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Cardiovascular System

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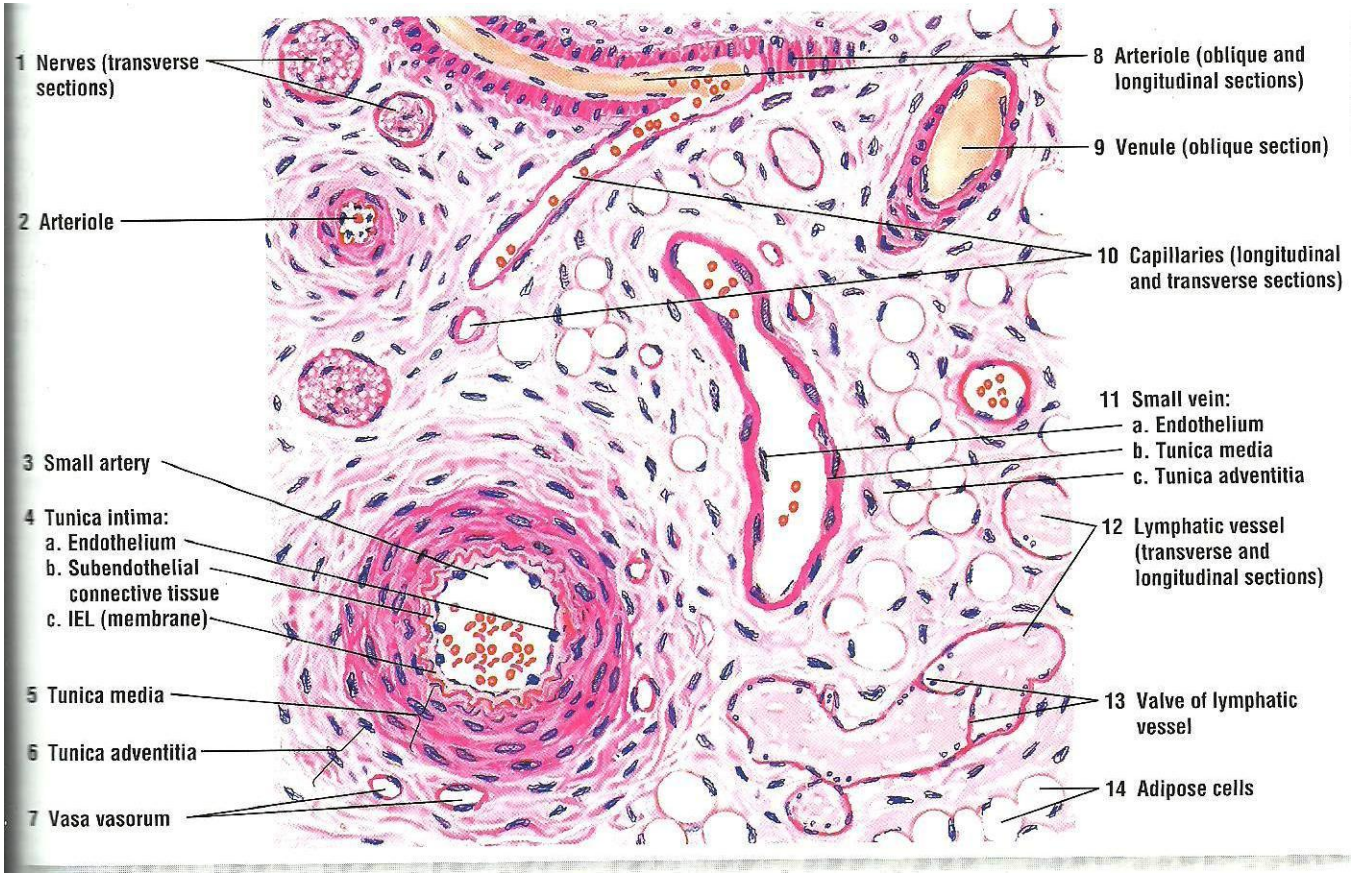
Blood & lymphatic vessels in the connective tissue



