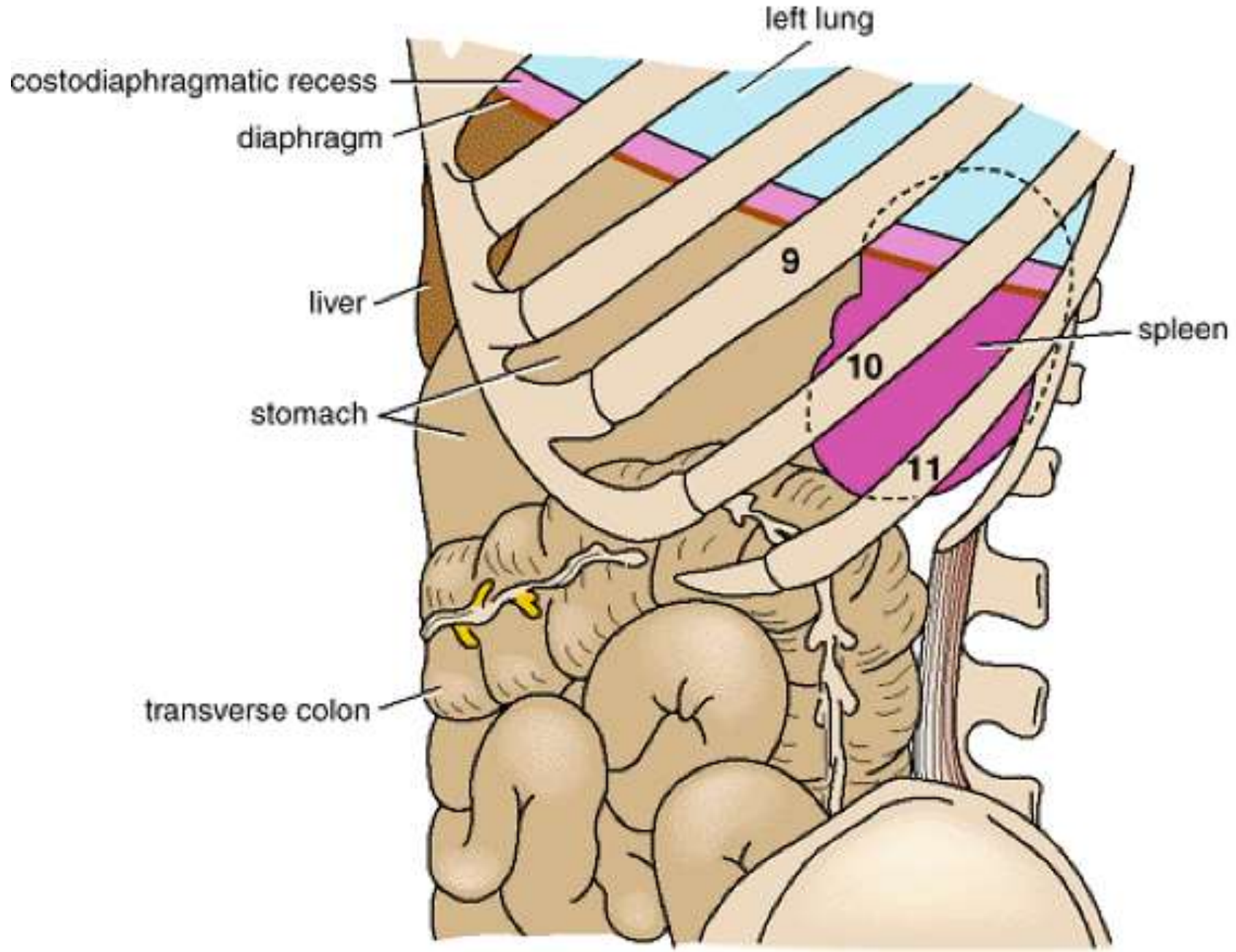
Anteriorly (visceral surface):

1. Stomach
2. Tail of pancreas
3. Left colic flexure
4. Left kidney



Posteriorly (diaphragmatic surface) of spleen:

1. Diaphragm
2. Left pleura (left costodiaphragmatic recess)
3. Left lung
4. Left 9^{th}, 10^{th} and 11^{th} ribs


left lung
costodiaphragmatic recess
diaphragm
liver
stomach
transverse colon
9
10
11
spleen

BLOOD SUPPLY OF SPLEEN:

ARTERIES: Celiac trunk

- **Splenic artery (6): Enter spleen at the hilum**

VEINS: Portal vein

- **Splenic vein: leaves the hilum and runs behind tail and body of pancreas to join superior mesenteric vein behind neck of pancreas to form portal vein**

LYMPH DRAINAGE:

- **Lymph vessels emerge from hilum and pass through lymph nodes along course of splenic artery and drain into celiac nodes**

NERVE SUPPLY:

