

# 高中生物人才培育計畫

任課教師 黃宏圖

- 人體概念
- 解剖學位置、解剖學方位、身體切面、體腔、身體區域

# 要探討人體結構先要熟悉下列觀念

- 解剖學位置(Anatomical Position)

身體是在一個直立的姿勢，雙臂下垂放在身體的兩側且手掌面向前，而且顏面及腳趾都是朝向前方。

- 解剖學方位(Anatomical Directions): 以下方為名詞用於描述身體構造的所在相關位置

- 1.上方(Superior)/頭端 及 下方(Inferior)/尾端

- 2.前方(Anterior)/腹面(Ventral) 及後方(Posterior)/背面(Dorsal)

- 如 鼻子在人體的腹面，肩膀在背面。

## ~續上

- **3.內側(Medial) 及外側(Lateral)**
- **內側** 是指“靠近身體的中線”。**外側**是靠近身體的兩側 (遠離中線)。例如**手掌的小指頭**位於手掌的內側，而**大拇指**位於手掌的外側。
- **4.近端 (Proximal) 及遠端(Distal)**
- **近端**是指靠近身體軀幹的方向，**遠端**是遠離軀幹。例如手掌和手肘 都長在手臂上，手掌是位於手臂的遠端，手肘是位於手臂的近端。
- **5.淺層(Superficial) 及深層(Deep)**
- **淺層**是指靠近表面，如手臂的皮膚位於體表。手臂的**骨骼**位於**深層**。

## ~續上

- 身體切面
  1. 矢狀切面(Sagittal Plane)/縱切面(Longitudinal Plane)
  2. 額切面(Frontal Plane)/冠狀切面(Coronal Plane)
  3. 橫切面(Transverse Plane)
- 體腔(Body Cavities)
  - 腹面體腔(Ventral Body Cavities): **胸腔** (Thoracic Cavity) 和 **腹腔**(Abdominal Cavity)。
- 身體區域(Body Regions)
  - 整個身體大致可以分為 (1)中軸區域(Axial Region): 頭、頸與軀幹。 (2)附肢區域(Appendicular Region): 上肢 和 下肢。



# Human Anatomy

Sixth Edition

Marieb  
—  
Wilhelm  
—  
Mallatt

PowerPoint® Lecture Slides  
prepared by  
Leslie Hendon  
University of Alabama,  
Birmingham

## CHAPTER 20

Part 1

循環系統：血管  
與心臟

黃宏圖老師

# 內容重點: 心臟、主動脈和肺動脈幹、上腔靜脈和下腔靜脈

- 人體心臟有兩個心房(Atrium)、兩個心室(Ventricle)和注入血液的孔(foramen)。
- 主動脈(Aorta)和肺動脈幹(Pulmonary trunk)是大型動脈，直徑有2 cm。各分出很多重要分支。
- 上腔靜脈(Superior vena cava)與下腔靜脈(Inferior vena cava)，直徑也超過2 cm。各有重要支流。

# 體表能按到的 動脈脈搏點(pulse points)

顳淺動脈

顏面動脈

頸總動脈

肱動脈

橈動脈

股動脈

腘動脈

後脛動脈

Superficial temporal artery

Facial artery

Common carotid artery

Brachial artery

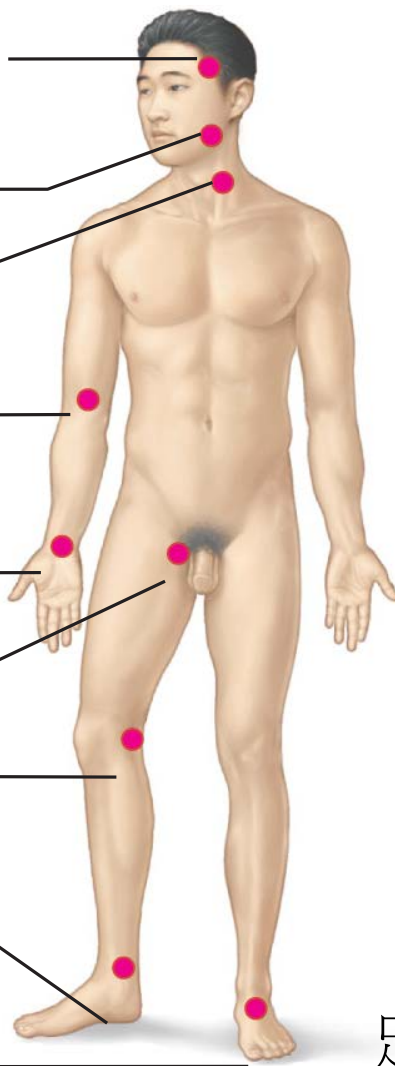
Radial artery

Femoral artery

Popliteal artery

Posterior tibial artery

Dorsalis pedis artery



足背動脈

# Arteries and veins

- Artery and its branches 動脈及其分支
- Vein and its tributaries 靜脈及其支流



# Types of Blood Vessels 血管類型

- **Arteries** 動脈—carry blood away from the heart
- **Capillaries** 微血管—*smallest* blood vessels
  - The site of exchange of molecules between blood and tissue fluid
- **Veins** 靜脈—carry blood toward the heart

# Structure of Blood Vessels

- Composed of three layers (tunics)
  - **Tunica intima** 內膜—composed of simple squamous epithelium (**endothelium**) and **connective tissue**
  - **Tunica media** 中膜 —sheets of smooth muscle
    - Contraction—vasoconstriction
    - Relaxation—vasodilation
  - **Tunica externa** 外膜 —composed of connective tissue
- Lumen 管腔
  - **Central** blood-filled space of a vessel

# Structure of Blood Vessels

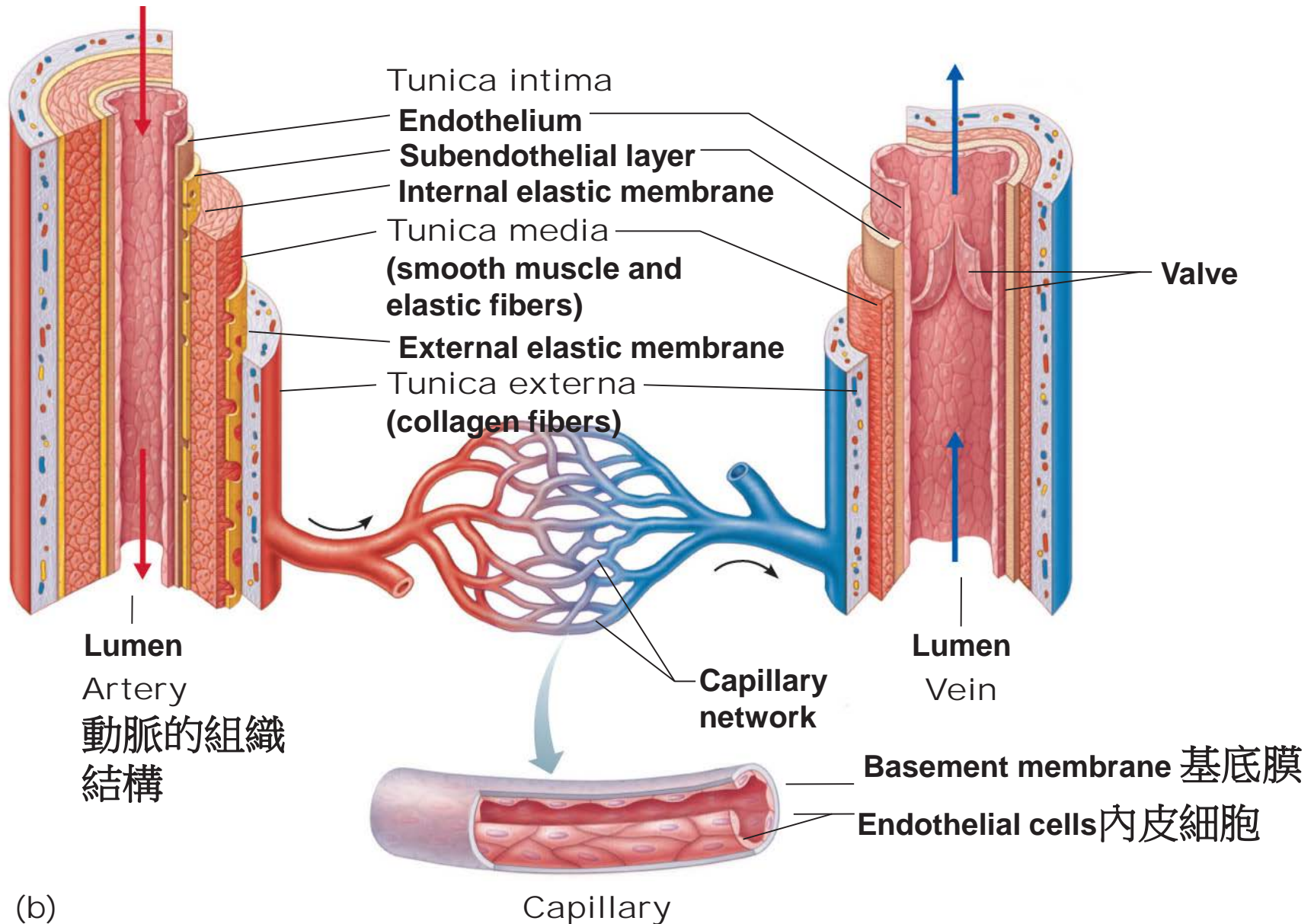
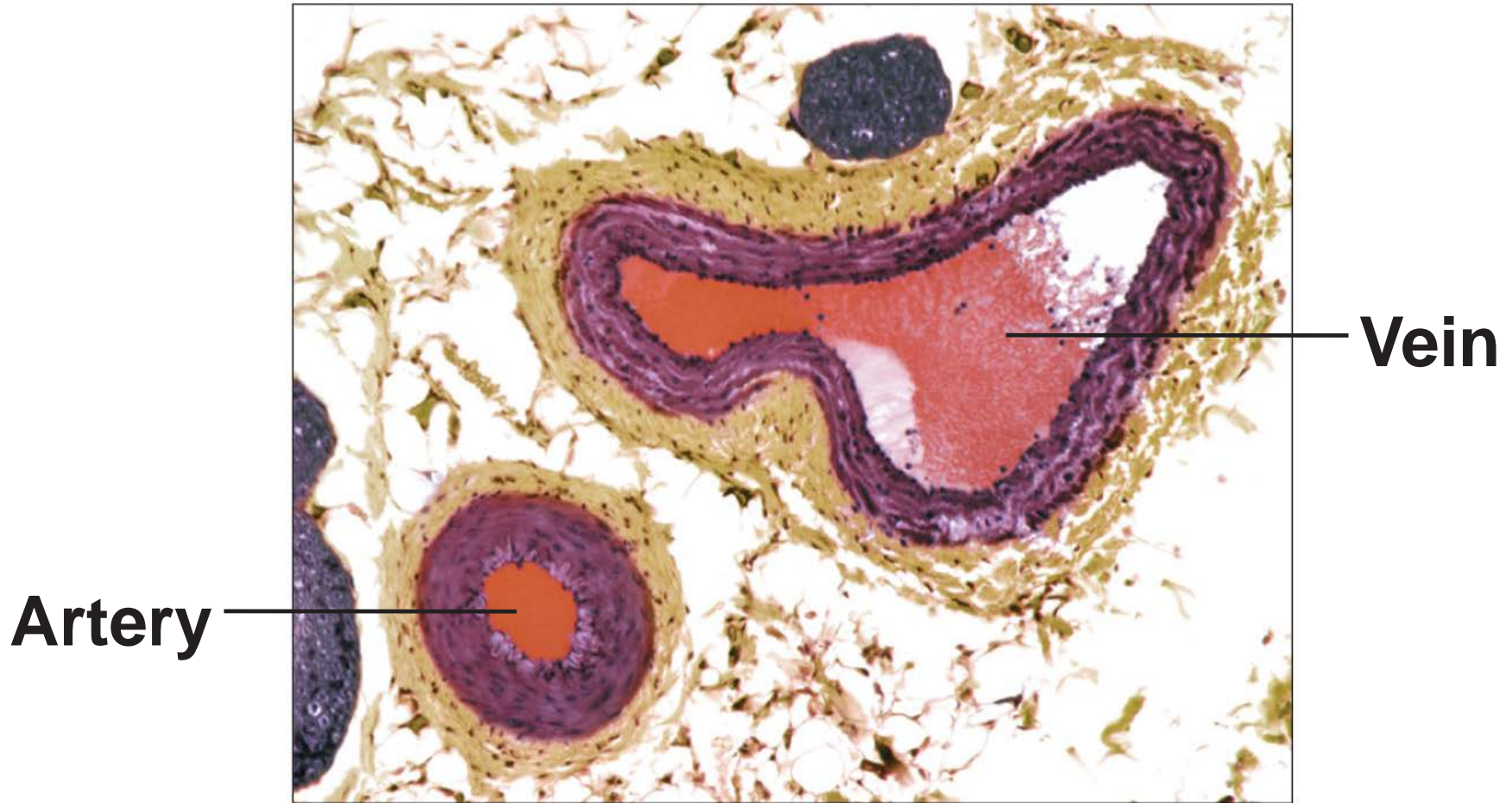


Figure 20.1b

# Tissue Section Showing Structure of Arteries, Veins, and Capillaries



(a)

# 3 Types of Arteries

Elastic arteries 彈性動脈

Conducting arteries

With diameters ranging from 2.5 cm – 1 cm

Muscular arteries 肌肉型動脈

Distributing arteries

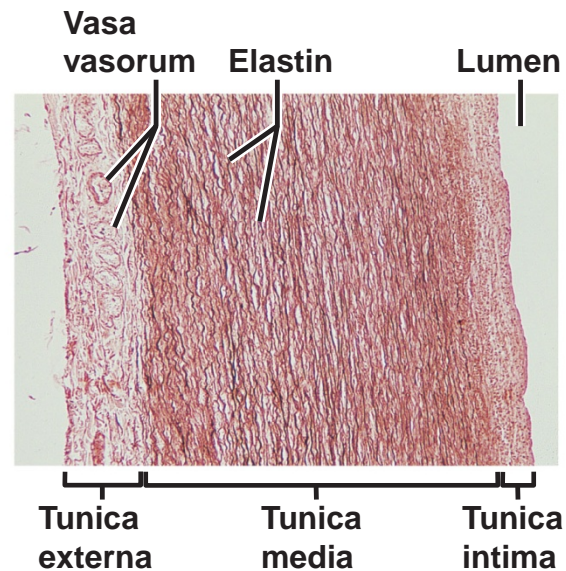
Diameters from about 1 cm to 0.3 mm

Arterioles (smallest arteries) 小動脈

Diameters ranging from about 0.3 mm to 10  $\mu\text{m}$

# Types of Arteries

- **Elastic arteries**—*the largest arteries*
  - Diameters range from 2.5 cm to 1 cm
  - Includes the **aorta** and its **major branches**
  - Sometimes called **conducting arteries**
  - High elastin content dampens surge of blood pressure



(a) Elastic artery (aorta, 12x)



# Types of Arteries

- **Muscular (distributing) arteries**
  - *Lie distal to elastic arteries*
  - Diameters range from 1 cm to 0.3 mm
  - *Includes most named arteries*
  - Tunica media is thick
  - Unique feature
    - Internal and external elastic laminae

