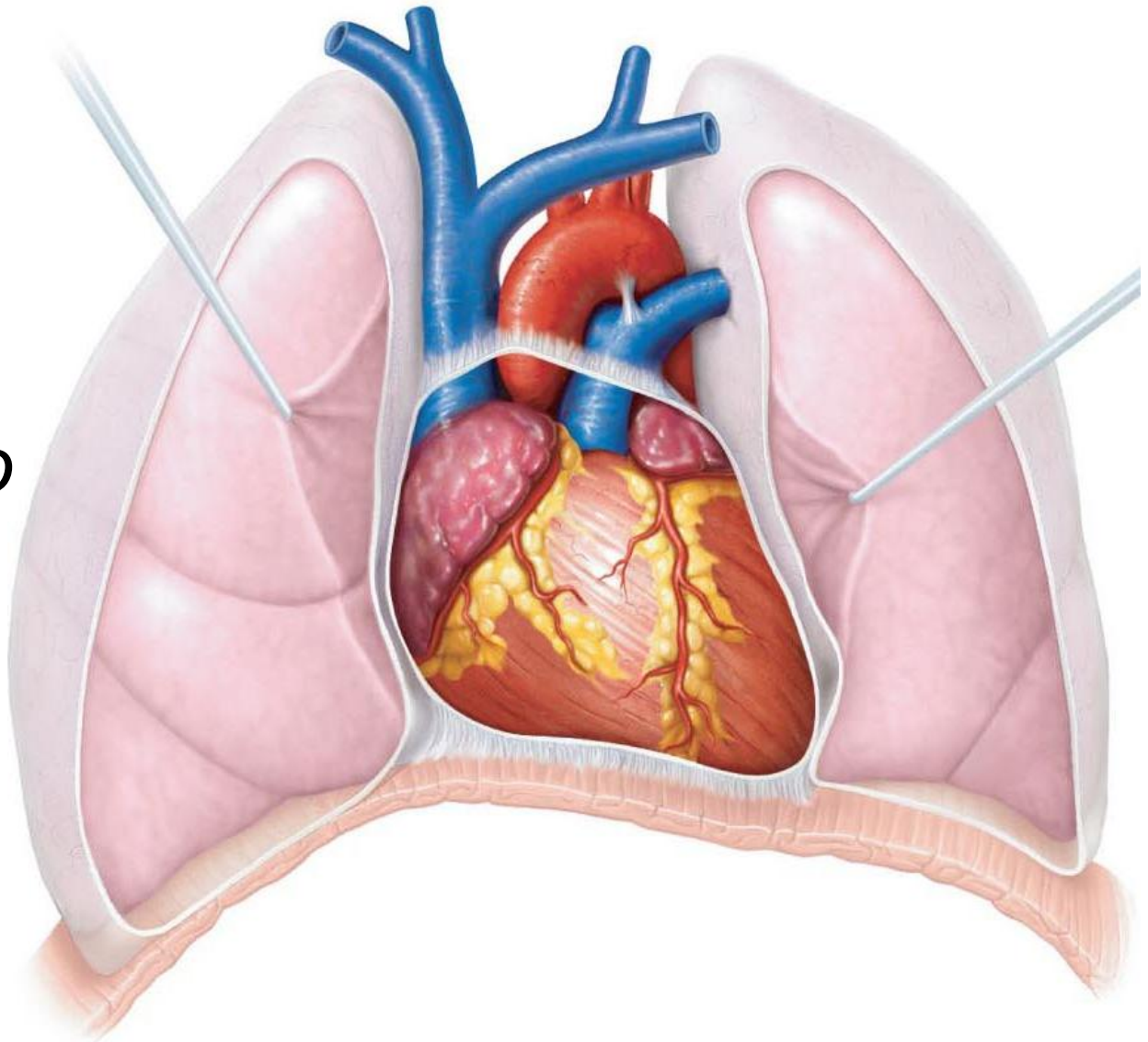
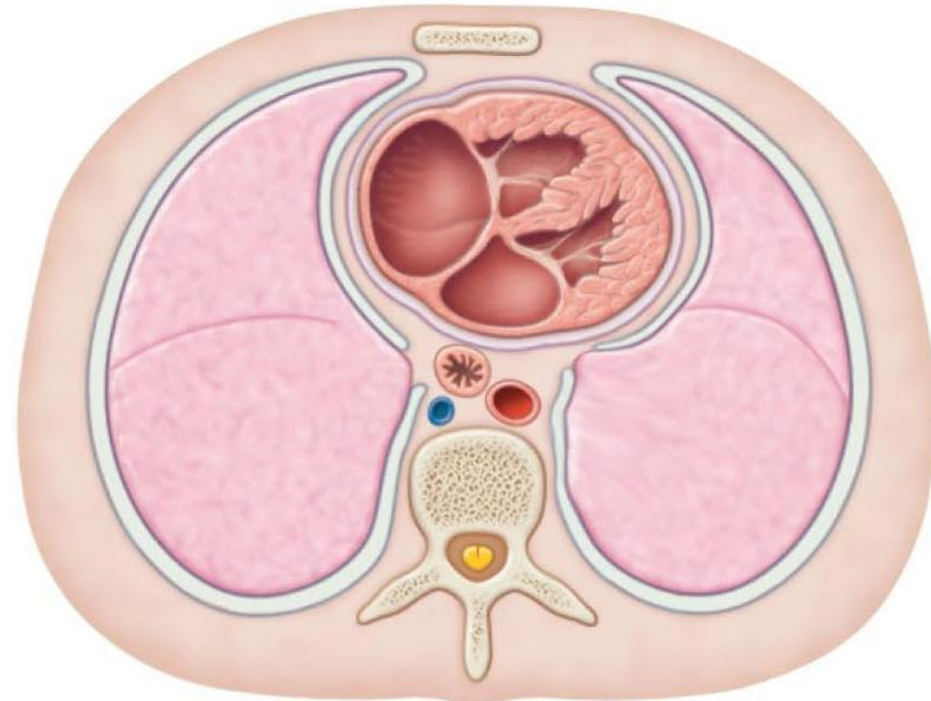
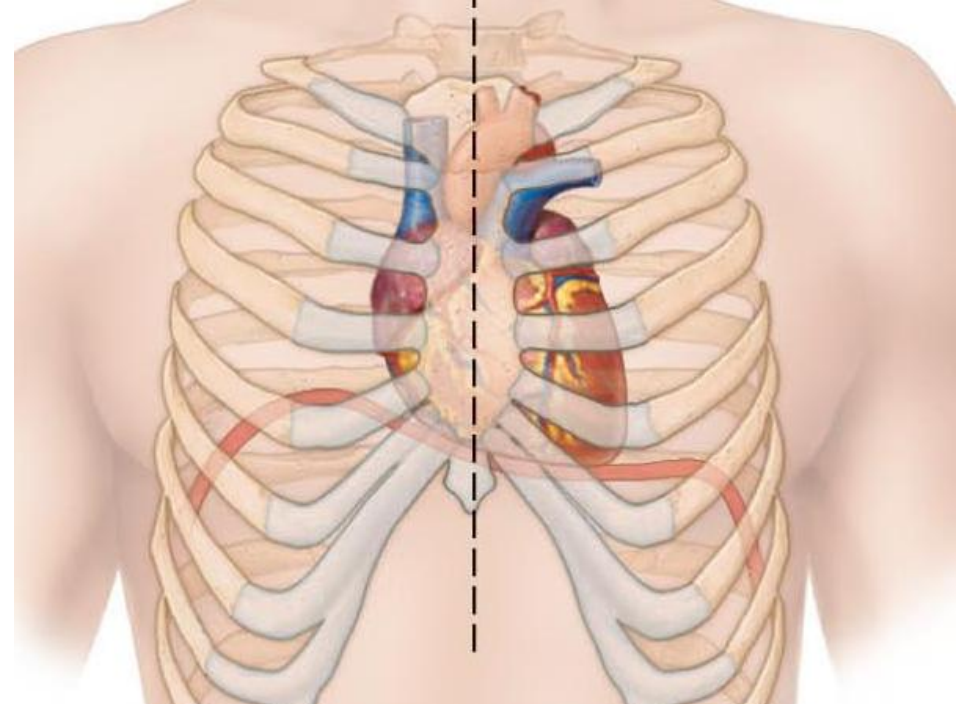


The Heart

- *What does it generate?*
- *Why is that so important?*

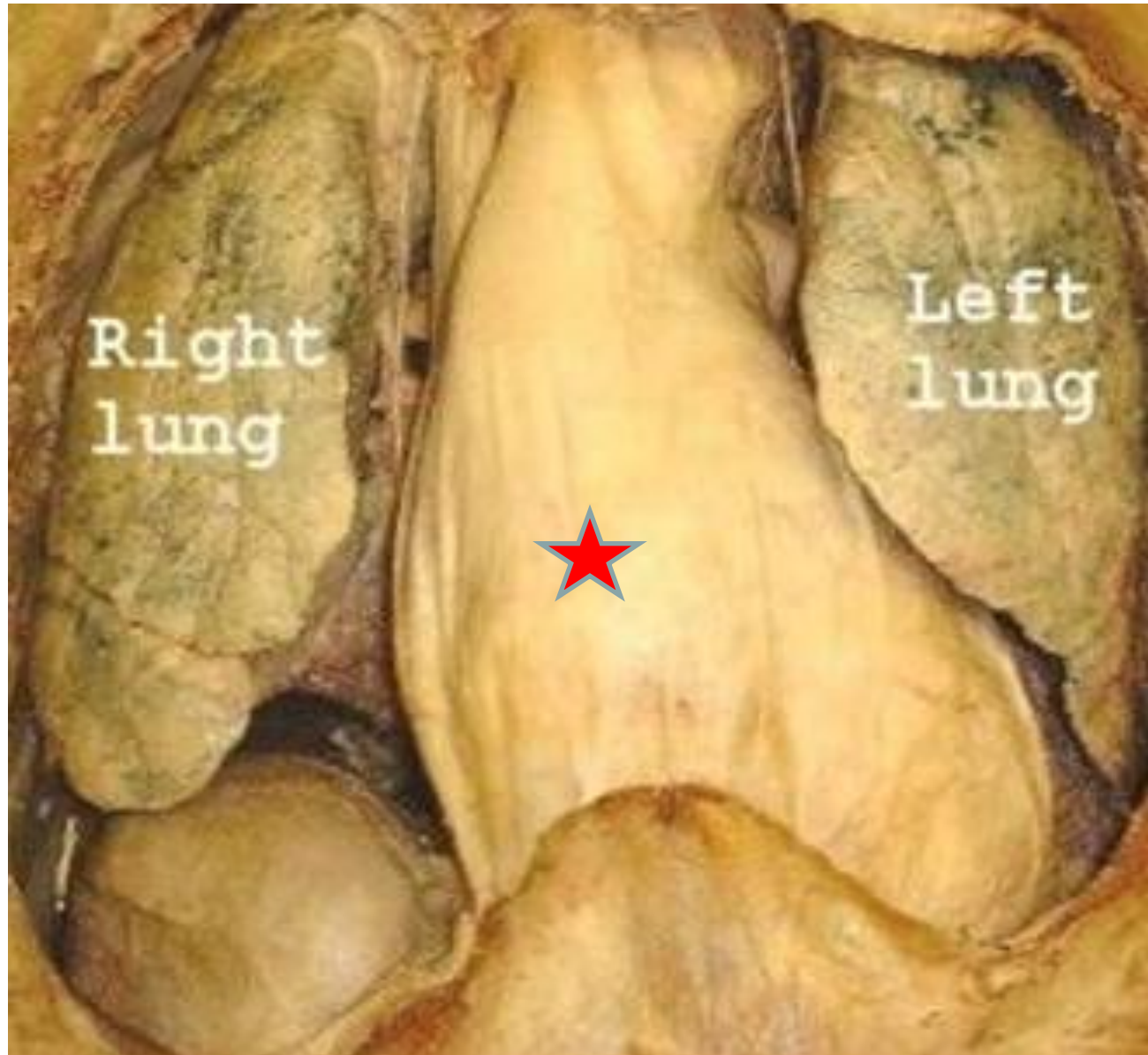


- Found in the...
- Apex points at...
- Base points at...
- Sits atop the...
- Medial to...
- Anterior to the...
- Posterior to the...



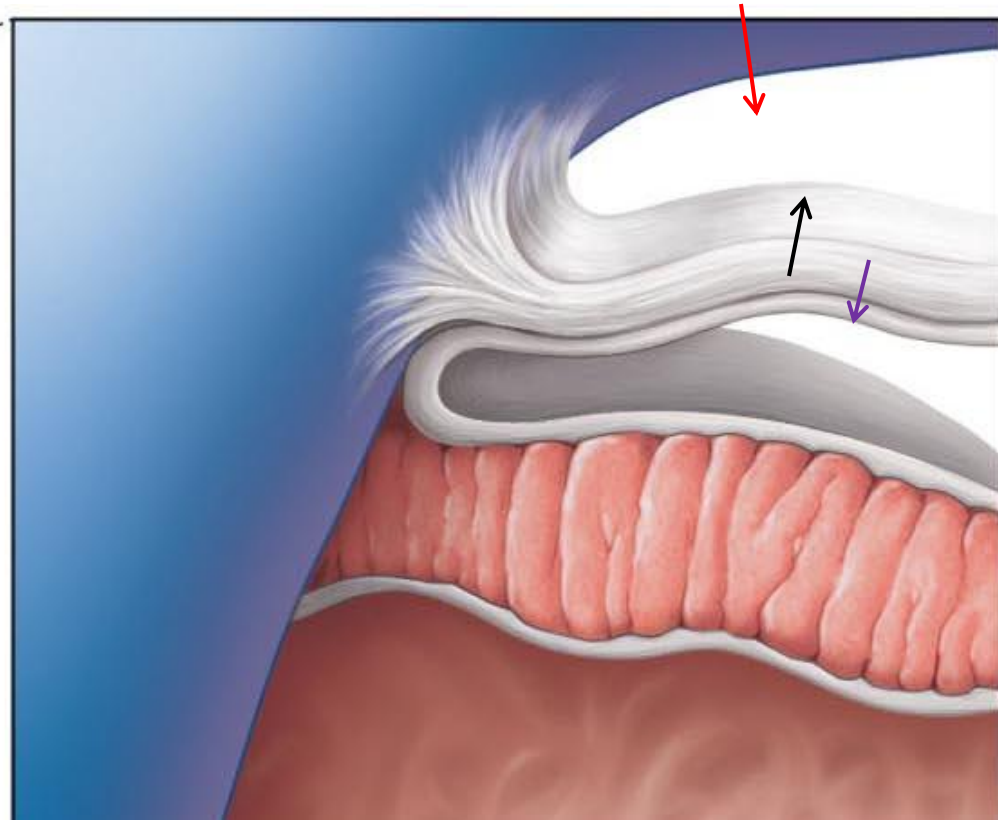
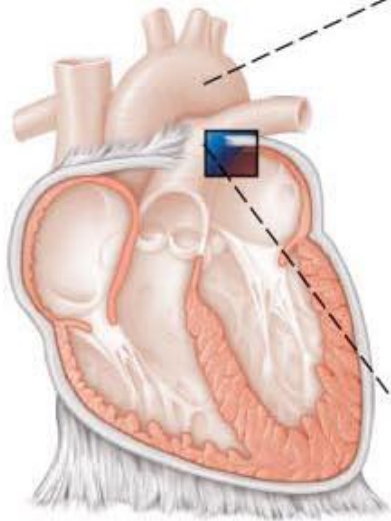
Fibrous Pericardium

- *Made of...*
- Encloses.
- Stabilizes.
- Prevents...



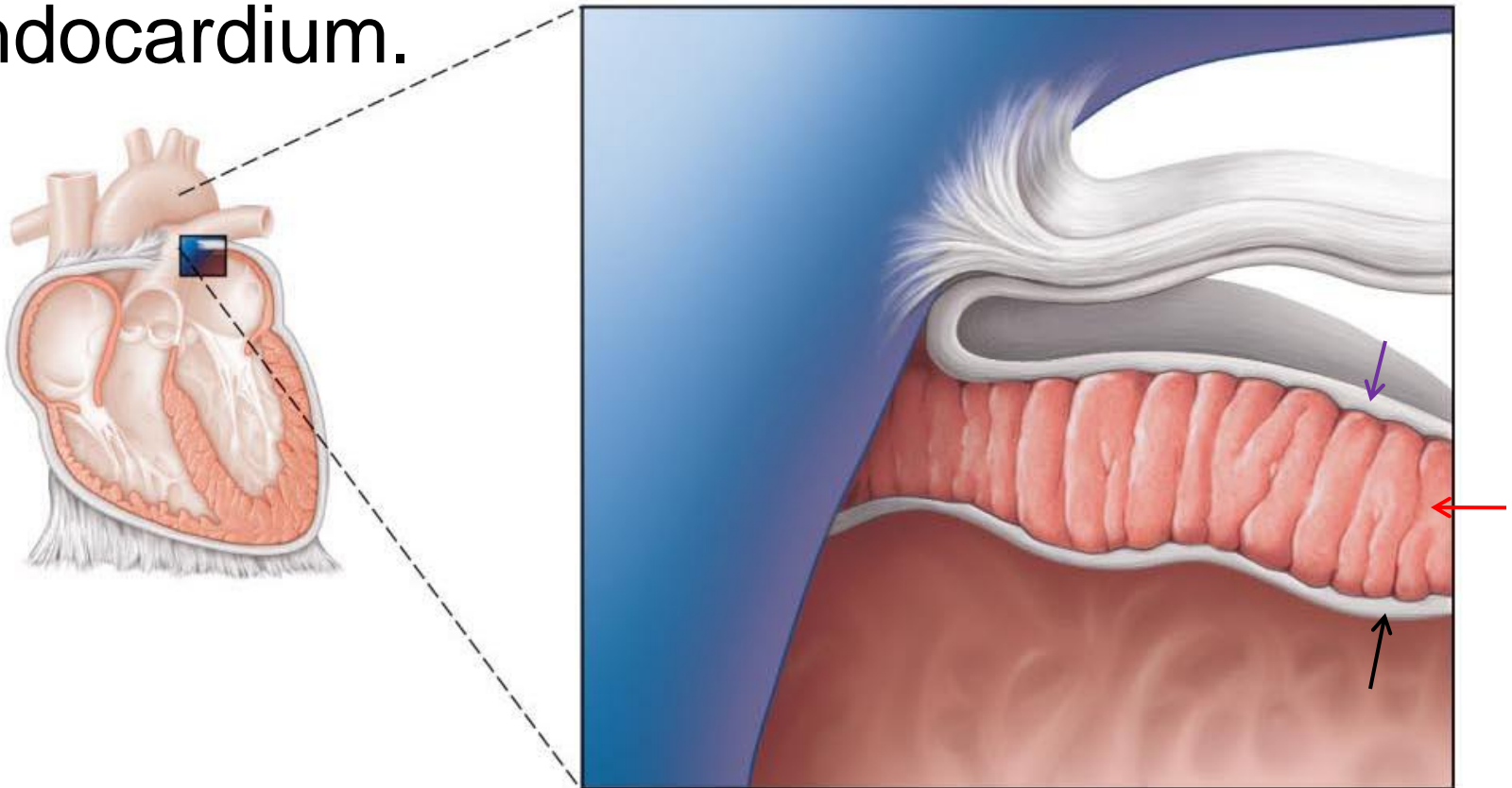
Parietal & Visceral Serous Pericardium

- Position
- Function
- Pericardial cavity



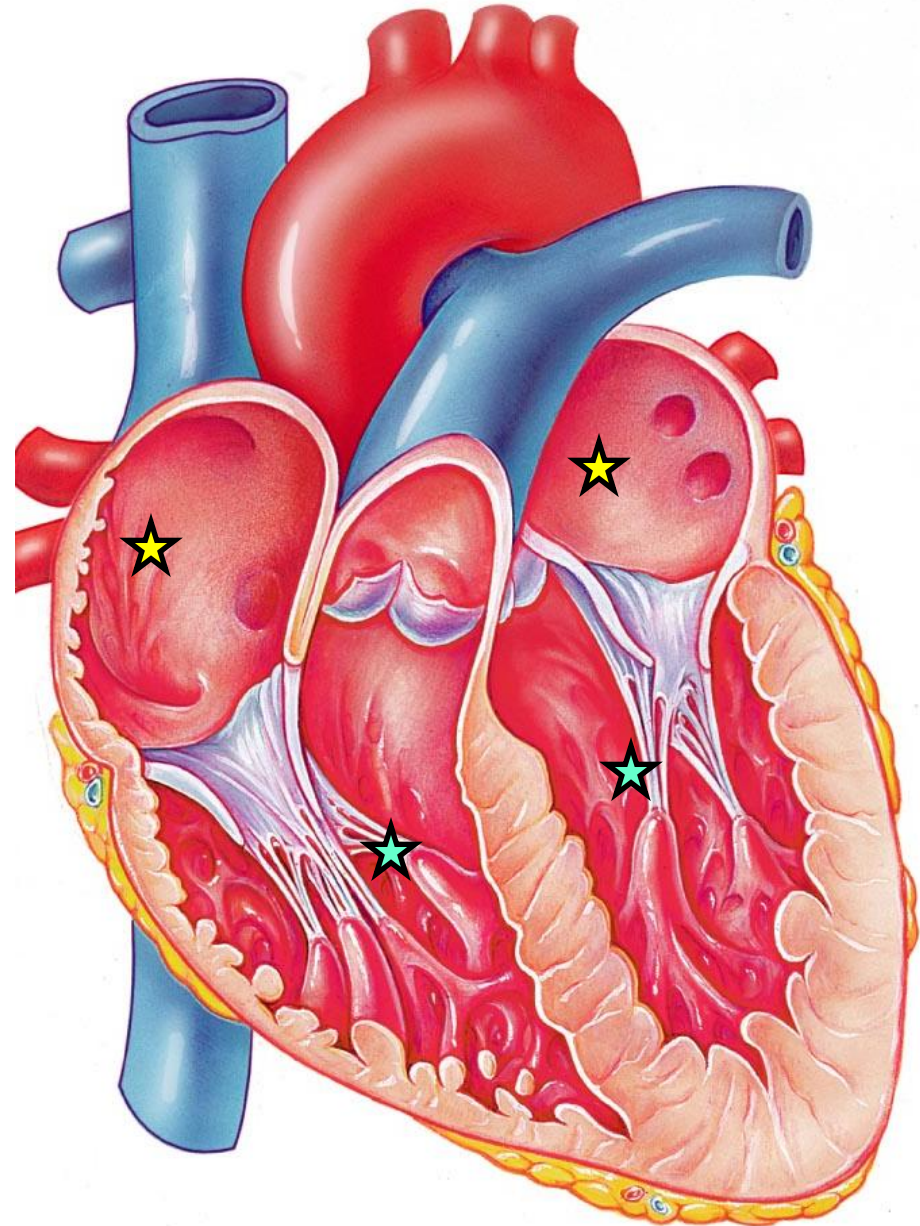
3 Layers of the Heart Wall

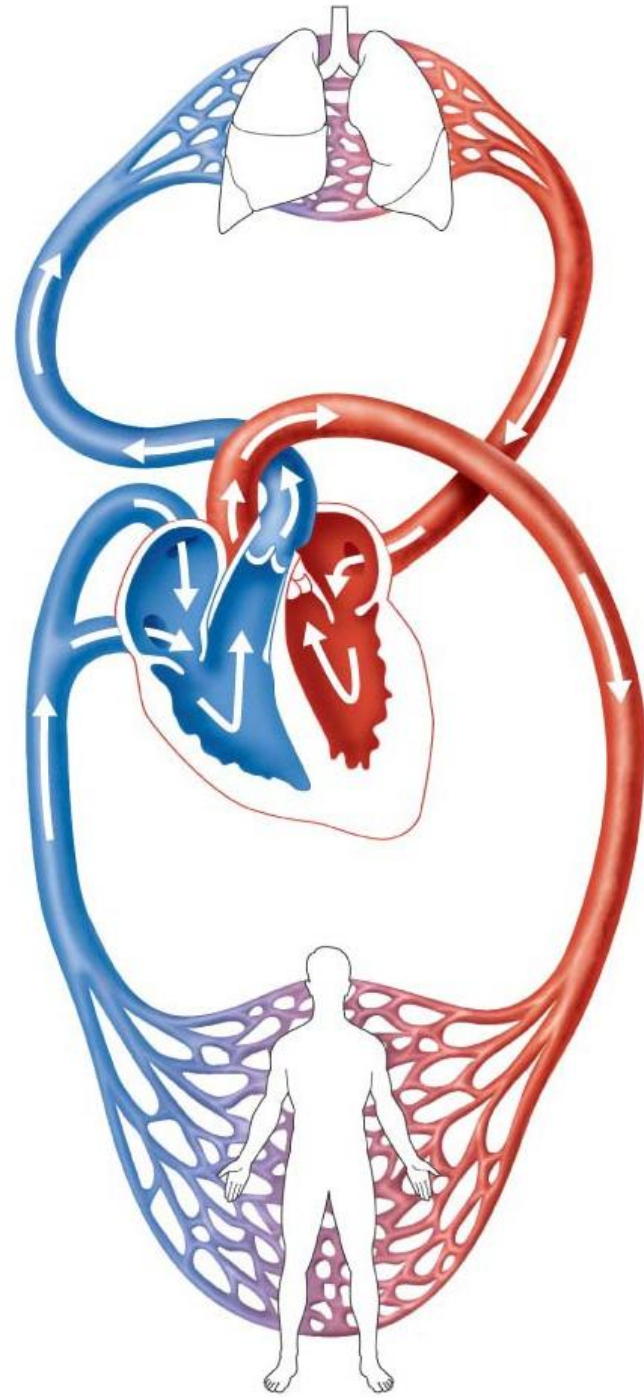
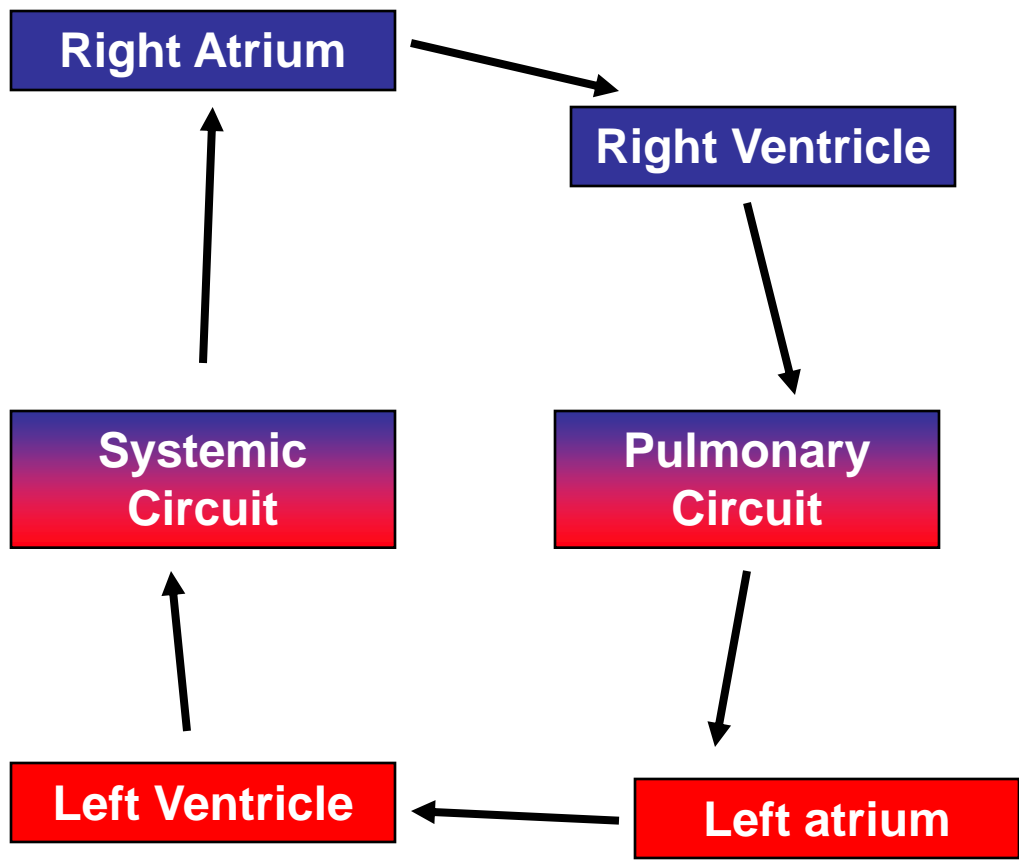
- Epicardium
- Myocardium
- Endocardium.



