Cardiovascular system

The system of blood circulation

Heart part 2

mid Moztarzadeh

Ventriculus dexter

- **Structures:**

  trabeculae carneae

  trabecula septomarginalis – part of Conduction system of heart

  mm. papillares (ant., post., septalis) – chordae tendineae

  crista supraventricularis

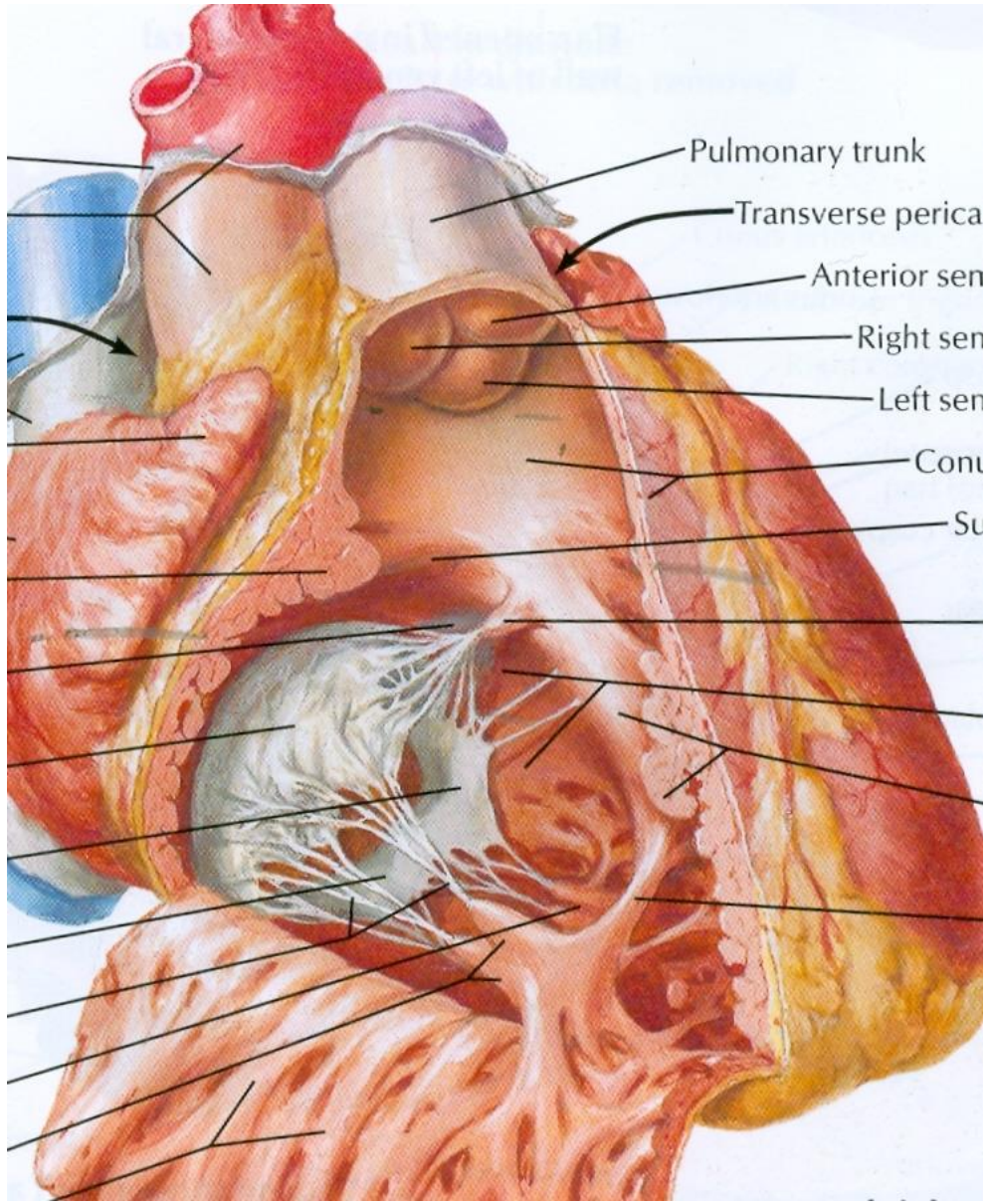
  infundibulum/conus arteriosus (trunci pulmonalis)

  Chordae tendinae

- **Orifices:**

- ostium atrioventriculare dextrum – valva tricuspidalis (cuspis ant., post., septalis)

  ostium trunci pulmonalis - valva trunci pulmonalis (valvula (cuspis) semilunaris ant., dx., sin.)



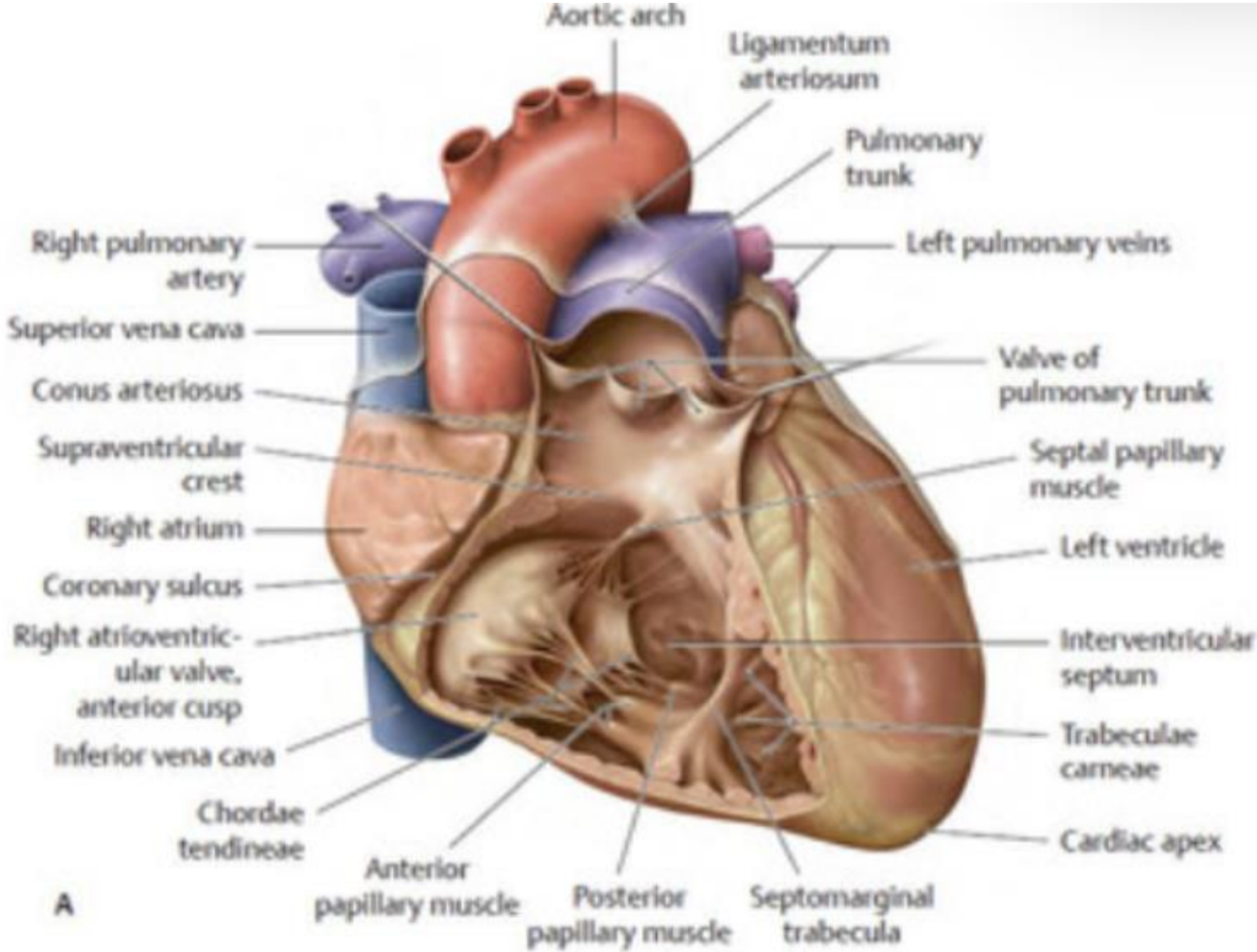
The medial wall is formed by the septum interventriculare

The right ventricular cavity can be divided into:

The inflow portion: (pars trabecularis) with the trabeculae carneae, from the ostium atrioventriculare dextrum to the apex cordis

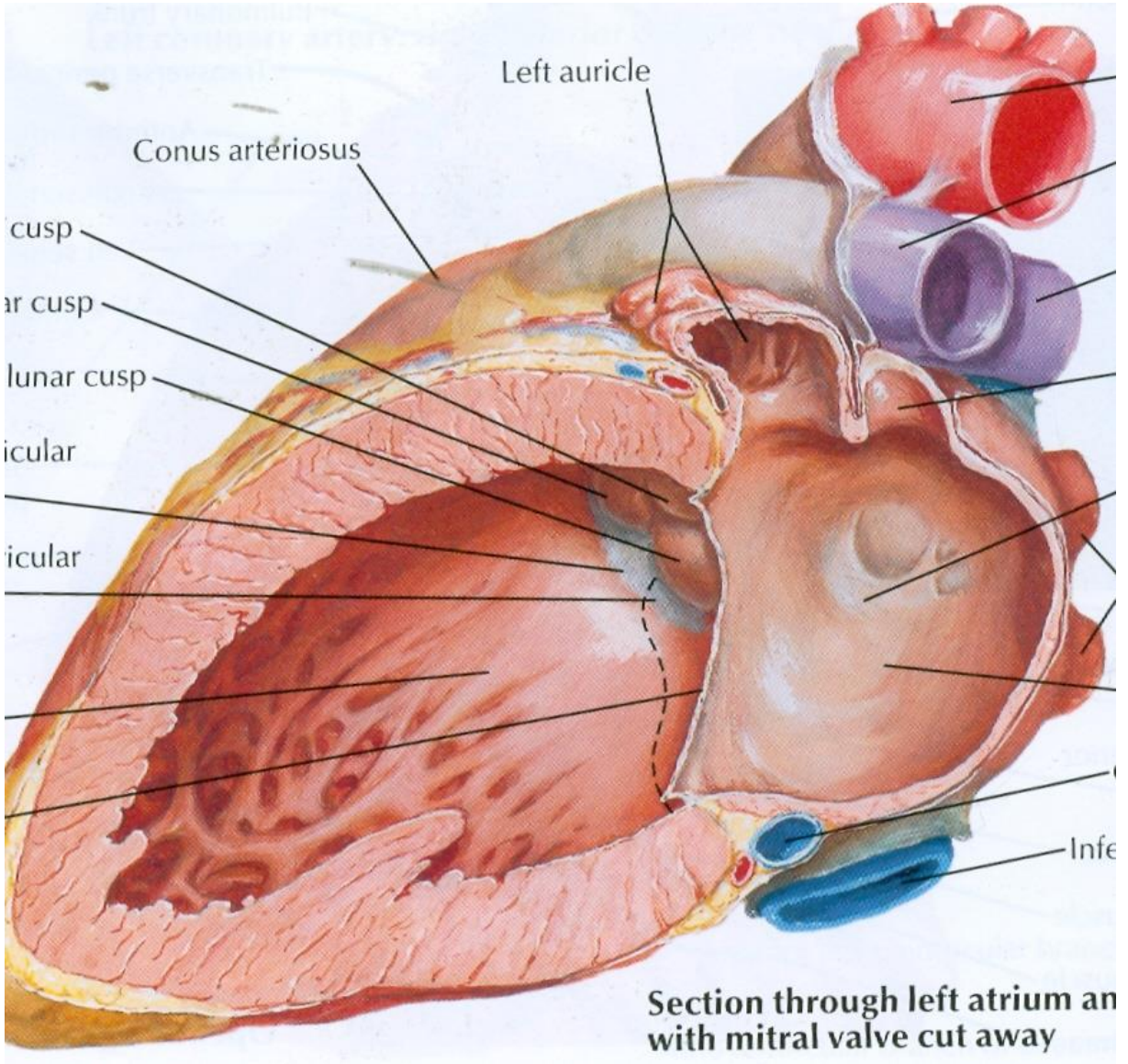
The outlet part: (pars glabra) is the smooth wall, from the cardiac apex upwards and forwards towards the truncus pulmonalis (infundibulum/conus arteriosus)

The boundary between the two compartments being the transversely oriented muscular crest (crista supraventricularis).


Aortic arch
Ligamentum arteriosum
Pulmonary trunk
Right pulmonary artery
Left pulmonary veins
Superior vena cava
Valve of pulmonary trunk
Conus arteriosus
Supraventricular crest
Septal papillary muscle
Right atrium
Left ventricle
Coronary sulcus
Right atrioventricular valve, anterior cusp
Interventricular septum
Trabeculae carneae
Inferior vena cava
Chordae tendineae
Cardiac apex
Anterior papillary muscle
Posterior papillary muscle
Septomarginal trabecula
A

Atrium sinistrum

- **Structures:**
  - mm. pectinati
  - auricula sinistra
  - valvula foraminis ovalis
- **Orifices:**
  - ostia venarum pulmonalium



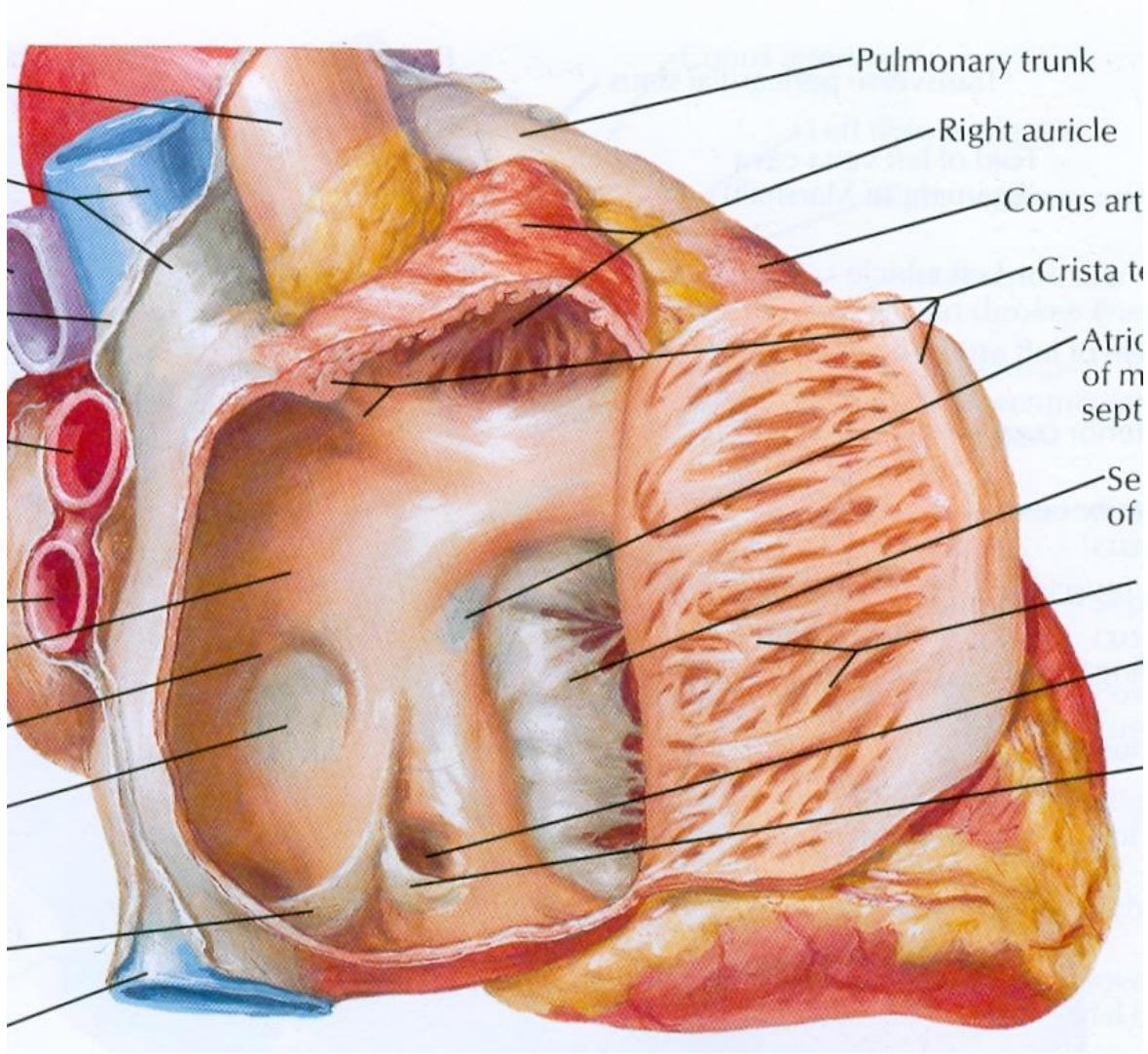
Atrium dextrum

- **Structures:**

  sinus venarum cavarum
  tuberculum intervenosum
  crista/sulcus terminalis
  mm. pectinati
  auricula dextra
  fossa ovalis – limbus fossae ovalis

- **Orifices:**

  ostium v. cavae superioris
  ostium v. cavae inferioris
  (valvula Eustachii)
  ostium sinus coronarii
  (valvula Thebesii)
  ostia venarum minimarum
  ostia vv. ventriculi dx. anteriorum



Ventriculus sinister

- **Structures:**

  trabeculae carneae

  m. papillaris (anterior, posterior)

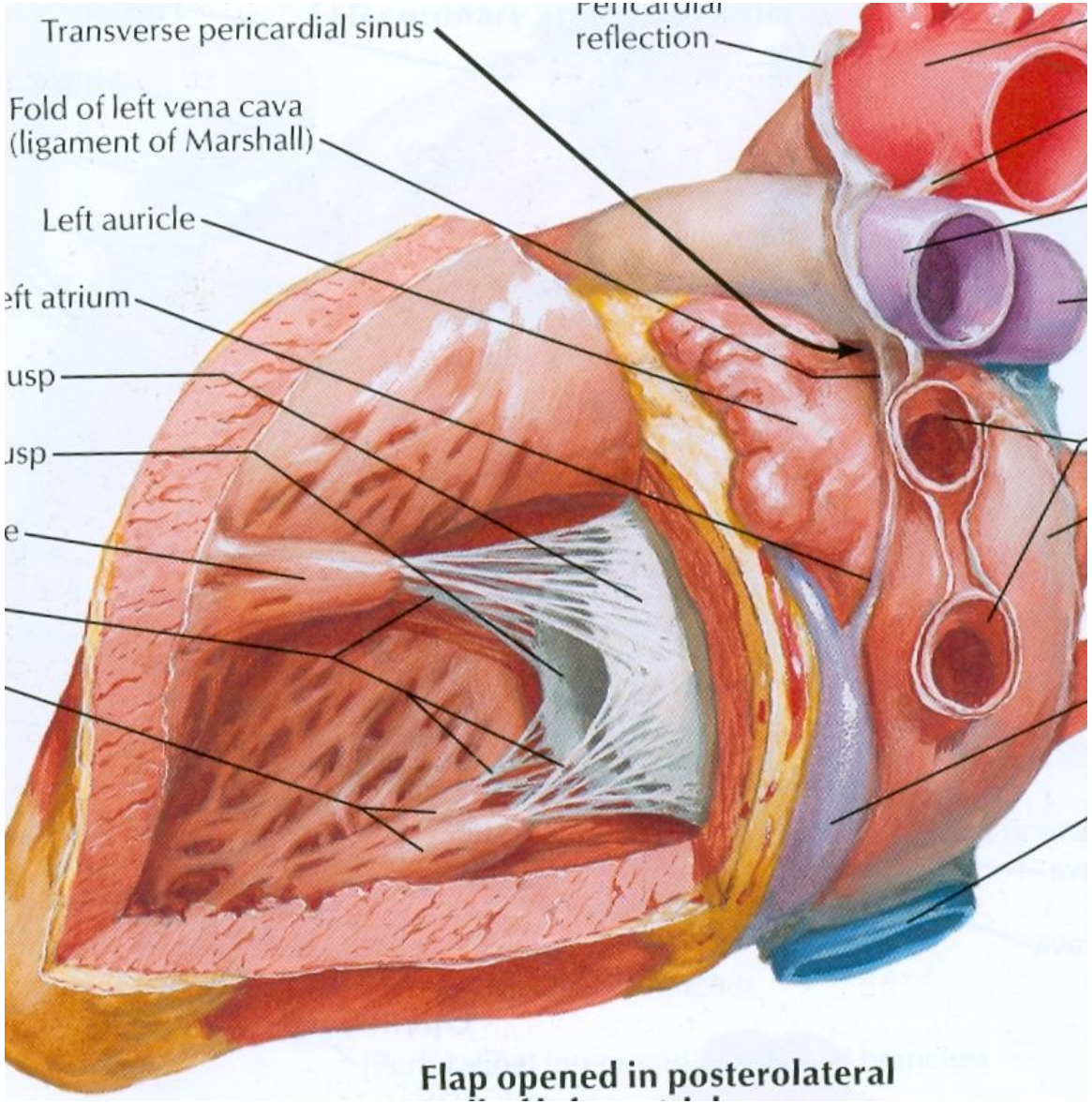
  chordae tendineae

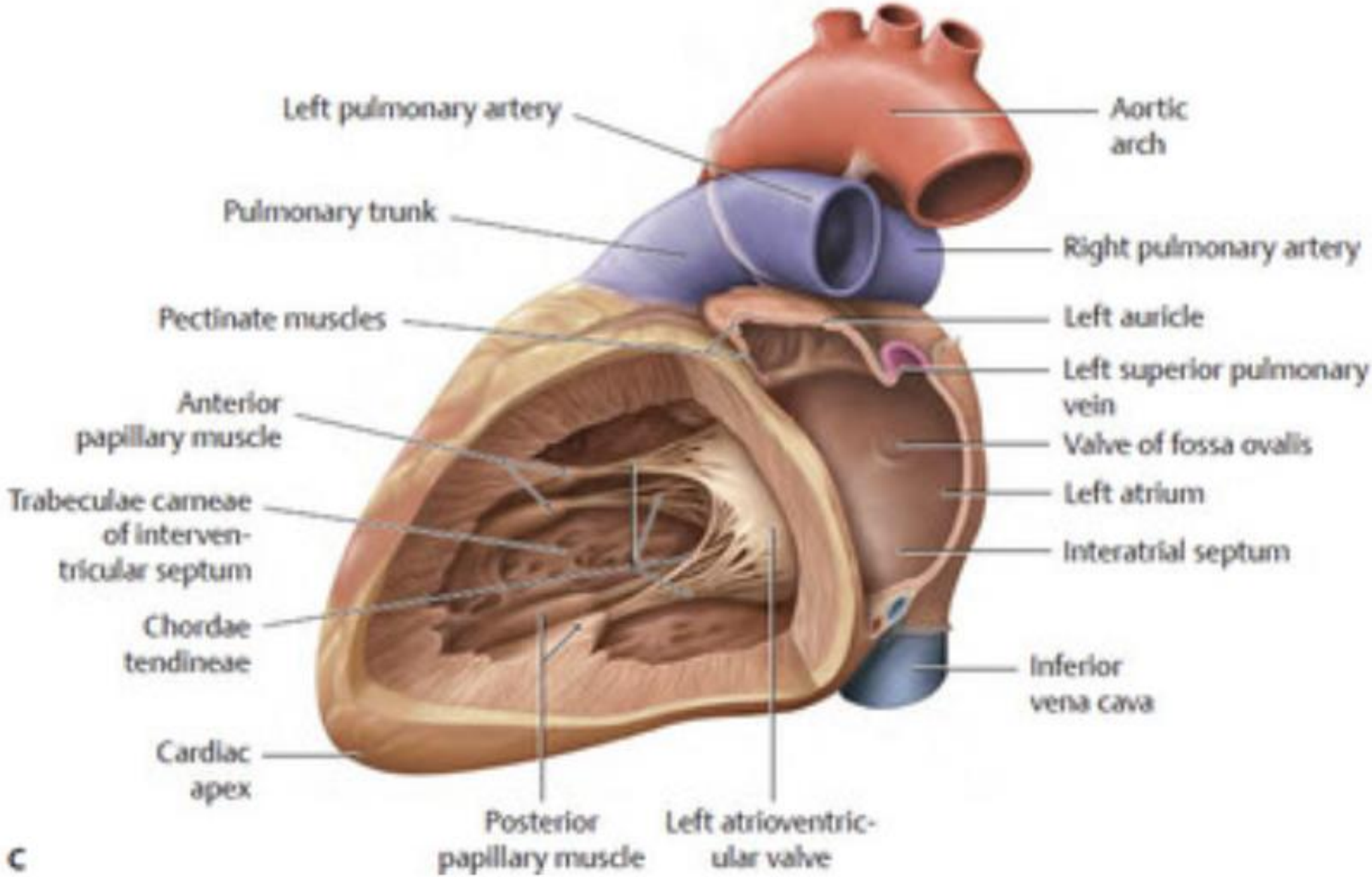
  vestibulum aortae

- **Orifices:**

- **ostium atrioventriculare sinistrum – valva bicuspidalis/mitralis (cuspis ant., post.), cuspides commissurales)**

  ostium aortae – valva aortae (valvula (cuspis) semilunaris dx., sin., post.)




Left pulmonary artery
Aortic arch
Pulmonary trunk
Right pulmonary artery
Pectinate muscles
Left auricle
Left superior pulmonary vein
Anterior papillary muscle
Valve of fossa ovalis
Left atrium
Trabeculae carneae of interventricular septum
Interatrial septum
Chordae tendineae
Inferior vena cava
Cardiac apex
Posterior papillary muscle
Left atrioventricular valve

C

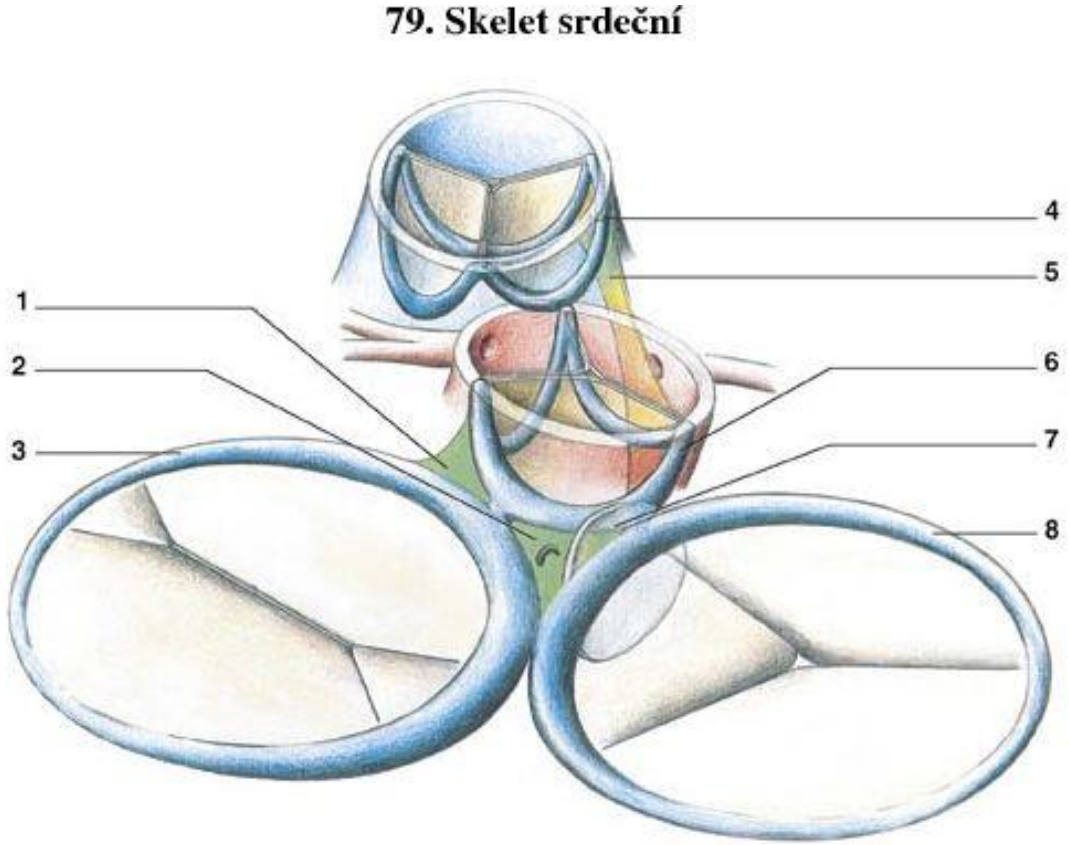
Cardiac skleton

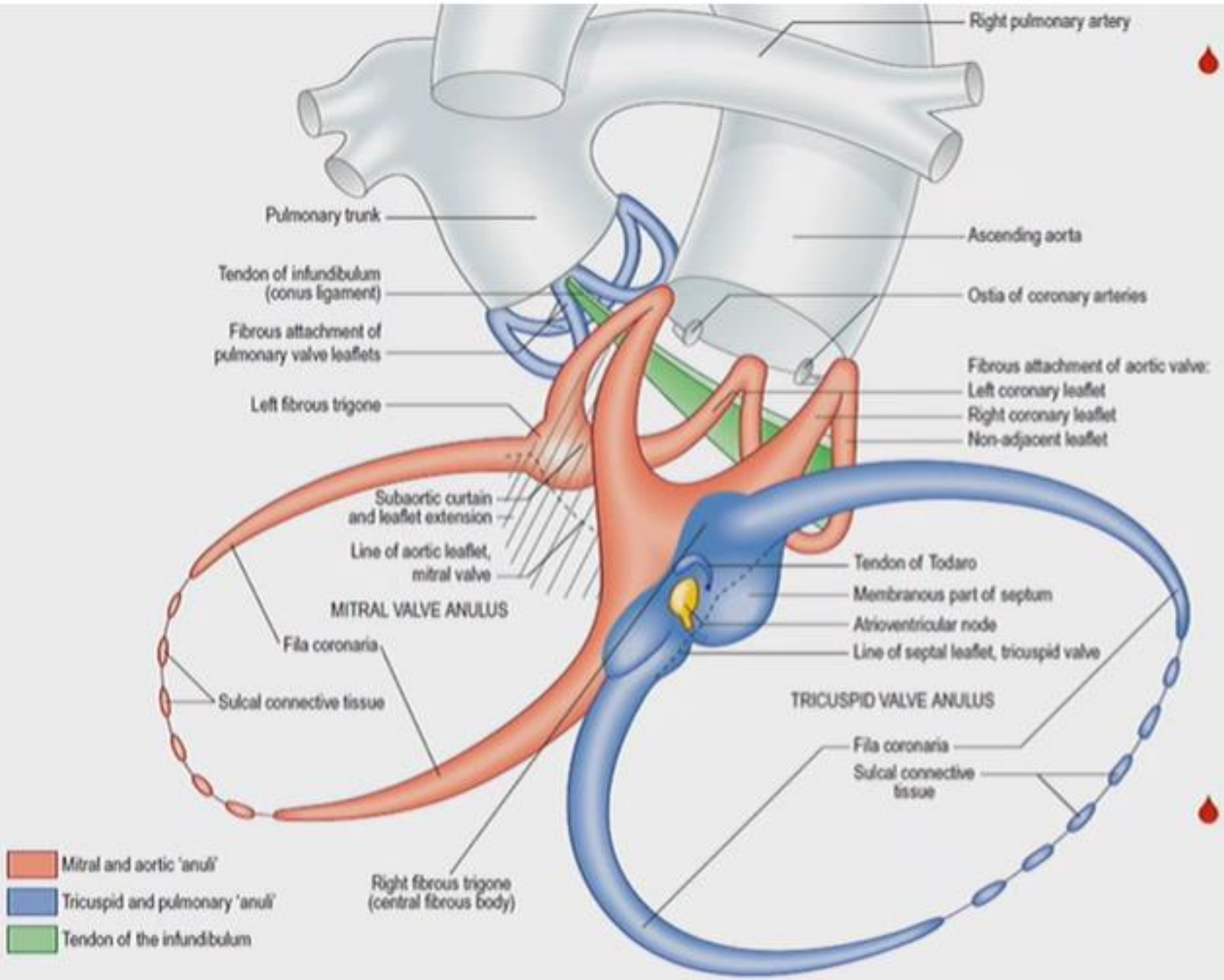
- Anuli fibrosi (fibrous rings)– four fibrous rings around the heart valves:
- 8.Anulus fibrosus dexter
- 3.Anulus fibrosus sinister
- 6.Anulus aorticus
- 4.Anulus trunci pulmonalis
- 2.Trigonum fibrosum dextrum (between anulus dexter, sinister and aorticus)
- 1.Trigonum fibrosum sinistrum (between anulus sinister and aorticus)
- 5.Tendo infundibuli (the tendon of infundibulum)
- Tendo valvulae v. cavae inf. - (tendon of Todaro)

- Cardiac skleton is made of dense fibrous connective tissue, to which the myocardium is attached together with all the valves. The skeleton electrically separates the atrial myocardium (originates from the upper border of the rings) from the ventricular myocardium (originates from the lower border of the rings).
- the only connection between the atrial myocardium and the ventricular myocardium is the so-called: Bundle of His (atrioventricular bundle) passing through trigonum fibrosum dextrum.

