Physiology of Cardiac Muscle

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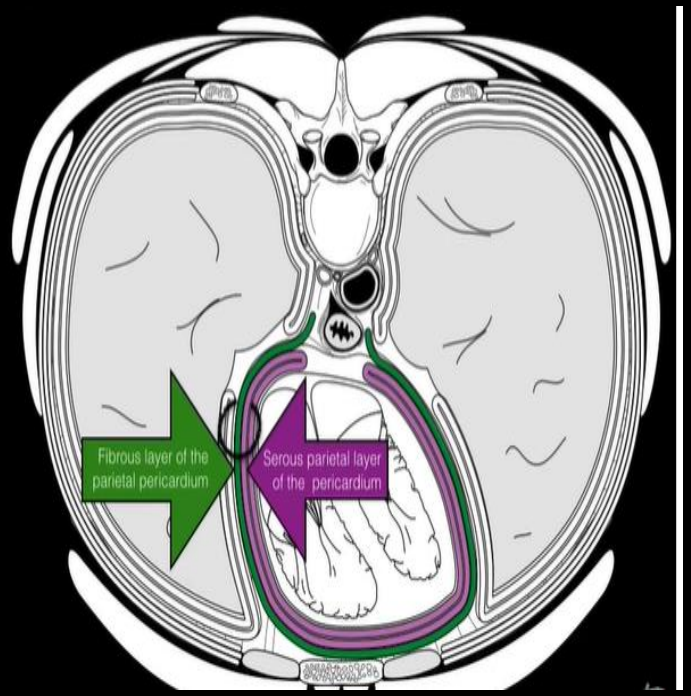
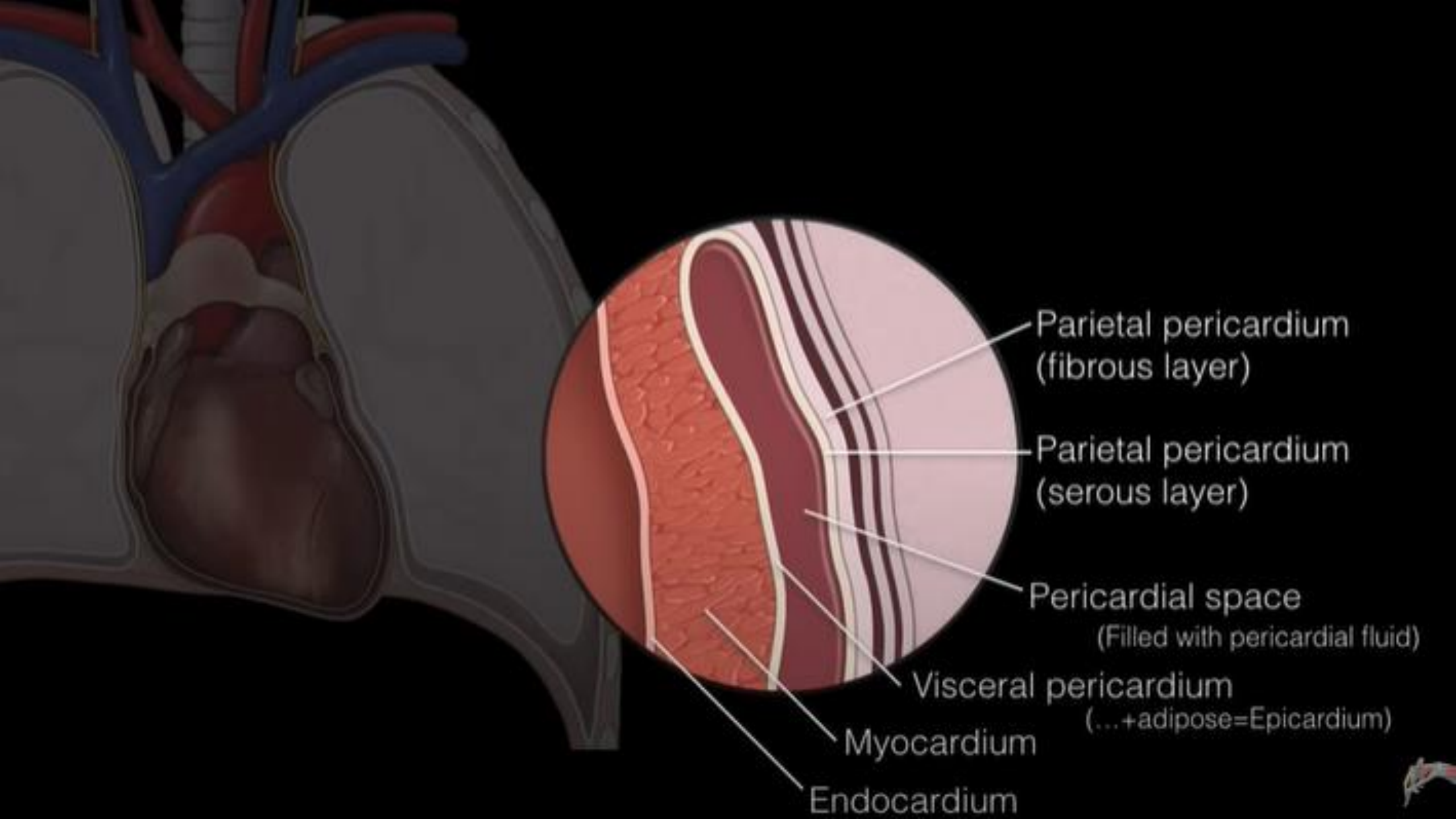
The human heart...

