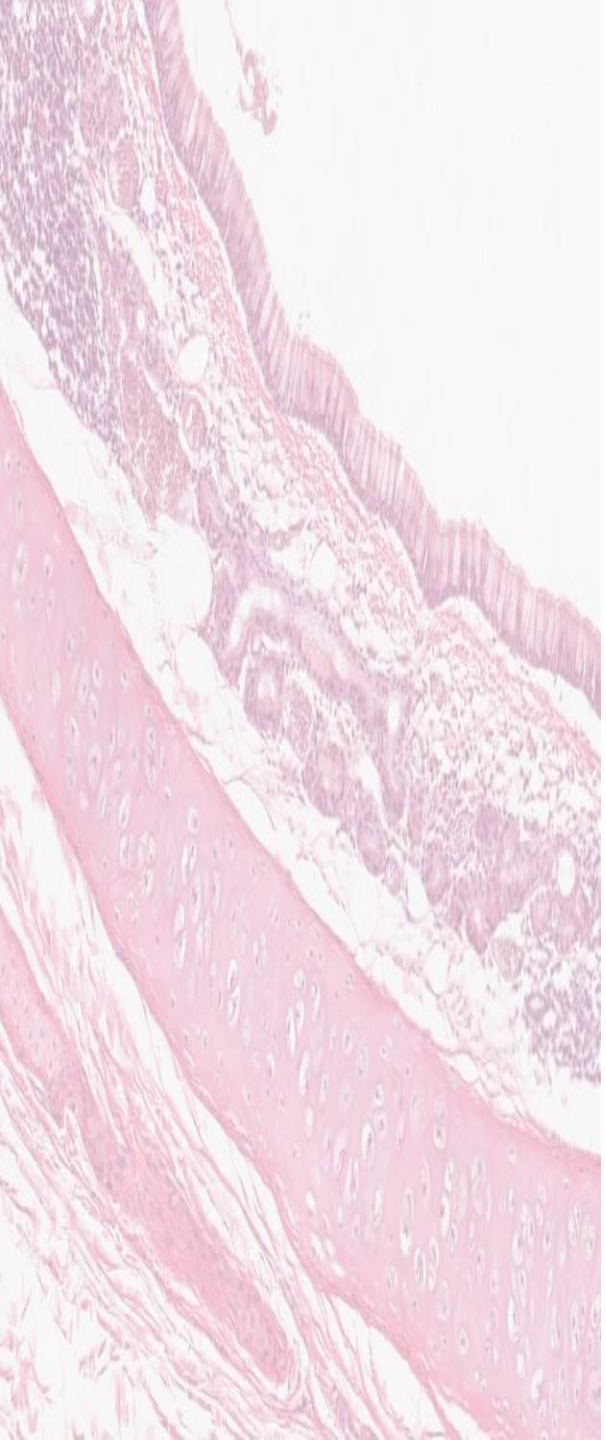

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436
MEDICINE
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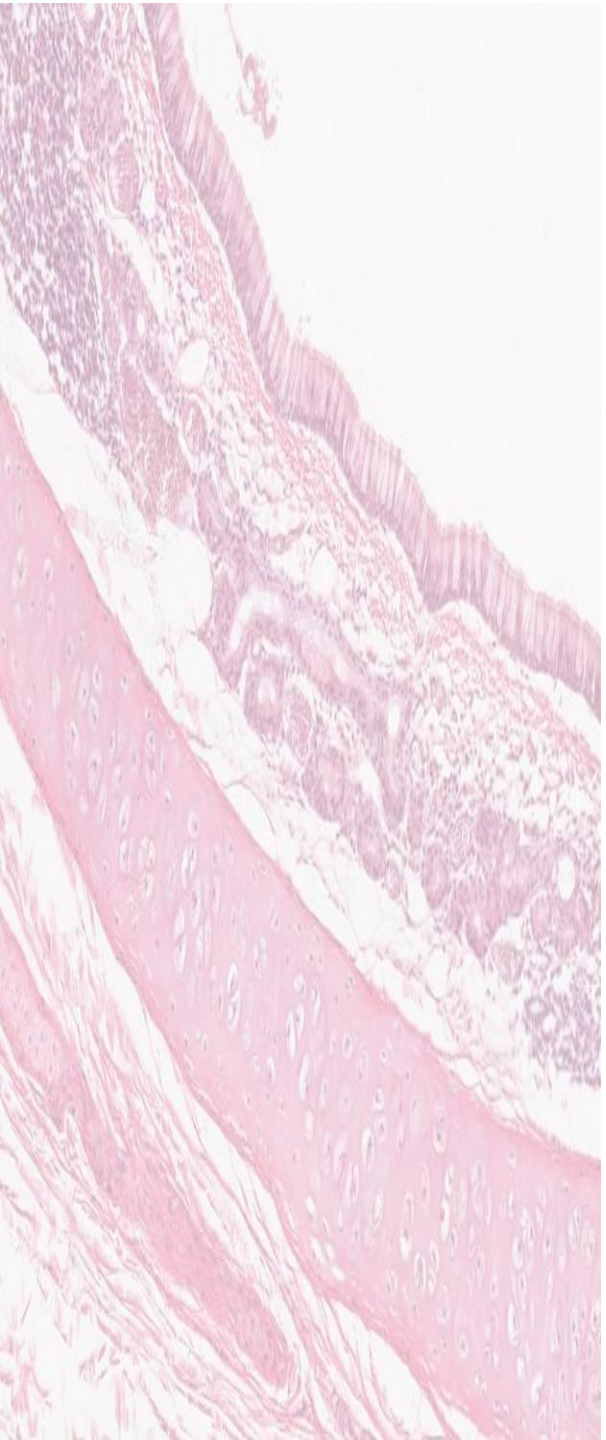
HISTOLOGY OF THE BLOOD VESSELS

Color index:
Slides.. Important ..Notes ..Extra..

