

HOSTOLOGY

BY

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Lecture 4

Blood capillaries and sensory structures of blood vessels

Learning objectives:

After this lecture, students should be able to:

- *Describe the general structure of blood capillaries.
- *Mention different types of blood capillaries (Continous, fenestrated, and sinusoidal capillaries).
- *Discuss the normal sensory structure of blood vessels (carotid sinuses & carotid and aortic bodies).

Blood Capillaries

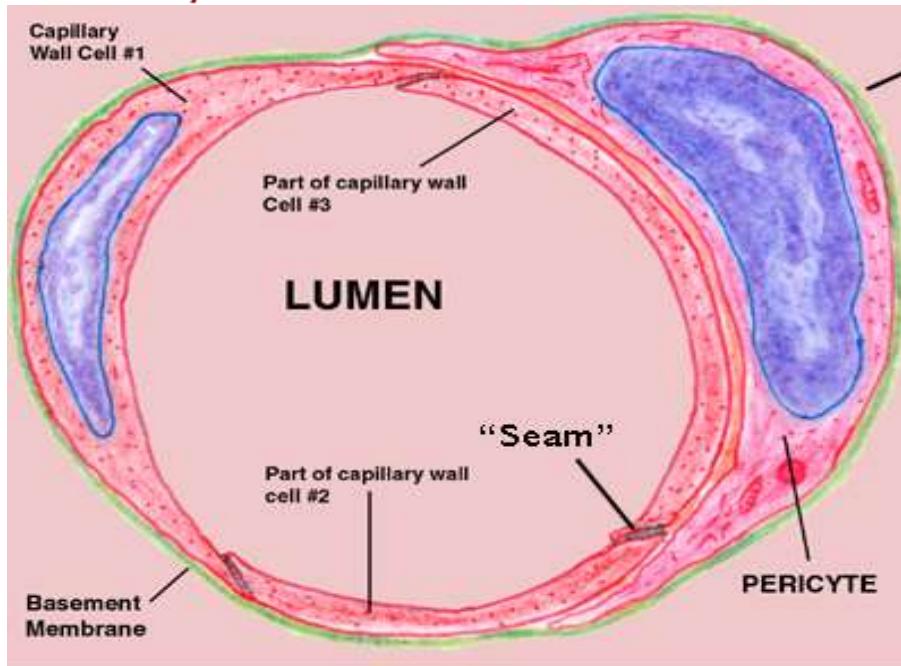
Capillaries form branching and anastomosing network between arterioles and venules. Their diameter is 8-10 um slightly larger than the diameter of RBCs.

General Structure of Capillaries:

- *Capillaries are formed of a single layer of squamous endothelial cells rolled into a tube rest on basal lamina. The basal lamina split to enclose pericytes..
- *The large number of pinocytotic vesicles on both surfaces of endothelial cells. These vesicles are responsible for transport of macromolecules in both directions across the endothelial cytoplasm. This process is called transcytosis.
- *At the cellular junctions, the endothelial cells tend to overlap forming marginal folders that project into the lumen. These folders may retard the flow of blood near the capillary wall.

Pericytes are located outside the capillaries and small venules and share the basal lamina of the endothelial cells. They regulates blood flow through the capillaries as they contain tropomyosin which is related to the contractile process.

*After injury, pericytes can differentiate to form new blood vessels & C.T. cells, thus participating in the repair process



Types of Capillaries

- By E.M. there are 3 types of capillaries that differ in structure, location and function.
 - 1- Continuous capillaries
 - 2- Fenestrated capillaries
 - 3- Sinusoidal capillaries(blood sinusoids)

1- Continuous Capillaries:

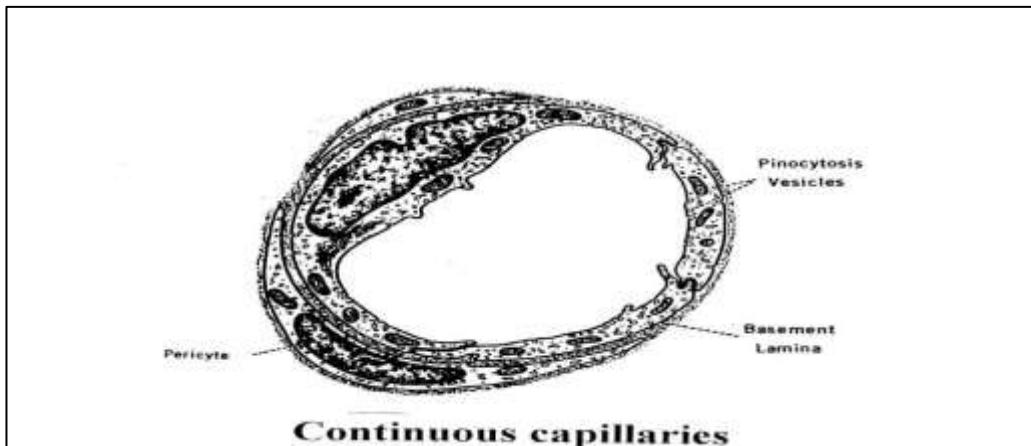
- The most common type
- Structure: They are characterized by uninterrupted endothelial and continuous basal lamina.
- The edges of adjacent endothelial cells interdigitate with each other with a space of 20 nm between them.
- Site: muscles, C.T. and nervous tissue.
- Function: Cells are tightly sealed and permeable only to fluid and the smallest of molecules, such as ions. Control the exchange of substances or macromolecules across the capillary wall between blood and surrounding tissues.

