

# Cardiovascular System



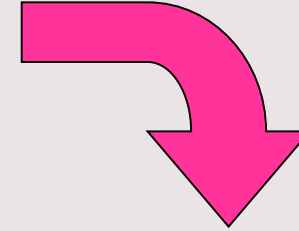
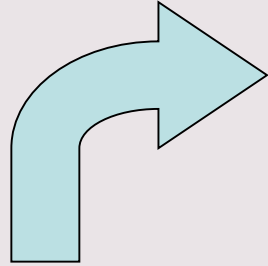
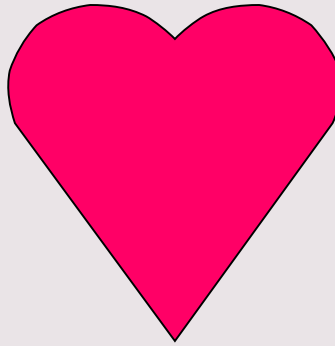
# Circulatory systems of the body

1. Vascular system
2. Lymphatic system
3. Circulation of csf Circulation of in cns.
4. Circulation of perilymphatic fluid in ear
5. Circulation of endococchlear fluid in ear.
6. Circulation of aqueous in eye
7. Circulation of synovial fluid in joint cavities
8. Circulation of serous fluid in PPP cavities.

# CARDIOVASCULAR SYSTEM

- **Is the transport system of the body, through which the nutrients are conveyed to places where these are utilized, and the metabolites are conveyed to appropriate places from where are excreted.**

# Basic Anatomy of Circulatory routes

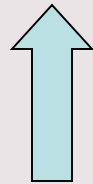


Carry blood towards the heart

**Veins**

**Arteries**

Carry blood away from the heart

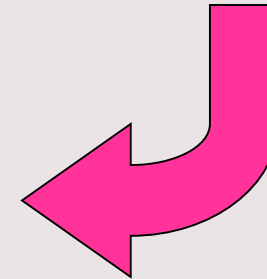
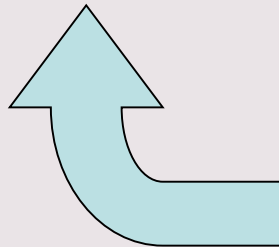


Connect capillaries to veins

**Venules**

**Arterioles**

Control blood flow into capillaries & help regulate BP



**Capillaries**

Allow for "exchange" (filtration/reabsorption) of O<sub>2</sub>/CO<sub>2</sub>, nutrients/wastes

# Vascular system

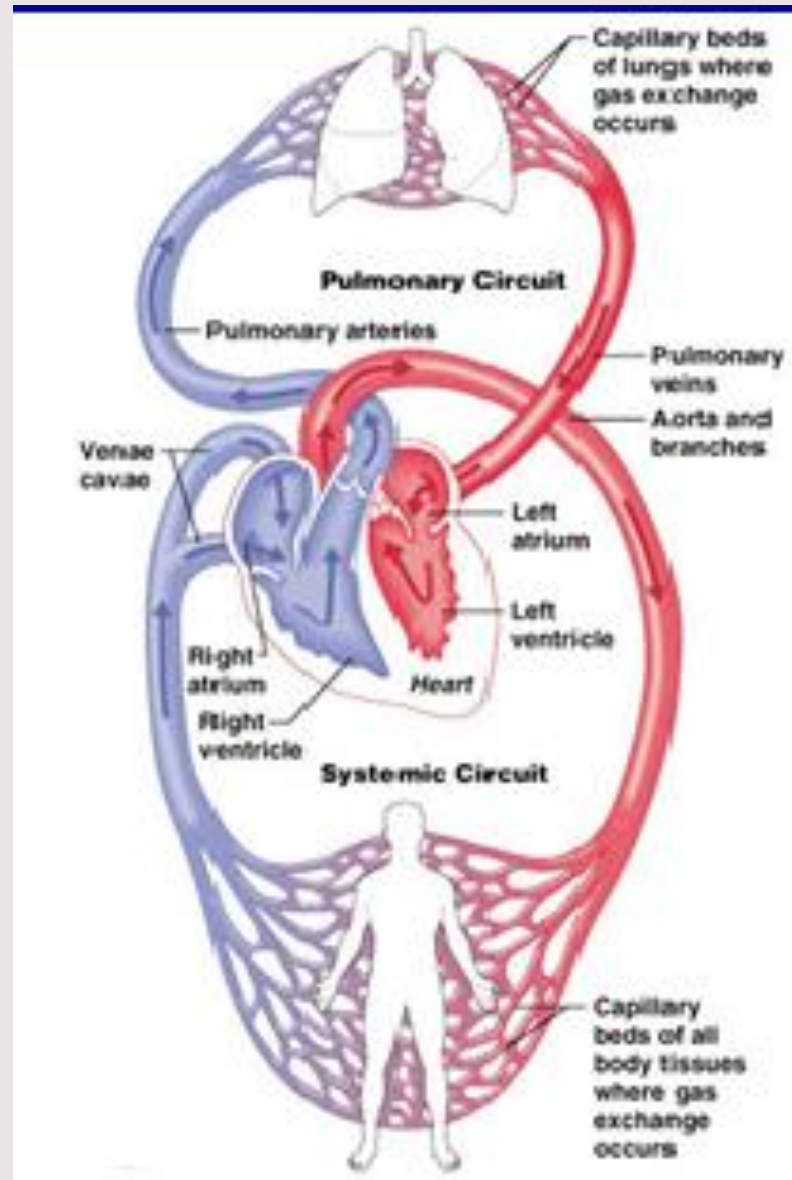
- Deals with the circulation of blood and lymph.
- Two main categories

