

HISTOLOGY OF THE BLOOD VESSELS

By the end of this lecture, the student should be able to identify and describe the microscopic structure of the wall of the blood vessels including:

- a. Elastic arteries.
- b. Muscular (medium-sized) arteries.
- c. Medium-sized veins.
- d. Blood capillaries.

Blood vessels:

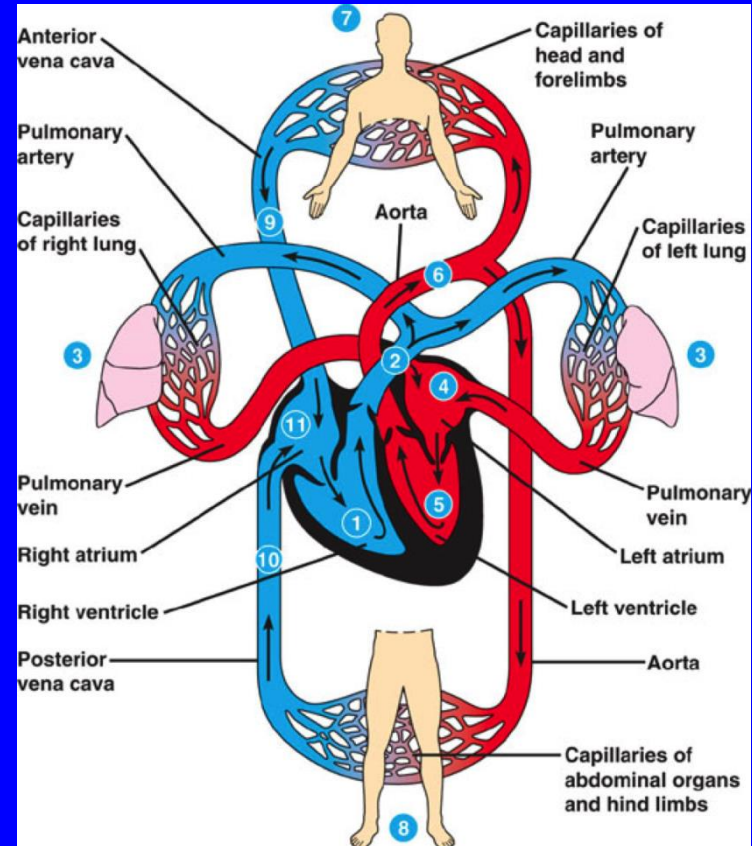
– Arteries:

- Elastic artery.
- Muscular (distributing) (medium-sized) artery.
- Arterioles.

– Blood capillaries.

– Veins:

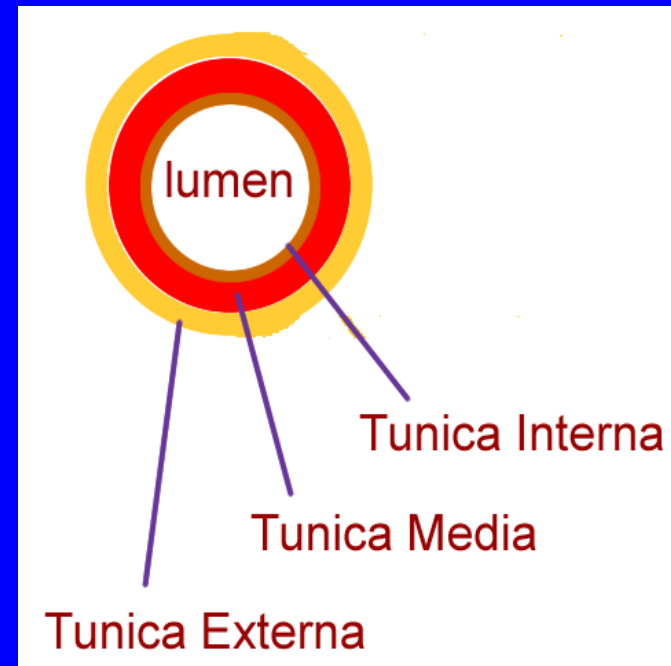
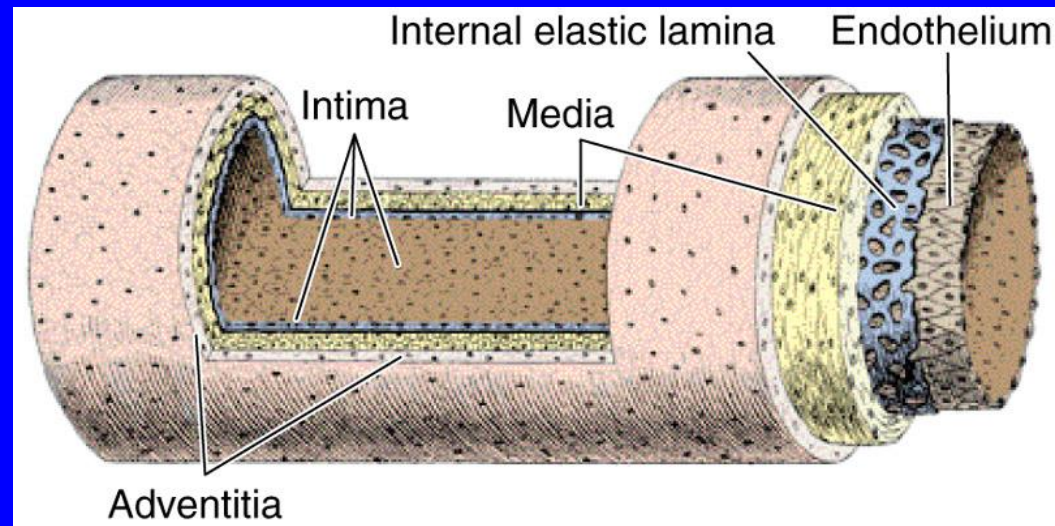
- Venules.
- Small veins.
- Medium-sized veins.
- Large veins.



