

CARDIOVASCULAR SYSTEM

SUBJECT : Anatomy.

LEC NO. : lecture (3)

DONE BY : Rawan Alhindi

وَقُلْ رَبِّ زِدْنِي عِلْمًا



SCAN ME!



CVS....

Lecture (3)

Anatomy of the Heart

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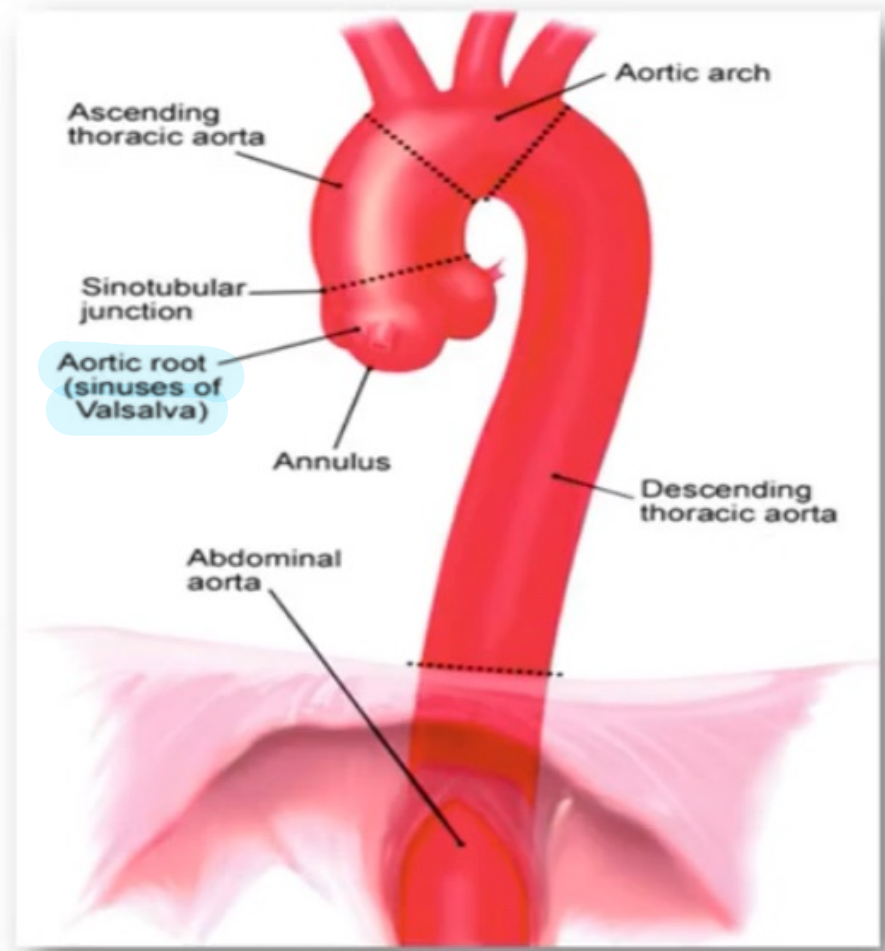
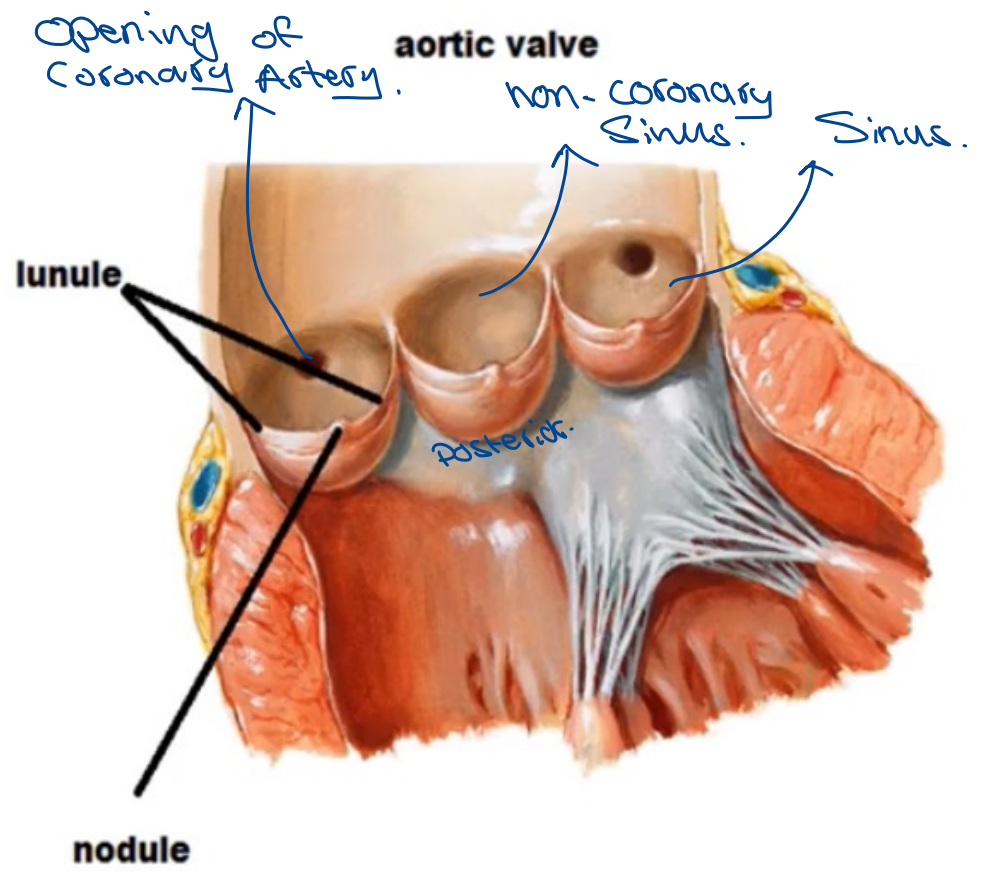
ILOs

1. To describe the arrangement of conductive system of the heart and their function within the myocardium.
2. To describe the origin of the coronary arteries and their course, branches, distribution & sites of anastomosis between branches of coronary arteries.
3. To describe the normal variation in the course of the coronary arteries and their branches.
4. To describe the venous drainage of the heart and cardiac veins (their names, location and drainage areas).
5. To describe the location and termination of the coronary sinus and its tributaries.
6. To describe innervations of the heart and the principal of cardiac referred pain.

Blood supply of the heart

- The heart **is supplied by** two **coronary arteries (right and left)** which are branches of the **ascending aorta.**
- **It's drained by** cardiac veins & Coronary sinus.
- The coronary arteries and their major branches are **distributed over** the surface of the heart, lying within subepicardial connective tissue.

من الكورة يس من الحاصلة
الانارة .



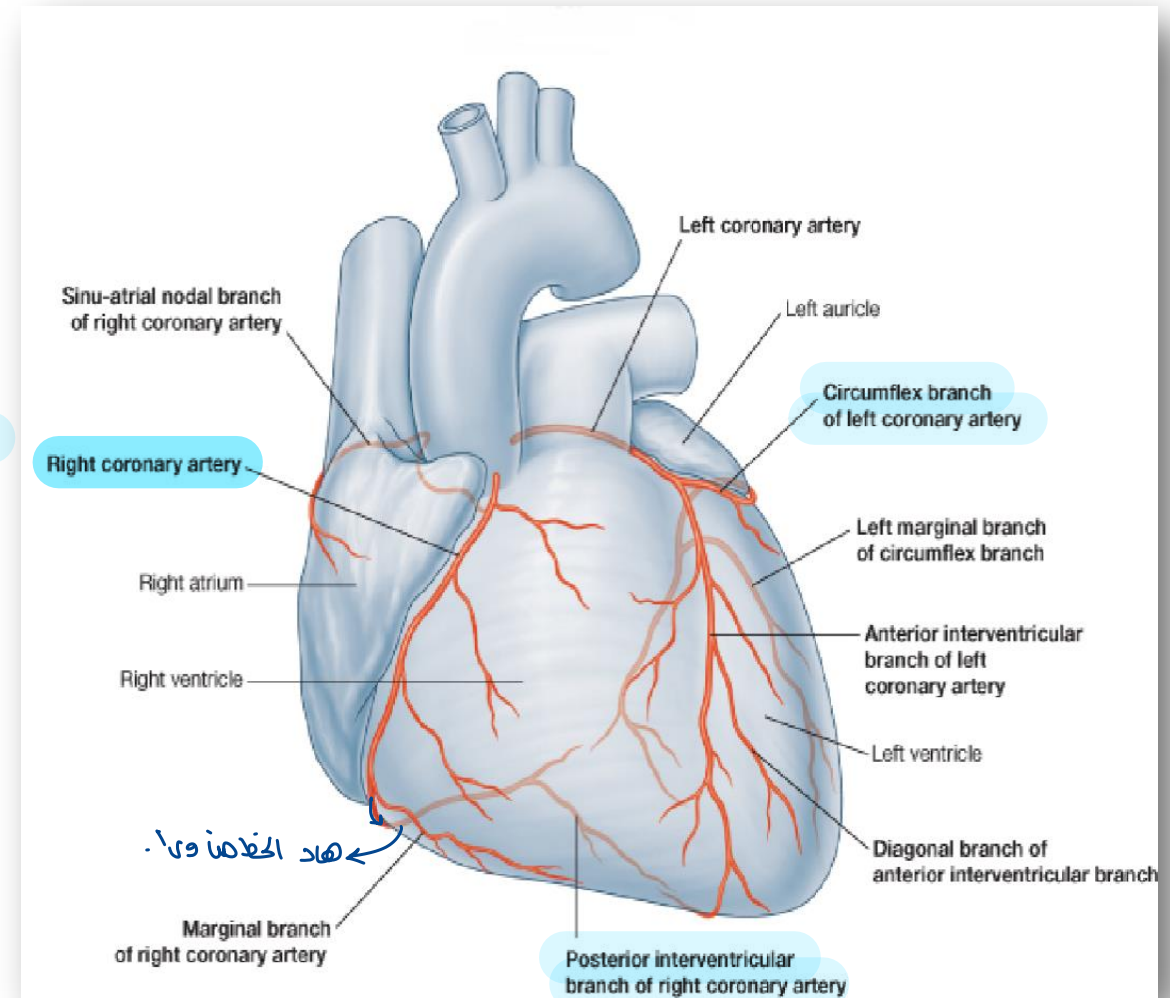
Right coronary artery:

Origin: from the right aortic sinus of the ascending aorta.

Course:

- It runs to the right in the coronary groove (anterior part of atrioventricular groove).
- Then it curves backwards to run in the posterior part of atrioventricular groove.

Termination: by anastomosing with the circumflex branch of the left coronary artery in the posterior part of the coronary groove.



Branches of the right coronary artery:

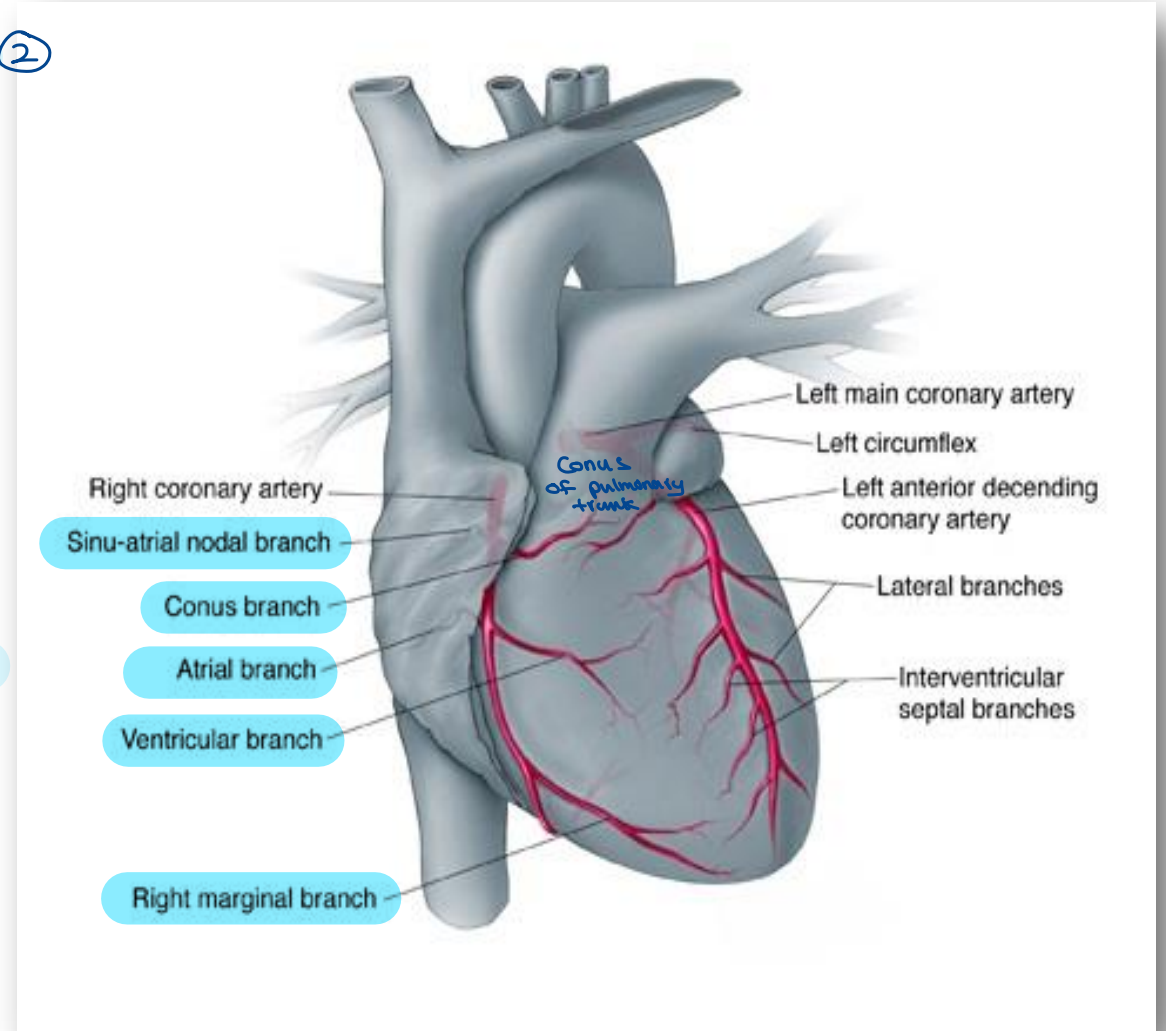
1- Right conus artery: It supplies the anterior surface of the pulmonary conus and the upper part of the anterior wall of the right ventricle.

