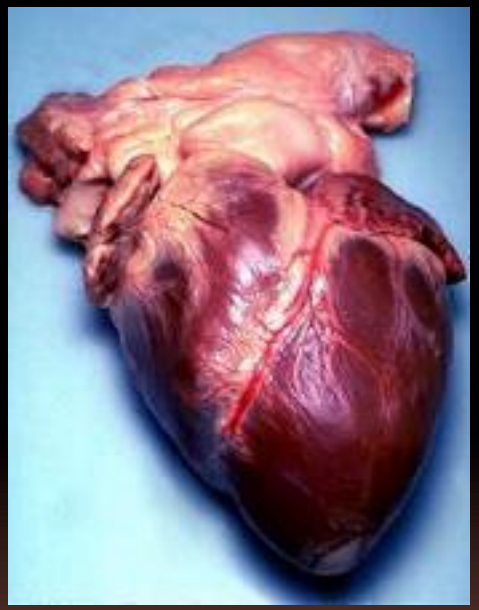
Chapter 14

THE HEART

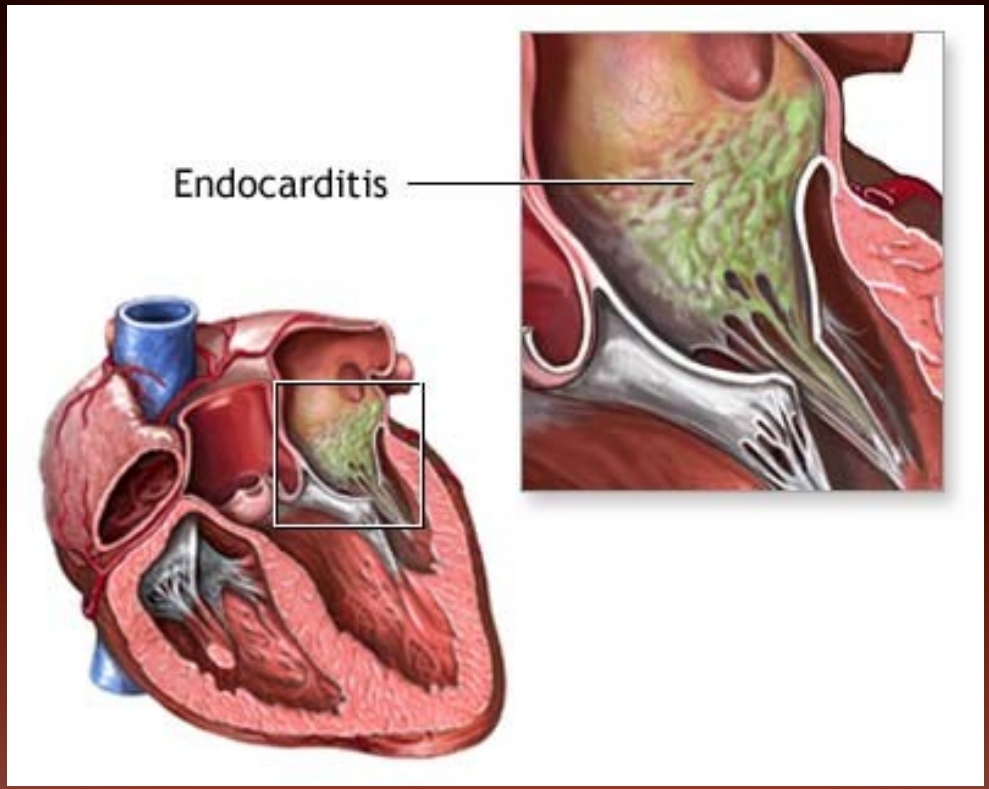
Layers of the Heart

- **Endocardium**
- **Myocardium**
- **Epicardium**



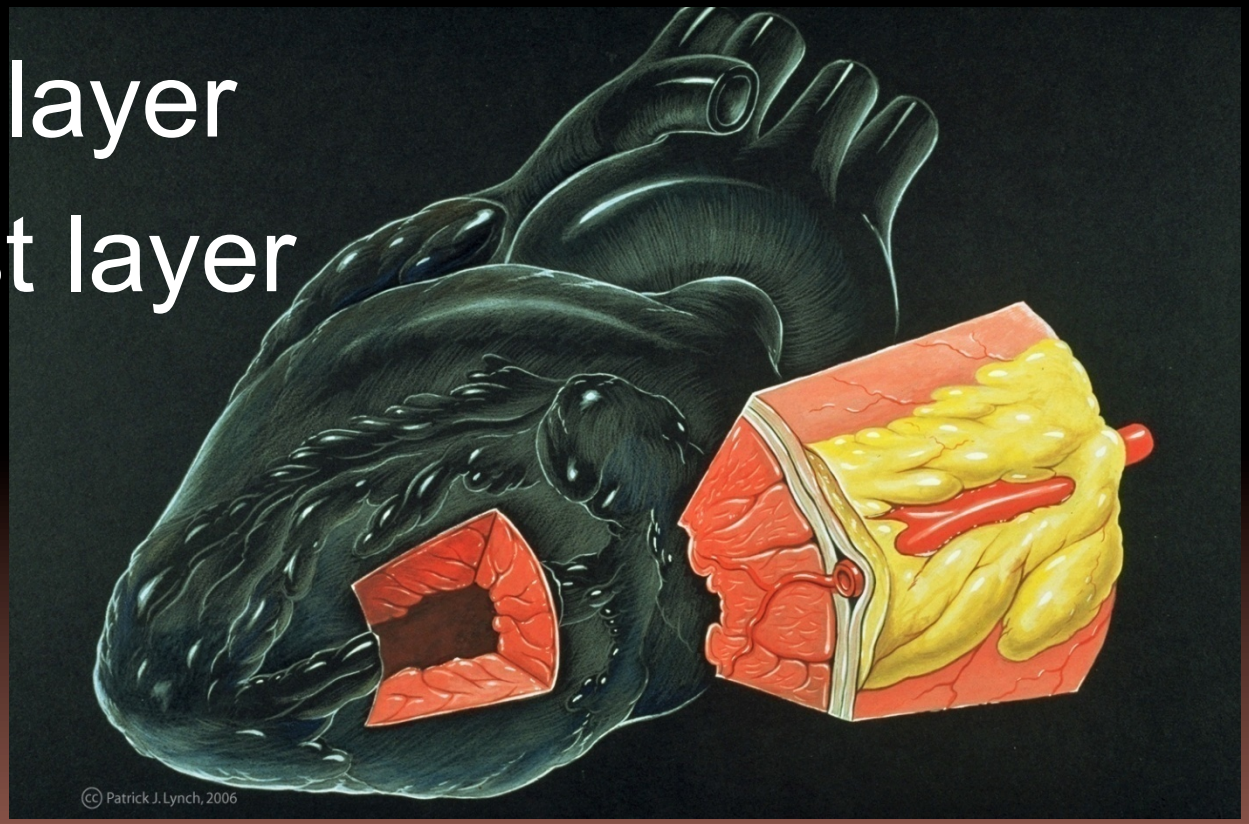
Layers of the Heart

- **Endocardium**
  - Smooth layer
  - Lines the interior
  - Valves are made from this layer



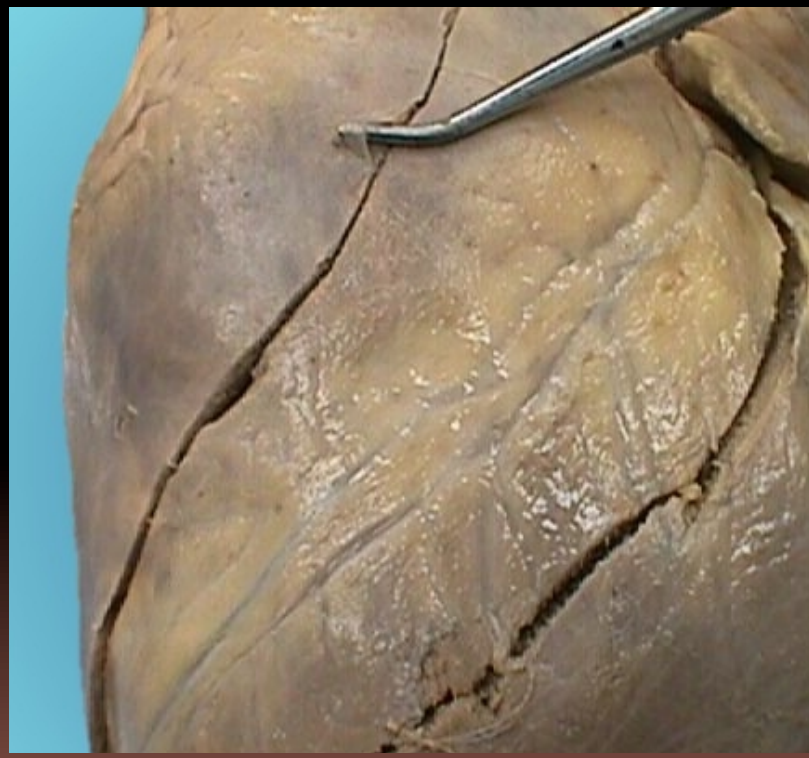
Layers of the Heart

- **Myocardium**
  - Muscle layer
  - Thickest layer



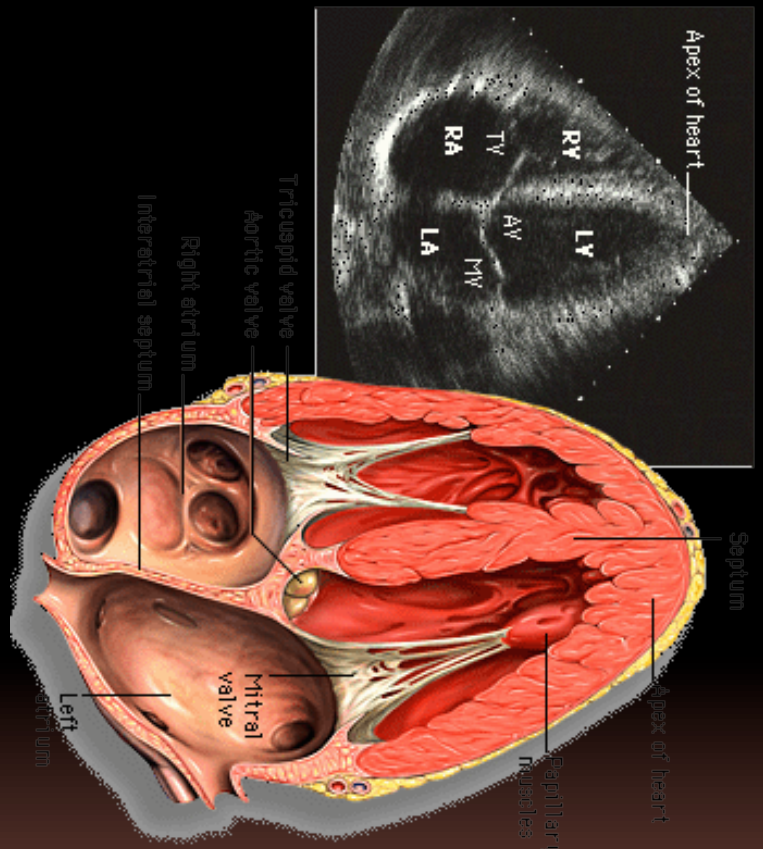
Layers of the Heart

- **Epicardium**
  - Thin, outermost layer
  - Joins with serous lining outside the heart to form the **pericardium**



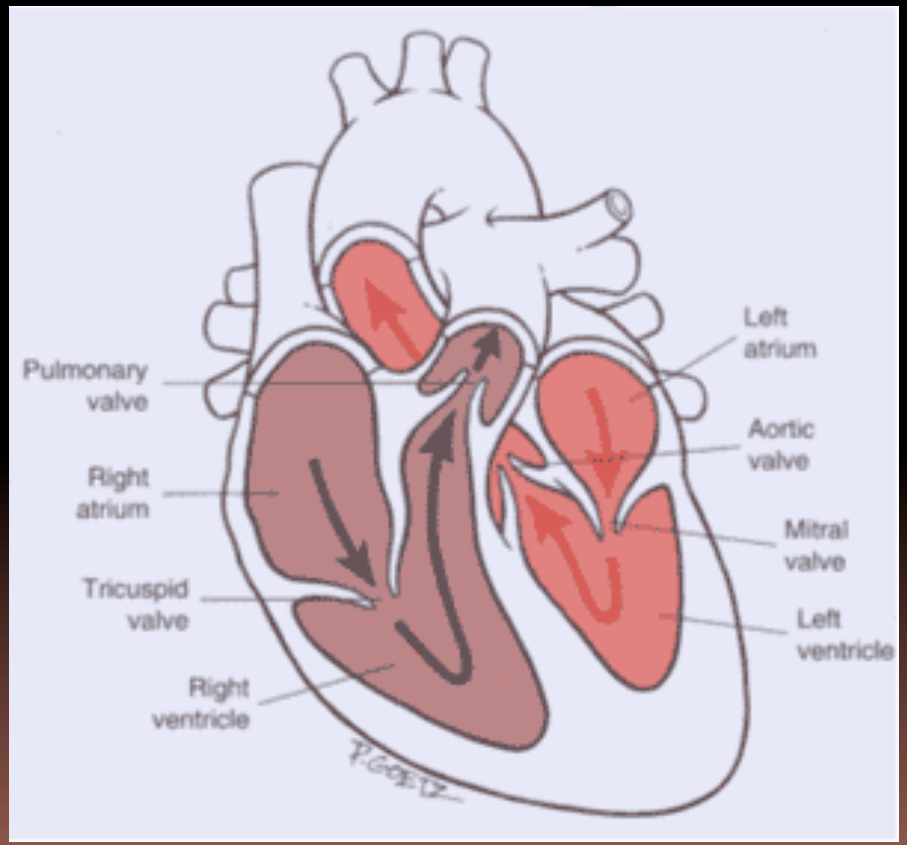
Septum

- Separates the left and right heart
- **Interatrial** – top part of the septum
- **Interventricular** – bottom part of the septum



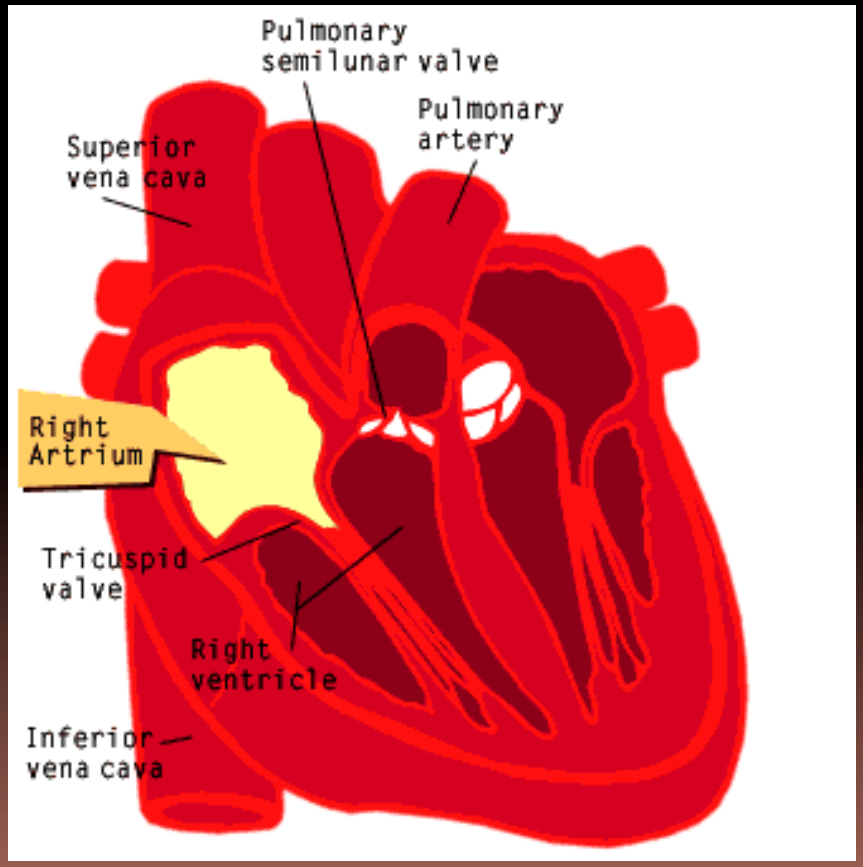
The Four Chambers

- **Right Atrium**
- **Right Ventricle**
- **Left Atrium**
- **Left Ventricle**



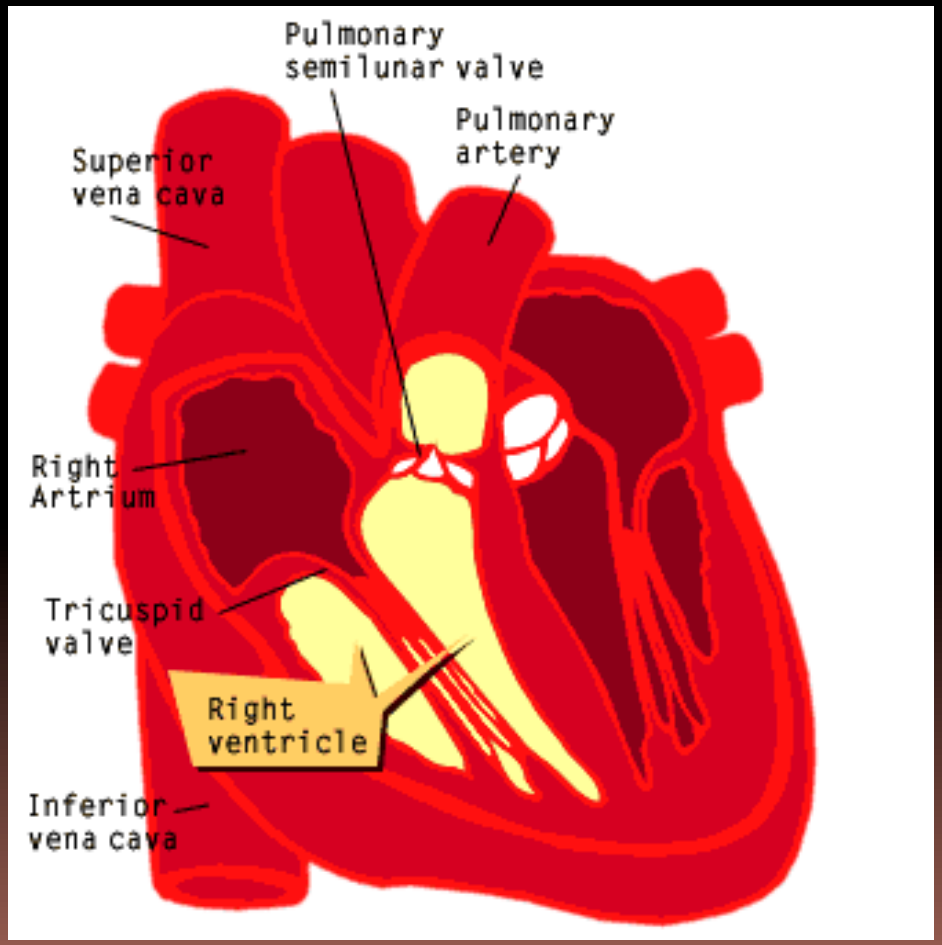
The Four Chambers

- **Right Atrium** – receives blood from the superior and inferior vena cava



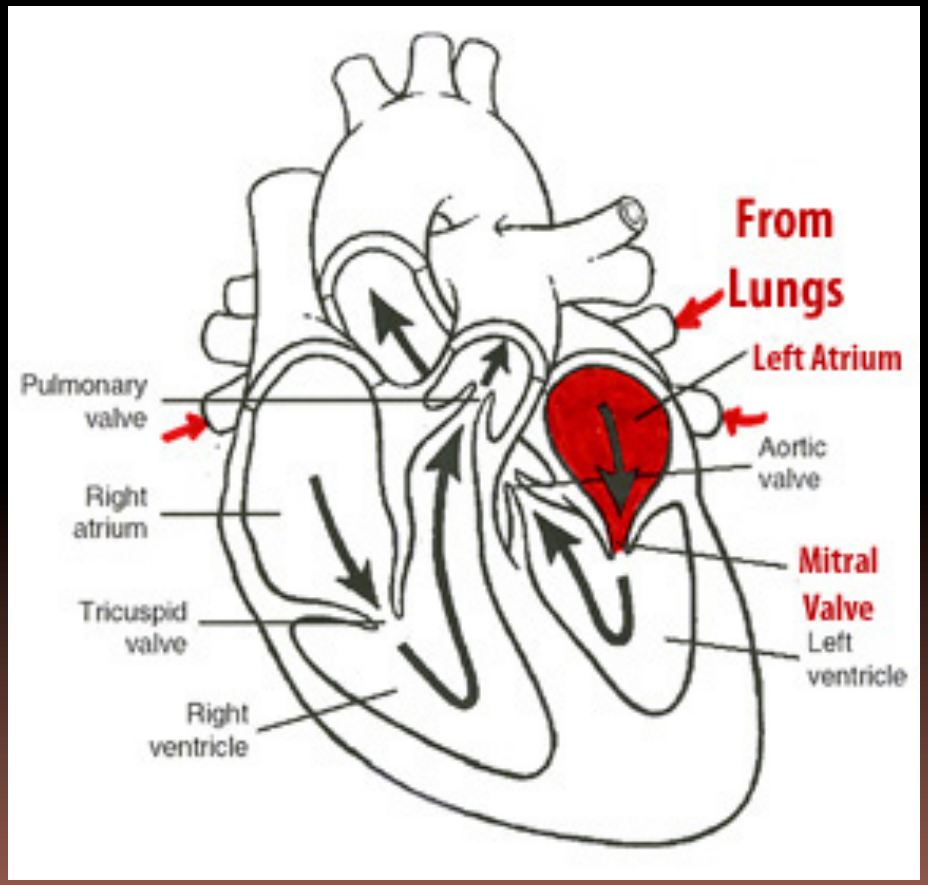
The Four Chambers

- **Right Ventricle** – pumps blood to the lungs



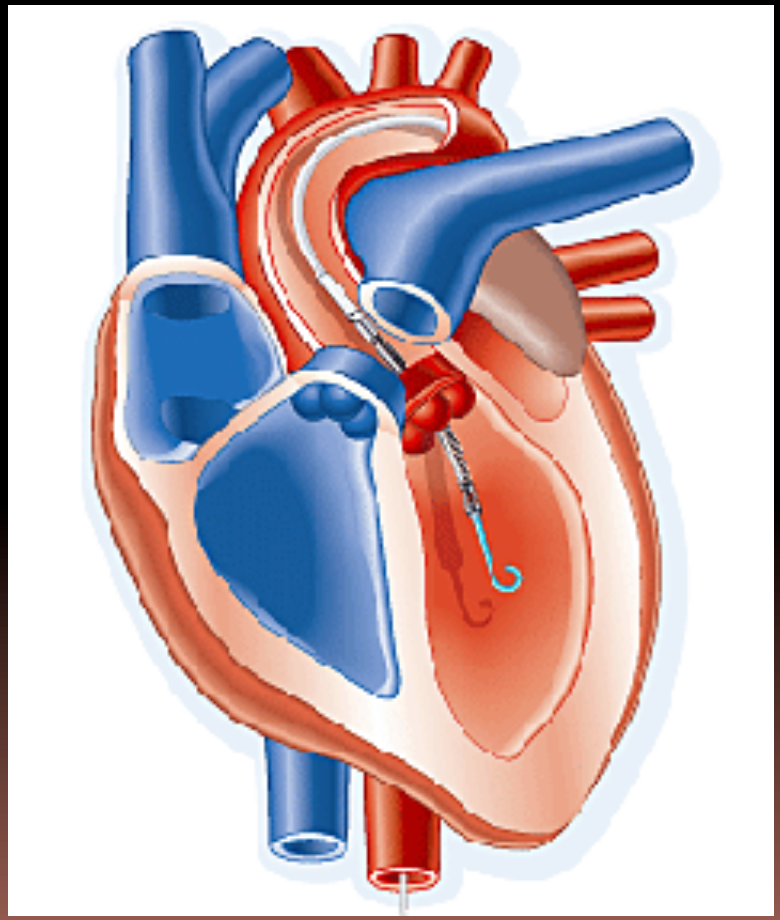
The Four Chambers

- **Left Atrium** – receives oxygenated blood from the lungs



The Four Chambers

- **Left Ventricle** – pumps oxygenated blood to the rest of the body, strongest chamber

