

Biology 223

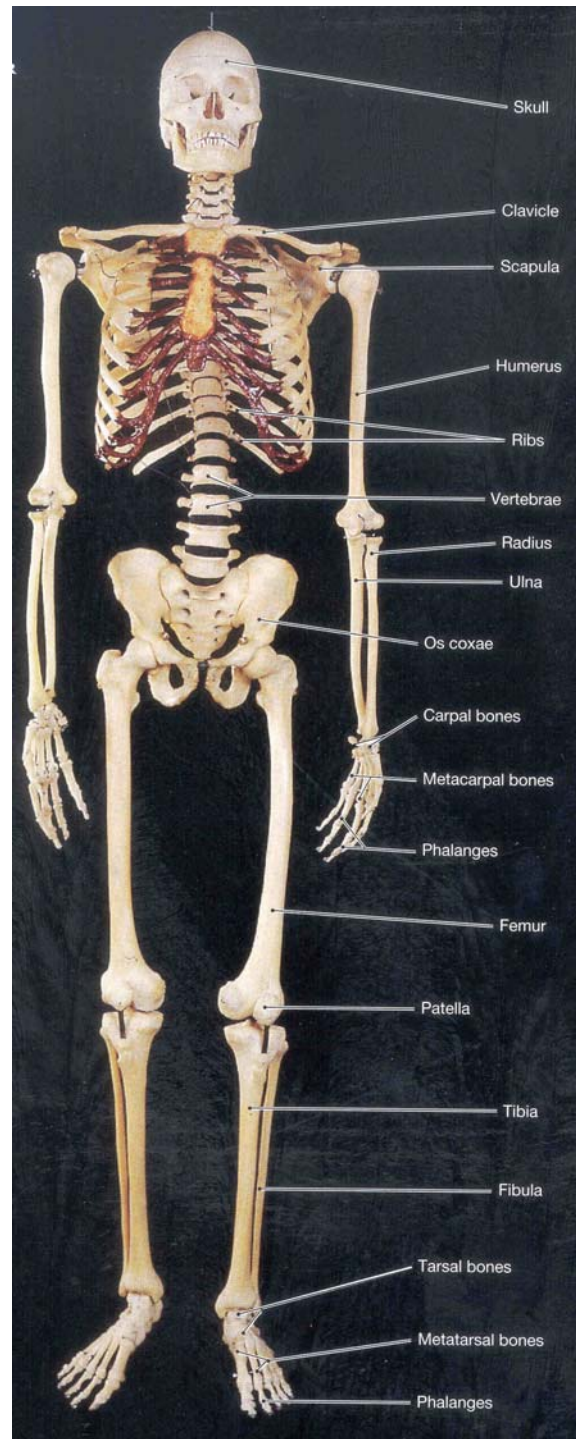
Human Anatomy and Physiology I

Week 3; Lecture 2; Wednesday

Dr. Stuart S. Sumida

Appendicular Skeleton





Remember that the body is made up of many segments.

Limbs are
multisegmental –
derived from more than
one segment, usually 6.

Segmental Distribution of Myotomes in Fetus of 6 Weeks

Region of each trunk myotome also represents territory of dermatome into which motor and sensory fibers of segmental spinal nerve extend

Mesenchymal mass representing 3 preotic myotomes of primitive vertebrates

Site of local mesenchyme, giving rise to all limb muscles except those of pectoral girdle

Ventral (hypaxial) column of hypomeres

Site of local mesenchyme, giving rise to all limb muscles except those of pelvic girdle

Coccygeal myotomes

Sacral myotomes

Lumbar myotomes

Membranous (otic) † labyrinth of inner ear

Occipital (postotic) myotomes

Cervical myotomes

Dorsal (epaxial) column of epimeres

Thoracic myotomes

H. Vetter
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Developing Skeletal Muscles at 8 Weeks (superficial exposure)

Orbicularis oculi

Zygomaticus

Orbicularis oris

Brachioradialis

Extensor carpi radialis longus

Extensor digitorum

Extensor carpi ulnaris

Flexor carpi ulnaris

Rectus abdominis

Tendinous intersection

Tibialis anterior

Extensor hallucis longus

Extensor digitorum longus

Peroneus (fibularis) longus

Fibula

Temporalis

Masseter

Deltoid

Brachialis

Triceps brachii

Teres minor

Teres major

Trapezius

Serratus anterior

Latissimus dorsi

Rib

Abdominal external oblique

Thoracolumbar fascia covering erector spinae

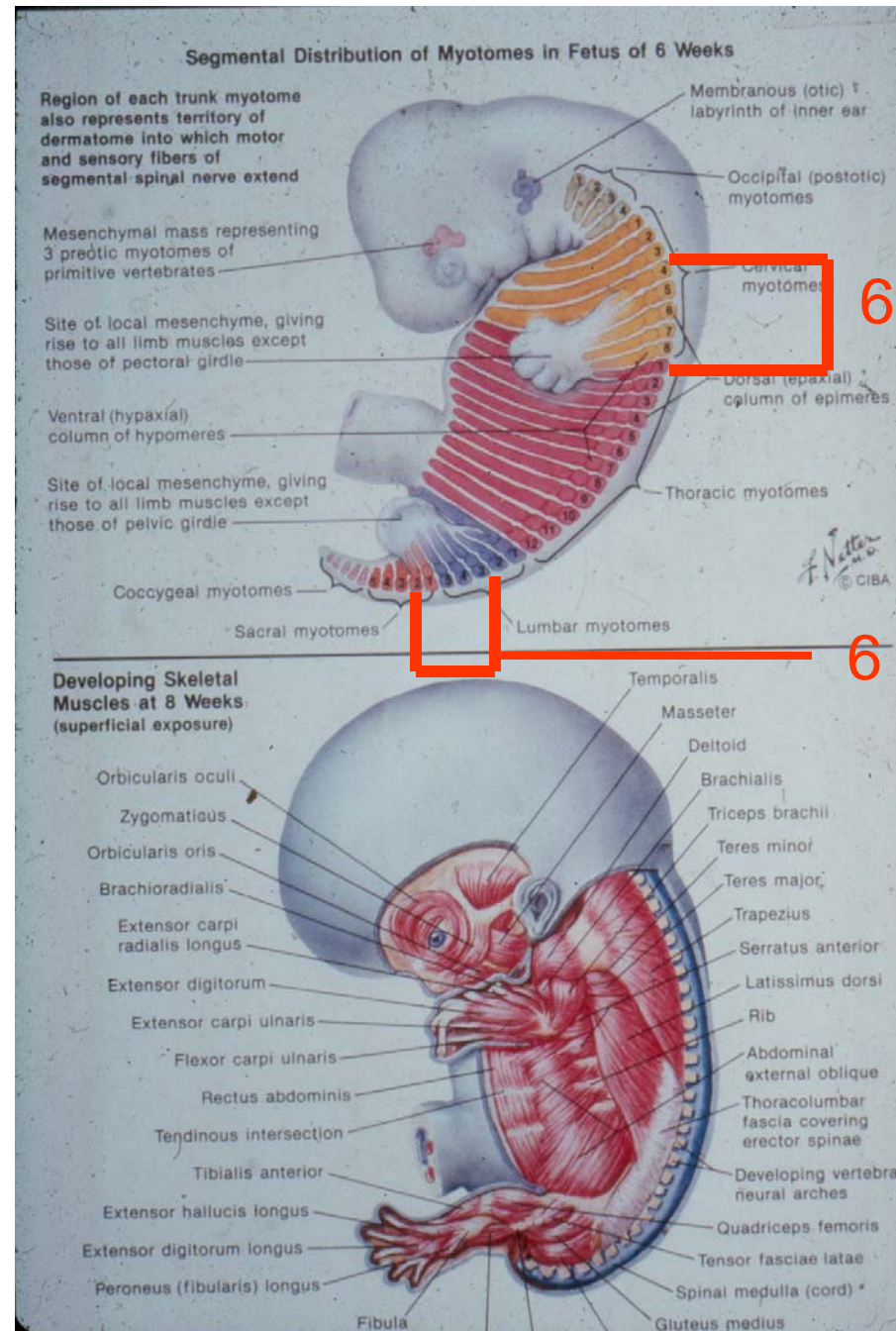
Developing vertebral neural arches

Quadriceps femoris

Tensor fasciae latae

Spinal medulla (cord) *

Gluteus medius

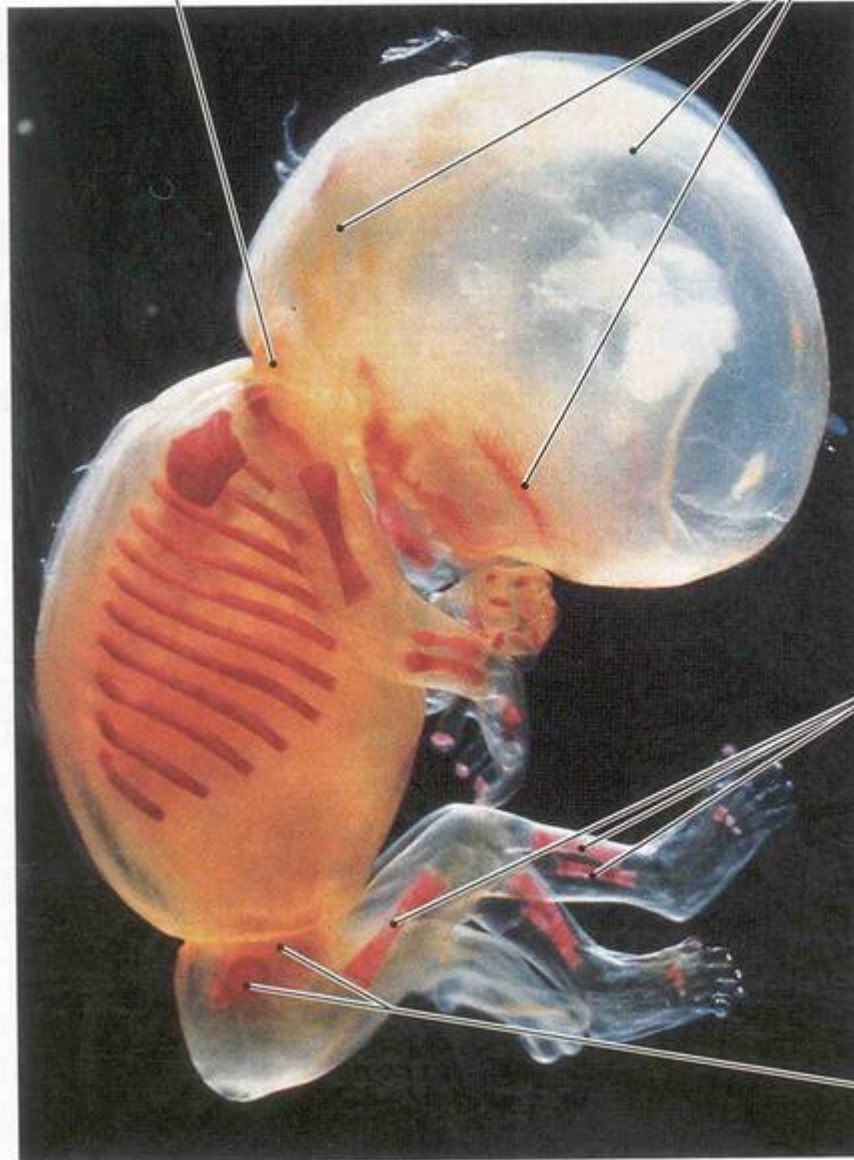


6 segments

6 segments

Endochondral ossification
replaces cartilages of
embryonic skull

Intramembranous
ossification
produces the roofing
bones of the skull



Primary
ossification
centers of the
diaphyses
(bones of
the lower limb)

Future
hip bone

Changes in Position of Limbs Before Birth



A. At 5 weeks. Upper and lower limbs have formed as finlike appendages pointing laterally and caudally



B. At 6 weeks. Limbs bend anteriorly, so elbows and knees point laterally, palms and soles face trunk

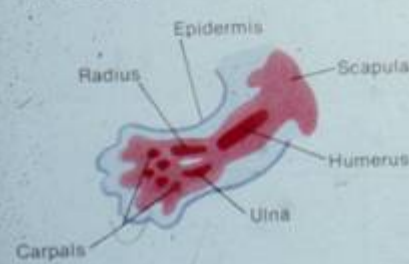


C. At 7 weeks. Upper and lower limbs have undergone 90° torsion about their long axes, but in opposite directions; so elbows point caudally and knees cranially

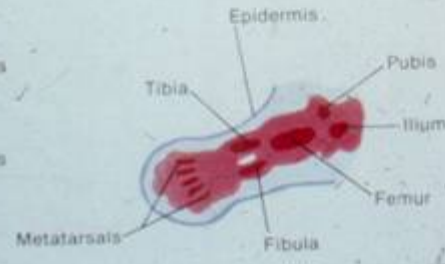


D. At 8 weeks. Torsion of lower limbs results in twisted or "barber pole" arrangement of their cutaneous innervation

Precartilage Mesenchymal Cell Concentrations of Appendicular Skeleton at 6th Week

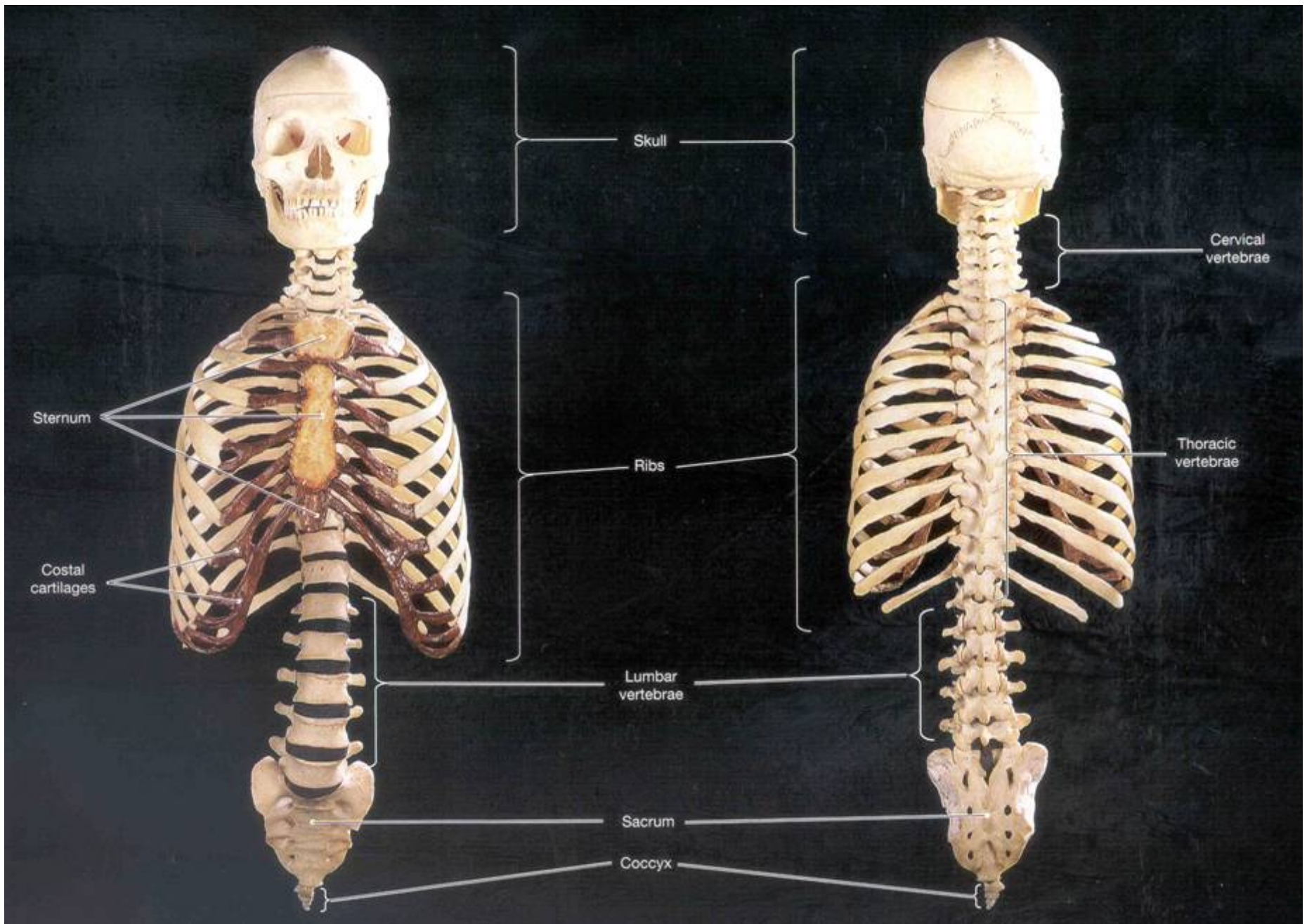


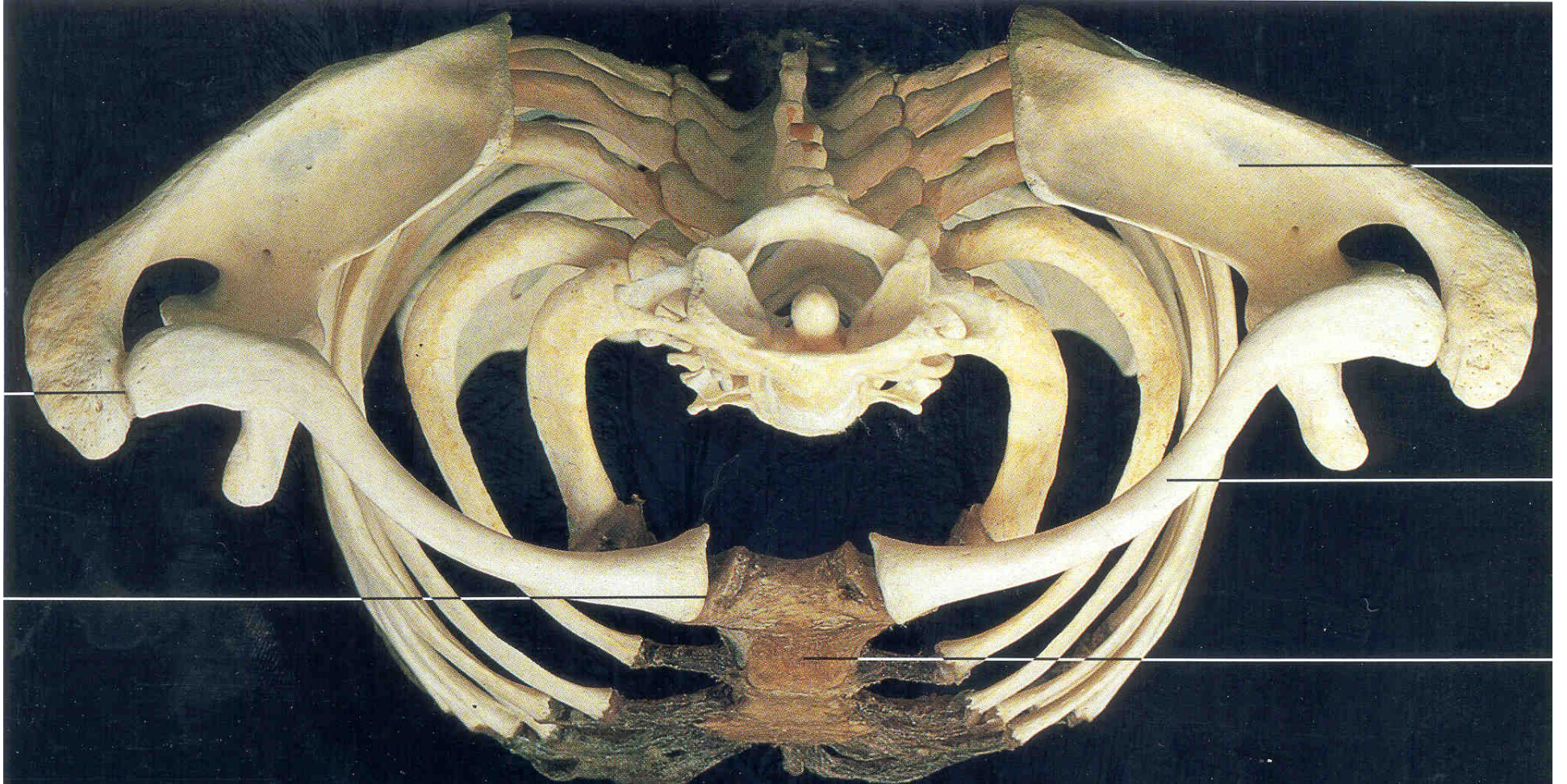
A. Upper limb



B. Lower limb

Handwritten signature
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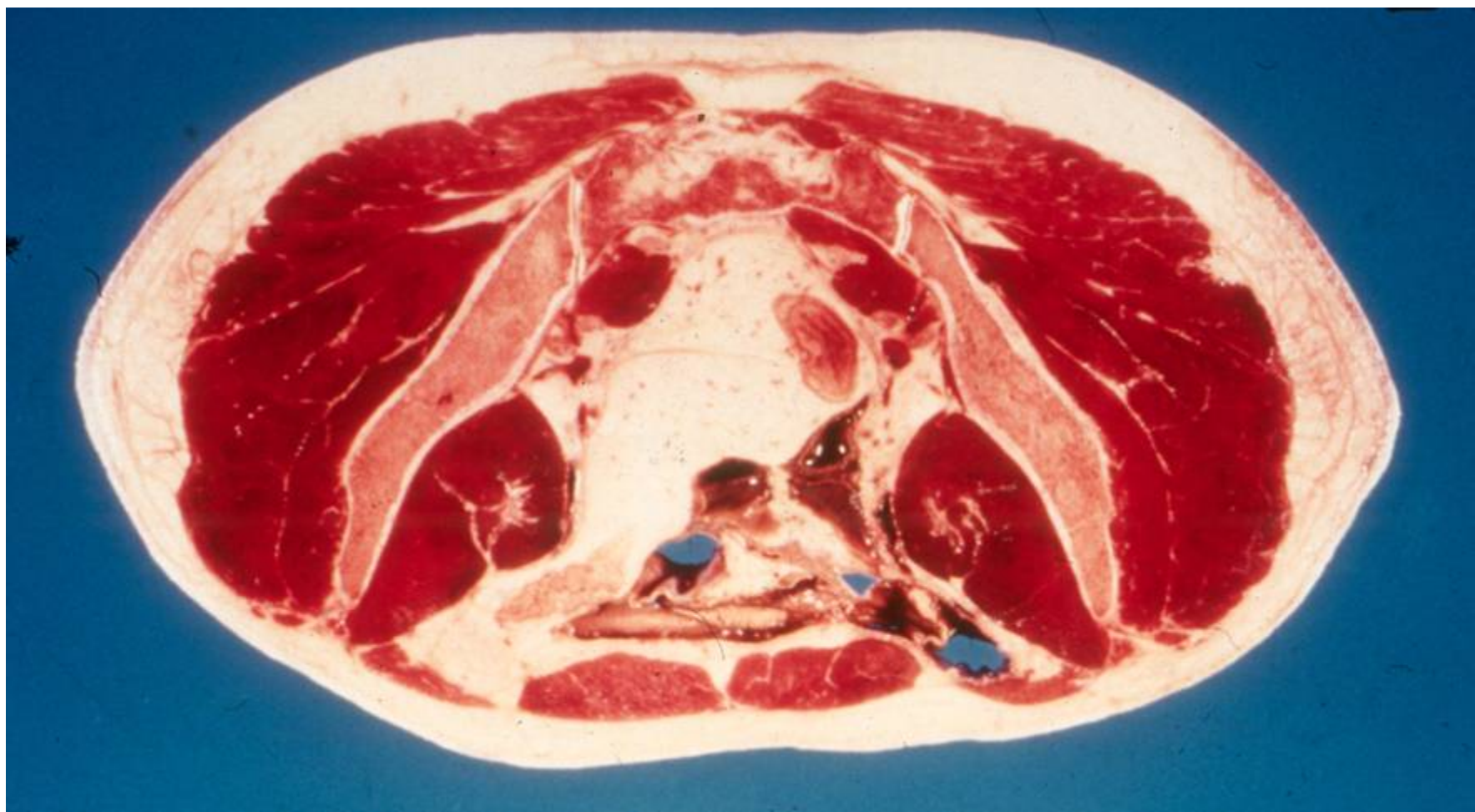


