

# VESSELS AND CIRCULATION

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# LEARNING OBJECTIVES

1. To study the structure of blood and lymphatic vessels.
2. To co-relate histology of these structure with their functions.
3. To identify various types of blood vessels in a given slide.

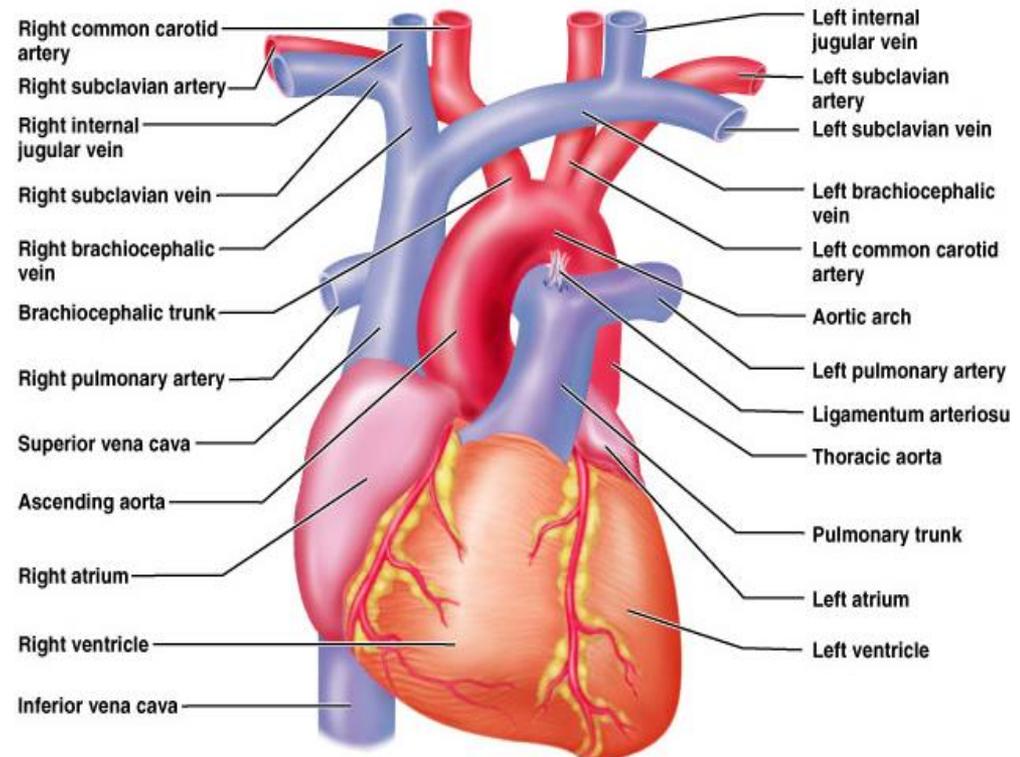
# CIRCULATORY SYSTEM

Heart

Blood vessels

Two separate loops:

1. Pulmonary Circuit
2. Systemic Circuit

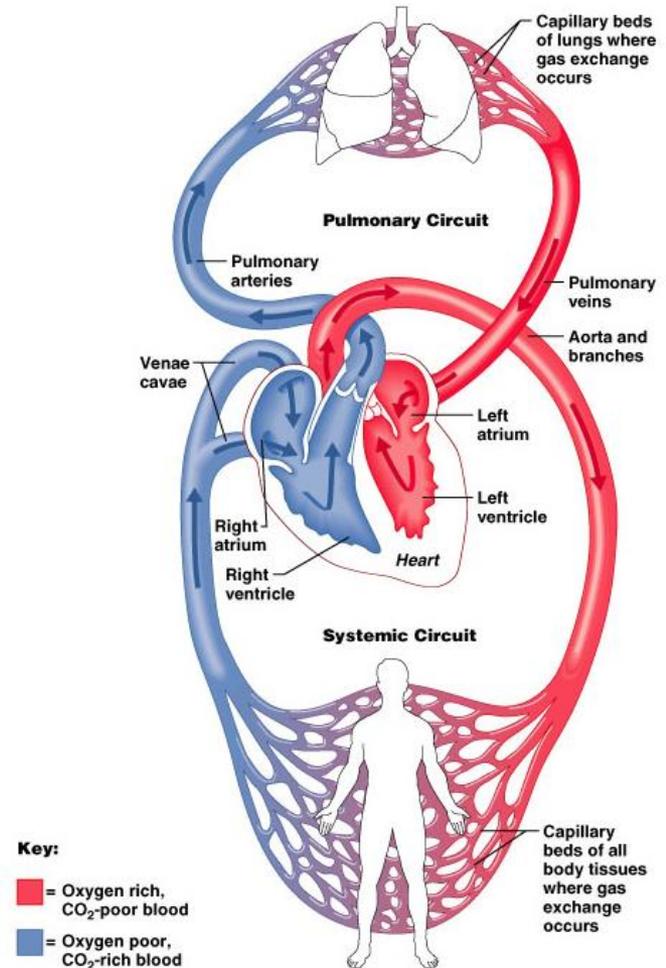


# 3 MAJOR BLOOD VESSELS

- Arteries- arterioles
- Capillaries
- Veins - venules

Arteries carry blood **away** from the heart

Veins carry blood **towards** the heart

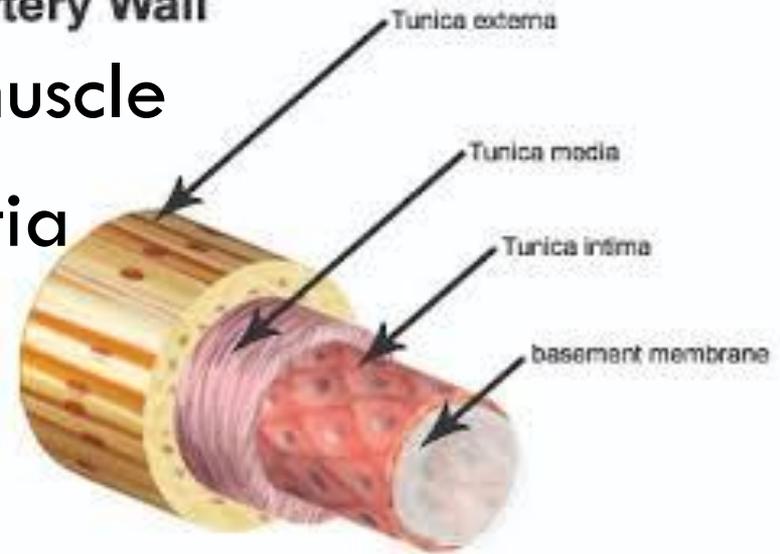


# GENERAL STRUCTURE OF VESSELS

Three layers

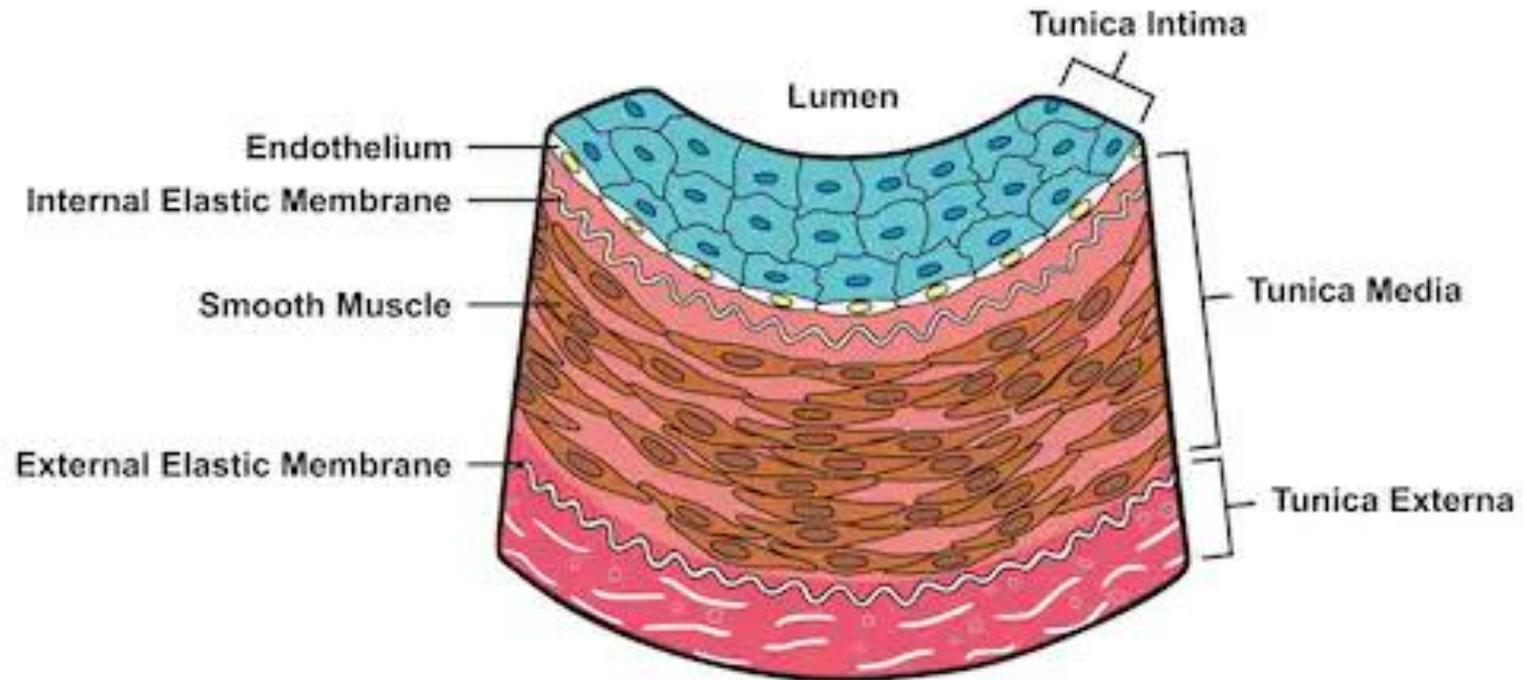
1. Tunica intima - intima
2. Tunica media – smooth muscle
3. Tunica externa - adventitia

