

Human Heart: Important Components And Its Functioning

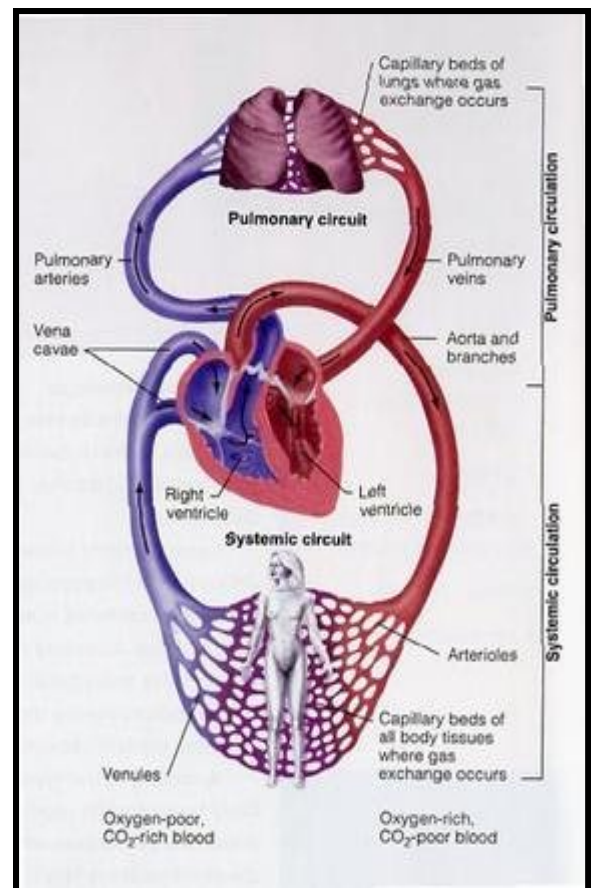
Learning Objective:

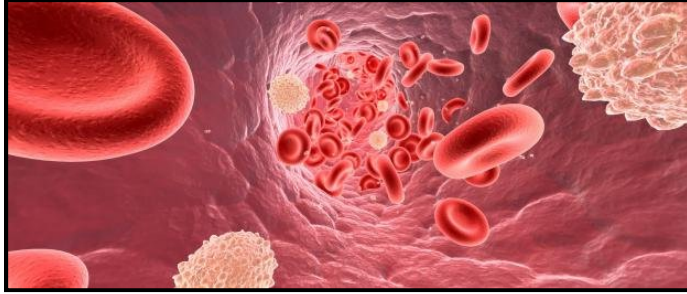
- Understands the basics of the heart and its structure.
- Detail Study of the functioning of the heart.

INTRODUCTION

Heart and blood vessels are two most important elements of human circulatory system. Our body itself has two circulatory systems:

- **Pulmonary Circulation:** It is a type of circulatory system in which cardiovascular system carries deoxygenated blood from the heart to the lungs and brings back oxygen rich blood (oxygenated blood) to the heart.
- **Systematic Circulation:** The oxygenated blood reached to the heart through the pulmonary process is then carried away to the different body parts. The deoxygenated blood from different body parts is also brought back to the heart so that it can be taken for oxygenation. This process of taking blood from heart to lungs and then lungs to heart & from heart to different body parts and from different body parts to the heart. This process keeps going without any interruption.





THE HEART: DETAIL STUDY

The heart is a muscular organ present in humans and several other animals. The purpose of heart is to pump blood through the blood vessels through blood

circulatory systems. When completely grown, the human heart of a strong muscle weighs around 300 grams, which is the hardest working muscle in the human body. It is located in the thorax, center of the chest, well protected from any injury enclosed in a safe cage of ribs and the sternum.

The heart pumps the blood throughout the body. The RBCs or red blood cells in the blood get oxygenated through the gas exchange procedure in the lungs, where CO_2 is exchanged for O_2 . The purified blood that returns from the lungs is then pumped to the different parts of the body through large arteries.

