

**Lecture title: The circulatory system for Second Year Students of Dentistry Department**

**Credits Units: 4**

**Theory Lecture: 2hrs**

**Practical Lab: 2 hrs**

## The circulatory system

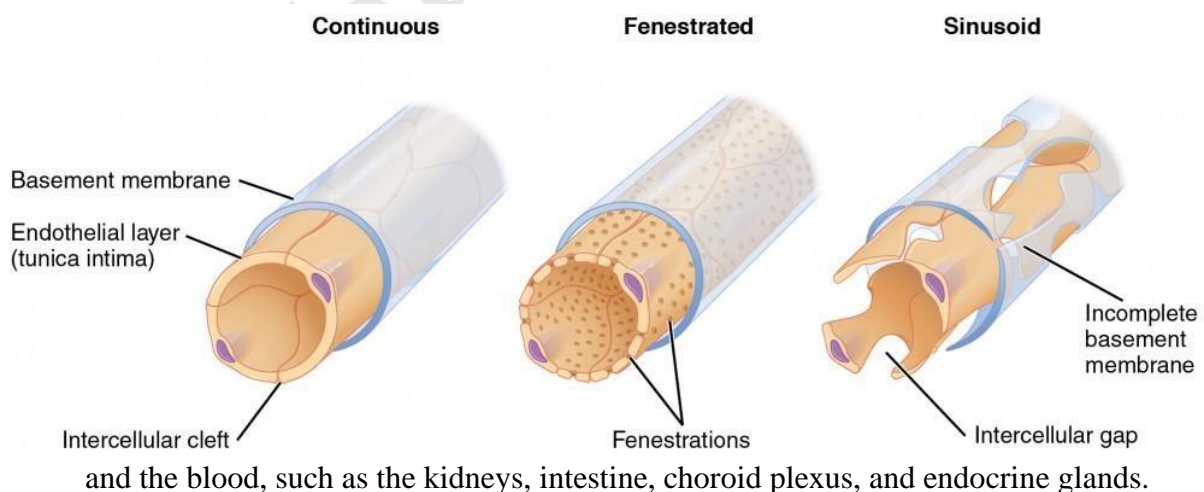
### Capillary Beds

Capillaries permit and regulate metabolic exchange between blood and surrounding tissues. These smallest blood vessels always function in networks called capillary beds. Capillaries are composed of the simple layer of endothelial cells rolled up as a tube surrounded by basement membrane. the structure of capillaries varies based on the functions of various organs.

Capillaries are generally grouped into three histologic types (Figure1):

**1- Continuous capillaries:** Continuous capillaries have many tight, well-developed occluding junctions between slightly overlapping endothelial cells, which provide for continuity along the endothelium and well-regulated metabolic exchange across the cells. This is the most common type of capillary and is found in muscle, connective tissue, lungs, exocrine glands, and nervous tissue.

**2- Fenestrated capillaries:** Fenestrated capillaries have a sieve-like structure that allows more extensive molecular exchange across the endothelium. The endothelial cells are penetrated by numerous small circular openings or fenestrations. Fenestrated capillaries are found in organs with rapid interchange of substances between tissues

