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Heart Preferred Concept UIM0009936 Scope NoteThe hollow, muscular organ that maintains the circulation of the blood. Terms Heart Preferred Term Term UI T019151 Date01/01/1999 LexicalTag NON ThesaurusID NLM (1966) Hearts Term UI T019150 Date03/17/1977 LexicalTag NON ThesaurusID BIOETHICS (1989) The heart has four chambers: two upper atria and two lower ventricles.The heart wall consists of three layers: epicardium, myocardium, and endocardium.Heart valves ensure blood flows in one direction, preventing backflow during pump cycles. The structure of the heart helps supply blood and oxygen to all parts of the body. It is divided by a partition (or septum) into two halves. The halves are, in turn, divided into four chambers. The heart is situated within the chest cavity and surrounded by a fluid-filled sac called the pericardium. This amazing muscle produces electrical impulses that cause the heart to contract, pumping blood throughout the body. The heart and the circulatory system together form the cardiovascular system. The structure of the heart has four chambers: Atria: Upper two chambers of the heart.Ventricles: Lower two chambers of the heart. The structure of the heart wall consists of three layers: Epicardium: The outer layer of the wall of the heart.Myocardium: The muscular middle layer of the wall of the heart.Endocardium: The inner layer of the heart. Cardiac conduction is the rate at which the heart conducts electrical impulses. Heart nodes and nerve fibers play an important role in causing the heart to contract. Atrioventricular Bundle: A bundle of fibers that carry cardiac impulses.Atrioventricular Node: A section of nodal tissue that delays and relays cardiac impulses.Purkinje Fibers: Fiber branches that extend from the atrioventricular bundle.Sinoatrial Node: A section of nodal tissue that sets the rate of contraction for the heart. The Cardiac cycle is the sequence of events that occurs when the heart beats. Below are the two phases of the cardiac cycle: Diastole phase: The heart ventricles are relaxed and the heart fills with blood.Systole phase: The ventricles contract and pump blood to the arteries. Valves are flap-like structures of the heart that allow blood to flow in one direction. Below are the four valves of the heart: Aortic valve: Prevents the backflow of blood as it is pumped from the left ventricle to the aorta. Mitral valve: Prevents the backflow of blood as it is pumped from the left atrium to the left ventricle. Pulmonary valve: Prevents the backflow of blood as it is pumped from the right ventricle to the pulmonary artery. Tricuspid valve: Prevents the backflow of blood as it is pumped from the right atrium to the right ventricle. Blood vessels are intricate networks of hollow tubes that transport blood throughout the entire body. The following are some of the blood vessels associated with the structure of the heart: Aorta: The largest artery in the body, of which most major arteries branch off from. Brachiocephalic artery: Carries oxygenated blood from the aorta to the head, neck, and arm regions of the body. Carotid arteries: Supply oxygenated blood to the head and neck regions of the body. Common iliac arteries: Carry oxygenated blood from the abdominal aorta to the legs and feet. Coronary arteries: Carry oxygenated and nutrient-filled blood to the heart muscle. Pulmonary artery: Carries deoxygenated blood from the right ventricle to the lungs. Subclavian arteries: Supply oxygenated blood to the arms. Brachiocephalic veins: Two large veins that join to form the superior vena cava.Common iliac veins: Veins that join to form the inferior vena cava.Pulmonary veins: Transport oxygenated blood from the lungs to the heart.Venae cavae: Transport de-oxygenated blood from various regions of the body to the heart. You can feel your heart beating every time you put your hand to your chest, but do you have any idea where is it exactly located? Is it on the left, right, or centre? Many of you must have answered that it is located on the left side. Well, it might be a shocker for some of you, but the heart isn't really located on the left side of the chest. The Heart sits in the center of the chest, not on the left side. It lies in the middle (center) of the chest between the right and left lungs. However it is slightly towards the left of the sternum. It feels like it's tilted to the left because the largest part of the it is on the left. The left lung is little smaller than the right lung to make room for the blood pumping machine of our body. Every day, our heart beats about 100,000 times, sending 2,000 gallons of blood surging through your body. It ticks 24*7 . It rarely gets a break. The average adult heart beats 72 times a minute. It is made up of four chambers, the left atrium, right atrium, left ventricle and right ventricle. The chambers have valves between them to check the flow of the blood. The distinctive sound of the heart – Lubb Dubb/Dupp is made due to the closure of these valves. The heart is a vital, fist-sized muscular organ located slightly on the left side of the chest. It consists of four main chambers: two atria and two ventricles. Understanding its basic anatomy is crucial to understanding how it functions. This article provides a comprehensive look at the heart's structure with a detailed, labeled diagram and realistic photos, guiding you through each part and its role in the circulatory system. The heart is a crucial organ that functions as the body's pump, ensuring blood circulation throughout the body. It consists of four main chambers: Left and right atria (upper chambers)Left and right ventricles (lower chambers) These chambers work in a coordinated manner to receive oxygen-poor blood, pump it to the lungs for oxygenation (adding blood to oxygen), and then distribute oxygen-rich blood to the rest of the body. The heart's structure also includes valves that prevent backflow and ensure blood flows in the correct direction. The heart has three layers of tissue: Endocardium: The innermost layer, provides a smooth lining for chambers and valves Myocardium: The middle layer, composed of muscle tissue that enables heart contractions Epicardium: The outermost layer protects the heart and reduces friction with surrounding structures. Understanding the heart's external and internal anatomy is essential for comprehending how this organ functions to maintain blood circulation throughout the body. The external structure of the heart includes several key components: Pericardium The pericardium is a double-walled sac that encloses the heart. It has two layers: A tough outer layer (fibrous pericardium) that protects the heart and anchors it to surrounding structures.An inner layer (serous pericardium) that includes the parietal layer lining the outer shell and the visceral layer (epicardium) directly on the heart's surface, acting as a cushion to prevent rubbing. Coronary Arteries and Veins Coronary arteries are blood vessels that supply the heart muscle (myocardium) with oxygen-rich blood. Coronary veins remove oxygen-poor blood. Key coronary arteries include: Left coronary artery: This artery supplies blood to the left side of the heart, including the left ventricle and left atrium. It also divides into the left anterior descending artery (to supply blood to the front of the left side of the heart) and the circumflex artery (to supply blood to the outer region and back of the heart. Right coronary artery: This artery supplies blood to the right side of the heart, including the right ventricle, right atrium, and important nodes that control heart rhythm. It branches into smaller arteries like the right posterior descending artery and acute marginal artery. Along with the left anterior descending artery, it supplies blood to the heart's middle section (septum). Coronary veins collect oxygen-poor blood from the myocardium and return it to the heart's right atrium, completing the circulation cycle. Major Blood Vessels: Major blood vessels of the heart include: Aorta: The largest artery in the body, carrying oxygen-rich blood from the left ventricle to the body. Pulmonary arteries: Vessels that carry oxygen-poor blood from the right ventricle to the lungs. 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The heart's valves that prevent backflow and ensure that the blood continues to flow in the right direction include: Tricuspid valve: Located between the right atrium and right ventricle, the tricuspid valve has three flaps (cusps) that open to allow blood to flow from the right atrium to the right ventricle and close to prevent blood from flowing backward.Pulmonary valve: Positioned between the right ventricle and the pulmonary artery, this valve opens to let blood flow from the right ventricle into the pulmonary artery, which leads to the lungs. It closes to prevent blood from returning to the right ventricle.Mitral valve: The mitral valve has two flaps (cusps) between the left atrium and left ventricle. It opens to allow oxygen-rich blood from the left atrium to flow into the left ventricle and closes to prevent backflow into the atrium.Aortic valve: Found between the left ventricle and the aorta, the aortic valve opens to allow blood to flow from the left ventricle into the aorta. This main artery carries oxygen-rich blood to the rest of the body. It closes to prevent blood from flowing back into the left ventricle. Septum The septum is the muscular wall that divides the heart into the left and right sides, preventing the mixing of oxygen-rich and oxygen-poor blood. Anatomical variations of the heart can include differences in size, shape, position, and the number of chambers or valves. These variations can sometimes occur without causing significant health issues, while in other cases, they may contribute to specific cardiac conditions or affect heart function. Some examples of anatomical variations of the heart include: Atrial Septal Defect (ASD): This is a congenital (present at birth) heart defect where there is an abnormal opening in the septum (wall) between the atria (upper chambers) of the heart. ASDs can vary in size and may lead to abnormal blood flow between the atria, which can cause permanent damage to the lung blood vessels. Ventricular Septal Defect (VSD): Similar to ASD, VSD is a congenital defect, but it occurs in the septum between the heart's ventricles (lower chambers). This defect allows blood to flow between the ventricles, potentially leading to symptoms like poor infant growth and rapid breathing. Mitral Valve Prolapse (MVP): In MVP, the mitral valve's flaps do not close properly, causing them to bulge (prolapse) back into the left atrium during the heart's contraction. MVP is a common condition and often doesn't cause significant problems. However, in some cases, it can lead to symptoms like palpitations, chest pain, or irregular heartbeats. Exploring how blood moves through it and how it beats can help explain how the heart functions. Oxygen-rich and oxygen-poor blood travels through different parts of the heart, ensuring that the body receives the oxygen and nutrients it needs to function properly. 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Here, it slows down slightly, allowing the ventricles to fill with blood.The AV node then sends a signal that spreads along the ventricle walls, causing them to contract and pump blood out of the heart.After this contraction, the ventricles relax, and the cycle restarts as the SA node generates a new electrical signal. Heart rate is measured in beats per minute (bpm) and reflects the number of times the heart contracts in a minute. A normal resting heart rate is between 60 and 100 beats per minute. Pulse is an artery's palpable expansion and contraction as blood is ejected from the heart during each heartbeat. It is commonly measured at the wrist's radial artery or the neck's carotid artery. Heart failure can result from various conditions that weaken or damage the heart muscle, impairing its ability to pump blood effectively. This can lead to a backup of blood in the heart's chambers or the blood vessels leading to the heart. 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This area is known as the mediastinum. It has four chambers: two upper atria (right and left) and two lower ventricles (right and left). The right side (right atrium and ventricle) and the left side (left atrium and ventricle) function together to ensure that blood flows in the proper direction.The heart's primary job is to pump blood, deliver oxygen and essential nutrients to cells, and carry away waste products for other organs to process. Beyond pumping, the heart also:Regulates heart rate and rhythm.Maintains blood pressure.This organ works closely with other systems to support these functions:Nervous System: The nervous system controls heart rate by signaling it to slow down during rest or speed up under stress.Endocrine System: Hormones released by the endocrine system influence blood pressure by signaling blood vessels to constrict or relax. The thyroid gland, for example, releases hormones that can alter the heart's speed.In this article, we will see the detailed anatomy of the heart with its different parts & systems that make every living thing breathe.ApexBaseCoronary SulcusAnterior and Posterior Interventricular SulcusPericardiumEpicardiumMyocardiumEndocardiumRight AtriumLeft AtriumRight VentricleLeft VentricleAtrioventricular (AV) ValvesTricuspid ValveMitral (Bicuspid) ValveSemilunar ValvesPulmonary ValveAortic ValvePulmonary CircuitPulmonary ArteryPulmonary VeinsSystemic CircuitAortaSuperior Vena CavaInferior Vena CavaChordae TendineaePapillary MusclesCoronary ArteriesLeft Coronary ArteryRight Coronary ArteryCardiac VeinsGreat Cardiac VeinMiddle and Small Cardiac VeinsCoronary SinusSinoatrial (SA) NodeAtrioventricular (AV) NodeAtrioventricular BundlePurkinje FibersThe apex of the heart is located at the tip of the left and right ventricles, opposite the base of the heart. It is facing toward the left side of the chest and angled slightly forward.The apex plays a key role in blood circulation. With each heartbeat, it twists and makes contact with the front of the chest, creating the apex beat. You can feel the apex beat by placing a hand just below the left nipple line.The apex helps the ventricles efficiently pump blood: The left ventricular apex pushes oxygen-rich blood to the body, while the right ventricular apex channels blood to the lungs for oxygenation.This movement aids in wringing out the ventricles and helps them push blood upward and out of the heart, ensuring a steady flow through the body and lungs.The base of the heart lies upward, slightly backward, and to the right, aligning with the fifth to eighth thoracic vertebrae. It closely neighbors the esophagus, aorta, and thoracic duct.The left atrium primarily forms the base, while the right atrium contributes a small portion. The base presents a quadrilateral shape.It lies just below the point where the pulmonary artery divides and meets the coronary sulcus at its lower border. The coronary sulcus forms a groove that contains the coronary sinus.On