



## Anatomy & Embryology

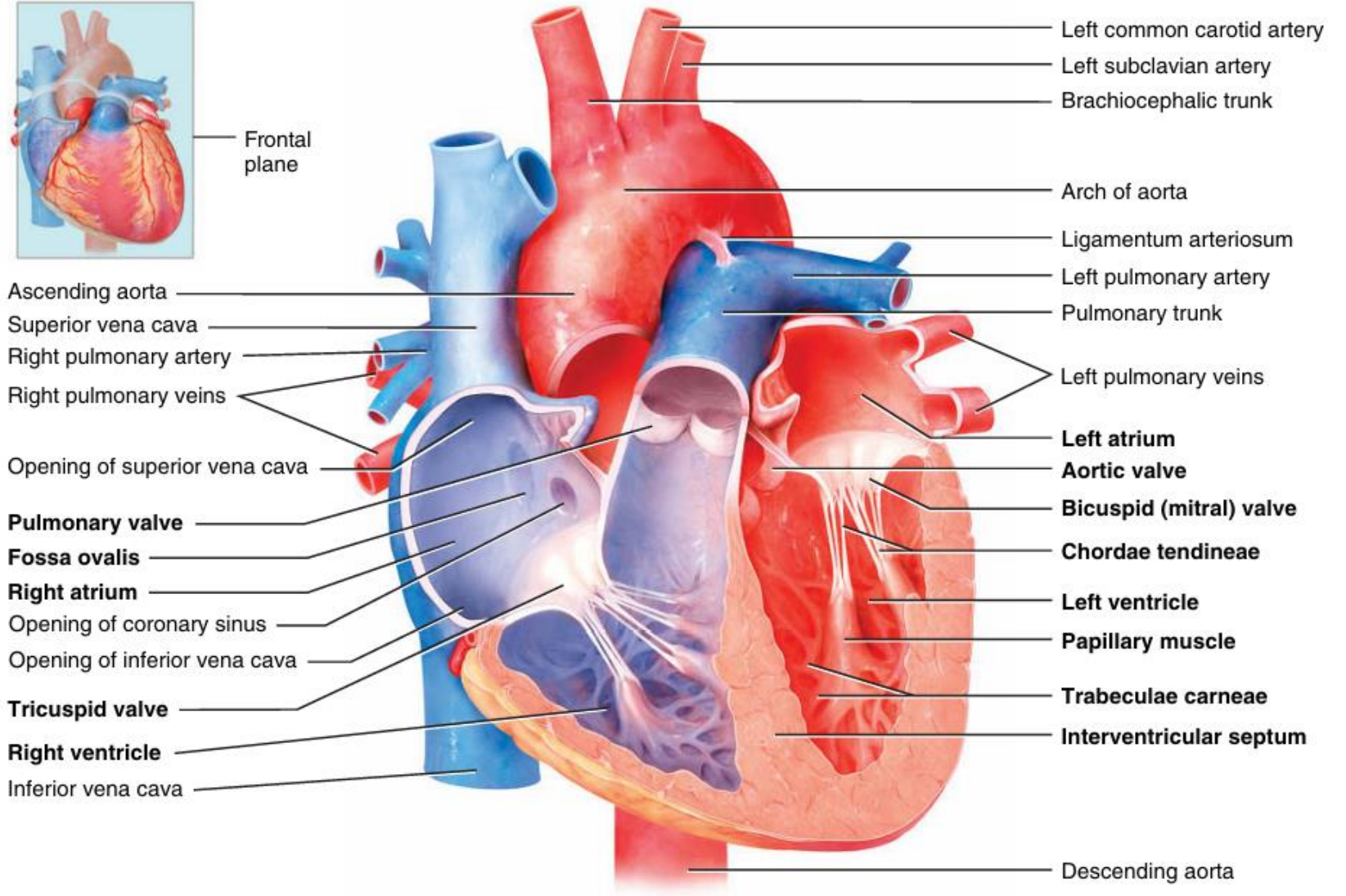
# Cardiovascular system (Part 2)

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# Quick recap.....



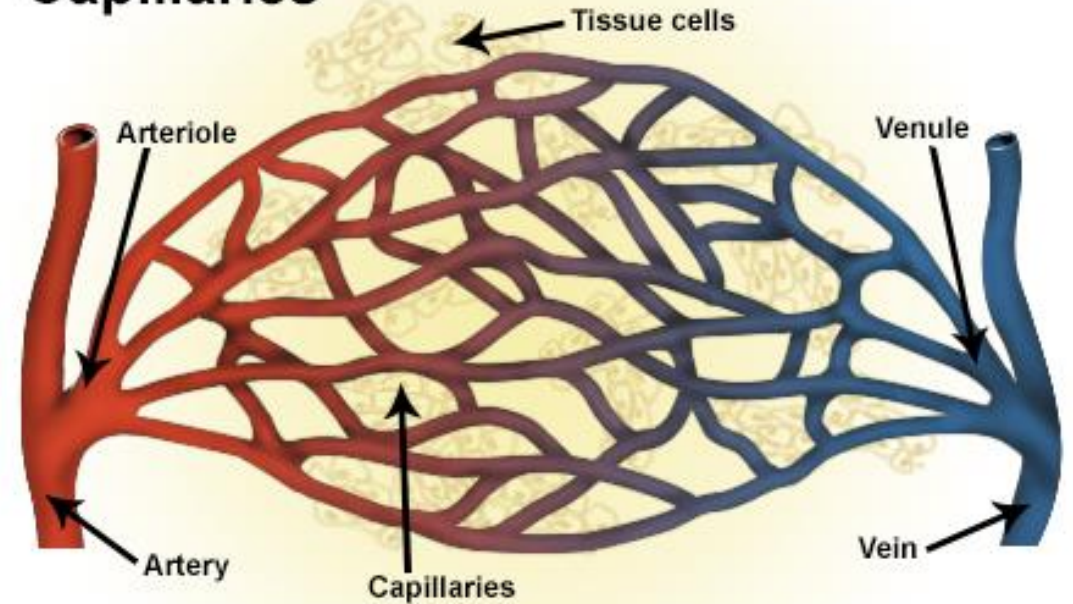
(a) Anterior view of frontal section showing internal anatomy

# Types of blood vessels

- 5-7 litres of blood
- 60,000 miles of vessels

- **Arteries**
- **Capillaries** (or in some tissues **sinusoids**) the smallest of blood vessels,
- **Veins**

## Capillaries



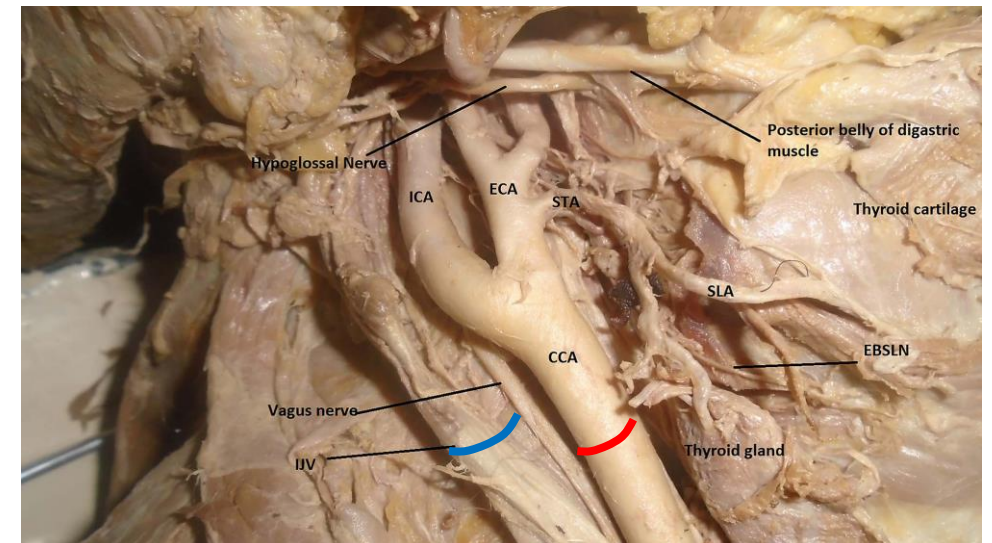
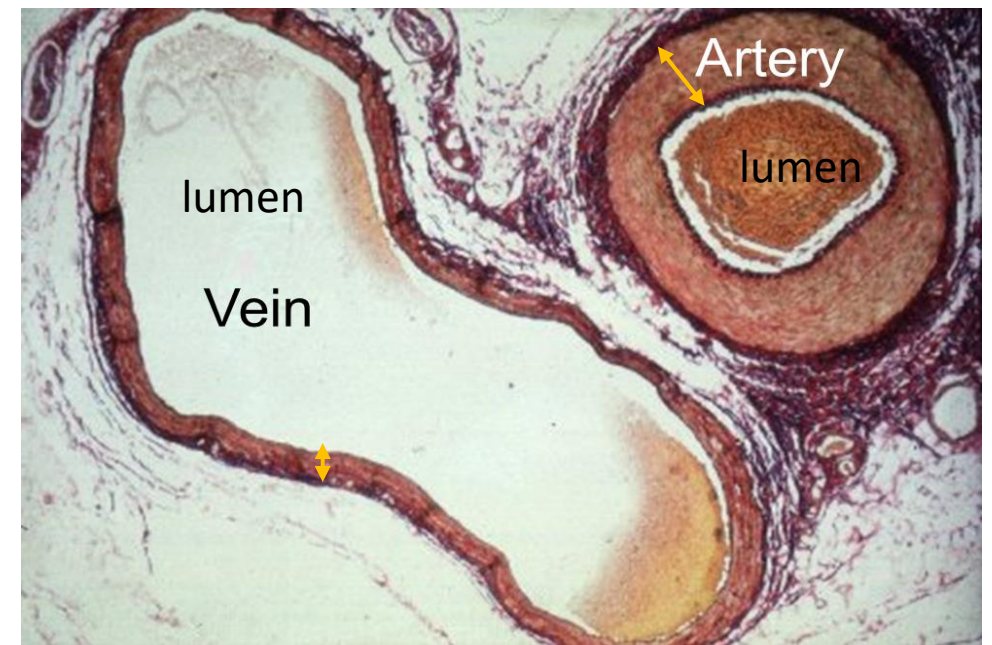
Gas and nutrients exchange occur at the capillaries



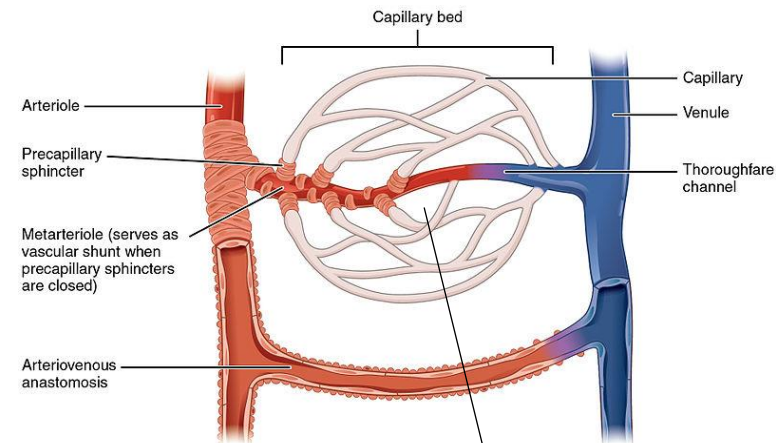
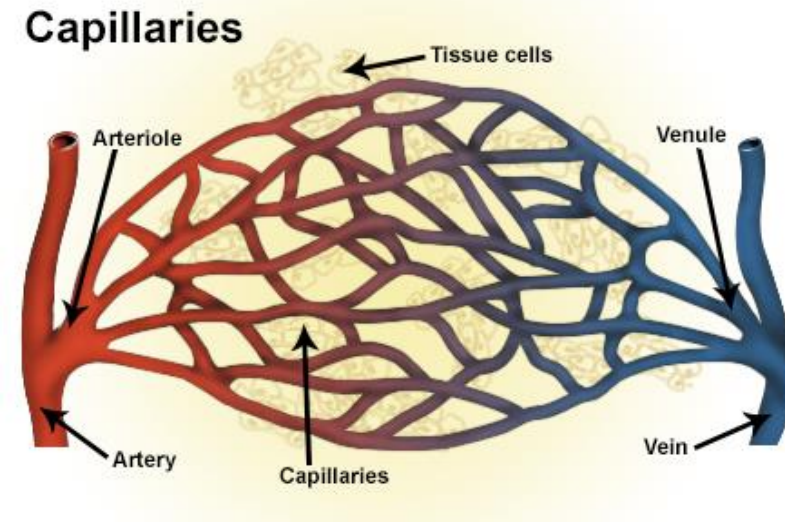
# Artery vs Vein

Artery	Vein
Carry <b>oxygenated</b> blood Except: <b>pulmonary artery</b>	Carry <b>non-oxygenated</b> blood Except: <b>pulmonary vein</b>
Carry blood <b>away</b> from the heart	Carry blood <b>towards</b> the heart
No valves	Have valves
Narrow lumen, thick wall	wide lumen, thin wall
Walls are rich with smooth muscles >>> <b>non-compressible</b>	Walls are poor with smooth muscles >>> <b>compressible</b>

Venous valves are important in moving blood toward the heart against the force of gravity.