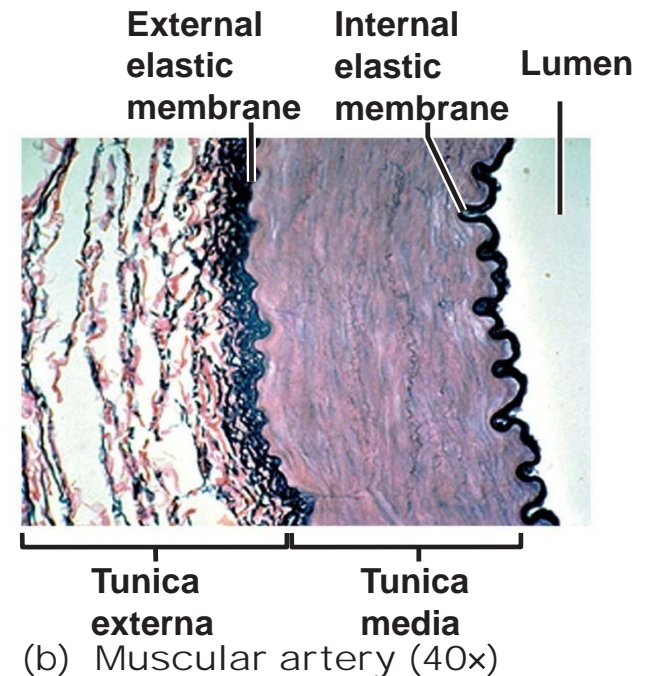
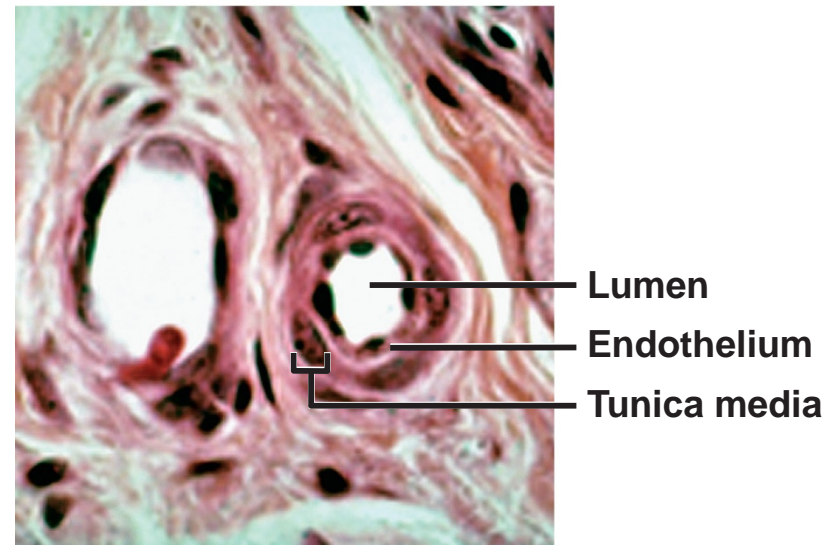


Figure 20.2b

# Types of Arteries

- **Arterioles**

- **Smallest arteries**
- Diameters range from 0.3 mm to 10  $\mu\text{m}$
- *Larger arterioles possess all three tunics*
- Diameter of arterioles controlled by
  - *Local factors in the tissues*
  - *Sympathetic nervous system*



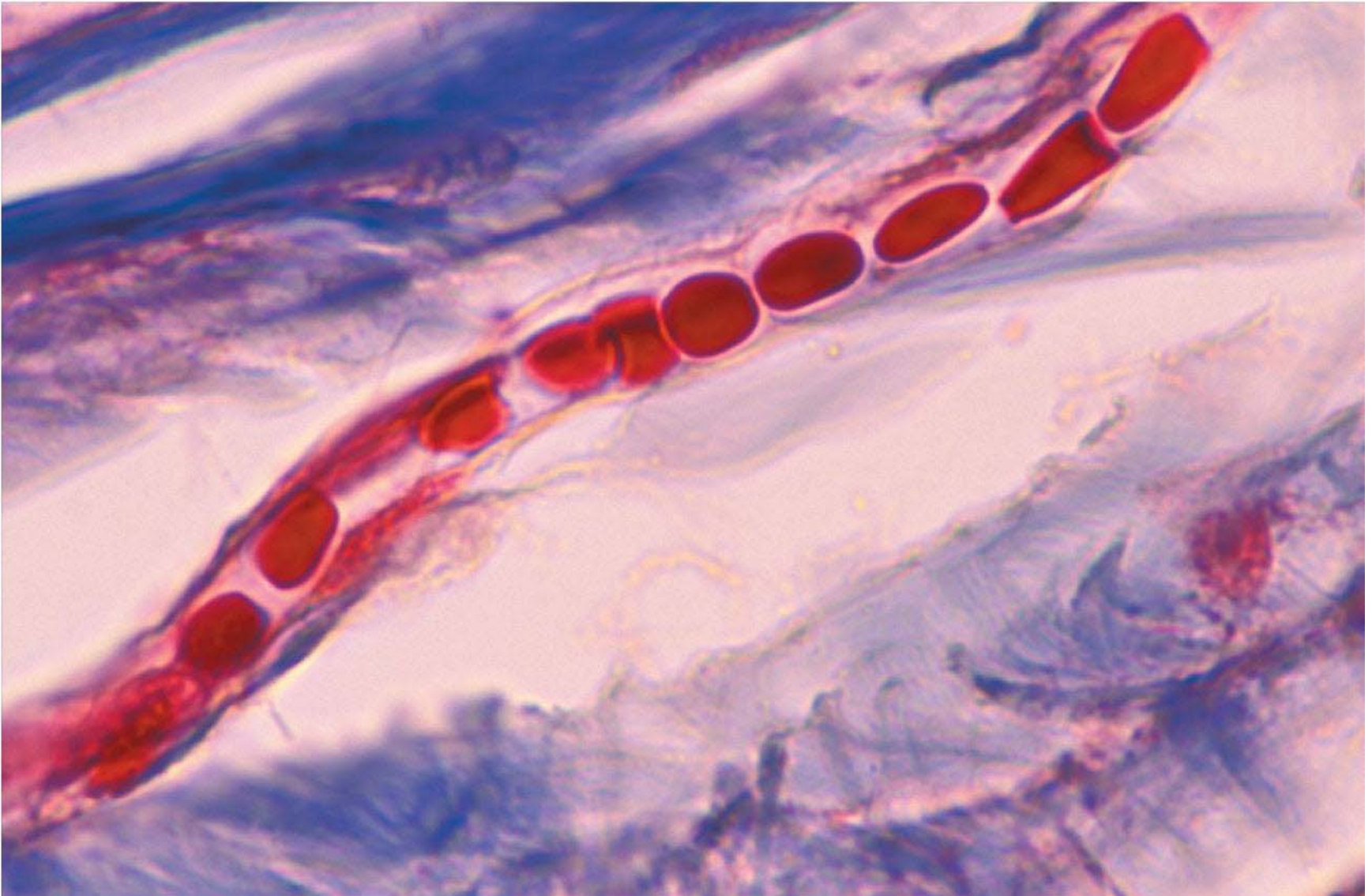
(c) Small arteriole (285x)



# Capillaries

- *Smallest blood vessels*
  - Diameter from 8–10  $\mu\text{m}$ 
    - Red blood cells pass through single file
- *Site-specific functions of capillaries*
  - Lungs—oxygen enters blood, carbon dioxide leaves
  - Small intestines—receive digested nutrients
  - Endocrine glands—pick up hormones
  - Kidneys—remove of nitrogenous wastes

# Red Blood Cells (RBCs) in a Capillary



**Figure 20.3**

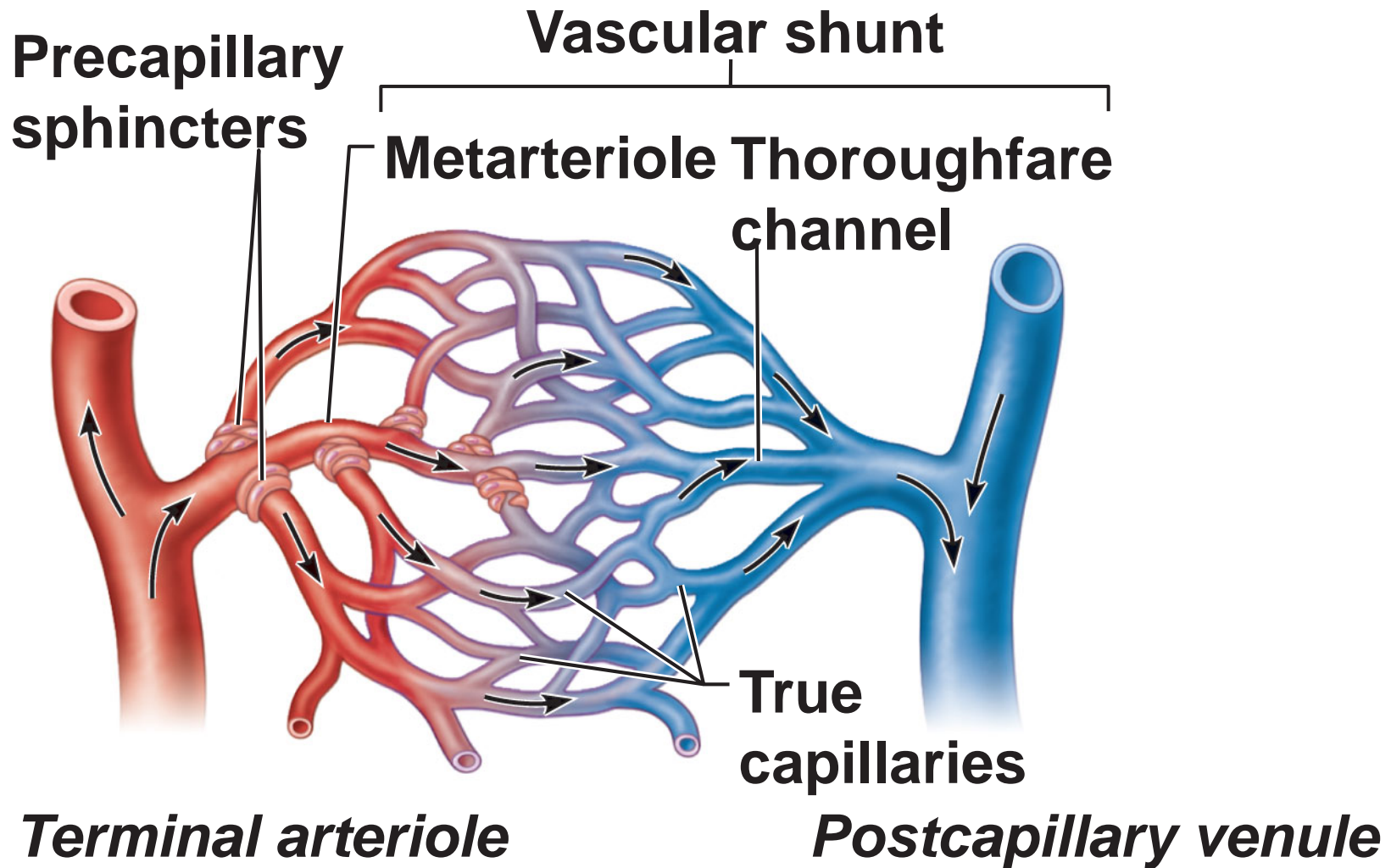
# Capillary Beds

- Network of capillaries running through tissues
- **Precapillary sphincters**
  - *Regulate the flow of blood to tissues*
- Tendons and ligaments—poorly vascularized
- Epithelia and cartilage—avascular
  - Receive nutrients from nearby CT

PLAY

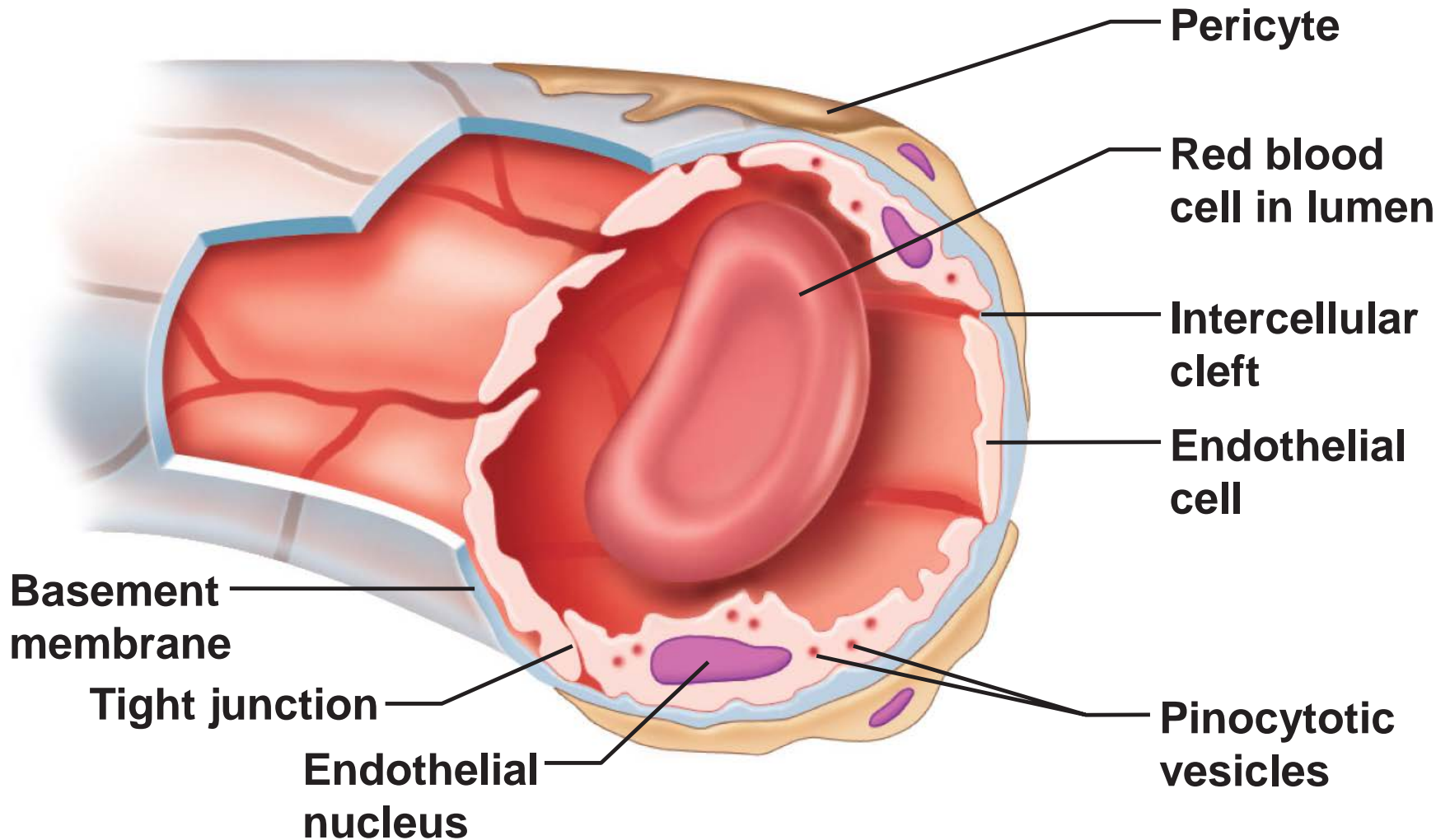
Anatomy Review: Blood Vessel Structure and Function