the right side, the sulcus terminalis of the right atrium defines the base.On the left, the ligament of the left vena cava and the oblique vein of the left atrium mark its boundary.The left atrium receives four pulmonary veins, with two on each side, and the right atrium takes in blood from the superior vena cava at the top and the inferior vena cava below.The coronary sulcus is a shallow groove on the heart's surface that separates the upper chambers (atria) from the lower chambers (ventricles).It is located near the base of the right auricle and contains key blood vessels that supply the heart with oxygen. In the front, this groove is interrupted by the pulmonary trunk, the large vessel carrying blood to the lungs.On the back side of the heart, the coronary sulcus houses the coronary sinus. This large vein collects blood returning from the heart's muscle tissue. This sinus extends from the area near the third left rib to the middle of the right sixth rib.There are two coronary sulci in the heart anatomy.The left portion of the coronary sulcus starts behind the pulmonary trunk. It runs down between the left atrium and left ventricle. The circumflex branch of the left coronary artery and the coronary sinus follow this path.On the right side, the coronary sulcus is visible from the front. It marks the path of the right coronary artery and the small cardiac vein. This part of the sulcus separates the right atrium from the right ventricle. It continues down to wrap around the heart's underside.The anterior interventricular sulcus is a groove on the front side of the heart that helps separate the two lower chambers, called ventricles. It works alongside another groove at the back of the heart, known as the posterior interventricular sulcus.Sometimes, these grooves are called the paraconal and subsinosal interventricular grooves, respectively. The anterior interventricular sulcus runs from the coronary sulcus (a groove encircling the heart) down to the tip of the heart, known as the apex.When it reaches the underside of the heart, it ends at a small indentation called the cardiac apex notch. This groove holds the anterior interventricular artery (a branch of the left coronary artery) and the great cardiac vein.The posterior interventricular sulcus is a distinct groove on the back of the heart. It marks the boundary between the two lower chambers or ventricles.The posterior interventricular sulcus is paired with the anterior interventricular sulcus on the heart's front and provides a pathway for critical blood vessels. It is the subsinosal interventricular groove and extends from the heart's base near the right side to the apex.This sulcus protects the posterior interventricular artery and the middle cardiac vein, which are essential in delivering oxygenated blood to the heart tissue and carrying deoxygenated blood away.The pericardium is a protective sac made of tough, flexible tissue that surrounds the heart. It has two layers: the outer fibrous pericardium, which is strong and helps keep the heart in place, and the inner serous pericardium, which is smooth and slippery to reduce friction as the heart beats.This design protects the heart, anchors it in the chest, and allows it to move easily while pumping blood. The pericardium doesn't cover the heart entirely—it leaves openings where the large blood vessels connect and where it rests on the diaphragm.The fibrous pericardium is a tough, non-flexible layer of connective tissue directly connected to the central tendon of the diaphragm. Its rigid nature limits the heart's ability to overfill quickly, providing structural support.However, this inflexibility can lead to life-threatening complications, such as cardiac tamponade, when fluid builds up and compresses the heart.It is housed within the fibrous pericardium, and the serous pericardium has two distinct layers. The outer parietal layer adheres to the inside of the fibrous pericardium. In contrast, the inner visceral layer, also called the epicardium, lies directly on the heart's surface.Both layers consist of a single layer of specialized epithelial cells called mesothelium, which help reduce friction during heart movement.In the heart anatomy, the heart wall has three main layers: the epicardium, myocardium, and endocardium. These layers are similar to the three layers found in blood vessels, which are called the tunica adventitia, tunica media, and tunica intima.In both structures, each layer serves a comparable purpose: the outer layer protects, the middle layer is muscular and controls movement, and the inner layer provides a smooth lining for blood flow.The epicardium is the outer protective layer of the heart. It is made up of mesothelial cells, connective tissue, and fat. It covers the heart and the beginnings of major blood vessels like the aorta, superior vena cava, and inferior vena cava.As part of the pericardium—the heart's enclosing membrane—the epicardium shields the heart from external harm and friction. Beyond protection, it has several key roles in heart health and development.During embryonic growth, it sends important signals that guide the formation and maturation of the heart.Additionally, it secretes factors crucial for the growth and survival of cardiomyocytes, the muscle cells of the heart.Epicardial cells can also act as progenitor cells, with the potential to develop into various cell types needed by the heart.The myocardium, located in the middle, is the thickest layer. It sits between the thin, inner endocardium layer and the outer epicardium, part of the pericardium that protects the heart.The myocardium is made up of special muscle cells called cardiomyocytes, which are designed for the heart's pumping action. These cells have unique structures called intercalated discs that contain gap junctions.These junctions allow quick communication between cells, helping the heart muscle contract well-coordinately.The myocardium's primary job is to help the heart contract and relax, allowing it to pump blood effectively through the body.Additionally, the myocardium supports the heart's structure and helps transmit electrical signals needed for a steady heartbeat.The endocardium is the heart's innermost tissue layer, lining its chambers and protecting the valves. Structurally, it resembles the endothelial cells that line blood vessels, reflecting shared biological origins.It is positioned beneath the thicker myocardium—the heart's muscular layer responsible for pumping. The endocardium is a smooth interface, promoting efficient blood flow through the heart.The epicardium is the heart's outermost layer. It has a small volume of lubricating fluid within the pericardium, a protective fibrous sac. This layered structure enables the heart's smooth and powerful contractions.The right atrium receives deoxygenated blood from three main sources:Superior vena cavaInferior vena cavaCoronary veins.The tricuspid valve then funnels this blood into the right ventricle, controlling its flow.The right side of the heart houses the right atrium, which connects to a small, expandable pouch called the right auricle, or right atrial appendage.This pouch helps increase the atrium's blood-holding capacity. Inside the right atrium, there are two main areas separated by a ridge called the crista terminalis. Each area has a specific role and developmental origin:Sinus Venarum: This smooth-walled part, located behind the crista terminalis, receives blood from the superior and inferior vena cavae. It originates from a fetal structure known as the sinus venosus.Atrium Proper: It is found in front of the crista terminalis. This area includes the right auricle and has rough, muscular walls due to pectinate muscles.Each part of the right atrium is specialized to support blood movement through the heart.The left atrium is a chamber in the heart that receives oxygenated blood from the lungs through four pulmonary veins.It pumps this blood into the left ventricle via the left atrioventricular orifice. This orifice is an opening regulated by the mitral valve to ensure one-way blood flow.The left atrium forms the heart's base and sits at the back of the heart. Its upper part bears the left auricle, a small, ear-shaped pouch that partially covers the base of the pulmonary trunk. The main artery carries blood from the heart to the lungs.The inner surface of the left atrium has two distinct regions with different origins:Inflow area: This smooth-surfaced section receives blood from the pulmonary veins, forming directly from them during development.Outflow area: Located toward the front and containing the left auricle, this region has muscle ridges known as pectinate muscles, developed from the embryonic atrium.Each part of the left atrium plays a role in efficiently moving oxygen-rich blood through the heart and into the body's circulation.The right ventricle receives deoxygenated blood from the right atrium. It pumps it into the pulmonary artery via the pulmonary valve. It is triangular in shape & forms most of the heart's front border.This ventricle has two main sections: the inflow section, where blood enters, and the outflow section, where blood exits to the lungs. These sections are divided by a muscular ridge called the supraventricular crest.Inflow Section: The inner surface of the inflow section is lined with muscular ridges called trabeculae carneae, which give it a sponge-like appearance. These trabeculae carneae have three main structures:Ridges – muscles attached along their entire length, forming raised lines along the ventricle walls.Bridges – muscles connected at both ends but free in the middle. Among these is the moderator band, which contains parts of the heart's right bundle branch, helping to transmit electrical signals efficiently.Papillary Muscles – These muscles anchor to the ventricle walls and connect to thin, fibrous strings called chordae tendineae. The chordae tendineae attach to the flaps of the tricuspid valve. It prevents them from flipping backward during contraction by tightening when the papillary muscles contract.Outflow Section (Conus Arteriosus): The outflow section, located at the top of the right ventricle, leads to the pulmonary artery. This part is known as the conus arteriosus and originates from the fetal heart structure called the bulbus cordis. It has smooth walls free of trabeculae carneae, which gives it a distinctly different appearance from the rest of the right ventricle.The left ventricle receives oxygen-rich blood from the left atrium. It pumps it through the aortic valve into the aorta. It is positioned at the apex of the heart in anatomical terms and contributes to the heart's left and diaphragmatic borders.Like the right ventricle, it has two main sections:Inflow Portion: The muscular ridges called trabeculae carneae line the inner walls of the inflow portion, similar to those in the right ventricle. It connects to the mitral valve, and the two papillary muscles actively stabilize the valve, preventing blood from flowing backward.Outflow Portion: The outflow portion, called the aortic vestibule, is a smooth-walled region free of trabeculae carneae. This part originates from the embryonic bulbus cordis and is specially structured to ensure efficient blood flow into the aorta.The heart is a powerful muscle that pumps blood through the entire body, supplying each organ with oxygen and nutrients. Inside the heart, some valves act like gates, opening and closing with each heartbeat to control blood flow between its chambers and maintain a steady rhythm.These valves ensure that blood moves in the right direction and at the right moment, preventing any backward flow. As they open and shut, they produce two distinct sounds—the familiar "lub-dub" of a heartbeat.The atrioventricular valves, positioned between the atria and ventricles, play a crucial role in heart function. At the onset of ventricular contraction (systole), these valves close tightly to prevent blood from flowing backward, creating the distinct first heart sound.The tricuspid valve is positioned between the right atrium and right ventricle, regulating blood flow through the right atrioventricular opening.It features three distinct cusps—anterior, septal, and posterior—each securely attached at its base to a fibrous ring encircling the orifice. This structure ensures efficient, one-way blood movement within the heart.The mitral valve is found between the left atrium and the left ventricle. It helps to control blood flow through the left atrioventricular opening.Often called the bicuspid valve, it has two flaps or cusps—one at the front (anterior) and one at the back (posterior). Each cusp is anchored to a strong fibrous ring that encircles the opening, ensuring it stays securely in place.The semilunar valves sit between the heart's ventricles and the major blood vessels that carry blood out of the heart. They close at the start of the heart's relaxation phase, known as diastole, and create the second "dub" sound in the heartbeat. There are two of these valves.The pulmonary valve sits at the junction of the right ventricle and the pulmonary trunk. It comprises three cusps—left, right, and anterior. These are named for their original orientation during fetal heart development before rotation occurs.The aortic valve is positioned between the left ventricle and the ascending aorta. It also consists of three cusps: right, left, and posterior.The left and right aortic sinuses are small pockets in the aortic wall that give rise to the left and right coronary arteries. During diastole, as the heart relaxes, blood briefly flows backward, filling these sinuses.It ensures that blood enters the coronary arteries to supply oxygen and nutrients to the heart muscle, supporting its function.The great vessels of the heart are important blood vessels that connect directly to the heart. These include arteries and veins that carry blood between the heart and the lungs, as well as to the rest of the body.The pulmonary circuit connects the heart and lungs, ensuring blood is refreshed with oxygen.Main Pulmonary Artery – The main pulmonary artery carries oxygen-poor blood from the right ventricle. This artery splits into two branches, one for each lung. In the lungs, the blood releases carbon dioxide and absorbs oxygen.Pulmonary Veins – Once oxygenated, the blood travels back to the heart through the pulmonary veins. Typically, there are four pulmonary veins—two from each lung—which deliver the oxygen-rich blood into the left atrium. This continuous cycle keeps the body supplied with oxygen for its essential functions.The ascending aorta, the initial section of your aorta, transports oxygen-rich blood from the left ventricle of your heart. This blood then moves through various aorta branches, supplying oxygen and nutrients to the entire body.The superior vena cava is a large vein responsible for carrying oxygen-depleted blood from the upper part of your body to the right atrium of your heart.Similarly, the inferior vena cava, another major vein, brings oxygen-depleted blood from the lower parts of your body into the right atrium.The chordae tendineae and papillary muscles are important parts