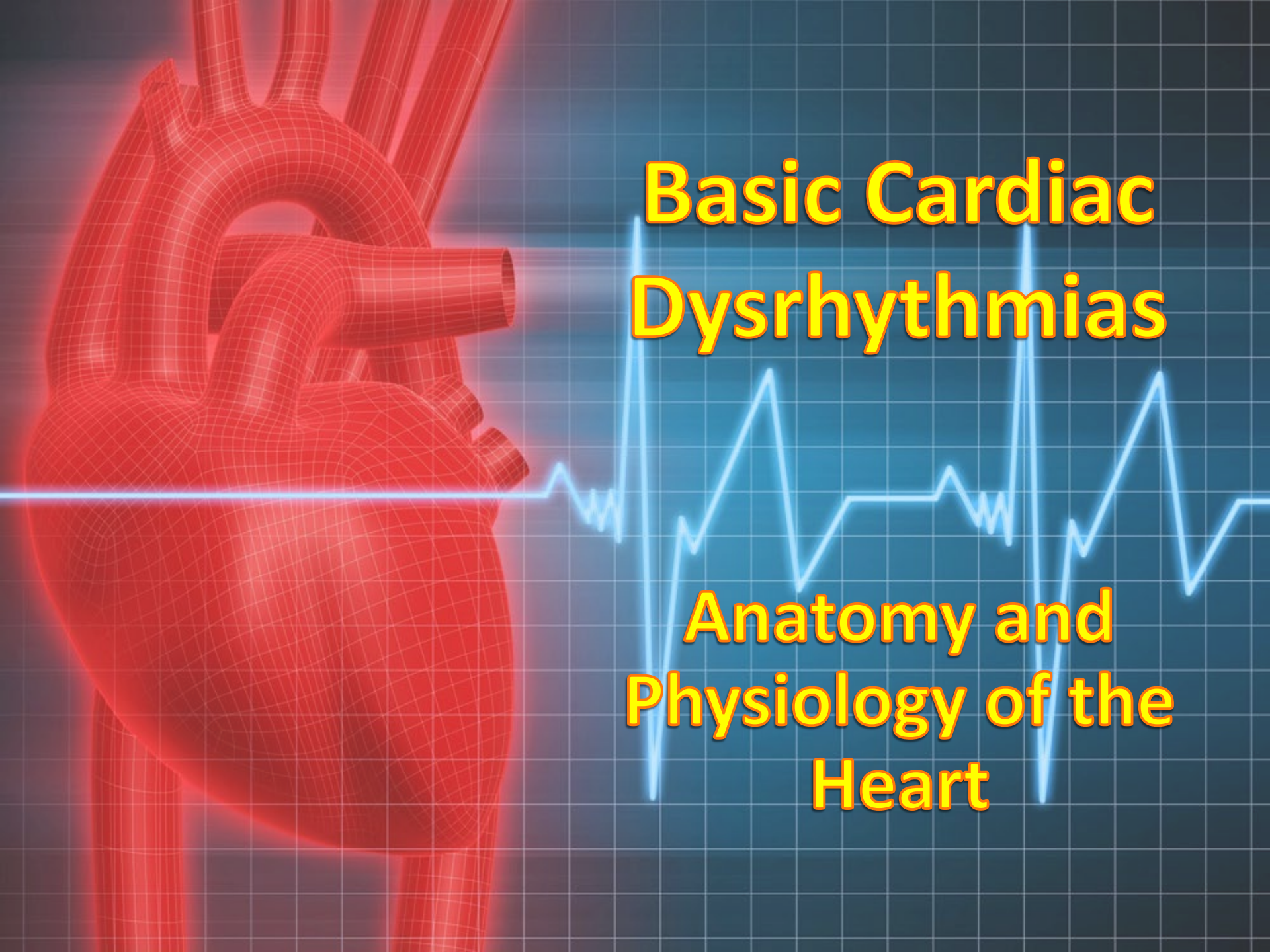

Basic Cardiac Dysrhythmias
Anatomy and Physiology of the Heart

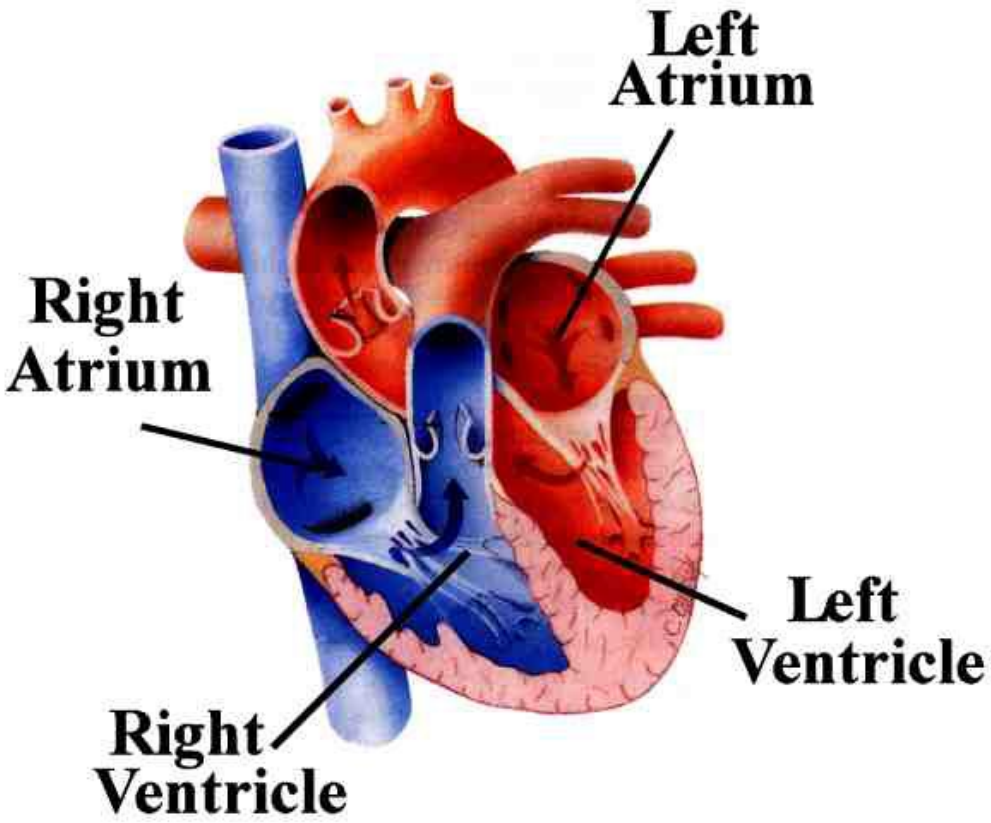
Heart Anatomy

- Heart is located in chest cavity between sternum and spinal column

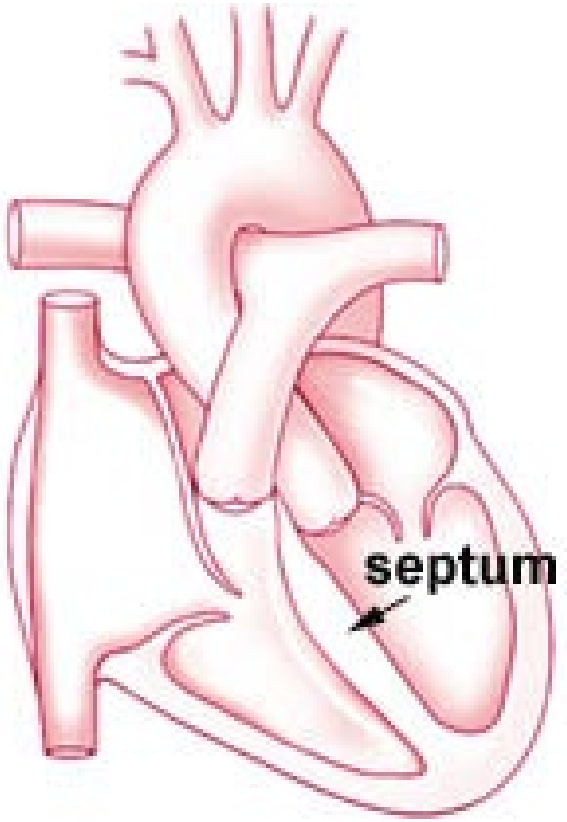
- Sole purpose is to circulate blood

Heart Chambers

- Four chambers:
  - Right Atrium
  - Left Atrium
