

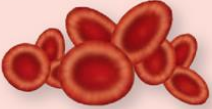
CVS

Blood Vessels




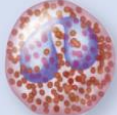

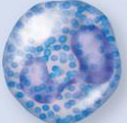
Dr. Hanan Malkawi

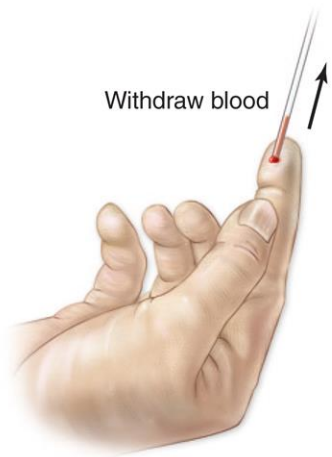
BLOOD

Plasma (55% of whole blood)		
Water 92% by weight	Proteins 7% by weight Albumins 58% Globulins 37% Fibrinogen 4% Regulatory proteins <1%	Other solutes 1% by weight Electrolytes Nutrients Respiratory gases Waste products

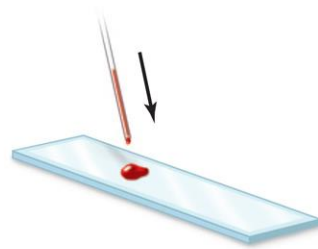
Erythrocytes (44% of whole blood)
Erythrocytes 4.2-6.2 million per cubic mm 



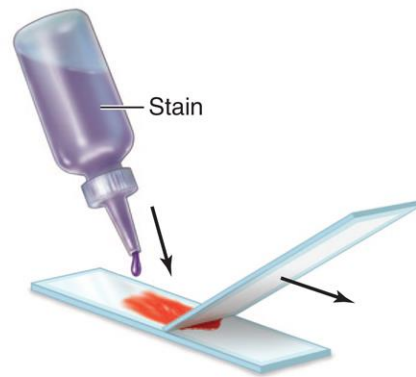
Buffy coat (<1% of whole blood)	
Platelets 150-400 thousand per cubic mm 	Leukocytes 4.5-11 thousand per cubic mm <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Neutrophils 50-70% </div> <div style="text-align: center;">  Lymphocytes 20-40% </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;">  Eosinophils 1-4% </div> <div style="text-align: center;">  Monocytes 2-8% </div> <div style="text-align: center;">  Basophils 0.5-1% </div> </div>



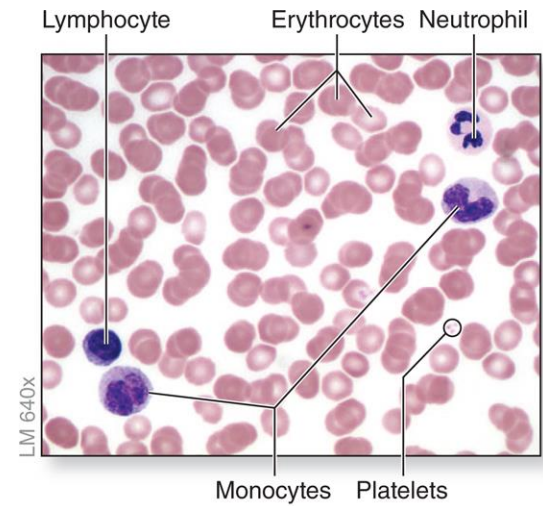
- ① Prick finger and collect a small amount of blood using a micropipette.



- ② Place a drop of blood on a slide.

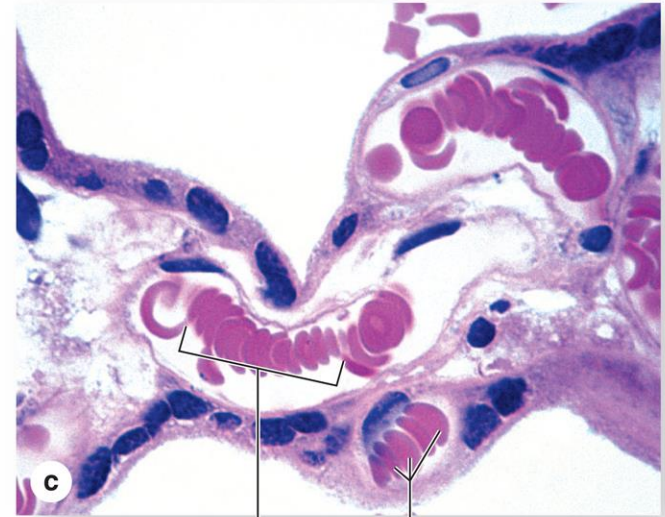
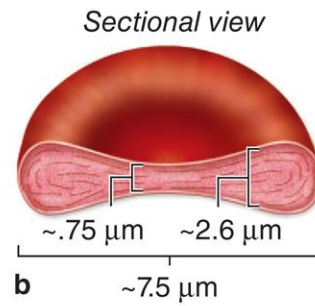
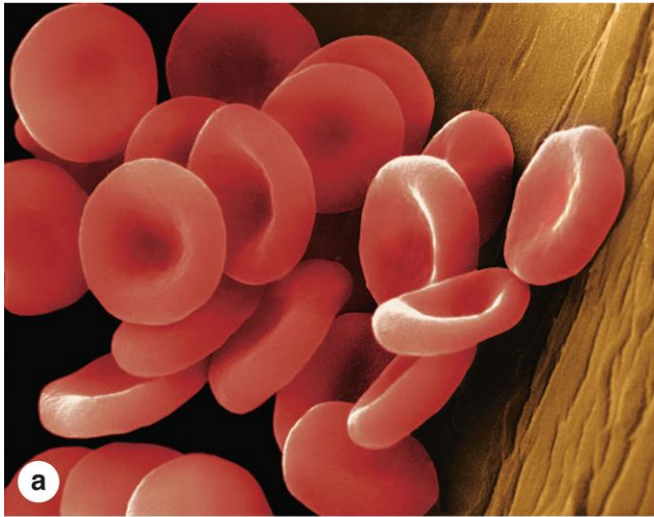


- ③a Using a second slide, pull the drop of blood across the first slide's surface, leaving a thin layer of blood on the slide.
- ③b After the blood dries, apply a stain briefly and rinse. Place a coverslip on top.



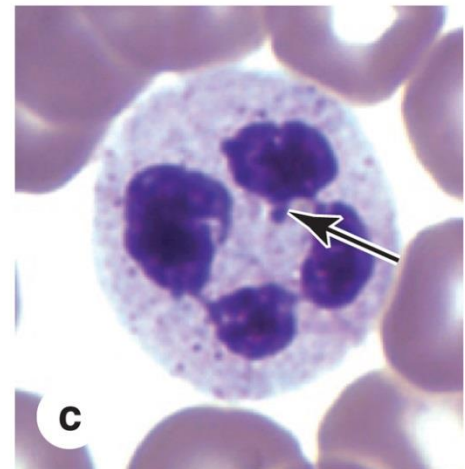
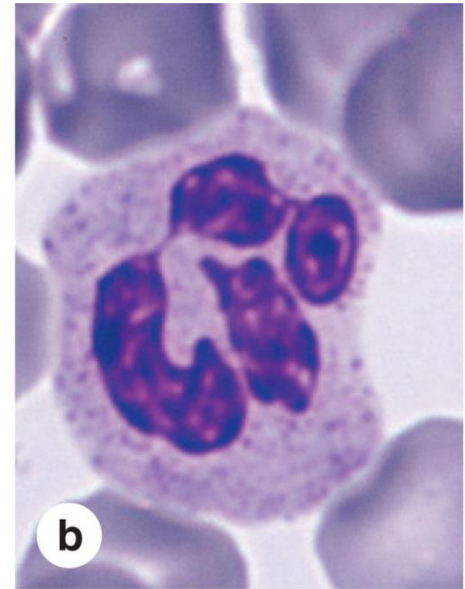
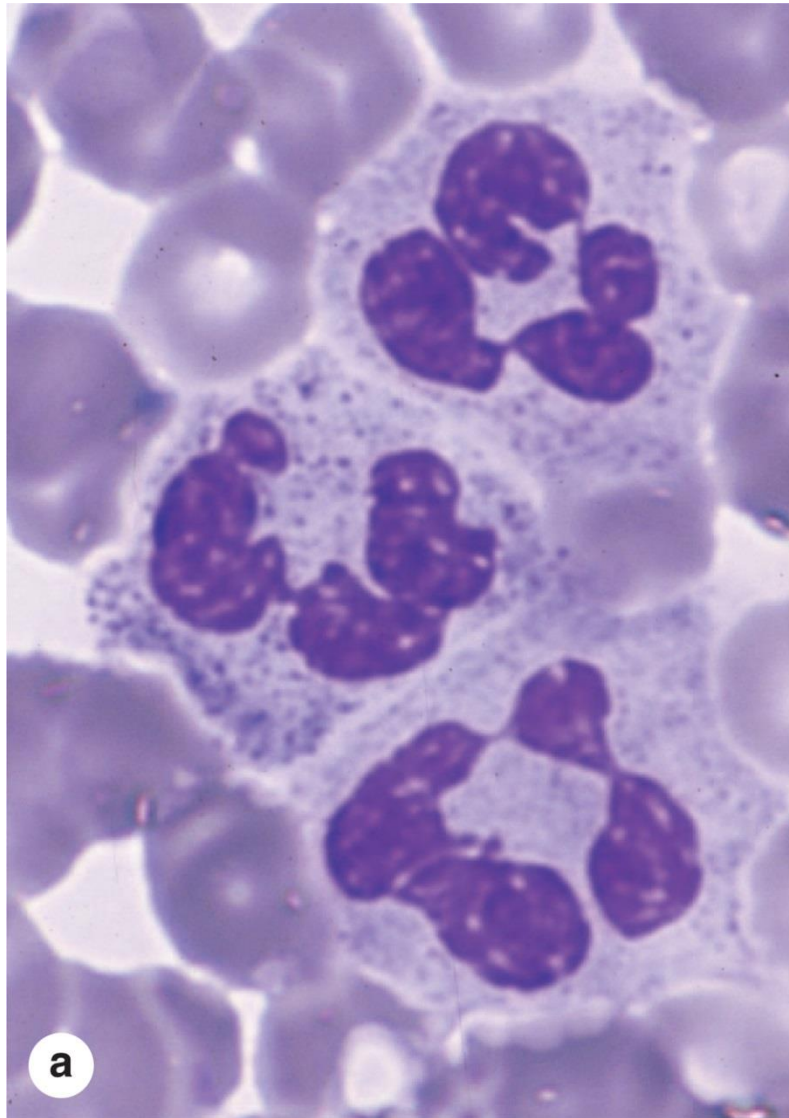
- ④ When viewed under the microscope, blood smear reveals the components of the formed elements.

ERYTHROCYTE/ RBC

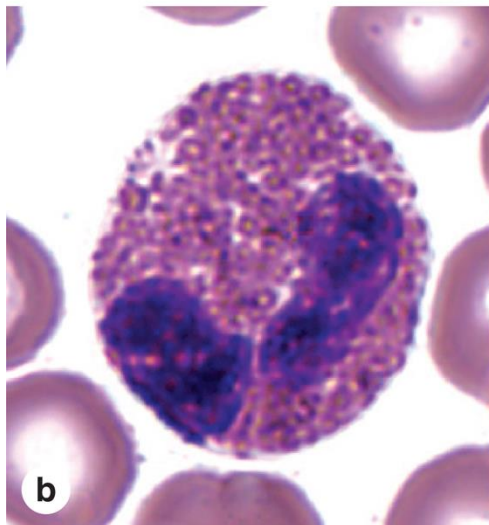
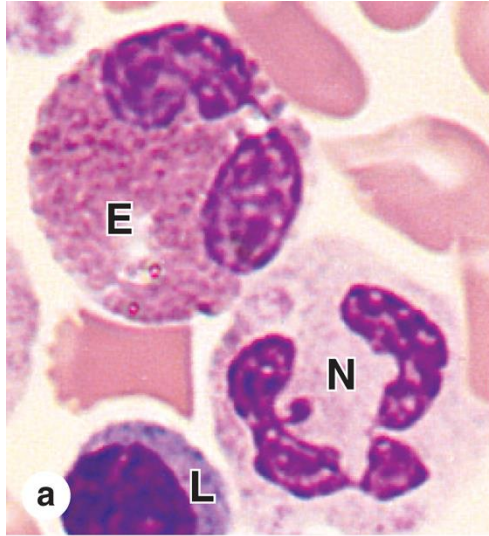


Rouleaux Erythrocytes

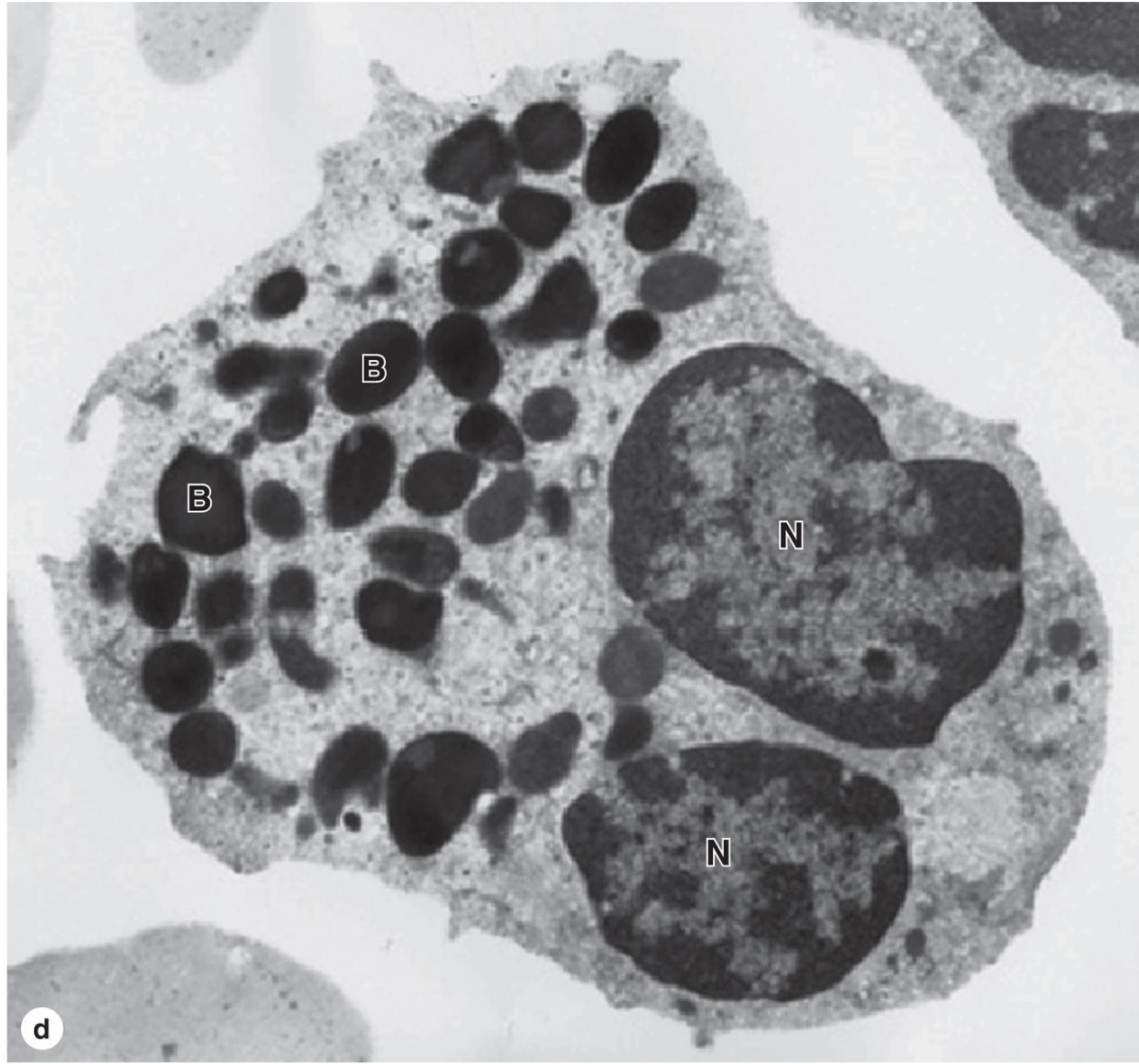
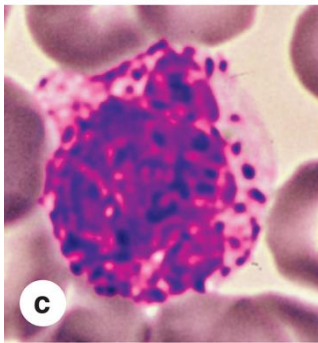
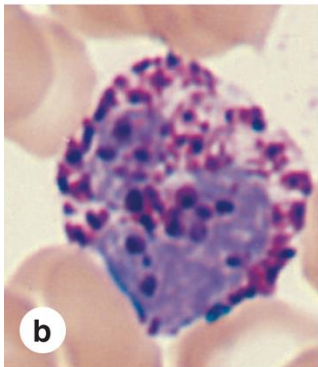
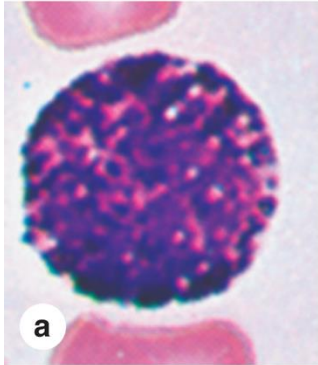
Neutrophils



