112年
高中生物人才
培育計畫

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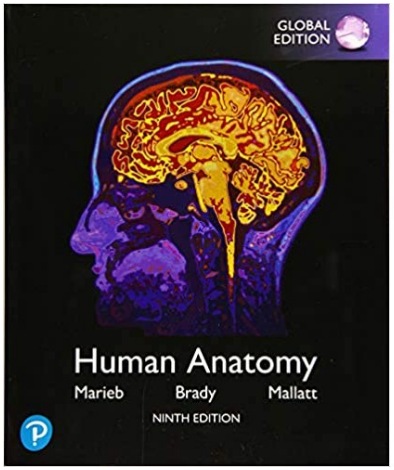
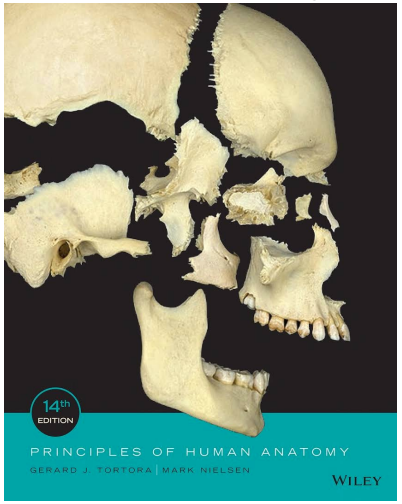
112.12.9

References (參考資料)



Human Anatomy
Marieb, Brady, Mallatt (9th)



Principles of Human Anatomy
G. J. Tortora, M. T. Nielsen
Jonh Wiley & Sons, Inc

高雄醫學大學解剖學科 解剖學影片
http://anatomy.kmu.edu.tw/app/

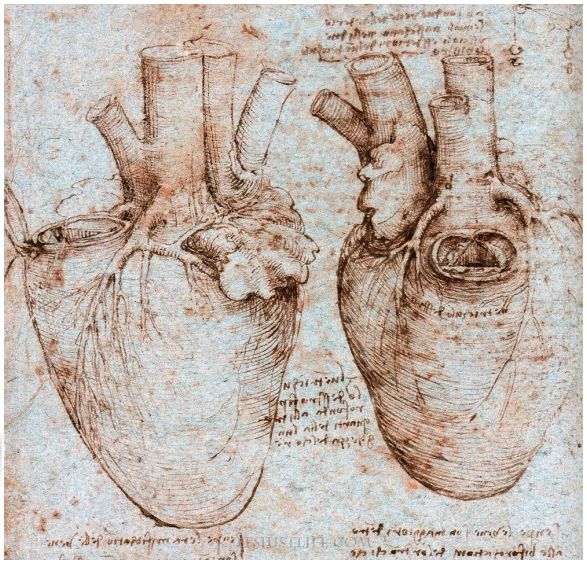
An Overview of Anatomy

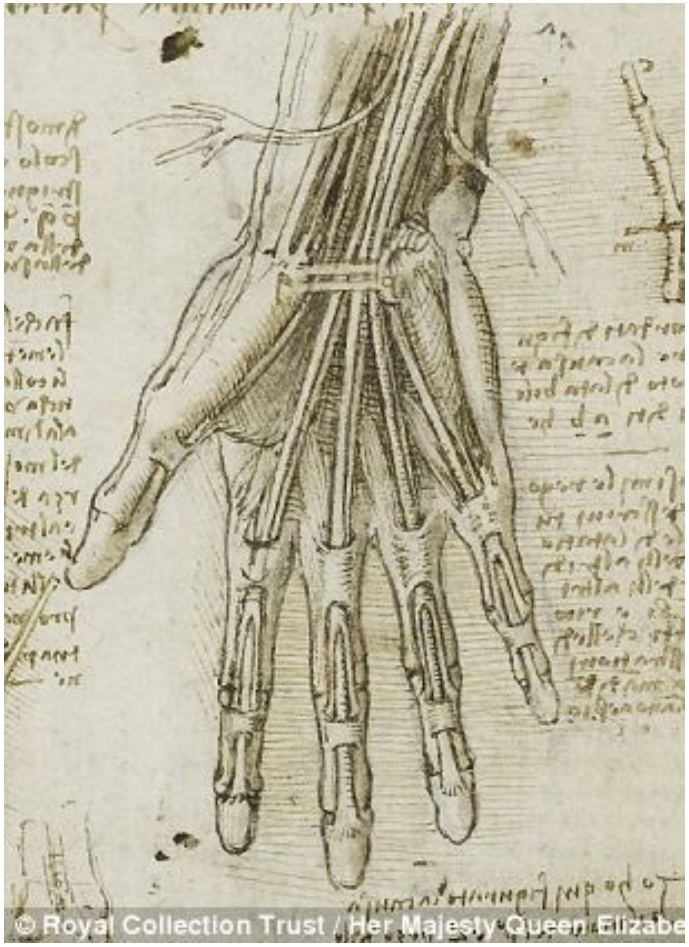
- **Anatomy** ("Ana" →向上; "tome" →切割)
  - The study of the ***structure*** of the human body
  - 1600-1700 B.C.→ the mummy
  - Galen (129-216) →dissection on cadavers and animals

A pig was dissected by Galen

An Overview of Anatomy

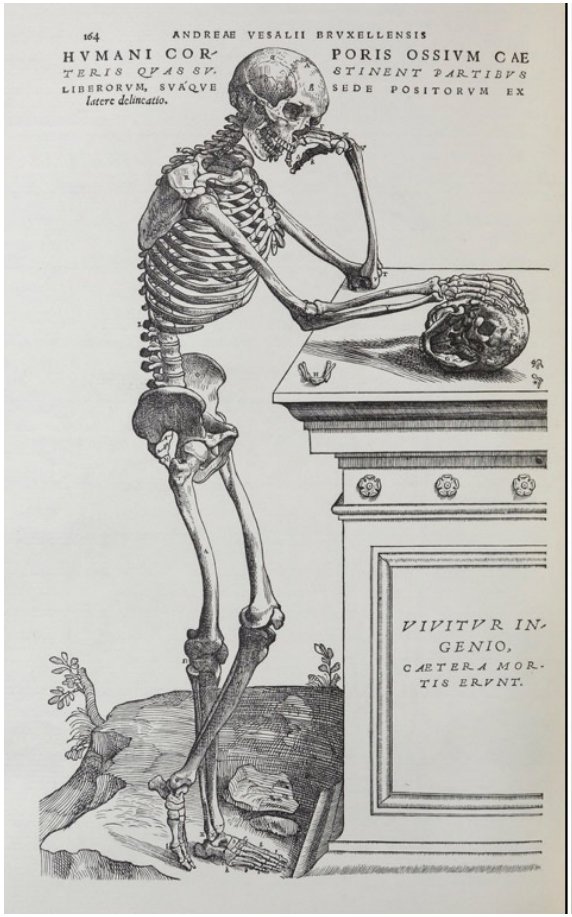
- **Leonardo da Vinci** (1452-1519)
  - 文藝復興時期
  - 解剖屍體
  - 胎兒在子宮的樣子
  - 提出動脈硬化

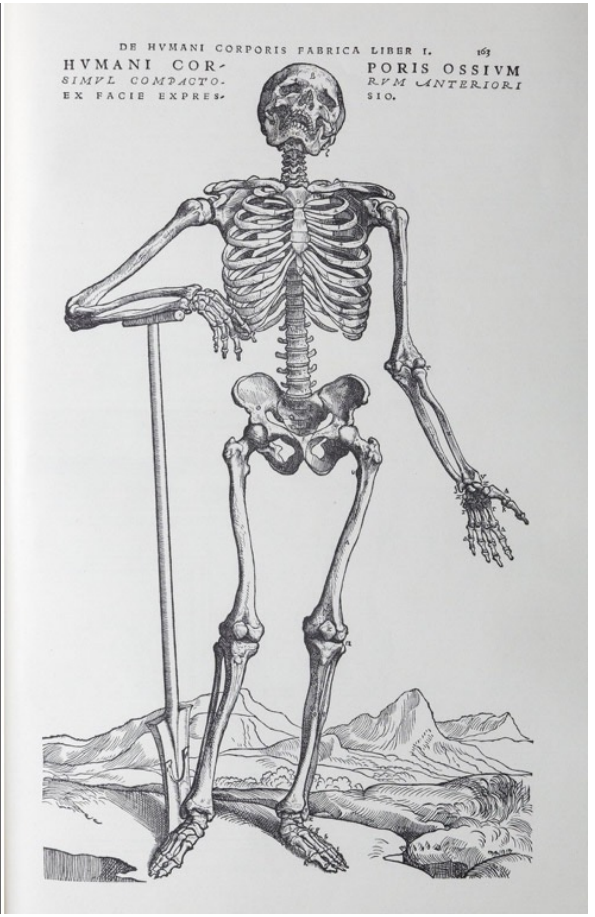




An Overview of Anatomy

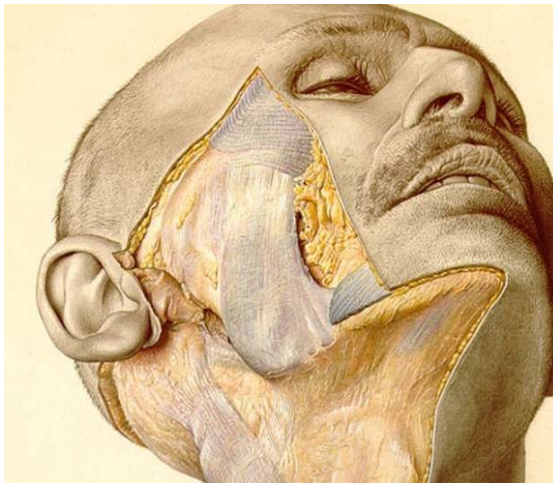
- 維薩里 (Andreas Vesalius)
  - 1514-1564
  - 解剖學之父
  - 解剖“人”
  - 蓋倫的信徒，但提出很多跟蓋倫不同的觀點





《人體的構造》
（De humani corporis fabrica）

一部60多年前出版的人體解剖圖集，今天仍是許多外科醫生不可或缺的工具書，書中每一幀解剖圖的細節和色彩在當今世界仍無出其右者。



皮膚、肌肉、軟組織、神經、器官、骨骼……繪圖之細緻、精準，醫學界公認最優。

但這套書已經絶版，不再印刷，網上仍可買到二手書，價格不菲，一套好幾卷，價格高達數千英鎊。更詭異的是擁有這套圖集的人或機構一般不會把它擺在顯眼的地方，而是藏在隱秘的地方，似乎並不以擁有這套頂級人體解剖圖集為傲。

這就是奧地利解剖學家愛德華·彭科夫（Eduard Pernkopf）主持繪製、出版的人體解剖學圖集（Pernkopf Topographic Anatomy of Man），簡稱彭科夫圖集。

因為這套人體解剖圖集的圖、文依據源自數百名被納粹處死的囚犯。

黑暗、血腥的身世使得醫生和科學家們在用這本圖集時心裏會產生某種牽涉道義和良心的糾結。

美國聖路易市華盛頓大學的蘇珊·麥金農博士對這種矛盾心理很熟悉。她在手術過程中遇到拿不定的時候就會讓助手拿來這本圖集，按圖索驥，通常都能順利完成手術。

http://about.storm.mg/article/1614256

學習解剖學前，要先有這些基本概念:

- 解剖姿勢(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): 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，臀部在背面。

  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。

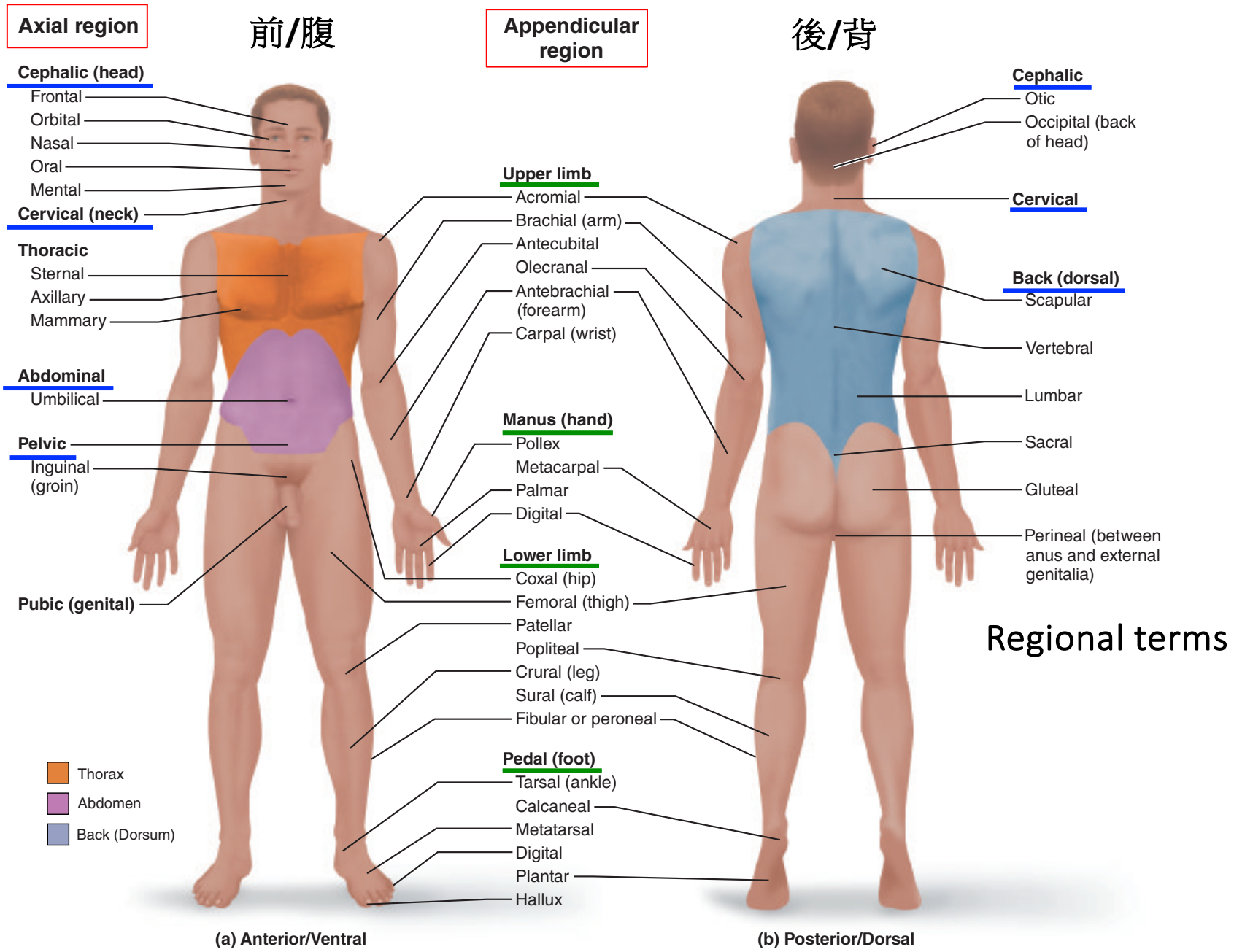
  4.近端 (Proximal) 及遠端(Distal)

  - 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。

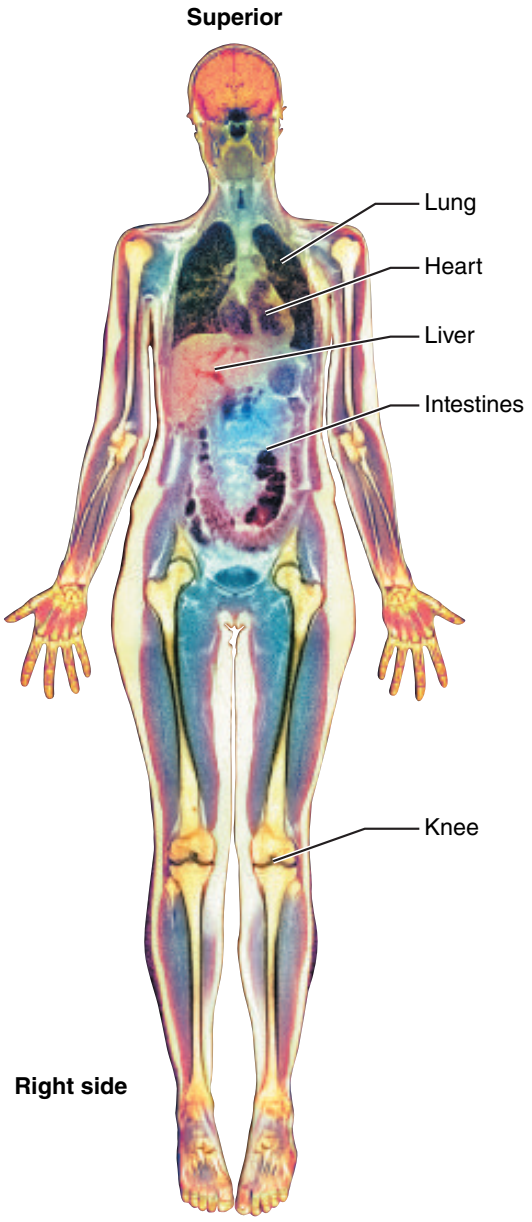
Anatomical position (解剖姿勢)



Regional terms

Table 1.1 Orientation and Directional Terms

Term	Definition/Example
Superior (cranial) 頭端	Toward the head end or upper part of a structure or the body; above *The head is superior to the abdomen.*
Inferior (caudal) 尾端	Away from the head end or toward the lower part of a structure or the body; below *The intestines are inferior to the liver.*
Medial 內側	Toward or at the midline of the body; on the inner side of *The heart is medial to the lungs.*
Lateral 外側	Away from the midline of the body; on the outer side of *The thumb is lateral to the pinky.*
Proximal 近端	Closer to the origin of the body part or the point of attachment of a limb to the body trunk *The elbow is proximal to the wrist.*
Distal 遠端	Farther from the origin of a body part or the point of attachment of a limb to the body trunk *The knee is distal to the thigh.*
Ipsilateral 同側	On the same side *The right hand and right foot are ipsilateral.*
Contralateral 對側	On opposite sides *The right hand and left foot are contralateral.*
Anterior (ventral)*	Toward or at the front of the body; in front of



Anterior (ventral)* 前側，腹側 Toward or at the front of the body; in front of

The sternum is anterior to the heart.

Posterior (dorsal)* 後側，背側 Toward or at the back of the body; behind

The vertebra is posterior to the heart.

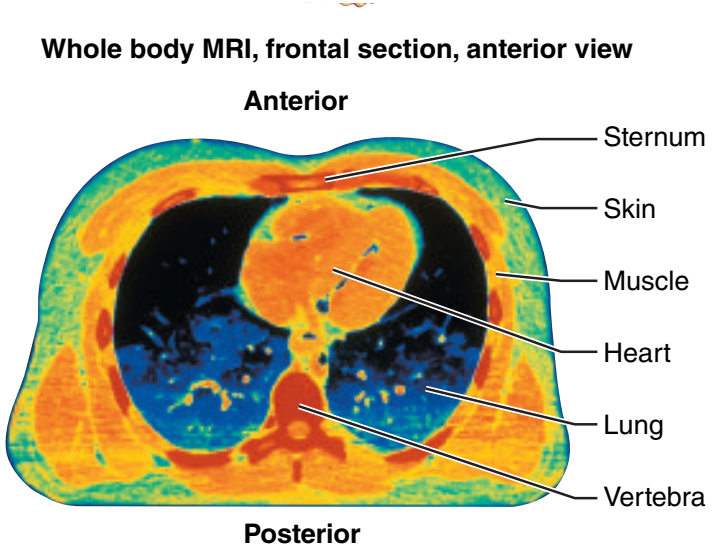
Superficial (external) 淺層 Toward or at the body surface

The skin is superficial to the skeletal muscles.

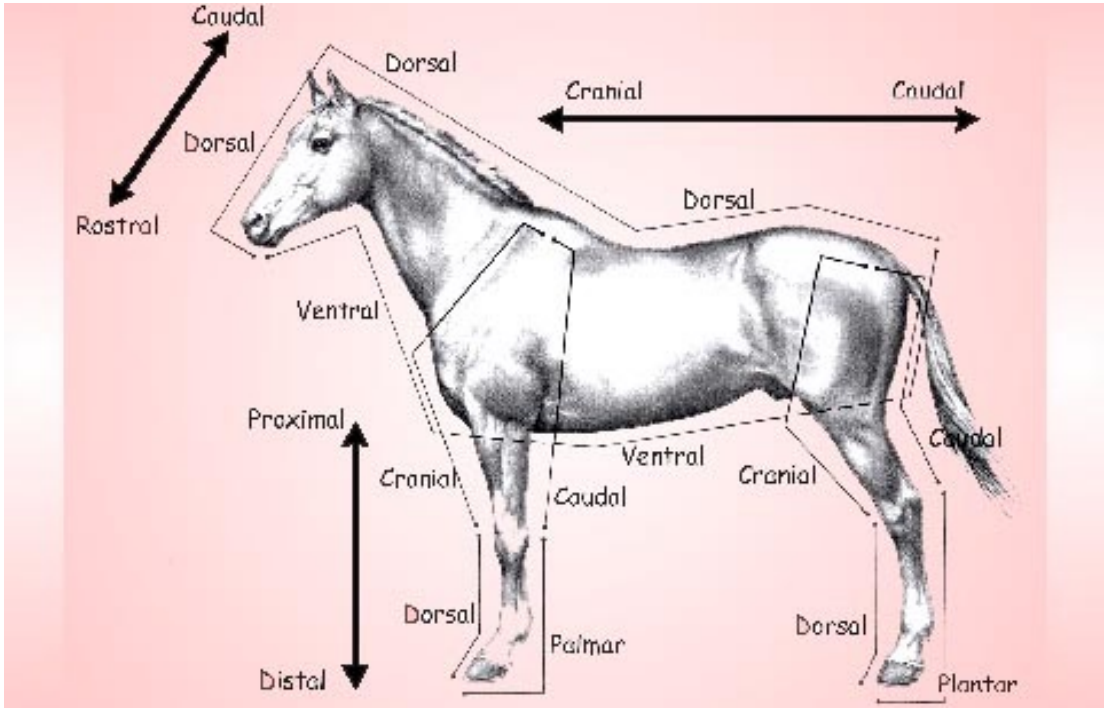
Deep (internal) 深層 Away from the body surface; more internal

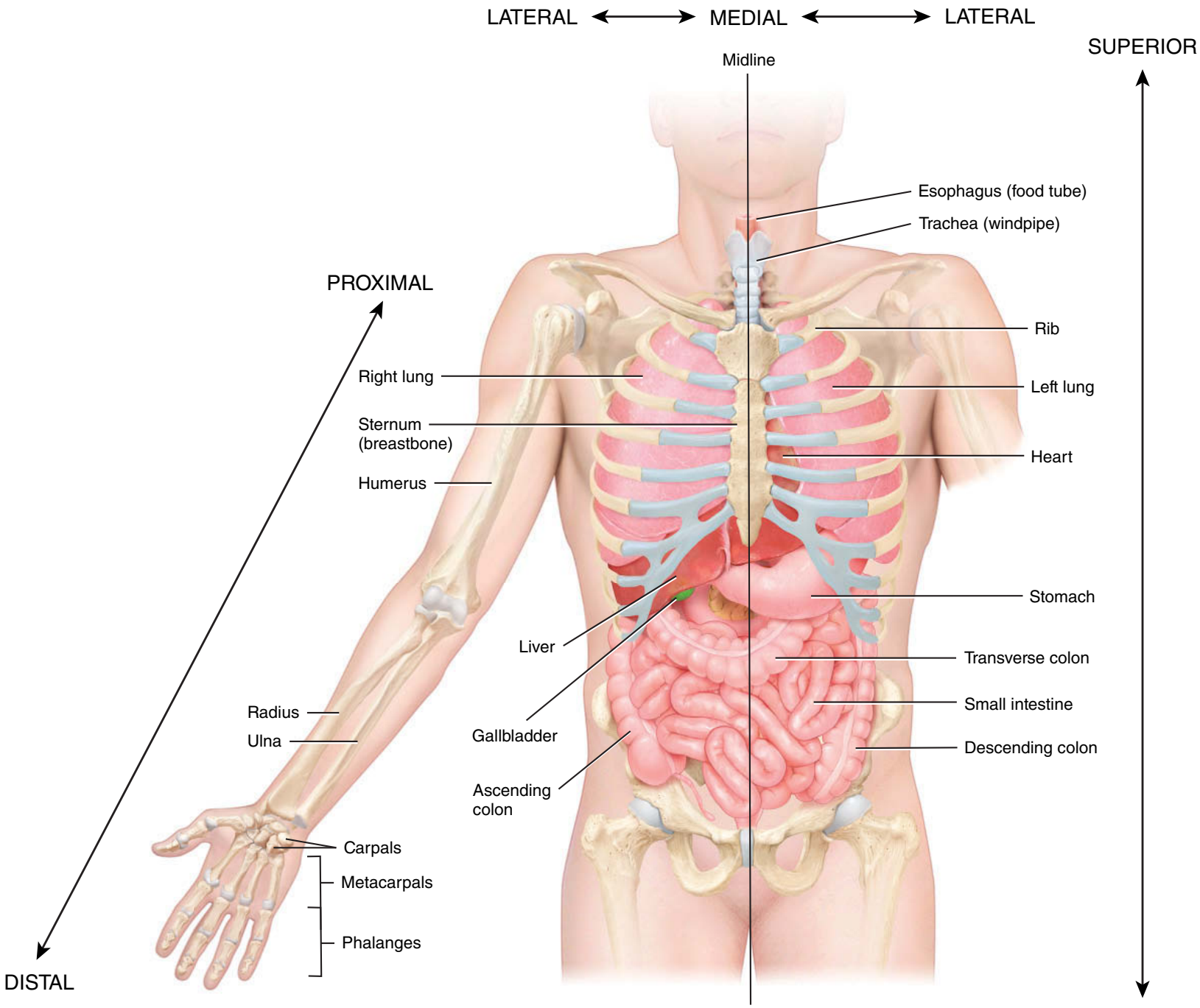
The lungs are deep to the skin.

Whole body MRI, frontal section, anterior view



CT scan, transverse section through thorax

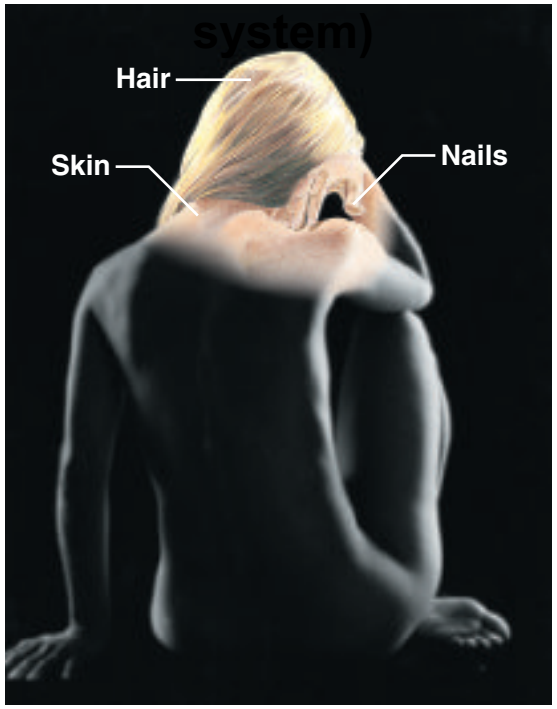




Anterior view of trunk and right upper limb

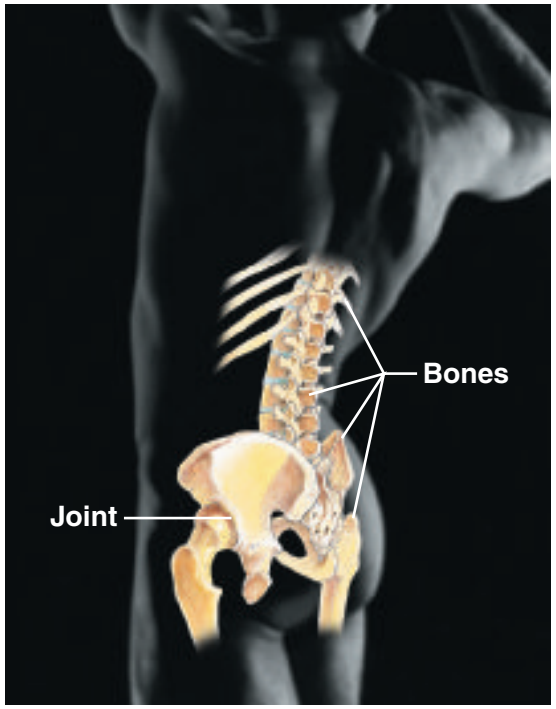
身體的器官系統

表皮系統 (Integumentary system)



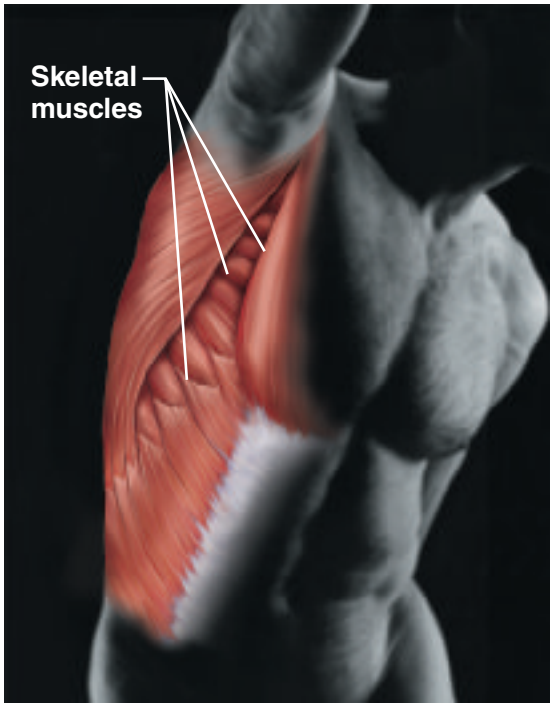
- Forms external body covering
- Protects deeper tissues from injury
- Synthesize vitamin D
- Cutaneous receptors (pain, pressure, etc.) and sweat and oil glands

骨骼系統 (Skeletal system)



- Protects and supports body organs
- Provides a framework for muscles
- Blood cells formed within bones
- Stores minerals

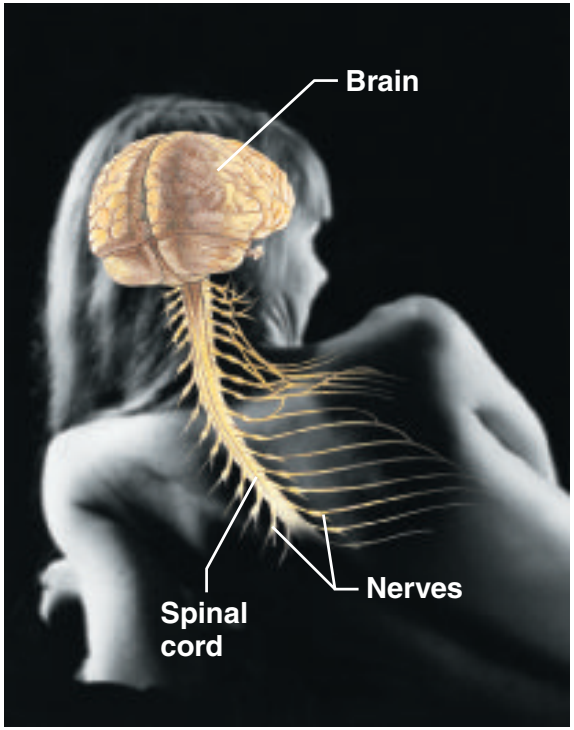
肌肉系統 (Muscular system)



- Allows manipulation of environment
- Locomotion
- Facial expression
- Maintains posture
- Produces heat

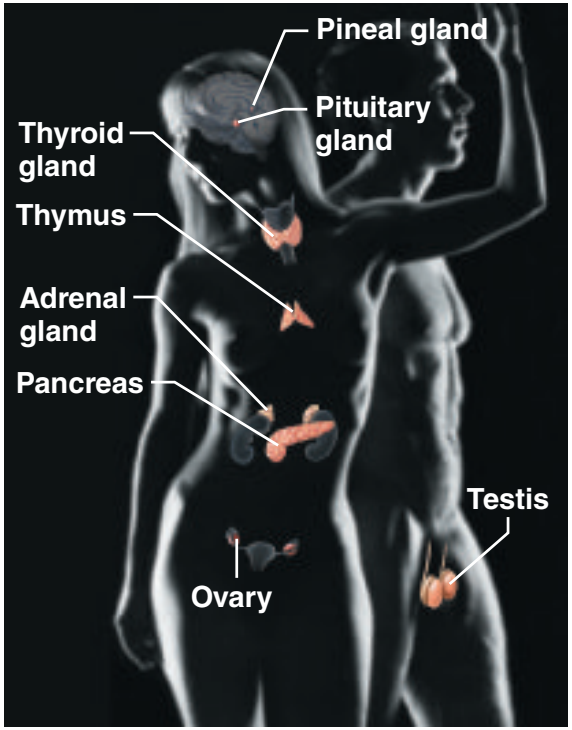
身體的器官系統

神經系統
(Nervous system)



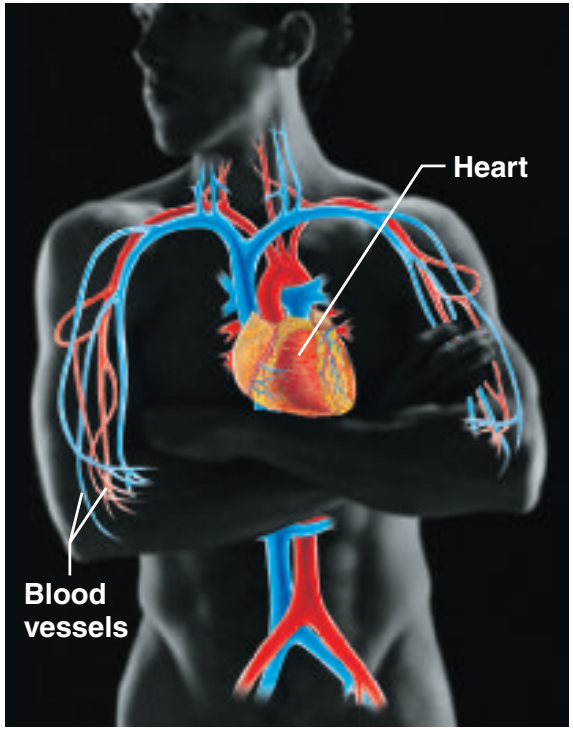
- Fast-acting control system
- Responds to internal and external changes

內分泌系統
(Endocrine system)



- Glands secrete hormones that regulate:
  - -Growth
  - -Reproduction
  - -Nutrient use

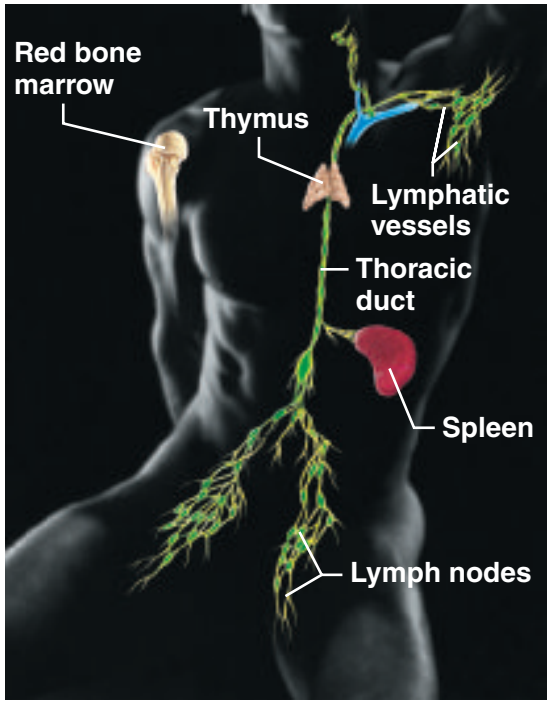
心血管系統
(Cardiovascular system)



- Blood vessels transport blood which carries oxygen, carbon dioxide, nutrients and wastes
- Heart pumps blood through blood vessels

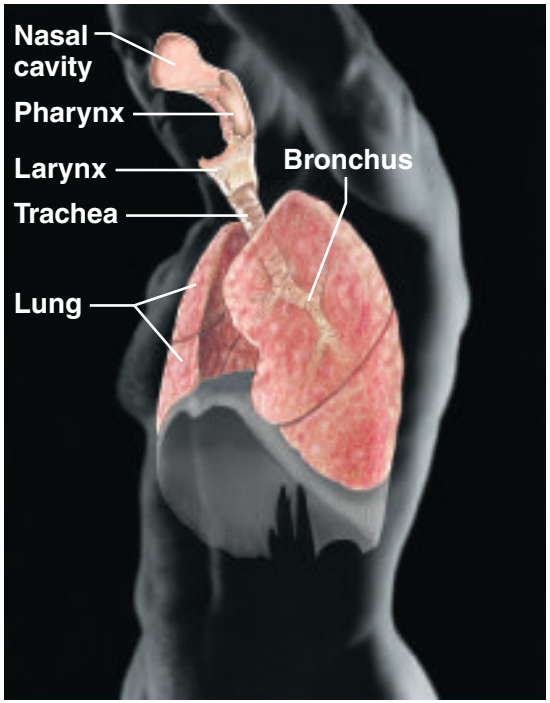
身體的器官系統

淋巴/免疫系統 (Lymphatic system/Immunity)



