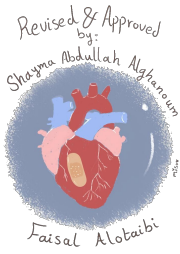


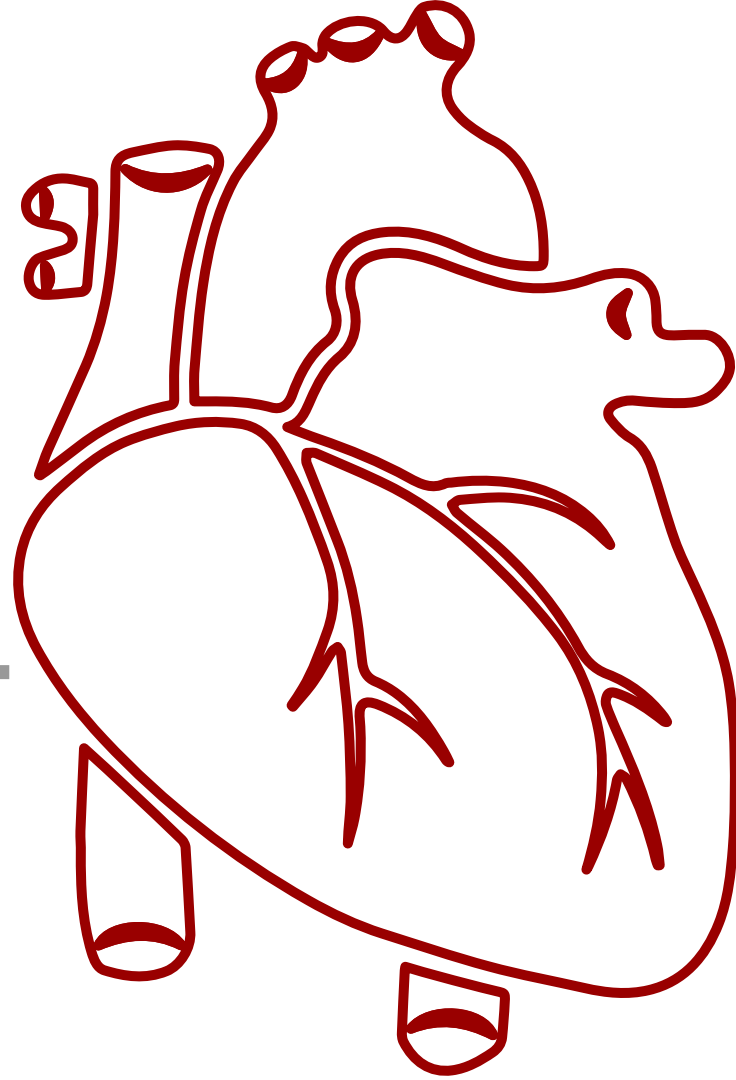


MED439  
KING SAUD UNIVERSITY



# HISTOLOGY OF THE BLOOD VESSELS

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Color index



Important



Extra notes



Notes

Editing file



## Objectives:



by the end of the lecture, our future doctors should be able to describe the microscopic structure of the wall of blood vessels including:

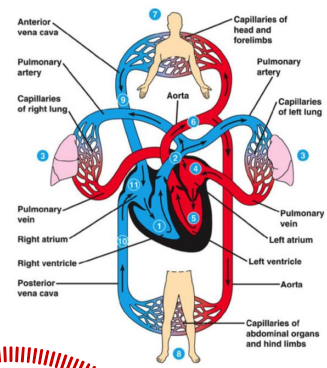
 Elastic arteries.

 Muscular (medium-sized) arteries.

 Medium-sized veins.

