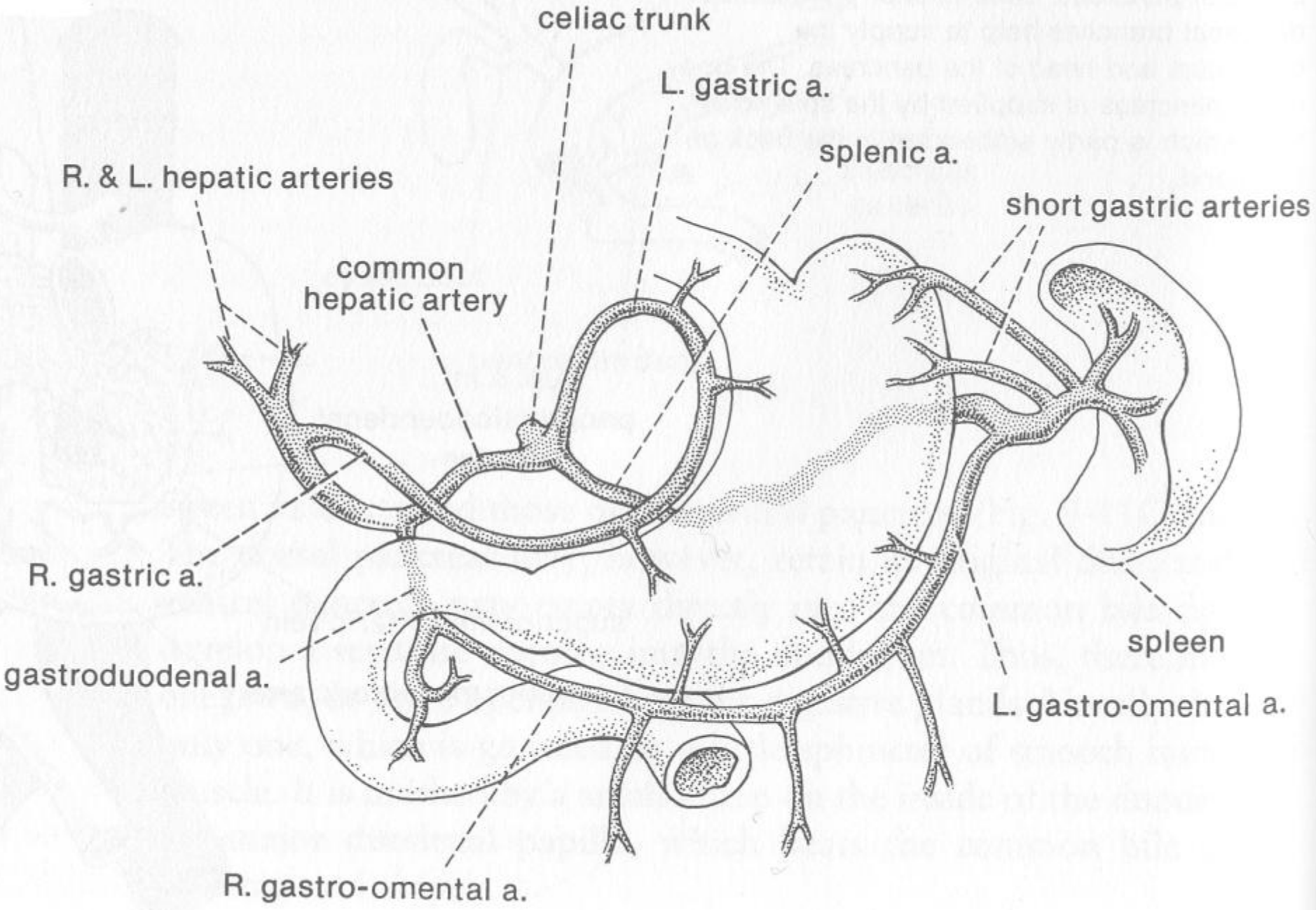
Biology 323
Human Anatomy for Biology Majors
Lecture 11
Dr. Stuart S. Sumida

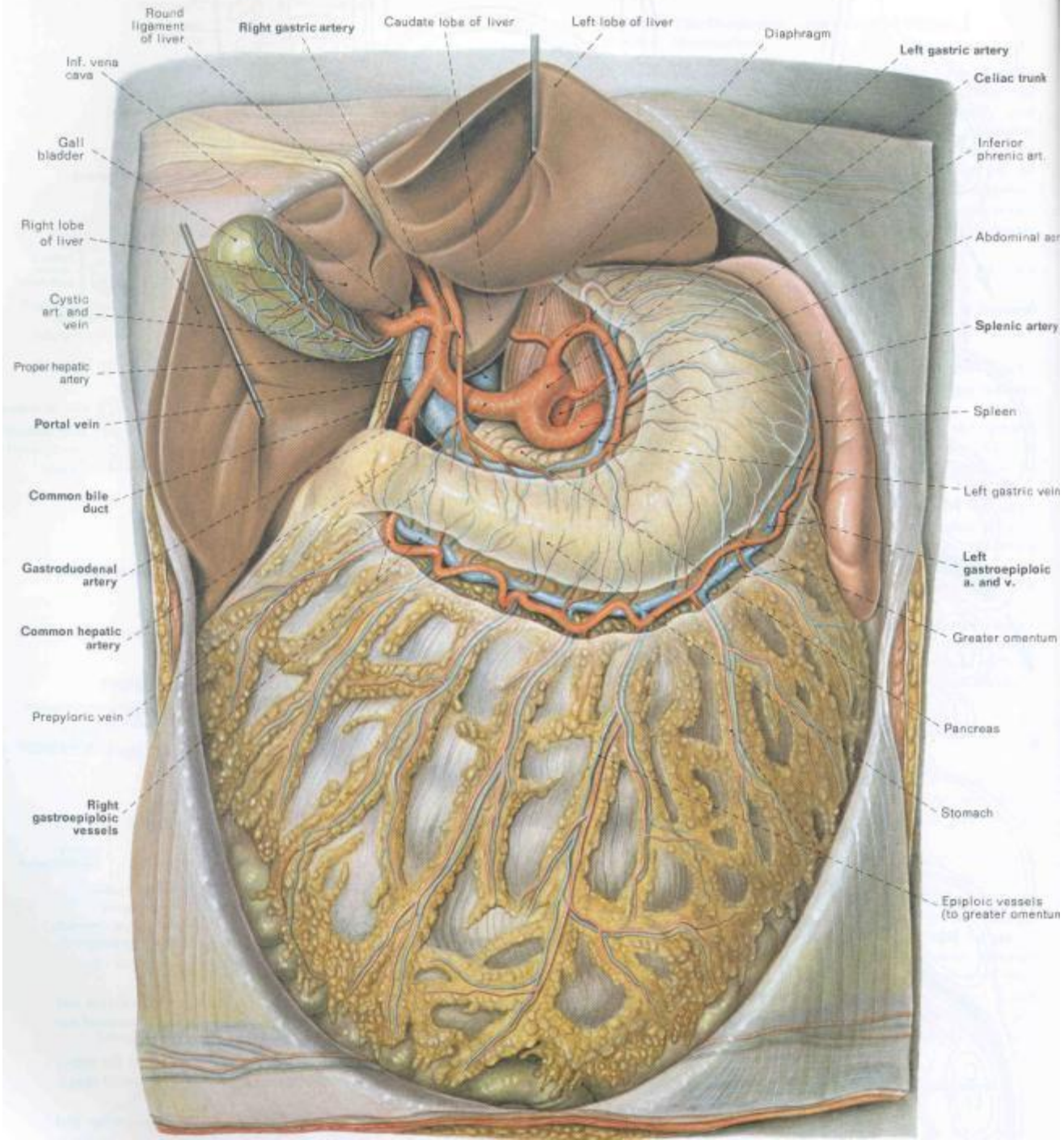
Peripheral Circulation

Structures of the Splanchnopleure: receive unpaired vessels of the abdominal aorta.

Structures of the Somatopleure: receive PAIRED vessels of the abdominal aorta.

Structures of the Splanchnopleure: receive unpaired vessels of the abdominal aorta.


celiac trunk
L. gastric a.
splenic a.
R. & L. hepatic arteries
short gastric arteries
common
hepatic artery
R. gastric a.
spleen
gastroduodenal a.
L. gastro-omental a.
R. gastro-omental a.


Round ligament of liver
Right gastric artery
Caudate lobe of liver
Left lobe of liver
Diaphragm
Left gastric artery
Celiac trunk
Inf. vena cava
Gall bladder
Inferior phrenic art.
Right lobe of liver
Abdominal aor
Cystic art. and vein
Splenic artery
Proper hepatic artery
Spleen
Portal vein
Left gastric vein
Common bile duct
Left gastroepiploic a. and v.
Gastroduodenal artery
Greater omentum
Common hepatic artery
Prepyloric vein
Pancreas
Right gastroepiploic vessels
Stomach
Epiploic vessels (to greater omentum

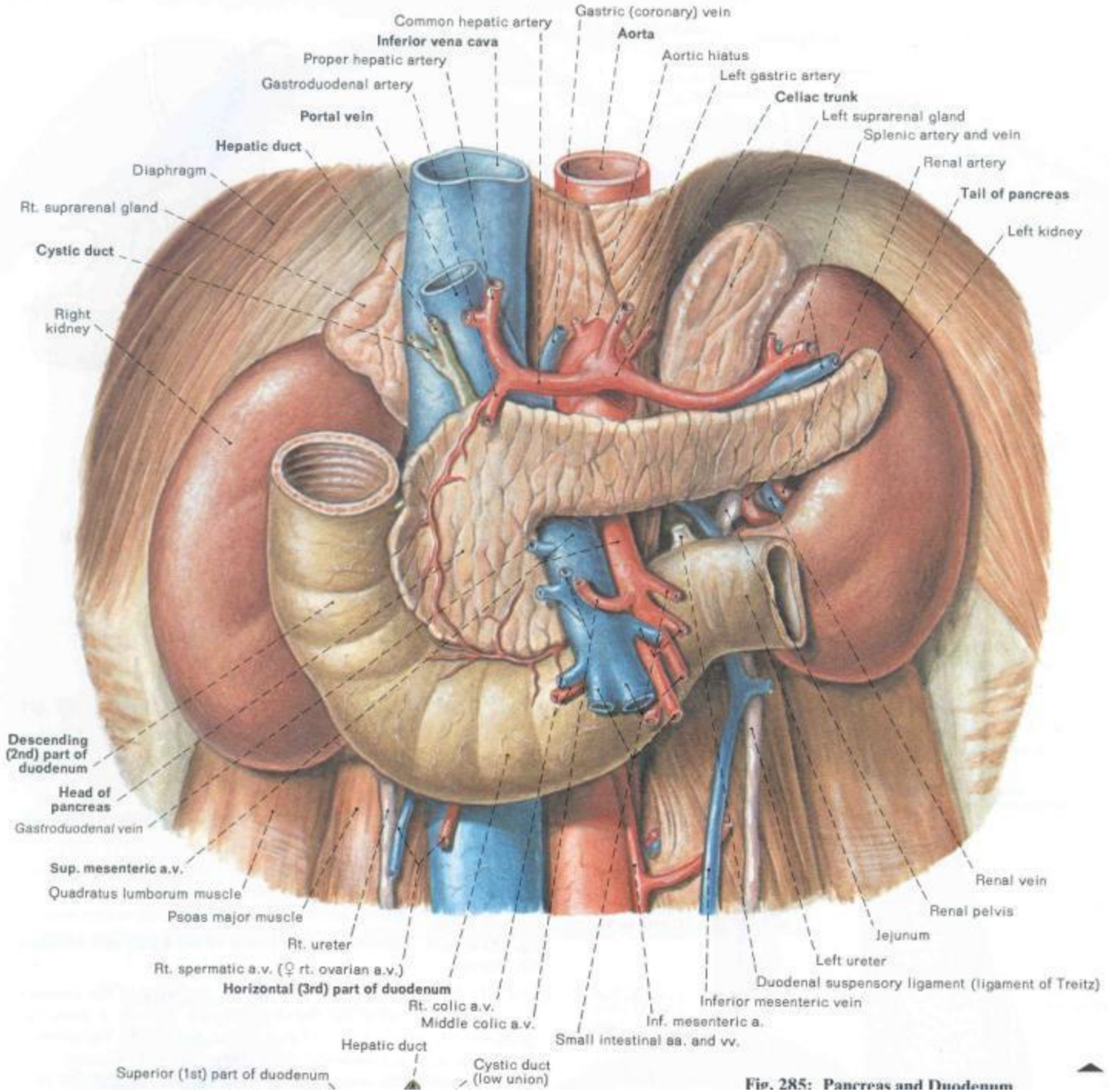
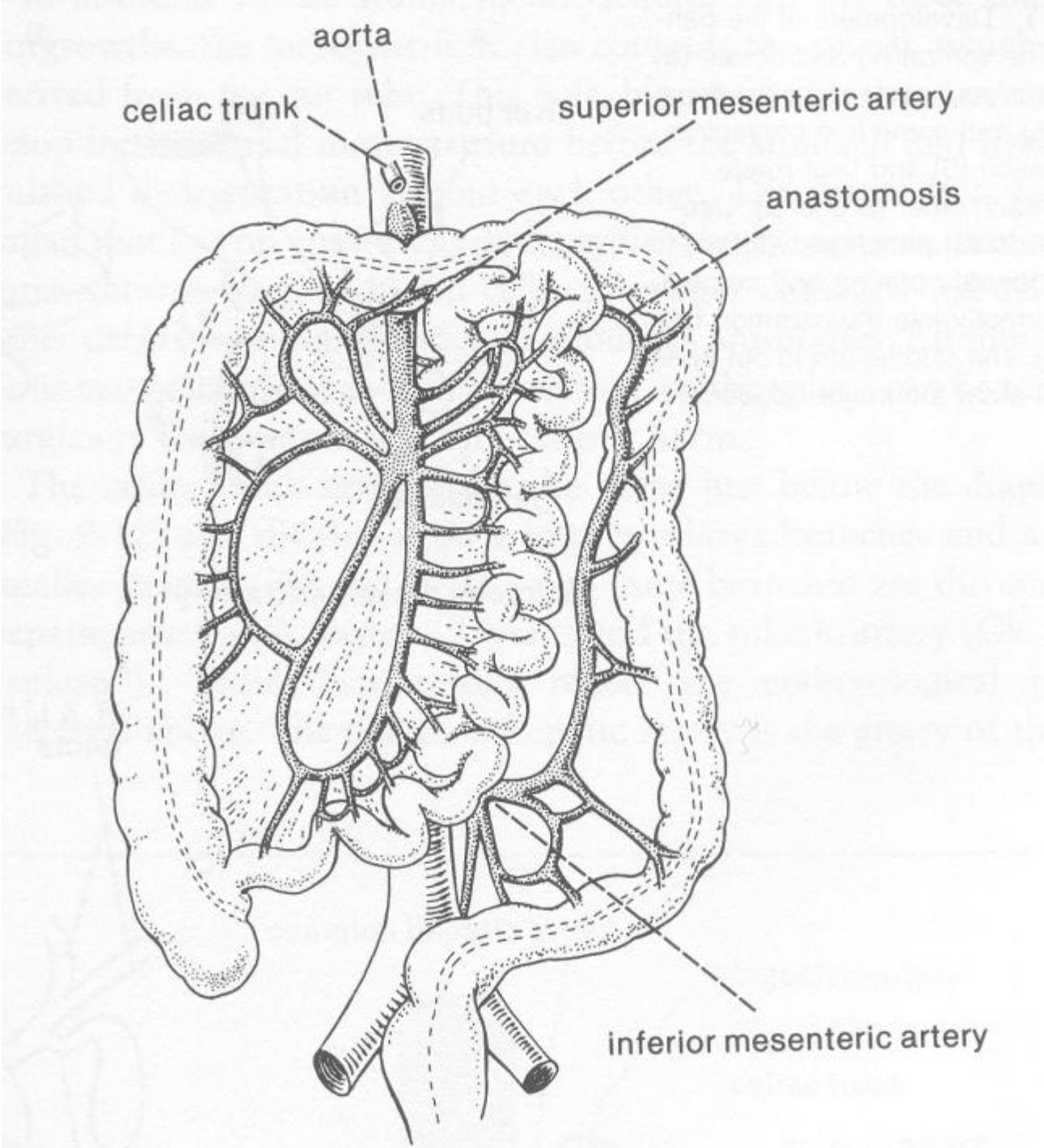
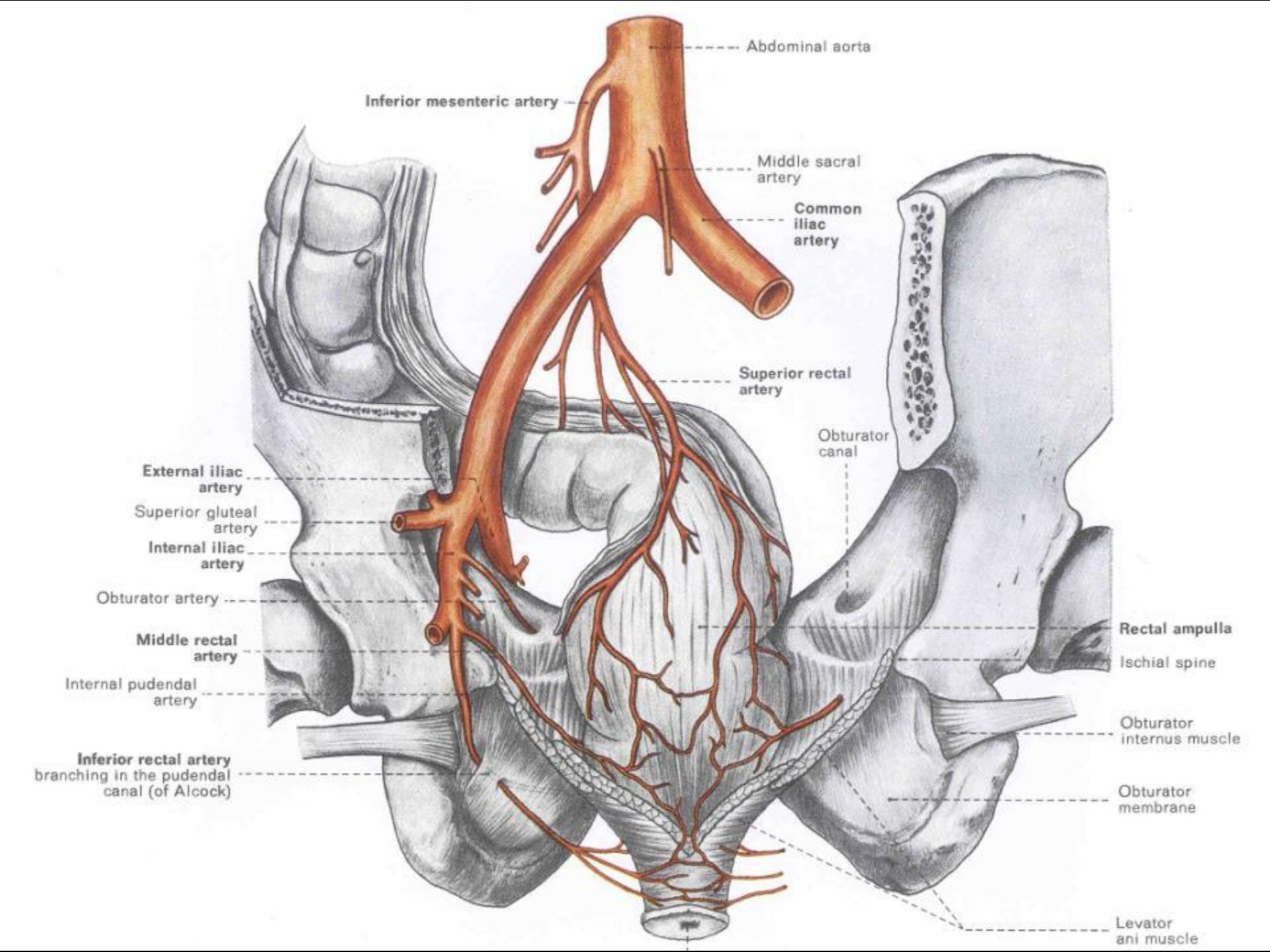
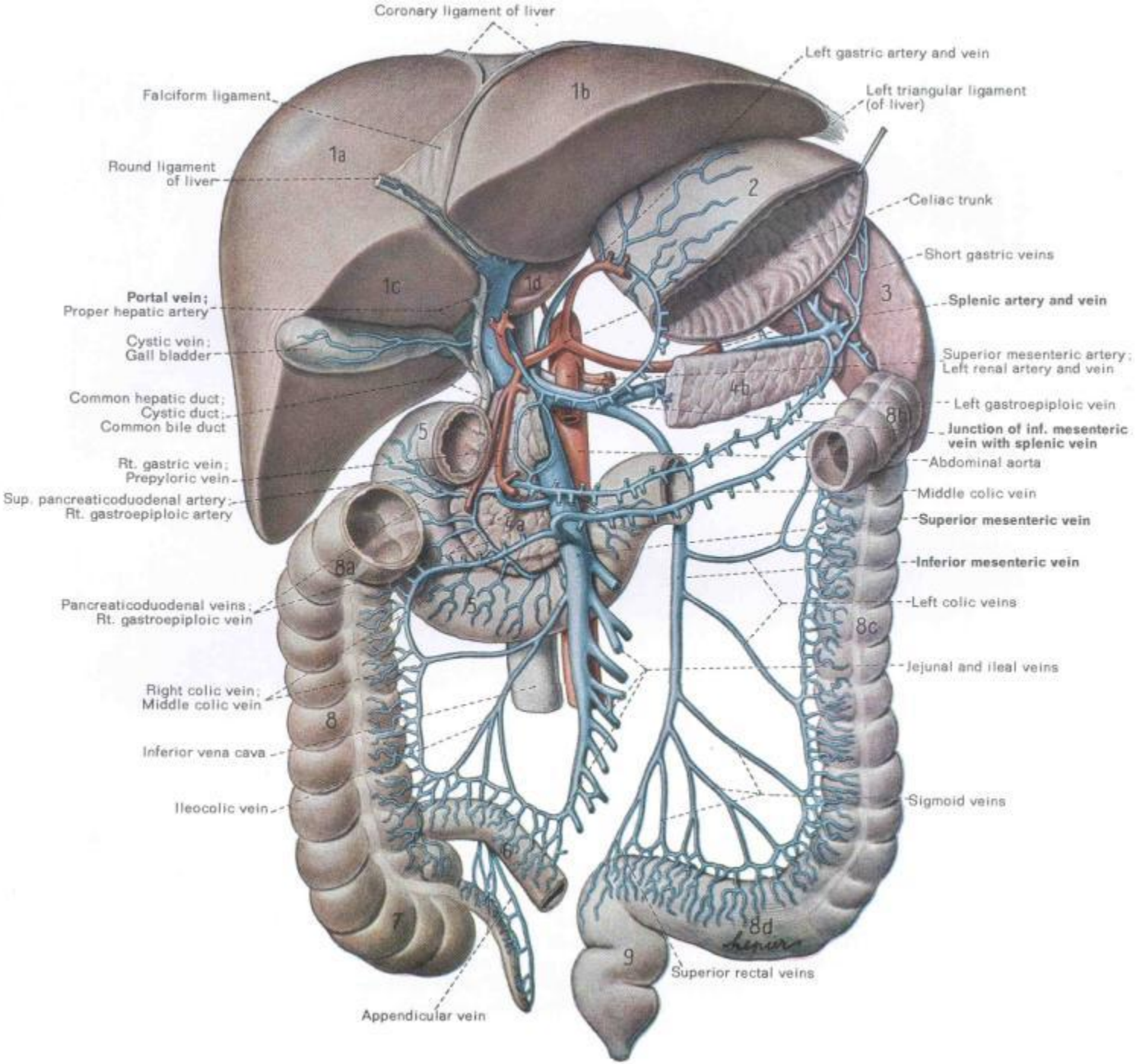


