

Physiology of the Heart



https://www.youtube.com/watch?v=Yns_tkOHIbw

What you should already have learned about...

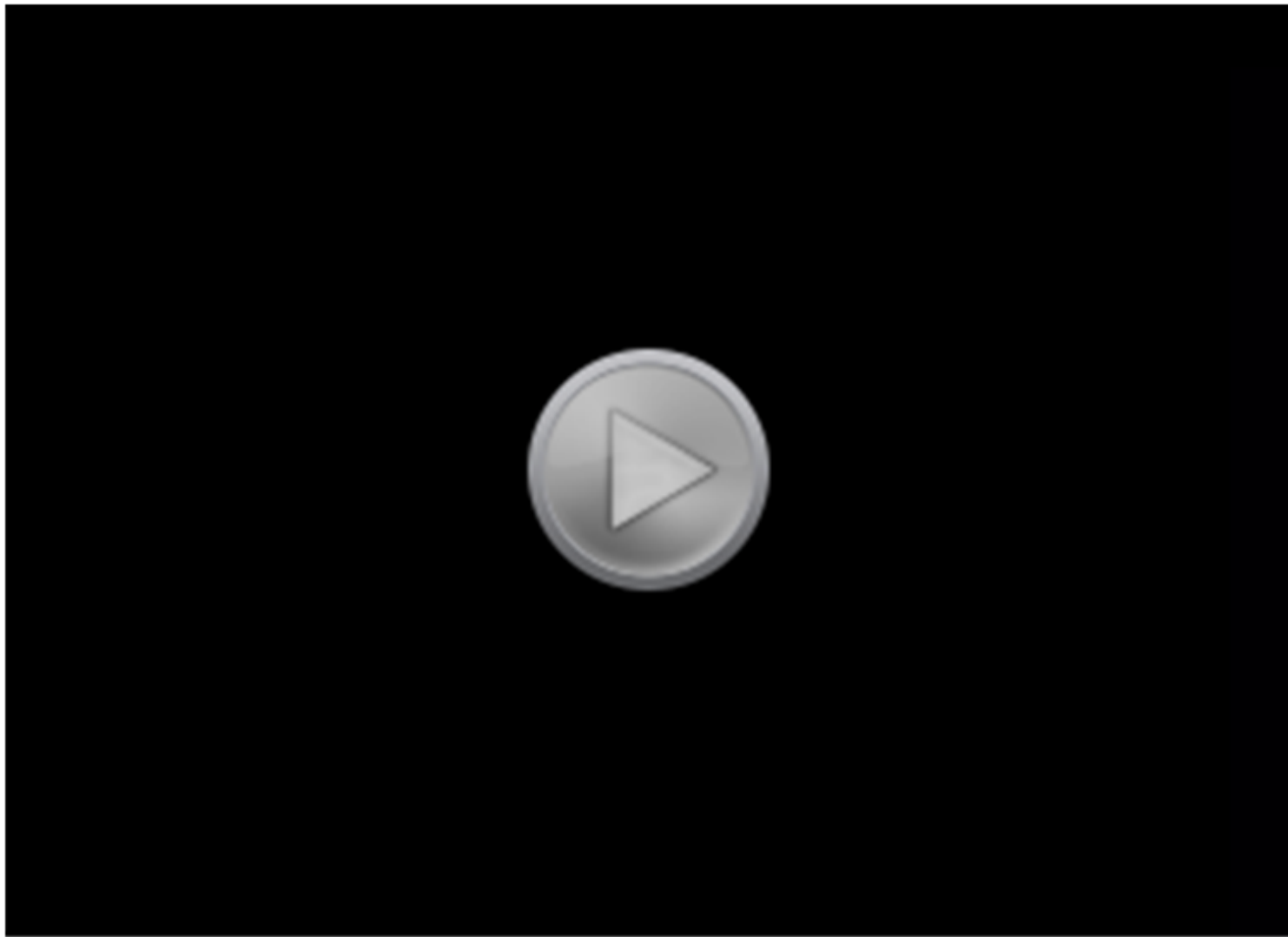
1. Parts of blood
2. Functions of blood
3. Parts of heart
4. Pulse / Heart Rate

About those valves....

The purpose of the valves is to direct blood flow and prevent 'backflow'.