- **Capillaries**, the smallest and most numerous of the blood vessels, form the connection between the vessels that carry blood away from the heart (arteries) and the vessels that return blood to the heart (veins).
- The primary function of capillaries is the exchange of materials between the blood and tissue cells.
- **Direct Arterio-venous anastomoses** is a direct connection between small arteries and small veins in certain tissues with **NO** capillary section between them (completely bypassing the capillary bed)
  - Regulation of blood flow
  - Regulation of the body temperature

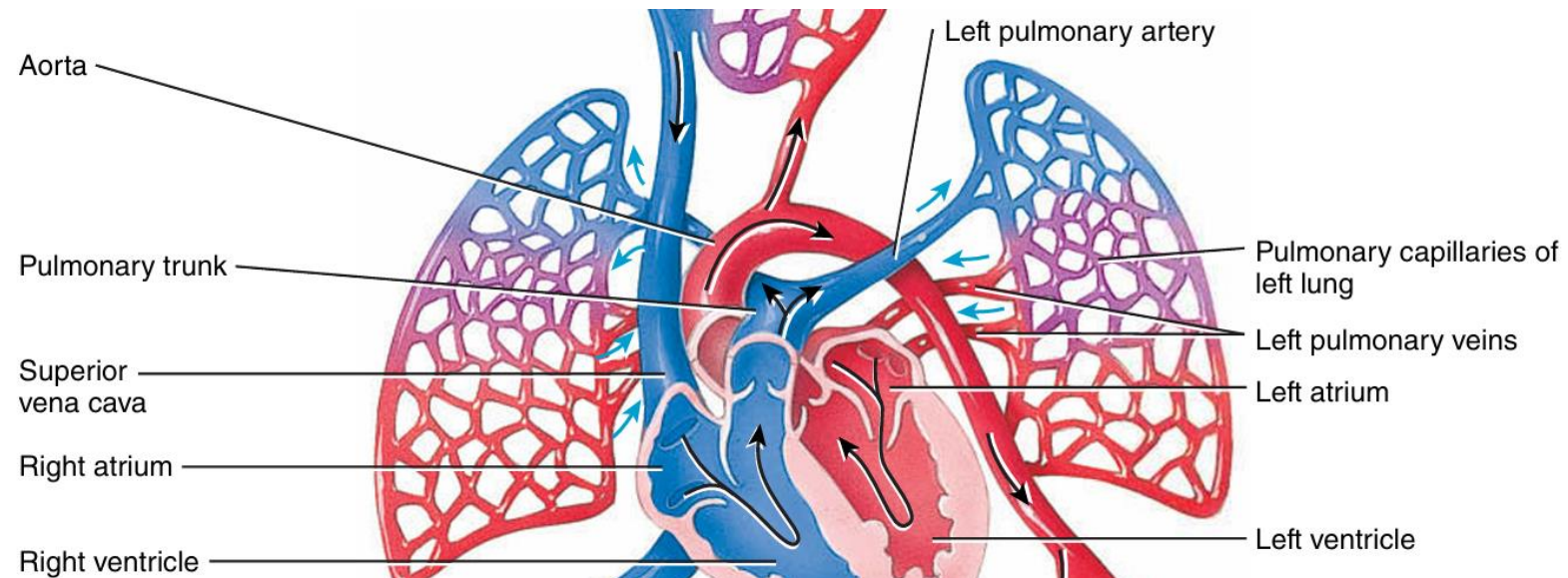
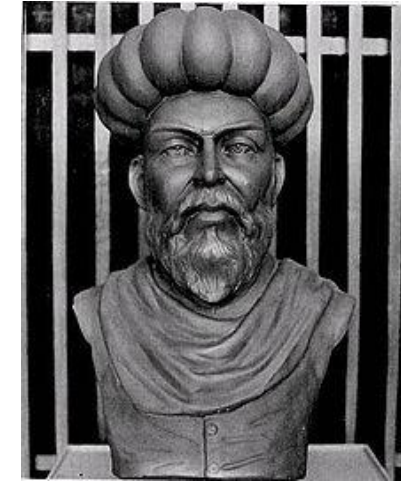
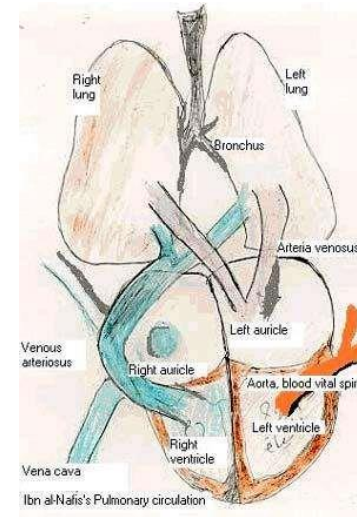


Arterio-venous anastomosis



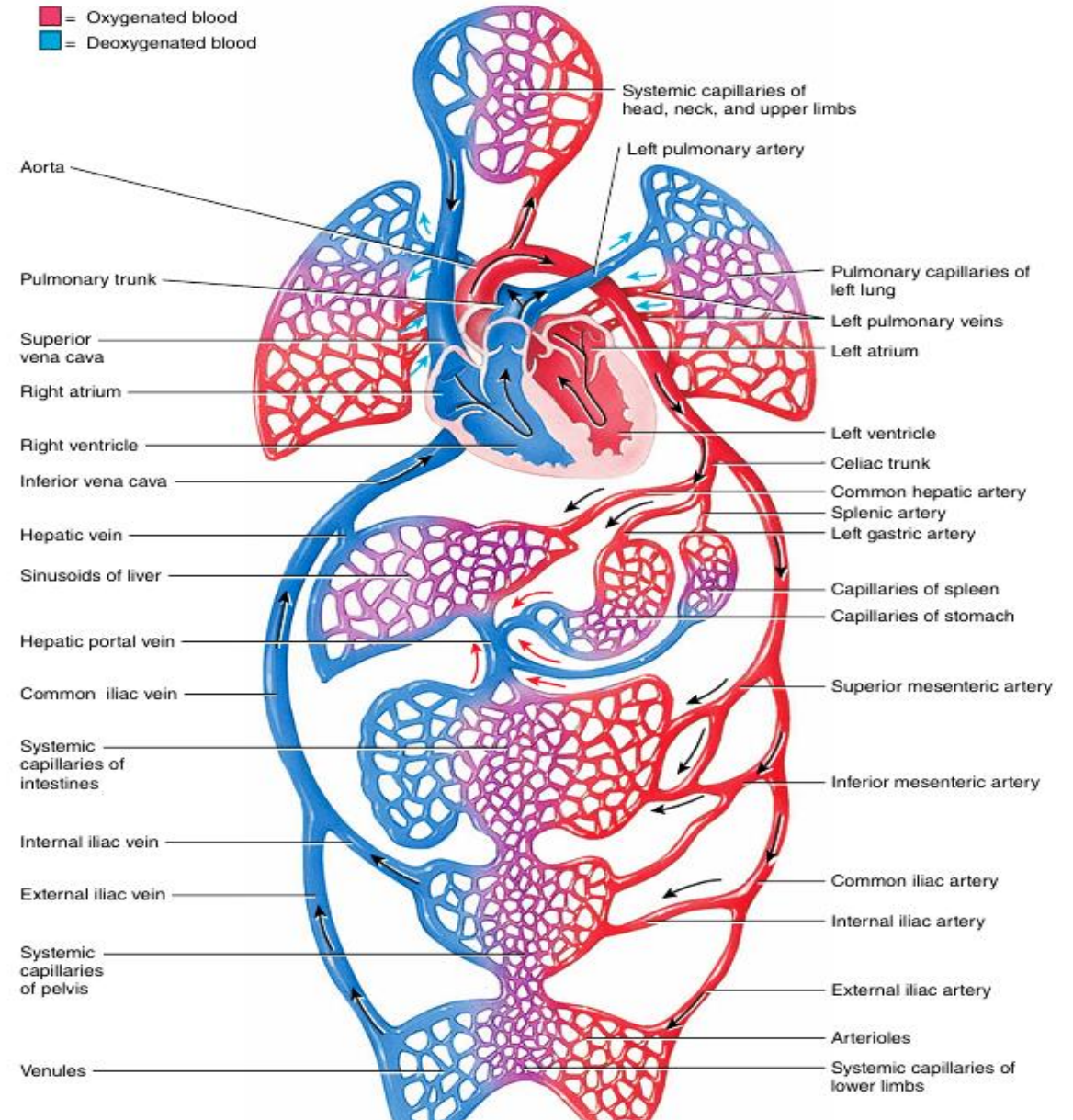
# Pulmonary circulation

- First described by the muslim physician Ibn Al-Nafees
- Blood leaves right ventricle to the lungs through **pulmonary arteries** and returns back to the heart through **pulmonary veins**.



# Systemic circulation

- Blood leaves **left ventricle** through aorta to all tissues of the body.
- Includes all arteries and arterioles that carry oxygenated blood from the left ventricle to systemic capillaries, plus the veins and venules that return deoxygenated blood to the right atrium after flowing through capillaries in the body organs.

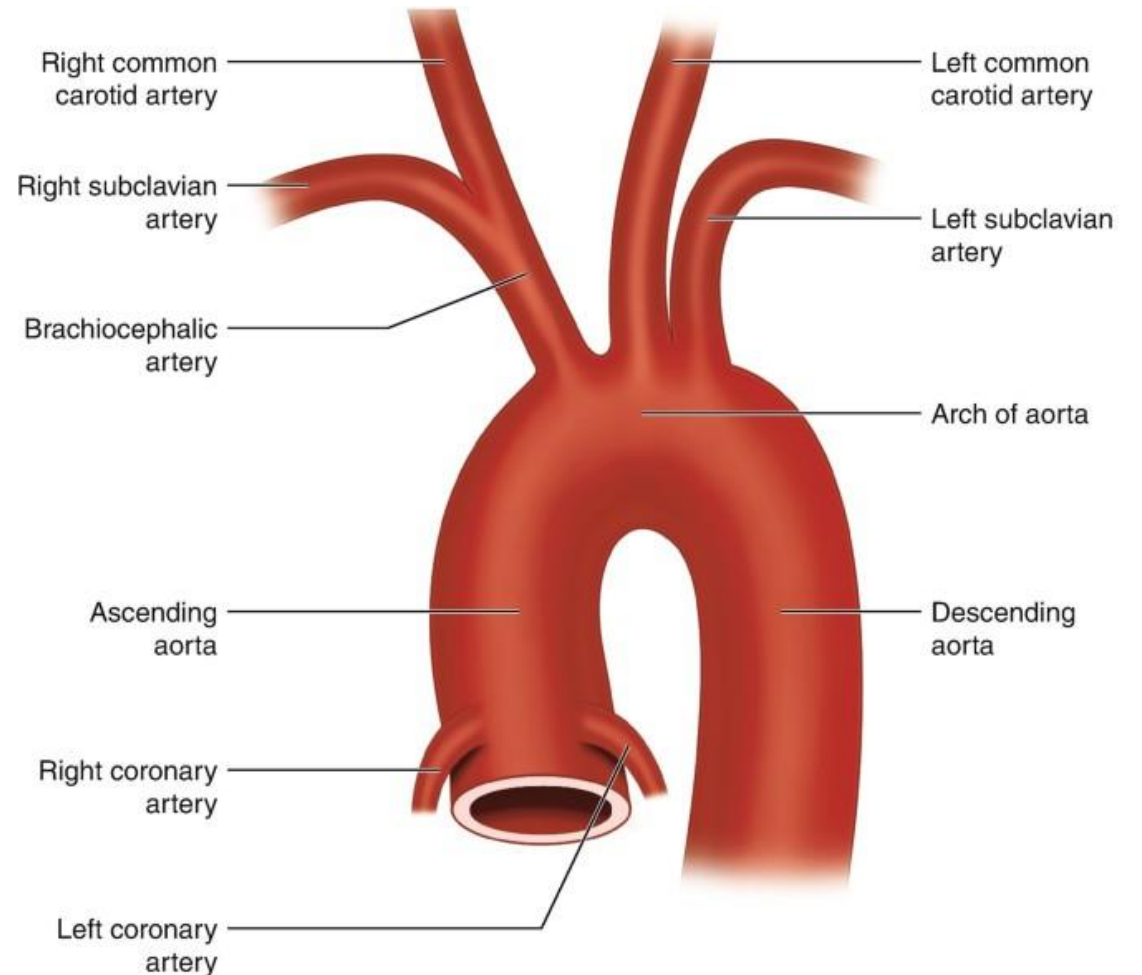


# The main blood vessels in the human body

1. **Pulmonary trunk** arises from right ventricle and carries de-oxygenated blood to the lungs.

