

الكلية : كلية الطب

القسم او الفرع : التشريح البشري

المرحلة: الاولى

أستاذ المادة : مهند سهيل نجم

اسم المادة باللغة العربية : التشريح

اسم المادة باللغة الإنكليزية : **anatomy**

اسم المحاضرة الأولى باللغة العربية: تشريح منطقة الصدر

اسم المحاضرة الأولى باللغة الإنكليزية : **Thorax Anatomy**

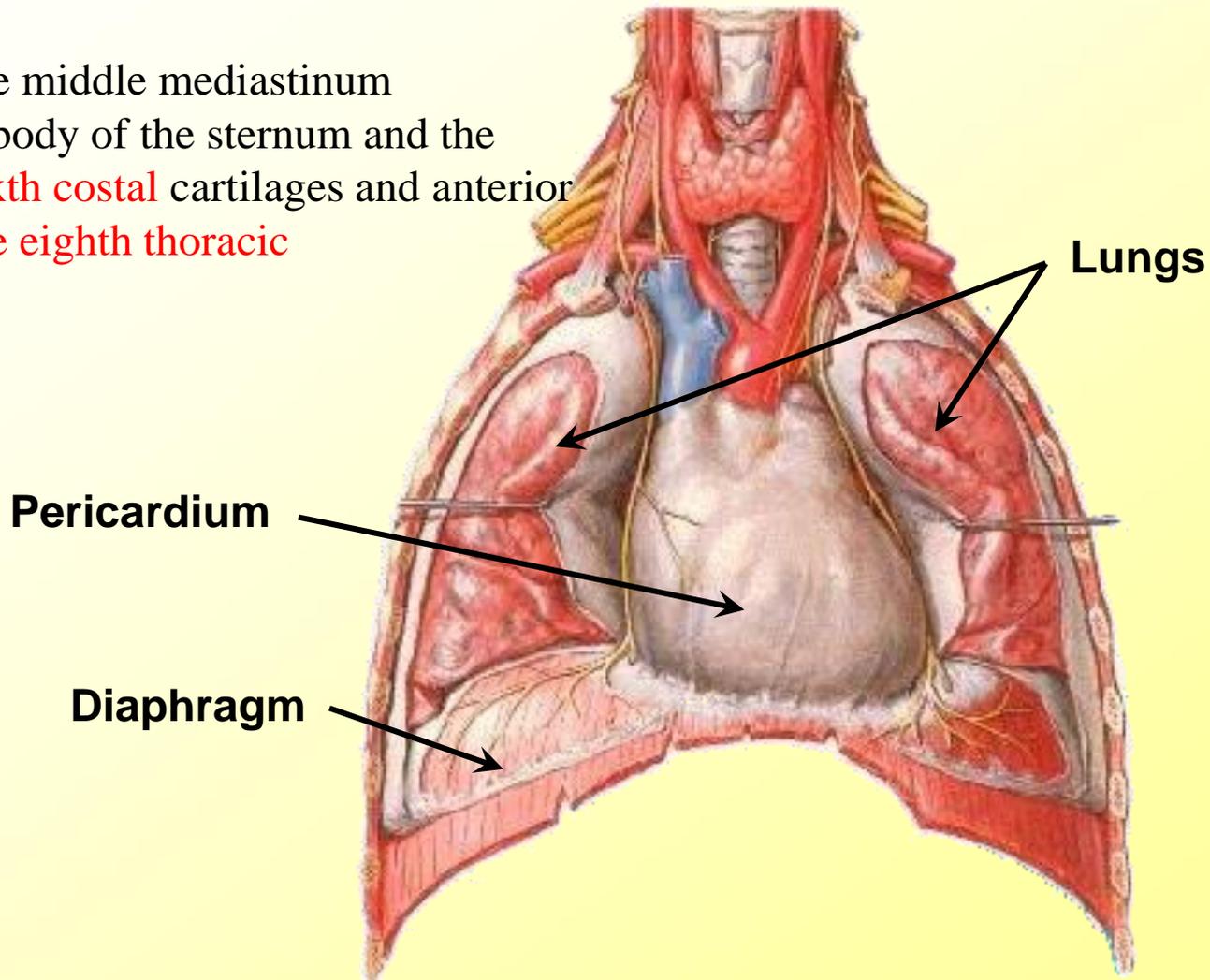
The Heart & Pericardium

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MSC. Human anatomy

The Pericardium

The pericardium is a fibroserous sac that encloses the heart and the roots of the great blood vessels.

It lies within the middle mediastinum posterior to the body of the sternum and the **second to the sixth costal** cartilages and anterior to the **fifth to the eighth thoracic** vertebrae.

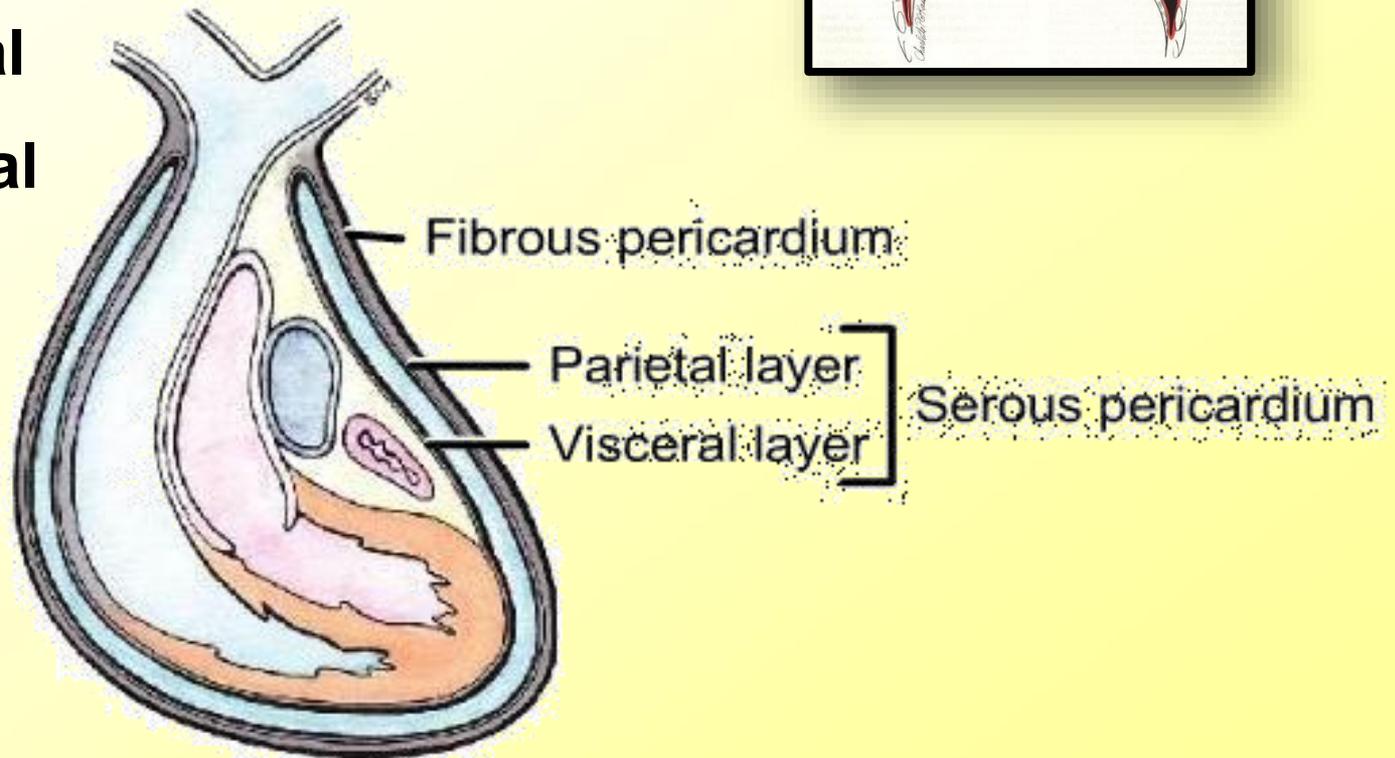
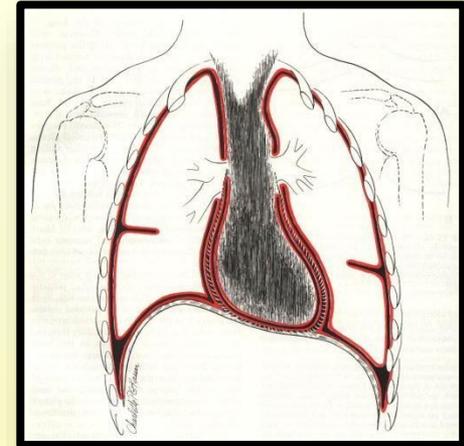


Layers of Pericardium

1. Fibrous

2. Serous

- Parietal
- Visceral



Fibrous Pericardium

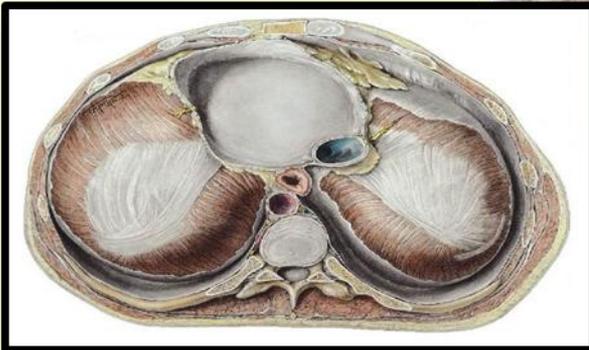
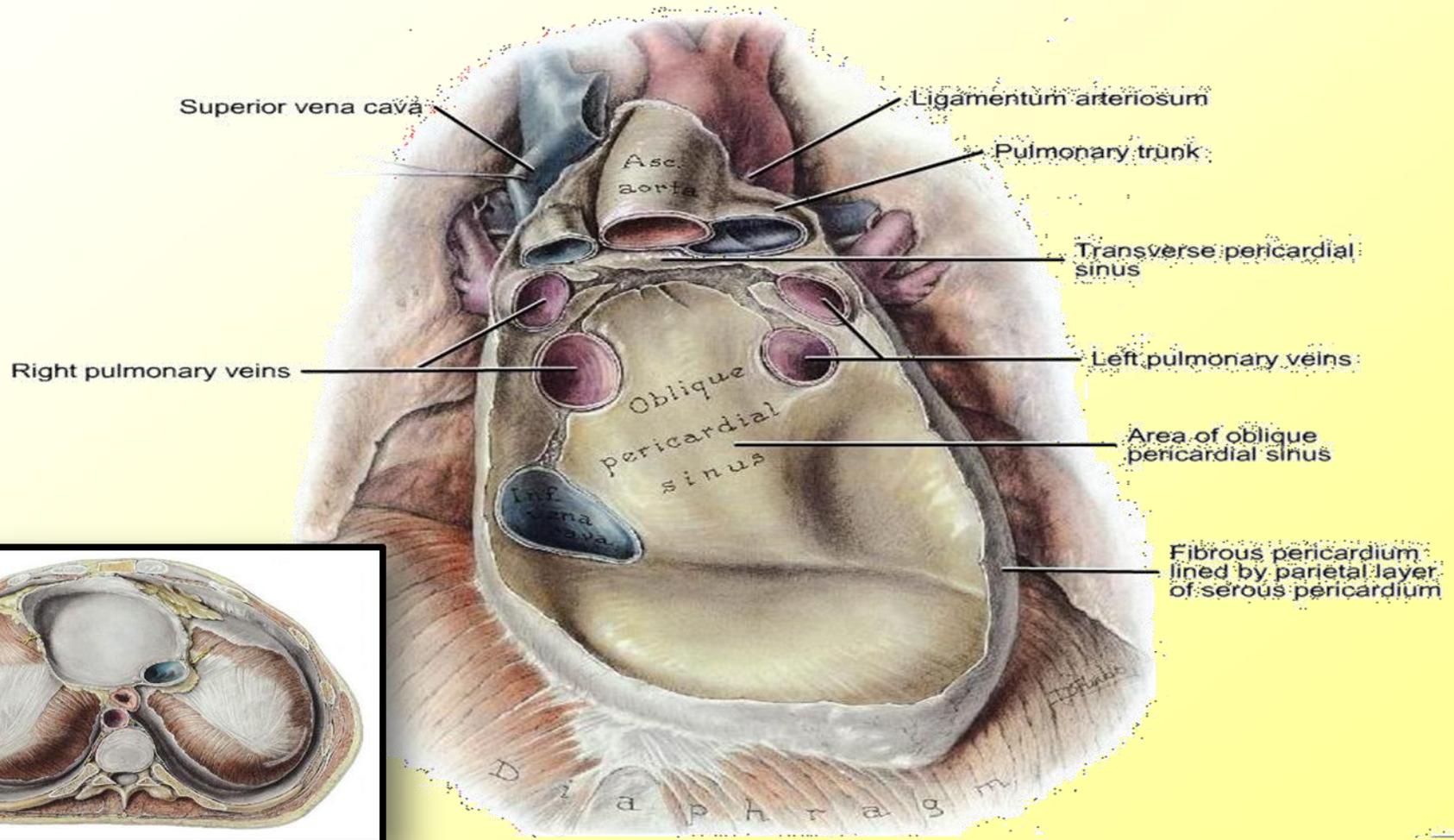
The fibrous pericardium is the strong, fibrous, outer layer of the sac.

It attaches firmly below to the **central tendon of the diaphragm**.

It fuses with the outer coats of the great blood vessels passing

through it—namely, **the aorta**, the **pulmonary trunk**, the **superior and inferior venae cavae**, and the **pulmonary veins**.

The fibrous pericardium attaches in front of the sternum by fibrous bands called the **sternopericardial ligaments**.



Serous Pericardium

The serous pericardium lines the fibrous pericardium and coats the heart. It is divided into parietal and visceral layers.

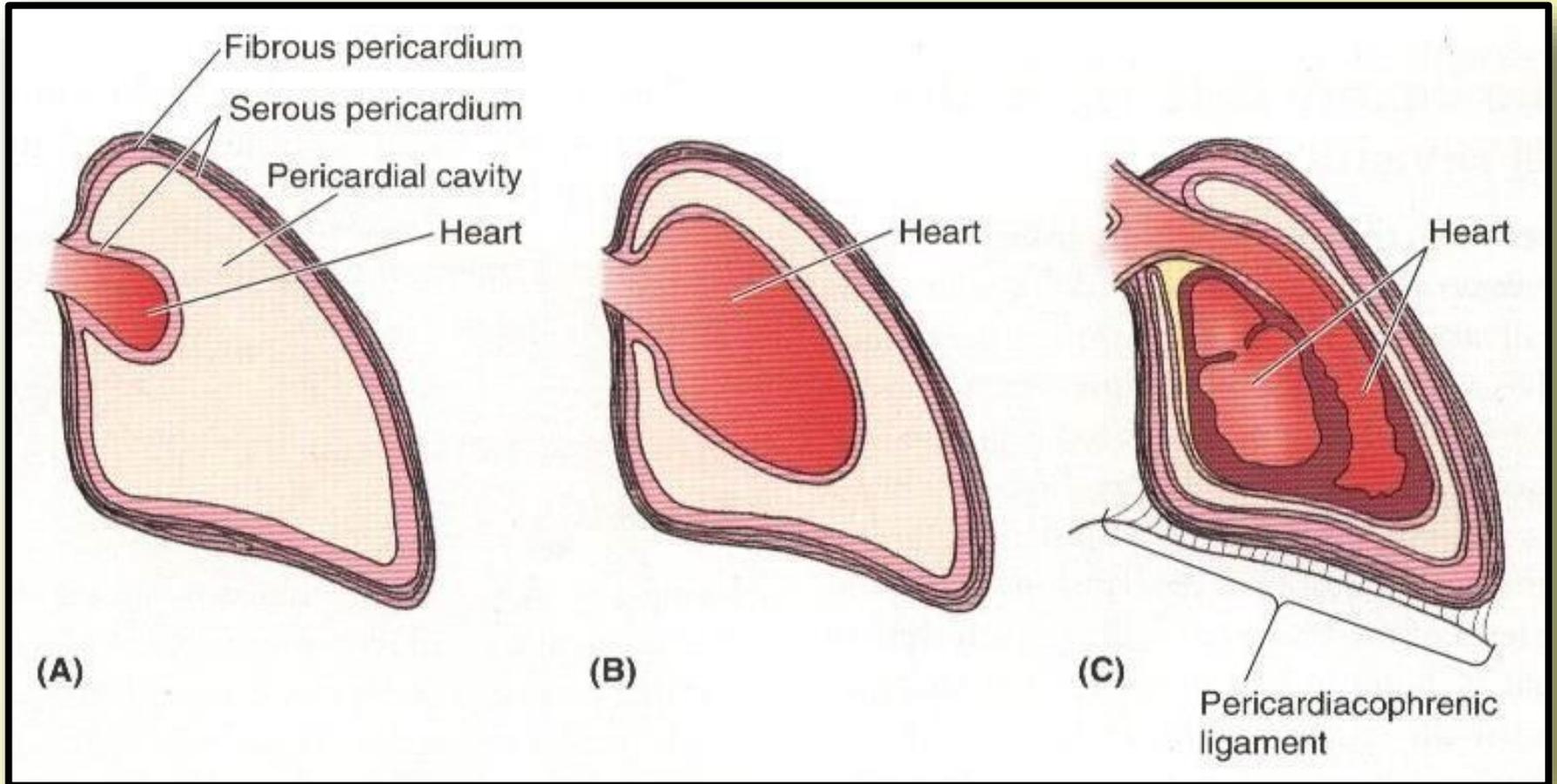
The **parietal layer** lines the inner surface of the fibrous pericardium and reflects around the roots of the great vessels to become continuous with the visceral layer of serous pericardium that closely covers the heart

The **visceral layer** is closely applied to the superficial surface of the heart and is often called the **epicardium**.

The slit like space between the parietal and visceral layers is referred to as the **pericardial cavity** .

Normally, the cavity contains a small amount of tissue fluid (about 50mL), the **pericardial fluid**, which acts as a lubricant to facilitate movements of the heart.