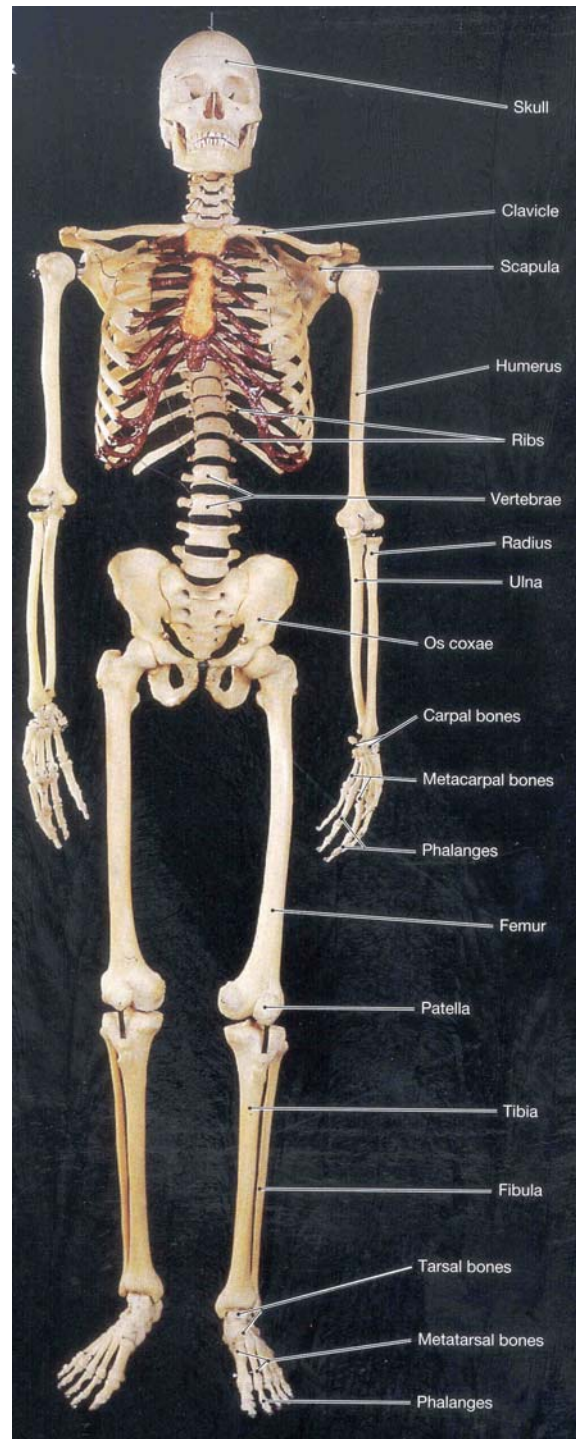


Placement of the Limbs Relative to Body Wall

- Pectoral girdle is SUPERFICIAL to the body wall.
- Pectoral limb attaches to dorsal aspect of body wall.
- Pelvic Girdle temporarily INTERRUPTS the body wall.
- Pelvic limb attaches to lateral aspect of body wall







Pectoral Girdle

1. FRONTAL BONE OF SKULL
2. TEMPORAL
3. MANDIBLE
4. HUMERUS
5. ULNA
6. RADIUS
7. CARPALS
8. PHALANGES
9. METACARPALS
10. TARSALS
11. METATARSALS
12. PHALANGES
13. ZYGOMA
14. MAXILLA
15. CLAVICLE
16. SCAPULA
17. STERNUM
18. RIBS
19. VERTEBRAL COLUMN
20. INNOMINATE
21. SACRUM
22. PUBIC SYMPHYSIS
23. FEMUR
24. PATELLA
25. TIBIA
26. FIBULA

Pelvic Girdle

Brachium

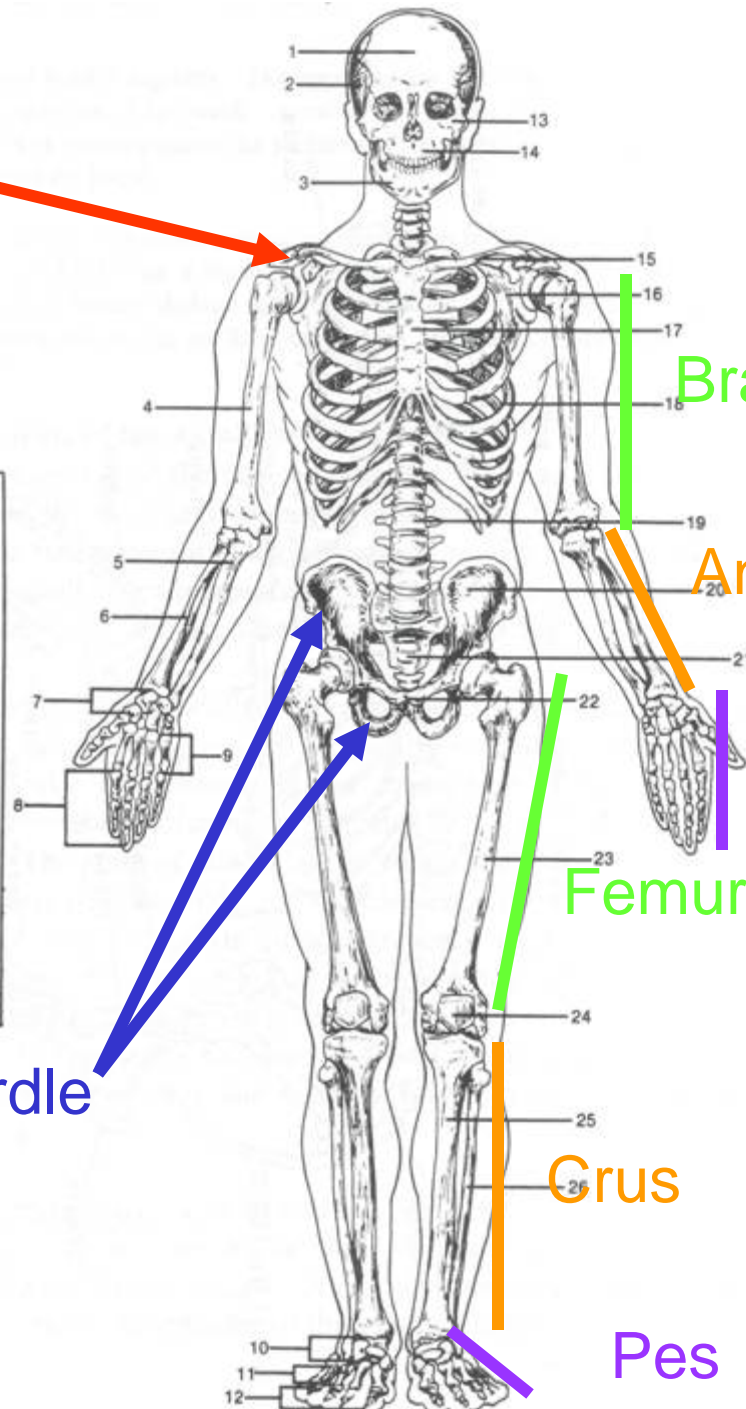
Antebrachium

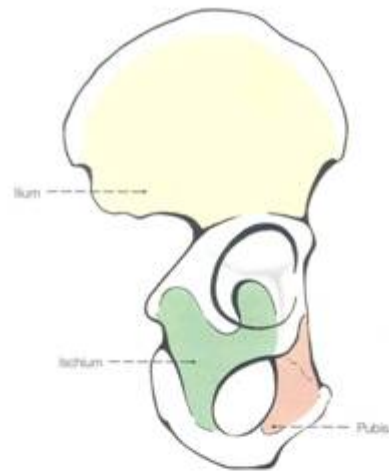
Manus

Femur, Thigh

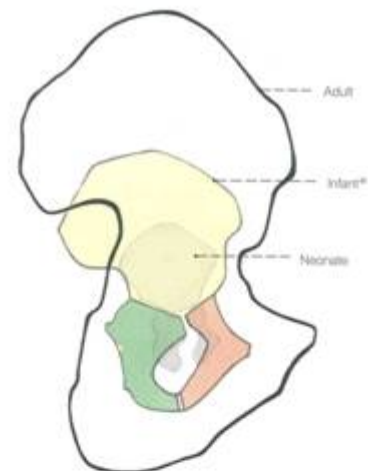
Crus

Pes



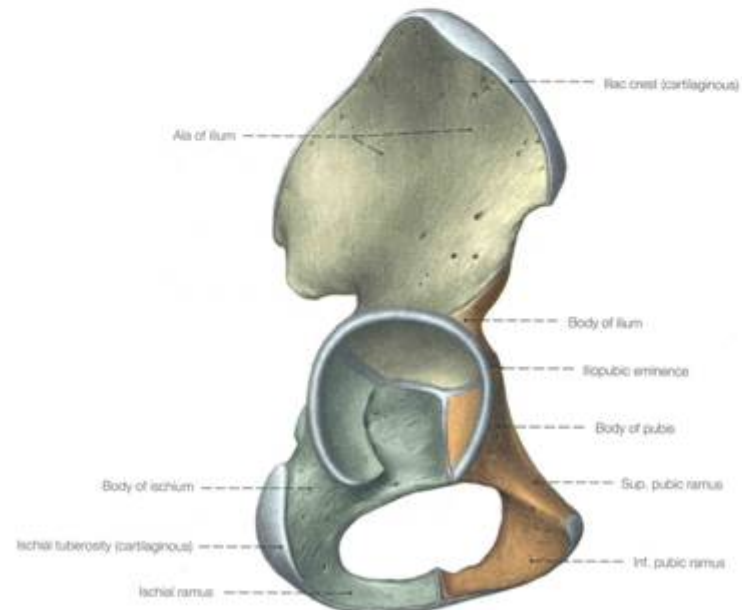


The right hip bone in a drawing showing the extent of its three osseous parts in a newborn, lateral aspect (110%).



The right hip bone in a drawing showing the extent of its three osseous parts at different ages, lateral aspect.

* At about 6 years of age



The right hip bone, developmental state in a 6-year-old child, lateral aspect (90%).

The three parts of the hip bone are connected with each other in the region of the acetabulum in a Y-shaped cartilaginous junction, which undergoes synostosis at about 13-18 years of age.

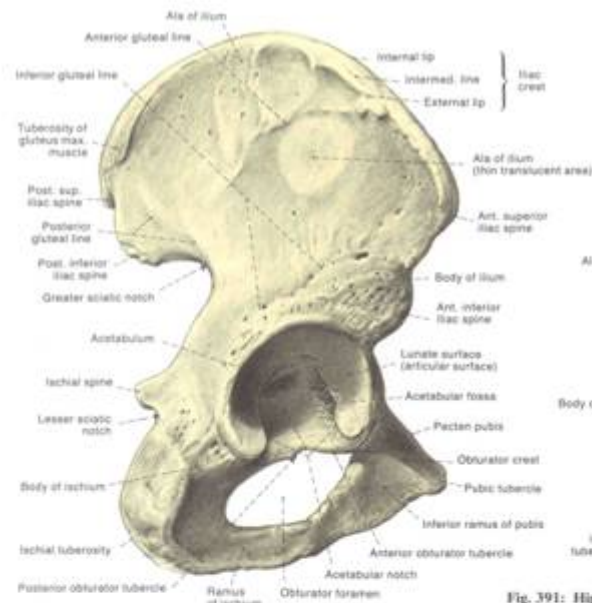


Fig. 389: Lateral View of the Adult Right Hip Bone

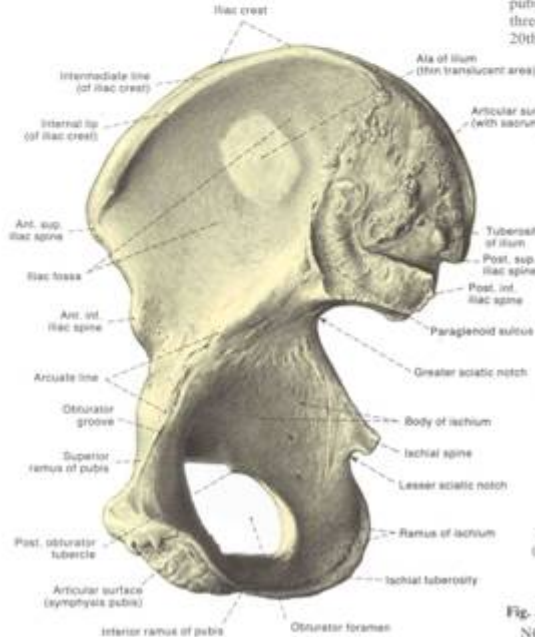


Fig. 390: Medial View of the Adult Right Hip Bone

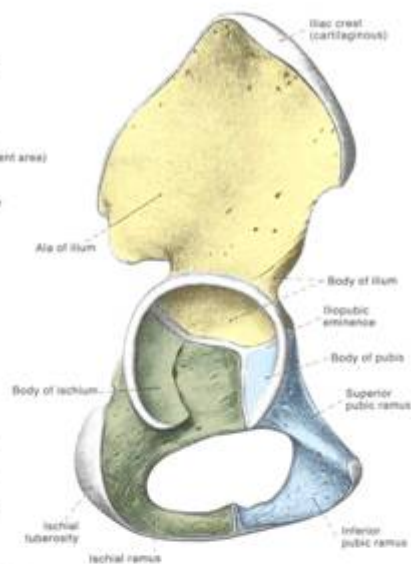


Fig. 391: Hip Bone of 5 Year Old Child: Lateral View

NOTE that the hip bone is formed by a fusion of the ilium (yellow), ischium (green) and pubis (blue). Although ossification of the inferior pubic ramus occurs during the 7th or 8th year, complete fusion of the three bones at the acetabulum occurs sometime between the 15th and 20th year.

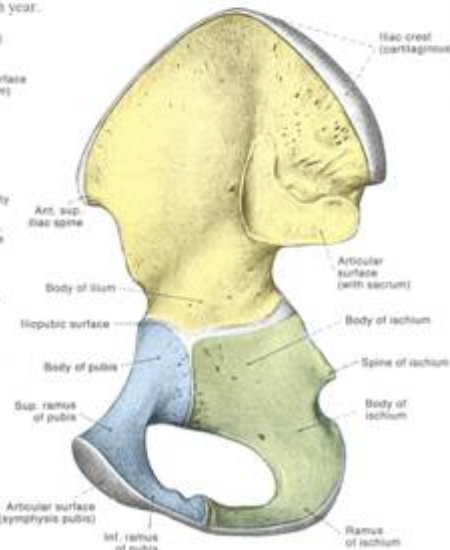
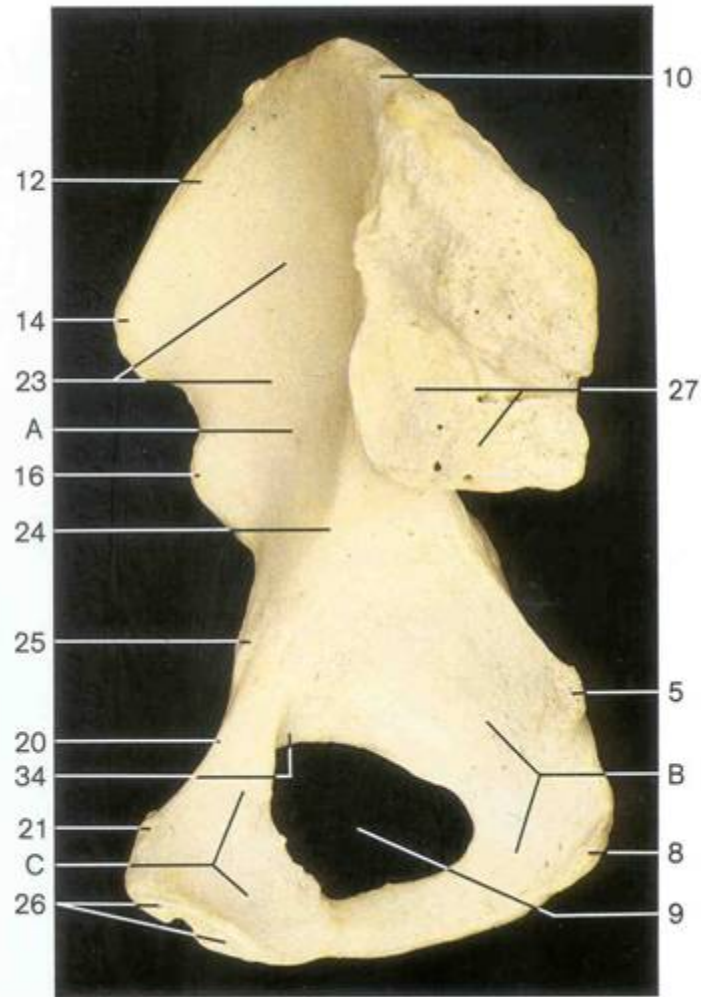
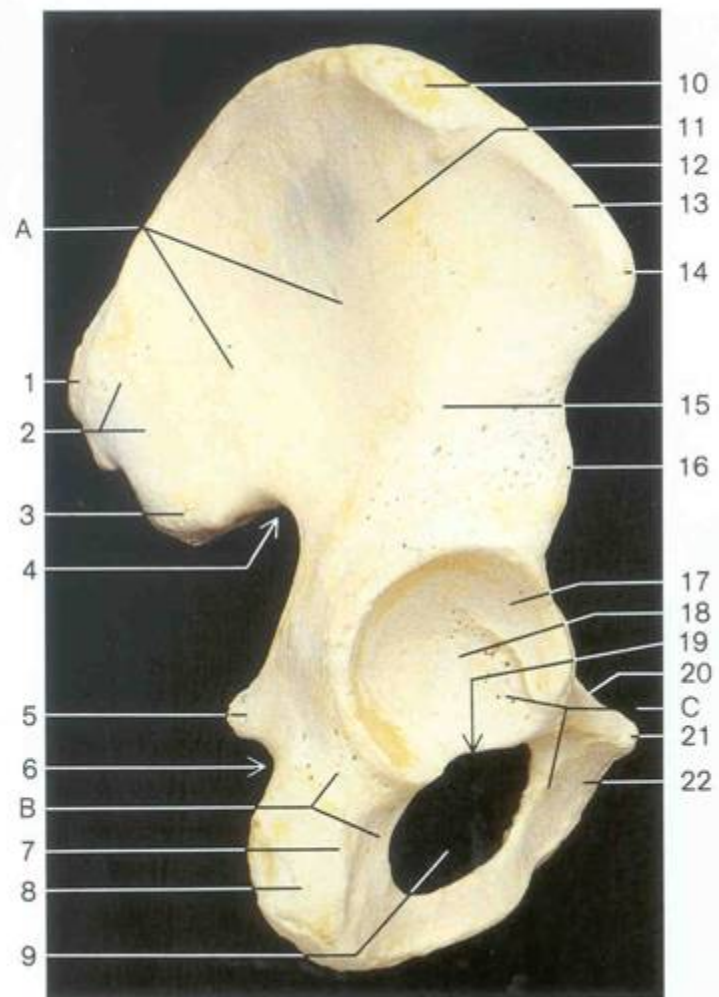
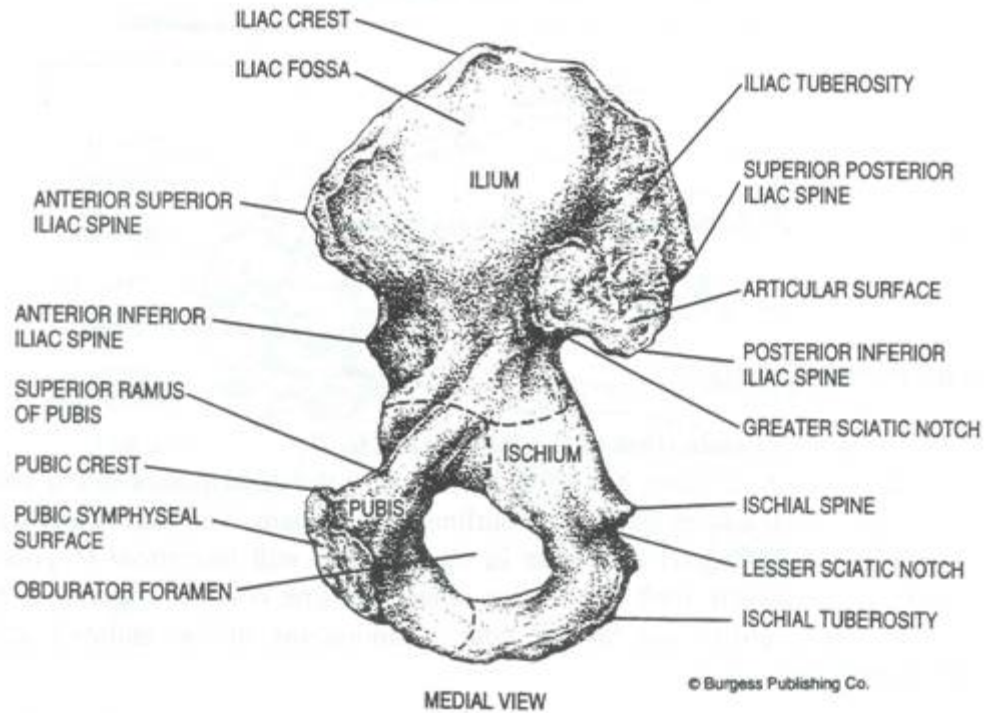
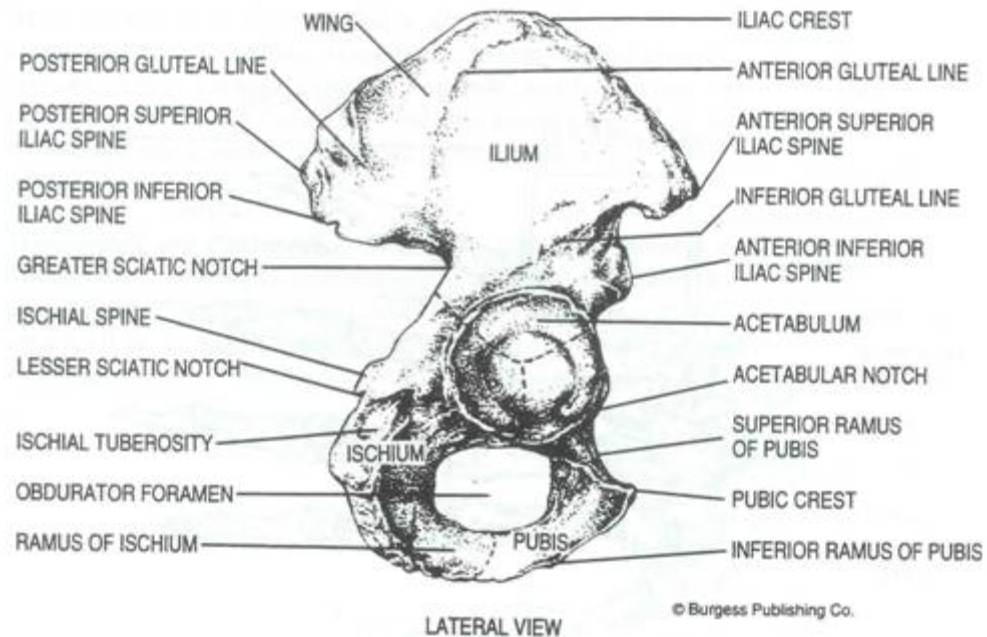
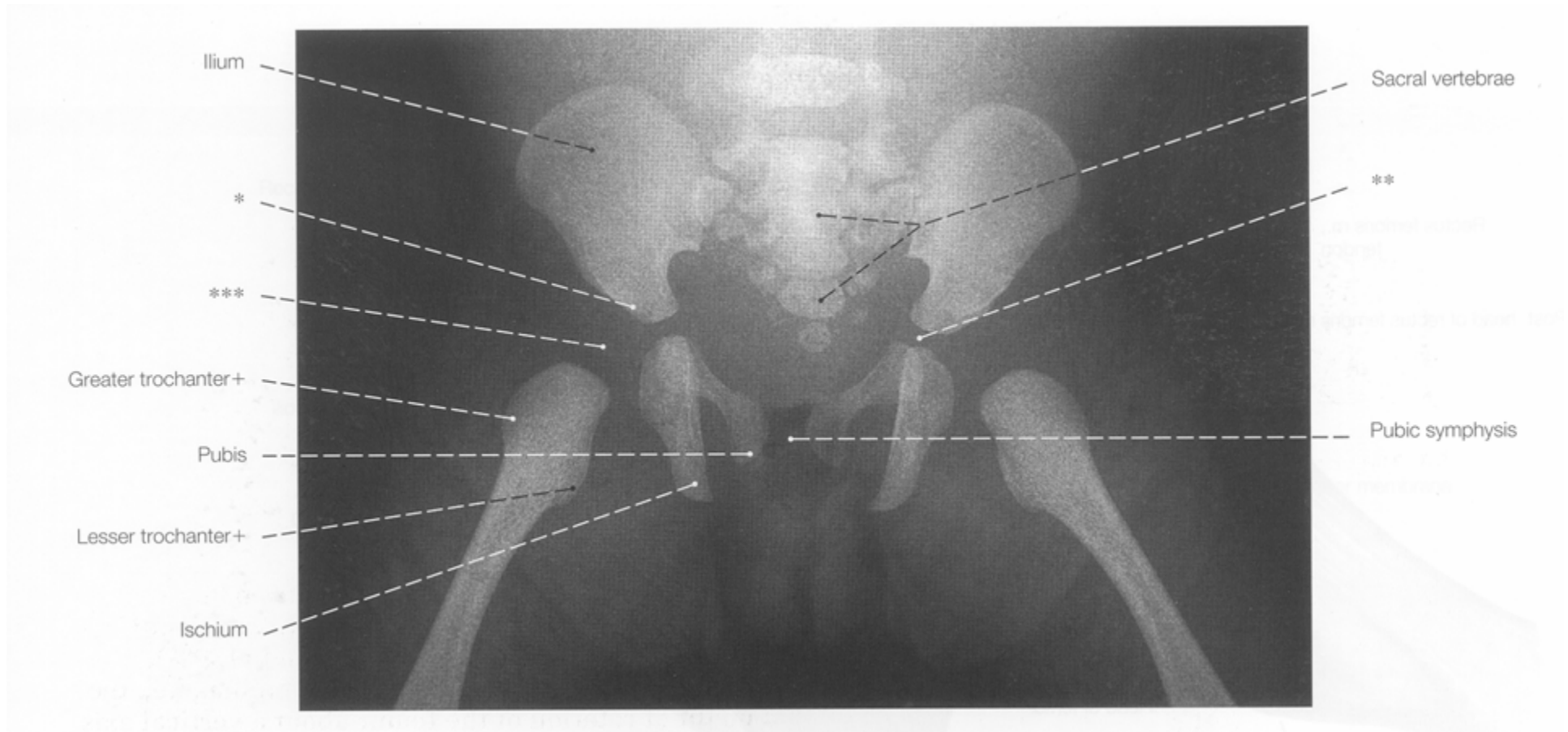


