



Anatomy Passion



Lecture: 14+15

Done By: Leen Al.Ashram



الجامعة الهاشمية
The Hashemite University

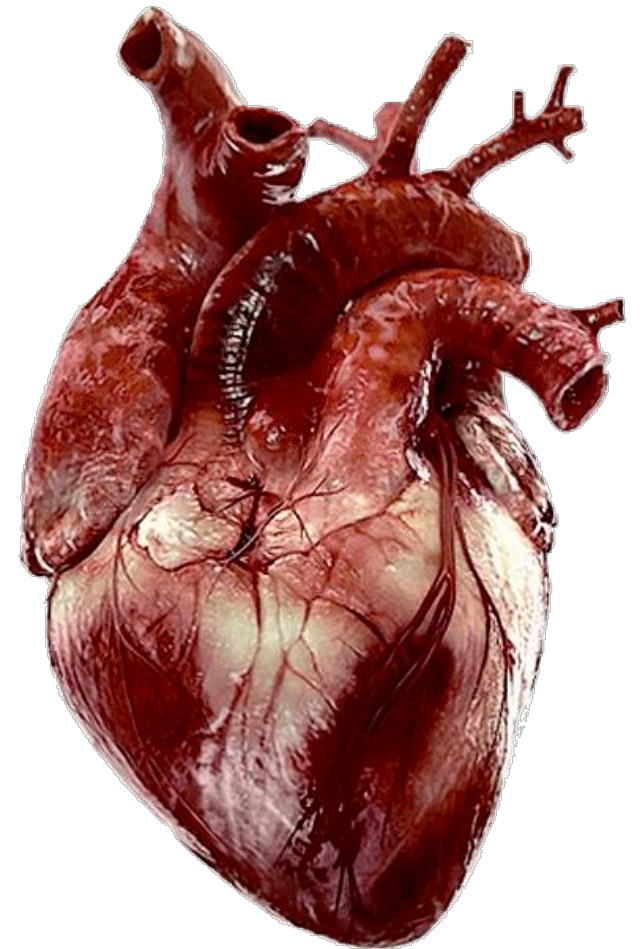


General Anatomy

Lecture 14: Cardiovascular System (1)

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THE CARDIOVASCULAR SYSTEM

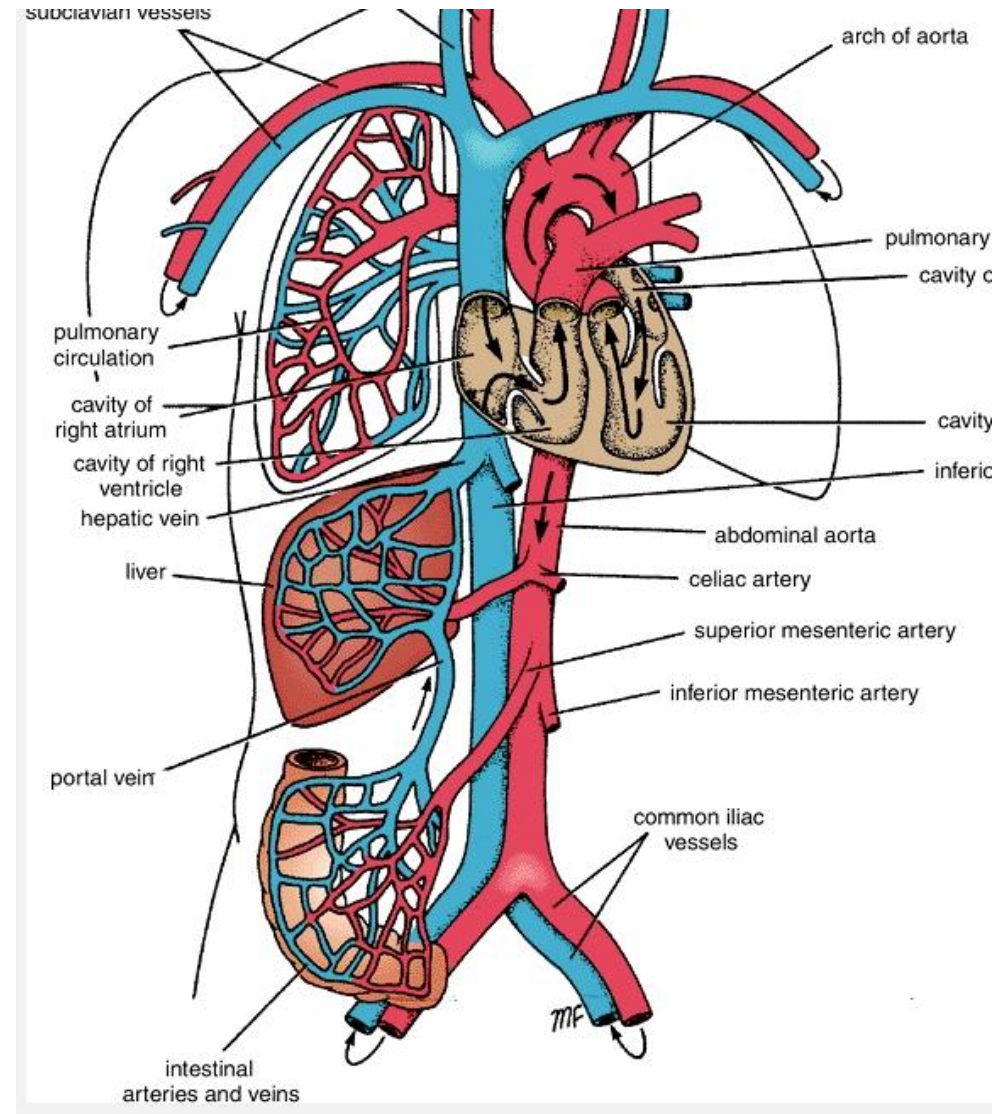
* Definition:

* It is the major part of the circulatory system.

* It consists of 2 main parts:

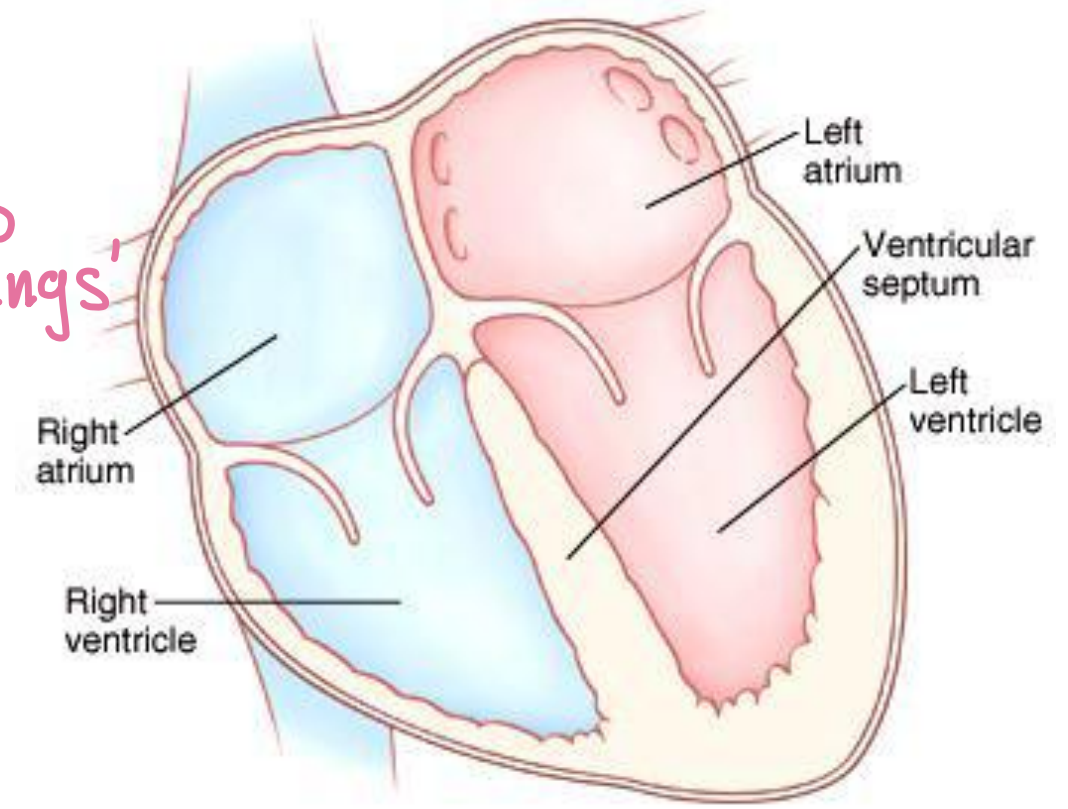
1. heart.

2. Blood vessels.



THE HEART

- * **Definition:** A conical hollow muscular organ that pumps the blood to various parts of the body.
- * **Site:** In the **middle mediastinum** (middle space of thoracic cavity). *"Between the two lungs"*
- * **Weight:** **300 gm in males & 250 gm in females.**
- * **Dimensions:** **12X9 cm.**



* the serous membrane covering the heart:

** **Pericardium**: The heart is surrounded by the **pericardium**, which is divided into:

a. **outer fibrous pericardium**: thick, fibrous & attached to diaphragm.

b. **inner serous pericardium**: which consists of 2 layers:

يفلحي
القلب من
الداخل

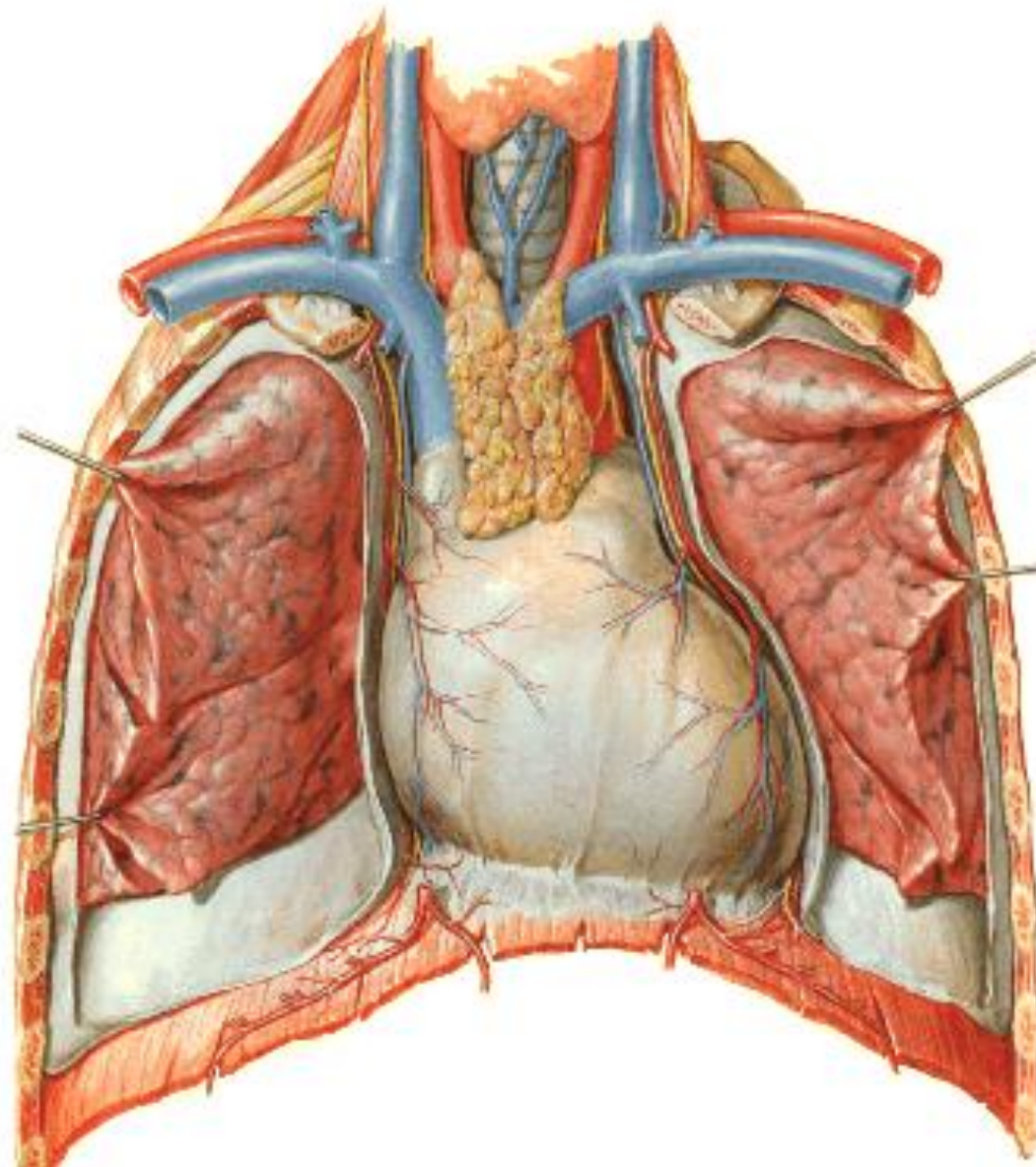
i. **outer parietal**: lines the fibrous pericardium.

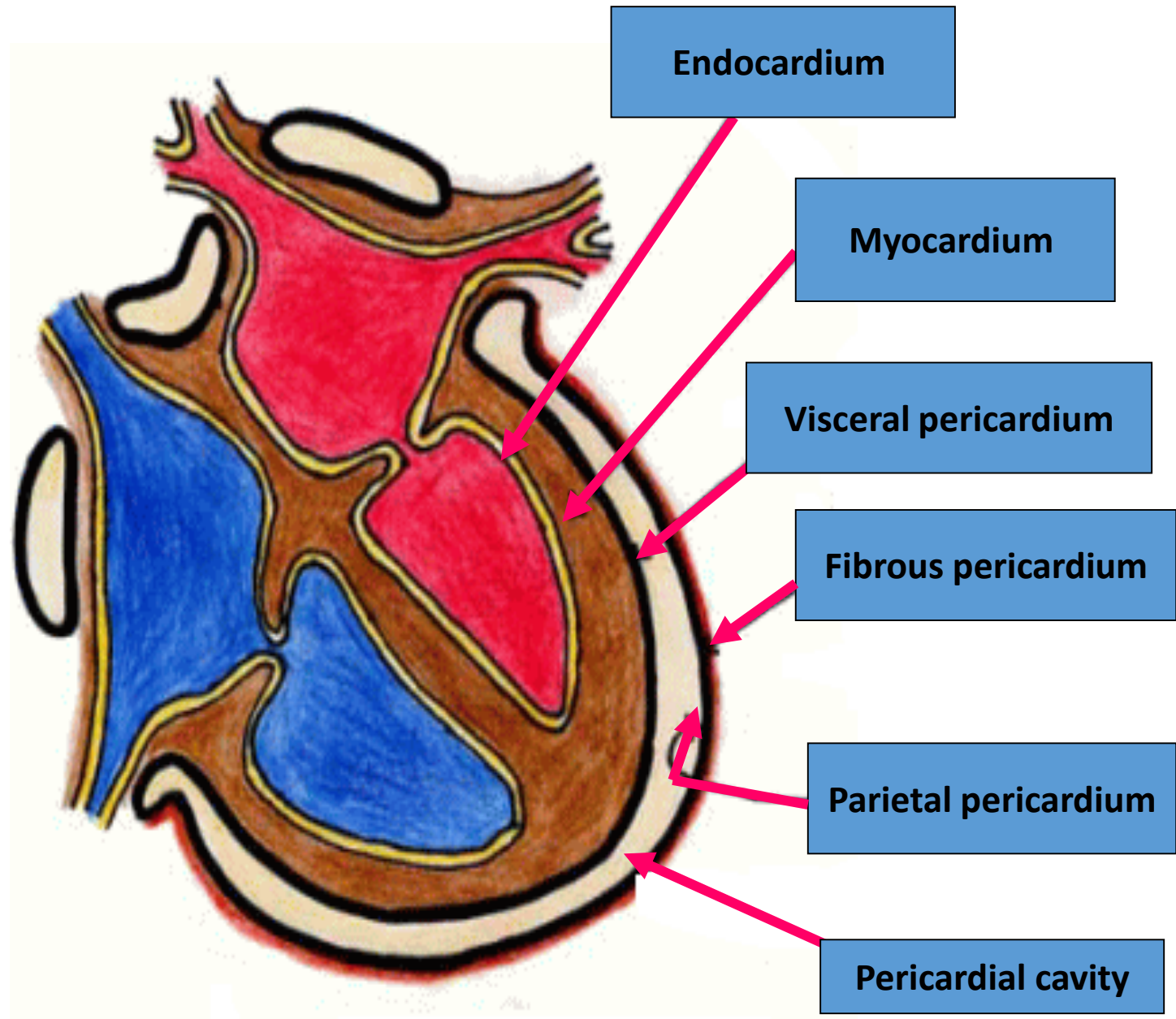
ii. **inner visceral**: covers the heart.