  - Right Ventricle
  - Left Ventricle



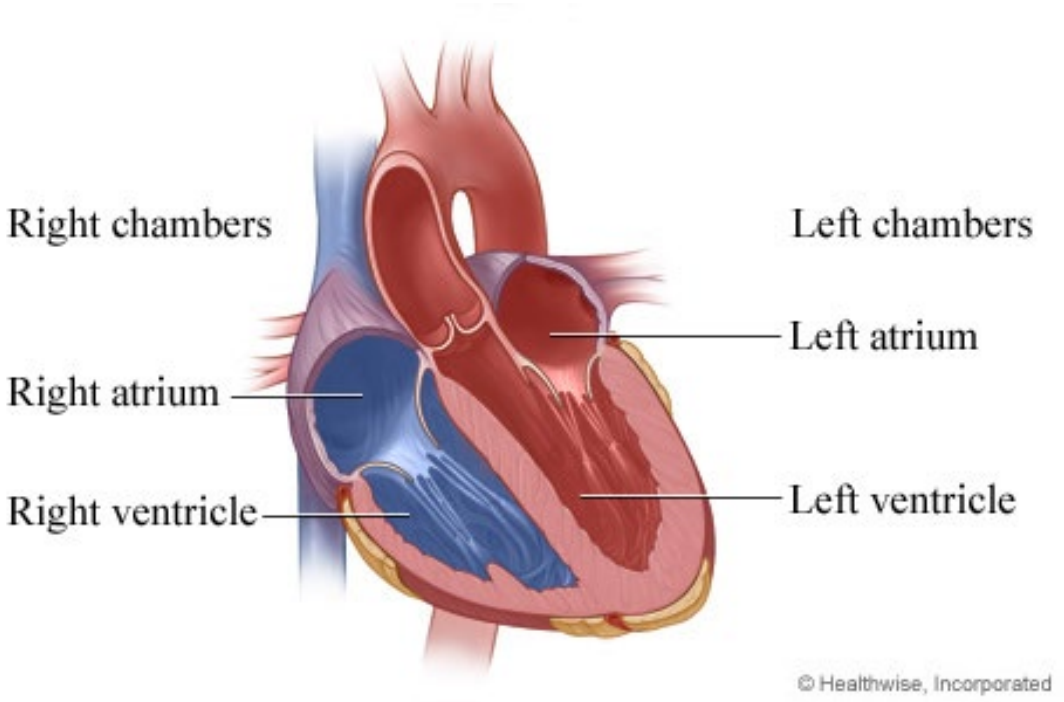
Heart Chambers



- Differences:
  - Atria
    - Upper chambers
    - Reservoirs for blood
    - Thin-walled
  - Ventricles
    - Lower chambers
    - Right = Thinner-walled than left
    - Left = Much thicker walls to pump blood throughout body
- Septum separates heart into left and right sides