- Is roughly the size of a fist
- Weighs ~300 grams
- Beats 60-80 times/min
- Pumps 5-6 L throughout body

Pericardial Sac

- Double-walled sac containing the heart and roots of great vessels
  - The parietal pericardium has 2 layers ... Fibrous layer and serous layer
  - The visceral pericardium adheres to the outside of the heart




Parietal pericardium
(fibrous layer)
Parietal pericardium
(serous layer)
Pericardial space
(Filled with pericardial fluid)
Visceral pericardium
(…+adipose=Epicardium)
Myocardium
Endocardium

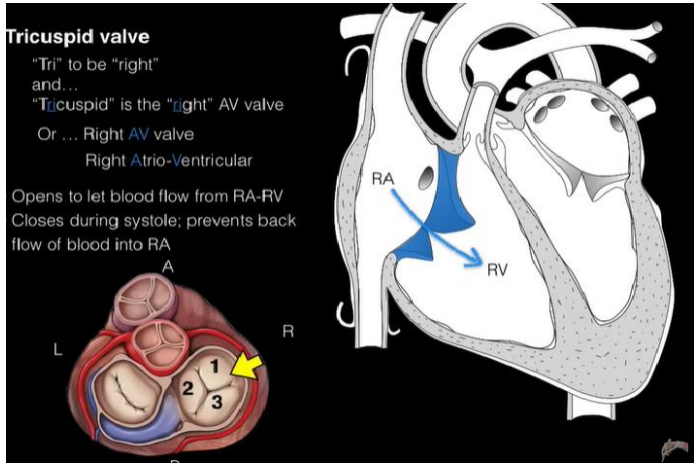
Heart chambers

Superior vena cava (SVC)
Inferior vena cava (IVC)
Coronary sinus
Right atrium (RA)
Tricuspid valve
Right ventricle
Pulmonary valve
Pulmonary arteries
Pulmonary veins
Left atrium
Bicuspid valve
Left ventricle
Aortic valve

Tricuspid valve

"Tri" to be "right"
and…
"Tricuspid" is the "right" AV valve
Or … Right AV valve
Right Atrio-Ventricular

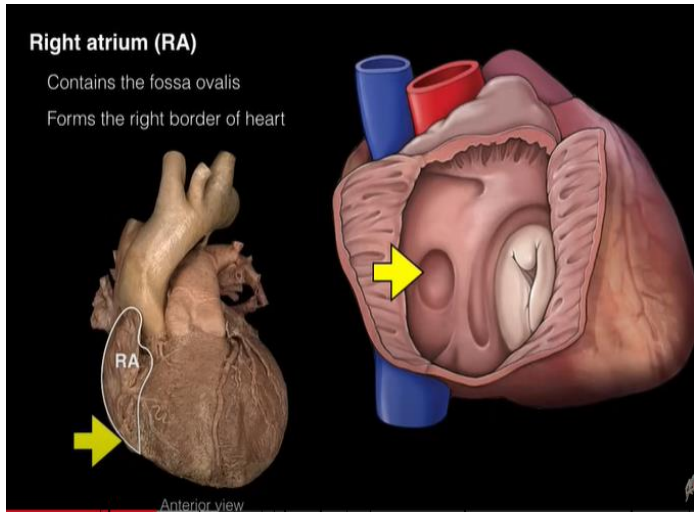
Opens to let blood flow from RA-RV
Closes during systole; prevents back flow of blood into RA



Right atrium (RA)

Contains the fossa ovalis

Forms the right border of heart



Right ventricle

Pumps deoxygenated blood into the pulmonary trunk

Forms the anterior border of the heart

Anterior view

Superior vena cava (SVC)

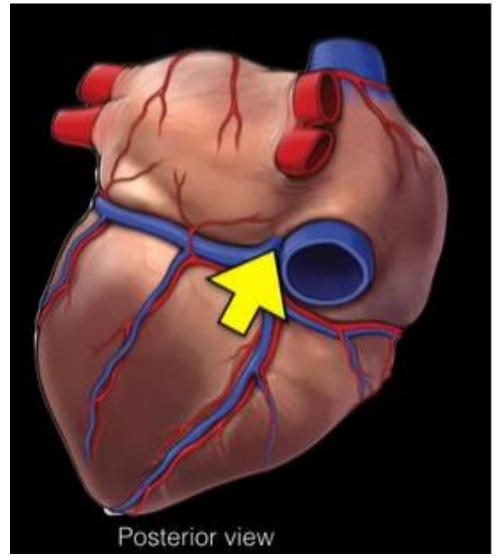
Delivers deoxygenated blood from all tissues above the diaphragm - RA

Inferior vena cava (IVC)

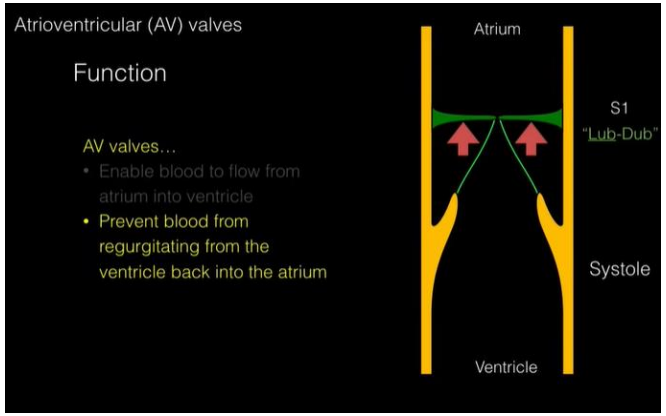
Delivers deoxygenated blood from all tissues below the diaphragm - RA