2- Anterior ventricular branches: they supply the anterior part of the right ventricle.

3- Atrial branches: they supply the right atrium.

4- S.A. nodal artery: it arises from right coronary artery in 60% of individuals. it supplies the sinoatrial node.

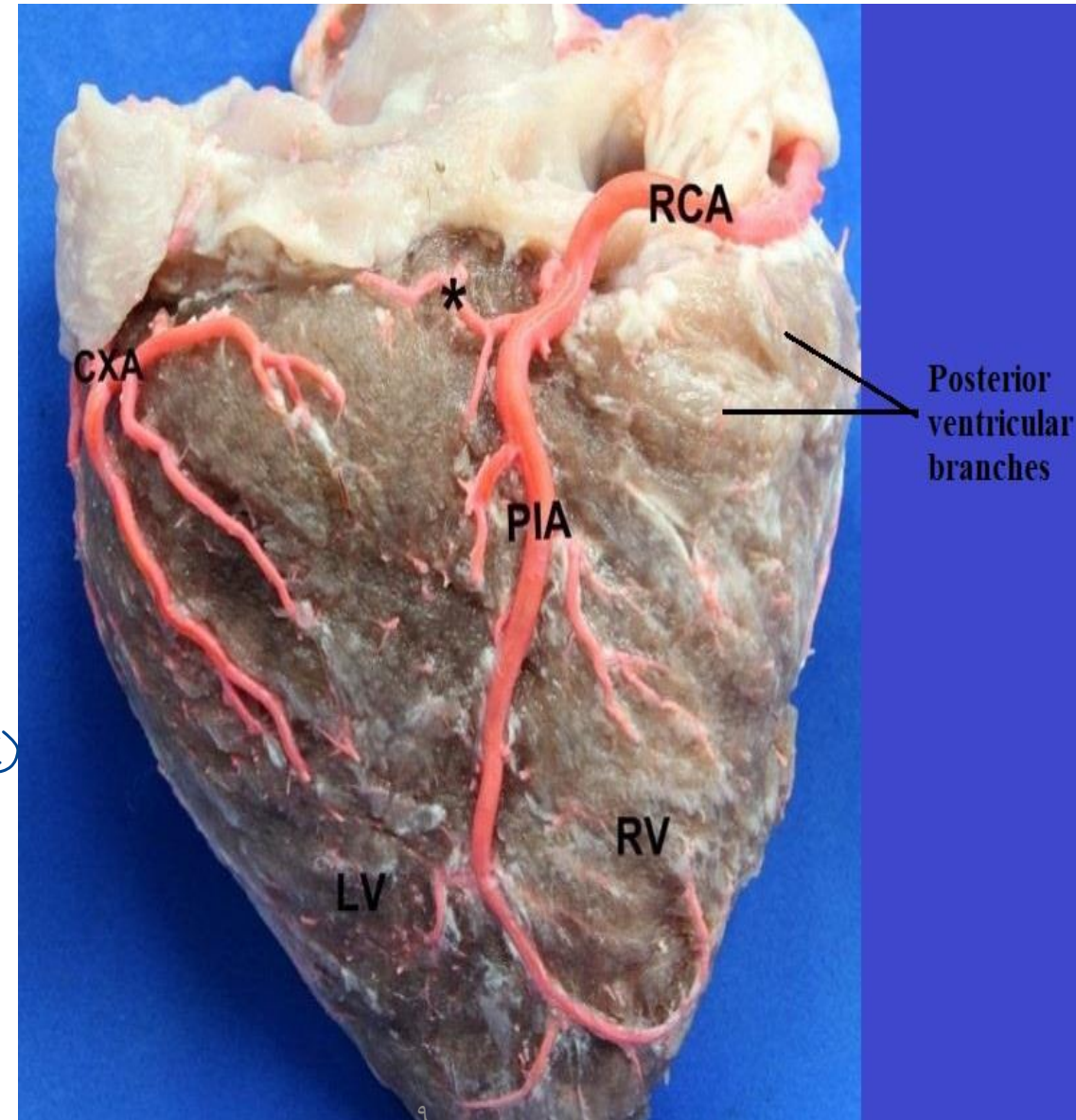
5- Right marginal branch: it runs along the lower margin of the heart.

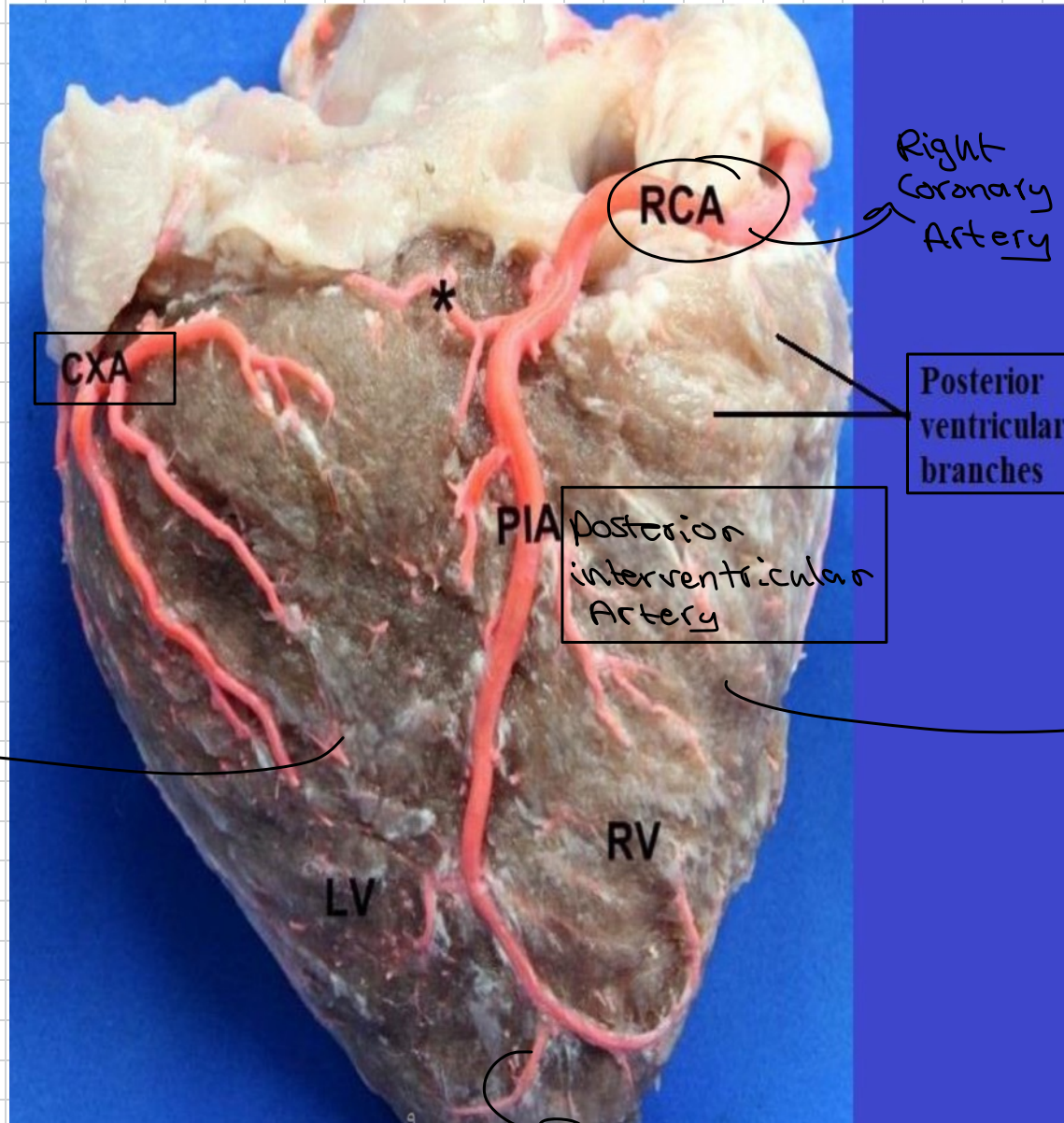


6- Posterior ventricular branches: they supply the diaphragmatic part of the right ventricle.

7- Posterior interventricular artery:

- In 90% of individuals, arises from the right coronary artery.
- It passes in the posterior interventricular groove.
- It anastomose with anterior interventricular artery near apex of heart.
- It supplies parts of diaphragmatic surface of both ventricles and also supplies the posterior 1/3 of interventricular septum.
- It gives AV nodal artery supplies the atrioventricular node.





RCA

Right Coronary Artery

CXA

Posterior ventricular branches

has supply part from diaphragmatic surface of Right ventricle.

PIA posterior interventricular Artery

diaphragmatic surface of Right ventricle.

diaphragmatic surface of left ventricle.

LV

RV

anterior groove is superior posterior inter ventricular groove

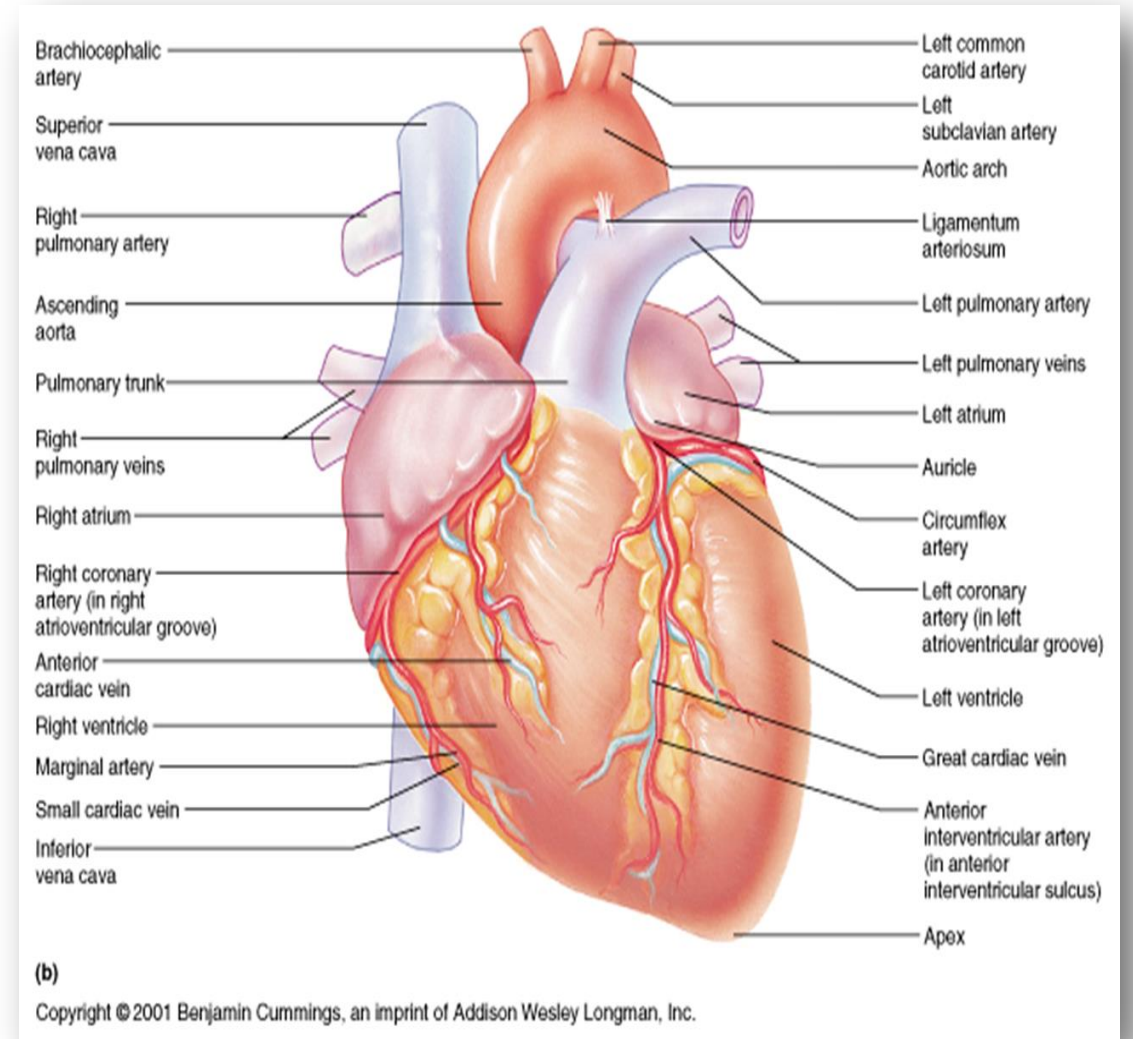
Left coronary artery:

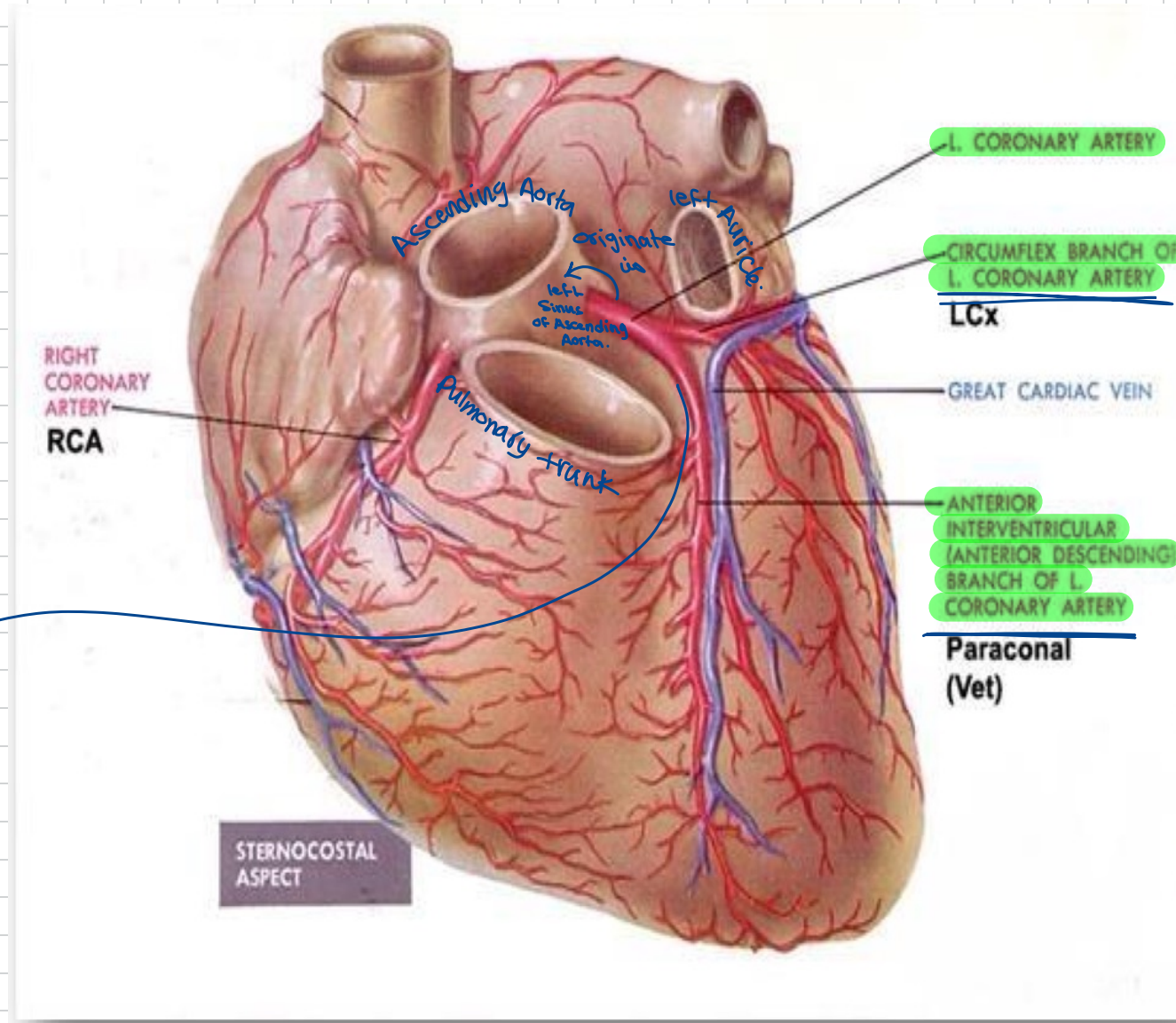
The left coronary artery is **larger than** the right coronary artery.

Origin: From the **left aortic sinus** of the ascending aorta.

Course:

- It **passes** forward between the pulmonary trunk and the left auricle.
- It then **runs to** the left in the atrioventricular groove and **divides** into an **anterior interventricular** branch and a **circumflex branch**.





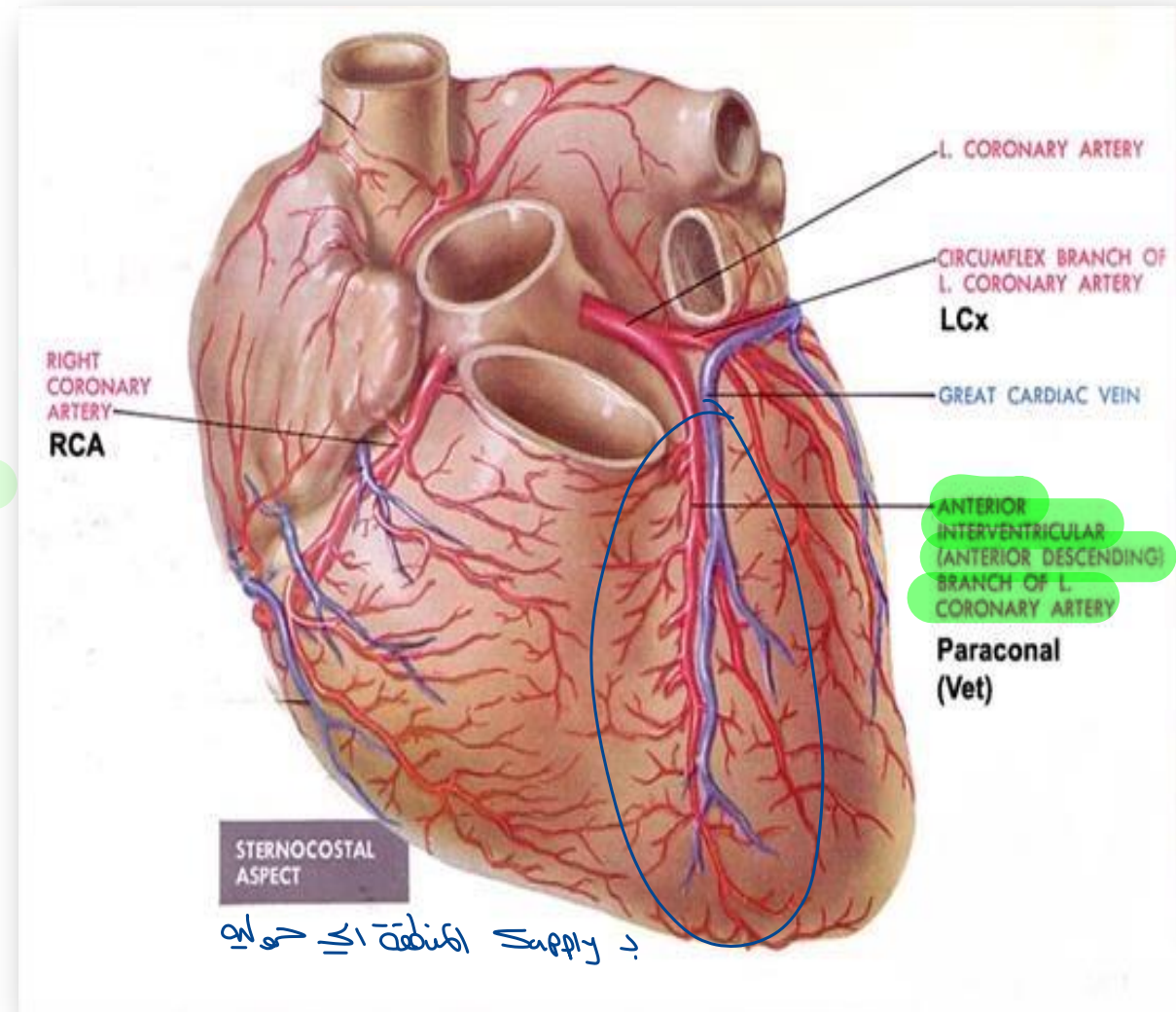
①
 ②
 انقباض
 انقباض
 في

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 Pulmonary trunk
 and left Auricle.

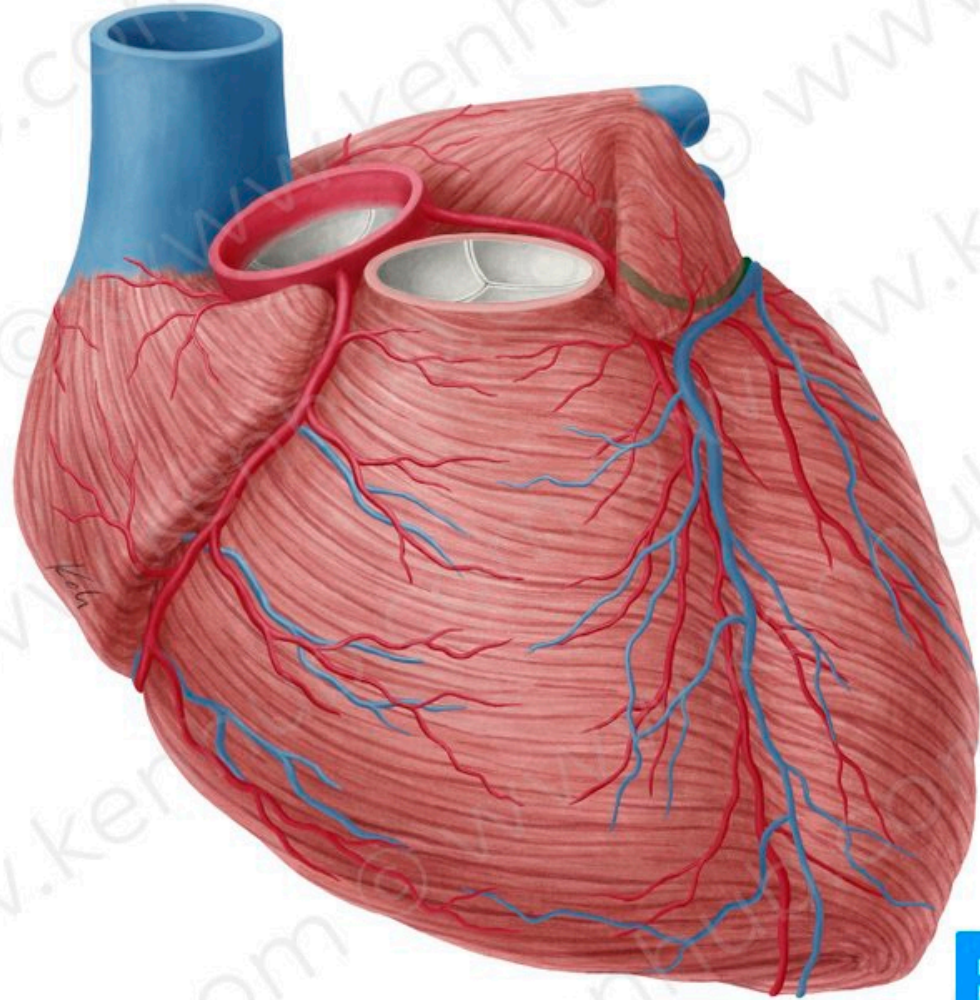
Branches of left coronary artery:

1-Anterior interventricular artery (AIA):

- It runs in the anterior interventricular groove.
- It ends by anastomosing with termination of (PIA).
- ① ▪ It supplies the anterior area of both ventricles, (adjacent to anterior interventricular groove) and anterior 2/3 of the interventricular septum.
- ②
- ③ ▪ It supplies the apex of the heart.
- ④ ▪ A small left conus artery from anterior interventricular artery supplies the pulmonary conus.

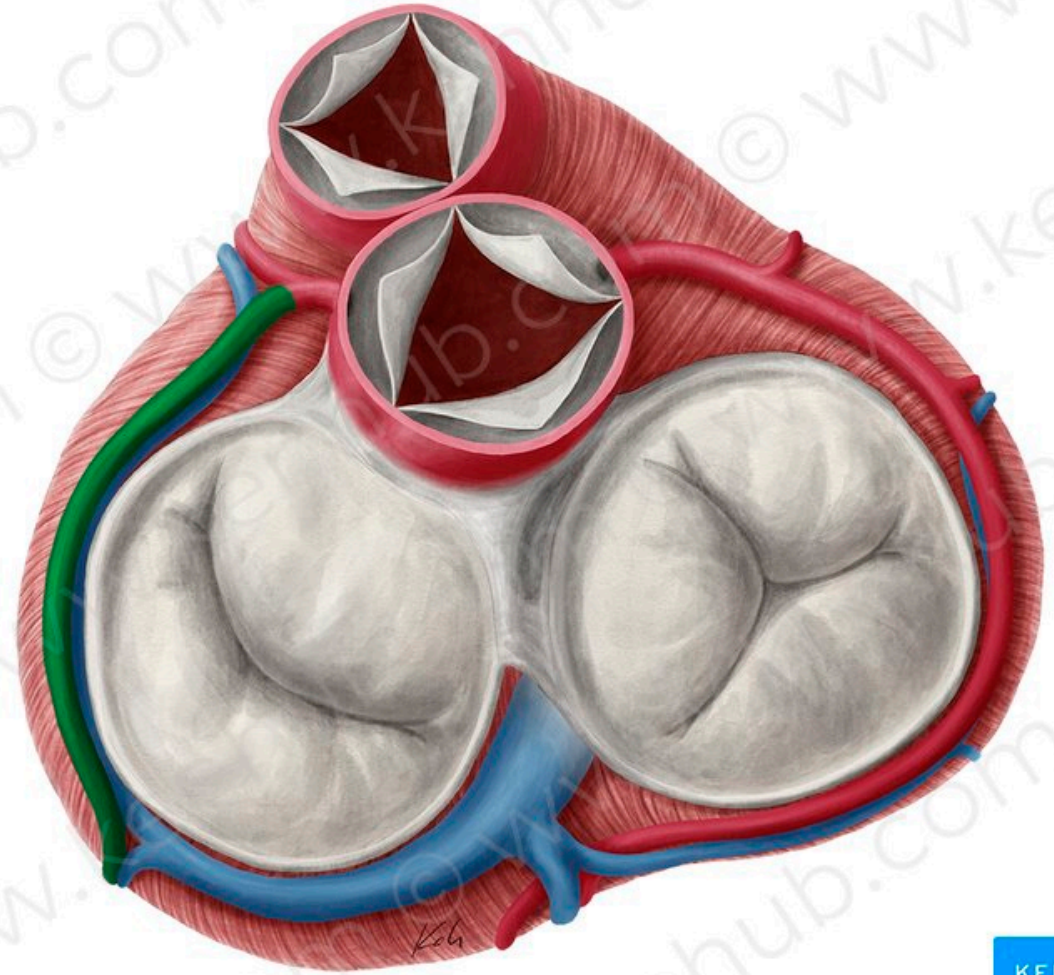


2] Circumflex Artery.



