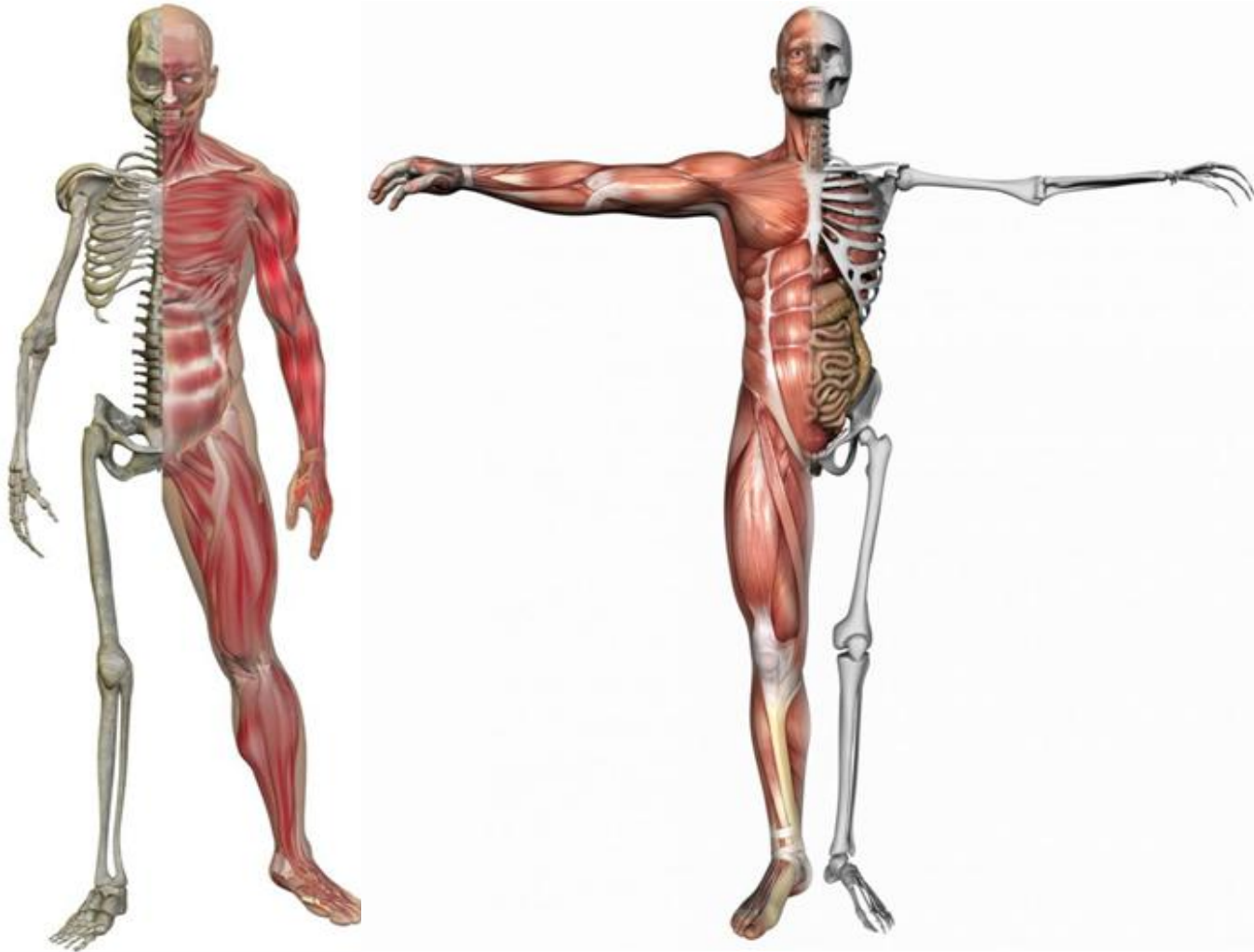


RANGKA DAN PERSENDIAN



dr. AL-MUQSITH, M.Si

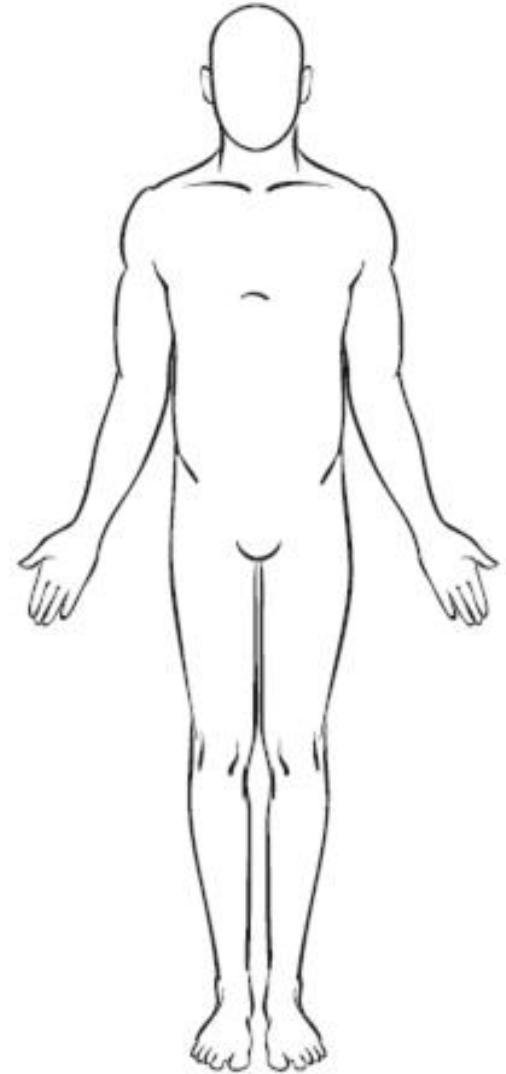
RANGKA



- bagian tubuh yg tdd:
 - tulang
 - sendi
 - tulang rawan (kartilago)
- Tempat menempelnya otot
- Memungkinkan tubuh untuk mempertahankan sikap dan posisi

SIKAP ANATOMI

- Berdiri tegak
- Ekstremitas atas di samping tubuh
- Wajah serta telapak tangan mengarah ke depan
- kedua kaki berdampingan dengan jari-jari kaki mengarah ke depan



Sistem Rangka dan Sendi

- Alat gerak tubuh manusia \Rightarrow sistem muskuloskeletal:
 - pasif : rangka (skeletal/osteon)
 - aktif : otot (muscle/musculus)
- Rangka-tulang: jaringan ikat yg keras & kaku (jaringan penyokong); banyak mengandung mineral, zat perekat dan zat kapur

Fungsi Sistem Rangka



1. Penyangga

berdirinya tubuh, tempat melekatnya ligamen-ligamen, otot, jaringan lunak & organ

2. Penyimpanan

mineral (kalsium & fosfat) dan lipid (*yellow marrow*)

3. Produksi sel darah (*red marrow*)

4. Pelindung

membentuk rongga → melindungi organ yang halus & lunak

5. Penggerak

mengubah arah & kekuatan otot rangka saat bergerak; adanya persendian

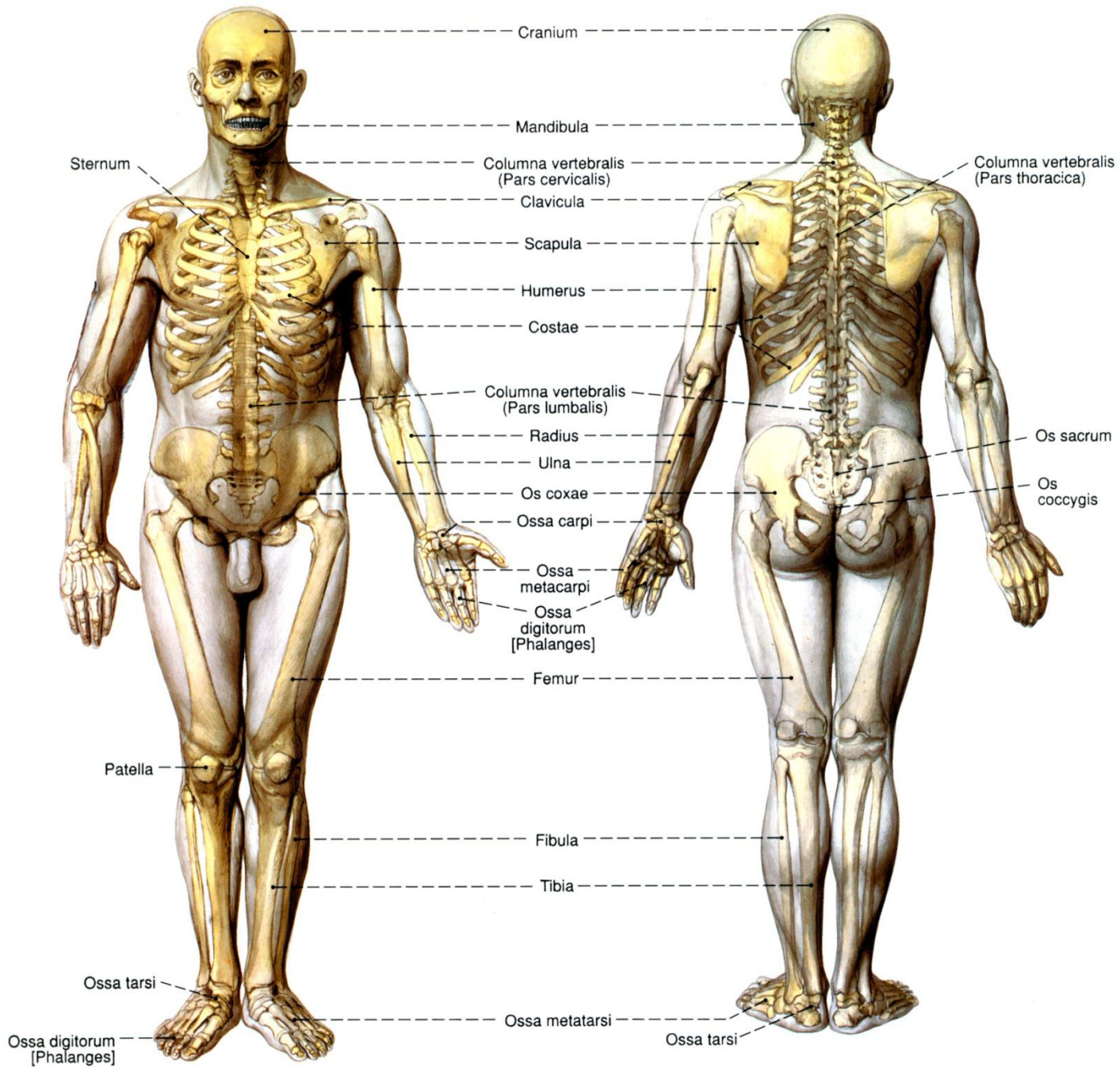
Tulang menurut bentuknya

1. Ossa longa (tulang panjang)
cth: os humerus, os femur
2. Ossa brevia (tulang pendek)
cth: ossa carpalia
3. Ossa plana (tulang gepeng/pipih)
cth: os parietale
4. Ossa irregular (tulang tak beraturan)
cth: os sphenoidale, os coxae
5. Ossa pneumatica (tulang berongga udara)
cth: os maxilla, os ethmoidale