Constituents

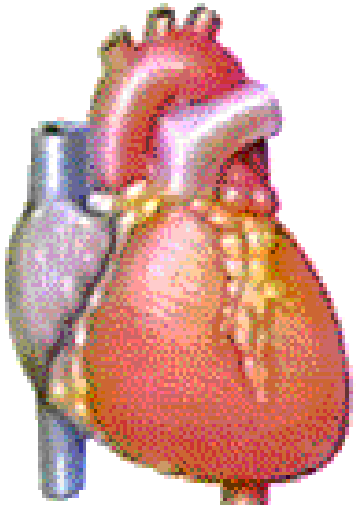
- **Heart**

- **Blood vessels:**

  (a) Arteries

  (b) Capillaries

  (c) Veins



elastic arteries

muscular arteries

arterioles

capillaries/sinusoids

venules

medium-sized vein

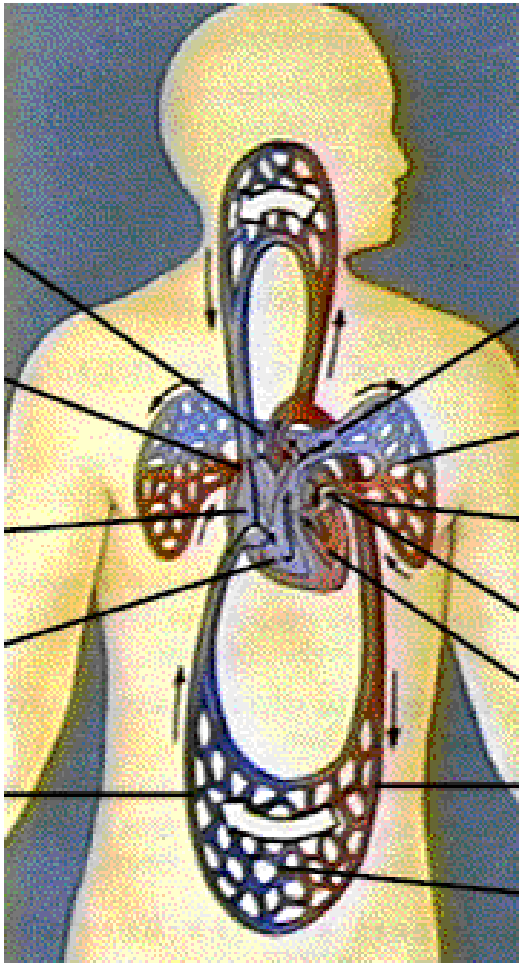
large vein

Arteries – ALWAYS carry blood away from the heart

Veins – ALWAYS return blood to the heart

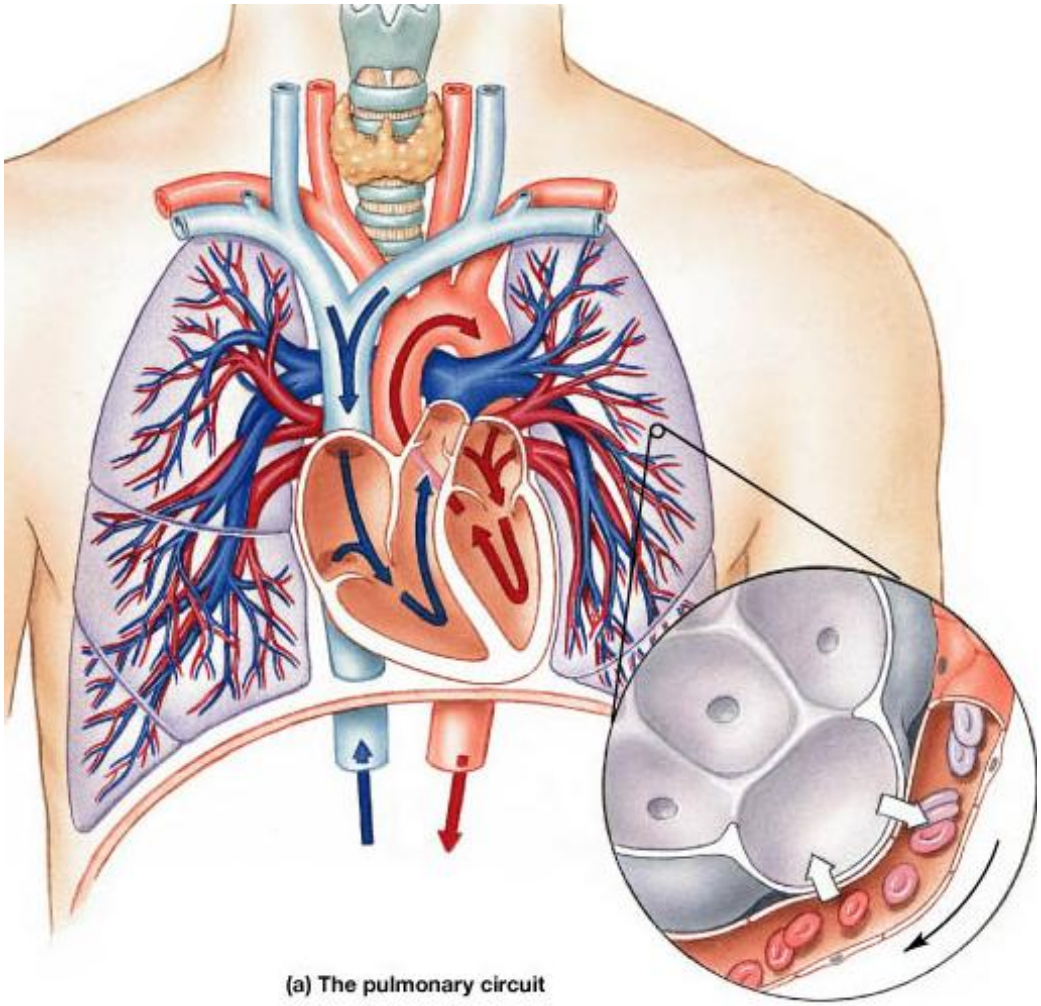
All are lined on their inner surface by endothelial cells (simple squamous)

Gross Anatomy of Circulatory System



Pulmonary &
Systemic Circulations

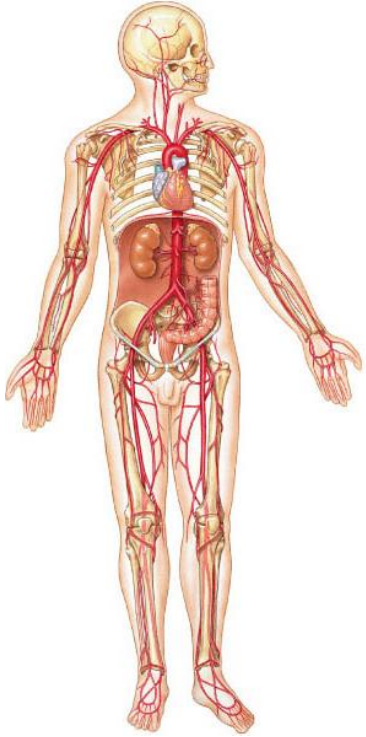
Pulmonary Circuit

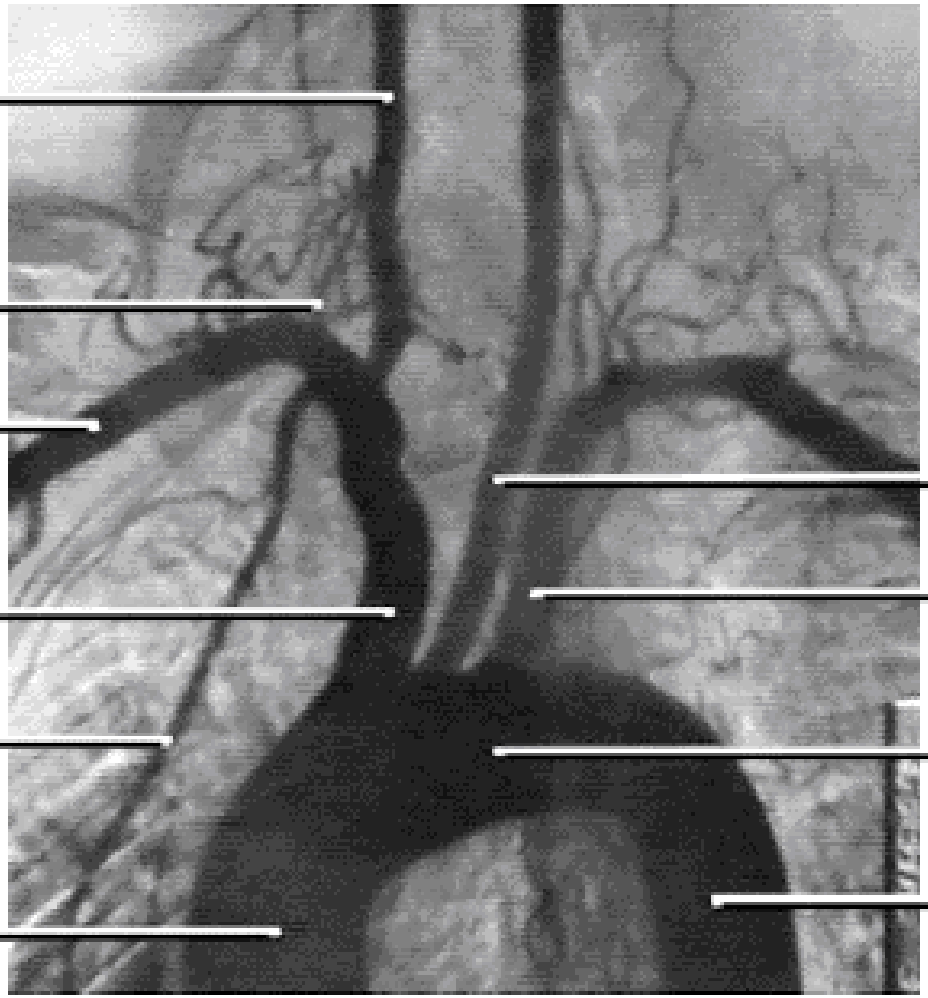


(a) The pulmonary circuit

- Right ventricle into pulmonary trunk to pulmonary arteries to lungs.
- Return by way of 4 pulmonary veins to left atrium.