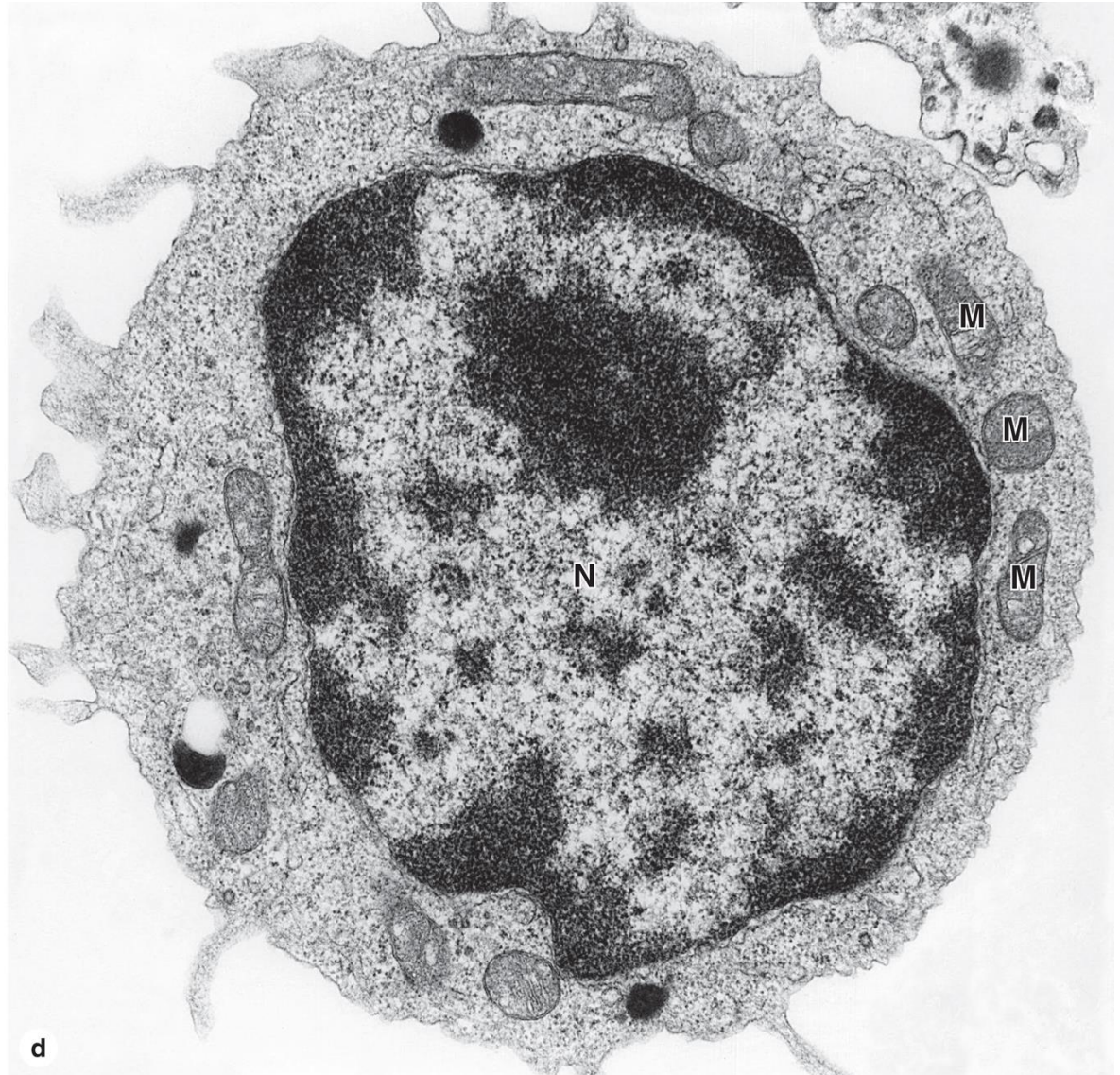
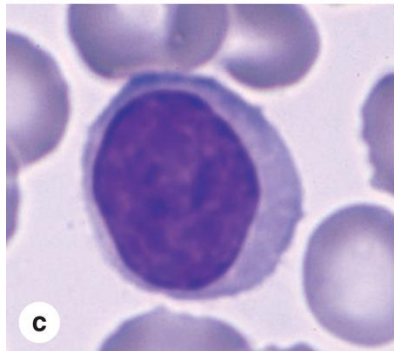
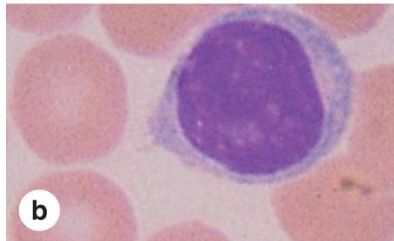
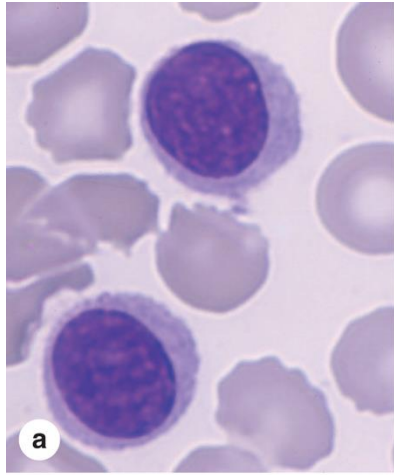
Eosinophils



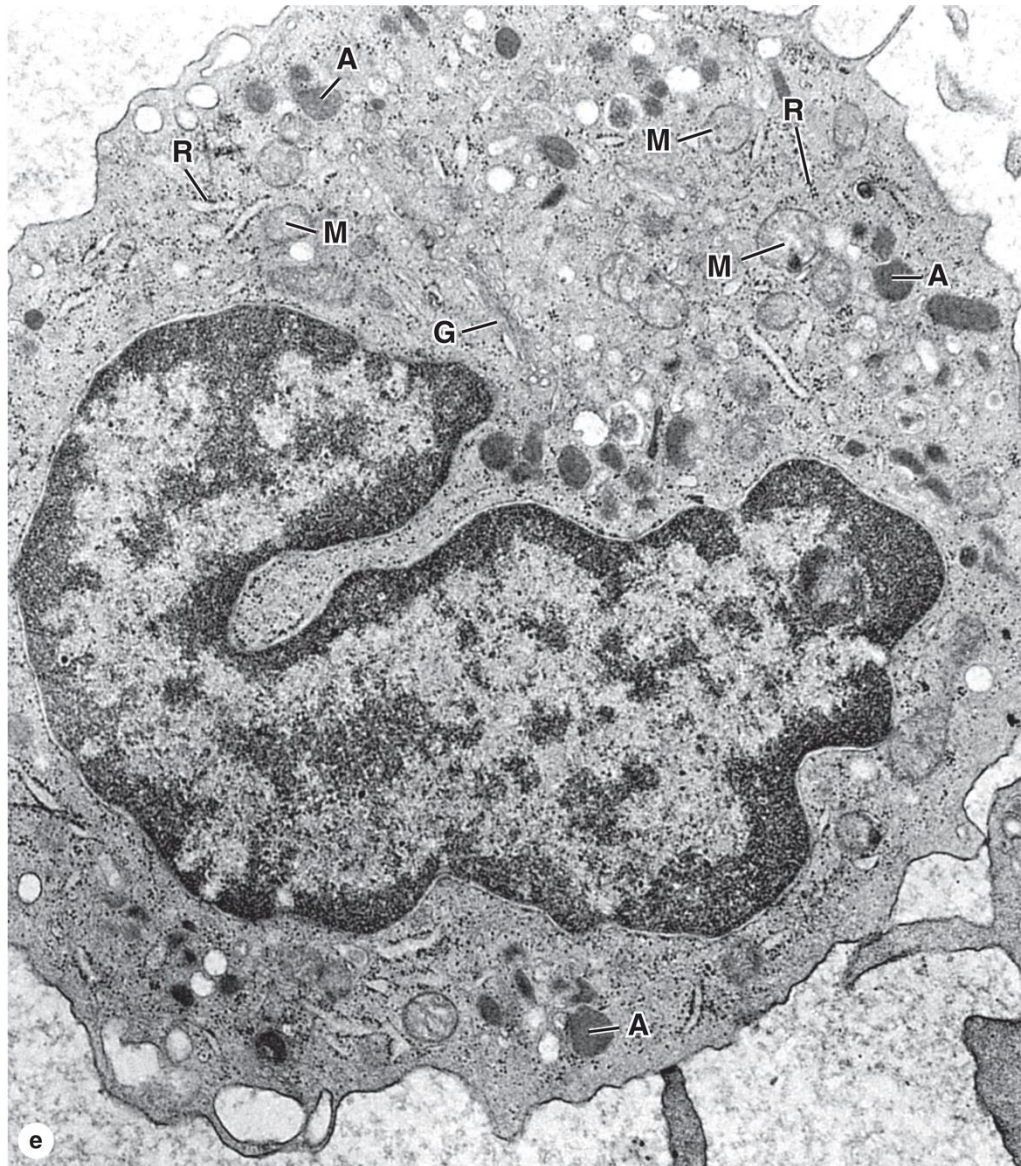
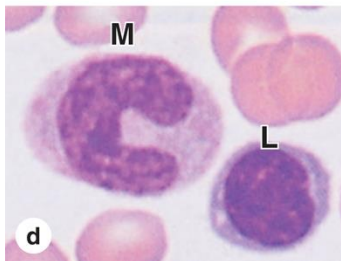
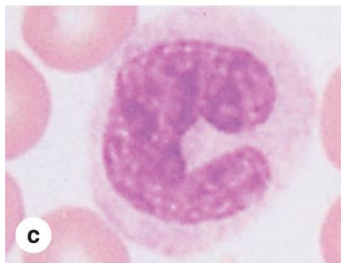
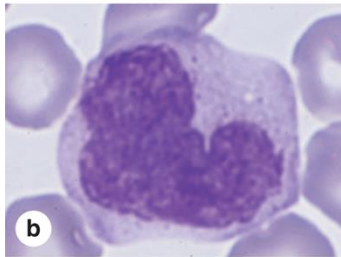
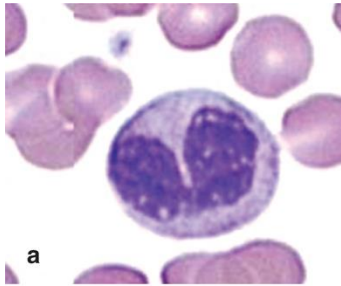
Basophils



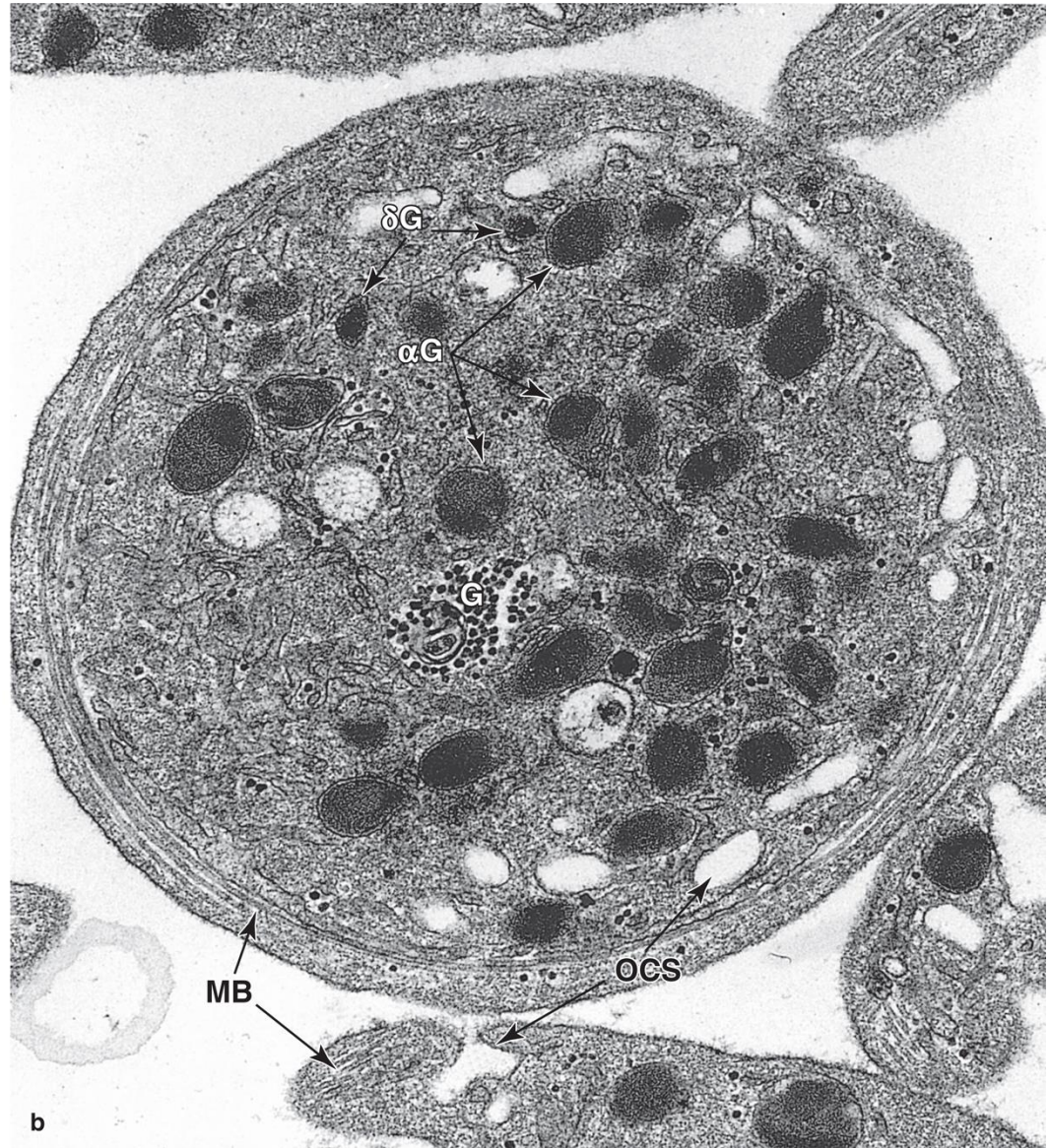
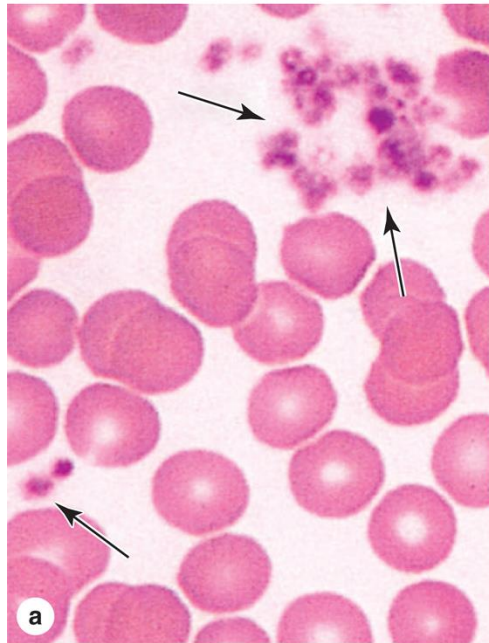
Lymphocytes

