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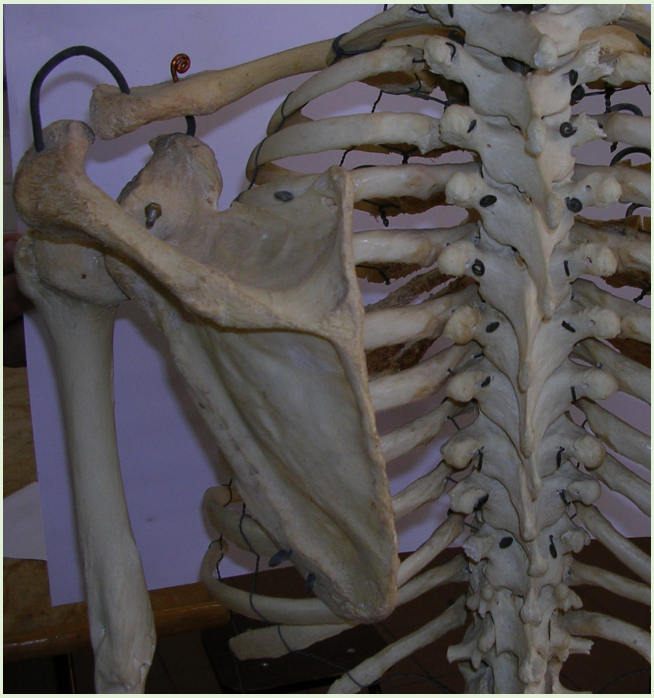
HUMAN ANATOMY:
BONES, JOINTS, AND NERVES OF THE UPPER LIMB



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I. INTRODUCTION AND TERMINOLOGY

Alina Maria Șișu

The general framework of the body is built up mainly of a series of bones, the bony part of the framework constituting the skeleton.

In the skeleton of the adult there are 206 distinct bones, as follows:

- ✓ The axial skeleton: vertebral column 26, skull 22, hyoid bone 1, ribs and sternum 25;
- ✓ And the appendicular skeleton: the upper extremities 64 and the lower extremities 62;

Bones are divisible into four classes: long, short, flat, and irregular.

- ➢ The long bones are found in the limbs, each consisting of a body or shaft and two extremities.
- ➢ The body or diaphysis is cylindrical, with a central cavity, the medullary canal;
- ➢ The wall consists of a dense, compact tissue of considerable thickness in the middle part of the body, but becoming thinner toward the extremities;
- ➢ Within the medullary canal is some cancellous tissue, greater in amount toward the ends.
- ➢ The extremities are expanded, for the articulation and to afford broad surfaces for muscular attachment.
- ➢ They are usually developed from separate centers of ossification termed epiphyses, consisting of cancellous tissue surrounded by thin compact bone.
- ➢ The medullary canal and the spaces in the cancellous tissue are filled with marrow.

- The long bones are not straight, but curved, the curve generally taking place in two planes, thus affording greater strength to the bone.
- The bones belonging to this class are: the clavicle, humerus, radius, ulna, femur, tibia, fibula, metacarpals, metatarsals, and phalanges.
- Where a part of the skeleton is intended for strength and compactness combined with limited movement, it is constructed of a number of short bones, as in the carpus and tarsus.
- These consist of cancellous tissue covered by a thin crust of compact substance.
- The patellæ, together with the other sesamoid bones, are by some regarded as short bones.
- Where the principal requirement is either extensive protection or the provision of broad surfaces for muscular attachment, the bones are expanded into broad, flat plates, as in the skull and the scapula.
- These bones are composed of two thin layers of compact tissue enclosing between them a variable quantity of cancellous tissue.
- In the cranial bones, the layers of compact tissue are familiarly known as the skull;
- The intervening cancellous tissue is called the diploë, and this, in certain regions of the skull, becomes absorbed so as to leave spaces filled with air between the two tables.
- The flat bones are: the occipital, parietal, frontal, nasal, lacrimal, vomer, scapula, coxal bone, sternum, ribs.

- The irregular bones are such as, from their peculiar form, cannot be grouped under the preceding heads.
- They consist of cancellous tissue enclosed within a thin layer of compact bone.
- The irregular bones are: the vertebræ, sacrum, coccyx, temporal, sphenoid, ethmoid, zygomatic, maxilla, mandible, palatine, inferior nasal concha, and hyoid.
- The eminences and depressions of the bones are of two kinds: articular and non-articular.
- The articular eminences are found in the heads of the humerus and femur; and of articular depressions in the glenoid cavity of the scapula, and the acetabulum of the hip bone.
- Non-articular eminences are designated according to their form.
- Thus, a broad, rough, uneven elevation is called a tuberosity, protuberance, or process, a small, rough prominence, a tubercle; a sharp, slender pointed eminence, a spine; a narrow, rough elevation, running some way along the surface, a ridge, crest, or line.
- Non-articular depressions are: fossæ, pits, depressions, grooves, furrows, fissures, notches.
- These non-articular eminences and depressions serve to increase the extent of surface for the attachment of ligaments and muscles.
- A short perforation is called a foramen, and a longer passage a canal.