# Capillary Beds 微血管床



(a) Sphincters open—**blood flows through true capillaries.**

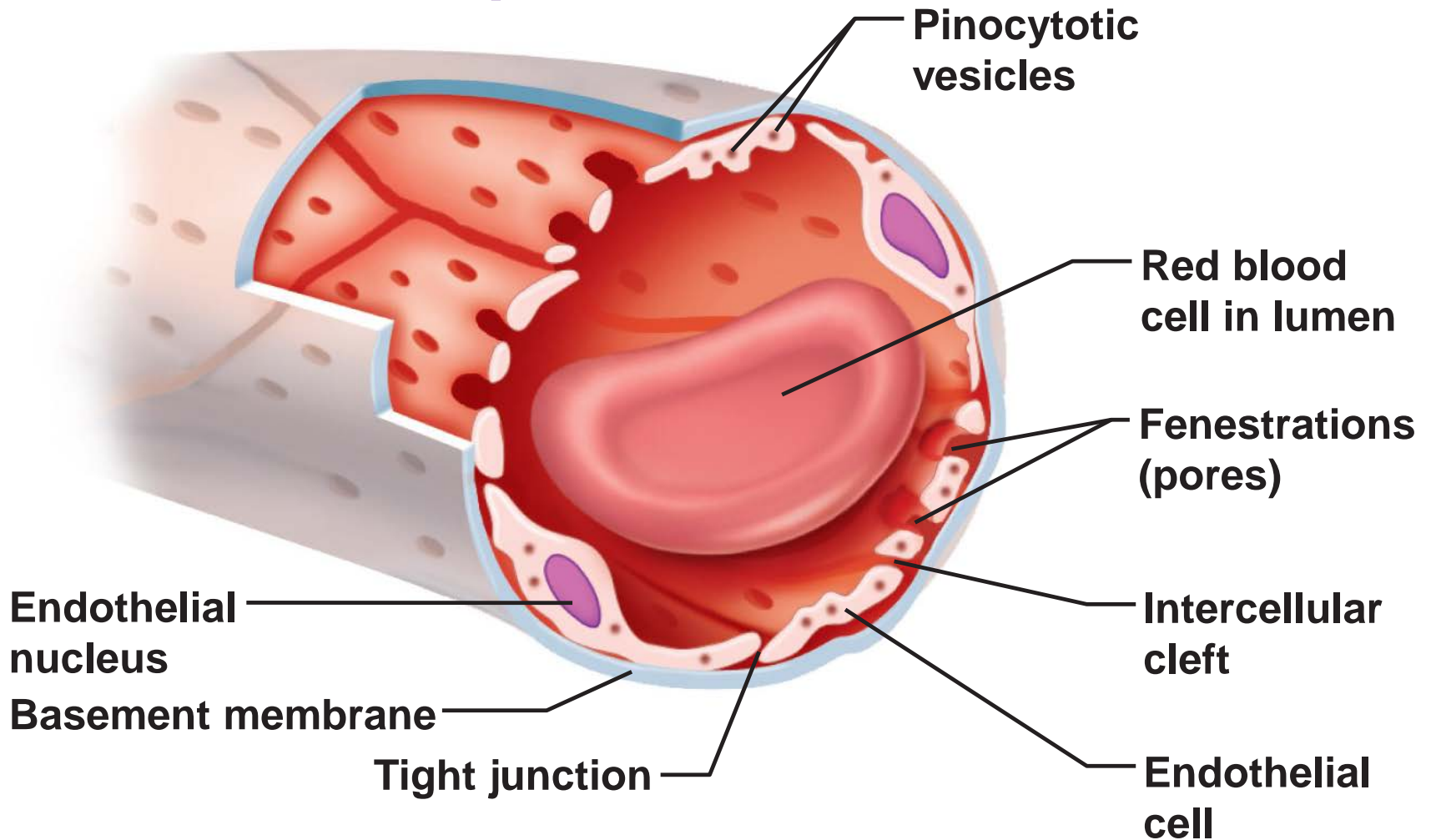
# Structure of Capillaries—Cross Section



(a) Continuous capillary. **Least permeable and most common (e.g., skin, muscle).**



# Structure of Capillaries—Cross Section



(b) Fenestrated capillary. **Large fenestrations (pores) increase permeability. Occurs in special locations (e.g., kidney, small intestine).**

# Mechanisms to Counteract Low Venous Pressure

- **Valves** *in some veins*
  - Particularly in limbs
- **Skeletal muscle pump**
  - Muscles press against thin-walled veins

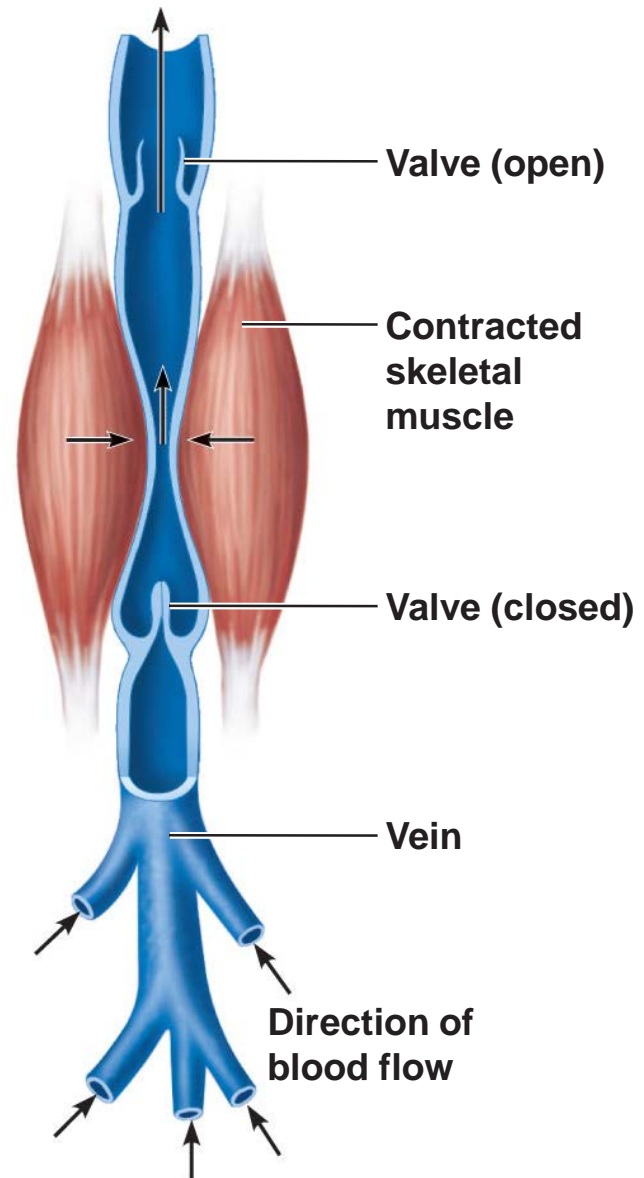


Figure 20.6

# Vasa Vasorum 血管壁的血管

- Tunica externa of large vessels have
  - Tiny arteries, capillaries, and veins
- **Vasa vasorum** — vessels of vessels
  - Nourish outer region of large vessels
- *Inner half of large vessels receive nutrients from luminal blood*



# Pulmonary Circulation

- Pulmonary trunk leaves the right ventricle
  - Divides into right and left pulmonary arteries
- Superior and inferior pulmonary veins
  - Carry oxygenated blood into the left atrium

# Pulmonary Circulation

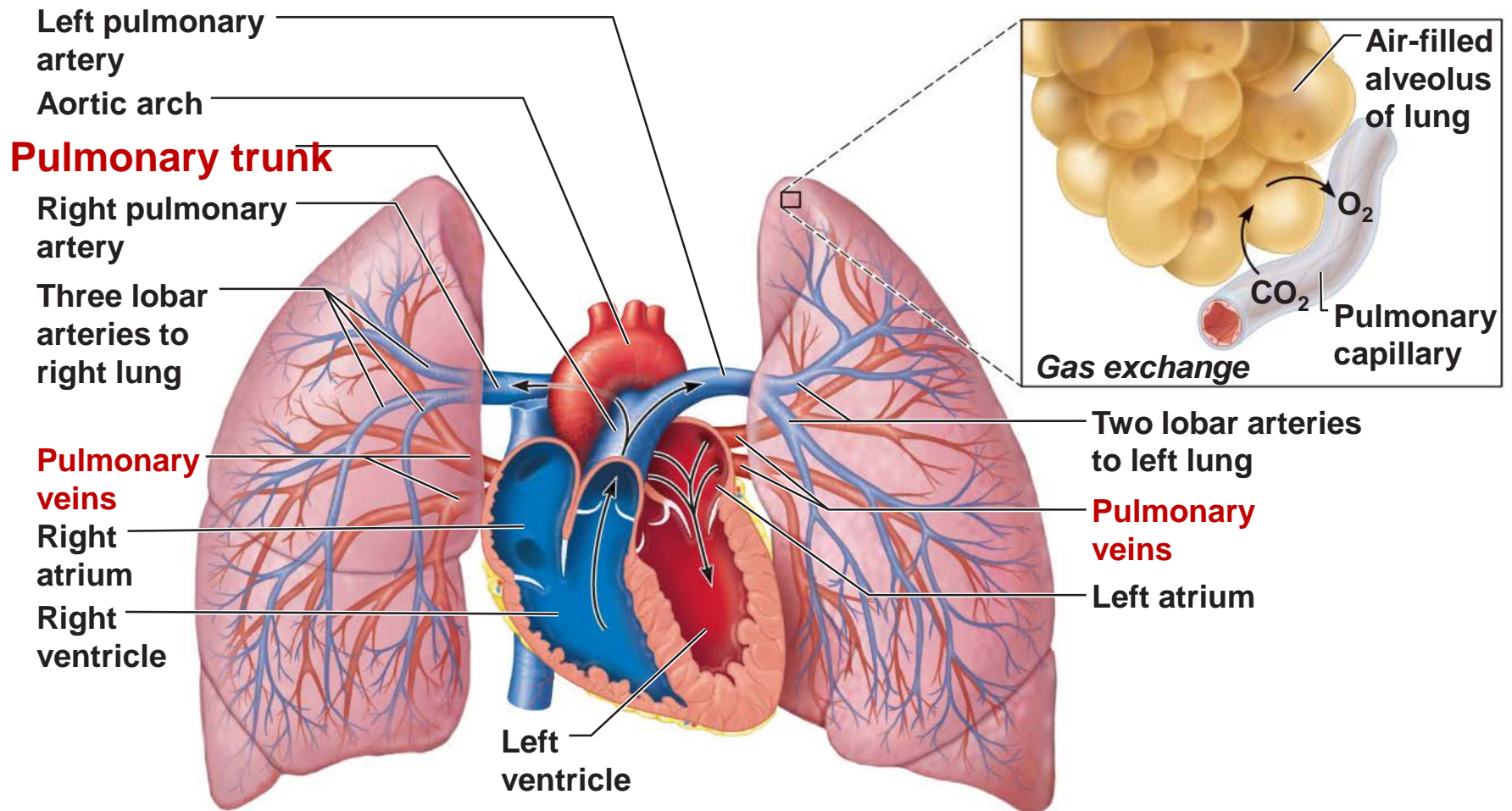


Figure 20.7

# Systemic Circulation

- Systemic arteries
  - Carry oxygenated blood away from the heart
  - **Aorta** 主動脈 — largest artery in the body

# Major Arteries in the Body 身體的主要動脈

## Arteries of the head and trunk

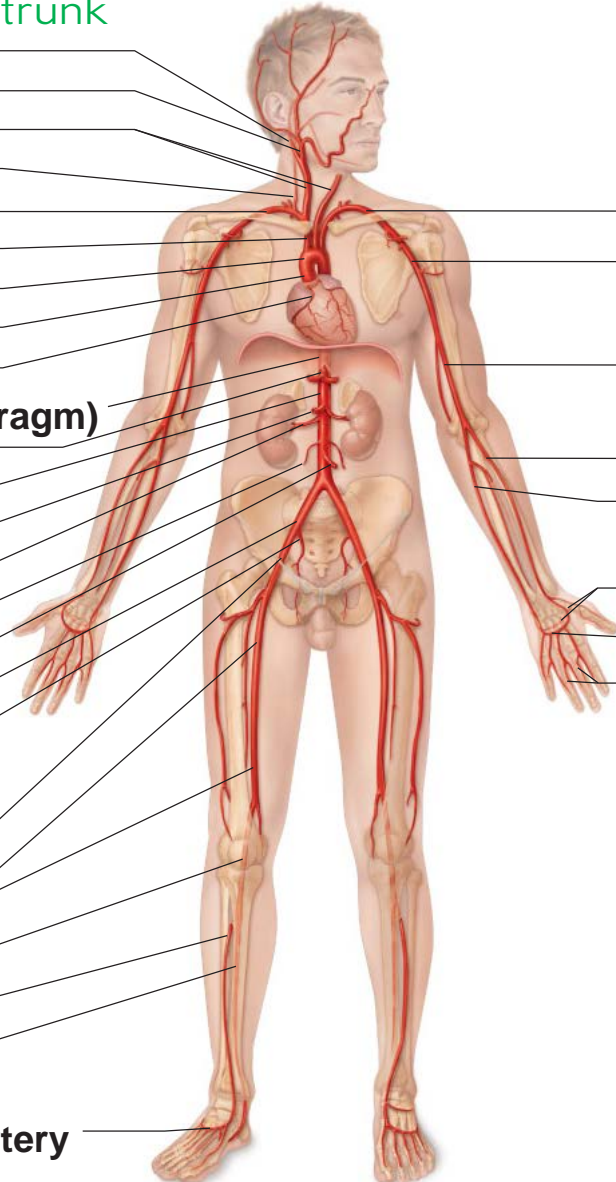
- Internal carotid artery
- External carotid artery
- Common carotid arteries
- Vertebral artery
- Subclavian artery
- Brachiocephalic trunk
- Aortic arch**
- Ascending aorta**
- Coronary artery
- Thoracic aorta (above diaphragm)**
- Celiac trunk
- Abdominal aorta**
- Superior mesenteric artery
- Renal artery
- Gonadal artery
- Inferior mesenteric artery
- Common iliac artery
- Internal iliac artery

## Arteries that supply the upper limb

- Subclavian artery
- Axillary artery
- Brachial artery
- Radial artery
- Ulnar artery
- Deep palmar arch
- Superficial palmar arch
- Digital arteries

## Arteries that supply the lower limb

- External iliac artery
- Femoral artery
- Popliteal artery
- Anterior tibial artery
- Posterior tibial artery
- Arcuate artery



(a) Anterior view

Figure 20.8a

# Aorta 分成4段

- **Ascending aorta (升主動脈):** 直接由右心室穿出來
- **Aortic arch (主動脈弓)**
- **Thoracic aorta (胸主動脈):** 走在胸腔後胸壁上。
- **Abdominal aorta (腹主動脈):** 走在腹腔後腹壁上
- **Thoracic aorta 和 abdominal aorta** 可以合稱為 **descending aorta (降主動脈)**，因為是由胸部走到腹部。

