

## Lec.(1)

### • **Cardiovascular System**

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The objectives : Are to know the histological features of heart and blood vessels at different sizes ..

#### **Functions of cardiovascular system: are**

- Pumping blood to the body tissues and cells
- Supplying oxygen and nutrients to tissues and cells
- Removing carbon dioxide and other waste products of metabolism from tissues and cells

The vascular system is subdivided into two functional parts:

1-The blood vascular system and 2-lymphatic vascular system.

#### **1. Blood vascular system:**

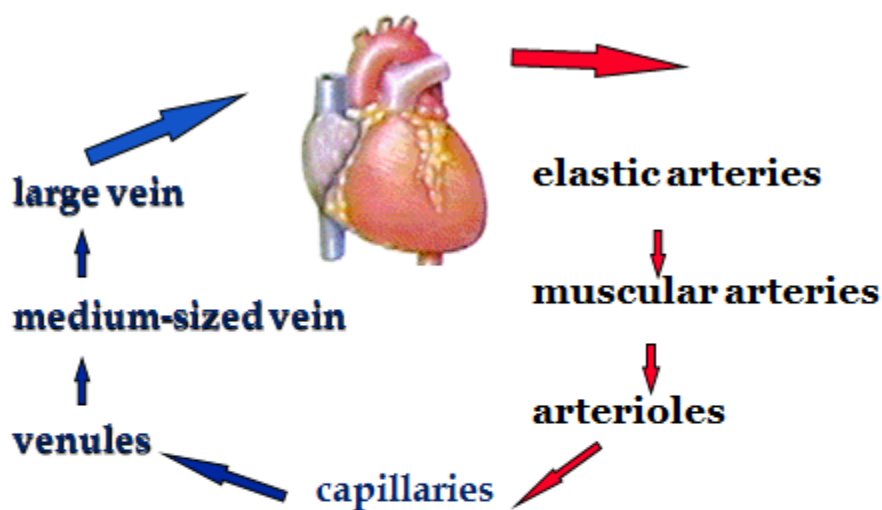
- A - It composed of muscular pump organ the heart and blood vessels (arteries, arterioles, capillaries, venules, and veins)
- B- Blood is the fluid found within the blood vascular system.
- C-. Distribute nutrients, gases, hormones to all parts of the body; collects wastes produced during cellular metabolism.

#### **2. Lymph vascular system:**

- a. It consists of blind-ended capillaries (lymphatic capillaries) connected to lymphatic vessels and various lymphatic organs (e.g., lymph nodes).
- b. It collects tissue fluid which is lymph from tissues and returns it to the blood vascular system.

#### **Circulation Through the Heart:**

- Pulmonary circulation :Circulation of blood from the heart to the lungs for oxygenation and back to the heart.
- Systemic circulation: Circulation of blood from the heart to all parts of the body and back to the heart.
- Blood flows through the blood vessels from the heart and back to the heart in the following order:
  - Elastic Arteries ( conducting) e.g. Aorta, pulmonary artery
  - Muscular Arteries(distributing)
  - Arterioles
  - Capillaries – the only vessels that allow exchange
  - Venules
  - Medium Veins
  - Large Veins e.g. vena cava, pulmonary vein



**Arteries : ALWAYS carry blood away from heart**

**Veins – ALWAYS return blood to heart,  
contain about 2/3 body's blood at any given time**

- **Histological features of Blood Vessels :**

- The wall of the blood vessels is divided into three layers or tunics:

1-The tunica intima

2-The tunica media

3-The tunica adventitia

**1-The tunica intima:** is composed of:

- Endothelium
- Sub endothelium
- Internal elastic lamina

What is endothelium?

