

The circulatory system

The circulatory system provides a means of conveying nutrients and oxygen to and wastes out of the internal cells that make-up our bodies. There are two major components of the circulatory system.

A. The cardiovascular system

1. Arteries, 2. Arterioles, 3. Capillaries, 4. Veins 5. Venules 6. Heart.

B. The lymph vascular system

1. Blind ended lymphatic capillaries that collect lymph fluid from tissues.
2. Larger lymphatic vessels that connect with one and other and finally empty collected lymph into large veins in the neck where the lymphatic and cardiovascular systems merge.

The cardiovascular system

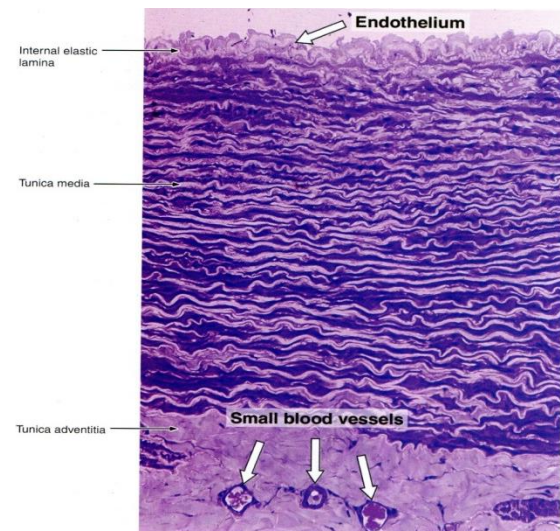
1. Arterial system:

There are three main types of arteries:

- **Elastic arteries**
- **Muscular arteries**
- **Arterioles**

○ **Elastic arteries**

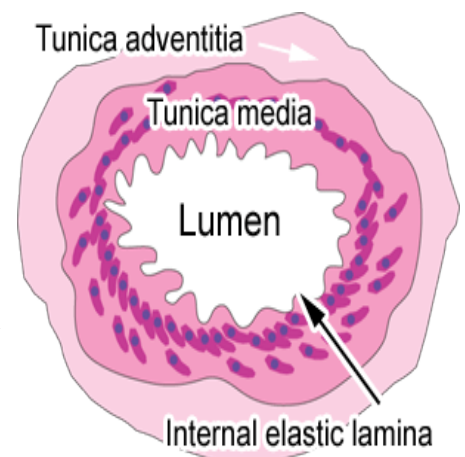
These arteries that **receive** blood directly from the heart; includes the **Aorta** and the **pulmonary artery**; they need to be elastic because when the heart contracts, and ejects blood into these arteries, the walls need to stretch to accommodate the blood surge. The walls of these arteries have lots of elastin.



a- **Tunica intima** is made up of an epithelium, which is a single layer of flattened epithelial cells, together with a supporting layer of elastin rich collagen. This layer also has fibroblasts and 'myointimal cells' that accumulate lipid with ageing, and the intima layer thickens, one of the first signs of atherosclerosis.

a- **Tunica media** is broad and elastic with concentric fenestrated sheets of elastin, and collagen and only relatively few smooth muscle fibers.

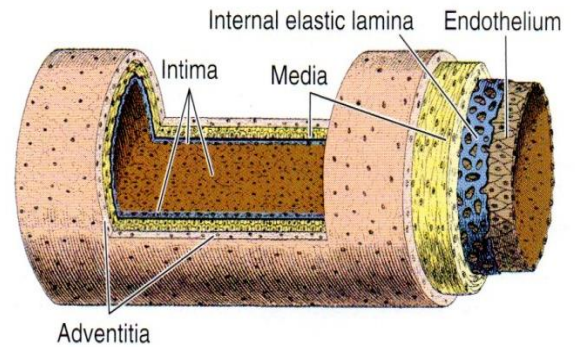
b- **Tunica adventitia** - has small **vasa vasorum** "a network of small blood vessels is present in the adventitia" as the large arteries need their own blood supply.



○ **Muscular artery**

These arteries **distribute** blood to various parts of the body. These include arteries such as the **femoral** and **coronary arteries**. The walls of these arteries have lots of smooth muscle, which means that they are able to contract or relax (dilate) to change the amount of blood delivered, as needed.

