

Arterial supply, venous and lymphatic drainage of upper limb

By Glenn André Breivik

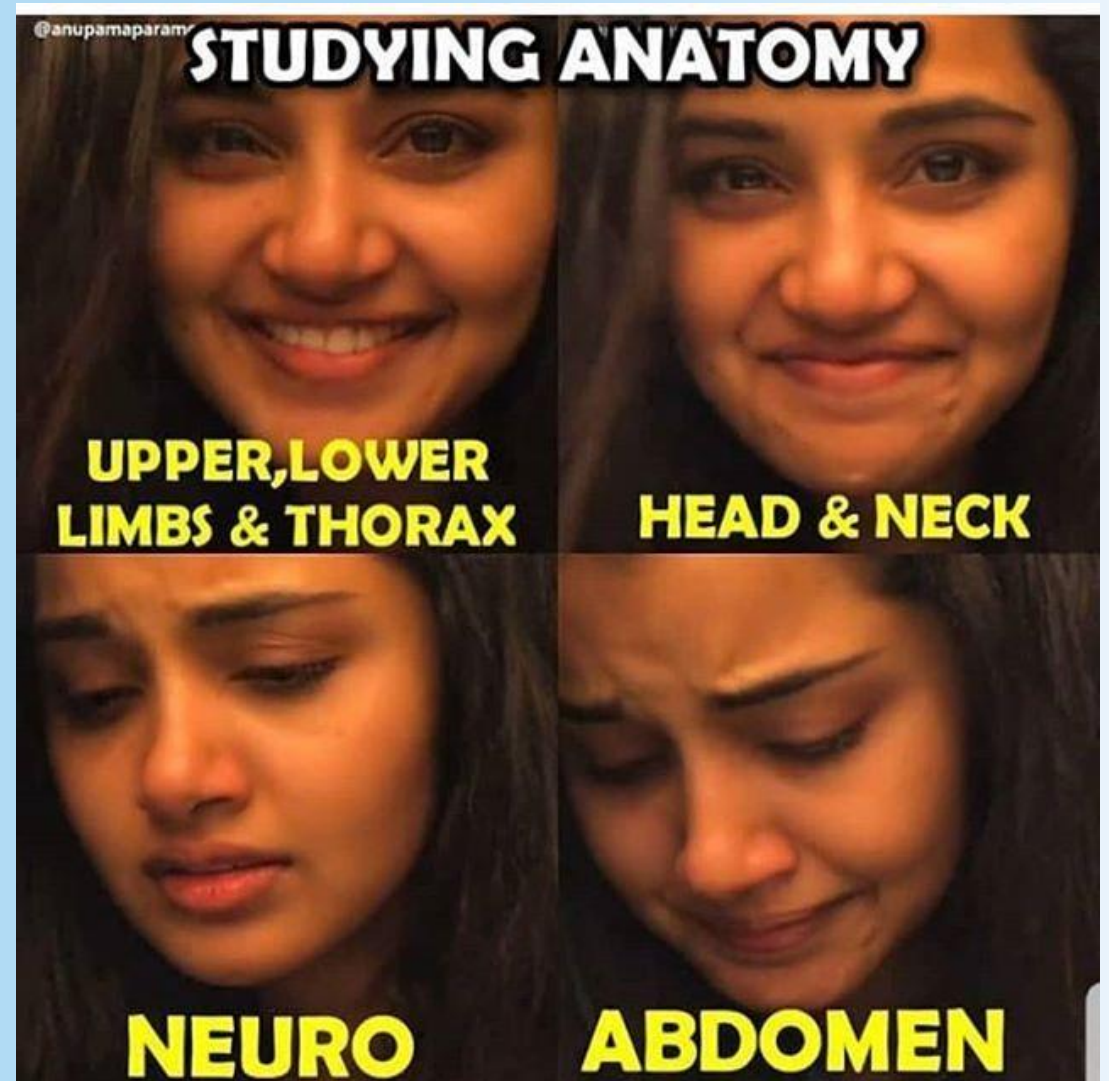
Agenda

1. Arterial supply:

- Arch of aorta anatomy review
- Subclavian artery with branches
- Axillary artery with branches
- Brachial artery with branches
- Arteries of the forearm with branches
- Arterial arches of the hand

2. Venous drainage

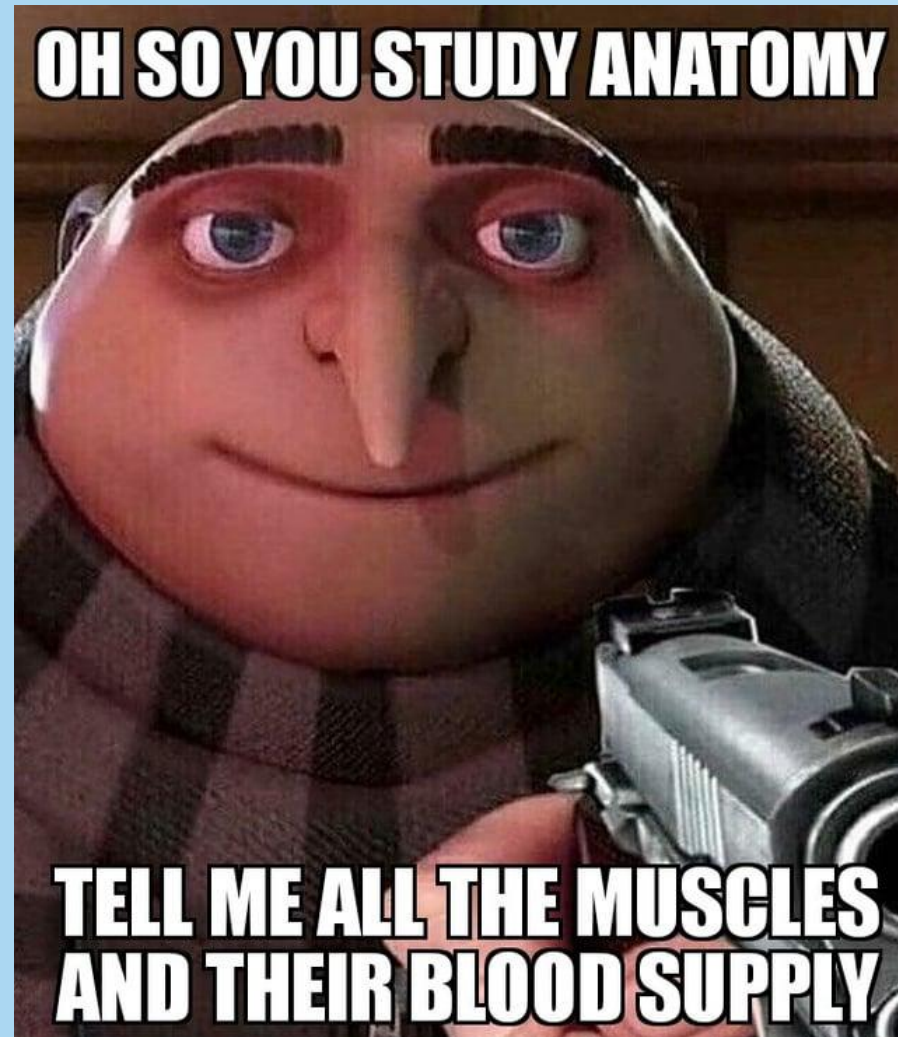
3. Lymphatic drainage

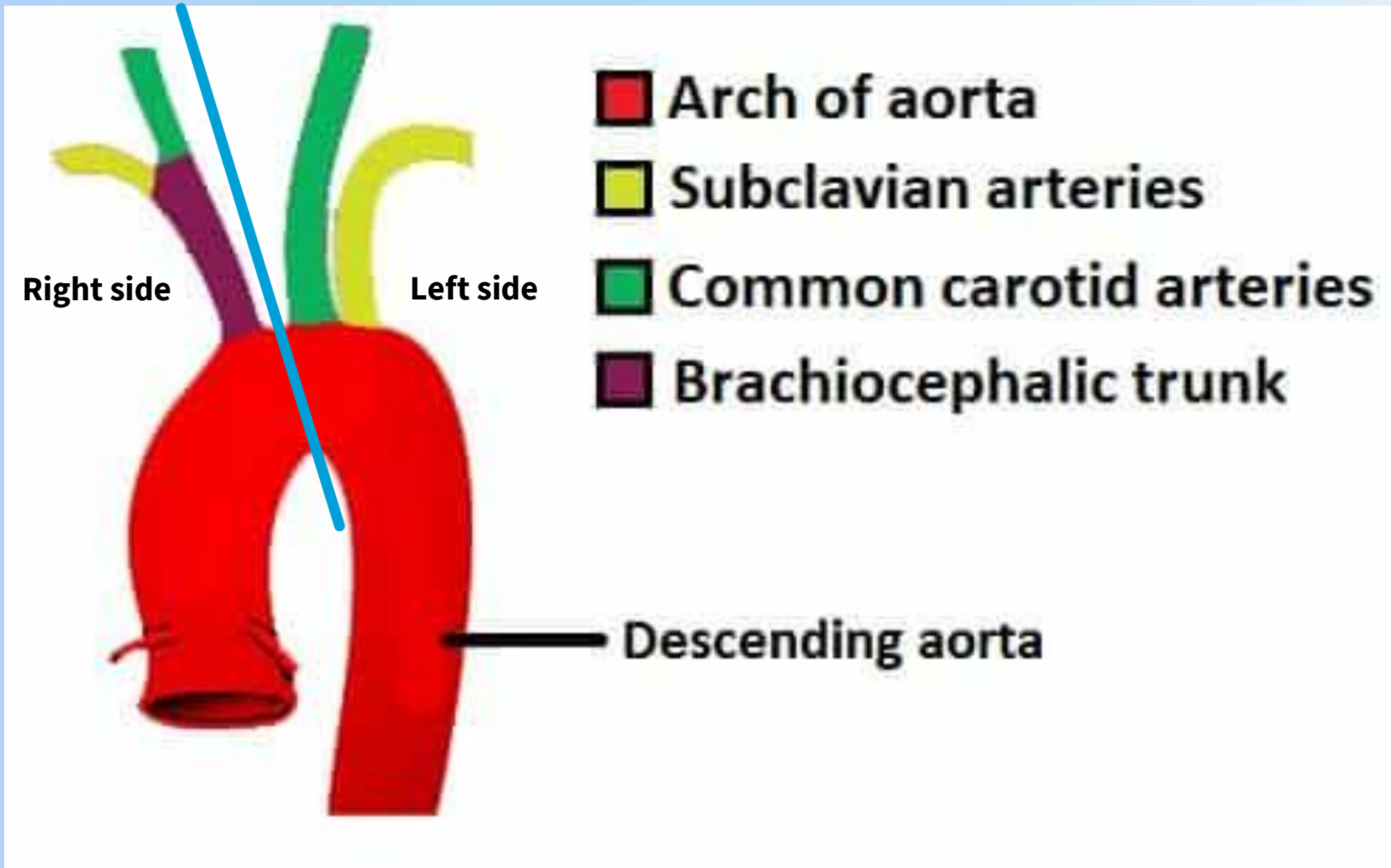


Do you use mnemonics to learn anatomy?

Reconsider.

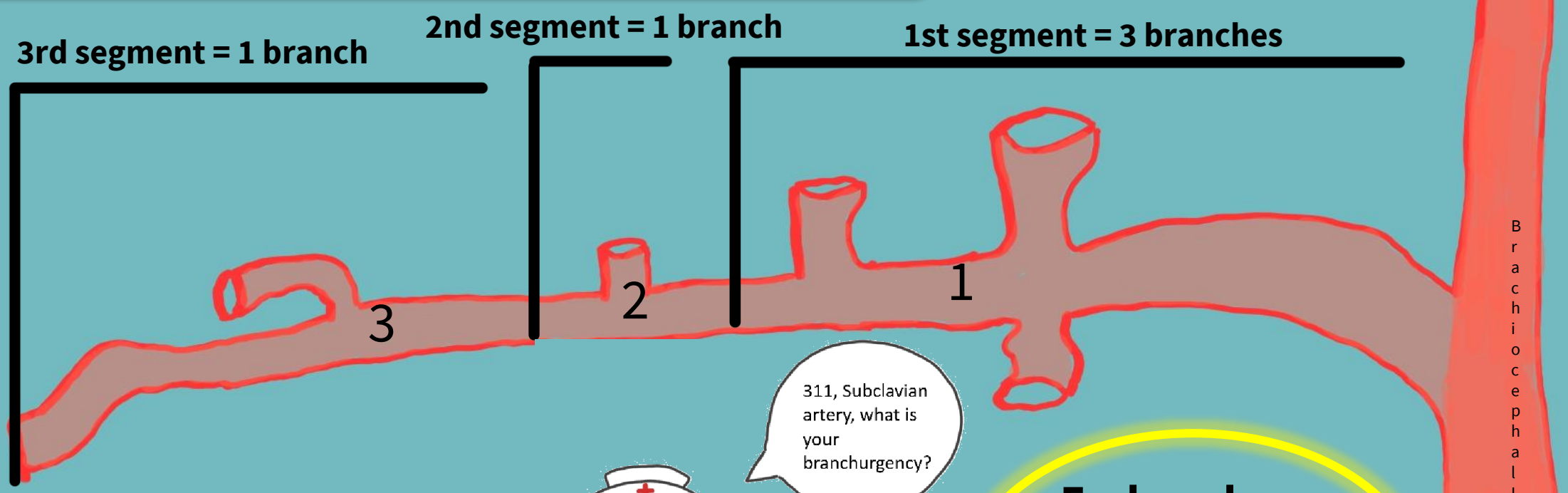
Arteries of upper limb





Orientation of the subclavian artery

Common carotid artery



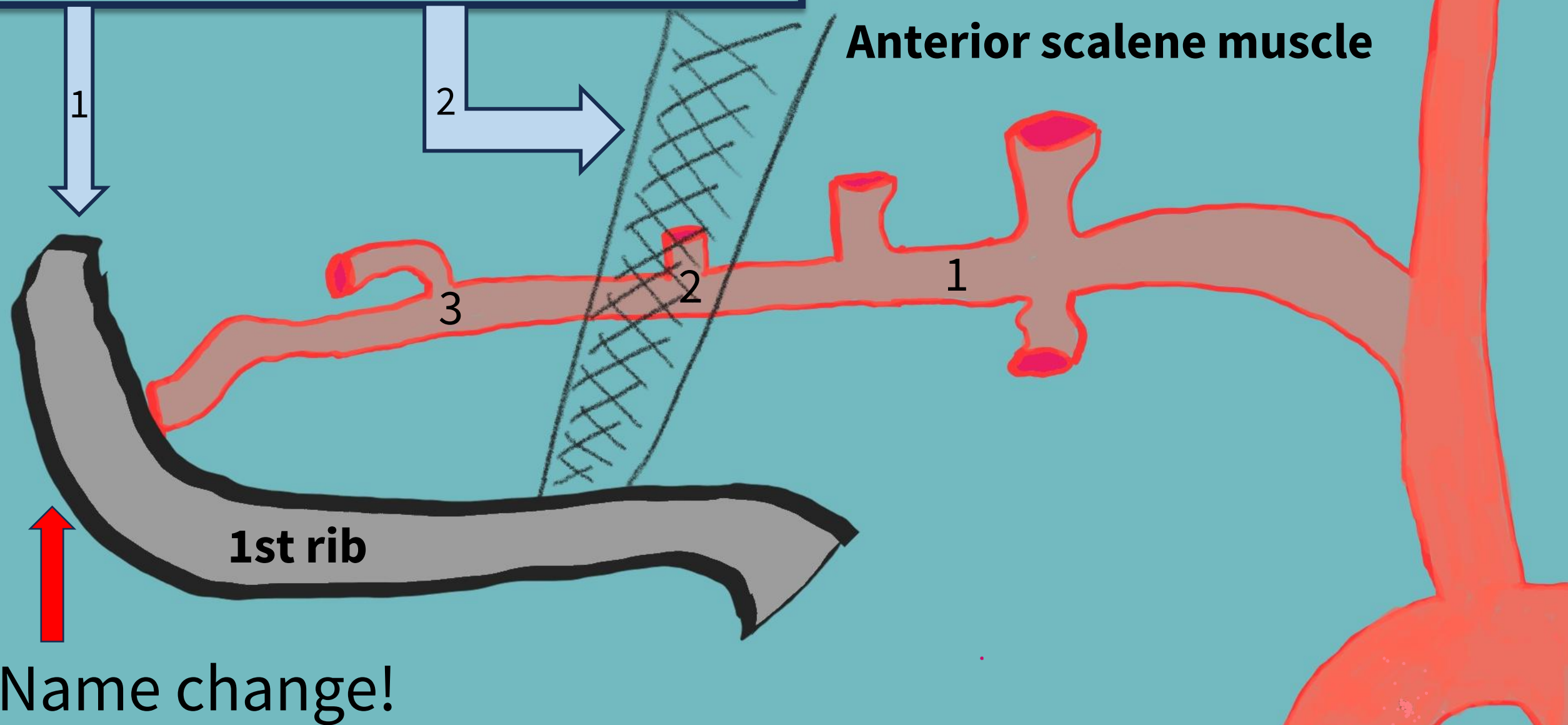
311, Subclavian artery, what is your branchurgency?

