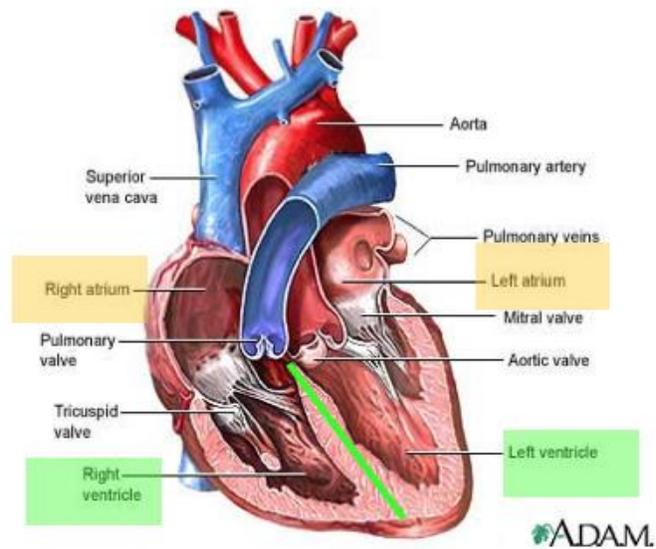


2.2.3 Describe the anatomy of the heart with reference to the heart chambers, valves and major blood vessels

- The heart is a highly efficient four-chambered double-pump system. It is split into left and right sides which works synchronously.
- The right side of the heart receives deoxygenated blood and sends blood to the lungs (pulmonary circuit)
- The left side of the heart receives oxygenated blood from the lungs and sends it to the body (systemic circuit)



**Pericardium** – a double-walled sac around the heart composed

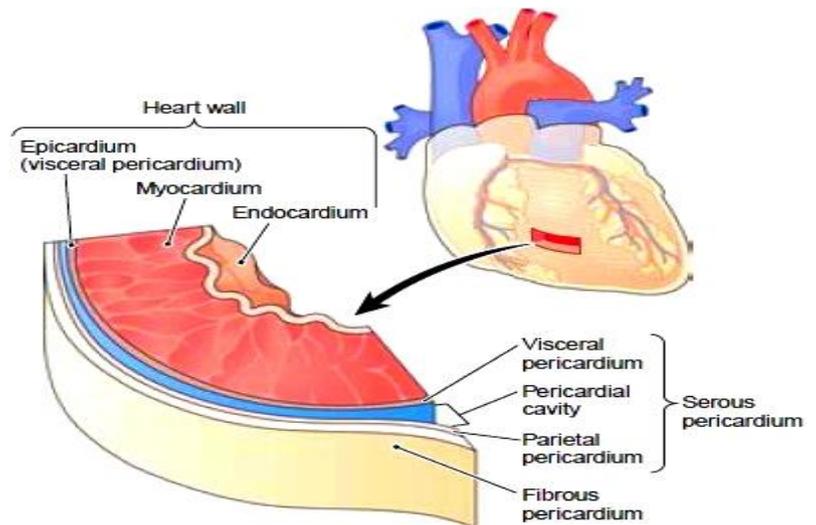
- The Function of the Pericardium:
  - Protects and anchors the heart
  - Prevents overfilling of the heart with blood
  - Allows for the heart to work in a relatively friction-free environment

