

Bones - osteology

- **Osteology is the study of the bony part of the skeleton.**
- **Structure of the bone**
 - **Bone cells (osteocytes).**
 - **Bone matrix**

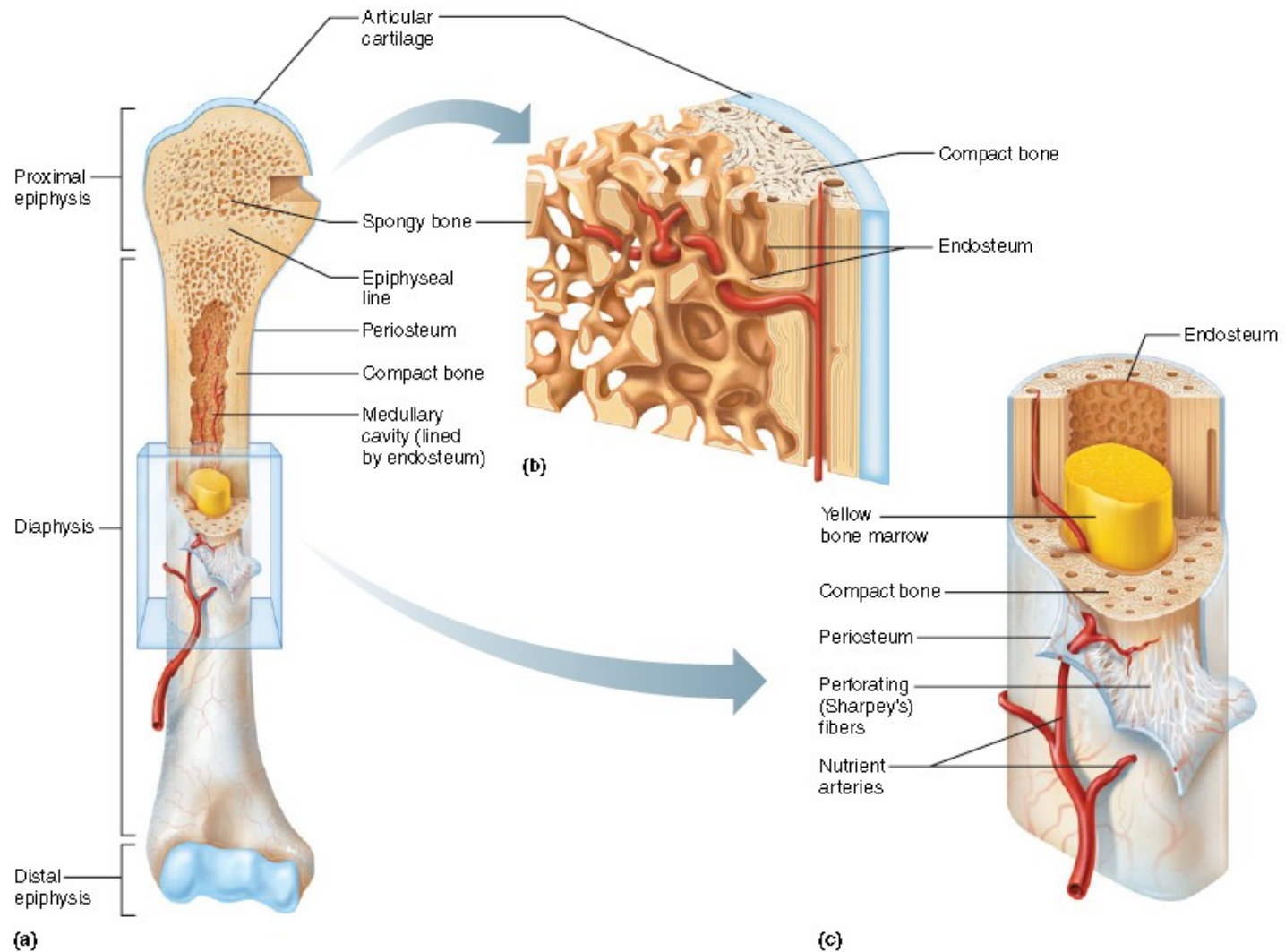


FIGURE 6.4 The structure of a long bone (humerus). (a) Anterior view, with the bone sectioned frontally to show the interior at the proximal end. (b) Enlargement of (a), showing the spongy bone and compact bone of the epiphysis. (c) Enlargement of the diaphysis from (a). Note that the external surface of the diaphysis is covered with periosteum but that the articular surface of the epiphysis is covered with hyaline cartilage.

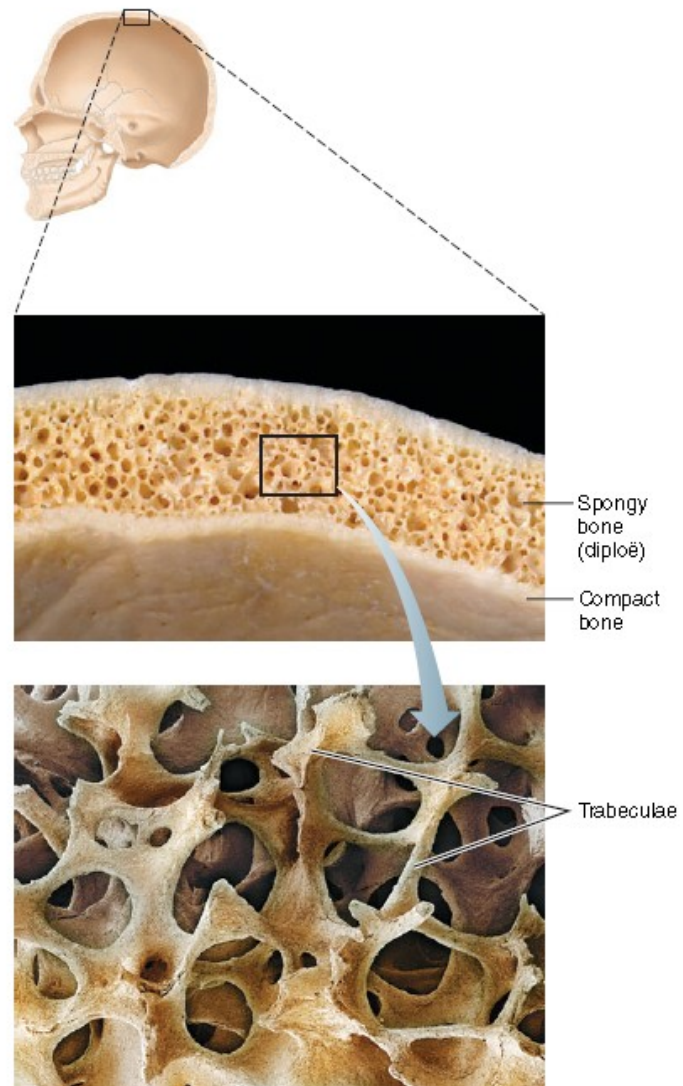


FIGURE 6.5 Structure of a flat bone. Flat bones consist of a layer of spongy bone (the diploë) sandwiched between two thin layers of compact bone. (Photomicrograph at bottom, 25 $\times$.)

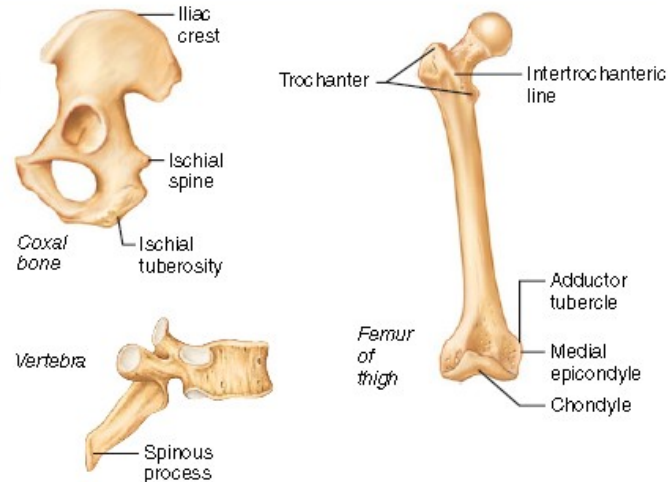
Main terms

- **Tuberosity (trochanter) - large projection**
- **Tubercle - small projection**
- **Condyle - smooth, rounded articular projection**
- **Ebicondyle - tubercle on condyle**
- **Process - projection from the bone**
- **Spine - pointed or sharp projection**
- **Ridge - linear elevation on the surface of the bone**
- **Fossa - shallow (oval, rounded or irregular depression**
- **Groove (sulcus)- elongated depression**
- **Foramen - hole or perforation**
- **Canal - tubular tunnel**
- **Fissure - linear opening between two bones**

Name of Bone Marking	Description	Illustration
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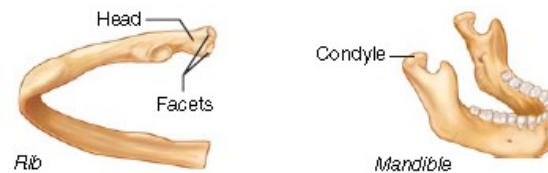
PROJECTIONS THAT ARE SITES OF MUSCLE AND LIGAMENT ATTACHMENT

Tuberosity (too'-be-ros'i-te)	Large rounded projection; may be roughened
Crest	Narrow ridge of bone; usually prominent
Trochanter (tro-kan'ter)	Very large, blunt, irregularly shaped process (the only examples are on the femur)
Line	Narrow ridge of bone; less prominent than a crest
Tubercle (too'ber-kl)	Small rounded projection or process
Epicondyle (ep'i-kon'dil)	Raised area on or above a condyle
Spine	Sharp, slender, often pointed projection
Process	Any bony prominence



SURFACES THAT FORM JOINTS

Head	Bony expansion carried on a narrow neck
Facet	Smooth, nearly flat articular surface
Condyle (kon'dil)	Rounded articular projection, often articulates with a corresponding fossa



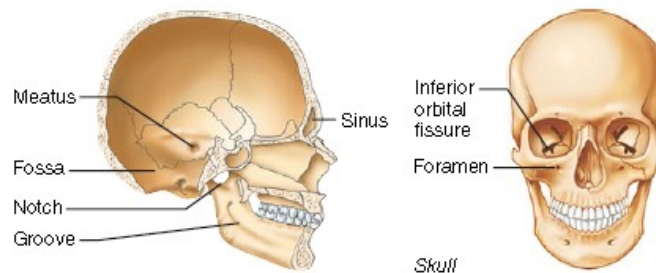
DEPRESSIONS AND OPENINGS

For passage of vessels and nerves:

Foramen (fo-ra'men)	Round or oval opening through a bone
Groove	Furrow
Fissure	Narrow, slitlike opening
Notch	Indentation at the edge of a structure

Others:

Fossa (fos'ah)	Shallow basinlike depression in a bone, often serving as an articular surface
Meatus (me-a'tus)	Canal-like passageway
Sinus	Cavity within a bone, filled with air and lined with mucous membrane



Functions of Bones

Give the body its shape.

Support the body and resist stress.

Carry, transmit the body weight to ground.

**Provide surface for attachment of muscles and tendons
Act as a lever for muscle action.**

Protect the vital soft parts of the body e.g. brain.

Reserve for calcium and phosphorus in emergencies.

Red bone marrow helps in formation of blood cells.

Pneumatic- bones around nasal cavity

Lightening the weight of the head.

Purification, regulation of inspired air, adjust temperature

Resonance of voice.

Chewing of food by teeth and jaws.

Classification of bones

- **Long bones**
 - It have shaft (body,or diaphysis) which extends between two expanded two epiphysis.
- **Short bones;** Short bones are roughly cube-shaped.
carpal and tarsal bones
- Flat bones** skull, ribs, sternum ,scapula
Formed of outer and inner lamina of compact bone separated by a layer of spongy.
- **Irregular bones** (Vertebrae, Hip bone ,Bones in the base of skull, **Pneumatic bones.**
- **Sesamoid bones** shaped like a sesame seed”) (patellae
Bony nodules found embedded in tendons of some muscles , ligaments or joint capsules.

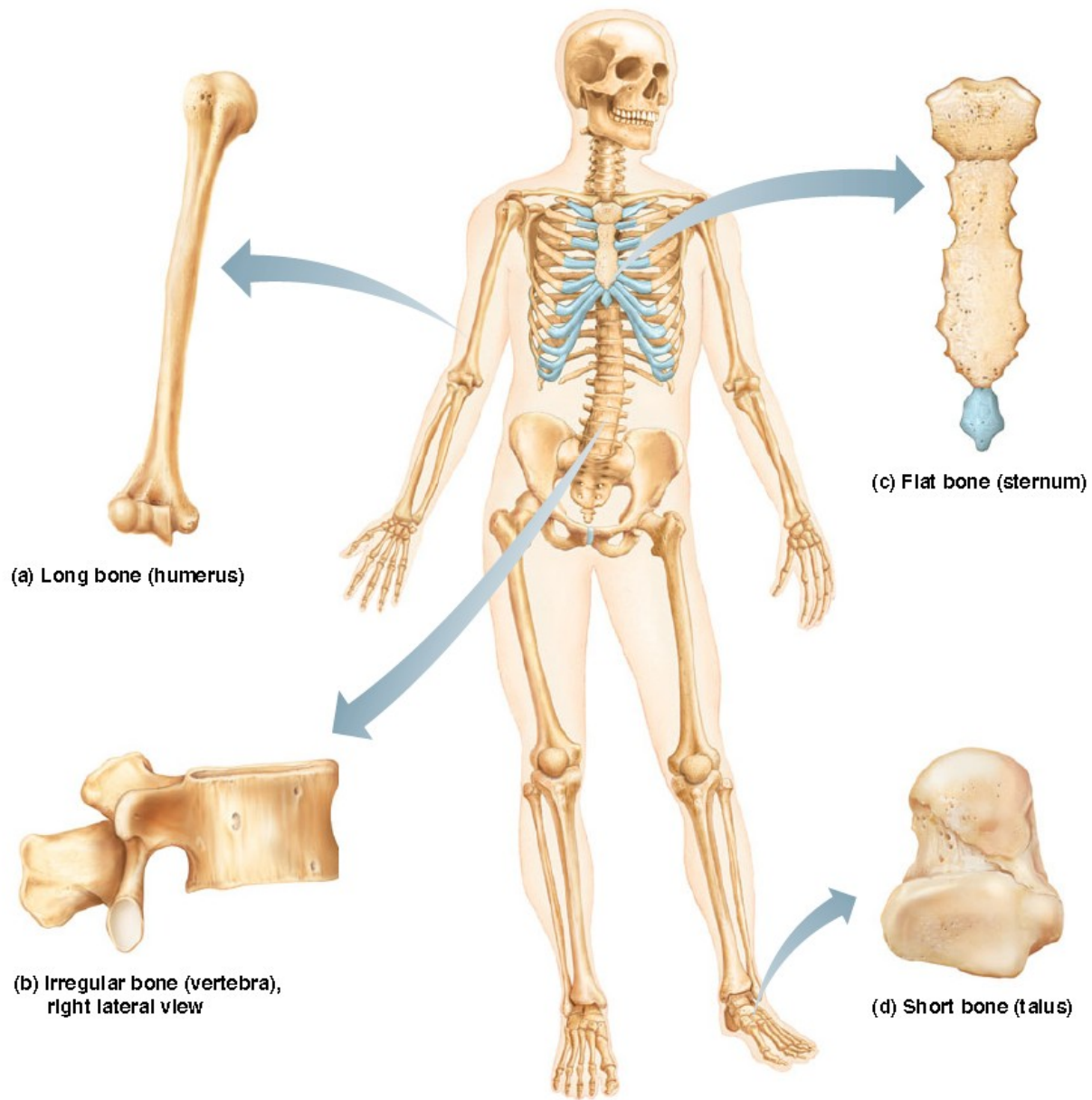


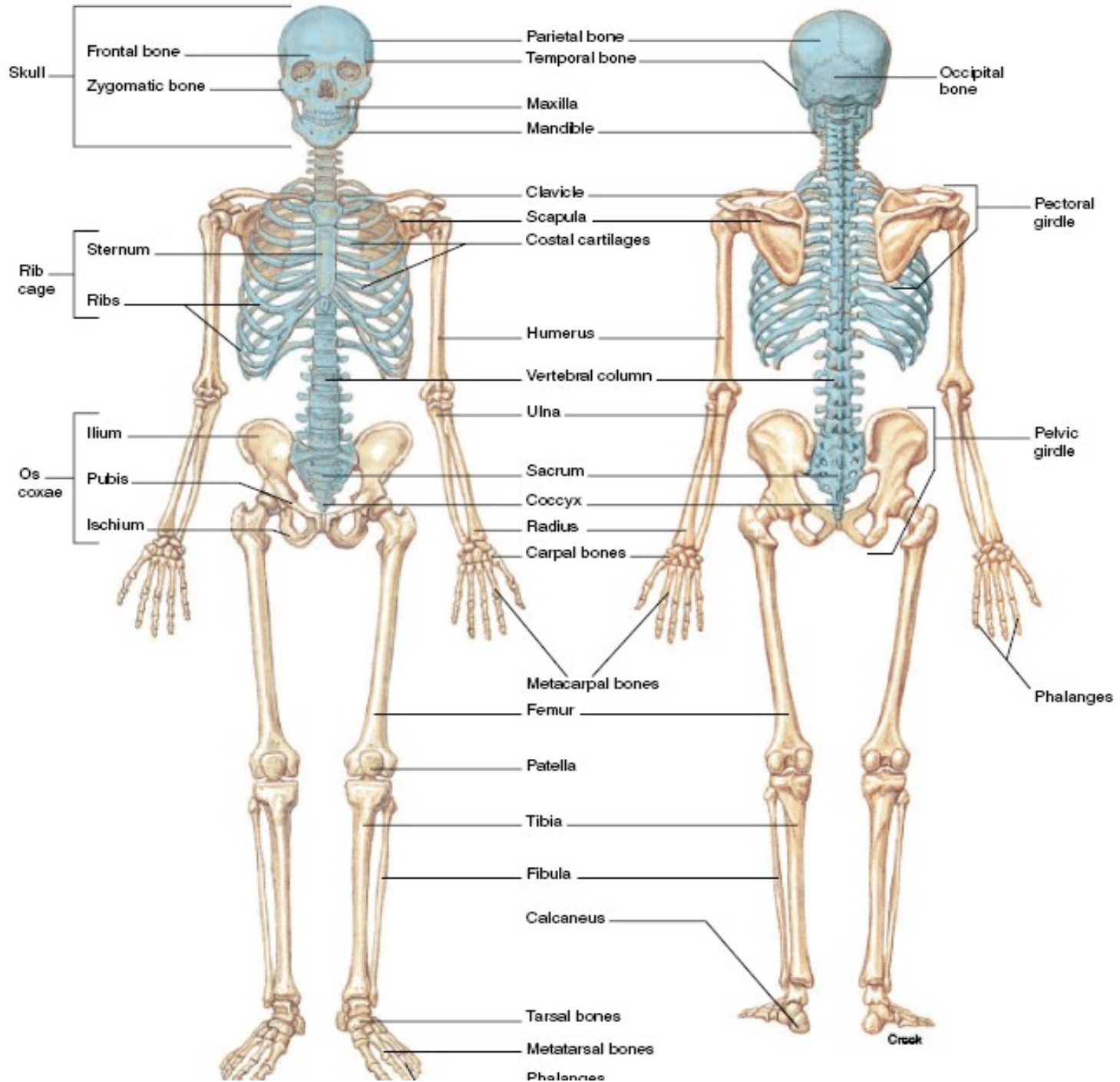
FIGURE 6.3 Classification of bones.