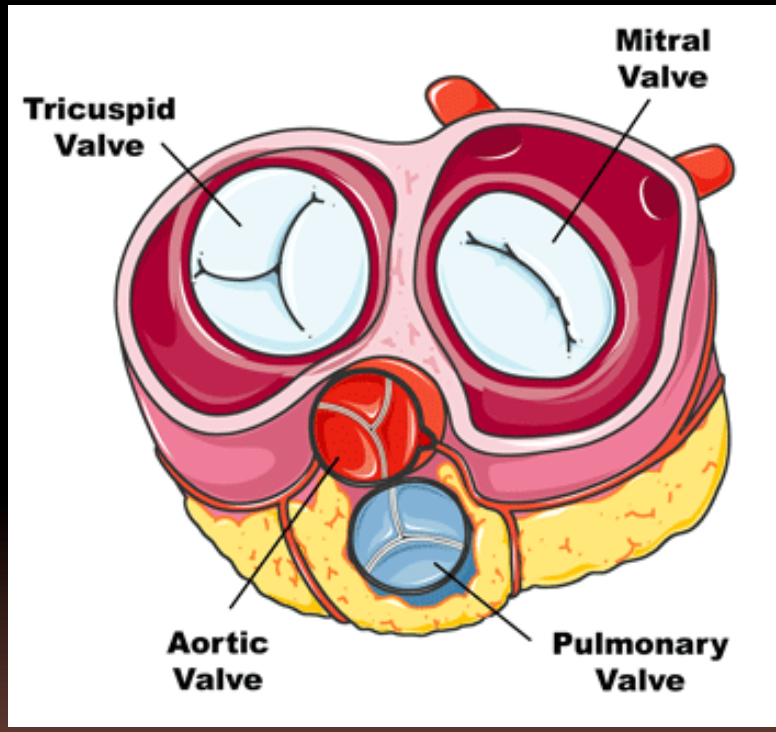


Valves

- Valves allow blood to flow in only one direction

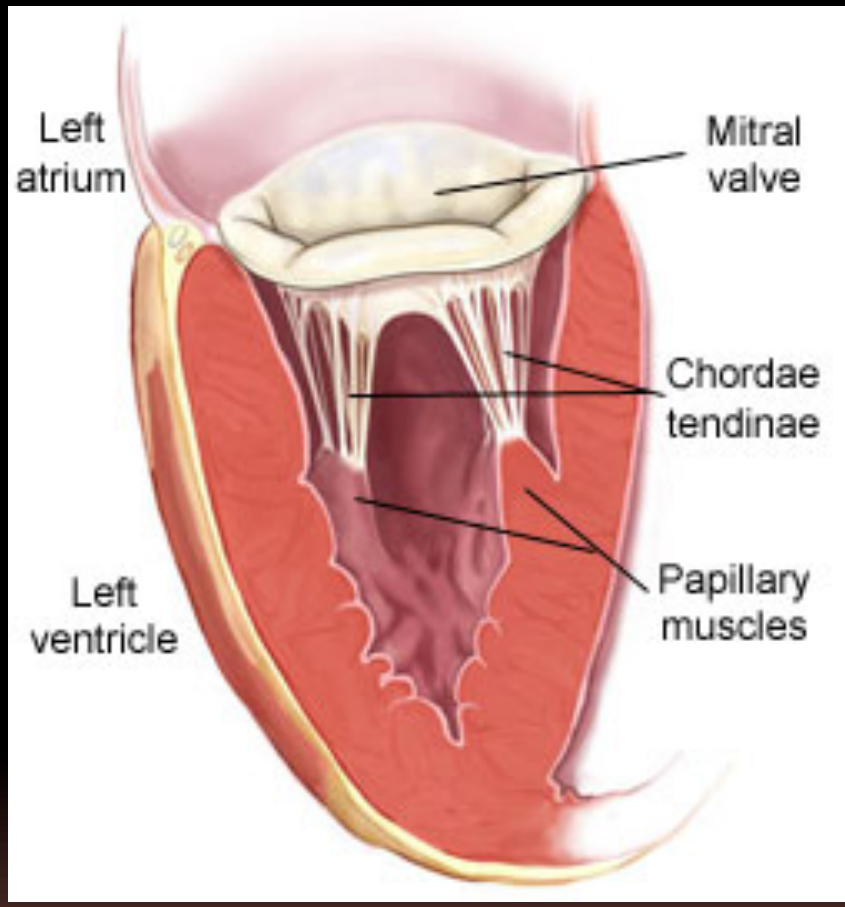
Valves

- ***Right Atrioventricular*** (tricuspid valve)
- ***Pulmonic*** (semilunar valve)
- ***Left Atrioventricular*** (bicuspid valve, mitral valve)
- ***Aortic Valve***



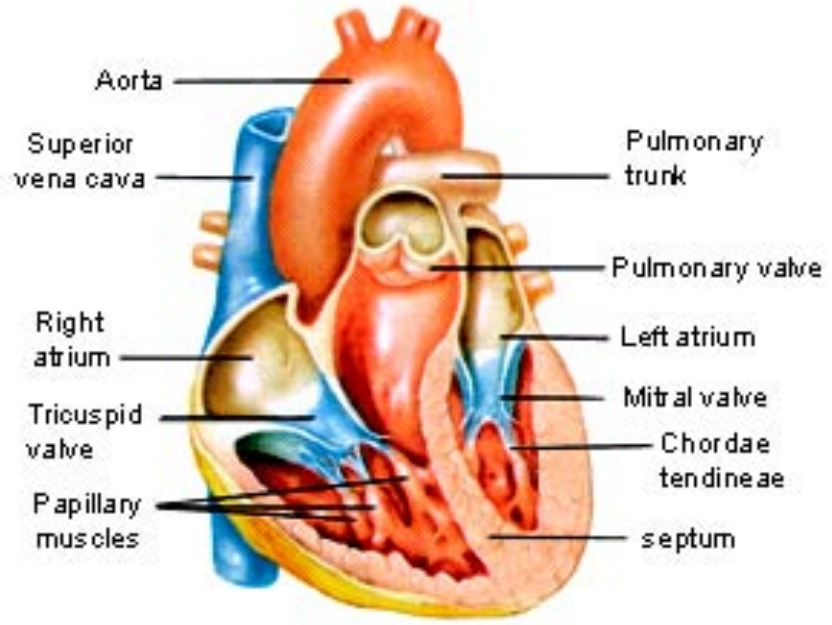
Valves

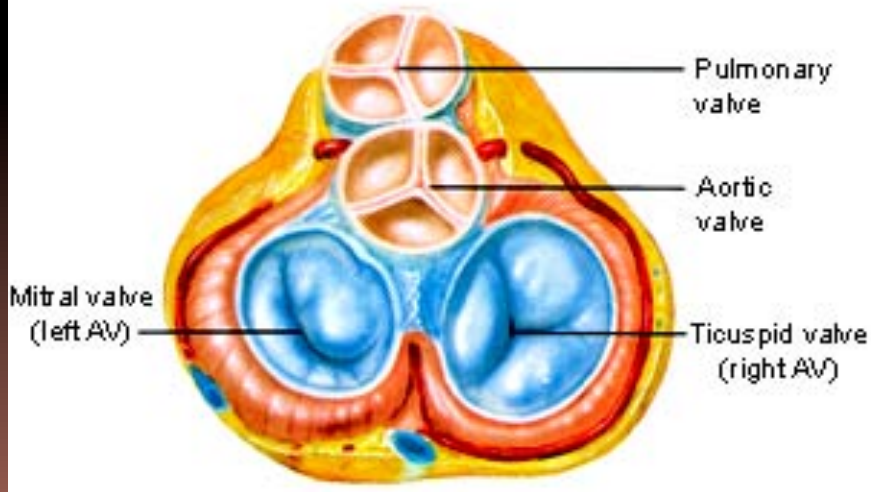
- Chordae tendineae – threads, keep valve flaps from flipping up into the atria



Valves

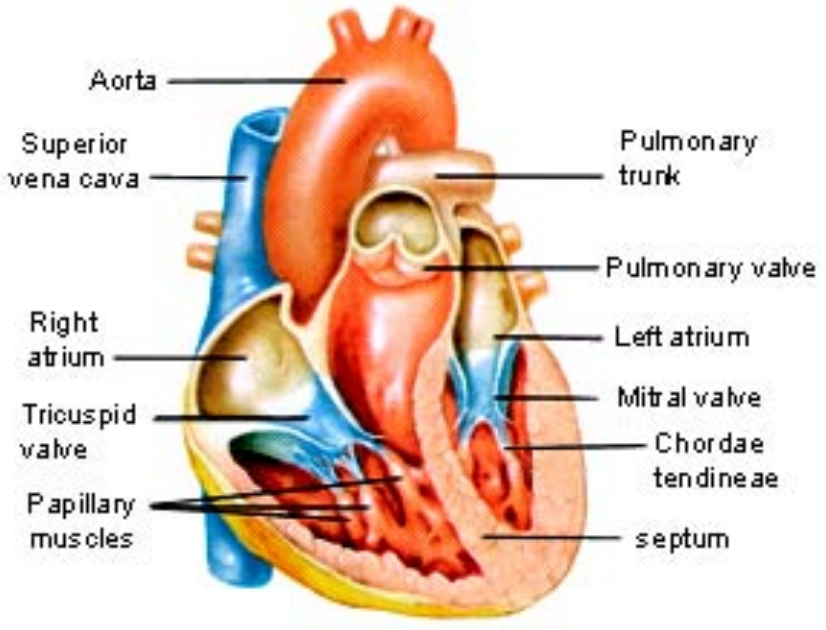
- ***Right Atrioventricular*** **(tricuspid valve)** – between the right atrium and right ventricle, has 3 flaps, prevents blood from flowing back into the right atrium

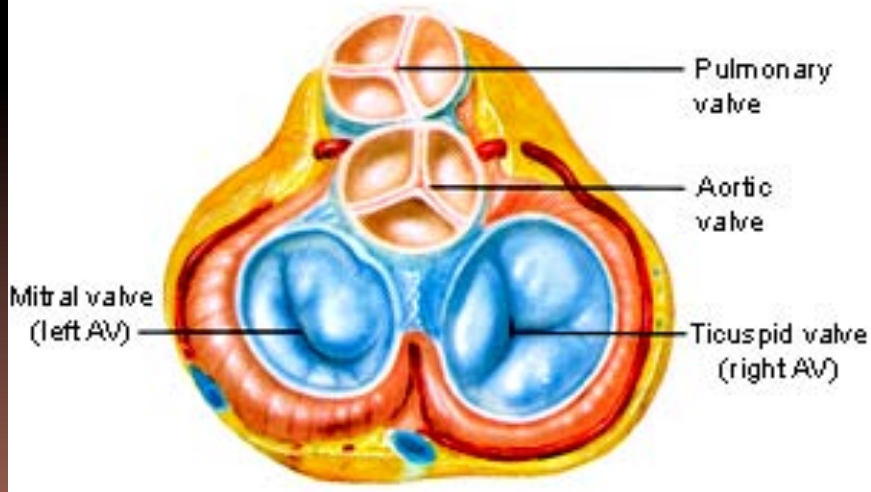




Valves

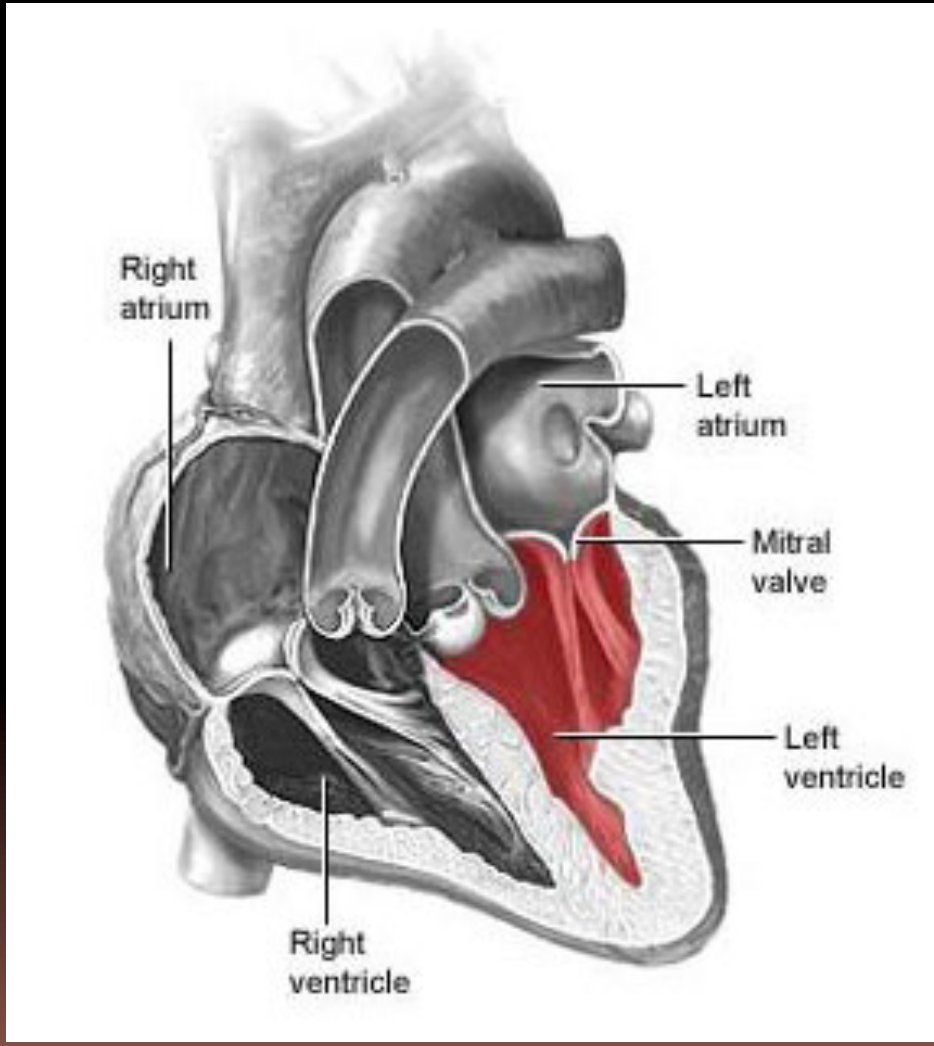
- **Pulmonic (semilunar valve)** – between the right ventricle and the pulmonary artery, prevents blood from flowing back into the right ventricle





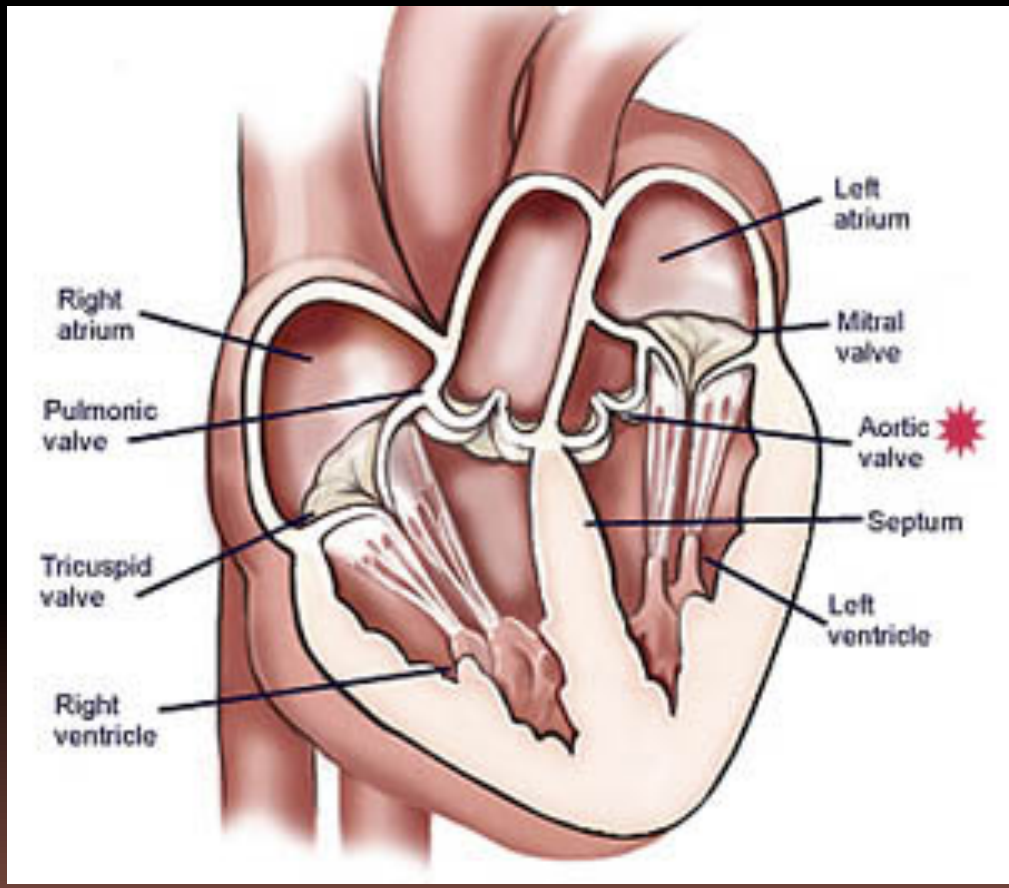
Valves

- **Left Atrioventricular (bicuspid valve)** – between the left atrium and left ventricle, prevents blood from flowing back into the left atrium, has 2 flaps (mitral valve)



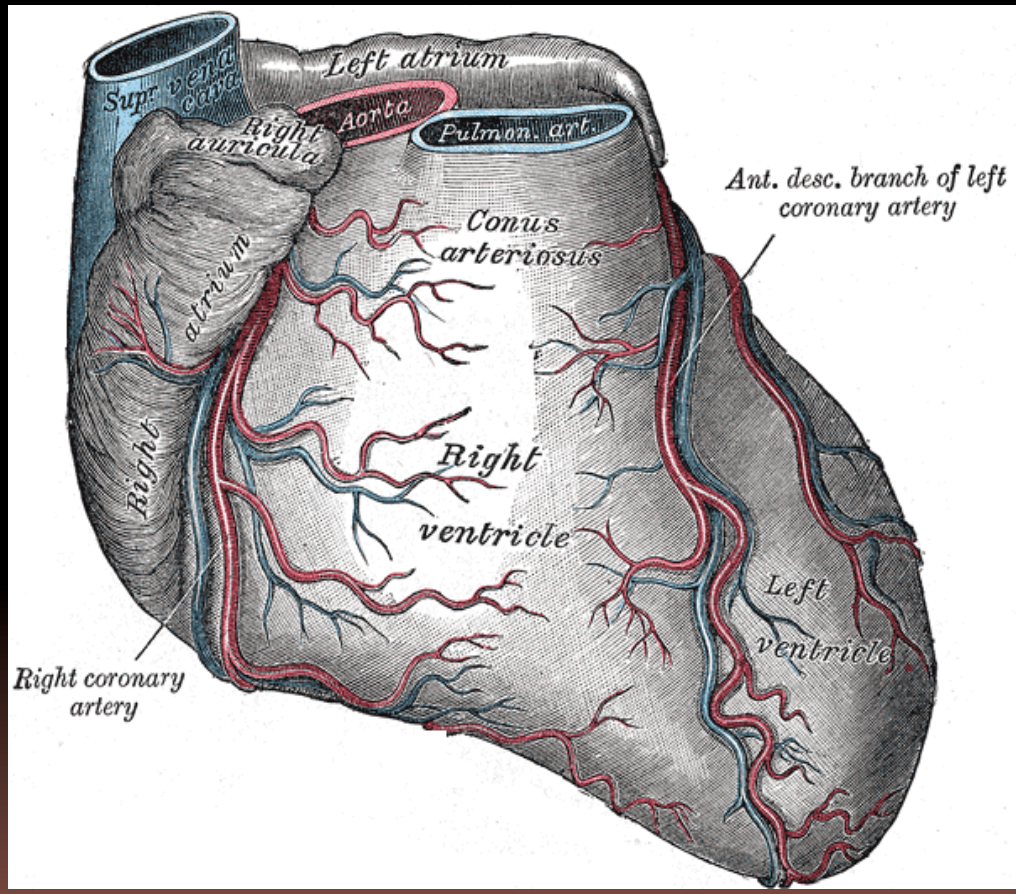
Valves

- **Aortic Valve** – between the left ventricle and the aorta, prevents blood from flowing back into the left ventricle



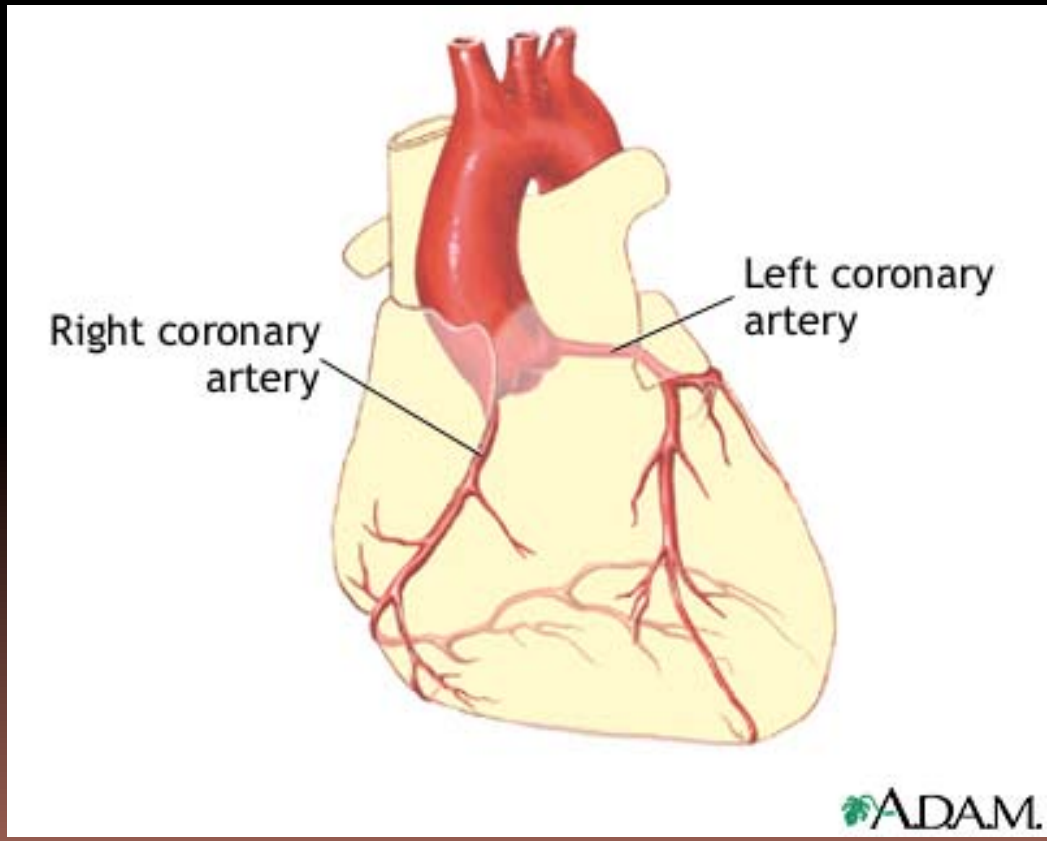
Blood Supply to the Myocardium

- Heart muscle itself needs blood supply



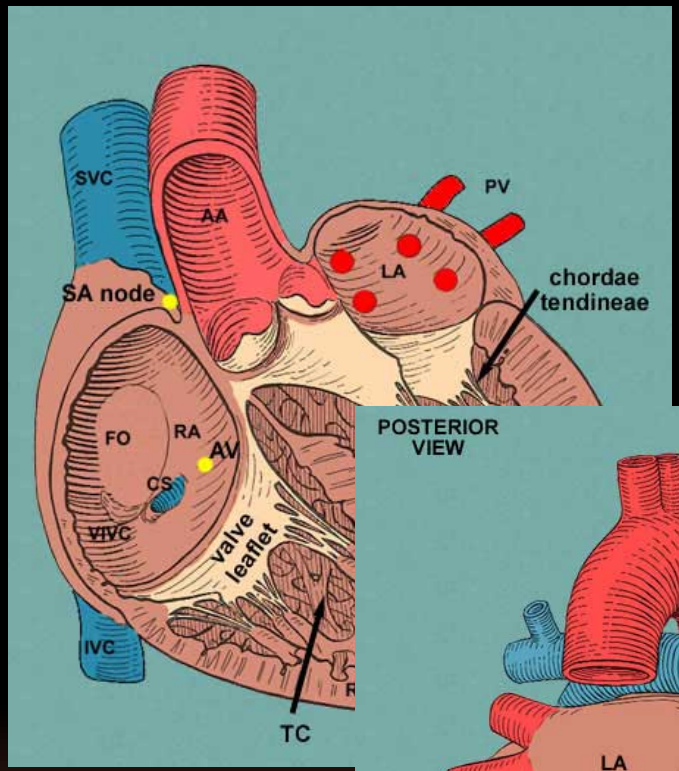
Blood Supply to the Myocardium

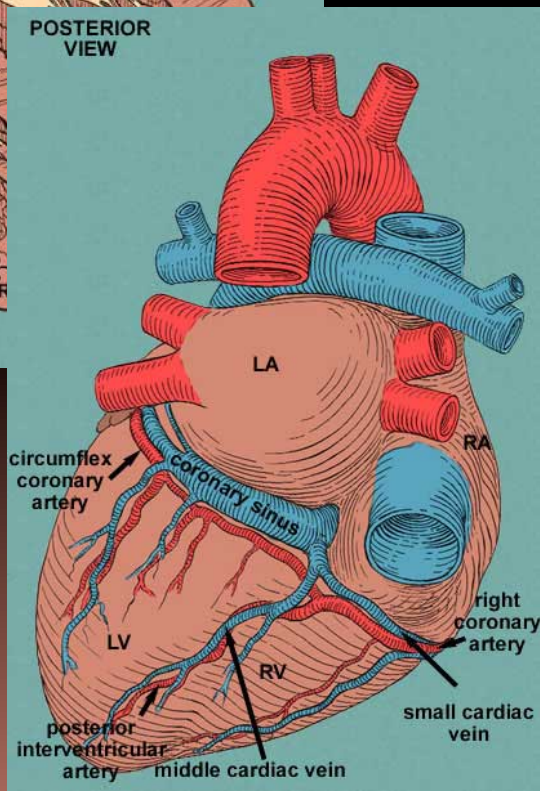
- Blood supplied through the right and left coronary arteries
  - First branches off the aorta



