



MED437
KING SAUD UNIVERSITY



Anatomy of the Heart

Lecture 1



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هذا العمل لا يعني عن المصدر الأساسي للمذاكرة

{وَمَنْ يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ}

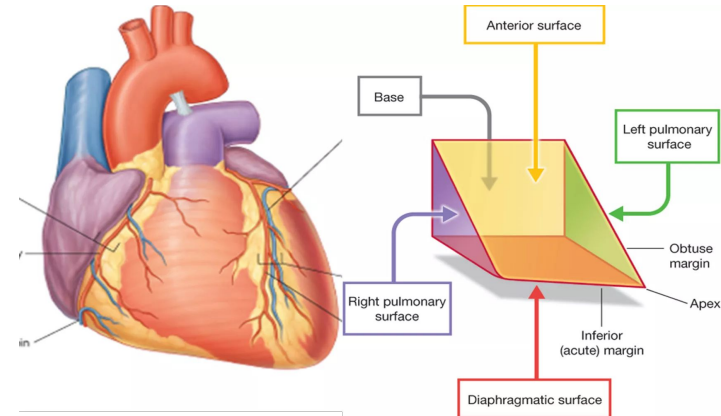
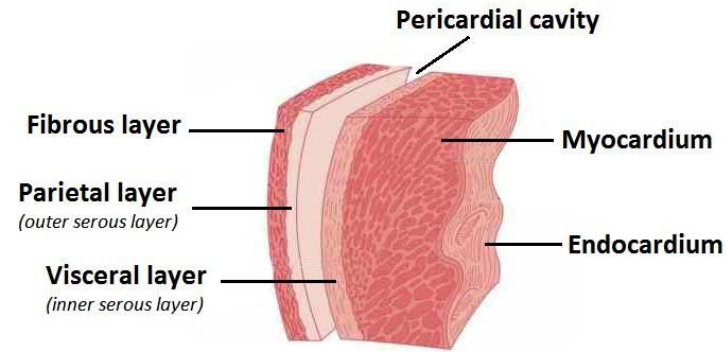
Objectives

- Describe the shape of heart regarding : apex, base, sternocostal and diaphragmatic surfaces.
- Describe the interior of the heart chambers : right atrium, right ventricle, left atrium and left ventricle.
- List the orifices of the heart:
 - Right atrioventricular (Tricuspid) orifice.
 - Pulmonary orifice.
 - Left atrioventricular (Mitral) orifice.
 - Aortic orifice.
- Describe the innervation of the heart.
- Briefly describe the conduction system of the heart.

- Text in **BLUE** was found only in the boys' slides
- Text in **PINK** was found only in the girls' slides
- Text in **RED** is considered important
- Text in **GREY** is considered extra notes

The Heart

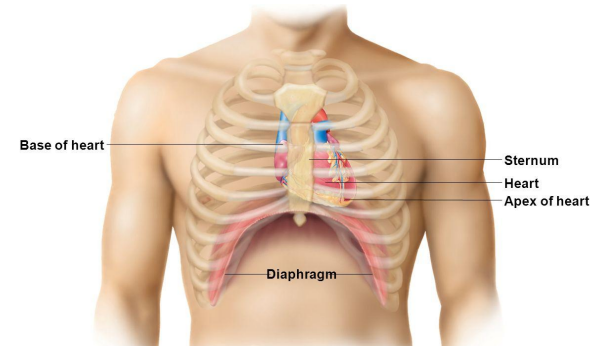
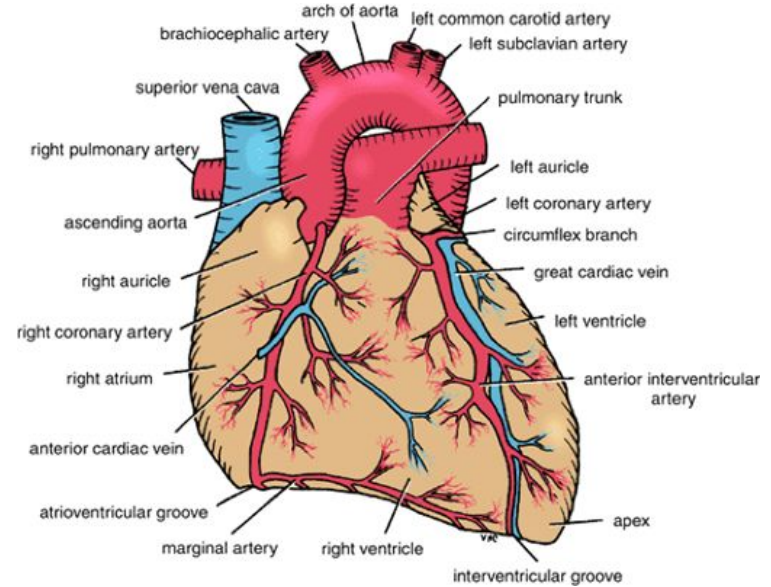
- It lies in the middle mediastinum.
- It is surrounded by a fibroserous sac called **Pericardium** which is differentiated into:
 - An outer fibrous layer (fibrous pericardium).
 - Inner serous sac (serous pericardium).
 - Parietal
 - Visceral
- The heart is somewhat, pyramidal in shape, having:
 - Apex
 - Sterno-costal (anterior surface)
 - Base (posterior surface)
 - Diaphragmatic (inferior surface)
- It consists of 4 chambers, 2 atria (right and left) & 2 ventricles (right and left)



1-Apex of The Heart

- Directed downwards, forwards and to the left.
- it is formed by the **left ventricle**.
- lies at the level of **left 5th intercostal space** 3.5 inch from midline.

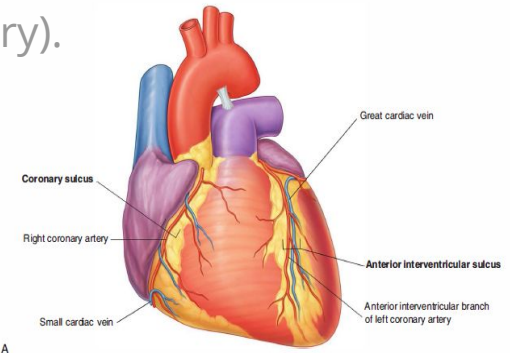
*Note that the base of the heart is called the base because the heart is pyramid shaped; the base lies opposite the apex. the heart does not rest on its base; it rests on its diaphragmatic (inferior) surface.



