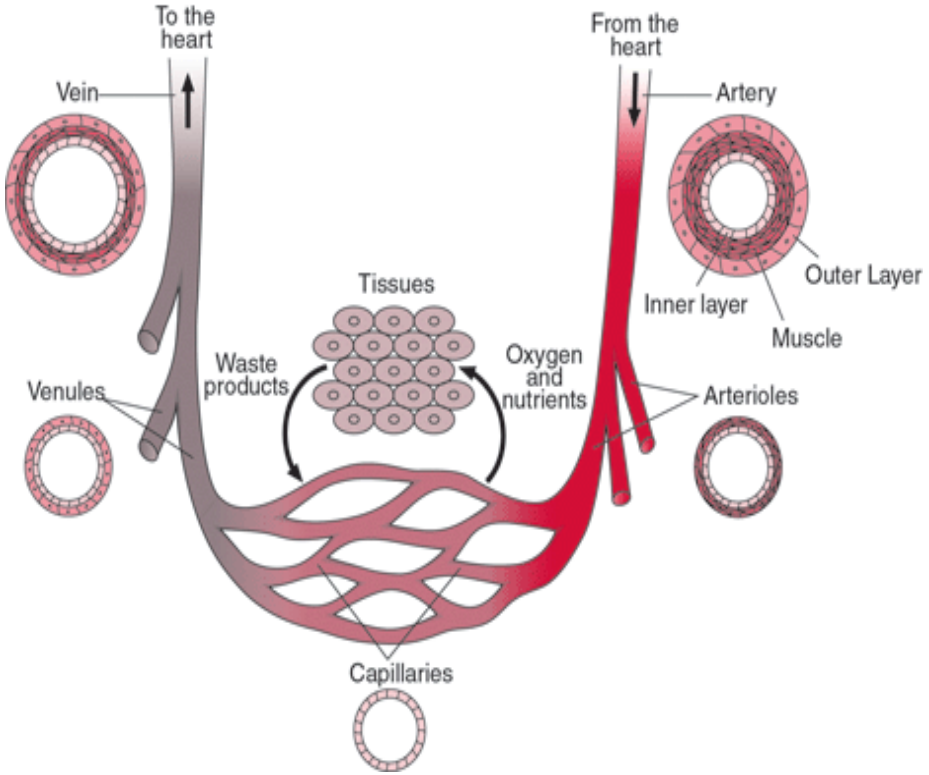
Histology of the Blood Vessels

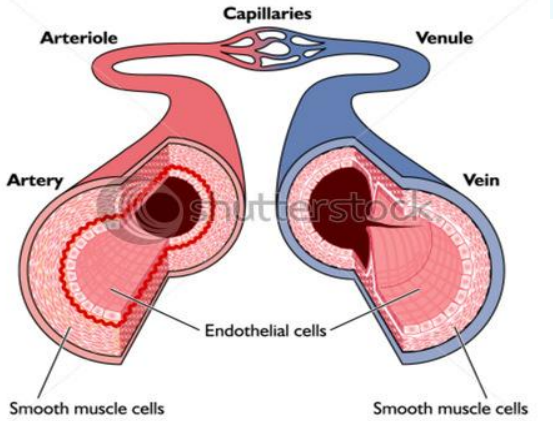
OBJECTIVES:

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:

- ✓ **Elastic Artieries**
- ✓ **Muscular "Medium-sized" Arteries**
- ✓ **Medium Sized Veins**
- ✓ **Blood Capillaries**