Systemic Circuit





Basic structure of arteries

1. **Tunica interna or intima:**
   consists of-

   a. Endothelium

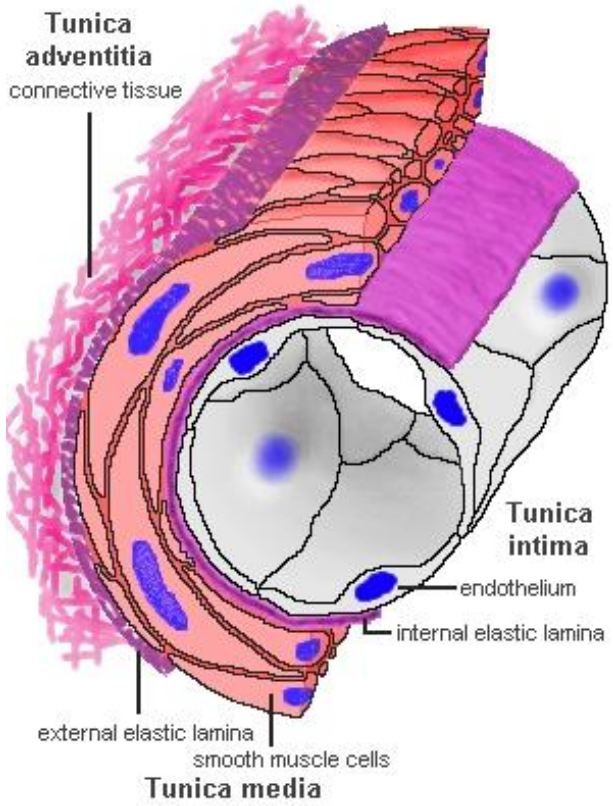
   b. Basal lamina

   c. Subendothelial connective tissue

   d. Internal elastic lamina

2. **Tunica media**

3. **Tunica externa or adventitia**



Classification of Arteries

- **Elastic (conducting/ large size arteries):**

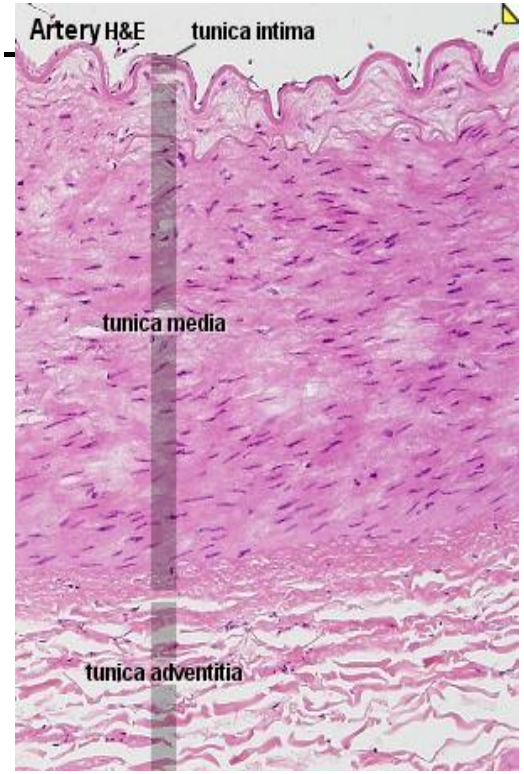
  e.g. aorta, pulmonary trunk, carotids, subclavian, axillary, iliac.

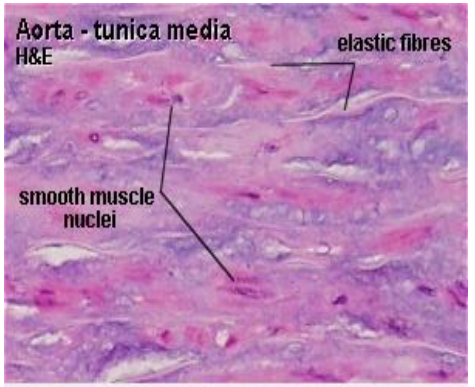
- **Muscular (distributing/ medium size arteries)**

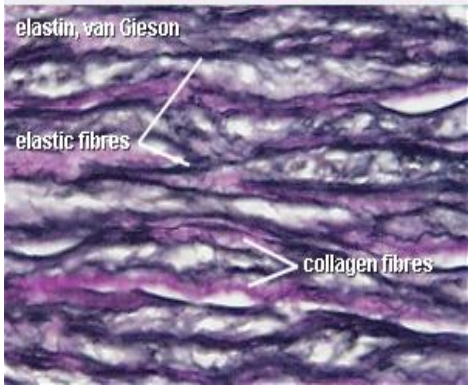
- **Arterioles**

Elastic arteries

- Internal elastic lamina is ill-defined.
- Tunica media is predominantly made up of elastic fibres.
- Tunica adventitia contains blood vessels (vasa vasorum).