Skeleton

➤ **Axial**

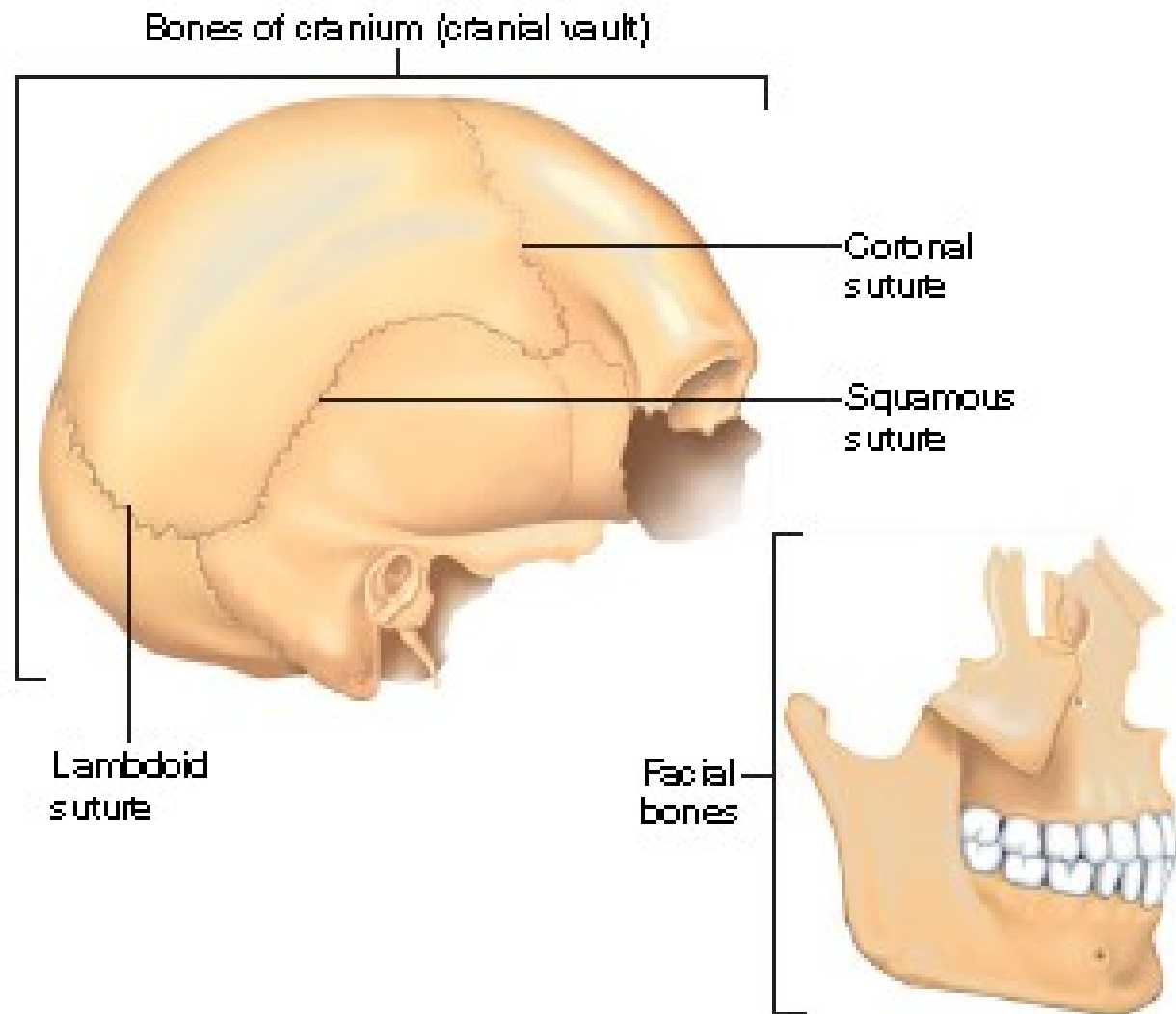


Appendicular

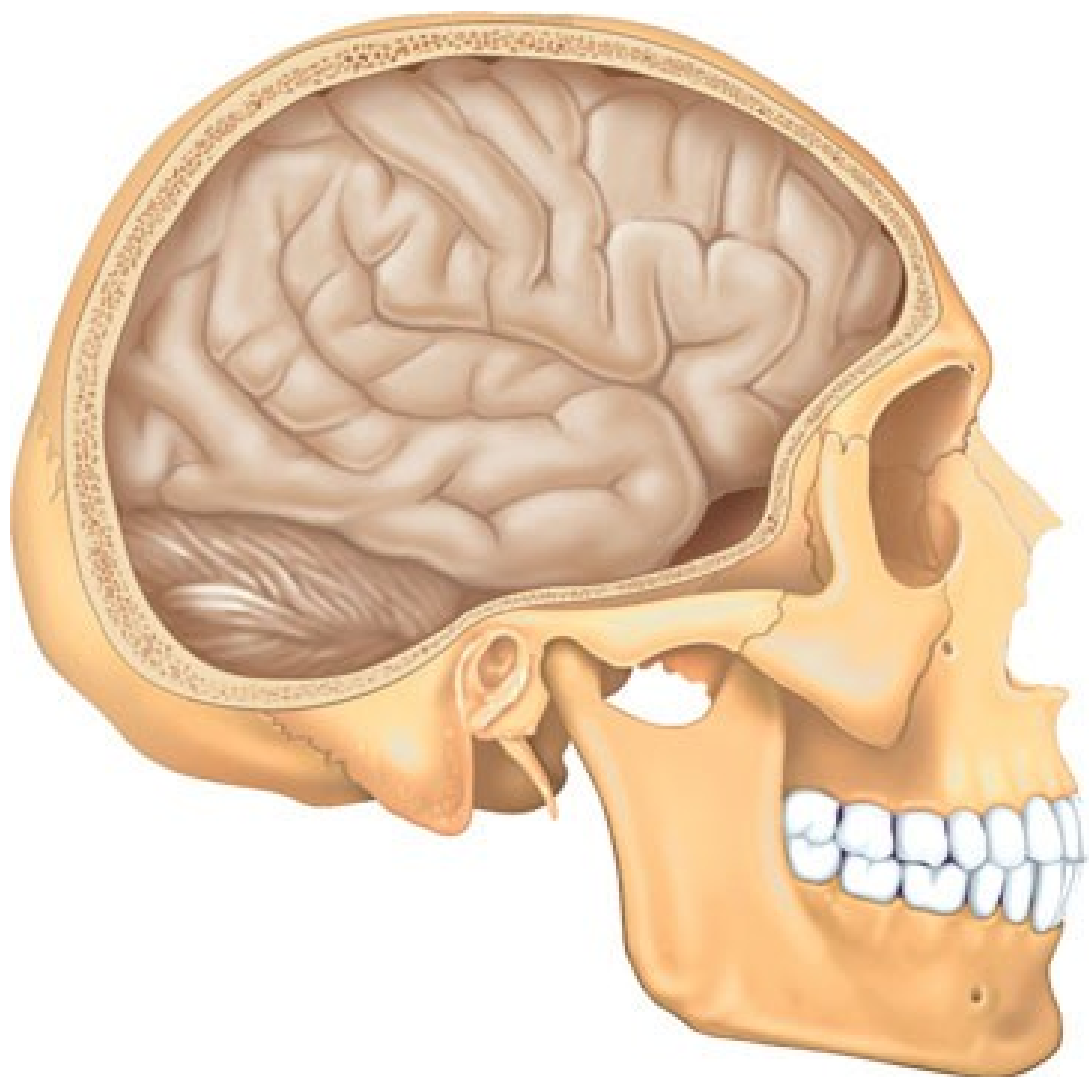


skull

- ❑ **The skull consists of two sets of bones:**
 - **cranial bones that form the cranium, or braincase (calveria).**
 - **facial bones that support the eyes and nose and form the bony framework of the oral cavity.**



(a) Cranial and facial divisions of the skull

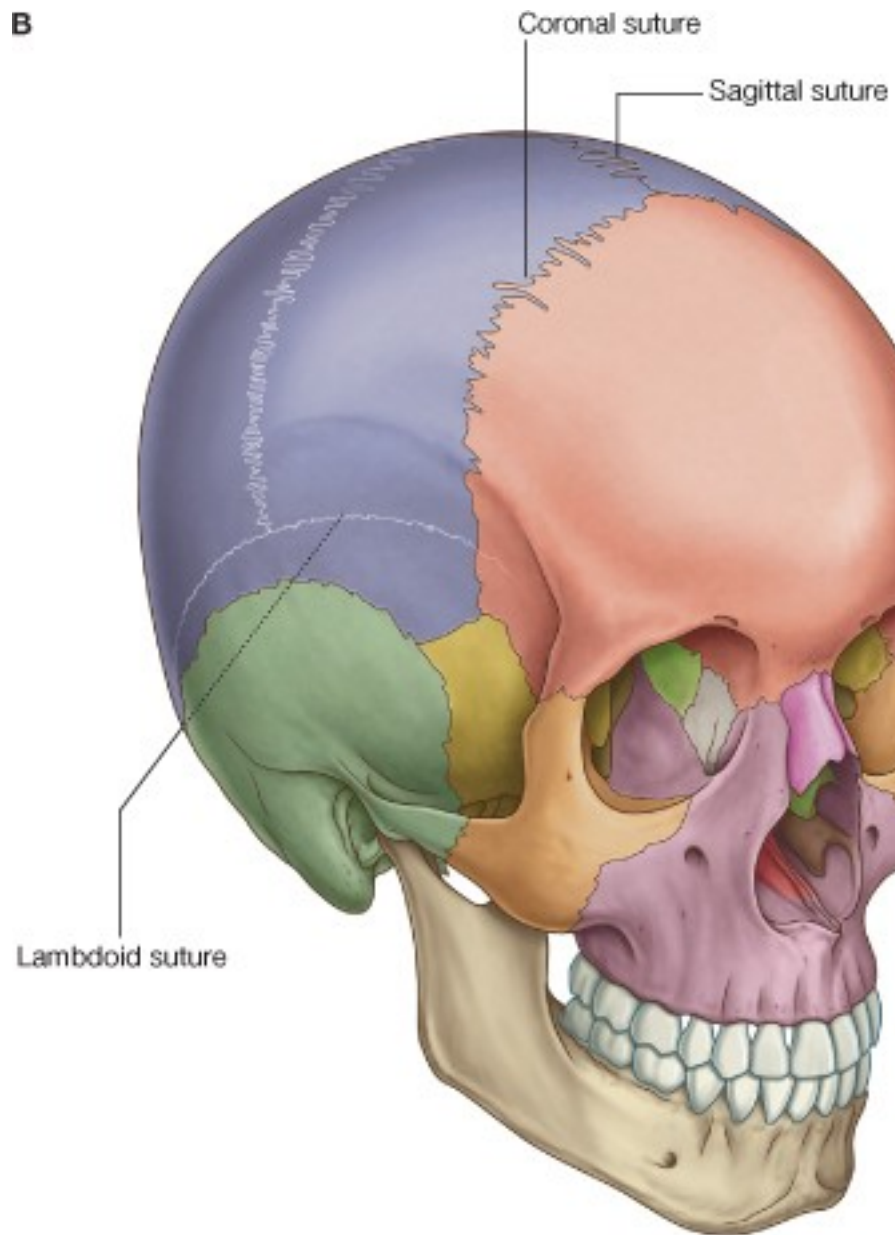
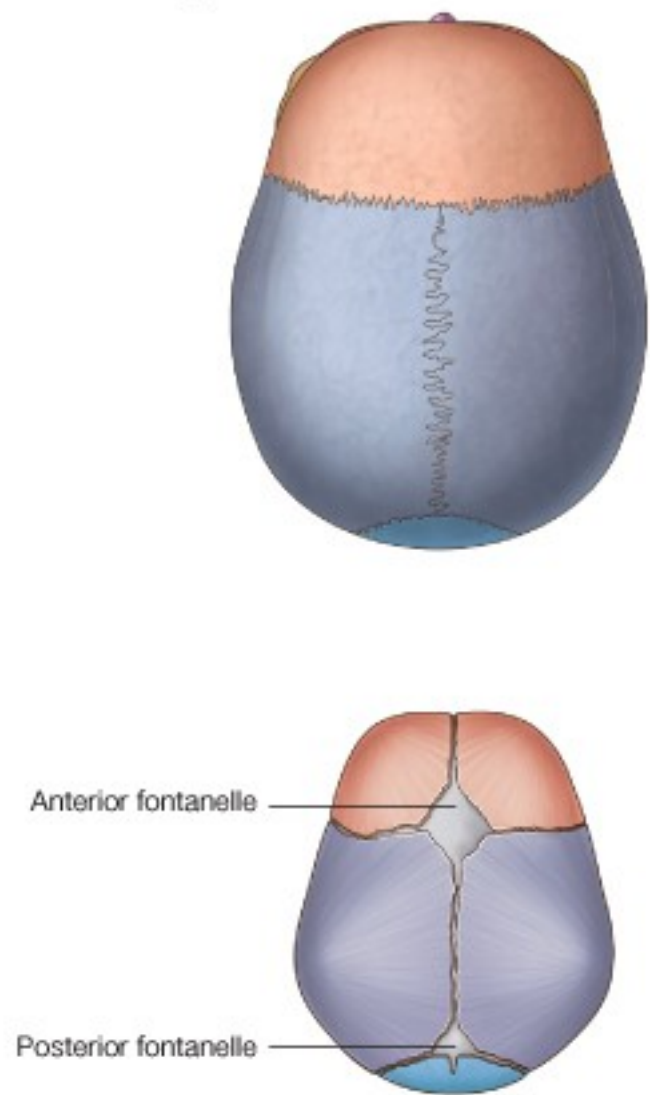


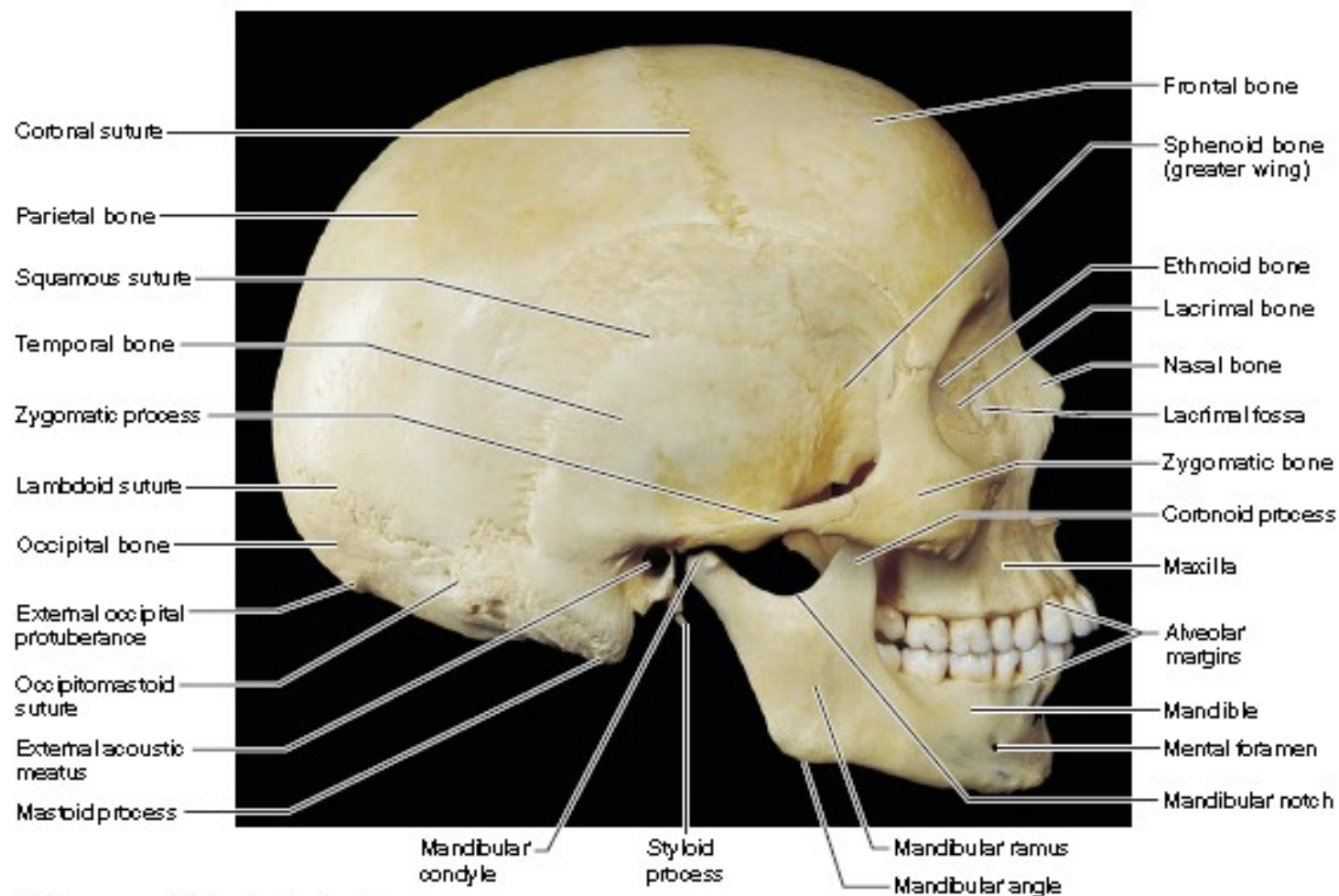
❑ Paired bones of the cranium:

- parietal.**
- temporal.**

❑ Unpaired bones:

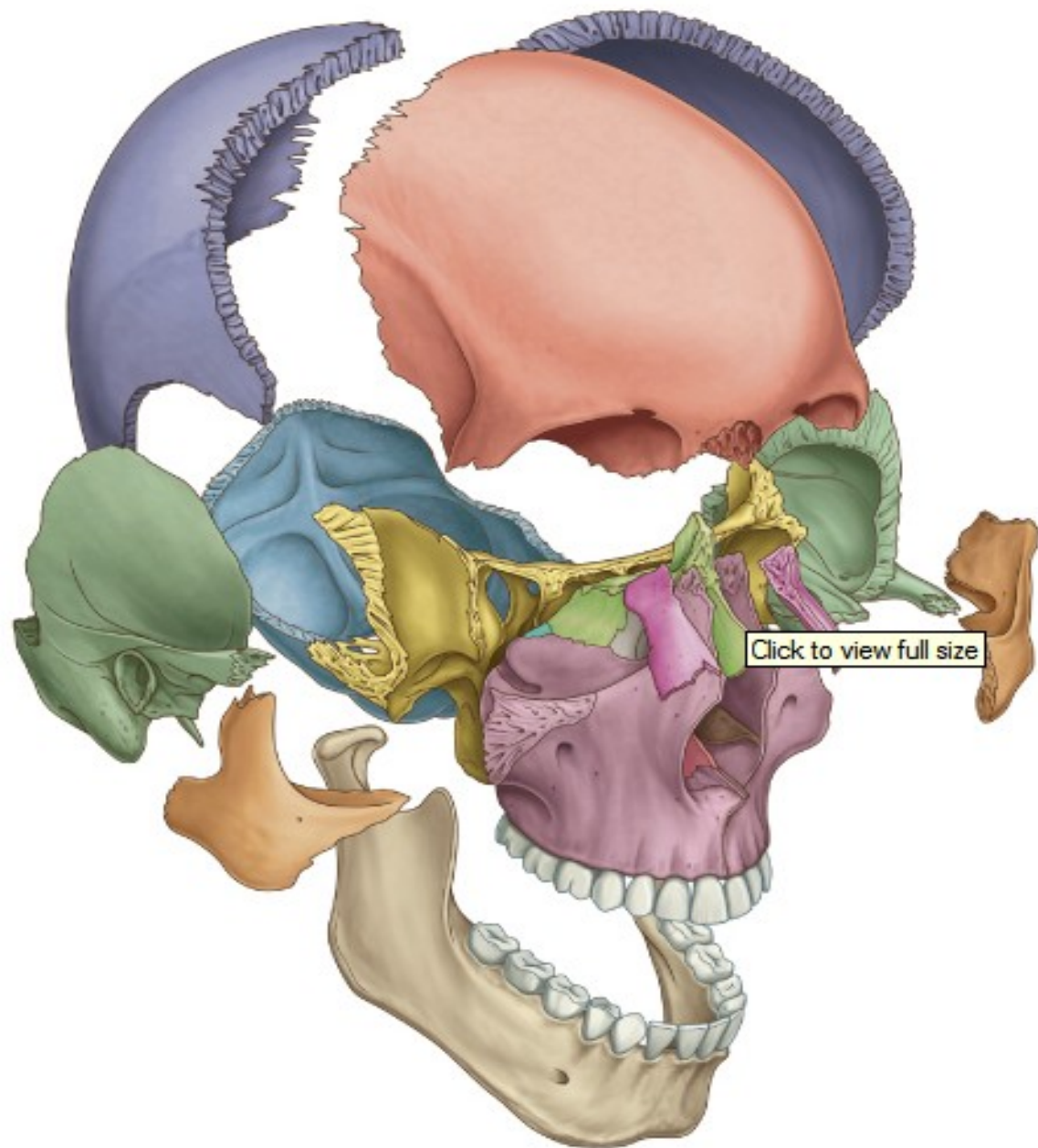
- Ethmoid**
- Frontal**
- Occipital**
- sphenoid**

B**C**



(b) Photograph of right side of skull

FIGURE 7.4 Lateral aspect of the skull, continued.