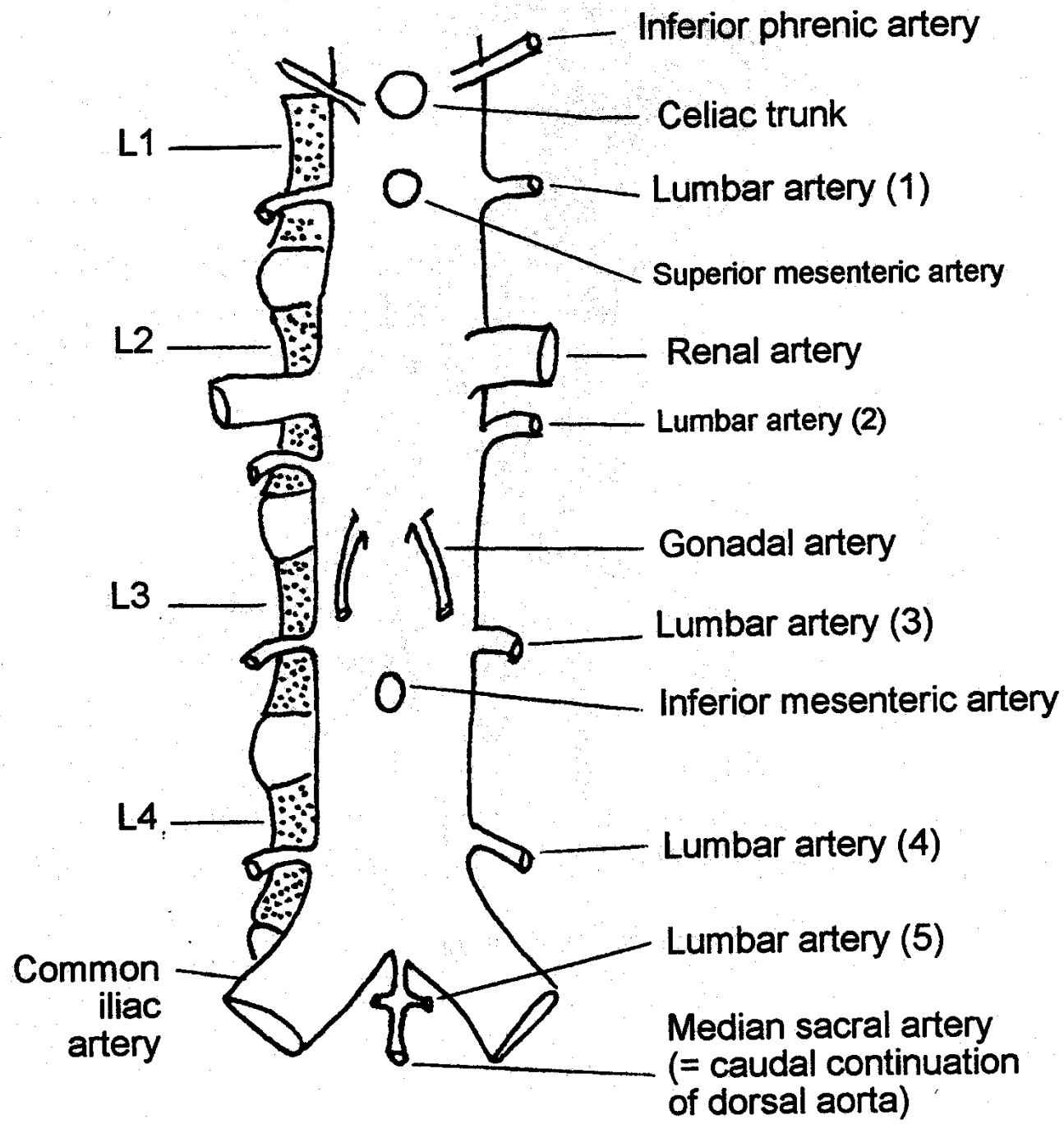
Fig. 285: Pancreas and Duodenum

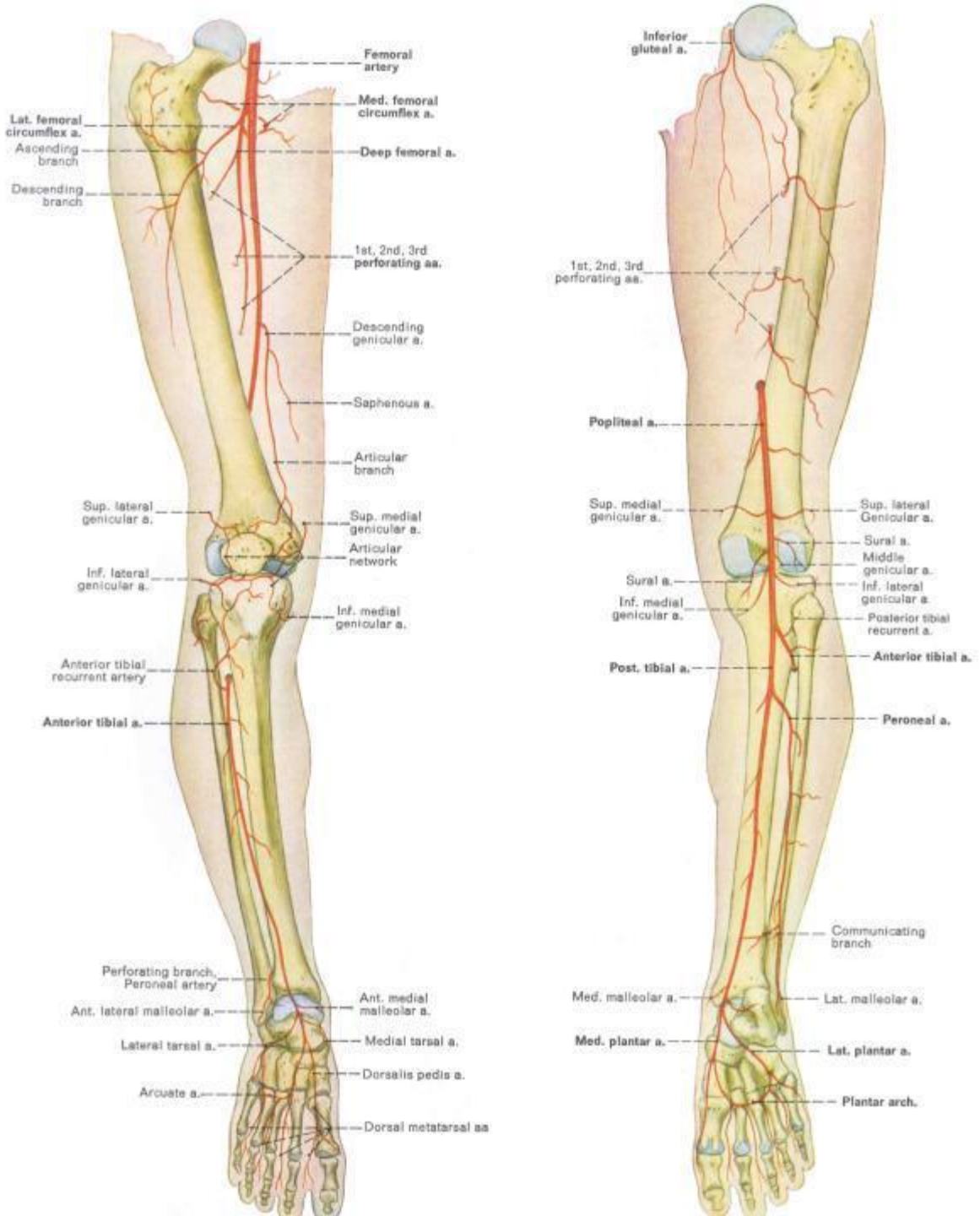

aorta
celiac trunk
superior mesenteric artery
anastomosis
inferior mesenteric artery

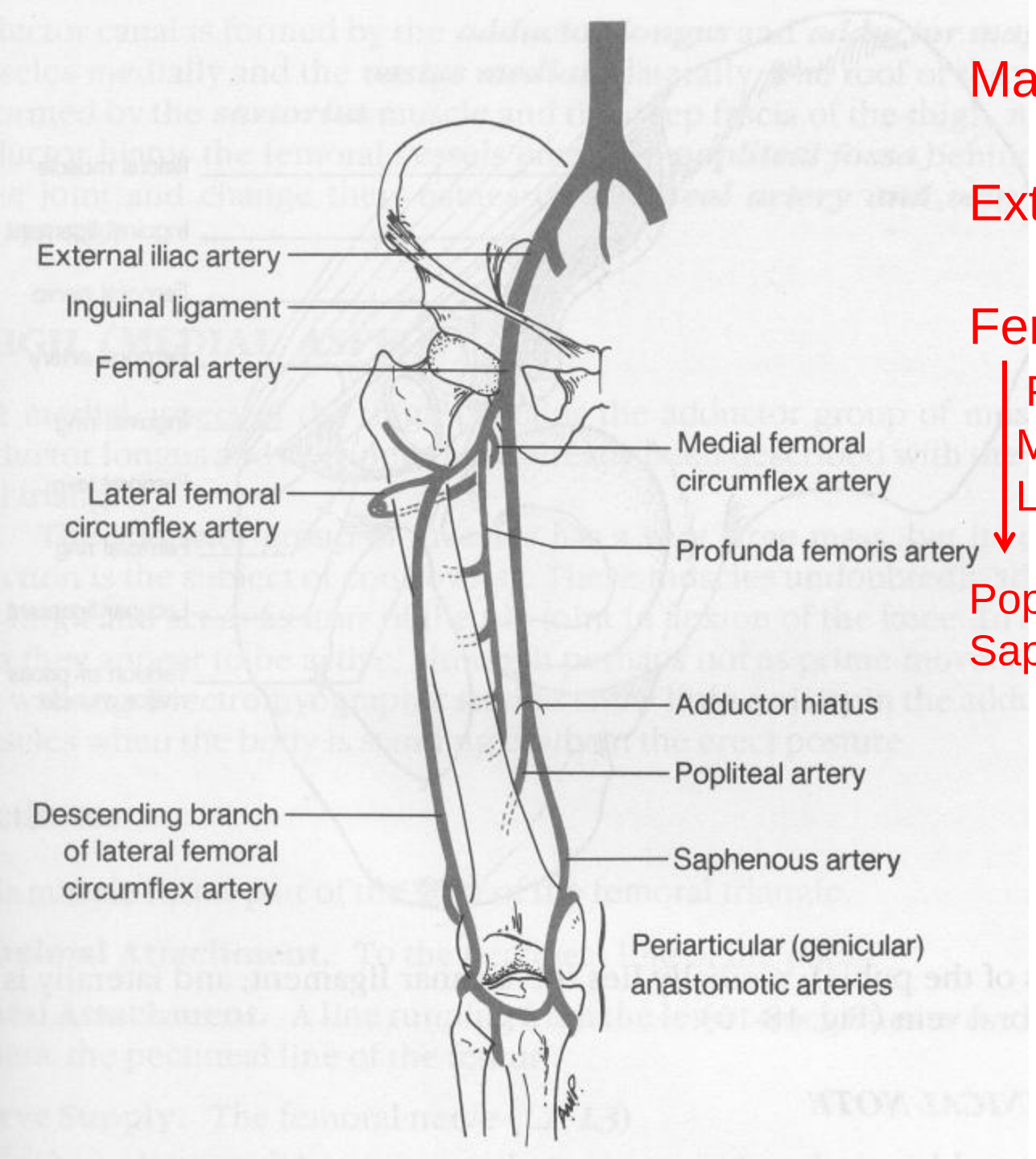

Abdominal aorta
Inferior mesenteric artery
Middle sacral artery
Common iliac artery
Superior rectal artery
Obturator canal
External iliac artery
Superior gluteal artery
Internal iliac artery
Obturator artery
Middle rectal artery
Internal pudendal artery
Inferior rectal artery branching in the pudendal canal (of Alcock)
Rectal ampulla
Ischial spine
Obturator internus muscle
Obturator membrane
Levator ani muscle


Coronary ligament of liver
Left gastric artery and vein
Falciform ligament
1b
Left triangular ligament (of liver)
1a
Round ligament of liver
2
Celiac trunk
Short gastric veins
1c
1d
3
Portal vein;
Proper hepatic artery
Splenic artery and vein
Cystic vein;
Gall bladder
Superior mesenteric artery;
Left renal artery and vein
4b
Common hepatic duct;
Cystic duct;
Common bile duct
Left gastroepiploic vein
8b
5
Junction of inf. mesenteric vein with splenic vein
Rt. gastric vein;
Prepyloric vein
Abdominal aorta
Sup. pancreaticoduodenal artery;
Rt. gastroepiploic artery
Middle colic vein
Superior mesenteric vein
4a
8a
Inferior mesenteric vein
Pancreaticoduodenal veins;
Rt. gastroepiploic vein
Left colic veins
8c
Jejunal and ileal veins
Right colic vein;
Middle colic vein
8
Inferior vena cava
Ileocolic vein
Sigmoid veins
8d
9
Superior rectal veins
Appendicular vein

Structures of the Somatopleure: receive paired vessels of the aorta.


Inferior phrenic artery
Celiac trunk
L1
Lumbar artery (1)
Superior mesenteric artery
L2
Renal artery
Lumbar artery (2)
Gonadal artery
L3
Lumbar artery (3)
Inferior mesenteric artery
L4
Lumbar artery (4)
Lumbar artery (5)
Common iliac artery
Median sacral artery (= caudal continuation of dorsal aorta)


Femoral artery
Med. femoral circumflex a.
Lat. femoral circumflex a.
Ascending branch
Deep femoral a.
Descending branch
1st, 2nd, 3rd perforating aa.
Descending genicular a.
Saphenous a.
Articular branch
Sup. lateral genicular a.
Sup. medial genicular a.
Articular network
Inf. lateral genicular a.
Inf. medial genicular a.
Anterior tibial recurrent artery
Anterior tibial a.
Perforating branch, Peroneal artery
Ant. lateral malleolar a.
Ant. medial malleolar a.
Lateral tarsal a.
Medial tarsal a.
Arcuate a.
Dorsalis pedis a.
Dorsal metatarsal aa
Inferior gluteal a.
1st, 2nd, 3rd perforating aa.
Popliteal a.
Sup. medial genicular a.
Sup. lateral Genicular a.
Sural a.
Middle genicular a.
Sural a.
Inf. lateral genicular a.
Inf. medial genicular a.
Posterior tibial recurrent a.
Anterior tibial a.
Post. tibial a.
Peroneal a.
Communicating branch
Med. malleolar a.
Lat. malleolar a.
Med. plantar a.
Lat. plantar a.
Plantar arch.



Major Arteries of Leg:

External Iliac Artery

↓

Femoral Artery

Profunda femoris

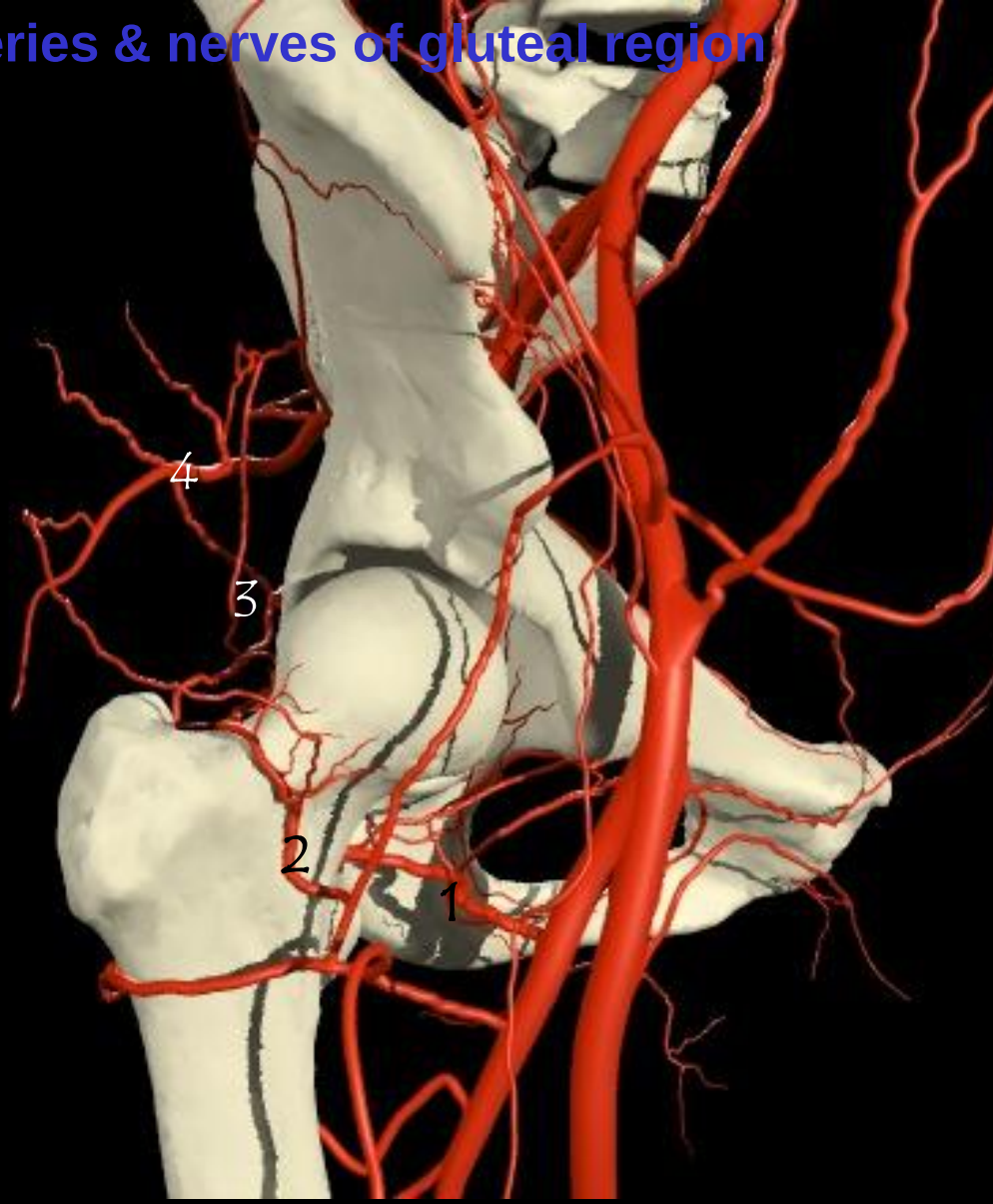
Medial femoral circumflex

Lateral femoral circumflex

Popliteal and Saphenous AA.

Descending branch lateral femoral circumflex

Arteries & nerves of gluteal region



Trochanteric Anastomosis

anastomotic ring of arteries found in the trochanteric fossa and around the neck of the femur.

Formed by the union of branches from:

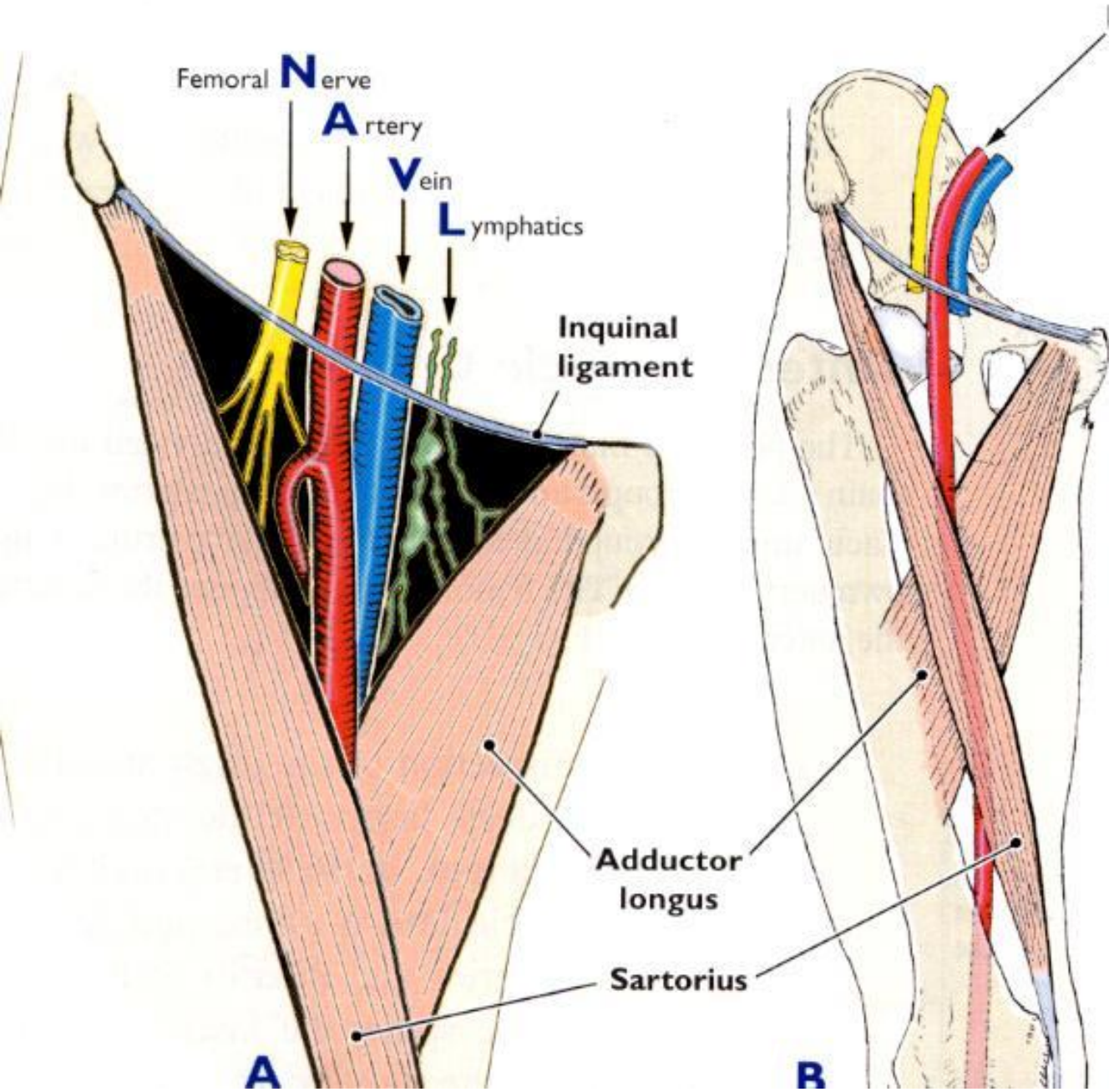
1) medial circumflex femoral artery.

2) ascending branch of the lateral circumflex femoral artery.

3) inferior gluteal artery.

4) superior gluteal artery.