STRUKTUR

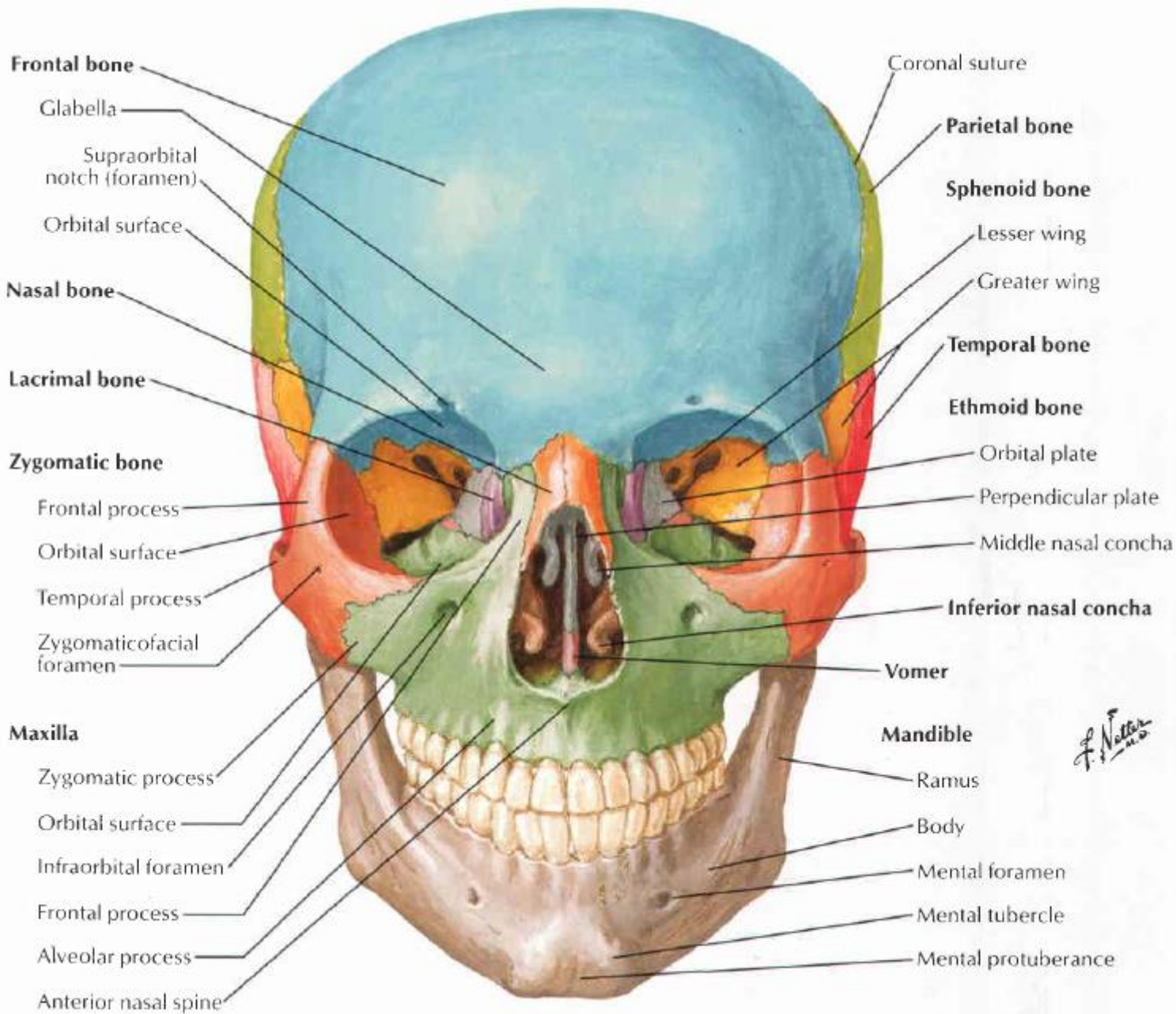


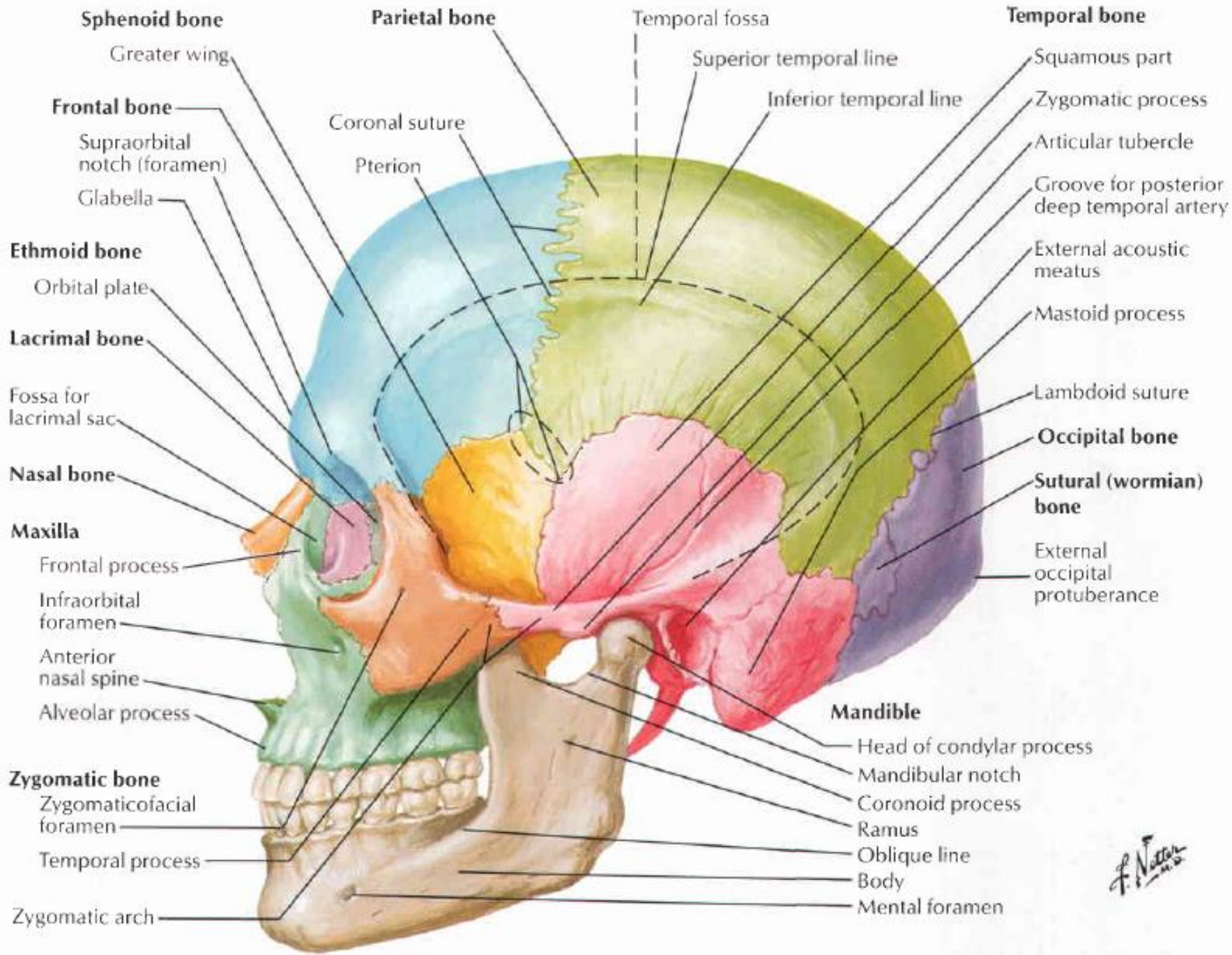
- Axial Skeleton
- Appendicular Skeleton
- Tulang pendengaran



Axial Skeleton (80 tulang)

<u>Tengkorak</u>			
Neurocranium (8)	Frontal (1)	Viscero-/Splanchnocranium (13)	Maxilla (2)
	Parietal (2)		Palatina (2)
	Occipital (1)		Zygomaticus (2)
	Temporal (2)		Lacrimal (2)
	Sphenoid (1)		Nasal (2)
	Ethmoid (1)		Vomer (1)
			Inferior nasal concha (2)
<u>Mandibula (1)</u>		<u>Tulang telinga tengah (6)</u>	Malleus (2)
<u>Hyoid (1)</u>			Incus (2)
			Stapes (2)
<u>Columna vertebrae (26)</u>	Cervical (7)	<u>Tulang rongga thorax (25)</u>	costae (24)
	Thorakal (12)		Sternum (1)
	Lumbal (5)		
	Sacrum (5) → (1)		
	Coccygis (3-5) → (1)		





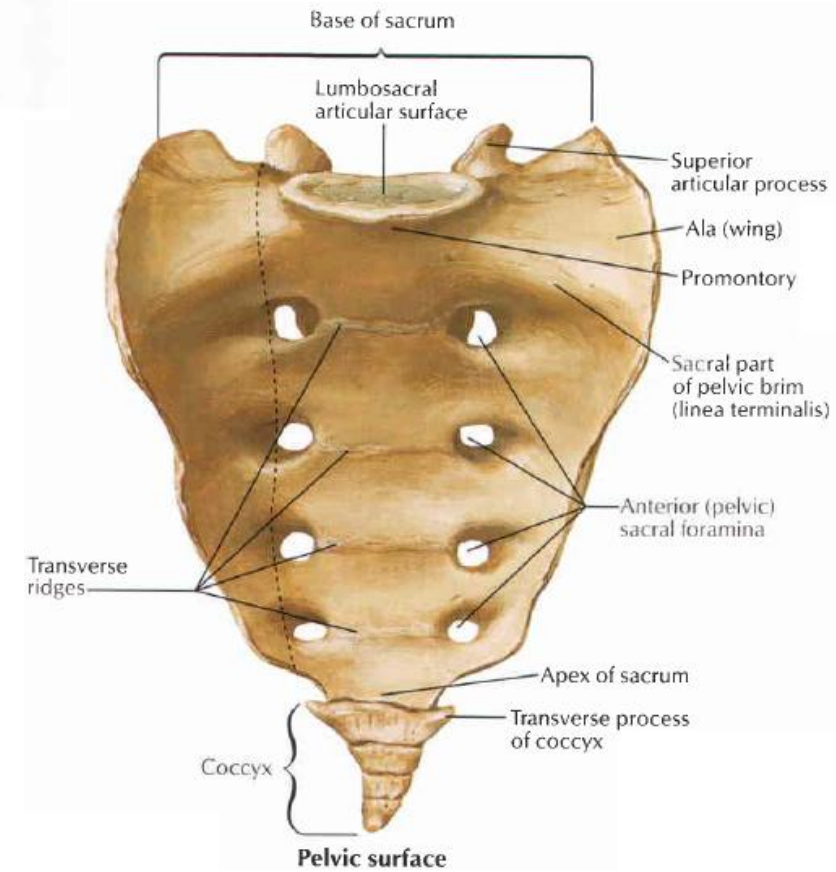
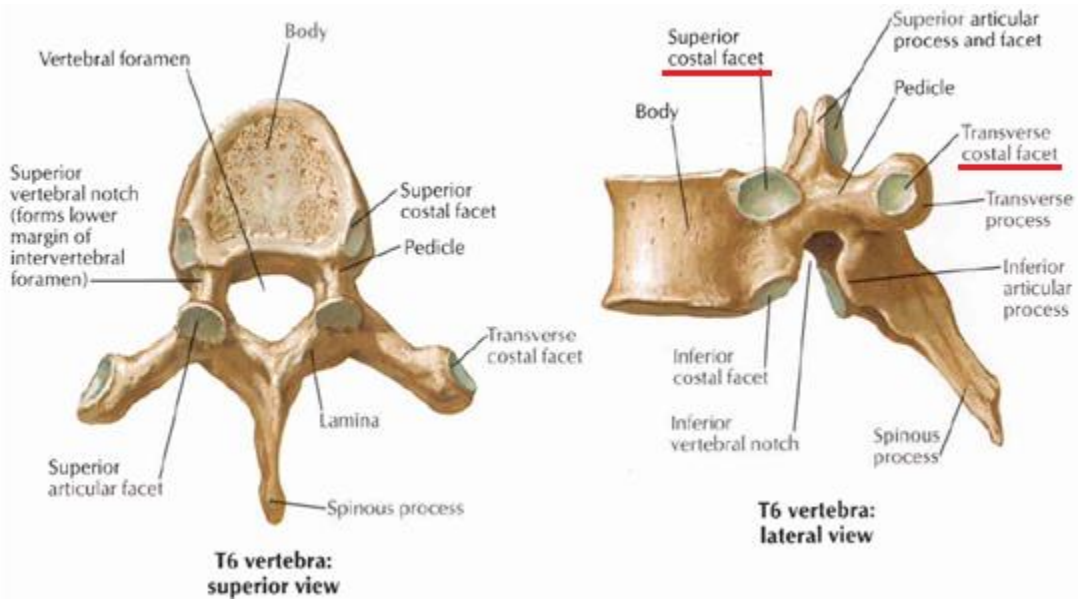
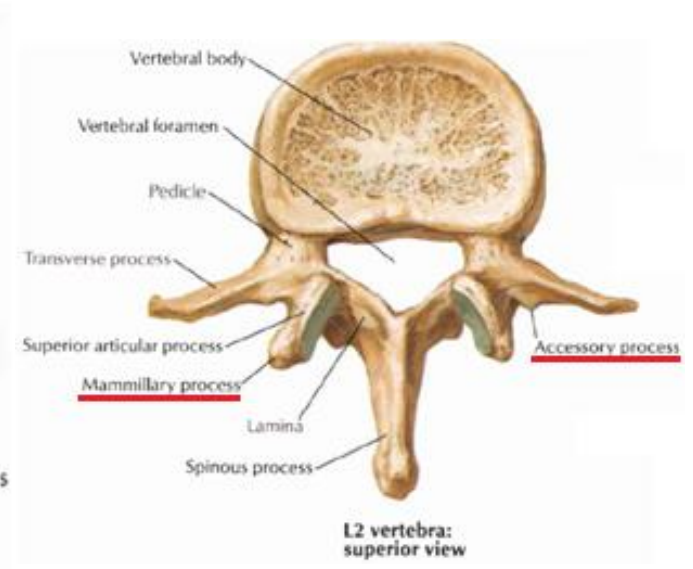
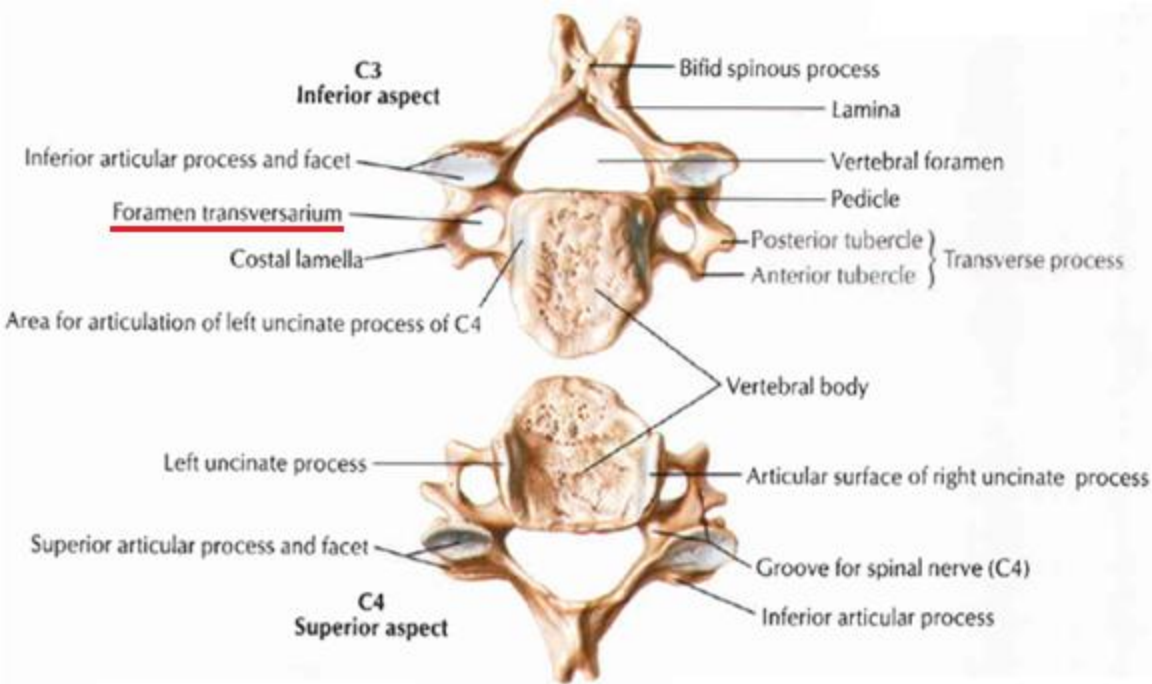
F. Netter M.D.