2. **Aorta** consists of four segments:

- Ascending aorta
- Arch of aorta
- Descending thoracic aorta
- Descending abdominal aorta

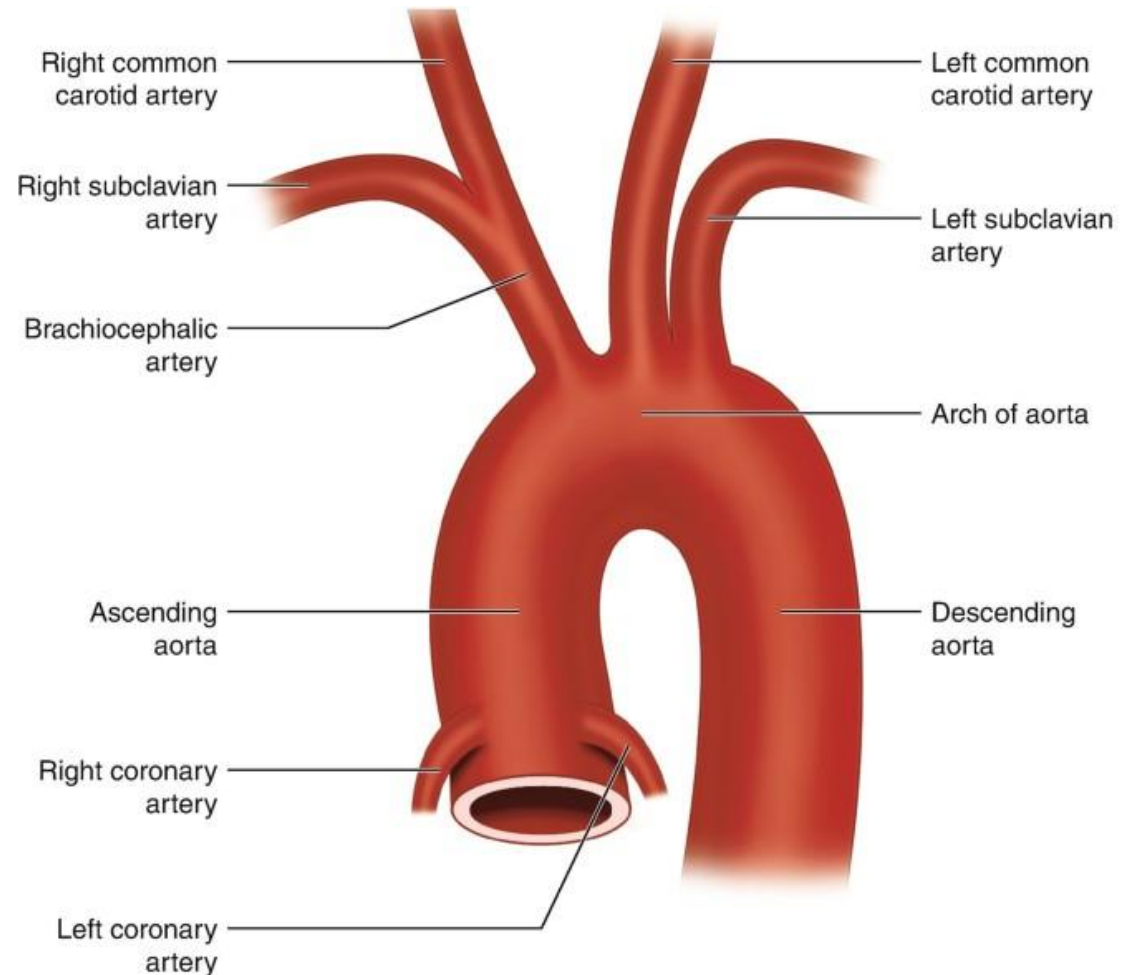




# Segments of the aorta

1. **Ascending aorta** (about 5cm in length, lies within the **fibrous pericardium**, passes upward to the right).

- Branches:
  - **Right coronary artery**
  - **Left coronary artery**



**2. Arch of aorta**, continues from the ascending aorta and lies mainly within the **superior mediastinum**

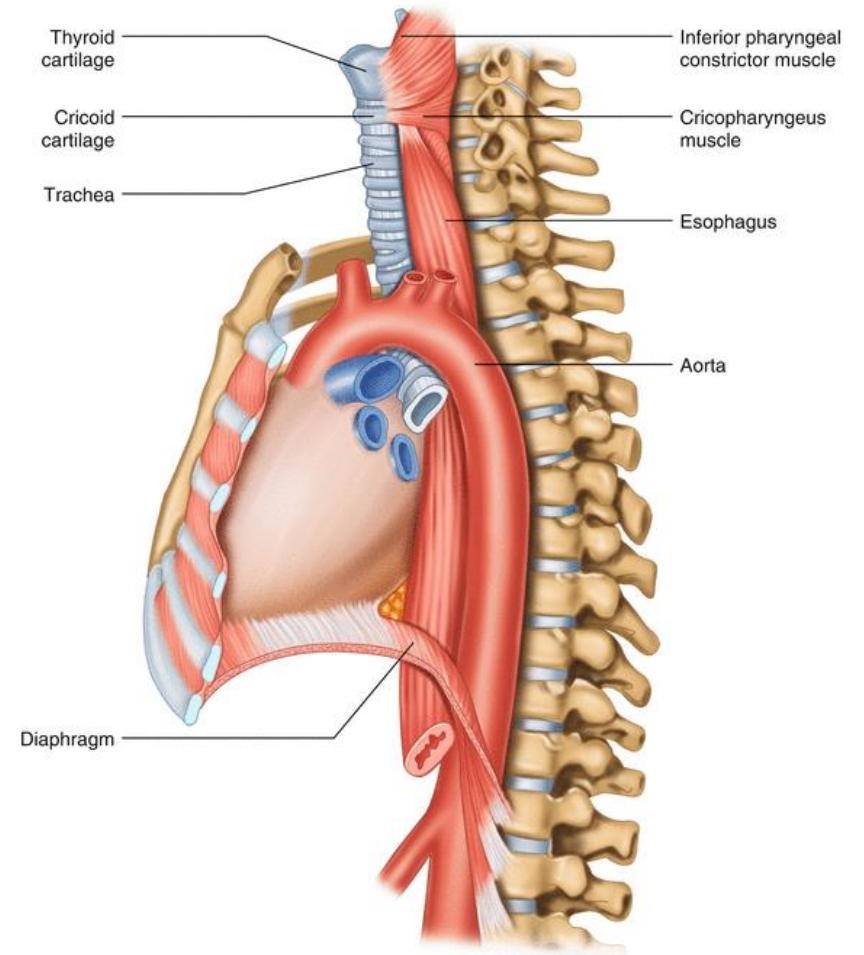
Branches:

1. **Left subclavian artery**
2. **Left common carotid artery**
3. **Brachiocephalic artery** (or brachiocephalic trunk) is the largest branch in diameter.

Divides into:

- Right subclavian artery
- Right common carotid artery

**The arch of aorta is anterior to the oesophagus and the trachea**

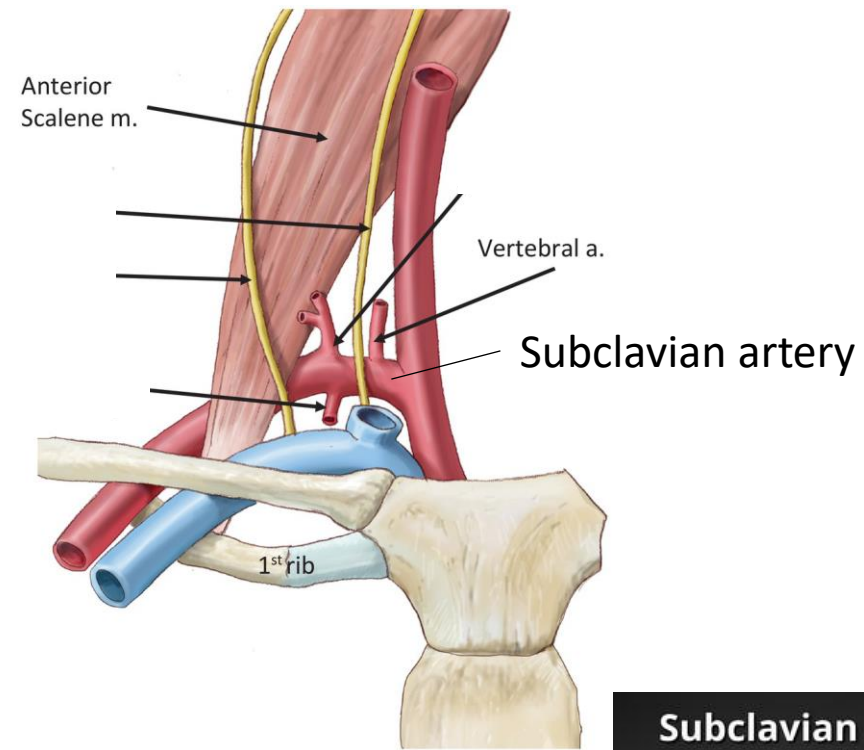


## Subclavian arteries:

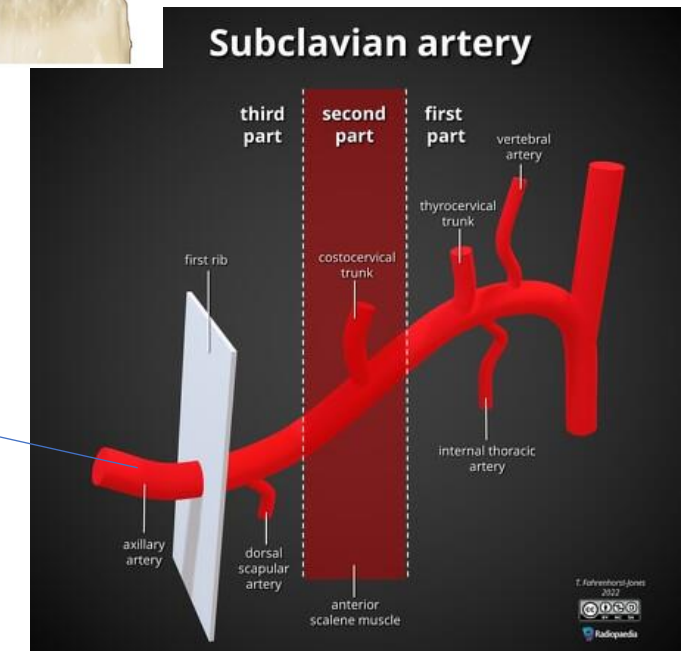
The right subclavian artery is a branch of the brachiocephalic trunk, while the left subclavian is a direct branch of the aortic arch.

Subclavian artery is divided into three segments:

1. First part from its origin to the **medial border of scalenus anterior**;
2. Second part **posterior to scalenus anterior**.
3. Third part from the **lateral margin of scalenus anterior to the outer border of the first rib**



## Axillary artery

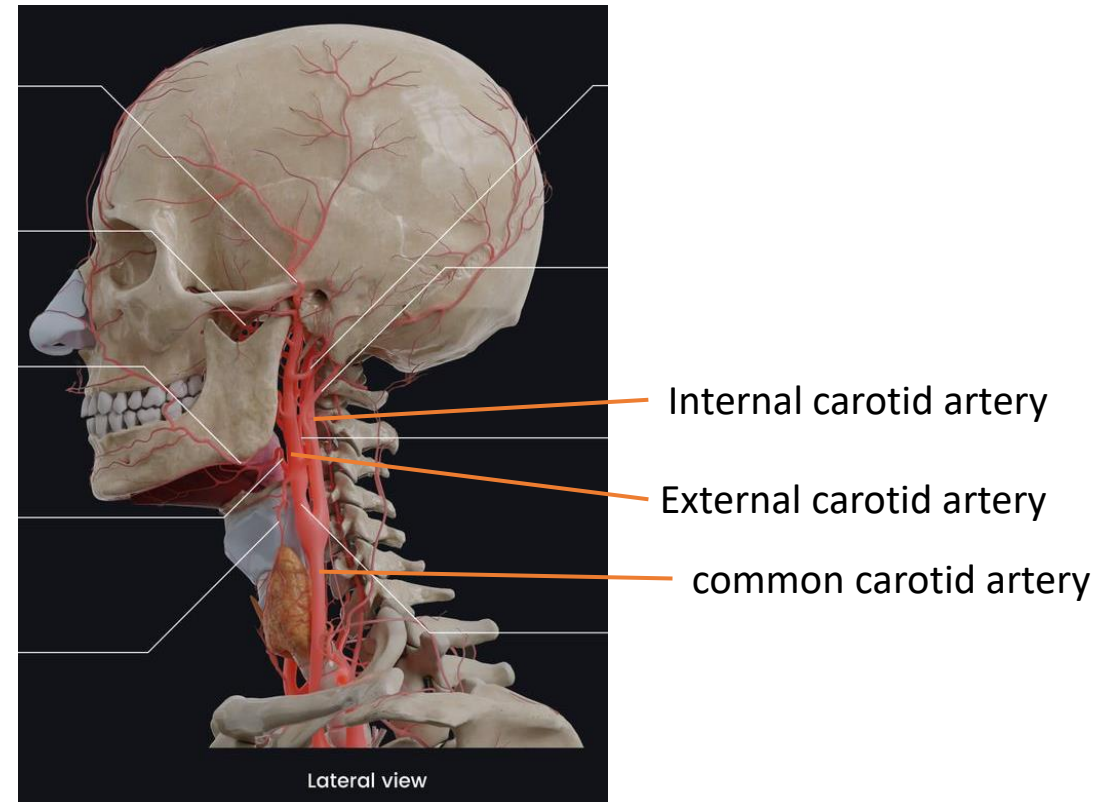
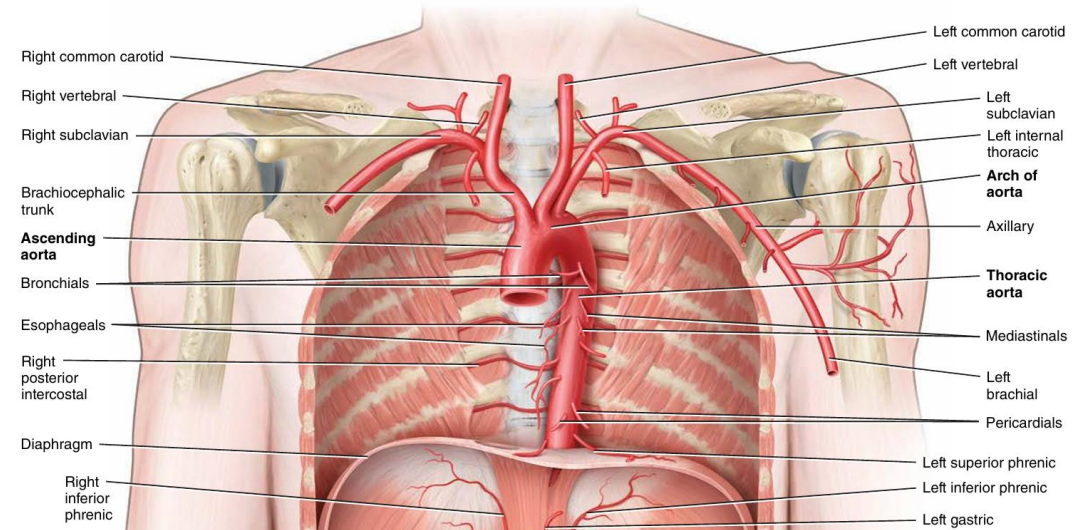