 **Blood capillaries.**

**Blood  
Capillaries**



**Blood vessels**

**Arteries**

**Veins**

Elastic arteries  
Medium-sized arteries (Muscular "distributing")  
Arterioles

Venules  
Small veins  
Medium-sized veins  
Large veins

# The wall of blood vessel is formed of 3 concentric layers:

## Tunica intima (interna)

It is the **innermost layer**

Composed of:

- **Endothelial cells:**

Simple squamous epithelium

- **Subendothelial layer:**

loose Connective tissue

- **Internal elastic lamina:**

fenestrated elastic sheet.

fenestrated: ثقوب

## Tunica media

It is the **Intermediate layer**

Composed of:

- **Smooth muscles:**

Helically arranged

- **Elastic fibers.**

- **Type III collagen (reticular fibers).**

- **Type I collagen.**

NB: Large muscular arteries have **external elastic lamina**, separating the tunica media from the tunica adventitia

## Tunica adventitia (externa)

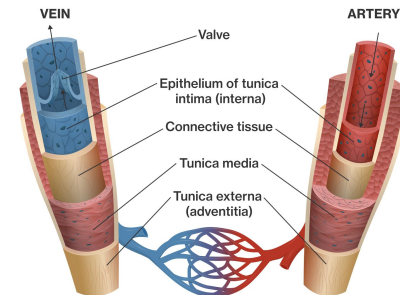
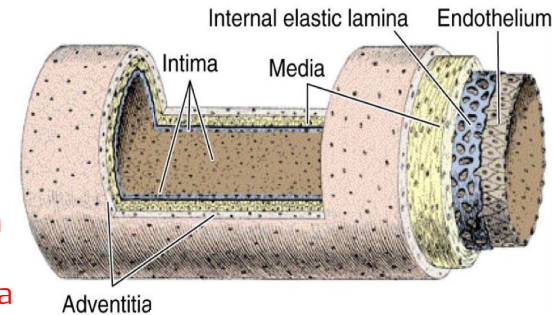
It is the **Outermost layer**

**Composed of connective tissue containing Vasa vasorum:**

- They are small arterioles **in tunica adventitia and the outer part of tunica media.**
- They are more prevalent in the walls of veins than arteries

**why?**

Venous blood contains less oxygen and nutrients than arterial blood.



# Arteries

## Elastic Artery (Large Artery)

- Aorta, common carotid artery, subclavian artery, common iliac artery, pulmonary Trunk.

### Tunica intima (interna)

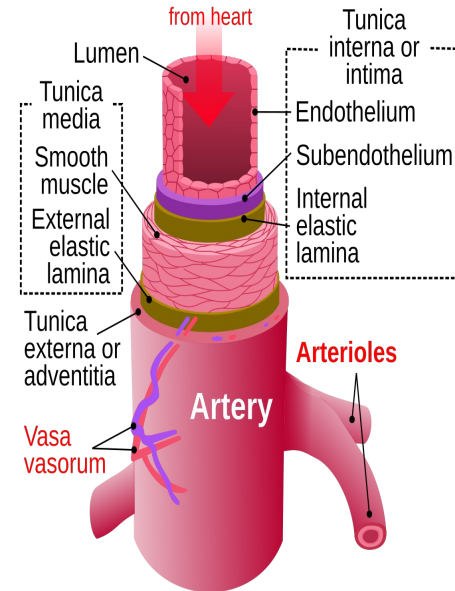
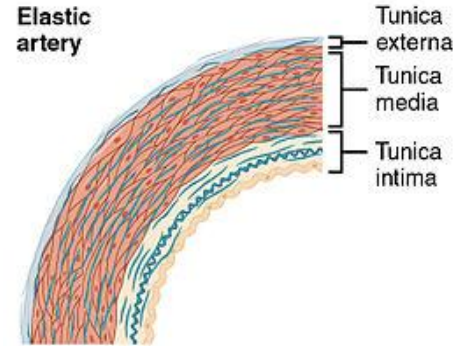
- Endothelium
- Sub-endothelial C.T. layer.
- Internal elastic lamina: not prominent “not clear” & indistinct

#### Components:

- A. Fenestrated elastic membranes:** sheets & lamellae “main component of T.M.” No fibroblasts, The fibers generated by SMC
- B. In between, there are:**
- 1) Elastic fibers “predominant (main) component= 90%”.
  - 2) Collagen fibers (type I collagen).
  - 3) Reticular fibers (type III collagen).
  - 4) Smooth muscle cells Much thicker than T.I and T.A.