Mind Map



Blood Vessels

- **Veins**
  - Venules
  - Small Veins
  - Medium-Sizeed Veins
  - Large Veins
  - *The wall is thinner than the Accompanying artery.
  - -T.Intima:
    - -Usually forms Valves
    - -No internal elastic lamina
  - -T.Media:
    - -Thinner than T.Adventita
  - -T.Adventitia:
    - -Thicker tha T.Media
- **Arteries**
  - Arterioles
  - Medium-Sized Artery
    - -T.Intima:
      - -Endothelium
      - -Subendothelial C.T Layer
      - -Internal elastic lamina:
        - *Is Prominent
    - -T.Media:
      - -Thicker than T.Adventitia or similar in thickness
    - -T.Adventitia:
      - -Loose C.T.
    - Brachial, ulnar
  - Elastic Artery
    - -T.Intima:
      - -Endothelium
      - -Subendothelial C.T
      - -Internal elastic lamina:
        - *Not prominent
    - -T.Media:
      - *Fenestrated elastic membranes is the main component of T.M
    - -T.Adventita:
      - -Much thinner than T.M
      - -Loose C.T
      - -Contains Vasa Vasorum
    - Aorta
- **Capillaries**
  - -Single layer of squamous endothelial cells
  - -Basal lamina
  - -Pericytes
  - Continuous Blood Capillaries
    - In muscles
  - Fenestrated Blood Capillaries
    - With Diaphragms
      - In intestine
    - Without Diaphragms
      - In renal glomerulus
  - Sinusoidal Blood Capillaries
    - liver,spleen

General Structure of Blood Vessels

- Wall of blood vessels formed of 3 concentric layers:

Tunica Intima

Innermost layer that comes in contact with blood

Composed of:

1- Endothelial Cells "Simple Squamous Epithelium"

2- Subendothelial Layer "Loose Connective Tissue"

3- Internal Elastic Lamina "fenestrated elastic sheet"

Tunica Media

Intermediate layer

Composed of:

1- Smooth Mucles **"mainly"**

2- Elastic Fibers

3- Type III Collagen "Reticular Fibers"

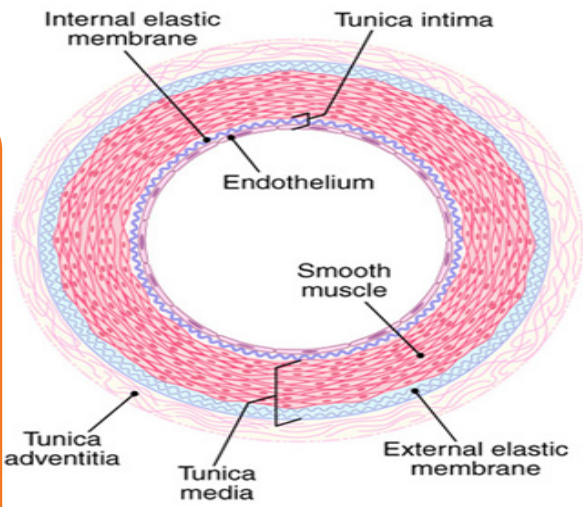
4- Type I Collagen

Tunica Adventitia

Outermost Layer

Composed of:

Connective Tissue containing **Vasa Vasorum** which are small arterioles in tunica adventitia and outer layer of Tunica media as if its supplying its self with blood



NOTE:

Tunica is general term for a membrane or other structure covering or lining

Elastic Arteries

- Examples: Aorta, Common Carotid, Subclavian, Common iliac and Pulmonary Trunk.

- Microscopic Structure

Tunica Intima

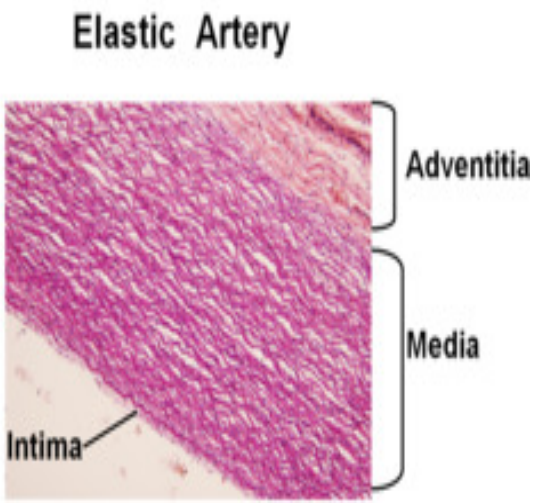
- Endothelium
- Subendothelial CT
- Internal Elastic Lamina: **NOT** prominent "indistinct".