- AV Valves are open until the ventricles contract. The contraction snaps the AV valves shut. The chordae tendinae prevent the cusps from going into the atrium.
- The semilunar valves are closed until the contraction of the ventricles push blood against the valve forcing them open. When the ventricle relaxes, the blood pushes backward closing the valve again.

Valves Opening and Closing in the Heart



https://www.youtube.com/watch?v=Rj_qD0SEGGk

I 'lub' You!

The heart makes a familiar 'lub-dub' sound as the chambers contract and the valves close.

'Lub' = ventricles contract and AV valves close (this is longer and has a slower pitch)

'Dub' = ventricles relax and semilunar valves close

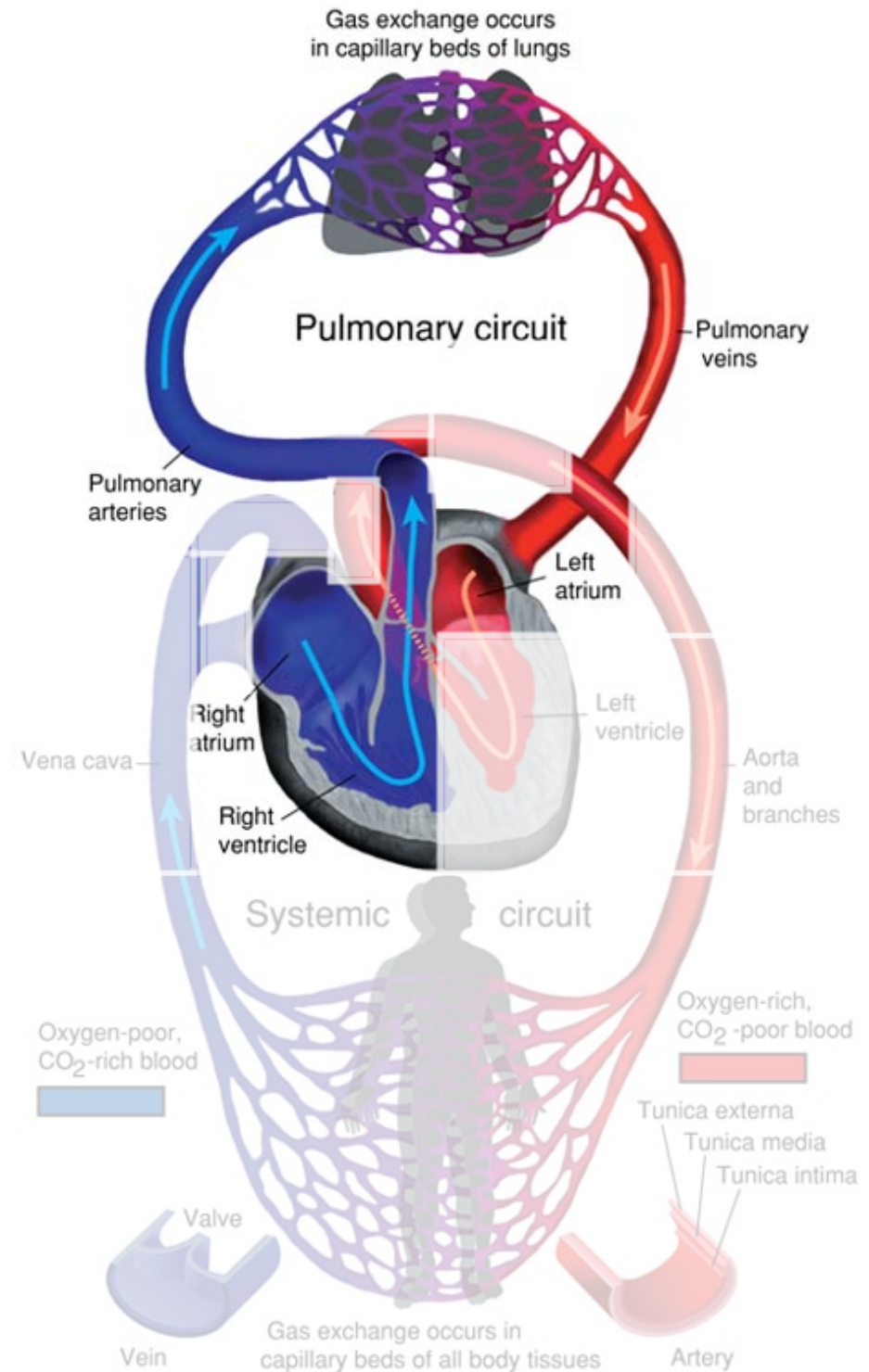
Bill 'lub's you too!



