CARDIOVASCULAR FUNCTION pdf

1: Functions of the Cardiovascular System

The cardiovascular system consists of the heart, blood vessels, and blood. This system has three main functions: Transport of nutrients, oxygen, and hormones to cells throughout the body and removal of metabolic wastes (carbon dioxide, nitrogenous wastes).

Circulatory Loops There are 2 primary circulatory loops in the human body: Pulmonary circulation transports deoxygenated blood from the right side of the heart to the lungs , where the blood picks up oxygen and returns to the left side of the heart. The pumping chambers of the heart that support the pulmonary circulation loop are the right atrium and right ventricle. Systemic circulation carries highly oxygenated blood from the left side of the heart to all of the tissues of the body with the exception of the heart and lungs. Systemic circulation removes wastes from body tissues and returns deoxygenated blood to the right side of the heart. The left atrium and left ventricle of the heart are the pumping chambers for the systemic circulation loop. The size of blood vessels corresponds with the amount of blood that passes through the vessel. All blood vessels contain a hollow area called the lumen through which blood is able to flow. Around the lumen is the wall of the vessel, which may be thin in the case of capillaries or very thick in the case of arteries. All blood vessels are lined with a thin layer of simple squamous epithelium known as the endothelium that keeps blood cells inside of the blood vessels and prevents clots from forming. The endothelium lines the entire circulatory system, all the way to the interior of the heart, where it is called the endocardium. There are three major types of blood vessels: Blood vessels are often named after either the region of the body through which they carry blood or for nearby structures. For example, the brachiocephalic artery carries blood into the brachial arm and cephalic head regions. One of its branches, the subclavian artery, runs under the clavicle; hence the name subclavian. The subclavian artery runs into the axillary region where it becomes known as the axillary artery. Arteries and Arterioles Arteries are blood vessels that carry blood away from the heart. The pulmonary trunk and arteries of the pulmonary circulation loop provide an exception to this rule â€” these arteries carry deoxygenated blood from the heart to the lungs to be oxygenated. Arteries face high levels of blood pressure as they carry blood being pushed from the heart under great force. To withstand this pressure, the walls of the arteries are thicker, more elastic, and more muscular than those of other vessels. The largest arteries of the body contain a high percentage of elastic tissue that allows them to stretch and accommodate the pressure of the heart. Smaller arteries are more muscular in the structure of their walls. The smooth muscles of the arterial walls of these smaller arteries contract or expand to regulate the flow of blood through their lumen. In this way, the body controls how much blood flows to different parts of the body under varying circumstances. The regulation of blood flow also affects blood pressure, as smaller arteries give blood less area to flow through and therefore increases the pressure of the blood on arterial walls. Arterioles are narrower arteries that branch off from the ends of arteries and carry blood to capillaries. They face much lower blood pressures than arteries due to their greater number, decreased blood volume, and distance from the direct pressure of the heart. Thus arteriole walls are much thinner than those of arteries. Arterioles, like arteries, are able to use smooth muscle to control their aperture and regulate blood flow and blood pressure. Capillaries Capillaries are the smallest and thinnest of the blood vessels in the body and also the most common. Capillaries connect to arterioles on one end and venules on the other. Capillaries carry blood very close to the cells of the tissues of the body in order to exchange gases, nutrients, and waste products. The walls of capillaries consist of only a thin layer of endothelium so that there is the minimum amount of structure possible between the blood and the tissues. The endothelium acts as a filter to keep blood cells inside of the vessels while allowing liquids, dissolved gases, and other chemicals to diffuse along their concentration gradients into or out of tissues. Precapillary sphincters are bands of smooth muscle found at the arteriole ends of capillaries. These sphincters regulate blood flow into the capillaries. Since there is a limited supply of blood, and not all tissues have the same energy and oxygen requirements, the precapillary sphincters reduce blood flow to inactive tissues and allow free flow into active tissues. Veins and Venules Veins are the large return vessels of the body and act as the blood return counterparts of arteries. This lack of pressure allows the walls of veins to be much thinner, less elastic, and less muscular than the walls of arteries. Veins rely on gravity, inertia, and the force of skeletal muscle contractions to help push blood back to the heart. To facilitate the movement of blood, some veins contain many one-way valves that prevent blood from flowing away from the heart. As skeletal muscles in the body contract, they squeeze nearby veins and push blood through valves closer to the heart. When the muscle relaxes, the valve traps the blood until another contraction pushes the blood closer to the heart. Venules are similar to arterioles as they are small vessels that connect capillaries, but unlike arterioles, venules connect to veins instead of arteries. Venules pick up blood from many capillaries and deposit it into larger veins for transport back to the heart. Coronary Circulation The heart has its own set of blood vessels that provide the myocardium with the oxygen and nutrients necessary to pump blood throughout the body. The left and right coronary arteries branch off from the aorta