Embryology:
First segment (proximal part) derives from the 4th pharyngeal arch!

And so does the arch of aorta!

Arch of aorta

Two major landmarks




Subclavian artery branches - first segment

Vertebral artery


- Spinal cord (C1-C6)
- Brainstem
- Cerebellum & posterior part of brain

Thyrocervical trunk

(Inferior thyroid artery, **Suprascapular artery**, Ascending and Transverse cervical arteries).

- **Thyroid**
- **cervical structures** (pharynx, larynx and anterior/superficial muscles of the neck)
- Scapula and trapezius muscle. 
(**suprascapular artery**)

Internal thoracic artery

- **Thoracic wall and breasts** (mammary artery)
- *Muscular part of the diaphragm* (musculophrenic artery)
- *Pericardium* (**Pericardiophrenic artery**) 

Subclavian artery branches - Second segment

Costocervical trunk

(Deep cervical artery and Superior intercostal artery)

- **Ribs (costals)**
- *Parietal pleura*
- *C7 and T1 vertebrates*
- *Skin of the chest at 1st and 2nd intercostal space*

- **Cervical structures**
(Posterior/Deep muscles of the neck)

- often directly in relation to the spine (C7 and T1).
(*Semispinalis capitis and Cervicis muscles*)

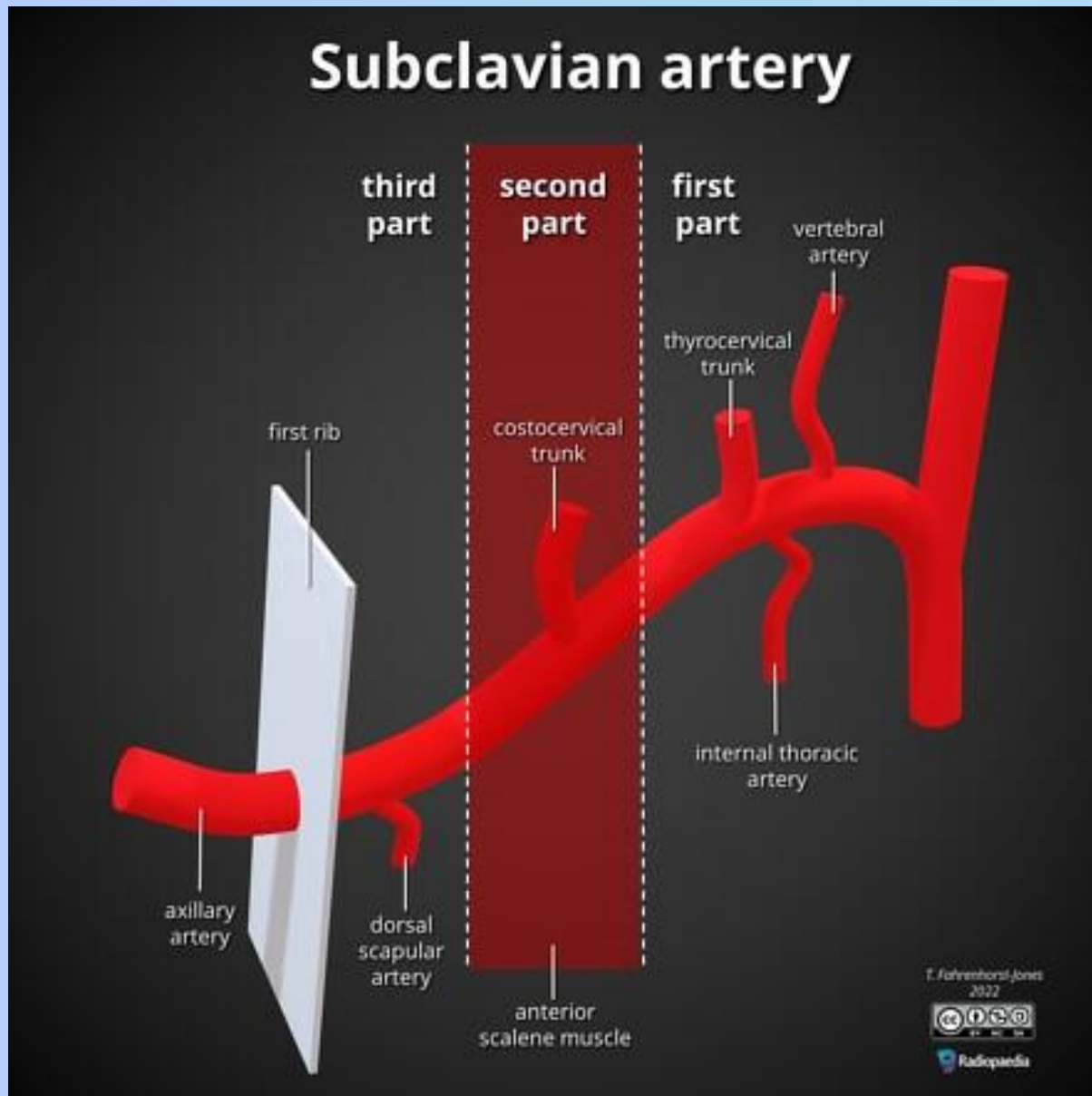
Subclavian artery branches - Third segment

Dorsal scapular artery



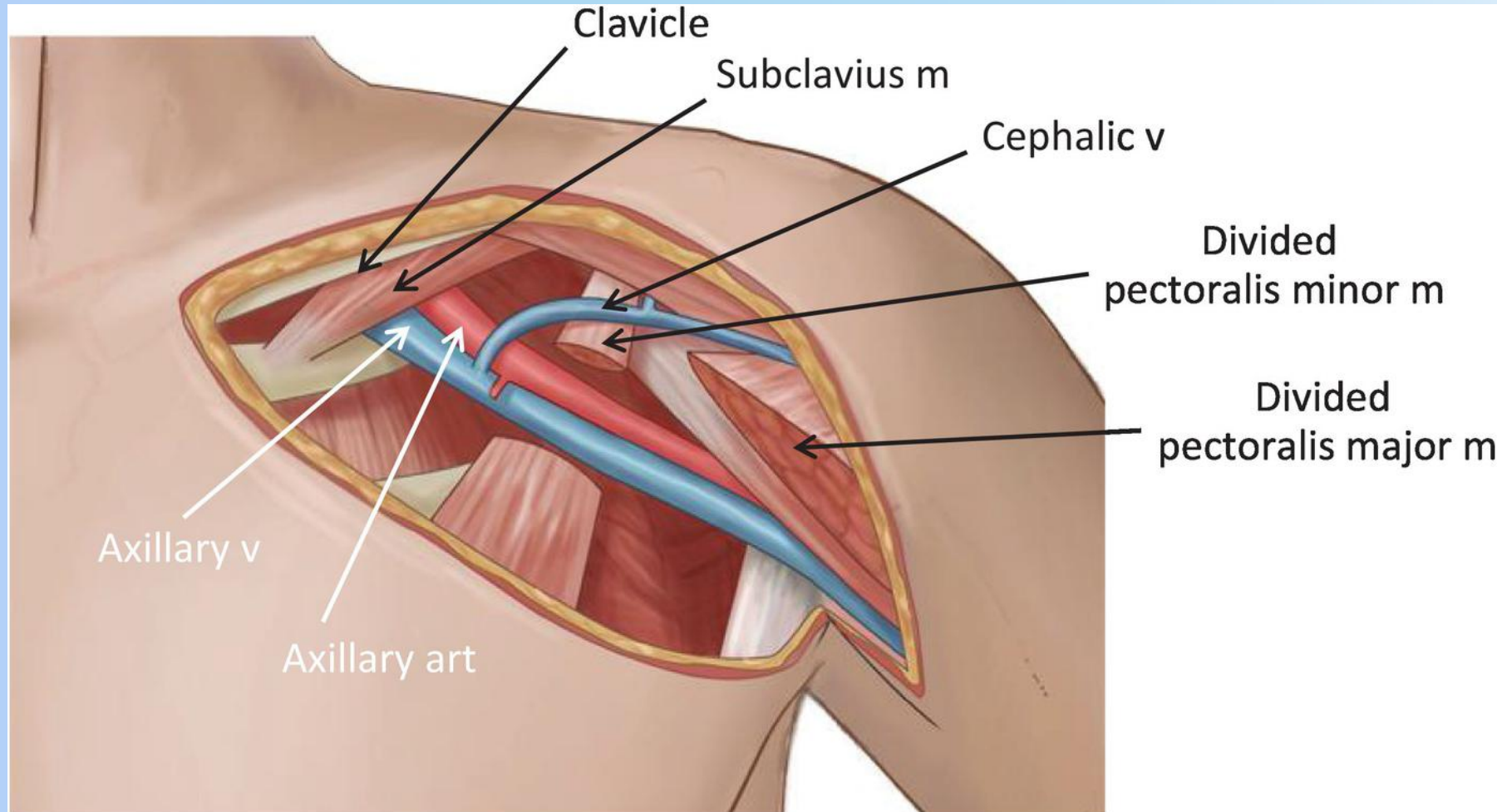
- Joins the **scapular arterial complex**
- **Muscles:**
 - Levator **scapulae** muscle
 - **Rhomboid muscles** (minor and major)
 - **Trapezius** muscle

Summary - does it make sense though? - YES!



- **Thyrocervical trunk**
= *ANTERIOR* neck muscles + thyroid
- **Costocervical trunk**
= *POSTERIOR* neck muscles
- Pericardiophrenic artery branches off the *internal thoracic artery* while supplying the *pericardium* and anterior part of the *diaphragm*.
- Proximal part of subclavian artery (1st segment) derives from the 4th pharyngeal arch, embryologically. So does the arch of aorta

Axillary arteries



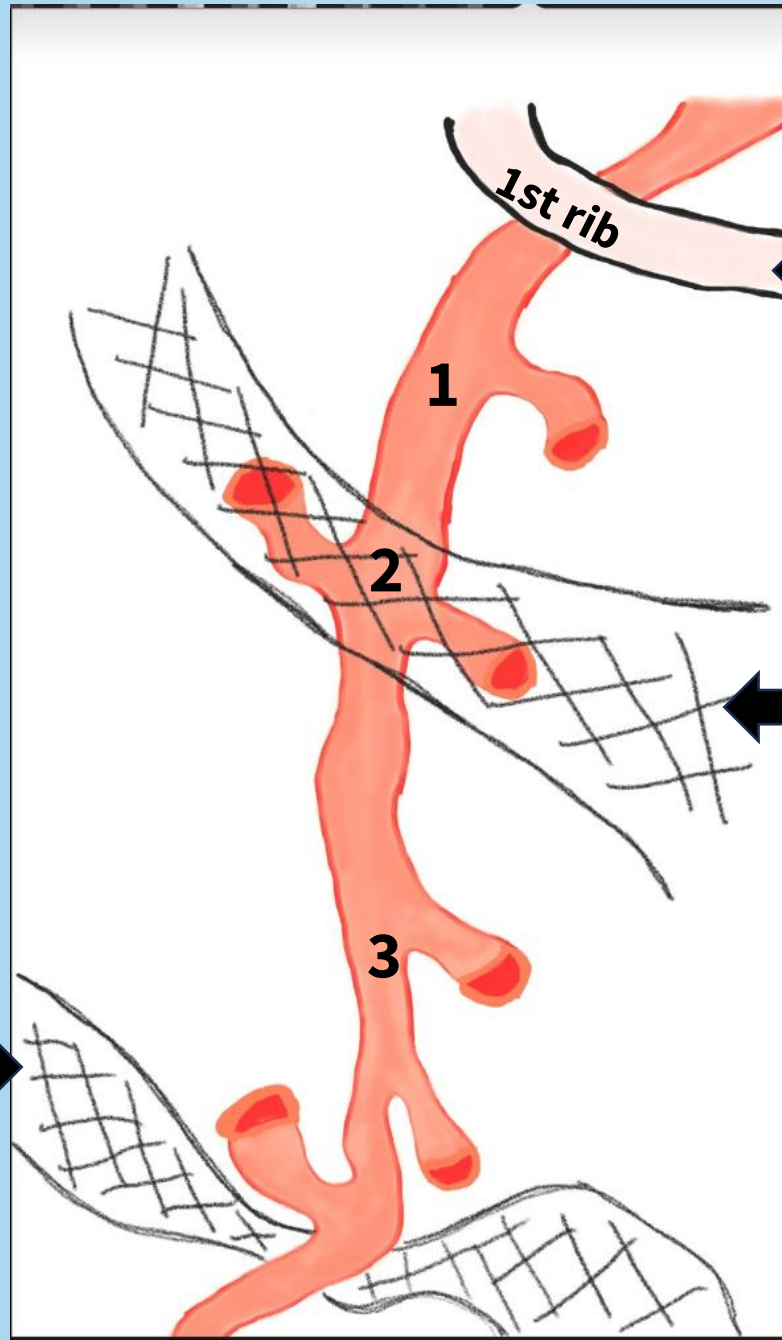
Axillary arteries segment and borders

3 segments:

- 1st segment = 1 branch
- 2nd segment = 2 branches
- 3rd segment = 3 branches

3 Borders, 3 landmarks:

- 1st segment = 1st rib to Pectoralis minor
- 2nd segment = Behind Pectoralis minor
- 3rd segment = Pectoralis minor to Teres major muscle



Subclavian artery

1st rib

1

1

2

2

Pectoralis minor muscle

3

3

Teres major muscle
Name change!

Branches of axillary artery


1st segment:

- 1. Superior thoracic artery**
(Pectoralis major and minor, subclavius muscle, 1st and 2nd intercostal muscles and the skin)

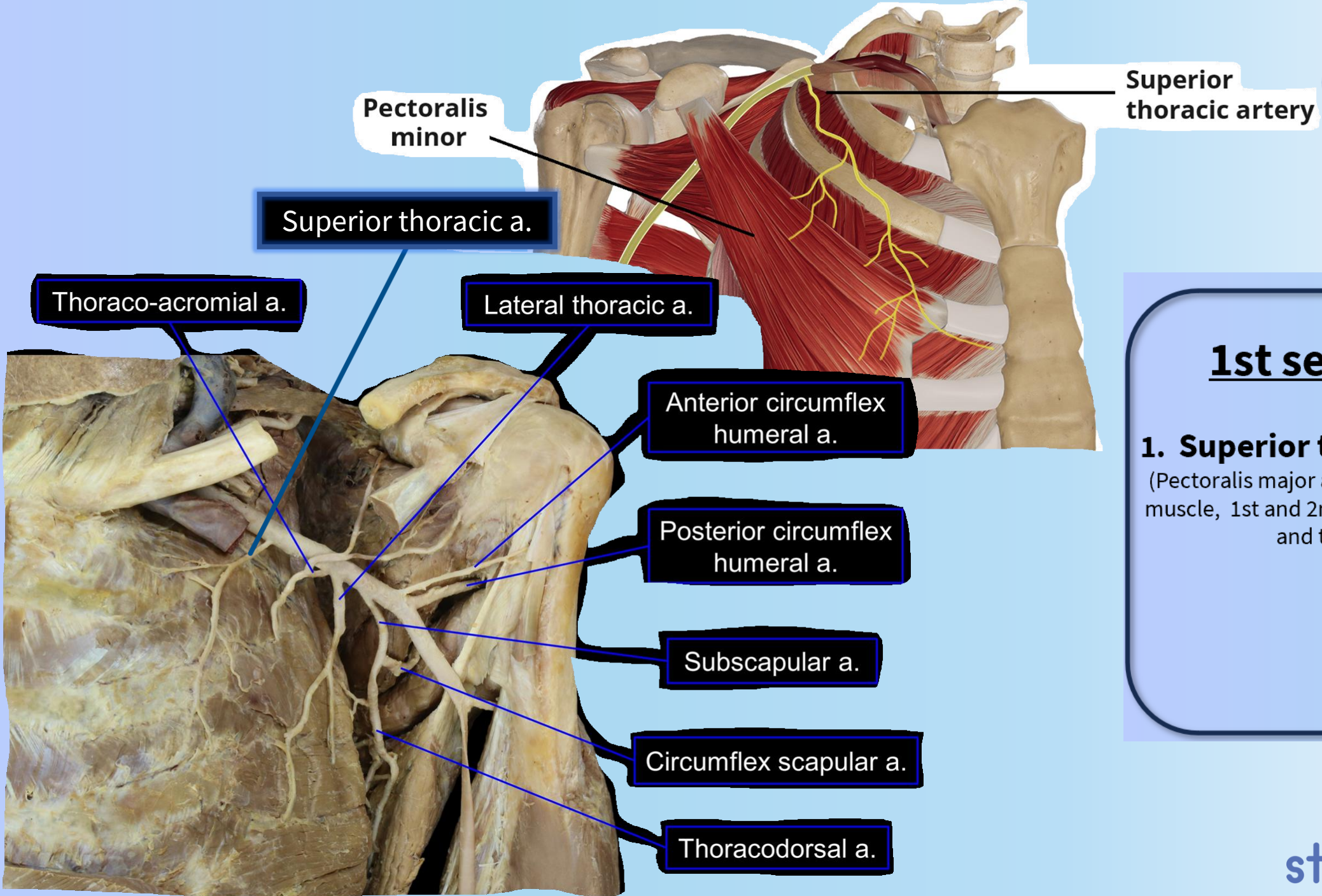
2nd segment:

- 1. Thoracoacromial artery**
(Pectoralis major and minor, deltoid, acromion + clavicle)
- 2. Lateral thoracic artery**
Axillary lymph nodes, serratus anterior, pectoralis major and minor.