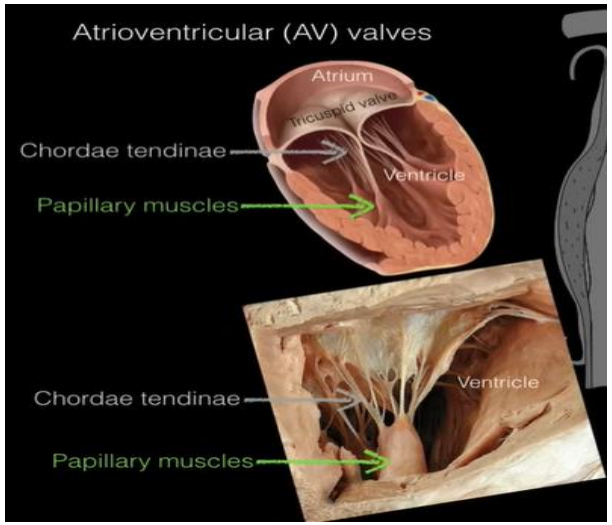
Coronary sinus

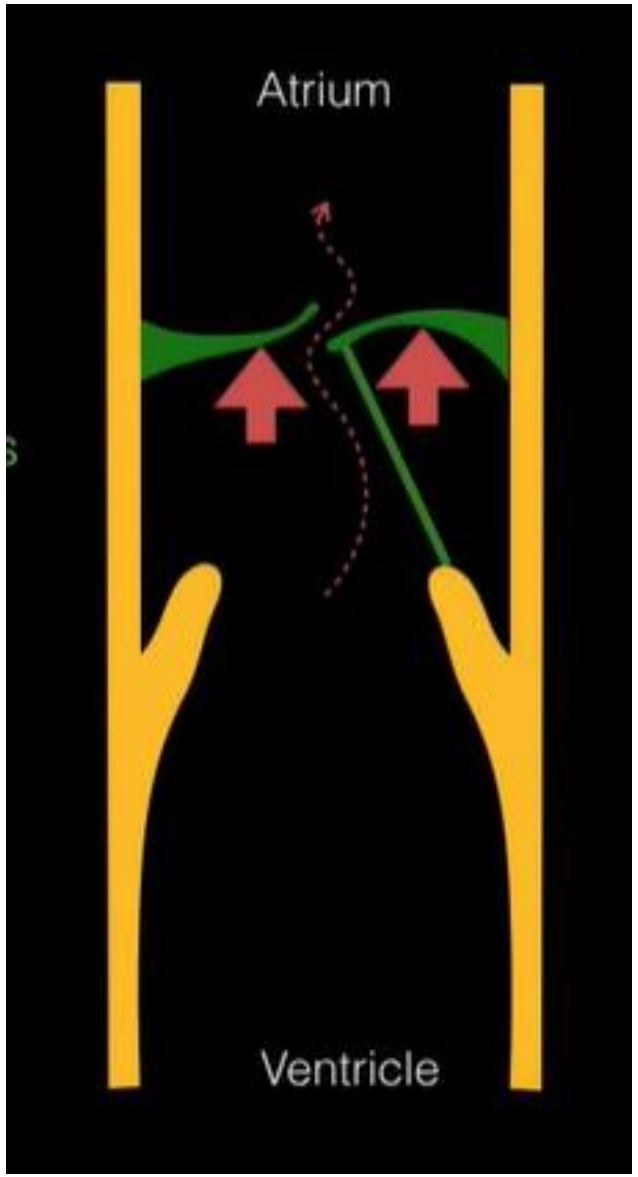
Delivers deoxygenated blood from myocardium (coronary circulation) - RA

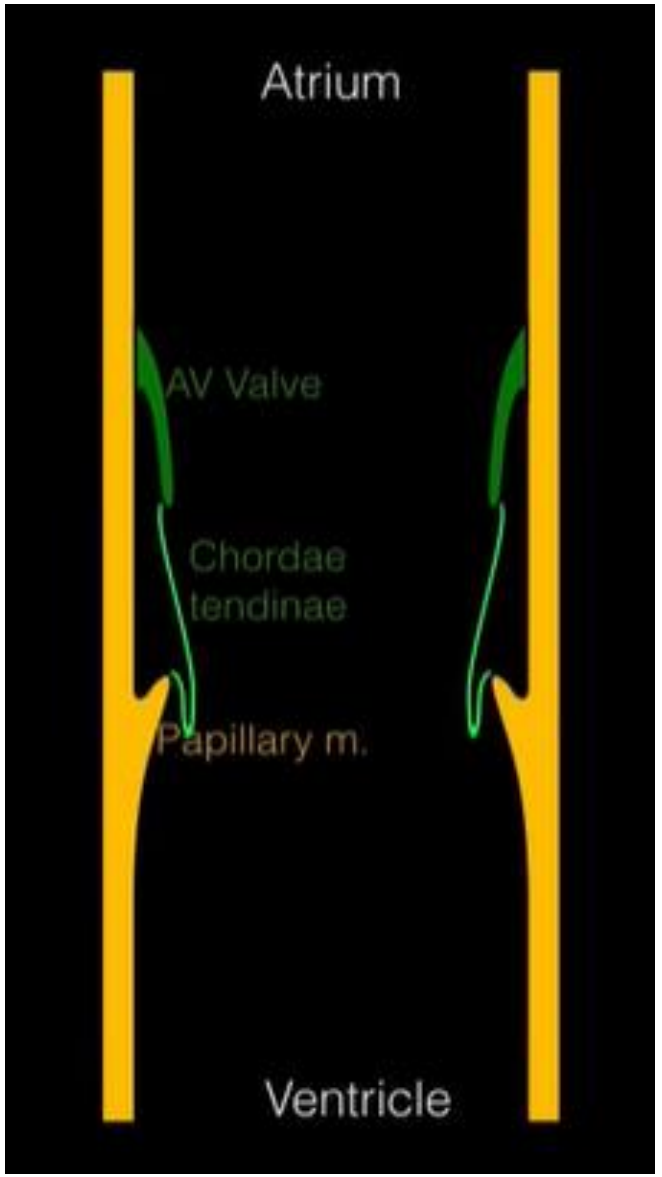


Posterior view


Atrioventricular (AV) valves
Function
AV valves…
• Enable blood to flow from atrium into ventricle
• Prevent blood from regurgitating from the ventricle back into the atrium
Atrium
S1
"Lub-Dub"
Systole
Ventricle

