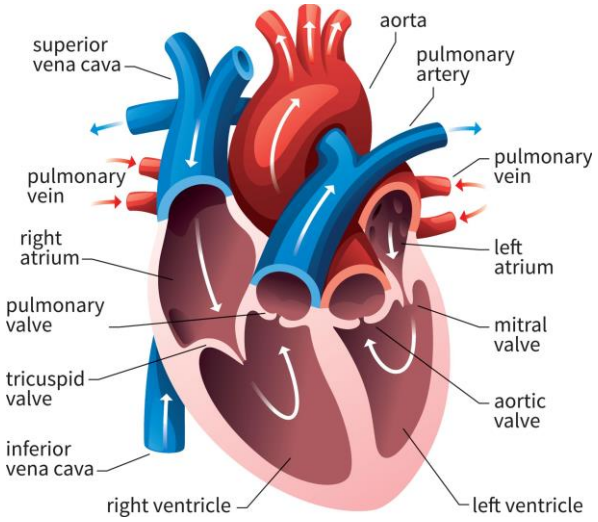
cardiovascular system

The cardiovascular system is considered as the transport system of the body. This system has three main components: the heart, the blood vessels and the blood itself. The heart is the system's pump and the blood vessels are the ways of delivery. Blood can be thought of as a fluid which contains the oxygen and nutrients the body needs and carries the wastes which need to be removed.

the heart

- The heart is a muscular organ that acts like a pump to continuously send blood throughout your body.
- The heart is located underneath the sternum in a thoracic compartment called the mediastinum, which occupies the space between the lungs.
- The narrow end of the heart is called the apex. It is directed downward and to the left and lie just above the arch of the diaphragm at the approximate level of the fifth or sixth rib.
- The broad end of the heart is called the base, which is directed upwards and to the right and lies at the approximate level of the second rib.



The Chambers of the Hearts

- The heart is made up of four chambers : 2 in left and 2 in right.
- 2 Atrium and 2 Ventricles
- The superior chamber consists of the right atrium and the left atrium.
- The lower chambers are the right ventricle and left ventricle, which are much larger than the atria.

The Valve of the Heart

- Four valves maintain the unidirectional flow of blood through the heart.
- The valves are located between each atrium and ventricle and in the two arteries that empty blood from the ventricle.
- The Tricuspid valve (right atroventricular) is composed of three flaps and controls blood flow from the right atrium to the right ventricle.
- The Mitral Valve (bicuspid valve) (left atroventricular) is made up of two flaps and controls blood flow from the left atrium to the left ventricle.
- Semilunar valves direct blood flow from the ventricles into the aortic artery(aortic valve) and pulmonary artery(pulmonary valve).
- The valves are located in the vessels just above the opening to ventricles

Layers of the heart wall

The wall of the heart consists of three layers

– The epicardium (external layer) contains blood vessels, lymphatics, and vessels that supply the myocardium.

– The myocardium (middle layer) is responsible for the pumping action of the heart and is composed of cardiac muscle tissue.

– The endocardium (inner layer) lines the heart chambers and the blood vessels leaving and entering the heart.

pericardium

pericardium is a thinner membrane that forms a double layer around the heart

- The outer parietal layer: it is fused to the fibrous pericardium.
- The inner visceral layer is also called the epicardium helps the layers of the heart wall to adheres tightly to the surface of the heart.
- pericardial cavity :The space between the two layers.

Blood vessels

Blood vessels are part of the circulatory system. Blood vessels play an important role in the transportation of blood around the body. There are three main types of blood vessels: arteries, veins and capillaries.

The average human adult has 4-6 litres of blood repeatedly cycled throughout the body in a closed circulatory system.

It is called a closed system because the blood is contained within the heart and blood vessels at all time and blood always flows in a forward direction.

Arteries

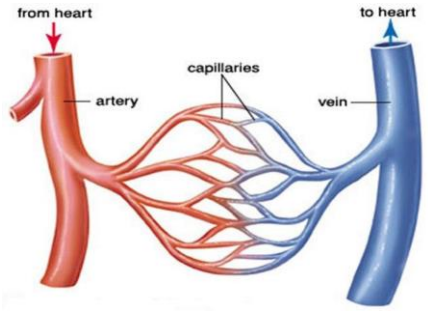
Arteries are the blood vessels that carry blood from the heart to the body. It has a thicker, more muscular wall with extensive development of elastic tissue when compared with a vein

Arterioles

They are the smallest branches of the arteries. Their walls have less elastic tissue than arteries. They are the site of the highest resistance to the blood flow.

Capillaries

Capillaries are the smallest of blood vessels. They serve to distribute oxygenated blood from arteries to the tissues of the body and to feed deoxygenated blood from the tissues back into the veins. They are the site where nutrients, gases, water and solutes exchange between the blood and tissues.