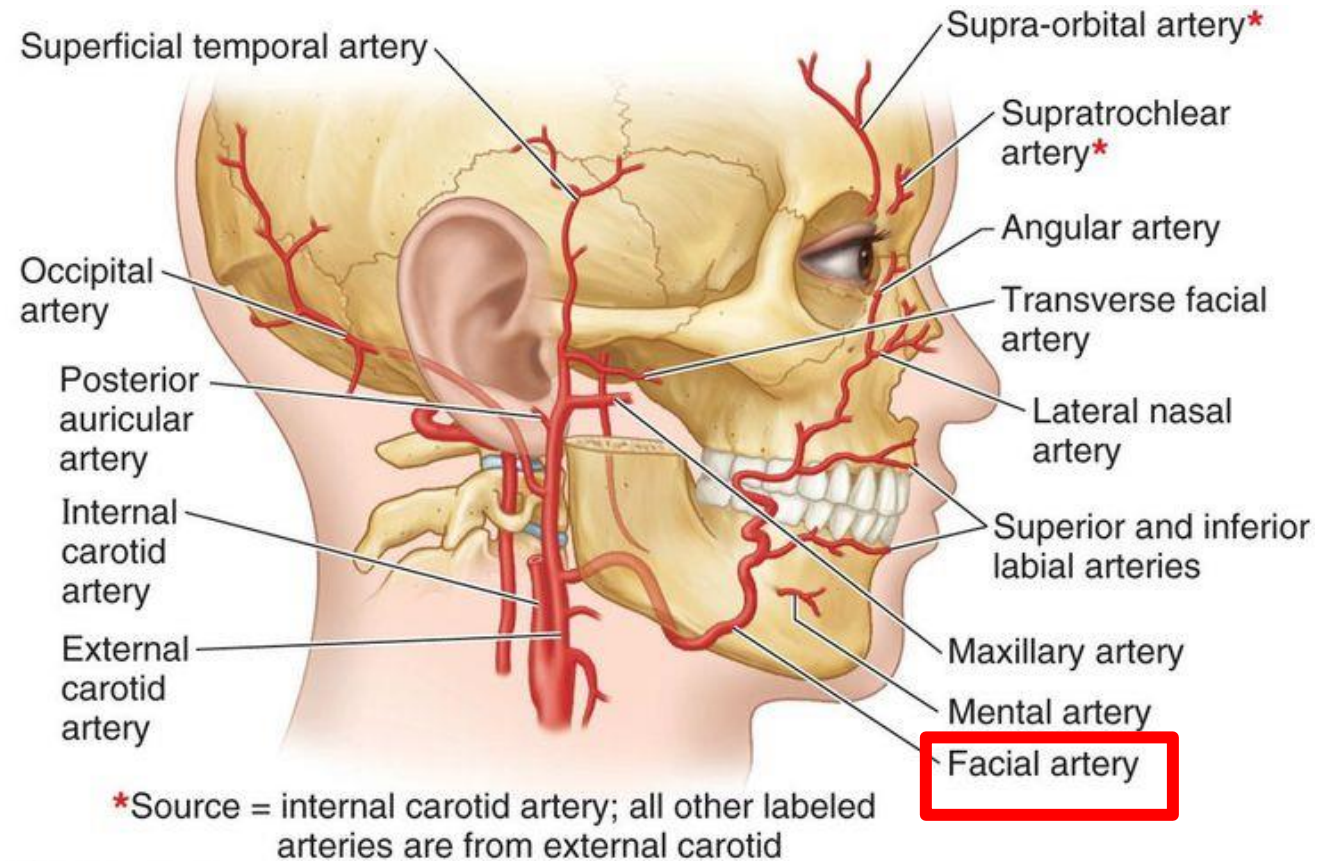
The right common carotid has only a **cervical part** whereas the left common carotid has **cervical and thoracic parts**.

Common carotid artery divides into:

1. **External carotid artery** which supplies the **face and neck**.
2. **Internal carotid artery** which provides main arterial blood supply to the **brain**.



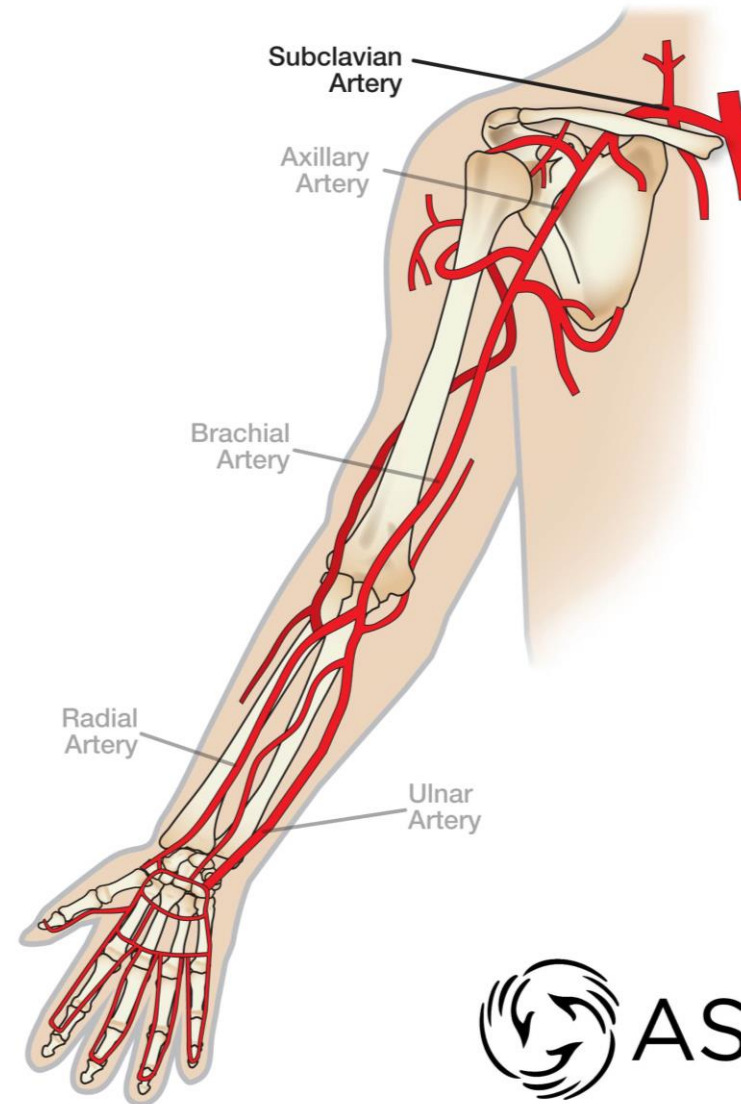
**Facial artery** is a branch of the **external carotid artery**, it has **tortuous route** along the nasolabial fold towards the medial angle of the eye. This is important as muscles and organs of the face are **very movable**



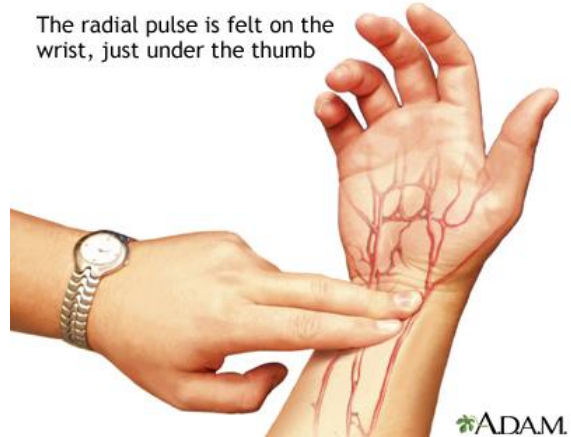
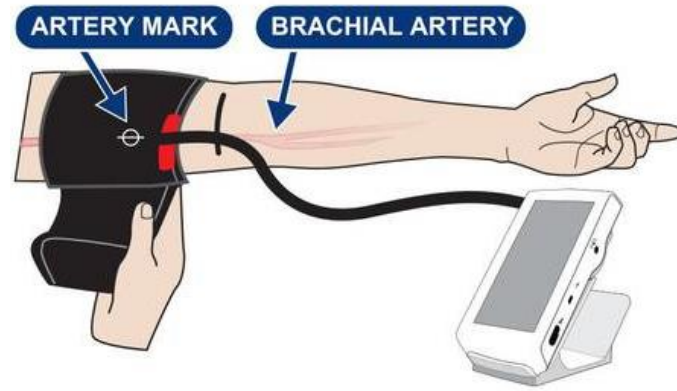
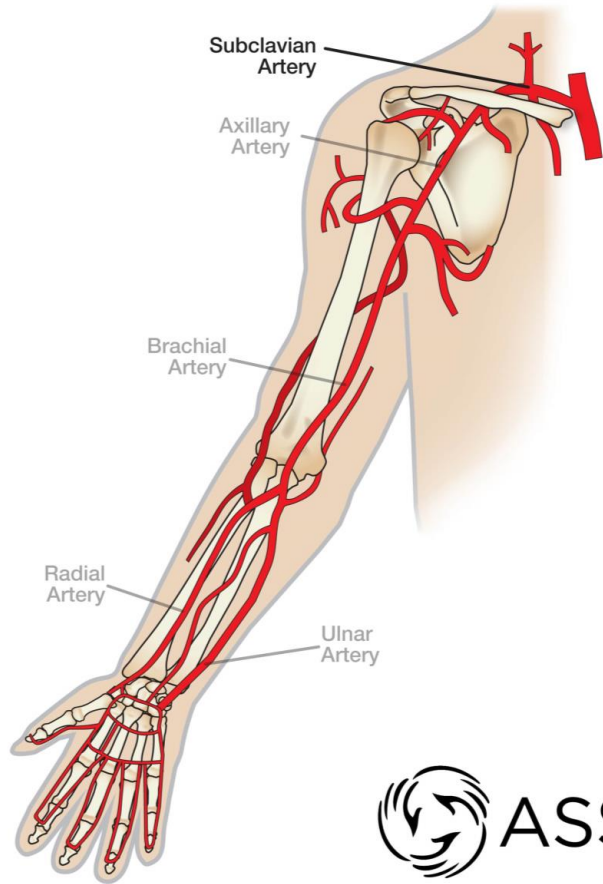
**The axillary artery**, a continuation of the subclavian artery, begins at the outer border of the first rib and ends at the inferior border of teres major, where it becomes the **brachial artery**

**The brachial artery** is a continuation of the axillary artery. It begins at the inferior border of the tendon of teres major and ends about a centimetre distal to the elbow joint (at the level of the neck of the radius) by dividing into the radial and ulnar arteries.

**Radial artery** is at the lateral side of forearm while the **ulnar artery** is at the medial side.







- **Brachial artery** is the artery used to measure your blood pressure medial to the tendon of biceps brachii.

**The radial pulse** is easily felt by the tip of the index and third fingers just lateral to the tendon of the flexors carpi radialis

**3. Descending thoracic aorta, lies within the posterior mediastinum.**

Extends between T4-T12.