Comparing these arteries to the elastic arteries, the sheet of elastin is now much reduced, and found at the border between the tunica intima and tunica media in a layer called the **internal elastic layer (IEL)**. Less well defined is the **external elastic layer (EEL)**, between the tunica media and tunica adventitia. There is a well-defined circular layer of smooth muscle in the tunica media.



The tunica intima has an endothelium of flattened endothelial cells. **The tunica media** is primarily a layer of smooth muscle, with some elastin and collagen fibers, and is sandwiched between the IEL and EEL. **The Tunica Adventitia** is very broad, and mostly contains collagen and elastin.

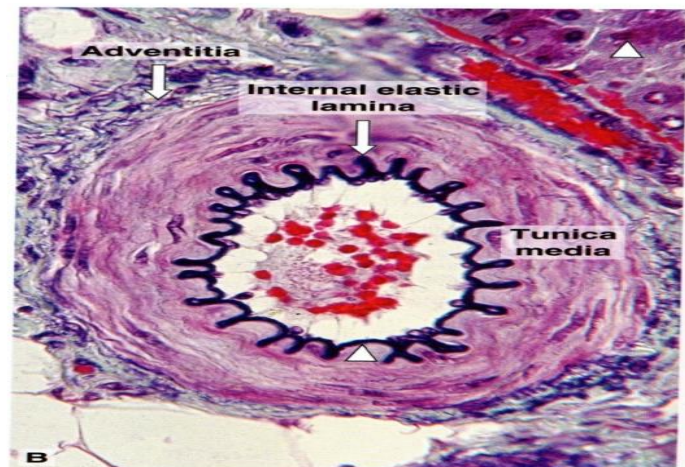
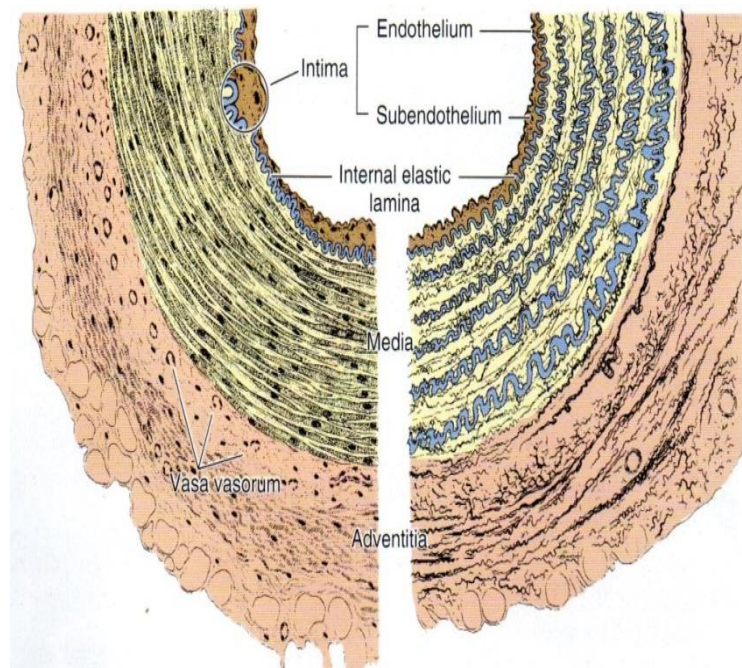
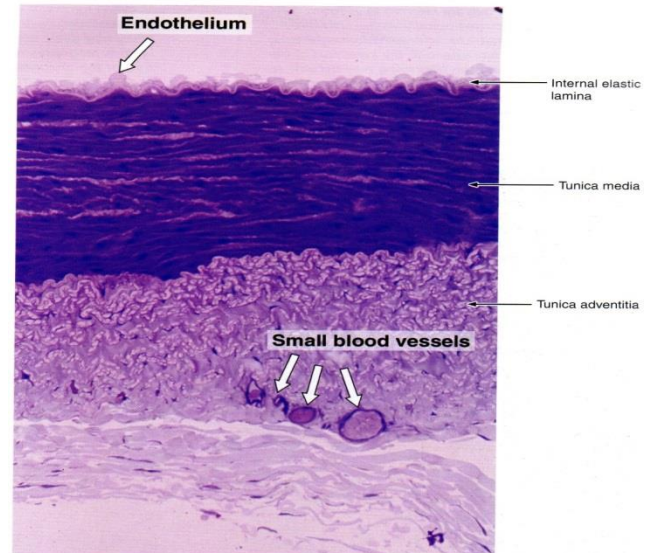