of the heart that help the valves work correctly. They work together to keep the valves in place and ensure that blood flows in the right direction.The chordae tendineae are thin, string-like structures inside the heart's ventricles. They connect the small muscles on the inner walls of the heart, called papillary muscles, to the flaps of the heart valves. Some of these strings branch into multiple strands, while others stay as single cords.In the right ventricle, they attach to the three flaps of the tricuspid valve, and in the left ventricle, they connect to the two flaps of the mitral valve.Their main job is to hold the valve flaps in place during heartbeats, stopping them from flipping backward into the atria and making sure blood flows in the right direction.Papillary muscles are small but vital parts inside the heart's ventricles. They play a key role in helping the heart's valves work correctly by connecting to them with thin, string-like fibers called chordae tendineae. These muscles ensure that blood flows in the right direction.In the heart anatomy, there are a total of five papillary muscles.In the right ventricle, there are three—named anterior, posterior, and septal papillary muscles—that support the tricuspid valve.In the left ventricle, there are two—anterolateral and posteromedial papillary muscles—that assist the mitral valve.When the heart beats and pumps blood (a phase called ventricular systole), the papillary muscles contract. This action pulls on the chordae tendineae, keeping the valves tightly shut so blood doesn't leak backward into the atria. This coordinated effort is essential for proper blood circulation and helps prevent issues like valve leakage.Coronary circulation refers to the flow of blood through a network of arteries and veins that deliver oxygen and nutrients to the heart muscle (myocardium) while removing waste products. This system ensures that the heart functions efficiently by meeting its constant energy demands.Left Main Coronary Artery (LMCA): This plays a crucial role in heart function by delivering oxygen-rich blood to the left atrium and left ventricle. These chambers receive oxygenated blood from the lungs and pump it throughout the body. Additionally, the LMCA branches supply most of the interventricular septum, supporting the heart's ability to circulate blood efficiently.Right Coronary Artery (RCA): This artery supplies blood to the right atrium and right ventricle, which are essential for pumping deoxygenated blood to the lungs. It also supplies the sinoatrial (SA) and atrioventricular (AV) nodes, which control the heart's electrical signals and ensure coordinated muscle contractions. Additionally, branches of the RCA nourish about one-third of the interventricular septum, the wall separating the heart's lower chambers and supporting its structural and functional integrity.The heart's veins play an essential role in carrying deoxygenated blood back to the heart chambers.Anterior Cardiac Veins: Usually numbering 2 to 5, these veins carry blood from the front of the right ventricle directly into the right atrium.Great Cardiac Vein: This vein starts at the heart's apex (the tip) and moves upward along the front groove between the ventricles. It joins with a small vein from the left atrium to form the coronary sinus, which is located on the back of the heart.Middle Cardiac Vein: It is at the beginning of the apex. This vein travels along the lower groove between the ventricles and empties into the coronary sinus near its end.Small Cardiac Vein: Also called the right coronary vein, it collects blood from parts of the right atrium and right ventricle.Thebesian Veins: These are very small, valve-free veins found in the walls of all four chambers of the heart. They directly drain blood from the heart muscle (myocardium) into the corresponding chamber.The coronary sinus is the heart's largest vein, carrying most of the heart muscle's deoxygenated blood back to the right atrium.It begins at the back of the heart, where the great cardiac and the oblique vein of the left atrium meet. It is positioned in the groove between the left atrium and left ventricle and gathers blood from several smaller veins.Finally, it delivers blood to the right atrium through an opening, often guarded by a tiny flap called the valve of the coronary sinus.The heart's conduction system is an internal electrical network that ensures a steady heartbeat by coordinating the contraction and relaxation of heart muscles.It generates and transmits electrical impulses along precise pathways and synchronizes the movements of the heart's chambers. This system ensures that blood is pumped efficiently and delivers oxygen and nutrients to the body.The sinoatrial (SA) node is a cluster of specialized pacemaker cells located in the upper wall of the right atrium, near the entry point of the superior vena cava. These cells have the unique ability to spontaneously produce electrical signals to initiate the heart's rhythmic contractions.The electrical impulses generated by the SA node propagate through gap junctions across both atria and trigger their contraction (atrial systole). This action pumps blood from the atria into the ventricles to ensure continuous blood flow.The autonomic nervous system modulates the activity of the SA node to regulate heart rate:The sympathetic nervous system accelerates the SA node's firing, increasing heart rate. The parasympathetic nervous system slows its activity, decreasing heart rate.This dynamic regulation ensures that the heart adapts to the body's changing needs.Once electrical signals pass through the atria, they reach the atrioventricular (AV) node. It is located in the wall separating the atria near the coronary sinus.The AV node briefly slows these signals, delaying them for about 120 milliseconds. This pause allows the atria enough time to fully transfer blood into the ventricles before the ventricles contract.After this delay, the signals move into the atrioventricular bundle, continuing the electrical pathway that drives the heart's coordinated contractions.Purkinje fibers, called the sub-endocardial conduction network, are special heart cells that play a key role in keeping the heart working smoothly. These fibers store glycogen and connect tightly through gap junctions, enabling quick and efficient communication between cells.Purkinje fibers lie just beneath the inner surface of the ventricles and transmit electrical signals from the atrioventricular (AV) bundle to the ventricular walls of the heart. This fast signal ensures that the ventricles contract together during a heartbeat (ventricular systole).As a result, the heart pumps blood efficiently—sending oxygen-poor blood to the lungs through the pulmonary artery and oxygen-rich blood to the rest of the body through the aorta.Lower LimbHip Bone Anatomy – Complete Guide with Parts, Names, Functions & DiagramComplete Guide on Leg Anatomy with Parts, Functions & DiagramComplete Guide to Thigh Muscle Anatomy: Learn Parts, Names & DiagramKnee Anatomy: Complete Guide to Parts, Names, Functions & DiagramFemur Anatomy: Complete Guide with Parts, Names, Functions & DiagramHip Muscle Anatomy – Complete Guide with Parts, Names, Functions & DiagramUpper LimbComplete Guide to Finger Anatomy with Parts, Names, Functions & DiagramComplete Guide to Forearm Anatomy: Parts, Names, Functions & DiagramComprehensive Guide to Arm Anatomy: Parts, Names & DiagramComprehensive Guide to Hand Anatomy: Parts, Functions & DiagramUltimate Guide to Bicep Anatomy: Parts, Names, Functions & DiagramShoulder Anatomy: Ultimate Guide to Parts, Names, Functions & DiagramWrist Anatomy: Ultimate Guide to Parts, Names, Functions & DiagramComplete Guide to Nail Anatomy with all Parts, Names & DiagramsSpine Anatomy: Complete Guide with Parts, Names, Functions & DiagramHuman HeadSkull Anatomy: Complete Guide with Parts, Names, Functions & DiagramUltimate Guide to Eye Anatomy: Parts, Structure, Functions & DiagramTongue Anatomy: Complete Guide with Parts, Names, Functions & DiagramMouth Anatomy: Complete Guide with Parts, Names, Functions & DiagramComplete Guide to Tooth Anatomy: Learn Parts, Names & DiagramUltimate Guide to Ear Anatomy: Parts, Structure, Functions & DiagramNose Anatomy: Complete Guide with Parts, Names, Functions & DiagramBrainOrgansExternal Sources-WikipediaKenHubOptometristsCleveland ClinicAmerican Academy of Ophthalmology Disclaimer: The content on this site is for educational purposes only and is not a substitute for professional medical advice, diagnosis, or treatment.Anatomy.co.ukLearn Human AnatomyMuscular organ that pumps blood through the bodySystemCardiovascular SystemThe heart is a muscular organ that pumps blood throughout the body via the circulatory system. It is approximately the size of a fist and consists of four chambers: two atria and two ventricles. The heart is composed of specialized muscle tissue, known as myocardium, and is encased within a double-layered protective sac called the pericardium.[5] The heart works in a rhythmic cycle of contraction and relaxation, ensuring continuous circulation of blood. The heart is located in the mediastinum, the central compartment of the thoracic cavity. It lies slightly to the left of the midline, behind the sternum, and between the lungs. The heart is situated on the diaphragm at its base, with its apex pointing downward and to the left. It is enclosed by the pericardium and surrounded by major blood vessels like the aorta, pulmonary arteries, and veins. The heart's exact position varies slightly from person to person, but its general location is central within the chest, protected by the ribcage. The heart is a four-chambered muscular organ with a complex structure that allows it to efficiently pump blood throughout the body. It is divided into two halves—the right and left sides—each responsible for different aspects of circulation. The heart consists of four chambers: the right atrium, right ventricle, left atrium, and left ventricle. These chambers are separated by valves and muscular septa, which direct blood flow and maintain efficient circulation.[4] The heart wall is composed of three layers: the epicardium, myocardium, and endocardium. Apex and Base: The apex of the heart is the pointed lower tip that is oriented downward and to the left. It is formed by the tip of the left ventricle and is located at the level of the 5th intercostal space, typically slightly to the left of the midline. The base of the heart is its broader upper part and is primarily formed by the atria, especially the left atrium. It faces posteriorly and is situated at the level of the 2nd intercostal space. The base is where the great vessels—the aorta, pulmonary trunk, and superior vena cava—enter or exit the heart. Surfaces of the Heart: Sternocostal (Anterior) Surface: This surface is formed mostly by the right ventricle and a small portion of the left ventricle. The right atrium also contributes to this surface, while the heart rests on the sternum and the costal cartilages of the ribs. Diaphragmatic (Inferior) Surface: This surface is formed by both ventricles, primarily the left ventricle, and is in contact with the diaphragm.[3] Pulmonary (Left) Surface: This surface is mainly composed of the left ventricle and is in contact with the left lung. Borders of the Heart: Right Border: Formed by the right atrium. Left Border: Formed by the left ventricle and part of the left atrium. Inferior Border: Formed by the right ventricle and part of the left ventricle. Superior Border: Formed by the right and left atria and the great vessels.[6] Right Atrium: The right atrium is a thin-walled chamber located in the upper right side of the heart. It receives deoxygenated blood from the body through the superior vena cava (from the upper body) and inferior vena cava (from the lower body), and from the heart itself via the coronary sinus. The right atrium contains the auricle, a small ear-shaped muscular pouch, and the fossa ovalis, a remnant of the fetal foramen ovale. Blood flows from the right atrium into the right ventricle through the tricuspid valve. Right Ventricle: The right ventricle is located below the right atrium and pumps blood into the pulmonary circulation. It has relatively thin walls compared to the left ventricle and is crescent-shaped in cross-section. The right ventricle's internal surface is irregular due to the presence of trabeculae carneae and papillary muscles, which anchor the tricuspid valve via the chordae tendineae. Blood flows from the right ventricle through the pulmonary valve into the pulmonary trunk and into the lungs. Left Atrium: The left atrium is located posteriorly, forming much of the base of the heart. It receives oxygenated blood from the lungs through the four pulmonary veins (two from each lung).[2] Like the right atrium, the left atrium also has a muscular auricle. Blood flows from the left atrium into the left ventricle through the mitral valve. Left Ventricle: The left ventricle is the thickest chamber of the heart due to its role in pumping oxygenated blood into the systemic circulation. It has a conical shape and forms the apex of the heart.[7] The internal structure of the left ventricle is similar to the right ventricle, with trabeculae carneae, papillary muscles, and chordae tendineae. Blood flows from the left ventricle through the aortic valve into the aorta, which distributes oxygenated blood to the body. The heart has four valves that ensure one-way blood flow between the chambers and into the great vessels: Tricuspid Valve: Located between the right atrium and right ventricle, the tricuspid valve has three leaflets or cusps.