General Structure of Blood Vessels

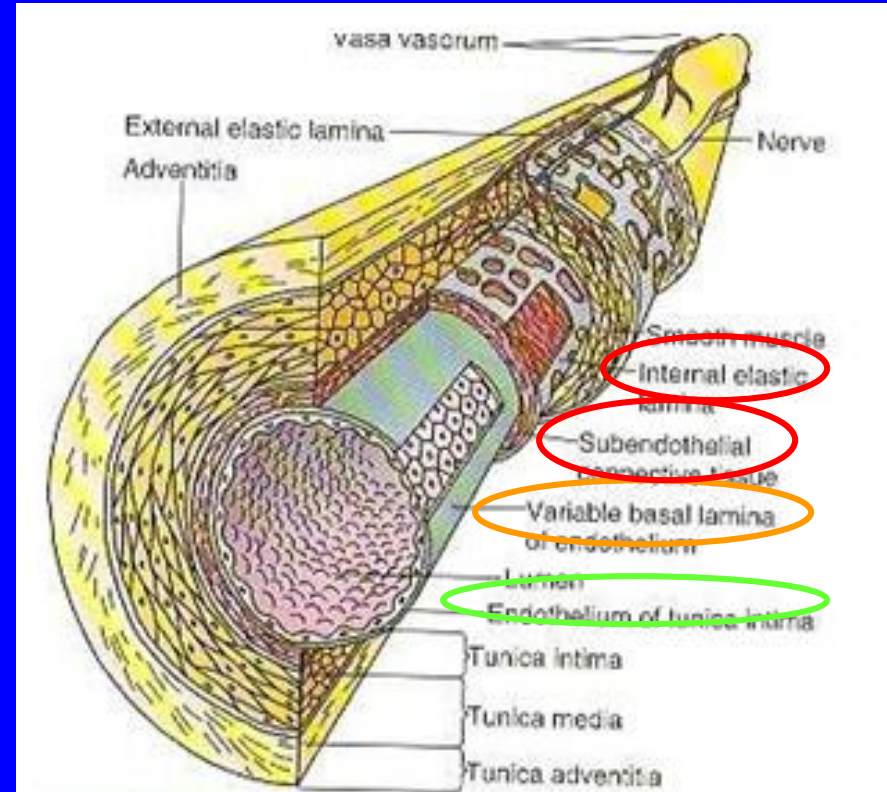
- The wall of blood vessel is formed of three concentric layers:

- Tunica intima (interna)
- Tunica media
- Tunica adventitia (externa)



Tunica Intima

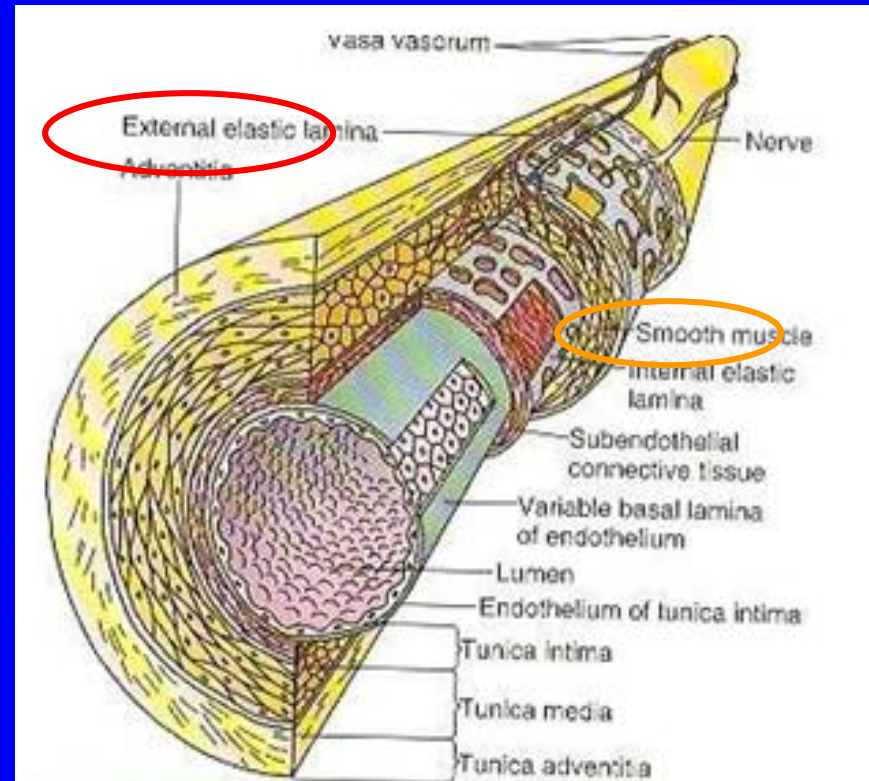
- Is the innermost layer
- Composed of:
 - Endothelial cells:
Simple squamous epithelium
 - Subendothelial layer:
loose C.T.
 - Internal elastic lamina:
fenestrated elastic sheet.



Tunica Media

- Intermediate layer
- Composed of:
 1. Smooth muscles:
 - Helically arranged
 1. Elastic fibers.
 2. Type III collagen (reticular fibers).
 3. Type I collagen.

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



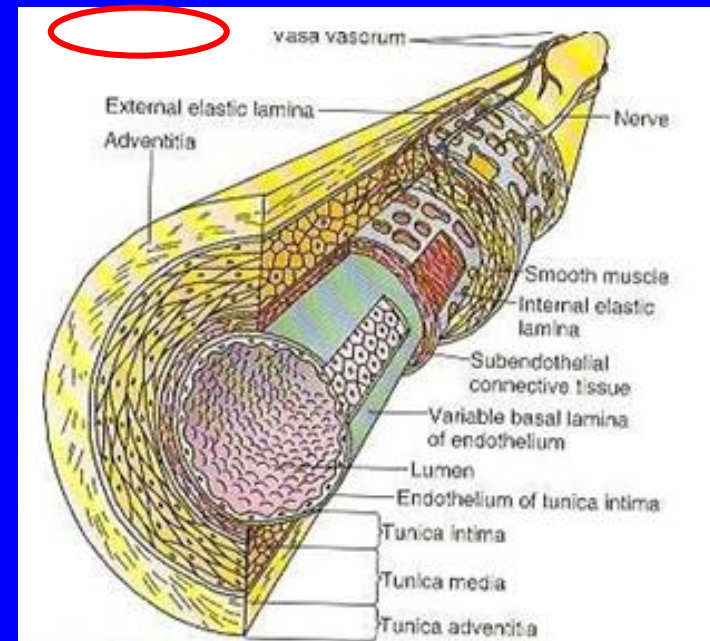
Tunica Adventitia

- 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.



ELASTIC ARTERIES

- Examples: aorta, common carotid a., subclavian a., common iliac a, pulmonary Trunk.