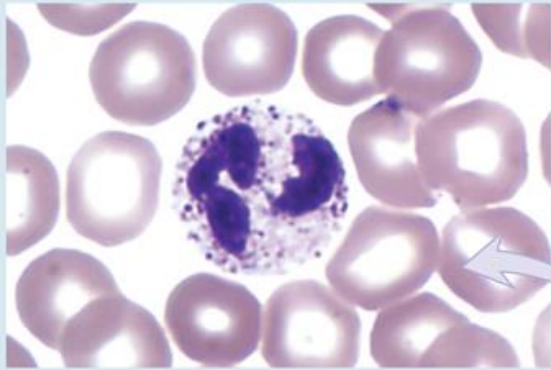


Monocytes

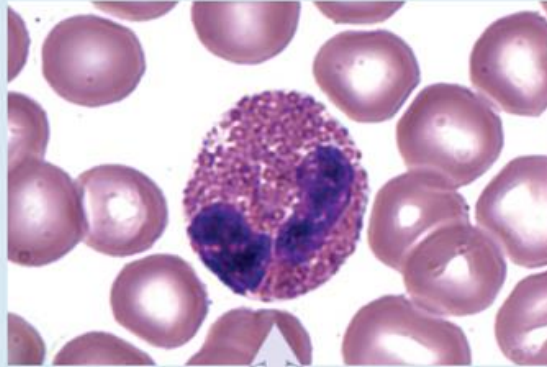


Platelets

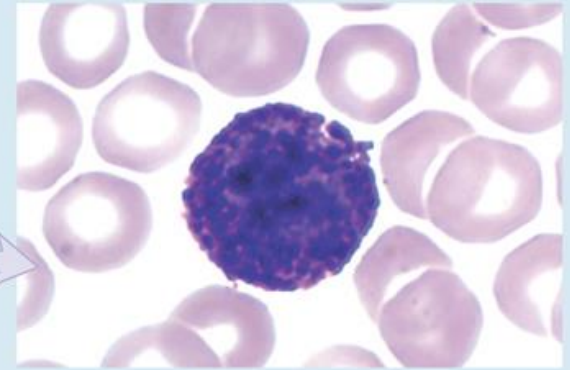




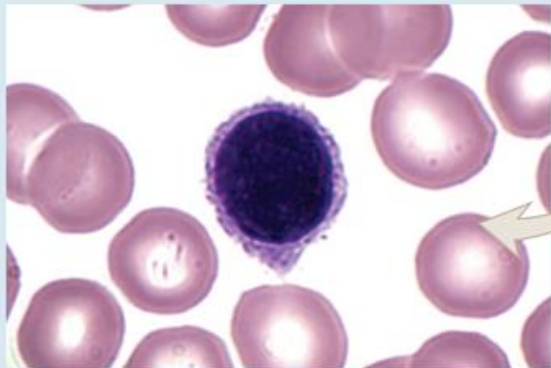
Neutrophil



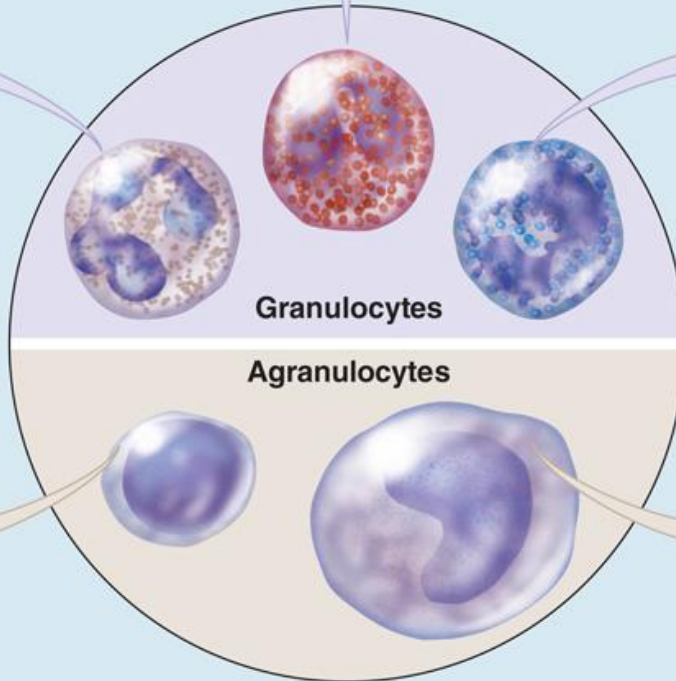
Eosinophil



Basophil

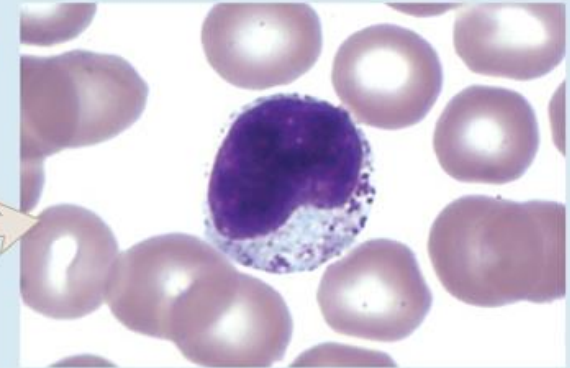


Lymphocyte



Granulocytes

Agranulocytes



Monocyte

Type	Nucleus	Specific Granules ^a	Differential Count ^b (%)	Life Span	Major Functions
Granulocytes					
Neutrophils	3-5 lobes	Faint/light pink	50-70	1-4 d	Kill and phagocytose bacteria
Eosinophils	Bilobed	Red/dark pink	1-4	1-2 wk	Kill helminthic and other parasites; modulate local inflammation
Basophils	Bilobed or S-shaped	Dark blue/purple	0.5-1	Several months	Modulate inflammation, release histamine during allergy
Agranulocytes					
Lymphocytes	Rather spherical	(none)	20-40	Hours to many years	Effector and regulatory cells for adaptive immunity
Monocytes	Indented or C-shaped	(none)	2-8	Hours to years	Precursors of macrophages and other mononuclear phagocytic cells

^aColor with routine blood smear stains. There are typically 4500-11,000 total leukocytes/ μL of blood in adults, higher in infants and young children.

^bThe percentage ranges given for each type of leukocyte are those used by the US National Board of Medical Examiners. The value for neutrophils includes 3%-5% circulating, immature band forms.

All micrographs X1600.

Structure and function of blood vessels

- 5 main types
 - Arteries – carry blood *AWAY* from the heart
 - Arterioles
 - Capillaries – site of exchange
 - Venules
 - Veins – carry blood *TO* the heart

Basic structure

- 3 layers or tunics
 1. Tunica interna (intima)
 2. Tunica media
 3. Tunica externa
- Modifications account for 5 types of blood vessels and their structural/ functional differences

Structure

- Tunica interna (intima)
 - Inner lining in direct contact with blood
 - Endothelium continuous with endocardial lining of heart
 - Active role in vessel-related activities
- Tunica media
 - Muscular and connective tissue layer
 - Greatest variation among vessel types
 - Smooth muscle regulates diameter of lumen
- Tunica externa
 - Elastic and collagen fibers
 - Vasa vasorum
 - Helps anchor vessel to surrounding tissue

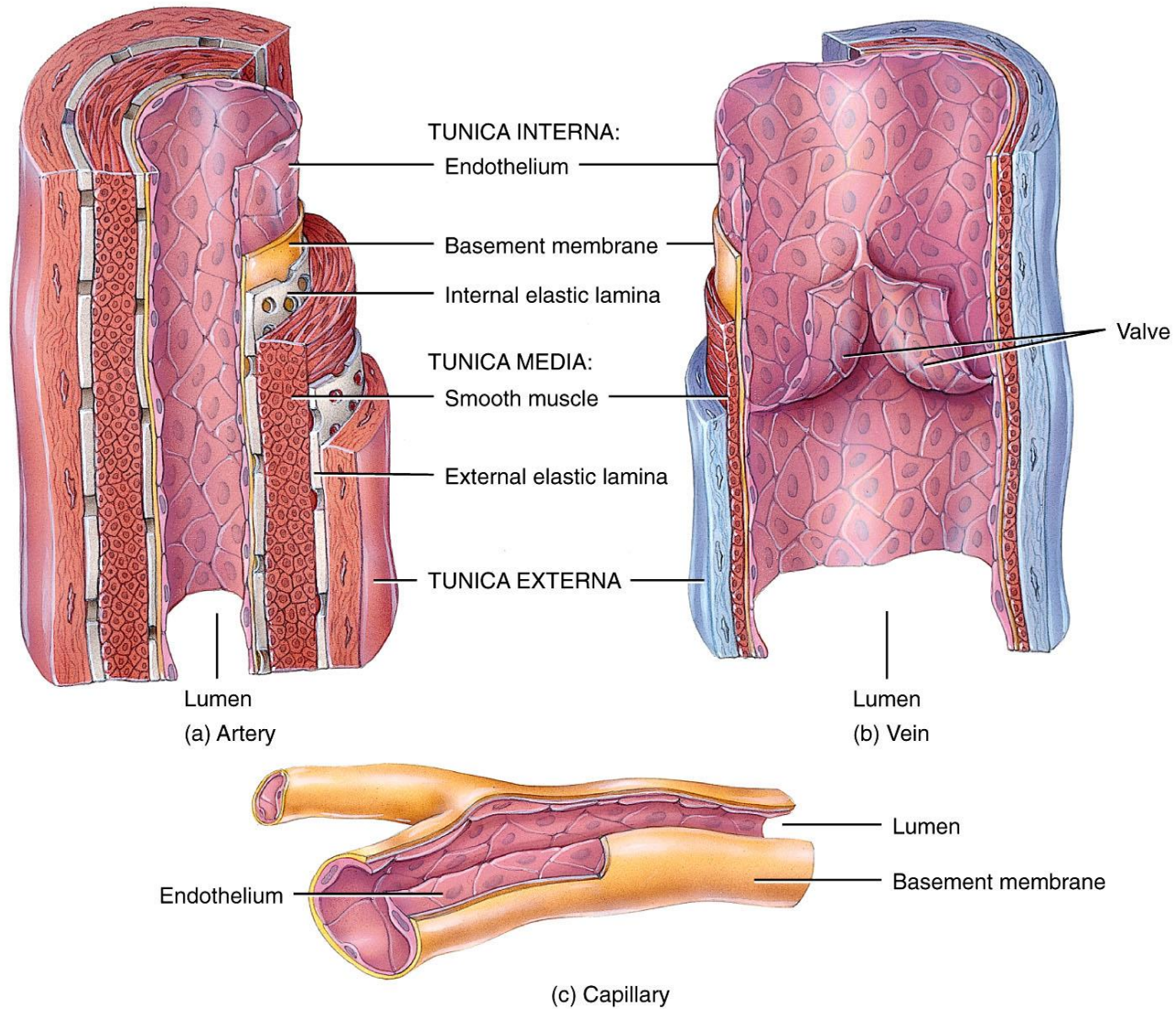


Figure 21.01abc Tortora - PAP 12/e
 Copyright © John Wiley and Sons, Inc. All rights reserved.

Arteries

- 3 layers of typical blood vessel
- Thick muscular-to-elastic tunica media
- High compliance – walls stretch and expand in response to pressure without tearing
- Vasoconstriction – decrease in lumen diameter
 - Vasodilation – increase in lumen diameter

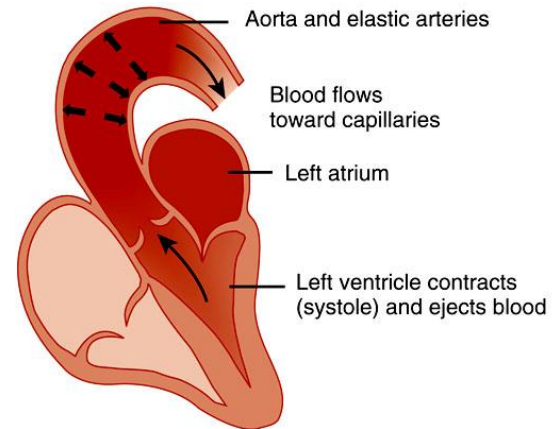
Anastomoses

Union of the branches of 2 or more arteries supplying the same body region

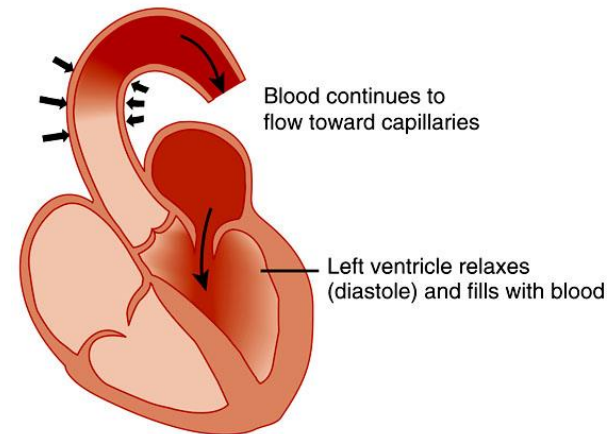
Provide alternate routes – collateral circulation

Elastic Arteries

- Largest arteries
- Largest diameter but walls relatively thin
- Function as pressure reservoir
- Help propel blood forward while ventricles relaxing
- Also known as conducting arteries – conduct blood to medium-sized arteries



(a) Elastic aorta and arteries stretch during ventricular contraction



(b) Elastic aorta and arteries recoil during ventricular relaxation

Figure 21.02 Tortora - PAP 12/e

Copyright © 2009, John Wiley & Sons, Inc. All rights reserved.

