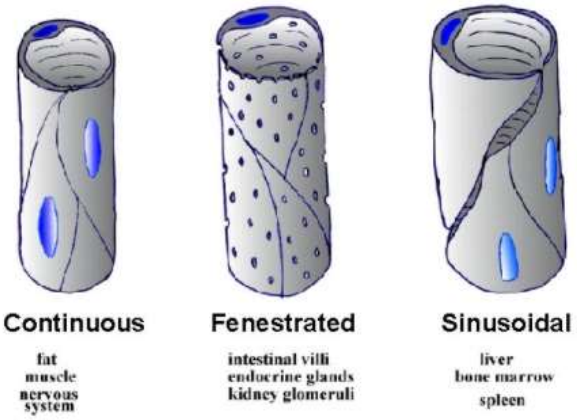


Functions of capillaries

1- Sites of exchange between blood and tissues (nutrients & Oxygen).
2- Drainage of body waste products.
3- Temperature regulation
4- The arterial system delivers blood to > 1 billion capillaries throughout the body. Total capillary surface area=1000 m2.

Exchange of materials across the capillary endothelium occurs by the following processes:

1-Diffusion (according to concentration gradient).

2- Filtration (according to pressure gradient). The hydrostatic pressure of the blood forces fluid the arteriolar ends of capillaries into the interstitial spaces of the tissues.

3- Pinocytosis (Vesicular transport).

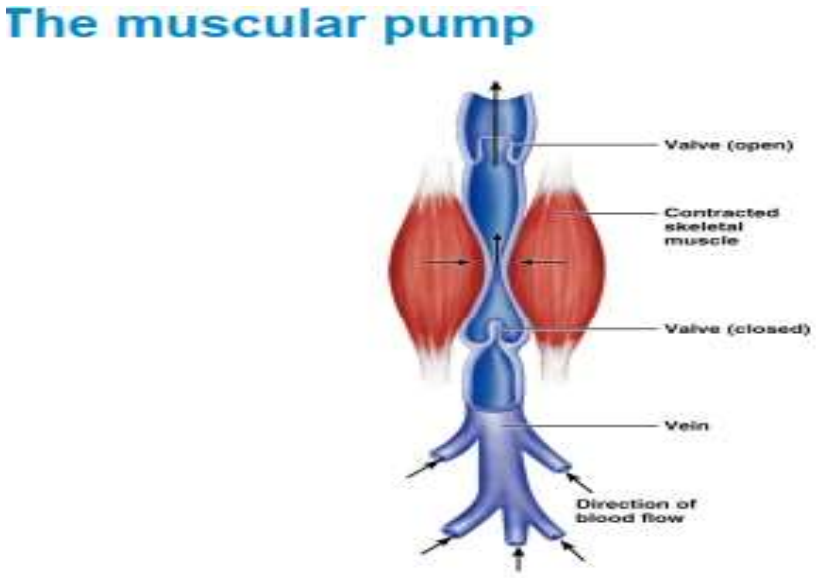
4- Mediated (membrane) transport: This occurs in capillaries of brain only and involves secondary active transport e.g., transport of glucose; moves by co-transporters in cell membrane.

Veins & Venules

Veins blood vessels that carry blood to the heart, from the lungs and tissues. Blood pressure in veins is extremely low, as a result valves formed by the tunica internal layer are necessary to prevent backflow.

- Most veins carry deoxygenated blood, except the pulmonary veins where they transport oxygenated blood from the lungs to the left atrium.

- Venules are small veins which continue from capillaries and merge to from veins.
- Very little pressure remains by the time blood leaves the capillaries and enters the venules.
- Blood flow through the veins is not the direct result of ventricular contraction. Instead, venous return depends on skeletal muscle action, respiratory movements, and constriction of smooth muscle in venous walls.
- veins contain flap like values that prevent blood from backing up. venous constriction can increase venous pressure and blood flow.
- Since the colloid osmotic pressure of plasma is greater than that of tissue fluid, water returns by osmosis to the venular end of capillaries.



Fetal Circulation

Most circulatory pathways in a fetus are like those in the adult but there are some notable differences because the lungs, the gastrointestinal tract, and the kidneys are not functioning before birth. The fetus obtains its oxygen and nutrients from the mother and also depends on maternal circulation to carry away the carbon dioxide and waste products.

The umbilical cord contains two umbilical arteries to carry fetal blood to the placenta and one umbilical vein to carry oxygen-and-nutrient-rich blood from the placenta to the fetus. The ductus venosus allows blood to bypass the immature

liver in fetal circulation. The foramen ovale and ductus arteriosus are modifications that permit blood to bypass the lungs in fetal circulation.

Difference between Adult and Fetal Circulation

Criteria	Adult Circulation	Fetal Circulation
Artery	Carries oxygenated blood away from the heart	Carries Non-oxygenated blood away from the fetal heart
Veins	Carries non-oxygenated blood towards the heart	Carries oxygenated blood back to the heart
Exchange of Gases	Takes places in the lungs	Takes place in the placenta
Pressure	Increase pressure on the left side of the heart	Increase pressure on the right side of the heart
Heart	Close Close	Foramen ovale (open circulation between left and right atria) Ductus arteriosus (Connection between pulmonary trunk and aorta) Ductus venosus (Connection between umbilical vein and inferior vena cava)

Regulation of cardiovascular system

1- Vasomotor center

Vasomotor center is situated medulla oblongata and the lower part of the pons.Vasomotor center regulates heart rate and arterial blood pressure by causing vasoconstriction or vasodilatation. However,its actions depend upon the impulses it receives from other structures such as baroreceptors, chemoreceptors, higher centers and respiratory centers. Among these structures, baroreceptors and chemoreceptors play a major role in the short term regulation of blood pressure.

1. *Baroreceptor Mechanism*

Baroreceptors are the receptors, which give response to change in blood pressure. Baroreceptors are situated in the **carotid sinus** and wall of the **aorta**

2. *Chemoreceptor Mechanism*

Chemoreceptors are the receptors giving response to change in chemical constituents of blood. Peripheral chemoreceptors influence the vasomotor center. are situated in the carotid body and aortic body.

2- Renal mechanism for regulation of blood pressure –long-term regulation

Kidneys regulate arterial blood pressure by two ways:
1. By regulation of ECF volume
2. Through renin angiotensin mechanism

3- Hormonal mechanism

Hormones, which increase the arterial blood pressure have different mechanism of action.

1. *Adrenaline*

Adrenaline is secreted by the adrenal medulla. It is also released by sympathetic postganglionic nerve
endings. Adrenaline regulates the blood pressure by acting through heart and blood vessels.

2. Noradrenaline due to its general vasoconstrictor effect.

3. Antidiuretic Hormone (ADH)

Release of ADH from posterior pituitary occurs when neurons in hypothalamus called osmoreceptors detect an increase in plasma osmolality (osmotic pressure) [produced by dehydration or

excessive salt intake]. ADH stimulates reabsorption of H2O from kidney filtrate and act to maintain blood volume. A decrease in blood flow to the kidneys activate the renin –angiotensin system. Angiotensin II stimulates vasoconstriction and the secretion of aldosterone by the adrenal cortex. Aldosterone acts on the kidneys to promote the retention of salt and water.