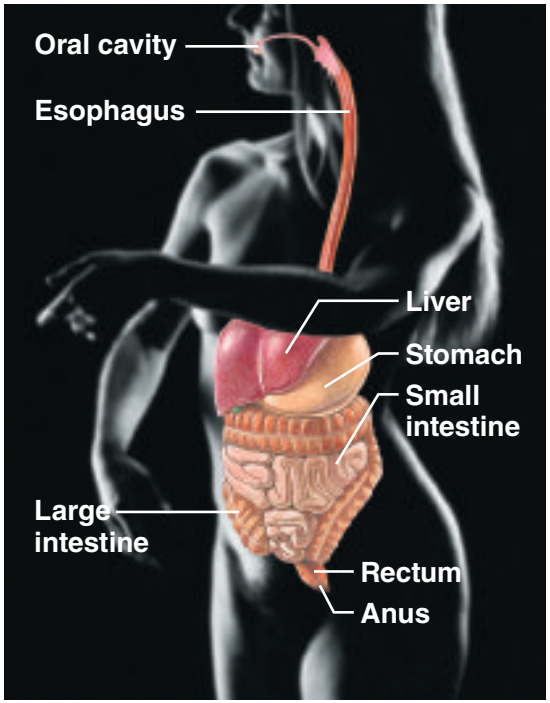
- Picks up fluid leaked from blood vessels
- Disposes of debris in the lymphatic system
- Houses white blood cells (lymphocytes)
- Mounts attack against foreign substances in the body

呼吸系統 (Respiratory system)



- Keeps blood supplied with oxygen
- Removes carbon dioxide
- Gas exchange occurs through walls of air sacs in the lungs

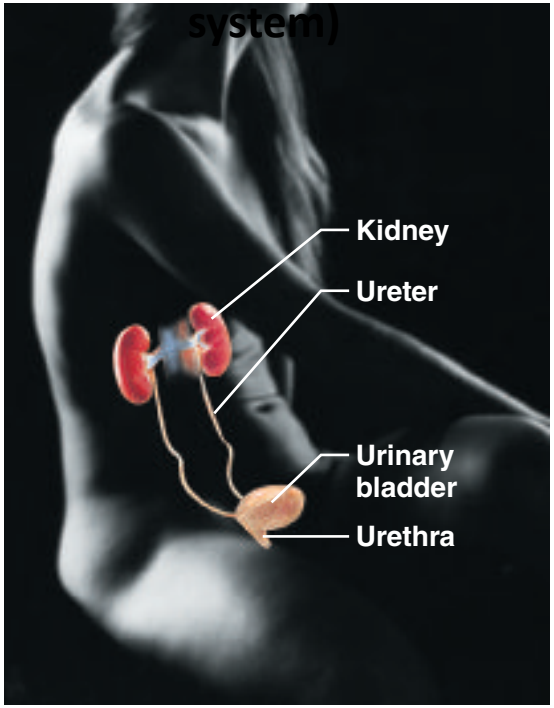
消化系統 (Digestive system)



- Breaks down food into absorbable units
- Indigestible foodstuffs eliminated as feces

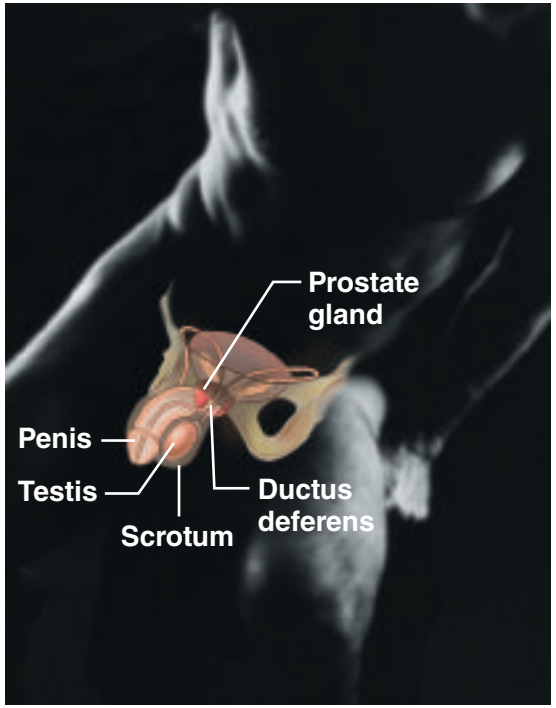
身體的器官系統

泌尿系統 (Urinary system)

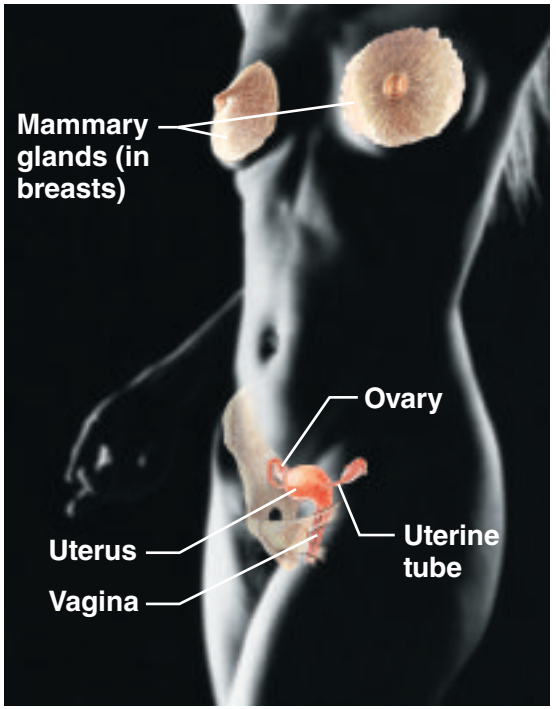


- Eliminates nitrogenous wastes
- Regulates water, electrolyte, and acid-base balance

男性生殖系統 (Male reproductive system)



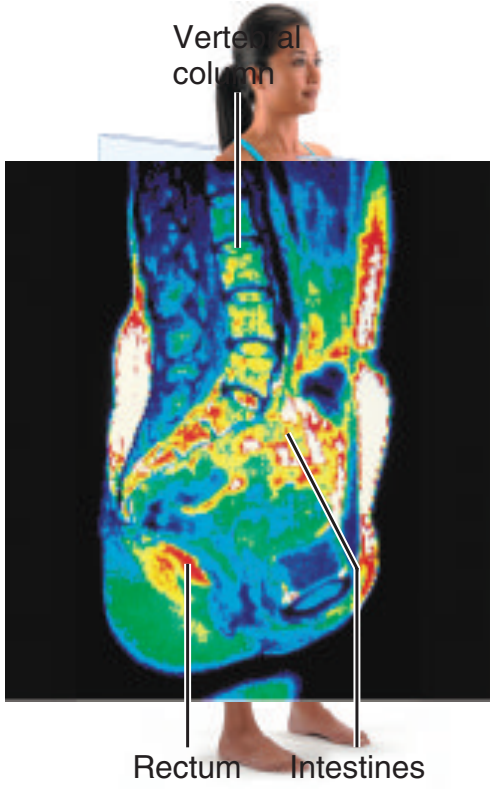
女性生殖系統 (Female reproductive system)



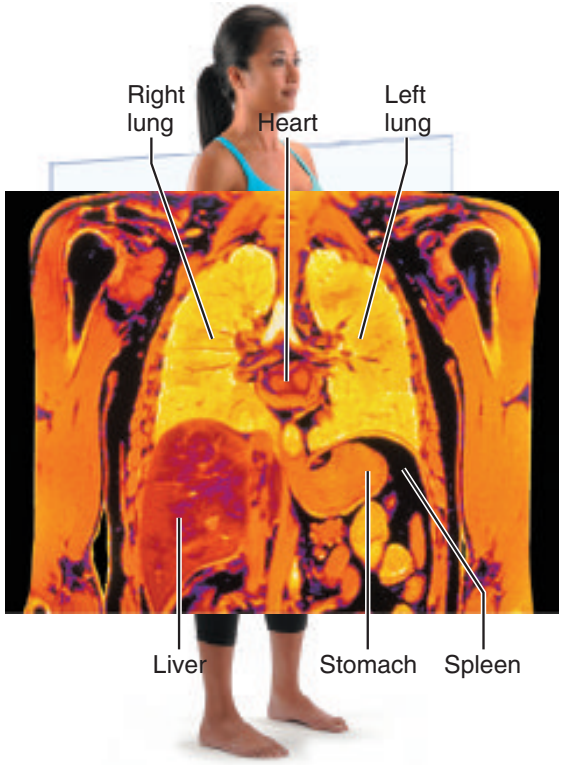
- Overall function is to produce offspring
- Testes produce sperm and male sex hormones
- Ovaries produce eggs and female sex hormones
- Mammary glands produce milk

Body Planes and Sections

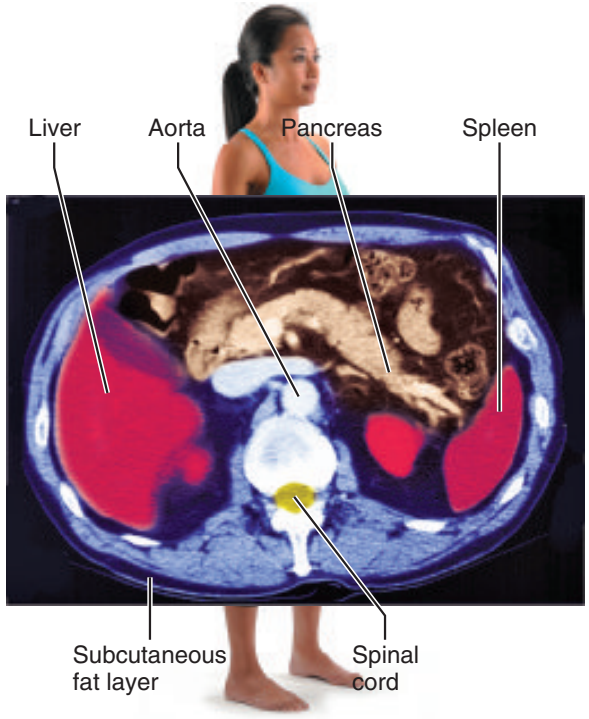
- **Sagittal plane (矢狀切面)**
  - Divide body into left and right parts
  - Sagittal plane that lies exactly in the midline is the median plane (midsagittal plane)
  - Parasagittal plane
- **Frontal plane (coronal plane) (冠狀切面)**
  - Divides body into anterior and posterior parts
- **Transverse (horizontal) plane (cross section) (橫切面)**
  - Divide the body into the body into superior and inferior parts



(a) Median (midsagittal) plane



(b) Frontal (coronal) plane

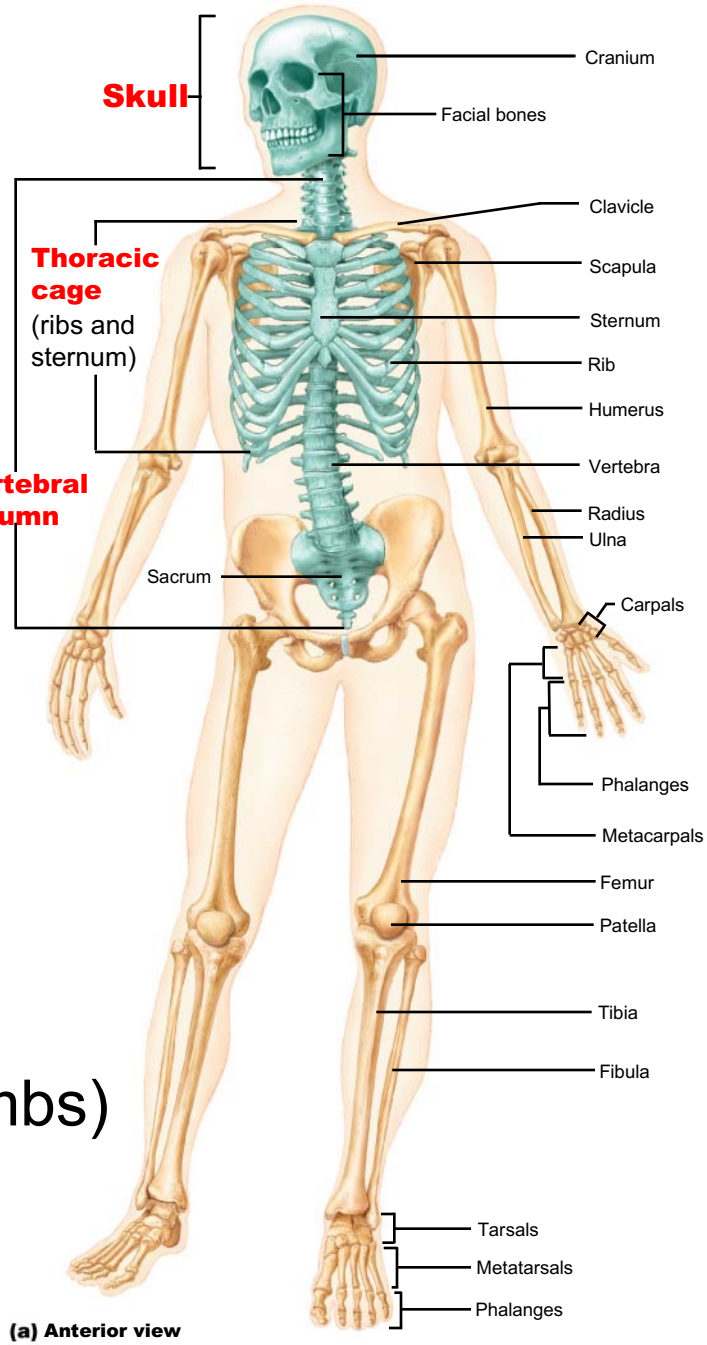


(c) Transverse plane

骨骼系統

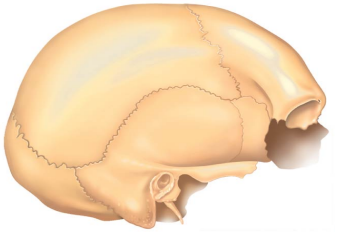
- 組成: 硬骨 (bones)
  軟骨 (cartilages)
  關節 (joints)
  韌帶 (ligaments)

- 全身由206塊骨頭組成，可分為：
  ★中軸骨（Axial skeleton）(80 bones)
  →顱骨 (skull), 脊柱 (vertebral column), 和胸廓 (thoracic cage)
  ★附肢骨 (Appendicular skeleton) (126 bones)
  → 上肢和下肢 (Upper and lower limbs)



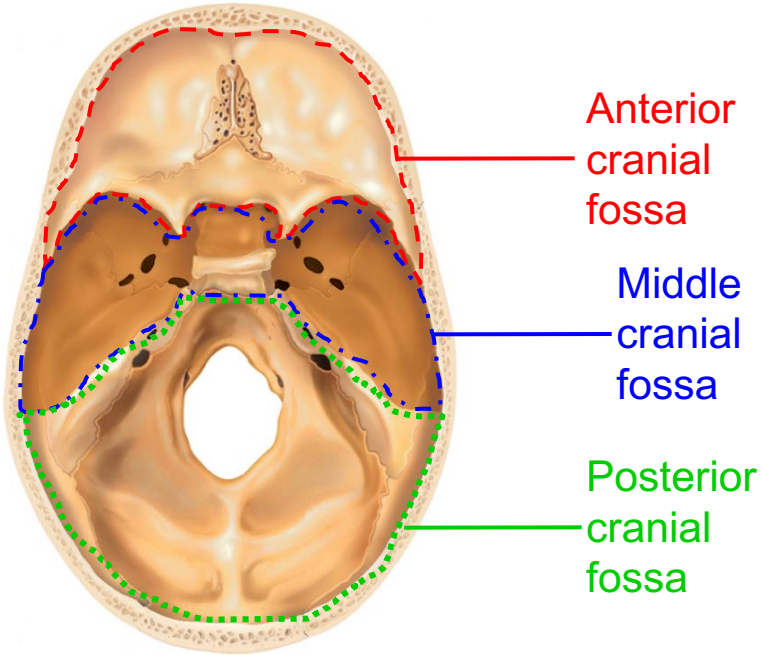
頭骨 (Skull)

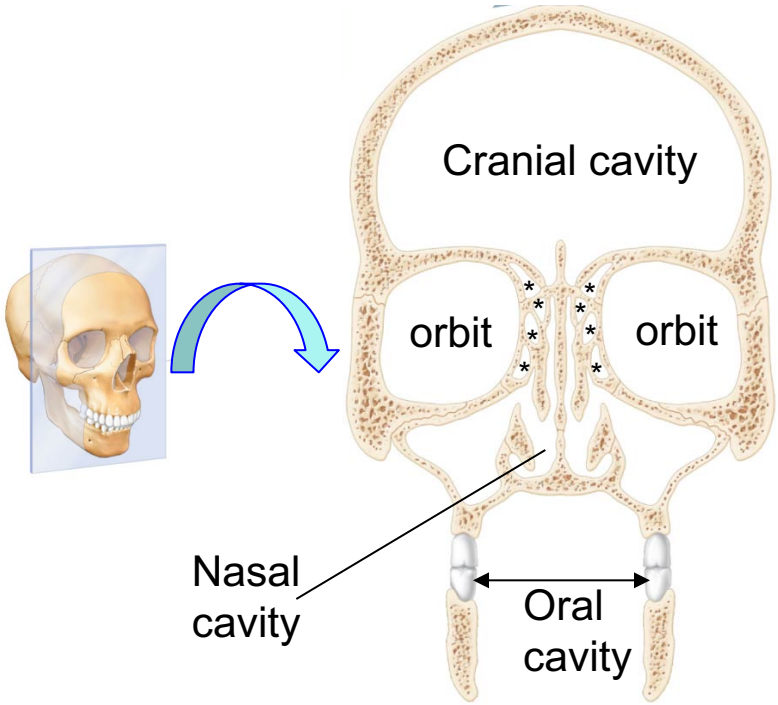
Cranial bones



Facial bones

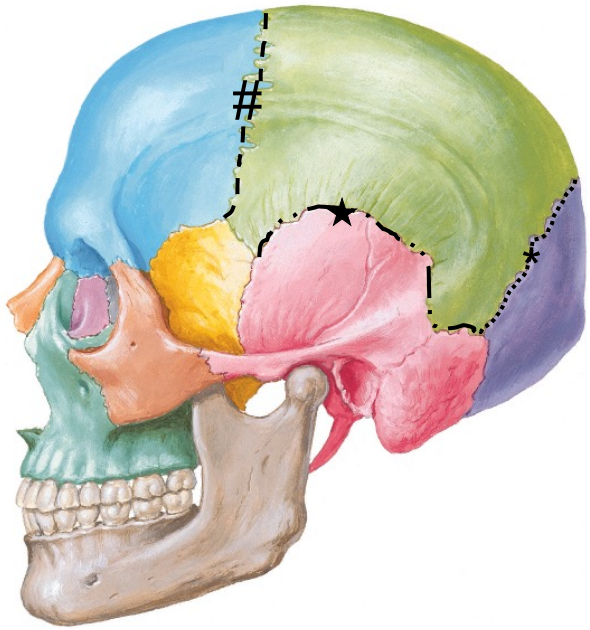
- 頭骨分成拱狀圓頂 (vault) 和底部 (base)
- 前方是顏面骨 (facial bone)
- 內部可分成前顱窩 (anterior fossa), 中顱窩 (middle fossa), 後顱窩 (posterior fossa)→腦部 (brain)位於此處
- 顱骨中含有小腔室, 包含中耳和內耳 (**middle** and **inner ear cavities**), 鼻腔 (**nasal** cavity), 眼眶 (**orbits**), 充滿空氣的鼻竇 (**air-filled sinuses**)(*)
- 顱骨有大約85個孔洞，提供脊髓, 血管和腦神經通過



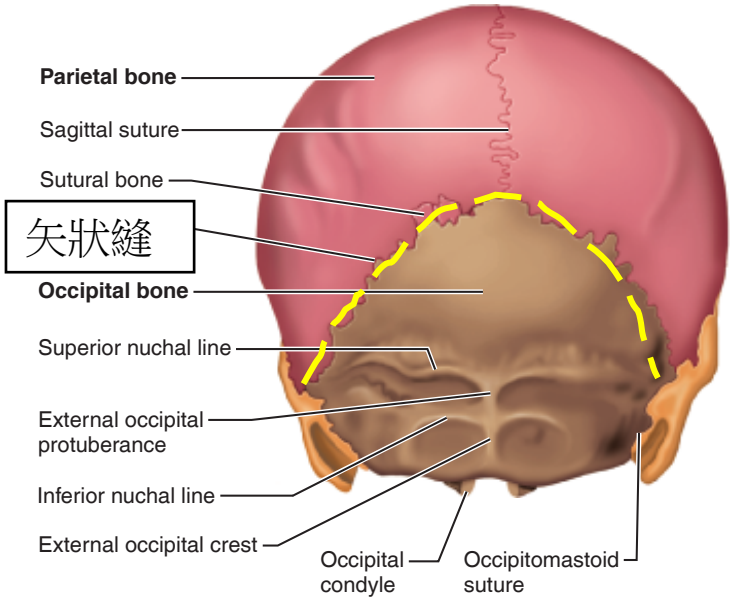


頭蓋骨 (Cranial bones)

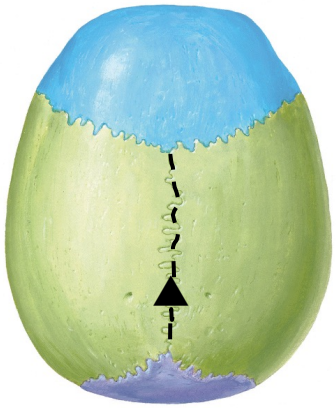
- 由八塊骨頭組成:
  - -成對→顳骨 (temporal bones)
    頂骨 (parietal bones)
  - -不成對→額骨 (frontal bone)
    枕骨 (occipital bone)
    蝶骨 (sphenoid bone)
    篩骨 (ethmoid bone)



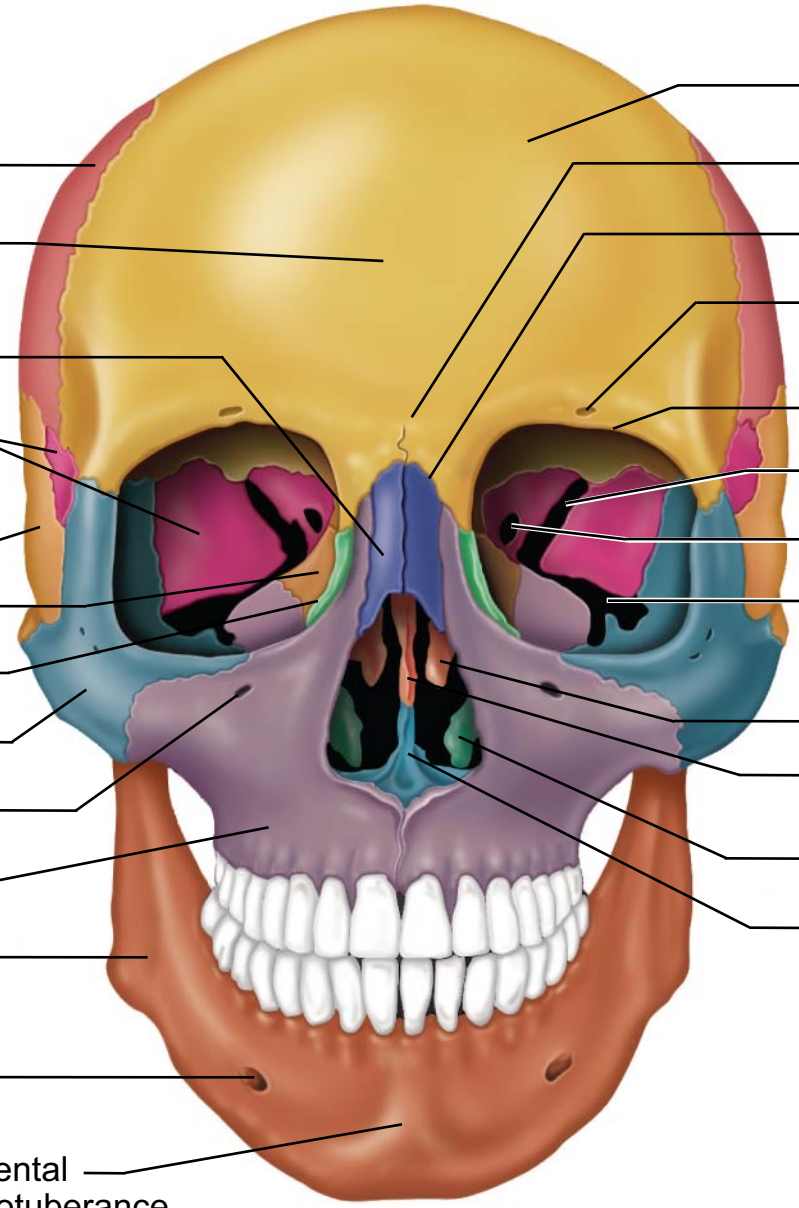
- 顱骨上四條接縫: 1. 冠狀縫 (coronal suture)(#) (頂骨-額骨)
  2. 鱗狀縫 (squamous suture)(★) (頂骨-顳骨)
  3. 矢狀縫 (sagittal suture)(▲) (左右頂骨之間)
  4. 人字縫 (lambdoid)(*) (頂骨-枕骨)



Posterior view of the skull.



顔面骨



Frontal bone

Parietal bone

Glabella

Squamous part of frontal bone

Frontonasal suture

鼻骨 **Nasal bone**

Supraorbital foramen (notch)

Sphenoid bone (greater wing)

Supraorbital margin

Superior orbital fissure

Temporal bone

Optic canal

Ethmoid bone

Inferior orbital fissure

涙骨 **Lacrimal bone**

頬骨 **Zygomatic bone**

Middle nasal concha

Perpendicular plate

Ethmoid bone

Infraorbital foramen

Inferior nasal concha 下鼻甲

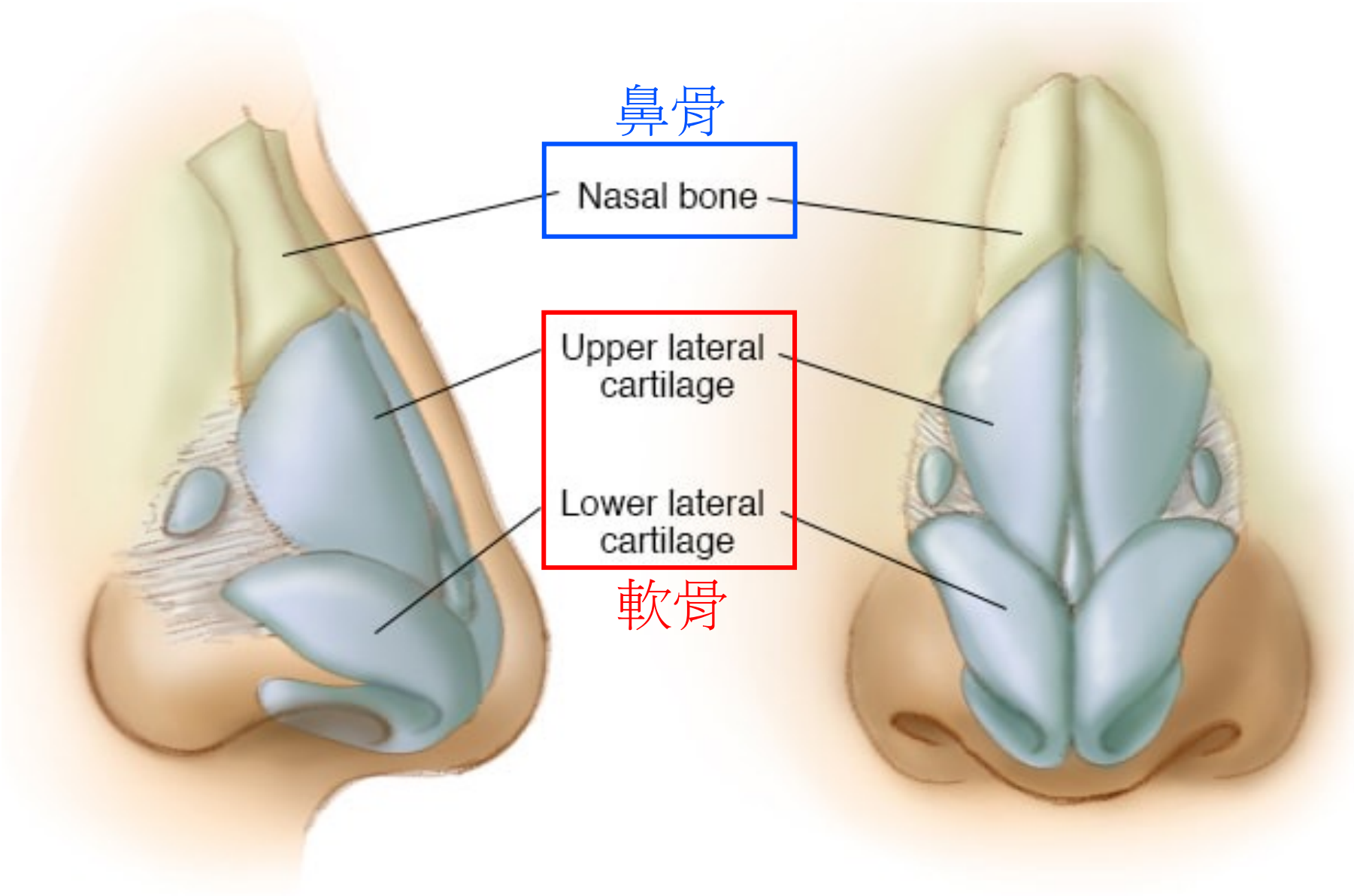
Maxilla

Vomer 犁骨

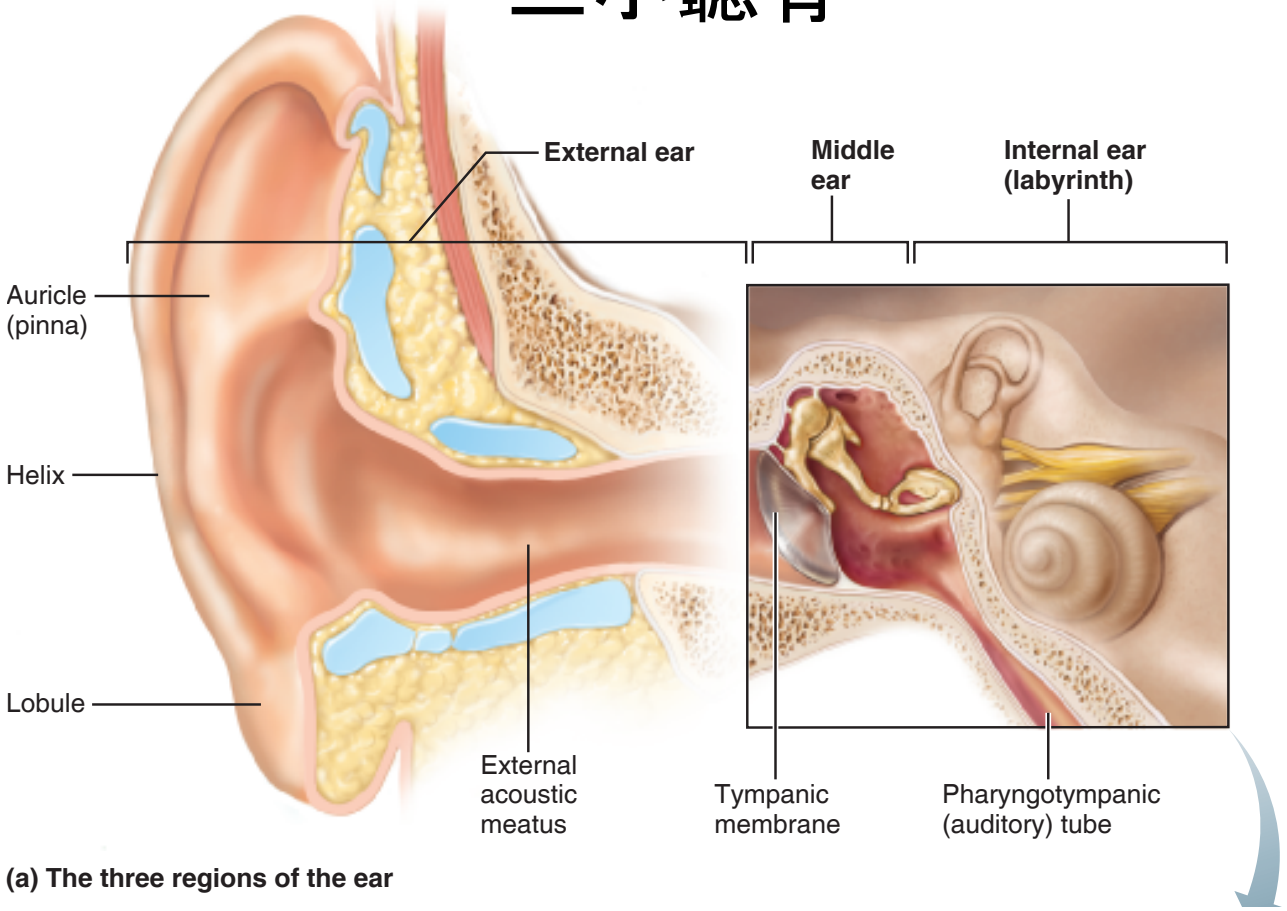
Mandible

Mental foramen

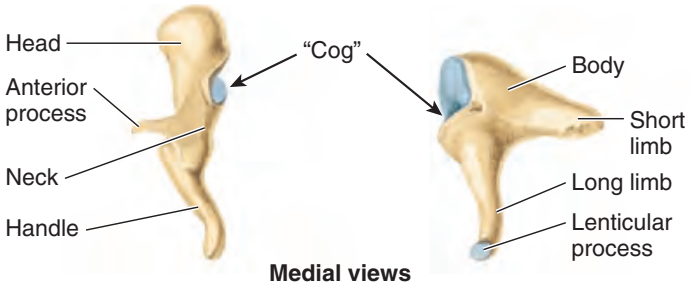
Mental protuberance



三小聽骨

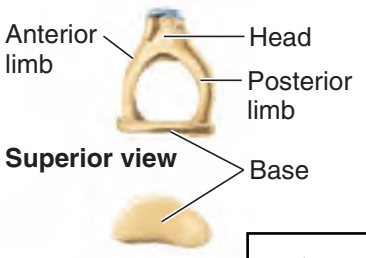


(a) The three regions of the ear



(B) MALLEUS

(C) INCUS



stapes

中耳

- 咽鼓管 (pharyngotympanic tube)
  - 又稱聽管 (auditory tube)，過去也稱歐氏管 (eustachian tube)
  - 連接中耳和咽部，約4公分長，往內側、前面及下面走
  - 外側1/3是由骨頭組成且位在顱骨下表面上的一條溝內；內側2/3則為軟骨，通往鼻腔後面的上咽部側壁
- 三小聽骨 (auditory ossicles)
  - 將鼓膜的震動傳送通過鼓室而到達內耳的液體
  - 由外而內為錘骨 (malleus, 把手附著在鼓膜上) →砧骨 (incus) →鐙骨 (stapes, 基部會震動卵圓窗)
  - 微細的韌帶使聽小骨懸吊在中耳內，聽小骨將聲波的震動壓力放大約20 倍
  - 中耳腔內有兩條 細小的骨骼肌：
    - →鼓膜張肌 (tensor tympani)源自咽鼓管的軟骨部上且終止在錘骨
    - →鐙骨肌 (stapedius)由中耳的後壁走到鐙骨
  - 當耳朵受到極大聲音襲擊時，這些肌肉會反射性收縮來限制聽小骨的震動