The Latin Terminology

SINGULAR	PLURAL
ramus	*rami*
foramen	*foramina*
fossa	*fossae*
sulcus	*sulci*
vertebra	*vertebrae*
lacuna	*lacunae*
septum	*septa*
areola	*areolae*
gemellus	*gemelli*
acetabulum	*acetabuli*
retinaculum	*retinacula*
lamina	*laminae*
rectus	*recti*
os	*ossa*
costa	*costae*
ala	*alae*
serratus	*serrati*
soleus	*solei*
vastus	*vasti*
gluteus	*glutei*
tuberculum	*tuberculi*
schapoideum	*schapoidei*
phalanx	*phalanges*
meniscus	*menisci*
scalenus	*scaleni*
synostosis	*synostoses*

II. THE SKELETON OF THE UPPER LIMB

- ✓ Each upper limb has a belt that connects to the trunk and three segments.
- ✓ The skeleton of the two pairs of membres includes four segments:
- ✓ The belt (shoulder or hip) that forms the bone pieces that connect the trunk with the limbs,
- ✓ Three segments that form the limb skeleton itself or free.
- ✓ The bones that connecting the trunk with the limbs form seat belts (shoulder or pelvic).
- ✓ The shoulder girdle is consists of the clavicle and scapula.
- ✓ It is completed anterior by the upper portion of the sternum.
- ✓ It articulated the two clavicles.
- ✓ Posteriorly the scapulae are separated by a distance one by each other.
- ✓ They are joined with the skeleton of the trunk only by muscles.

The Skeleton of the Upper Limb *(Skeleton membri superioris)*

- ✓ It is composed of shoulder girdle and upper free, mobile limb skeleton.

The Upper Limb Belt *(cingulum membri superioris)* or Shoulder Girdle

- ✓ It forms the skeleton of the shoulder.
- ✓ It connects the free upper limb bones with the bony thorax.
- ✓ It consists of two bones: the clavicle and the scapula.

The Clavicle (*clavicula*)

Sorin Lucian Bolintineanu

- ✓ It forms the anterior portion of the shoulder girdle.
- ✓ It is a pair elongated bone situated in a transversally, at the limit between the manubrium of the sternum and acromion of the scapula.
- ✓ It has two unequal curvatures that give shape characteristic italic „S'' bone, elongated: one concave posterior medial and lateral curvature concave anterior.
- ✓ Being located subcutaneously clavicle can be palpated.
- ✓ Clavicle is flattened from superior to posterior.
- ✓ It presents two surfaces, two borders and two extremities.

Figure 1: The right clavicle

Orientation

- ✓ Put the laterally flattened extremity,
- ✓ anterior the concave border of the lower extremities
- ✓ inferiorly the surface provided with a groove.

The superior surface

- ✓ It is wide.
- ✓ In the third lateral where presents the *Deltoideus* muscle insertion (anterior) and *Trapezius* muscle insertion (posterior).
- ✓ The middle third is smooth and convex anterior-posterior
- ✓ It is covered by skin and *Platysma* muscle,
- ✓ It cames in contact with the supraclavicular and supraacromial superficial sensory branches and cervical plexus.
- ✓ The middle third presents the insertion of the *Pectoralis major* (above) and *Sternocleidomastoideus* muscles (posterior).

The inferior surface

- ✓ The lateral third presents the coracoidian tuberosity for insertion the two coraco-clavicular ligaments: conoidian and trapezoidian.
- ✓ The Coracoidian tuberosity has two segments: conoidian tubercle (*tuberculum conoideum),*
- ✓ Here inserts the conoidian ligament,
- ✓ The trapezoidal line *(trapezoidal linea*),
- ✓ The two coracoclavicular ligaments strongly attache the clavicle by the coracoid process of the scapula.
- ✓ The middle third has a groove elongated transverse that serves at the bone orientation, called underclavicular grove, for the underclavicular muscle insertion.
- ✓ On the ridges of the groove is inserted the two foils (anterior and posterior) of the clavipectoral fascia.
- ✓ In the area of the subclavicular groove there is the nutritive bone foramen.

- ✓ This affords passage to a branch of suprascapular artery.
- ✓ In the middle third there is the impression of the costoclavicular ligament *(lig. impressio costo-clavicularis*) for insertion of the costo clavicular ligament.

The Anterior Border

- ✓ It is concave and sharp in the third lateral, where the deltoid muscle inserts.
- ✓ Sometimes the medial portion of this segment can be found a small tuber called tubercle deltoid.
- ✓ In two thirds medial convex and wider, giving the *Pectoralis major* muscle insertion.
- ✓ The two insertions of the *Deltoideus* muscle and *Pectoralis Major* muscle are not in contact.
- ✓ They remain separated by a space, the subclavian fossa (Krause) or Mohrenheim fossa.

The Posterior Border

- ✓ It is also convex-concave, but in the opposite direction.
- ✓ In its third side is convex, and gives insertion for the *Trapezius* muscle.
- ✓ In its middle third is smooth and thin.