2-Sterno-costal (anterior) surface

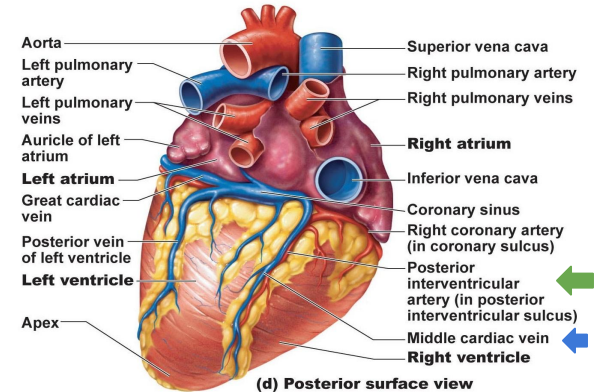
- The surface is formed **mainly by the right atrium and the right ventricle**.
- divided by **coronary (atrio-ventricular) groove** into:
 - **Atrial part**, formed mainly by right atrium.
 - **Ventricular part**, the right $\frac{2}{3}$ is formed by right ventricle, while the left $\frac{1}{3}$ is formed by left ventricle. So, it is also formed of some of left ventricle
- The 2 ventricles are separated by **Anterior interventricular groove**,
- which lodges (contains or embedded in):
 - **Anterior interventricular artery** (branch of left coronary).
 - **Great cardiac vein**
- **The coronary groove** lodges the **right coronary artery**.

sulcus = groove



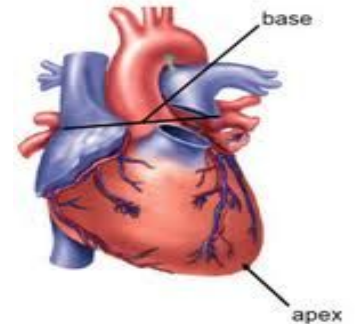
3-diaphragmatic (inferior) surface

- formed by the two ventricles, mainly **left ventricle (left 2/3)**.
- slightly concave as it rests on diaphragm.
- directed inferiorly and backward.
- separated from base of heart by **posterior part of coronary sulcus**.
- The 2-ventricles are separated by **posterior interventricular groove** which lodges:
 - **posterior interventricular artery**. ★
 - **middle cardiac vein**. ★



4-base of the heart (posterior surface)

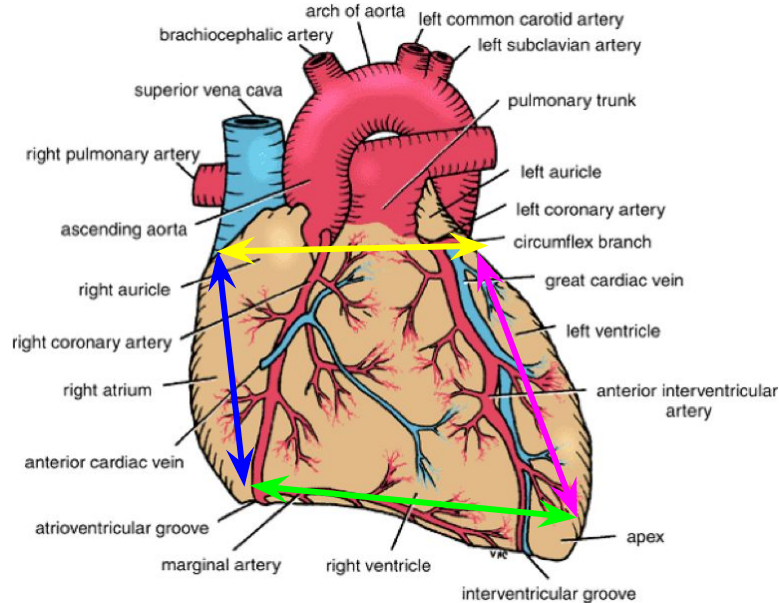
- it is formed by the two atria, **mainly left atrium**, into which open 4 pulmonary veins.
- it is directed backwards.
- lies opposite middle thoracic vertebrae (5-7) (T5,T6,T7)
- is separated from the vertebral column by **descending Aorta**, **esophagus** and **oblique sinus of pericardium**.
- bounded inferiorly by **post part of coronary sulcus** which lodges the **coronary sinus**.



Borders of the heart

Upper border

- Is formed by the 2 atria.
- It's concealed by ascending aorta and pulmonary trunk.



Left border

- Is formed mainly by left ventricle + auricle of left atrium.

Right border

- Is formed by right atrium.

Lower border

- Is formed mainly by right ventricle + apical part of left ventricle.

Chambers of the heart

The heart is divided by **vertical septa** into four chambers:

- Left and right atria .
- Left and right ventricles.

The right atrium lies **anterior** to the left atrium, and the right ventricle lies **anterior** to the left ventricle