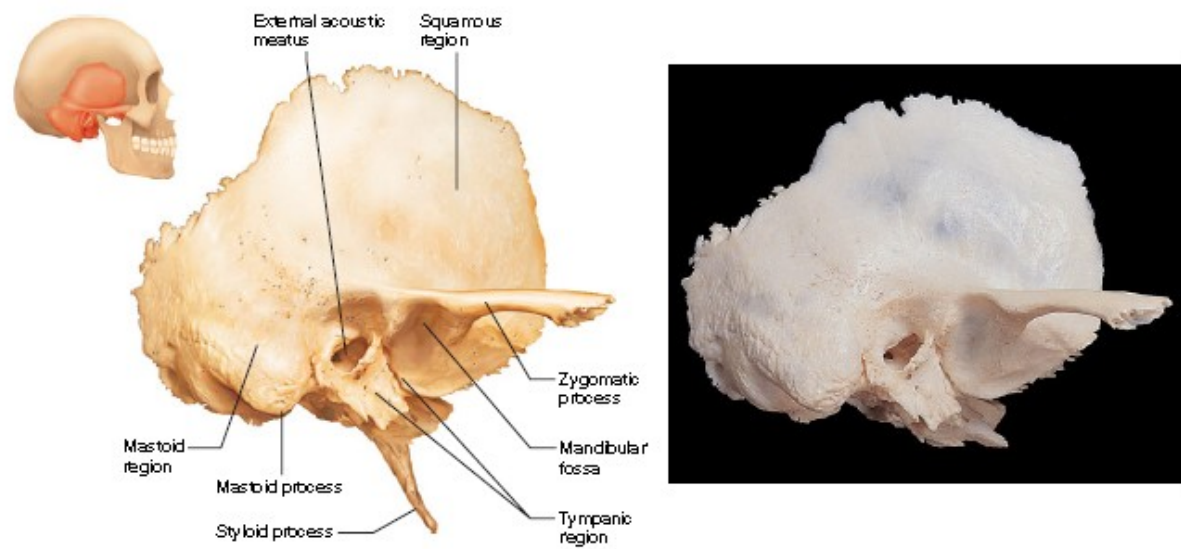
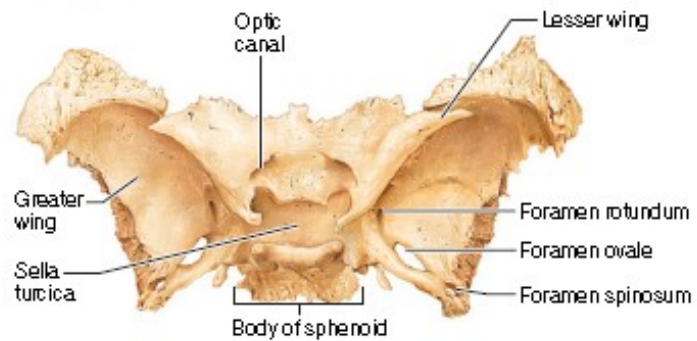
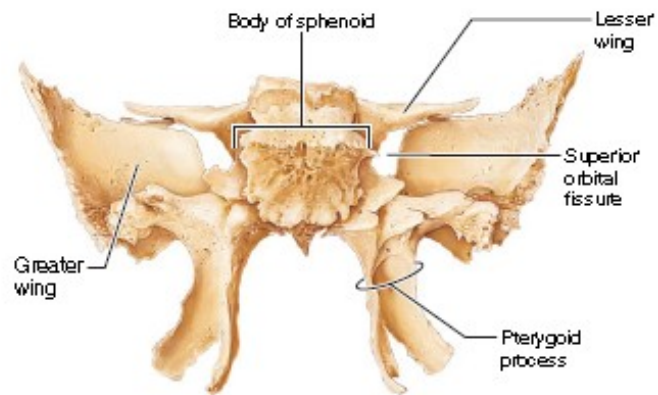


FIGURE 7.8 The temporal bone. Right lateral view. (See *A Brief Atlas of the Human Body*, Second Edition, Figures 2 and 8.)



(a) Superior view, as in Figure 7.9



(b) Posterior view



FIGURE 7.10 The sphenoid bone. (See *A Brief Atlas of the Human Body* Second Edition, Figures 3 and 9.)

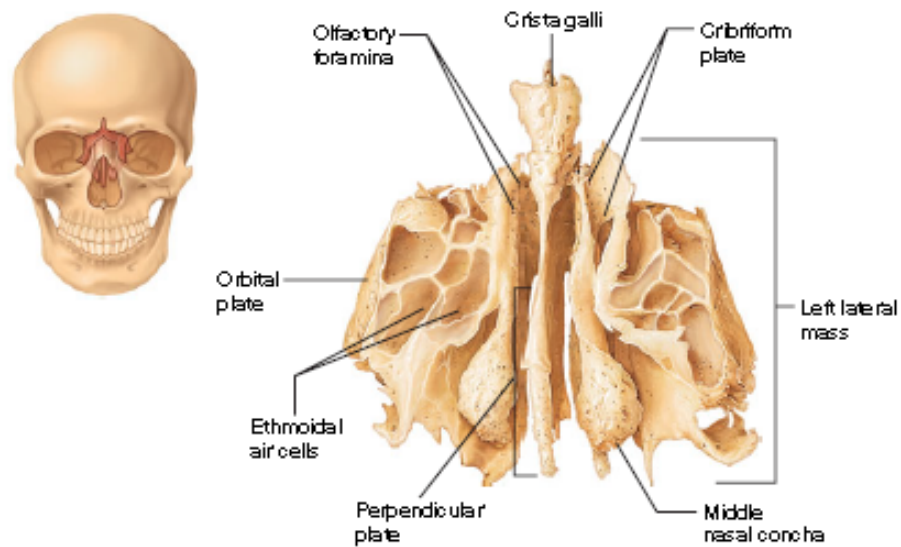
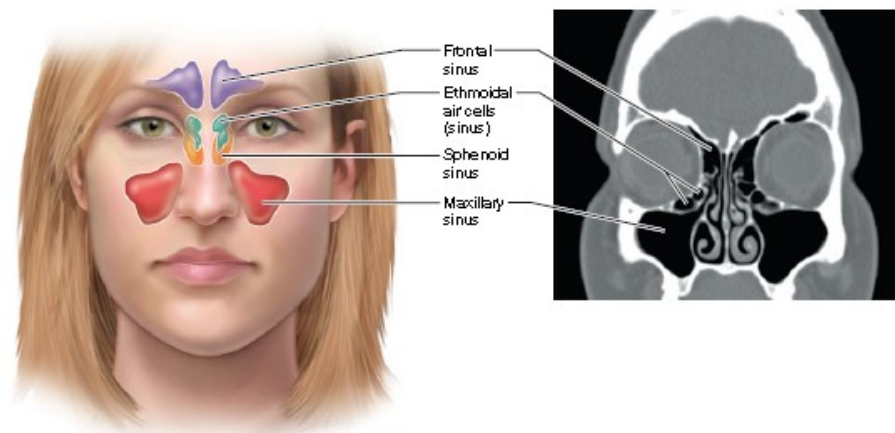
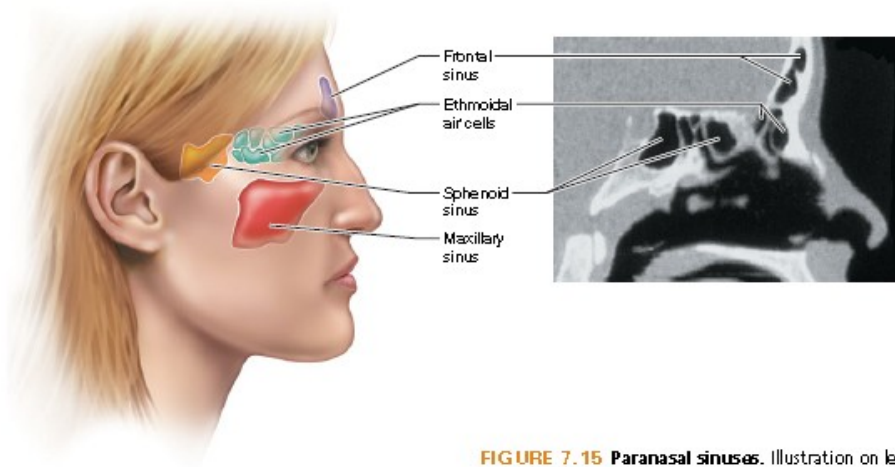


FIGURE 7.12 The ethmoid bone. Anterior view. (See *A Brief Atlas of the Human Body*, Second Edition, Figures 3 and 10.)



(a) Anterior aspect



(b) Medial aspect

FIGURE 7.15 Paranasal sinuses. Illustration on left, CT scan on right.

bones of the face:

Paired bones:

Maxillary

Zygomatic

Nasal

Lacrimal

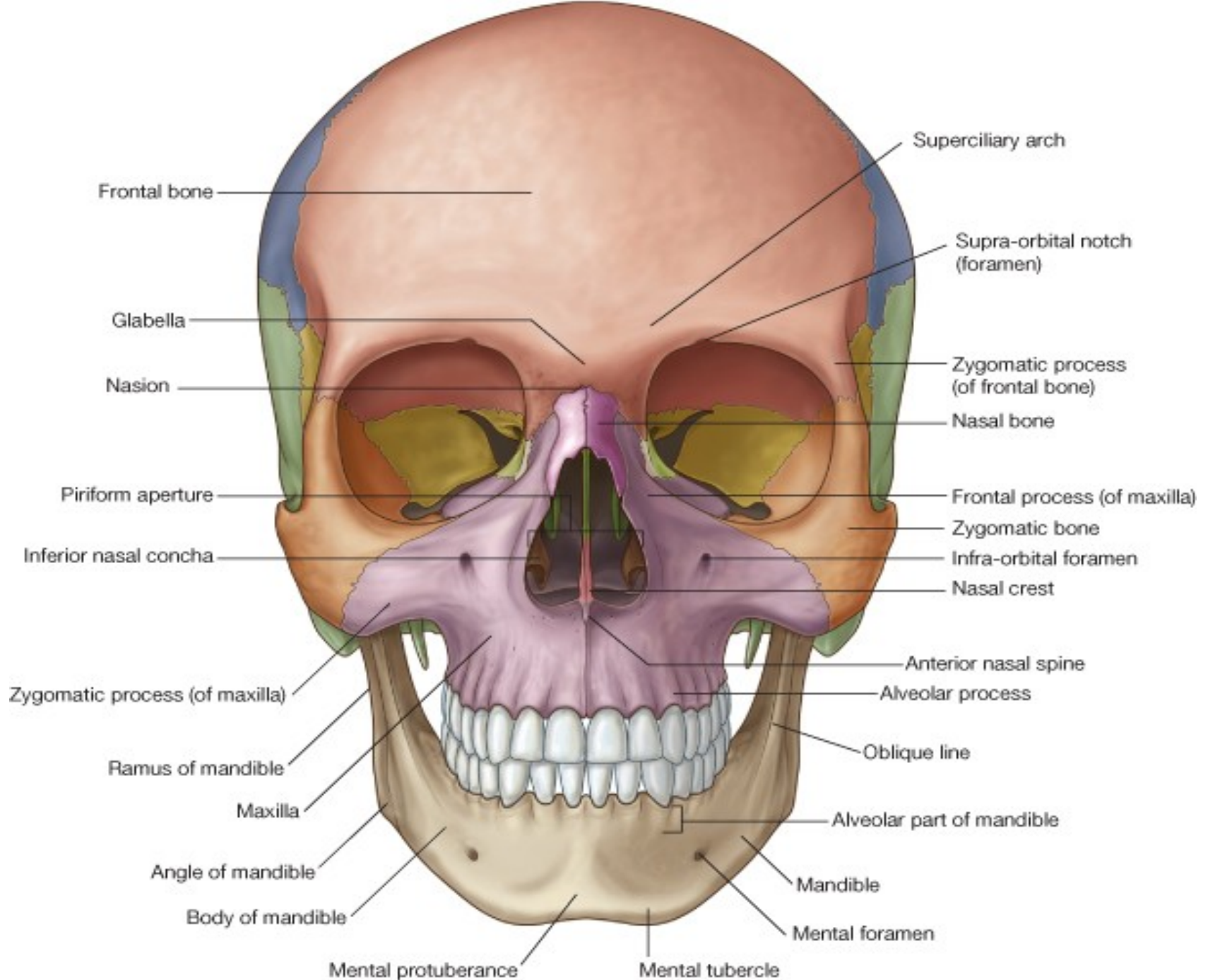
Inferior concha

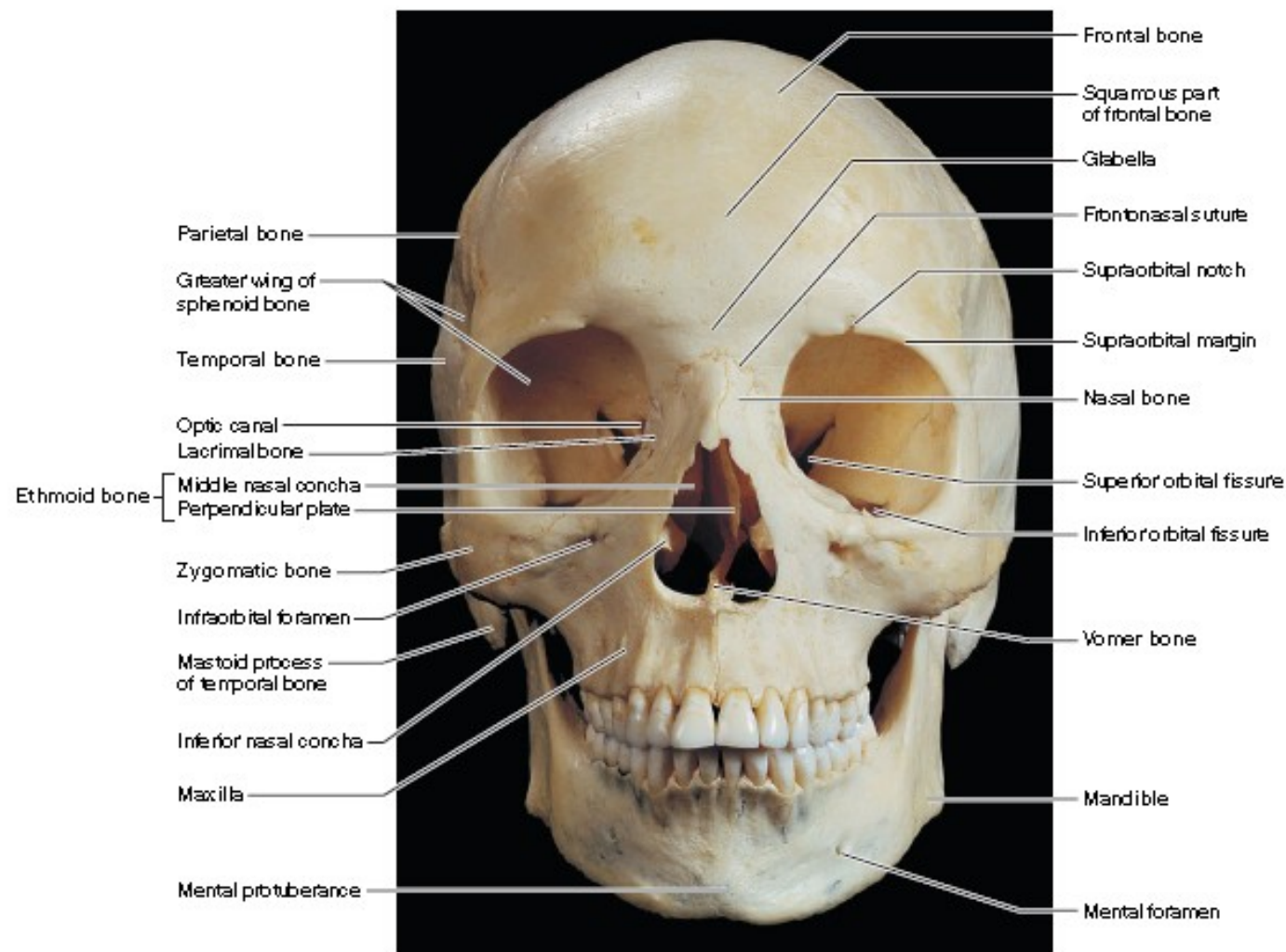
Palatine

Unpaired bones:

Vomer

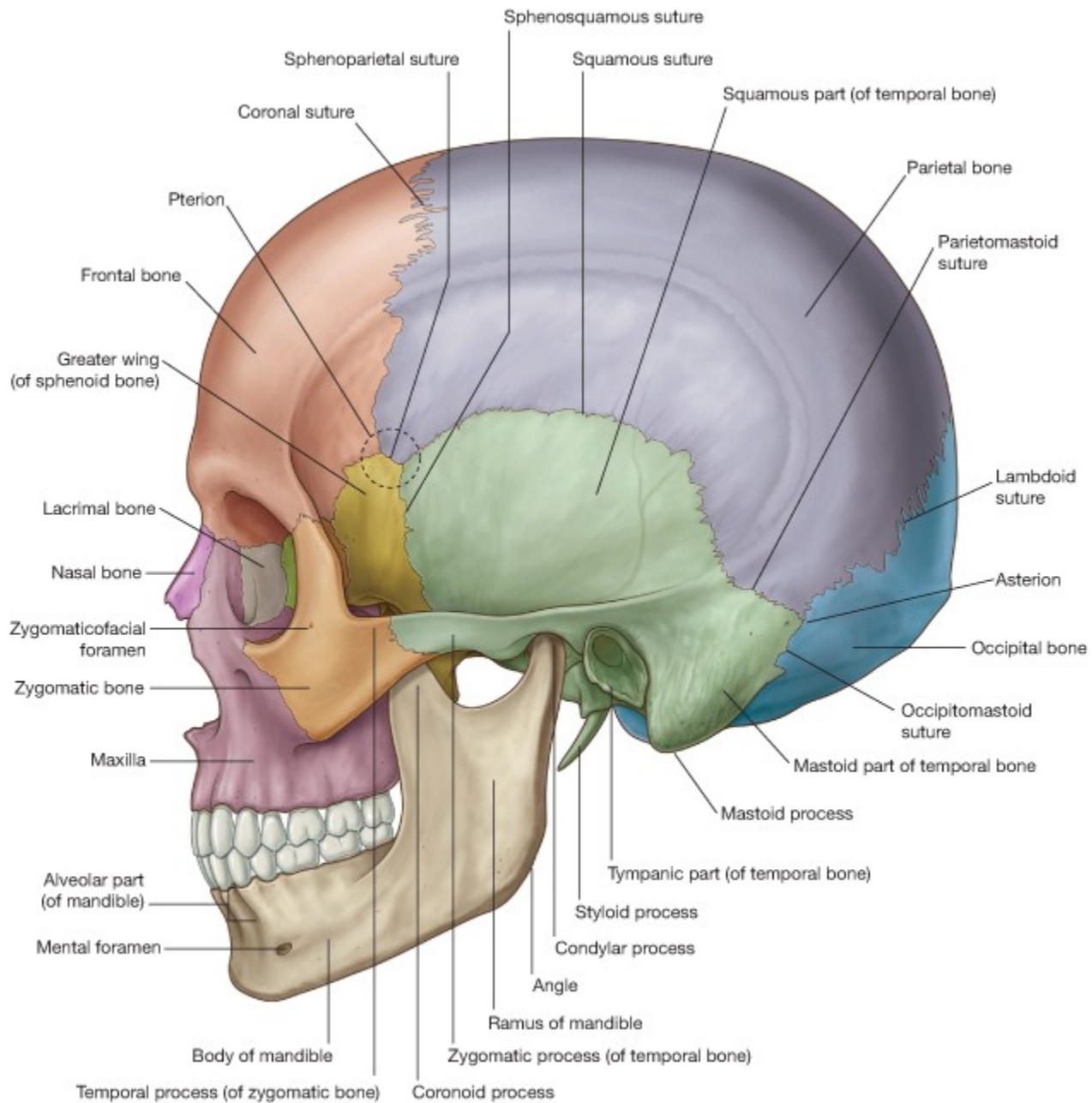
Mandible

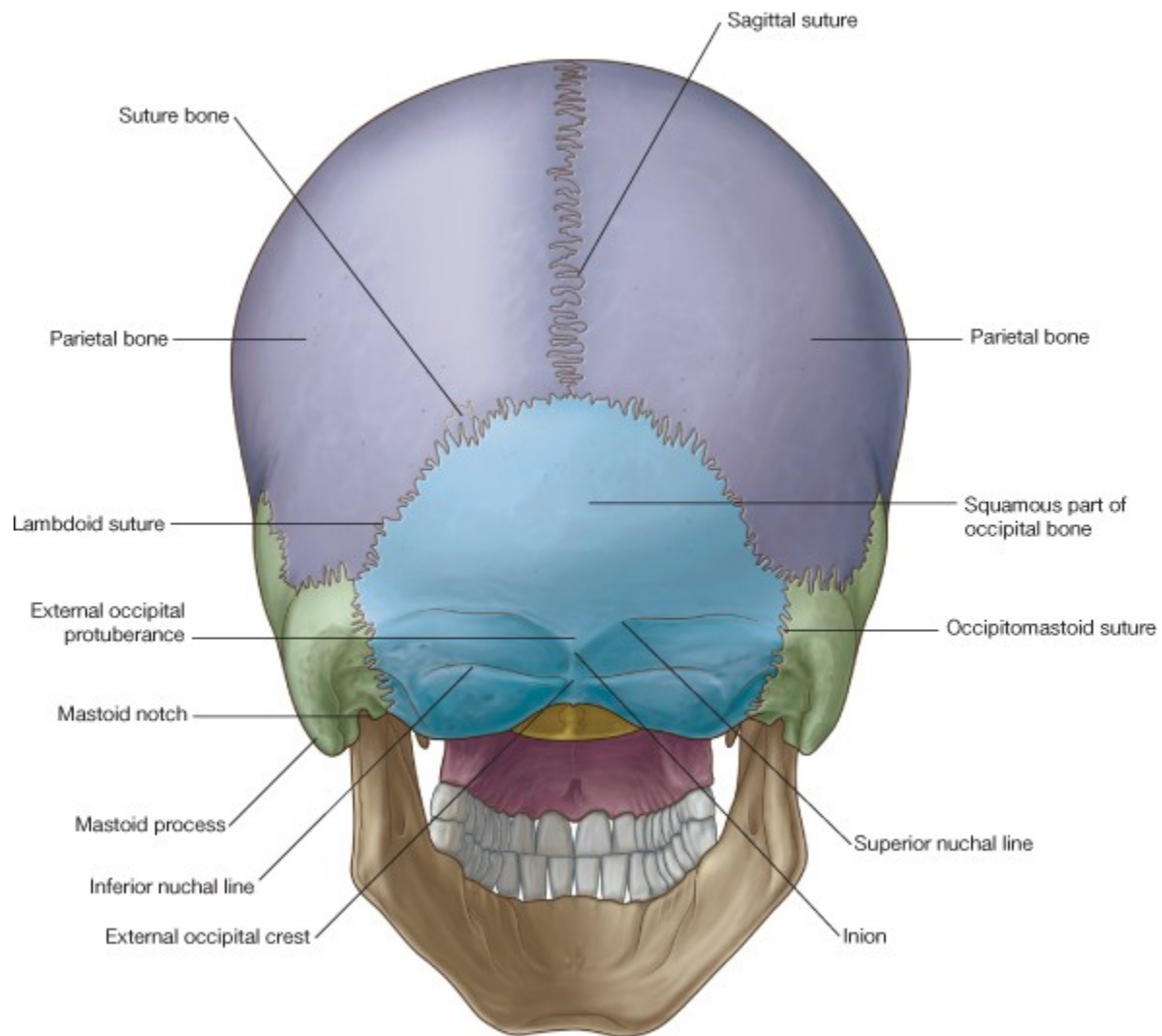


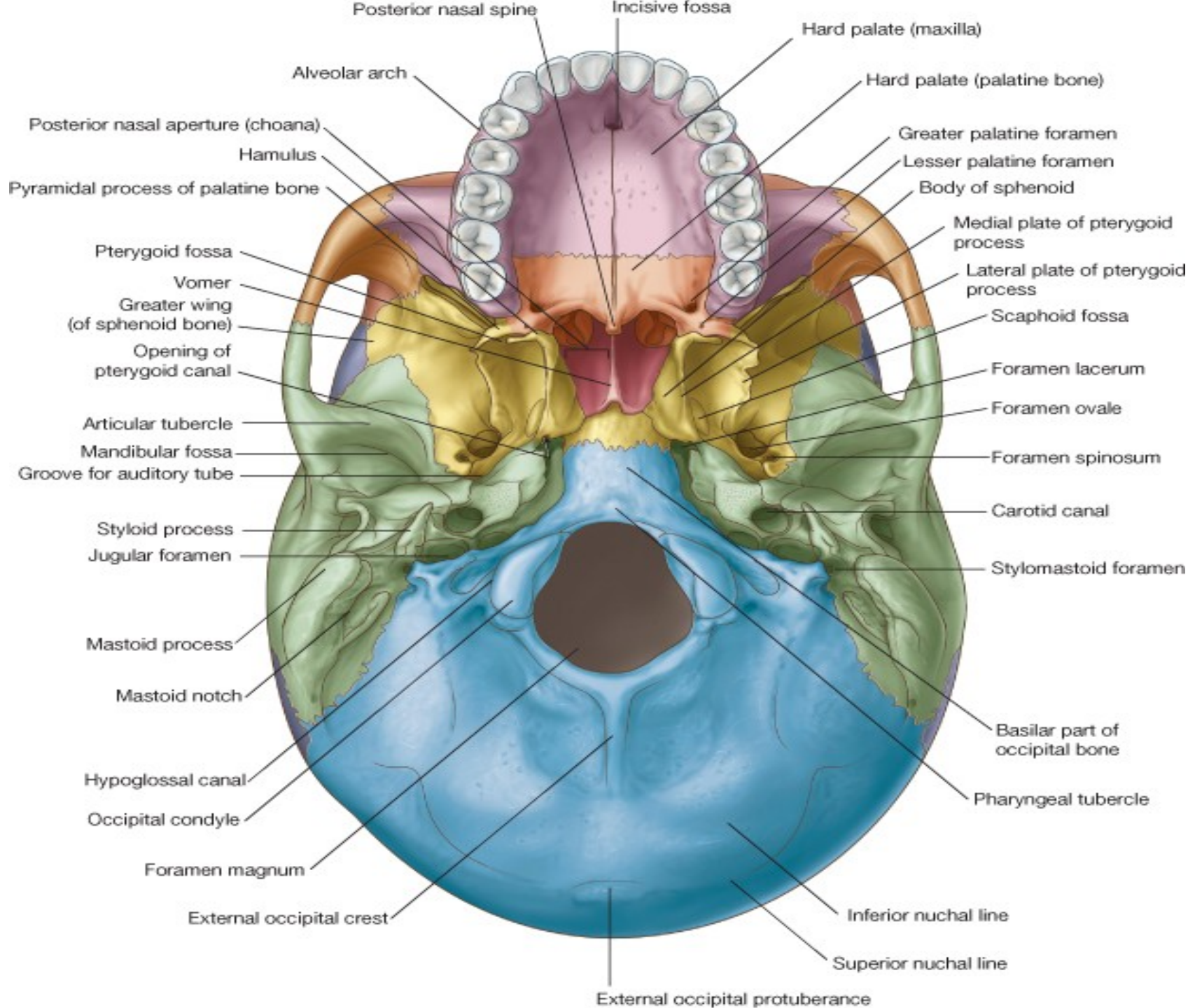


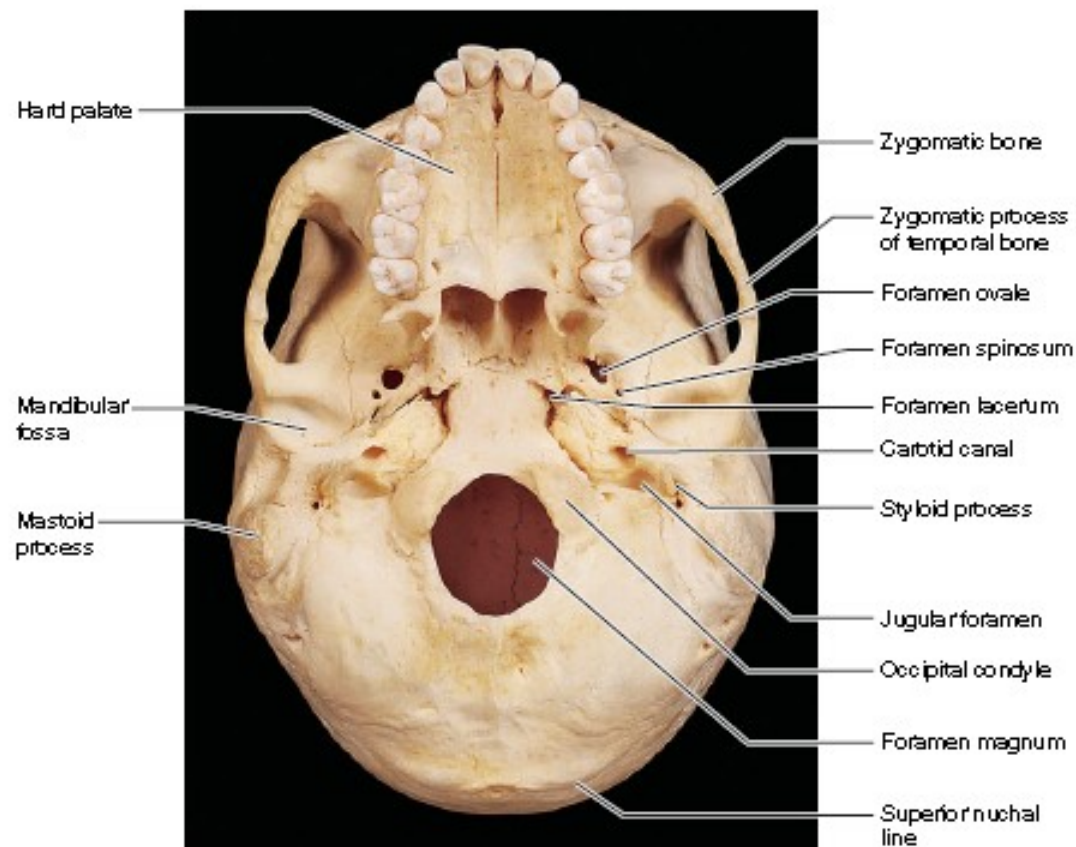
(b) Photo of anterior view of skull

FIGURE 7.6 Anterior view of the skull, continued.









(b) Photo of inferior view of the skull

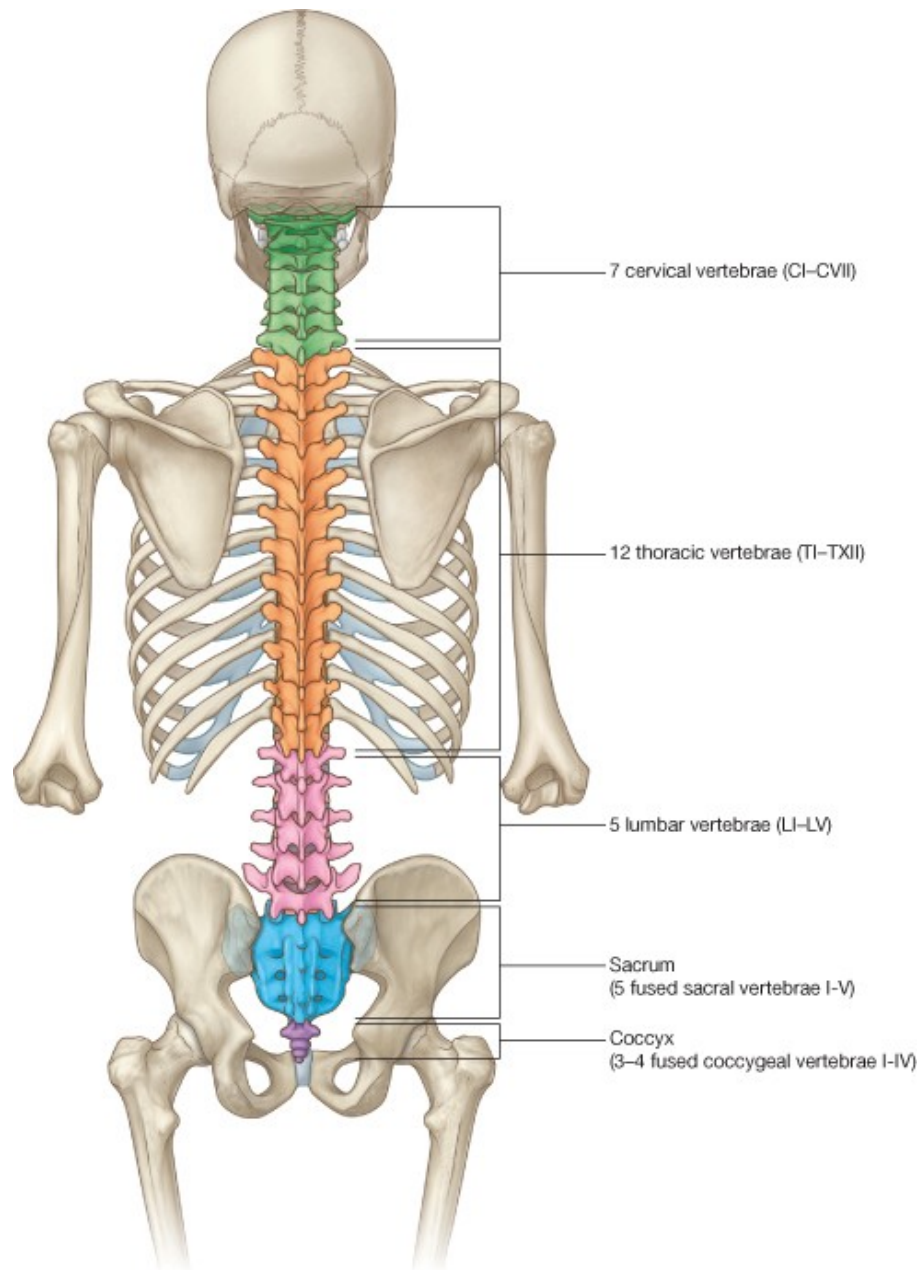
FIGURE 7.7 Inferior aspect of the skull.

Vertebral column

**Formed by 24 separate vertebrae
and**

**Sacrum (which composed of 5
fused vertebrae)**

**Coccyx (which composed of 2-4
fused vertebrae)**



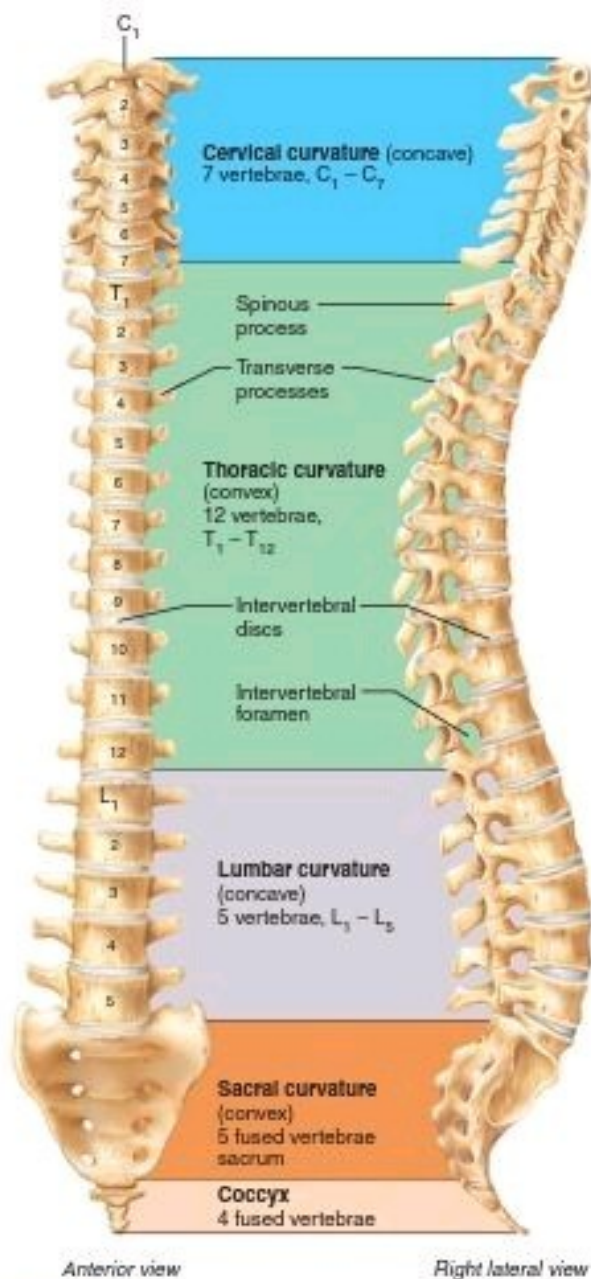
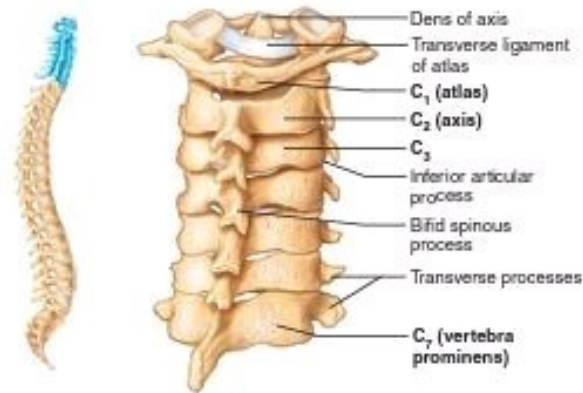
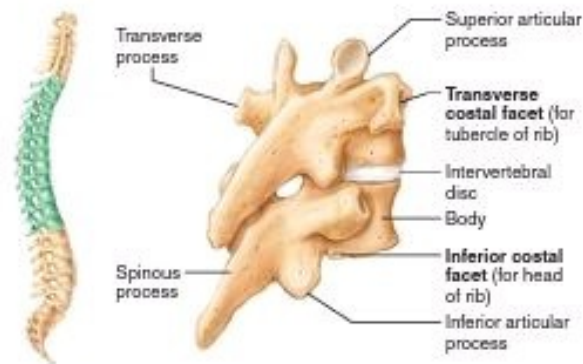


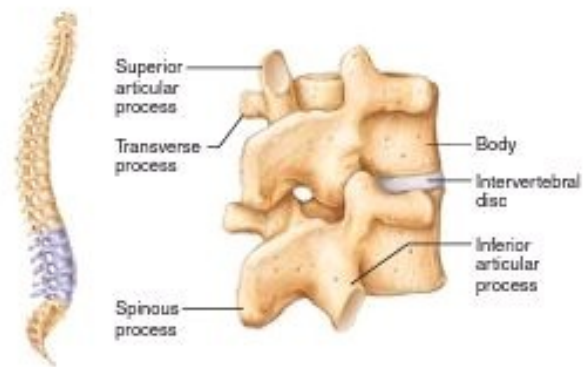
FIGURE 7.18 The vertebral column. Note the four curvatures in the lateral view at right. The terms *convex* and *concave* are relative to the *posterior* aspect of the column. (See *A Brief Atlas of the Human Body*, Second Edition, Figure 17.)



(a) Cervical vertebrae



(b) Thoracic vertebrae



(c) Lumbar vertebrae

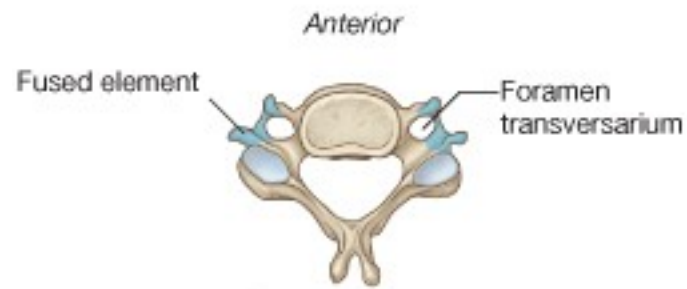
FIGURE 7.22 Posterolateral views of articulated vertebrae. In (a), note the prominent spinous process of C_7 , the vertebra prominens. (See *A Brief Atlas of the Human Body*, Second Edition, Figures 19, 20, and 21.)

