Blood Vessels

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Blood vessels are tube-shaped organs that transport blood to the body

Blood vessels are characterized by size and the direction in which they carry blood. Most blood vessels have three distinct layers in their walls. From the inside to the outside, these are the layers:

The tunica interna is the inner layer in the wall of a blood vessel and is in contact with the blood being carried by the vessel. It comprised of simple squamous epithelial tissue and a basement membrane. The thin cells are semipermeable and function in exchange. This layer is also known as endothelium.

The tunica media is the middle layer in the vessel wall. It contains smooth muscle as well as collagen and elastic fibers. Smooth muscle in the wall of a vessel allows for greater control of blood delivery and flow because the vessel can change diameter to meet different needs. Vasdilation, an increase in vessel diameter, occurs when the smooth muscle in the tunica media relaxes. An increase in diameter allows the vessel to carry more blood. Vasoconstriction, a decrease in vessel diameter, is caused by smooth muscle contraction of the tunica media. A decrease in vessel size restricts blood flow to a specific area.

The tunica externa is outermost layer in the vessel wall. The loose connective tissue in the tunica externa protects the vessel and also helps anchor the vessel in place by attaching it to surrounding structures.

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Here is an illustration showing the three layers in the wall of a vessel.

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Blood vessels are classified both on size and also the direction in which they carry blood. The heart is the standard frame of reference for blood flow. The ventricles of the heart pump blood away from the heart into the pulmonary or systemic system.

Arteries are blood vessels that carry blood away from the heart out into the circulatory routes. As arteries travel away from the heart, they branch to form smaller and smaller pathways. There are three different types of arteries. All of them have three layers in their walls.

Conducting arteries are the largest arteries. Examples include the aorta and the pulmonary trunk

Distributing arteries are smaller and deliver blood to specific regions or organs. Examples include the circumflex artery and the left pulmonary artery

Arterioles (also known as resistance arteries) are the smallest forms of arteries. They branch from distributing arteries to supply very local regions of the body.

Capillaries are the smallest blood vessels and are formed when arterioles branch. They are found at sites of exchange between blood and surrounding tissues. Capillaries exchange gases, nutrients and waste products. Unlike the other types of blood vessels, capillaries only consist of the endothelium and a thin basement membrane. Capillaries are found at the half way points of circulatory routes. They form beds between arterioles (which carry blood away from the heart) and venules (which start blood on a return journey towards the heart). The lack of a tunica externa and a tunica media allows capillaries to be highly permeable and they exchange substances between blood and surrounding interstitial fluid.

Veins form when capillaries merge and vessels technically start to carry blood back towards the heart. As with arteries, there are different types based on size. All types have the three layers in their walls.

Venules drain blood from capillary beds and carry blood on the return journey to the heart

Medium veins form when venules merge, like tributaries of a river. They drain larger areas and carry more blood. Many contain special folds of tunica interna called valves. The valves are important because they insure that blood does not back up and flow in the wrong direction

Large veins are the biggest vessels on the return journey to the heart. They form when medium veins merge. Examples include the inferior vena cava and the pulmonary veins

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This diagram shows the details of the major types of vessels. The color of the tunica externa represents the oxygen conditions inside the vessel. Vessels that carry oxygen rich blood are red in color and vessels that carry oxygen poor blood have a blueish in color. Recall that blood vessels form a continuous and closed loops.

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This illustration depicts the anatomy of a capillary. The tunica externa and tunica media are absent. In order for materials to move into or out of blood, they must pass through

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The ventricles of the heart contact and pump blood out to body tissues. The force generated by the ventricles is sufficient to push blood through arteries, arterioles and into capillary beds. The flow of blood back to the heart is known as venous return and is influenced by several factors.

Pressure generated by the heart is responsible for most venous return. This pressure gradient is dependent of the force generated by the ventricles. Blood flows from area of high pressure to areas of low pressure. As important as ventriclular pressure is, the pressure gradient is not sufficient to return 100% of the blood, especially from long systemic loops into the legs, for example. Gravity is an essential force in venous return, especially for blood flowing from the head and neck area. Additionally, the alternating contraction and relaxation of skeletal muscles helps to squeeze deep veins and causes blood to move through valves back towards the heart.

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Blood Pressure is an important physiological trait. Blood pressure is the force exerted by blood on the inner walls of vessels.

The blood pressure is always higher in arteries than in veins because the ventricles of the heart contact with the most force. Veins are found on the return journey and are farther away on the path from ventricles.

When the ventricles contract (systole) they pump blood into the pulmonary circuit and the systemic circuit. The highest pressure in the arteries when the ventricles are contracting is known as the systolic pressure. Blood vessels always contain blood so there is always some pressure. When the ventricles are relaxing and resting, the pressure is lower. The lowest pressure is known as the diastolic pressure.