لا تده على
القلب

** The space between the 2 layers is called the pericardial cavity.

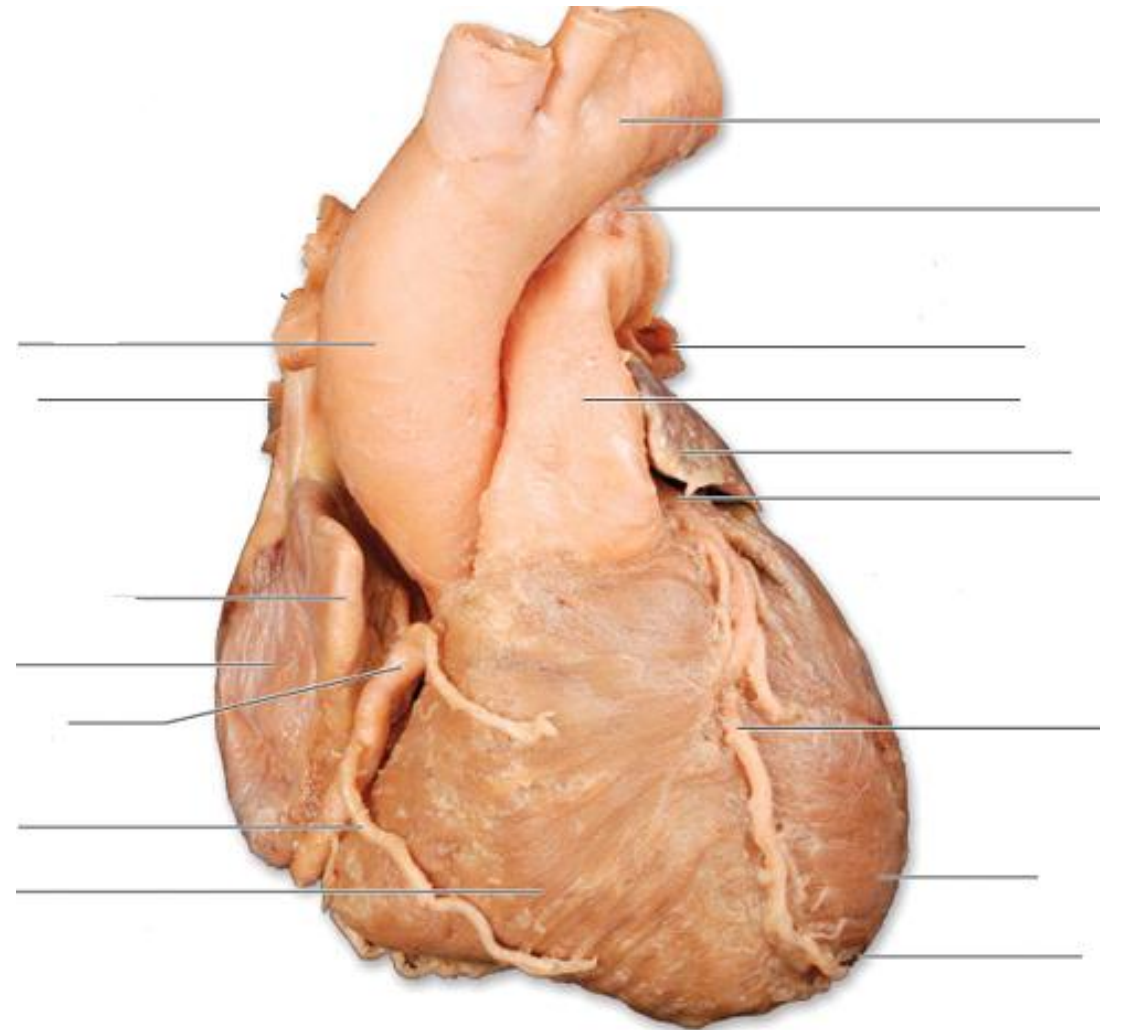
outer with inner منعوا يتكلم
parietal visceral





**** External
features of the
heart: it has:**

- 1. Apex.**
- 2. Base.**
- 3. Four borders.**
- 4. Two surfaces**
- 5. Four chambers.**

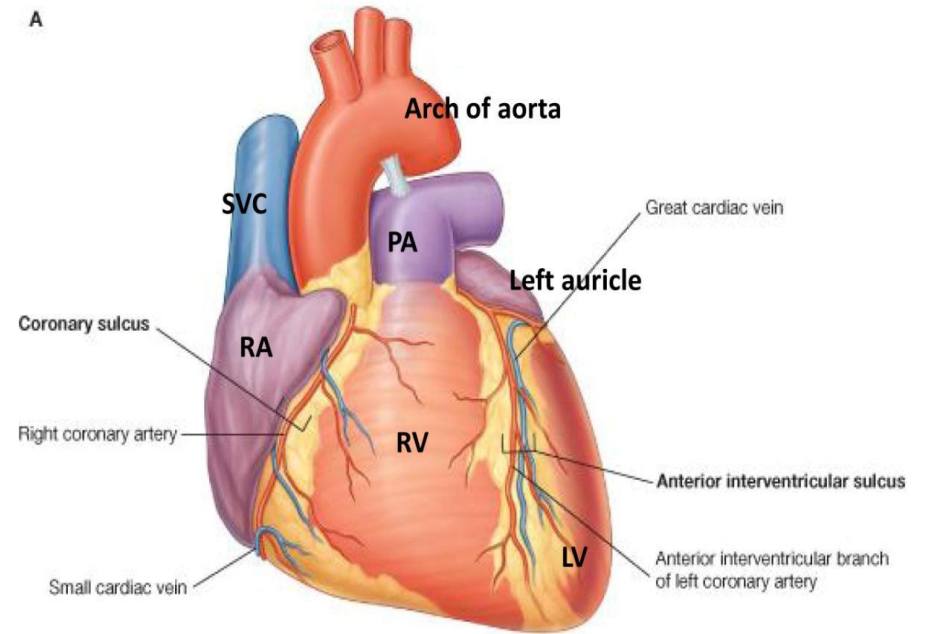


(a) Anterior view

1. The apex of the heart:

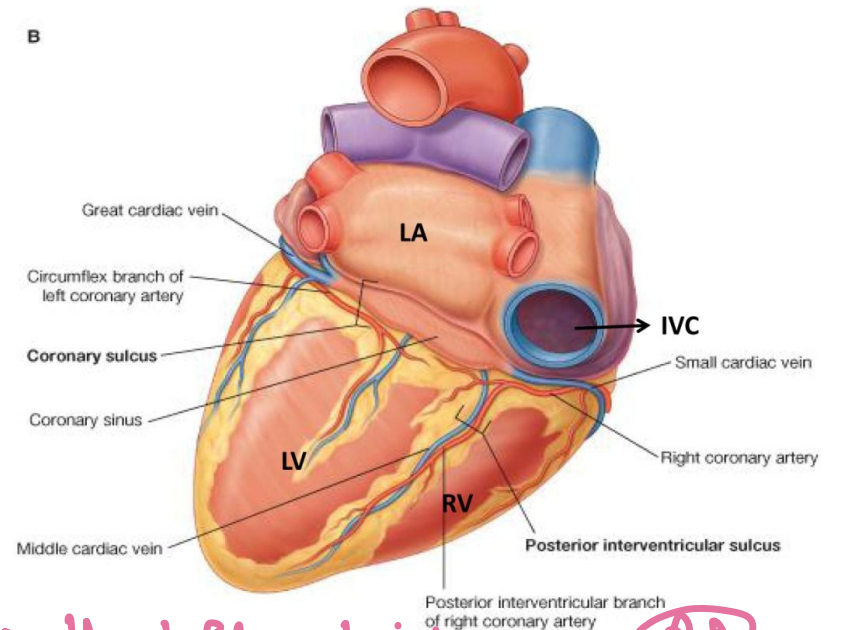
* Formed of the **Lt ventricle & directed downward forward to the left.** (*laterally*)

* It lies in the **5th left intercostal space, 9.5 cm from the mid-sternal line.** [*medial plane*]



2. The base of the heart:

* Formed of both atria, **mainly the left atrium** & directed backward, upward & to the right, forming the posterior aspect of the heart.



* the base is made by: left & right atrium / the base is mainly made by: *the left atrium*

3. The borders of the heart are:

4 borders

a. **Upper border** formed by the 2 atria.

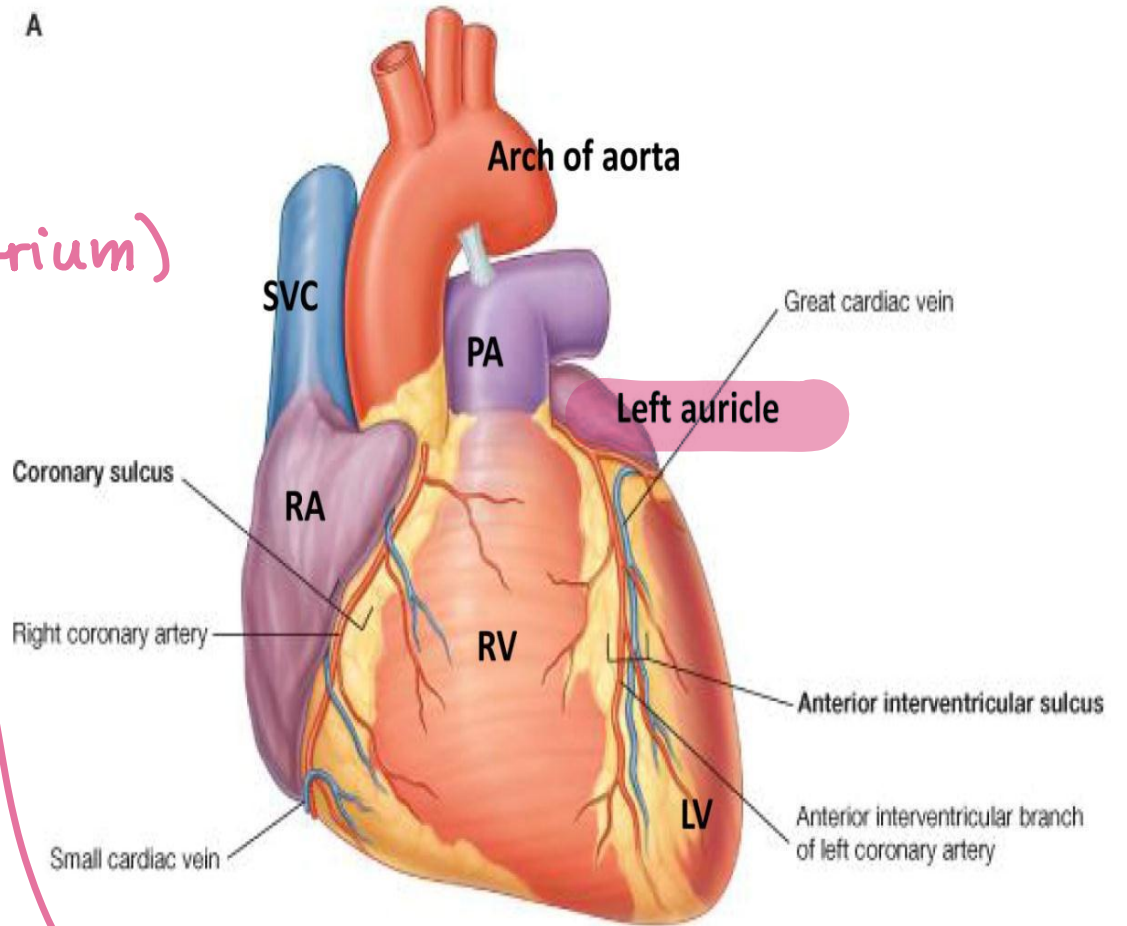
(left + right atrium) + left auricle

b. **Lower border** formed by the 2 ventricles.

c. **Right border** formed by the right atrium.

d. **Left border** formed by the left ventricle & left auricle.

↳ mainly by this



Both right & left, but mainly by the right V.

|||

4. The surfaces of the heart:

* It has 2 surfaces:

a. Anterior or sternocostal surface: is divided by **coronary sulcus** into: [coronary group is btw Atrial part & V. part]

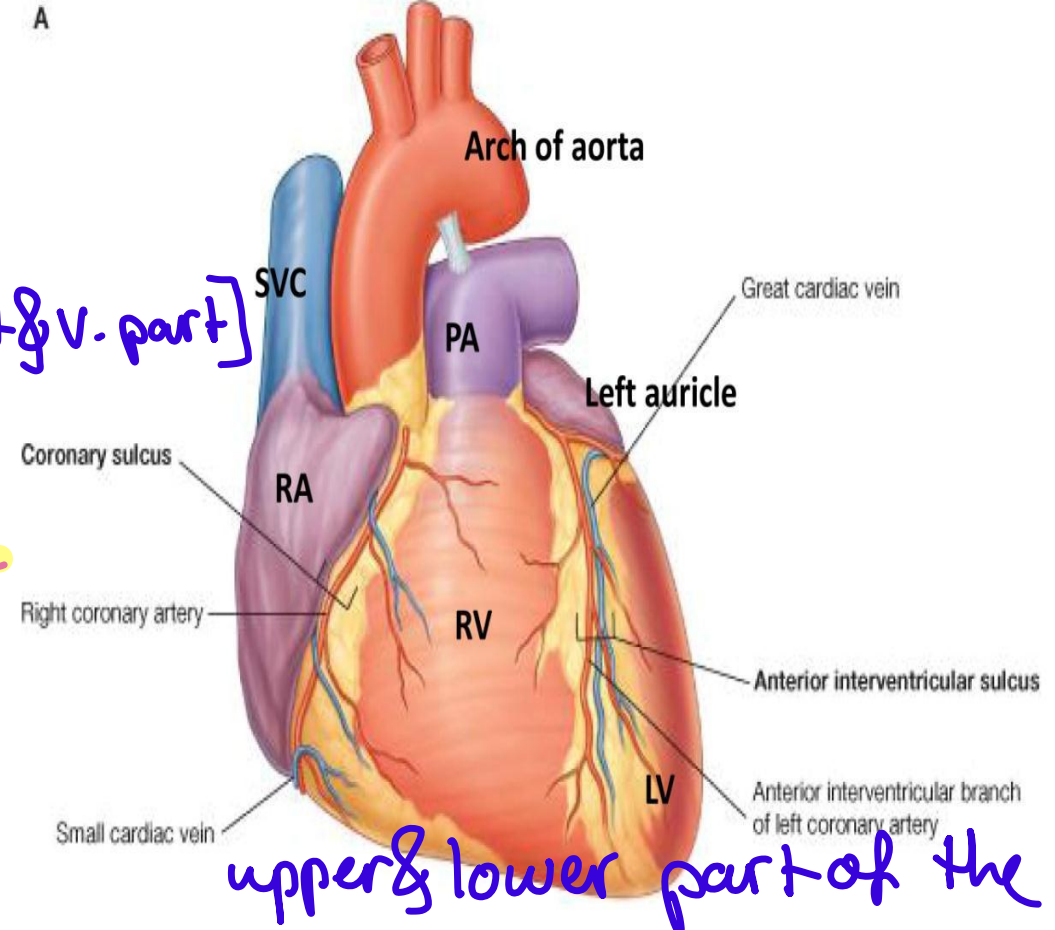
1. Atrial part formed mainly by RT atrium. / formed by RT atrium & left auricle

2. Ventricular part: subdivided by anterior interventricular sulcus into:

* RT 2/3 formed by RT ventricle.