Separate vertebrae divided in to:

- **Cervical**
- **Thoracic**
- **lumbar**

Each typical vertebra has:

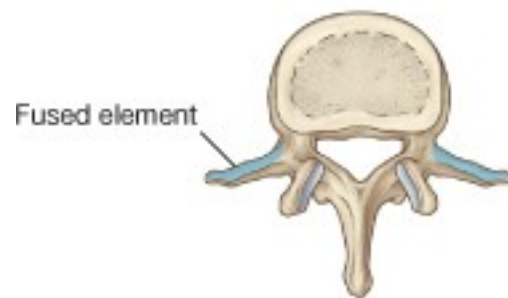
- **Body**
- **Vertebral foramen**
- **Pedicle**
- **Laminae**
- **Spine**
- **Transverse process**
- **Superior and inferior articular facets**



Cervical vertebra

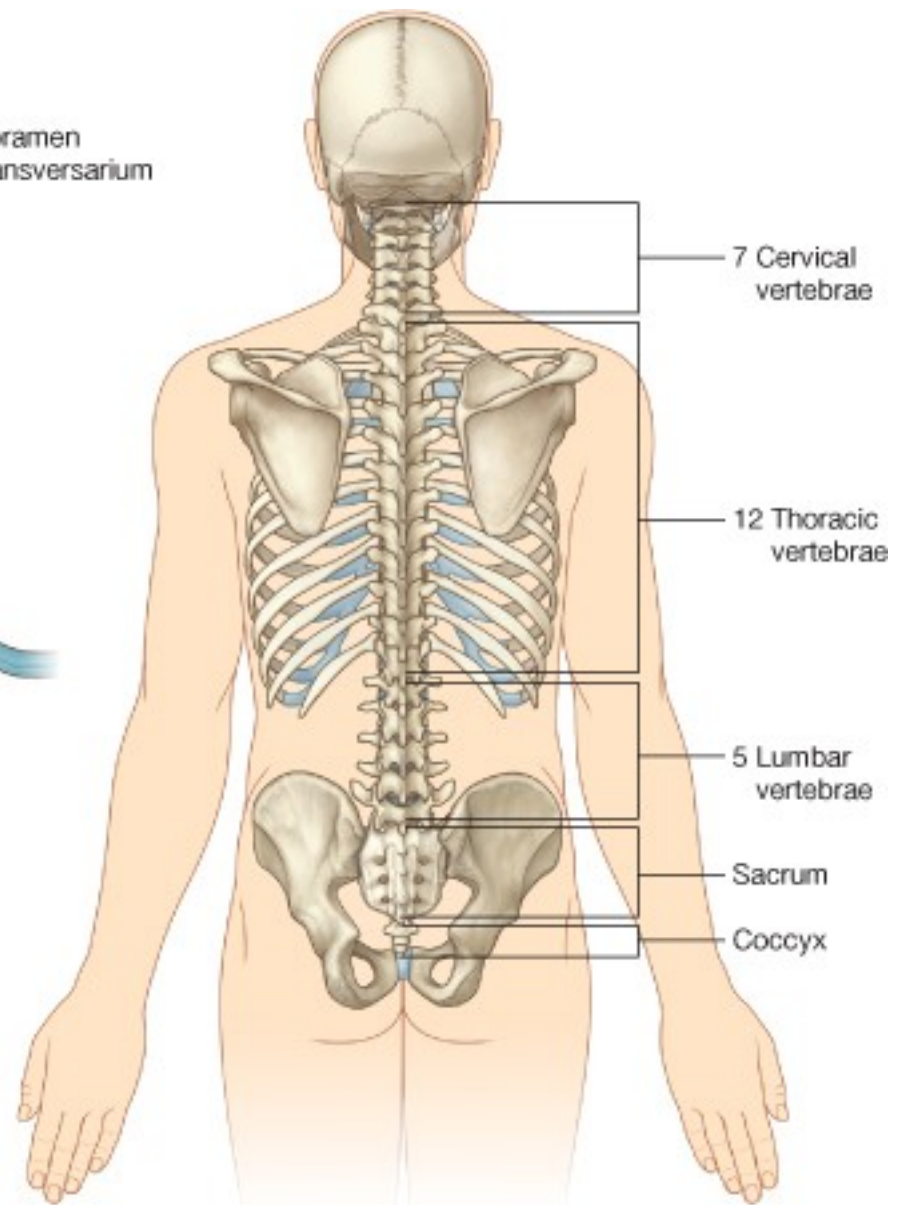


Thoracic vertebra



Lumbar vertebra

Posterior



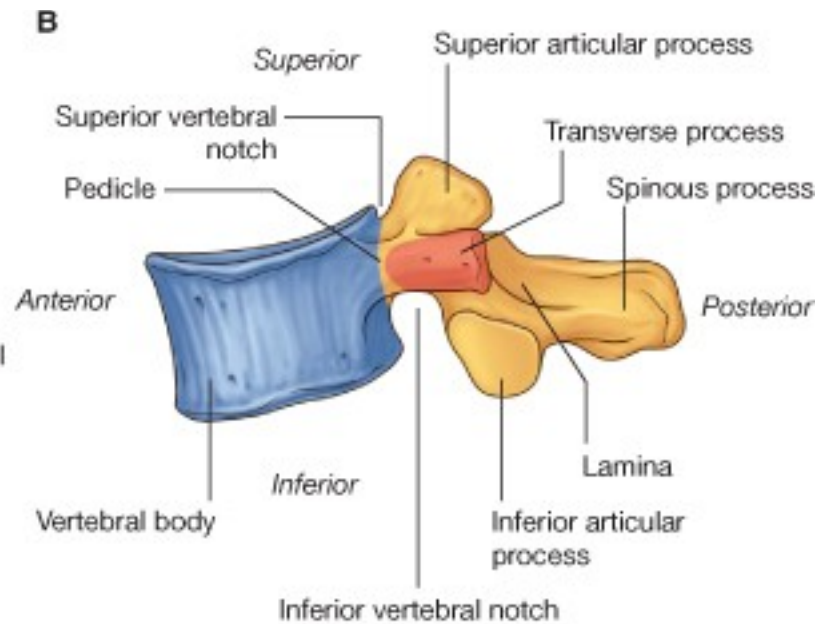
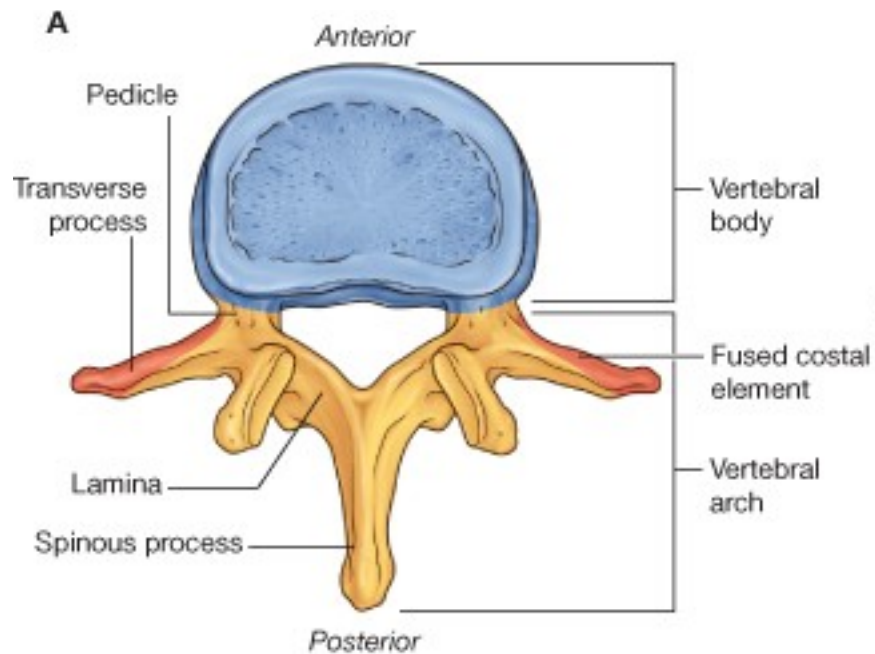
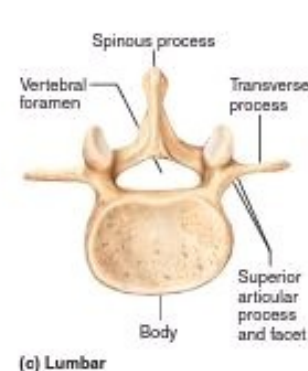
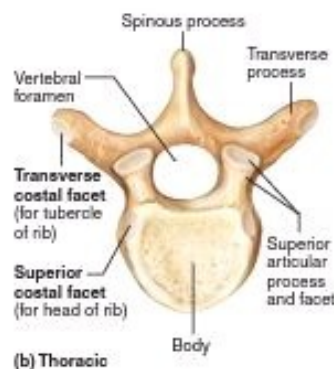
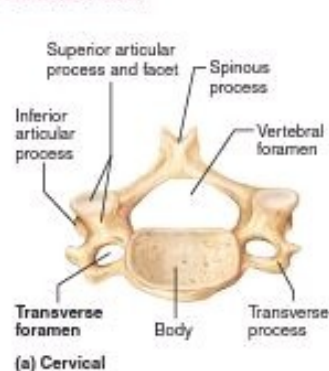


TABLE 7.2

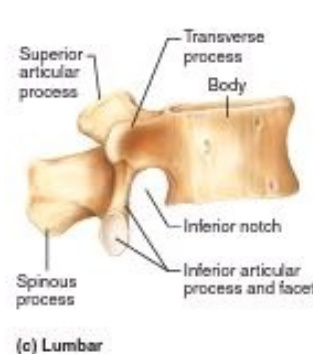
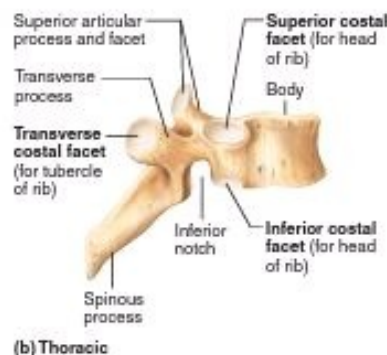
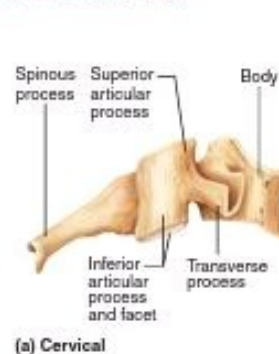
Regional Characteristics of Cervical, Thoracic, and Lumbar Vertebrae

Characteristic	Cervical (3–7)	Thoracic	Lumbar
Body	Small, wide side to side	Larger than cervical; heart-shaped; bears two costal facets	Massive; kidney-shaped
Spinous process	Short; forked; projects directly posteriorly	Long; sharp; projects inferiorly	Short; blunt; rectangular; projects directly posteriorly
Vertebral foramen	Triangular	Circular	Triangular
Transverse processes	Contain foramina	Bear facets for ribs (except T ₁₁ and T ₁₂)	Thin and tapered
Superior and inferior articulating processes	Superior facets directed superoposteriorly Inferior facets directed inferoanteriorly	Superior facets directed posteriorly Inferior facets directed anteriorly	Superior facets directed posteromedially (or medially) Inferior facets directed anterolaterally (or laterally)
Movements allowed	Flexion and extension; lateral flexion; rotation; the spine region with the greatest range of movement	Rotation; lateral flexion possible but restricted by ribs; flexion and extension limited	Flexion and extension; some lateral flexion; rotation prevented

SUPERIOR VIEW



RIGHT LATERAL VIEW



Cervical vertebrae

❑ Characteristic by:

- **Small body.**
- **Short spinous process (bifid).**
- **Transverse process contain foramen**

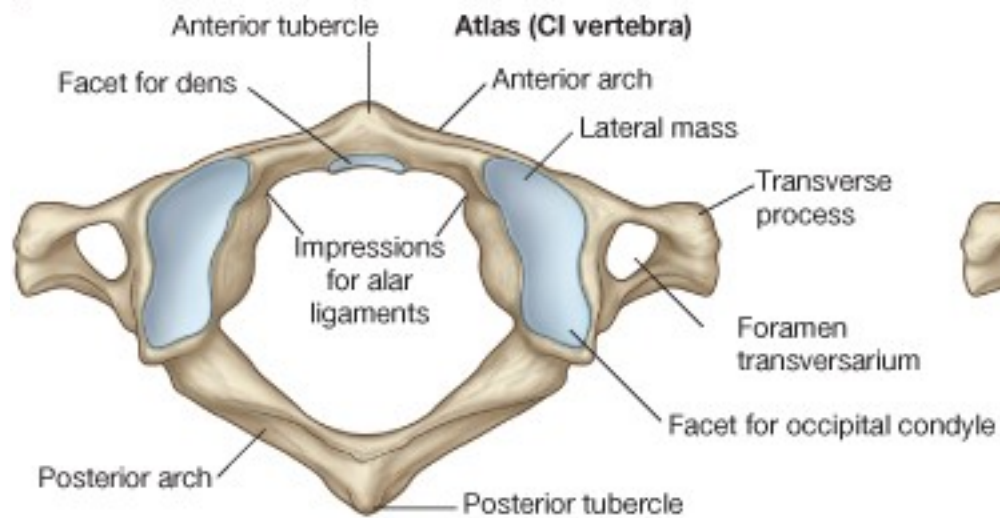
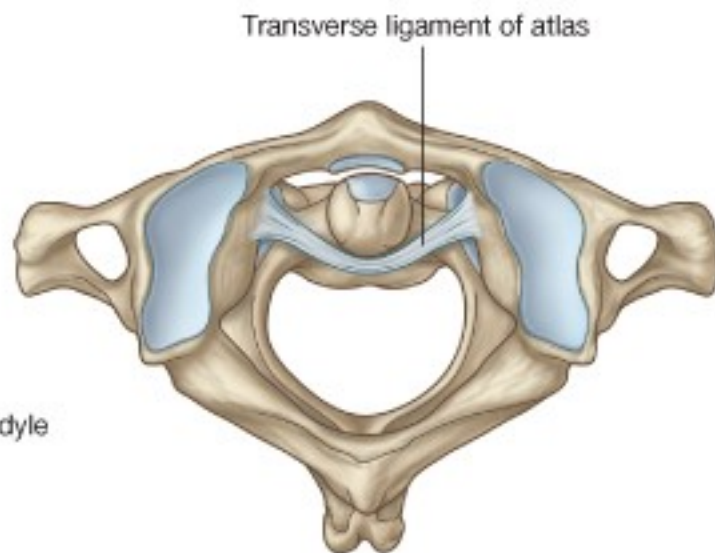
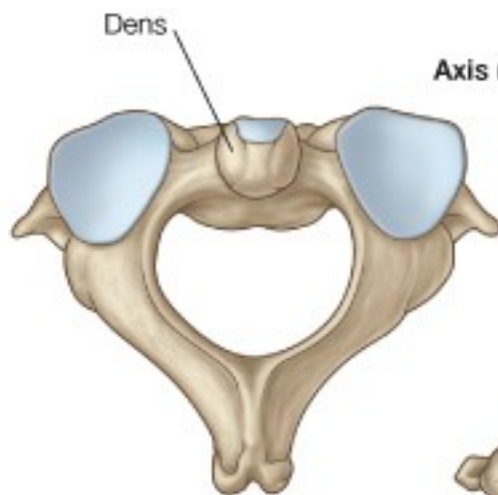
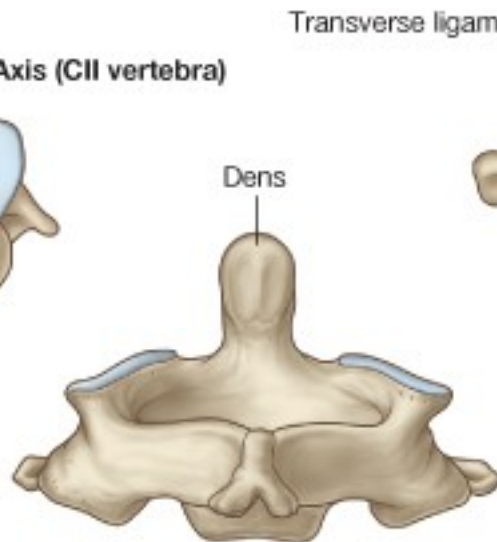
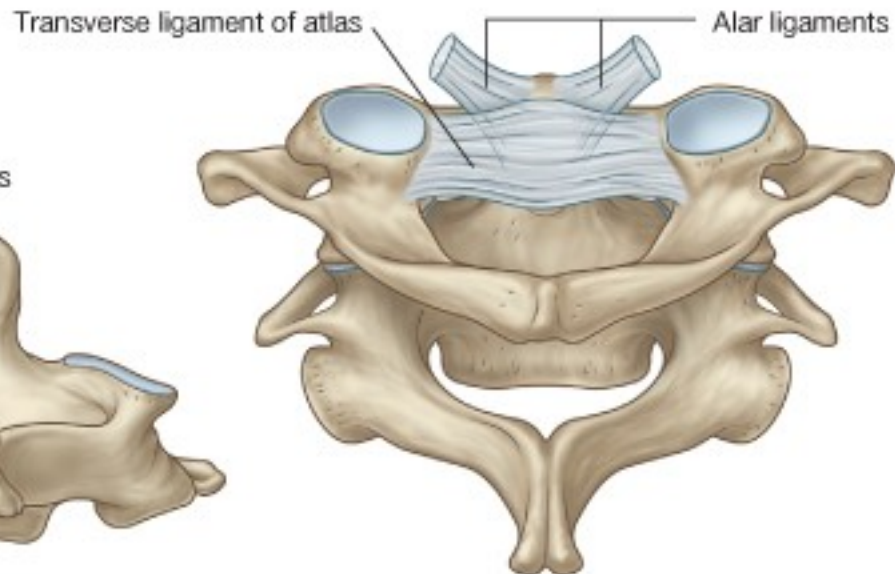
❑ Atypical cervical vertebrae:

❑ Atlas

- **Ringlike shape**
- **No body**

❑ Axis

- **It has odontoid process**
- **Seventh cervical v.(vertebral prominens)**

B*Superior view**Superior view**Superior view**Posterior view**Posterosuperior view*

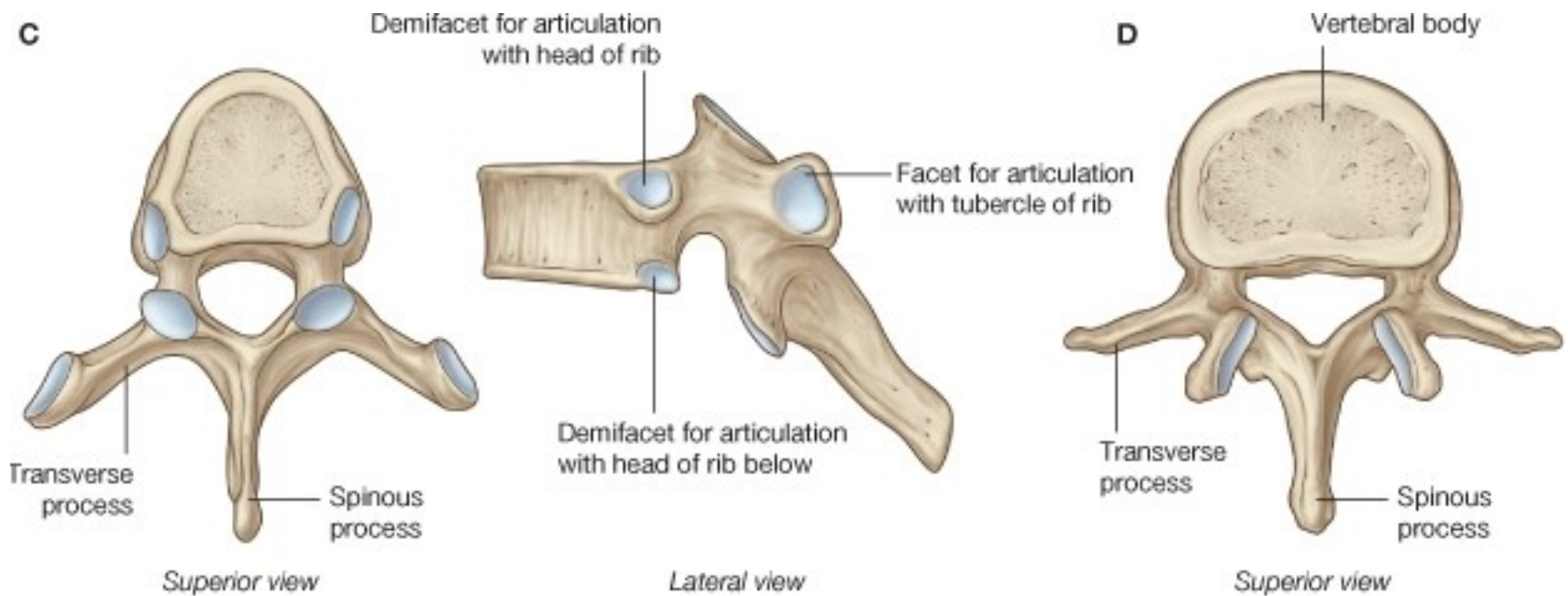
Thoracic vertebrae

It have:

Facets for articulation with ribs

Spinous process is long and oblique

Vertebral foramen is small

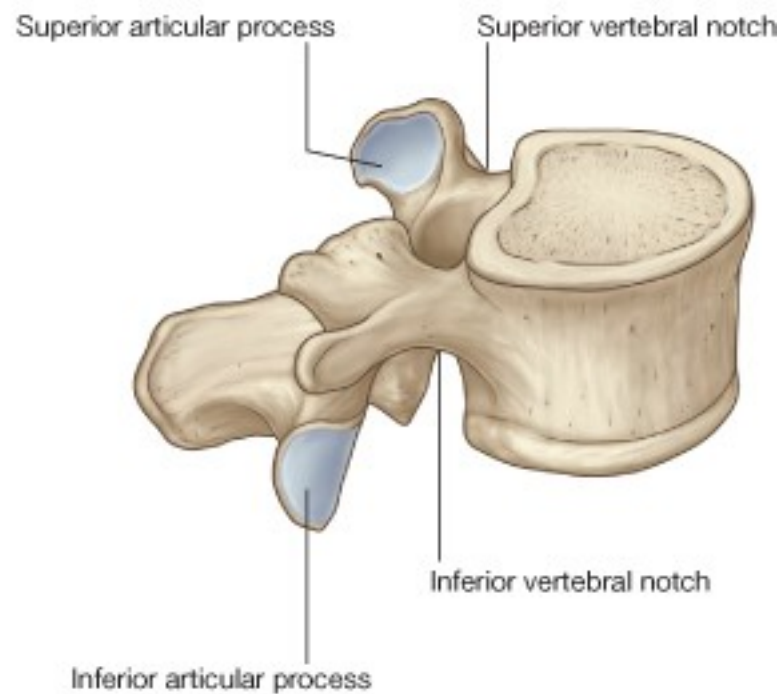
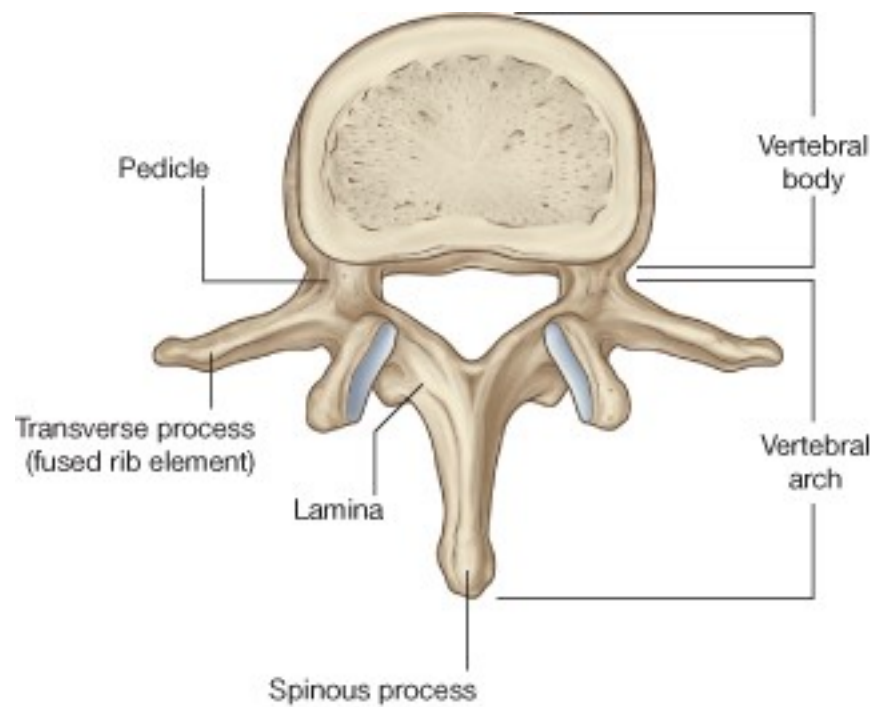


Lumbar vertebrae

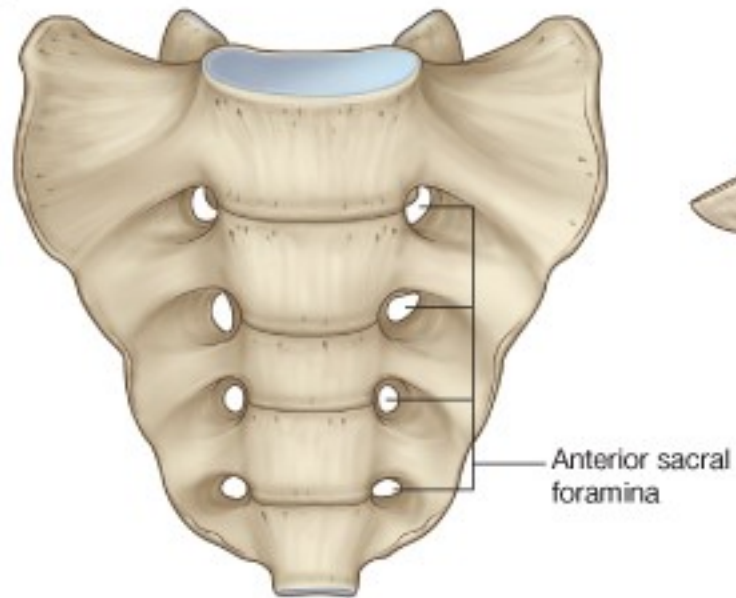
Characteristic by:

Large size of body

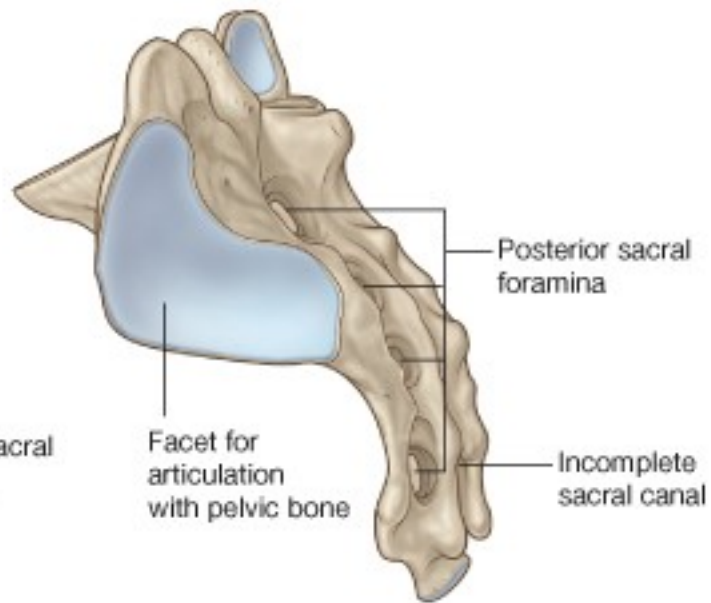
**Spinous process quadrangular in shape,
flat and project straight back**



E

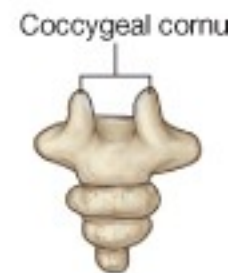


Anterior view



Dorsolateral view

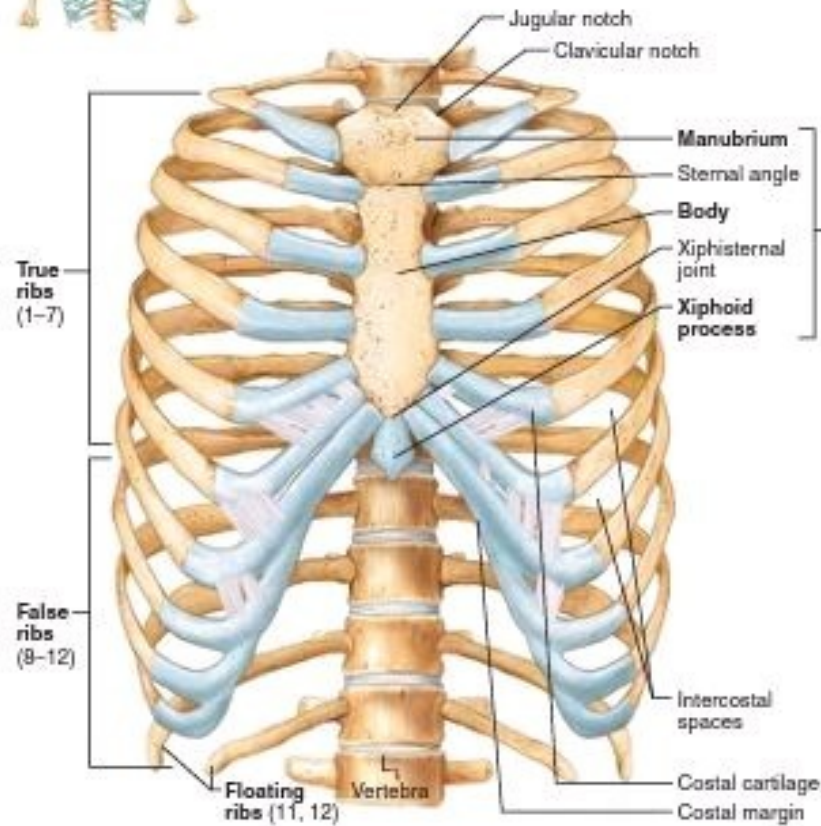
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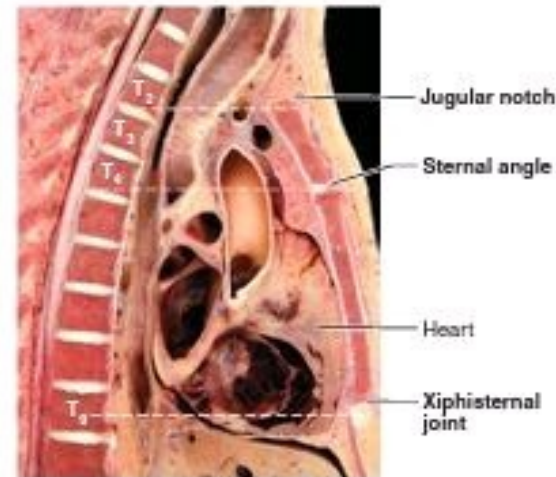
Posterior view

Thoracic cage

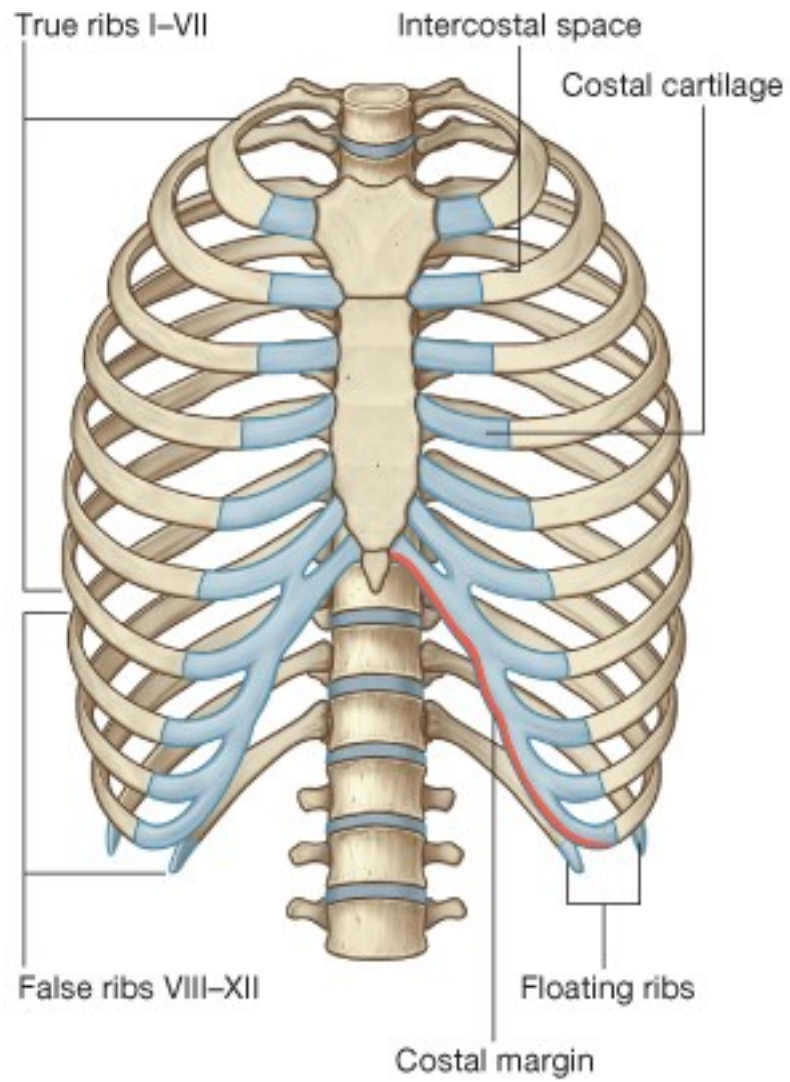
FIGURE 7.24 The thoracic cage. (See *A Brief Atlas of the Human Body*, Second Edition, Figure 23.)

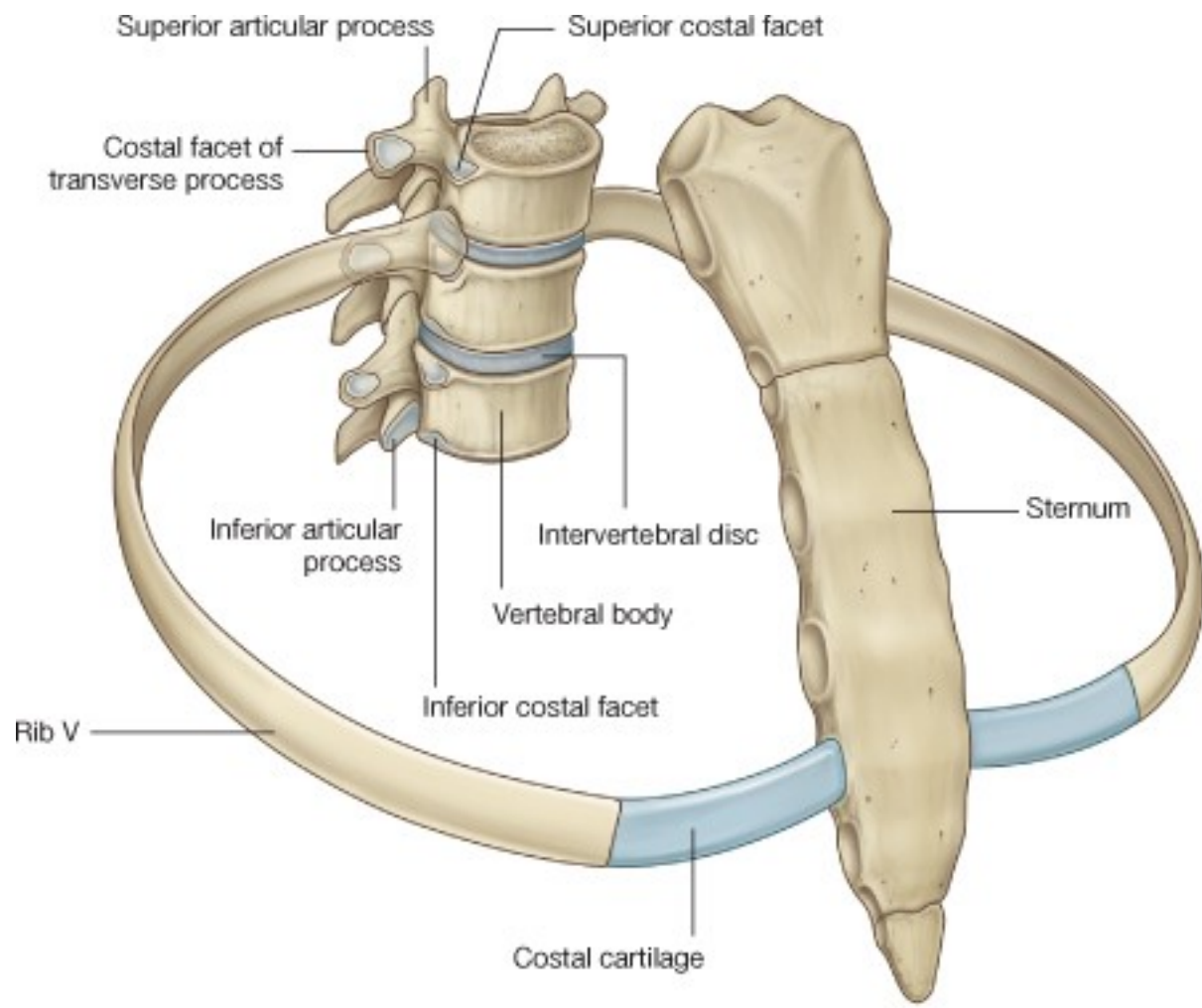


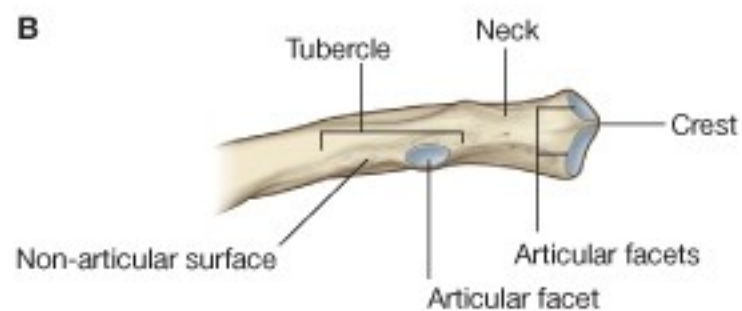
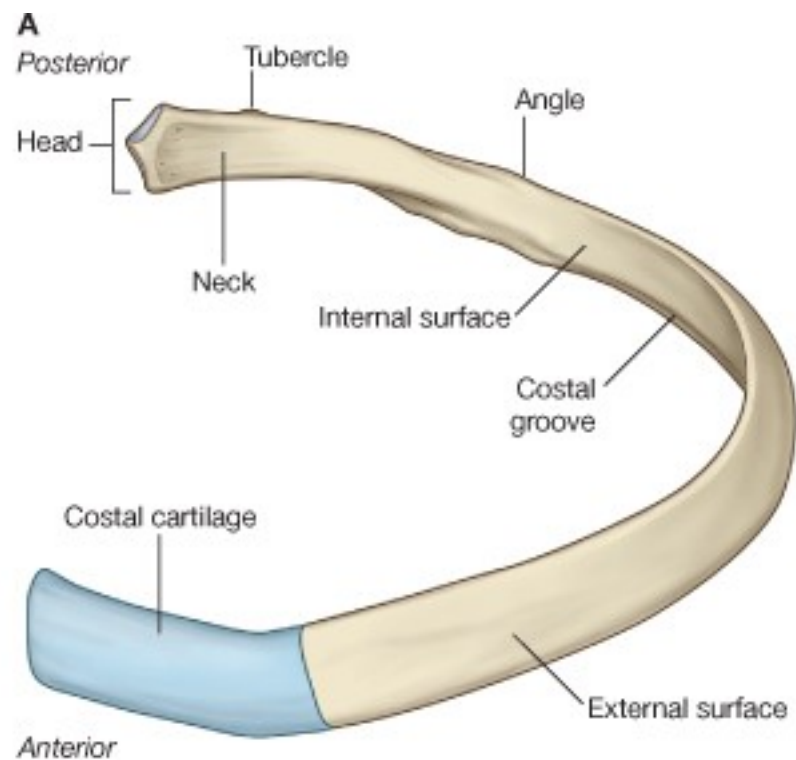
(a) Skeleton of the thoracic cage, anterior view



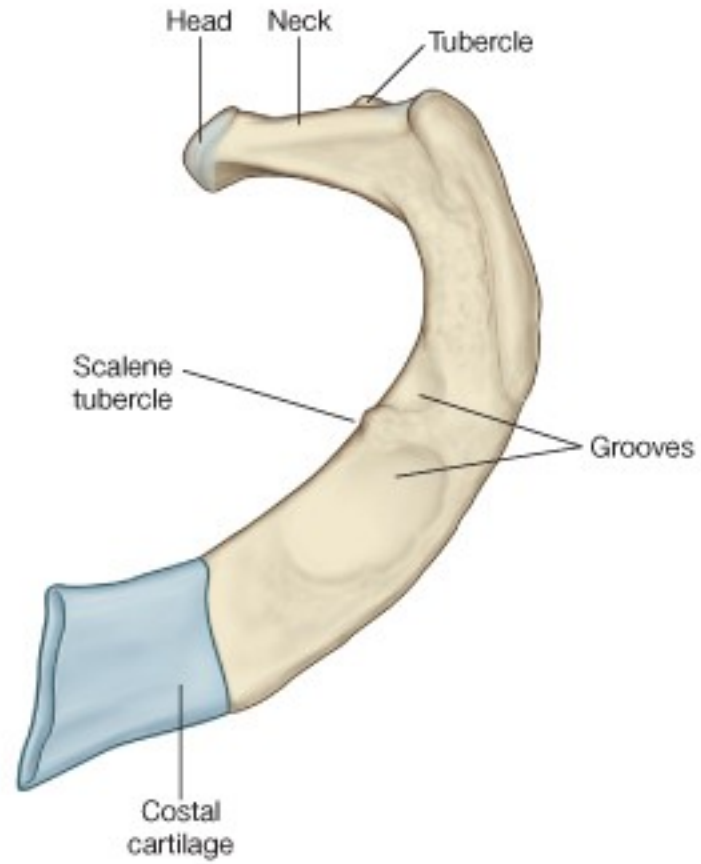
(b) Midsagittal section through the thorax, showing the relationship of surface anatomical landmarks of the thorax to the vertebral column





