

The Circulatory System

The Heart, Blood & Blood Vessels

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The Closed Circulatory System

Humans have a closed circulatory system, typical of all vertebrates, in which blood is confined to vessels and is distinct from the interstitial fluid.

The heart pumps blood into large vessels that branch into smaller ones leading into the organs.

Materials are exchanged by diffusion between the blood and the interstitial fluid bathing the cells.

The Cardiovascular System

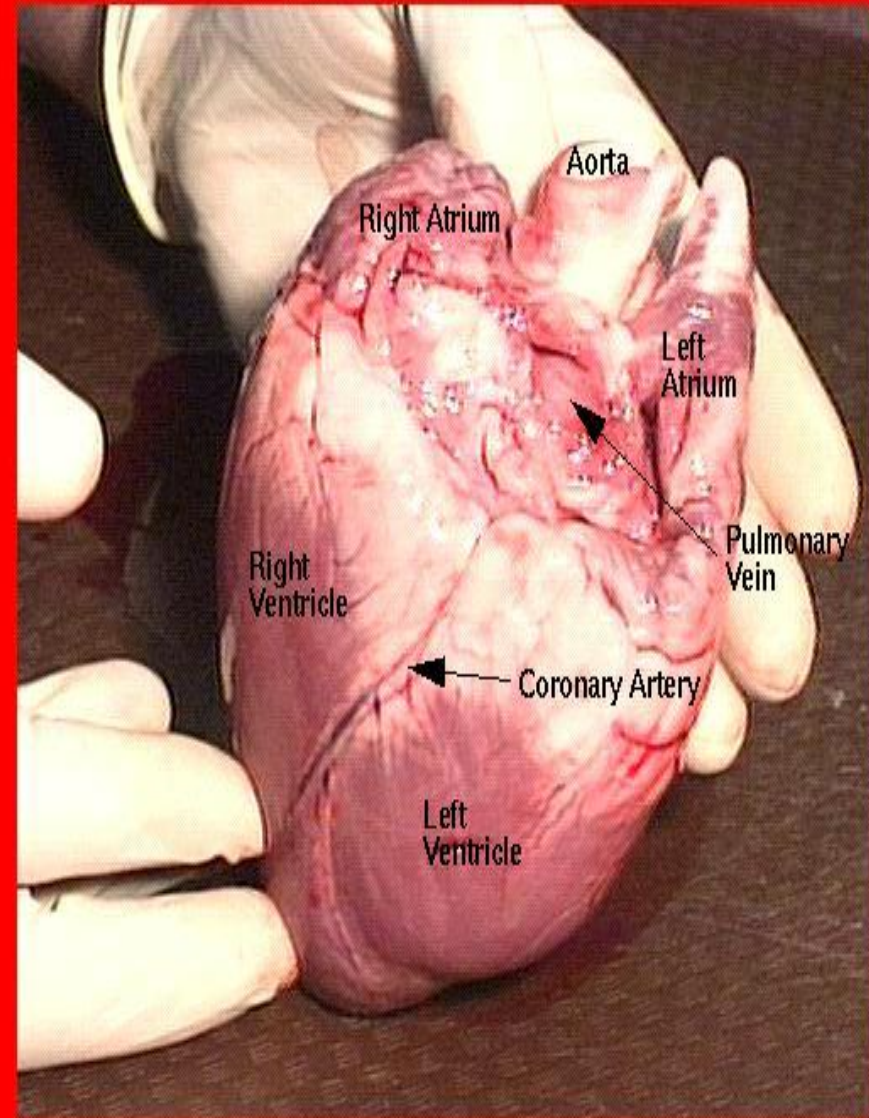
- **Three Major Elements – Heart, Blood Vessels, & Blood**

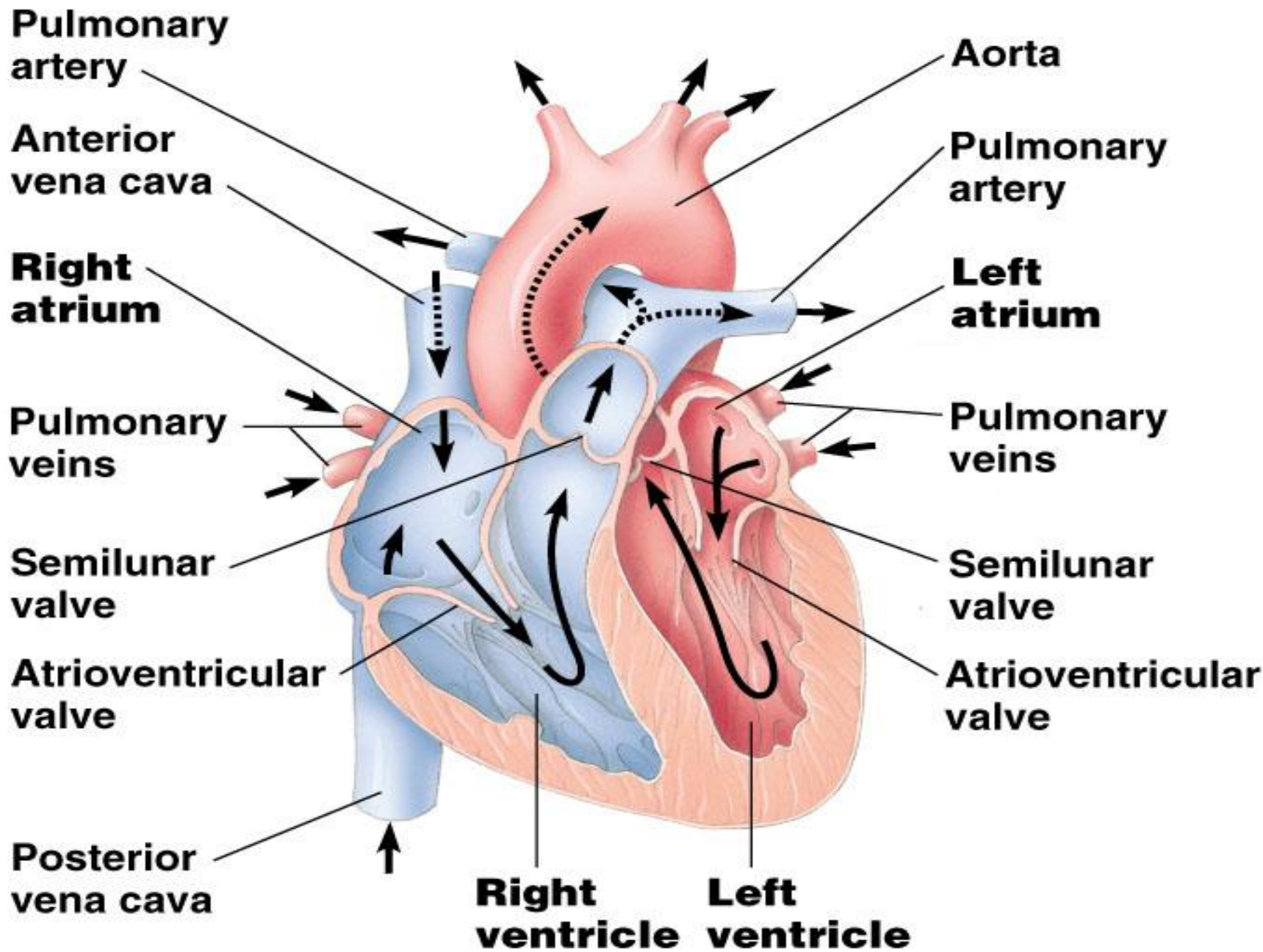
- 1. **The Heart**- cardiac muscle tissue

- highly interconnected cells

- four chambers

- Right atrium
 - Right ventricle
 - Left atrium
 - Left ventricle





Pathway of the blood

Superior Vena Cava

Right Atrium

Tricuspid Valve

Right Ventricle

Pulmonary Semilunar Valve

Lungs

Pulmonary Vein

Bicuspid Valve

Left Ventricle

Aortic Semilunar Valve

Aorta

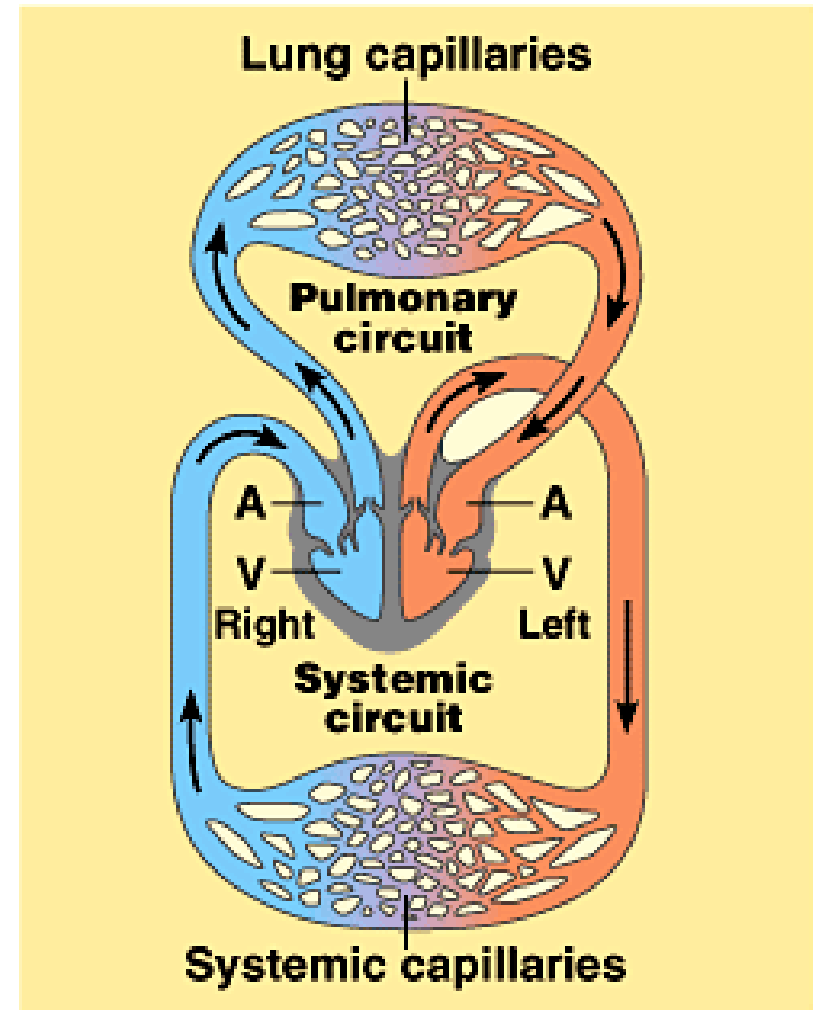
To the bodies organs & cells

- **Pulmonary circuit**

- The blood pathway between the right side of the heart, to the lungs, and back to the left side of the heart.

