



## The Heart

The heart is about the size of a fist and lies in the chest behind and slightly to the left of the breastbone, and between the lungs. It is a muscular organ that works constantly to circulate blood throughout the body. The word cardiac is often used when referring to the heart.

There are four chambers in the heart: two atria (atrium, singular, also referred to as upper chambers) and two ventricles (lower chambers). Additionally, the heart is divided into two sides, right and left. Hence, there is a right atrium, right ventricle, left atrium, and left ventricle. The ventricles are larger than the atria because they have to work (pump) harder to circulate blood. Basically, blood coming from the body is low in oxygen and enters the right side of the heart. From here, it flows to the lungs to get rid of carbon dioxide and pick up oxygen. Oxygen-rich blood then returns to the left side of the heart where it will be pumped out to the rest of the body to deliver oxygen and nutrients and carry away waste products.

Chambers of the Heart

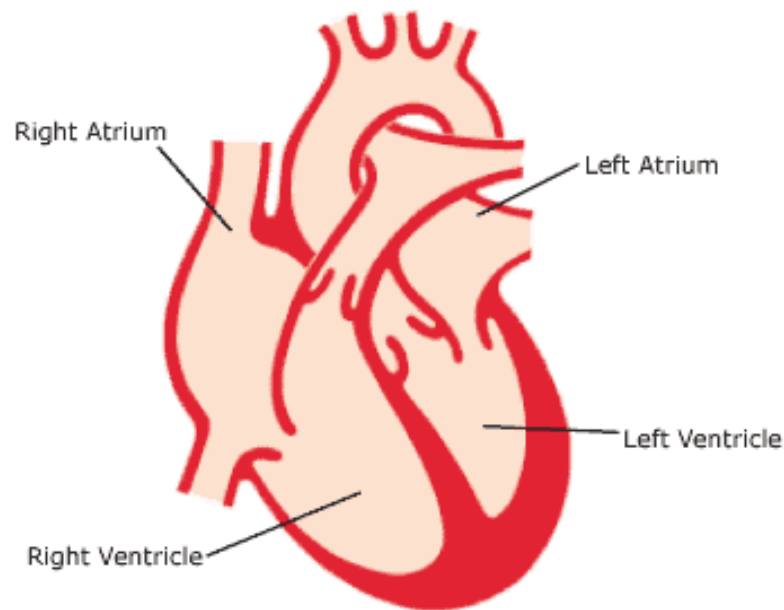


Figure 1: Chambers of the Heart

As blood circulates through the heart to go to the lungs or body, some of the blood flows into a set of much smaller blood vessels that provide blood flow directly to the muscle of the heart. This separate circulatory system keeps the heart nourished and oxygenated. Coronary (heart) artery disease affects the arteries of this circulatory system and causes a decrease in blood flow to the heart muscle, which may result in damage to the heart.



## The Heart Valves

The heart has four heart valves that function like one-way doors to keep the blood flowing in one direction. There is a valve between each atrium and ventricle. There is also a valve between each ventricle and the vessel (artery) that carries the blood away from the heart (to the lungs or to the body). In the right side of the heart, the tricuspid valve is between the atrium and the ventricle, and the pulmonic valve separates the right ventricle from the pulmonary artery. In the heart's left side, the mitral valve is between the atrium and ventricle, and the aortic valve separates the left ventricle from the aorta.

The valves open to allow blood to flow through, and they close to prevent the backflow of blood (the flow of blood back into the chamber that the blood just came from). Opening and closing of the valves is controlled by blood pressure changes within each heart chamber.