Revised by
شوق الأحمري & طراد الوكيل



وَمَن يَتَوَكَّلْ عَلَى ٱللَّهِ فَهُوَ حَسْبُهُۥٓ

Objectives:

The microscopic structure of the wall of the blood vessels including:

- ✓ Elastic arteries.
- ✓ Muscular (medium-sized) arteries.
- ✓ Medium-sized veins.
- ✓ Blood capillaries.

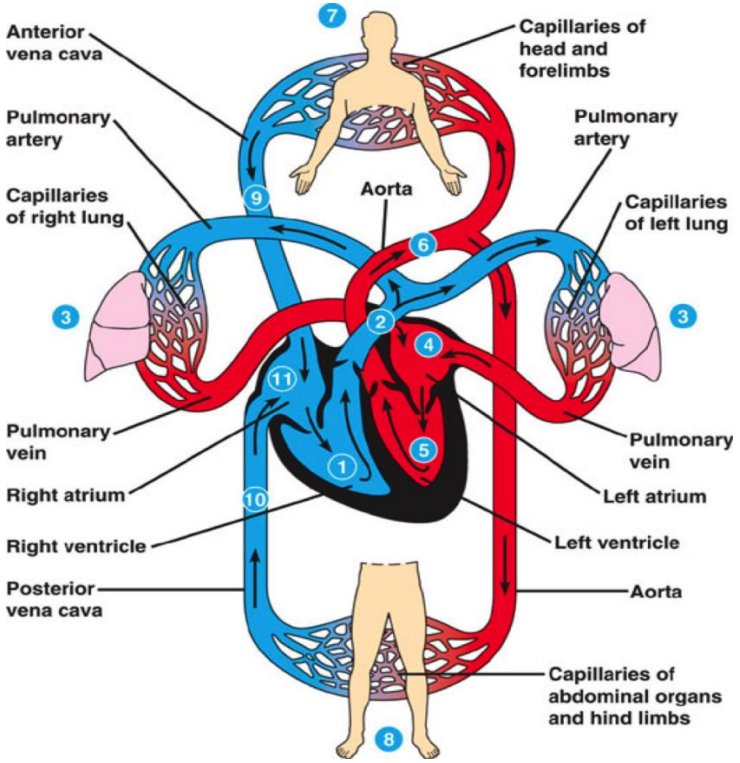
Since the blood vessels are a continuation of the heart, so the structure of their walls should be similar with difference in thickness.

Blood vessels

1- Arteries :

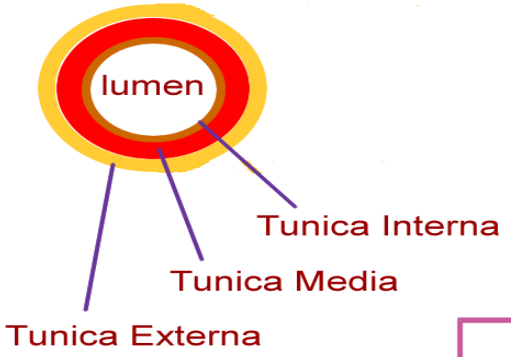
- Elastic artery.
- Muscular (distributing) (medium-sized) artery.
- Arterioles.

2- Blood capillaries



3- Veins :

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



General Structure of Blood Vessels:

The wall is made of three concentric layers

Tunica means Layer.

Tunica intima

Is the innermost layer

Composed of:

1- Endothelial cells: Simple squamous epithelium

2- Basal Lamina

3- Subendothelial layer: loose C.T.

4- Internal elastic lamina: fenestrated elastic sheet

fenestrated يعني في فتحات

Tunica media

Intermediate layer

Composed of:

1- Smooth muscles.

2- Elastic fibers.

3- Type III collagen (reticular fibers).

4- Type I collagen

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

But the internal elastic lamina is in all arteries.