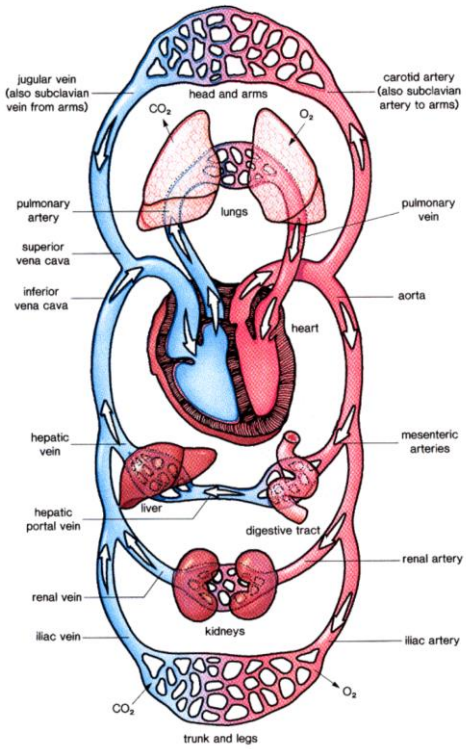


Venules

The venules collect blood from the capillaries and coalesce to larger veins.

Veins

Veins are the blood vessels that drain blood back from the body to the heart. It has thin, flexible walls when compared to an artery. Some veins, especially large ones, have valves in them to prevent blood from running away from the heart again



The Circulation System

pulmonary circulation

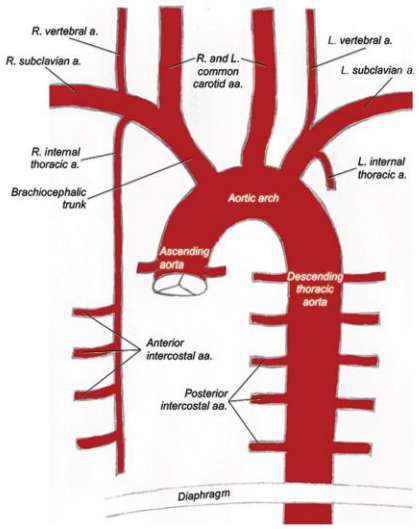
- Blood is delivered to the right atrium from the systemic circulatory system by two veins. The superior vena cava transport Deoxygenated blood from the upper extremities
- The inferior vena cava transport oxygen-depleted blood from the lower extremities.
- Blood exits the right ventricles through the pulmonary trunk artery
- This vessel branches into the left and right pulmonary arteries, which transport blood into the lungs.
- The left pulmonary veins and right pulmonary veins return oxygenated blood from the lungs to the left atrium.

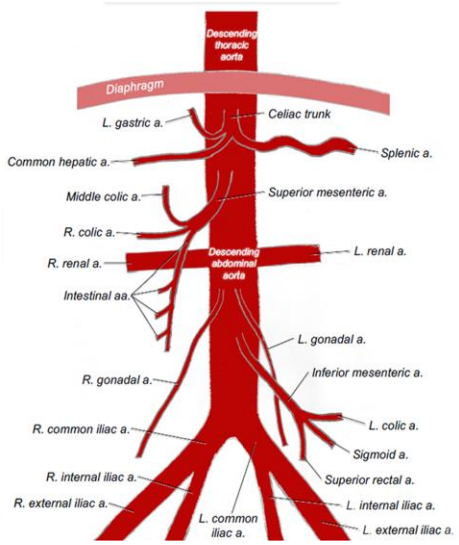
systemic circulatory

Blood passes from the left atrium into the left ventricle and then is pumped into the systemic circulatory system through a large elastic artery called the aorta.

The aorta

Many smaller blood vessels branch off from the aorta, including:





Ascending aortic branches

Coronary arteries supply blood to muscle tissue in your heart.

Aortic arch branches

- **Brachiocephalic trunk**, which branches into the right subclavian artery (supplies the right arm) and right carotid artery (supplies the brain and right side of the head and neck).
- Left subclavian artery supplies your left arm and the back of your brain.
- Left carotid artery supplies your brain and the left side of the head and neck.

Descending thoracic aortic branches

- Bronchial arteries supply the bronchioles, structures deep within the lungs.
- Mediastinal arteries supply the mediastinum, a space between the lungs that houses the windpipe, esophagus .
- Esophageal arteries supply the esophagus, a tube that connects the throat to the top of the stomach.
- Pericardial arteries supply the pericardium.
- Superior phrenic arteries supply the thoracic vertebrae, spinal cord and muscles, joints and skin of the middle back.

Descending abdominal aortic branches

- Inferior phrenic arteries diaphragm.
- **Celiac trunk** arteries supply organs of gastrointestinal system, including the stomach, liver, spleen and pancreas.
- Superior and inferior mesenteric arteries supply intestines.
- Renal arteries supply kidneys.
- Gonadal arteries supply ovaries in women and testes in men.
- Lumbar arteries supply the lumbar vertebrae, spinal cord, muscles, joints and skin of lower back.
- Median sacral arteries supply the lowest part of your spine (tailbone) and top of your pelvis.
- Iliac arteries supply the lower extremities.