Fig. 392: Hip Bone of 5 Year Old Child: Medial View

NOTE the lines of fusion of the three bones above the obturator foramen and the fusion of the inferior pubic ramus and the ischial ramus below that foramen.

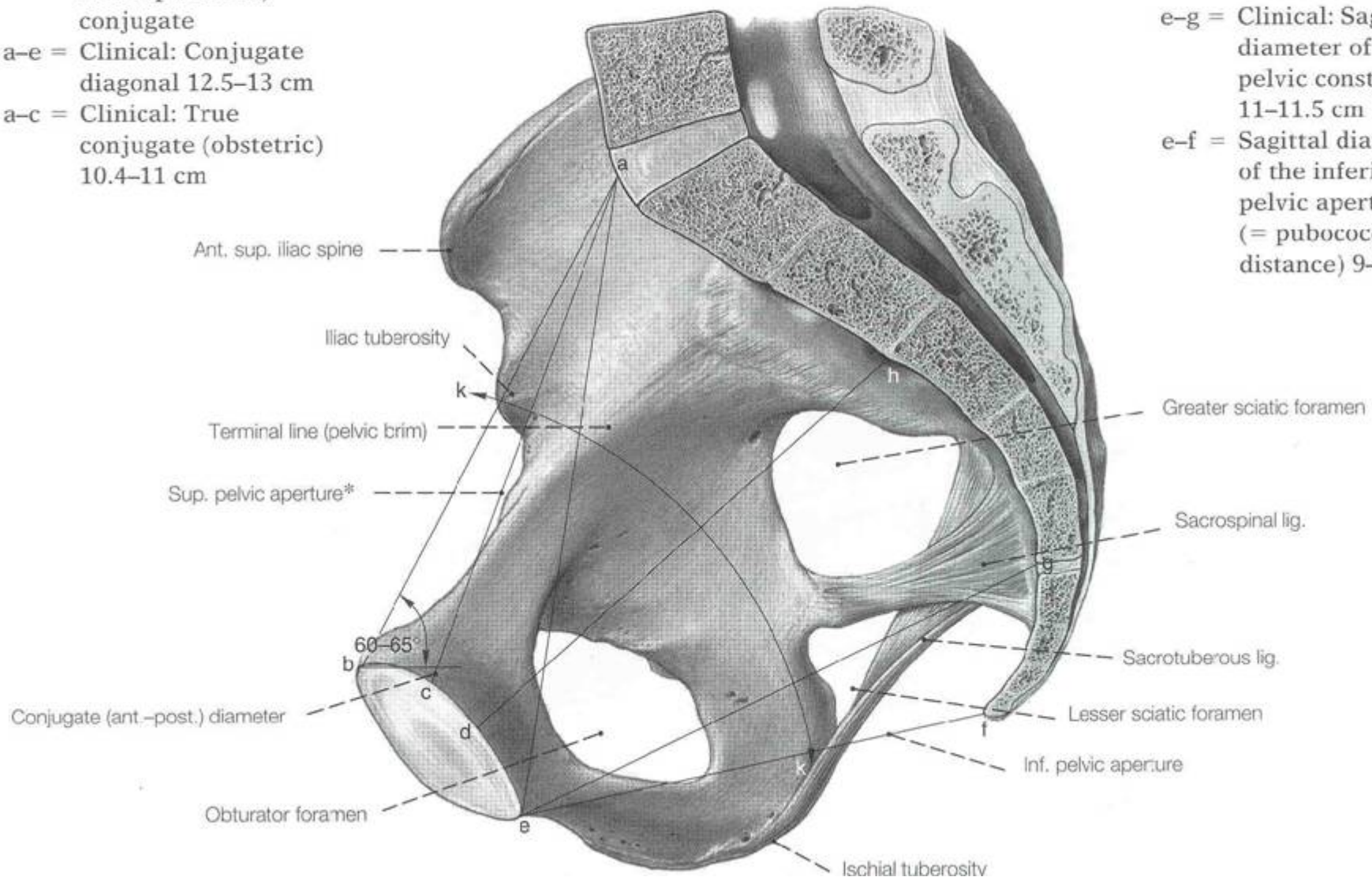


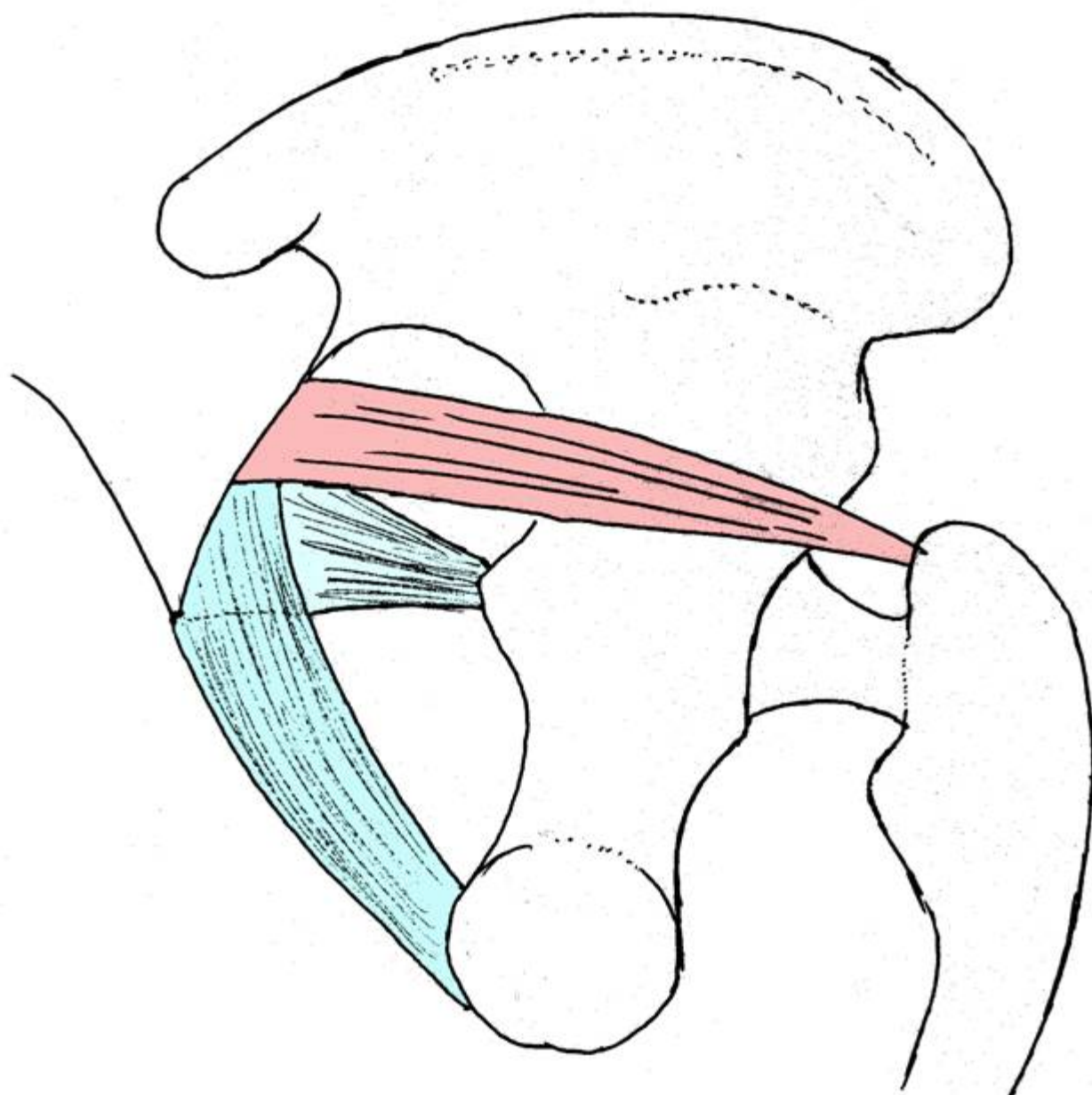


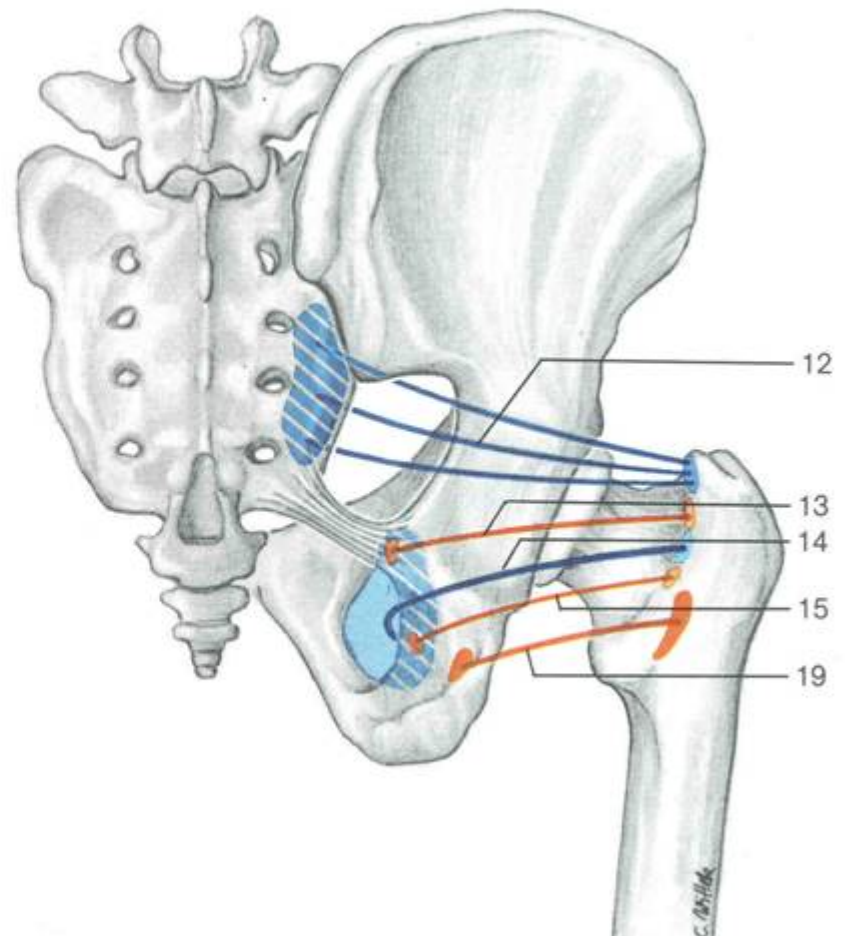
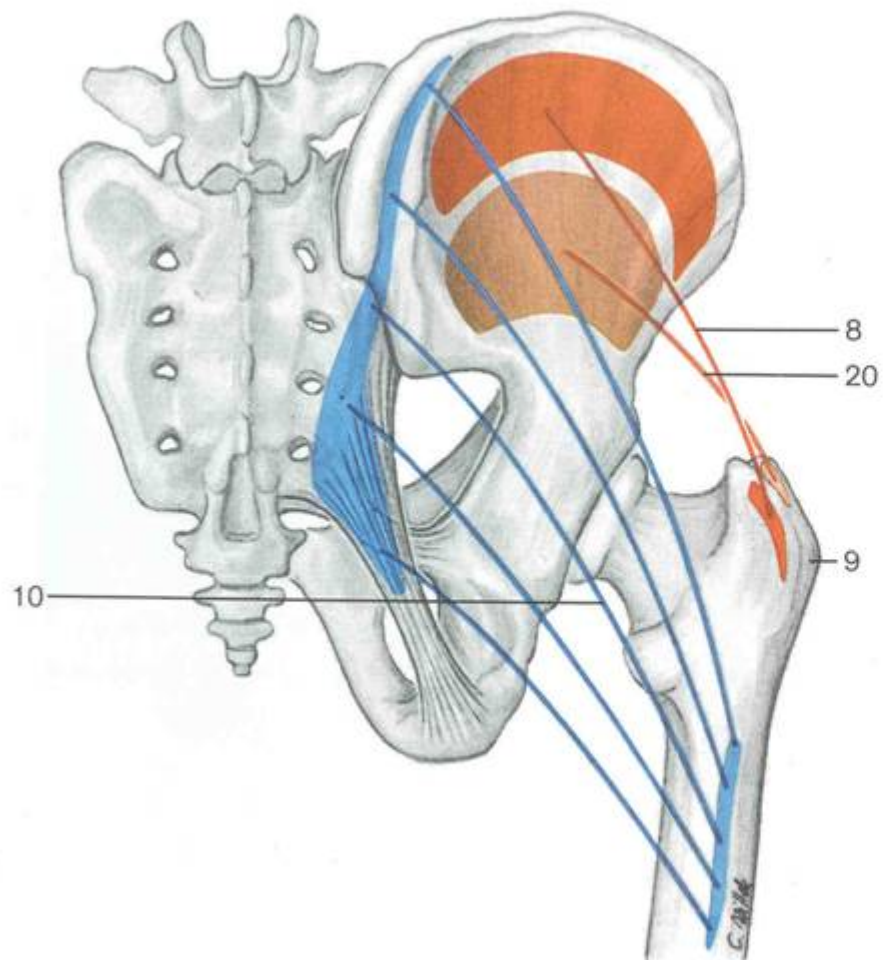


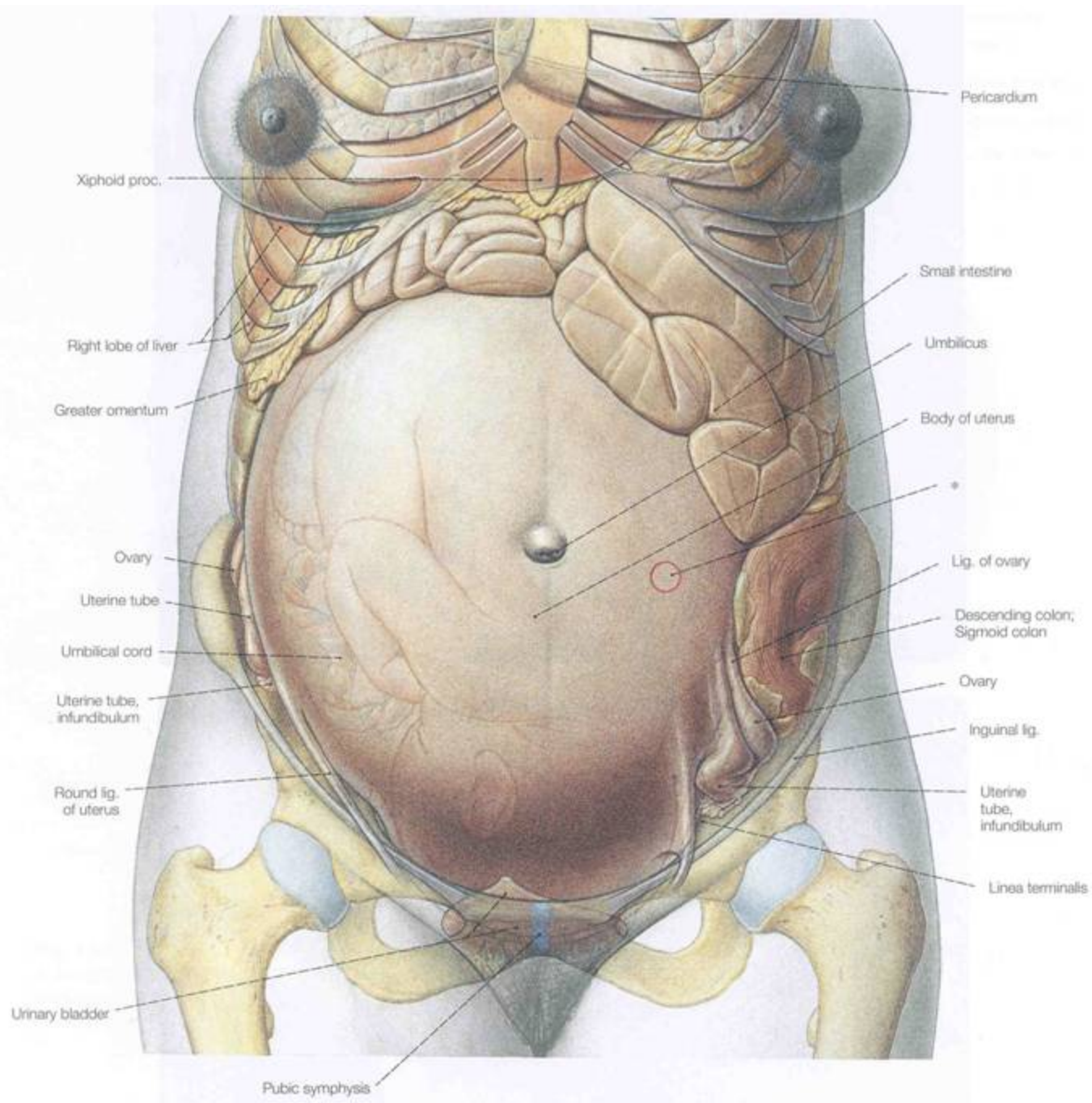
k-k = Pelvic axis
 a-b = Clinical: Anatomical
 (true,
 anteroposterior)
 conjugate
 a-e = Clinical: Conjugate
 diagonal 12.5-13 cm
 a-c = Clinical: True
 conjugate (obstetric)
 10.4-11 cm