- **Systemic circuit**

- The pathway between the left and right sides of the heart.

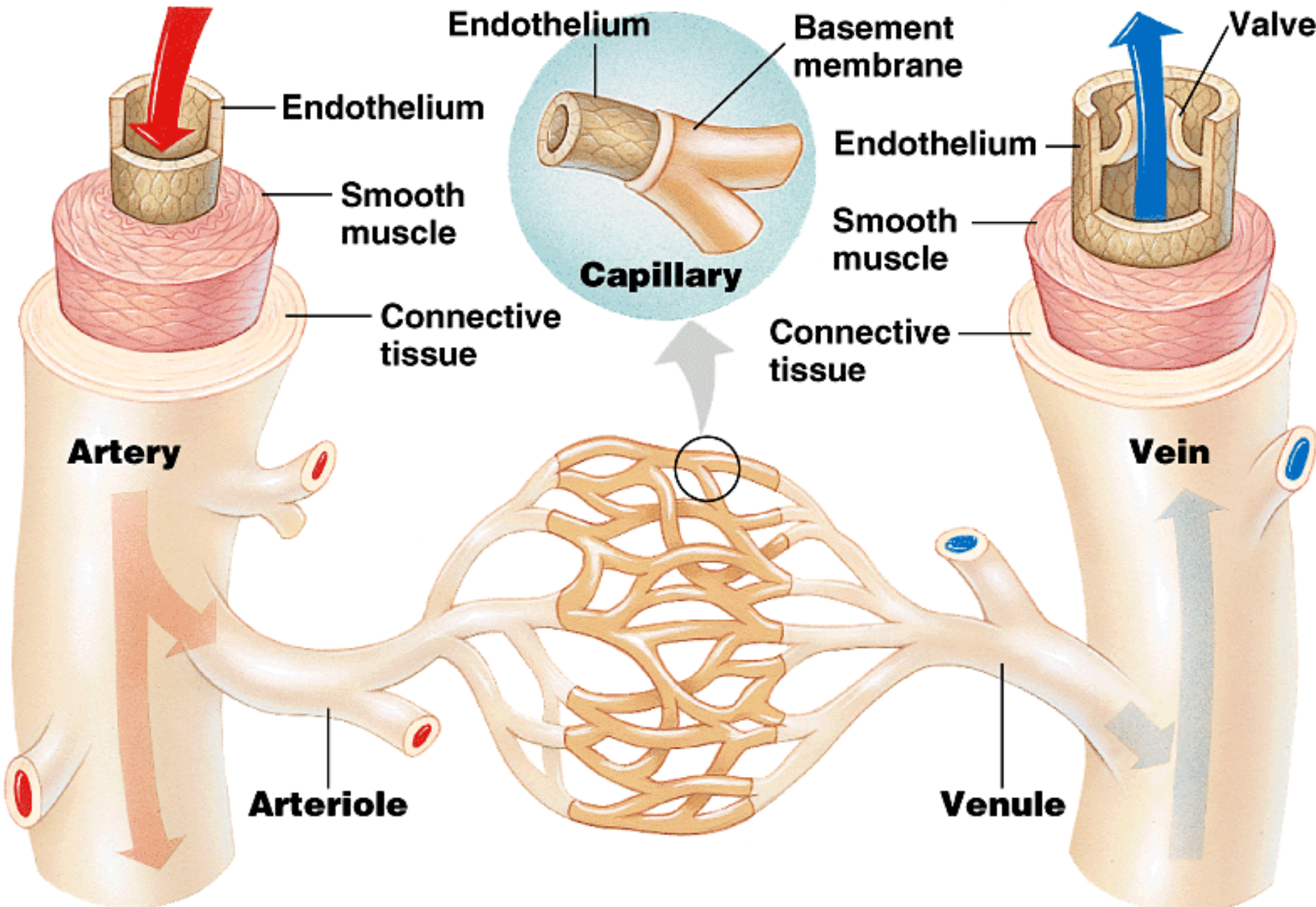


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The Cardiovascular System

2. Blood Vessels -A network of tubes

- **Arteries** → **arterioles** move away from the heart
 - Elastic Fibers
 - Circular Smooth Muscle
- **Capillaries** – where gas exchange takes place.
 - One cell thick
 - Serves the Respiratory System
- **Veins** → **Venules** moves towards the heart
 - Skeletal Muscles contract to force blood back from legs
 - One way valves
 - When they break - varicose veins form

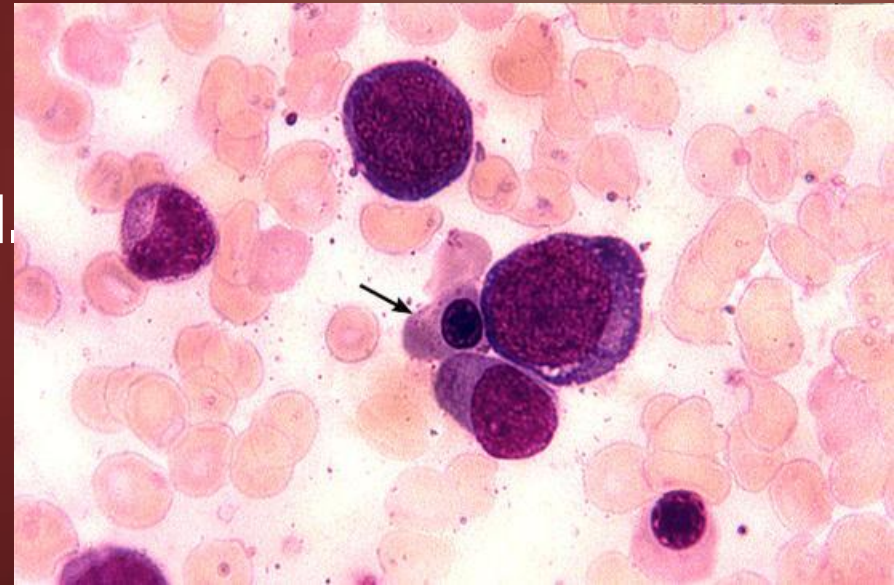


The Cardiovascular System

3. The Blood

A. Plasma

**Liquid portion of the blood
Contains clotting factors,
hormones, antibodies,
dissolved gases, nutrients
and waste**



The Cardiovascular System

•The Blood

B. Erythrocytes - Red Blood Cells

–Carry hemoglobin and oxygen. Do not have a nucleus and live only about 120 days.

–Can not repair themselves.



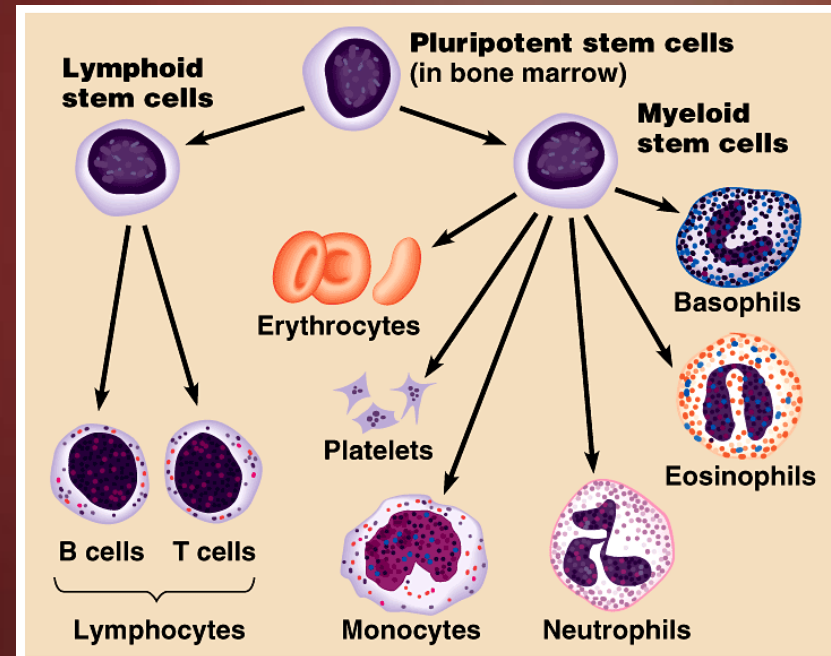
The Cardiovascular System

•The Blood

C. Leukocytes – White Blood cells

–Fight infection and are formed in the bone marrow

–Five types – neutrophils, lymphocytes, eosinophils, basophils, and monocytes.



The Cardiovascular System

The Blood

- **D. Thrombocytes – Platelets.**

- These are cell fragments that are formed in the bone marrow from megakaryocytes.

- Clot Blood by sticking together – via protein fibers called **fibrin**.