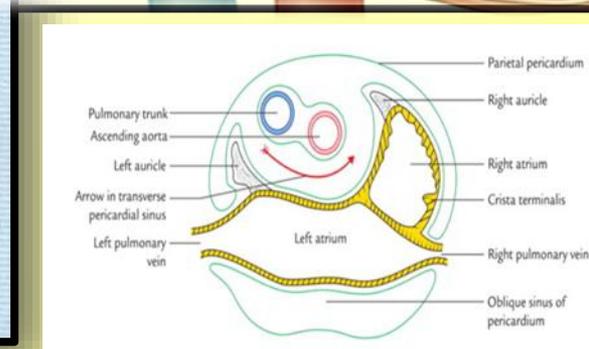
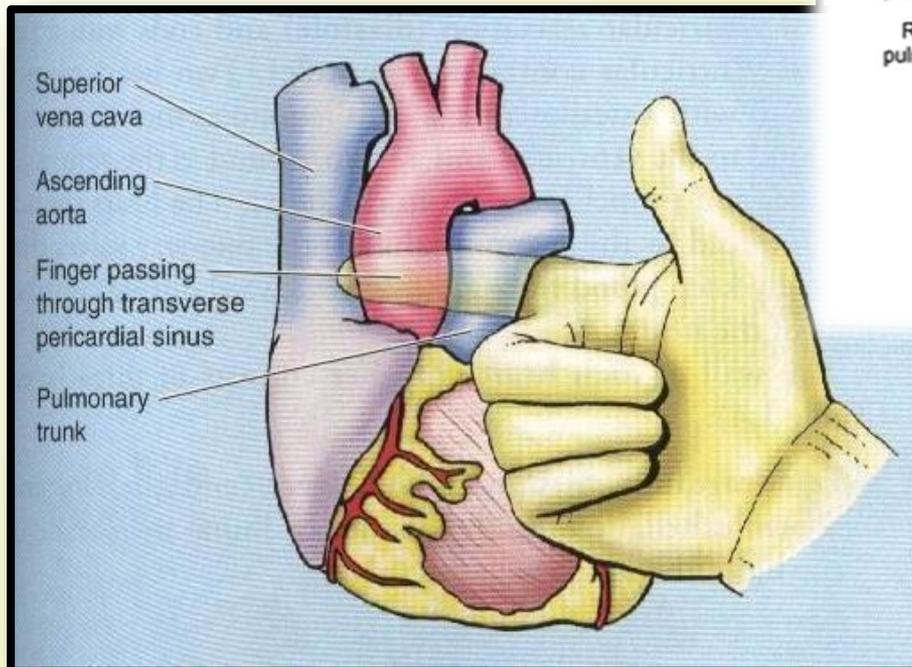
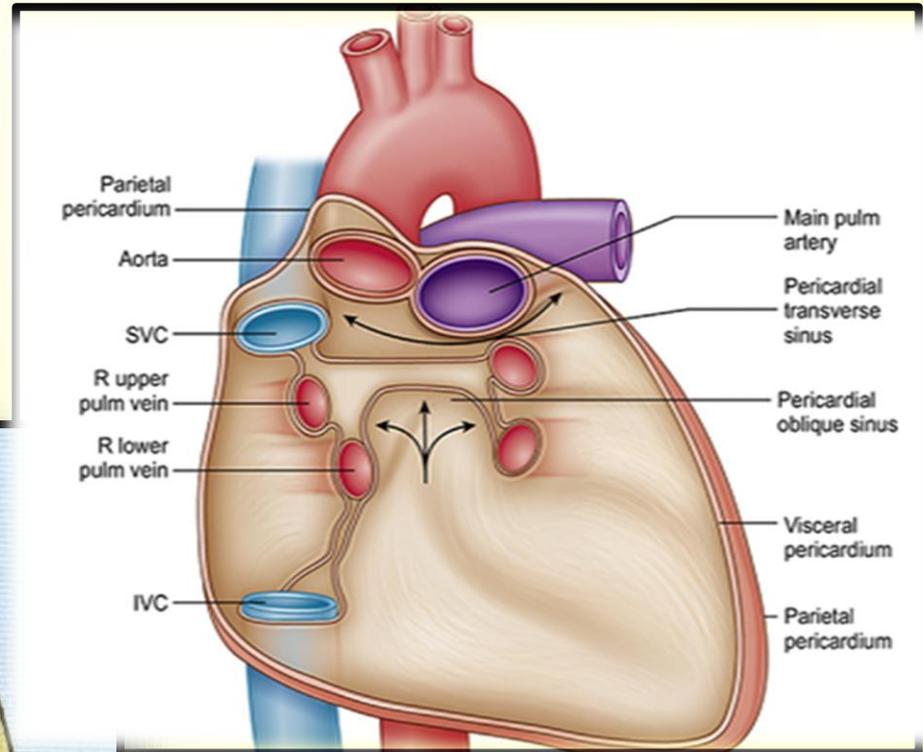
Serous Pericardium



Pericardial Sinuses

❑ Transverse

❑ Oblique



Pericardial Sinuses

The pericardial sinuses are spaces posterior to the heart formed by the reflections of the serous pericardium around the great vessels.

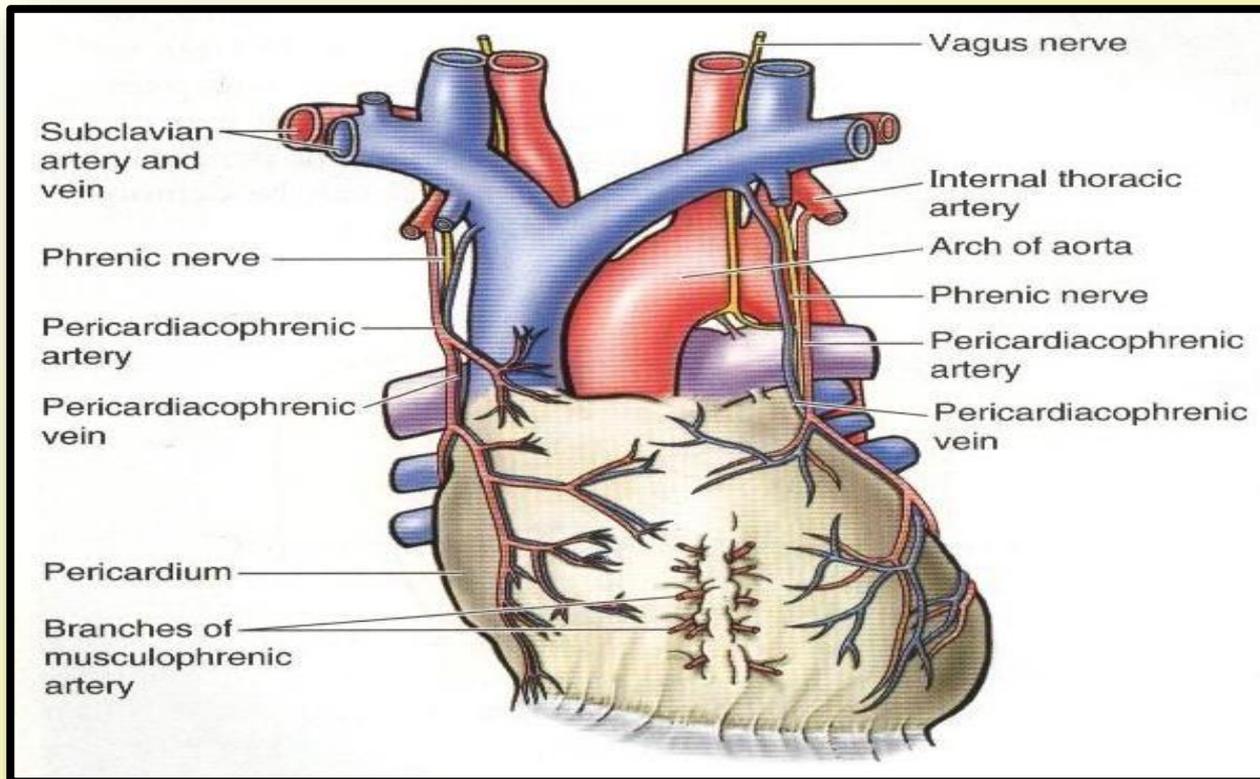
The reflection around the large veins forms an inverted U-shaped called the **oblique sinus**. It runs along the long axis of the heart, from the apex to the ascending aorta.

The relatively short horizontal space between, the reflection of the serous pericardium around the aorta and pulmonary trunk and the reflection around the large veins is the **transverse sinus**.

Nerves of Pericardium

The **phrenic nerves** carry sensory fibers from the **fibrous pericardium** and the **parietal layer of the serous pericardium**.

Visceral afferent fibers travel with branches of the **sympathetic trunks** and the **vagus nerves** from the visceral layer of the serous pericardium.



HEART

Orientation

The heart is aligned obliquely within the thorax, with an apex (pointed end) directed downward, forward, and to the left .

The left ventricle forms the **apex** of the heart. It lies at the level of the **fifth left** intercostal space, (9 cm) from the midline.

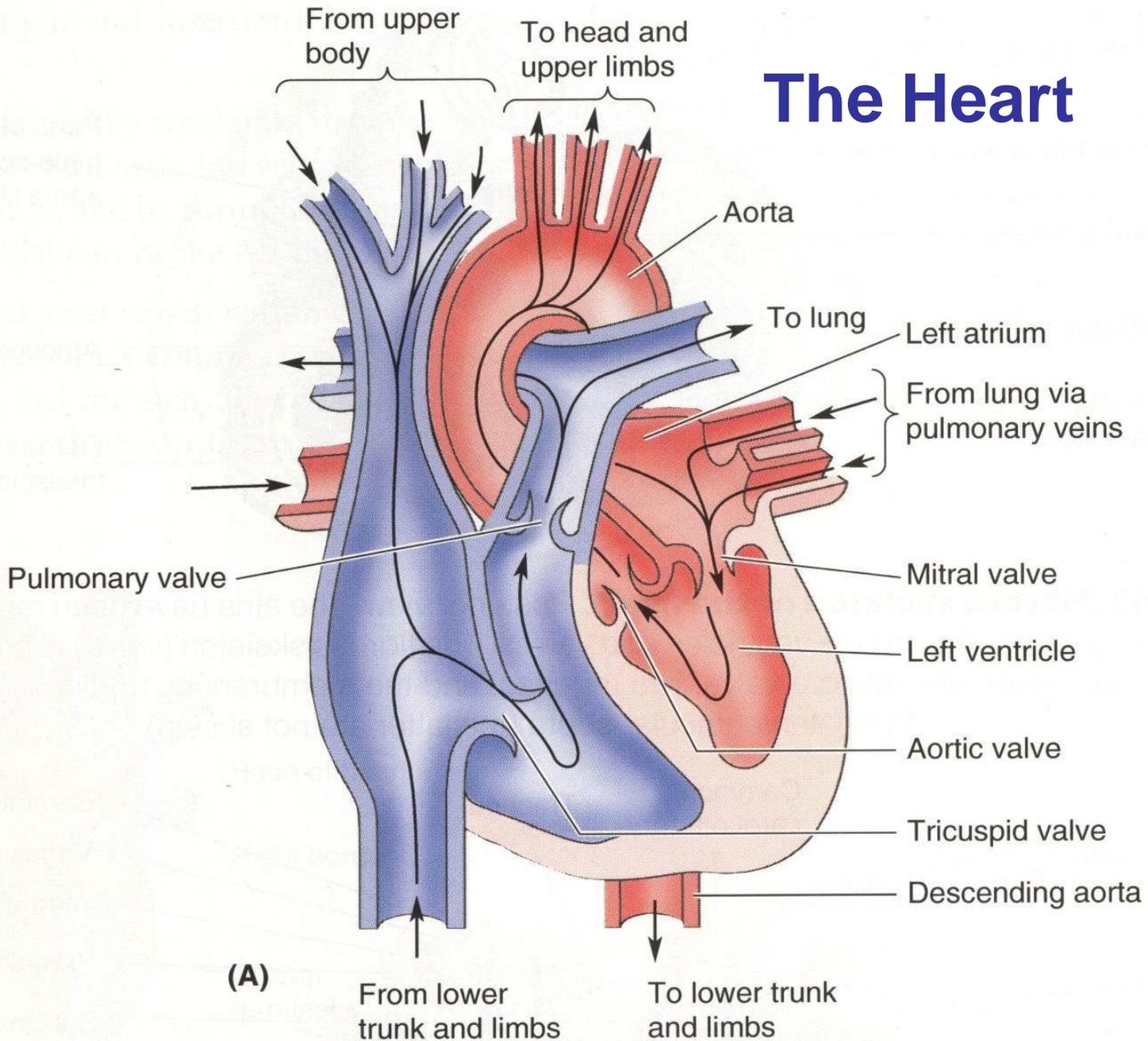
- ❖ The heart is somewhat pyramid shaped and lies within the pericardium in the middle mediastinum It is connected at its base to the great blood vessels but otherwise lies free within the pericardium.

The heart contains four chambers,

- two **atria**
- two **ventricles**

. The atria and ventricles are connected via **atrioventricular valves**.

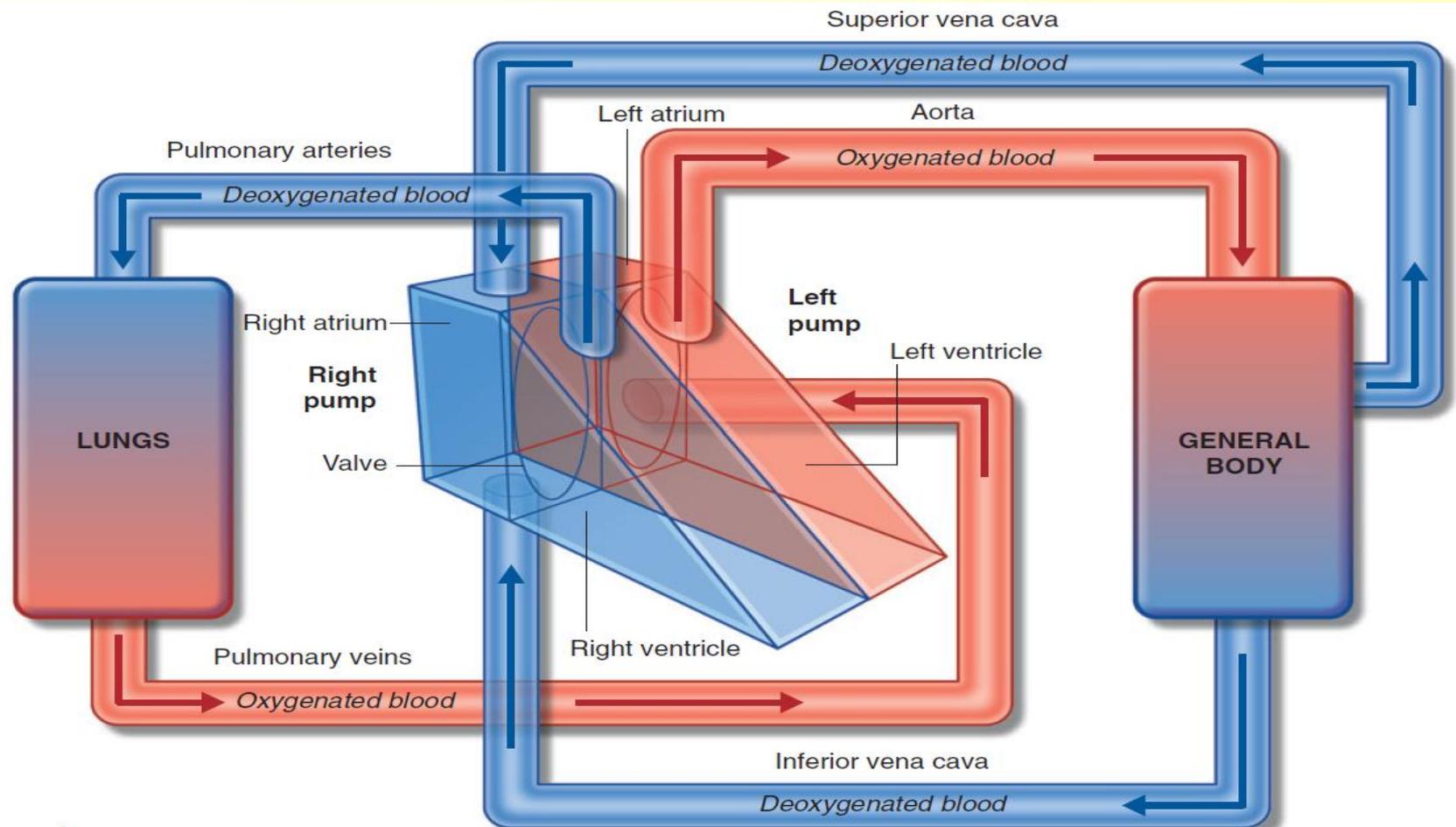
The Heart



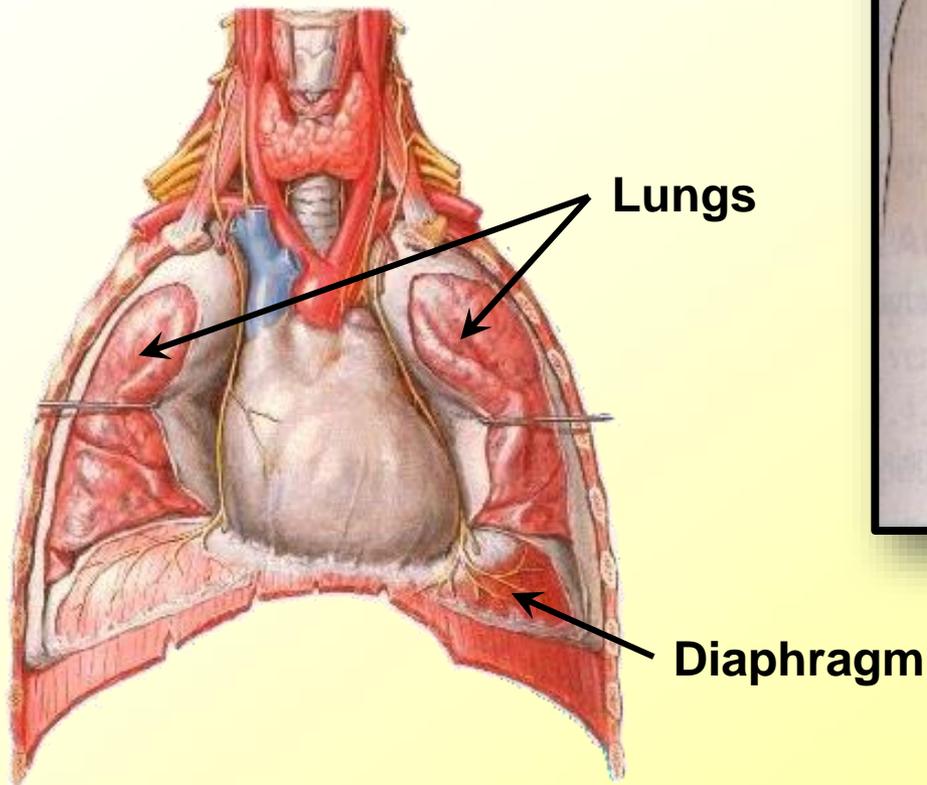
The heart has two functional circuits, the right heart and the left heart.

The **right heart** (right atrium and right ventricle) is the **pulmonary circuit** pump. In this, blood travels a relatively short distance to the lungs and back against

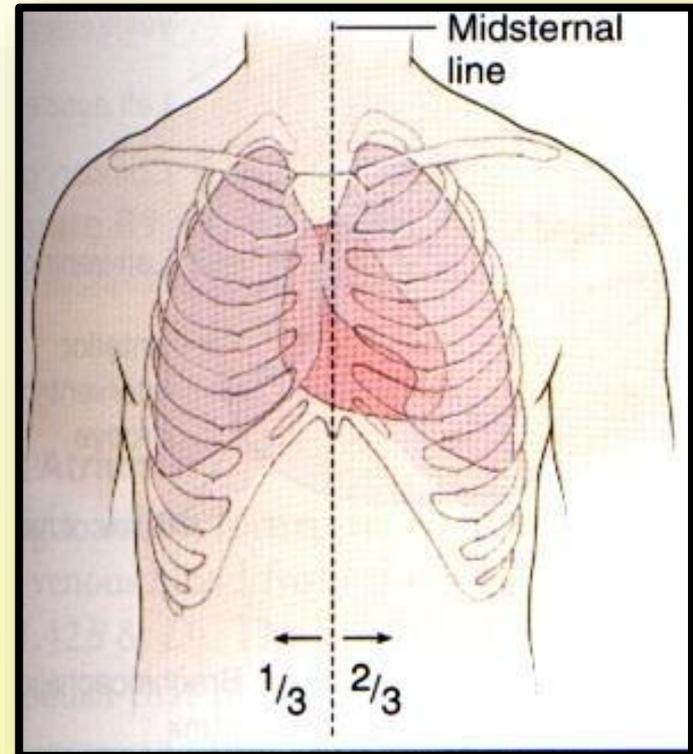
The **left heart** (left atrium and left ventricle) is the **systemic circuit** pump. Here, blood travels a long distance through the body against



Position of the Heart



Ref.1



Ref.2

Shape & Surfaces

1. **anterior (sternocostal) surface:** faces anteriorly and consists mostly of the right ventricle, with some of the right atrium on the right and some of the left ventricle on the left.
 - The right atrium and the right ventricle are separated from each other by the vertical **atrioventricular groove (coronary sulcus)**.
 - The right ventricle is separated from the left ventricle by the **anterior interventricular groove**.