* LT 1/3 formed by LT ventricle.

→ formed by: RV, LV ⇒ mainly: RV 



upper & lower part of the sternocostal surface:

1. above coronary group: RA + left auricle
2. below coronary group: RV + LV

b. Inferior or diaphragmatic surface:

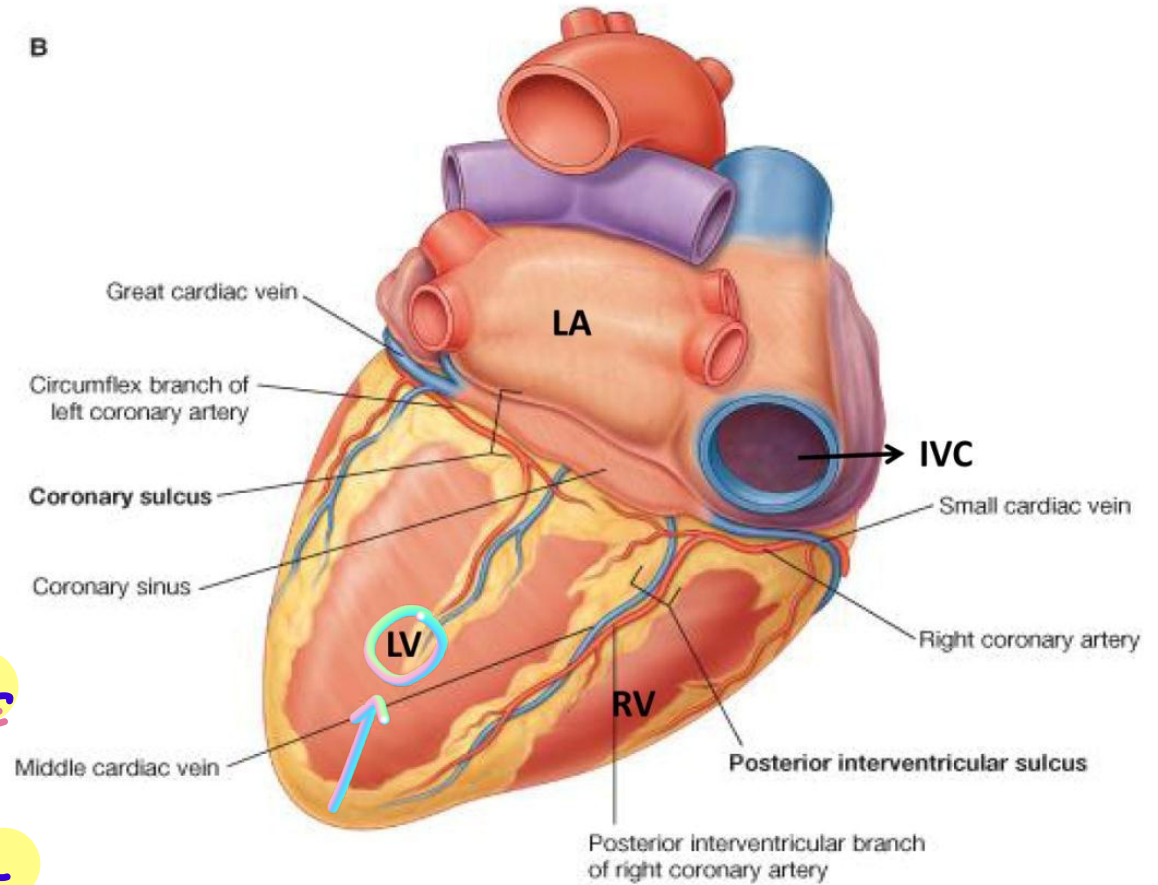
* Formed by the 2 ventricles & divided by posterior interventricular sulcus into:

formed by both left + right v.

LT 2/3 formed by LT ventricle.

RT 1/3 formed by the RT ventricle.

mainly
By left ventricle



5. The chambers of the heart:

a. The RT atrium: has 2 walls:

→ because of:

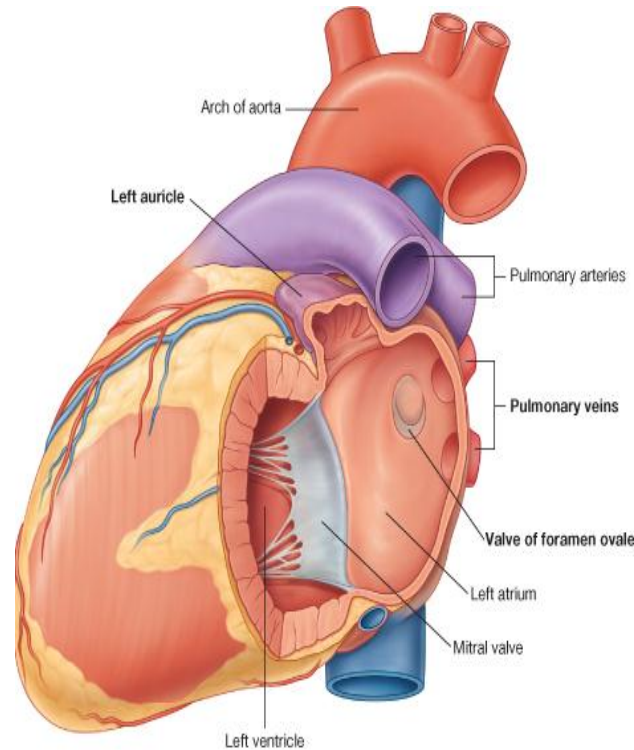
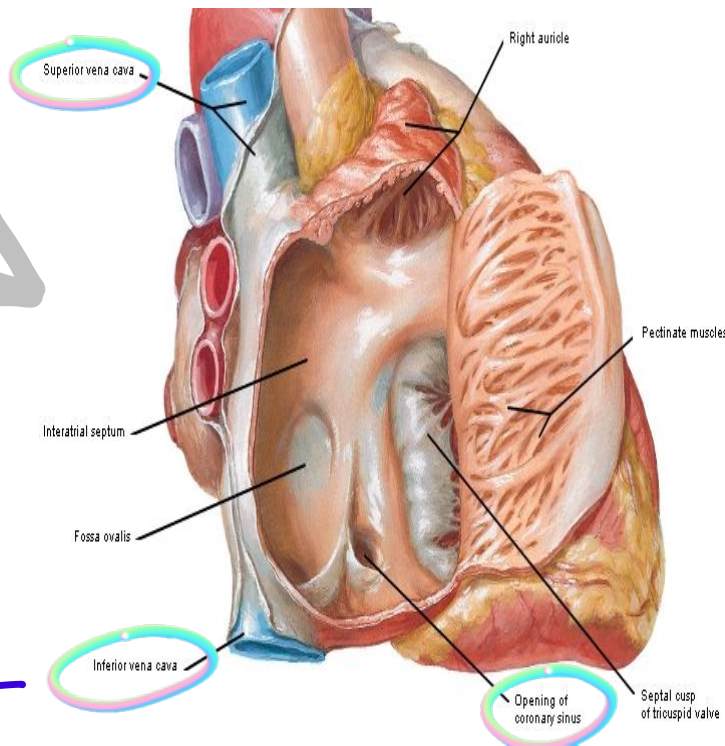
* Anterior rough or muscular.

* Posterior smooth receiving the openings of big veins SVC, IVC & Coronary sinus.

b. The LT atrium: its wall is mostly smooth, receiving the openings of the 4 pulmonary veins.

① superior + inferior vena cava
②
③

دلیل این
right A.



→ has 3 papillary muscles

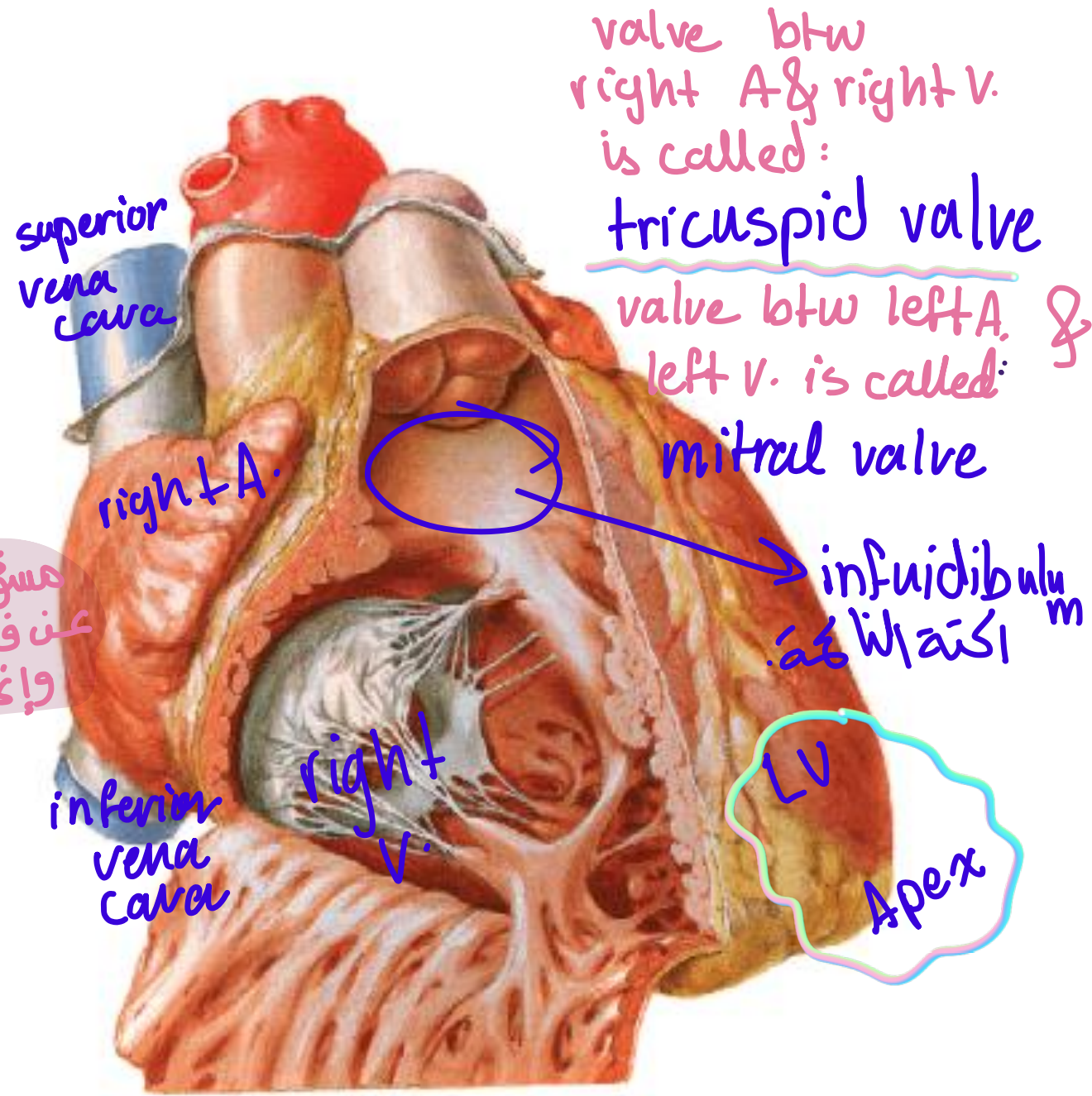
c. The RT ventricle: is divided into 2 parts:

1. Rough muscular inflowing part: receives the blood from the right atrium & contains **3 papillary muscles**.

attached to the tricuspid valve
مسؤولين عن فتحة وإغلاقه
منها 3 أبواب
العضلة ملاح

2. Smooth outflowing part: It is called **Infundibulum**: it pushes the blood into the pulmonary trunk.

pulm. trunk ← pulmonary valve ← ... إلى ...
Then to the lung



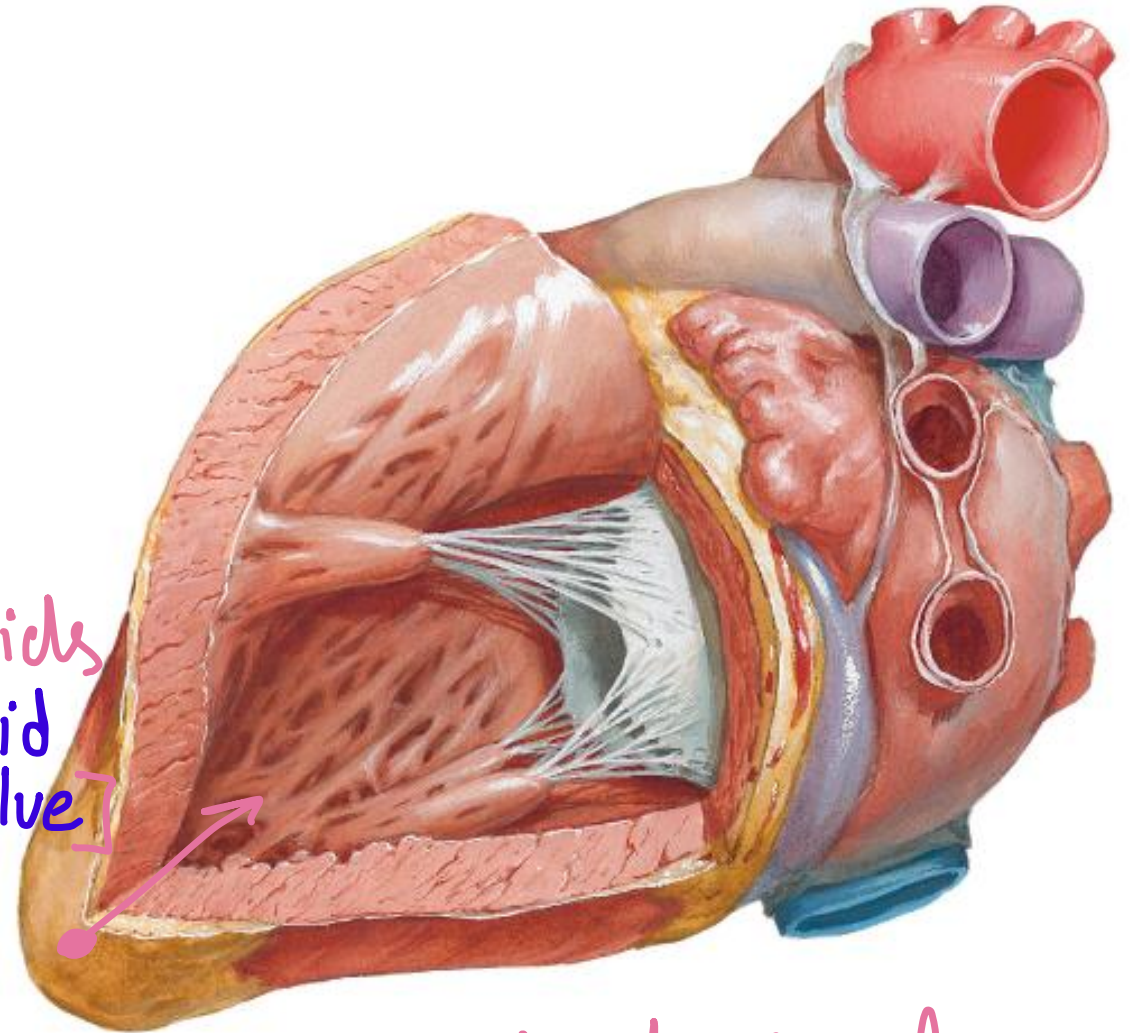
valve btw right A & right V. is called: tricuspid valve
valve btw left A. & left V. is called: mitral valve

infundibulum
اكتمل كذا

d. LT ventricle: is divided into 2 parts:

1. Rough muscular inflowing part: receives the blood from the left atrium & contains 2 papillary muscles. → attached to the 2 cusps in mitral valve [bicuspid valve]

2. Smooth outflowing part: It is called vestibule: it pushes the blood into the aorta. ← أوعية قبل Aorta



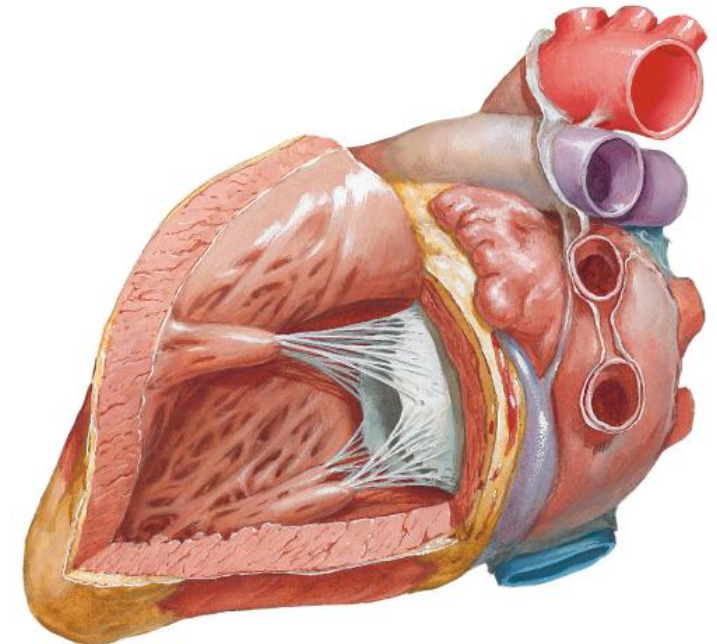
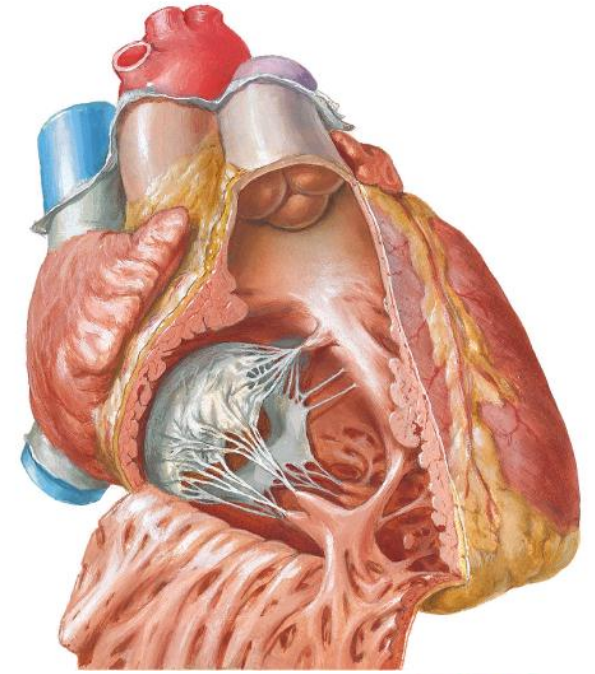
when LV contracts, blood go to Aorta

**** The valves of the heart:**

There are 2 types of heart valves:

a. Atrio-ventricular (AV) valves: *btw A & V.*

- 1. The right valve called Tricuspid. It has 3 cusps separating the right atrium from right ventricle.**
- 2. The left valve called Bicusped or Mitral. It has 2 cusps separating the left atrium from left ventricle.**



beginning of vessels.

b. Semilunar valves:

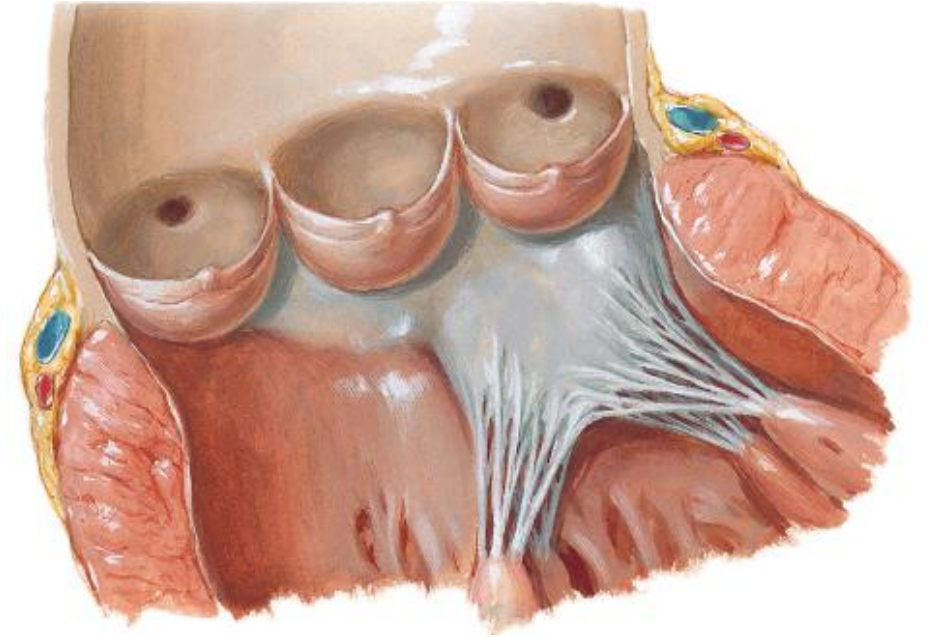
out hollow of the heart

→ [Aorta or palm. trunk]

They are formed of 3 cusps, each cusp has a hollow space above called sinus.

1. Aortic valve: has one sinus anterior & 2 sinuses posterior.

2. Pulmonary valve: has one sinus posterior & 2 sinuses anterior.



في حجرة
ناطقة في
palm trunk
infundibulum

RV → palm. trunk
[palm. valve]
LV → Aorta
[Aortic valve]

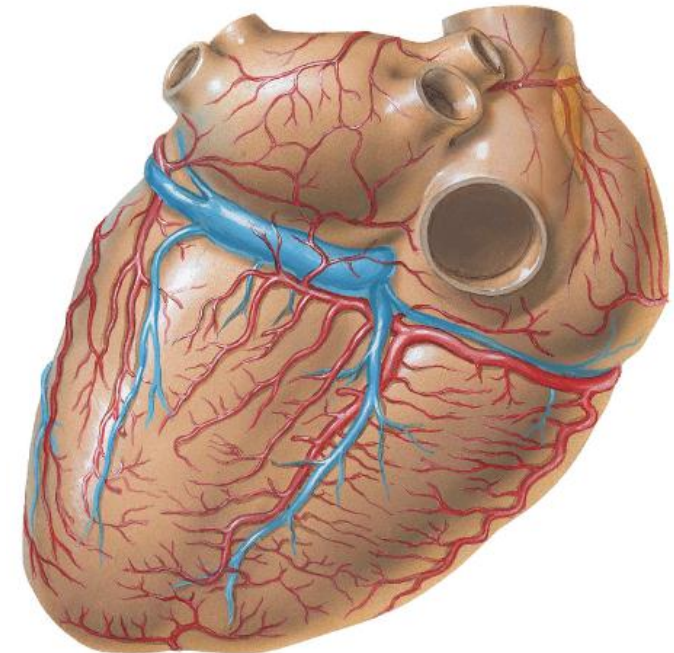
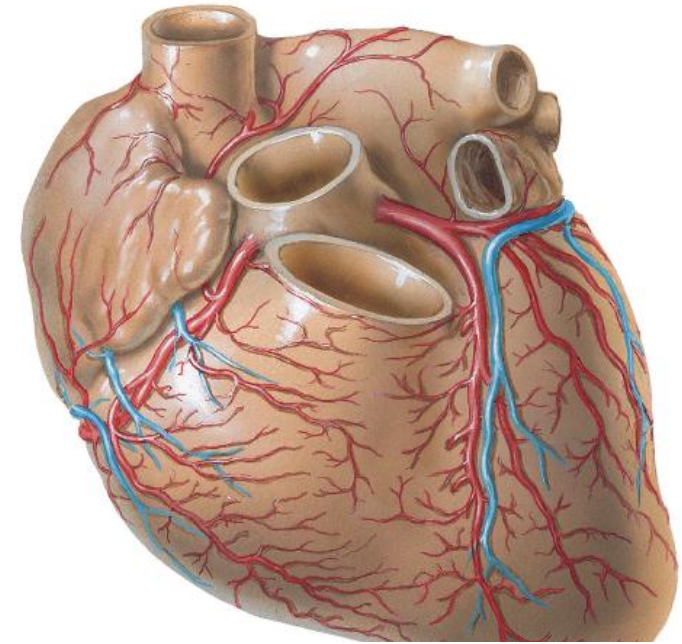
lec 15.

****Blood supply of heart:**

1. Arterial supply: by the **coronary arteries (RT<)** that arise from the beginning of **ascending aorta**.

2. Venous drainage: through **small veins** that end in short **venous channel** called **coronary sinus** that opens in the **RT atrium**.

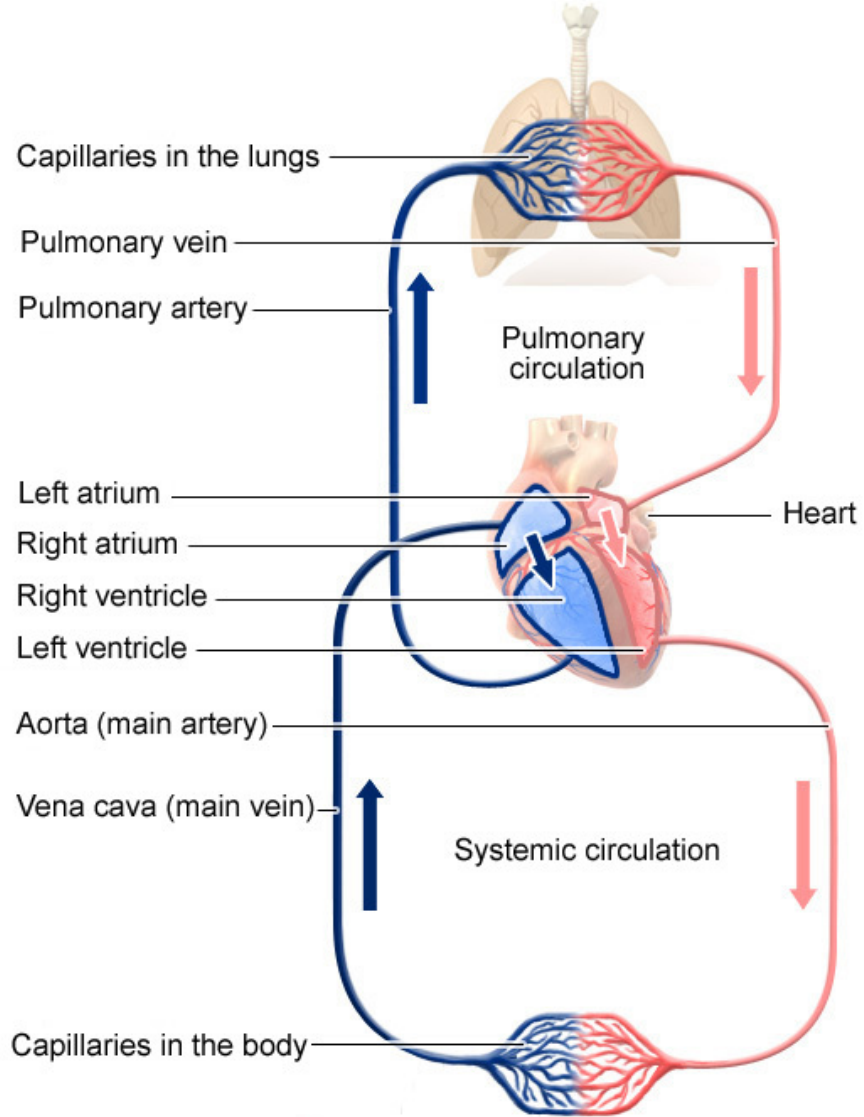
great
middle
small



Pulmonary and systemic circulation

In the **systemic circulation**, the left ventricle pumps oxygen-rich blood into the main artery (aorta). The blood travels from the main artery to larger and smaller arteries and into the capillary network. There the blood drops off oxygen, nutrients and other important substances and picks up carbon dioxide and waste products. The blood, which is now low in oxygen, is collected in veins and travels to the right atrium and into the right ventricle.

This is where **pulmonary circulation** begins: The right ventricle pumps low-oxygen blood into the pulmonary artery, which branches off into smaller and smaller arteries and capillaries. The capillaries form a fine network around the pulmonary vesicles (grape-like air sacs at the end of the airways). This is where carbon dioxide is released from the blood into the air inside the pulmonary vesicles, and fresh oxygen enters the bloodstream. When we breathe out, carbon dioxide leaves our body. Oxygen-rich blood travels through the pulmonary veins and the left atrium into the left ventricle. The next heartbeat starts a new cycle of systemic circulation.