# The Aorta

- **Ascending aorta**—arises from the left ventricle
  - Branches—coronary arteries (冠狀動脈)
- **Aortic arch**—lies posterior to the manubrium
  - Branches
    - Brachiocephalic trunk(頭臂動脈)
    - Left common carotid artery (左頸總動脈)
    - Left subclavian artery (左鎖骨下動脈)

# The Aorta

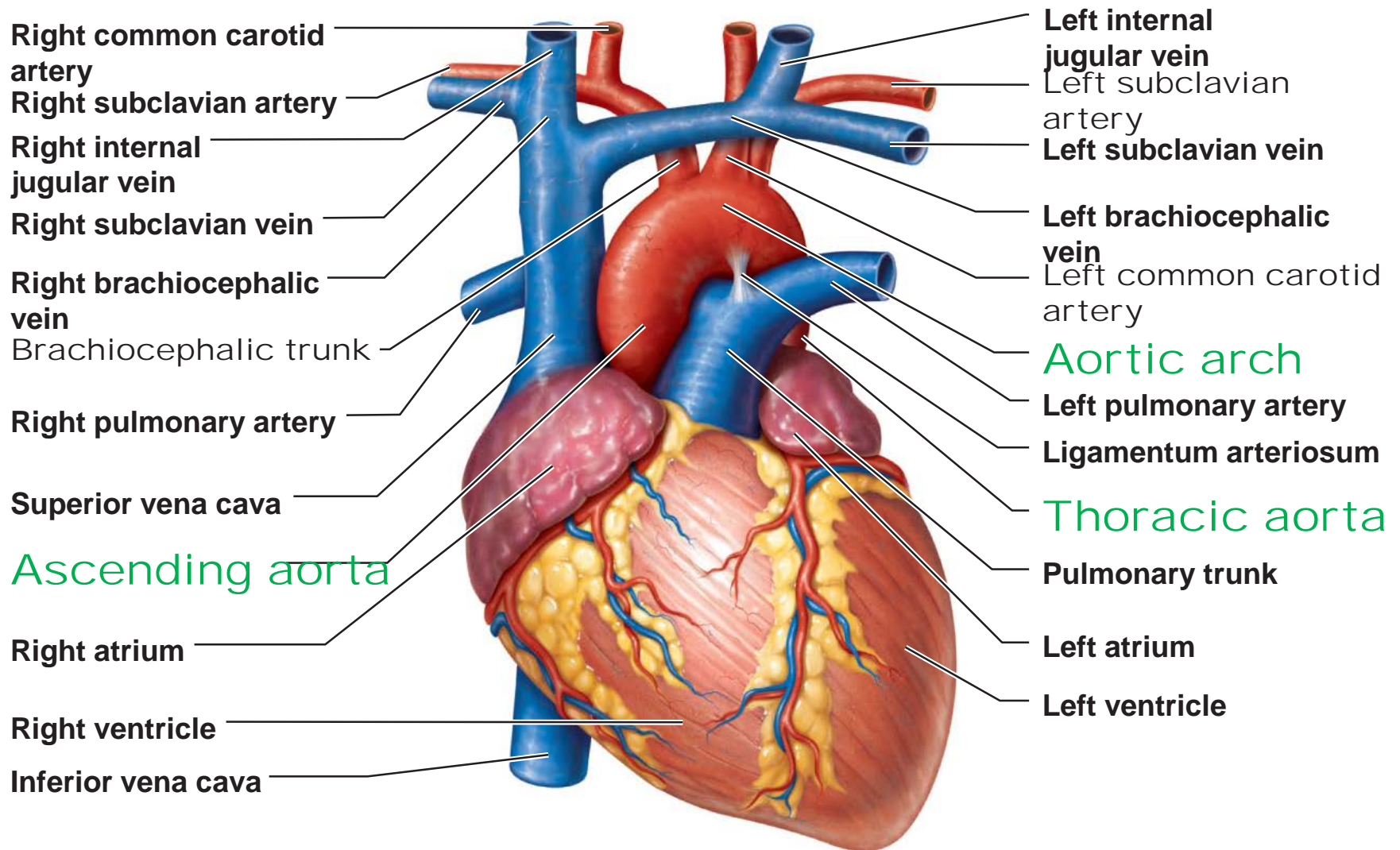


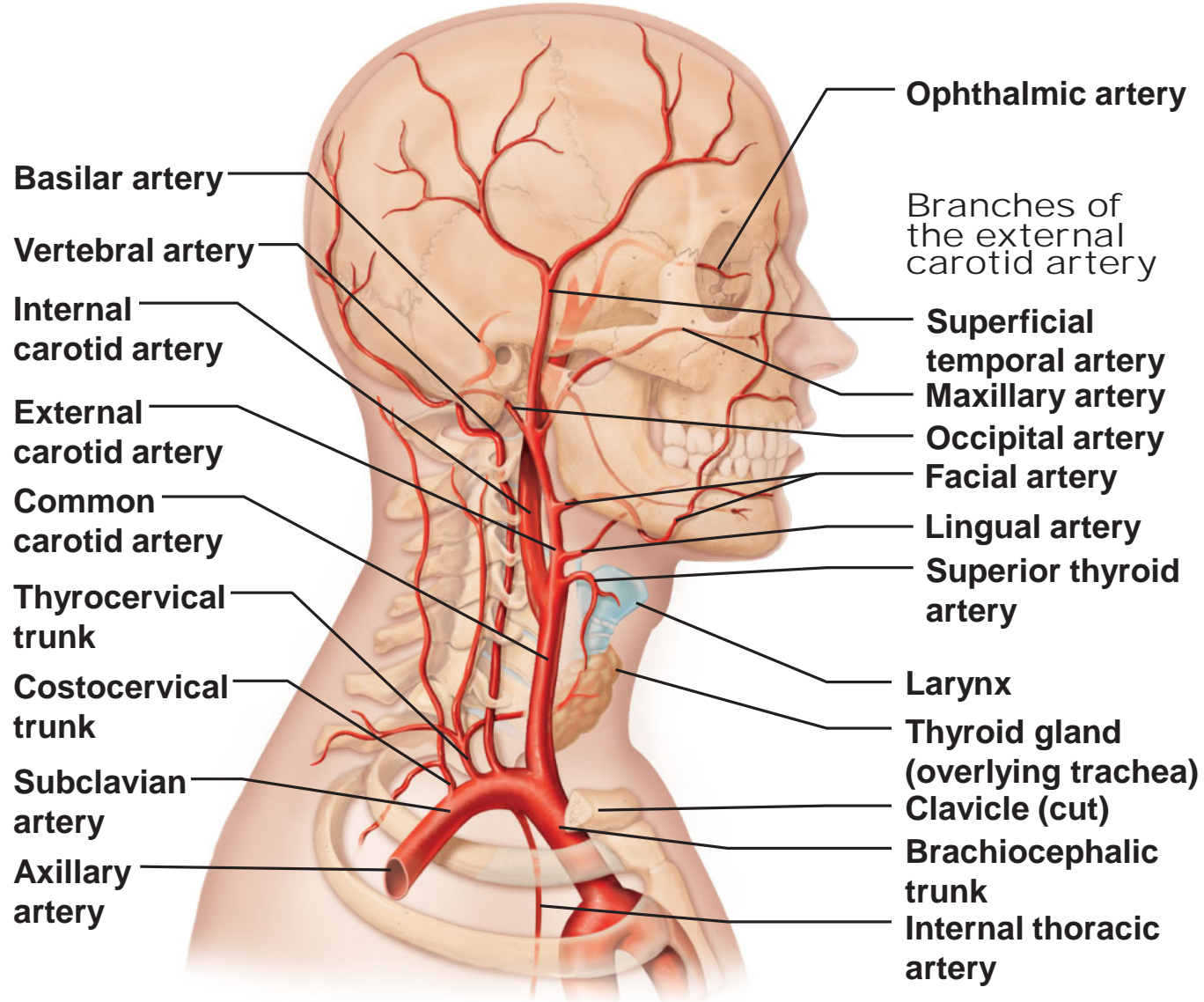
Figure 20.9

# The Aorta

- **Descending aorta**—continues from the aortic arch
  - **Thoracic aorta**—in the region of T<sub>5</sub>–T<sub>12</sub>
  - **Abdominal aorta**—ends at L<sub>4</sub>
- Divides into right and left **common iliac arteries**



# Arteries of the Head and Neck



(a) Arteries of the head and neck, right aspect

Figure 20.10a

# Common Carotid Arteries

- 外頸動脈 (External carotid artery) branches
  - Superior thyroid artery
  - Lingual artery
  - Facial artery
  - Occipital artery
  - Posterior auricular artery
  - Superficial temporal artery
  - Maxillary artery

# Common Carotid Arteries

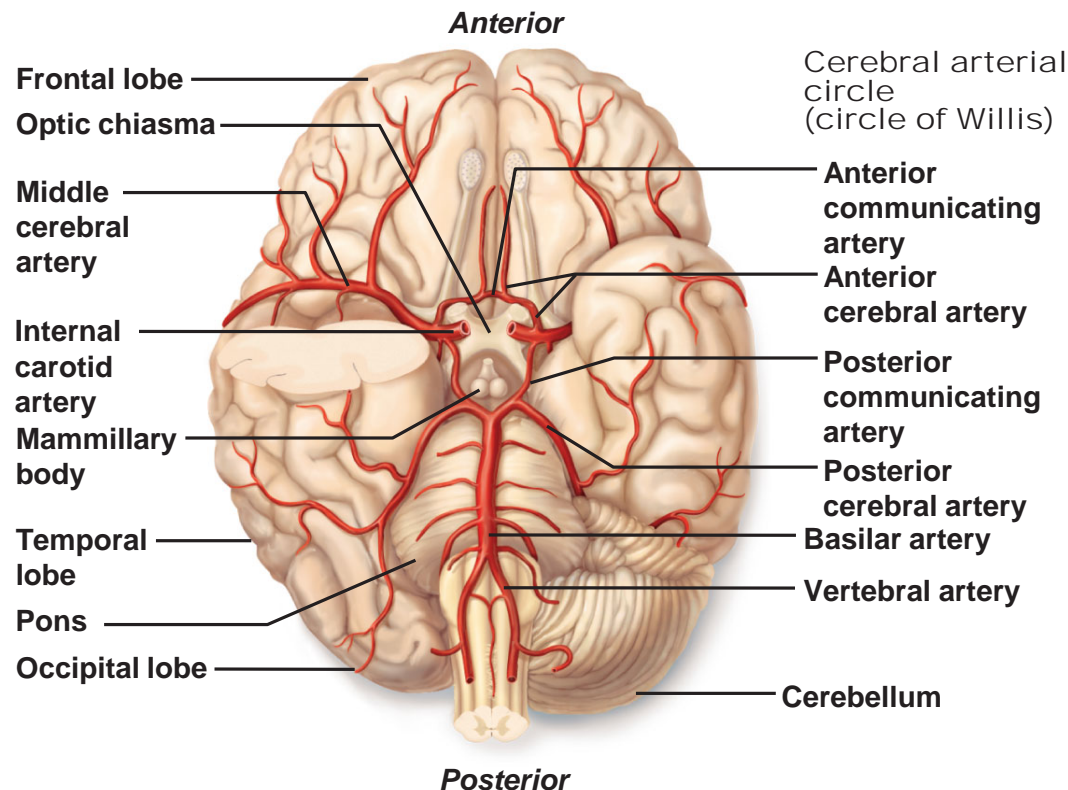
- 內頸動脈(Internal carotid artery) branches
  - Optithalamic artery
  - Anterior cerebral artery
  - Anterior communicating artery
    - Forms part of the cerebral arterial circle
  - Middle cerebral artery

# Vertebral Arteries

- Supply the posterior brain
- Join to form the basilar artery
  - Basilar artery divides into two posterior cerebral arteries
    - Posterior cerebral arteries connect to the posterior communicating arteries

# Cerebral Arterial Circle 大腦動脈環

- Two posterior communicating arteries join the anterior communicating artery



(c) Major arteries serving the brain (inferior view, right side of cerebellum and part of right temporal lobe removed)

# Arteries of the Upper Limb 上肢的動脈

- Subclavian artery enters the axilla as the **axillary artery** 腋動脈
- Axillary artery becomes the **brachial artery** 肱動脈 at the inferior border of teres major
- Brachial artery divides into **Radial artery** 橈動脈 and **ulnar artery** 尺動脈

# Arteries of the Upper Limb and Thorax

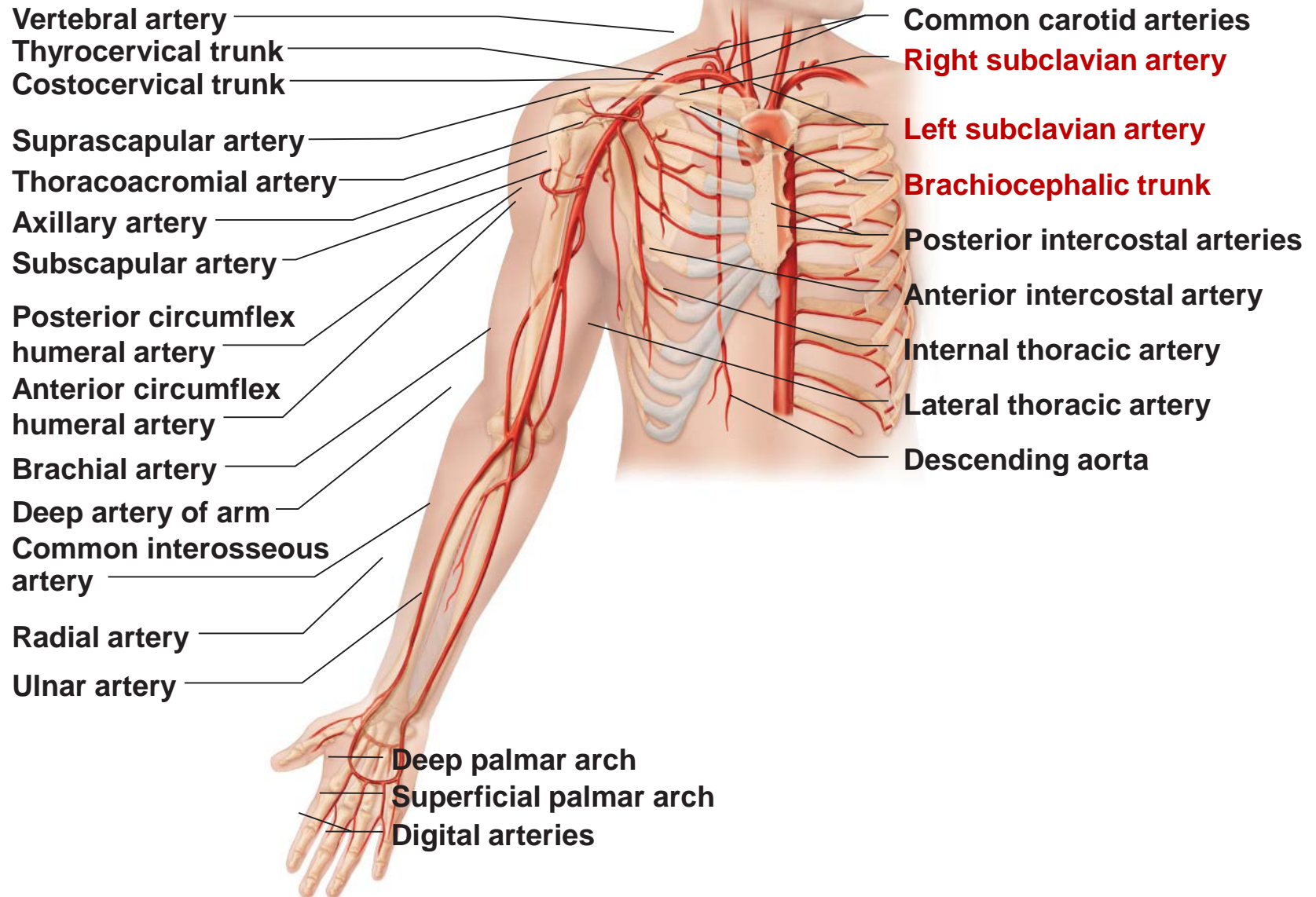


Figure 20.11

# Arteries of the Abdominal Aorta

- Inferior phrenic arteries
- Celiac trunk
- Superior mesenteric artery
- Suprarenal arteries
- Renal arteries
- Gonadal (testicular or ovarian) arteries
- Inferior mesenteric artery
- Common iliac arteries