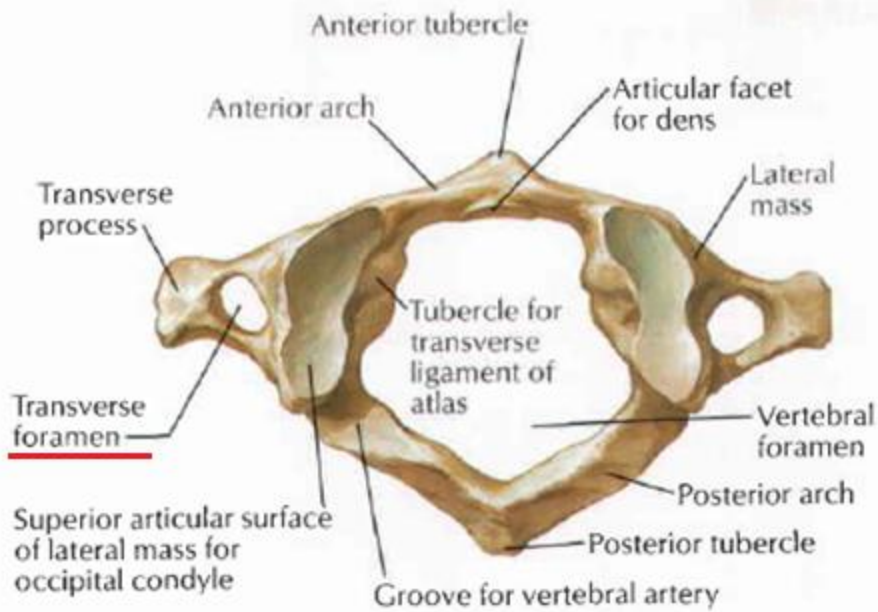
Columna vertebralis



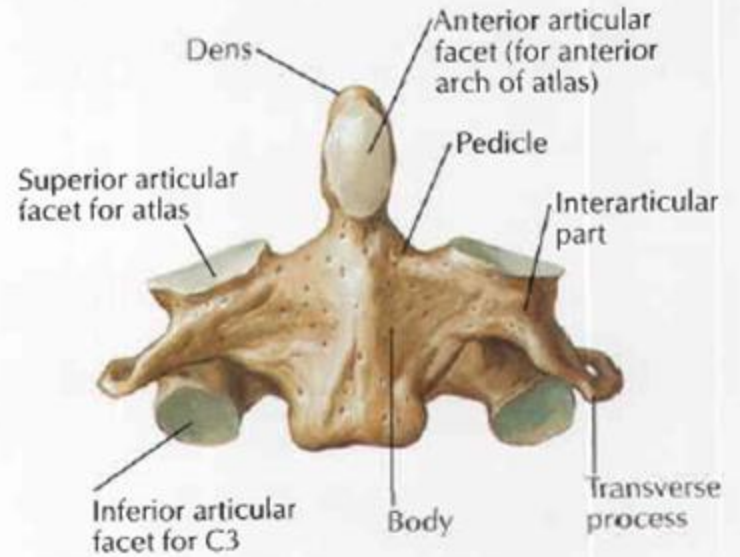
- Vert. cervicales (7)
 - VC I : Atlas
 - VC II : Epistropheus/Axis
 - VC VII : Prominens
- Vert. thoracales (12)
- Vert. Lumbales (5)
- Vert. Sacrales (5) → (1)
- Vert. coccygeus (3-5) → (1)



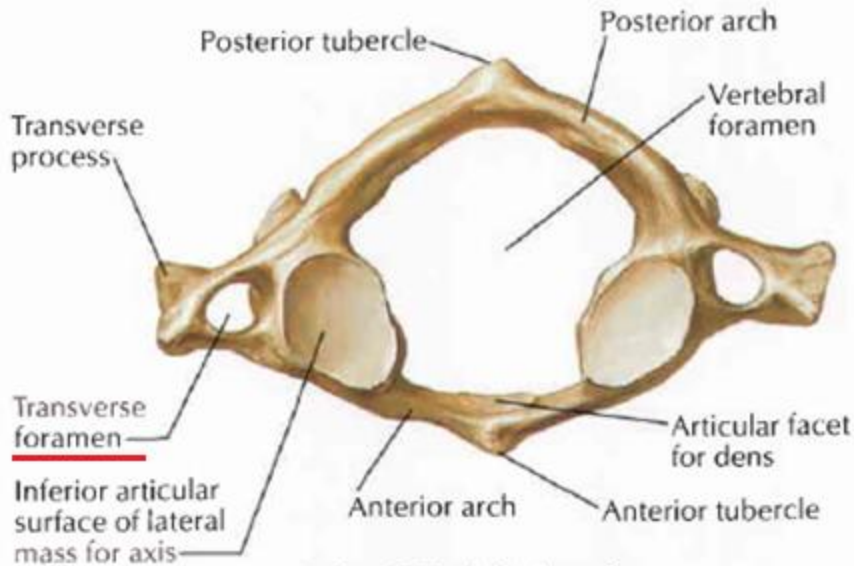




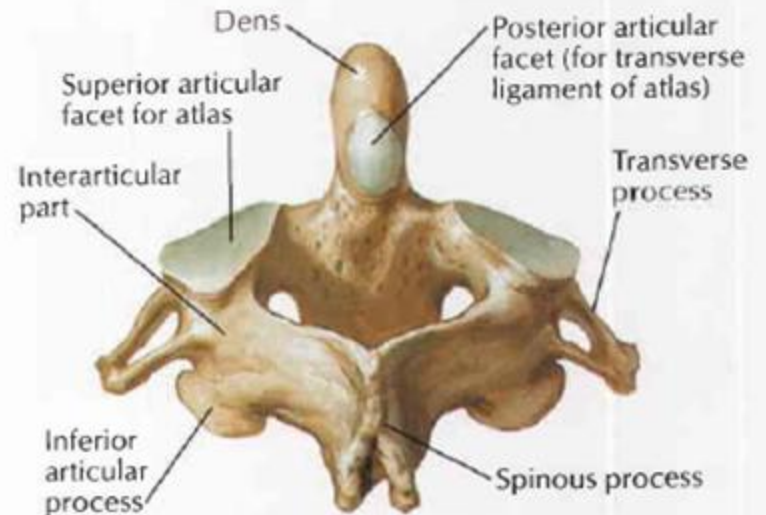
Atlas (C1): superior view



Axis (C2): anterior view

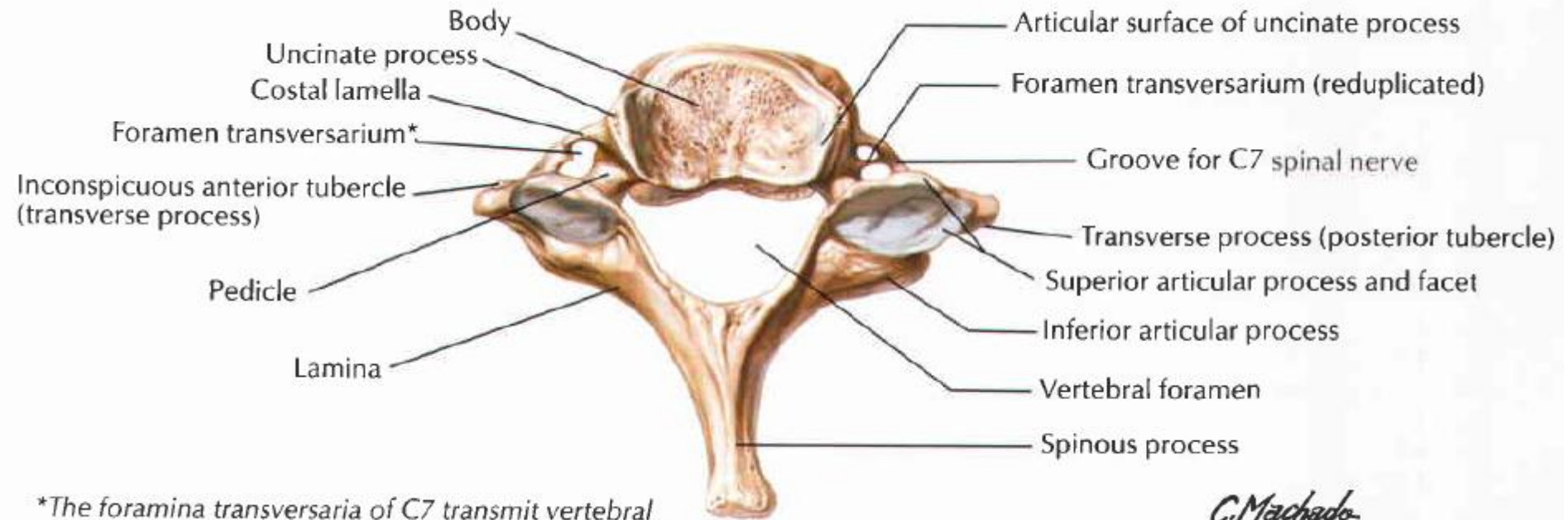


Atlas (C1): inferior view



Axis (C2): posterosuperior view

7th cervical vertebra (vertebra prominens): superior view



**The foramina transversaria of C7 transmit vertebral veins, but not the vertebral artery, and are asymmetrical in this specimen*

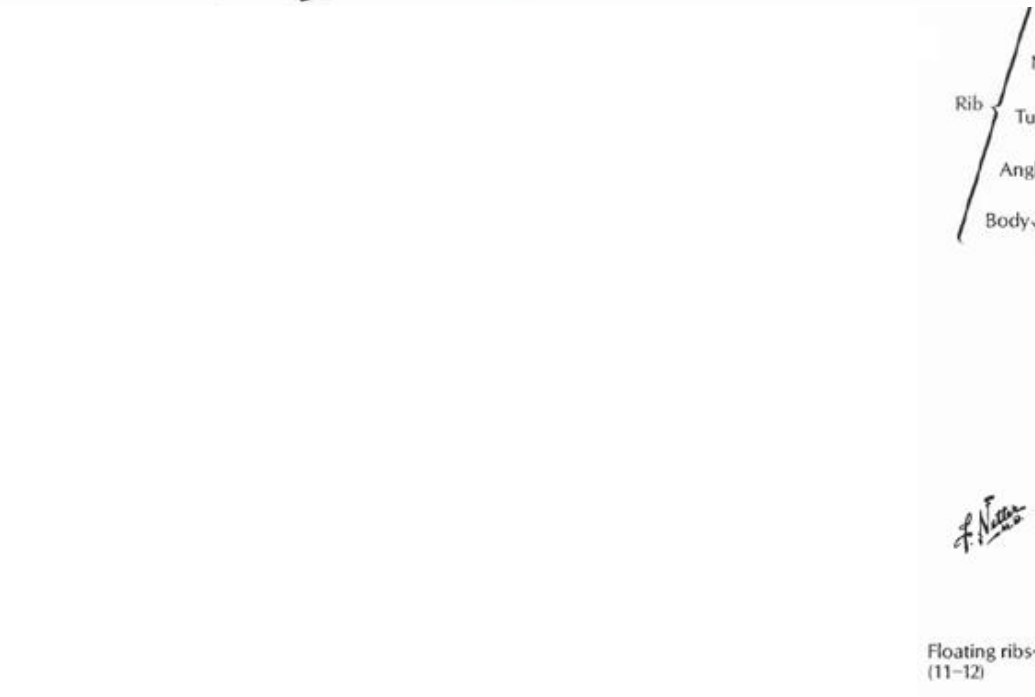
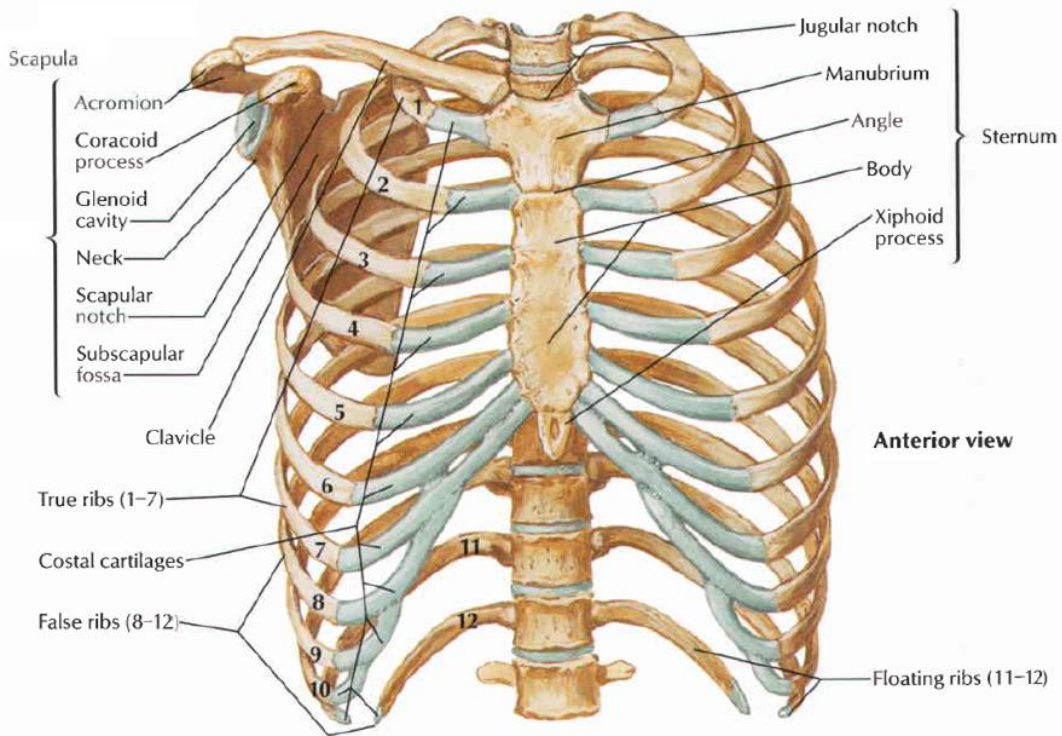
C. Machado
—M.D.