Heart Chambers

- Ventricles
  - Right
    - Pumps blood to the lungs
  - Left
    - Pumps blood throughout the body
    - Produces a pulse



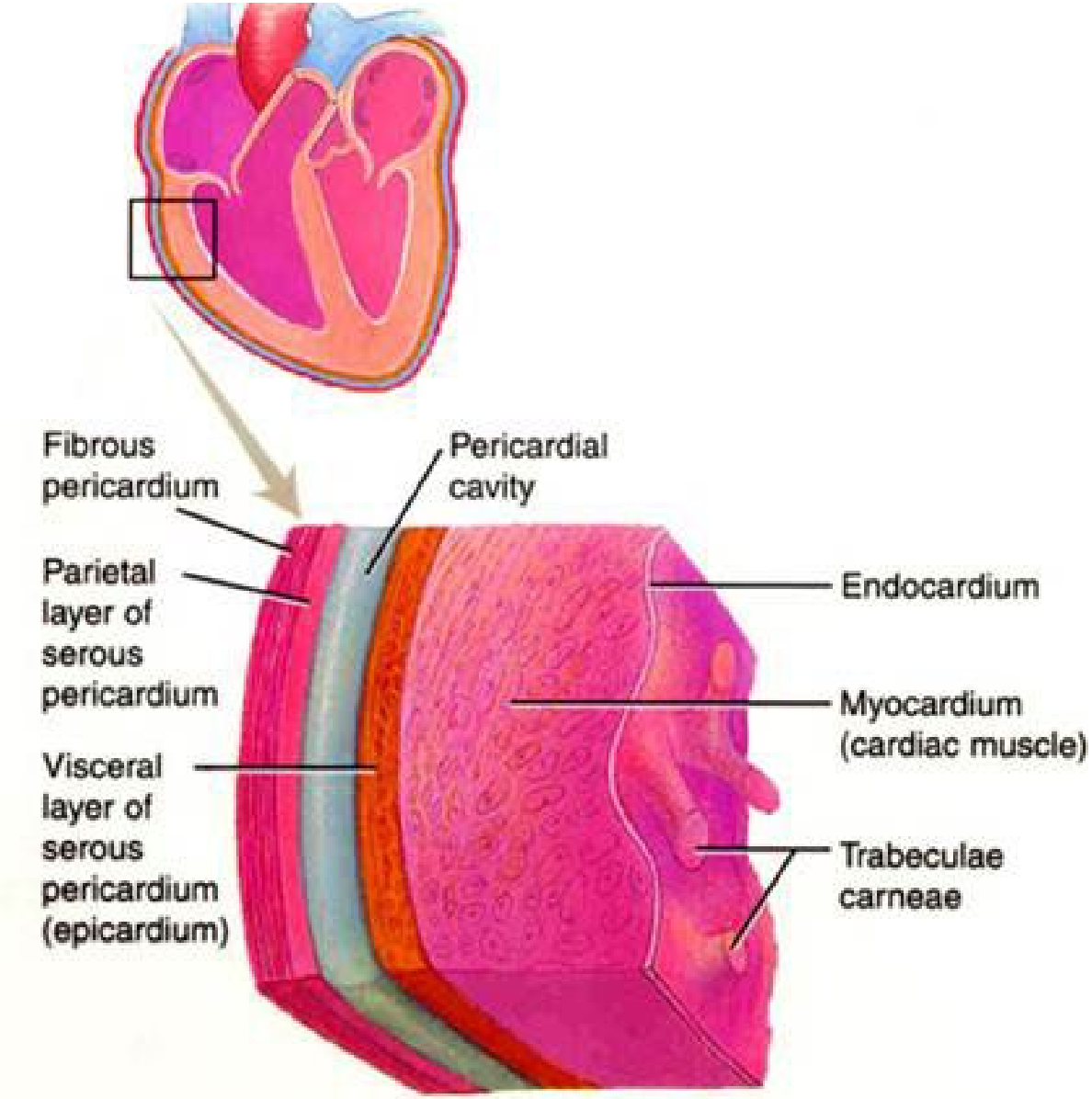
Heart Muscle

- Three main layers of heart tissue
  - Endocardium
    - Inner layer
    - Lines chambers of heart and covers the valves
  - Myocardium
    - Middle layer
    - Provides pumping action to circulate blood
  - Epicardium
    - Outer layer
    - Thin, protective membrane that covers outside of heart

Heart Muscle

- Heart contained in pericardial sac
  - Fluid in sac (pericardial fluid) acts as lubricant to allow heart to move within sac as it beats
- Myocardium and pericardium further divided into sub-layers