Tunica adventitia

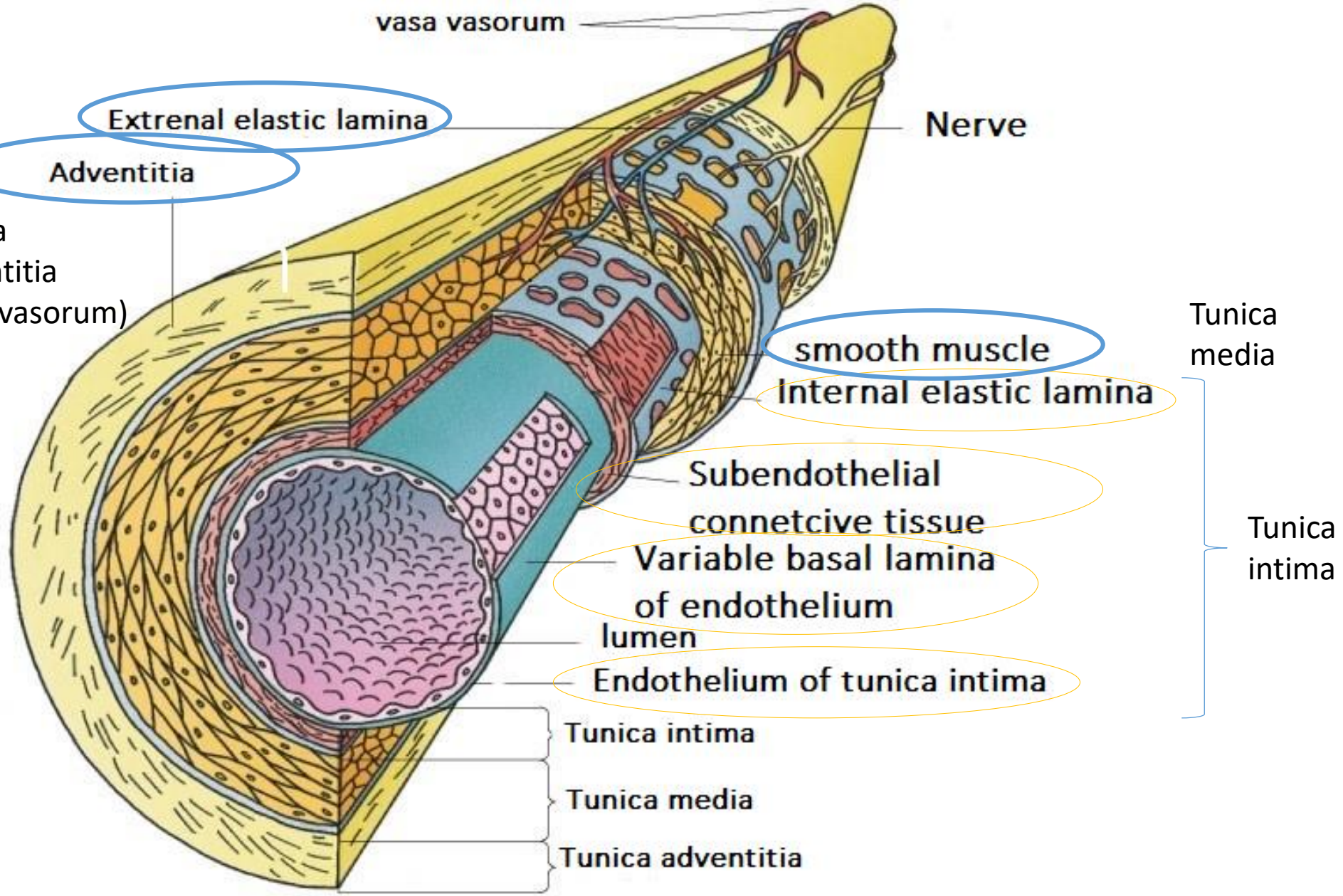
Outermost layer

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 because venous blood contains less oxygen and nutrients than arterial blood

Greater numbers of Vasa Vasorum are found in the veins than the ones found in arteries , because the arteries carry oxygenated blood which can be beneficial for them as nutrition source unlike the veins so they need another source of blood which is the Vasa Vasorum


vasa vasorum
Extrenal elastic lamina
Adventitia
Nerve
Tunica adventitia (vasa vasorum)
smooth muscle
Internal elastic lamina
Tunica media
Subendothelial connetcive tissue
Variable basal lamina of endothelium
Tunica intima
lumen
Endothelium of tunica intima
Tunica intima
Tunica media
Tunica adventitia

Elastic Arteries

Examples: Aorta - Common Carotid Artery - Subclavian Artery - Common Iliac Artery - Pulmonary Trunk.

Microscopic structure:

1. T. Intima:

- Endothelium and basal lamina.
- Subendothelial C.T.
- Internal elastic lamina: (not prominent) (indistinct).

Why the internal elastic lamina is not prominent ? Because the entire layer is rich in elastic fibers forming a lamina and this is the main distinguish feature between the elastic and muscular arteries

2. T. Media: **It Consists Of*:

A- Fenestrated elastic membranes (sheets) (lamellae):

- It is the main component of T.M.

Also here the elastic fibers are enormous in number and form a membrane (lamina)

B- In between, there are:

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

3. T. Adventitia:

- Much thinner than T.M. (Tunica media)
- 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

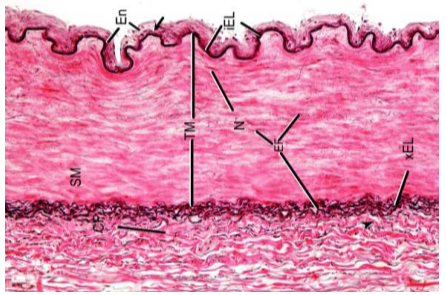
2. T. Media: (Thicker than T. Adventitia or similar in thickness)

**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.

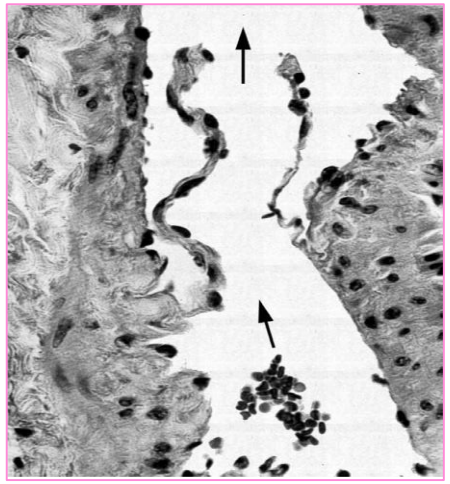
T. Media:
- Thinner than T. Adventitia.
- Consists of:
  1- Fewer SMCs.
  2- Types I & III Collagen fibers.

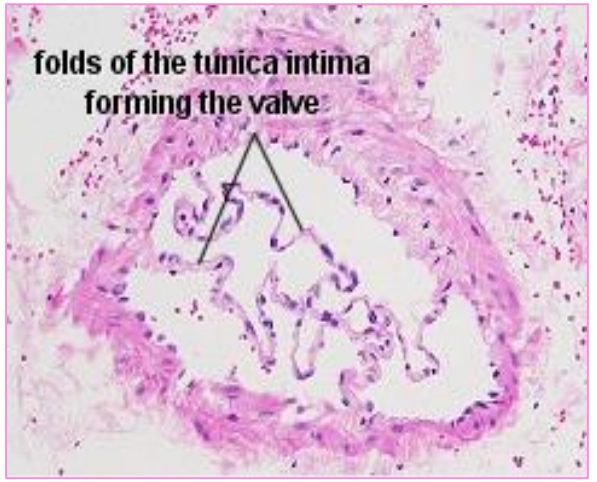
T. Adventitia:
- Thicker than T. Media.

