NAME: ATERE OLUWADAMILOLA OPEYEMI

1. **LONG-TERM REGULATION OF MEAN ARTERIAL BLOOD PRESSURE**
   The long-term regulation of BP is dependent mainly on the blood volume- urine output balance which in turn is mainly influenced by the renin – angiotensin – aldosterone system. For instance, an increase in arterial BP causes fluid output through the kidneys and reduction in the ECF volume, blood volume and venous return. This will lead to a decrease in C.O which will result in BP decrease. Blood volume itself depends on a balance between fluid intake and fluid losses and that only very small changes in fluid volume are required to produce marked changes arterial BP. Thus 2% increase in blood volume can result in an increase in arterial BP of as much as 5%. Although the rapidly acting control system will serve to reduce this changes, the long- term adjustment will be by increased fluid loss by the kidneys. By reabsorbing 99% of the water and sodium filtered in the glomerus per day, the kidneys help in conserving body water and therefore maintaining blood volume. By so doing, it ensures a long-term maintenance of normal blood pressure.

2. **(I) Pulmonary circulation:** is the system of transportation that shunts deoxygenated blood from the heart to the lungs to re-saturated with oxygen before being dispersed into systemic circulation. Deoxygenated blood from the lower half of the body enters the heart from inferior vena cava while deoxygenated blood from the upper body is delivered to the heart via the superior vena cava. Both the superior vena cava and inferior vena cava empty blood intothe right atrium. Blood flows through the tricuspid valve into the right ventricle. It then flows through the pulmonic valve into pulmonary artery before being delivered to the lungs. While in the lungs, blood diverges into the numerous pulmonary capillaries where it releases carbon dioxide and is replenished with oxygen. Once fully saturated with oxygen, the blood is transported via the pulmonary vein into the left atrium which pumps blood through the mitral valve and into the left ventricle. With a powerful contraction, the left ventricle expels oxygen-rich blood through the aortic valve and into the aorta.
   (II) Circle of Willis: the circle of Willis encircles the stalk of the pituitary gland and provides important communications between the blood supply of the forebrain and

hindbrain (i.e, between the internal carotid and vertebra-basilar 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 iernal 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 flow by the anterior communicating (ACOM) artery. The ACAs supply most midline portions of the frontal lobes and superior medial parietal lobes. The MCAs supply most of the lateral surface of the hemisphere, except the superior portion of the parietal lobe (via ACA) and the inferior portion of the temporal lobe and occipital lobe. The ACAs, ACOM, and MCAs form the anterior half, better known as the anterior cerebral circulation. Posteriorly, the basilar artery (BA), formed by the left and right vertebral arteries, branches into a left and right posterior cerebral artery (PCA), forming the posterior circulation. The PCAs mostly supply blood to the occipital lobe and inferior portion of the temporal lobe.

(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 in 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 that supplies blood to and provides drainage from the tissues of the heart. In the human heart, two coronary arteries arise from the aorta just beyond the semilunar valves; during diastole, 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, which drains into the right atrium. The heart normally extracts 70 to 75 percent of the available oxygen from the blood in coronary circulation, which is much more than the amount extracted by other organs from their circulations—e.g., 40 percent by resting skeletal muscle and 20 percent by the liver. Obstruction of a coronary artery, depriving the heart tissue of oxygen-rich blood, leads to death of part of the heart muscle (myocardial infarction) in severe cases, and total heart failure and death may ensue.

(V) Cutaneous circulation: The cutaneous circulation is the circulation and blood supply of the skin. The skin is not a very metabolically active tissue and has relatively small energy requirements, so its blood supply is different to that of other tissues. A mechanistic treatment of interaction between adrenergic control of cutaneous blood vessels and their temperature brought physical factors and pharmacological approaches to the consideration of reflex control. Finally, the more slowly developing changes in the control of the skin circulation that accompany circadian rhythms, changes in blood volume or its distribution, physical training, and acclimatization were discussed. Because the cutaneous circulation has potentially large vascular conductance, blood flow, and blood volume, control of the resistance and compliance vessels within the skin has an importance well beyond that of tissue nutrition. Indeed, overall hemodynamics are dependent on how much blood flow and how much blood volume are distributed to skin. Consequently, reflex factors, physical factors, and their interaction all have roles of importance with respect to exchange of heat with environment as well as maintenance of blood pressure, cardiac output, and blood flow to other tissues.

3. 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. However, in the presence of circulatory impairment, where oxygen delivery to the exercising muscles is impaired as occurs to complete heart block where normal heart rate increases during exercise are prevented, or in congestive right heart failure, where normal stroke volume increases during exercise are impaired, or in the presence of severe anemia, where oxygen-carrying capacity of the blood is limited, visceral blood flows are reduced drastically and blood is diverted to the exercising musculature. Thus,, visceral flow is normally maintained during severe exercise as long as all other compensatory mechanisms remain intact. However, when any other compensatory mechanism is disrupted (even the elimination of splenic reserve in the dog), reduction and diversion of visceral flow occur.