[1] It prevents backflow of blood into the right atrium during ventricular contraction. Pulmonary Valve: The pulmonary valve is located between the right ventricle and the pulmonary trunk. It has three semilunar cusps that prevent backflow of blood into the right ventricle after contraction. Mitral Valve (Bicuspid Valve): Located between the left atrium and left ventricle, the mitral valve has two cusps. It prevents backflow of blood into the left atrium during ventricular contraction. Aortic Valve: The aortic valve is located between the left ventricle and the aorta. It has three semilunar cusps and prevents backflow of blood into the left ventricle after contraction. Epicardium: The epicardium is the outermost layer of the heart and is also considered the visceral layer of the serous pericardium. It is a thin, transparent layer that protects the heart and produces serous fluid to reduce friction during heart movements. Myocardium: The myocardium is the thick, muscular middle layer of the heart wall and is composed of cardiomyocytes(heart muscle cells). The myocardium is responsible for the contractile force of the heart. It is thickest in the left ventricle, which must generate enough force to pump blood throughout the entire body. Endocardium: The endocardium is the innermost layer of the heart and lines the interior of the heart chambers and valves. It is made of a thin layer of endothelial cells and connective tissue, providing a smooth surface for blood flow and protecting the heart tissue from direct contact with blood. Interatrial Septum: The interatrial septum separates the right and left atria. It contains the fossa ovalis, a depression that is a remnant of the fetal foramen ovale, which allowed blood to bypass the lungs in fetal circulation. Interventricular Septum: The interventricular septum separates the right and left ventricles. It is composed of a thick muscular portion and a thinner membranous portion near the base of the heart. The interventricular septum plays a critical role in supporting the contraction of the ventricles and maintaining the integrity of the heart chambers. The heart's electrical conduction system controls the timing and coordination of the heart's contractions: Sinoatrial (SA) Node: The SA node is located in the right atrium near the opening of the superior vena cava. It acts as the natural pacemaker of the heart, initiating electrical impulses that spread across the atria, causing them to contract. Atrioventricular (AV) Node: The AV node is located at the junction of the atria and ventricles. It delays the electrical impulse slightly, allowing the ventricles to fill with blood before they contract. Bundle of His: The bundle of His is a pathway of specialized muscle fibers that carries electrical impulses from the AV node to the ventricles. It runs along the interventricular septum and divides into the right and left bundle branches. Purkinje Fibers: The Purkinje fibers are specialized conducting fibers that spread throughout the ventricular myocardium, ensuring coordinated contraction of the ventricles.[8] Coronary Arteries: The heart receives its blood supply through the coronary arteries, which branch from the ascending aorta. There are two main coronary arteries: Right Coronary Artery (RCA): Supplies blood to the right atrium, right ventricle, and portions of the left ventricle and interventricular septum. Left Coronary Artery (LCA): Divides into the left anterior descending artery (LAD), which supplies the anterior walls of the left ventricle and septum, and the circumflex artery (LCx), which supplies the lateral and posterior walls of the left ventricle. Cardiac Veins: Deoxygenated blood from the myocardium is drained by the cardiac veins, which empty into the coronary sinus, a large vein that returns the blood to the right atrium. The heart's primary function is to pump blood throughout the body, ensuring the circulation of oxygenated and deoxygenated blood. Its role in maintaining the flow of blood allows the body to receive oxygen and nutrients while also removing waste products like carbon dioxide. The heart works as a dual-pump system, with the right side handling pulmonary circulation and the left side managing systemic circulation. Pumping Blood into the Pulmonary and Systemic Circulations The heart is divided into two sides—right and left—each responsible for a specific circulatory pathway: Right Side: Pulmonary Circulation: The right atrium receives deoxygenated blood from the body via the superior and inferior venae cavae. This blood is then passed into the right ventricle, which contracts and pumps the blood into the pulmonary trunk and pulmonary arteries, sending it to the lungs for oxygenation. This process is essential for gas exchange, where carbon dioxide is expelled, and oxygen is absorbed by the blood. Left Side: Systemic Circulation: The left atrium receives oxygenated blood from the lungs via the pulmonary veins. This blood is then pumped into the left ventricle, which contracts forcefully, pushing the blood into the aorta and throughout the entire body. The left ventricle must generate significant pressure to overcome the resistance of the systemic circulation, delivering oxygen and nutrients to all tissues and organs. Maintaining Unidirectional Blood Flow The heart ensures unidirectional blood flow through a system of four valves, which prevent backflow and maintain the efficiency of the cardiac cycle: Atrioventricular Valves: Tricuspid Valve: Located between the right atrium and right ventricle, this valve ensures that blood flows in one direction—from the atrium to the ventricle—and prevents backflow into the right atrium during ventricular contraction. Mitral Valve: Positioned between the left atrium and left ventricle, the mitral valve prevents backflow of blood into the left atrium during the contraction of the left ventricle. Semilunar Valves: Pulmonary Valve: Located at the exit of the right ventricle, this valve opens when the right ventricle contracts, allowing blood to flow into the pulmonary trunk. It closes during relaxation to prevent backflow into the right ventricle. Aortic Valve: Positioned between the left ventricle and the aorta, the aortic valve ensures that blood flows from the left ventricle into the aorta and prevents backflow into the ventricle during diastole. Generation of Pressure for Blood Ejection The heart, especially the ventricles, generates the pressure required to eject blood into the arteries: Right Ventricle: The right ventricle generates relatively low pressure as it pumps blood into the pulmonary circulation, where resistance is lower due to the shorter distance and lower pressure needed for blood to reach the lungs. Left Ventricle: The left ventricle generates much higher pressure to overcome the resistance of the systemic arteries and ensure blood is pushed through the entire body. This high pressure is critical for delivering oxygen and nutrients to tissues far from the heart, such as the brain, kidneys, and muscles. Coordinating Contraction and Relaxation The heart contracts and relaxes in a coordinated manner to maintain continuous blood flow through the body. The cardiac cycle involves two main phases: Systole (Contraction): During systole, the ventricles contract, generating

the force needed to pump blood into the pulmonary arteries and the aorta. The contraction of the myocardium reduces the volume of the ventricles, increasing the pressure inside them and forcing the blood through the semilunar valves into the arteries. Diastole (Relaxation): During diastole, the heart relaxes, allowing the ventricles to refill with blood from the atria. The atrioventricular valves open, and the atria contract to ensure that the ventricles are filled adequately before the next contraction. The heart functions as a vital pump responsible for circulating blood throughout the body. Its primary role is to maintain the flow of oxygenated and deoxygenated blood to sustain bodily functions. The heart achieves this through a coordinated system of chambers, valves, and electrical impulses, which work together to regulate blood flow, pressure, and oxygen delivery. Pumping Blood to the Pulmonary and Systemic Circulations The heart is divided into two sides—right and left—each responsible for a specific circulation pathway: Right Side: Pulmonary Circulation: The right atrium receives deoxygenated blood from the body through the superior and inferior vena cava. This blood flows into the right ventricle, which pumps it through the pulmonary valve into the pulmonary trunk and pulmonary arteries, transporting the blood to the lungs. In the lungs, carbon dioxide is exchanged for oxygen in the alveoli. Left Side: Systemic Circulation: The left atrium receives oxygenated blood from the lungs via the pulmonary veins. This blood flows into the left ventricle, which contracts powerfully, pumping blood through the aortic valve into the aorta and systemic circulation. The oxygenated blood is distributed to the tissues and organs of the body through a network of arteries, delivering oxygen and nutrients essential for cellular functions. The heart ensures unidirectional blood flow through a series of valves that prevent backflow and maintain efficient circulation: Atrioventricular (AV) Valves: Tricuspid Valve: Between the right atrium and right ventricle, this valve prevents backflow of blood into the right atrium during ventricular contraction. Mitral Valve: Located between the left atrium and left ventricle, the mitral valve ensures blood does not flow backward into the left atrium when the left ventricle contracts. Semilunar Valves: Pulmonary Valve: Situated between the right ventricle and pulmonary trunk, this valve prevents the return of blood into the right ventricle after it has been ejected to the lungs. Aortic Valve: Positioned between the left ventricle and the aorta, the aortic valve ensures that blood flows only into the aorta and does not return to the ventricle after contraction. These valves coordinate the movement of blood between chambers and major arteries, ensuring a one-way flow throughout the heart and circulatory system. The heart generates the pressure required to propel blood through both the pulmonary and systemic circulations: Right Ventricle: The right ventricle generates low pressure, sufficient to pump deoxygenated blood to the lungs, where resistance is low. Since the lungs are nearby and the pulmonary arteries are short, less force is required for blood circulation through the pulmonary circuit. Left Ventricle: The left ventricle generates high pressure to pump oxygenated blood throughout the entire body. The systemic circulation involves greater resistance due to the extensive network of arteries, capillaries, and veins that blood must travel through to reach tissues far from the heart. The thicker myocardium of the left ventricle provides the necessary force for this task. The heart works in a rhythmic cycle of contraction and relaxation, known as the cardiac cycle, which ensures continuous blood flow. This cycle is divided into two main phases: Systole (Contraction): During systole, the ventricles contract, increasing pressure within the chambers. This pressure forces blood out of the heart into the pulmonary arteries and aorta. The atrioventricular valves (tricuspid and mitral) close to prevent backflow, and the semilunar valves (pulmonary and aortic) open to allow blood to flow into the arteries. Diastole (Relaxation): During diastole, the ventricles relax, reducing pressure and allowing them to refill with blood from the atria. The atrioventricular valves open to facilitate this filling, while the semilunar valves close to prevent blood from flowing back into the heart. Diastole is essential for proper chamber filling and ensuring sufficient blood volume is pumped out during the next contraction. Cardiac output refers to the volume of blood the heart pumps per minute and is a key indicator of the heart's function. It is determined by the heart rate (beats per minute) and stroke volume (the amount of blood pumped per beat). The heart adjusts both heart rate and stroke volume to meet the body's demands: Heart Rate (Chronotropy): The heart can increase or decrease its rate of contraction in response to factors such as exercise, stress, or rest. The sinoatrial (SA) node acts as the natural pacemaker of the heart, controlling the rate at which the heart beats by generating electrical impulses that spread through the heart muscle. Stroke Volume (Inotropy): Stroke volume depends on the contractility of the heart muscle, the volume of blood filling the ventricles (preload), and the resistance the ventricles must overcome to eject blood (afterload). The heart can adjust its stroke volume by increasing the force of contraction or altering the volume of blood it pumps, depending on the body's needs. The heart ensures that oxygen and nutrients are delivered to tissues efficiently by maintaining blood pressure and flow. Oxygenated blood from the left ventricle is distributed throughout the body via arteries and capillaries, supplying cells with essential nutrients. The continuous pumping action of the heart ensures that oxygen-depleted blood is returned to the right side of the heart, from where it is sent to the lungs for reoxygenation. This cycle ensures that all tissues and organs receive a constant supply of oxygen and nutrients for proper metabolic functioning. The heart's electrical conduction system coordinates the contraction and relaxation of the atria and ventricles, ensuring efficient blood flow. The sequence of electrical impulses begins in the sinoatrial (SA) node, spreads through the atria, and reaches the atrioventricular (AV) node. From there, the impulse travels down the bundle of His and through the Purkinje fibers, causing the ventricles to contract: SA Node: The pacemaker of the heart, the SA node initiates electrical signals that regulate the heart rate. AV Node: Acts as a relay station, delaying the impulse slightly to allow the atria to finish contracting before the ventricles contract. Bundle of His and Purkinje Fibers: Conduct electrical signals to the ventricles, ensuring a coordinated and forceful contraction that efficiently pumps blood out of the heart. The heart plays a critical role in maintaining blood pressure, which is necessary for blood to reach all parts of the body: Systolic Pressure: The force exerted by blood against the walls of the arteries during ventricular contraction (systole). This pressure is responsible for pushing blood through the arteries. Diastolic Pressure: The pressure in the arteries when the ventricles are relaxed (diastole). Diastolic pressure ensures that blood continues to flow between heartbeats and helps maintain consistent circulation. The heart's ability to adjust its output in response to the body's changing demands—such as during exercise, stress, or rest—allows for the regulation of blood pressure and ensures that tissues receive an adequate supply of blood. The heart is integral to maintaining homeostasis by ensuring that oxygen, nutrients, hormones, and waste products are transported efficiently throughout the body. By continuously circulating blood, the heart helps regulate body temperature, pH levels, and the distribution of essential electrolytes. It also plays a role in filtering waste products through organs like the kidneys and liver, which remove toxins from the bloodstream. The heart is central to maintaining life, and its proper function is essential for sustaining circulation and oxygen delivery throughout the body. Any abnormalities in the heart's structure or function can lead to serious cardiovascular conditions. Common heart-related disorders include: Coronary Artery Disease (CAD): Narrowing or blockage of coronary arteries due to plaque buildup, which can lead to myocardial infarction (heart attack) when the blood supply to the heart muscle is compromised. Heart Failure: A condition where the heart cannot pump blood efficiently, leading to fluid retention, fatigue, and reduced oxygen delivery to tissues. It can affect the left, right, or both sides of the heart. Arrhythmias: Abnormal heart rhythms due to dysfunction in the heart's electrical conduction system, leading to bradycardia (slow heart rate), tachycardia (fast heart rate), or irregular rhythms such as atrial fibrillation. Valvular Heart Disease: Disorders of the heart valves, such as aortic stenosis, mitral regurgitation, or tricuspid insufficiency, can impede normal blood flow and increase the heart's workload. Published on November 29, 2024Last updated on May 17, 2025HomeExploreDiscussFlashcardsQuiz