

INTERIOR OF HEART CONDUCTING SYSTEM OF HEART

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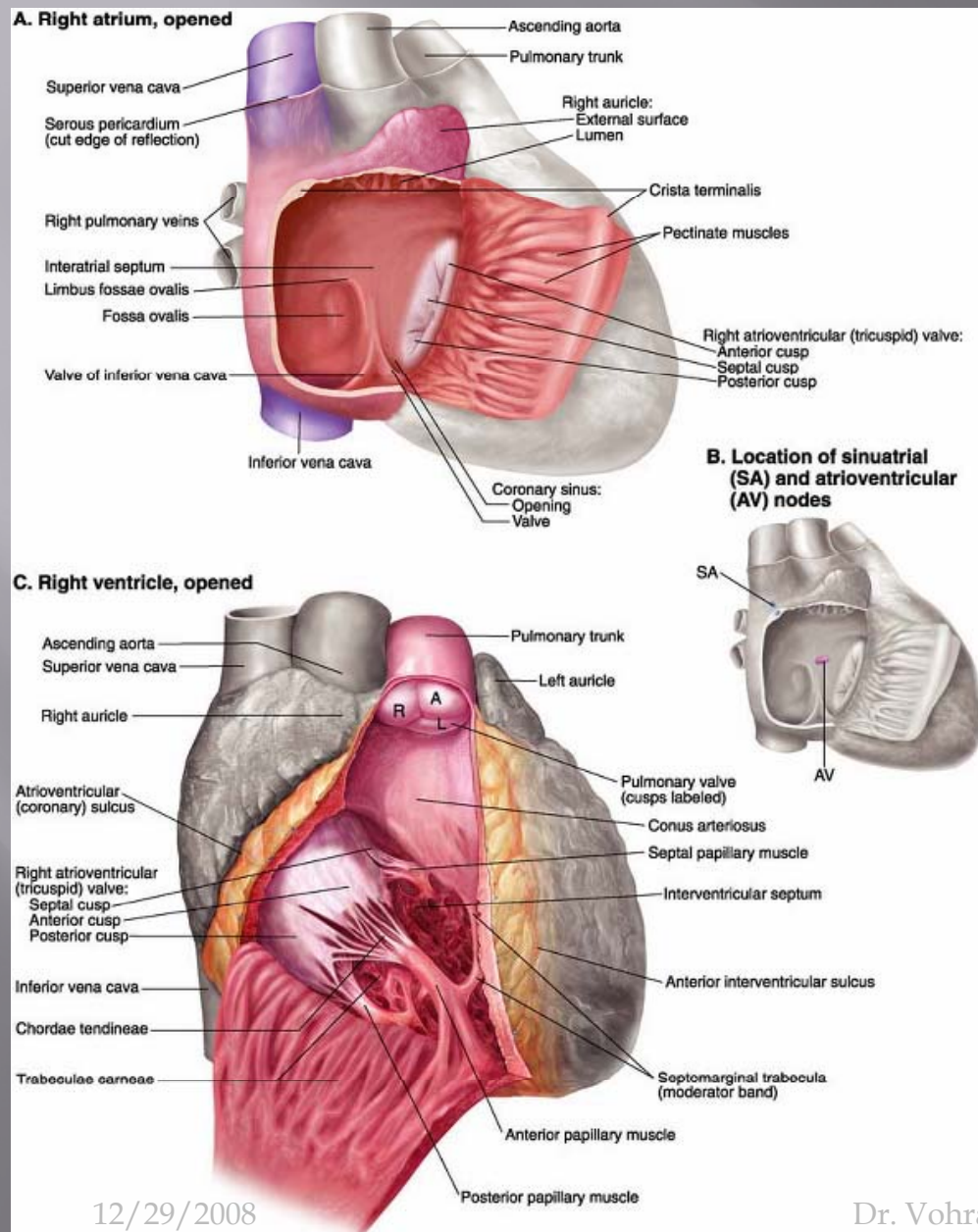
Chambers of Heart

- The heart is divided by vertical septa into four chambers:
- The right and left atria
- The right and left ventricles
- The right atrium lies anterior to the left atrium
- The right ventricle lies anterior to the left ventricle

Chambers of Heart

- The walls of the heart are composed of cardiac muscle called myocardium
- Covered externally with serous pericardium called **epicardium**
- Lined internally with a layer of endothelium called **endocardium**

Right Atrium

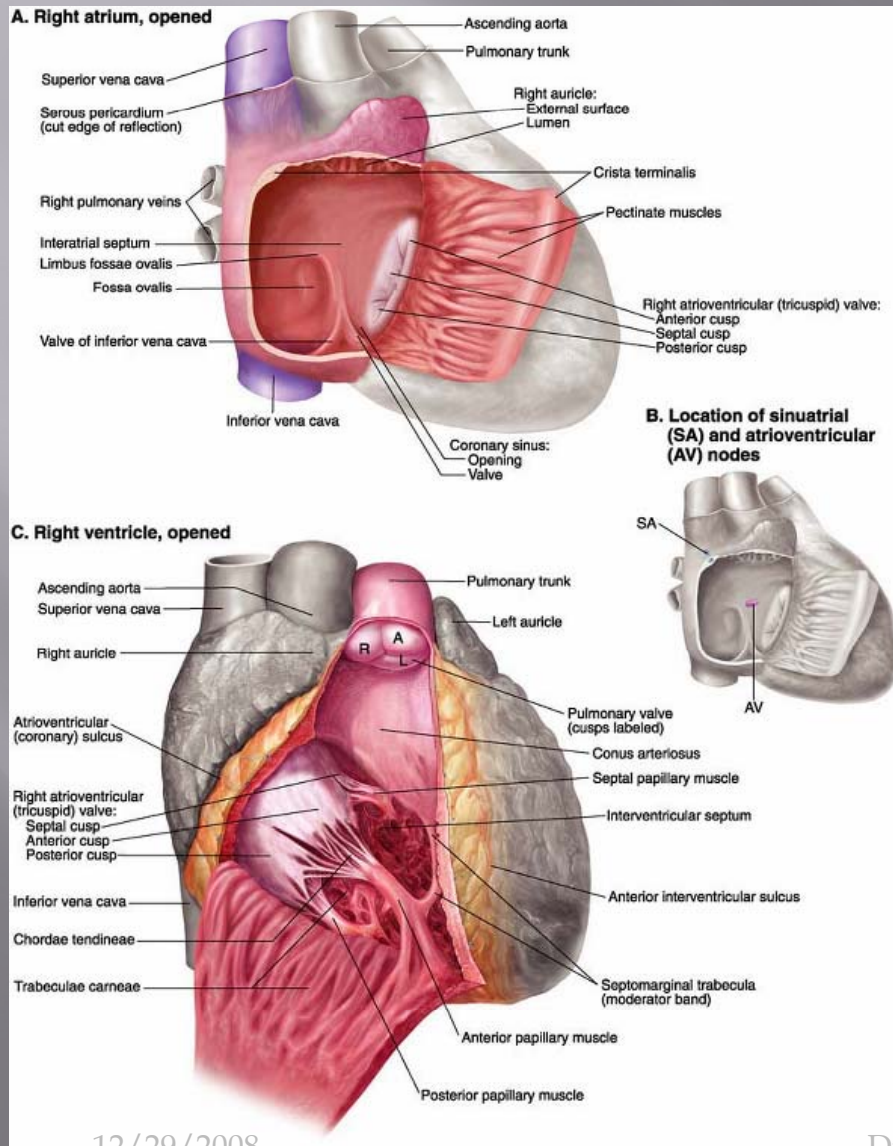


The right atrium consists of a main cavity and a small outpouching called auricle

On the outside of the heart at the junction between the right atrium and the right auricle is a vertical groove called **sulcus terminalis**

Inside it forms a ridge called **crista terminalis**

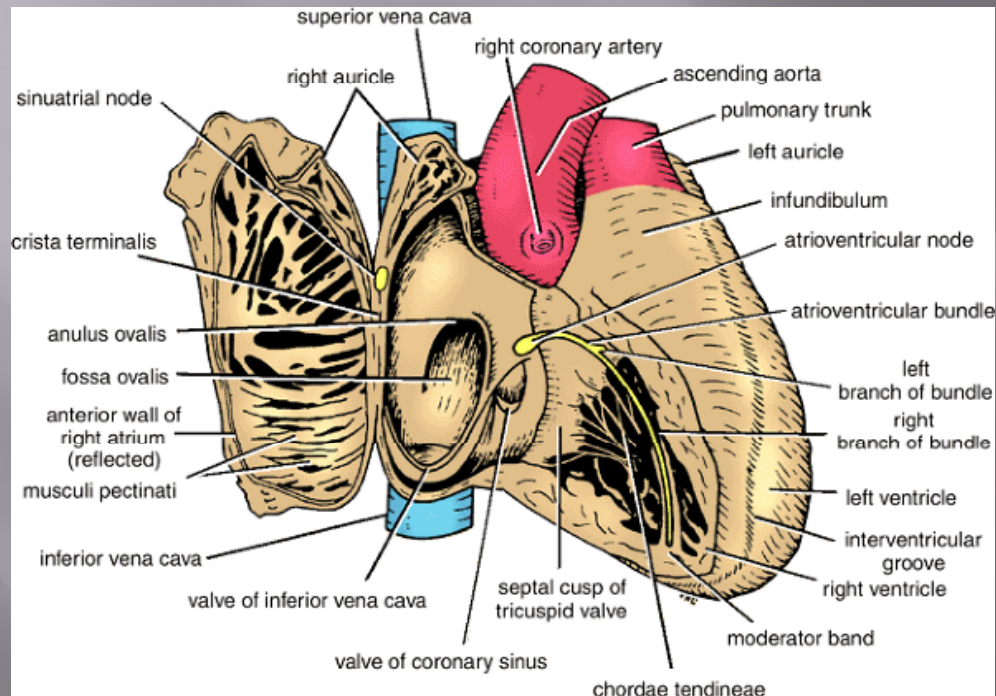
Right Atrium



➤ Main part of the atrium posterior to the ridge is smooth walled and is derived embryologically from the sinus venosus

➤ The part of the atrium in front of the ridge is roughened or trabeculated derived embryologically from the primitive atrium