Heart Chambers

- 4 chambers.
- 2 superior atria.
- 2 inferior ventricles.





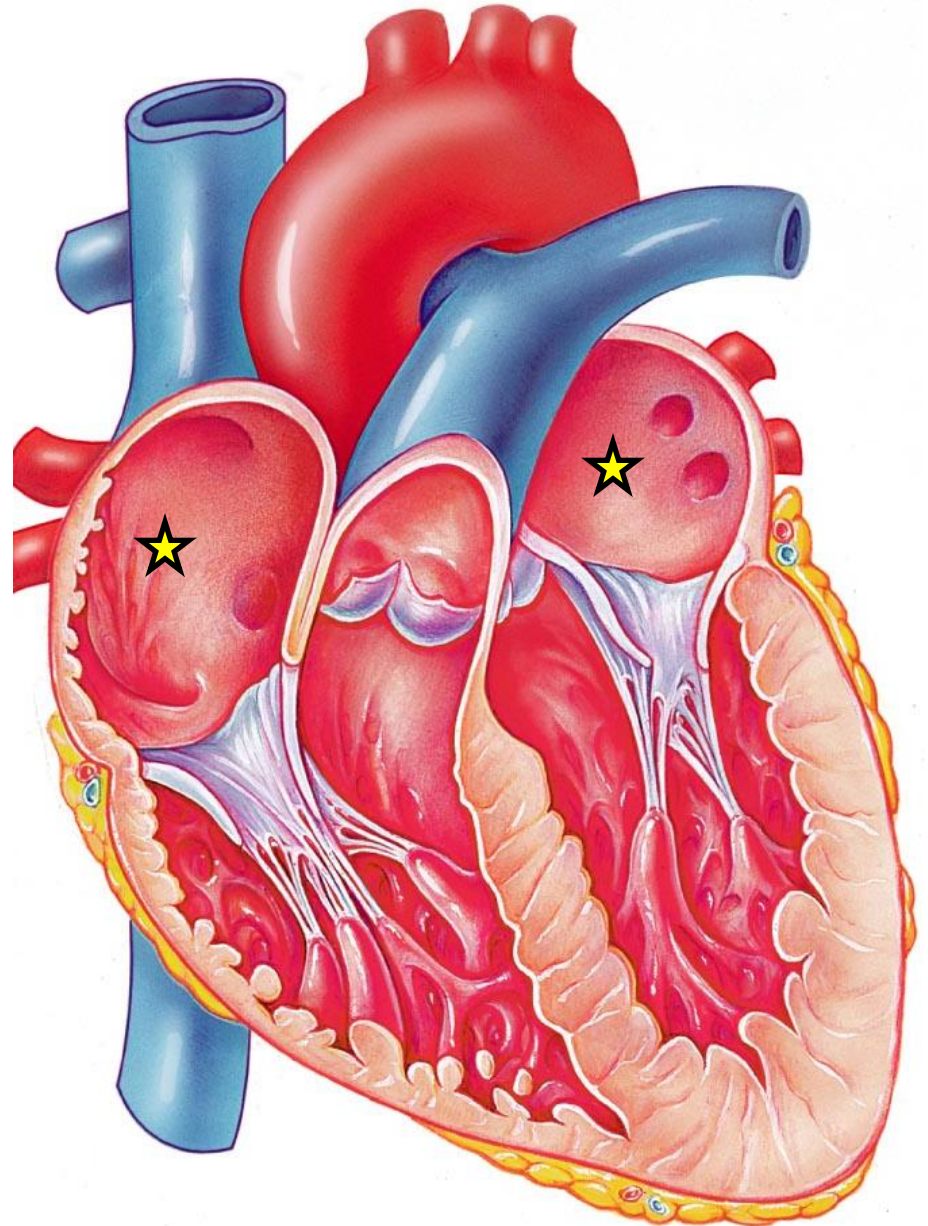
- Superior.

Atria

- Receive...

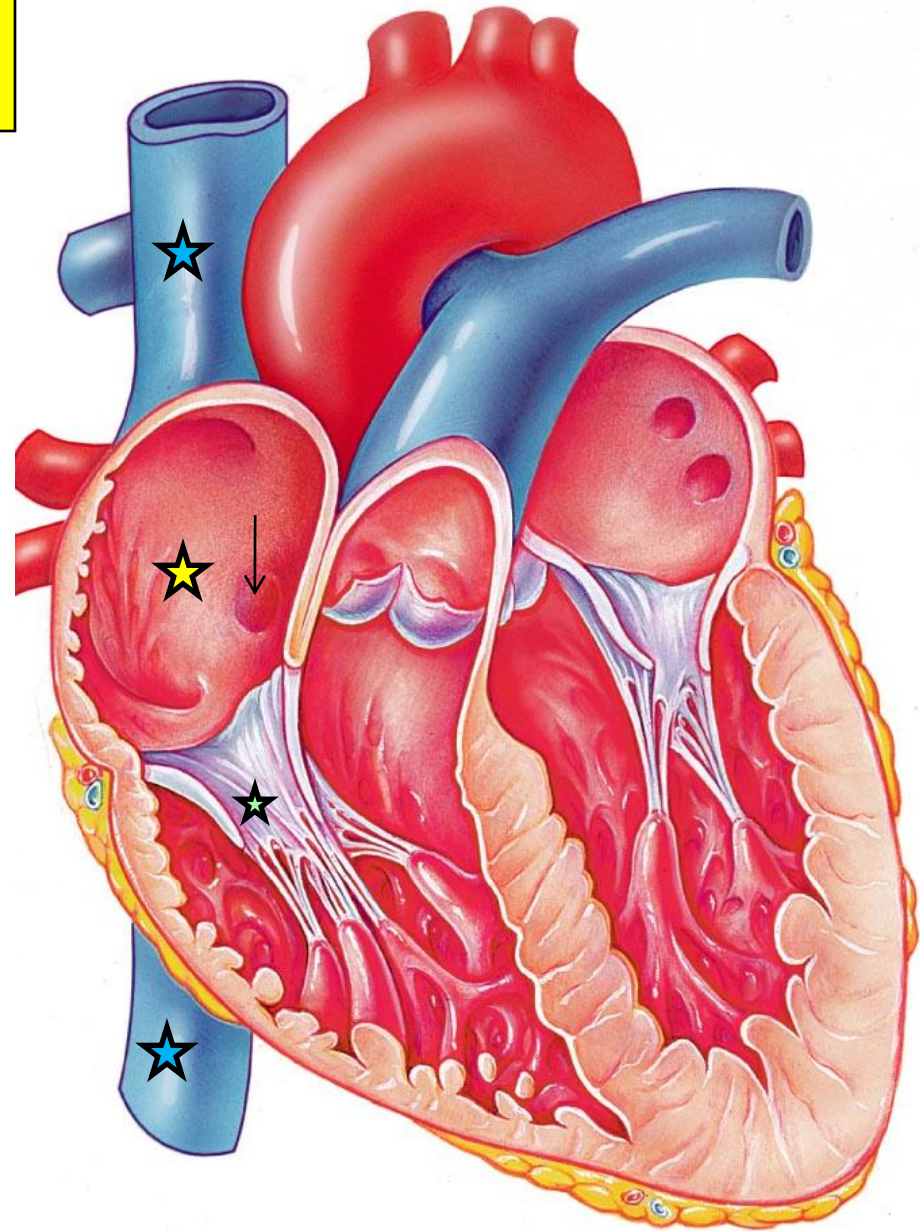
- Separated by...

- Small.



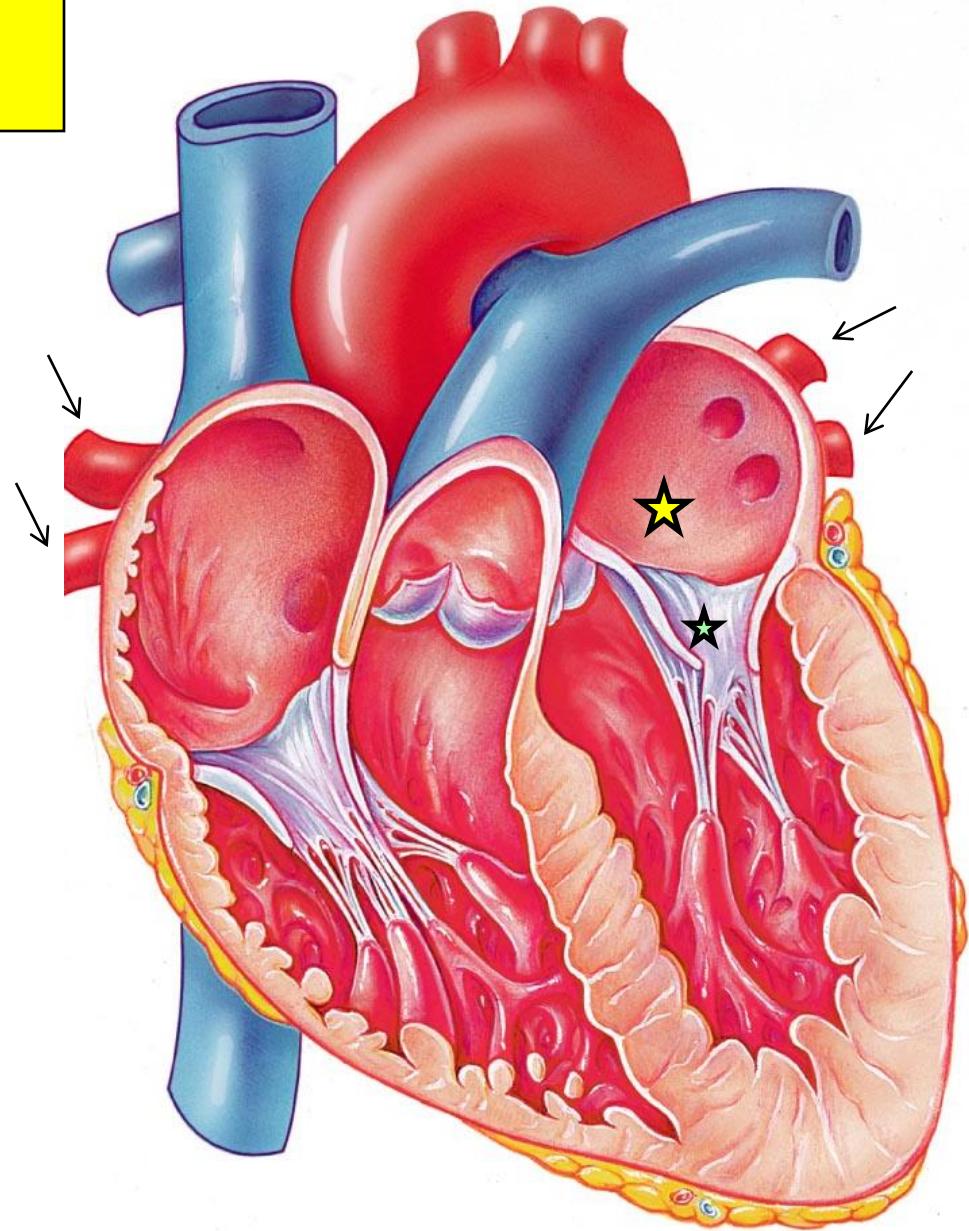
Right Atrium

- *Receives what kind of blood?*
- *From which circuit?*
- Receives 3 main vessels
 - SVC
 - IVC
 - CS
- Sends blood thru the tricuspid orifice (past the tricuspid valve) to the...



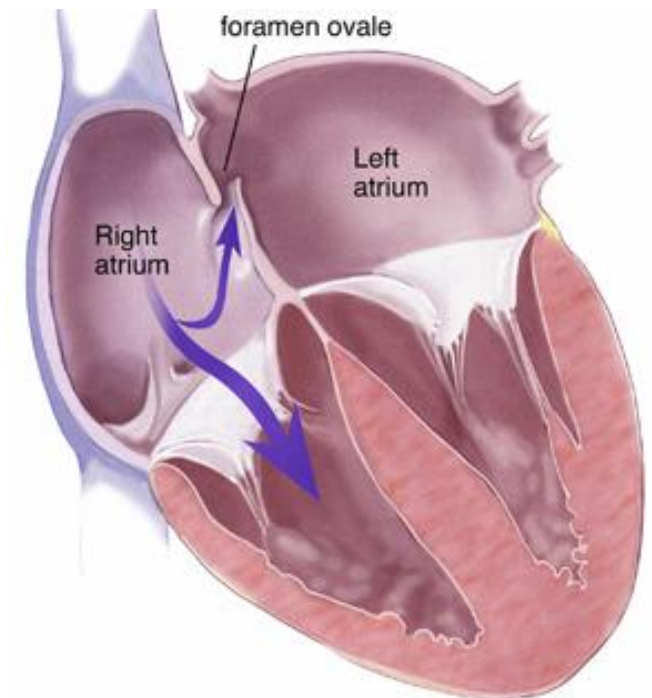
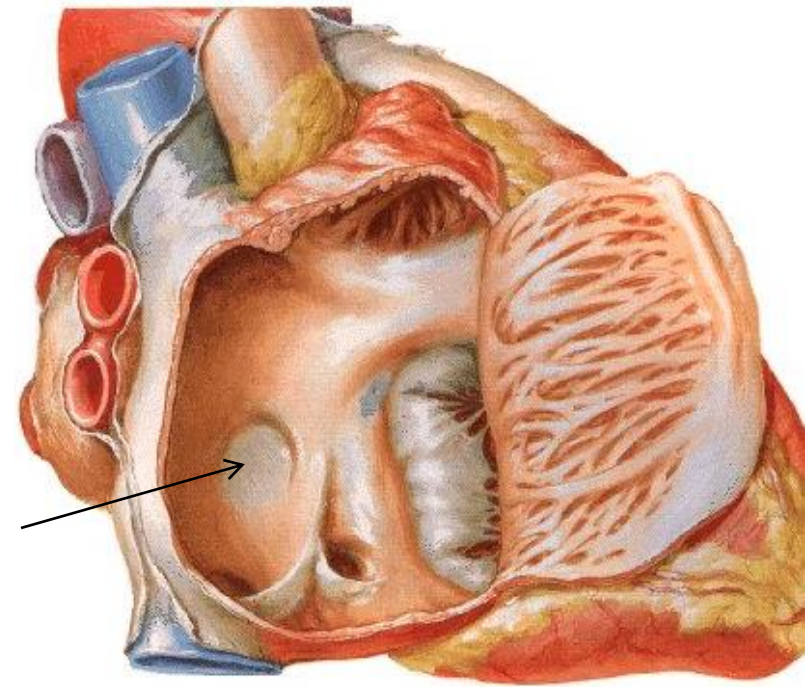
Left Atrium

- *Receives what kind of blood?*
- *From which circuit?*
- Receives 4 vessels
 - Pulmonary veins
- Sends blood thru the mitral orifice (past the mitral valve) to the...



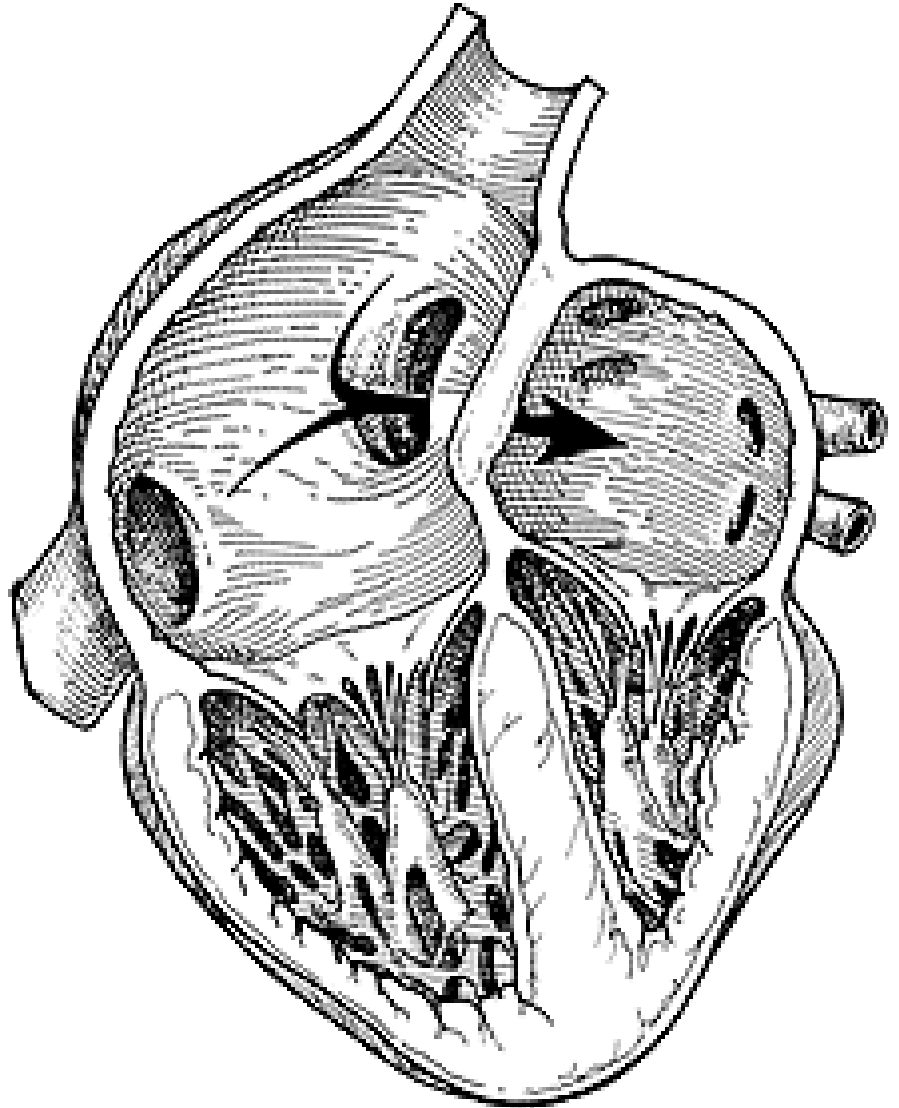
Interatrial Septum

- *Function?*
- Adult vs. Fetus
- Fossa ovalis.
- Foramen ovale.



Why do the fetal atria connect?

- *What gets skipped?*
- *Where does fetal gas exchange occur?*
- *Which direction does blood flow?*
- Right atrium BP _____ Left Atrium BP



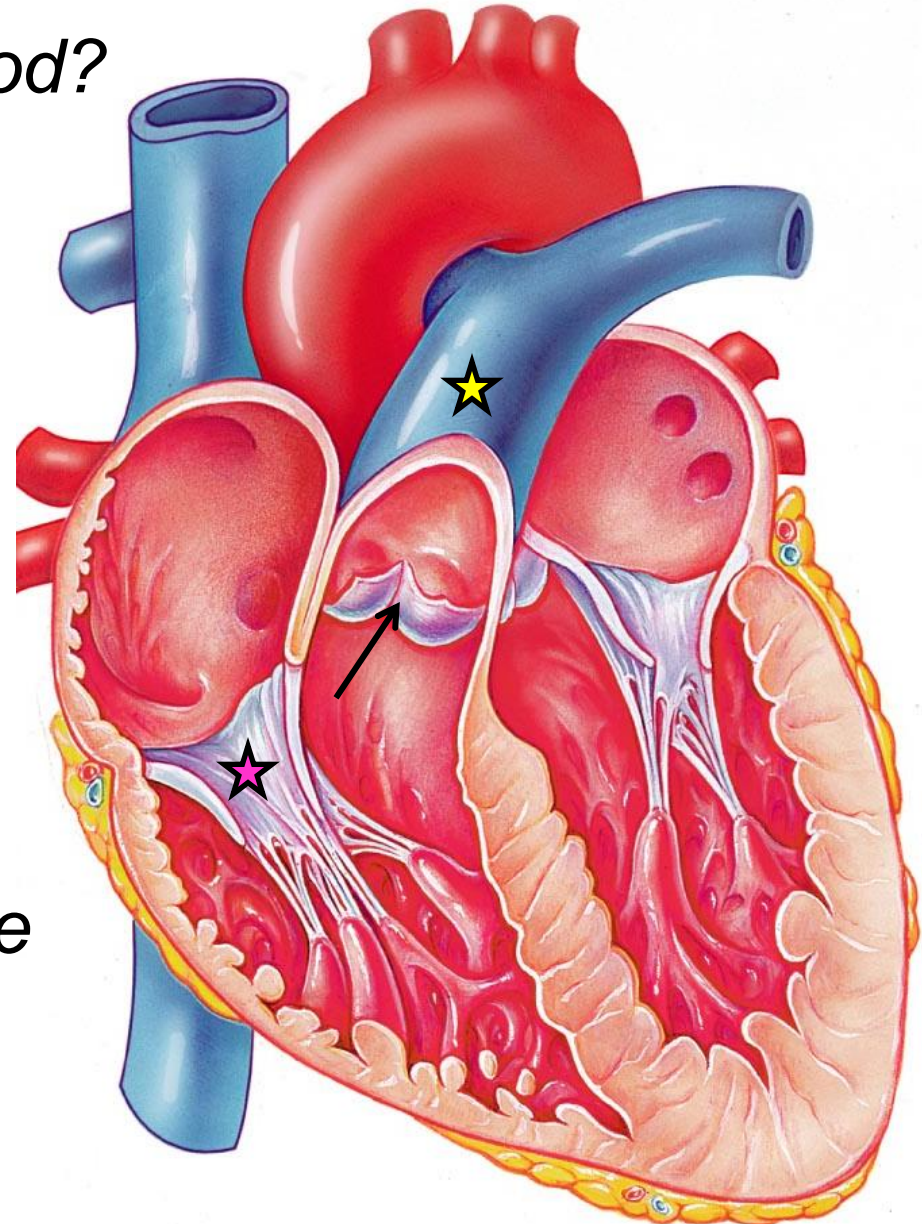
Ventricles

- Inferior chambers.
- Pumps.
- Separated by...
- Muscular.
- Trabeculae carneae



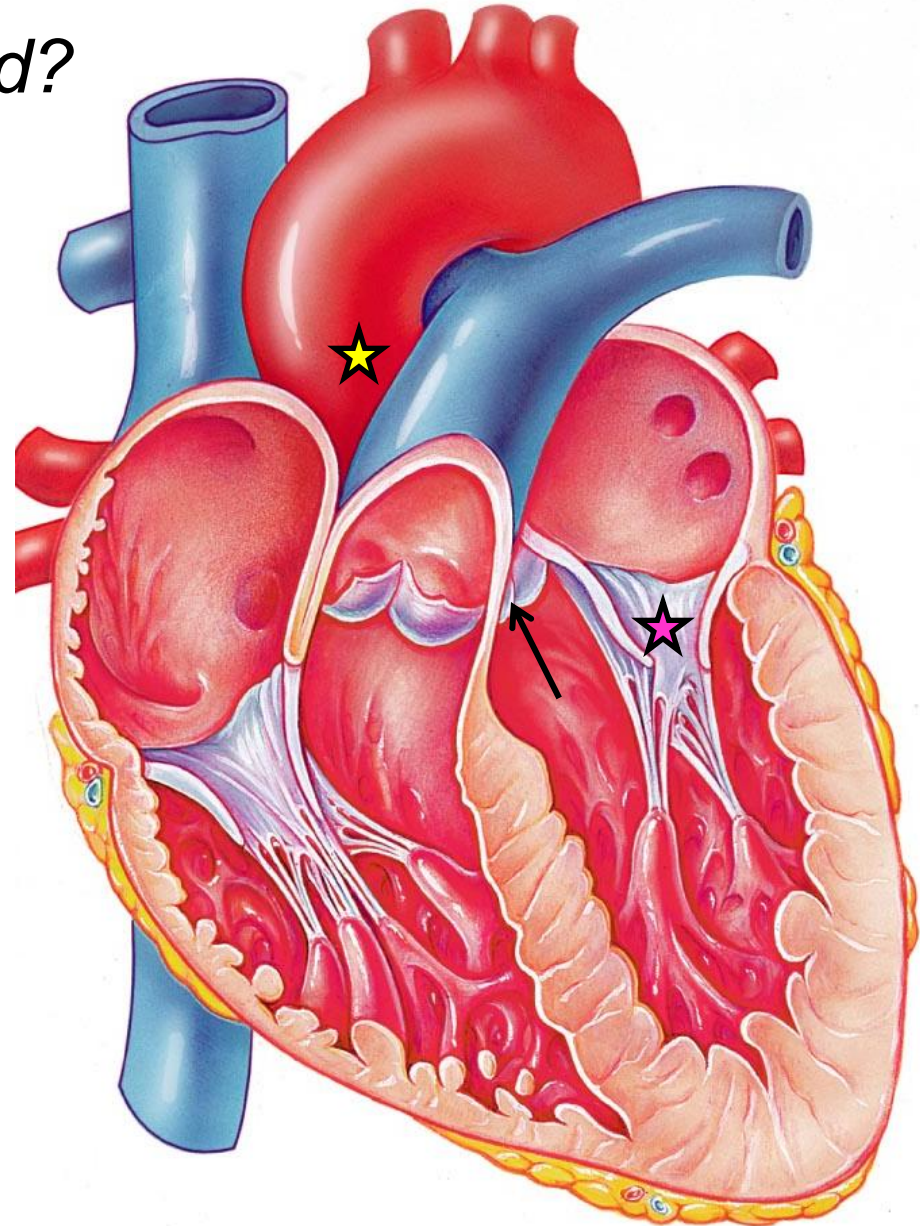
Right Ventricle

- *Receives what kind of blood?*
- *From where?*
- *Pumps to what circuit?*
- *Into what vessel?*
- *Pulmonary semilunar valve*
- *Tricuspid valve*