Costa

- Costae verae (sejati)
→ 7 pasang
- Costae spuria (palsu)
→ 3 pasang
- Costae fluctuantes
(melayang)
→ 2 pasang

Sternum

- Manubrium sterni
- Corpus sterni
- Proc. Xiphoideus /
Proc. ensiformis



Appendicular Skeleton (126 tulang)

Pectoral girdle (4)	Scapula 2		
	Clavicula 2		
Ekstremitas Superior (60)	Humerus 2	Ulna 2	Metacarpal 10
	Radius 2	Carpal 16	Phalanx 28
Pelvic girdle (2)	Os coxa 2 (setiap os coxa terdiri dari penggabungan 3 tulang)		
Ekstremitas Inferior (60)	Femur 2	Patella 2	Metatarsal 10
	Tibia 2	Tarsal 14	Phalanx 28
	Fibula 2		

Axial Skeleton (80 tulang)



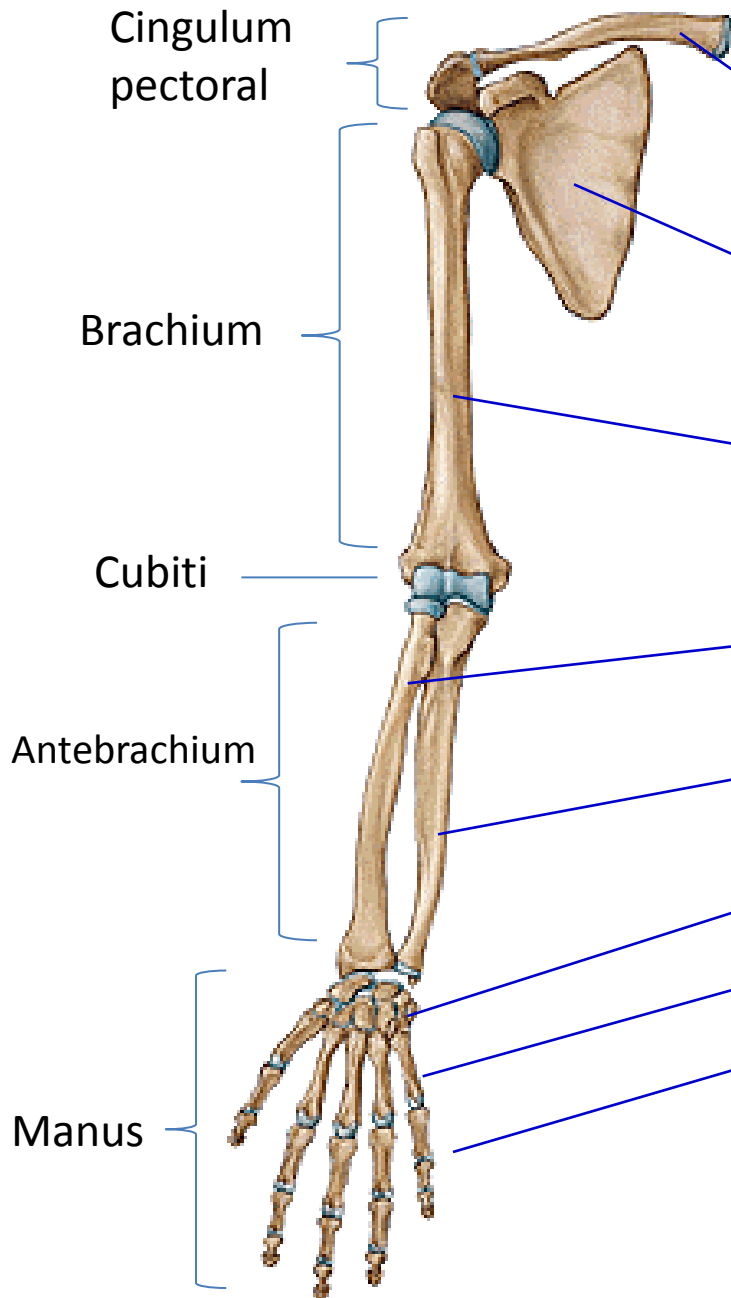
Appendicular Skeleton (126 tulang)



206

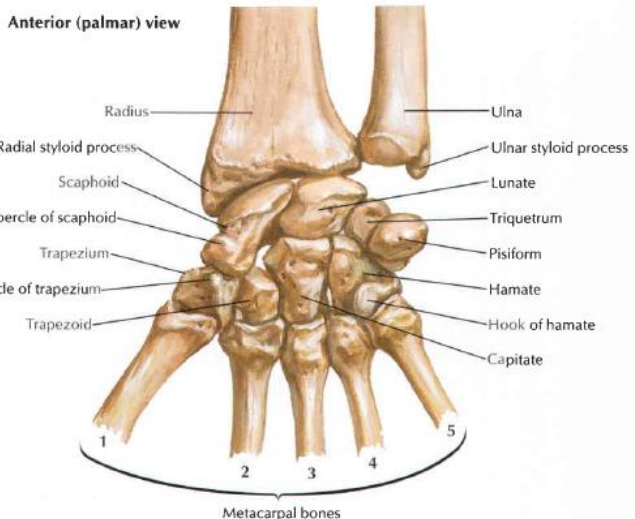
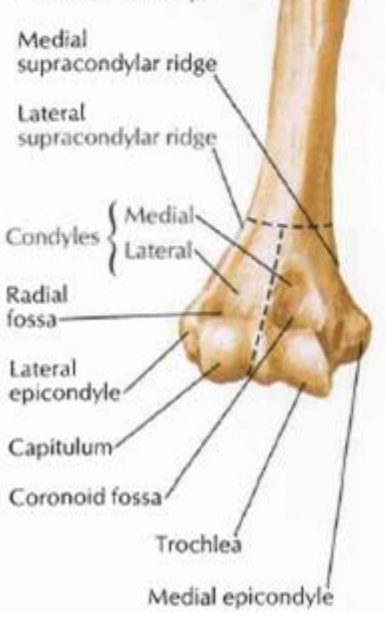
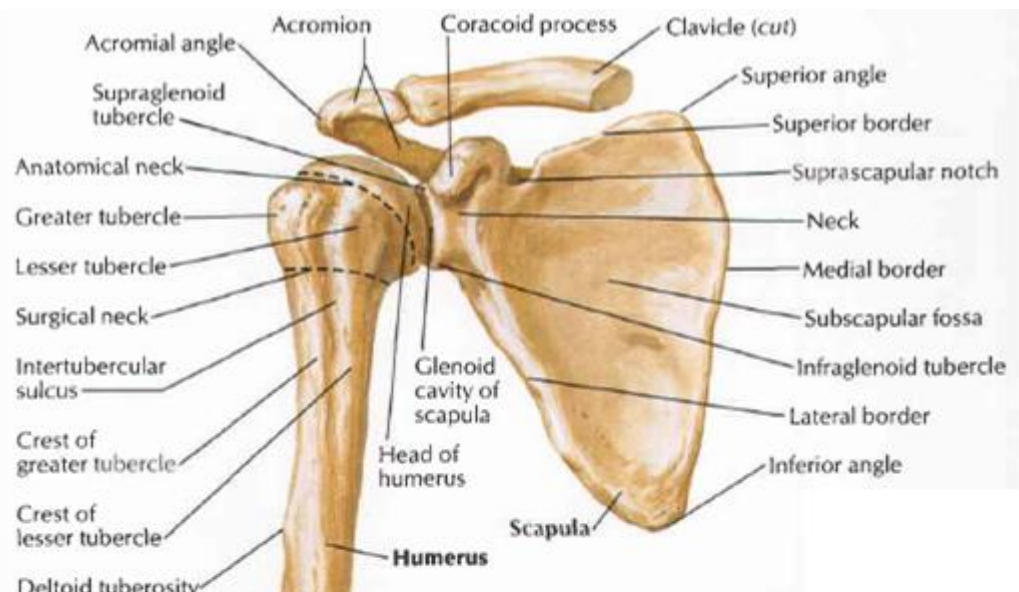
EKSTREMITAS

SUPERIOR

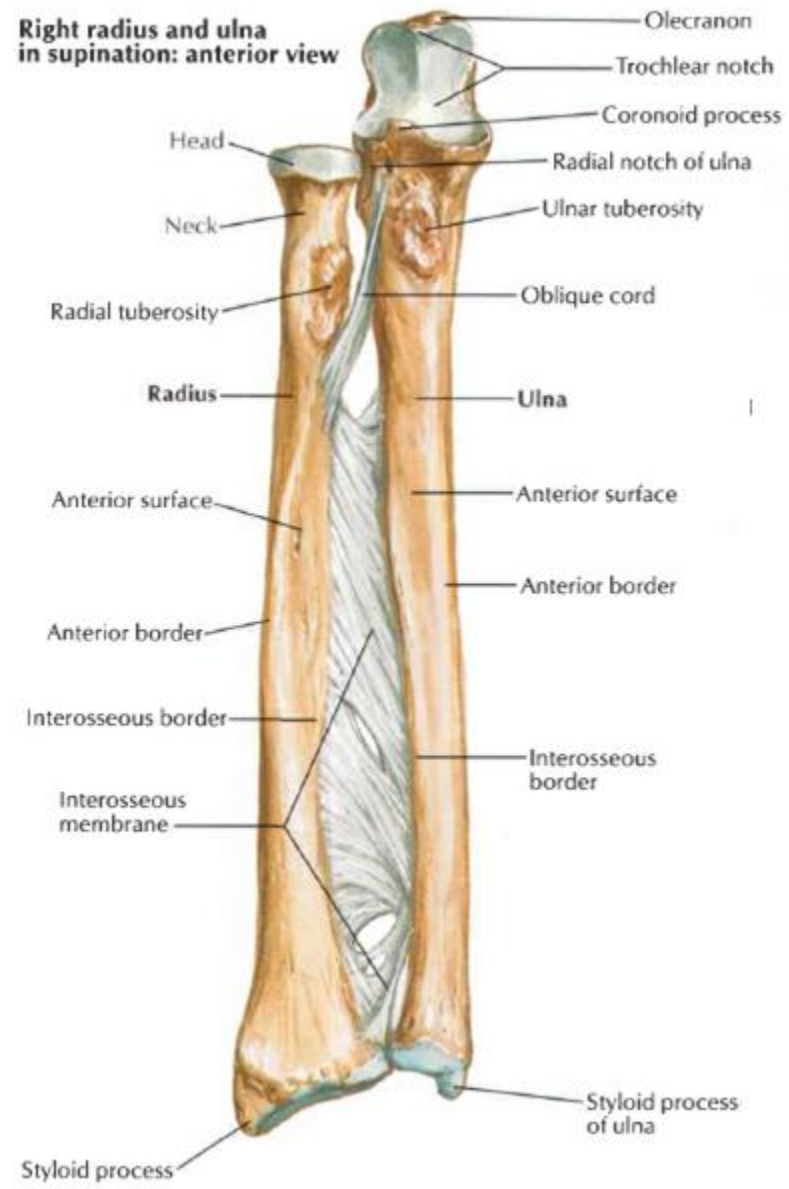


TULANG-TULANG
EXTREMITAS SUPERIOR
TERDIRI DARI:

1. Os clavicula
2. Os scapula
3. Os humerus
4. Os radius
5. Os ulna
6. Ossa carpalia
7. Ossa metacarpalia
8. Ossa phalanges