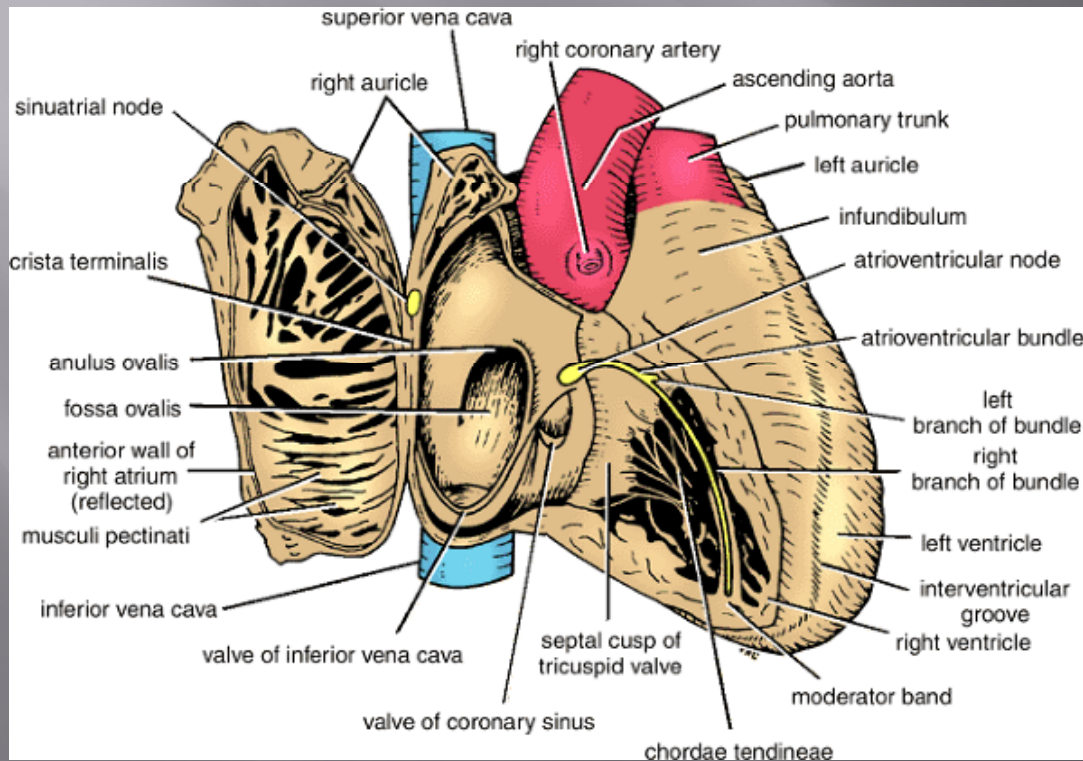
Openings in Right Atrium

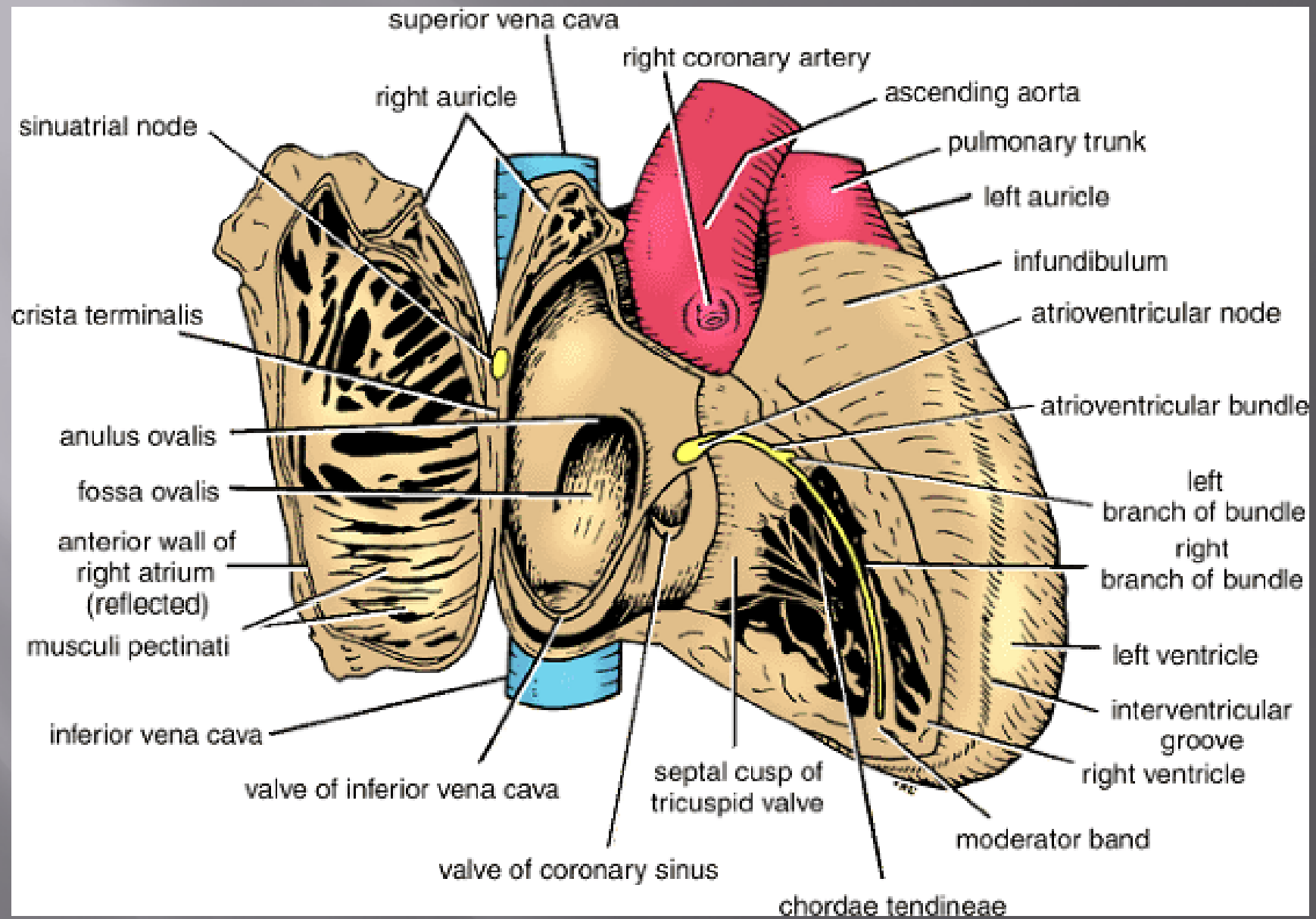


- The superior vena cava opens into the upper part of the right atrium, it has no valve. It returns the blood to the heart from the upper half of the body
- Inferior vena cava opens into the lower part of the right atrium. It is guarded by a rudimentary, (non-functioning) valve. It returns the blood to the heart from the lower half of the body

Openings in Right Atrium

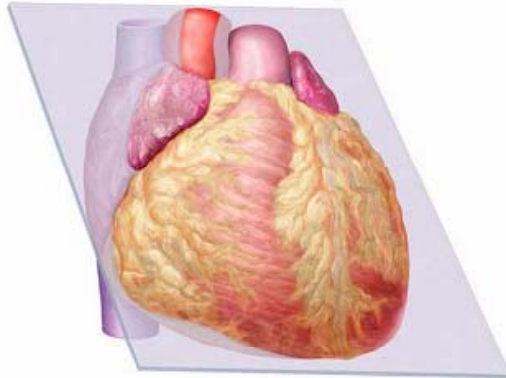
- The coronary sinus drains most of the blood from the heart wall
- It opens into the right atrium between the inferior vena cava and the atrioventricular orifice
- It is guarded by a rudimentary, nonfunctioning valve



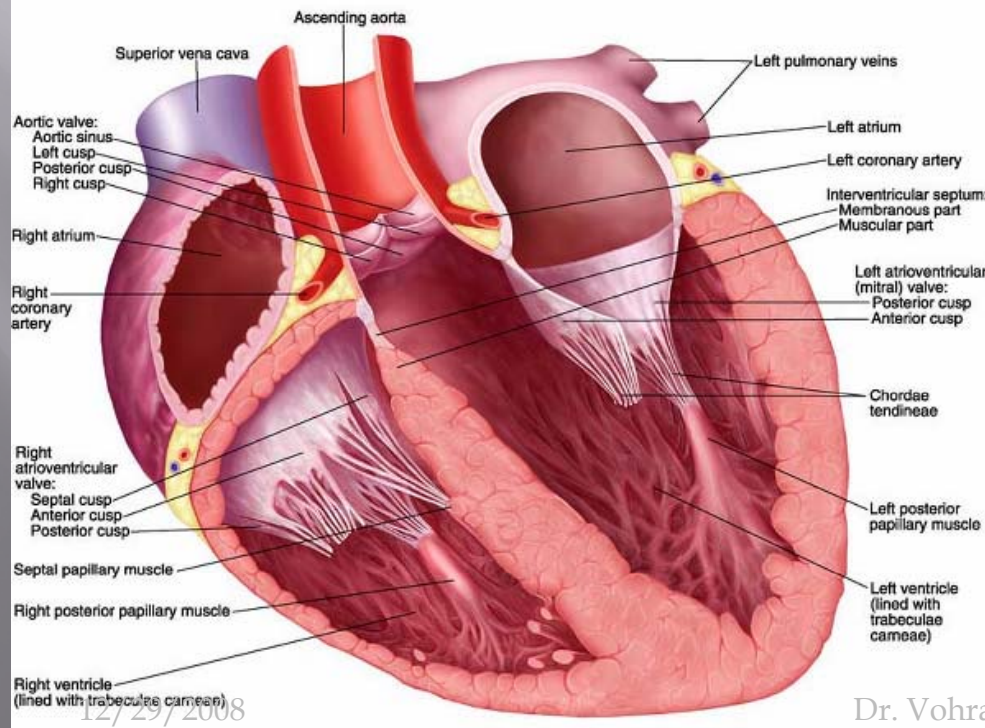


Right Atrioventricular Orifice

A. Plane of section



B. Section through the heart showing the posteroinferior portion

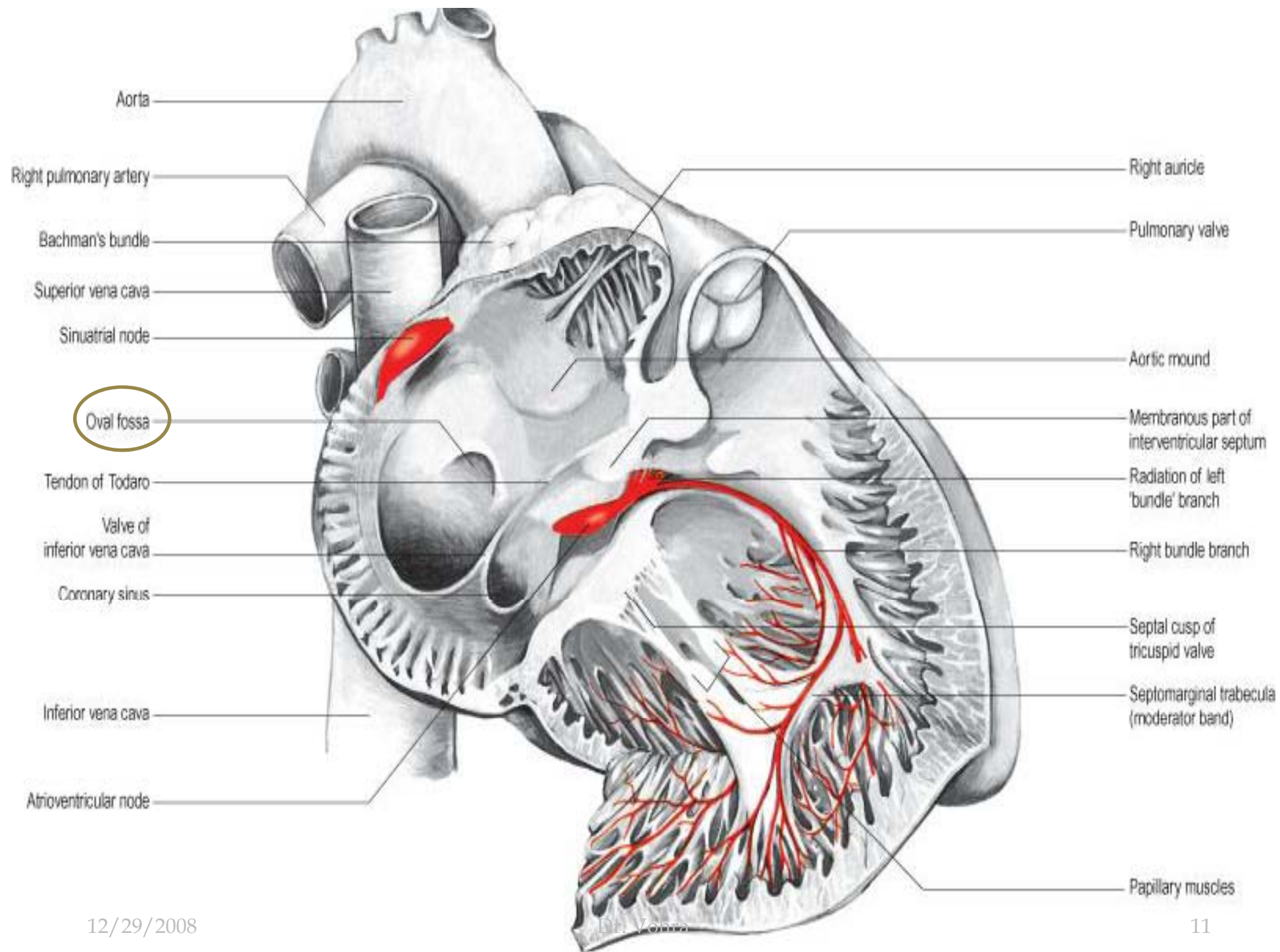


- The right atrioventricular orifice lies anterior to the inferior vena caval opening and is guarded by the tricuspid valve

- Many small orifices of small veins also drain the wall of the heart and open directly into the right atrium

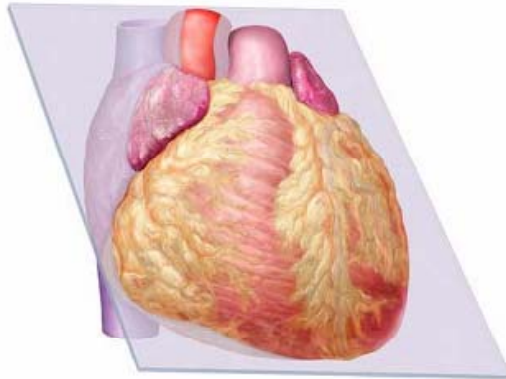
Fetal Remnants

- Fossa ovalis and anulus ovalis lie on the atrial septum which separates the right atrium from the left atrium
- The fossa ovalis is a shallow depression which is the site of the foramen ovale in the fetus. The anulus ovalis forms the upper margin of the fossa.