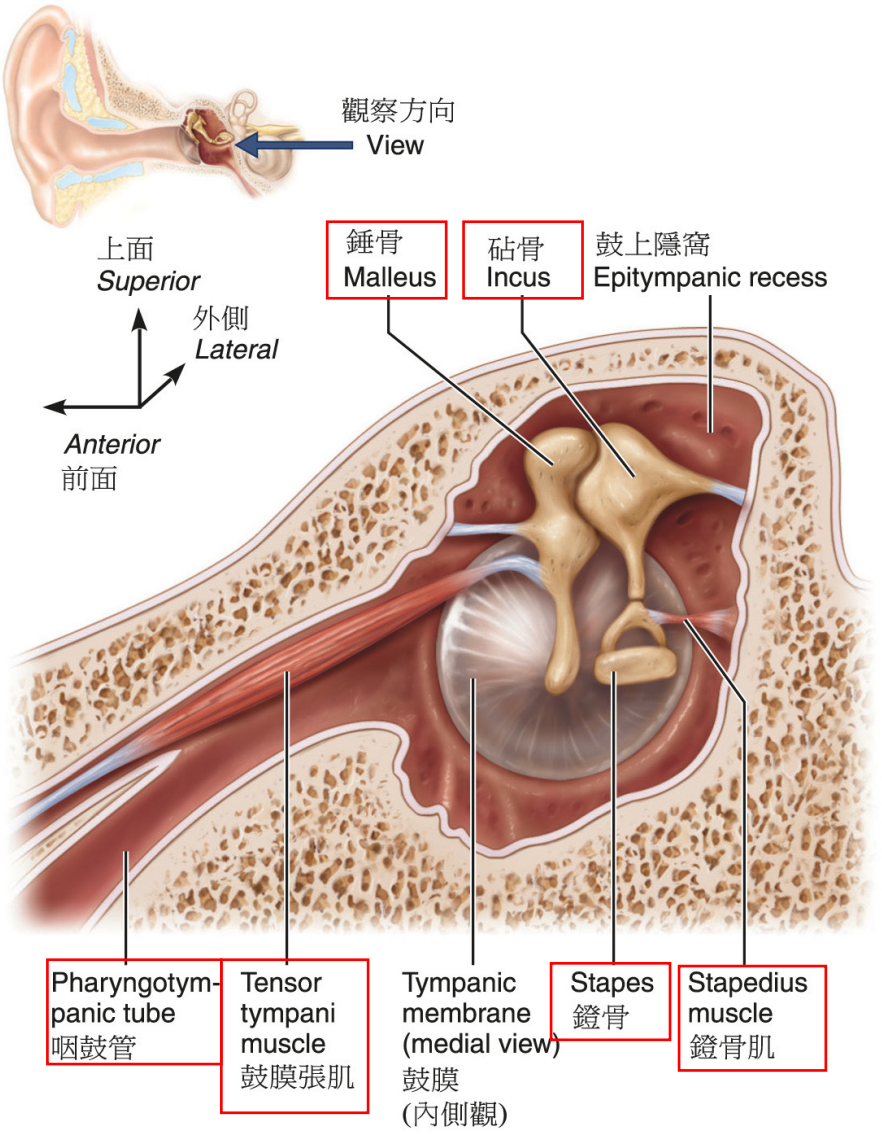


圖 16.17 與聽小骨 (錘骨、砧骨、鐙骨) 相連的骨骼肌 (右耳，內側觀)。

脊柱 (vertebral column)

- 成人的脊柱由26塊骨頭所組成

  頸椎 (cervical vertebrae) (7)

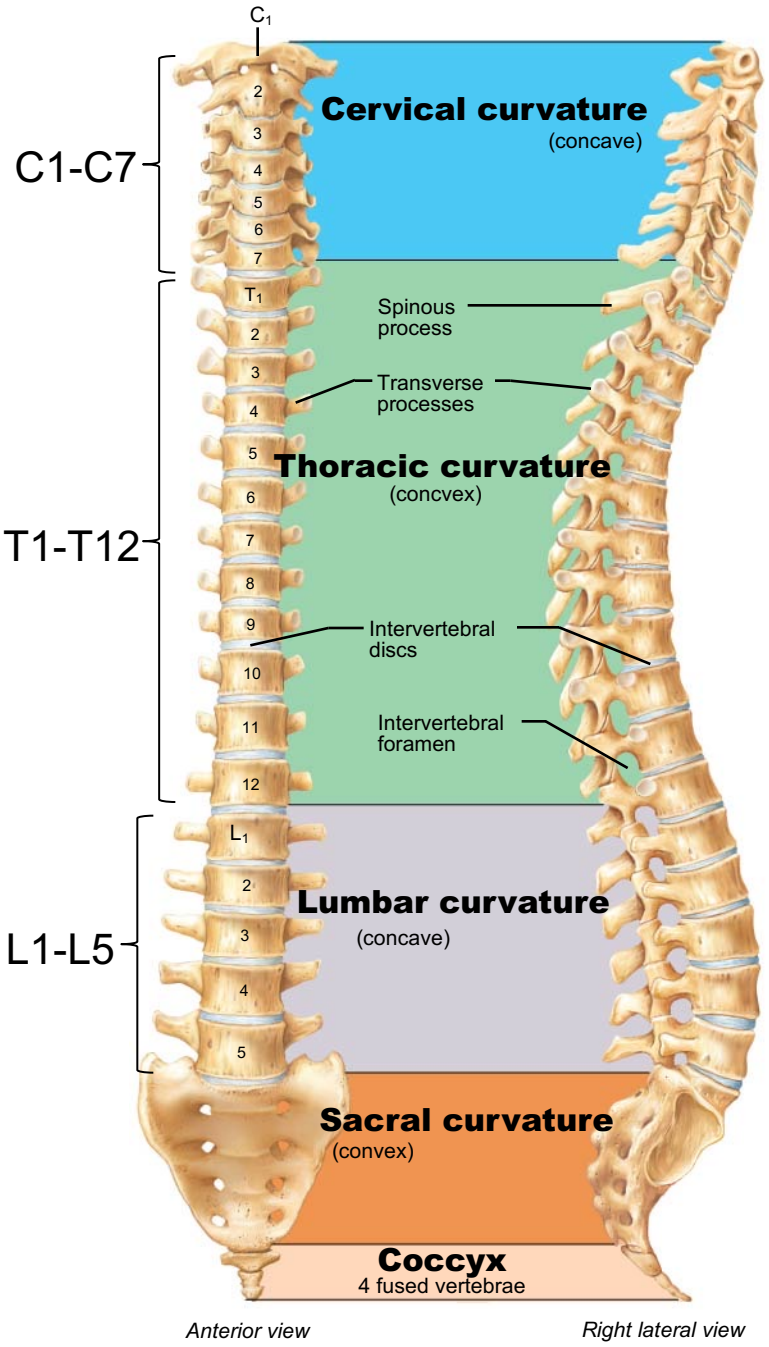
  胸椎 (thoracic vertebrae) (12)

  腰椎 (lumbar vertebrae) (5)

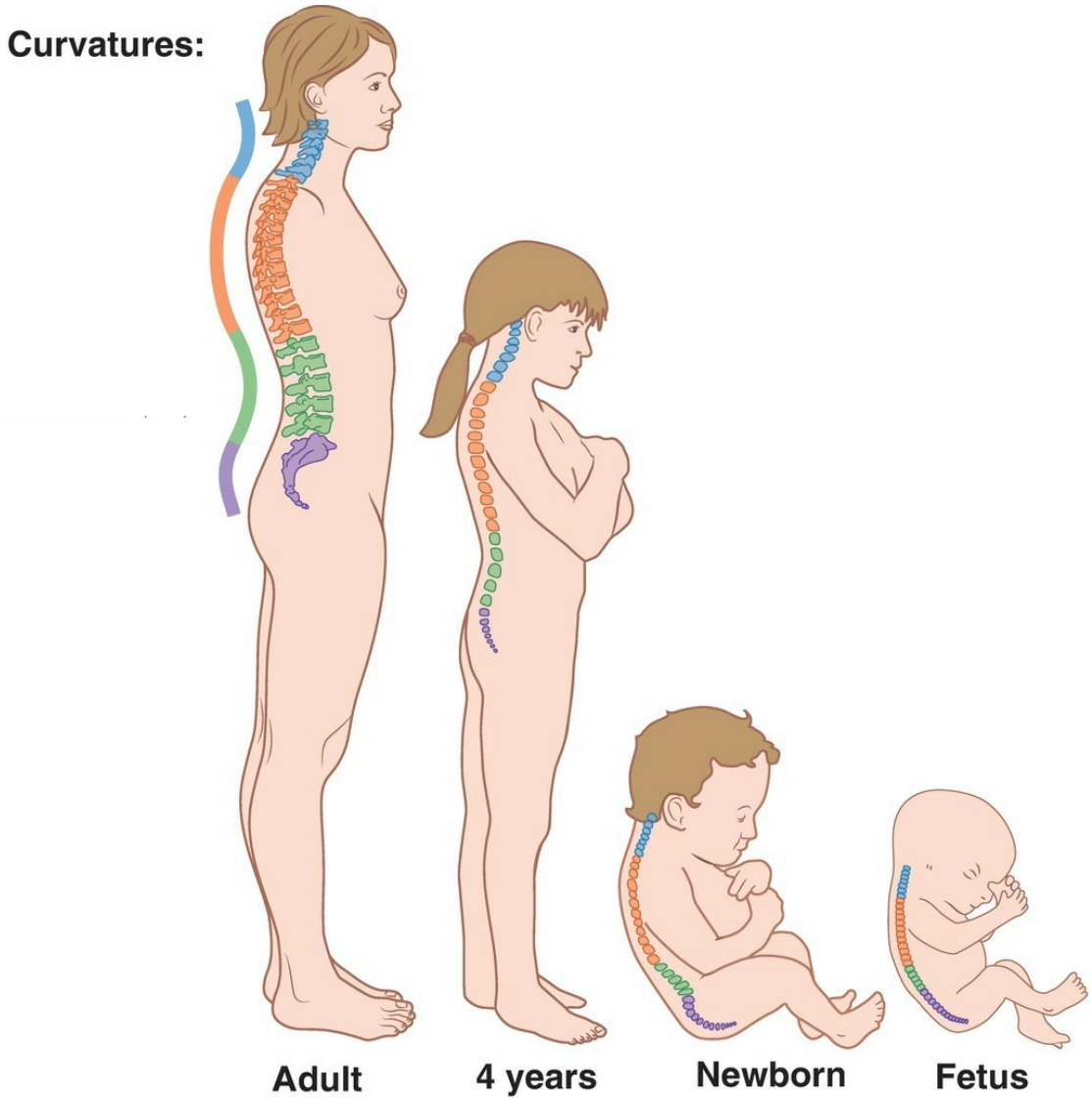
  薦椎 (sacrum) (1)

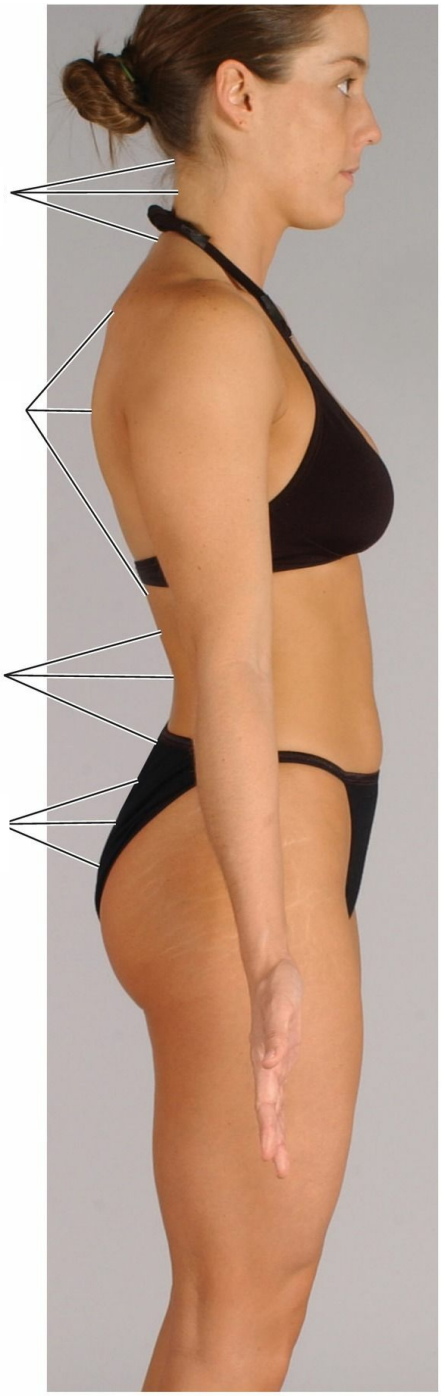
  尾椎 (coccyx) (1)

- 脊柱的功能:
  - 將身體的重量由中軸轉移給下肢
  - 圍繞並保護脊髓
  - 提供頸部和背部肌肉附著的地方



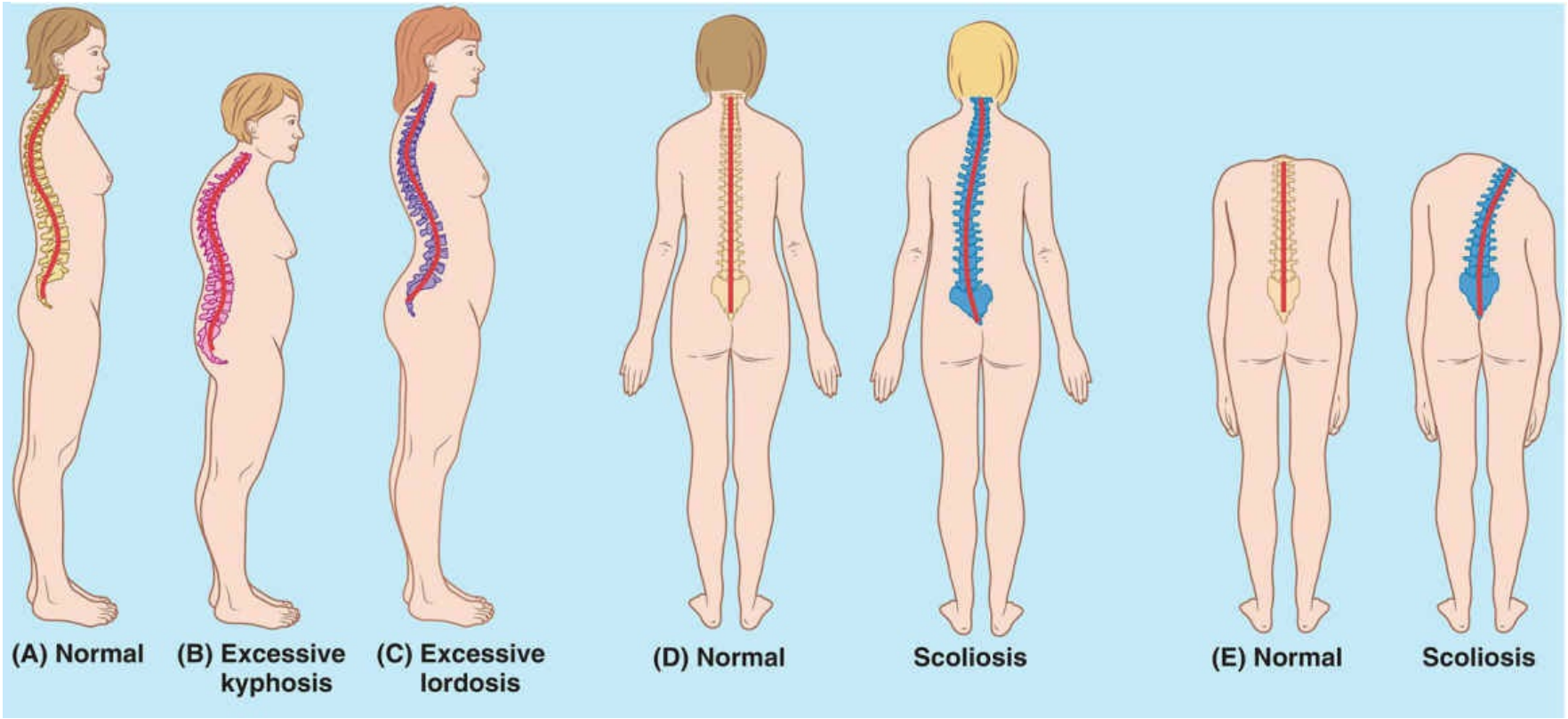
脊柱的彎曲




Lateral view

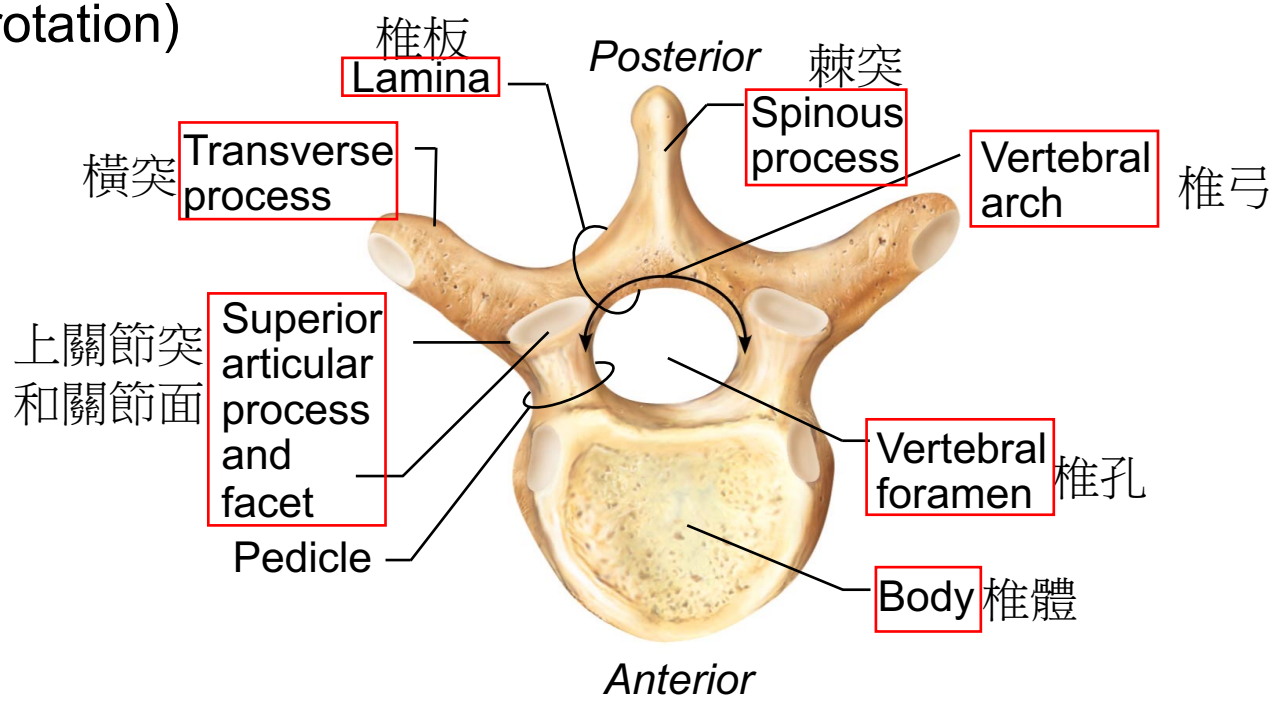
Abnormal Curvatures of Vertebral Column

- Excessive **thoracic kyphosis** → humpback (駝背)
- Excessive **lumbar lordosis**→ sway back, associated with weakened trunk musculature
  → women develop a temporary excessive lumbar lordosis during late pregnancy
- **Scoliosis** (脊椎側彎) →abnormal lateral curvature
  → idiopathic (先天的)約佔80 %
  → functional scoliosis



脊椎骨的一般構造

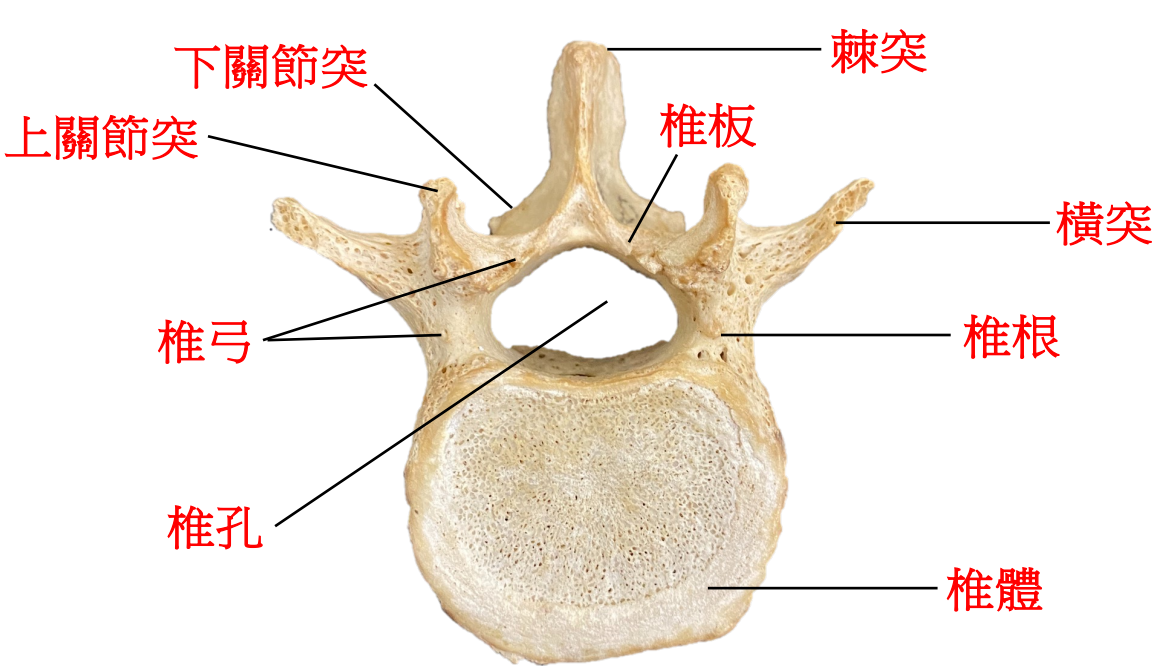
- 不同位置的脊椎骨會有型態上的差異，但典型的脊椎骨會有以下的結構：
  → 椎體 (body), 椎弓 (vertebral arch), 椎板 (lamina), 椎孔 (vertebral foramen), 棘突 (spinous process), 橫突 (transverse process), 上/下關節突 (superior and inferior articular process), 椎間孔 (intervertebral foramina)
- 脊柱的運動型式：
  1. 屈曲 (flexion)和伸展 (extension)
  2. 側曲 (lateral flexion)
  3. 旋轉 (rotation)



脊椎的基本構造

- **椎體 (Vertebral body)**：脊椎主體，圓柱狀
- **椎弓 (Vertebral arch)**
  - 椎根 (2 pedicles): 連接椎體後方
  - 椎板 (2 lamina): 椎根往後延伸
- **椎孔 (Vertebral foramen):** 椎弓和錐體後表面所圍成的區域
- **突起 (Process):** 椎弓上突起的構造，會有肌肉組織附著在上面，使脊椎能夠動作
  - 棘突 (Spinous process): 典型的脊椎有一個
  - 橫突 (Transverse process): 椎根與椎板 交接處往側邊的突起，典型的脊椎有兩個
  - 關節突 (Articular process): 用於上下脊椎骨相接的突起，分為上關節突 (superior articular process)(朝上)和下關節突 (inferior articular process)(朝下)，兩種關節突有相反方向的facet(接合平面)來做連接。典型的脊椎有四個關節突

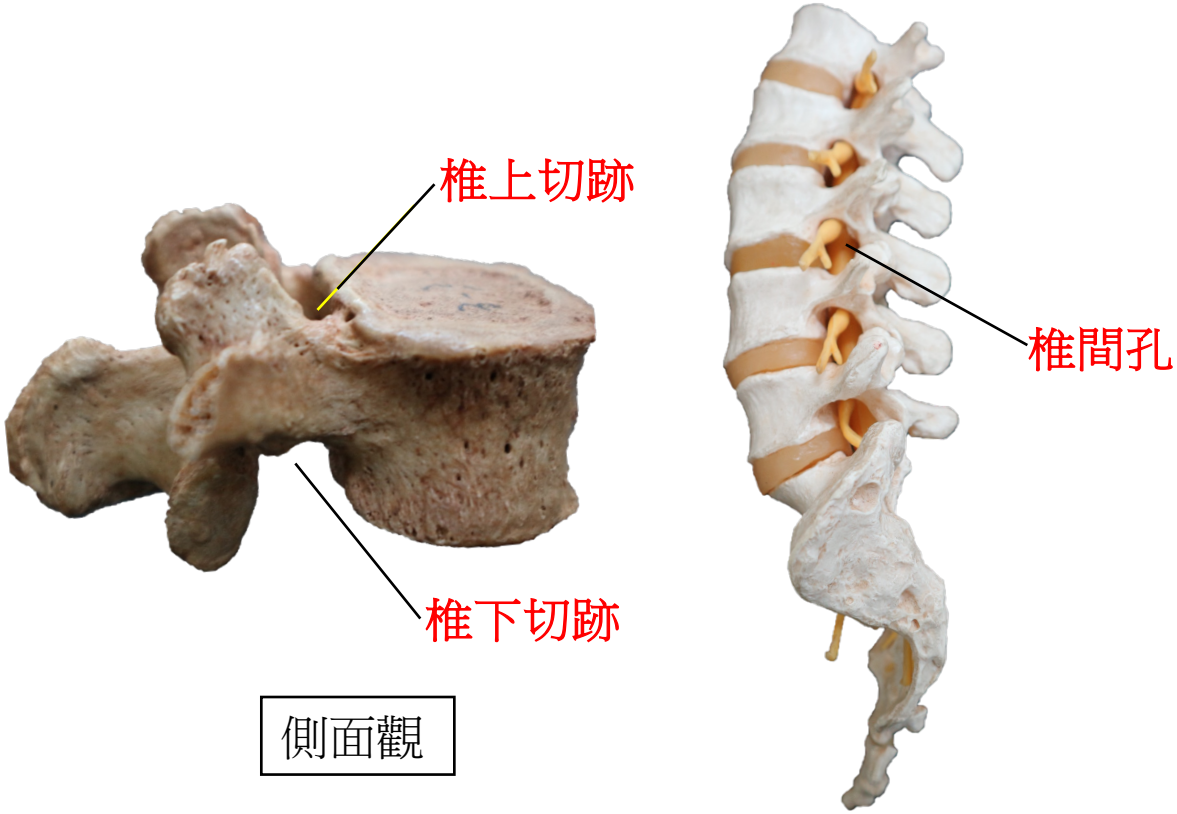
上面觀



脊椎的基本構造

- **脊椎切跡 (Vertebral notch):** 上關節突 (superior articular process) 與 椎根 (pedicle) 形成一凹陷稱為 椎上切跡 (superior vertebral notch)，同理下關節突 (inferior articular process) 與椎根形成之凹陷則稱椎下切跡 (inferior vertebral notch)

- **椎間孔 (Intervertebral foramen):** 上節的椎下切跡與下節椎上切跡接合後兩凹陷形成一孔洞，可讓spinal nerve (脊神經)伸出



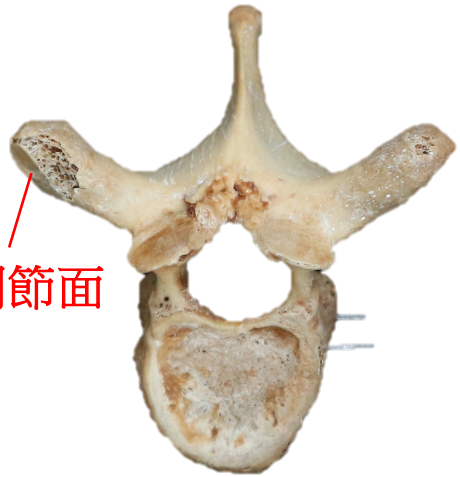
側面觀

不同區段的脊椎比較

上面觀

橫突孔

頸椎



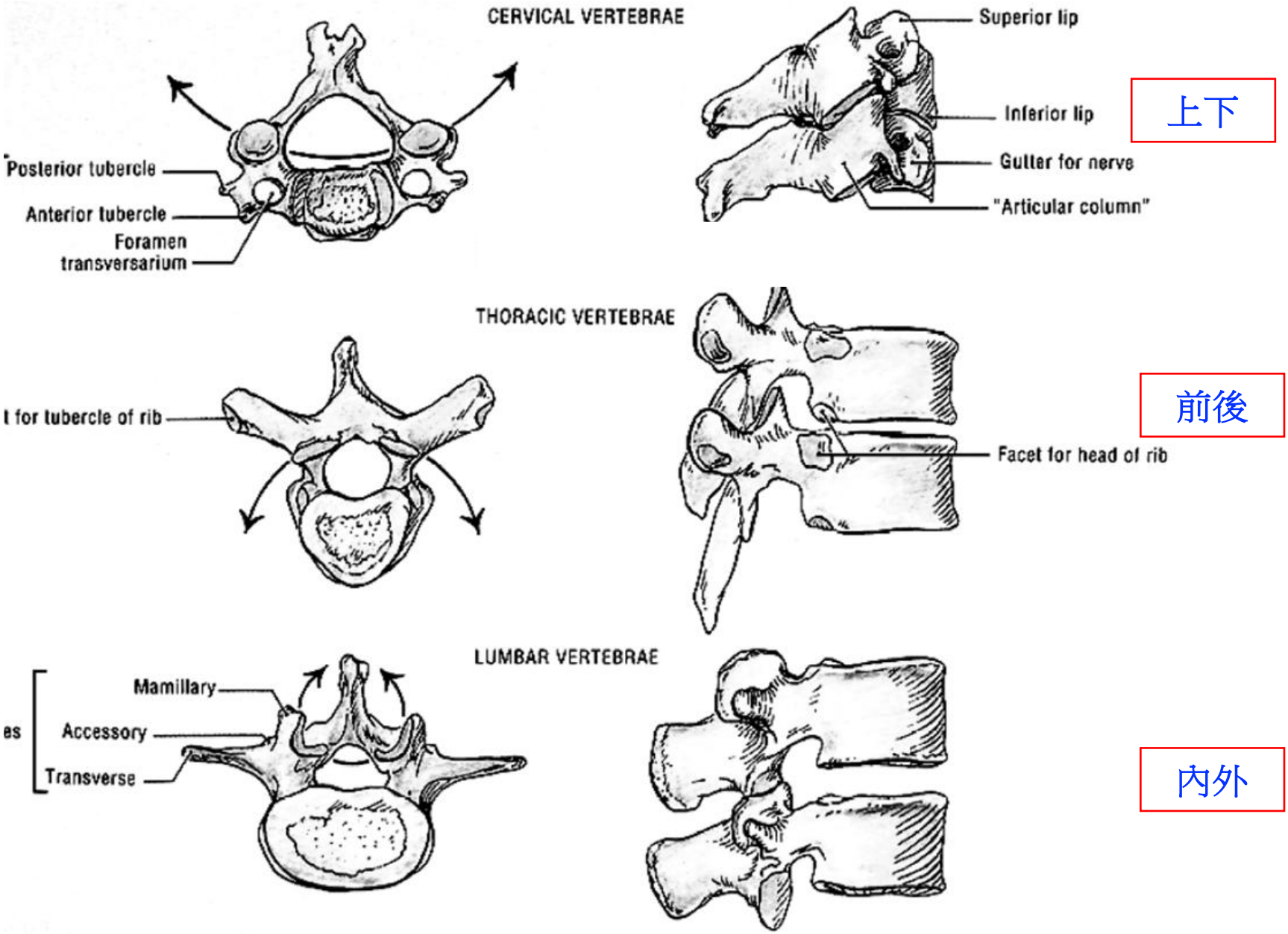
肋關節面

胸椎

腰椎

- 頸椎有<u>橫突孔</u>
- 胸椎有肋關節面跟肋骨形成關節
- **椎體變大**：因為承受的重量變重
- 椎孔在頸椎和腰椎最大(因為脊髓在頸部和腰部會膨大發出支配上肢和下肢的神經)，呈現三角形

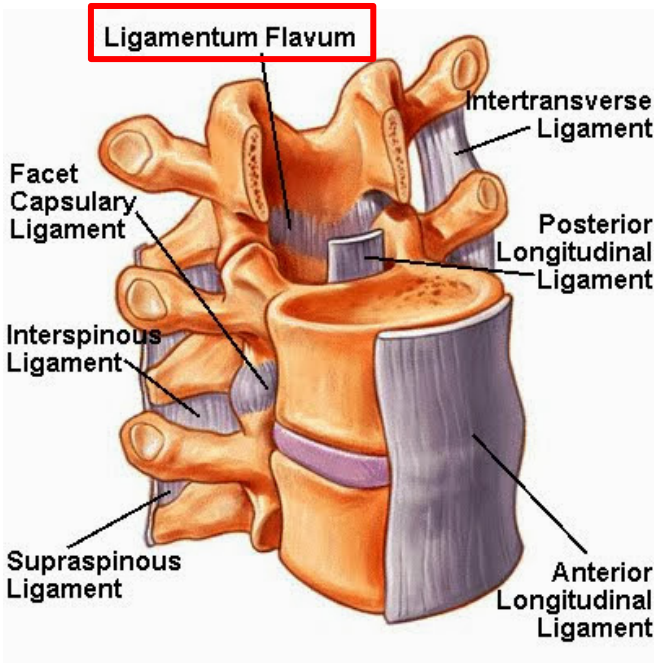
Comparisons of vertebra

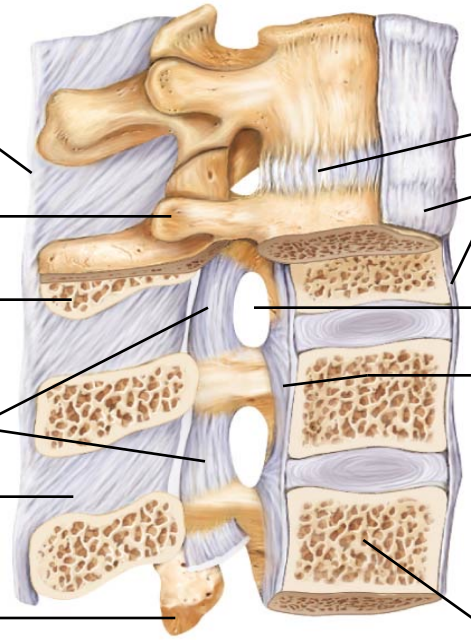


固定脊椎骨的主要韌帶

主要支持韌帶:

1. 前縱韌帶 (Anterior longitudinal ligament)→
   - 連結脊椎前方以及椎間盤
   - 防止過度伸展
2. 後縱韌帶 (Posterior longitudinal ligament)→
   - 狹窄且相對較弱
   - 連結椎體後方和椎間盤
   - 防止過度屈曲
3. 黃韌帶 (Ligamentum flavum)
   - 連接椎板





Supraspinous ligament

Transverse process

Sectioned spinous process

黃韌帶 **Ligamentum flavum**

Interspinous ligament

Inferior articular process

Intervertebral disc

Anterior longitudinal ligament 前縱韌帶

Intervertebral foramen

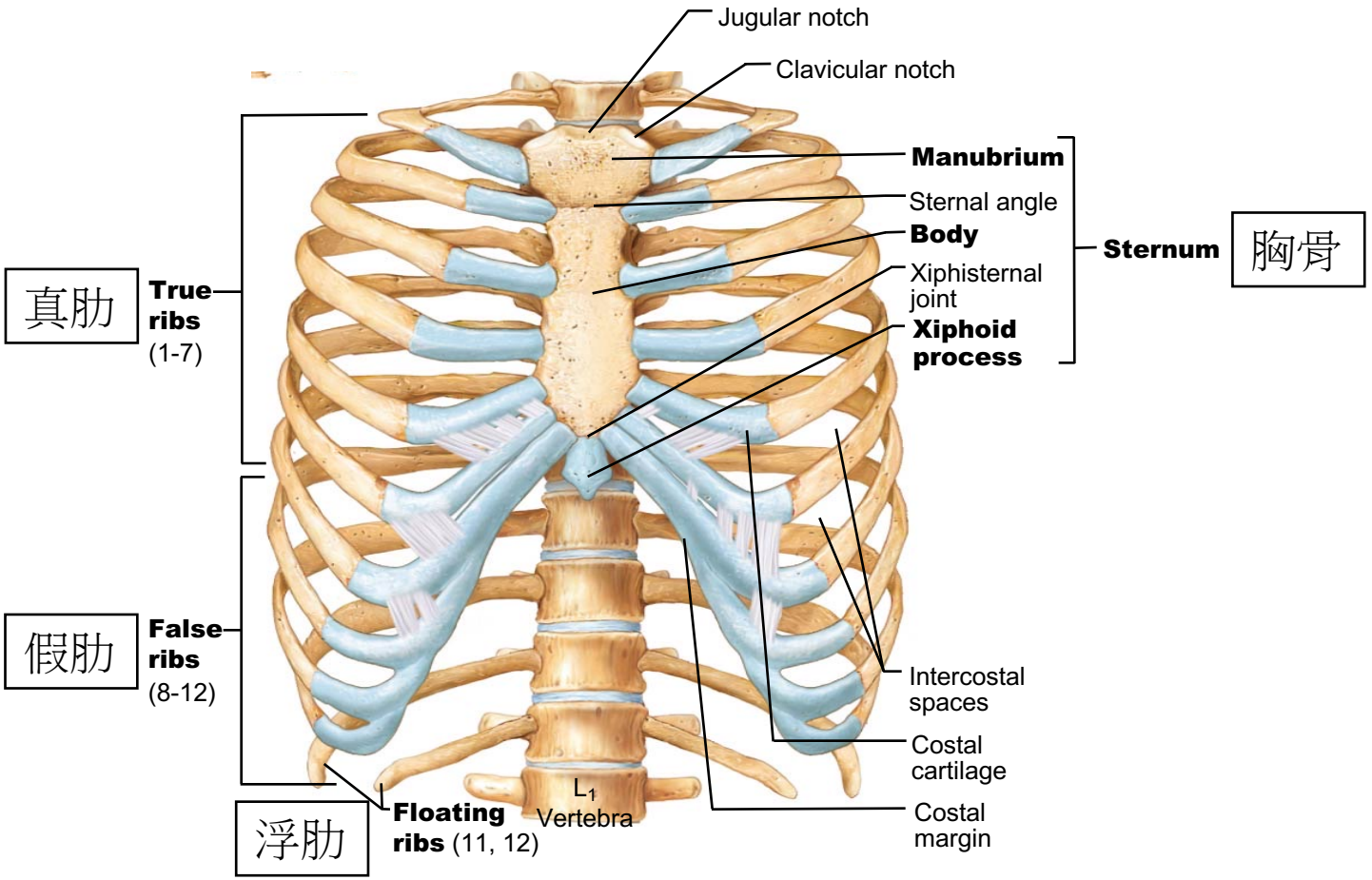
Posterior longitudinal ligament

後縱韌帶

Sectioned body of vertebra

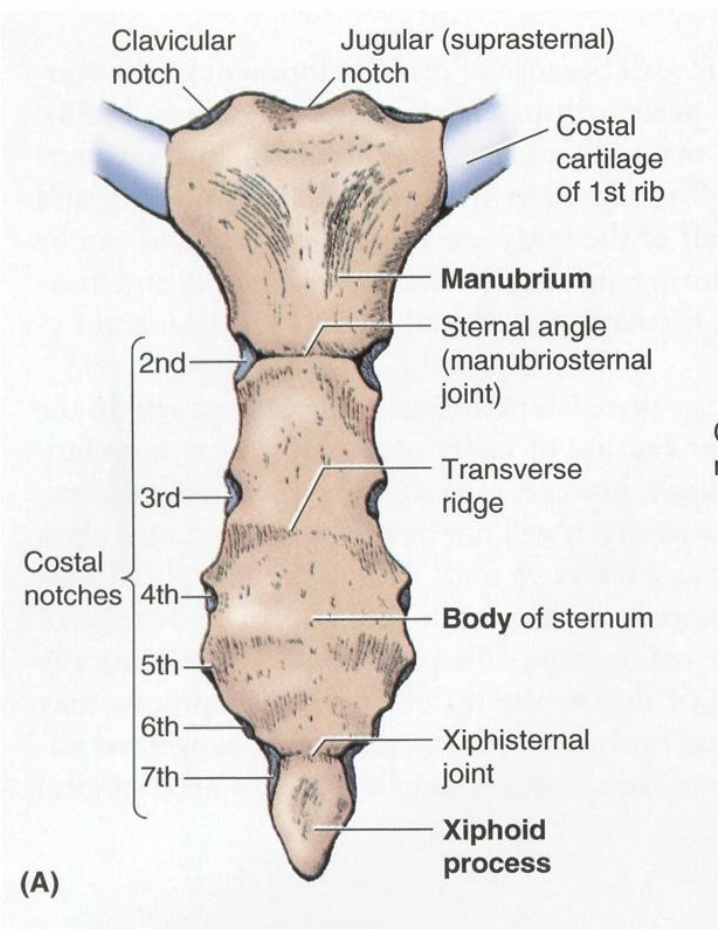
胸廓 (thoracic cage)