**The endothelium** =Is simple squamous epithelium.

**Sub endothelium**=a layer of loose fibro elastic connective tissue is present in most medium to large vessels.

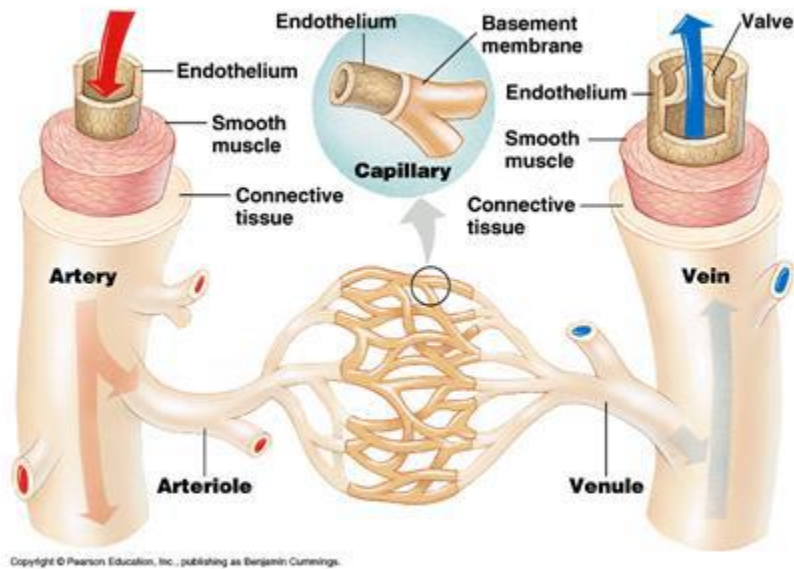
**Internal elastic lamina**, beneath the sub endothelium, which delimits the tunica intima from the tunica media.

**2-The tunica media:**

- Is a layer of smooth muscle circularly arranged and variable amounts of fibro elastic connective tissue alternating with layers of smooth muscle.
- It contains elastic fibers as elastic lamellae (fenestrated sheets).

The external elastic lamina, is located beneath the smooth muscle. It delimits the tunica media from the tunica adventitia.

**3- The tunica adventitia :** Is composed of connective tissue fibers blends with the connective tissue of surrounding the vessel.



- **Types of arteries according to their sizes:**

- **Large arteries=** (elastic arteries or conducting )

The elastic arteries are the aorta and its large branches, that have diameters up to 2.5cm.

They help to stabilize the blood flow.

**Why** Large arteries are called elastic or conducting arteries?

**Histological features of Large arteries:**

1- The tunica intima is thicker than the corresponding tunic of other arteries.

- **A-** The endothelium is thin (relative to other layers in this type of vessel).
- The endothelial cells are flattened easily damaged during preparation and may be difficult to identify the endothelium.

**B-** The sub endothelial layer: Contains elastic fibers, collagen fibers.

These vessels often have a large sub endothelial layer, which grows with age or disease conditions.

**C-**Internal elastic lamina:

- The border between the tunica intima and tunica media .It is not easily to be recognized.
- The intima ends and the media begins where the first elastic sheet or lamella is located.

**(Why?)** Internal elastic lamina is not be seen easily as in other arteries,

2-The tunica media ;It consists of elastic fibers and smooth muscle .

The elastic fibers are concentrically arranged, as fenestrated elastic laminae whose number increases with age (there are about 40 in the newborn, 70 in the adult).

- The smooth muscles are circularly arranged between elastic laminae .
- Collagen fibers reticular fibers, are found.

3-The tunica adventitia: Is layer of connective tissue consists mainly of collagen fibers some elastic fibers, fibroblasts, nerves, macrophages , and vasa vasorum are found.

-What are vasa vasorum ?(They are small blood vessels of blood vessels)

They are small blood vessels, penetrating into the outer part of the tunica media and in tunica adventitia of large blood vessels

**What is the function of :**Elastic fibers ,Fenestrated elastic laminae and muscles in large blood vessels?

- The elastic fibres allow the artery to *stretch* under pressure
- Distension of the walls is facilitated by concentric fenestrated lamellae of elastic fibers in a thick tunica media.
- The thick muscle can contract to *push* the blood along.