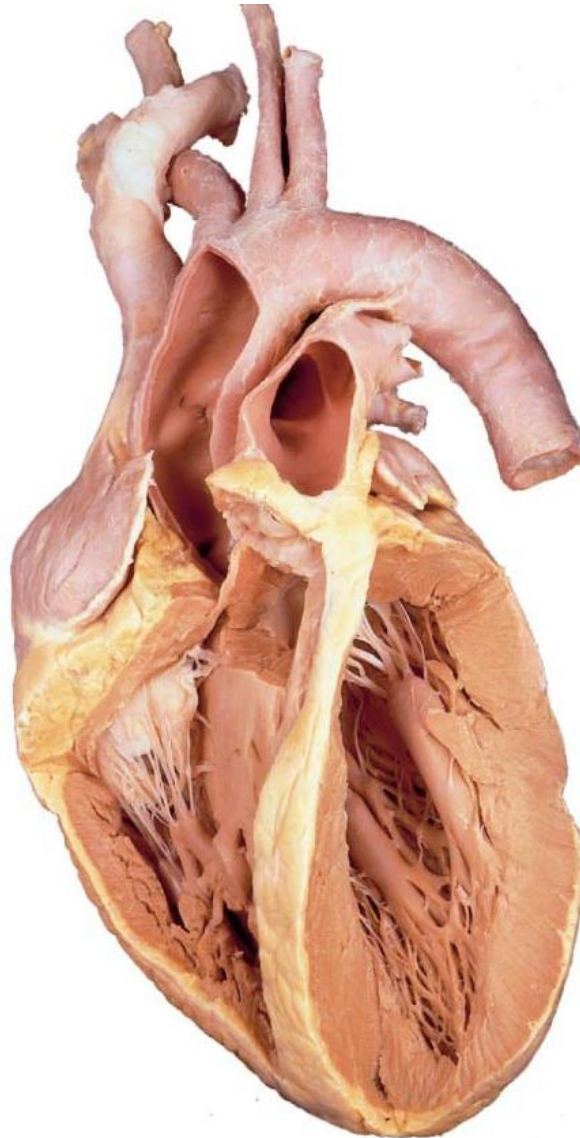
Left Ventricle

- *Receives what kind of blood?*
- *From where?*
- *Pumps to what circuit?*
- *Into what vessel?*
- *Aortic semilunar valve*
- *Mitral valve*

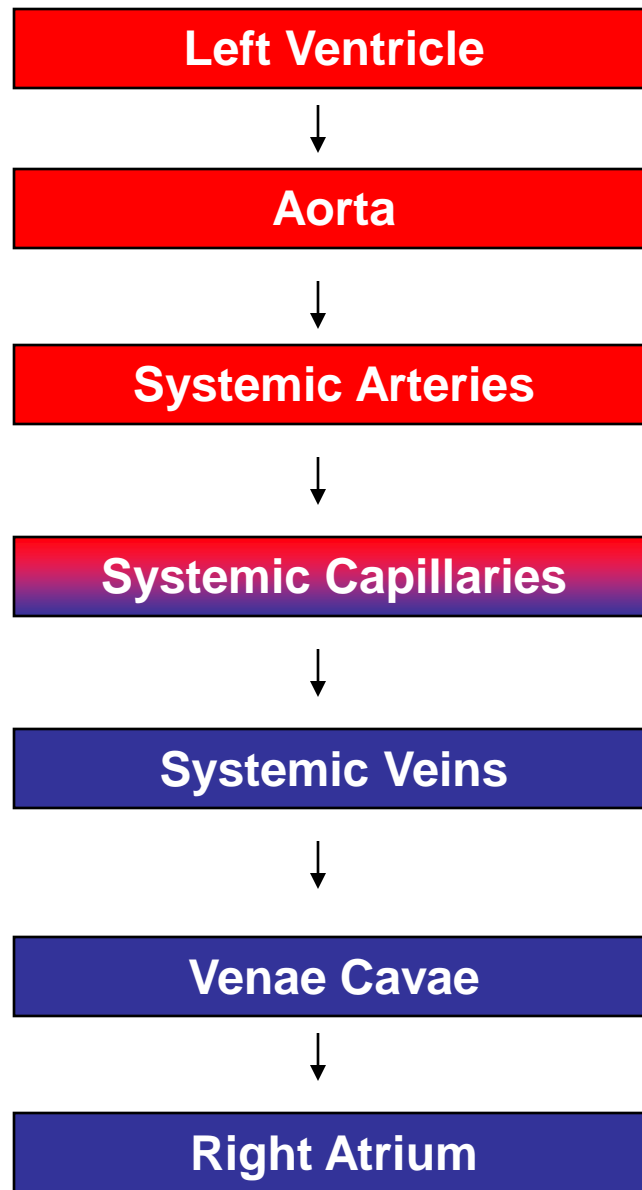


Left Ventricle vs. Right Ventricle

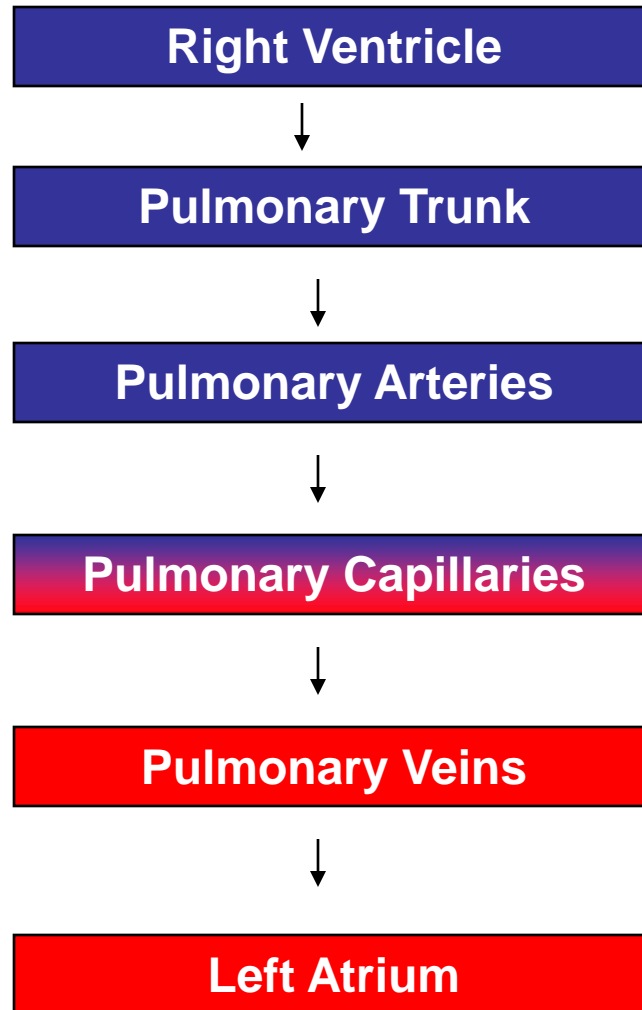
- Volume
- Pressure
- Muscle



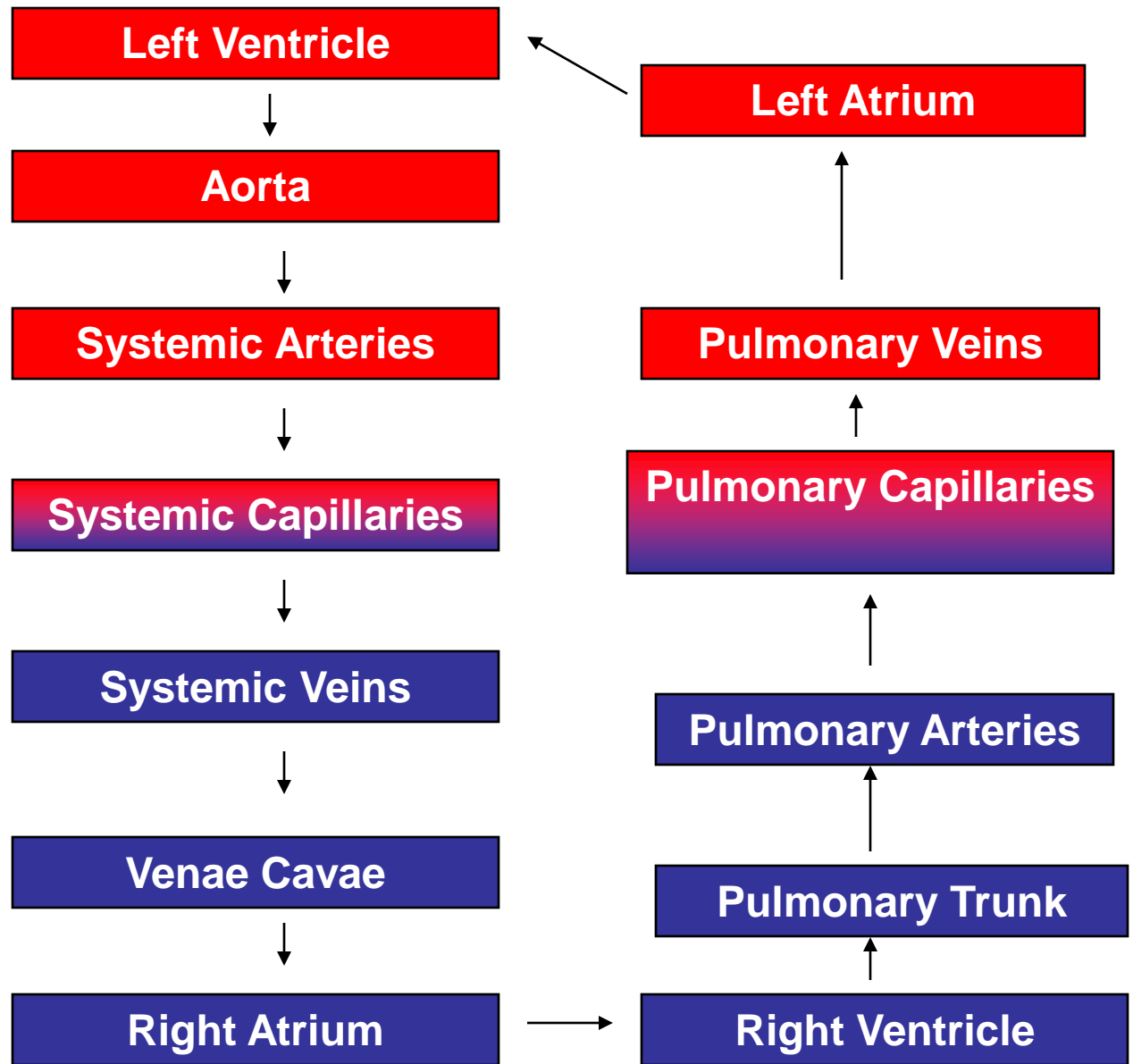
Systemic Circuit



Pulmonary Circuit

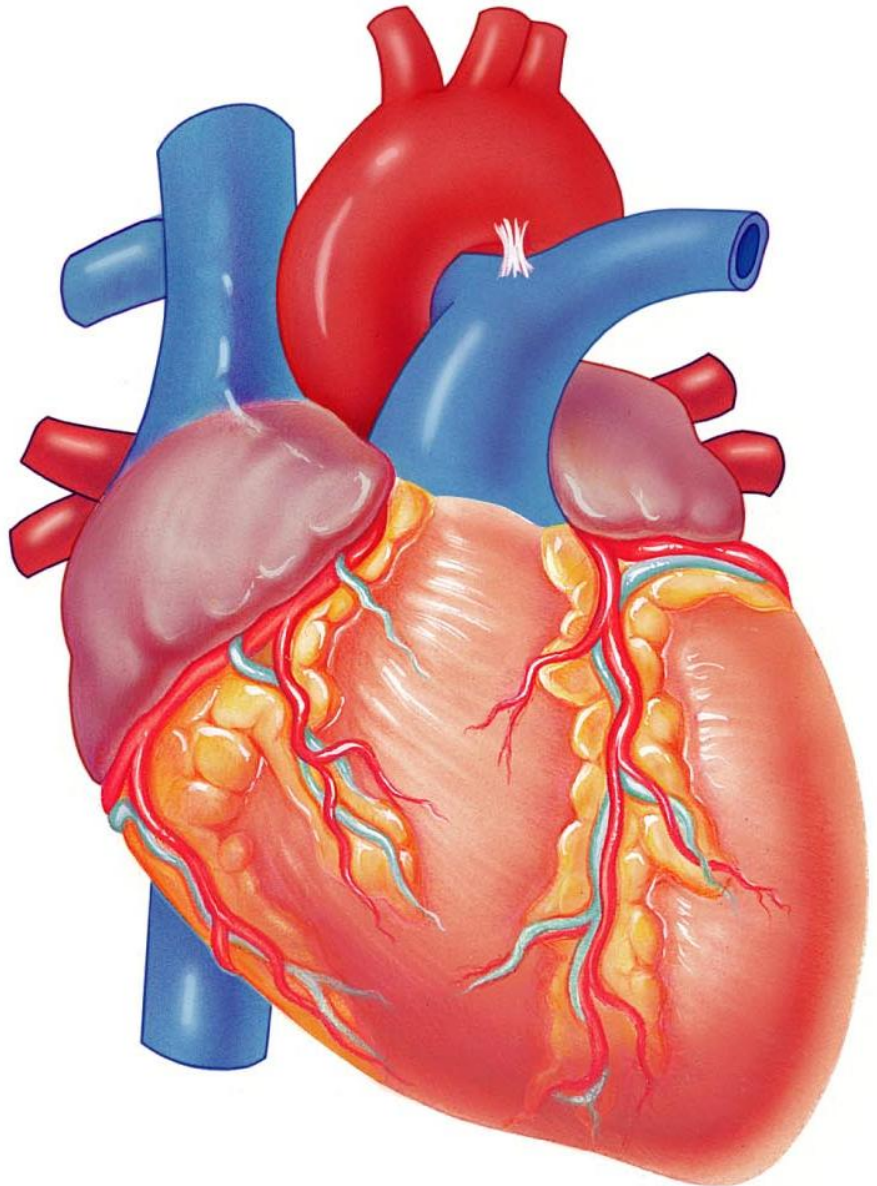


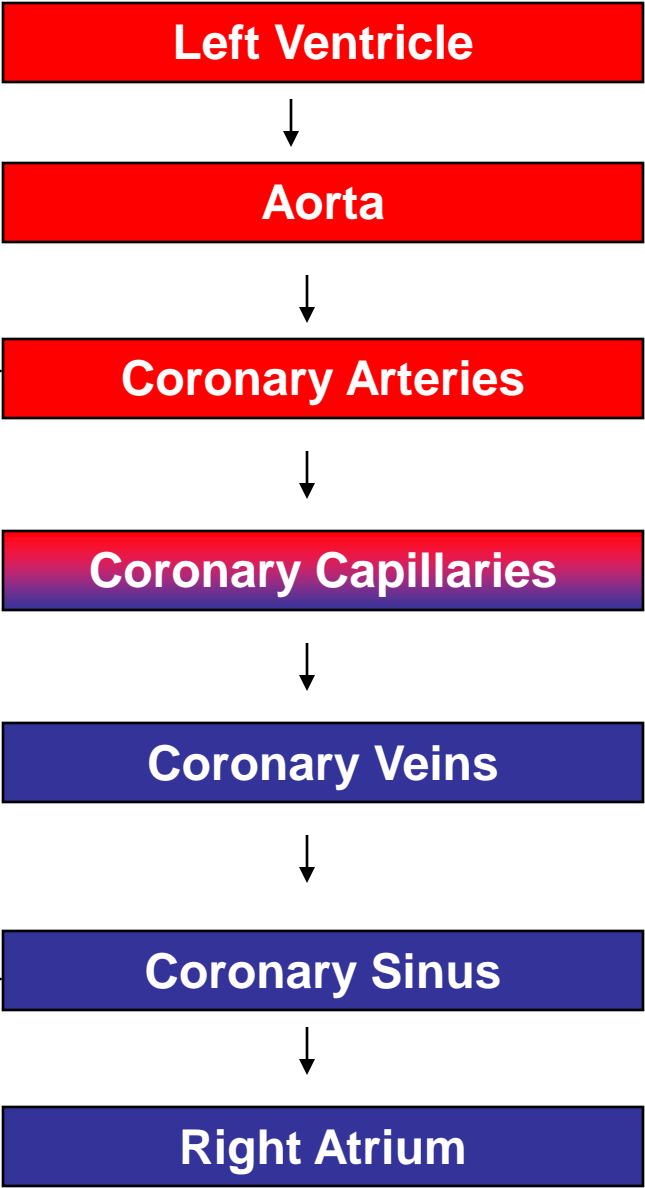
Systemic & pulmonary circuits are in series



Coronary Circuit

- Special branch of the systemic circuit.
- Provides blood to...
- All 3 layers require a blood supply.
 - *Which layer is the neediest?*
 - *What does it need?*





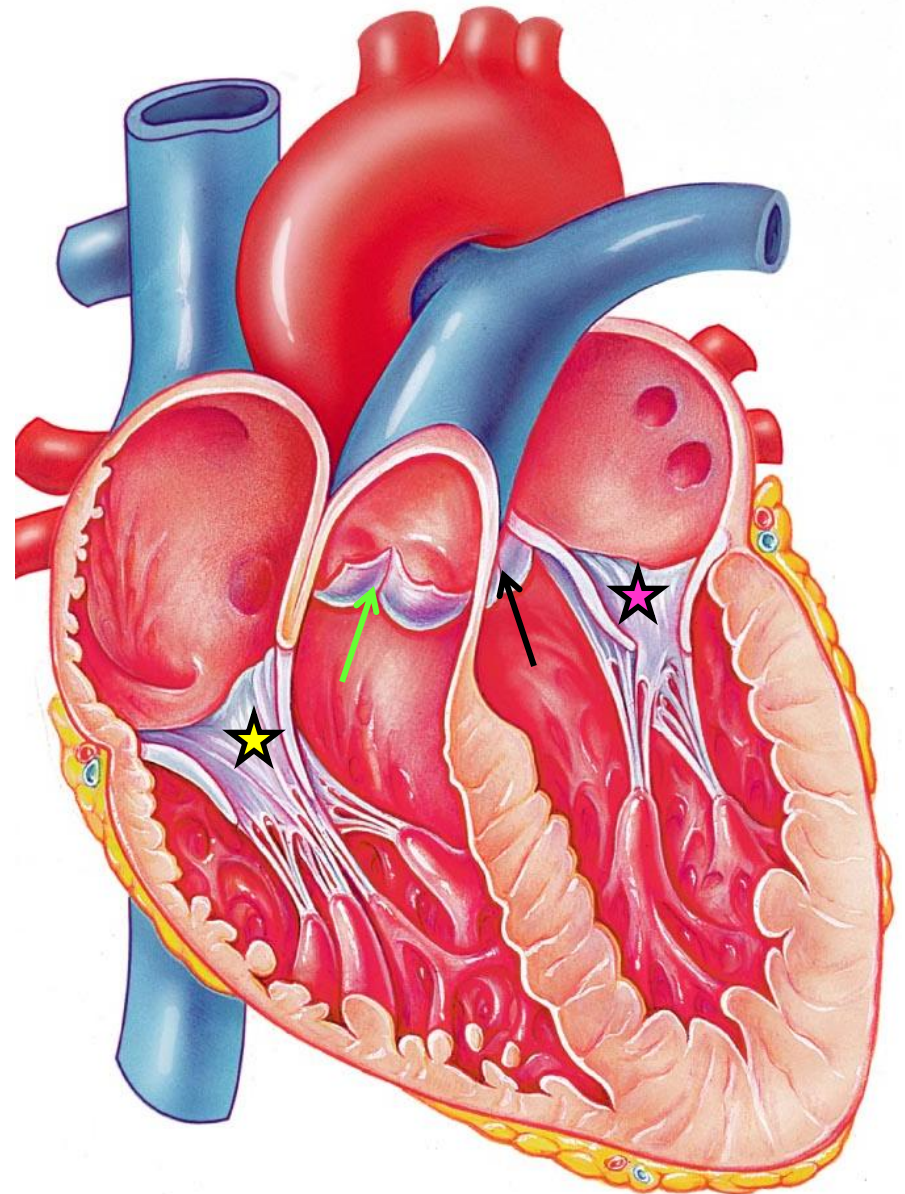
Coronary Circuit

- A special branch of the systemic circuit

How much blood enters the coronary circulation?

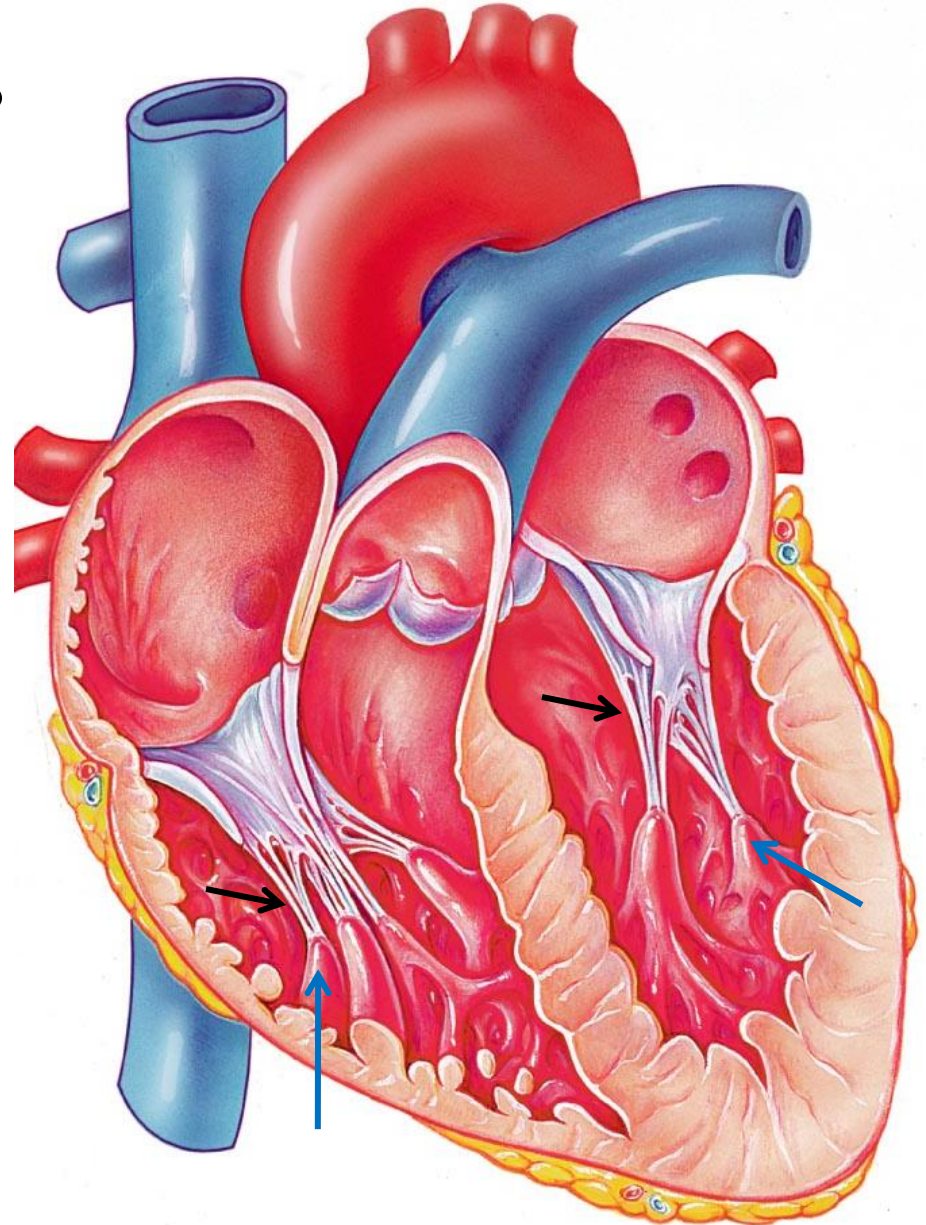
Heart Valves

- *Function?*
- 2 atrioventricular (AV)
 - Prevent backflow from...
 - Tricuspid
 - Mitral.
- 2 semilunar
 - Prevent backflow from...
 - Pulmonary
 - Aortic.