## 1. Blood vascular system.

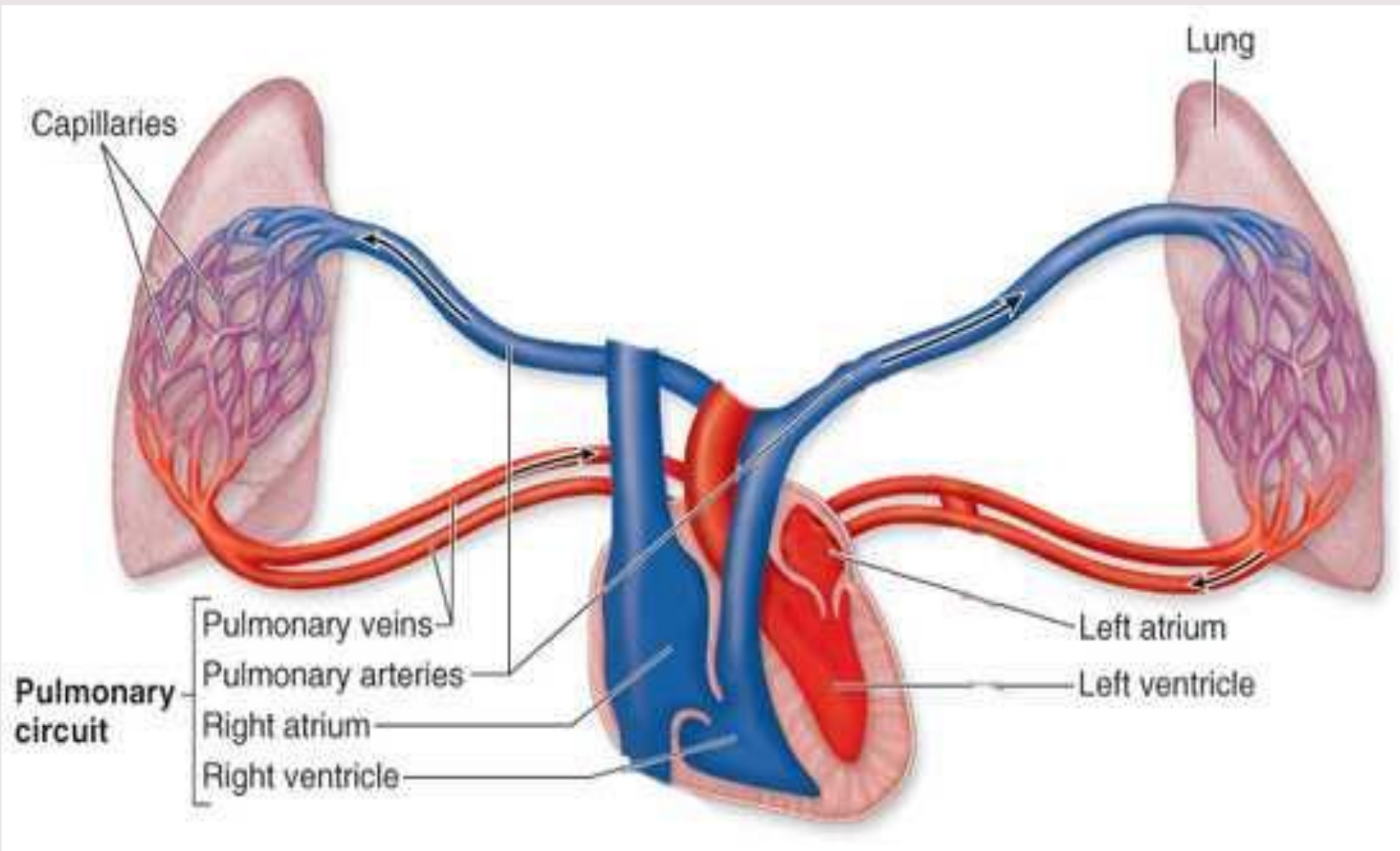
- Systemic circulation
- Pulmonary circulation
- Portal circulation.
  - HEPATIC PORTAL CIRCULATION
  - HYPOTHALAMO-HYPOPHYSIAL PORTAL CIRCULATION
  - RENAL PORTAL CIRCULATION