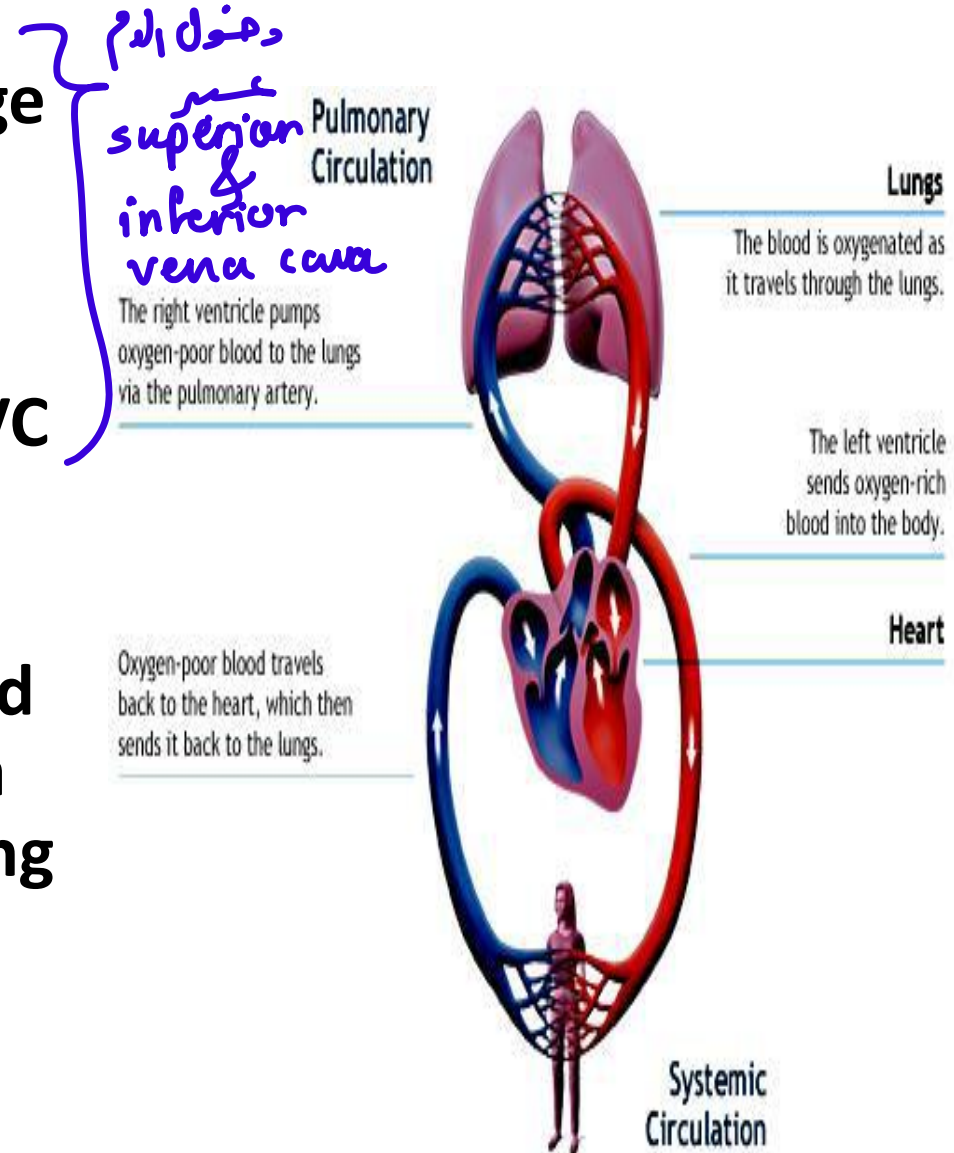


Red: Oxygen-rich blood
Blue: Oxygen-poor blood

Types of Blood Circulations

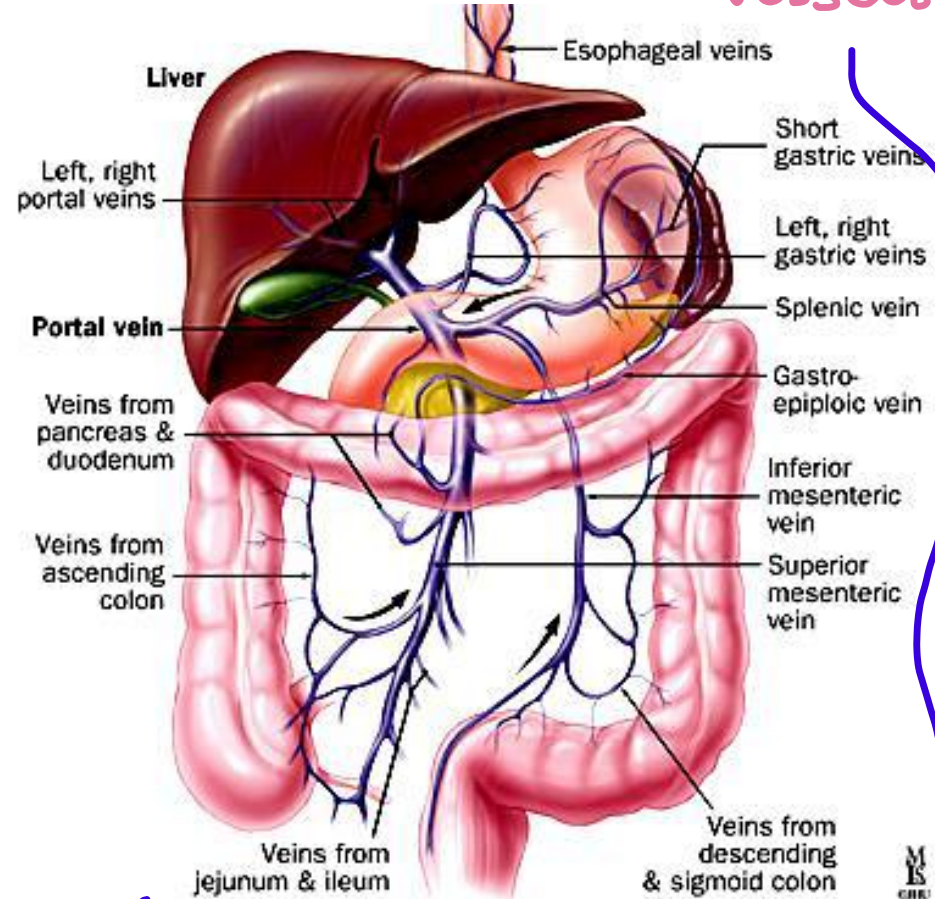
1. **Systemic circulation:** It is the passage of blood from the Lt ventricle to the whole body via the aorta & its branches then returning the blood back to the Rt atrium through the SVC & IVC.

2. **Pulmonary circulation:** It is the passage of the non-oxygenated blood from the Rt ventricle to the lungs via the pulmonary arteries then returning the blood back to the Lt atrium through the pulmonary veins after oxygenation.



3. Portal circulation: It is the passage of the **venous blood** from the **gastrointestinal system** carrying the products of digestion & absorption to the **liver** via the **portal vein** where the liver cells metabolize these products, then returning back the blood to the **systemic circulation** through the **hepatic veins** to the **IVC** to the **right atrium**.

هو وجوده بأماكن محددة
 مثل: GIT، pituitary gland
 here, we have sinusoid blood vessels



← كل على امتصاص أى غذاء أو أكسجينه
 مستقبلي، ثم ترجع إلى systemic circulation



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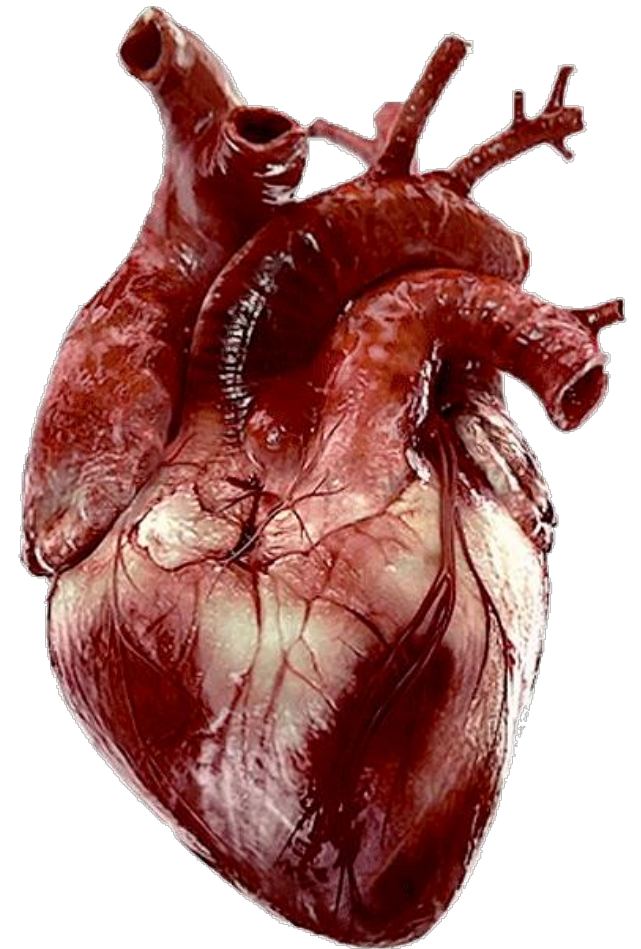


General Anatomy

Lecture 15: Cardiovascular System (2)

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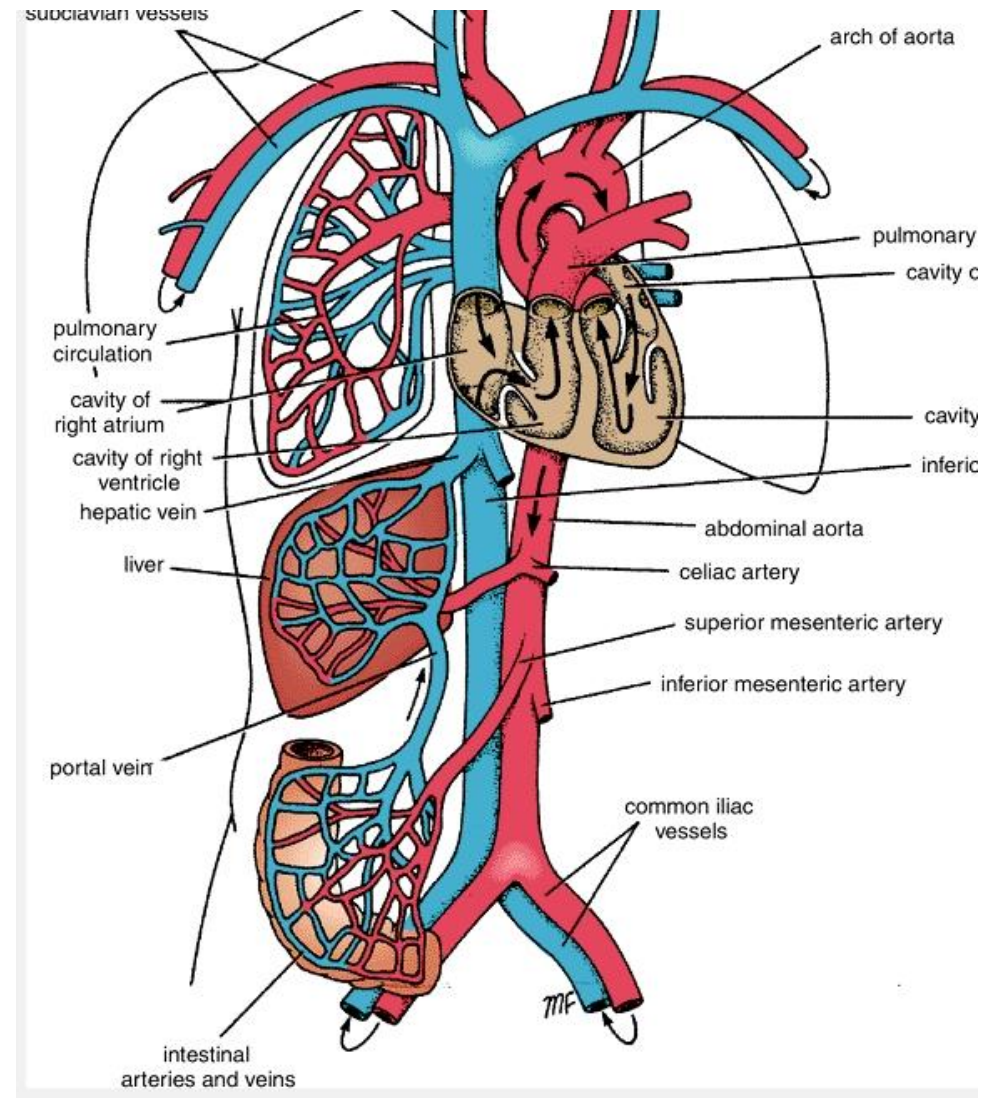
BLOOD VESSELS

**** Types of blood vessels:**

1. Arteries.

2. veins.

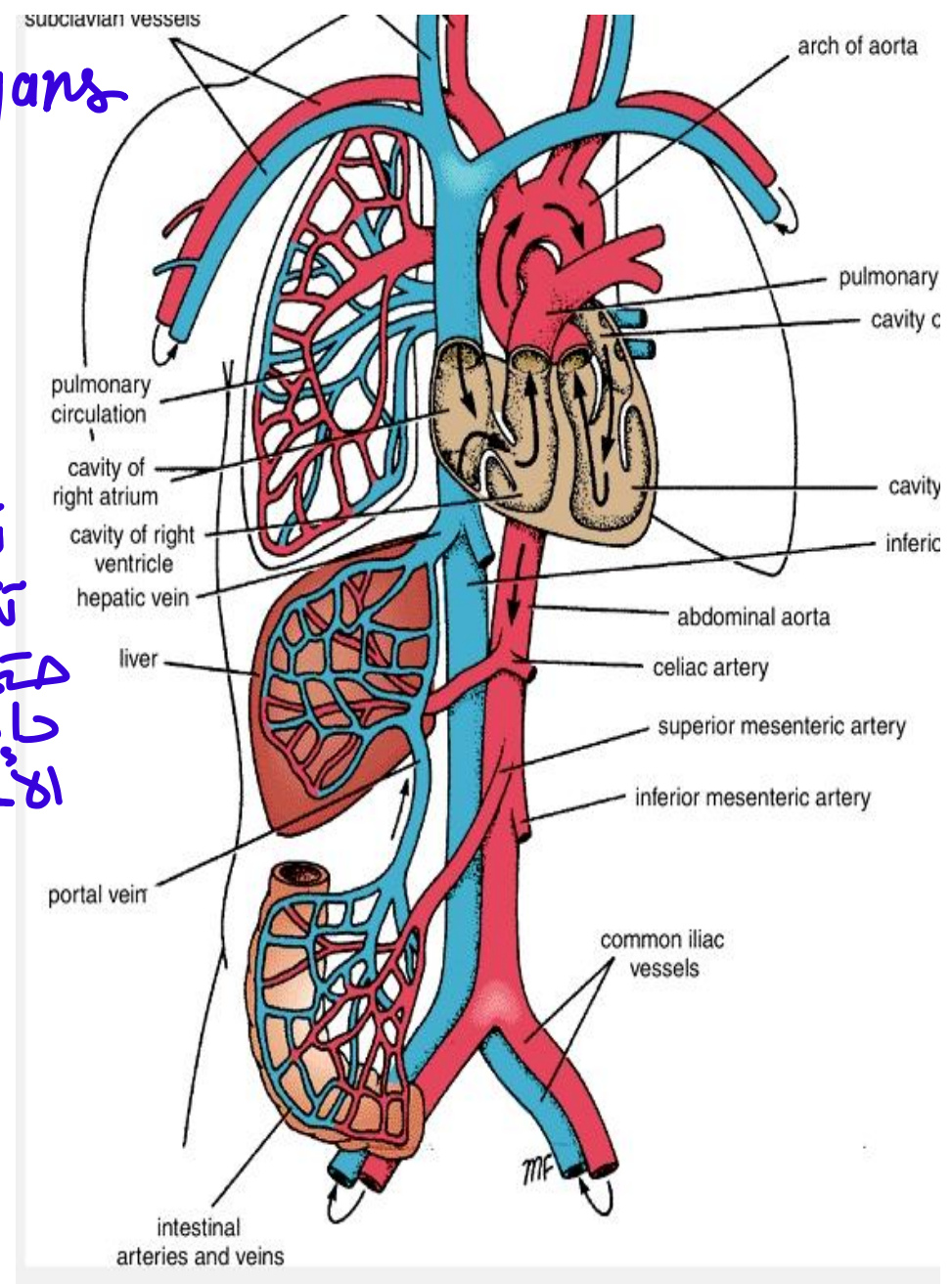
3. Capillaries. → connection btw arteries & veins