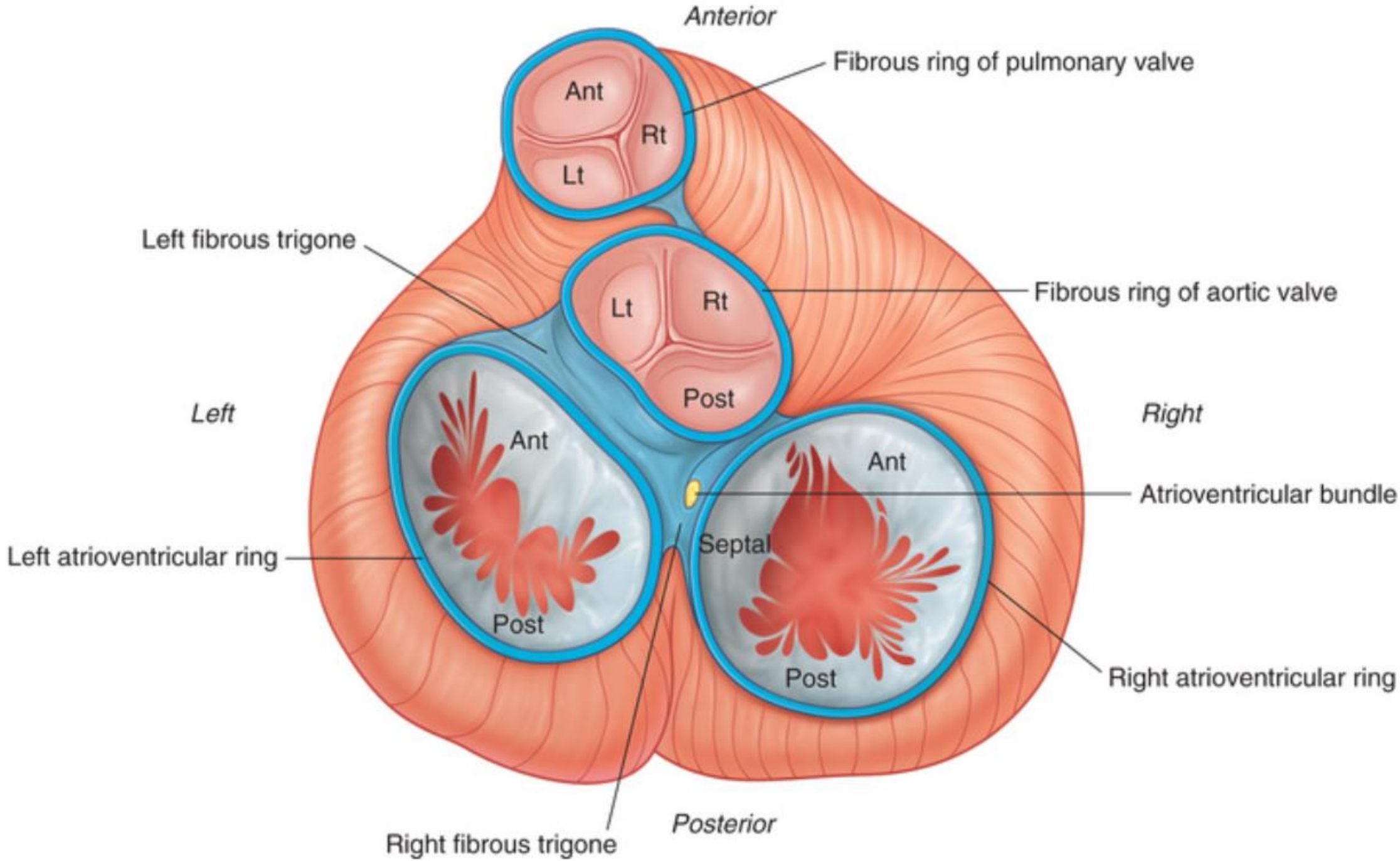
5.Tendo infundibuli (the tendon of infundibulum): **from the right edge of the trigonum fibrosum dx.to the anulus aorticus and anulus trunci pulmonalis**

Tendo valvulae v. cavae inf. - (tendon of Todaro) : **fibrous tendon; diameter 1 mm; from the upper side of the trigonum dx. to the myocardium of the posterior wall of the right atrium, to the valvula of the VCI, where it disappears.**





- **Anuli fibrosi (anulus fibrosus)**
  - **4 valves**
  - **Mitral and tricuspidal**
  - *Fila coronaria, sulcal connective tissue*
  - **Aortal and tr. pulmonalis**
  - *„coronet“*
  - *Conus ligament (ligamentum infundibuli)*
  - **Trigonum fibrosum dextrum**
  - *Opening for fasciculus atrioventricularis*
  - *Tendo Todara*
  - **Trigonum fibrosum sinistrum**
  - **Connection of mitral + aortal ring**
- **Skeleton of hte heart**
  - **Origin of the musculature**
  - **Electrical isolation**


Anterior
Fibrous ring of pulmonary valve
Ant
Rt
Lt
Left fibrous trigone
Fibrous ring of aortic valve
Lt
Rt
Post
Left
Right
Ant
Ant
Atrioventricular bundle
Septal
Left atrioventricular ring
Post
Post
Right atrioventricular ring
Posterior
Right fibrous trigone

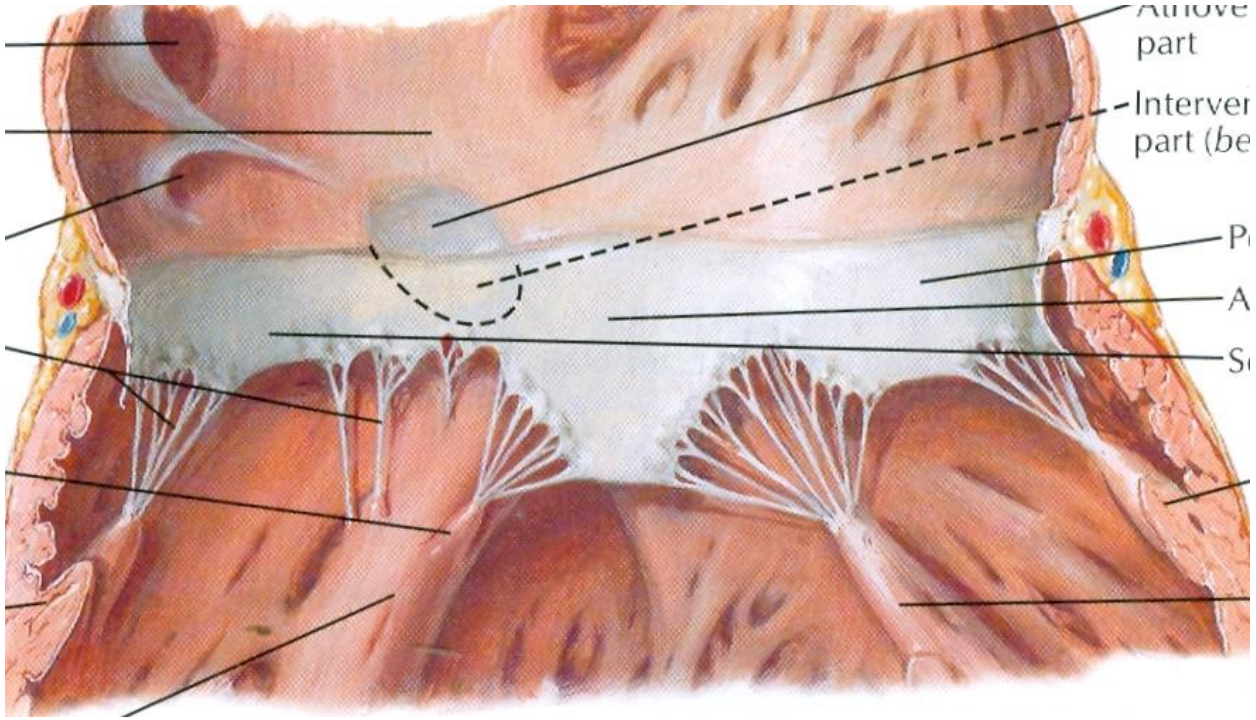
Cardiac valves

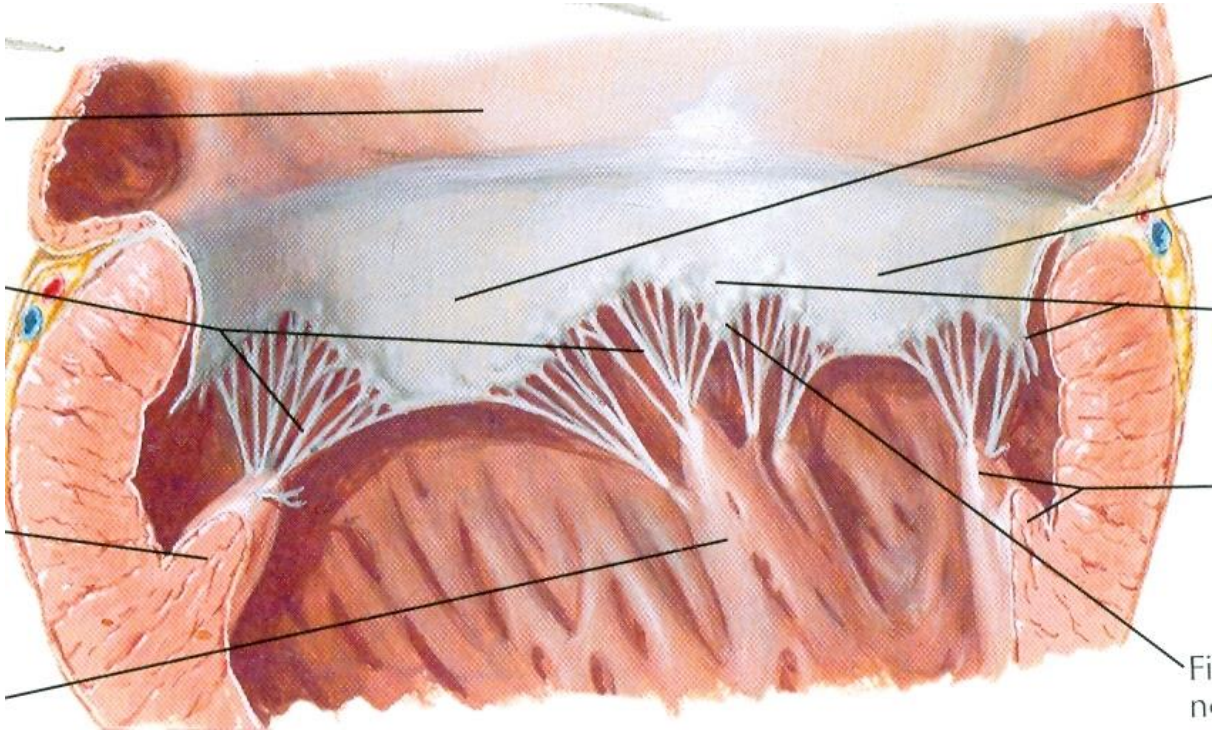
- Heart valves are valves that provide one-way blood flow in the heart.
- They are not innervated and are without blood vessels (they open and close based on a pressure gradient).
- From the histological point of view, these are duplications of the endocardium. They consist of an inner fibrous plate (collagen and elastic fibres), covered by endothelium on the surface.
- They are attached to the fibrous rings of the cardiac skeleton.
- The cardiac valves are divided into two groups: semilunar and atrioventricular

Valva tricuspidalis – Valva bicuspidalis (mitralis)

the tips of the individual cusps are directed into the ventricular cavity and are attached to the papillary muscles by chordae tendineae.

Thanks to this, the valves always open in one direction only - towards the ventricles, thus ensuring blood flow from the atrium to the ventricles.

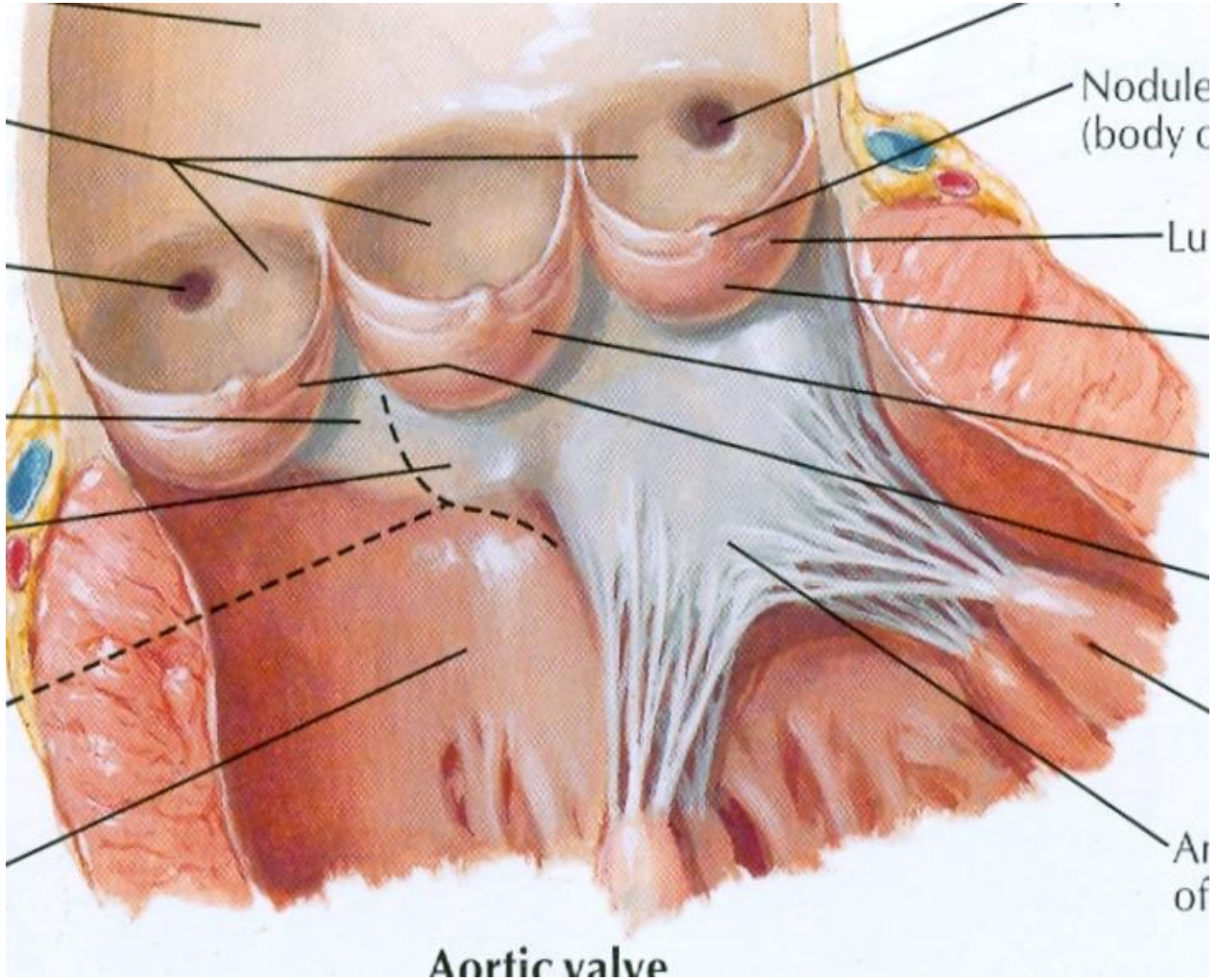


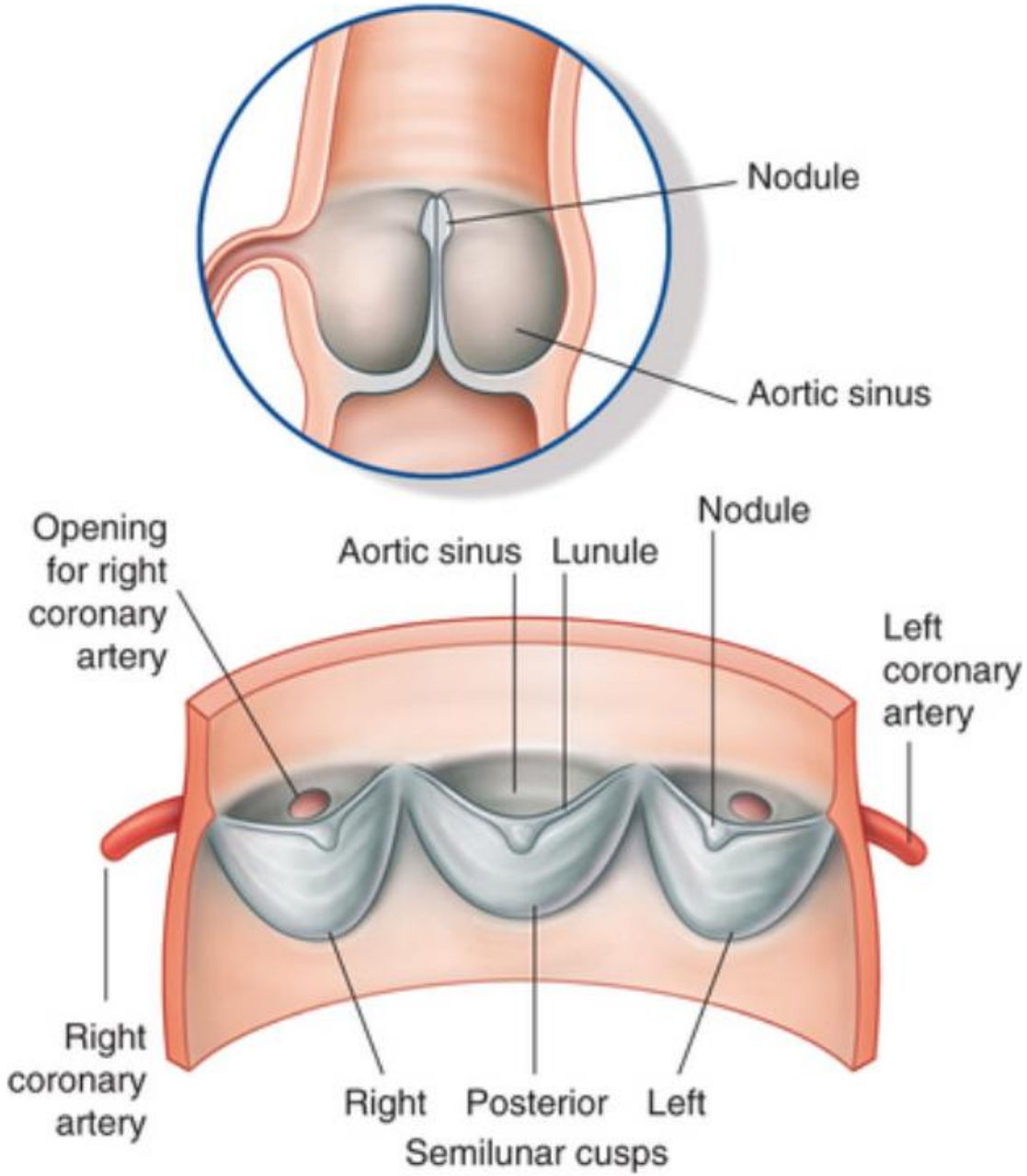


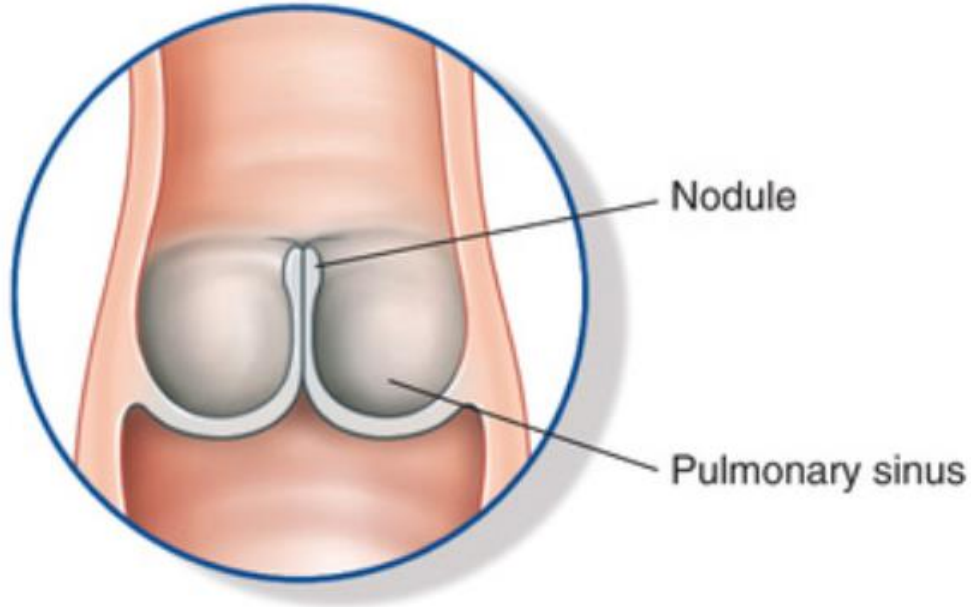
Pulmonary and aortic valve – semilunar valve

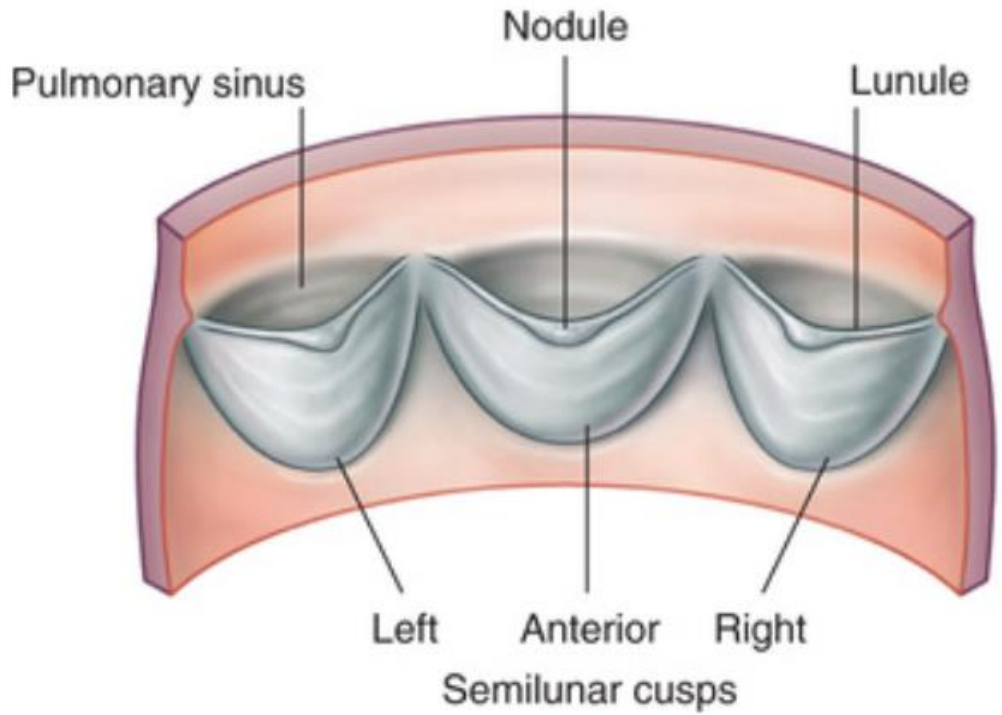
consist of three half-moon folds (valvulae semilunares), which attach to the wall of the vessel in the form of swallow nests. They allow the blood to flow out of the chambers into the adjacent vessel.

