

## ANATOMY / HISTOLOGY

☒ Sheet

☐ Slide

☐ Handout

Number

1

Subject

**Anatomy lab 1**

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Price:

## Introduction to the cardiovascular system

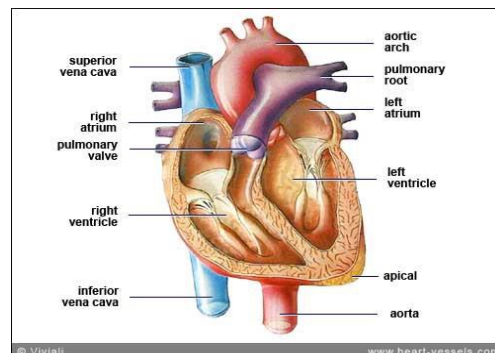
This sheet is more like a theoretical Lecture than a lab one, and the arrangement of this sheet is different than the lab recording.

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The cardiovascular system is a closed system and has two primary components: the heart and blood vessels, and these components are located in the pericardium.

The heart has two atria and two ventricles:

- 1) Right atrium forms the right border of the heart.
  - 2) The left atrium forms the posterior part of the heart.
  - 3) The right ventricle forms the anterior surface of the heart.
  - 4) The left ventricle forms the left border of the heart.
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### The blood circulation

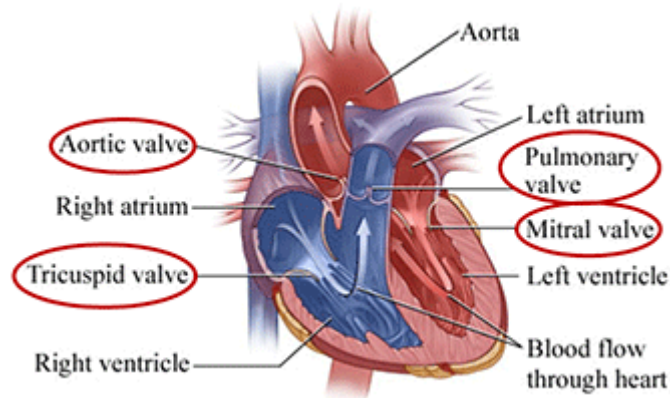
- There are the systemic and pulmonary circulation.

The right atrium receives blood from all our body except the LUNGS through the superior and inferior vena cava. Then the blood passes to the right ventricle via the right atrioventricular opening, which maintains the unidirectional flow of blood and prevents regurgitation (the passage of blood from the atrium to the ventricle occurs almost passively with the atrial systole only contributes minimally). Then, where it's pumped through the pulmonary trunk to the lungs, where the blood gets rid of its content of CO<sub>2</sub> and has its supply of O<sub>2</sub>. Then the blood is returned back to the left atrium through four valveless pulmonary veins (pulmonary circulation). Then from the left atrium the blood moves to the left ventricle via the left atrioventricular orifice. Then it's pumped through the ascending aorta back to the systemic circulation.

### Very important notes

- The blood passes from the right atrium to the right ventricle through an opening called (the right atrioventricular orifice). This opening is controlled by a valve, the right atrioventricular valve. Formed by three parts, this valve is also called the tricuspid valve.

