

# **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:

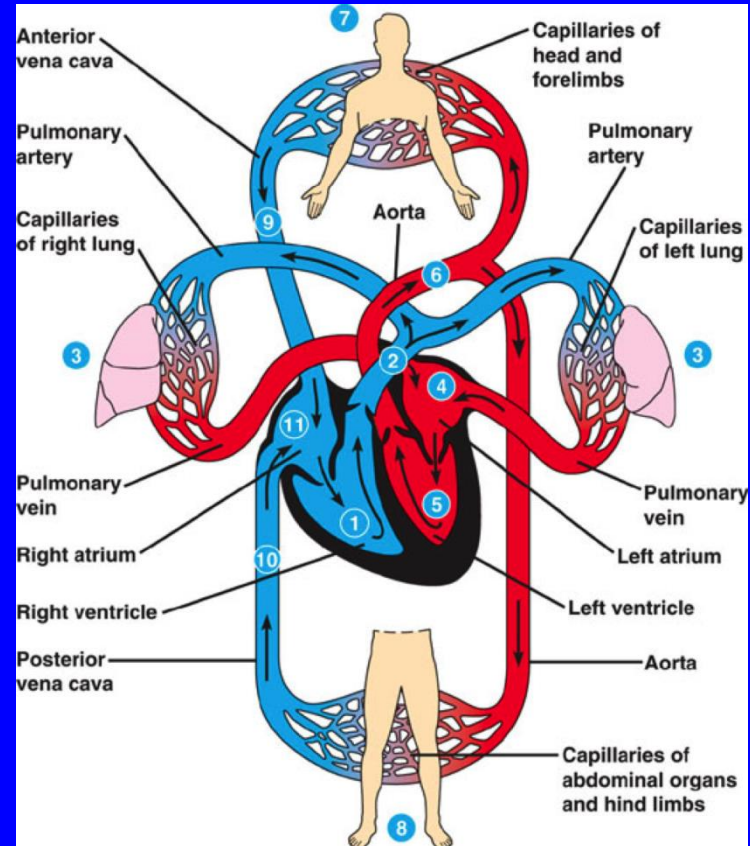
## – Arteries:

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

## – Blood capillaries.

## – Veins:

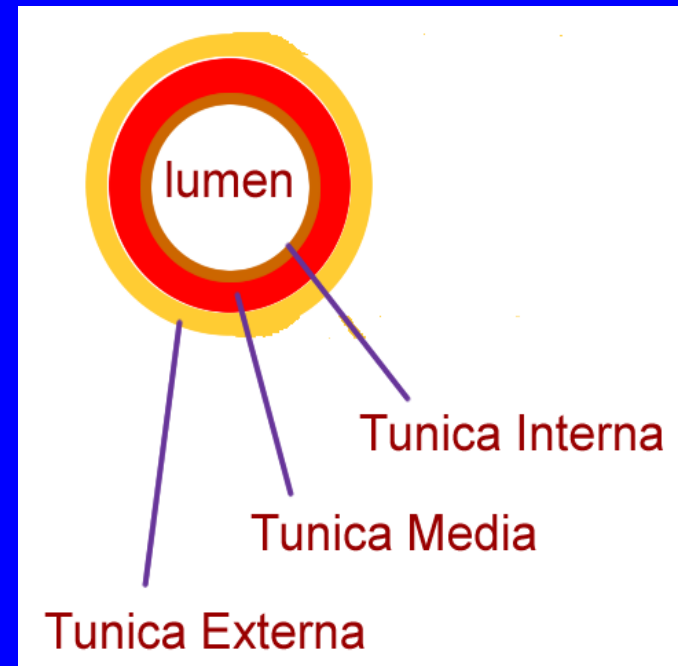
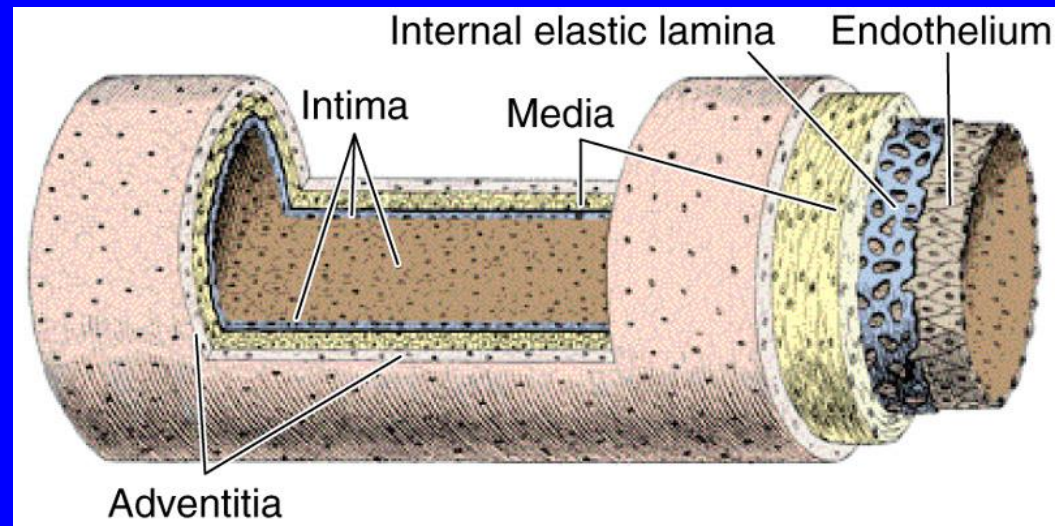
- Venules.
- Small veins.
- Medium-sized veins.
- Large veins.



