The Circulatory System

The many functions of the circulatory system can be grouped into two broad areas: **transportation** and **protection**.

1. **Transportation.** All of the substances involved in cellular metabolism are transported by the circulatory system. These substances can be categorized as follows:

A. Respiratory: Red blood cells called **erythrocytes** transport oxygen to the tissue cells. Carbon dioxide produced by cellular respiration is carried by the blood to the lungs for elimination in the exhaled air.

B. **Nutritive:** The digestive system is responsible for the mechanical and chemical breakdown of food to forms that can be absorbed through the intestinal wall into the blood and lymph vessels. The blood then carries these absorbed products of digestion through the liver to the cells of the body.

C. Excretory: Metabolic wastes, excess water and ions are filtered through the capillaries of the kidneys into kidney tubules and excreted in urine.

D. Regulatory: The blood carries hormones and other regulatory molecules from their site of origin to distant target tissues.

2. Protection. The circulatory system protects against injury and foreign microbes or toxins introduced into the body. The clotting mechanism protects against blood loss when vessels are damaged, and white blood cells called **leukocytes** render the body immune to many disease-causing agents.

Heart

Heart: is a muscular organ that pumps blood throughout the circulatory system. It is situated in between two lungs. It is made up of four chambers, two atria and two ventricles. The musculature of ventricles is thicker than that of atria.

- Right side of the heart has two chambers, right atrium and right ventricle. Right atrium is a thin walled and low pressure chamber receives venous (deoxygenated) blood.
- Left side of the heart has two chambers, left atrium and left ventricle. Left atrium is a thin walled and low pressure chamber. It receives oxygenated blood from the lungs.

Layers of Wall of the Heart

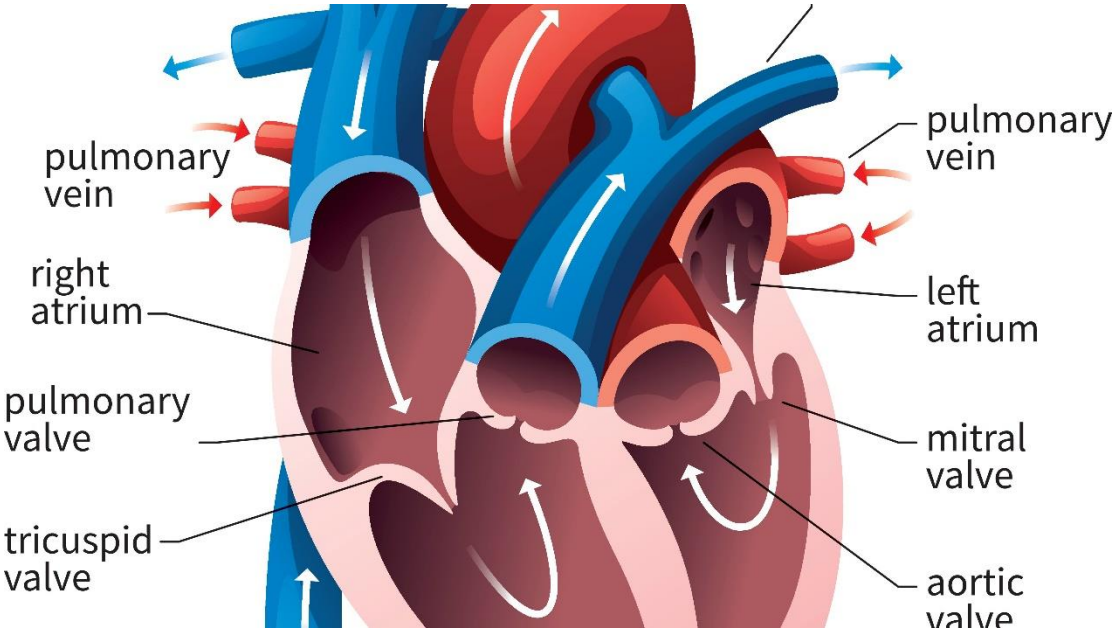
Heart is made up of three layers of tissues:

1- Outer pericardium: is the outer covering of the heart.
2- Middle myocardium: Myocardium is the middle layer of wall of the heart and it is formed by cardiac muscle fibers or cardiac myocytes. Myocardium forms the bulk of the heart and it is responsible for pumping action of the heart.
3- Inner endocardium:

Valves of the Heart

There are four valves in human heart. Two valves are in between atria and the ventricles called **atrioventricular** valves (Tricuspid **Valve, Mitral Valve)**. Other two are the semilunar valves, placed at the opening of blood vessels arising from ventricles, namely (**Aortic Valve)** and **(pulmonary Valve**). Valves of the heart permit the flow of blood through heart in only one direction.

A- Tricuspid Valve: Separates the top right chamber (right atrium) from the bottom right chamber (right ventricle) .Opens to allow blood to flow from the right atrium to the right ventricle. Prevents the back flow of blood from the right ventricle to the right atrium.
B- Pulmonary Valve: Separates the right ventricle from the pulmonary artery .Opens to allow blood to be pumped from the right ventricle to the lungs (through the pulmonary artery) where it will receive oxygen .Prevents the back flow of blood from the pulmonary artery to the right ventricle.
C- Mitral Valve: Separates the top left chamber (left atrium) from the bottom left chamber (left ventricle) .Opens to allow blood to be pumped from the lungs to the left atrium .Prevents the back flow of blood from the left ventricle to the left atrium.
D- Aortic Valve: Separates the left ventricle from the aorta .Opens to allow blood to leave the heart from the left ventricle through the aorta and the body.Prevents the backflow of blood from the aorta to the left ventricle.



Cardiac Cycle

Definition: Cardiac cycle is defined as the (sequence of) **coordinated events** taking place in the heart during each beat. Each heartbeat consists of two major periods called systole and diastole. During systole, heart contracts and pumps the blood through arteries. During diastole, heart relaxes and blood is filled in the heart. All these changes are repeated during every heartbeat, in a cyclic manner.

Cardiac Output

Cardiac output is the amount of blood pumped from each ventricle. Cardiac output is the most important factor in cardiovascular system, because rate of blood flow through different parts of the body depends upon cardiac output.

Heart Sounds

Heart sounds are the sounds produced by mechanical activities of heart during each cardiac cycle.

Heart sounds are produced by:

1. Flow of blood through cardiac chambers
2. Contraction of cardiac muscle
3. Closure of valves of the heart.