- **Accompany splenic artery and derived from celiac plexus**

THYMUS GLAND

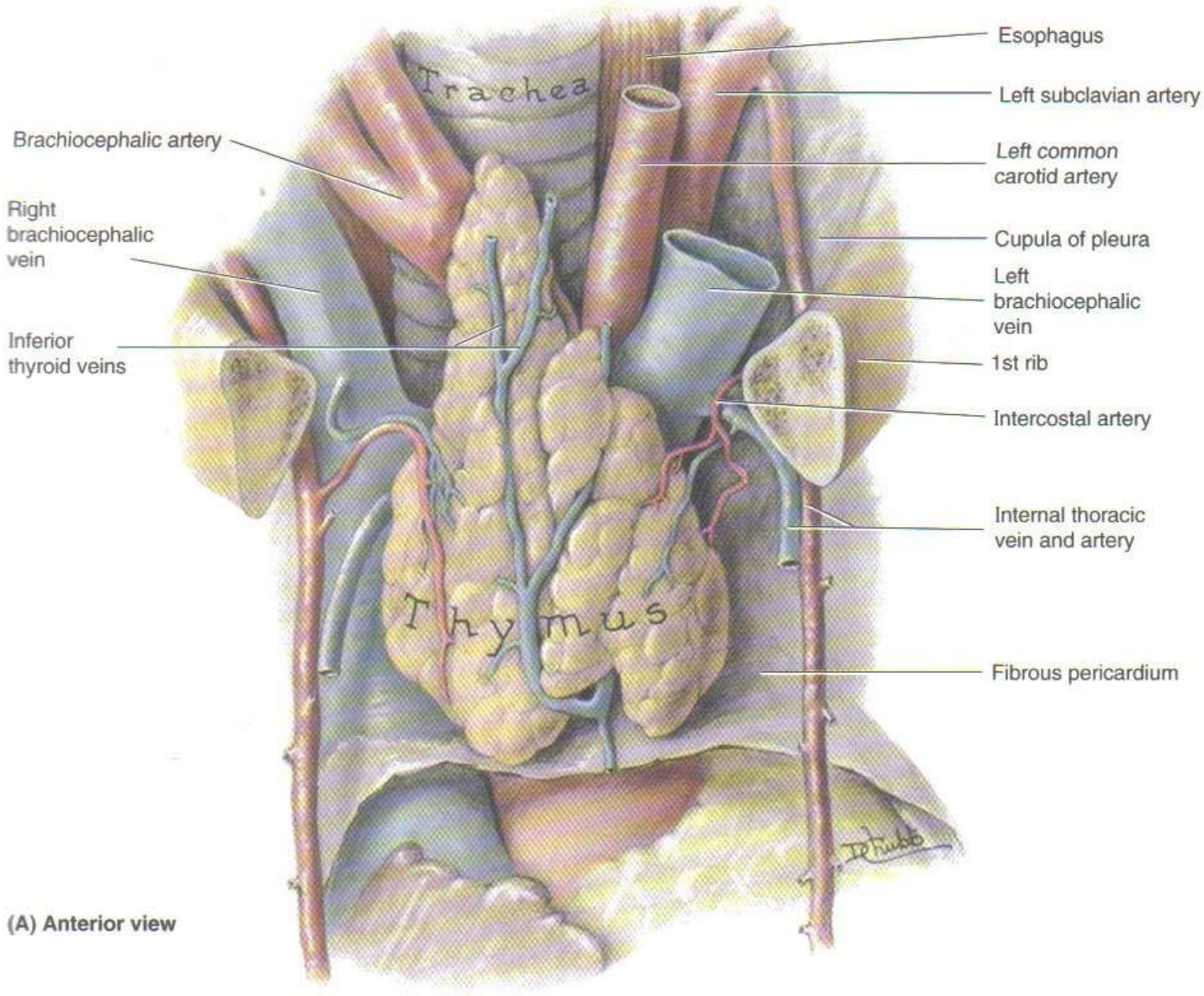
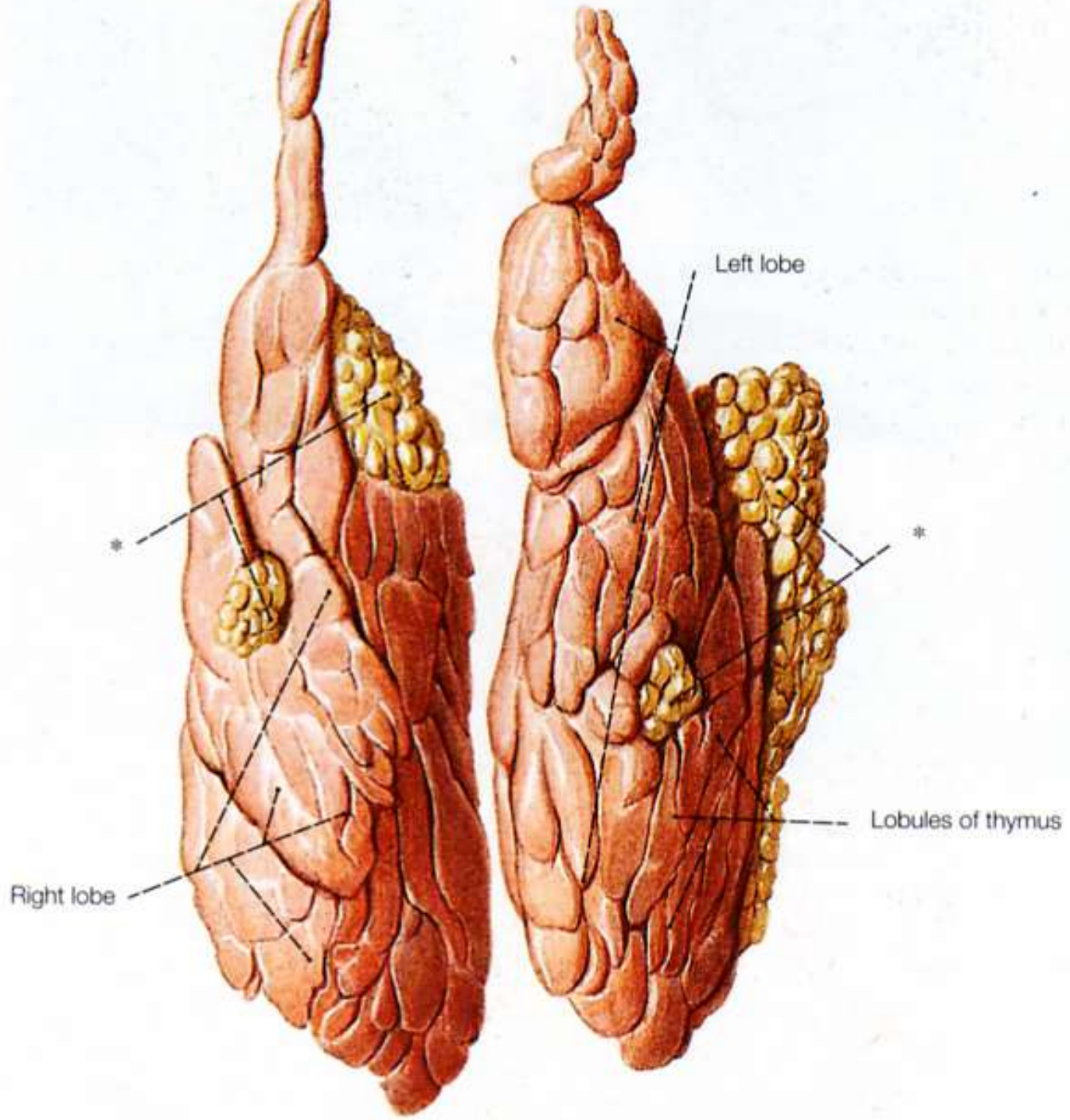