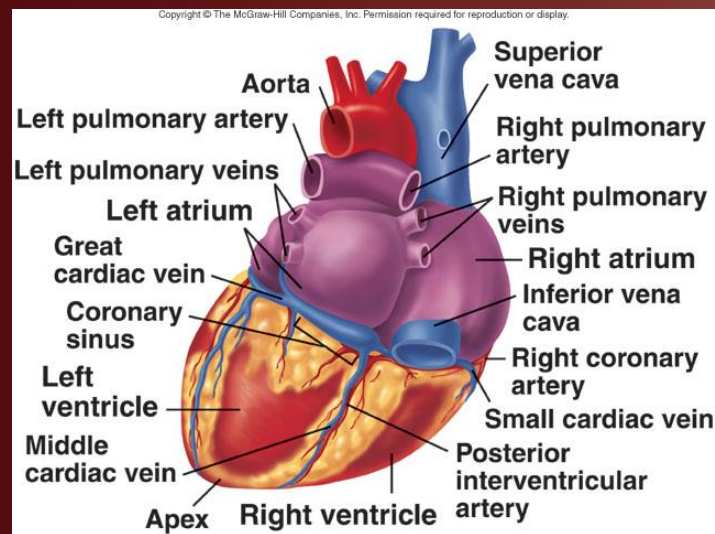
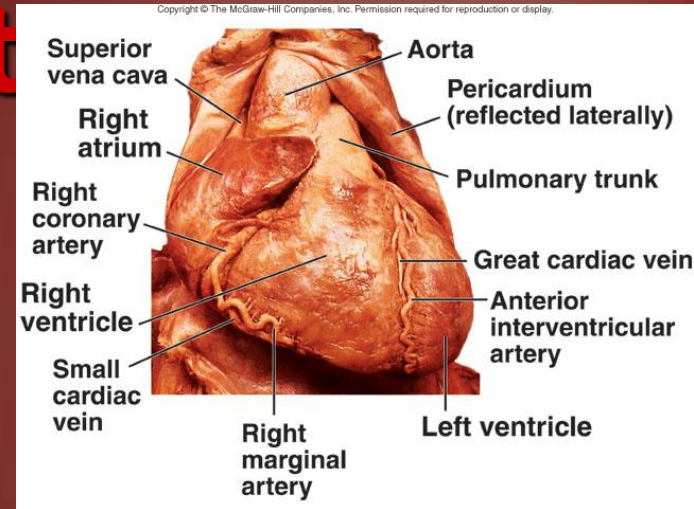
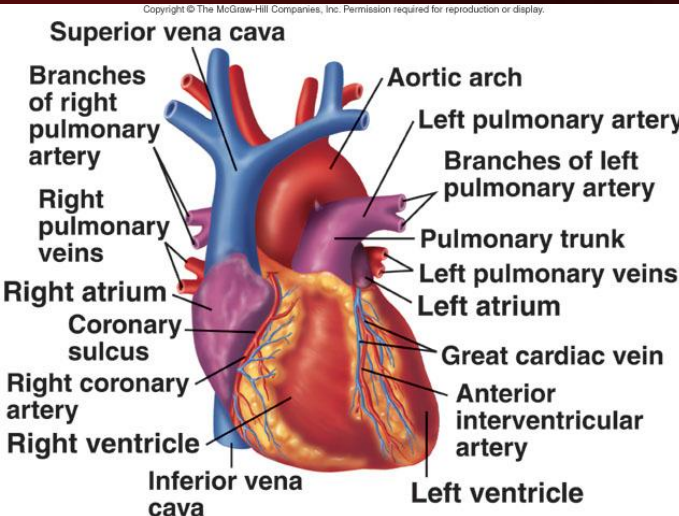
Disorders of the Circulatory System

- **Anemia** - lack of iron in the blood, low RBC count
- **Leukemia** - white blood cells proliferate wildly, causing anemia
- **Hemophilia** - bleeder's disease, due to lack of fibrinogen in thrombocytes
- **Heart Murmur** - abnormal heart beat, caused by valve problems
- **Heart attack** - blood vessels around the heart become blocked with plaque, also called *myocardial infarction*

Unit 9 – The Heart

Cardiovascular System

The Heart

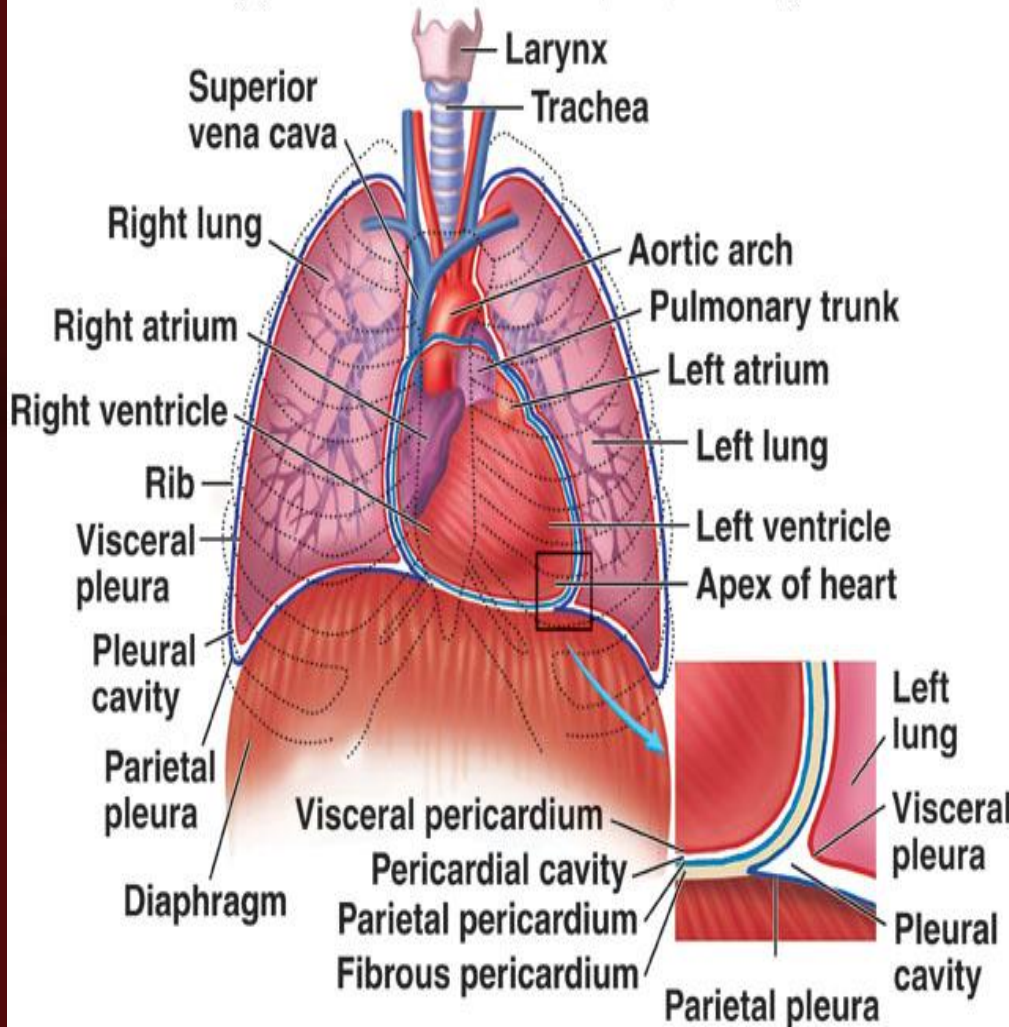


Functions of the Heart

- **Generating blood pressure**
- **Routing blood**
 - Heart separates pulmonary and systemic circulations
- **Ensuring one-way blood flow**
 - Heart valves ensure one-way flow
- **Regulating blood supply**
 - Changes in contraction rate and force match blood delivery to changing metabolic needs

Size, Shape, Location of the Heart

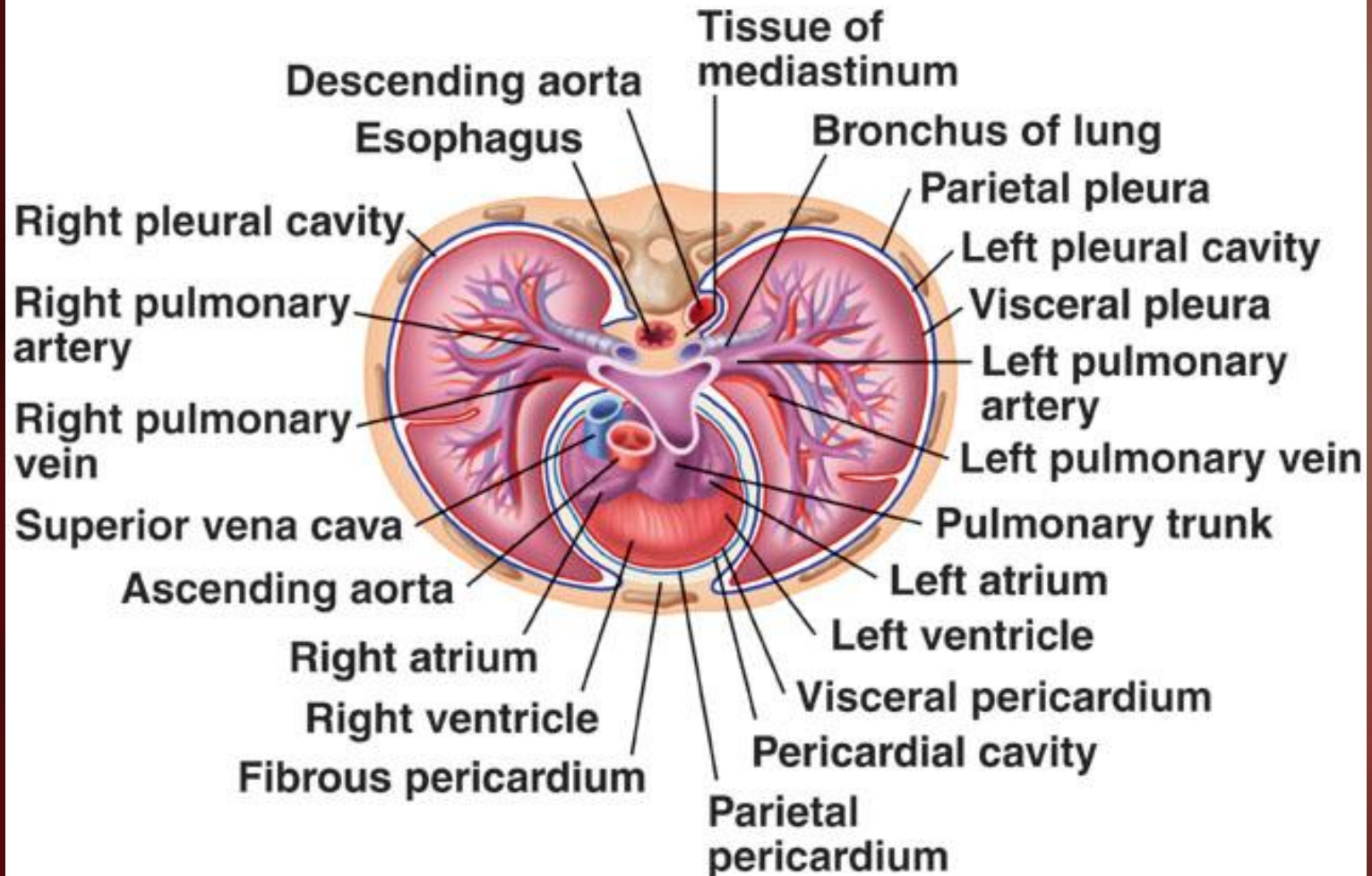
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- Size of a closed fist
- Shape
 - **Apex:** Blunt rounded point of cone
 - **Base:** Flat part at opposite of end of cone
- Located in thoracic cavity in mediastinum