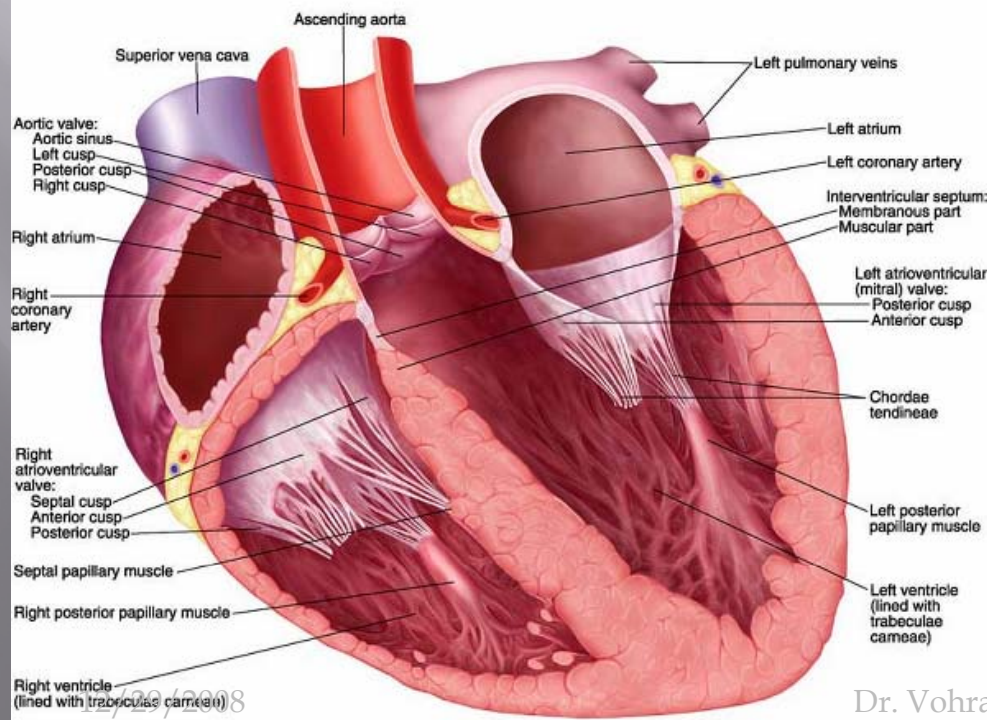


Right Ventricle

A. Plane of section



B. Section through the heart showing the posteroinferior portion



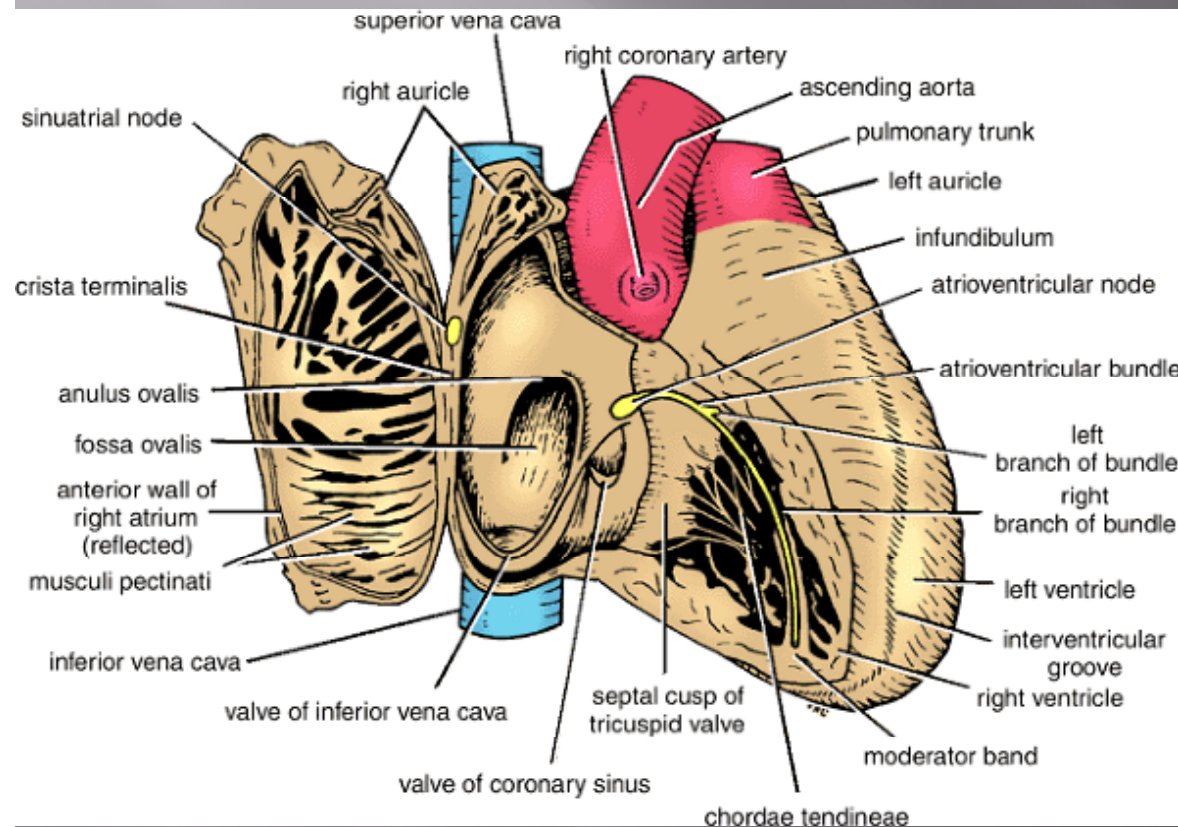
- The right ventricle communicates with the right atrium through the atrioventricular orifice and with the pulmonary trunk through the pulmonary orifice

- As the cavity approaches the pulmonary orifice it becomes funnel shaped, at which point it is referred to as the infundibulum

Right Ventricle

- The walls of the right ventricle are much thicker than right atrium
- Show several internal projecting ridges formed of muscle bundles
- The projecting ridges give the ventricular wall a spongelike appearance known as **trabeculae carneae**

Right Ventricle



➤ The trabeculae carneae are composed of three types

➤ First type comprises the papillary muscles, which project inward

➤ Their apices are connected by fibrous chords called chordae tendineae to the cusps of the tricuspid valve

Right Ventricle

- The second type is attached at the ends to the ventricular wall
- One of these, the **moderator band**, crosses the ventricular cavity from the septal to the anterior wall
- It conveys the right branch of the atrioventricular bundle, which is part of the conducting system of the heart
- The third type is simply composed of prominent ridges

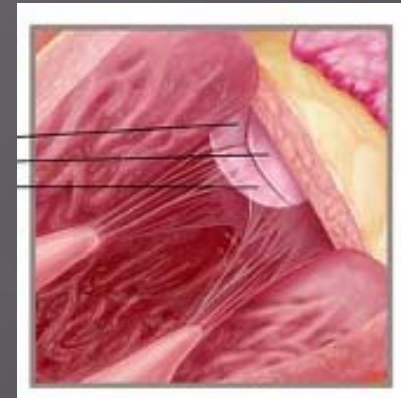
Cusps

- Tricuspid valve guards the atrioventricular orifice
- Consists of three cusps formed by a fold of endocardium
- Anterior, septal, and inferior (posterior) cusps
- Anterior cusp lies anteriorly
- Septal cusp lies against the ventricular septum
- Inferior or posterior cusp lies inferiorly

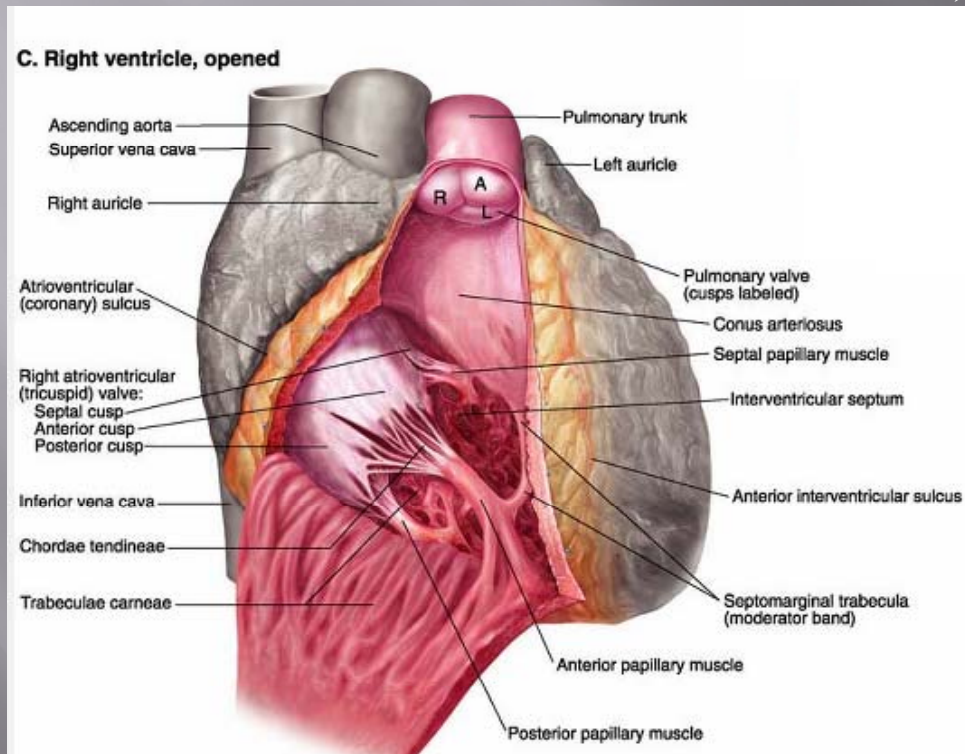


Chordae Tendinae

- The chordae tendineae connect the cusps to the papillary muscles
- During ventricular contraction, the papillary muscles prevent the cusps from being forced into the atrium
- Chordae tendineae of one papillary muscle are connected to the adjacent parts of two cusps



Pulmonary Valve



➤ Pulmonary valve guards the pulmonary orifice

➤ It consists of three semilunar cusps formed by folds of endocardium

➤ The curved lower margins and sides of each cusp are attached to the arterial wall