- **Microscopic structure:**

1. T. Intima:

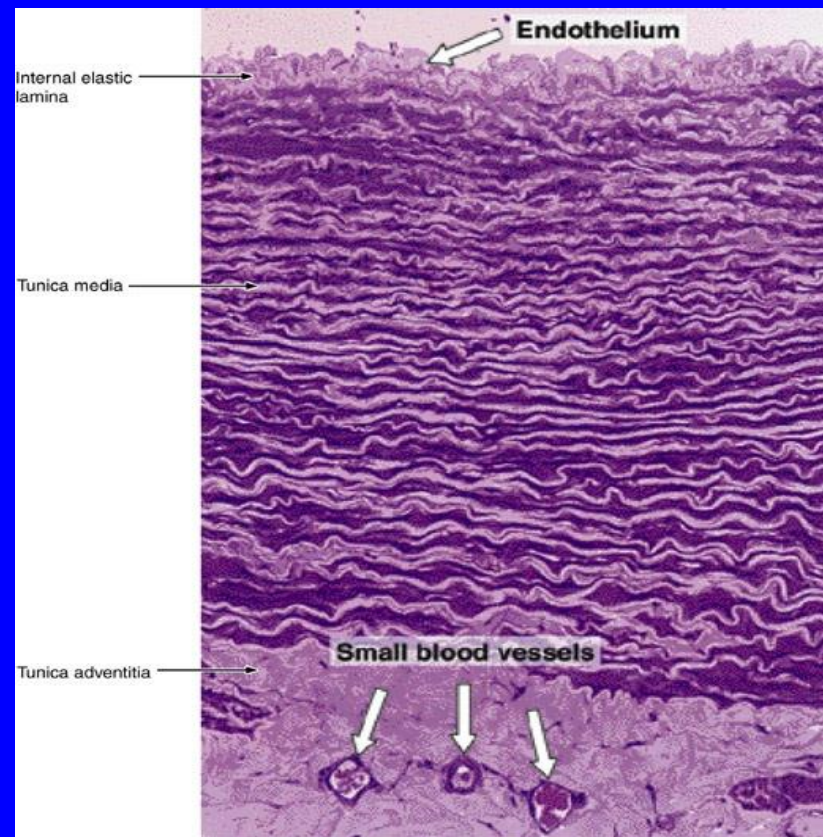
- *Endothelium.

- *Subendothelial C.T.

- *Internal elastic lamina:

 - (not prominent)

 - (indistinct)



ELASTIC ARTERIES (Cont.)

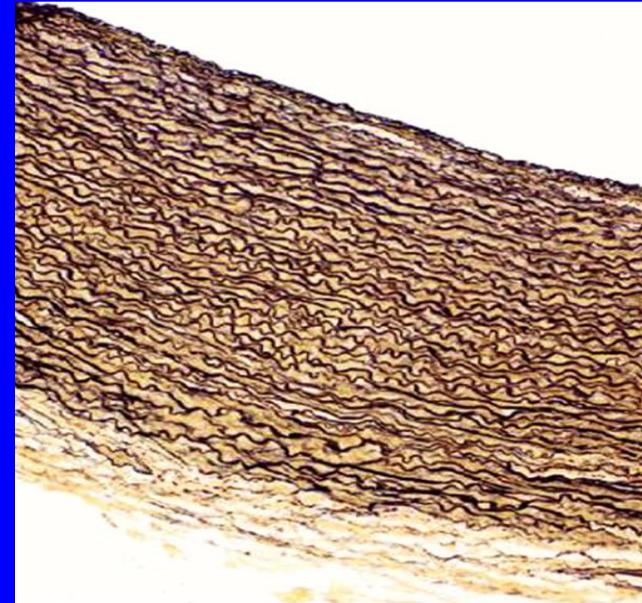
2. T. Media: it consists of:

A. **Fenestrated elastic membranes (sheets) (lamellae):**

It is the main component of T.M.

B. **In between, there are:**

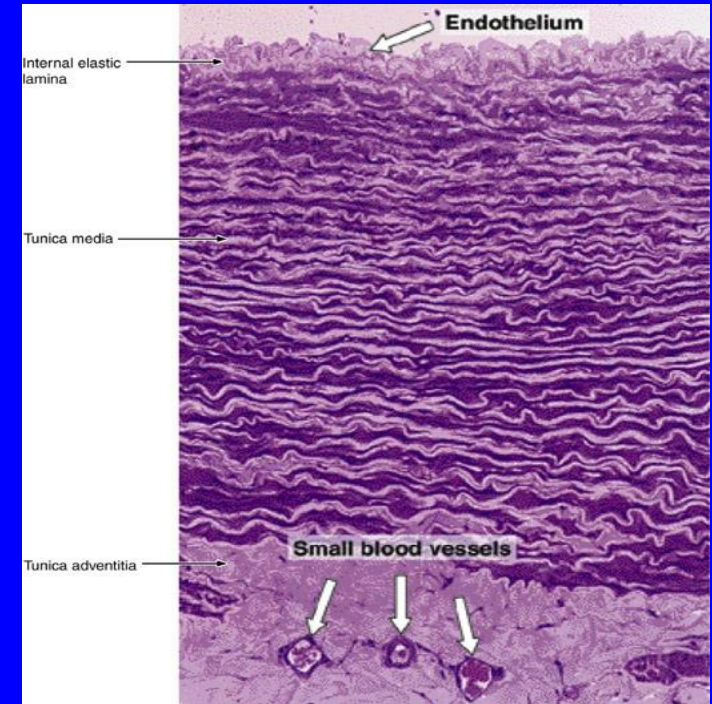
1. Smooth muscle cells.
2. Collagen fibers (type I collagen).
3. Reticular fibers (type III collagen).
4. Elastic fibers.



ELASTIC ARTERIES (Cont.)

3. T. Adventitia:

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



MUSCULAR ARTERIES

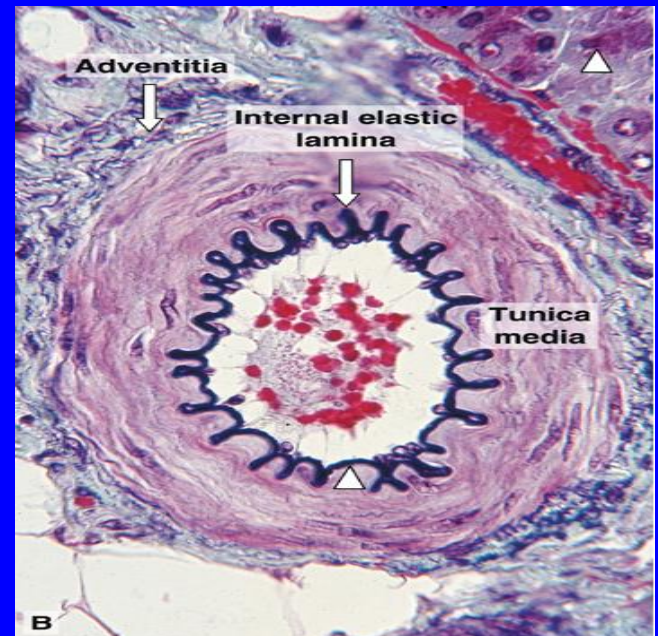
(Medium-sized artery)

■ Examples: brachial, ulnar, renal.