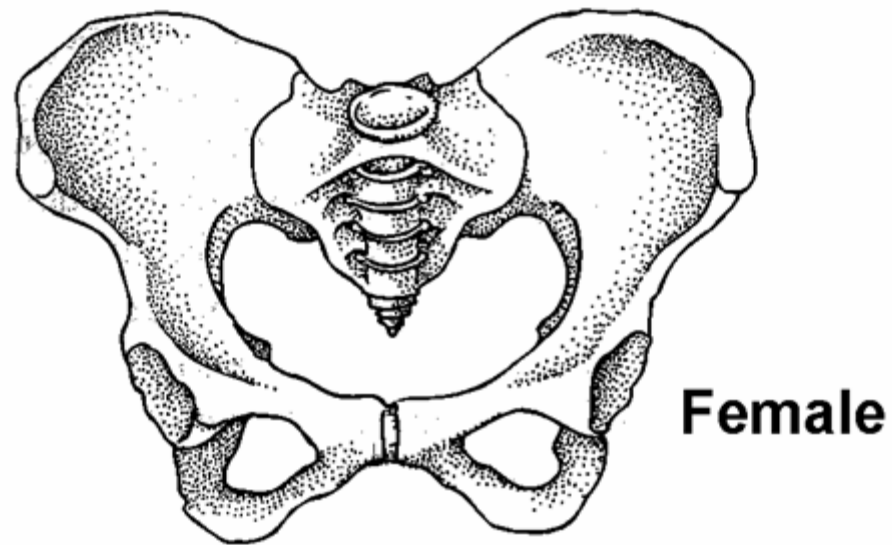
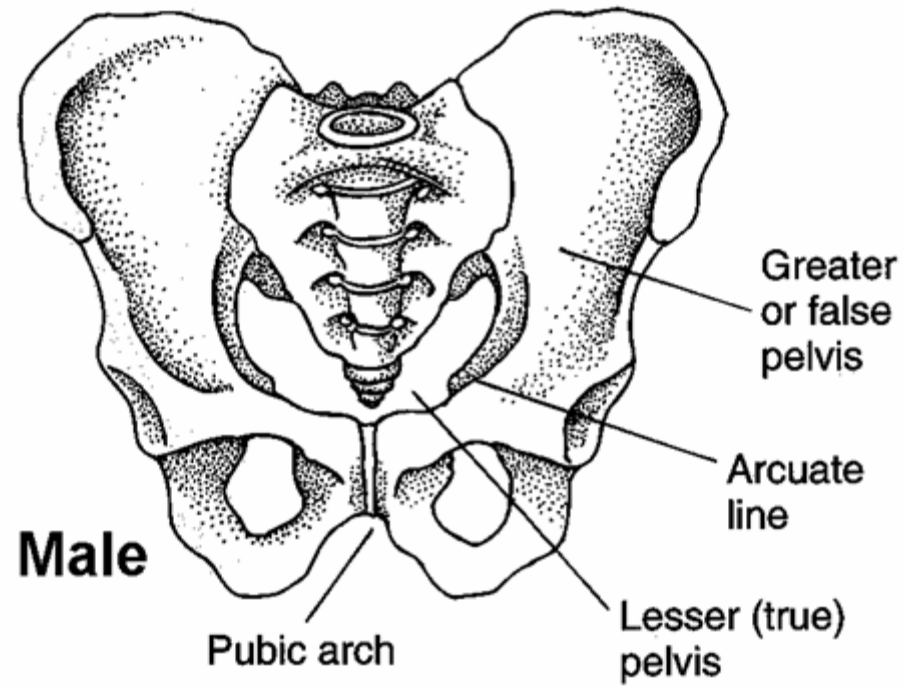
h-d = Clinical: Sagittal
 diameter of the
 pelvic brim
 12-12.5 cm
 e-g = Clinical: Sagittal
 diameter of the
 pelvic constriction
 11-11.5 cm
 e-f = Sagittal diameter
 of the inferior
 pelvic aperture
 (= pubococcygeal
 distance) 9-10 cm



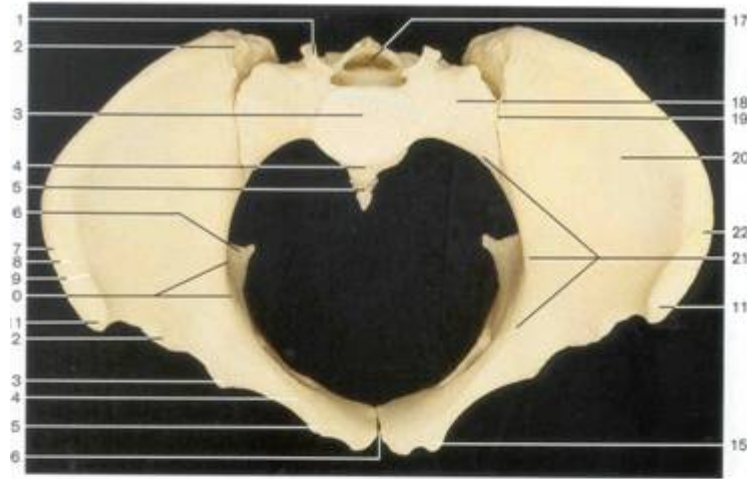




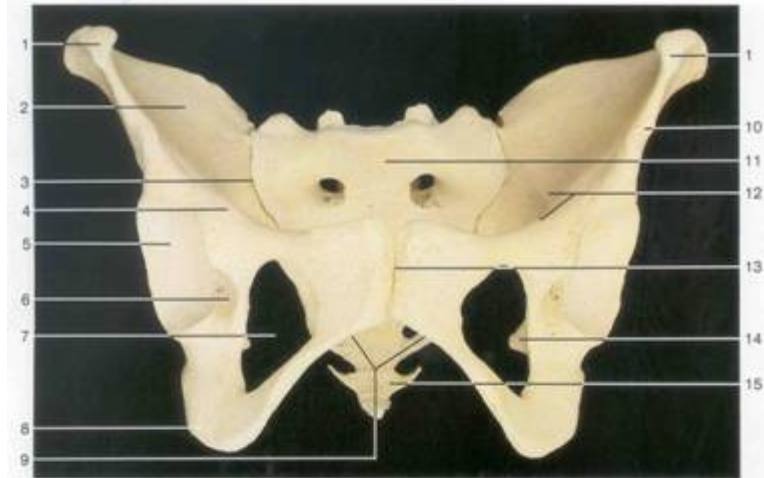




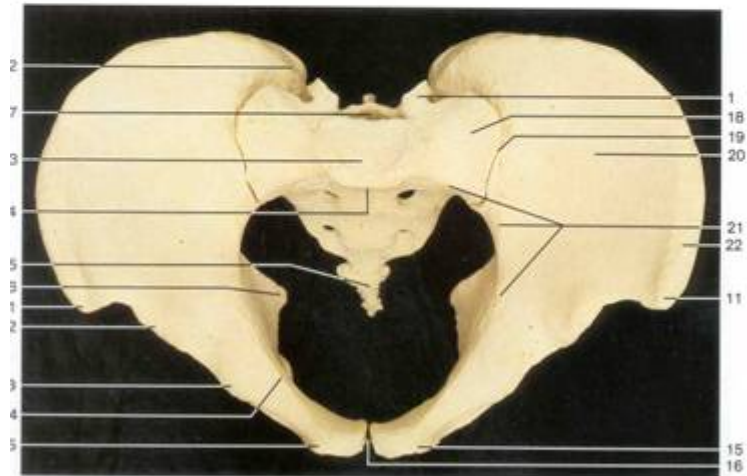
Female



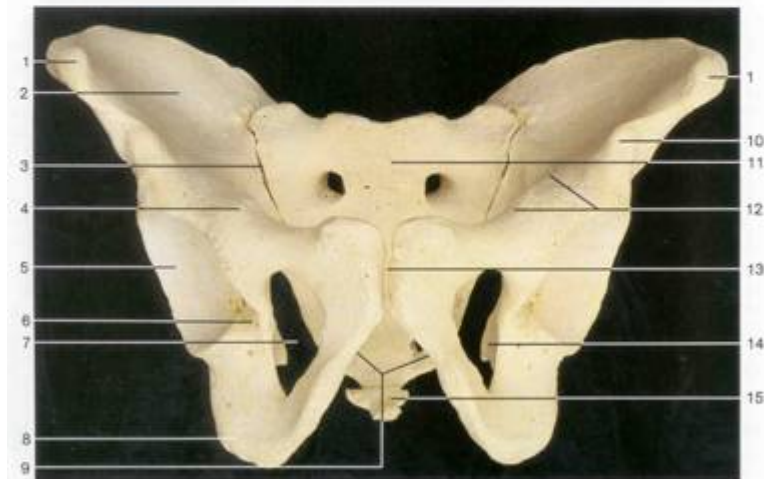
Female pelvis (superior aspect). Note the differences between the male and the female pelvis, predominantly in the form and dimensions of the sacrum, the superior and inferior apertures and the alae of the ilium.



Female pelvis (anterior aspect). Note the differences between the form and dimensions of the male and the female pelvis. The female pubic arch is wider than the male. The obturator foramen in the female pelvis is triangular, while that in the male pelvis is ovoid.



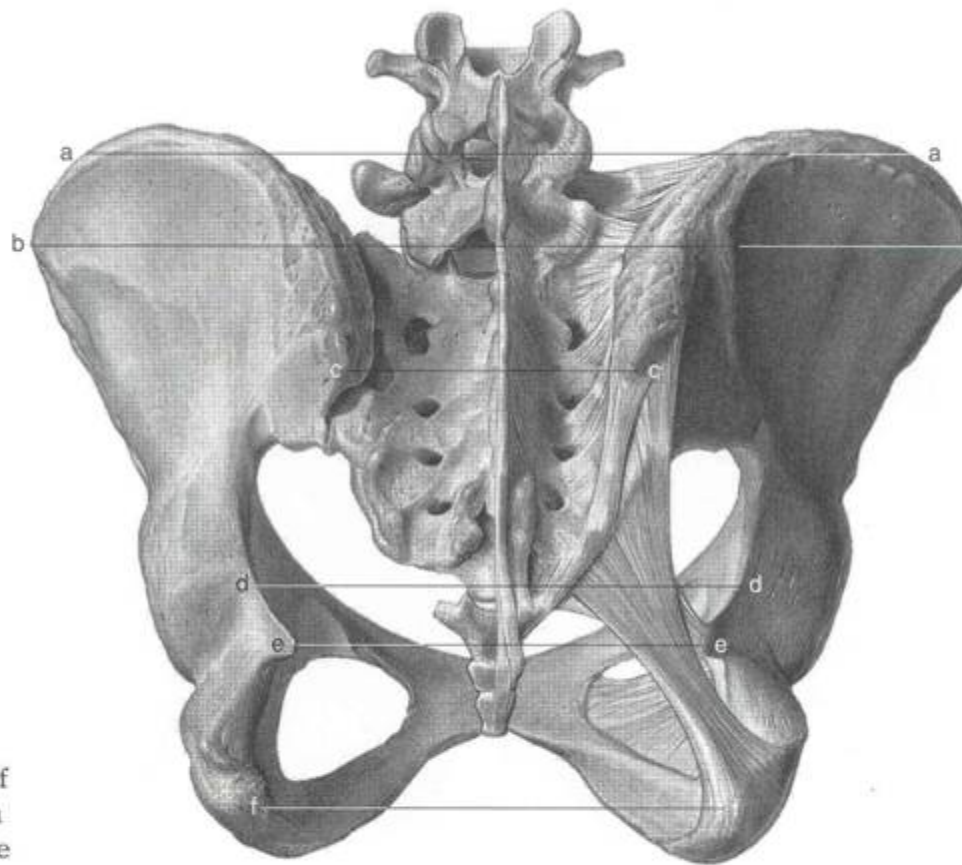
Male pelvis (superior aspect). Compare with the female pelvis (depicted above).



Male pelvis (anterior aspect). Compare with foregoing figure.

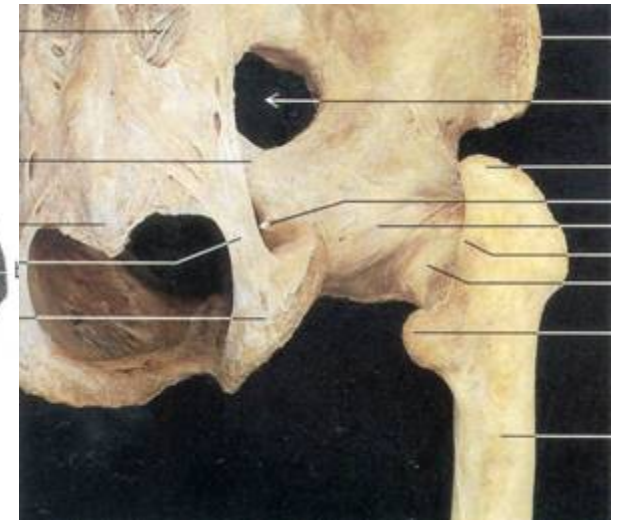
- | | |
|----------------------------------------|----------------------------------|
| 1 Superior articular process of sacrum | 12 Anterior inferior iliac spine |
| 2 Posterior superior iliac spine | 13 Iliopubic eminence |
| 3 Base of sacrum | 14 Pecten pubis |
| 4 Sacral promontory | 15 Pubic tubercle |
| 5 Coccyx | 16 Pubic symphysis |
| 6 Ischial spine | 17 Sacral canal |
| 7 External lip | 18 Ala of sacrum |
| 8 Intermediate line | 19 Position of sacroiliac joint |
| 9 Internal lip | 20 Iliac fossa |
| 10 Arcuate line | 21 Linea terminalis |
| 11 Anterior superior iliac spine | 22 Iliac crest |

- | | |
|----------------------------------|------------------------------------------------------|
| 1 Anterior superior iliac spine | 9 Pubic arch |
| 2 Iliac fossa | 10 Anterior inferior iliac spine |
| 3 Position of sacroiliac joint | 11 Sacrum |
| 4 Iliopubic eminence | 12 Linea terminalis (at margin of superior aperture) |
| 5 Laminate surface of acetabulum | 13 Pubic symphysis |
| 6 Acetabular notch | 14 Ischial spine |
| 7 Obturator foramen | 15 Coccyx |
| 8 Ischial tuberosity | |



- a-a = Crestal distance
28-29 cm*
- b-b = Spinal distance
25-26 cm*
- c-c = Post. spinal
diameter (width of
the sacrum) 10 cm
- * In perspective, the
crestal distance
appears shorter
than the spinal
distance

The pelvis, dimensions in the
female, dorsal aspect



- d-d = Transverse diameter
of the pelvic brim (=
interacetabular line)
12-12.5 cm
- e-e = Transverse diameter
of the pelvic
constriction
(=interspinous line)
10.5 cm
- f-f = Transverse diameter
of the inferior pelvic
aperture (= tuberal
diameter) 11-12 cm