A diagrammatic view of the anterior surface of the heart

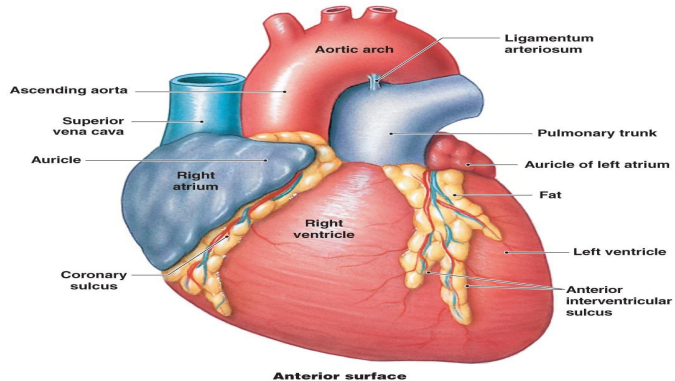
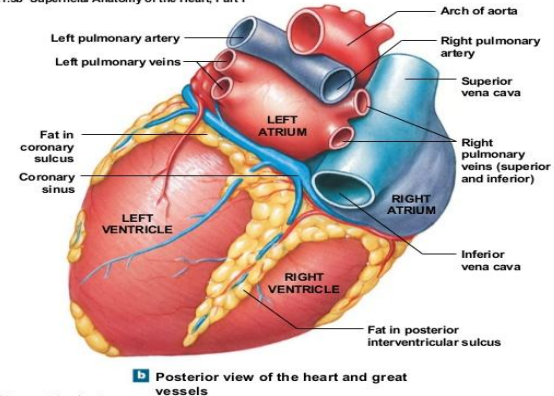
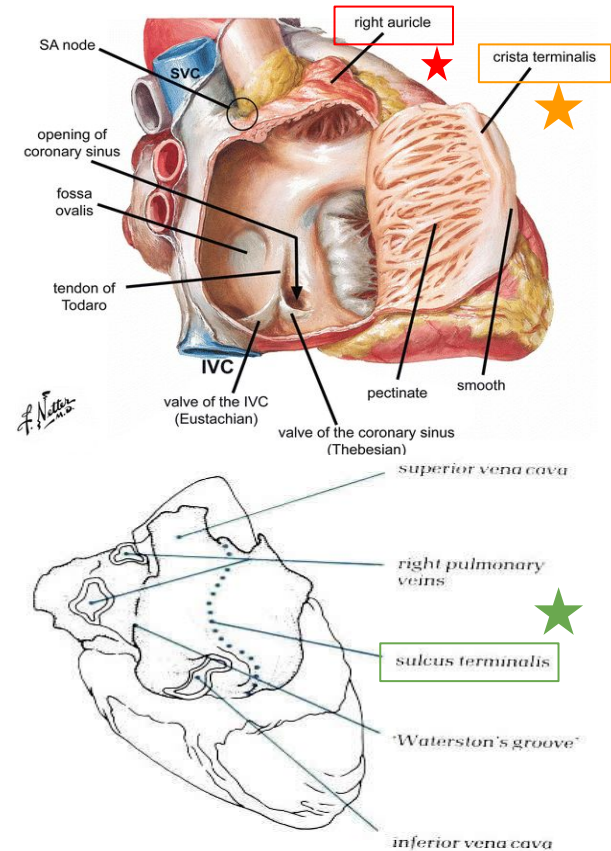


Figure 21.5b Superficial Anatomy of the Heart, Part I



Right atrium

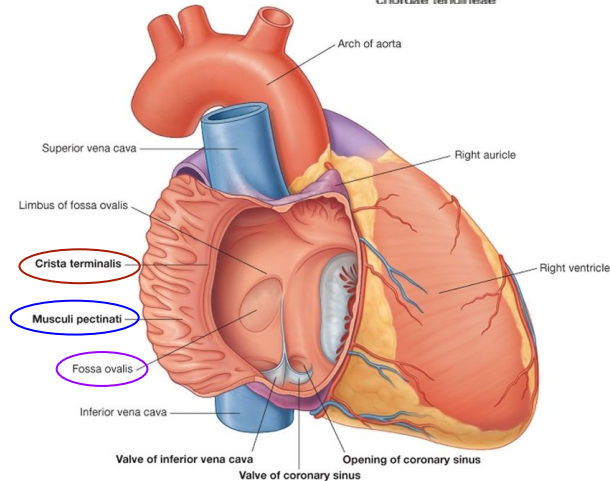
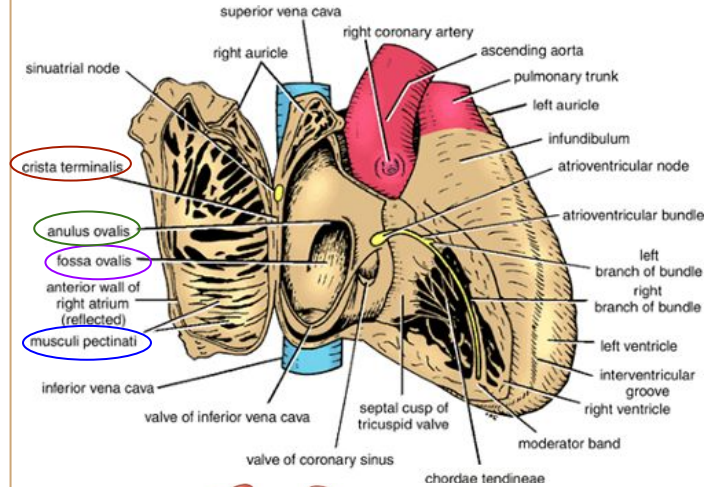
- The right atrium consists of a main cavity and a small out pouching, the **auricle**. (upward protrusion resembling ear)
- On the outside of the heart at the junction between the right atrium and the right auricle is a **vertical groove**, the **sulcus terminalis**, which on the inside forms a ridge, the **crista terminalis**.



Cavity of the right atrium

Crista terminalis divides the **right atrium** into:

1. **Anterior part:** **rough** and trabeculated by bundles of muscle fibres (**musculi pectinati**).
2. **Posterior part (sinus venarum)** is **smooth**.
 - The interatrial septum carries an oval depression called **fossa ovalis**. The margin of this depression is called **anulus ovalis**.
 - The blood leaves right atrium to right ventricle via **tricuspid valve**.