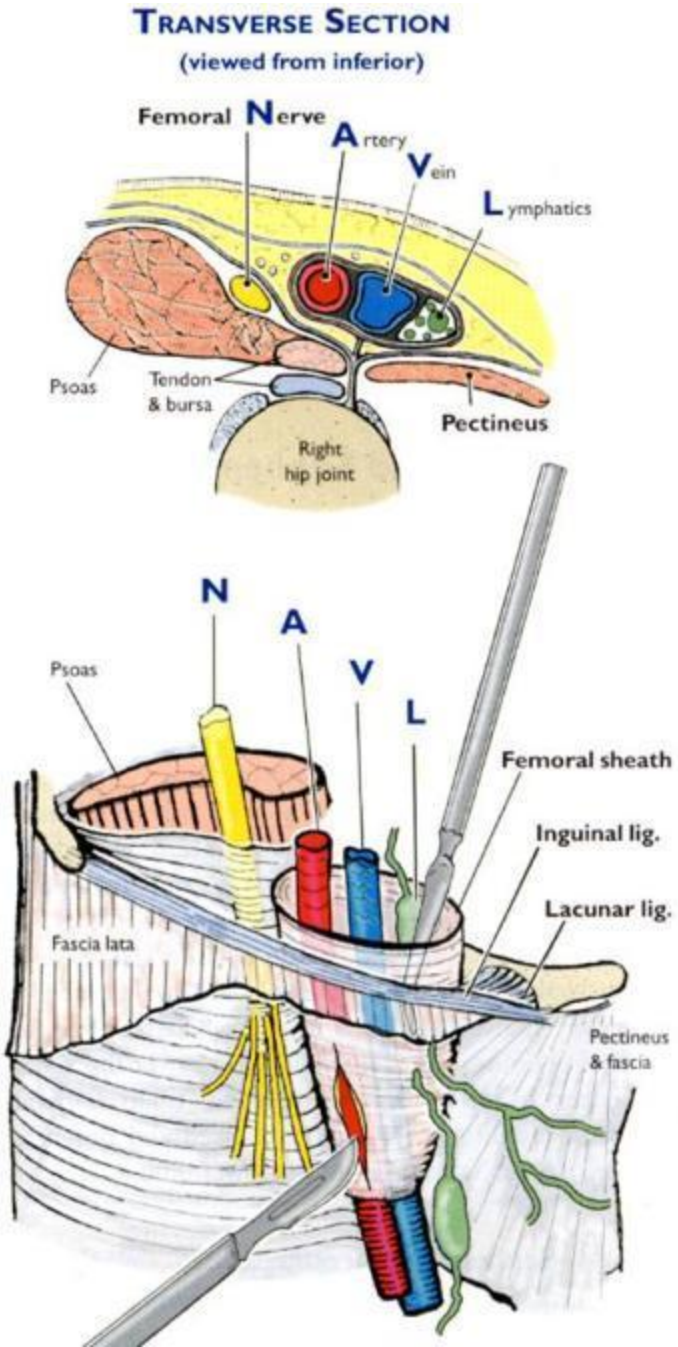
Femoral triangle / RELATIONS



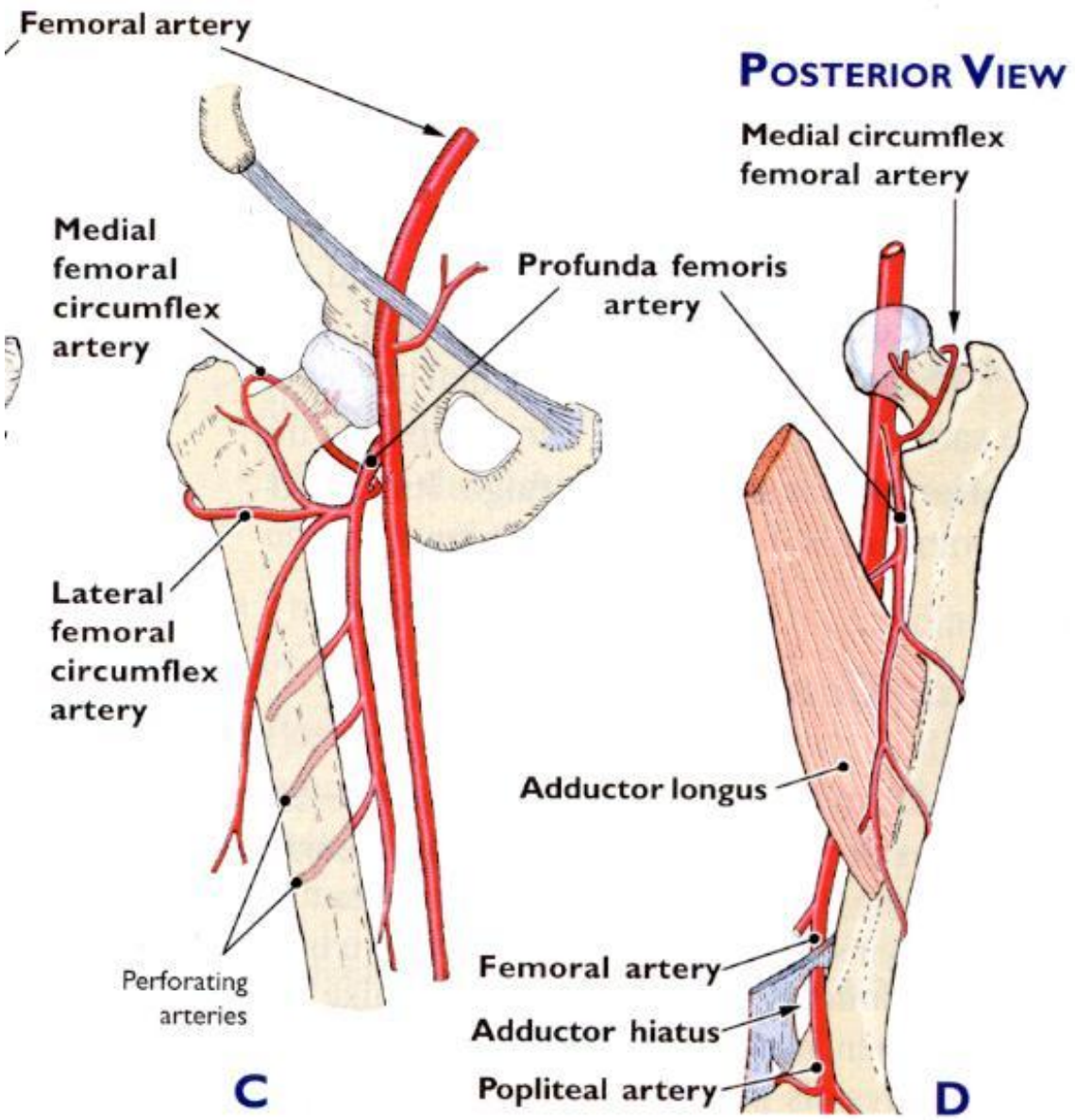
Deep contents

- *Femoral a. & v.* surrounded by *femoral sheath*
- *Profunda femoris a.* – principal artery of thigh
- *Lat and med. femoral circumflex aa.*
- *Deep external pudendal a.*
- *Femoral n.*
- A few deeper lymph nodes --

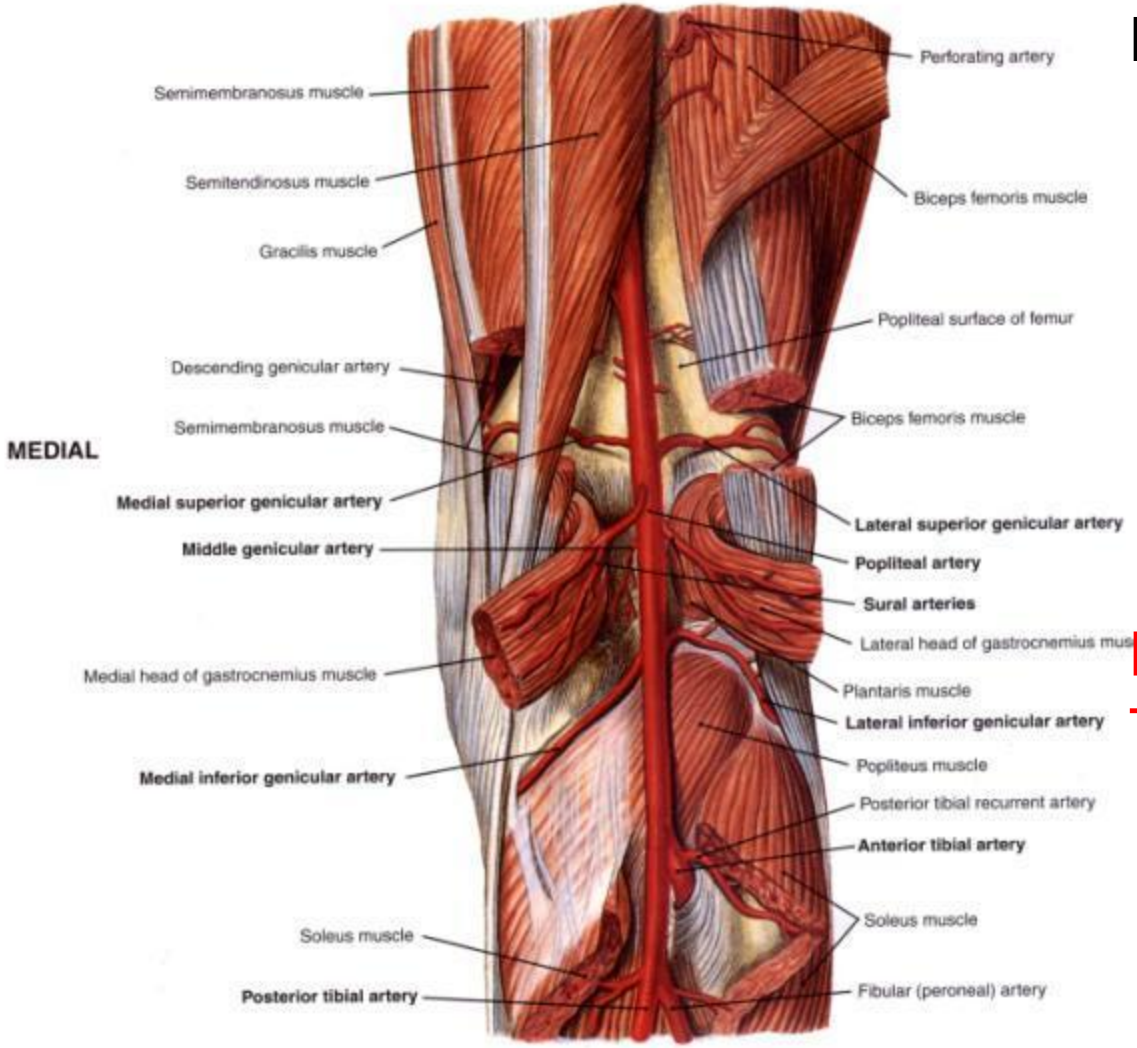
Femoral triangle / RELATIONS



Femoral triangle / PRINCIPAL VASCULATURE OF THIGH



Region of Popliteal Fossa



Femoral

↓

Popliteal

Posterior Tibial A.

Anterior Tibial A.

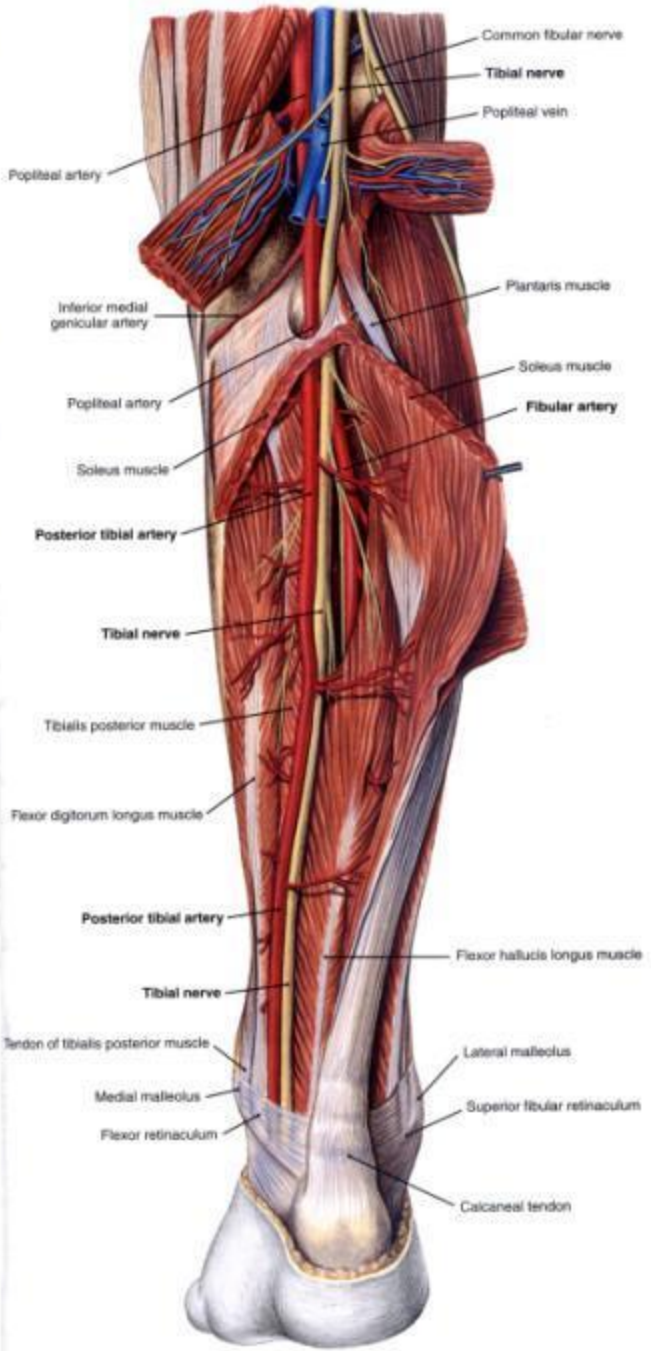
Peroneal A.

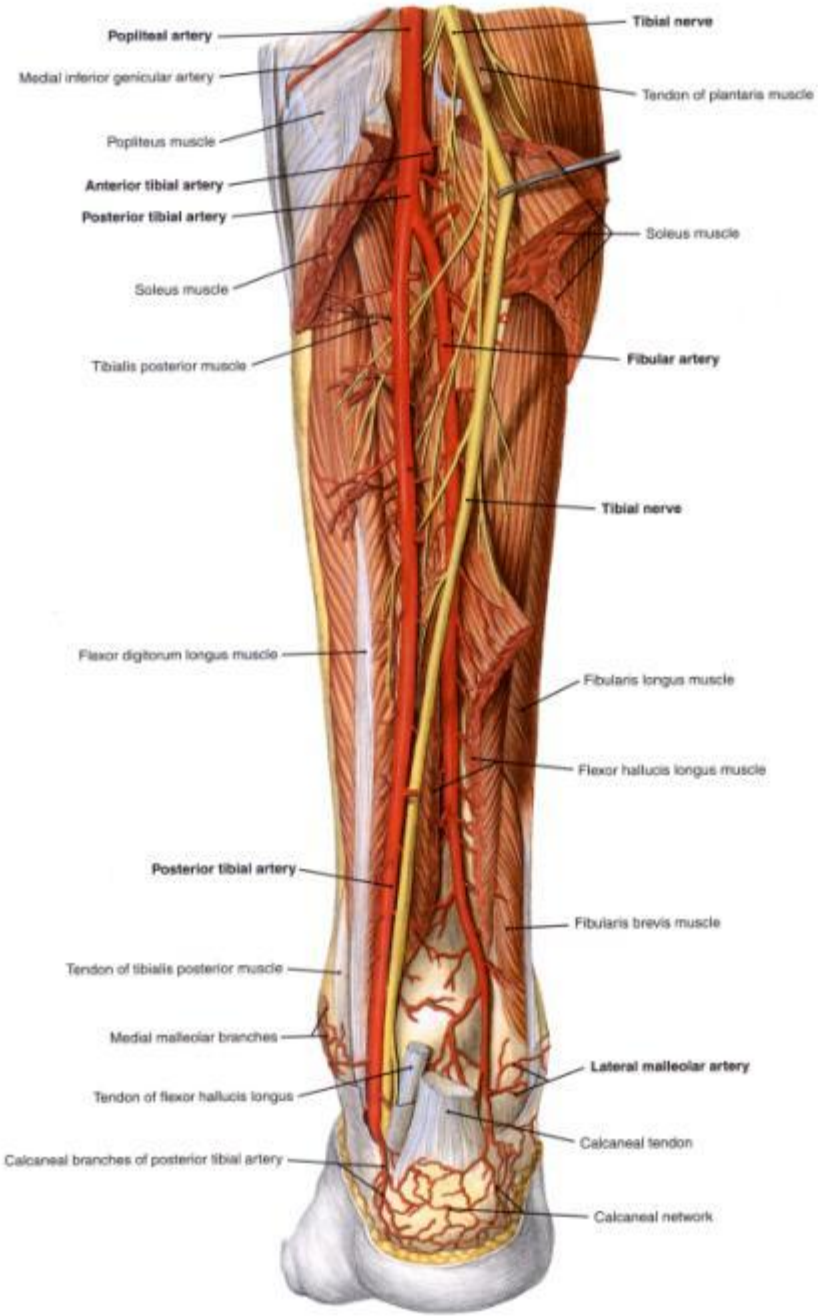
<u>Anastomosing branches of Popliteal Artery:</u>

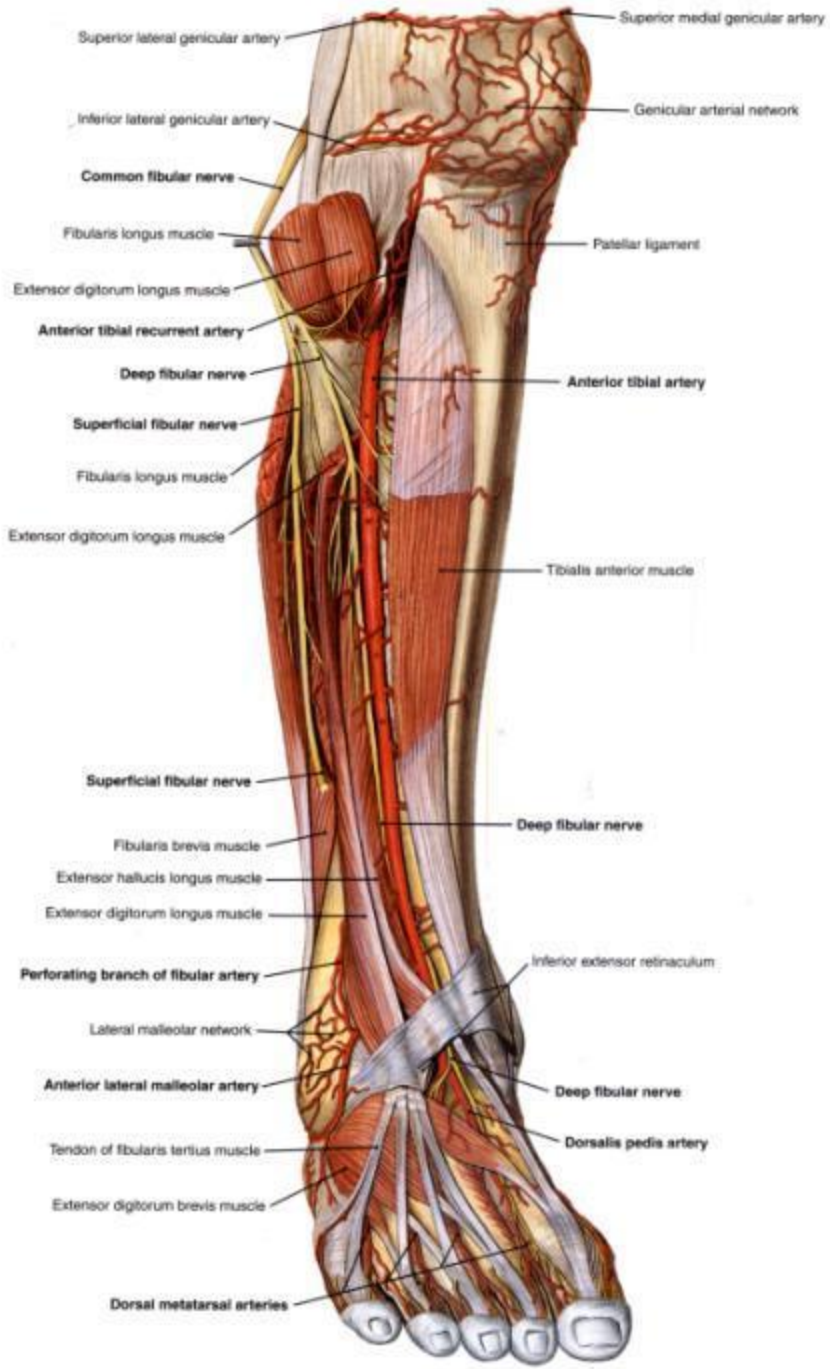
Medial and lateral superior geniculate aa.

Medial and lateral sural aa.

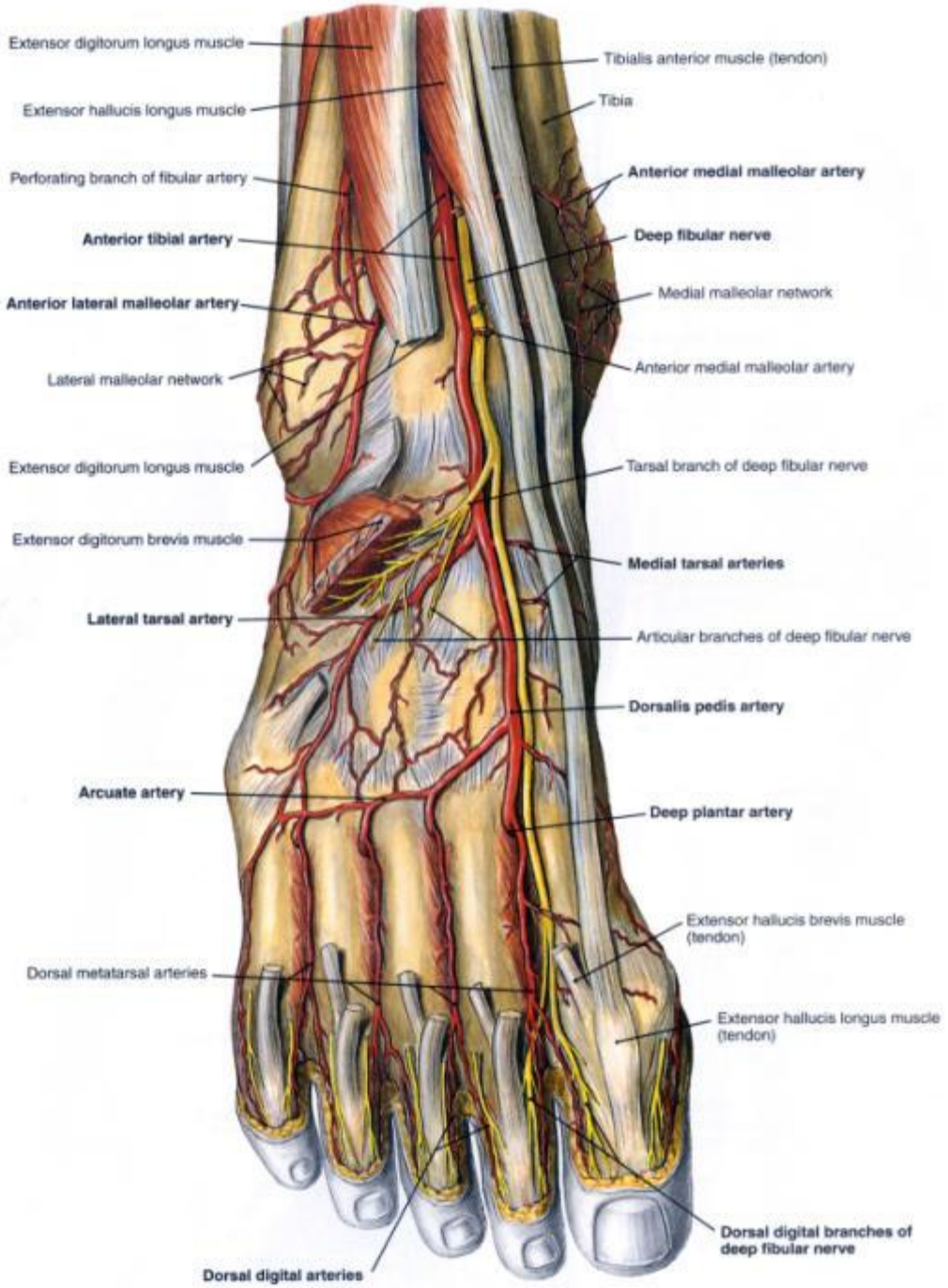
Medial and lateral inferior geniculate aa.


Common fibular nerve
Tibial nerve
Popliteal vein
Popliteal artery
Plantaris muscle
Inferior medial genicular artery
Soleus muscle
Popliteal artery
Fibular artery
Soleus muscle
Posterior tibial artery
Tibial nerve
Tibialis posterior muscle
Flexor digitorum longus muscle
Posterior tibial artery
Flexor hallucis longus muscle
Tibial nerve
Tendon of tibialis posterior muscle
Lateral malleolus
Medial malleolus
Superior fibular retinaculum
Flexor retinaculum
Calcaneal tendon


Popliteal artery
Tibial nerve
Medial inferior genicular artery
Tendon of plantaris muscle
Popliteus muscle
Anterior tibial artery
Posterior tibial artery
Soleus muscle
Soleus muscle
Tibialis posterior muscle
Fibular artery
Tibial nerve
Flexor digitorum longus muscle
Fibularis longus muscle
Flexor hallucis longus muscle
Posterior tibial artery
Fibularis brevis muscle
Tendon of tibialis posterior muscle
Medial malleolar branches
Lateral malleolar artery
Tendon of flexor hallucis longus
Calcaneal tendon
Calcaneal branches of posterior tibial artery
Calcaneal network



Tibialis Anterior Artery running in anterior compartment next to tibialis anterior muscle.