Artery Wall

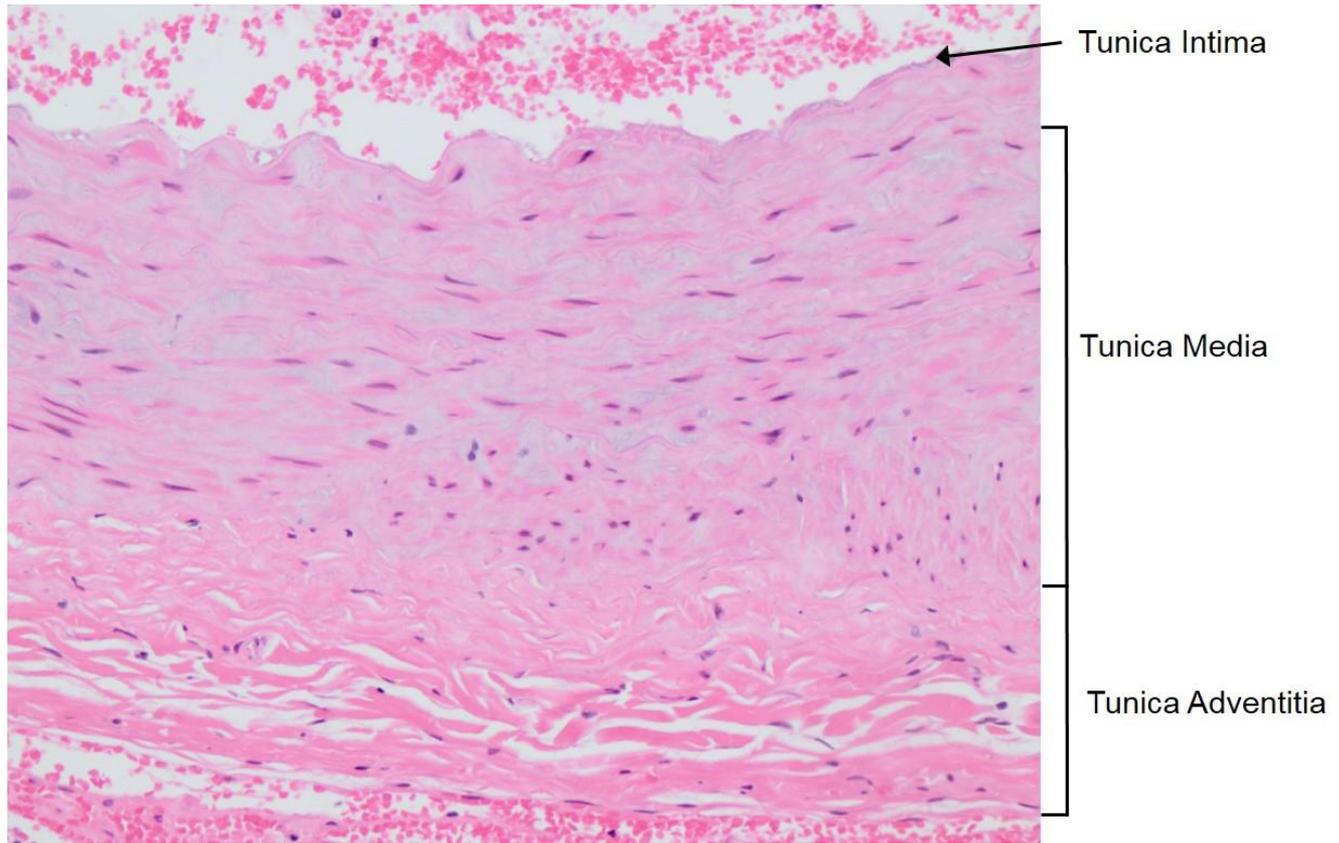


# GENERAL STRUCTURE OF VESSELS

The Structure of an Artery Wall

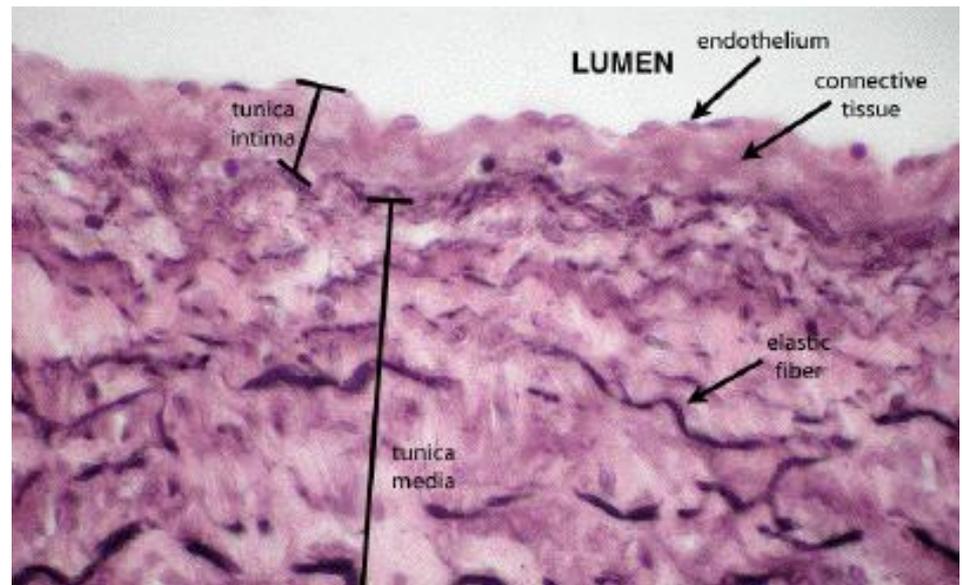


# 3 TUNICAE



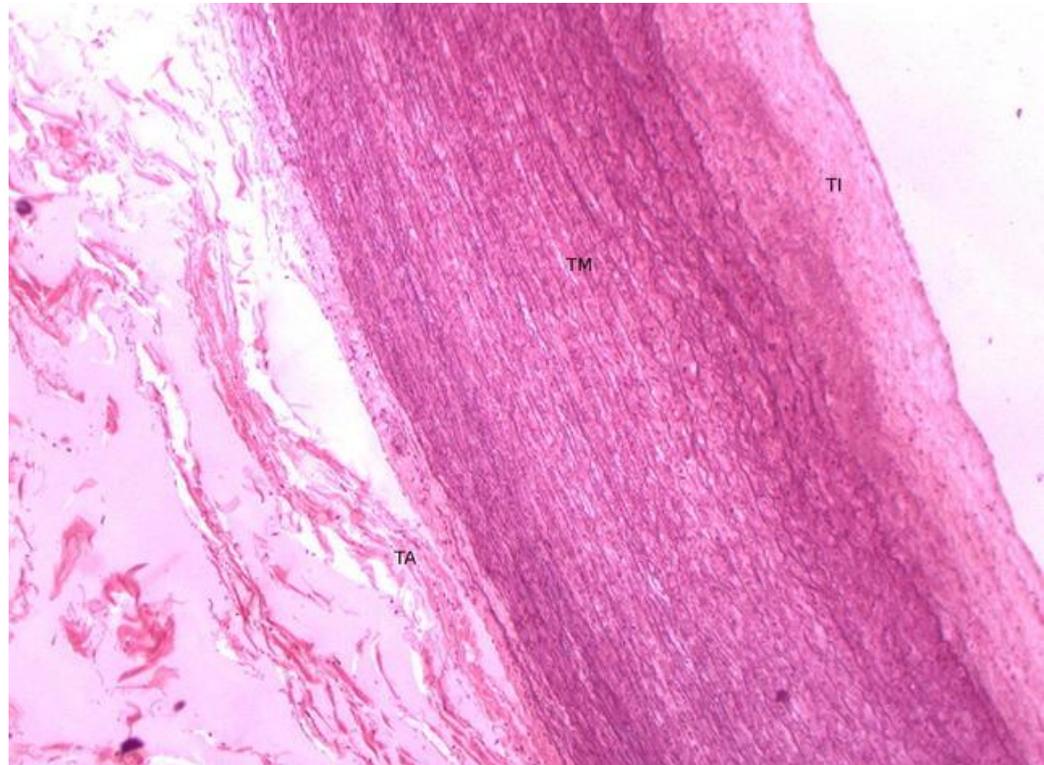
# TUNICA INTIMA

- Endothelium
  - Mechanical support
  - Channels
  - Tight junctions,
  - gap junctions
- Basal lamina
- Subendothelial connective tissue
- Internal elastic lamina



# TUNICA MEDIA

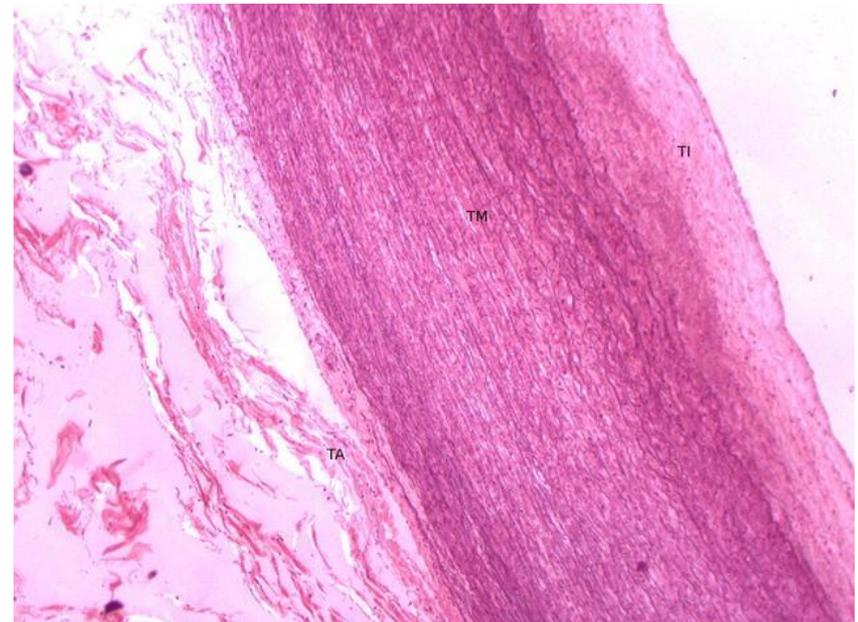
- Smooth muscle
- Circumferential smooth
- Some connective tissue
- External elastic lamina



# TUNICA ADVENTITIA

Connective tissue fibres- collagen type ?

Elastic fibres- fenestrated sheets



# ARTERIES

## Specialisation

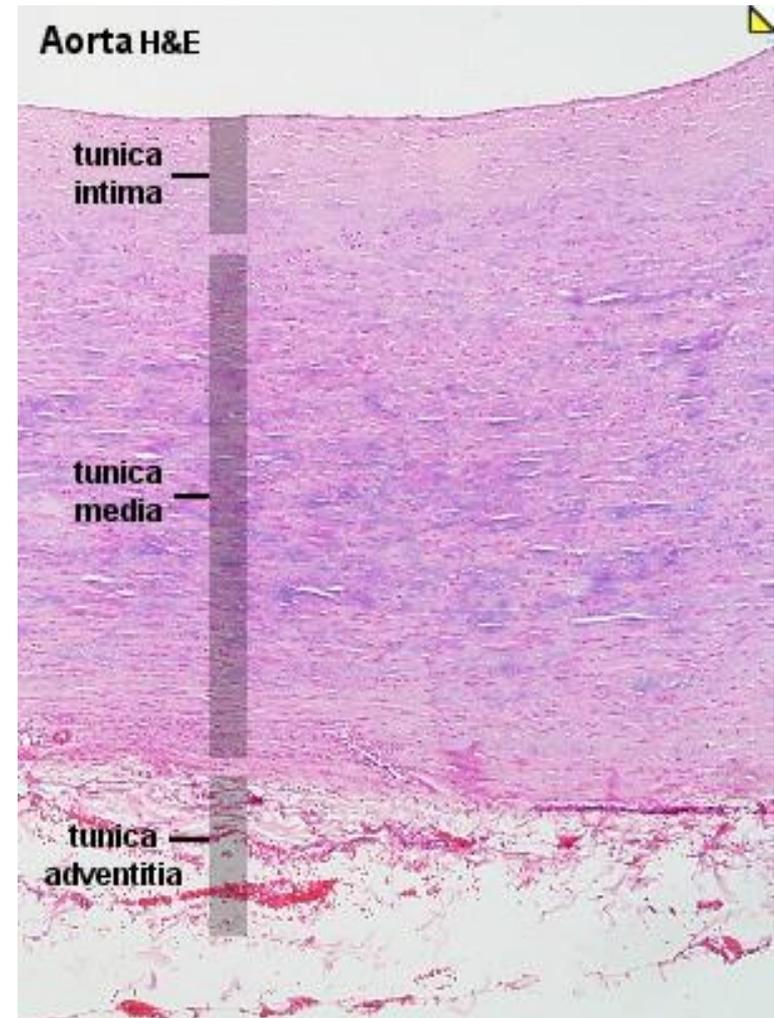
- pressure generated during systole
- regulation of blood supply to the target tissues of the arteries.

