

The *vascular system* is the name for the collection of **blood vessels** and lymph vessels of the body. Arteries take blood away from the heart (pump) and deliver it to capillary networks for distribution to cells and tissues. Veins bring the blood back to the heart from the capillary networks. See page 120 for the lymph vascular section.

Arteries are characterized by smooth muscle and one or two elastic laminae in their walls. The layers of an arterial wall are generally distinctive except in the largest (endothelial-lined elastic tubes) and smallest (precapillaries). Small arteries (**arterioles**; resistance vessels) can cut off blood to a maze of capillaries when required. **Medium arteries** tend to be vessels of distribution, diverting flow as needed. **Large arteries** are the equivalent of elastic aqueducts, moving large volumes of blood out of the heart or aorta to distant parts (head, lower limbs, etc.). All arteries have a fibrous outer layer (**tunica externa** or adventitia). Within this tunica much smaller nutrient blood vessels (*vasa vasorum*) and motor/sensor nerves (*nervi vasorum*) are found.

Arteries have the ability to respond to changing circumstances by vasodilating to increase flow and decrease blood pressure, by vasoconstricting to decrease flow and increase blood pressure, by diverting/redirecting blood flow, and literally shutting circulation down in a particular locale (e.g., capillary blanching when in shock, or suspension of bleeding in a traumatically amputated limb).

Veins generally lack significant layers of smooth muscle and elastic tissue in their walls. They function largely as conduits with considerable increased capacity when subjected to pressure loads. Large veins are especially capacious (see dural sinuses, page 115). **Venules** (small veins) are formed by the merging of capillaries and are of basically the same construction. Veins get progressively larger as they approach the heart. Veins, like rivers, have tributaries, not branches (except in portal circulations). Most medium veins of the neck and extremities have a series of small pockets, called *valves*, formed from the endothelial layer. These valves are paired and point in the direction of blood flow. They are particularly numerous in the lower limbs. Though offering no resistance to blood flow, a reversed blood flow closes the valves (and the lumen) of the vein. Venous flow in the lower limbs is enhanced by the contraction of skeletal muscles, whose contractile bulges give an antigravity boost to the movement of blood.

Capillaries, the smallest of the lot, are thin-walled, potentially porous endothelial tubes with some fibrous support. Lacking muscle and elastic tissues, capillaries are concerned with the release of nutrients, gases, and fluids to surrounding tissue, and the taking-up of carbon dioxide and other “unnecessary” gases and micro-particulate matter. Capillaries can generally accommodate the passage of cells between endothelial cells. Specialized capillaries of this nature are called *sinusoids* (see page 124).