Figure 1.56. Dissections of the superior mediastinum. A. Superficial dissection. The sternum and ribs have been excised and the pleurae removed. It is unusual to see such a distinct thymus in an adult.

THYMUS GLAND

- Primary lymphoid organ
- Flattened, bilobed structure, no main hilum
- Lying between sternum and pericardium in anterior mediastinum



Thymus gland in newborn infant:

- Has largest size relative to size of the body
- Extend up into superior mediastinum front great vessels into root of the neck
- Continues to grow until puberty, but later undergoes involution
- Pink, lobulated appearance
- Site for development of T (thymic) lymphocytes (immunity)

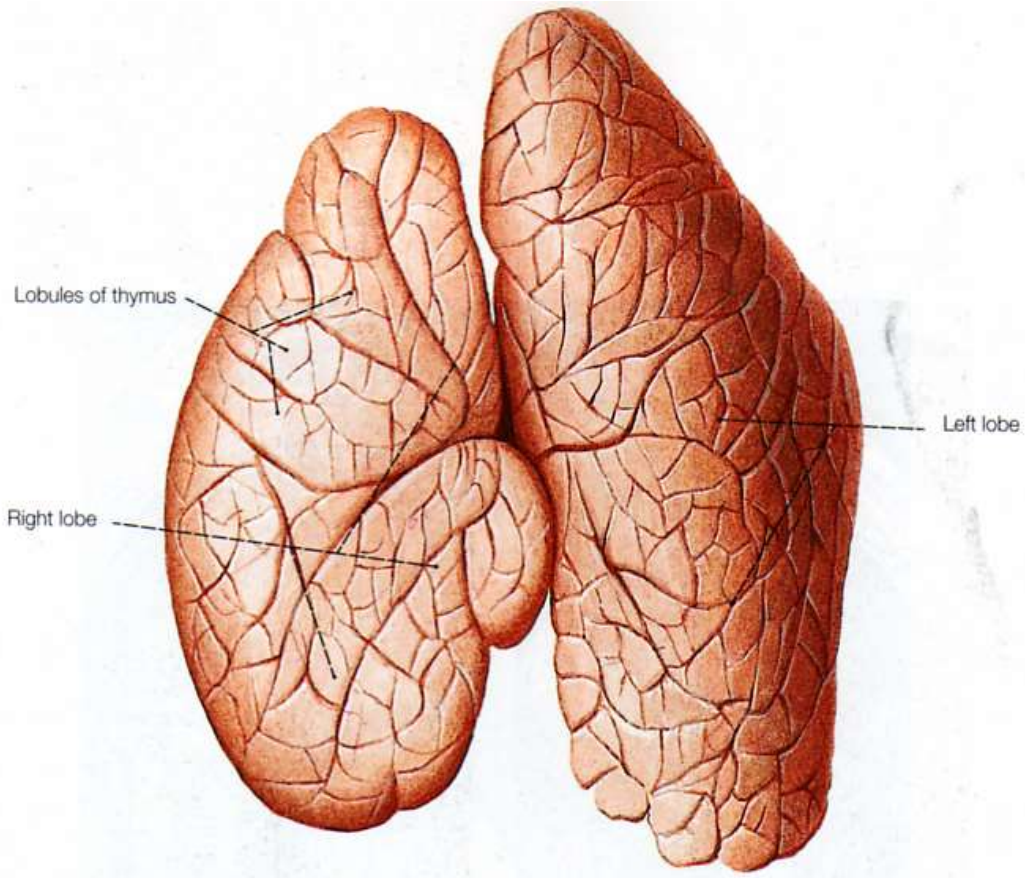
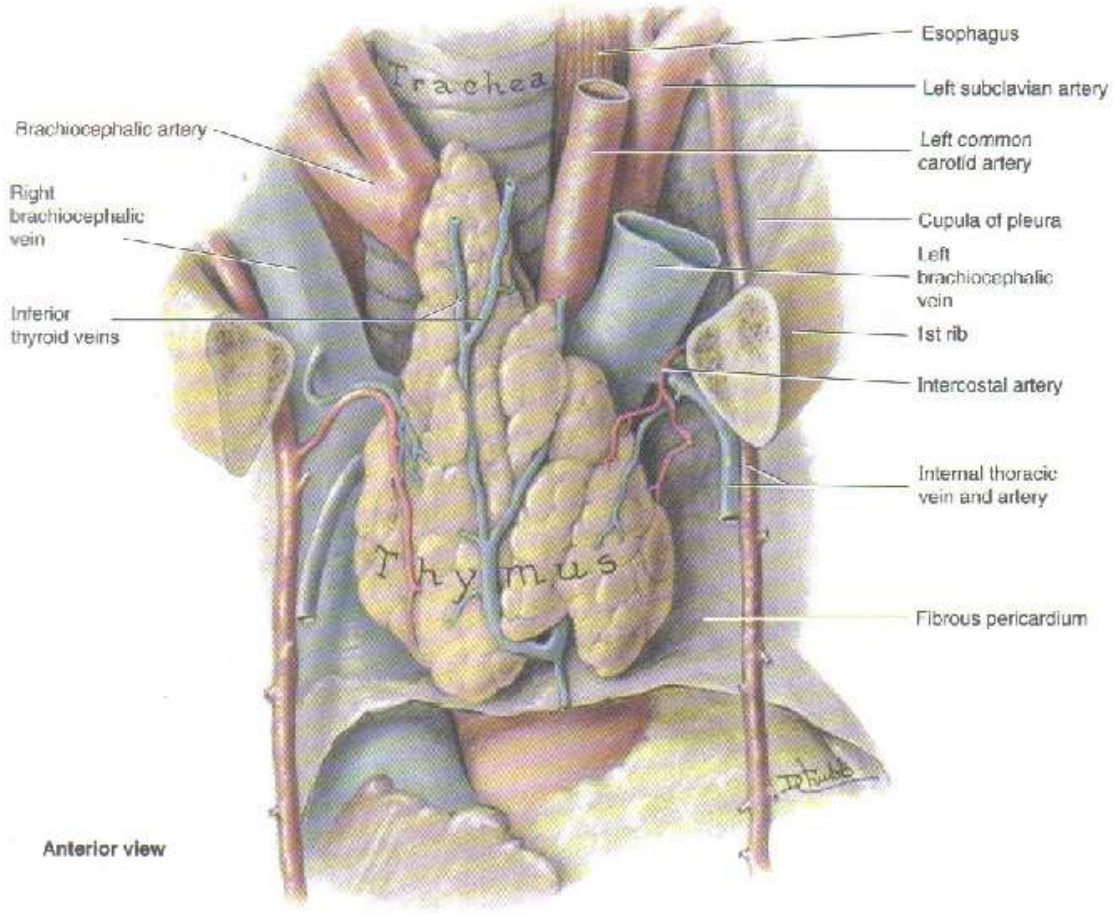


Fig. 882 The thymus of a 2-year-old child, ventral view.