and provide blood to the left and right sides of the heart. The coronary sinus is a vein on the posterior side of the heart that returns deoxygenated blood from the myocardium to the vena cava. Hepatic Portal Circulation The veins of the stomach and intestines perform a unique function: Blood leaving the digestive organs is rich in nutrients and other chemicals absorbed from food. The liver removes toxins, stores sugars, and processes the products of digestion before they reach the other body tissues. Blood from the liver then returns to the heart through the inferior vena cava. Blood The average human body contains about 4 to 5 liters of blood. As a liquid connective tissue, it transports many substances through the body and helps to maintain homeostasis of nutrients, wastes, and gases. Blood is made up of red blood cells, white blood cells, platelets, and liquid plasma. Erythrocytes are produced inside of red bone marrow from stem cells at the astonishing rate of about 2 million cells every second. The shape of erythrocytes is biconcaveâ€”disks with a concave curve on both sides of the disk so that the center of an erythrocyte is its thinnest part. The unique shape of erythrocytes gives these cells a high surface area to volume ratio and allows them to fold to fit into thin capillaries. Immature erythrocytes have a nucleus that is ejected from the cell when it reaches maturity to provide it with its unique shape and flexibility. The lack of a nucleus means that red blood cells contain no DNA and are not able to repair themselves once damaged. Erythrocytes transport oxygen in the blood through the red pigment hemoglobin. Hemoglobin contains iron and proteins joined to greatly increase the oxygen carrying capacity of erythrocytes. The high surface area to volume ratio of erythrocytes allows oxygen to be easily transferred into the cell in the lungs and out of the cell in the capillaries of the systemic tissues. There are two major classes of white blood cells: The three types of granular leukocytes are neutrophils, eosinophils, and basophils. Each type of granular leukocyte is classified by the presence of chemical-filled vesicles in their cytoplasm that give them their function. Neutrophils contain digestive enzymes that neutralize bacteria that invade the body. Eosinophils contain digestive enzymes specialized for digesting viruses that have been bound to by antibodies in the blood. Basophils release histamine to intensify allergic reactions and help protect the body from parasites. The two major classes of agranular leukocytes are lymphocytes and monocytes. Lymphocytes include T cells and natural killer cells that fight off viral infections and B cells that produce antibodies against infections by pathogens. Monocytes develop into cells called macrophages that engulf and ingest pathogens and the dead cells from wounds or infections. Platelets Also known as thrombocytes, platelets are small cell fragments responsible for the clotting of blood and the formation of scabs. Platelets form in the red bone marrow from large megakaryocyte cells that periodically rupture and release thousands of pieces of membrane that become the platelets. Platelets do not contain a nucleus and only survive in the body for up to a week before macrophages capture and digest them. Plasma is a mixture of water, proteins, and dissolved substances. The proteins within plasma include antibodies and albumins. Antibodies are part of the immune system and bind to antigens on the surface of pathogens that infect the body. Many different substances can be found dissolved in the plasma, including glucose, oxygen, carbon dioxide, electrolytes, nutrients, and cellular waste products. The plasma functions as a transportation medium for these substances as they move throughout the body. Cardiovascular System Physiology Functions of the Cardiovascular System The cardiovascular system has three major functions: The blood delivers essential nutrients and oxygen and removes wastes and carbon dioxide to be processed or removed from the body. The cardiovascular system protects the body through its white blood cells. White blood cells clean up cellular debris and fight pathogens that have entered the body. Platelets and red blood cells form scabs to seal wounds and prevent pathogens from entering the body and liquids from leaking out. Blood also carries antibodies that provide specific immunity to pathogens that the body has previously been exposed to or has been vaccinated against. Blood vessels help maintain a stable body temperature by controlling the blood flow to the surface of the skin. Many serious conditions and diseases can cause our cardiovascular system to stop working properly. Browse our content to learn more about cardiovascular health. Also, explore how DNA health testing can allow you to begin important conversations with your doctor about genetic risks for disorders involving clotting, hemophilia, hemochromatosis a common hereditary disorder causing iron to accumulate in the heart and glucosephosphate dehydrogenase which affects about 1 in 10 African American men. The left and right sides of the heart are separated by a muscular wall of tissue known as the septum of the heart. The right side of the heart receives deoxygenated blood from the systemic veins and pumps it to the lungs for oxygenation. The left side of the heart receives oxygenated blood from the lungs and pumps it through the systemic arteries to the tissues of the body. Each heartbeat results in the simultaneous pumping of both sides of the heart, making the heart a very efficient pump. Regulation of Blood Pressure Several functions of the cardiovascular system can control blood pressure. Certain hormones along with autonomic nerve signals from the brain affect the rate and strength of heart contractions. Greater contractile force and heart rate lead to an increase in blood pressure. Blood vessels can also affect blood pressure. Vasoconstriction decreases the diameter of an artery by contracting the smooth muscle in the arterial wall.