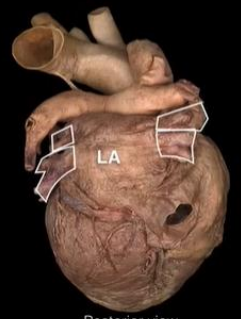

Atrioventricular (AV) valves
Atrium
Tricuspid valve
Chordae tendinae
Ventricle
Papillary muscles
Chordae tendinae
Ventricle
Papillary muscles


Atrium
Ventricle

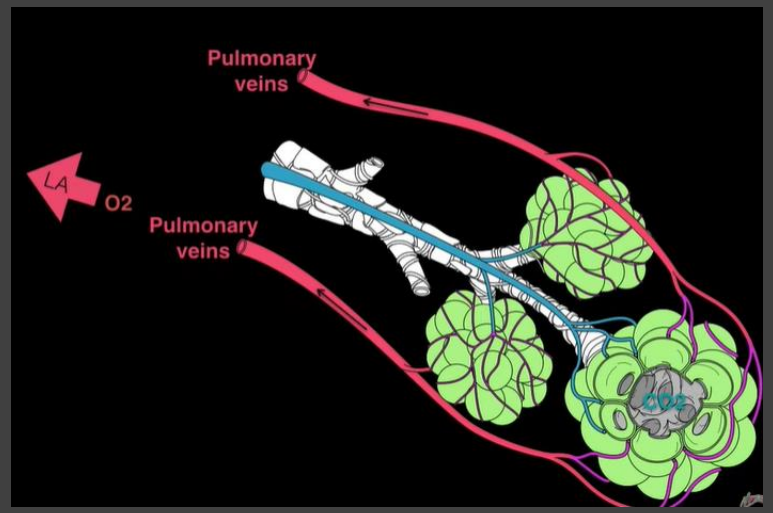

Atrium
AV Valve
Chordae tendinae
Papillary m.
Ventricle

Pulmonary veins (PV)

Transports oxygenated blood from lungs - LA
(only vein in adult that transports oxygenated blood)

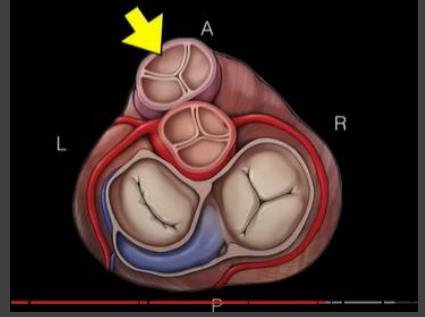


Posterior view



Pulmonary valve

- Opens to let blood flow from RV-PA
- Closes during diastole; prevents back flow of blood into RV



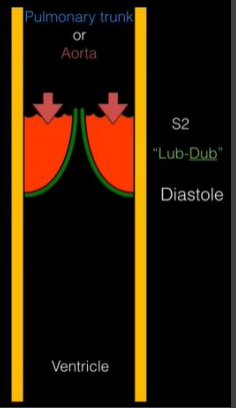
Heart - Valves

Semilunar valves

Function

Semilunar valves…

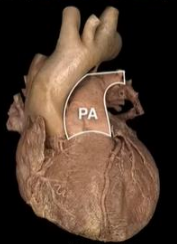
- Enable blood to flow out of the ventricles
- Prevent blood from regurgitating back into the ventricles



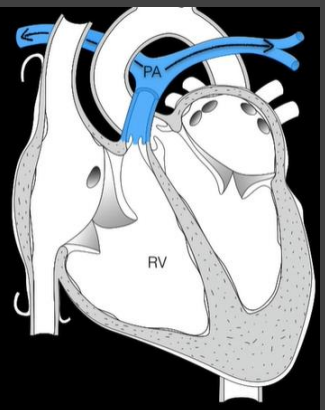
Pulmonary arteries (PA)

Transports deoxygenated blood from RV - lungs
(only artery in adult that transports deoxygenated blood)