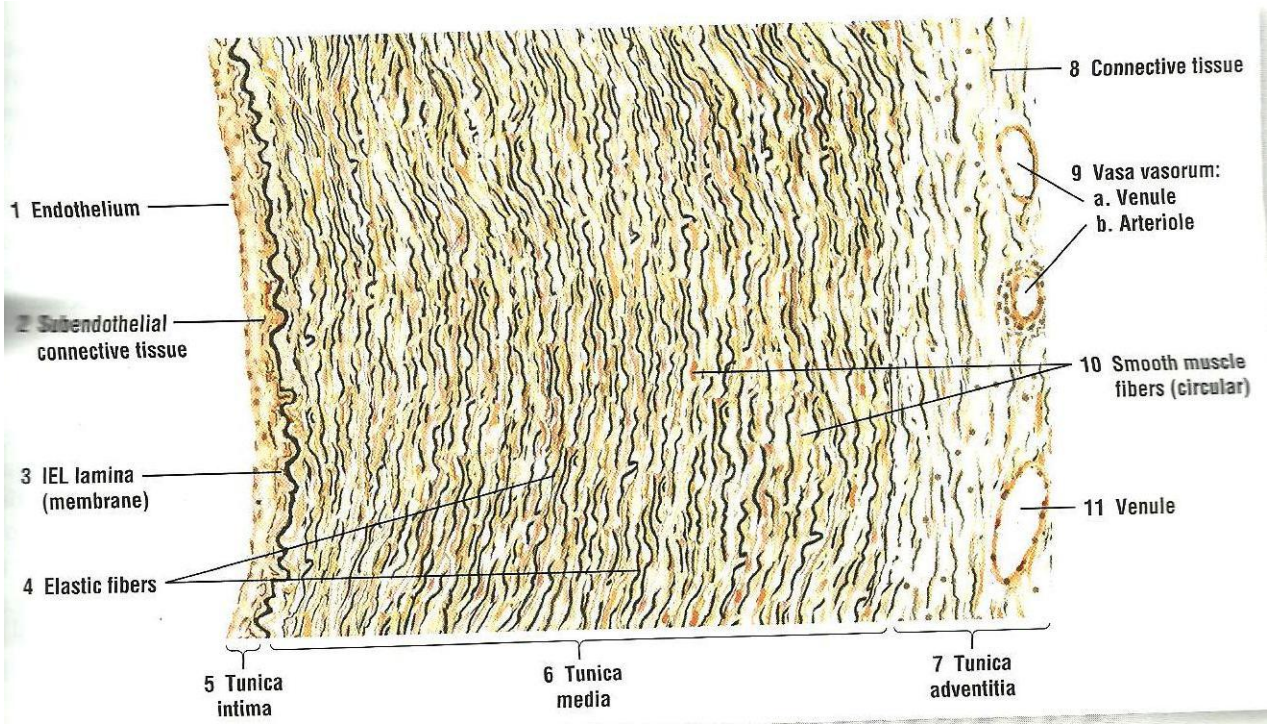






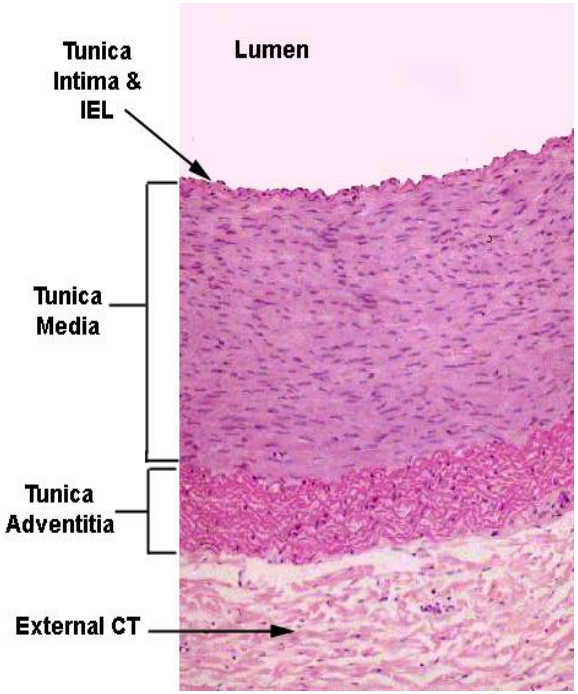
Diameter: > 1 cm

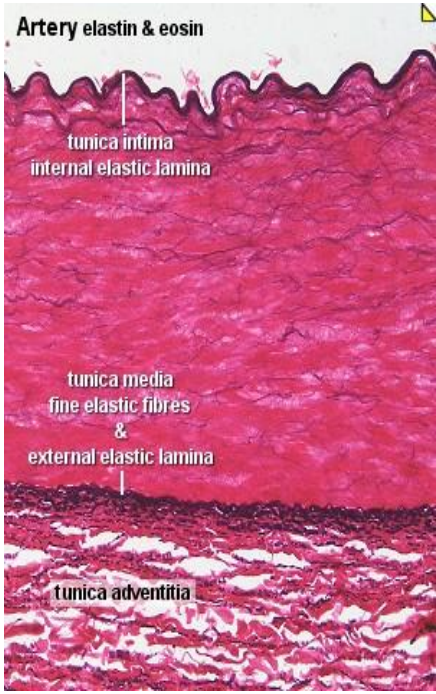
Elastic artery



Muscular arteries (Medium sized arteries)

- Internal elastic lamina is clearly visible.
- Tunica media is predominantly made up of smooth muscle cells.
- Tunica adventitia is thicker than of elastic artery.

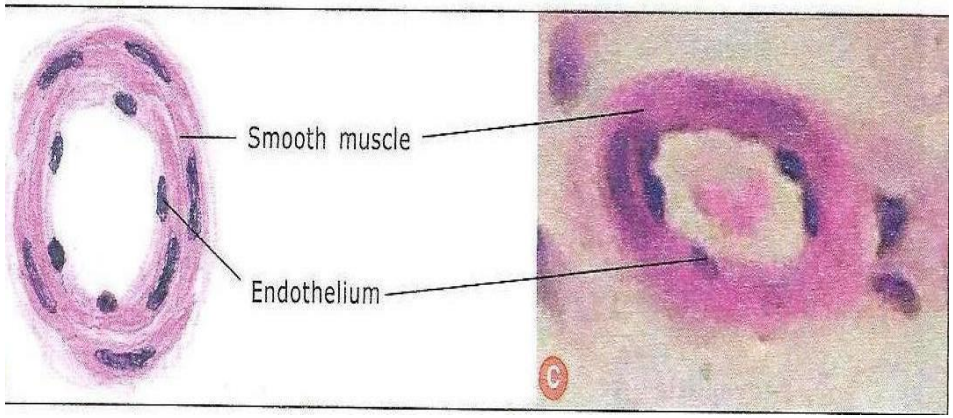




Diameter: 2-10 mm

Arterioles

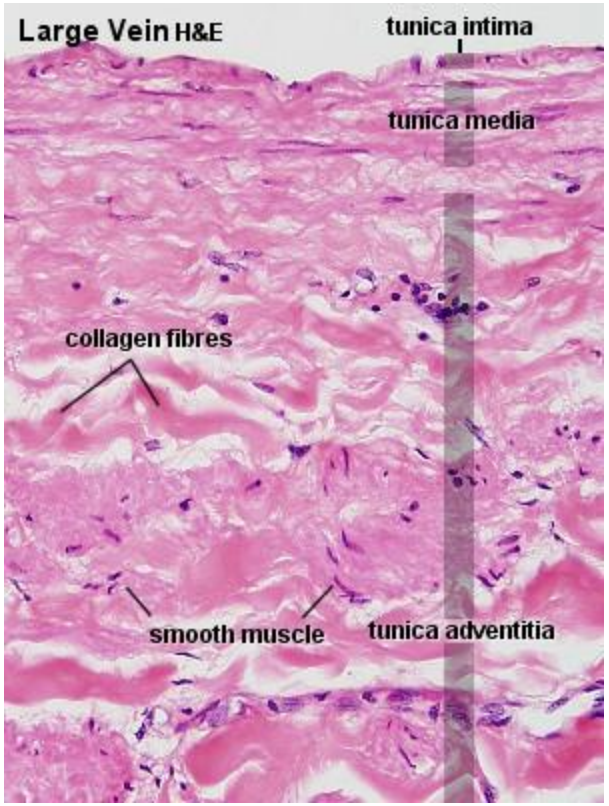
- Arterioles less than 50 μm diameter are called terminal arterioles.
- The smallest terminal arteriole is < 12 μm
- Internal elastic lamina is poorly developed.
- Thin layer of smooth muscle in tunica media.
- Precapillary sphincter
- Tunica adventitia is thin.
- Metarterioles