3rd segment:

- 1. Subscapular artery**
(Thoracodorsal artery + **Circumflex Scapular Artery**) 
- 2. Anterior humeral circumflex artery**
- 3. Posterior humeral circumflex artery**

Does it make sense though?



1st segment:

1. Superior thoracic artery

(Pectoralis major and minor, subclavius muscle, 1st and 2nd intercostal muscles and the skin)

2nd segment:

1. **Thoracoacromial artery**

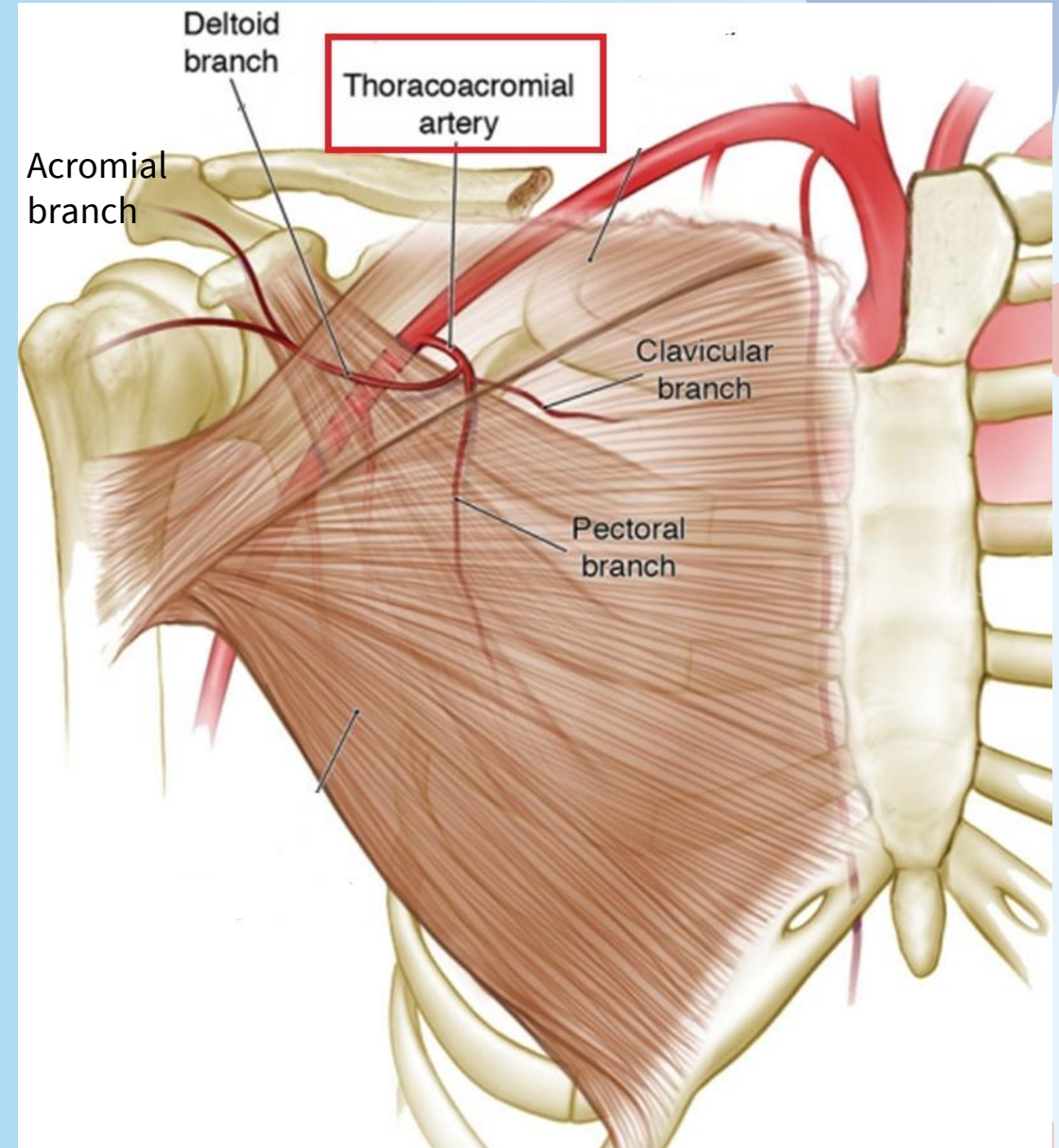
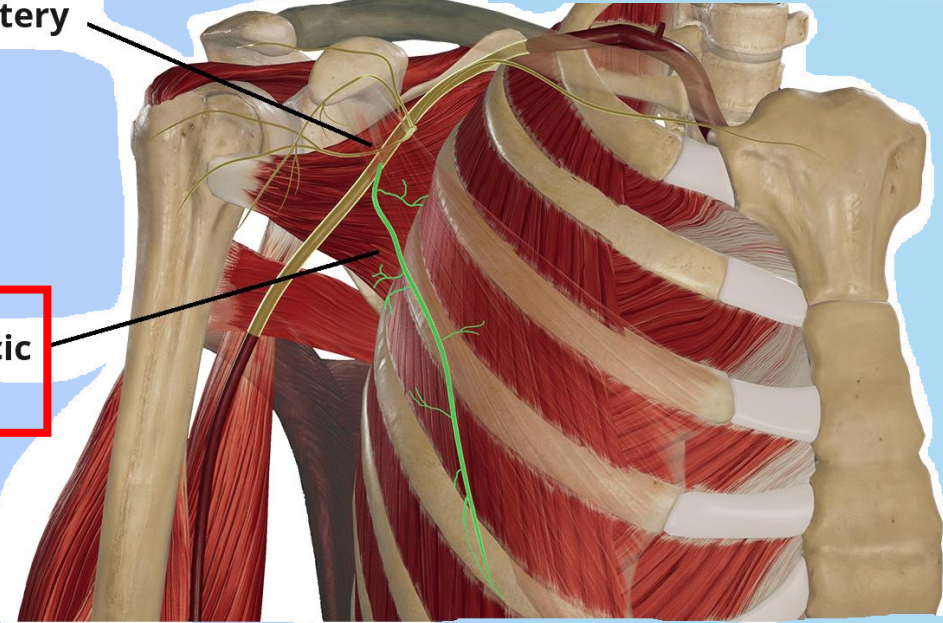
(Pectoralis major and minor, deltoid, acromion + clavicle)

2. **Lateral thoracic artery**

Axillary lymph nodes, serratus anterior, pectoralis major and minor.

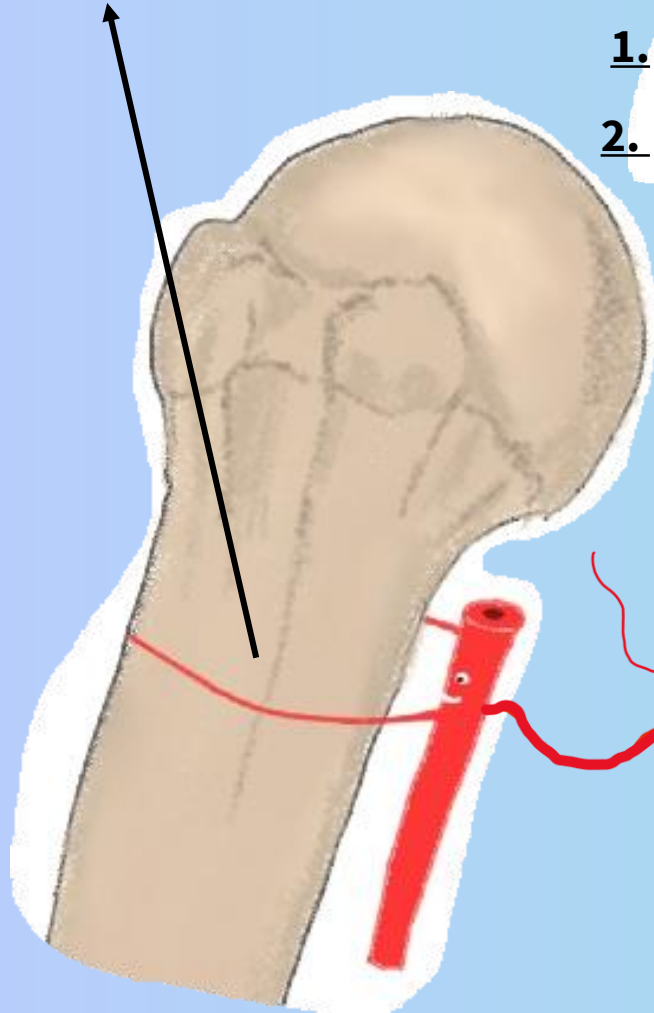
Axillary artery

Lateral thoracic artery



3rd segment

Surgical neck of the humerus.
Clinically important!



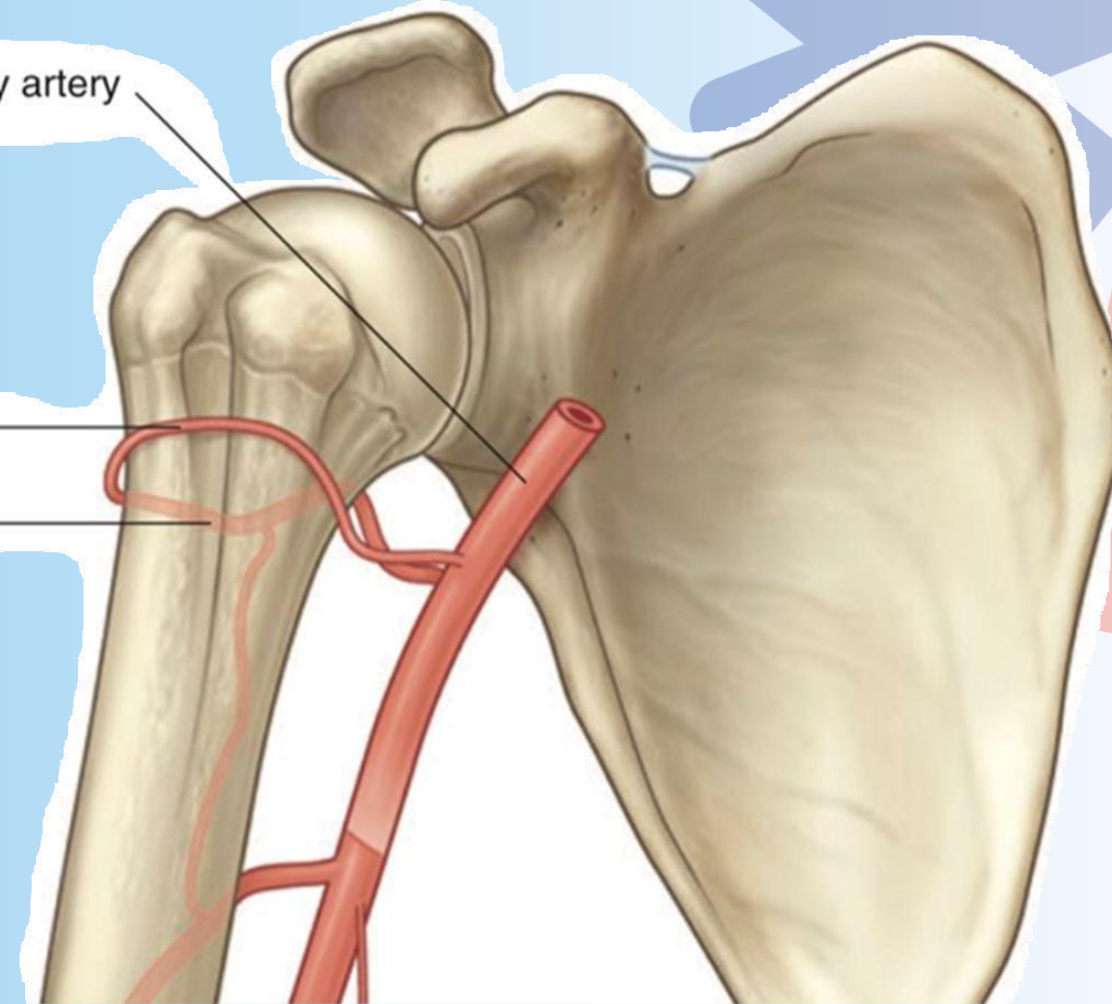
1. Anterior circumflex humeral artery

2. Posterior circumflex humeral artery

3.

Subscapular artery

Axillary artery



Did you collect us?

Arterial supply of scapula

(Scapular collateral circulation)



Suprascapular artery

Branch of thyrocervical trunk



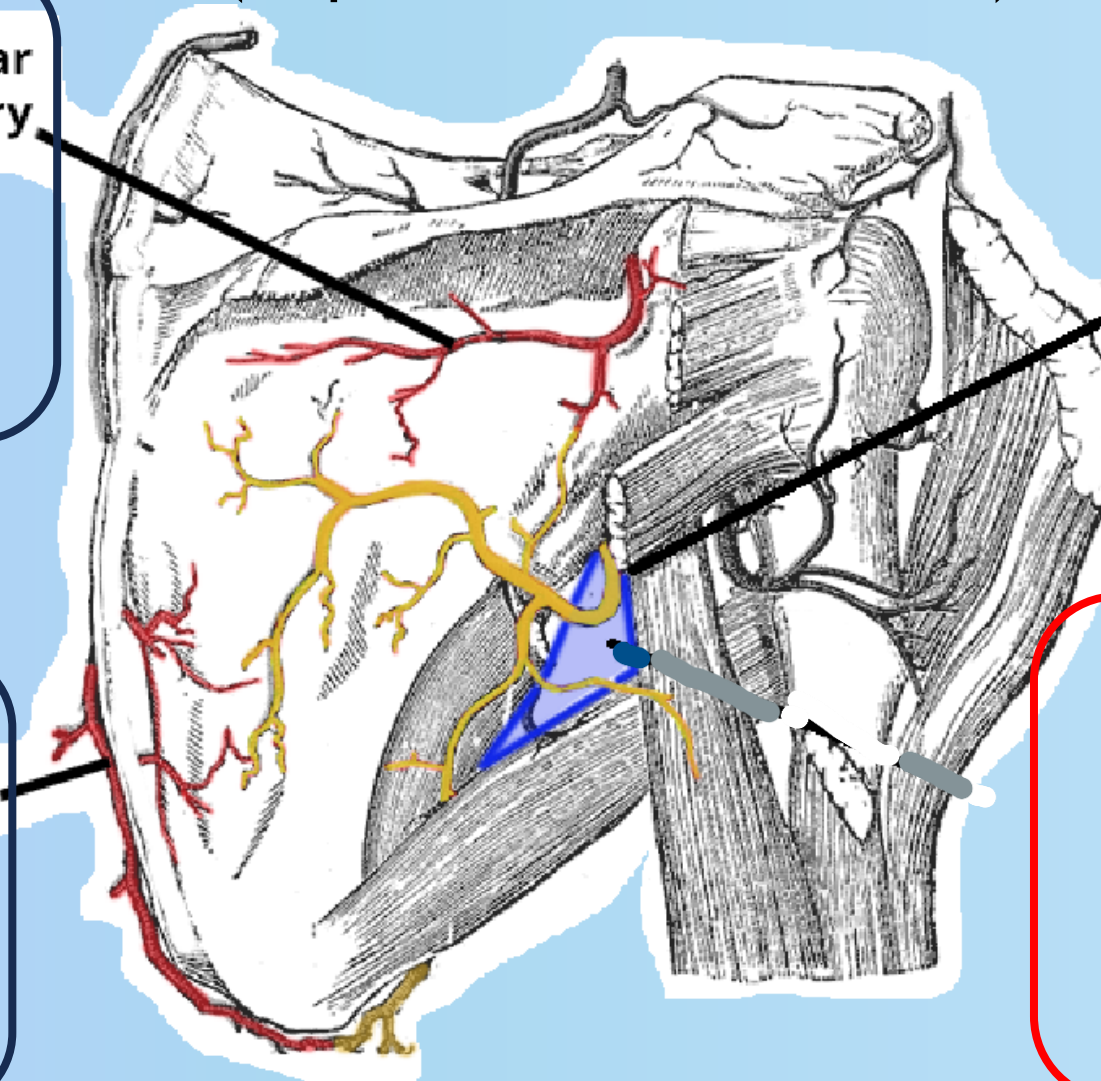
Circumflex scapular artery

Branches off from the **subscapular artery** (3rd segment of axillary artery)