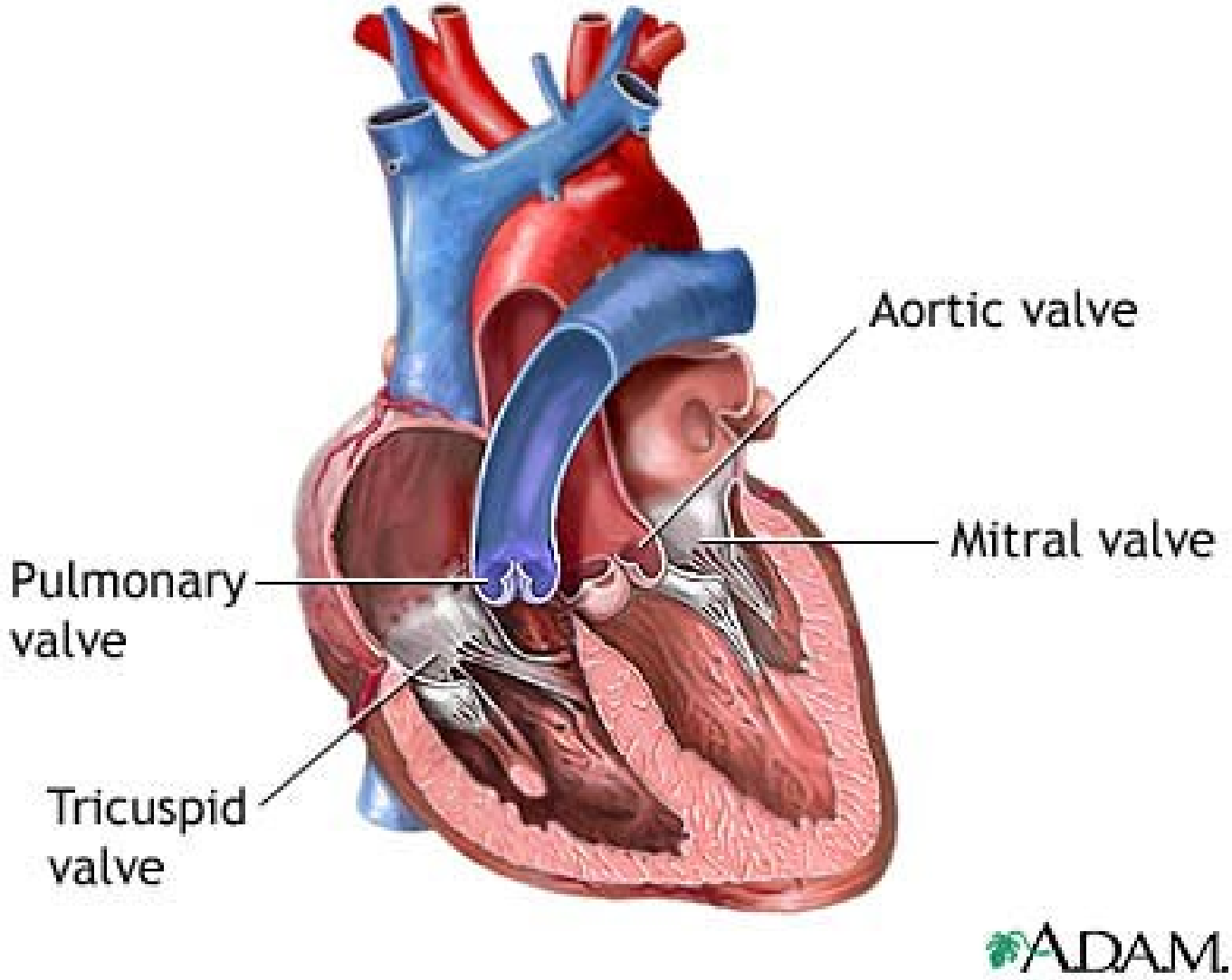
Heart Muscle



Heart Valves

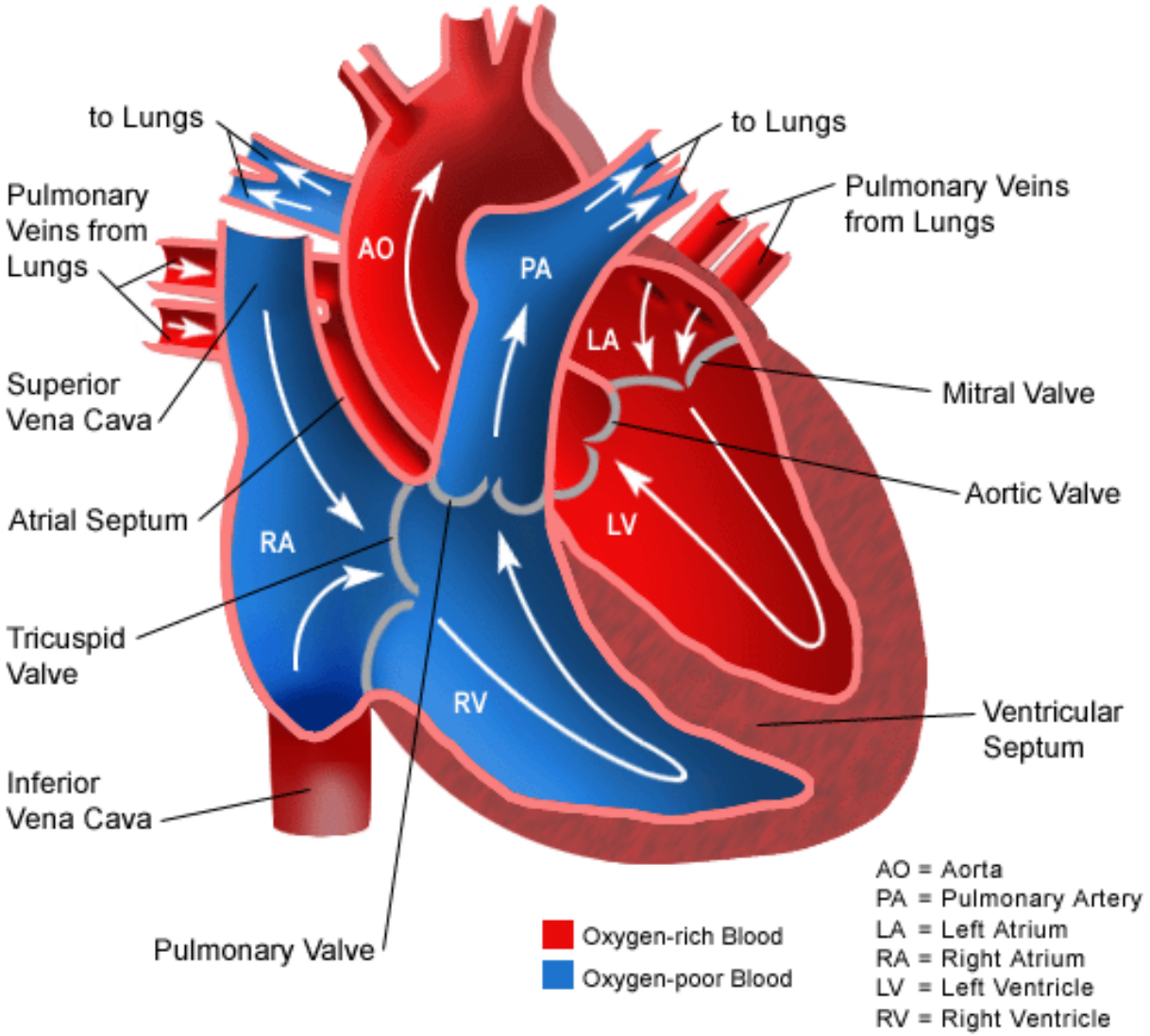
- Four valves
  - Tricuspid valve = Between right atrium and right ventricle
  - Pulmonary valve = Between right ventricle and pulmonary artery
  - Mitral valve = Between left atrium and left ventricle
  - Aortic valve = Between left ventricle and aorta

Heart Valves



Heart Valves

- Flaplike structures that open and close in response to pumping action of heart
- Video



Heart Valves

- Heart sounds are the sounds caused by the normal closing of the valves
- Murmur = Abnormal sound made by blood flowing through a malfunctioning valve, usually the mitral valve