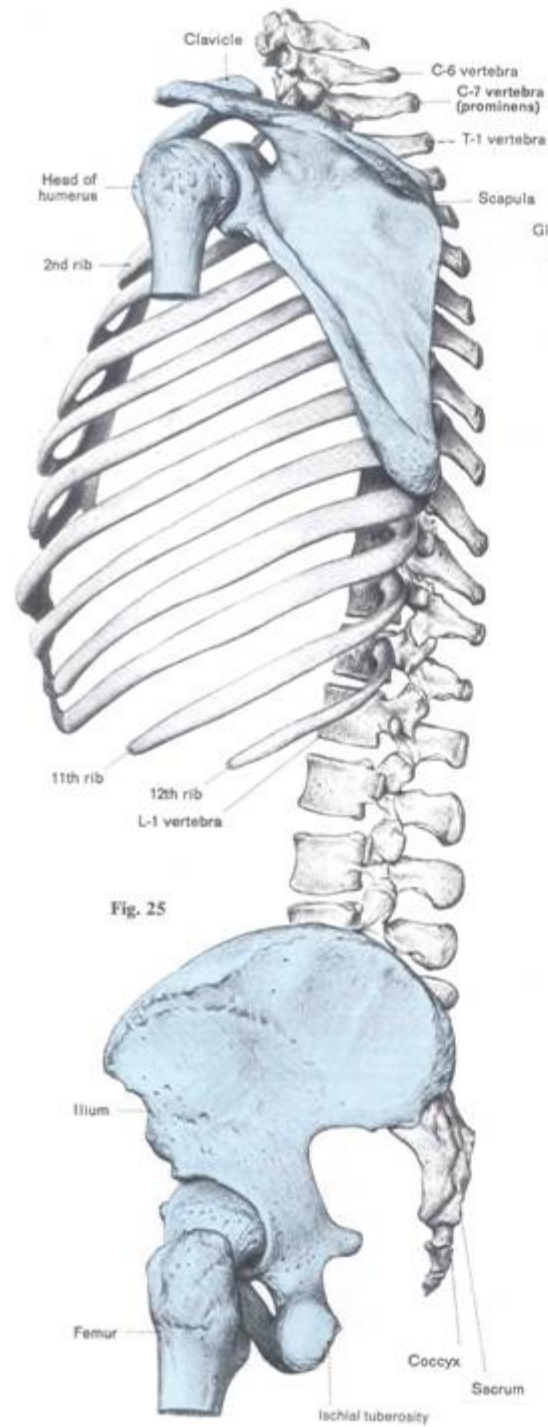


Fig. 25

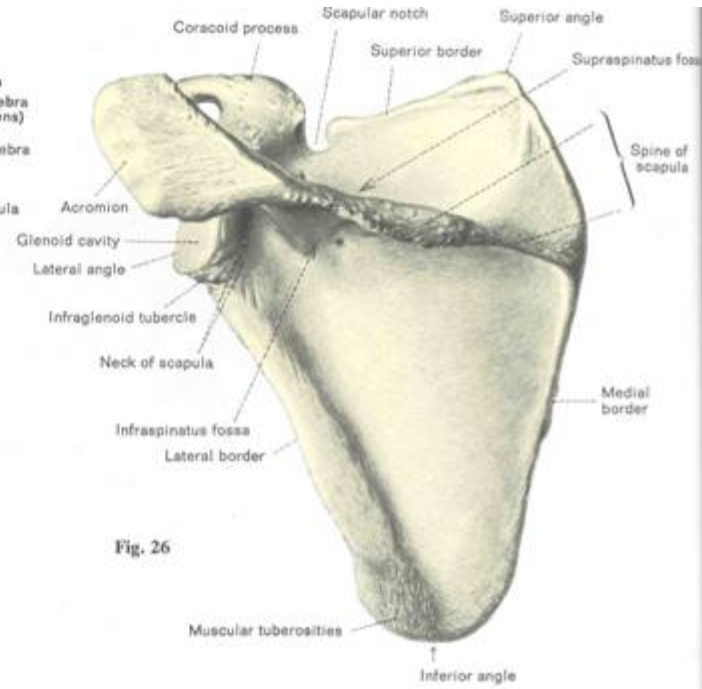


Fig. 26

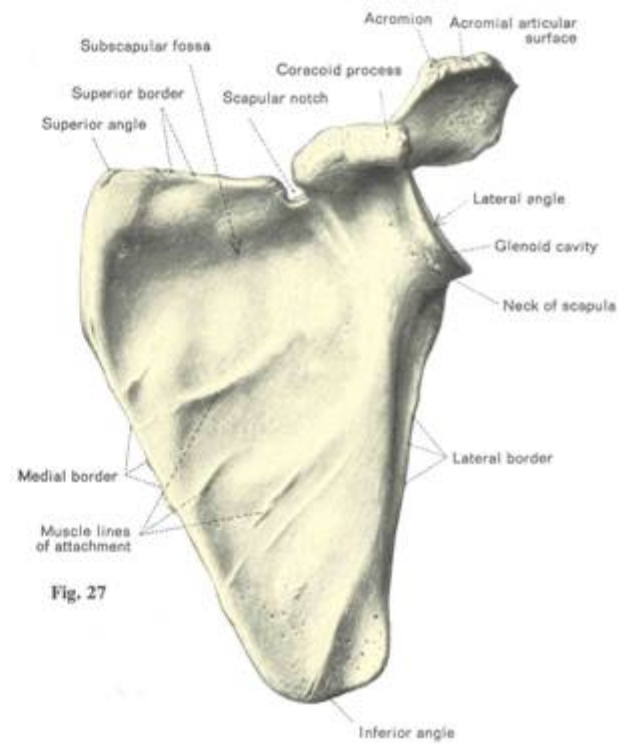
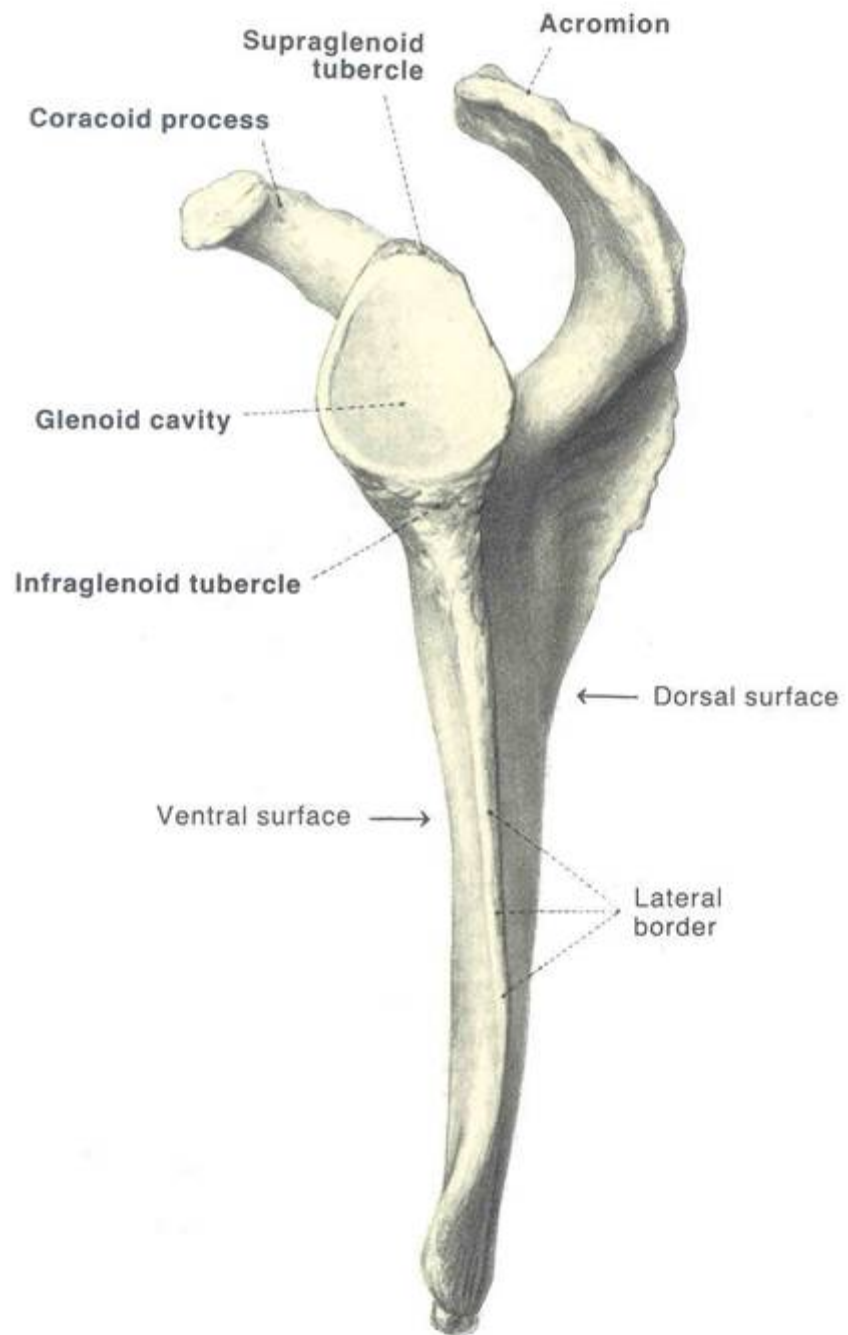
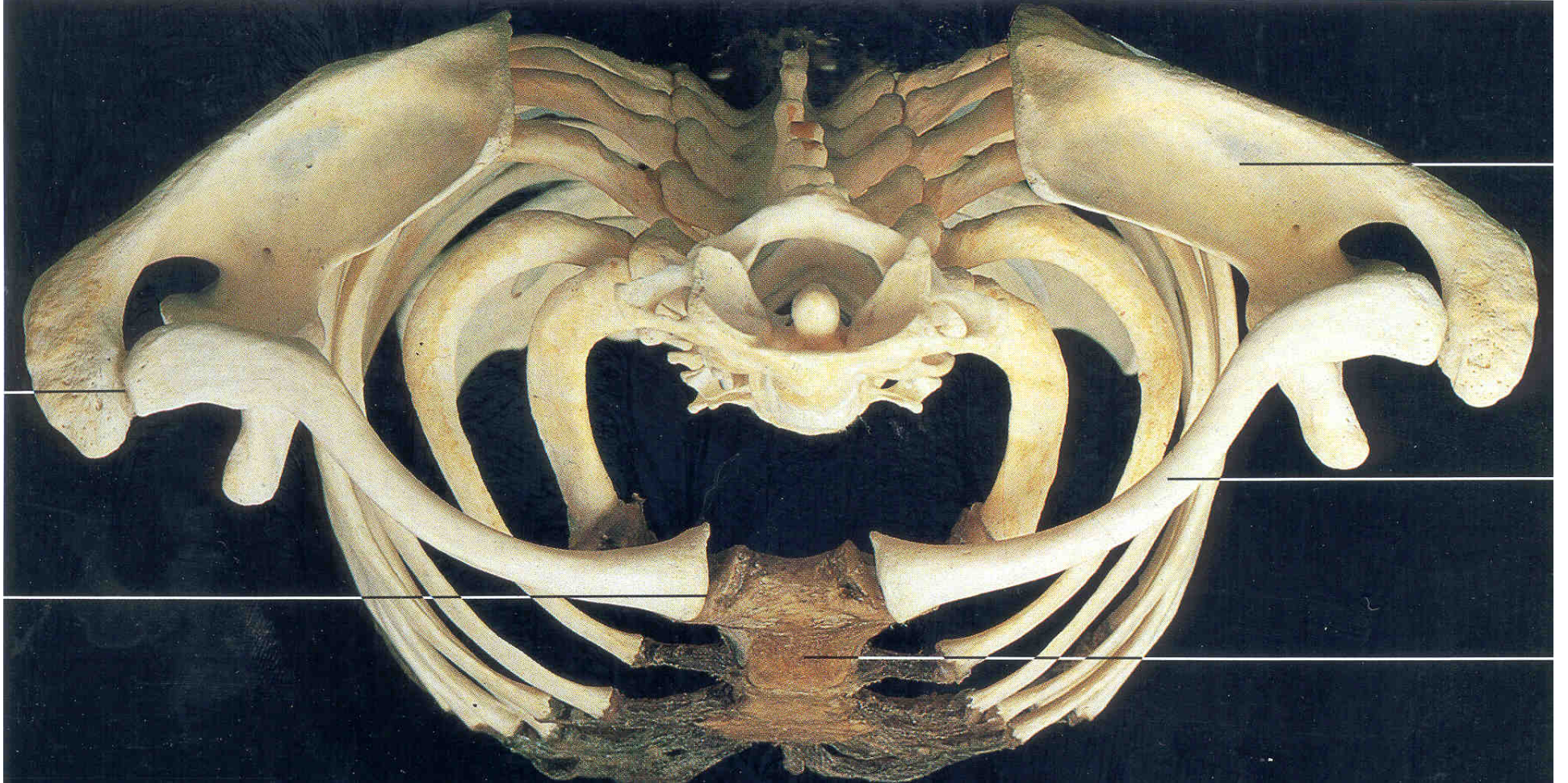
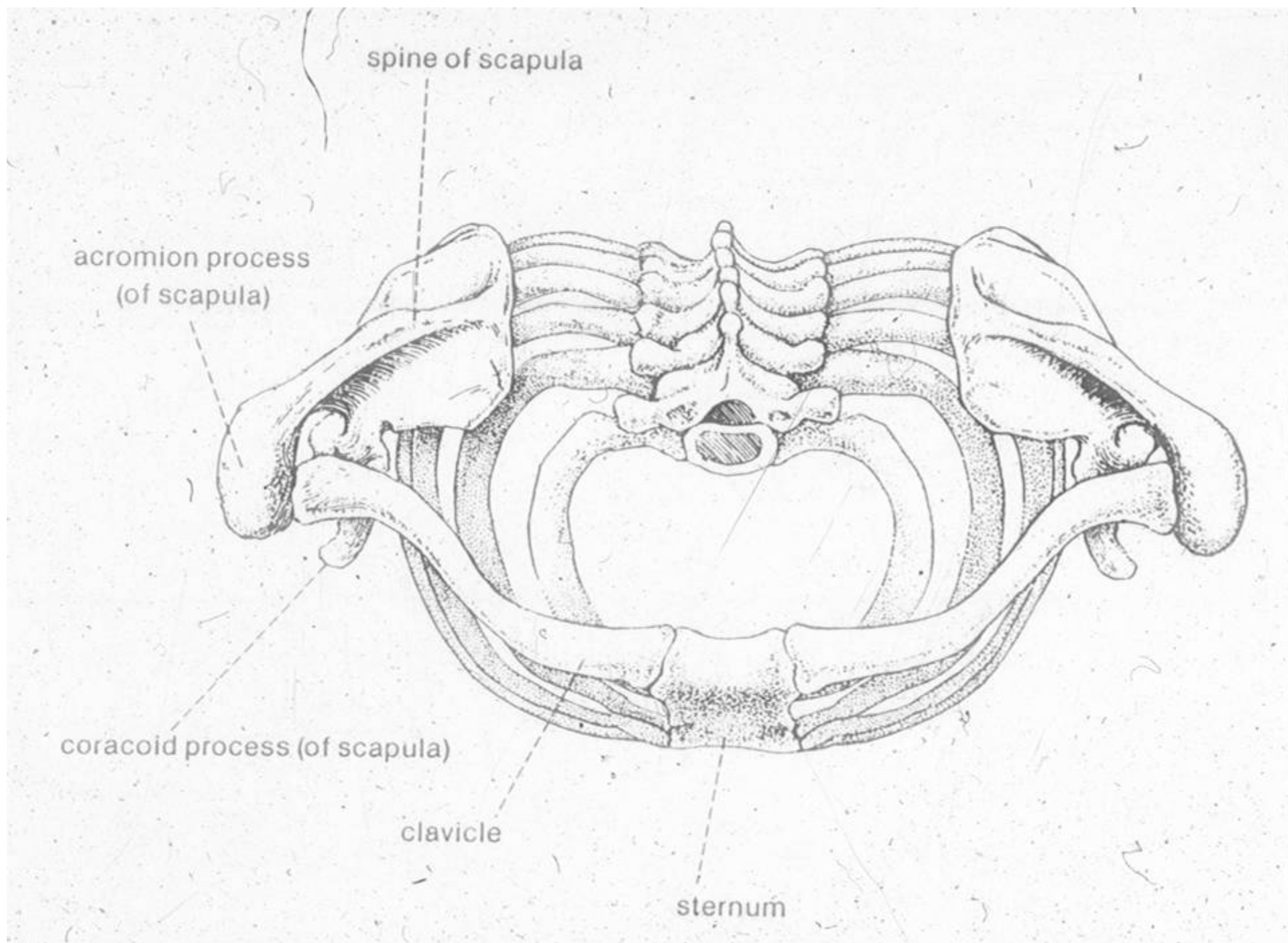


Fig. 27

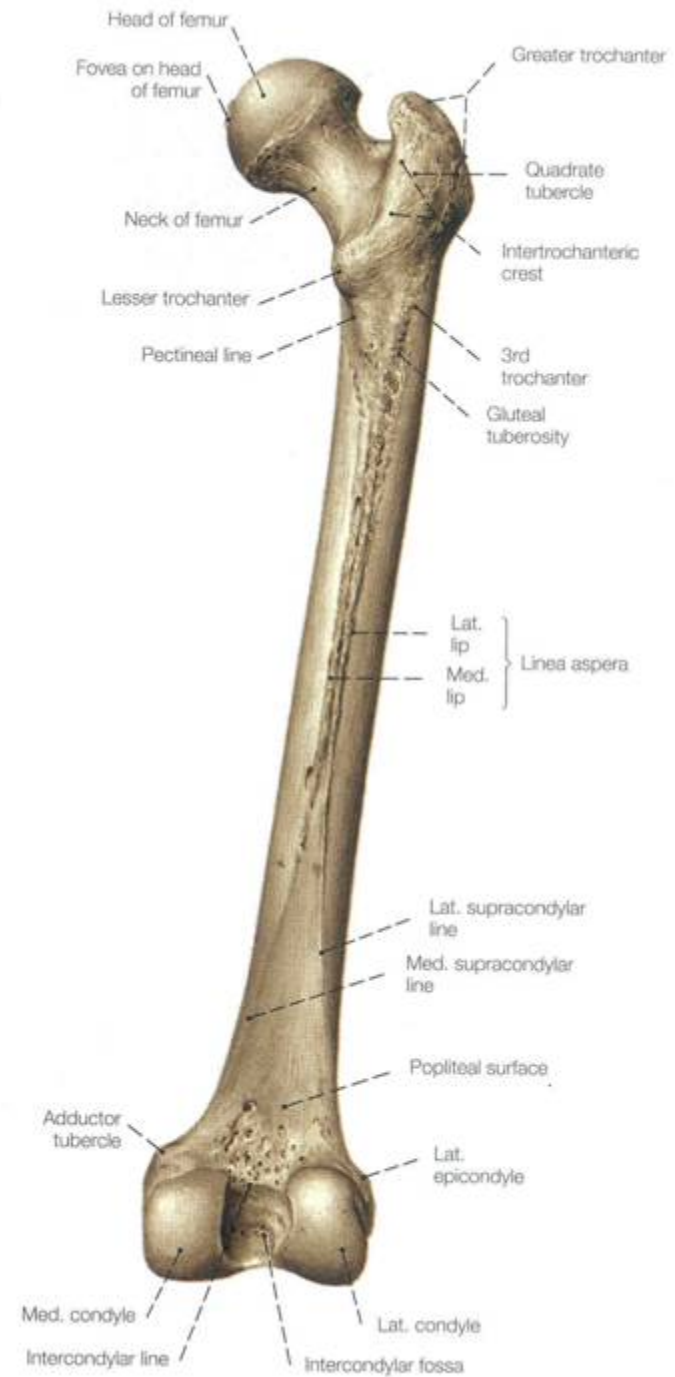
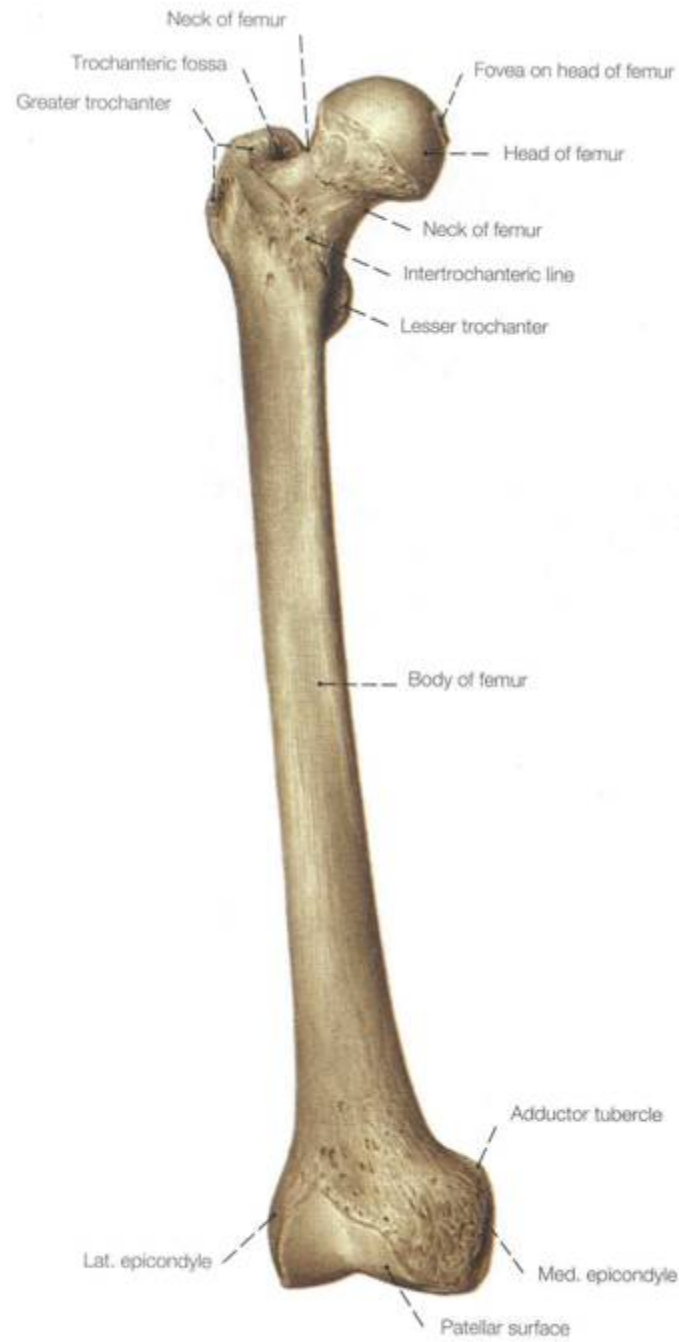


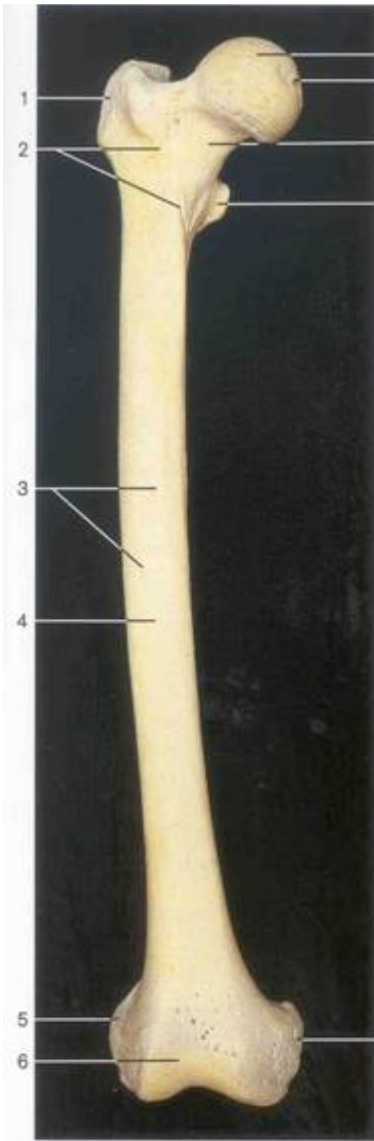




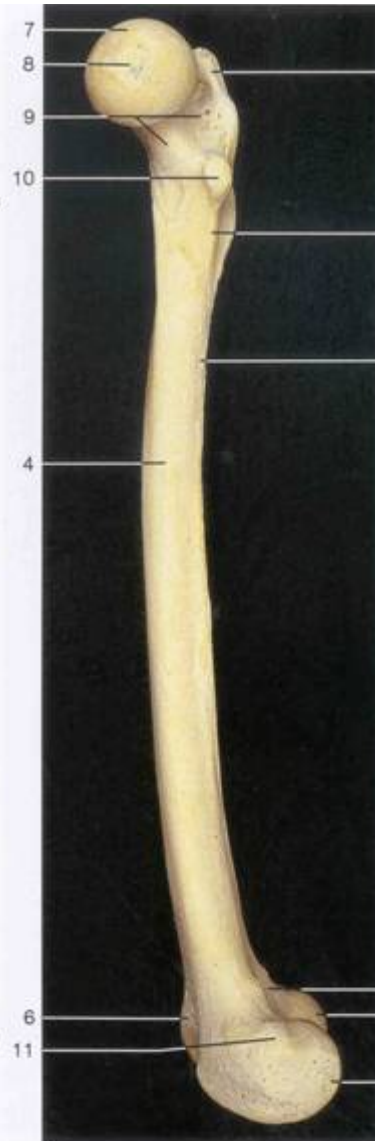
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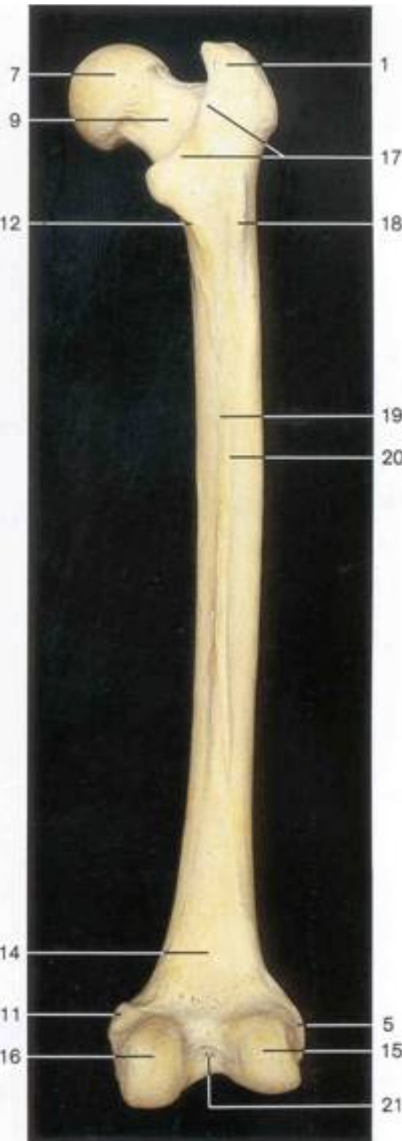




Right femur (anterior aspect).



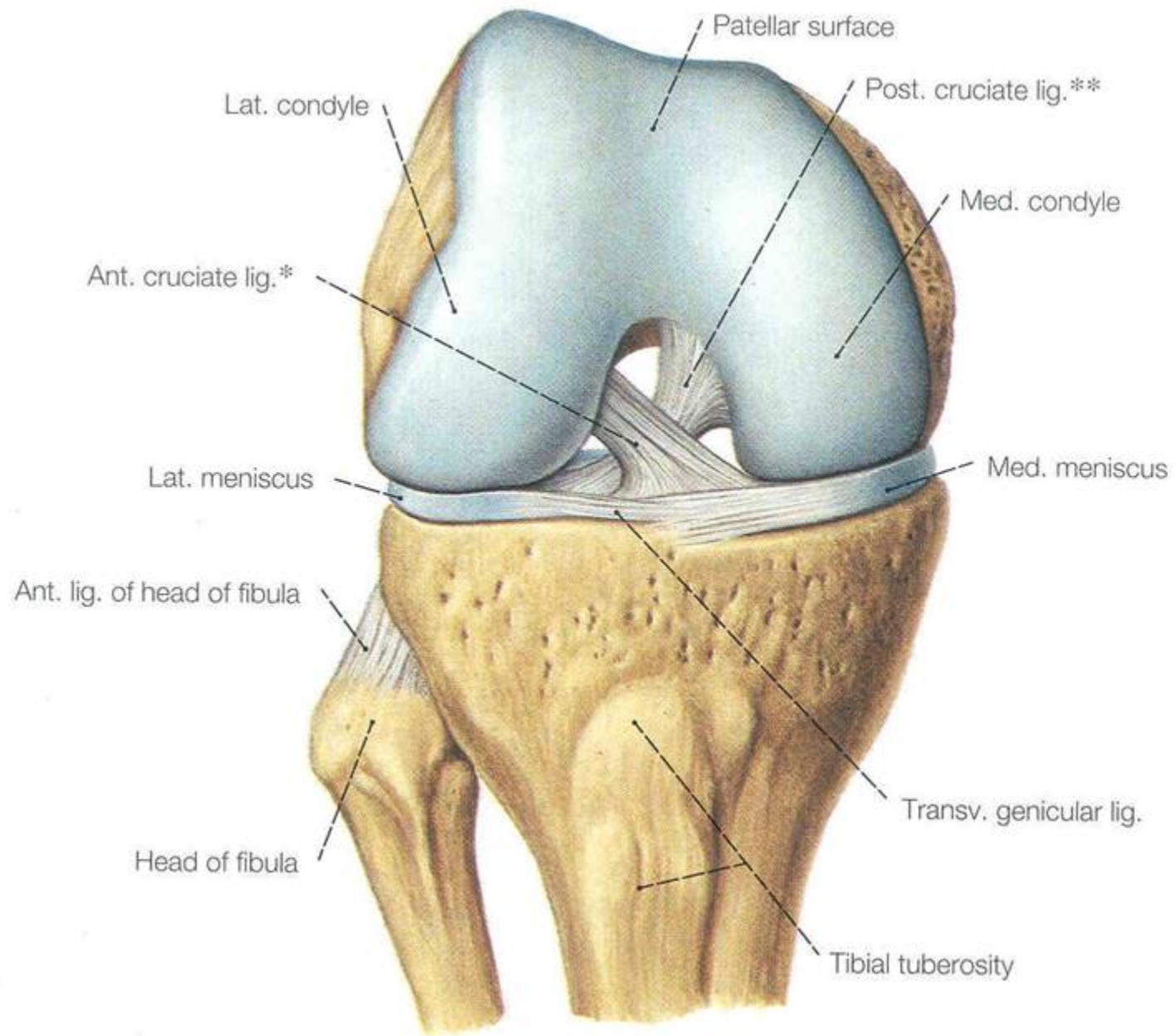
Right femur (medial aspect).

