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**MATRIC NUMBER: 19/MHS01/444 (DE)**

**COLLEGE: MEDICINE AND HEALTH SCIENCES**

**DEPARTMENT: MEDICINE AND SURGERY**

**COURSE: PHYSIOLOGY**

## QUESTIONS:

1. Discuss the long term regulation of mean arterial blood pressure?
2. Write short notes on the following
   a. Pulmonary circulation
   b. Circle of Willis
   c. Splanchnic circulation
   d. Coronary circulation
   e. Cutaneous circulation
3. Discuss the cardiovascular adjustment that occurs during exercise.

## LONG TERM REGULATIONS OF MEAN ARTERIAL BLOOD PRESSURE.

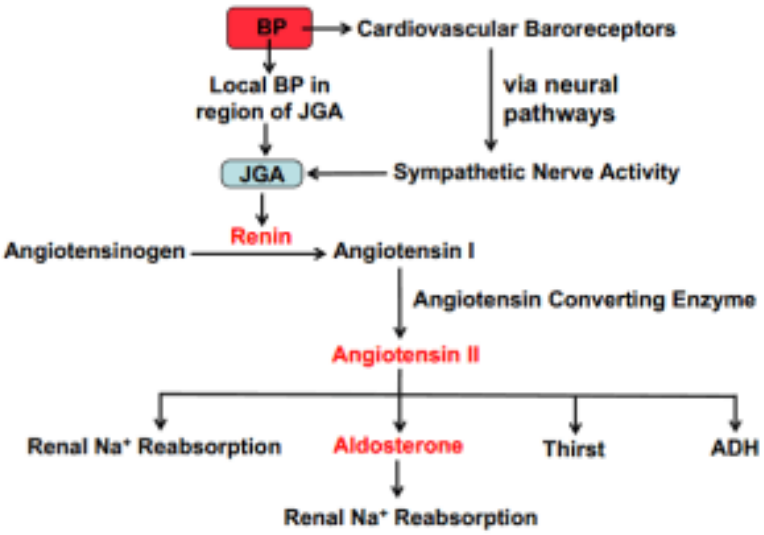
Firstly, mean arterial blood pressure is the average pressure existing in the arteries. It is not the arithmetic mean of the systole and diastolic pressure.

To determine the mean pressure, diastolic pressure is considered than the systolic pressure because diastolic period of cardiac cycle is longer than the systolic period. Normal mean arterial pressure is 93mmHg

LONG TERM REGULATIONS OF MEAN ARTERIAL BLOOD PRESSURE**.** it is also knowns as **renal mechanism**. Kidney plays an important role in the long term regulation of arterial blood pressure. When the blood pressure alters slowly in several days/ months/ years, the nervous mechanism adapts to the altered pressure and loses the sensitivity for changes. It cannot regulate the pressure anymore in such conditions, the renal mechanism operates efficiently to regulate the blood pressure. It is called **long term regulation**.