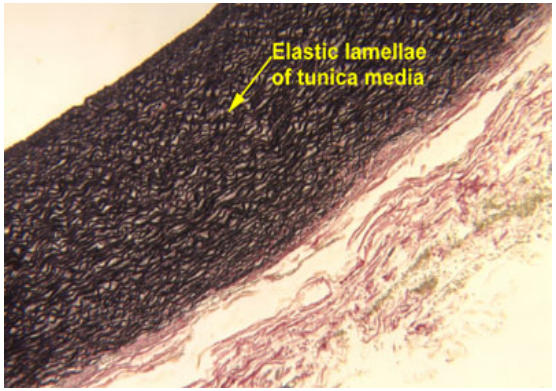
Tunica Media

- **Fenestrated Elastic Membrane** "sheets" lamellae: Main Component of Tunica Media
- In between there are: Smooth Muscle cells, Collagen Type I & Type III "reticular fibers" and Elastic Fibers.

Tunica Adventitia

- Thinner than Tunica Media, Composed of Loose CT.
- Contains **Vasa Vasorum** to send branches to outer part of Tunica Media

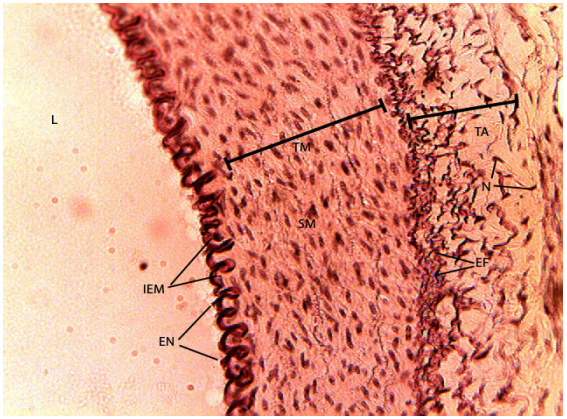




Stained with Orisin to show Elastic Fibers

Muscular Arteries "Medium-sized Artery"

- Examples: Brachial, Ulnar and Renal Artery.
- Microscopic Structures:



Tunica Intima

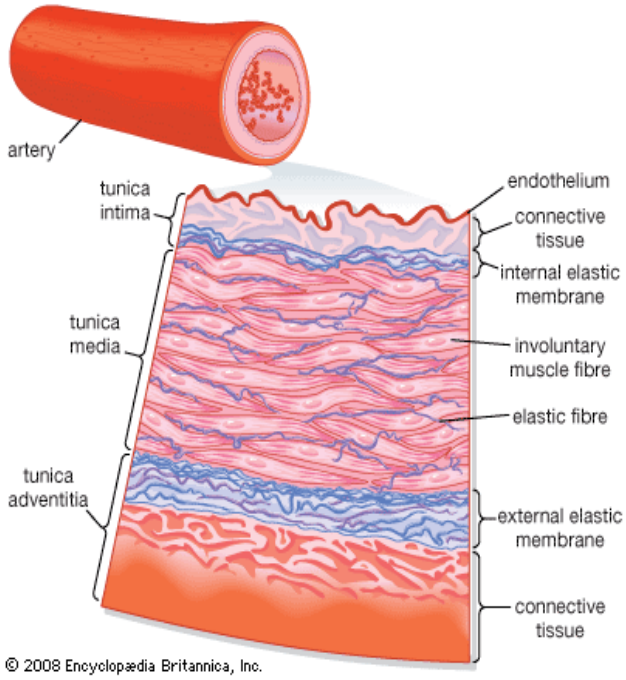
- Endothelium
- Subendothelial CT
- Internal Elastic Lamina: **PROMINENT** and displays and undulating "wave-like" surface