2. **diaphragmatic (inferior) surface:**

The heart in the anatomical position rests on the diaphragmatic surface, which consists of the left ventricle and a small portion of the right ventricle separated by the **posterior interventricular groove**

3. **right pulmonary surface**, formed mainly by the right atrium.

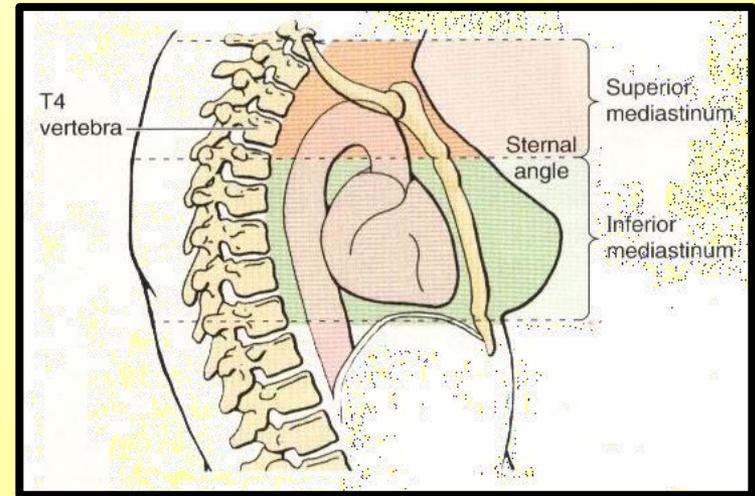
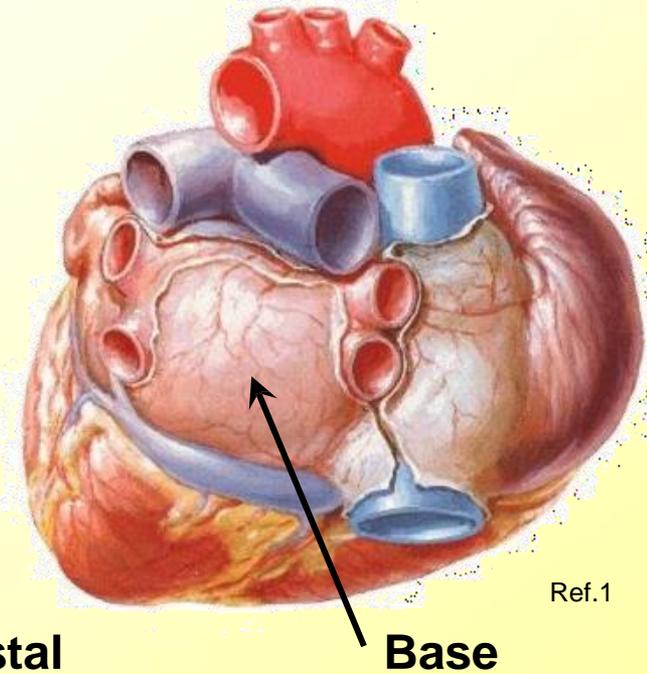
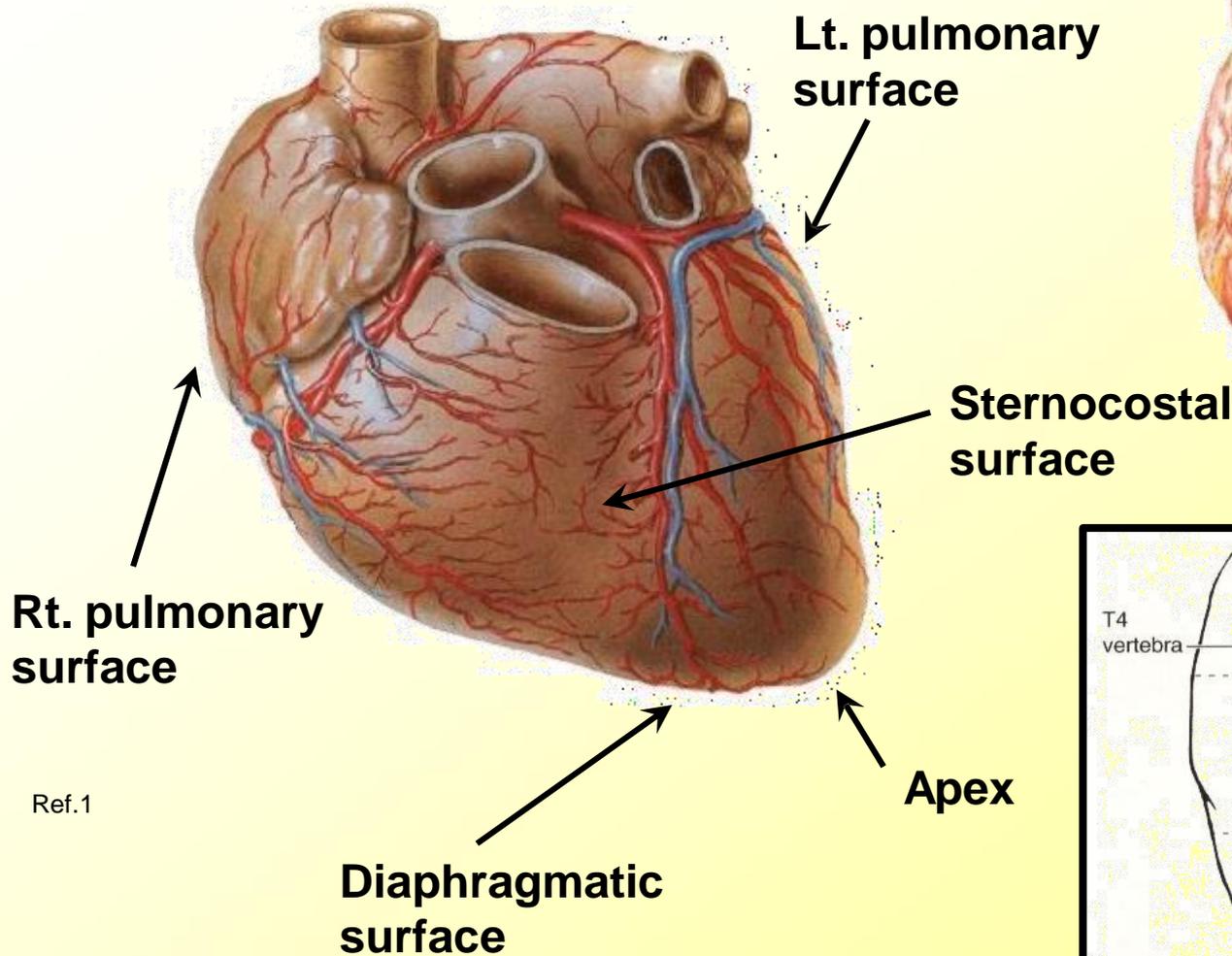
4. **left pulmonary surface**, formed mainly by the left ventricle and a portion of the left atrium; it forms the cardiac impression in the left lung.

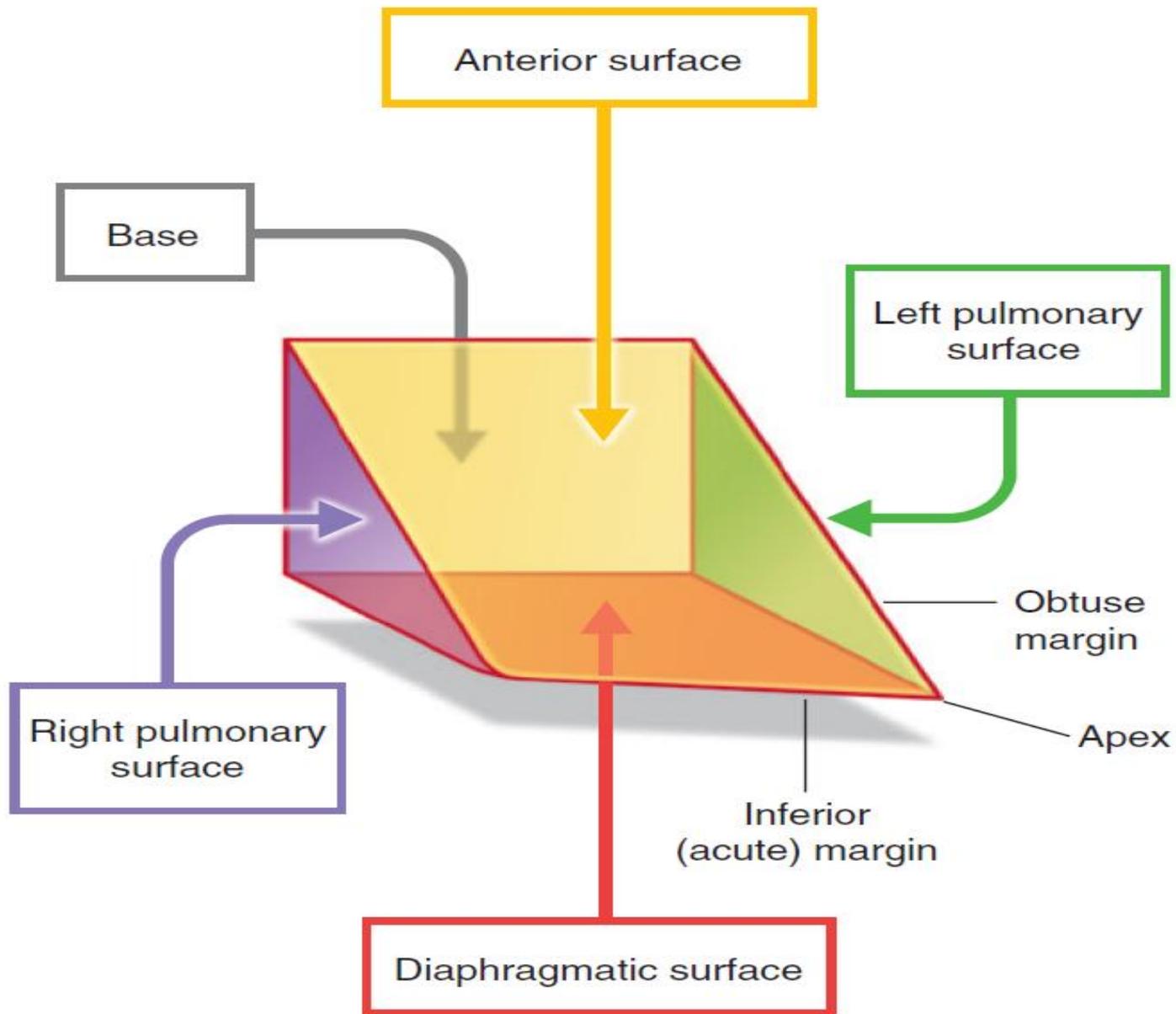
❖ **Base (posterior surface)**

The **base of the heart** is quadrilateral and directed posteriorly. It consists of:

- the left atrium,
- a small portion of the right atrium, and
- the proximal parts of the great veins (superior and inferior venae cavae and the pulmonary veins)

Shape & Surfaces



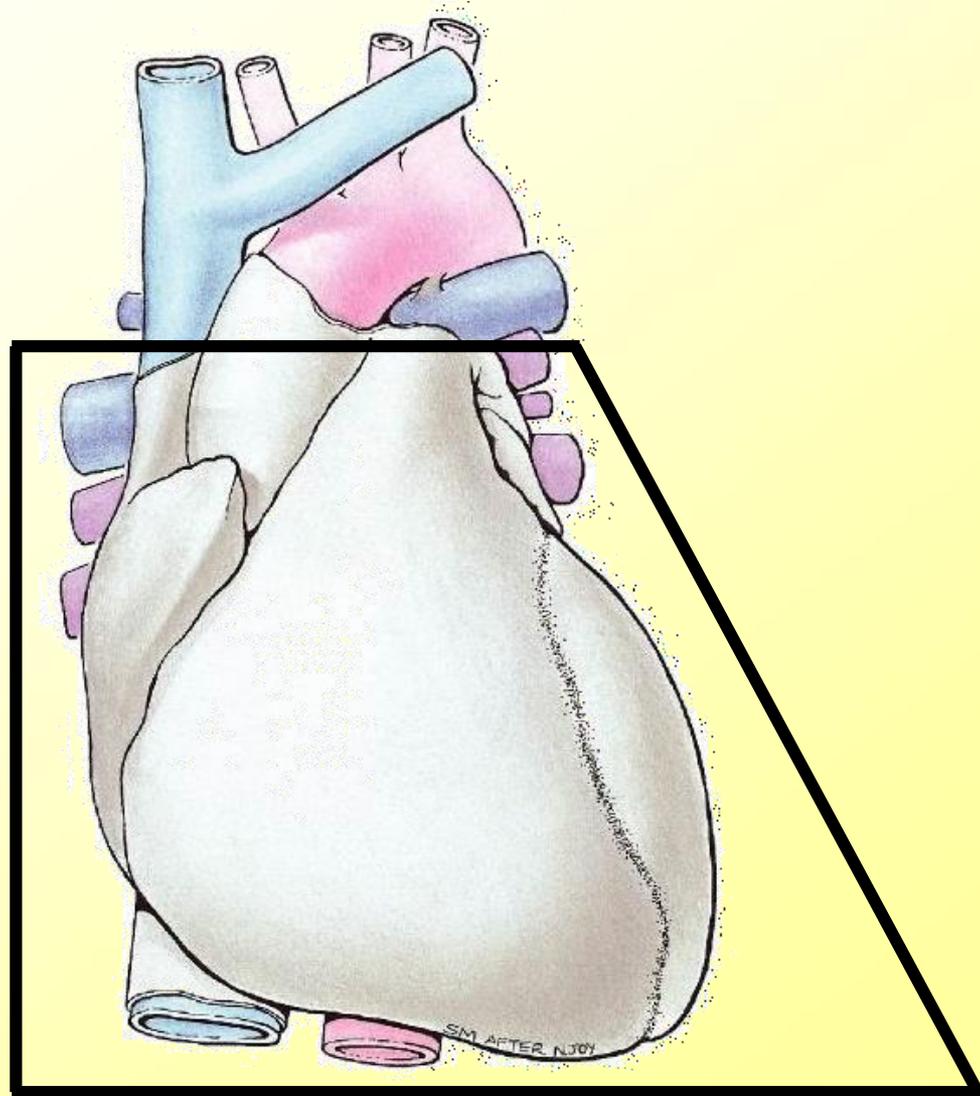


Borders

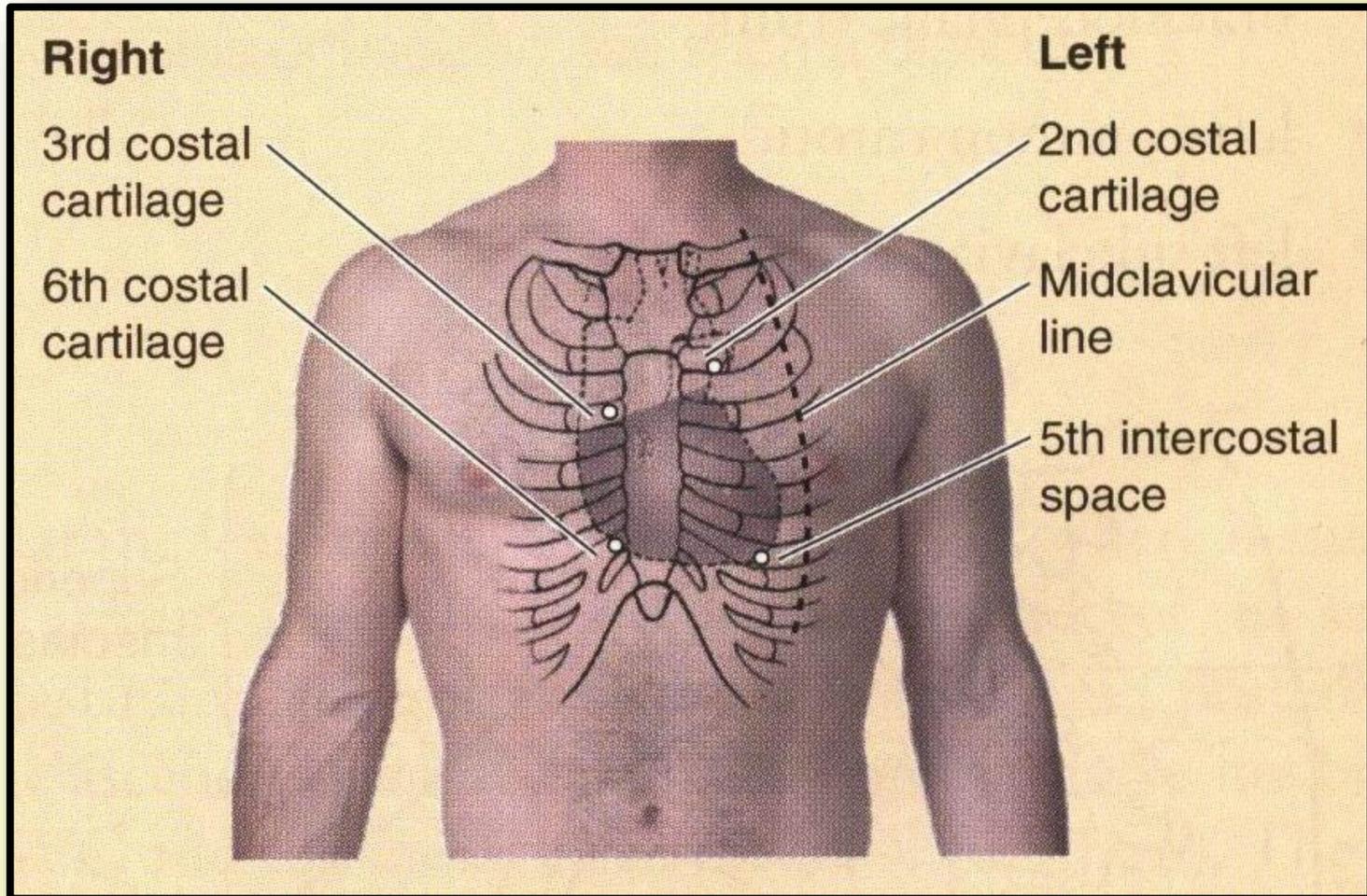
1. **right border** (slightly convex), formed by the right atrium and extending between the SVC and the IVC.
2. **inferior border** (nearly horizontal), formed mainly by the right ventricle and slightly by the left ventricle.
3. **left border** (oblique, nearly vertical), formed mainly by the left ventricle and slightly by the left auricle.
4. **superior border**, formed by the right and left atria and auricles in an anterior view; the ascending aorta and pulmonary trunk emerge from this border and the SVC enters its right side. Posterior to the aorta and pulmonary trunk and anterior to the SVC, this border forms the inferior boundary of the transverse pericardial sinus.