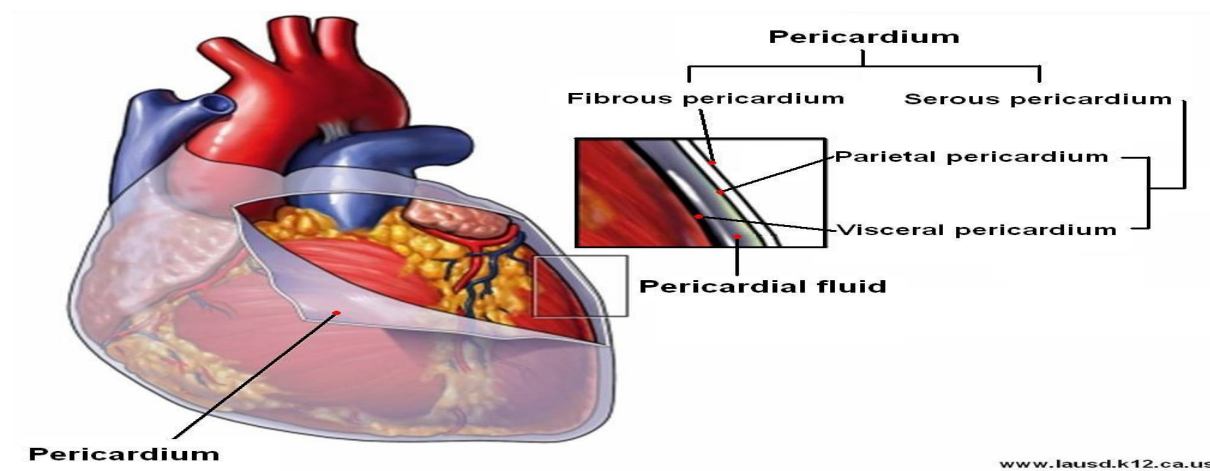
- The blood passes from the left atrium to the left ventricle through an opening called (the left atrioventricular orifice). this opening is controlled by a valve, the left atrioventricular valve. Also known as bicuspid valve or mitral valve.
- At the beginning of the pulmonary trunk there's a valve, the semilunar pulmonary valve( 3 cups Crescent-shaped).
- At the beginning of the ascending aorta there is the semilunar aortic valve(3 cup Crescent-shaped).



## Pericardium

it has two layers a fibrous layer ( the outer one ) and a serous layer ( the inner one) and both of those layers are pain sensitive,(example in cases of pericarditis the patient will suffer from a severe pain) because the nerve supply for those pericardium layers comes from the phrenic nerve and the phrenic nerve is a spinal nerve which comes from c3,c4,c5 .

**Note** : phrenic nerve is a spinal nerve which means that it has sensory , motor, and sympathetic fibers (SMS).



- Structures that are found INSIDE the pericardium

Ascending aorta is found inside the pericardium , left to it you can find the pulmonary trunk , right to the ascending aorta you can find the lower half of the superior vena cava as well as the heart.

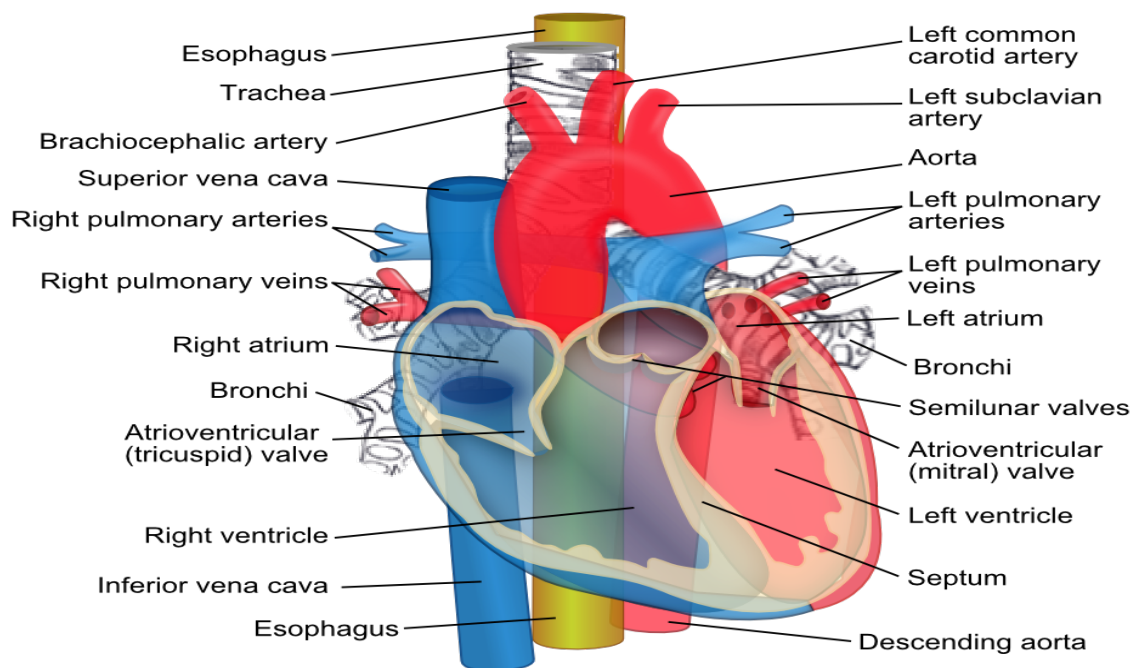
- Structures that are found outside the pericardium

aortic arch and it's branches and those branches are arranged from right forward to left backward as this: the most anterior branch is the brachiocephalic artery , next the left common carotid artery , then the left subclavian artery which is the most posterior branch.