Tunica Media

- Thicker than Tunica Adventitia or similar. Comosed of:
- Smooth Muscle cells MOST dominant feature
- In between: Elastic Fibers, Collagen Type I & Type III "reticular fibers"
- **External Elastic Lamina**: may be identified

Tunica Adventitia

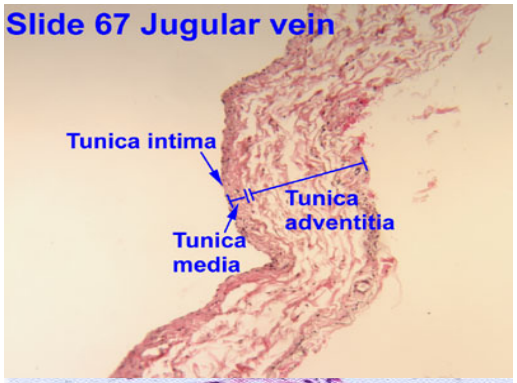
- Loose CT

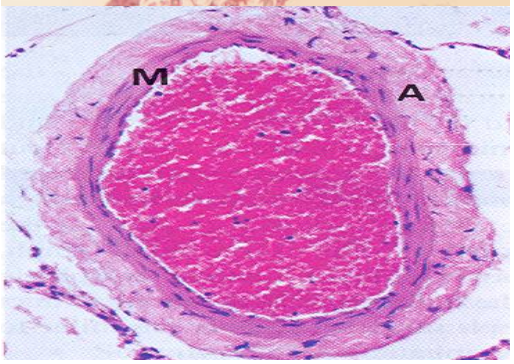


Medium Sized Vein

- Thinner than the accompanying artery
- Microscopic Structure:

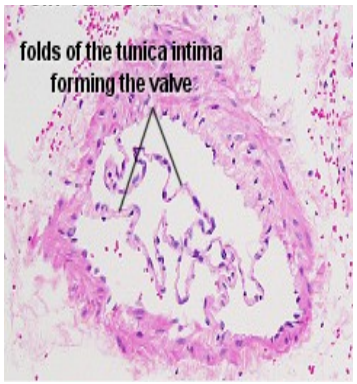
Tunica Intima	• Usually forms valves • Has **NO** Internal Elastic Lamina
Tunica Media	•Thinner than Tunica Adventitia •Consist of: Few Smooth Muscle Cells and Collagen Type I & III.
Tunica Adventitia	• Thicker than Tunica Media. Loose CT

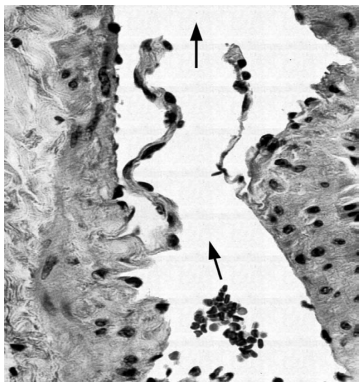




Valves of Veins

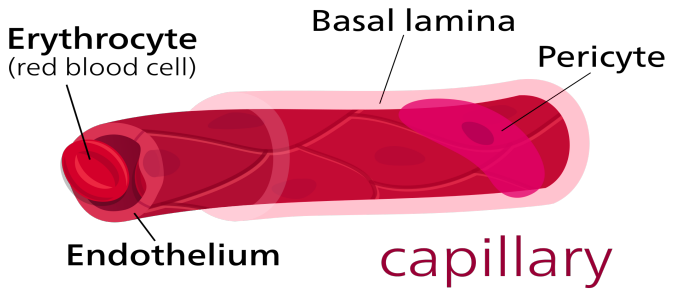
- Valves of a vein composed of 2 leaflets, which are a continuation "fold: of Tunica Intima.
- Composed of: Endothelium and Core of CT.