Arterial supply of thymus gland:

1) Inferior thyroid artery
2) Internal thoracic artery
3) Superior thyroid artery (sometimes)



Venous drainage of thymus gland:

1) Left brachiocephalic vein (common)
2) Internal thoracic veins
3) Inferior thyroid veins

Lymphatic drainage of thymus gland:

No afferent lymphatics

Efferent vessels end into following nodes:

1) Brachiocephalic
2) Tracheobronchial
3) Parasternal

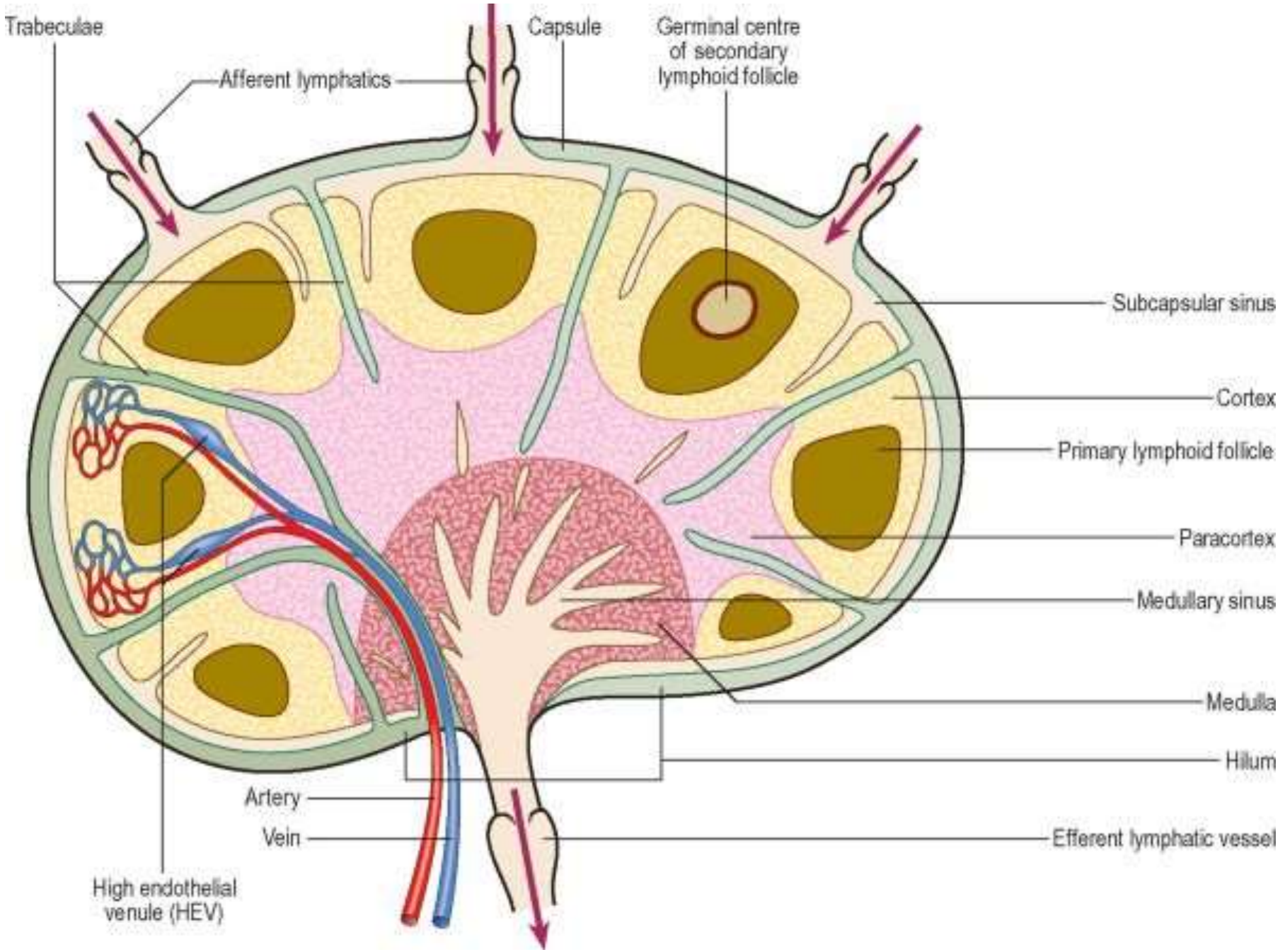
Nerve supply of thymus gland:

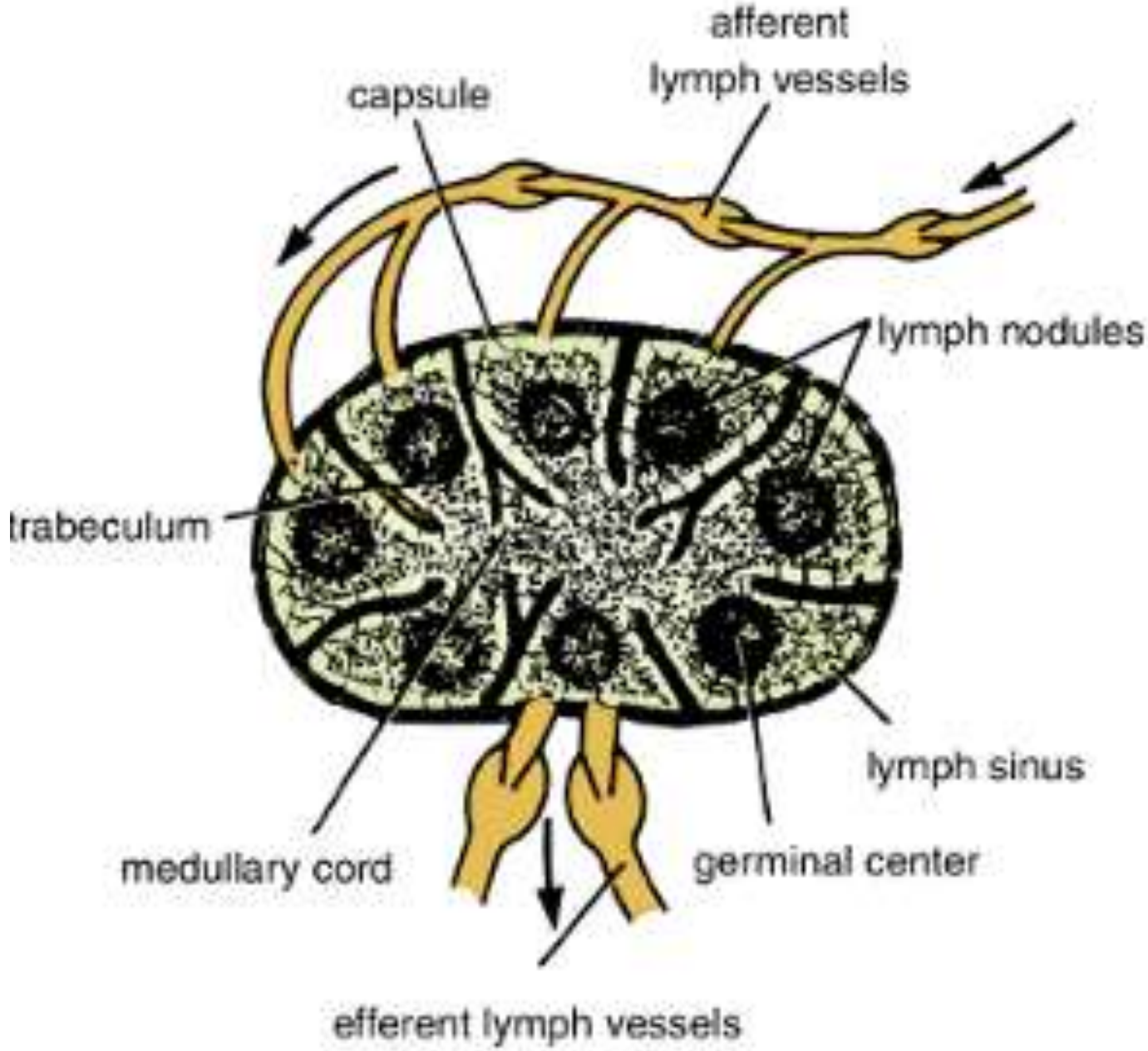
1) Sympathetic chain via cervico-thoracic (stellate) ganglion and vagus nerve (ANS)
2) Branches from phrenic and descending cervical nerves to its capsule (sensory)

LYMPH NODES

Lymph nodes

- Encapsulated centres of antigen presentation and lymphocyte activation, differentiation and proliferation.
- Generate mature, antigen-primed, B and T cells, and filter particles, including microbes, from the lymph by the action of numerous phagocytic macrophages.
- Normal young adult body contains up to 450 lymph nodes, of which 60–70 are found in the head and neck, 100 in the thorax and as many as 250 in the abdomen and pelvis.
- Lymph nodes are particularly numerous in the neck, mediastinum, posterior abdominal wall, abdominal mesenteries, pelvis and proximal regions of the limbs (axillary and inguinal lymph nodes).
- The greatest number lie close to the viscera, especially in mesenteries.


Trabeculae
Afferent lymphatics
Capsule
Germinal centre of secondary lymphoid follicle
Subcapsular sinus
Cortex
Primary lymphoid follicle
Paracortex
Medullary sinus
Medulla
Hilum
Efferent lymphatic vessel
Artery
Vein
High endothelial venule (HEV)

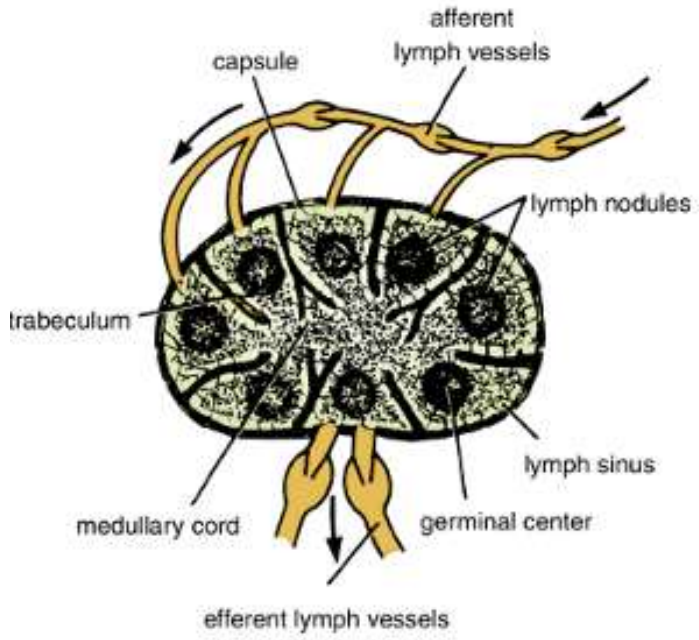

afferent
lymph vessels
capsule
lymph nodules
trabeculum
lymph sinus
medullary cord
germinal center
efferent lymph vessels