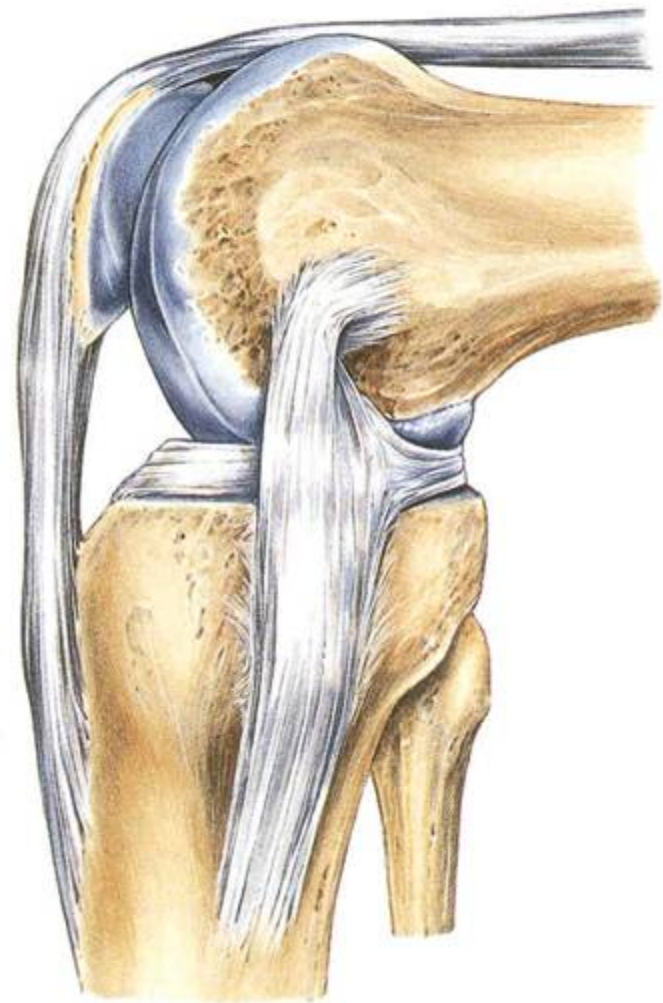
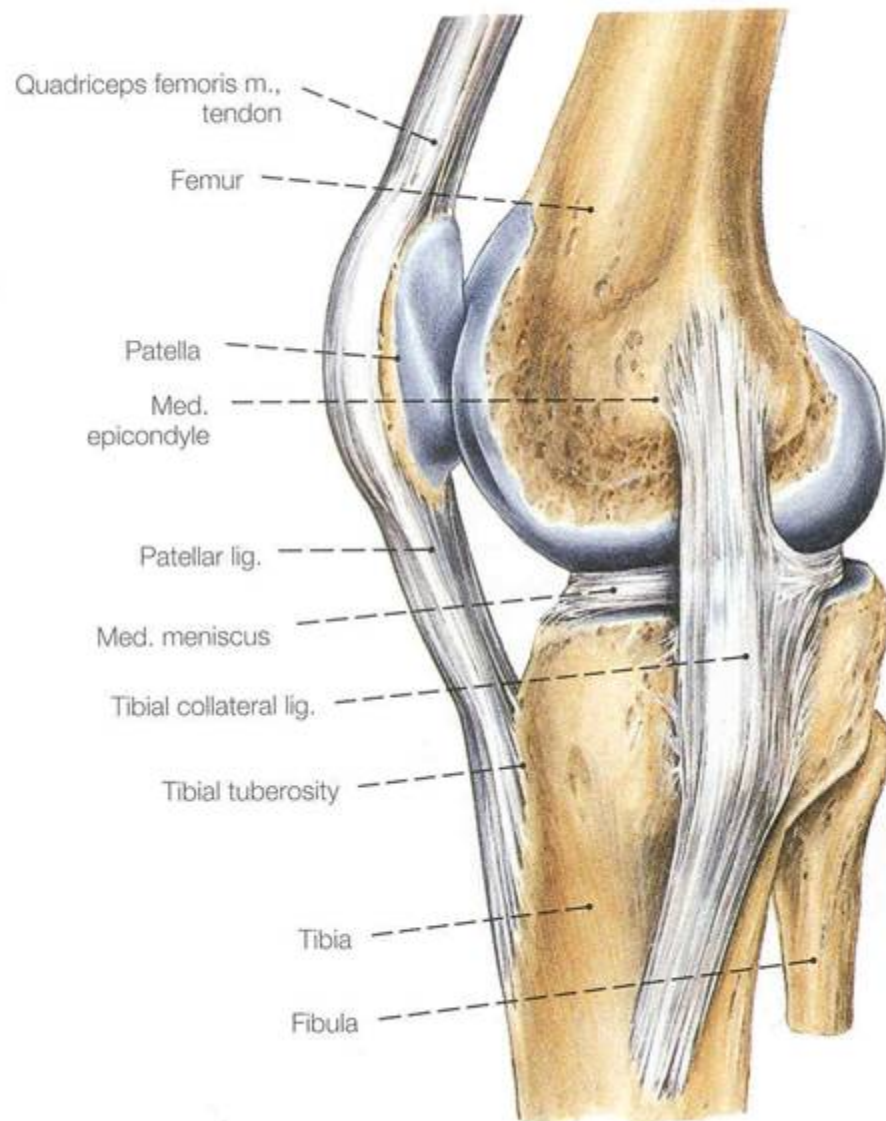


Right femur (posterior aspect).

- | | | |
|------------------------------|----------------------|--------------------------------|
| 1 Greater trochanter | 8 Fovea of head | 15 Lateral condyle |
| 2 Intertrochanteric line | 9 Neck | 16 Medial condyle |
| 3 Nutrient foramina | 10 Lesser trochanter | 17 Intertrochanteric crest |
| 4 Shaft of femur (diaphysis) | 11 Medial epicondyle | 18 Third trochanter |
| 5 Lateral epicondyle | 12 Pectineal line | 19 Medial lip of linea aspera |
| 6 Patellar surface | 13 Linea aspera | 20 Lateral lip of linea aspera |
| 7 Head | 14 Popliteal surface | 21 Intercondylar fossa |





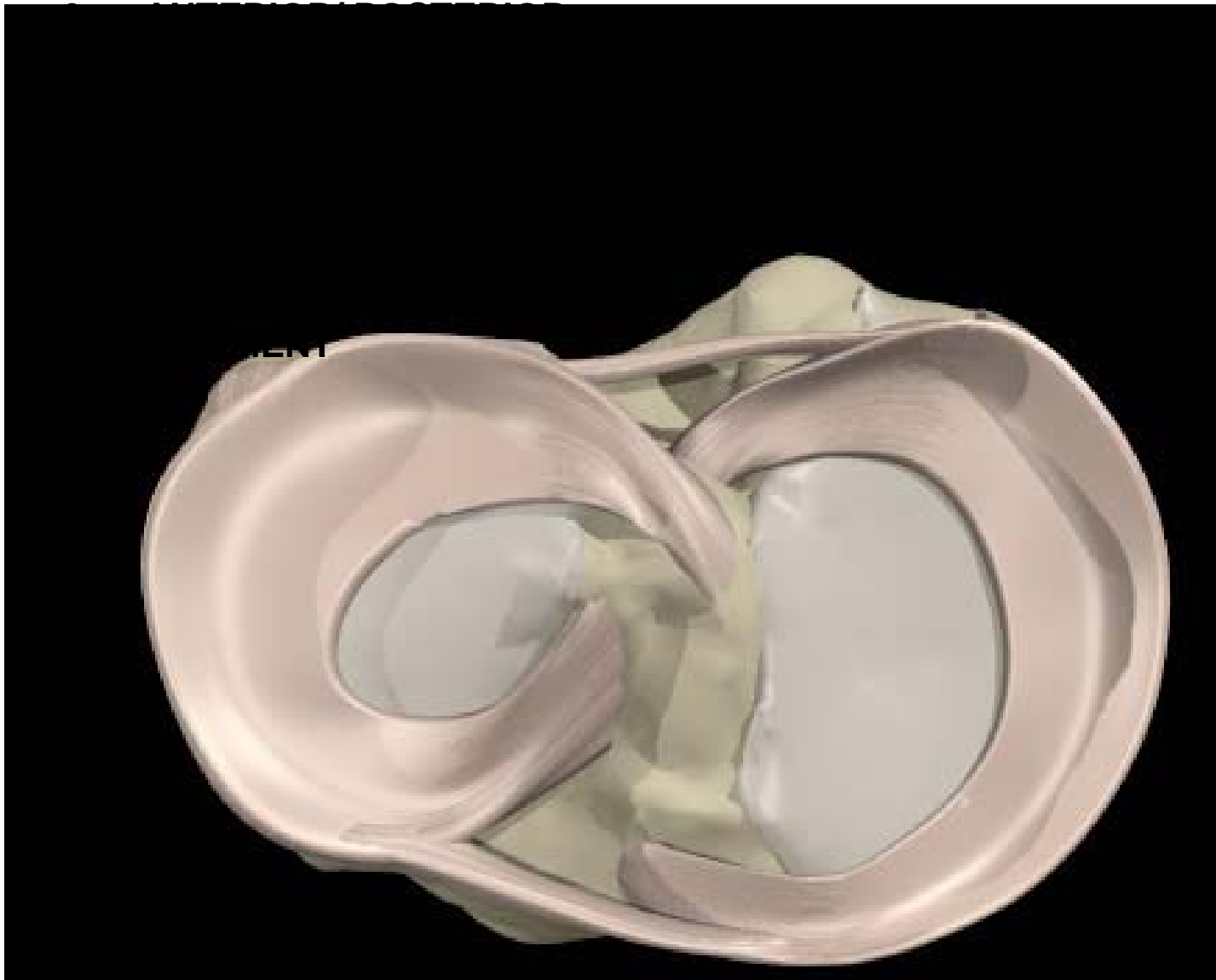


LATERAL MENISCUS

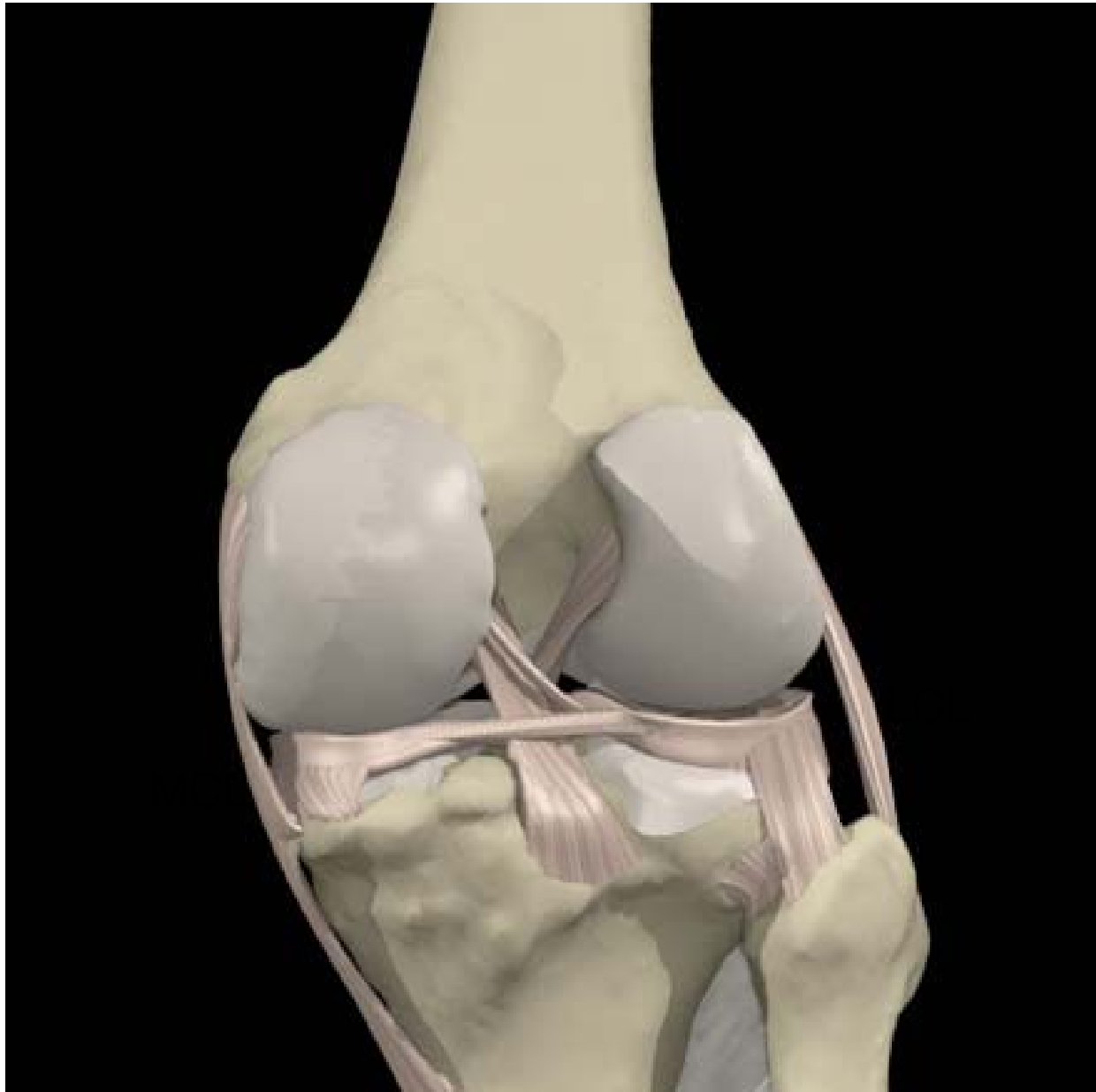
1. DEEP CAPSULE SURFACE

MEDIAL MENISCUS

1. DEEP CAPSULE SURFACE



ANTERIOR/
POSTERIOR HORNS
MENISCO-FEMORAL &
LIGAMENTS
LIGAMENTS (DISPUTED)
CL







LATERAL LIGAMENT
R CRUCIATE LIGAMENT
CRUCIATE LIGAMENT



Fig. 290 The left humerus, anterior view (45%).

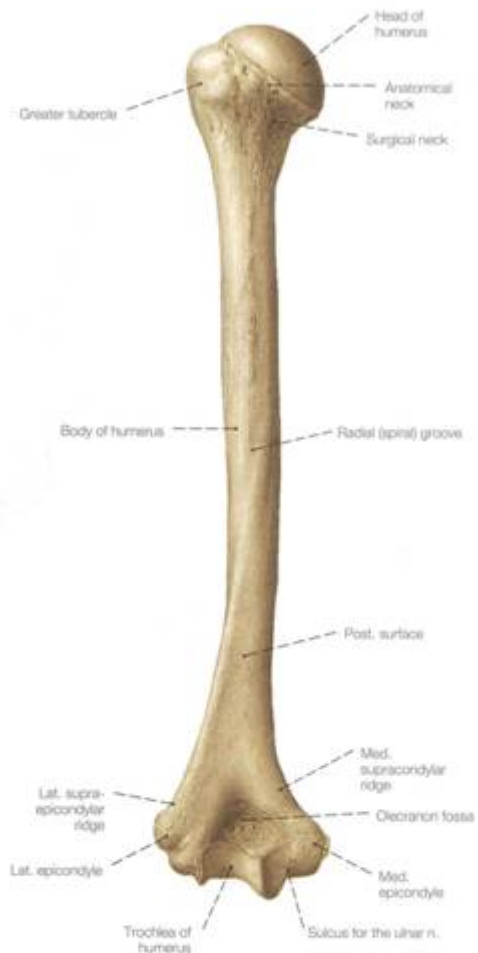
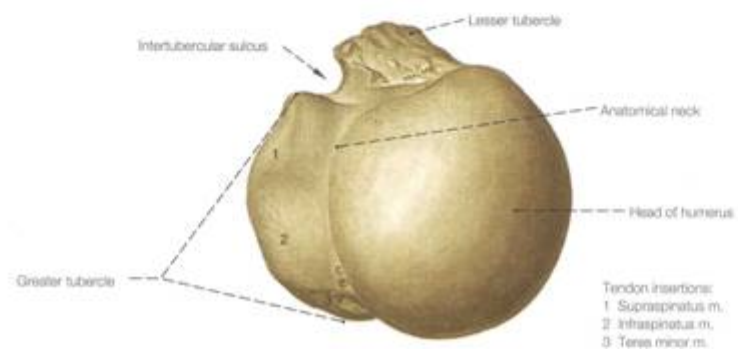
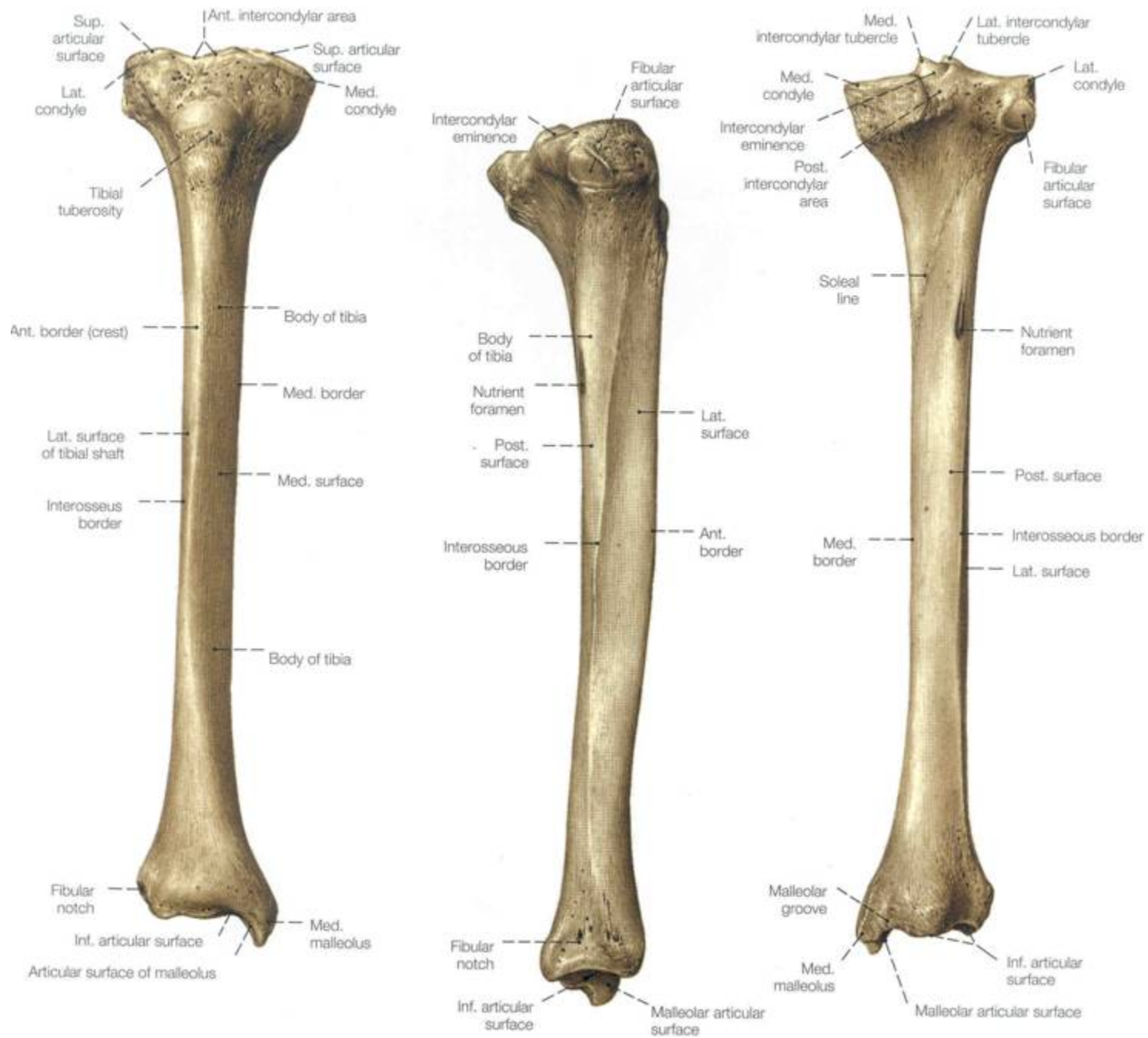
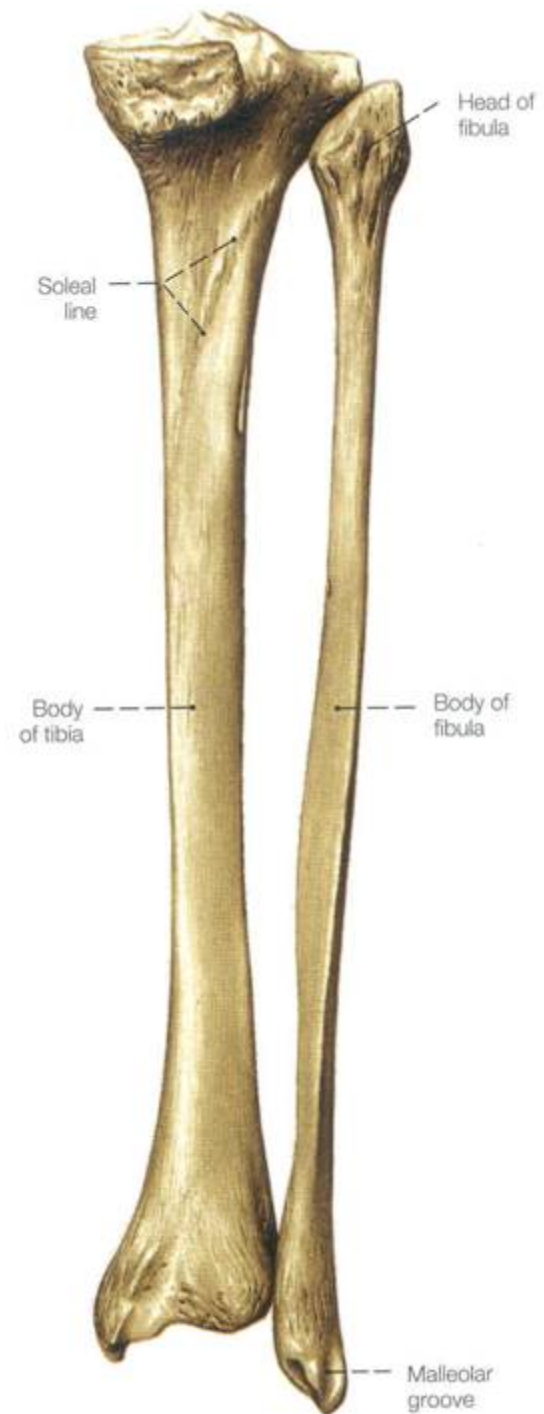
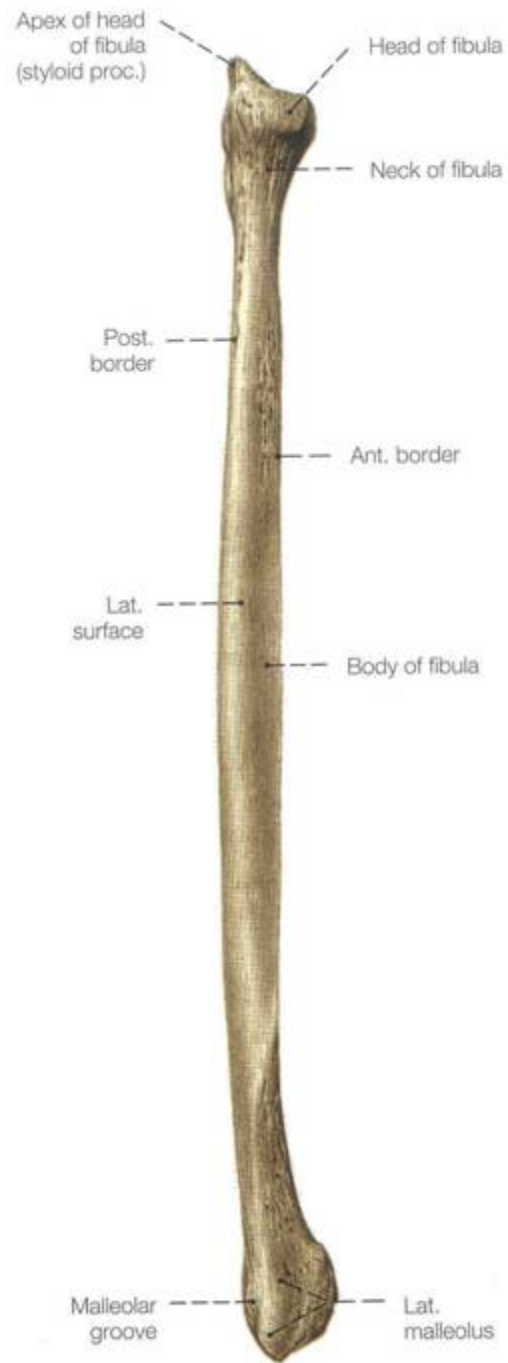
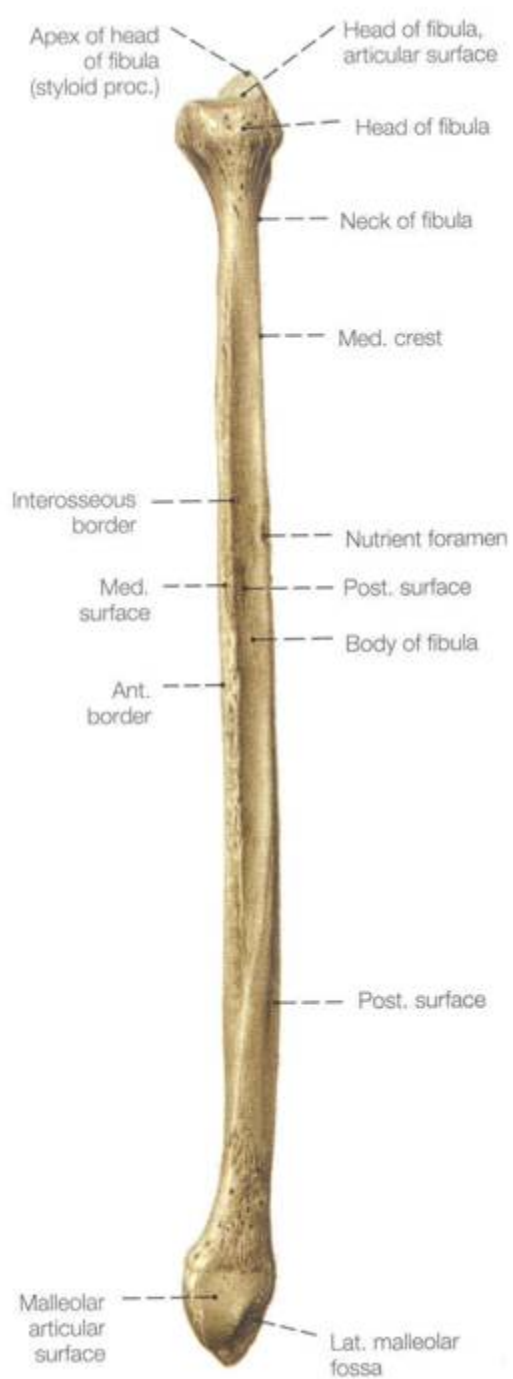
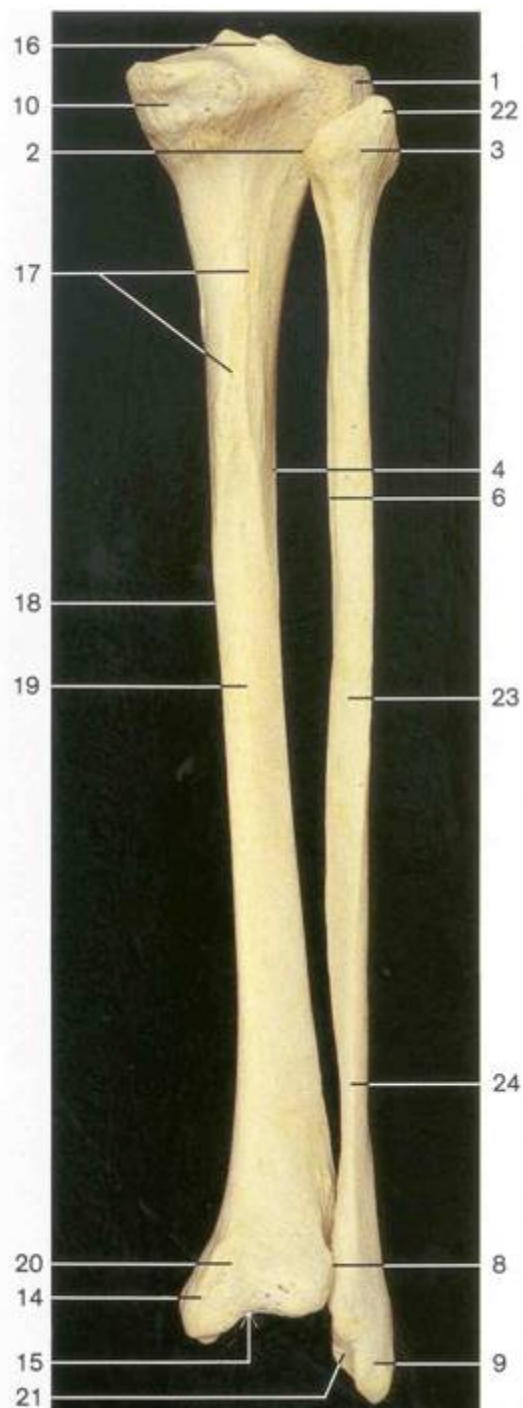
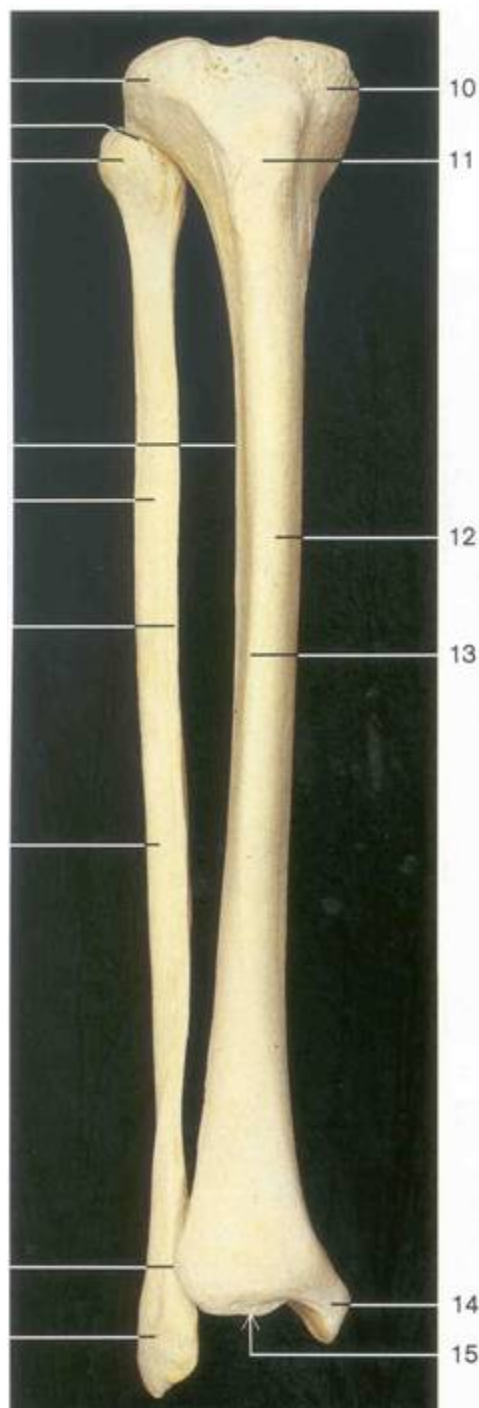