https://www.youtube.com/watch?v=riDPxasIz_I

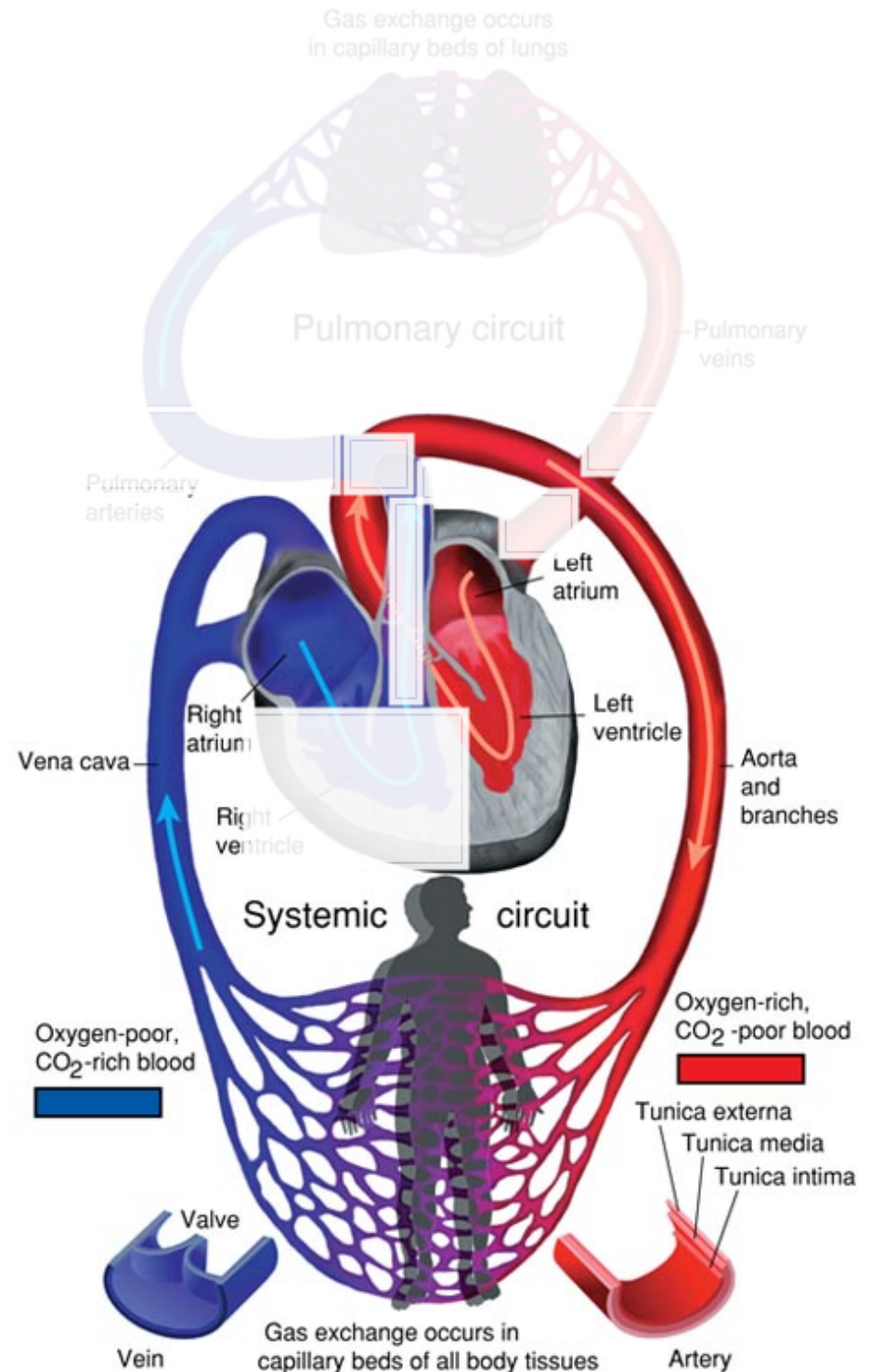
Just a quick review...

The pulmonary circuit involves the blood starting at the right atrium and making its way to the lungs to exchange carbon dioxide for oxygen and then making its way to the left atrium.