# General Structure of Blood Vessels

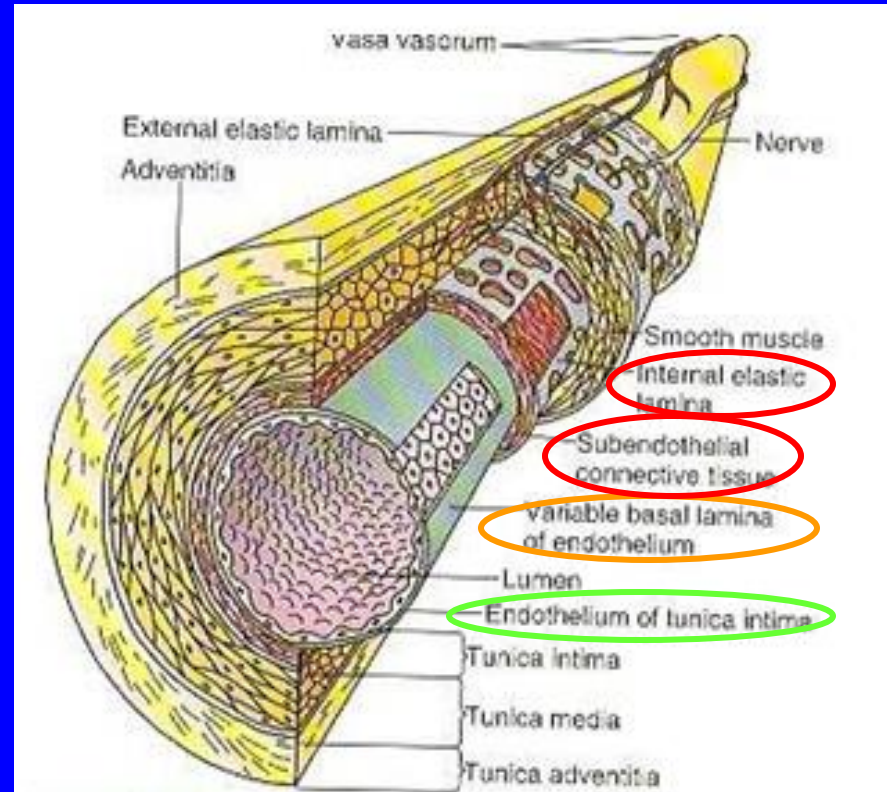
■ The wall of blood vessel is formed of three concentric layers:

- 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.

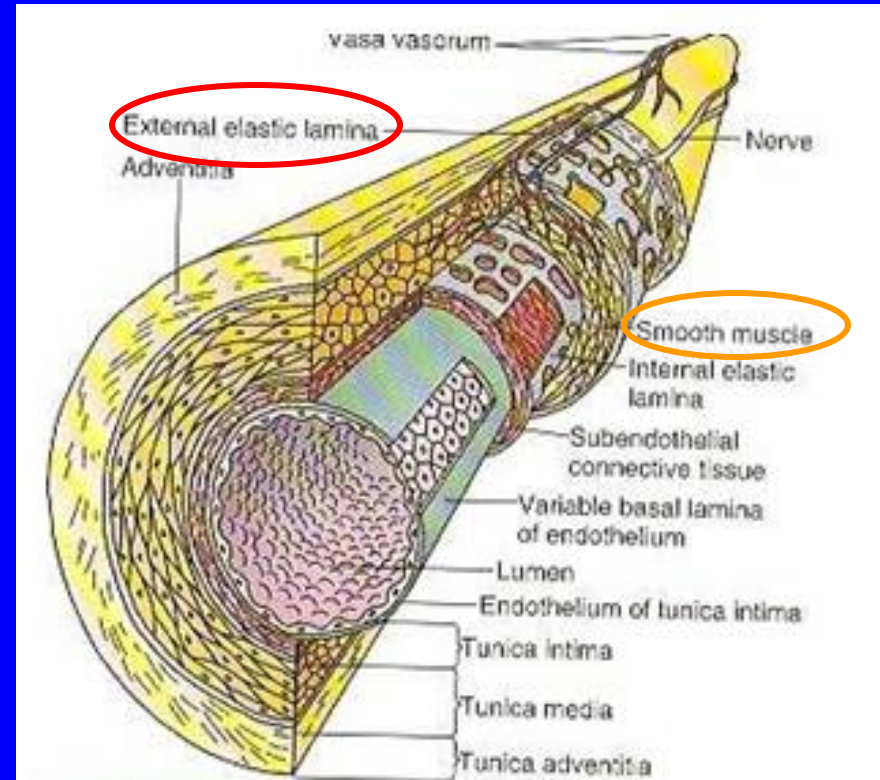




# Tunica Media

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

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



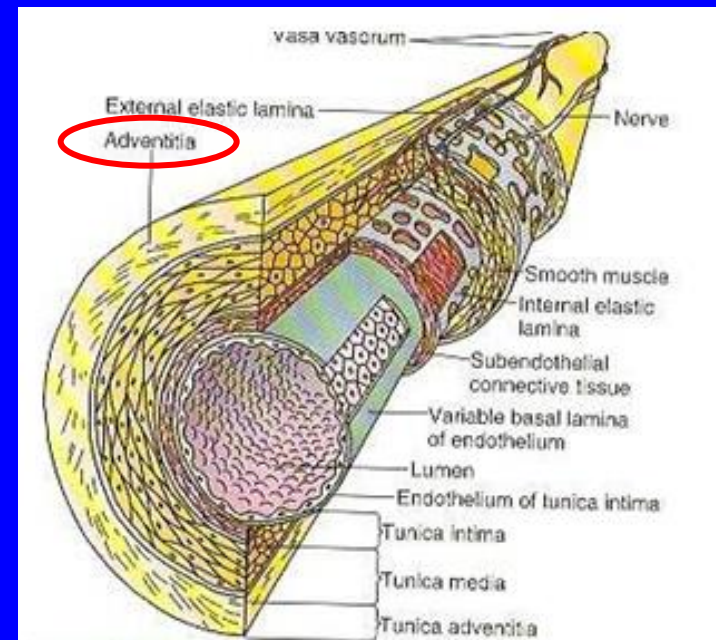
# Tunica Adventitia

- 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:

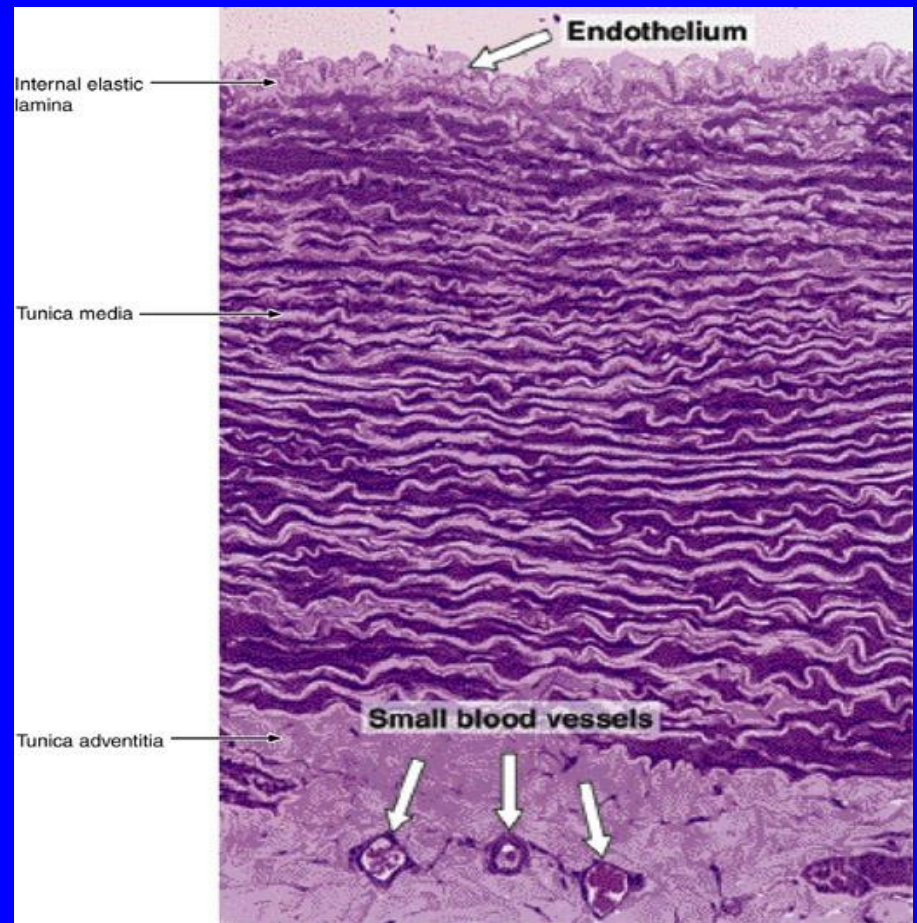
- \*Endothelium.

- \*Subendothelial C.T.

- \*Internal elastic lamina:

- (not prominent)

- (indistinct)





# ELASTIC ARTERIES (Cont.)

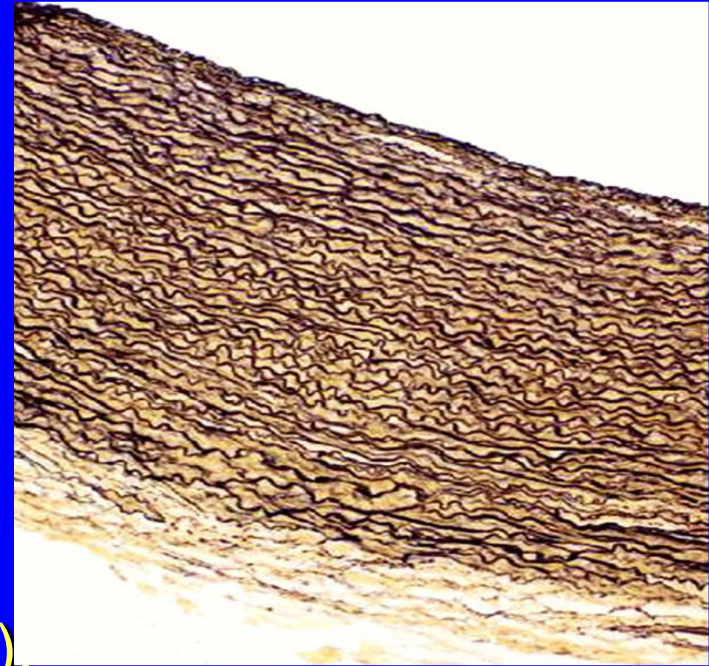
## 2. T. Media: it consists of:

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.