The kidney regulates the arterial blood pressure in two ways

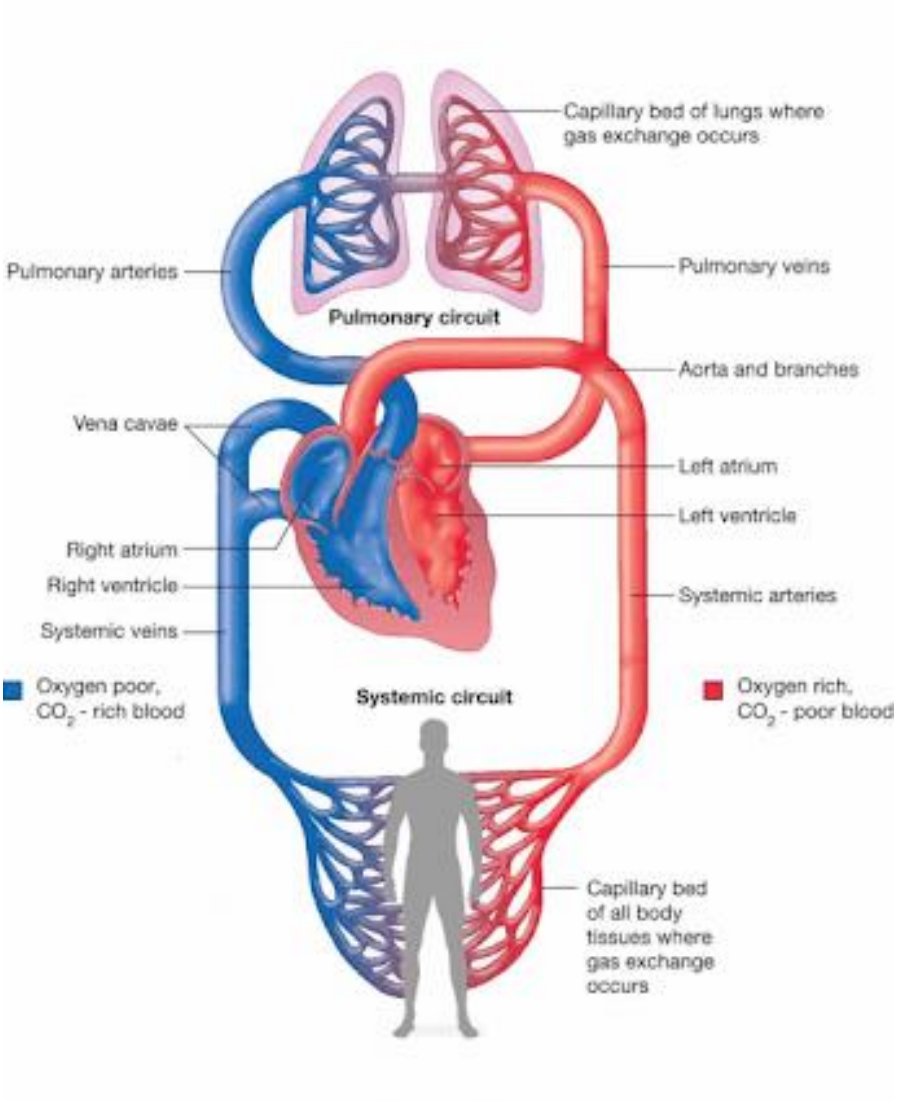
A. By regulation of the extracellular fluid(ECF) volume.
B. Through the renin-angiotensin mechanism.



## PULMONARY CIRCULATION

It is otherwise called lesser circulation. Blood is pumped from the right ventricle to the lungs through pulmonary artery. Exchange of gases occurs between the blood and alveoli of the lungs at the pulmonary capillaries. Oxygenated blood returns to the left atrium through the pulmonary veins.

Thus, the left side of the heart contains oxygenated or arterial blood and the right side of the heart contains the deoxygenated or venous blood.



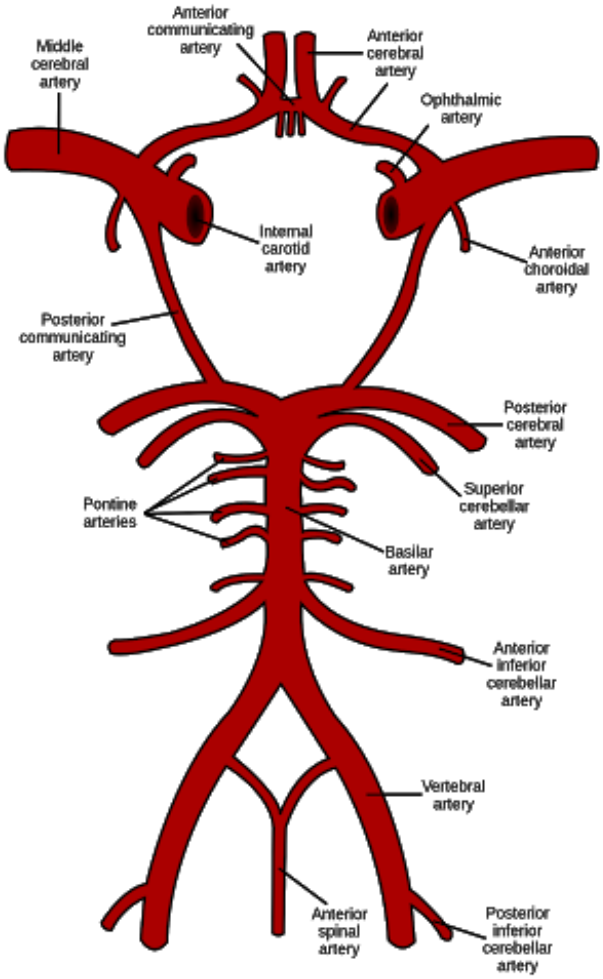
**CIRCLE OF WILLIS**

It is a circulatory anastomosis that supplies blood to the brain and surrounding structures.

The Circle of Willis is the joining area of several arteries at the bottom(inferior) side of the brain. At the Circle of Willis, the internal carotid arteries branch into smaller arteries the supply oxygenated blood to over 80% of the cerebrum.