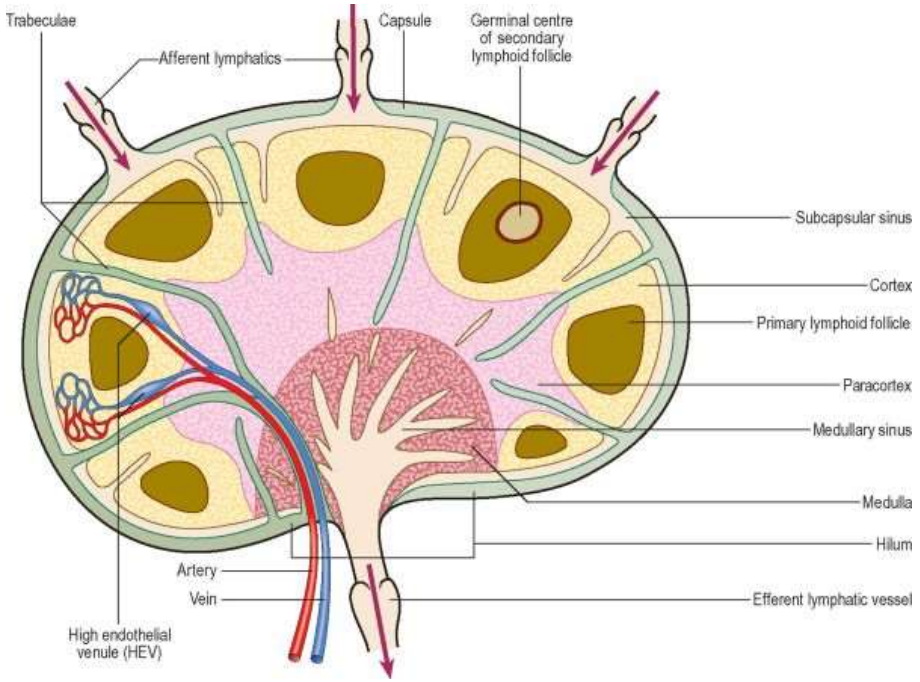
Lymph nodes (Cont.)

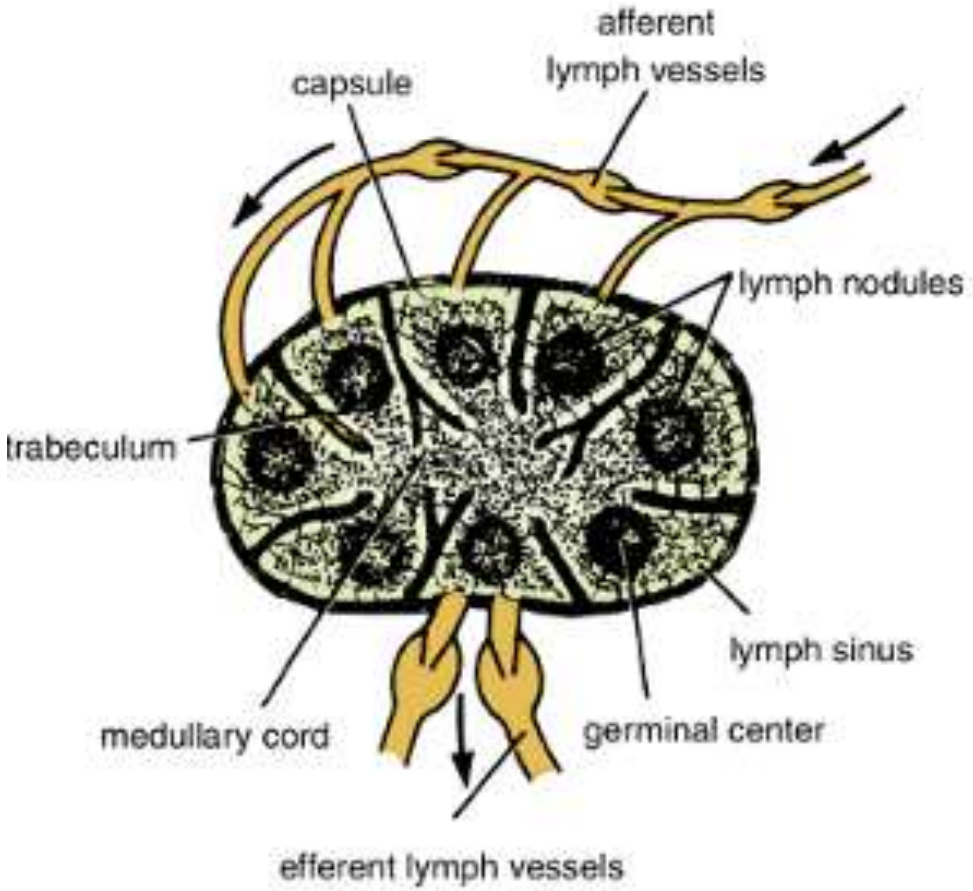
- Small, oval or kidney-shaped bodies, 0.1–2.5 cm long, lying along course of the lymphatic vessels.
- Each usually has a hilum, through which blood vessels enter and leave and efferent lymphatic vessel leaves.
- Several afferent lymphatic vessels enter the capsule around periphery.
- Lymph nodes have a highly cellular cortex and a medulla which contains a network of minute lymphatic channels (sinuses) through which lymph from the afferent lymphatics is filtered, to be collected at the hilum by the efferent lymphatic.
- The cortex is absent at the hilum, where medulla reaches the surface.