Elastic arteries

Muscular arteries

# ELASTIC ARTERIES

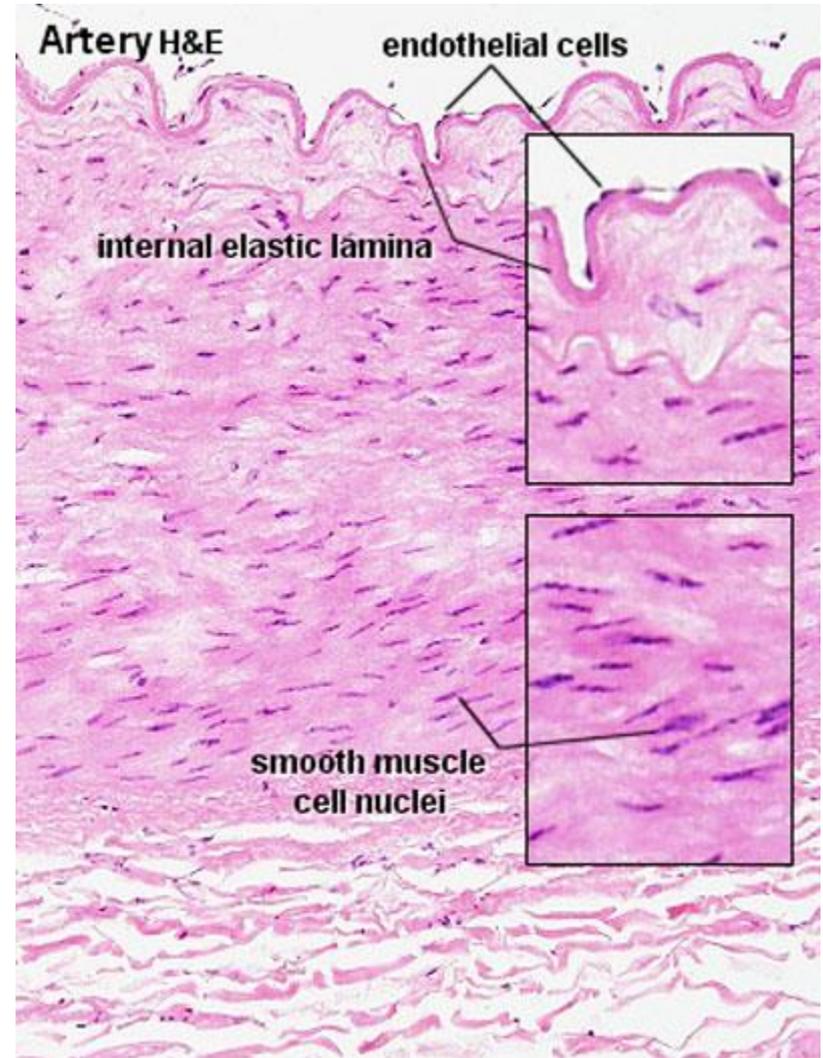
- Expand
- Recoil- additional force
- Propagates blood
- Dampens pressure
- Eg. Aorta and its branches



# MUSCULAR ARTERY

- Change in diameter and
- Regulate flow to organs
- Internal and external elastic lamina clearly seen

Eg. Coronary artery



# ARTERIOLES



- 100 micron diameter
- **No internal elastic lamina**
- Terminal arterioles- less than 50 micron -12 micron
  - ↓
  - meta-arterioles (precapillary sphincter)
    - ↓
    - capillaries

# CAPILLARY BED



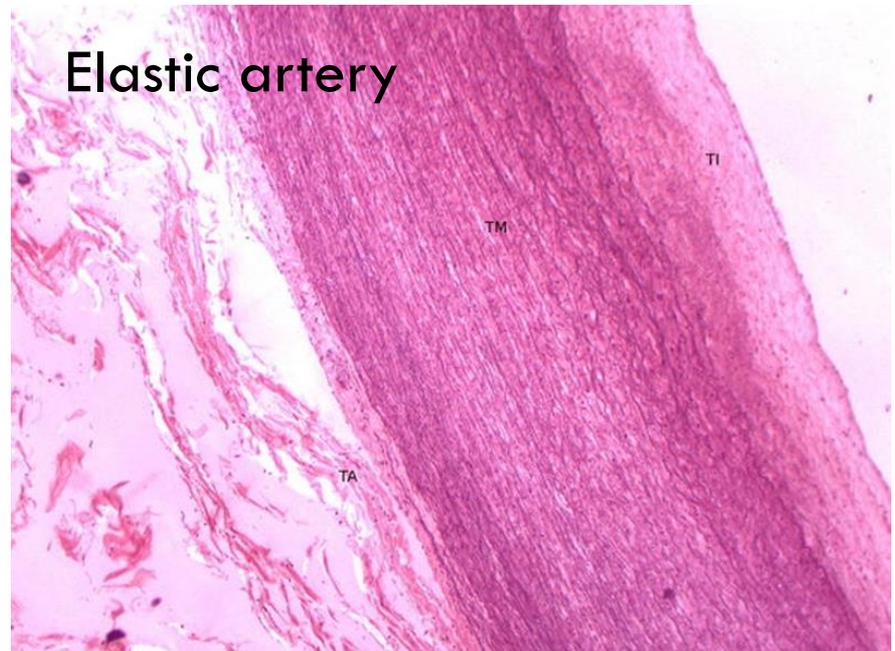
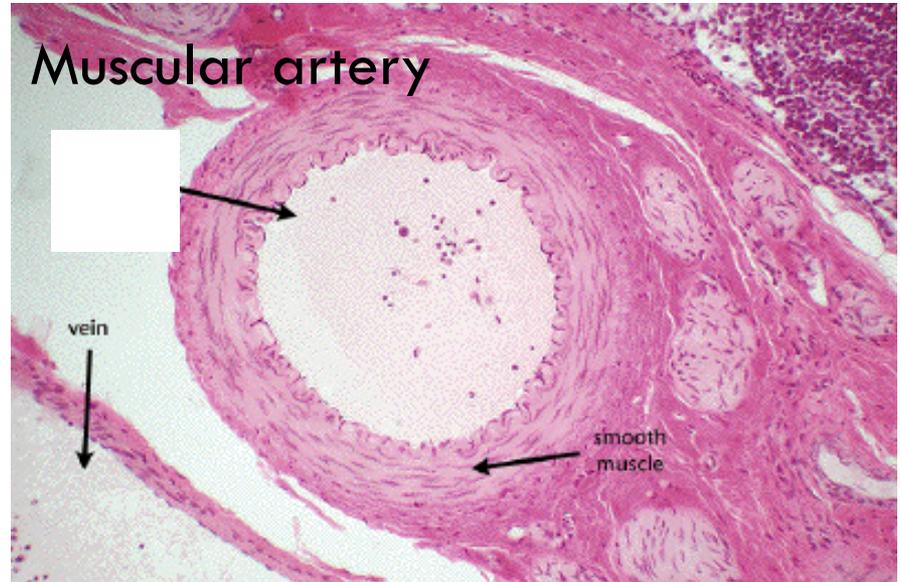
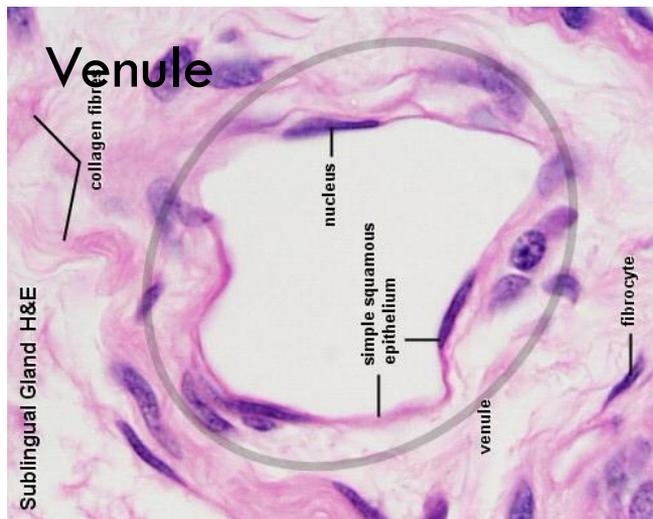
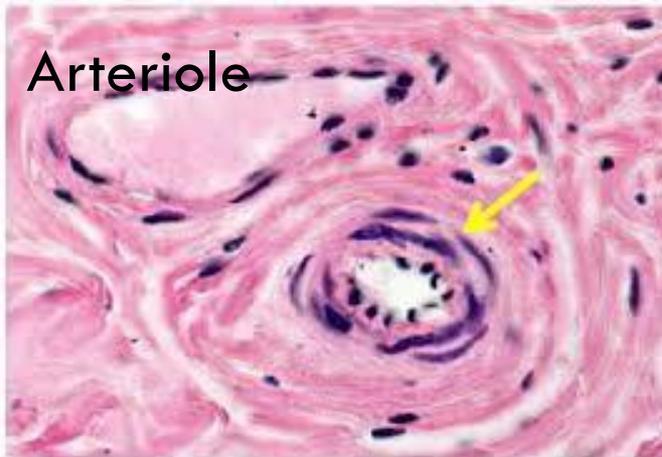
**Small artery**