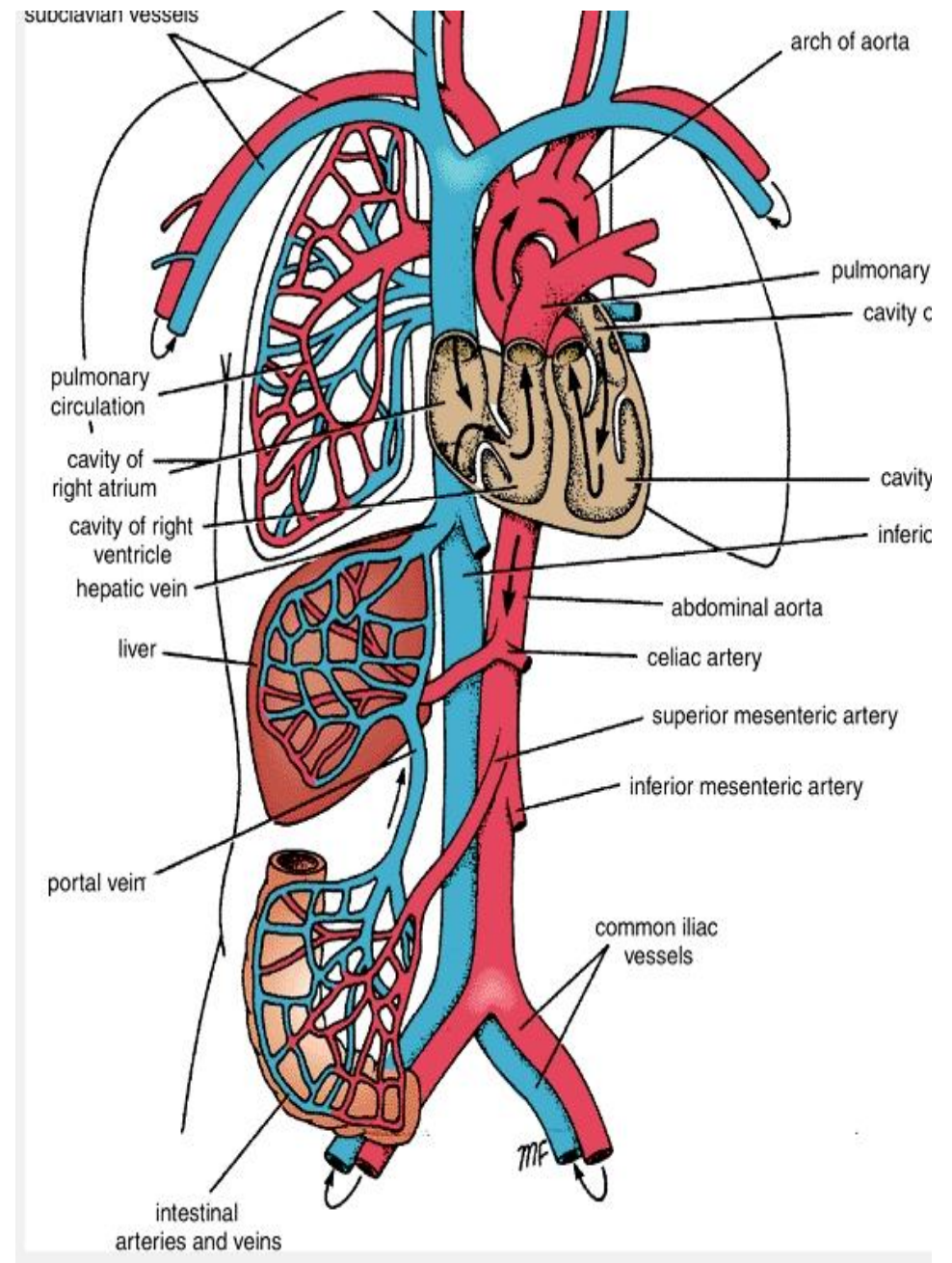
→ the main artery, & it has branches for the organs

- The blood leaves the left ventricle of the heart through the **aorta**, which divides into **smaller** branches to supply the different systems & tissues of the body.
- These branches divide into smaller & smaller arteries till they end inside tissues by giving small **arterioles**. These arterioles divide into smaller arterioles & finally, the smaller ones join the **capillaries**.

تسمى
شعب
أصغر
والأصغر



*** Capillaries collect into very minute venules, which collect into small veins. These veins unite to form large veins, which collect into larger veins, & finally, veins collect in 2 big veins; Superior vena cava (SVC) & inferior vena cava (IVC), which open into the **right atrium** of the heart.**



Arteries

1. Carry **blood** away from the heart.
to organs

2. Carry **oxygenated** bl. (except **Pulmonary A.**)
↑

3 3. **Divide into branches.**
↓

4. Its wall is rich in smooth ms. & elastic fibers (Non-compressible).
أكبر

5. **Thick-walled** & **narrow** lumen.

6. Do not contain valves.

Veins

1. Carry blood **towards** the heart.
from the organs

2. Carry **deoxygenated** bl. (except **Pulmonary V.**)
↑

3 Collect from tributaries.
↓

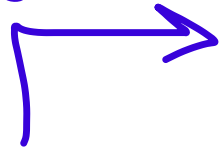
4. Its wall is poor in its smooth muscle & elastic fibers (compressible).
أصغر

5. **Thin-walled** & **wide** lumen.

6. Contain valves.

لو سٺڪو ۾ ٻنهن:

سٺڪو



Arterial Anastomosis

* This is a connection between branches of one artery & branches of adjacent artery.

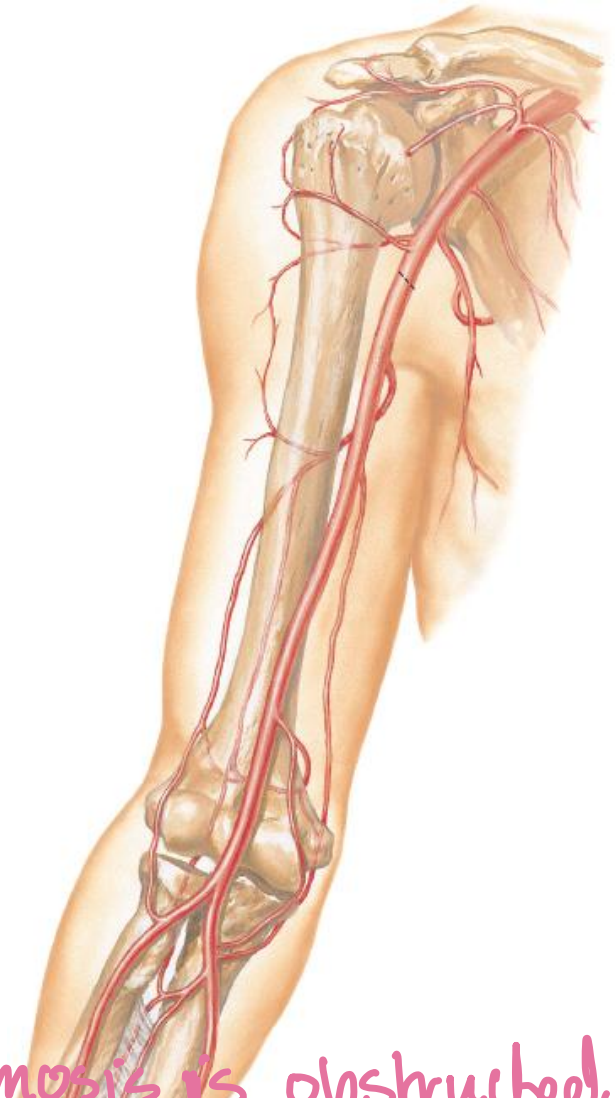
* It allows a **collateral circulation** in case of obstruction of one of the 2 arteries.

* It is present mainly around joints.

* Arteries which do not anastomose are called **end arteries**.

ٽي حالن ۾ اسٽيٽيڪل

→ if it is obstructed, its organ will die
But if an artery w/ Anastomosis is obstructed,
→ compensation directly



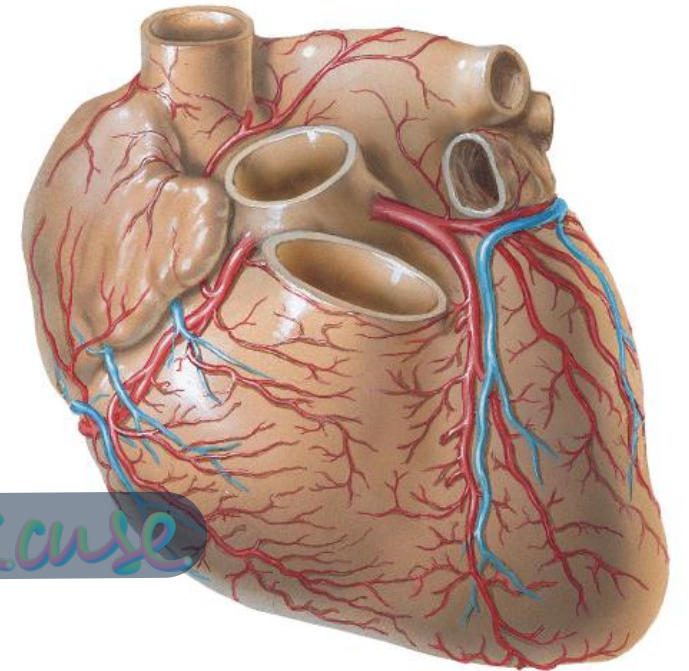
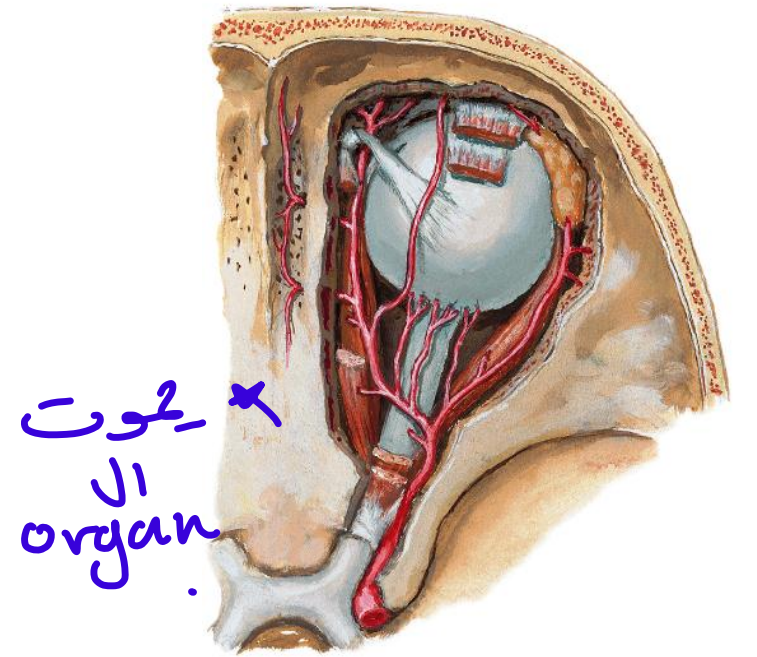
End Arteries

* Are of 2 types:

1. Anatomical end arteries: which do not acquire any sort of anastomosis
e.g. [central retinal artery of the retina]

2. Functional end arteries: which have some anastomosis between its arteries, however, it is insufficient to compensate the obstructed artery, e.g. [coronary arteries of the heart]

myocardial infarction with age, because collateral doesn't work anymore



Types of anastomosis between arteries & veins

A. Capillaries: Small vascular connections present in all body organs connecting the small arterioles to the small venules.

connects
ends of arteries,
beginnings of veins

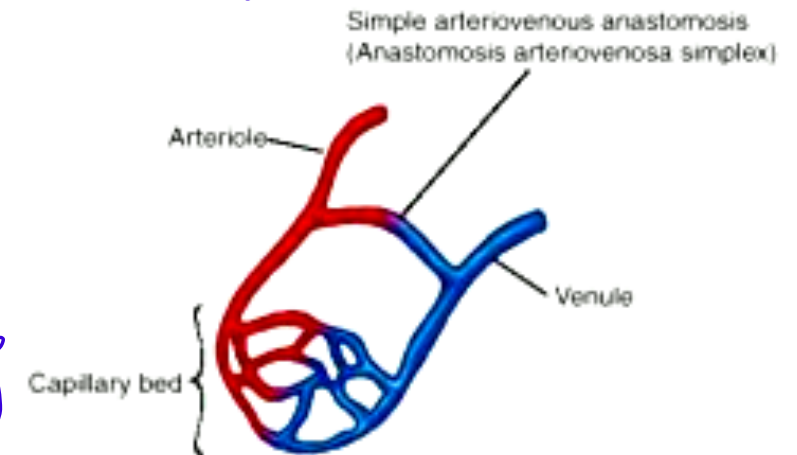
B. Direct arterio-venous Shunt: *anastomose*

* This is a **direct shunt** between arteries & veins in the tissues.

* It is present in certain areas, such as in palm of hand, sole of foot, *صحنه الأذن* auricle, nose, lips & gastro-intestinal tract.

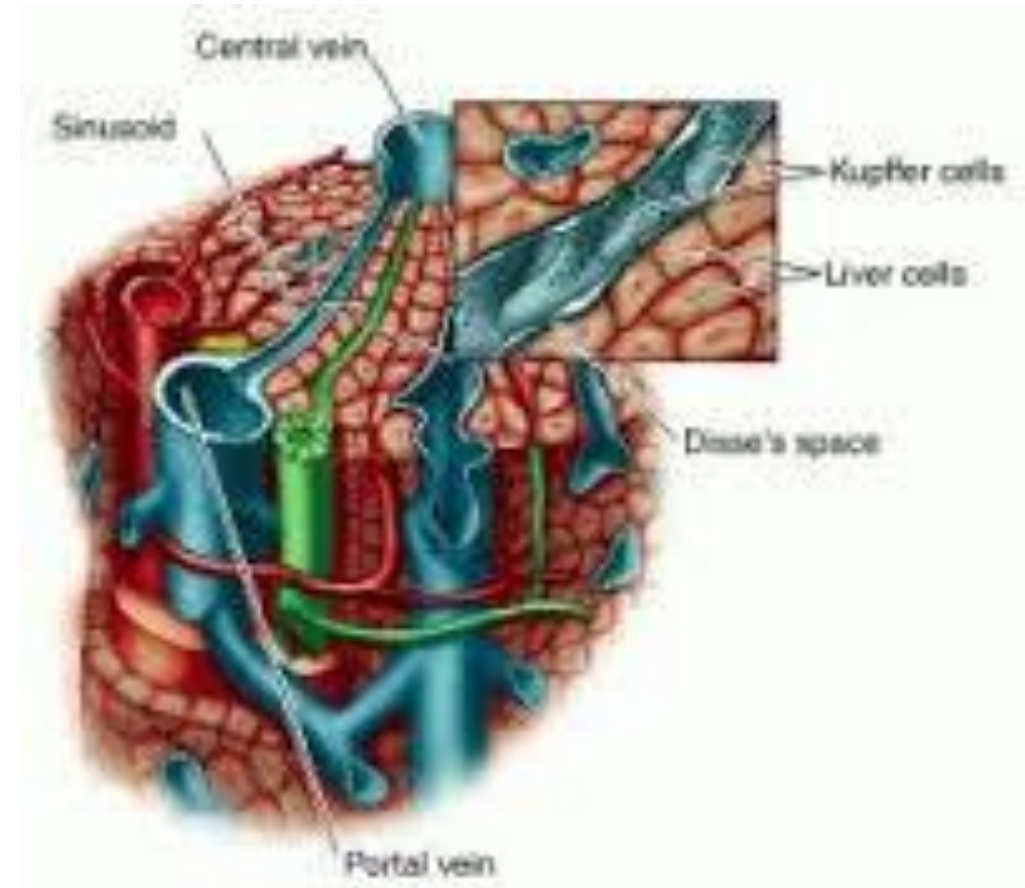
* It plays an important role in:

1. Regulation of the blood flow to each organ.
2. Regulation of body temperature (since it can help losing temperature in some cases or storing temperature in other cases).



* **C. Sinusoids**: are wide tortuous vascular spaces lined with phagocytes, present in liver, spleen & bone marrow. They slow down blood flow allowing maximum exchange of O_2 , CO_2 & nutrients between blood & tissues.

→ found in liver & pituitary gland,
يُنقل بِقِيَاةِ الْكَبِيْرَةِ وَالْغِيَاةِ
Blood circulation



D. Cavernous (erectile) tissue: تَقْوِد
Small vascular spaces filled with blood, present in the erectile tissues of penis & clitoris.