### Tunica adventitia (externa)

- Much thinner than T.M.
- It is composed of loose connective tissue Contains vasa-vasorum → send branches to the outer part of T.M



# Arteries

## Muscular arteries (Medium-sized artery)

- Example: brachial, ulnar, renal.  
Muscular because numerous muscle cells

### Tunica intima (interna)

- Endothelium
- Sub-endothelial C.T. layer.
- Internal elastic lamina: Is prominent and Displays an undulating surface.

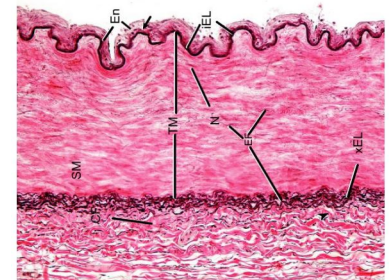
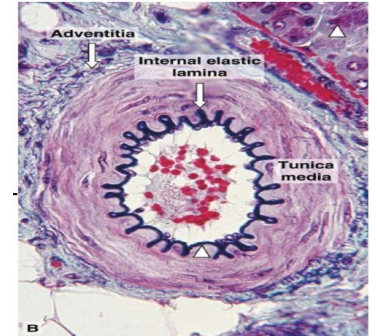
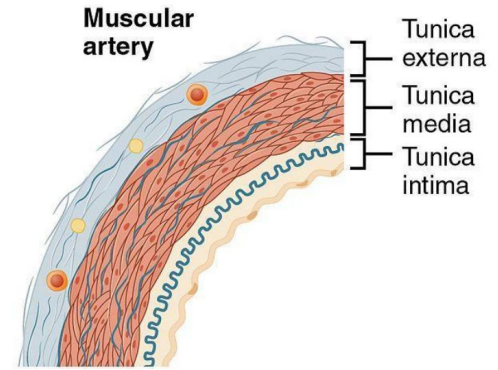
#### Components:

### Tunica media

- A. Smooth muscle cell (SMCs) "predominant component".
- B. In between the smooth muscle, there are:
  - 1) Elastic fibers "predominant (main) component= 90%".
  - 2) Collagen fibers (type I collagen).
  - 3) Reticular fibers (type III collagen).
  - 4) Smooth muscle cells Much thicker than T.I and T.A.

### Tunica adventitia (externa)

- C. External elastic lamina: may be identifiable. (Thicker than T. Adventitia or similar in thickness).
- loose C.T.



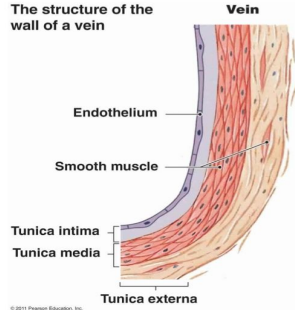
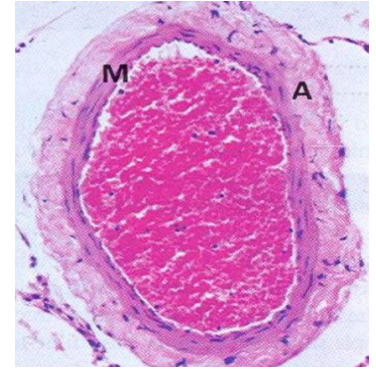
# Medium-Sized Vein

## Thickness of the wall:

thinner than the accompanying artery.

## Tunica media:

- Thinner than T. Adventitia
- **Consists of:**
  1. Fewer Smooth muscle cells.
  2. Types I & III Collagen fibers.