Valves of the Heart

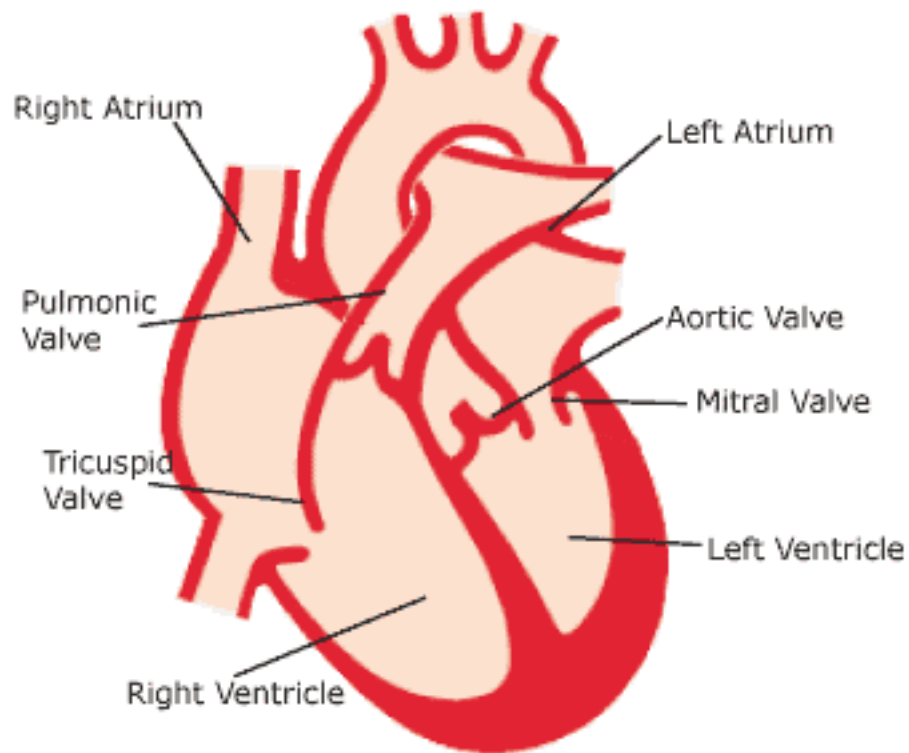


Figure 2: Valves of the Heart



## How Blood Flows Through the Heart

To follow the circulation of the blood through the heart, begin on the heart's right side (see diagram). Large veins (the superior vena cava and inferior vena cava) return blood from the body to the right atrium. This blood then flows through the tricuspid valve, into the right ventricle, and leaves the right ventricle through the pulmonary valve to go to the lungs (blue arrows). The blood circulates through the lungs and re-enters the heart flowing into the left atrium, through the mitral valve, and into the left ventricle. The blood leaves the left ventricle through the aortic valve to enter the aorta (the body's largest blood vessel) and circulate throughout the body.

This cycle is repeated over and over again, about 60 to 90 times per minute. This is the heart rate, also known as a pulse that is felt at the wrist. During the course of a day, the heart beats more than 100,000 times, pumping 7,000 liters of blood through thousands of miles of blood vessels.