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2- Circumflex artery:

- It runs to the left in the atrioventricular groove, continuing round the left cardiac border and runs into the posterior part of the atrioventricular groove.
- It ending by anastomosing with the right coronary artery.

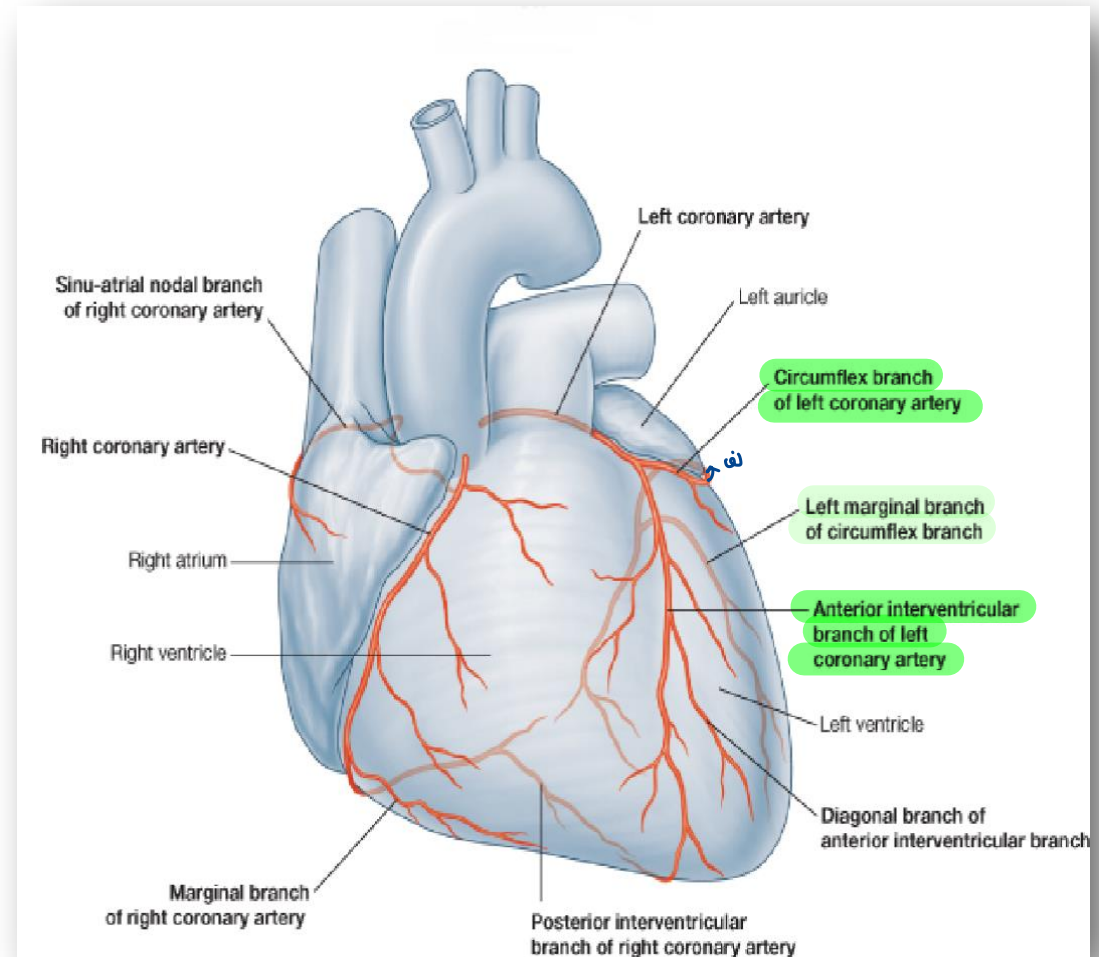
It gives the following branches:

1- Left marginal artery: supplies the left margin.

2-Posterior ventricular branches: supply part at the diaphragmatic surface of left ventricle.

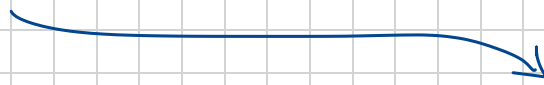
3-Atrial branches: Supply the left atrium. It give S.A nodal artery, supply SAN in 40% of individuals.

4-Posterior interventricular artery: in 10% of individuals (Lt coronary dominance) which give A.V. nodal artery, supply AVN.



Coronary groove ۱۱ ۶ اءا ۱۱ Coronary Arteries ۱۱ *

۱۱ اءا ۱۱ ۱۱ ۱۱ ۱۱ ۱۱



Right side of coronary groove



Right ۱۱ اءا ۱۱ ۱۱ ۱۱
Coronary Artery.

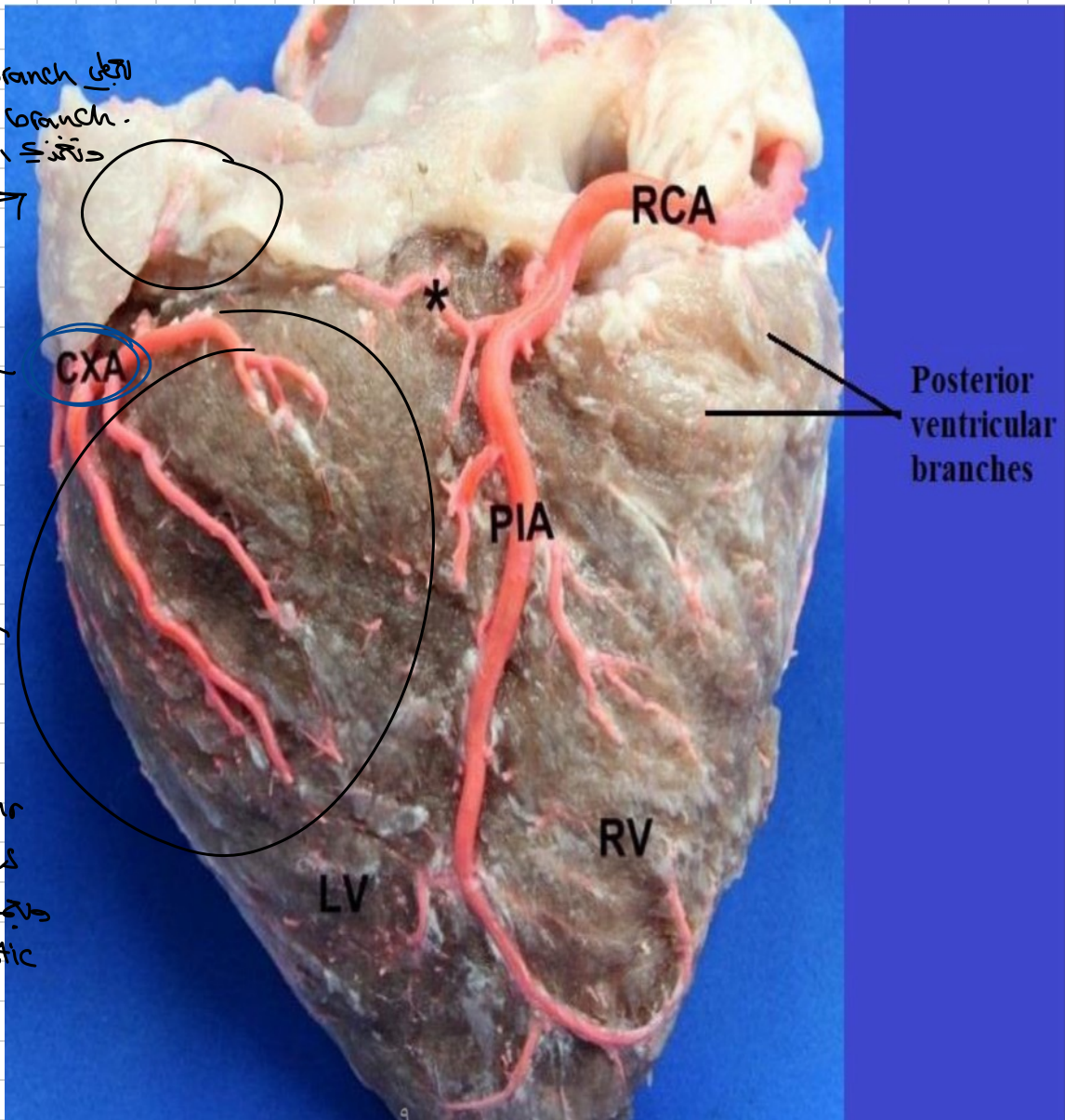
left side of the coronary groove



Circumflex ۱۱ اءا ۱۱ ۱۱ ۱۱
branch of left Coronary Artery.

3

Arterial branch -
left Atrium



Posterior ventricular branches

1

Posterior ventricular branches
Supply to the diaphragmatic surface of LV.

2

diaphragmatic surface of left ventricle.

Supplied by.

branches of circumflex Artery

branches of Posterior interventricular Artery.

branch of Right Coronary Artery.

4

Supplied by Right Atrium *
by the branches of Right Coronary Artery

Supplied by Left Atrium *
the branches of left Coronary Artery.
Circumflex branch of left Coronary Artery.

Coronary artery distribution:

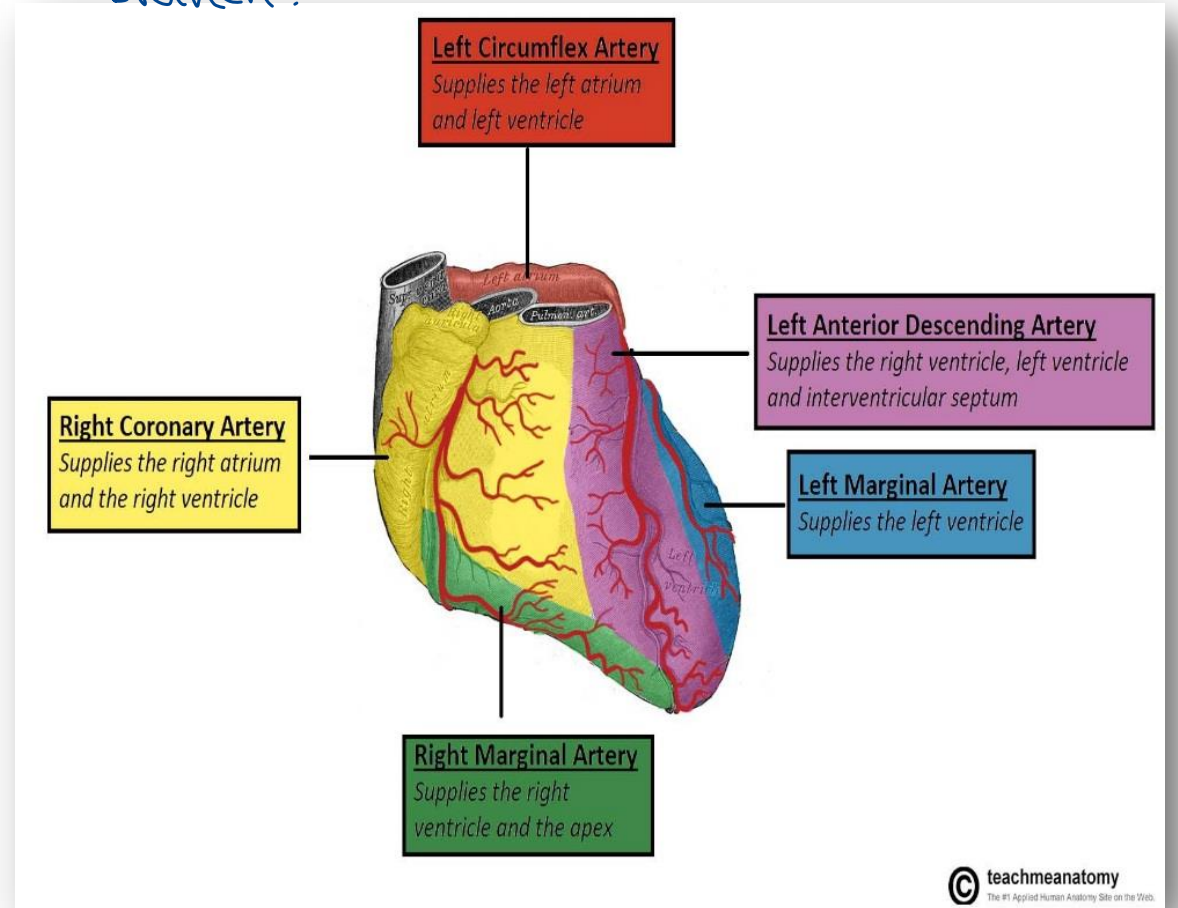
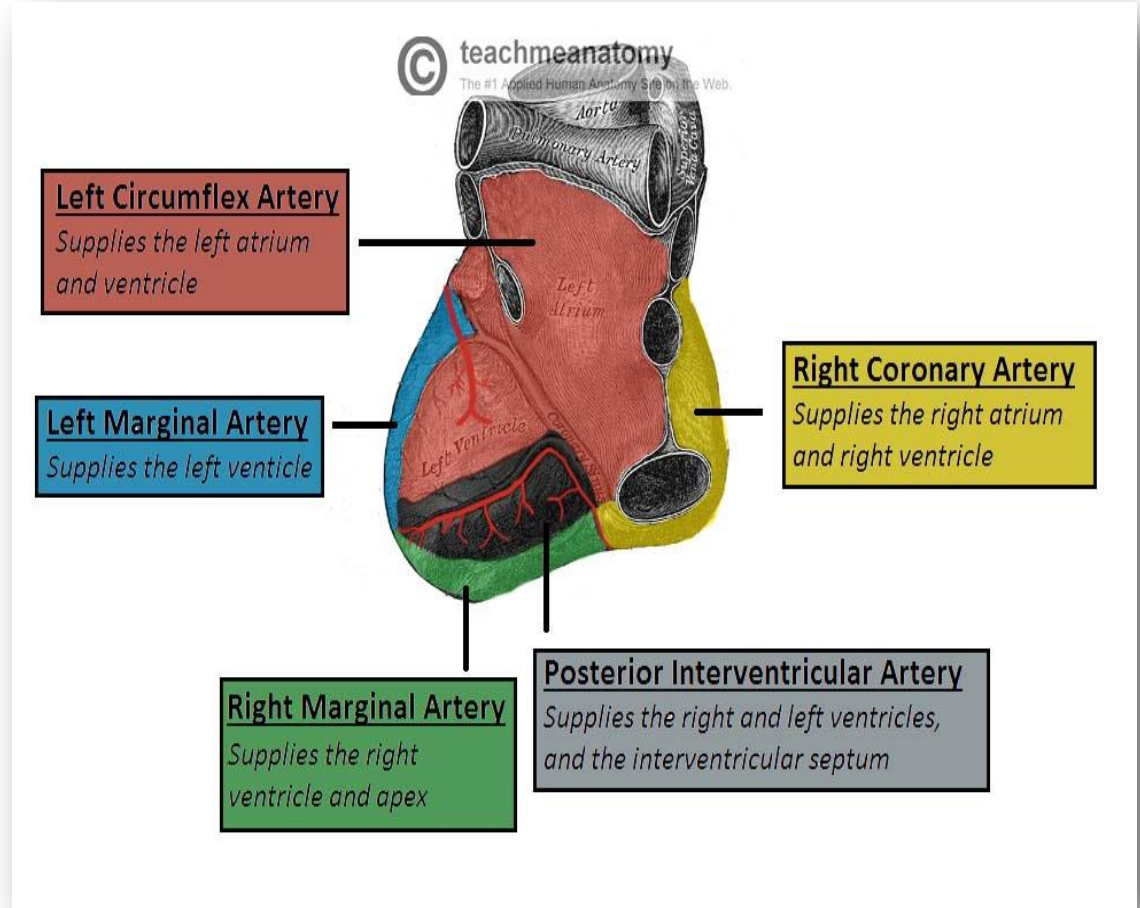
Right coronary artery	Left coronary artery
Right atrium	Left atrium
Right ventricle except small area to the right of the anterior interventricular groove	Left ventricle except small area at diaphragmatic surface.
Small area of diaphragmatic surface of left ventricle (to the left of posterior interventricular groove).	Small area of anterior surface of right ventricle to the right of the anterior interventricular groove.
Posterior 1/3 of interventricular septum.	Anterior 2/3 of interventricular septum.
SAN in <u>60%</u> .	SAN in <u>40%</u> of individuals
AVN in <u>90%</u>	AVN in <u>10%</u> of individuals
Right bundle branch.	Left bundle branch