General Structure of Blood Vessels

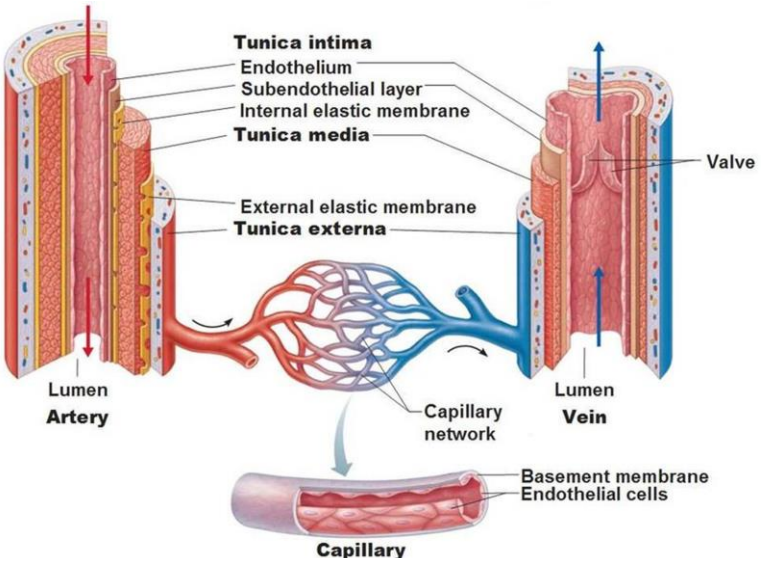
Arteries and veins are composed of three tunics:

tunica interna : Endothelial layer that lines the lumen of all vessels.

tunica media :Smooth muscle and elastic fiber layer

tunica externa : Collagen fibers that protect and reinforce vessels

Capillaries are composed of endothelium.



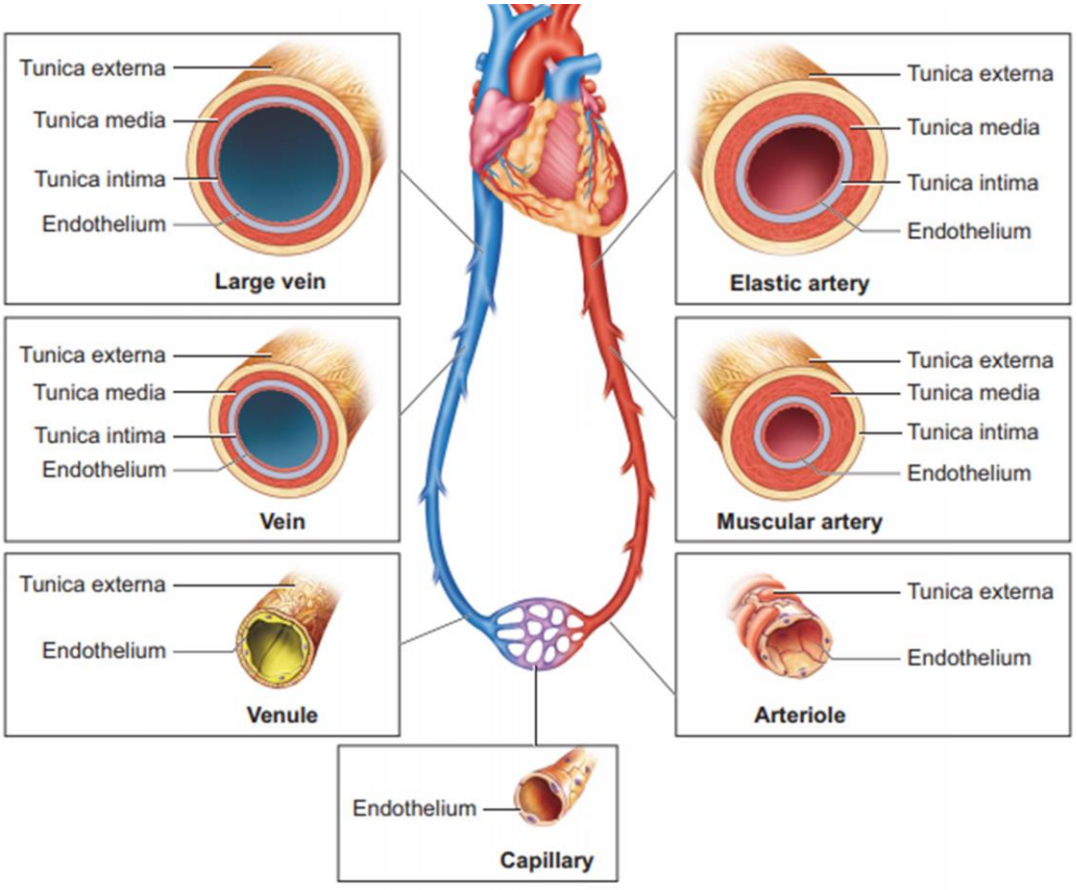


Figure 7.6 Structure of Blood vessels