## 2. Lymphatic system

# SYSTEMIC CIRCULATION



# PULMONARY CIRCULATION

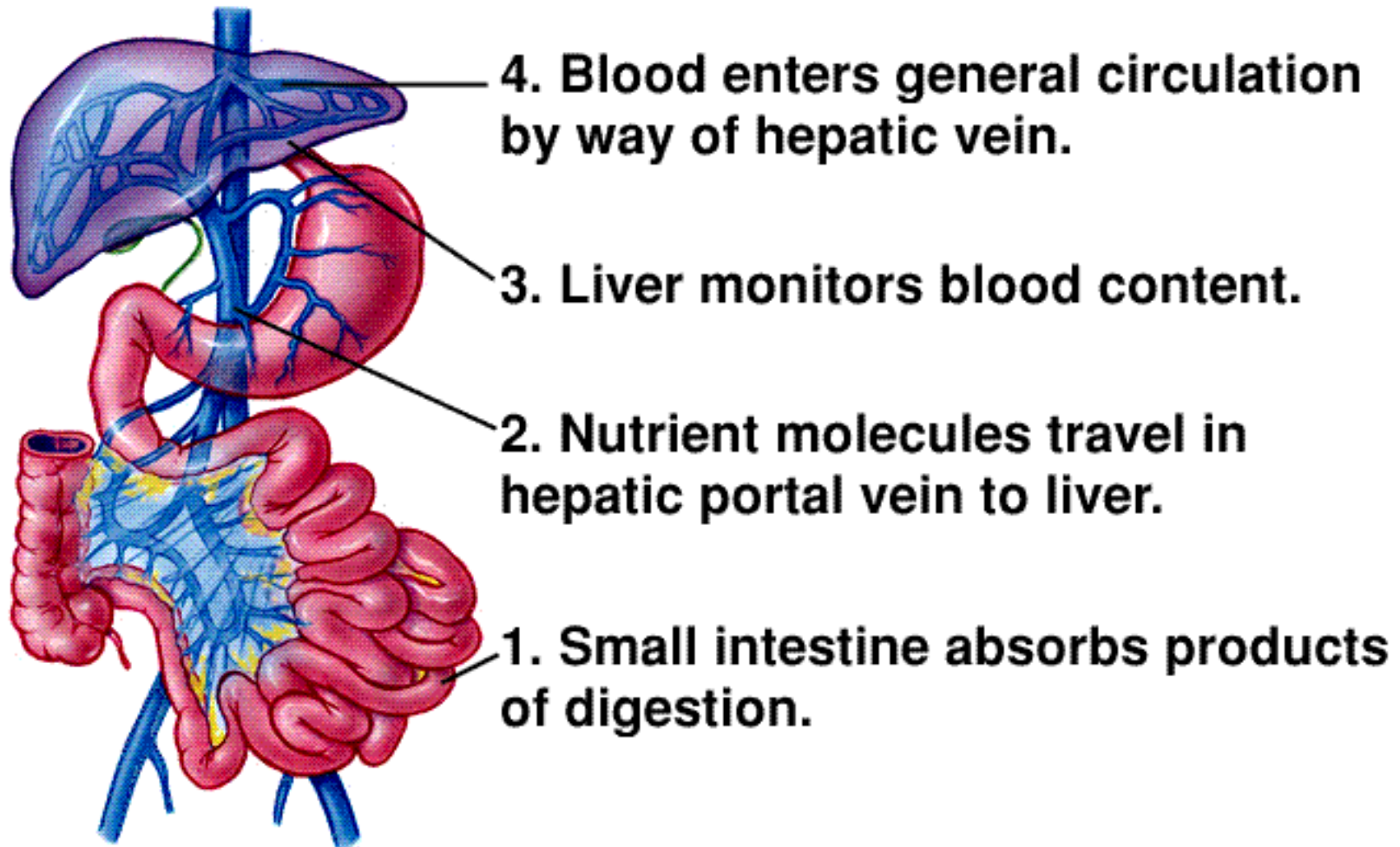


# PORTAL CIRCULATION

- **HEPATIC**
- **HYPOPHYSEAL**
- **RENAL**

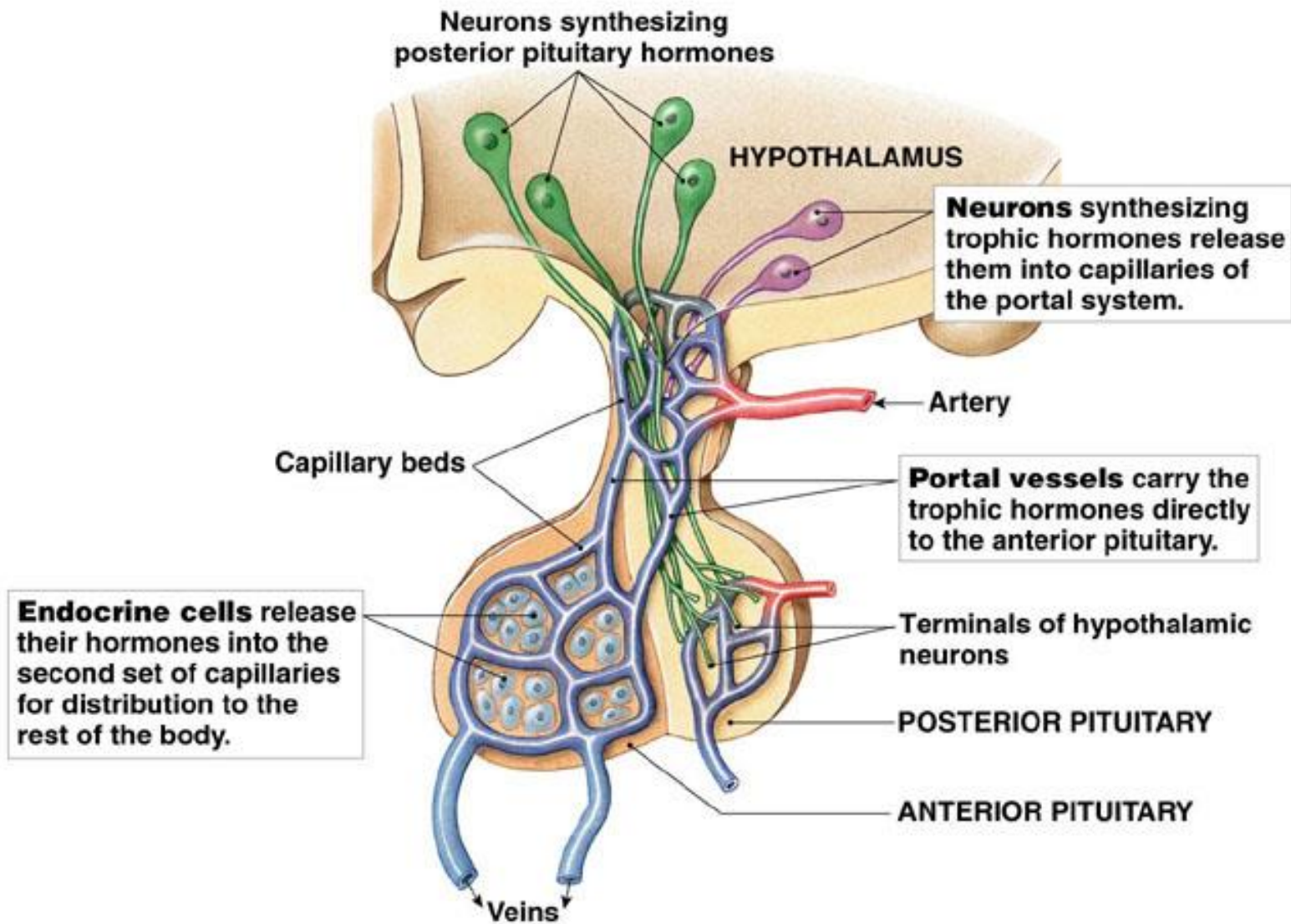


# Hepatic Portal System



**HEPATIC**

PORTAL CIRCULATION

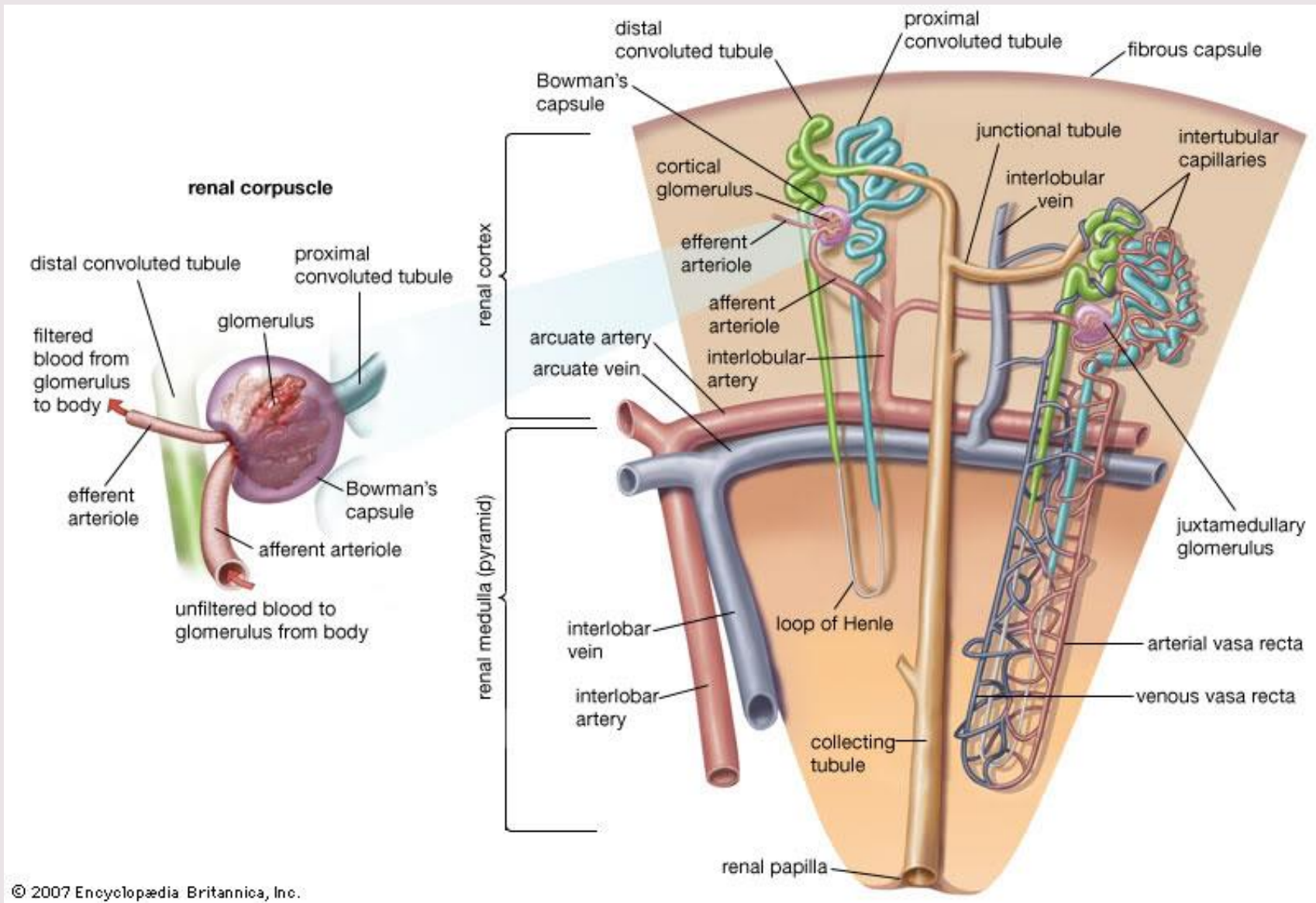


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Fig. 7-16