CARDIOVASCULAR FUNCTION pdf

2: Major Functions of the Cardiovascular System â€” PT Direct

The cardiovascular system, also known as the circulatory system, includes the heart, arteries, veins, capillaries and blood. The heart functions as the pump that moves blood through the body. The arterial circulation delivers blood from the heart to the body, and the venous circulation carries it back to the heart.

Home Illnesses and conditions Heart and blood vessels About the heart Understanding how your heart functions Understanding how your heart functions Your heart is roughly the size of a fist and sits in the middle of your chest, slightly to the left. This blood sends oxygen and nutrients to all parts of your body, and carries away unwanted carbon dioxide and waste products. Structure of your heart Your heart is made up of three layers of tissue: There are four chambers that make up the heart â€” two on the left side and two on the right. The two small upper chambers are the atria. The two larger lower chambers are the ventricles. These left and right sides of the heart are separated by a wall of muscle called the septum. Circulatory system Your heart pumps blood around the body all the time - about five litres eight pints of it - and this is called circulation. Your heart, blood and blood vessels together make up your cardiovascular system or heart and circulatory system. The right side of the heart receives blood that is low in oxygen because most has been used up by the brain and body. It pumps this to your lungs, where it picks up a fresh supply of oxygen. The blood then returns to the left side of the heart, ready to be pumped back out to the brain and the rest of your body. Blood vessels Your blood is pumped around your body through a network of blood vessels: This action is partly controlled by hormones. Valves Your heart has four valves. They act like gates, keeping the blood moving in the right direction: This signal crosses the atria, making them contract. Blood is pumped through the valves into the ventricles. Where the atria meet the ventricles, there is an area of special cells - called the atrio-ventricular node - which pass the electrical signals throughout your heart muscle by a system of electrical pathways, known as the conducting system. The muscles of the ventricles then contract, and blood is pumped through the pulmonary and aortic valves into the main arteries. Blood pressure This is the measurement of the pressure within the arteries. It plays a vital role in the way your heart delivers fresh blood to all your blood vessels. For blood to travel throughout your body quickly enough, it has to be under pressure. This is created by the relationship between three things: At rest, the normal heart beats approximately 60 to times every minute, and it increases when you exercise. To ensure an adequate blood supply around your body, the four chambers of your heart have to pump regularly and in the right sequence. What can go wrong? Structure Some people are born with a heart that has not developed properly in the womb before birth - this is called congenital heart disease.

3: The Cardiovascular System (Heart and blood) | Medical Terminology for Cancer

The cardiovascular system has three major functions: transportation of materials, protection from pathogens, and regulation of the body's homeostasis. Transportation: The cardiovascular system transports blood to almost all of the body's tissues.

Red blood cells are responsible for transporting oxygen around the body to the tissues and organs that need it. As oxygen enters the blood stream through the alveoli of the lungs it binds to a special protein in the red blood cells called haemoglobin. This can be seen in the adjacent image. The job of white blood cells is to detect foreign bodies or infections and envelop and kill them, as seen in the below image. When they detect and kill an infection they create antibodies for that particular infection which enables the immune system to act more quickly against foreign bodies or infections it has come into contact with previously. Platelets are cells which are responsible for clotting the blood, they stick to foreign particles or objects such as the edges of a cut. Platelets connect to fibrinogen a protein which is released in the site of the cut producing a clump that blocks the hole in the broken blood vessel. On an external wound this would become a scab. If the body has a low level of platelets then clotting may not occur and bleeding can continue. Excessive blood loss can be fatal â€” this is why people with a condition known as haemophilia low levels or absence of platelets need medication otherwise even minor cuts can become fatal as bleeding continues without a scab being formed. Alternatively, if platelet levels are excessively high then clotting within blood vessels can occur, leading to a stroke and or heart attack. This is why people with a history of cardiac problems are often prescribed medication to keep their blood thin to minimise the risk of clotting within their blood vessels. Maintenance of constant body temperature thermoregulation The core temperature range for a healthy adult is considered to be between If the core temperature drops below this range it is known as hypothermia and if it rises above this range it is known as hyperthermia. As temperatures move further into hypo or hyperthermia they become life threatening. Because of this the body works continuously to maintain its core temperature within the healthy range. This process of temperature regulation in known as thermoregulation and the cardiovascular system plays an integral part. Temperature changes within the body are detected by sensory receptors called thermoreceptors, which in turn relay information about these changes to the hypothalamus in the brain. When a deviation in temperature is recorded the hypothalamus reacts by initiating certain mechanisms in order to regain a safe temperature range. There are four sites where these adjustments in temperature can occur, they are: These glands are instructed to secrete sweat onto the surface of the skin when either the blood or skin temperature is detected to be above a normal safe temperature. This allows heat to be lost through evaporation and cools the skin so blood that has been sent to the skin can in turn be cooled. Smooth muscle around arterioles: Increases in temperature result in the smooth muscle in the walls of arterioles being stimulated to relax causing vasodilation increase in diameter of the vessel. This in turn increases the volume of blood flow to the skin, allowing cooling to occur. We see this is in the adjacent diagram where blood that is normally concentrated around the core organs is shunted to the skin to cool when the body is under heat stress. If however the thermoreceptors detect a cooling of the blood or skin then the hypothalamus reacts by sending a message to the smooth muscle of the arteriole walls causing the arterioles to vasoconstrict reduce their diameter , thus reducing the blood flow to the skin and therefore helping to maintain core body temperature. When a drop in blood temperature is recorded the hypothalamus can also react by causing skeletal muscles to start shivering. Shivering is actually lots of very fast, small muscular contractions which produce heat to help warm the blood d. The hypothalamus may trigger the release of hormones such as thyroxin, adrenalin and noradrenalin in response to drops in blood temperature. These hormones all contribute to increasing the bodies metabolic rate rate at which the body burns fuel and therefore increasing the production of heat. When the fluid levels in the body do not balance a state of dehydration or hyperhydration can occur, both of which impede normal body function and if left unchecked can become dangerous or even fatal. Dehydration is the excessive loss of body fluid, usually accompanied by an excessive loss of electrolytes. The symptoms of dehydration include; headaches, cramps, dizziness, fainting and raised blood pressure blood becomes thicker as its volume decreases requiring more force to pump it around the body. Hyperhydration on the other hand results from an excessive intake of water which pushes the normal balance of electrolytes outside of their safe limits. This can occur through long bouts of intensive exercise where electrolytes are not replenished and excessive amounts of water are consumed. If this swelling occurs in the brain it can put excessive pressure on the brain stem that may result in seizures, brain damage, coma or even death. Where as hyperhydration or a gain in body fluid intake of water usually results in a reduction of blood tonicity and an increase in blood volume. Any change in blood tonicity and volume is detected by the kidneys and osmoreceptors in the hypothalamus. Osmoreceptors are specialist receptors that detect changes in the dilution of the blood. Essentially they detect if we are hydrated diluted blood or dehydrated less diluted blood. In response hormones are released and transported by the cardiovascular system through the blood to act on target tissues such as the kidneys to increase or decrease urine production. Another way the cardiovascular system maintains fluid balance is by either dilating widening or constricting tightening blood vessels to increase or decrease the amount of fluid that can be lost through sweat.