# Arteries of the Abdominal Aorta

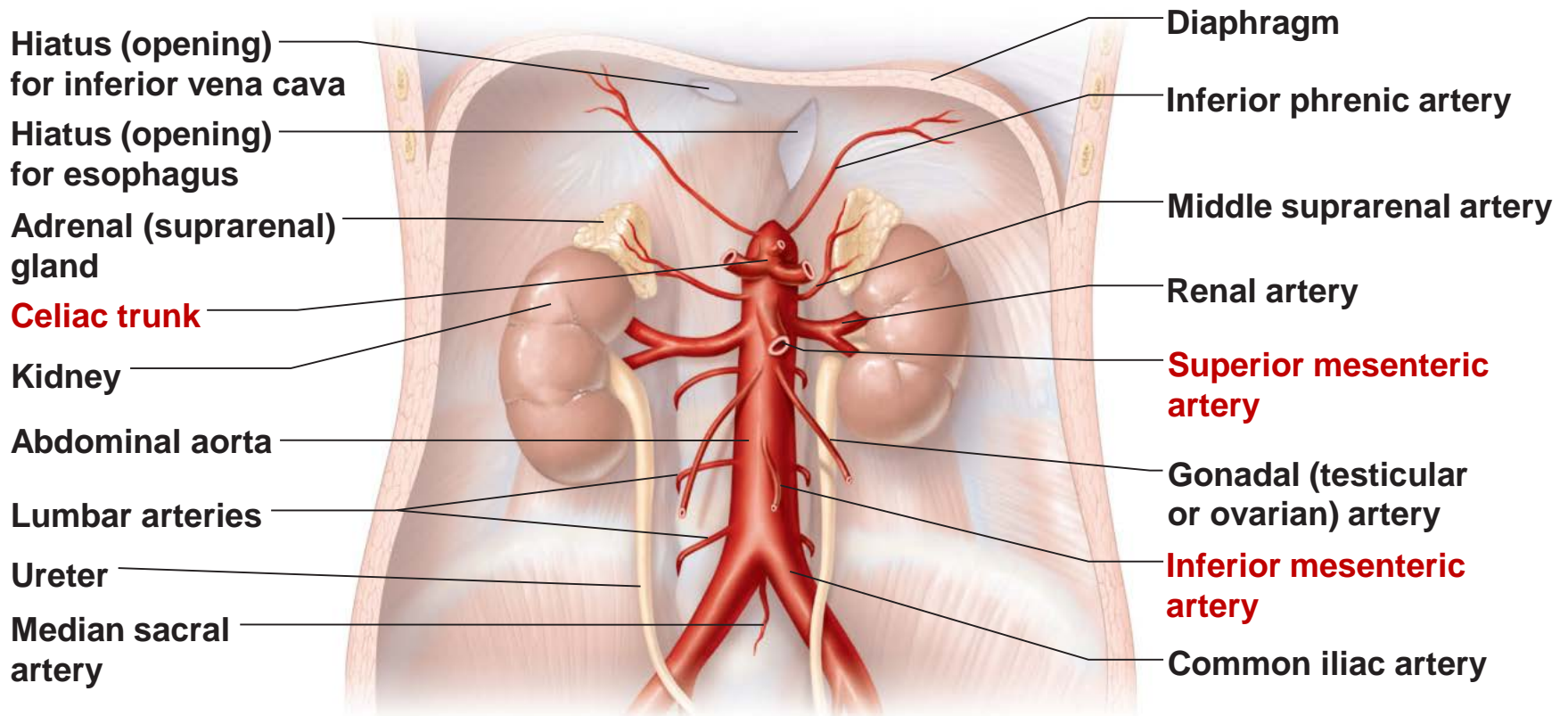
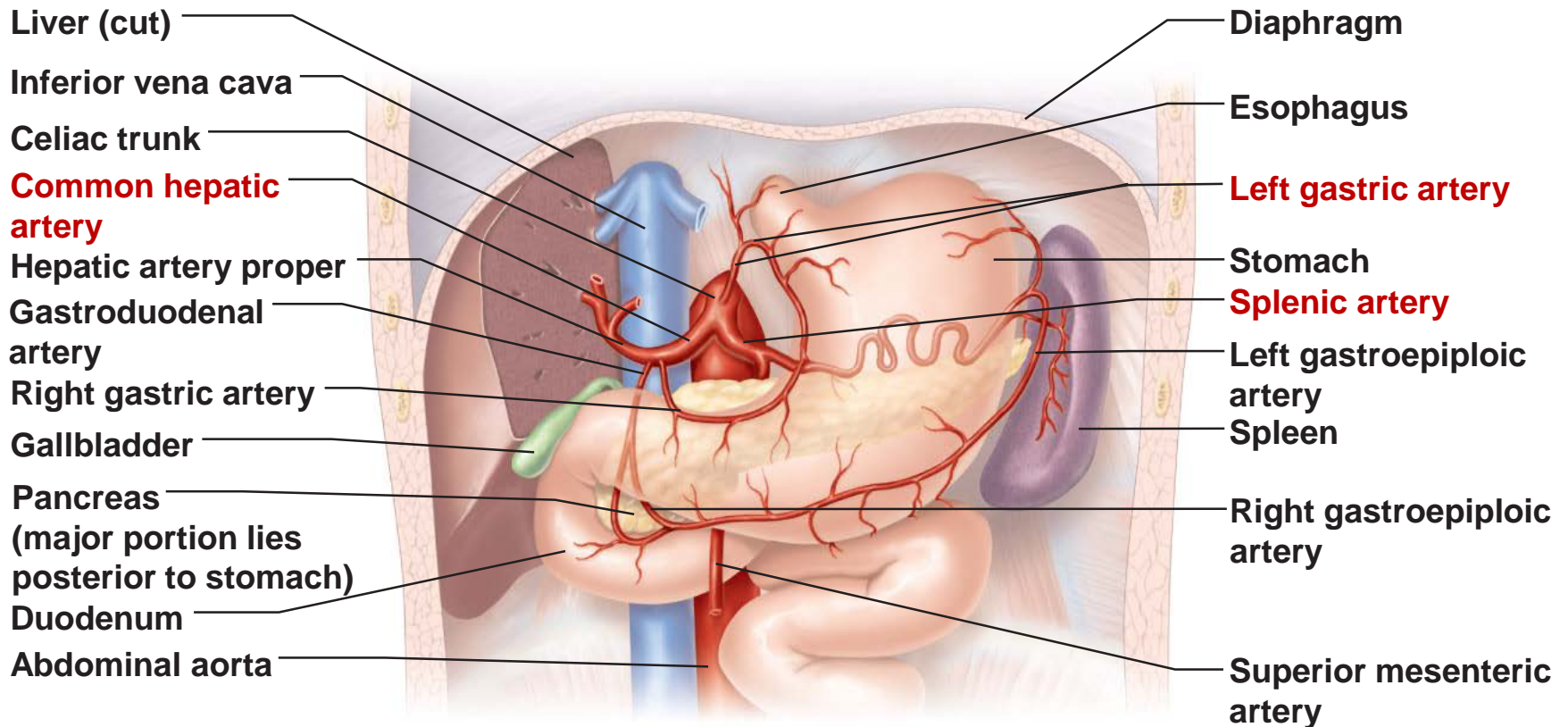


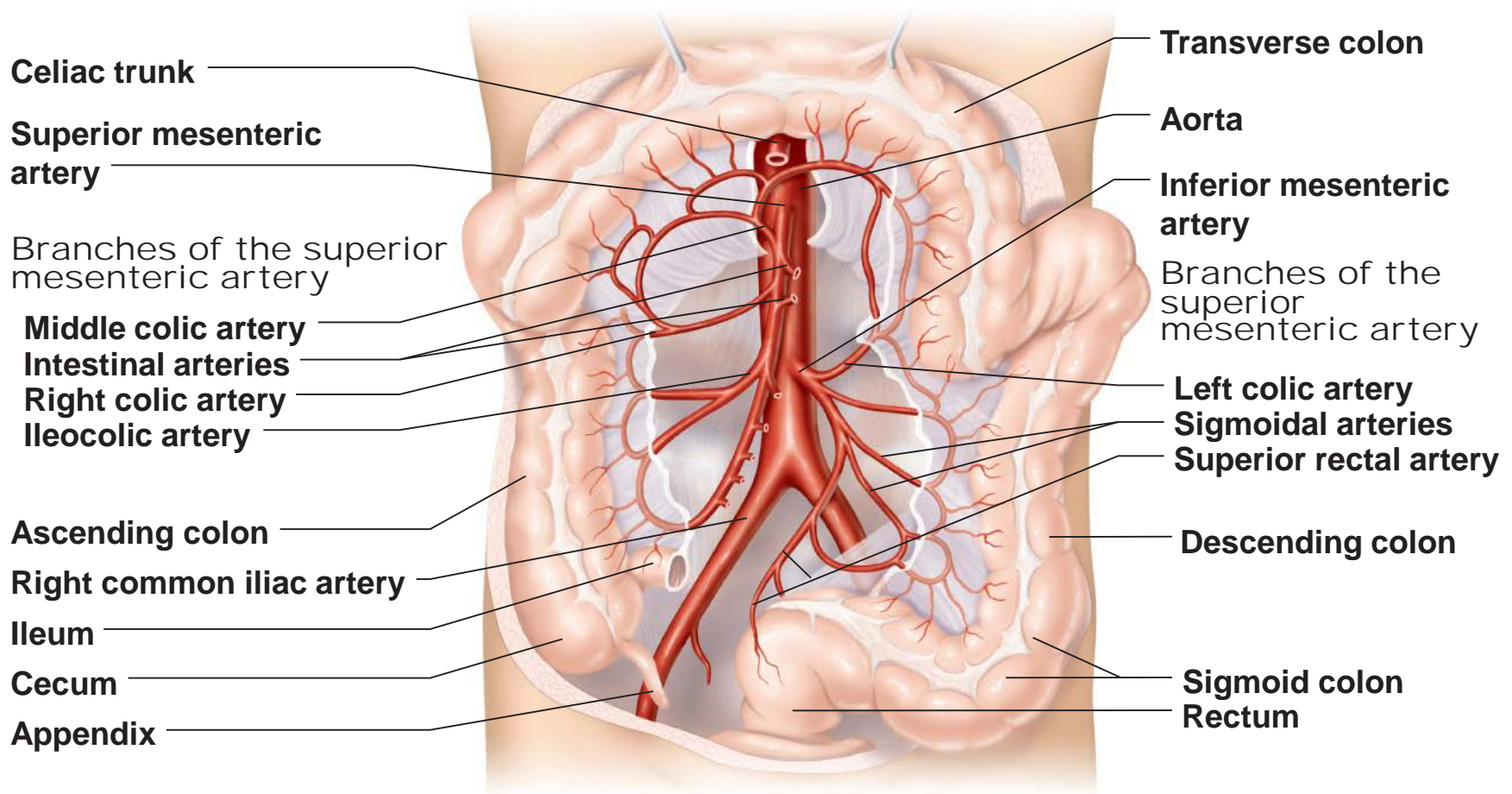
Figure 20.12

# The Celiac Trunk and Main Branches



(a) The celiac trunk and its major branches. **The left half of the liver has been removed.**

# Distribution of the Superior and Inferior Mesenteric Arteries



(b) Distribution of the superior and inferior mesenteric arteries. **The transverse colon has been pulled superiorly.**

# Arteries of the Pelvis and Lower Limbs

- Internal iliac arteries
- External iliac artery
- Femoral artery
- Popliteal artery
- Anterior tibial artery
- Posterior tibial artery