In the brain, the blood capillaries are modified continuous capillaries that form **the blood brain barrier**, with very low permeability.

The blood brain barrier is formed by:

- Few or no pinocytotic vesicles in endothelial cells
- Continuous basement membrane.

- **Occluding junction** between endothelial cells represent the main structural component of the barrier

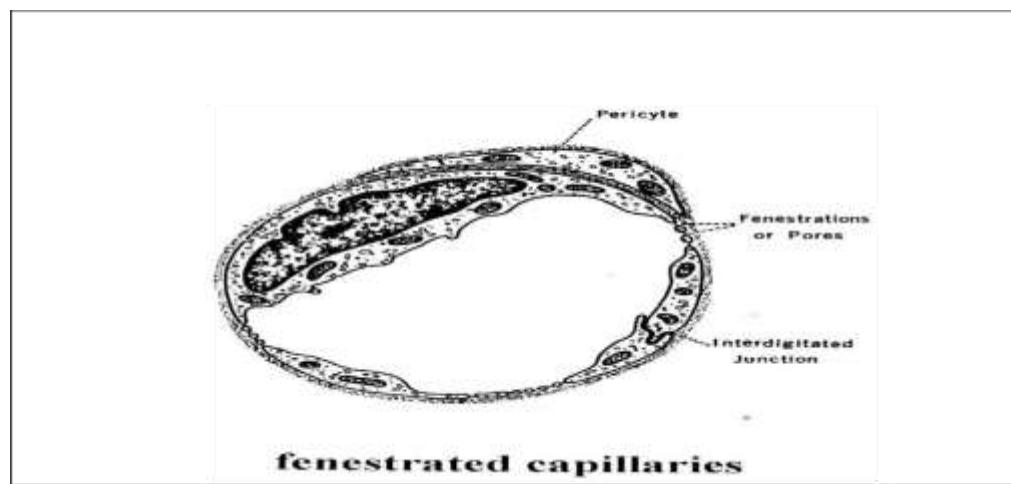


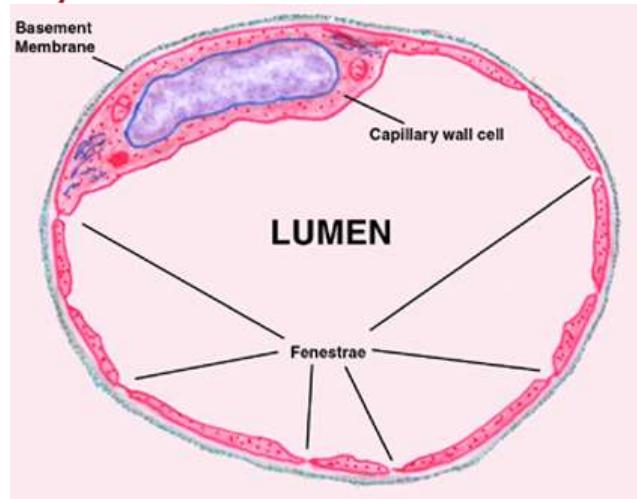
2-Fenestrated Blood capillaries:

Structure: The endothelial cells have pores (60 -80 nm in diameter), and usually covered by a pore diaphragm. The basal lamina is continuous.

Site: They are present in the intestinal mucosa, endocrine glands and choroid capillaries. The glomerular capillaries have fenestrae without diaphragm to speed up process of exchange.

Function: They are leakier than continuous capillaries and allow regulated exchange through the pores where their structure allows for the transport of larger molecules such as hormones or fat particle .