Blood circulation through the heart

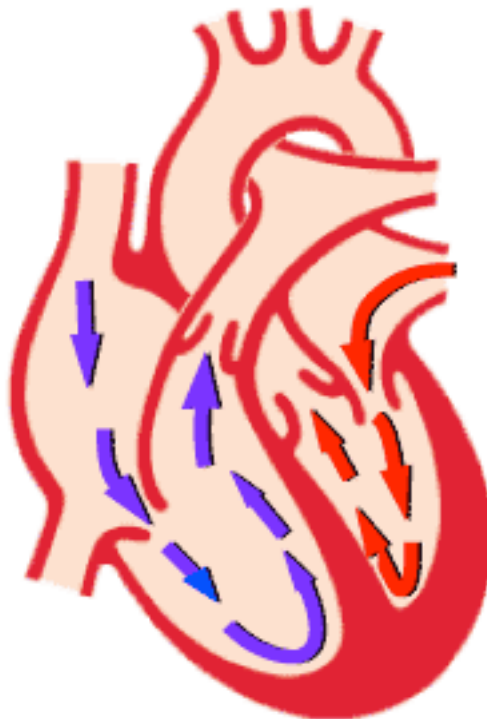


Figure 3: Blood circulation through the heart



## How the Heart Beats

The heart muscle pumps (contracts) to move the blood through the heart and body. The heartbeat is the sound of this pumping action. In order for the heart to pump, a series of electrical signals pass through the heart muscle and cause it to contract. This electrical conduction system has many specialized cells to move the electrical impulse at an extremely fast rate through the entire heart. This electrical impulse begins in the sinoatrial (SA) node, a specialized area in the right atrium. The SA node is the heart's natural pacemaker and starts every electrical impulse to cause every heartbeat. Messages from the brain and other centers direct the SA node to adjust the heart rate to meet the body's needs. After an impulse is generated by the SA node, it travels quickly through both atria, making them contract and pump blood into the ventricles. The electrical impulse then reaches a point at the very top of the right and left ventricles called the atrioventricular (AV) node. When the electrical signal reaches this point, it travels extremely fast, through a specialized set of fibers (Bundle of His, right and left bundle branches, and Purkinje fibers), to spread throughout the ventricles and cause them to contract and pump the blood to the lungs or the rest of the body. After each beat, the heart muscle recharges itself and the cycle starts over. Each heartbeat is the result of this complete passage of electrical signals that cause the atria to contract first, followed by the ventricles. Again, this cycle repeats itself 60 to 90 times a minute, or more than 42 million beats per year.

Conduction system of the heart

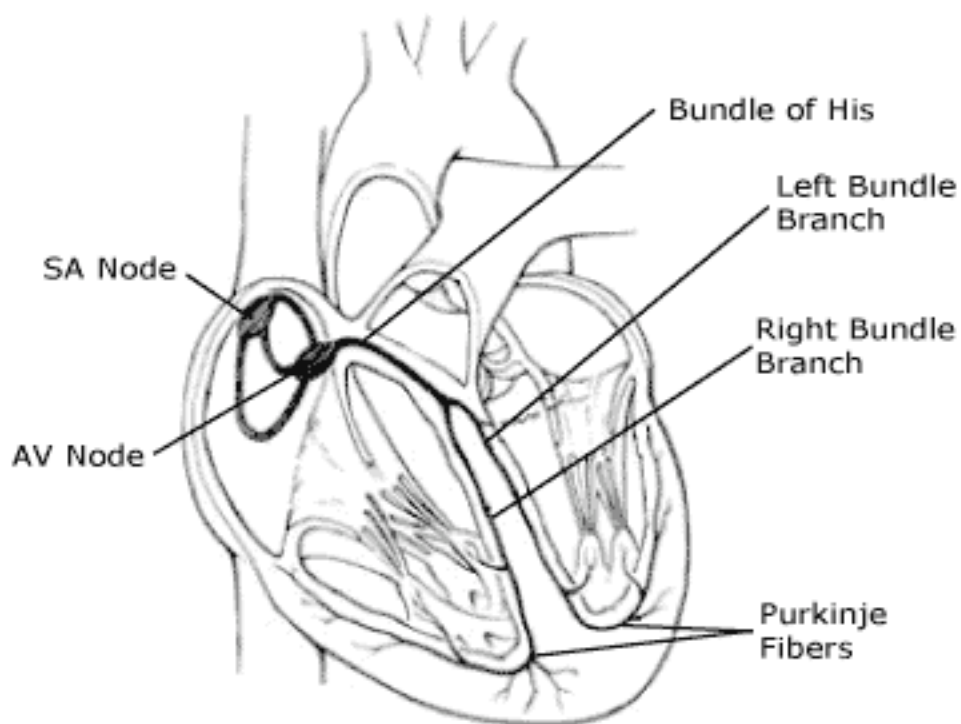


Figure 4: Conduction system of the Heart