Heart Cross Section

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Pericardium

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Pericardium

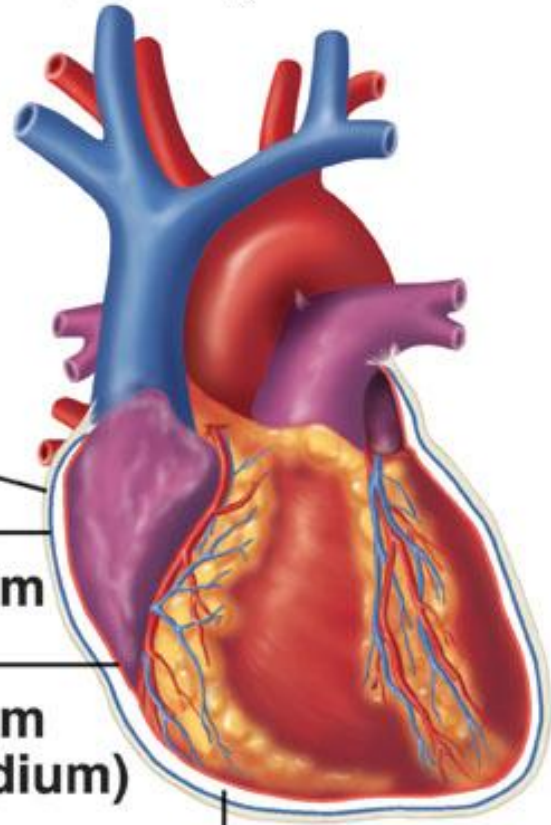
Fibrous pericardium

Serous pericardium

Parietal pericardium

Visceral pericardium
(or epicardium)

Pericardial cavity filled with pericardial fluid

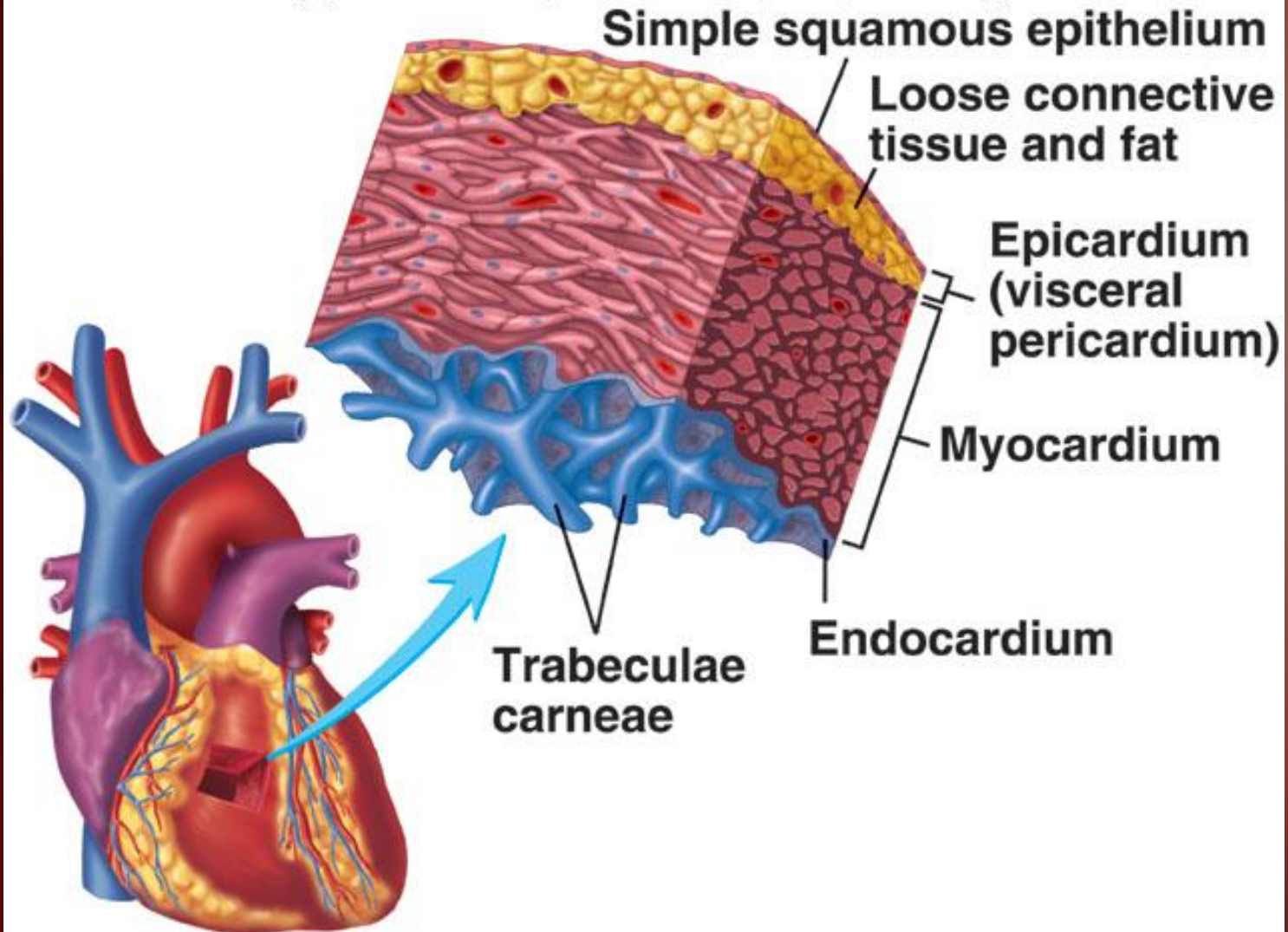


Three layers of tissue

- **Epicardium:** This serous membrane of smooth outer surface of heart
- **Myocardium:** Middle layer composed of cardiac muscle cell and responsibility for heart contracting
- **Endocardium:** Smooth inner surface of heart chambers