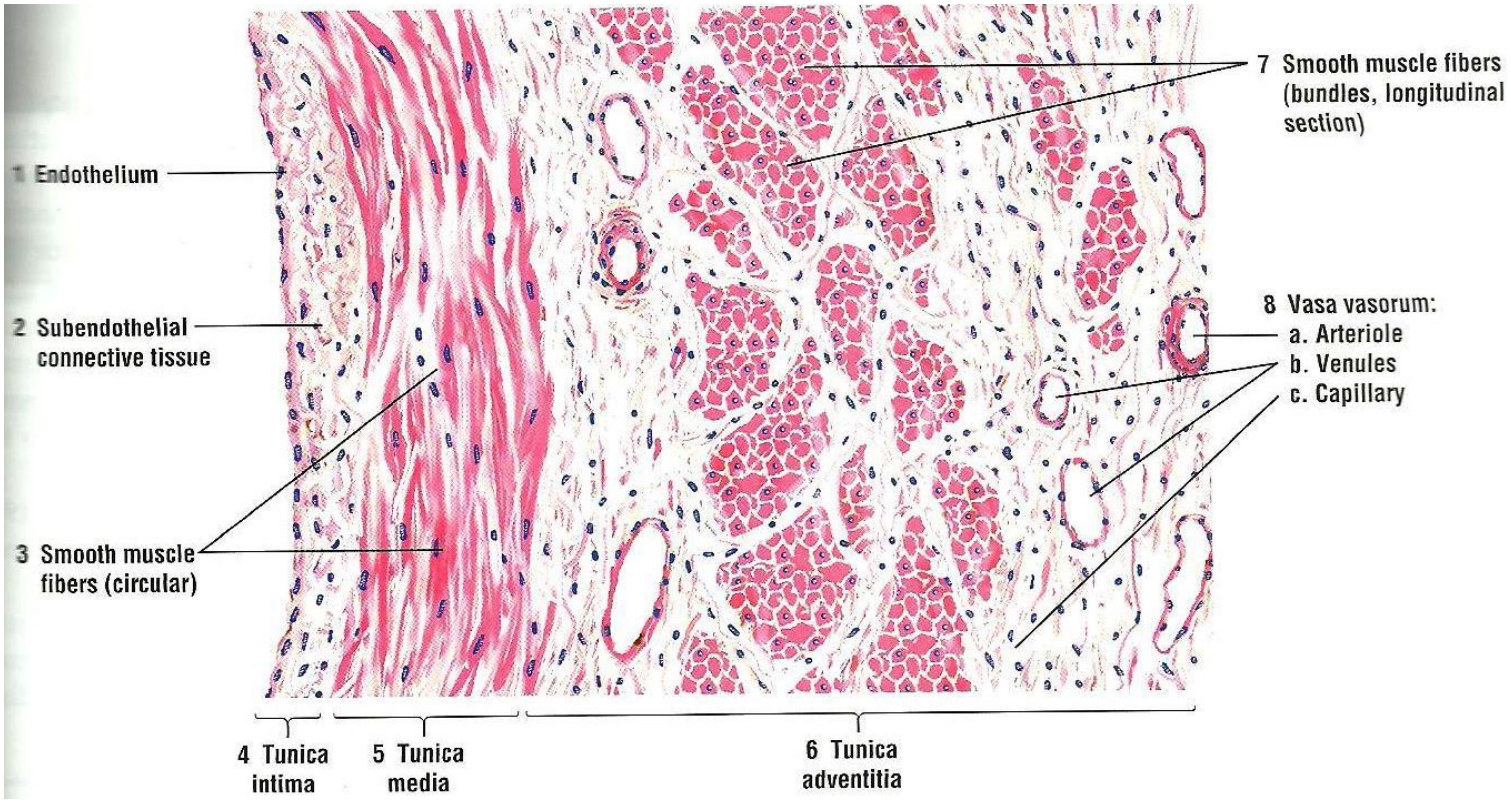
Diameter: < 100 μm

Veins

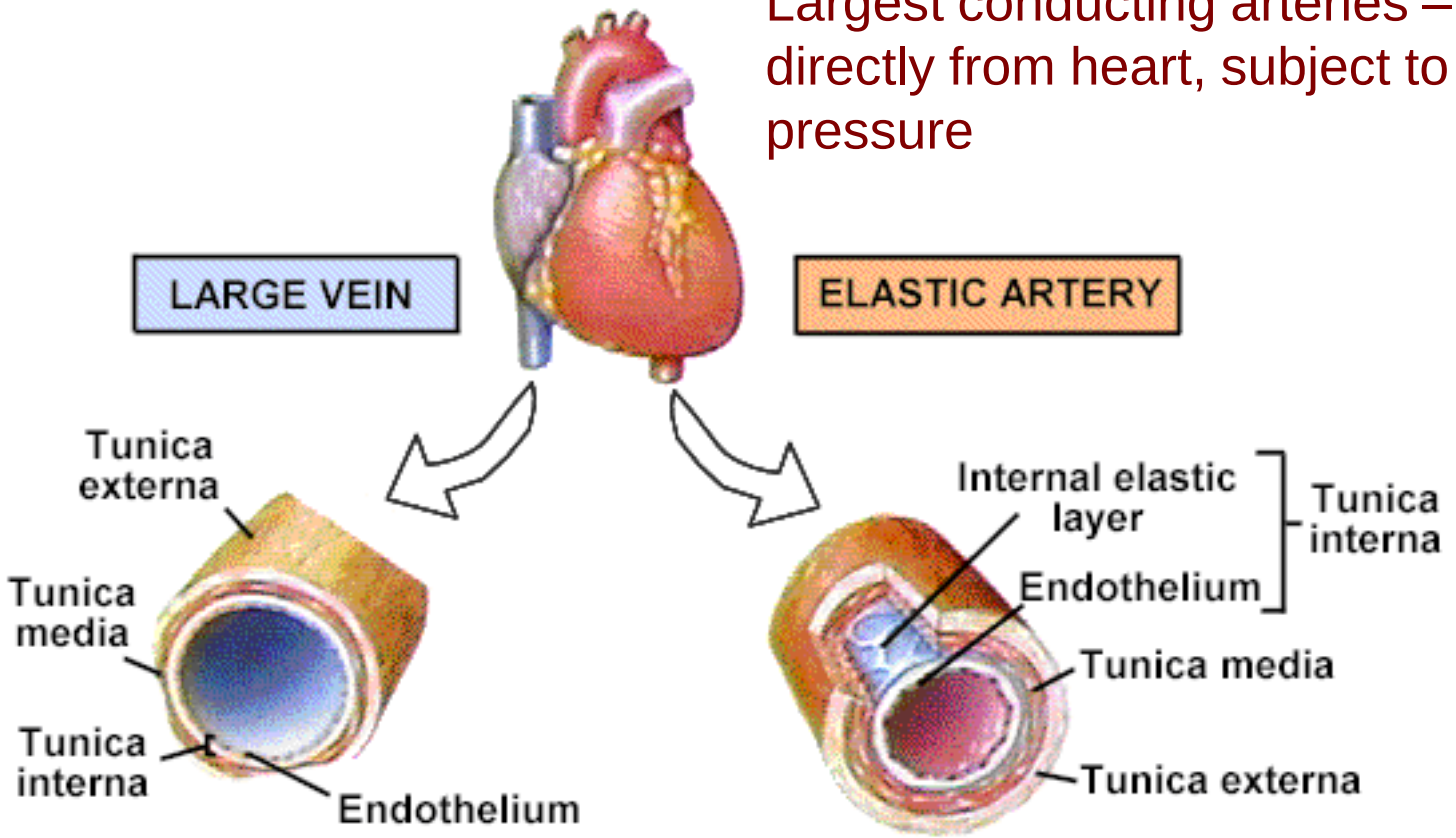
- Classified as large, medium & small (venules).
- All the 3 tunics are present but not well defined.
- T. intima: endothelial cells, basal lamina, subendothelial connective tissue & few smooth muscle cells
- T. media: larger amount of collagen, thinner
