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1)Discuss the long term regulation of mean arterial blood pressure

The body’s blood pressure is a measure of the pressures within the cardiovascular system during the pumping cycle of the heart. It is influenced by a vast number of variables, and can alter in either direction for various reasons. Everyone’s blood pressure is slightly different and can change throughout the day depending oThere are several physiological mechanisms that regulate blood pressure in the long-term, the first of which is the renin-angiotensin-aldosterone system **.**

Renin-Angiotensin-Aldosterone System (RAAS)-Renin is a peptide hormone released by the granular cells of thejuxtaglomerular apparatus in the kidney. It is released in response to sympathetic stimulation, reduced sodium chloride delivery to the distal convulated tubule, decreased blood flow to the kidney.Renin facilitates the conversion of angiotensinogen to angiotensin I which is then converted to angiotensin II using angiotensin-converting enzyme **.**

Angiotensin II is a potent vasoconstrictor. It acts directly on the kidney to increase sodium reabsorption in the proximal convoluted tubule. Sodium is reabsorbed via the sodium-hydrogen exchanger. Angiotensin II also promotes release of aldosterone.ACE also breaks down a substance called bradykinin which is a potent vasodilator. Therefore, the breakdown of bradykinin potentiates the overall constricting effect.

The second mechanism by which blood pressure is regulated is release of Anti Diuretic Hormone (ADH) from the OVLT of the hypothalamus in response to **thirst** or an increased plasma osmolarity.ADH acts to increase the permeability of the collecting duct to water by inserting aquaporin channels (AQP2) into the apical membrane.It also stimulates sodium reabsorption from the thick ascending limb of the loop of Henle. This increases water reabsorption thus increasing plasma volume and decreasing osmolarity.

There is a range of normal blood pressures that we consider as acceptable. When blood pressure is outside of this normal range of values, people can start to have problems in both the long and short term. Our body tries to maintain a stable blood pressure in the process of **homeostasis**.

2Write short notes on

i)Pulmonary Circulation

The pulmonary circulation conducts the entire cardiac output with a remarkably low driving pressure between the [pulmonary artery](https://www.sciencedirect.com/topics/medicine-and-dentistry/pulmonary-artery) (mean Ppa = 15–20 mmHg) and the [left atrium](https://www.sciencedirect.com/topics/medicine-and-dentistry/left-atrium) (Pla = 7–12 mmHg).Pulmonary circulation moves blood between the heart and the lungs. It transports deoxygenated blood to the lungs to absorb oxygen and release carbon dioxide. The oxygenated blood then flows back to the heart. Systemic circulation moves blood between the heart and the rest of the body. It sends oxygenated blood out to cells and returns deoxygenated blood to the heart.

ii) Circle of Willis-This encircles the stalk of the pituitary gland and provides important communications between the blood supply of the forebrain and hindbrain (ie, between the internal carotid and [vertebro-basilar](http://emedicine.medscape.com/article/323409-overview) systems following obliteration of primitive embryonic connections).Although a complete circle of Willis is present in some individuals, it is rarely seen radiographically in its entirety; anatomical variations are very common and a well-developed communication between each of its parts is identified in less than half of the population.

The circle of Willis begins to form when the right and left internal carotid artery (ICA) enters the cranial cavity and each one divides into two main branches: the anterior cerebral artery (ACA) and middle cerebral artery (MCA). The anterior cerebral arteries are then united and blood can cross .The **circle of Willis** is a ring of interconnecting arteries located at the base of the brain around the optic chiasm or chiasma (partial crossing of the [optic nerve](https://www.kenhub.com/en/library/anatomy/the-optic-nerve) – CNII; this crossing is important for binocular vision), infundibulum of the pituitary stalk and the [hypothalamus](https://www.kenhub.com/en/library/anatomy/hypothalamus).

This arterial ring provides blood to the brain and neighbouring structures. Polygonal anastomotic shape offers the possibility of alternate pathways for the blood flow, which is essential for the brain functioning, since it is the structure that is mostly sensitive to hypoxia. Hypoxia of the brain tissue that lasts longer than 6 minutes results with the irreversible changes in the brain parenchyma, and depending on the location of the lesion, the functional damages vary widely.

iii) Splanchnic circulation

The splanchnic circulation is composed of gastric, small intestinal, colonic, pancreatic, hepatic, and splenic circulations, arranged in parallel with one another. The three major arteries that supply the splanchnic organs, cellac and superior and inferior mesenteric, give rise to smaller arteries that anastomose extensively. The circulation of some splanchnic organs is complicated by the existence of an intramural circulation. Redistribution of total blood flow between intramural vascular circuits may be as important as total blood flow. Numerous extrinsic and intrinsic factors influence the splanchnic circulation.