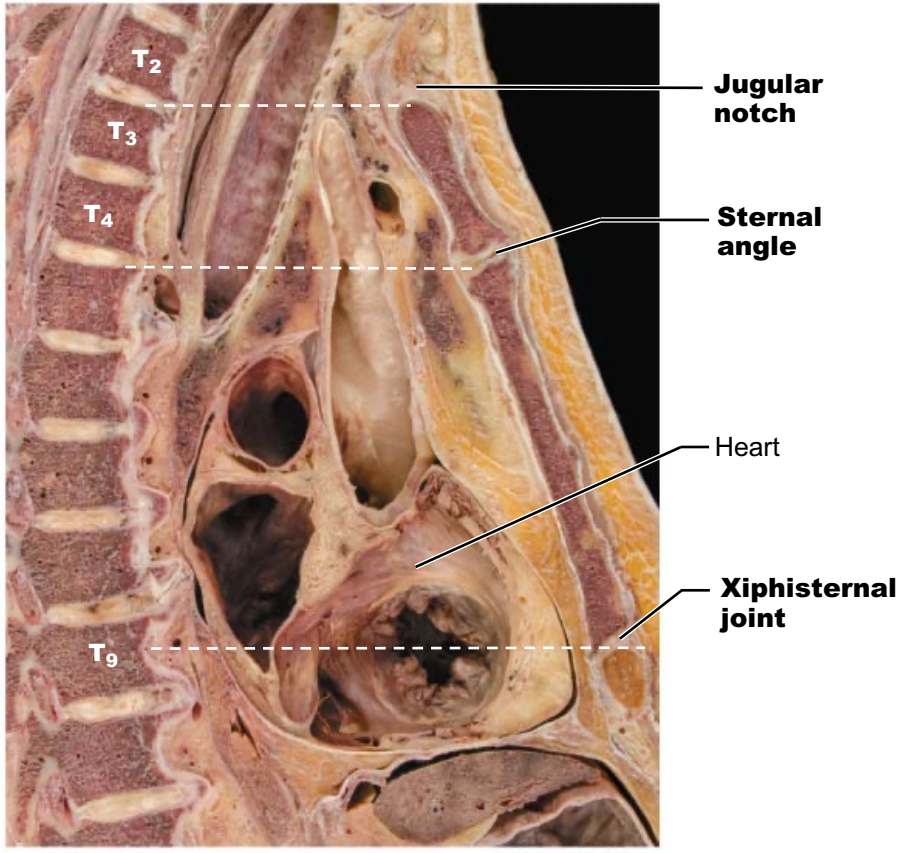
- 組成：後方→胸椎
  側邊→肋骨
  前方→胸骨和肋軟骨
- 功能: 保護胸腔器官, 支持肩膀的構造和上肢, 提供背部肌肉的附著處



胸骨 (sternum)

- 由三個部分組成:
  - -胸骨柄 (manubrium)→跟鎖骨形成關節
  - -胸骨體 (body)→會跟肋骨形成關節
  - -劍突 (xiphoid process) →四十歲左右會骨化





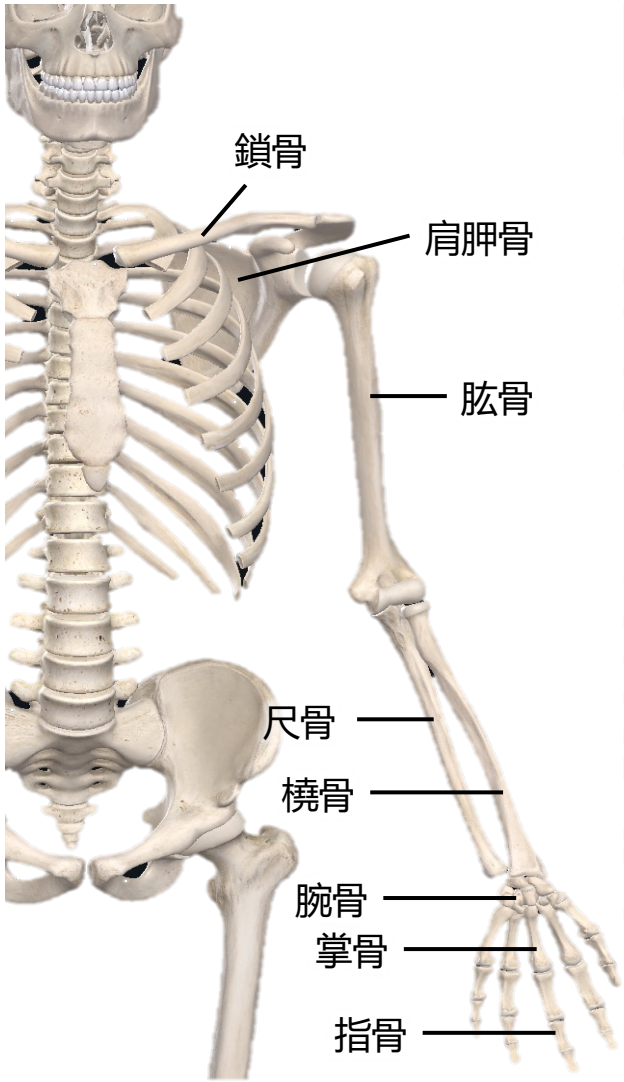
上肢骨骼

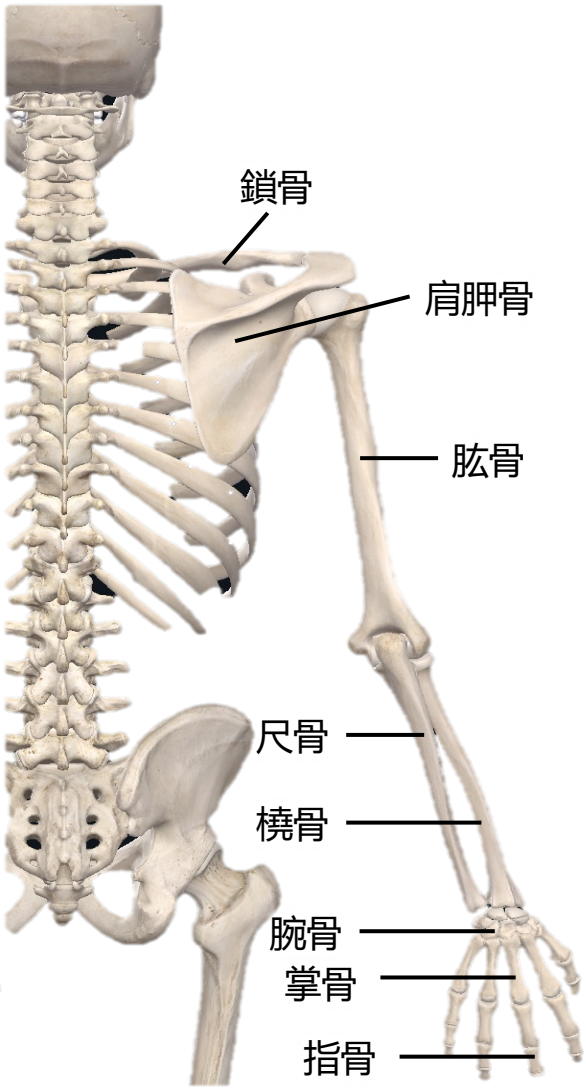
- 肩帶
  - 肩胛骨
  - 鎖骨
- 上臂
  - 肱骨
- 前臂
  - 尺骨
  - 橈骨
- 手部
  - 腕骨
  - 掌骨
  - 指骨