It is composed of the following arteries

1. Anterior cerebral artery (right and left)
2. Anterior communicating artery
3. Internal carotid artery (right and left)
4. Posterior cerebral artery (right and left)
5. Posterior communicating artery (right and left)



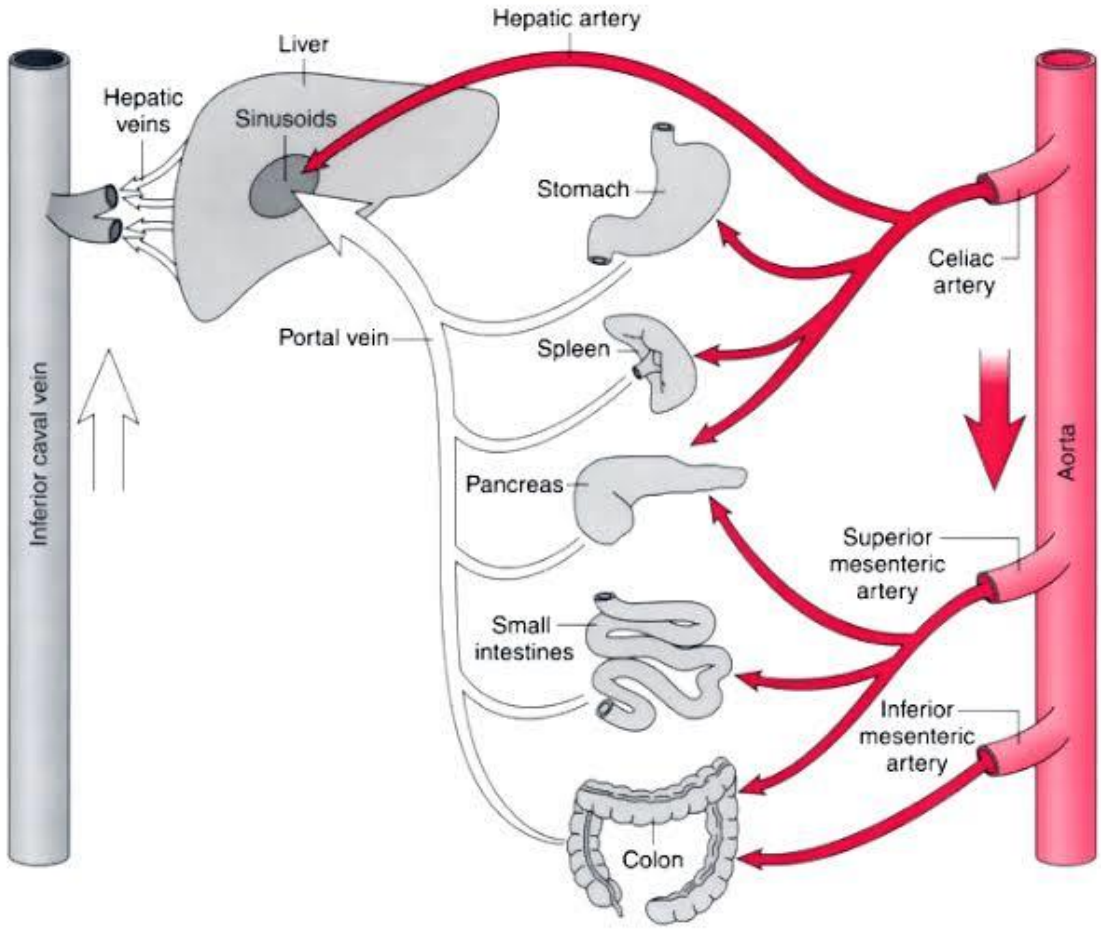
## SPLANCHNIC CIRCULATION

The splanchnic circulation consists of the blood supply to the gastrointestinal tract, liver, spleen and pancreas. It consists of two large capillary beds partially in series. The small splanchnic arterial branches supply the capillary beds, and then efferent venous blood flows into the PV.