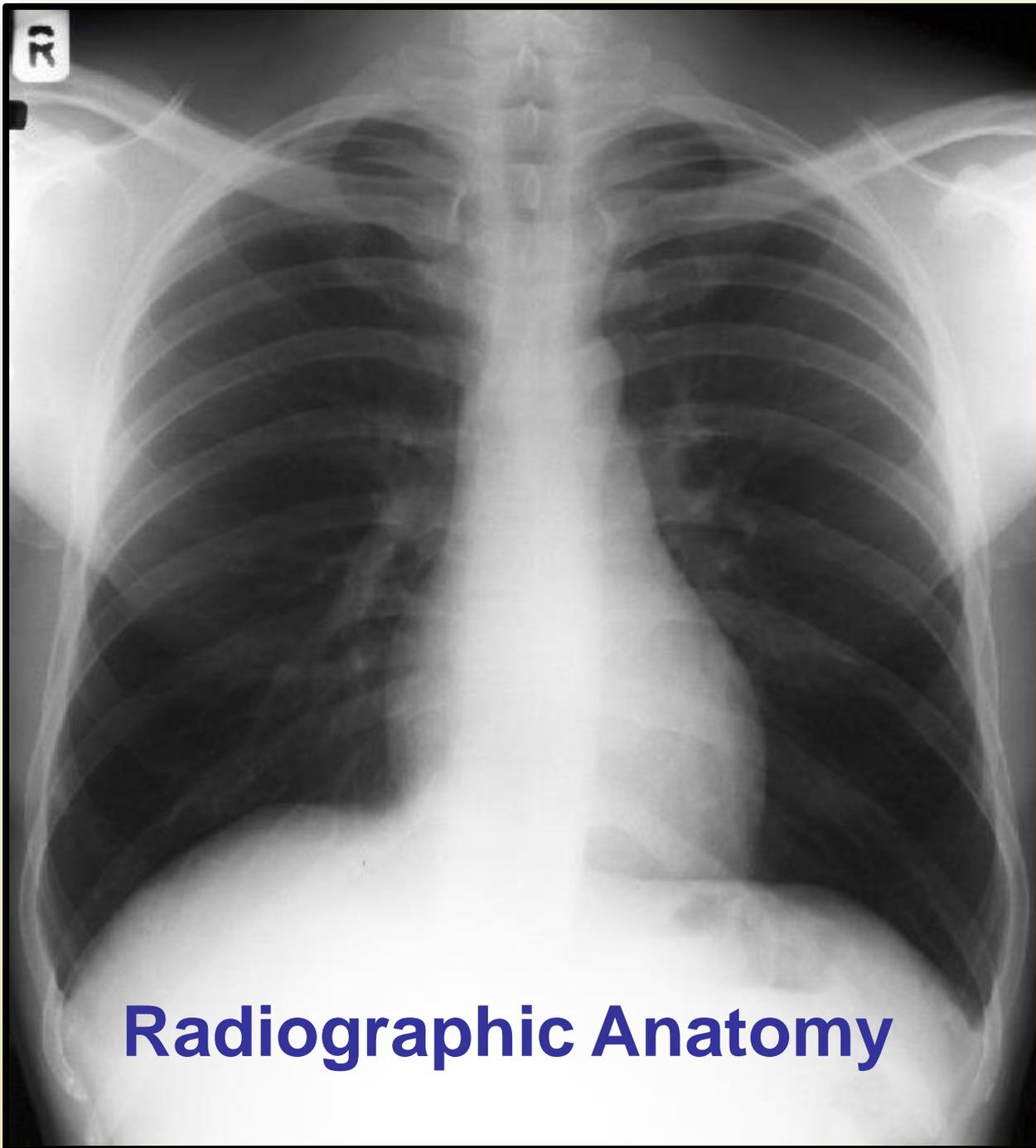
Borders of the Heart

- **Right**
- **Inferior**
- **Left**
- **Superior**



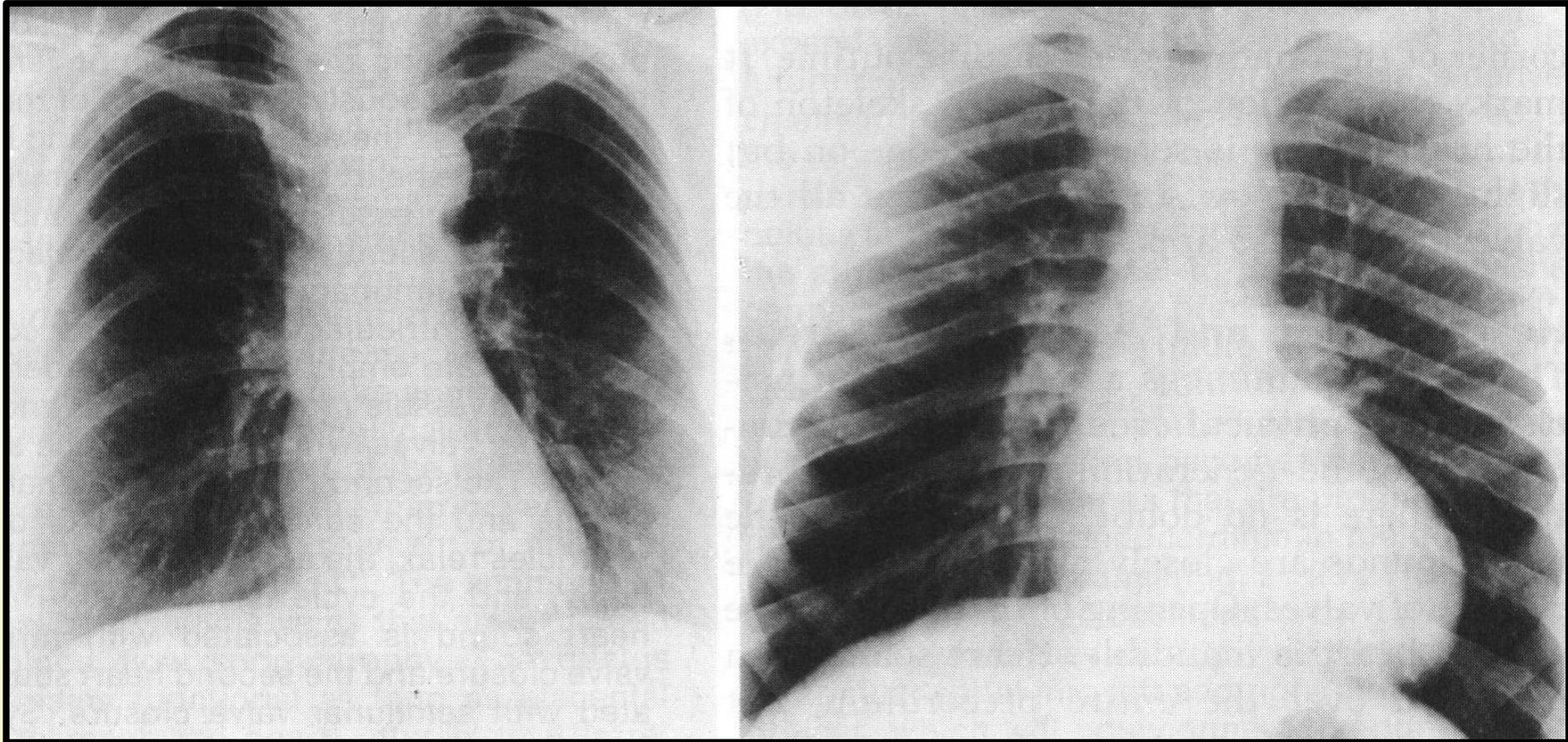
Surface Projection





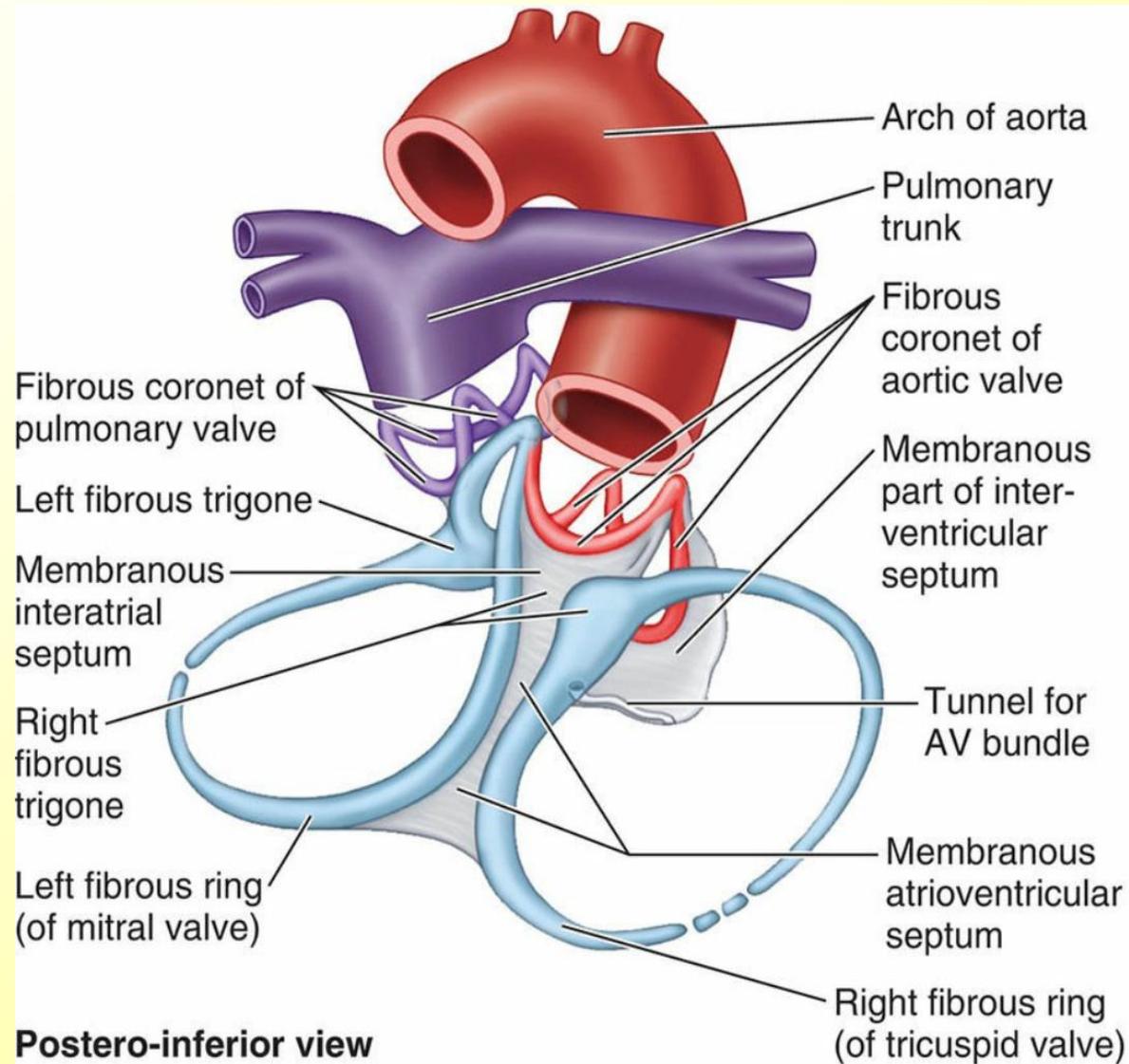
Radiographic Anatomy

Types of Shadows



Fibrous Skeleton

- **Annuli fibrosi**
- **Trigones**
- **Membranous interatrial septum**
- **Membranous interventricular septum**



The cardiac skeleton

is a collection of dense, fibrous connective tissue in the form of four rings with interconnecting areas in a plane between the atria and the ventricles. The four rings of the cardiac skeleton surround the

- two atrioventricular orifices,
- the aortic orifice
- opening of the pulmonary trunks.

They are the **anulus fibrosus**.

The interconnecting areas include:

■ **the right fibrous trigone**, which is a thickened area of connective tissue between the aortic ring and right atrioventricular ring

■ **the left fibrous trigone**, which is a thickened area of connective tissue between the aortic ring and the left atrioventricular ring.

- The cardiac skeleton helps maintain the integrity of the openings it surrounds and provides points of attachment for the cusps. It also separates the atrial musculature from the ventricular musculature. The atrial myocardium originates from the upper border of the rings, whereas the ventricular myocardium originates from the lower border of the rings.
- The cardiac skeleton also serves as a dense connective tissue partition that electrically isolates the atria from the ventricle

Heart Structure

The heart wall has three layers.

1. **epicardium**: The visceral layer of serous pericardium makes up the external layer.
2. **Myocardium**: Cardiac muscle is the primary constituent of the middle layer.
3. **endocardium**: A layer of endothelium (**endocardium**) lines the inner surface and forms the internal layer of the heart.

- ❖ The atrial portion of the heart has relatively thin walls.
- ❖ ventricular portion of the heart has thick walls

Two internal septa divide the heart into its four chambers.

1. The **atrial (interatrial) septum** separates the right and left atria.
 2. The **ventricular(interventricular) septum** separates the right and left ventricles.
- ❖ The ventricular septum has a lower, thicker **muscular part** and a smaller upper, thinner **membranous part**. The **anterior and posterior interventricular grooves** on the surface of the heart mark the position of the ventricular septum.

Right Atrium

The right atrium consists of two parts:

- 1. main cavity (atrium proper):** The atrium proper is smooth walled and forms from the embryonic **sinus venosus**
- 2. Auricle:** The auricle is roughened or trabeculated by bundles of muscle fibers, the **musculi pectinati (pectinate muscles)**

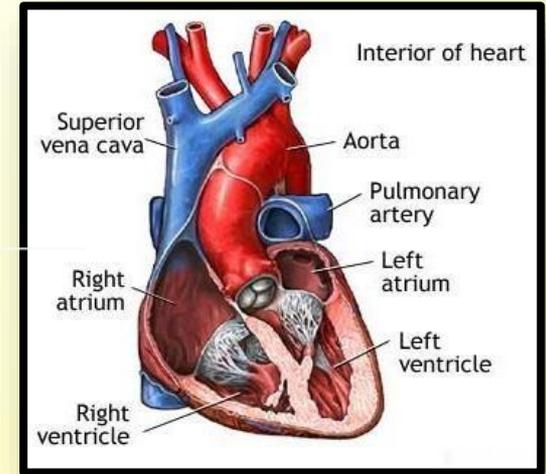
sulcus terminalis:

crista terminalis:

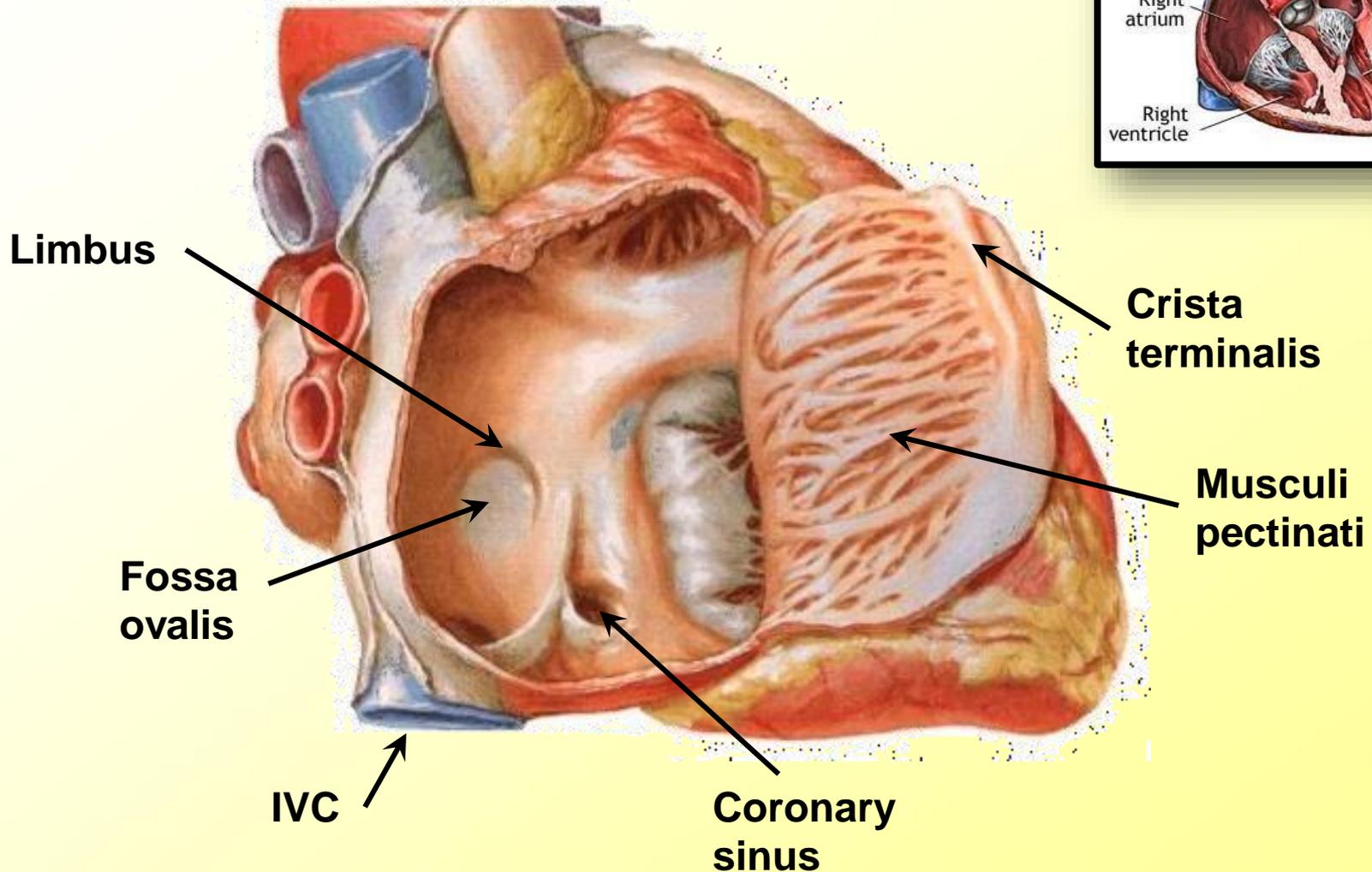
Openings into the Right Atrium

- **Superior vena cava:** which opens into the upper part of the right atrium; **it has no valve.**
 - Blood returns to the heart from the upper half of the body via the superior vena cava
- **inferior vena cava:** (larger than the superior vena cava), which opens into the lower part of the right atrium. A rudimentary, nonfunctioning (in the adult) valve, the valve of the inferior vena cava, guards the opening of the inferior vena cava.
 - Blood returns to the heart from the lower half of the body through the inferior vena cava
- **coronary sinus:** which drains most of the blood from the heart wall
- **right atrioventricular valve (tricuspid valve): right atrioventricular orifice**
- ❖ **fossa ovalis:** lie on the atrial septum, which separates the right atrium from the left atrium, The fossa ovalis is a shallow depression that marks the site of the fetal **foramen ovale**

Right Atrium



Ref.3



Ref.2

Right Ventricle

Blood flows through the **right atrioventricular orifice** passing from the right atrium to the right ventricle. Blood then leaves the ventricle through the **pulmonary orifice** and enters the **pulmonary trunk** .