## HYPOPHYSEAL

## PORTAL CIRCULATION

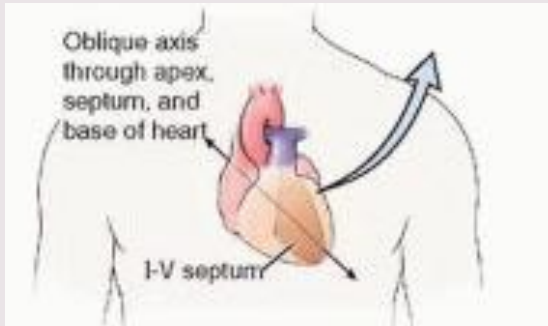


# RENAL

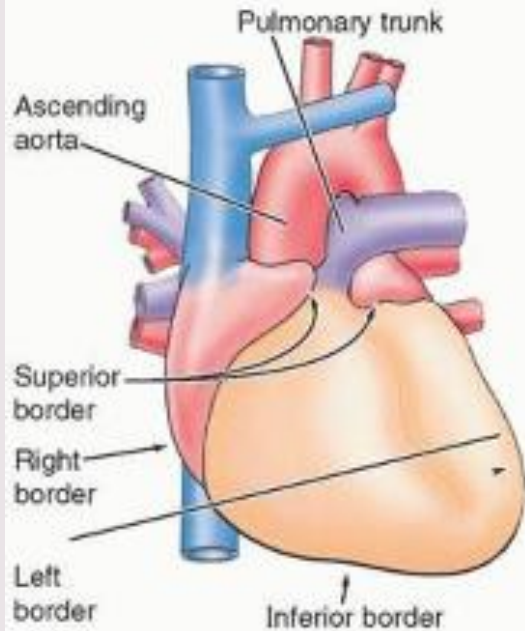
## PORTAL CIRCULATION

# COMPONENTS OF CVS

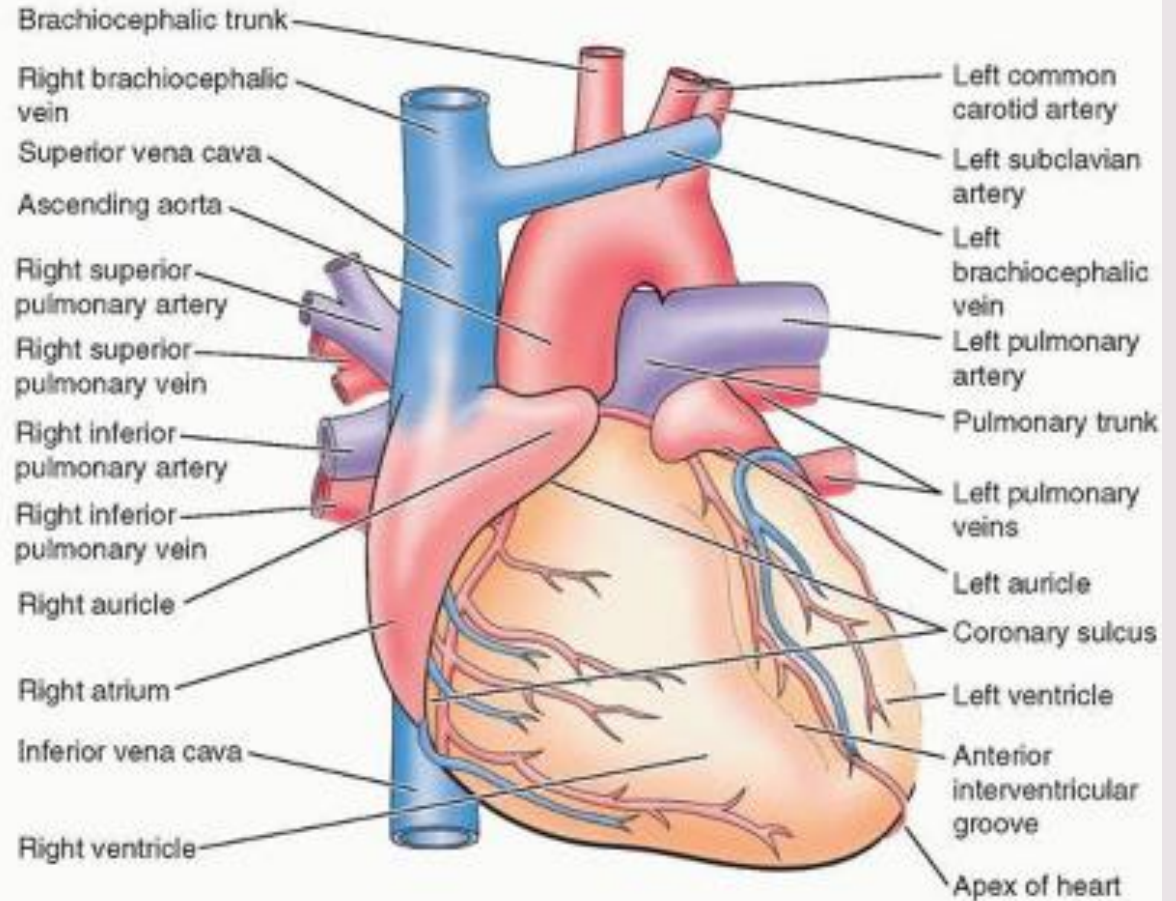
- **HEART**
- **ARTERIES**
- **VEINS**
- **CAPILLARIES**



Placement of heart and interventricular (IV) septum in thorax



(A)



(B)

Anterior views

# HEART

## COMPONENTS OF CVS

# ARTERIES

- Arteries are blood vessels that supply blood to the tissues of body.
- They carry the blood away from heart and because the blood inside them is oxygenated, they appear red in color.

# Characteristic Features of Arteries

- Arteries are thick-walled, being uniformly thicker than the accompanying veins, except for the arteries within the cranium and vertebral canal where these are thin.
- Their lumen is smaller than that of the accompanying veins,