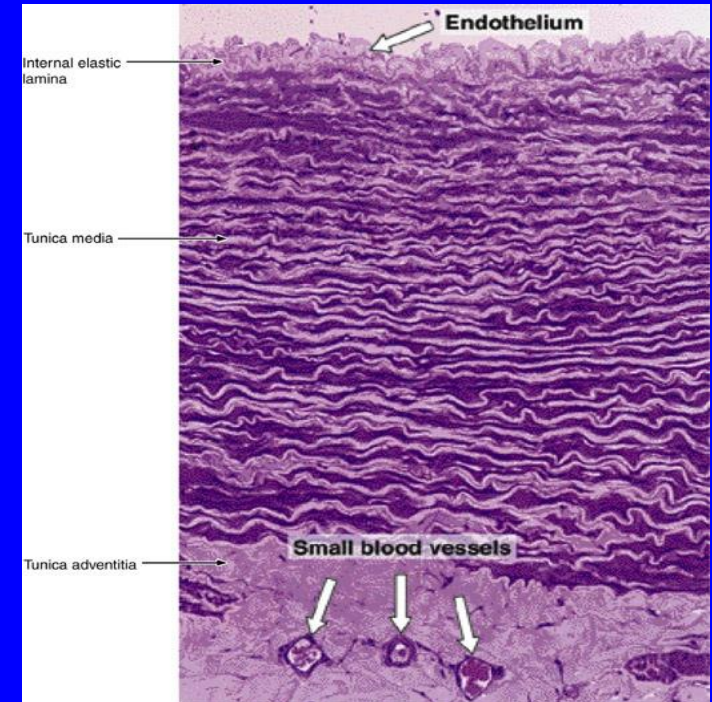




# ELASTIC ARTERIES (Cont.)

## 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

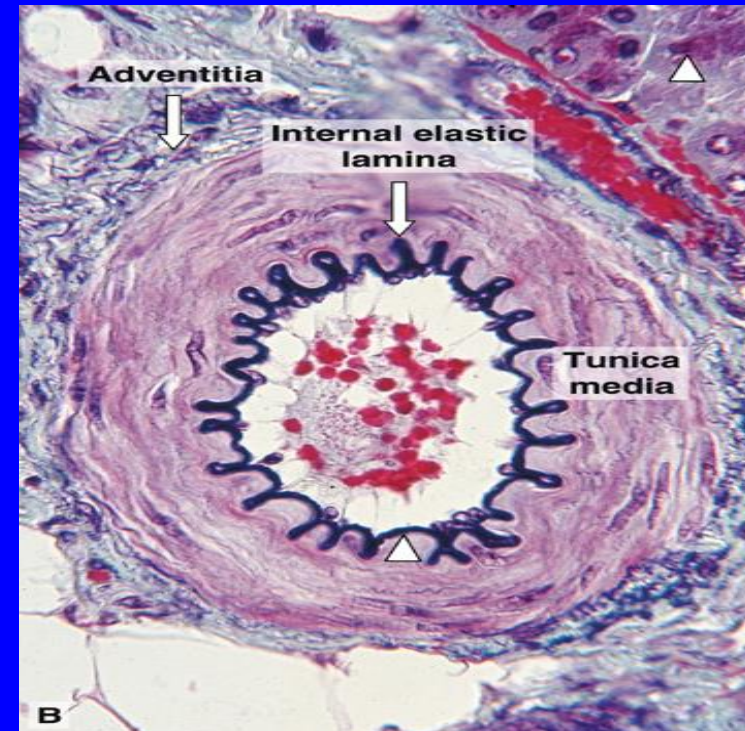
## (Medium-sized artery)

■ 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:

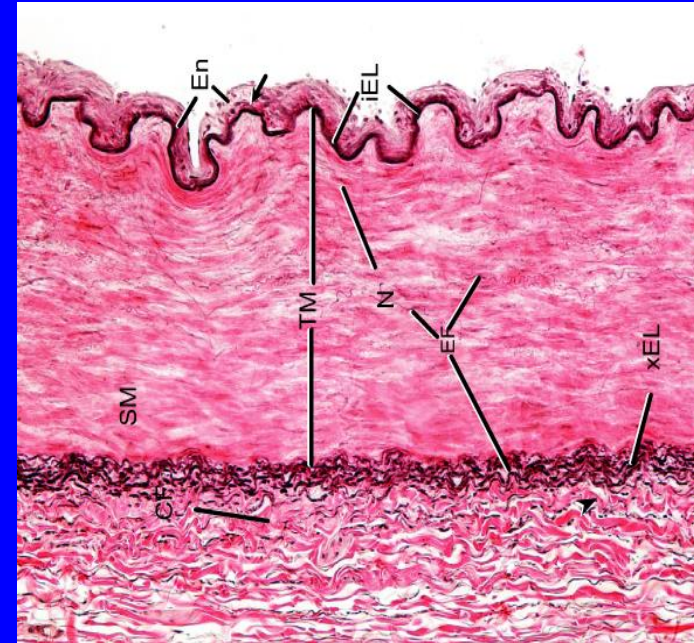
A. Smooth muscle cells (SMCs): are the predominant component.

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

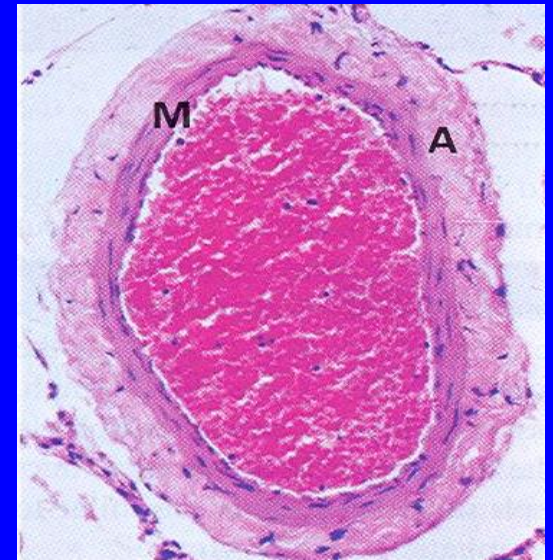
- T. Media:

- Thinner than T. Adventitia

- Consists of:

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

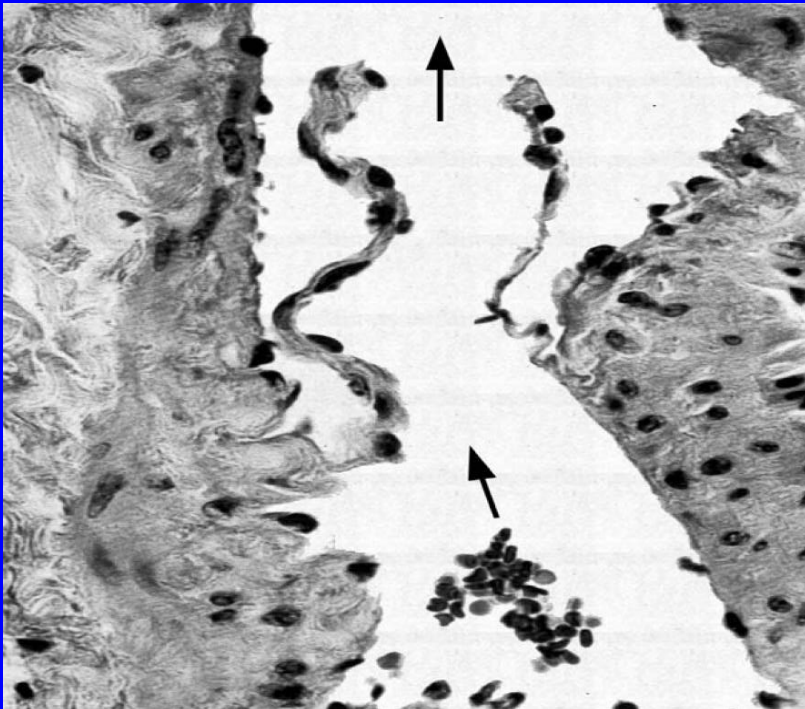
- T. Adventitia: thicker than T. Media



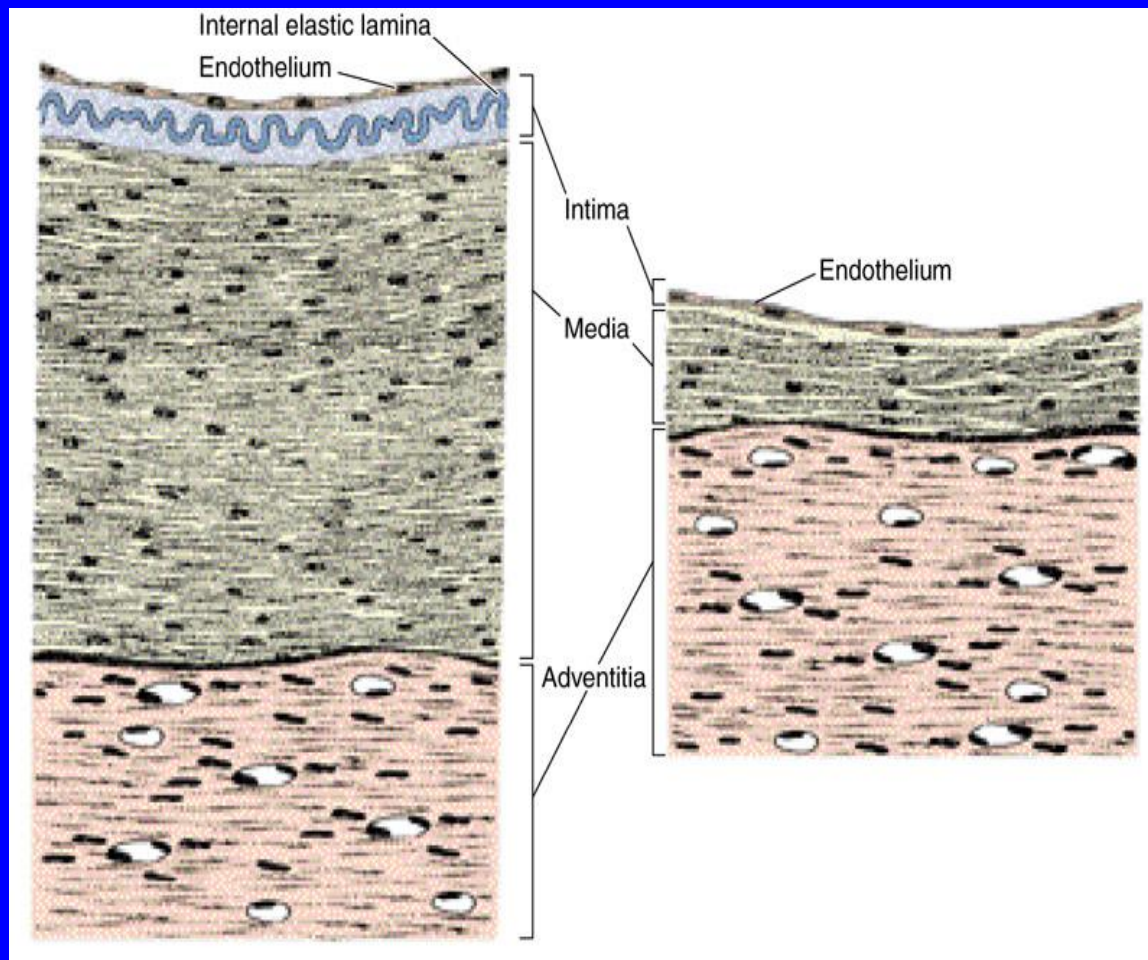


# VALVES OF VEINS

- 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.

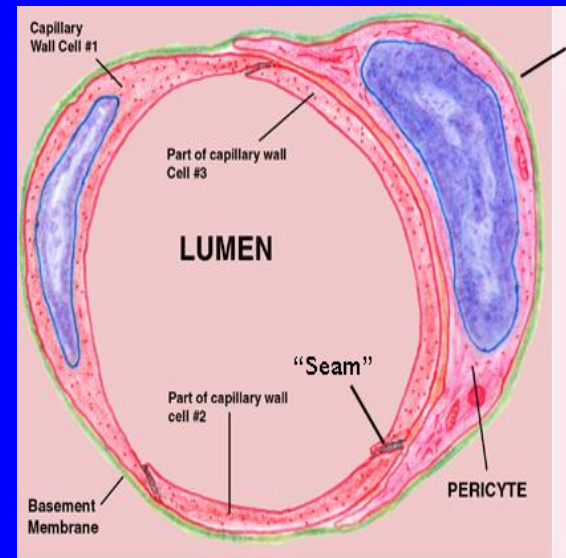


# MEDIUM-SIZED ARTERY AND VEIN



# BLOOD CAPILLARIES

- Diameter: usually 8-10  $\mu\text{m}$ .
- 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:

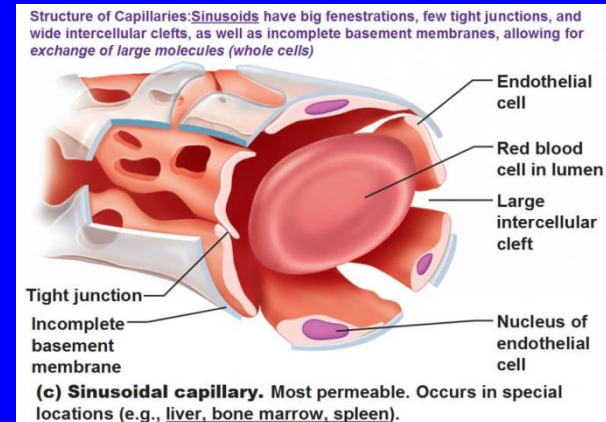
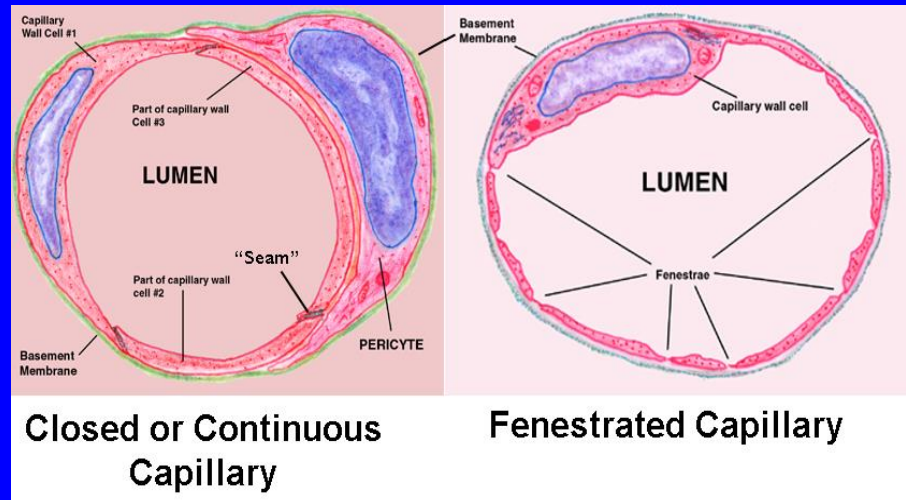
1- Continuous blood capillaries