**Arteriole**

**Metarterioles**

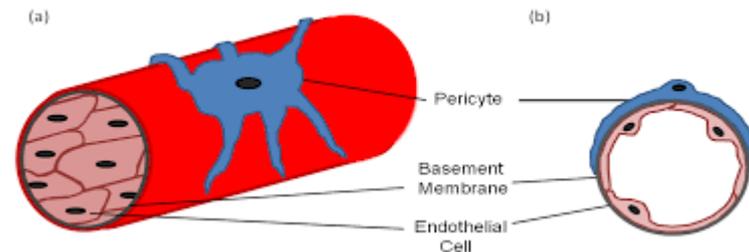
**Capillary beds**

# IDENTIFY

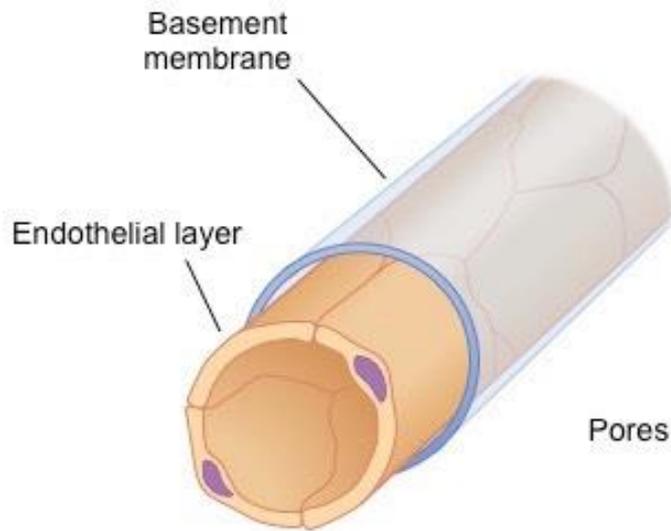


# CAPILLARIES

- 8 micron
- Universal function
  - Oxygen and nutrient delivery
  - CO<sub>2</sub> and nitrogenous waste removal
- Single layer of endothelial cells
- surrounded by basal lamina
- Pericytes