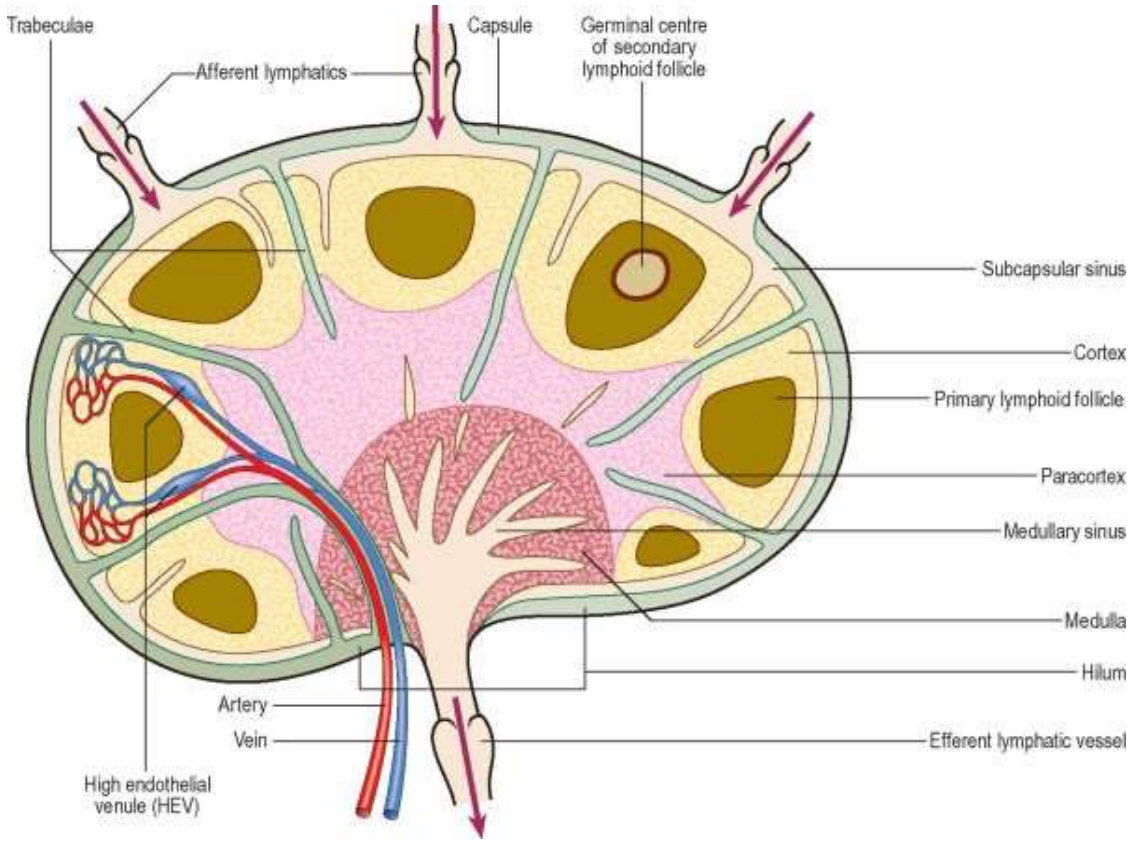
Lymphatic and vascular supply

- The lymph vessels that carry lymph to a lymph node through the cortex are referred to as afferent vessels; those that transport it away from a node through the hilum are efferent vessels.






afferent
lymph vessels
capsule
lymph nodules
trabeculum
lymph sinus
medullary cord
germinal center
efferent lymph vessels


Trabeculae
Afferent lymphatics
Capsule
Germinal centre
of secondary
lymphoid follicle
Subcapsular sinus
Cortex
Primary lymphoid follicle
Paracortex
Medullary sinus
Medulla
Hilum
Efferent lymphatic vessel
Artery
Vein
High endothelial
venule (HEV)

Arteries and veins

- Pass through the hilum, giving off straight branches which traverse the medulla, and sending out minor branches.
- In the cortex, arteries form dense arcades of arterioles and capillaries in numerous anastomosing loops, eventually returning to highly branched venules and veins.
- Veins leave a node through its principal trabeculae and capsule, and drain them and the surrounding connective tissue.

Lymph nodes (Appied):

- May swell as the result of metastases, or primary tumor

- For this reason, lymphatic drainage of all major organs of the body, including the skin, should be known.

THANK YOU