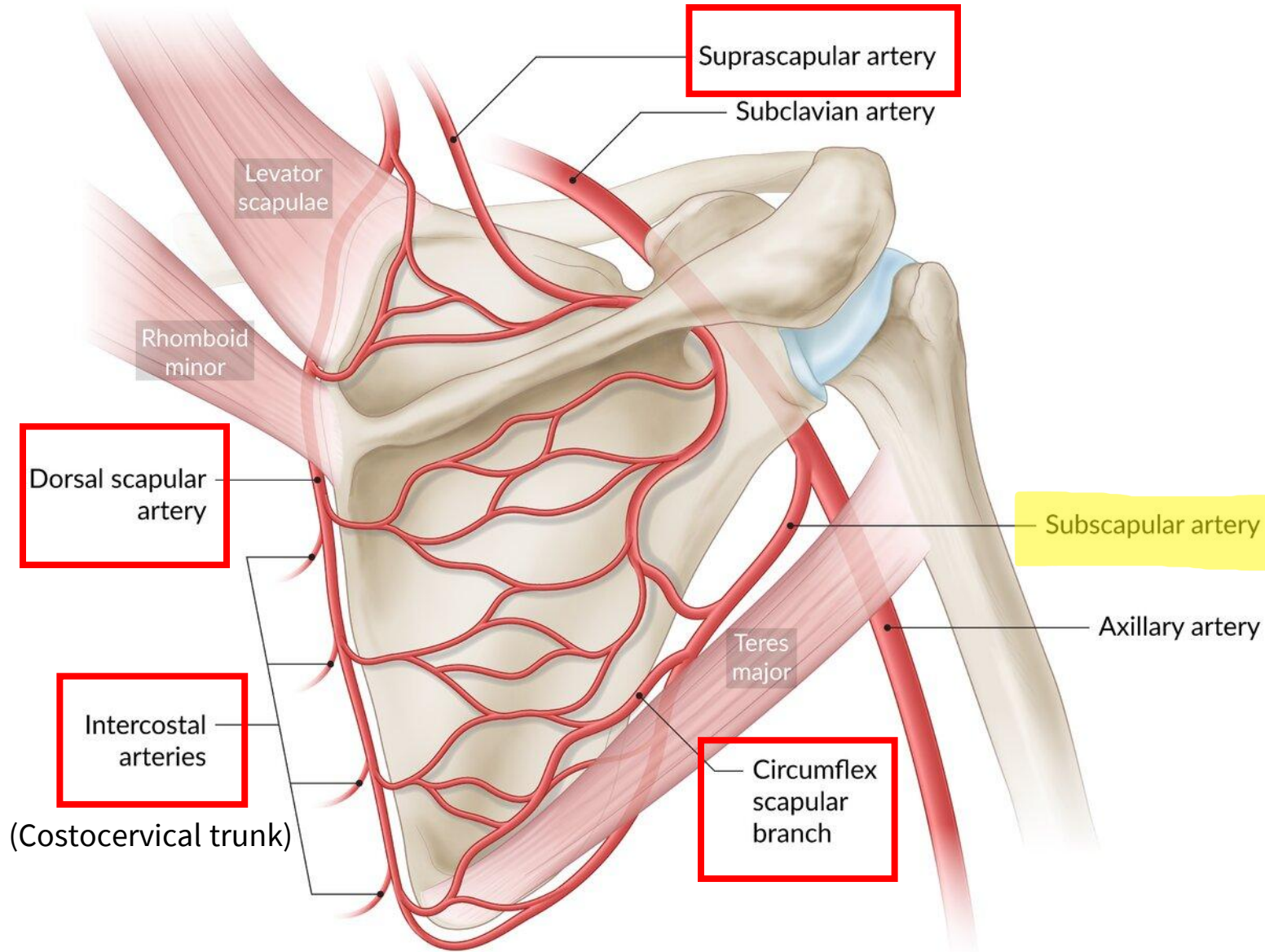
Dorsal scapular artery

3rd segment of subclavian artery



The **scapular arterial complex** consists of arteries from *both* subclavian artery and axillary artery. These arteries will anastomose on the dorsal part of scapula

Scapular collateral circulation





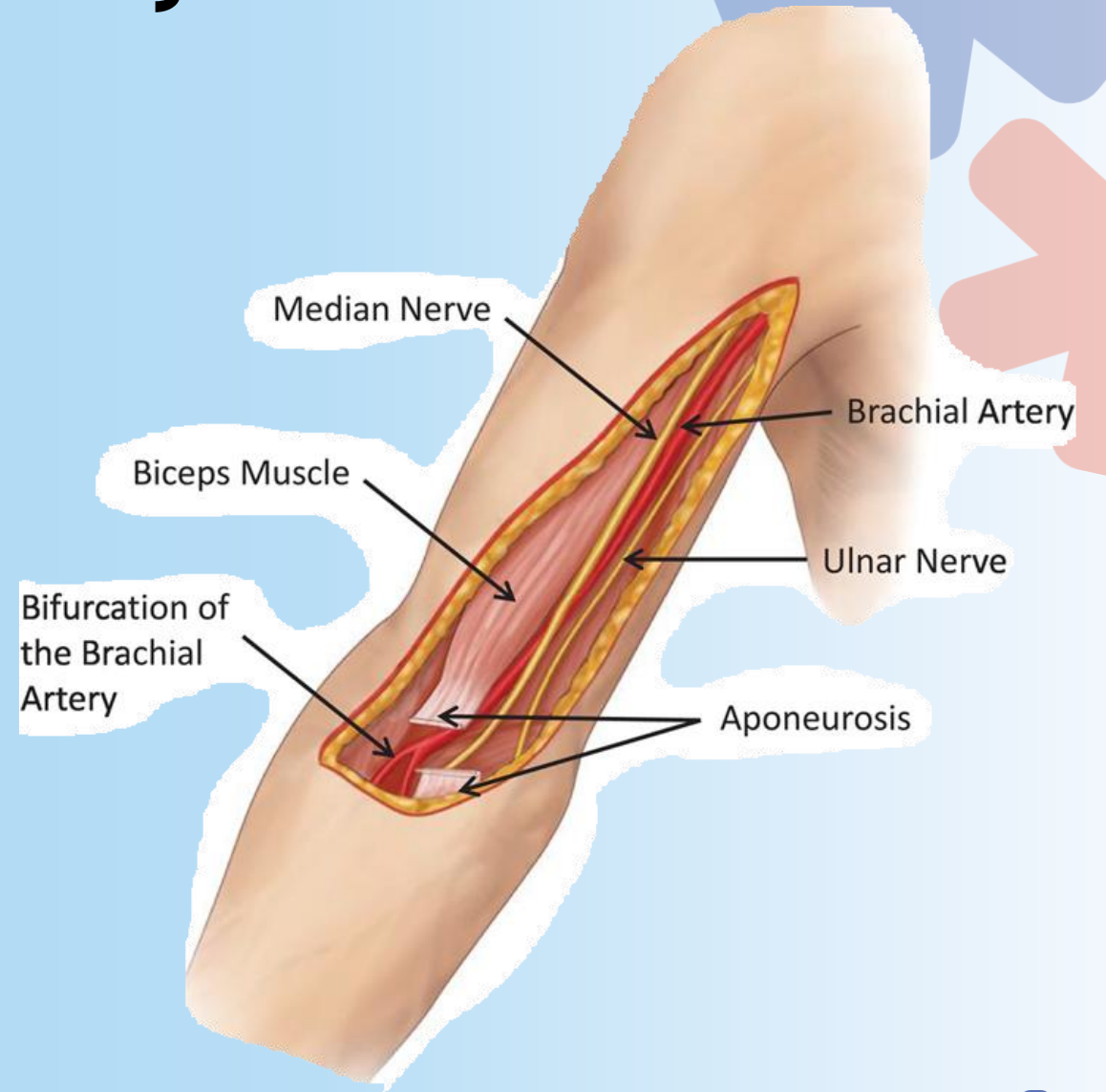
Brachial artery

My red blood cells when the brachial artery is ruptured or blocked.



Brachial artery

- No actual borders!
- **Starts:**
Where the Teres major muscle crosses.
- **Ends:**
Bifurcation in the cubital fossa.
- **Coursing:**
In the groove between the biceps and triceps muscles (Medial bicipital groove), which is quite superficial.
It courses together with ulnar and median nerves.
- In the cubital fossa, it will be accompanied by the *basilic vein* → **Easy exam question!**



Branches of brachial artery

«the reinforcement branches»



4 branches:

1. Profunda Brachii artery (Deep brachial artery)

- Ascending branch - Posterior humeral circumflex artery

- **Bifurcates** into Middle and radial collateral arteries (elbow joint anastomoses arterial plexus)

- **Deep brachial artery supplies the radial nerve**

2. Superior Ulnar Collateral artery

(elbow joint arterial anastomoses plexus)

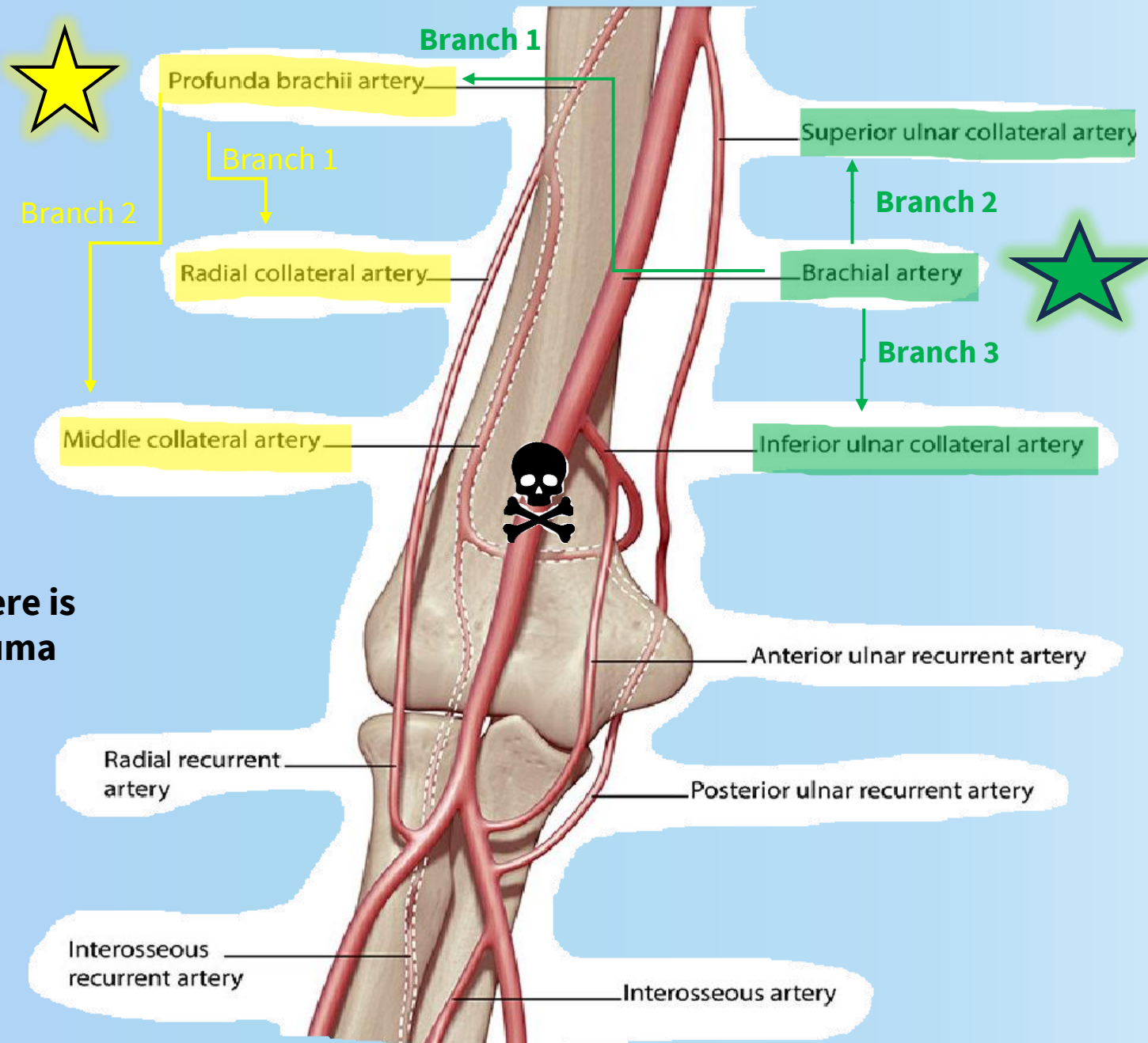
3. Inferior Ulnar Collateral artery

(elbow joint arterial anastomoses plexus)

4. Humeral nutrient artery

(Enters the nutrient canal around the middle of the humerus, anteromedial surface).





What happens if there is an occlusion or trauma here?