Valves Of Veins

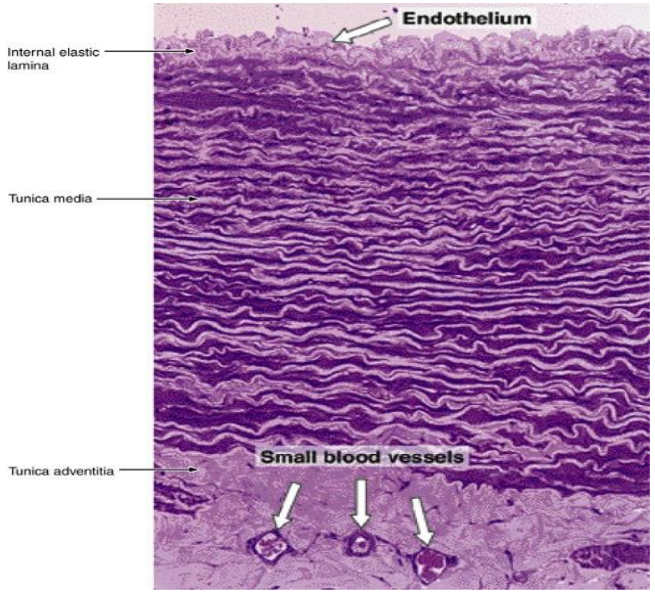
- Valve of a vein is composed of 2 leaflets.
- Each leaflet has a thin fold of the T. Intima.

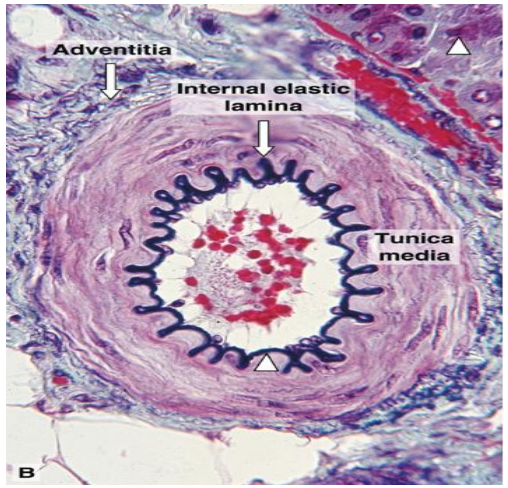
Components:
1- Endothelium
2- Core of C.T.