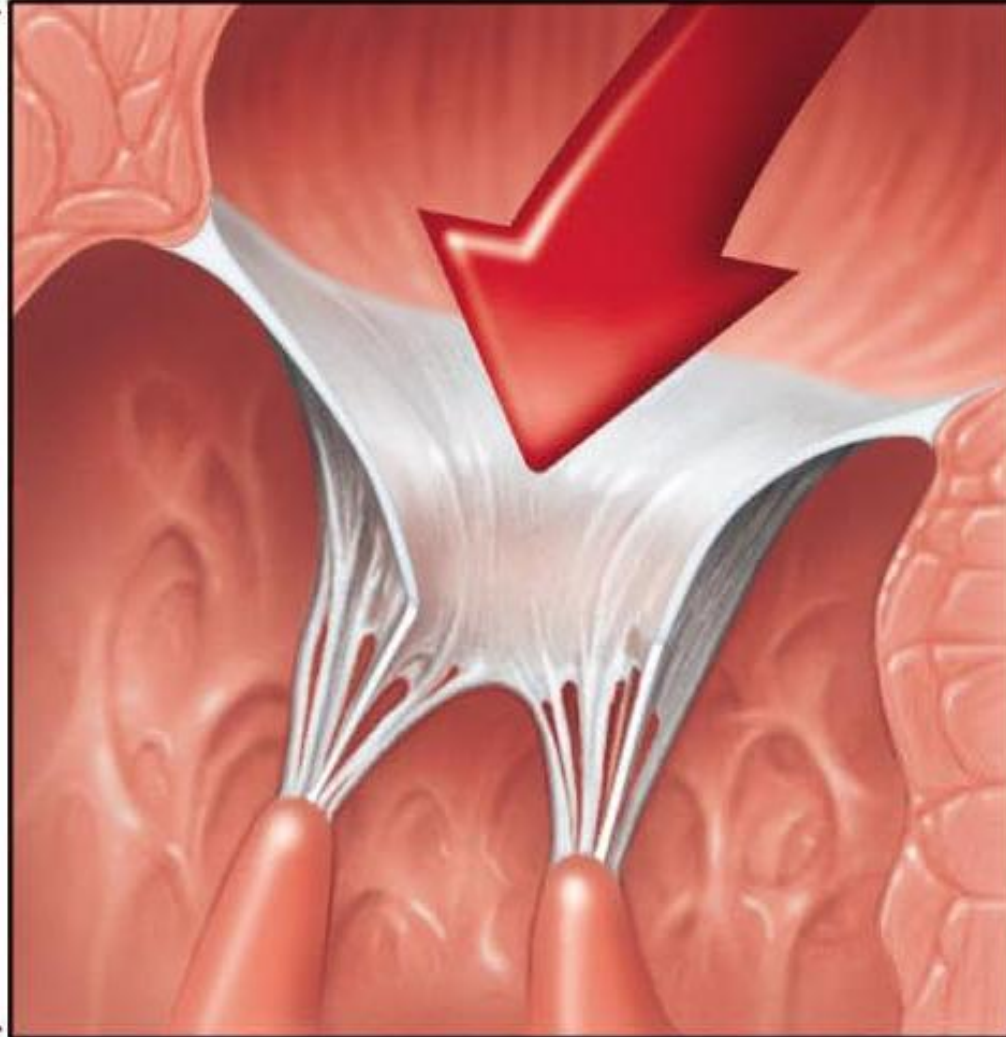


Papillary Muscles & Chordae Tendineae

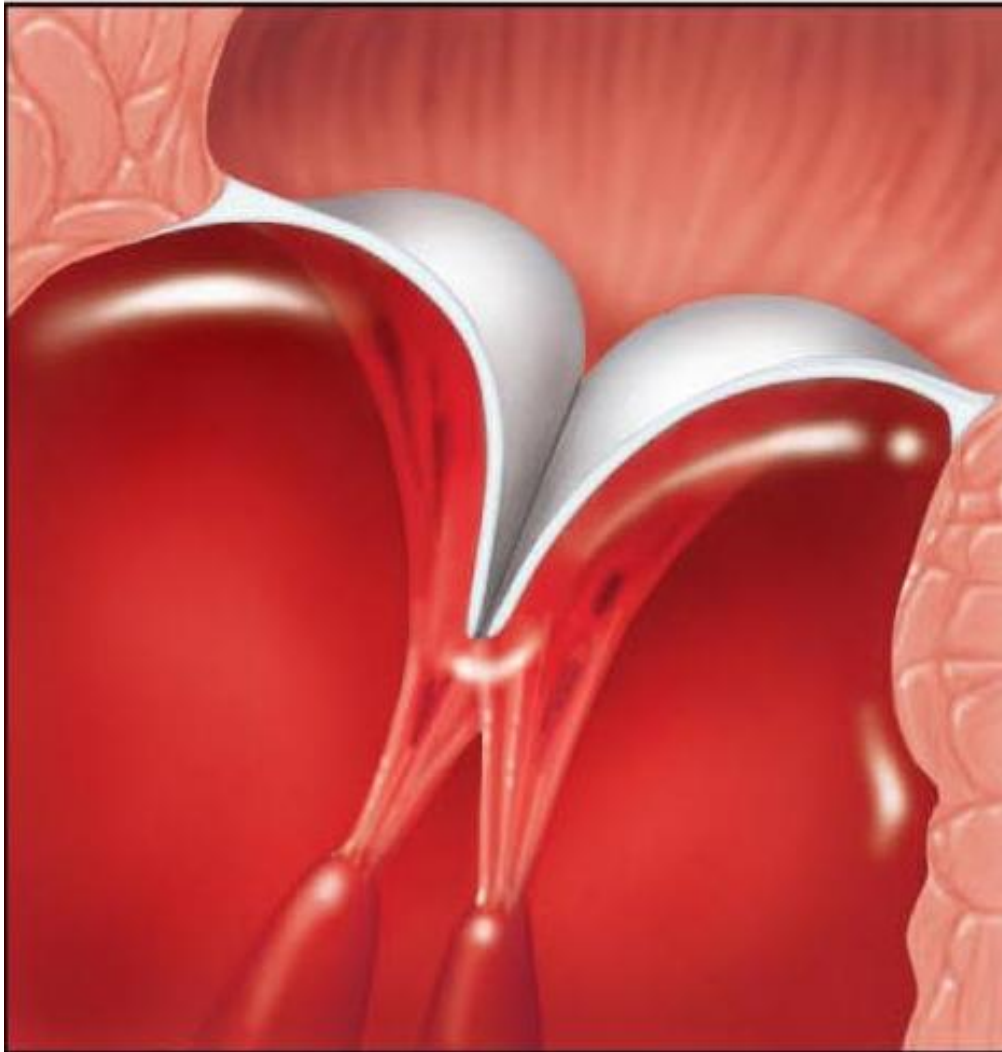
- *What do these NOT do?*
- *What do they do?*



- Tricuspid valve is open when RAP is _____ than RVP.
- Mitral valve is open when LAP is _____ than LVP.

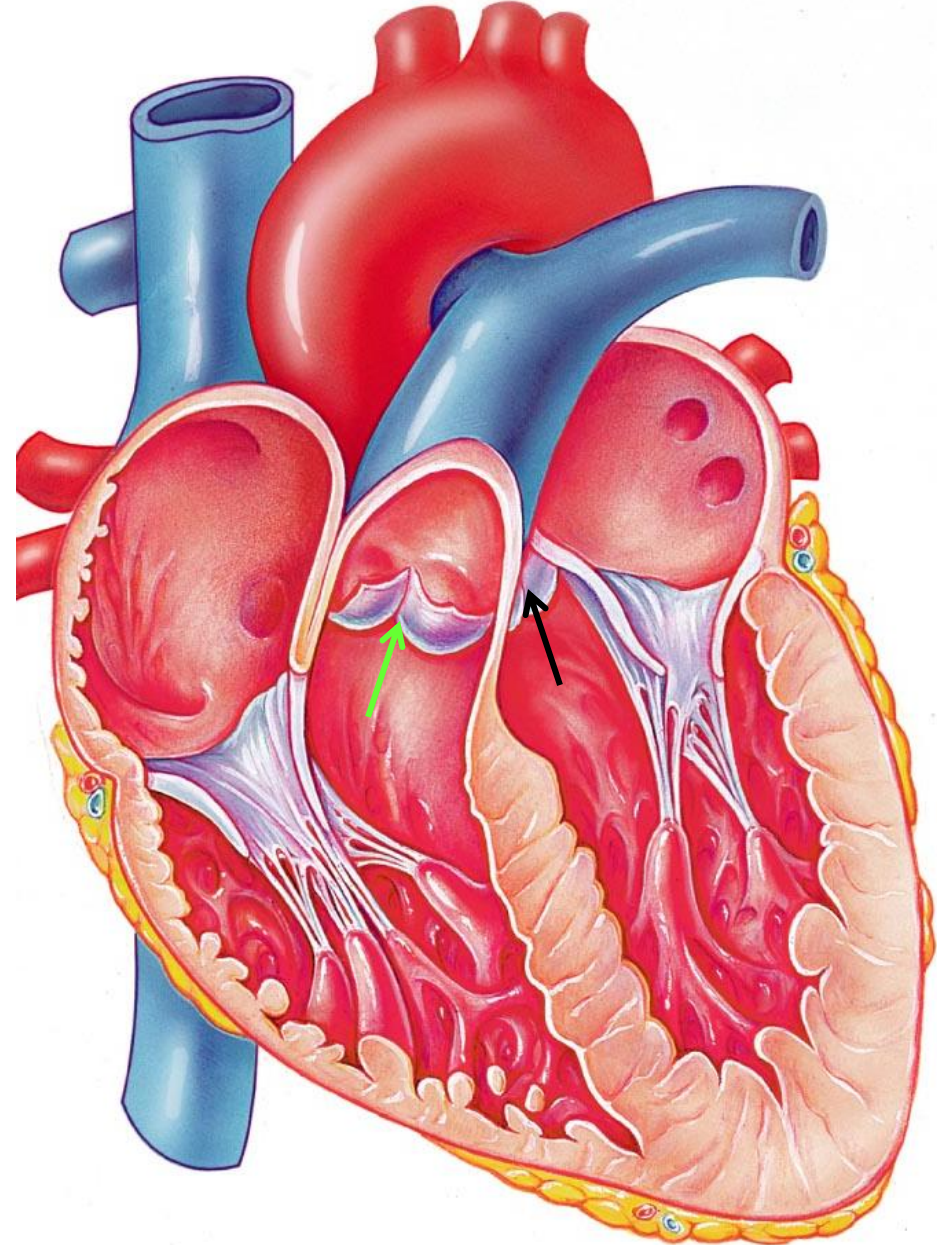


- Tricuspid valve is closed when RAP is _____ RVP.
- Mitral valve is closed when LAP is _____ LVP.



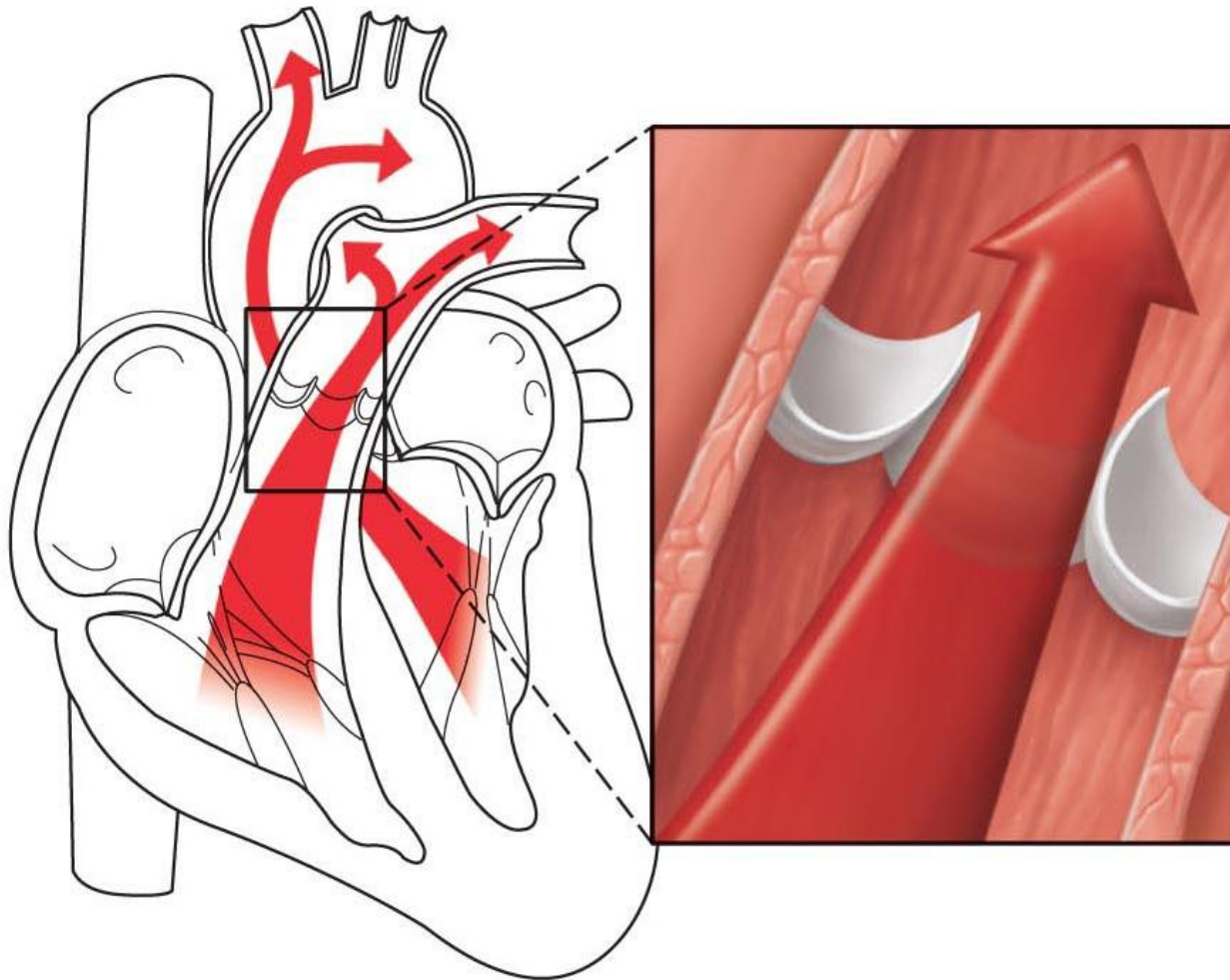
Semilunar Valves

- No chordae tendineae
- No papillary muscles.



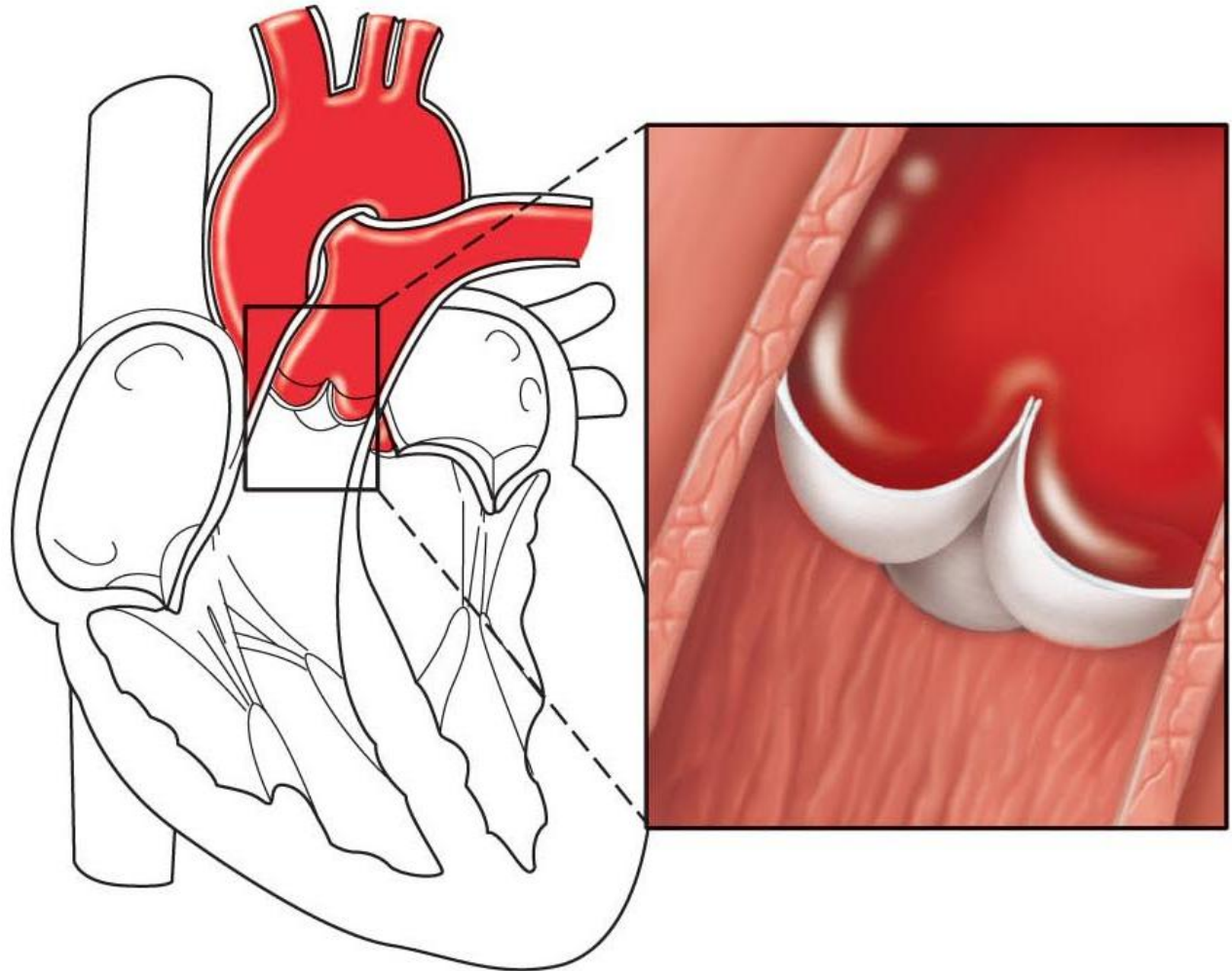
Pulmonary valve is open when RVP is _____ Pulmonary Trunk P.

Aortic valve is open when LVP is _____ Aortic P.



Pulmonary valve is closed when RVP is _____ Pulmonary Trunk P.

Aortic valve is closed when LVP is _____ Aortic P.



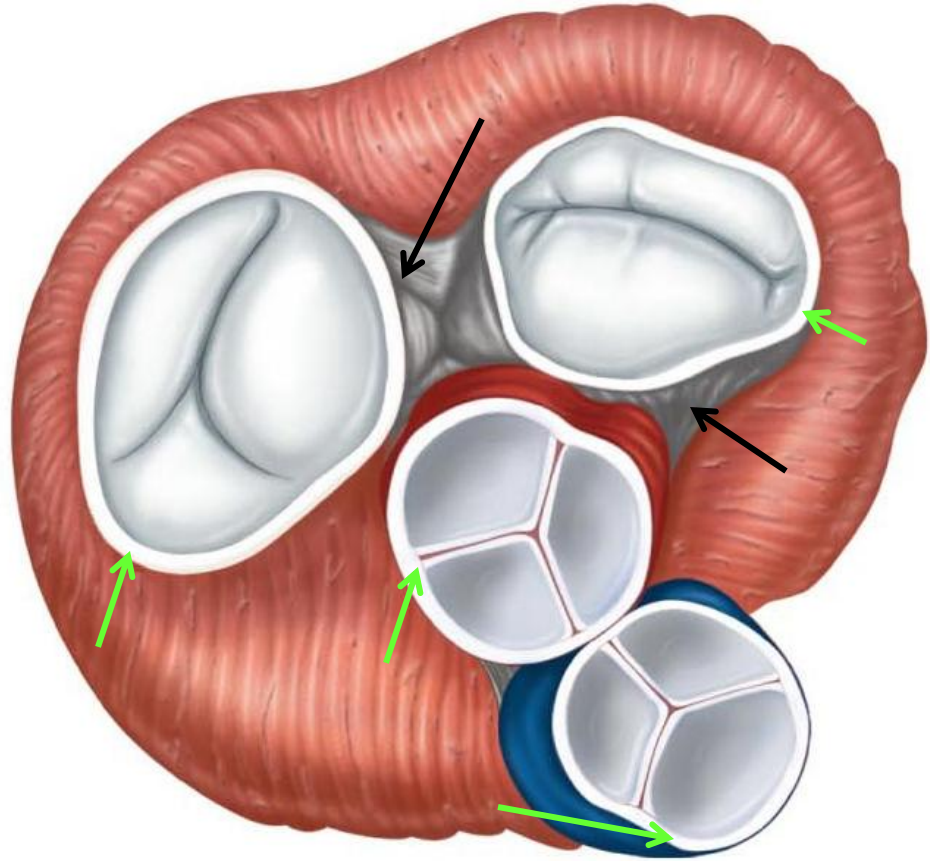
Myocardium

- *Location?*
- *Primary tissue?*
- *Primary cells?*
- Fibrous skeleton



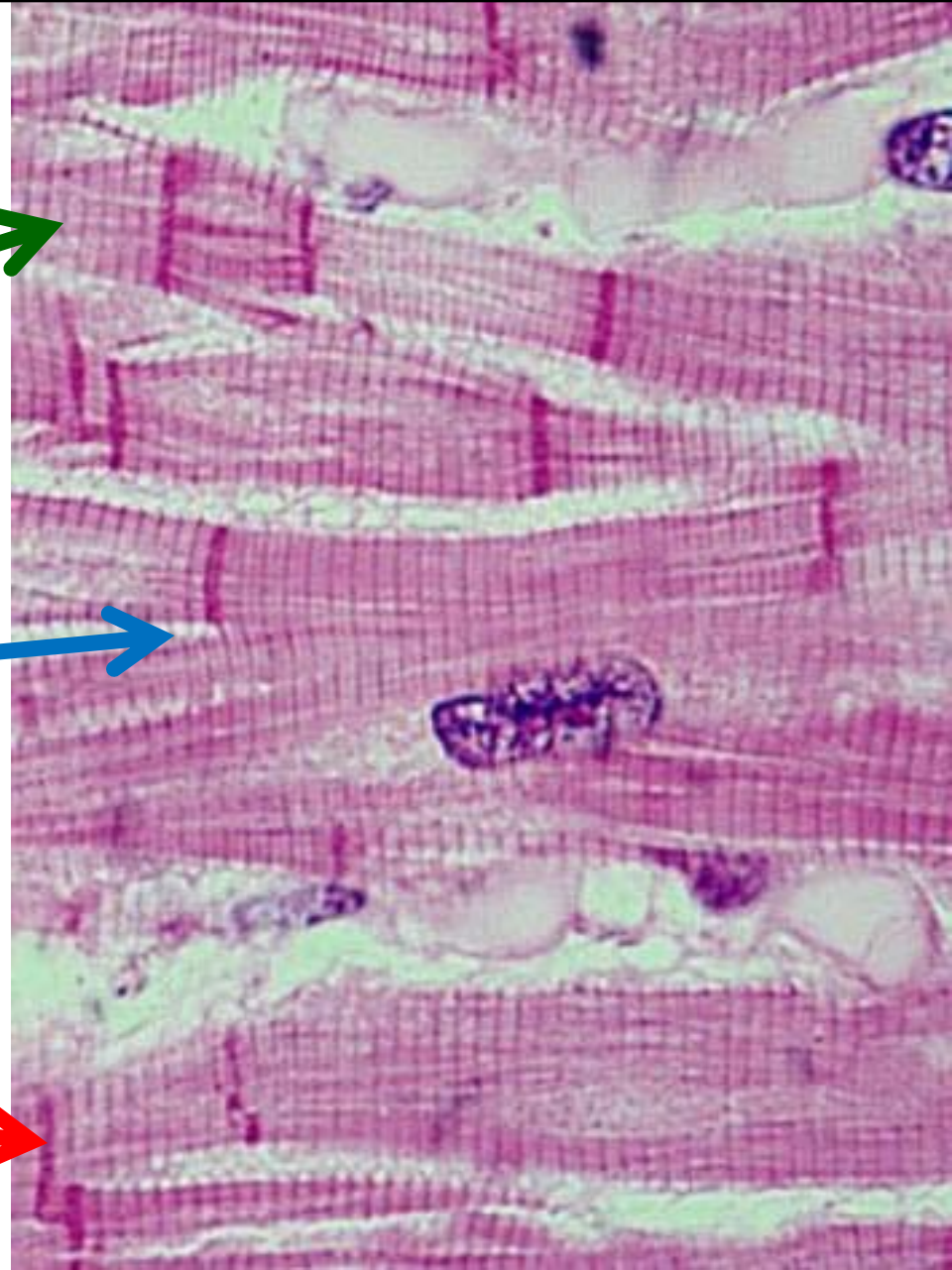
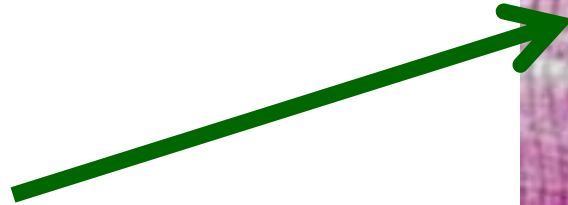
Fibrous Skeleton of the Heart