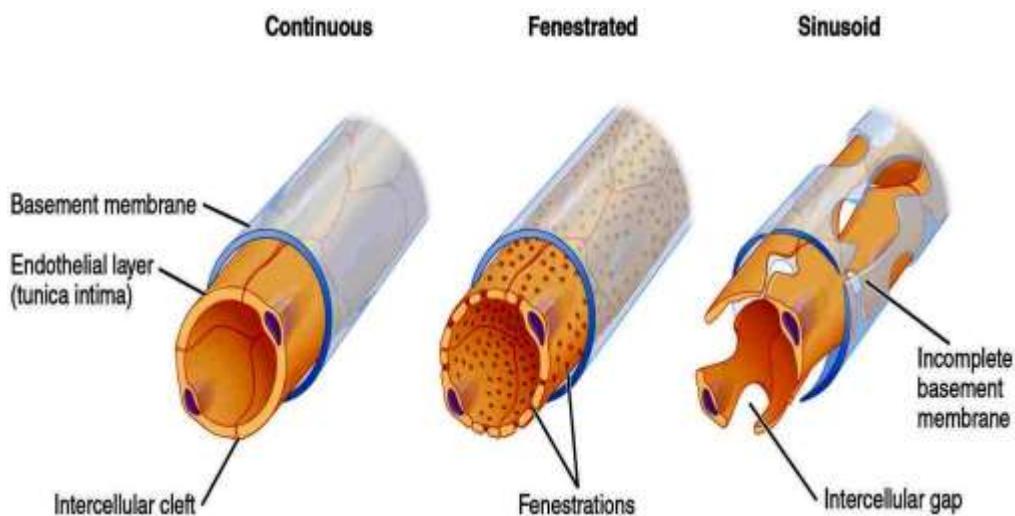
3-Blood Sinusoids:

Structure: They have an enlarged diameter of 30-40um & irregular path.

The endothelial wall and the basal lamina are discontinuous. The fenestrae in the endothelial cells are without diaphragm. Macrophages may be located either in or along the outside of the endothelial wall.

Site: Present in bone marrow, liver& spleen.

Function: Allow more facilitated exchange between blood and surrounding tissue than other types of capillaries .They have large gaps between cells that allow larger particles, and even blood cells, to enter or exit the blood. .



Types of Blood Capillaries

Type of Capillary	Structure	Site	Function
Continuous Capillaries	-Uninterrupted endothelium -continuous basal lamina.	Muscles, connective tissue, nervous tissue, brain	Control exchange of substances/macromolecules between blood and tissues; in brain, form blood-brain barrier.
Fenestrated Capillaries	Endothelial cells contain pores (60–80 nm) often with diaphragms; continuous basal lamina.	Intestinal mucosa, endocrine glands, choroid capillaries, renal glomeruli	Leakier than continuous type; allow regulated exchange through pores.
Blood Sinusoids	-Enlarged (30–40 µm), irregular paths. Discontinuous endothelium and basal lamina. Fenestrae lack diaphragms. Macrophages may lie within or outside the wall.	Bone marrow, liver, spleen	Permit more facilitated exchange between blood and surrounding tissue than other capillary types.

Specialized Sensory Structures in Arteries

- They are located in the major arteries of the body; they include carotid sinuses, carotid and aortic bodies.
- Function: Nerve endings in these structures monitor blood pressure and blood composition, by sending impulses to the brain for controlling heart rate, respiratory rate and blood pressure.

1 -Carotid sinus :

- **Site:** It is a dilatation of the wall of the internal carotid artery just above the bifurcation of the common carotid artery .

- **Histological structure:** At the site of the carotid sinus, the adventitia of the carotid artery is relatively thicker and heavily supplied with sensory nerve ending from the glossopharyngeal nerve (IX). The media is thinner, so, it distends during increase in blood pressure .
- **Function:** It is a baroreceptor when stimulated by an increase of arterial blood pressure: it sends inhibitory impulses to respiratory and cardiovascular centers.

2 -Carotid Body :

- **Site:** It is located at the bifurcation of the common carotid artery .
- **Histological structure:** It is composed of multiple clusters of pale staining cells embedded in C.T. Glomus cells :(chemoreceptor cells) and Sheath cells: (supporting cells)
- **Function:** It has specialized chemoreceptor nerve endings responsible for monitoring changes in O₂ &CO₂.

3 -Aortic Body :

- **Site:** they are located on the aortic arch between the common carotids and the subclavian arteries .
- **Structure & function** are similar to those of the carotid bod

Lecture References:

- Kaplan Medical, USMLE Step 1 Lecture Notes, Pathology, 2021
- Elsevier 's integrated Histology: 1st edition
- Junqueira's Basic Histology: Text and Atlas 14th Edition