Blood Capillaries

- Diameter: usually 8-10 µm.
- Microscopic Structure:

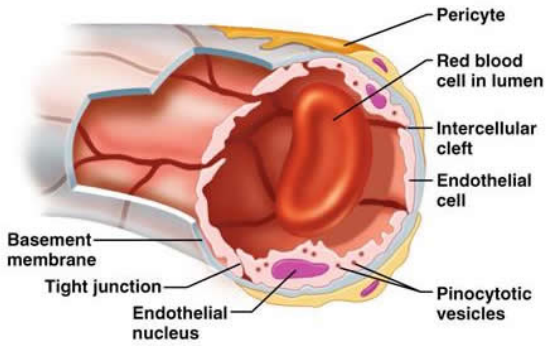


1- Single layer of **Squamous endothelial cells**
"1 cell hugging its self"

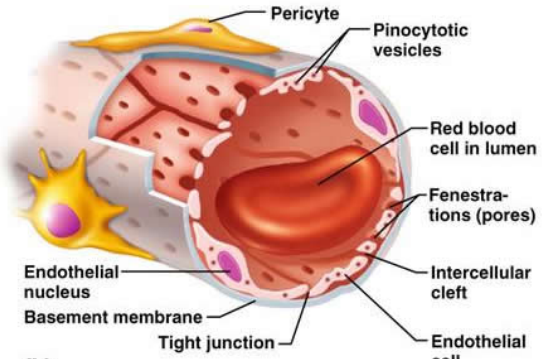
2- **Basal Lamina**: surround the external surface of the endothelial cells

3- **Pericyte**: Has processes"hand-like" and they share the basal lamina of endothelial cells

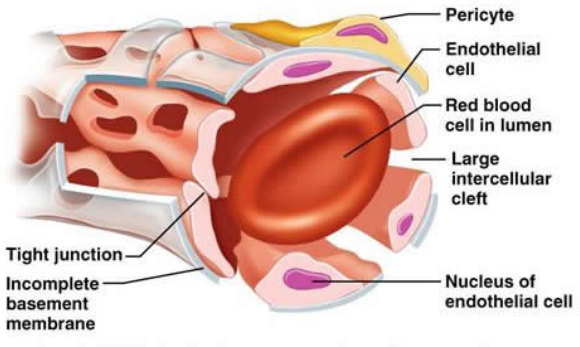
- Types of Blood Capillaries



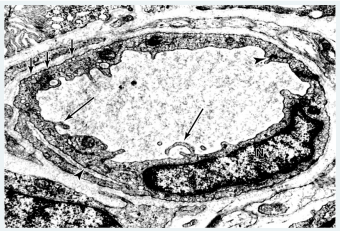
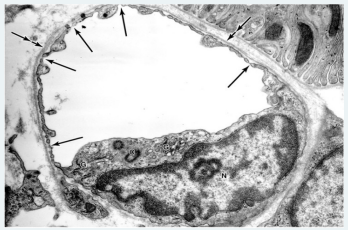
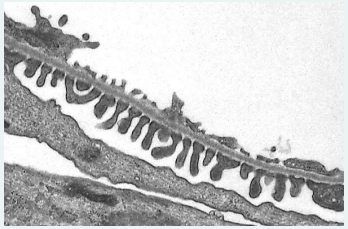
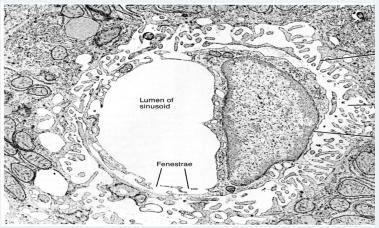
Continuous