Blood Supply to the Myocardium

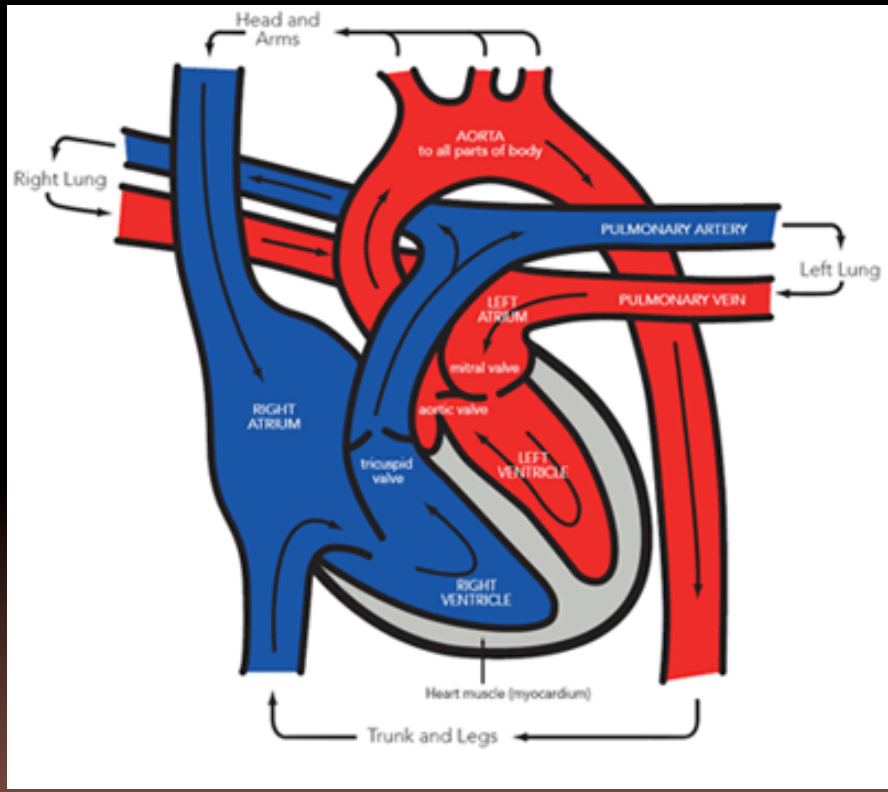
- Coronary sinus collects venous blood from the heart and empties into the right atrium





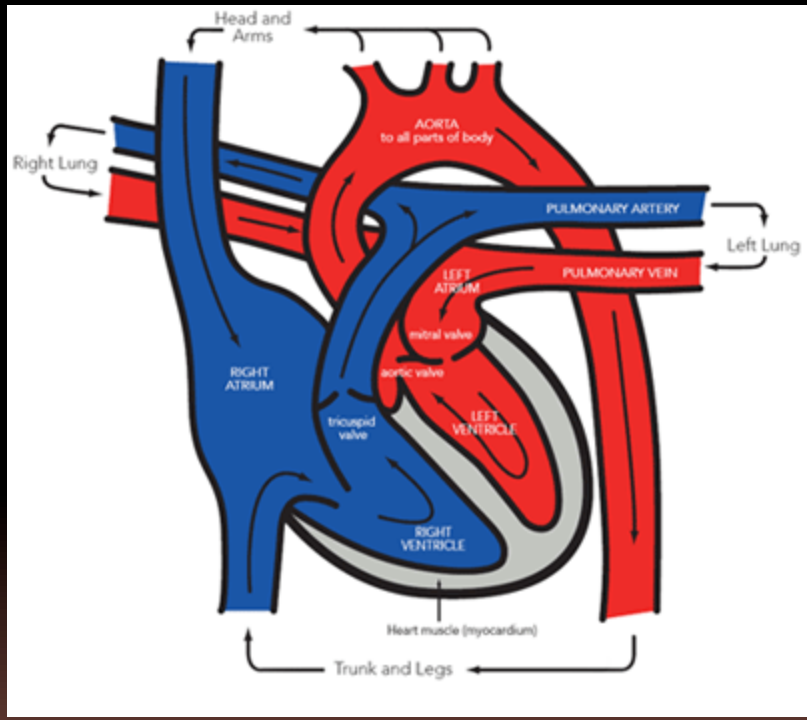
Physiology of the Heart

- Blood flow through the heart: Enters the right atrium through the superior & inferior vena cava. When the atria contract, blood flows through the tricuspid valve to the right ventricle.



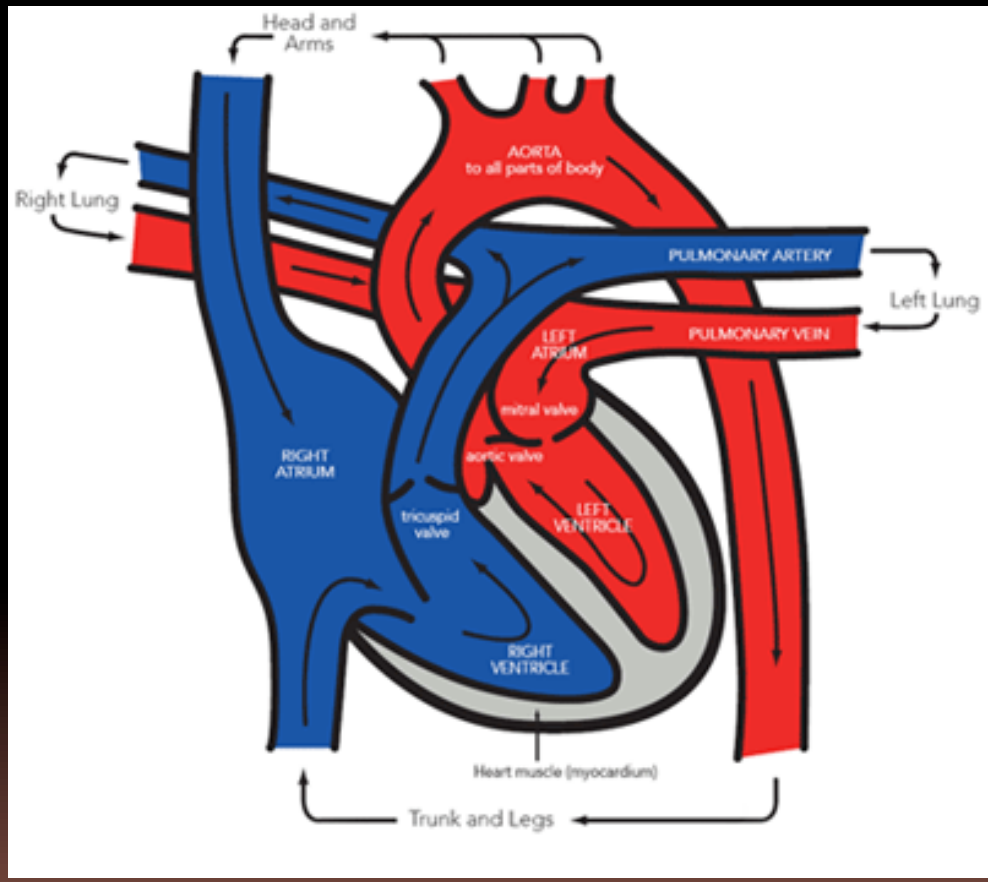
Physiology of the Heart

- When the ventricles contract, blood flows through the pulmonic valve to the pulmonary arteries and to the lungs. There blood is oxygenated, then returned to the heart though the pulmonary veins.



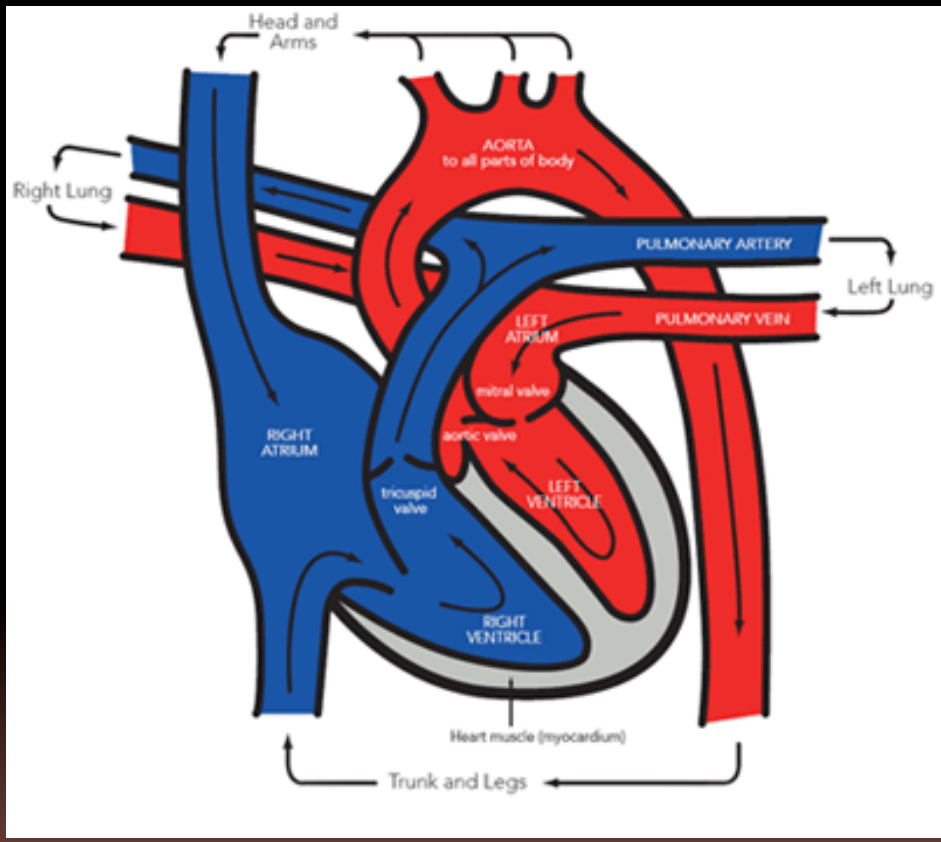
Physiology of the Heart

- Oxygenated blood enters the left atrium through the pulmonary veins.
- When the atria contract, blood flows through the bicuspid valve and into the left ventricle.

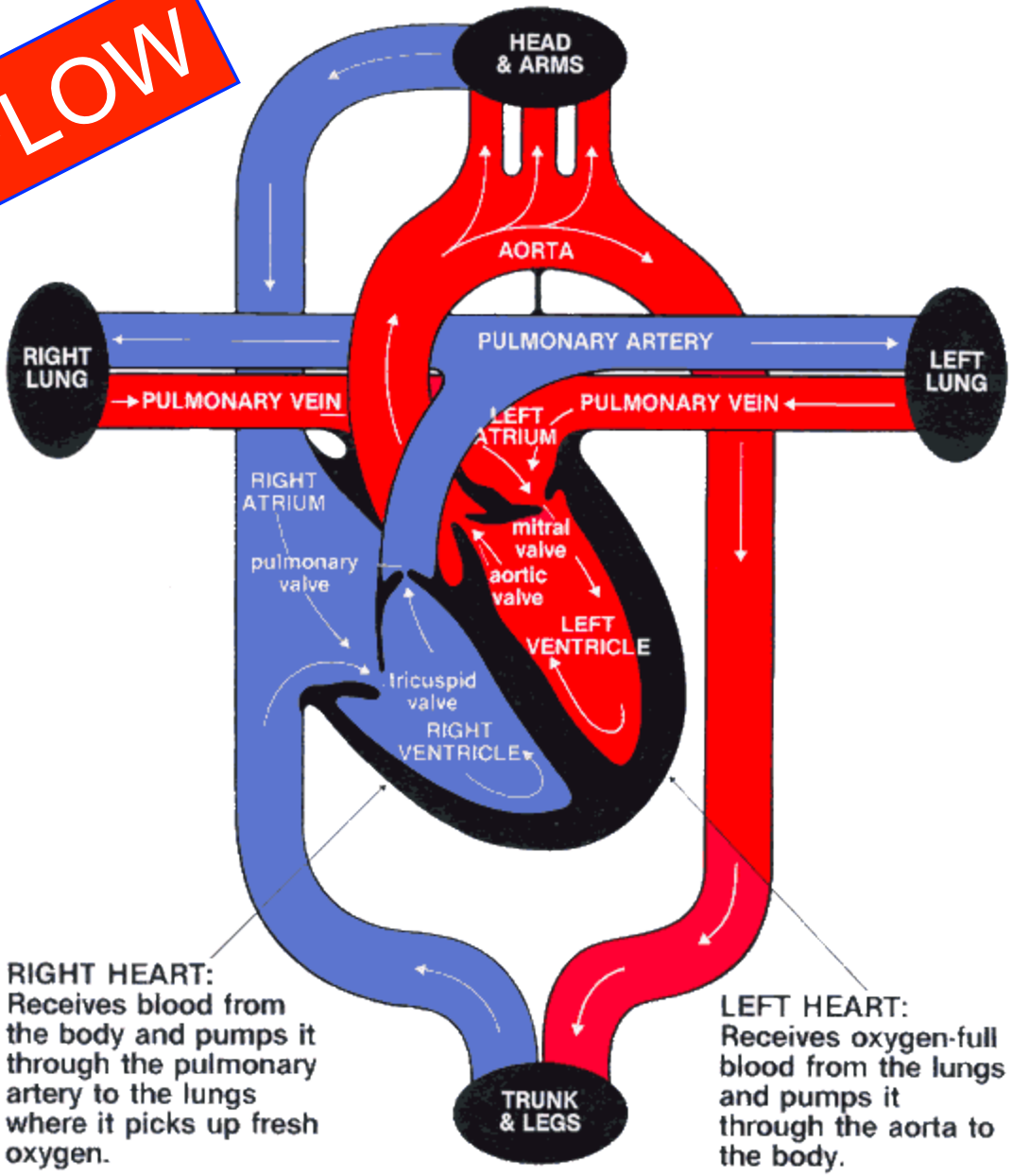


Physiology of the Heart

- When the ventricles contract, blood flows through the aortic valve and into the aorta, then to the rest of the body



BLOOD FLOW

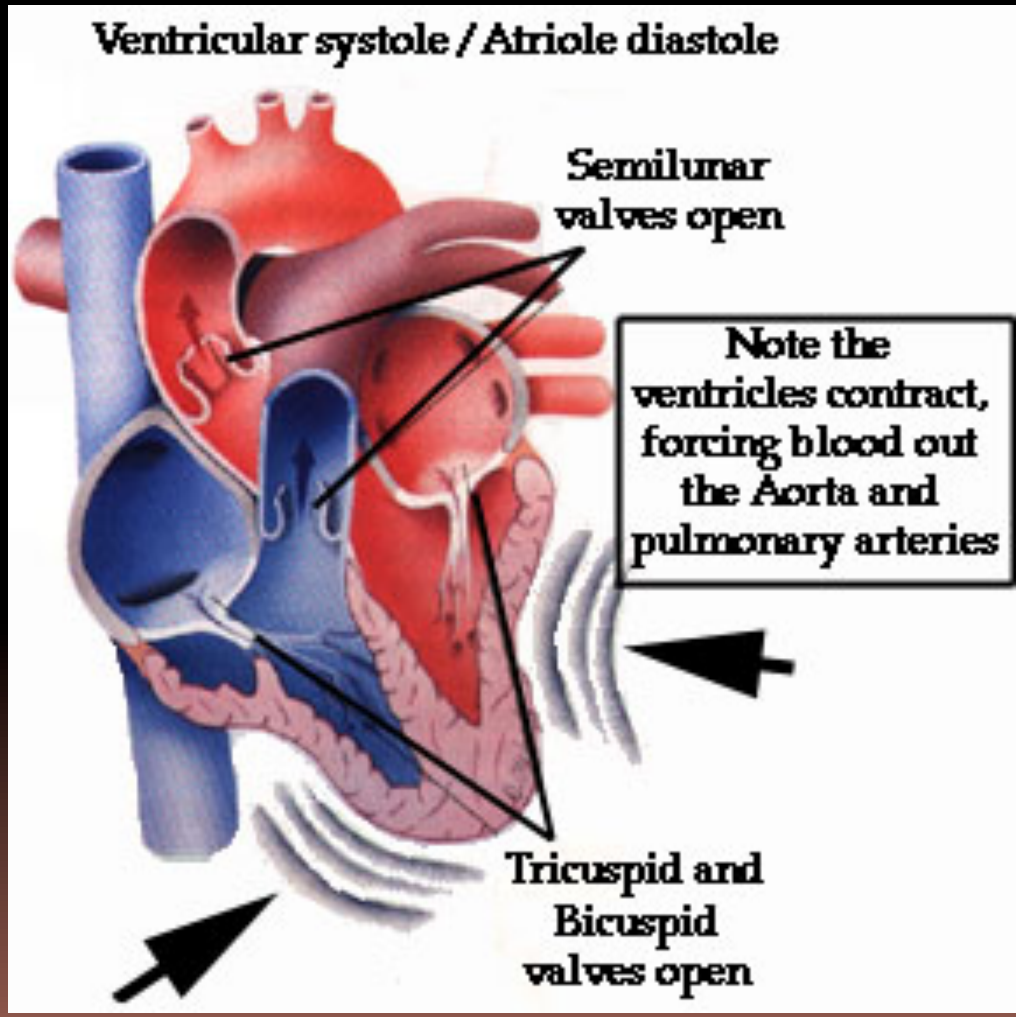


RIGHT HEART:
Receives blood from the body and pumps it through the pulmonary artery to the lungs where it picks up fresh oxygen.

LEFT HEART:
Receives oxygen-full blood from the lungs and pumps it through the aorta to the body.

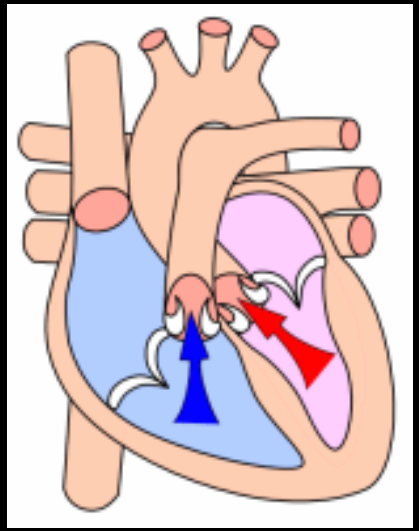
Physiology of the Heart

- Both atria contract at the same time, followed by the contraction of both ventricles

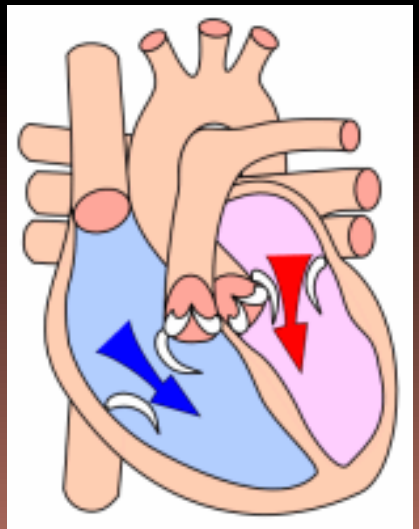


Physiology of the Heart

- **Systole** – active phase of the heart when the chambers are contracting

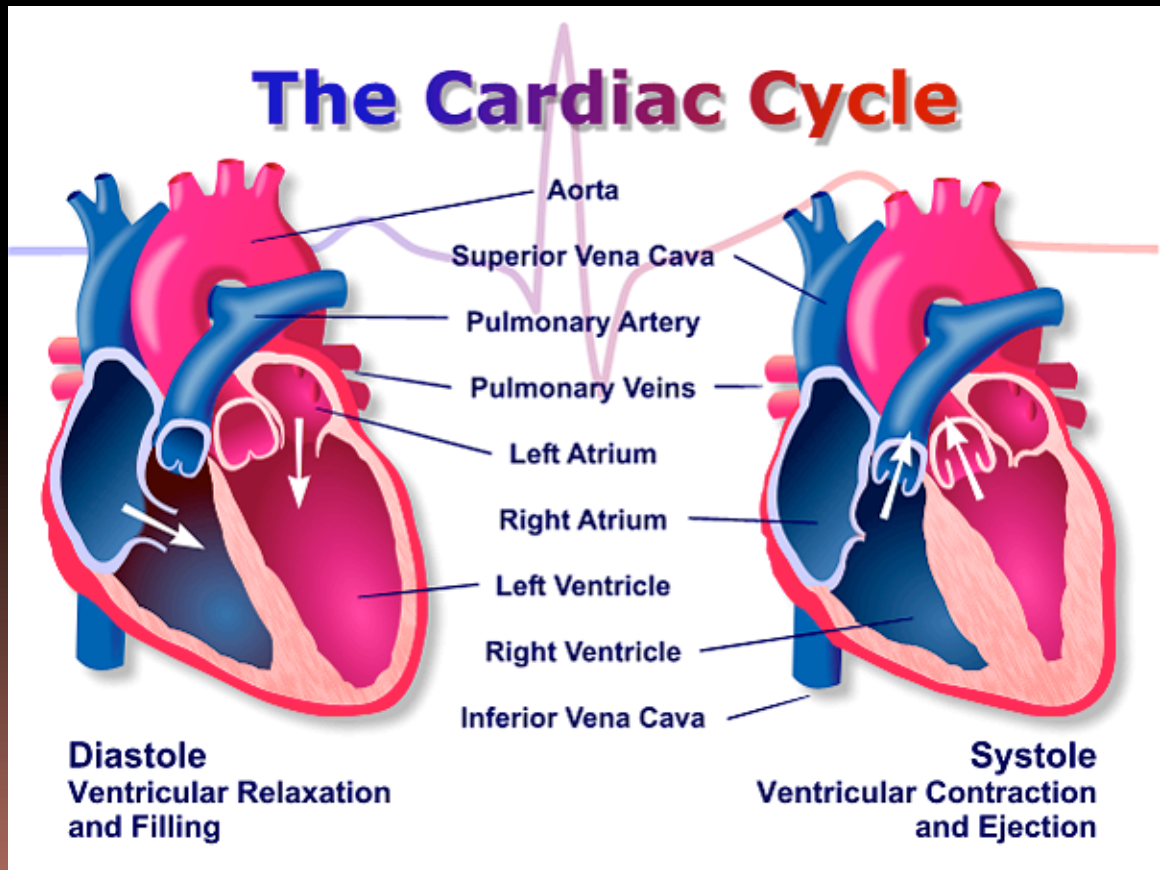


- **Diastole** – resting phase of the heart, when the chambers are filling with blood