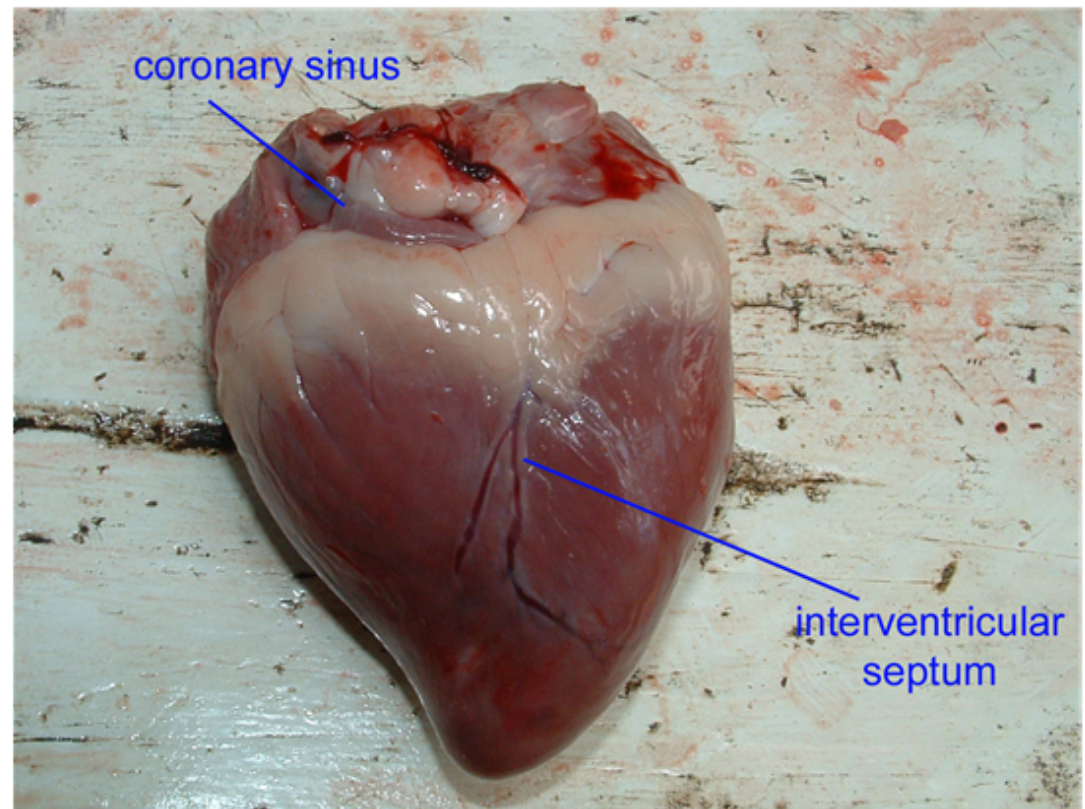
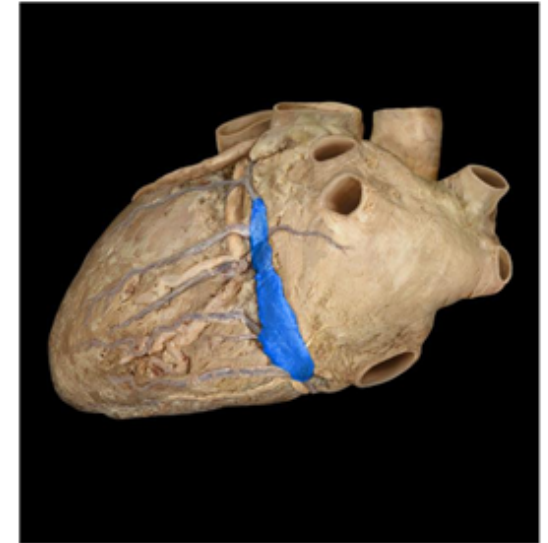
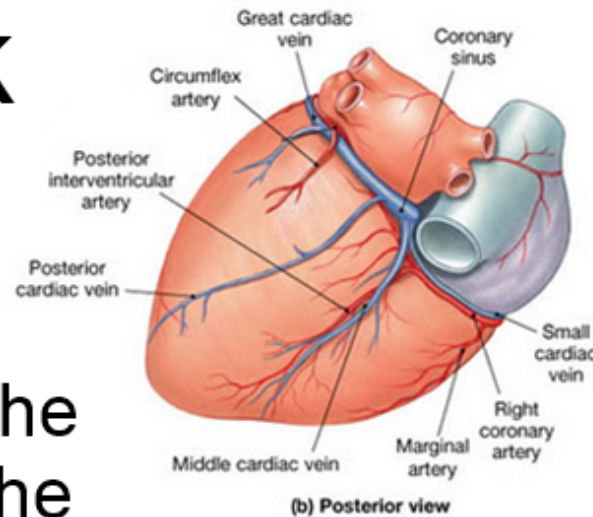
Just a quick review...