* الخسفة بالكلية مياستة

* مياستة تجيب سوال :-

Supplied by the branch. ← الجوان الحيز ال ← بالكلية السؤال هو ال ← جزء
 ← infarction ال ←

Coronary Artery 1 Branches ال ← block ال ← myocardial infarction ال ←
 ← this branch.



Variations in the Coronary Arteries:

The posterior interventricular artery are variable.

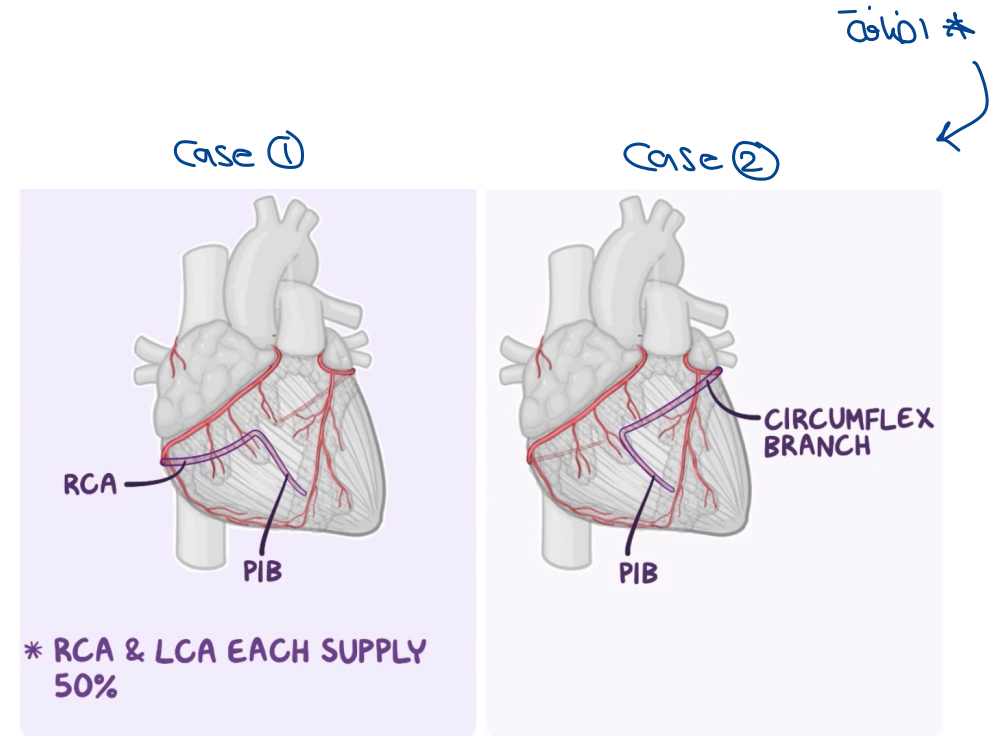
① In right coronary dominance;

هڪ ٻي طرح
ڪري ٿو.

- Posterior interventricular artery is a branch of the right coronary artery.
- It is present in most individuals (90%).

② In left coronary dominance;

- Posterior interventricular artery is a branch of the circumflex branch of the left coronary artery.
- It is present in (10%) of individuals.



Coronary Artery Anastomoses:

- Anastomoses between the terminal branches of the right and left coronary arteries allow collateral circulation.
- But cannot rapidly provide collateral routes sufficient to sudden coronary obstruction.
- A sudden block of one of the larger branches of either coronary artery usually leads to myocardial death (myocardial infarction).
- The functional value of such anastomoses appear to become more effective in slowly progressive pathological conditions (gradual block of one of the larger branches of either coronary artery).
- **Coronary arteries are essentially functional end arteries.**

Venous Drainage of the heart

Most of the venous blood from the heart wall drains into the right atrium through **the coronary sinus**.

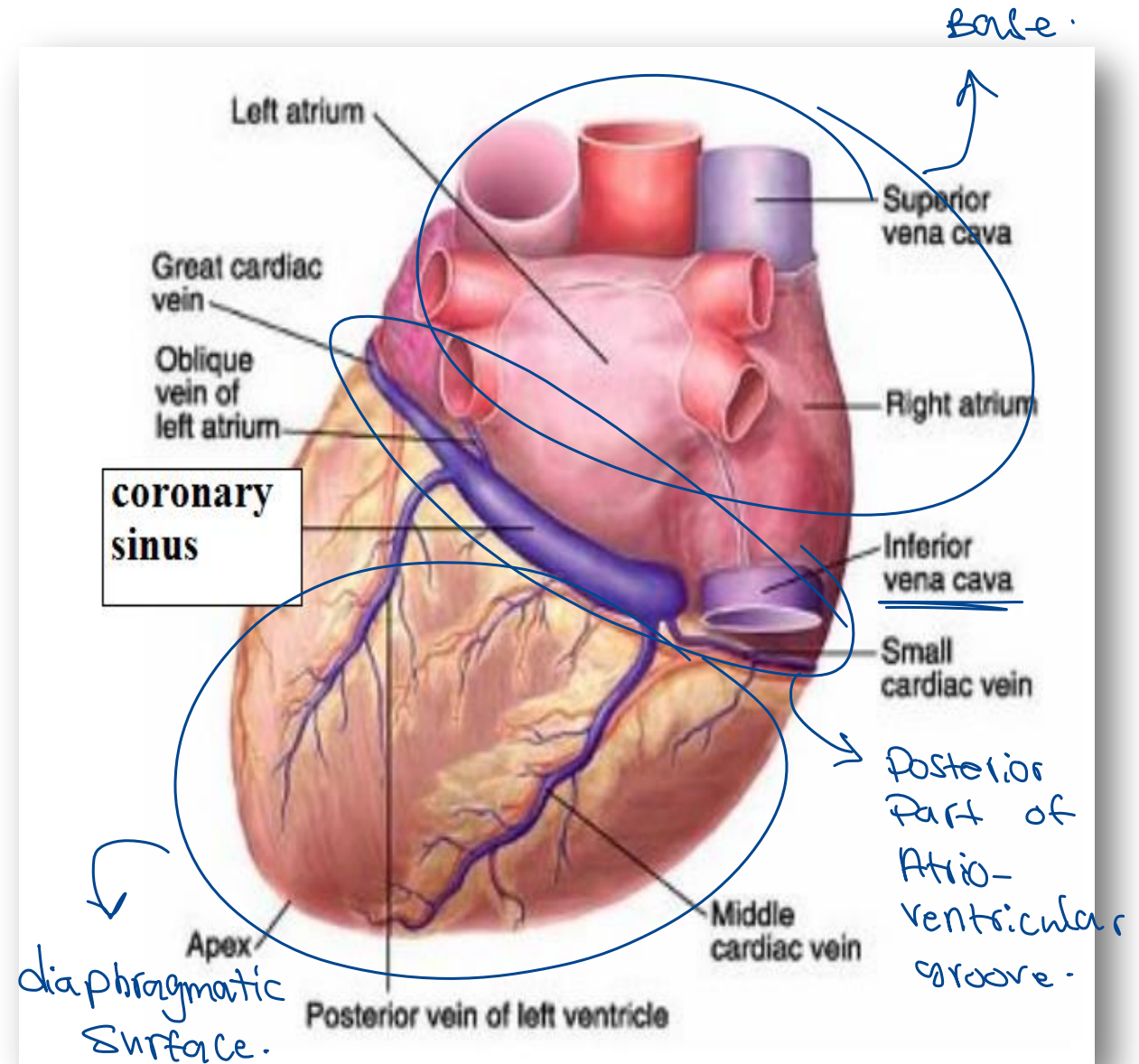
Remainder of the venous blood is drained by:

- 1- **Anterior cardiac veins** to the right atrium.
- 2- **Small veins** that open directly into the heart chambers.

Coronary sinus:

Site: Lies in left 1/2 of posterior coronary groove.

End: It opens into the posterior wall of the right atrium to the left of the inferior vena cava.



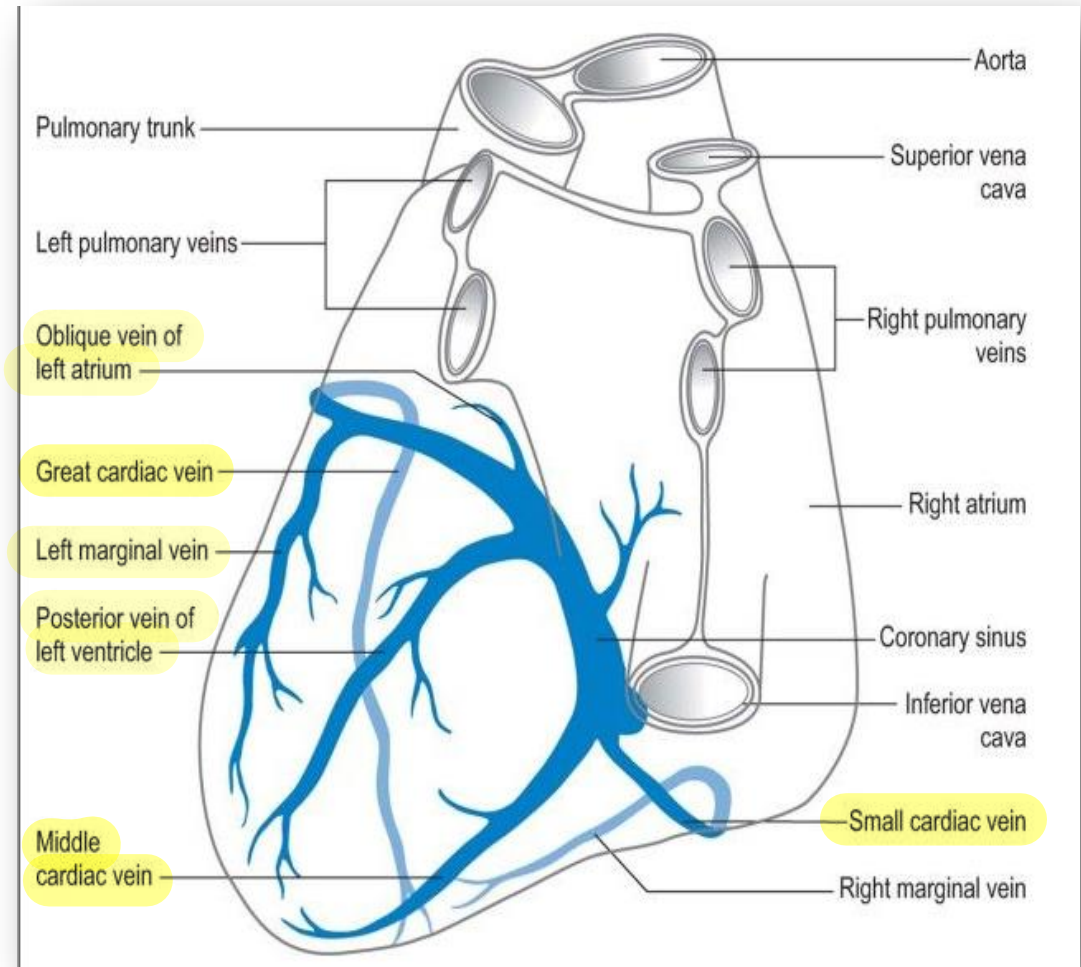
Tributaries of the coronary sinus (6):