anterior to those branches there is the left brachiocephalic vein which will join the right brachiocephalic vein to form the superior vena cava ( remember : the upper half of the superior vena cava is found outside the pericardium whereas the lower half is found inside the pericardium ).

note :

- each brachiocephalic vein composed of internal jugular vein and subclavian vein.
- the most anterior to the previous mentioned structures is the thymus.



## x-ray chest

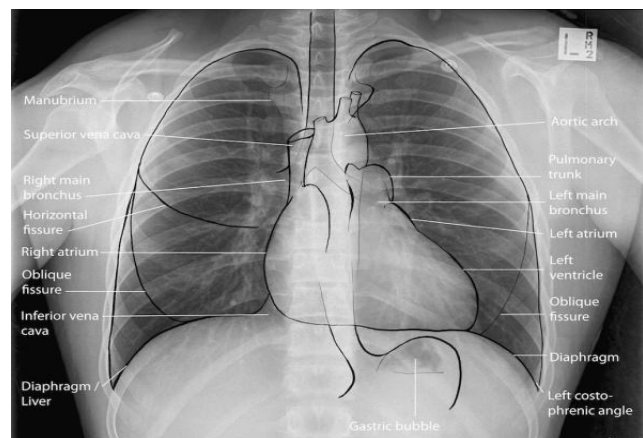
if the bicuspid valve become narrow, the blood will accumulate in left atrium and the blood will go back to the lungs , the patient will become pulmonary congested and he will suffer from dyspnea and orthopnea ( which is the difficulty in breathing that occurs when lying down). If the patient doesn't get the proper care, this will affect the right ventricle negatively by becoming over loaded.

### Note:

Complications of tonsillitis may lead to the weak or stenosis(become narrow) of the heart valves(bicuspid valve )cause a disease called rheumatic endocarditis .

In the X-ray image the shown ribs are the posterior part because the anterior part is cartilage known as the costal cartilage which does not appear on the X-ray .

When we want to have an X-ray for the stomach and colon we give the patient barium (dye)and it'll be shown,but In case of the heart we don't give a dye, we only position the film on one side and the imaging device on the other side of the patient. the rays will pass through the lungs easily because they're filled with air and as soon as they penetrate the body they burn the film that's why it looks black. But in case of the heart, vessels and bones they absorb the rays so they will appear white on the film. Why ? because the heart has a thick wall where it absorb the rays and the blood in the vessels prevent the rays from penetrating. The white area is where the rays didn't get to the film and didn't burn it .



- Left margin of the heart is left ventricle and above it there are pulmonary trunk , left auricle and above pulmonary trunk there is Aortic arch(aortic knuckle in x- rays),

### Notes

- we cant distinguish between the Pulmonary trunk and the left auricle – ill defined
- We can distinguish right and left dome of diaphragm.where right dome higher than left dome.
- If we see air under the left dome is normal,while if we see air under the right dome is abnormal

- The most common cause of the presence of air under the right dome of diaphragm is Perforating duodenal ulcer.
- How to know if the heart is in normal size or not ? Approximately, the width of the heart is lesser than the half width of the thorax .

**Depending on the figure :**

- \* the width of the heart is large, we call it enlargement of the heart.
- \* is this enlargement in the left or right ventricle ? the enlargement is in the left ventricle.



### **The Structures inside the heart**

Posterior to right atrium there is left atrium and between them interatrial septum  
And there is a septum that separates the left and the right ventricles, which is the interventricular septum.

if you open the right ventricle you can see that has part which is rough wall and The upper part is smooth which is called infundibulum.

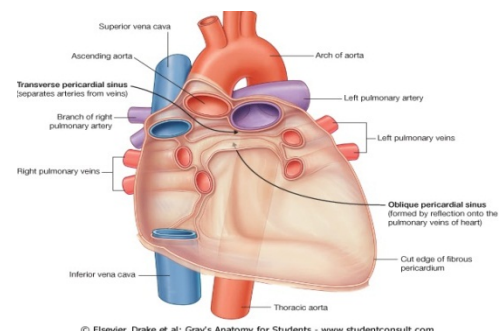
if you open the left ventricle you can see that has part which is rough wall and has Muscular projections and The upper part is smooth which is called aortic vestibule.