2- Fenestrated blood capillaries

a- with diaphragms

b- without diaphragms

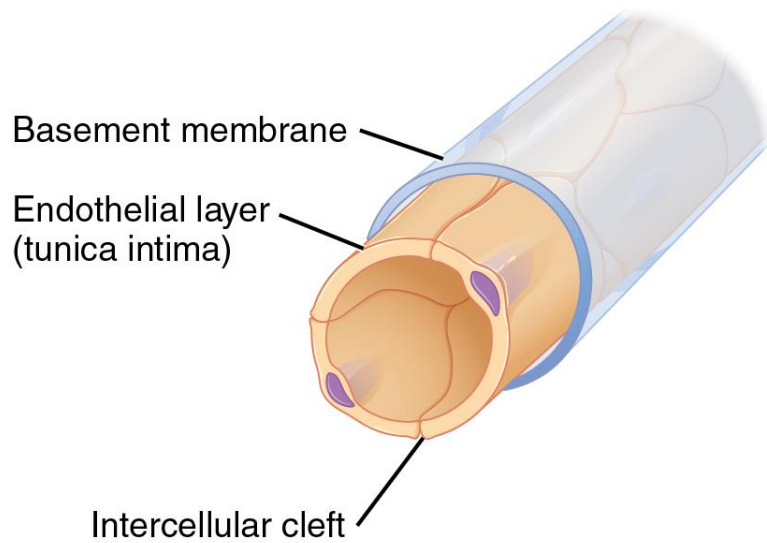
3- Sinusoidal blood capillaries



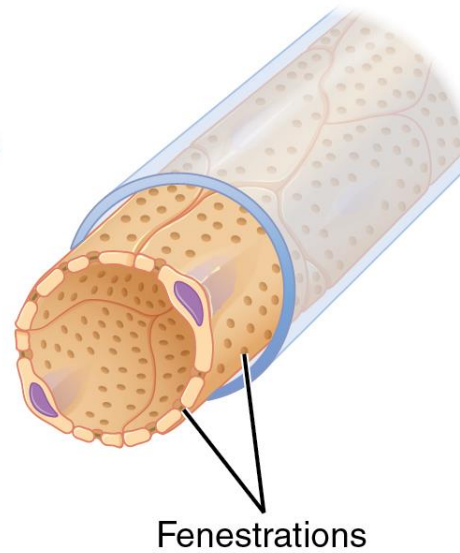


# Types of Blood Capillaries

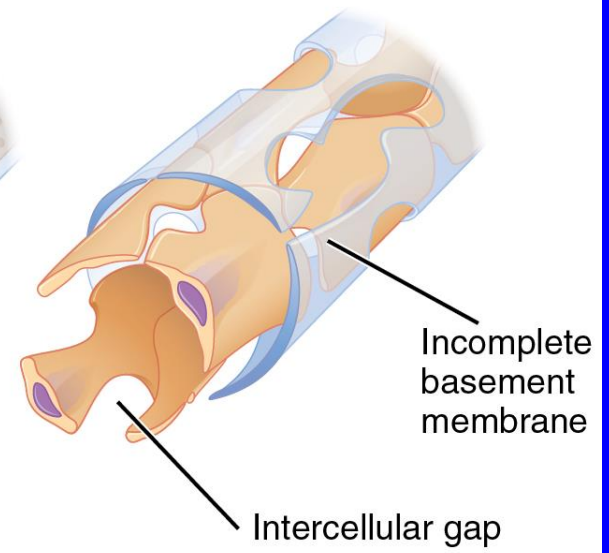
Continuous



Fenestrated



Sinusoid



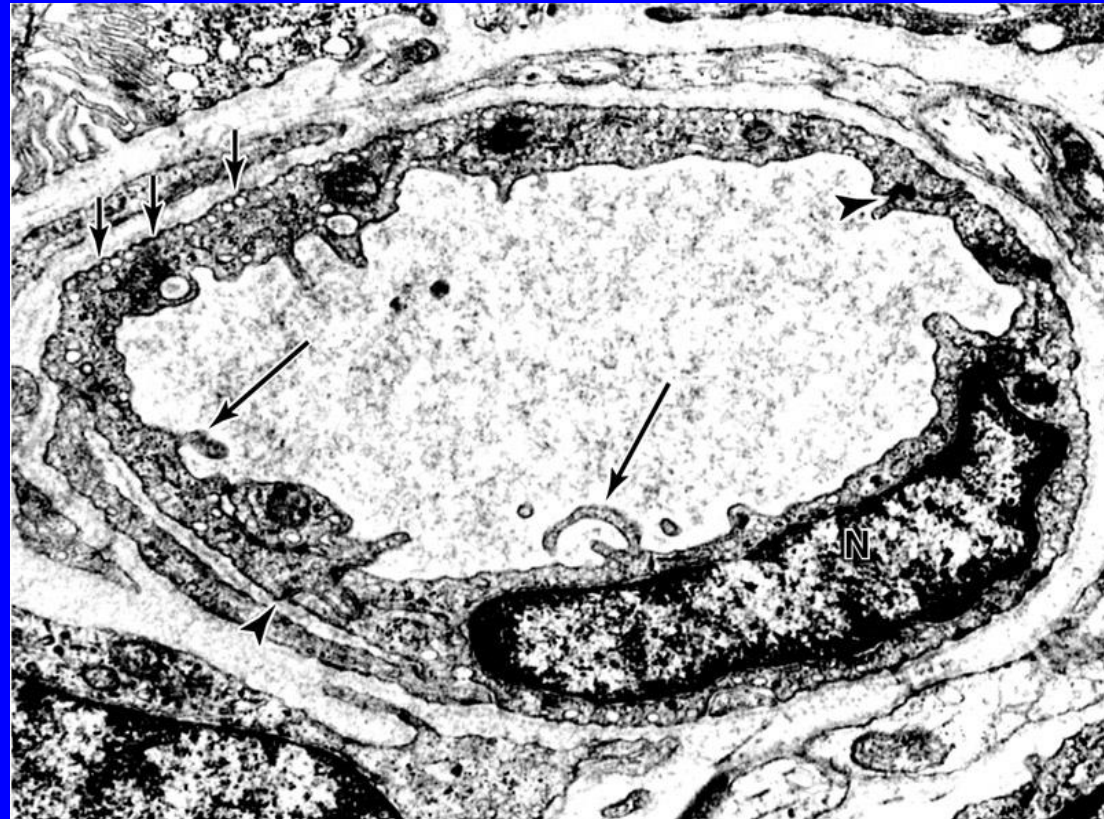
# Continuous Blood Capillaries

## ■ Microscopic structure:

- No pores or fenestrae in their walls.