Figure: Diagrams of a muscular artery (left) and an elastic artery (right). The tunica media of a muscular artery contains predominantly smooth muscle, whereas the tunica media of an elastic artery is formed by layers of smooth muscle intercalated by elastic laminas. The adventitia and the outer part of the media have small blood vessels (vasa vasorum) and elastic and collagenous fibers.



Vasa Vasorum

- Founded in Large vessels ("vessels of the vessel"),
- which are arterioles, capillaries, and venules that branch profusely in the adventitia and the outer part of the media.
- Function: provide metabolites to the adventitia and the media.

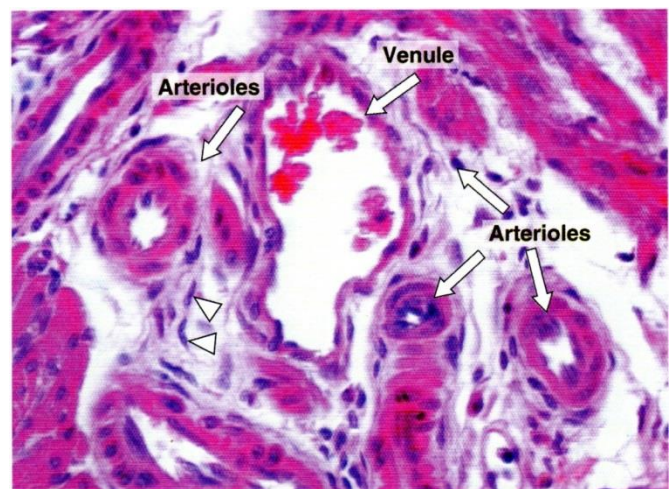
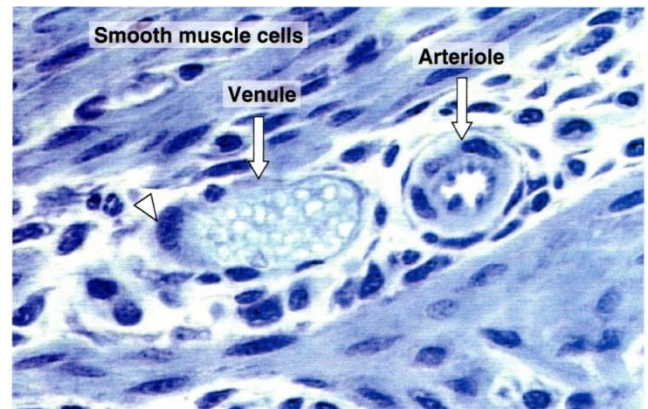


- In arteries of intermediate and large diameter, the intima and the most internal region of the media are devoid of vasa vasorum. These layers receive oxygen and nutrition by diffusion from the blood that circulates into the lumen of the vessel.

Arterioles:

Arterioles are small arteries that deliver blood to capillaries. Arterioles control blood flow through capillary beds by contracting or dilating the size of the lumen, and therefore the **tunica media** layer contains concentric rings of smooth muscle to do this.

The **tunica intima** is very thin, and mostly consists of a single layer of squamous epithelium. The tunica media consists almost entirely of a single layer up to six layers of smooth muscle cells, and there is no EEL. The **Tunica adventitia** is about the same size as the tunica media layer, merges in with surrounding tissue.



Reference:

1- diFIORE'S Atlas of histology with Functional Correlations, eleventh edition,2008.

2- diFIORE'S Atlas of histology with Functional Correlations, twelfth edition,2013.

3- Jonquiere's basic histology text and atlas 13th edition (2013) by Anthony L. Mescher ; Di Fiore's Atlas of Histology 12th ed. (2013) Victor P. Eroschenko