- **Velum- lamina fibrosa together with the endocardium**
- **Lunula- the thinned edge**
- **Nodulus valvulae semilunaris (Aranzii)- the middle of each lamella-ensures closure of the centre of the valve**
- **Sinus aortae (Valsalvae)**




Nodule
Aortic sinus
Opening for right coronary artery
Aortic sinus
Lunule
Nodule
Left coronary artery
Right coronary artery
Right
Posterior
Left
Semilunar cusps

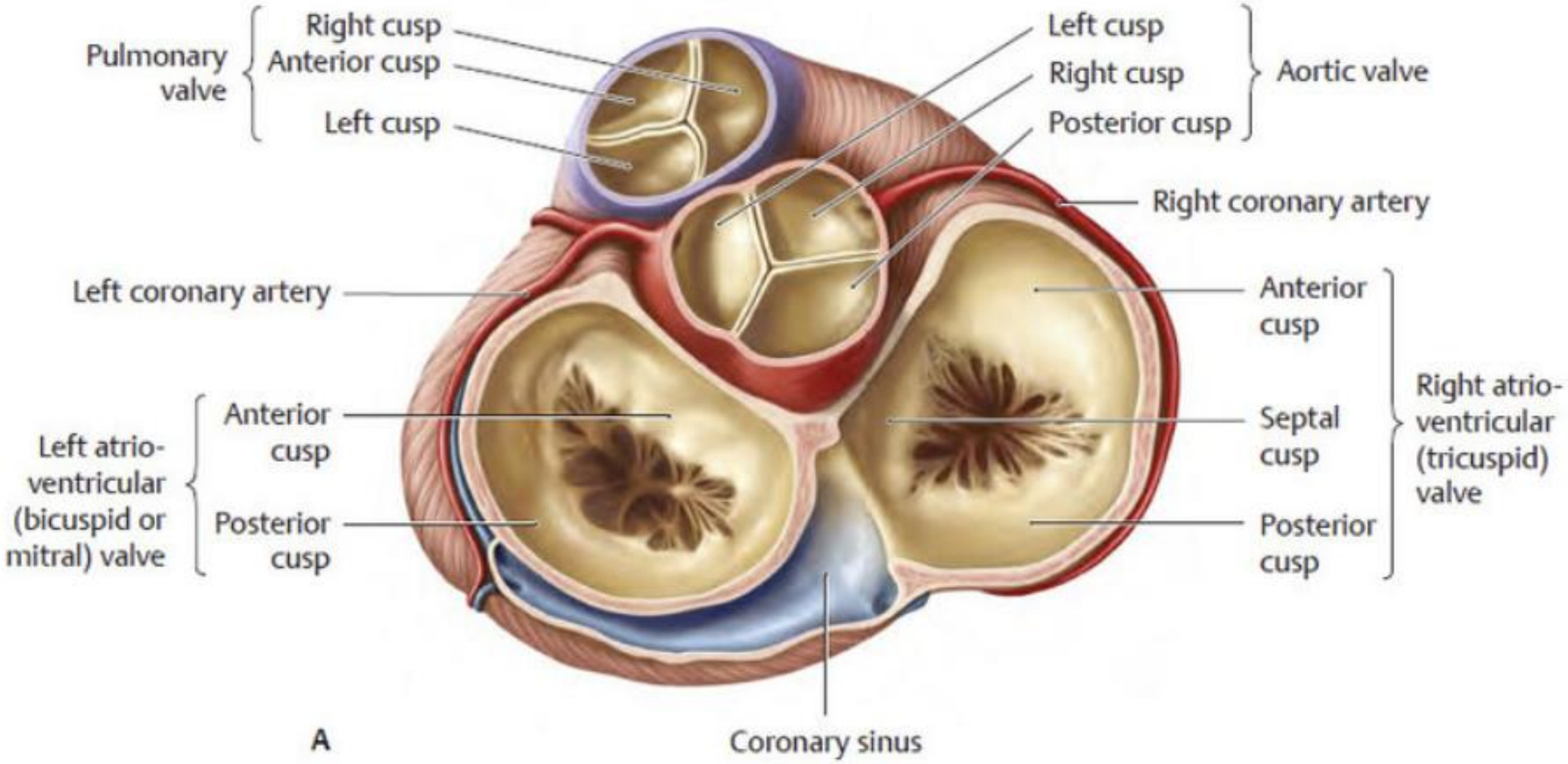

Nodule
Pulmonary sinus


Nodule
Pulmonary sinus
Lunule
Left
Anterior
Right
Semilunar cusps

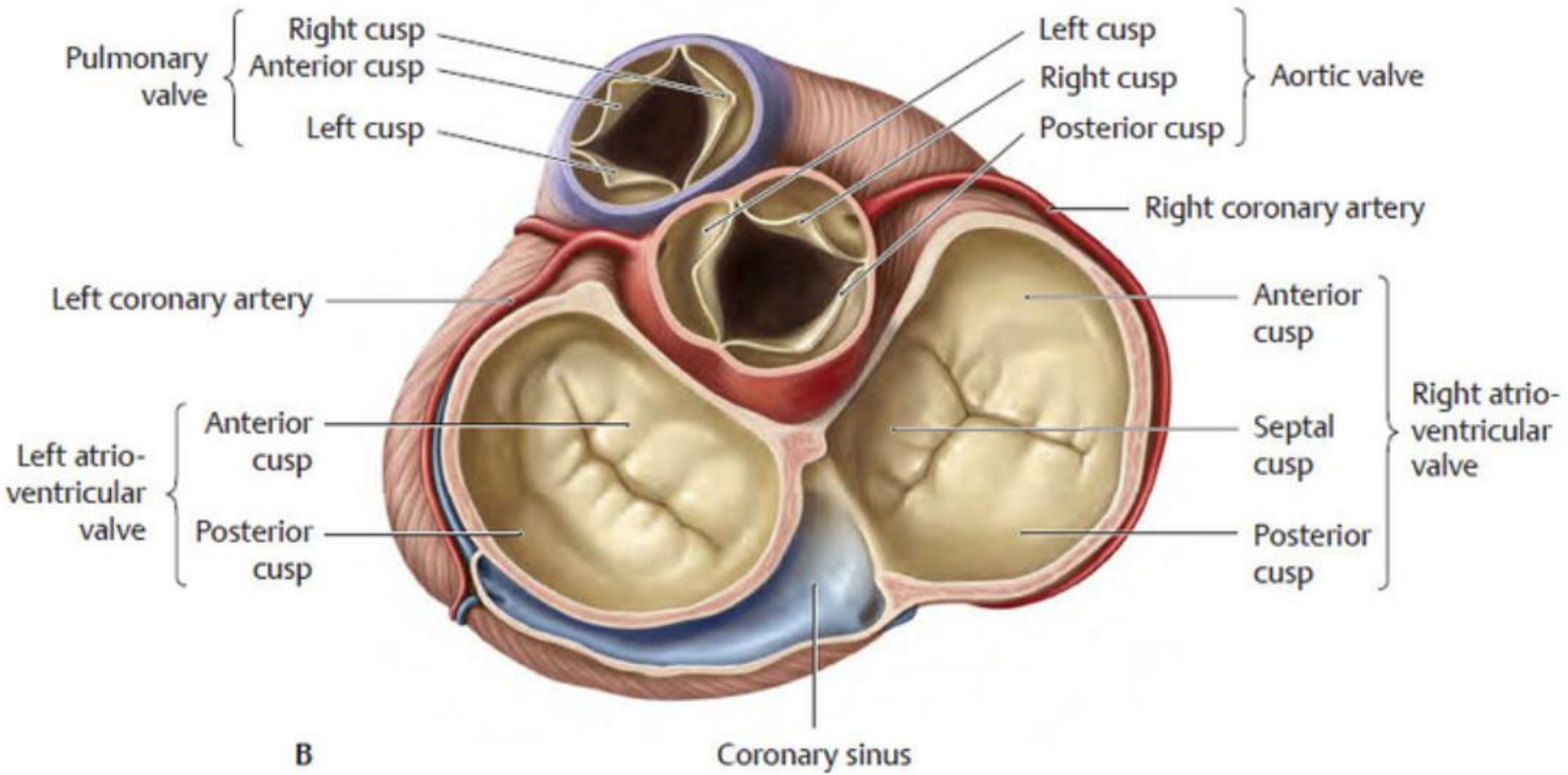
Systole - Diastole

- Heart Action is divided into two basic activities:
- relaxation (diastole),
- contraction (systole)
- During diastole, the heart is relaxed and the atria and ventricles fill with blood. Before the end of diastole, the atria contract and fill the ventricles. This is followed by ventricular contraction (systole) and the ejection of blood from the heart. The whole cycle of relaxation and contraction is repeated.
- At the beginning of ventricular contraction (systole), the tricuspid and mitral valves close. This allows blood to flow from the heart chambers only to the pulmonary artery and aorta.
- Then the situation reverses (diastole), the pulmonary and aortic valves close in turn. This prevents the flow of ejected blood back to the heart.

Ventricular diastole (relaxation of the ventricles).
Closed: Semilunar valves. *Open:* Atrioventricular valves

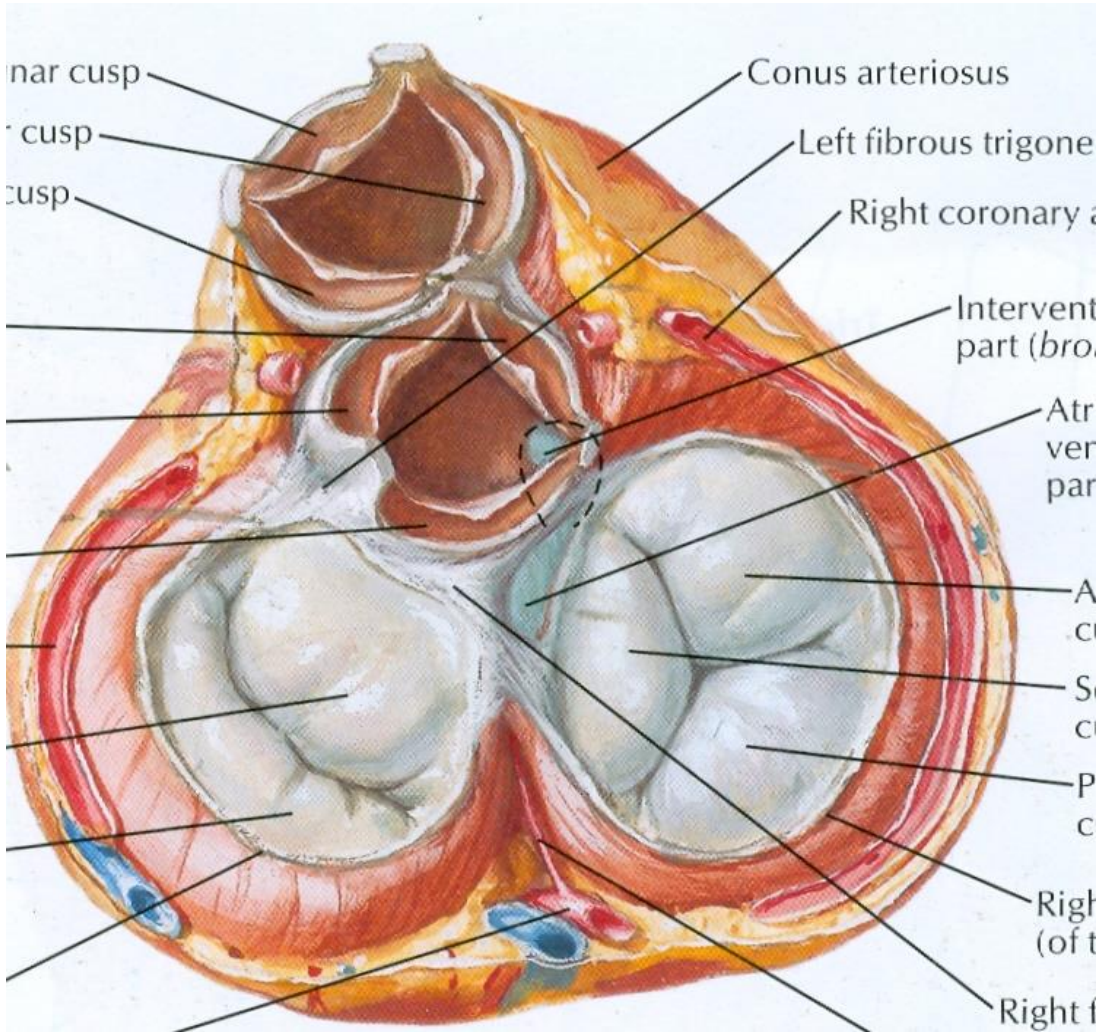


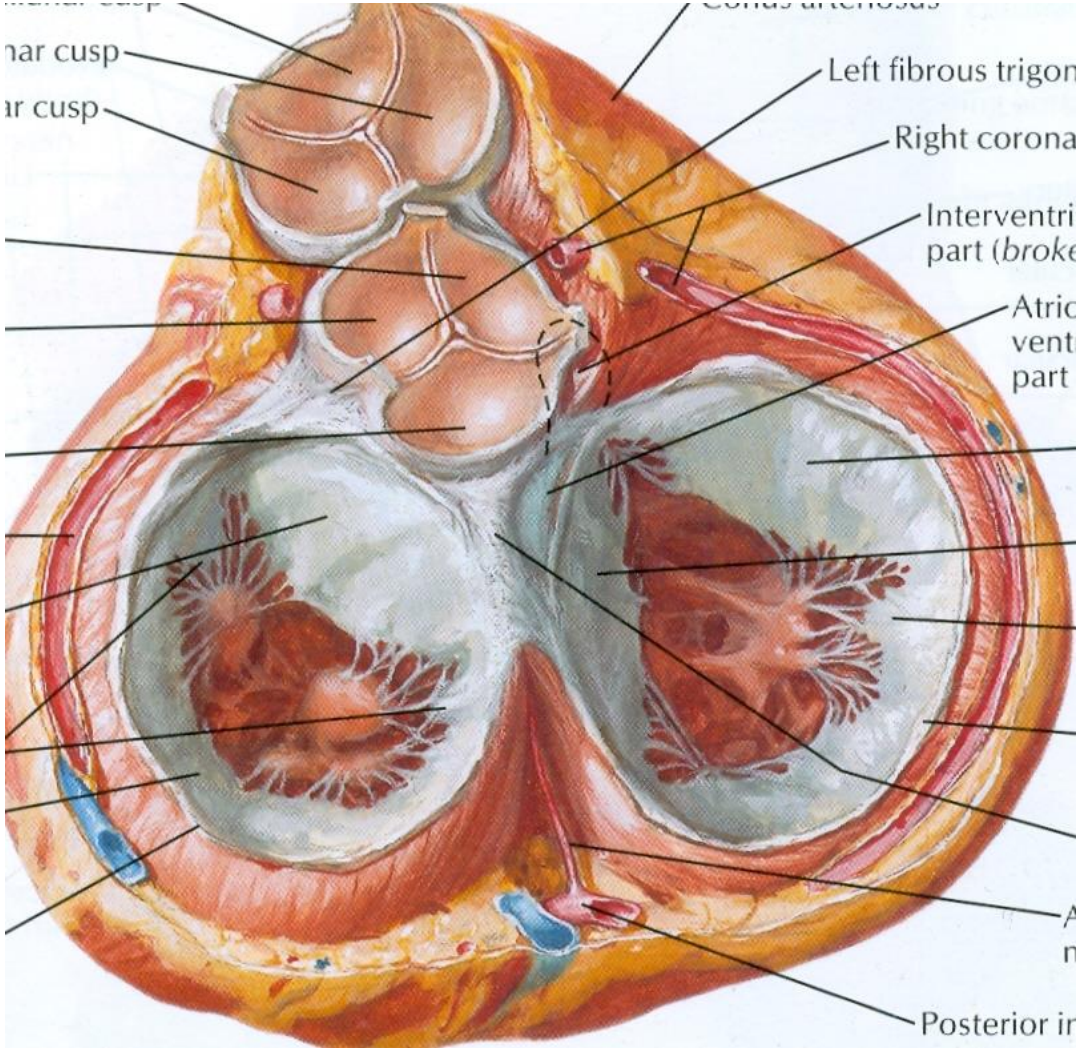
Ventricular systole (contraction of the ventricles).
Closed: Atrioventricular valves. *Open:* Semilunar valves.

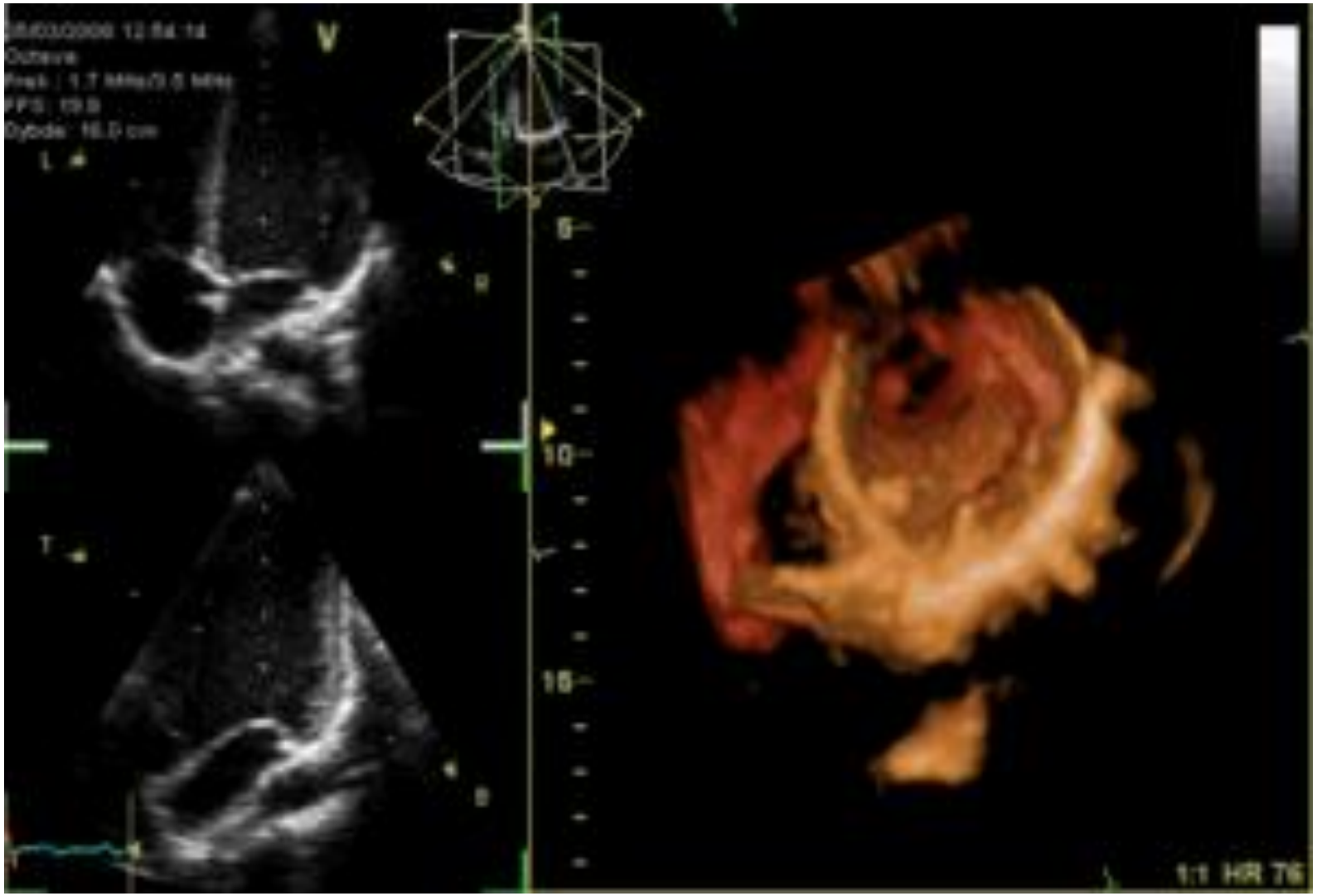


Heart valves
systole - diastole

The typical "lub-dub" sound of the heart causes alternating phases of contraction (systole) and expansion (diastole).






Octave
5
10
15
1:1 HR 76

Myocardium

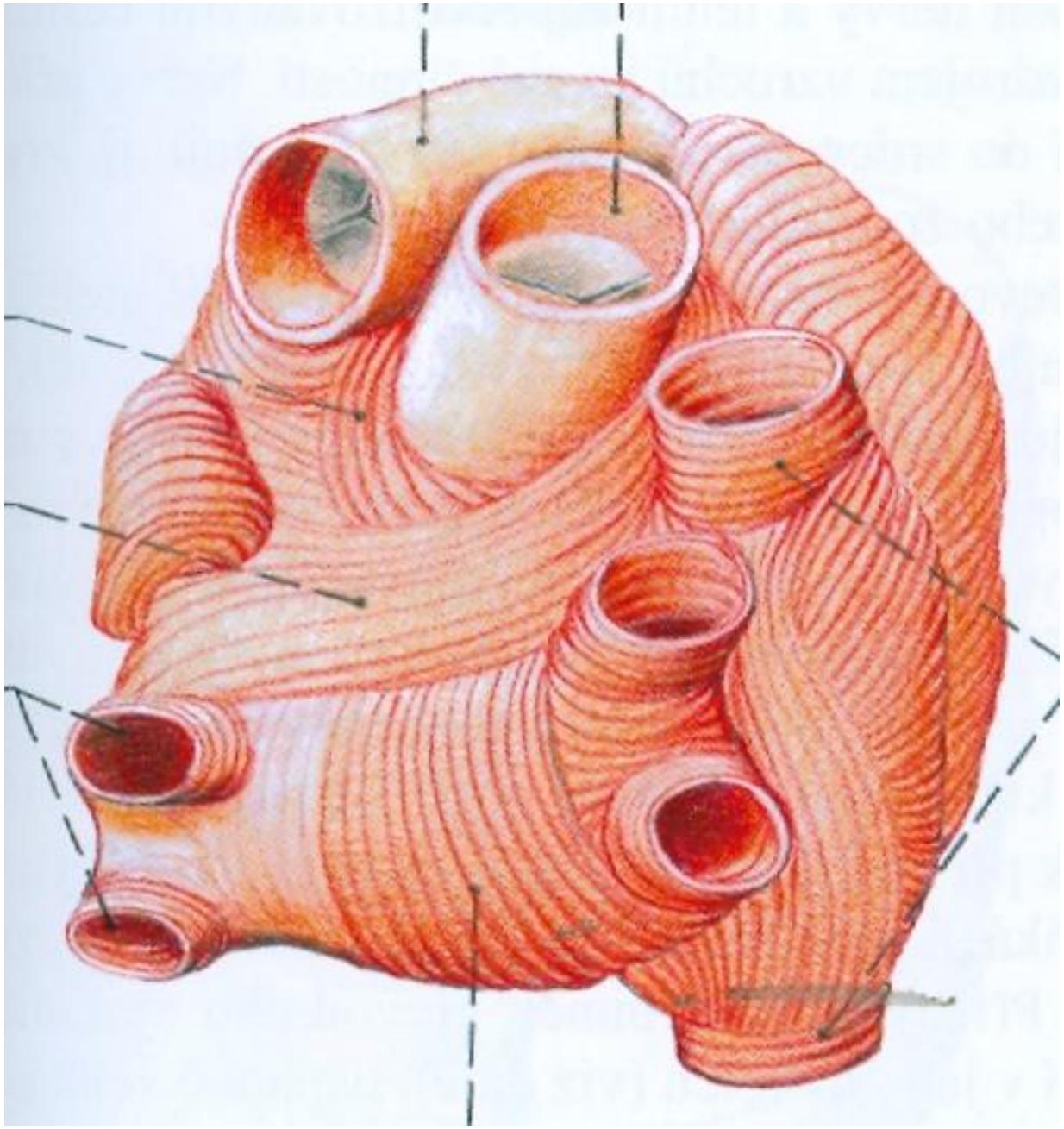
- The main component of the heart wall
- A. working myocardium (contraction of the heart chambers)- Myocardium of the atria and ventricles- separated by the cardiac skeleton
- B. conductive myocardium (cardiac conduction system)

Myocardium of atrium
2 layers

Superficial layer: transverse fibres across both atria, fasciculus interauricularis horizontalis / verticalis

Deep layer: for each atrium separately, arches beginning and ending at anulus fibrosus dx et sin,

Circles, in the right atrium: around the crista terminalis-fasciculus terminalis, in the veins- fasc. intervenosus and in the atrial septum- fasc. Limbicus superior et inferior. the deepest layer forms mm. pectinati

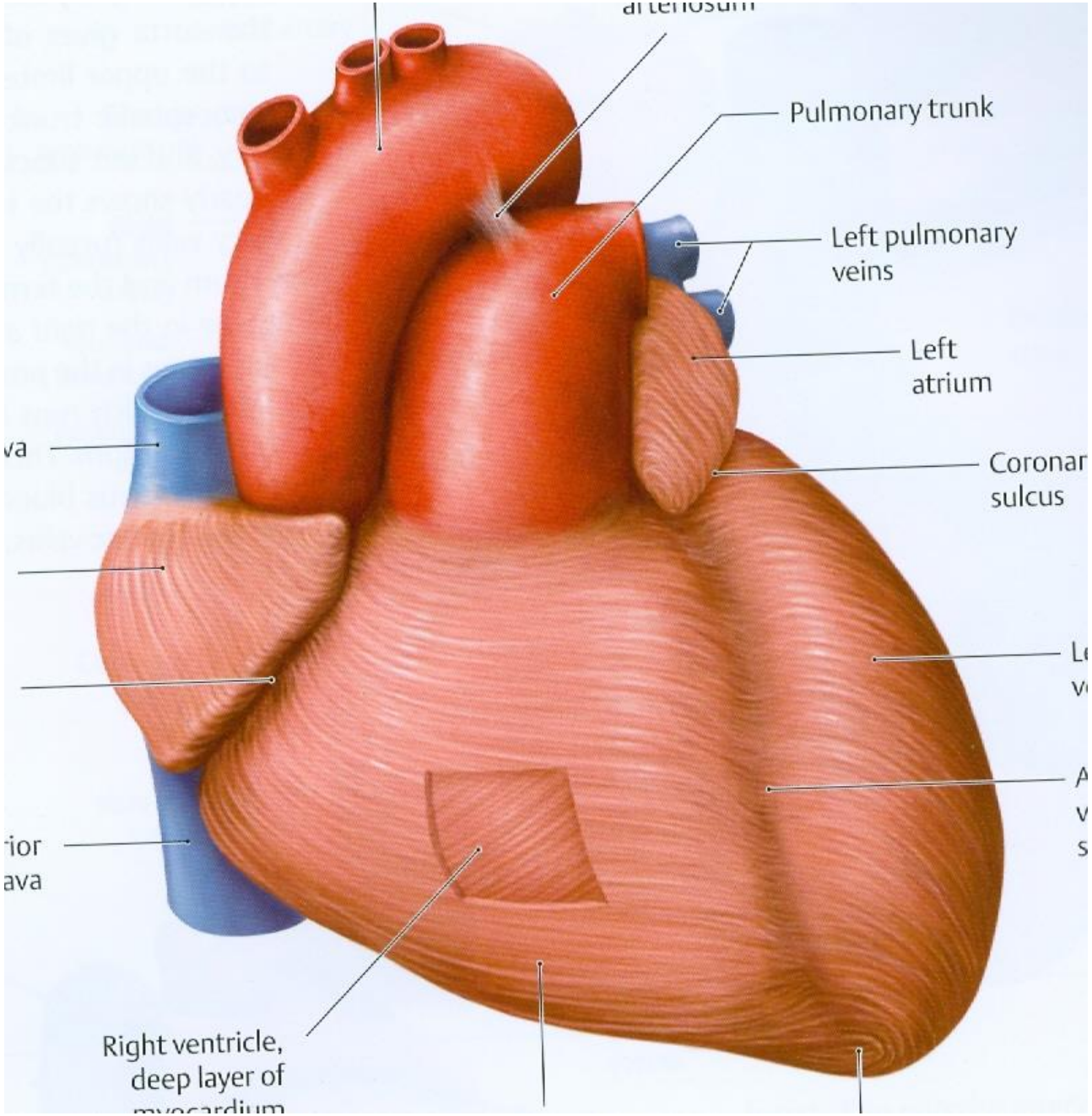


Myocardial ventricles (thicker)
3 layers

Superficial layer: spirals from the fibrous skeleton descending leftward to the apex - vortex cordis, then merging with the deep layer

Middle layer: oriented circularly, for each ventricle separately, consists of interventricular septum

Deep layer: longitudinal ('reticular'), forming mm. papillares and trabeculae carneae



Myocardium

Atrium dextrum –

2 mm

Atrium sinistrum –

3 mm

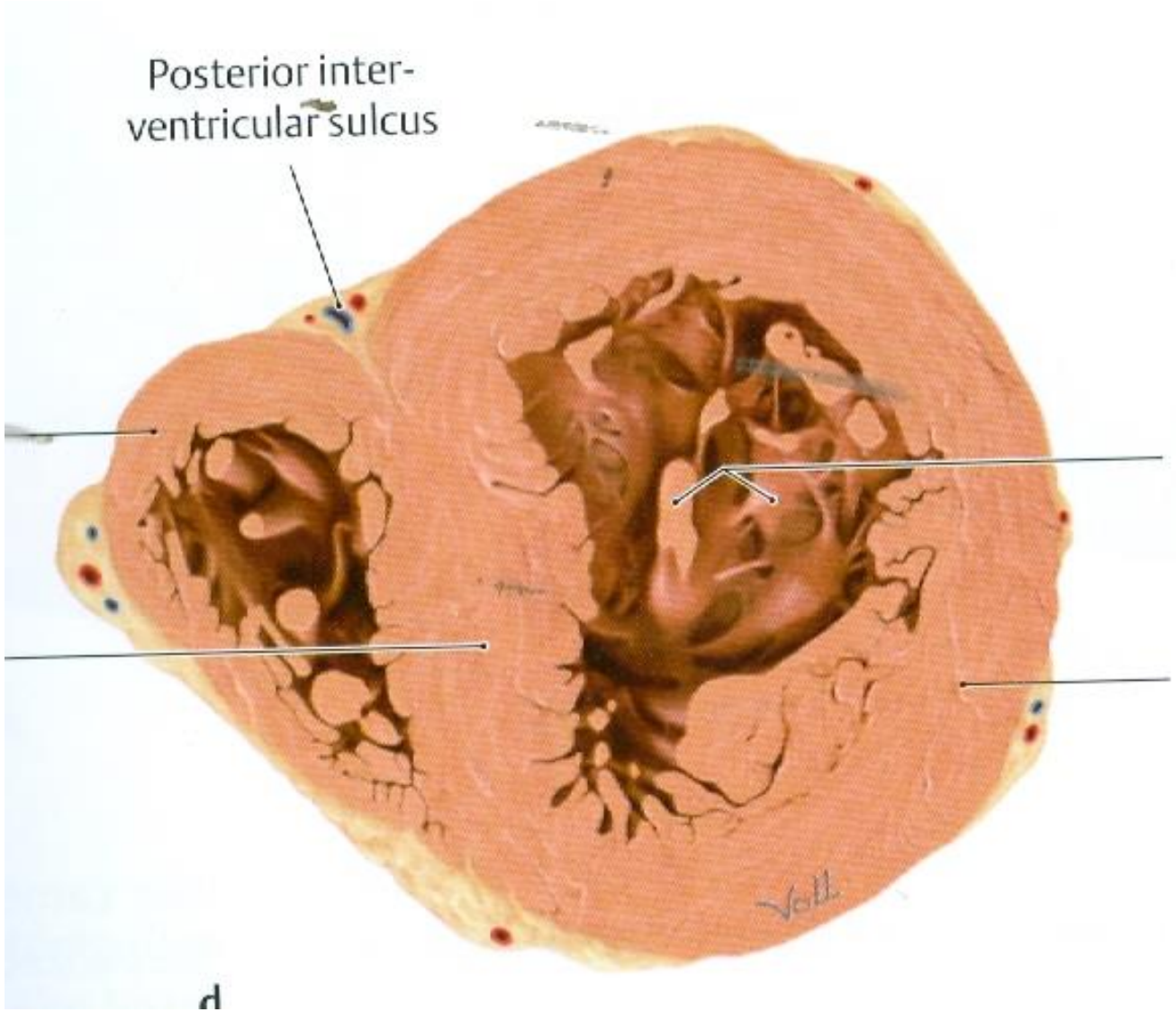
Ventriculus dexter –

3 – 5 mm

Ventriculus sinister –

8 - 12 mm:

(3 times stronger than the muscle of the right ventricle)



B) Systema conducens cordis – apparatus stimulans
Conduction system - excitomotor apparatus:

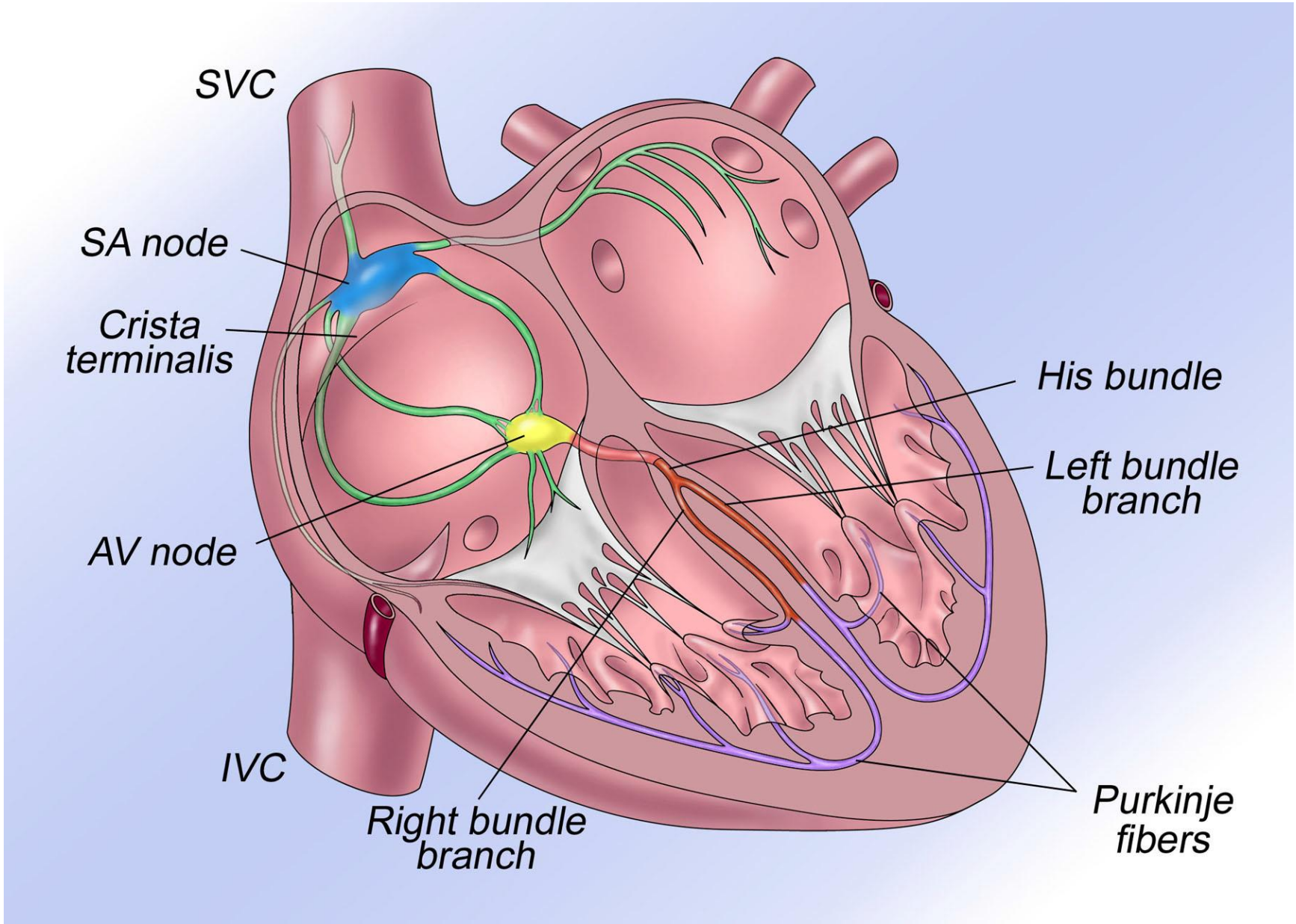
made up of a special type of myocardium, the cells have the ability to generate and conduct automatic rhythmic impulses that stimulate muscle contractions. It initiates and coordinates contraction.