Arteries

- Muscular arteries
 - Tunica media contains more smooth muscle and fewer elastic fibers than elastic arteries
 - Walls relatively thick
 - Capable of great vasoconstriction/ vasodilatation to adjust rate of blood flow
 - Also called distributing arteries
- Anastomoses
 - Union of the branches of 2 or more arteries supplying the same body region
 - Provide alternate routes – collateral circulation

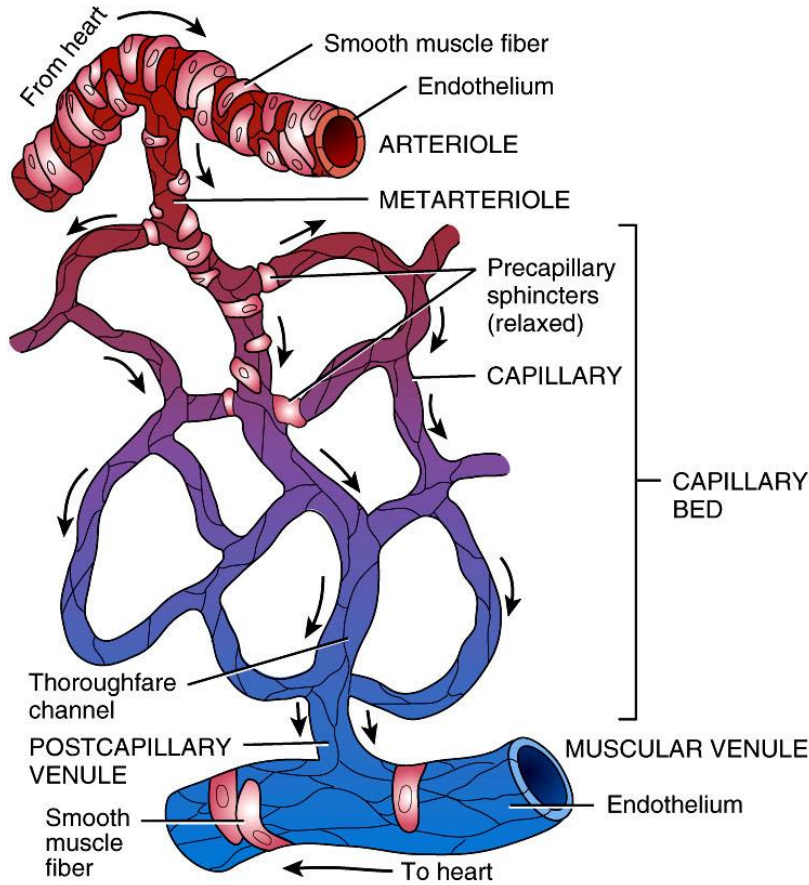
Arterioles

- Abundant microscopic vessels
- Metarteriole has precapillary sphincter which monitors blood flow into capillary
- Sympathetic innervation and local chemical mediators can alter diameter and thus blood flow and resistance
- Resistance vessels – resistance is opposition to blood flow
- Vasoconstriction can raise blood pressure

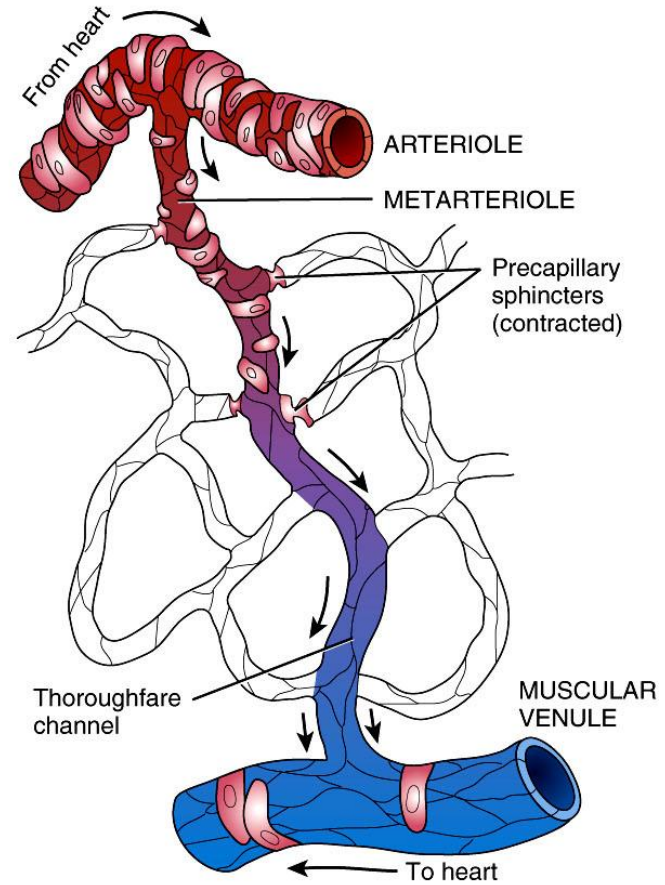
Capillaries

- Capillaries
 - Smallest blood vessels connect arterial outflow and venous return
 - Microcirculation – flow from metarteriole through capillaries and into postcapillary venule
 - Exchange vessels – primary function is exchange between blood and interstitial fluid
 - Lack tunica media and tunica externa
 - Substances pass through just one layer of endothelial cells and basement membrane
 - Capillary beds – arise from single metarteriole
 - Vasomotion – intermittent contraction and relaxation
 - Throughfare channel – bypasses capillary bed

Arteries, Capillaries, and Venule



(a) Sphincters relaxed: blood flowing through capillaries

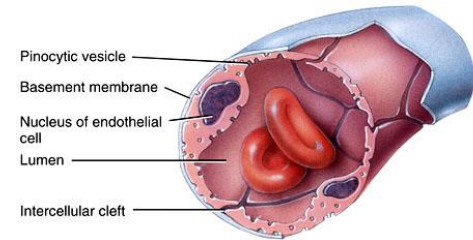


(b) Sphincters contracted: blood flowing through thoroughfare channel

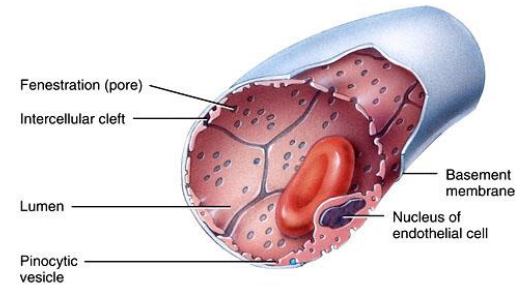
Figure 21.03 Tortora - PAP 12/e
Copyright © John Wiley and Sons, Inc. All rights reserved.

Types of Capillaries

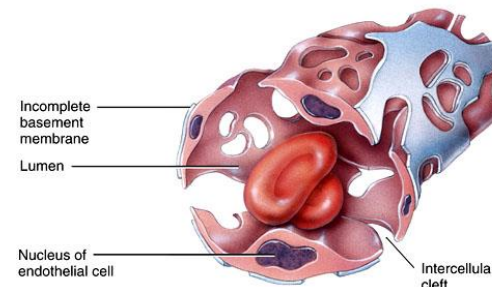
- 3 types
1. Continuous
 - Endothelial cell membranes form continuous tube
 2. Fenestrated
 - Have fenestrations or pores
 3. Sinusoids
 - Wider and more winding
 - Unusually large fenestrations



(a) Continuous capillary formed by endothelial cells



(b) Fenestrated capillary



(c) Sinusoid

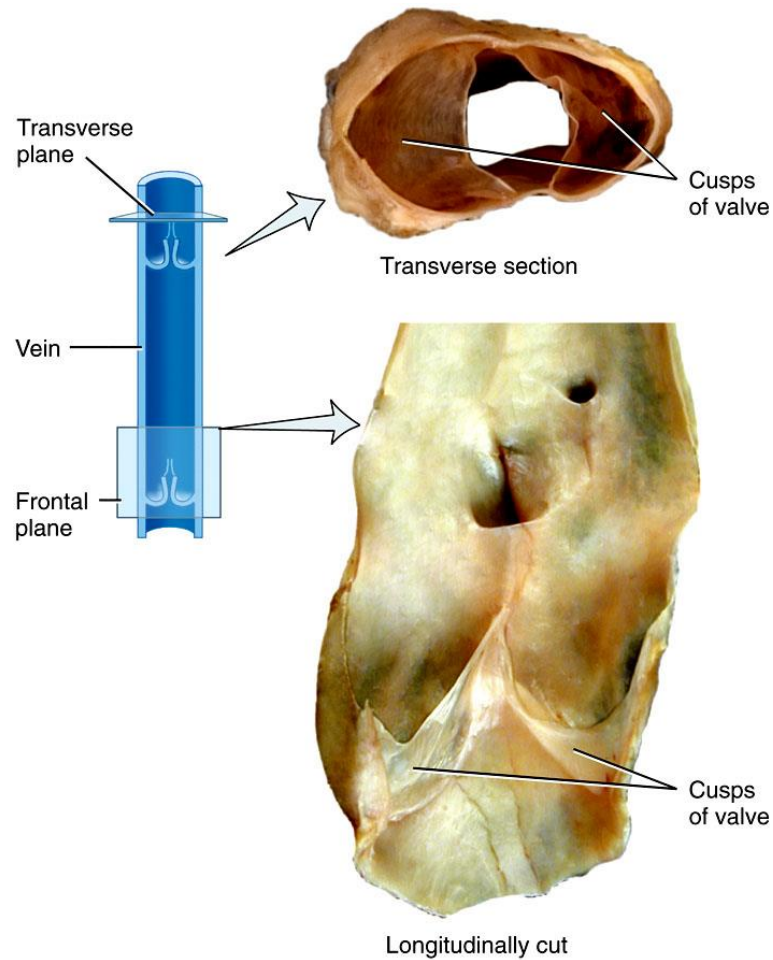
Figure 21.04 Tortora - PAP 12/e
Copyright © John Wiley and Sons, Inc. All rights reserved.

- Portal vein – blood passes through second capillary bed
 - Hepatic or hypophyseal
- Venules
 - Thinner walls than arterial counterparts
 - Postcapillary venule – smallest venule
 - Form part of microcirculatory exchange unit with capillaries
 - Muscular venules have thicker walls with 1 or 2 layers of smooth muscle

Veins

- Structural changes not as distinct as in arteries
- In general, very thin walls in relation to total diameter
- Same 3 layers
 - Tunica interna thinner than arteries
 - Tunica interna thinner with little smooth muscle
 - Tunica externa thickest layer
- Not designed to withstand high pressure
- Valves – folds on tunica interna forming cusps
 - Aid in venous return by preventing backflow

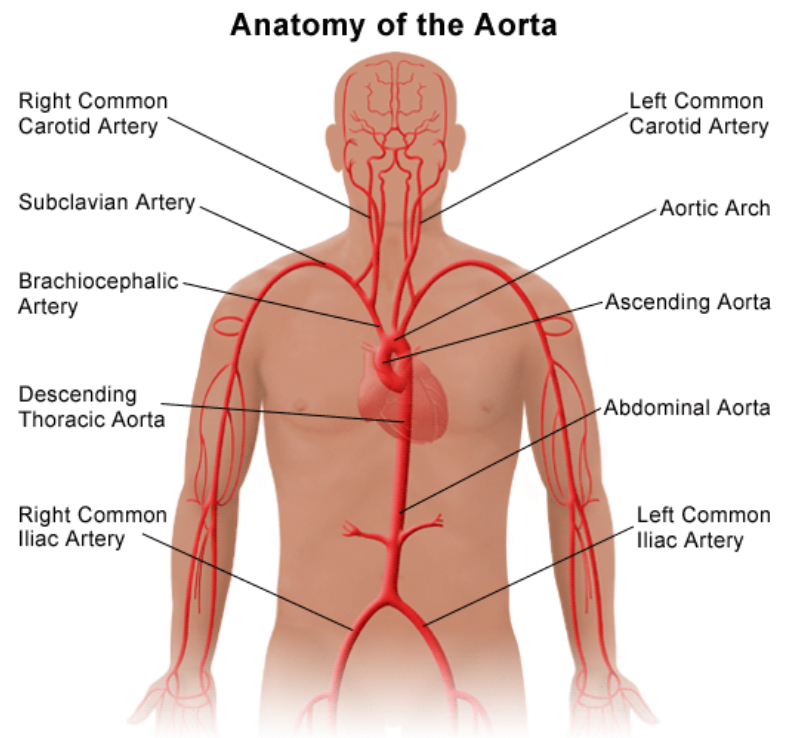
Venous Valves



Photographs of a valve in a vein

Main arteries of the body

Aorta

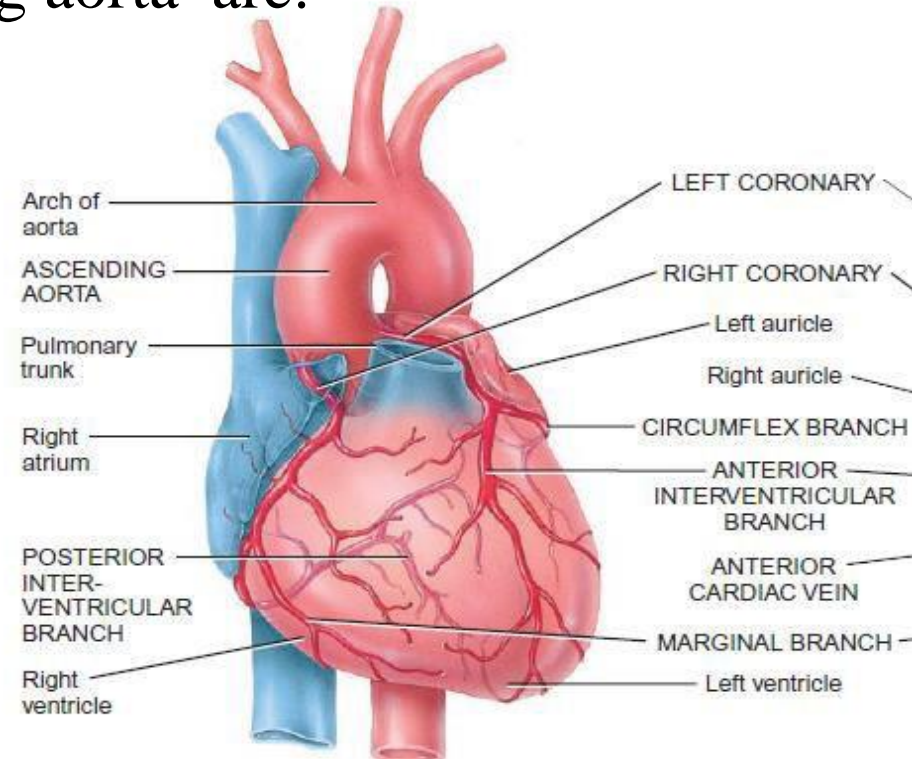
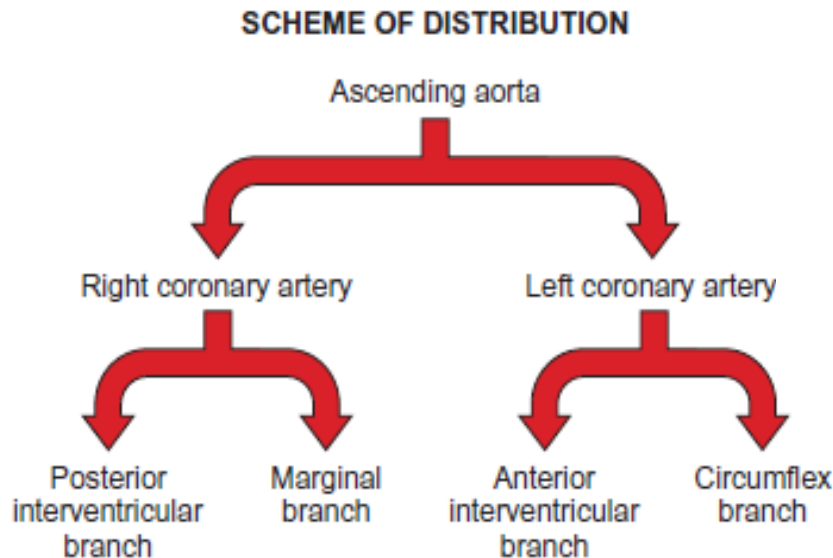


- The aorta is the largest artery of the body
- Different parts of aorta are named for their location or shape.
- The aorta arise from left ventricle of the heart as **ascending aorta**.
- It arches to the left as **arch of aorta**.
- Then descends in the thorax as **descending or thoracic aorta**.
- It passes through diaphragm to enters the abdominopelvic cavity and becomes **abdominal aorta**.