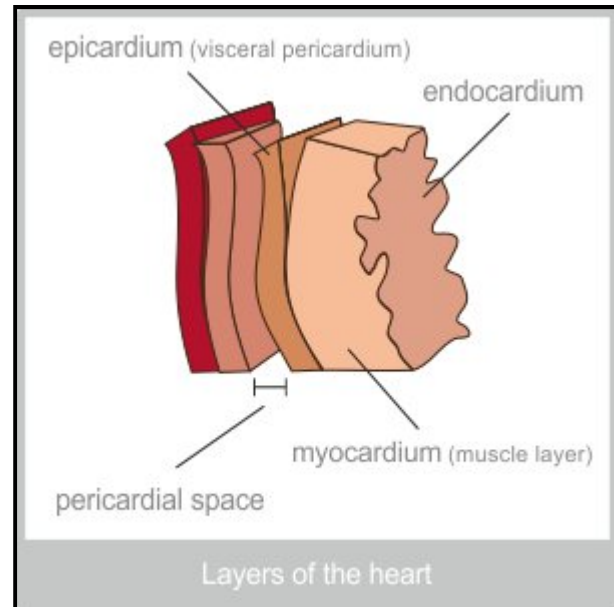
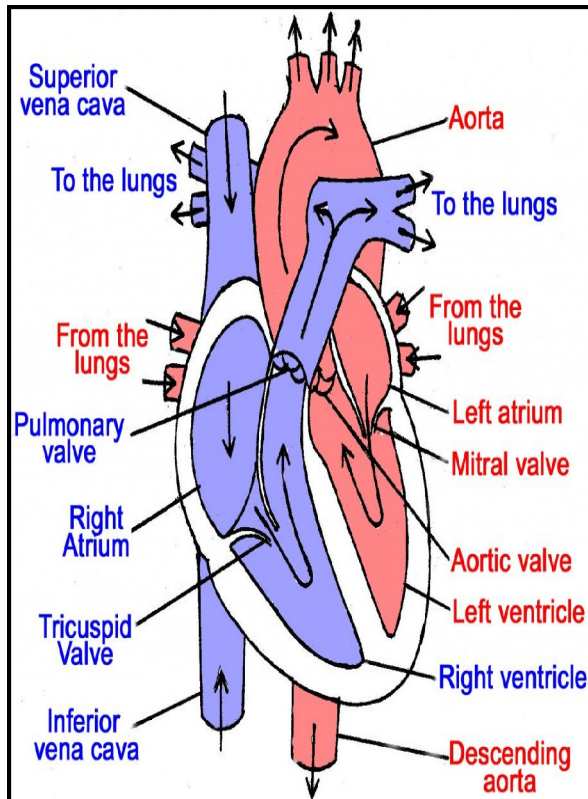
An average heart rate is 60-70 beats per minute at rest and it pumps out nearly 70 milliliters of blood each time. In a 70 year of a lifetime, an average heart will beat more than 2.5 billion times. The heart continuously works hard even if you are at rest, it doesn't stop working.

STRUCTURE OF THE HEART

The Heart plays a very important role in the circulatory system. It is a hollow, four-chambered muscular organ. Its shape and size is roughly similar to the man's closed fist. It is enclosed in a pericardial sac lined with three layers of tissue.

- Epicardium – outer layer
- Myocardium – middle layer
- Endocardium – inner layer





HEART CHAMBERS

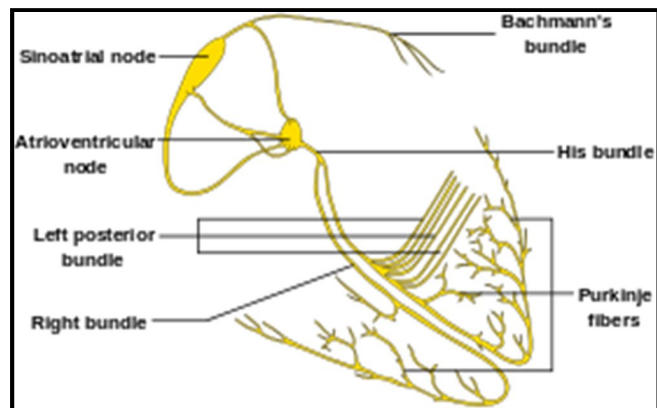
As already mentioned, there are four chambers in the heart:

1. The right atrium receives deoxygenated blood from different body parts, which is then pumped into the right ventricle.
2. The right ventricle pumps deoxygenated blood to the lungs.
3. The left atrium receives oxygenated blood from the lungs, which is then pumped to the left ventricle.
4. The left ventricle pumps this oxygenated blood to different parts of the body.

This movement of blood from atrium to ventricle is caused due to ventricular contractions and relaxations known as Systole and Diastole respectively. Systole is a ventricular contraction which takes place when blood is pumped from the heart into the circulation. On the other hand, diastole is a ventricular relaxation which takes place when blood pumped from the atria to the ventricles.



But this movement of blood from one chamber to the other is impossible without the heart valves, i.e. bicuspid and tricuspid valves. The set of valves keep the fluid flowing in the correct direction. The valves present between the atria and ventricles are defined as atrioventricular valves or cuspid vales. The right atrioventricular valve is called the tricuspid valve and the left atrioventricular valve is known as the bicuspid valve. The valves present at the base of the large vessels known as semilunar valves. There is a pulmonary semilunar valve that is present between the right ventricle and pulmonary trunk while the valve lying between the left ventricle and the aorta is the aortic semilunar valve. When the ventricles contract, atrioventricular valves shut down to stop blood from flowing back into the atria. When the ventricles relax, semilunar valves shut down to prevent blood from flowing back into the ventricles.