# Internal Iliac Artery

**Aorta**

末端

**Common iliac artery**

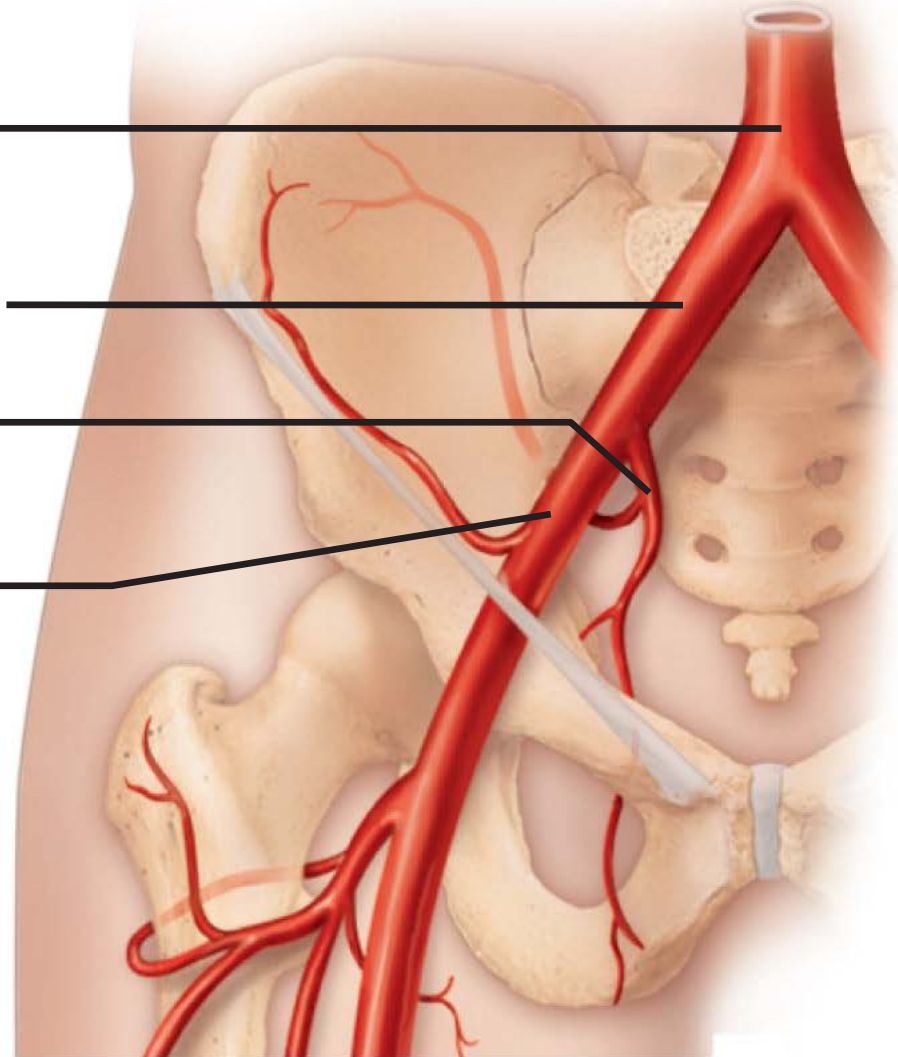
總腸骨動脈

**Internal iliac artery**

內腸骨動脈

**External iliac artery**

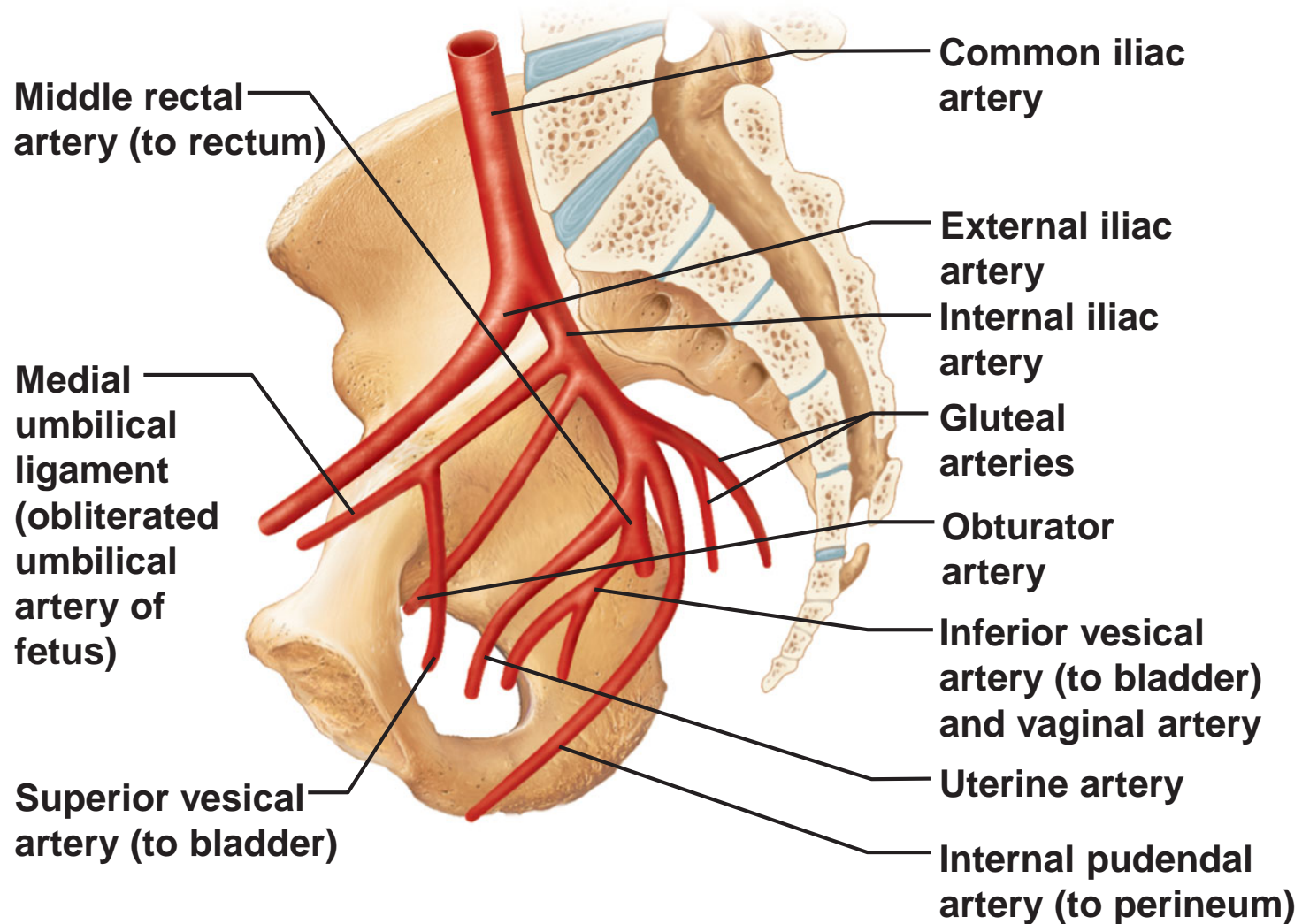
外腸骨動脈



(a) Anterior view

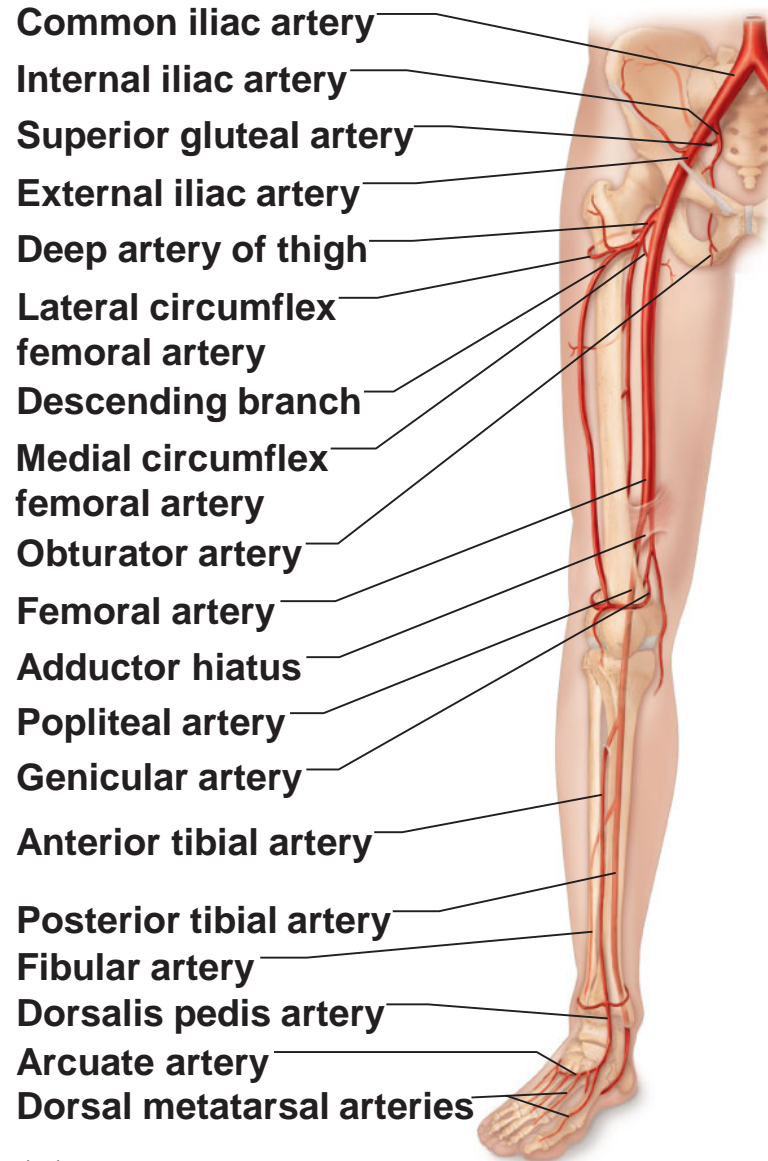


# Internal Iliac Artery



(b) Medial view of the right pelvis of a female

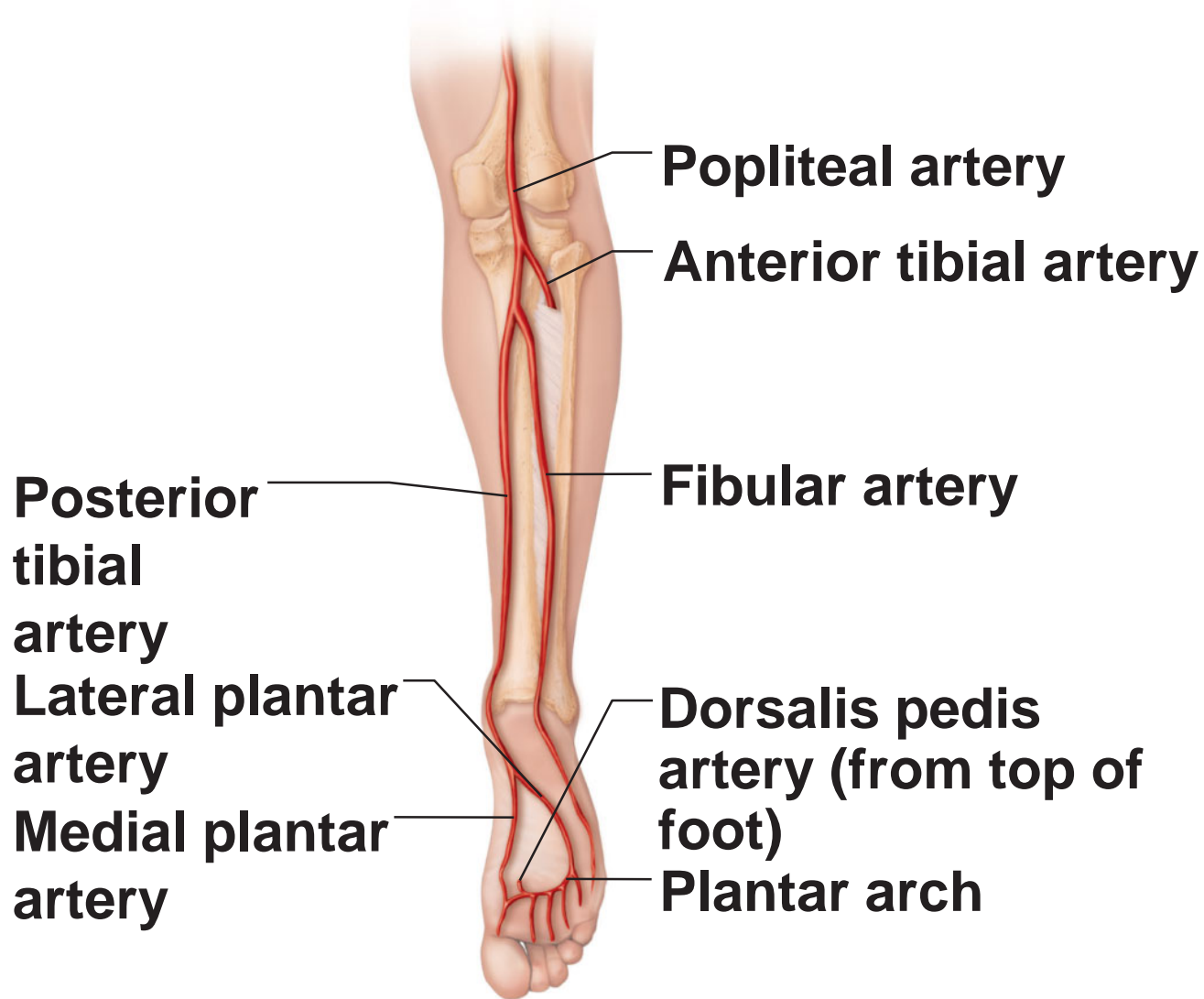
# Arteries of the Pelvis and Lower Limbs



(a) Anterior view



# Arteries of the Pelvis and Lower Limbs



(b) Posterior view of leg

# Venae Cavae and Tributaries

- **Superior vena cava** 上腔靜脈
  - Returns blood from body regions superior to the diaphragm
- **Inferior vena cava** 下腔靜脈
  - Returns blood from body regions inferior to the diaphragm
- Superior and inferior vena cava
  - Join the right atrium

# Major Veins of the Systemic Circulation

## Veins of the head and trunk

Dural venous sinuses

External jugular vein

Vertebral vein

Internal jugular vein

Right and left

brachiocephalic veins

Superior vena cava

Great cardiac vein

Hepatic veins

Splenic vein

Hepatic portal vein

Renal vein

Superior mesenteric vein

Inferior mesenteric vein

Inferior vena cava

Common iliac vein

Internal iliac vein

## Veins that drain the upper limb

Subclavian vein

Axillary vein

Cephalic vein

Brachial vein

Basilic vein

Median cubital vein

Ulnar vein

Radial vein

Digital veins

## Veins that drain the lower limb

External iliac vein

Femoral vein

Great saphenous vein

Popliteal vein

Posterior tibial vein

Anterior tibial vein

Small saphenous vein

Dorsal venous arch

Dorsal metatarsal veins

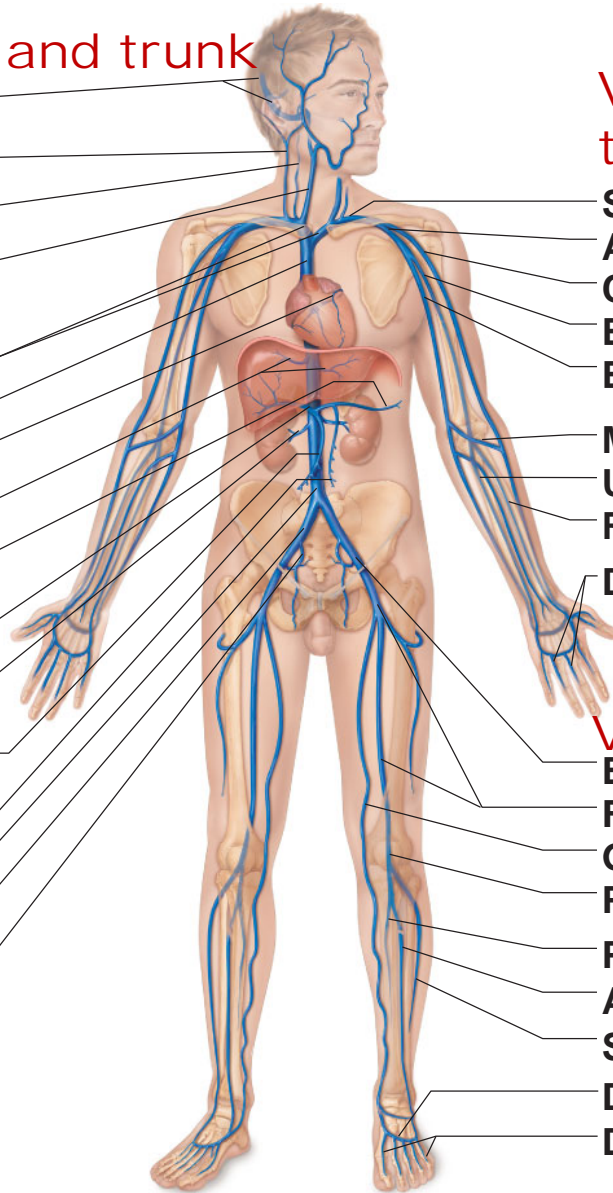
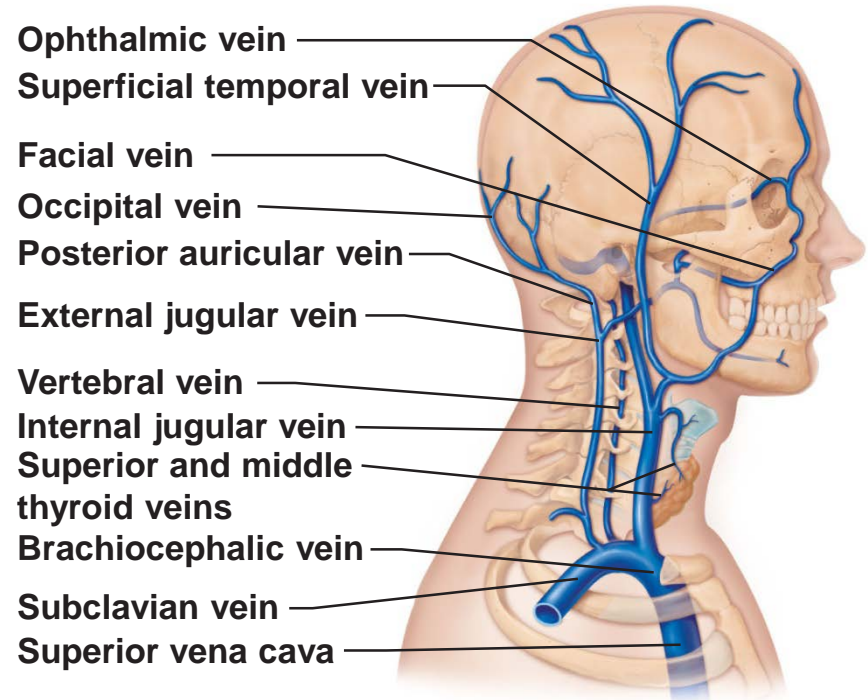