肩關節

肘關節

腕關節





肩帶

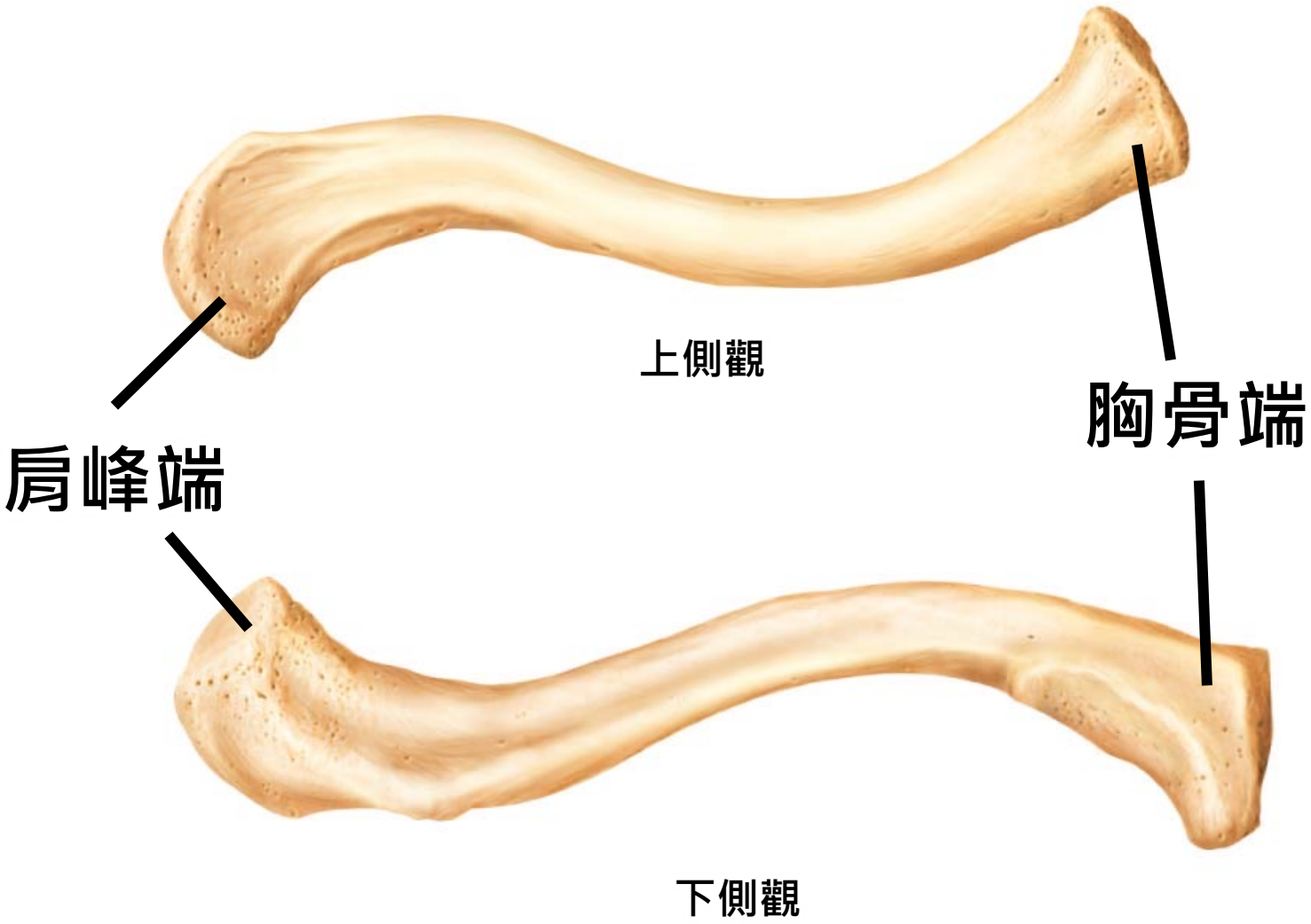
鎖骨

肱骨

肩胛骨

前側觀

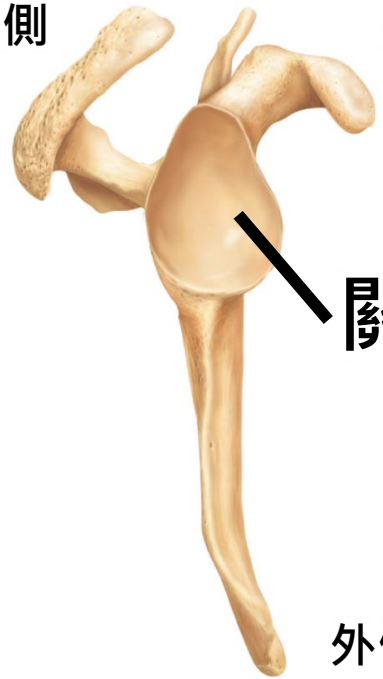
鎖骨



肩胛骨

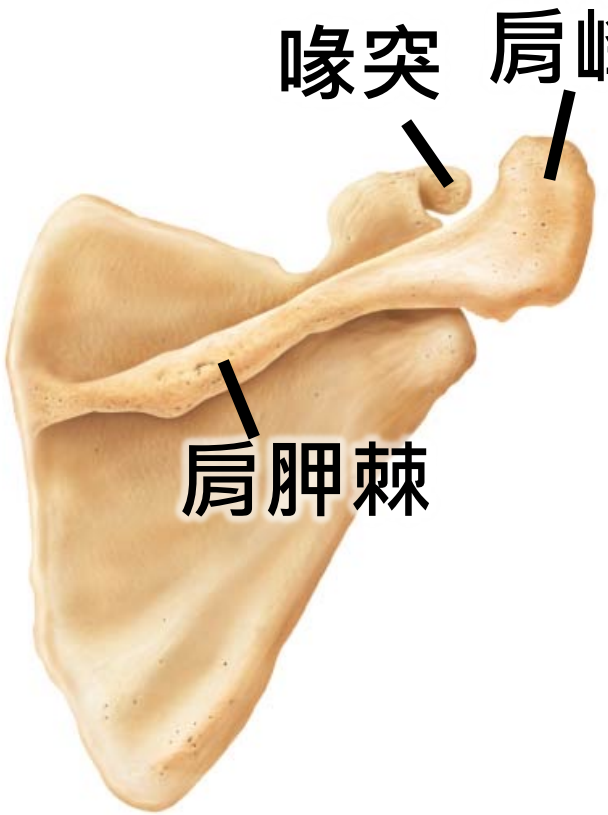
後側

前側



外側觀

前側觀



後側觀

肱骨

肱骨頭

大結節

小結節

大結節

鷹嘴窩

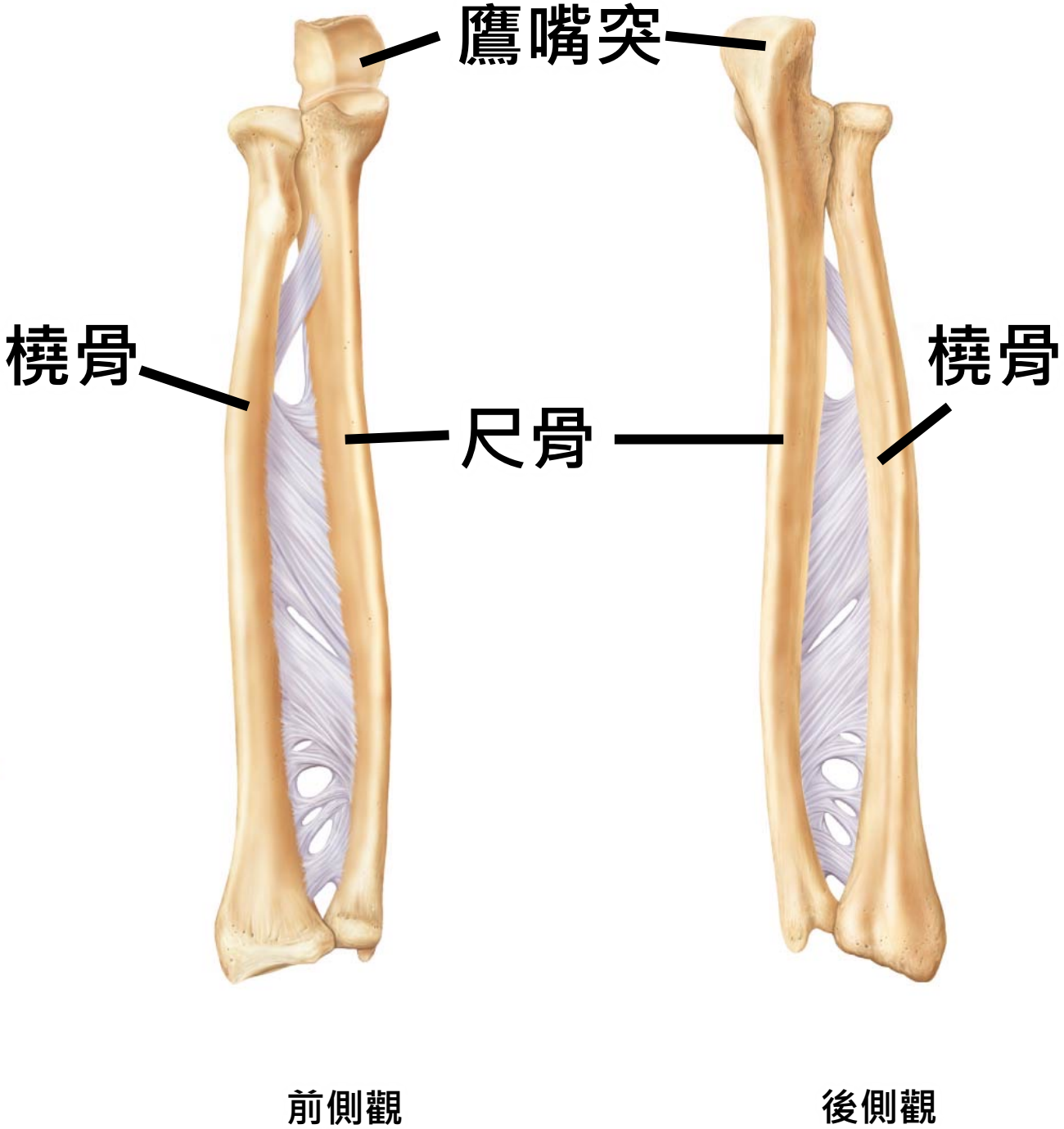
內上髁

外上髁

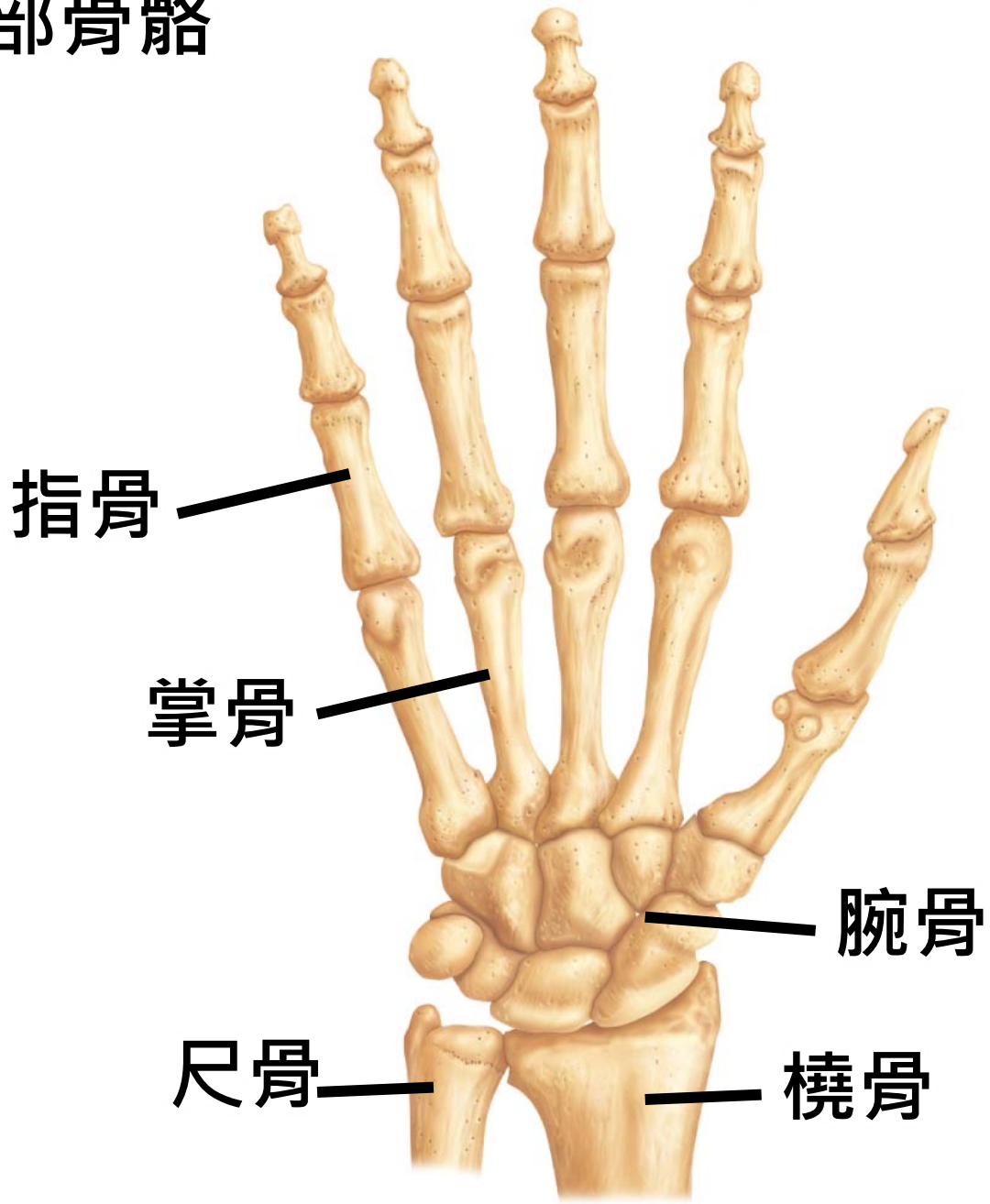
前側觀

後側觀

橈骨、尺骨

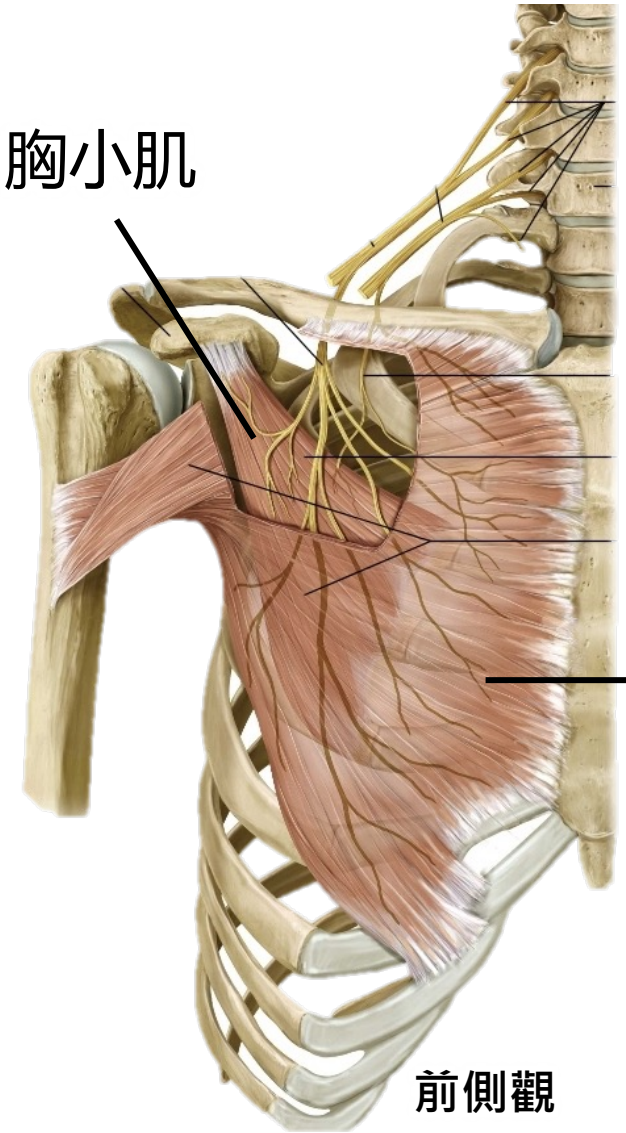


手部骨骼

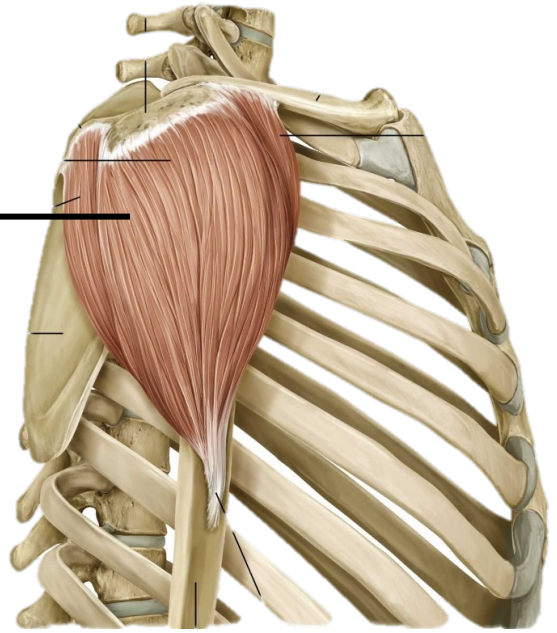


掌側觀

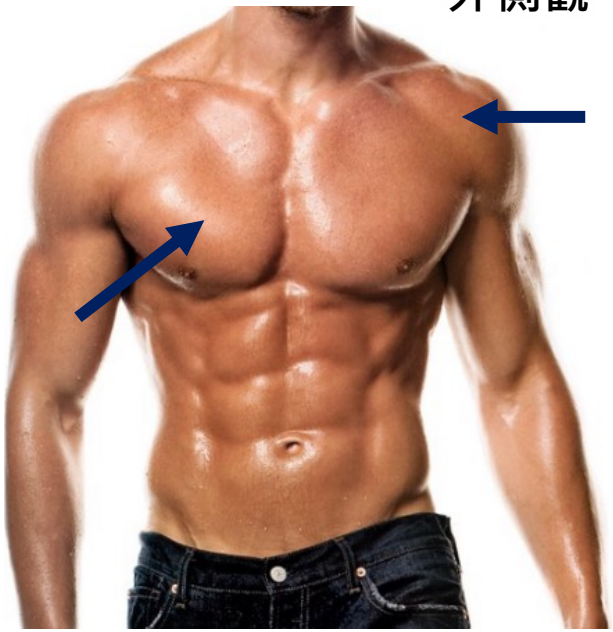
胸部及肩部前側肌肉



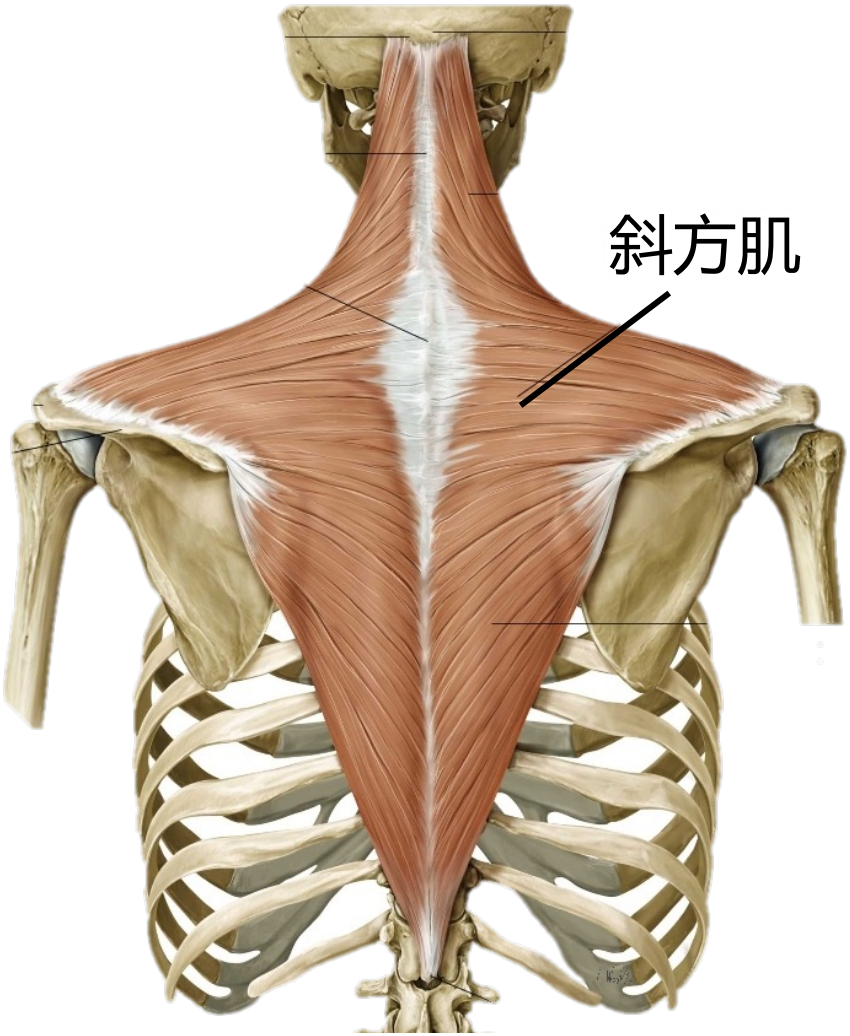
前側觀

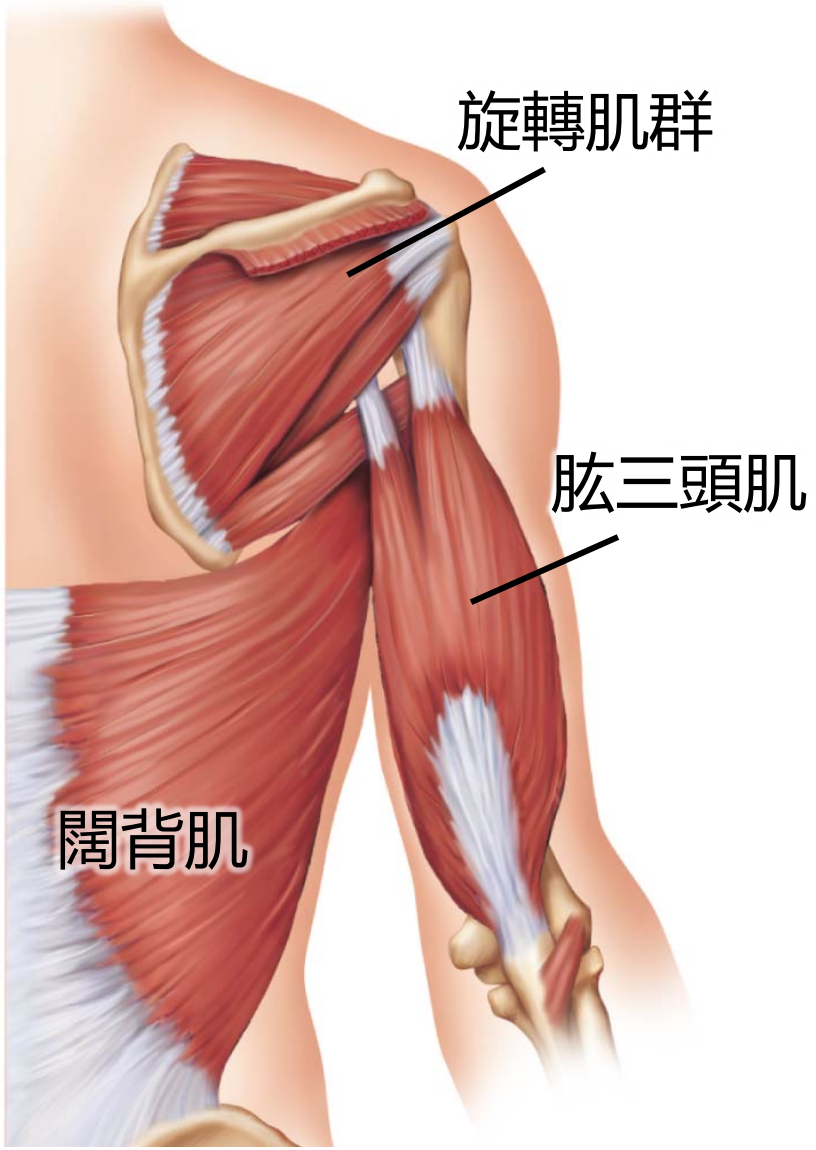


外側觀



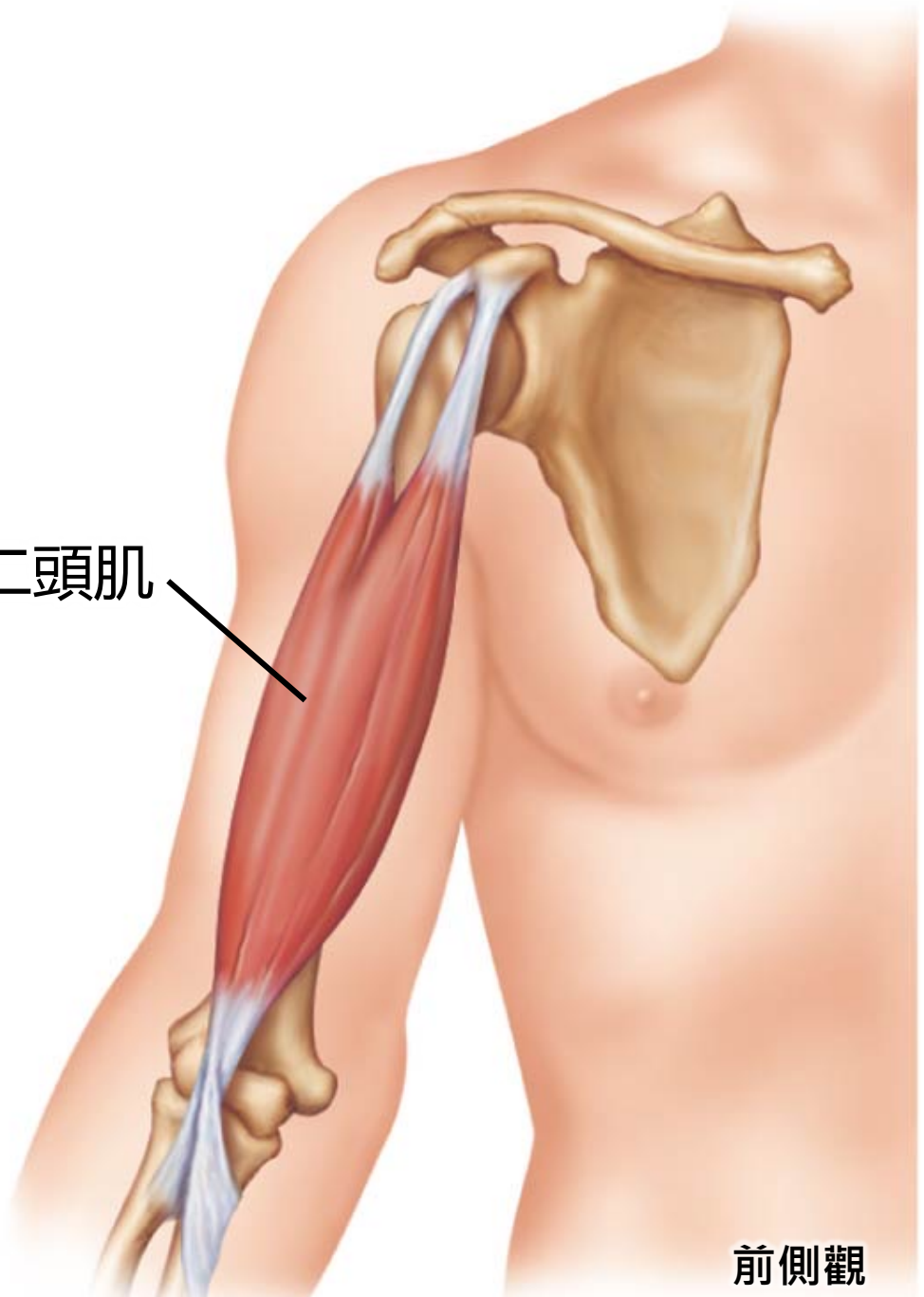
背部、肩部及上臂後側肌肉



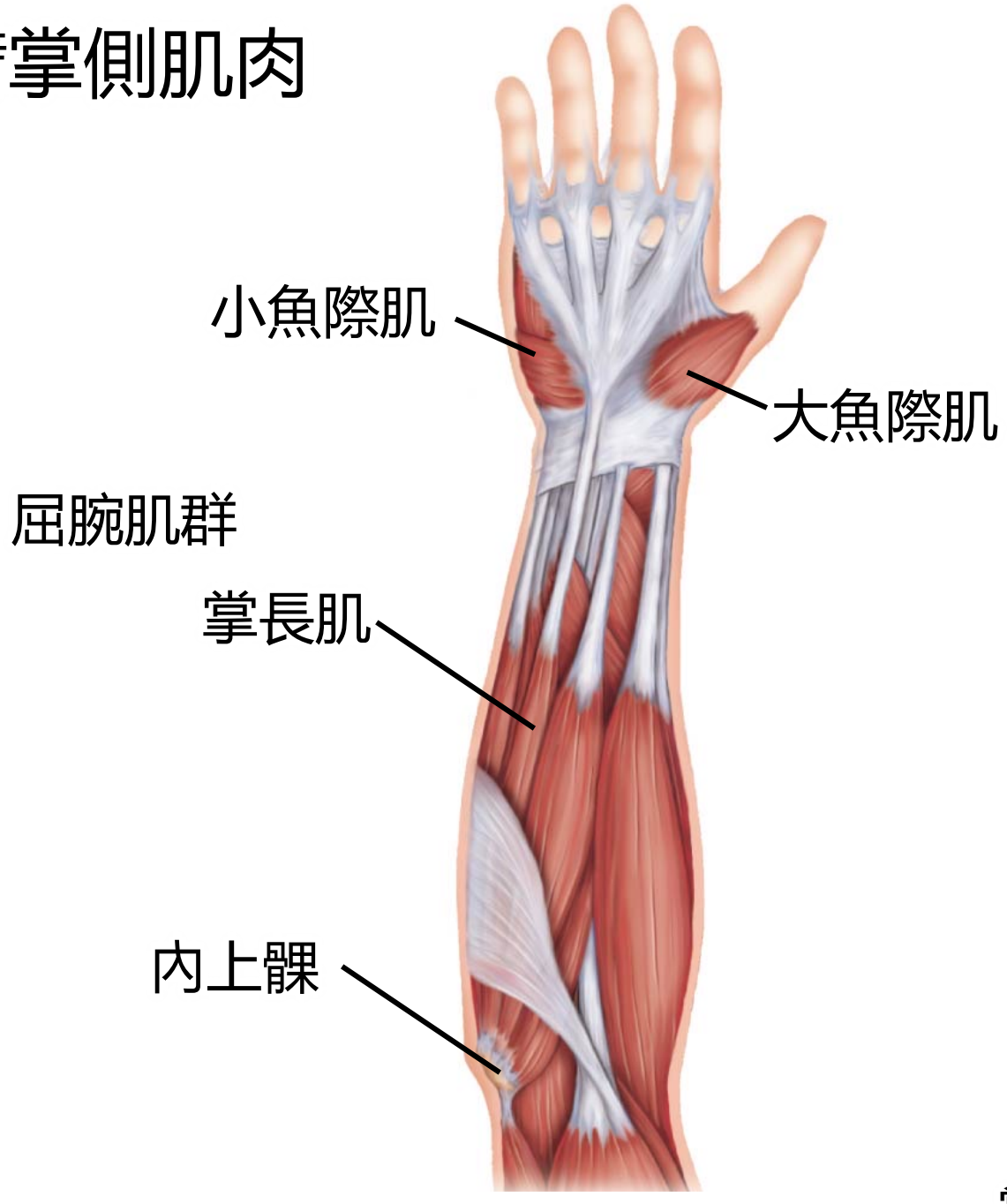


後側觀

上臂前側肌肉



前臂掌側肌肉



掌側觀

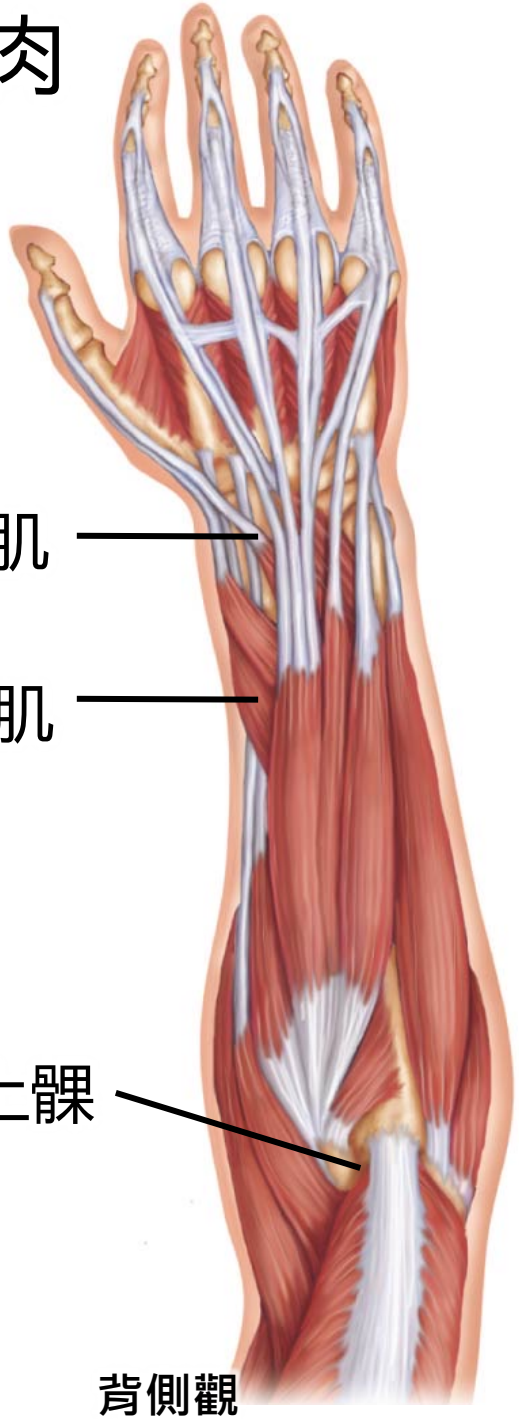
前臂背側肌肉

伸腕肌群

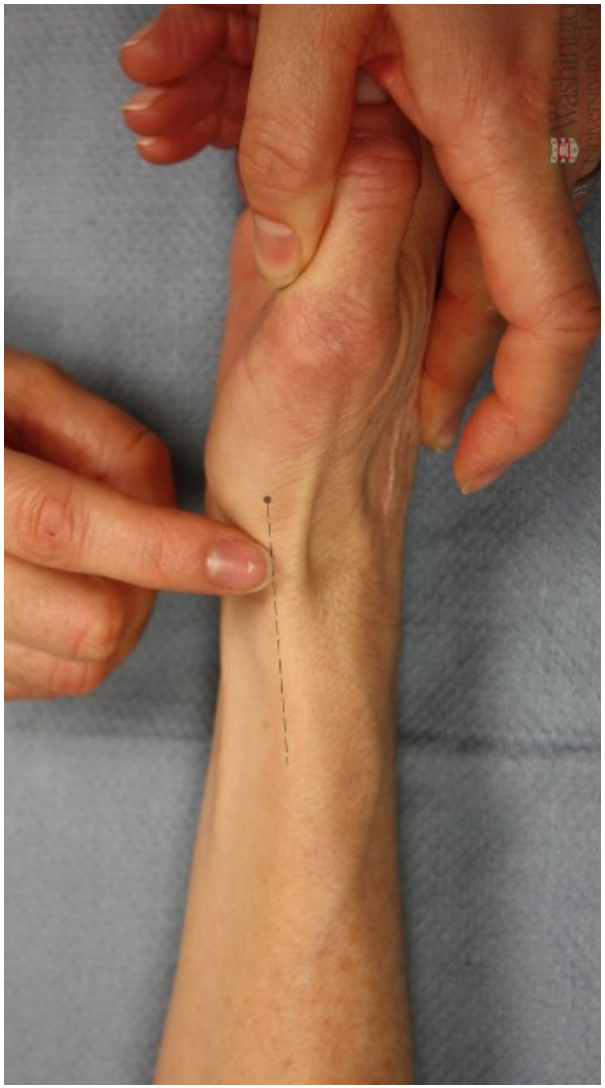
伸姆長肌

外展姆長肌

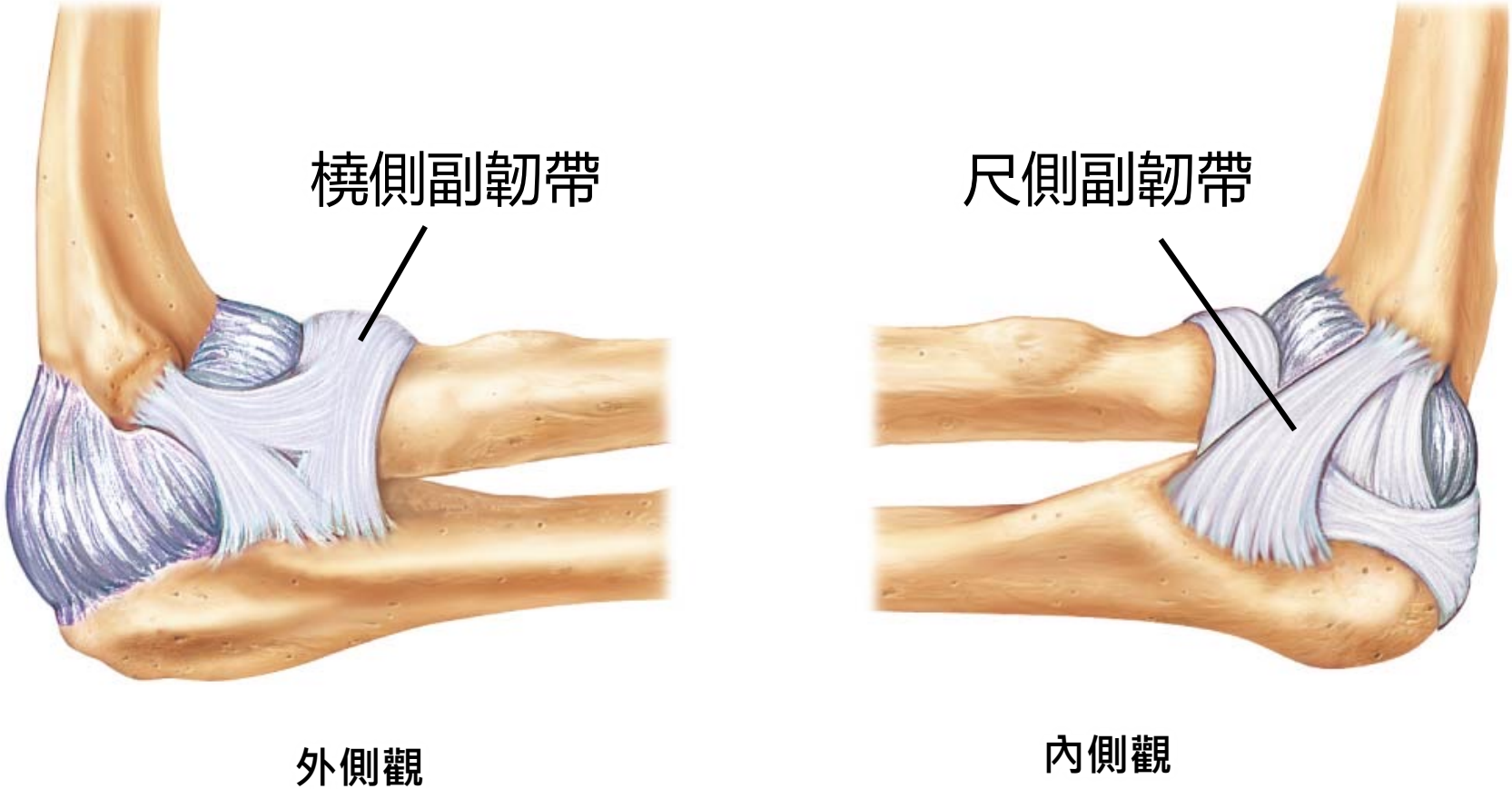
外上髁



背側觀



肘關節靭帯



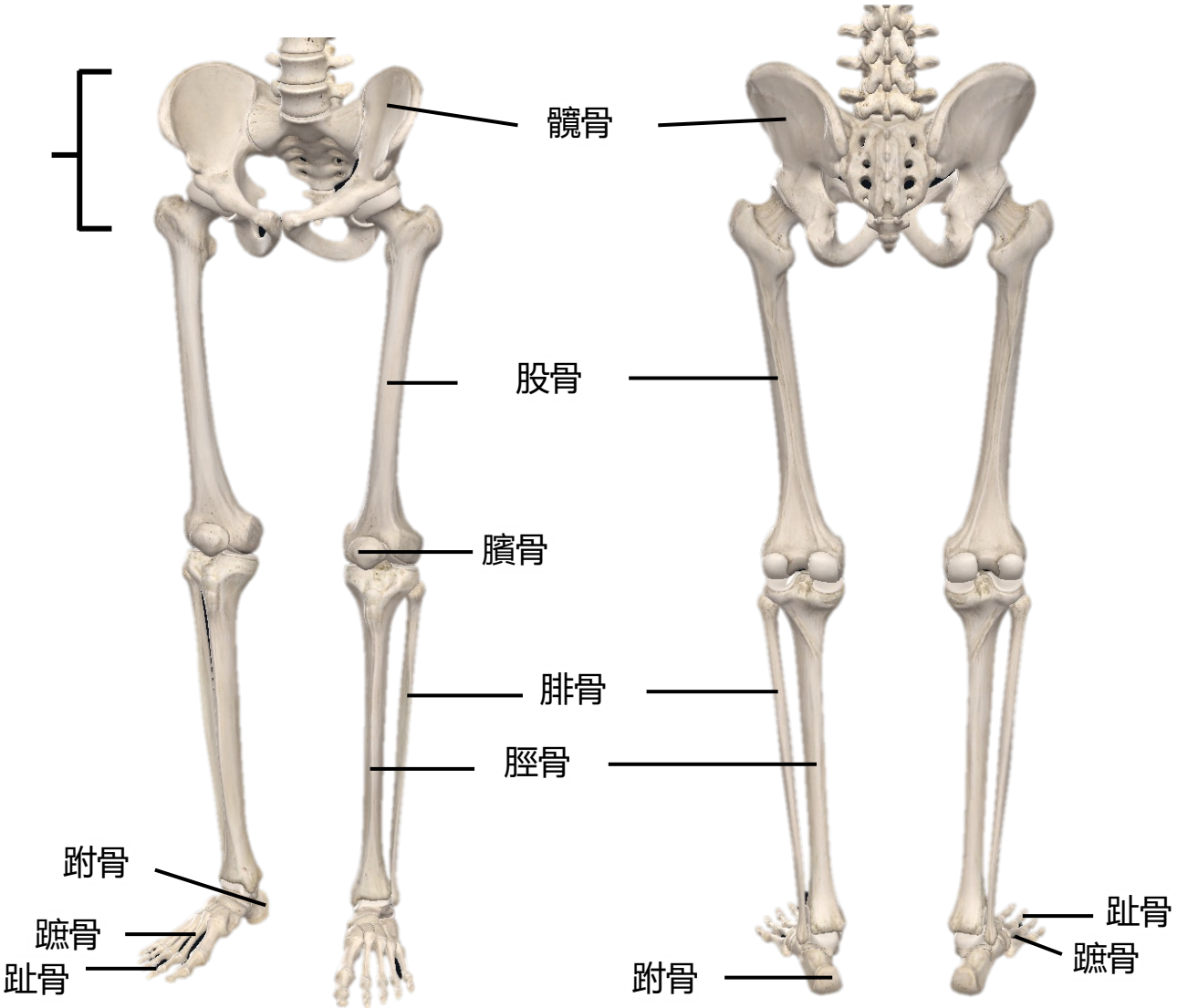
下肢骨骼

- 骨盆
  - 薦骨
  - 尾骨
  - 髖骨
- 大腿
  - 股骨
  - 髕骨
- 小腿
  - 脛骨
  - 腓骨
- 足部
  - 跗骨
  - 蹠骨
  - 趾骨