CARDIOVASCULAR FUNCTION pdf

4: Cardiovascular System - Human Veins, Arteries, Heart

The circulatory system is a vast network of organs and vessels that is responsible for the flow of blood, nutrients, hormones, oxygen and other gases to and from cells. Without the circulatory.

Blood circulates through a network of vessels throughout the body to provide individual cells with oxygen and nutrients and helps dispose of metabolic wastes. The heart pumps the blood around the blood vessels. Functions of blood and circulation: Removes the waste products of metabolism to the excretory organs for disposal. Protects the body against disease and infection. Clotting stops bleeding after injury. Helps regulate body temperature. The plasma is largely water, containing proteins, nutrients, hormones, antibodies, and dissolved waste products. General types of blood cells: The haemoglobin then returns carbon dioxide waste to the lungs. Erythrocytes are formed in the bone marrow in the knobby ends of bones. When a tissue is damaged or has an infection the number of leukocytes increases. Leukocytes are formed in the small ends of bones. Leukocytes can be classed as granular or non granular. There are three types of granular leukocytes eosinophils, neutrophils, and basophils , and three types of non-granular monocytes, T-cell lymphocytes, and B-cell lymphocytes. See also the lymphatic system. When the body is injured thrombocytes disintegrate and cause a chemical reaction with the proteins found in plasma, which eventually create a thread like substance called FIBRIN. The fibrin then "catches" other blood cells which form the clot, preventing further loss of blood and forms the basis of healing. Simplified diagram of the circulatory system. Arterioles feed oxygenated blood to the capillaries. The AORTA is the largest artery in the body, taking blood from the heart, branching into other arteries that send oxygenated blood to the rest of the body. They are extremely thin, the walls are only one cell thick and connect the arterioles with the venules very small veins. The vein walls are similar to arteries but thinner and less elastic. Veins carry deoxygenated blood towards the lungs where oxygen is received via the pulmonary capillaries. The right side of the heart receives blood and sends it to the lungs to be oxygenated, while the left side receives oxygenated blood from the lungs and sends it out to the tissues of the body. In a normal heart beat the atria contract while the ventricles relax, then the ventricles contract while the atria relax. There are VALVES through which blood passes between ventricle and atrium, these close in such a way that blood does not backwash during the pauses between ventricular contractions. The walls of the left ventricle are thicker as it has to pump blood to all the tissues, compared to the right ventricle which only pumps blood as far as the lungs. It is a non-vital organ and it is possible to survive after removal of the spleen. Perinicious anaemia is a Vitamin B12 deficiency resulting in a reduction in number of erythrocytes. Aplastic anemia is a failure of the bone marrow to produce the enough red blood cells. Septicaemia - bacterial toxins in blood. Here are some examples related to the Integumentary System. For more details see Chapter 4: Understanding the Components of Medical Terminology component.

CARDIOVASCULAR FUNCTION pdf

5: Cardiovascular physiology - Wikipedia

The four major functions of the cardiovascular system are: 1. To transport nutrients, gases and waste products around the body 2. To protect the body from infection and blood loss.

Go to the U of M home page Cardiac output in a normal individual at rest ranges between 4 to 6 liters per minute, but during severe exercise the heart may be required to pump three to four times this amount. There are two primary modes by which the blood volume pumped by the heart, at any given moment, is regulated: The intrinsic ability of the heart to adapt to changing volumes of inflowing blood is known as the Frank-Starling mechanism law of the heart. In general, this response can simply be described as: In other words, within its physiological limits, the heart will pump out all the blood that enters it without allowing excessive damming of blood in veins. The underlying basis for this phenomenon is related to the optimization of the lengths of sarcomeres and the functional subunits of striate muscle; there is optimization in the potential for the contractile proteins actin and myosin to form crossbridges. It should also be noted that "stretch" of the right atrial wall e. The pumping effectiveness of the heart is also effectively controlled by the autonomic nervous system by both the sympathetic and parasympathetic components of this system. There is extensive innervation of the myocardium by such. Cardiovascular function is also modulated through reflex mechanisms that involve baroreceptors, the chemical composition of the blood, and via the release of various hormones. More specifically, baroreceptors, which are located in the walls of some arteries and veins, exist to monitor the relative blood pressure. Those specifically located in the carotid sinus help to reflexively maintain normal blood pressure in the brain, whereas those located in the area of the ascending arch of the aorta help to govern general systemic blood pressure for more details, see the chapter on the Autonomic Nervous System. Chemoreceptors that monitor the chemical composition of blood are located close to the baroreceptors of the carotid sinus and arch of the aorta, in small structures known as the carotid and aortic bodies. In response to this increased signaling, the central nervous system control centers, the hypothalamus, in turn, cause an increased sympathetic stimulation to arterioles and veins, producing vasoconstriction and a subsequent increase in blood pressure. In addition, the chemoreceptors simultaneously send neural input to the respiratory control centers in the brain, so to induce the appropriate control of respiratory function e. The role of the heart needs be considered in three different ways: As described above, the pulmonary right heart and system left heart circulations are arranged in a series. Thus, cardiac output increases in each at the same rate; hence an increased systemic need for a greater cardiac output will automatically lead to a greater flow of blood through the lungs a greater potential for O2 delivery. In contrast, the systemic organs are functionally arranged in a parallel arrangement; hence: For example, during exercise, the circulatory response is an increase in blood flow through some organs e. The brain, heart and skeletal muscles typify organs in which blood flows solely to supply the metabolic needs of the tissue; they do not recondition the blood. The blood flow to the heart and brain is normally only slightly greater than that required for their metabolism; hence small interruptions in flow are not well tolerated. Likewise, stoppage of flow to the brain will lead to unconsciousness within a few seconds and permanent brain damage can occur in as little as four minutes without flow. Many organs in the body perform the task of continually reconditioning the circulating blood. Primary organs performing such tasks include: Blood conditioning organs can often withstand, for short periods of time, significant reductions of blood flow without subsequent compromise. Provided is a functional representation of the blood circulatory system. The percentages indicate the approximate relative percentages of the cardiac output that is delivered, at a given moment in time, to the major organ systems within the body. The University of Minnesota is an equal opportunity educator and employer.