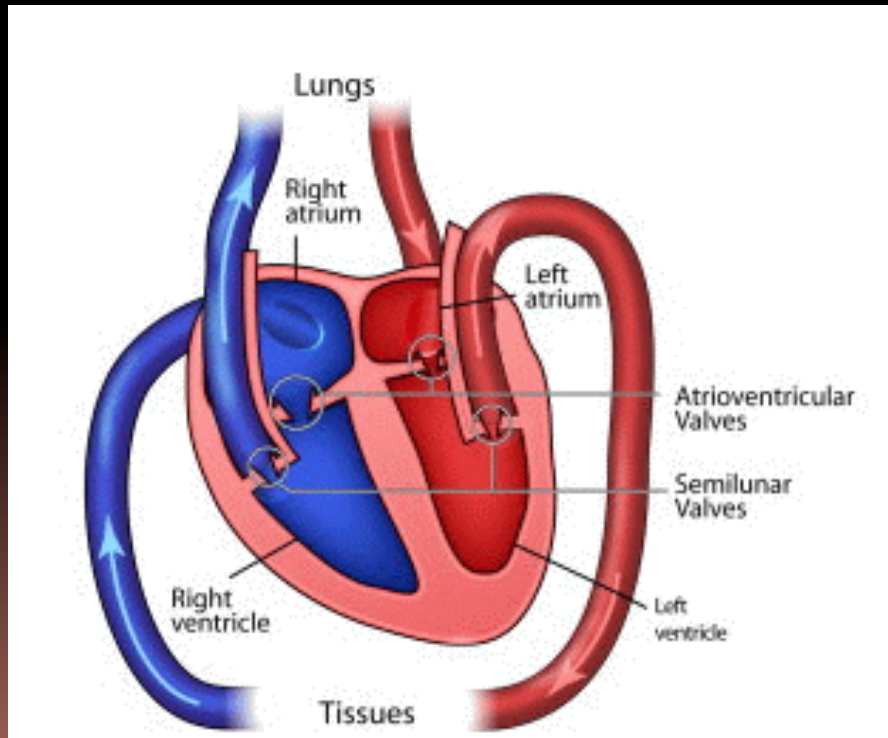
Physiology of the Heart

- **Cardiac Cycle** – sequence of heart contractions and relaxations



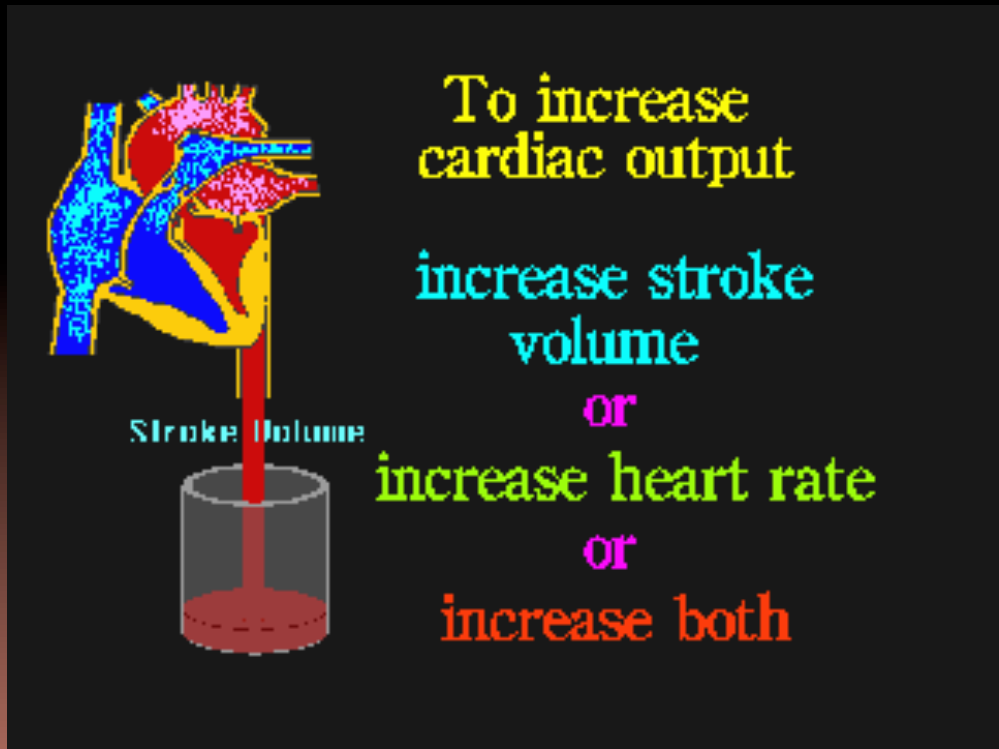
Physiology of the Heart

- **Cardiac Output** – volume of blood pumped by each ventricle in 1 min, avg about 5 liters/ min for an adult at rest



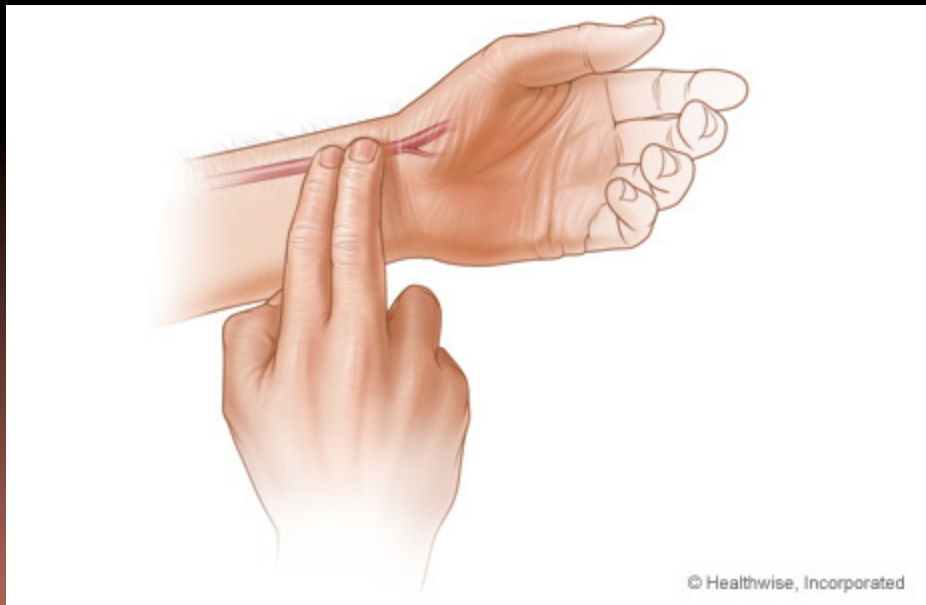
Physiology of the Heart

- **Stroke Volume** – amount of blood ejected from the ventricle with each beat



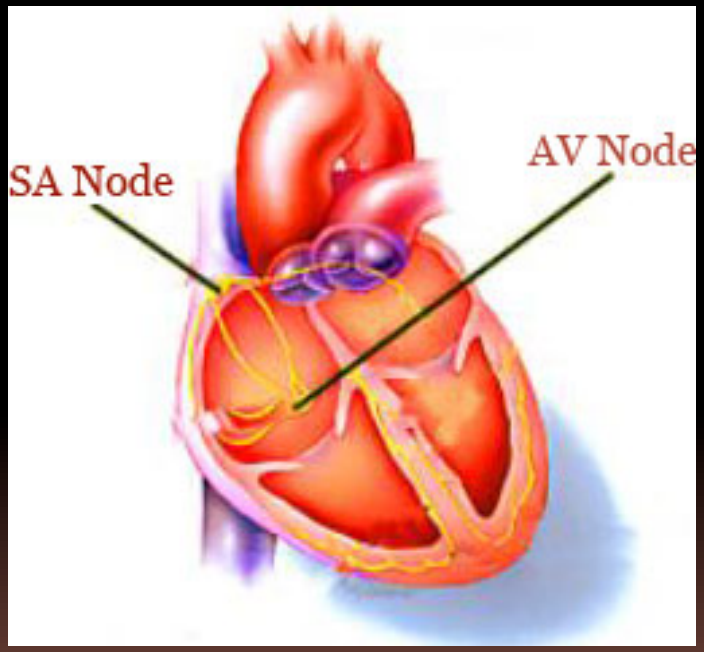
Physiology of the Heart

- **Heart Rate (pulse rate)** – number of times the heart beats in 1 min



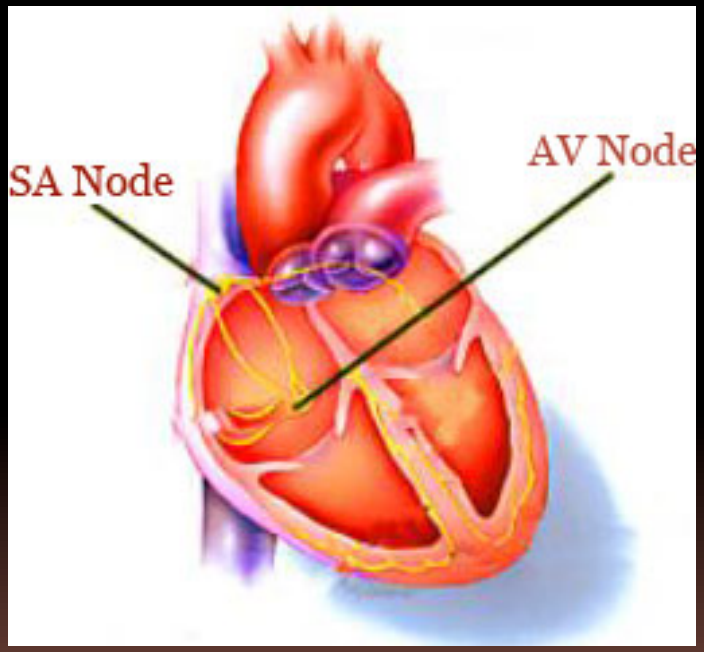
Conduction System

- **Sinoatrial Node (SA Node)** – pacemaker, located in the upper wall of the right atrium, initiates the heartbeat.
- Impulse travels throughout the muscle of the atria, causing them to contract.



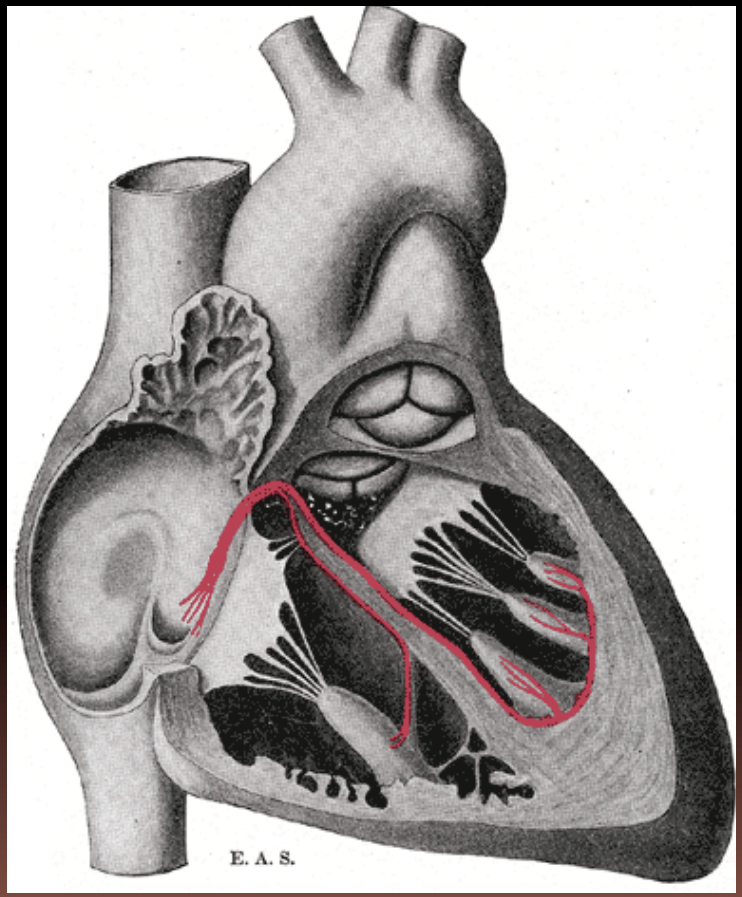
Conduction System

- This stimulates the **atrioventricular node (AV Node),** located in the septum at the bottom of the right atrium.



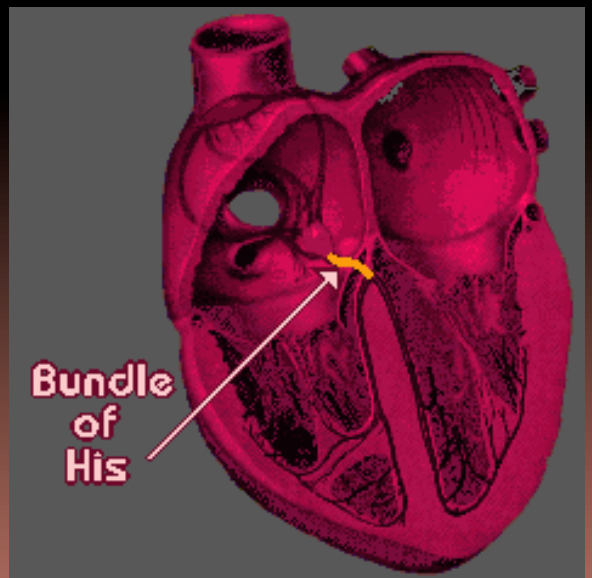
Conduction System

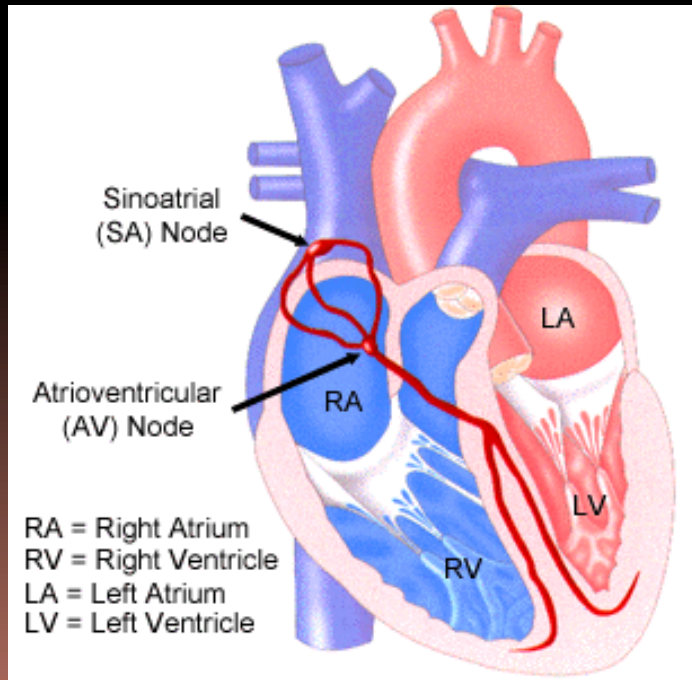
- Impulse travels through the atrioventricular bundle (**bundle of His**) located in the septum between the ventricles,



Conduction System

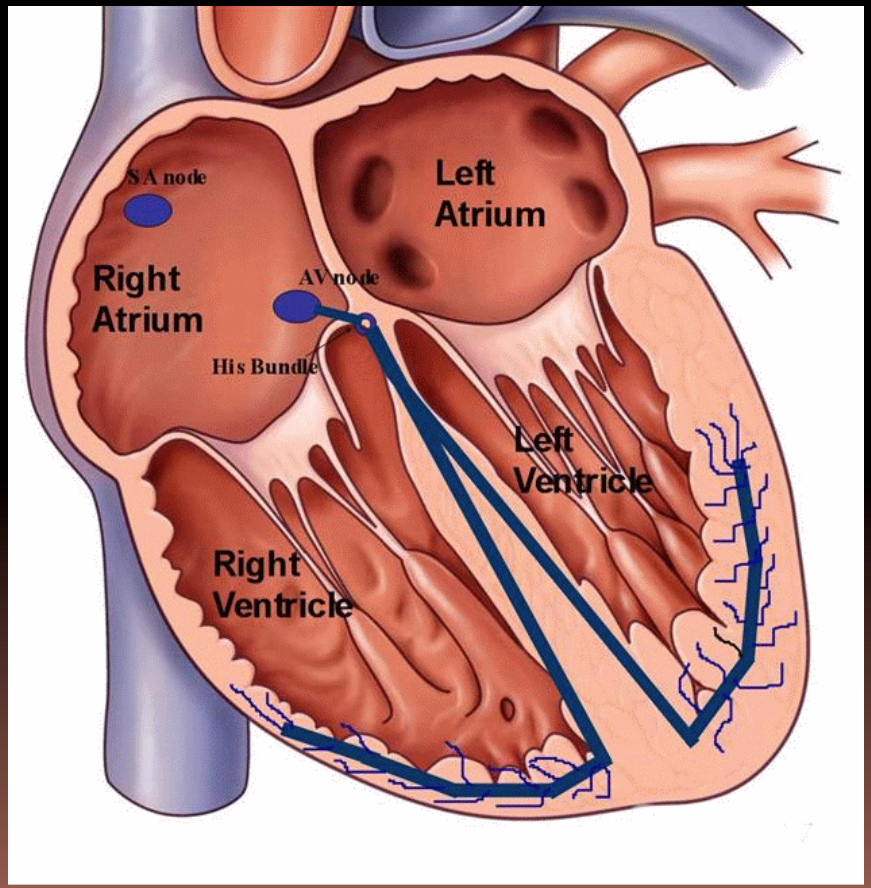
- Impulse travels from the **bundle of His** (Atrioventricular bundle) throughout the ventricular walls by way of the right & left bundle branches and the **purkinje fibers**, causing the ventricles to contract





Conduction System

- **Sinus Rhythm** – when the heartbeat is initiated by the SA Node

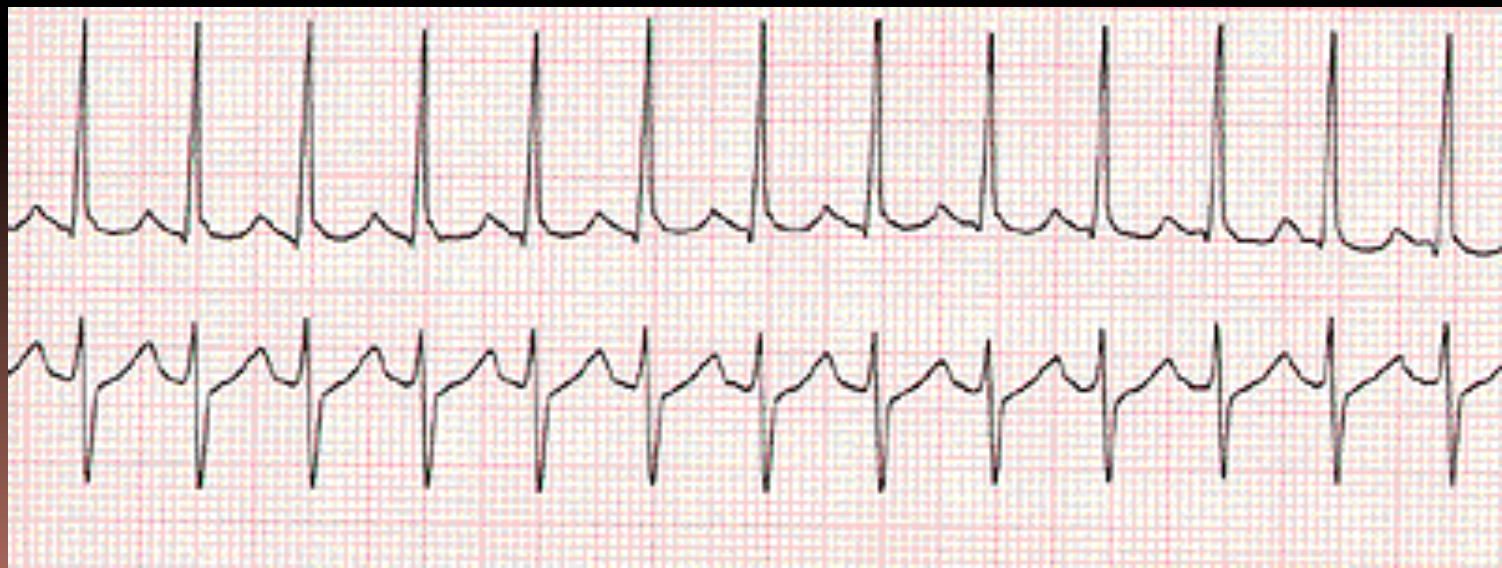


Heart Rates

- **Bradycardia** – pulse rate below 60 beats/min

Heart Rates

- **Tachycardia** – pulse rate above 100 beats/min

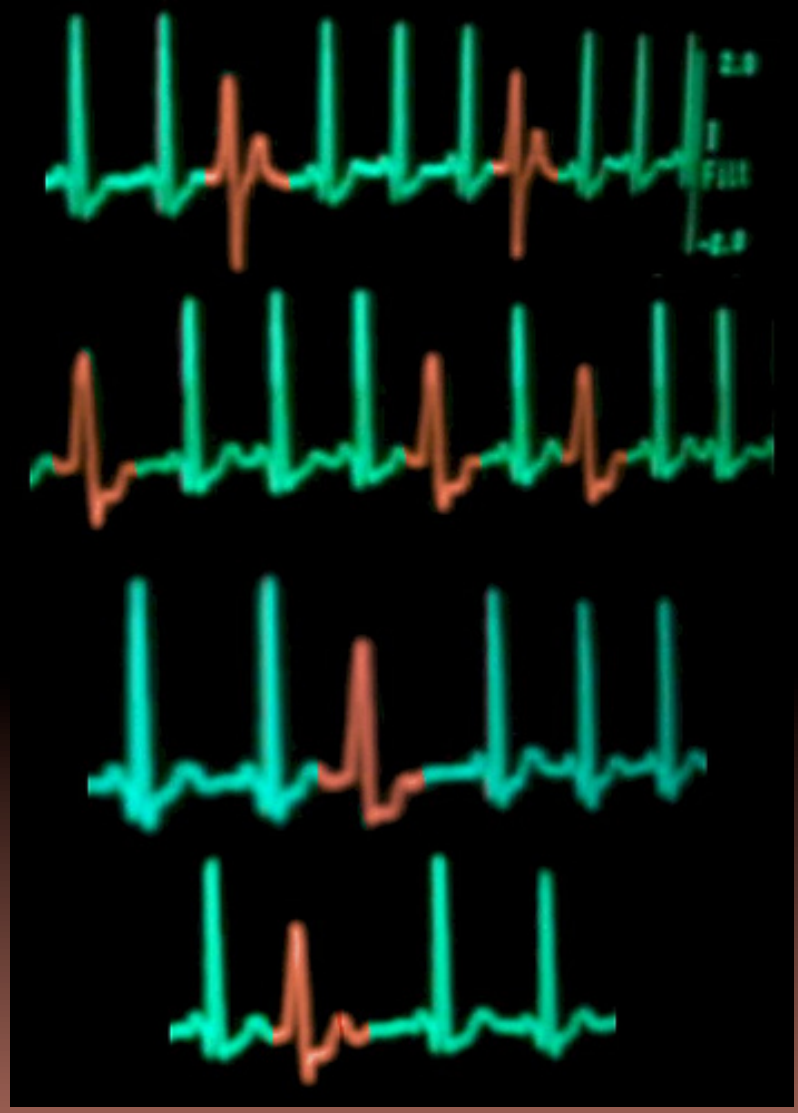


Heart Rates

- **Sinus Arrhythmia** – regular variation in heart rate due to changes in the rate and depth of breathing, Normal.

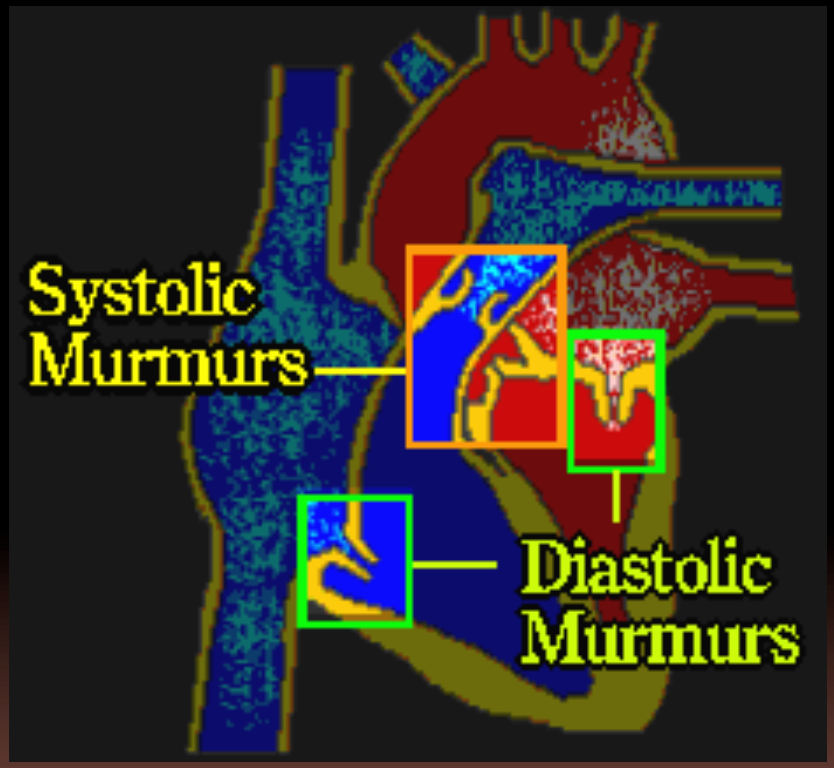
Heart Rates

- **Premature Beats (extrasystoles)** – beats that come before the expected normal beats.