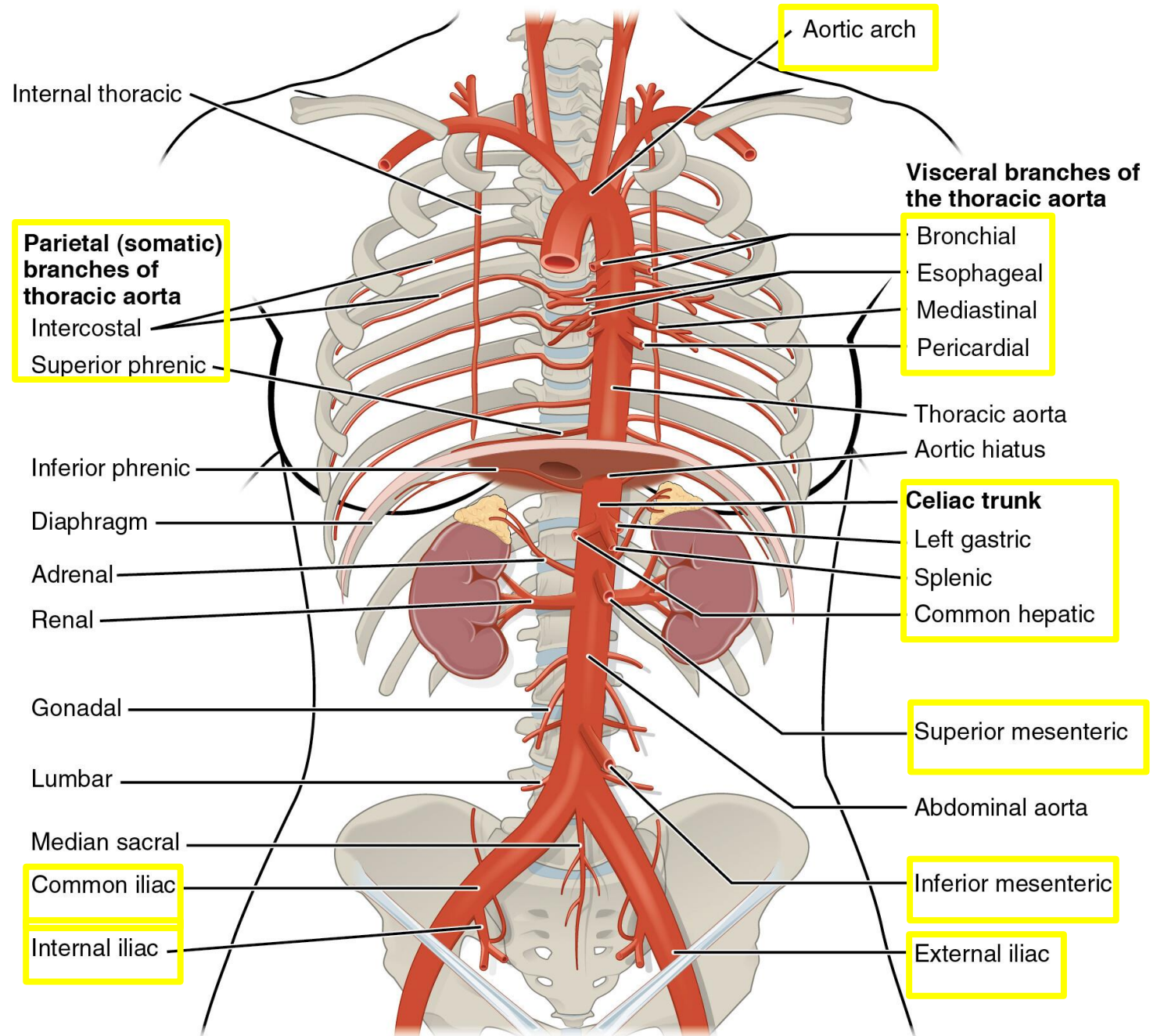
Main branches are divided into:

**Visceral branches:**

1. Pericardial branches
2. Bronchial arteries
3. Oesophageal arteries
4. Mediastinal arteries

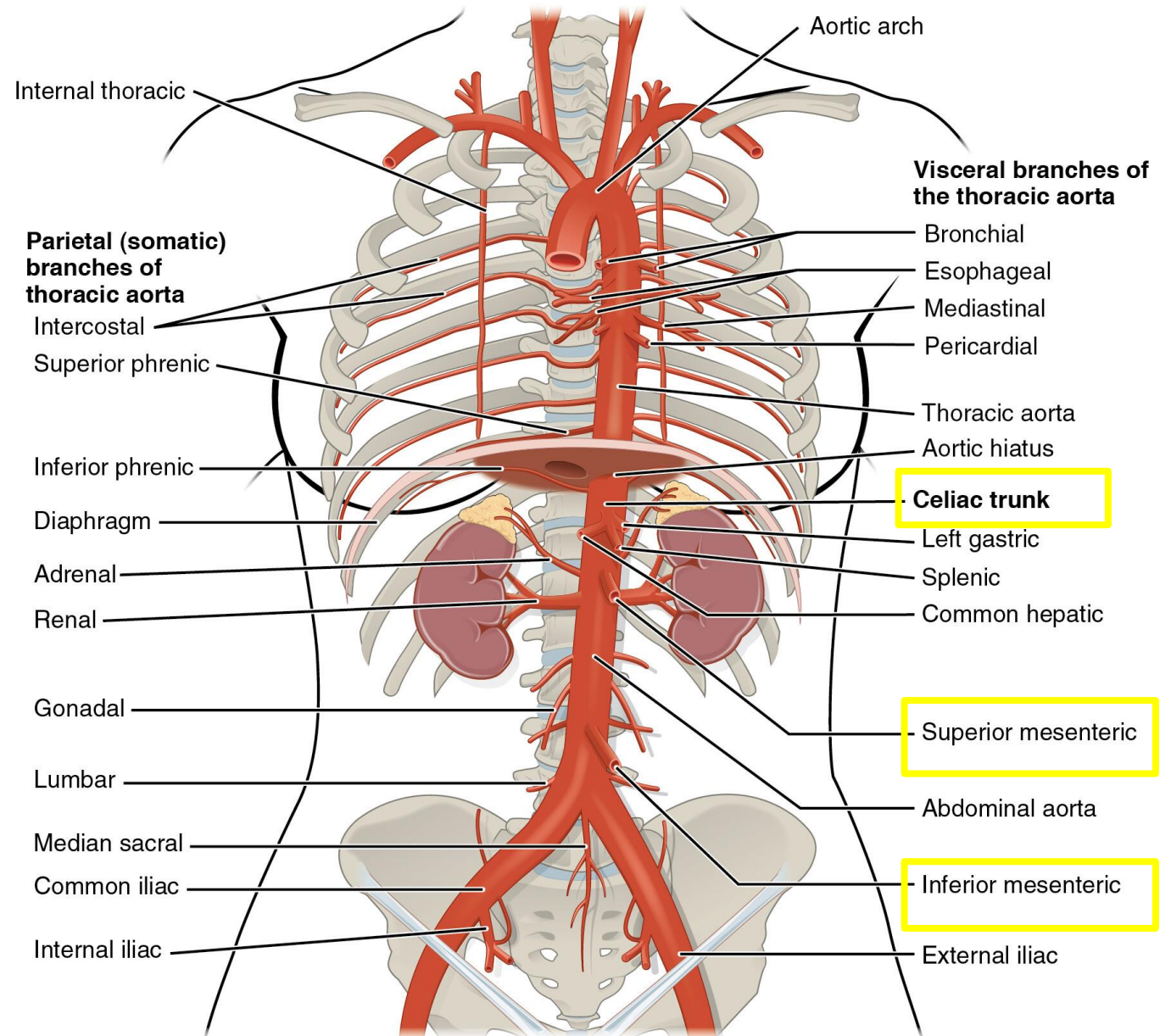
**Parietal branches:**

1. Intercostal arteries
2. Superior phrenic



4. Descending abdominal aorta, starts at T12 and ends at L4, main branches are:

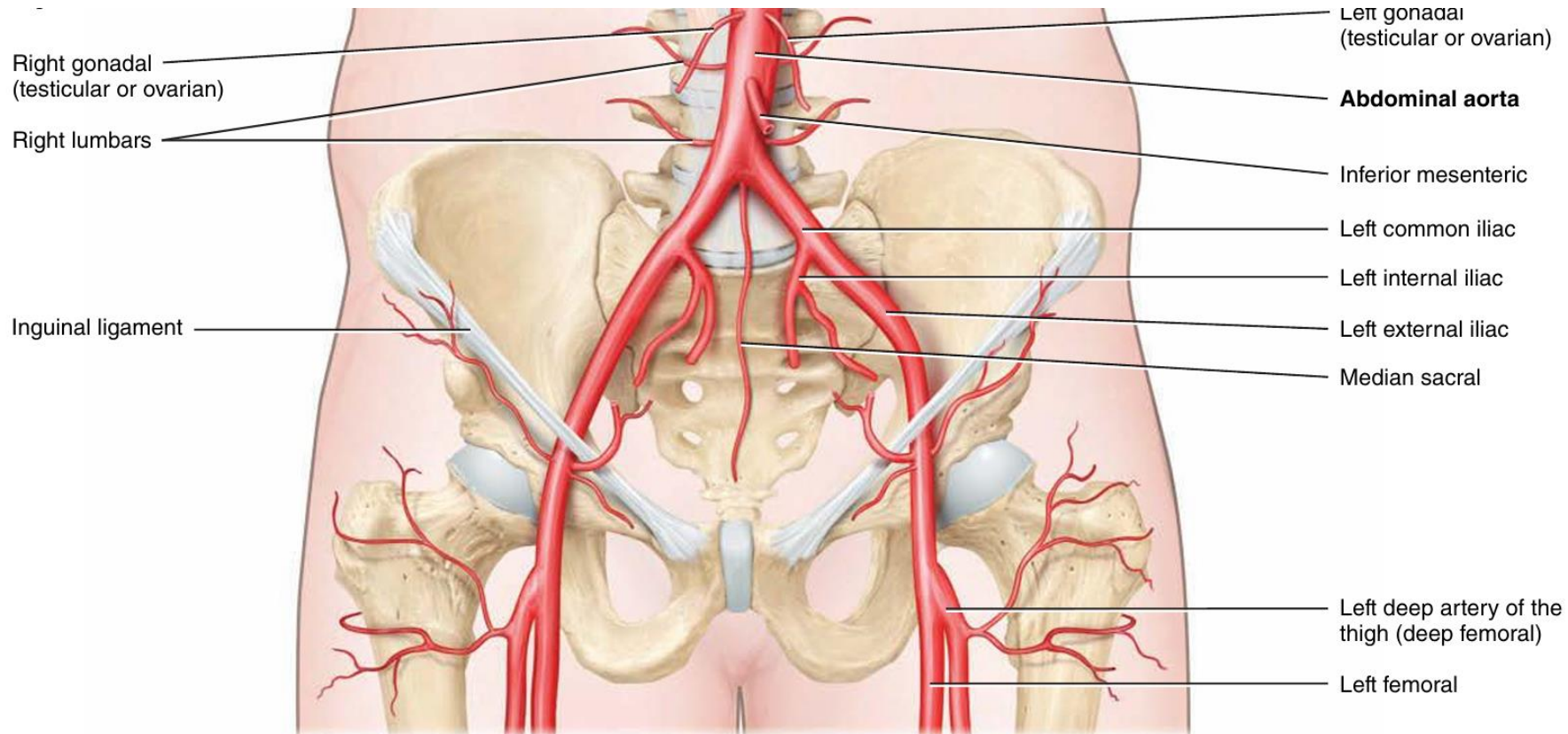
- Unpaired branches that arise from the anterior aspect:
  1. Celiac trunk
  2. Superior mesenteric artery
  3. Inferior mesenteric artery
  
- Paired branches arise from the lateral aspect
  1. Renal arteries
  2. Adrenal arteries
  3. Gonadal arteries
  4. Four lumbar arteries
  
- Terminal branches (two common iliac arteries)





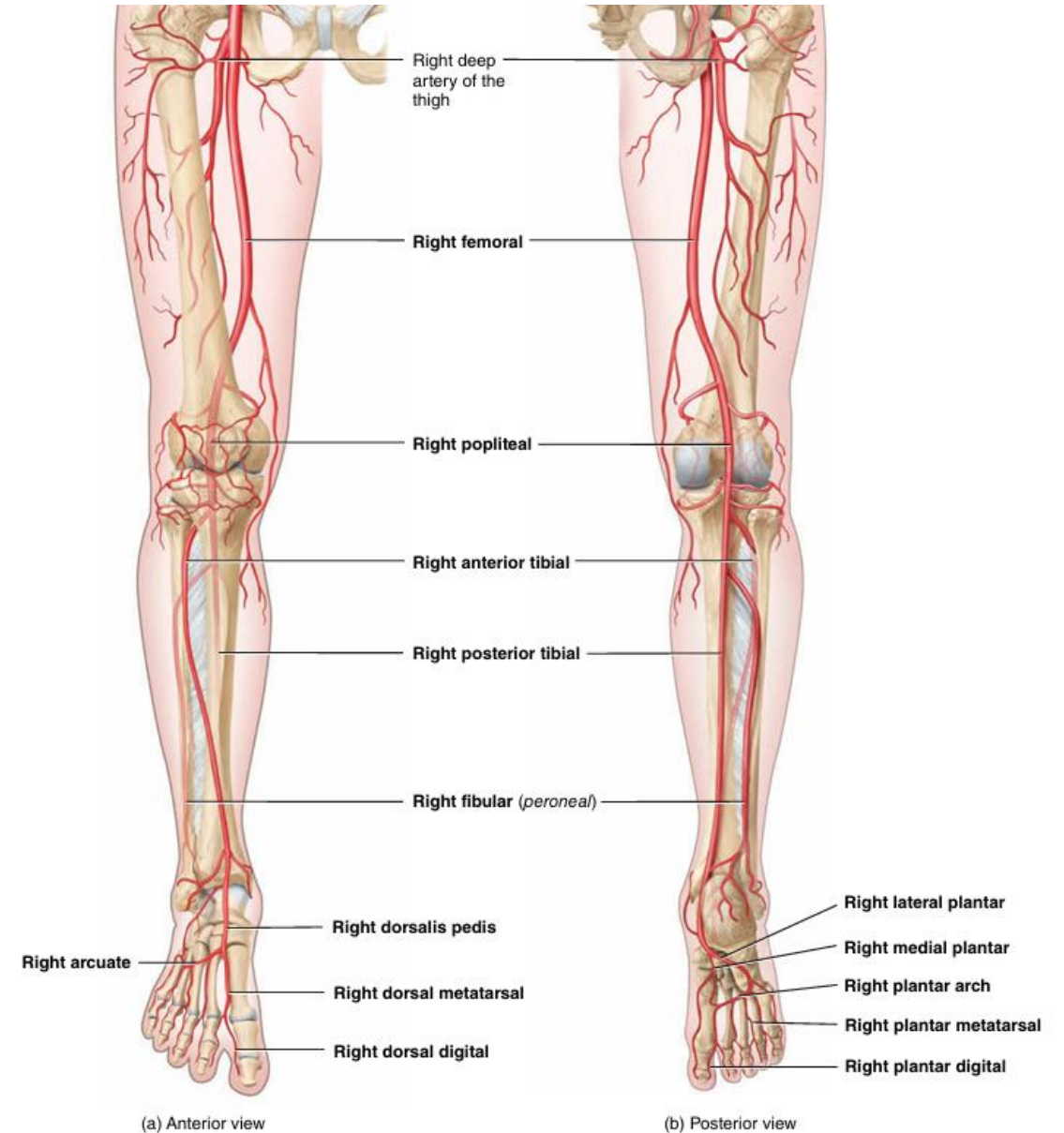
## Arterial supply to the lower limb

**The femoral artery** is a continuation of the **external iliac artery** and provides the principal arterial supply to the lower limb. It begins posterior to the inguinal ligament, midway between the anterior superior iliac spine and the pubic symphysis, descends in **the femoral triangle**, enters and passes through the adductor canal, and becomes the **popliteal artery** as it passes through an opening in adductor magnus.