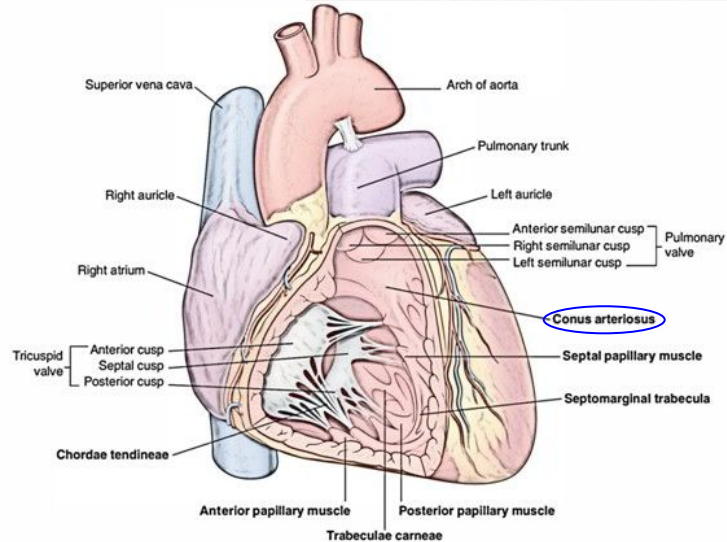
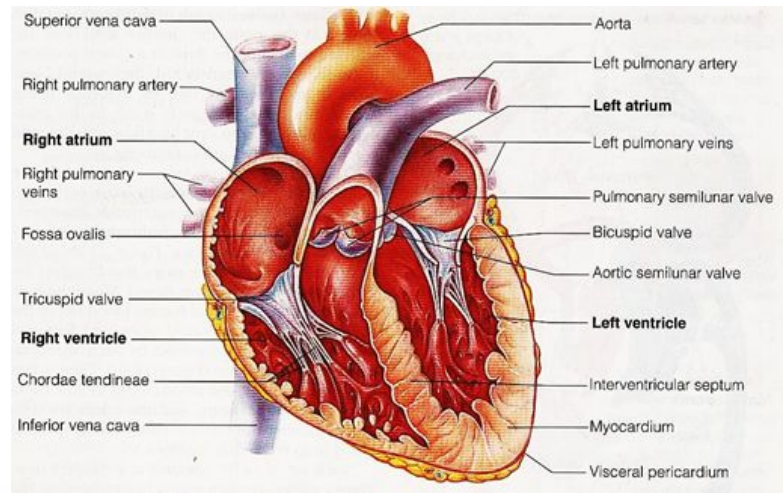


Openings in the right atrium:

1. **Superior Vena Cava (SVC)** - has **no valve**.
2. **Inferior Vena Cava (IVC)** - guarded by a **valve**.
3. **Coronary sinus** - has a **well-defined valve**.
4. **Right atrioventricular orifice** lies anterior to IVC opening, it is surrounded by a **fibrous ring** which gives attachment to the **tricuspid valve**.
5. Small orifices of small veins.

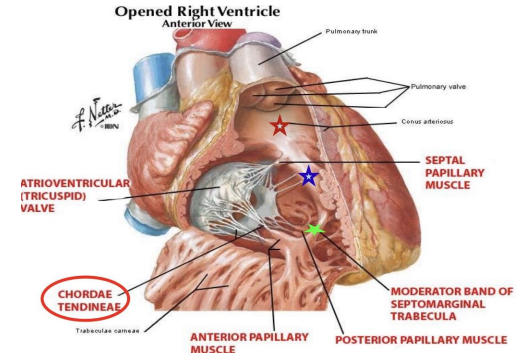
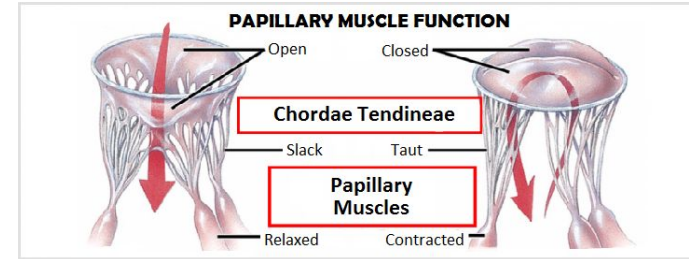
Right Ventricle

- 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** (also known as the **conus arteriosus**).



Cavity of right ventricle

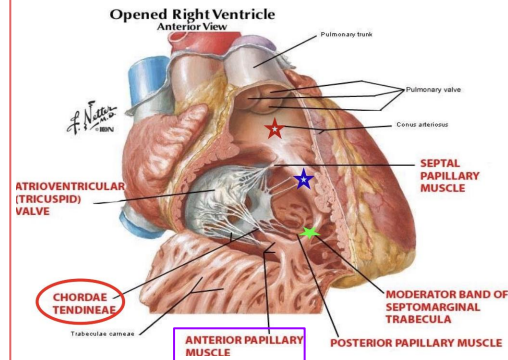
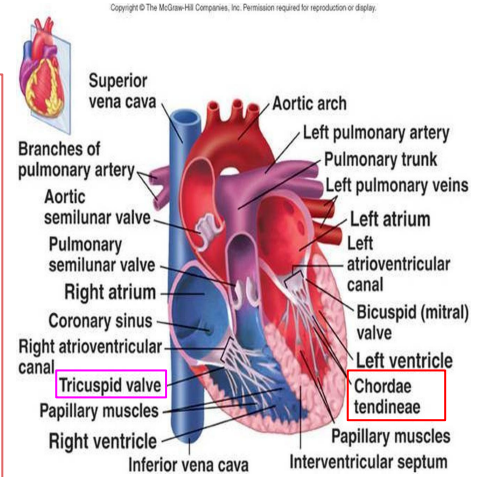
- its wall is **thinner** that of left ventricle
- its wall contains projections called **trabeculae carneae**
- the right ventricle communicates with the right atrium through **right atrioventricular orifice** & with pulmonary trunk through **pulmonary orifice**
- Large projections arise from the walls called **papillary muscles**:
 - **Anterior papillary muscle**
 - **Posterior papillary muscle**
 - **Septal papillary muscle**



Cavity of right ventricle

*each papillary muscle attaches to a chordae tendinae > each chordae tendinae attaches to a cusp > cusps give a valve.