- *Tissue type?*
- *Functions?*



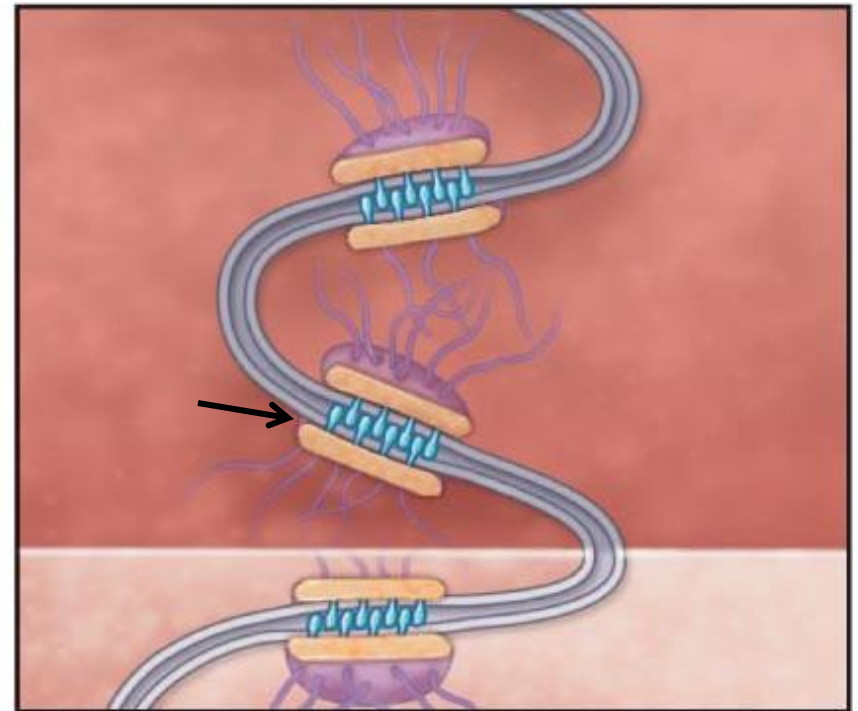
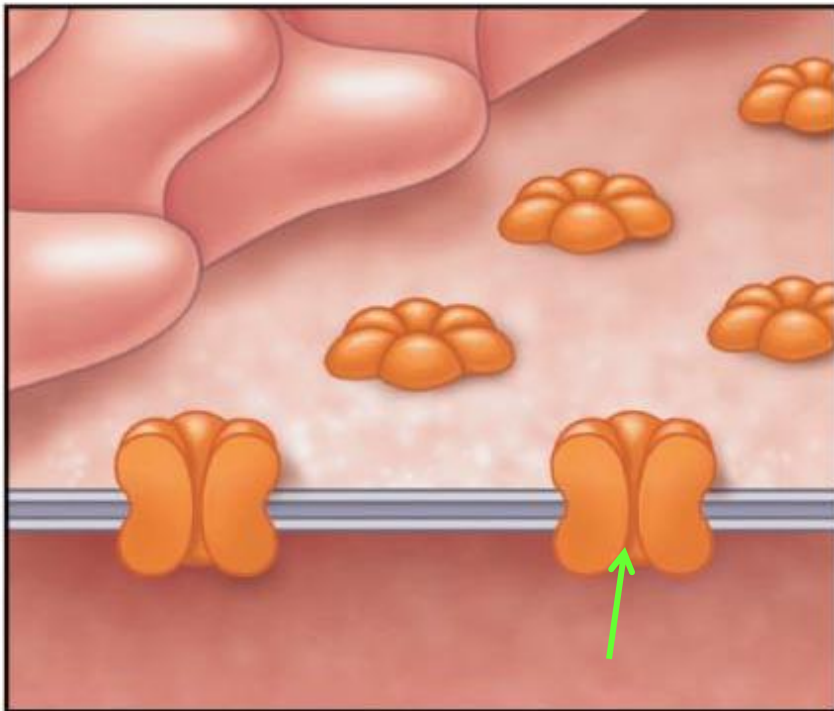
Cardiac Contractile Cells

- *Function?*



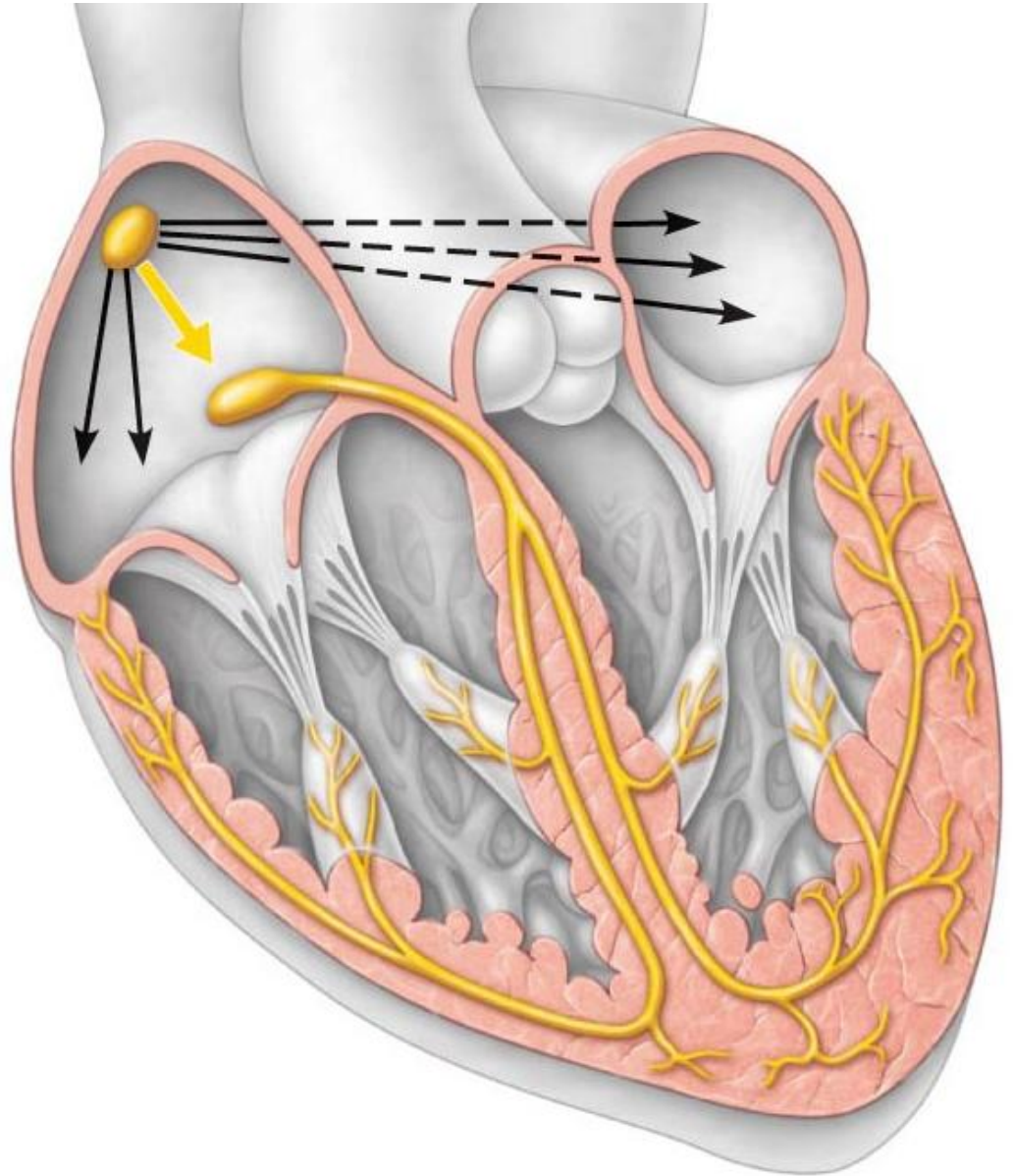
Intercalated Discs Contain 2 Structures:

- Desmosomes
- Gap junctions



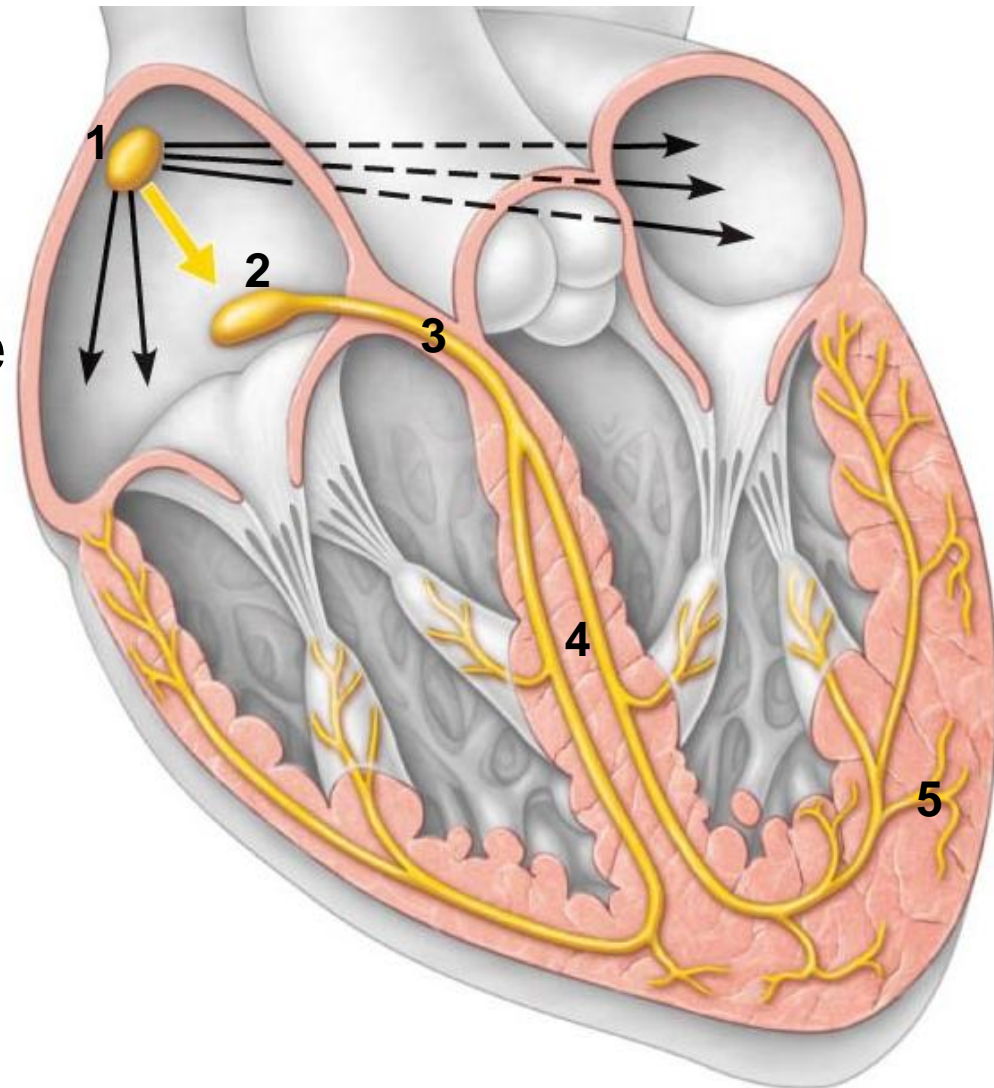
Autorhythmic Cells

- Intrinsic control
- Spontaneous
- Rhythmic
- Electrically linked.



Autorhythmic Cell Location

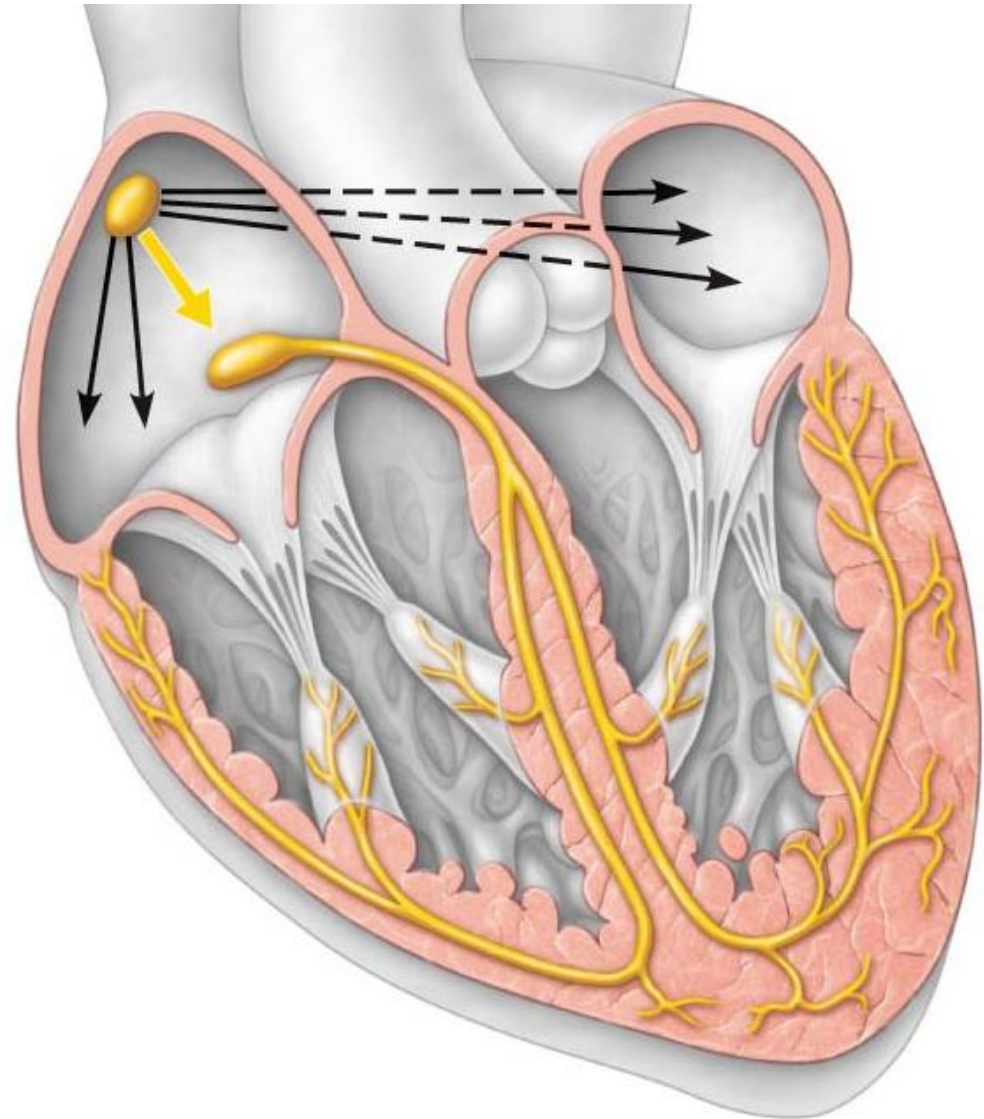
1. Sinoatrial node
2. Atrioventricular node
3. Atrioventricular bundle
4. Right/left bundle branches
5. Purkinje fibers.



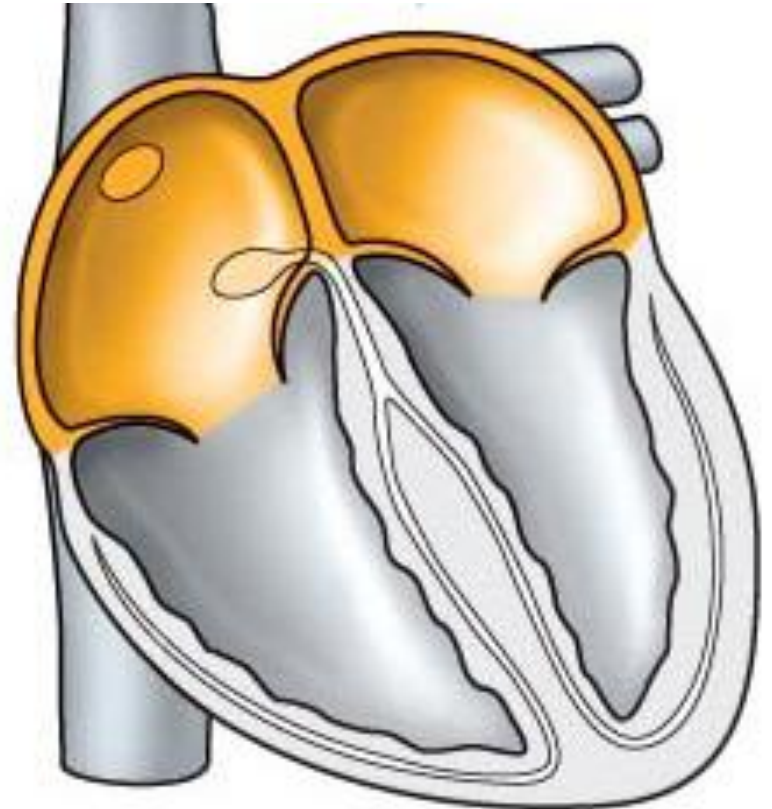
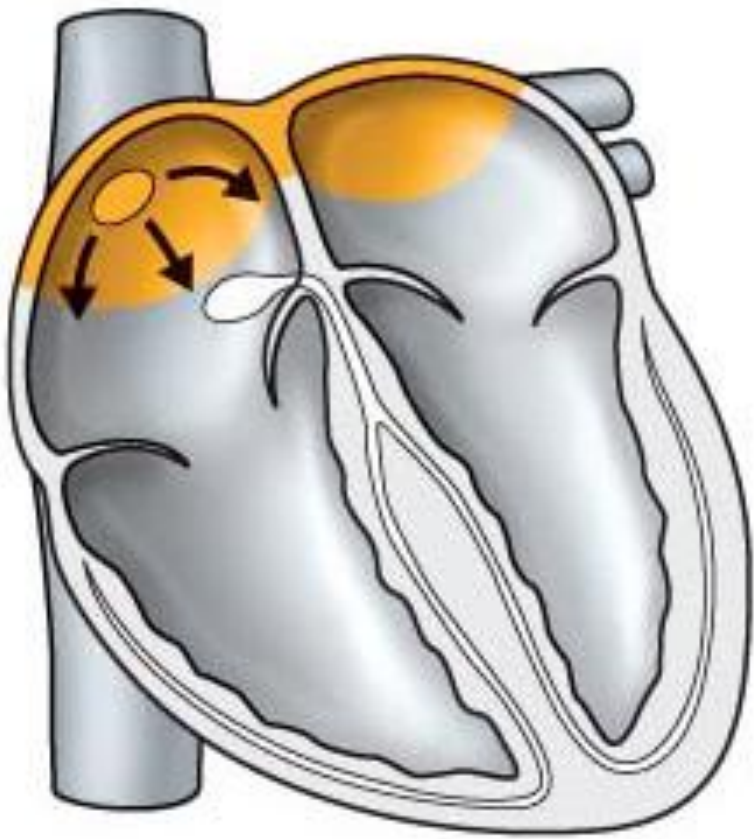
Autorhythmic Cell Depolarization Rates

- From fastest to slowest:

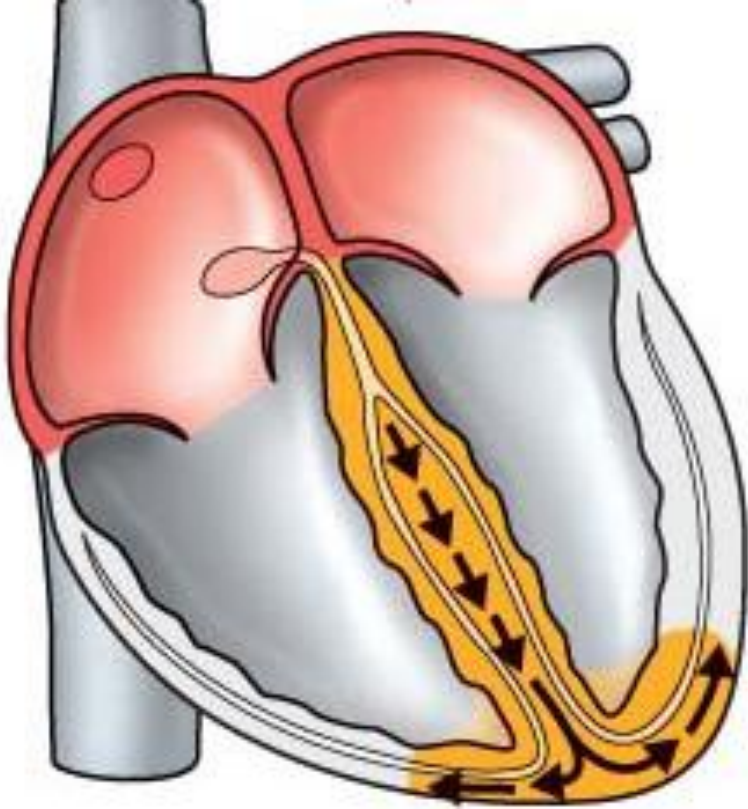
- SA node
- AV node
- AV bundle
- Bundle branches
- Purkinje fibers



- *Who sets the pace?*

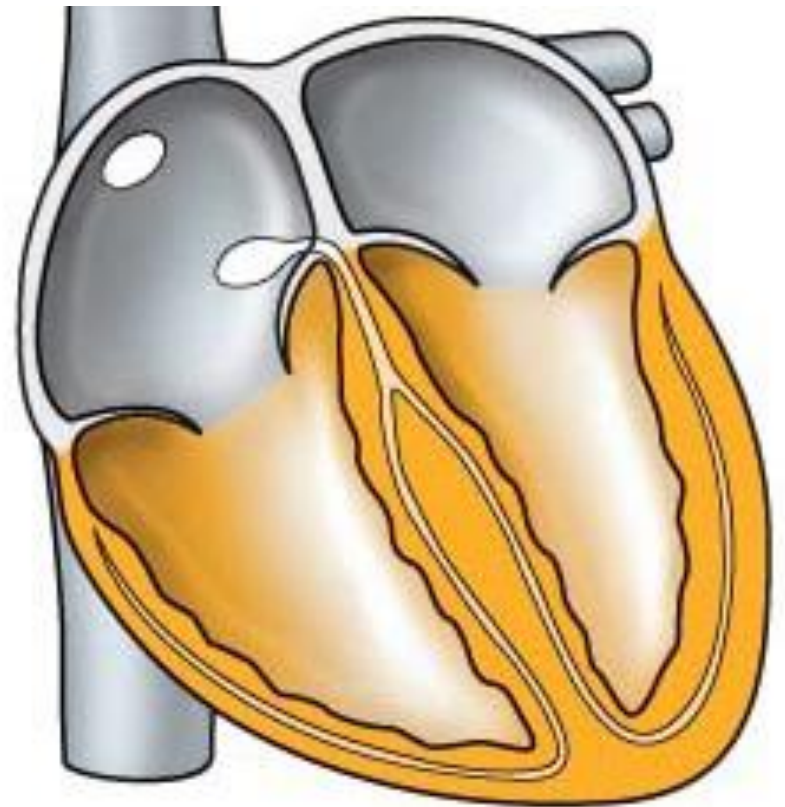


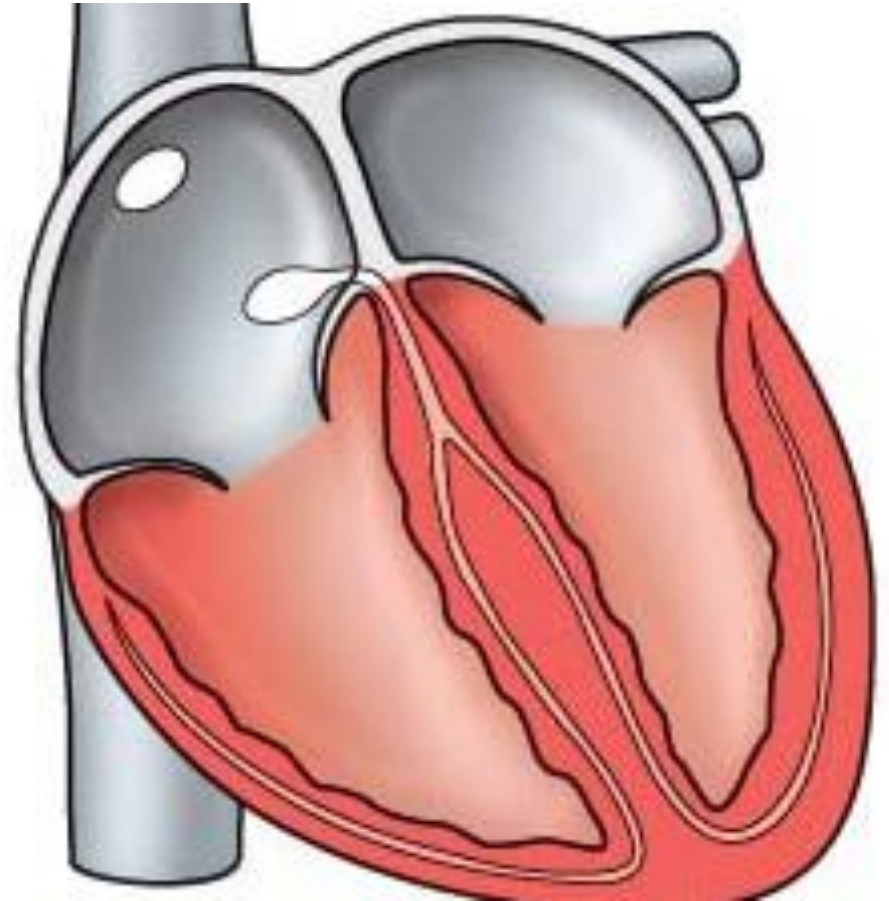
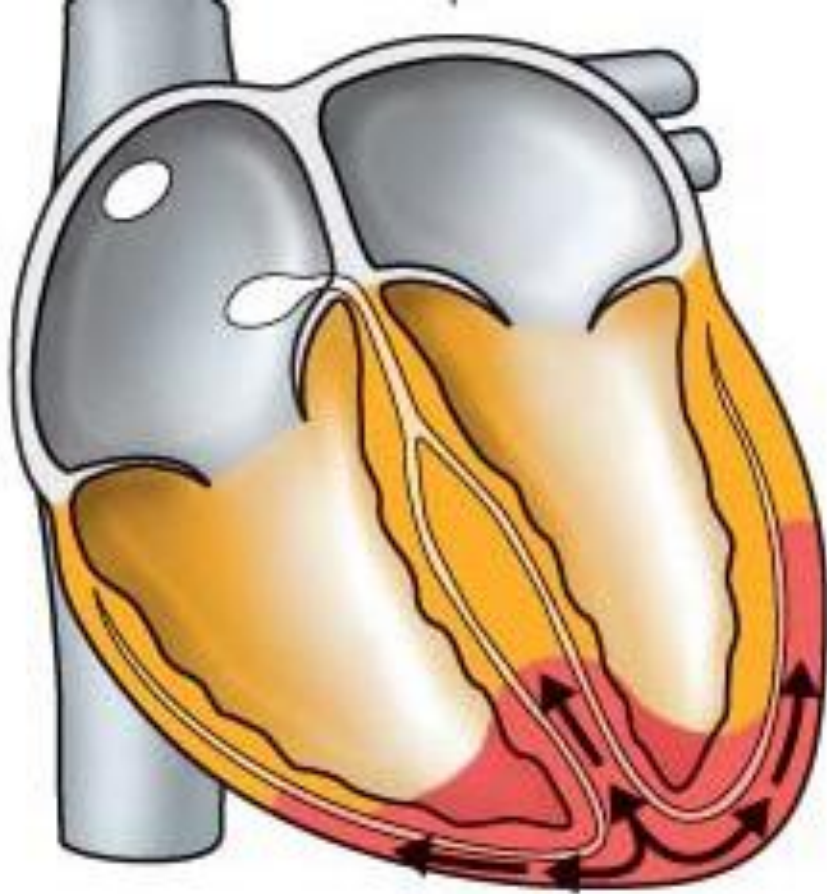
Why is the “slow-down” in the AV node significant?



What makes the signal go down the septum?