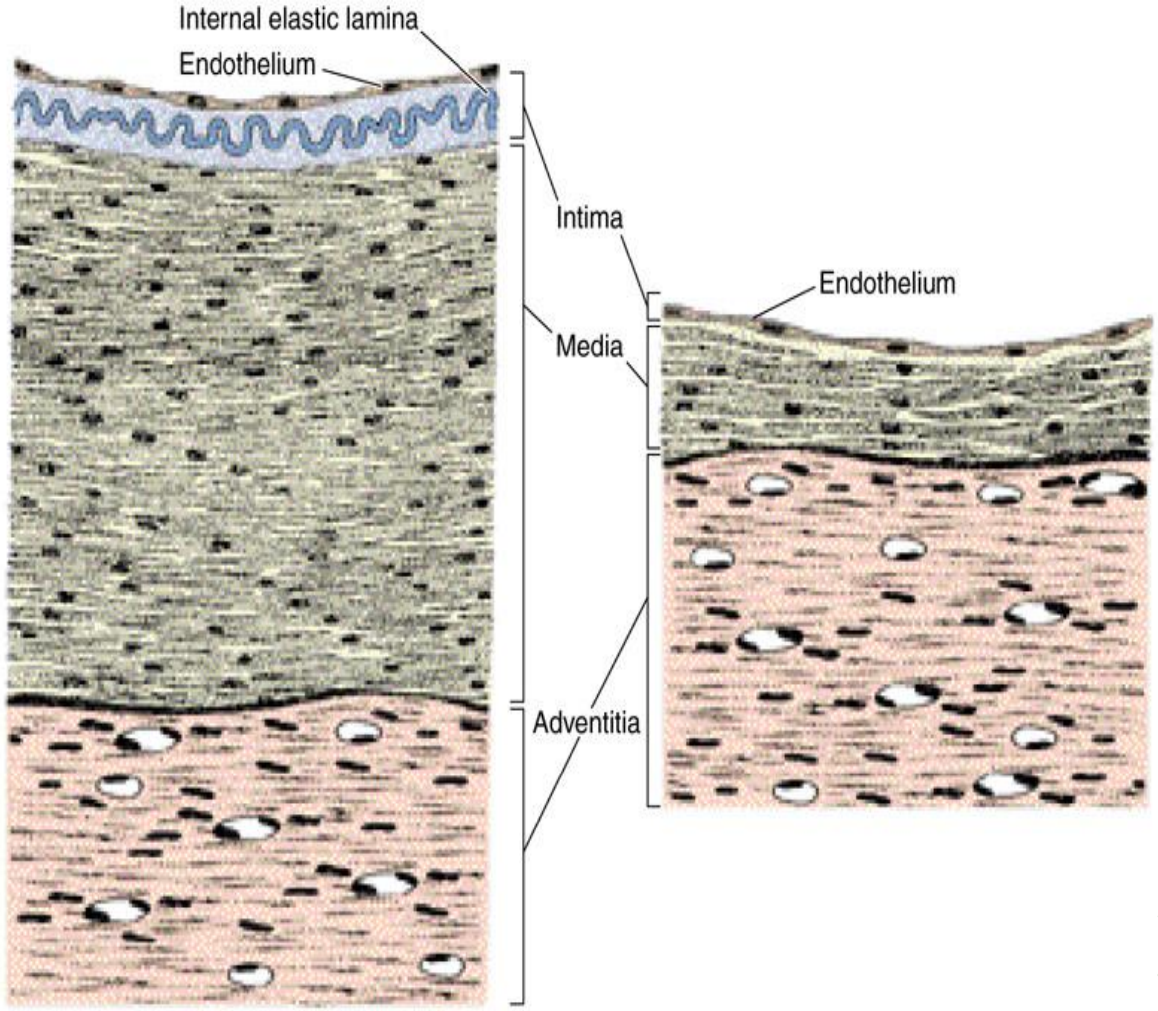


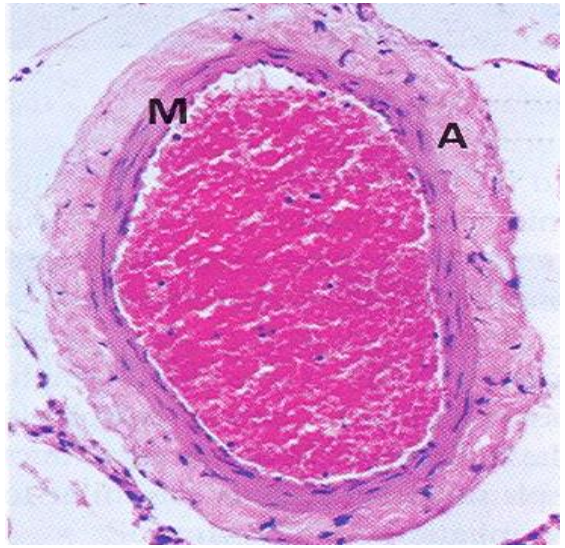


MEDIUM-SIZED ARTERY AND MEDIUM-SIZED VEIN









we see blood in the lumen of veins (unlike arteries) because the blood is not pushed.

BLOOD CAPILLARIES

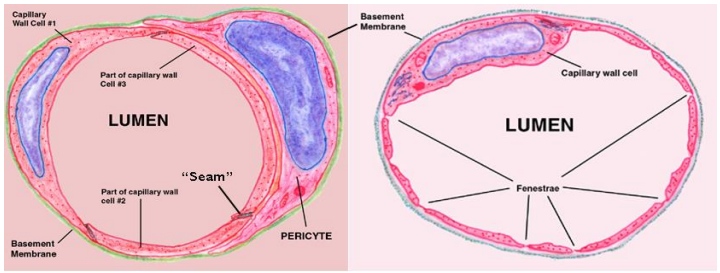
Diameter: usually 8-10 µm.

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 .

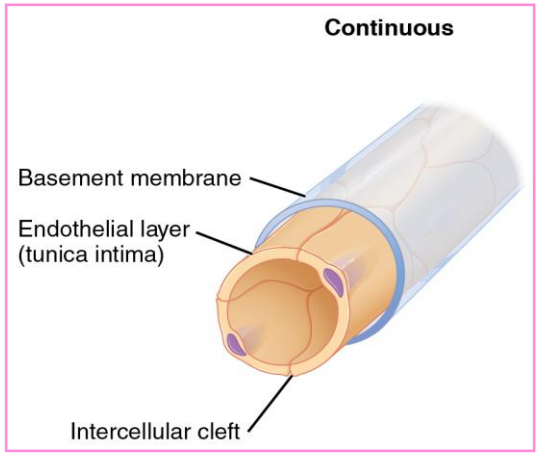
3 Types of **BLOOD CAPILLARIES**

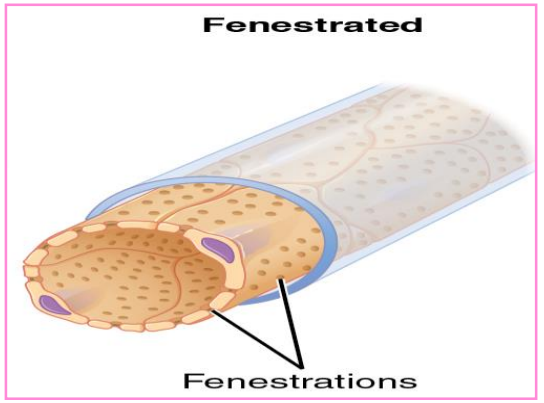
- Continuous blood capillaries
- Fenestrated blood capillaries
  - with diaphragms
  - without diaphragms
- Sinusoidal blood capillaries