The splanchnic circulation comprises

a. Mesenteric circulation supplying blood to the gastrointestinal tract.
b. Splenic circulation supplying blood to the spleen
c. Hepatic circulation supplying blood to the liver

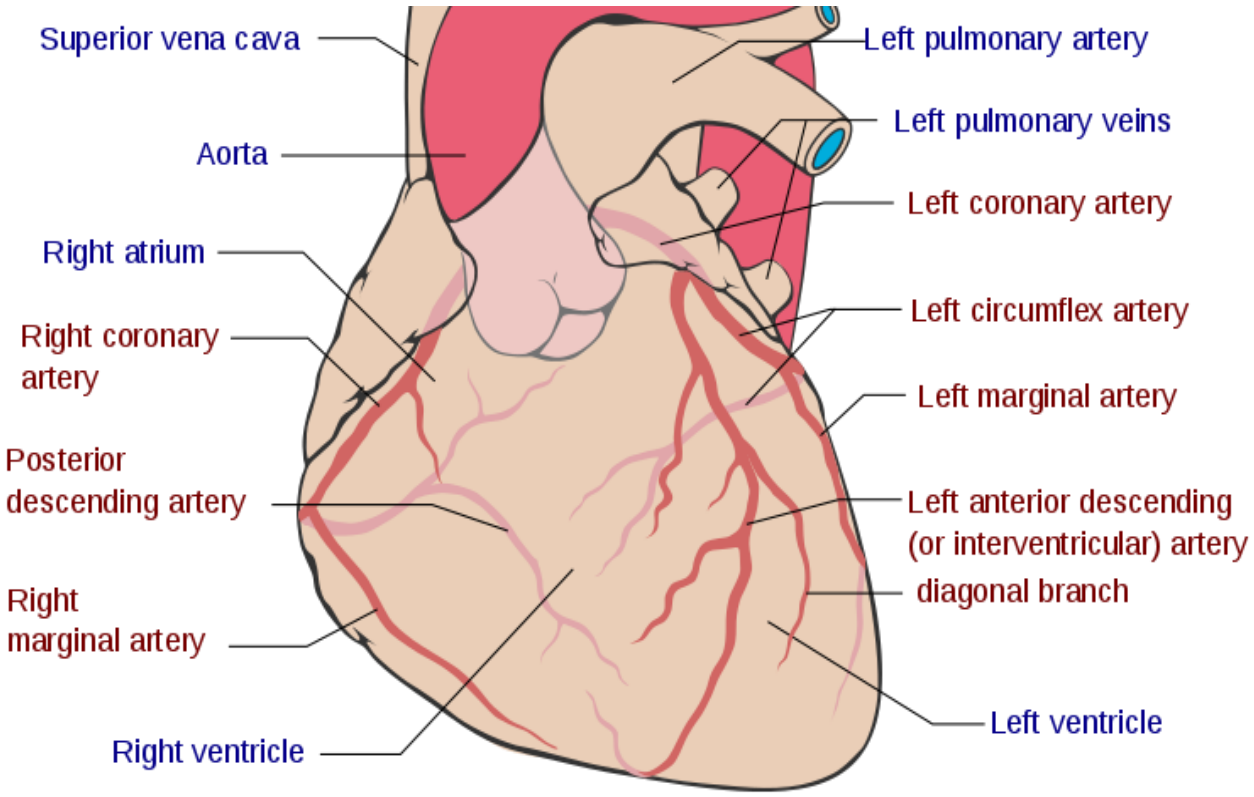
They are arranged in parallel and fed by the celiac artery and the superior and inferior mesenteric arteries. A unique feature of splanchnic circulation is that blood from mesenteric bed and spleen forms a major amount of blood flowing to the liver. Blood flows to liver from gastrointestinal tract and spleen through portal system.



## CORONARY CIRCULATION

It is one of the regional circulations. The circulation of blood through a particular organ or region of the body is called regional circulation.

Coronary circulation is the circulation of blood through blood vessels of the heart muscle (myocardium). It is responsible for functional blood supply to the heart muscle itself. Blood flowing through the chambers of the heart does not nourish the myocardium. When functioning normal, blood in coronary vessels supply adequate oxygen to the myocardium. The heart muscle is supplied by two coronary arteries (right and left coronary arteries), which are the first branches of aorta. The arteries encircle the heart in the manner of a crown.