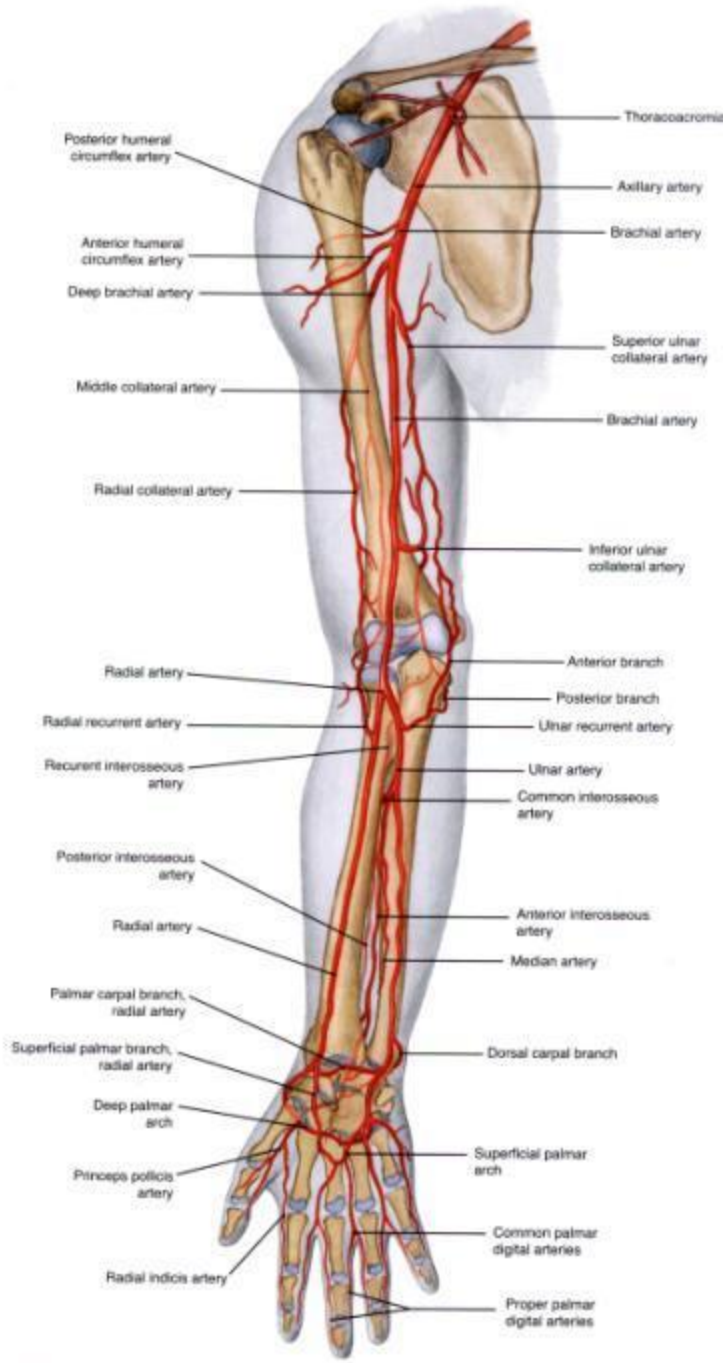
Anterior Tibial Artery

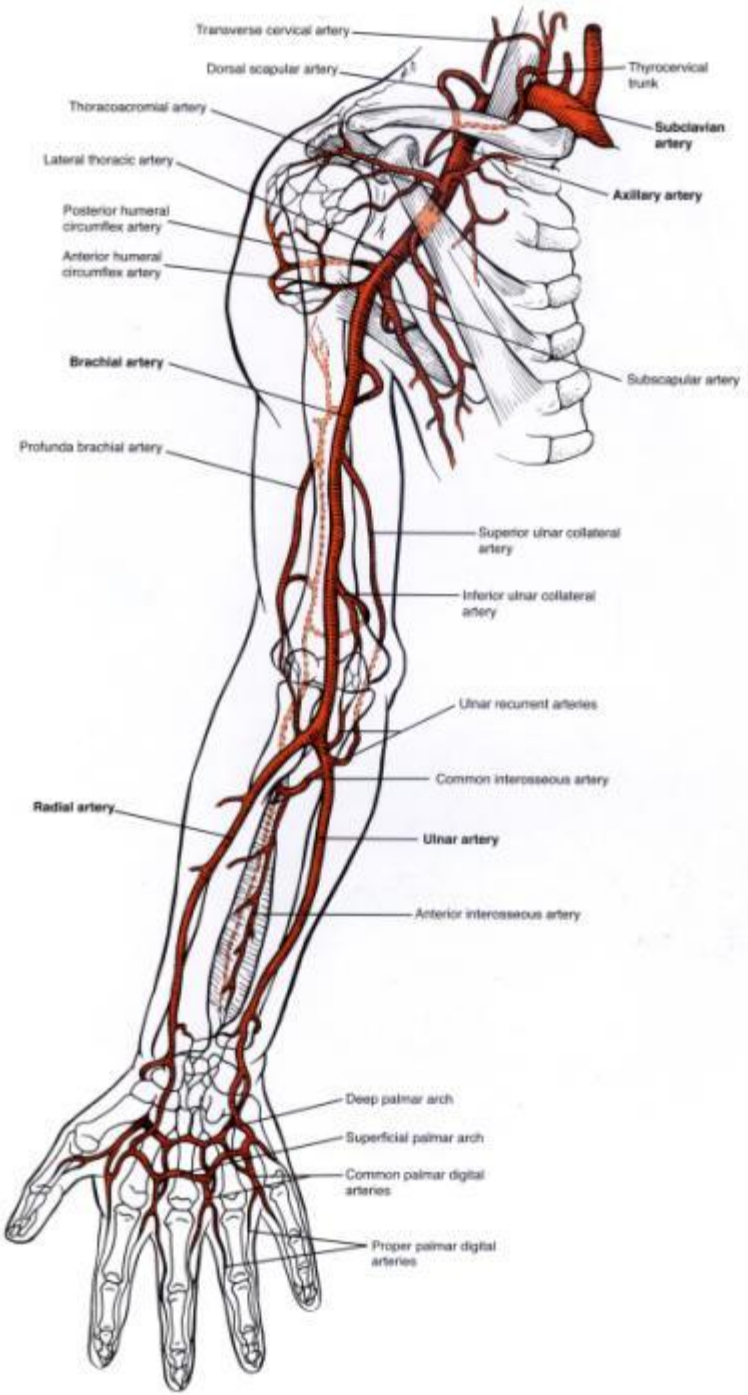
↓

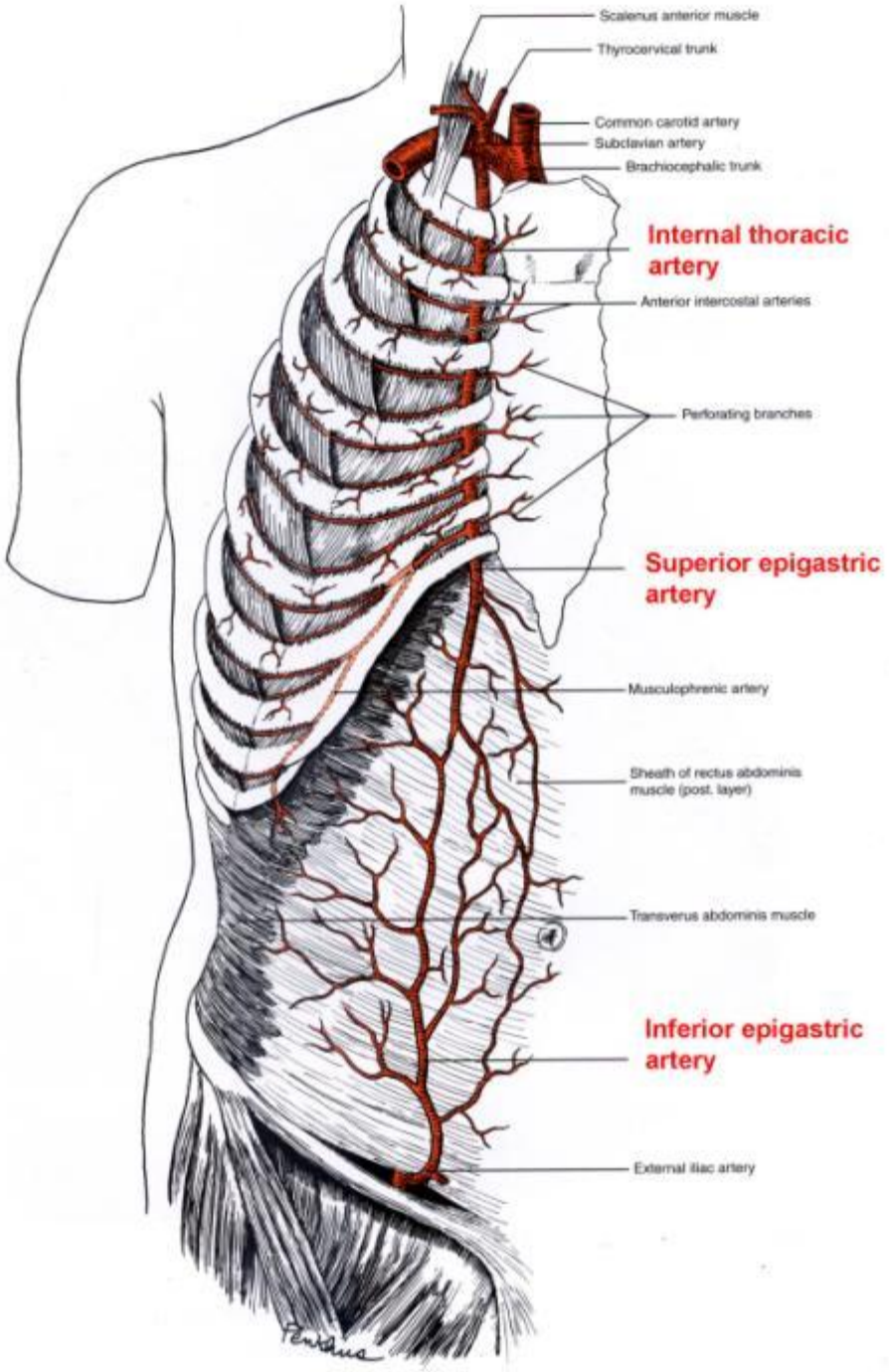
Dorsalis pedis artery

↓

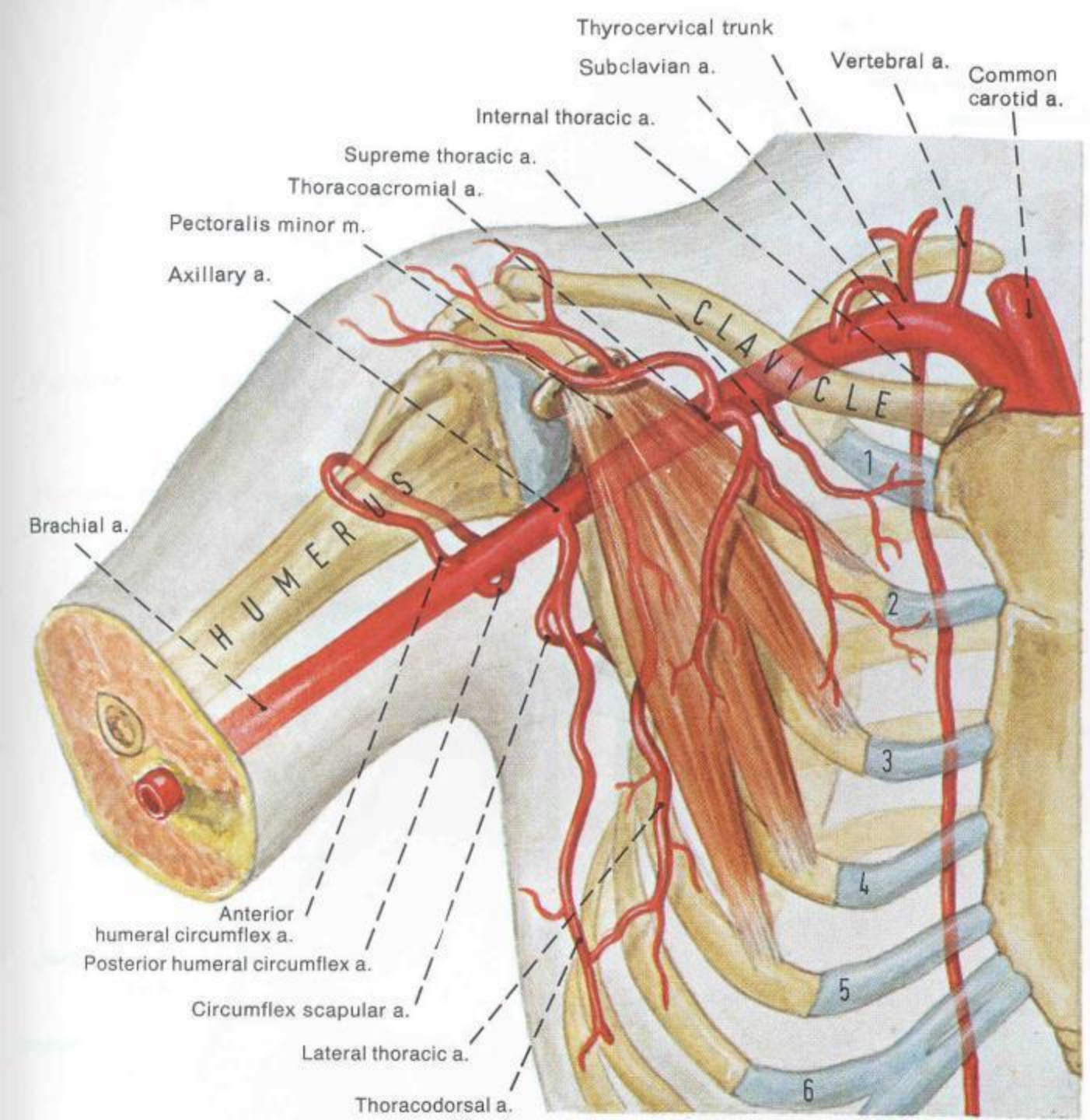
Deep plantar artery


Thoracoacromial
Posterior humeral circumflex artery
Axillary artery
Brachial artery
Anterior humeral circumflex artery
Deep brachial artery
Superior ulnar collateral artery
Middle collateral artery
Brachial artery
Radial collateral artery
Inferior ulnar collateral artery
Radial artery
Anterior branch
Posterior branch
Radial recurrent artery
Ulnar recurrent artery
Recurent interosseous artery
Ulnar artery
Common interosseous artery
Posterior interosseous artery
Anterior interosseous artery
Radial artery
Median artery
Palmar carpal branch, radial artery
Superficial palmar branch, radial artery
Dorsal carpal branch
Deep palmar arch
Superficial palmar arch
Princeps pollicis artery
Common palmar digital arteries
Radial indicis artery
Proper palmar digital arteries


Transverse cervical artery
Dorsal scapular artery
Thyrocervical trunk
Thoracoacromial artery
Subclavian artery
Lateral thoracic artery
Axillary artery
Posterior humeral circumflex artery
Anterior humeral circumflex artery
Brachial artery
Subscapular artery
Profunda brachial artery
Superior ulnar collateral artery
Inferior ulnar collateral artery
Ulnar recurrent arteries
Common interosseous artery
Radial artery
Ulnar artery
Anterior interosseous artery
Deep palmar arch
Superficial palmar arch
Common palmar digital arteries
Proper palmar digital arteries



Anastomosis of Internal Thoracic Artery with External Iliac Artery



Sublcavian AA. pass into each arm, becomin Axillary A. past clavicle.

Subclavian <u>Branches:</u>

Vertebral A.

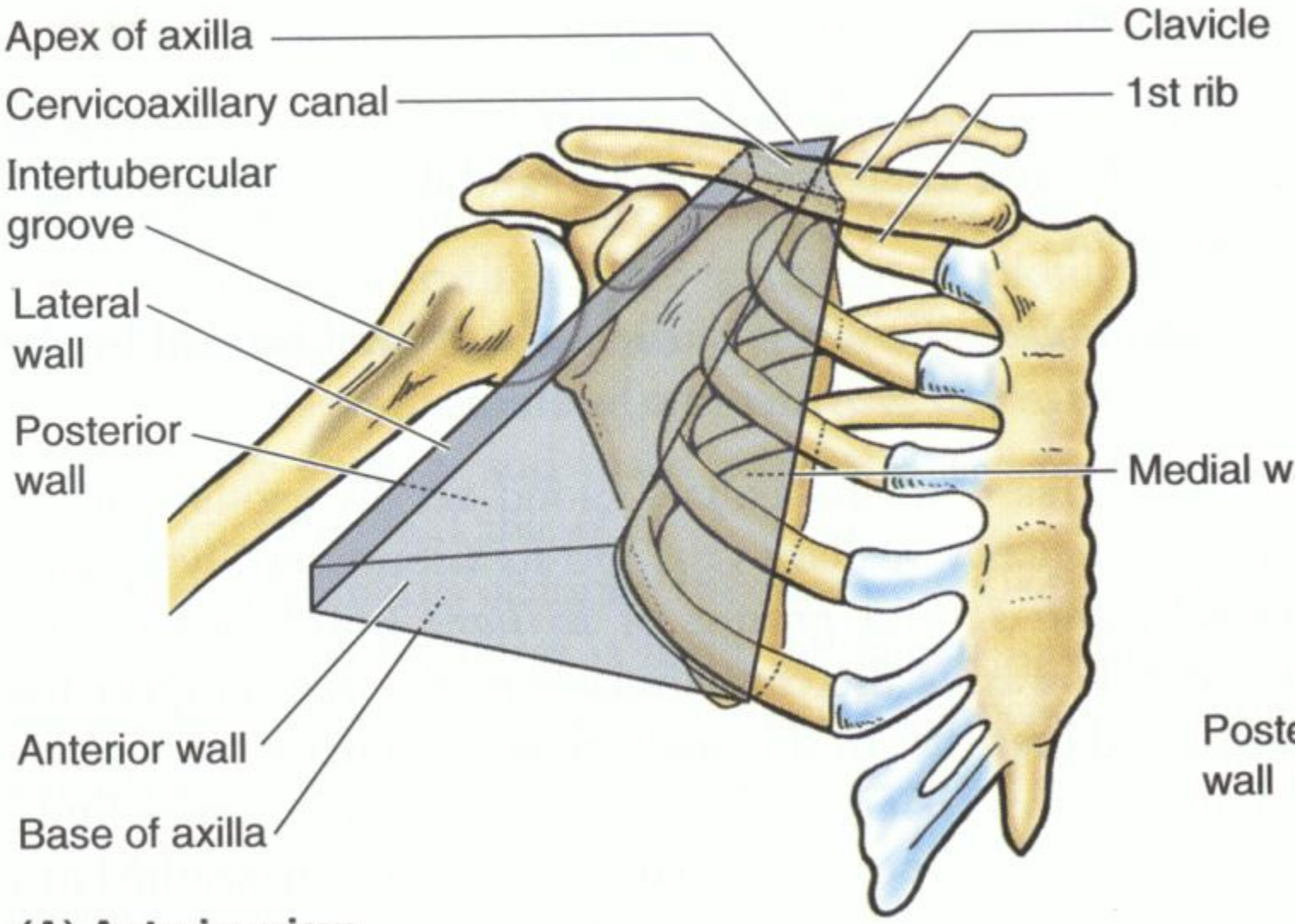
Internal Thoracic A.

Thyrocervical trunk

What is the Axilla?

- A region (the axillary space) associated with the armpit.
- It actually begins around the cervicoaxillary canal, at the edge of the first rib.
- It continues to the armpit, with the bottom being the axillary fascia. (remember? The lower attachment of the clavipectoral membrane?)
- It has musculoskeletal boundaries that are lateral, medial, anterior and posterior.

AXILLARY SPACE



(A) Anterior view

Walls of the axillary space

- Medial—Serratus anterior muscle
- Lateral—Intertubercular sulcus.
- Anterior—Pectoralis major and minor MM.
- Posterior—Scapula with subscapularis M.; in places, latisimus dorsi M. and teres major M.
- Apex—clavicle.
- Base—Axillary fascia.

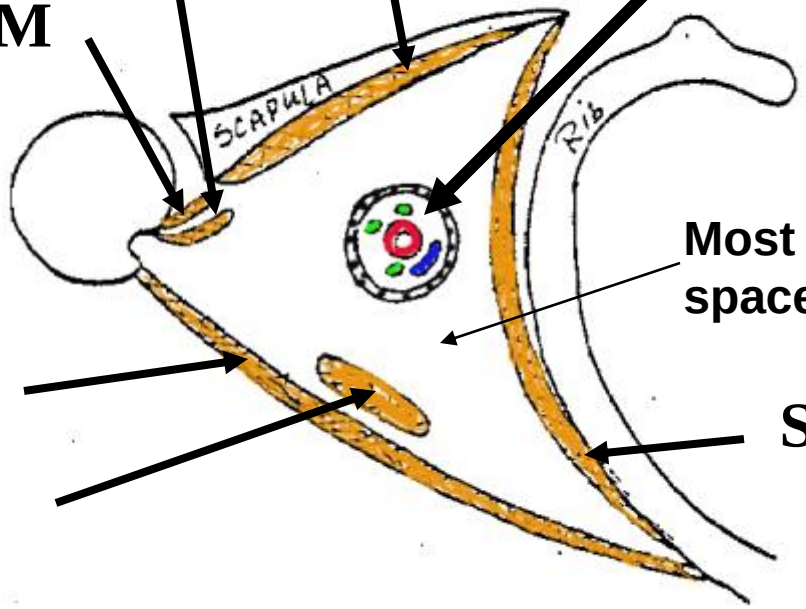
MUSCLES

Subscapularis M

Latissimus dorsi M

Teres major M

Major structures inside: Axillary sheath and contents!



Most of the rest of the space is adipose tissue.

Pectoralis major M

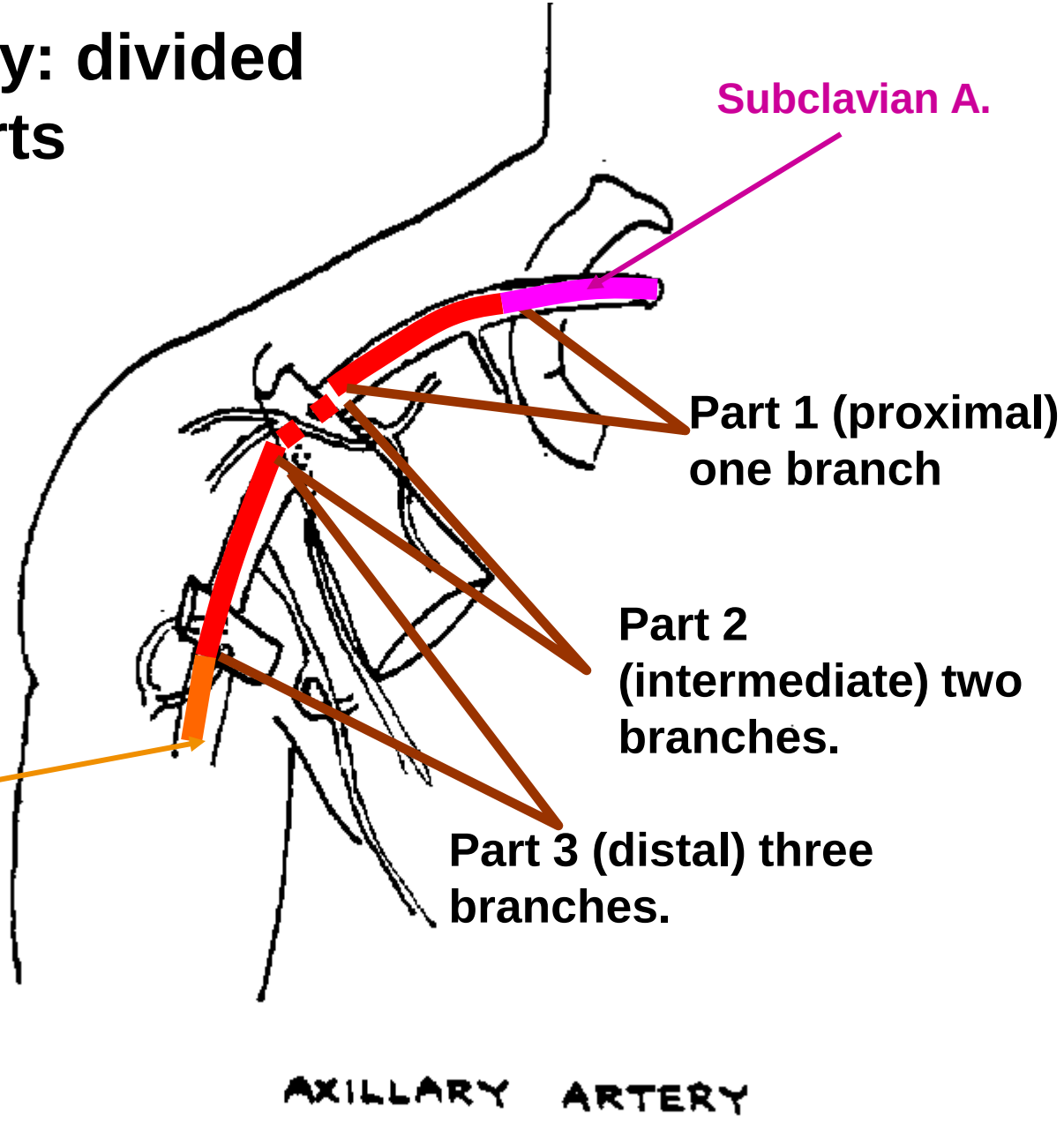
Pectoralis minor M

Serratus anterior M

Axillary sheath

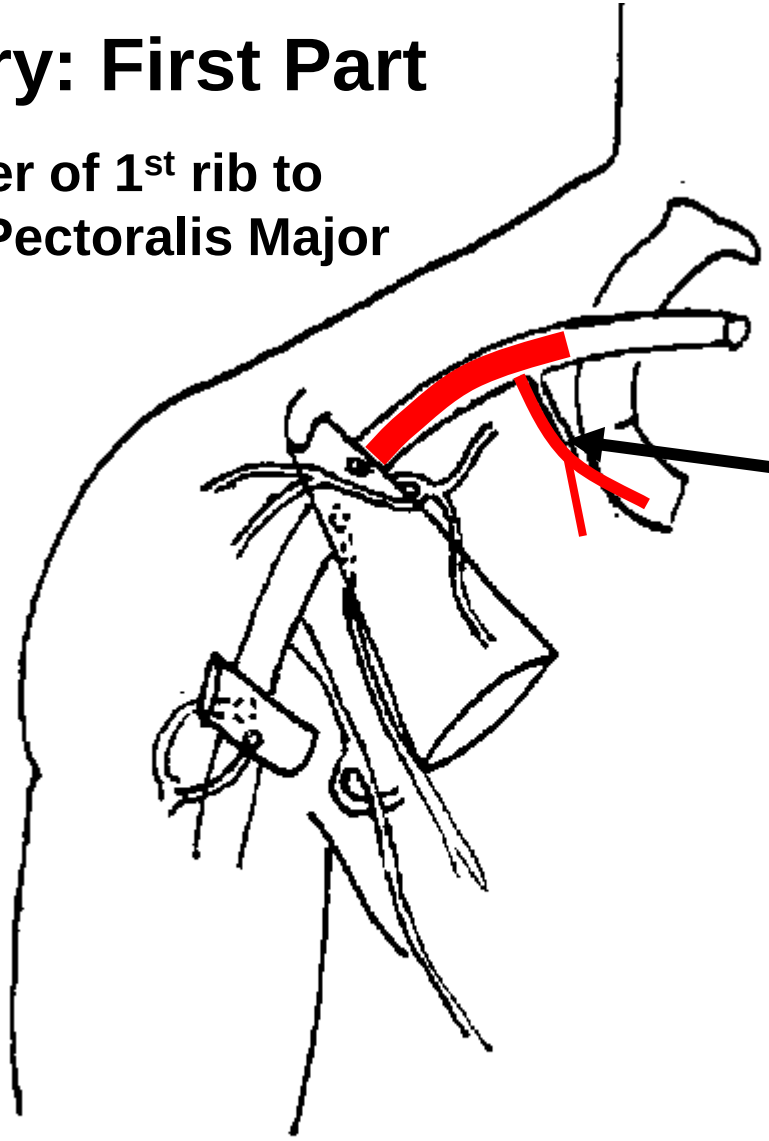
- Derived, at least in part, from anterior and middle scalene muscle fascia.
- Covers over a series of contents:
  - Axillary artery
  - Axillary vein
  - Brachial plexus and nerves derived from it.
- The axillary sheath is just the fascia surrounding these structures. You will open it up in lab to see them.