The infundibulum (conus arteriosus) is the funnel-shaped narrowing of the ventricular cavity where the cavity approaches the pulmonary orifice. This constitutes the right ventricular outflow tract.

trabeculae carneae: The walls of the right ventricle are much thicker than those of the right atrium and show many internal projecting ridges formed of muscle bundles, the trabeculae carneae, are characteristic features of the ventricular walls and give the walls a sponge like appearance

papillary muscles, which project inward and attach by their bases to the ventricular wall; their apices connect by fibrous chords (**chordae tendineae**) to the cusps of the tricuspid valve

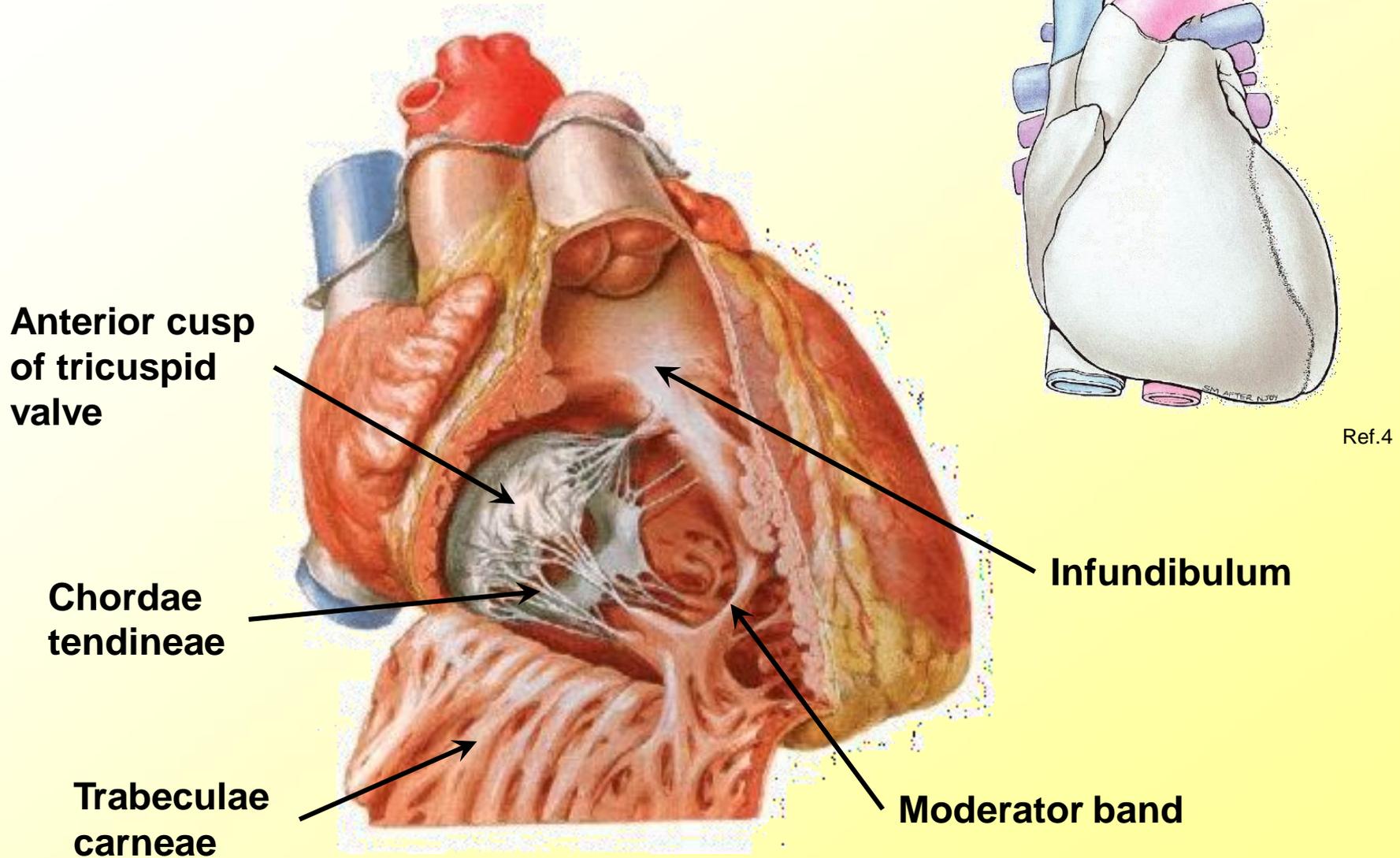
The right atrioventricular (tricuspid) valve:

The valve consists of three cusps (leaflets):

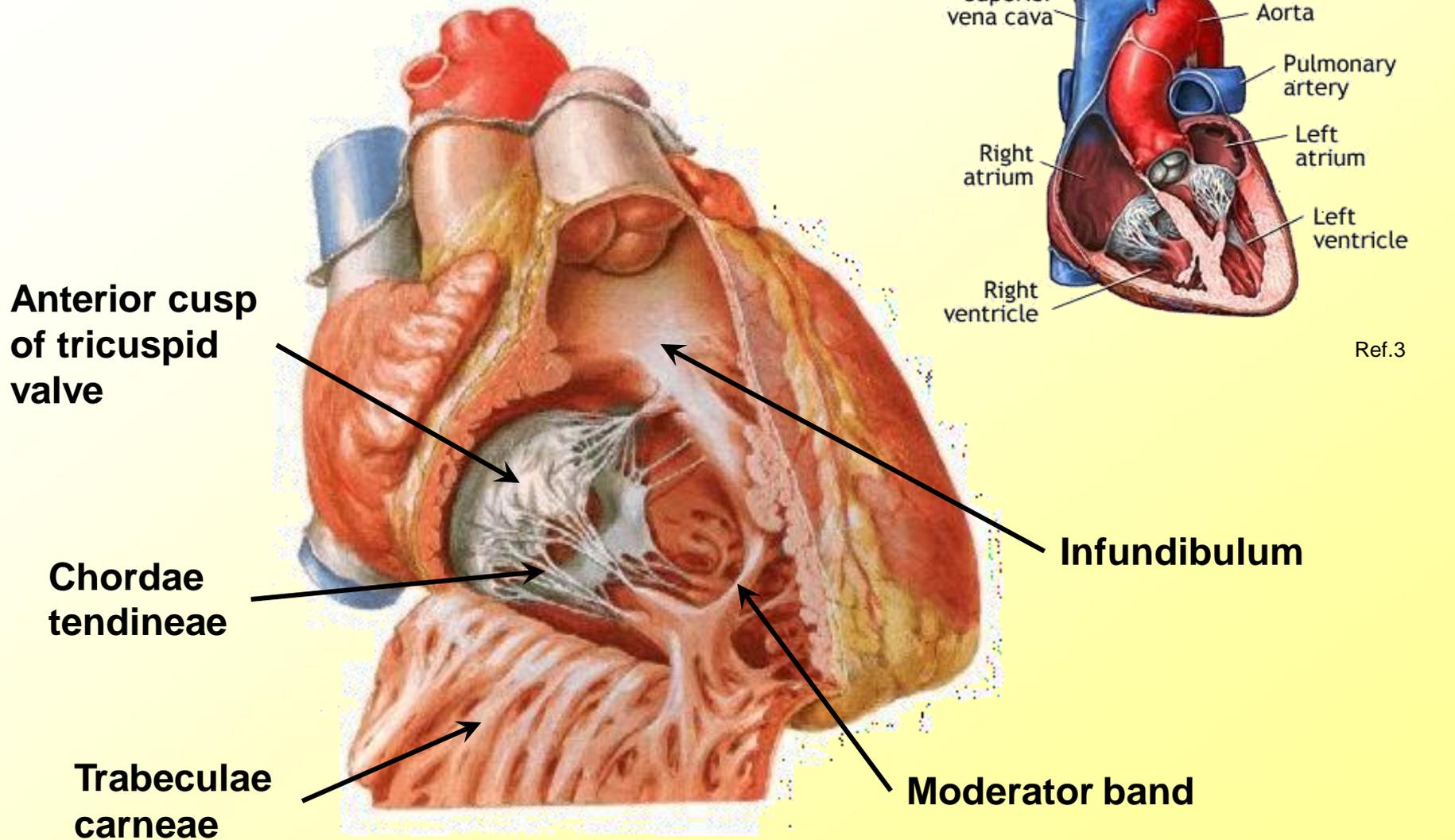
anterior, **septal**, and **inferior** (posterior) cusps

The **pulmonary valve** guards the pulmonary orifice and consists of three **semilunar cusps**

Right Ventricle



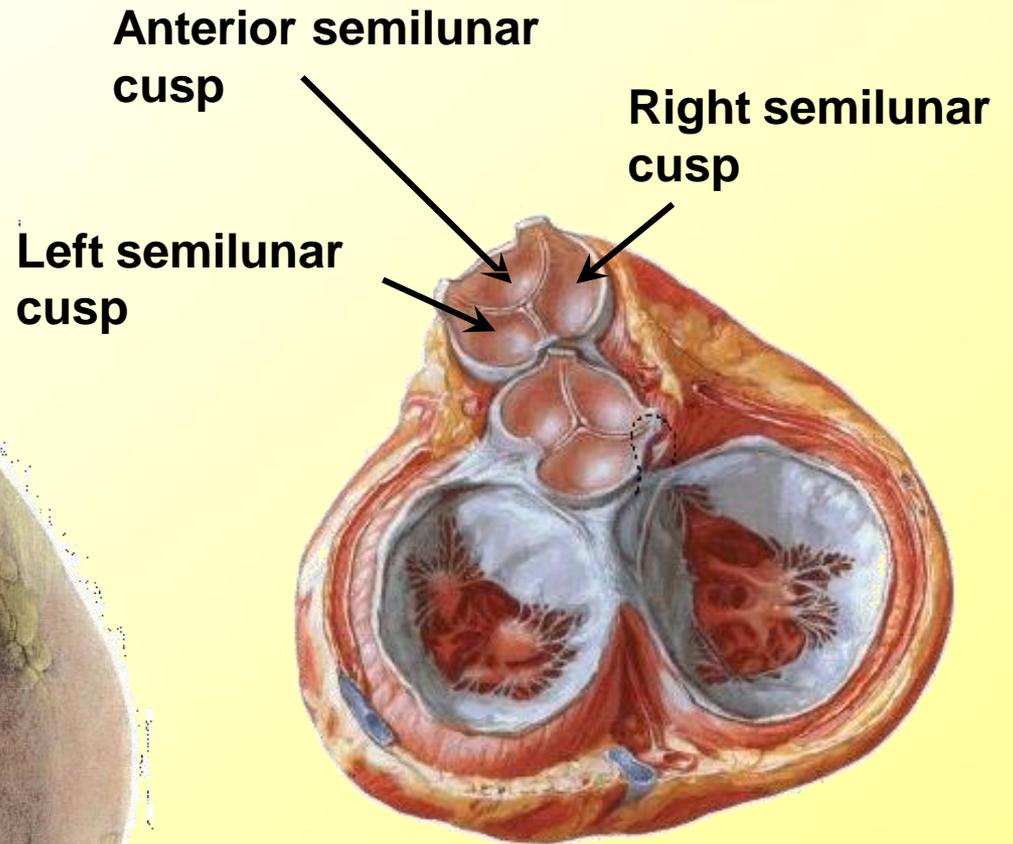
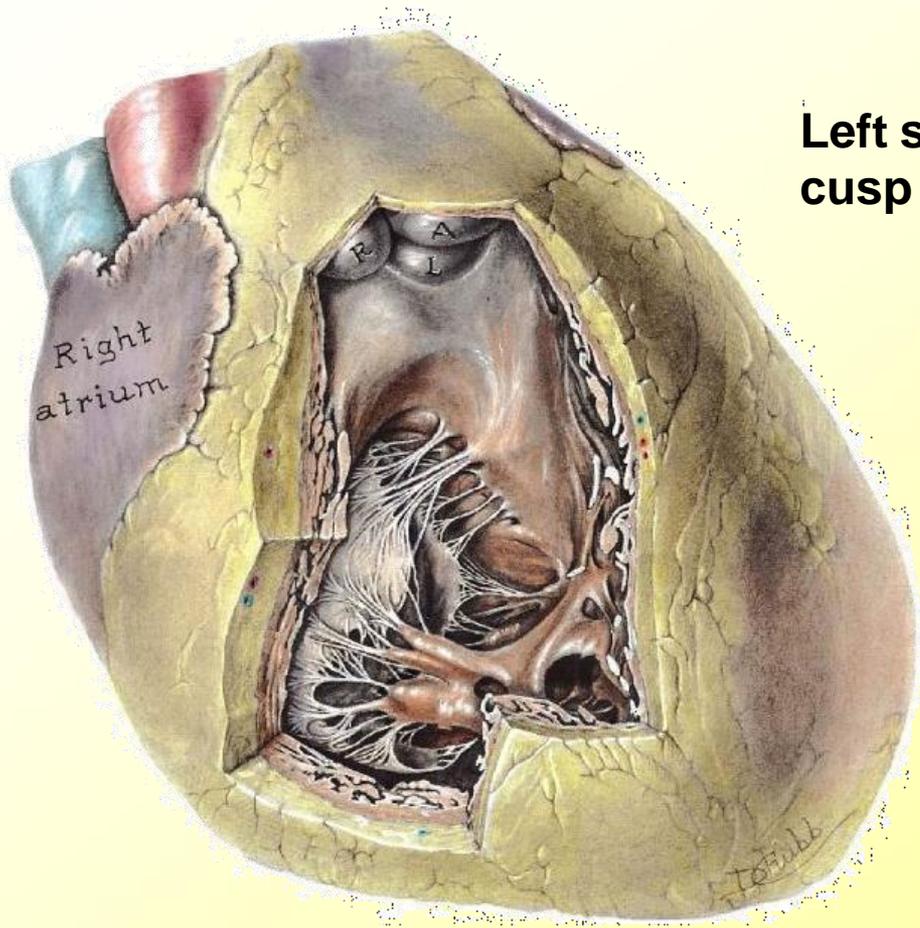
Right Ventricle



Ref.3

Ref.2

Pulmonary Valve



Left Atrium

1. main cavity (atrium proper)
2. auricle

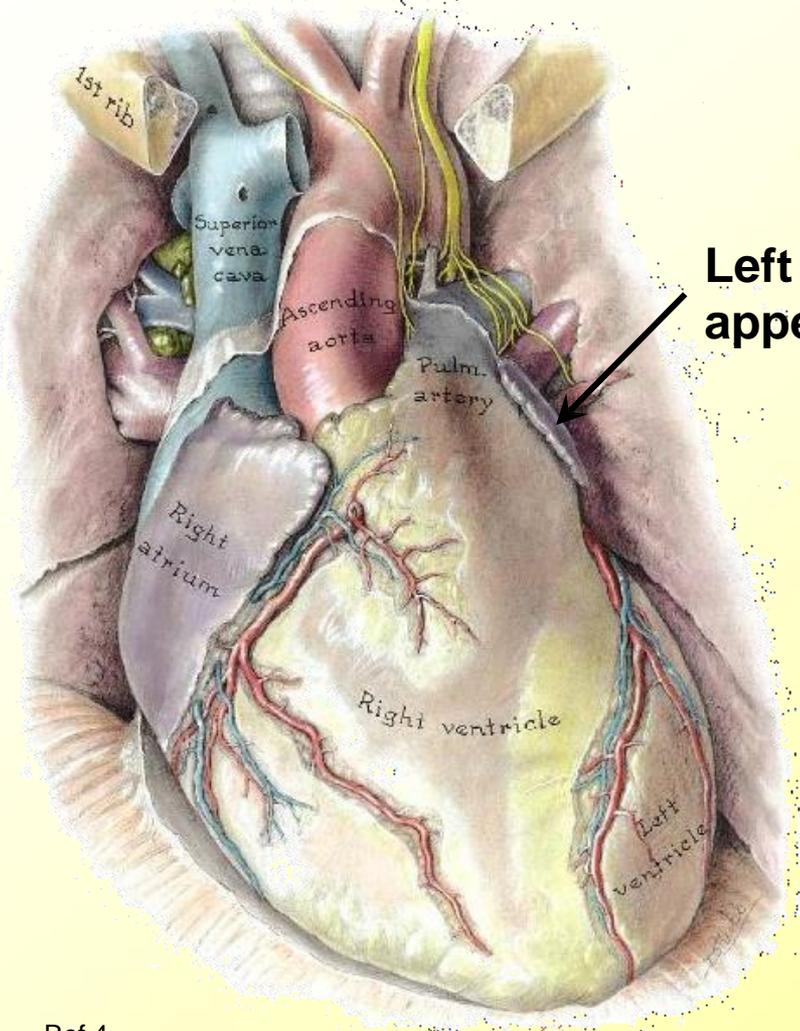
❖ there is no crista terminalis. The fossa ovalis is not a distinctive structure on the left side of the atrial septum

Openings into the Left Atrium

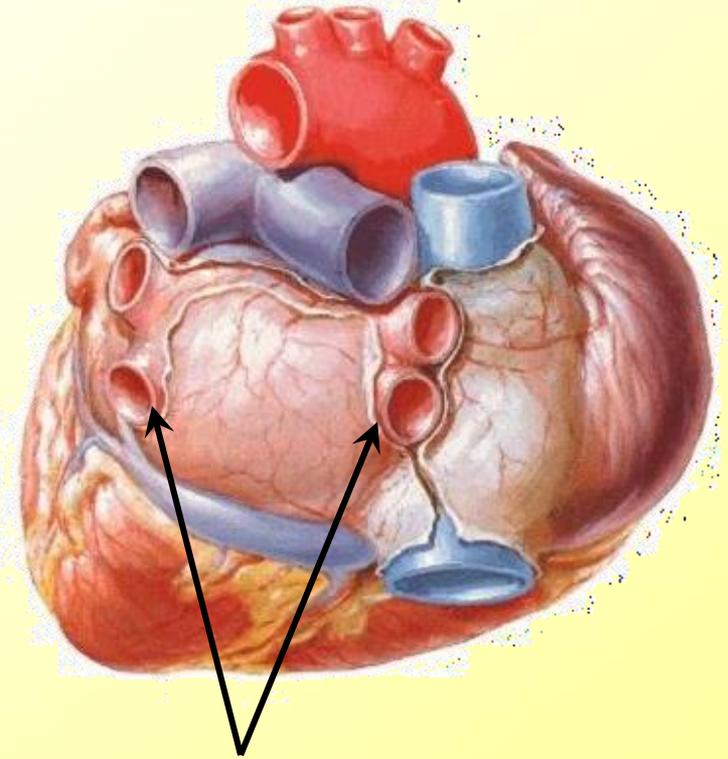
The four pulmonary veins, two from each lung, open through the posterior wall and have no valves.

The left atrioventricular orifice is guarded by the mitral valve.