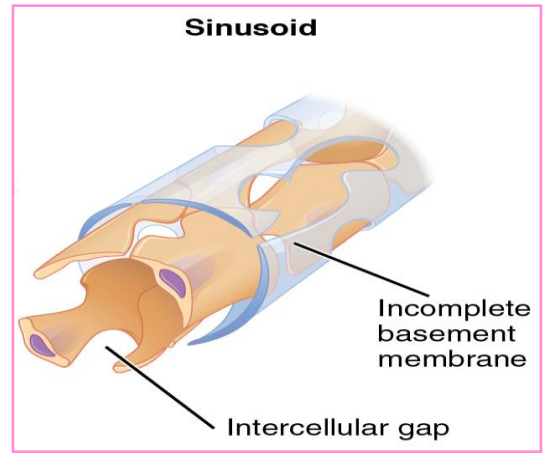


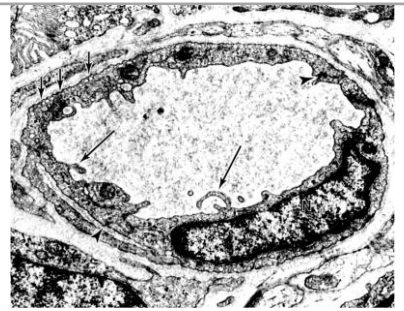
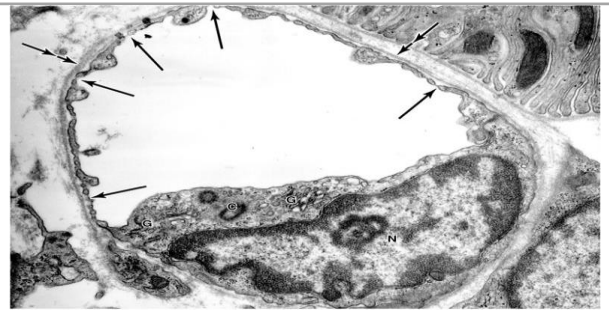
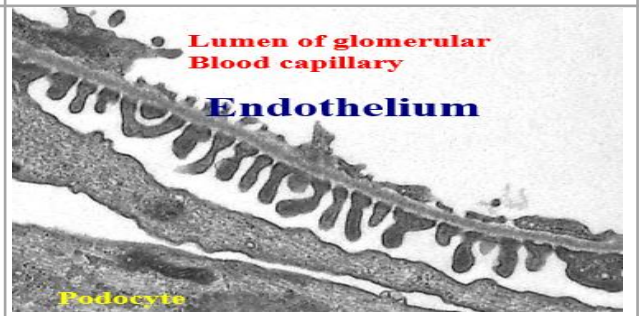
Closed or Continuous Capillary

Fenestrated Capillary







Type of blood capillary:	Continuous Blood Capillaries	Fenestrated Blood Capillaries with Diaphragms	Fenestrated Blood Capillaries without Diaphragms	SINUSOIDAL CAPILLARIES
Microscopic structure:	No pores or fenestrae in their walls. This type of capillaries do not contain fenestrae why ? Because the fluid leakage could damage organs such as lungs and brain	▪ The walls of their endothelial cells have pores (fenestrae). ▪ These pores are covered by diaphragm.	▪ The walls of their endothelial cells have pores (fenestrae). ▪ These pores are *NOT* covered By diaphragm.	Diameter: irregular (30-40 µm). ▪ Their endothelial cells have fenestrae without diaphragms. ▪ They possess: - Discontinuous endothelial cells. - Discontinuous basal lamina. Macrophages may be located in or along the outside of the endothelial wall.
Distribution:	In muscles ,pulmonary capillaries, C.T, and nervous tissue.	In intestine, pancreas and endocrine glands	In renal glomerulus.	Red bone marrow, liver, spleen and certain endocrine glands.
EM:				here the entire wall contain fenestrae why ? Because areas like the red bone marrow they make RBCs and WBCs and therefore the wall of the its capillaries must contains large pores so these large cells can diffuse