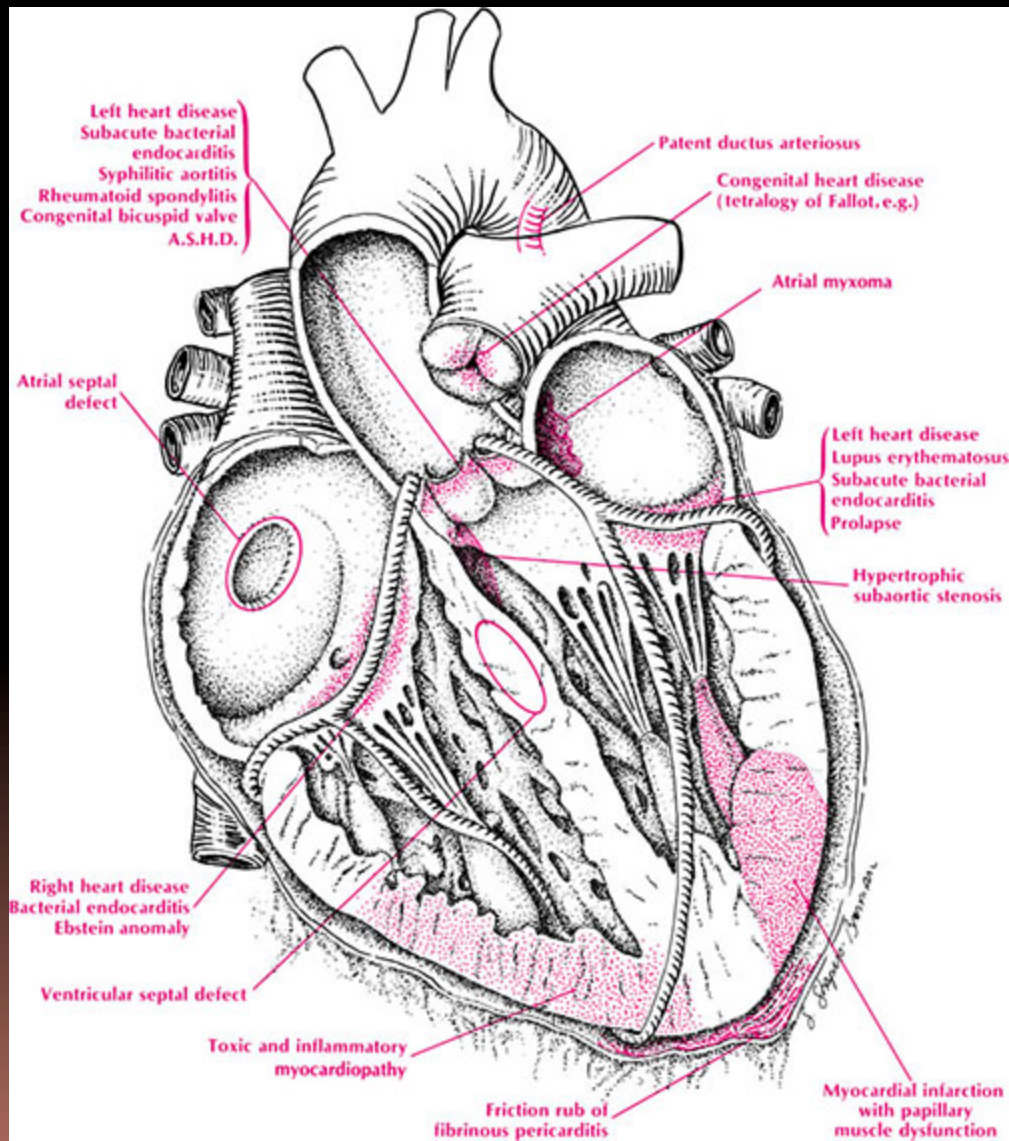
Murmurs

- **Murmurs** – abnormal heart sound due to valves not functioning properly



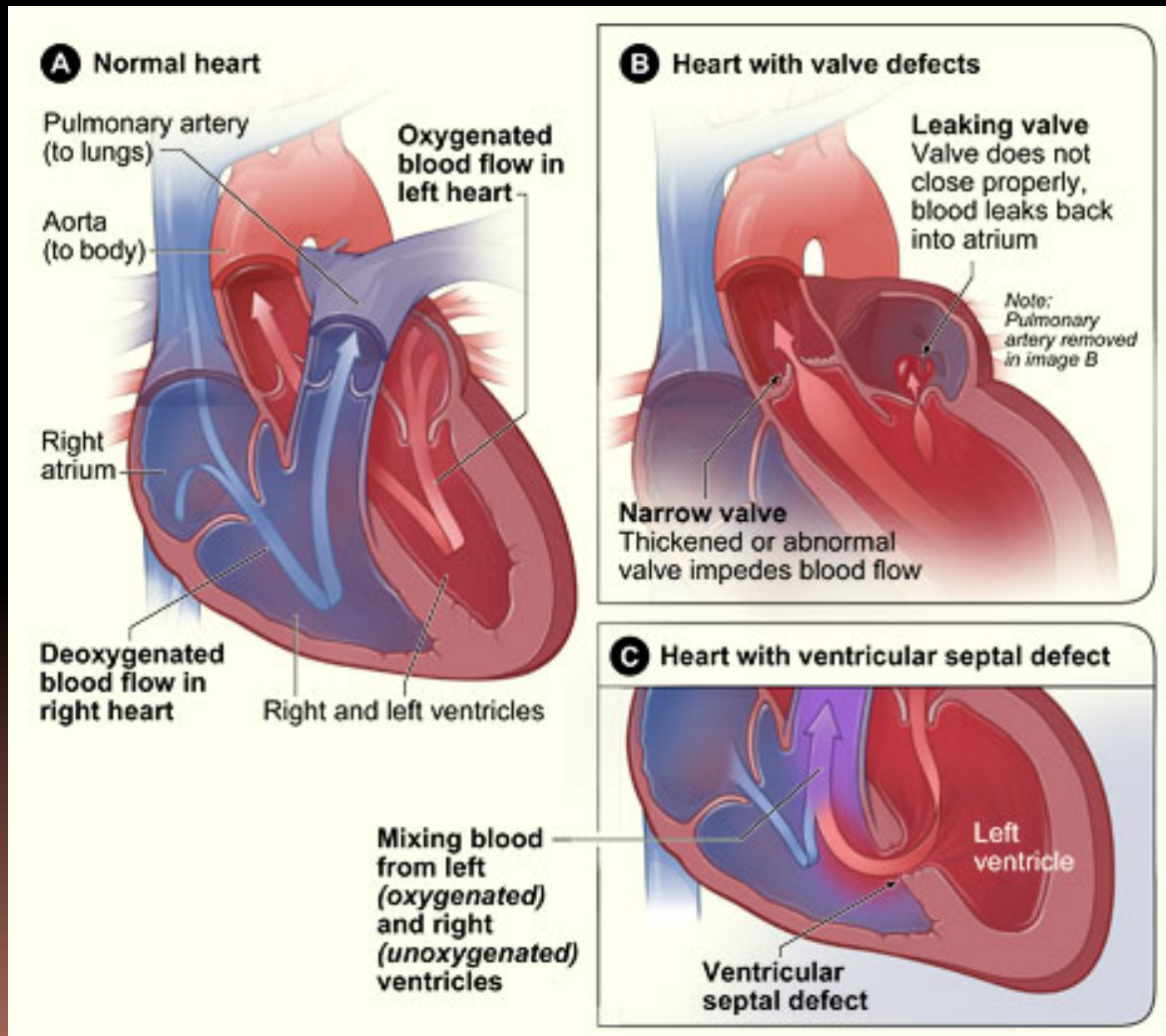
Murmurs

- **Functional** – not abnormal structure, ventricles fill too rapidly



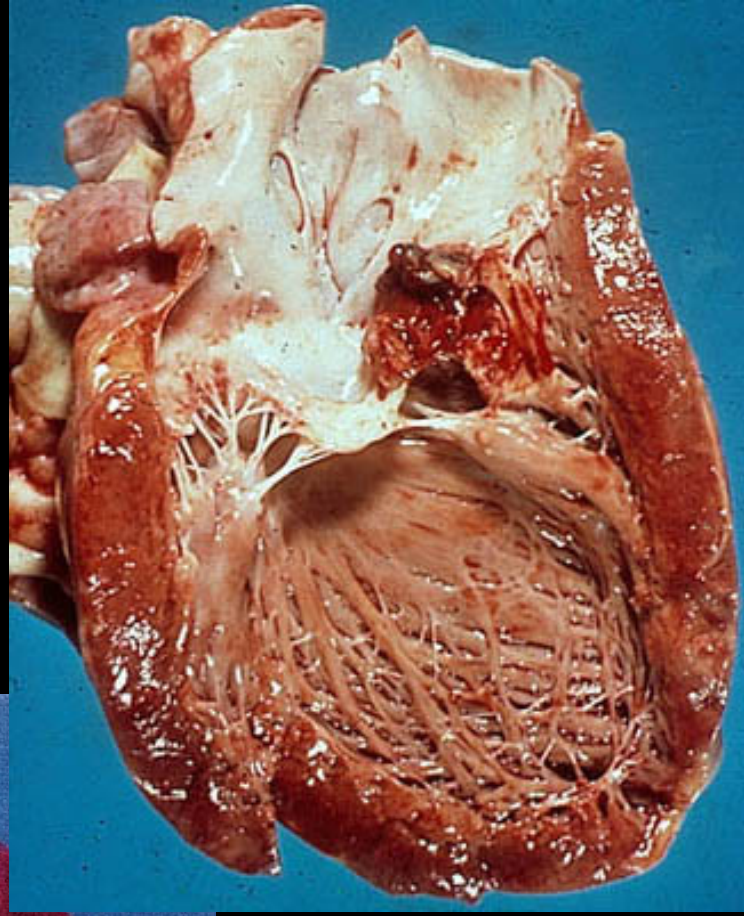
Murmurs

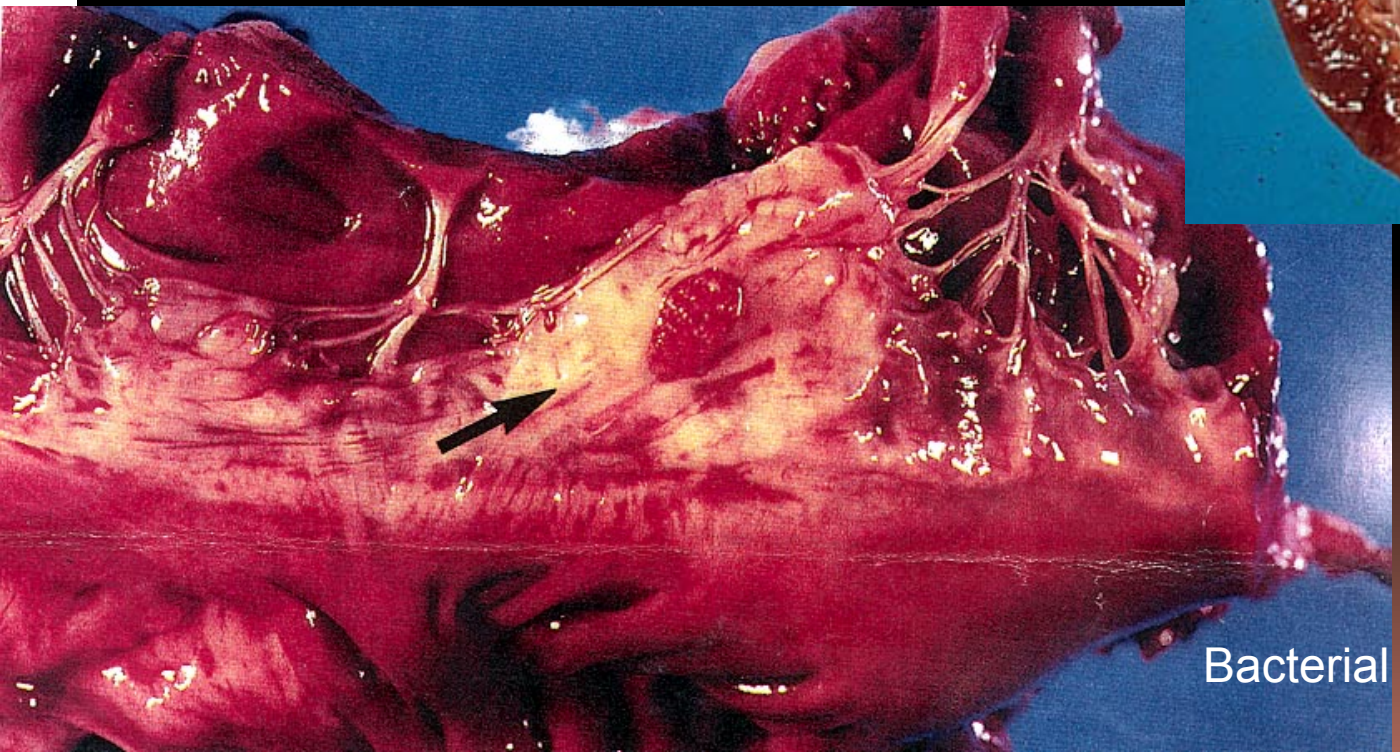
- **Organic** – caused by structural changes in the heart



Heart Disease

Endocarditis – inflammation of the endocardium

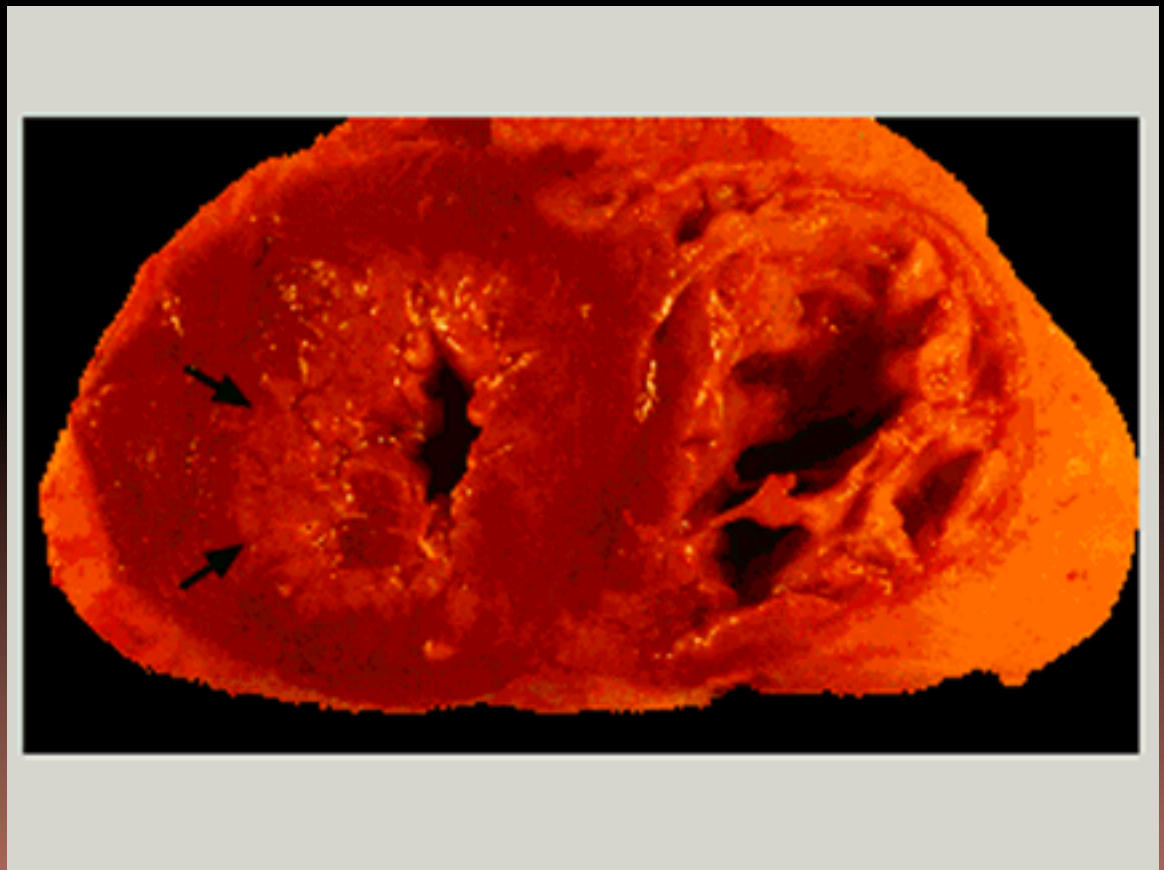




Bacterial Endocarditis

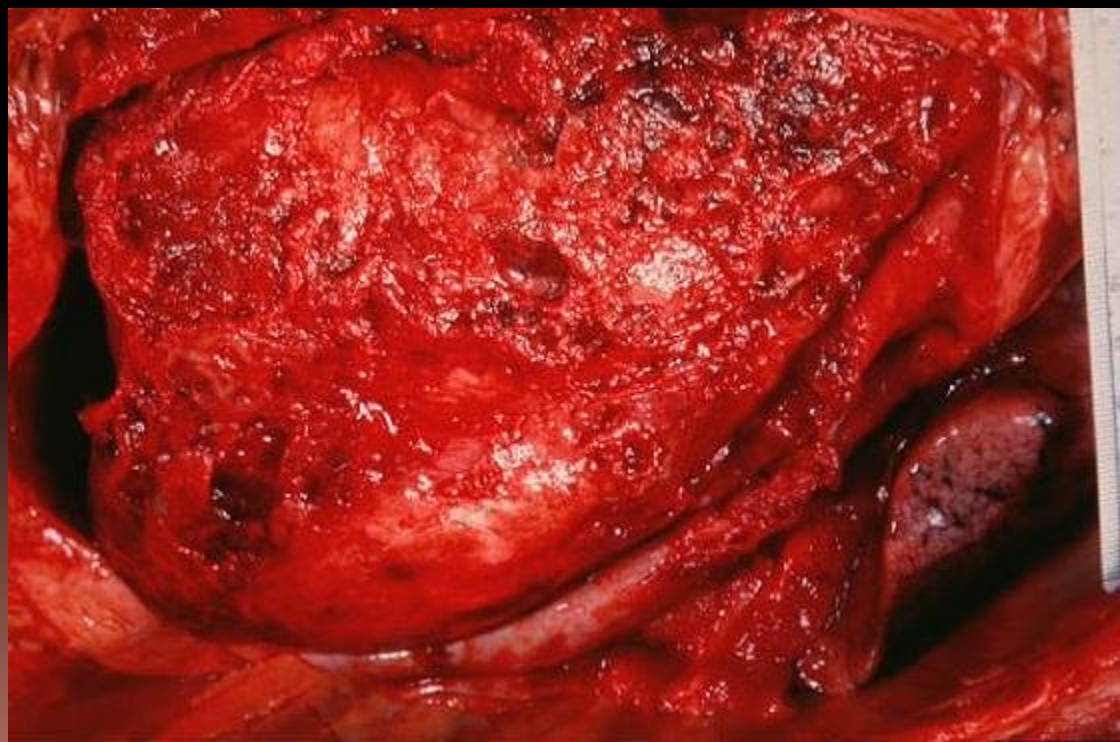
Heart Disease

- **Myocarditis** – inflammation of the heart muscle



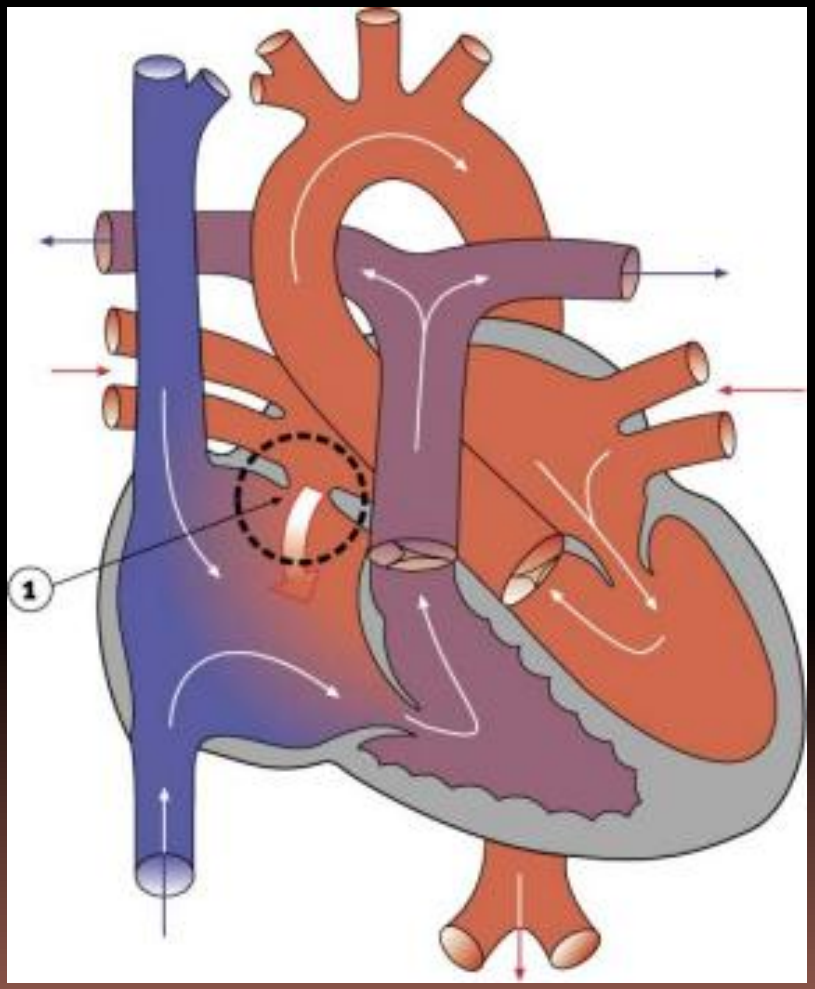
Heart Disease

- **Pericarditis** – inflammation of the pericardium, the sac which surrounds the heart



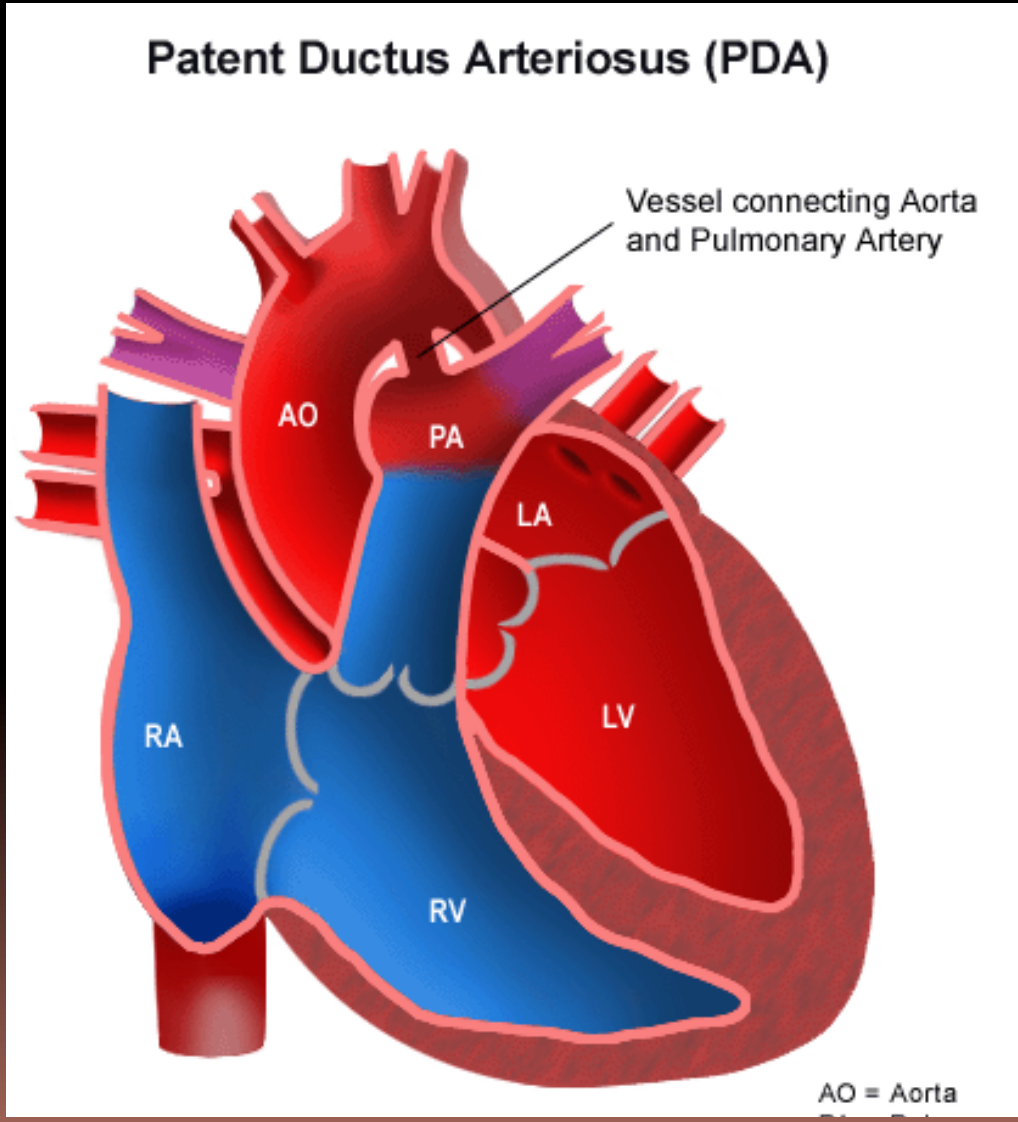
Congenital Heart Disease

- **Patent Foramen Ovale** – hole present between the 2 atria fails to close at birth