Fig. 291 The left humerus, posterior view (45%).









- 1 Lateral condyle of tibia
- 2 Position of tibiofibular joint
- 3 Head of fibula
- 4 Interosseous border of tibia
- 5 Shaft of fibula
- 6 Interosseous border of fibula
- 7 Lateral surface of fibula
- 8 Position of tibiofibular joint
- 9 Lateral malleolus
- 10 Medial condyle of tibia
- 11 Tuberosity of tibia
- 12 Shaft of tibia (diaphysis)
- 13 Anterior margin of tibia
- 14 Medial malleolus
- 15 Inferior articular surface of tibia
- 16 Intercondylar eminence
- 17 Soleal line
- 18 Medial border of tibia
- 19 Posterior surface of tibia
- 20 Malleolar sulcus of tibia
- 21 Malleolar articular surface of fibula
- 22 Apex of head of fibula
- 23 Posterior surface of fibula
- 24 Posterior border of fibula
- 25 Medial intercondylar tubercle
- 26 Posterior intercondylar area
- 27 Anterior intercondylar area
- 28 Lateral intercondylar tubercle

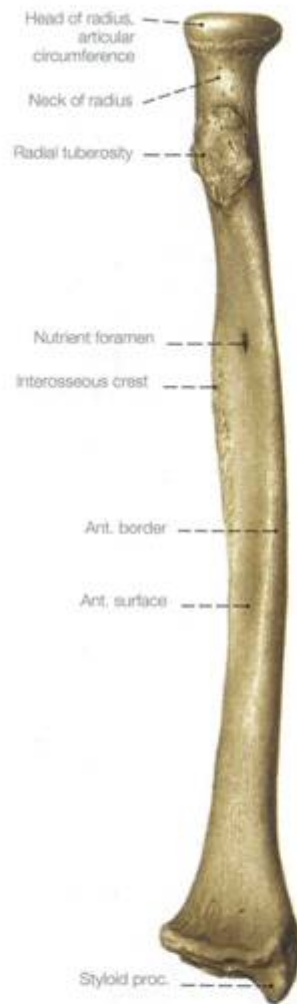


Fig. 304 The left radius, anterior view (50%).

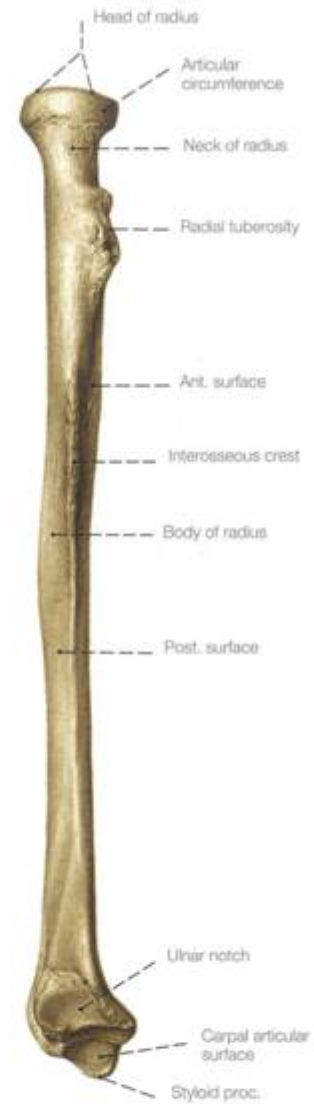


Fig. 306 The left radius, ulnar aspect (50%).

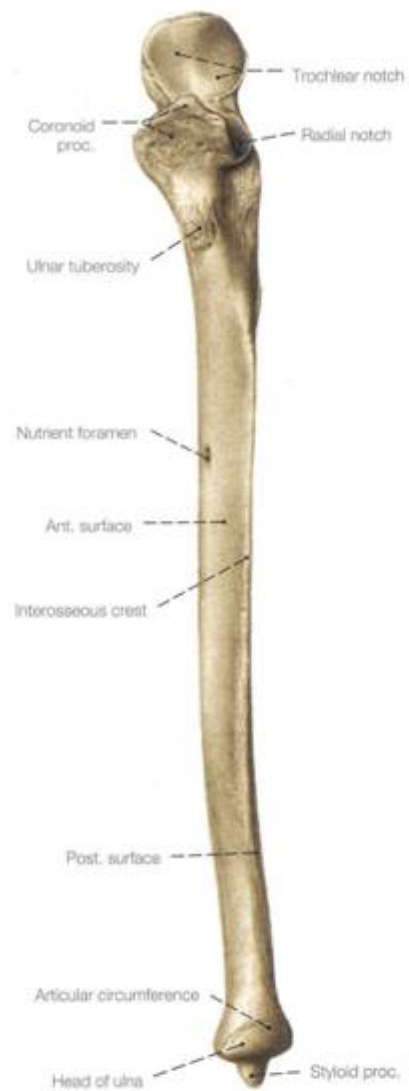


Fig. 301 The left ulna, anterior view (50%).

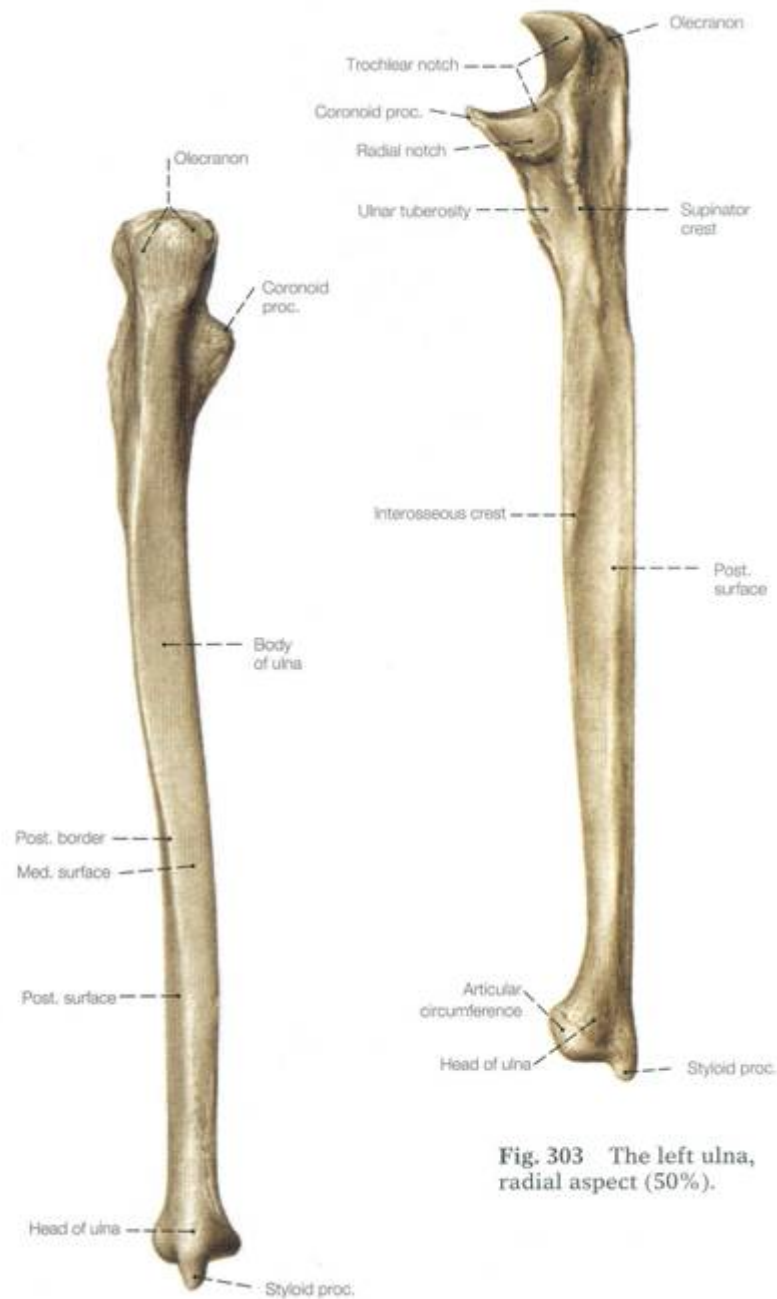
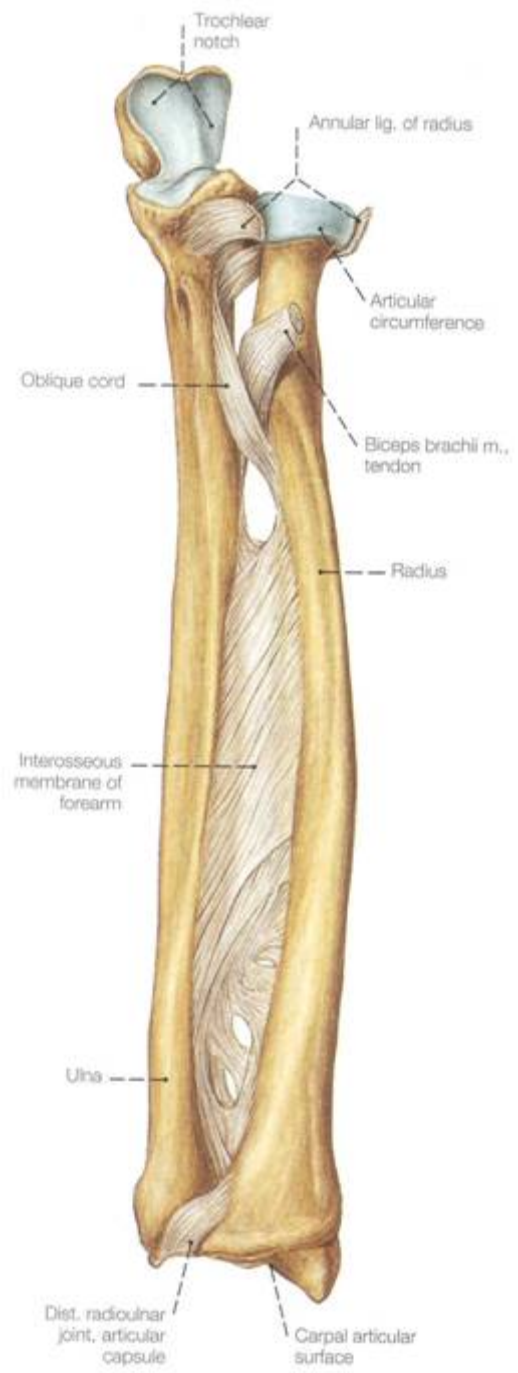


Fig. 303 The left ulna, radial aspect (50%).



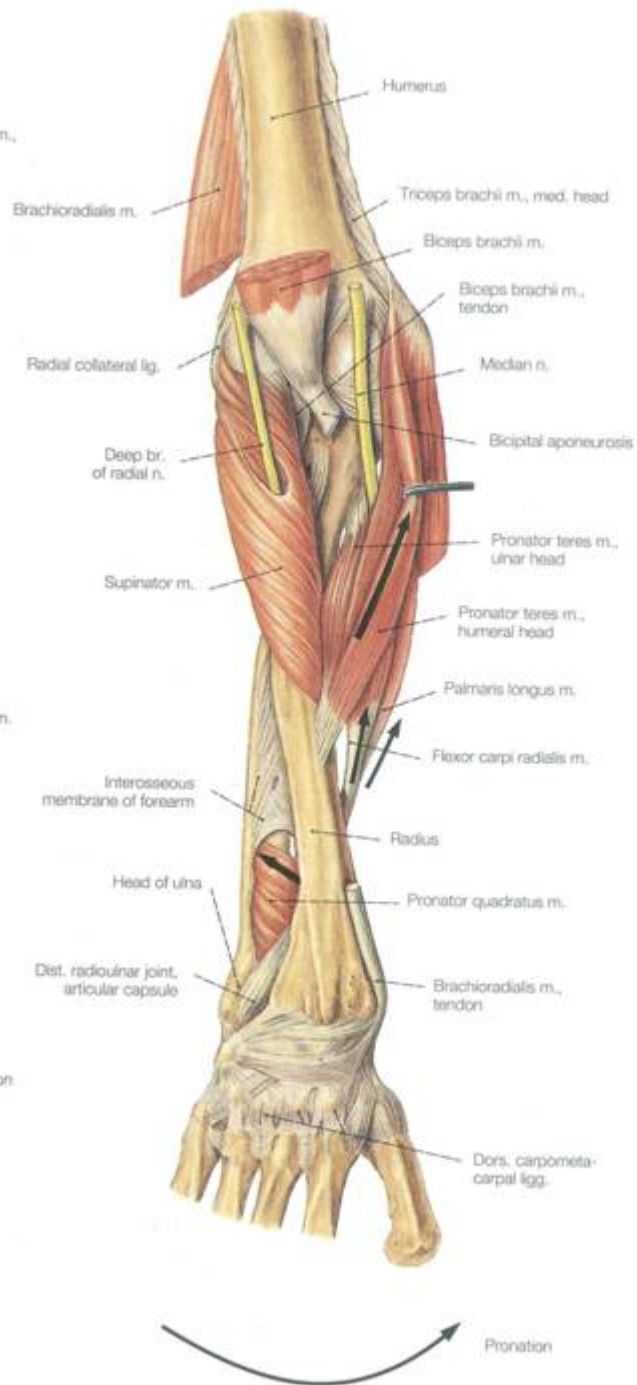
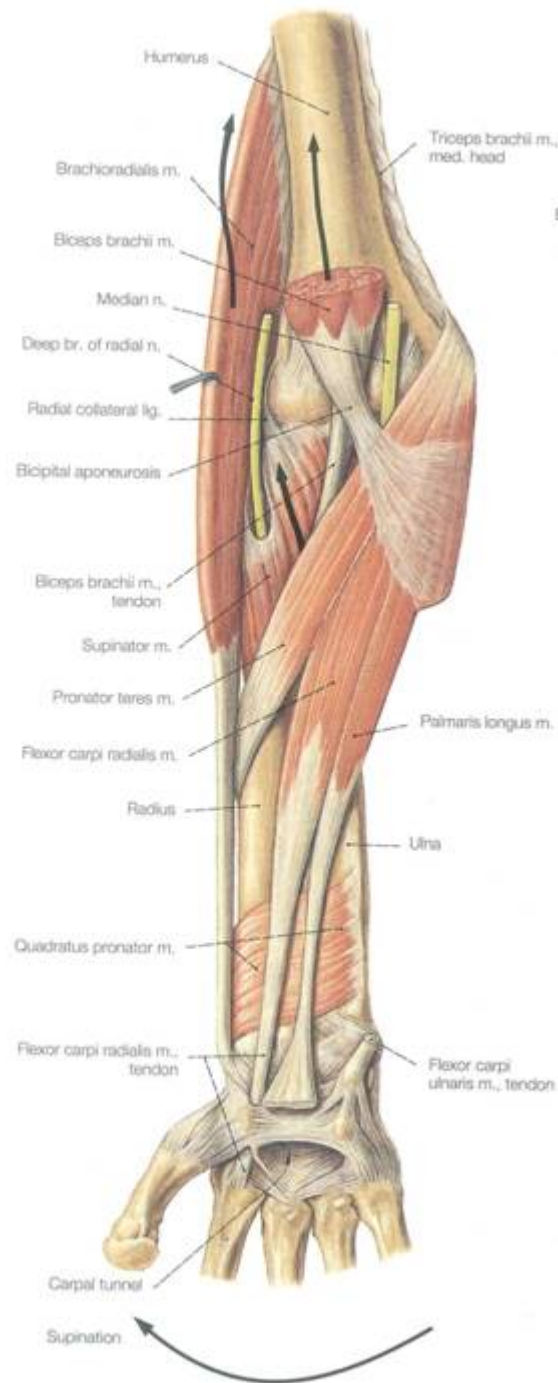


Fig. 1208 Bones of the right foot,
dorsal aspect (50%).