6: Circulatory system - Wikipedia

Cardiovascular function is also modulated through reflex mechanisms that involve baroreceptors, the chemical composition of the blood, and via the release of various hormones. More specifically, baroreceptors, which are located in the walls of some arteries and veins, exist to monitor the relative blood pressure.

March Other animals While humans, as well as other vertebrates , have a closed cardiovascular system meaning that the blood never leaves the network of arteries , veins and capillaries , some invertebrate groups have an open cardiovascular system. The lymphatic system, on the other hand, is an open system providing an accessory route for excess interstitial fluid to be returned to the blood. The blood vascular system first appeared probably in an ancestor of the triploblasts over million years ago, overcoming the time-distance constraints of diffusion, while endothelium evolved in an ancestral vertebrate some â€" million years ago. Hemolymph The open circulatory system of the grasshopper â€" made up of a heart, vessels and hemolymph. The hemolymph is pumped through the heart, into the aorta, dispersed into the head and throughout the hemocoel, then back through the ostia in the heart and the process repeated. In arthropods , the open circulatory system is a system in which a fluid in a cavity called the hemocoel bathes the organs directly with oxygen and nutrients and there is no distinction between blood and interstitial fluid ; this combined fluid is called hemolymph or haemolymph. When the heart relaxes, blood is drawn back toward the heart through open-ended pores ostia. Hemolymph fills all of the interior hemocoel of the body and surrounds all cells. Hemolymph is composed of water , inorganic salts mostly sodium , chlorine , potassium , magnesium , and calcium , and organic compounds mostly carbohydrates , proteins , and lipids. The primary oxygen transporter molecule is hemocyanin. There are free-floating cells, the hemocytes , within the hemolymph. They play a role in the arthropod immune system. Flatworms, such as this Pseudoceros bifurcus , lack specialized circulatory organs Closed circulatory system Two-chambered heart of a fish The circulatory systems of all vertebrates , as well as of annelids for example, earthworms and cephalopods squids , octopuses and relatives are closed, just as in humans. Still, the systems of fish , amphibians , reptiles , and birds show various stages of the evolution of the circulatory system. This is known as single cycle circulation. The heart of fish is, therefore, only a single pump consisting of two chambers. In amphibians and most reptiles, a double circulatory system is used, but the heart is not always completely separated into two pumps. Amphibians have a three-chambered heart. In reptiles, the ventricular septum of the heart is incomplete and the pulmonary artery is equipped with a sphincter muscle. This allows a second possible route of blood flow. Instead of blood flowing through the pulmonary artery to the lungs, the sphincter may be contracted to divert this blood flow through the incomplete ventricular septum into the left ventricle and out through the aorta. This means the blood flows from the capillaries to the heart and back to the capillaries instead of to the lungs. This process is useful to ectothermic cold-blooded animals in the regulation of their body temperature. Birds, mammals, and crocodilians show complete separation of the heart into two pumps, for a total of four heart chambers; it is thought that the four-chambered heart of birds and crocodilians evolved independently from that of mammals. Their body cavity has no lining or enclosed fluid. Instead a muscular pharynx leads to an extensively branched digestive system that facilitates direct diffusion of nutrients to all cells. Oxygen can diffuse from the surrounding water into the cells, and carbon dioxide can diffuse out. Consequently, every cell is able to obtain nutrients, water and oxygen without the need of a transport system. Some animals, such as jellyfish , have more extensive branching from their gastrovascular cavity which functions as both a place of digestion and a form of circulation , this branching allows for bodily fluids to reach the outer layers, since the digestion begins in the inner layers. History Human anatomical chart of blood vessels, with heart, lungs, liver and kidneys included. Other organs are numbered and arranged around it. Before cutting out the figures on this page, Vesalius suggests that readers glue the page onto parchment and gives instructions on how to assemble the pieces and paste the multilayered figure onto a base "muscle man" illustration. The earliest known writings on the circulatory system are found in the Ebers Papyrus 16th century BCE , an ancient Egyptian medical papyrus containing over prescriptions and remedies, both physical and spiritual. In the papyrus , it acknowledges the connection of the heart to the arteries. The Egyptians thought air came in through the mouth and into the lungs and heart. From the heart, the air travelled to every member through the arteries. Although this concept of the circulatory system is only partially correct, it represents one of the earliest accounts of scientific thought. In the 6th century BCE, the knowledge of circulation of vital fluids through the body was known to the Ayurvedic physician Sushruta in ancient India. However their function was not properly understood then. Because blood pools in the veins after death, arteries look empty. Ancient anatomists assumed they were filled with air and that they were for transport of air. The Greek physician , Herophilus , distinguished veins from arteries but thought that the pulse was a property of arteries themselves. Greek anatomist Erasistratus observed that arteries that were cut during life bleed. He ascribed the fact to the phenomenon that air escaping from an artery is replaced with blood that entered by very small vessels between veins and arteries. Thus he apparently postulated capillaries but with reversed flow of blood. Growth and energy were derived from venous blood created in the liver from chyle, while arterial blood gave vitality by containing pneuma air and originated in the heart. Blood flowed from both creating organs to all parts of the body where it was consumed and there was no return of blood to the heart or liver. In , The Canon of Medicine by the Persian physician , Avicenna , "erroneously accepted the Greek notion regarding the existence of a hole in the ventricular septum by which the blood traveled between the ventricles. The thick septum of the heart is not perforated and does not have visible pores as some people thought or invisible pores as Galen thought. The blood from the right chamber must flow through the vena arteriosa pulmonary artery to the lungs, spread through its substances, be mingled there with air, pass through the arteria venosa pulmonary vein to reach the left chamber of the heart and there form the vital spirit He stated that "there must be small communications or pores manafidh in Arabic between the pulmonary artery and vein," a prediction that preceded the discovery of the capillary system by more than years. Michael Servetus was the first European to describe the function of pulmonary circulation, although his achievement was not widely recognized at the time, for a few reasons. He firstly described it in the "Manuscript of Paris" [24] [25] near , but this work was never published. And later he published this description, but in a theological treatise, Christianismi Restitutio, not in a book on medicine. Only three copies of the book survived but these remained hidden for decades, the rest were burned shortly after its publication in because of persecution of Servetus by religious authorities. Most importantly, he argued that the beat of the heart produced a continuous circulation of blood through minute connections at the extremities of the body. However, Harvey was not able to identify the capillary system connecting arteries and veins; these were later discovered by Marcello Malpighi in Richards were awarded the Nobel Prize in Medicine "for their discoveries concerning heart catheterization and pathological changes in the circulatory system.