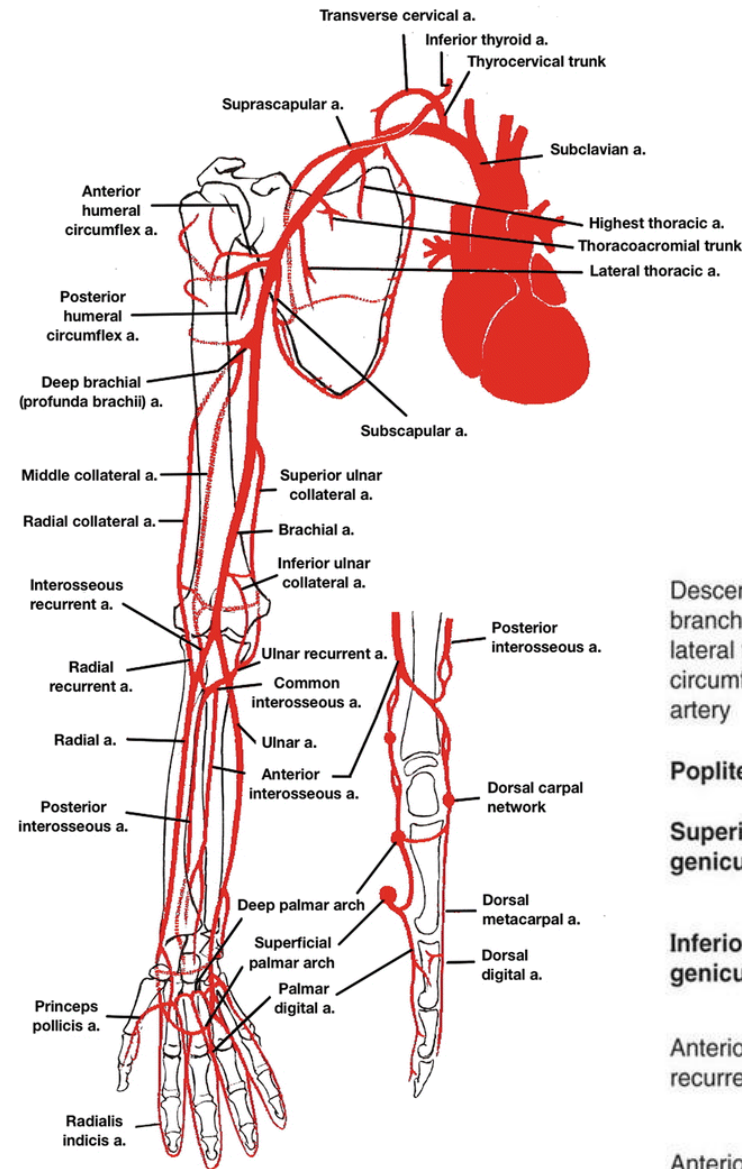
# Arterial supply to the lower limb

- **Popliteal artery** is the continuation of the **femoral artery** and crosses the popliteal fossa. It descends laterally from the opening in adductor magnus to the femoral intercondylar fossa.
- It gives two branches; the anterior and posterior tibial arteries.

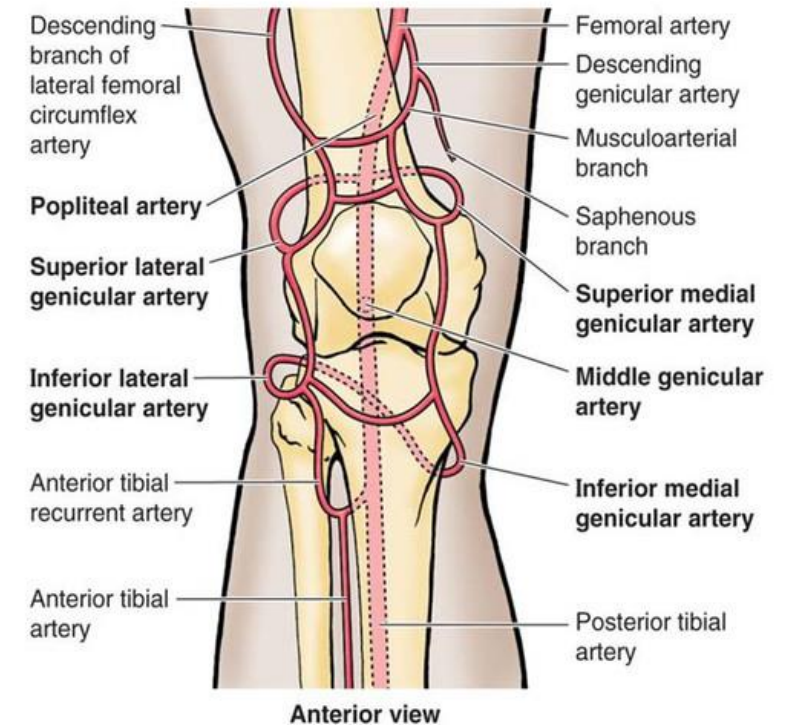
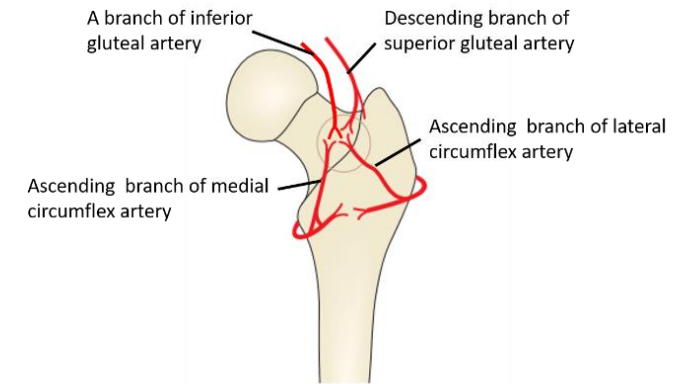


# Collateral circulation

- Is a connection or (anastomosis) between the branches of adjacent arteries
- Back-up blood supply in case of blockages.
- **Exists mainly around joints**



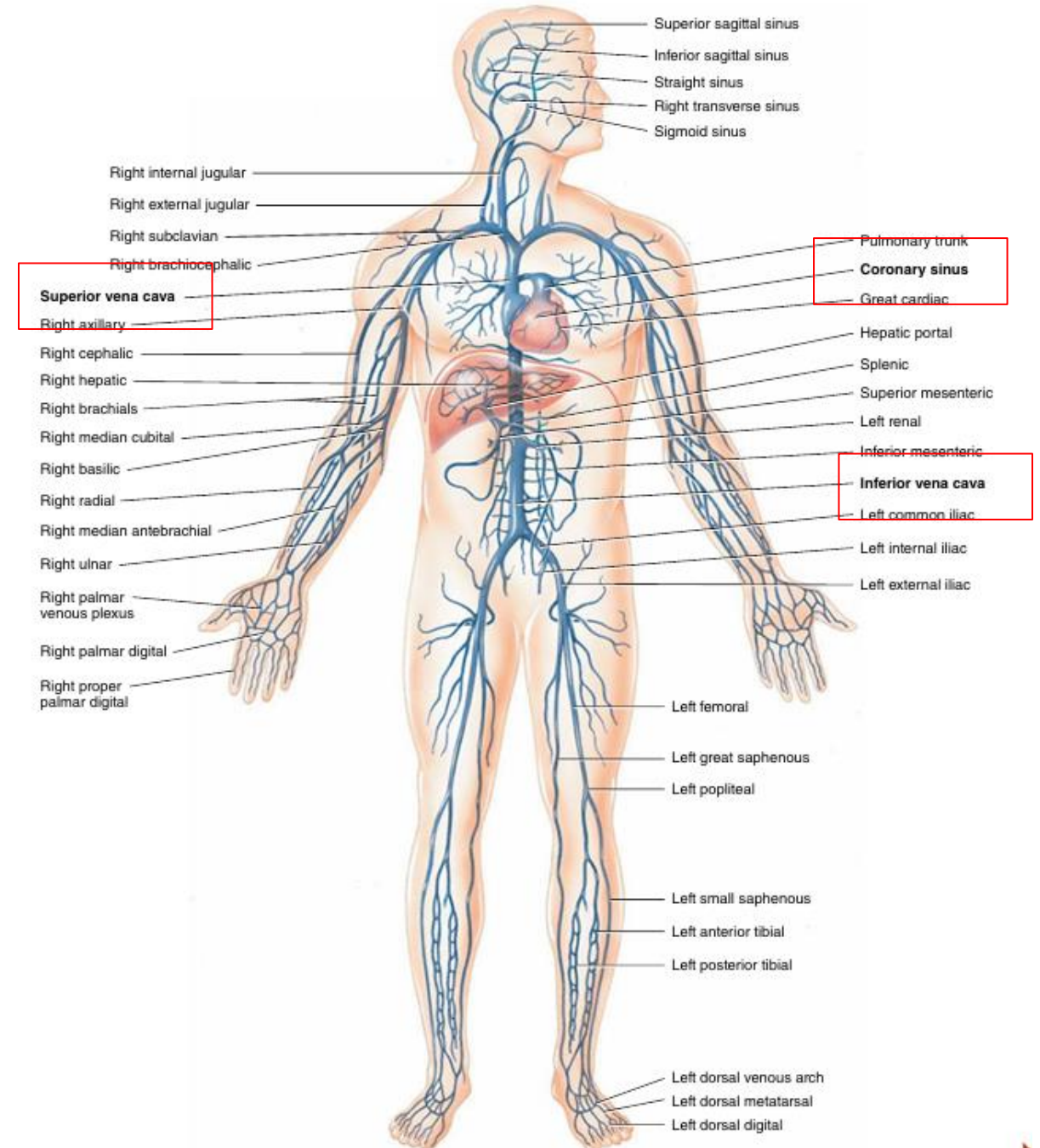
## Trochanteric Anastomosis





# Venous drainage of the body

- Deoxygenated blood returns to the heart via 3 main veins: the **superior and inferior venae cavae** and the **coronary sinus**.
- There are two types of veins:
  1. **Superficial veins**: beneath the skin
  2. **Deep veins** : accompany the arteries, some arteries have wo accompanying veins called v=ena comitans; one vein at each side of the artery.



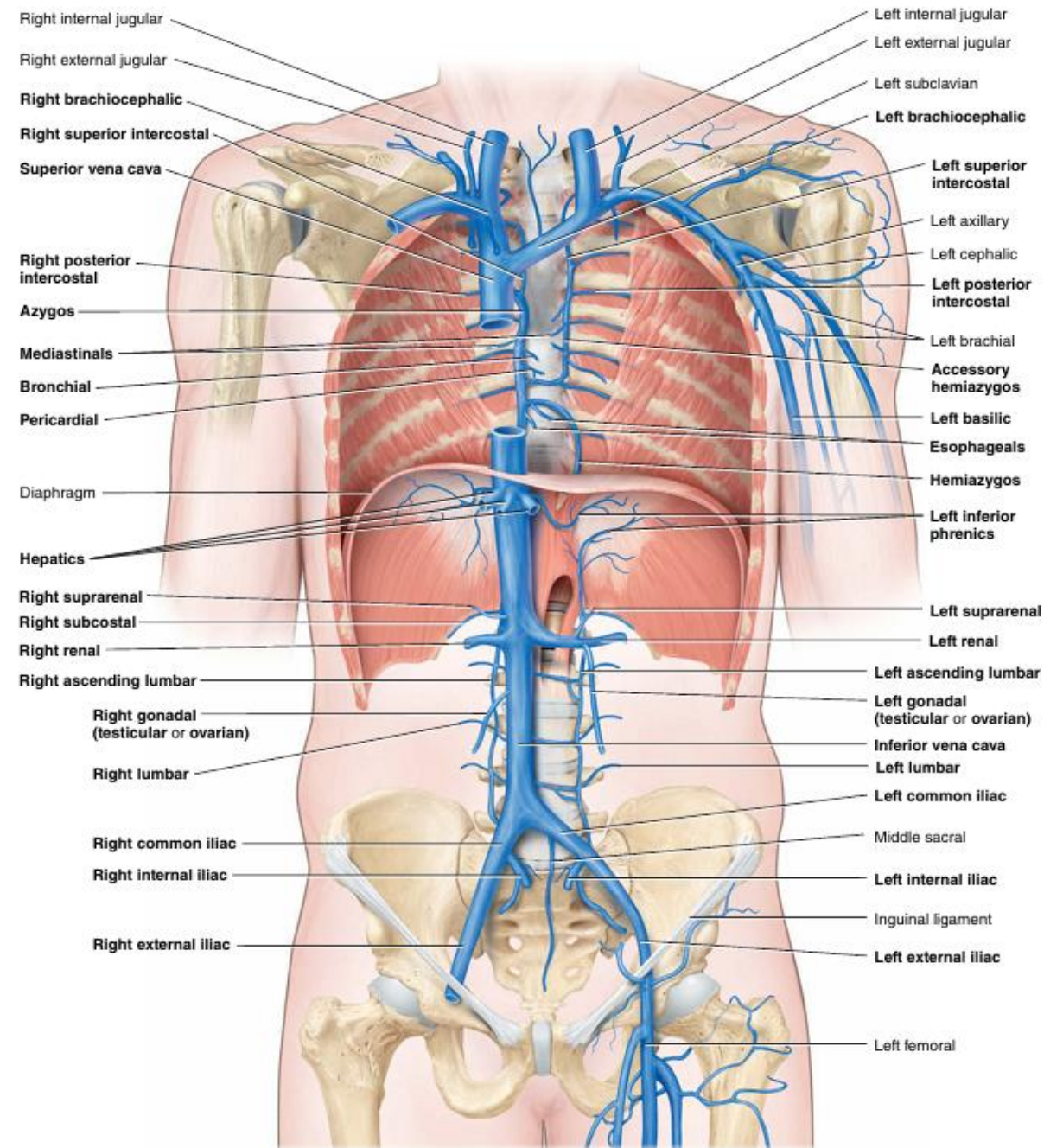
# Large venous vessels

- Superior vena cava

Returns blood to the heart from the tissues **above** the respiratory diaphragm. Formed by the junction of the **left** and **right** brachiocephalic veins.