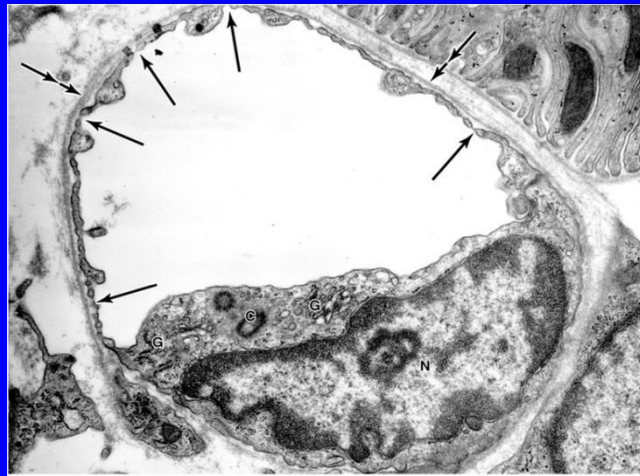
## ■ Distribution:

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

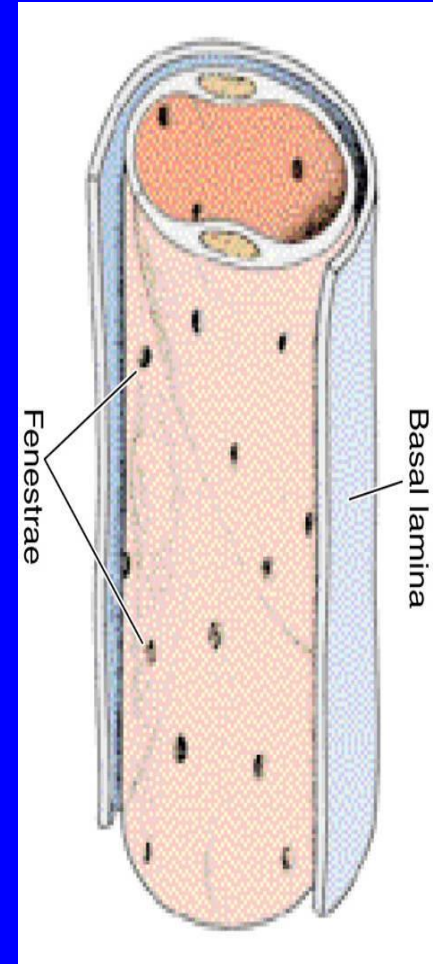


# Fenestrated Blood Capillaries with Diaphragms

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



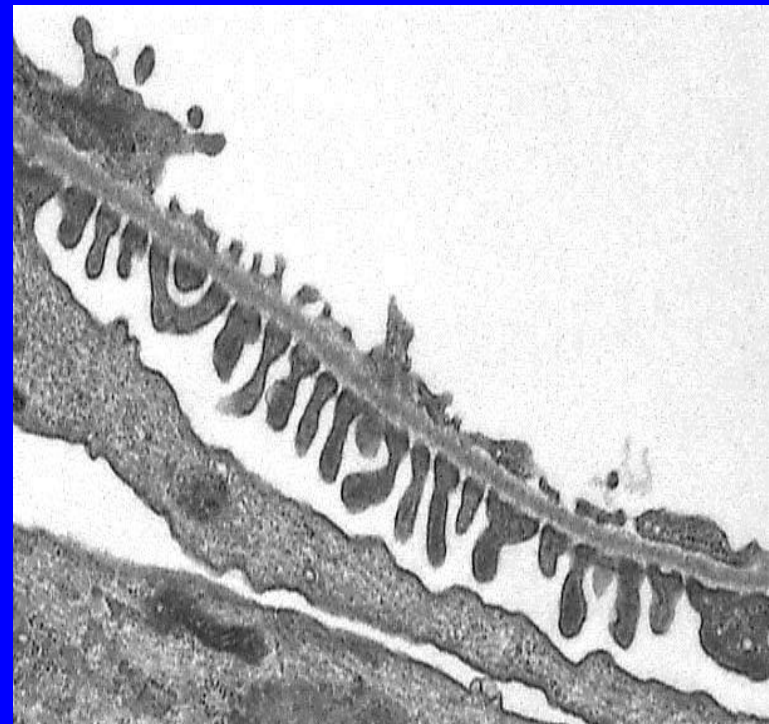
- Distribution:
  - In intestine, pancreas and endocrine glands.