Branches of ascending aorta

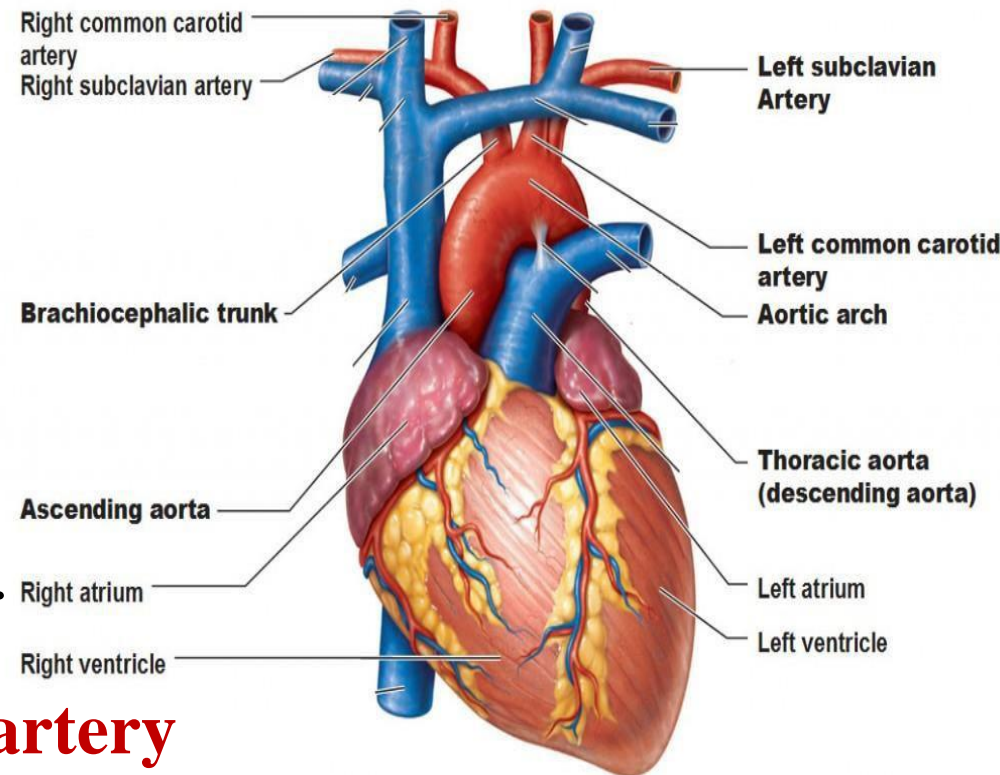
The **only** branches of descending aorta are:

1. Right coronary artery.
2. Left coronary artery.



Branches of the arch of Aorta

The Aorta and its Thoracic Branches



1. Brachiocephalic trunk

divides into:

Right common carotid a.

Right subclavian a

2. Left common carotid artery

3. Left subclavian artery

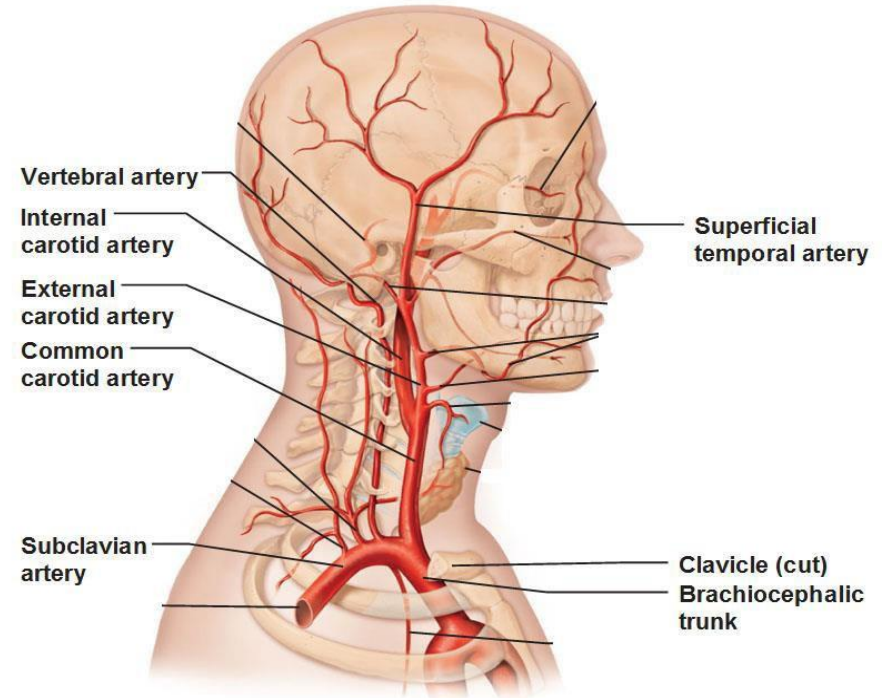
Common carotid artery

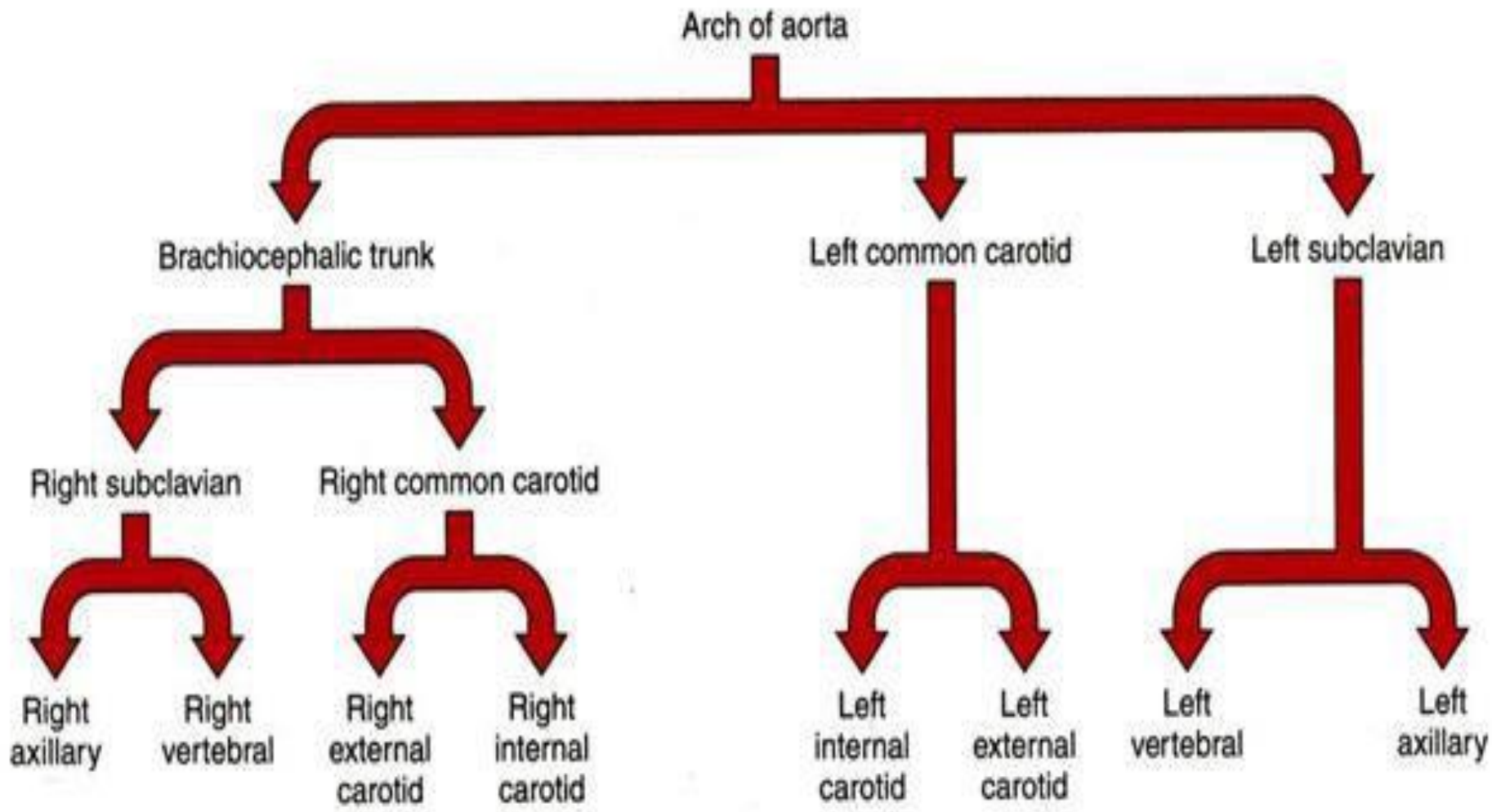
divided into

1. External carotid artery
which supplies skin and muscles of the head & neck.

2. Internal carotid artery
which supplies brain

Arteries of the head and neck, right aspect

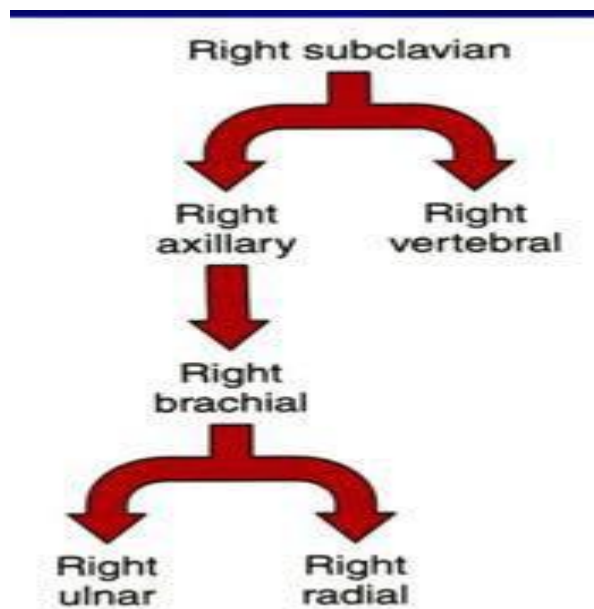
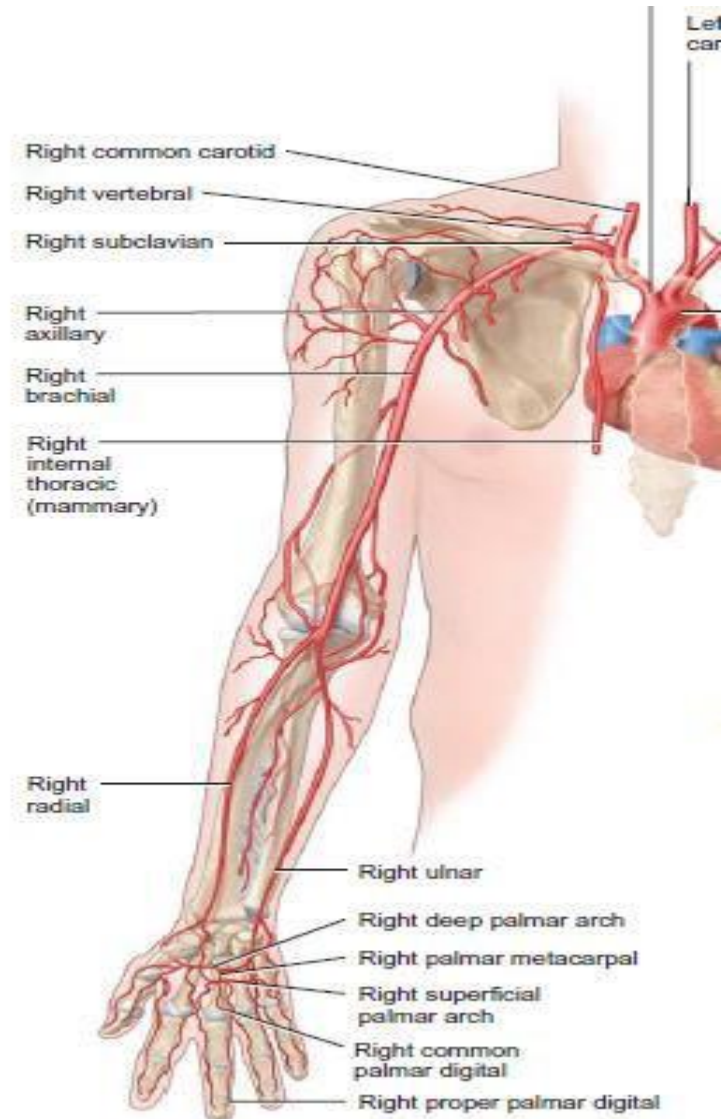