heart, organ that serves as a pump to circulate the blood. It may be a straight tube, as in spiders and annelid worms, or a somewhat more elaborate structure with one or more receiving chambers (atria) and a main pumping chamber (ventricle), as in mollusks. In fishes the heart is a folded tube, with three or four enlarged areas that correspond to the chambers in the mammalian heart. In animals with lungs—amphibians, reptiles, birds, and mammals—the heart shows various stages of evolution from a single to a double pump that circulates blood (1) to the lungs and (2) to the body as a whole.In humans and other mammals and in birds, the heart is a four-chambered double pump that is the centre of the circulatory system. In humans it is situated between the two lungs and slightly to the left of centre, behind the breastbone; it rests on the diaphragm, the muscular partition between the chest and the abdominal cavity.The heart consists of several layers of a tough muscular wall, the myocardium. A thin layer of tissue, the pericardium, covers the outside, and another layer, the endocardium, lines the inside. The heart cavity is divided down the middle into a right and a left heart, which in turn are subdivided into two chambers. The upper chamber is called an atrium (or auricle), and the lower chamber is called a ventricle. The two atria act as receiving chambers for blood entering the heart; the more muscular ventricles pump the blood out of the heart. Facts You Should Know: The Human Body Quiz The heart, although a single organ, can be considered as two pumps that propel blood through two different circuits. The right atrium receives venous blood from the head, chest, and arms via the large vein called the superior vena cava and receives blood from the abdomen, pelvic region, and legs via the inferior vena cava. Blood then passes through the tricuspid valve to the right ventricle, which propels it through the pulmonary artery to the lungs. In the lungs venous blood comes in contact with inhaled air, picks up oxygen, and loses carbon dioxide. Oxygenated blood is returned to the left atrium through the pulmonary veins. Valves in the heart allow blood to flow in one direction only and help maintain the pressure required to pump the blood.The low-pressure circuit from the heart (right atrium and right ventricle), through the lungs, and back to the heart (left atrium) constitutes the pulmonary circulation. Passage of blood through the left atrium, bicuspid valve, left ventricle, aorta, tissues of the body, and back to the right atrium constitutes the systemic circulation. Blood pressure is greatest in the left ventricle and in the aorta and its arterial branches. Pressure is reduced in the capillaries (vessels of minute diameter) and is reduced further in the veins returning blood to the right atrium.The pumping of the heart, or the heartbeat, is caused by alternating contractions and relaxations of the myocardium. These contractions are stimulated by electrical impulses from a natural pacemaker, the sinoatrial, or S-A, node located in the muscle of the right atrium. An impulse from the S-A node causes the two atria to contract, forcing blood into the ventricles. Contraction of the ventricles is controlled by impulses from the atrioventricular, or A-V, node located at the junction of the two atria. Following contraction, the ventricles relax, and pressure within them falls. Blood again flows into the atria, and an impulse from the S-A starts the cycle over again. This process is called the cardiac cycle. The period of relaxation is called diastole. The period of contraction is called systole. Diastole is the longer of the two phases so that the heart can rest between contractions. In general, the rate of heartbeat varies inversely with the size of the animal. In elephants it averages 25 beats per minute, in canaries about 1,000. In humans the rate diminishes progressively from birth (when it averages 130) to adolescence but increases slightly in old age; the average adult rate is 70 beats at rest. The rate increases temporarily during exercise, emotional excitement, and fever and decreases during sleep. Rhythmic pulsation felt on the chest, coinciding with heartbeat, is called the apex beat. It is caused by pressure exerted on the chest wall at the outset of systole by the rounded and hardened ventricular wall.heartCross section of a four-chambered heart.The rhythmic noises accompanying heartbeat are called heart sounds. Normally, two distinct sounds are heard through the stethoscope: a low, slightly prolonged "lub" (first sound) occurring at the beginning of ventricular contraction, or systole, and produced by closure of the mitral and tricuspid valves, and a sharper, higher-pitched "dup" (second sound), caused by closure of aortic and pulmonary valves at the end of systole. Occasionally audible in normal hearts is a third soft, low-pitched sound coinciding with early diastole and thought to be produced by vibrations of the ventricular wall. A fourth sound, also occurring during diastole, is revealed by graphic methods but is usually inaudible in normal subjects; it is believed to be the result of atrial contraction and the impact of blood, expelled from the atria, against the ventricular wall. Heart "murmurs" may be readily heard by a physician as soft swishing or hissing sounds that follow the normal sounds of heart action. Murmurs may indicate that blood is leaking through an imperfectly closed valve and may signal the presence of a serious heart problem. Coronary heart disease, in which an inadequate supply of oxygen-rich blood is delivered to the myocardium owing to the narrowing or blockage of a coronary artery by fatty plaques, is a leading cause of death worldwide. Your heart is in the center of your chest, near your lungs. It has four hollow chambers surrounded by muscle and other heart tissue. The chambers are separated by heart valves, which make sure that the blood keeps flowing in the right direction. Read more about heart valves and how they help blood flow through the heart. Anatomy of the interior of the heart. This image shows the four chambers of the heart and the direction that blood flows through the heart. Oxygen-poor blood, shown in blue-purple, flows into the heart and is pumped out to the lungs. Then oxygen-rich blood, shown in red, is pumped out to the rest of the body, with the help of the heart valves. The two upper chambers of your heart are called atria , and the two lower chambers are called ventricles . Blood flows from the body and lungs to the atria and from the atria to the ventricles. The ventricles pump blood out of the heart to the lungs and other parts of the body. An internal wall of tissue divides the right and left sides of your heart. This wall is called the septum. Watch to learn about chambers of the heart. Medical Animation Copyright © Nucleus Medical Media, All rights reserved. The heart is made of three layers of tissue.Endocardium is the thin inner lining of the heart chambers and also forms the surface of the valves.Myocardium is the thick middle layer of muscle that allows your heart chambers to contract and relax to pump blood to your body.Pericardium is the sac that surrounds your heart. Made of thin layers of tissue, it holds the heart in place and protects it. A small amount of fluid between the layers helps reduce friction between the beating heart and surrounding tissues. Watch to learn about heart muscles. Medical Animation Copyright © Nucleus Medical Media, All rights reserved. Some conditions can affect the heart's tissue.Cardiomyopathy is when the heart muscle becomes enlarged, thick, or rigid. As cardiomyopathy worsens, the heart becomes weaker and is less able to pump blood through the body and maintain a normal electrical rhythm.Heart inflammation is inflammation in one or more of the layers of tissue in the heart, including the pericardium, myocardium, or endocardium. This can lead to serious complications, including heart failure, cardiogenic shock, or irregular heart rhythm.Congenital heart disease is when the heart does not develop in the typical way. A congenital heart defect can happen at any point during development of an unborn baby, or embryo, inside the pregnant mother. The parts of your heart are like the parts of a building. Your heart anatomy includes:Walls.Chambers that are like rooms.Valves that open and close like doors to the rooms.Blood vessels like plumbing pipes that run through a building.An electrical conduction system like electrical power that runs through a building.Heart wallsYour heart walls are the muscles that contract (squeeze) and relax to send blood throughout your body. A layer of muscular tissue called the septum divides your heart walls into the left and right sides.Your heart walls have three layers:Endocardium: Inner layer.Myocardium: Muscular middle layer.Epicardium: Protective outer layer.The epicardium is one layer of your pericardium. The pericardium is a protective sac that covers your entire heart. It produces fluid to lubricate your heart and keep it from rubbing against other organs.Heart chambersYour heart has four separate chambers. You have two chambers on the top (atrium, plural atria) and two on the bottom (ventricles), one on each side of your heart.Right atrium: Two large veins deliver oxygen-poor blood to your right atrium. The superior vena cava carries blood from your upper body. The inferior vena cava brings blood from your lower body. Then the right atrium pumps the blood to your right ventricle.Right ventricle: The lower right chamber pumps the oxygen-poor blood to your lungs through the pulmonary artery. The lungs reload the blood with oxygen.Left atrium: After the lungs fill your blood with oxygen, the pulmonary veins carry the blood to the left atrium. This upper chamber pumps the blood to your left ventricle.Left ventricle: The left ventricle is slightly larger than the right. It pumps oxygen-rich blood to the rest of your body.Heart valvesYour heart valves are like doors between your heart chambers. They open and close to allow blood to flow through. They also keep your blood from moving in the wrong direction.Atrioventricular valvesThe atrioventricular (AV) valves open between your upper and lower heart chambers. They include:Tricuspid valve: Door between your right atrium and right ventricle.Mitral valve: Door between your left atrium and left ventricle.Semilunar valvesSemilunar (SL) valves open when blood flows out of your ventricles. They include:Aortic valve: Opens when blood flows out of your left ventricle to your aorta (artery that carries oxygen-rich blood to your body).Pulmonary valve: Opens when blood flows from your right ventricle to your pulmonary arteries (the only arteries that carry oxygen-poor blood to your lungs).Blood vesselsYour heart pumps blood through three types of blood vessels:Arteries carry oxygen-rich blood from your heart to your body's tissues. The exception is your pulmonary arteries, which go to your lungs.Veins carry oxygen-poor blood back to your heart.Capillaries are small blood vessels where your body exchanges oxygen-rich and oxygen-poor blood.Coronary arteriesYour heart receives nutrients through a network of coronary arteries. These arteries run along your heart's surface. They serve the heart itself and include the:Left coronary artery: Divides into two branches (the circumflex artery and the left anterior descending artery).Circumflex artery: Supplies blood to the left atrium and the side and back of the left ventricle.Left anterior descending artery (LAD): Supplies blood to the front and bottom of the left ventricle and the front of the septum.Right coronary artery (RCA): Supplies blood to the right atrium, right ventricle, bottom portion of the left ventricle and back of the septum.Electrical conduction systemYour heart's conduction system is like the electrical wiring of a building. It controls the rhythm and pace of your heartbeat. Signals start at the top of your heart and move down to the bottom. Your conduction system includes:Sinoatrial (SA) node: Sends the signals that make your heart beat.Atrioventricular (AV) node: Carries electrical signals from your heart's upper chambers to its lower ones.Left bundle branch: Sends electric impulses to your left ventricle.Right bundle branch: Sends electric impulses to your right ventricle.Bundle of His: Sends impulses from your AV node to the Purkinje fibers.Purkinje fibers: Make your heart ventricles contract and pump out blood.Where is your heart located?Your heart is in the front of your chest. It sits slightly behind and to the left of your sternum (breastbone), which is in the middle of your chest.Your heart is slightly on the left side of your body. It sits between your right and left lungs. The left lung is slightly smaller to make room for the heart in your left chest. Your rib cage protects your heart.What does your heart look like?Your heart looks a little bit like an upside-down pyramid with rounded edges. Large blood vessels go into and out of your heart to bring blood into and away from your heart. They connect your heart to the rest of your body, which it supplies with blood and oxygen.How big is your heart?Everyone's heart is a slightly different size. Generally, your heart is about the same size as your fist. On average, an adult's heart weighs about 10 ounces. Your heart may weigh a little more or a little less, depending on your body size and sex. The human heart is a finely-tuned instrument that serves the whole body. It is a muscular organ around the size of a closed fist, and it sits in the chest, slightly to the left of center.The heart beats around 100,000 times a day, pumping approximately 8 pints of blood throughout the body 24/7. This delivers oxygen- and nutrient-rich blood to tissues and organs and carries away waste.The heart sends deoxygenated blood to the lungs, where the blood loads up with oxygen and unloads carbon dioxide, a waste product of metabolism.Together, the heart, blood, and blood vessels — arteries, capillaries, and veins — make up the circulatory system.In this article, we explore the structure of the heart, how it pumps blood around the body, and the electrical system that controls it.The heart consists of four chambers:The atria: These are the two upper chambers, which receive blood.The ventricles: These are the two lower chambers, which discharge blood.A wall of tissue called the septum separates the left and right atria and the left and right ventricle. Valves separate the atria from the ventricles.The heart's walls consist of three layers of tissue:Myocardium: This is the muscular tissue of the heart.Endocardium: This tissue lines the inside of the heart and protects the valves and chambers.Pericardium: This is a thin protective coating that surrounds the other parts.Epicardium: This protective layer consists mostly of connective tissue and forms the innermost layer of the pericardium.The left and right sides of the heart work in unison. The atria and ventricles contract and relax in turn, producing a rhythmic heartbeat.The right side of the heart receives deoxygenated blood and sends it to the