➤ The open mouths of the cusps are directed upward into the pulmonary trunk

Pulmonary Valve

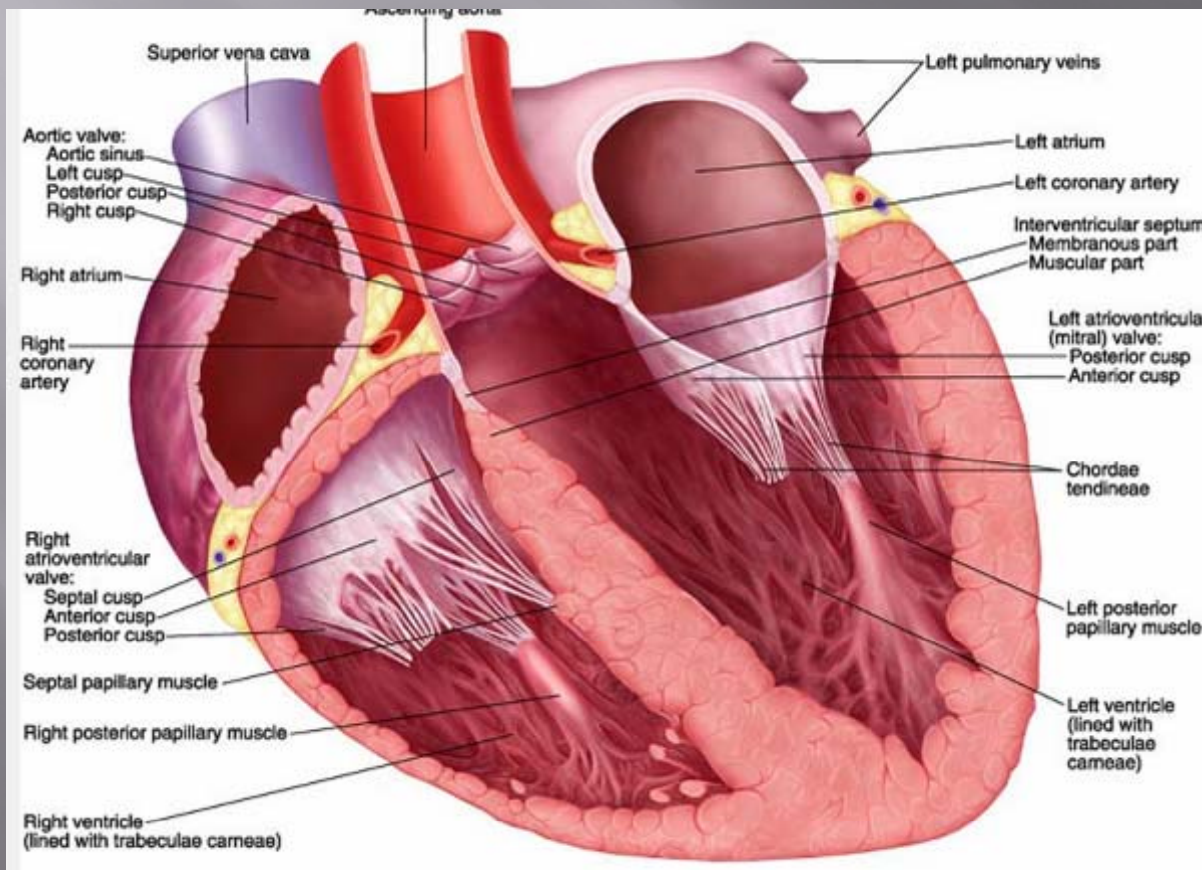
- No chordae or papillary muscles are associated with these valve cusps
- The attachments of the sides of the cusps to the arterial wall prevent the cusps from prolapsing into the ventricle
- At the root of the pulmonary trunk are three dilatations called the sinuses

Pulmonary Valve

- The three semilunar cusps are arranged with one posterior and two anterior
- During ventricular systole, the cusps of the valve are pressed against the wall of the pulmonary trunk by the out-rushing blood
- During diastole, blood flows back toward the heart and enters the sinuses
- The valve cusps fill, come into apposition in the centre of the lumen, and close the pulmonary orifice

Left Atrium

- Left atrium consists of a main cavity and a left auricle

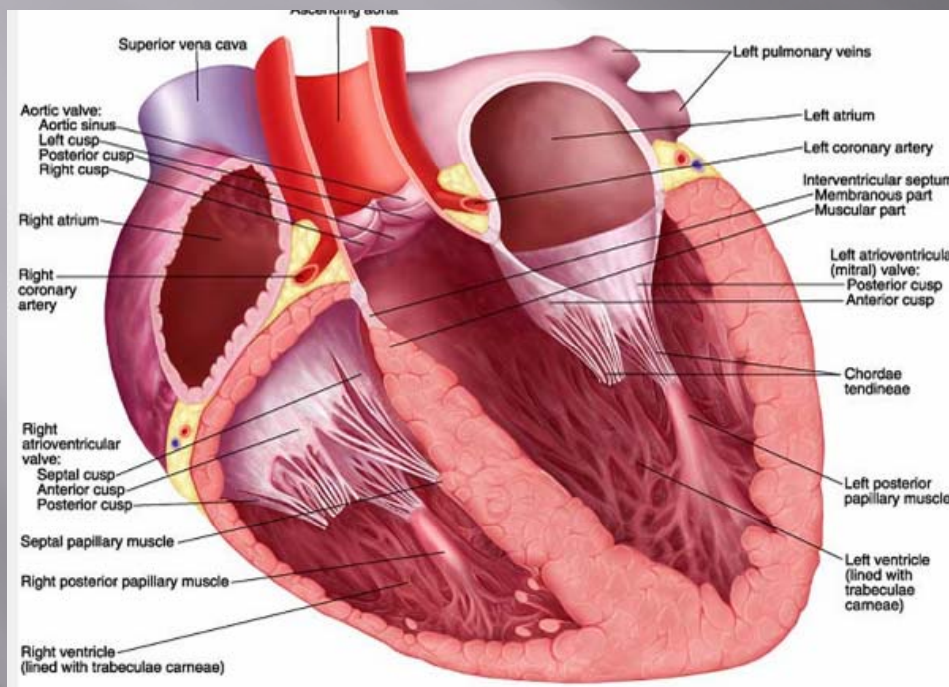


- It is situated behind the right atrium and forms the greater part of the base or the posterior surface of the heart

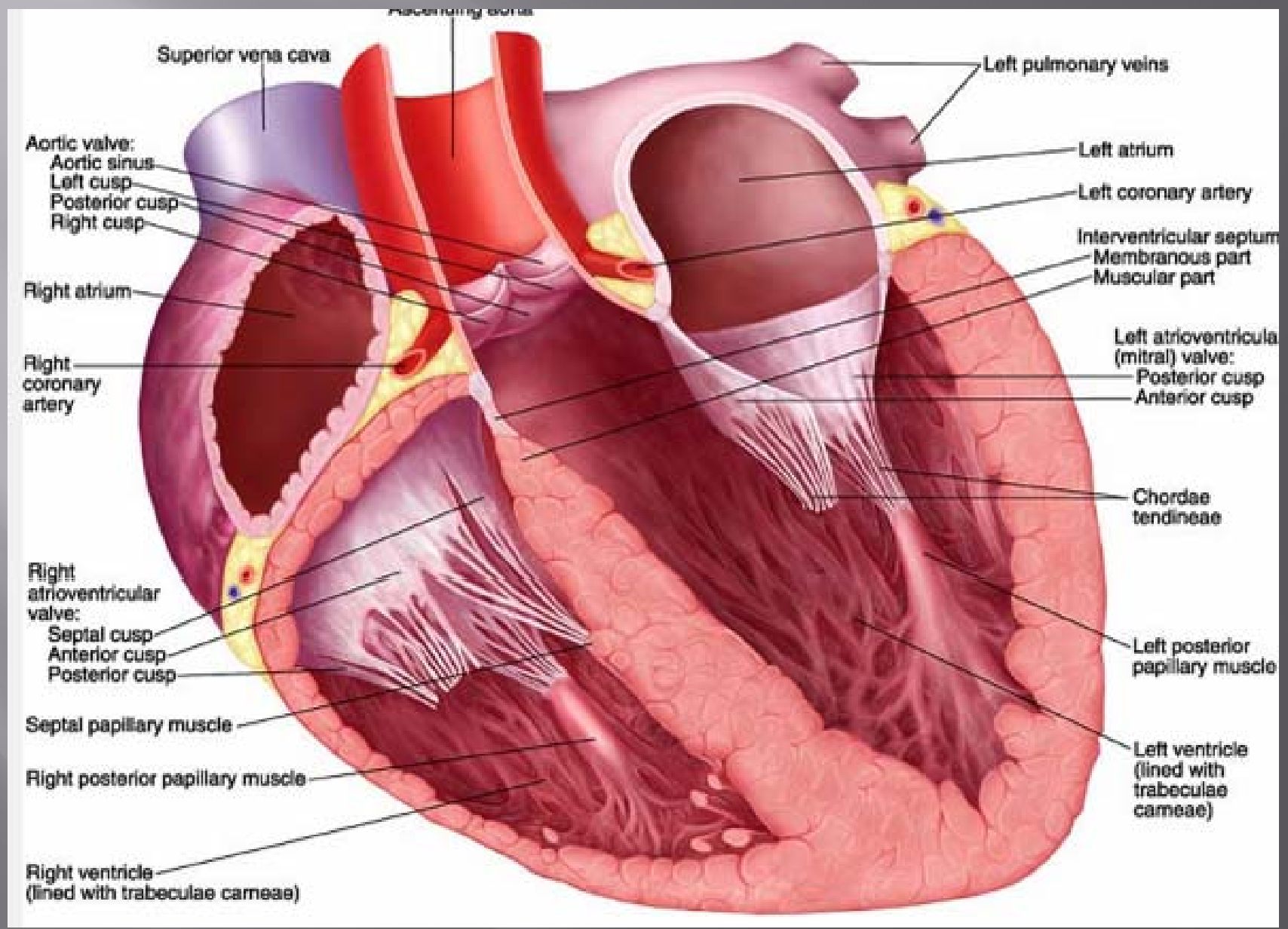
Left Atrium

- The interior of the left atrium is smooth, but the left auricle possesses muscular ridges
- 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 Ventricle



- Left ventricle communicates with the left atrium through the atrioventricular orifice and with the aorta through the aortic orifice
- The walls of the left ventricle are three times thicker than those of the right ventricle
- In cross section the left ventricle is circular
- Right ventricle is crescentic because of the bulging of the ventricular septum into right ventricular cavity



Left Ventricle

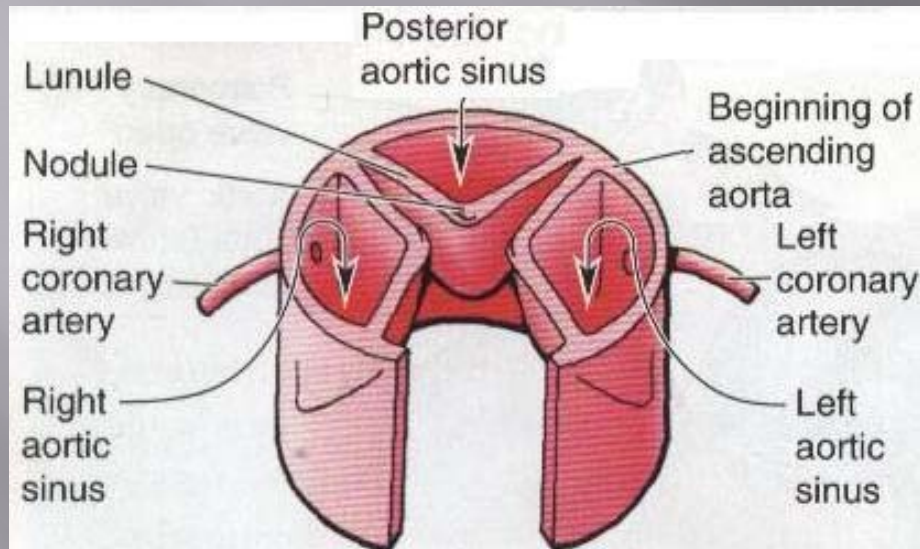
- There are well-developed trabeculae carneae
- Two large papillary muscles but no moderator band
- The part of the ventricle below the aortic orifice is called the aortic vestibule