Left Atrium

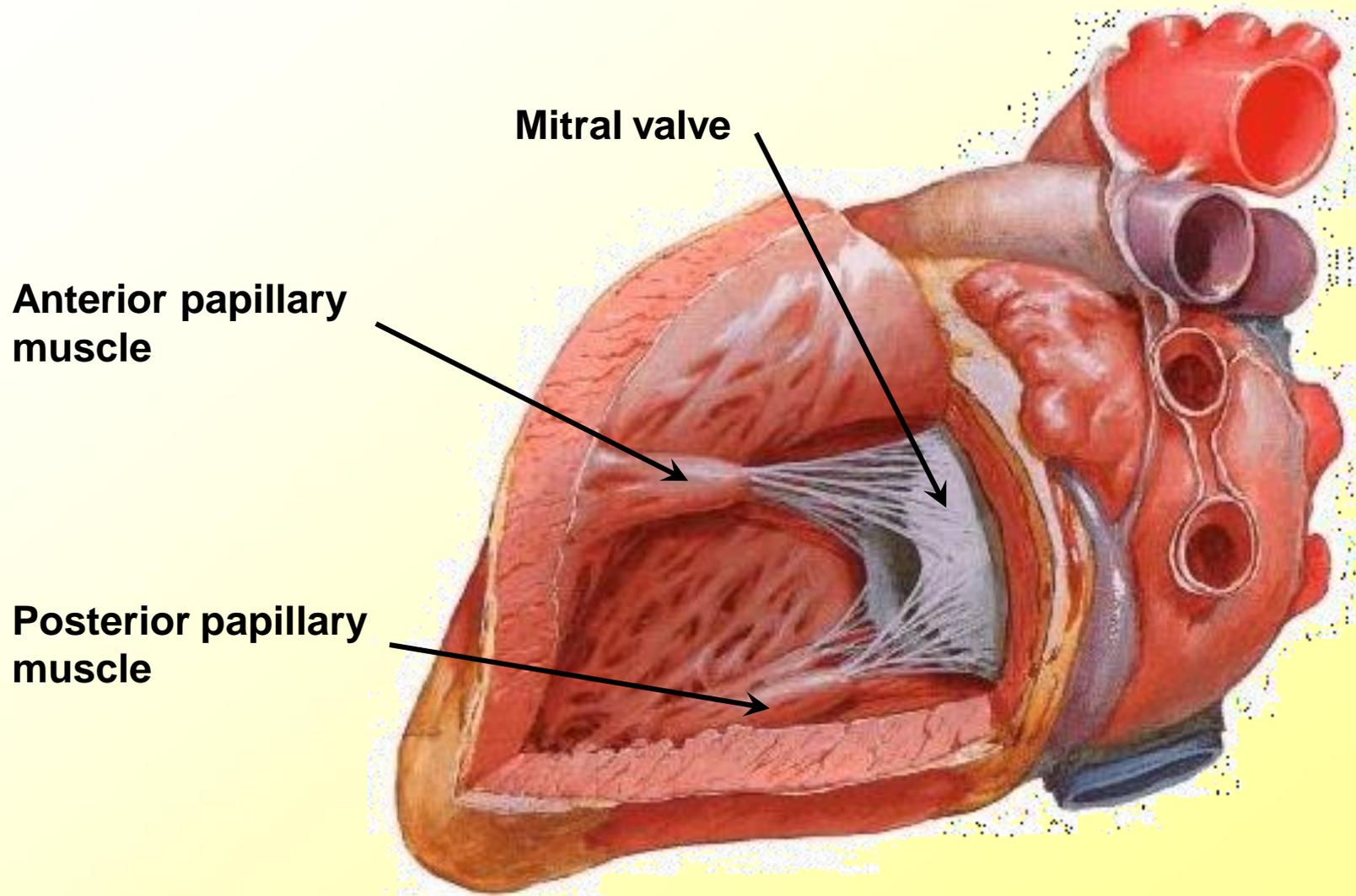


Left atrial appendage



Pulmonary veins

Mitral Valve



Left Ventricle

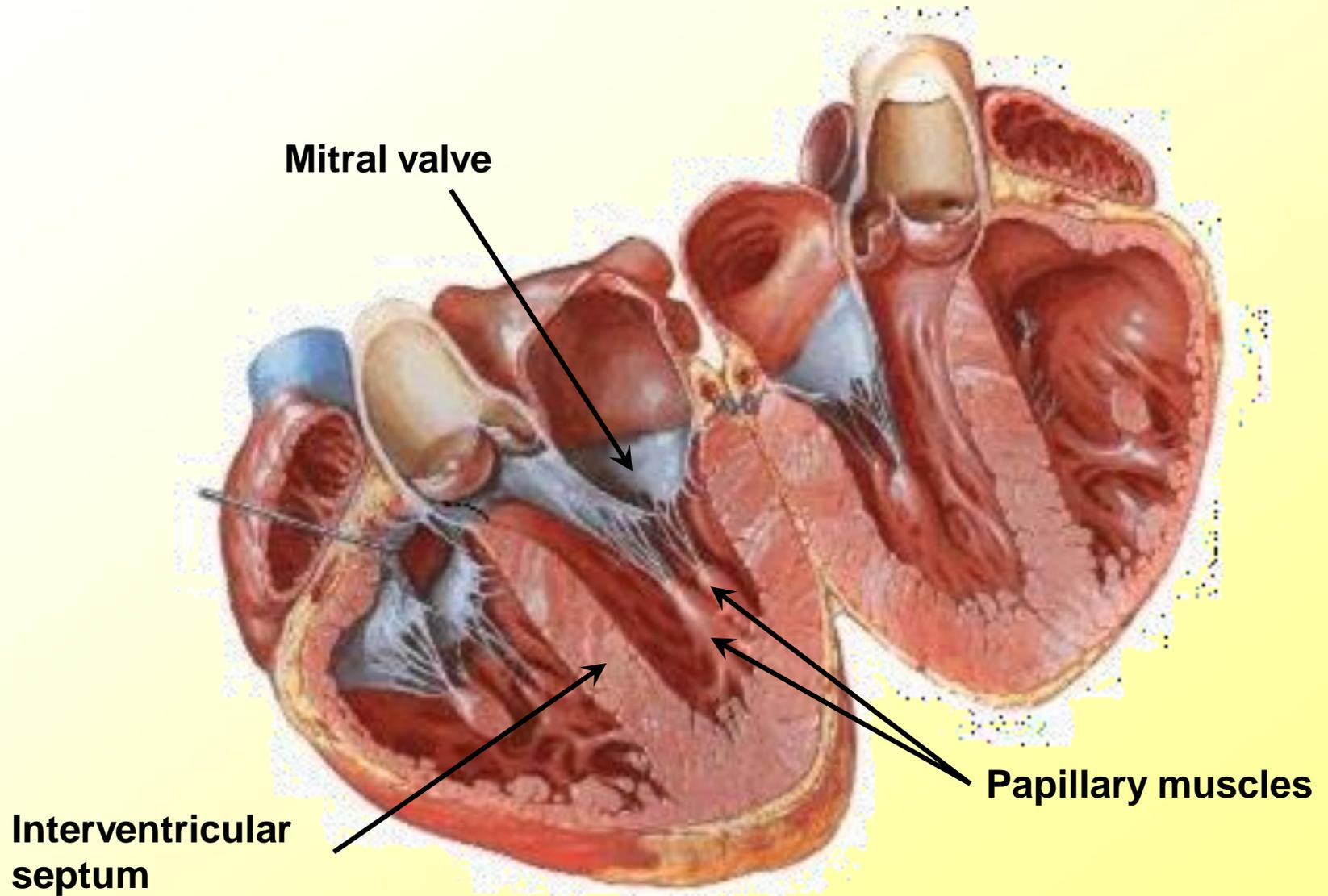
- Blood enters the left ventricle from the left atrium through the **left atrioventricular orifice** and then leaves the ventricle through the **aortic orifice**, where it passes into the ascending aorta . The area just below the aortic orifice is the **aortic vestibule**, which constitutes the left ventricular outflow tract.
- The walls of the left ventricle are three times thicker than those of the right ventricle , and the left intraventricular blood pressure is six times higher than that inside the right ventricle.
 - **trabeculae carneae**
 - **papillary muscles**
 - **chordae tendineae**
 - **left atrioventricular (mitral) valve:** two cusps, one anterior and one posterior.

The aortic valve:

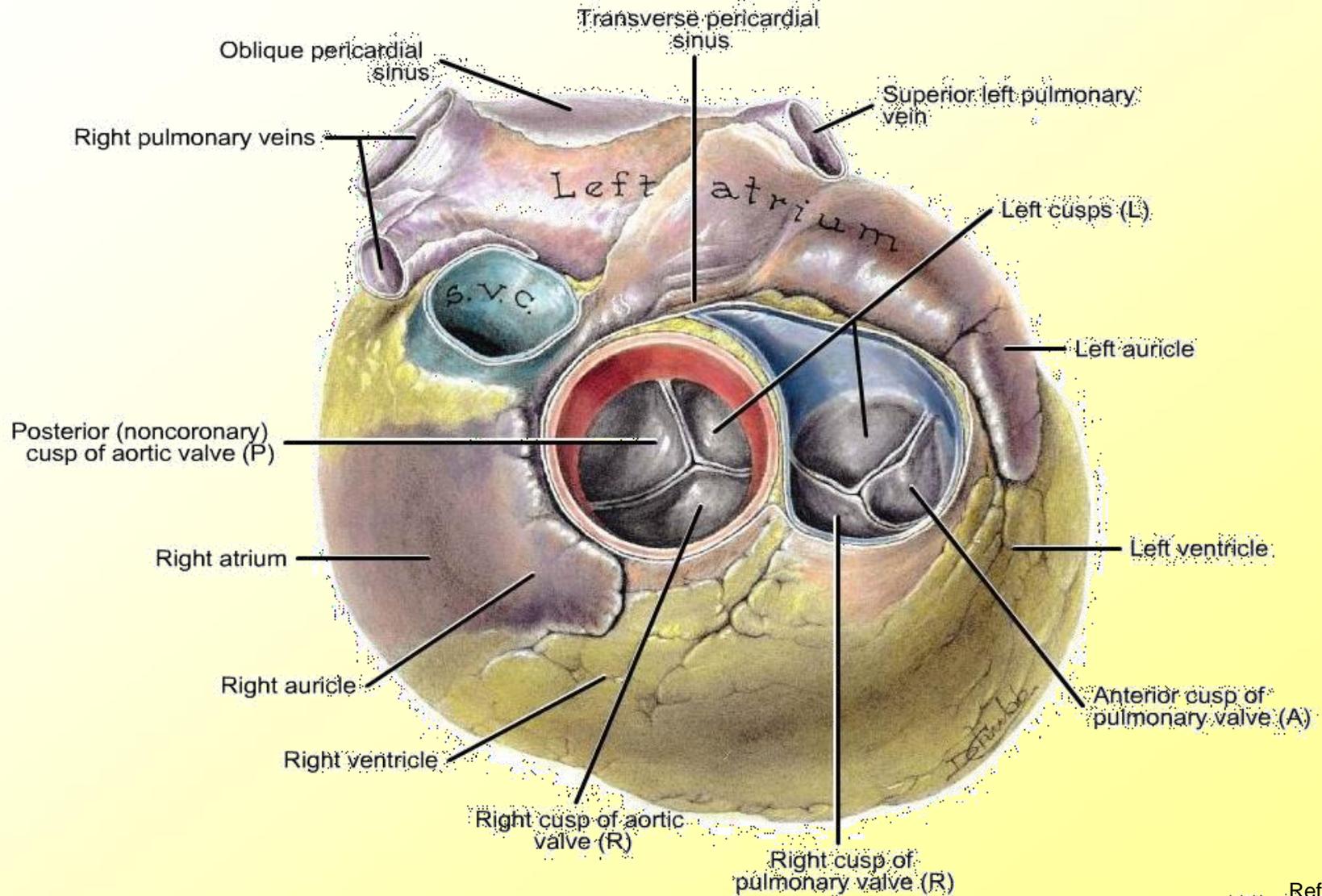
The three cusps are the right coronary, left coronary, and posterior (noncoronary).

Behind each cusp, the aortic wall bulges to form an aortic sinus

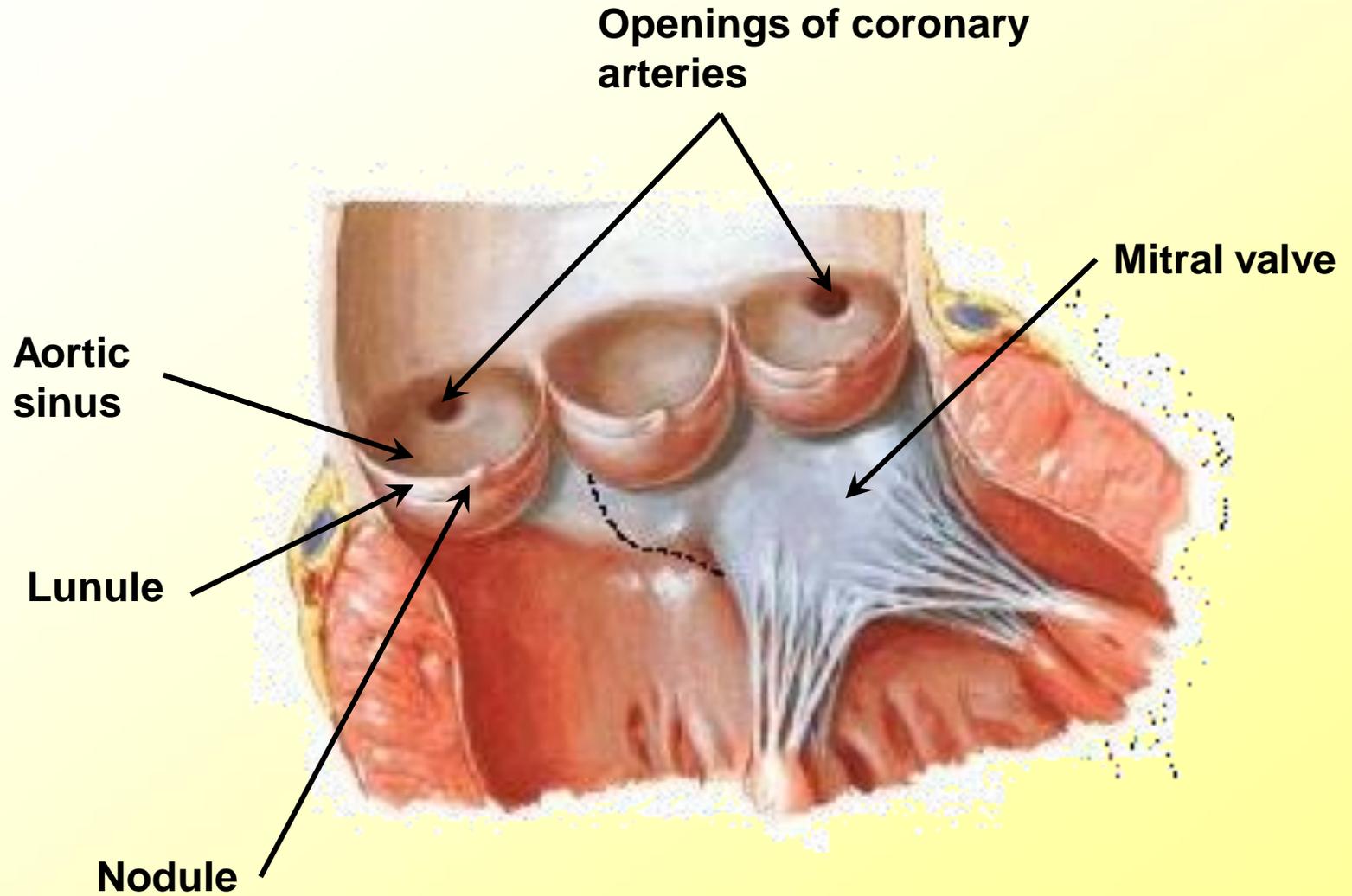
Left Ventricle



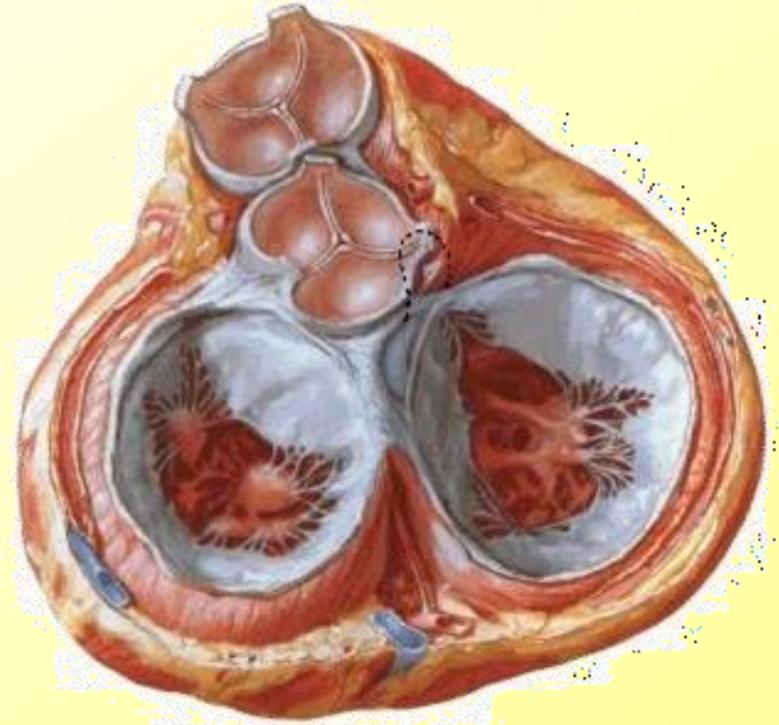
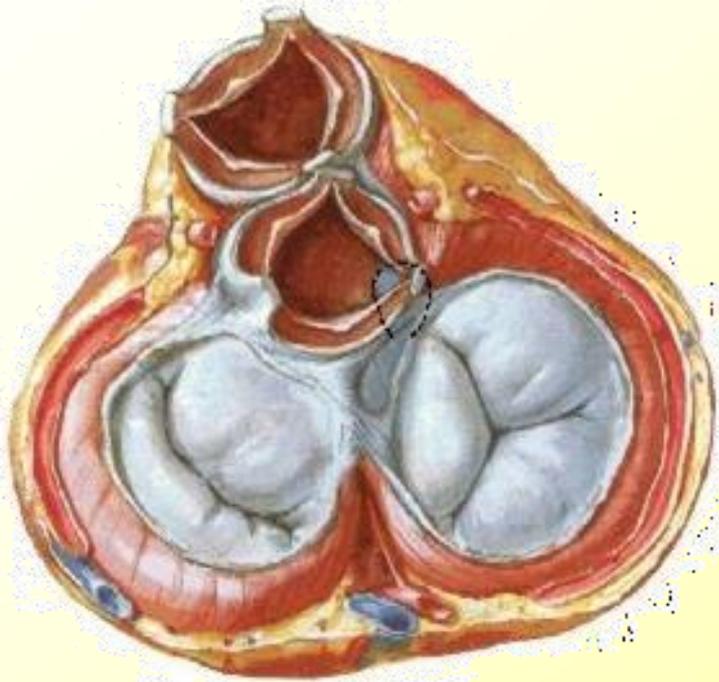
Aortic Valve