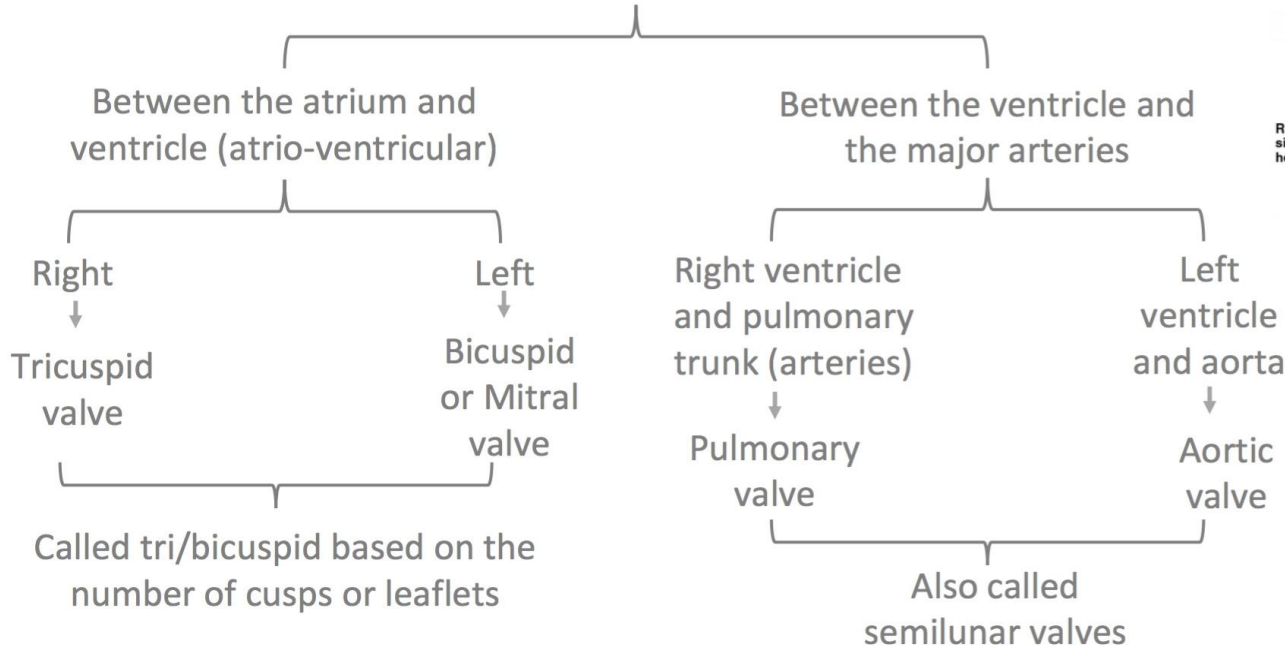
- Each papillary muscle is attached to the cusps of tricuspid valve by tendinous threads called chordae tendinae.*
- Blood leaves the right ventricle to pulmonary trunk through pulmonary orifice.
- The wall of infundibulum★ is smooth and contains no trabeculae.
- Interventricular septum★ is connected to anterior papillary muscle by a muscular band called moderator band★



Extra explanation of the coming slides (orifices):

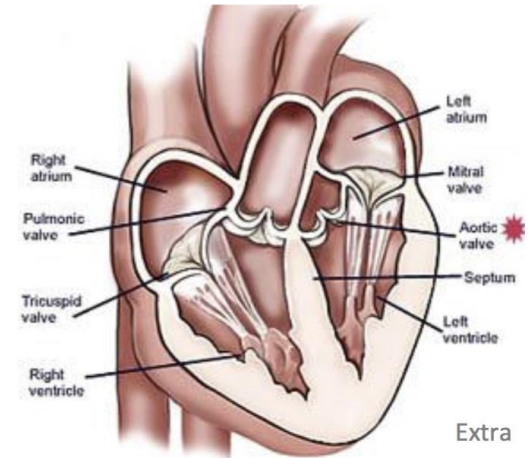
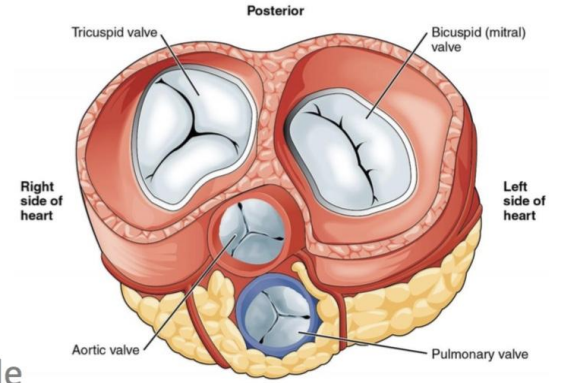
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Orifice means opening and there are 4 main orifices in the heart:



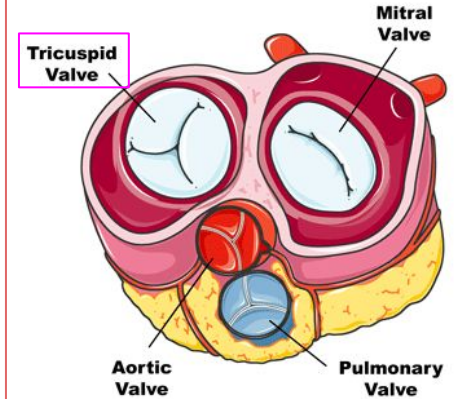
Called tri/bicuspid based on the number of cusps or leaflets

In order to make sure the blood travels in one direction the orifices are surrounded by a fibrous ring which helps to maintain the shape of the opening. Attached to this ring are cusps (نتوء). Two or three cusps make a valve (صمام). The valves guard the orifice.



Right atrio-ventricular (tricuspid) orifice

- About one inch wide, admitting tips of 3 fingers.
- It is guarded by a fibrous ring which gives attachment to the cusps of tricuspid valve.★
- It has 3-cusps (anterior,posterior,septal or medial).
- **The atrial surface** of the cusps are smooth, while their **ventricular surfaces** give attachment to the **chordae tendinae**.

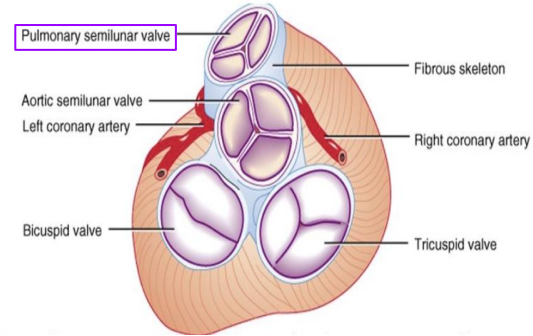


Pulmonary orifice

- Surrounded by a fibrous ring which gives attachment to the cusps of the pulmonary valve.
- The valve is formed of 3 semilunar cusps 2 anterior and one posterior which are **concave superiorly** and **convex inferiorly**.