Role of the Lungs

- When blood leaves right side of heart, goes into lungs
- Main function of lungs is remove CO_2 from blood and replace it with O_2
- Video

Blood Vessels

- Primary purpose is transportation of oxygenated blood to body cells and then blood with CO_2 from the body cells to lungs
- Three main types
  - Arteries
  - Veins
  - Capillaries

Arteries

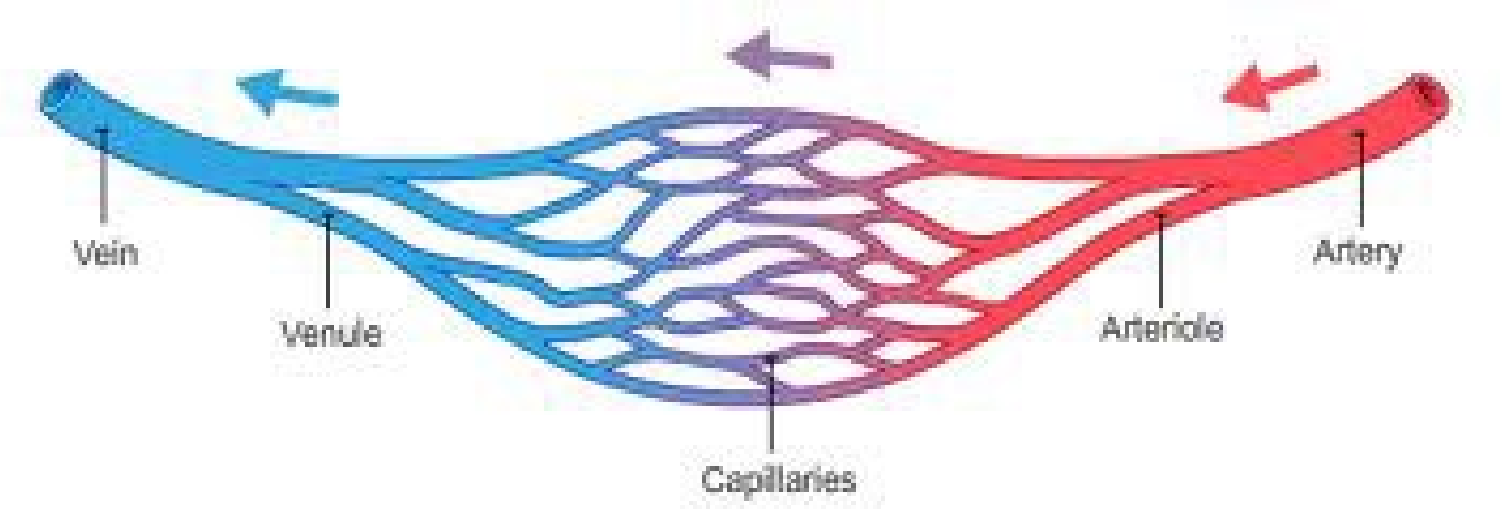
- Carry oxygenated blood away from heart
- Thickest walls of all blood vessels
- Aorta is largest artery
- Arteries divide into arterioles
- Arterioles connect arteries to capillaries