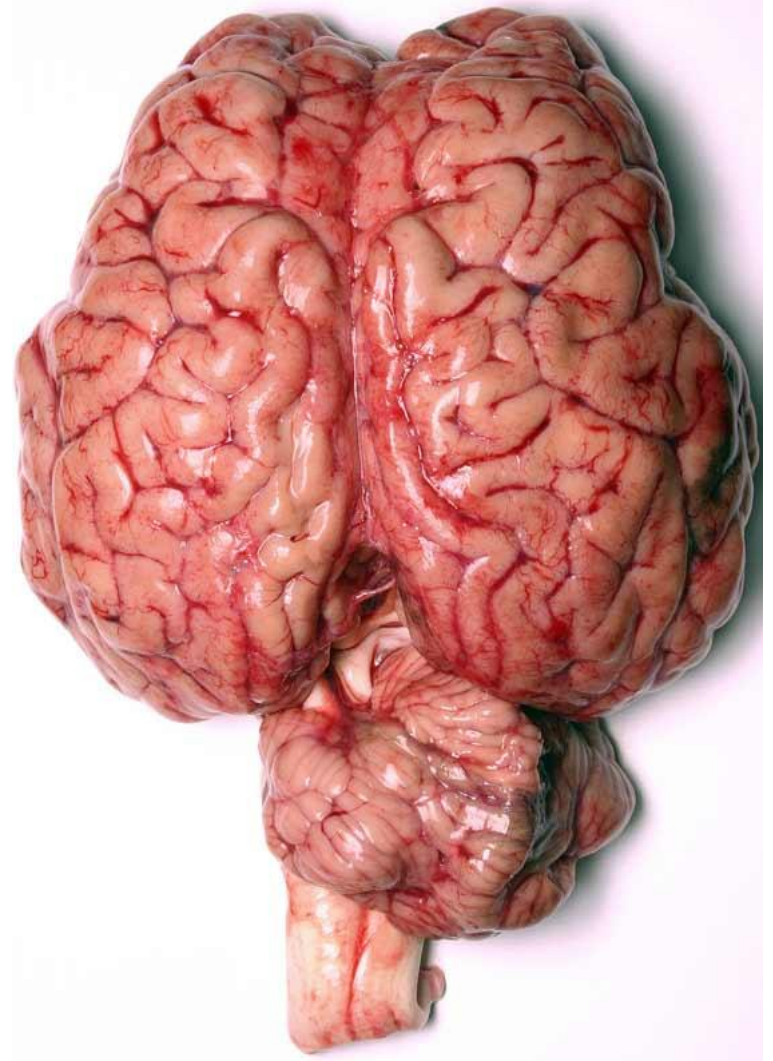
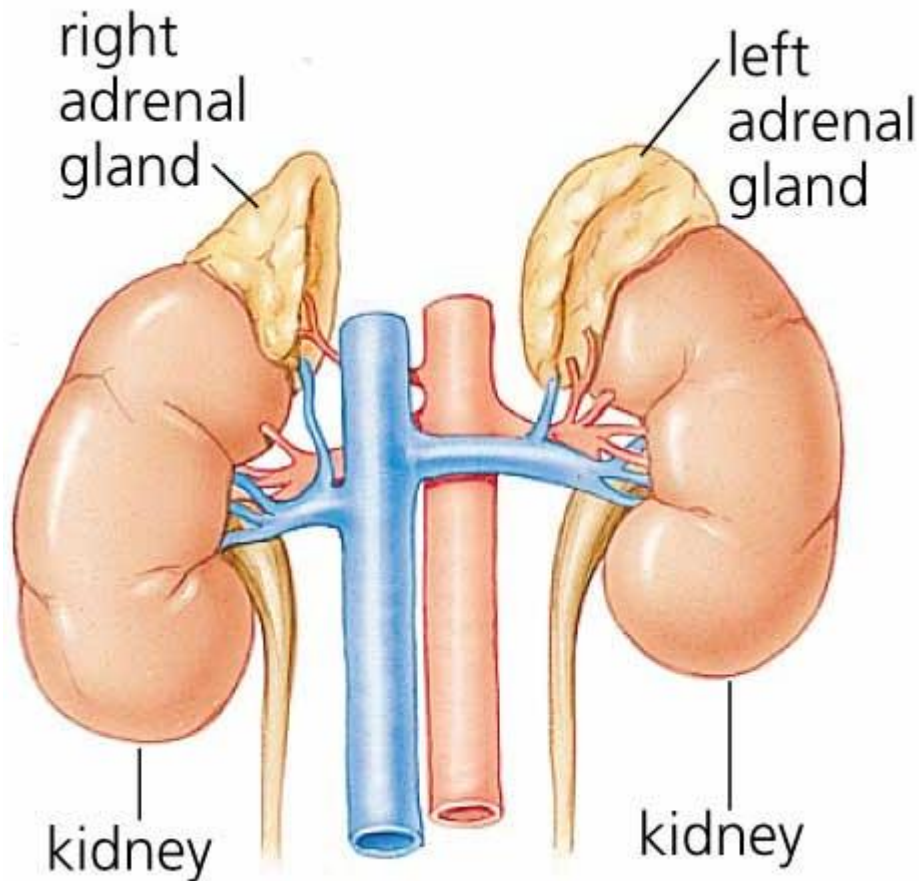
Why doesn't it go down the side or front or back?





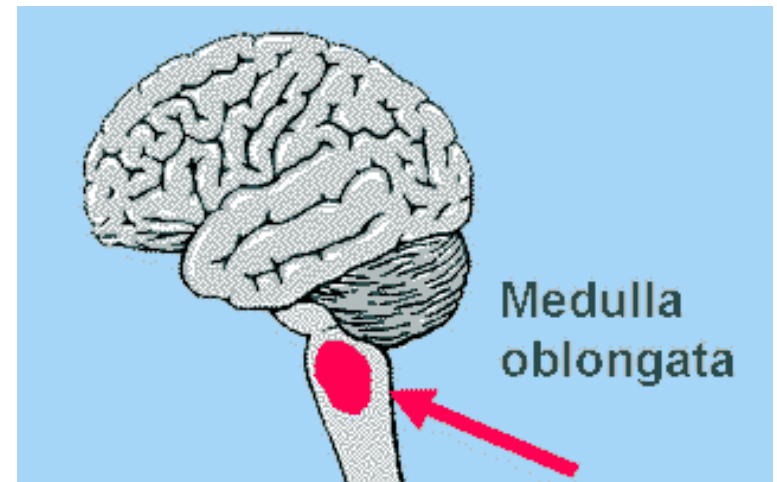
Extrinsic Influence on Heart Activity

- What 2 organ systems are the biggest extrinsic influence on the heart?*



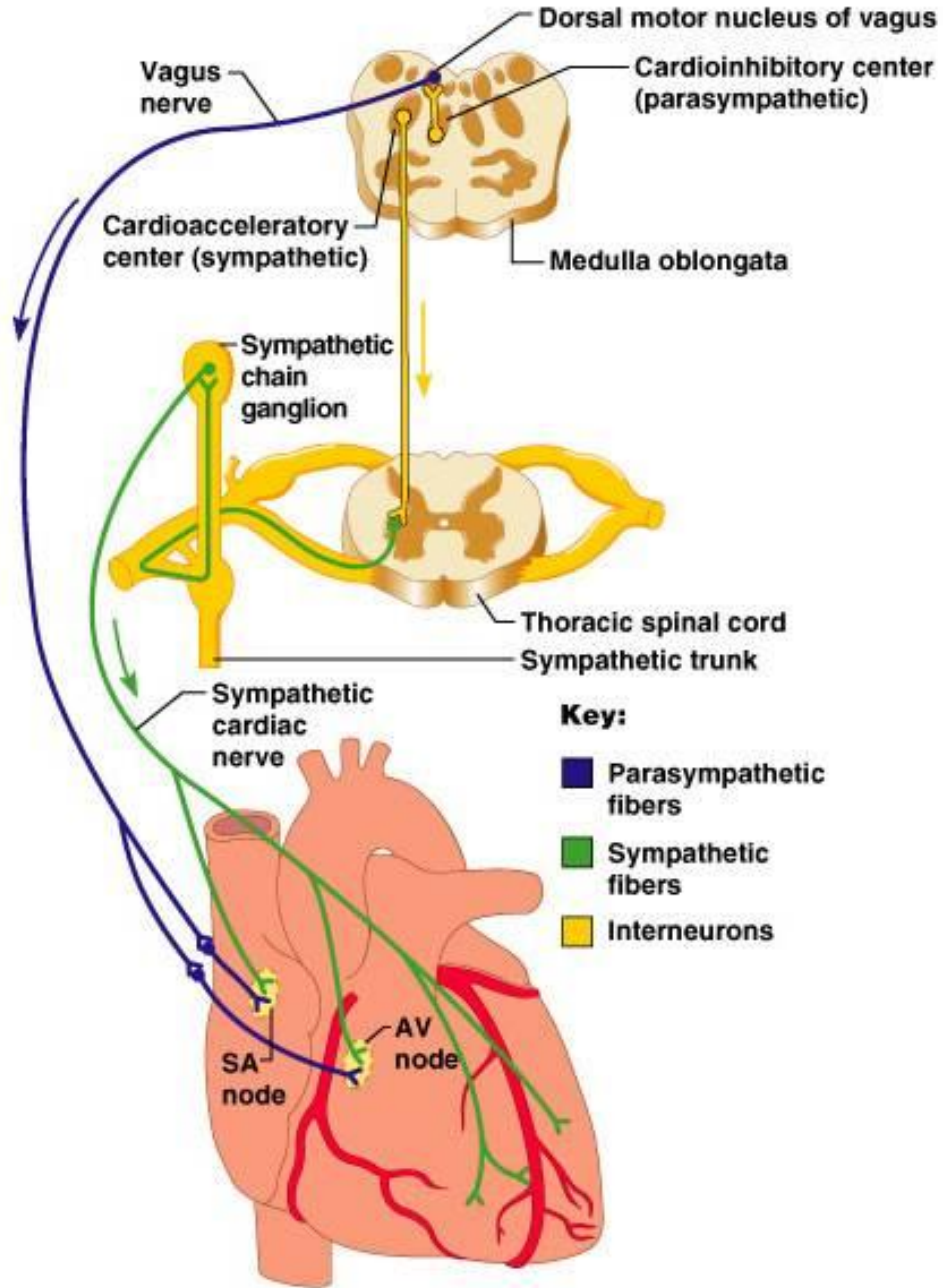
Medullary Cardiac Centers

- Cardioacceleratory center
- Cardioinhibitory center



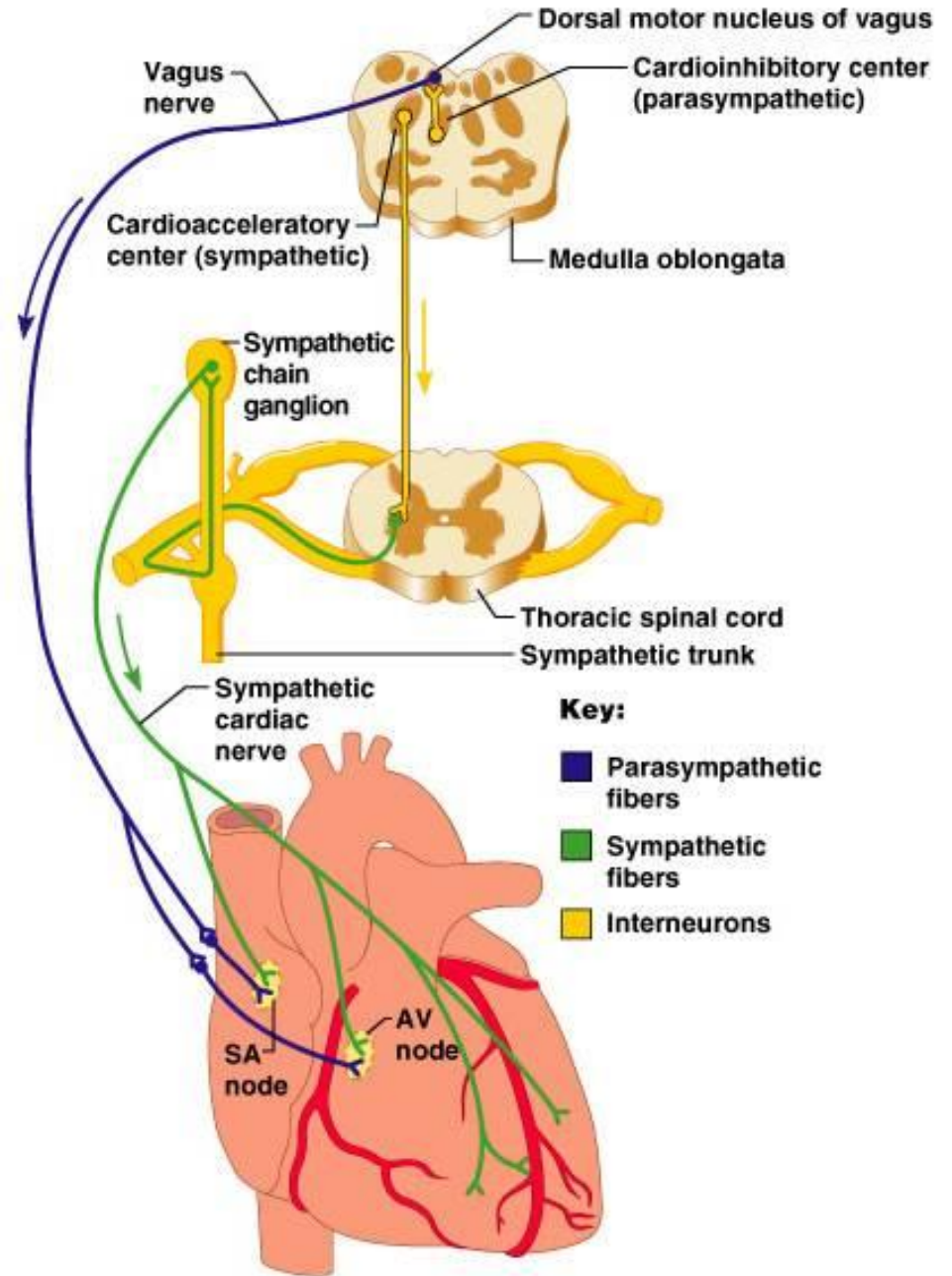
Cardioacceleratory center

- Cardiac sympathetic nerves
- Norepinephrine
- Innervation



Cardioinhibitory center

- Vagus nerve (CN X)
- Acetylcholine
- Innervation





Resting
parasympathetic
influence on the
heart.

Resting
sympathetic
influence on the
heart.

Vagal Tone

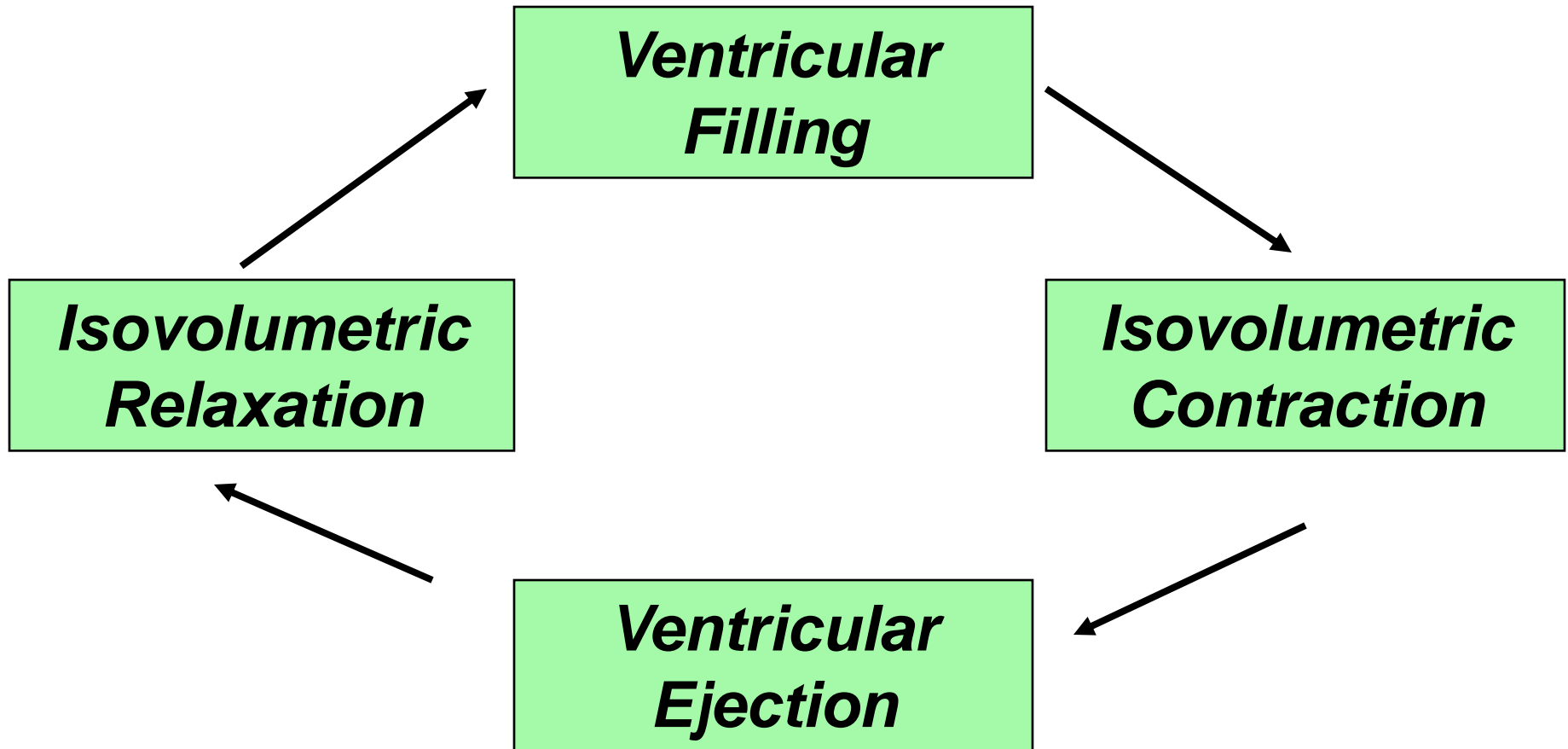
What about during exercise?

- *How would a decrease in cardioacceleratory center activity affect heart rate?*
- *How does acetylcholine affect the amount of time in between heart beats?*
- *How would a vagotomy affect heart rate?*

Cardiac Cycle

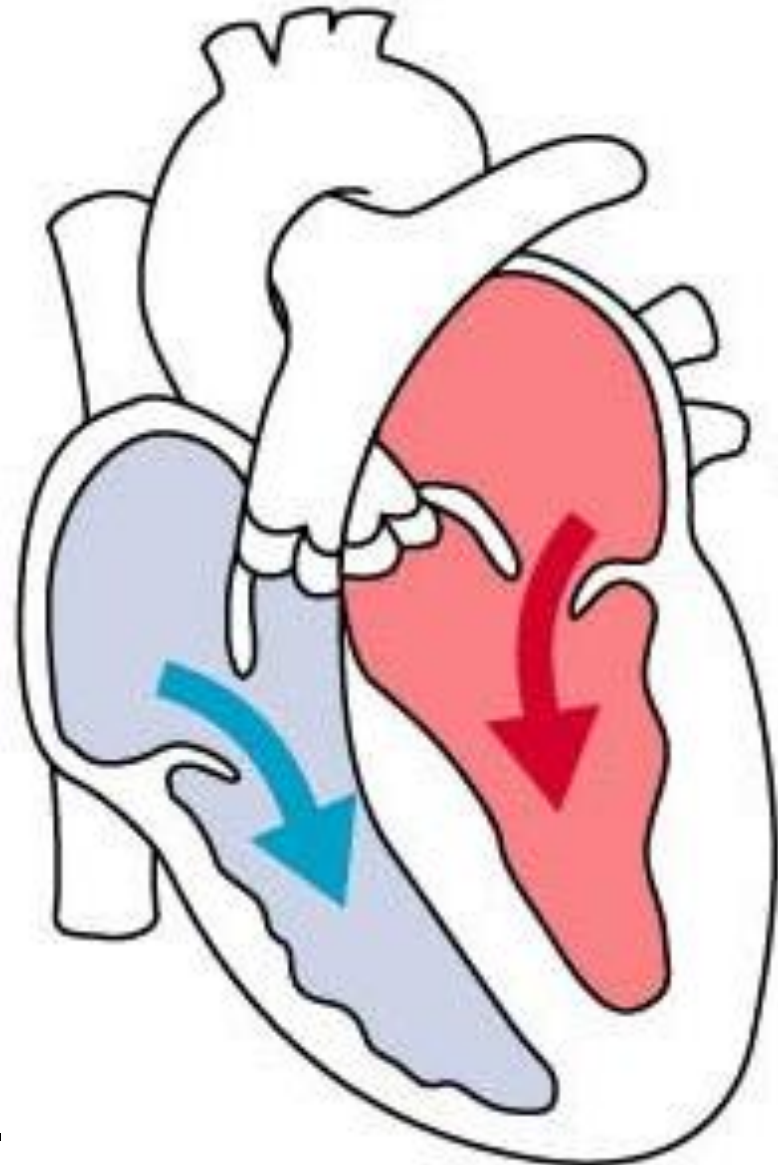
- All the events associated with one heartbeat.
- Includes systole and diastole of all chambers.
- Pressures and volumes of all 4 chambers change in a predictable way during each cycle.

Phases of the Cardiac Cycle



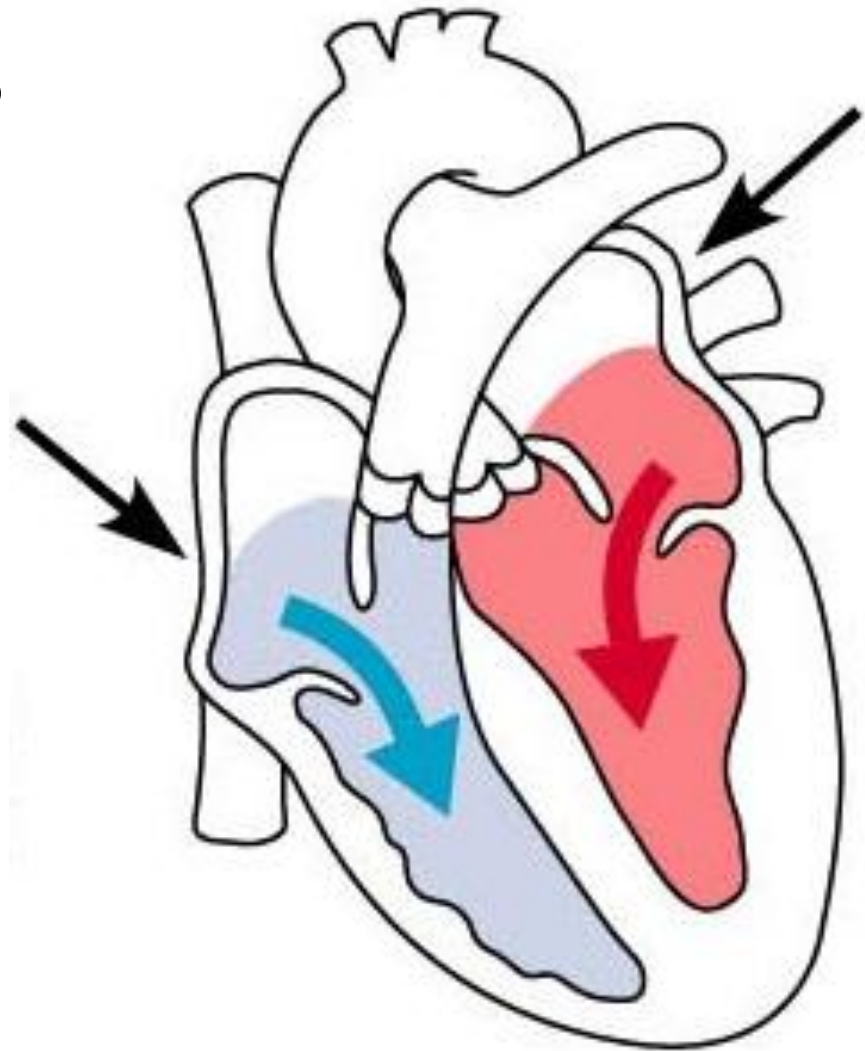
Ventricular Filling

- LV volume is...
- Mitral valve is...
- LVP is _____ LAP
- LV is in...
- Aortic valve is...
- LVP is _____ Aortic P.



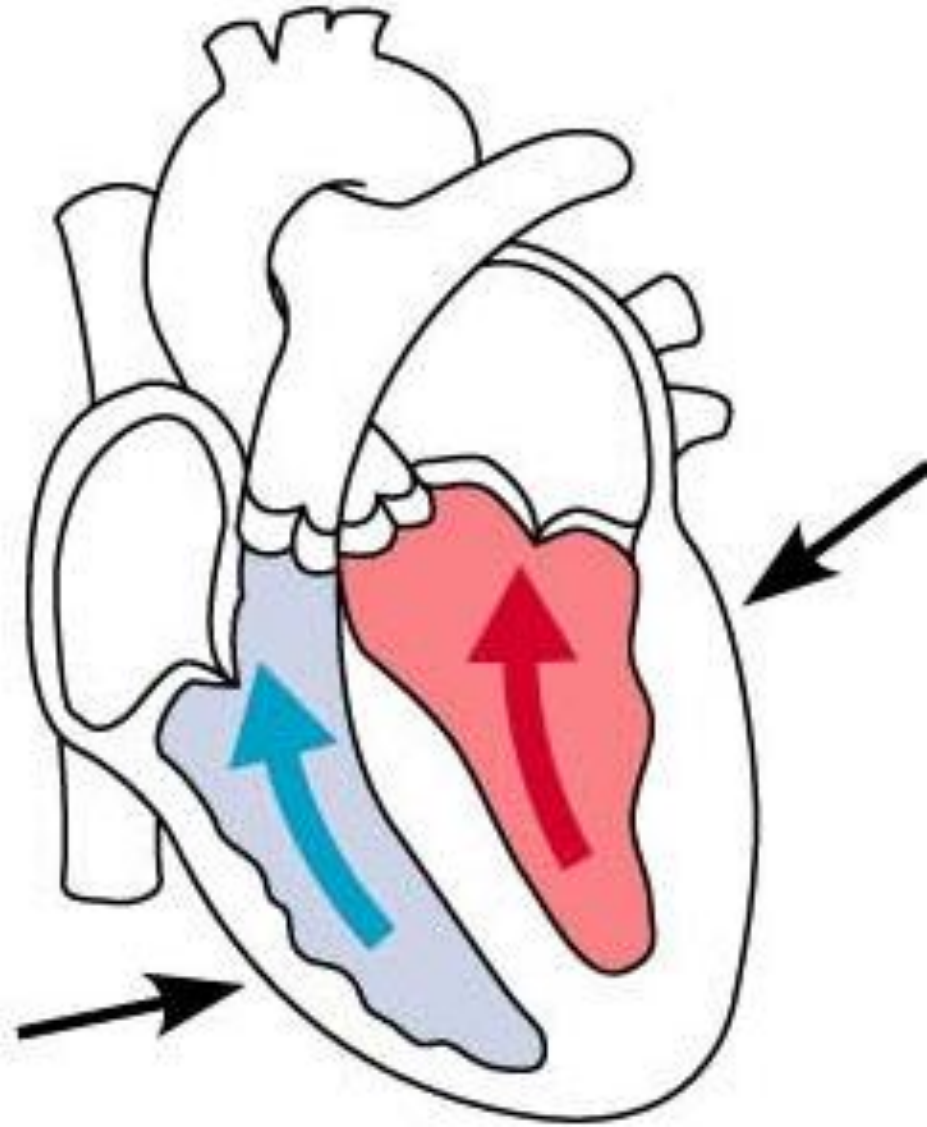
Ventricular Filling

- First 80% vs. Last 20%
- End Diastolic Volume.