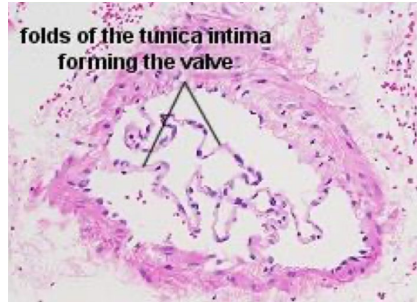
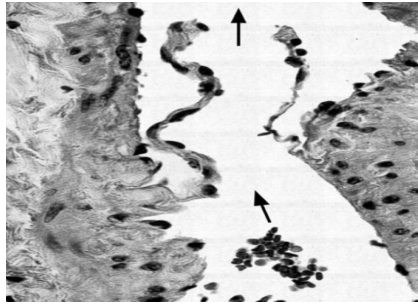
## Tunica intima(interna):

- usually forms valves.
- no internal elastic lamina.

## Tunica adventitia(externa):

- thicker than Tunica Media.





folds of the tunica intima forming the valve

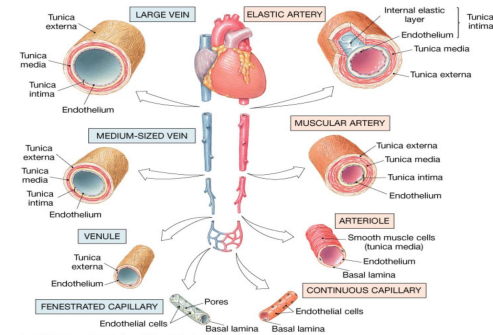
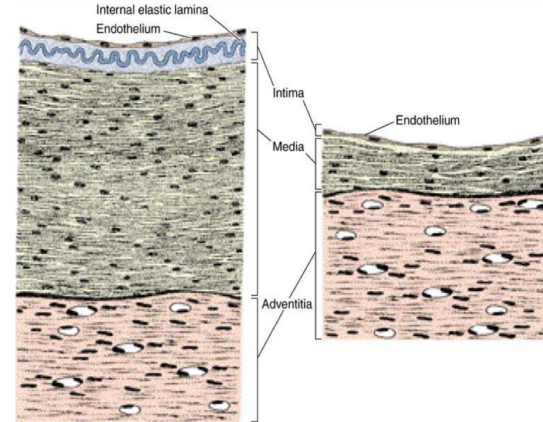
## VALVES OF VEINS

- Valve of a vein is composed of **2 leaflets**.
- Each leaflet has a thin fold of the **Tunica Intima**.

### Components:

- 1) Endothelium
- 2) Core of C.T.

## MEDIUM-SIZED ARTERY AND VEIN



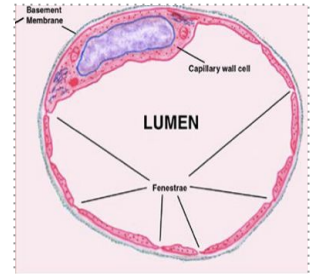


# Blood capillary

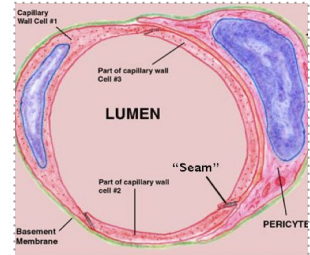
Diameter: usually 8-10

Microscopic structure:

- 1- **Single layer** of squamous endothelial cells.
- 2- **Basal lamina**: surrounds the external surface of the endothelial cells.
- 3- **Pericytes**: Can differentiate into endothelial cells when needed
  - Have processes.
  - Share the basal lamina of the endothelial cells.

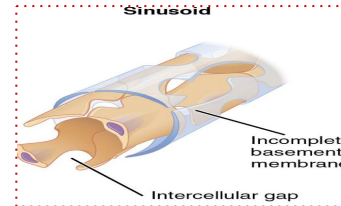
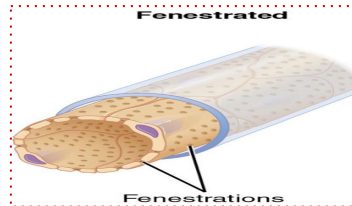
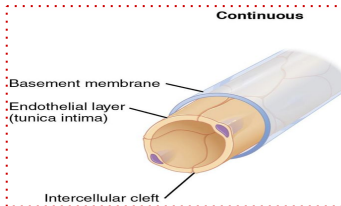
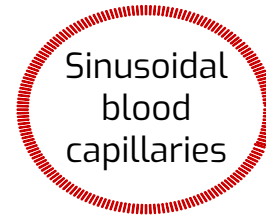
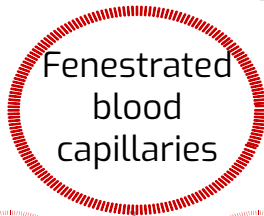
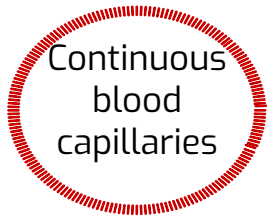