Mitral valve

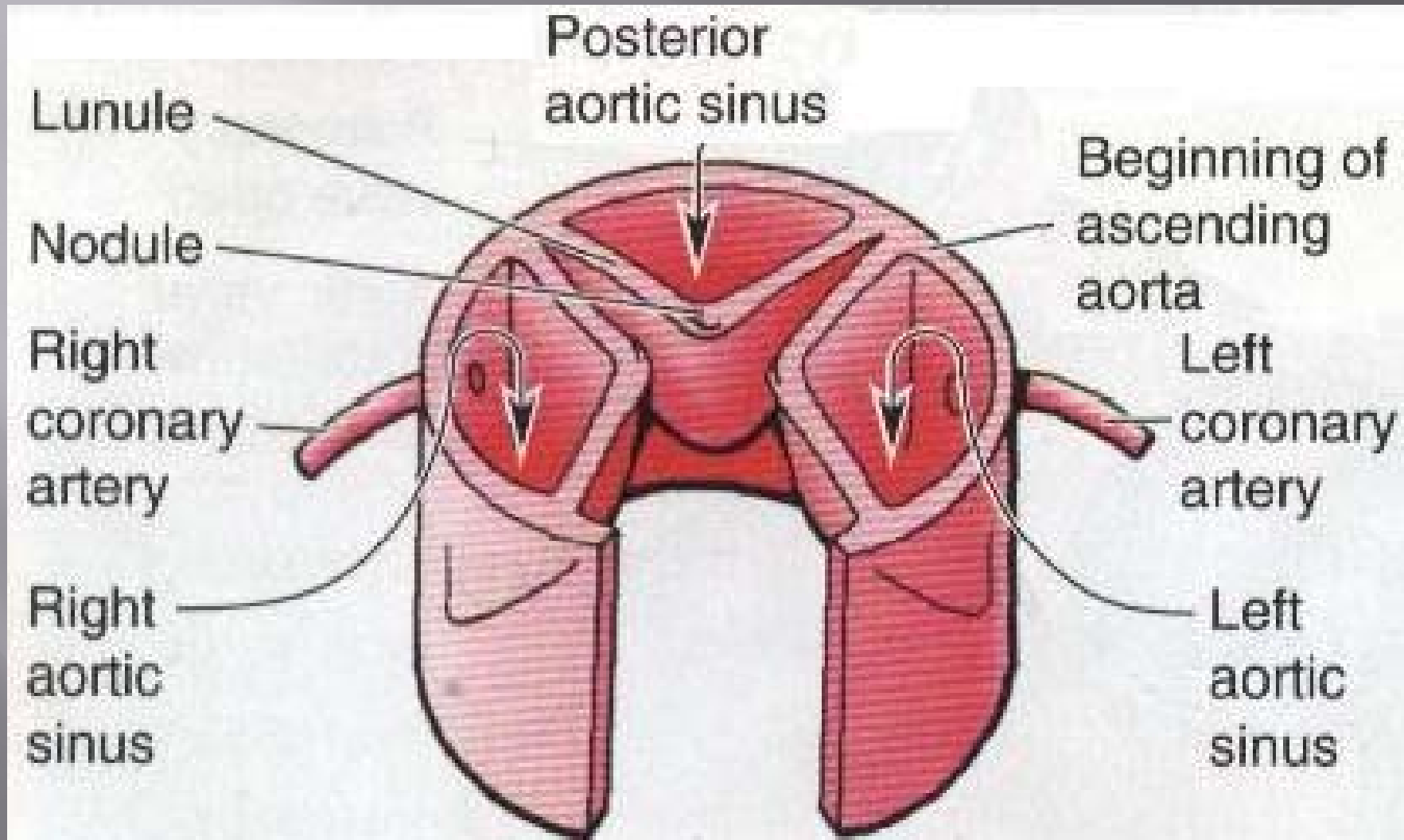
- The mitral valve guards the atrioventricular orifice
- It consists of two cusps, one anterior and one posterior
- Structure of the cusps is similar to that of the cusps of the tricuspid valve
- The anterior cusp is the larger and intervenes between the atrioventricular and the aortic orifices

Aortic Valve

- The aortic tricuspid valve guards the aortic orifice



- One cusp is situated on the anterior wall (right cusp)
- Two are located on the posterior wall (left and posterior cusps)
- Behind each cusp the aortic wall bulges to form an aortic sinus
- The anterior aortic sinus gives origin to the right coronary artery
- Left posterior sinus gives origin to the left coronary artery



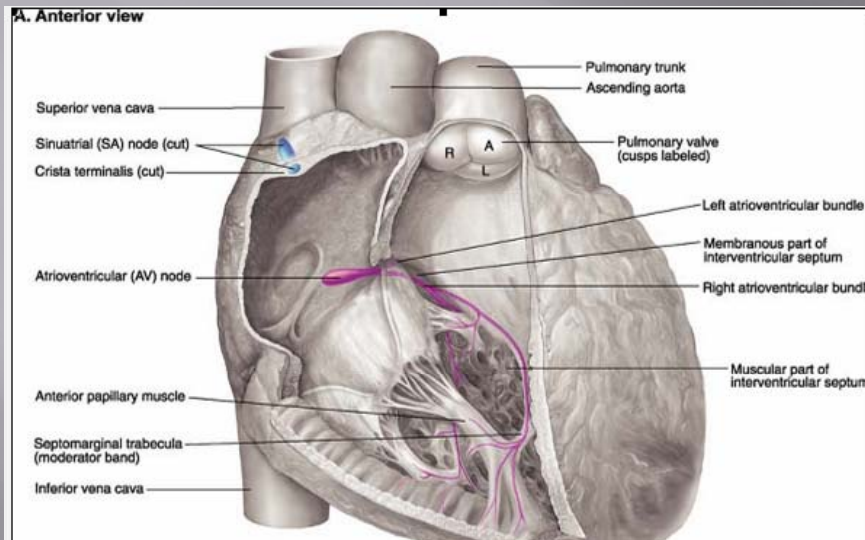
Conducting System

- Normal heart contracts rhythmically at about 70 to 90 beats per minute in resting adult
- Rhythmic contractile process originates spontaneously in the conducting system
- Impulse travels to different regions of the heart
- Atria contract first and together
- Followed later by the contractions of both ventricles together

Conducting System

- The slight delay in the passage of the impulse from the atria to the ventricles allows time for the atria to empty their blood into the ventricles before the ventricles contract

Conducting System

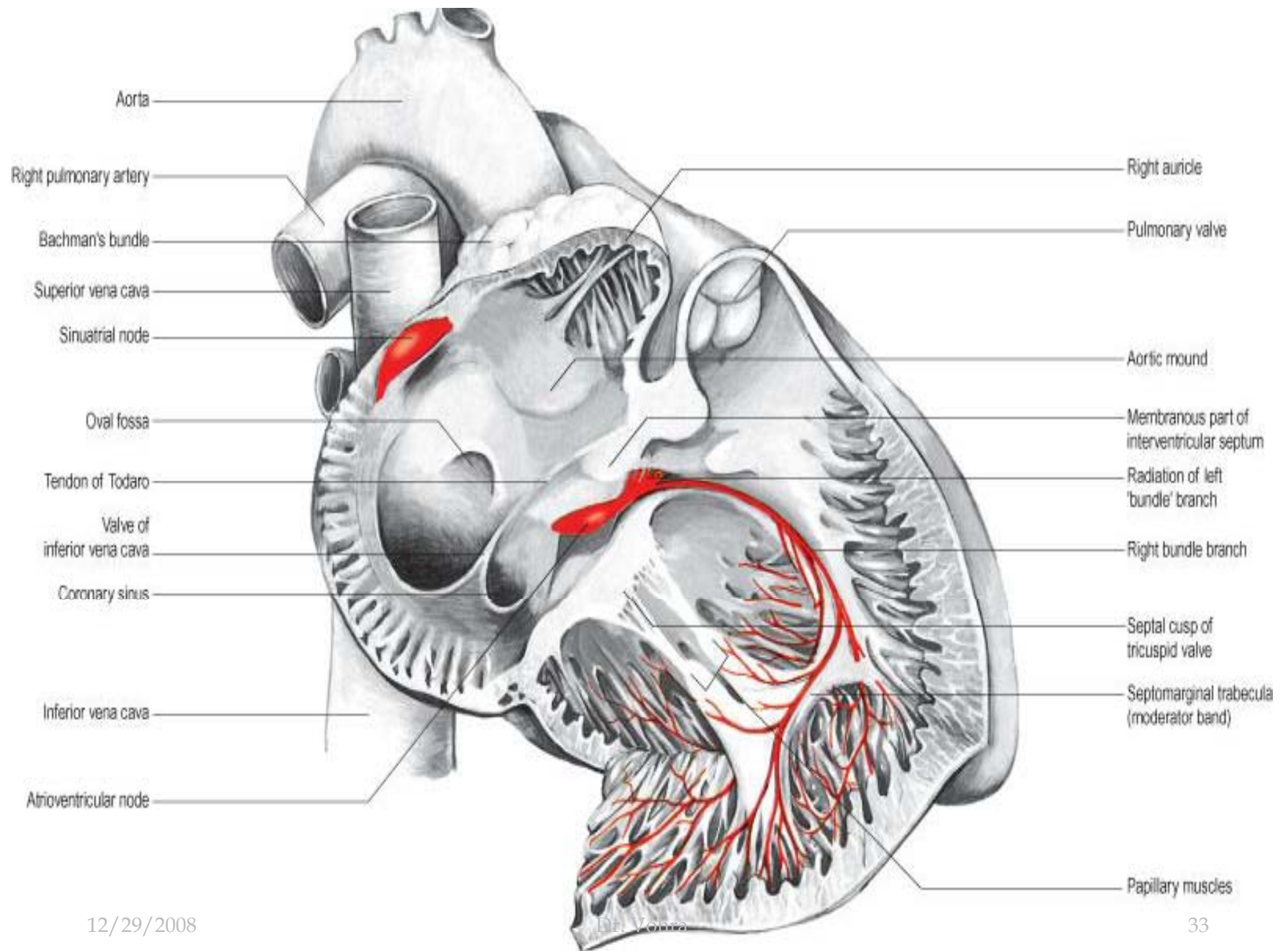


The conducting system of the heart consists of specialized cardiac muscle present in:

Sinuatrial node

Atrioventricular node

- Atrioventricular bundle (His) and its right and left terminal branches
- Subendocardial plexus of Purkinje fibers