Fenestrated

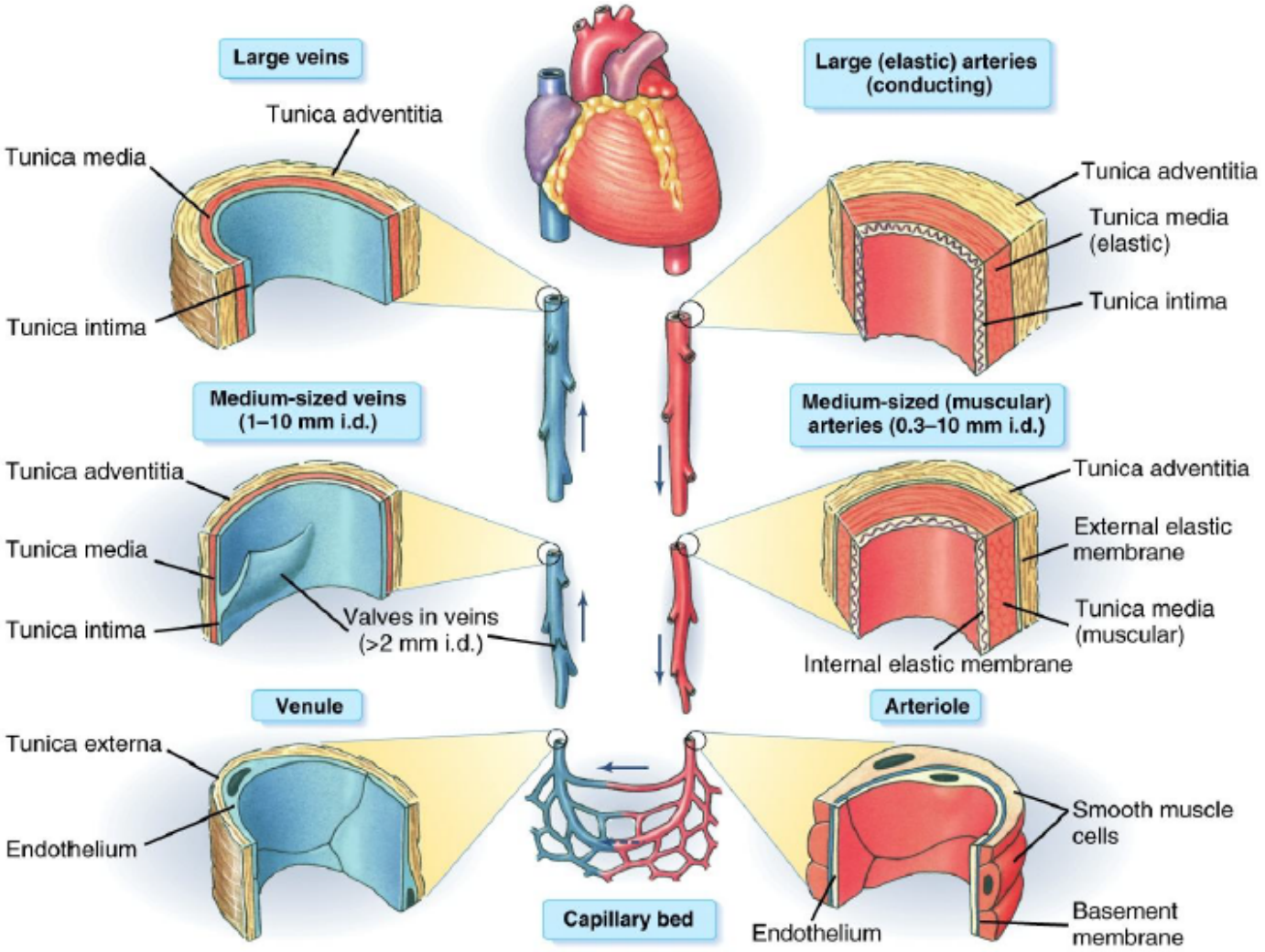


Sinusoidal

Type	Continuous	Fenestrated		Sinusoidal*
		With Diaphragm	With No Diaphragm	
Microscopic Structure				
	Has no pores or fenestrae in their walls "to prevent toxins to enter CNS ans MSK tissue	-Their endothelial wall has pores "fenestrae" these pores are covered by a Diapgragm "like a bridge"	They have pores "fenestrae" with NO Diaphragm	-Their enodthelial wall has fenestrae with NO Diaphragm -They have discontinuous endothelial cells & basal lamina - Macrophages may be located in or along the outside of the endothelial wall
Distribution	In Muscles, Nervous Tissue and Connective Tissue	In Intestine, Pancreas and Endocrine Glands	In renal glomerulus	In Red bone marrow, liver, spleen and certain endocrine glands.