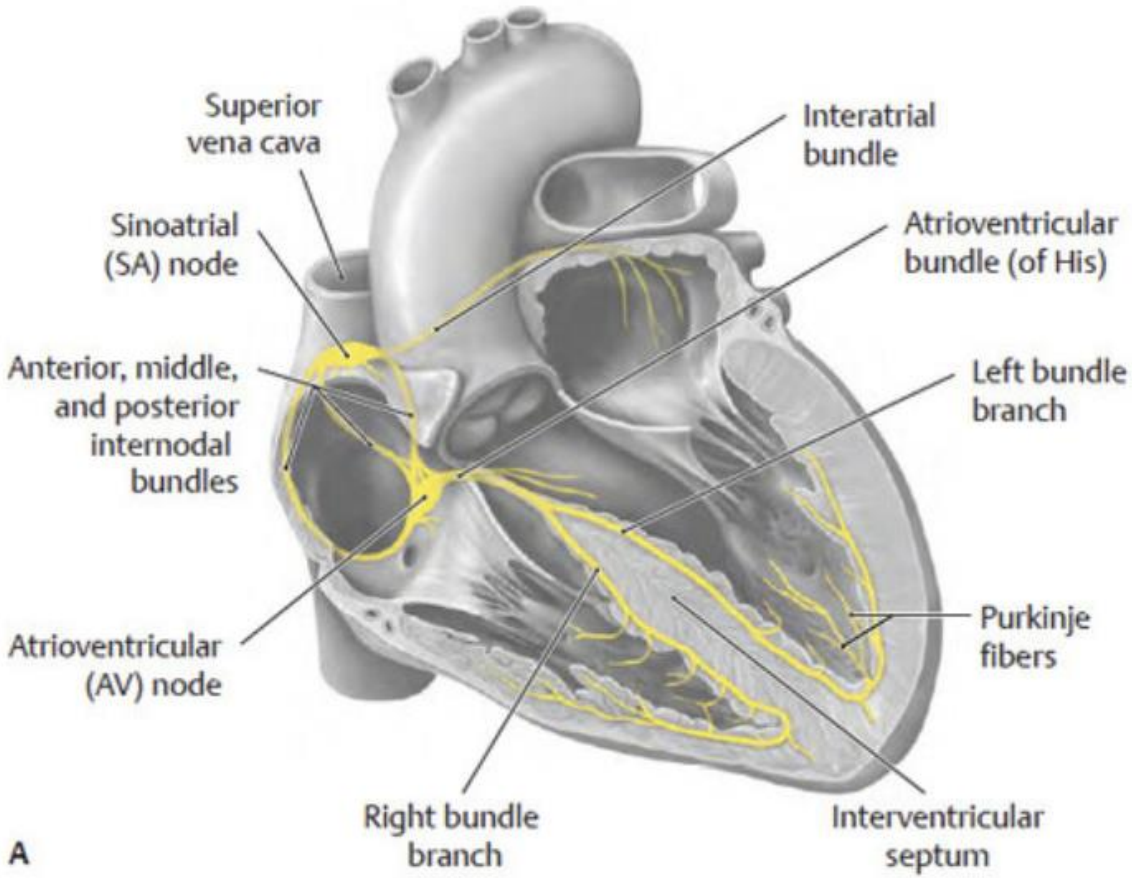
- **Nodus sinuatrialis (Keith-Flack): 10-20x3x1 mm, located transversely under the epicardial wall of the right atrium in front of the SVC orifice, sinus rhythm 70/min. It is the so-called primary pacemaker.**
- **Internodal connections (anterior, middle, posterior), interatrial connections**
- **Nodus atrioventricularis (Aschoff-Tawara): located sagittally under the endocardium in the wall of the right atrium about 1 cm in front of the ostium of sinus coronarius over the septal cusp of the tricuspid valve. 7-8x3x1 mm, rhythm 40-60/min.**
- **Fasciculus atrioventricularis, Bundle of His, is a direct continuation of the atrioventricular node, follows along the lower border of the membranous part of the interventricular septum, penetrates through the fibrous skeleton (through the trigonum fibrosum dextrum) into the interventricular septum.**

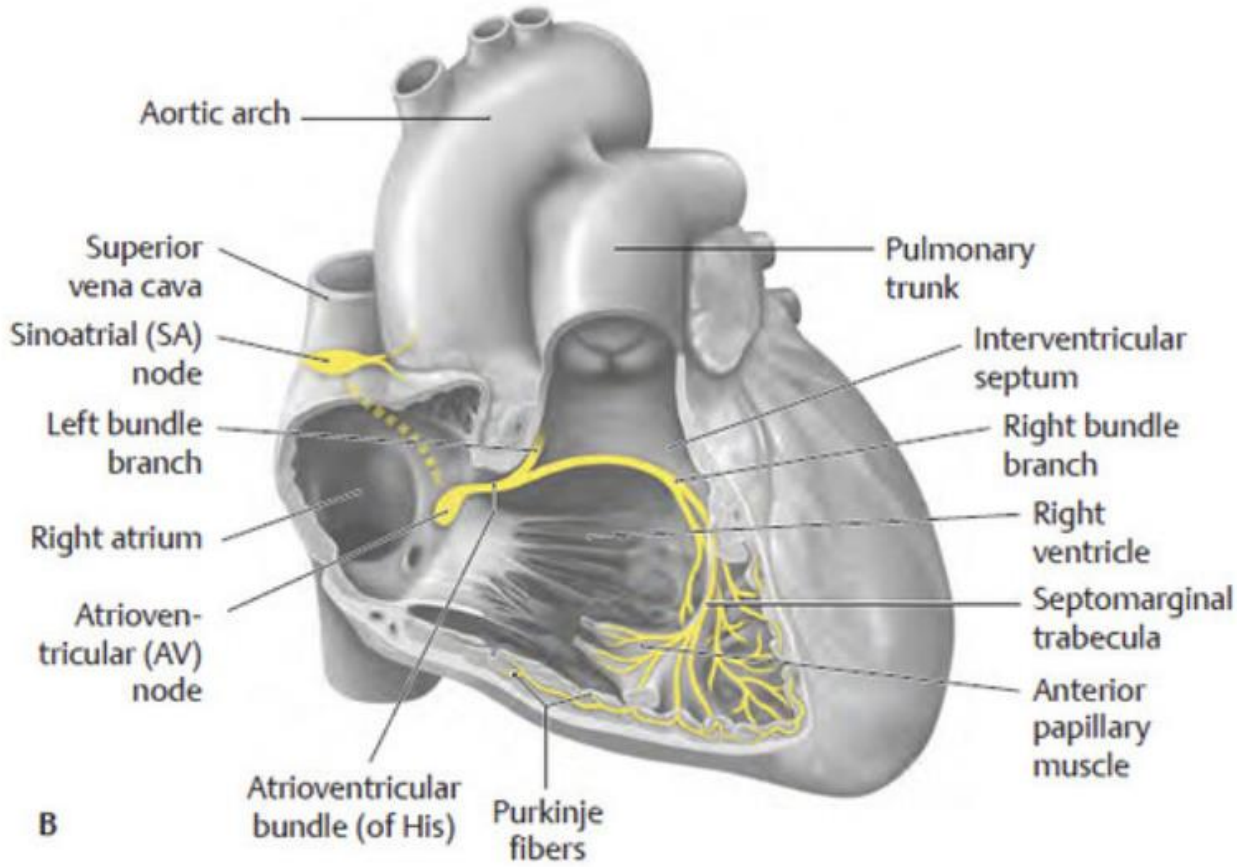
  crus dextrum (right bundle branch) leads the excitation to the myocardium of the right ventricle (trabecula septomarginalis (moderator band)- muscle bundle from the ventricular septum to the base of the anterior papillary muscle)

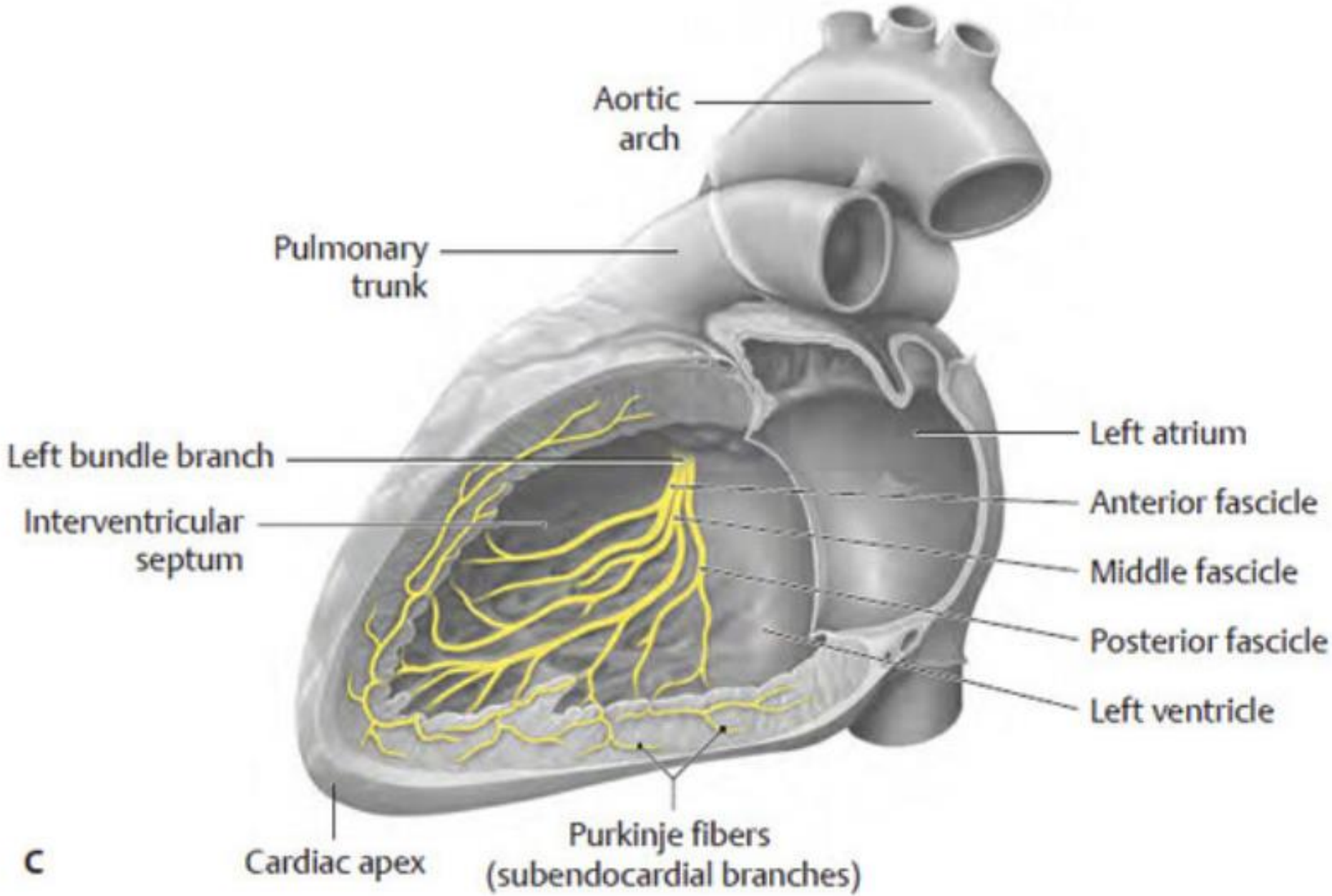
  crus sinistrum (left bundle branch) leads the excitation to the interventricular septum and left ventricular myocardium (apex cordis)
- **Rami subendocardiales (Purkinje fibers) distributes the excitation to the working myocardium of the ventricles.**
- **Automatic ventricular myocardial activity: 20-40/min.**

Conduction system - excitomotor apparatus




Superior vena cava
Interatrial bundle
Sinoatrial (SA) node
Atrioventricular bundle (of His)
Anterior, middle, and posterior internodal bundles
Left bundle branch
Purkinje fibers
Atrioventricular (AV) node
Right bundle branch
Interventricular septum
A

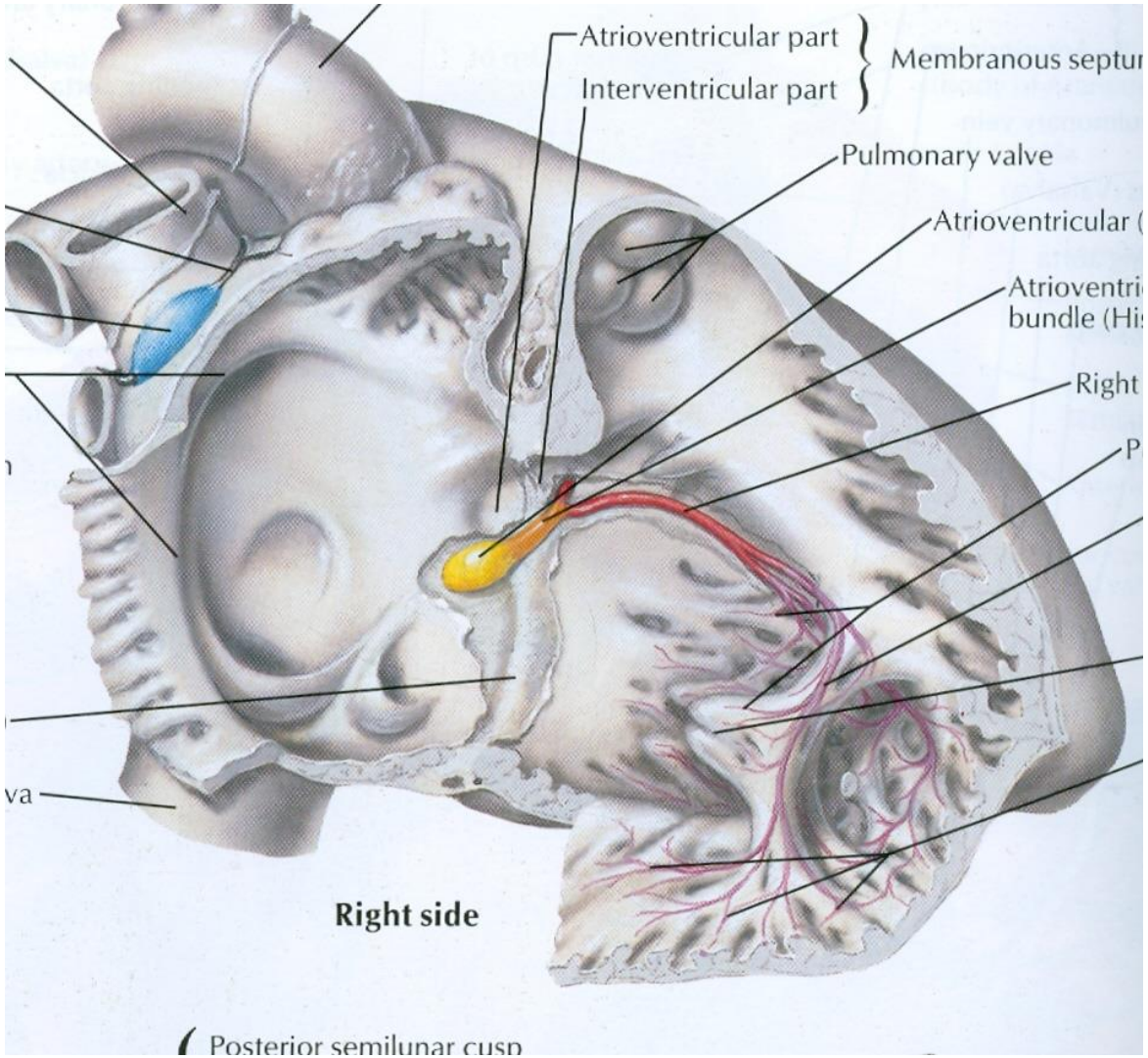

Aortic arch
Pulmonary trunk
Superior vena cava
Interventricular septum
Sinoatrial (SA) node
Right bundle branch
Left bundle branch
Right ventricle
Right atrium
Septomarginal trabecula
Atrioven-tricular (AV) node
Anterior papillary muscle
Atrioventricular bundle (of His)
Purkinje fibers
B

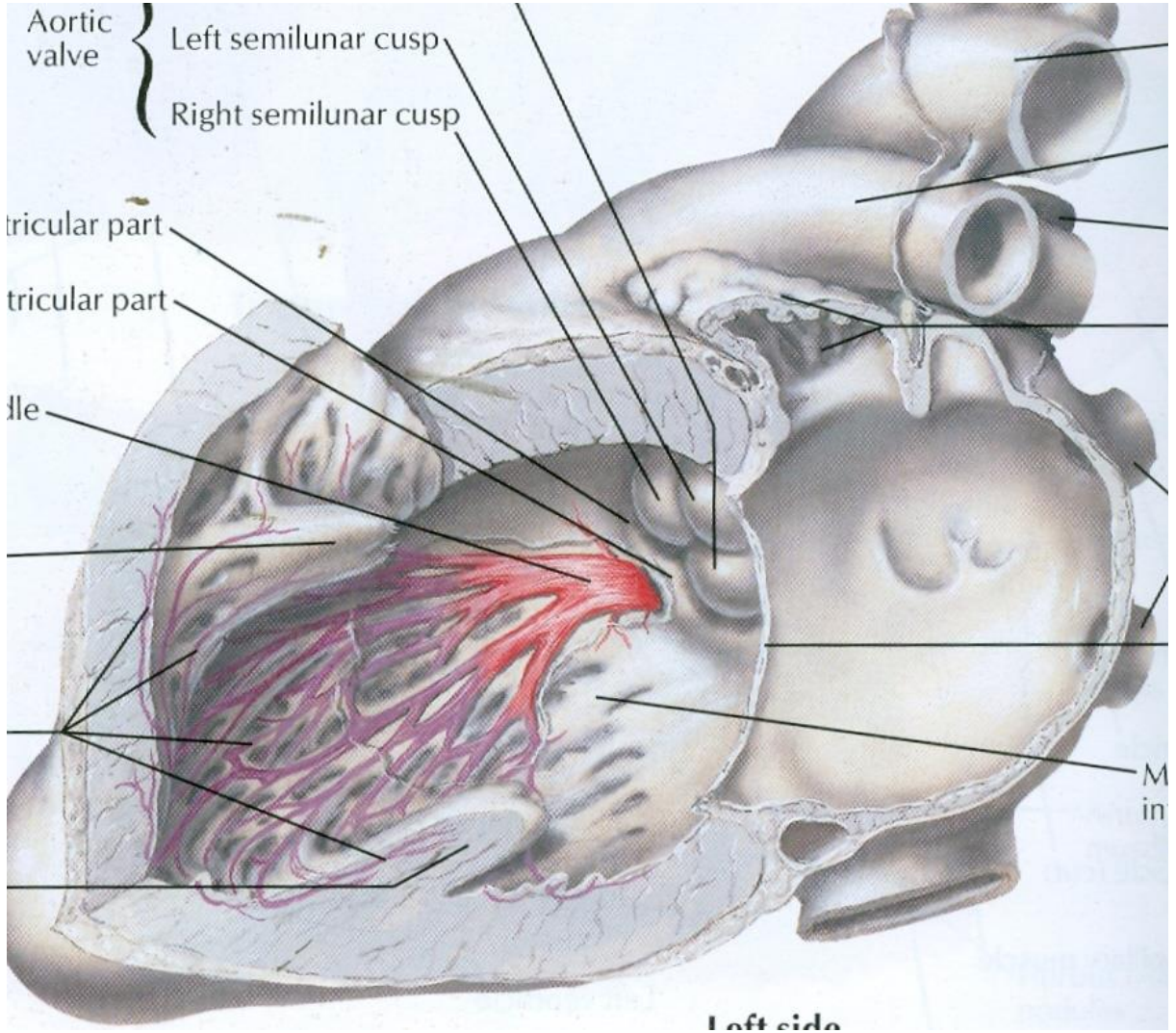

Aortic arch
Pulmonary trunk
Left bundle branch
Interventricular septum
Left atrium
Anterior fascicle
Middle fascicle
Posterior fascicle
Left ventricle
Cardiac apex
Purkinje fibers (subendocardial branches)
C

Systema conducens cordis

The SA node is in 60% of cases supplied by the branches of a. coronaria dextra

The AV node is in 90% of cases supplied by the branches of a. coronaria dextra





Triangle of Koch

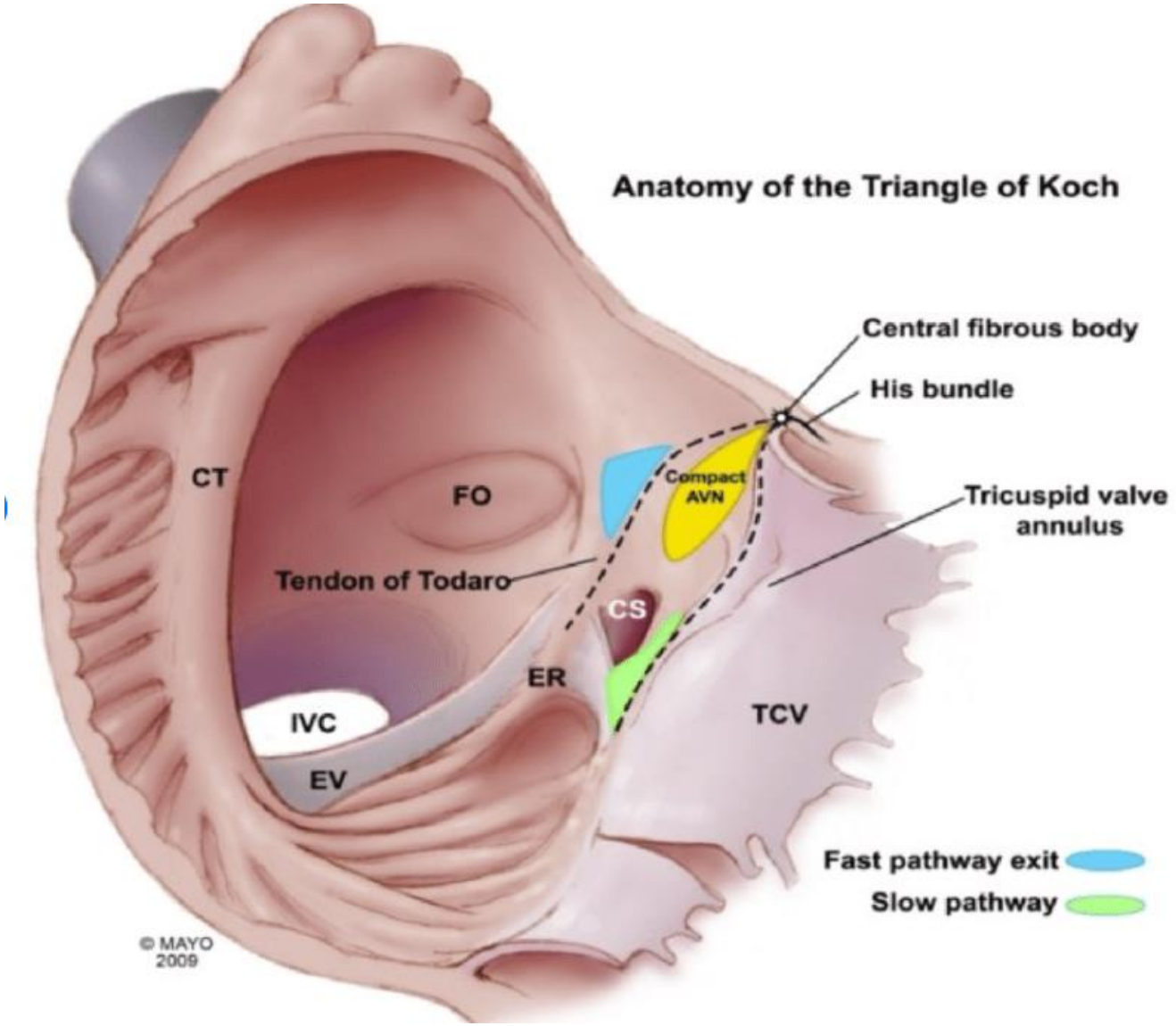
Below the endocardium of Koch's triangle is located the nodus atrioventricularis

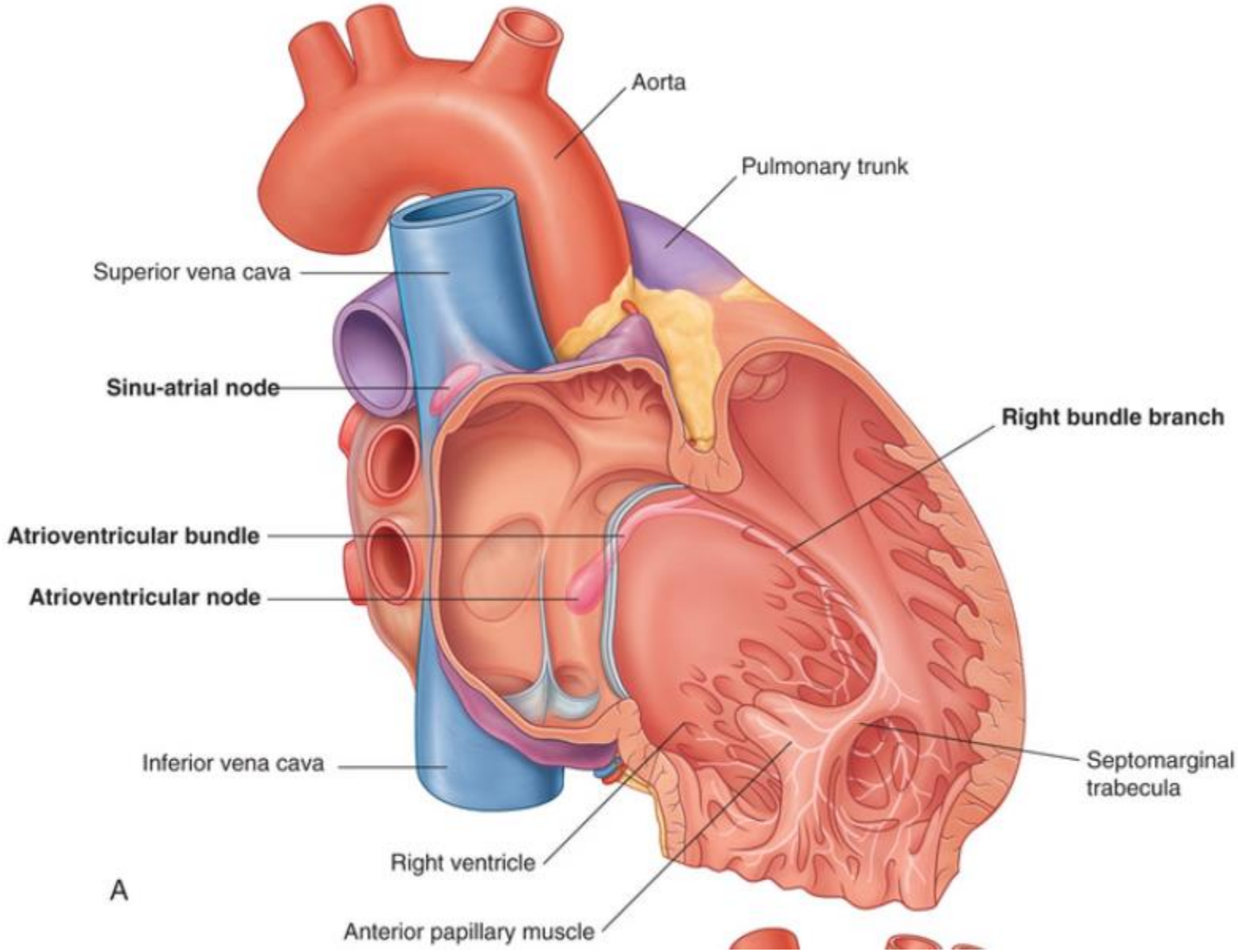
Defined by three anatomical borders:

Inferior border: the base of the septal tip of the tricuspid valve.