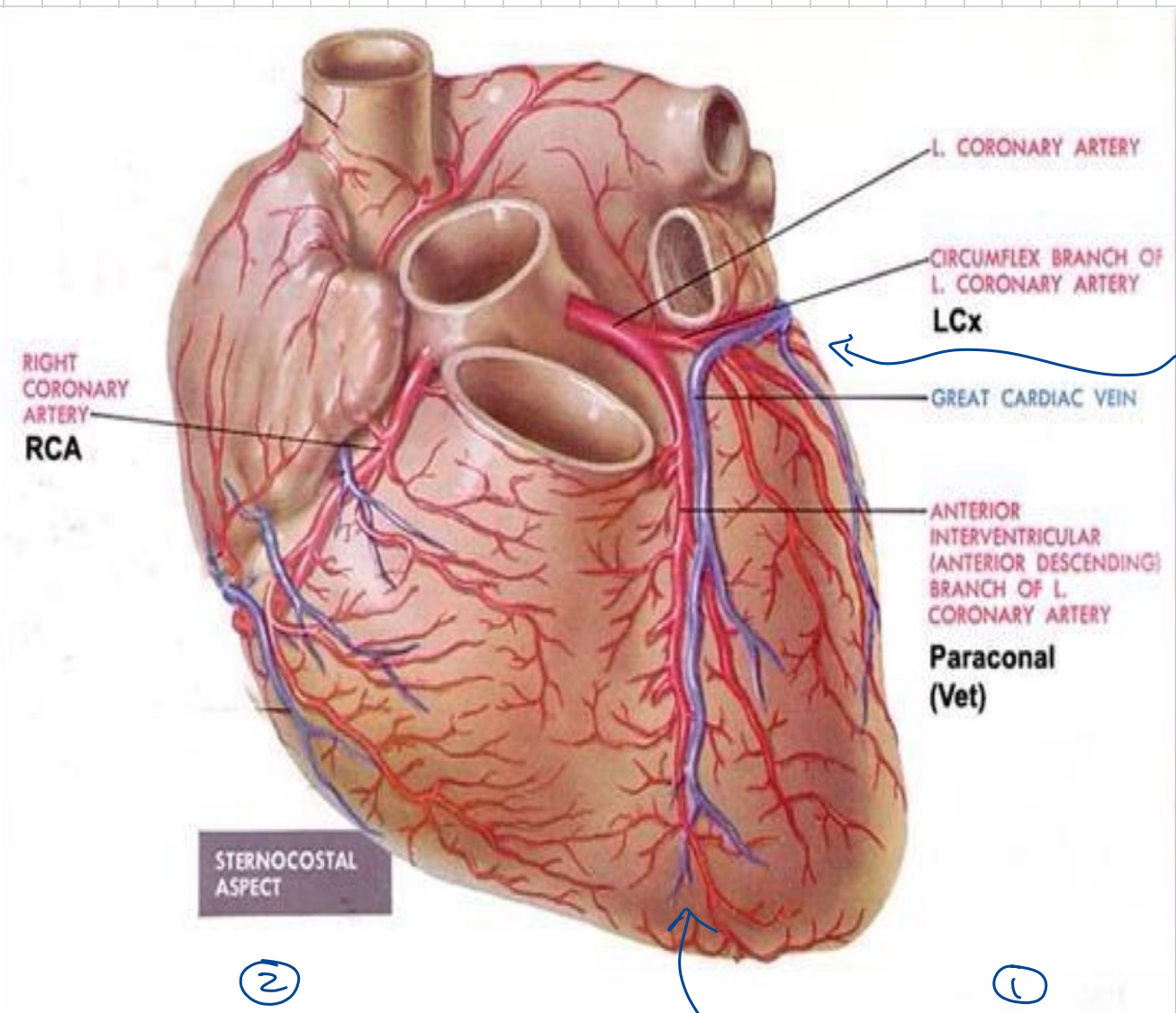
1- Great cardiac vein:

- It **begins** near the apex of heart and **ascend** in the anterior interventricular groove with (AIA).
- **Ends in** the left end of the coronary sinus.
- It **receives** tributaries from the left atrium and both ventricles.

2- Middle cardiac vein:

- It **begins** near apex of heart and **runs in** the posterior interventricular groove with (PIA).
- It **ends in** the coronary sinus near its termination.

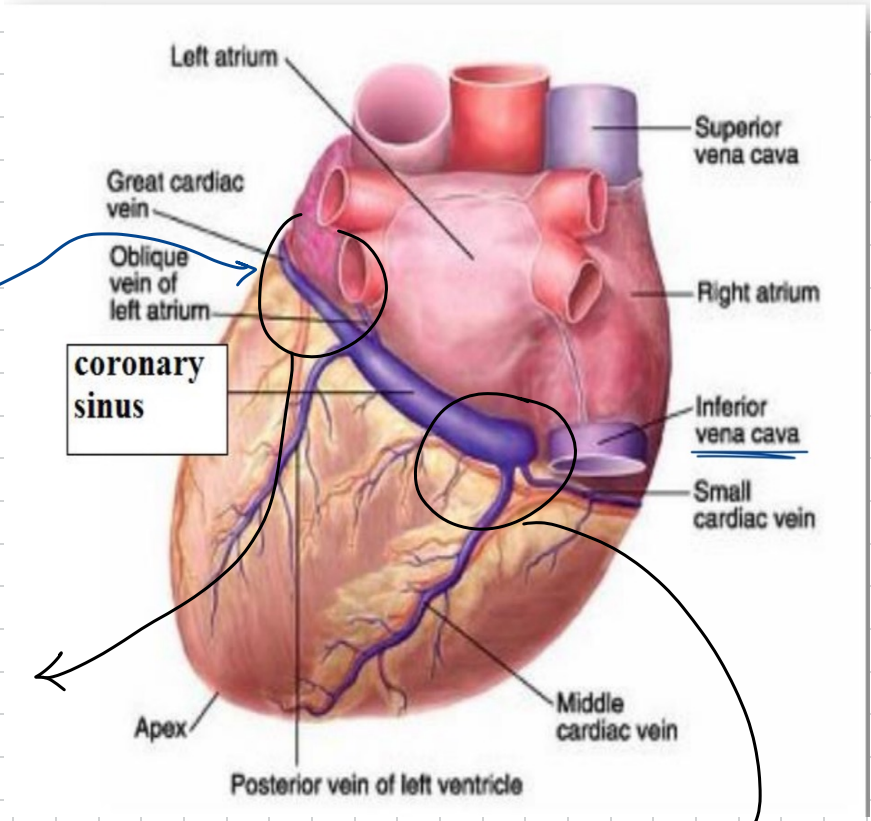




②
 Anterior inter-ventricular groove
 Ant. inter-ventricular Artery

①
 Great cardiac vein
 Apex of heart

③
 This is the left part of coronary groove.
 لفافة اللسان



left end of coronary sinus.

Right end of coronary sinus

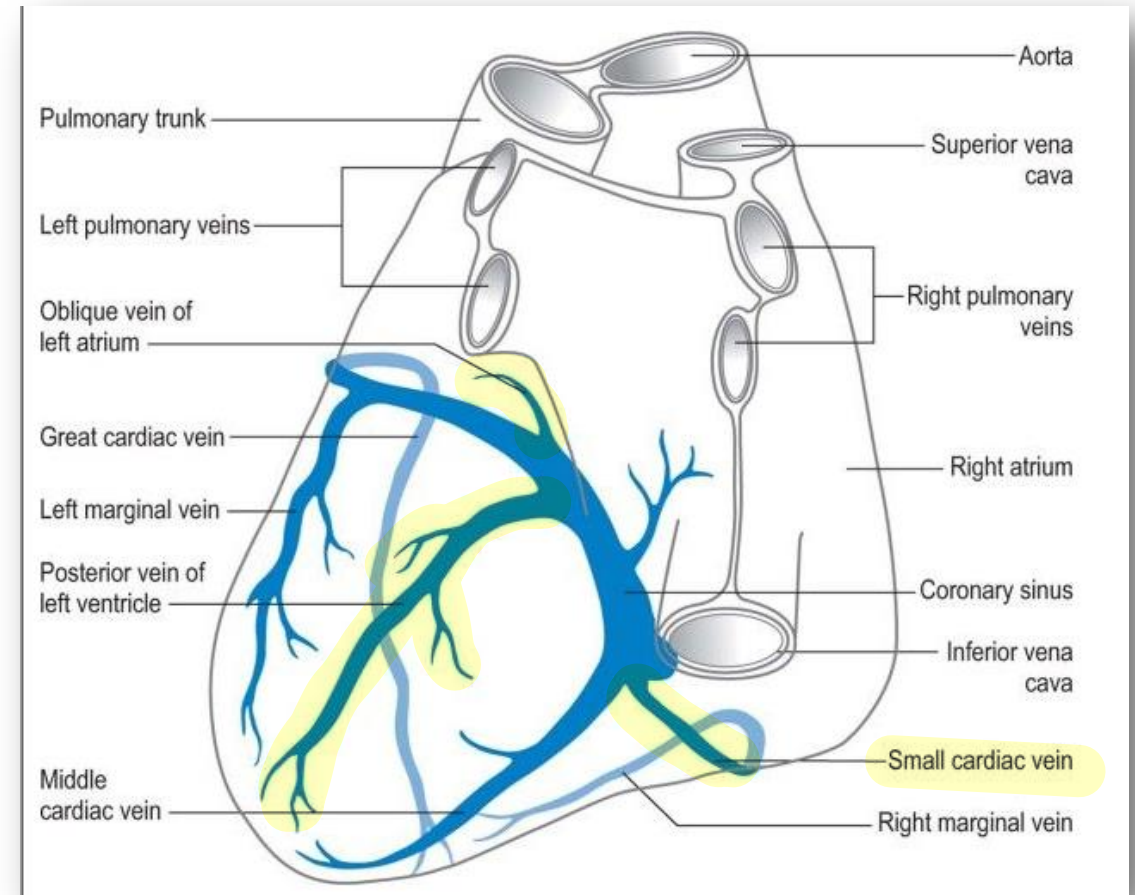
3- Small cardiac vein:

- **Lies in** the posterior part of coronary groove.
- It **receives** blood from the posterior part of the right atrium and ventricle.

4- Oblique vein of the left atrium.

5- Posterior vein of Left ventricle:

- It is **found on** the diaphragmatic surface of the left ventricle.

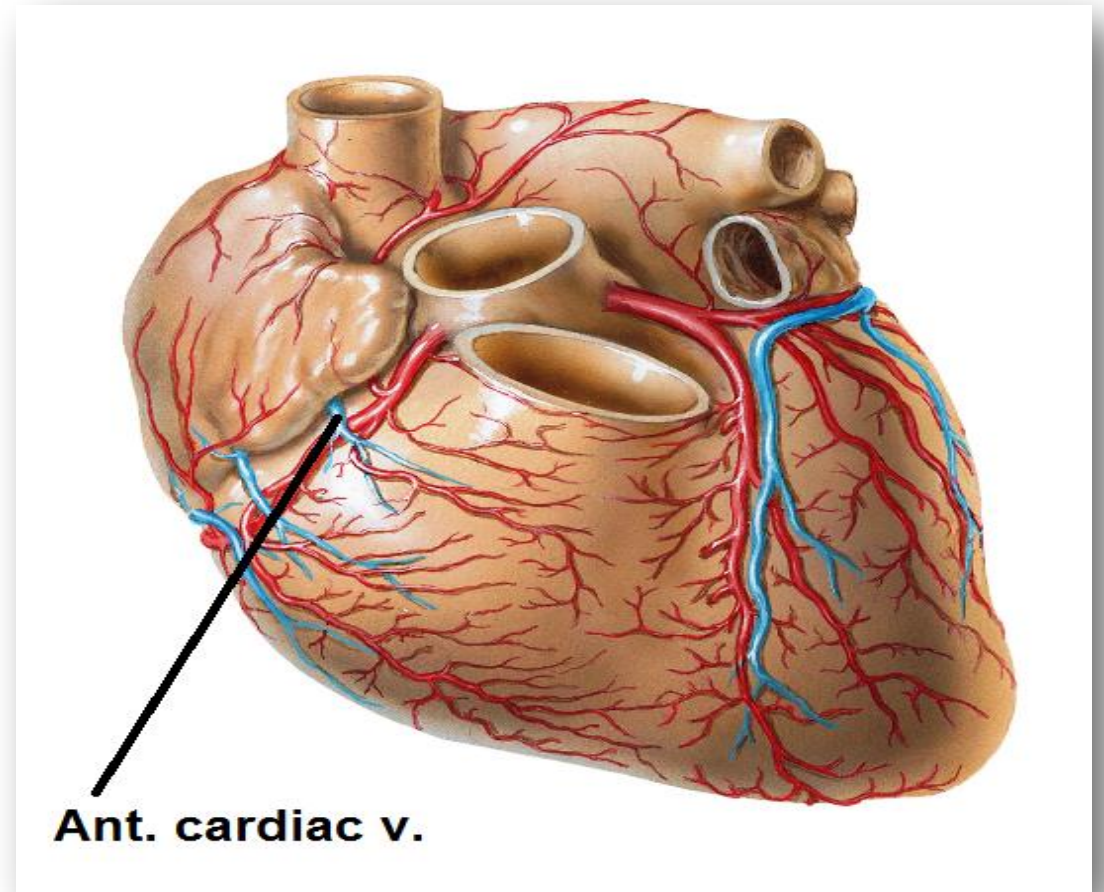


Anterior cardiac veins:

- Small veins run from the anterior surface of the right ventricle & right atrium to open directly in the right atrium.