Pulmonary Arteries → Away



Anterior view



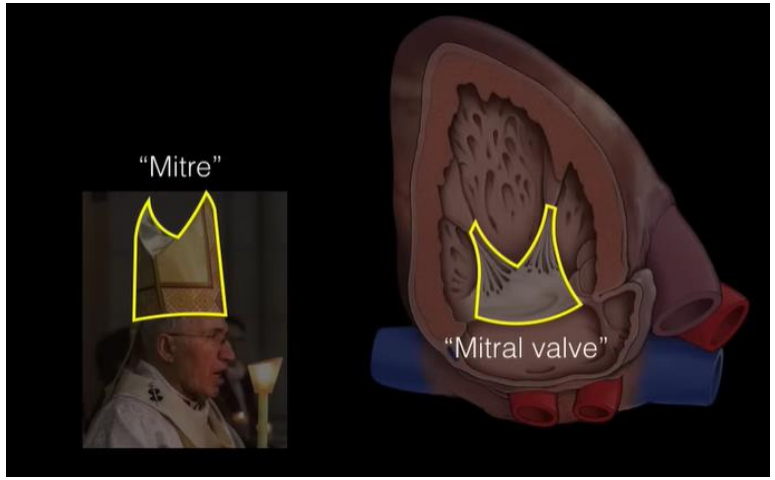
Bicuspid valve

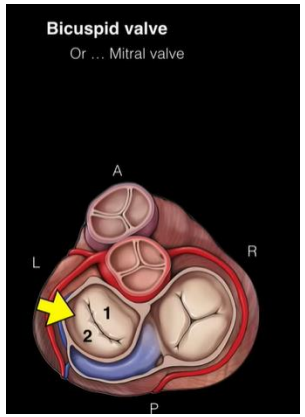
Or … Mitral valve

Or … Left AV valve

Mitral valve is left side

- Opens to let blood flow from LA-LV

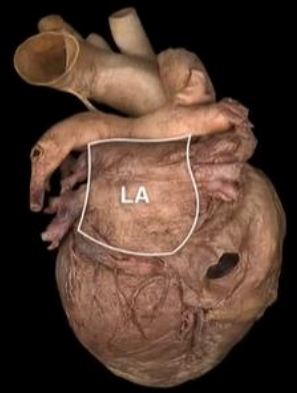




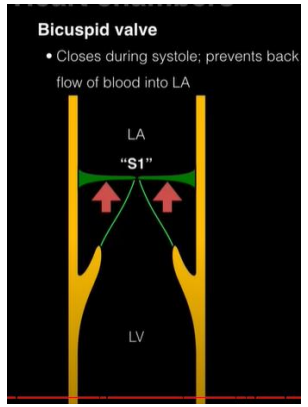
Left atrium (LA)