Superior border: Tendon of Todaro,

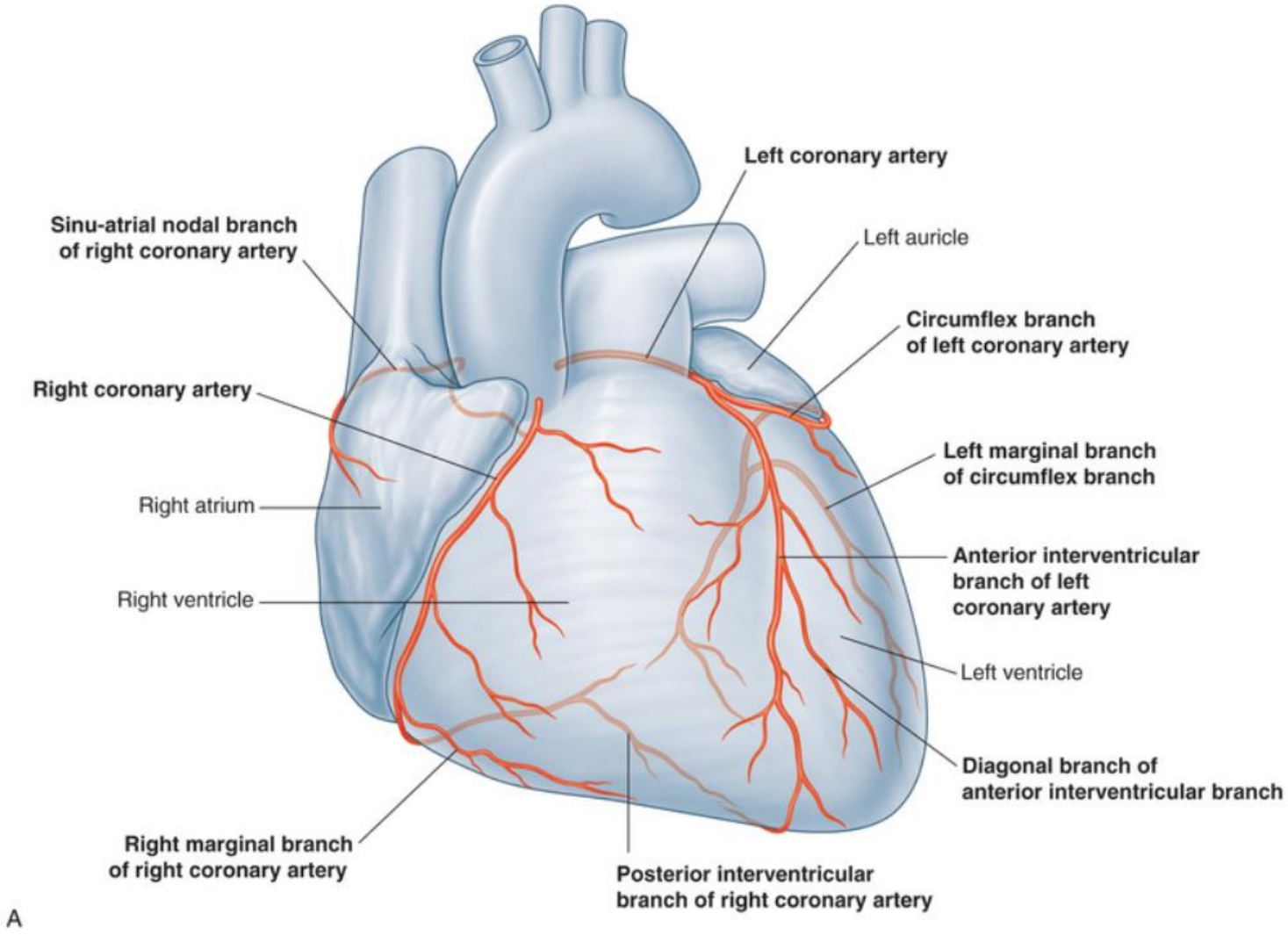
Posterior border: Ostium of the Coronary Sinus

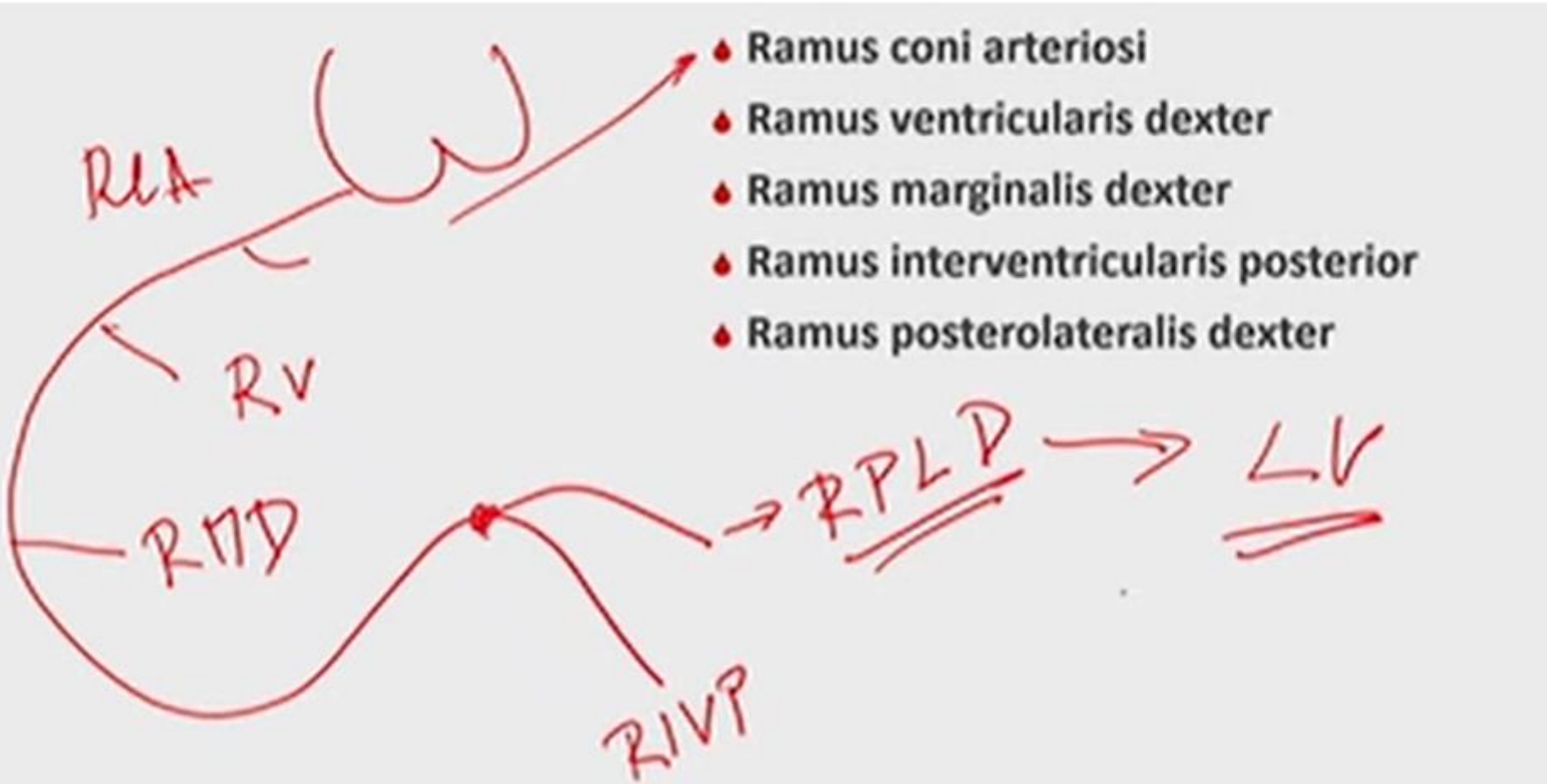



Aorta
Pulmonary trunk
Superior vena cava
Sinu-atrial node
Right bundle branch
Atrioventricular bundle
Atrioventricular node
Inferior vena cava
Septomarginal trabecula
Right ventricle
A
Anterior papillary muscle

Right coronary artery (RCA) originates from the right aortic sinus of the ascending aorta

- Conus branch
- Atrial branch (gives
- Branch to SA node)
- Right ventricular a.
- Right marginal a.
- Posterior interventricular branch (posterior descending)
- Branch to AV node
- Right posterolateral a. (it supply the Left ventricle!!)





- Ramus coni arteriosi
- Ramus ventricularis dexter
- Ramus marginalis dexter
- Ramus interventricularis posterior
- Ramus posterolateralis dexter

A. CORONARIA DEXTRA

Left coronary artery (LCA) originates from the left aortic sinus of the ascending aorta

Stem (Left main – LM)

1. Anterior interventricular branch (left anterior descending) (LAD)

Conus branch

Interventricular septal branches

Lateral branch (Diagonal branches 1-3)

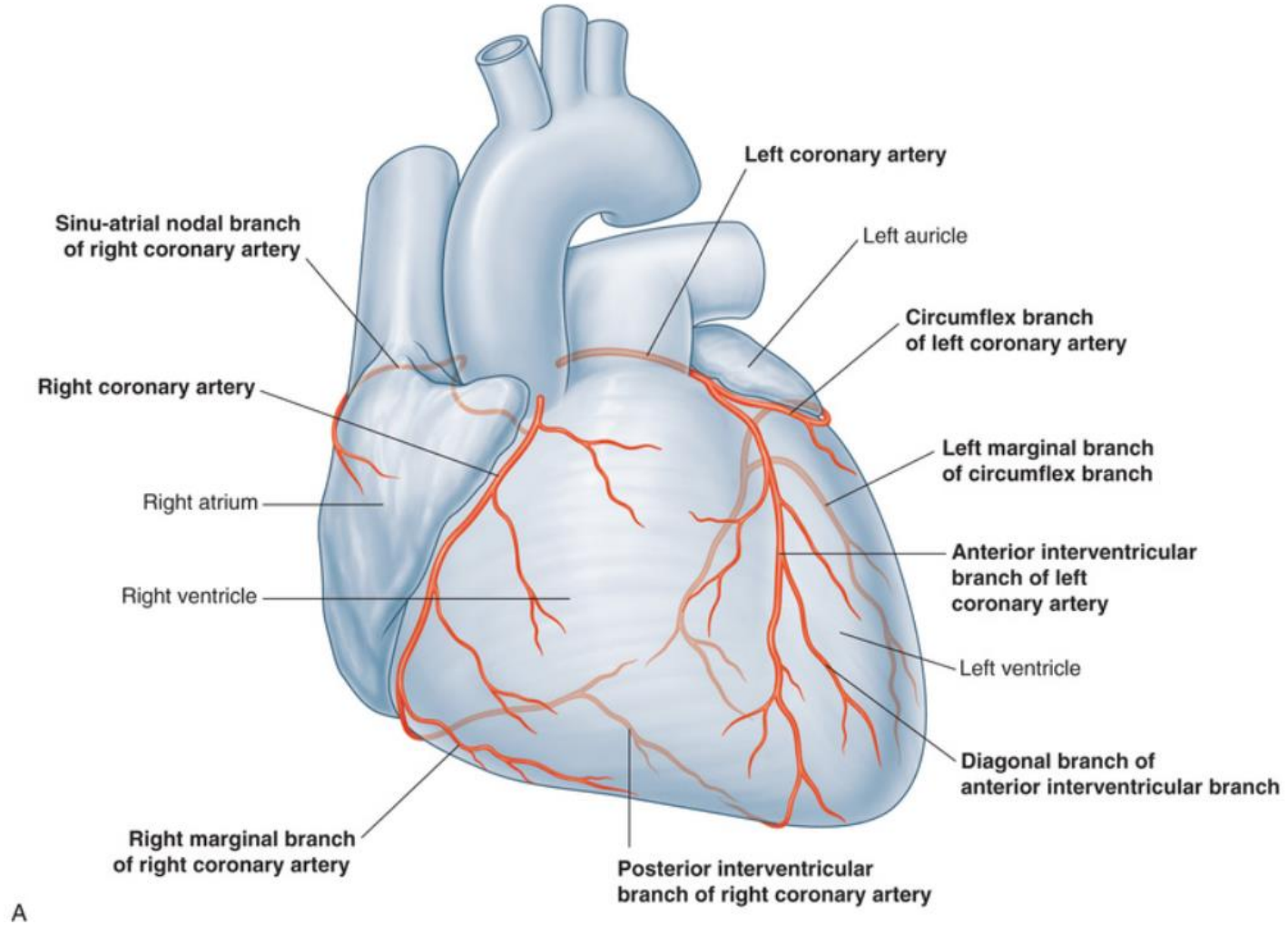
2. Circumflex branch (CX)

Atrial branch

Left marginal a.

Posterior left ventricular branch

Left posterolateral a.



- stem
- Ramus interventricularis anterior
- Ramus septalis
- Rami diagonales
- Ramus circumflexus
- Rami marginales
- Ramus posterolateralis sinister

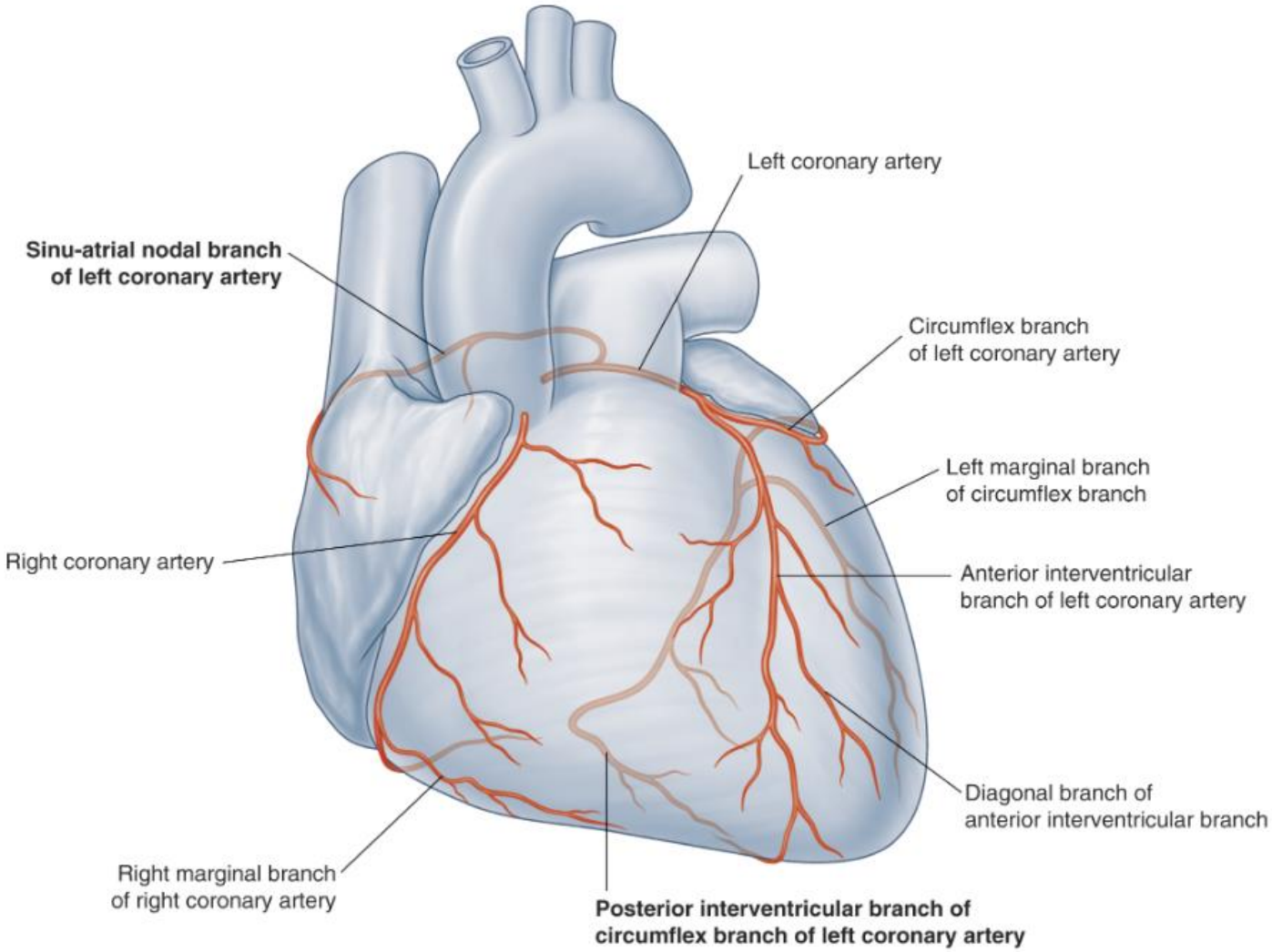
A. CORONARIA SINISTRA

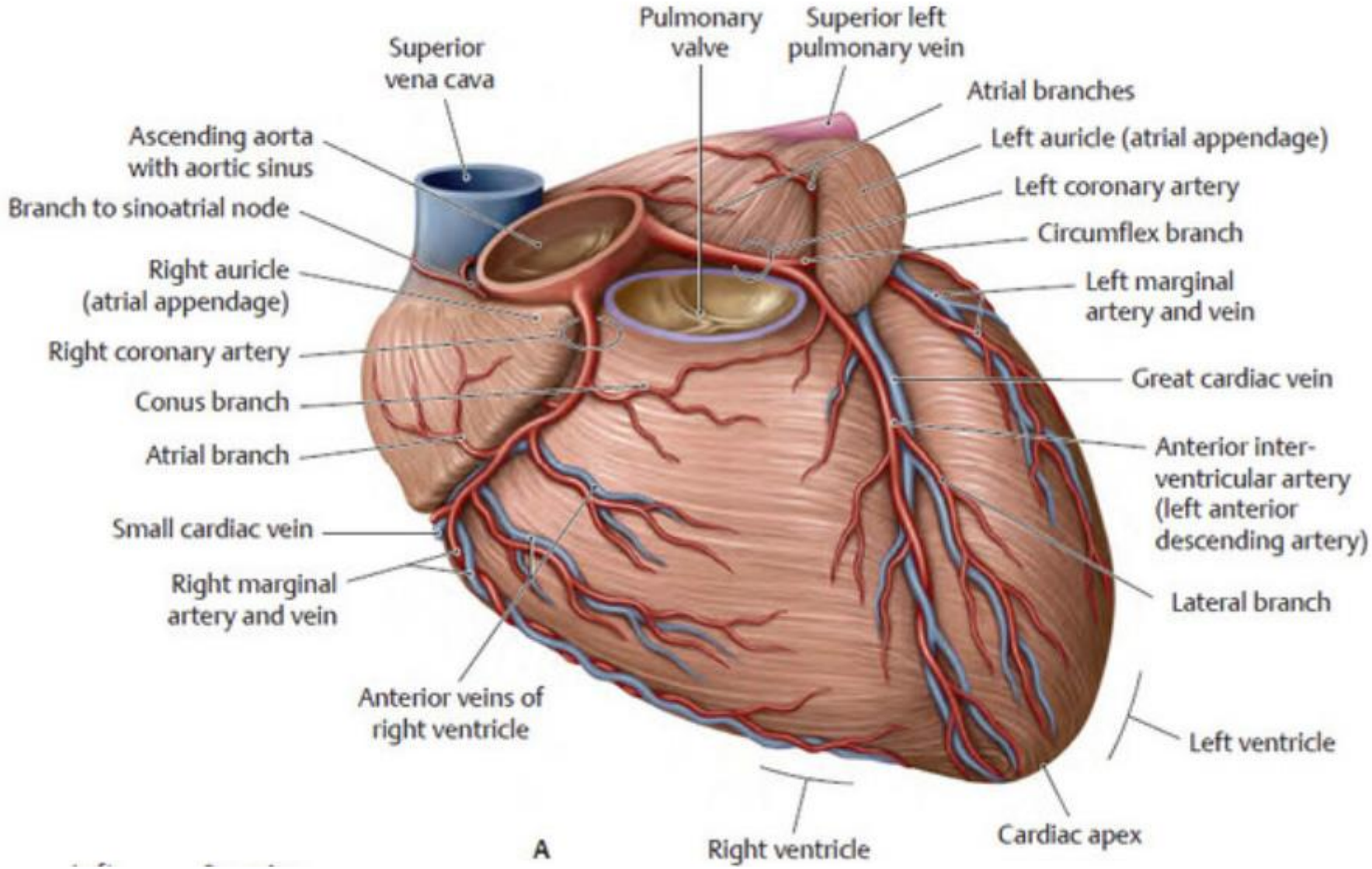
Variations in the distribution patterns of coronary arterie

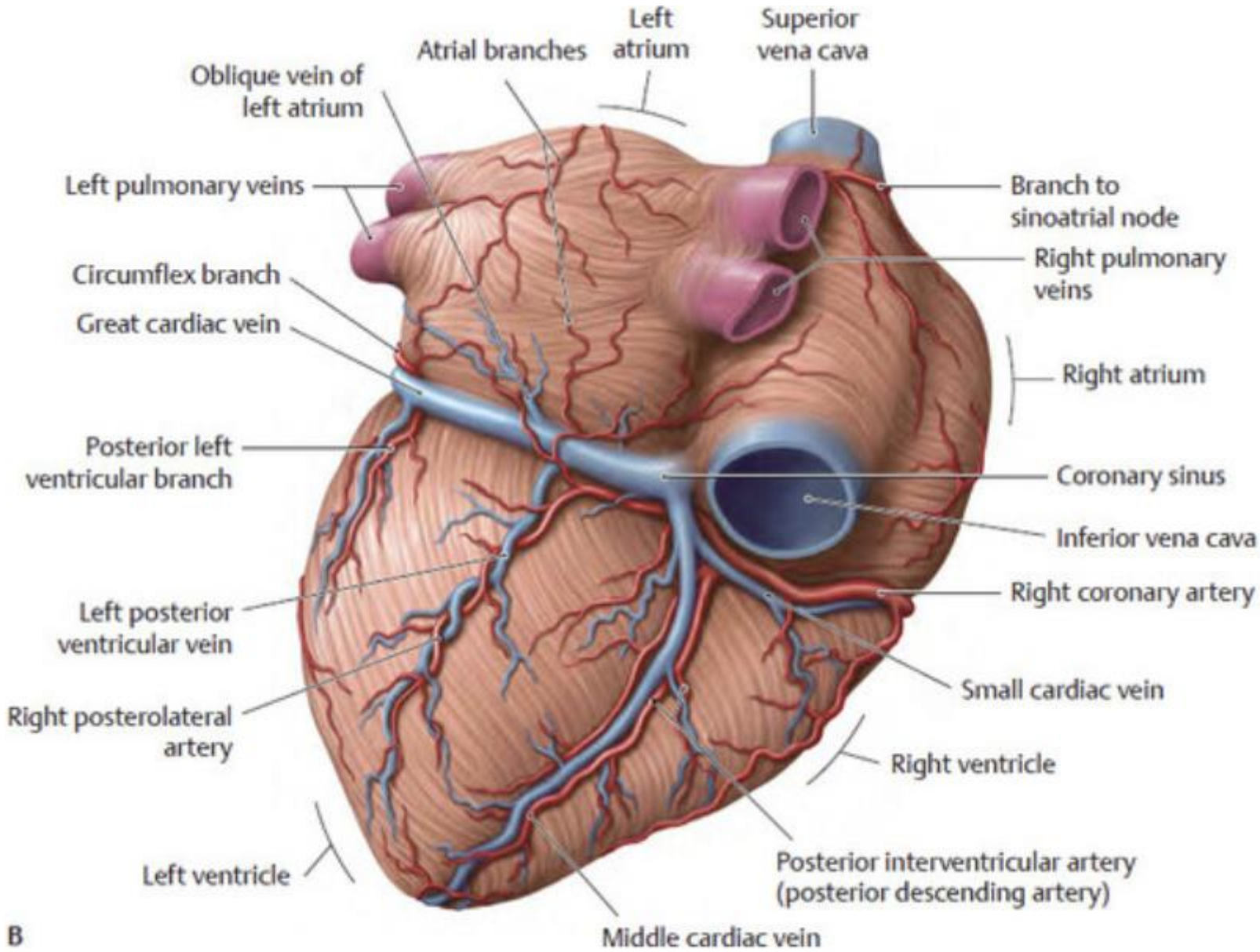
Right dominant coronary artery is The most common. This means that the posterior interventricular branch arises from the right coronary artery. The right coronary artery therefore supplies a large portion of the posterior wall of the left ventricle and the circumflex branch of the left coronary artery is relatively small.

- In contrast, in hearts with a left dominant coronary artery, the posterior interventricular branch arises from an enlarged circumflex branch and supplies most of the posterior wall of the left ventrikle.

Another point of variation relates to the arterial supply to the sinu-atrial and atrioventricular nodes.

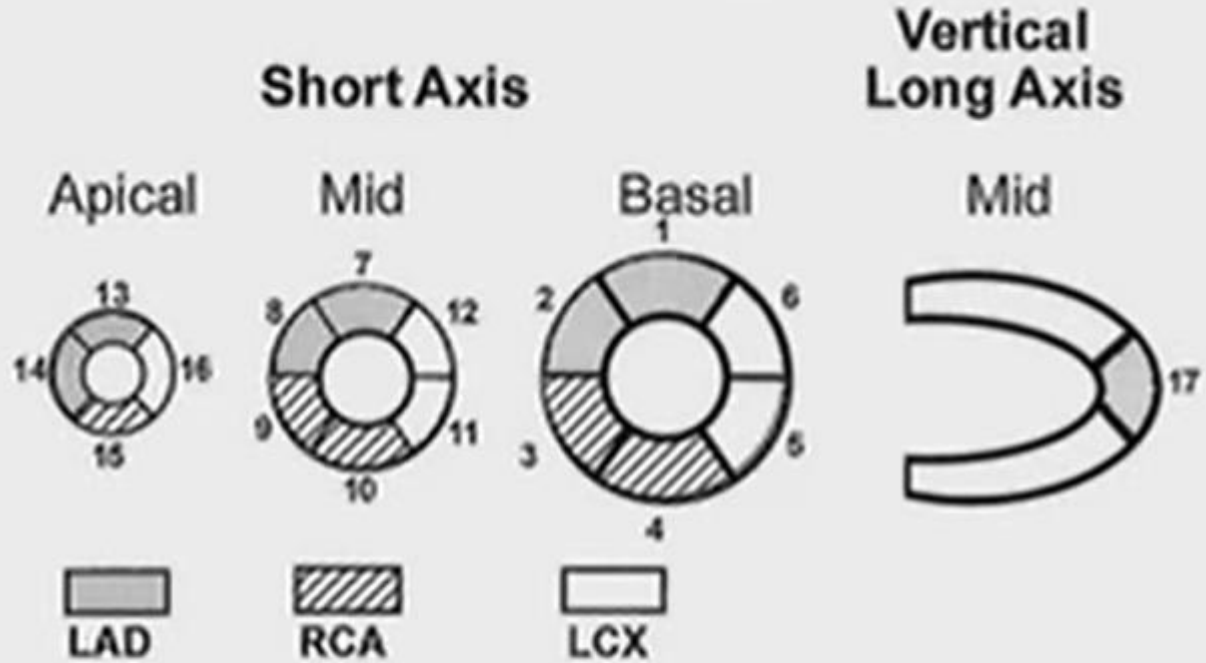


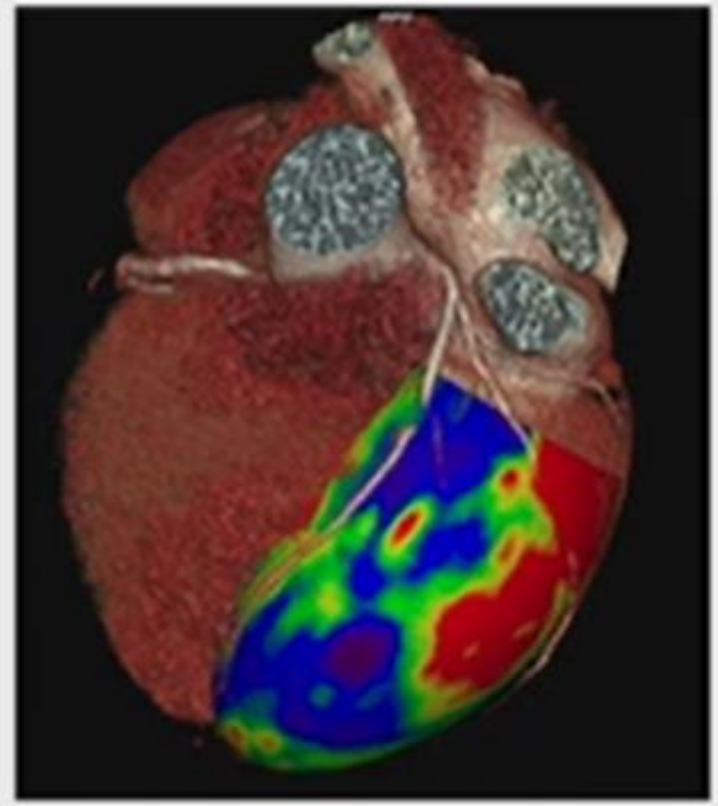

Pulmonary valve
Superior left pulmonary vein
Superior vena cava
Atrial branches
Ascending aorta with aortic sinus
Left auricle (atrial appendage)
Branch to sinoatrial node
Left coronary artery
Circumflex branch
Right auricle (atrial appendage)
Left marginal artery and vein
Right coronary artery
Great cardiac vein
Conus branch
Atrial branch
Anterior inter-ventricular artery (left anterior descending artery)
Small cardiac vein
Right marginal artery and vein
Lateral branch
Anterior veins of right ventricle
Left ventricle
Right ventricle
Cardiac apex
A


Left atrium
Superior vena cava
Atrial branches
Oblique vein of left atrium
Left pulmonary veins
Branch to sinoatrial node
Right pulmonary veins
Circumflex branch
Great cardiac vein
Right atrium
Posterior left ventricular branch
Coronary sinus
Inferior vena cava
Right coronary artery
Left posterior ventricular vein
Small cardiac vein
Right posterolateral artery
Right ventricle
Left ventricle
Posterior interventricular artery (posterior descending artery)
Middle cardiac vein
B