7: Autonomic Regulation of Cardiovascular Function - Neuroscience - NCBI Bookshelf

The main function of the cardiovascular system is to transport nutrients, waste products and gases around the body. Moreover, it protects the body from blood loss and infection, helps the body keep a constant body temperature and helps maintain fluid balance.

Functions of the Cardiovascular System Bodytomy Staff Sep 30, Cardiovascular system is one of the important organ systems of the human body that performs several vital functions like the transportation of blood and oxygen and the regulation of body temperature. The heart is one of the most vital components of the human cardiovascular system, which is a complex organ system that performs the vital function of distributing blood throughout the body. Blood is transported to various parts of the body through a network of arteries, veins and capillaries. The components of this body system works in tandem to facilitate the task of distribution of blood and vital nutrients throughout the body. Functions of the Cardiovascular System: The functions that are performed by this organ system can be categorized into three main domains: The heart and blood vessels carry out these functions in coordination with the other systems for the proper functioning of the body. Transportation The components of the cardiovascular system work collectively so as to transport oxygen from the lungs to the various cells of the body. Oxygen and nutrients that are assimilated in the blood after the process of digestion are circulated via blood to various parts of the body. The removal of carbon dioxide which is produced by the cells and transportation of hormones from various endocrine glands are also performed by this organ system. This function of transport is mainly carried out by blood and the network of blood vessels. Protection White blood cells that are present in the blood protect the body from infection and diseases. Proteins and antibodies required for destroying viruses, bacteria and disease-causing germs are also provided by blood to the various parts of the body. Another important function is to protect the body from excessive blood loss through the process of blood clotting during an injury. Regulation Another important function is the regulation of the concentration of hydrogen ions pH in the body, and the regulation of the body temperature and body heat. It also regulates the salt and water content of the cells in the body. Components of the Cardiovascular System The Heart The human heart is the key organ of the cardiovascular system. The heart has four chambers, and is approximately the size of a clenched fist. The upper chambers of the heart are called right atrium and the left atrium. The lower chambers are known as the right ventricle and the left ventricle. Mitral valve and the tricuspid valve are atrioventricular valves that are situated between the atria and the ventricles. While the mitral valve is located between the left atrium and the left ventricle, the tricuspid valve is located between the right atrium and the right ventricle. These valves open and close as the heart contracts and relaxes. Pulmonary valve and aortic valve are semilunar valves that are located at the base of the pulmonary artery and the aorta respectively. Deoxygenated blood from the body enters the right atrium. When the atrium contracts, blood passes to right ventricle through the tricuspid valve. Pulmonary valve contracts with the contraction of the right ventricle. Blood passes from the pulmonary artery to the lungs. While the right atrium and right ventricle get the deoxygenated blood from the veins and pump it into the lungs, the left atrium and left ventricle receive the oxygenated blood from the lungs and pumps this blood to the various parts of the body. The contraction of the left atrium is followed by the opening of the mitral valve. Blood enters the left ventricle. As the left ventricle contracts, the aortic valve opens. Blood enters the aorta, and this oxygen-rich blood is circulated to the body. Blood Blood is a specialized body fluid that is constantly being circulated around the body with the help of heart and the blood vessels. While the lungs enrich the deoxygenated blood with oxygen, the heart pumps oxygenated blood to various parts of the body. Blood contains plasma, white blood cells, red blood cells and platelets. While white blood cells help in protecting the body from disease-causing agents, red blood cells help carry oxygen to the tissues. Platelets play a vital role in coagulation of blood. Blood helps transport oxygen and nutrients to the tissues and organs of the body. The process of disposal of metabolic wastes to the excretory organs is also carried out with the help of blood. Blood vessels are categorized into arteries, capillaries and veins. Arteries are blood vessels that carry blood from the heart to other parts of the body. Aorta and the coronary arteries are systemic arteries. Aorta is the large trunk artery that carries oxygenated blood from the left ventricle, coronary arteries supply blood to the heart. Pulmonary artery carries deoxygenated blood from the heart to the lungs. Arterioles are arteries from which blood from the heart is carried to the veins. Capillaries are small blood vessels that connect the arterioles to the small veins called venules. These small veins branch into a network of larger veins that carry blood to vena cava, which is the largest vein in the human body. Deoxygenated blood from the upper half and the lower half of the body is carried to the right atrium by superior vena cava and inferior vena cava respectively. The blood is then pumped into the lungs for oxygen absorption. The oxygenated blood is then pumped into the left side of the heart and from here the arteries carry it to the other parts of the body. The capillaries distribute oxygen and nutrients supplied to them by the arteries and remove waste products from the blood stream. All the organs of the cardiovascular system must work in tandem to provide the tissues and organs of the body with oxygen and nutrients. To keep them healthy, it is essential to eat right, exercise and follow a healthy lifestyle.