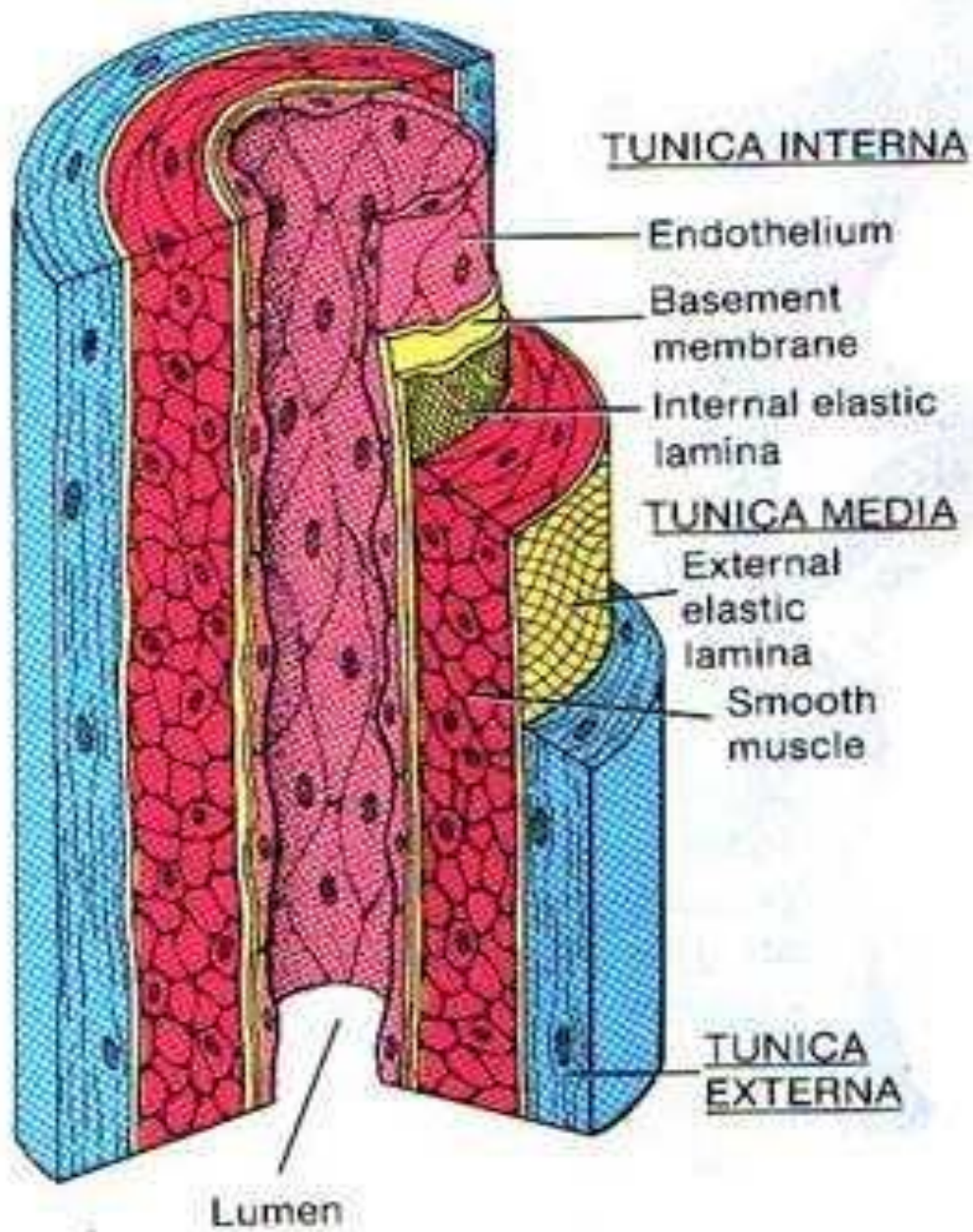
# Characteristic Features of Arteries

- Arteries have no valves.
- An artery is usually accompanied by veins and nerves, and the three of them together form the neurovascular bundle which is surrounded and supported by a fibro-areolar sheath.



# MICROSCOPIC FEATURES OF ARTERY

- The inner coat is called **Tunica Intima**.
- The middle coat is called **Tunica Media**.
- The outer coat is called **Tunica Adventitia**.  
( It is strongest of all coats and merges with the perivascular sheath.)



ARTERIES

# Types and Structure of Arteries

- **Large Arteries Of Elastic Type,**

e.g. 1. **Aorta** and its main branches (brachiocephalic, common carotid, subclavian and common iliac)

2. **pulmonary** arteries.

- **Medium & Small Arteries Of Muscular Type**

e.g. Temporal, Occipital, Radial, Popliteal, etc.

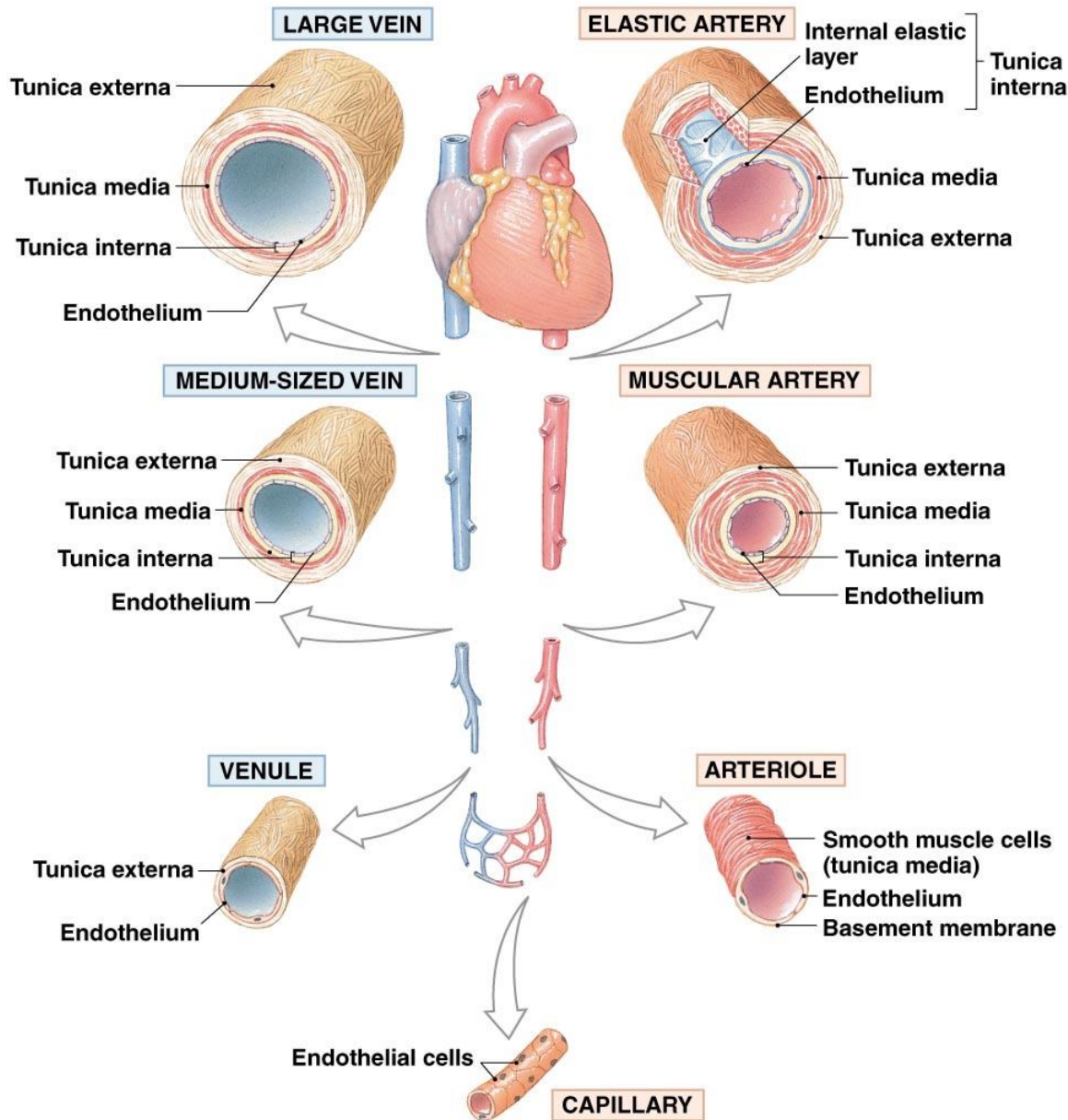
# Types and Structure of Arteries

- **Smallest Arteries Of Muscular Type (Arterioles)**
- They measure 50-100 micron in diameter.
- Arterioles divide into Terminal Arterioles with a diameter of 15-20 micron.
- The side branches from terminal arterioles are called Metarterioles which measure 10-15 micron at their origin and about 5 micron at their termination.