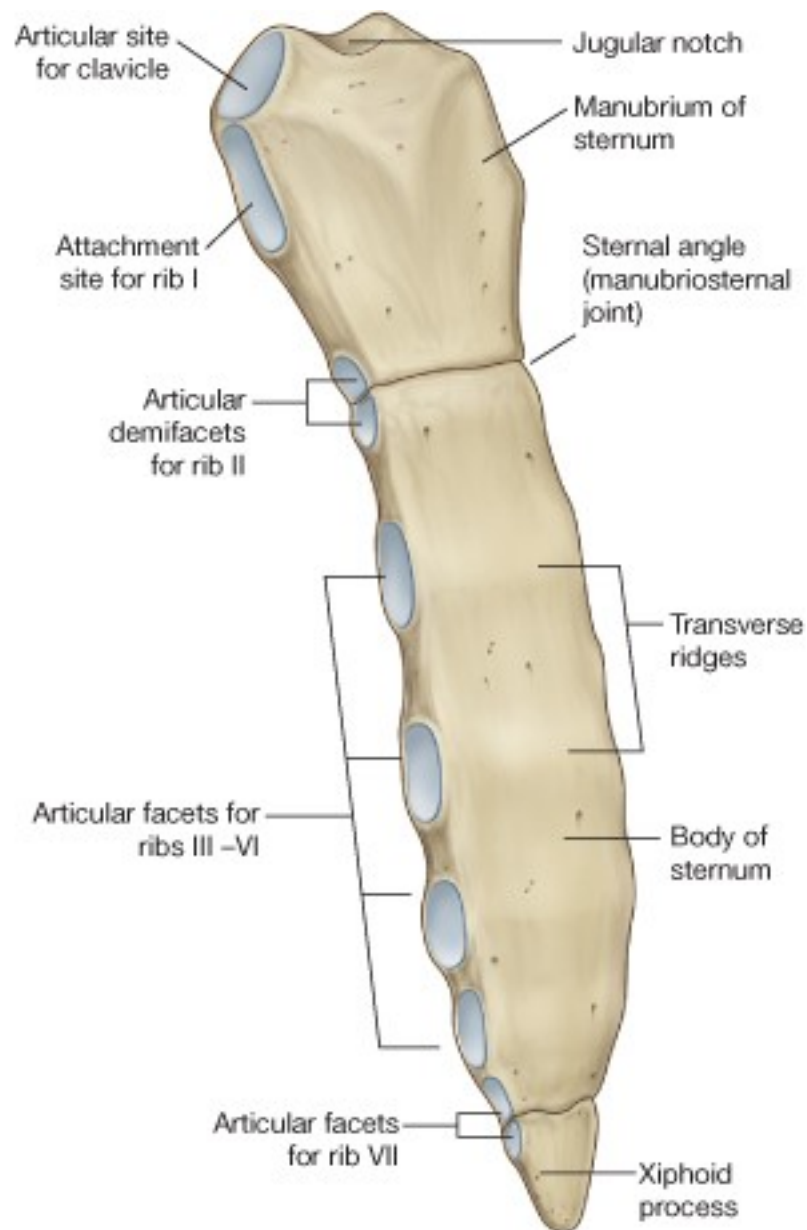


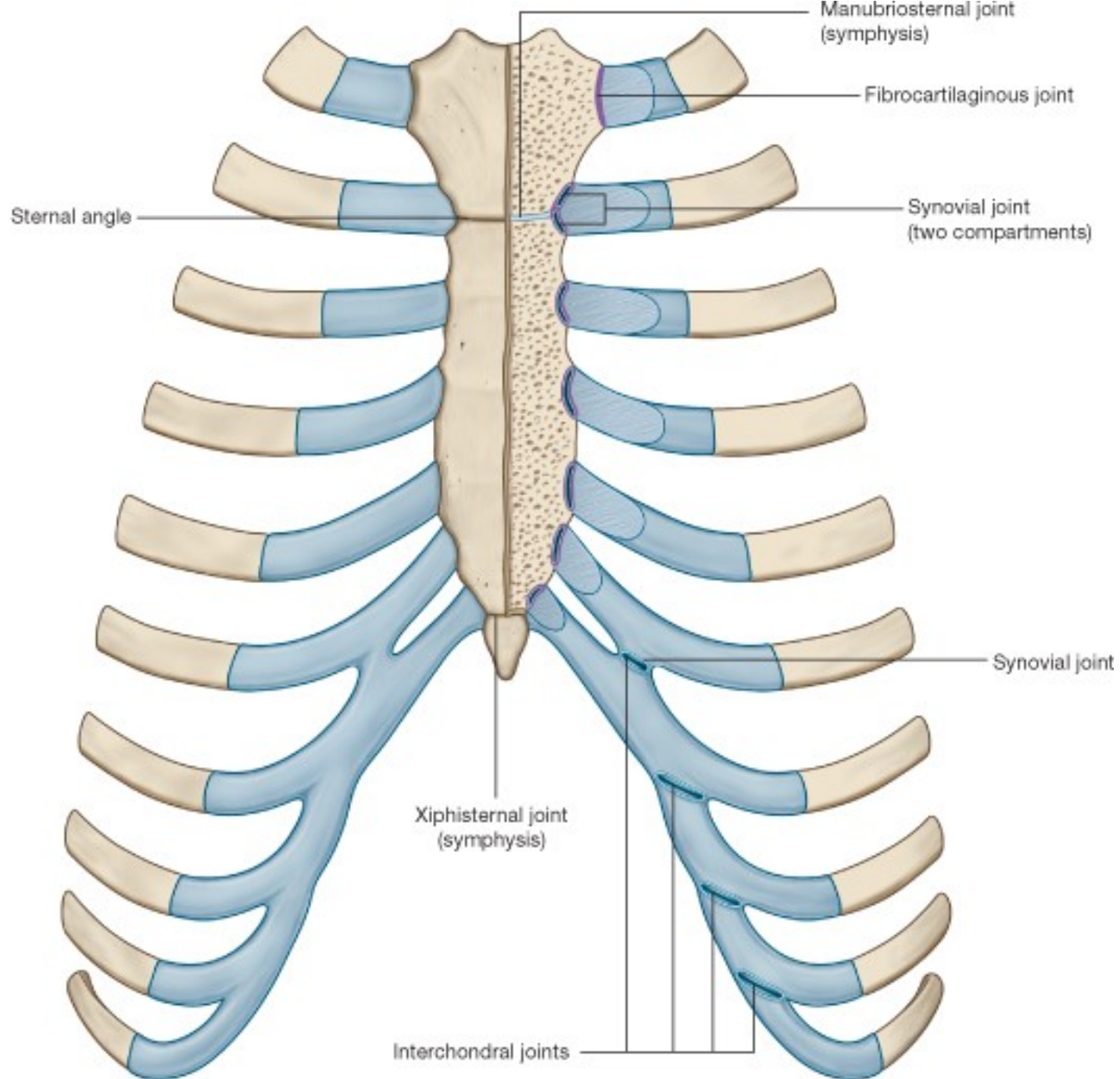
Rib I



Rib XII







Bones of the upper Limb

A- Shoulder Girdle

- Scapula
- Clavicle
- Humerus - Proximal end

B- Arm

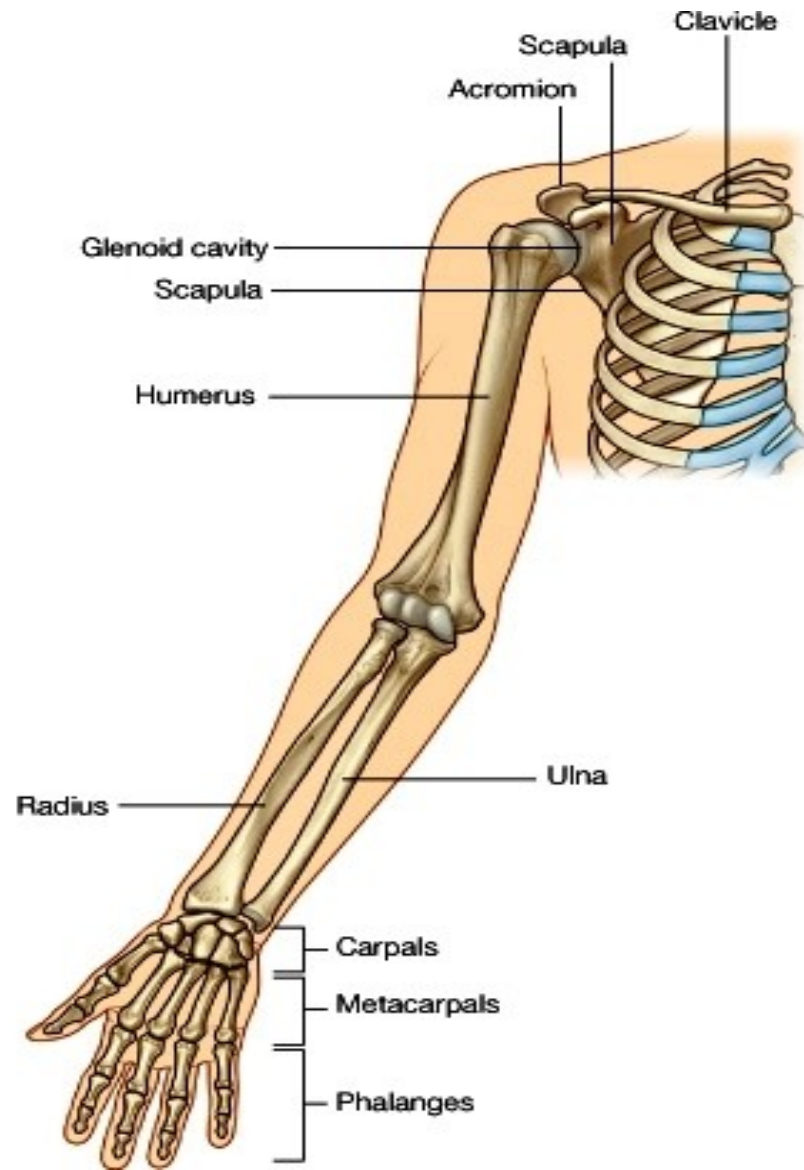
- Humerus

C - Forearm

- Radius (lateral)
- Ulna (Medial)

D - Wrist

- Carpal Bones
- Hand
- Metacarpals
- Phalanges



clavicle (collar bone, Small key)

Long S-shaped bone. its the only bony attachment between the trunk and the upper limb.

It has:

- **Convex medial end (or sternal).**
- **Concave lateral end (or acromial).**
- **Two borders (anterior, posterior).**
- **Two surfaces (superior, inferior).**

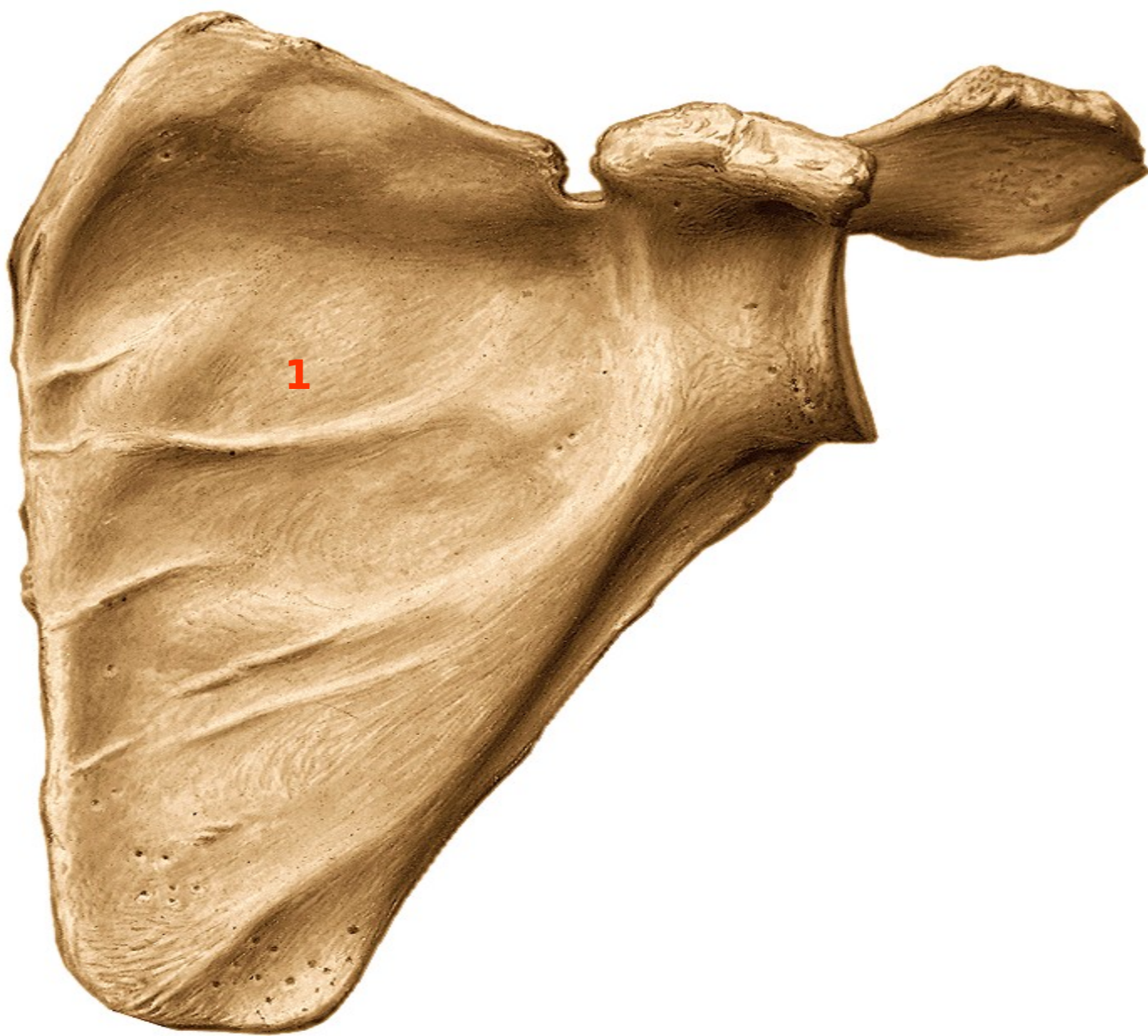


Clavicle; a- superior view (left); b- inferior view (left). 1. sternal end with articular surface 2. costoclavicular impression 3. groove for subclavius muscle 4. conoid tubercle 5. trapezoid line 6. acromial end with articular surface 7. shaft of clavicle

Scapula

The scapula is a large, flat triangular bone with:

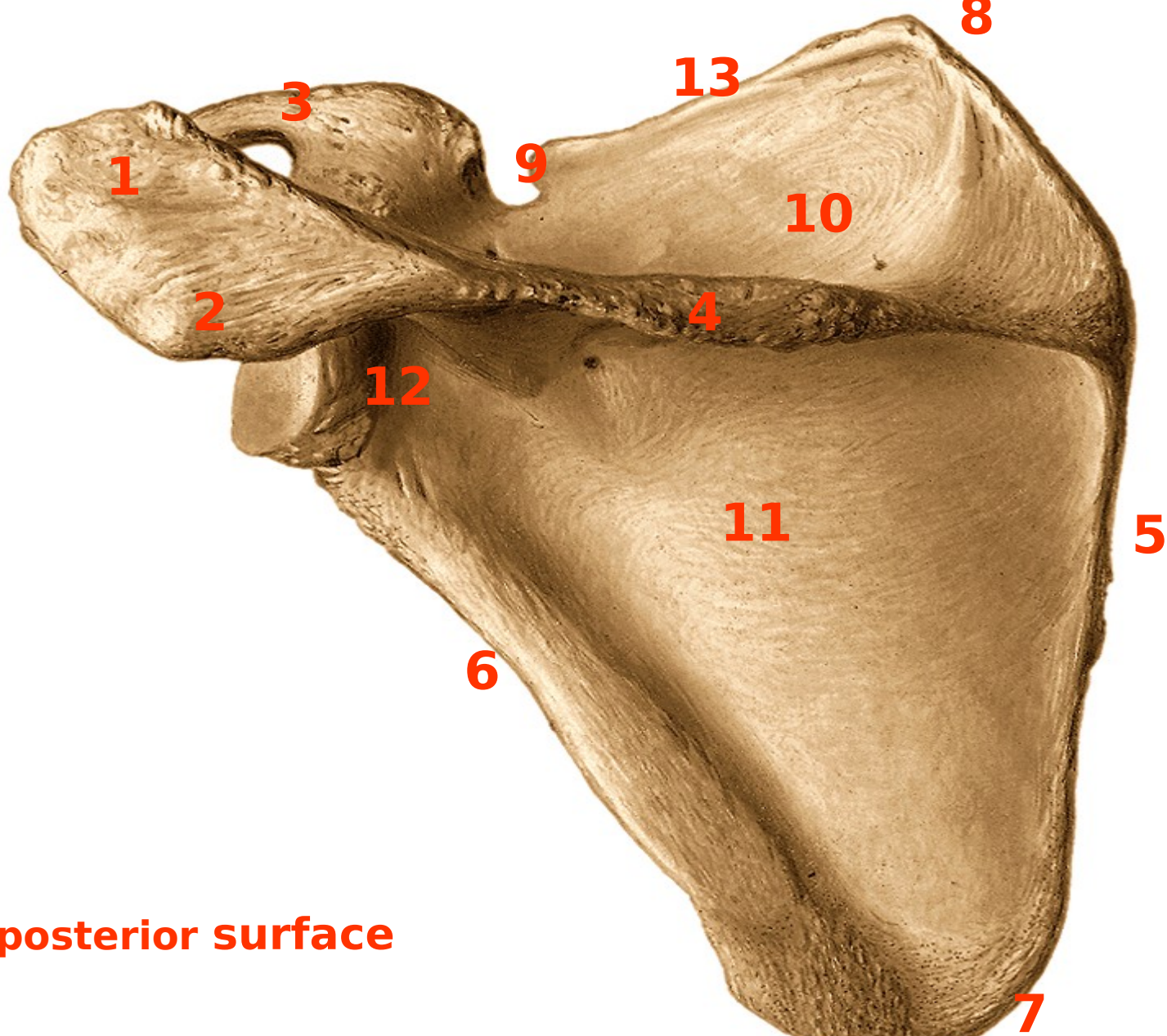
- **Three angles (lateral, superior, and inferior);**
- **three borders (superior, lateral, and medial);**
- **two surfaces (costal and posterior); and**
- **three processes (acromion, spine, and coracoid process).**



scapula, ventral view (left). Costal surface 1. subscapular fossa.



Scapula; lateral view (left). 1. supraglenoid tubercle 2. infraglenoid tubercle 3. glenoid cavity 4. coracoid process 5. acromion



capula posterior surface

1. Acromion 2. acromial angle 3. coracoid process 4. spine 5. medial border 6. lateral border 7. inferior angle 8. superior angle 9. suprascapular notch 10. supraspinous fossa 11. infraspinous fossa

Humerus

's a long bone with:

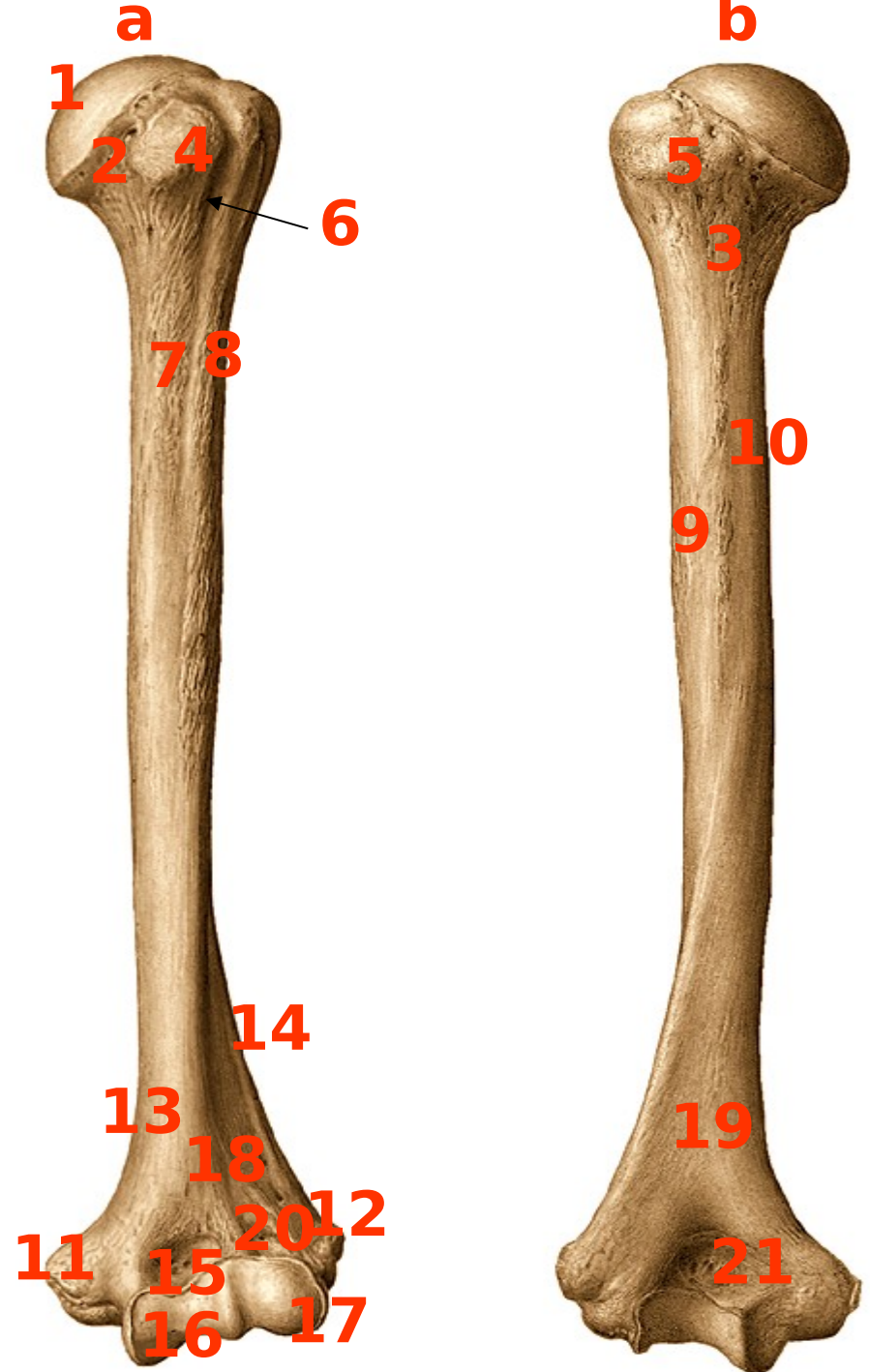
-) Proximal end (proximal epiphysis)**
-) Shaft (diaphysis)**
-) Distal end (distal epiphysis)**

Humerus

a. ventral view

b. dorsal view

1. head
2. anatomical neck
3. surgical neck
4. Lesser tubercle
5. greater tubercle
6. bicipital groove (intertubercle)
7. medial lip
8. lateral lip
9. deltoid tubercle
10. sulcus for radial nerve
11. medial epicondyle
12. lateral epicondyle
13. medial supraepicondylar ridge
14. lateral supraepicondylar ridge
15. coronoid fossa
16. trochlea
17. capitulum
18. anterior surface
19. posterior surface



Ulna

The ulna: is a long bone, prismatic in form placed at the medial side of the forearm, parallel with the radius.