髖關節

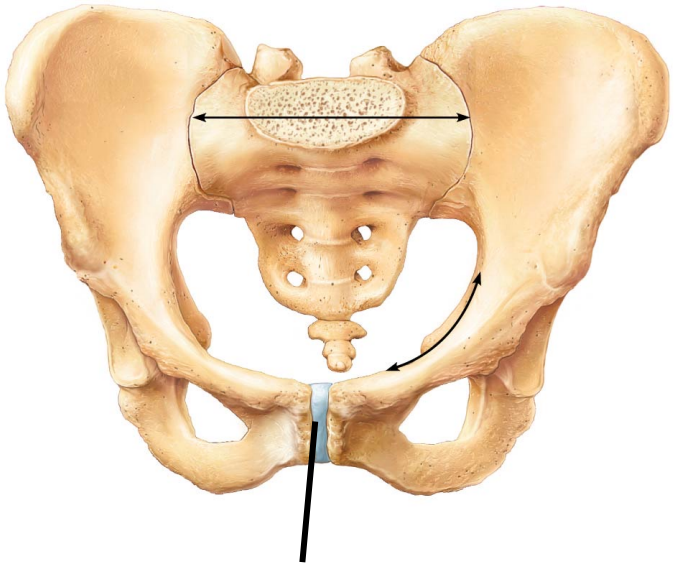
膝關節

踝關節

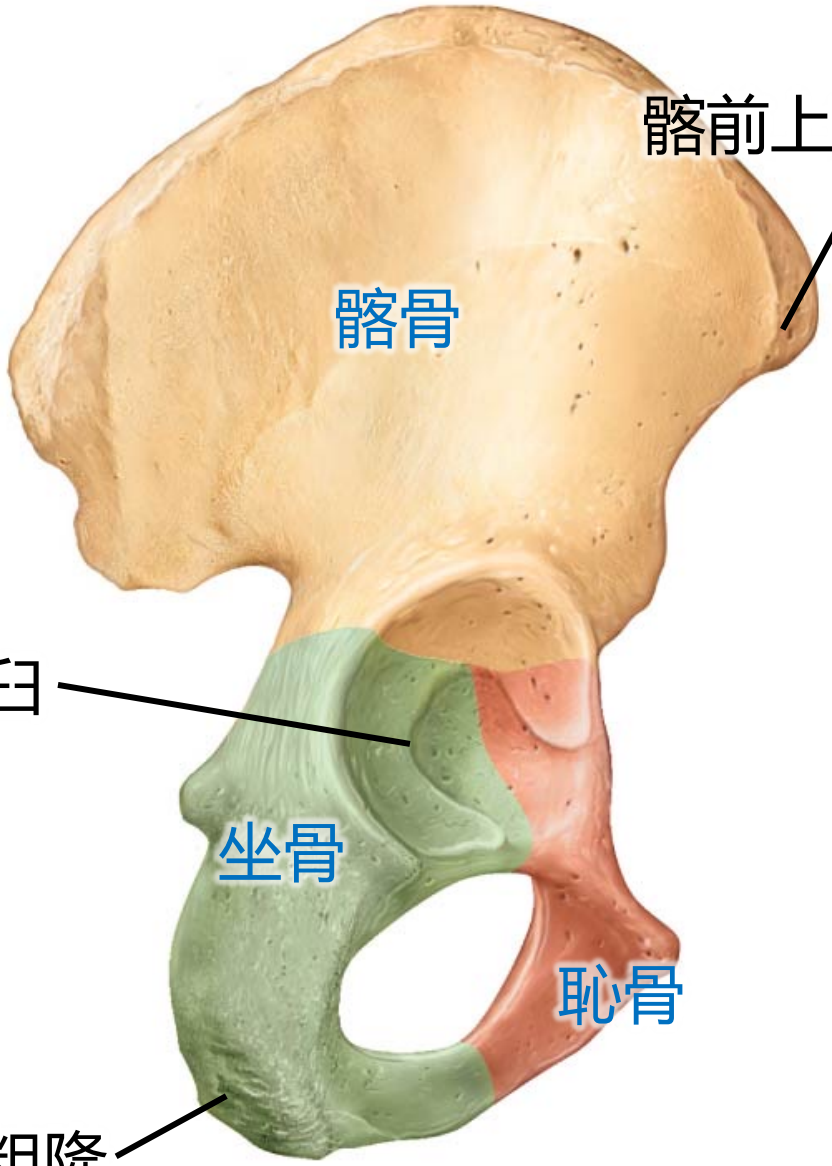


前側觀　　後側觀

髖骨

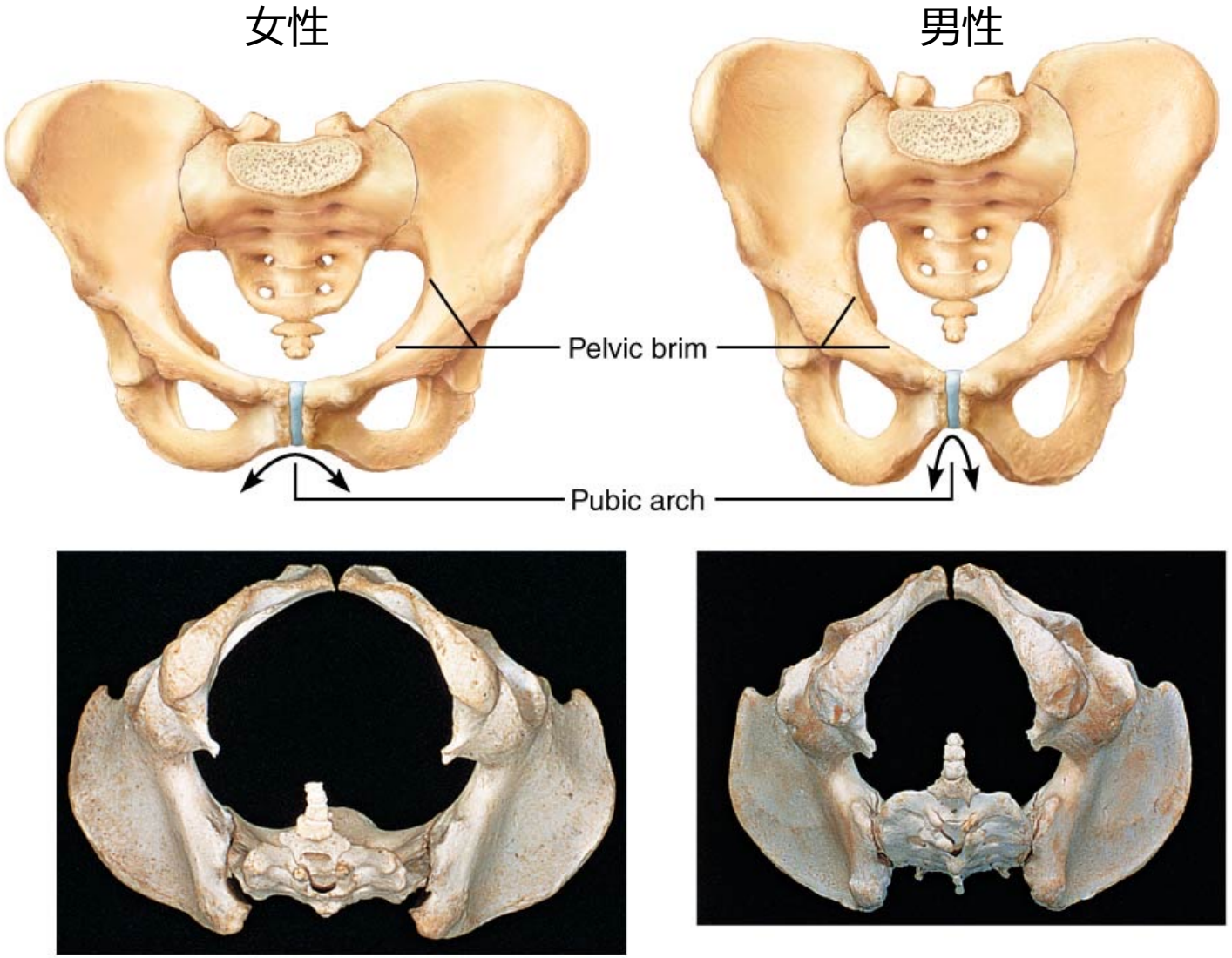


恥骨聯合



外側觀

男女性髖骨比較

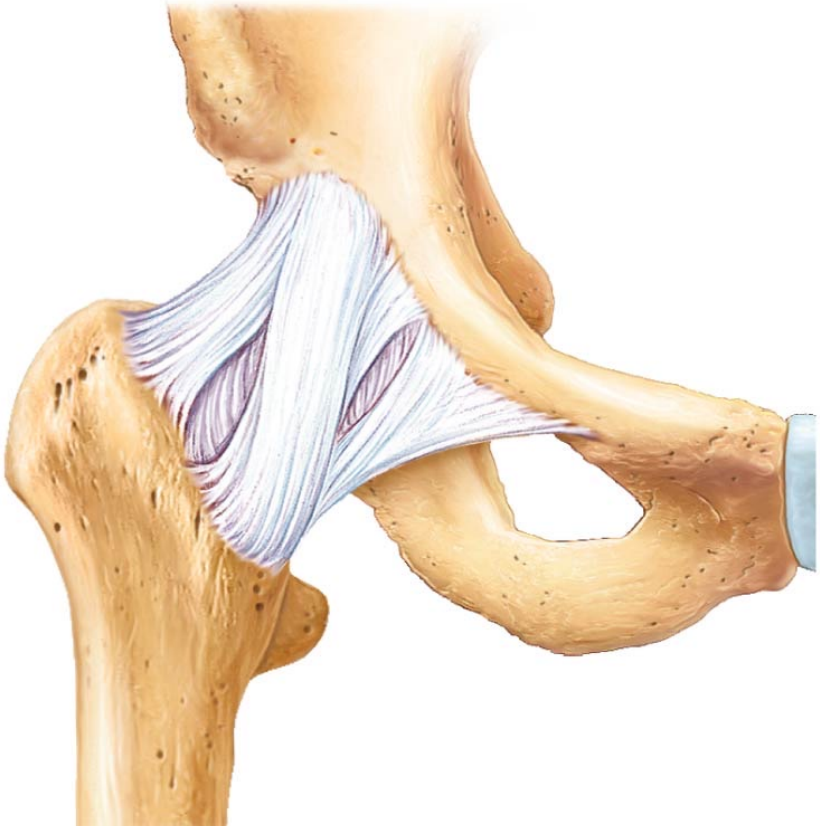


股骨

前側觀

後側觀

髖關節



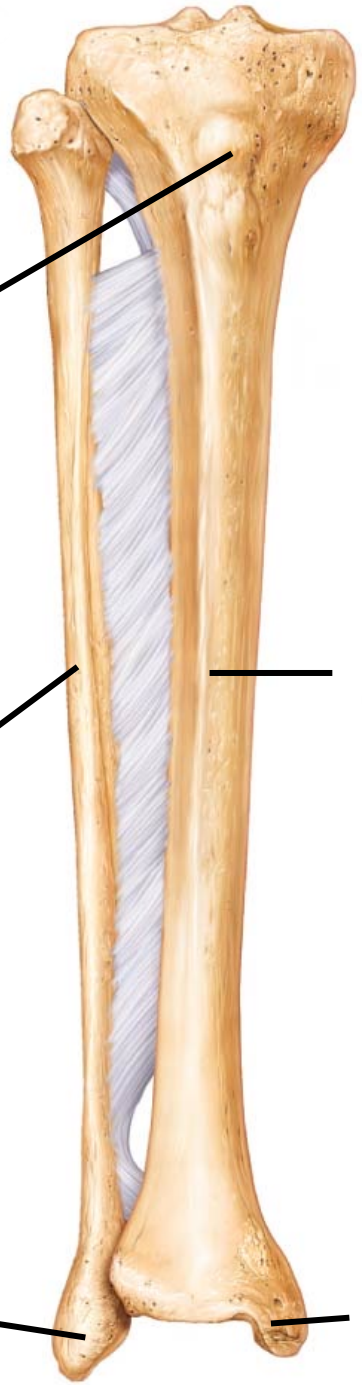
前側觀

髕骨

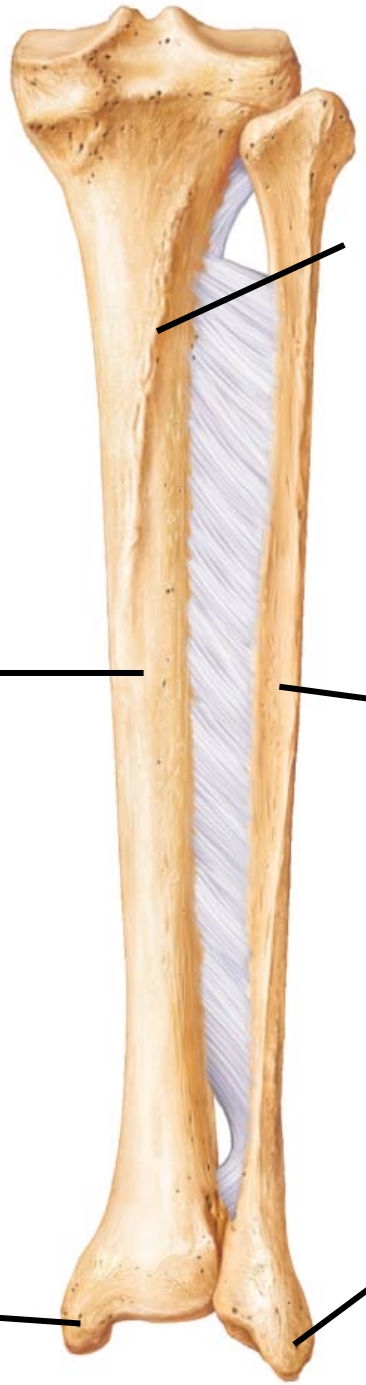
前側觀

後側觀

脛骨、腓骨

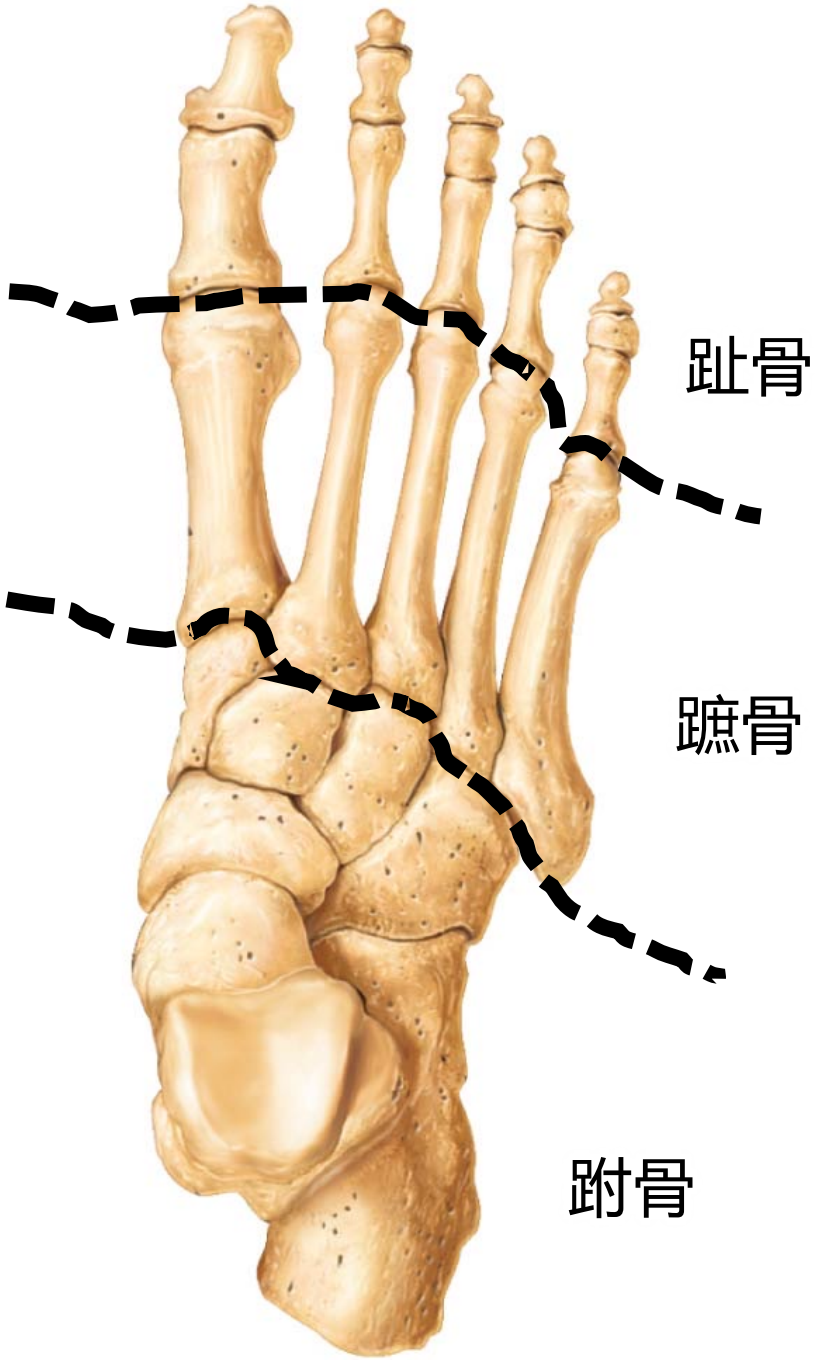


前側觀



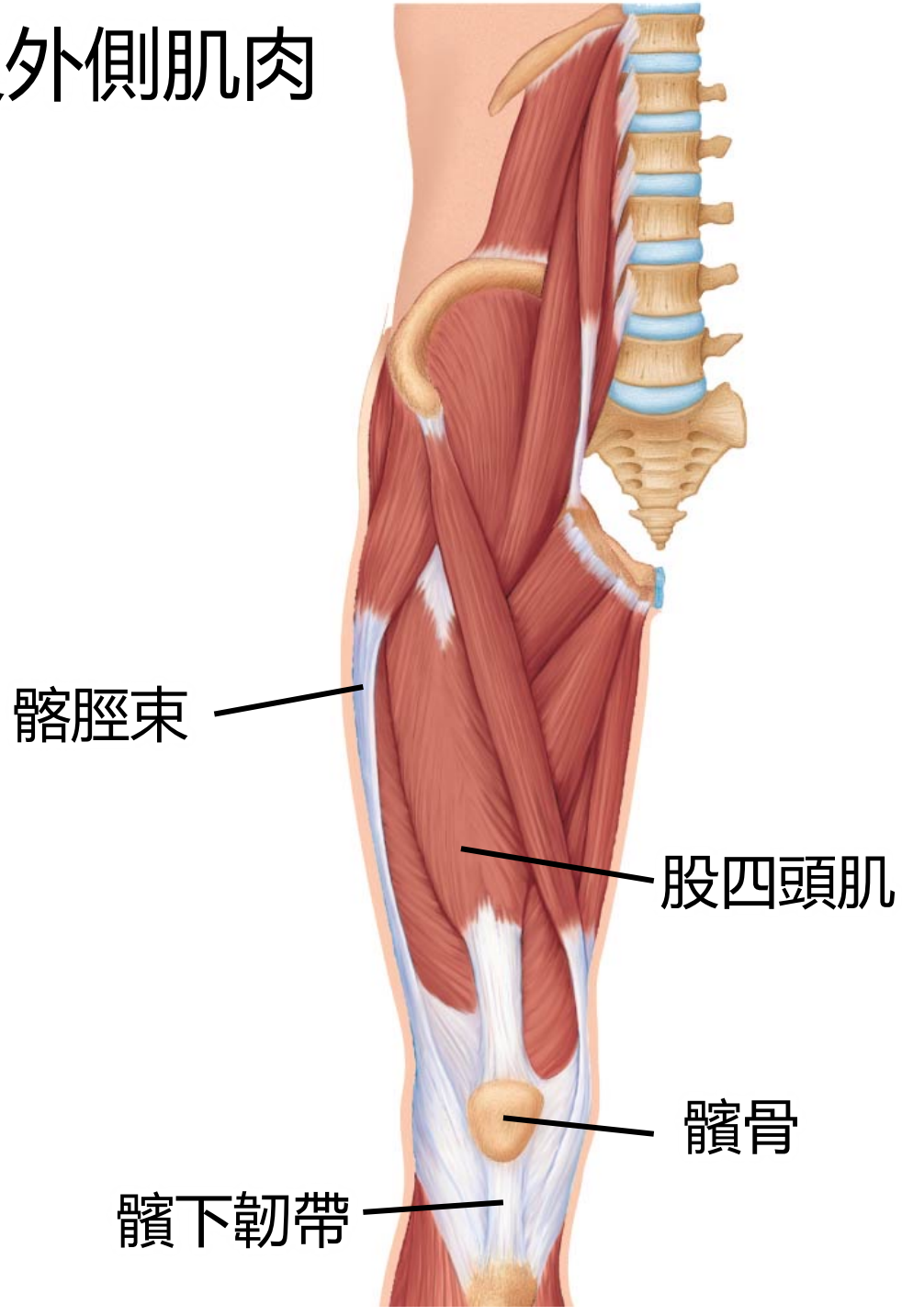
後側觀

腳部骨骼



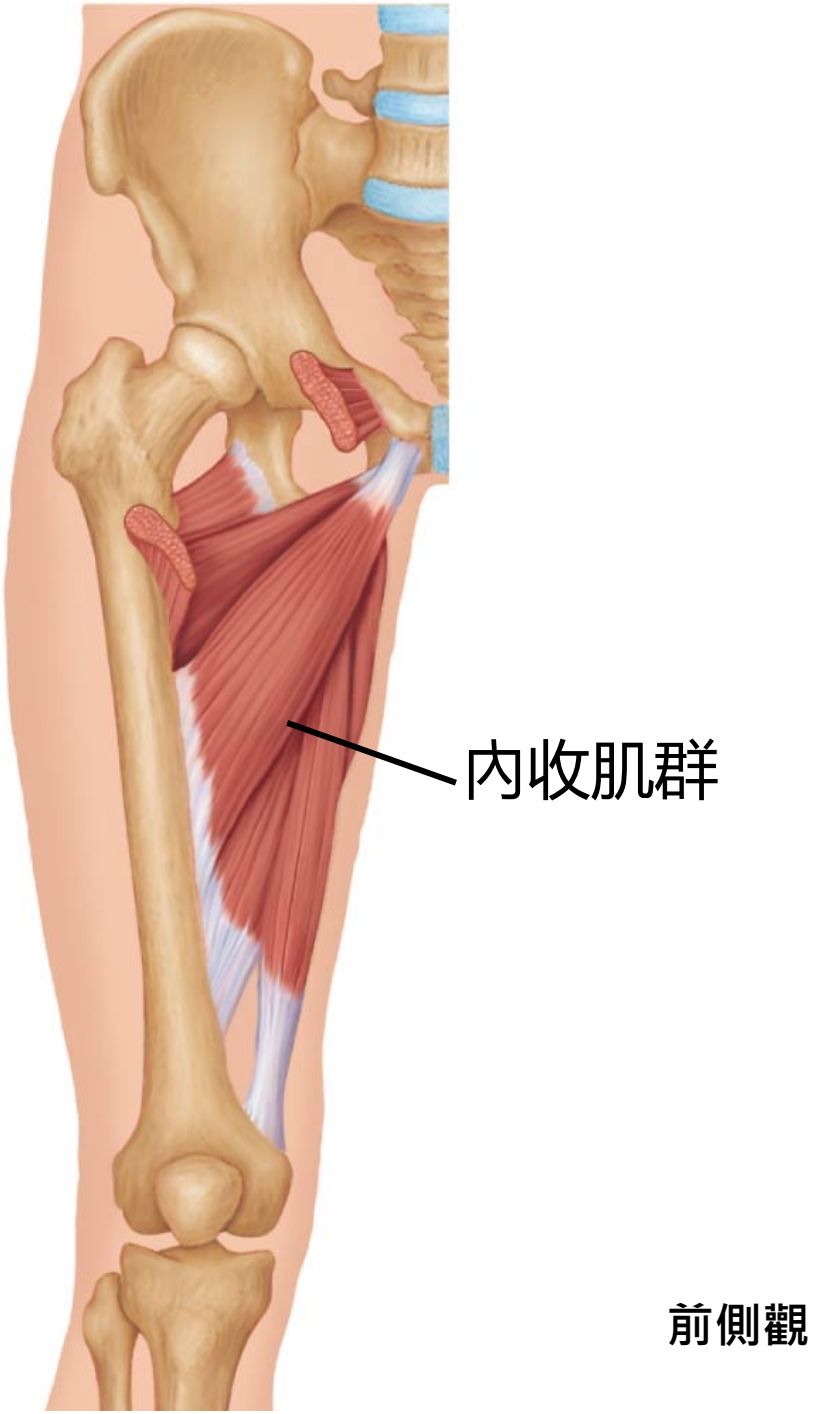
上側觀

大腿前側及外側肌肉



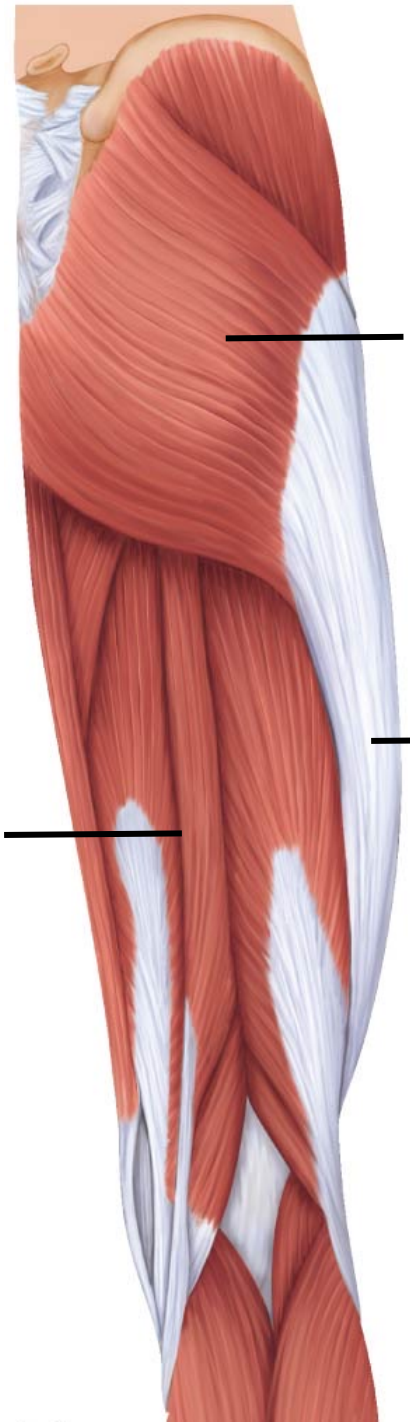
前側觀

大腿内側肌肉



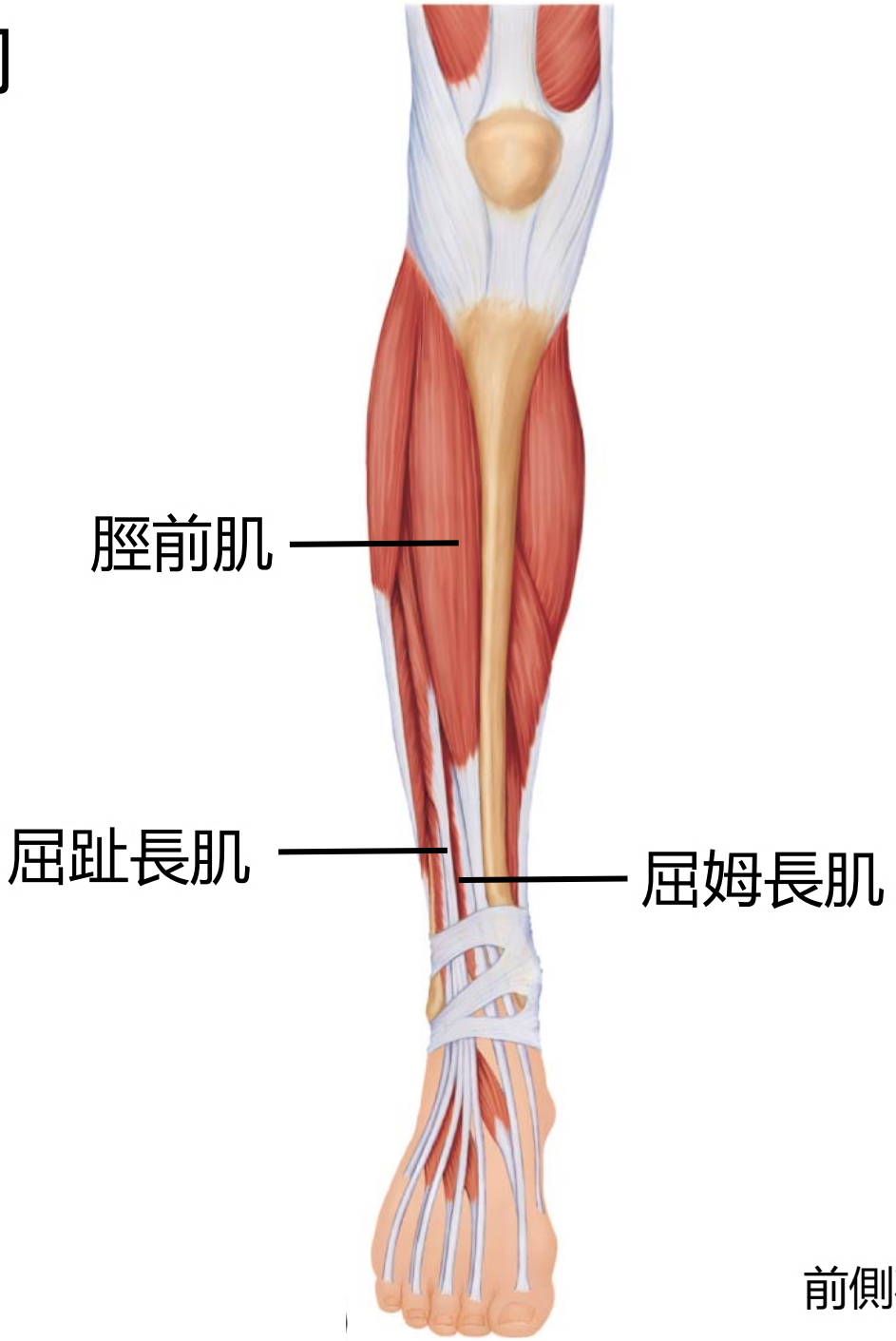
前側觀

大腿後側肌肉



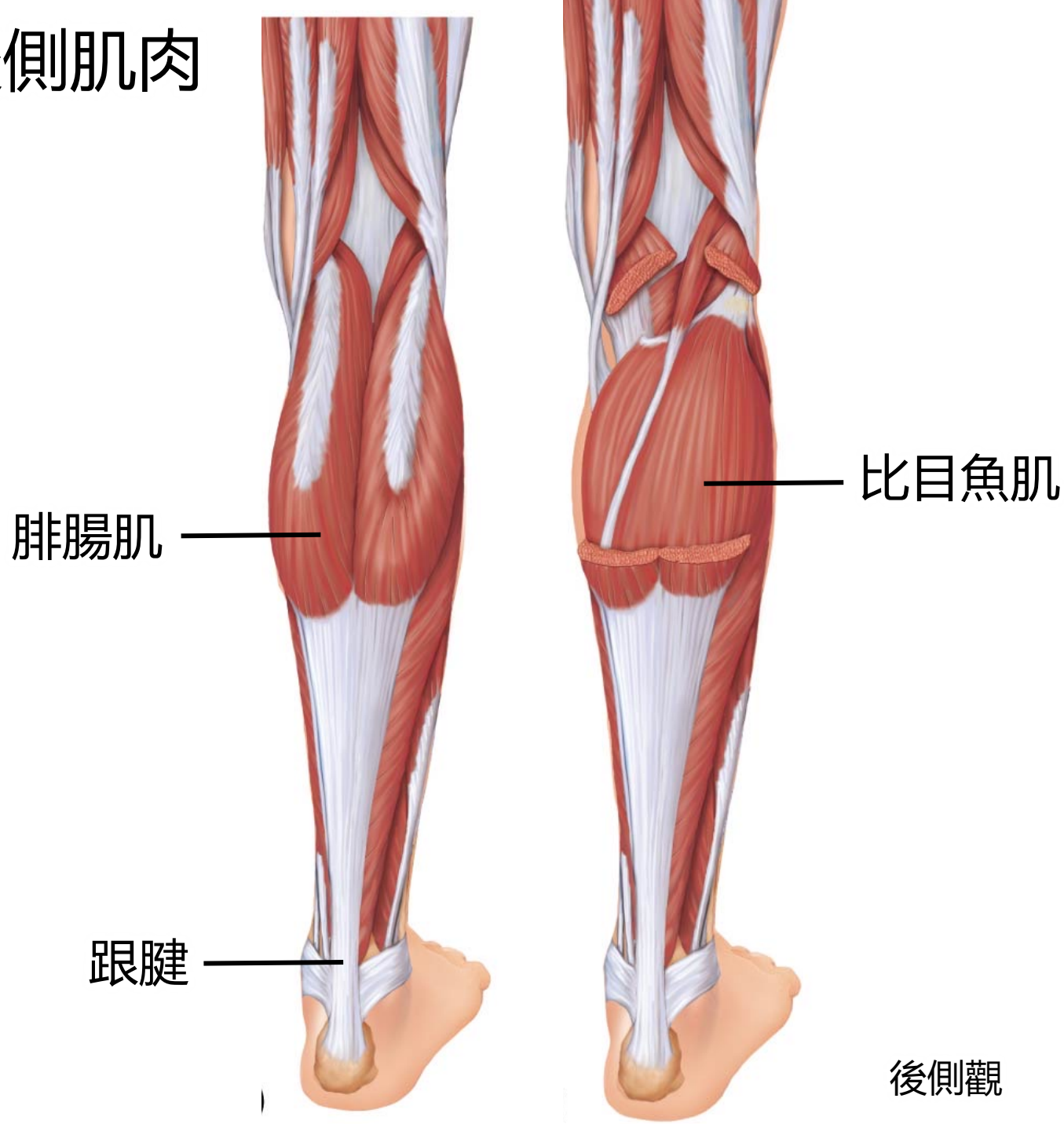
後側觀

小腿前側肌肉

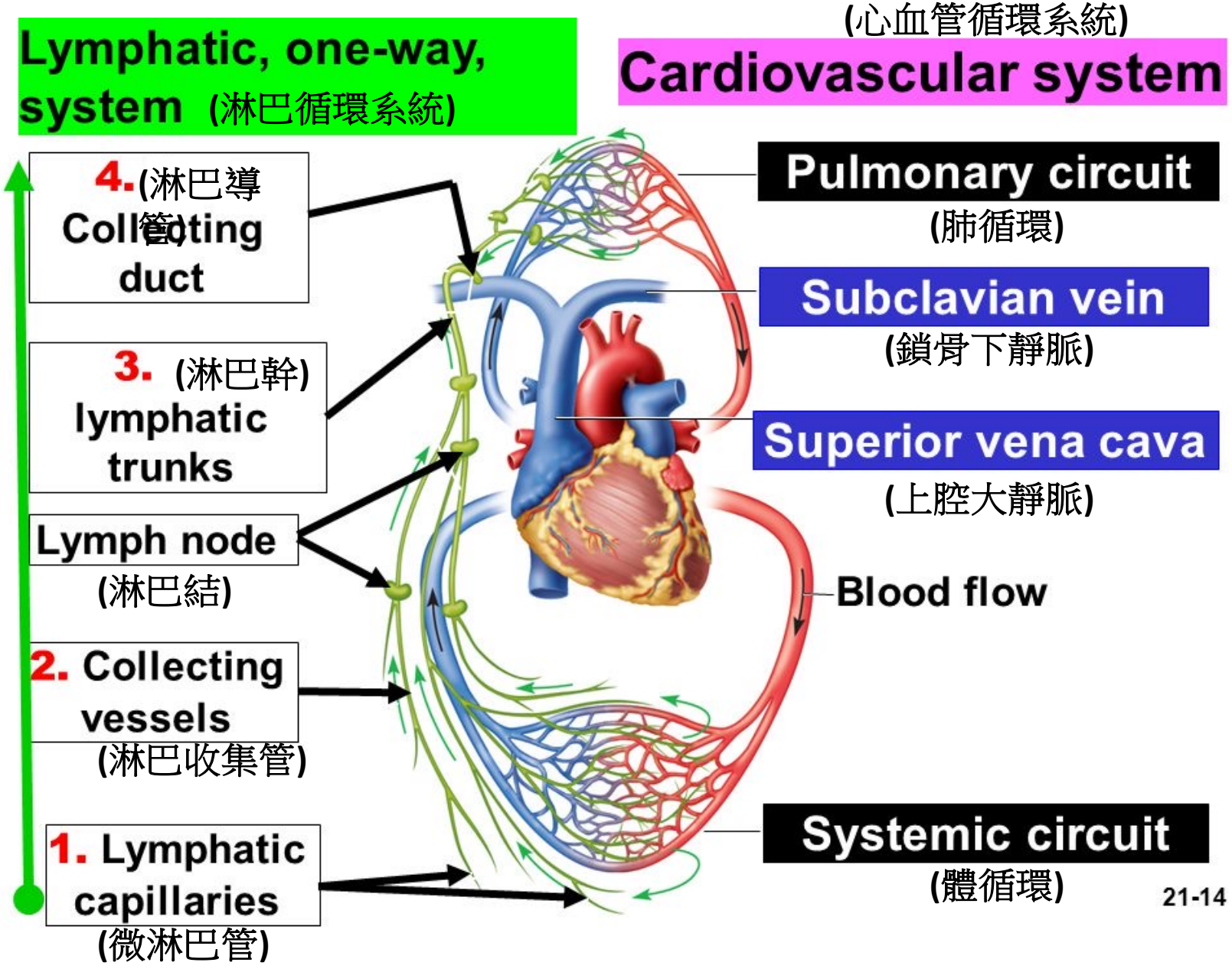


前側觀

小腿後側肌肉

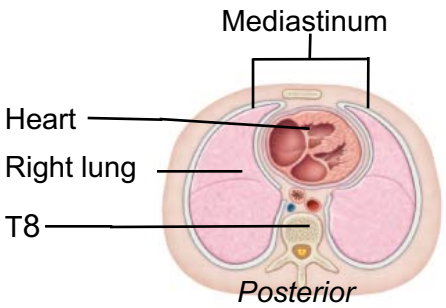


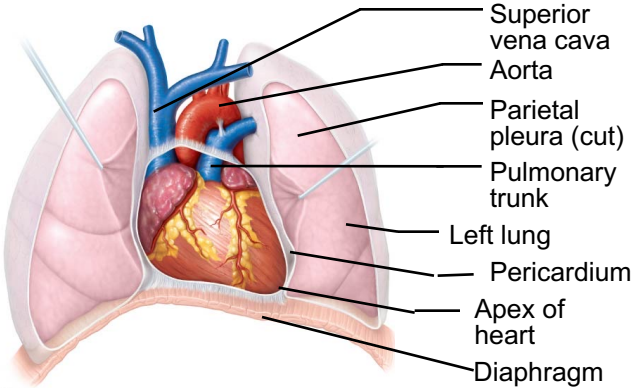
循環系統 (Cardiovascular system)

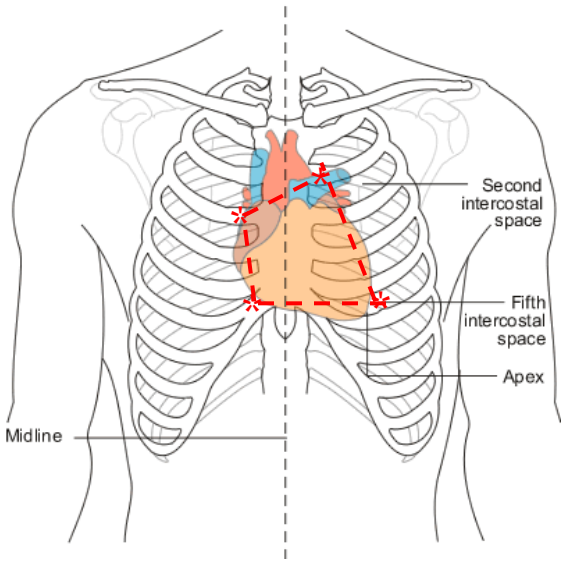


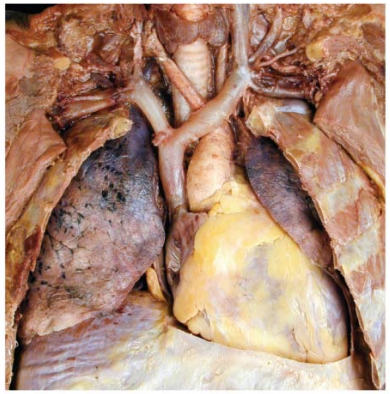
心臟在胸腔的位置

- 位於肺臟之間
- 健康的心臟重量約為250-350 g
- 心尖在左側中線
- 心臟的底部是寬闊的後表面
- 心臟的四個角落:
  1. 右上角→
     第三肋軟骨和胸骨之間
  2. 右下角→
     第六肋軟骨，胸骨右側
  3. 左上角→
     第二肋軟骨，胸骨左側
  4. 左下角→
     第五肋間和鎖骨中線交會處







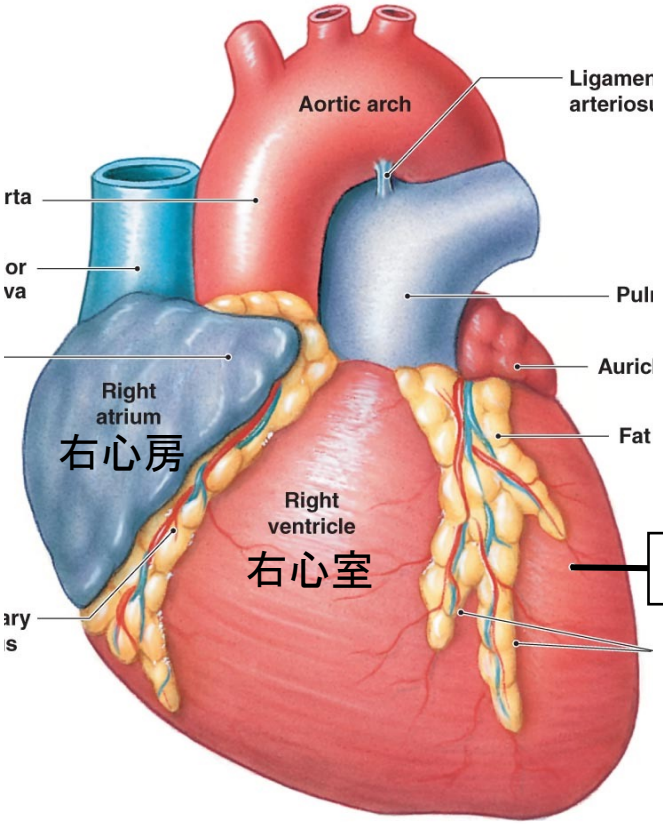


(Color atlas of anatomy, Rohen)

心臟的腔室

- 上方腔室 –左右心房
- 下方腔室 –左右心室

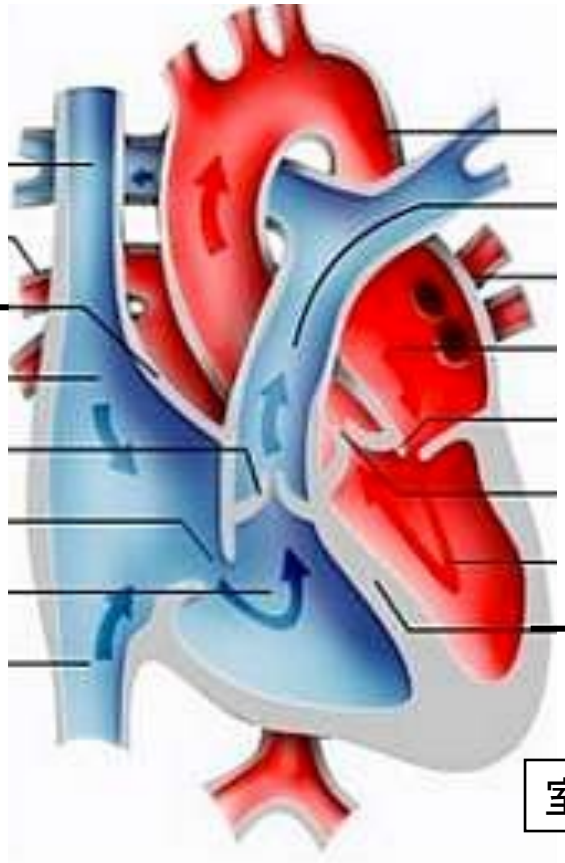
- 內部的分隔
  -室間隔
  -房間隔



前側觀

房間隔

左心室



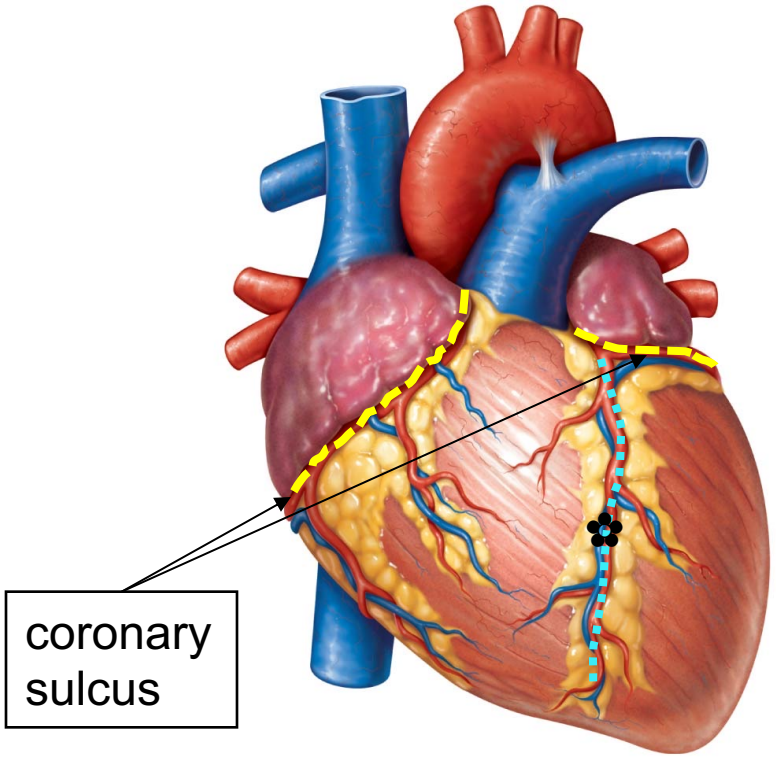
室間隔

心臟的外部構造

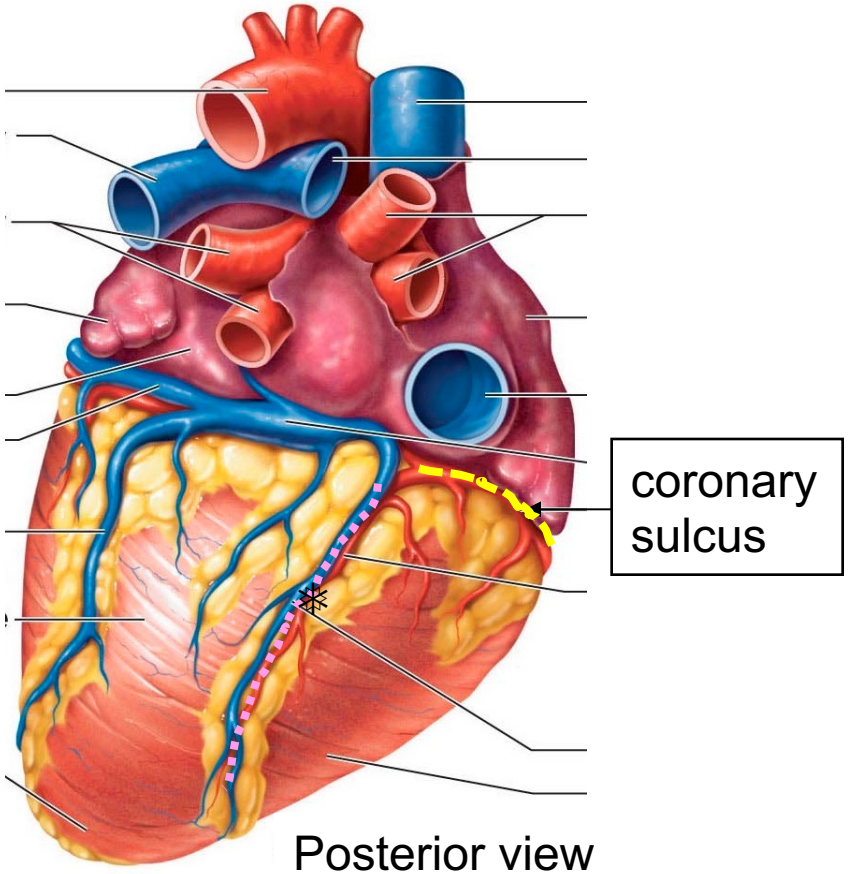
☞冠狀溝 (Coronary sulcus)- 圍繞在心房心室之間，往水平方向延伸

✿ 前室間溝 (Anterior interventricular sulcus) –室間隔的前方

❄後室間溝 (Anterior interventricular sulcus) –下方的心室之間的分隔



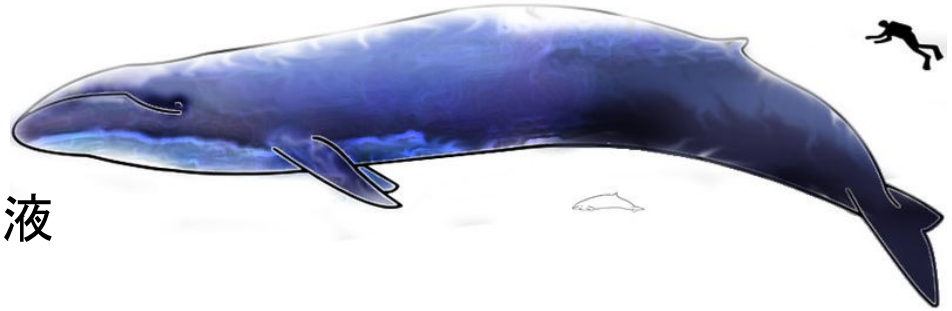
Anterior view



Posterior view (Inferior)

藍鯨的心臟 (The heart of a blue whale)

- 世界上最大的心臟
- 180公斤
- Dimensions: 5 ft X 4 ft X 4 ft
- 每跳一下可以輸出220 公升的血液



肺循環和體循環

- 心臟是由肌肉構成的pump，包含了兩個部分：

1. 肺循環
   右心房接收來自身體的缺氧血，而右心室將缺氧血送至肺臟
2. 體循環
   左心房接收來自肺臟的充氧血，並且由左心室打至全身

- 心房：接收來自肺臟和身體的血液
- 心室：心臟的幫浦，將血液打到肺臟跟全身

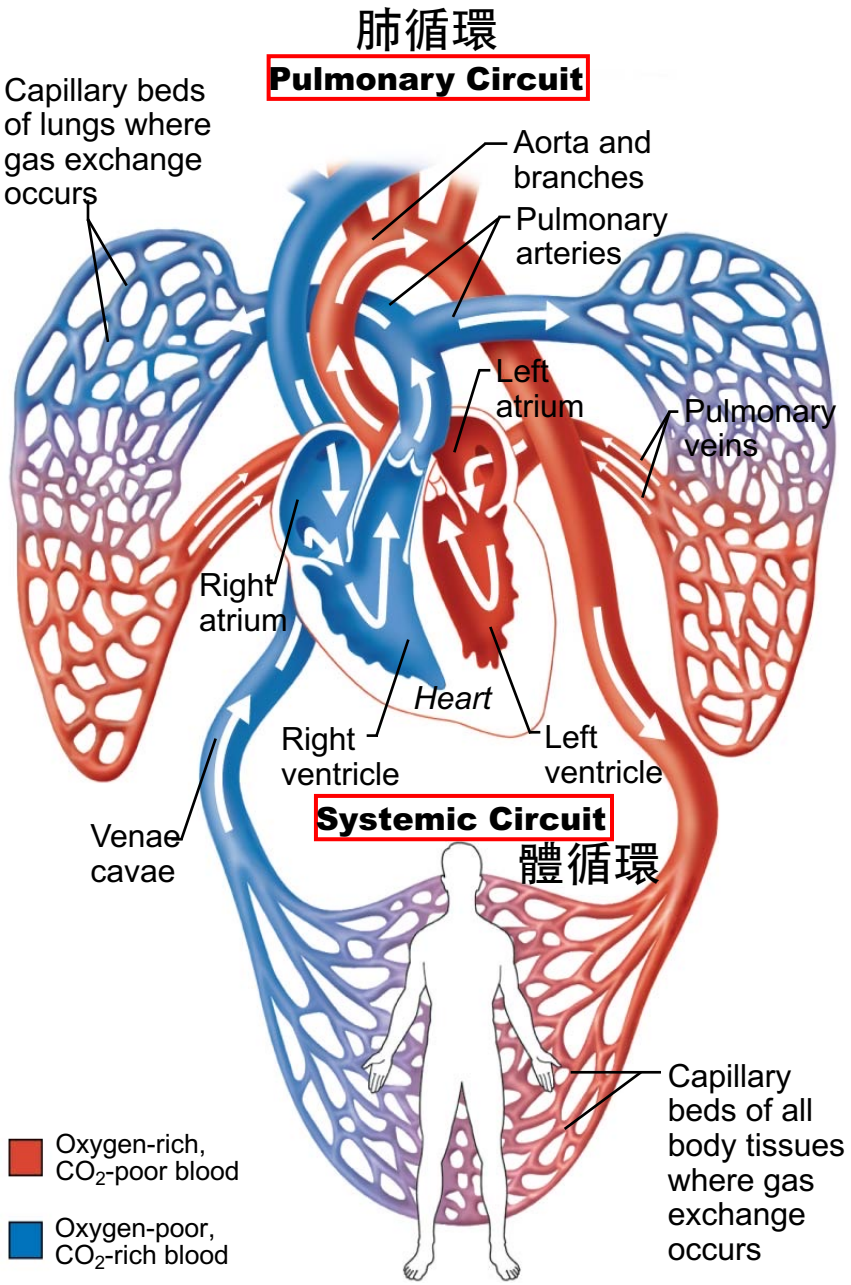
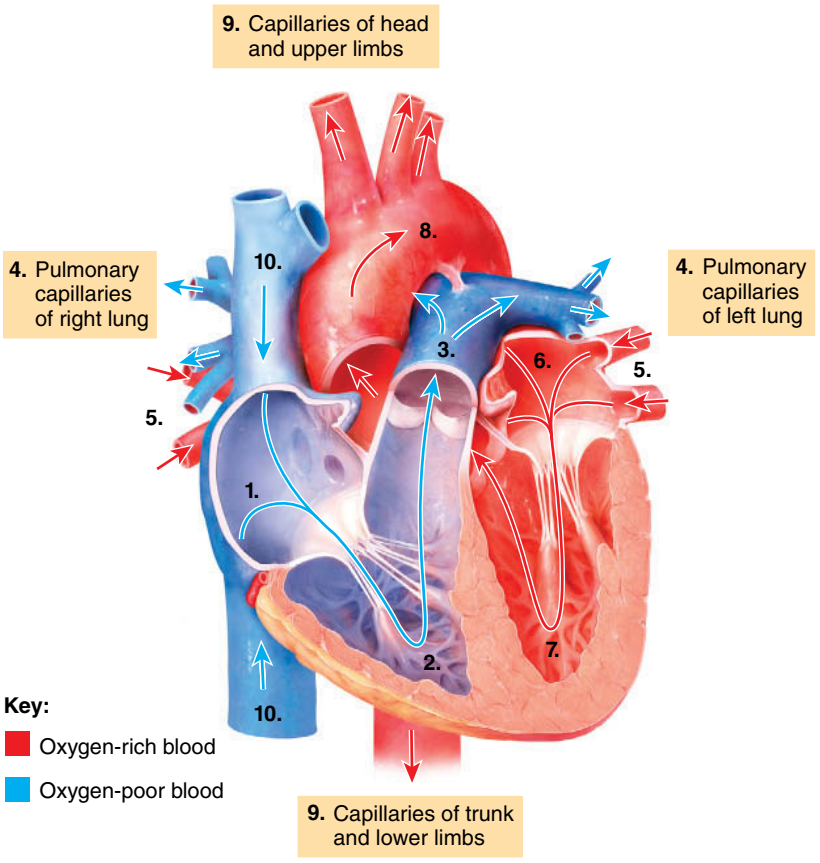
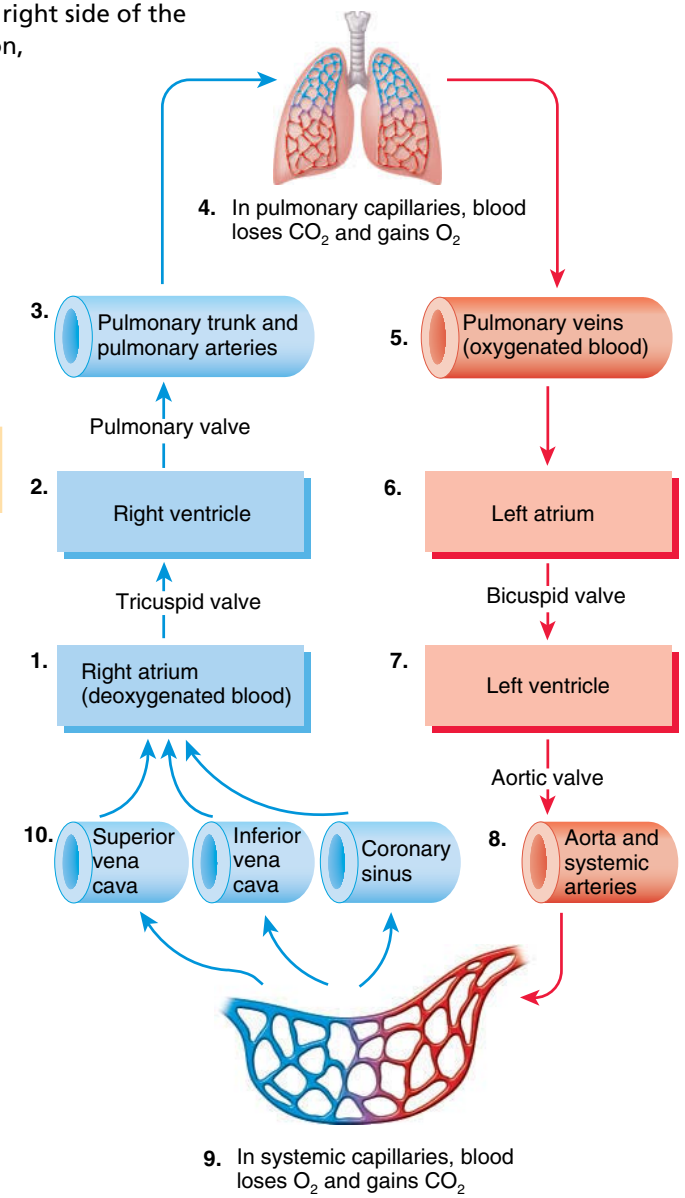


Figure 13.7 Systemic and pulmonary circulations.