# Types and Structure of Arteries

- The terminal narrow end of Metarteriole is surrounded by a **Precapillary Sphincter** which regulates blood flow into the capillary bed.
- The muscular arterioles are responsible for **Generating Peripheral Resistance**, & thereby for regulating the **Diastolic Blood Pressure**.

# Structure of Blood Vessels



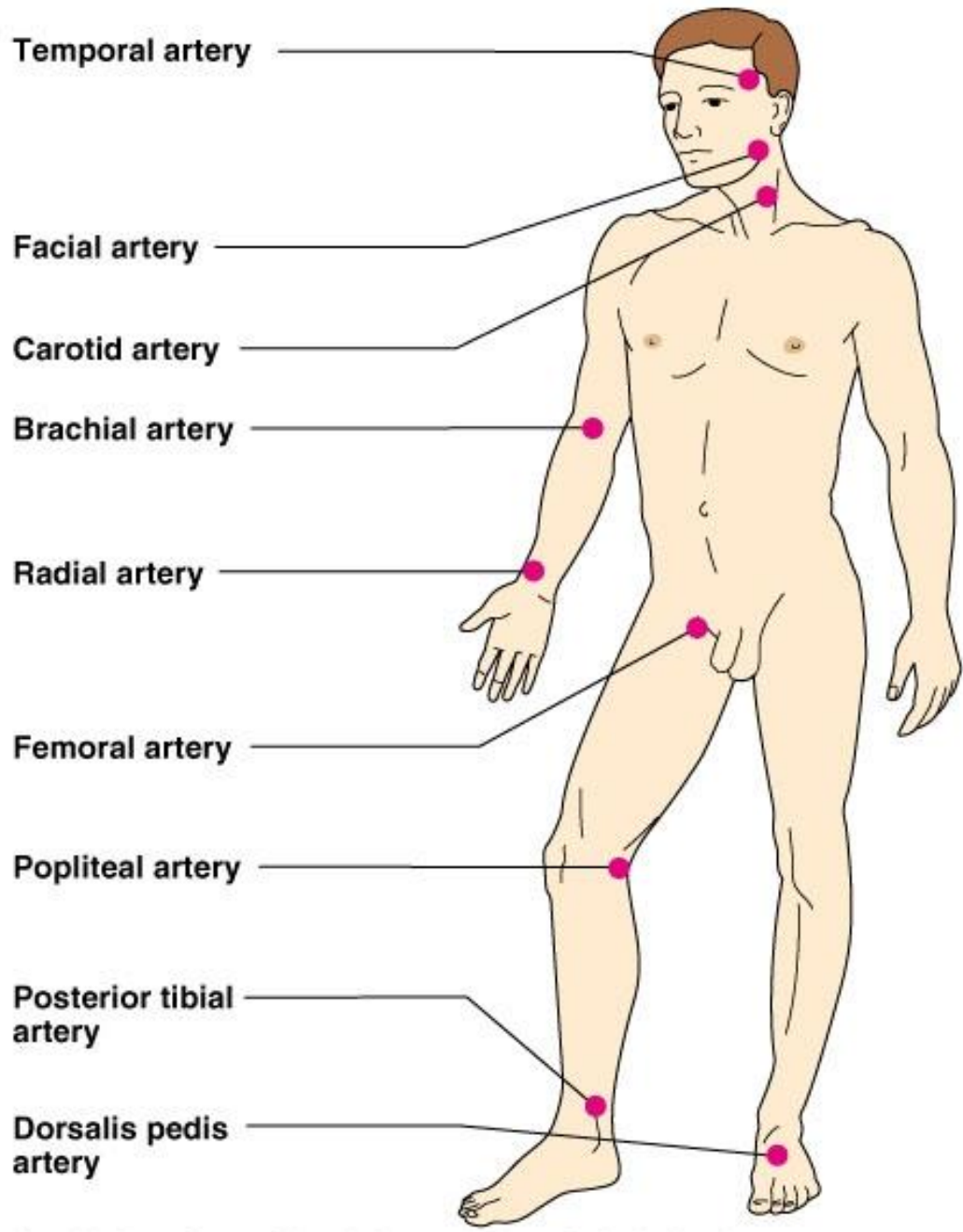
# Blood Supply of Arteries

- The large arteries (of more than 1 mm diameter) are supplied with blood vessels. The nutrient vessels, called **vasa vasorum**,
- Vasa vasorum supply the adventitia and the outer part of tunica media
- . The rest of the vessel wall (intima + inner part of media) is nourished directly by **Diffusion** from the luminal blood.
- **Minute veins** accompanying the arteries drain the blood from the outer part of arterial wall.
- **Lymphatics** are also present in the adventitia.

# Palpable Arteries

- Some arteries can be palpated through the skin.
  1. Common Carotid.
  2. Facial.
  3. Brachial.
  4. Radial.
  5. Abdominal aorta.
  6. Femoral.
  7. Posterior Tibial.
  8. Dorsalis pedis.





# Nerve Supply of Arteries

- The nerves supplying an artery are called **Nervi Vascularis**.
- The nerves are mostly **Nonmyelinated Sympathetic fibers** which are **Vasoconstrictor** in function.
- A few fibers are **Myelinated**, and are believed to be sensory to the outer and inner coats of the arteries.