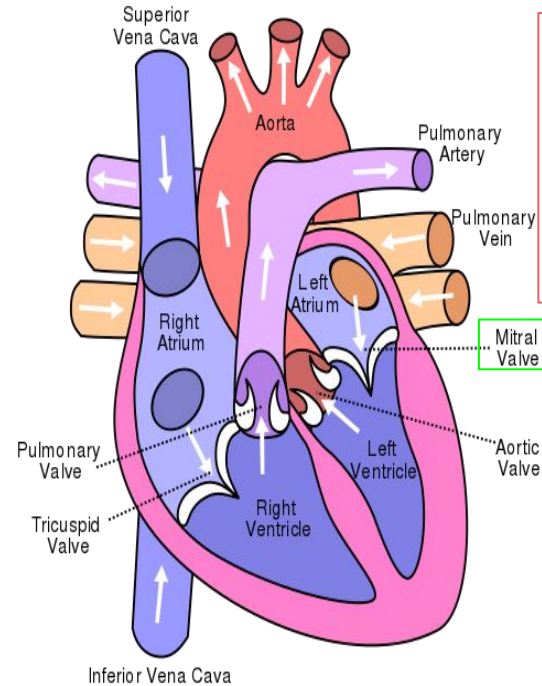
*No chordae tendineae or papillary muscles are attached to these cusps.

Semilunar Valves



Left atrium of the heart

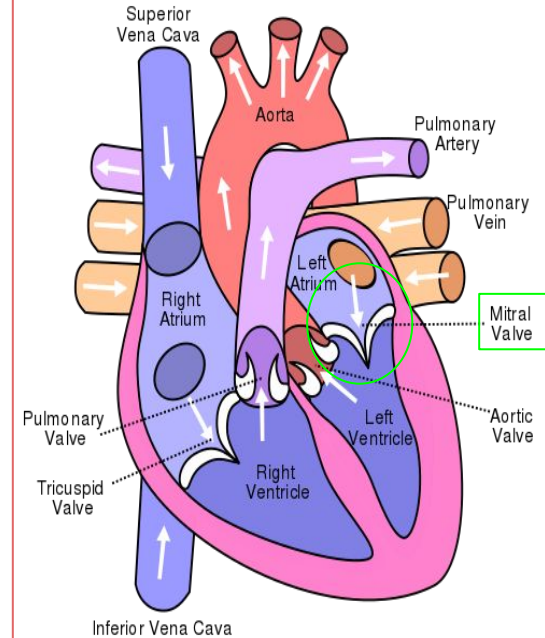
- The left atrium communicates with the left ventricle through the atrioventricular orifice
- It forms the greater part of **base of heart**.
- Its wall is smooth except for small **musculi pectinati** in the left auricle.
- Receives **4 pulmonary veins** which have no valves.



Sends blood to left ventricle through the **left atrioventricular orifice** which is guarded by mitral valve (bicuspid valve).

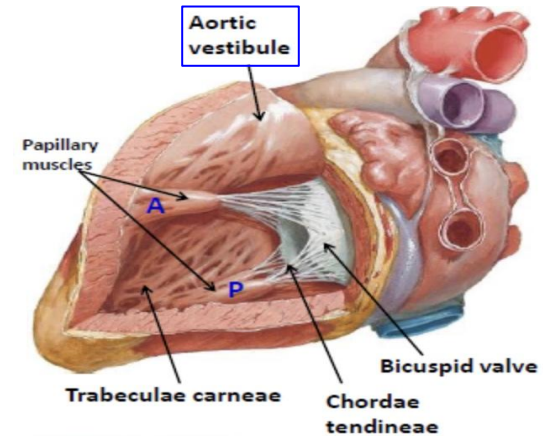
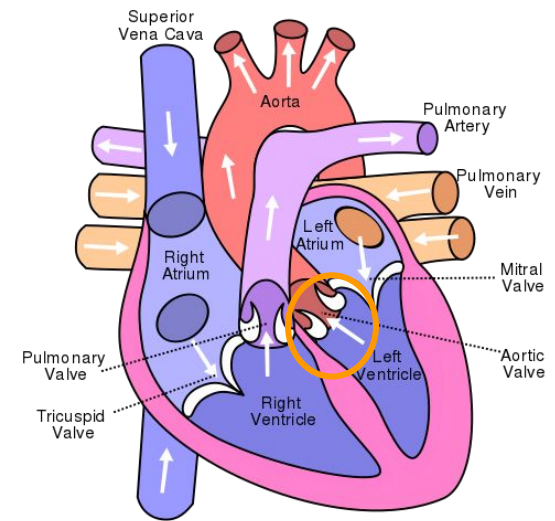
Left ventricle of the heart

- Its wall is thicker than that of right ventricle.
- It receives blood from left atrium through **left atrioventricular orifice** which is guarded by **mitral valve** (**bicuspid**).
- Its wall contains **trabeculae canae** (اللي يعطيه الخشونة).
- Its wall contains 2 large papillary muscles (**anterior & posterior**). They are attached by **chordae tendinae** to **cusps of mitral valve**.



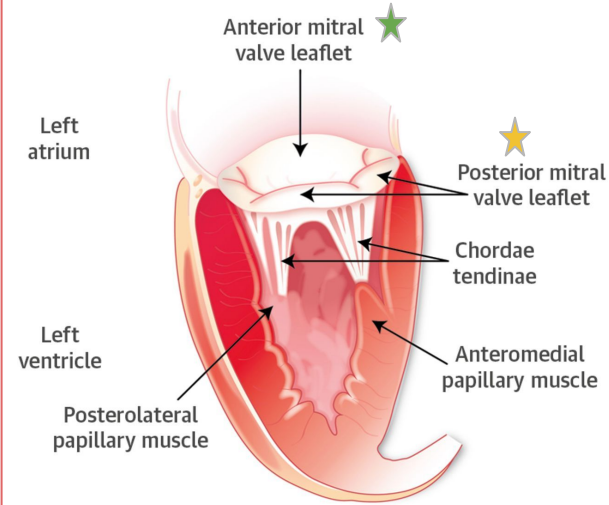
Left ventricle of the heart

- The blood leaves the left ventricle to the ascending aorta through the **aortic orifice**. ★
- The part of left ventricle leading to ascending aorta is called aortic vestibule.
- The wall of aortic vestibule is fibrous and smooth.