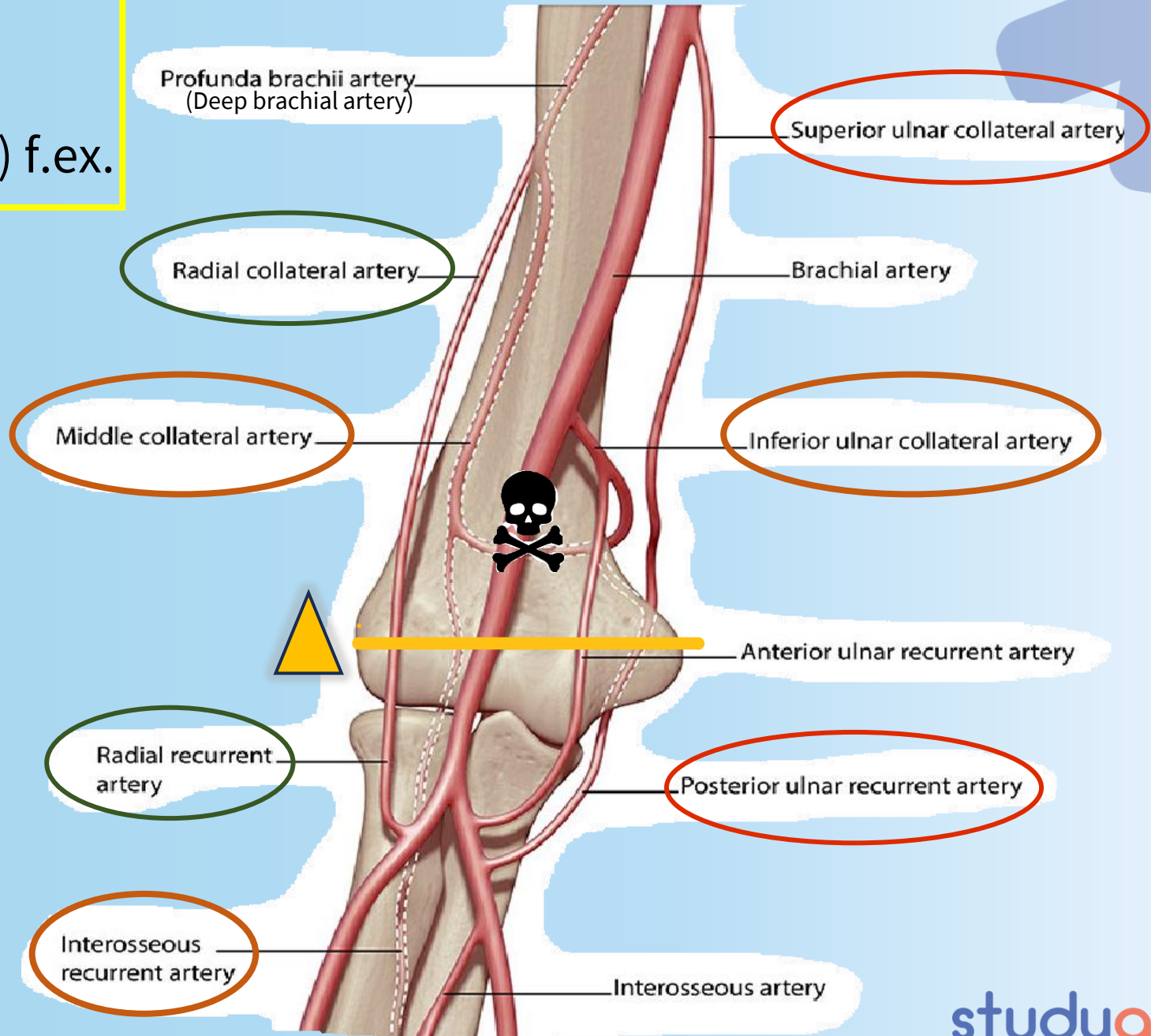
Rules:

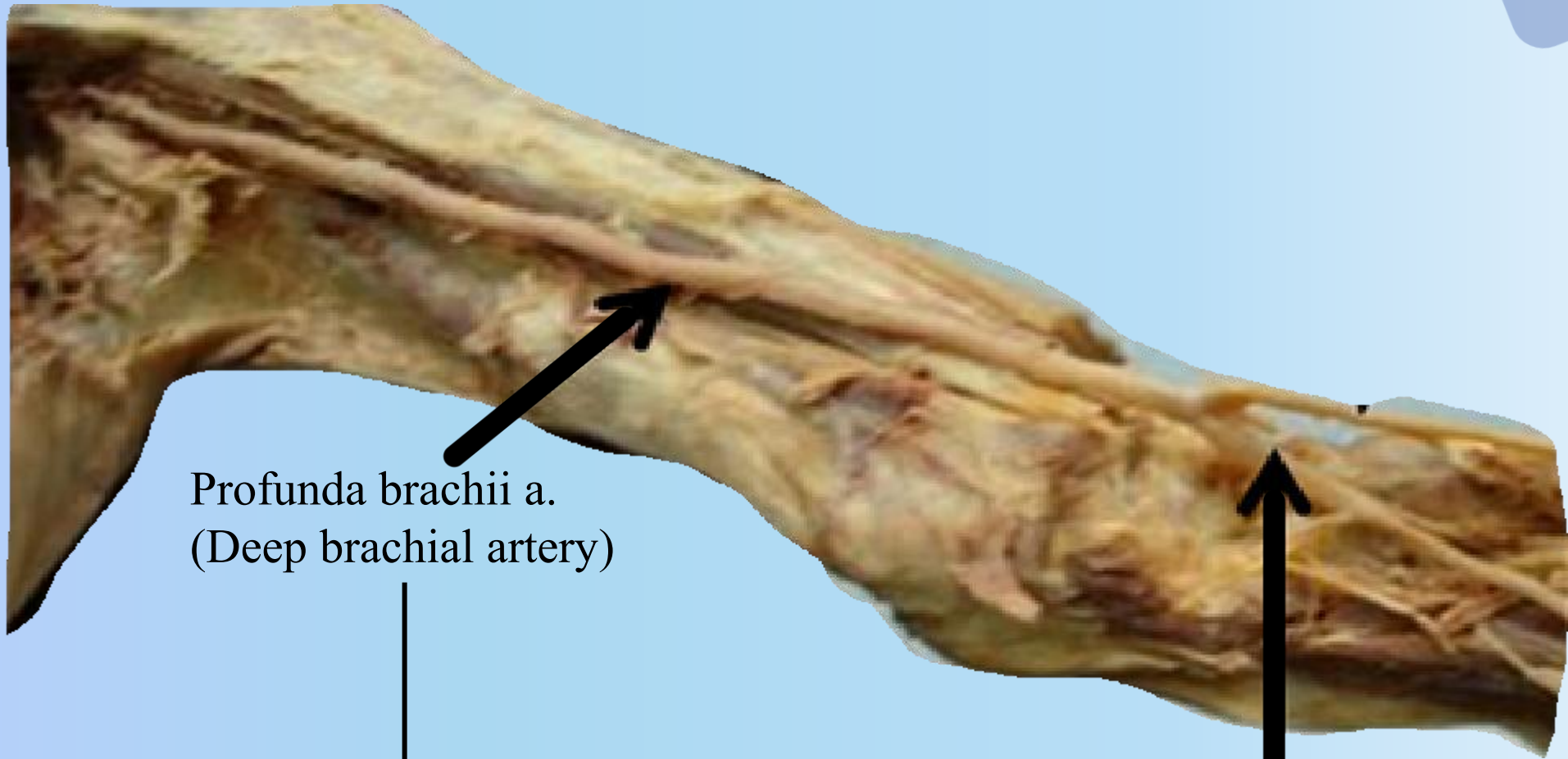
1. Collateral = Recurrent

2. Same «side» (radial + radial) f.ex.



***Change of name at
the medial
epicondyle!***





Profunda brachii a.
(Deep brachial artery)

Runs posteriorly

Bifurcation of the brachial artery
(ulnar and radial artery)

Radial and ulnar arteries



Endgoal: 4 Arches in wrist and hand

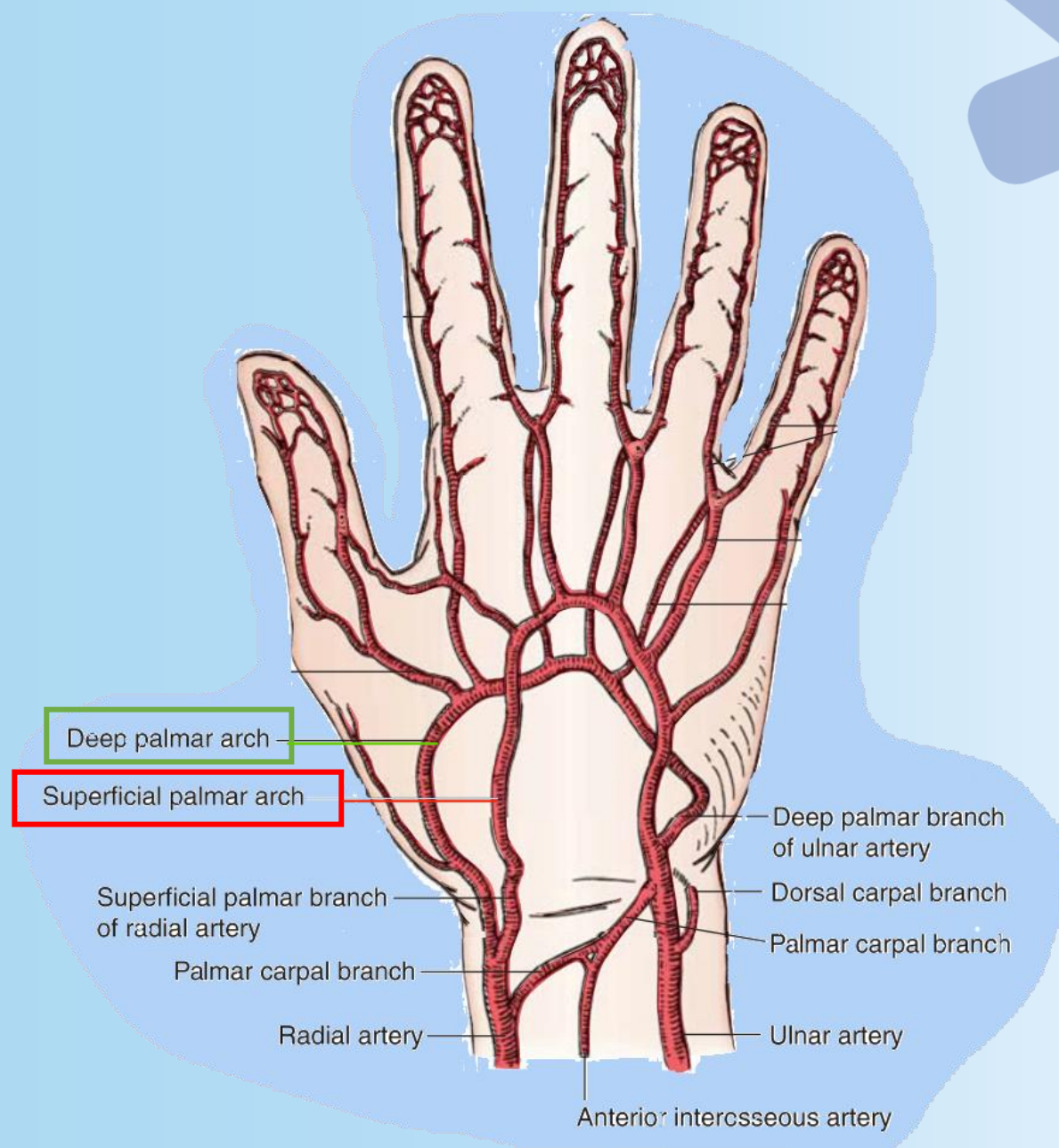
1. Superficial palmar arch
2. Deep palmar arch
3. Palmar carpal arch
4. *Dorsal carpal arch (or Dorsal carpal Rete)*

Where are they?

Arch 1 and 2:

Deep palmar arch

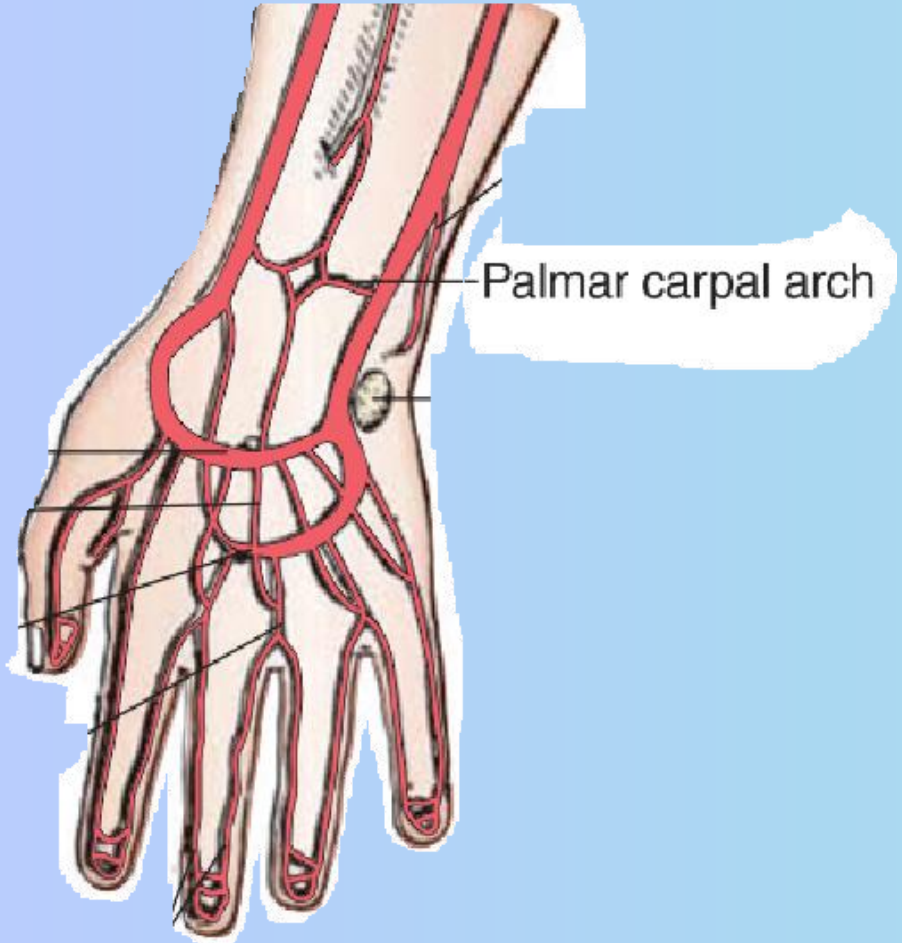
Superficial palmar arch



**Anterior view
(flexor side)**

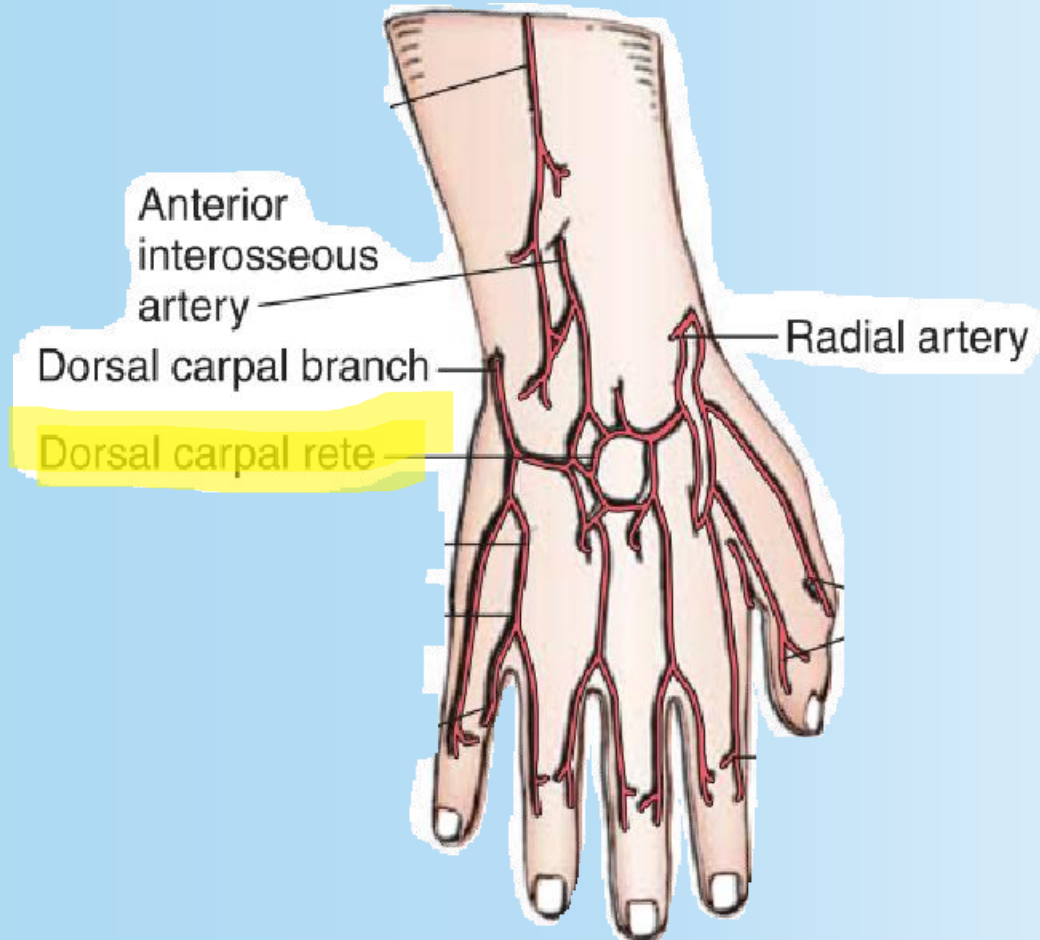
Arch 3 and 4:

Palmar carpal arch



Anterior view
(flexor side)