It has:

- 1- Proximal end.**
- 2- shaft (with three borders and three surfaces).**
- 3- Distal end.**

**Ventral view (left);
Dorsal view (left);
Radial view (left)**

- . anterior border**
 - . anterior surface**
 - . coronoid process**
 - . interosseous border**
 - . medial surface**
 - . olecranon**
 - . posterior border**
 - . posterior surface**
 - . radial notch**
- 0. supinator crest**
1. trochlear notch
2. tuberosity of ulna
3. styloid process
4. head



Radius

The radius: is a long bone, prismatic in form and slightly curved longitudinally.

It has:

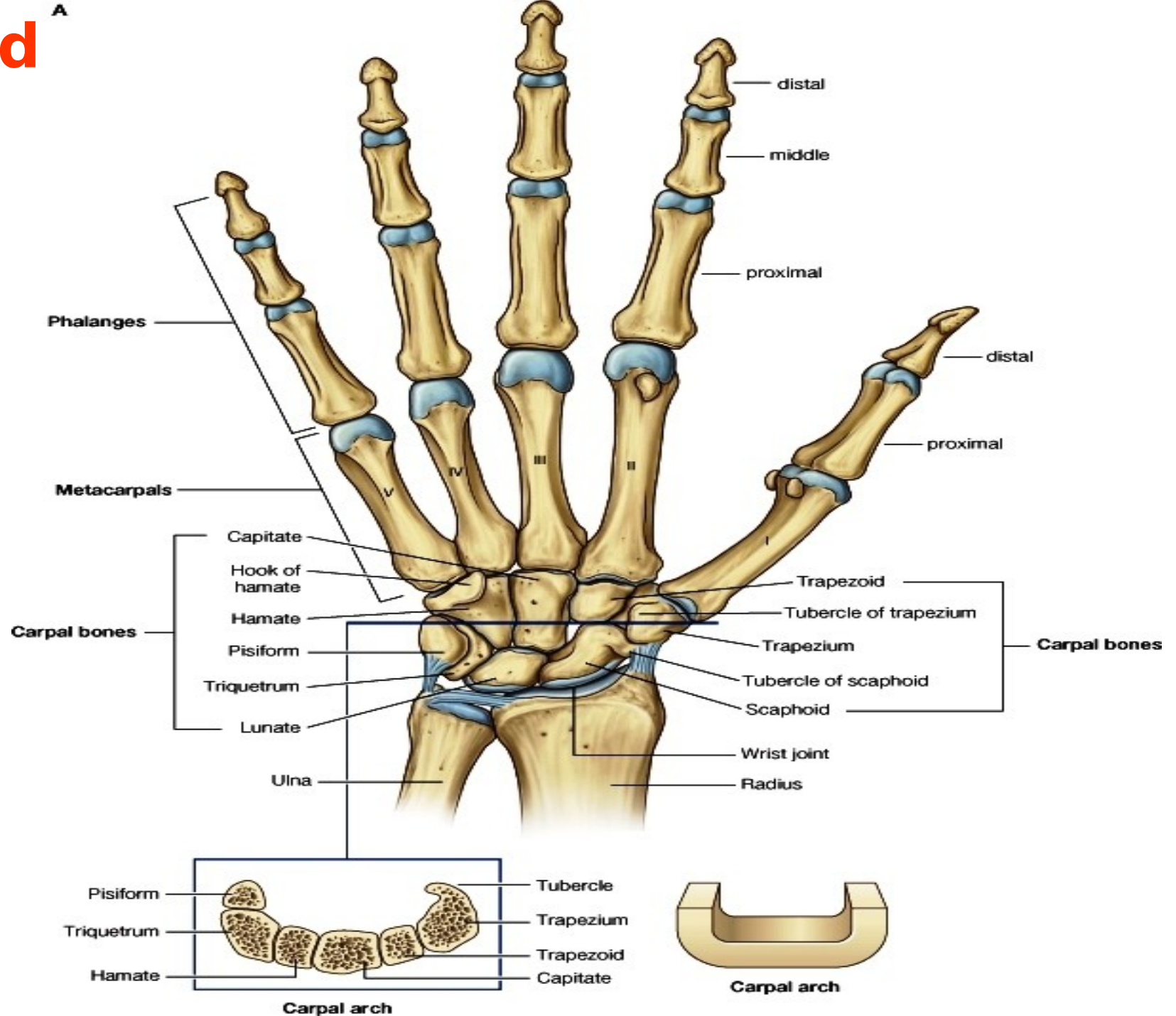
A- Proximal end

B- Shaft (with three borders and three surfaces).

C- Distal end

A

hand



- a. Ventral view (left);**
b. Dorsal view (left);
c. Ulnar view (left)
radius
4. anterior border
5. anterior oblique line
6. interosseous border
7. lateral surface
8. posterior border
9. posterior surface
10. dorsal tubercle
11. ulnar notch
12. styloid process



The skeleton of the lower limb

Pelvis

Composed of:

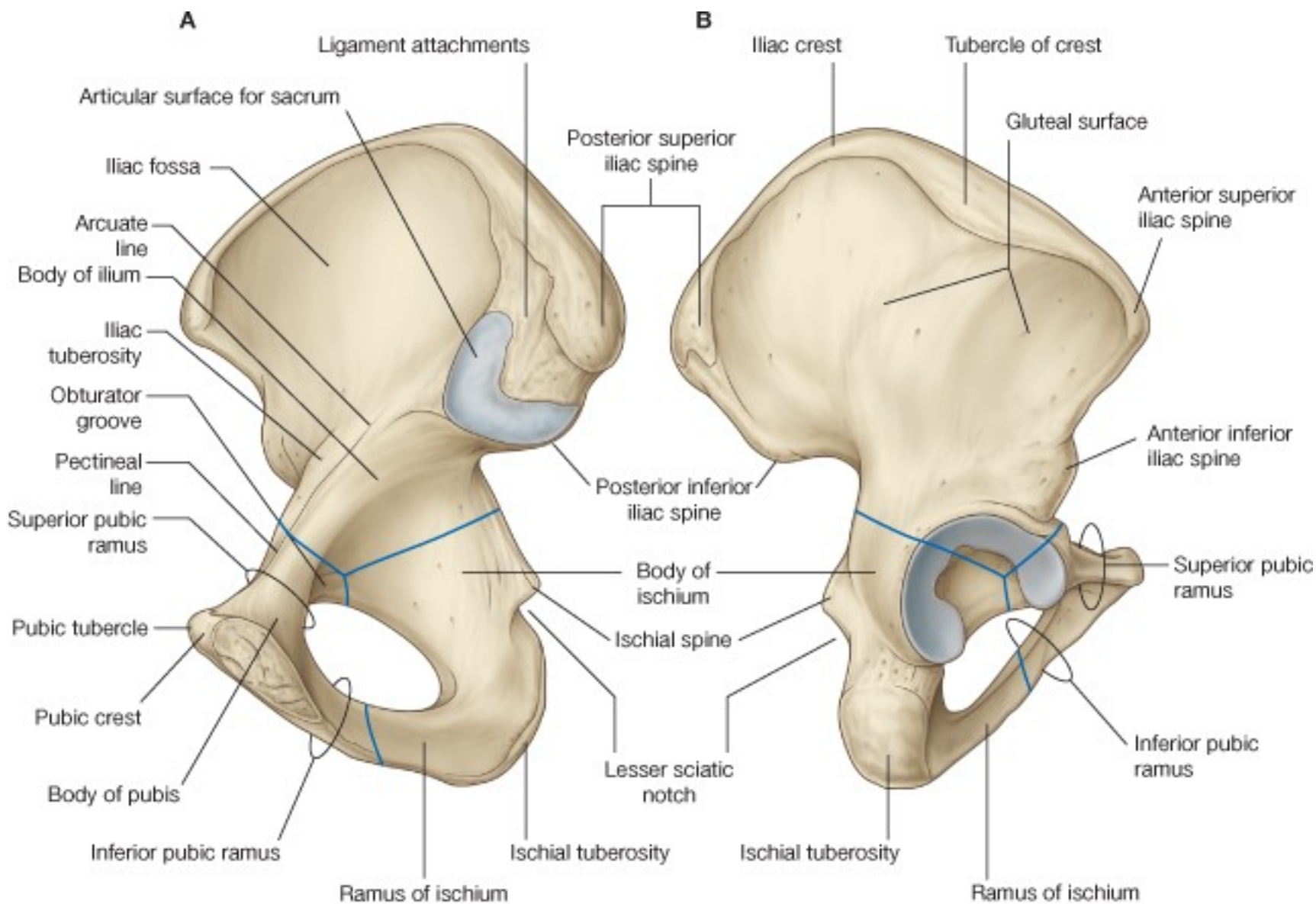
Two hip bones anteriorly

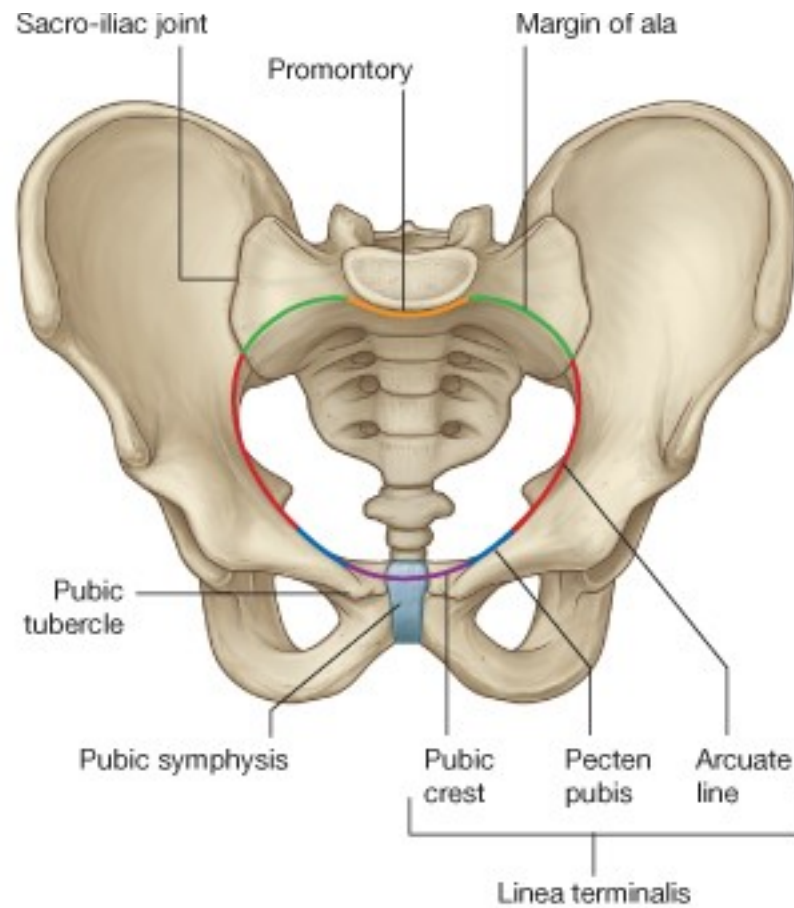
**Sacrum and coccyx
posteriorly**

Hip bone

Consist of three part fused together.

- **Ilium**
- **Pubis**
- **ischium**





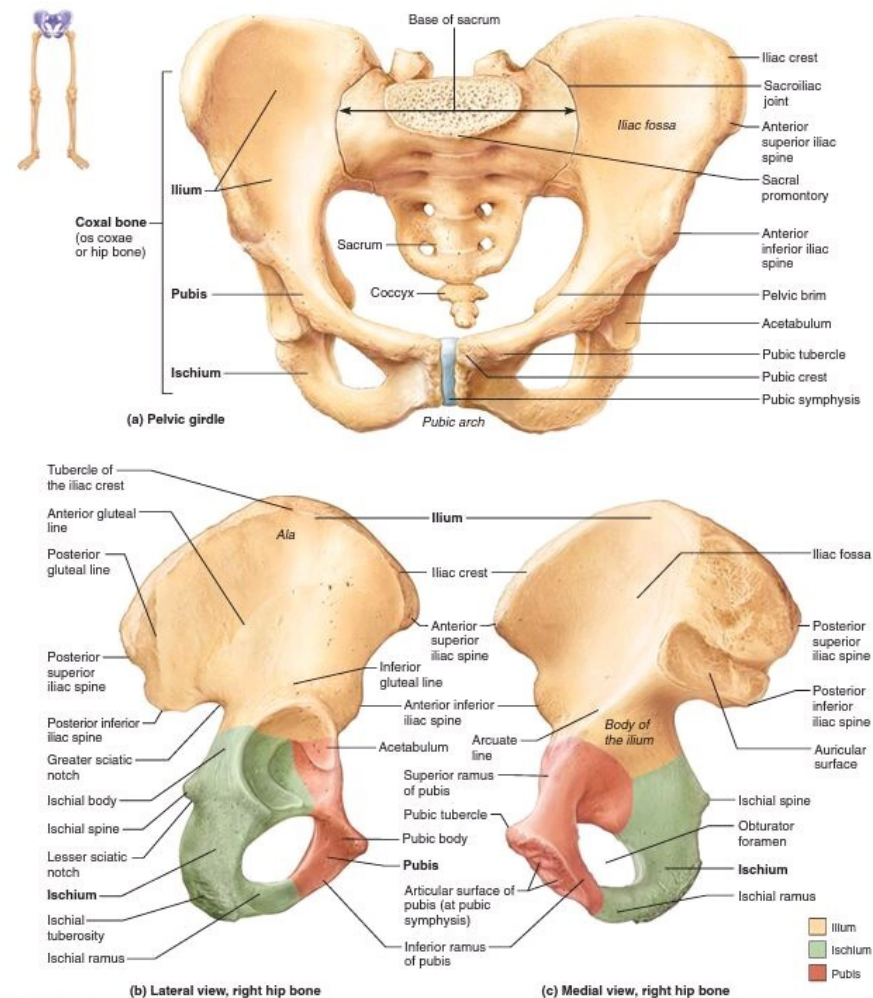


FIGURE 8.8 Bones of the pelvic girdle. (a) Articulated pelvis showing the two hip bones, the sacrum, and the coccyx. (b) Lateral view of the right hip bone (anterior is to the right). (c) Medial view of the right hip bone (anterior is to the left). (See *A Brief Atlas of the Human Body*, Second Edition, Figure 28.)

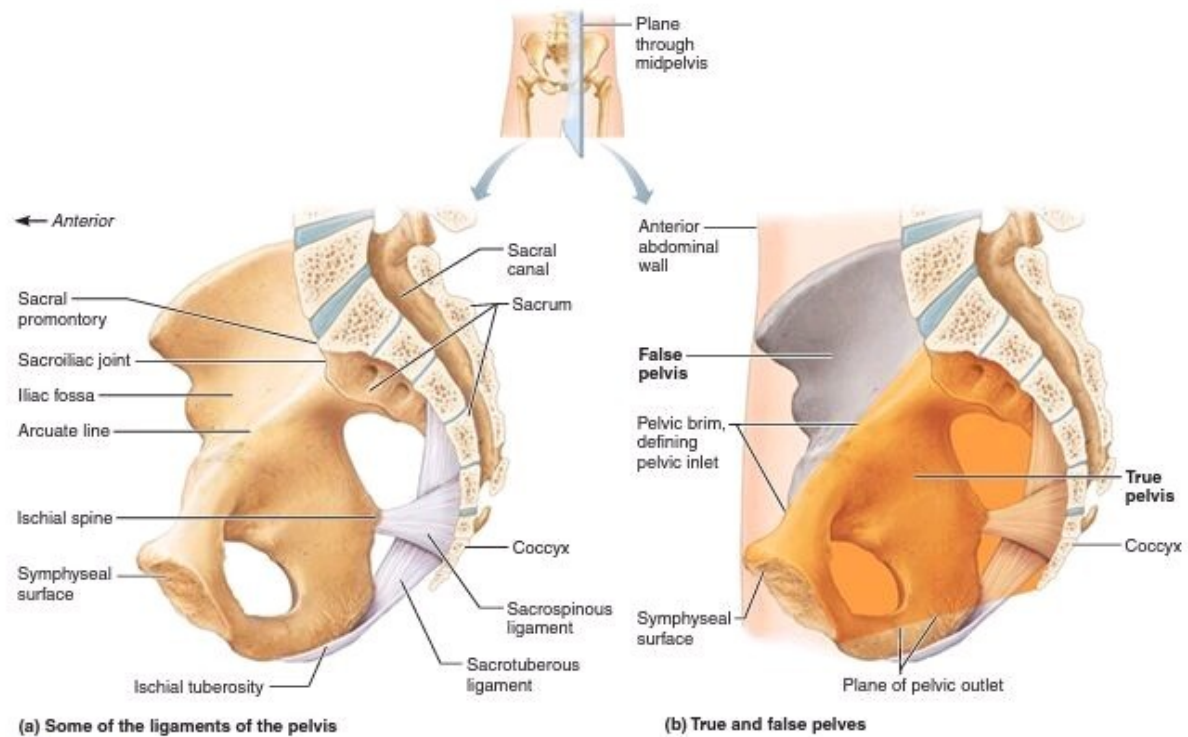
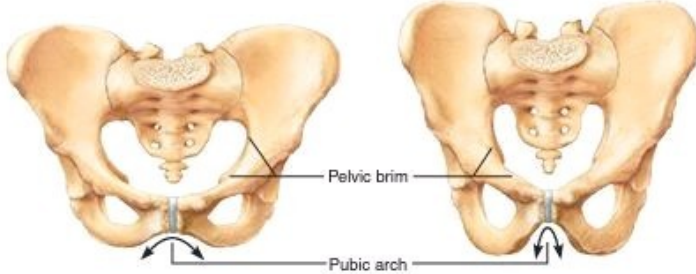


FIGURE 8.9 Midsagittal section through the pelvis.

TABLE 8.2

Comparison of the Male and Female Pelves

Characteristic	Female	Male
General structure and functional modifications	Tilted forward; adapted for childbearing; true pelvis defines the birth canal; cavity of the true pelvis is broad, shallow, and has a greater capacity	Tilted less far forward; adapted for support of a male's heavier build and stronger muscles; cavity of the true pelvis is narrow and deep
Bone thickness	Less; bones lighter, thinner, and smoother	Greater; bones heavier and thicker, and markings are more prominent
Acetabula	Smaller; farther apart	Larger; closer
Pubic angle/arch	Broader (80° to 90°); more rounded	Angle is more acute (50° to 60°)
Anterior view		
Sacrum	Wider; shorter; sacral curvature is accentuated	Narrow; longer; sacral promontory more ventral
Coccyx	More movable; straighter	Less movable; curves ventrally
Greater sciatic notch	Wide and shallow	Narrow and deep
Left lateral view		
Pelvic inlet (brim)	Wider; oval from side to side	Narrow; basically heart-shaped
Pelvic outlet	Wider; ischial tuberosities shorter, farther apart, and everted	Narrower; ischial tuberosities longer, sharper, and point more medially
Posteroinferior view		

Bones of free part of the lower limb

- thigh (Femur(**
- leg (tibia, fibula, patella(**
- foot**
 - a- tarsus (talus, calcaneus, navicular, cuneiform bone)**
 - b- metatarsus.**
 - c- phalanges**