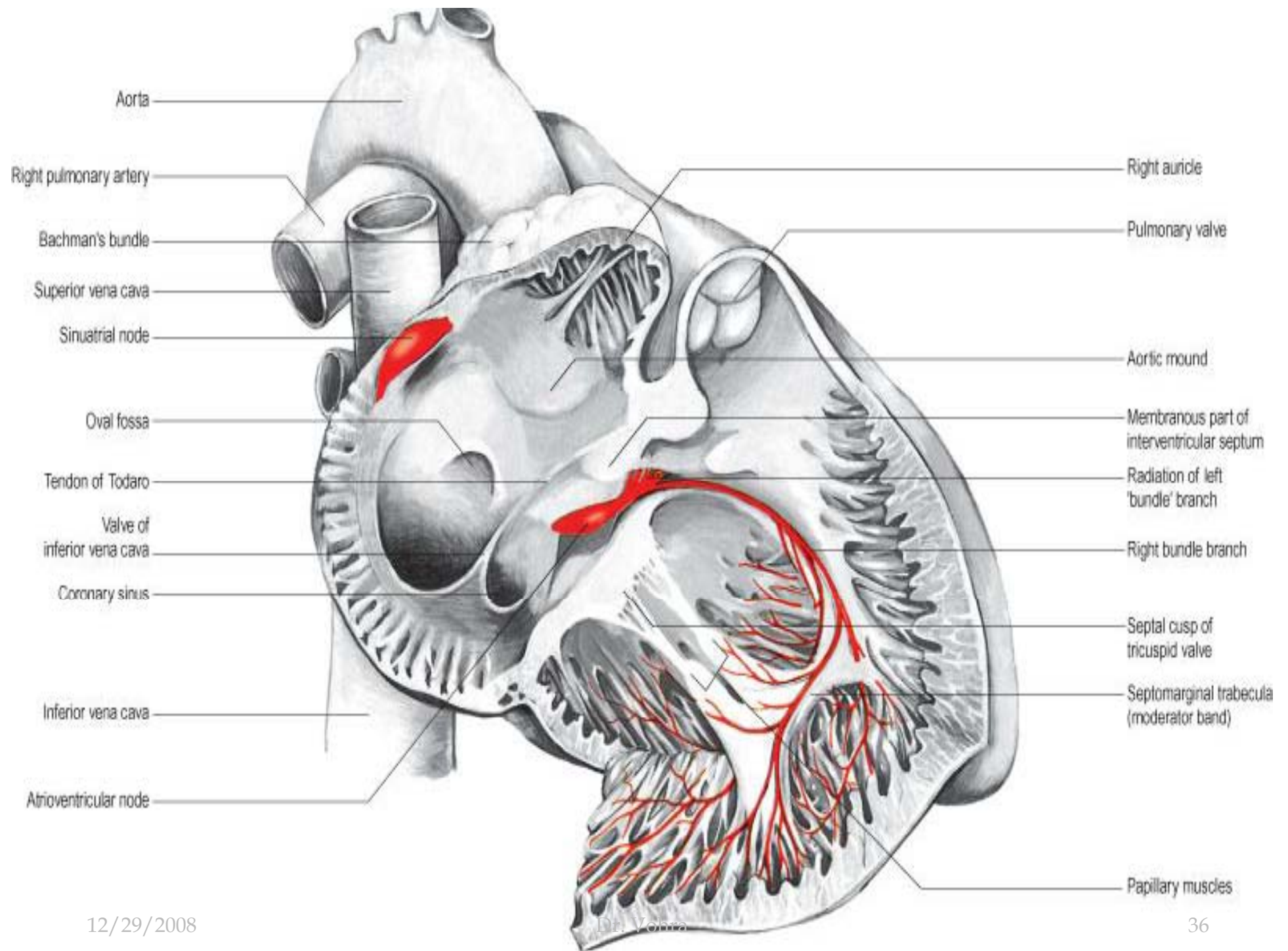


Sinuatrial Node

- It is located in the wall of the right atrium in the upper part of the sulcus terminalis just to the right of the opening of the superior vena cava
- The node spontaneously gives origin to rhythmic electrical impulses that spread in all directions through the cardiac muscle of the atria and cause the muscle to contract

Atrioventricular Node

- It is strategically placed on the lower part of the atrial septum just above the attachment of the septal cusp of the tricuspid valve
- Cardiac impulse is conducted to the ventricles by the atrioventricular bundle
- Atrioventricular node is stimulated by the excitation wave as it passes through the atrial myocardium



Atrioventricular Node

- Conduction speed of the cardiac impulse through the atrioventricular node allows sufficient time for the atria to empty their blood into the ventricles before the ventricles start to contract

Atrioventricular Bundle

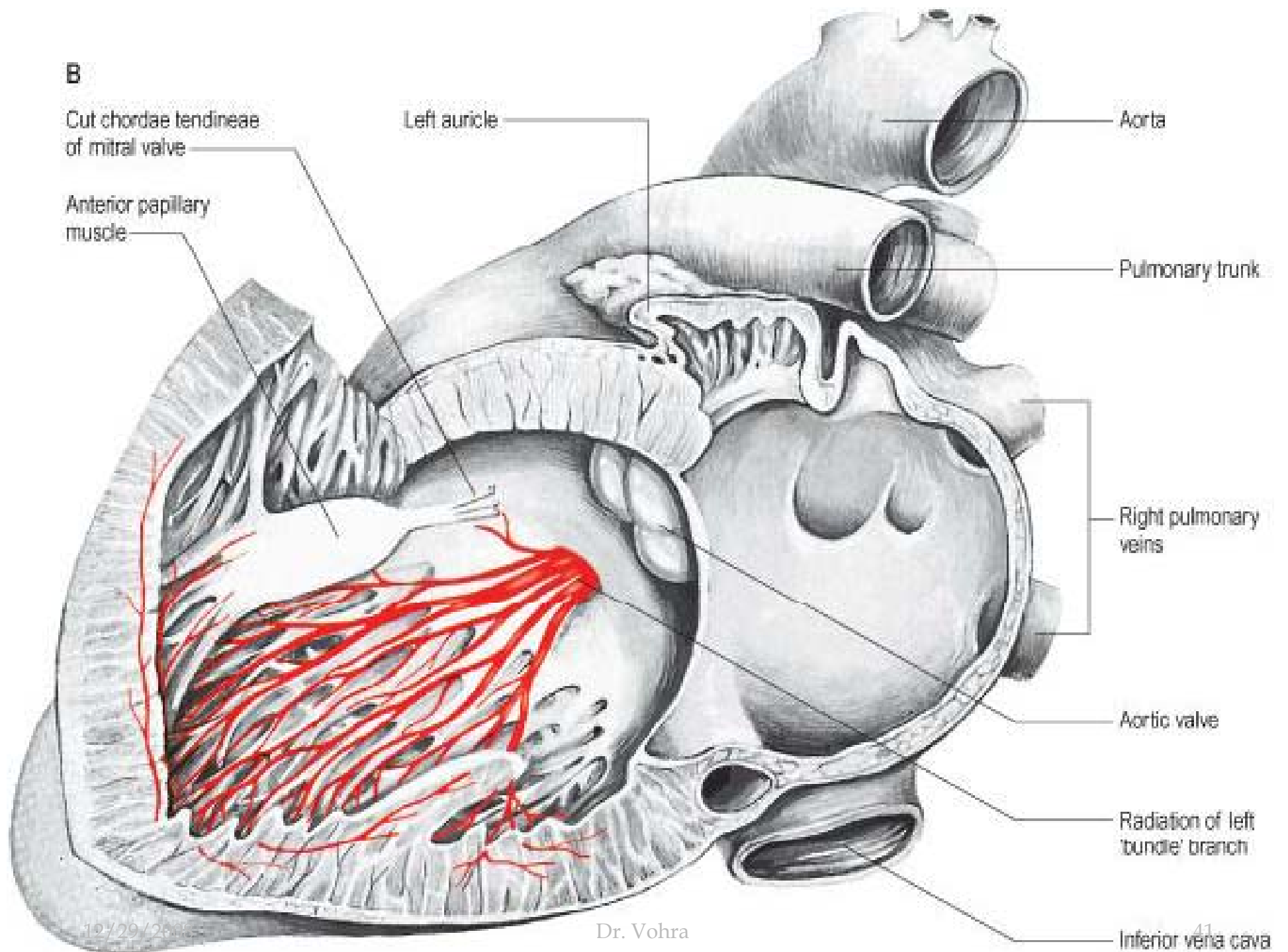
- The atrioventricular bundle (bundle of His) is the only pathway of cardiac muscle that connects the myocardiums of atria and ventricles
- It is the only route along which the cardiac impulse can travel from the atria to the ventricles
- The bundle descends through the fibrous skeleton of the heart

Atrioventricular Bundle

- It then descends behind the septal cusp of the tricuspid valve to reach the inferior border of the membranous part of the ventricular septum
- At the upper border of the muscular part of the septum it divides into two branches, one for each ventricle
- The right bundle branch (RBB) passes down on the right side of the ventricular septum
- It crosses to the anterior wall of the right ventricle

Atrioventricular Bundle

- Here it becomes continuous with the fibers of the Purkinje plexus
- Left bundle branch (LBB) pierces the septum and passes down on its left side beneath the endocardium
- It usually divides into two branches (anterior and posterior) which continuous with the fibers of the Purkinje plexus of the left ventricle



Atrioventricular Bundle

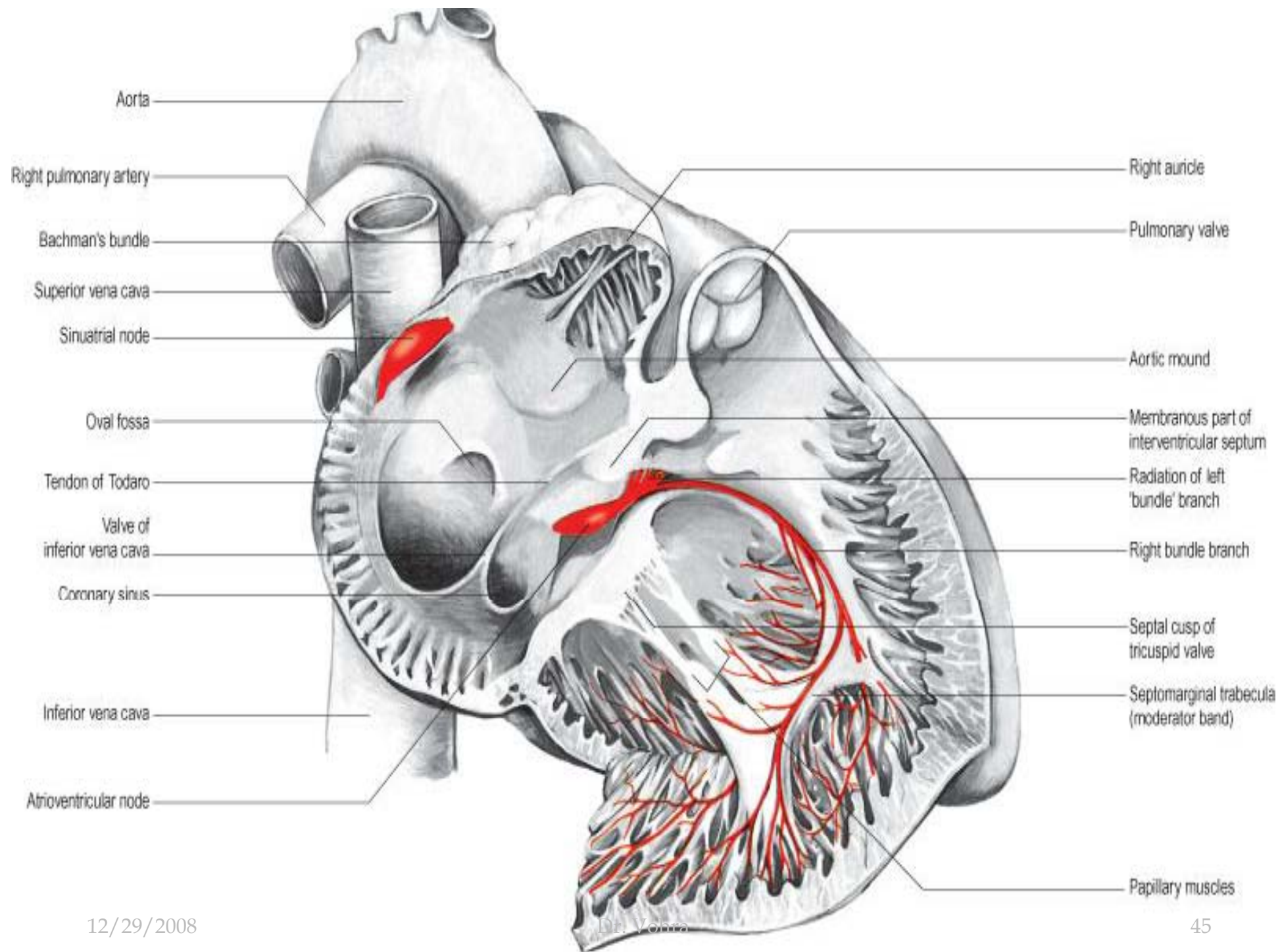
- Conducting system of the heart is responsible not only for generating rhythmic cardiac impulses
- Also for conducting these impulses rapidly throughout the myocardium of the heart
- In this way the different chambers contract in a coordinated and efficient manner

Atrioventricular Bundle

- The activities of the conducting system can be influenced by the autonomic nerve supply to the heart
- Parasympathetic nerves slow the rhythm and diminish the rate of conduction of the impulse
- Sympathetic nerves have the opposite effect

Internodal Conduction Path

- Impulses from the sinuatrial node travel to the atrioventricular node more rapidly than they travel along the ordinary myocardium
- Anterior internodal pathway leaves the anterior end of the sinuatrial node and passes anterior to the superior vena caval opening
- It descends on the atrial septum and ends in the atrioventricular node



Internodal Conduction Path

- Middle internodal pathway leaves the posterior end of the sinuatrial node and passes posterior to the superior vena caval opening
- It descends on the atrial septum to the atrioventricular node
- Posterior internodal pathway leaves the posterior part of the sinuatrial node and descends through the crista terminalis and the valve of the inferior vena cava to the atrioventricular node

Mediastenum

The median septum or the central compartment of the thorax between the two lungs.