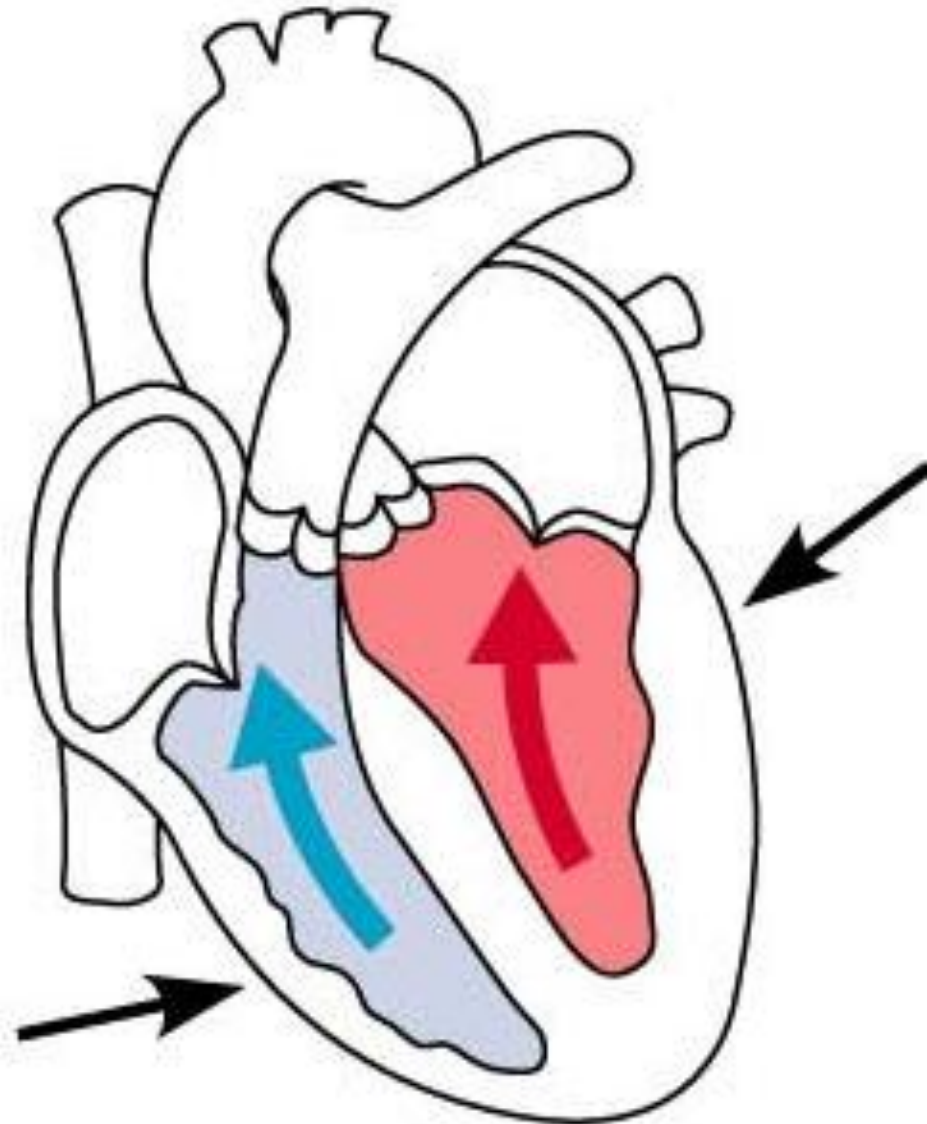
Isovolumetric Contraction

- LV contracts and LVP...
- LAP is a lot lower than Aortic P.
- LUB



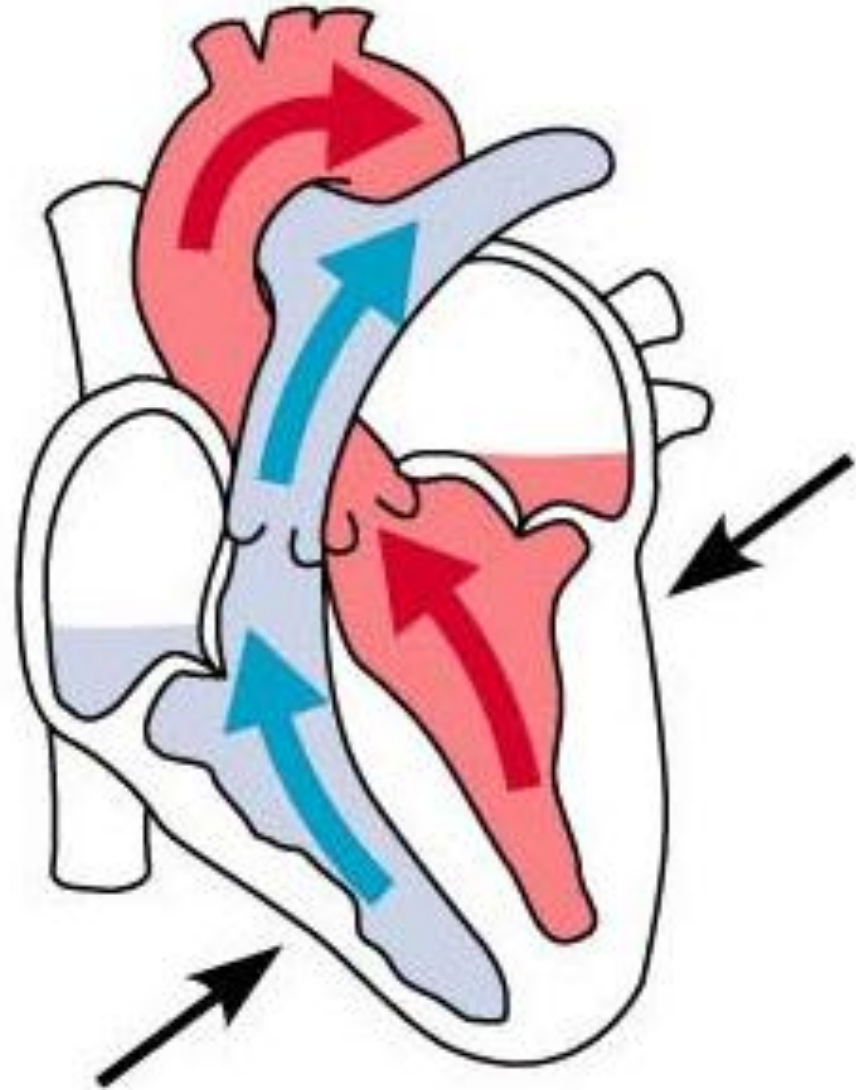
Isovolumetric Contraction

- Mitral valve is...
- Aortic valve is...
- LV volume is...
- LVP is _____ LAP
- LVP is _____ Aortic P



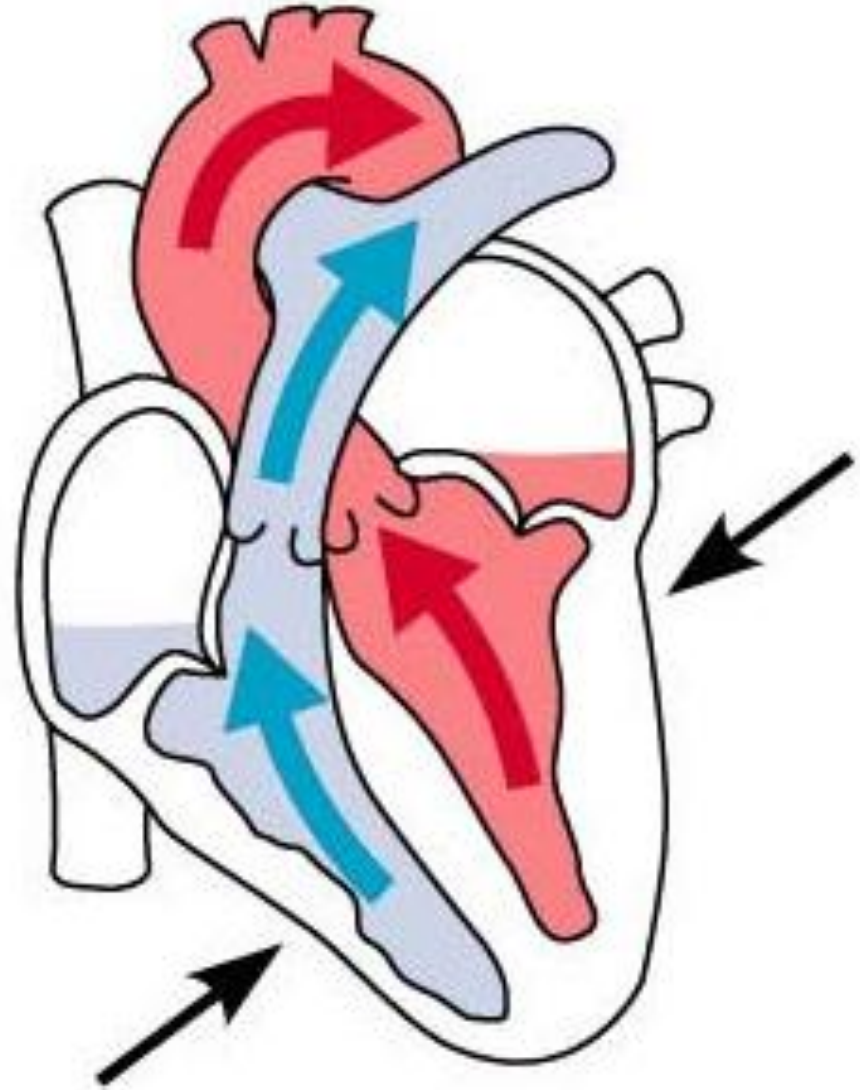
Ventricular Ejection

- LV volume is...
- Aortic valve is...
- LVP is _____ Aortic P
- Mitral valve is...
- LVP is _____ LAP



Ventricular Ejection

- *Is the entire EDV ejected?*
- End systolic volume (70mL).

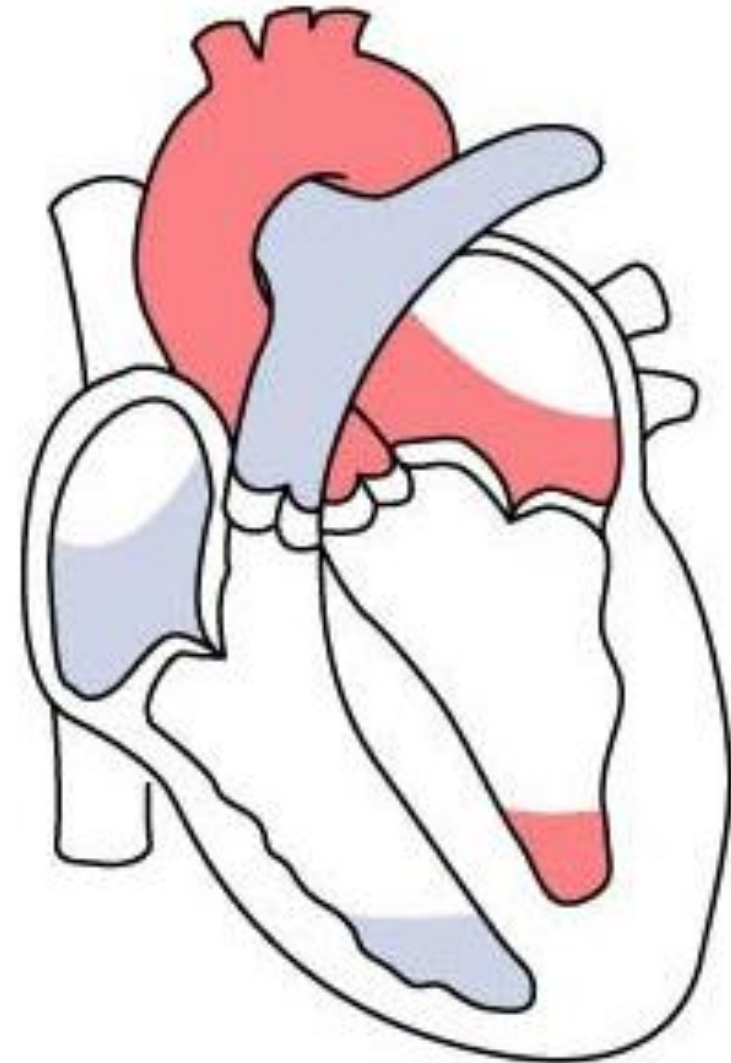


Stroke Volume

- Vol. ejected by a ventricle per cardiac cycle.
- *Stroke Volume* = *End diastolic volume* – *End systolic volume*
- $SV = EDV - ESV$
- **Stroke volumes of the ventricles must equilibrate!**

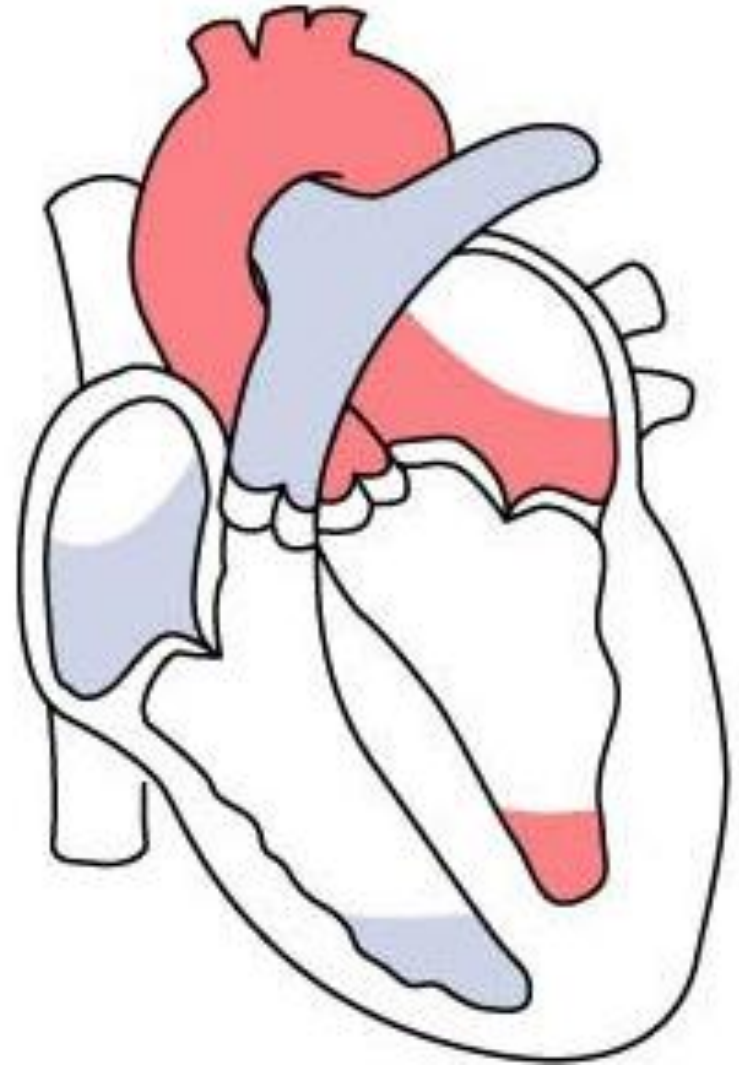
Isovolumetric Relaxation

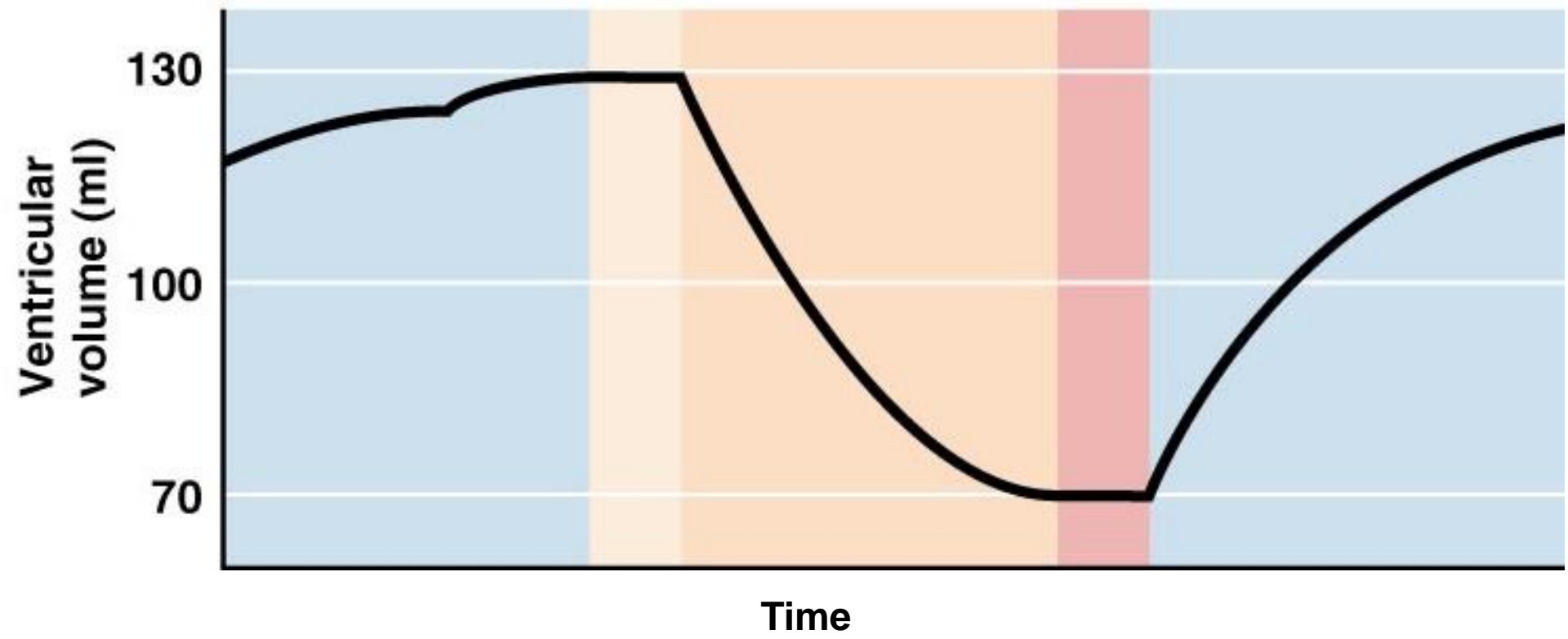
- LV relaxes and LVP...
- Aortic P is a lot higher than LAP.
- DUP

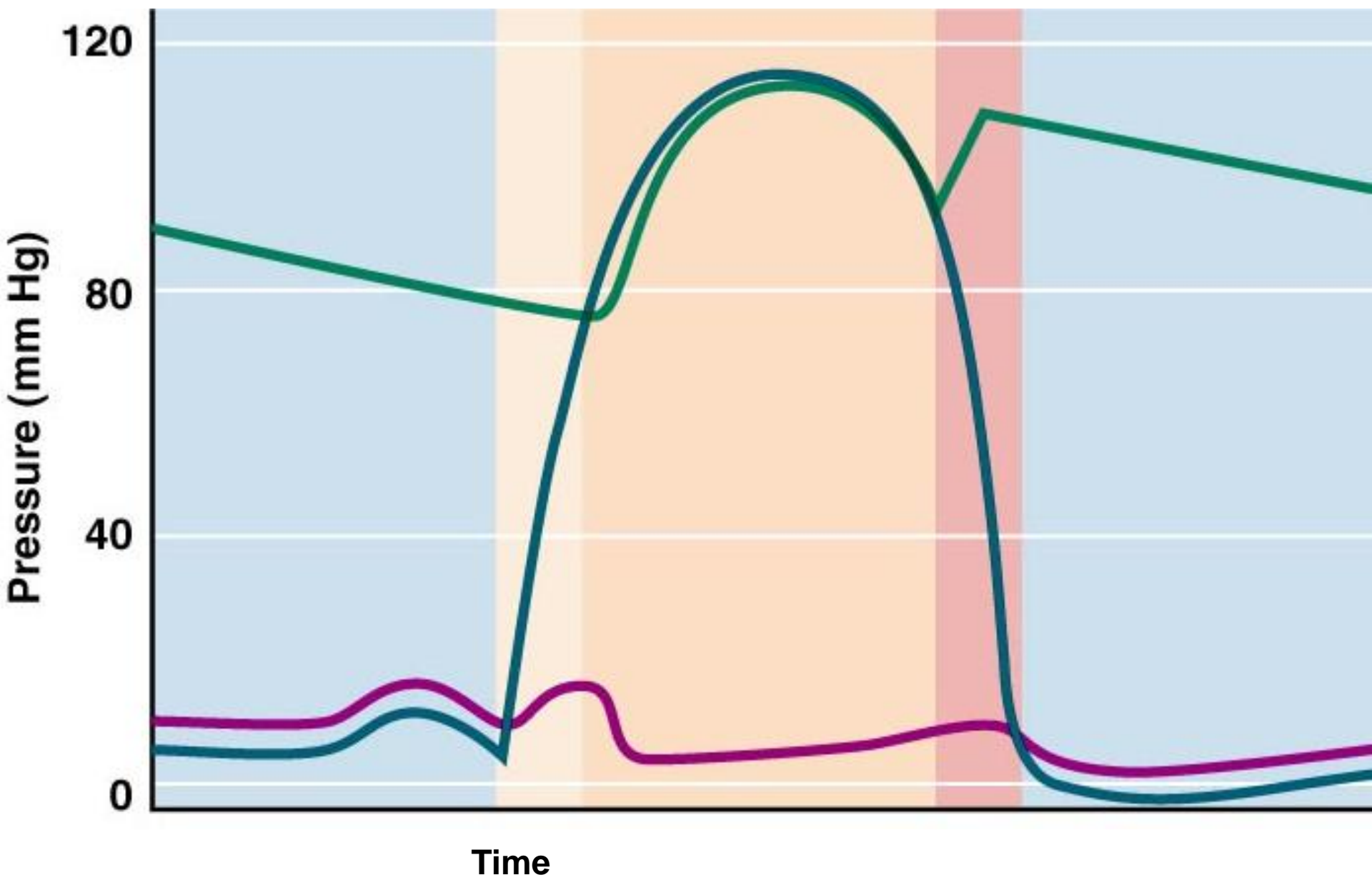


Isovolumetric Relaxation

- Mitral valve is...
- Aortic valve is...
- LV volume is...
- LVP is _____ LAP
- LVP is _____ Aortic P





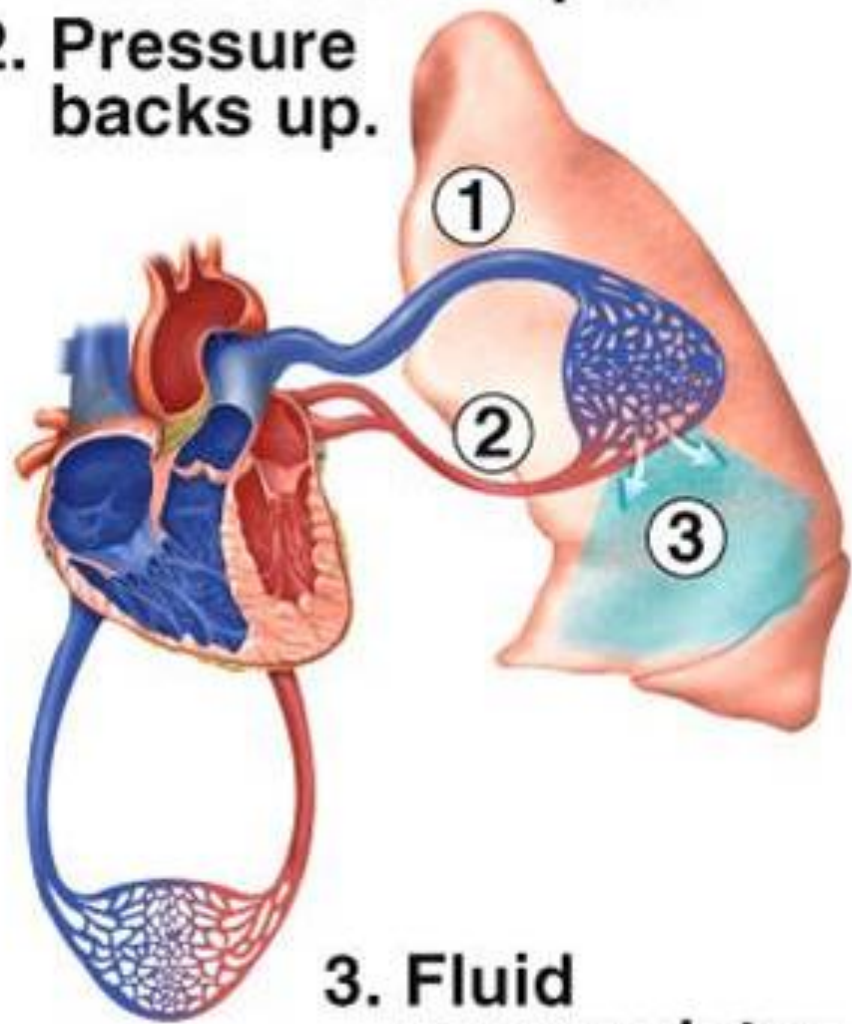


- Given that:
 - Aortic Pressure = 82mmHg
 - Left Atrium Pressure = 11mmHg
 - Left Ventricle Pressure = 61 mmHg and falling
- Answer the following:
 - The mitral valve is...
 - The tricuspid valve is...
 - The aortic semilunar valve...
 - The pulmonary semilunar valve is...
 - LV volume is...
 - LA volume is...
 - The current phase of the cardiac cycle is...
 - The previous phase of the cardiac cycle was...
 - The next phase of the cardiac cycle will be...
 - The most recent heart sound was caused by...
 - The next heart sound will be caused by...