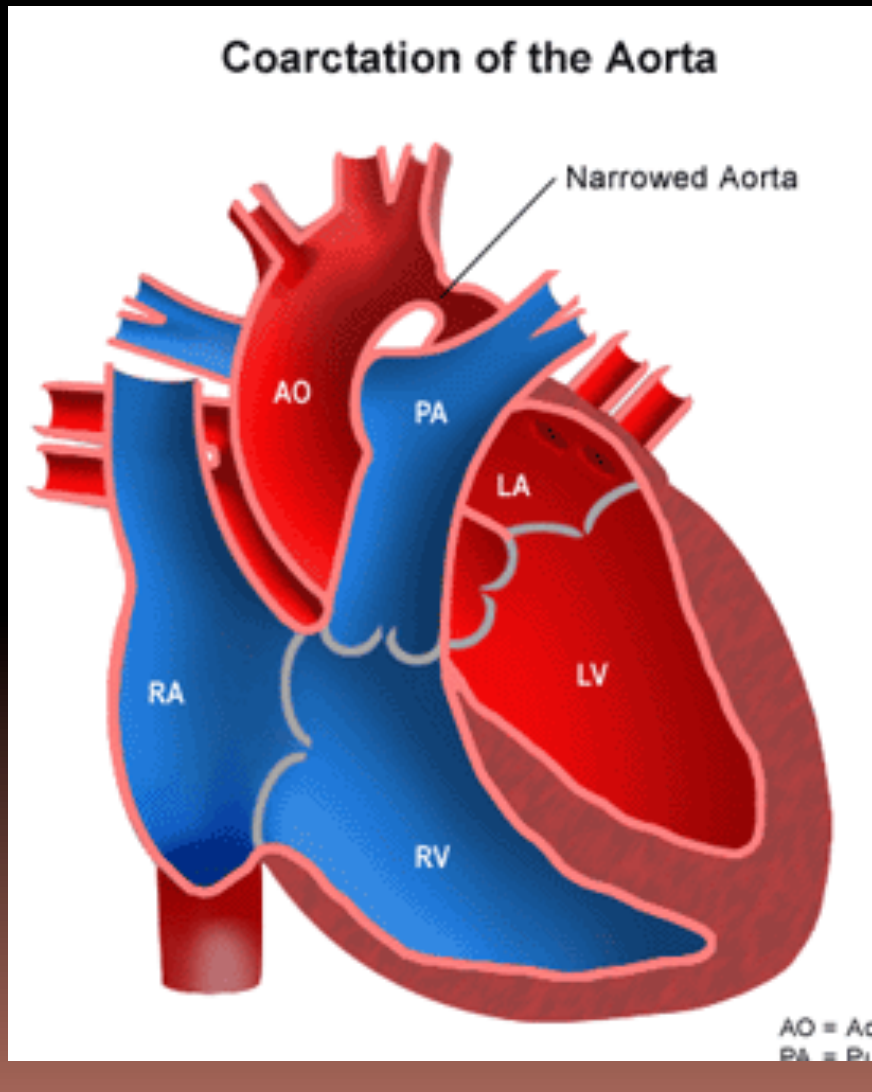
Congenital Heart Disease

- **Patent Ductus Arteriosis** – duct between the pulmonary artery and the aorta fails to close at birth



Congenital Heart Disease

- **Coarctation of the Aorta** – localized narrowing of the arch for the aorta

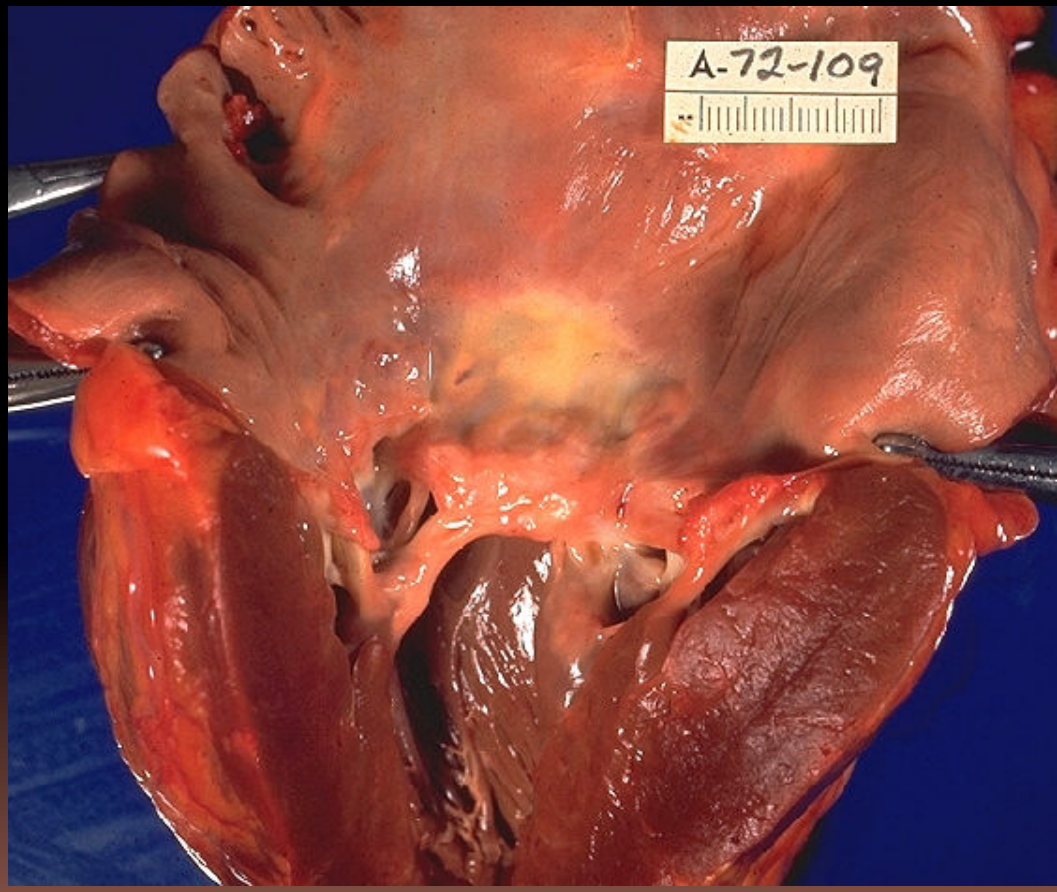


Congenital Heart Disease

- **Tetralogy of Fallot** – combination of 4 defects that occur together, “blue baby”

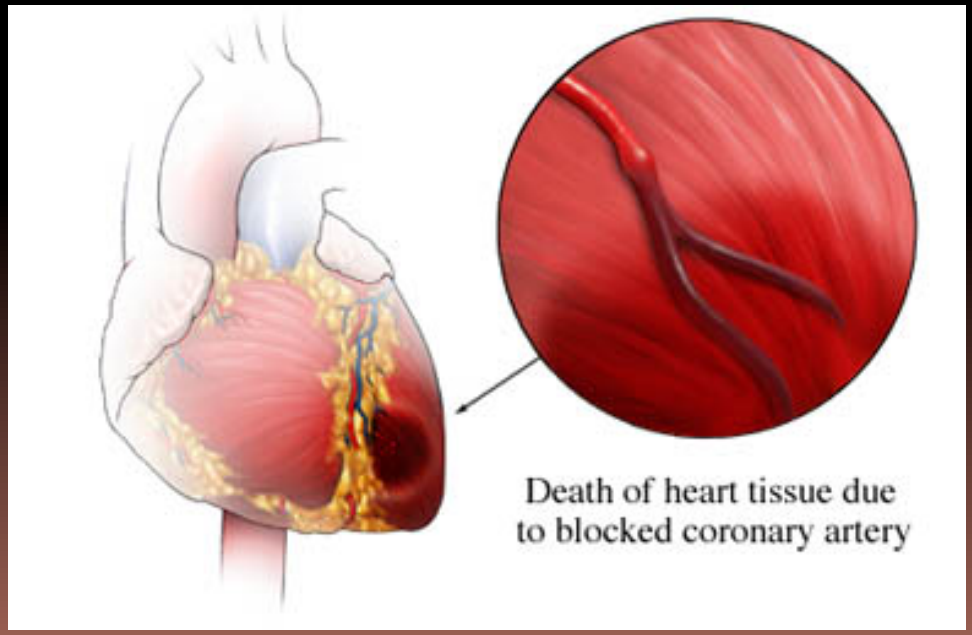
Rheumatic Heart Disease

- Toxins produced by streptococci affect the valves of the heart so they do not open completely (mitral stenosis) or close completely (mitral regurgitation)



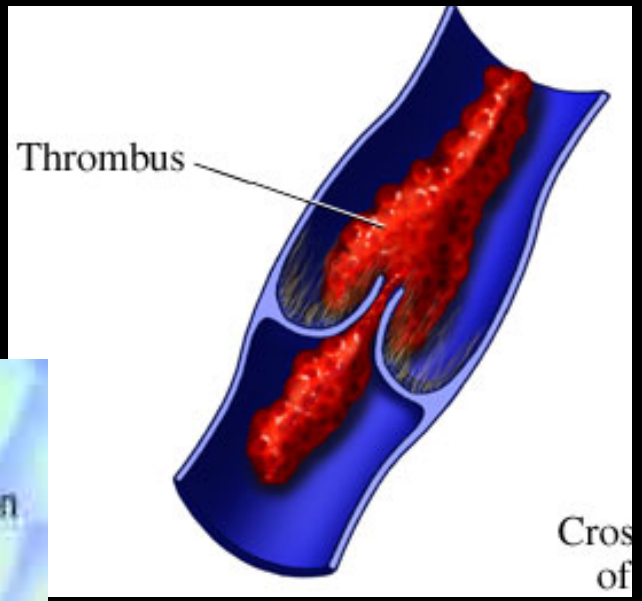
Coronary Heart Disease

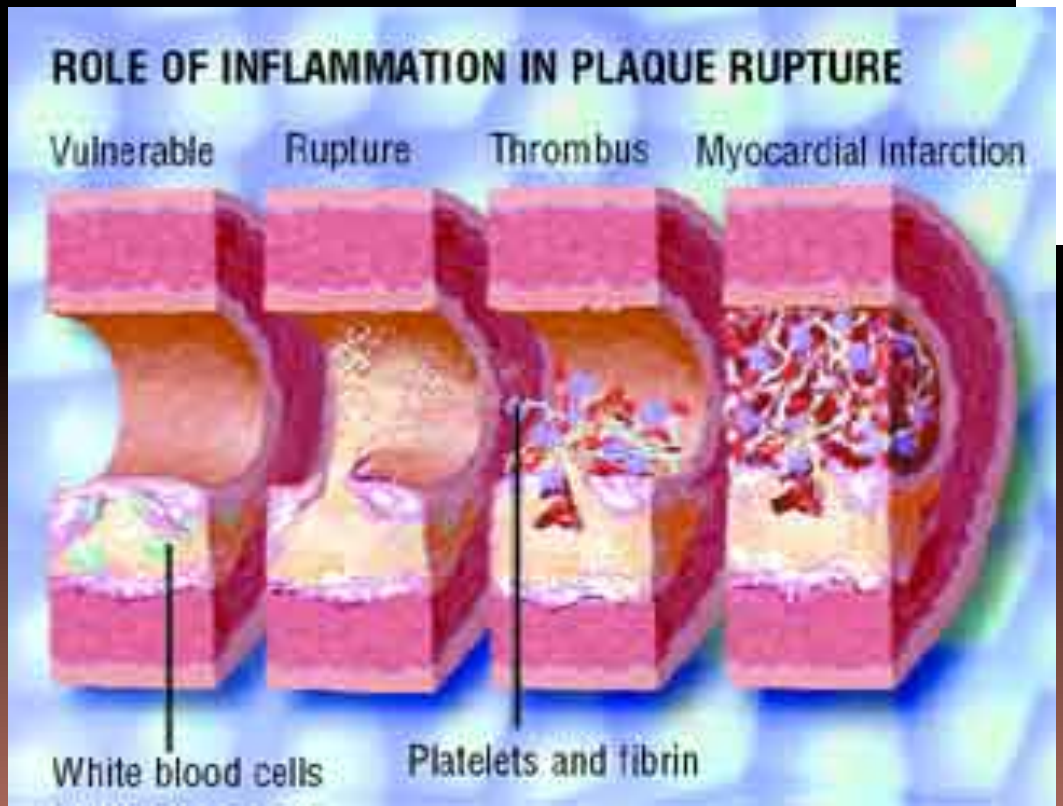
- Coronary occlusion - Coronary arteries become clogged; therefore, not as much blood goes to the heart muscle. If an artery is completely clogged, it leads to ischemia, a lack of blood supply to an area.



Coronary Heart Disease

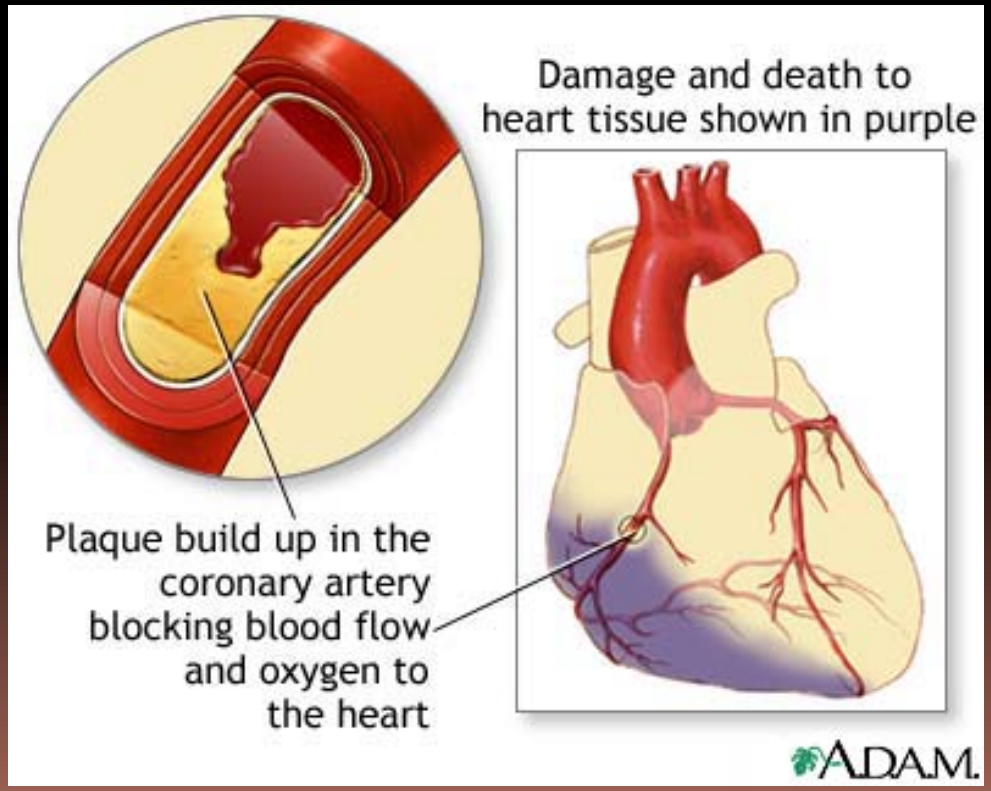
- **Thrombus** – blood clot, can clog coronary arteries





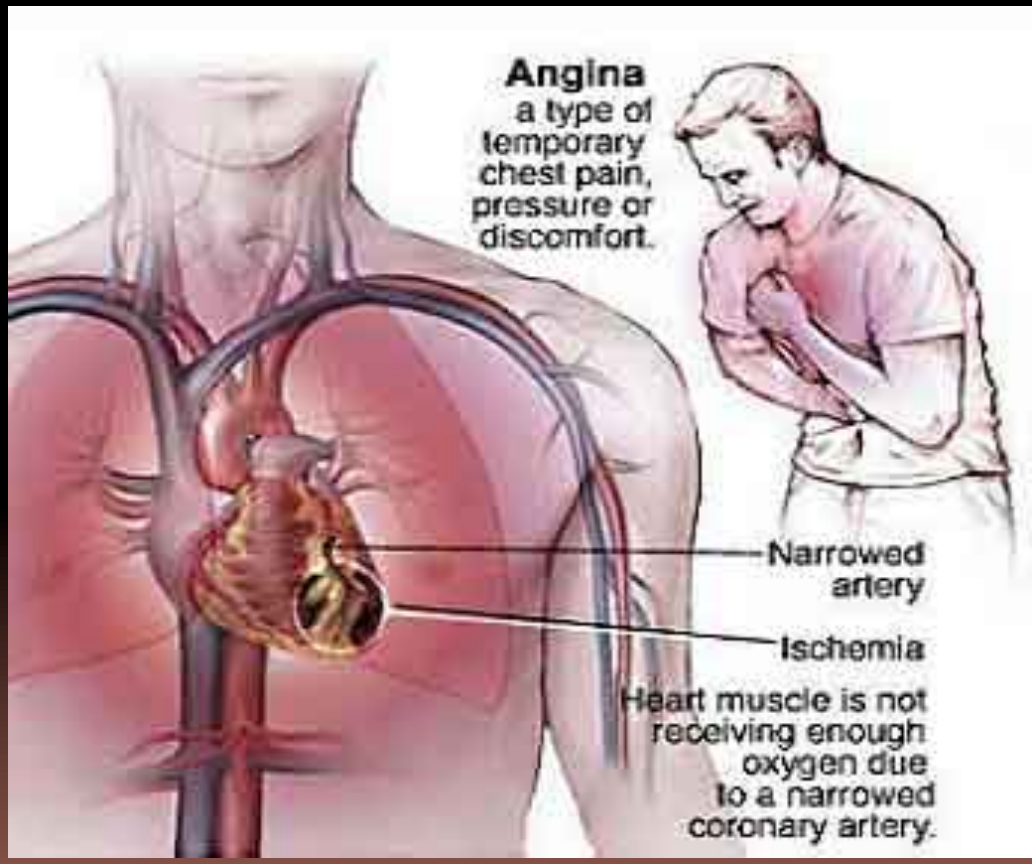
Coronary Heart Disease

- **Infarct** – an area that has been cut off from its blood supply
- **Myocardial Infarction** – heart attack