Fenestrated Capillary

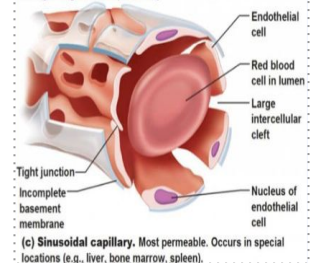


Closed or Continuous Capillary

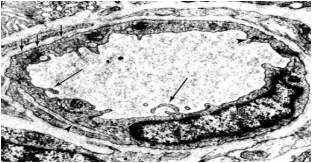
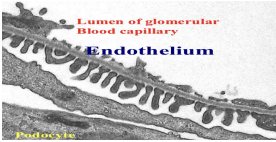
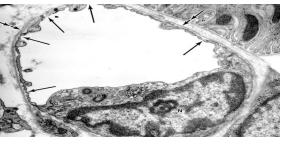
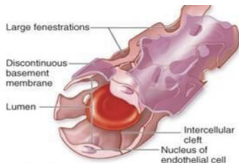
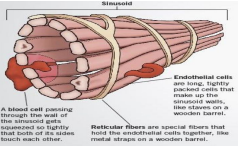
## Types of Blood Capillaries:



Structure of Capillaries: **Sinusoids** have big fenestrations, few tight junctions, and wide intercellular clefts, as well as incomplete basement membranes, allowing for exchange of large molecules (whole cells)



(c) **Sinusoidal capillary**. Most permeable. Occurs in special locations (e.g., liver, bone marrow, spleen).

	Continuous Blood Capillaries	Fenestrated Blood Capillaries	Sinusoidal Capillaries
Microscopic structure	No pores or fenestrae in their walls.	<p><b>Fenestrated Blood Capillaries with Diaphragms:</b></p> <ul style="list-style-type: none"> <li>The walls of their endothelial cells.</li> <li>Have pores (fenestrae).</li> <li>These pores are covered by diaphragm.</li> </ul> <p><b>Fenestrated Blood Capillaries without Diaphragms:</b></p> <ul style="list-style-type: none"> <li>The walls of their endothelial cells.</li> <li>have pores (fenestrae).</li> <li>These pores are <b>NOT covered by diaphragm.</b></li> </ul>	<p>Diameter: <b>irregular</b> (30-40m).</p> <ul style="list-style-type: none"> <li>Their endothelial cells have fenestrae <b>without diaphragms.</b></li> <li>They possess discontinuous endothelial cells.</li> <li>They possess discontinuous basal lamina.</li> <li>Macrophages may be located in or along the outside of the endothelial wall.</li> </ul>
Distribution	<ul style="list-style-type: none"> <li>Muscles</li> <li>Nervous Tissue</li> <li>Connective Tissue</li> </ul>	<p><b>Fenestrated Blood Capillaries with Diaphragms:</b></p> <ul style="list-style-type: none"> <li>Intestine</li> <li>Pancreas</li> <li>Endocrine glands</li> </ul> <p><b>Fenestrated Blood Capillaries without Diaphragms:</b></p> <ul style="list-style-type: none"> <li>Renal glomerulus</li> </ul>	<ul style="list-style-type: none"> <li>Red bone marrow</li> <li>Liver</li> <li>Spleen</li> <li>Certain endocrine glands</li> </ul>
Pic		 <p>Lumen of glomerular blood capillary Endothelium Erythrocyte</p> <p>without Diaphragms</p>  <p>with Diaphragms</p>	 