Branches of the subclavian artery

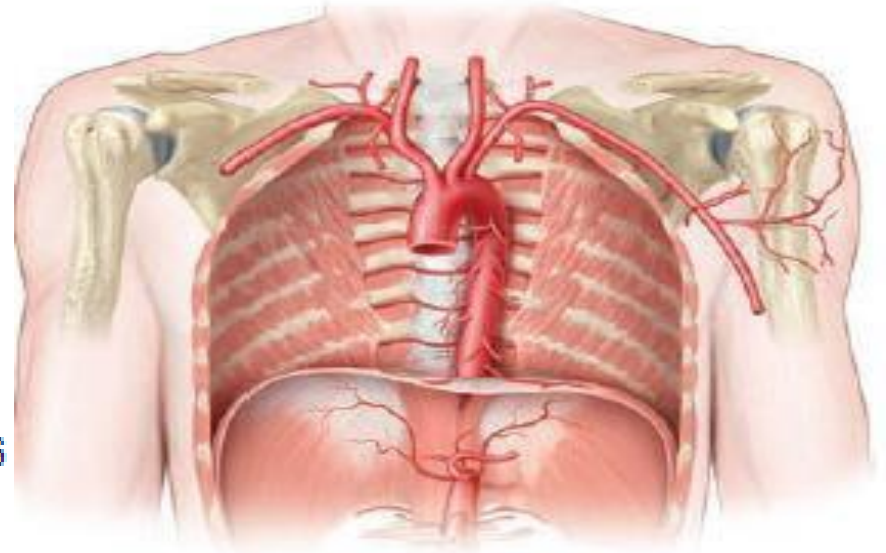
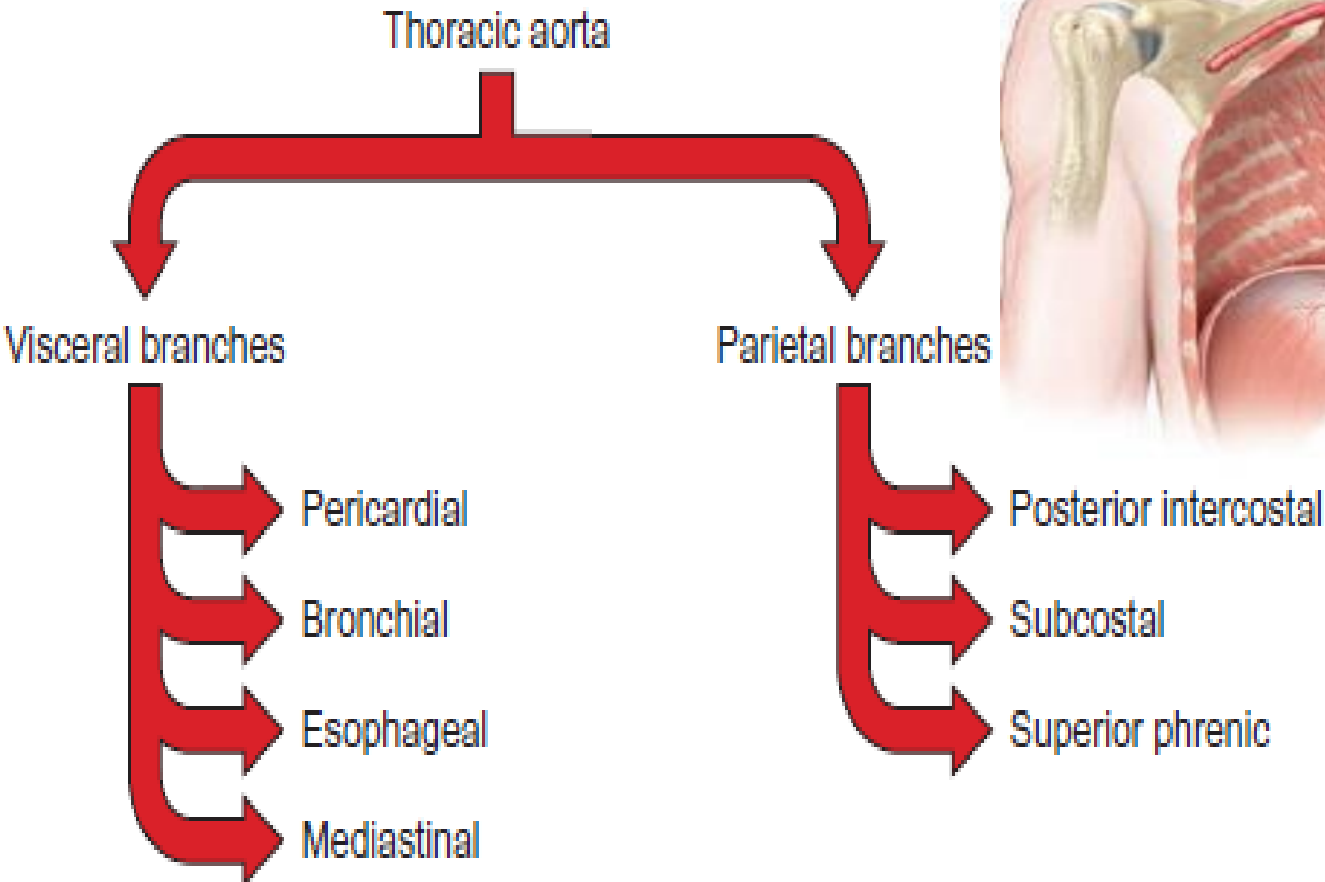
1. **Vertebral artery:** supplies part of the brain
2. **Axillary artery**
3. **Brachial artery**
4. **Radial artery**
5. **Ulnar artery**

Supply upper limb



Branches of the thoracic aorta

SCHEME OF DISTRIBUTION



Branches of the abdominal aorta

Celiac trunk: liver, spleen & stomach.

Superior mesenteric artery small intestine

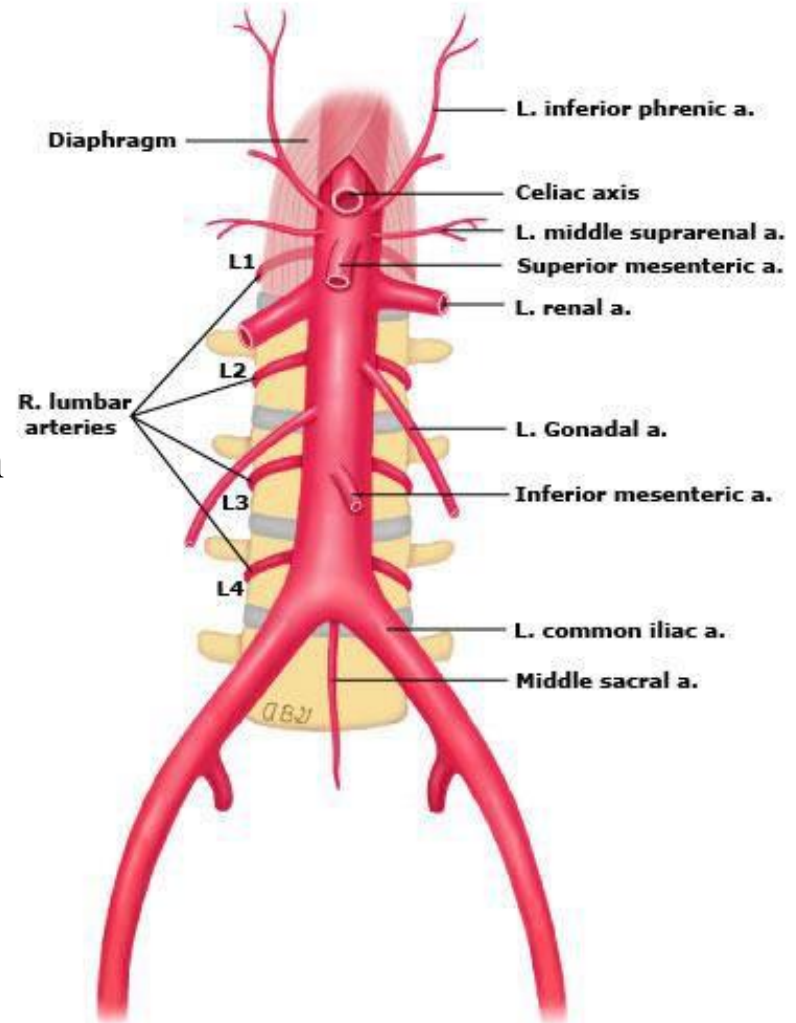
Inferior mesenteric artery large intestine.

Renal arteries kidneys

Gonadal arteries testis and ovaries.

Common iliac arteries pelvis and lower limbs.

Lumbar arteries the muscles of the abdomen and wall of the trunk.



Common iliac artery

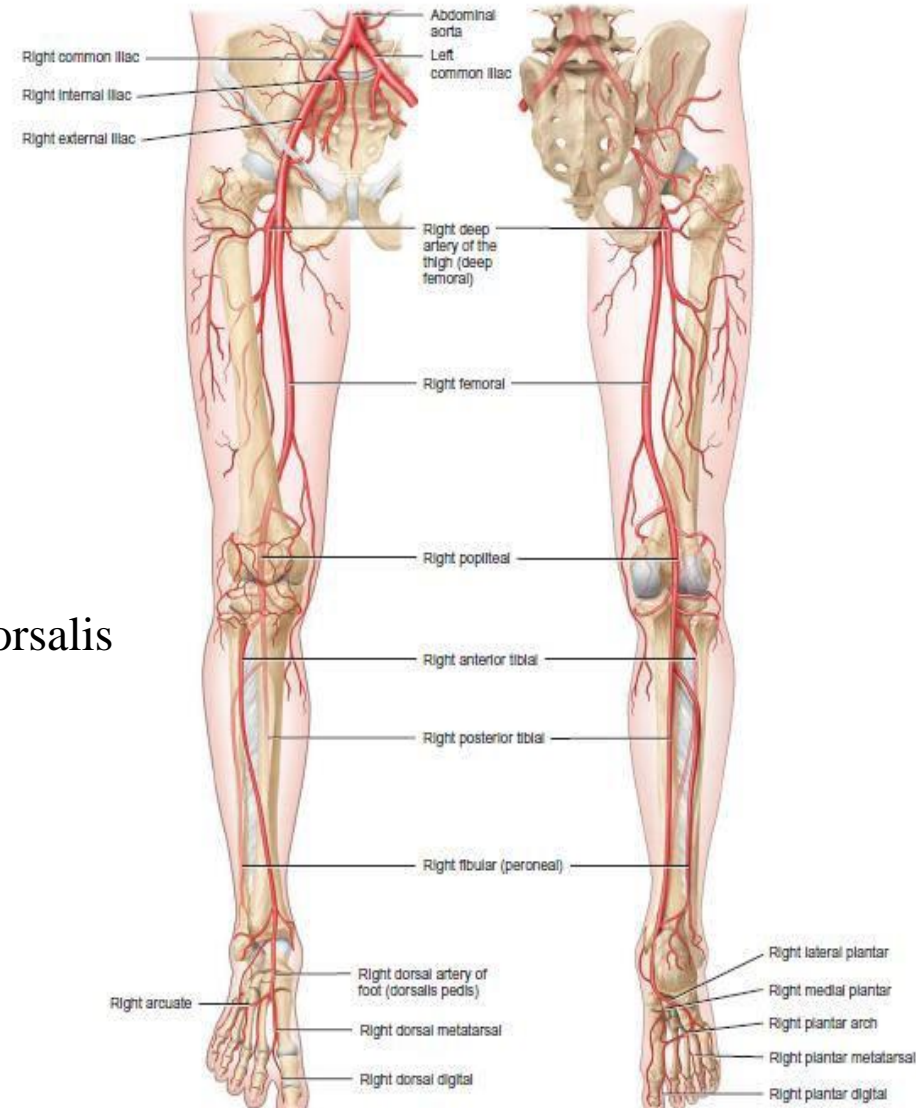
final branches of the abdominal aorta each one divides into:

1. Internal iliac artery

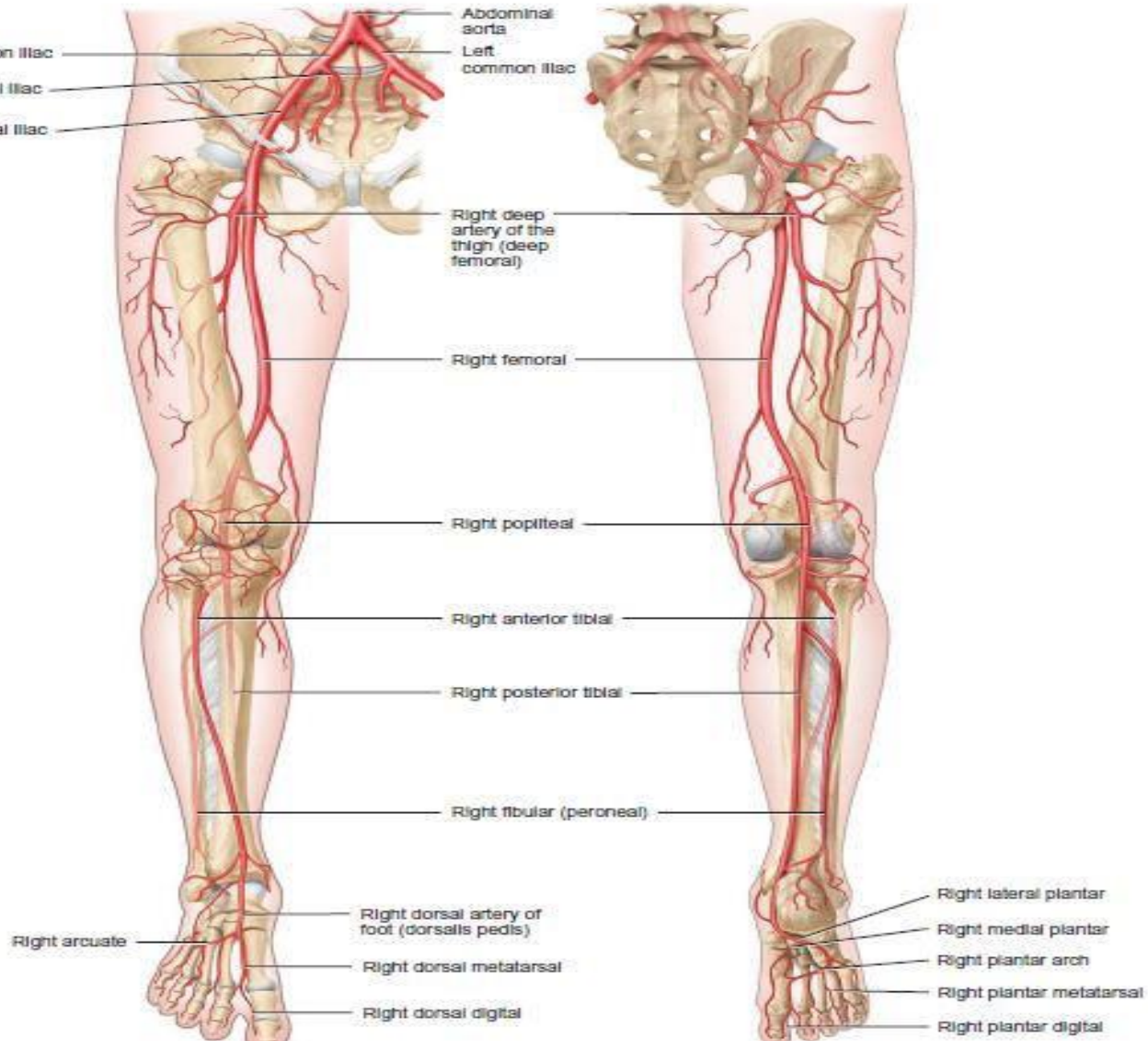
supplies the pelvic organs like urinary bladder

1. External iliac artery

- enters the thigh to become **femoral artery**; which supplies thigh
- at the knee the femoral artery becomes the **popliteal** artery which then divides into:
 - a. **Anterior tibial** artery which terminates as dorsalis pedis artery.
 - b. **Posterior tibial** artery



Common iliac artery



Main veins of the systemic circulation

In limbs there are two types of veins:

Deep: most of the deep veins follow the course of the major arteries and their names are identical.

Superficial: visible under skin

The veins drain into venae cavae which open into the right atrium:

Superior vena cava

drains upper limbs and head & neck.

Inferior vena cava

drains lower parts of the body.

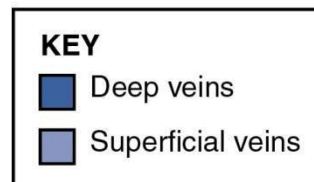
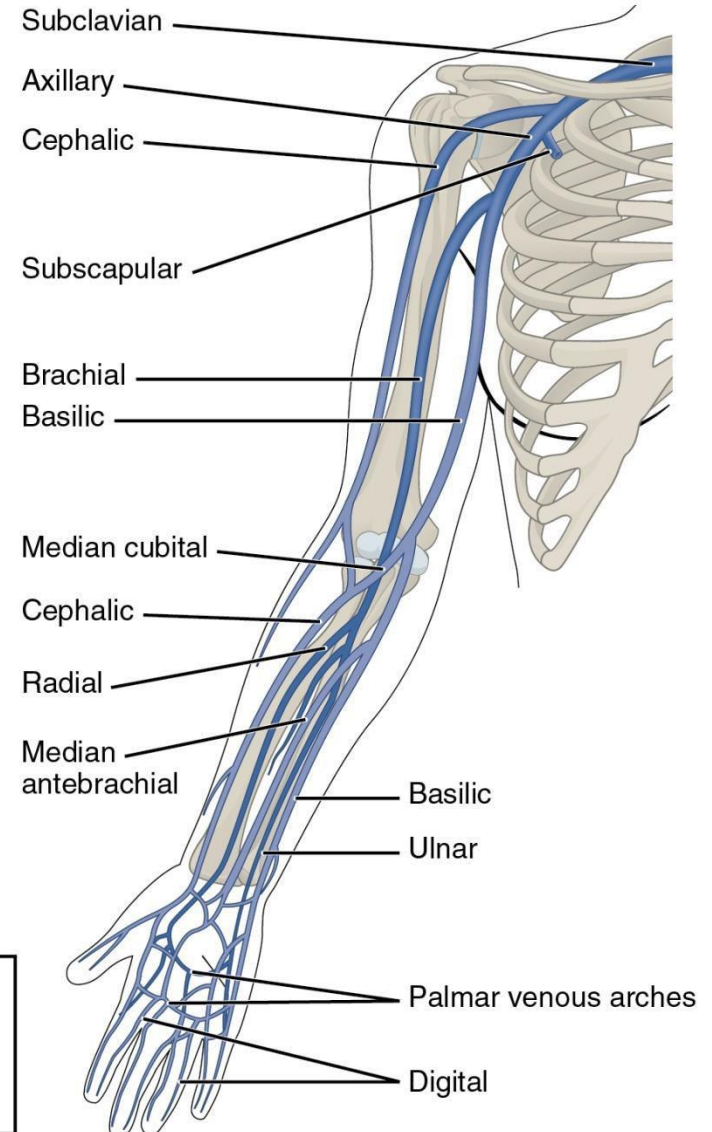


Veins draining into superior vena cava

Deep veins:

Radial and ulnar veins drain the forearm

They unite to form **brachial vein** which drains the arm and empties into **axillary vein**.