■ **Microscopic structure:**

1. T. Intima.:

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



MUSCULAR ARTERIES (Cont.)

2. T. Media: (Thicker than T. Adventitia or similar in thickness).

Components:

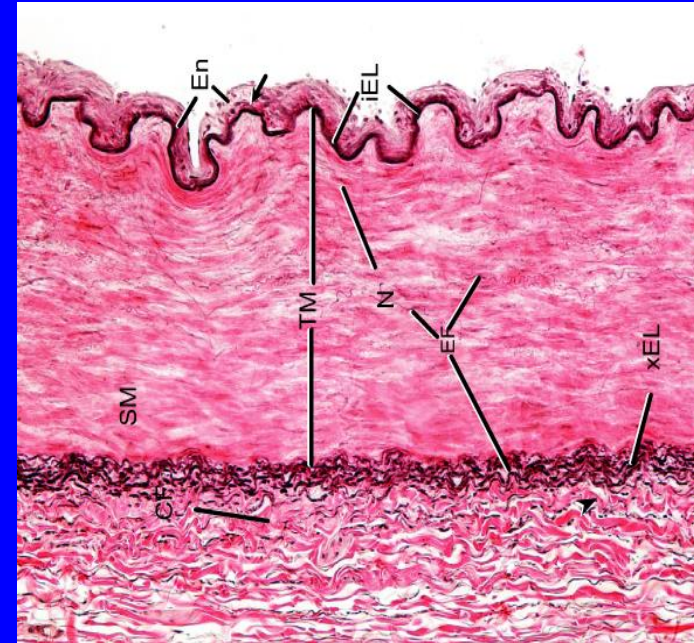
A. **Smooth muscle cells (SMCs):** are the predominant component.

B. **In between there are:**

- Elastic fibers.
- Type III collagen fibers.
- Type I collagen fibers.

C. **External elastic lamina:** may be identifiable.

3. T. Adventitia.: loose C.T.



MEDIUM-SIZED VEIN

- **Thickness of the wall:** thinner than the accompanying artery.

T. Intima: *usually forms **valves**.

*no internal elastic lamina

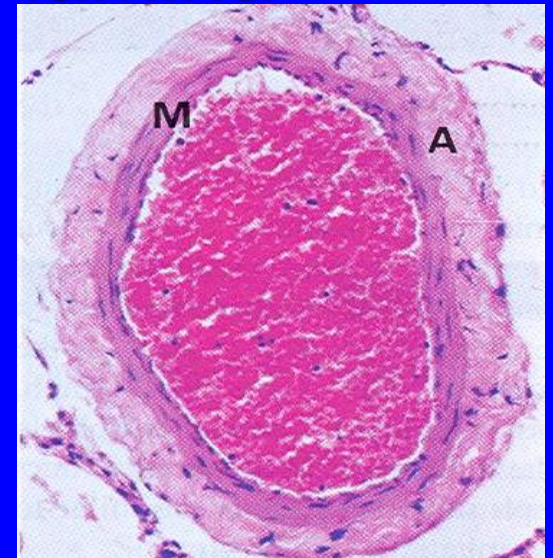
- **T. Media:**

- Thinner than T. Adventitia

- Consists of:

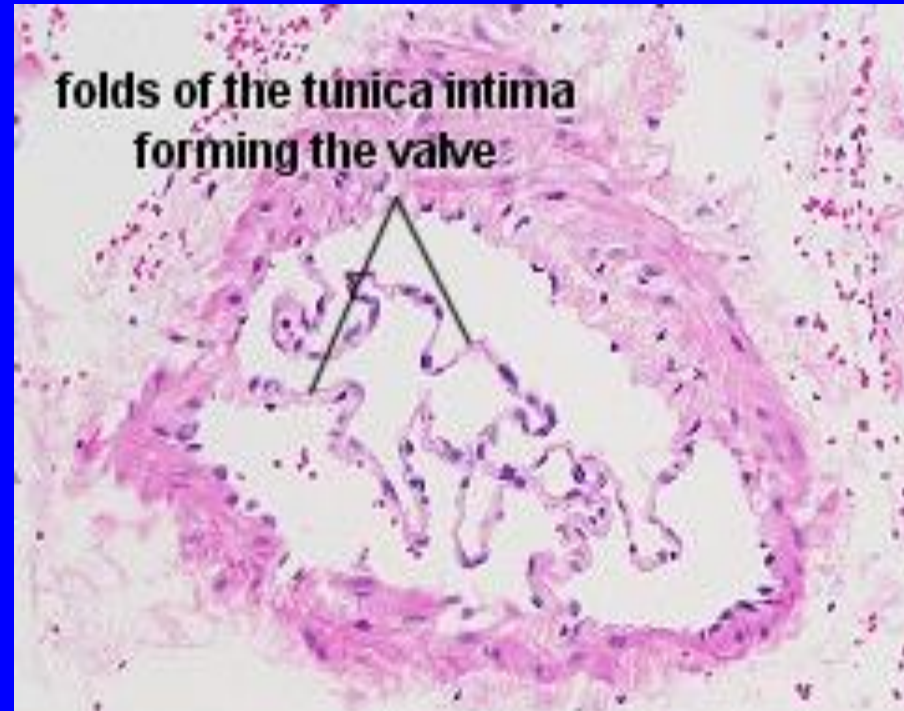
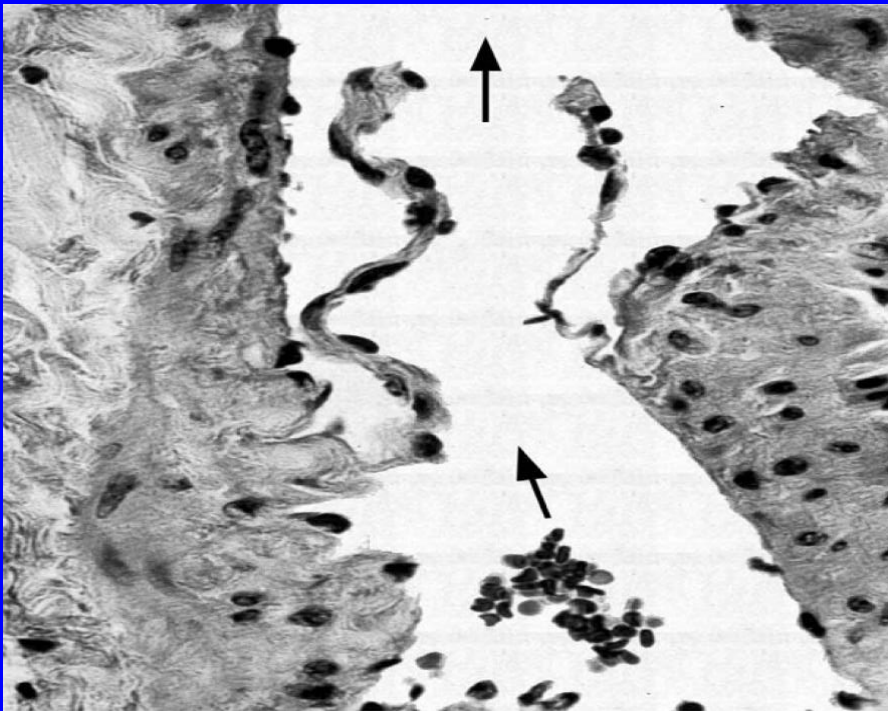
- Fewer SMCs.
- Types I & III Collagen fibers.