**Epicardium** – a membrane that forms the innermost layer of the pericardium and the outer surface of the heart.

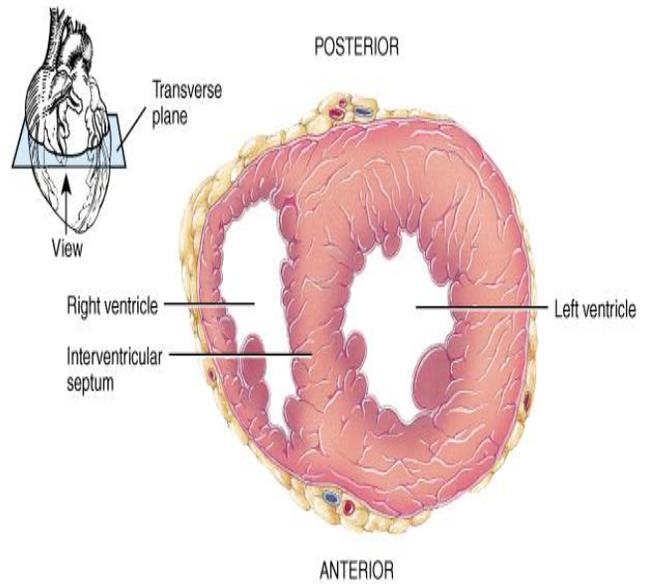
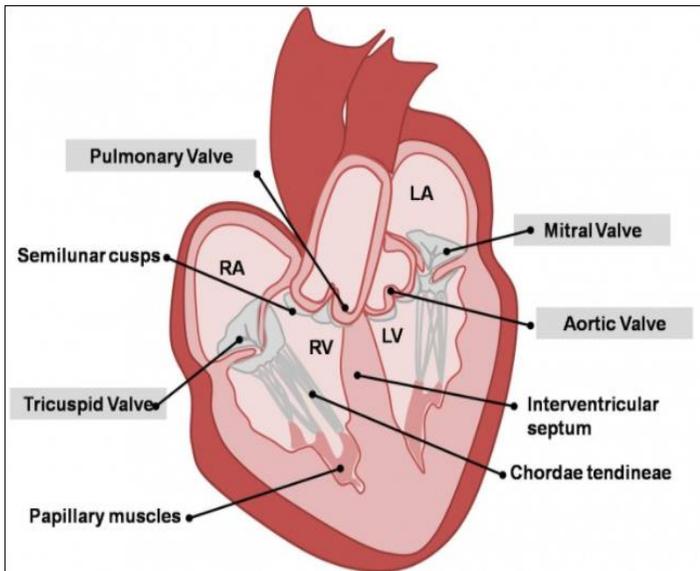
**Myocardium** – cardiac muscle layer forming the bulk of the heart

**Fibrous skeleton** of the heart – crisscrossing, interlacing layer of connective tissue

**Endocardium** – layer of the inner myocardial surface



- Thickness of myocardium varies according to the function of the chamber
- Atria are thin walled, deliver blood to adjacent ventricles
- Ventricle walls are much thicker and stronger. Right ventricle supplies blood to the lungs (little flow resistance) left ventricle wall is the thickest to supply systemic circulation (high flow resistance)



- There are a series of valves between chambers that close and open by force based on a coordinated sequence of heart muscle contractions
- The valves promote blood flow through the heart in one direction
- The valves also ensure that heart muscle contractions increase pressure in the heart chambers to properly eject blood

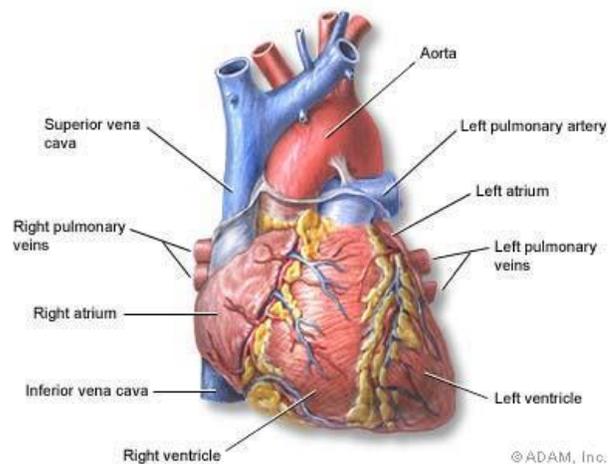
## Atria

- **Atria are the blood receiving chambers of the heart**
- Each side of the heart has an atrium (each counts as one of the four chambers) which receives blood from a vein
  - Blood enters right atria from superior and inferior vena cava and coronary sinus (deoxygenated blood)

- Coronary sinus = carries blood used

by heart

- Blood enters left atria from pulmonary veins (oxygenated blood from lungs)
- As the atria fill with blood, the pressure increases. Once it matches the pressure of the valve, the valve opens and the blood flows to the ventricles
- After the blood moves through the atrium, it is directed into a larger and thicker-walled ventricle.
- The ventricles then push blood out of the heart into an artery for transport away from the heart



## Ventricles

- Ventricles are the discharging chambers of the heart
- **Right ventricle** pumps blood into the pulmonary system (to the lungs)
- **Left ventricle** pumps blood into the aorta (to the body)

## Vessels

- Vessels **returning blood to the heart** include:

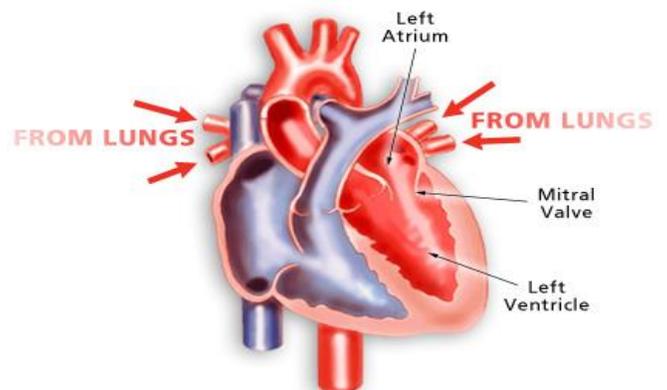
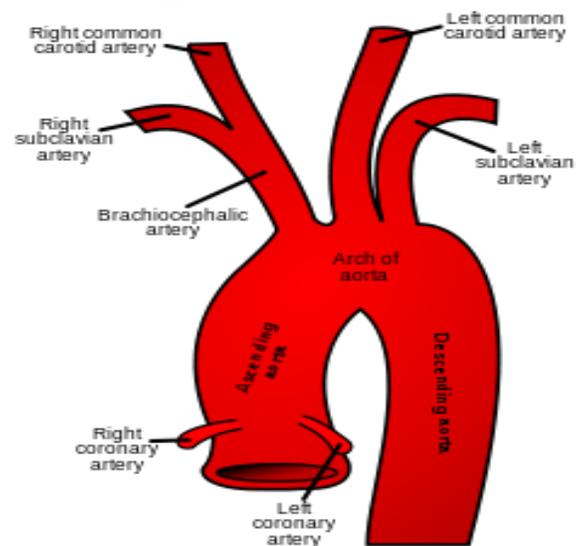
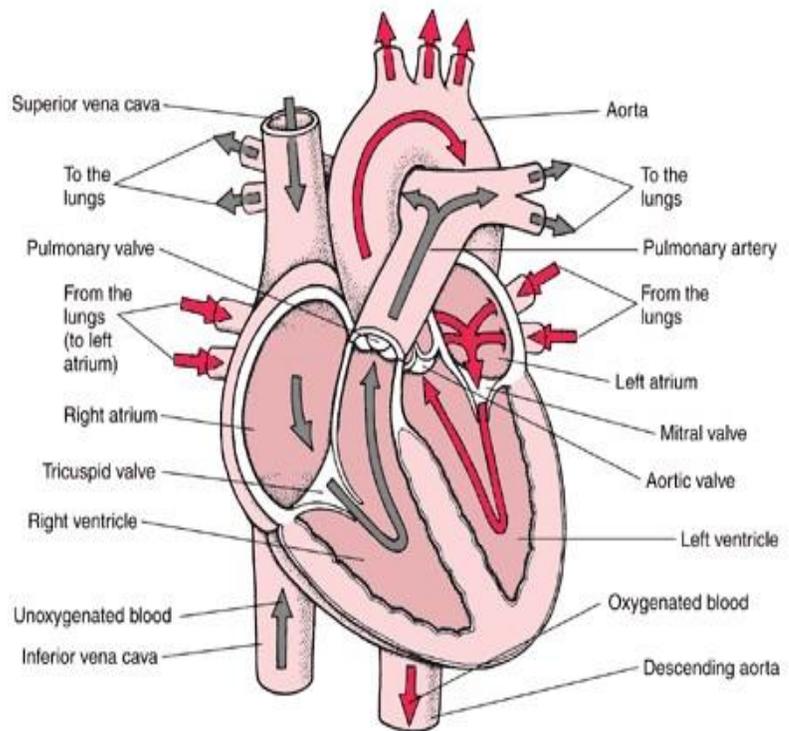
1. Right and left pulmonary veins
2. Superior and inferior vena cava

- Vessels moving **blood away from the heart** include:

1. Pulmonary trunk, which splits into right and left pulmonary arteries
2. Ascending aorta (three branches) (see below)
  - a. Brachiocephalic
  - b. Left common carotid
  - c. Subclavian arteries

- Vessels **returning blood to the heart** include:

1. **Superior vena cava** - A large vein that receives blood from the head, neck, upper extremities, and thorax and delivers it to the right atrium of the heart.
2. **Inferior vena cava** -



returns deoxygenated blood to the heart from parts of the body below the diaphragm (kidneys to toes)

### 3. Right and left pulmonary veins

- They return oxygenated blood to the left atrium from the lungs

- Vessels moving **blood away from the heart** include:

1. **Right & Left Pulmonary Artery** - responsible for transporting oxygen-depleted blood away from the heart and back toward the lungs.

- The main **artery** splits into the **left pulmonary artery** and the **right pulmonary artery**, each of which directs the blood to the corresponding lung.