Extra picture for understanding the types of capillaries

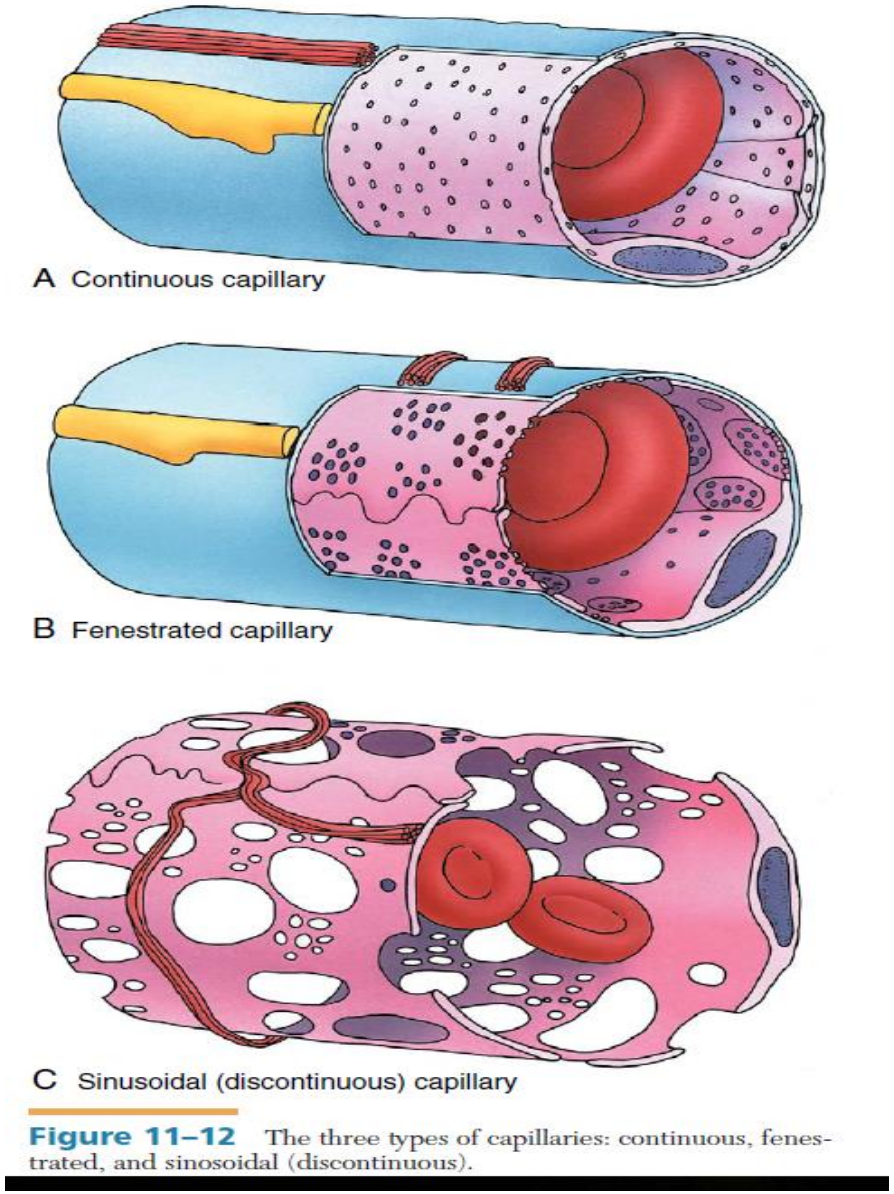
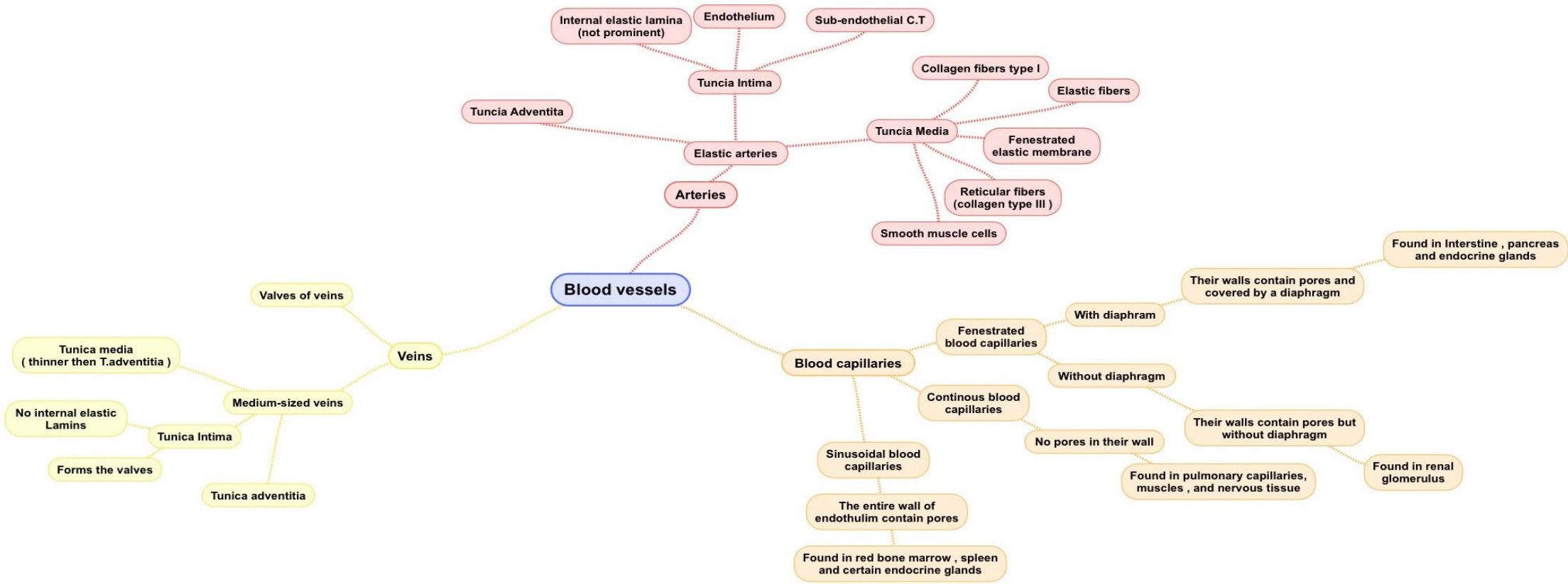
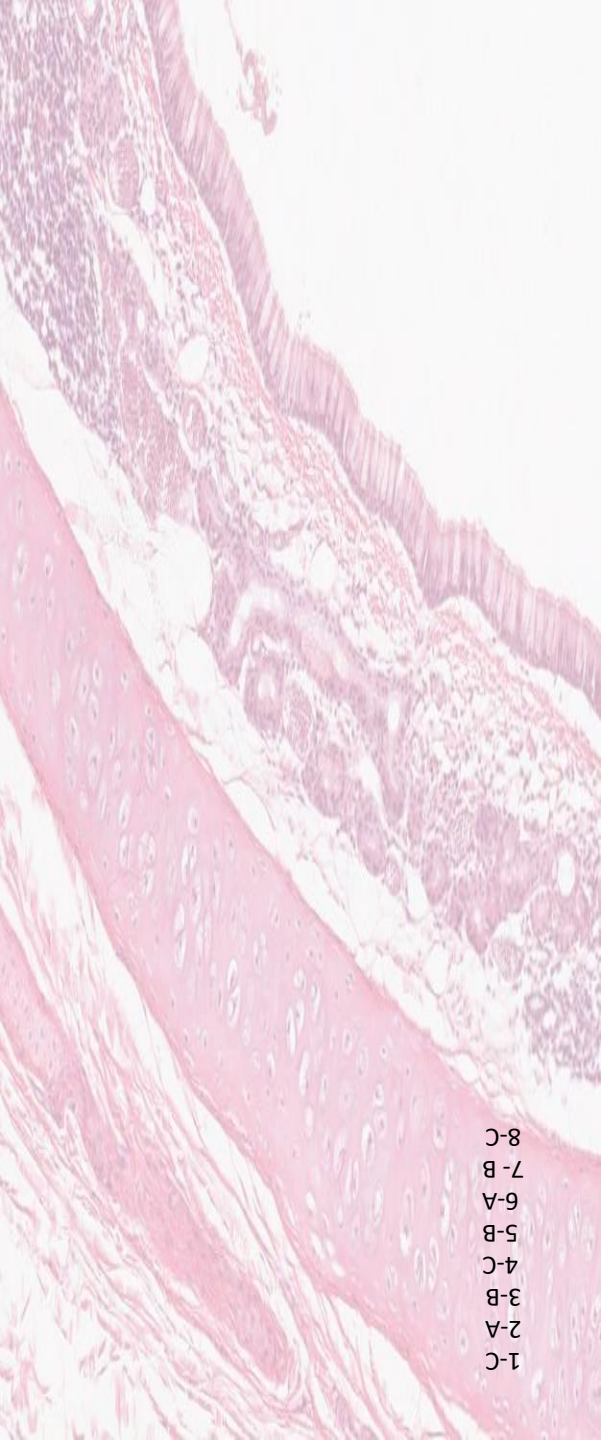


Figure 11–12 The three types of capillaries: continuous, fenestrated, and sinosoidal (discontinuous).