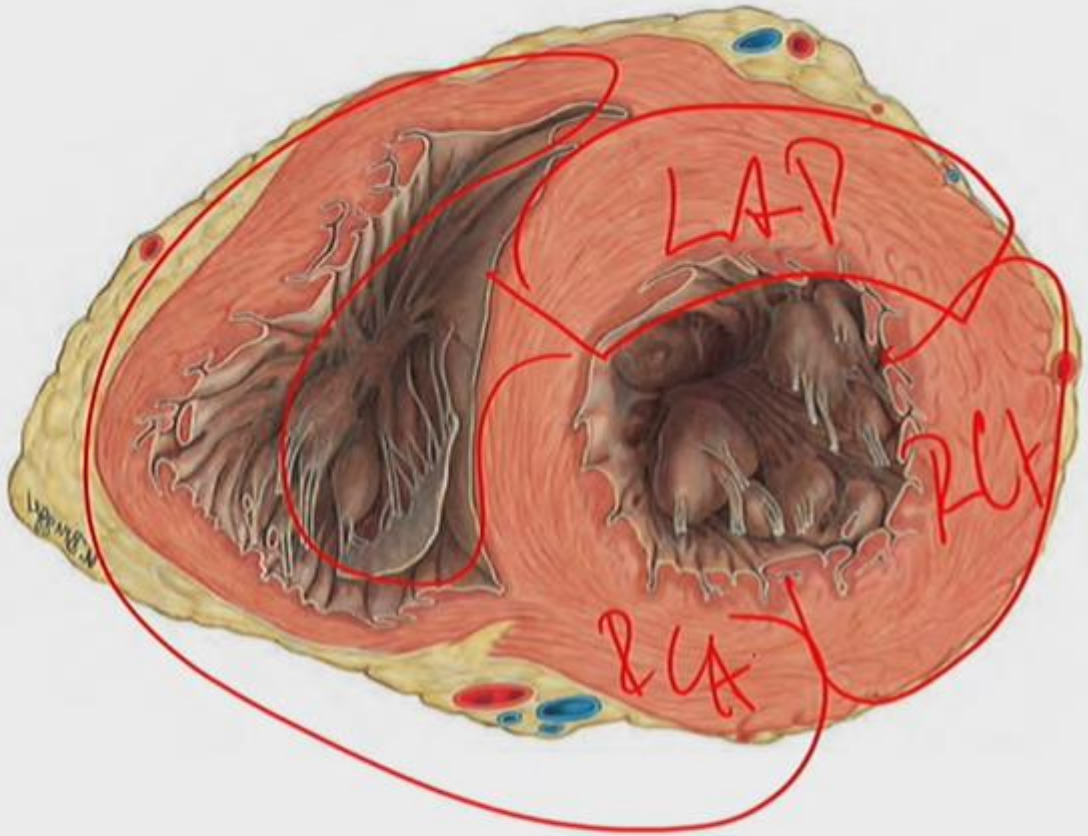
Coronary Artery Territories

- Basic territories

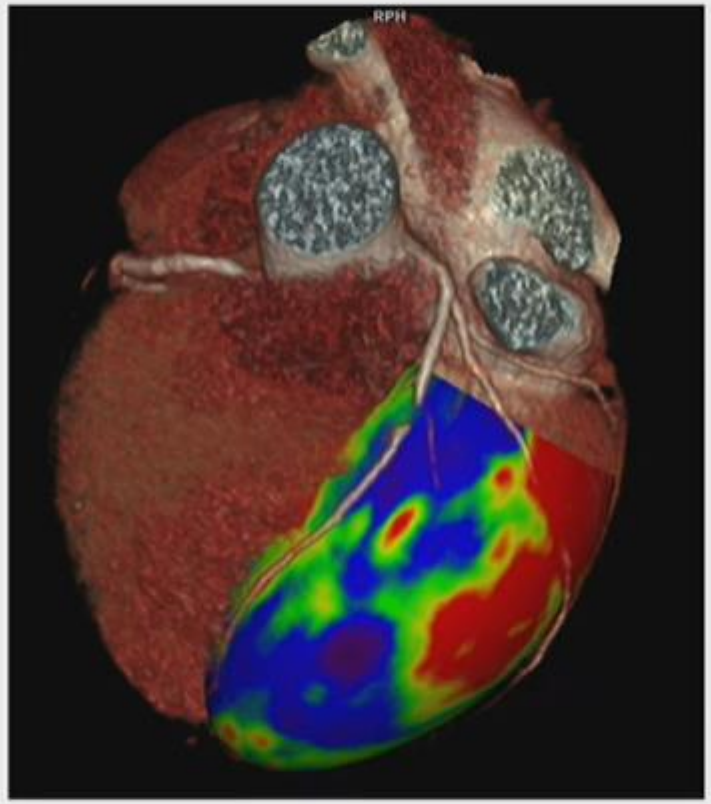




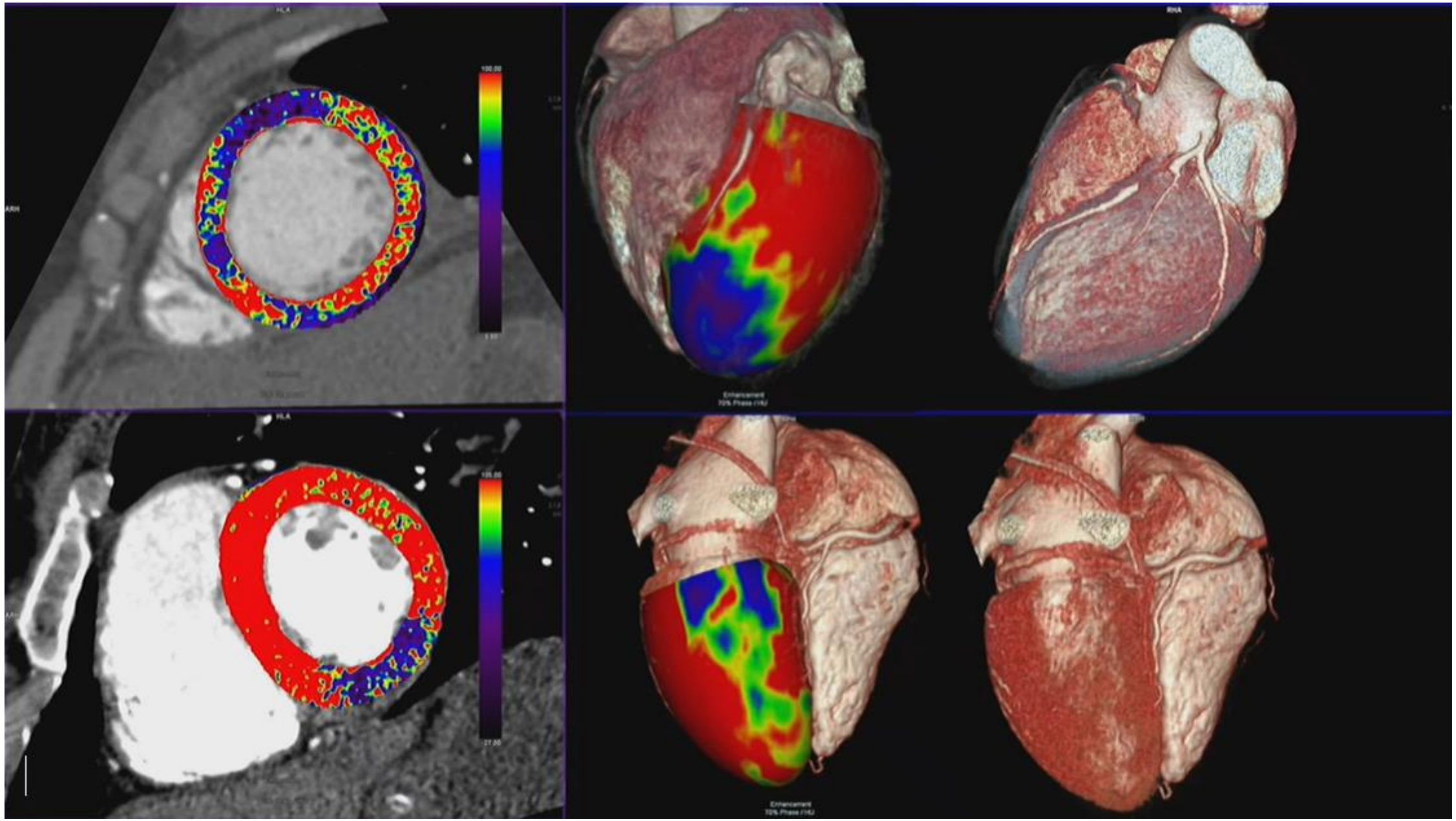
NUTRITIVE TERRITORIES



- Basic territories



NUTRITIVE TERRITORIES



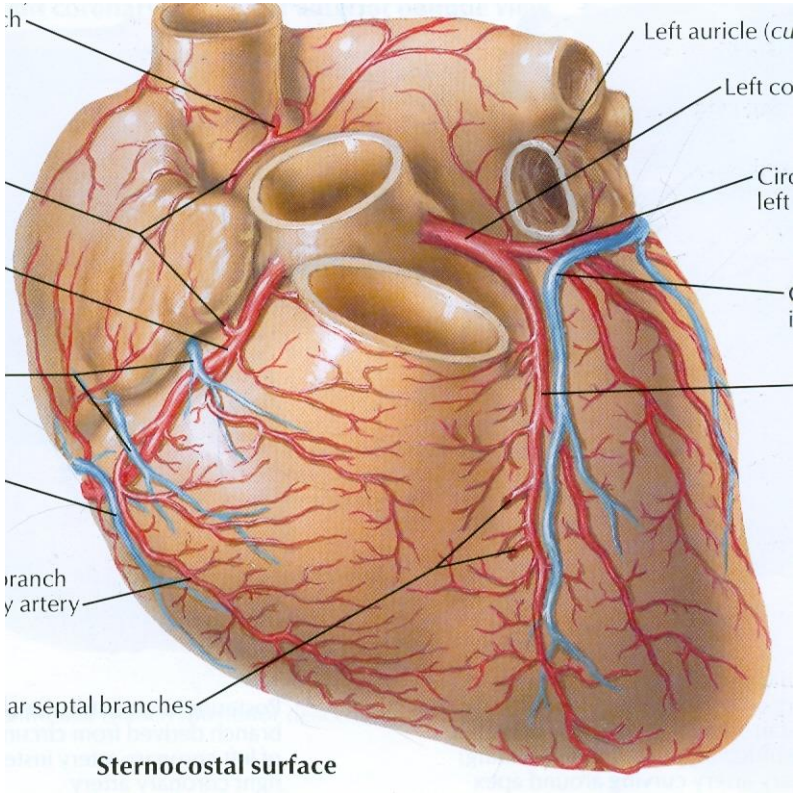
Venae cordis

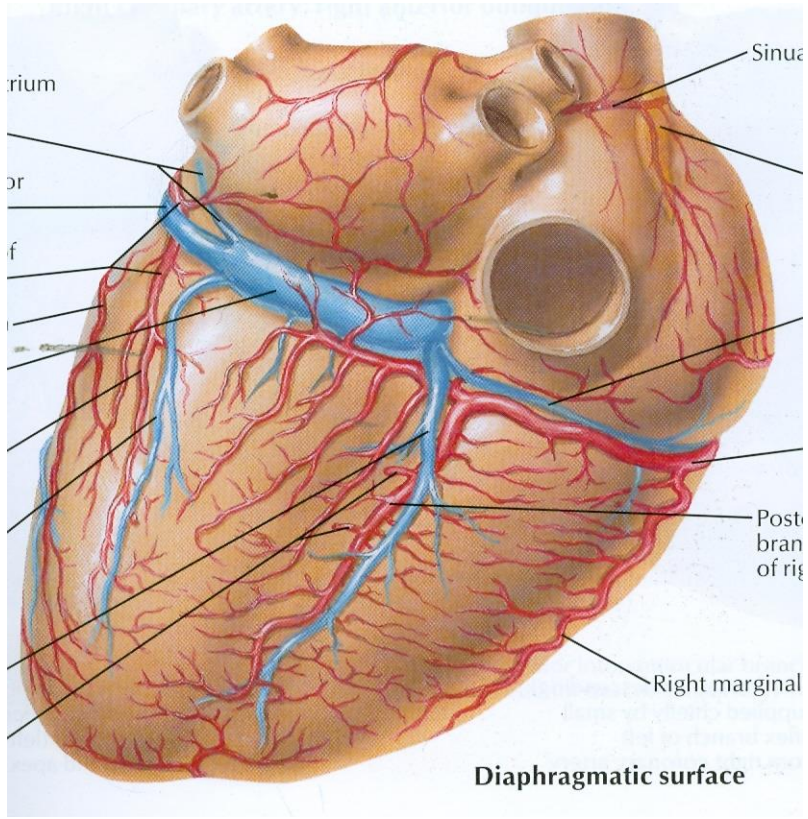
- **Sinus coronarius (60% blood) confluence:**
- **v. cordis magna (Great cardiac vein) (sin.):← v. interventricularis ant., v. marginalis sin., v. obliqua atrii sin. (The vein of Marshall), v. ventriculi sin. post.**

  v. cordis media (middle cardiac vein) - v. interventricularis post.

  v. cordis parva (small cardiac vein) (dx.): v. marginalis dextra, (vv. ventriculi dx. ant.-sometimes!)
- **Vv. ventriculi dextri anteriores (vv. Cordis anteriores) (Anterior cardiac vein) : there are 2 to 4 veins that collect blood from the anterior wall of the right ventricle-open independently into the right atrium (they may drain into the v.cordis parva).**
- **Vv. cordis minimae (Thebesii) (Smallest cardiac vein): opens through separate small orifices (foramina venarum minimarum) into all cardiac chambers – without any major clinical importance!**

Blood vessels of the heart

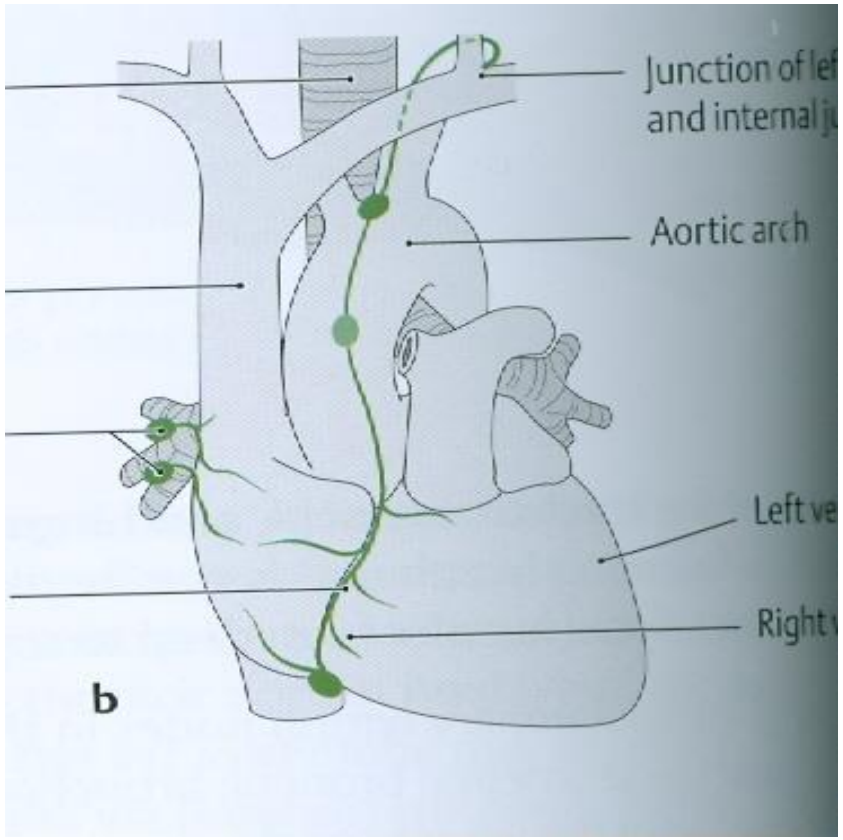


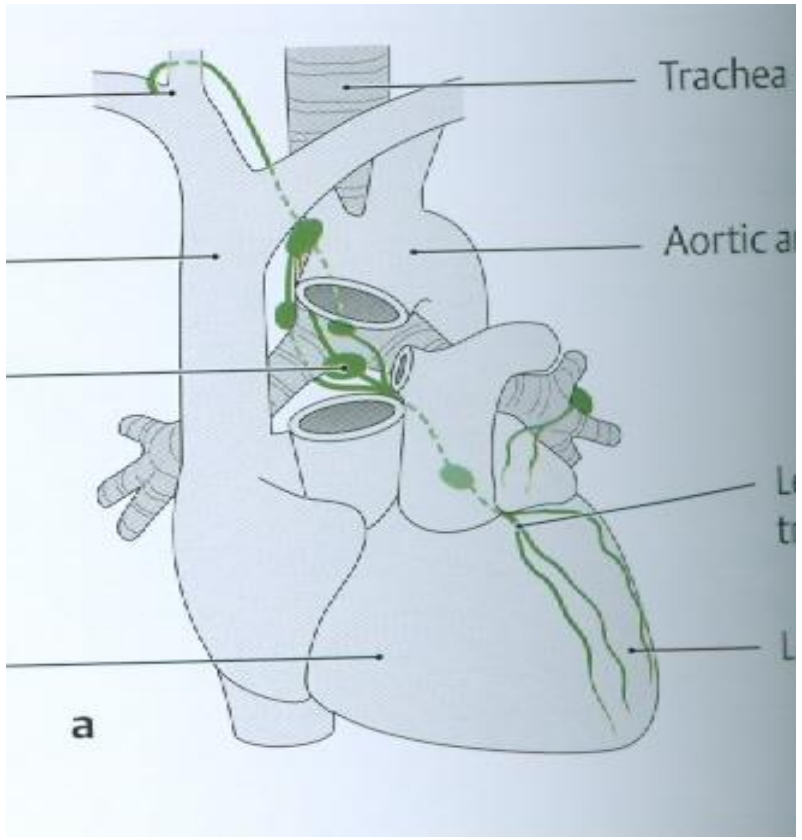


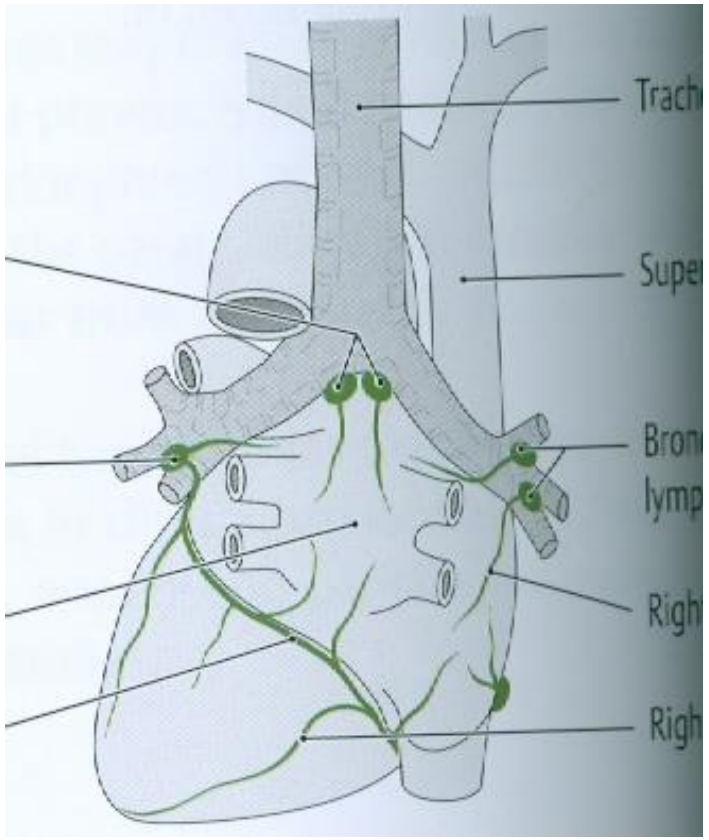
Lymphatic vessels of the heart

- form three lymphatic networks in the heart wall:
- Plexus lymphaticus subepicardialis
  myocardialis
  subendocardialis
- The lymph is drained by two main lymphatic trunks (along the coronary vessels):
- Truncus lymphaticus cordis dexter → sulcus coronarius dx. → *nodus lymphaticus praeaorticus* → *nodi mediastinales anteriores* → brachiocephalic nodes, anterior to the brachiocephalic veins
- Truncus lymphaticus cordis sinister→ sulcus interventricularis ant. → sulcus coronarius sin.→ tracheobronchial nodes, at the inferior end of the trachea

Lymphatic vessels of the heart







Innervation of the heart: autonomic nervous system, which affects the cardiac conduction system and is responsible for regulating:

- heart rate, force of each contraction, and cardiac output. Also change the lumen of the coronary arteries.

Sympathetic and parasympathetic fibres combine in a mixed cardiac plexus. This plexus consists of a superficial part, inferior to the aortic arch and between it and the pulmonary trunk and a deep part, between the aortic arch and the tracheal bifurcation

- Sympathicus
- (tachycardia: increase in heart rate, increases the force of contraction + vasodilation of the coronary arteries)
- ganglion cervicale sup. – n. cardiacus cervicalis sup.

  gangl. cervicale medium – n. cardiacus cervicalis medius,

  gangl. stellatum – n. cardiacus cervicalis inf.,

  ganglia thoracica 2-4 – nn. cardiaci thoracici

Sympathetic fibers reach the cardiac plexus through the cardiac nerves from the sympathetic trunk. Preganglionic sympathetic fibers from the upper four or five segments of the thoracic spinal cord enter and move through the sympathetic trunk. They synapse in cervical and upper thoracic sympathetic ganglia, and postganglionic fibers proceed as bilateral branches from the sympathetic trunk to the cardiac plexus.

- Parasympathicus
- (bradycardia: slowing of the heart rate, reduces force of contraction + vasoconstriction of the coronary arteries)
- n. vagus:

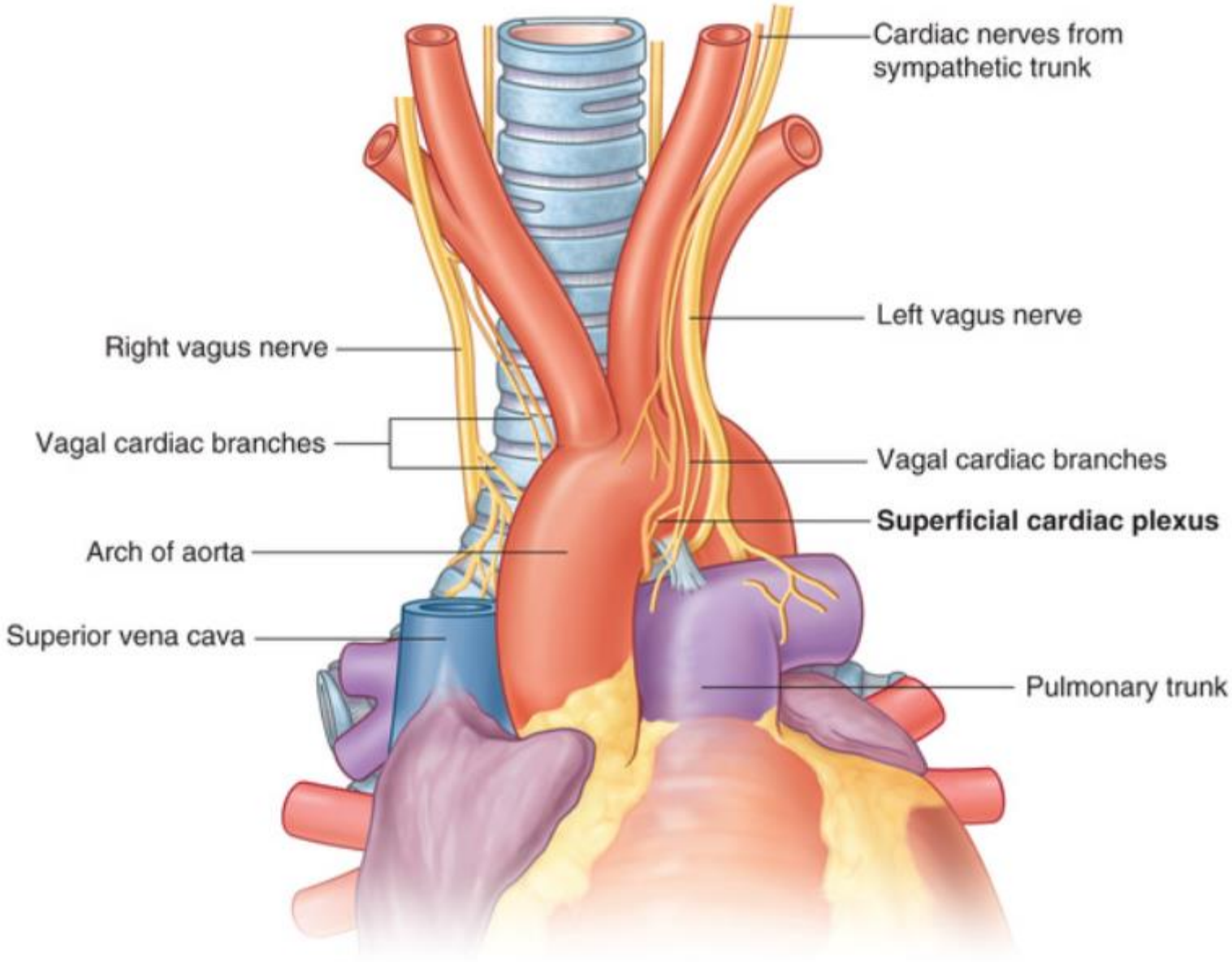
  rr. cardiaci cervicales

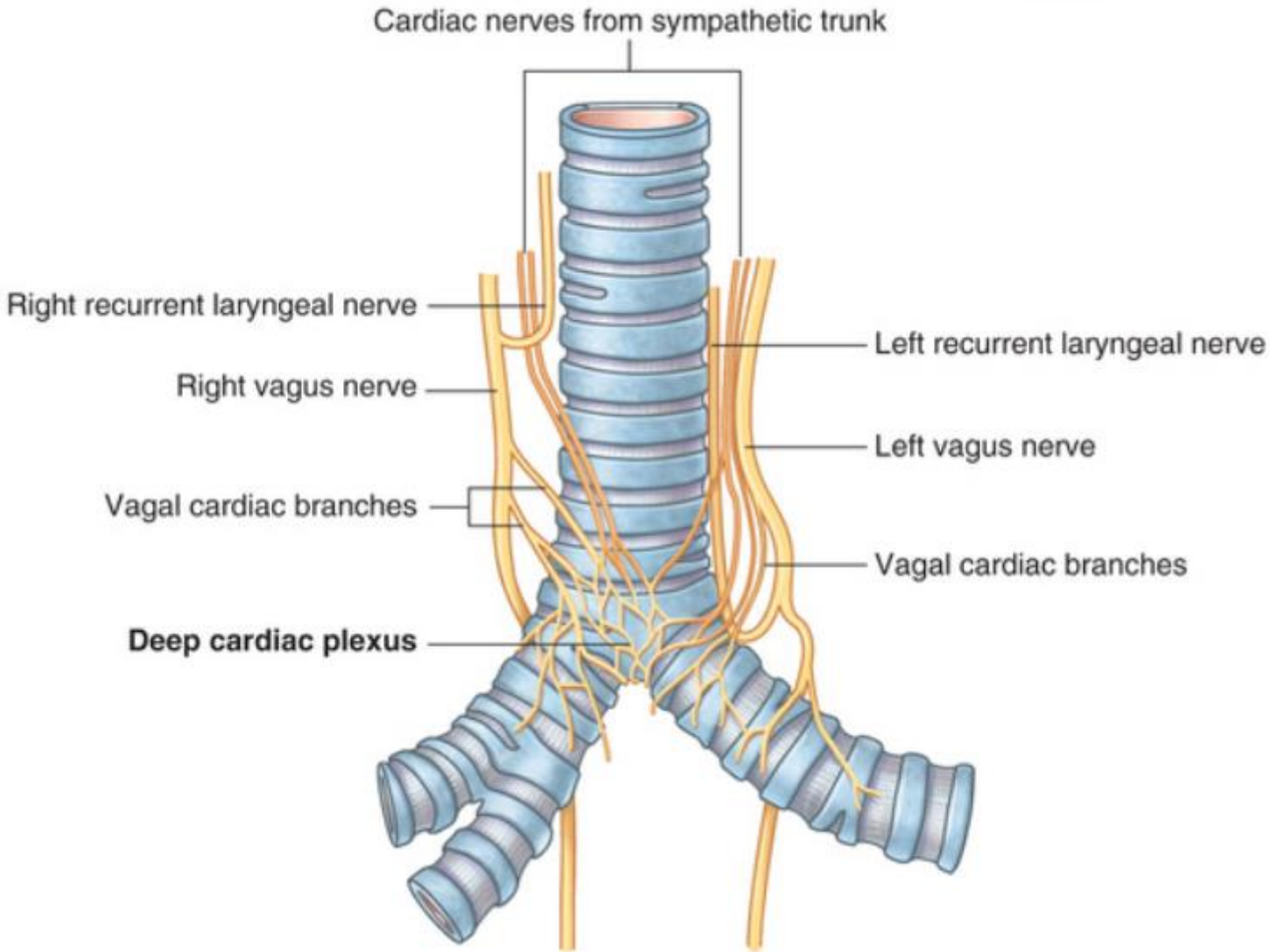
  superiores

  inferiores

  rr. cardiaci thoracici

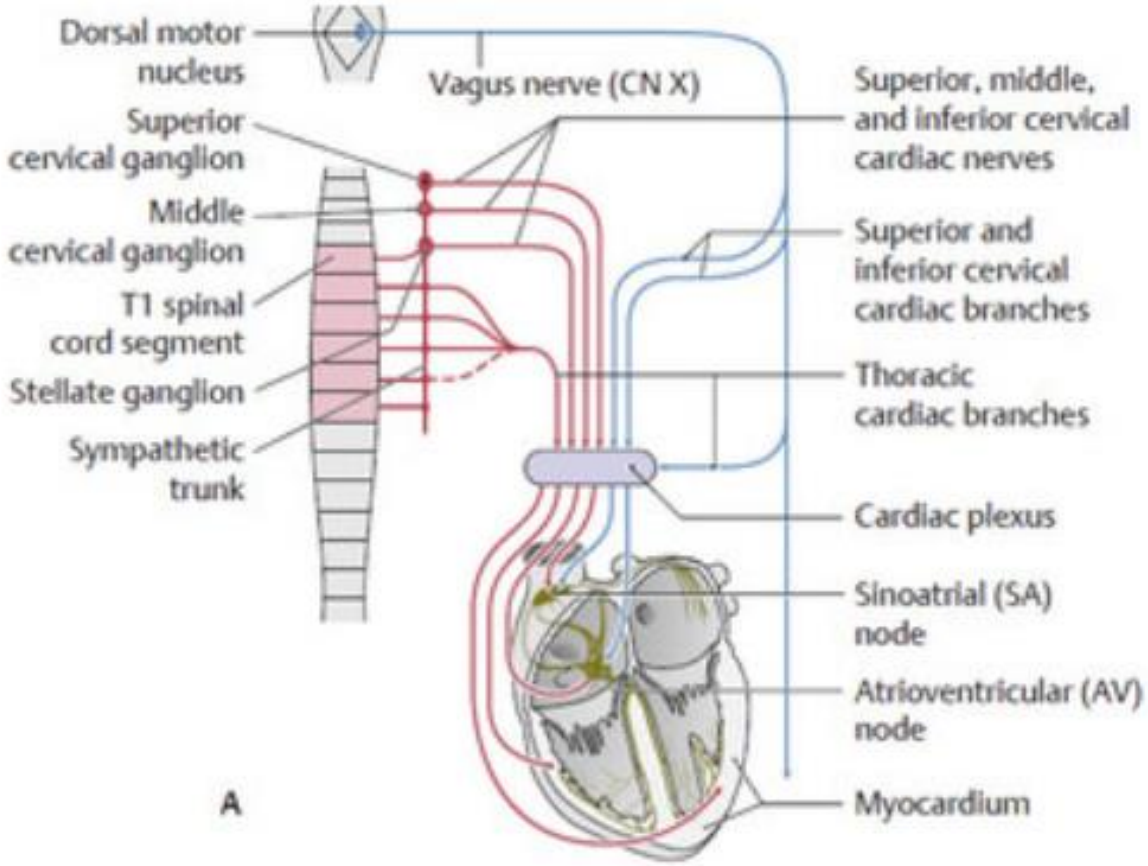
The preganglionic parasympathetic fibers reach the heart as cardiac branches from the right and left vagus nerves.They enter the cardiac plexus and synapse in ganglia located either within the plexus or in the walls of the atria.