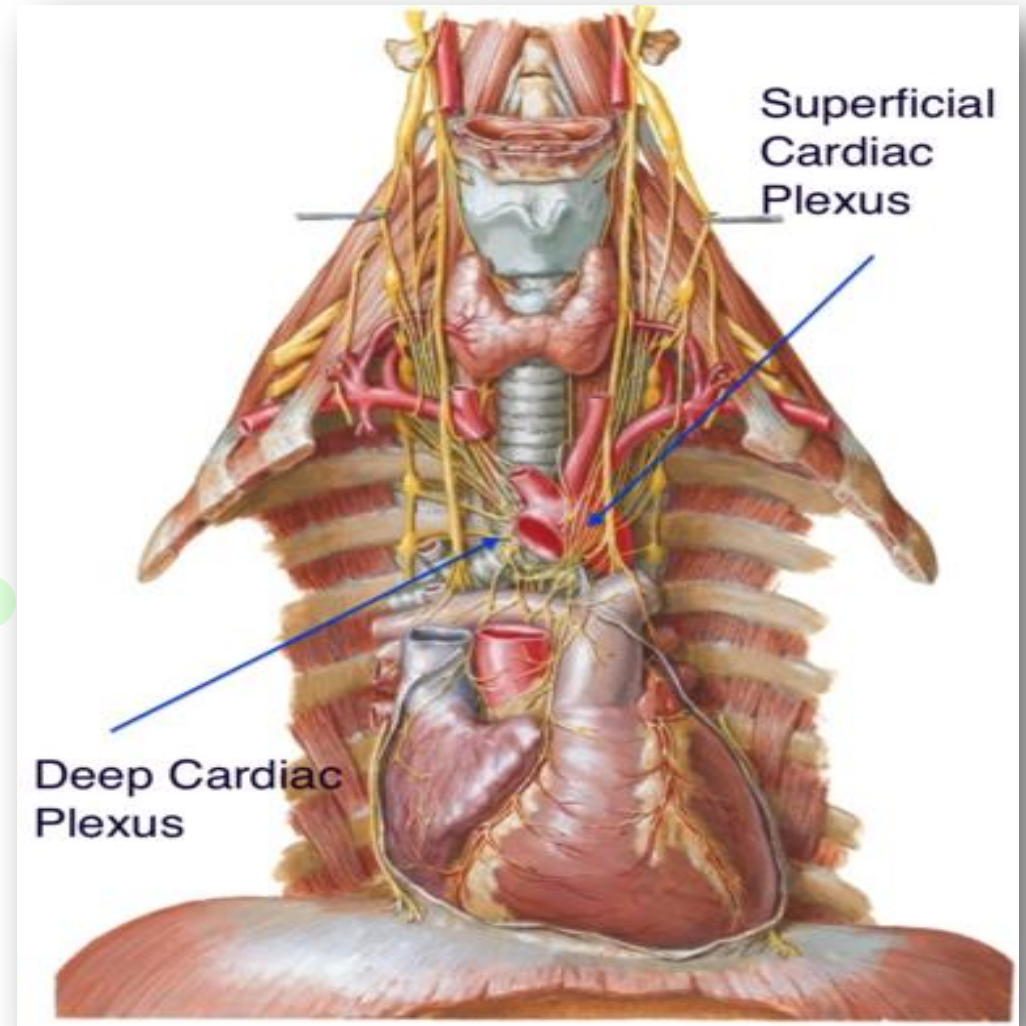
Venae cordis minimae:

- Small veins open in all chambers of the heart.



Nerve Supply of the Heart

- The heart is **innervated by** sympathetic and parasympathetic fibers via the cardiac plexuses.
- **Sympathetic component of the cardiac plexus** comes from **cardiac nerves**, which originate from the cervical and upper thoracic portions of the sympathetic trunk.
- **Parasympathetic component of the cardiac plexus** originates from the **cardiac branches of the vagus nerve**.
- **Sympathetic & parasympathetic fibers terminate on:** the sinuatrial and atrioventricular nodes, on cardiac muscle fibers, and on the coronary arteries.



Cardiac Pain:

- Afferent pain fibers run in the sympathetic fibers to enter spinal cord segment T1-T4 especially on left side.
- **Pain originating in the heart as the result of: acute myocardial ischemia.**

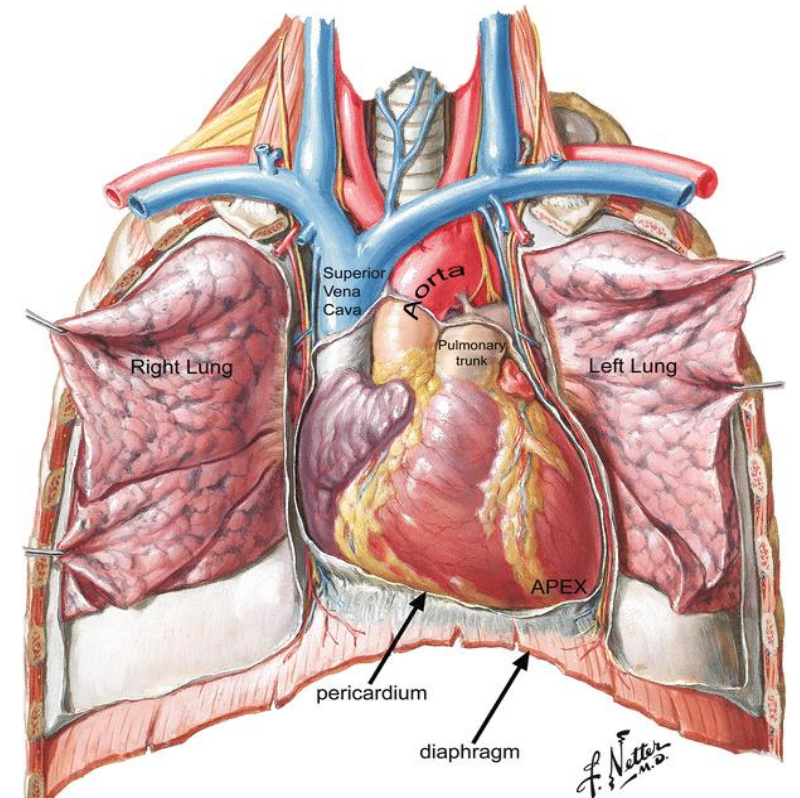
Referred cardiac pain

- It is referred to the skin areas that coincide with the dermatomes of somatic sensory fibers that enter the same spinal cord segment as afferent pain fibers coming from the heart.
- So cardiac pain is referred to the left side of chest (dermatome T3&T4) and medial aspect of left arm (dermatome T1&T2).

Great arteries of the heart

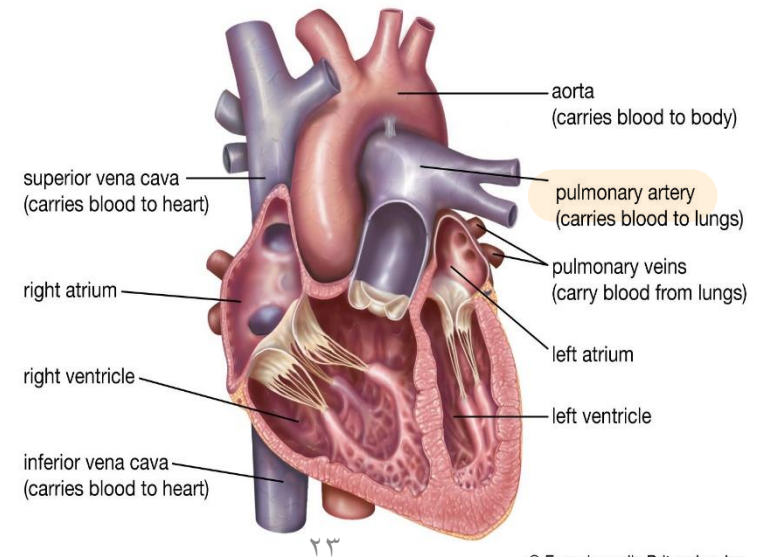
Pulmonary Trunk

- It leaves the upper part of the right ventricle and runs upward, backward, and to the left.
- It is about (5 cm) long.
- It terminates in the concavity of the aortic arch by dividing into right and left pulmonary arteries.
- Together with the ascending aorta, it is enclosed in the fibrous pericardium and a sheath of serous pericardium.



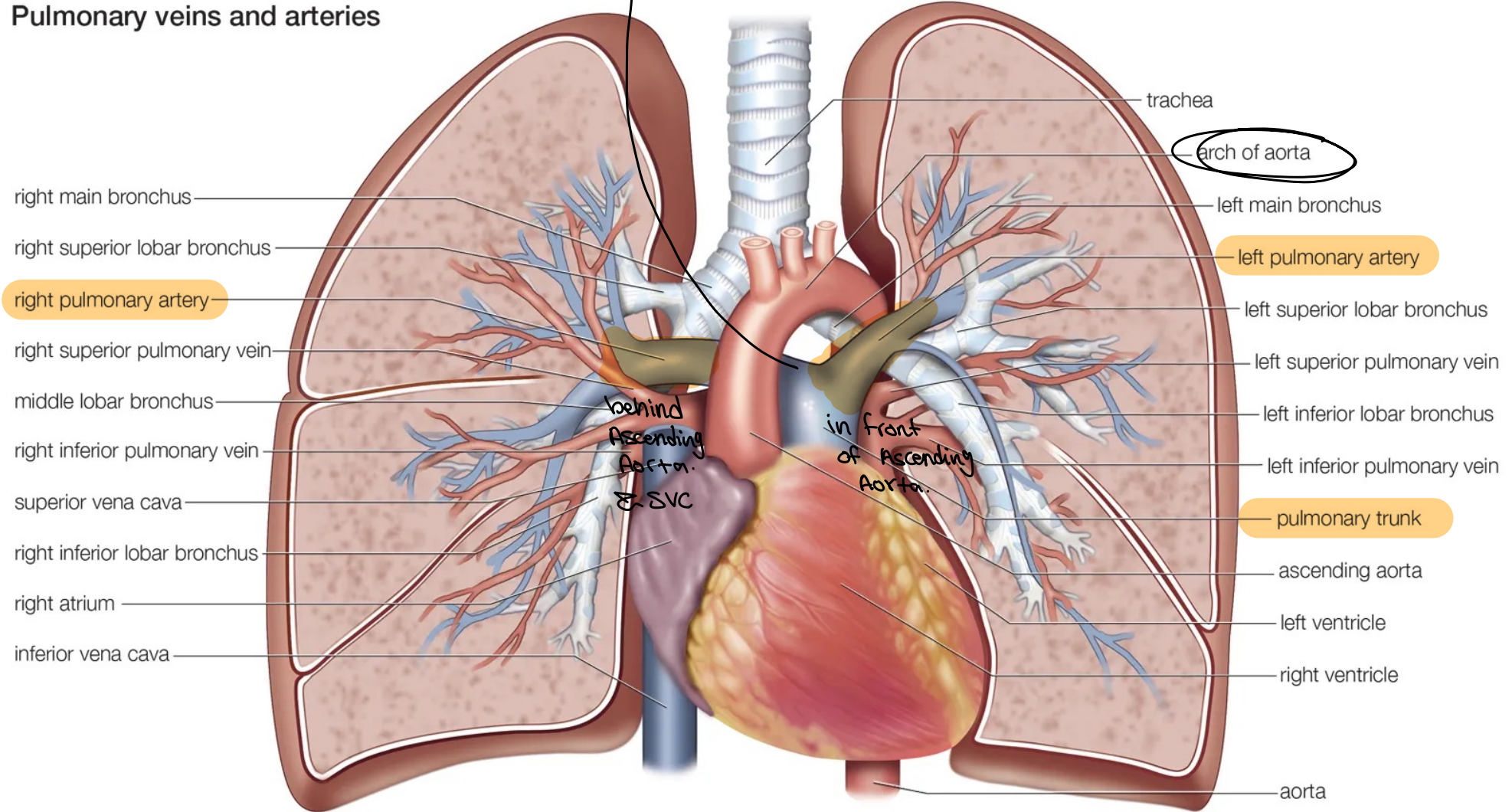
Branches

- **Right pulmonary artery;** Runs to the right behind the ascending aorta and superior vena cava to enter the root of the right lung.
- **Left pulmonary artery;** Runs to the left in front of the descending aorta to enter the root of the left lung.



التركيبة التشريحية للجذع الرئوي
 Concavity of the Aortic Arch.