The Lateral or Acromial Extremity (*Extremitas acromialis)*

- ✓ Is is flattened from top to bottom and lateral,
- ✓ It presents an oval articular facet wihch articulates with the acromion of the scapula.

The Medial or Sternal Extremity *(Extremitas sternalis)*

- ✓ It is triangular prismatic in form.
- ✓ Medial it presents a little articular facet, for the articulation with manubrium of sternum (*facies articularis sternalis*) and the first costal cartilage.
- ✓ Here, the sternoclavicular ligaments insert (anterior and posterior sternoclavicular ligaments and ligament interclavicular).

The Scapula *(scapula)*

Laura Andreea Ghenciu

- ✓ Scapula makes the posterior aspect of the scapulohumeral joint.
- ✓ It is a triangular bone.
- ✓ It presents two surfaces, three borders, and three angles.

Surfaces:

- ✓ The costal or anterior surface presents the subscapular fossa.
- ✓ The medial 2/3 of the fossa present some oblique ridges, which go lateral and superior.
- ✓ In between those, the *Subscapularis* muscle is inserted.
- ✓ The lateral 1/3 of the fossa is covered by the same muscle.
- ✓ Some parts and the crest afford attachment to the *Serratus anterior* muscle.
- ✓ The posterior surface has an archiform shape, from superior inferior.

- ✓ It is divided into two parts by the spine.
- ✓ The area superior the spine is the supraspinatous fossa.
- ✓ The one situated inferior is called the infraspinatous fossa.

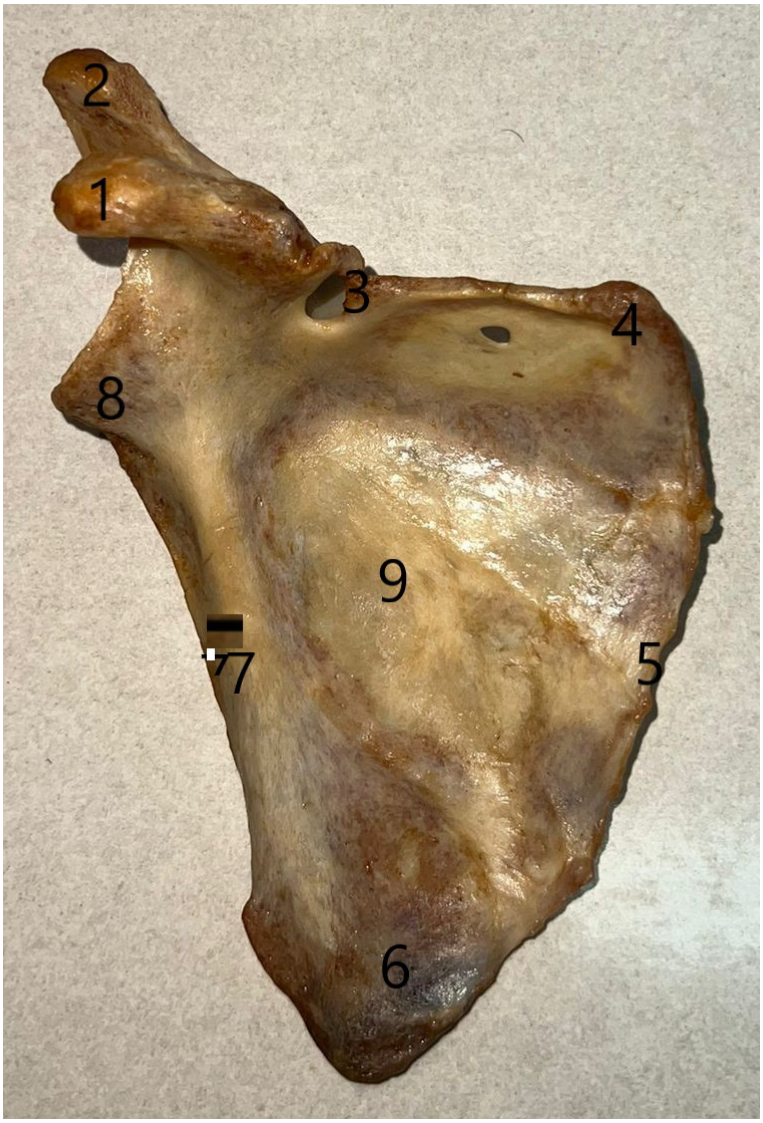

Figure 2: The right scapula, anterior view. 1. Coracoid process, 2. Acromion, 3. Suprascapular notch, 4. Medial angle, 5. Medial border, 6. Inferior angle, 7. Lateral border, 8. Glenoid fossa, 9. Subscapular fossa.

Figure 3: The right scapula, lateral view. 1. Infraglenoid tubercle, 2. Glenoid cavity/fossa, 3. Acromion, 4. Supraglenoid tubercle, 5. Coracoid process.