Receives oxygenated blood from lungs

Forms posterior border of the heart

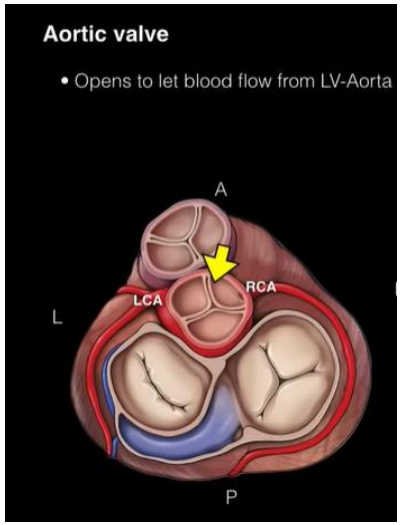


Posterior view



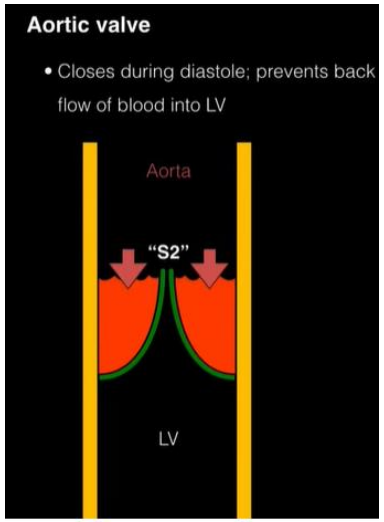
Aortic valve

- Opens to let blood flow from LV-Aorta



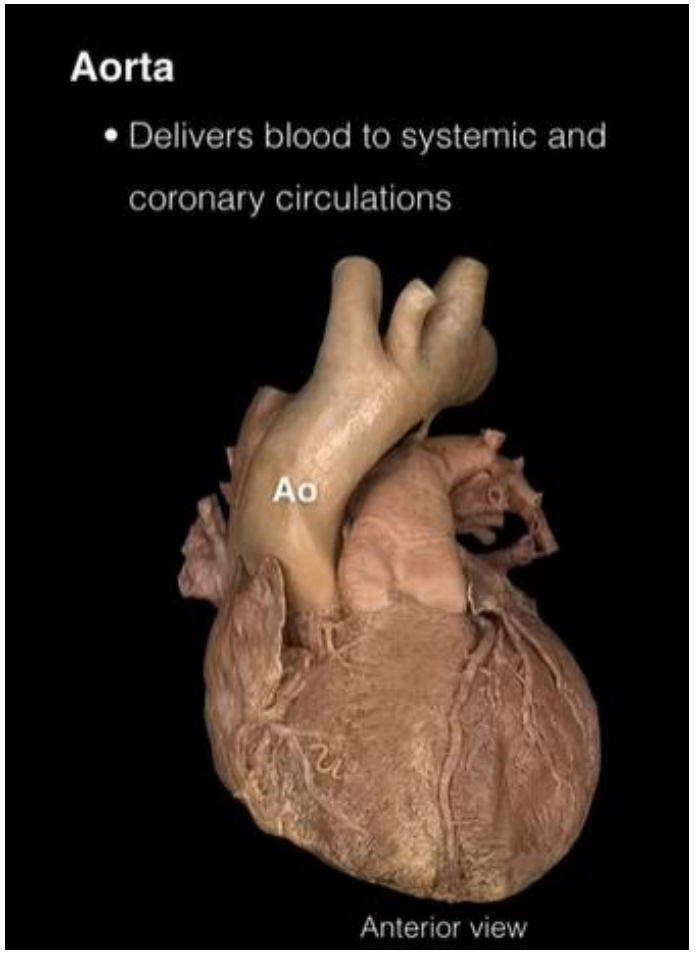
Aortic valve

- Closes during diastole; prevents back flow of blood into LV



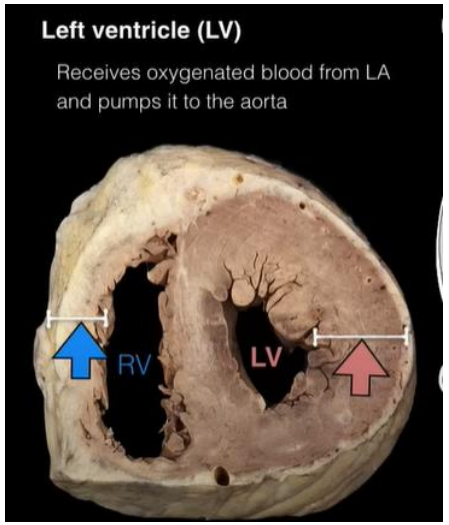
Aorta

- Delivers blood to systemic and coronary circulations



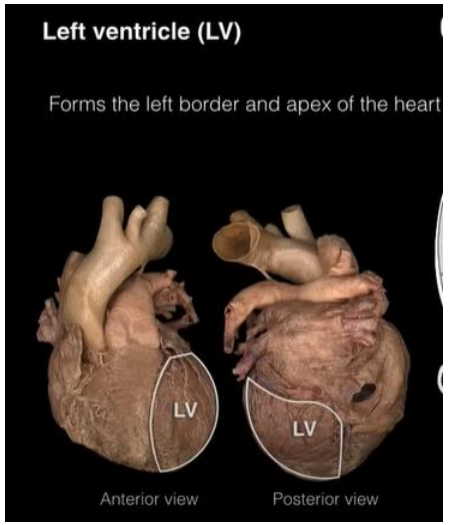
Left ventricle (LV)

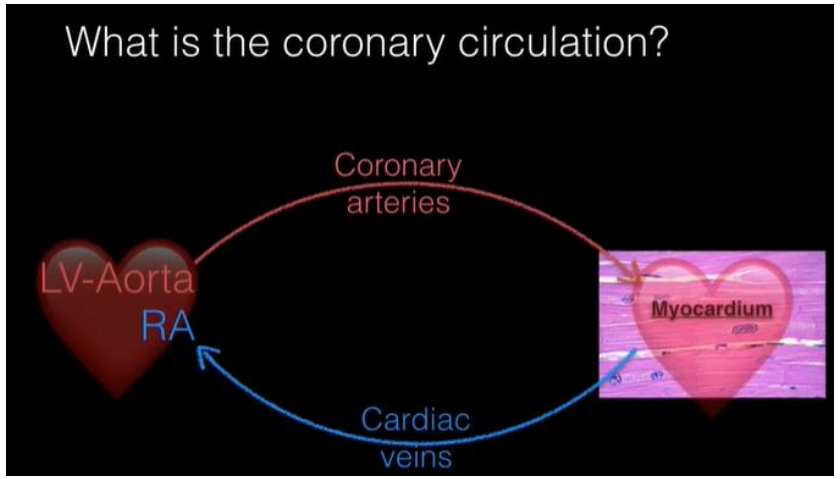
Receives oxygenated blood from LA and pumps it to the aorta

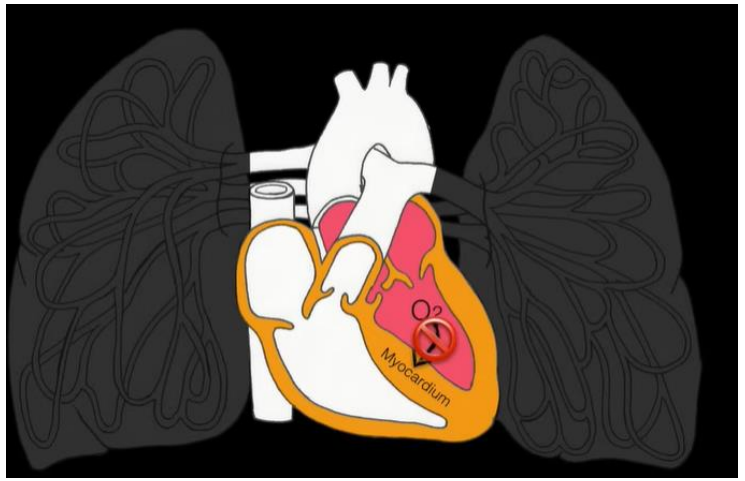


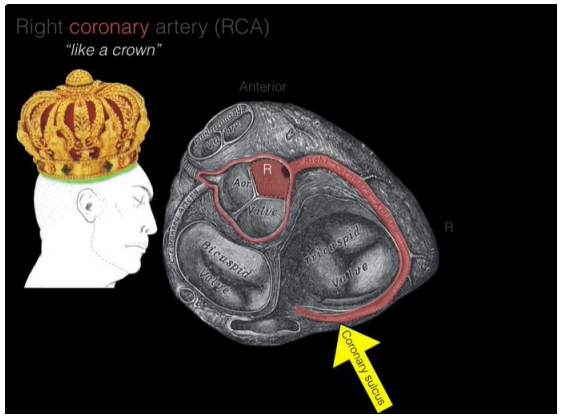
Left ventricle (LV)

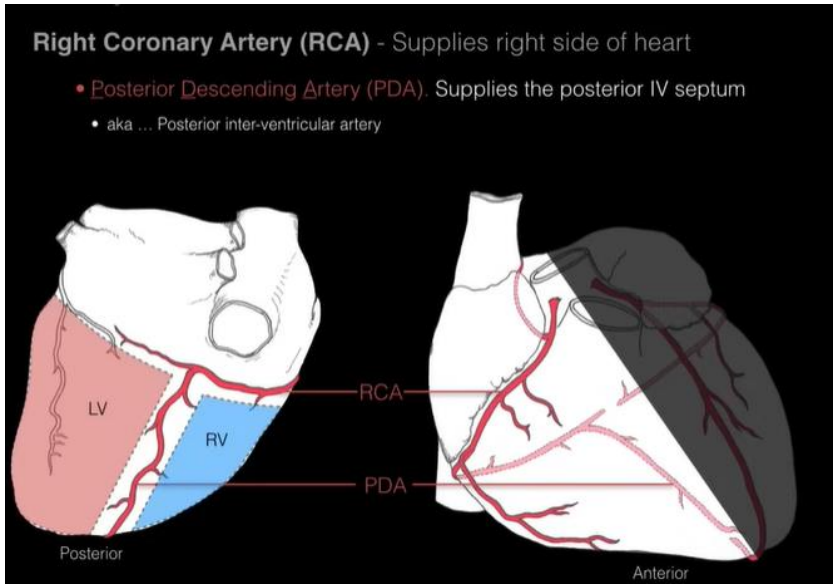
Forms the left border and apex of the heart