Figure 20.16

# Veins of the Head and Neck

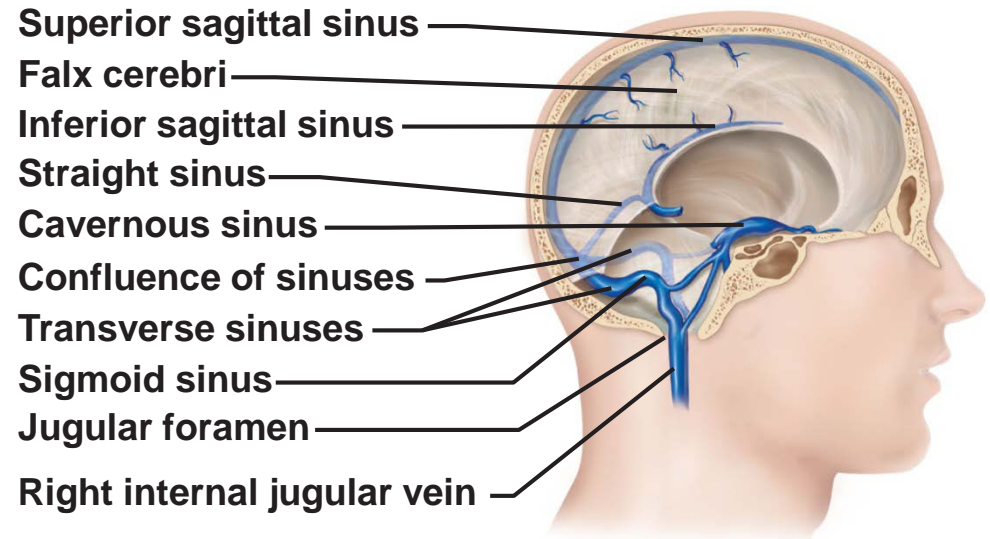
- Venous drainage
  - Internal jugular veins
  - External jugular veins
  - Vertebral veins



(a) Veins of the head and neck, right superficial aspect

# Veins of the Head and Neck

- **Dural sinuses** 硬腦膜竇
  - Superior and inferior sagittal sinuses
  - Straight sinus
  - Transverse sinuses
  - Sigmoid sinus



(b) Dural venous sinuses of the brain

# Veins of the Upper Limbs

- **Deep veins** 深靜脈
  - Follow the paths of companion arteries
  - Have the same names as the companion arteries
- **Superficial veins** 淺靜脈
  - Visible beneath the skin
    - Cephalic vein
    - Basilic vein
    - Median cubital vein
    - Median vein of the forearm

# Veins of the Thorax and Right Upper Limb

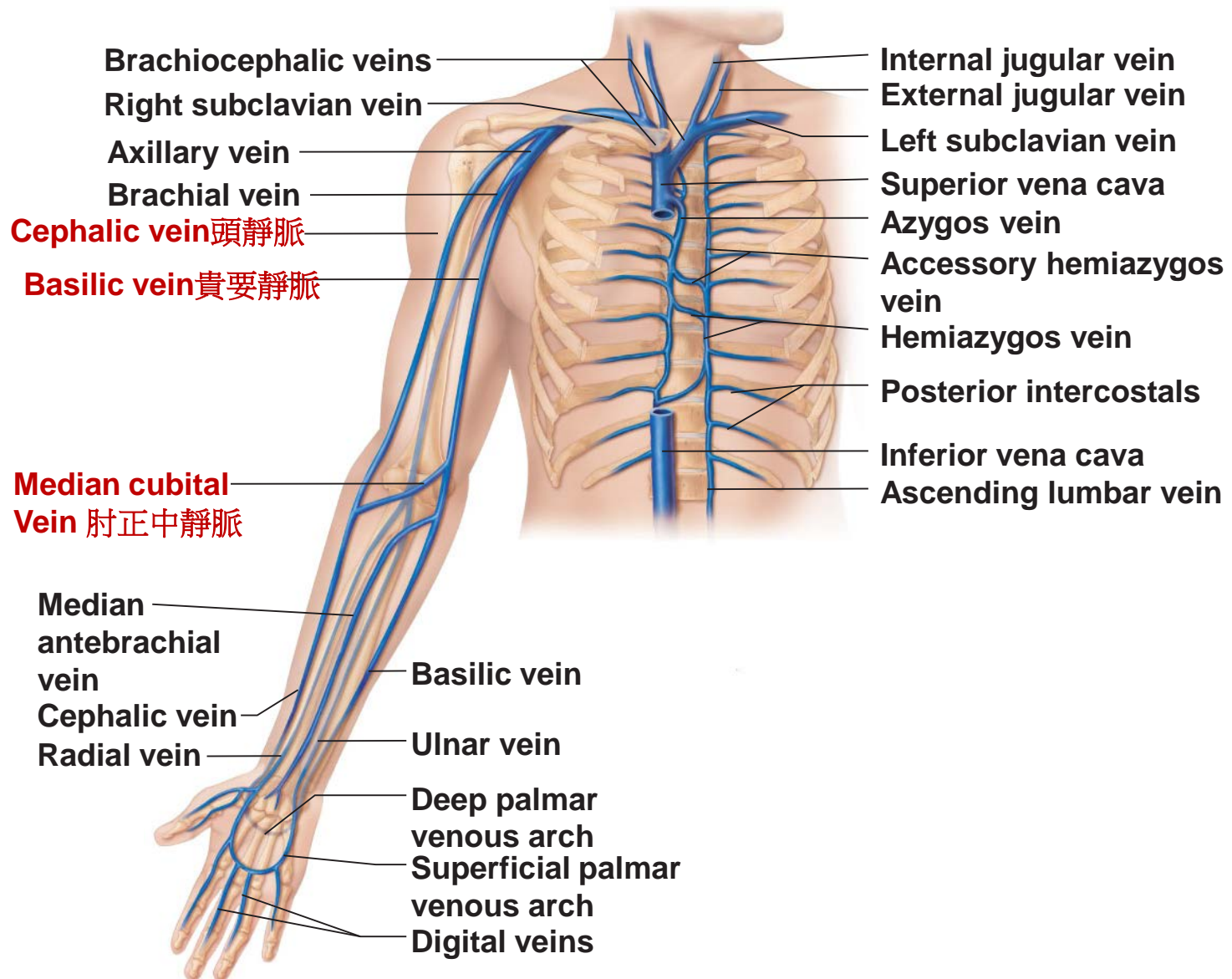
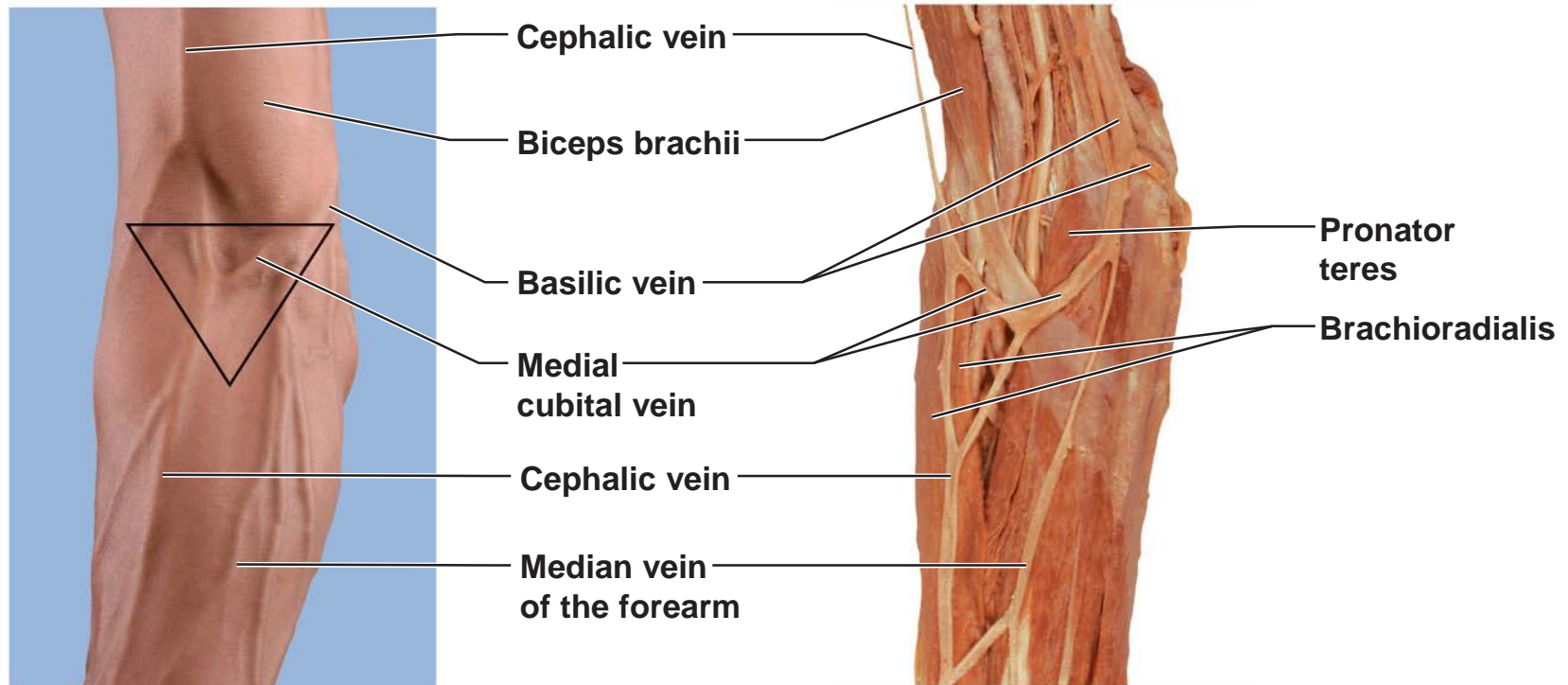


Figure 20.18



# Superficial Veins of the Right Upper Limb

- Form anastomoses frequently
- **Median cubital vein** is used to obtain blood or administer IV fluids



(a) Surface view, right upper limb

(b) Cadaver dissection of same view

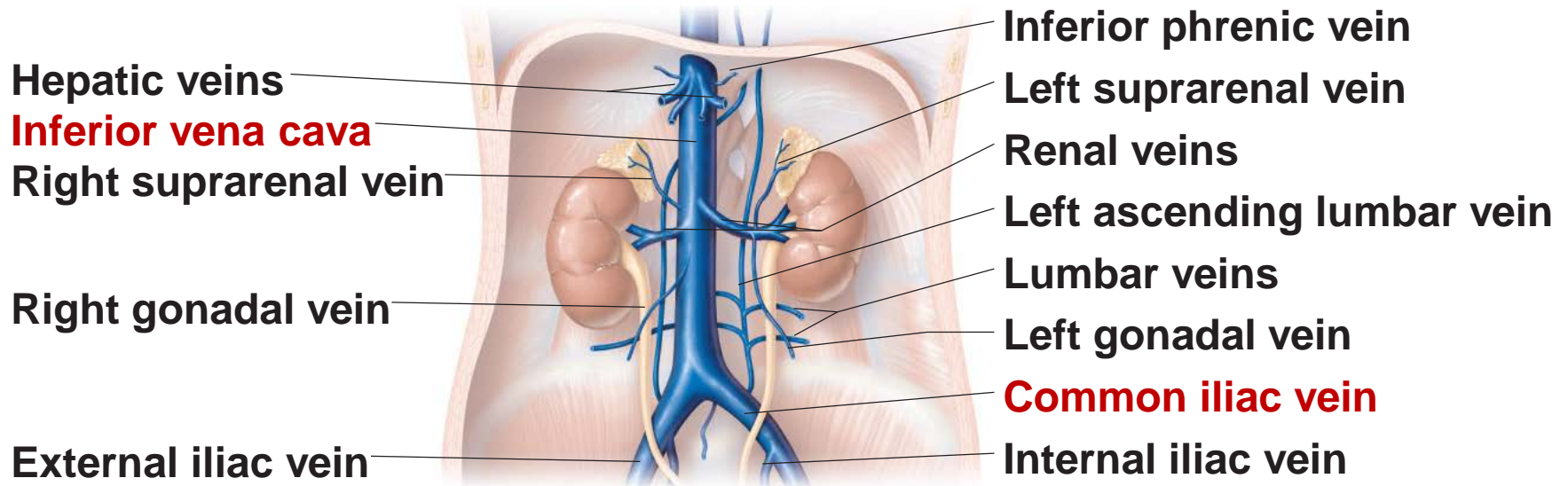
# Veins of the Thorax

- Azygos vein 奇靜脈
- Hemiazygos vein 半奇靜脈
- Accessory hemiazygos vein 副半奇靜脈

# Veins of the Abdomen

- Lumbar veins
- Gonadal (testicular or ovarian) veins
- Renal veins
- Suprarenal veins
- Hepatic veins