- ✓ The supraspinatous fossa on its medial 2/3 gives origin to the *Supraspinatus* muscle.
- ✓ The infraspinatous fossa is larger than the supraspinatous fossa.
- ✓ The medial 2/3 of the fossa afford origin to the *Infraspinatus* muscle.
- ✓ There is a sulcus for the scapular circumflex vessels.
- ✓ attachment = the *Teres minor* muscle.
- ✓ Its inferior 1/3 gives origin to the *Teres major* muscle.

The Spine ***(****spina scapulæ*)

- ✓ The spine is a bony plate.
- ✓ It crosses the medial 5/4 of the posterior aspect of the scapula.
- ✓ It separates the supra- from the infraspinatous fossae.
- ✓ It starts from the vertical border, where takes place the insertion of the *Trapezius* muscle.
- ✓ It and ends in the acromion.
- ✓ The spine is triangular.
- ✓ Its apex goes toward the vertebral border.
- ✓ It presents two surfaces and three borders.
- ✓ Its superior surface is concave.
- ✓ It helps in forming supraspinatous fossa.
- ✓ It gives origin to the *Supraspinatus* muscle.

Its inferior surface:

- ✓ Takes part of the *Infraspinatus* muscle fossa.
- ✓ Attachment= the *Infraspinatus* muscle.
- ✓ Presents in the middle the orifice of the nutrient canal.

- ✓ The posterior is large.
- ✓ It presents two crests.
- ✓ The *Trapezius* muscle is attached to superior crest.
- ✓ The *Deltoideus* muscle attaches to the inferior crest.
- ✓ The lateral border is concave.
- ✓ It forms the medial limit of the great scapular notch.
- ✓ This units the supra- and infraspinatous fossæ.

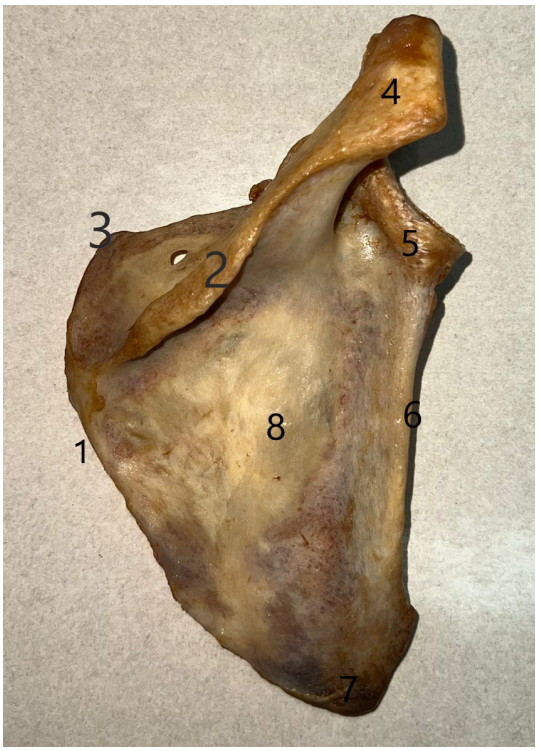

Figure 4: The right scapula, posterior view. 1. Medial border, 2. The spine of scapula, 3. Medial angle, 4. Acromion, 5. Glenoid cavity, 6. Lateral border, 7. Inferior angle, 8. Subspinous fossa, 9. Supraspinous fossa.

The Acromion

- ✓ It forms the higher of the shoulder.
- ✓ Is a triangular process, flattened from posteriorto anterior.
- ✓ Its superior surface gives attachmentto the *Deltoideus* muscle.
- ✓ Its inferior surface is concave.
- ✓ Its lateral border is thick.
- ✓ It presents tubercles for the attachment of the *Deltoideus* muscle.
- ✓ Its medial border is concave.
- ✓ It affords attachment to the *Trapezius* muscle.
- ✓ It presents in the middle a surface for articulation with the clavicle.

The apex of the scapula:

- ✓ It corresponds to the uniting of these two borders anteriorly.

Borders

The superior:

- ✓ It is the shortest.
- ✓ It is concave.
- ✓ It spreds from the medial angle to coracoid process.
- ✓ The scapular notch is made of the coracoid process.
- ✓ This notch becomes a foramen.
- ✓ It allows the passage of the suprascapular nerve.
- ✓ The side of the superior border gives insertion to the *Omohyoideus* muscle.

The axillary border:

- ✓ It is the thickest.
- ✓ It begins superiorly, at the inferior border of the glenoid cavity.
- ✓ Inferior to the glenoid cavity is an impression, the infraglenoid tuberosity.
- ✓ The long head of the *Triceps brachii* muscle inserts here.
- ✓ Anterior to this groove, there is an area which affords origin to part of the *Subscapularis* muscle.
- ✓ The inferior 1/3 gives attachment of the *Teres major* muscle posteriorly, and of the *Subscapularis* muscle anteriorly.

The vertebral border:

- ✓ It is s the longest.
- ✓ It spreads from the medial to the inferior angles.