The systemic circuit is the blood starting at the left atrium and making its way through the body and back to the right atrium.



Just a quick review...

The coronary circuit is the blood leaving through the coronary arteries (the base of the aorta) and supplying blood to the surface of the heart. It filters back into the coronary sinus by the cardiac veins. The coronary sinus deposits the blood that was used in the coronary circuit into the right atrium.

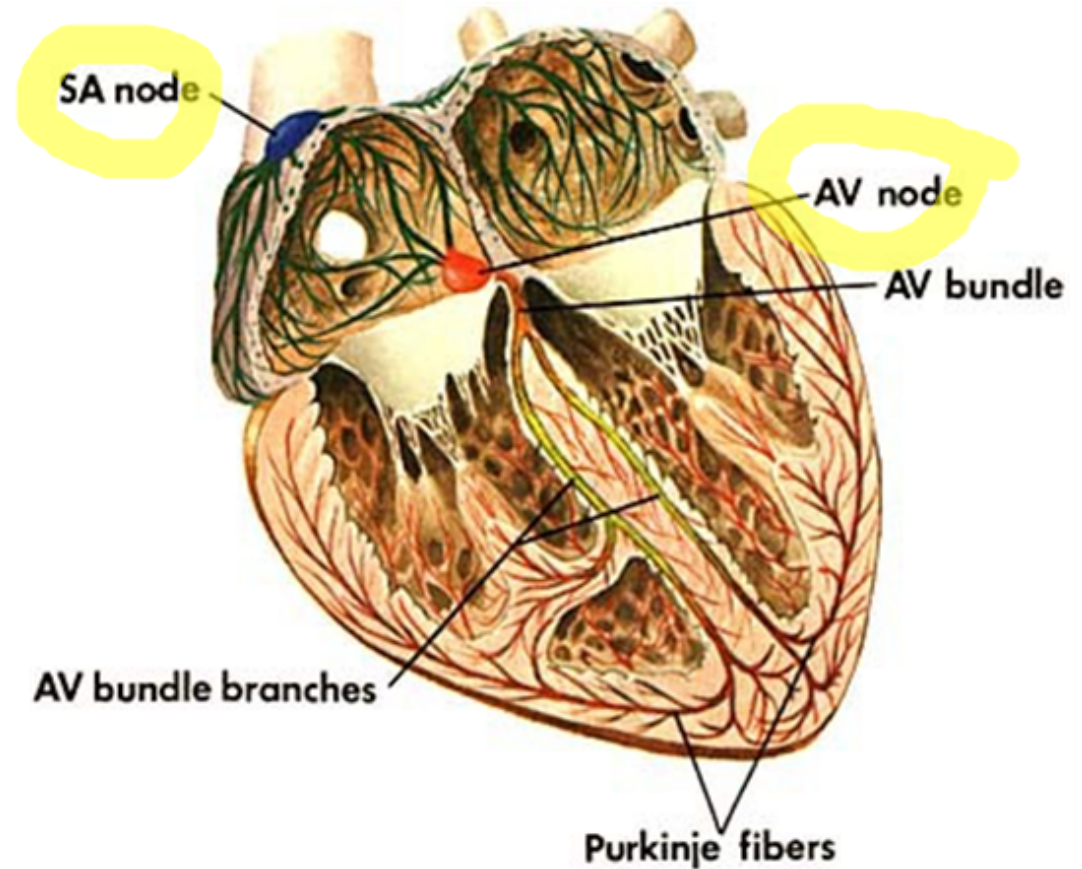


Conduction System of the Heart

- a route of specialized cardiac muscle fibers that initiate and stimulate contraction of the atria and ventricles
- intrinsic - the heart beats automatically without external nervous system stimulation
- coordinates the contraction of the atria and ventricles so that the heart is an effective pump (without the conduction system, the atria and ventricles would contract at different rates)