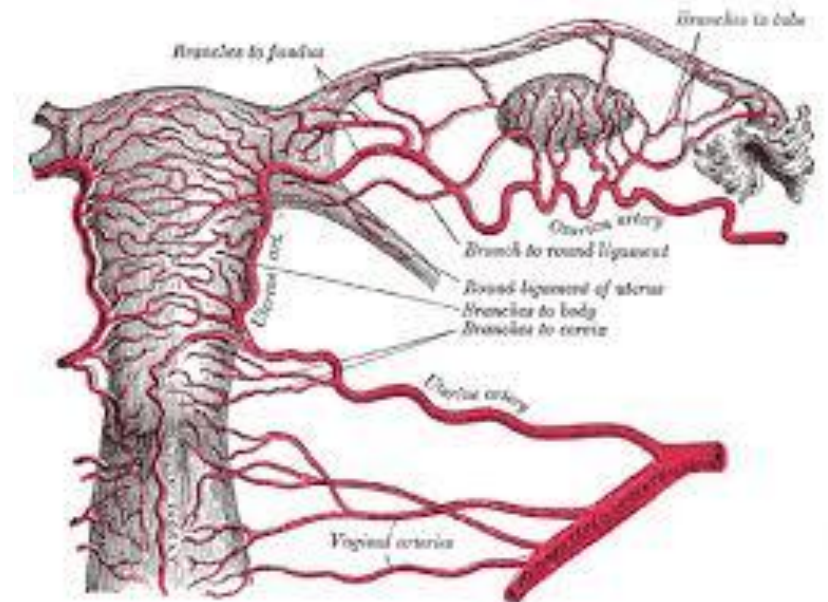
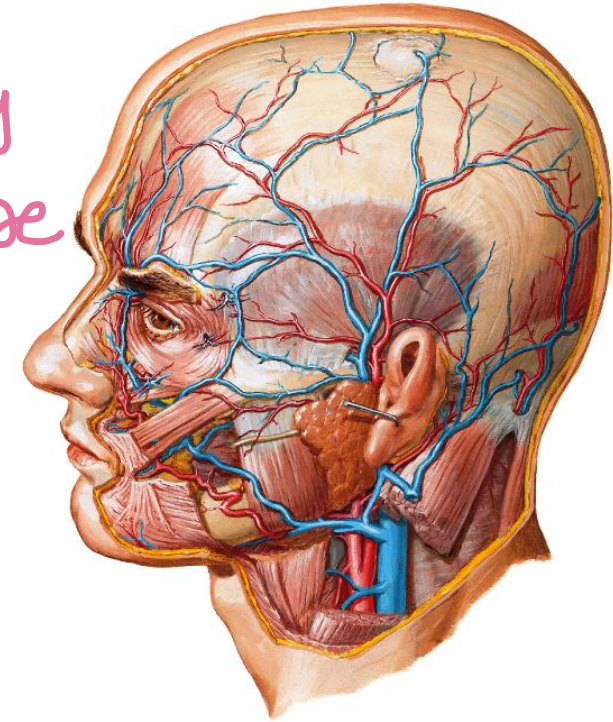
* Tortuous arteries → zig-zag in shape

* Are irregular arteries & are present in:

a. **Movable organ;** as facial A.

b. **Expansile organ;** as arteries of uterus & urinary bladder.

c. **Protrudable organ;** as lingual A.

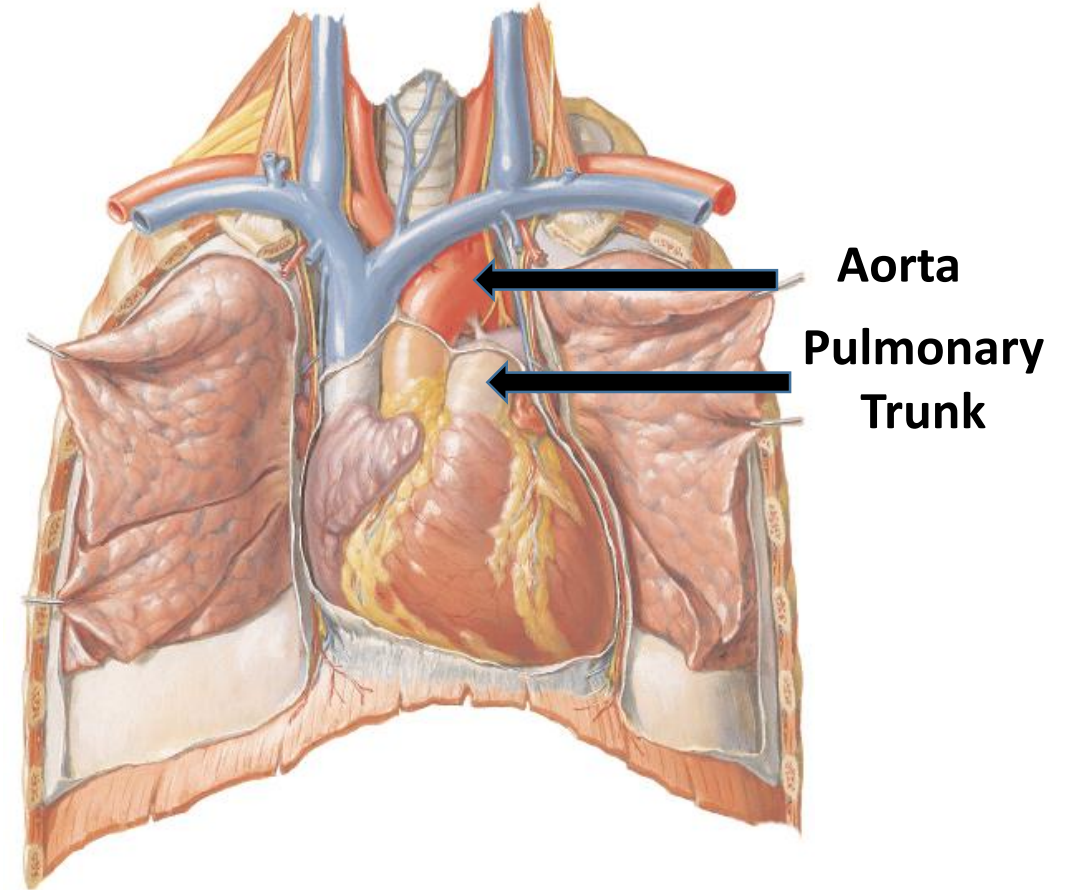


Main Arteries of the Body

* Important arteries originating from heart:

I. Pulmonary Trunk: arises from right ventricle carrying deoxygenated blood to lungs.

II. Aorta: arises from left ventricle carrying oxygenated blood to be distributed to all systems of body.

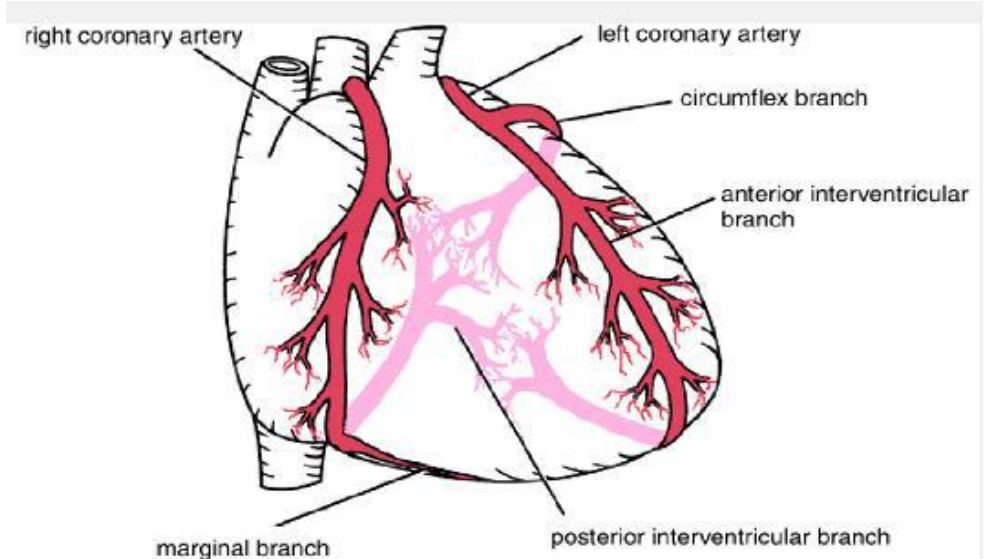
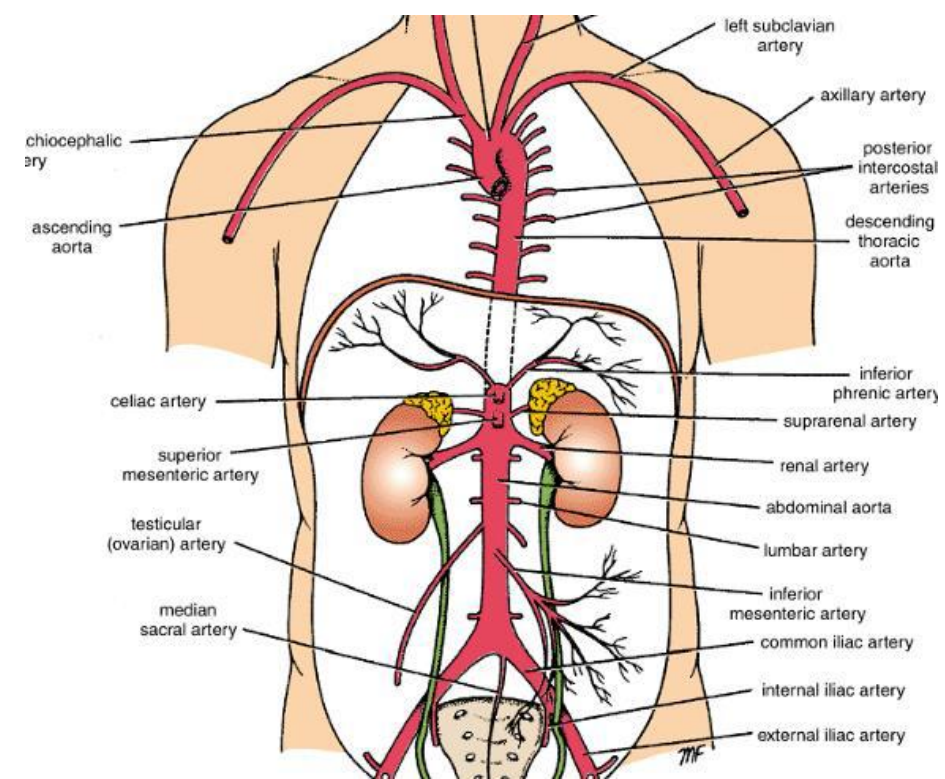


The AORTA

* It is divided into 4 parts: ascending aorta, aortic arch, descending thoracic aorta & abdominal aorta.

1. Ascending Aorta: هذا القلب

- * It passes upward to the right within the pericardium.
- * It gives the **RT** & **LT** coronaries (which supply the heart).



2. Aortic Arch:

* It lies within the superior mediastinum of the thoracic cavity in front of trachea & esophagus.

* It gives 3 branches:

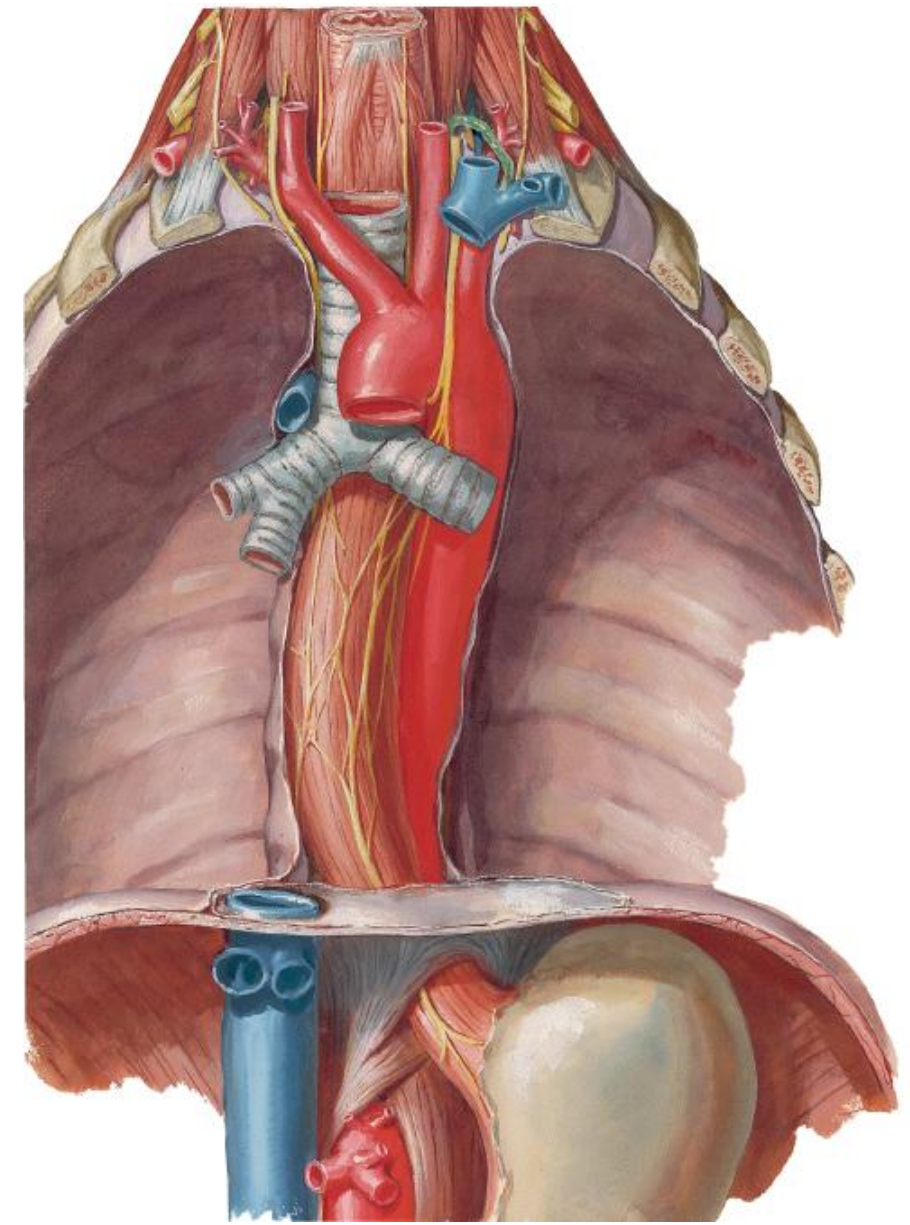
1. **Left subclavian A.:** which lies in neck & continues in left upper limb as **left axillary artery**.