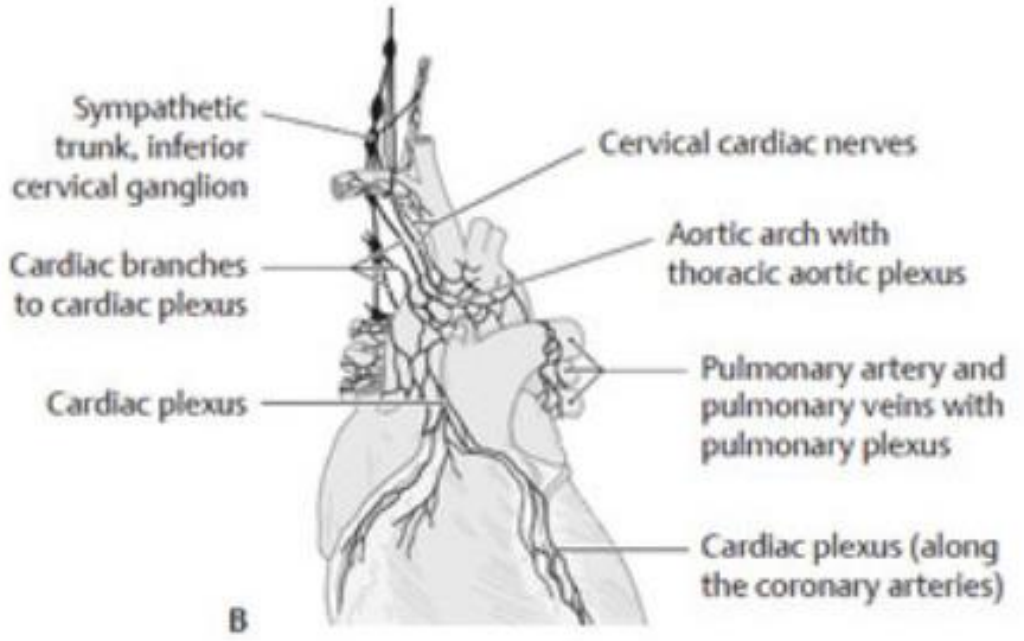

Cardiac nerves from sympathetic trunk
Left vagus nerve
Right vagus nerve
Vagal cardiac branches
Vagal cardiac branches
Superficial cardiac plexus
Arch of aorta
Superior vena cava
Pulmonary trunk


Cardiac nerves from sympathetic trunk
Right recurrent laryngeal nerve
Right vagus nerve
Vagal cardiac branches
Deep cardiac plexus
Left recurrent laryngeal nerve
Left vagus nerve
Vagal cardiac branches

B

Sympathetic innervation: Preganglionic neurons from T1 to T6 spinal cord segments send fibers to synapse on postganglionic neurons in the cervical and upper thoracic sympathetic ganglia. The three cervical cardiac nerves and their thoracic cardiac branches contribute to the cardiac plexus. **Parasympathetic innervation:** Preganglionic neurons and fibers reach the heart via cardiac branches of n. Vagus, some of which also arise in the cervical region. They synapse on postganglionic neurons near the SA node and along the coronary arteries.



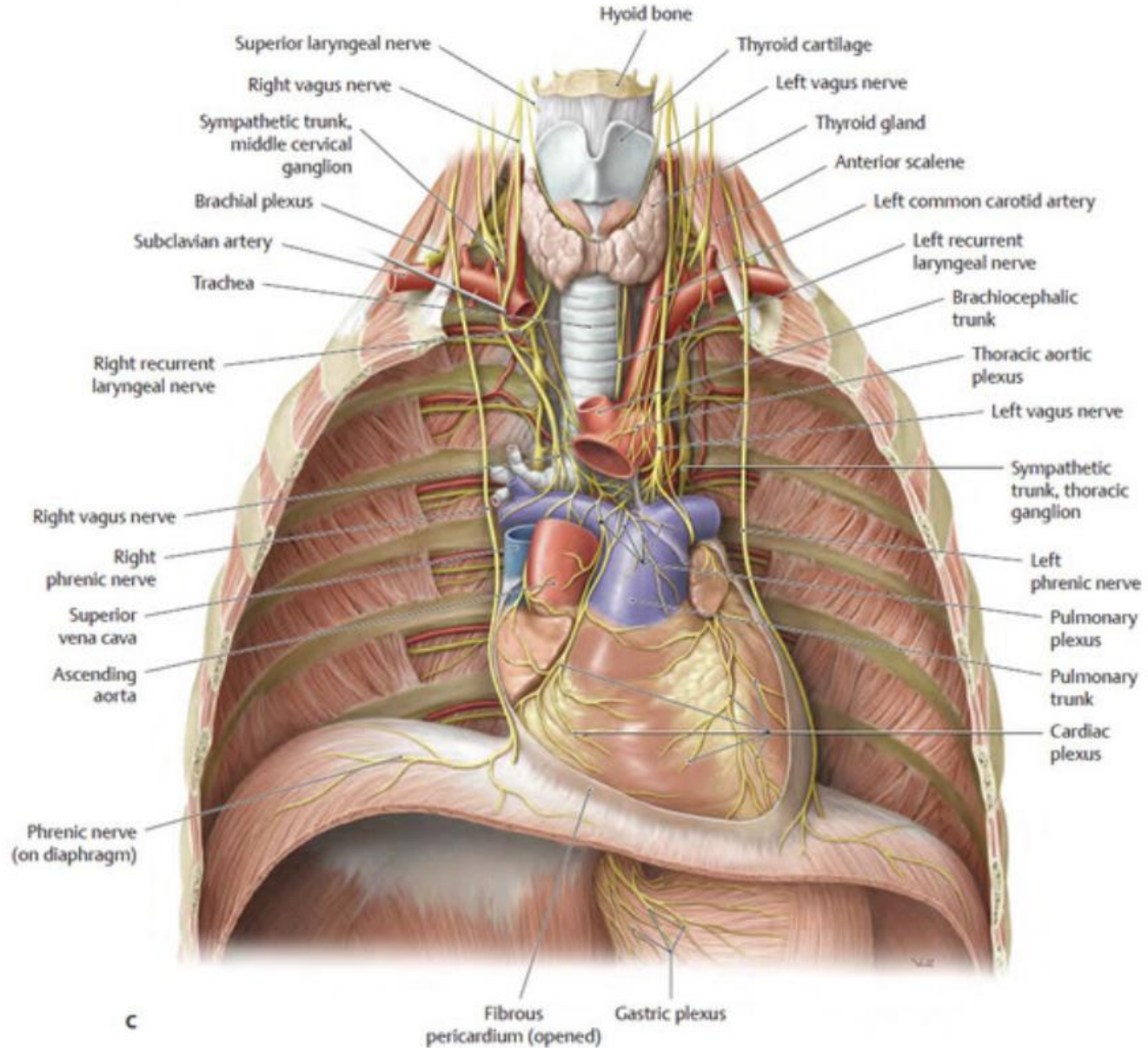


Viscerosensory fibres

The afferents associated with the cardiac nerves from the sympathetic trunks, reenter the upper four or five thoracic spinal cord segments **(T1-T4).**

Conduct pain sensation (i.e., **cardiac ischemia**) from the heart is often **“referred”** to cutaneous regions supplied by the same spinal cord levels:

Head´s zone **behind sternum and in ulnar edge of left upper limb**



Pericardium

The pericardium is a fibroserous sac surrounding the heart and the roots of the great vessels. It consists of two components, the fibrous pericardium and the serous pericardium.

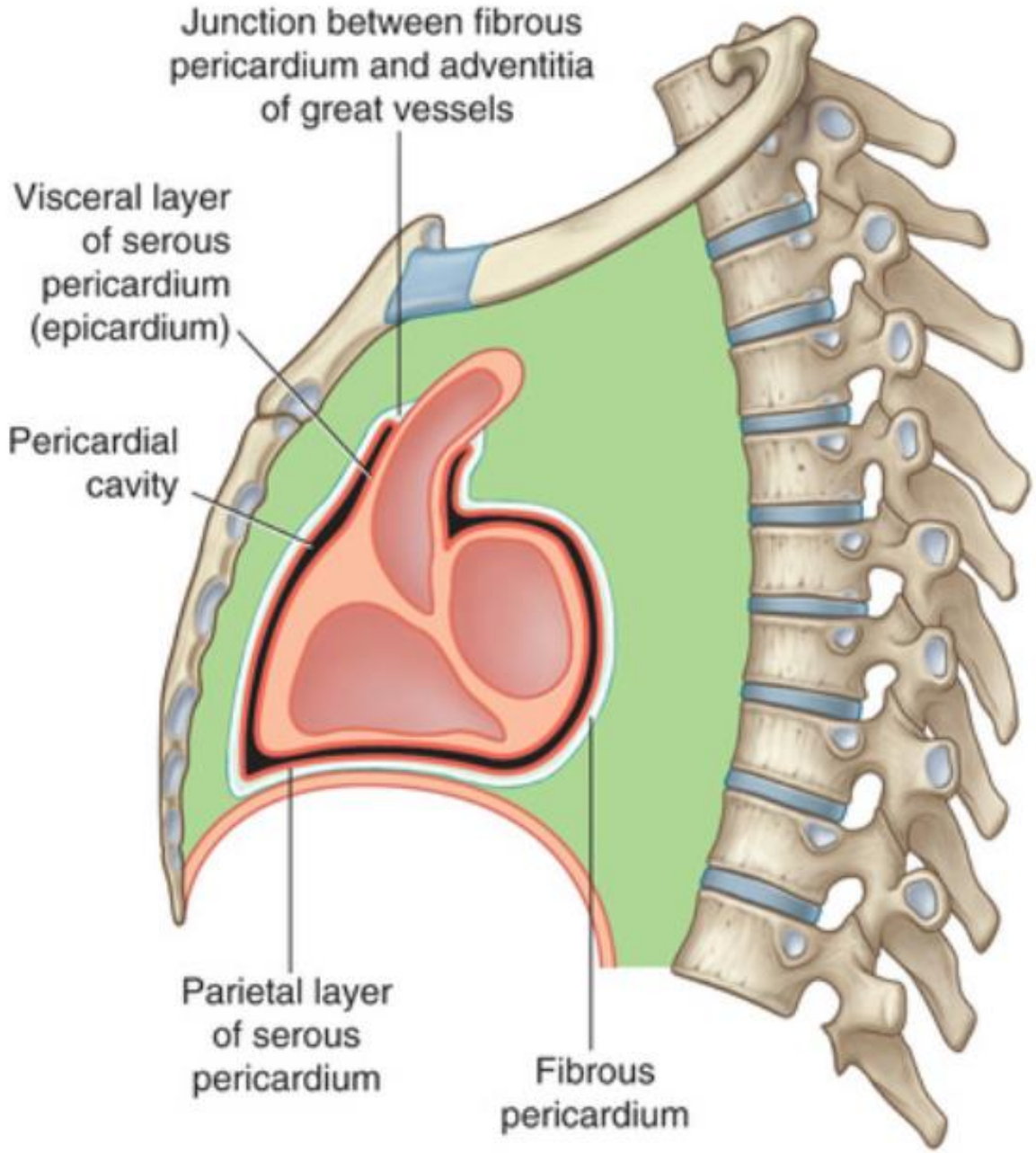
The fibrous pericardium is a tough connective tissue outer layer that defines the boundaries of the middle mediastinum. The serous pericardium is thin and consists of two parts:

The parietal layer of serous pericardium lines the inner surface of the fibrous pericardium.

- The visceral layer (epicardium) of serous pericardium adheres to the heart and forms its outer covering

The narrow space created between the two layers of serous pericardium, containing a small amount of fluid, is the pericardial cavity. This potential space allows for the relatively uninhibited movement of the heart

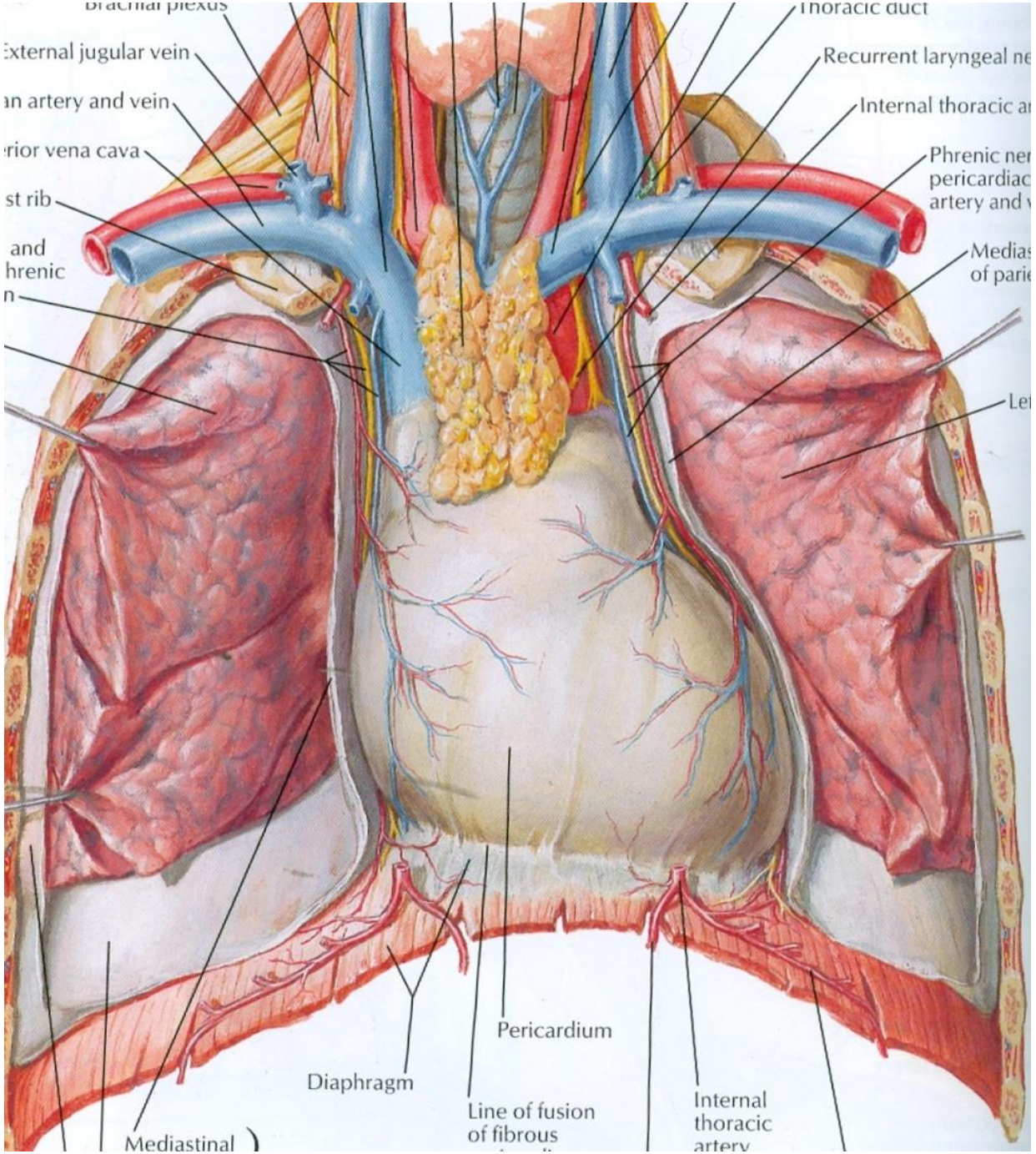
The parietal and visceral layers of serous pericardium are continuous at the roots of the great vessels.



Fibrous pericardium

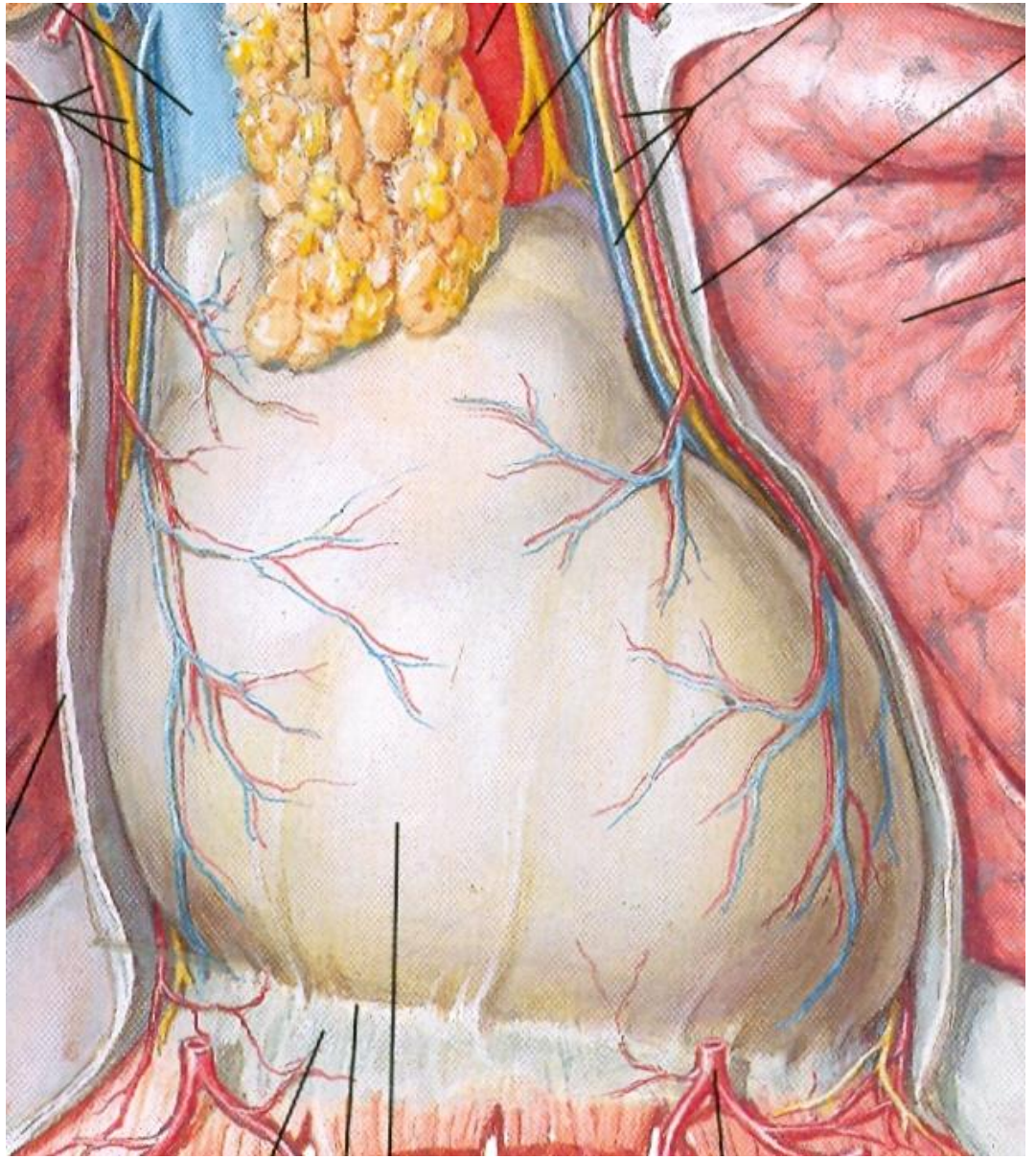
The fibrous pericardium is a cone-shaped bag with its base on the diaphragm and its apex **continuous with the adventitia of the great vessels.** The base is attached to the **central tendon of the diaphragm** and to a small muscular area of the diaphragm on the left side. Anteriorly, it is attached to the posterior surface of the sternum by **sternopericardial ligaments**. These attachments help to retain the heart in its position in the thoracic cavity.

Bronchopericardial membrane.



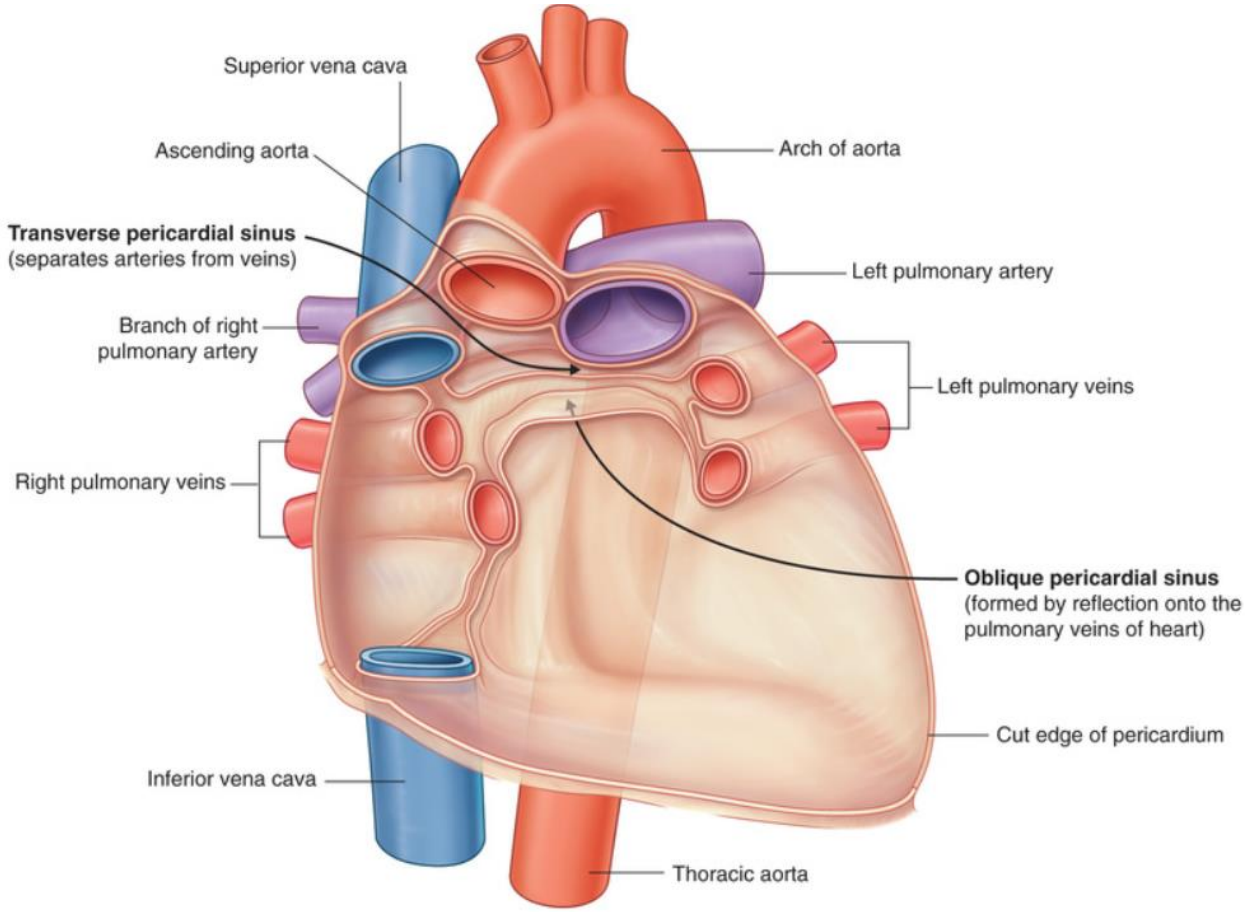
Blood vessels and nerves of the pericardium

- **A. pericardiacophrenica** ← a. thoracica interna
- **Vv. pericardiacophrenicae** → vv. thoracicae int., vv. brachiocephalicae
- **N. phrenicus**



Cavum serosum pericardii: **The parietal layer of serous pericardium is continuous with the visceral layer of serous pericardium around the roots of the great vessels. These reflections of serous pericardium occur in two locations:**

- **Porta arteriarum (vagina serosa arteriarum)- superiorly, surrounding the arteries—the aorta and the pulmonary trunk;**
- **Porta venarum- more posteriorly, surrounding the veins—the superior and inferior vena cava and the pulmonary veins, the shape of a horizontal letter T**
- **Sinus transversus pericardii- passage at the back of the cavum pericardii (between porta arteriarum and porta venarum**
- **Sinus obliquus pericardii (between vv. pulmonales sin., vv. pulmonales dx., v. cava inf.)**

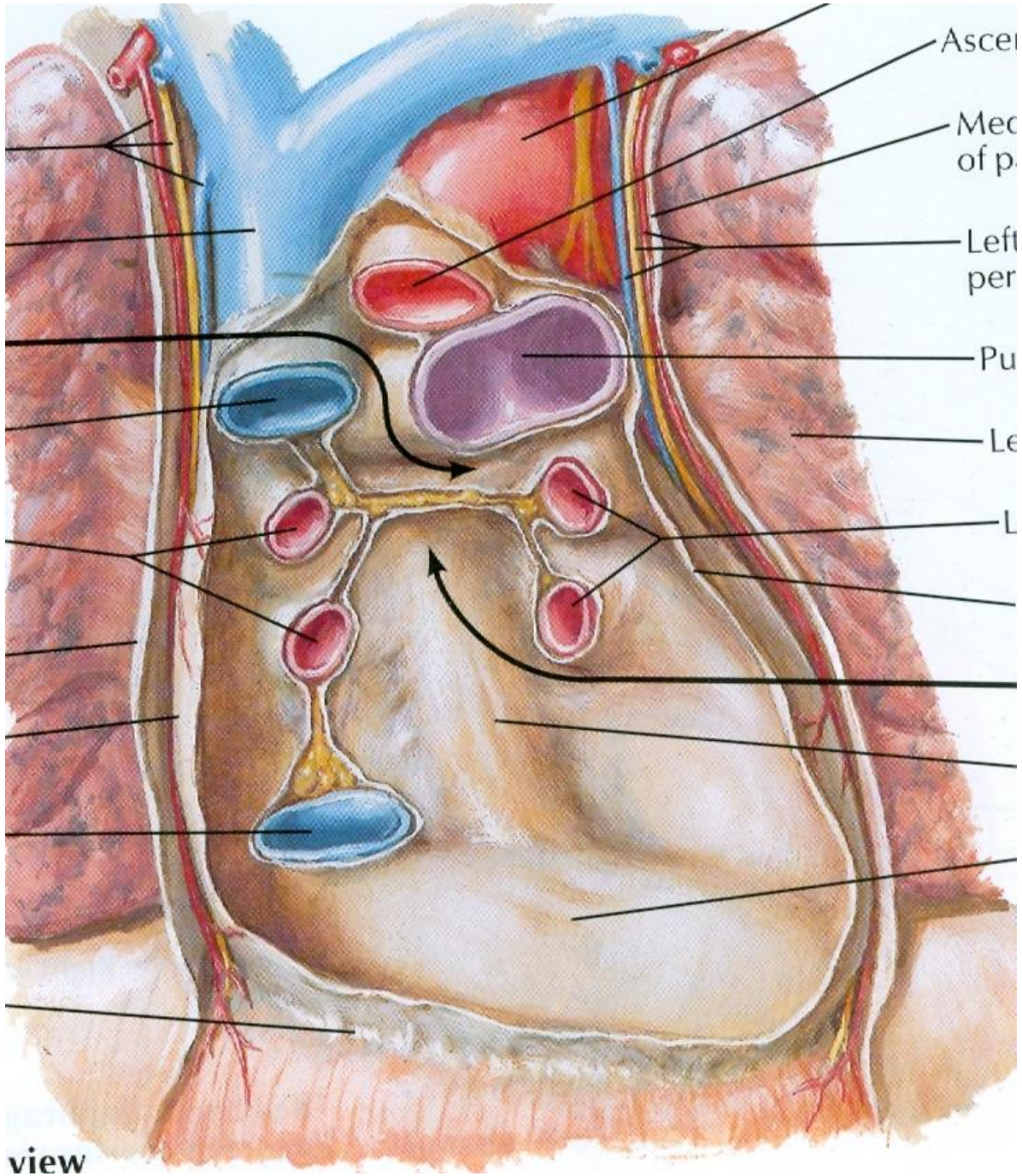


Posterior portion of pericardial sac showing reflections of serous pericardium.