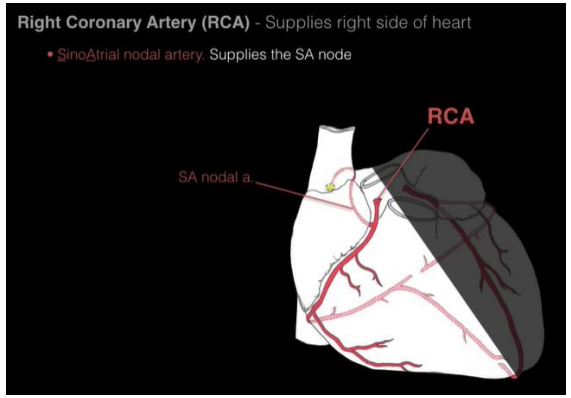



What is the coronary circulation?
Coronary arteries
LV-Aorta
RA
Myocardium
Cardiac veins


O2
Myocardium

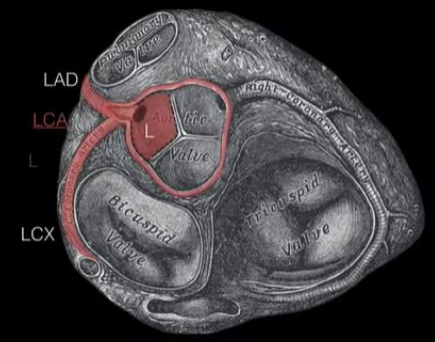

Right coronary artery (RCA)
"like a crown"
Anterior
R
Coronary sinus


Right Coronary Artery (RCA) - Supplies right side of heart
• Posterior Descending Artery (PDA). Supplies the posterior IV septum
• aka … Posterior inter-ventricular artery
LV
RV
RCA
PDA
Posterior
Anterior


Right Coronary Artery (RCA) - Supplies right side of heart
• SinoAtrial nodal artery. Supplies the SA node
RCA
SA nodal a.

Left Coronary Artery (LCA) - Supplies left side of heart

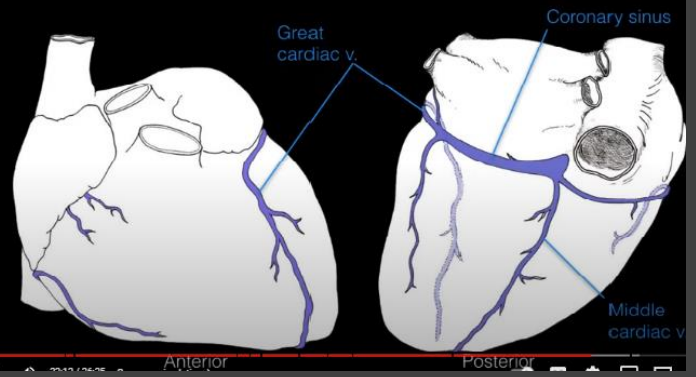
Anterior



Superior view of heart; atria removed

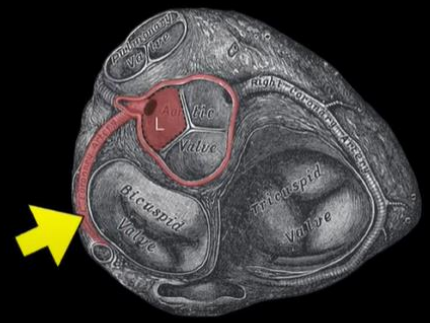
Coronary sinus - Drains all of the heart

- Great cardiac vein. Drains same territory as LAD
- Middle and small cardiac veins. Drains same territory as RCA



Left Coronary Artery (LCA) - Supplies left side of heart

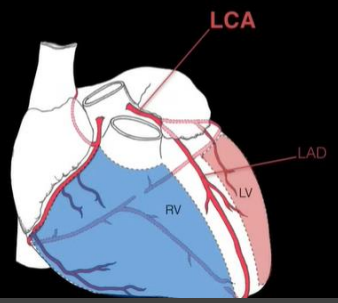
- **Left Circumflex artery (LCX).** Supplies the left lateral wall



Superior view of heart; atria removed

Left Coronary Artery (LCA) - Supplies left side of heart

- **Left Anterior Descending artery (LAD).** Supplies the anterior IV septum and Apex
  - aka … Anterior inter-ventricular artery



Coronary sinus - Drains all of the heart

- Great cardiac vein. Drains same territory as LAD
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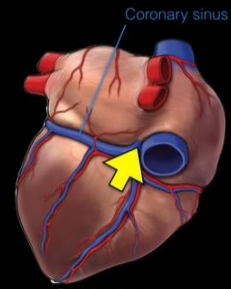
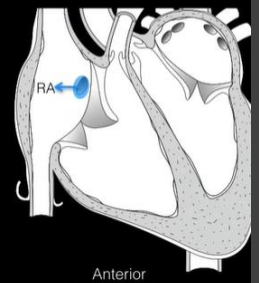