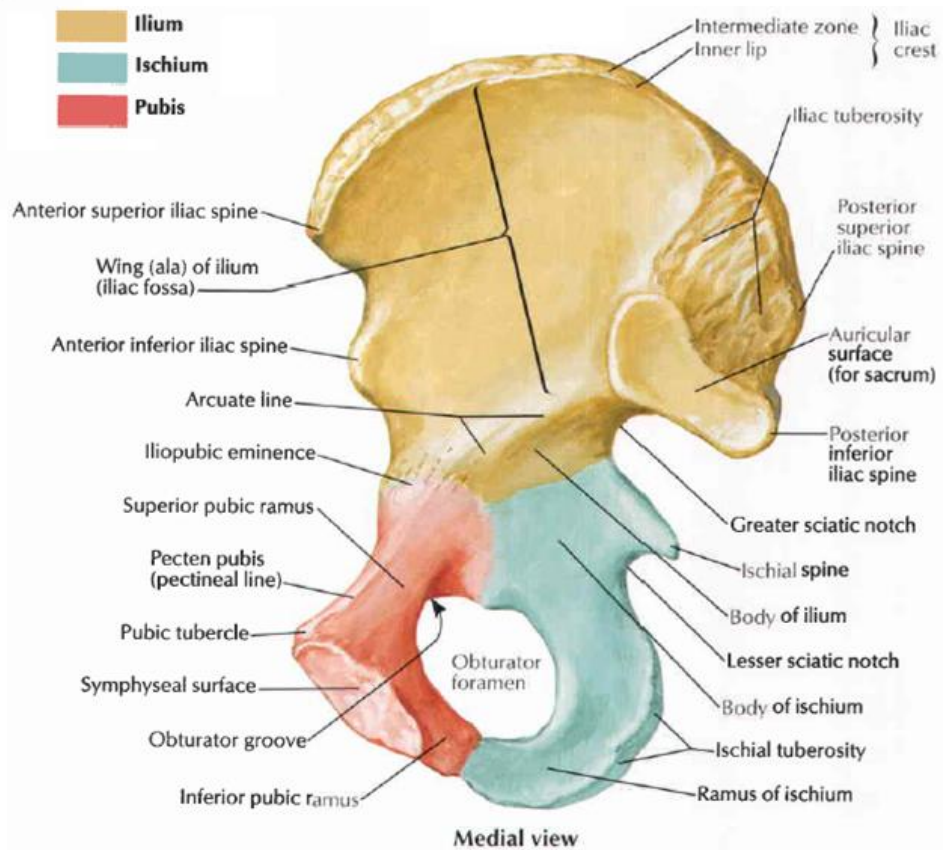
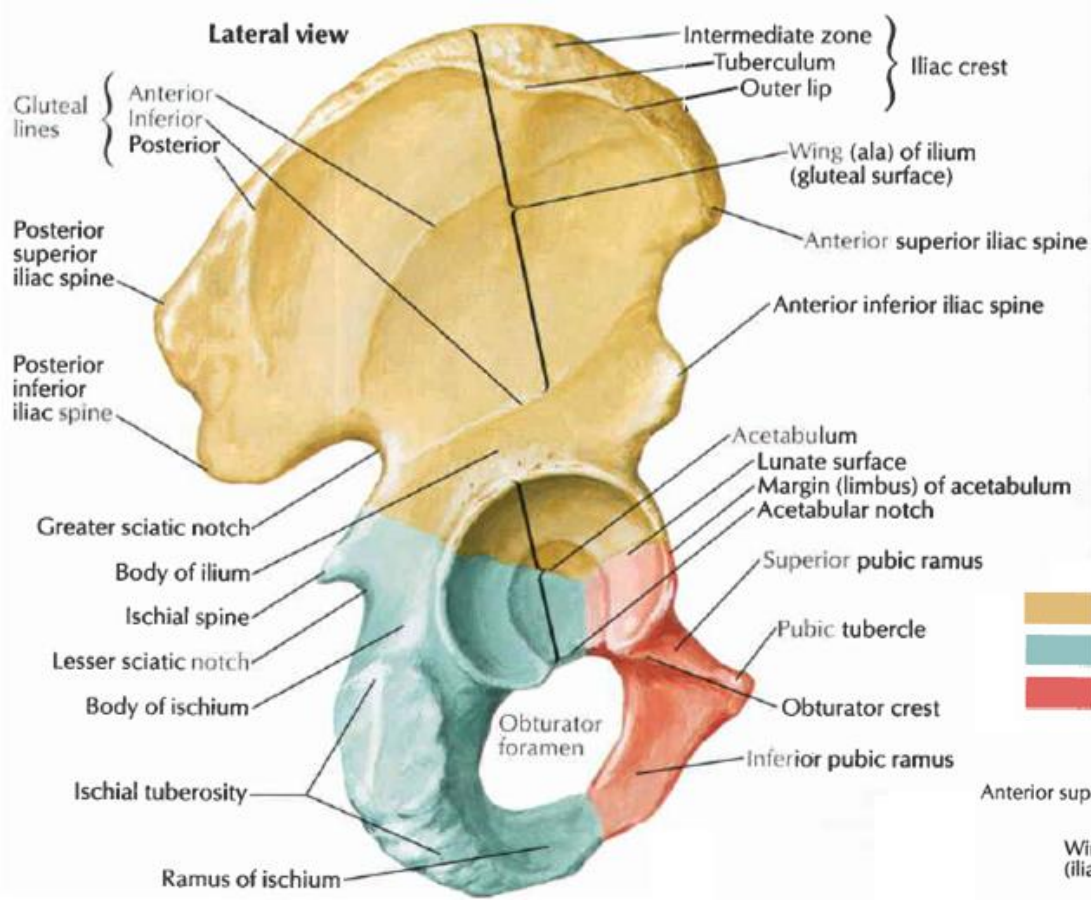


Right radius and ulna in supination: anterior view



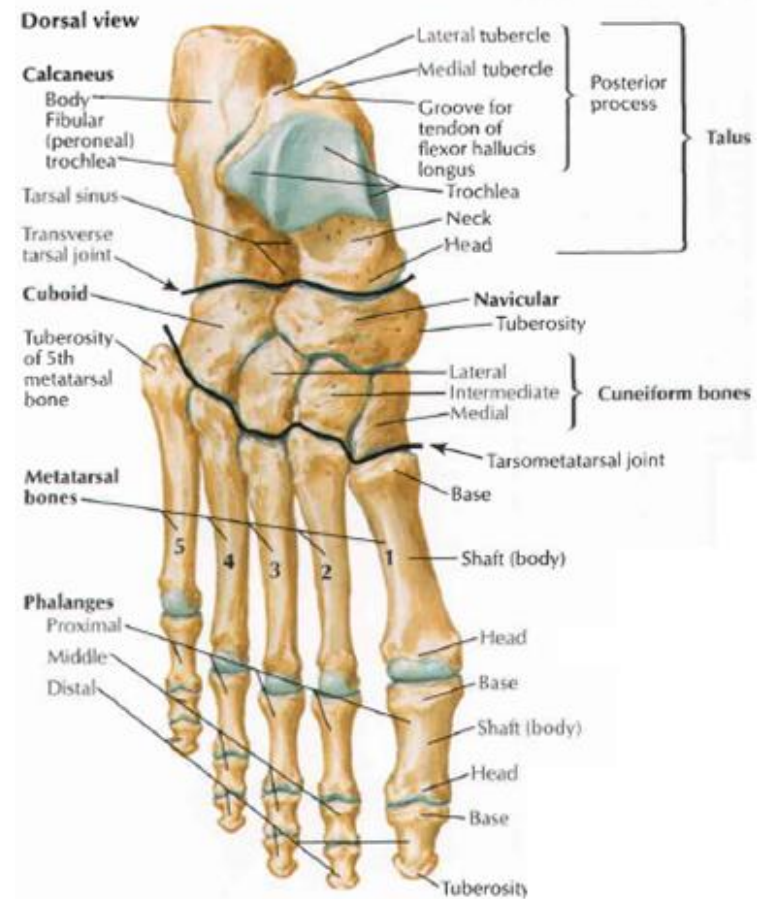
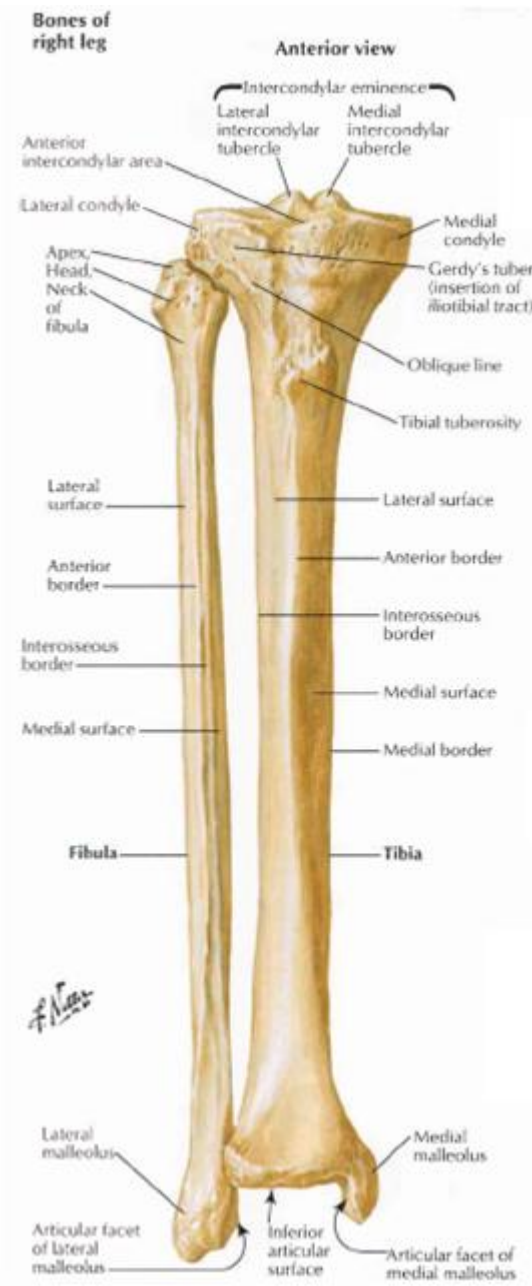
EKSTREMITAS

INFERIOR



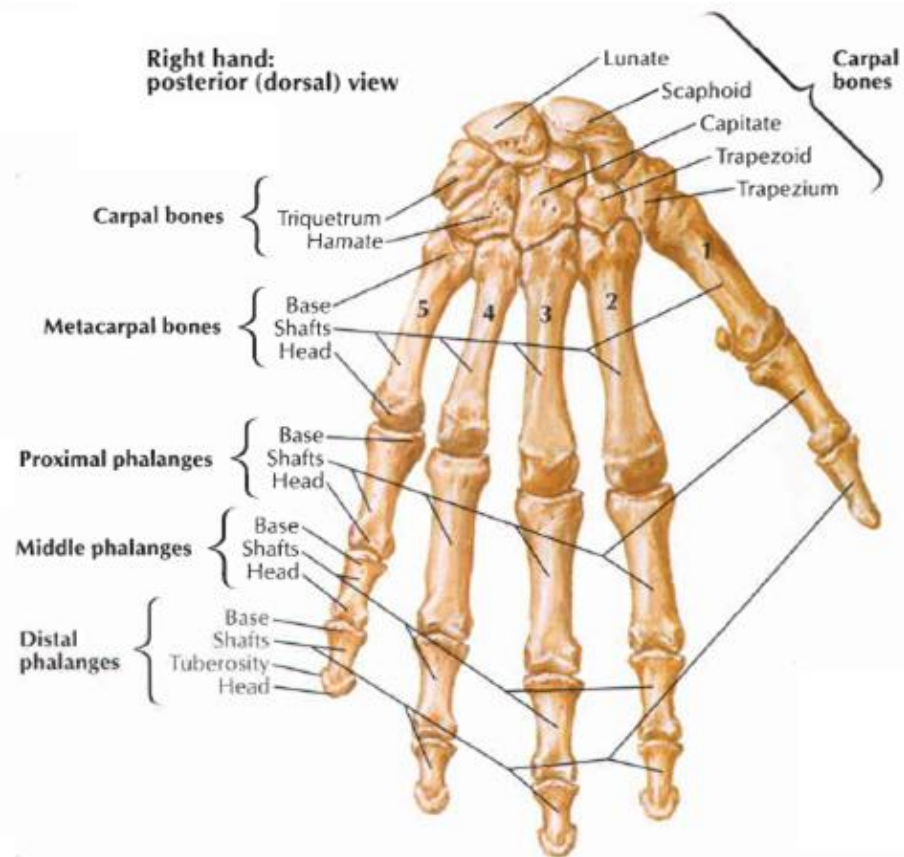
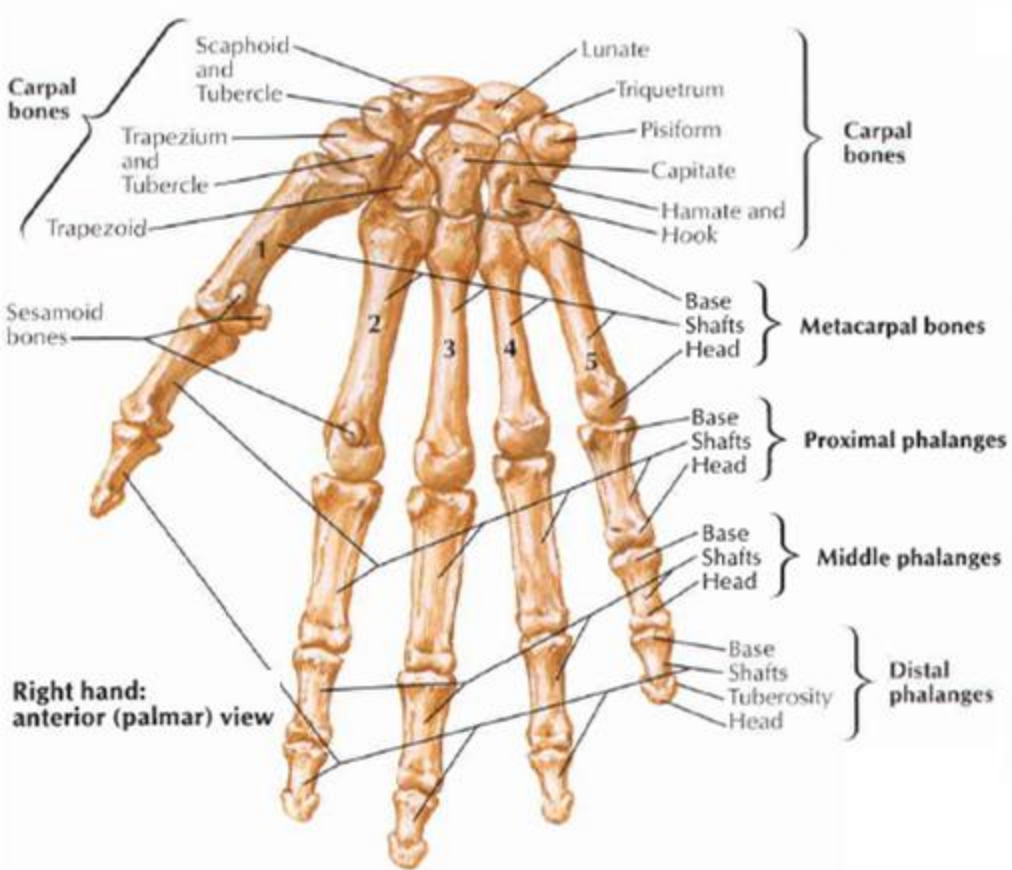
Ilium
 Ischium
 Pubis