Boundaries of the Mediastinum

Anterior

Sternum

Posterior

Thoracic vertebrae

Superior

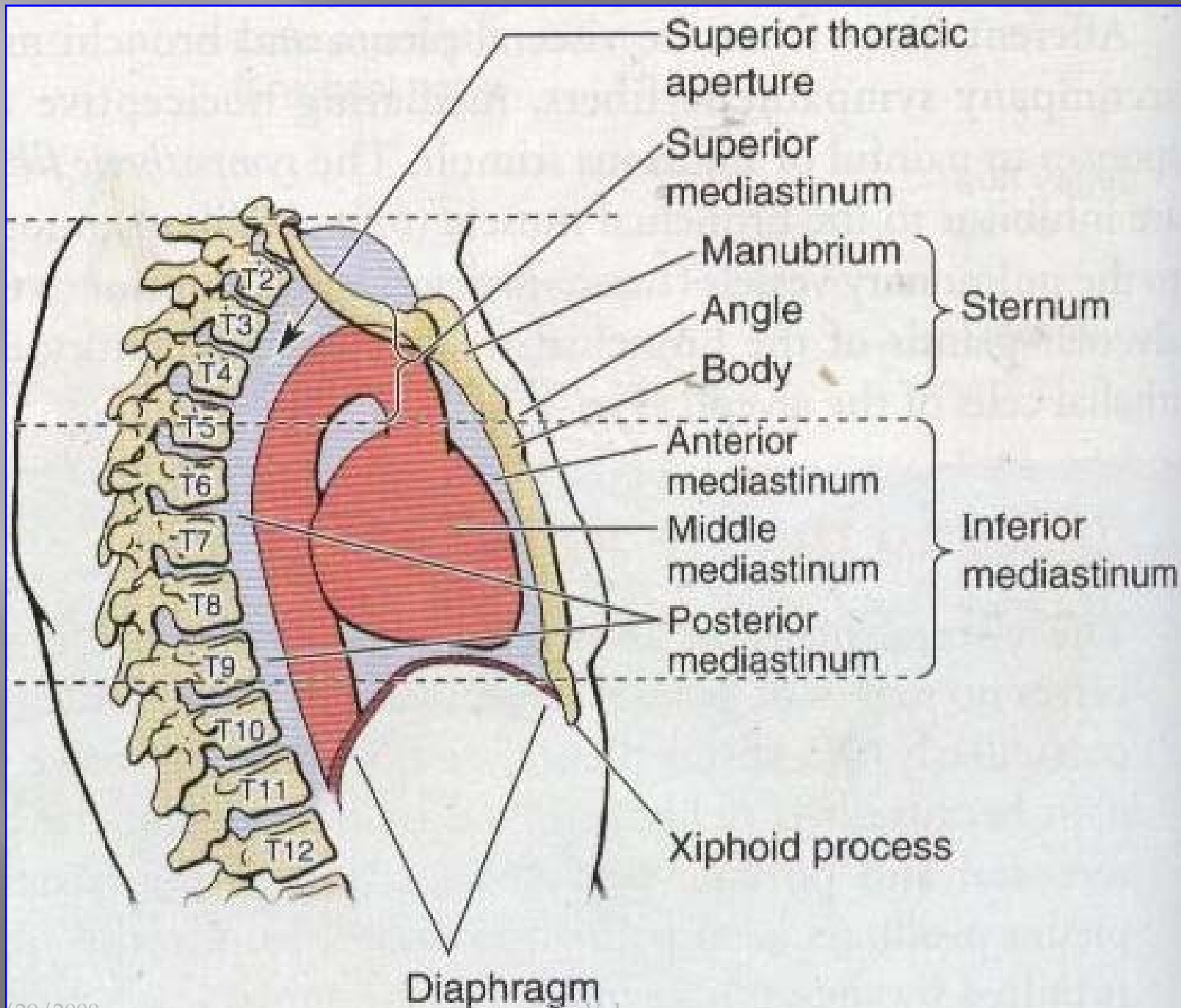
Thoracic inlet

Inferior

Diaphragm

On each side

Mediastinal pleurae



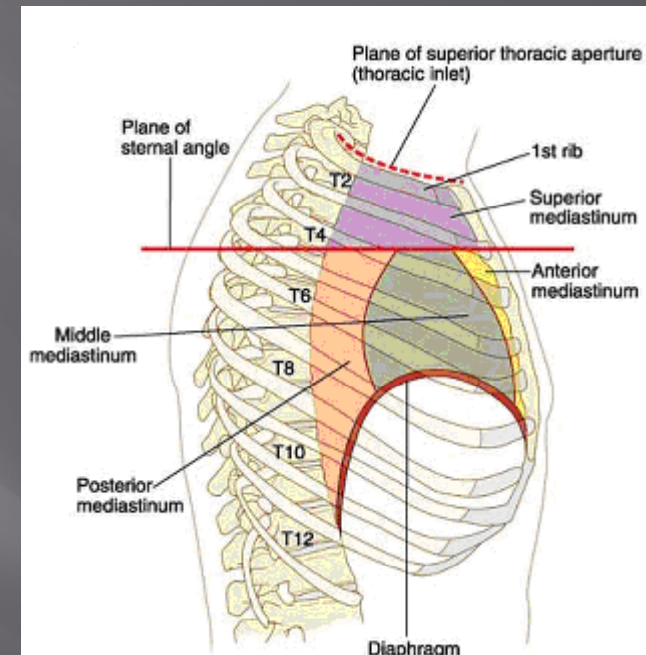
Divisions of the Mediastinum

For description purpose the mediastinum is divided into:

- a. Superior Mediastinum
- b. Inferior mediastinum

which is further divided into:

- i. Anterior mediastinum
- ii. Middle mediastinum
- iii. Posterior mediastinum



Transverse thoracic plane

Imaginary plane passing through sternal angle to the body of T4 & T5 vertebrae, divides the superior & inferior mediastinum