- ✓ It is arcuated.
- ✓ The *Serratus anterior* muscle inserts here.
- ✓ The posterior crest fives attachments to the *Supraspinatus* muscle above the spine, and to the I*nfraspinatus* muscle inferiorly.
- ✓ In between the crests the *Levator scapulæ* muscle is inserted superior and the *Rhomboideus major* muscle inferior it.

The Angles:

- ✓ The scapula has three angles.

The medial:

- ✓ It is formed by the unit of the superior and vertebral borders.
- ✓ It gives attachment to fibers of the *Levator scapulæ* muscle.

The inferior angle:

- ✓ Its posterior surface attaches the *Teres major* muscle.

The lateral angle:

- ✓ Is the larger part of the bone.
- ✓ It is named the head of the scapula.
- ✓ The glenoid cavity articulates with the humeral head.
- ✓ Here is inserted glenoidal *labrum*.
- ✓ At its apex it prersents the supraglenoid tubercle.
- ✓ Here, the long head of the *Biceps brachii* muscle is attached.

The Coracoid Process (*processus coracoideus*)

- ✓ It is a thick curved lump attached by a base to the superior part of the neck.

- ✓ The ascending portion presents anteriorly a surface which the *Subscapularis* muscle passes.
- ✓ Its superior surface gives attachment to the *Pectoralis minor* muscle.
- ✓ Its medial border gives attachment to the *Pectoralis minor* muscle and the lateral border to the coracoacromial ligament.
- ✓ The apex affords attachment to the origin of the *Coracobrachialis* muscle.
- ✓ the short head of *Biceps brachii* attaches here.
- ✓ On the medial part is attached the conoid ligament.
- ✓ On the transversal part is attached the trapezoid ligament.

III. THE FREE UPPER LIMB SKELETON

(SKELETON MEMBRI SUPERIORIS LIBERI)

THE BONES OF THE ARM

The Humerus (*humerus*)

Ecaterina Dăescu

- ✓ The humerus is the unique bone of the arm.
- ✓ It is the strongest of the upper extremity.
- ✓ It presents a body and two extremities.

The Upper Extremity

- ✓ It is formed by a round head and a grooved part, the neck.
- ✓ And they present two elevations, the greater and lesser tubercles.

Figure 5: Upper Extremity of the Humerus, posterior view: 1. Head, 2. Greater tubercle, 3. Anatomical neck, 4. Surgical neck, 5. Body/shaft.

The Head (*caput humeri)*

- ✓ It is hemispherical in form.
- ✓ It is directed superior, medial, and posterior.
- ✓ It articulates with the glenoid cavity.
- ✓ The circumference of its articular surface is grooved.
- ✓ It is called the anatomical neck.
- ✓ Below the tubercles there is the surgical neck.
- ✓ The fractures can occur here.

- ✓ **The Anatomical Neck** (*collum anatomicum)*
- ✓ It is obliquely in direction.
- ✓ It forms an angle with the body of the humerus.
- ✓ The capsule of the shoulder-joint attaches here.
- ✓ It is pierced by vessels orifices.

Figure 6: Upper Extremity of the Humerus, anterior view. 1. Head, 2. Lesser tubercle, 3. Intertubercular sulcus/groove, 4. Greater tubercle.

The Greater Tubercle (*tuberculum majus*)

- ✓ It is situated lateral to the head and lesser tubercle.
- ✓ Its upper surface is marked by three areas:
  - The highest one affords attachments to the *Supraspinatus* muscle.
  - The middle gives insertion to the *Infraspinatus* muscle.
  - The lowest one gives attachment to the *Teres minor* muscle.
- ✓ The lateral surface of the greater tubercle is continued with the lateral surface of the shaft.

The Lesser Tubercle *(tuberculum minus*)

- ✓ It is smaller than the greater tubercle.
- ✓ It is situated anteriorly.
- ✓ It is directed medially and anteriorly.
- ✓ Superior and anterior it presents the insertion of the *Subscapularis* muscle.
- ✓ The tubercles are separated by a deep sulcus, the intertubercular groove (bicipital groove, *culisa bicipitalis).*
- ✓ It affords passage the long tendon of the *Biceps brachii* muscle.
- ✓ It gives a twig of the anterior humeral circumflex artery to the shoulder-joint.
- ✓ It limits anterolateral and posterior surfaces.
- ✓ Its superior 1/2 gives attachment of the inferior part of the *Teres minor* muscle.
- ✓ Inferiorly, attaches lateral head of *Triceps brachii*.

- ✓ Its middle part is travelled by an oblique groove, the radial sulcus.
- ✓ Its inferior part forms a prominent border, the lateral supracondylar ridge.
- ✓ This presents a crest for the origin of the *Brachioradialis* superior, and *Extensor carpi radialis longus* muscle inferior.
- ✓ On its posterior crest inserts the *Triceps brachii* muscle.

The Medial Border

- ✓ It spreads from the lesser tubercle to the medial epicondyle.
- ✓ Its superior 1/3 has a crest, the crest of the lesser tubercle.
- ✓ It gives insertion to the *Teres major* muscle.
- ✓ In its middle part inserts the *Coracobrachialis* muscle.
- ✓ Inferiorly, there is the door of the nutrient canal.
- ✓ The inferior 1/3 finishes into a ridge, the medial supracondylar ridge.
- ✓ This ridge presents an anterior crest for the *Brachialis* and *Pronator teres* muscles.
- ✓ The posterior one affords attachment to the medial head of the *Triceps brachii* muscle.