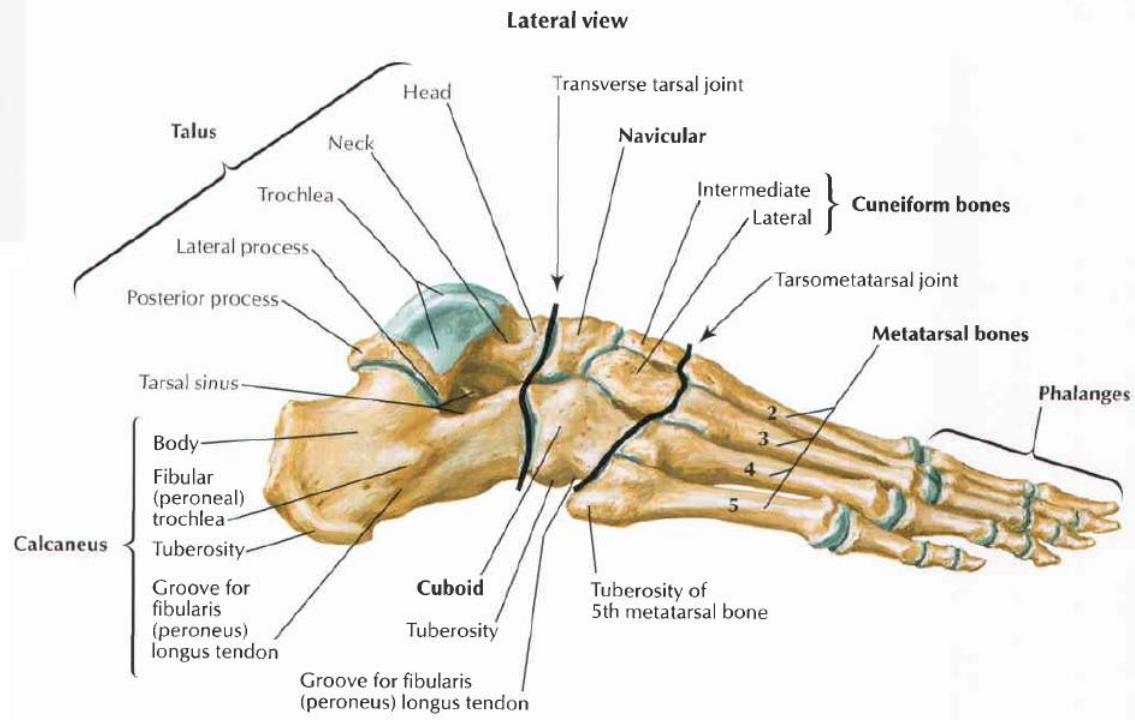
Medial view



- **Os carpalia** (lateral – medial)
 - naviculare manus/scapoid
 - lunatum/semilunar
 - triquetrum/cuneiform
 - pisiforme
 - multangulum manus/trapezium
 - multangulum minus/trapezoideum
 - capitatum/magnum
 - hamatum/unciform
- } atas
- } bawah

- **Ossa tarsalia**
 - thalus
 - calcaneus
 - naviculare pedis
 - cuneiform I / medialis / primum
 - cuneiform II / intermedia / secundum
 - cuneiform III / lateralis / tertium
 - cuboideum





ARTHROLOGI



- Hubungan antar tulang akan membentuk sendi (articulatio, joint)

Jenis Sendi

1. Synarthrosis (*immovable*)

Persendian yg tidak dpt digerakkan

2. Amphiarthrosis (*slightly movable*)

Persendian yg dpt digerakkan sedikit

3. Diarthrosis (*freely movable*)

Persendian yg dpt digerakkan bebas



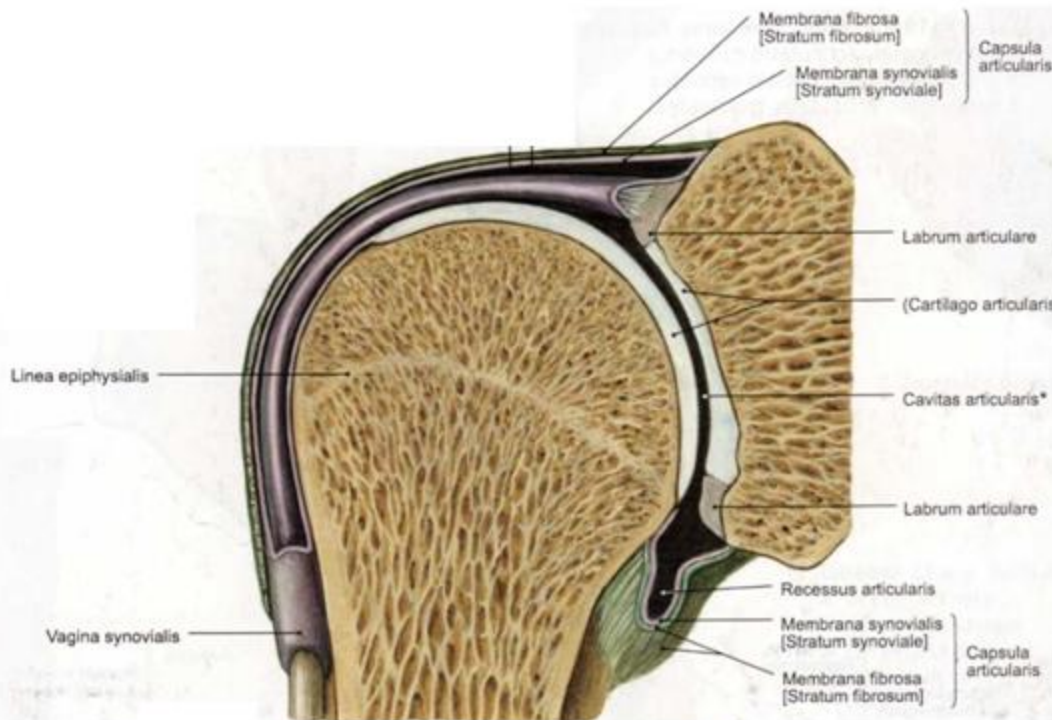
Articulatio fibrosa



Articulatio cartilaginea



Articulatio ossea



Articulatio synoviali

Synarthrosis

(junctura fibrosae, immovable articulation)

1. Sutura

Menyusun tulang cranium

2. Schindylesis

Persendian antara lamina perpendiculare ossis ethmoidale dgn vomer, os maxilla dgn os palatina

3. Gomphosis

Articulatio dentoalveolaris

4. Synchrondrosis

epiphysis tulang panjang, pars petrosa ossis temporalis dgn processus jugularis ossis occipitalis

Amphiarthrosis

(junctura cartilagineae, Slightly movable articulation)