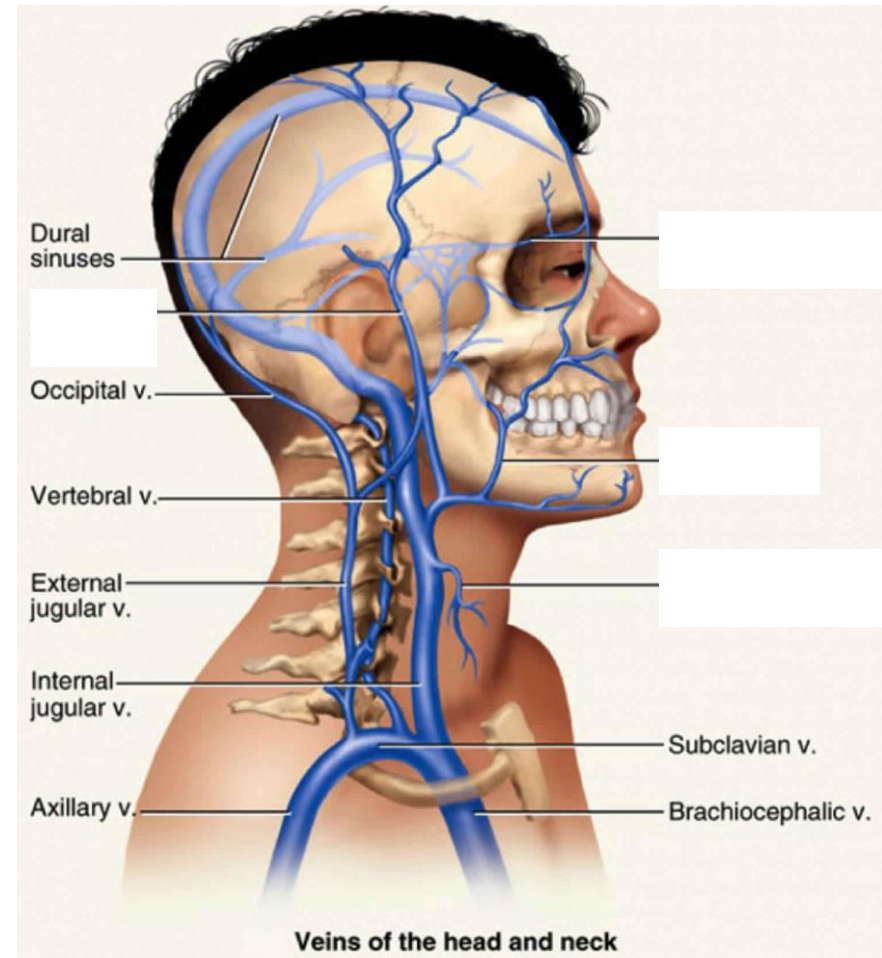
- Inferior vena cava

Returns blood to the heart from tissues **below** the respiratory diaphragm..



# Venous drainage of the upper limb, head and neck

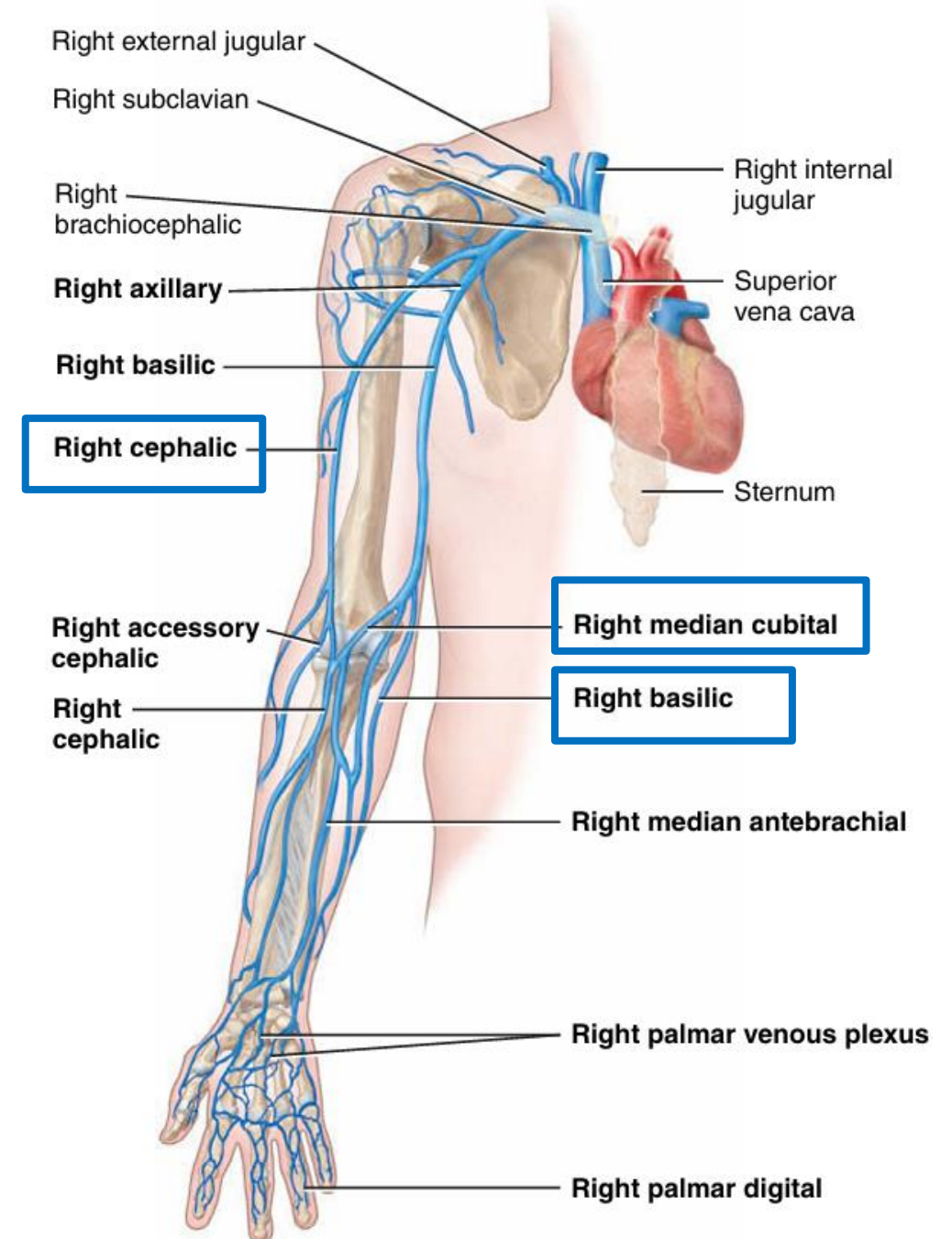
- **Dural venous sinuses** are **valveless**
- All drain into the **internal jugular vein**
- Internal jugular vein joins **subclavian vein** to form **brachiocephalic vein**



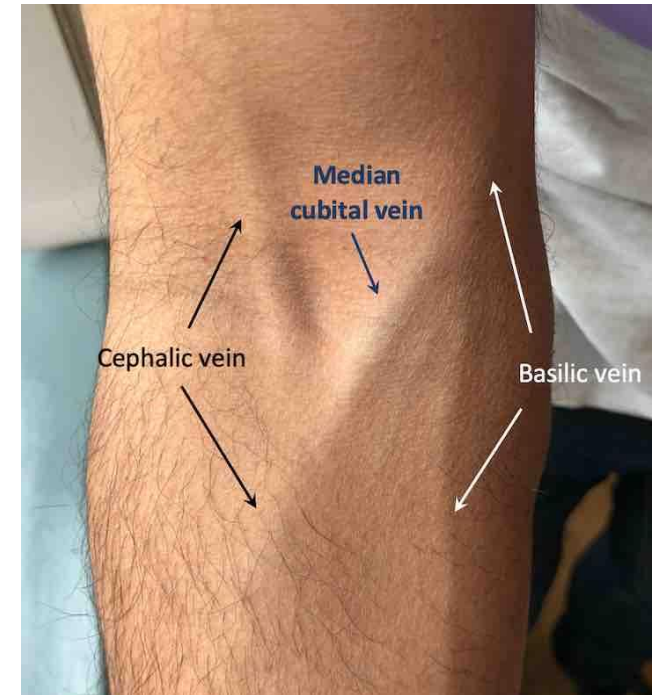
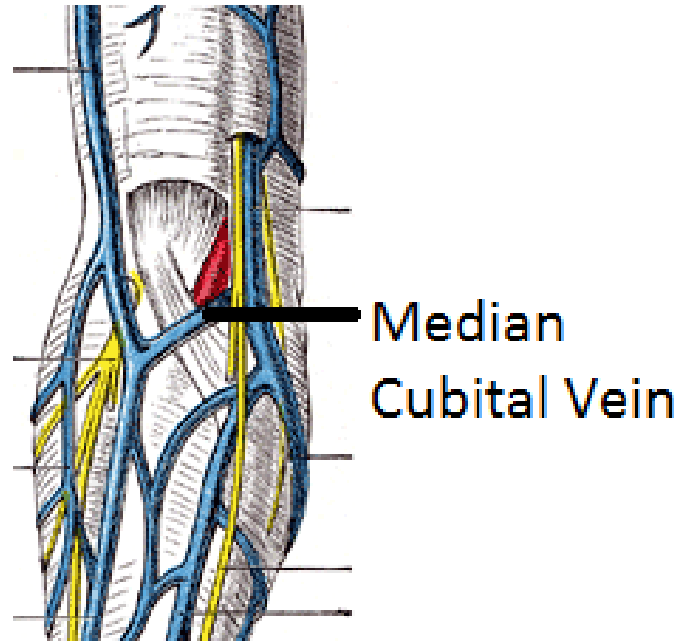


# Venous drainage of the upper limb

- **Cephalic veins** begin on the lateral aspect of dorsal venous arch
- **Basilic veins** begin on the medial aspects of dorsal venous arch.
- Connected to the cephalic veins anterior to the elbow by the median cubital veins



**The median cubital vein** is the most superficial vein in the body and connects the cephalic and basilic veins.



# Venous drainage of the lower limb

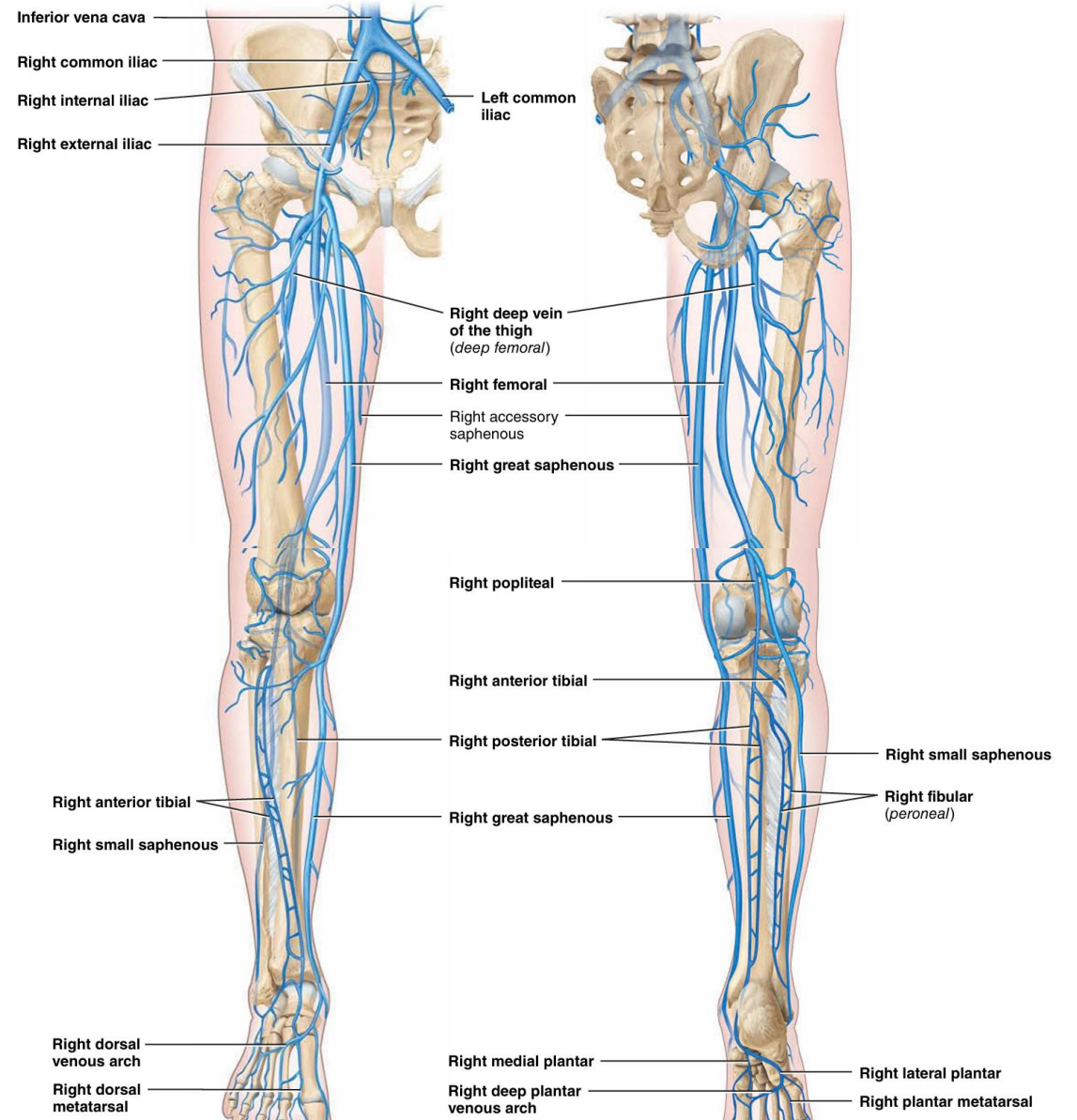
All veins of the lower limbs have valves.