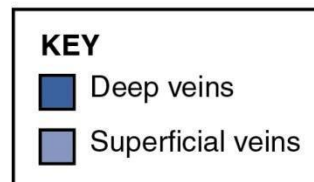
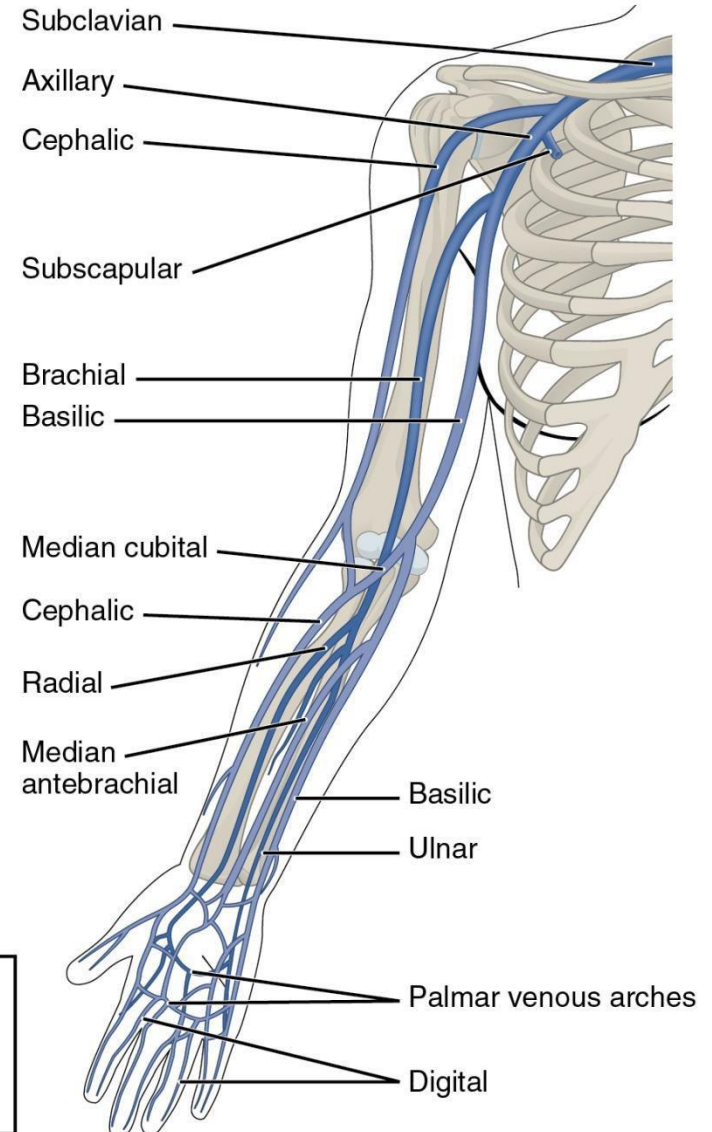


Veins draining into superior vena cava

Superficial veins:

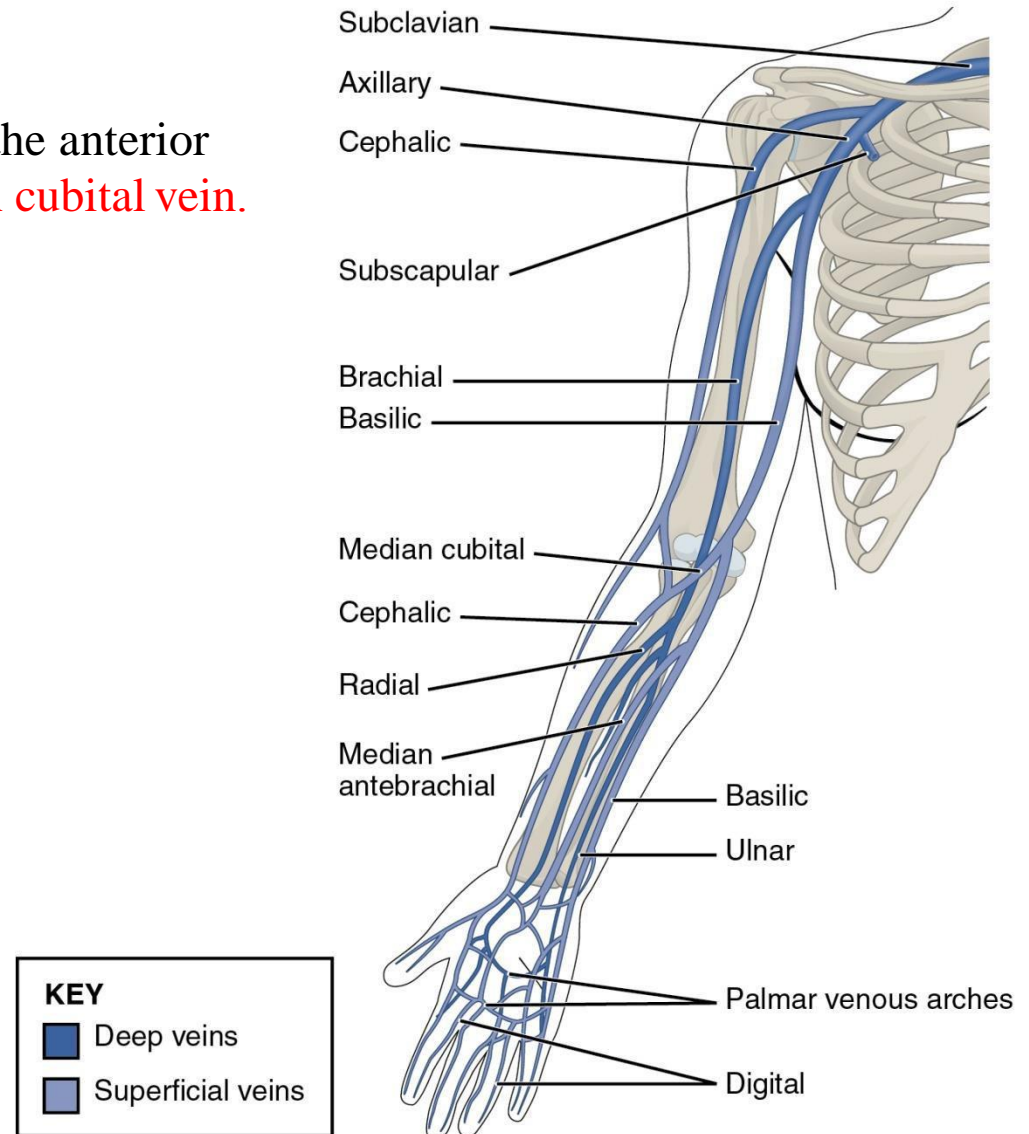
Cephalic vein which drains the superficial lateral aspect of the arm and empties into the **axillary vein**.

Basilic vein which drains the superficial medial aspect of the arm and empties into the **brachial vein**.

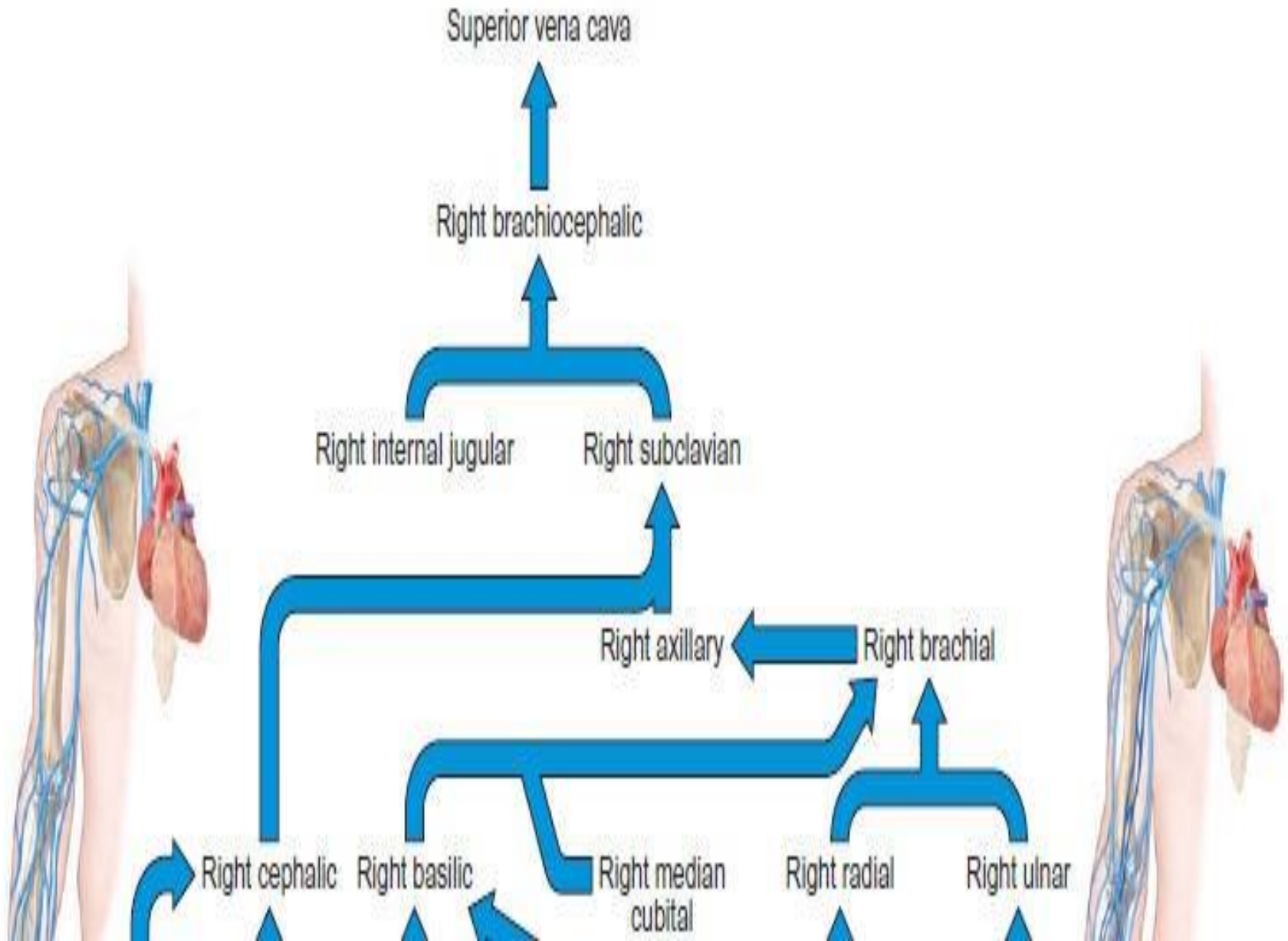


Veins draining into superior vena cava

cephalic and basilic veins are joined at the anterior aspect of the elbow to form **the median cubital vein**.