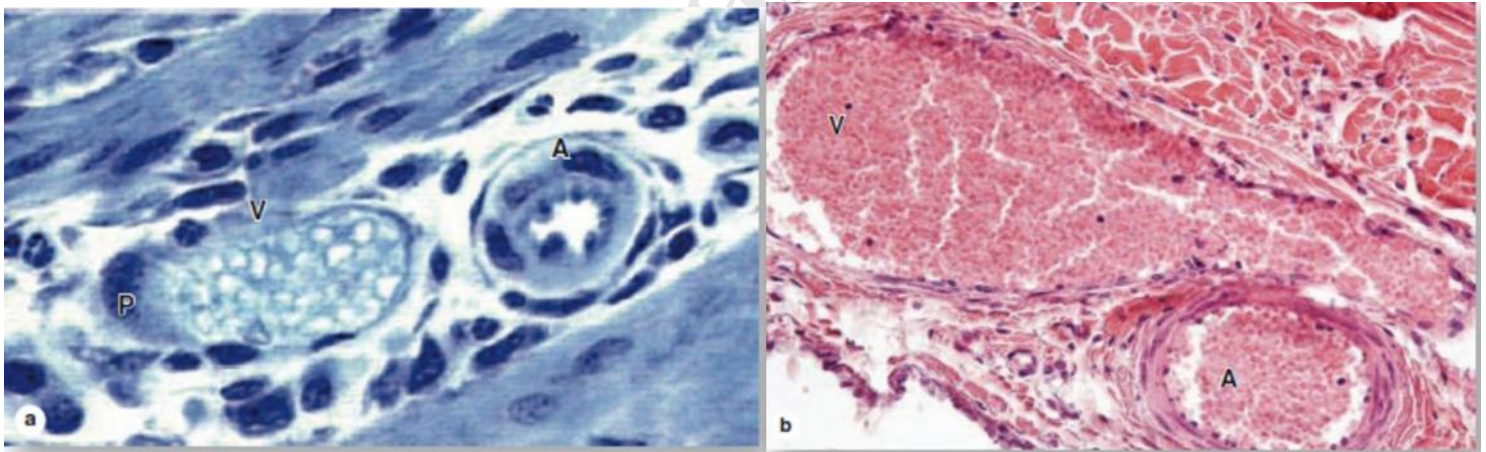


**Figure 1:** Types of capillaries

**3- Discontinuous capillaries:** Discontinuous capillaries commonly called sinusoids, permit maximal exchange of macromolecules as well as allow easier movement of cells between tissues and blood. The endothelium here has large perforations without diaphragms and irregular intercellular clefts. Sinusoidal capillaries of this type are found in the liver, spleen, some endocrine organs, and bone marrow.

### 3- Venules

The transition from capillaries to venules occurs gradually. Post-capillary venules are similar to capillaries with pericytes but larger, ranging in diameter from 15 to 20  $\mu\text{m}$ . Post-capillary venules are the primary site at which white blood cells adhere to endothelium and leave the circulation at sites of infection or tissue damage.



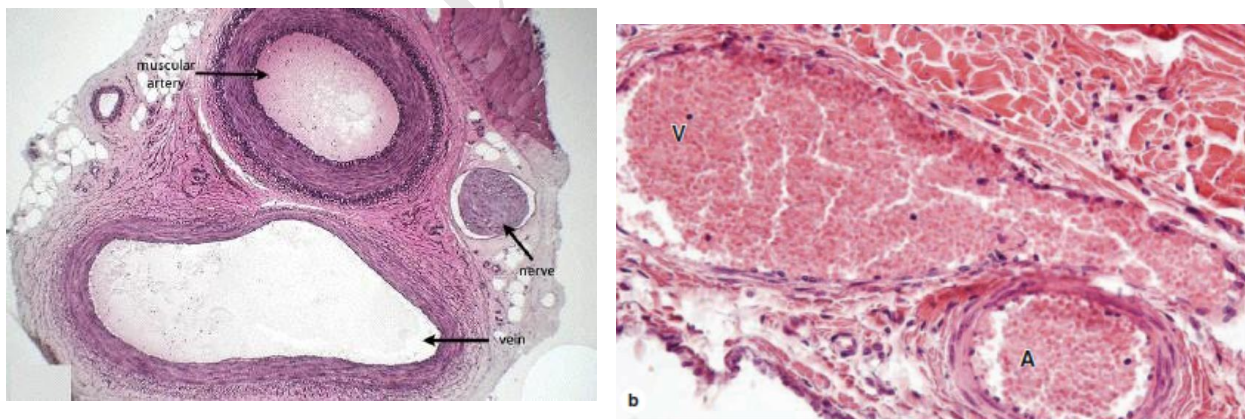
**Figure 2:** Structure of vein

Post-capillary venules converge into larger collecting venules that have more distinct contractile cells. With increasing size venules become surrounded by a recognizable tunica media with two or three smooth muscle layers and are called muscular venules. A characteristic feature of all venules is the large diameter of the lumen compared to the overall thinness of the wall.