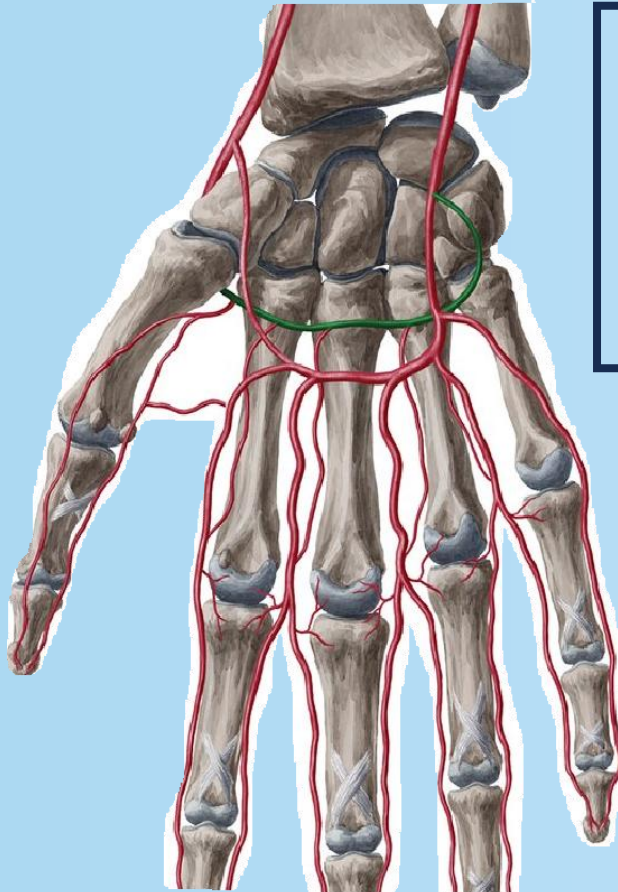
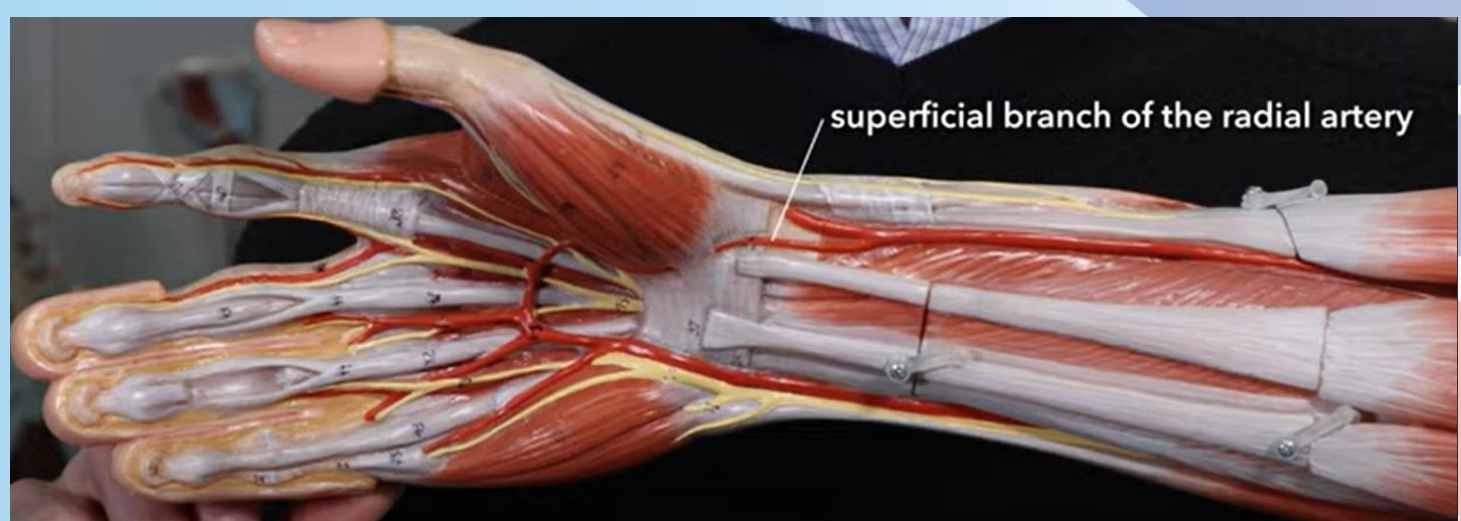
Dorsal carpal arch (or Dorsal carpal Rete)



Posterior view
(extensor side/dorsal)

Radial artery

- Radial artery courses just behind brachioradialis muscle, then superficially towards the wrist (radial pulse).
- Radial artery provides some small muscular branches before it bifurcates at the wrist - **blood supply to extensor muscles**.
- «Radial muscles» = Radial recurrent artery and radial artery.
- **Splits at the wrist, where it provides a SUPERFICIAL BRANCH of the radial artery (and palmar carpal branches of the radial artery).**
- Superficial radial branch creates/joins the **superficial palmar arch**.
- Radial artery courses around the thumb (through the *anatomical snuffbox*) to leave off a branch for the dorsal arterial plexus (**dorsal carpal rete**).
- The radial artery then goes back into the palm to create the **deep palmar arch**.



Superficial palmar arch:

- Superficial branch of radial artery

Deep palmar arch:

- Radial artery (main)



Superficial palmar arch:

- Digits, skin, lumbricals

Deep palmar arch:

- Bones, joints and interossei muscles (**only to metacarpals**)

Ulnar artery and its branches

- Provides branches to supply the forearm, flexors and extensors + the elbow
- Courses on top of flexor retinaculum, into *Guyon canal* when entering the hand.

Branches:

1. Common interosseous artery

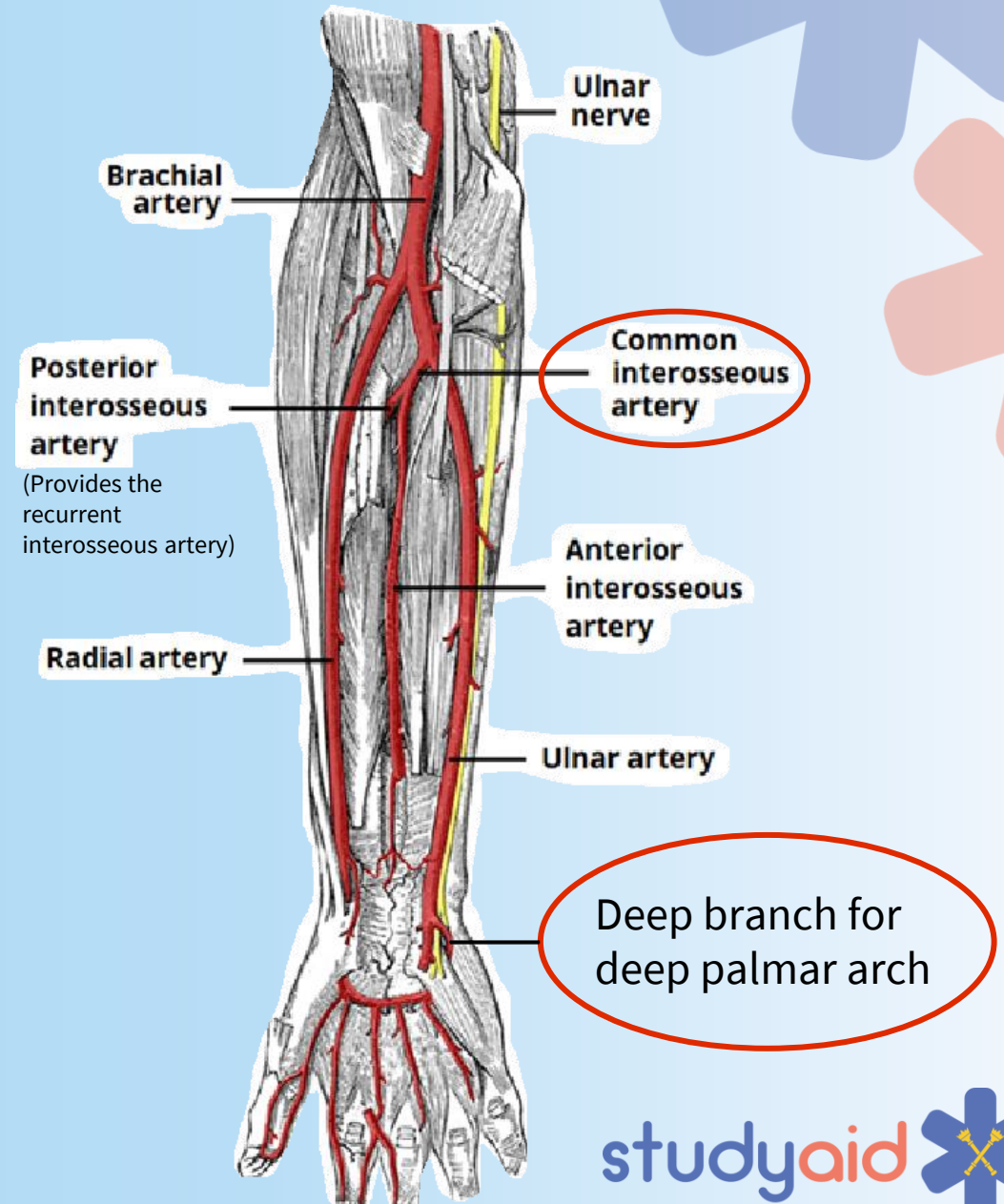
- Posterior interosseous artery, which gives off a branch called the Interosseous recurrent artery).

- *Anterior interosseous artery* that will merge with the *Palmar carpal arch* in the wrist.

2. Branch for the Palmar Carpal Arch

3. Branch for deep palmar artery

Ulnar artery (main artery) terminates in the *superficial palmar arch* and gives off a deep branch to the deep palmar arch!



Rules:

1.

SUPERFICIAL radial artery branch
+
SUPERFICIAL palmar arch

2.

DEEP ulnar artery branch
+
DEEP palmar arch

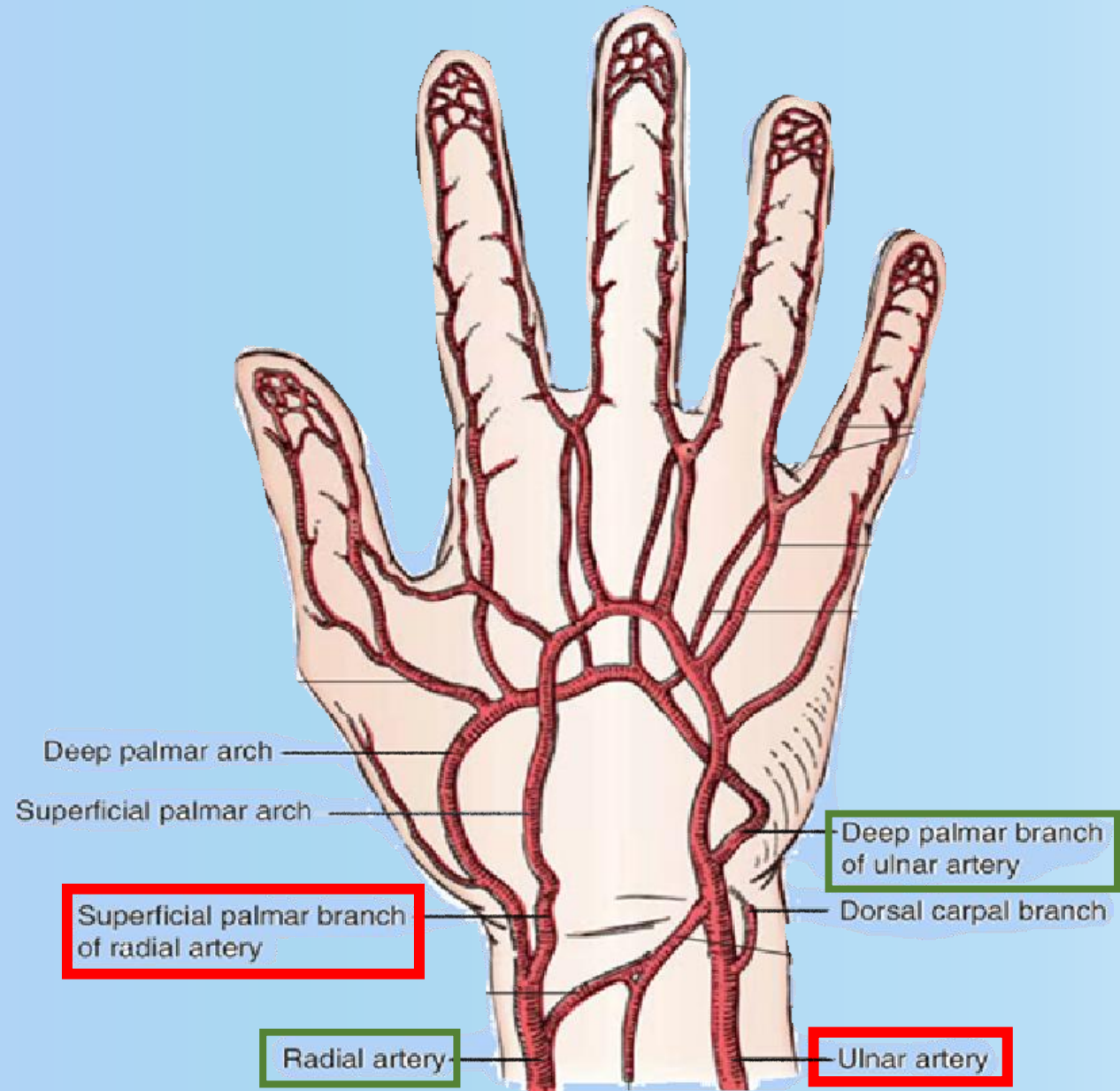
3.

*Radial artery goes to the **deep** palmar arch to meet **deep** ulnar branch*

*Ulnar artery goes to **superficial** palmar arch to meet **superficial** radial branch.*

Radial and ulnar arteries will NOT meet each other

- They meet the respective BRANCHES from one another!



Venous drainage of the limb

**Finally
beating the
really hard
level**

**”Tutorial
completed”**



Venous drainage of upper limb

- There are two types of veins:

1. Deep veins
2. Superficial veins

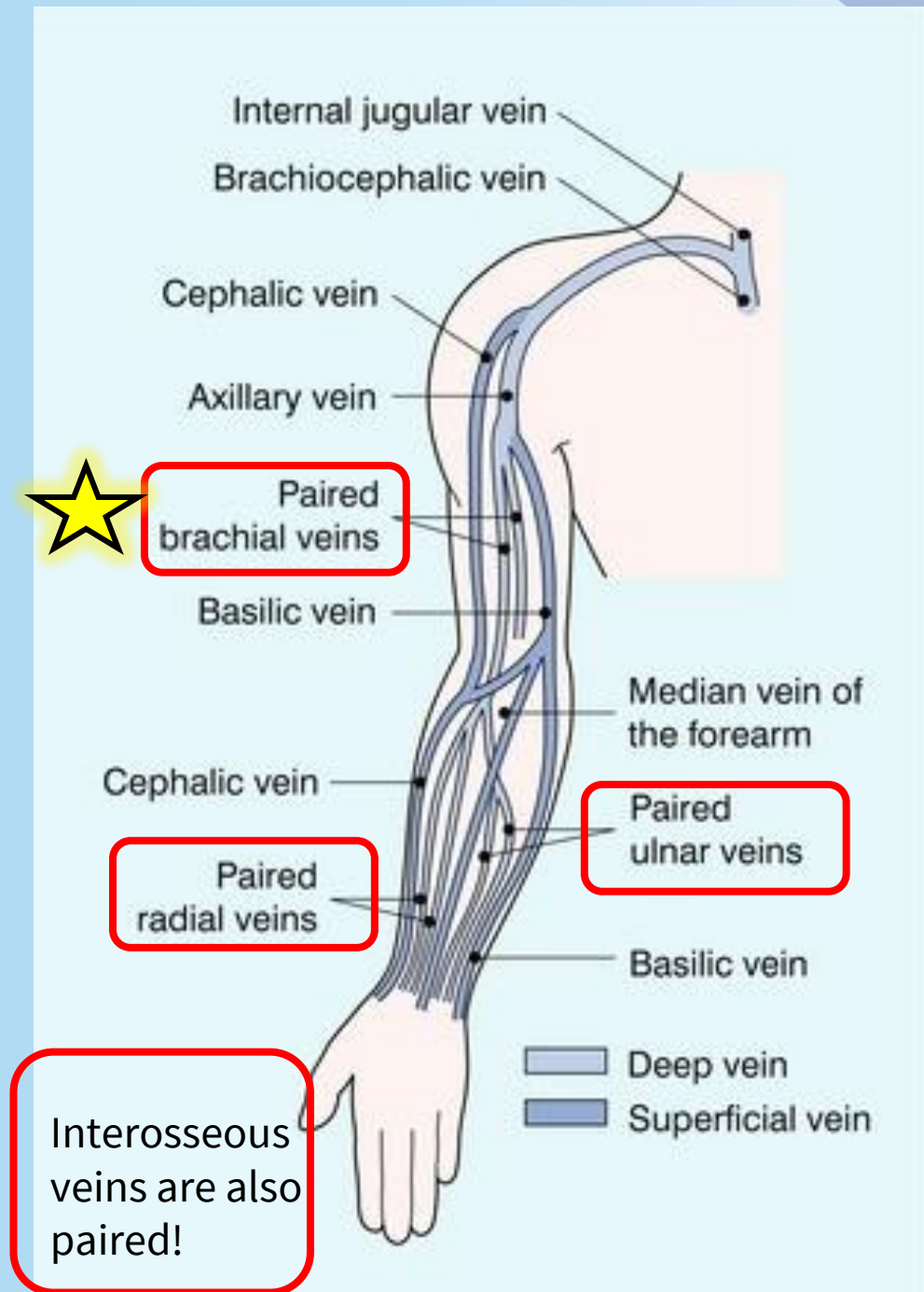
- The deep veins have the same name as the arteries, and they usually course with the arteries.