Veins

- Carry blood with CO_2 from body cells back to heart
- Thinner than arterial walls
- Peripheral veins (arms and legs) contain tiny valves to prevent back flow of blood
- Inferior and superior vena cava are largest veins and do not have these types of valves
- Venules= smallest veins that connect

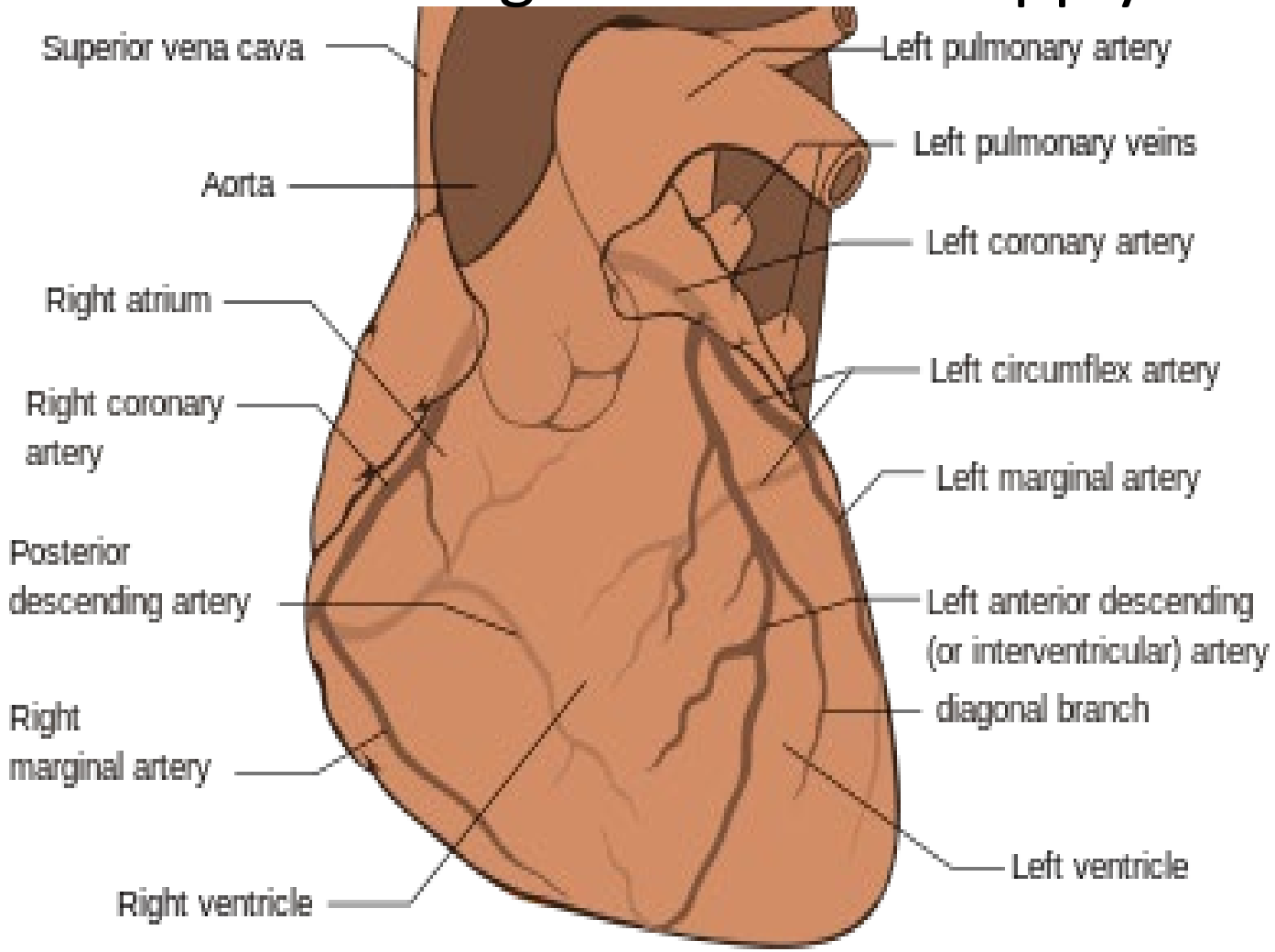
Capillaries

- Exchange of nutrients and waste products for body cells
- Smallest blood vessels
- Thinnest walls



Coronary Arteries

- Where the heart gets its blood supply



Myocardial Infarction

- Blockage occurs in coronary artery
- Muscle nourished by blood supply from artery does not get necessary oxygen (ischemia)
- Ischemia causes chest pain (angina pectoris or angina)
  - Can be mild or severe
- Angina may be centered in chest or move to left shoulder, either arm, jaw or upper back