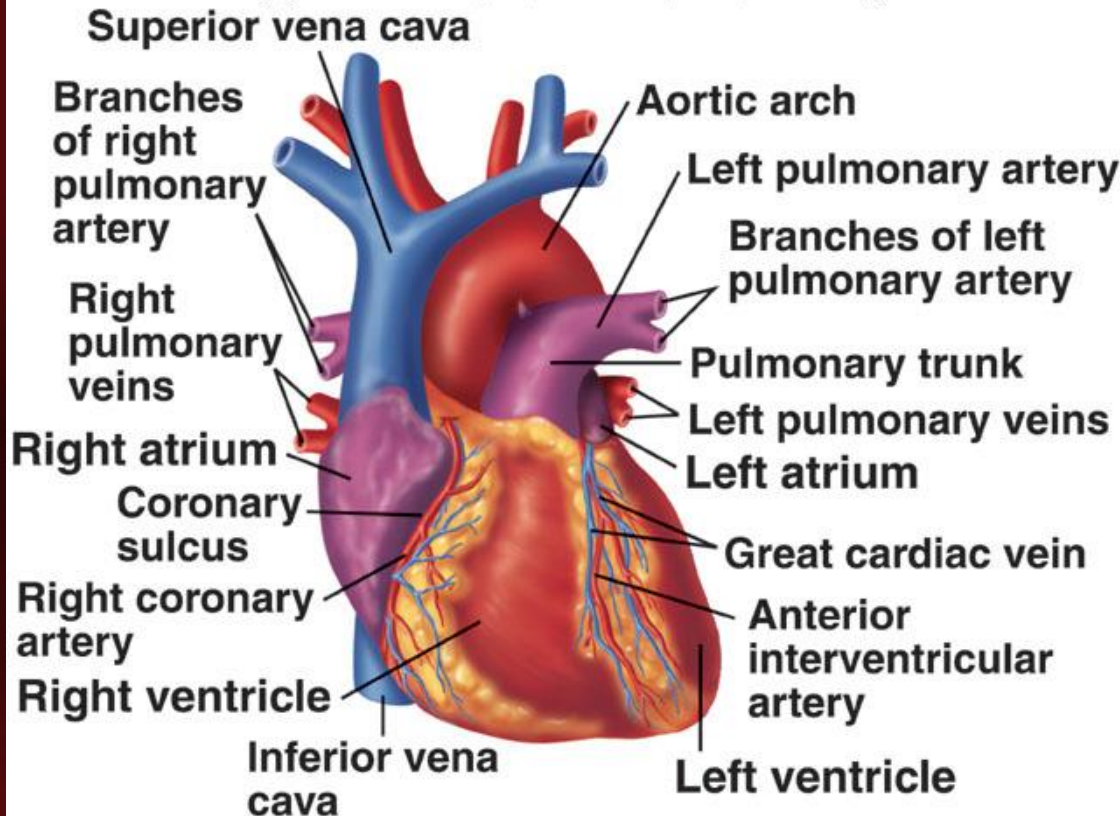
Heart Wall

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External Anatomy

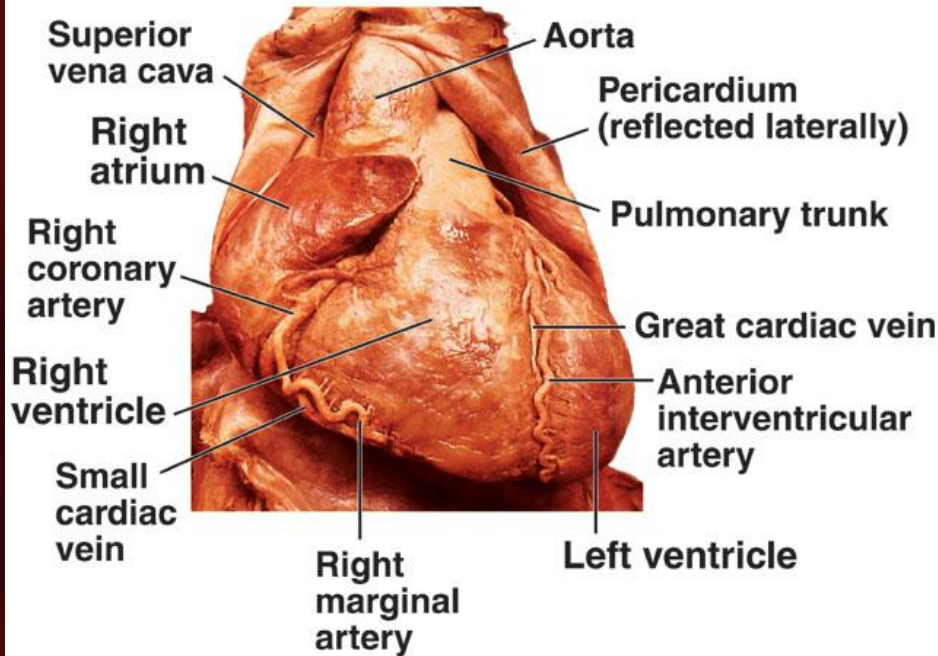
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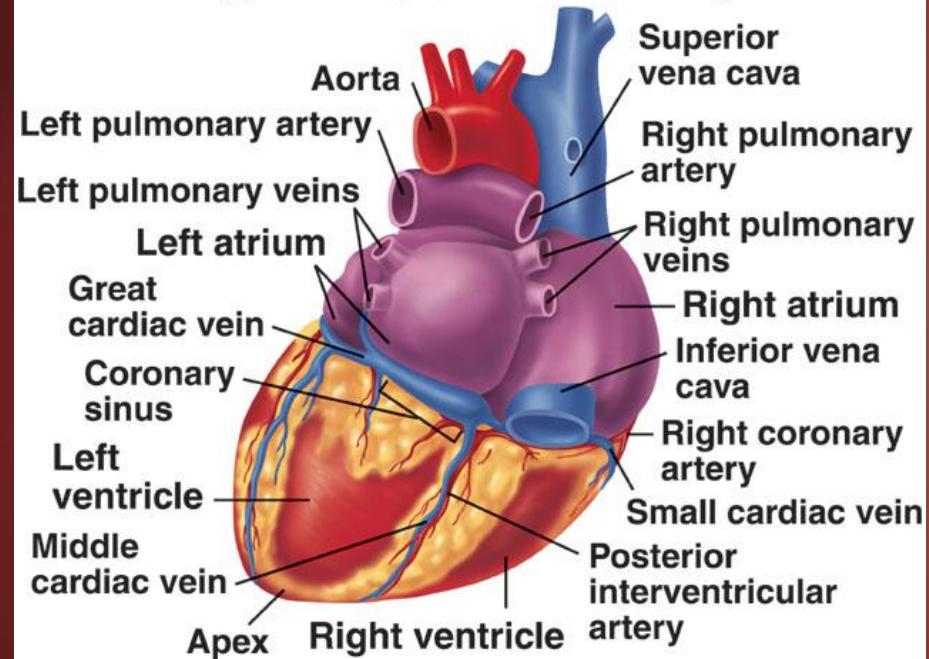
- **Four chambers**
 - 2 atria
 - 2 ventricles
- **Major veins**
 - Superior vena cava
 - Pulmonary veins
- **Major arteries**
 - Aorta
 - Pulmonary trunk

External Anatomy

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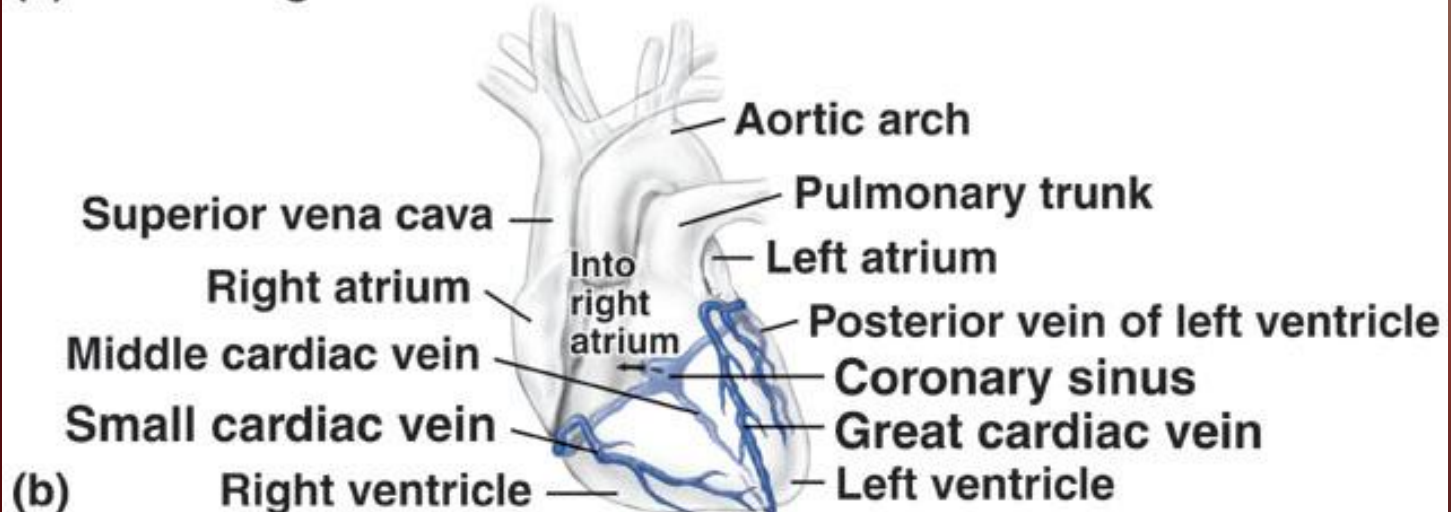
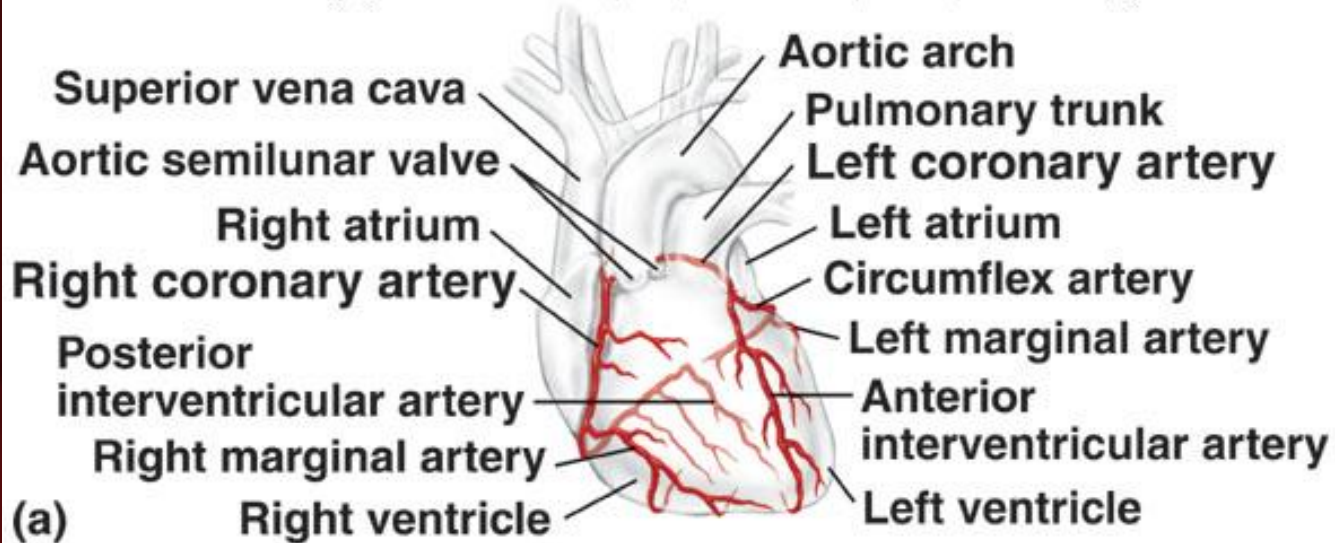