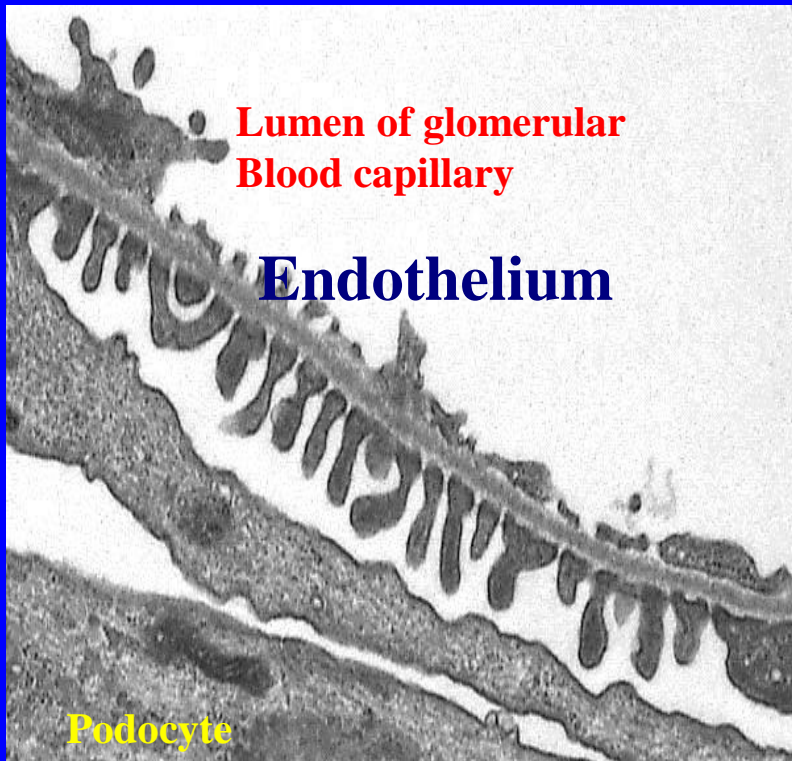
# Fenestrated Blood Capillaries without Diaphragms

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

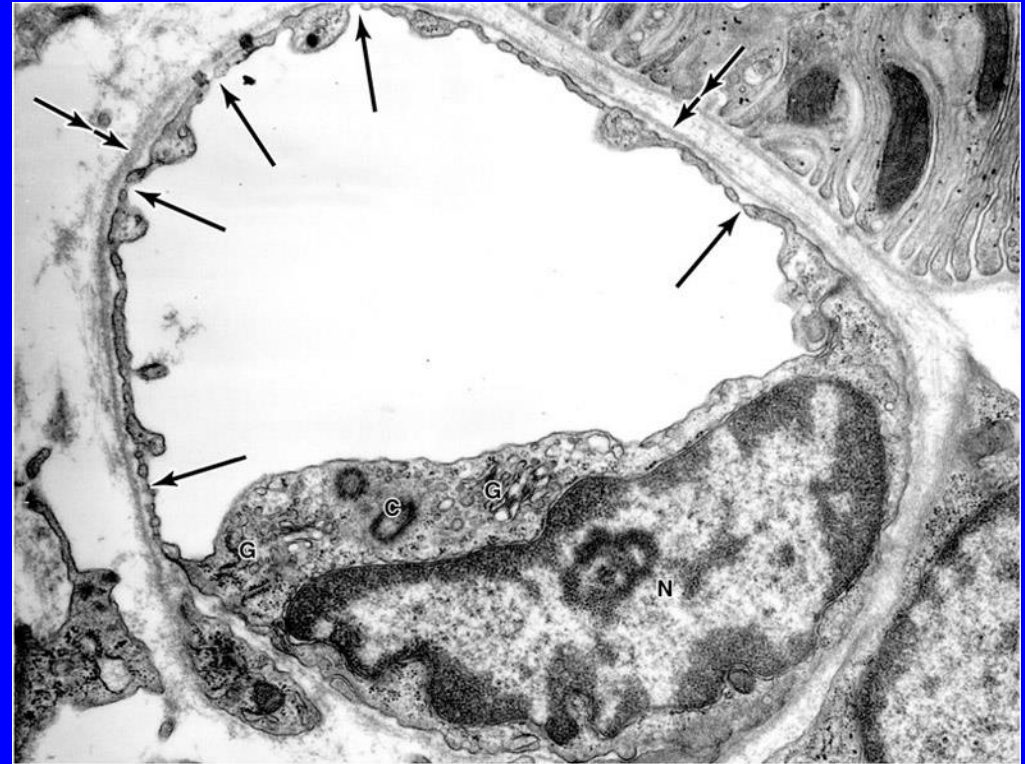




**FENESTRATED  
CAPILLARY  
WITHOUT  
DIAPHRAGMS**



**FENESTRATED  
CAPILLARY  
WITH DIAPHRAGMS**



# SINUSOIDAL CAPILLARIES

- Diameter: irregular (30-40  $\mu\text{m}$ ).

- Microscopic features:

- Their endothelial cells

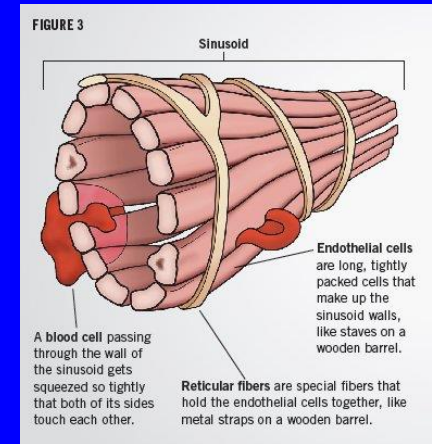
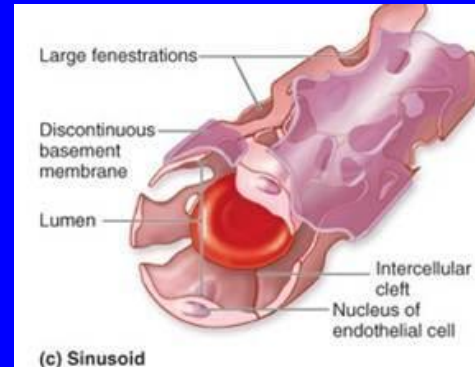
have fenestrae without diaphragms.

- 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**