- **T. Adventitia:** thicker than T. Media

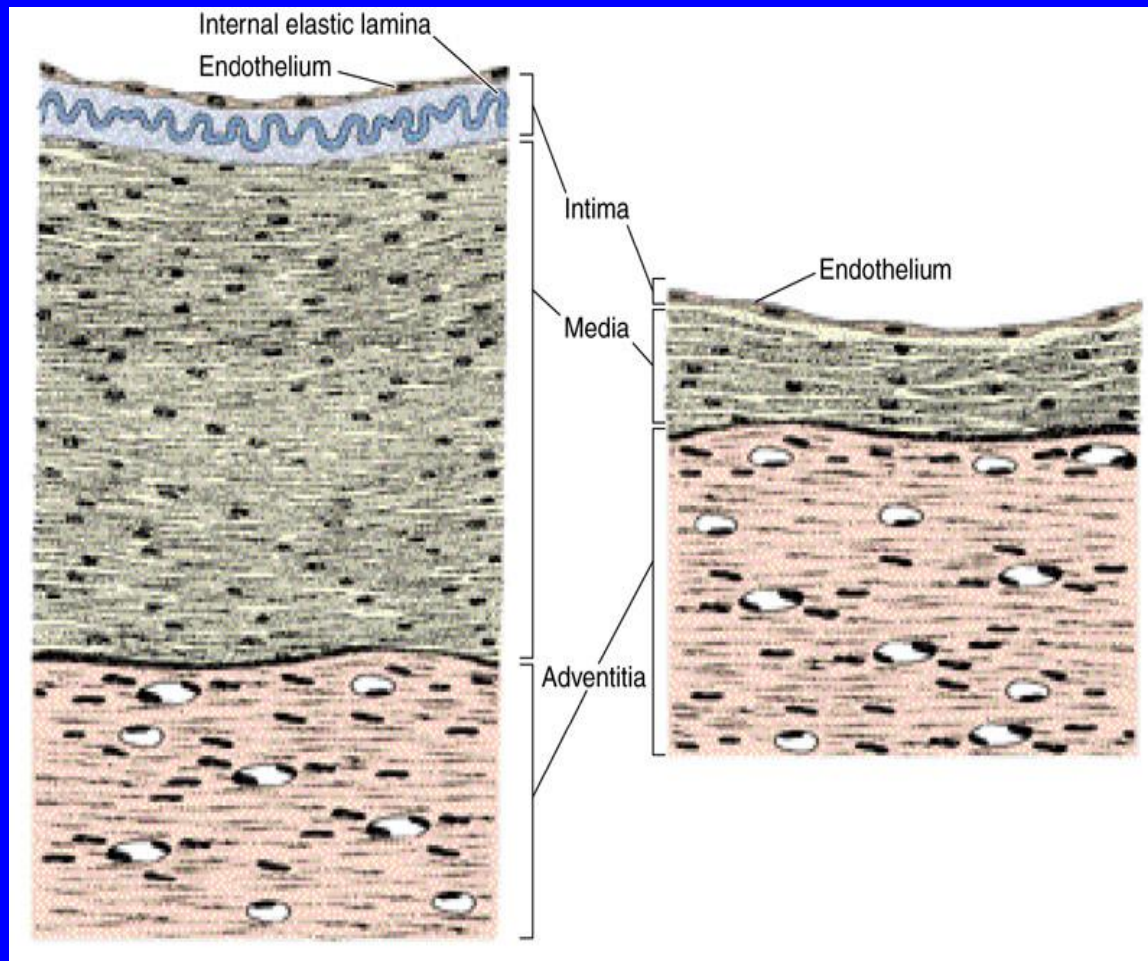


VALVES OF VEINS

- Valve of a vein is composed of 2 leaflets
- Each leaflet has a thin fold of the T. Intima.
- Components:
 - Endothelium
 - Core of C.T.

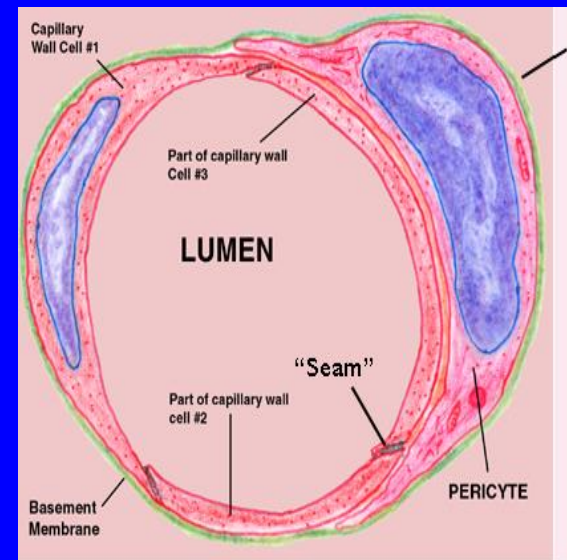


MEDIUM-SIZED ARTERY AND VEIN



BLOOD CAPILLARIES

- Diameter: usually 8-10 μm .
- Microscopic structure:
 1. Single layer of squamous endothelial cells.
 2. Basal lamina: surrounds the external surface of the endothelial cells.
 3. Pericytes:
 - Have processes.
 - Share the basal lamina of the endothelial cells.