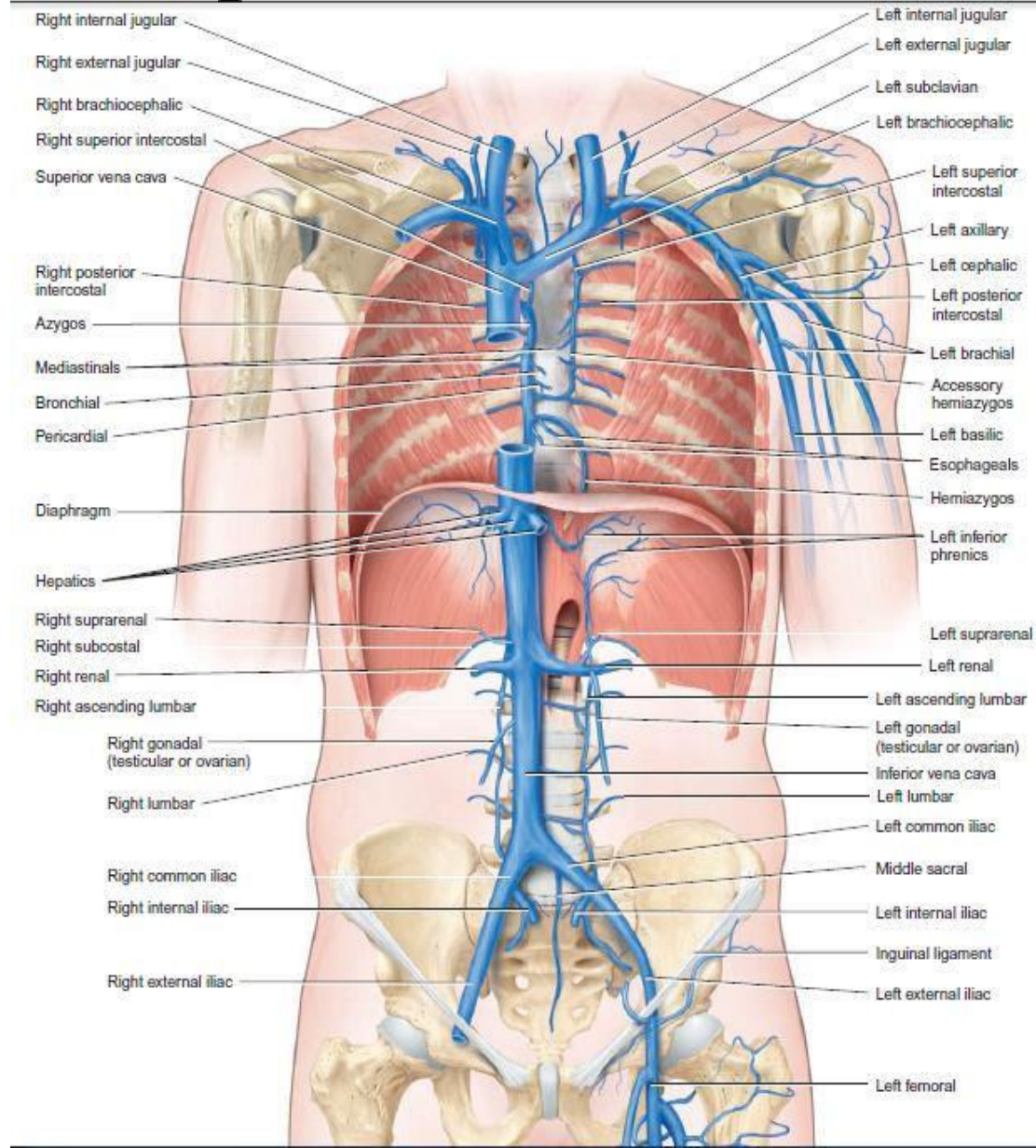
SCHEME OF DRAINAGE



Veins draining into superior vena cava

The subclavian veins

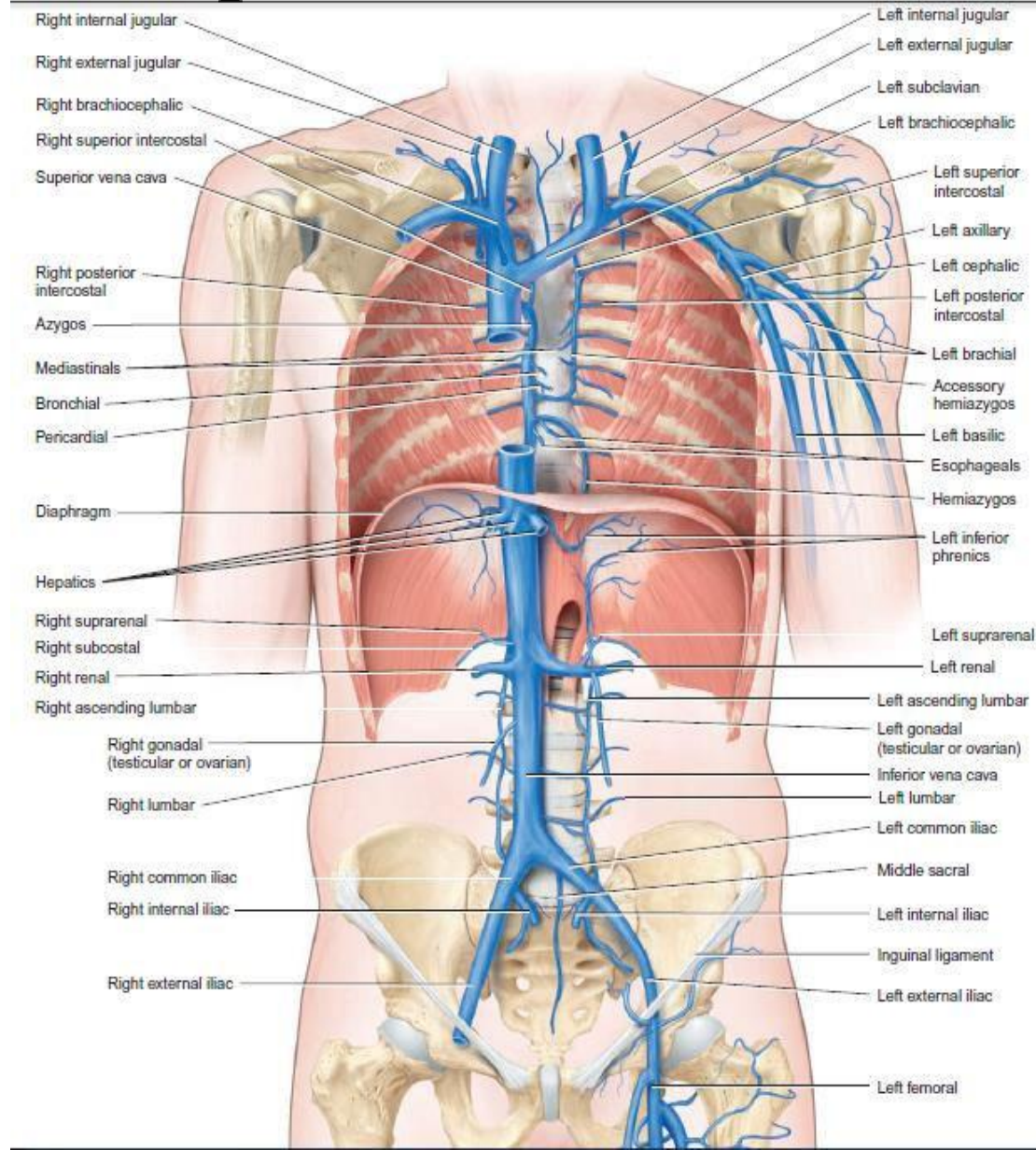
The brachiocephalic veins



Veins draining into superior vena cava

The brachiocephalic veins

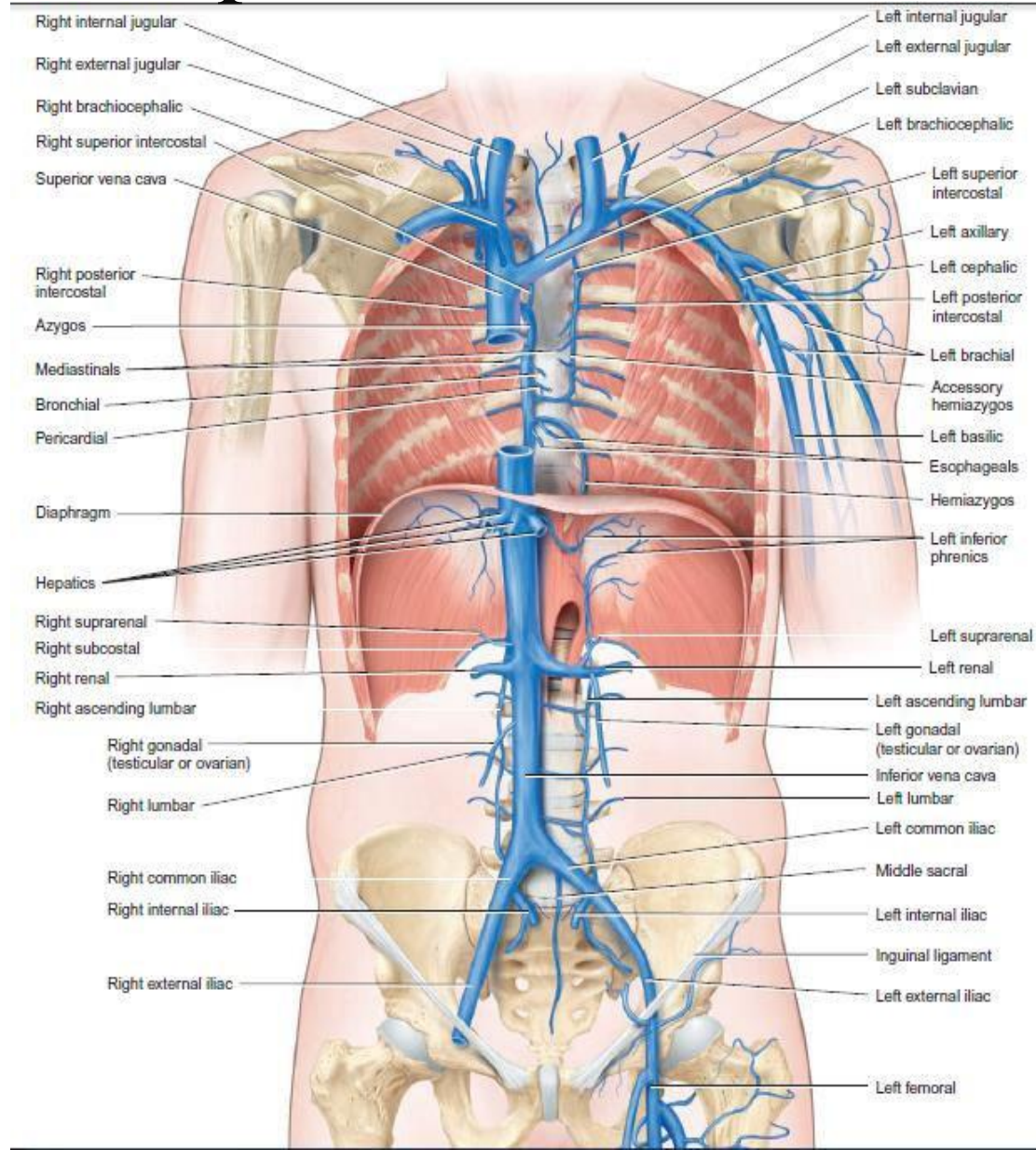
large veins that receive blood from
subclavian
vertebral
internal jugular veins.



Veins draining into superior vena cava

brachiocephalic veins

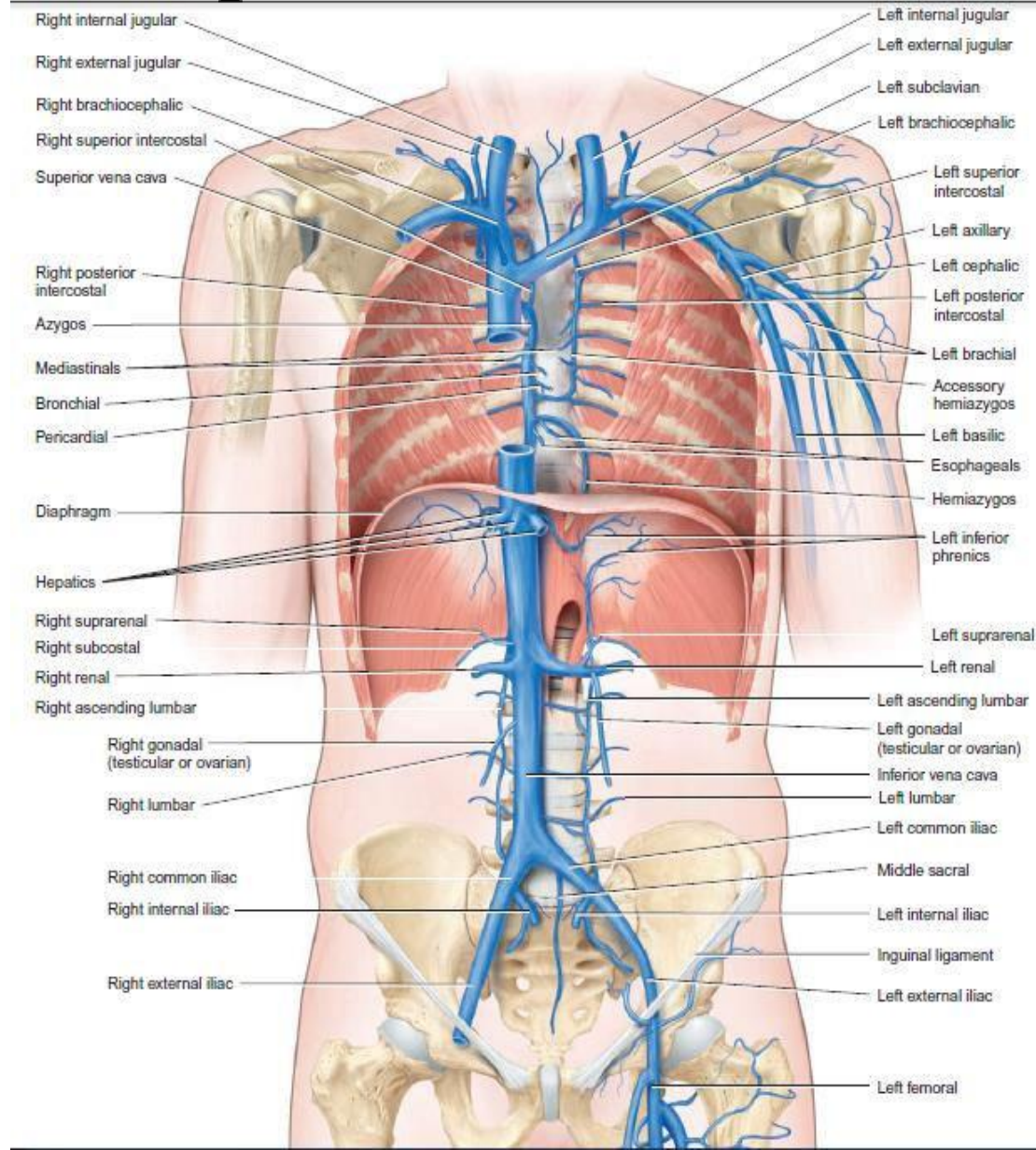
right and left
joined to form the **Superior vena cava**
which empties into the right
atrium of the heart.



Veins draining into superior vena cava

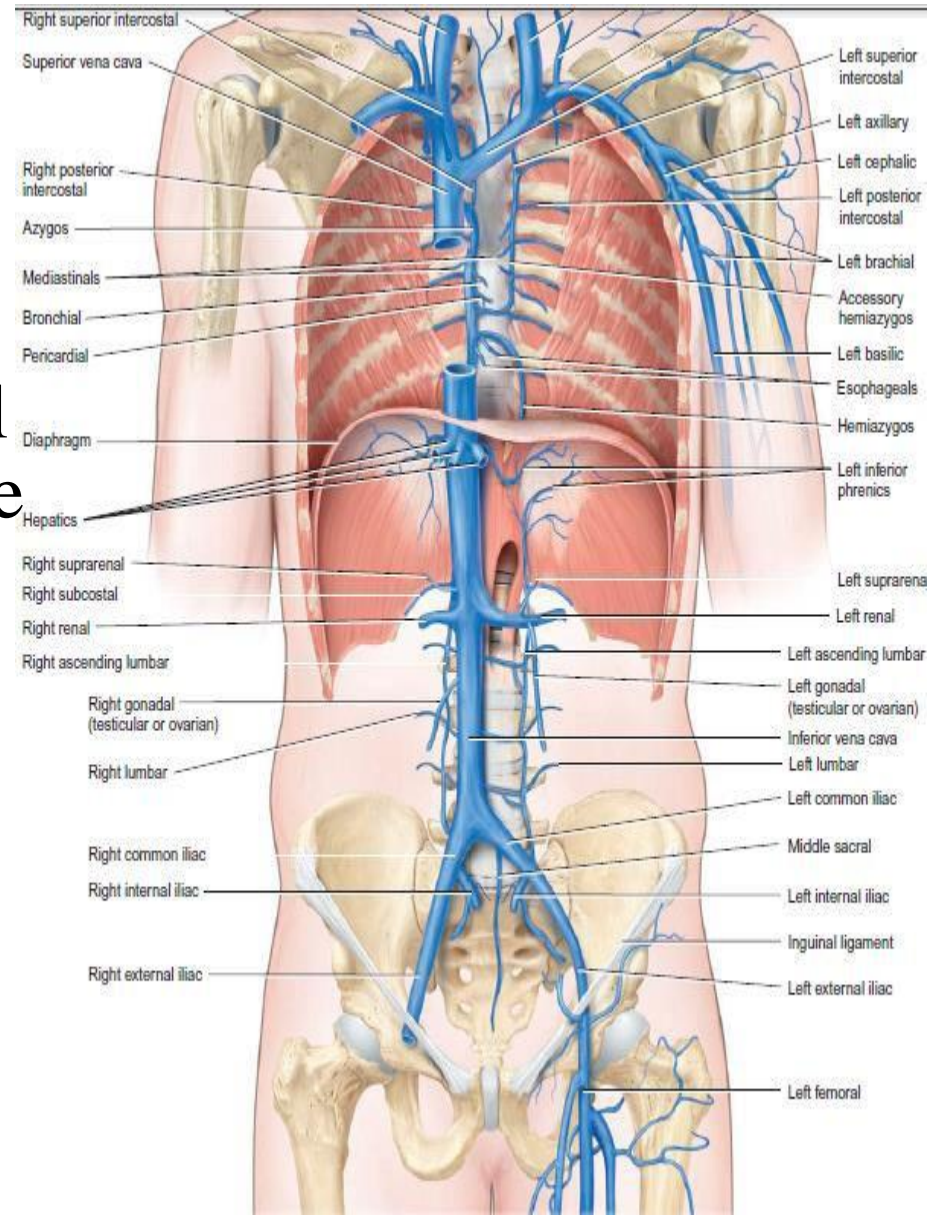
The azygos vein

- single vein
- drains the thorax
- empties into the superior vena cava just before the superior vena cava enters the heart.



Veins draining into inferior vena cava

- Longer than superior vena cava
- Returns blood to the right atrium of the heart from all parts of the body below the diaphragm.



Veins draining into inferior vena cava

SCHEME OF DRAINAGE