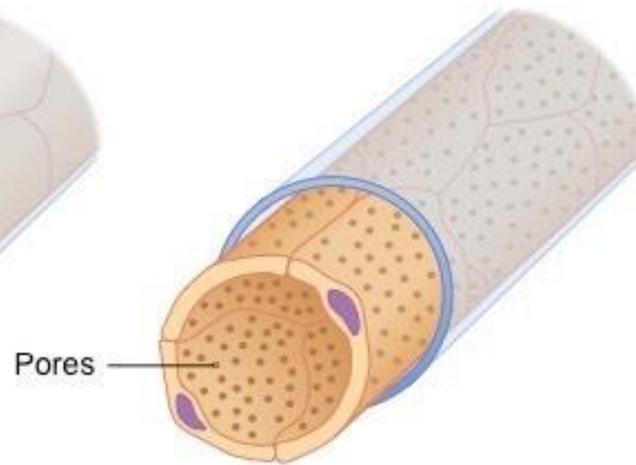


# CAPILLARIES



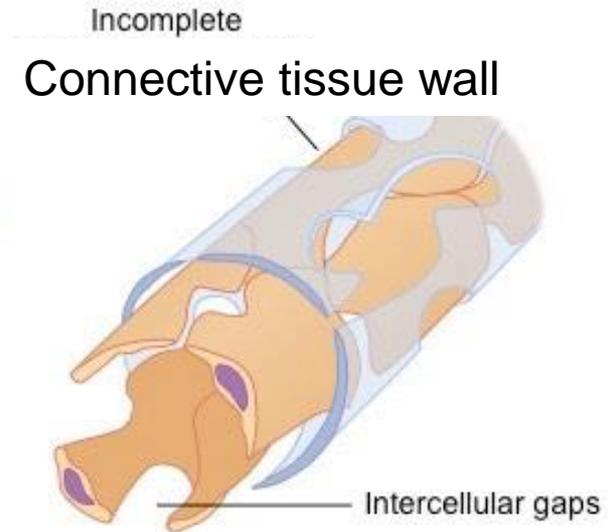
**Continuous**

Skin  
Connective tissue  
Muscle  
Lung  
Brain



**Fenestrated**

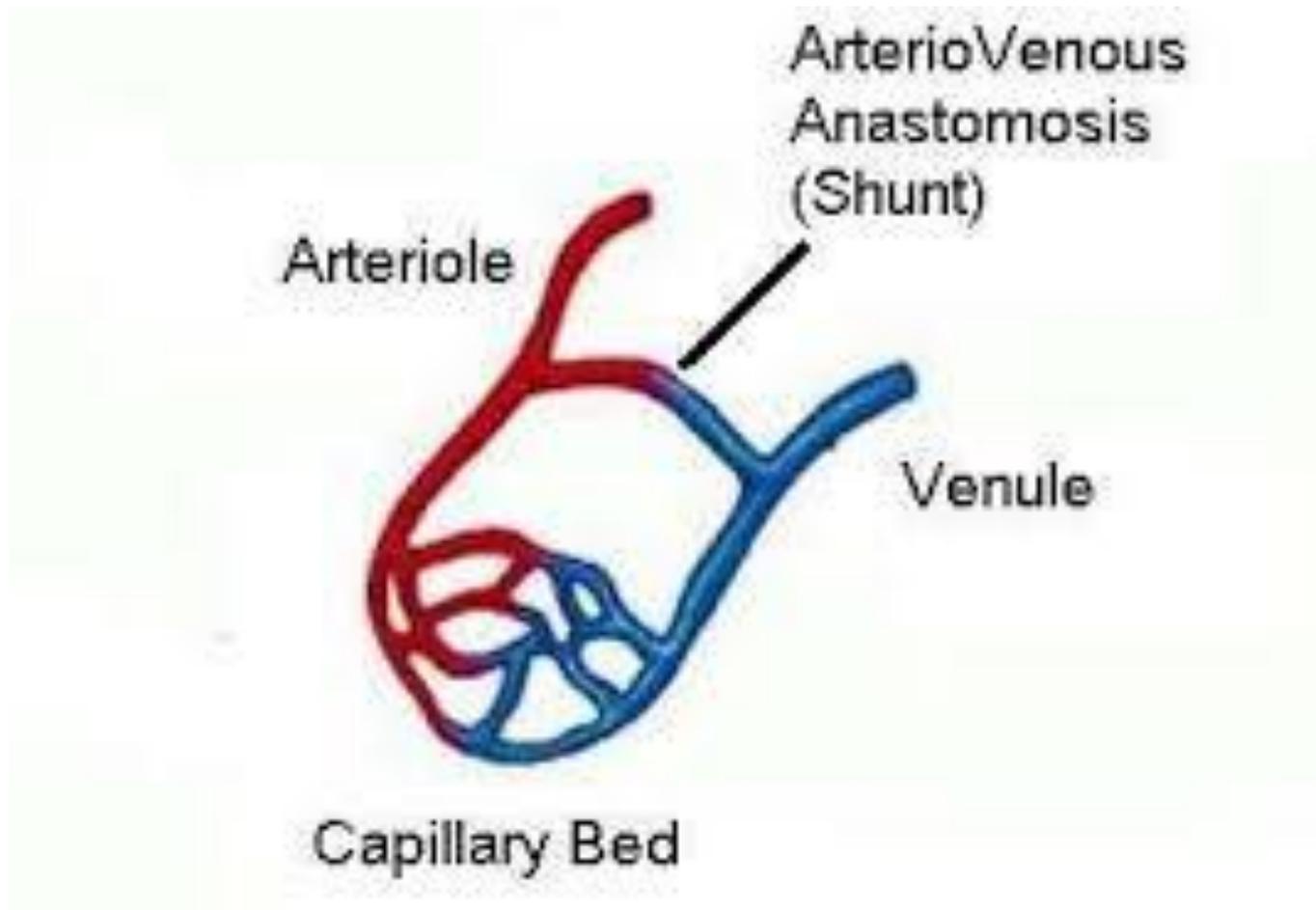
Renal glomeruli  
Intestinal villi  
Endocrine glands  
pancreas



**Sinusoid**

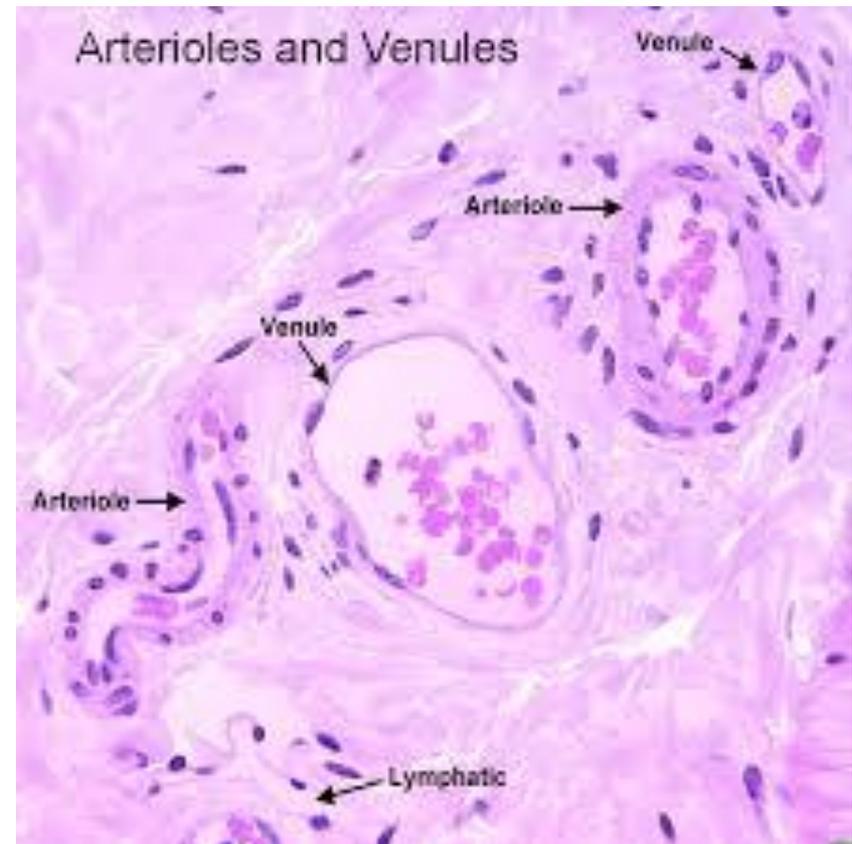
Spleen  
Liver  
Adrenal cortex  
Hypophysis  
Parathyroid gland