Axillary Artery: divided into three parts



Axillary Artery: First Part

From lateral border of 1st rib to medial border of Pectoralis Major M.



AXILLARY ARTERY

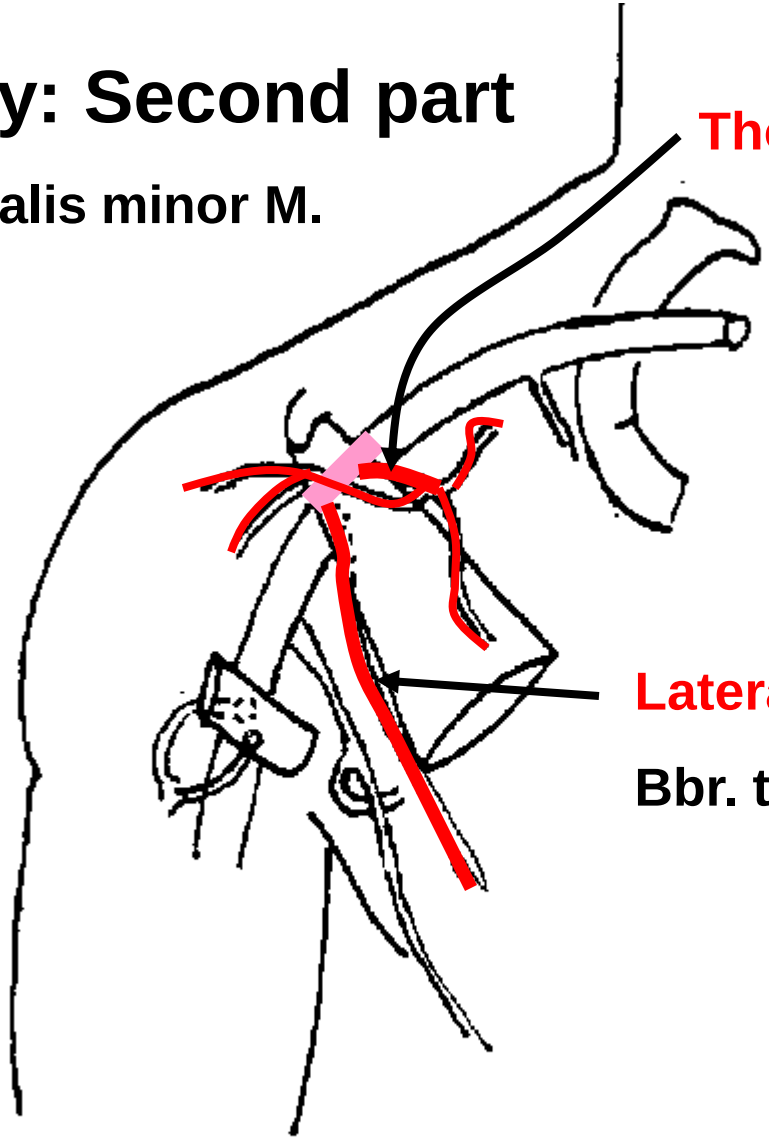
Named Branch:

Supreme Thoracic A. (to external thoracic body wall)

Supplies blood to first and second intercostal spaces

Axillary Artery: Second part

Deep to the pectoralis minor M.



Thoracoacromial trunk

Branches to:
Clavicular area
Pectoralis region
Acromion of Scapula
Deltoid Muscle.

Lateral Thoracic Artery

Bbr. to Serratus Ant. M.

AXILLARY ARTERY

Axillary Artery: third part

Lateral border of Pectoralis minor M. to lateral border of Teres major M.

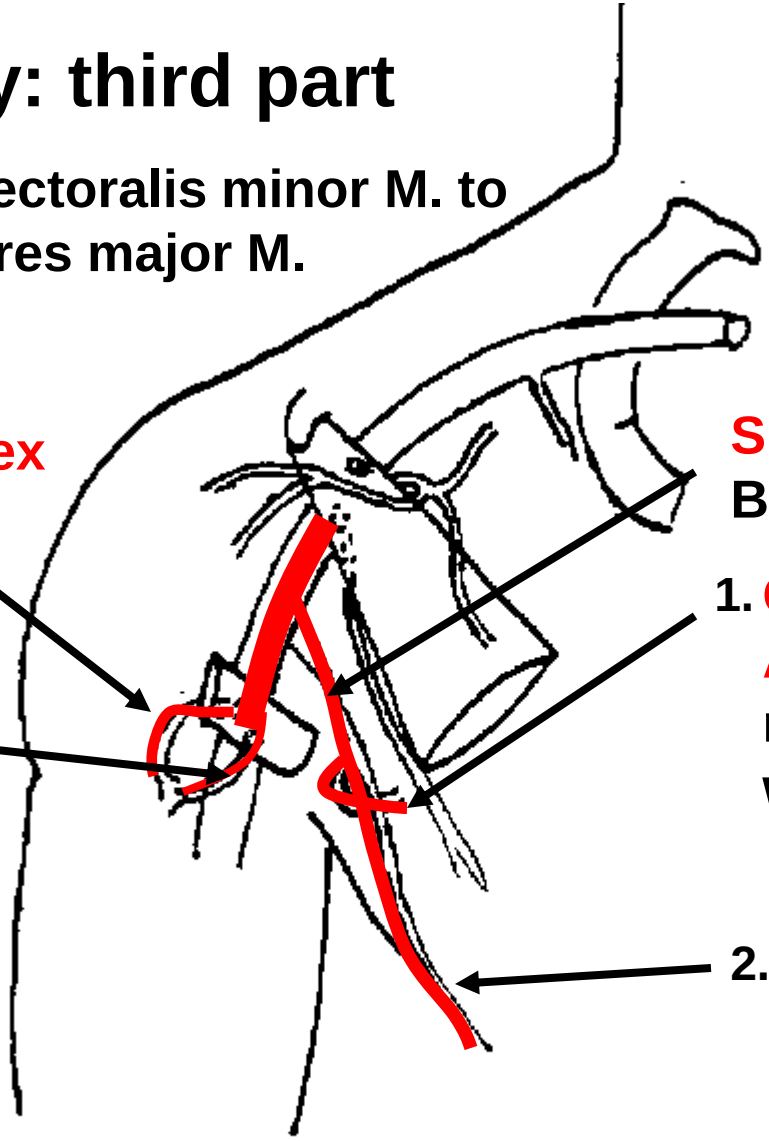
Posterior circumflex humeral A.

Anterior circumflex humeral A.

Subscapular A.:
Branches:

1. **Circumflex scapular A. (to multiple muscles associated with the scapula)**

2. **Thoracodorsal A. (to Latissimus dorsi M.)**

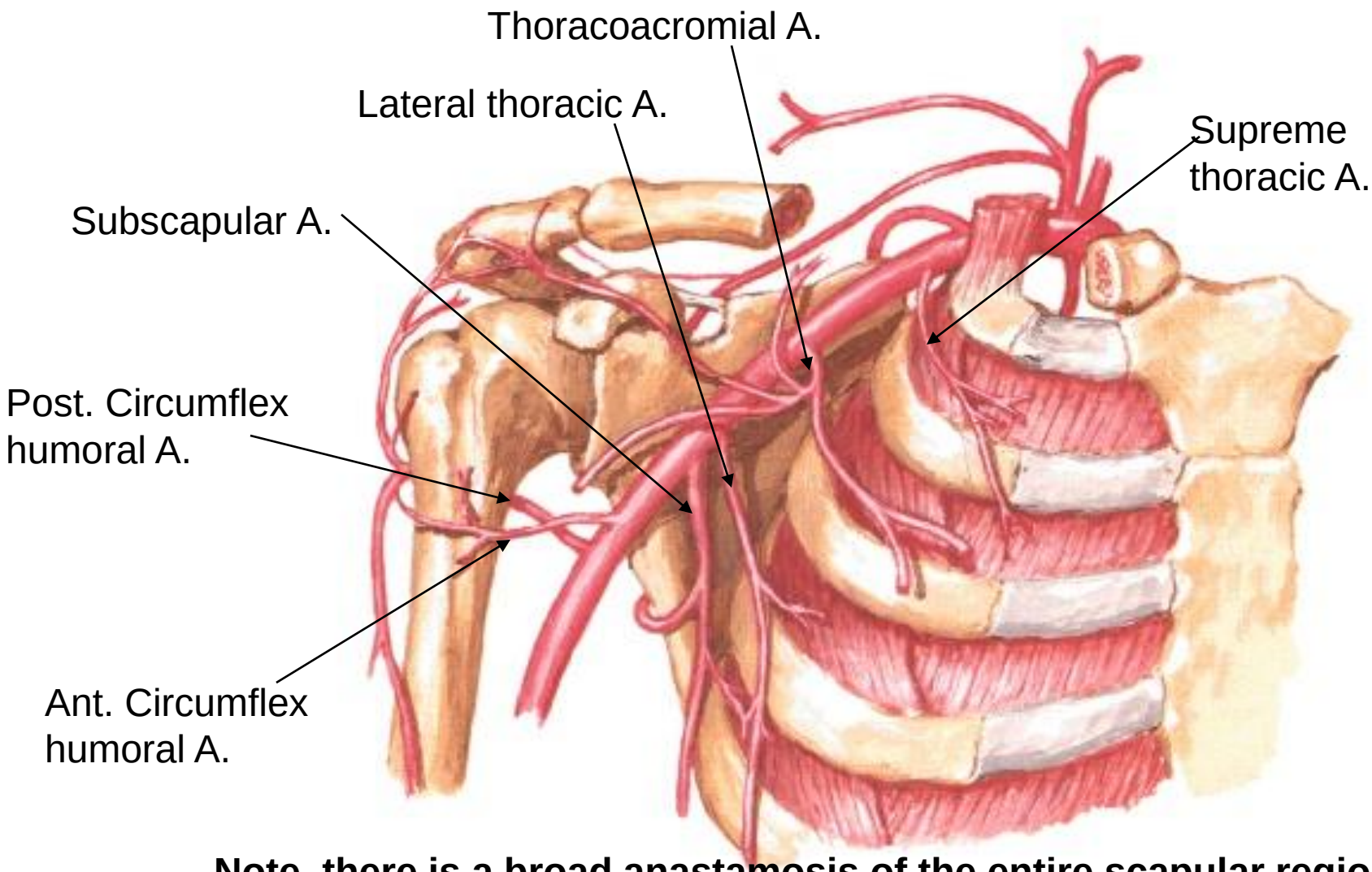


AXILLARY ARTERY

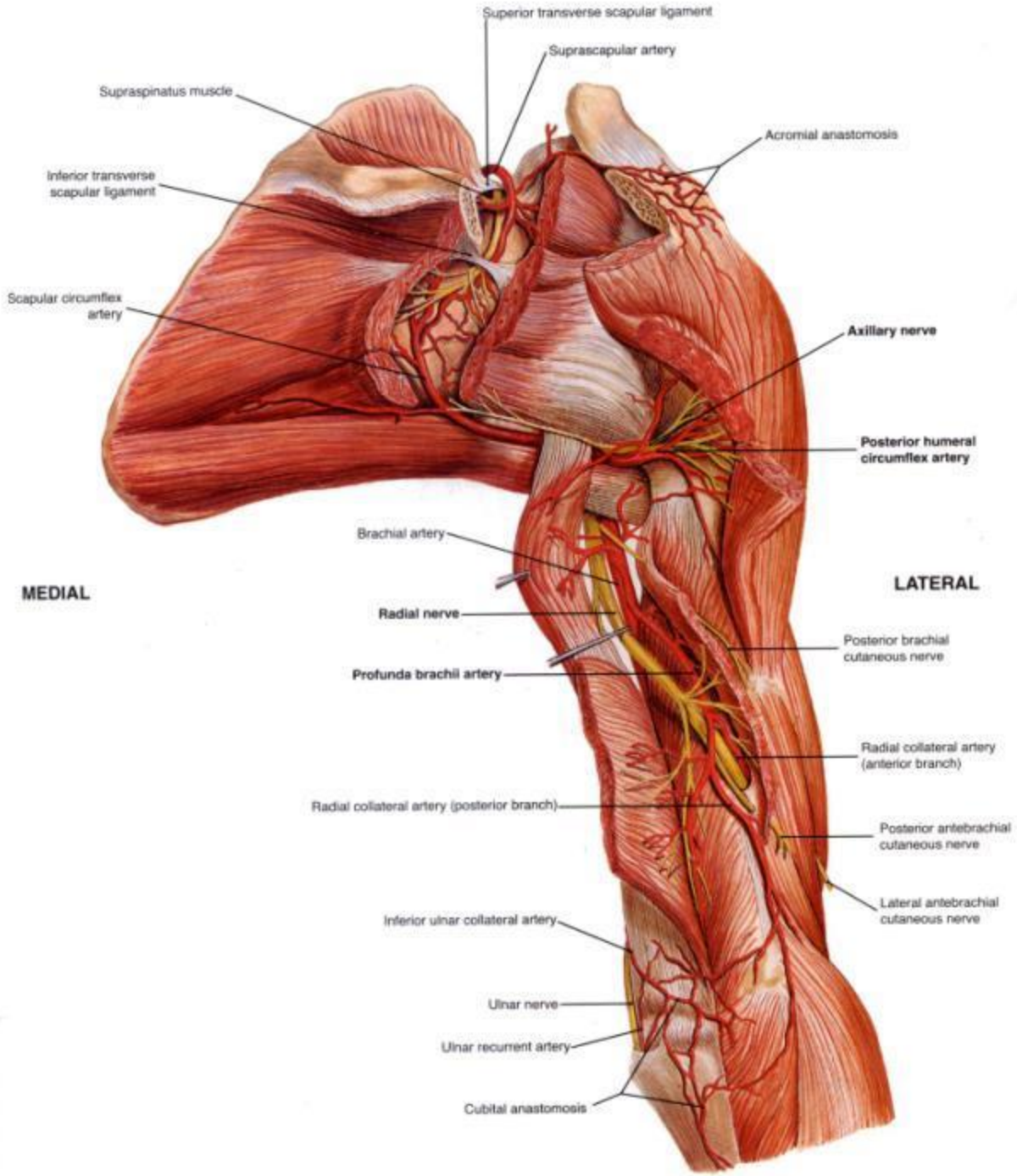
How it will look in lab

Axillary Artery and Anastomoses Around Scapula

Anterior View



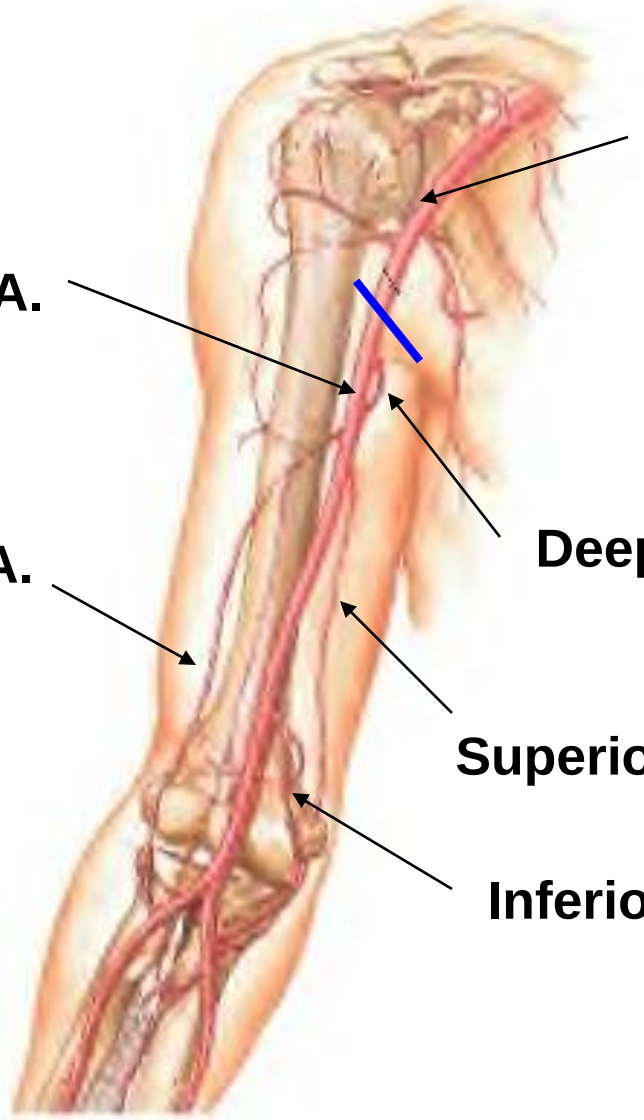
Note, there is a broad anastamosis of the entire scapular region including circumflex humorals, subscapular, dorsal scapular, and suprascapular AA.


Superior transverse scapular ligament
Suprascapular artery
Supraspinatus muscle
Acromial anastomosis
Inferior transverse scapular ligament
Scapular circumflex artery
Axillary nerve
Posterior humeral circumflex artery
Brachial artery
MEDIAL
LATERAL
Radial nerve
Posterior brachial cutaneous nerve
Profunda brachii artery
Radial collateral artery (anterior branch)
Radial collateral artery (posterior branch)
Posterior antebrachial cutaneous nerve
Lateral antebrachial cutaneous nerve
Inferior ulnar collateral artery
Ulnar nerve
Ulnar recurrent artery
Cubital anastomosis

Arteries of Proximal Arm

- The arterial pattern has one major vessel, with several important branches, which can supply muscles:
  - **Deep brachial A. to posterior compartment (branches to medial collateral and radial collateral AA).**
  - Superior ulnar collateral A.
  - Inferior ulnar collateral A.
- Note, many muscles are supplied directly by unnamed muscular branches. Do not even think of giving all the vessels you see a distinct name.

Brachial Artery and Anastomoses Around Elbow



Axillary A.

Brachial A.

Deep brachial A.

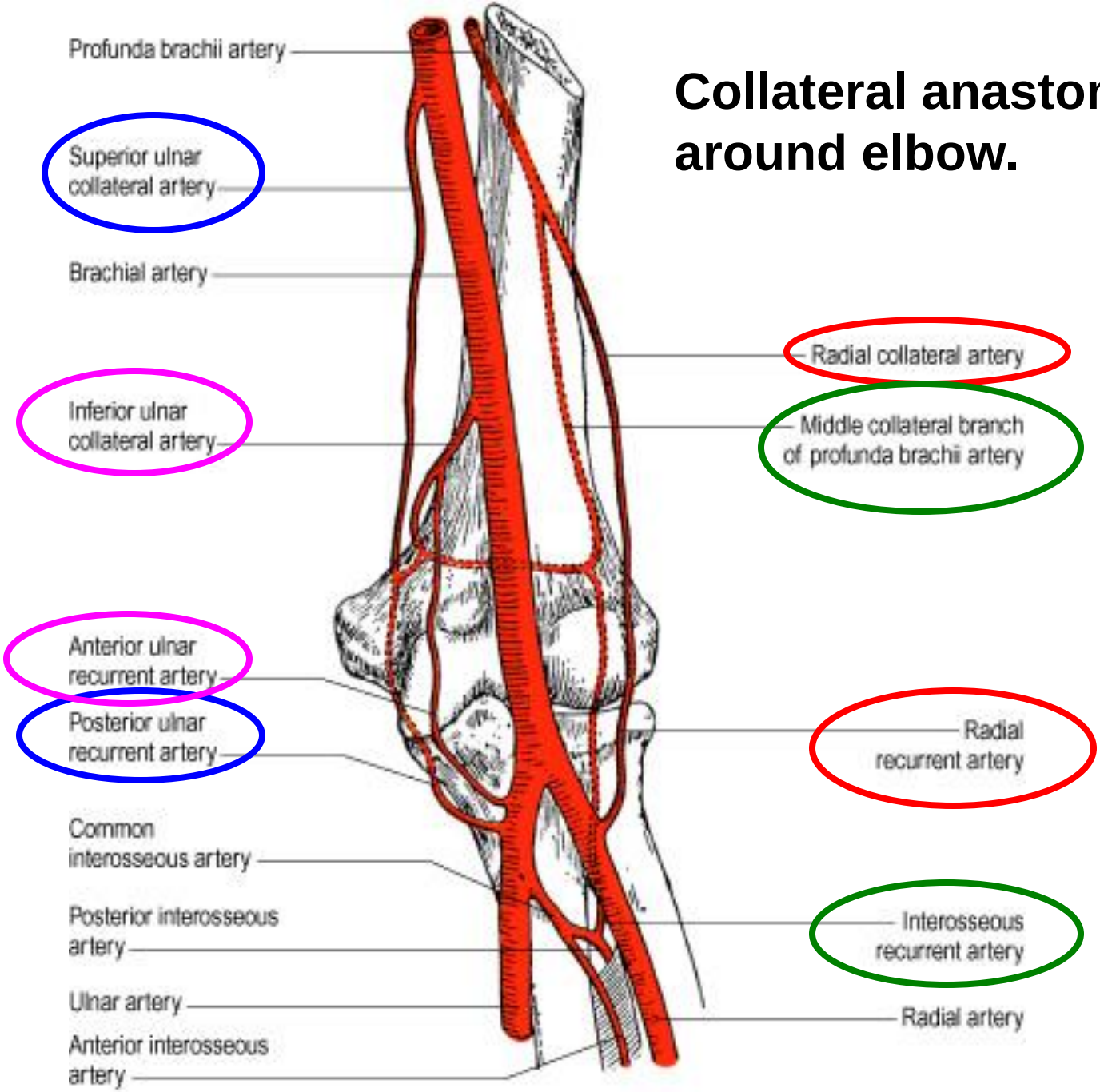
Radial collateral A.
(a branch of the
deep brachial A.)

Superior ulnar collateral A.

Not seen, middle collateral A., another branch of the deep brachial A.