Summary


Blood vessels
Arteries
Internal elastic lamina (not prominent)
Endothelium
Sub-endothelial C.T
Tuncia Intima
Tuncia Adventita
Elastic arteries
Collagen fibers type I
Elastic fibers
Tuncia Media
Fenestrated elastic membrane
Reticular fibers (collagen type III)
Smooth muscle cells
Veins
Valves of veins
Tunica media (thinner then T.adventitia)
Medium-sized veins
No internal elastic Lamins
Tunica Intima
Forms the valves
Tunica adventitia
Blood capillaries
Fenestrated blood capillaries
With diaphram
Their walls contain pores and covered by a diaphragm
Found in Interstine , pancreas and endocrine glands
Without diaphragm
Their walls contain pores but without diaphragm
Found in renal glomerulus
Continous blood capillaries
No pores in their wall
Found in pulmonary capillaries, muscles , and nervous tissue
Sinusoidal blood capillaries
The entire wall of endothulim contain pores
Found in red bone marrow , spleen and certain endocrine glands



MCQ’S

1- The medium sized vein:
a. The wall is thicker than medium sized artery
b. Have internal elastic lamina
c. Form valves

2-The T.adventitia in muscular artery is composed of?
a. Loose connective tissue
b. Vasa vasorum
c. Macrophages

3-Squamous endothelial cells of blood capillaries are?
a. Douple layer
b. Single layer
c. Triple layer

4- The Distribution of Fenestrated Blood Capillaries without Diaphragms ?
a. Intestine
b. Pancreas
c. Renal glomerulus.

5- The Microscopic structure of Continuous Blood Capillaries?
a. Have pores (fenestrae).
b. No pores or fenestrae in their walls.
c. Pores are covered by diaphragm.

6- Vasa vasorum are small arterioles in:
a. T. Adventitia and outer T.Media
b. T. Media only
c. T. intima

7- The internal elastic lamina found in elastic arteries is:
a. Prominent
b. Not prominent
c. None of them

8- Which of the following contains sinusoidal capillaries?
A- Pulmonary capillaries
B- Endocrine glands
C- Red bone marrow

1-C
2-A
3-B
4-C
5-B
6-A
7- B
8-C

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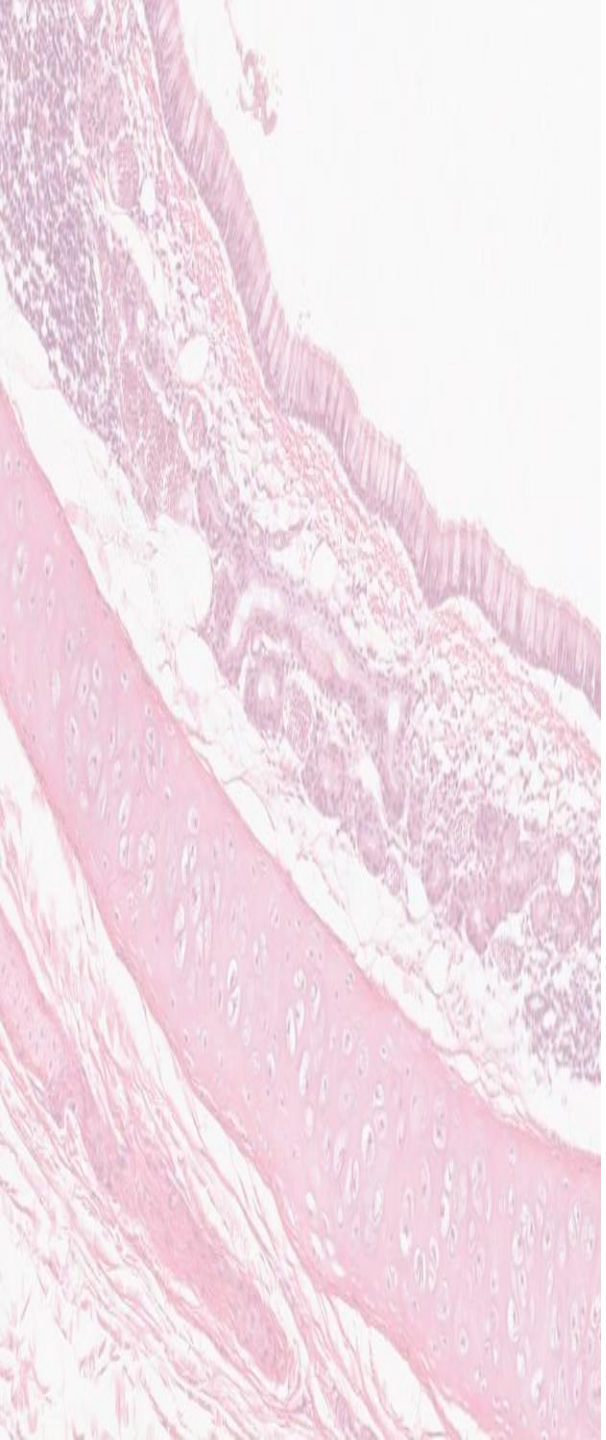

Thank you & good luck

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