The left side of the heart pumps freshly oxygenated blood into the systemic circulation, which supplies all tissues of the body except the air sacs (alveoli) of the lungs; the right side of the heart pumps deoxygenated blood into the pulmonary circulation, which includes the air sacs (alveoli) of the lungs.



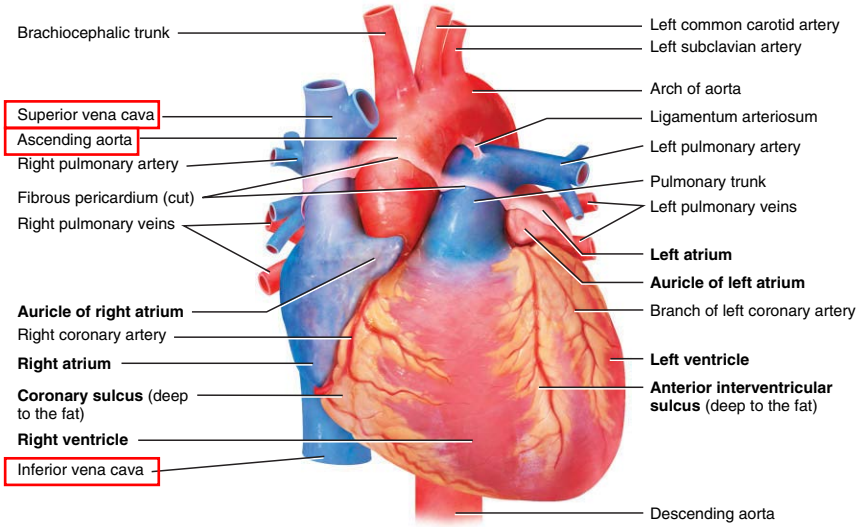
(a) Path of blood flow through heart



(b) Path of blood flow through systemic and pulmonary circulation

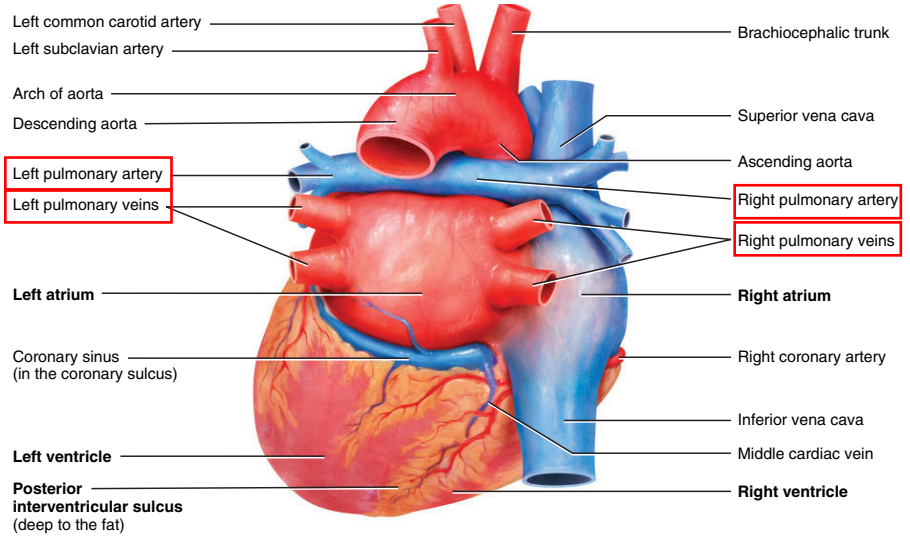
連接心臓的血管

前

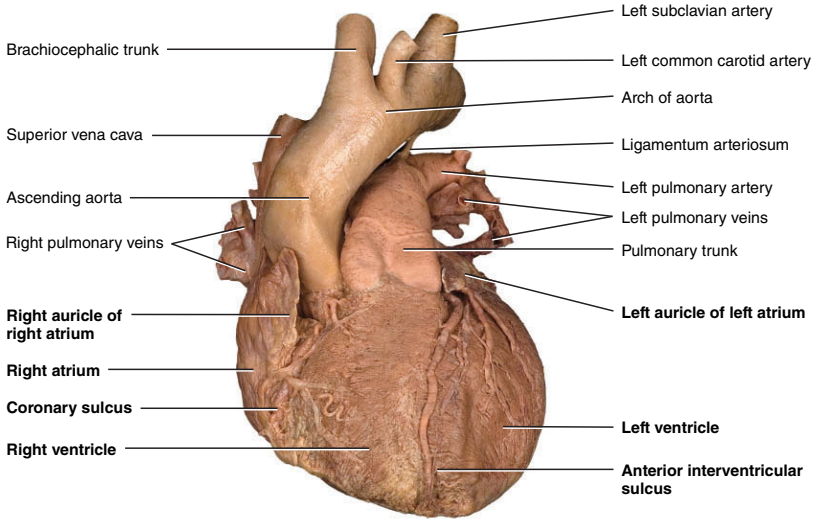


(a) Anterior external view showing surface features

後

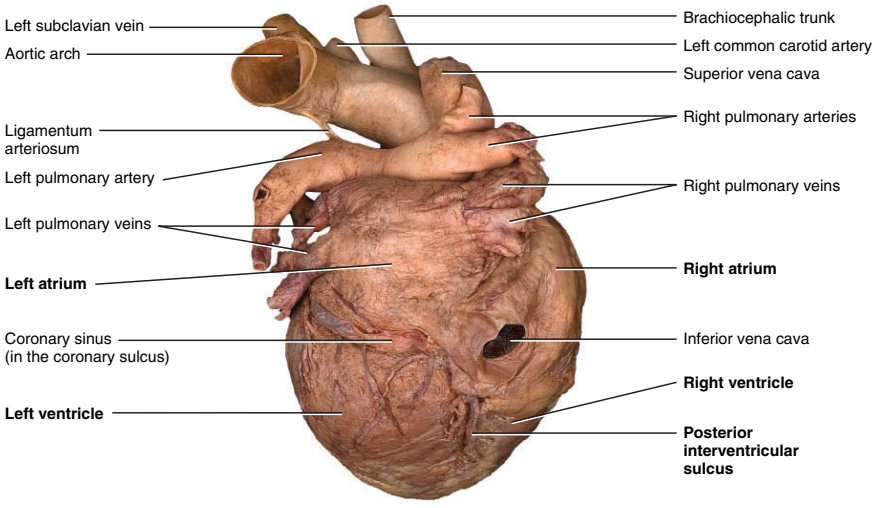


(c) Posterior external view showing surface features



Dissection Shawn Miller, Photograph Mark Nielsen

(b) Anterior external view



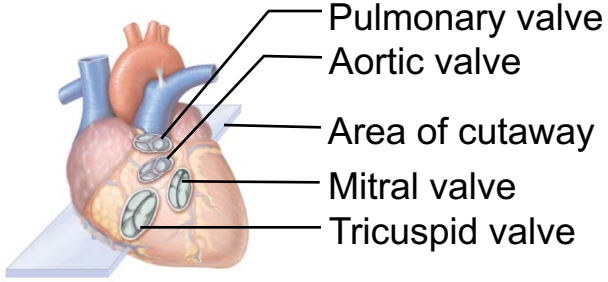
Dissection Shawn Miller, Photograph Mark Nielsen

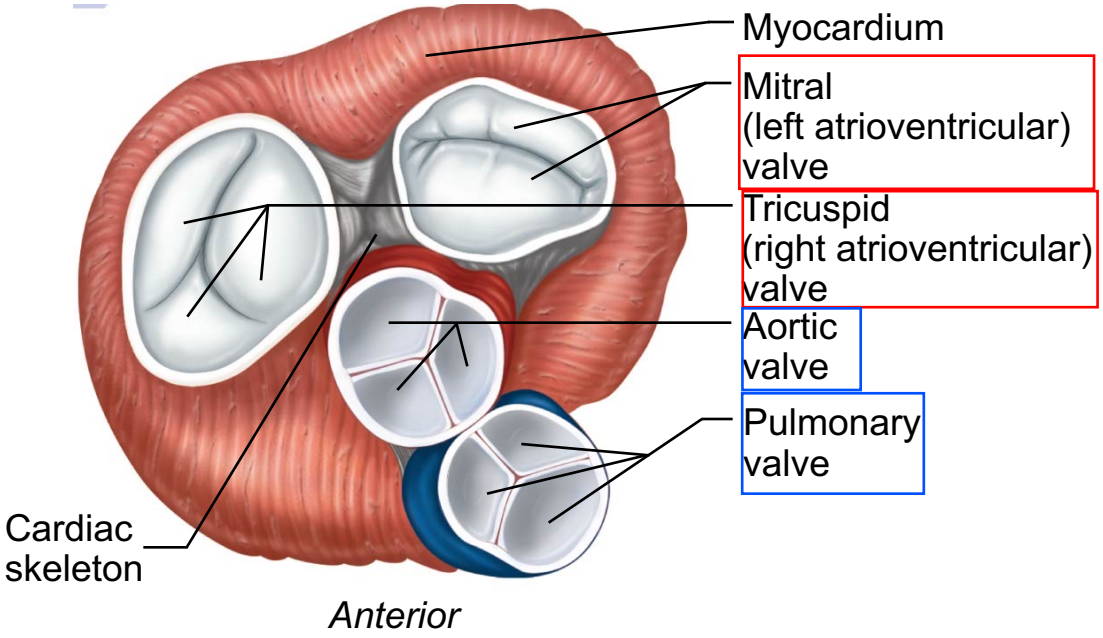
(d) Posterior external view

FIGURE 13.3 con

心臟瓣膜 (Heart valves)

- Atrioventricular (AV) valves: valves between atria and ventricles (房室瓣)
  - Right AV valve=tricuspid valve
  - Left AV valve=bicuspid(mitral) valve
- Aortic and pulmonary valves: at junction of ventricles and great arteries (3 semilunar valves)
  - 主動脈瓣和肺動脈瓣





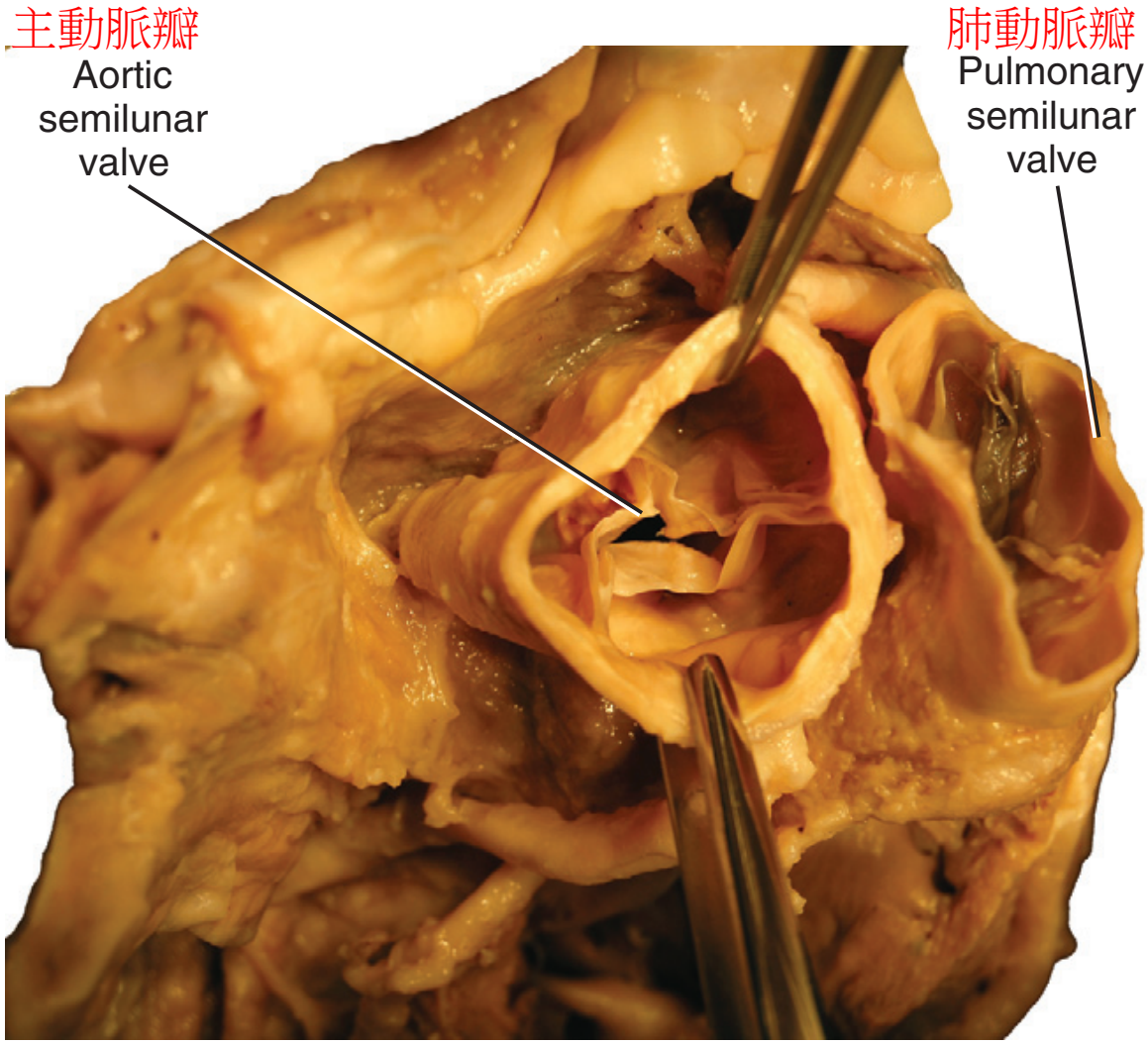


FIGURE 6-38. Aorta and pulmonary vessels transected superior to base of heart revealing their valves, respectively.

SVC
IVC
Coronary sinus

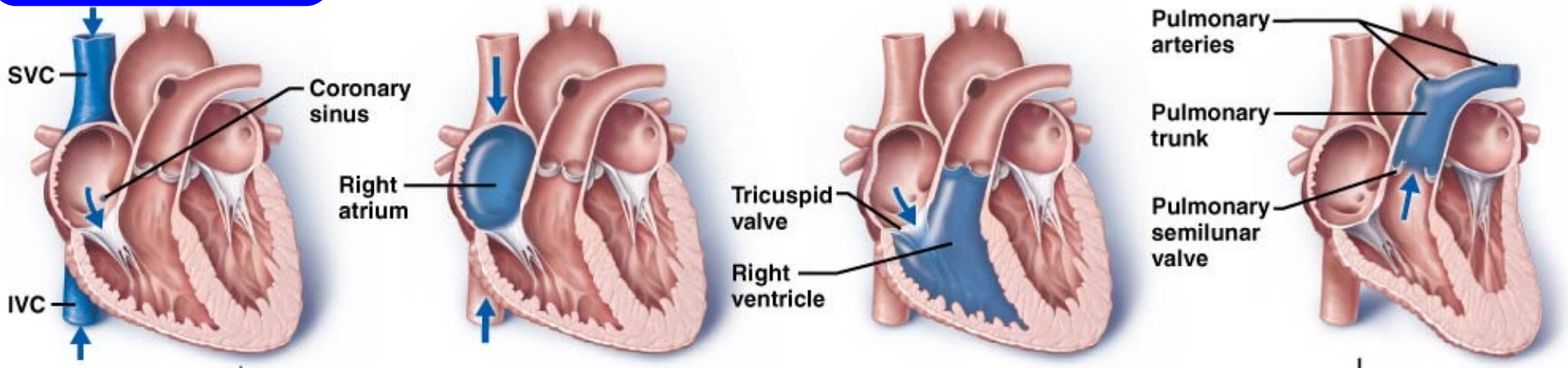
Right atrium

Tricuspid valve

Right ventricle

Pulmonary semilunar valve

Pulmonary trunk



To heart

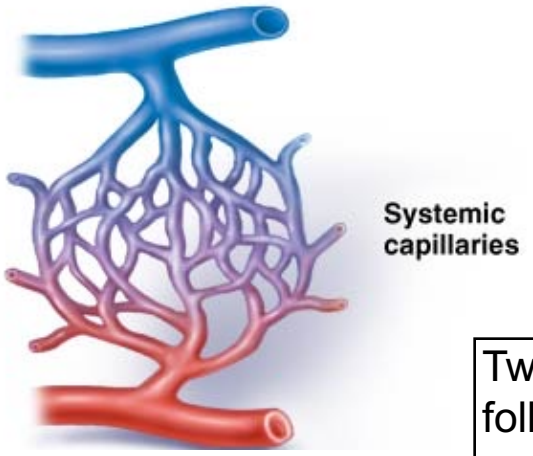
Oxygen-poor blood returns from the body tissues back to the heart.

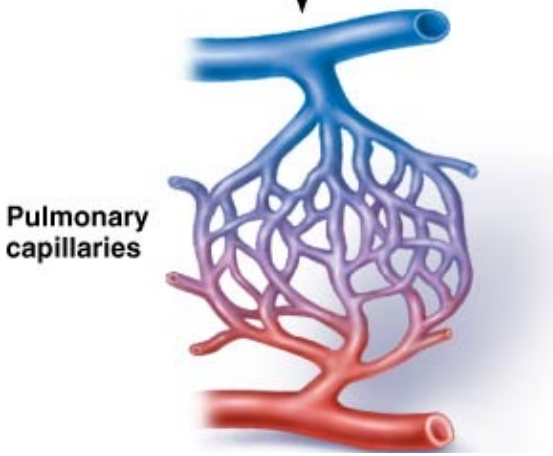
Oxygen-poor blood is carried in two pulmonary arteries to the lungs *(pulmonary circuit)* to be oxygenated.

To lungs

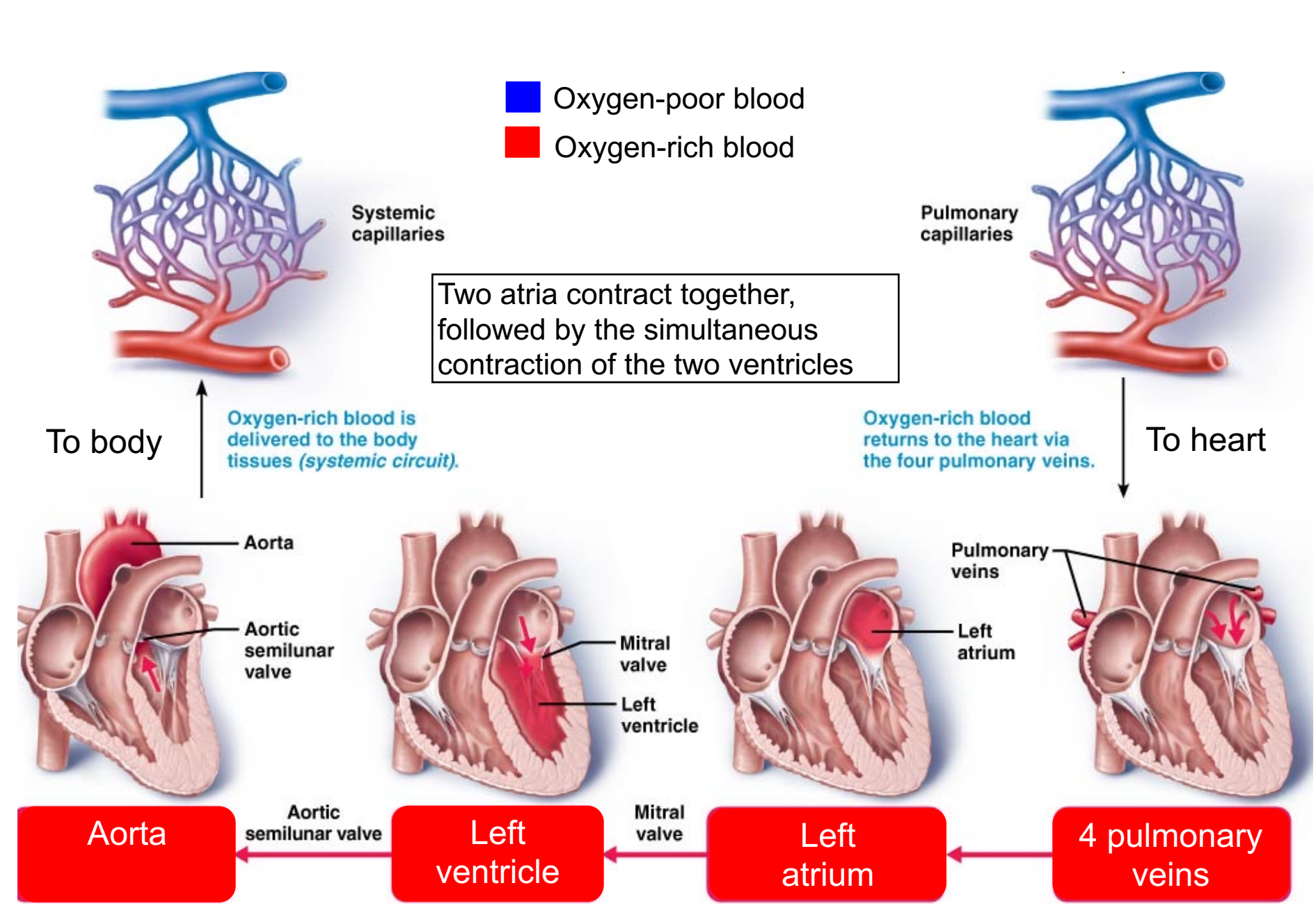
Oxygen-poor blood

Oxygen-rich blood

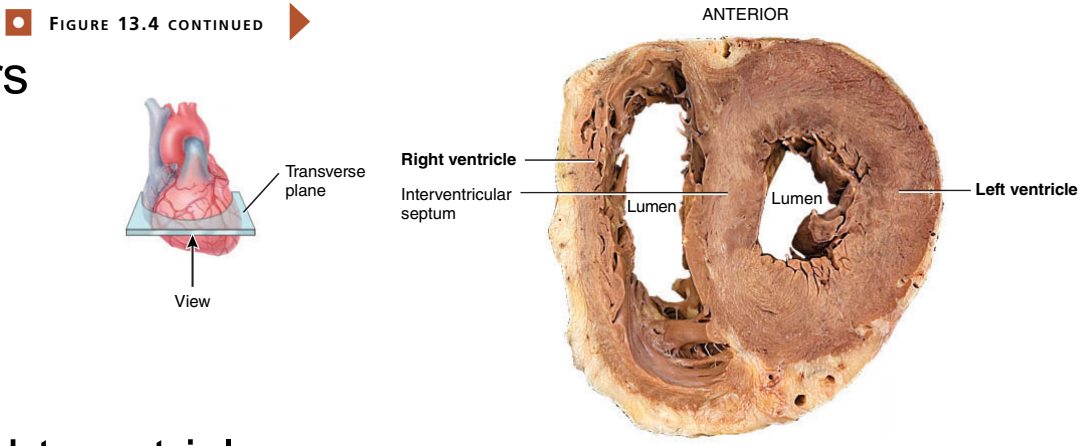




Two atria contract together, followed by the simultaneous contraction of the two ventricles

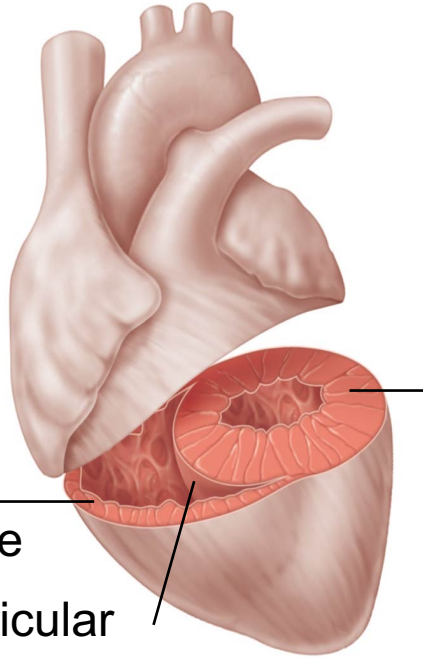

Oxygen-poor blood
Oxygen-rich blood
Systemic capillaries
Pulmonary capillaries
Two atria contract together, followed by the simultaneous contraction of the two ventricles
To body
Oxygen-rich blood is delivered to the body tissues (systemic circuit).
Oxygen-rich blood returns to the heart via the four pulmonary veins.
To heart
Aorta
Aortic semilunar valve
Mitral valve
Left ventricle
Pulmonary veins
Left atrium
Aorta
Aortic semilunar valve
Left ventricle
Mitral valve
Left atrium
4 pulmonary veins

The walls of the heart



- The walls of the heart differs in thickness:
  -<u>Atria</u>→thin walls
  -<u>Ventricles</u> →thick walls

- Left ventricle
  -three times thicker than right ventricle
  -systemic circuit is longer than pulmonary circuit
  -flatten right ventricle into a crescent shape

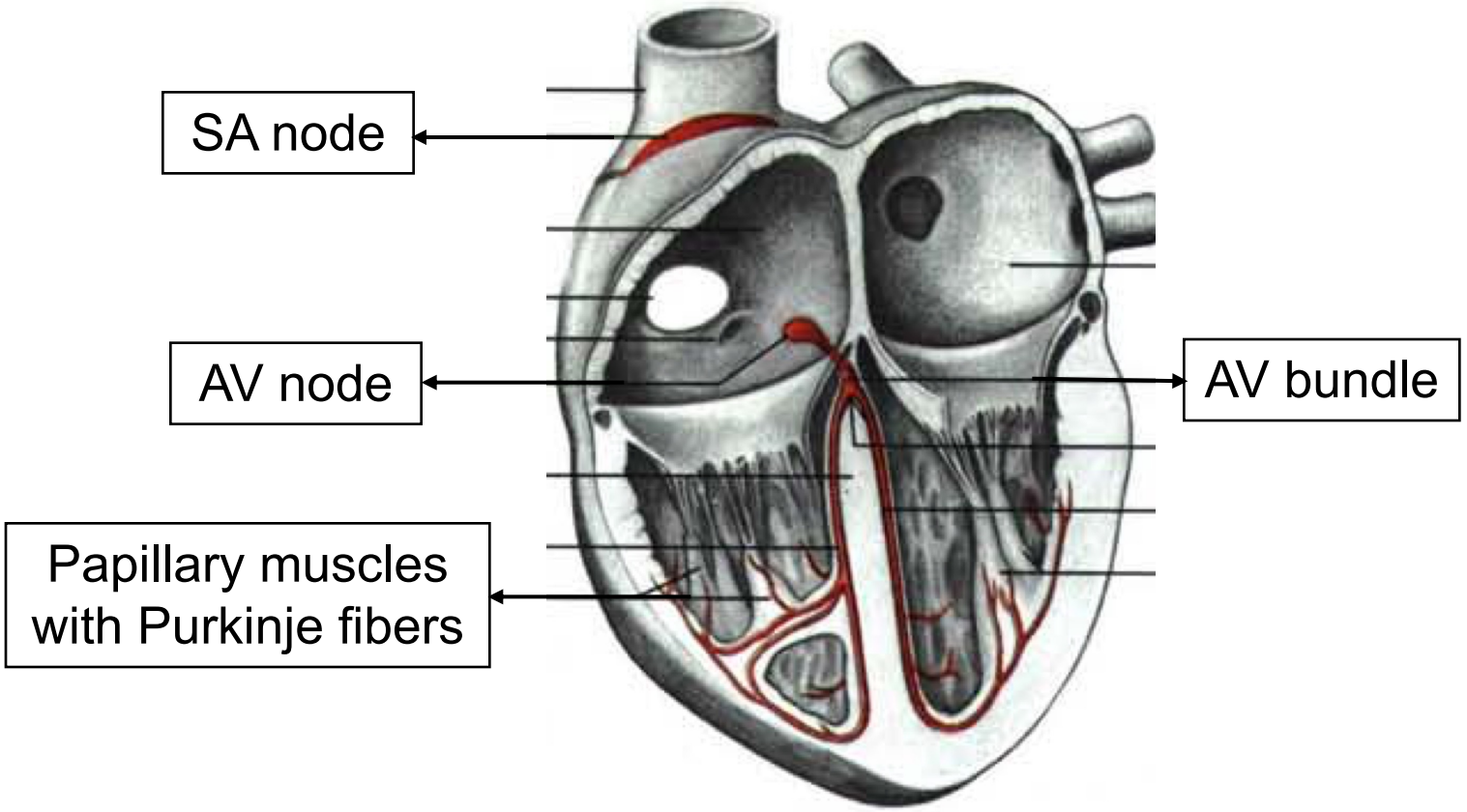


Crescent shape

Circular shape

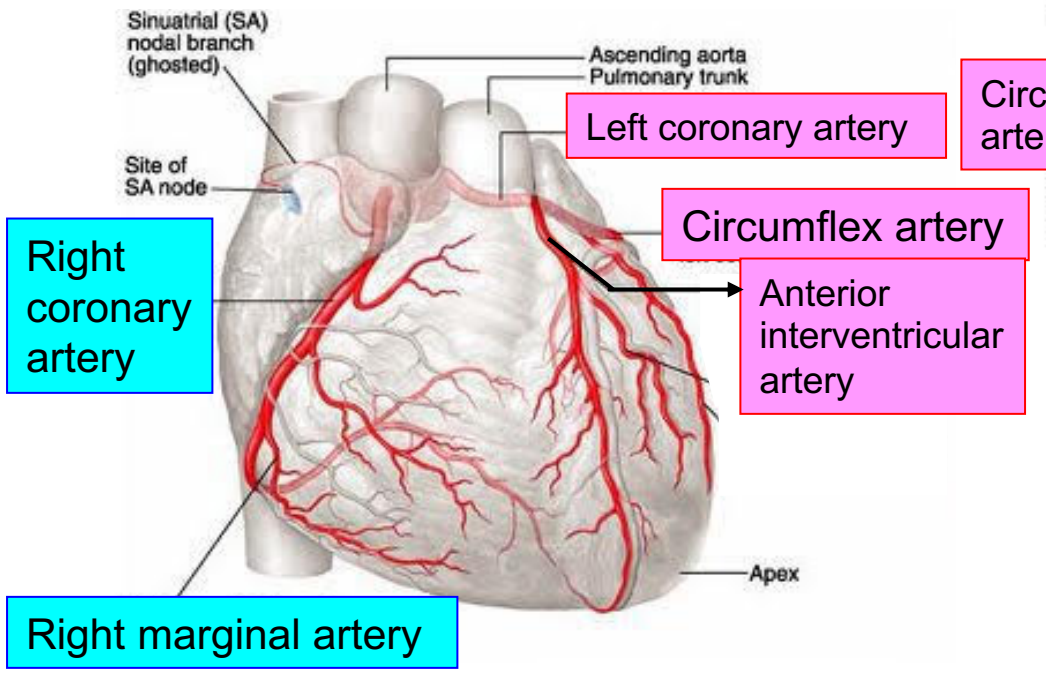
心臟的傳導系統 (Conducting system)

- From SA node (sinoatrial node, 竇房結)
  -internodal pathway to the atrioventricular (AV) node (房室結)
  -AV node→AV bundle (bundle of His) (房室束，希氏束)
  -divide in to right and left bundle branches
  -bundle branch terminate in the subendocardial conducting network (Purkinjie fibers)(浦金氏纖維)

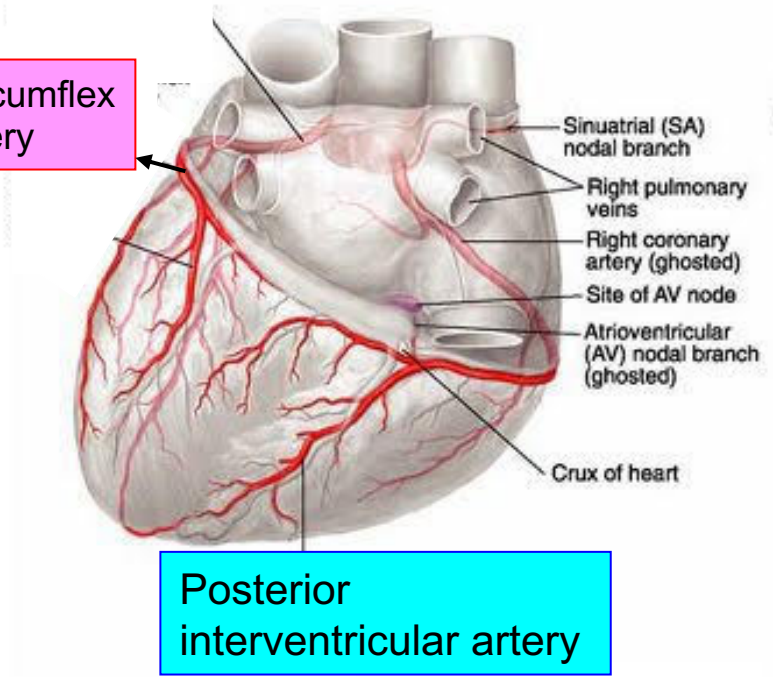


心臟的血管-動脈

- Left coronary artery (LCA)(左冠狀動脈) (from the base of aorta):
  1. Anterior interventricular a.(前室間動脈)(left anterior descending a., LAD)
     →interventricular septum
       anterior walls of both ventricles
  2. Circumflex artery (迴旋動脈) →left atrium
                                    posterior part of the left ventricle
- Right coronary artery (RCA)(右冠狀動脈)(from the right side of aorta):
  1. Marginal artery (邊緣動脈)
  2. posterior interventricular artery (後室間動脈) (post. Descending a., PDA)
  3. Supply the right atrium and much of the right ventricle