2. **AORTA**

- **Brachiocephalic artery** – supplies blood to the right arm, head and neck (includes the right common carotid artery)
- **Left common carotid artery** – supplies blood to the head, neck and left arm
- **Left subclavian artery** – supplies blood to the upper body and left arm

## Valves

**The heart has 4 valves:**

- The mitral valve and tricuspid valve, which control blood flow from the atria to the ventricles
- The aortic valve and pulmonary valve, which control blood flow out of the ventricles

**Essentials for properly working valves:**

- The valve is properly formed and flexible.
- The valve should open all the way so that the right amount of blood can pass through
- The valve closes tightly so that no blood leaks back into the chamber.

Human heart valves are remarkable structures. These tissue-paper thin membranes attached to the heart wall constantly open and close to regulate blood flow (causing the sound of a heartbeat). This flexing of the tissue occurs day after day, year after year. In fact, the tissue withstands about 80 million beats a year, or 5 to 6 billion beats in an average lifetime. Each beat is an amazing display of strength and flexibility.

**How the valves on the RIGHT SIDE of the heart work:**

1. The veins of the body all eventually drain into the right atrium, which is the receiving chamber of the right side of the heart.
2. Once the right atrium is full, the tricuspid valve opens, allowing the oxygenated blood to flow into the right ventricle.

3. As the pressures begin to change in the right atrium and right ventricle, the tricuspid valve closes.
4. The right ventricle then contracts and pumps the deoxygenated blood through the pulmonary valve, and into the lungs.
5. After the right ventricle empties, the pulmonary valve closes and everything starts again

**How the valves on the LEFT SIDE of the heart work:**

1. The newly oxygenated blood flows from the lungs to the left atrium
2. As the left atrium fills with oxygenated blood, the mitral valve remains closed.
3. As the pressure changes within the left atrium and left ventricle, the mitral valve opens, allowing the oxygenated blood to flow into the left ventricle.
4. As the left ventricle fills, the pressures in the left atrium and left ventricle changes. Once the left ventricle is filled, the mitral valve closes as the left ventricle begins to contract. (By closing at this time, the mitral valve prevents the oxygenated blood in the left ventricle from flowing back to the lungs.)
5. As the left ventricle contracts, the oxygenated blood leaves the heart and crosses the aortic valve.
6. The oxygenated blood leaves the left ventricle and crosses the aortic valve which enters the aorta and distributes blood to the body.

**MITRAL VALVE (aka Bicuspid valve, aka right Atrioventricular valve)**

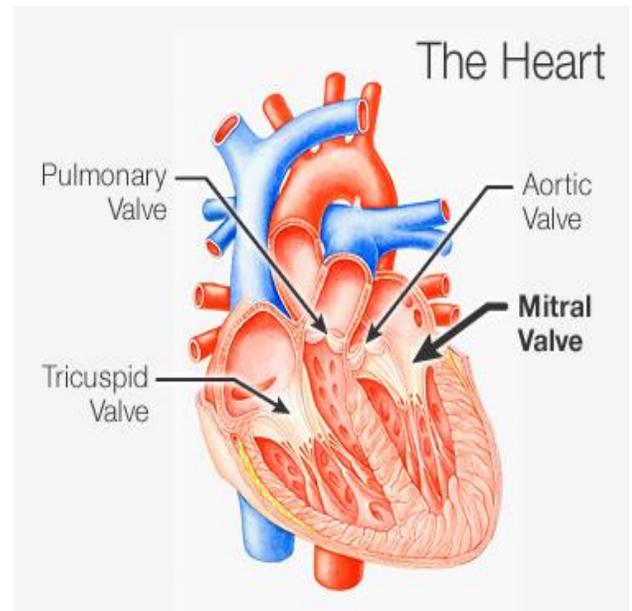
- Closes off the left atrium, collecting the oxygen-rich blood coming in from the lungs.
- Opens to allow blood to pass from the left atrium to the left ventricle.

**AORTIC VALVE**

- Closes off the left ventricle that holds the oxygen-rich blood before it is pumped out to the body.
- Opens to allow blood to leave the heart (from the left ventricle to the aorta and on to the body).

**TRICUSPID VALVE (aka Right Atrioventricular Valve)**

- Closes off the right atrium that holds blood coming in from the body.



- Opens to allow blood to flow from the right atrium to the right ventricle.
- Prevents the back flow of blood from the ventricle to the atrium when blood is pumped out of the ventricle.

**PULMONARY VALVE  
(or Pulmonic Valve)**

- Closes off the right ventricle.
- Opens to allow blood to be pumped from the heart to the lungs (through the pulmonary artery) where it will receive oxygen.