# Tributaries of the Inferior Vena Cava

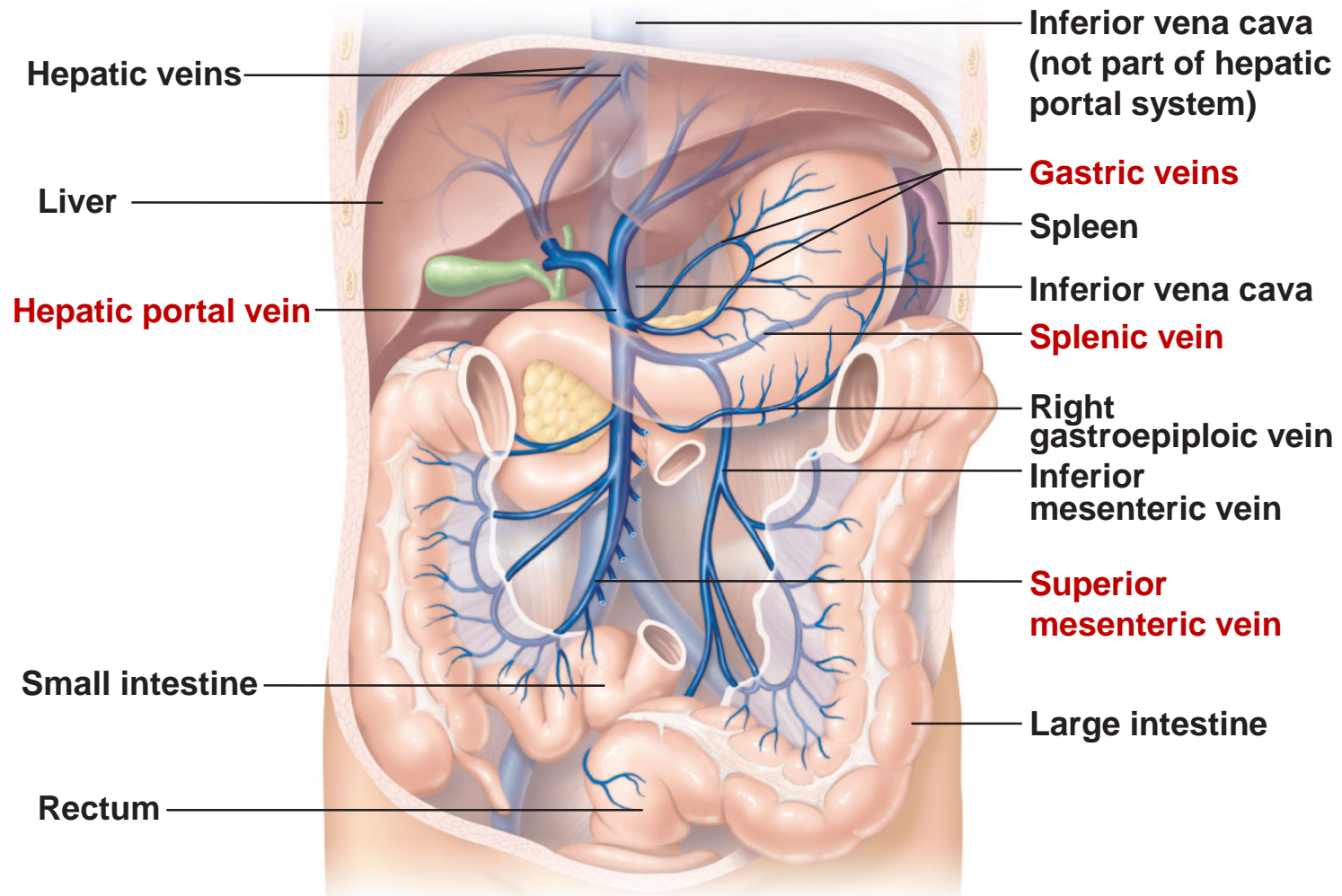


(a) Tributaries of the inferior vena cava; **venous drainage of the paired abdominal organs.**

# The Hepatic Portal System

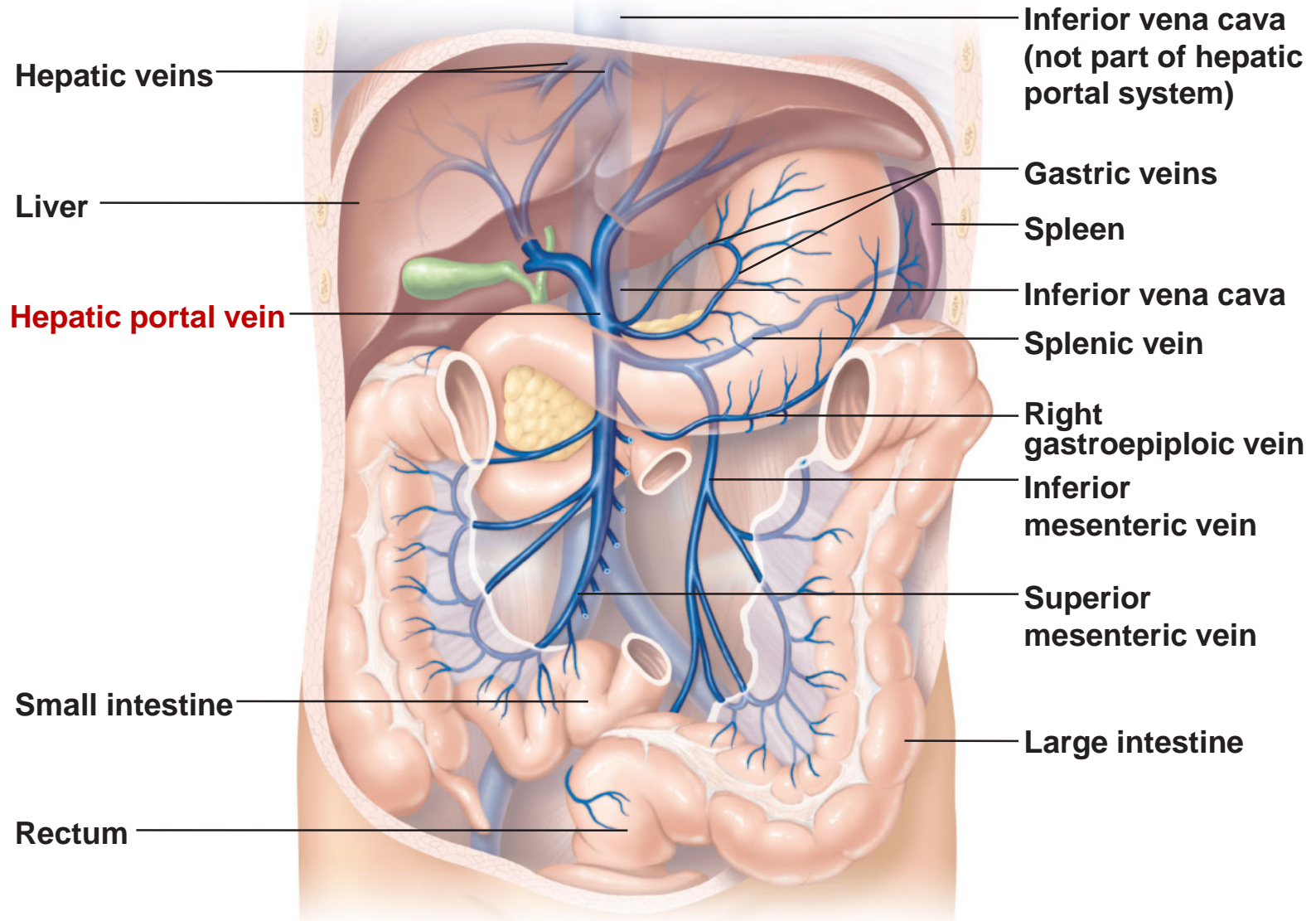
- *A specialized part of the vascular circuit*
- Picks up digested nutrients
- Delivers nutrients to the liver for processing

# The Basic Scheme of the Hepatic Portal System



(b) The veins of the hepatic portal system

# Veins of the Hepatic Portal System



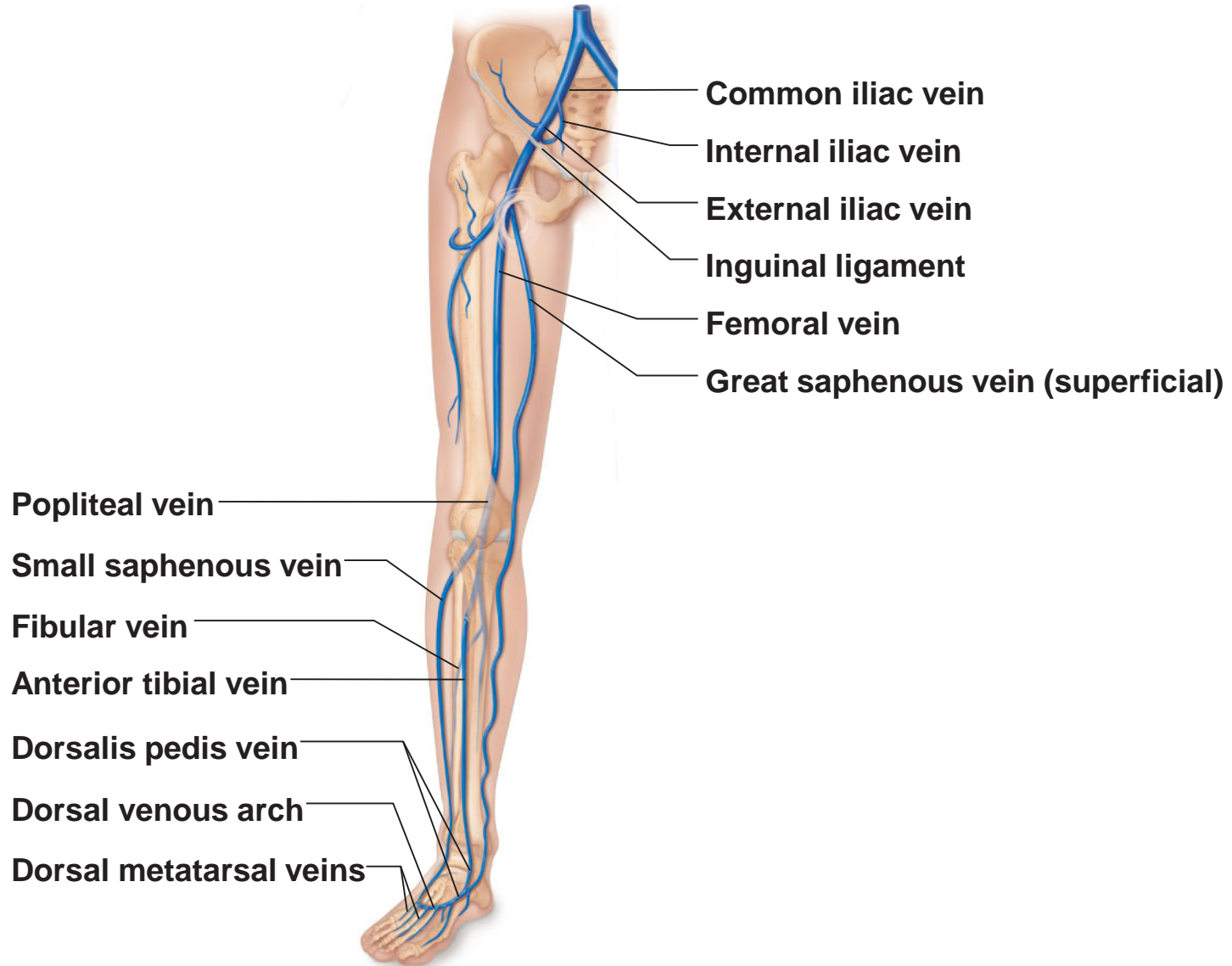
(b) The veins of the hepatic portal system



# Veins of the Pelvis and Lower Limbs

- **Deep veins**
  - Share the name of the accompanying artery
- **Superficial veins**
  - **Great saphenous vein** empties into the femoral vein
  - **Small saphenous vein** empties into the popliteal vein

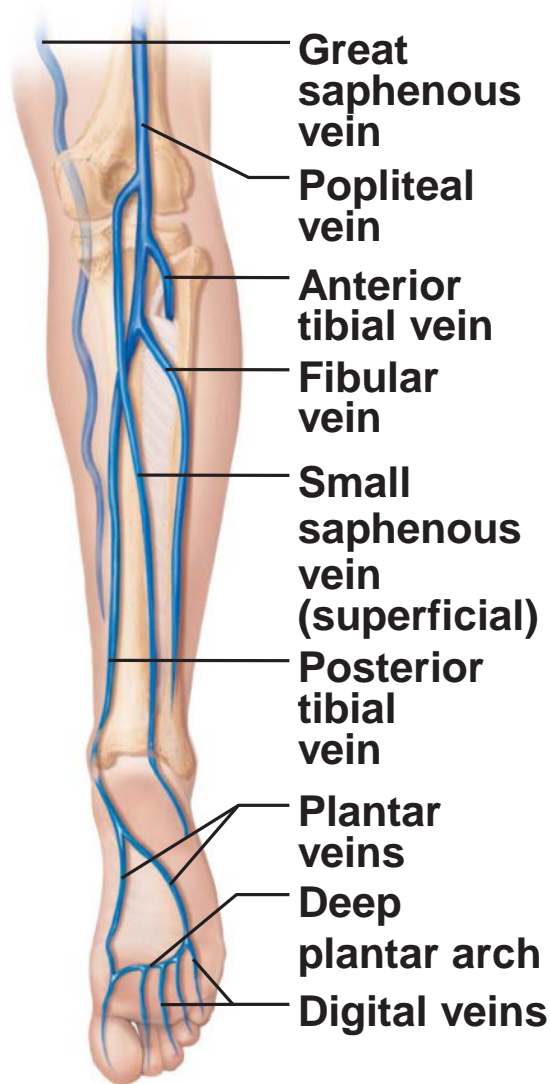
# Veins of the Right Lower Limb and Pelvis



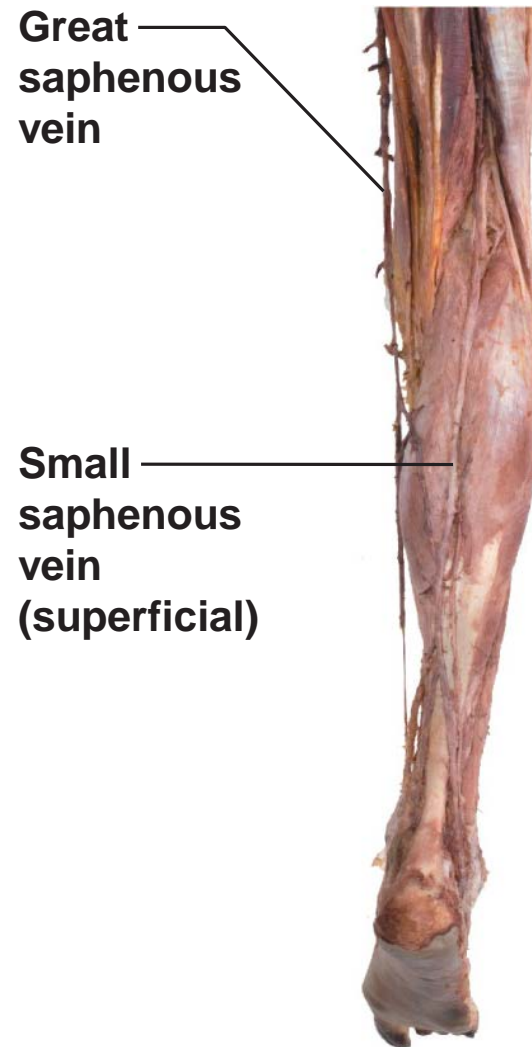
(a) Anterior view

Figure 20.22a

# Veins of the Right Lower Limb and Pelvis



(b) Posterior view of leg



(c) Superficial veins of leg, posterior view