CARDIOVASCULAR FUNCTION pdf

8: Heart and Circulatory System

The heart is a muscular organ about the size of a fist, located just behind and slightly left of the breastbone. The heart pumps blood through the network of arteries and veins called the.

Sinauer Associates ; Search term Autonomic Regulation of Cardiovascular Function The cardiovascular system is subject to precise reflex regulation so that an appropriate supply of oxygenated blood can be reliably provided to different body tissues under a wide range of circumstances. The sensory monitoring for this critical homeostatic process entails primarily mechanical barosensory information about pressure in the arterial system and, secondarily, chemical chemosensory information about the level of oxygen and carbon dioxide in the blood. The parasympathetic and sympathetic activity relevant to cardiovascular control is determined by the information supplied by these sensors. The mechanoreceptors called baroreceptors are located in the heart and major blood vessels; the chemoreceptors are located primarily in the carotid bodies , which are small, highly specialized organs located at the bifurcation of the common carotid arteries some chemosensory tissue is also found in the aorta. The nerve endings in baroreceptors are activated by deformation as the elastic elements of the vessel walls expand and contract. The chemoreceptors in the carotid bodies and aorta respond directly to the partial pressure of oxygen and carbon dioxide in the blood. Both afferent systems convey their status via the vagus nerve to the nucleus of the solitary tract Figure The afferent information from changes in arterial pressure and blood gas levels reflexively modulates the activity of the relevant visceral motor pathways and, ultimately, of target smooth and cardiac muscles and other more specialized structures. For example, a rise in blood pressure activates baroreceptors that, via the pathway illustrated in Figure In parallel, the pressure increase stimulates the activity of the parasympathetic preganglionic neurons in the dorsal motor nucleus of the vagus and the nucleus ambiguus that influence heart rate. The carotid chemoreceptors also have some influence, but this is a less important drive than that stemming from the baroreceptors. As a result of this shift in the balance of sympathetic and parasympathetic activity, the stimulatory noradrenergic effects of postganglionic sympathetic innervation on the cardiac pacemaker and cardiac musculature is reduced an effect abetted by the decreased output of catecholamines from the adrenal medulla and the decreased vasoconstrictive effects of sympathetic innervation on the peripheral blood vessels. At the same time, activation of the cholinergic parasympathetic innervation of the heart decreases the discharge rate of the cardiac pacemaker in the sinoatrial node and slows the ventricular conduction system. These parasympathetic influences are mediated by an extensive series of parasympathetic ganglia in and near the heart, which release acetylcholine onto cardiac pacemaker cells and cardiac muscle fibers. As a result of this combination of sympathetic and parasympathetic effects, heart rate and the effectiveness of the atrial and ventricular mycoardial contraction are reduced and the peripheral arterioles dilate, thus lowering the blood pressure. In contrast to this sequence of events, a drop in blood pressure, as might occur from blood loss, has the opposite effect, inhibiting parasympathetic activity while increasing sympathetic activity. As a result, norepinephrine is released from sympathetic postganglionic terminals, increasing the rate of cardiac pacemaker activity and enhancing cardiac contractility, at the same time increasing release of catecholamines from the adrenal medulla which further augments these and many other sympathetic effects that enhance the response to this threatening situation. Norepinephrine released from the terminals of sympathetic ganglion cells also acts on the smooth muscles of the arterioles to increase the tone of the peripheral vessels, particularly those in the skin, subcutaneous tissues, and muscles, thus shunting blood away from these tissues to those organs where oxygen and metabolites are urgently needed to maintain function e. If these reflex sympathetic responses fail to raise the blood pressure sufficiently in which case the patient is said to be in shock , the vital functions of these organs begin to fail, often catastrophically. A more mundane circumstance that requires a reflex autonomic response to a fall in blood pressure is standing up. The adjustment to this normally occurring drop in blood pressure called orthostatic hypotension must be rapid and effective, as evidenced by the dizziness sometimes experienced in this situation. The sympathetic innervation of the heart arises from the preganglionic neurons in the intermediolateral column of the spinal cord , extending from roughly the first through fifth thoracic segments see Table The primary visceral motor neurons are in the adjacent thoracic paravertebral and prevertebral ganglia of the cardiac plexus. The parasympathetic preganglionics, as already mentioned, are in the dorsal motor nucleus of the vagus nerve and the nucleus ambiguus, projecting to parasympathetic ganglia in and around the heart and great vessels. By agreement with the publisher, this book is accessible by the search feature, but cannot be browsed.