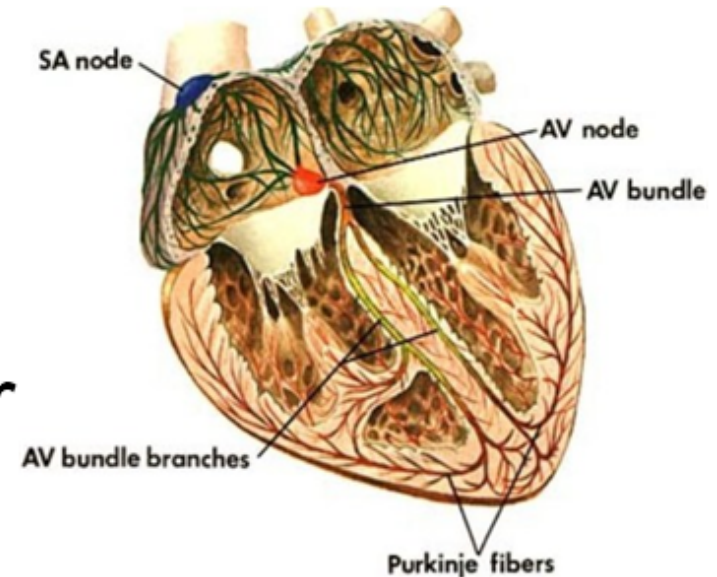
Nodal Tissue

- has characteristics of both muscle and nervous tissue
- controls heartbeat
- is located in two parts of the heart; the SA node and the AV node



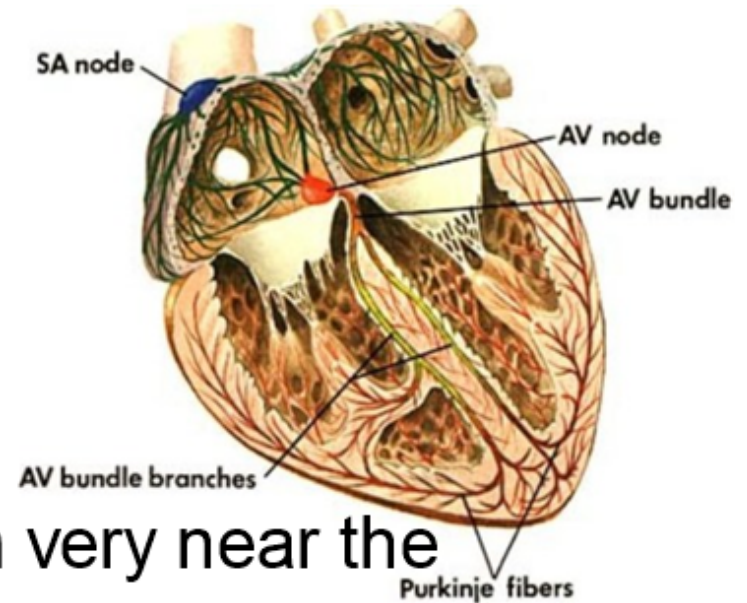
Nodal Tissue

- SA (Sinoatrial) Node
- located in the upper posterior wall of the right atrium
- initiates the heartbeat and sends out an impulse every .85 seconds
- normally functions as the pacemaker for the entire heart because its intrinsic rate is the fastest in the system
- causes atria to contract