- The deep veins are PAIRED (2 with the same name).

Why do we have a pair of veins, but only one artery?


Hint:

Arterial pressure vs venous pressure.



Superficial veins

4 main veins + arches and plexuses:

1. **Cephalic vein** (lateral side (thumb) - on top of or lateral to biceps brachii)
2. **Basilic vein** (medial side (little finger) - courses over the medial epicondyle and shortly, in the groove *between* the biceps and triceps brachii muscles before it merges with the axillary vein)
3. **Median vein of the forearm** (drains into the basilic vein or the median cubital vein) 
4. **Median cubital vein** (connects Cephalic and Basilic vein in cubital fossa)
5.
 1. Dorsal venous network (on top of hand)
 2. Palmar carpal venous arch
 - 3-4. Superficial and deep palmar venous arches

Some superficial veins are usually not named, so they get unified names:

- Perforating veins.
- Plexuses.

Superficial veins will eventually drain into deep veins - **same as lymph nodes**

Coursing of the Cephalic and Basilic veins

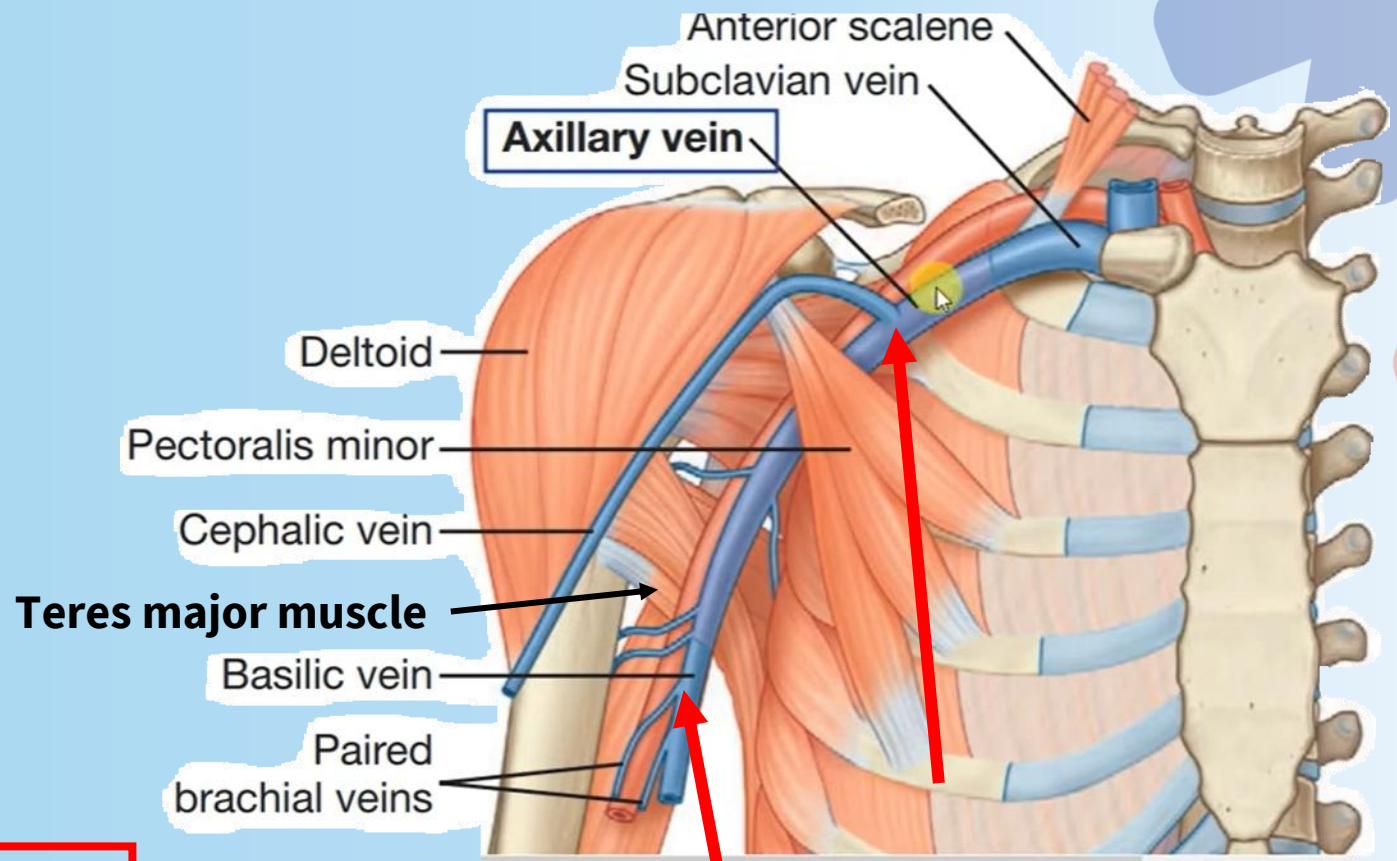
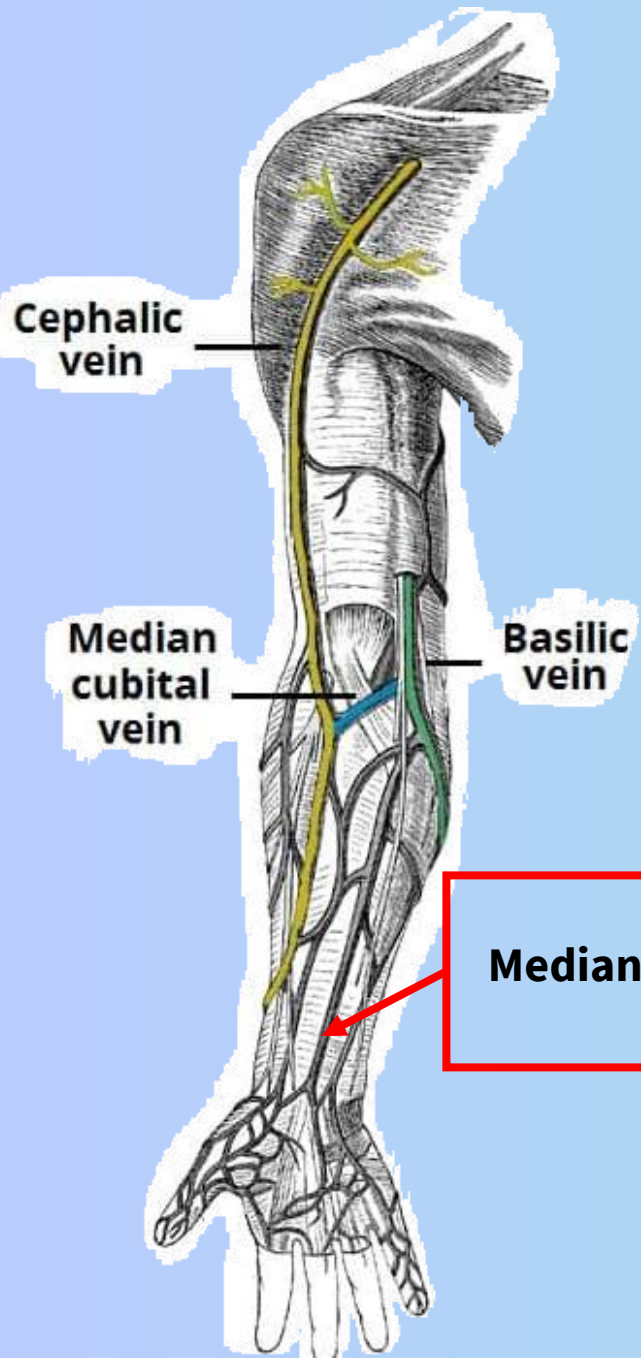
Cephalic vein:

- Branches out from the *dorsal venous network* of the hand, and crosses the **anatomical snuffbox** to enter the wrist.
- Drains the lateral side (radial side) from the hand to the shoulder.
- The cephalic vein will then course up «on top of» the medial bicipital groove
- It drains into the *Axillary vein* **at the clavicle**

Basilic vein:

- Branches out from the *dorsal venous network* of the hand.
- Drains the medial side (ulnar side) from the hand to the shoulder
- It will course superficially, but then penetrate the *brachial fascia*, merge with the paired brachial veins and it will form an **extension of the axillary vein BEFORE the Teres Major muscle.**

Remember the **limb bud** from embryology to separate these two!



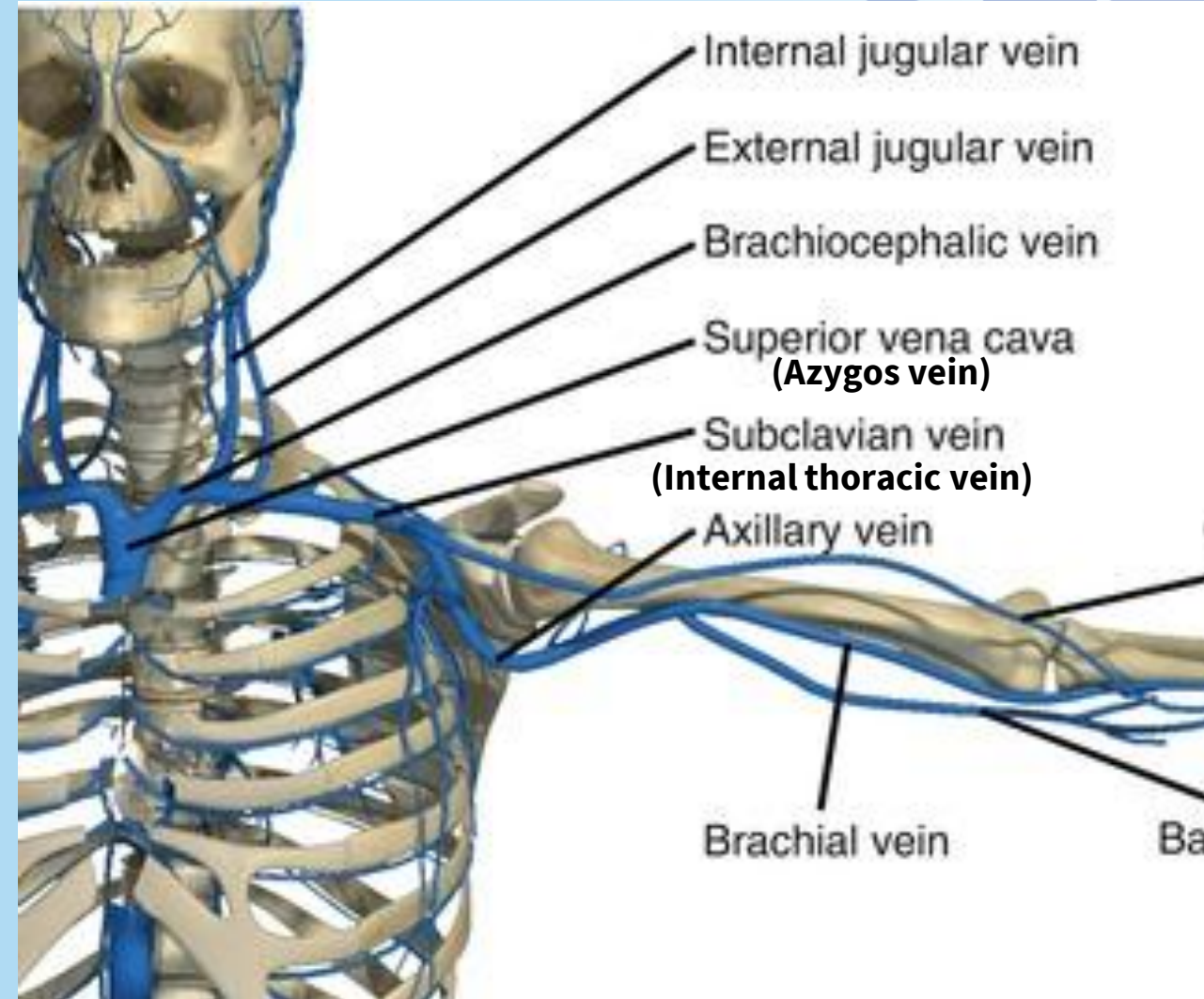
Median vein of the forearm

Paired brachial veins forms an extension of the axillary vein together with the basilic vein – which then merges with the original axillary vein (before Teres major muscle)

Venous system of upper limb - finish

- Axillary vein becomes subclavian vein (first rib).
- Subclavian vein merges with *internal jugular vein* to become the *brachiocephalic vein*
- The two brachiocephalic veins (right and left) merge to form the superior vena cava, which drains into the heart's right atrium.

The right and left side are **SYMMETRICAL** when it comes to the veins



Lymphatic system



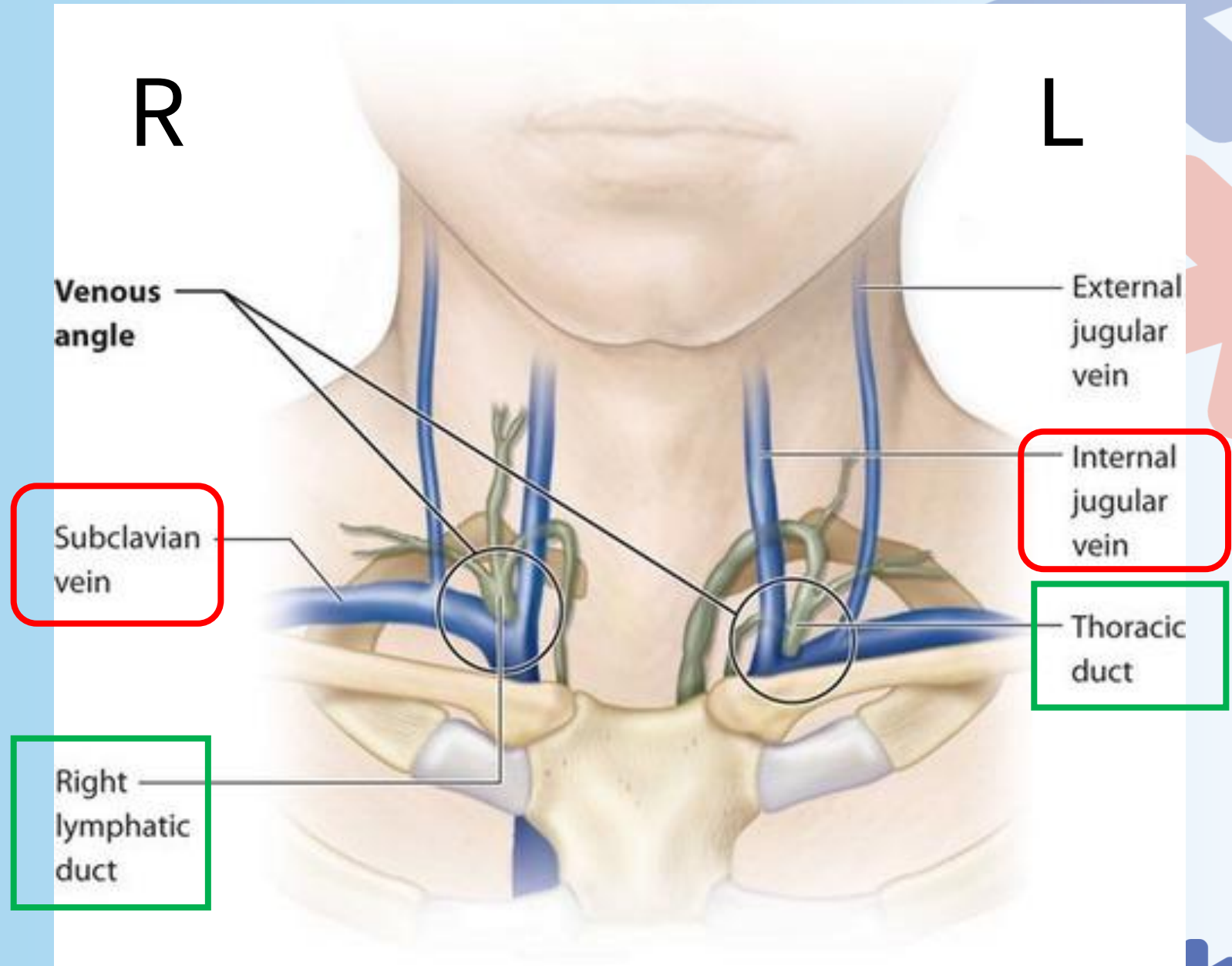
Venous angle

Venous angle on both sides are formed by the merging of:

- Subclavian veins
- &
- Internal jugular veins

Thoracic duct collects lymph from lower limb, abdomen and left thorax + left upper limb.