Closed or Continuous
Capillary

BLOOD CAPILLARIES

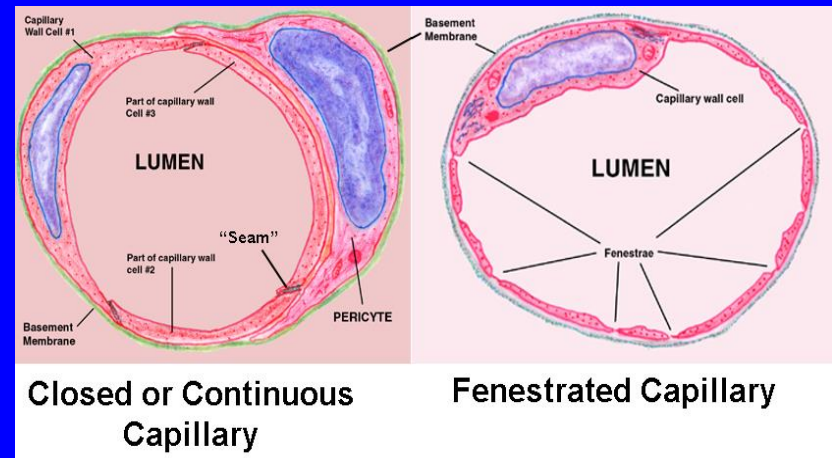
Types:

1- Continuous blood capillaries

2- Fenestrated blood capillaries

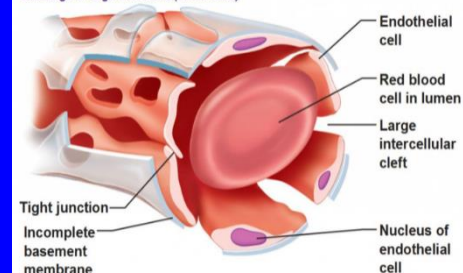
a- with diaphragms

b- without diaphragms



3- Sinusoidal blood capillaries

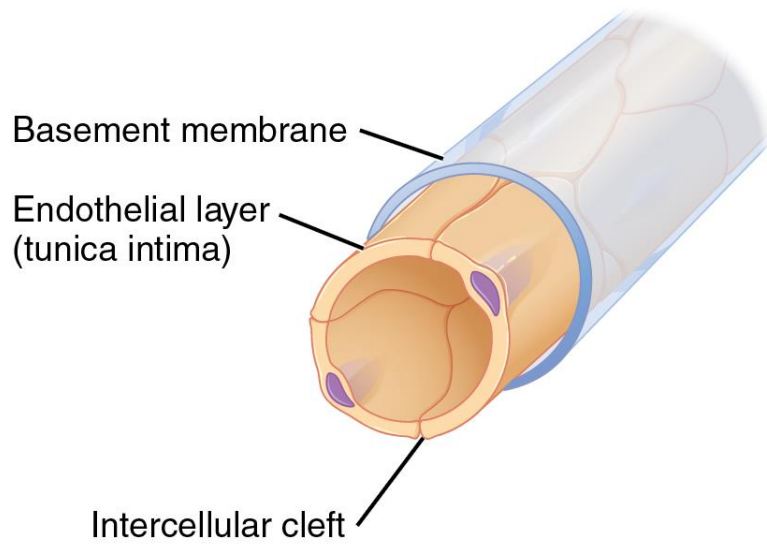
Structure of Capillaries: *Sinusoids* have big fenestrations, few tight junctions, and wide intercellular clefts, as well as incomplete basement membranes, allowing for exchange of large molecules (whole cells)



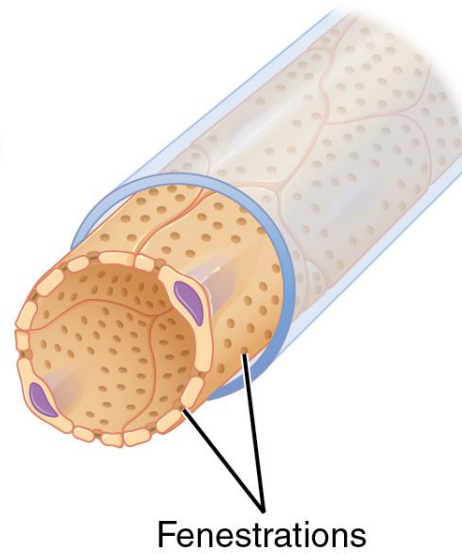
(c) **Sinusoidal capillary.** Most permeable. Occurs in special locations (e.g., liver, bone marrow, spleen).