lungs.The right atrium receives deoxygenated blood from the body through veins called the superior and inferior vena cava. These are the largest veins in the body.The right atrium contracts, and blood passes to the right ventricle.Once the right ventricle is full, it contracts and pumps the blood to the lungs via the pulmonary artery. In the lungs, the blood picks up oxygen and offloads carbon dioxide.The left side of the heart receives blood from the lungs and pumps it to the rest of the body.Newly oxygenated blood returns to the left atrium via the pulmonary veins.The left atrium contracts, pushing the blood into the left ventricle.Once the left ventricle is full, it contracts and pushes the blood back out to the body via the aorta.Each heartbeat has two parts:Diastole: The ventricles relax and fill with blood as the atria contract, emptying all blood into the ventricles.Systole: The ventricles contract and pump blood out of the heart as the atria relax, filling with blood again.When a person takes their blood pressure, the machine will give a high and a low number. The high number is the systolic blood pressure, and the lower number is the diastolic blood pressure.Systolic pressure: This shows how much pressure the blood creates against the artery walls during systole.Diastolic pressure: This shows how much pressure is in the arteries during diastole.When blood travels through the pulmonary artery to the lungs, it passes through tiny capillaries that connect on the surface of the lung's air sacs, called the alveoli. The body's cells need oxygen to function, and they produce carbon dioxide as a waste product. The heart enables the body to eliminate the unwanted carbon dioxide.Oxygen enters the blood and carbon dioxide leaves it through the capillaries of the alveoli. The coronary arteries on the surface of the heart supply oxygenated blood to the heart muscle.A person can feel their pulse at points where arteries pass close to the skin's surface, such as on the wrist or neck. The pulse is the same as the heart rate. When you feel your pulse, you feel the rush of blood as the heart pumps it through the body. A healthy pulse is usually 60–100 bpm, and what is normal can vary from person to person. A very active person may have a pulse as low as 40 bpm. People with a larger body size tend to have a faster pulse, but it is not usually over 100 bpm.Learn how to take the pulse here.The heart has four valves to ensure that blood only flows in one direction:Aortic valve: This is between the left ventricle and the aorta.Mitral valve: This is between the left atrium and the left ventricle.Pulmonary valve: This is between the right ventricle and the pulmonary artery.Tricuspid valve: This is between the right atrium and right ventricle.Most people are familiar with the sound of the heart. In fact, the heart makes many types of sound, and doctors can distinguish these to monitor the health of the heart.The opening and closing of the valves are key contributors to the sound of the heartbeat. If there is leaking or a blockage of the heart valves, it can create sounds called "murmurs." To pump blood throughout the body, the muscles of the heart must work together to squeeze the blood in the right direction, at the right time, and with the right force. Electrical impulses coordinate this activity.The electrical signal begins at the sino-atrial node, sometimes called the sinus, or SA, node. This is the heart's pacemaker, and it sits at the top of the right atrium. The signal causes the atria to contract, pushing blood down into the ventricles.The electrical impulse then travels to an area of cells at the bottom of the right atrium, between the atria and ventricles, called the atrioventricular, or AV, node. These cells act as a gatekeeper. They coordinate the signal so that the atria and ventricles do not contract at the same time. There needs to be a slight delay.From here, the signal travels along fibers, called Purkinje fibers, within the ventricle walls. The fibers pass the impulse to the heart muscle, causing the ventricles to contract.There are three types of blood vessels:Arteries: These carry oxygenated blood from the heart to the rest of the body. The arteries are strong, muscular, and stretchy, which helps push blood through the circulatory system, and they also help regulate blood pressure. The arteries branch into smaller vessels called arterioles.Veins: These carry deoxygenated blood back to the heart, and they increase in size as they get closer to the heart. Veins have thinner walls than arteries.Capillaries: These connect the smallest arteries to the smallest veins. They have very thin walls, which allow them to exchange compounds such as carbon dioxide, water, oxygen, waste, and nutrients with surrounding tissues.The heart is essential to life — if it stops beating, blood will not reach the brain and other organs, and the person can die within minutes. This is called cardiac arrest.If a person experiences cardiac arrest, they will be unable to speak or breathe, and they will have no heartbeat.Anyone nearby should call 911 immediately and start cardiopulmonary resuscitation (CPR), pressing hard and fast with locked hands on the center of the person's chest. According to the Centers for Disease Control and Prevention (CDC), CPR can double or triple a person's chance of survival after their heart stops.Here, learn how to do CPR.Cardiovascular / Cardiology Enjoy sharper detail, more accurate color, lifelike lighting, believable backgrounds, and more with our new model update. Your generated images will be more polished than ever.See What's NewExplore how consumers want to see climate stories told today, and what that means for your visuals.Download Our Latest VisualGPS ReportData-backed trends. Generative AI demos. Answers to your usage rights questions. 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Our original video podcast covers it all—now on demand.Watch Now heart, Organ that pumps blood, circulating it to all parts of the body (see circulation). The human heart is a four-chambered double pump with its right and left sides fully separated by a septum and subdivided on both sides into an atrium above and a ventricle below. The right atrium receives venous blood from the superior and inferior venae cavae (see vena cava) and propels it into the pulmonary circulation. The left atrium takes in blood from the pulmonary veins and sends it into the systemic circulation. Electrical signals from a natural pacemaker cause the heart muscle to contract. Valves in the heart keep blood flowing in one direction. Their snapping shut after each contraction causes the sounds heard as the heartbeat. See also cardiovascular system. This clear and comprehensive anatomical illustration presents the fundamental structures of the human heart with precise labeling and color-coding. The diagram effectively distinguishes between oxygenated (red) and deoxygenated (blue) blood pathways, while showcasing the heart's chambers, valves, and major vessels in an easy-to-understand format. Aorta: The largest artery in the body, carrying oxygenated blood from the left ventricle. This vital vessel distributes blood to all body parts through its complex branching network.- Advertisement - Gray's Anatomy: The Anatomical Basis of Clinical Practice Enhance your anatomical knowledge with Gray's Anatomy: The Anatomical Basis of Clinical Practice. This authoritative text offers in-depth insights and illustrations, perfect for medical students and practitioners aiming for clinical excellence. Shop Now on Amazon At AnatomyNote.com, we offer free resources on anatomy, pathology, and pediatric medicine for medical students and professionals. Purchasing through our Amazon links, like Gray's Anatomy, supports our server costs and content creation at no additional cost to you. Disclosure: As an Amazon Associate, we earn a commission from qualifying purchases. Disclosure: As an Amazon Associate, we earn a commission from qualifying purchases at no extra cost to you. Superior Vena Cava: A major vein collecting deoxygenated blood from the upper body regions. It empties directly into the right atrium and handles blood return from the head, arms, and upper torso. Pulmonary Artery: Carries deoxygenated blood from the right ventricle to the lungs for oxygenation. This vessel divides into left and right branches to serve both lungs effectively. Pulmonary Vein: Returns newly oxygenated blood from the lungs to the left atrium. These vessels are crucial for completing the pulmonary circulation circuit. Right Atrium: The upper right chamber that receives deoxygenated blood from both venae cavae. It features specialized muscle bands that help regulate blood flow.- Advertisement - Master anatomy with detailed, exam-ready flash cards. AnatomyNote.com offers free anatomy and pathology resources. Your purchase of Anatomy Flash Cards supports our site at no extra cost. As an Amazon Associate, we earn from qualifying purchases. Left Atrium: Receives oxygenated blood from the pulmonary veins before passing it to the left ventricle. This chamber plays a crucial role in maintaining proper blood flow timing. Tricuspid Valve: A three-leaflet valve controlling blood flow between the right atrium and ventricle. It prevents backward flow during ventricular contraction. Mitral Valve: Also known as the bicuspid valve, it regulates blood flow between the left atrium and ventricle. This valve ensures unidirectional flow of oxygenated blood. Pulmonary Valve: Controls blood flow from the right ventricle into the pulmonary artery. It prevents the backflow of blood during ventricular relaxation. Aortic Valve: Regulates blood flow between the left ventricle and aorta. This valve prevents backflow of blood into the left ventricle during cardiac relaxation. Right Ventricle: The lower right pumping chamber that sends deoxygenated blood to the lungs. Its walls are thinner than the left ventricle due to the shorter distance blood needs to travel. Left Ventricle: The most muscular chamber of the heart, responsible for pumping blood throughout the body. Its thick walls generate the pressure needed for systemic circulation. Septum: The muscular wall separating the right and left sides of the heart. It prevents mixing of oxygenated and deoxygenated blood. The internal view of heart anatomy reveals the intricate arrangement of chambers and valves that facilitate proper blood flow. Each component is precisely positioned to ensure optimal cardiac function and efficient circulation. The heart's internal structure demonstrates the complexity of cardiac blood flow patterns. The strategic placement of valves and chambers creates a sophisticated system for blood movement and pressure regulation. Understanding the internal cardiac anatomy is crucial for medical professionals in diagnosing and treating heart conditions. This knowledge forms the foundation for modern cardiac care and surgical interventions. The relationship between different heart chambers and their associated vessels showcases the remarkable engineering of human cardiac anatomy. This understanding is essential for both medical education and clinical practice. Modern cardiac care relies heavily on comprehensive anatomical knowledge for effective treatment. Continuous research and understanding of heart anatomy drive advances in cardiovascular medicine. Regular monitoring of heart health and understanding of cardiac structures remain vital for preventing and managing heart conditions. This knowledge continues to shape the future of cardiovascular care. Disclaimer: The content on this site is for educational purposes only and is not a substitute for professional medical advice, diagnosis, or treatment.Anatomy.co.ukLearn Human AnatomyMuscular organ that pumps blood through the bodySystemCardiovascular SystemThe heart is a muscular organ that pumps blood throughout the body via the circulatory system. It is approximately the size of a fist and consists of four chambers: two atria and two ventricles. The heart is composed of specialized muscle tissue, known as myocardium, and is encased within a double-layered protective sac called the pericardium.[5] The heart works in a rhythmic cycle of contraction and relaxation, ensuring continuous circulation of blood. The heart is located in the mediastinum, the central compartment of the thoracic cavity. It lies slightly to the left of the midline, behind the sternum, and between the lungs. The heart is situated on the diaphragm at its base, with its apex pointing downward and to the left. It is enclosed by the pericardium and surrounded by major blood vessels like the aorta, pulmonary arteries, and veins. The heart's exact position varies slightly from person to person, but its general location is central within the chest, protected by the ribcage. The heart is a four-chambered muscular organ with a complex structure that allows it to efficiently pump blood throughout the body. It is divided into two halves—the right and left sides—each responsible for different aspects of circulation. The heart consists of four chambers: the right atrium, right ventricle, left atrium, and left ventricle. These chambers are separated by valves and muscular septa, which direct blood flow and maintain efficient circulation.[4] The heart wall is composed of three layers: the epicardium, myocardium, and endocardium. Apex and Base: The apex of the heart is the pointed lower tip that is oriented downward and to the left. It is formed by the tip of the left ventricle and is located at the level of the 5th intercostal space, typically slightly to the left of the midline. The base of the heart is its broader upper part and is primarily formed by the atria, especially the left atrium. It faces posteriorly and is situated at the level of the 2nd intercostal space. The base is where the great vessels—the aorta, pulmonary trunk, and superior vena cava—enter or exit the heart. Surfaces of the Heart: Sternocostal (Anterior) Surface: This surface is formed mostly by the right ventricle and a small portion of the left ventricle. The right atrium also contributes to this surface, while the heart rests on the sternum and the costal cartilages of the ribs. Diaphragmatic (Inferior) Surface: This surface is formed by both ventricles, primarily the left ventricle, and is in contact with the diaphragm.[3] Pulmonary (Left) Surface: This surface is mainly composed of the left ventricle and is in contact with the left lung. Borders of the Heart: Right Border: Formed by the right atrium. Left Border: Formed by the left ventricle and part of the left atrium. Inferior Border: Formed by the right ventricle and part of the left ventricle. Superior Border: Formed by the right and left atria and the great vessels.