2. **Left common carotid A.:** which supplies left half of head & neck. *& Brain*

3. **Brachiocephalic (Innominate) A.:** which divides into:

a. **Right Subclavian A.;** which lies in neck & continues in right upper limb as **right axillary A.**

b. **Right Common carotid A.;** which supplies right half of head & neck *& Brain*



* **Each common carotid A.** [either left or right]:

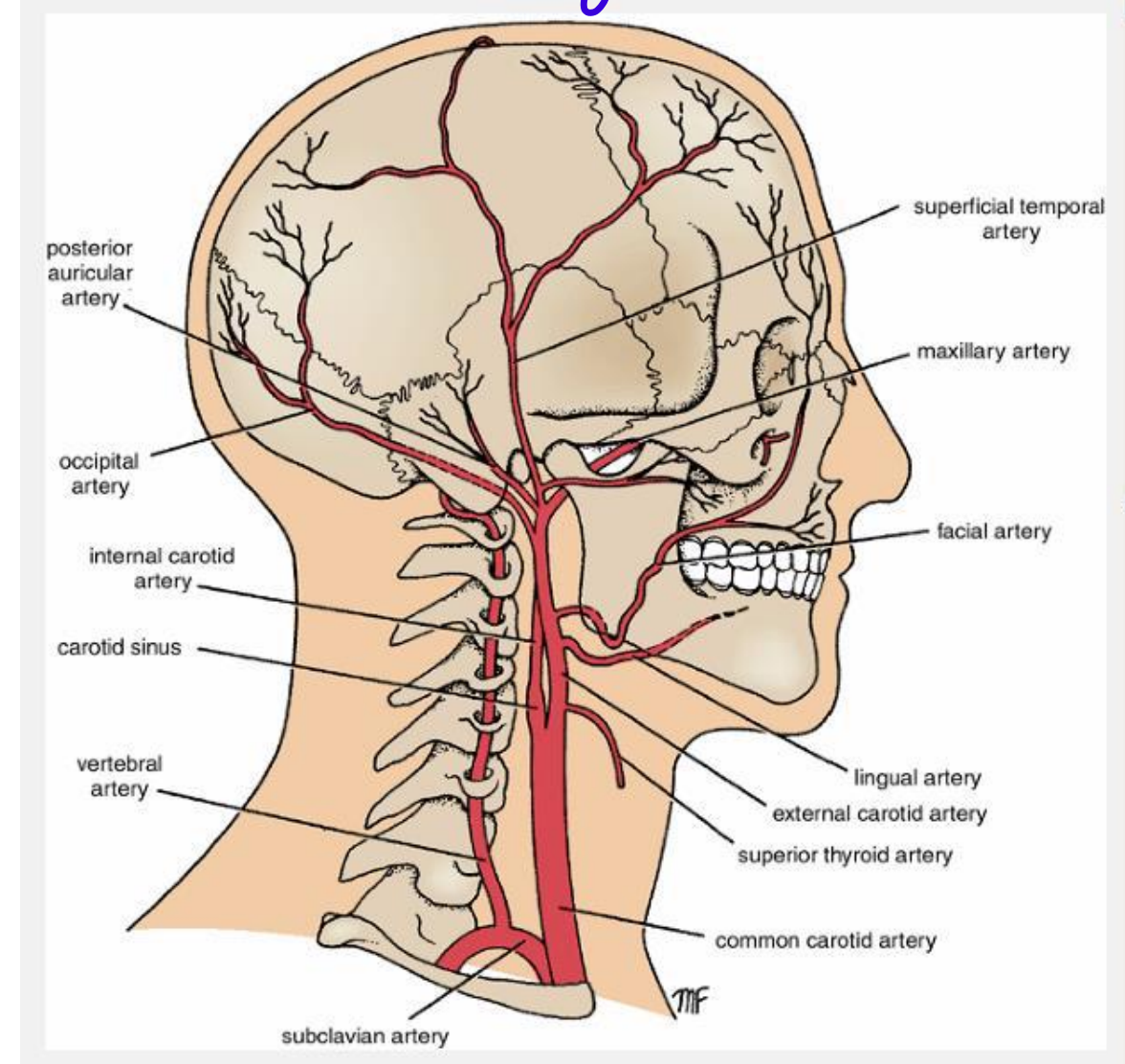
divides into:

a. External carotid A.;

which supplies mainly the structures of **head & neck** outside the skull.

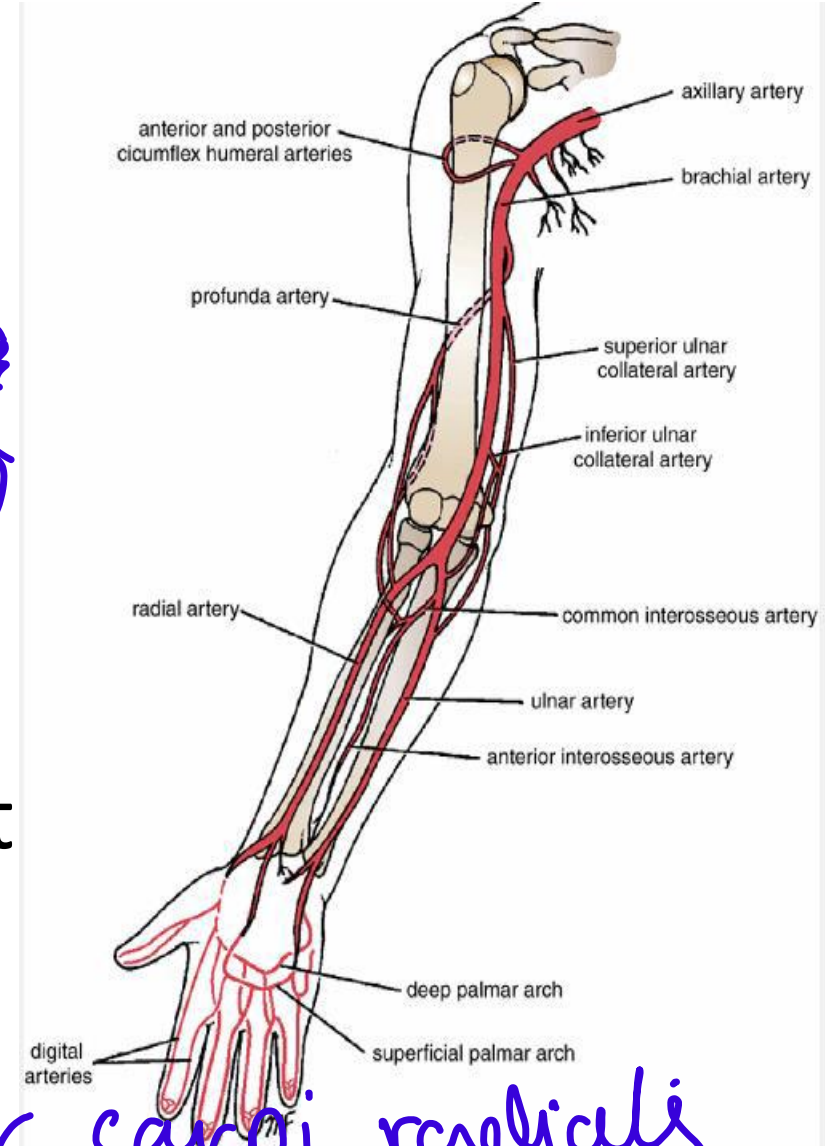
b. Internal carotid A.;

which enters the skull & supplies mainly **brain** and intracranial structures.



Main arteries of upper limb

- * Subclavian artery: Continues in the upper limb as axillary artery.
- * Axillary artery: continues as Brachial artery in the arm. *بنقسم لرفي؟ lateral radius, medial ulna*
- * Brachial artery: descends to the cubital fossa (in front of elbow), where it lies medial to the tendon of biceps muscle. This is an important site, because we put the stethoscope on it when we measure the blood pressure. *1cm after elbow*



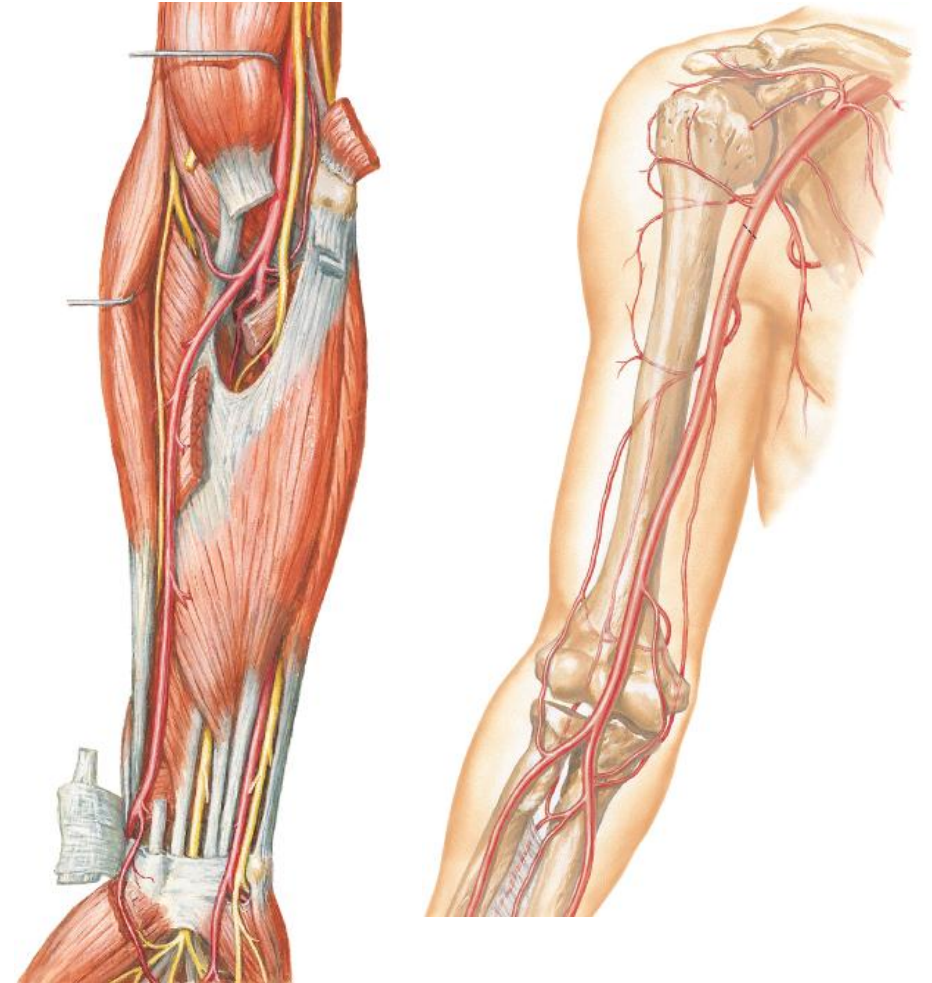
بنانرف واحد radial pulse: lateral tendon of flexor carpi radialis
عائش آره

Main arteries of upper limb (contd)

* One cm below bent of elbow, the brachial artery divides into:

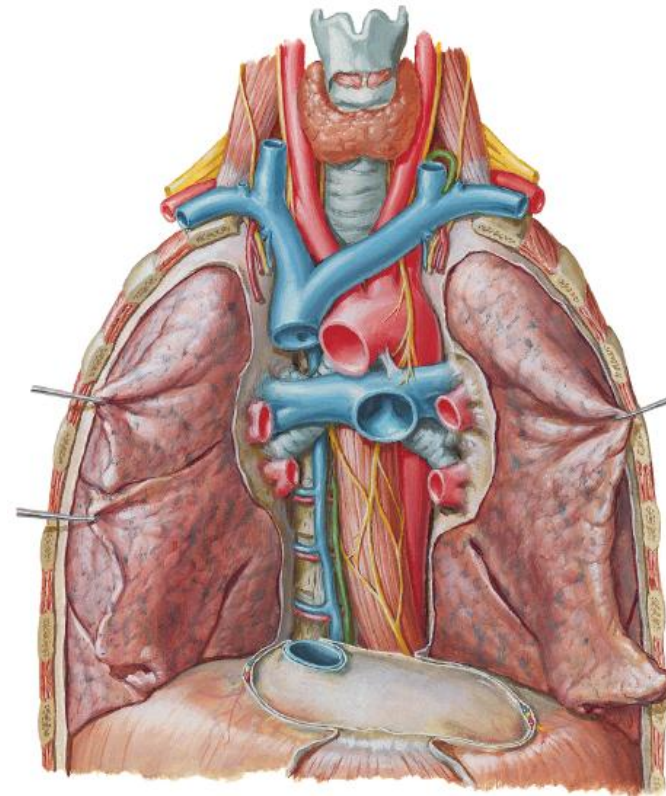
a. Ulnar artery, which runs along the medial side of forearm.

b. Radial artery, which runs along the lateral side of forearm. Above wrist, we can feel the pulse of the radial artery lateral to the tendon of flexor carpi radialis.



3. Descending Thoracic Aorta:

- * It lies in the posterior mediastinum.
- * It starts at the level of T4 & ends at the level of T12.
- * It gives 2 groups of branches:
 - a. **Parietal group** → supplying the **thoracic cage**; e.g.: **Intercostal arteries**.
 - b. **Visceral group** → supplying the **lungs, trachea & esophagus**.



4. Abdominal Aorta:

* Lies in front of lumbar vertebrae.

* It starts at T12 & ends at L4.

* It gives 3 groups of branches:

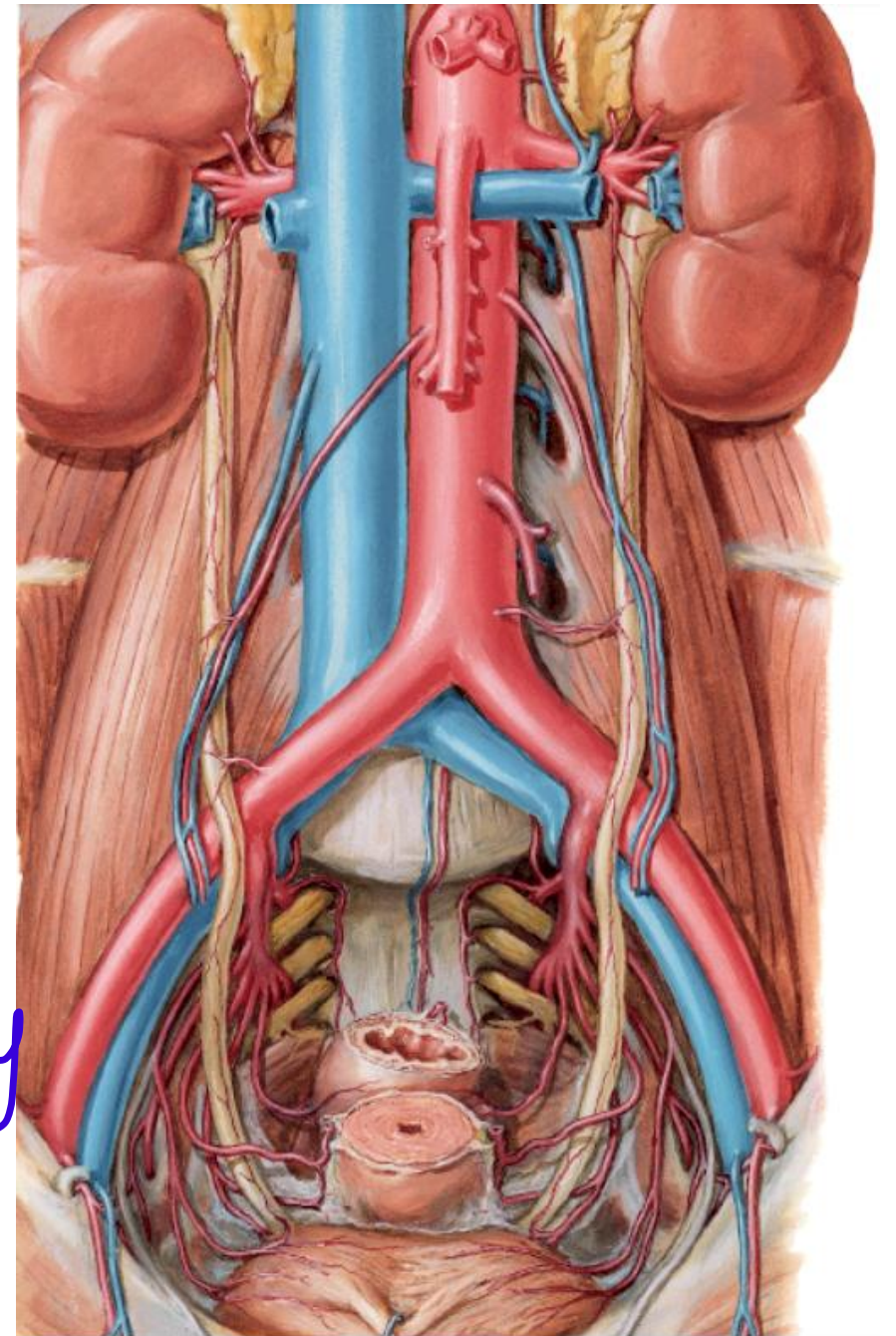
a. Single branches: from its anterior aspect for gastrointestinal tube & its related glands (liver, pancreas & spleen) ; They are:

i. celiac trunk.

ii. Superior mesenteric A.

iii. Inferior mesenteric A.

} main
Blood supply
of GIT



b. Paired branches: from its lateral aspect.

1. Phrenic artery: to diaphragm.
2. Middle suprarenal artery: to suprarenal gland.
3. Renal artery: to kidney.
4. Gonadal artery: testicular artery (to testis) or ovarian artery (to ovary).
5. Four Lumbar arteries: to abdominal wall.

c. Terminal branches: Two common iliac arteries