Types of Blood Capillaries

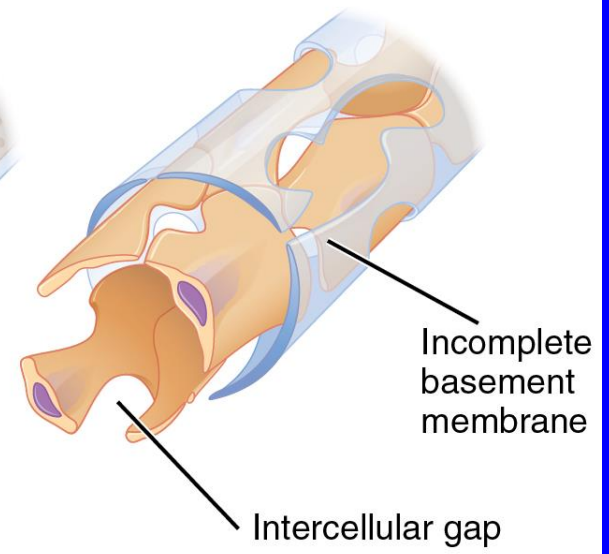
Continuous



Fenestrated



Sinusoid



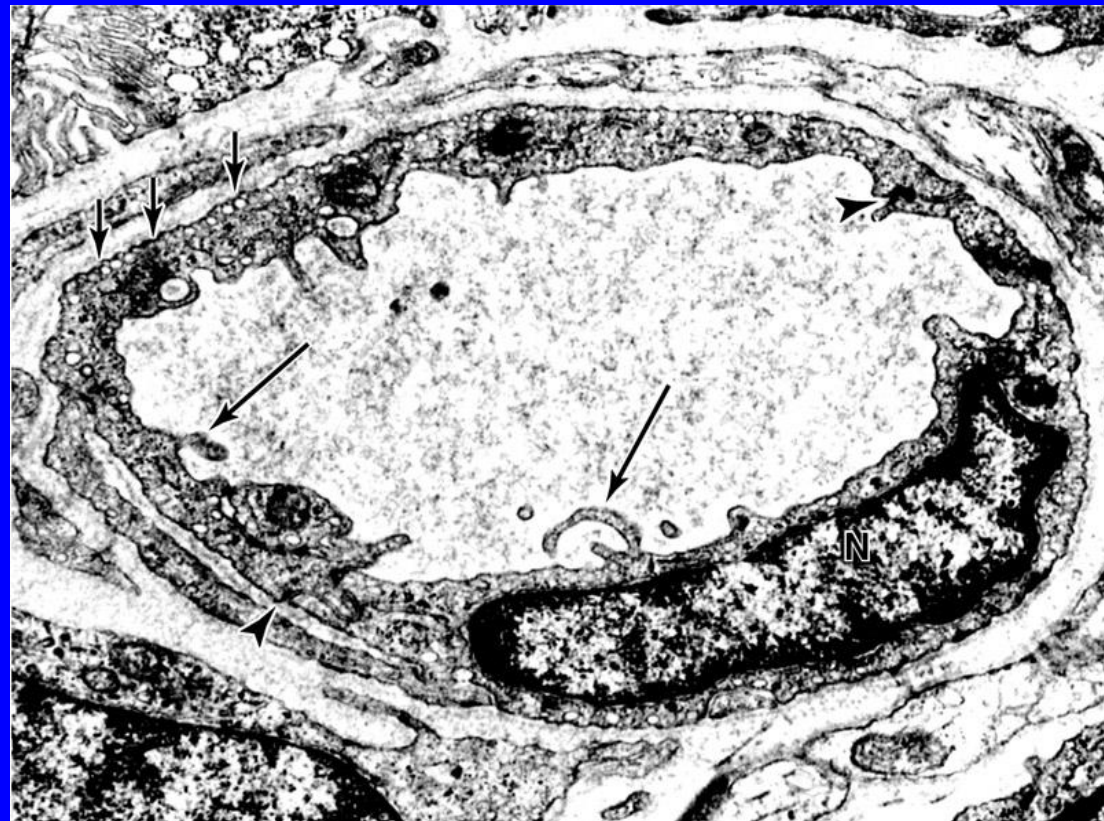
Continuous Blood Capillaries

■ Microscopic structure:

- No pores or fenestrae in their walls.

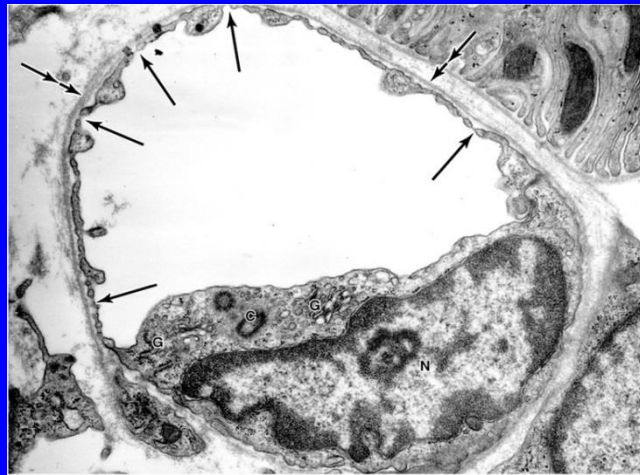
■ Distribution:

- In muscles,
nervous T., C.T.

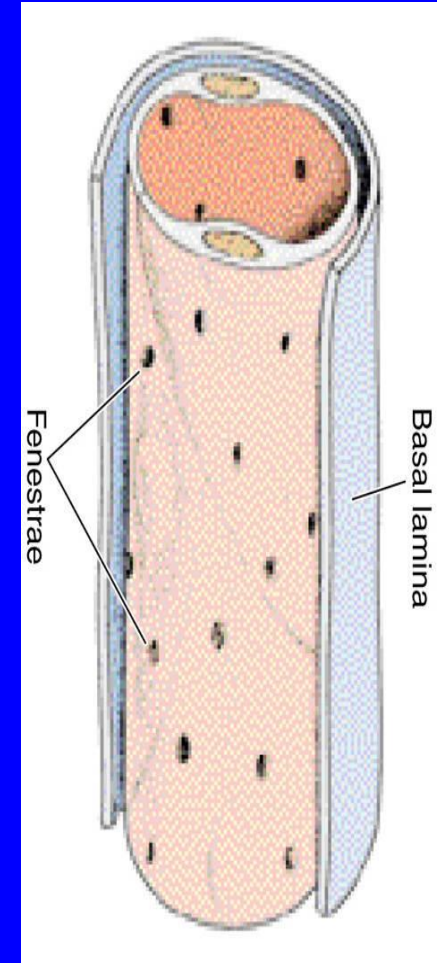


Fenestrated Blood Capillaries with Diaphragms

- Microscopic structure:
 - The walls of their endothelial cells have pores (fenestrae).
 - These pores are covered by diaphragm.

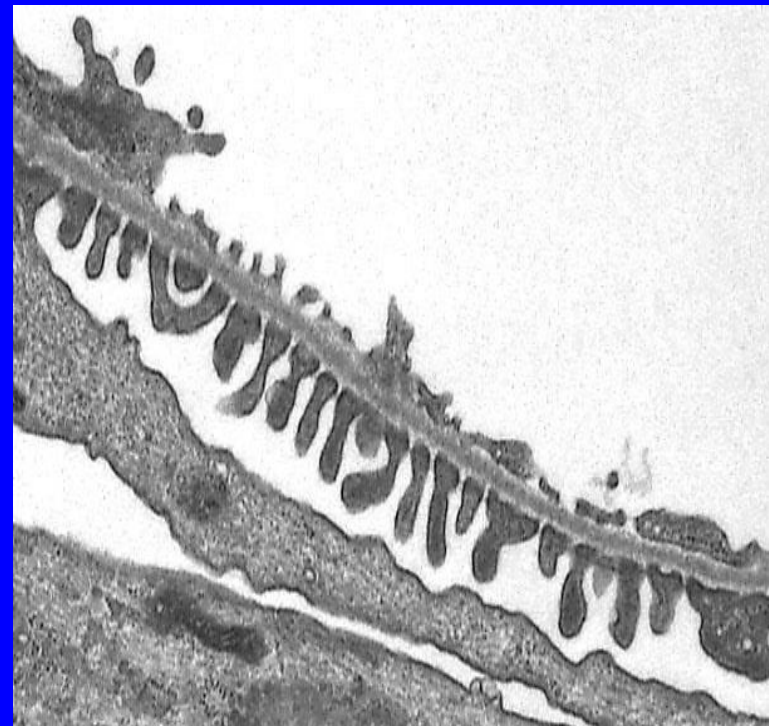


- Distribution:
 - In intestine, pancreas and endocrine glands.