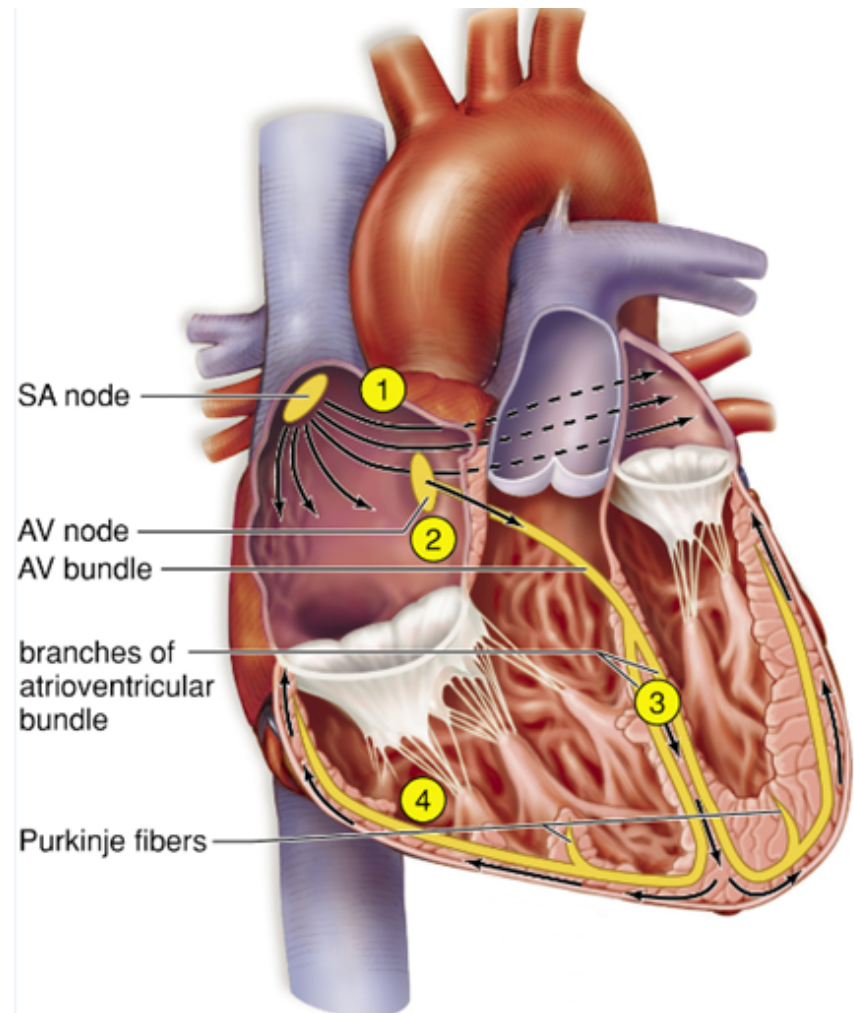


Nodal Tissue

- AV (Atrioventricular) Node
- located in the base of the right atrium very near the interatrial septum
- when impulse from SA reaches AV node, there is a slight delay to allow the atria to finish contracting and then the ventricles begin contraction
- the signal for the ventricles to contract travels from the AV node to the two branches of the atrioventricular bundle (AV Bundle) before reaching the Purkinje Fibers (special cardiac muscle fibers that spread the electrical current throughout ventricles) and the ventricle contracts



1. The SA node sends out a stimulus causing the atria to contract.
2. When the stimulus reaches the AV node, it passes through the atrial wall to the AV bundle.
3. Impulses pass down the two branches of the atrioventricular bundle to the Purkinje fibers in the apex of the heart.
4. After the stimulus reaches the Purkinje fibers, the ventricles contract.



Video of Contraction of the Heart through the Conduction System of the Heart



<https://www.youtube.com/watch?v=fZT9vlbL2uA>

The Cardiac Cycle

- includes all of the events that occur during a heartbeat
- both atria contract at the same time (stimulated by the AV node)
- both ventricles contract at the same time (Stimulated by the SA node conducting through atrioventricular bundle to Purkinje Fibers)
- Systole = contraction of the heart muscle
- Diastole = refers to the relaxation of the heart muscle
- During the cardiac cycle, atrial systole is followed by ventricular systole

The Cardiac Cycle

cont.

- Phase 1 - Atrial Systole = about .15s, both atria are contracting and ventricles are relaxed, blood pressure in the atria forces the blood to enter ventricles through the AV valves (both AV valves are open at this time and semilunar valves are closed), this phase ends when the AV valves close (closure is caused by rising blood pressure from blood filling ventricles), this is the 'lub' in the heartbeat sound