Figure 7: Lower Extremity of the Humerus, posterior view. 1. Shaft, 2. Olecranon fossa.

Surfaces

The Antero-Lateral Surface

- ✓ It is directed lateral and superior.
- ✓ It is covered by the *Deltoideus* muscle.
- ✓ Anteriorly and lateral it gives origin to the *Brachialis* muscle.
- ✓ In the middle part of this surface there is the deltoid tuberosity for the insertion of the *Deltoideus* muscle.
- ✓ Inferior to this, there is the radial sulcus, directed obliquely from posterior, anterior, and inferior.
- ✓ It transmits the radial nerve and *profunda brachii* artery.

The Antero-Medial Surface

- ✓ It is directed medial in the superior part, and anterior and medial in the inferior part.
- ✓ Its superior part constitutes the floor of the *culisa bicipitalis.*
- ✓ This gives insertion to the *Latissimus dorsi* muscle.
- ✓ Its middle part affords attachment of the *Coracobrachialis muscle.*
- ✓ Its inferior part affords attachments to the *Brachialis* muscle.

The Posterior Surface

- ✓ This surface is covered by the lateral and medial heads of the *Triceps brachii* muscle.

The Lower Extremity

- ✓ It is flattened from anterior to posterior.
- ✓ It terminates inferiorly in an articular surface.
- ✓ This is divided into two parts by a crest.
- ✓ On both sides there are the lateral and medial epicondyles.

The Articular Surface

- ✓ It extends more inferiorly than the epicondyles.
- ✓ Its medial extremity is projecting more inferiorly than the lateral.
- ✓ Its lateral part is formed by an elevation, **the *capitulum*** of the humerus.
- ✓ It articulates with the radial head.
- ✓ On the medial side of the elevation is a sulcus, **the intermediate groove**.
- ✓ In this is received the medial border of the head of the radius.
- ✓ Superior to the *capitulum* is a depression, **the radial fossa.**
- ✓ Here is received the anterior border of the head of the radius, in the flexion of the forearm.
- ✓ The medial part of this surface is named **the trochlea.**
- ✓ It is convex from anterior to posterior.
- ✓ Also, is concave from side to side.
- ✓ It accommodates the anterior, inferior, and posterior parts of the extremity.
- ✓ It articulates with the head of the radius.
- ✓ The medial border is thick.
- ✓ The groove of this surface articulates with the semilunar notch.
- ✓ Superior to the trochlea is a depression, **the coronoid fossa.**
- ✓ It accommodates the coronoid process during flexion of the forearm.
- ✓ Superior the trochlea, in its posterior part, there is a triangular deep area, **the olecranon fossa.**
- ✓ **Here**, the olecranon is accommodated in extension of the forearm.