9: CVfunction - About

The cardiovascular system, also known as the circulatory system, is the transportation system of the body. The major structures that make this possible are the heart, blood vessels and blood.

Functions of the Cardiovascular System Functions of the Cardiovascular System The cardiovascular system supports every other function in our bodies. From the way we move to the fact that our brain gets enough oxygen, we have the cardiovascular system to thank. The cardiovascular system includes the heart and all the vessels and arteries that branch out from it, delivering blood and oxygen to every inch of our bodies. How does it work? The heart pumps about 10 pints of blood through the body with very beat. That blood travels through a complex system of arteries, veins and capillaries. The blood carries oxygen and nutrients to every cell of the body. The cardiovascular system is actually comprised of two systems: The pulmonary circulation, in which the heart pumps the blood to your lungs and back again, and the circulatory system, in which the heart pumps the oxygen-rich blood to the rest of the body. Major Functions of the Cardiovascular System The cardiovascular system is crucial in many other ways, not just in moving oxygen and blood around. The function of the cardiovascular system include keeping our bodies at a constant temperature, maintaining fluid balance throughout the tissues, protecting the body from blood loss and infection, and helping move waste products out of the body. Here is more detail about what the cardiovascular system does: Transportation Picture a major highway. Now, picture the small roads that branch off that major highway, the ones that lead to small town. Now picture even more roads, those that lead to small neighborhoods. Then add in more roads - the driveways that lead to houses. This system of transportation is the same kind of system that makes up the cardiovascular system. All those "roads" are veins, arteries and capillaries that carry the blood from the major artery all the way out to the small capillaries. The heart works with the lungs to take oxygen to the farthest reaches of your body and exhale the carbon dioxide that has built up in the cells. The blood also carries nutrients, hormones, waste products and sometimes medications through the body. This is all a seamless transportation system that happens without any thought at all on your part. Your body works like a well-oiled machine through the functions of the cardiovascular system. Protection Blood cells are made up of three parts, and each part has a job to do when it comes to protecting your body from infection or illness. The red blood cells are what carry oxygen through the body. They travel to the lungs, where the lungs provide oxygen with every breath. That oxygen then binds with hemoglobin, a special protein in the red blood cells. The cells then travel throughout the body, dropping the oxygen where it is needed and picking up the carbon dioxide to be released into the lungs. White blood cells are the warriors of the body. Their job is to find infection or foreign bodies, then wrap around them and attack, killing the invader. Once that is done, they also create antibodies, which can help your immune system fight off the infection if it happens again. When you get cut or injured, platelets do the job of closing up the wound. They connect to proteins released at the site of the cut, thus creating a thick barrier that blocks the loss of blood. If you have too many, the buildup in the body can lead to problems, like strokes or heart attacks. To avoid this, sometimes doctors prescribe blood thinning medications. Thermoregulation In order to stay healthy and work at the optimum level, your body must keep a nearly constant temperature. Though the optimum temperature can vary from one person to another, for most it lies between 97 and 99 degrees Fahrenheit. The cardiovascular system helps regulate the temperature with the following: Thermoreceptors in the body go on alert when the temperature rises. The response is sweat secreted onto the surface of the skin in an attempt to cool things down. At the same time, the muscles around the vessels relax, allowing more blood to pump through. This brings a rush of blood to the skin, allowing the body to cool off. The cardiovascular system diverts just enough blood from the organs to the skin to make this happen. But if the temperature of the body drops, the muscles around the arterioles will constrict, thus forcing blood back to the organs and thus maintaining a core body temperature. Have you ever begun shivering when you were really cold? The body will trigger very small, constant muscle contractions. These muscle contractions produce heat, which can then help raise your body temperature. When the temperature of the blood drops, the body goes into overdrive with hormone production, creating plenty of thyroxin, adrenaline and noradrenaline. These hormones trigger an increase in the metabolic rate, which then warms the body. Fluid Balance Balancing the fluids in the body means that every cell gets the proper amount of electrolytes, nutrients and gases. When you are dehydrated or when you have far too much fluid in your body, your cardiovascular system knows by the changes in blood volume. To compensate, your body then triggers hormones that target certain functions, such as increasing urine output or kidney function. The functions of the cardiovascular system happen involuntarily, creating a complex web of actions that help keep your body as healthy as it can be.

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