# ARTERIOVENOUS ANASTOMOSIS



# VENULES

- 20-30 micron
- Endothelium
- Basal lamina
- Thin adventitia
  
- Permeable wall



# VEINS

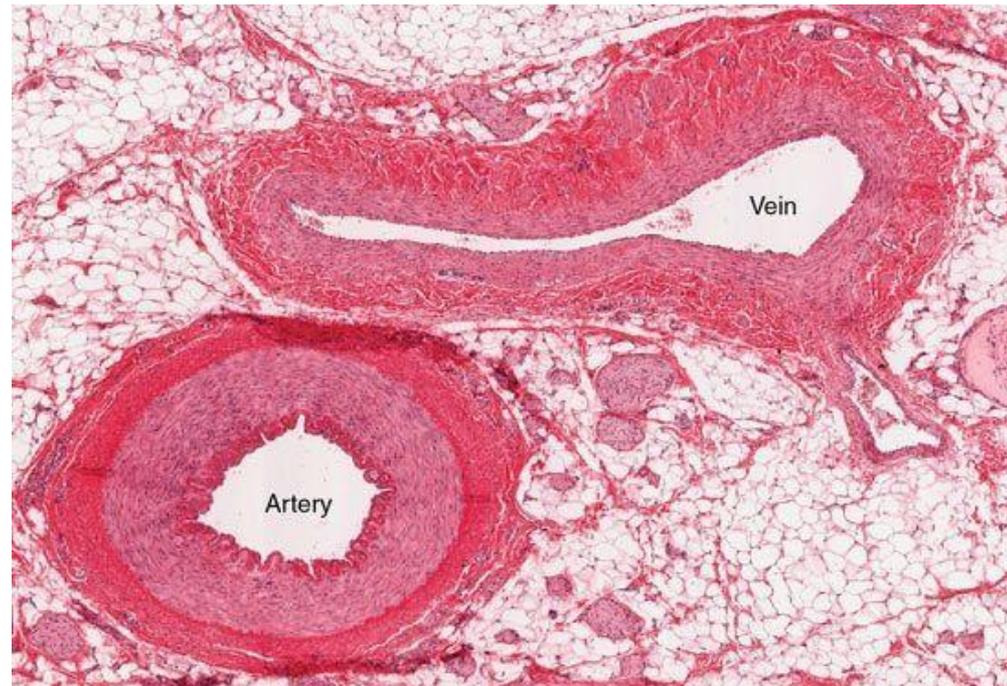
Veins are larger than arteries

Thin walled

More collagen in tunica media

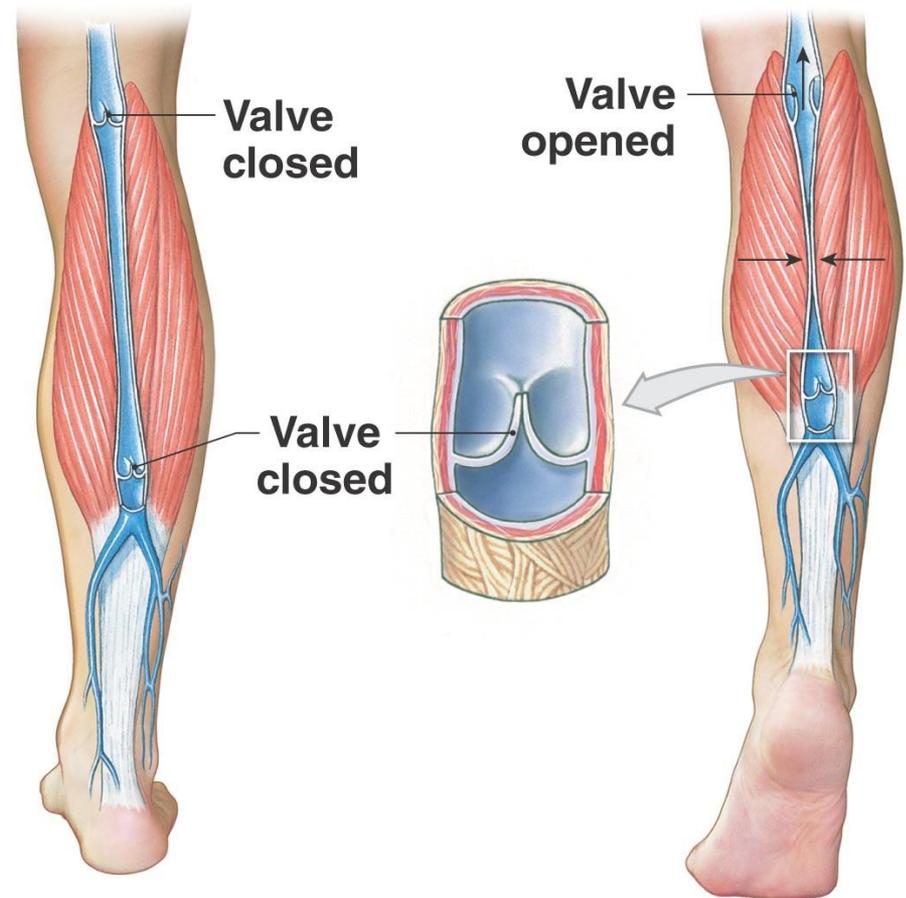
Less elastic tissue

Tunica adventitia thicker than tunica media

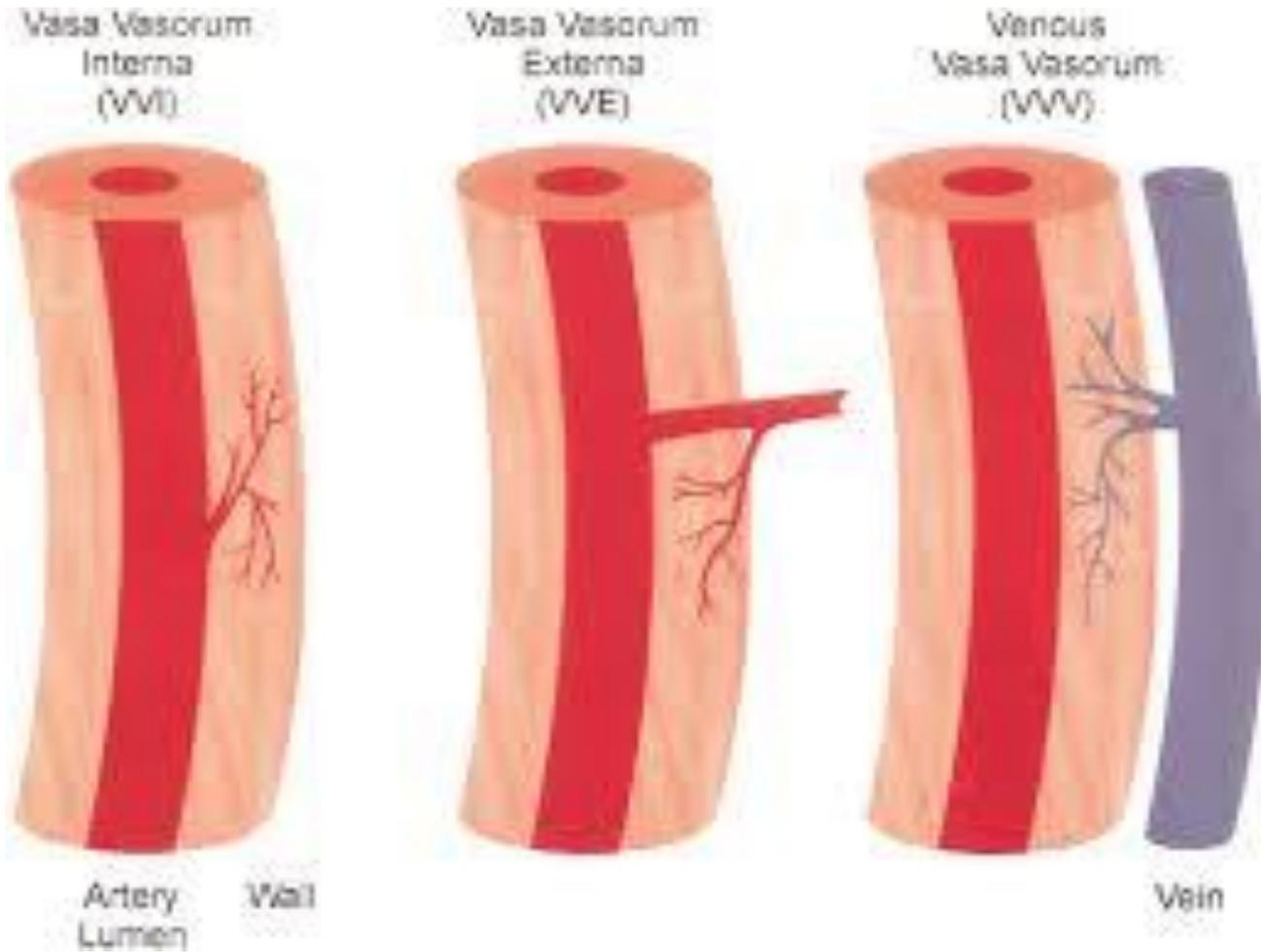


# VALVES

- Allow flow towards heart
- Prevent backflow
- Most abundant in legs
- Muscular contraction helps



# VASA VASORUM



# SOME DISEASES

## Atherosclerotic cardiovascular disease

- Cerebrovascular disease – affects brain, strokes
- Coronary artery disease (CAD) – arteries of heart
- Peripheral vascular disease (PVD) – arterial

## Affecting veins

- Chronic venous insufficiency
- Deep venous thrombosis (DVT)