Superior Mediastinum

Boundaries

Anterior

Manubrium sterni

Posterior

Upper 4 thoracic vertebrae

Superior

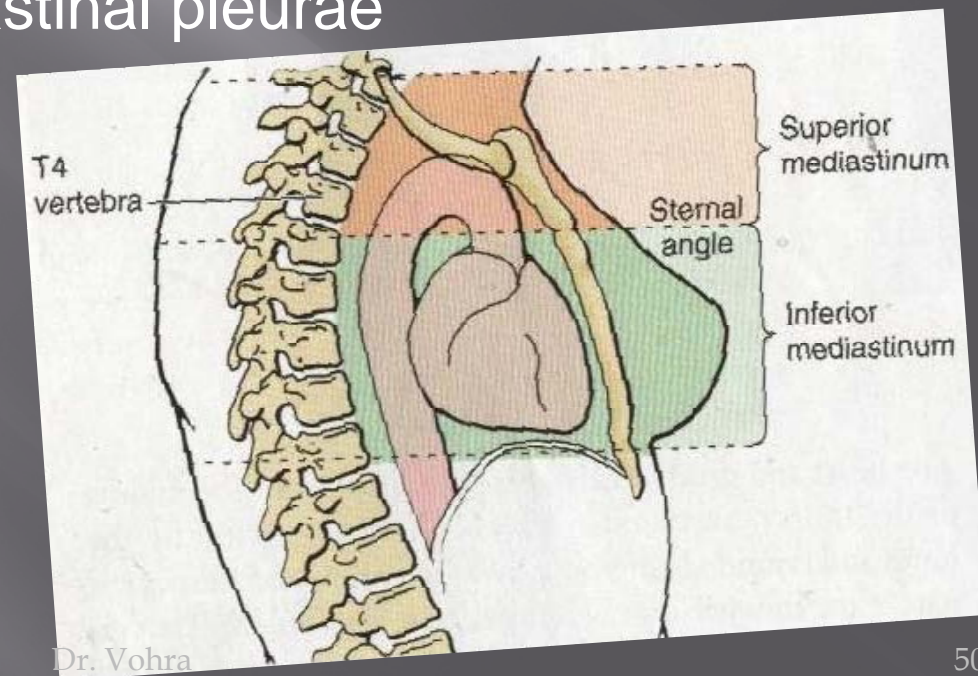
Thoracic inlet

Inferior

Transverse thoracic plane

On each side

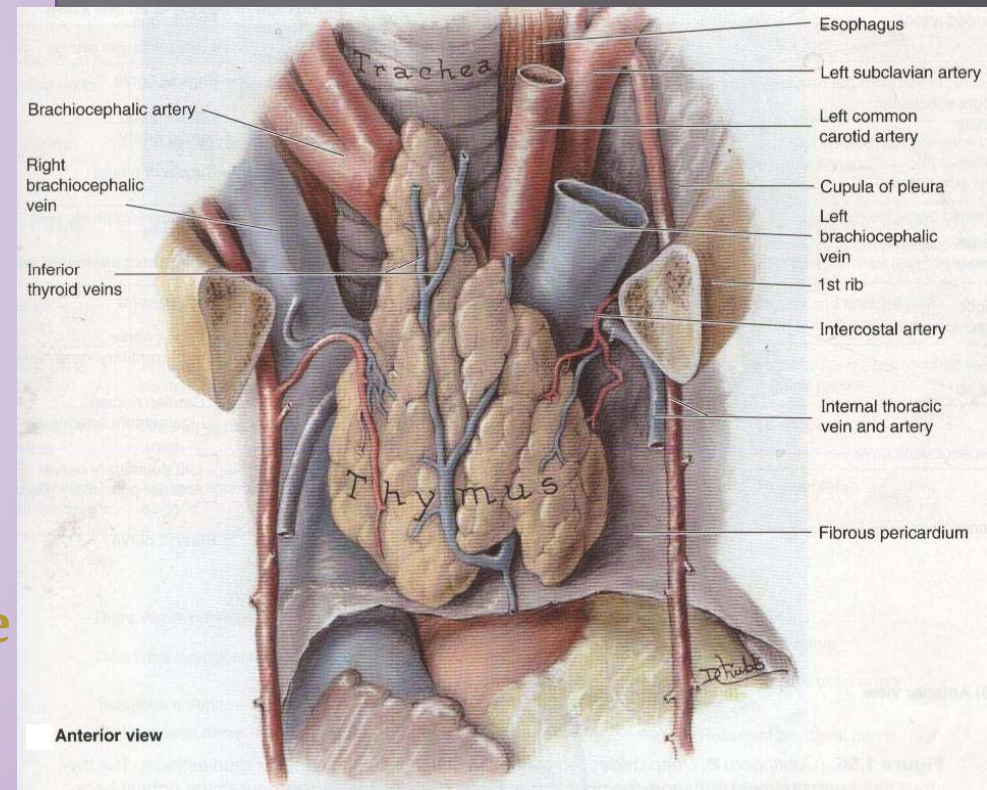
Mediastinal pleurae

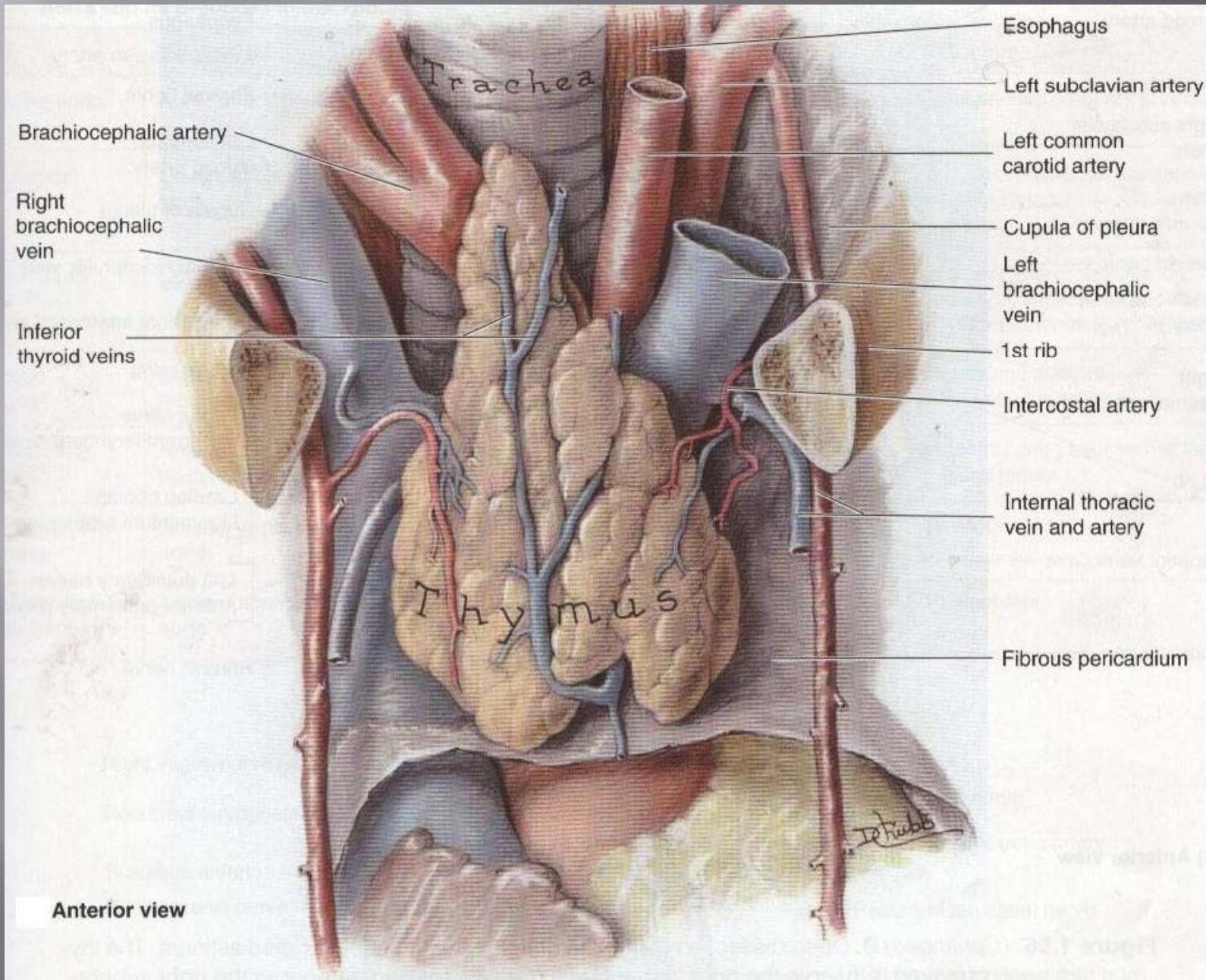


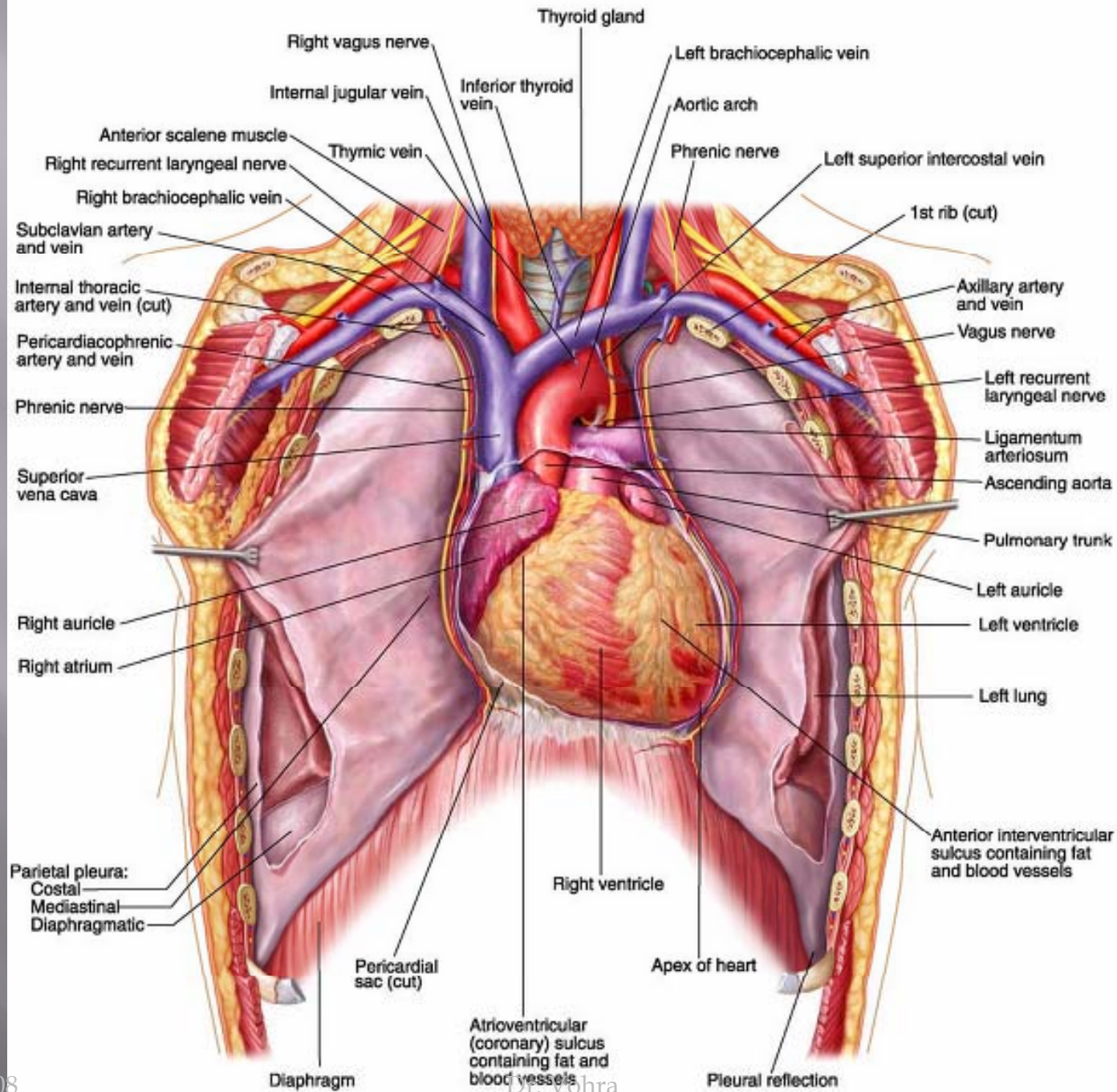
Contents of Superior Mediastinum

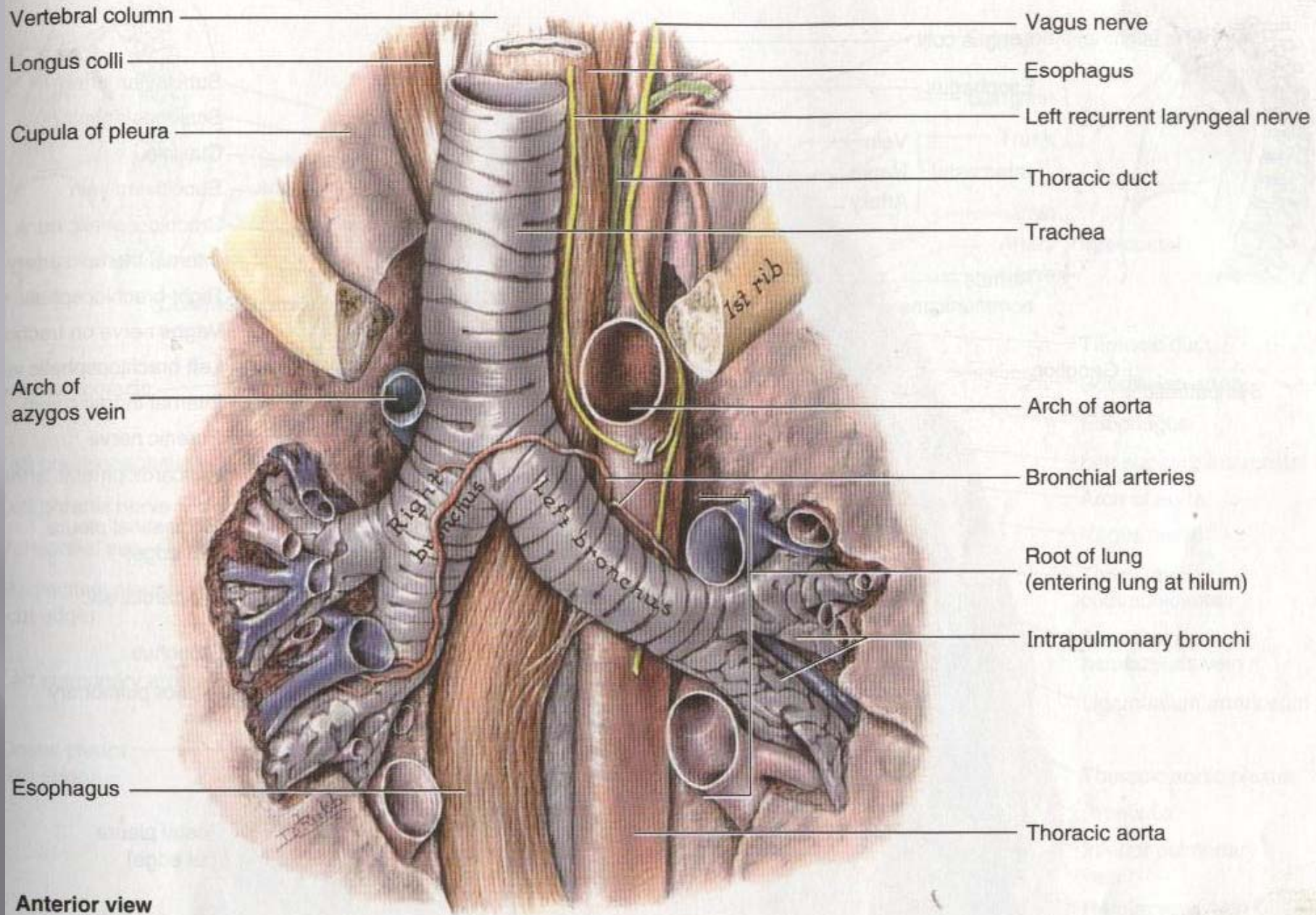
From anterior to posterior the main contents are:

- **Thymus**
- **Great vessels**
 - **Brachiocephalic veins**
 - **SVC**
 - **Arch of aorta**
 - **Brachiocephalic trunk**
 - **Left common carotid**
 - **Left subclavian artery**
- **Vagus & phrenic nerves**
- **Cardiac plexus of nerves**
- **Left recurrent laryngeal nerve**
- **Trachea**
- **Esophagus**
- **Thoracic duct**
- **Prevertebral muscles**









Anterior Mediastinum

A very narrow space in front of the pericardium overlapped by the anterior borders of both lungs

Boundaries

<i>Anterior</i>	Body of the sternum
<i>Posterior</i>	Upper 4 thoracic vertebrae
<i>Superior</i>	Transverse thoracic plane
<i>Inferior</i>	Diaphragm superior aspect
<i>On each side</i>	Mediastinal pleurae

Contents of Anterior Mediastinum

- **Sternopericardiac ligament**
- **Branches of internal thoracic vessels**
- **Thymus**
- **Fat**
- **Lymph vessels & nodes**

Middle Mediastinum

Occupied by the pericardium & its contents along with phrenic nerve & pericardiophrenic vessels

Contents

- Heart enclosed in pericardium
- Ascending aorta, Pulmonary trunk, & Pulmonary arteries
- SVC
- Azygos vein, right & left pulmonary veins
- Phrenic nerve
- Deep cardiac plexus
- Lymph node
- Bifurcation of trachea

Posterior Mediastinum

Boundaries

Anterior

Pericardium & bifurcation of trachea

Posterior

Lower 8 thoracic vertebrae

On each side

Mediastinal pleurae

Contents

- **Esophagus**
- **Descending thoracic aorta and its branches**
- **Azygos, Hemiazygos, & Accessory Hemiazygos veins**
- **Vagus nerve & splanchnic nerves**
- **Thoracic duct**