Structures that are found posterior to the heart are two (Pipes) ascending aorta and beside it esophagus.so when occurs enlargement in the left atrium(posterior surface of heart)will Exerts pressure on the esophagus Where barium does not come down easily.(abnormal left atrium is evaluated through a barium swallow)

Note: the esophagus open during swallowing only.

**NOW inside the pericardium**

- if you put your index finger behind the ascending aorta and the pulmonary trunk and in the front of the



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- superior vena cava , then your finger will be in the transverse sinus of pericardium .
- if you put your index finger between the left atrium and the pericardium , then your finger will be in the oblique sinus.

note:

aortic arch and it's branches and all the vein which was mentioned lie behind manubrium sterni(upper part of sternum) is called inferior mediastinum and the heart and all that surrounds it is called superior mediastinum.

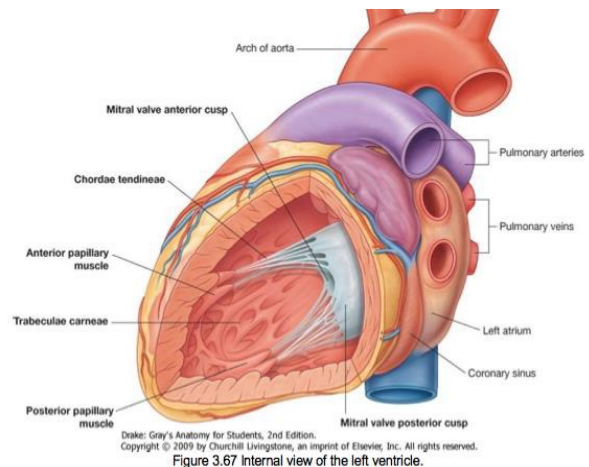
### Atrioventricular valve

- The blood passes from the right atrium to the right ventricle through an opening called "the right atrioventricular orifice". this opening is controlled by a valve, the right atrioventricular valve. Formed by three parts, this valve is also called the tricuspid valve.
- The blood passes from the left atrium to the left ventricle through an opening called "the left atrioventricular orifice".. this opening is controlled by a valve, the left atrioventricular valve. Also known as bicuspid valve or mitral valve.

When you open the left ventricle you can see that it has a thick wall more than right ventricle. and You can see the anterior cusp and behind it the posterior cusp and in between them the bicuspid valve so in front and behind the bicuspid valve there is a cusp.

So if you insert the forceps in the valve you will be in the left atrium.

And we will see The papillary muscle is attached to the cusps by chordae tendineae .



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### How does atrioventricular valve close ??

the Tricuspid valve will close in the same mechanism of bicuspid valve.

During early systole there is a stage from contraction, this contraction increases the pressure inside the ventricle then the blood pressure increases then the interventricular pressure increases then the closed valve will try to move to the atrium side, and try to open but the papillary muscle with the chordate tendineae will prevent the valve from moving and opening.

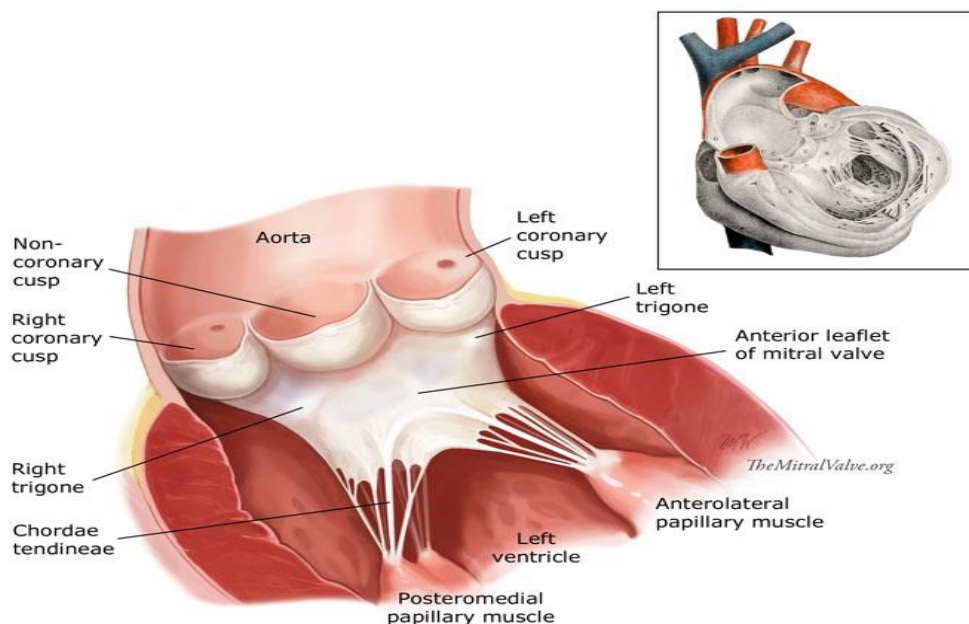
So what closes the valve is the increase in the interventricular pressure in early systole (in contraction stage), and it will open when : the blood fill the atrium during systole then the atrium pressure will be higher than the ventricular pressure then the valve will open .