Cardiac Output

- Volume of blood pumped by a ventricle per minute.
- *Cardiac Output = Heart Rate x Stroke Volume*
- Units are mL/min or L/min.

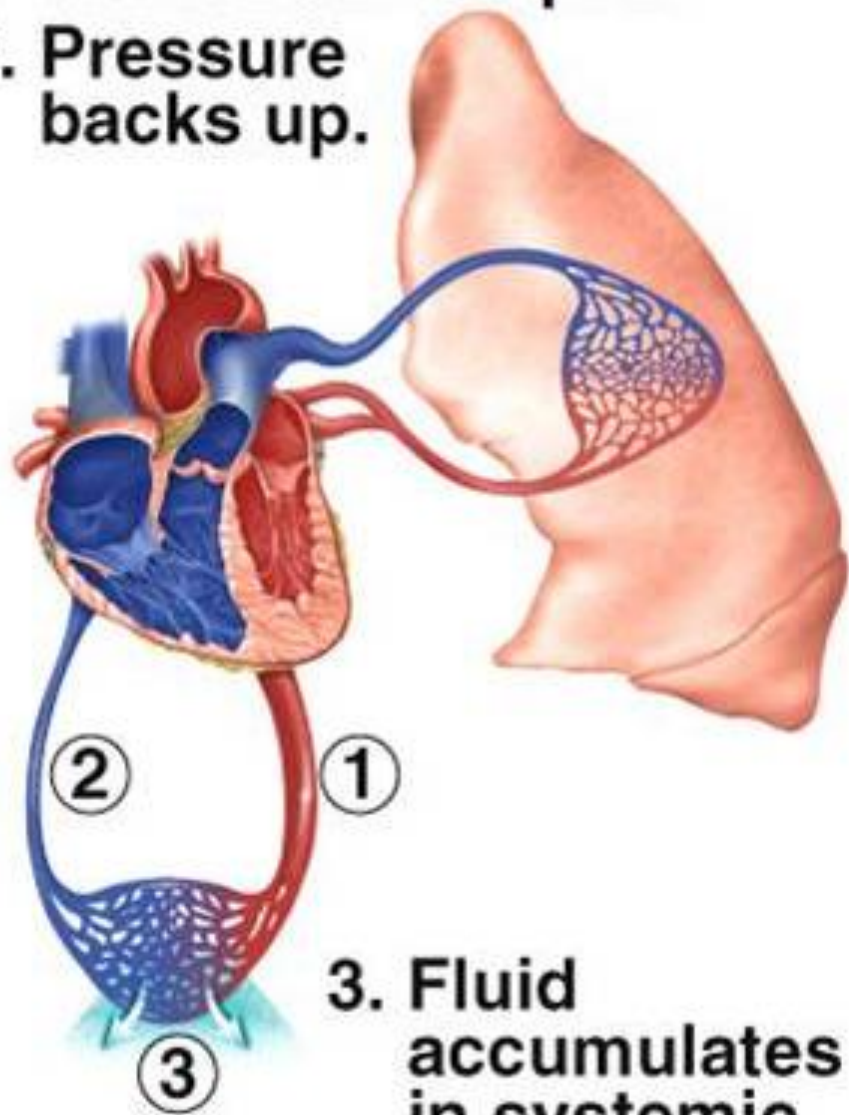
1. Right ventricular output exceeds left ventricular output.
2. Pressure backs up.



3. Fluid accumulates in pulmonary tissue.

(a)

1. Left ventricular output exceeds right ventricular output.
2. Pressure backs up.



3. Fluid accumulates in systemic tissue.

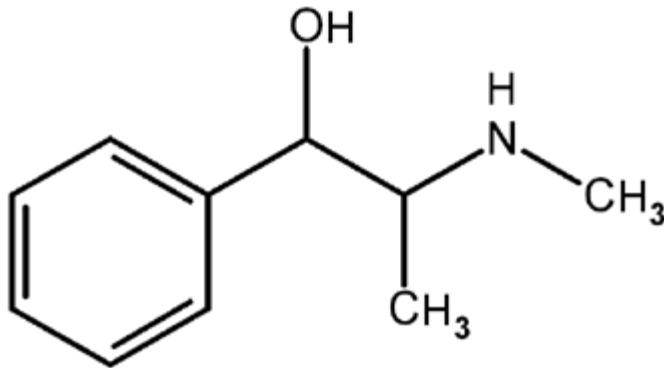
(b)

Hector had a cardiac output of 6000 mL and a heart rate of 100 beats/minute. How much blood left his heart during each cardiac cycle?

- a) 58.6 mL
- b) 62 mL
- c) 100 mL
- d) 110 mL
- e) 120 mL

Heart rate will increase when...

- Cardioacceleratory activity...
- Cardioinhibitory activity...
- Plasma levels of epinephrine...
- Plasma levels of thyroxine...



Heart rate will decrease when...

- Cardioacceleratory activity...
- Cardioinhibitory activity...

- Plasma levels of epinephrine...
- Plasma levels of thyroxine...



- If heart rate increases:
 - *The time between beats will...*
 - *Filling time will...*
 - *The end diastolic volume will...*

- If heart rate decreases:
 - *The time between beats will...*
 - *Filling time will...*
 - *The end diastolic volume will...*

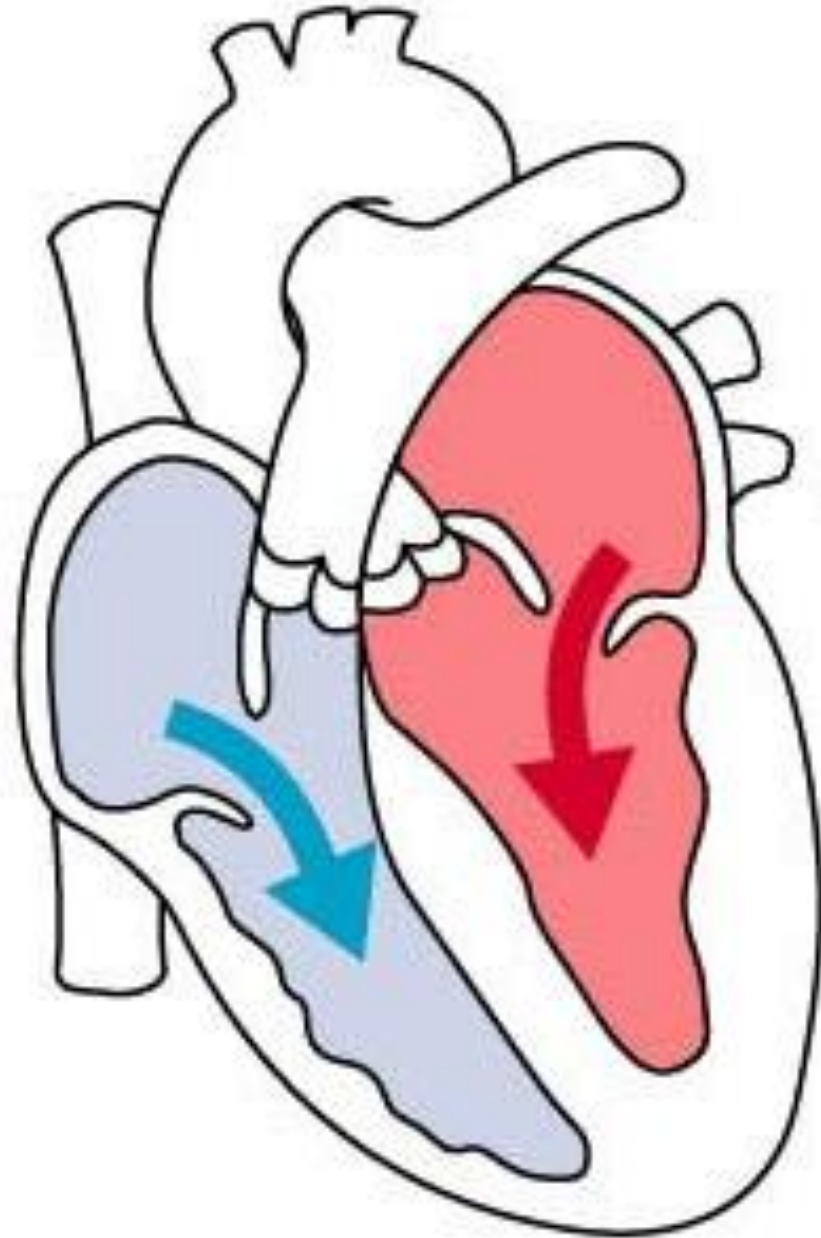
Regulating Stroke Volume

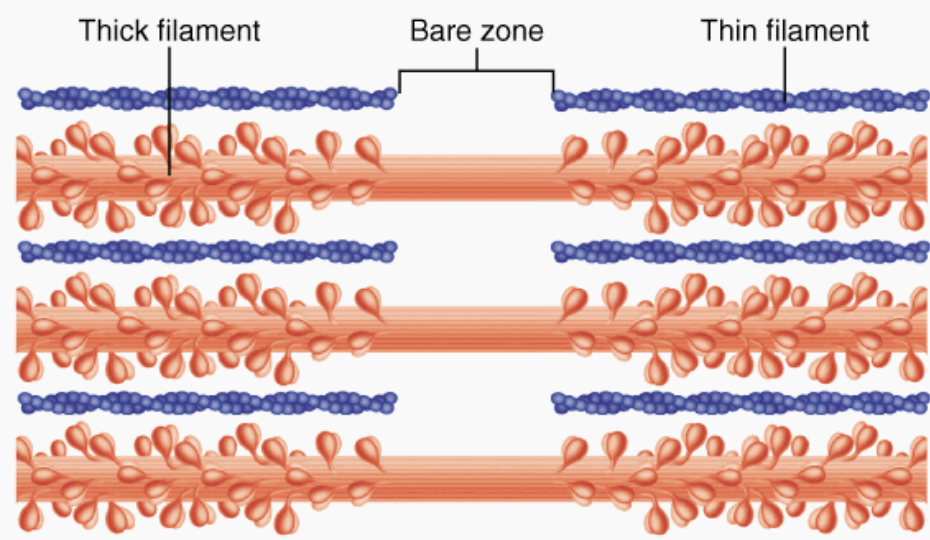
- Primary influence on stroke volume is:
 - Preload

- Other important influences are:
 - Contractility
 - Afterload

Preload

- Degree of ventricular stretch.
- *What stretches the ventricle?*





More blood returns to the heart.



Ventricular stretch...



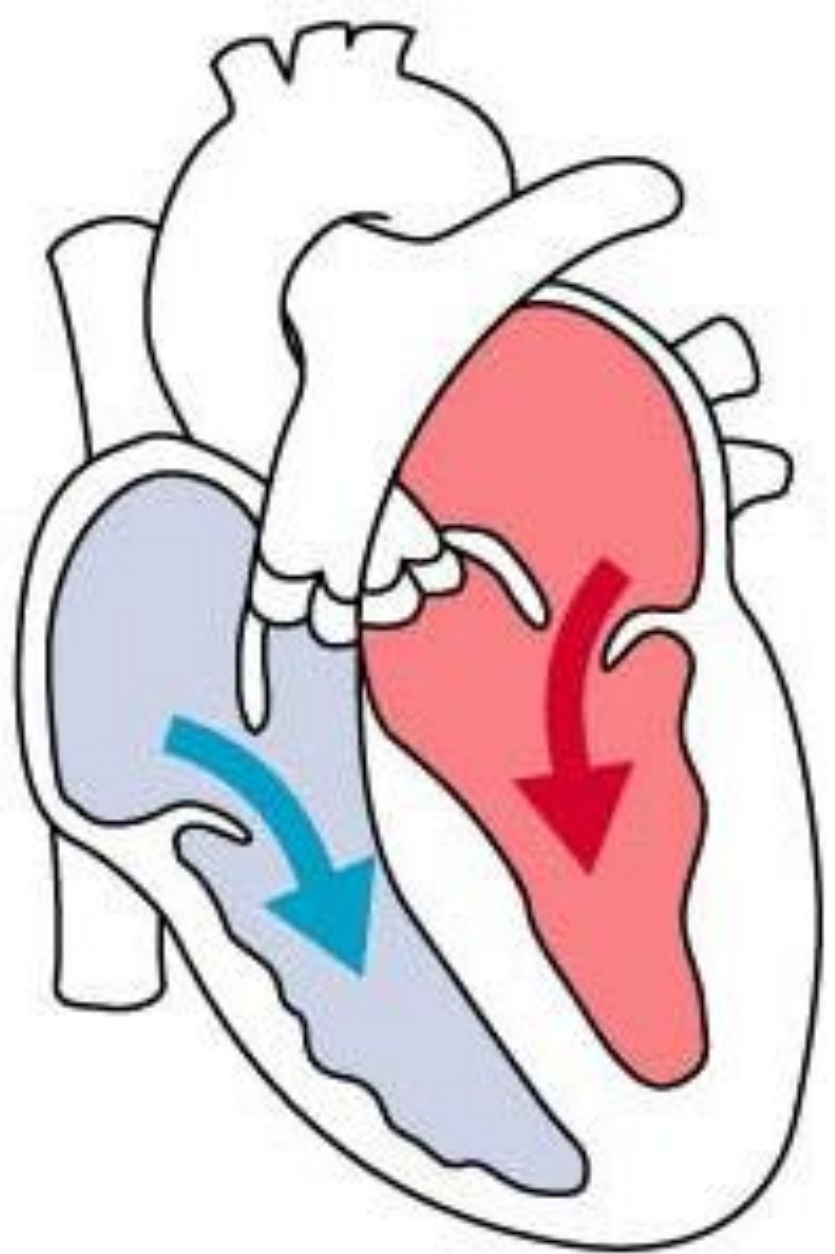
Overlap between actin & myosin gets...



Ventricular tension...

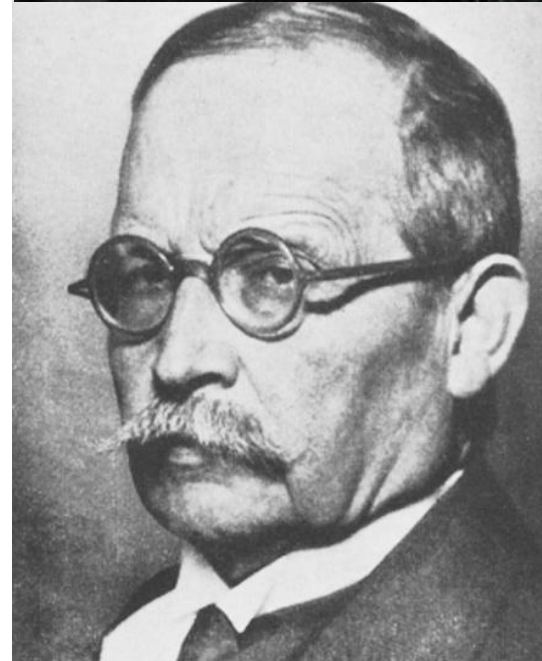


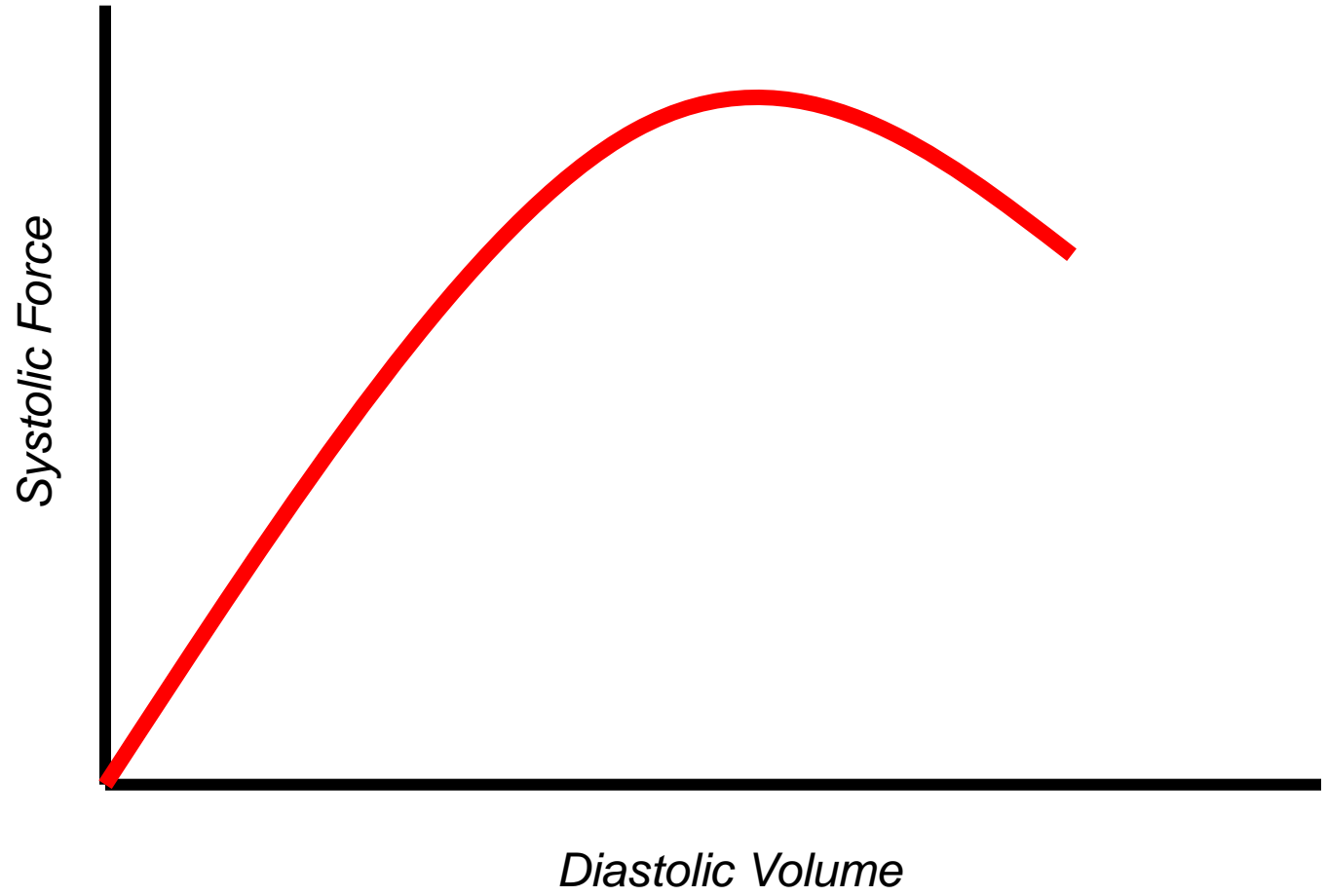
Stroke volume...



Frank-Starling Law of the Heart

- Whatever goes in the heart gets pumped out.
- *What's the relationship btwn SV and EDV?*
- *How does the FS Law account for the fact that LV and RV have the same average stroke volume?*

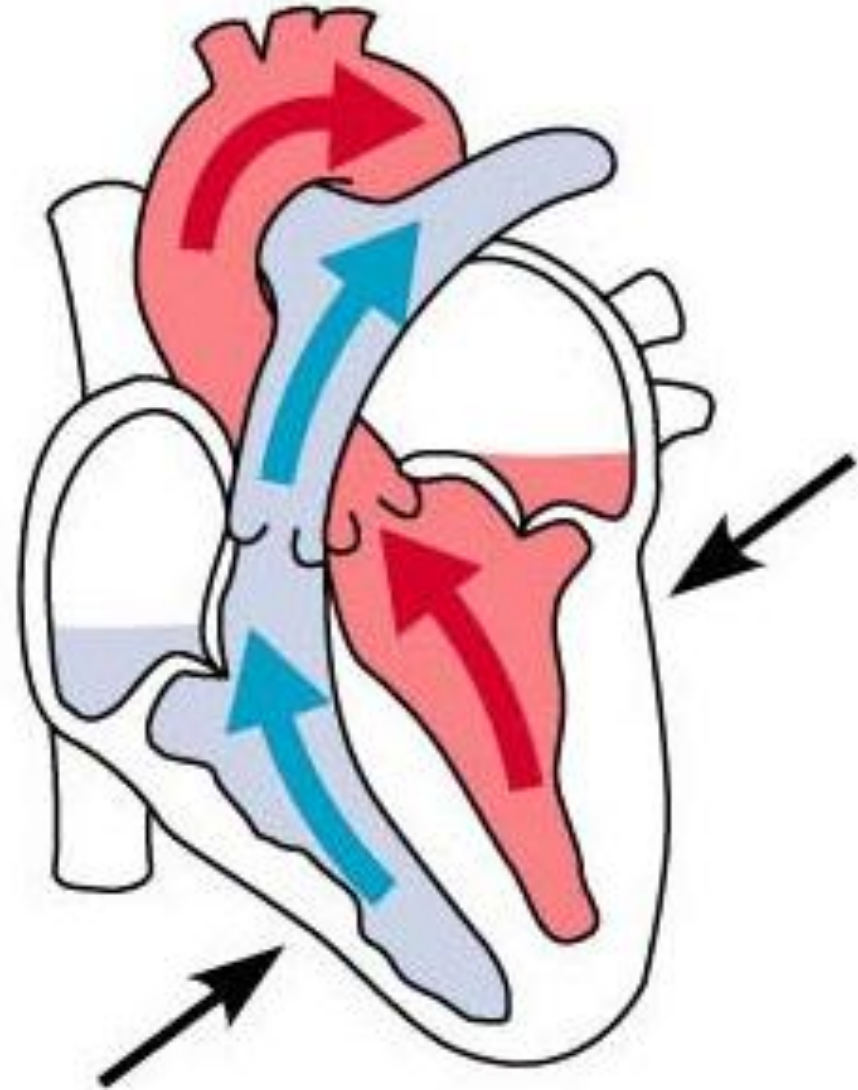




- *As EDV decreases, SV will...*
- *As HR increases, SV will...*
- *As venous pressure increases, SV will...*

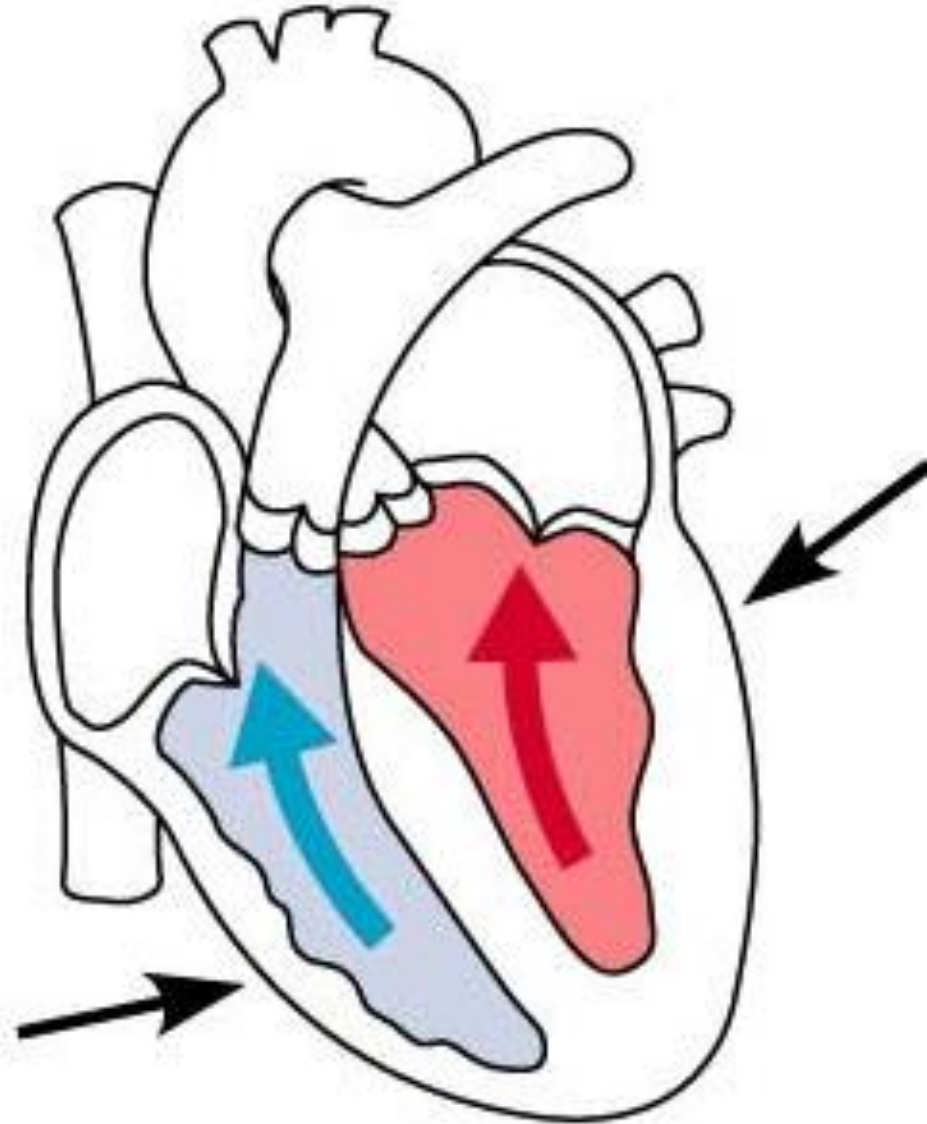
Contractility

- Strength of ventricular squeezing regardless of how stretched it is.
- ↑ in contractility SV to...
- *What affects contractility?*



Afterload

- Pressure that the LV must overcome in order to open the semilunar valve and eject blood.
- Aortic blood pressure.



Suppose Aortic P is high:

- *Will it be easy to open the aortic semilunar valve?*
- *How would this affect the amount of blood pumped out?*
- *How would this affect ESV?*