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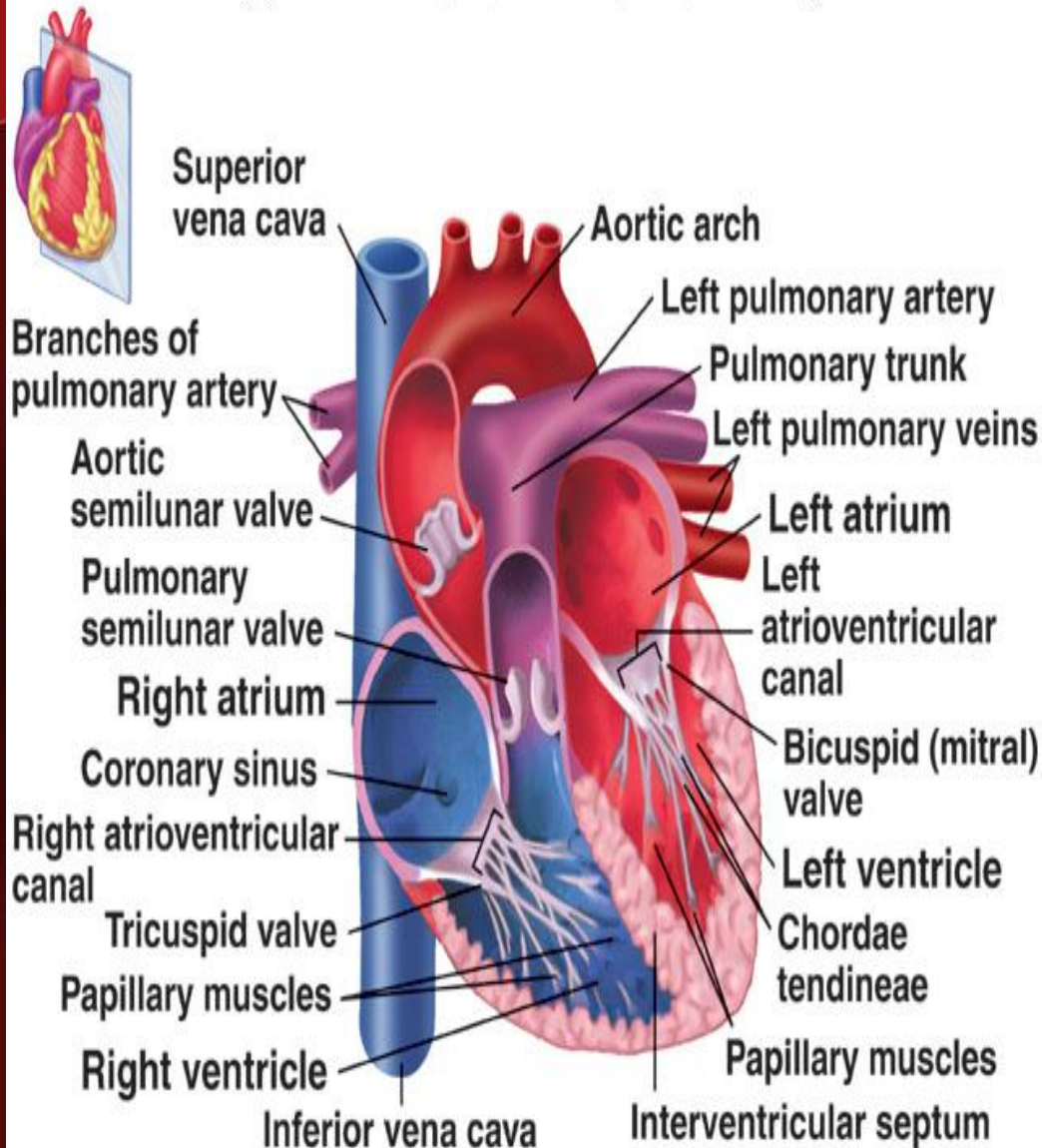
Coronary Circulation

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Heart Valves

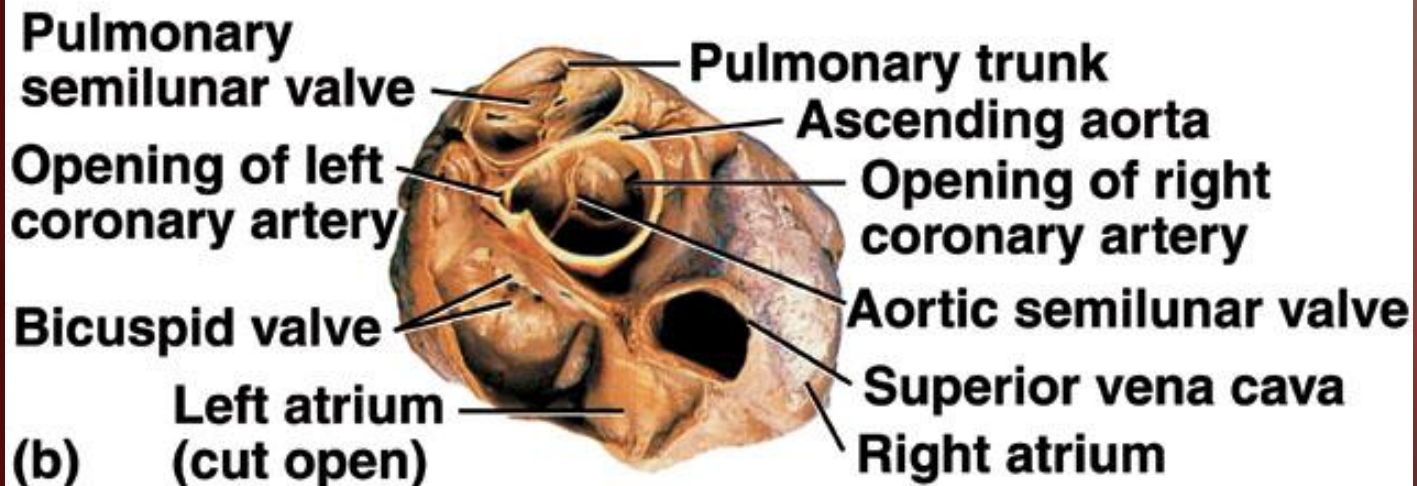
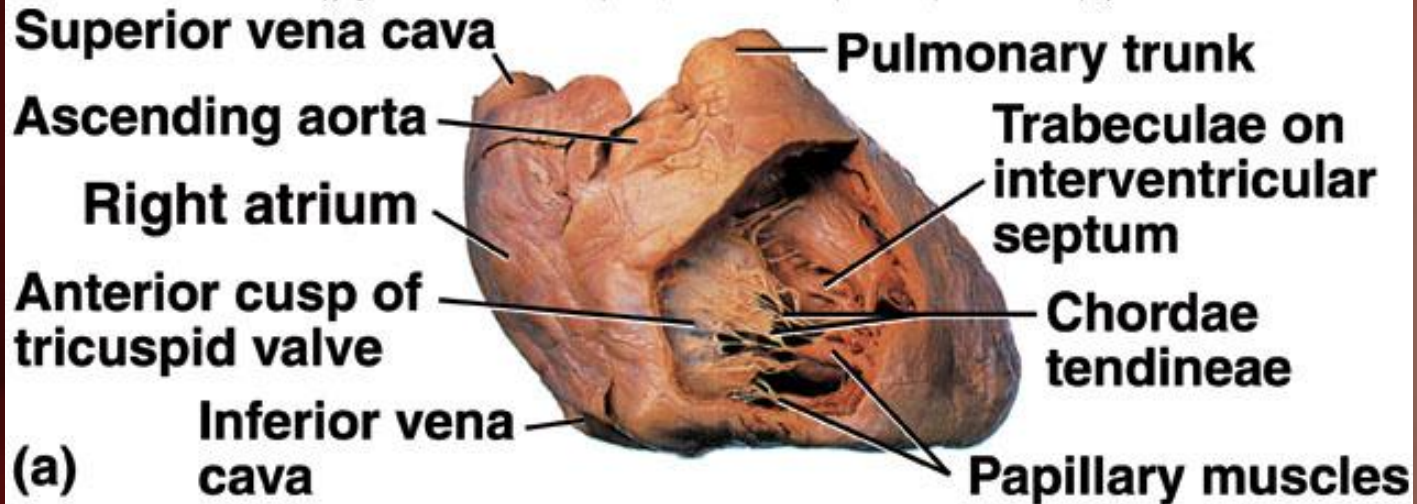
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- **Atrioventricular**
 - Tricuspid
 - Bicuspid or mitral
- **Semilunar**
 - Aortic
 - Pulmonary
- **Prevent blood from flowing back**