When the pericardium is opened anteriorly during surgery, a finger placed in the transverse sinus separates arteries from veins.

This sinus lies posterior to the ascending aorta and the pulmonary trunk, anterior to the superior vena cava, and superior to the left atrium.

A hand placed under the apex of the heart and moved superiorly slips into the oblique sinus.



Pericardium: ***The heart is housed in a tough connective tissue sheath, consisting of:***

outer layer - pericardium fibrosum inner layer - pericardium serosum

- **Pericardium fibrosum- adherent to the centrum tendineum of the diaphragm-lig. phrenicopericardiaca,**

  ligg. Sternopericardiaca,

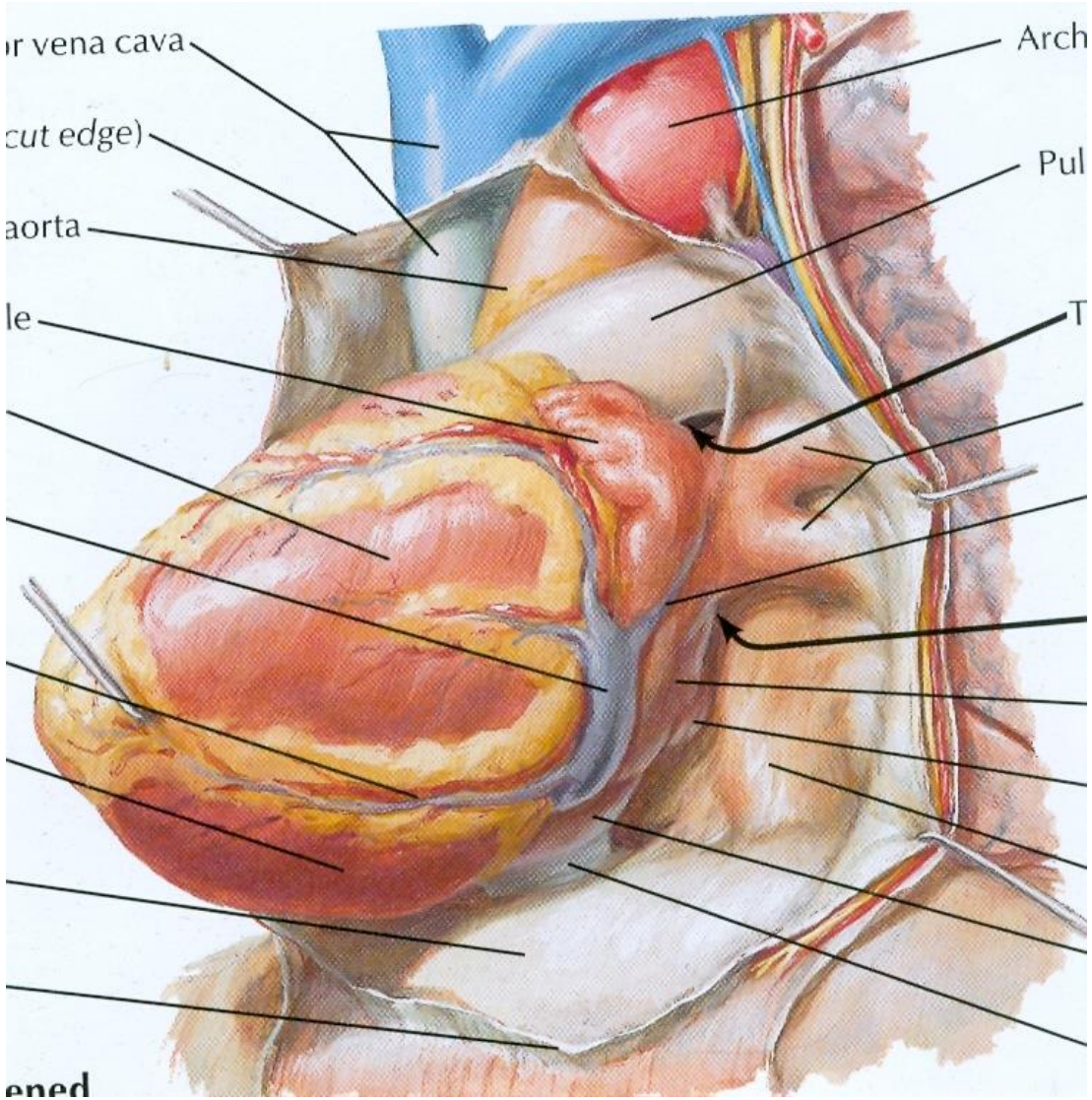
  membrana bronchopericardiaca

Pericardium serosum

lamina parietalis

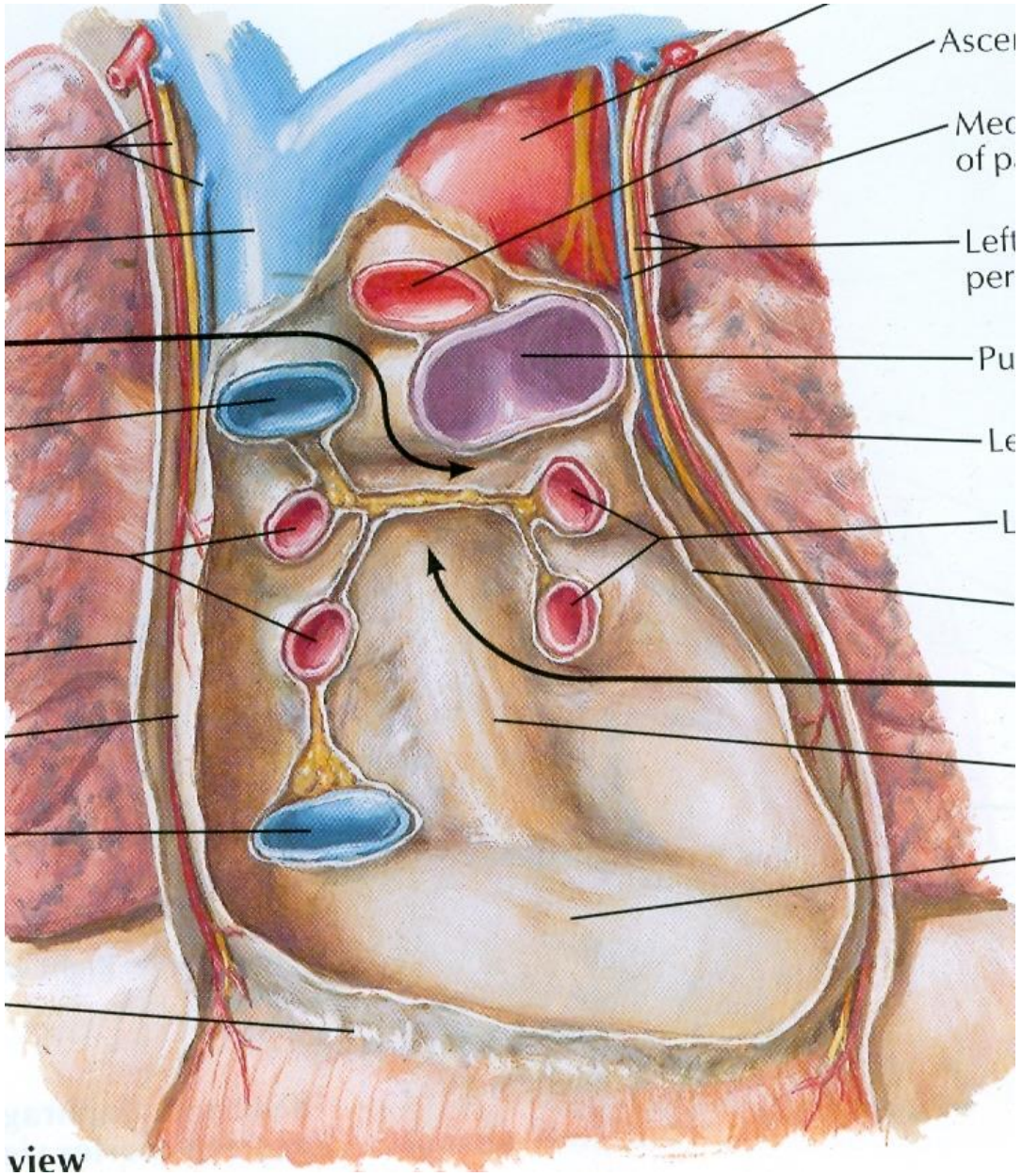
lamina visceralis = epicardium: tunica serosa, tela subserosa

- **Cavitas pericardialis- Contains liquor pericardii**



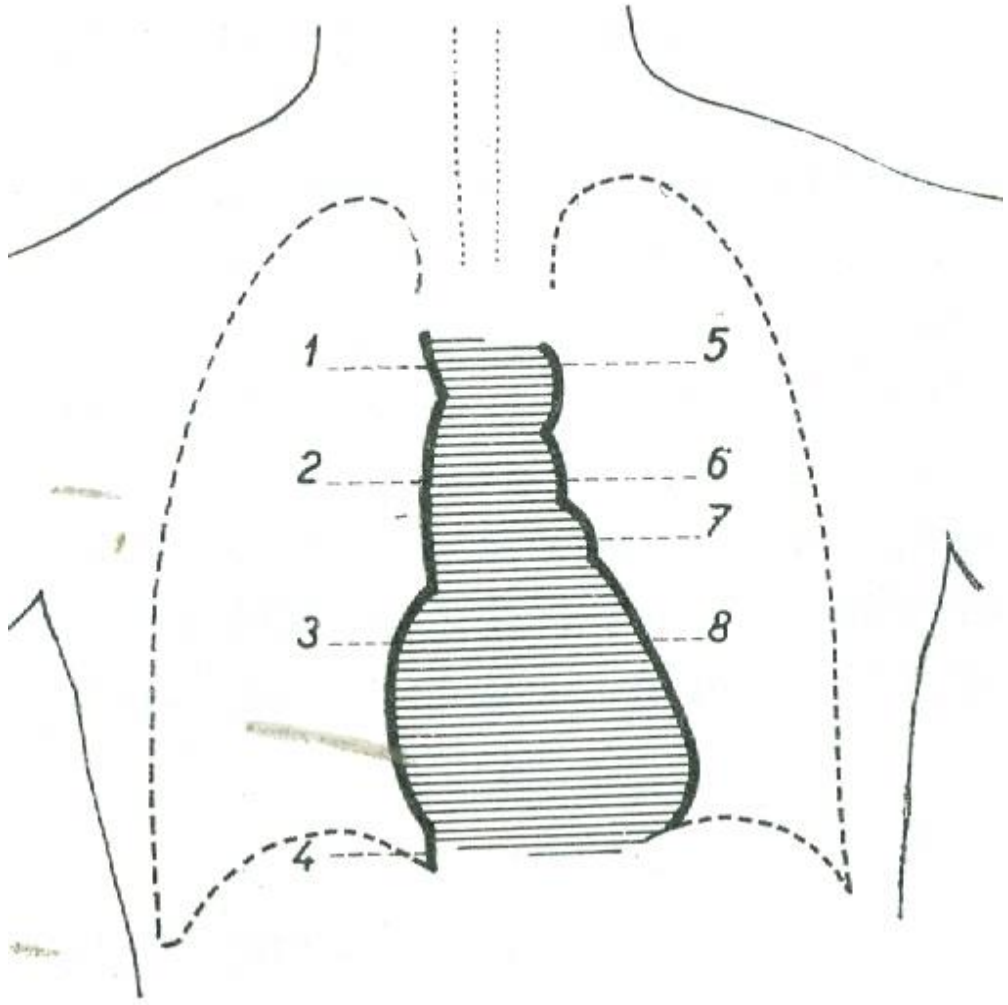
Cavum serosum pericardii: a cavity between the two sheets, the sheets merge smoothly into each other in two places:

- **Porta arteriarum (vagina serosa arteriarum)-** the transition along the aorta and truncus pulmonalis
- **Porta venarum**- the transition along the veins on the posterior wall of the pericardium, the shape of a horizontal letter T
- **Sinus transversus pericardii-** passage at the back of the cavum pericardii (between porta arteriarum and porta venarum
- **Sinus obliquus pericardii** (between vv. pulmonales sin., vv. pulmonales dx., v. cava inf.)

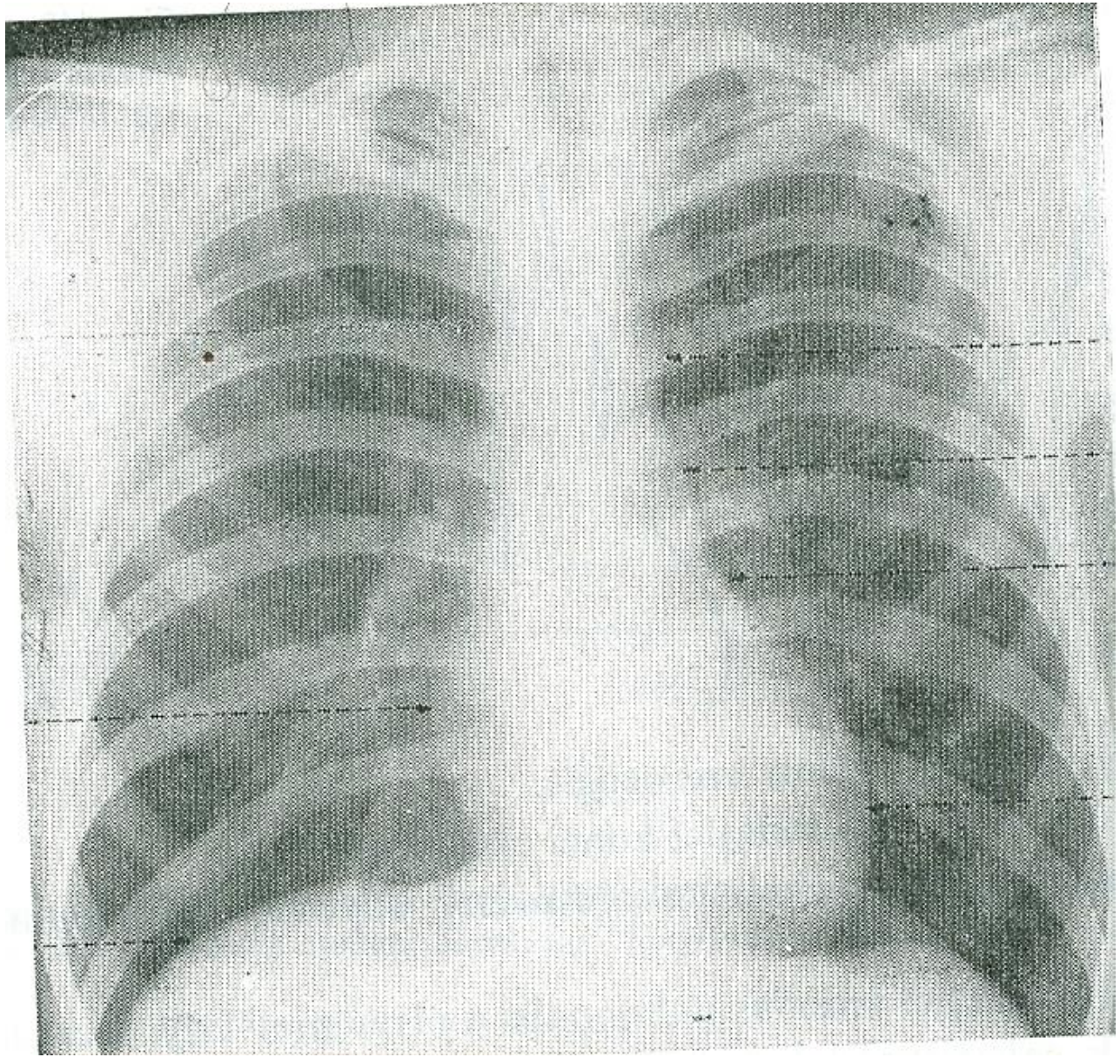


X-ray of the heart

- **Right outline:**
  1. v. brachiocephalica
  2. v. cava superior
  3. atrium dextrum
  4. v. cava inferior
- **Left outline:**
  5. arcus aortae
  6. a. pulmonalis sin.
  7. auricula sin.
  8. ventriculus sin.

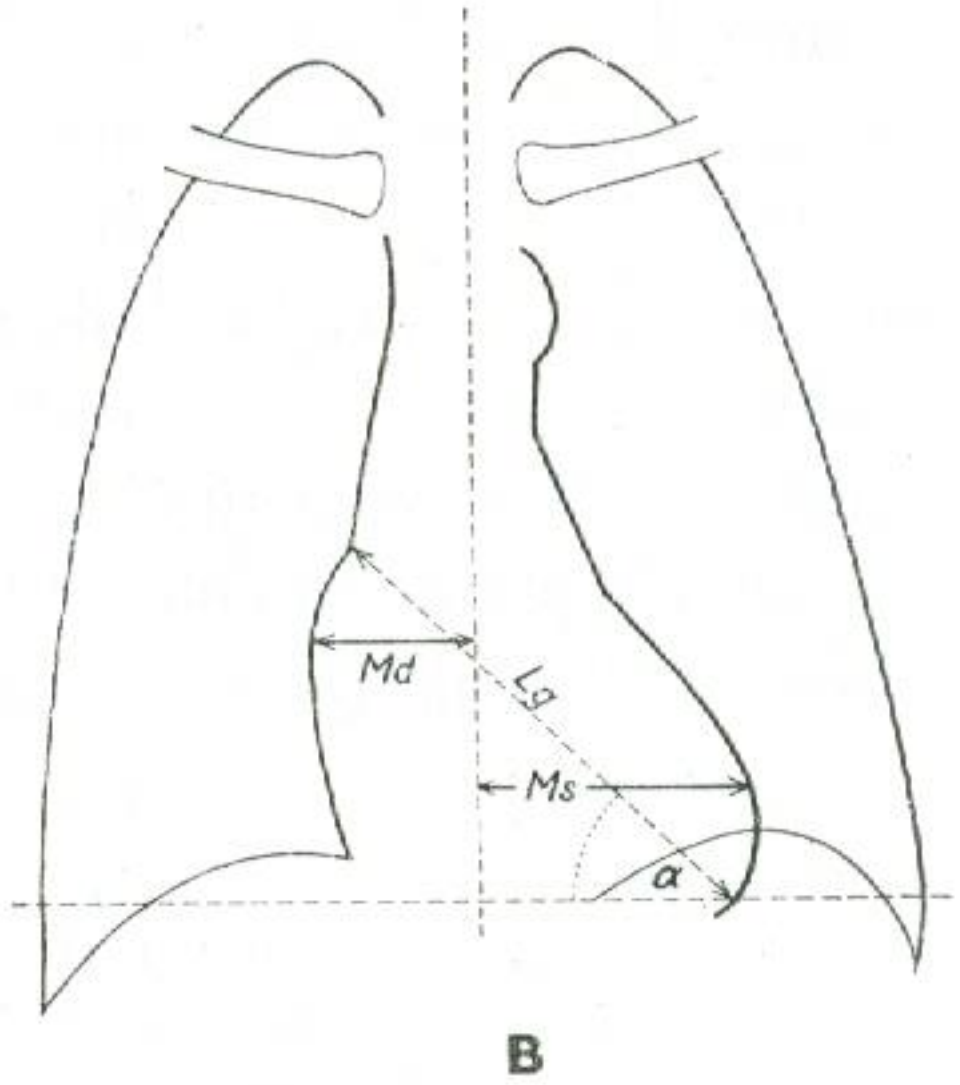


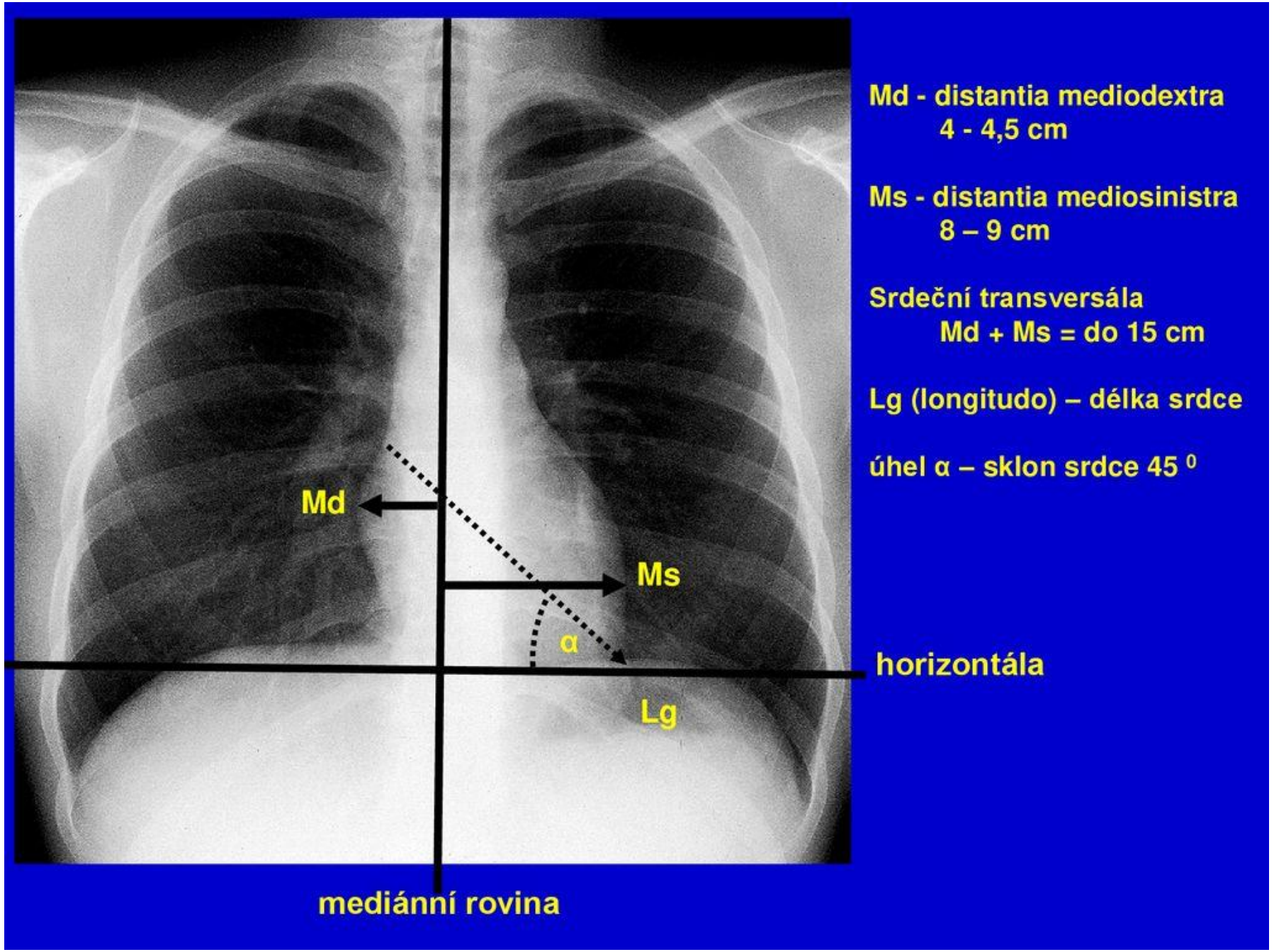
X-ray of the heart



Dimensions of the heart

- **Distantia mediodextra** – 4-4.5 cm
- **Distantia mediosinestra** – 8-9 cm
- **Transversala** (Ms+Md) – 12-14 cm (<15 cm)
- **Longitudo cordis:** line connecting the ostium of the SVC with the cardiac apex: 15.5-18 cm
- **Angulus (inclination of the heart)** α – 45°





Md - distantia mediodextra
4 - 4,5 cm

Ms - distantia mediosinistra
8 – 9 cm

Srdeční transversála
Md + Ms = do 15 cm

Lg (longitudo) – délka srdce

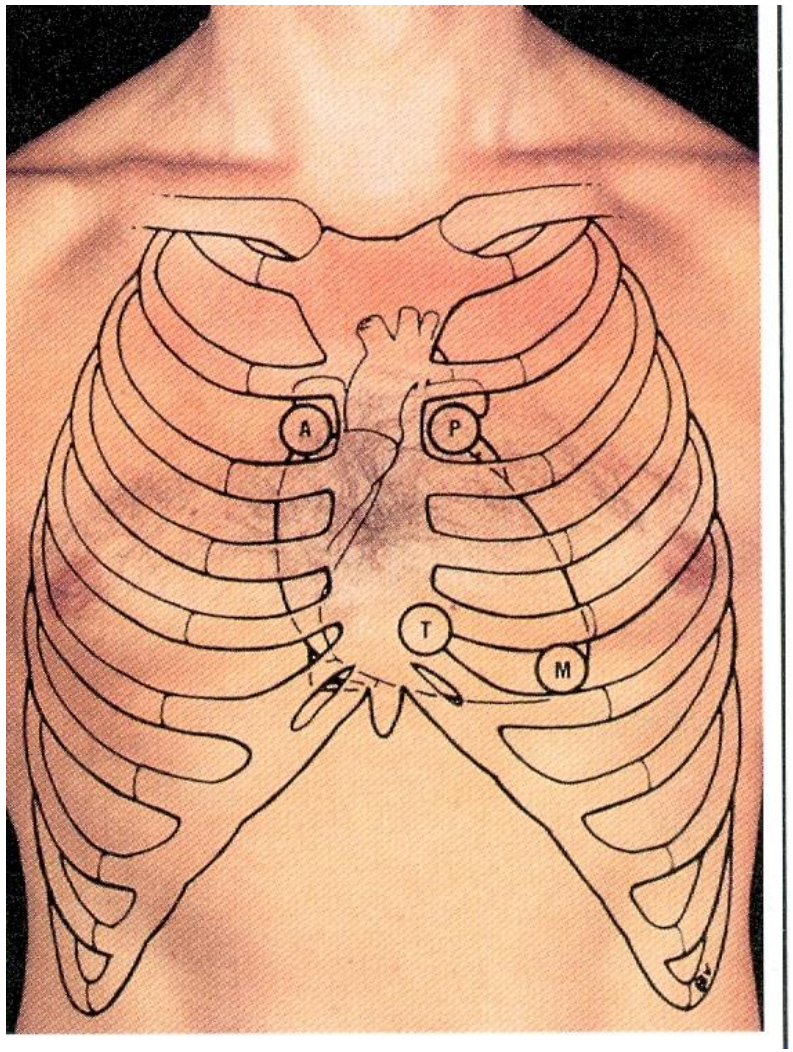
úhel α – sklon srdce 45 ^{0}

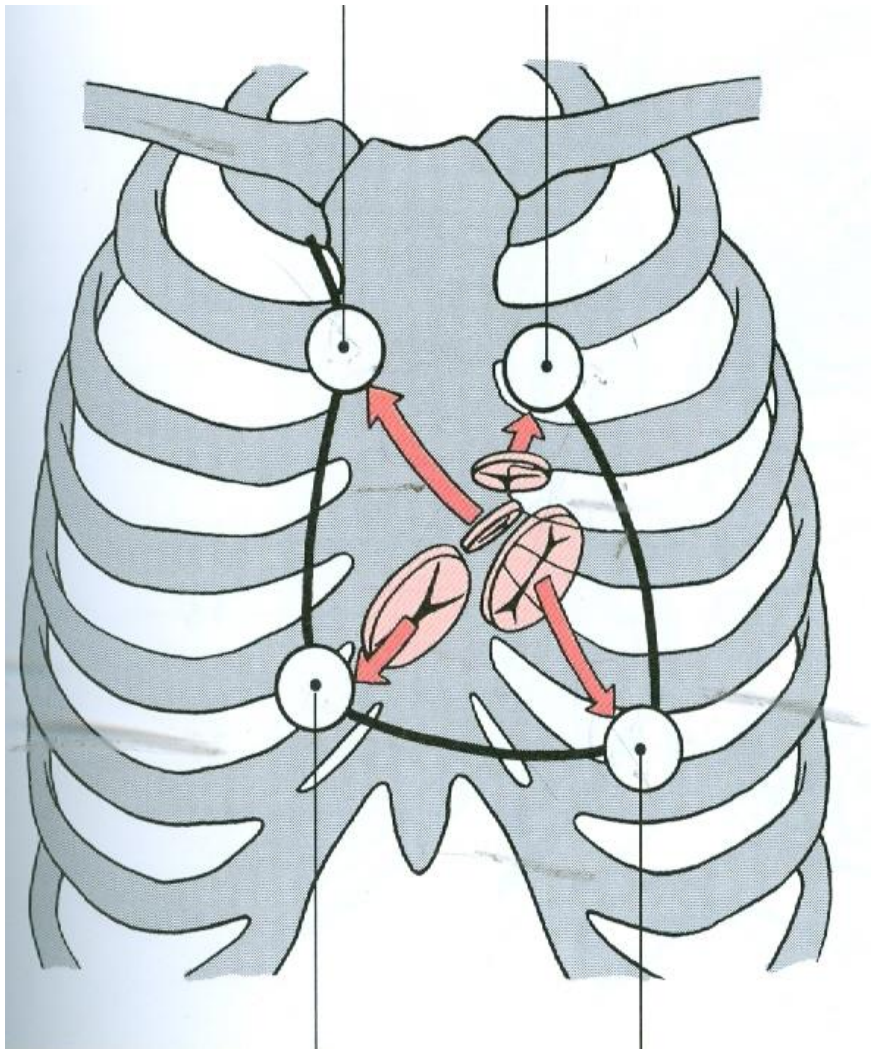
Projection of the heart onto the chest wall - Testut points, auscultation points

- **A –** 2nd intercostal space 1 cm to the right of the sternum- ausc. point for the aortic valve
- **B (T) –** 5th intercostal space just at the right edge of the sternum- ausc. point for the tricuspid valve
- **C (M) –** 5th intercostal on the left 8 cm from the linea mediana ant. (inside from MCL)- ausk. point for mitral valve, site of projection of apex cordis
- **D (P) -** 2nd intercostal space 2 cm to the left of the sternum- ausc. point for pulmonary valve
- Connecting these points gives the approximate dimensions of the heart shadow

Projection of the heart, valves, auscultation points

Valve projection sites do not correspond to auscultation points!!





Thank you for your attention