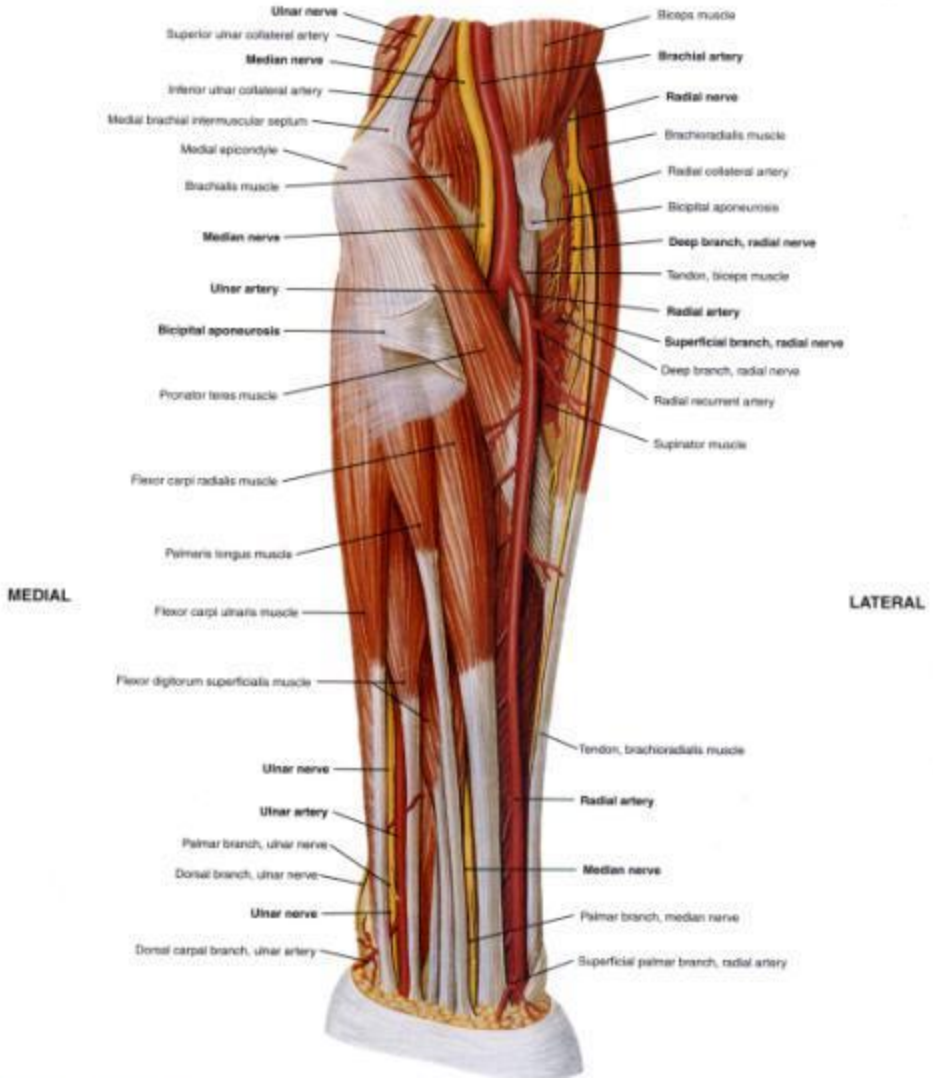
Inferior ulnar collateral A.

Collateral anastomosis around elbow.

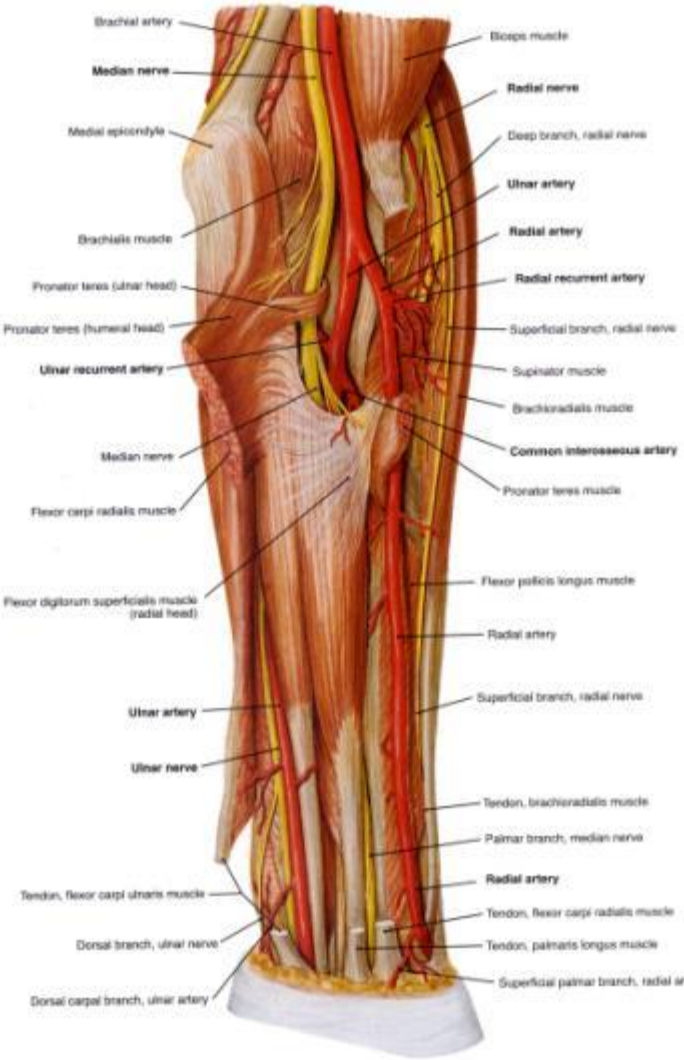


Antebrachium – Major Arteries

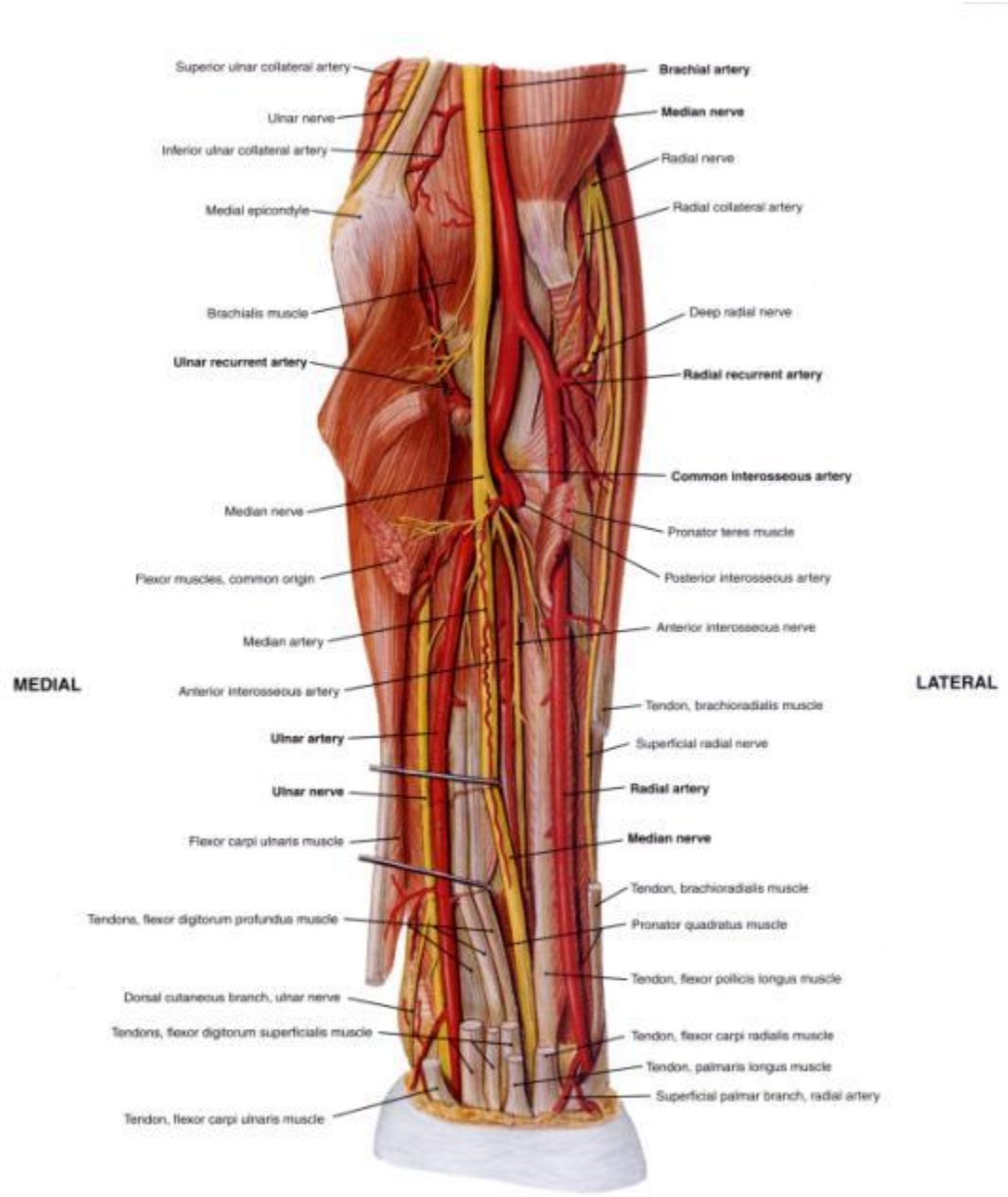
Superficial



Deeper Dissection



Antebrachium – Major Arteries (Deepest Dissection)



Brachial Artery

Radial Artery

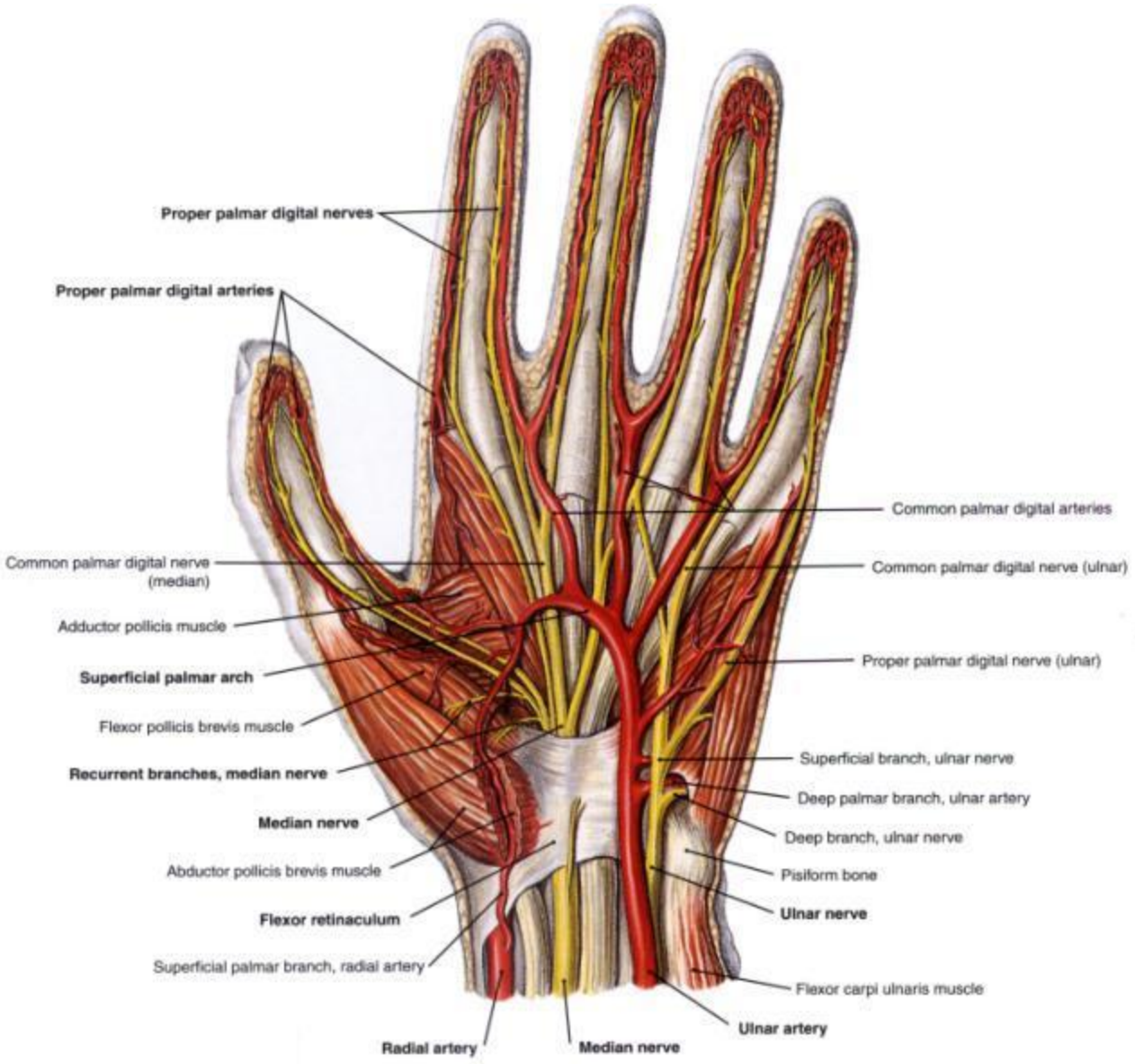
Ulnar Artery

Common Interosseous A.

Anterior Interosseus Artery

Posterior Interosseus Artery

Manus – Major Arteries of Palmar Aspect



Ulnar & Radial AA

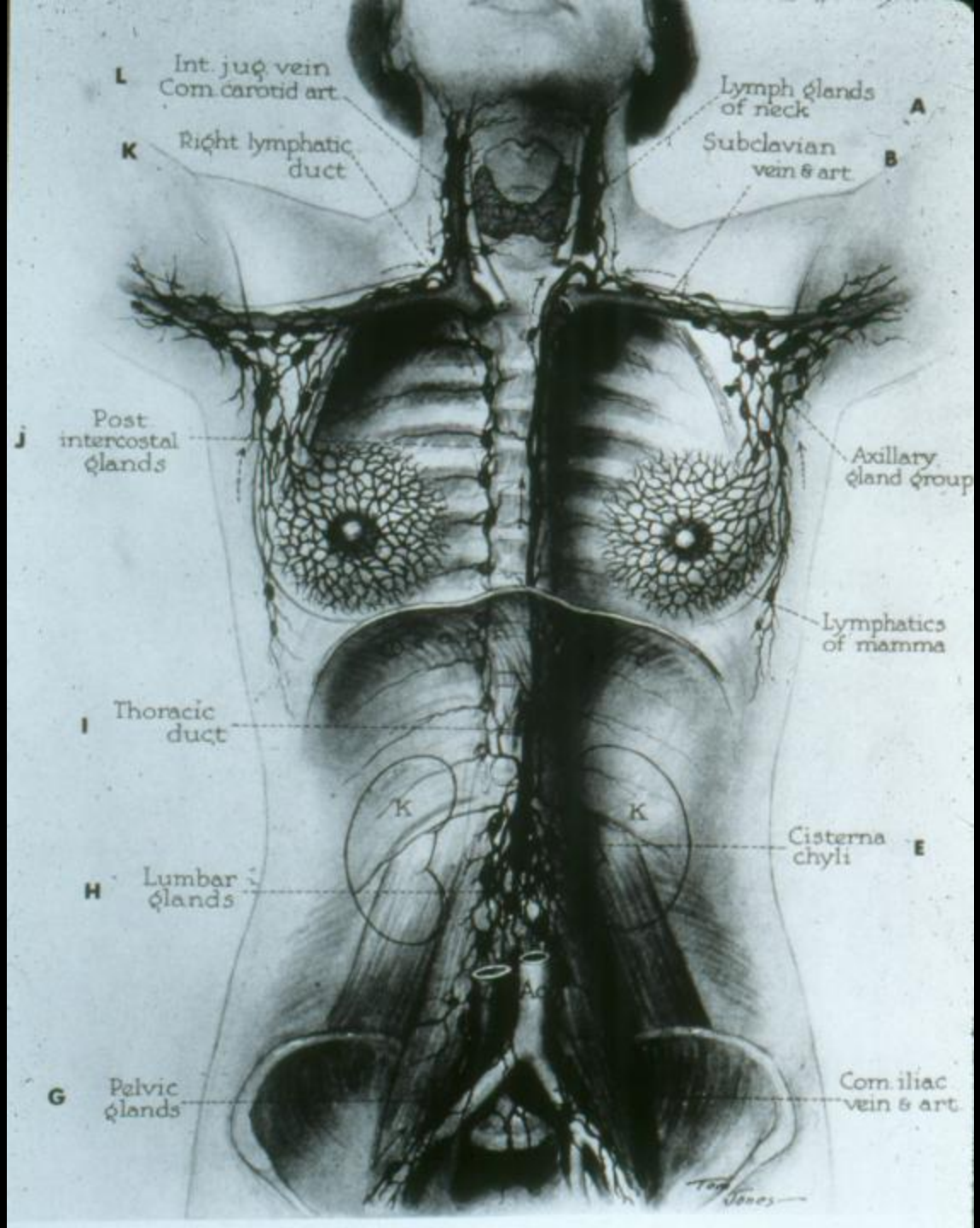
↓ ↓

Superficial Palmar Arch

↙ ↓ ↘

Common Palmar Digital AA.

Lymphatic System


L
Int. jug. vein
Com. carotid art.
K
Right lymphatic duct
Lymph glands of neck
A
Subclavian vein & art.
B
J
Post intercostal glands
Axillary gland group
Lymphatics of mamma
I
Thoracic duct
K
K
Cisterna chyli
E
H
Lumbar glands
G
Pelvic glands
Com. iliac vein & art.

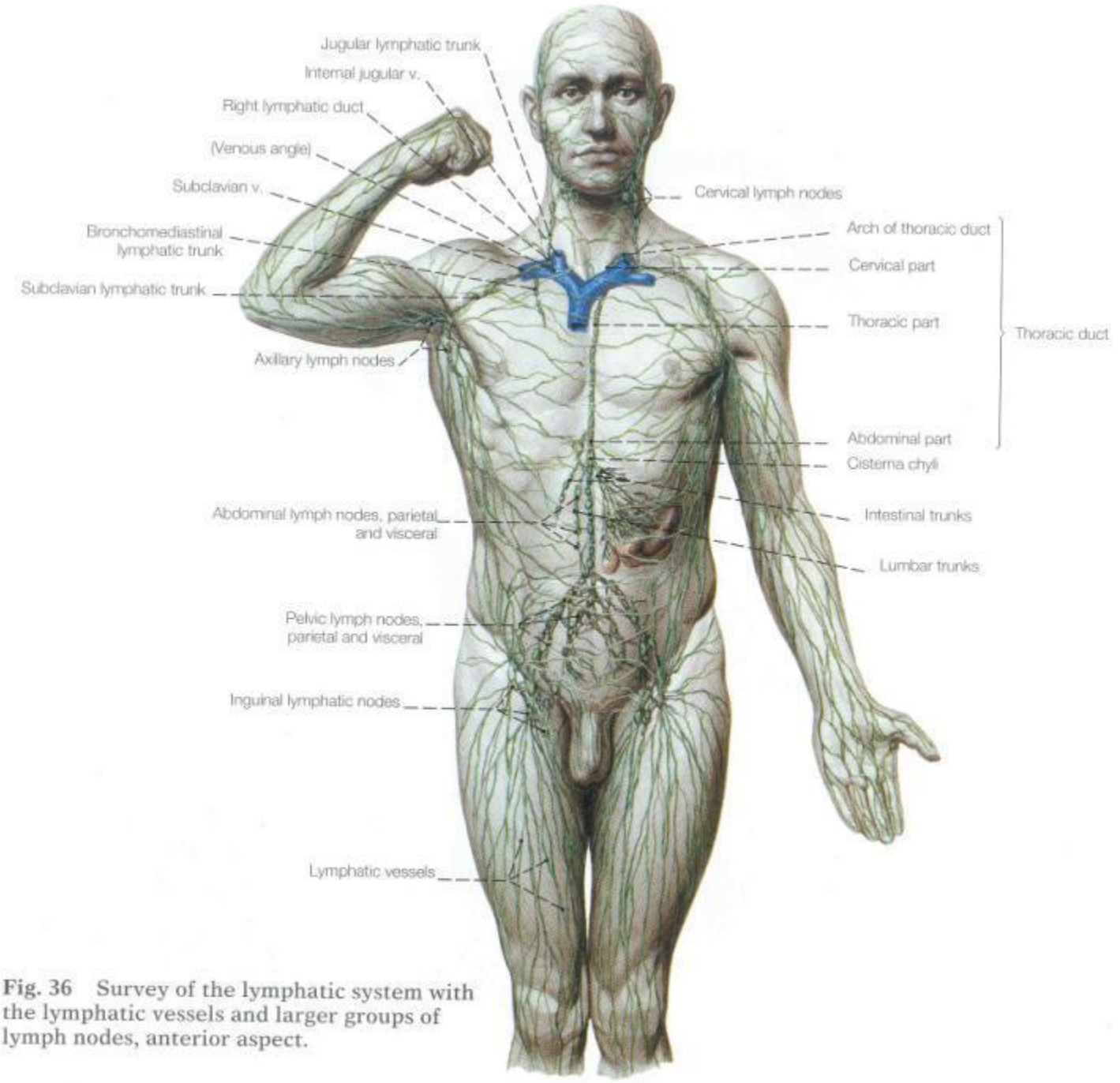


Fig. 36 Survey of the lymphatic system with the lymphatic vessels and larger groups of lymph nodes, anterior aspect.

STRUCTURAL & MORPHOLOGICAL ORGANIZATION

Generally run parallel to arteries and/or veins.

Over three-fourths of the body dump into the thoracic duct – which runs on the inside or the dorsal body wall (retroperitoneal).

THORACIC DUCT

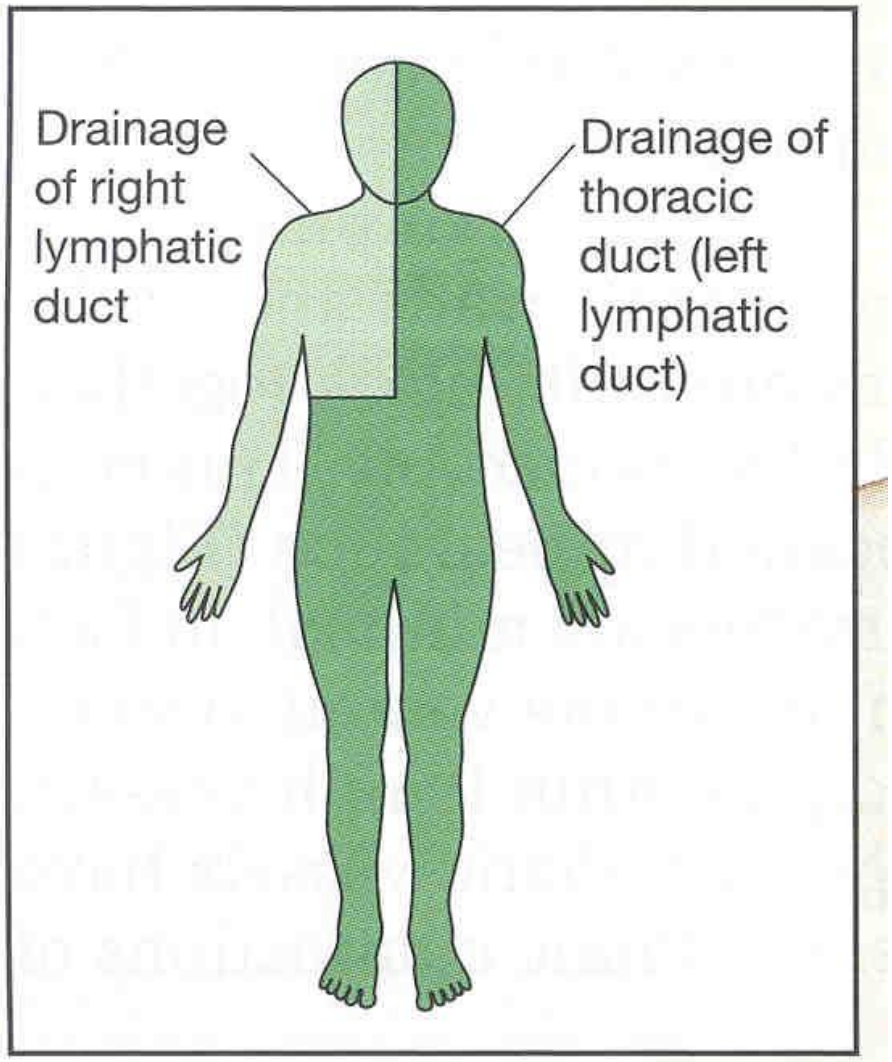
Begins as a loosely dilated sac and connections in the abdomen called the CYSTERNA CHYLI.