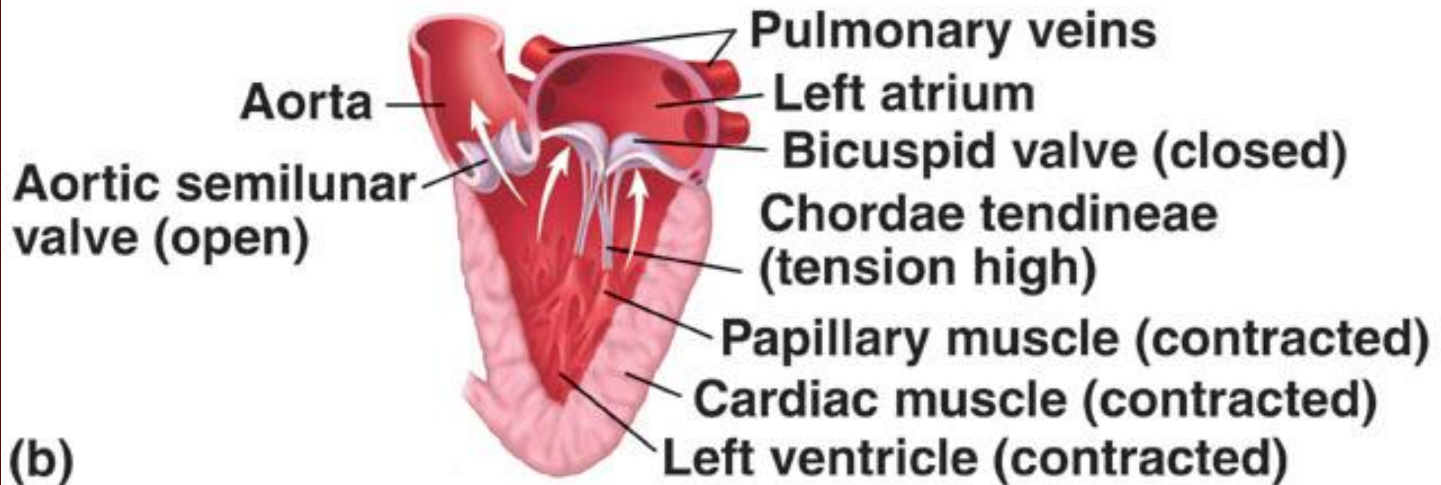
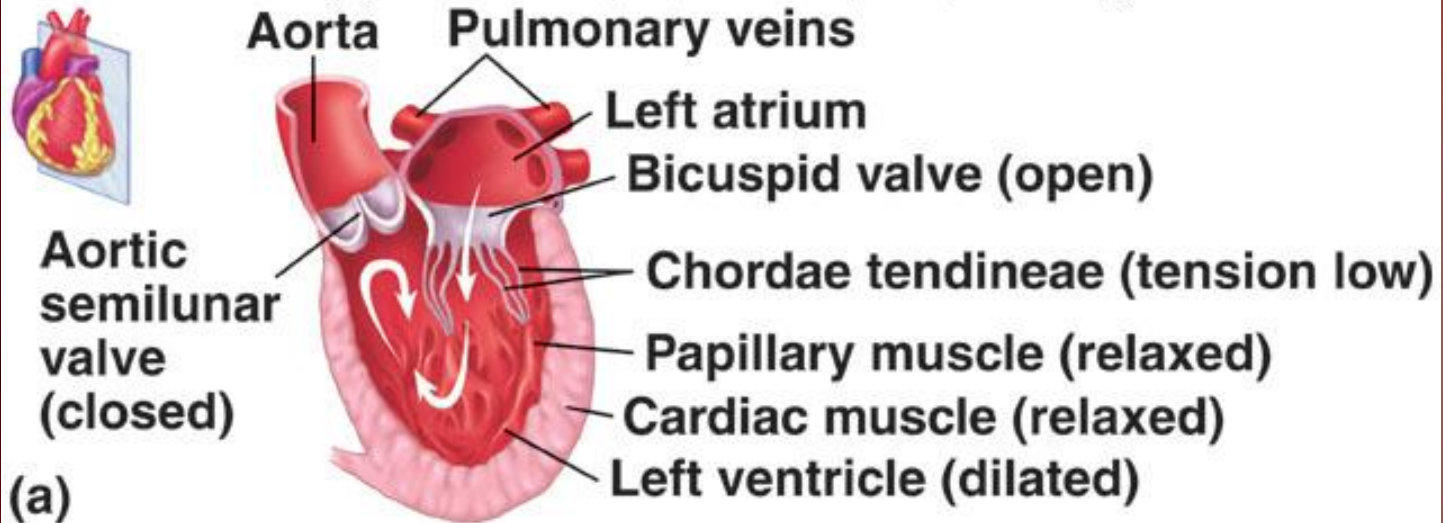
Heart Valves

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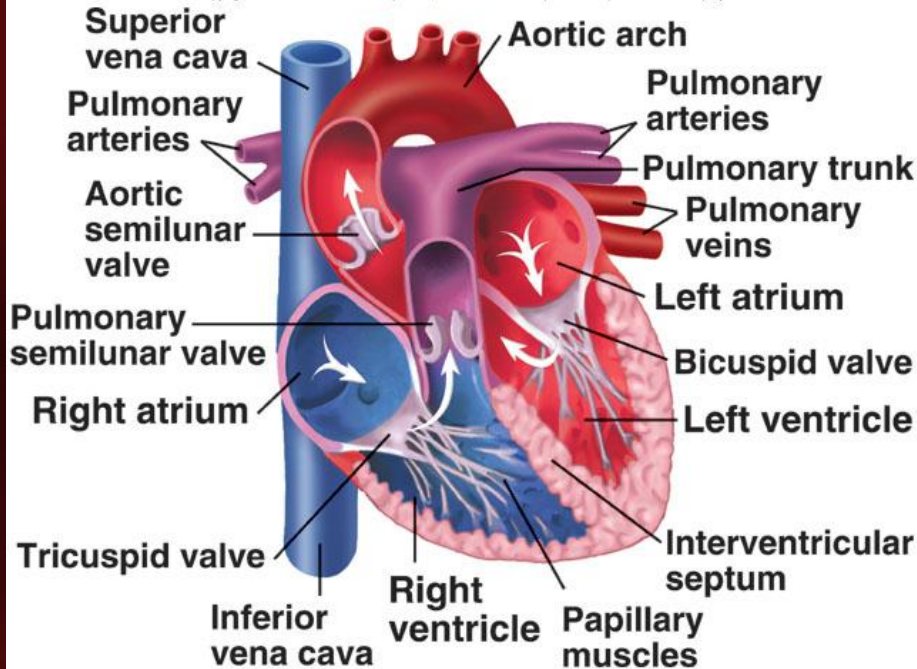
Function of the Heart Valves

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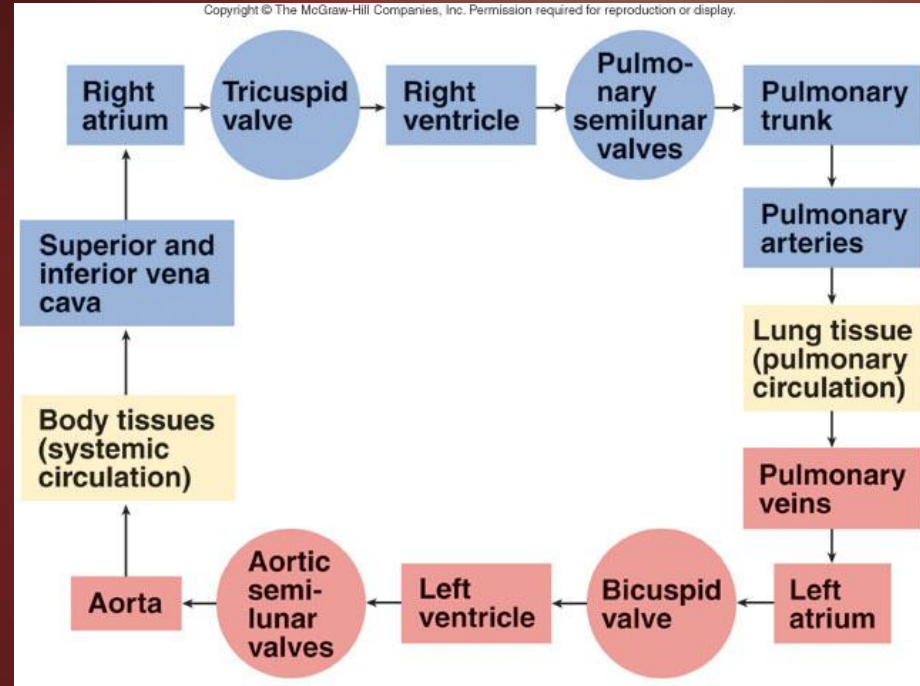


Blood Flow Through Heart

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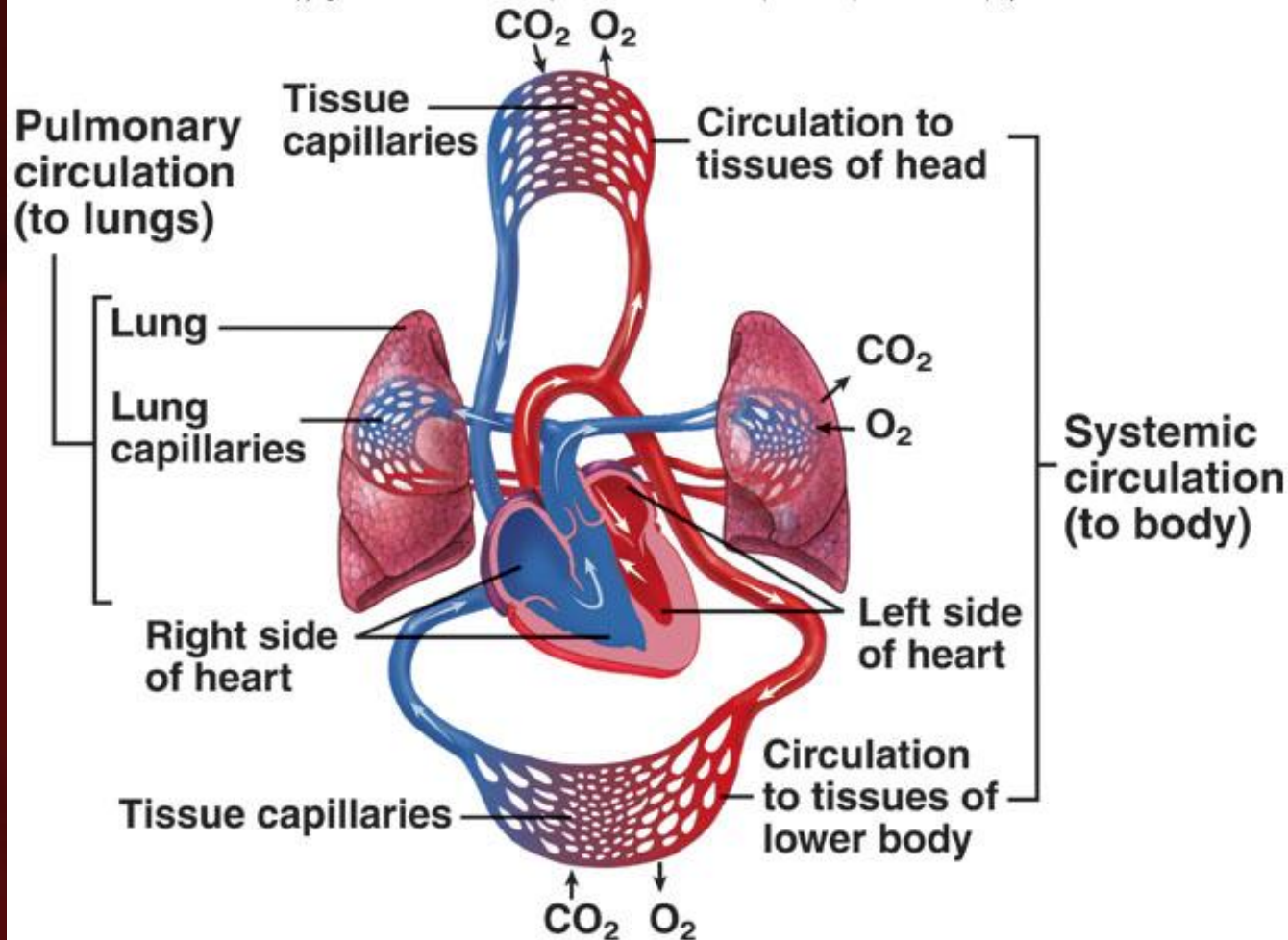