Myocardial Infarction

- Shortness of breath may occur
- Myocardial infarction = Death of cardiac tissue
  - Can affect any area of heart muscle
  - May cause interruption to electrical conduction, causing dysrhythmias
- Video

Heart/Lung Circulation

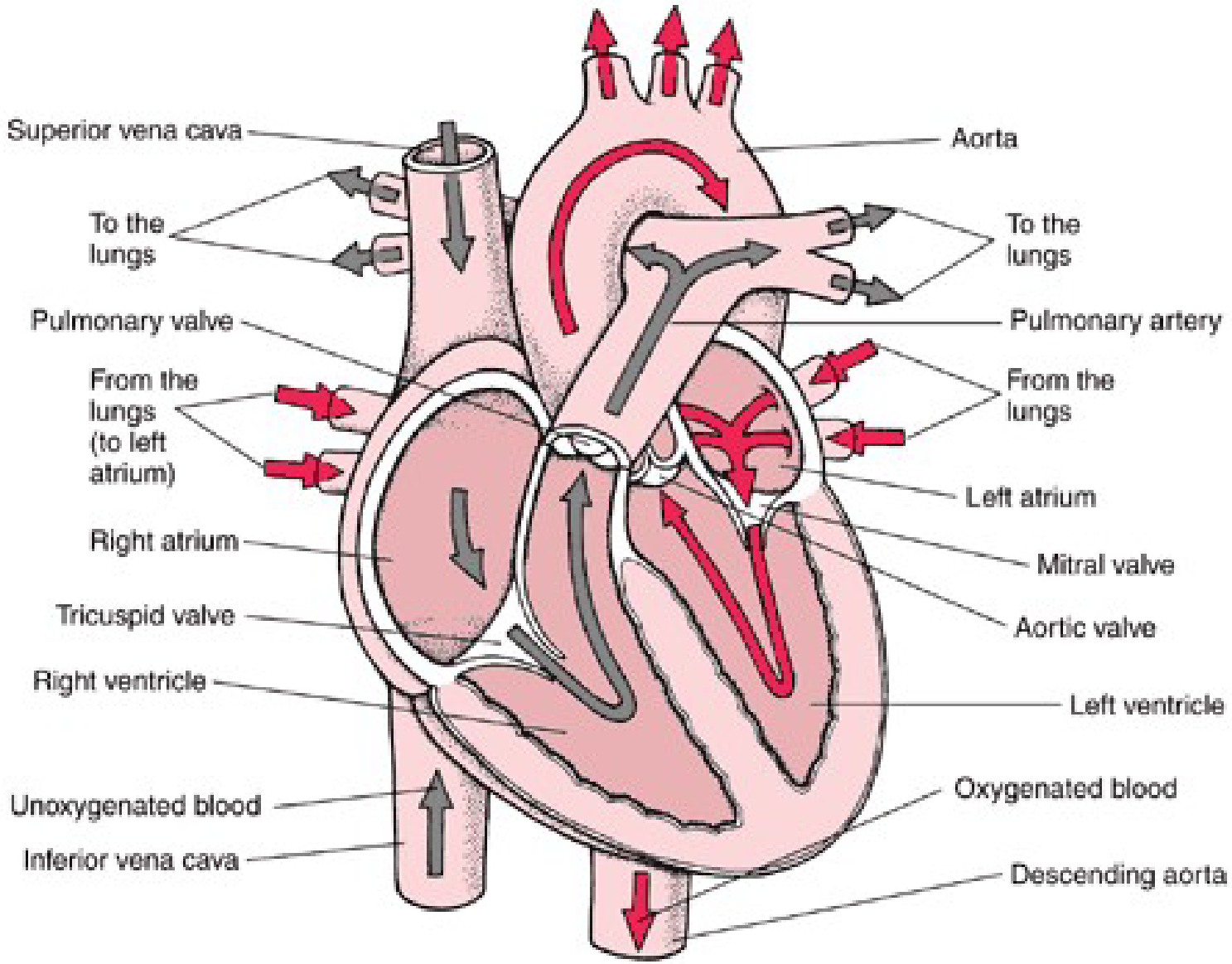
- Right side of heart gets blood from inferior and superior vena cava
- Sends this blood to lungs
- Lungs filter CO2 and exchange with O2
- Oxygenated blood flows to left side of heart
- Left side pumps into aorta

Heart/Lung Circulation

Inferior and superior vena cava →
R atrium → Tricuspid valve → R ventricle →
Pulmonary valve → Pulmonary arteries →
Lungs → Pulmonary veins → L atrium →
Mitral valve → L ventricle → Aortic valve →
Aorta → Rest of body (incl. heart)

Video

Heart/Lung Circulation



Cardiac Output

- Measures efficiency of heart pumping and blood circulation
- Cardiac Output (CO) = Amount of blood pumped by left ventricle (LV) in 1 min
- Measured by multiplying heart rate (HR) by stroke volume (SV)
  - CO = SV x HR
- SV = Amount of blood pumped by LV with each contraction (beat) – approx. 70 ml
- HR = # of times LV contracts in 1 min – normal is 60-100 bpm