1. Symphysis

discus intervertebralis, symphysis pubis

2. Syndesmosis

articulatio tibiofibulare inferior dgn penghubung
berupa ligamen

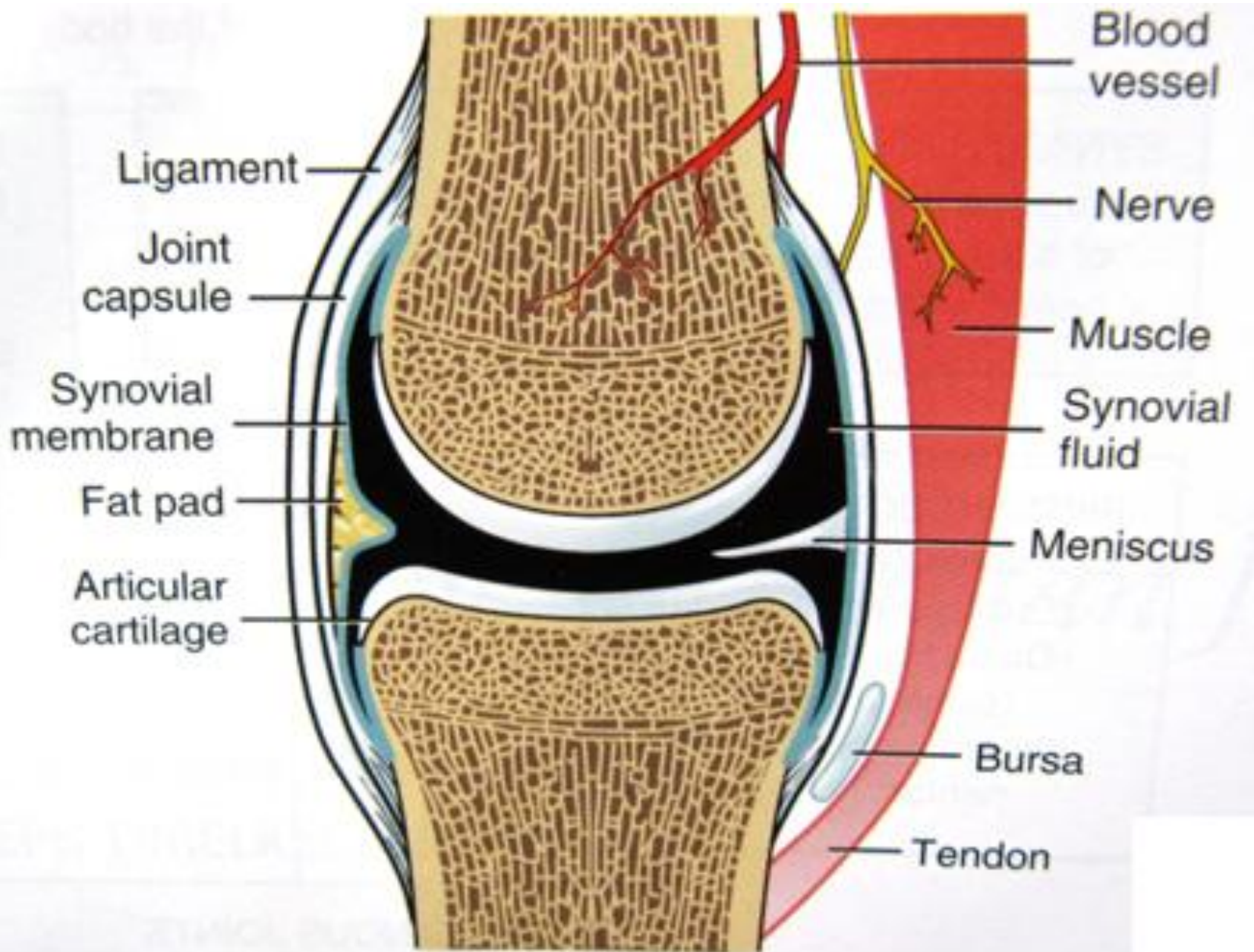
Diarthrosis

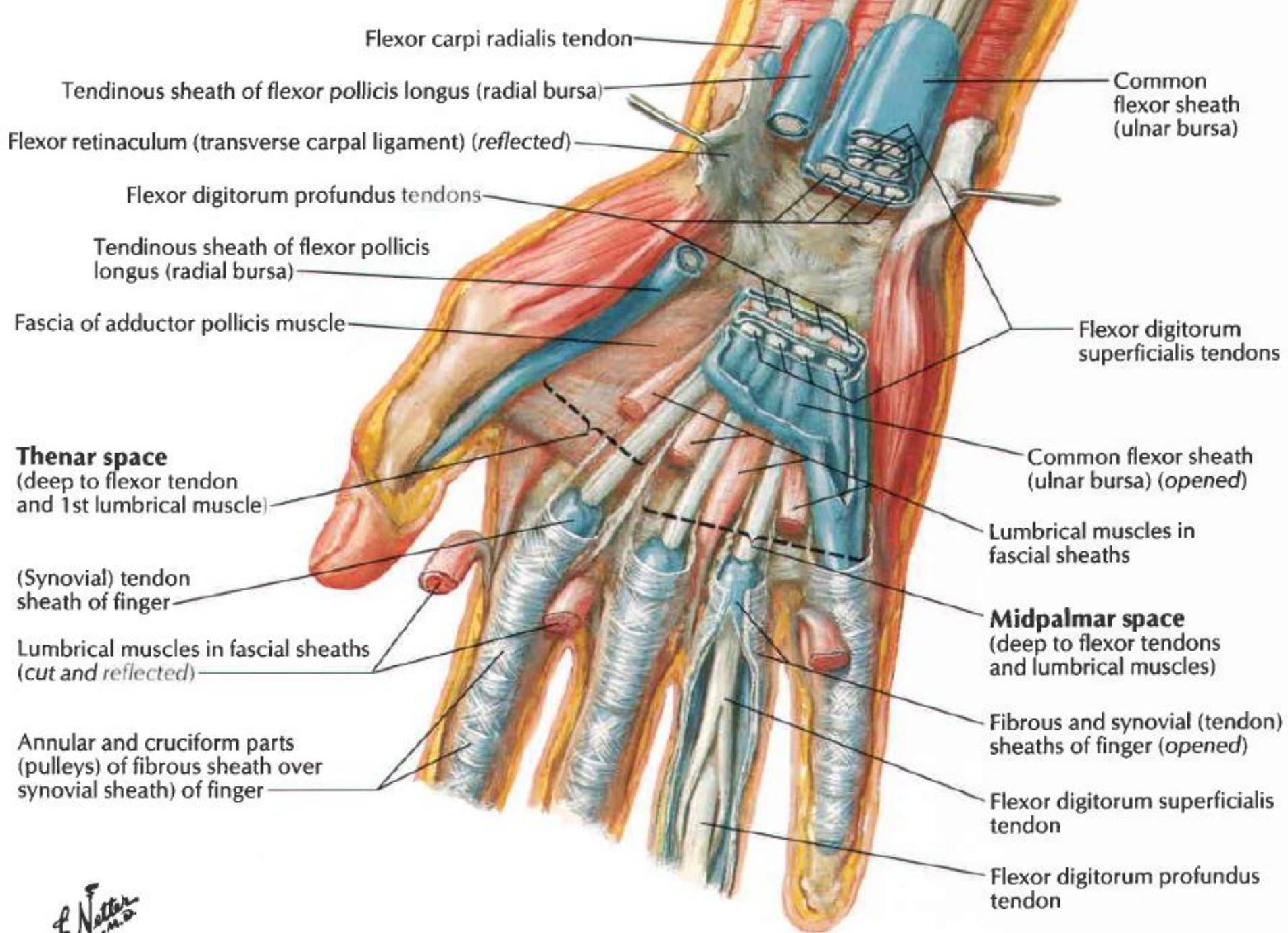
(junctura synovialis, *freely movable articulation*)

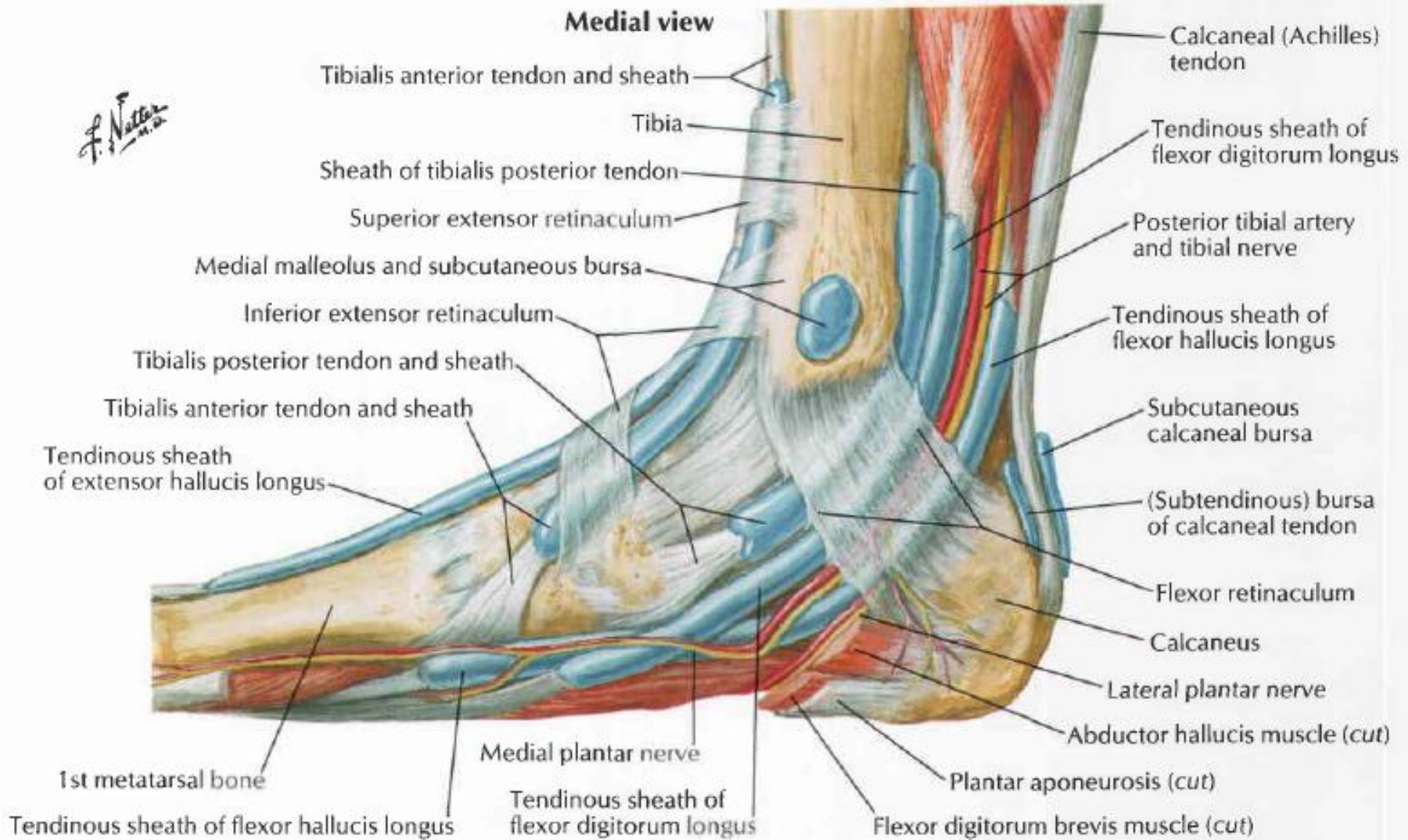


Komponen penyusun:

1. Caput articulare
2. Capsula articularis
3. Cavitas articularis
4. Ligament
 - intracapsularis
 - capsularis
 - ekstracapsularis







Struktur Mengatasi Diskongruensi Sendi

1. Discus Articularis (jar. fibrocartilago)

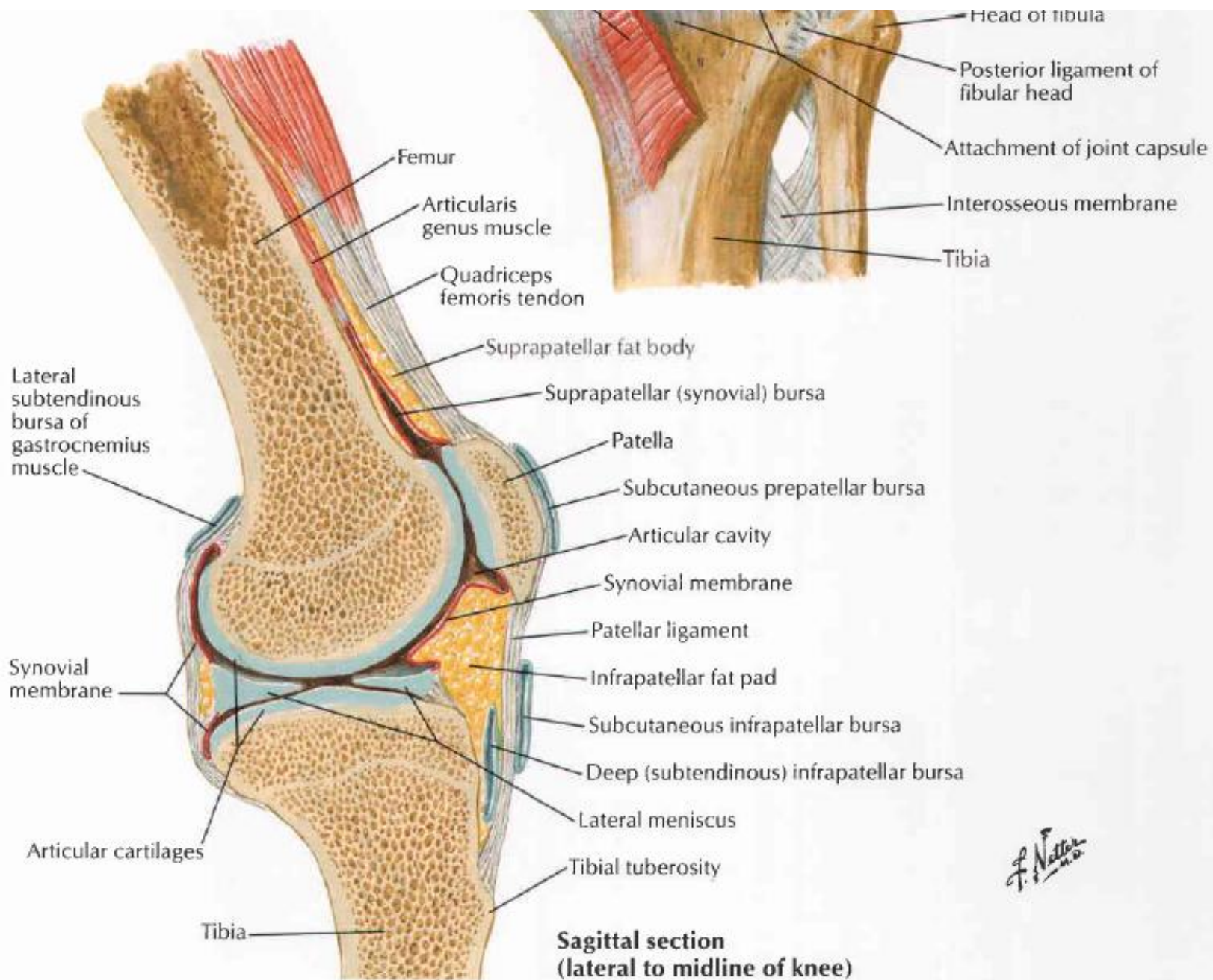
- Art. Temporomandibularis
- Art. Sternoclavicularis
- Art. Acromioclavicularis
- Art. Genu, berupa meniscus articularis
- Art. Radioulnaris distalis

2. Labrum Articularis

- Labrum glenoidale, pd art. Humeri
- labrum acetabulare

3. Plica Synovialis

- Plica alares, pd Art. Genu
- Plica synovialis infrapatellaris



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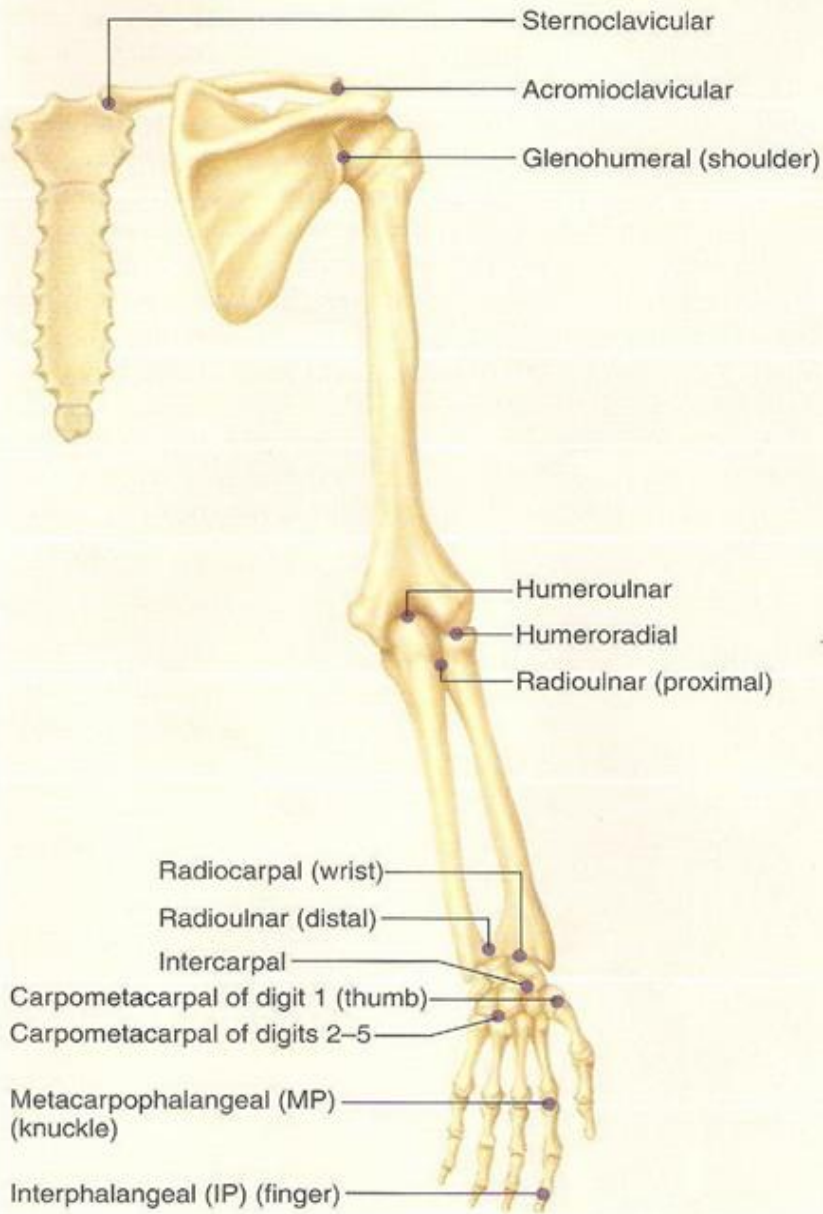