- T. adventitia: thicker



Large vein

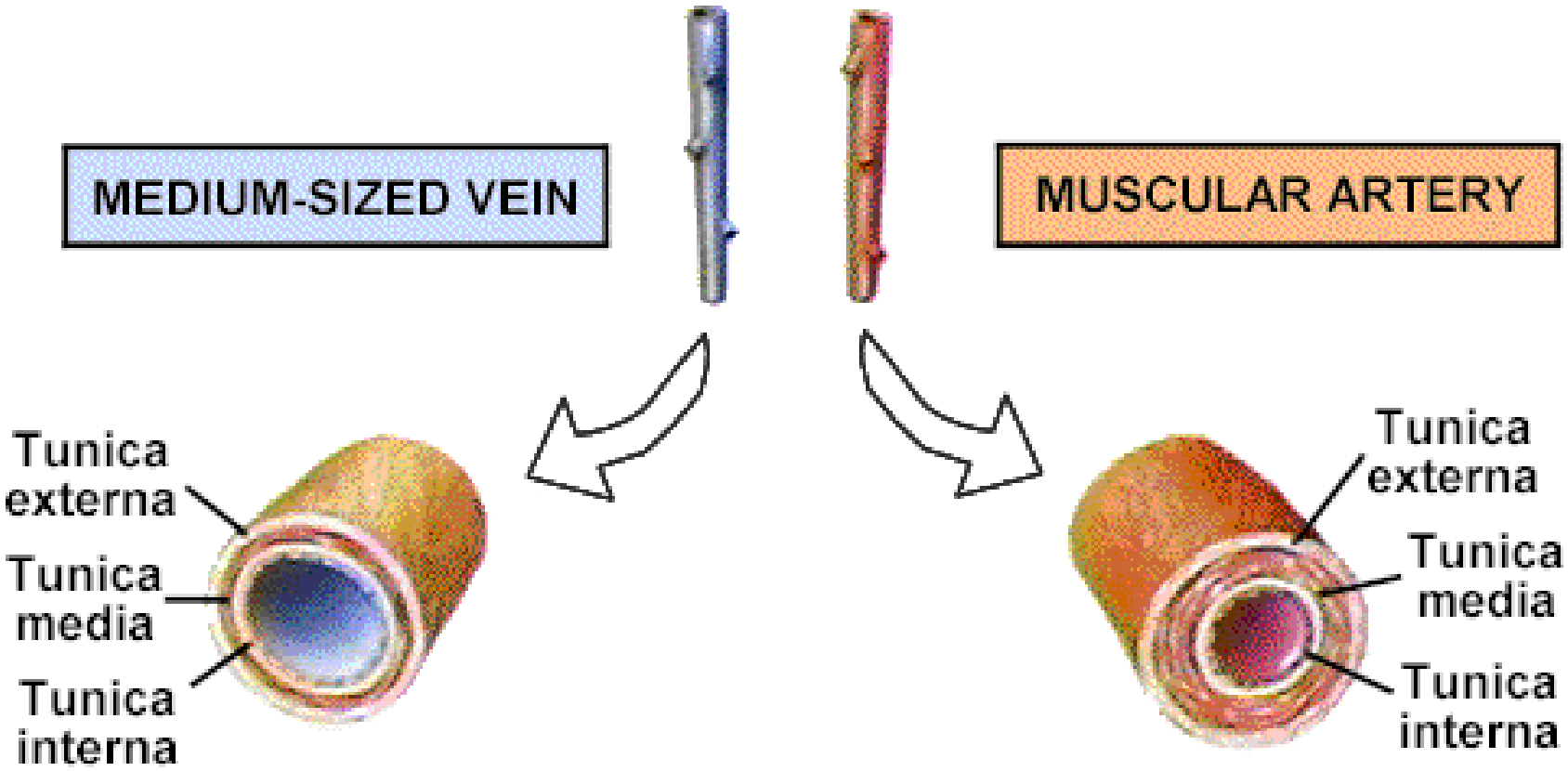

1 Endothelium
2 Subendothelial connective tissue
3 Smooth muscle fibers (circular)
4 Tunica intima
5 Tunica media
6 Tunica adventitia
7 Smooth muscle fibers (bundles, longitudinal section)
8 Vasa vasorum:
a. Arteriole
b. Venules
c. Capillary