[6] Right Atrium: The right atrium is a thin-walled chamber located in the upper right side of the heart. It receives deoxygenated blood from the body through the superior vena cava (from the upper body) and inferior vena cava (from the lower body), and from the heart itself via the coronary sinus. The right atrium contains the auricle, a small ear-shaped muscular pouch, and the fossa ovalis, a remnant of the fetal foramen ovale. Blood flows from the right atrium into the right ventricle through the tricuspid valve. Right Ventricle: The right ventricle is located below the right atrium and pumps blood into the pulmonary circulation. It has relatively thin walls compared to the left ventricle and is crescent-shaped in cross-section. The right ventricle's internal surface is irregular due to the presence of trabeculae carneae and papillary muscles, which anchor the tricuspid valve via the chordae tendineae. Blood flows from the right ventricle through the pulmonary valve into the pulmonary trunk and into the lungs. Left Atrium: The left atrium is located posteriorly, forming much of the base of the heart. It receives oxygenated blood from the lungs through the four pulmonary veins (two from each lung).[2] Like the right atrium, the left atrium also has a muscular auricle. Blood flows from the left atrium into the left ventricle through the mitral valve. Left Ventricle: The left ventricle is the thickest chamber of the heart due to its role in pumping oxygenated blood into the systemic circulation. It has a conical shape and forms the apex of the heart.[7] The internal structure of the left ventricle is similar to the right ventricle, with trabeculae carneae, papillary muscles, and chordae tendineae. Blood flows from the left ventricle through the aortic valve into the aorta, which distributes oxygenated blood to the body. The heart has four valves that ensure one-way blood flow between the chambers and into the great vessels: Tricuspid Valve: Located between the right atrium and right ventricle, the tricuspid valve has three leaflets or cusps.[1] It prevents backflow of blood into the right atrium during ventricular contraction. Pulmonary Valve: The pulmonary valve is located between the right ventricle and the pulmonary trunk. It has three semilunar cusps that prevent backflow of blood into the right ventricle after contraction. Mitral Valve (Bicuspid Valve): Located between the left atrium and left ventricle, the mitral valve has two cusps. It prevents backflow of blood into the left atrium during ventricular contraction. Aortic Valve: The aortic valve is located between the left ventricle and the aorta. It has three semilunar cusps and prevents backflow of blood into the left ventricle after contraction. Epicardium: The epicardium is the outermost layer of the heart and is also considered the visceral layer of the serous pericardium. It is a thin, transparent layer that protects the heart and produces serous fluid to reduce friction during heart movements. Myocardium: The myocardium is the thick, muscular middle layer of the heart wall and is composed of cardiomyocytes(heart muscle cells). The myocardium is responsible for the contractile force of the heart. It is thickest in the left ventricle, which must generate enough force to pump blood throughout the entire body. Endocardium: The endocardium is the innermost layer of the heart and lines the interior of the heart chambers and valves. It is made of a thin layer of endothelial cells and connective tissue, providing a smooth surface for blood flow and protecting the heart tissue from direct contact with blood. Interatrial Septum: The interatrial septum separates the right and left atria. It contains the fossa ovalis, a depression that is a remnant of the fetal foramen ovale, which allowed blood to bypass the lungs in fetal circulation. Interventricular Septum: The interventricular septum separates the right and left ventricles. It is composed of a thick muscular portion and a thinner membranous portion near the base of the heart. The interventricular septum plays a critical role in supporting the contraction of the ventricles and maintaining the integrity of the heart chambers. The heart's electrical conduction system controls the timing and coordination of the heart's contractions: Sinoatrial (SA) Node: The SA node is located in the right atrium near the opening of the superior vena cava. It acts as the natural pacemaker of the heart, initiating electrical impulses that spread across the atria, causing them to contract. Atrioventricular (AV) Node: The AV node is located at the junction of the atria and ventricles. It delays the electrical impulse slightly, allowing the ventricles to fill with blood before they contract. Bundle of His: The bundle of His is a pathway of specialized muscle fibers that carries electrical impulses from the AV node to the ventricles. It runs along the interventricular septum and divides into the right and left bundle branches. Purkinje Fibers: The Purkinje fibers are specialized conducting fibers that spread throughout the ventricular myocardium, ensuring coordinated contraction of the ventricles.[8] Coronary Arteries: The heart receives its blood supply through the coronary arteries, which branch from the ascending aorta. There are two main coronary arteries: Right Coronary Artery (RCA): Supplies blood to the right atrium, right ventricle, and portions of the left ventricle and interventricular septum. Left Coronary Artery (LCA): Divides into the left anterior descending artery (LAD), which supplies the anterior walls of the left ventricle and septum, and the circumflex artery (LCx), which supplies the lateral and posterior walls of the left ventricle. Cardiac Veins: Deoxygenated blood from the myocardium is drained by the cardiac veins, which empty into the coronary sinus, a large vein that returns the blood to the right atrium. The heart's primary function is to pump blood throughout the body, ensuring the circulation of oxygenated and deoxygenated blood. Its role in maintaining the flow of blood allows the body to receive oxygen and nutrients while also removing waste products like carbon dioxide. The heart works as a dual-pump system, with the right side handling pulmonary circulation and the left side managing systemic circulation. Pumping Blood into the Pulmonary and Systemic Circulations The heart is divided into two sides—right and left—each responsible for a specific circulatory pathway: Right Side: Pulmonary Circulation: The right atrium receives deoxygenated blood from the body via the superior and inferior venae cavae. This blood is then passed into the right ventricle, which contracts and pumps the blood into the pulmonary trunk and pulmonary arteries, sending it to the lungs for oxygenation. This process is essential for gas exchange, where carbon dioxide is expelled, and oxygen is absorbed by the blood. Left Side: Systemic Circulation: The left atrium receives oxygenated blood from the lungs via the pulmonary veins. This blood is then pumped into the left ventricle, which contracts forcefully, pushing the blood into the aorta and throughout the entire body. The left ventricle must generate significant pressure to overcome the resistance of the systemic circulation, delivering oxygen and nutrients to all tissues and organs. Maintaining Unidirectional Blood Flow The heart ensures unidirectional blood flow through a system of four valves, which prevent backflow and maintain the efficiency of the cardiac cycle: Atrioventricular Valves: Tricuspid Valve: Located between the right atrium and right ventricle, this valve ensures that blood flows in one direction—from the atrium to the ventricle—and prevents backflow into the right atrium during ventricular contraction. Mitral Valve: Positioned between the left atrium and left ventricle, the mitral valve prevents backflow of blood into the left atrium during the contraction of the left ventricle. Semilunar Valves: Pulmonary Valve: Located at the exit of the right ventricle, this valve opens when the right ventricle contracts, allowing blood to flow into the pulmonary trunk. It closes during relaxation to prevent backflow into the right ventricle. Aortic Valve: Positioned between the left ventricle and the aorta, the aortic valve ensures that blood flows from the left ventricle into the aorta and prevents backflow into the ventricle during diastole. Generation of Pressure for Blood Ejection The heart, especially the ventricles, generates the pressure required to eject blood into the arteries: Right Ventricle: The right ventricle generates relatively low pressure as it pumps blood into the pulmonary circulation, where resistance is lower due to the shorter distance and lower pressure needed for blood to reach the lungs. Left Ventricle: The left ventricle generates much higher pressure to overcome the resistance of the systemic arteries and ensure blood is pushed through the entire body. This high pressure is critical for delivering oxygen and nutrients to tissues far from the heart, such as the brain, kidneys, and muscles. Coordinating Contraction and Relaxation The heart contracts and relaxes in a coordinated manner to maintain continuous blood flow through the body. The cardiac cycle involves two main phases: Systole (Contraction): During systole, the ventricles contract, generating the force needed to pump blood into the pulmonary arteries and the aorta. The contraction of the myocardium reduces the volume of the ventricles, increasing the pressure inside them and forcing the blood through the semilunar valves into the arteries. Diastole (Relaxation): During diastole, the heart relaxes, allowing the ventricles to refill with blood from the atria. The atrioventricular valves open, and the atria contract to ensure that the ventricles are filled adequately before the next contraction. The heart functions as a vital pump responsible for circulating blood throughout the body. Its primary role is to maintain the flow of oxygenated and deoxygenated blood to sustain bodily functions. The heart achieves this through a coordinated system of chambers, valves, and electrical impulses, which work together to regulate blood flow, pressure, and oxygen delivery. Pumping Blood to the Pulmonary and Systemic Circulations The heart is divided into two sides—right and left—each responsible for a specific circulation pathway: Right Side: Pulmonary Circulation: The right atrium receives deoxygenated blood from the body through the superior and inferior vena cava. This blood flows into the right ventricle, which pumps it through the pulmonary valve into the pulmonary trunk and pulmonary arteries, transporting the blood to the lungs. In the lungs, carbon dioxide is exchanged for oxygen in the alveoli. Left Side: Systemic Circulation: The left atrium receives oxygenated blood from the lungs via the pulmonary veins. This blood flows into the left ventricle, which contracts powerfully, pumping blood through the aortic valve into the aorta and systemic circulation. The oxygenated blood is distributed to the tissues and organs of the body through a network of arteries, delivering oxygen and nutrients essential for cellular functions. The heart ensures unidirectional blood flow through a series of valves that prevent backflow and maintain efficient circulation: Atrioventricular (AV) Valves: Tricuspid Valve: Between the right atrium and right ventricle, this valve prevents backflow of blood into the right atrium during ventricular contraction. Mitral Valve: Located between the left atrium and left ventricle, the mitral valve ensures blood does not flow backward into the left atrium when the left ventricle contracts. Semilunar Valves: Pulmonary Valve: Situated between the right ventricle and pulmonary trunk, this valve prevents the return of blood into the right ventricle after it has been ejected to the lungs. Aortic Valve: Positioned between the left ventricle and the aorta, the aortic valve ensures that blood flows only into the aorta and does not return to the ventricle after contraction. These valves coordinate the movement of blood between chambers and major arteries, ensuring a one-way flow throughout the heart and circulatory system. The heart generates the pressure required to propel blood through both the pulmonary and systemic circulations: Right Ventricle: The right ventricle generates low pressure, sufficient to pump deoxygenated blood to the lungs, where resistance is low. Since the lungs are nearby and the pulmonary arteries are short, less force is required for blood circulation through the pulmonary circuit. Left Ventricle: The left ventricle generates high pressure to pump oxygenated blood throughout the entire body. The systemic circulation involves greater resistance due to the extensive network of arteries, capillaries, and veins that blood must travel through to reach tissues far from the heart. The thicker myocardium of the left ventricle provides the necessary force for this task. The heart works in a rhythmic cycle of contraction and relaxation, known as the cardiac cycle, which ensures continuous blood flow. This cycle is divided into two main phases: Systole (Contraction): During systole, the ventricles contract, increasing pressure within the chambers. This pressure forces blood out of the heart into the pulmonary arteries and aorta. The atrioventricular valves (tricuspid and mitral) close to prevent backflow, and the semilunar valves (pulmonary and aortic) open to allow blood to flow into the arteries. Diastole (Relaxation): During diastole, the ventricles relax, reducing pressure and allowing them to refill with blood from the atria. The atrioventricular valves open to facilitate this filling, while the semilunar valves close to prevent blood from flowing back into the heart. Diastole is essential for proper chamber filling and ensuring sufficient blood volume is pumped out during the next contraction. Cardiac output refers to the volume of blood the heart pumps per minute and is a key indicator of the heart's function. It is determined by the heart rate (beats per minute) and stroke volume (the amount of blood pumped per beat). The heart adjusts both heart rate and stroke volume to meet the body's demands: Heart Rate (Chronotropy): The heart can increase or decrease its rate of contraction in response to factors such as exercise, stress, or rest. The sinoatrial (SA) node acts as the natural pacemaker of the heart, controlling the rate at which the heart beats by generating electrical impulses that spread through the heart muscle. Stroke Volume (Inotropy): Stroke volume depends on the contractility of the heart muscle, the volume of blood filling the ventricles (preload), and the resistance the ventricles must overcome to eject blood (afterload). The heart can adjust its stroke volume by increasing the force of contraction or altering the volume of blood it pumps, depending on the body's needs. The heart ensures that oxygen and nutrients are delivered to tissues efficiently by maintaining blood pressure and flow. Oxygenated blood from the left ventricle is distributed throughout the body via arteries and capillaries, supplying cells with essential nutrients. The continuous pumping action of the heart ensures that oxygen-depleted blood is returned to the right side of the heart, from where it is sent to the lungs for reoxygenation. This cycle ensures that all tissues and organs receive a constant supply of oxygen and nutrients for proper metabolic functioning. The heart's electrical conduction system