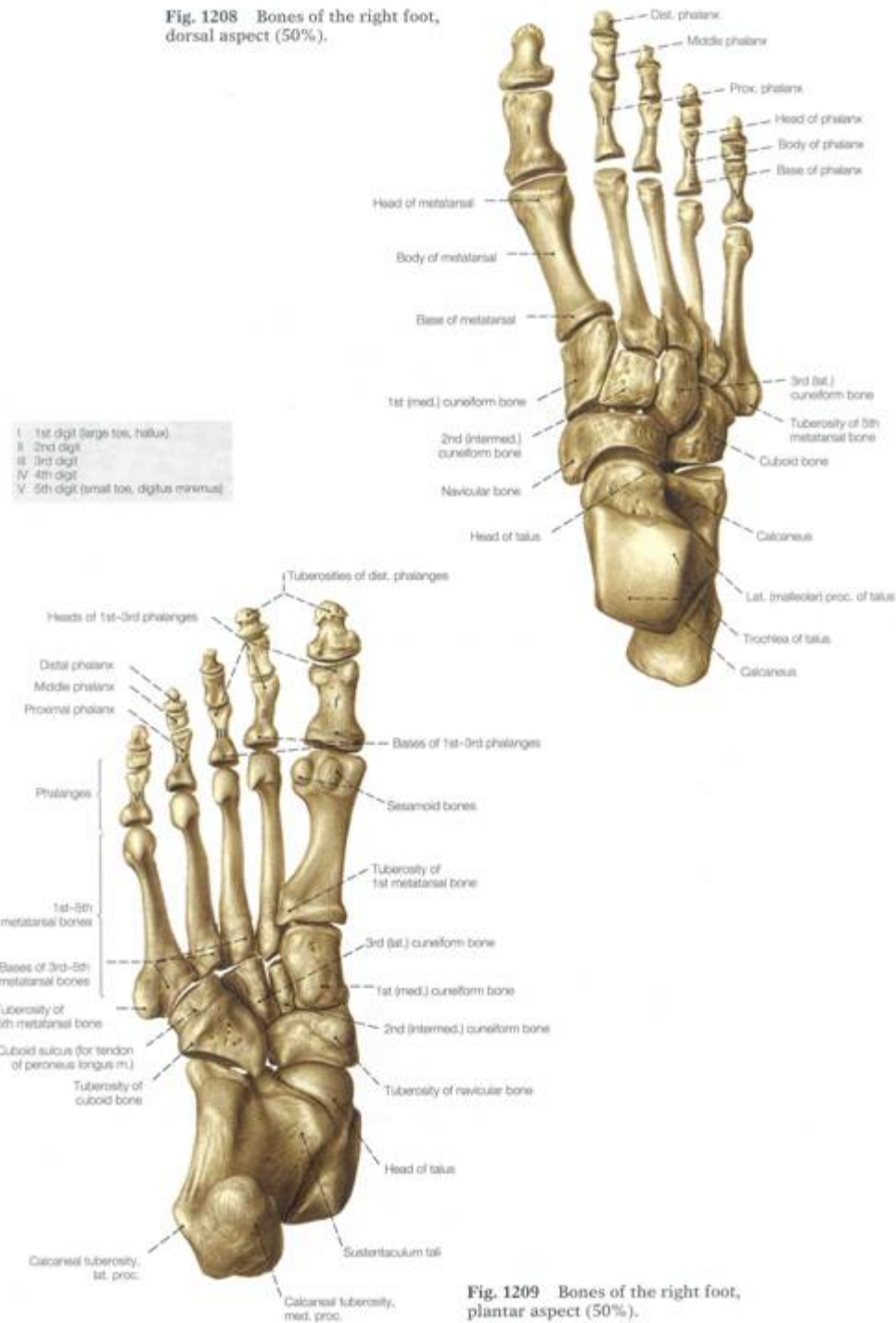
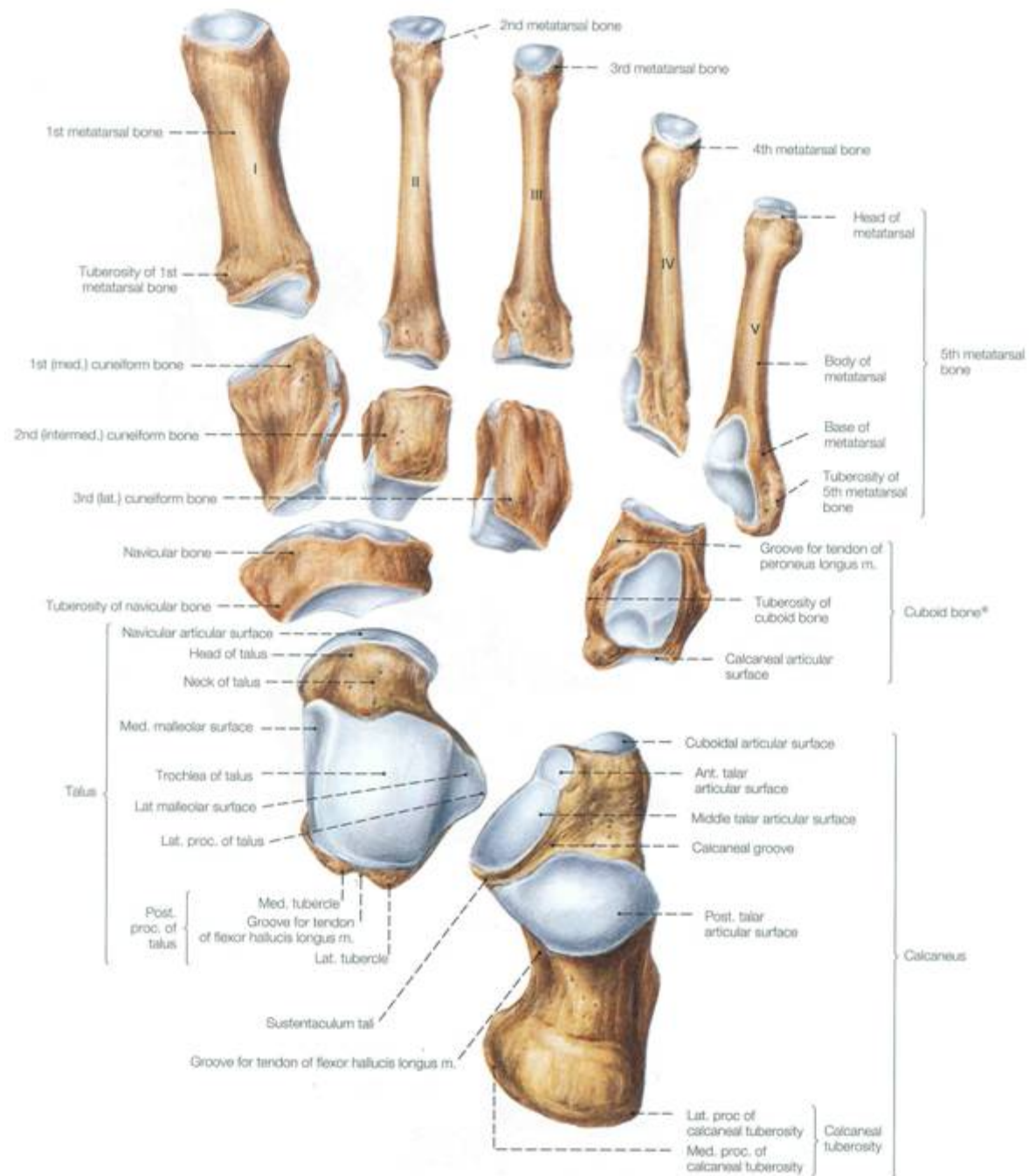
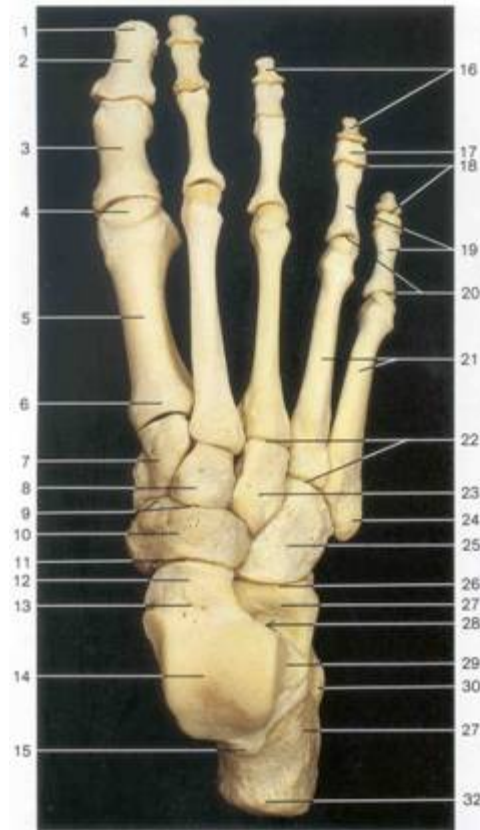


Fig. 1209 Bones of the right foot,
plantar aspect (50%).





Bones of right foot (dorsal aspect).



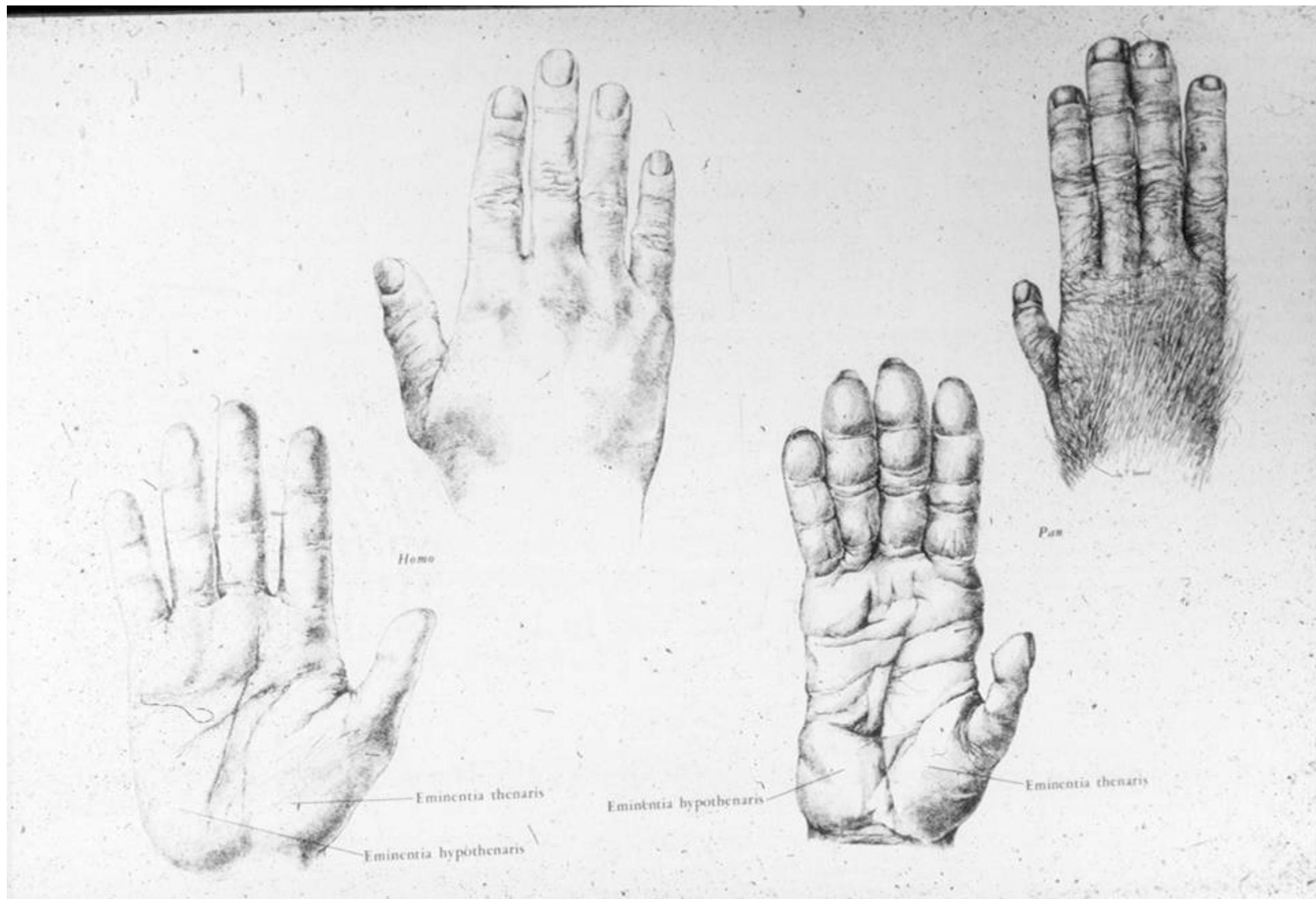
Bones of right foot (plantar aspect).



Bones of right foot together with tibia and fibula (posterior aspect).

- 1 Tuberosity of distal phalanx of great toe
- 2 Distal phalanx of great toe
- 3 Proximal phalanx of great toe
- 4 Head of first metatarsal bone
- 5 First metatarsal bone
- 6 Base of first metatarsal bone
- 7 Medial cuneiform bone
- 8 Intermediate cuneiform bone
- 9 Position of cuneonavicular joint
- 10 Navicular bone





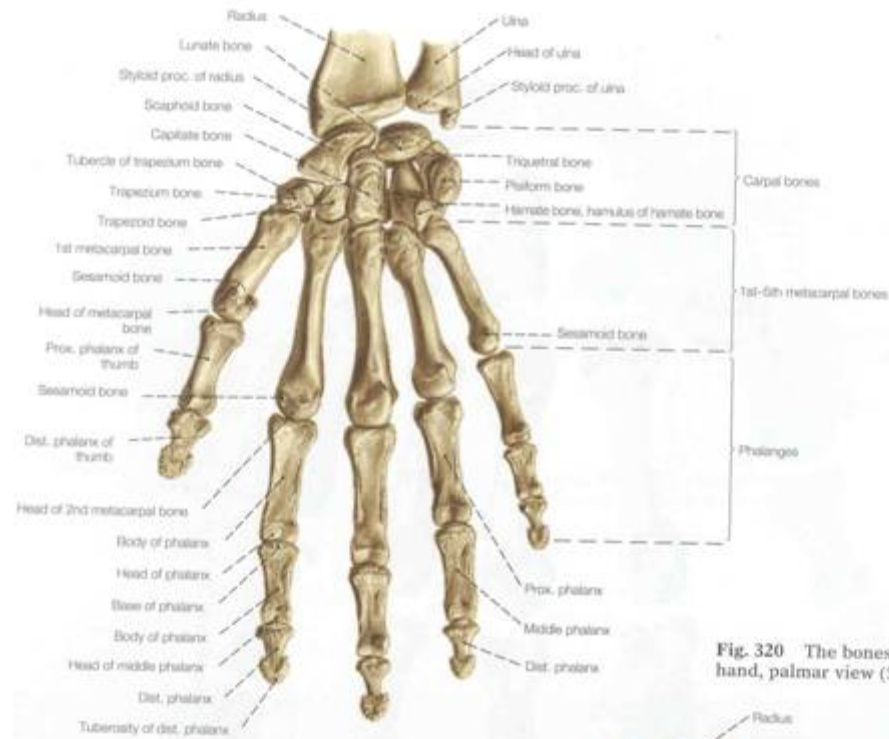


Fig. 320 The bones of the right hand, palmar view (50%).

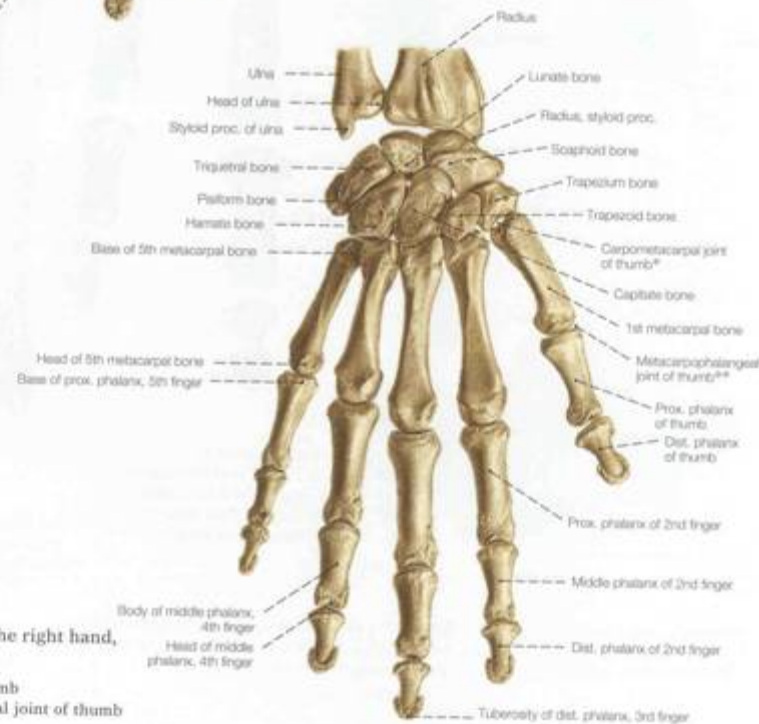
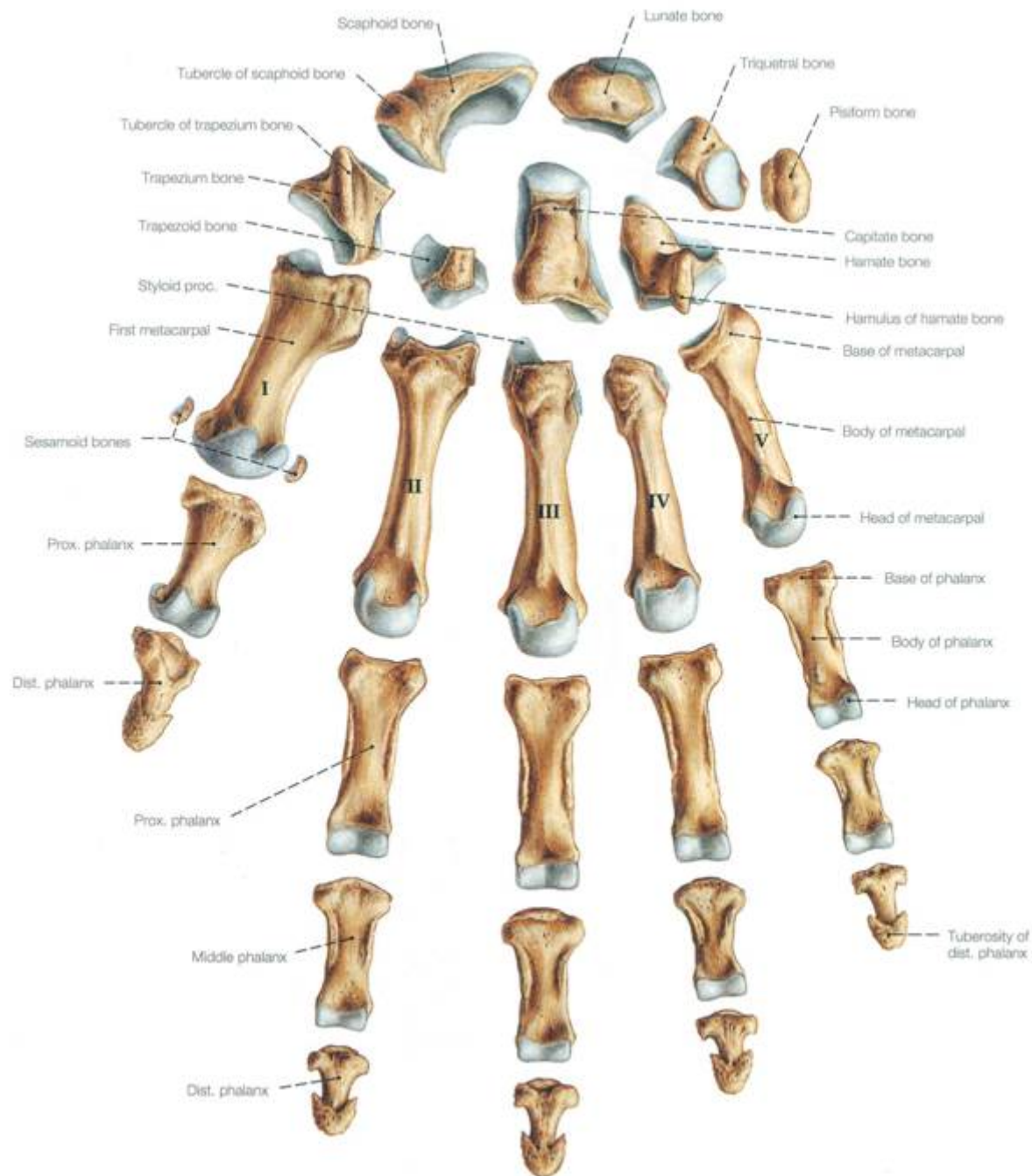


Fig. 321 The bones of the right hand, dorsal view (50%).

* Also: Saddle joint of thumb

** Also: Proximal phalangeal joint of thumb



The Skeleton, Nutrition, Sex, and Growth

SEX

NUTRITION

Good

Poor

Male

Continued Growth,
Greater Height

Reduced Growth
Shorter than
normal height

Female

Energy to
Reproduction &
Supporting Fat
Reserves

Delayed onset of
reproductive ability;
Continued bone
growth; TALLER