# Summary

	Tunica intima (interna)	Tunica media	Tunica adventitia (externa)	1) Continuous Blood Capillaries
Elastic Arteries	<ol style="list-style-type: none"> <li>1) Endothelium</li> <li>2) Subendothelil C.T.</li> <li>3) Internal elastic lamina (Not prominent)</li> </ol>	<ol style="list-style-type: none"> <li>1) Fenestrated Elastic Membranes</li> <li>2) In between, there are:               <ol style="list-style-type: none"> <li>A. Smooth muscle cells</li> <li>B. Collagen fibers (Type I)</li> <li>C. Reticular fibers (Type III)</li> <li>D. Elastic Fibers</li> </ol> </li> </ol>	<ul style="list-style-type: none"> <li>• <u>Much Thinner than T.M.</u></li> <li>• Composed of loose C.T.</li> <li>• Contains vasa vasorum</li> </ul>	<p>No pores or fenestrae in their walls</p>
Muscular Arteries	<ol style="list-style-type: none"> <li>1) Endothelium</li> <li>2) Subendothelil C.T. Layer</li> <li>3) Internal Elastic Lamina (Prominent)</li> </ol>	<ul style="list-style-type: none"> <li>• <u>Thicker than T.Adventitia or similar in thickness</u></li> </ul> <ol style="list-style-type: none"> <li>1) Smooth muscle cells</li> <li>2) In between, there are:               <ol style="list-style-type: none"> <li>A. Smooth muscle cells</li> <li>B. Collagen fibers (Type I)</li> <li>C. Reticular fibers (Type III)</li> <li>D. External elastic lamina</li> </ol> </li> </ol>	<ul style="list-style-type: none"> <li>• Loose C.T.</li> </ul>	<p><u>A) Without Diaphragms</u> The walls of their endothelial cells have pores (fenestrae).</p> <p><u>B) With Diaphragms</u> The walls of their endothelial cells have pores (fenestrae) which are <b>covered</b> by a diaphragm.</p>
Medium-sized Veins	<ul style="list-style-type: none"> <li>• <u>Usually forms valves</u></li> <li>• No internal elastic lamina</li> <li>• Composed of 2 leaflets each leaflet has a thin fold of T.Intima Which contain:</li> </ul> <ol style="list-style-type: none"> <li>1) Endothelium</li> <li>2) Core of C.T.</li> </ol>	<ul style="list-style-type: none"> <li>• <u>Thinner than T.Adventitia</u></li> </ul> <ol style="list-style-type: none"> <li>1) Smooth Muscle Cells (Fewer)</li> <li>2) Type I &amp; III Collagen Fibers</li> </ol>	<ul style="list-style-type: none"> <li>• <u>Thicker than T.Media</u></li> </ul>	<p>3) Sinusoidal Blood Capillaries</p> <p>Their endothelial cells have fenestrae without diaphragms and they possess both discontinuous endothelial cells and basal lamina.</p>

# MCQ's

1) Tunica intima of veins forms ..

- A. Internal elastic lamina
- B. Valves
- C. Smooth muscle cells
- D. Collagen fibers

2) The valves of the veins are composed of ?

- A. smooth muscle cells
- B. collagen fibers
- C. endothelium
- D. elastic fibers

3) Which of the following capillaries have fenestrated blood capillaries without diaphragm ?

- A. Muscle
- B. Pancreas
- C. Spleen
- D. Renal glomerulus

4) Smooth muscle cell (SMCs) is Components of ..

- A. Tunica intima
- B. Tunica media
- C. Tunica adventitia
- D. Both b&c

5) Which of the following is found in Tunica Intima ?

- A. endothelium
- B. Elastic fibers
- C. smooth muscles
- D. loose connective tissue

6) Which of the following is false about Arterial Tunica Externa ?

- A. Much thicker than T.M
- B. composed of loose C.T.
- C. Vasa vasorum
- D. All

# Team members



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**Joud Alarifi**

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