Extrinsic factors include general hemodynamic conditions of the cardiovascular system, autonomic nervous system, and circulating neurohumoral agents. Intrinsic mechanisms include special properties of the vasculature, local metabolites, intrinsic nerves, paracrine substances, and local hormones. The existence of a multiplicity of regulatory mechanisms provides overlapping controls and restricts radical changes in tissue perfusion.

iv) Coronary circulation

**Coronary circulation**, part of the systemic [circulatory system](https://www.britannica.com/science/circulatory-system) that supplies blood to and provides drainage from the tissues of the [heart](https://www.britannica.com/science/heart). In the human heart, two coronary arteries arise from the [aorta](https://www.britannica.com/science/aorta) just beyond the semilunar valves; during [diastole](https://www.britannica.com/science/diastole-heart-function), the increased aortic pressure above the valves forces blood into the coronary arteries and thence into the musculature of the heart. Deoxygenated blood is returned to the chambers of the heart via coronary veins; most of these converge to form the coronary [venous sinus](https://www.britannica.com/science/venous-sinus), which drains into the right [atrium](https://www.britannica.com/science/atrium-heart).

The major vessels of the coronary circulation are the left main coronary that divides into leftanterior descending and circumflex branches, and the right main coronary artery. The left and right coronary arteries originate at the base of the aorta from openings called the coronary ostia located behind the aortic valve leaflets.

The left and right coronary arteries and their branches lie on the surface of the heart, and therefore are sometimes referred to as the epicardial coronary vessels. These vessels distribute blood flow to different regions of the heart muscle. When the vessels are not diseased, they have a low [vascular resistance](https://cvphysiology.com/Hemodynamics/H002) relative to their more distal and smaller branches that comprise the [microvascular network](https://cvphysiology.com/Microcirculation/M014). As in all vascular beds, it is the small arteries and arterioles in the microcirculation that are the primary sites of vascular resistance, and therefore the primary site for regulation of blood flow. The arterioles branch into numerous capillaries that lie adjacent to the cardiac myocytes.

v) Cutaneous circulation

The cutaneous tissue has a relatively low metabolic activity compared to others tissues and organs. Therefore under normal conditions, circulation to the skin makes up about 4% of the total cardiac output. However, cutaneous circulation plays an important role in the regulation of core body temperature. Here we will cover systemic and local thermoregulation along with the skins response to injury.

Some of the circulating blood volume in the skin will flow through will flow through **arteriovenous anastomoses (AVAs)** instead of capillaries. AVAs serve a role in temperature regulation. In this article we shall consider the different adaptations of the cutaneous circulation, and its role in body temperature control.

## Arteriovenous Anastomoses

AVAs are low-resistance connections between the small arteries and small veins that supply and drain the skin. These allow the shunt of blood directly into the **venous plexus** of the skin, without it passing through capillaries. Since AVAs contain no capillary section, they are not involved in transport of nutrients to/from the tissues, but instead play a major role in temperature regulation.

3) Discuss the cardiovascular adjustment that occurs during exercise

The integrated response to severe exercise involves fourfold to fivefold increases in cardiac output, which are due primarily to increases in cardiac rate and to a lesser extent to augmentation of stroke volume. The increase in stroke volume is partly due to an increase in end-diastolic cardiac size (Frank-Starling mechanism) and secondarily due to a reduction in end-systolic cardiac size. The full role of the Frank-Starling mechanism is masked by the concomitant tachycardia. The reduction in end-systolic dimensions can be related to increased contractility, mediated by beta adrenergic stimulation. Beta adrenergic blockade prevents the inotropic response, the decrease in end-systolic dimensions, and approximately 50% of the tachycardia of exercise.

The enhanced cardiac output is distributed preferentially to the exercising muscles including the heart. Blood flow to the heart increases fourfold to fivefold as well, mainly reflecting the augmented metabolic requirements of the myocardium due to near maximal increases in cardiac rate and contractility. Blood flow to the inactive viscera (e.g., kidney and gastrointestinal tract) is maintained during severe exercise in the normal dog. It is suggested that local autoregulatory mechanisms are responsible for maintained visceral flow in the face of neural and hormonal autonomic drive, which acts to constrict renal and mesenteric vessels and to reduce blood flow.