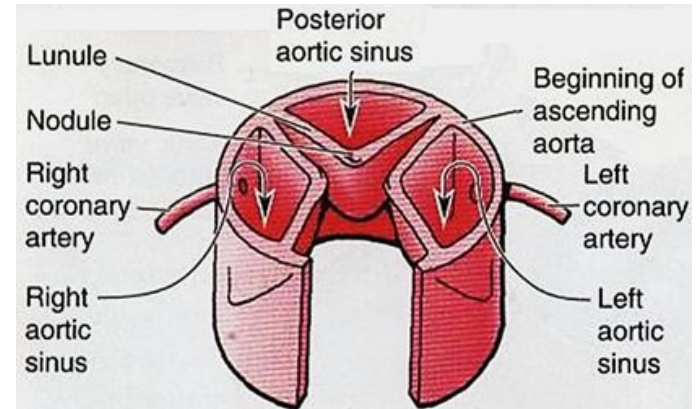
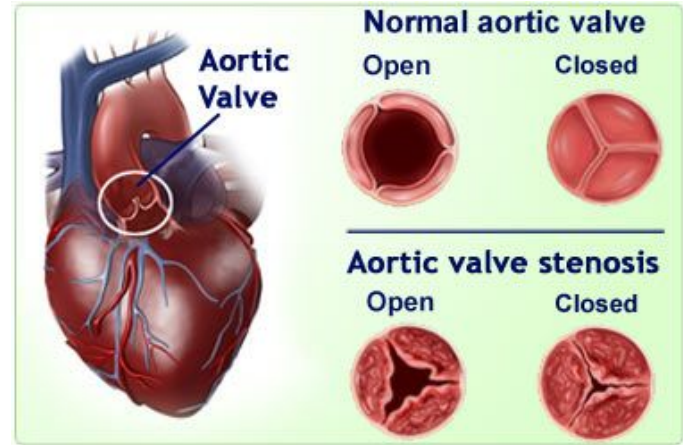
Left Atrio-ventricular (mitral) orifice

- Smaller than the right, admitting only tips of 2 fingers.
- Guarded by a **mitral valve**.
- Surrounded by a fibrous ring which gives attachment to the cusps of mitral valve.
- Mitral valve is composed of 2 cusps:
 - **Anterior cusp** : lies anteriorly and to right. ★
 - **Posterior cusp** : lies posteriorly and to left. ★
- The atrial surfaces of the cusps are smooth, while ventricular surfaces give attachment to chordae tendinae.



Aortic orifice

- Surrounded by a fibrous ring which gives attachment to the cusps of aortic valve.
- **Aortic valve** is formed of 3 **semilunar cusps** which are similar to those of pulmonary valve, but the position of the cusps differs being one anterior and 2 posterior.

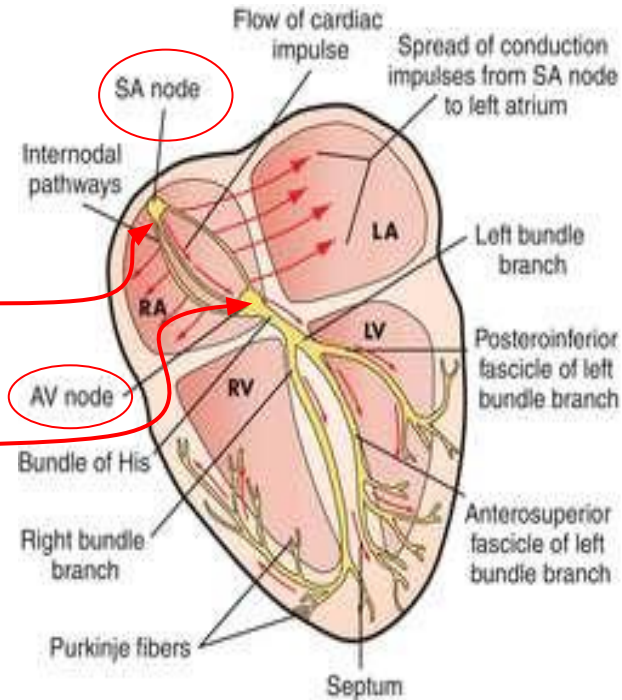


Nerve supply of the heart

- **By sympathetic & parasympathetic fibers** via the **cardiac plexus** situated below arch of aorta.
- **The sympathetic fibres** arise from the cervical & upper thoracic ganglia of **sympathetic trunks**.
- **The parasympathetic fibres** arise from the **vagus nerves**.
- Postganglionic fibres reach heart along – **SAN, AVN & nerve plexus around coronary arteries**.
- Symp. Fibers --- accelerate heart rate but Parasymp. Fibers --- slow heart rate (constriction of coronary arteries)

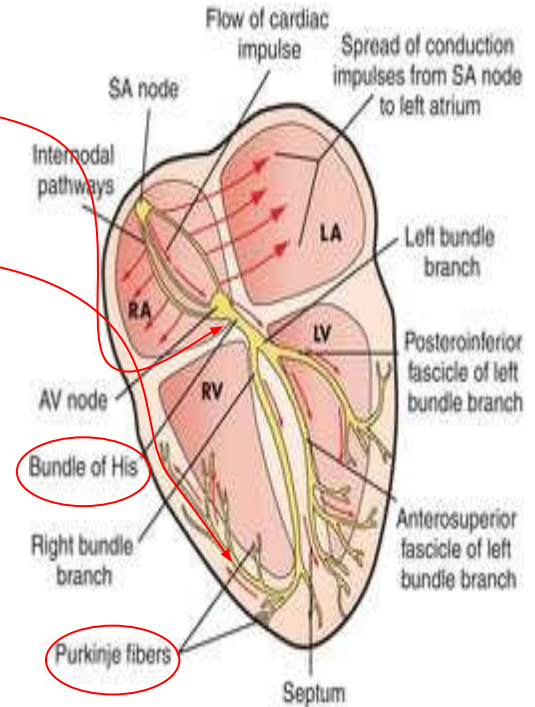
Conduction system of the heart

- heart beating is regulated by **intrinsic conduction (nodal) system** this system ensures that the heart chambers are beating in a **proper rhythm and sequence**:
- the main center is the **sinoatrial(SA) node**
 - is the on the right atrium below the SVC.
- the **atrioventricular (AV) node**
 - is at the junction of the atria and the ventricles.