**Great saphenous veins** are the longest veins in the body. They pass anterior to the medial malleolus of the tibia and then superiorly along the medial aspect of the leg and thigh.

**Small saphenous veins** begin at the lateral aspect of the dorsal venous arches of the foot; they pass posterior to the lateral malleolus of the fibula.

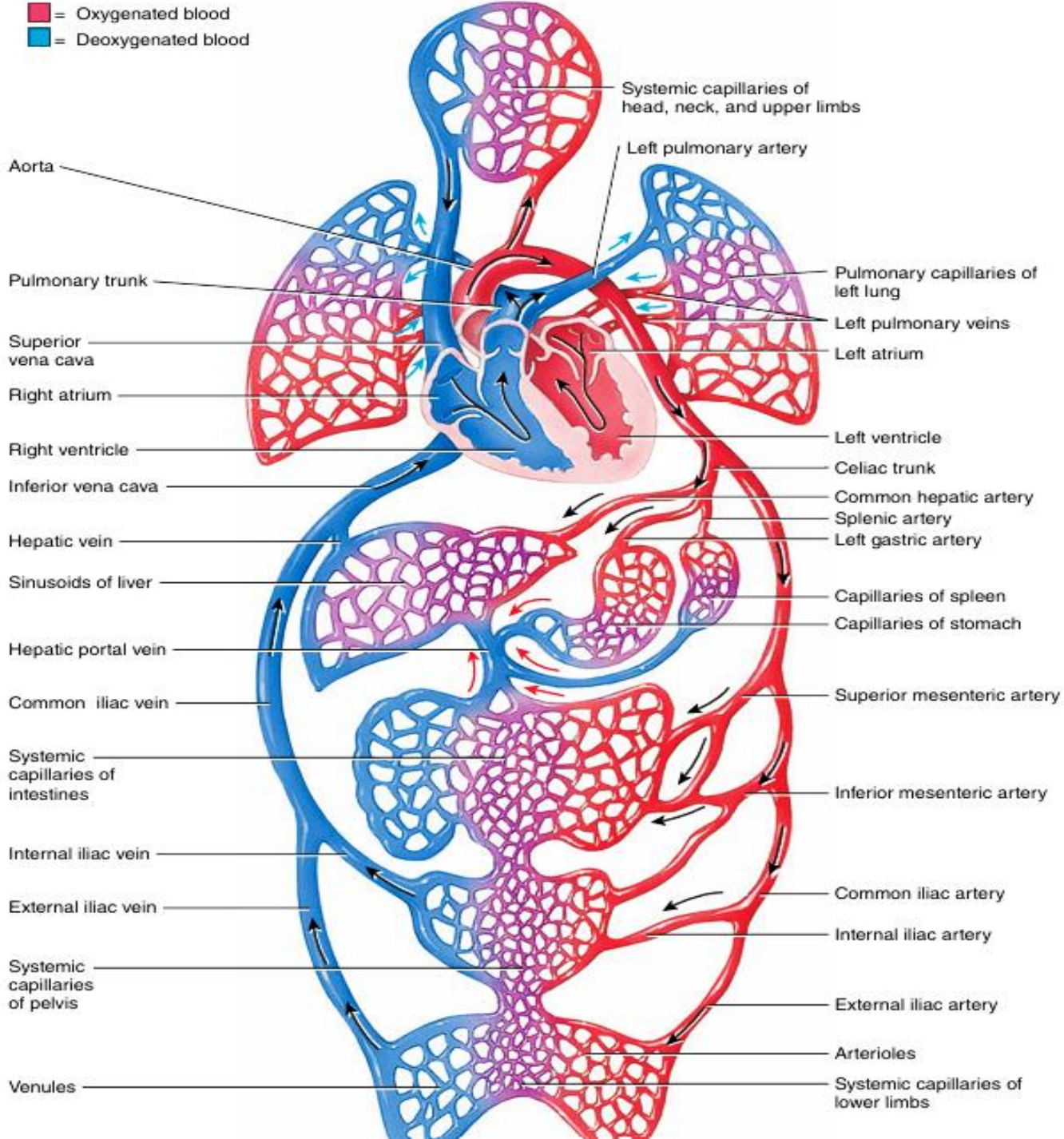
## Clinical notes:

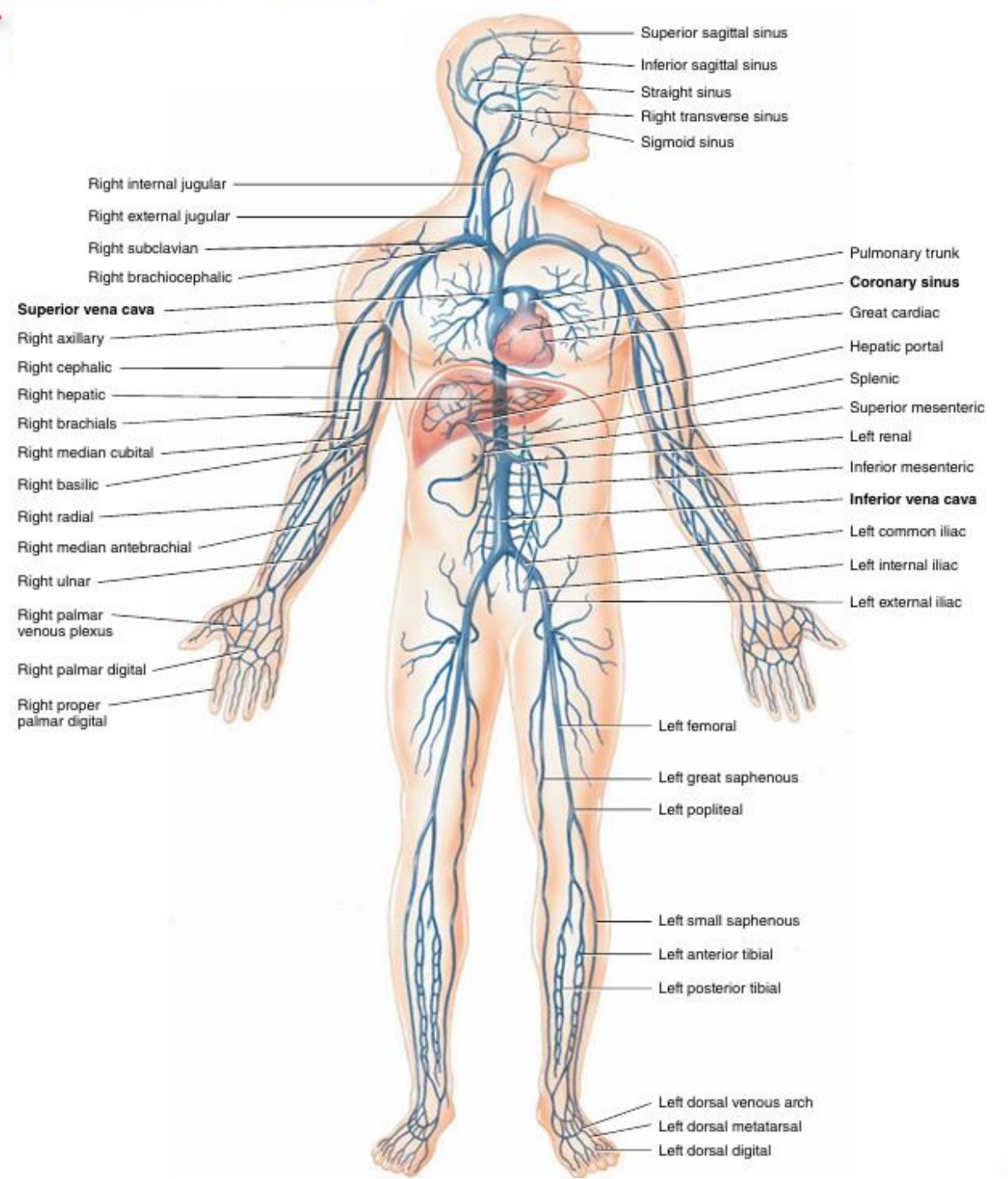
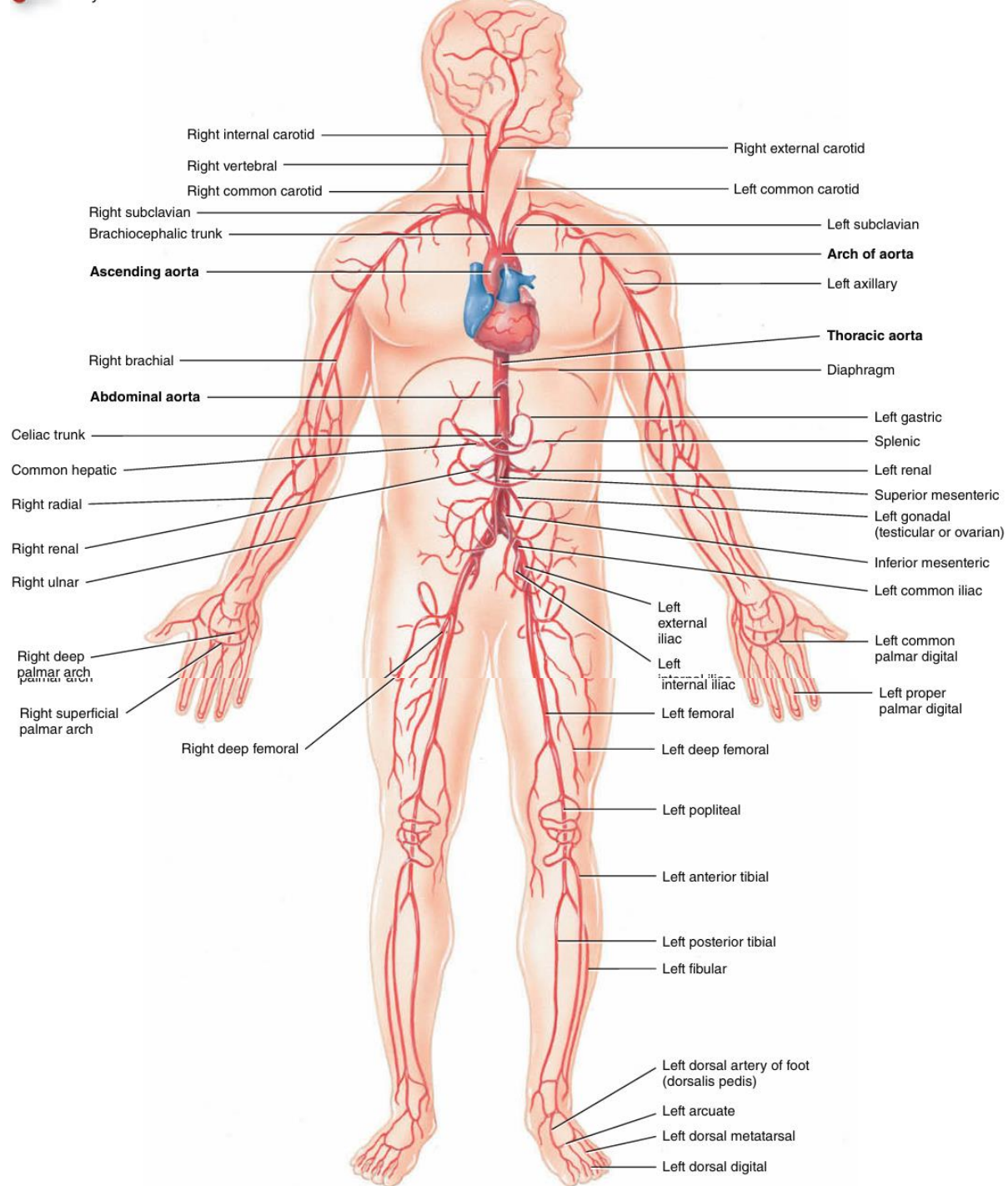
- More likely to be subject to Varicose veins than other veins in the lower limbs.
- Prolonged administration of intravenous fluids.
- Coronary artery bypass grafting





■ = Oxygenated blood  
■ = Deoxygenated blood





- Thank you!