Right lymphatic duct collects lymph from right side of head and neck + thorax.

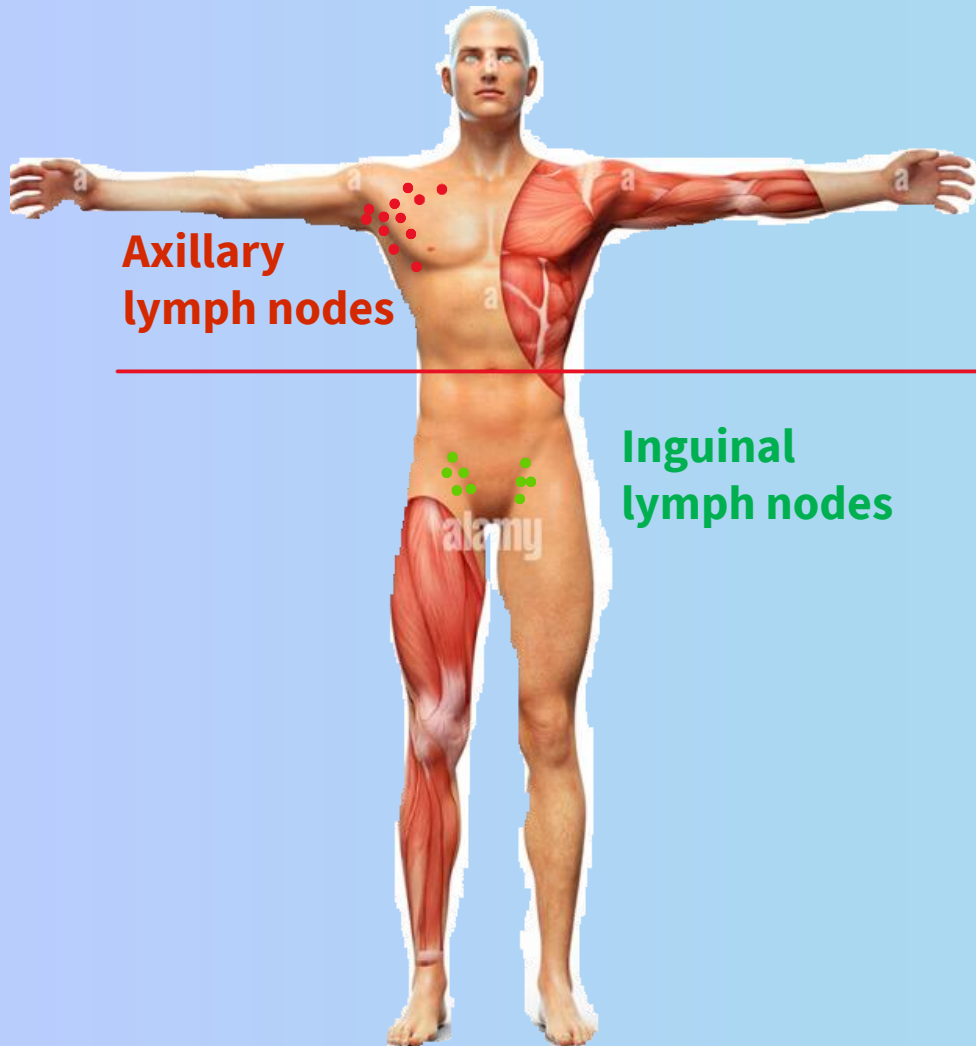


Lymphatic system of upper limb

General overview regarding lymph nodes:

- Lymph nodes usually follow the veins
- Lymph nodes group up together in the joints
- They drain the excess fluid within a tissue
- They drain from one group to another group (like checkpoints), and often from a superficial group to a deep group.
- They are always clinically relevant in terms of cancer metastasis and generally when the lymphatic system is not working properly (oedema).

Rule:



**Axillary
lymph nodes**

**Inguinal
lymph nodes**

❖ **Skin above umbilicus (bellybutton):**

Drains into **axillary lymph nodes**

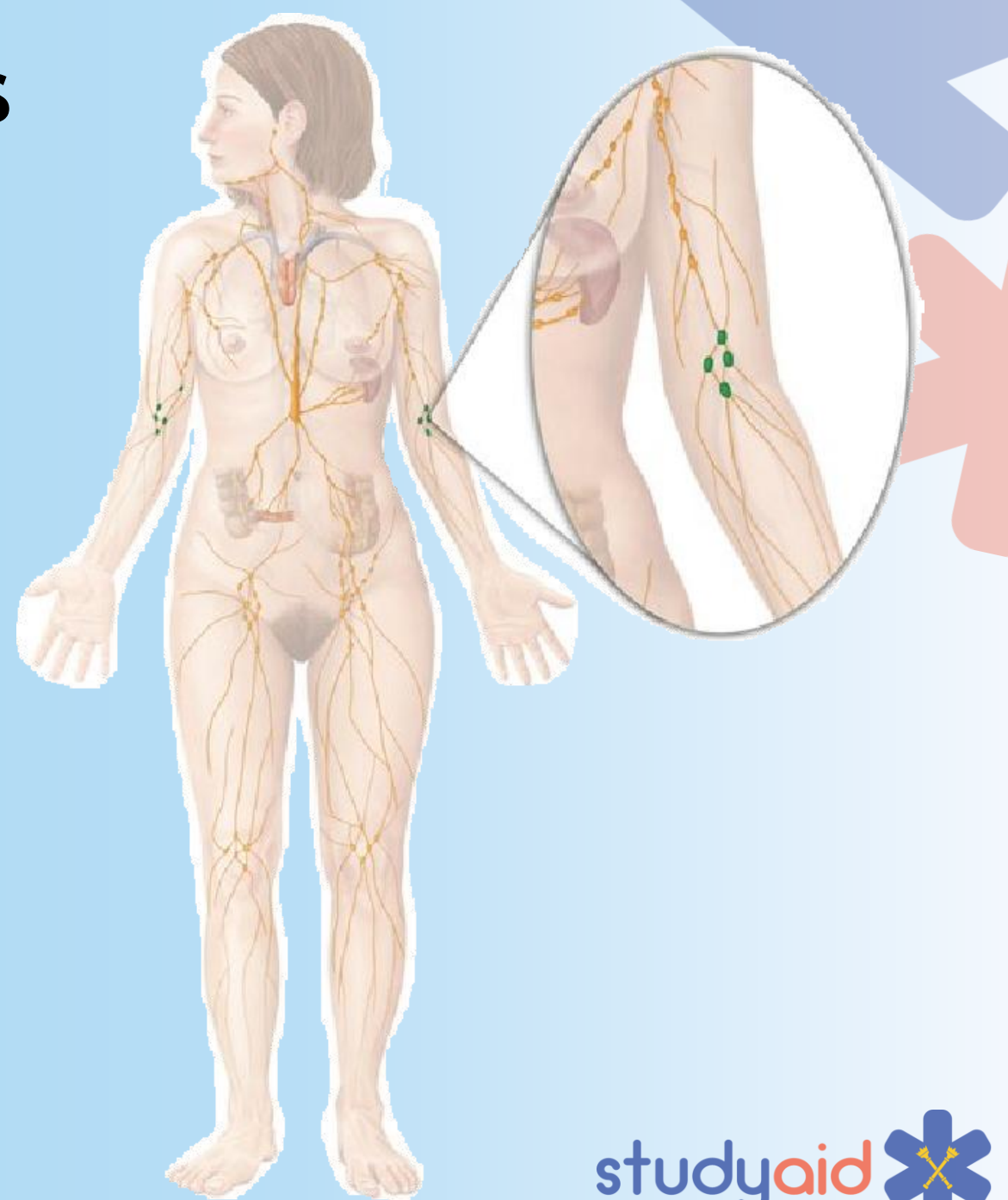
❖ **Skin below umbilicus (bellybutton):**

Drains into **superficial inguinal lymph nodes** (in the hip)

Cubital lymph nodes

(Epitrochlear/supratrochlear lymph nodes)

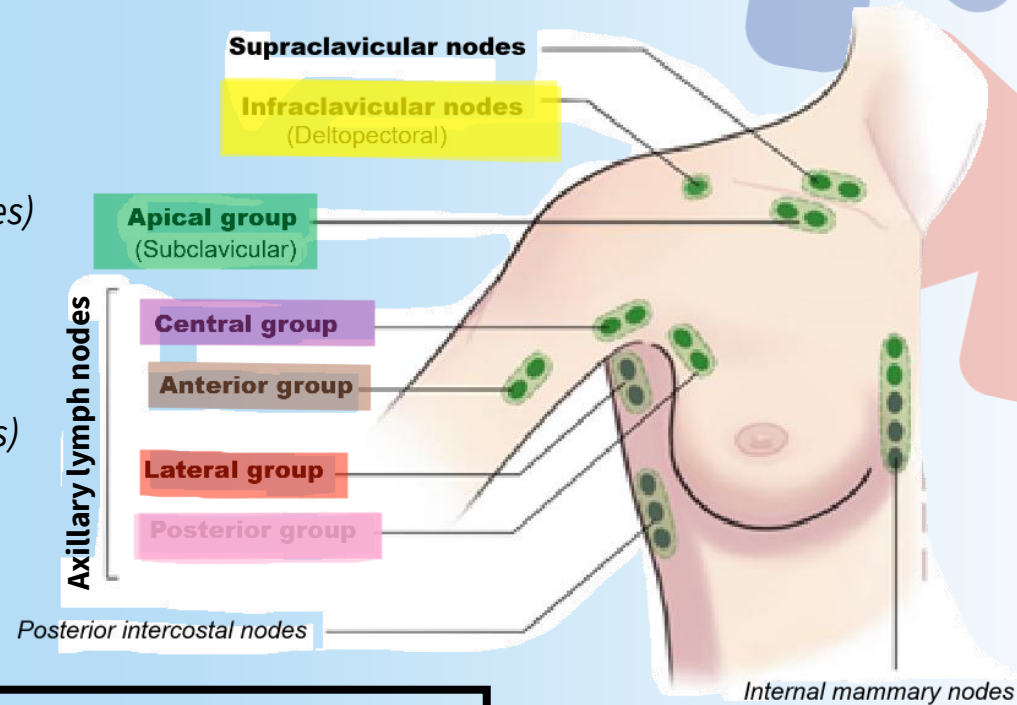
- Drain the skin of the medial forearm (ulnar side), digits 3-5 + the medial part of the hand («ulnar» side)
- Few (1-4), but enough to be called a “group”.
- Not a very “efficient” group of lymph nodes. They get “overwhelmed” and “need help”.
- Drains into the brachial lymph nodes, and then the anterior axillary lymph nodes.



Axillary lymph nodes

- There are 5 groups of axillary lymph nodes:

1. **Lateral** axillary lymph nodes (*Humeral lymph nodes*)
2. **Anterior** axillary lymph nodes (*Infrapectoral minor lymph nodes*)
3. **Posterior** axillary lymph nodes (*Subscapular lymph nodes*)
4. **Central** axillary lymph nodes (*Subpectoralis minor lymph nodes*)
5. **Apical** axillary lymph nodes (*subclavicular lymph nodes*)
 - *Infraclavicular lymph nodes* (**Deltopectoral** lymph nodes)



Drainage is from *distal* groups to *proximal* groups

Example:

The **central** group of lymph nodes will receive lymph from the **anterior**, **lateral**, and **posterior** groups. Then, they drain into the **apical** group.

The central group is more *proximal* than anterior, lateral and posterior (which are therefore considered *distal* groups compared to the central group).

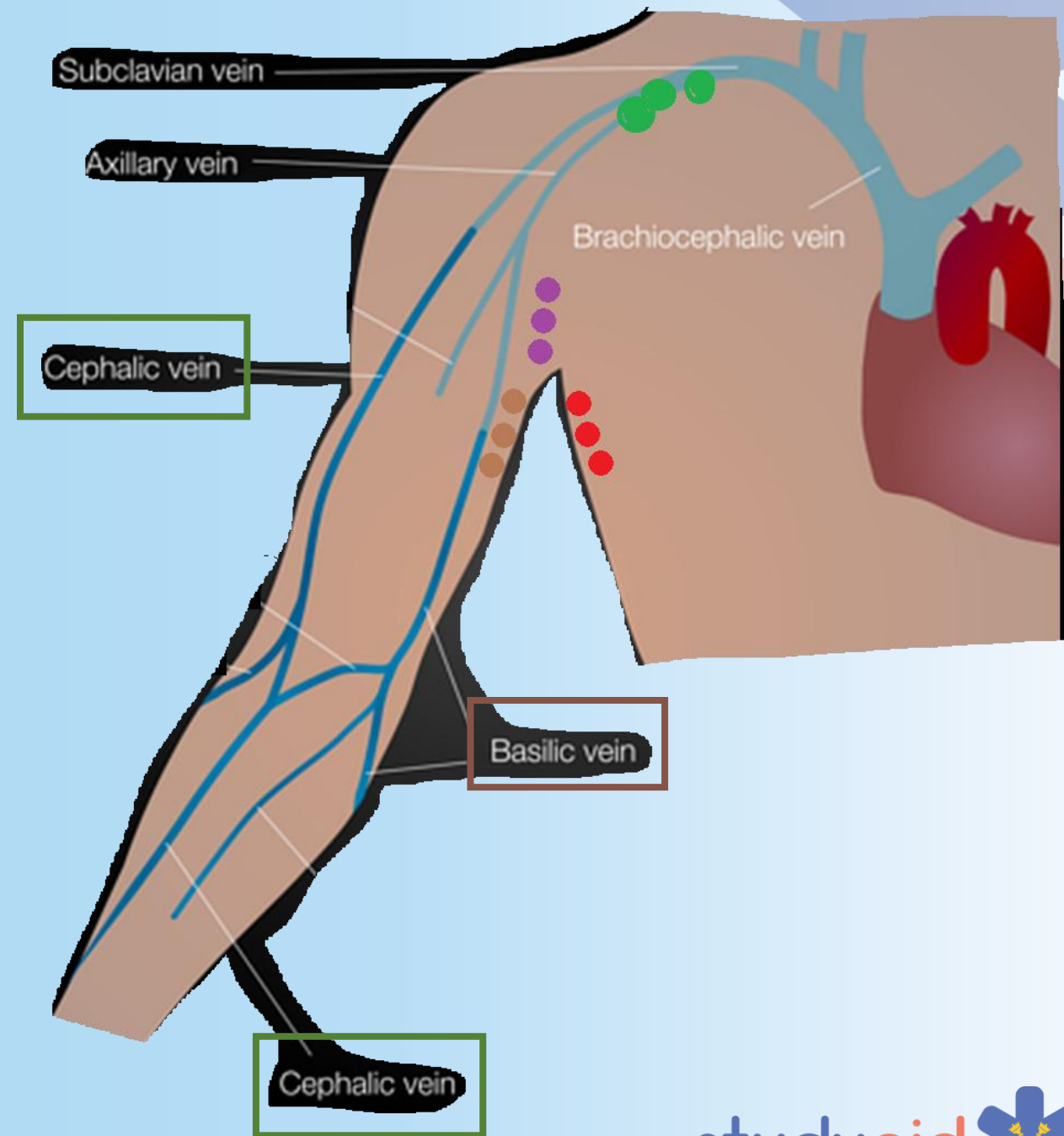
Lymph node drainage of hand

- **Lateral** group
- **Anterior** group
- **Central** group
- **Apical** group

- ❖ Remember that the cubital lymph nodes drain the medial forearm and digits 3-5!
- ❖ The **infraclavicular lymph nodes** will directly receive lymph from the skin of the 1st and 2nd digits + lateral forearm, then to the **apical group**

Cephalic vein = **infraclavicular** → **Apical** group

Basilic vein = Cubital group → **Anterior** → **Central**



Basilic vein

- ❖ 3rd, 4th and 5th digits
- ❖ Medial part of the hand and forearm

- ❖ Cubital group → **Anterior** → **Central**



Cephalic vein

- ❖ 1st and 2nd digits
- ❖ Lateral part of the hand and forearm

- ❖ **Directly to *infraclavicular* → Apical** group