Drains both legs, and left side of body.

Goes through thorax, receives tributaries from: LEFT SUBCLAVIAN TRUNK (from left arm) and LEFT JUGULAR TRUNK (left side of head and neck).

Dumps into venous circulation at junction between left subclavian vein and left jugular vein. (Technically into left brachiocephalic vein.)

THORACIC DUCT



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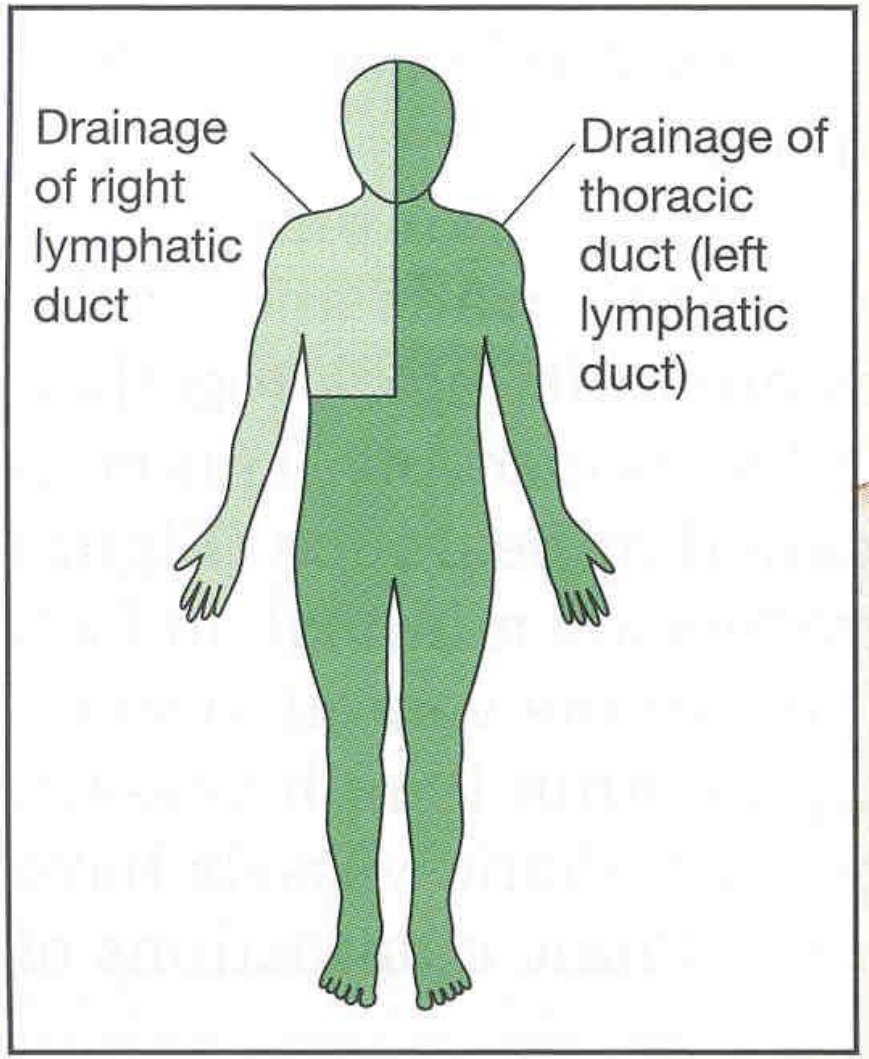
RIGHT LYMPHATIC DUCT

Upper right quadrant is drained by right lymphatic duct.

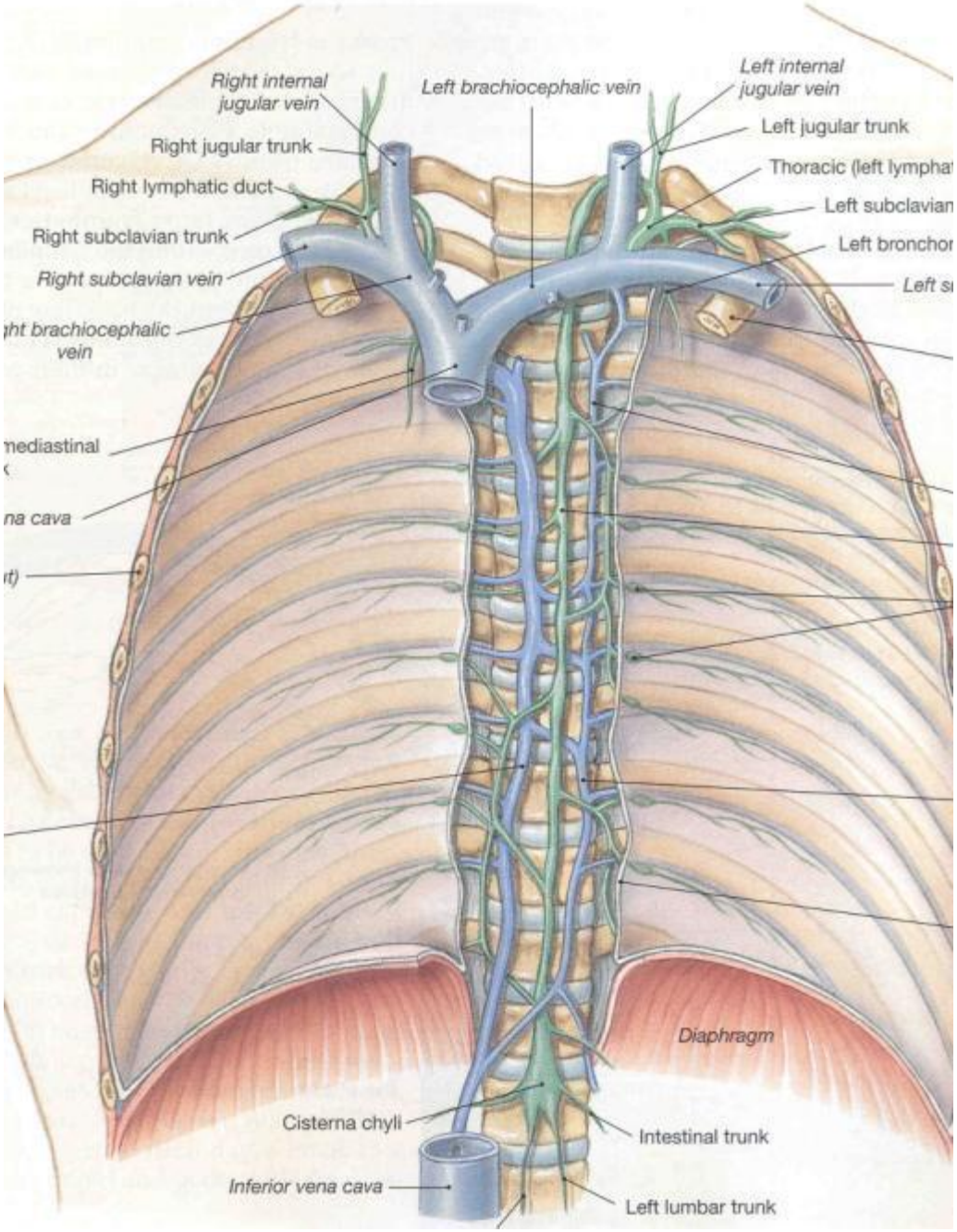
It dumps into venous circulation at junction between right subclavian vein and right jugular vein. (Technically into right brachiocephalic vein.)

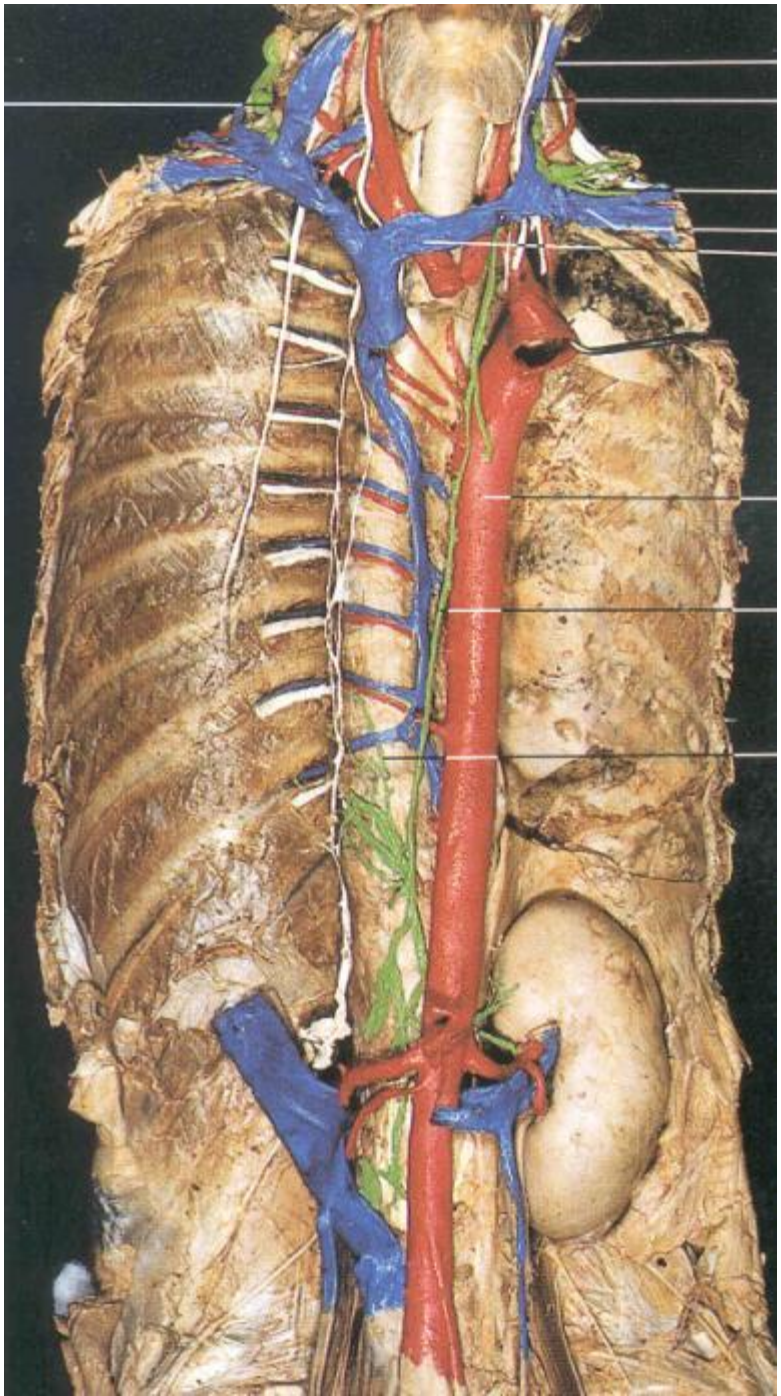


RIGHT LYMPHATIC DUCT

Upper right quadrant is drained by right lymphatic duct.

It dumps into venous circulation at junction between right subclavian vein and right jugular vein. (Technically into right brachiocephalic vein.)


Right internal jugular vein
Left brachiocephalic vein
Left internal jugular vein
Right jugular trunk
Left jugular trunk
Right lymphatic duct
Thoracic (left lympha
Right subclavian trunk
Left subclavian
Left bronchor
Right subclavian vein
Left s
ght brachiocephalic vein
mediastinal
na cava
rt)
Diaphragm
Cisterna chyli
Intestinal trunk
Inferior vena cava
Left lumbar trunk



OTHER LYMPHATIC STRUCTURES

- Lymph Nodes
- Tonsils
- Spleen
- Thymus Gland
- Pyer’s Patches

LYMPH NODES

•Scattered along lymph vessels are concentrated masses of lymph tissue called "lymph nodes."

•Usually 1-25 mm in length, but they can be larger.

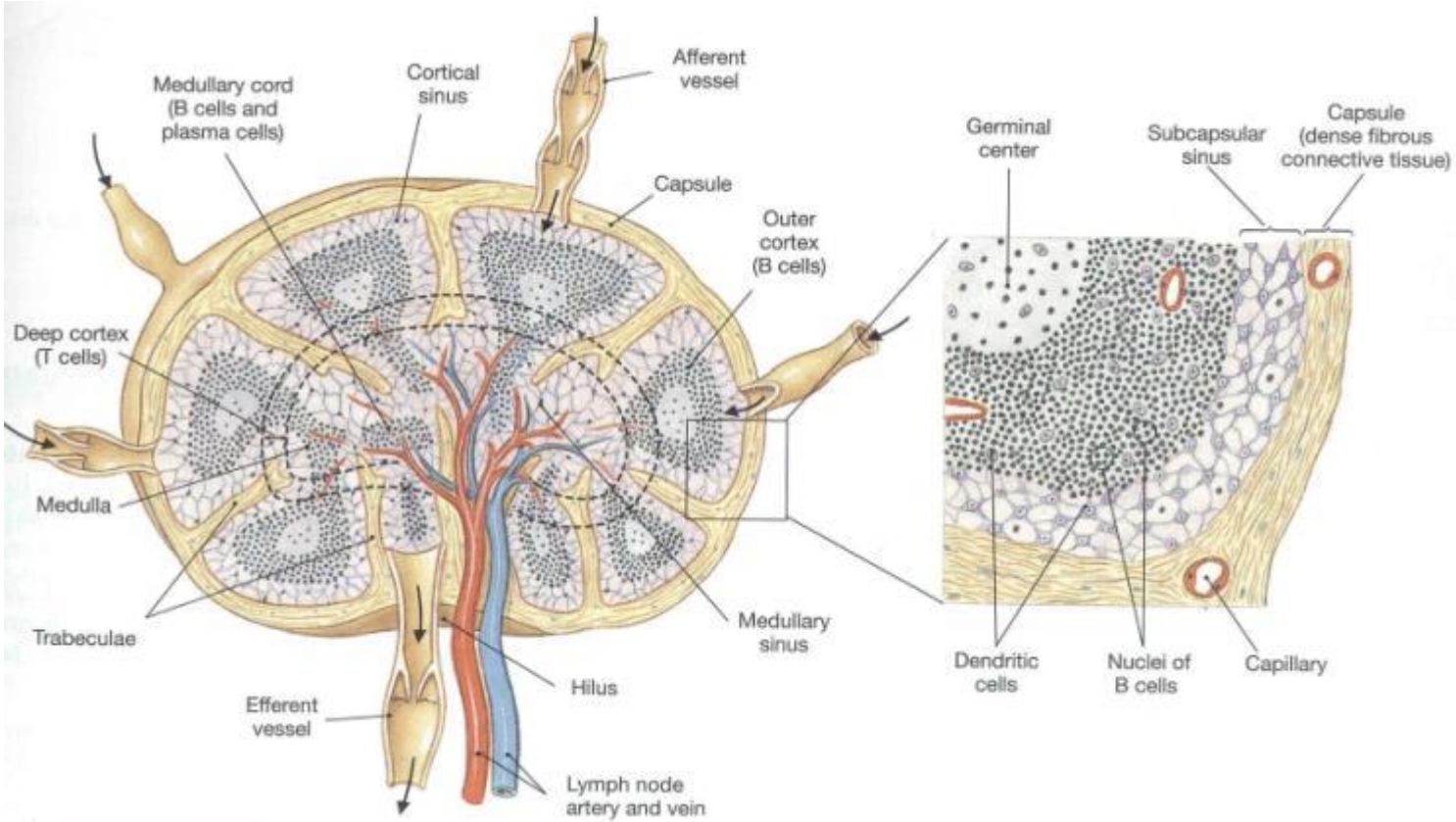
•Greatest concentration near groin, axilla, neck, thorax, and along gut tube in abdomen. In women, near mammary glands.

•Macrophages and lymphocytes resident in the outer ("cortex") region of a lymph node. Thus, the nodes can act as filters.

•Afferent (entering) vessels bring lymph in; lymph is filtered through cortex.

•"Medulla" is the inner collecting area.

•Efferent (exiting) vessel leaves at the "hilus."



Macrophages and lymphocytes resident in the outer ("cortex") region of a node.

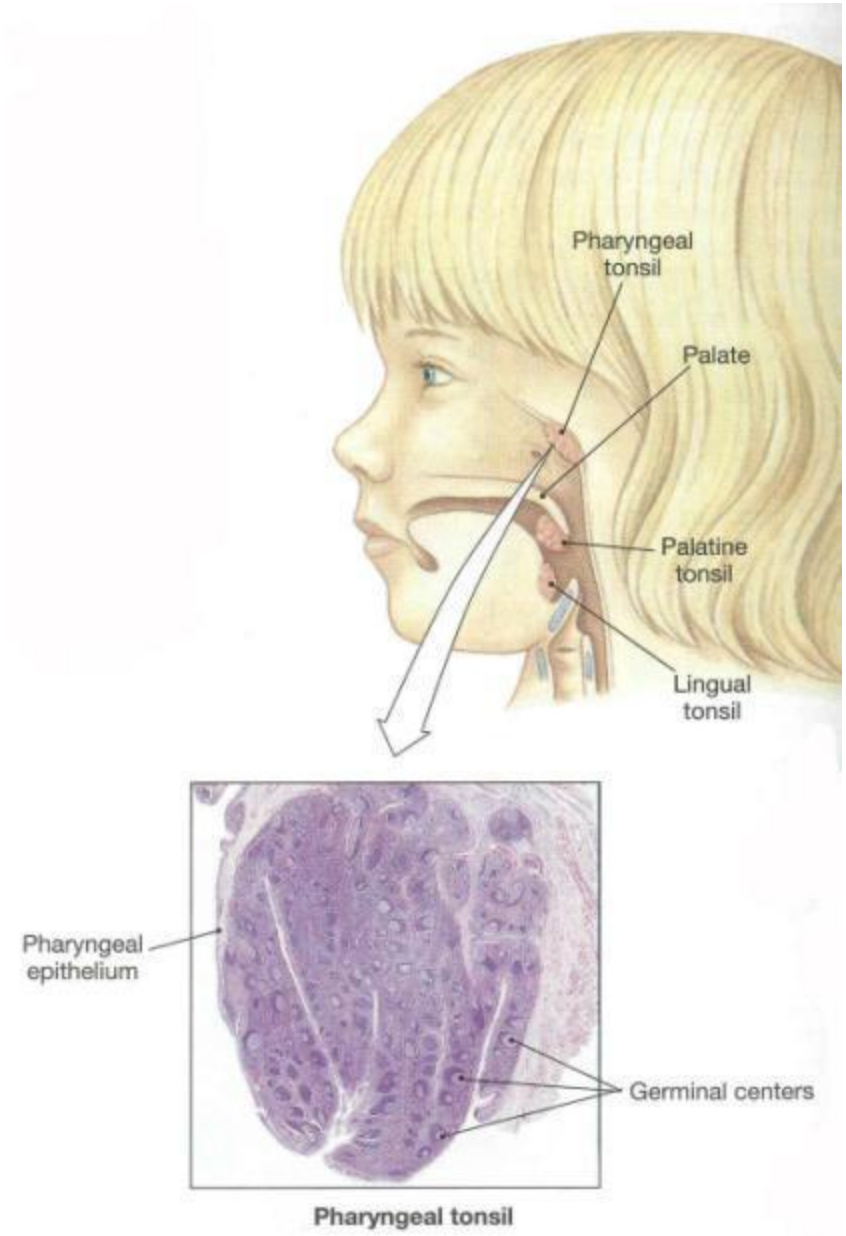
Afferent (entering) vessels bring lymph in; lymph is filtered through cortex.

"Medulla" is the inner collecting area.

Efferent (exiting) vessel leaves at the "hilus."

TONSILS

- (Sort of like large, glorified lymph nodes, but…)
- They don't act as filters.
- Only produce lymphocytes for export.
- Phayrngeal tonsils, palatine tonsils, and lingual tonsils are defensive structures at the mouth, entrance to digestive and respiratory systems.



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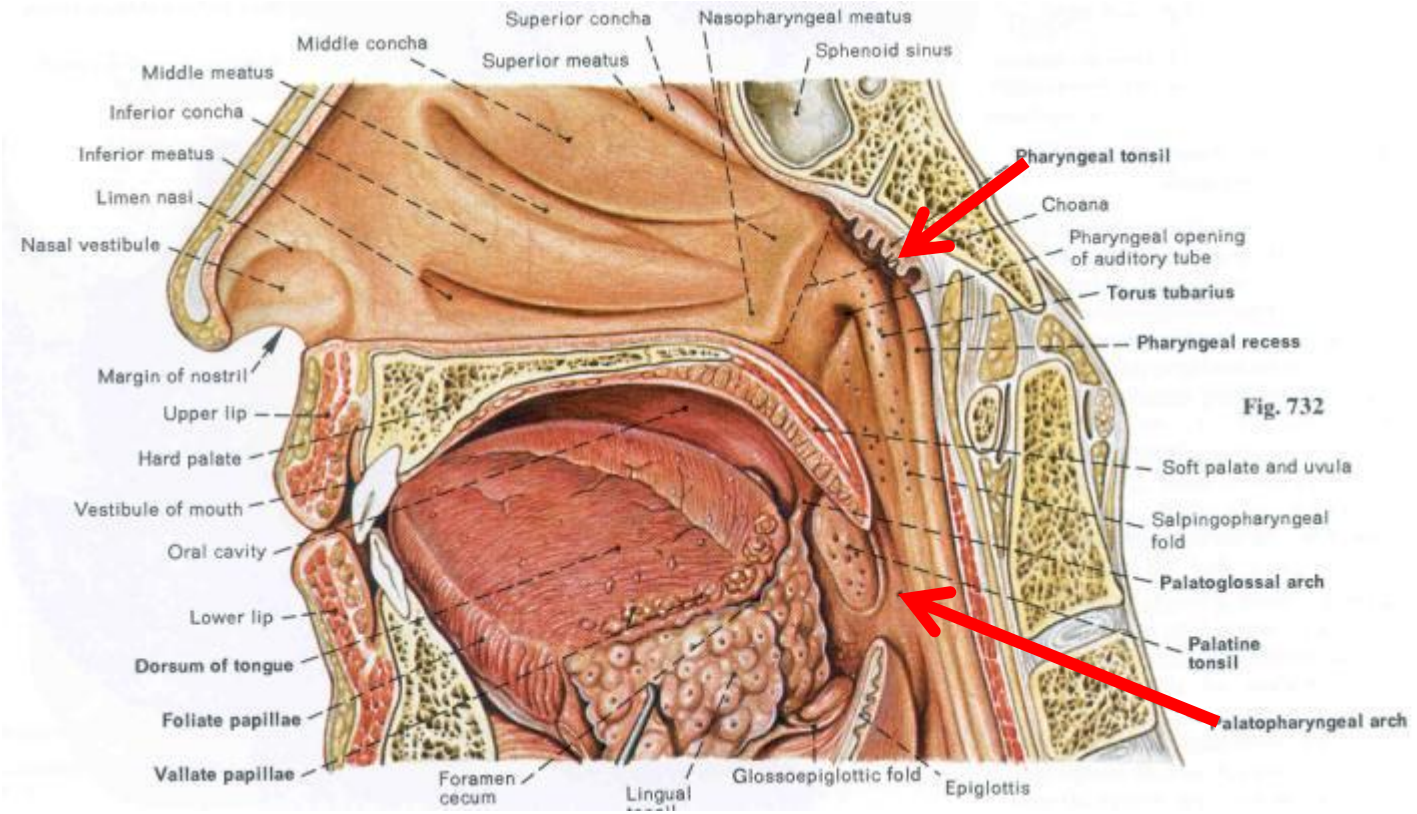