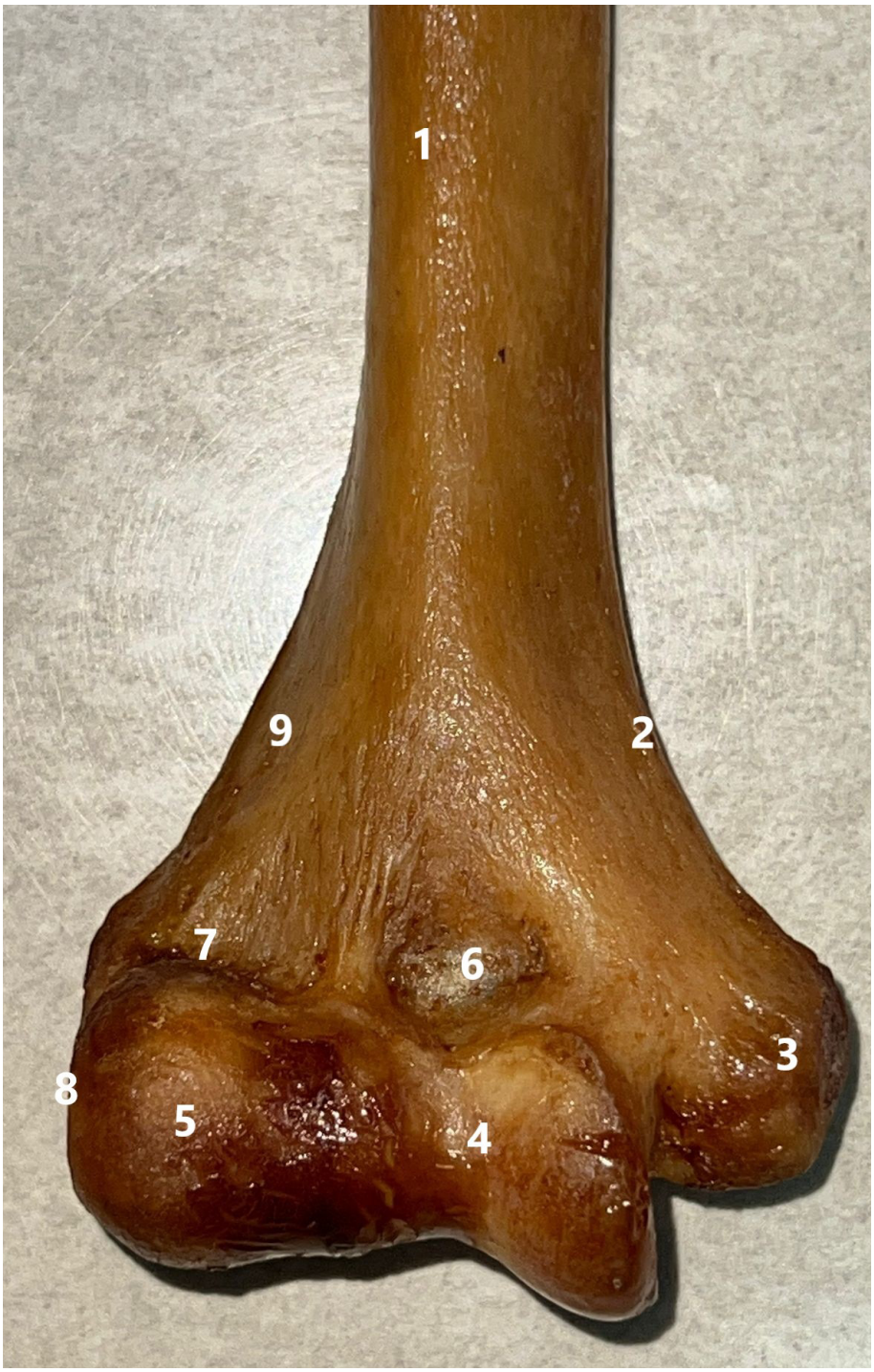

Figure 8: Lower Extremity of the Humerus, anterior view. 1. Body, 2. Medial supracondylar ridge, 3. Medial epicondyle, 4. Trochlea, 5. Capitulum, 6. Coronoid fossa, 7. Radial fossa, 8. Lateral epicondyle, 9. Lateral epicondylar ridge.

The Lateral Epicondyle

- ✓ It is a tuberculated eminence.
- ✓ It gives attachment to the radial collateral ligament of the elbow-joint.
- ✓ Also, affords insertion to a tendon common to the origin of the *Supinator* muscle and some of the *Extensor* muscles.

The Medial Epicondyle

- ✓ It is larger.
- ✓ It affords insertion to the ulnar collateral ligament of the elbow-joint, to the *Pronator teres* muscle
- ✓ a common tendon of the Flexors.
- ✓ The ulnar nerve goes posterior to this epicondyle.
- ✓ The epicondyles are continuous superiorly with the supracondylar ridges.

IV. THE BONES OF THE FOREARM

- ✓ It consists of two long bones: **the ulna** and **the radius.**
- ✓ They are articulated in the extremities (radio-ulnar joints proximal and distal).
- ✓ They are separated from the body through an elliptical space occupied by a fibrous membrane: antebrachial interosseous membrane.
- ✓ The proximal extremity of the ulna is larger and exceeds the upward the radius.
- ✓ The distal end of the radius is larger, exceeding the downward the ulna.

The Ulna

Alexandra Corina Faur

- ✓ It is a long bone.
- ✓ It is prismatic in form.
- ✓ It is situated at the medial side of the forearm.
- ✓ It goes parallel with the radius.
- ✓ It consists of a body and two extremities.

The upper extremity

- ✓ It is very thick.
- ✓ It forms part of the elbow-joint.

The lower extremity

- ✓ It is small.
- ✓ It is eliminated from the wrist-joint because the articular disk.

Figure 9: Ulna, anterior view. 1. Upper extremity, 2. Body, 3. Lower extremity.

The Superior Extremity presents:

- ✓ two processes.
- ✓ the olecranon.
- ✓ the coronoid process.
- ✓ two concave, articular cavities.
- ✓ the semilunar notch.
- ✓ the radial notch.

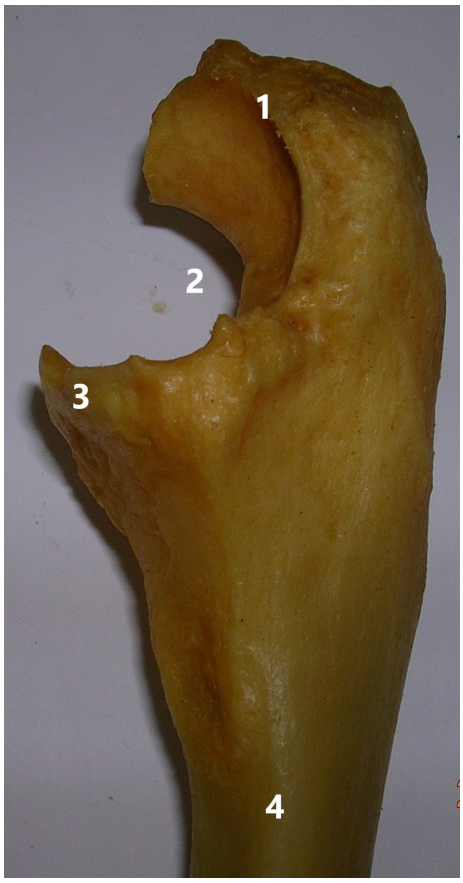

Figure 10: Ulna, Upper Extremity. 1. Olecranon, 2. Trochlear notch, 3. Coronoid procerss, 4. Tuberosity.