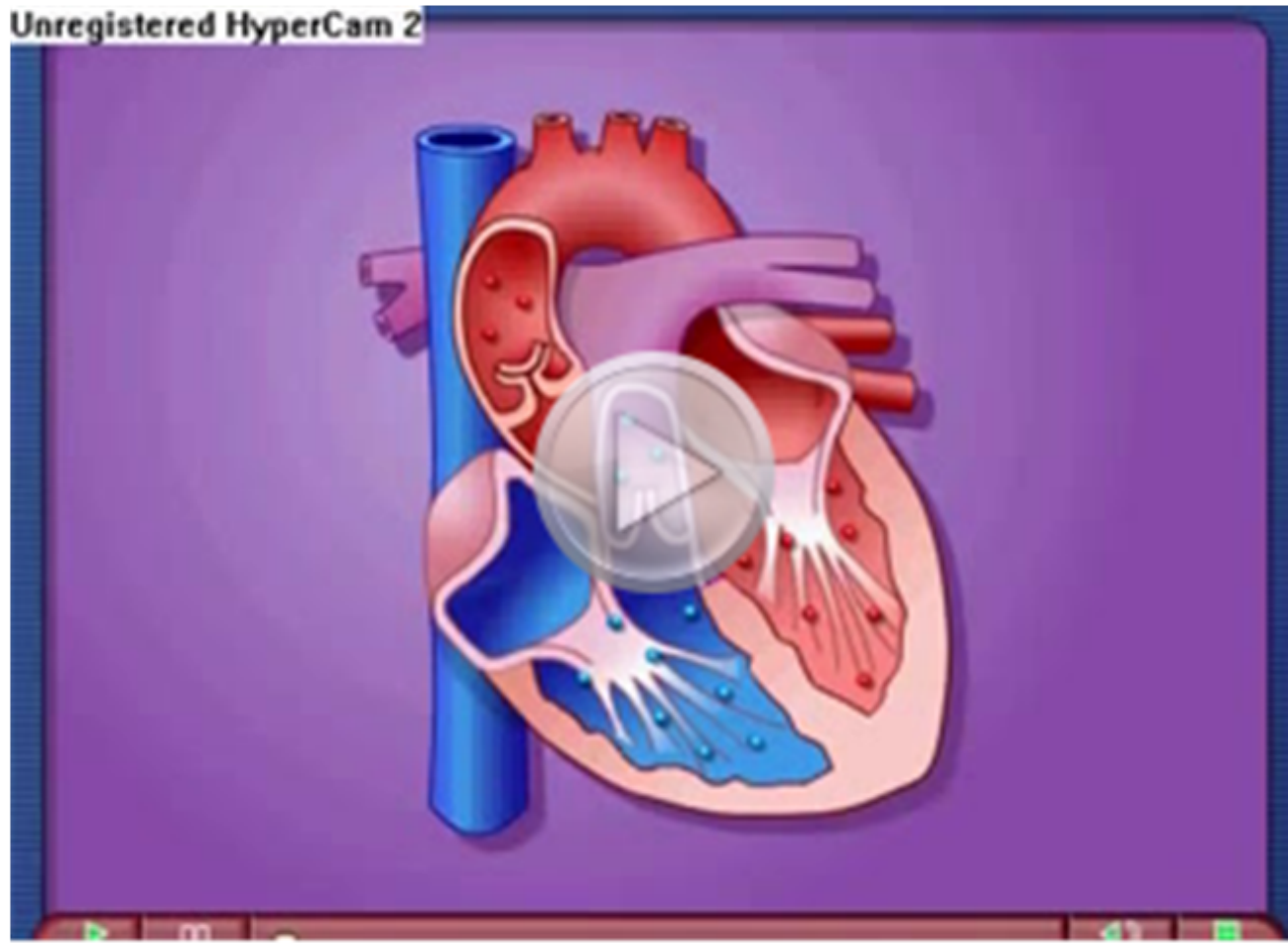
The Cardiac Cycle cont.

.Phase 2 - Ventricular Systole = about .30s, both ventricles are contracted and atria are relaxed, rising blood pressure causes semilunar valves to open, blood in right ventricle exits through the pulmonary artery trunk to the right and left pulmonary arteries as blood in the left ventricle exits into the aorta, closure of the semilunar valves (end of ventricular systole) causes the 'dup' sound of heartbeat

The Cardiac Cycle cont.

• Phase 3 - Atrial and Ventricular Diastole = .40s, both atria and ventricles are relaxed, pressure in all chambers is low, blood returning to the heart from the venae cavae and the pulmonary veins fills the right and left atria and flows passively into the ventricles, both AV valves are open and semilunar valves are closed

The Cardiac Cycle Video



<http://www.youtube.com/watch?v=jLTdgrhpDCg>

Blood Pressure

Blood pressure is the amount of force exerted on the blood vessels when the heart pumps blood. We want to stay below 120/80.



Systolic Pressure
(pressure when the
atrium contracts)

Diastolic Pressure
(pressure when the
atrium relaxes)

High Blood Pressure = Hypertension 140/90

Low Blood Pressure = Hypotension 90/60