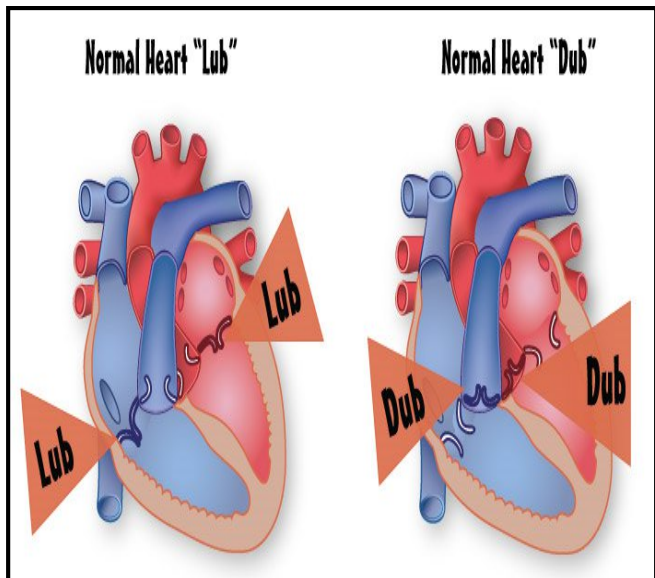
ELECTRICAL CONDUCTION

The human heart beats rhythmically. This normal rhythmical heart beat is known as sinus rhythm, which is initiated by the sinoatrial node. It is also called as the pacemaker of the heart. The sinoatrial node is present in the upper portion of the right atrium. An electrical signal is generated that travels through the heart and result in the contraction of heart muscles. Starting from the sinoatrial node, this electrical signal travels through the right atrium and then to the left atrium through Bachmann's bundle. This makes both right and left atrium contract together. Later, this signal moves to the atrioventricular node, which is found at the base of the right atrium. Moving through the atrioventricular node, this signal then passes to the Bundle of His which then spreads to both the right and left bundle branches, then reaches to the ventricles of the heart. Ventricles carry this signal to a specialized tissue known as Purkinje Fibers. After that, they transfer this electric signal to stimulate cardiac muscle cells to contract together to pump blood well out of the heart.



HEART SOUNDS

Two major heart sounds of the normal heart are “lub” & “dub”. The “lub” is the first type of heart sound, which is also called as S1. This sound is produced by turbulence caused by the closing of bicuspid and tricuspid valves at the beginning of systole. The “dub”, second heart sound, is caused by the closing of the pulmonic and aortic valves at the end of the systole. Thus, the time period the first and the second heart sound characterize systole or ventricular ejection. The time between the second and the next first sound characterizes diastole or ventricular filling.



Given below is the list of normal heart rate values in the humans of different age groups. A heart rate above the normal values result in tachycardia condition and the heart rate below the normal values result in bradycardia condition.

- Infants: 100 to 160 beats per minute
- Children 1 to 10 years: 70 to 120 beats per minute
- Children over 10 and adults: 60 to 100 beats per minute
- Athletes: 40 to 60 beats per minute

SOME COMMON HEART DISEASES

- Rheumatic Heart Disease: It is caused by rheumatic fever attacks, which cause damage to the heart, mostly the heart valves. Rheumatic fever typically takes place in infancy, and may follow a streptococcal infection. This infection affects the heart and may result



in weakening of the heart muscle, scarring the heart valves, or injuring the sac that encloses the heart. The scarred valves do not open and close generally, which create problems in the functioning of the heart.

- Hypertensive Heart Disease: This is also known as high blood pressure of unknown origin. It is caused by infections or specific diseases, like kidney diseases, damage to the blood vessels or tumor in the adrenal glands. High blood pressure may overstrain the heart and blood vessels resulting in the diseased condition.
- Ischemic Heart Disease: Heart illness caused by contraction of the coronary arteries and therefore, blood supply to the heart gets reduced.
- Cerebrovascular Disease: This disease affects the blood vessels in the brain. A cerebrovascular stroke is caused due to the obstructed blood supply to some part of the brain.
- Inflammatory Heart Disease: Several inflammations in heart components cause damage to them. These include:
 - o Myocarditis: Inflammation of the heart muscle
 - o Pericarditis: Inflammation of the membrane sac
 - o Endocarditis: Inflammation of the inner lining of the heart
 - o Myocardium Inflammation: Inflammation of the heart muscle

There are several myths regarding heart and functioning. You should not believe them without considering the facts. Keeping your heart healthy is extremely important for long life. Physician or health expert can help you keep your heart healthy through their advice. Regular exercise and healthy food are the true mantra of better heart functionality.