Largest conducting arteries – lead directly from heart, subject to high pressure



Superior & inferior vena cava and their tributaries

Pulmonary trunk & aorta and their major branches

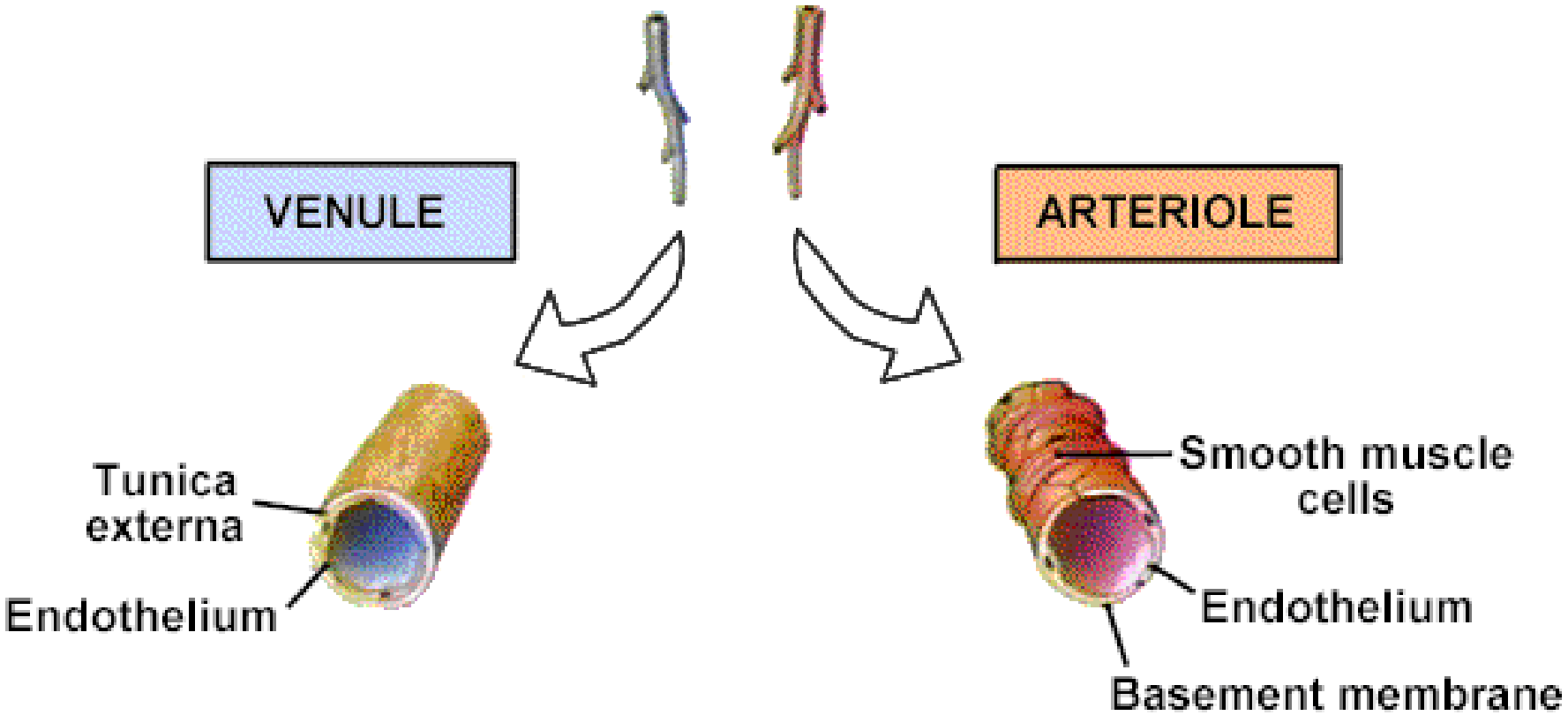


∅ 2 - 9 mm

∅ ~ 4 mm

External and internal jugular, brachial & femoral veins

External and internal carotids, brachial & femoral arteries


VENULE
ARTERIOLE
Tunica externa
Endothelium
Smooth muscle cells
Endothelium
Basement membrane

∅ ~ 10-50 µm

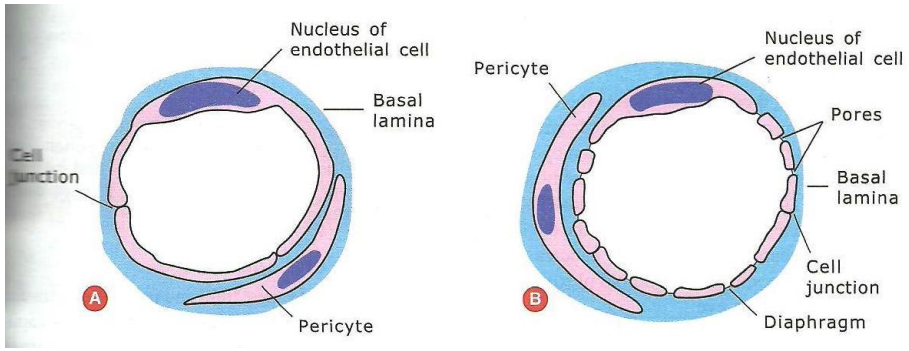
∅ ~ 30 µm

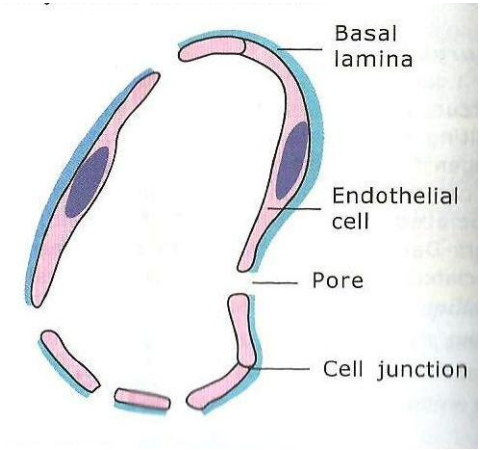
Capillaries

- Thin-walled endothelial-lined microscopic vessels that connect arterioles & venules.
- Extensive network
- Diameter: 5-10 μm
- Flow of blood through capillary is called Microcirculation.
- **Absence of T. media & adventitia.**