# Nerve Supply of Arteries

- The Skeletal Muscle vessels are dilated by Cholinergic **Sympathetic** Nerves.
- The Exocrine Gland vessels are dilated on **Parasympathetic** Stimulation.
- The cutaneous vessels are dilated **locally** to produce the flare (redness) after an injury.

# Veins

- Veins are the blood vessels which carry the blood from peripheral tissues towards heart.
- They carry the deoxygenated blood, which is bluish in color and for the same reason veins appear blue.

# Characteristic Features

- Veins are **Thin-Walled**, being thinner than the arteries.
- Their **Lumen is Larger** than that of the accompanying arteries.
- Veins have **Valves** which maintain the unidirectional flow of blood, even against gravity.

# Characteristic Features

- Since the venous pressure is low (7 mm Hg) the valves are of utmost value in the venous return.
- The valves are Absent in:
  - The veins of less than 2 mm diameter.
  - The venae cavae.
  - The hepatic, renal, uterine, ovarian (not testicular), cerebral, spinal, pulmonary, and umbilical veins.

# Characteristic Features

- The muscular and elastic tissue content of the venous walls is much less than that of the arteries. This is directly related to the low venous pressure.
- Large veins have Dead Space around them for their dilatation during increased venous return. The dead space commonly contains regional lymph nodes.

# Structure of Veins

- Veins are made up of usual Three Coats .
- Coats are ill-defined,
- In Poorly Developed Tunica media, the Amount of **Collagen Fibers** is more than the elastic and muscle fibers.
- The Adventitia is Thickest and Best Developed.



# Structure of Veins

**The Smooth Muscle is Altogether Absent in:**

1. The Veins of Maternal part of Placenta;
2. The Cranial Venous Sinuses and Pial veins;
3. The Retinal Veins;
4. The veins of Cancellous Bone.
5. The Venous Spaces of the Corpora Cavernosa and Corpus Spongiosum.

TUNICA INTERNA

Endothelium

Basement  
membrane

Internal elastic  
lamina

TUNICA MEDIA

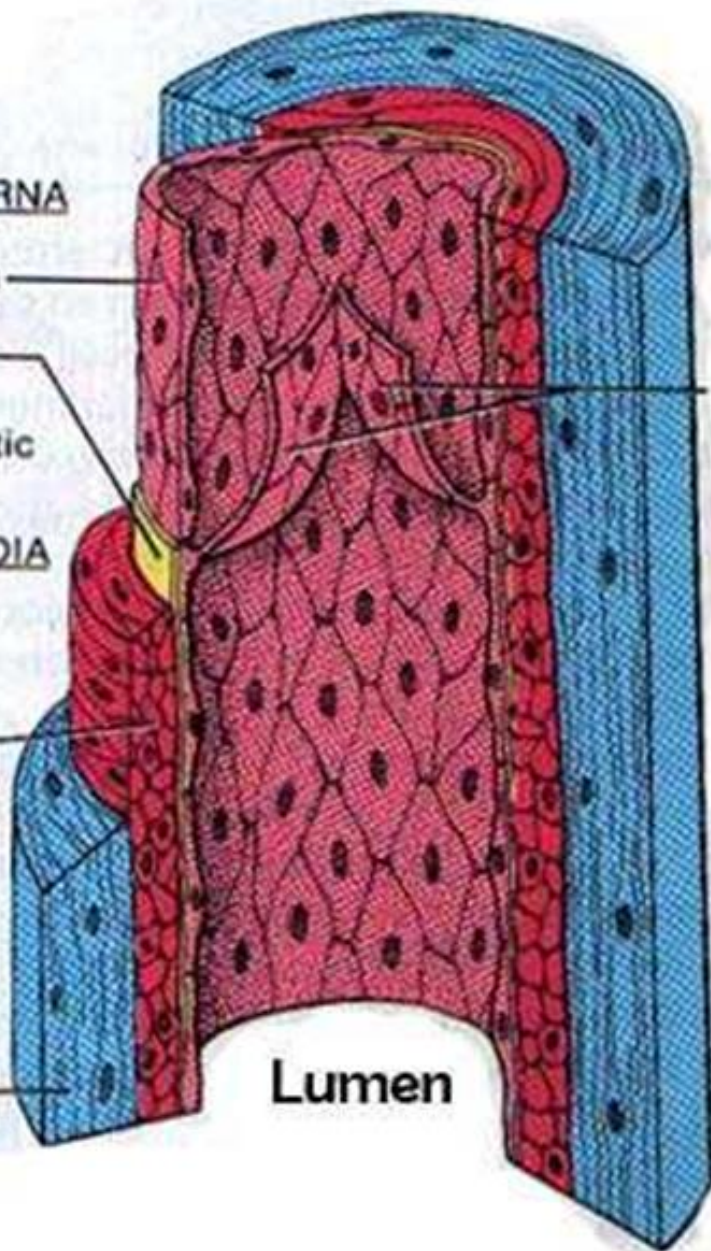
External  
elastic  
lamina

Smooth  
muscle

TUNICA  
EXTERNA

Valve

Lumen



# Blood and Nerve Supply of Veins

- The larger veins, are supplied with nutrient vessels called **vasa vasorum**.
- **vasa vasorum** may penetrate up to the intima, probably because of the low venous pressure and the low oxygen tension.
- Nerves also are distributed to the veins in the same manner as to the arteries, but are **fewer** in number.

# Factors Helping in Venous Return:

- **Overflow from the capillaries pushed from behind by the arteries.**
- **Negative intrathoracic pressure sucks the blood into the heart from all over the body.**
- **Gravity helps venous return in the upper part of the body.**

# Factors Helping in Venous Return

- **Arterial pulsations** press on the **venae comitantes** intermittently and drive the venous blood towards the heart.
- **Venous valves** prevent any regurgitation (back flow) of the luminal blood.
- **Muscular contractions** press on the veins and form a very effective mechanism of venous return.  
(**peripheral heart**).