## CUTANEOUS CIRCULATION

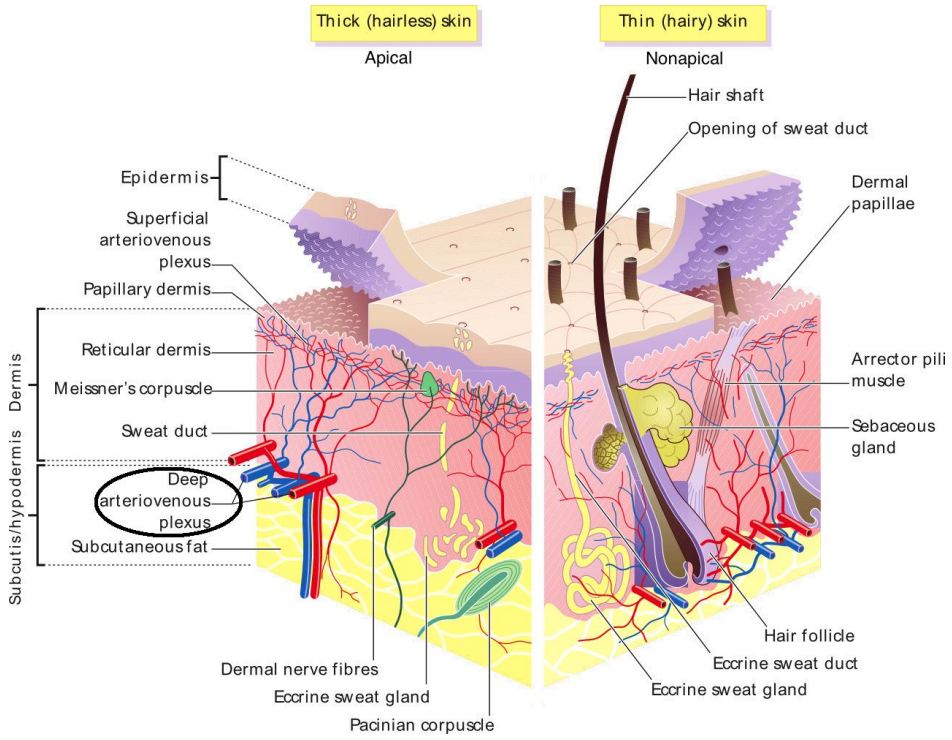
The cutaneous circulation is the blood supply of the skin. The skin is not a very metabolically active tissue and has relatively small energy requirements, so its blood supply is different to that of other tissues.

Architecture of cutaneous blood vessels is formed in the following manner:

1. Arterioles arising from the smaller arteries reach the base of **papillae dermis**
2. Then, these arterioles turn horizontally and give rise to **meta-arterioles.**
3. From meta-arterioles, hairpin-shaped **capillary loops** arise. Arterial limb of loop ascends vertically in the papillae and turns to form a venous limb, which descends down.
4. After reaching the base of papillae, few venous limbs of neighboring papillae unite to form the **collecting venule.**
5. Collecting venules anastomose with one another to form the **subpapillary venous plexus.**
6. Subpapillary plexus runs horizontally beneath the base of papillae and drain into deeper veins.

Cutaneous blood flow performs two functions

a. Supply of nutrition to the skin.
b. Regulation of body temperature by het loss.



## CARDIOVASCULAR ADJUSTMENT THAT OCCURS DURING EXERCISE

During exercise, there is an increase in metabolic needs of tissues, particularly the muscles. Various adjustments in the body during exercise are aimed at:

1. Supply of various metabolic requisites like nutrients and oxygen to muscles and other tissues involved in the exercise.
2. Prevention of increase in body temperature.

Exercise is generally classified into two types depending on the type of muscular contraction. Cardiovascular changes are slightly different in these two types of exercise.

### a. DYNAMIC EXERCISE

In this type of exercise, the heart rate, force of contraction, cardiac output and systolic blood pressure increase. However, the diastolic blood pressure is unaltered or decreased. It is because, during dynamic exercise, peripheral resistance is unaltered or decreased depending upon the severity of exercise.

### b. STATIC EXERCISE

During this exercise, apart from increase in heart rate, force of contraction, cardiac output and systolic blood pressure, the diastolic blood pressure also increases. It is because of increase in peripheral resistance during static exercise.

## EFFECTS OF EXERCISE ON CARDIOVASCULAR SYSTEM

1. Heart rate increases during exercise. Even the thought of exercise or preparation for exercise increases the heart rate. It is because of impulses from cerebral cortex to medullary centers, which reduces vagal tone
2. More heat is produced during exercise and the thermoregulatory system is activated. This in turn, causes secretion of large amount of sweat leading to fluid loss and reduced blood volume.
3. During exercise, the cardiac output increases because of increase in heart rate and stroke volume. Increase in cardiac output is directly proportional to the increase in the amount of oxygen consumed during the exercise.
4. During moderate isotonic exercise, the systolic pressure is increased.it is due to increase in heart rate and stroke volume. But in exercises involving isometric contraction, the peripheral resistance increases. So, the diastolic pressure also increases along with systolic pressure.

5. Mild hypoxia developed during exercise stimulates the secretion of erythropoietin. It stimulates the bone marrow and causes release of red blood cells. Increased carbon dioxide content in blood decreases the pH of blood.