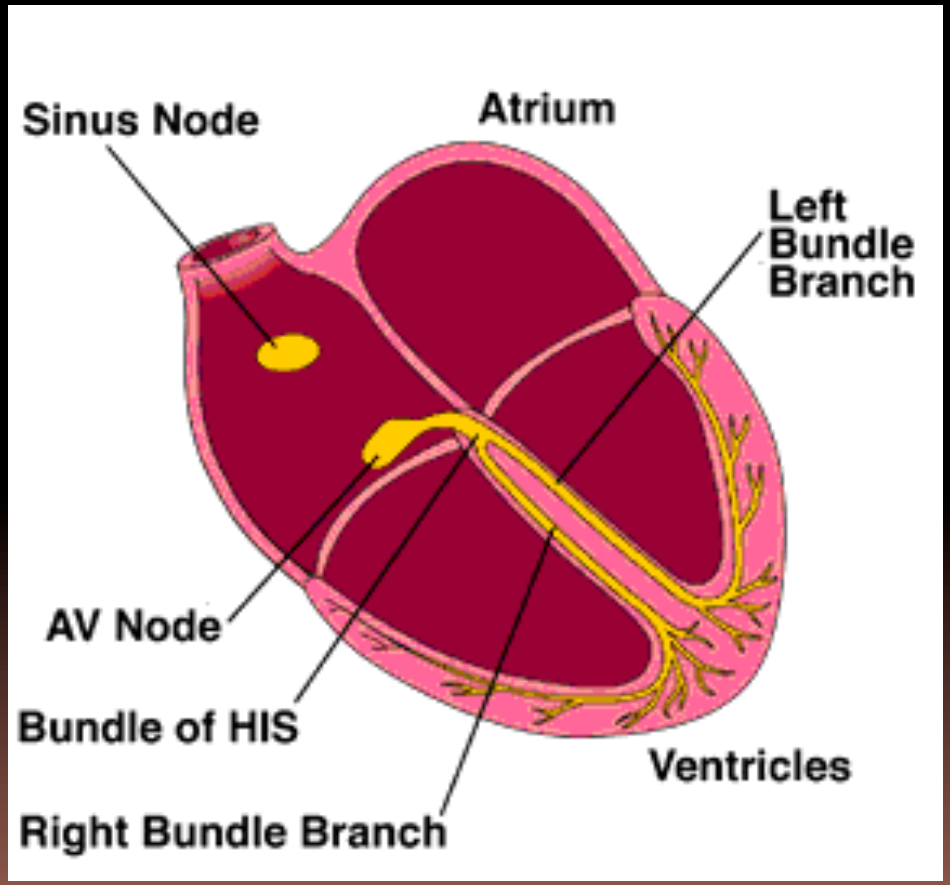
Coronary Heart Disease

- **Angina Pectoris** – pain felt due to inadequate blood flow to the heart



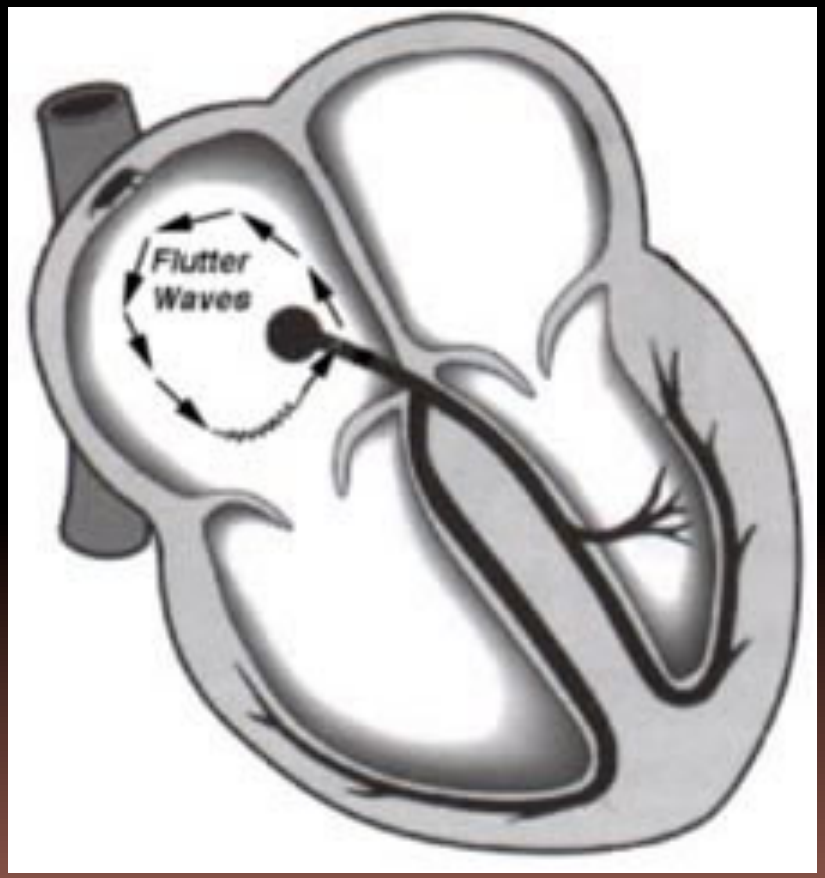
Rhythm Abnormalities

- **Arrhythmia** – abnormality in the rhythm of the heart



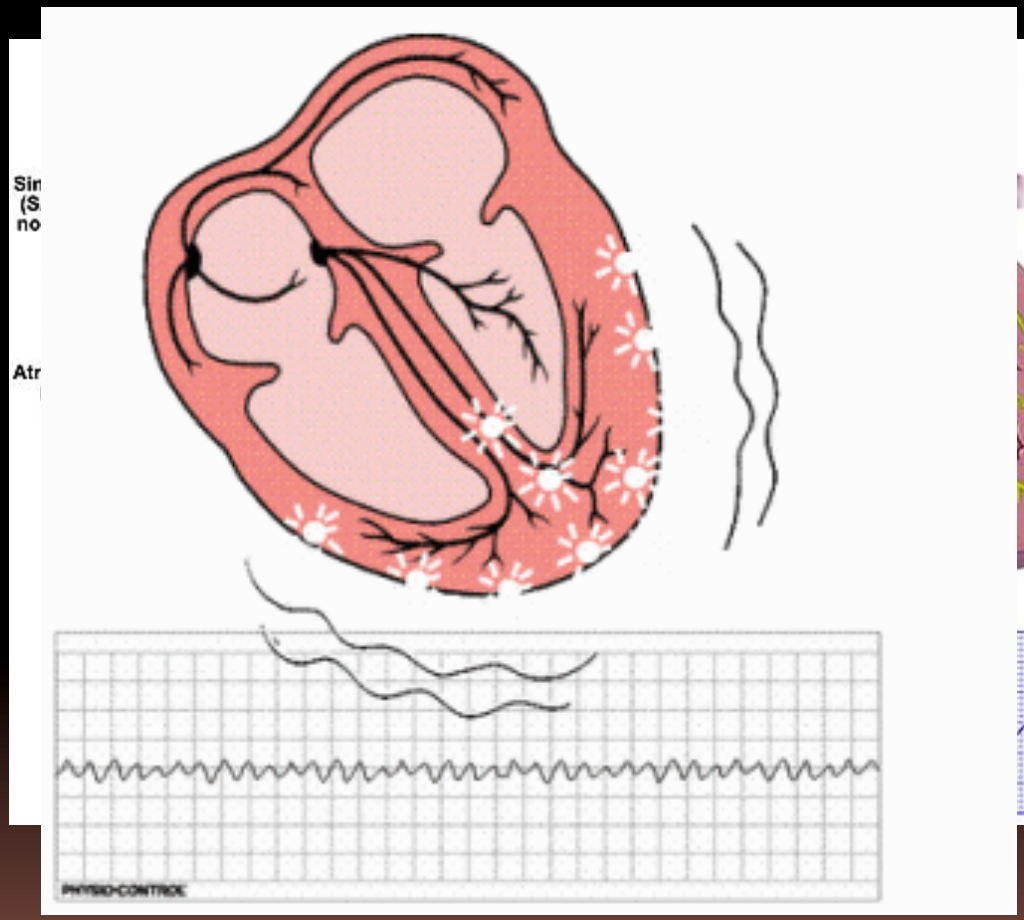
Rhythm Abnormalities

- **Flutter** – rapid, coordinated contractions up to 300 per min



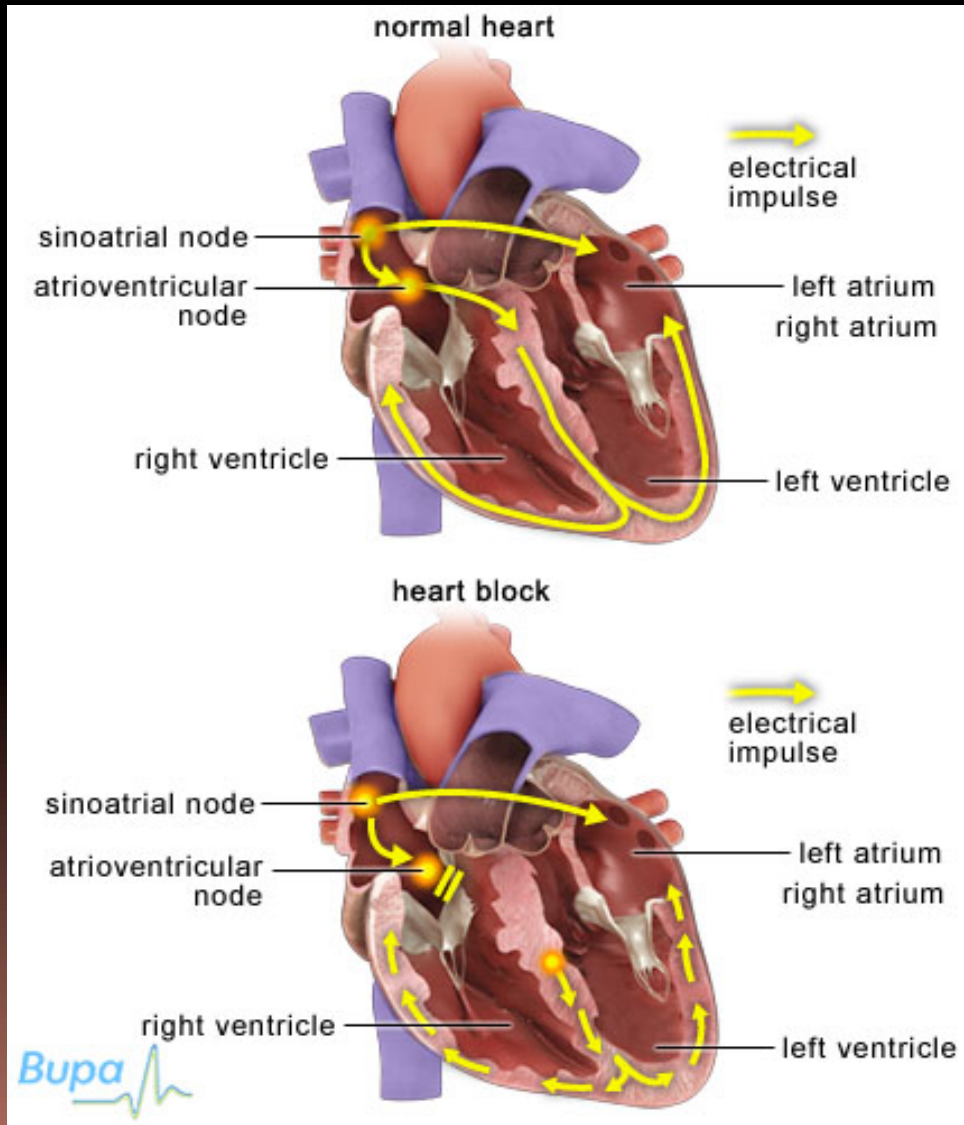
Rhythm Abnormalities

- **Fibrillations** – extremely serious, rapid, irregular contractions



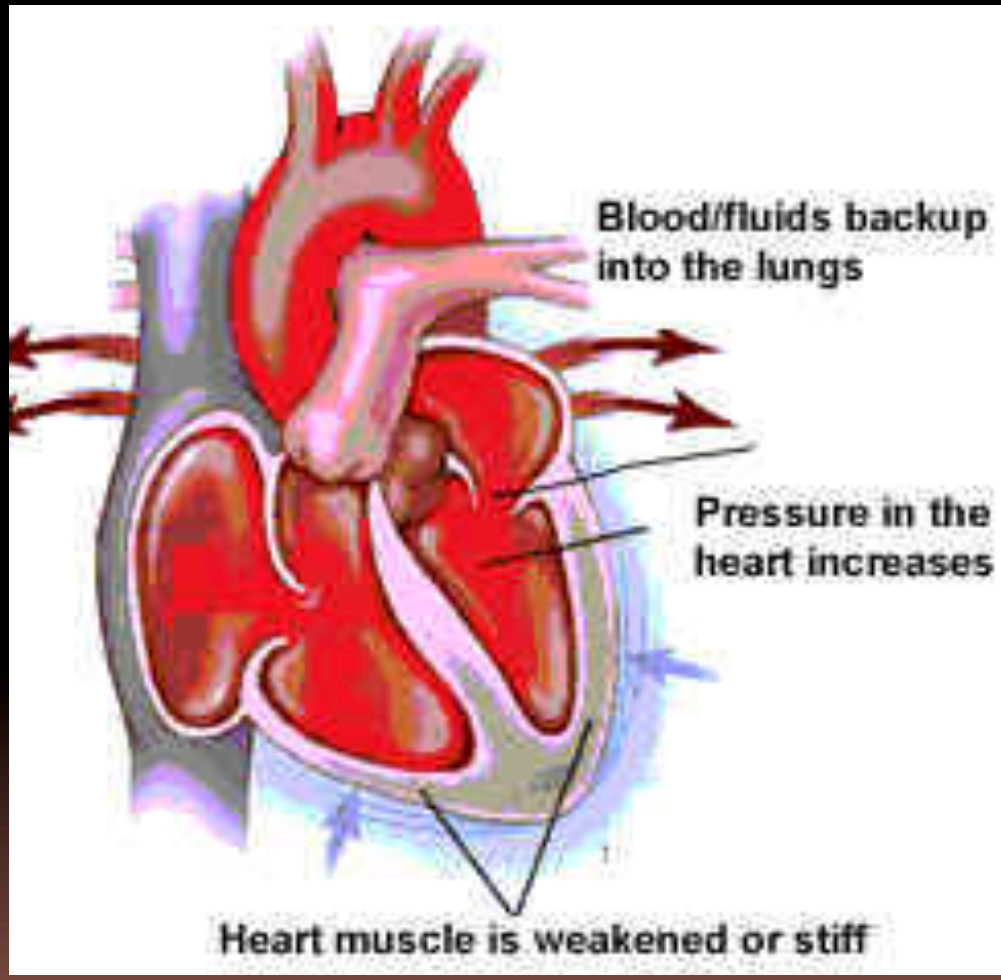
Rhythm Abnormalities

- **Heart Block** – interruption of electrical conduction



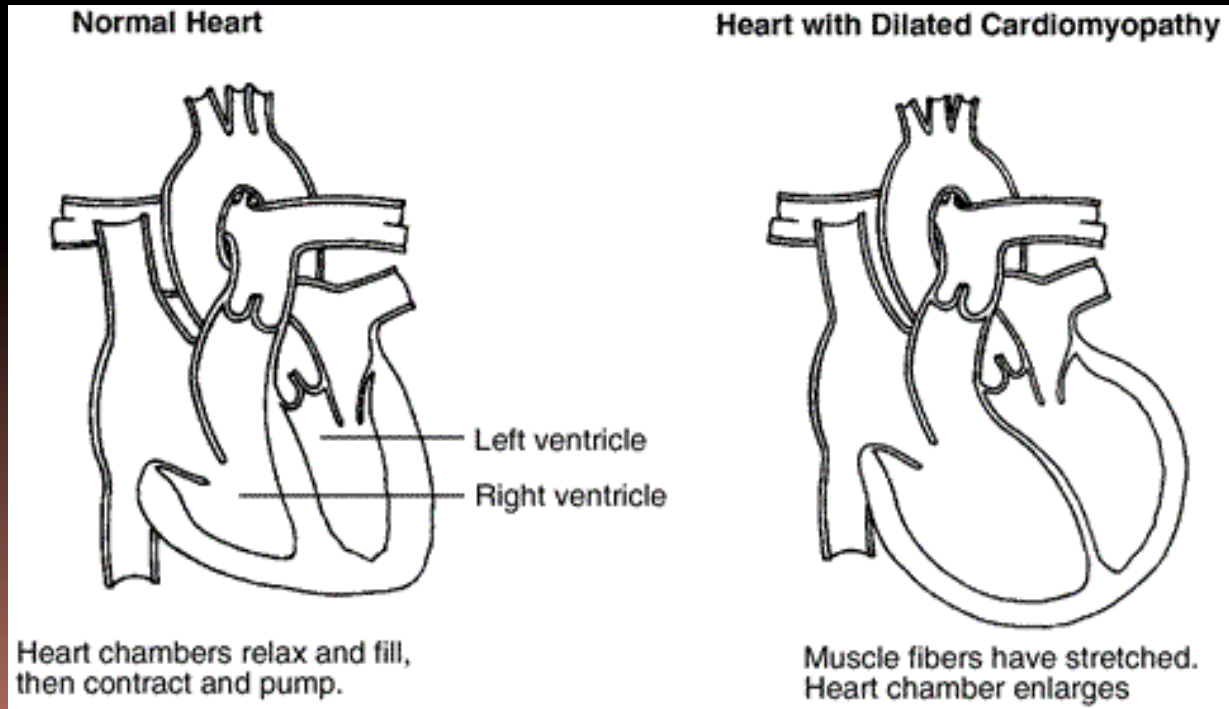
Congestive Heart Failure

- Many times caused by hypertension
- Causes enlargement of heart



Congestive Heart Failure

- Heart unable to pump effectively because it is weak
  - Kidneys save fluid
  - Short of breath
  - Edema