coordinates the contraction and relaxation of the atria and ventricles, ensuring efficient blood flow. The sequence of electrical impulses begins in the sinoatrial (SA) node, spreads through the atria, and reaches the atrioventricular (AV) node. From there, the impulse travels down the bundle of His and through the Purkinje fibers, causing the ventricles to contract: SA Node: The pacemaker of the heart, the SA node initiates electrical signals that regulate the heart rate. AV Node: Acts as a relay station, delaying the impulse slightly to allow the atria to finish contracting before the ventricles contract. Bundle of His and Purkinje Fibers: Conduct electrical signals to the ventricles, ensuring a coordinated and forceful contraction that efficiently pumps blood out of the heart. The heart plays a critical role in maintaining blood pressure, which is necessary for blood to reach all parts of the body: Systolic Pressure: The force exerted by blood against the walls of the arteries during ventricular contraction (systole). This pressure is responsible for pushing blood through the arteries. Diastolic Pressure: The pressure in the arteries when the ventricles are relaxed (diastole). Diastolic pressure ensures that blood continues to flow between heartbeats and helps maintain consistent circulation. The heart's ability to adjust its output in response to the body's changing demands—such as during exercise, stress, or rest—allows for the regulation of blood pressure and ensures that tissues receive an adequate supply of blood. The heart is integral to maintaining homeostasis by ensuring that oxygen, nutrients, hormones, and waste products are transported efficiently throughout the body. By continuously circulating blood, the heart helps regulate body temperature, pH levels, and the distribution of essential electrolytes. It also plays a role in filtering waste products through organs like the kidneys and liver, which remove toxins from the bloodstream. The heart is central to maintaining life, and its proper function is essential for sustaining circulation and oxygen delivery throughout the body. Any abnormalities in the heart's structure or function can lead to serious cardiovascular conditions. Common heart-related disorders include: Coronary Artery Disease (CAD): Narrowing or blockage of coronary arteries due to plaque buildup, which can lead to myocardial infarction (heart attack) when the blood supply to the heart muscle is compromised. Heart Failure: A condition where the heart cannot pump blood efficiently, leading to fluid retention, fatigue, and reduced oxygen delivery to tissues. It can affect the left, right, or both sides of the heart. Arrhythmias: Abnormal heart rhythms due to dysfunction in the heart's electrical conduction system, leading to bradycardia (slow heart rate), tachycardia (fast heart rate), or irregular rhythms such as atrial fibrillation. Valvular Heart Disease: Disorders of the heart valves, such as aortic stenosis, mitral regurgitation, or tricuspid insufficiency, can impede normal blood flow and increase the heart's workload. Published on November 29, 2024Last updated on May 17, 2025HomeExploreDiscussFlashcardsQuiz Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Information and support How you can help Shop What we do Donate The human heart is a four-chambered muscular organ, shaped and sized roughly like a man's closed fist with two-thirds of the mass to the left of midline. The heart is enclosed in a pericardial sac that is lined with the parietal layers of a serous membrane. The visceral layer of the serous membrane forms the epicardium. Layers of the Heart Wall Three layers of tissue form the heart wall. The outer layer of the heart wall is the epicardium, the middle layer is the myocardium, and the inner layer is the endocardium. Chambers of the Heart The internal cavity of the heart is divided into four chambers: Right atrium Right ventricle Left atrium Left ventricle The two atria are thin-walled chambers that receive blood from the veins. The two ventricles are thick-walled chambers that forcefully pump blood out of the heart. Differences in thickness of the heart chamber walls are due to variations in the amount of myocardium present, which reflects the amount of force each chamber is required to generate. The right atrium receives deoxygenated blood from systemic veins; the left atrium receives oxygenated blood from the pulmonary veins. Valves of the Heart Pumps need a set of valves to keep the fluid flowing in one direction and the heart is no exception. The heart has two types of valves that keep the blood flowing in the correct direction. The valves between the atria and ventricles are called atrioventricular valves (also called cuspid valves), while those at the bases of the large vessels leaving the ventricles are called semilunar valves. The right atrioventricular valve is the tricuspid valve. The left atrioventricular valve is the bicuspid, or mitral, valve. The valve between the right ventricle and pulmonary trunk is the pulmonary semilunar valve. The valve between the left ventricle and the aorta is the aortic semilunar valve. When the ventricles contract, atrioventricular valves close to prevent blood from flowing back into the atria. When the ventricles relax, semilunar valves close to prevent blood from flowing back into the ventricles. Pathway of Blood through the Heart While it is convenient to describe the flow of blood through the right side of the heart and then through the left side, it is important to realize that both atria and ventricles contract at the same time. The heart works as two pumps, one on the right and one on the left, working simultaneously. Blood flows from the right atrium to the right ventricle, and then is pumped to the lungs to receive oxygen. From the lungs, the blood flows to the left atrium, then to the left ventricle. From there it is pumped to the systemic circulation. Blood Supply to the Myocardium The myocardium of the heart wall is a working muscle that needs a continuous supply of oxygen and nutrients to function efficiently. For this reason, cardiac muscle has an extensive network of blood vessels to bring oxygen to the contracting cells and to remove waste products. The right and left coronary arteries, branches of the ascending aorta, supply blood to the walls of the myocardium. After blood passes through the capillaries in the myocardium, it enters a system of cardiac (coronary) veins. Most of the cardiac veins drain into the coronary sinus, which opens into the right atrium. « Previous (Heart)Next (Physiology of the Heart) » Health & Medicine Anatomy & Physiology What is the circulatory system in the human body? What are the main components of the circulatory system? What role does the heart play in the circulatory system? How do blood vessels function within the circulatory system? circulatory system, system that transports nutrients, respiratory gases, and metabolic products throughout a living organism, permitting integration among the various tissues. The process of circulation includes the intake of metabolic materials, the conveyance of these materials throughout the organism, and the return of harmful by-products to the environment.Invertebrate animals have a great variety of liquids, cells, and modes of circulation, though many invertebrates have what is called an open system, in which fluid passes more or less freely throughout the tissues or defined areas of tissue. All vertebrates, however, have a closed system—that is, their circulatory system transmits fluid through an intricate network of vessels. This system contains two fluids, blood and lymph, and functions by means of two interacting modes of circulation, the cardiovascular system and the lymphatic system; both the fluid components and the vessels through which they flow reach their greatest elaboration and specialization in the mammalian systems and, particularly, in the human body. A full treatment of human blood and its various components can be found in the article human blood. A discussion of how the systems of circulation, respiration, and metabolism work together within an animal organism is found in the article respiration. The Editors of Encyclopaedia Britannica human circulatory systemParts of the human circulatory system that highlight arterial supply and venous drainage of the organs.All living organisms take in molecules from their environments, use them to support the metabolism of their own substance, and release by-products back into the environment. The internal environment differs more or less greatly from the external environment, depending on the species. It is normally maintained at constant conditions by the organism so that it is subject to relatively minor fluctuations. In individual cells, either as independent organisms or as parts of the tissues of multicellular animals, molecules are taken in either by their direct diffusion through the cell wall or by the formation by the surface membrane of vacuoles that carry some of the environmental fluid containing dissolved molecules. Within the cell, cyclosis (streaming of the fluid cytoplasm) distributes the metabolic products. Molecules are normally conveyed between cells and throughout the body of multicellular organisms in a circulatory fluid, called blood, through special channels, called blood vessels, by some form of pump, which, if restricted in position, is usually called a heart. In vertebrates blood and lymph (the circulating fluids) have an essential role in maintaining homeostasis (the constancy of the internal environment) by distributing substances to parts of the body when required and by removing others from areas in which their accumulation would be harmful. One phylum, Cnidaria (Coelenterata)—which includes sea anemones, jellyfish, and corals—has a diploblastic level of organization (i.e., its members have two layers of cells). The outer layer, called the ectoderm, and the inner layer, called the endoderm, are separated by an amorphous, acellular layer called the mesoglea; for these animals, bathing both cellular surfaces with environmental fluid is sufficient to supply their metabolic needs. All other major eumetazoan phyla (i.e., those with defined tissues and organs) are triploblastic (i.e., their members have three layers of cells), with the third cellular layer, called the mesoderm, developing between the endoderm and ectoderm. At its simplest, the mesoderm provides a network of packing cells around the animal's organs; this is probably best exhibited in the phylum Platyhelminthes (flatworms). Nematoda, Rotifera, and a number of other smaller eumetazoan classes and phyla have a fluid-filled cavity, called the pseudocoelom, that arises from an embryonic cavity and contains the internal organs free within it. All other eumetazoans have a body cavity, the coelom, which originates as a cavity in the embryonic mesoderm. Mesoderm lines the coelom and forms the peritoneum, which also surrounds and supports the internal organs. While this increase in complexity allows for increase in animal size, it has certain problems. As the distances from metabolizing cells to the source of metabolites (molecules to be metabolized) increases, a means of distribution around the body is necessary for all but the smallest coelomates. Many invertebrate animals are aquatic and the problem of supplying fluid is not critical. For terrestrial organisms, however, the fluid reaching the tissues comes from water that has been drunk, absorbed in the alimentary canal, and passed to the bloodstream. Fluid may leave the blood, usually with food and other organic molecules in solution, and pass to the tissues, from which it returns in the form of lymph. Especially in the vertebrates, lymph passes through special pathways, called lymphatic channels, to provide the lymphatic circulation. In many invertebrates, however, the circulating fluid is not confined to distinct vessels, and it more or less freely bathes the organs directly. The functions of both circulating and tissue fluid are thus combined in the fluid, often known as hemolymph. The possession of a blood supply and coelom, however, does not exclude the circulation of environmental water through the body. Members of the phylum Echinodermata (starfishes and sea urchins, for example) have a complex water vascular system used mainly for locomotion. An internal circulatory system transports essential gases and nutrients around the body of an organism, removes unwanted products of metabolism from the tissues, and carries these products to specialized excretory organs, if present. Although a few invertebrate animals circulate external water through their bodies for respiration, and, in the case of cnidarians, nutrition, most species circulate an internal fluid, called blood. There may also be external circulation that sets up currents in the environmental fluid to carry it over respiratory surfaces and, especially in the case of sedentary animals, to carry particulate food that is strained out and passed to the alimentary canal. Additionally, the circulatory system may assist the organism in movement; for example, protoplasmic streaming in amoeboid protozoans circulates nutrients and provides pseudopodal locomotion. The hydrostatic pressure built up in the circulatory systems of many invertebrates is used for a range of whole-body and individual-organ movement. Question: On average, how many times does the human heart beat each minute? Answer: The heart muscle beats an average of 70 times per minute. More than 1 gallon (3.8 liters) of blood pass through the heart every minute. Question: What are the chambers of the heart called? Answer: The chambers of the heart are called atria and ventricles. There are two of each. Question: What is the main organ of the cardiovascular system? Answer: The heart is the main organ of the cardiovascular system, which supplies blood to the body. Question: For what organ is dialysis used? Answer: When the kidney fails in its work of filtering impurities in the bloodstream, artificial filtering called dialysis is often used. Question: What percentage of our body energy is used to power the brain? Answer: The brain uses some 20 percent of all caloric energy. This is about twice the amount required by chimpanzees and other nonhuman primates. Question: What is another word for the alimentary canal? Answer: The alimentary canal and the digestive tract describe the organs through which food passes in the human body. Question: What is the part of the eye where the image must be focused? Answer: The eye contains a lens that bends light rays so that they meet, focusing on a part of the eye known as the retina. Question: If you lined up all the neurons in the brain end to end, they would stretch: Answer: The brain's 100,000,000,000 neurons would stretch approximately 621 miles (1,000 kilometers). They would be too narrow to see without a microscope, however! Question: Which of these are found in the eyes? Answer: Cones are photoreceptor cells in the retinas of vertebrates. They are essential for distinguishing colors.

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