Aortic Valve



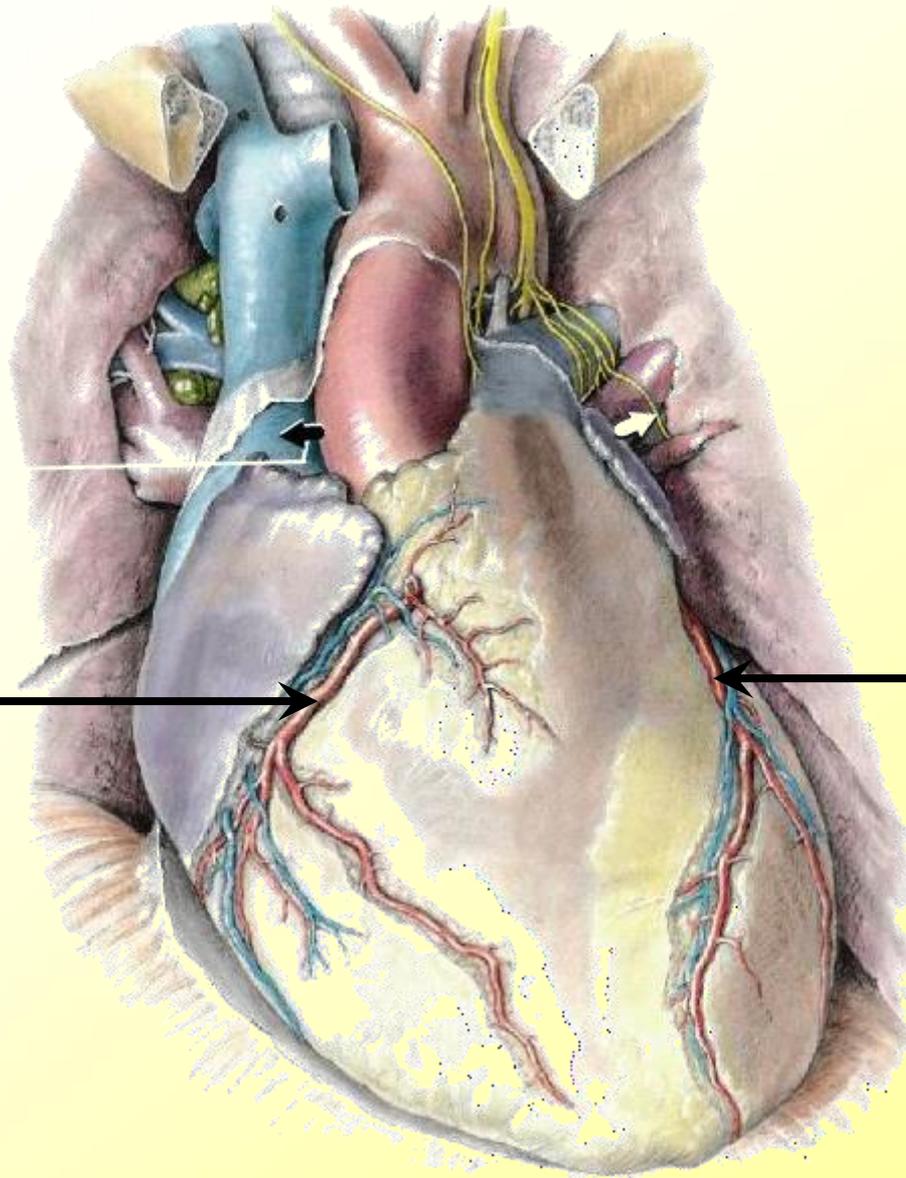
Heart Valves in Systole and Diastole



Arteries of the Heart

Right coronary artery

Left coronary artery



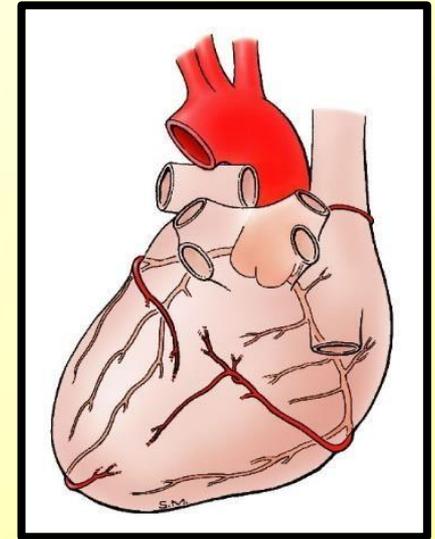
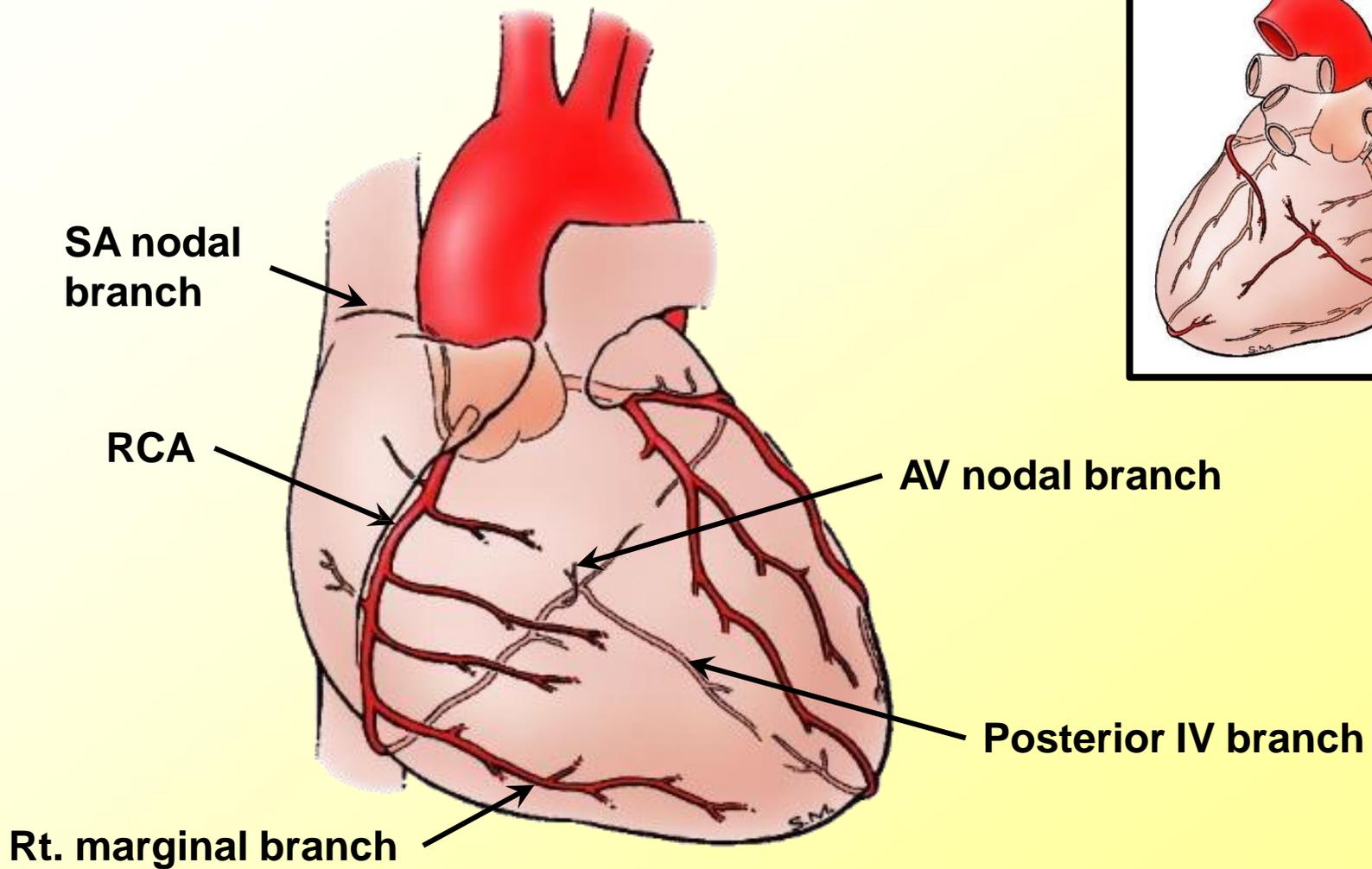
right coronary artery

right coronary artery arises from the right aortic sinus of the ascending aorta, runs forward between the right side of the pulmonary trunk and the right auricle, and descends almost vertically in the **right atrioventricular groove (coronary sulcus)**. At the inferior border of the heart, it continues posteriorly along the atrioventricular groove to anastomose with the left coronary artery in the **posterior interventricular groove**.

Branches

1. The **right conus artery** supplies the anterior surface of the pulmonary conus (infundibulum of the right ventricle) and the upper part of the anterior wall of the right ventricle.
2. Two or three **anterior ventricular branches** supply the anterior surface of the right ventricle. The **right marginal artery** is the largest and runs along the right margin of the anterior surface toward the apex.
3. Two or three **posterior ventricular branches** supply the diaphragmatic surface of the right ventricle. One of these, the **atrioventricular nodal branch**, supplies the AV node.
4. The **posterior interventricular (posterior descending) artery** runs toward the apex in the **posterior interventricular groove**
5. **Atrial branches** supply the anterior and lateral surfaces of the right atrium

Right Coronary Artery (RCA)



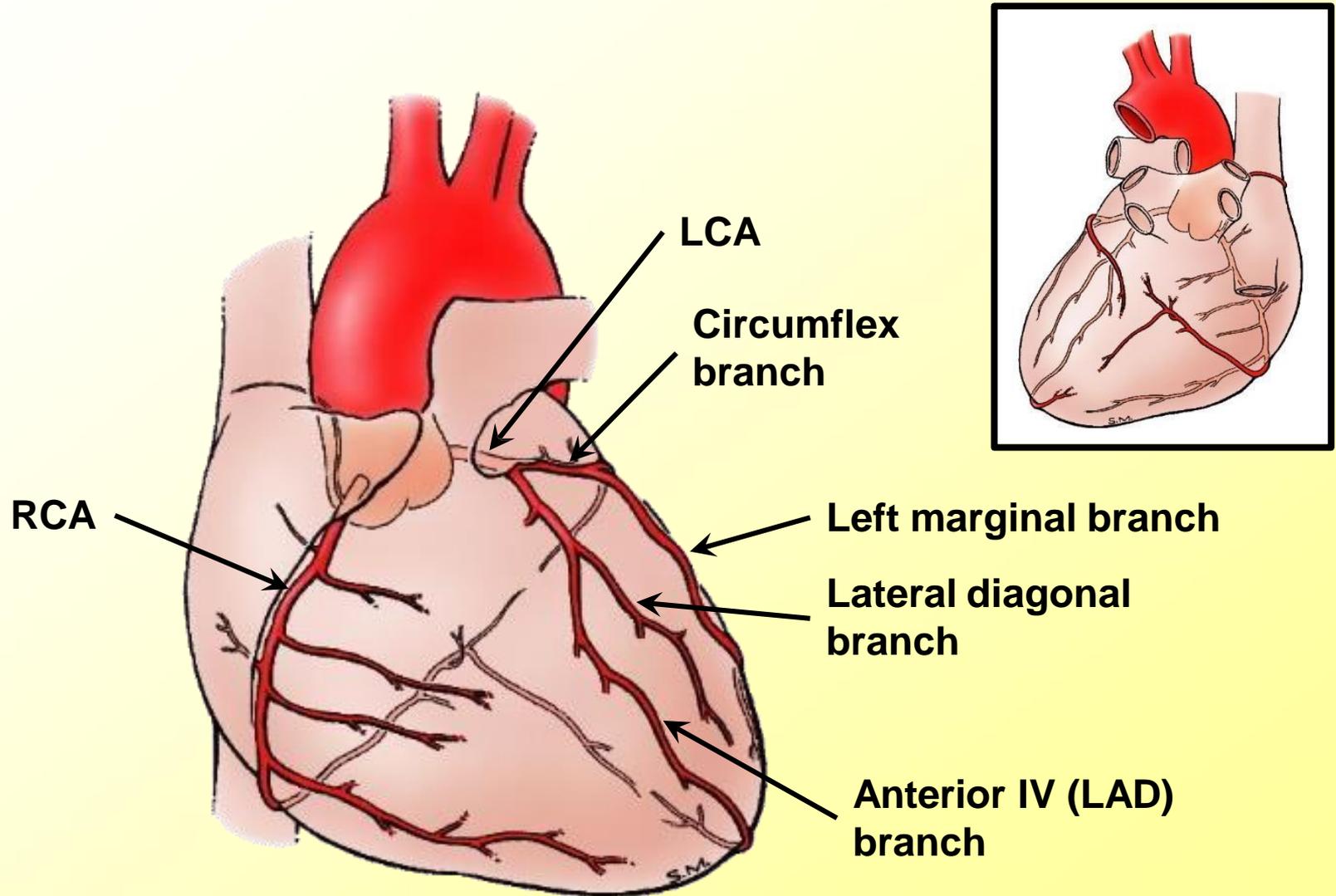
Left Coronary Artery

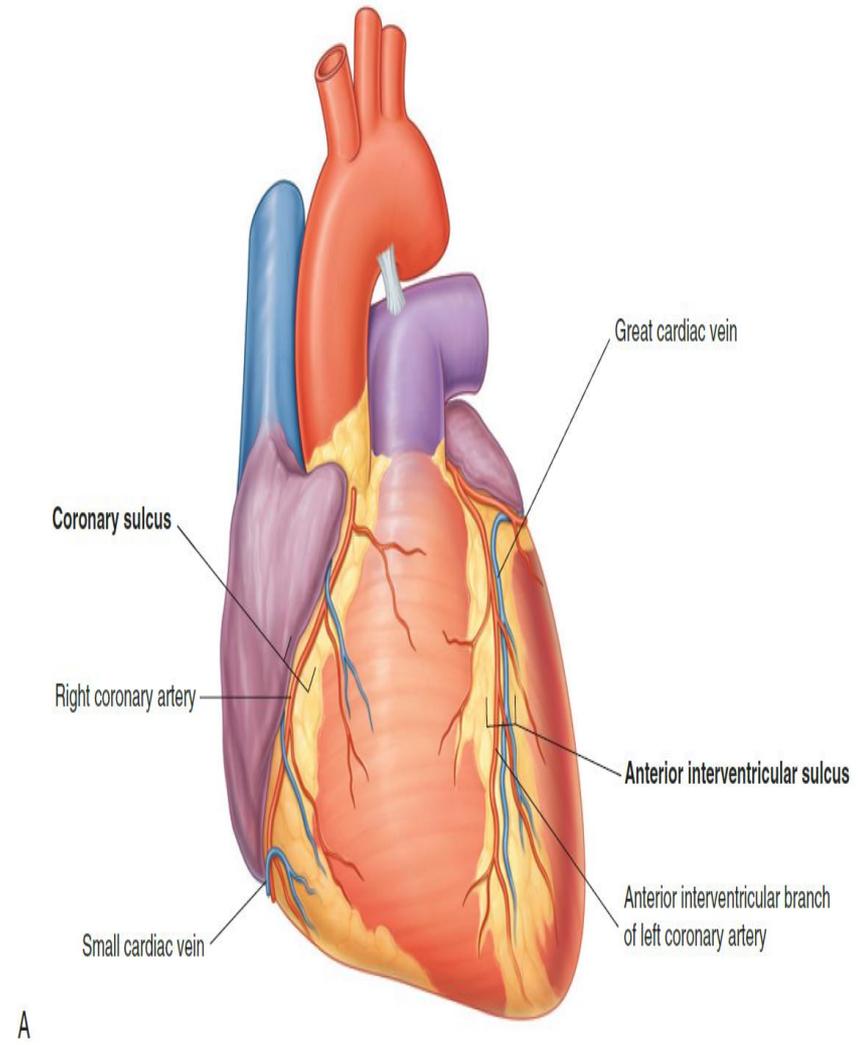
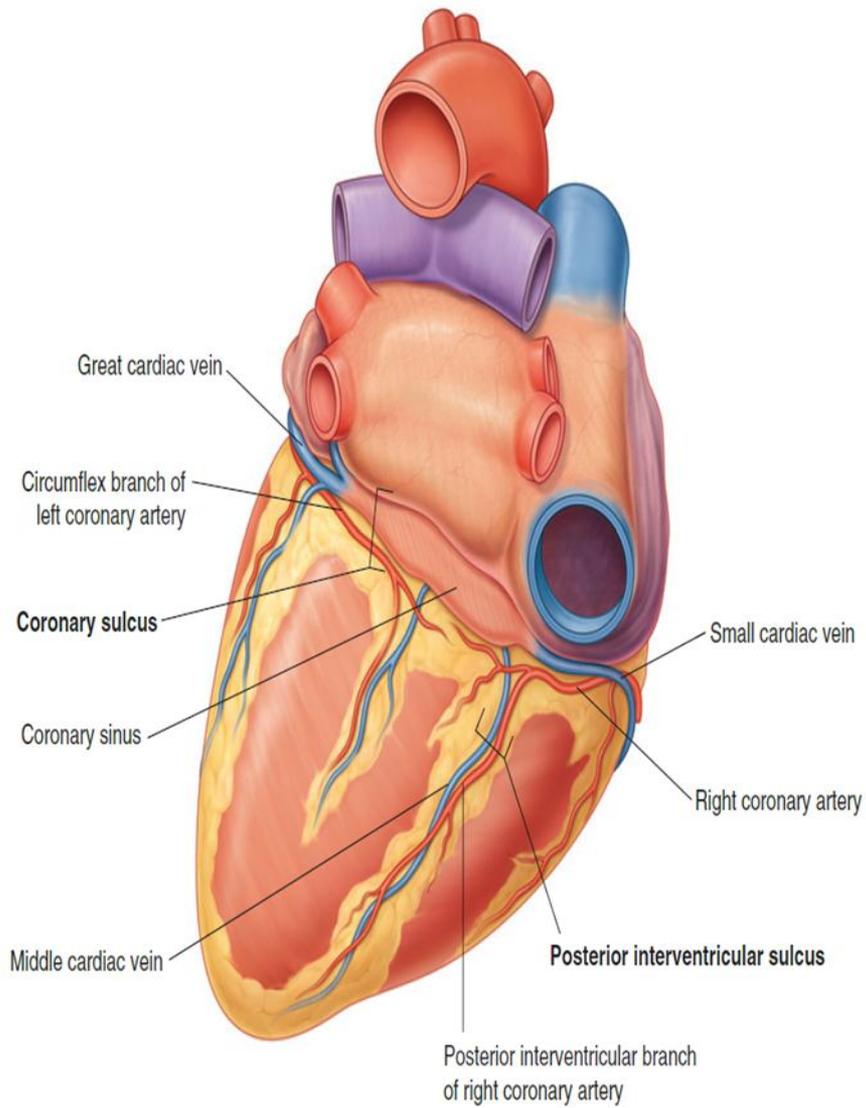
The left coronary artery, which is usually larger than the right coronary artery, supplies the major part of the heart. It arises from the left aortic sinus of the ascending aorta, divides into an anterior **interventricular branch** and a **circumflex branch**

Branches

- 1. The anterior interventricular artery** (left anterior descending artery, LAD) runs downward along the ventricular septum in the anterior interventricular groove to the apex of the heart
 - **diagonal artery**
- 2. The circumflex artery** winds around the **left margin of the heart** in the atrioventricular groove. A **left marginal artery** is a large branch that supplies the left margin of the left ventricle down to the apex

Left Coronary Artery (LCA)