KESATUAN TULANG DAN SENDI

Pectoral Girdle and Upper Limb Joints

Joint

Articulation Components



Sternoclavicular

Sternal end of clavicle, manubrium of sternum, and first costal cartilage

Acromioclavicular

Acromial end of clavicle and acromion of scapula

Glenohumeral (shoulder)

Glenoid cavity of scapula and head of humerus

Humeroulnar

Trochlea of humerus and trochlear notch of ulna

Humeroradial

Capitulum of humerus and head of radius

Radioulnar

Proximal joint: Head of radius and radial notch of ulna
Distal joint: Distal end of ulna and ulnar notch of radius

Radiocarpal

Distal end of radius; lunate, scaphoid, and triquetrum

Intercarpal

Adjacent bones in proximal row of carpal bones

Adjacent bones in distal row of carpal bones

Adjacent bones between proximal and distal rows (midcarpal joints)

Carpometacarpal

Thumb: Trapezium (carpal bone) and first metacarpal

Other digits: Carpals and metacarpals II-V

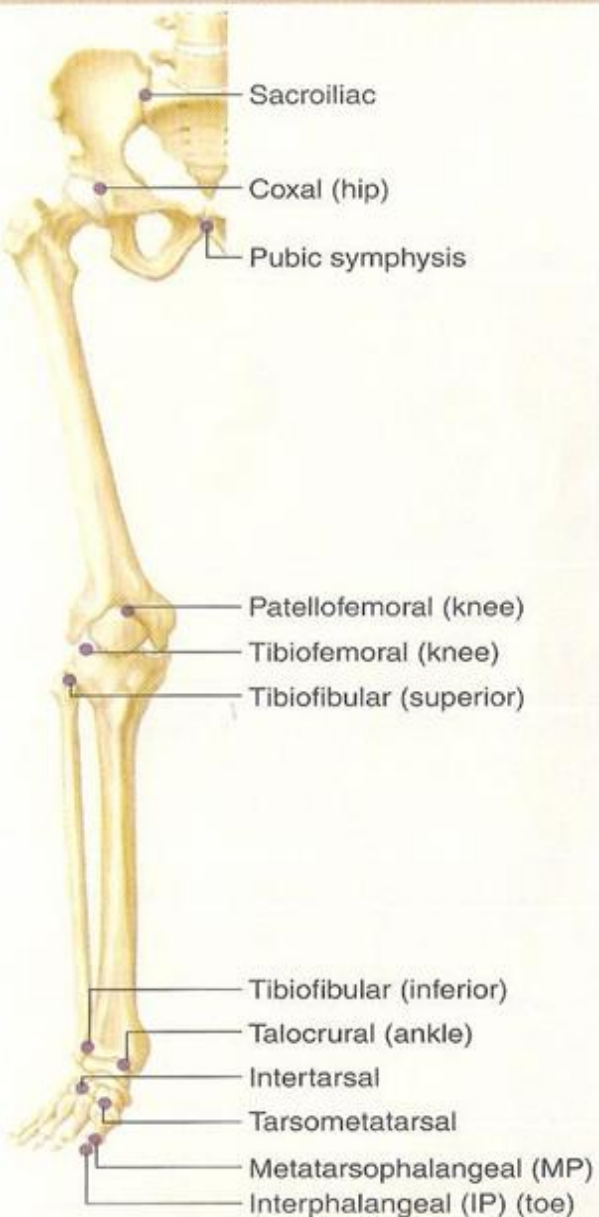
Metacarpophalangeal (MP joints, "knuckles")

Heads of metacarpals and bases of proximal phalanges

Interphalangeal (IP joints)

Heads of proximal and middle phalanges with bases of middle and distal phalanges

Pelvic Girdle and Lower Limb Joints



Joint	Articulation Components	Structural Classification
Sacroiliac	Auricular surfaces of sacrum and ilia	Synovial (planar)
Coxal (hip)	Head of the femur and acetabulum of os coxae	Synovial (ball-and-socket)
Pubic symphysis	Two pubic bones	Cartilaginous (symphysis)
Knee	Tibiofemoral joint: Condyles of femur and condyles of tibia Patellofemoral joint: Patella and patellar surface of femur	Synovial (hinge) at tibiofemoral joint ¹ ; both synovial (hinge) and synovial (planar) at patellofemoral joint
Tibiofibular	Superior joint: Head of fibula and lateral condyle of tibia Inferior joint: Distal end of fibula and fibular notch of tibia	Superior joint: synovial (planar) Inferior joint: fibrous (syndesmosis)
Talocrural (ankle)	Distal end of tibia and medial malleolus with talus Lateral malleolus of fibula and talus	Synovial (hinge)
Intertarsal	Between the tarsal bones	Synovial (planar)
Tarsometatarsal	Three cuneiforms (tarsal bones), cuboid, and bases of five metatarsal bones	Synovial (planar)
Metatarsophalangeal (MP joints)	Heads of metatarsals and bases of proximal phalanges	Synovial (condyloid)
Interphalangeal (IP joints)	Heads of proximal and middle phalanges with bases of middle and distal phalanges	Synovial (hinge)

Mobilitas Persendian



Jarak suatu gerakan (*range of motion*) persendian tergantung dari faktor:

1. Ligamen
2. Derajat perpanjangan (*extensibility*) otot, fascia, dan tendon
3. Jaringan lunak sekitar sendi
4. Pergeseran tulang dengan tulang
5. Kekuatan kontraksi otot skelet

RANGE OF MOTION



JARAK SUATU GERAKAN (FLEXIBILITAS),
TERGANTUNG:

1. JARINGAN SEKITAR SENDI
2. ELASTISITAS OTOT, TENDON, LIGAMENT SEKITAR SENDI
3. STRUKTUR TULANG → SENDI

RANGE OF MOTION

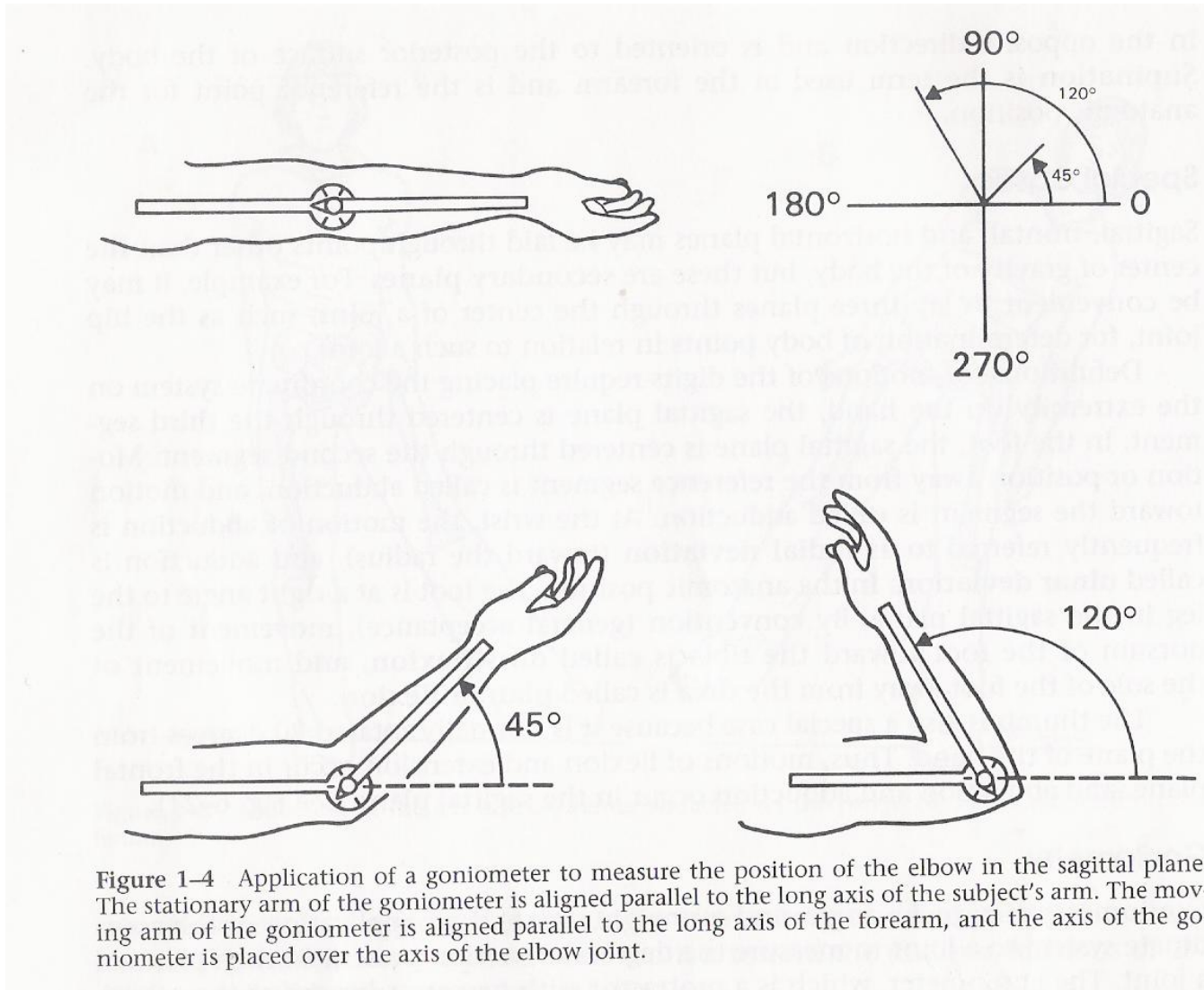


Figure 1-4 Application of a goniometer to measure the position of the elbow in the sagittal plane. The stationary arm of the goniometer is aligned parallel to the long axis of the subject's arm. The moving arm of the goniometer is aligned parallel to the long axis of the forearm, and the axis of the goniometer is placed over the axis of the elbow joint.

Summary Ranges of Joint Motion

SHOULDER	flexion 0° to 180° (150° to 180°) extension 0° hyperextension 0° to 45° (40° to 60°) abduction 0° to 180° (150° to 180°) internal rotation 0° to 90° (70° to 90°) external rotation 0° to 90° (80° to 90°)	THUMB	MCP flexion 0° to 45° (40° to 90°) MCP abduction and adduction (NEGLIGIBLE) IP flexion 0° to 90° (80° to 90°)
ELBOW	flexion 0° to 145° (120° to 160°) extension 0°	HIP	flexion 0° to 120° (110° to 125°) hyperextension 0° to 10° (0° to 30°) abduction 0° to 45° (40° to 55°) adduction 0° (30° to 40° across midline) external rotation 0° to 45° (40° to 50°) internal rotation 0° to 35° (30° to 45°)
FOREARM	supination from midposition 0° to 90° (80° to 90°) pronation from midposition 0° to 80° (70° to 80°)	KNEE	flexion 0° to 120° (120° to 160°) extension 0°
WRIST	neutral when the midline between flexion and extension is 0° and when forearm and third metacarpal are in line flexion 0° to 90° (75° to 90°) extension 0° to 70° (65° to 70°) radial abduction 0° to 20° (15° to 25°) ulnar abduction 0° to 30° (25° to 40°)	ANKLE	neutral with foot at a right angle to the leg and knee flexed plantar flexion 0° to 45° (40° to 50°) dorsiflexion 0° to 15° (10° to 20°) inversion and eversion (see Chapter 10).
FINGERS	MCP flexion 0° to 90° (85° to 100°) MCP hyperextension 0° to 20° (0° to 45°) MCP abduction 0° to 20° MCP adduction 0° PIP flexion 0° to 120° (90° to 120°) DIP flexion 0° to 90° (80° to 90°) IP extension 0°	TOES	MTP flexion 0° to 40° (30° to 45°) MTP hyperextension 0° to 80° (50° to 90°) MTP abduction (present) IP flexion 0° to 60° (50° to 80°) IP extension 0°

TERIMA KASIH