***Irregular Diameter "30-40" µm**

Comparison


Large veins
Tunica adventitia
Tunica media
Tunica intima
Large (elastic) arteries (conducting)
Tunica adventitia
Tunica media (elastic)
Tunica intima
Medium-sized veins (1–10 mm i.d.)
Tunica adventitia
Tunica media
Tunica intima
Valves in veins (>2 mm i.d.)
Medium-sized (muscular) arteries (0.3–10 mm i.d.)
Tunica adventitia
External elastic membrane
Tunica media (muscular)
Internal elastic membrane
Venule
Tunica externa
Endothelium
Capillary bed
Arteriole
Smooth muscle cells
Endothelium
Basement membrane

MCQ's

1- Which one of the following separate the tunica media from the tunica adventitia?

A\external elastic lamina
B\Internal elastic lamina
C\Endothelium
D\ Subendothelial C.T

3- Which one of the following is the innermost layer of the **Blood Vessels?**

A\Tunica media
B\Tunica Intima
C\Tunica adventitia

2- The diameter of the BLOOD CAPILLARIES are usually?

A\12-14 µm
B\10-12 µm
C\5-8 µm
D\8-10 µm

4- Small arterioles in tunica adventitia and the outer part of tunica media?

A\Smooth muscles
B\Vasa vasorum
C\Elastic fibers.

Answers:
1- A
2- B
3- D
4- B

Motivation Corner

Done By:
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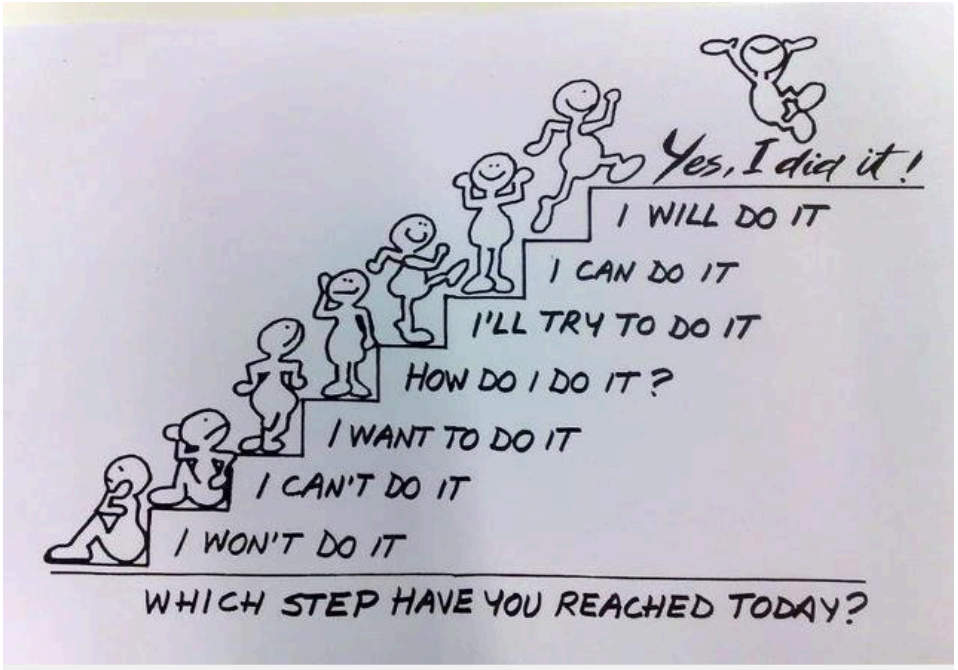

Thank you for Checking our Work

For any correction, suggestion or any useful information do not hesitate to contact us:

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