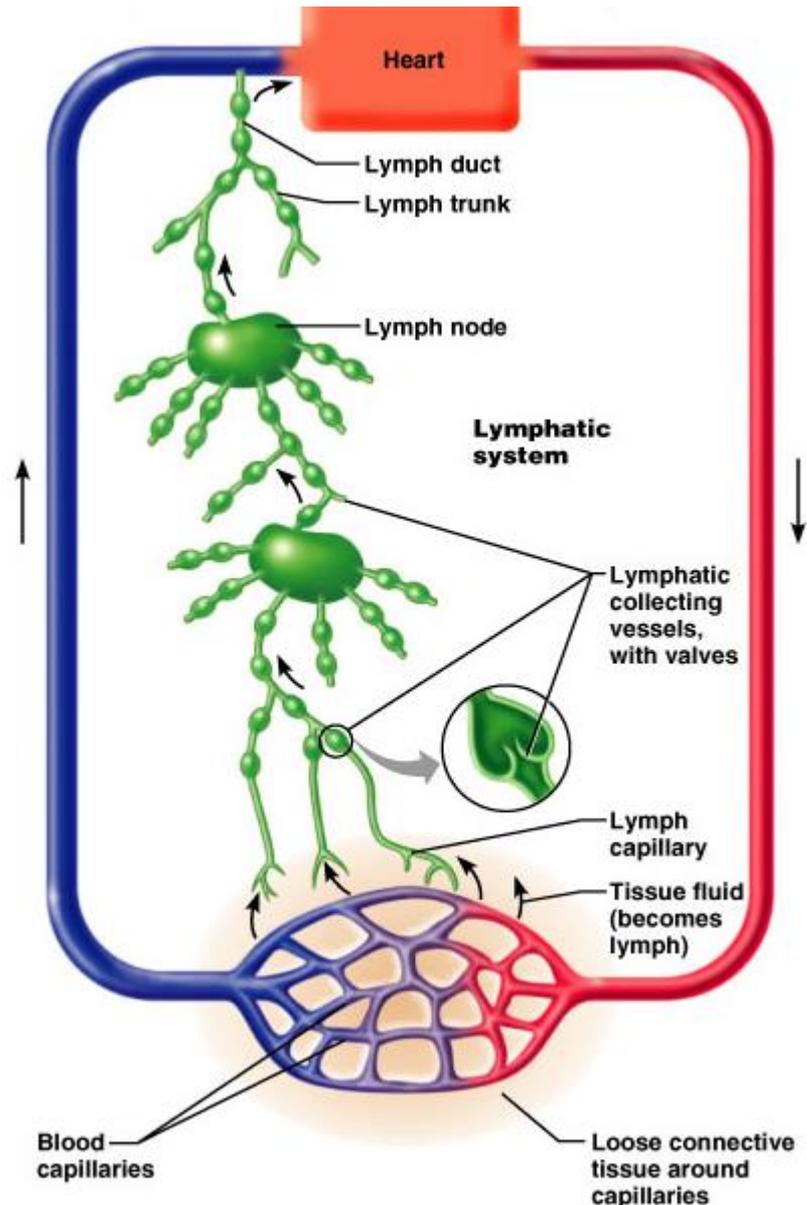
## Aneurysms

## Portal hypertension

## Hypertension

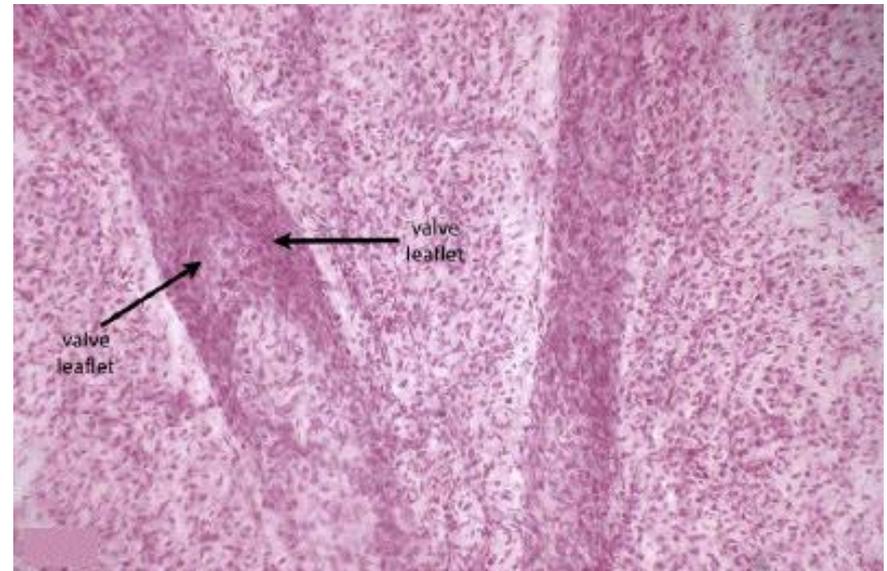
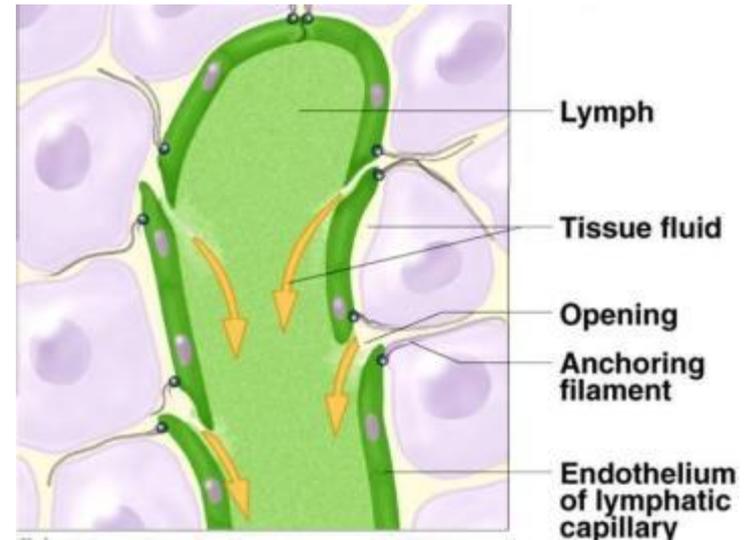
# LYMPHATIC SYSTEM

- One way system: to the heart
- Return excess tissue fluid and leaked proteins
- “Lymph” is this fluid
- Edema results if system blocked or surgically removed



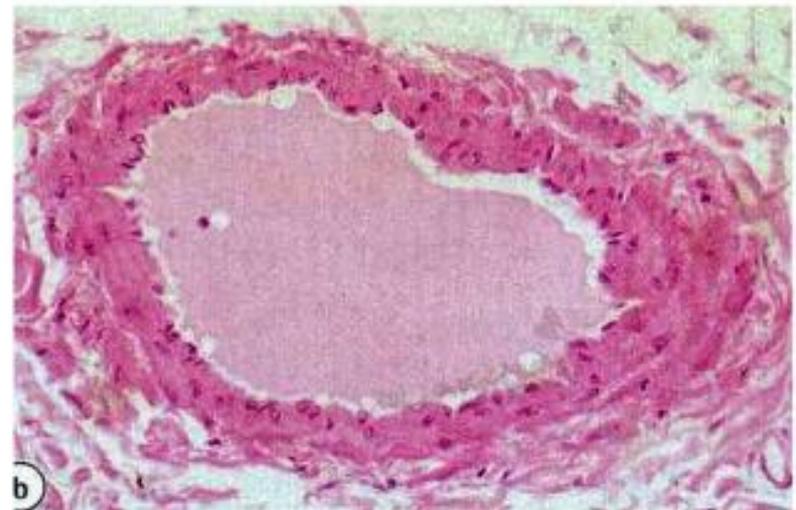
# LYMPH CAPILLARIES

- Greater permeability
- Endothelium
- Basal Lamina Absent
- No pericytes
- No connective tissue
- Absent in avascular tissues



# LYMPHATIC VESSELS

- Similar to blood vessels (3 layers), but thin & delicate
- Superficial - skin with superficial veins
- Deep - trunk and digestive viscera with deep arteries
- Very low pressure
- Drain into lymph nodes



# LYMPHATIC VESSELS