conduction system of the heart

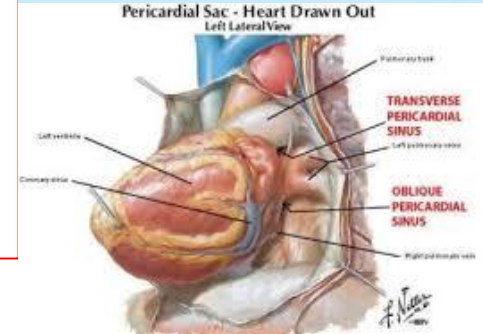
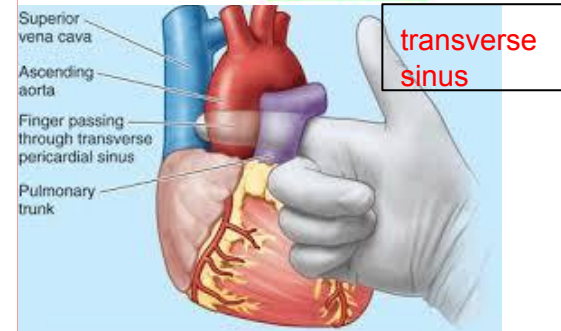
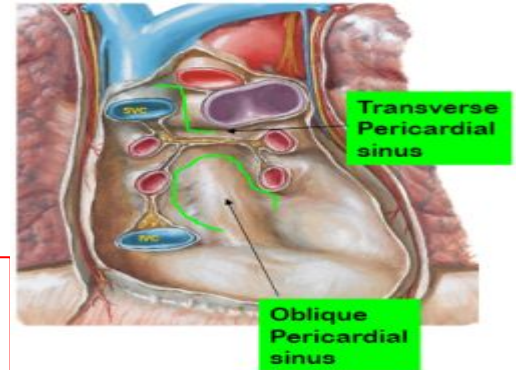
- The **atrioventricular(AV) bundle (bundle of His)** is located in the interventricular septum.
- the **purkinje fibers** are located inside the walls of the ventricles.
- the **SA node** is called the **pacemaker** of the heart, because it generates the impulse.



pericardial sinuses

Transverse sinus: it is a recess of serous pericardium **between:** **ascending aorta** and **pulmonary trunk** **anteriorly** , upper parts of 2 atria and **SVC** **posteriorly**.

Oblique sinus: it lies **posterior to the heart**. it is a recess of serous pericardium **behind** the base of the heart (left atrium), separate base from: **descending aorta**, **esophagus** and **vertebral column**.



MCQs

(1) Blood reaches the right ventricle from the right atrium through the?

- A) Mitral valve
- B) Tricuspid valve
- C) Semilunar valve
- D) Aortic Valve

(2) The anterior part of the right atrium is _____ and the posterior part is _____?

- A) Rough, smooth
- B) Smooth, smooth
- C) Smooth, Rough
- D) Rough, Rough

(3) Which of the following is an opening in the right atrium?

- A) Pulmonary vein
- B) Fossa ovalis
- C) Sinus venarum
- D) Coronary Sinus

(4) The right ventricle communicates with the right atrium through the?

- A) Pulmonary orifice
- B) Atrioventricular orifice
- C) Infundibulum
- D) Bicuspid Valve

(5) What divides the right atrium into its anterior and posterior parts?

- A) Crista terminalis
- B) Musculi pectinati
- C) Right auricle
- D) Moderator band

MCQs

(6) The apex of heart is directed?

- A) upwards, backwards & to the left
- D) upwards, forwards & to the left
- C) downwards, backwards & to the left
- D) downwards, forwards & to the left

(7) The heart rests on its?

- A) base B) diaphragmatic surface
- C) inferior surface D) both B & C

(8) The base of the heart is formed mainly by?

- A) the two ventricles b) the two atria mainly left atrium
- C) the right atrium and the right ventricle
- D) the left atrium and the left ventricle

(9) The anterior interventricular groove lodges?

- A) great cardiac vein
- B) middle cardiac vein
- C) posterior interventricular artery
- D) both B & C

(10) The diaphragmatic (inferior) surface is formed by the two ventricles, mainly?

- A) left $\frac{2}{3}$ of the left ventricle
- B) right $\frac{2}{3}$ of the right ventricle
- C) left $\frac{1}{3}$ of the left ventricle
- D) right $\frac{1}{3}$ of the right ventricle

Answers

(1) B

(6) D

(2) A

(7) B

(3) D

(8) B

(4) B

(9) A

(5) A

(10) A

Team Members

Team leader: Faisal Fahad Alsaif

Abdulaziz Al dukhayel
Abdulelah Aldossari
Abdulrahman Alduhayyim
Hamdan Aldossari
Fahad Alfaiz
Zeyad Al-khenaizan
Abdullah Almeaither
Abduljabbar Al-yamane
Abdulmajeed Alwardi
Abdulaziz Al-drgam
Ali Alammari
Muhammad Binmayouf
Majed Aljohani

Team leader: Rawan Mohammad Alharbi

Abeer Alabduljabbar
Afnan Almustafa
Ahad Algrain
Albandari Alshaye
AlFhadah alsaleem
Ghaida Alsanad
Lojain Azizalrahman
Majd AlBarrak
Maha barakah
Nouf Alotaibi
Rinad Alghoraiby
Wejdan Albadrani