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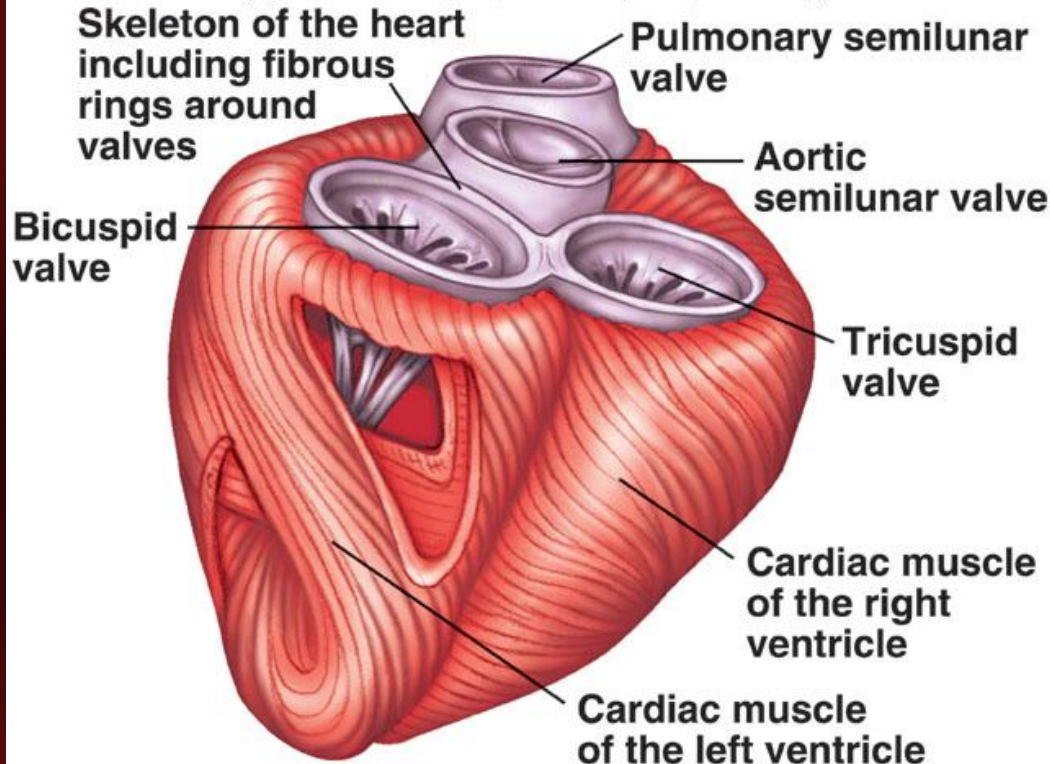
Systemic and Pulmonary Circulation

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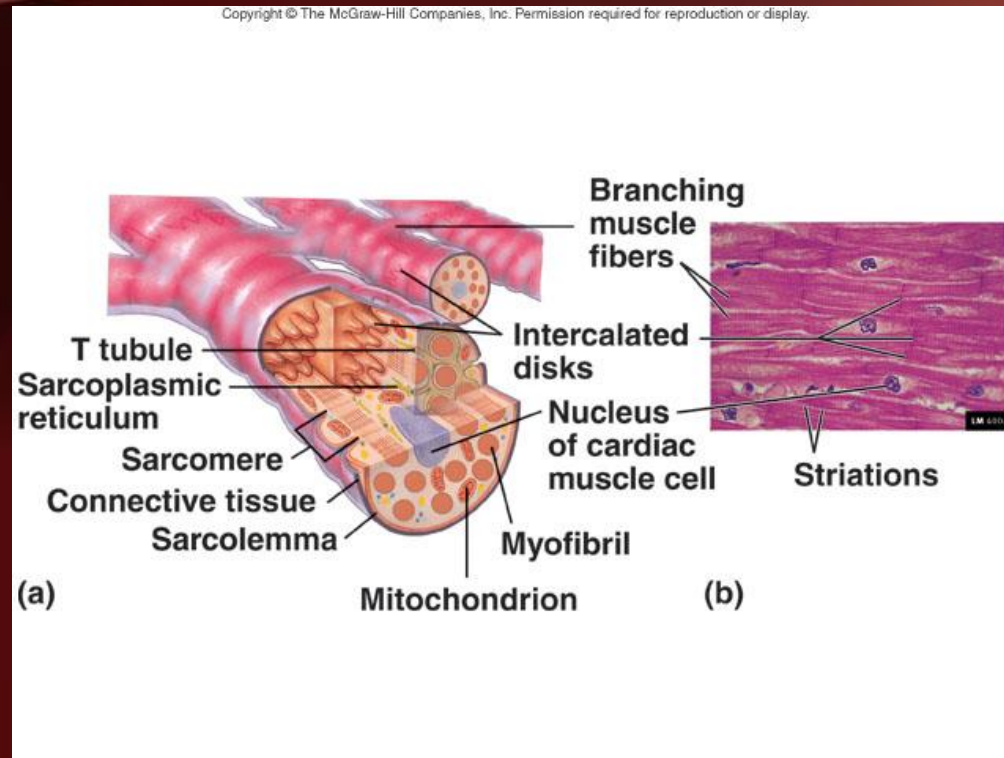
Heart Skeleton

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- Consists of plate of fibrous connective tissue between atria and ventricles
- Fibrous rings around valves to support
- Serves as electrical insulation between atria and ventricles
- Provides site for muscle attachment

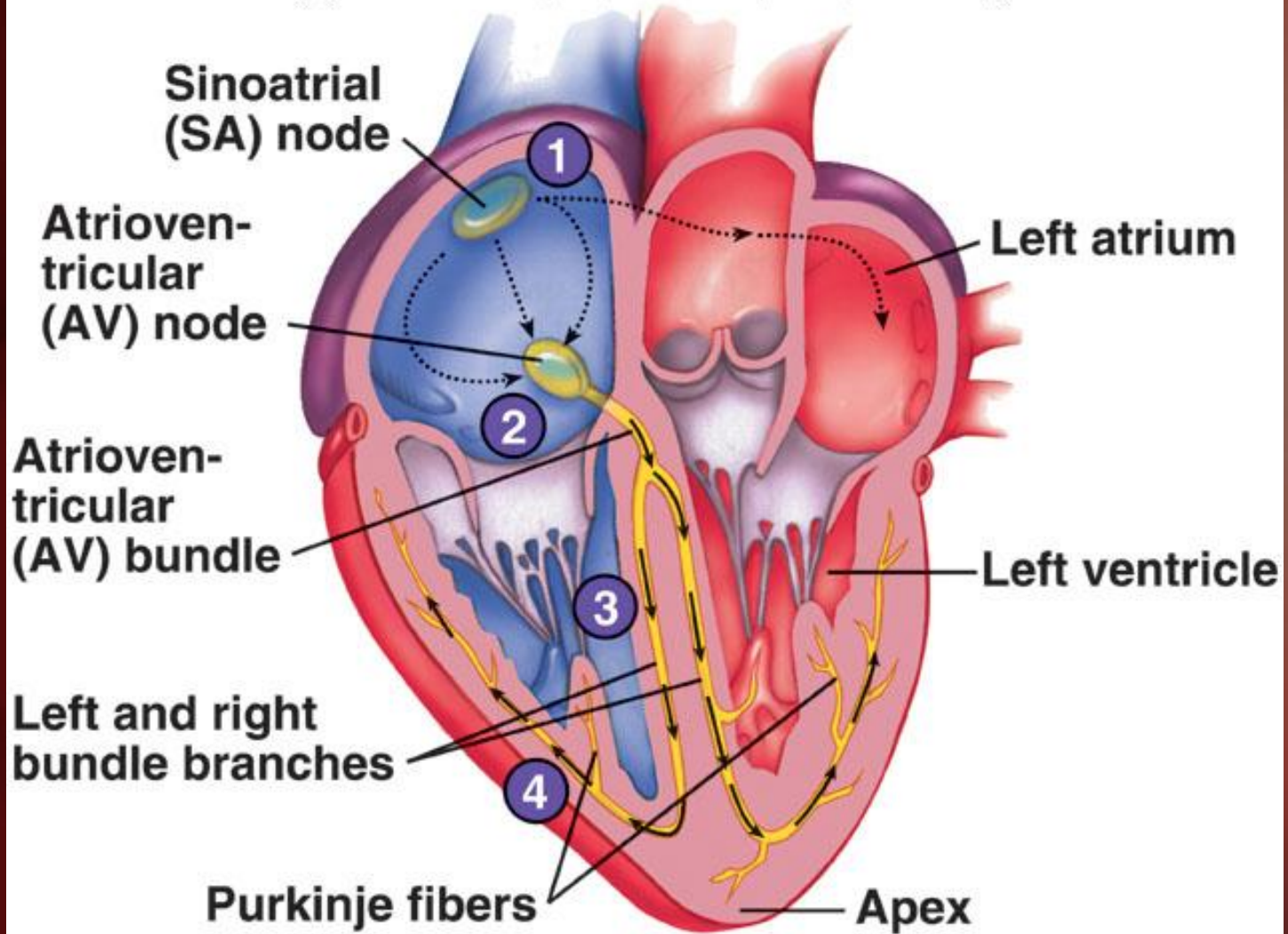
Cardiac Muscle




- Elongated, branching cells containing 1-2 centrally located nuclei
- Contains actin and myosin myofilaments
- **Intercalated disks:** Specialized cell-cell contacts
- Desmosomes hold cells together and gap junctions allow action potentials
- Electrically, cardiac muscle behaves as single unit

Conducting System of Heart

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Thank You