Anterior view



Posterior view

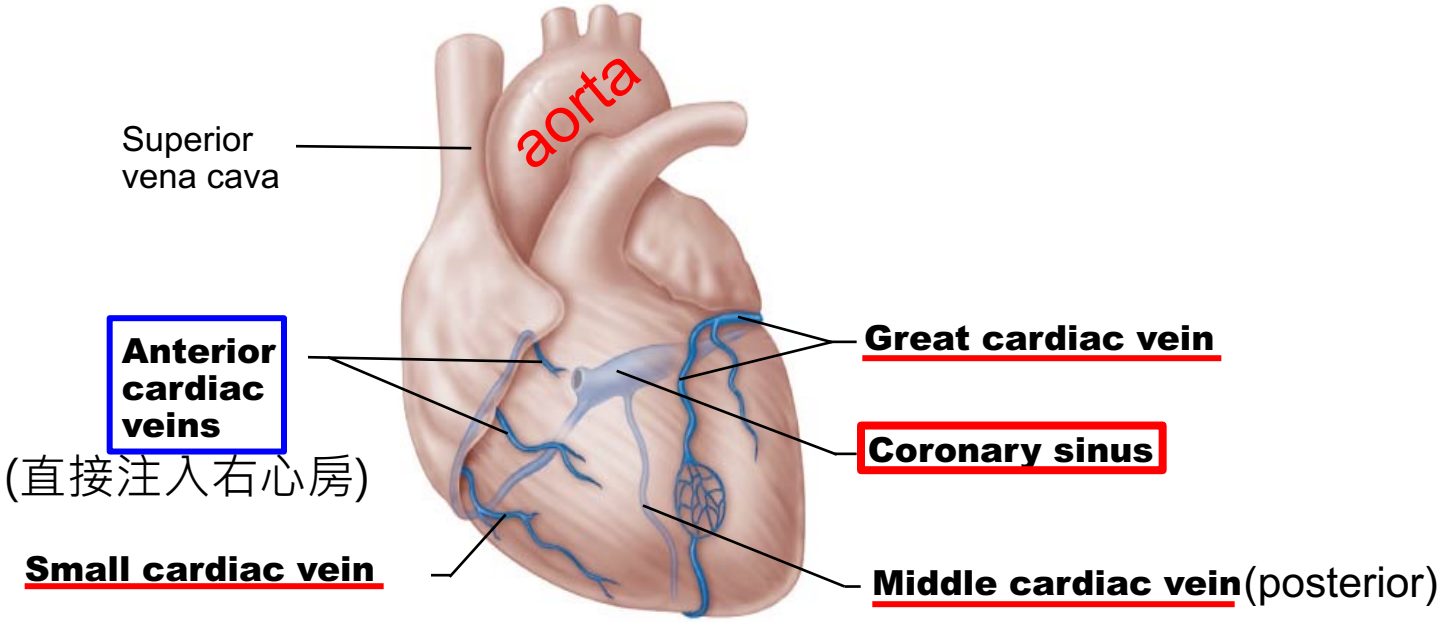
心臟的血管-靜脈

- Carry deoxygenated blood from the heart wall to the right atrium
- Occupy sulci on the heart's surface
- **Coronary sinus (冠狀竇)**

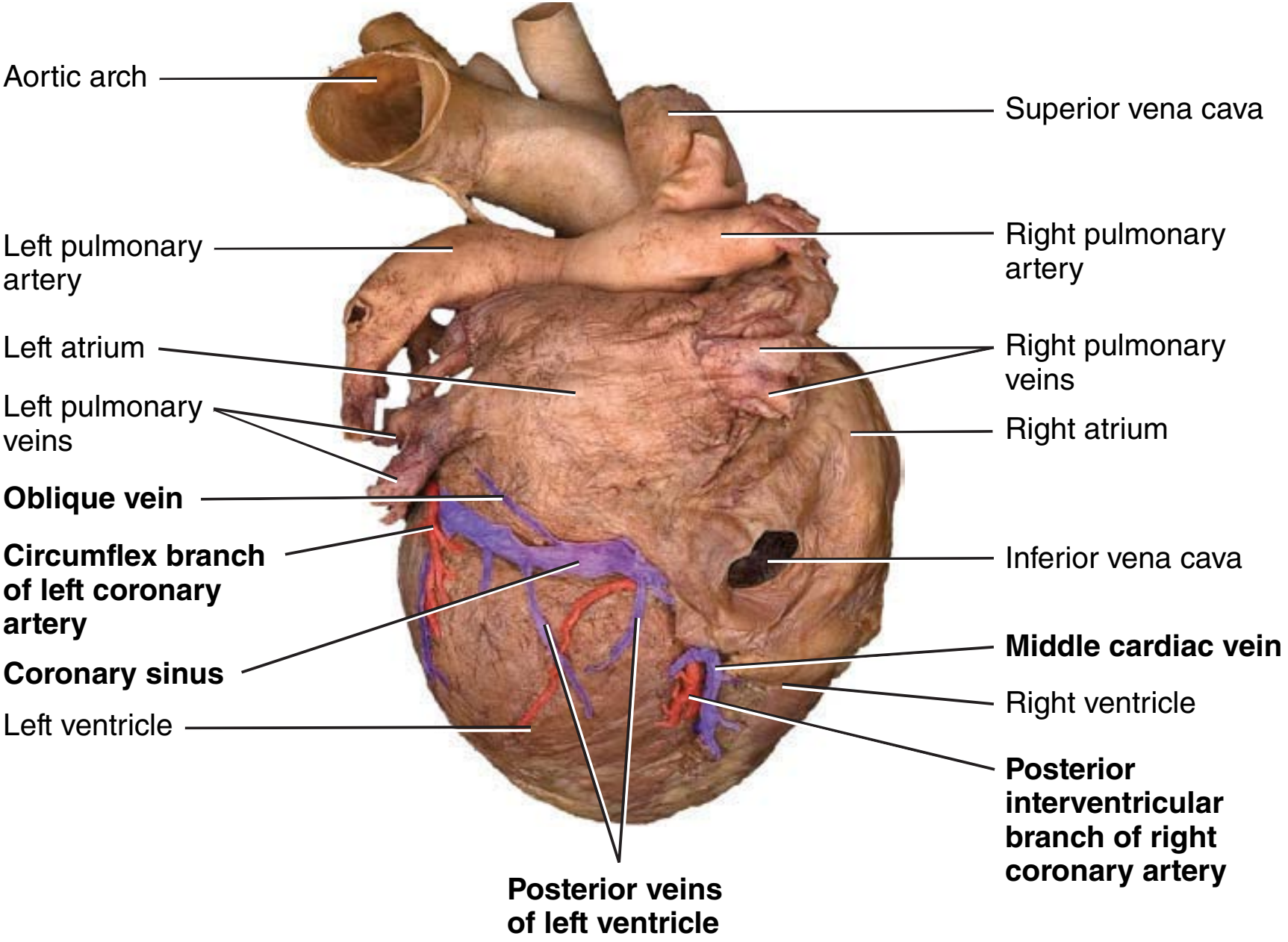
  -runs in the posterior part of the coronary sulcus(冠狀溝)

  -returns majority of venous blood from the heart to the right atrium
- Three tributaries of coronary sinus:

  Great cardiac vein (大心靜脈), middle cardiac vein (中心靜脈), small cardiac vein (小心靜脈)



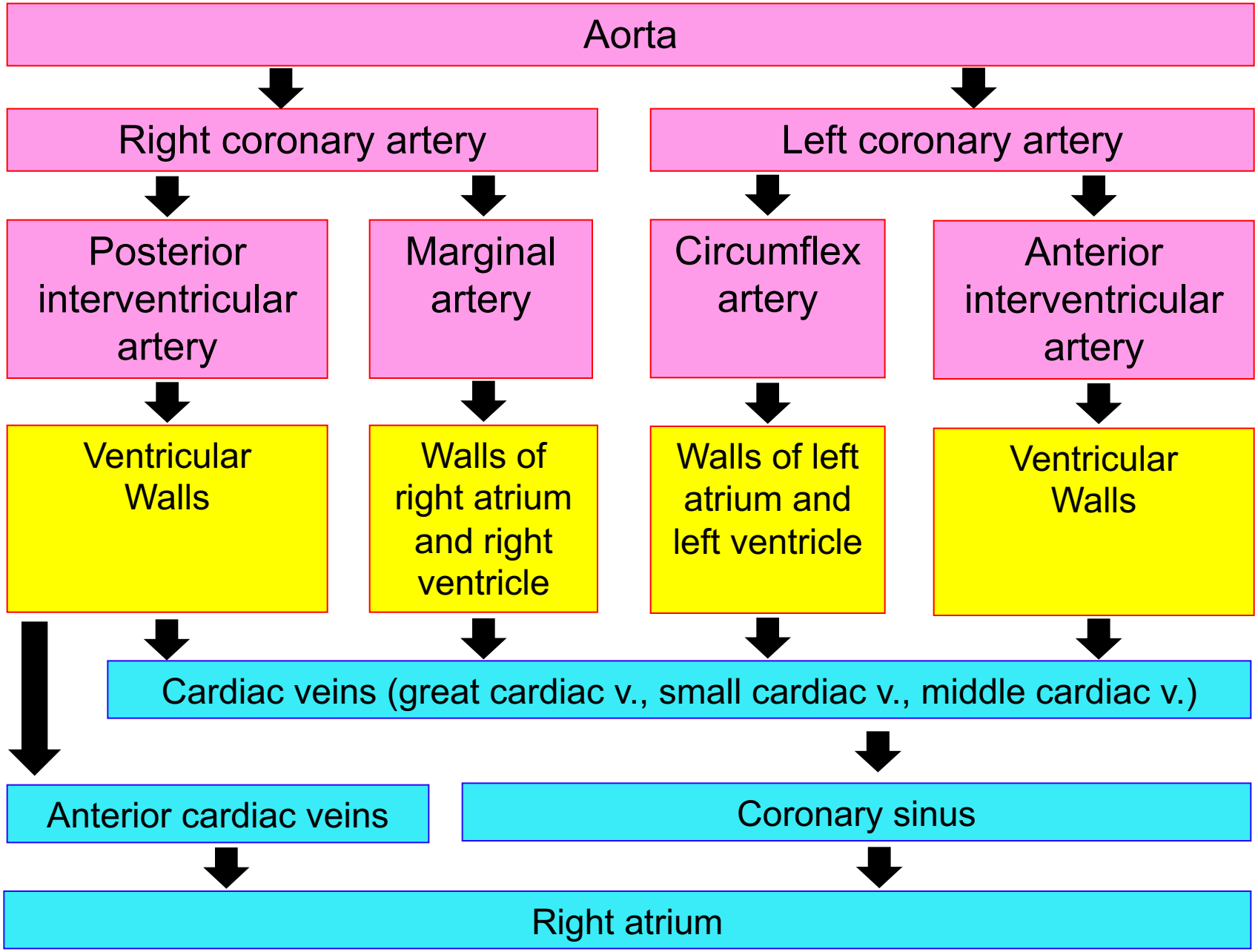
The major cardiac veins



Dissection Shawn Miller, Photograph Mark Nielsen

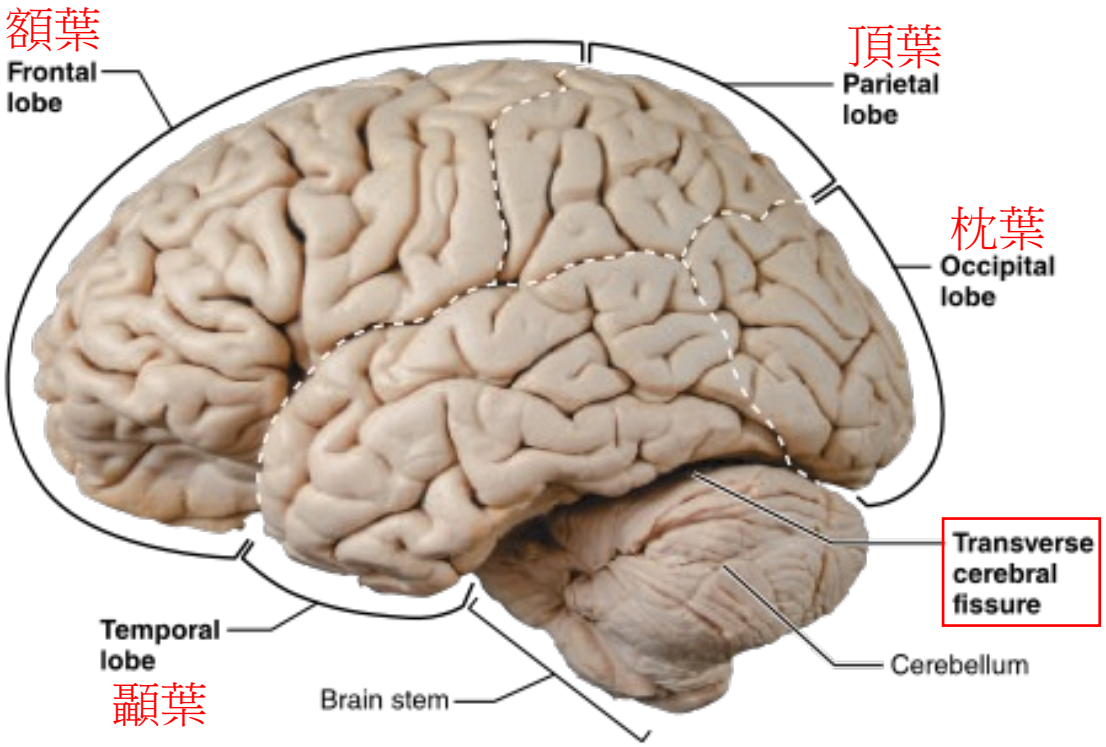
(d) Posterior view

Blood supply to the heart

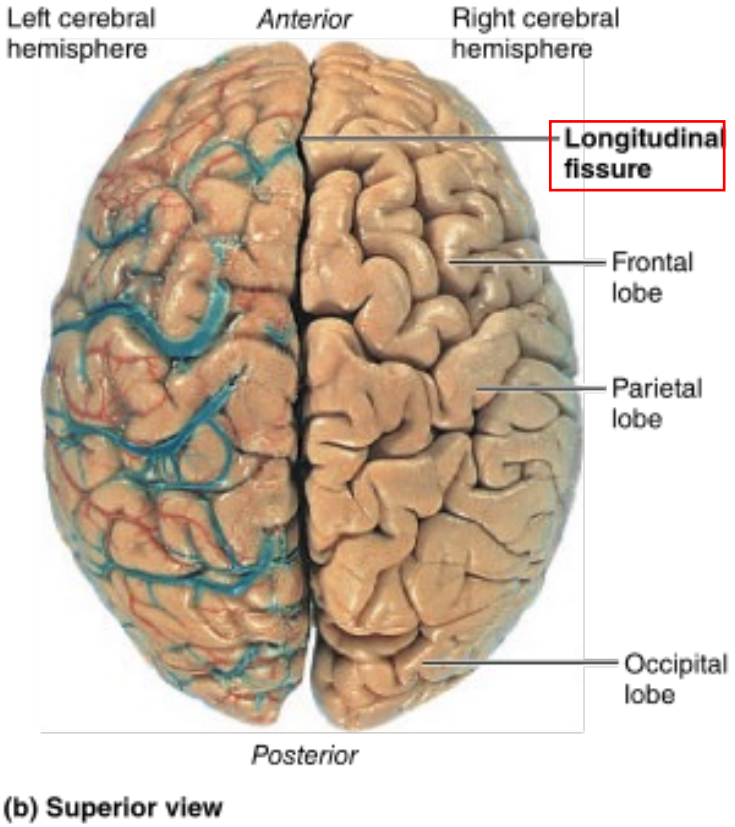


Cerebrum (大腦)

- Made up two cerebral hemispheres that account for 83 % of total brain mass
- **Fissures (裂)**
  - Transverse cerebral fissures (大腦橫裂): separate cerebral hemispheres from the cerebellum
  - Longitudinal fissure (縱裂): separates the right and left cerebral hemispheres
- Cerebral cortex (大腦皮質)(gray matter, 灰質)- cerebral white matter (大腦白質)- deep gray matter of cerebrum (大腦深層灰質) (from superficial to deep)



(a) Left lateral view of brain



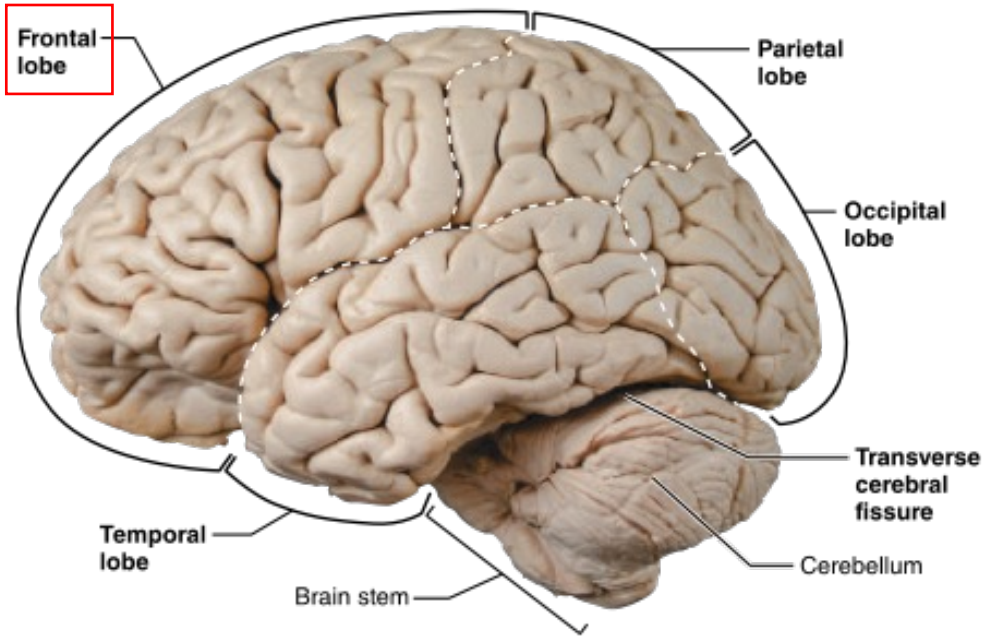
(b) Superior view

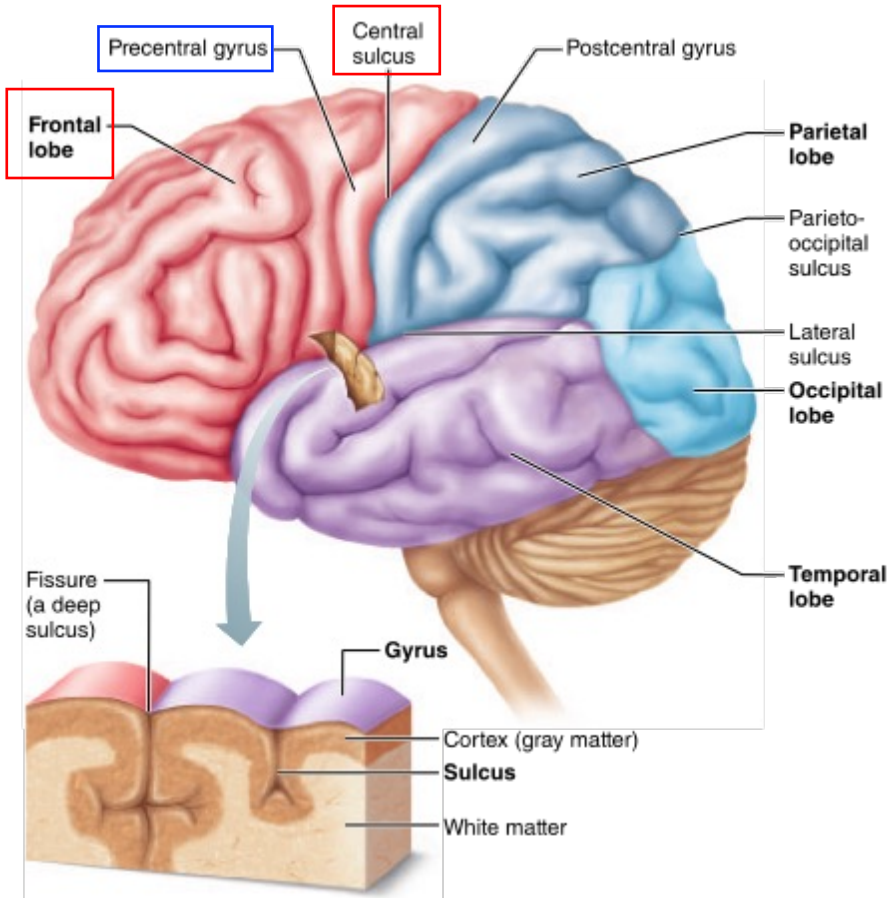
Lobes of the Cerebral Cortex (大腦皮質的腦葉)

- **Sulci (溝)**: shallow grooves on the surface of the cerebral hemispheres
- **Gyrus (迴)**: ridges of brain tissue between the sulci
- Five major lobes divided by deeper sulci:

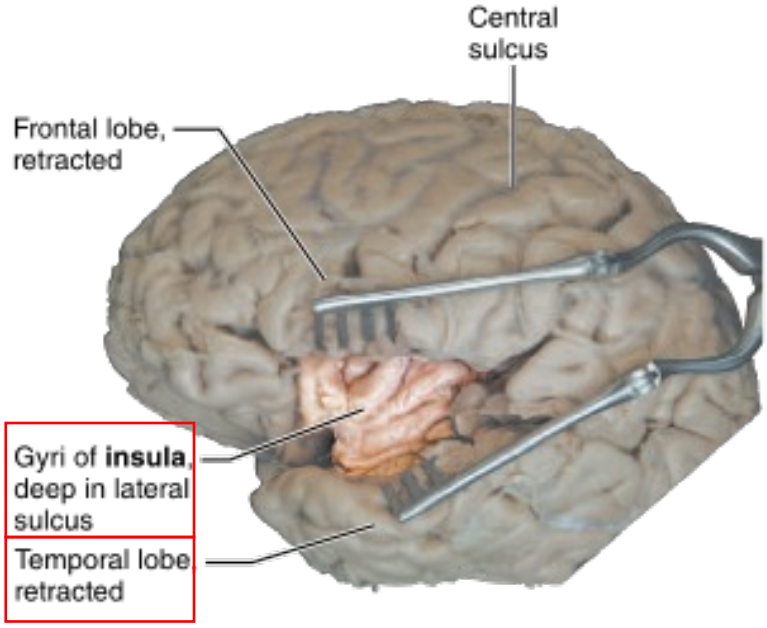
1. Frontal lobe (額葉)

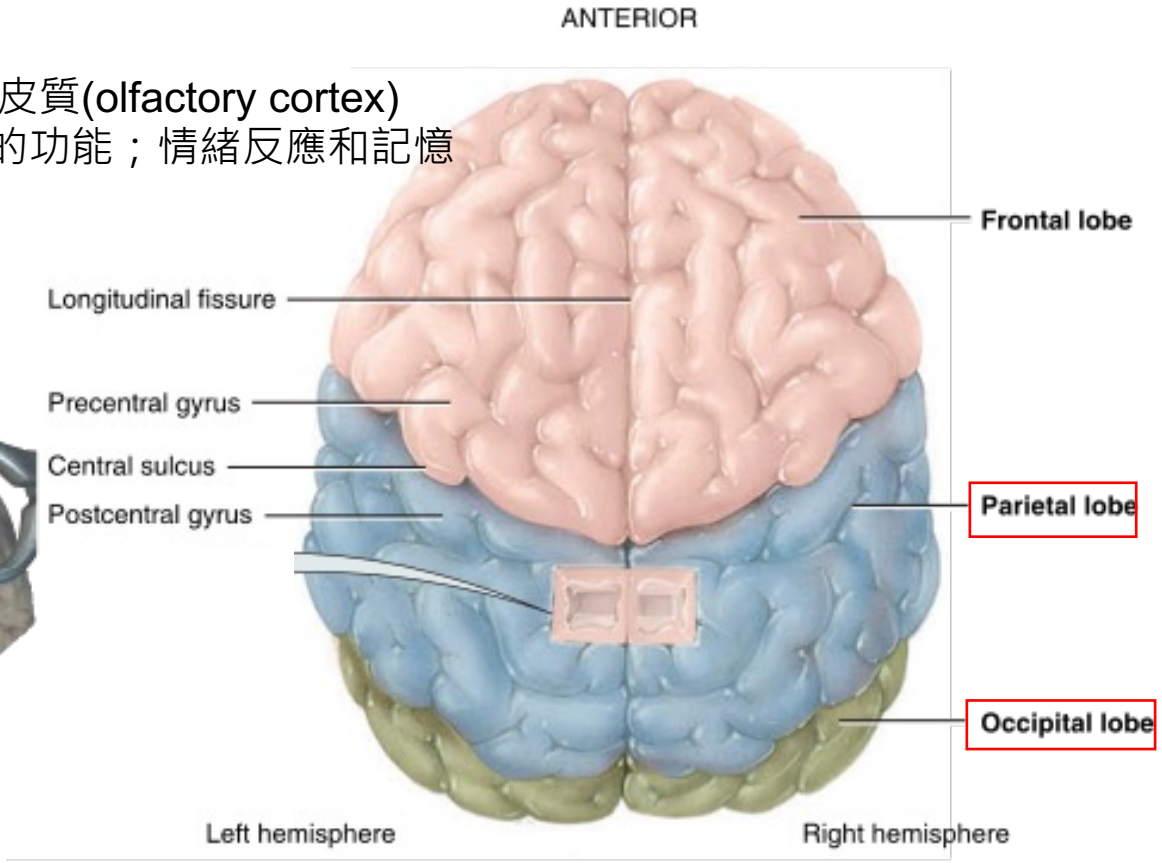
- 位於額骨深處往後延伸至中央溝(central sulcus)，中央溝將額葉和頂葉隔開
- 含有初級運動皮質(primary motor cortex)的中央前回(precentral gyrus)
- 計畫、啟動、及執行包括眼球運動及言語產生等運動動作的功能區
- 最前端的區域執行高階的認知功能





2. **Parietal lobe (頂葉)**
   - 位於頂骨深處，由中央溝向後延伸至頂枕溝(parieto-occipital sulcus)
   - 外側溝(lateral sulcus)形成下方界線
   - 中央後回(postcentral gyrus)含有初級體壁感覺皮質(primary somatosensory cortex)
   - 有意識地察覺到一般體壁感覺；對物體、聲音、及身體部位的空間感覺；理解說話內容
3. **Occipital lobe (枕葉)**
   - 位於枕骨深處，形成大腦最後面的部分
   - 含視覺皮質(visual cortex)
4. **Temporal lobe (顳葉)**
   - 位在大腦半球側面，顳骨的中顱窩 (middle cranial fossa)
   - 外側溝隔開頂葉和額葉
   - 含聽覺皮質(auditory cortex)和嗅覺皮質(olfactory cortex)
   - 辨識物體，文字，臉孔及語言理解的功能；情緒反應和記憶
5. **Insula (腦島)**
   - 埋在外側溝的深處
   - 被部分的顳葉，頂葉，額葉所覆蓋
   - 味覺的內臟感覺皮質和一班體壁感覺

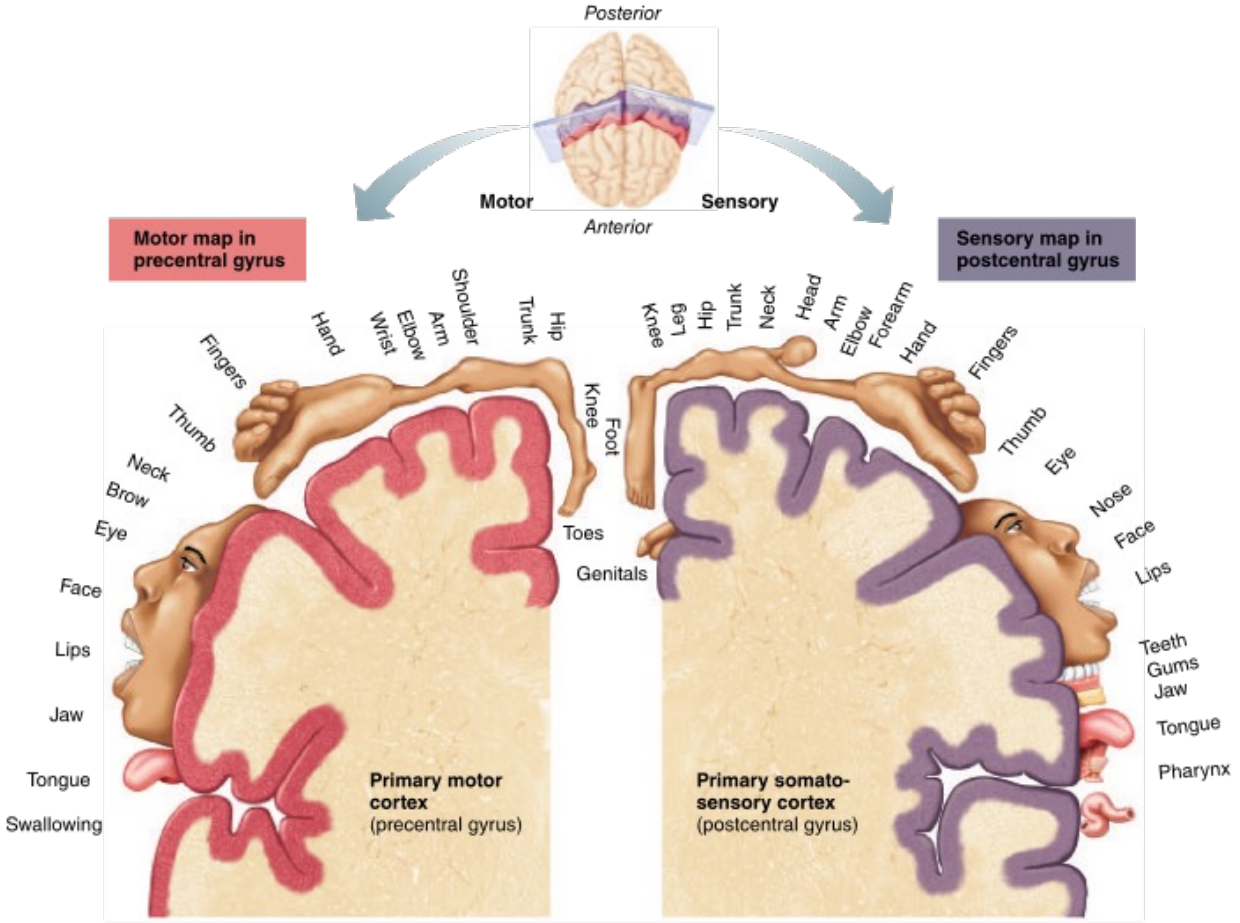




Sensory areas (感覺區)

- 與意識到感覺有關大腦皮質區在部分的頂葉，顳葉，枕葉

1. 體壁感覺區 (Somatosensory areas)
   - **Somatosensory areas (初級體壁感覺皮質)**: 接收來自一般體壁感覺訊號
   - Sensory homunculus (感覺侏儒圖)
   - 感覺受器至感覺皮質的對側投射 (contralateral projection)
   - **Somatosensory association cortex (體壁感覺聯絡皮質)**: 位在初級體壁感覺皮質的後面；將感覺輸入整合成對被感受事務的綜合理解

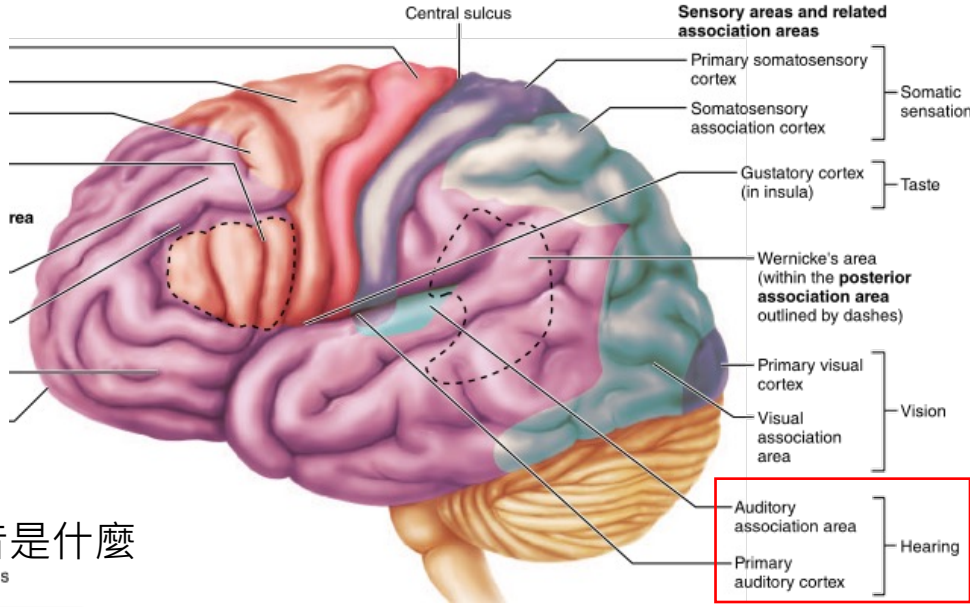


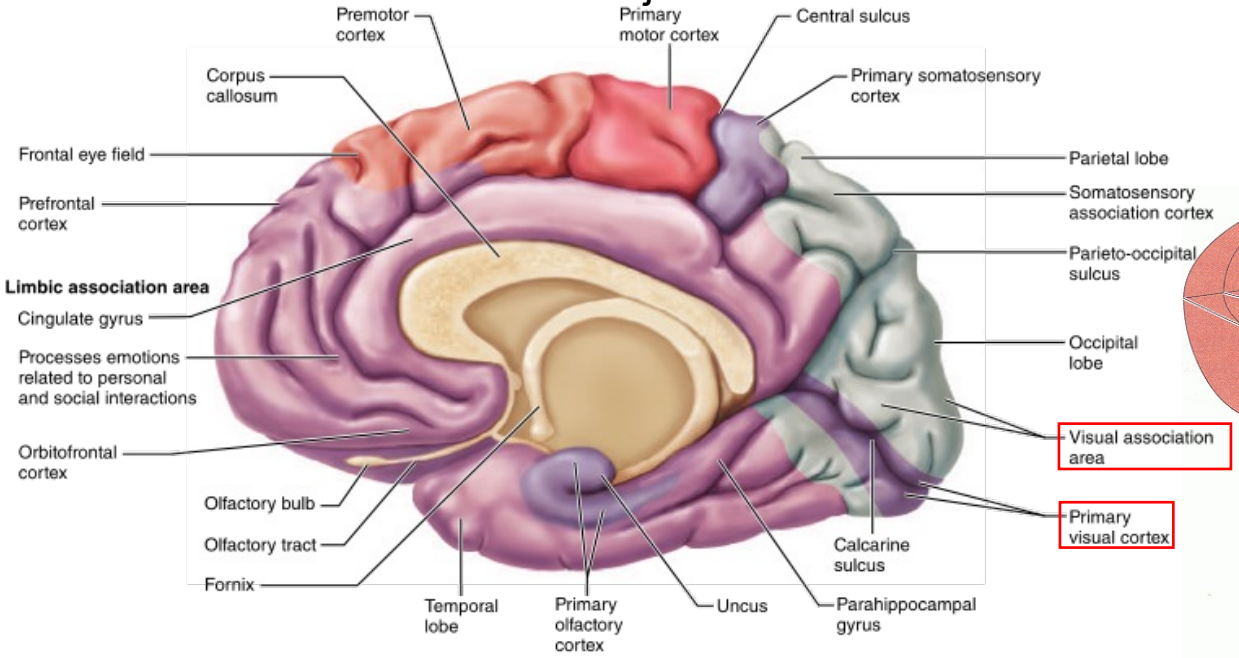
2. 視覺區 (Visual areas)

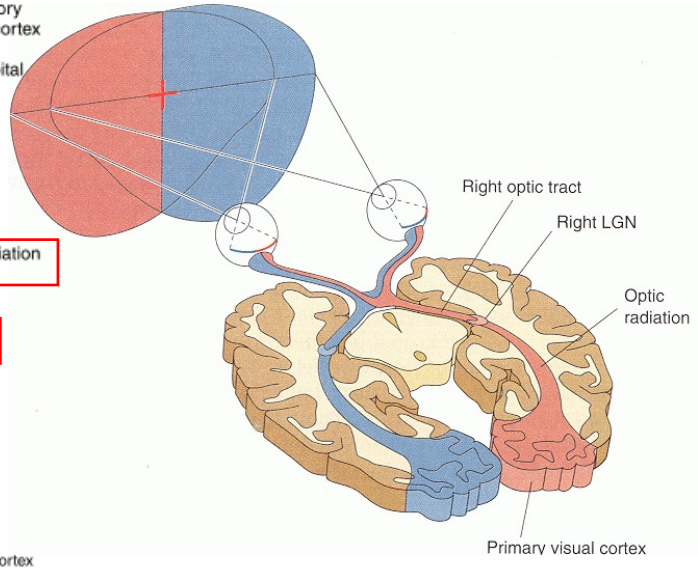
- **Primary visual cortex(初級視覺皮質)**：位於枕葉的後部和內側部上，大部分包埋深層的禽距溝(calcarine sulcus)上
- 所有皮質感覺區中最大的
- Contralateral projection
- **Visual association area (視覺聯絡區):** 圍繞初級視覺皮質且覆蓋大部分的枕葉；分析顏色，形狀及運動而持續處理視覺訊號

3. 聽覺區(Auditory areas)

- 顳葉上緣，主要在外側溝的內面
- 音量，節奏，音調
- **聽覺聯絡區(auditory association area):** 位在初級聽覺皮質的後方和外側j，可評估聲音是什麼







Motor areas (運動區)

■**初級運動皮質 (primary motor cortex)**
- 位在額葉的中央前回 (precentral gyrus)，在初級感覺皮質前方
- 錐狀細胞(pyramidal cells)
- 錐體徑(pyramidal tract): 裡面的軸突在運動神經元形成突觸以引發精確的身體隨意運動
- 錐狀細胞軸突的投射為對側投射
- 運動侏儒圖(motor homunculus)

■**前運動皮質 (premotor cortex)**
- 在中央前回的正前方
- 計畫並協調複雜的動作

■**額葉眼動區 (frontal eye field)**
- 位在前運動皮質前方，控制眼睛的隨意運動

■**布洛卡氏區(Broca's area)**
- 位在左邊語言優勢的大腦半球前運動皮質的下部
- 控制說話所需的運動動作
- 右邊大腦半球相對應的位置稱為intuitive-emotional (直覺與情緒)，賦予說話的情緒色彩
- 會聽不會講