During the diastole the blood come back from the aorta to the left ventricle, (and from the pulmonary trunk to right ventricle), but the blood will face these cusps they will adhere to each other and they will be closed and filled with blood

### Very important note:

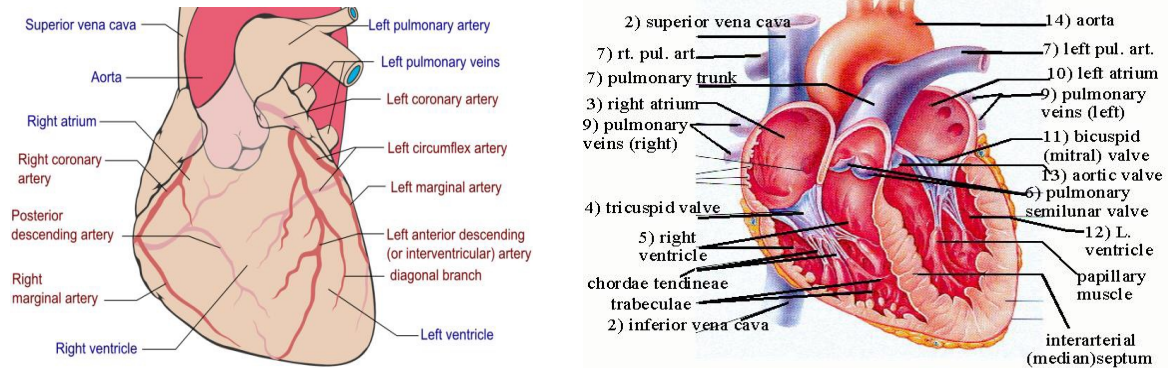
**The papillary muscle doesn't open or close the valve, they just strengthens the closure of the valve. If there was a problem in its closure like for ex: the papillary muscle had been cut, the valve become incompetent, then the blood will come back to the atrium.**

- Beside the anterior cusp of the bicuspid you can see the semilunar Aortic valve which has 3 cusps.





## Coronary arteries:



They are a branches of ascending aorta that is located on the surface of heart and there are two: a- Right Coronary b- Left coronary

Branches from These Coronary arteries penetrate thick heart muscle and provide the heart muscle by the blood .

The Left coronary arteries filled with blood during systole.

The wall of the left ventricle much thicker (3 times )than the right ventricle,and it's called a high pressure pump, while right ventricle it's called a low pressure pump .

the reason the wall of the left ventricle is thicker than that of the right ventricle simply is because the resistance in the systemic circulation is much higher than that in the pulmonary circulation, the left ventricle needs to have a thicker wall in order to pump the blood in a much stronger pattern to get over the systemic resistance.

In the systemic circulation the blood passes through the ascending aorta then the arch of the aorta then the descending aorta,, and so on until it branches into smaller arteries. now as the arteries get smaller and smaller, resistance increases due to that. the resistance in the arterioles is the greatest, they are called the major resistant vessels.

the blood flow is controlled by The pressure gradient and resistant vessels.: the pressure gradient is the main moving force for the blood flow in the body .. e.g: when the pressure in the left ventricle is higher than that in the aorta the semilunar aortic valve opens allowing the blood to pass to the aorta.

**End of the text**

**Sorry for any mistake**