Venous Drainage

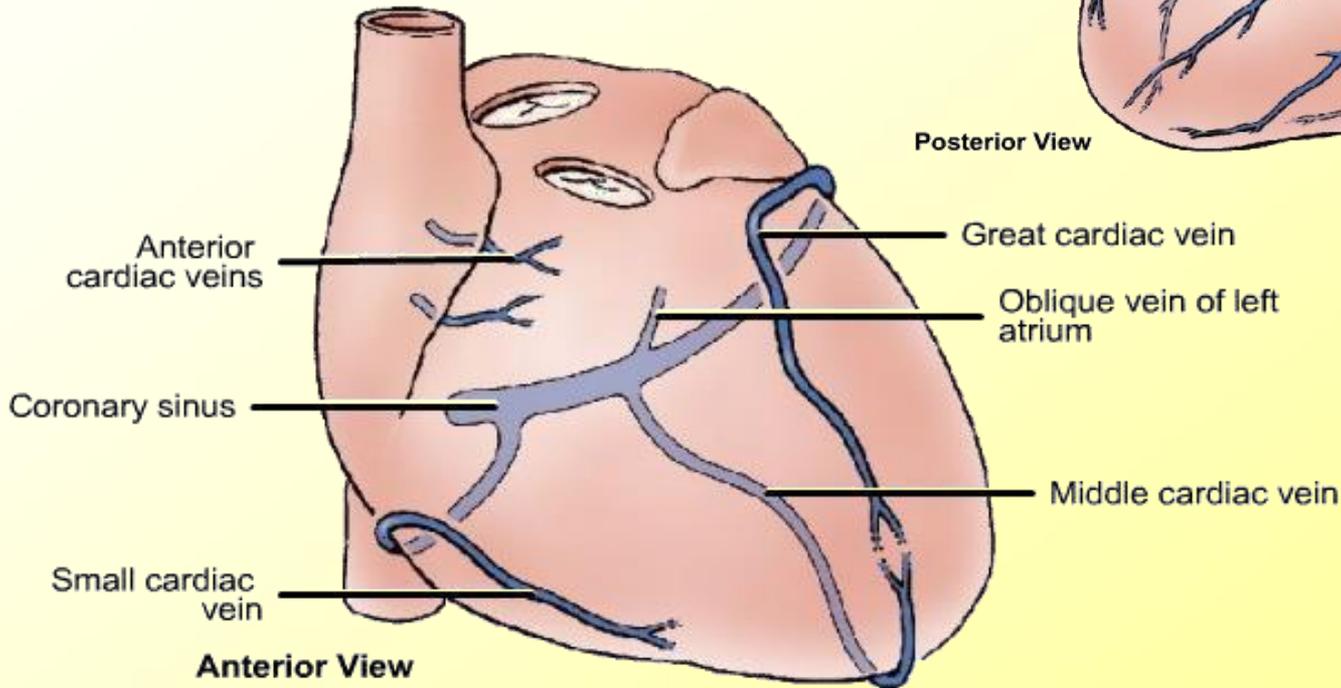
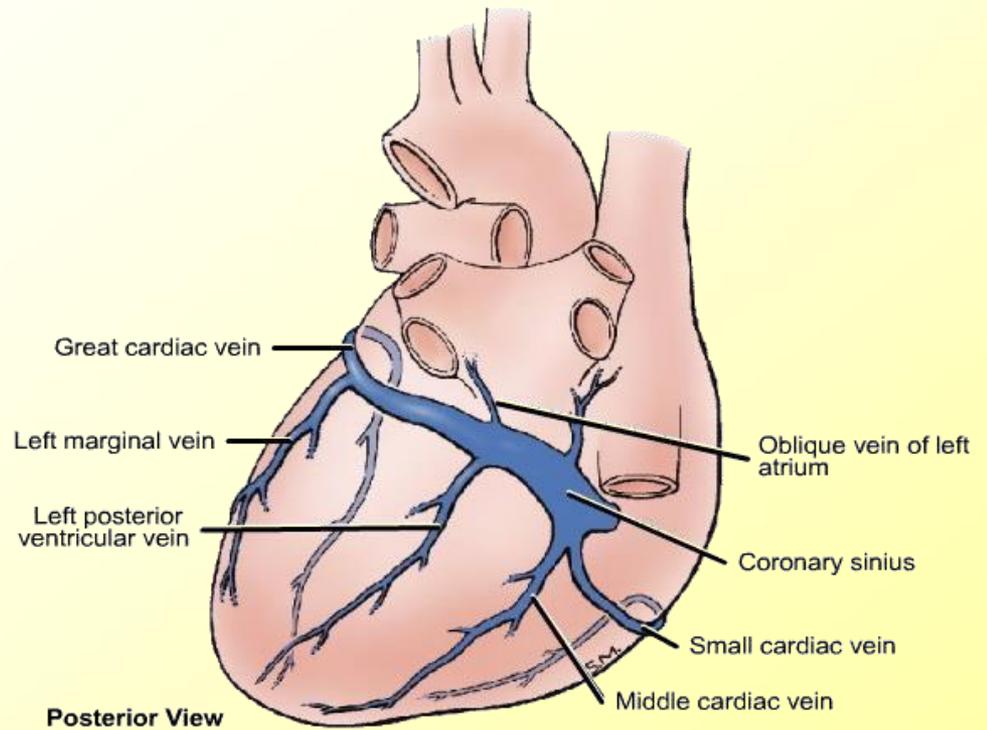
VEIN

Great cardiac vein

Middle cardiac vein

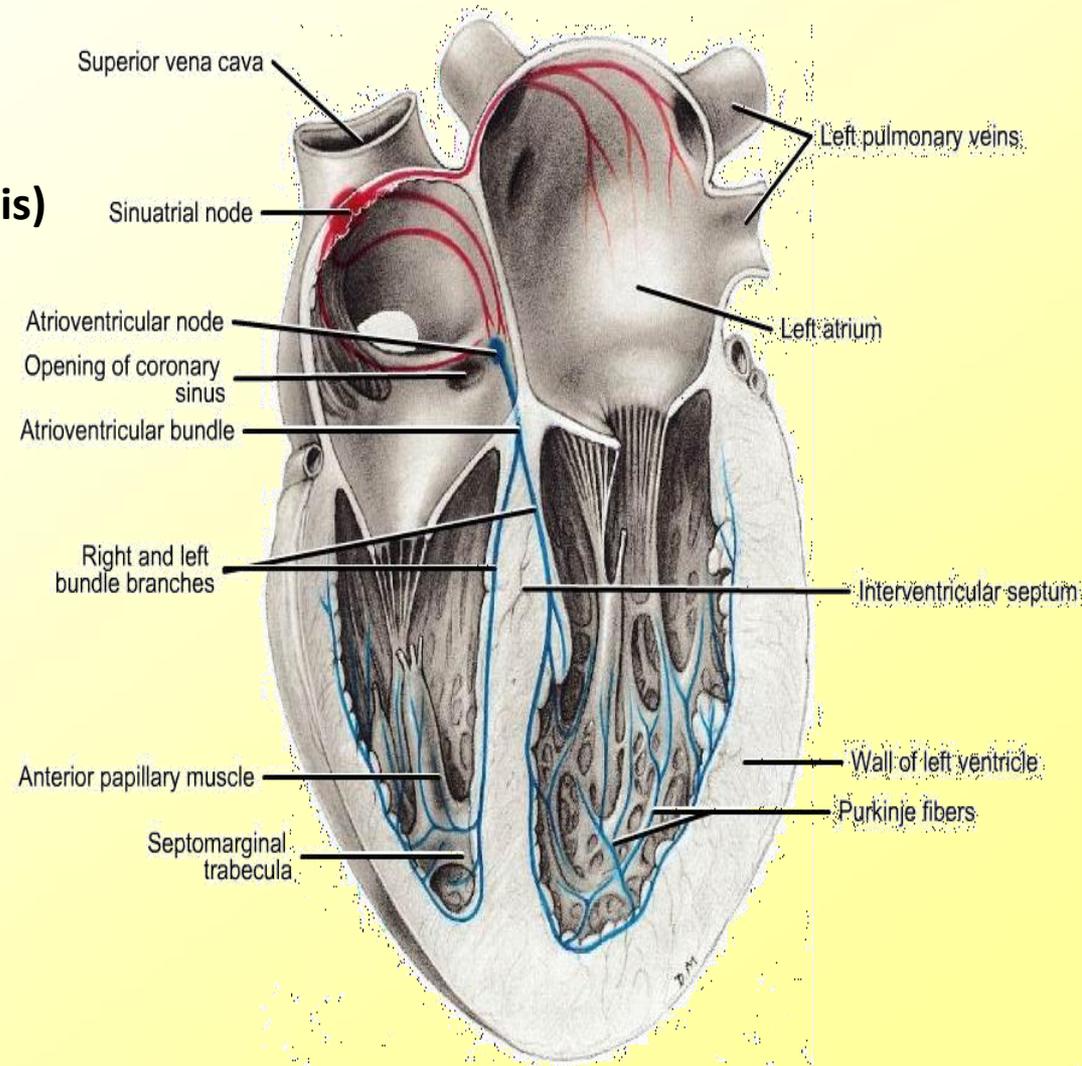
Small cardiac vein

Venous Drainage

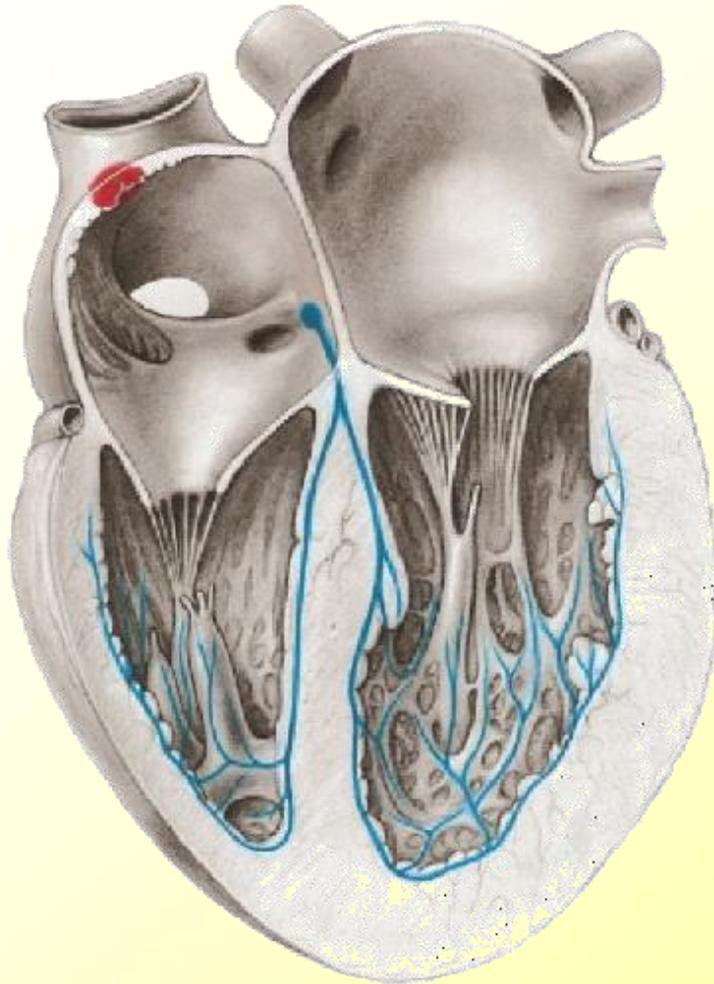


Conducting System

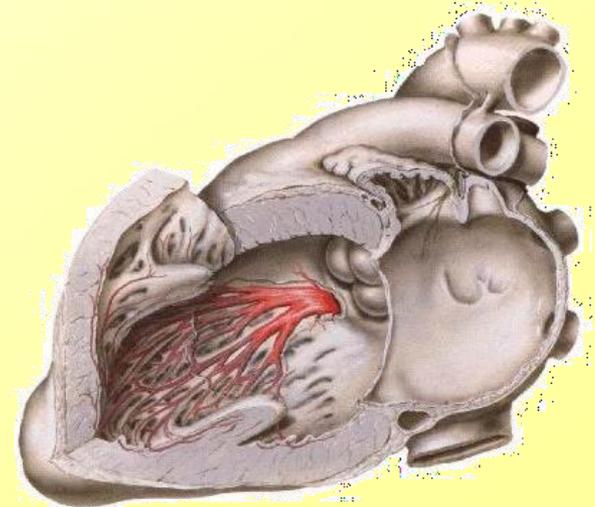
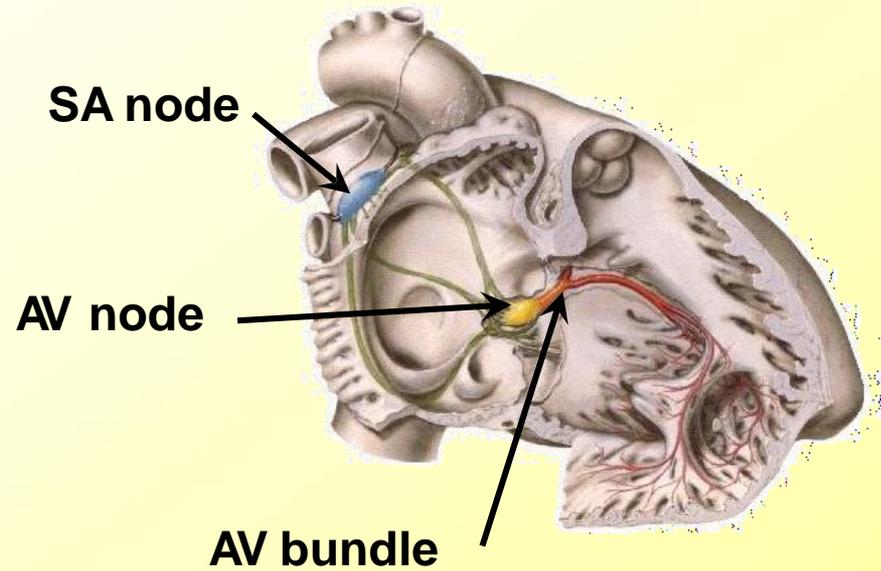
- **SINUATRIAL NODE (PACEMAKER)**
- **ATRIOVENTRICULAR NODE**
- **Atrioventricular bundle (bundle of His)**
- **Right and left bundle branches**
- **Purkinje plexus**



Conducting System



Ref.1



Ref.2

Cardiac Plexus

- **Sympathetic**

- T1 – T5

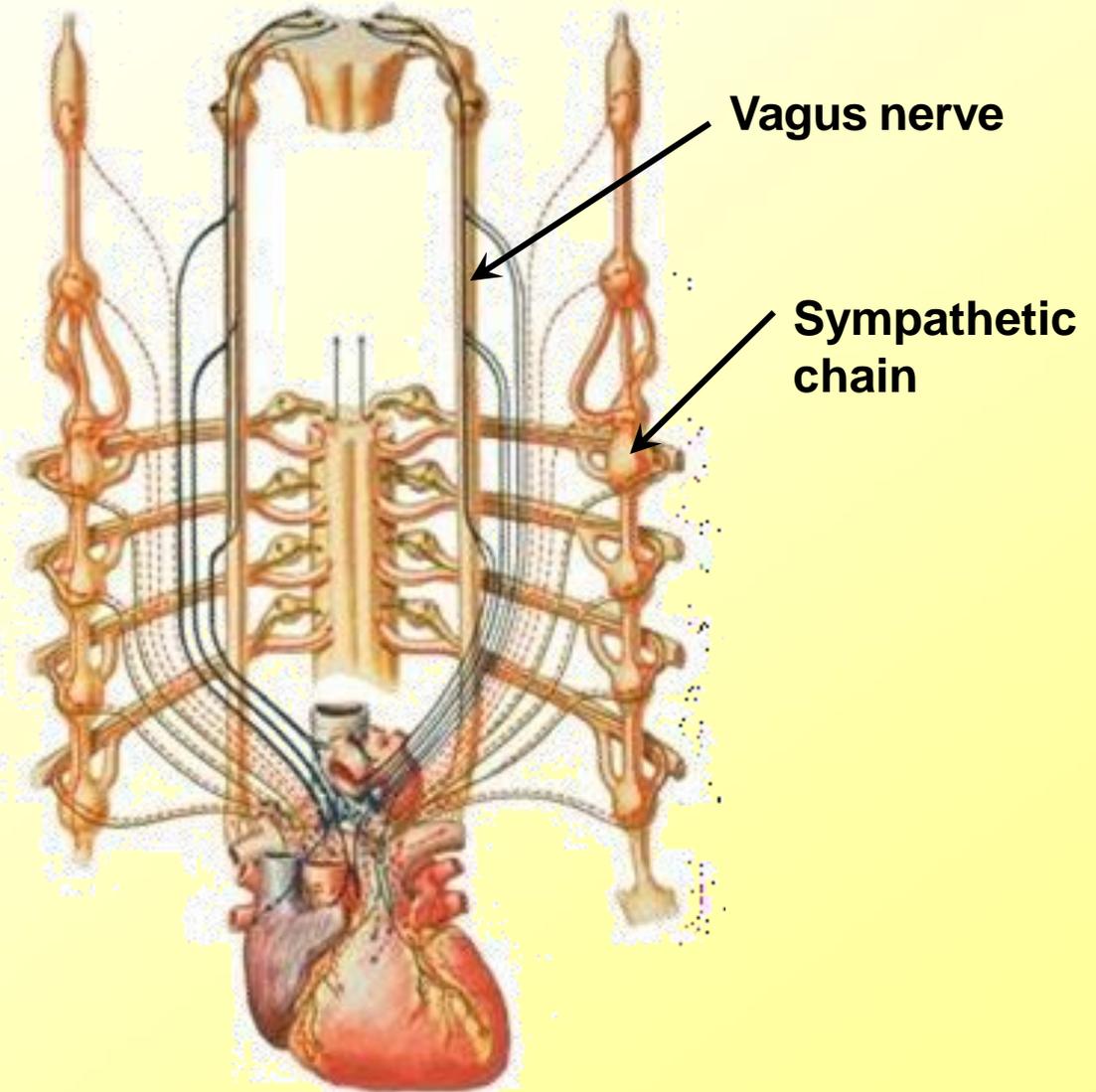
- **Segments**

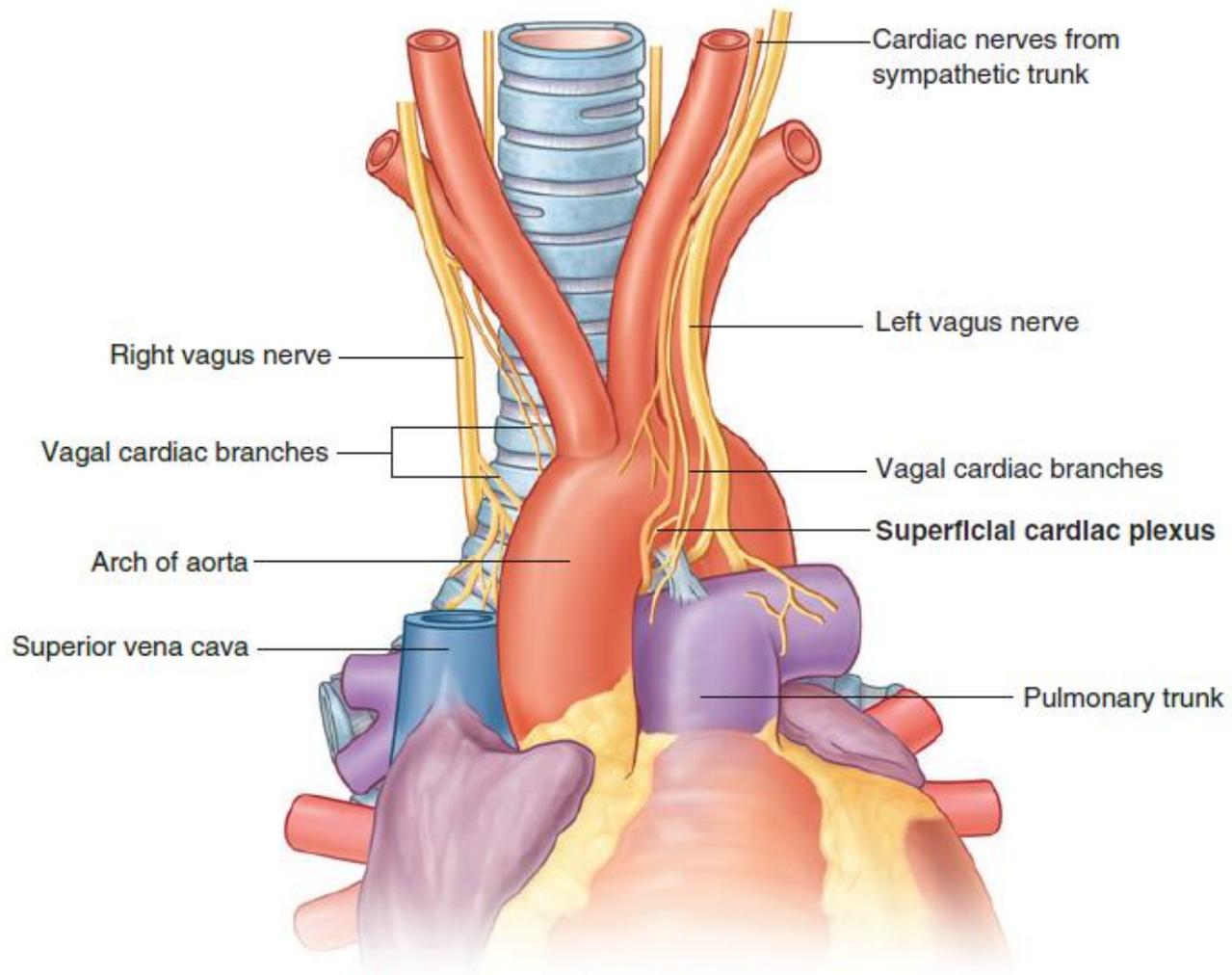
- increases heart rate

- **Parasympathetic**

- **Vagus nerve**

- decreases heart rate,





A

Cardiac nerves from sympathetic trunk