Cardiac Output

- Example:
  - SV = 70 ml
  - HR = 80
  - CO = SV x HR so CO = 5600 ml
- Exercise can make SV ↑ and HR ↓
- Injury or disease can make SV ↓ and HR ↑ to compensate for less blood
- If heart can't ↑ SV or HR, CO will ↓
- Poor CO can cause damage to major organs
- Video

Electrophysiology

- Cardiac muscle can respond to or generate an electrical impulse
- Mechanical function ability of cardiac cells:
  - Contractility: Shorten (contraction of cardiac muscle)
- Electrical function abilities of cardiac cells:
  - Automaticity: Pacemaker cells generate/initiate own electrical impulses
  - Excitability: Respond to electrical stimulus; Irritability
  - Conductivity: Transmit electrical stimulus to other cardiac cells

Cardiac Action Potential

- Divided into 5 phases:
  - Phase 0: Depolarization phase
  - Phase 1: Early rapid repolarization phase
  - Phase 2: Plateau phase
  - Phase 3: Terminal phase
  - Phase 4: Period between action potentials

Polarization

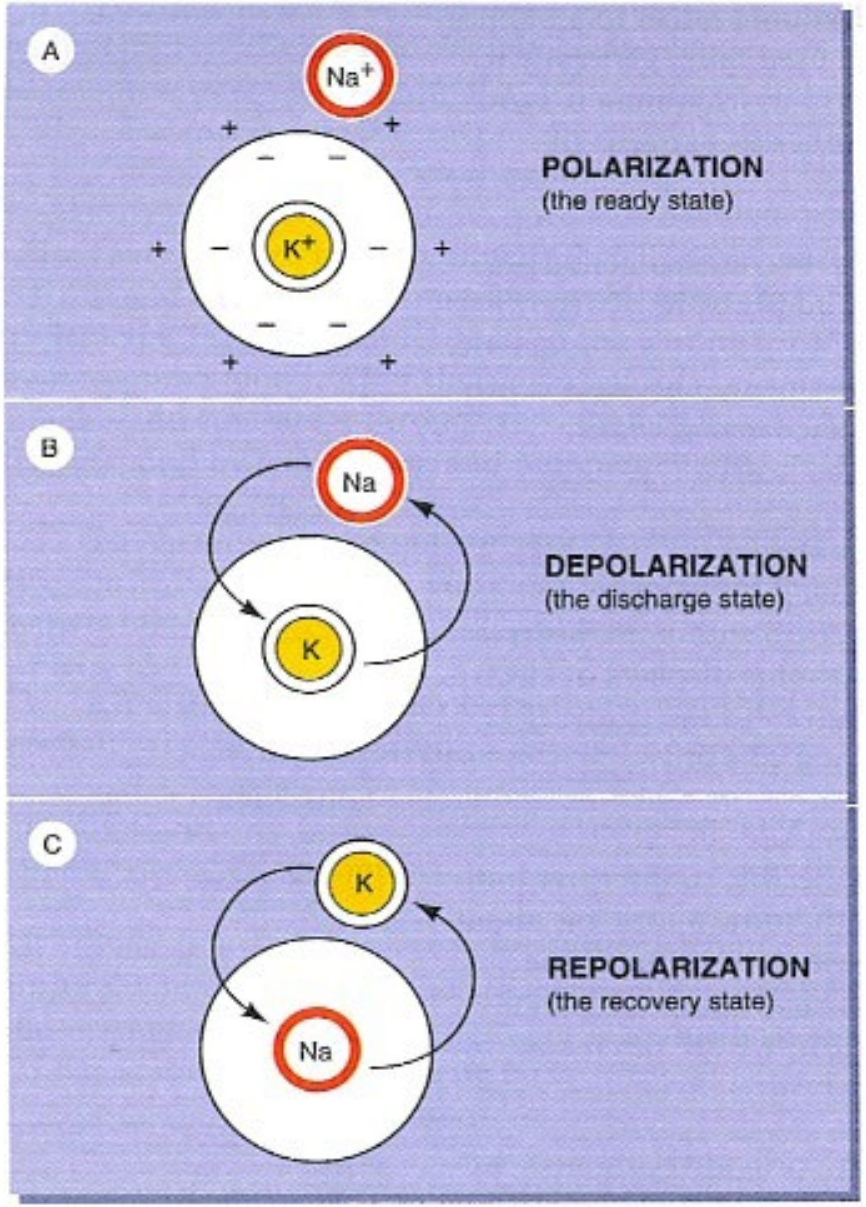
- Polarization = Readiness
- Depolarization = Contraction
- Repolarization = Recovery

Electrical Activity at the Cellular Level

Polarization

Depolarization

Repolarization



Electrical Conduction Pathways

- Conduction pathway of heart: (Video)

Sinoatrial (SA) node (Pacemaker of heart)

↓

Intraatrial and Internodal Pathways

↓

Atrioventricular (AV) node

↓

Bundle of His

↓

Bundle branches

↓

Purkinje's fibers

↓

Ventricular muscle

Autonomic Nervous System

- Affects electrical conduction of heart
- Divided into two parts:
  - Sympathetic
    - Prepares body to react in emergencies/stress – "Fight or Flight"
    - Increases cardiac output (HR, BP, and force of cardiac contractions)
  - Parasympathetic
    - Decreases rate of contractions
    - Kicks in after stress/emergency over
    - Restores energy
- Video