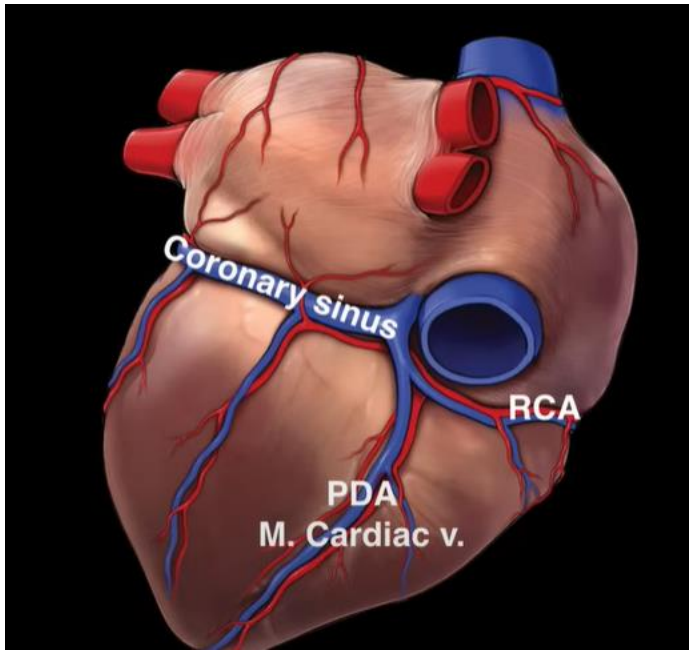
Posterior view

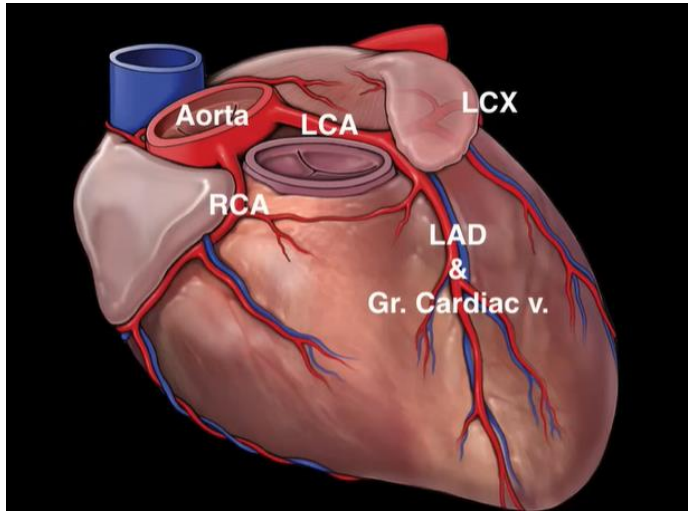


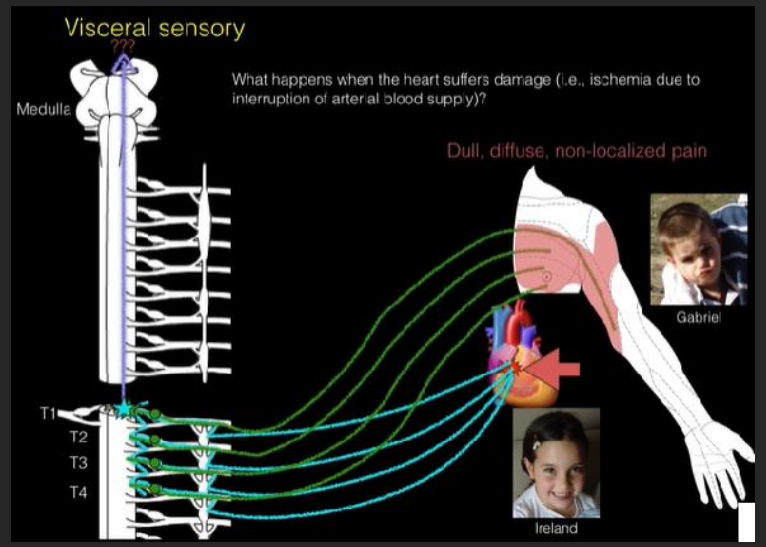
Anterior
(coronal section)

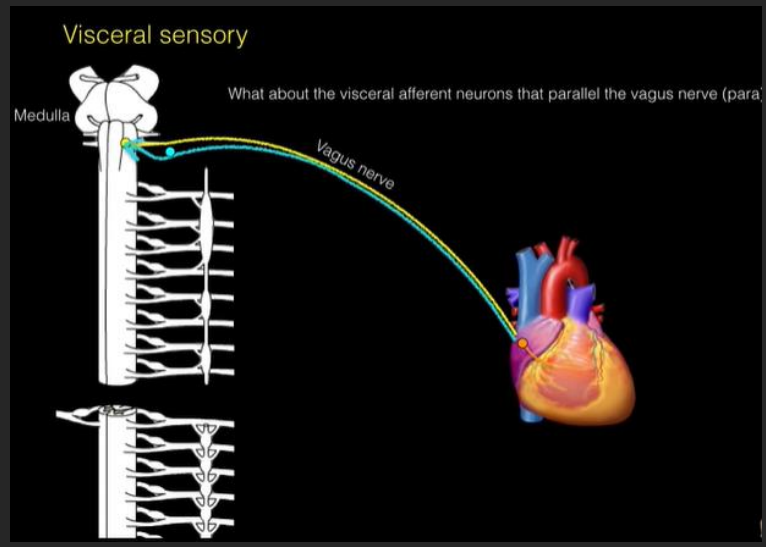
Pulmonary circulation
(heart-lungs-heart)

Systemic circulation
(heart-systemic tissues-heart









Take home message:

- Medulla
- Vagus
- Intramural ganglion
- Decrease heart rate and contraction

Take home message:

- T1-T4 (T5)
- Sympathetic chain
- Cervical and Thoracic sympathetic nerves
- Increase heart rate and contraction

Myocardium clinical disorders

Angina pectoris

Myocardial infarction (heart attack)