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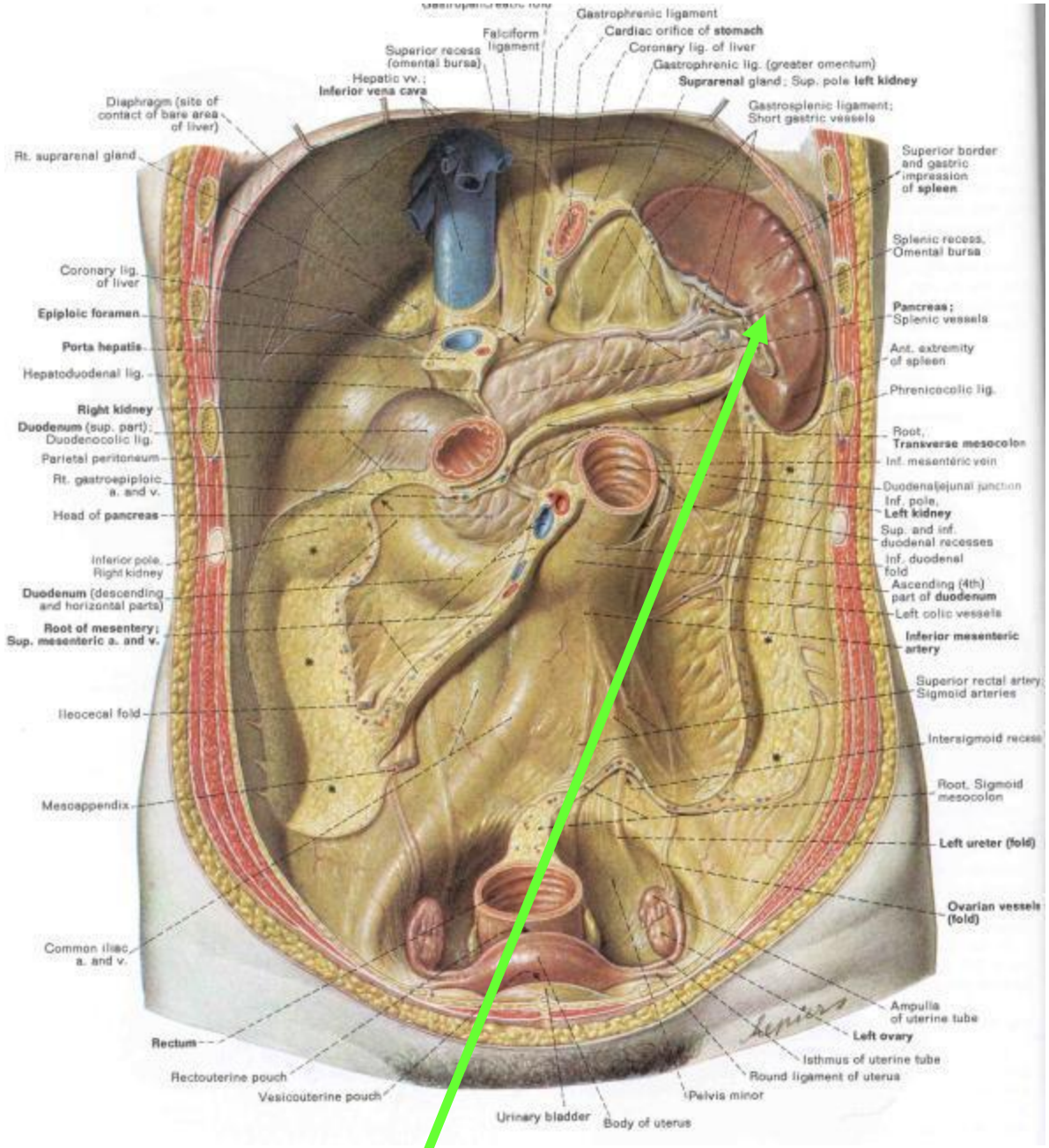
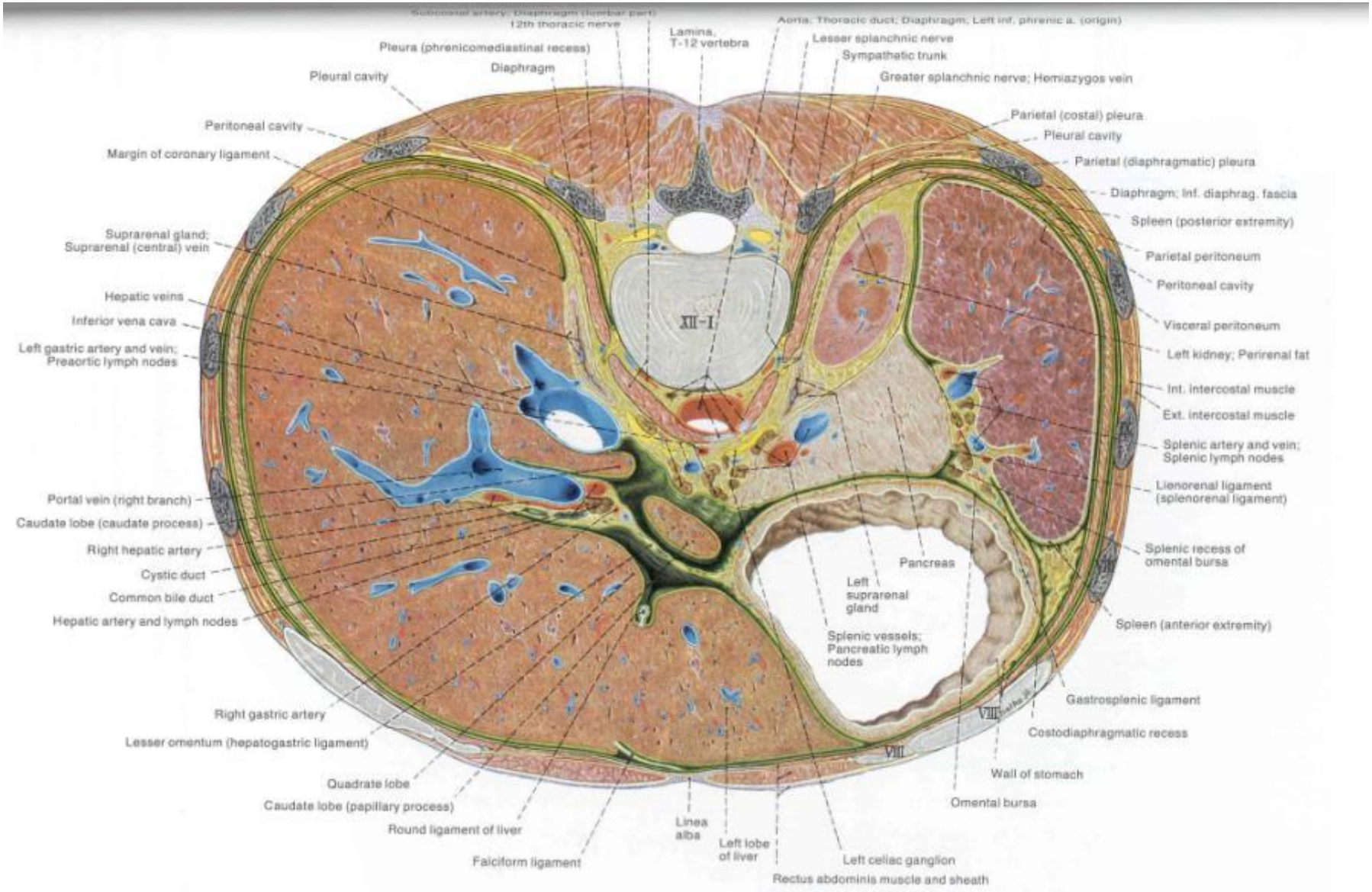
SPLEEN

- Not part of the gut (just near it).
- Largest lymphoid organ of body.
- Highly vascularized (perfect for a filter).
- In spleen, BLOOD passes resident macrophages and lymphocytes.
- Not strictly a lymph filter, but its interaction with blood can stimulate production and action of materials normally found in lymph.
- Macrophages abundant: help to scavenge spent red blood cells and recycle hemoglobin.
- Antigens (nasty stuff) in blood active lymphocytes in spleen for antibody production.
- Produces red blood cells in fetus, can be called back into action in adults under stressful conditions.


Gastrophrenic ligament
Falciform ligament
Cardiac orifice of stomach
Superior recess (omental bursa)
Coronary lig. of liver
Gastrophrenic lig. (greater omentum)
Hepatic vv.; Inferior vena cava
Suprarenal gland; Sup. pole left kidney
Diaphragm (site of contact of bare area of liver)
Gastrosplenic ligament; Short gastric vessels
Rt. suprarenal gland
Superior border and gastric impression of spleen
Splenic recess, Omental bursa
Coronary lig. of liver
Epiploic foramen
Pancreas; Splenic vessels
Porta hepatis
Ant. extremity of spleen
Hepatoduodenal lig.
Phrenicocolic lig.
Right kidney
Duodenum (sup. part); Duodenocolic lig.
Root, Transverse mesocolon
Parietal peritoneum
Inf. mesenteric vein
Rt. gastroepiploic a. and v.
Duodenojejunal junction
Inf. pole, Left kidney
Head of pancreas
Sup. and inf. duodenal recesses
Inf. duodenal fold
Inferior pole, Right kidney
Ascending (4th) part of duodenum
Duodenum (descending and horizontal parts)
Left colic vessels
Root of mesentery; Sup. mesenteric a. and v.
Inferior mesenteric artery
Superior rectal artery; Sigmoid arteries
Ileocecal fold
Intersigmoid recess
Root, Sigmoid mesocolon
Mesoappendix
Left ureter (fold)
Ovarian vessels (fold)
Common iliac a. and v.
Ampulla of uterine tube
Left ovary
Rectum
Isthmus of uterine tube
Rectouterine pouch
Round ligament of uterus
Vesicouterine pouch
Pelvis minor
Urinary bladder
Body of uterus

SPLEEN

SPLEEN


Subcostal artery; Diaphragm (lumbar part)
12th thoracic nerve
Lamina, T-12 vertebra
Aorta; Thoracic duct; Diaphragm; Left inf. phrenic a. (origin)
Lesser splanchnic nerve
Sympathetic trunk
Greater splanchnic nerve; Hemiazygos vein
Pleura (phrenicomediastinal recess)
Diaphragm
Pleural cavity
Peritoneal cavity
Margin of coronary ligament
Parietal (costal) pleura
Pleural cavity
Parietal (diaphragmatic) pleura
Diaphragm; Inf. diaphrag. fascia
Spleen (posterior extremity)
Suprarenal gland; Suprarenal (central) vein
Parietal peritoneum
Peritoneal cavity
Hepatic veins
Inferior vena cava
Left gastric artery and vein; Preaortic lymph nodes
XII–I
Visceral peritoneum
Left kidney; Perirenal fat
Int. intercostal muscle
Ext. intercostal muscle
Splenic artery and vein; Splenic lymph nodes
Portal vein (right branch)
Caudate lobe (caudate process)
Right hepatic artery
Cystic duct
Common bile duct
Hepatic artery and lymph nodes
Lienorenal ligament (splenorenal ligament)
Splenic recess of omental bursa
Pancreas
Left suprarenal gland
Splenic vessels; Pancreatic lymph nodes
Spleen (anterior extremity)
Gastrosplenic ligament
Costodiaphragmatic recess
Right gastric artery
Lesser omentum (hepatogastric ligament)
Quadrate lobe
Caudate lobe (papillary process)
Round ligament of liver
Falciform ligament
Linea alba
Left lobe of liver
Left celiac ganglion
Rectus abdominis muscle and sheath
Wall of stomach
Omental bursa

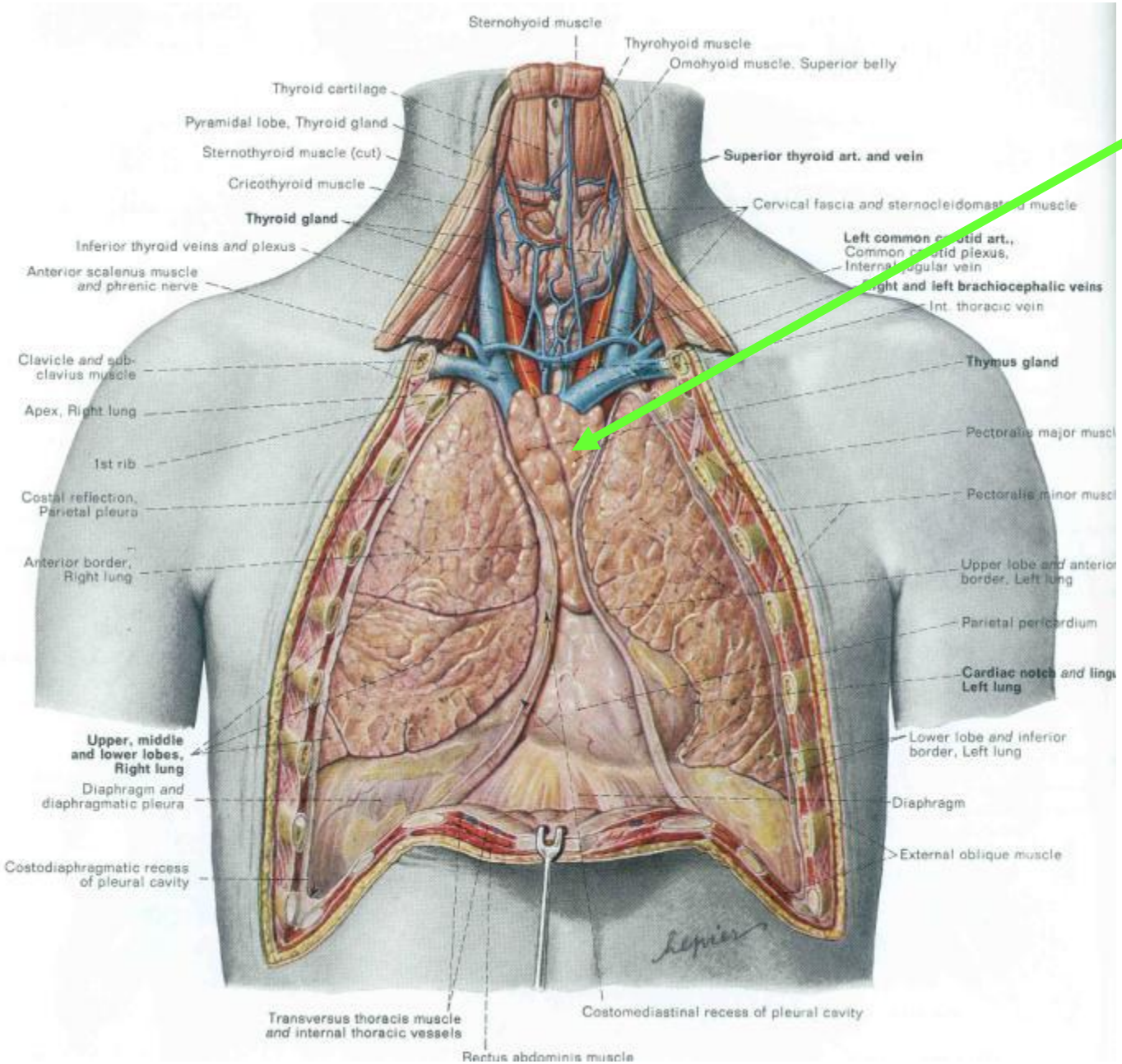
THYMUS GLAND

- Ventral to heart and laryngeal structures.

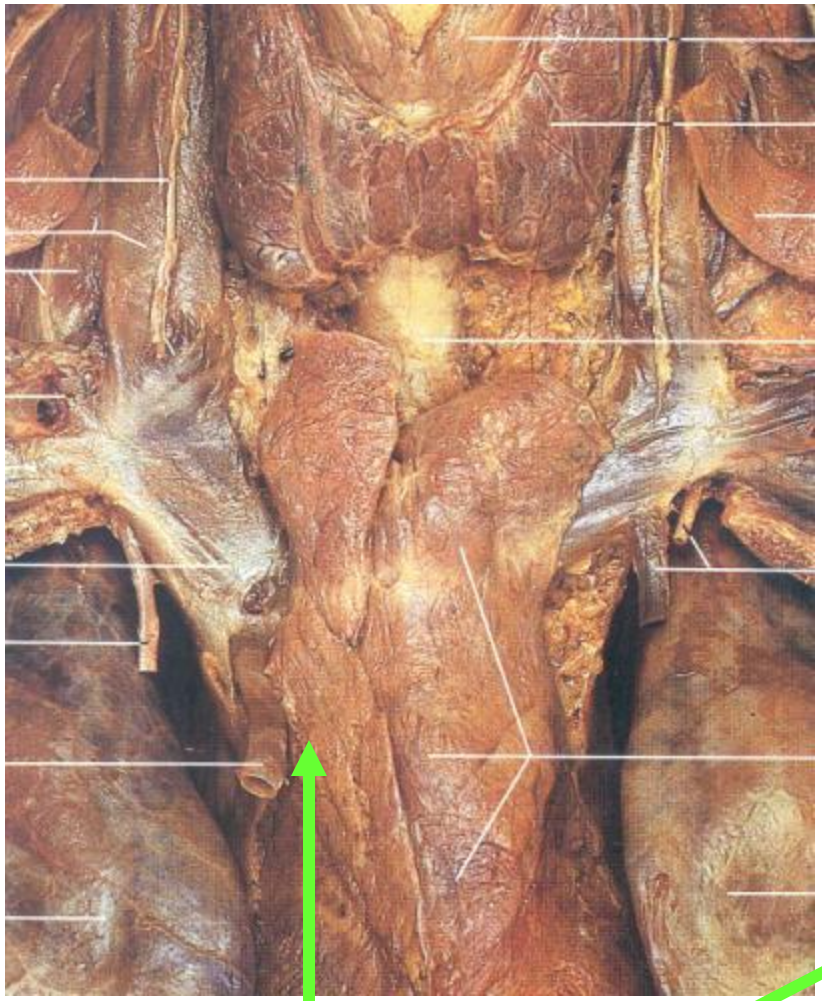
- Has outer cortex (containing many lymphocytes) and inner medulla.

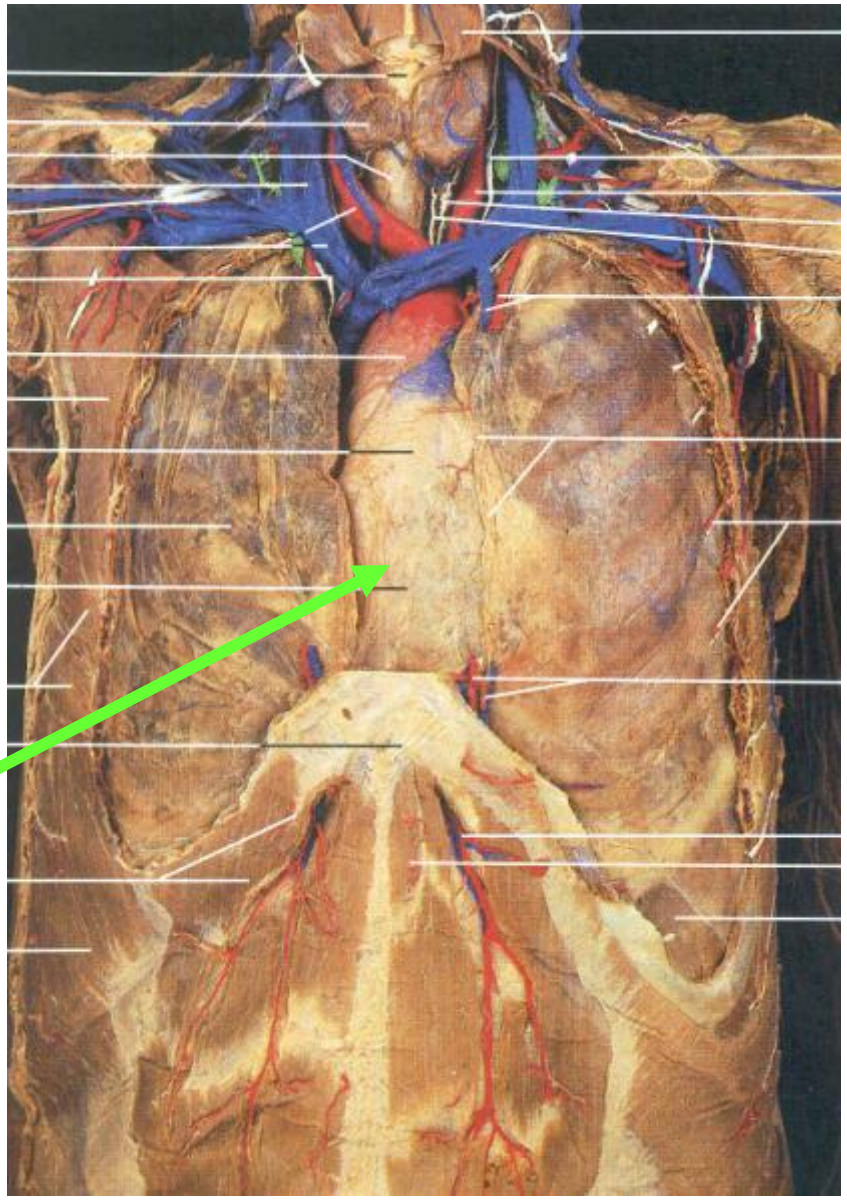
- Fetal thymus: transforms undifferentiated lymphocytes from bone marrow into T-lymphocytes.

- (More later…)

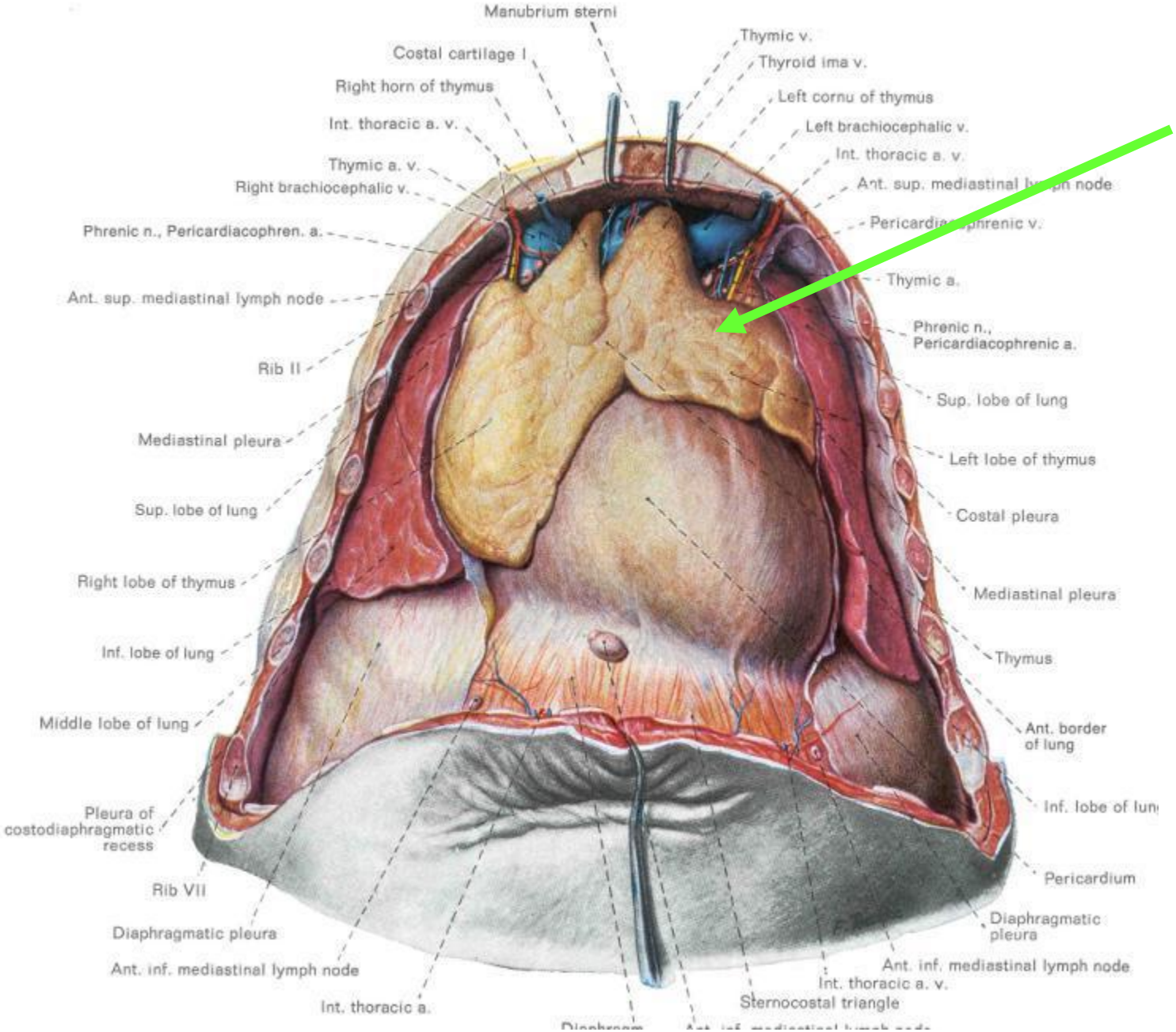


Adult
THYMUS





Adult
THYMUS



One-year old THYMUS

PYER'S PATCHES

(Also known as aggregated lymph nodes.)

Clusters of lymphoid tissue without a fibrous capsule.

Common in tonsils, small intestine, and appendix.

Secrete antibodies in response to antigens in gut tube, particularly ingested viruses and bacteria.