Pulmonary veins and arteries



- right main bronchus
- right superior lobar bronchus
- right pulmonary artery
- right superior pulmonary vein
- middle lobar bronchus
- right inferior pulmonary vein
- superior vena cava
- right inferior lobar bronchus
- right atrium
- inferior vena cava

- trachea
- arch of aorta
- left main bronchus
- left pulmonary artery
- left superior lobar bronchus
- left superior pulmonary vein
- left inferior lobar bronchus
- left inferior pulmonary vein
- pulmonary trunk
- ascending aorta
- left ventricle
- right ventricle
- aorta

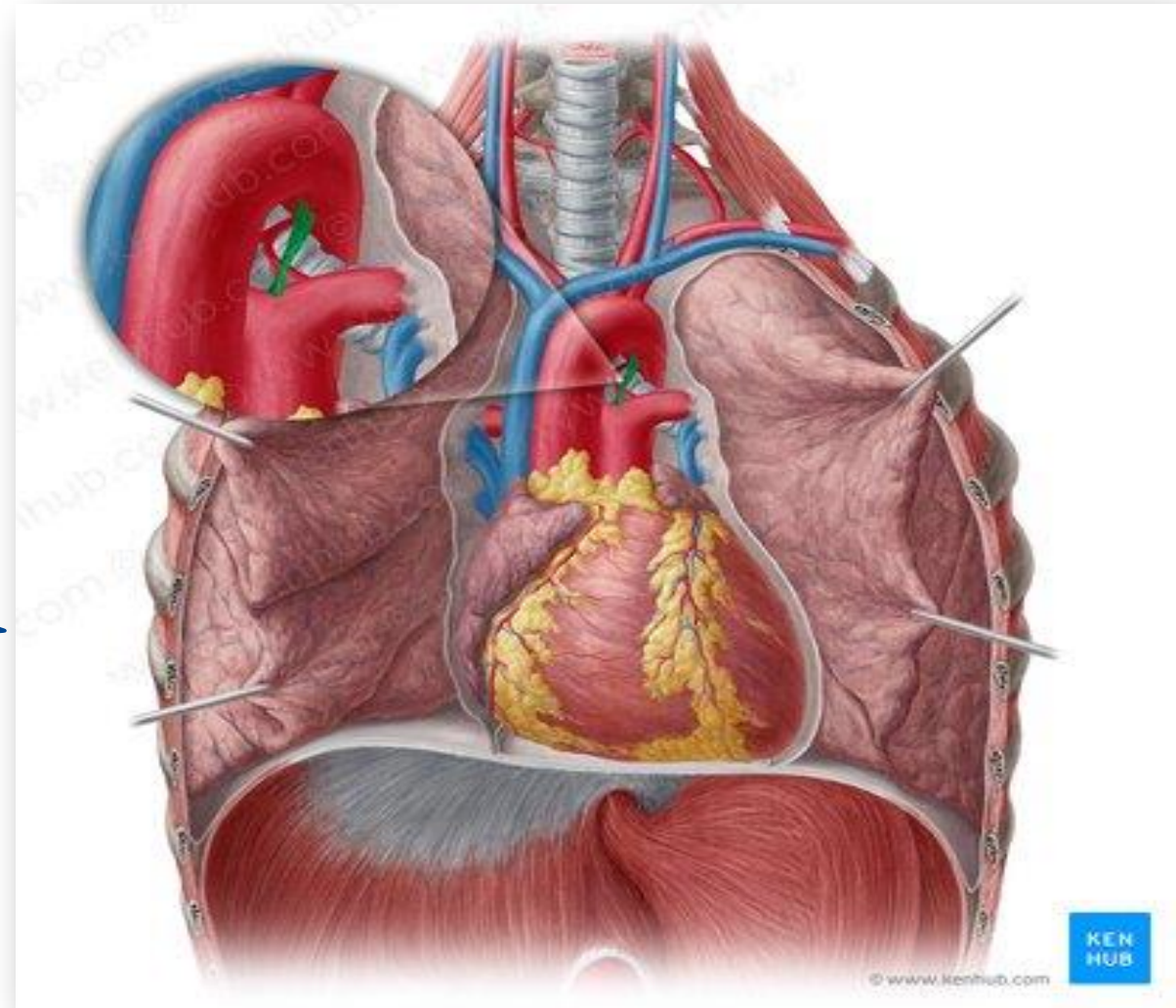
behind
 Ascending
 Aorta.
 & SVC

in front
 of Ascending
 Aorta.

Ligamentum arteriosum:

- Is a short fibrous band that connects the bifurcation of pulmonary trunk with the arch of the aorta.
- It is the remnant of the ductus arteriosus.

* in development of \heartsuit \rightarrow ductus arteriosus
* after birth \rightarrow ligament of دوست



Ascending aorta

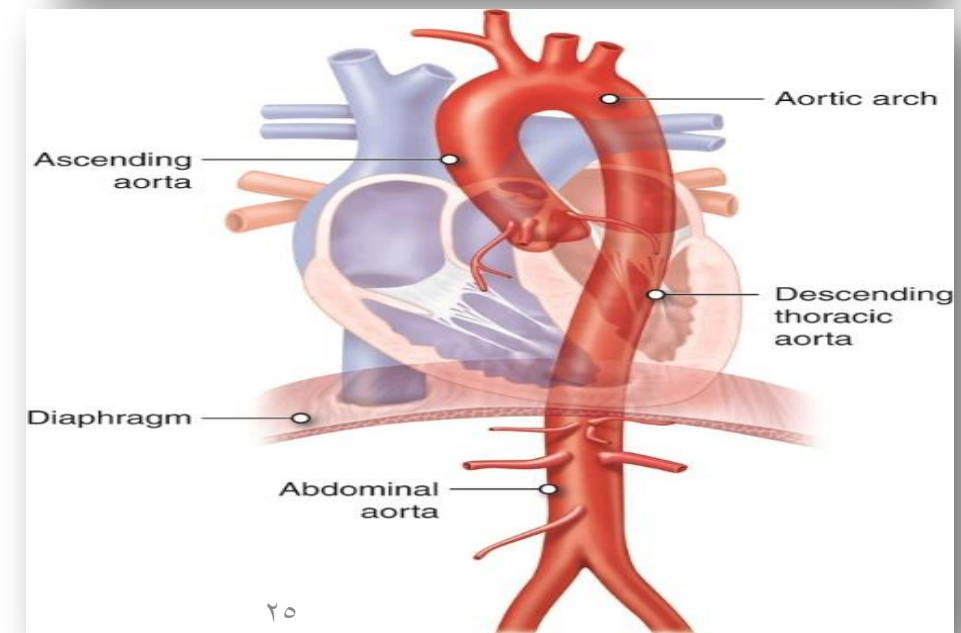
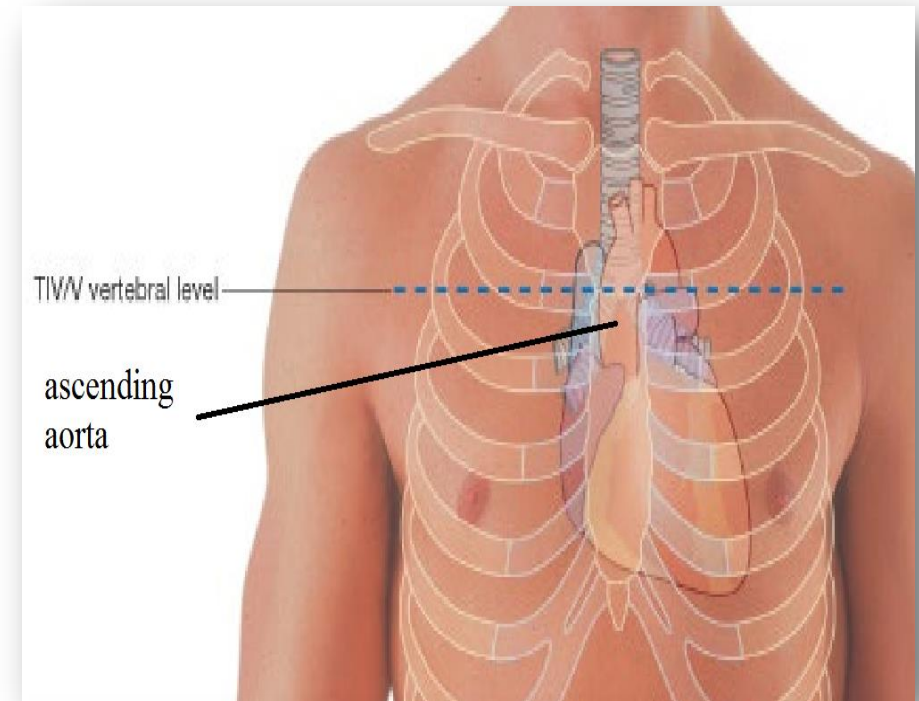
Origin:

- From the left ventricle at the level of left 3rd costal cartilage.
- At its origin, there were three outward bulges (sinuses of Valsalva), posterior (non-coronary), left and right aortic sinuses.

Course: It ascends obliquely to the right.

End:

- It ends at the level of the right second costal cartilage, where it becomes continuous with the arch of the aorta.



Relations of the ascending aorta

Anterior relations:

- Pulmonary trunk.
- Right auricle.
- Right pleura & lung.

Posterior relations:

- Right pulmonary artery.

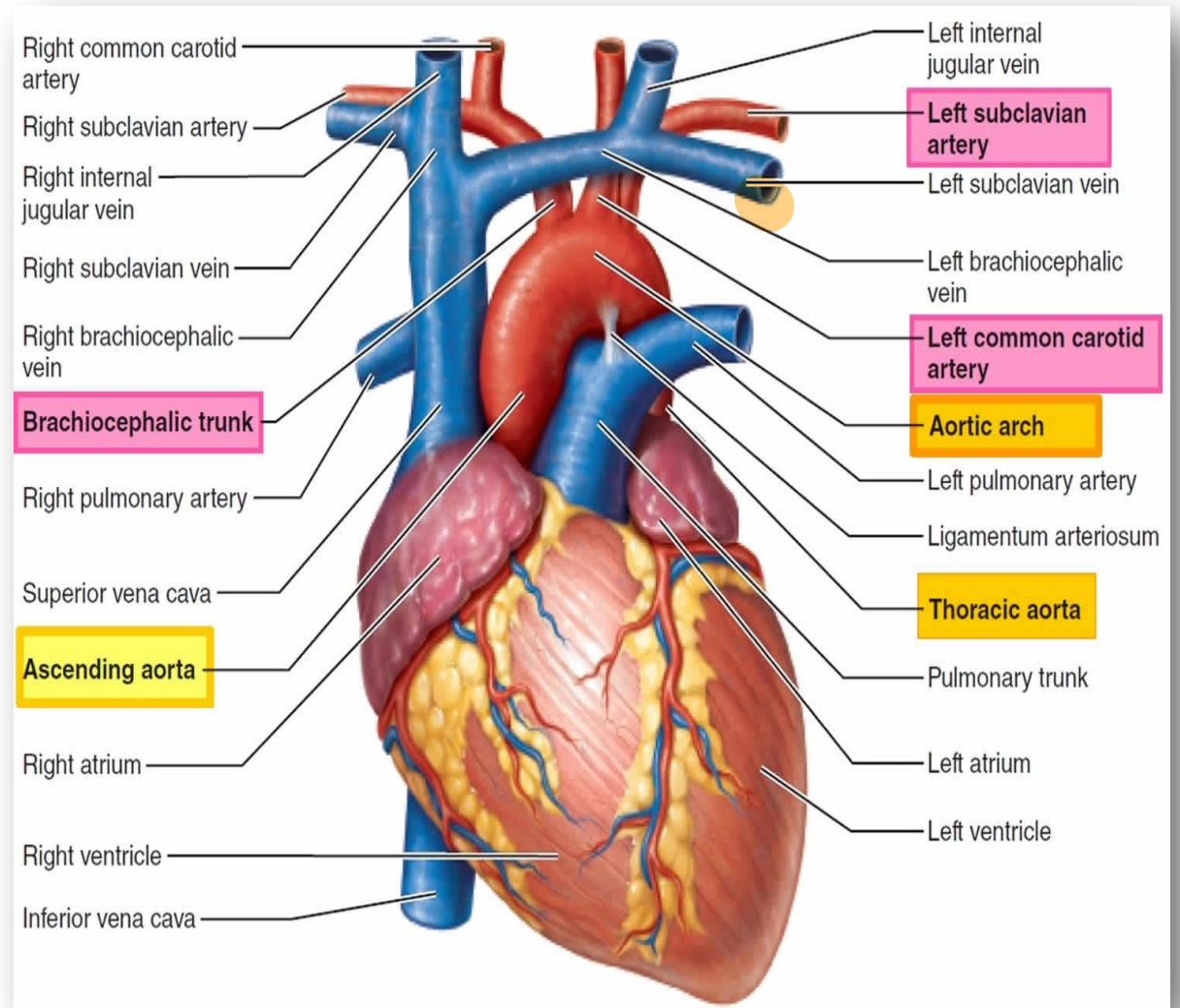
Right to it:

- Right atrium & SVC.

Left to it:

- Left atrium & Pulmonary trunk.

Branches: Right & Left coronary arteries.



Quiz

Coronary angiographs of a 44-year-old male patient reveal an occlusion of the anterior interventricular branch of the left coronary artery produces infarction in which one of the following areas?

- A) The entire diaphragmatic surface of the left ventricle
- B) The anterior part of the interventricular septum.
- C) The posterior wall of the left atrium.
- D) The right auricle.

Which of the following veins accompanies the posterior interventricular artery.

- (A) Great cardiac vein
- (B) Middle cardiac vein
- (C) Anterior cardiac vein
- (D) Small cardiac vein
- (E) Oblique veins of the left atrium

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- C) The posterior wall of the left atrium.
- D) The right auricle.

Supplied by Right Coronary Artery.

Supplied by Circumflex branch of left Coronary Artery

Which of the following veins accompanies the posterior interventricular artery.

- (A) Great cardiac vein
- (B) Middle cardiac vein
- (C) Anterior cardiac vein
- (D) Small cardiac vein
- (E) Oblique veins of the left atrium