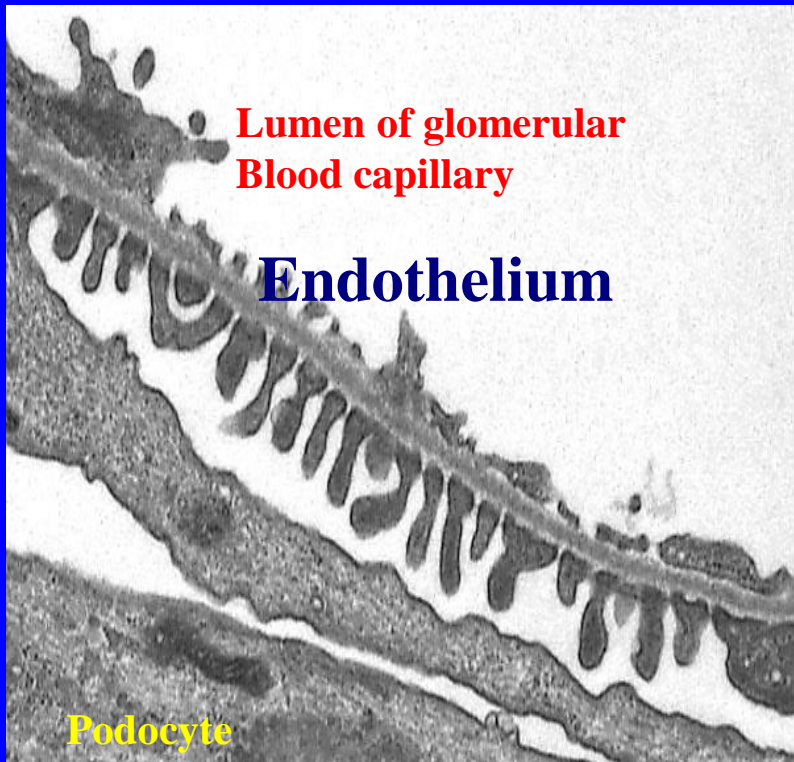


Fenestrated Blood Capillaries without Diaphragms

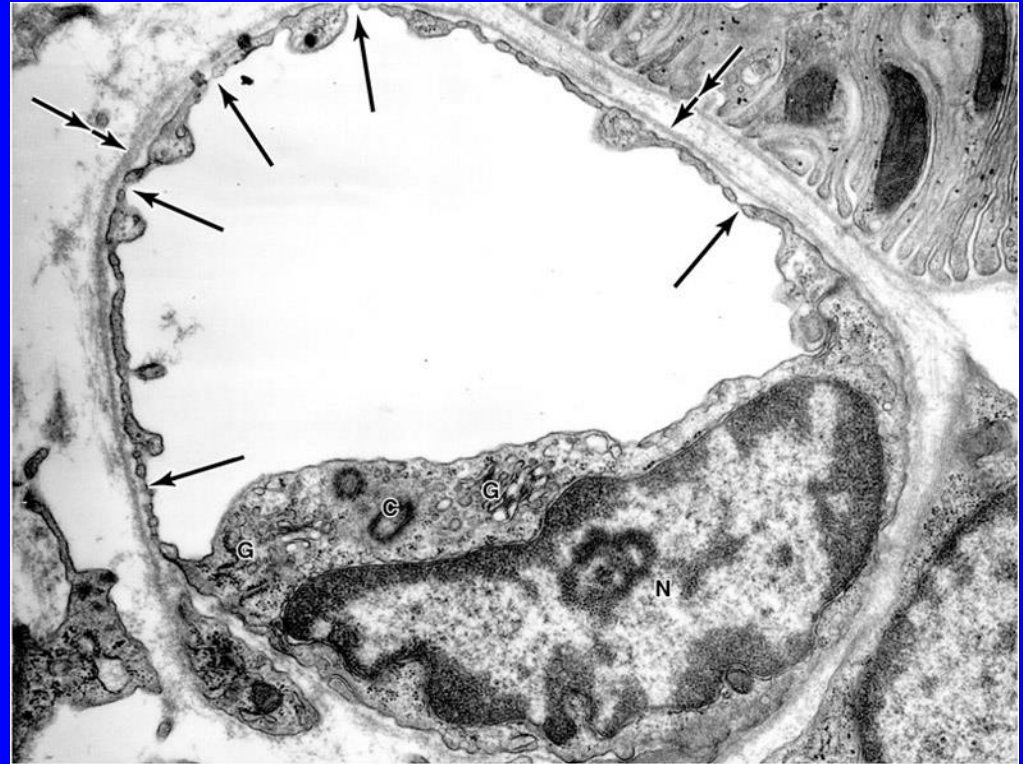
- Microscopic structure:
 - The walls of their endothelial cells have pores (fenestrae).
 - These pores are **NOT** covered By diaphragm.
- Distribution:
 - In renal glomerulus.



**FENESTRATED
CAPILLARY
WITHOUT
DIAPHRAGMS**



**FENESTRATED
CAPILLARY
WITH DIAPHRAGMS**



SINUSOIDAL CAPILLARIES

- Diameter: irregular (30-40 μm).

- Microscopic features:

- Their endothelial cells

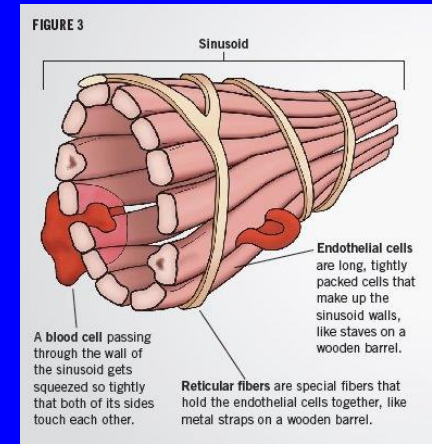
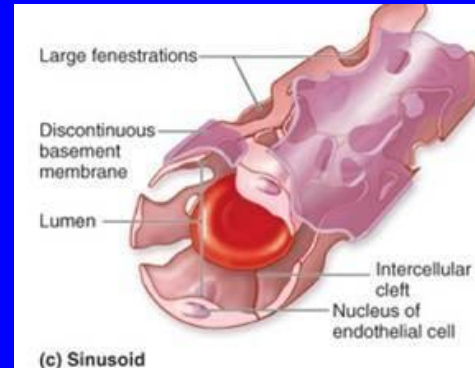
have fenestrae without diaphragms.

- They possess discontinuous endothelial cells.

- They possess discontinuous basal lamina.

- Macrophages may be located in or along the outside of the endothelial wall.

- Distribution: Red bone marrow, liver, spleen and certain endocrine glands.



BEST WISHES