Types of capillaries

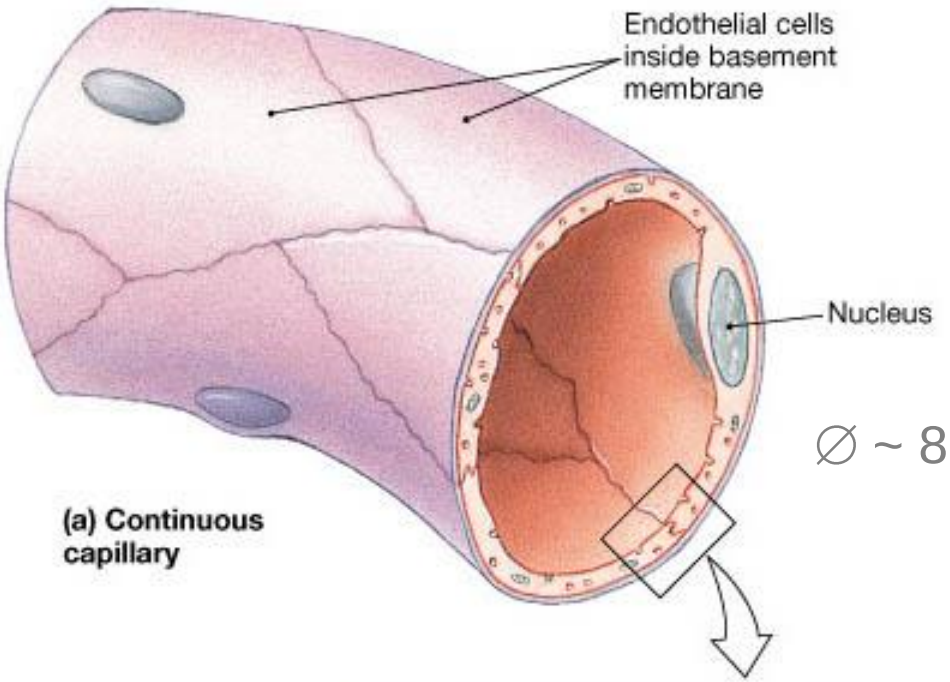
- Continuous capillaries
- Fenestrated capillaries
- Sinusoids



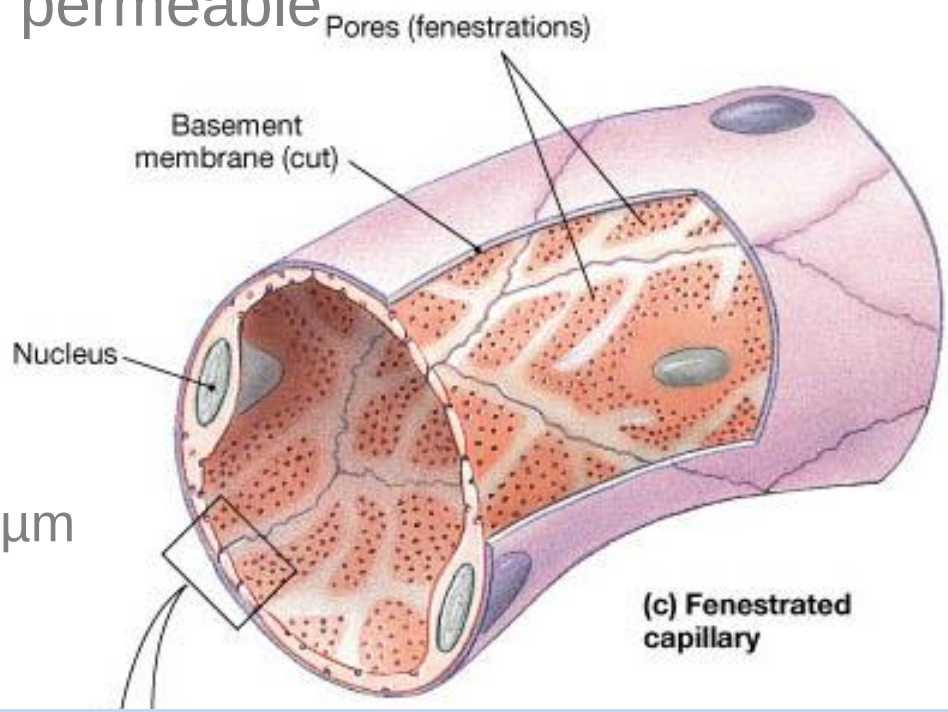


Capillaries

Only endothelium
Variably permeable

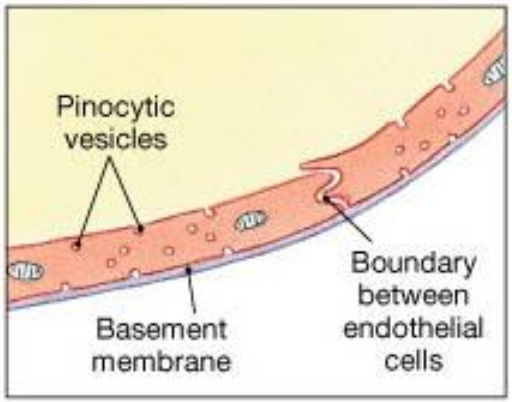


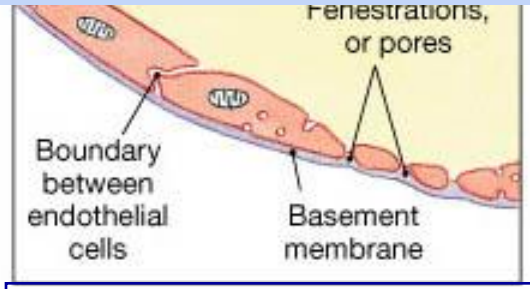
∅ ~ 8 µm



Characterized by circular fenestrae or pores that penetrate the endothelium - permit exchange of larger molecules.

somewhat permeable

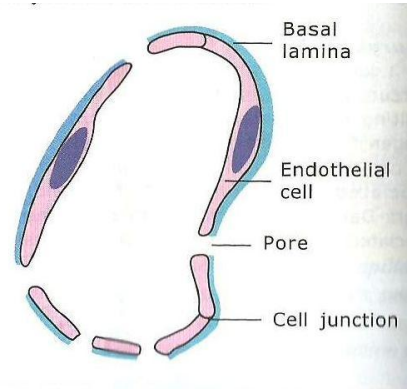




Most body regions

Intestinal mucosa, choroid plexus, endocrine glands, kidneys

Sinusoids



- Resemble fenestrated capillaries but have:
  a. irregular shapes
  b. longer pores
  c. thinner (or no) basement membrane
- Blood flow is sluggish
- Found in the liver, bone marrow, spleen etc.
- Sometimes called as sinusoidal capillary.

References

1. diFiore's Atlas of Histology with functional Correlations, 12th Edition.

2. Textbook of Human Histology. Inderbir Singh, 1st Edition.

3. Textbook of Histology. GP Pal, 3rd Edition.

MCQ

- Prominent external elastic lamina is a feature of:

1. Elastic artery
2. Muscular artery
3. Arteriole
4. Vein

MCQ

- Tunica media is thinner than adventitia in:

1. Elastic artery
2. Muscular artery
3. Arteriole
4. Vein

MCQ

- All are components of Tunica intima ***except:***

1. Endothelium
2. Subendothelial layer
3. Internal elastic lamina
4. Cell junction

MCQ

- Internal elastic lamina is poorly developed in:

1. Elastic artery
2. Muscular artery
3. Arteriole
4. Vein

MCQ

- All are present in Tunica adventitia of arteries ***except:***

1. Collagen fibres
2. Elastic fibres
3. Plasma cells
4. Vasa vasorum