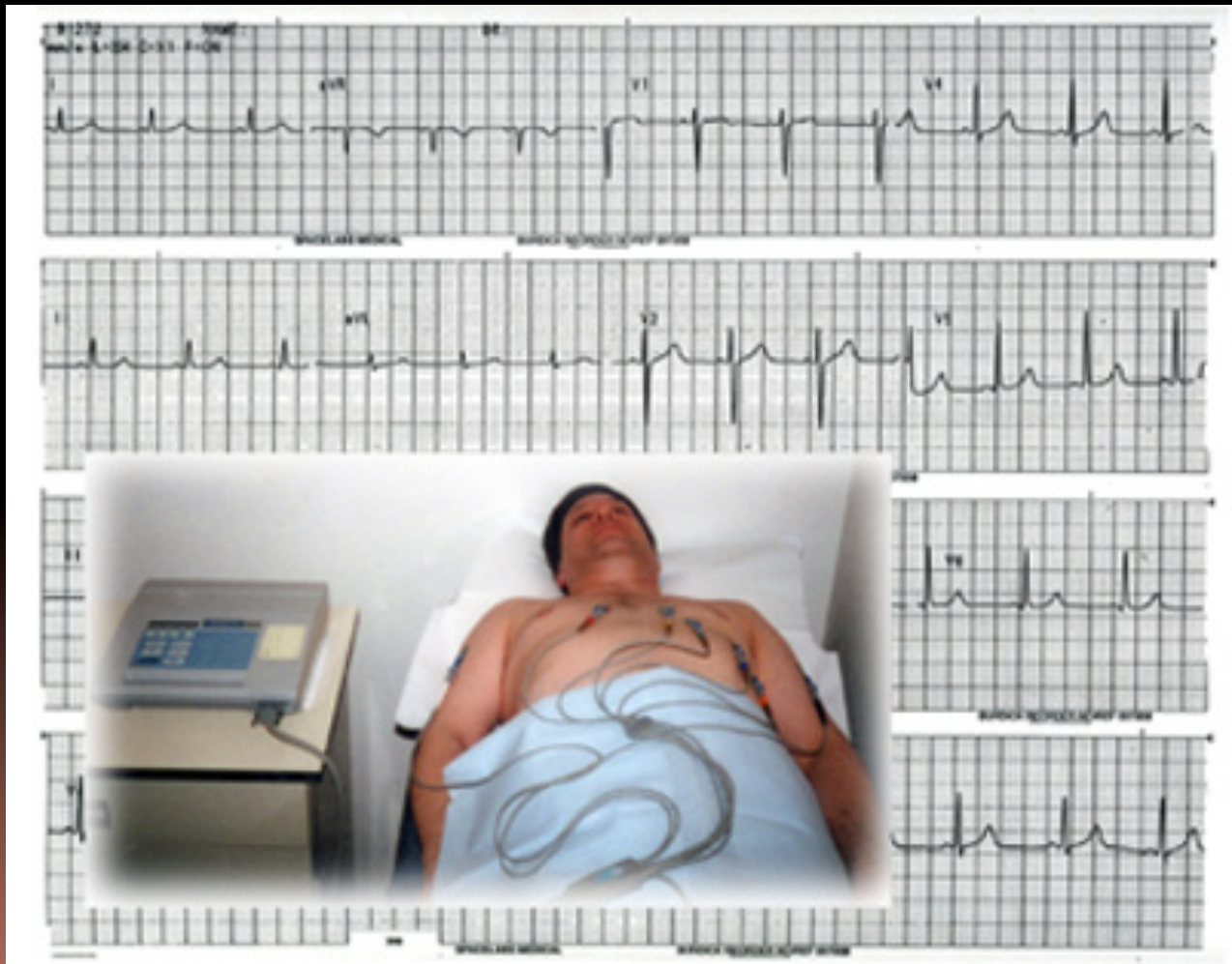


Instruments Used for Heart Study

- Stethoscope

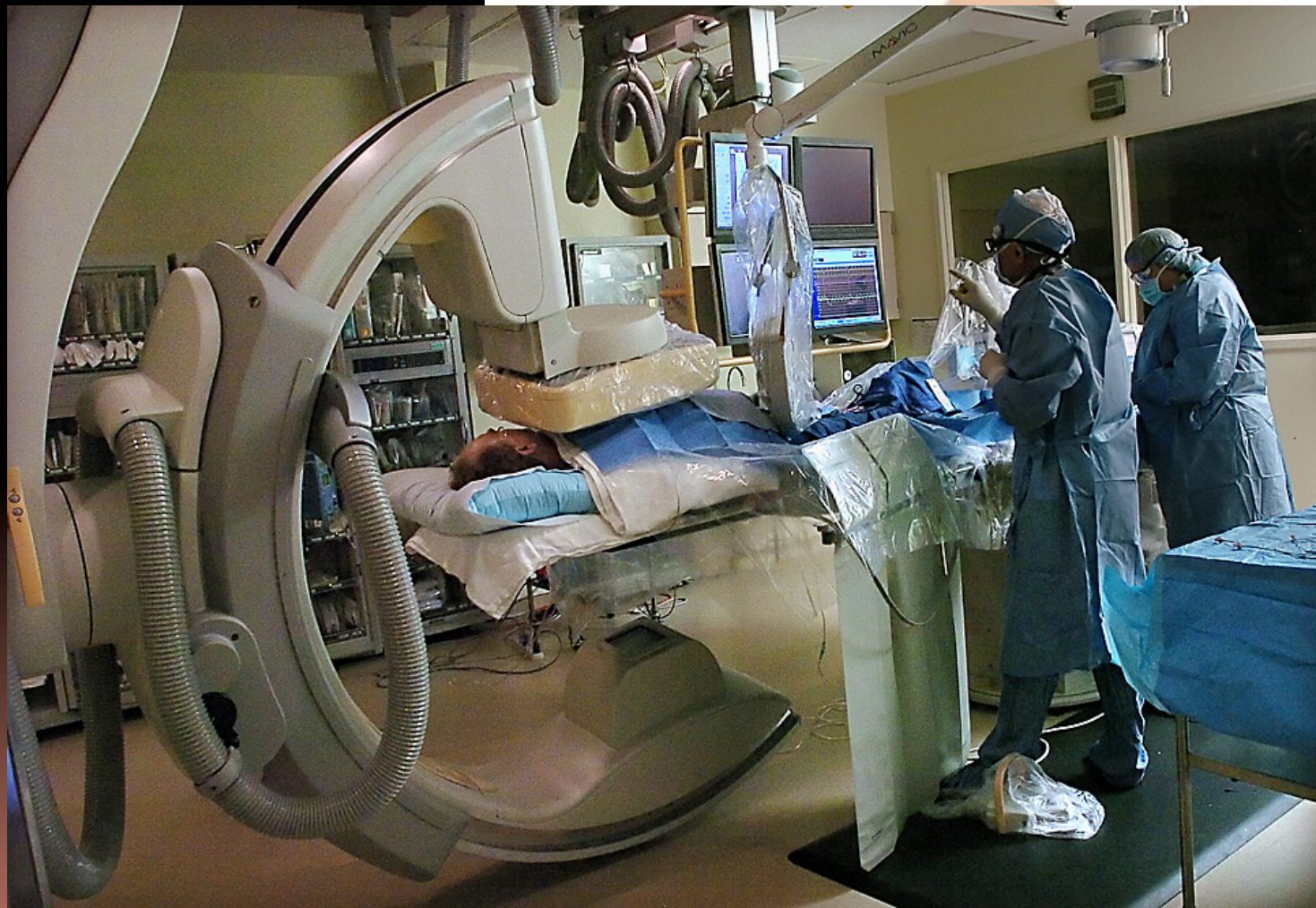
Instruments Used for Heart Study

- EKG



Instruments Used for Heart Study

- Heart Catheterization

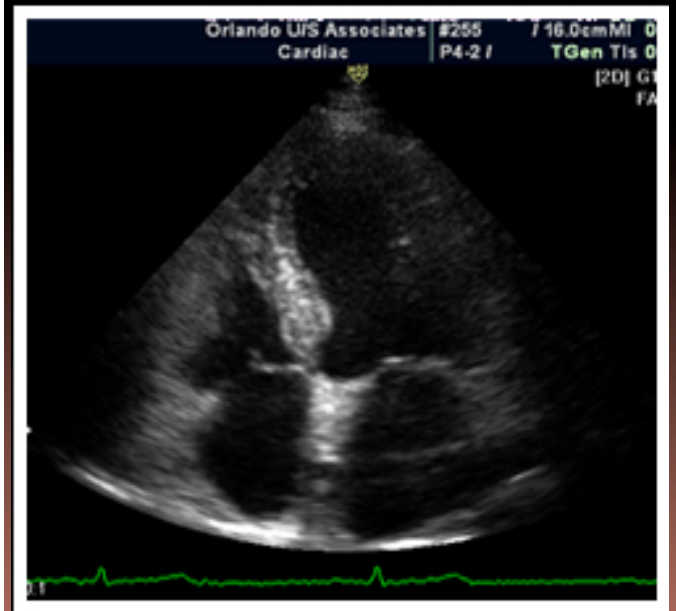


Instruments Used for Heart Study

- Fluoroscope

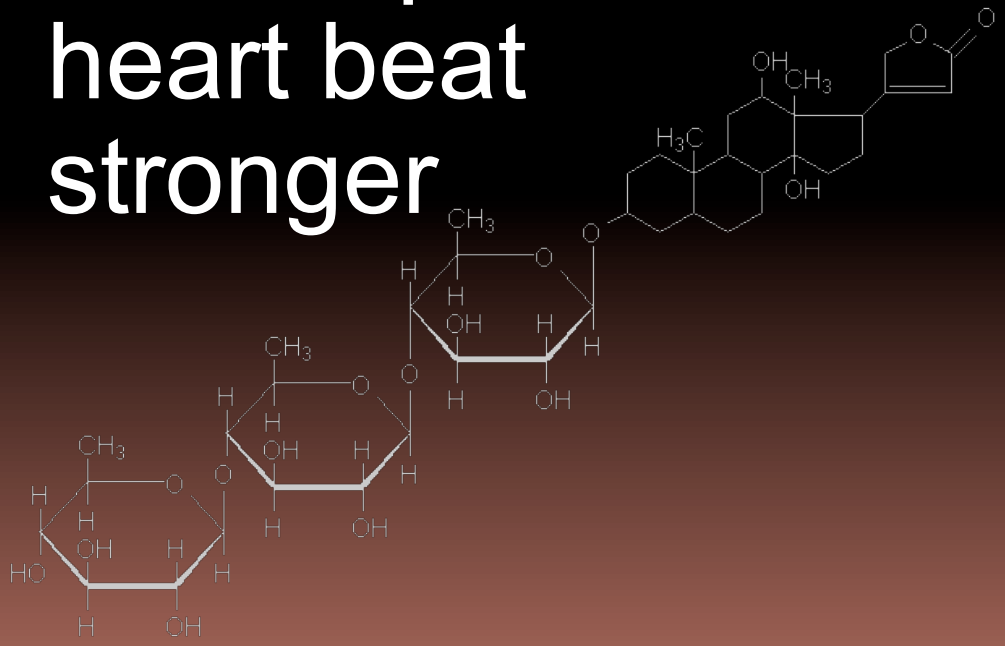
Instruments Used for Heart Study

- Echocardiogram



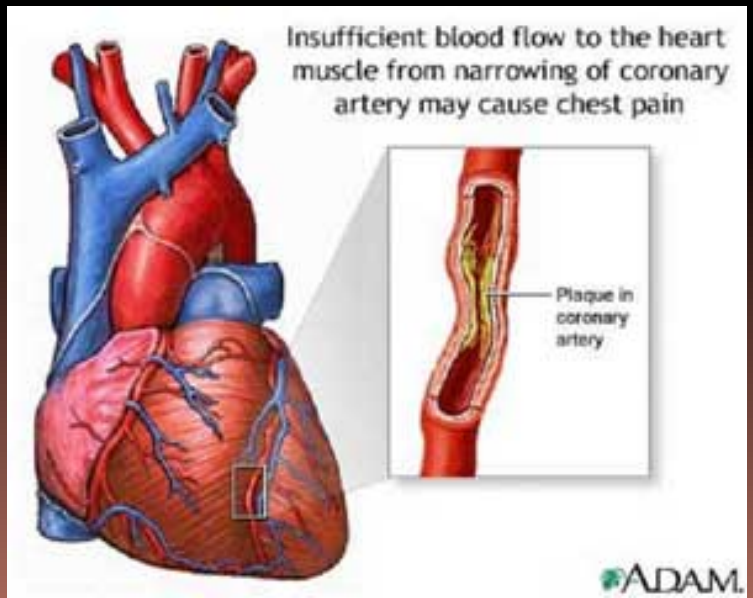
Medications

- **Digitalis** – slows contractions and helps heart beat stronger



Medications

- **Nitroglycerin** – dilates blood vessels to the heart

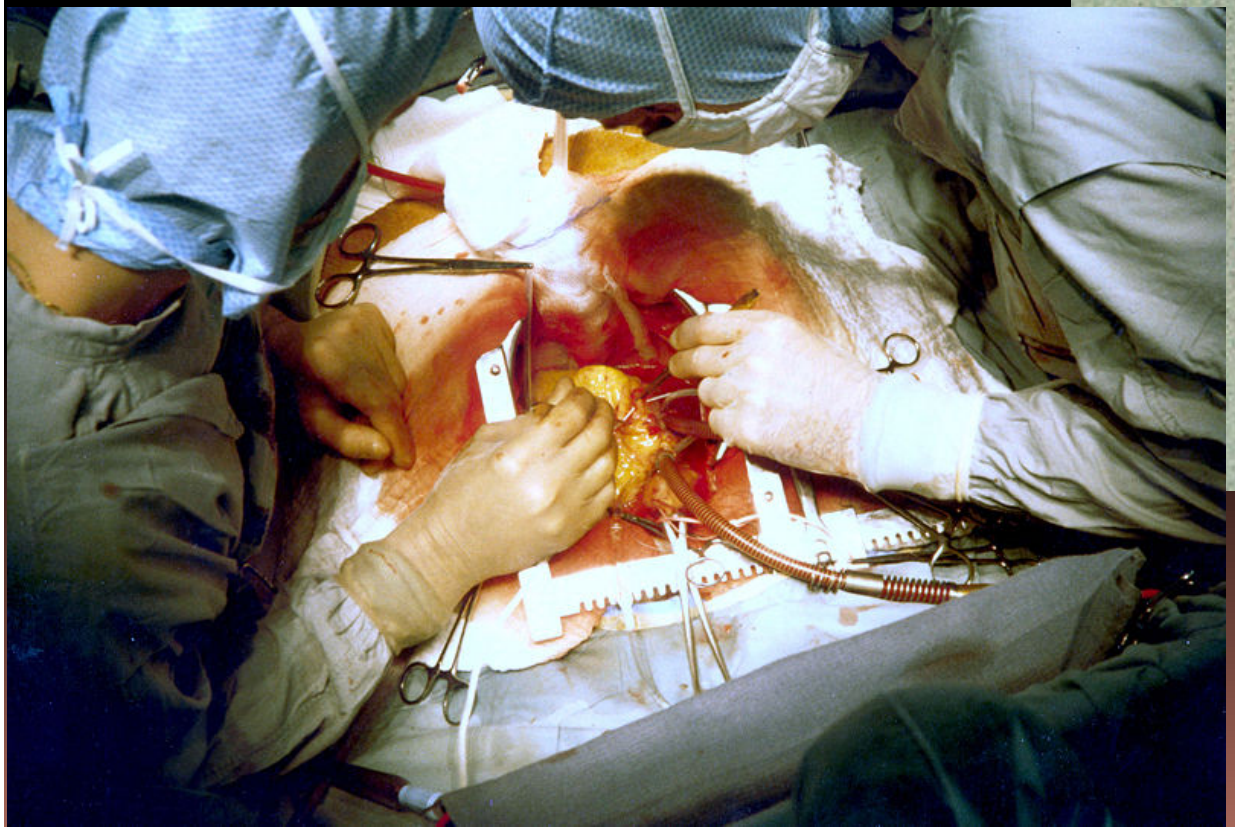


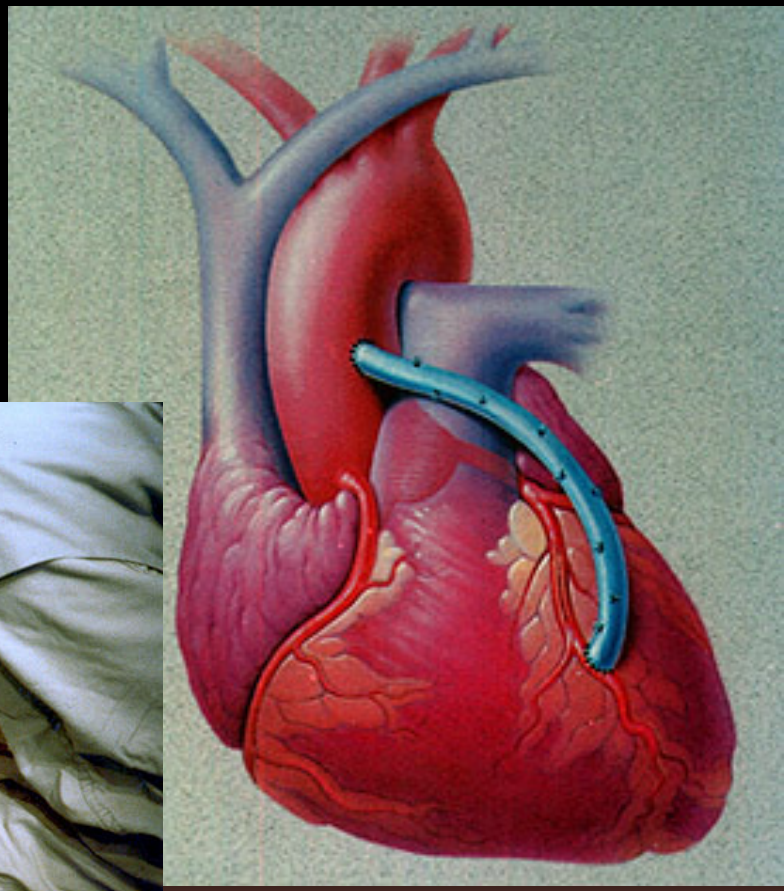
Medications

- **Antiarrhythmics** – regulate heart rhythm and rate
- **Anticoagulants** – prevent clotting
- **Beta Blockers** -decrease rate and strength of heart contractions reducing the hearts' oxygen demand

Surgeries

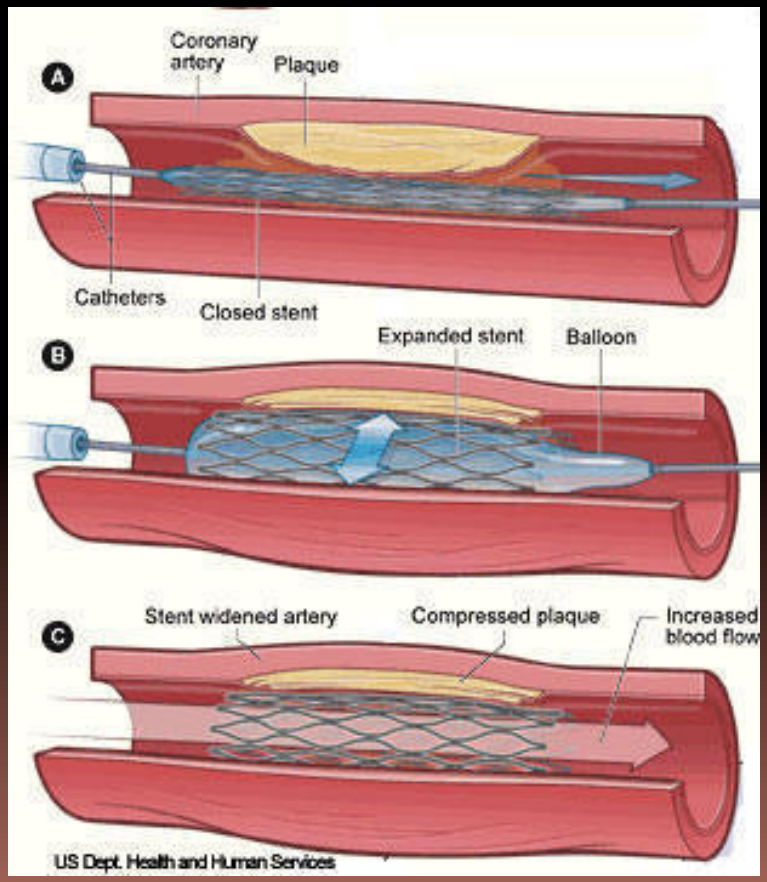
- Coronary Bypass

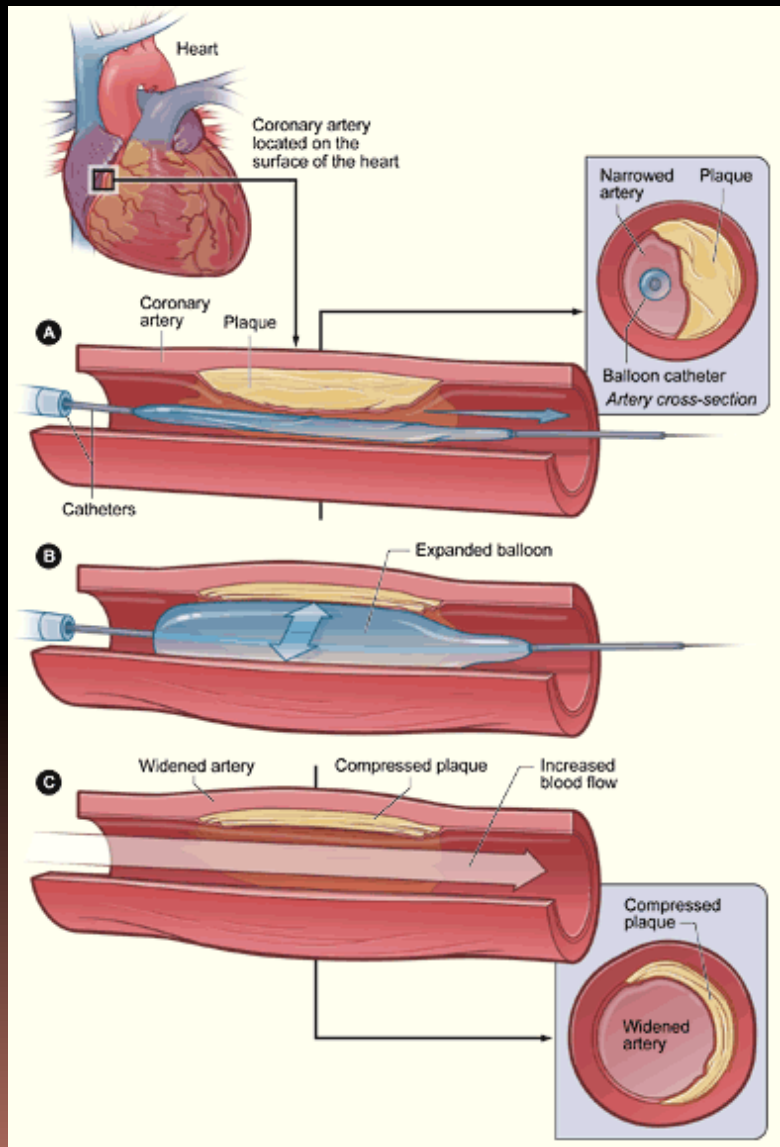




Surgeries

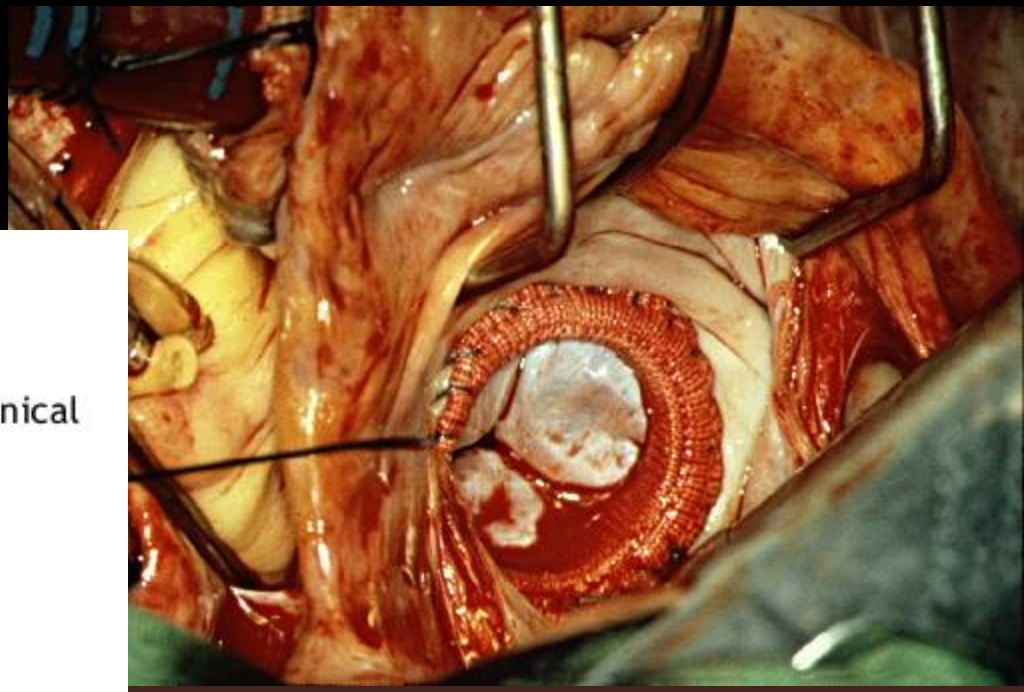
- Angioplasty

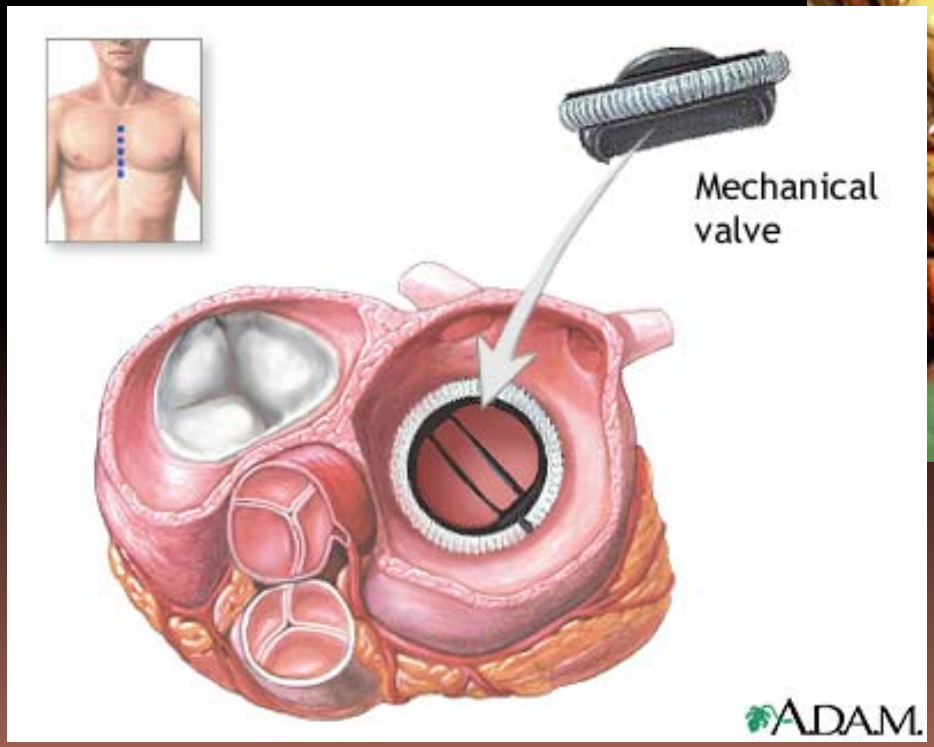




Surgeries

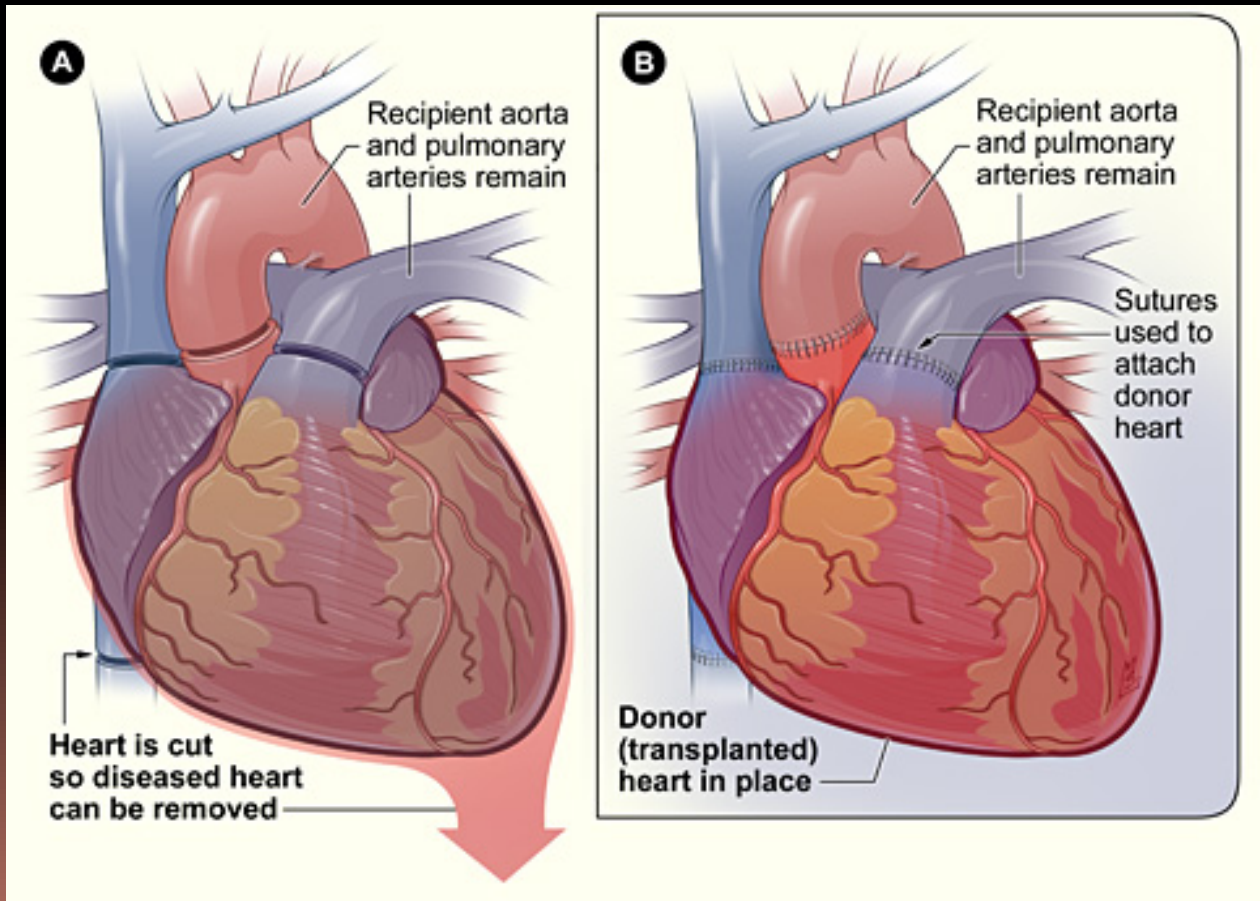
- Valve Replacement





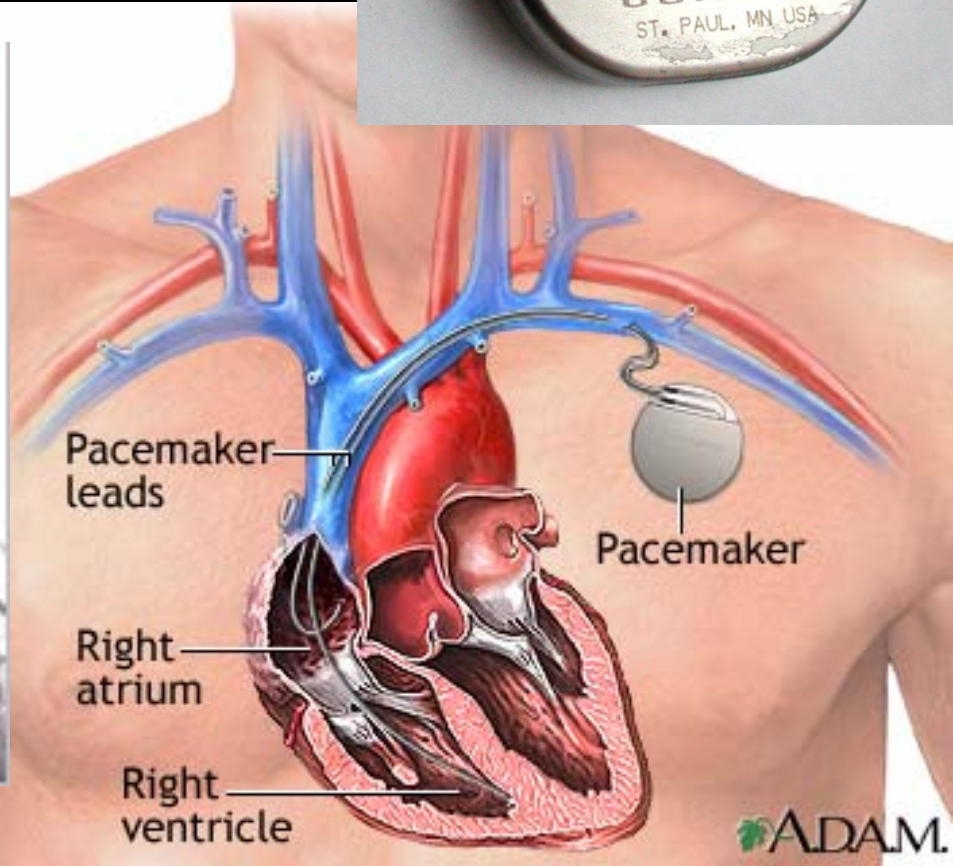
Surgeries

- Transplants



Surgeries

- Pacemakers

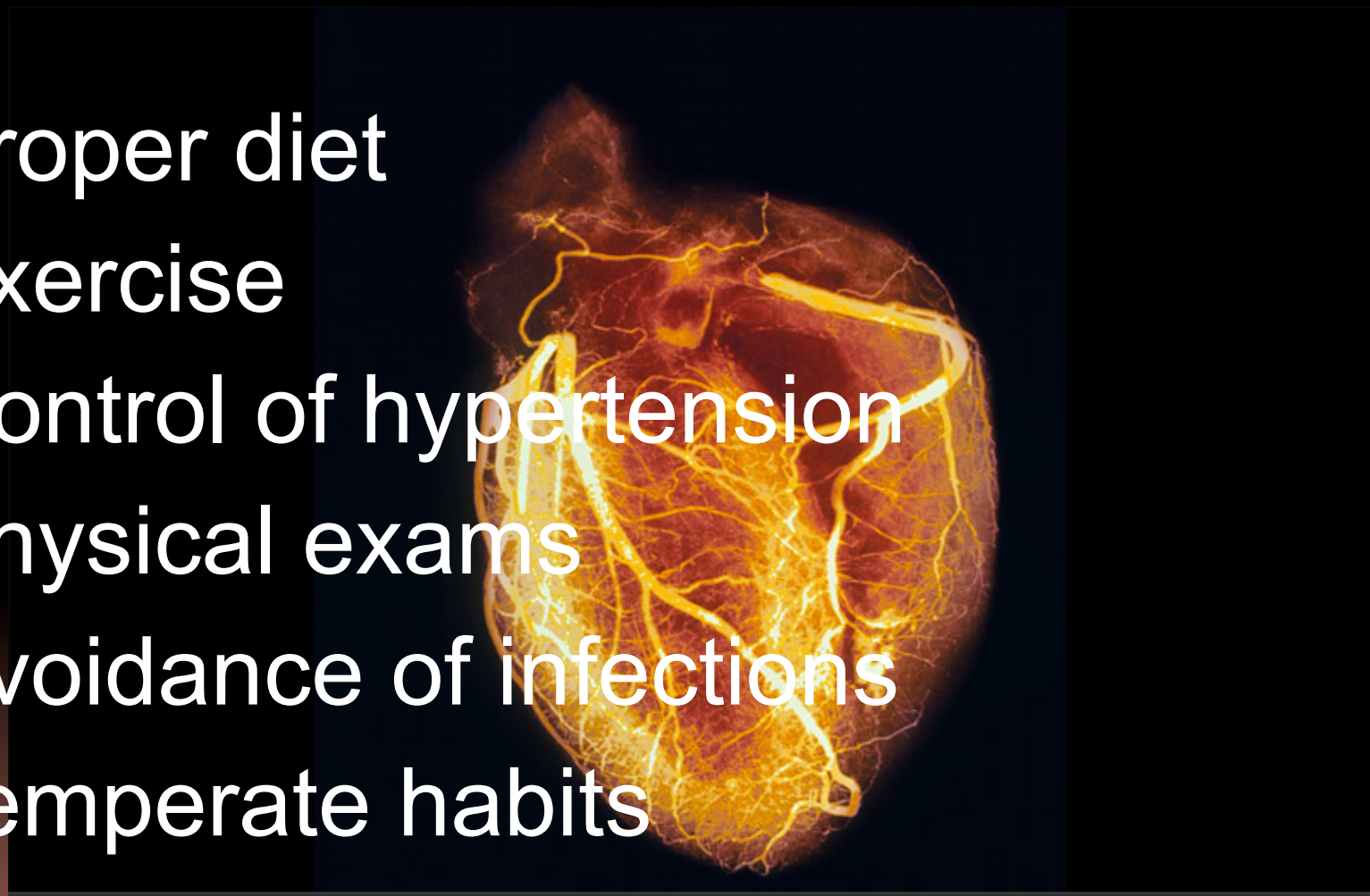


Surgeries

- Artificial hearts

Prevention of heart ailments

- Proper diet
- Exercise
- Control of hypertension
- Physical exams
- Avoidance of infections
- Temperate habits



Angiogram of a healthy heart
Photograph by SPL/Photo Researchers, Inc.

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