Veins carry blood back to the heart from microvasculature all over the body. Blood entering veins is under very low pressure and moves toward the heart by contraction of the smooth muscle fibers in the media and by external compressions from surrounding skeletal muscles and other organs. Most veins are classified as small or medium veins, with diameters of 10 mm or less.

#### 4- Veins

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**Figure 3:** Types of veins

These veins are usually located close and parallel to corresponding muscular arteries. The tunica intima is usually thin, the media has small bundles of smooth muscle cells mixed with a network of reticular fibers and delicate elastic fibers, and the collagenous adventitial layer is thick and well developed.

The big venous trunks, paired with elastic arteries close to the heart, are the large veins. These have well-developed intimal layers, but relatively thin media with alternating smooth muscle and connective tissue. The tunica adventitia is thicker than the media in large veins and frequently contains longitudinal bundles of smooth muscle. Both the media and adventitia contain elastic fibers, and an internal elastic lamina like those of arteries may be present (Figure 4).

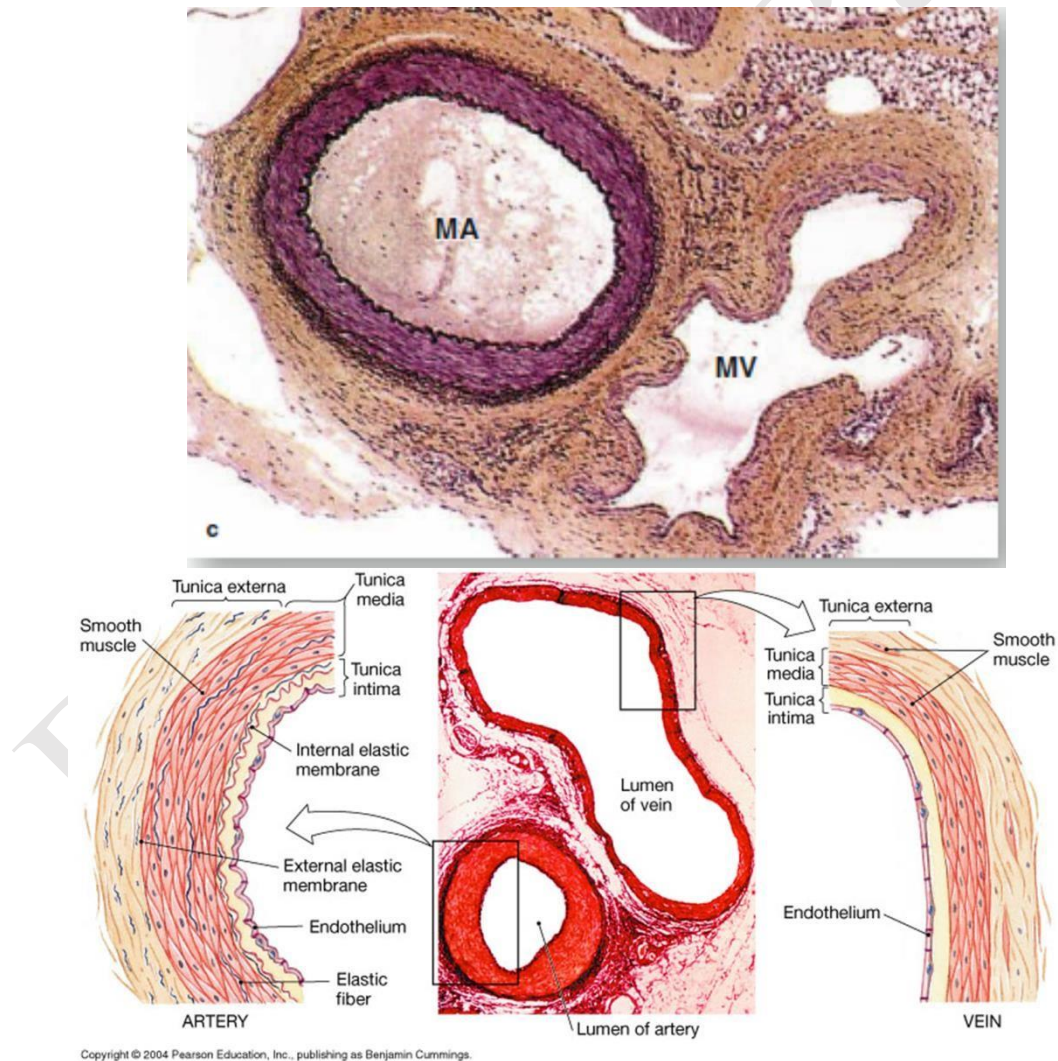


Figure 4: Types of veins

An important feature of large and medium veins are valves, which consist of thin, paired folds of the tunica intima projecting across the lumen, rich in elastic fibers and covered on both sides by endothelium. The valves, which are especially numerous in veins of the legs, help keep the flow of venous blood directed toward the heart (Figure 5).

### Structure of Blood Vessels – 3 Layers “Tunics”

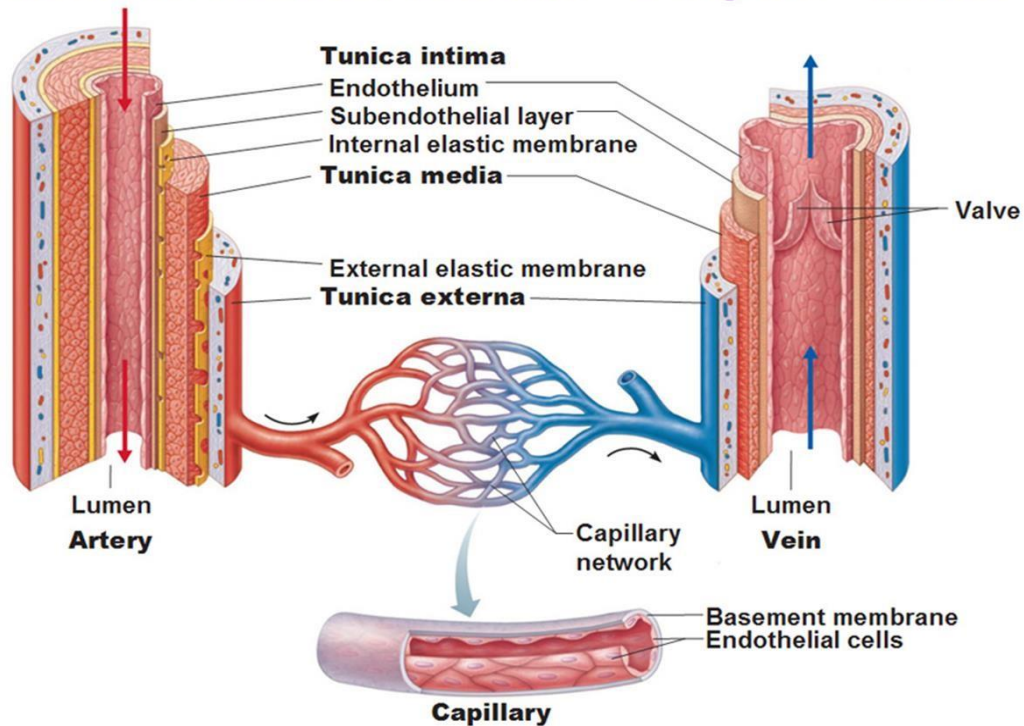


Figure 5: Types of veins