The Olecranon

- ✓ It is a thick elevation.
- ✓ It is situated at the superior and posterior part of the ulna.
- ✓ It presents a crest.
- ✓ It enters the olecranon fossa in extension of the forearm.
- ✓ Its superior surface has an area for the attachment of the *Triceps brachii* muscle.
- ✓ Its anterior surface is concave, and forms the superior part of the semilunar notch.
- ✓ Its borders offer the attachment of ligament.

- ✓ Also, the ulnar collateral ligament, and posterior ligament.
- ✓ Onto the medial border the *Flexor carpi ulnaris* muscle attaches.
- ✓ Onto the lateral border the *Anconæus* muscle is attached.

The Coronoid Process (*processus coronoideus)*

- ✓ It is an eminence going anteriorly, from the superior and anterior side of the ulna.
- ✓ Its base is continuous with the body.
- ✓ Its apex is pointed.
- ✓ In flexion of the forearm this is received into the coronoid fossa.
- ✓ Its superior surface is concave.
- ✓ It forms the inferior part of the semilunar notch.
- ✓ Its antero-inferior surface gives insertion to the *Brachialis* muscle.
- ✓ Where this surface units with the body there is an elevation, **the tuberosity** of the ulna.
- ✓ It gives insertion to the *Brachialis* muscle.
- ✓ The lateral surface presents a depression, **the radial notch.**
- ✓ Its medial surface affords attachment of the ulnar collateral ligament.
- ✓ On this surface the origin of one head of the *Flexor digitorum superficialis* muscle attaches.
- ✓ Behind this attachment there is an area for the *Flexor digitorum profundus* muscle.
- ✓ Inferiorly, there is a crest which gives origin to the *Pronator teres* muscle.
- ✓ The *Flexor pollicis longus* muscle of the coronoid process.

The Semilunar Notch (*incisura semilunaris*)

- ✓ It is a large depression.
- ✓ It consists of the olecranon and the coronoid process.
- ✓ It articulates with trochlea.
- ✓ The notch is concave from superior inferior.
- ✓ It is divided into a medial and a lateral portion by a crest.
- ✓ The medial portion is the largest.
- ✓ The lateral is convex superior, and concave inferior.

The Radial Notch (*incisura radialis*)

- ✓ It is an articular fossa
- ✓ lateral to coronoid process.
- ✓ It receives the articular surface of the head of the radius.
- ✓ It is concave from anterior to posterior.
- ✓ Its extremities afford the attachment of the annular ligament.

The Body or Shaft (*corpus ulnæ)*

- ✓ Its superior part is prismatic.
- ✓ It is convex from posterior to lateral.
- ✓ Its inferior part is round.
- ✓ It has three borders and three surfaces.

Borders

The Anterior Border (*margo volaris***)**

- ✓ It starts superiorly, at the coronoid process.
- ✓ It ends inferiorly, anterior to the styloid process.
- ✓ Its superior part and its middle portion give origin to the *Flexor digitorum profundus* muscle.

- ✓ Its inferior 1/4 gives attachments for the origin of the *Pronator quadratus* muscle
- ✓ It separates the anterior from the medial surfaces.

The Posterior Border *(margo dorsalis***)**

- ✓ It begins superior, at the apex of the olecranon.
- ✓ It terminates inferiorly at the styloid process.
- ✓ Attachment=the aponeurosis.
- ✓ This gives insertion to a common origin to the *Flexor carpi ulnaris*, the *Extensor carpi ulnaris*, and the *Flexor digitorum profundus* muscles.
- ✓ Its inferior 1/4 separates the medial surface from the posterior surface.

The Interosseous Crest (*crista interossea***)**

- ✓ It affords origin of a part of the *Supinator* muscle.
- ✓ It ends inferiorly at the head of the ulna.
- ✓ Its superior part is sharp.
- ✓ Its lower 1/4 is smooth.
- ✓ The interosseous membrane attaches here.
- ✓ It separates the anterior from the posterior surfaces.

Surfaces

The Anterior Surface (*facies volaris***)**

- ✓ It is larger superior than inferior.
- ✓ It is concave in its superior 3/4.
- ✓ It affords attachment to the *Flexor digitorum profundus* muscle.
- ✓ Its inferior 1/4 is covered by the *Pronator quadratus* muscle.

- ✓ Where the superior and middle thirds unit is the nutrient canal.

The Posterior Surface (*facies dorsalis*)

- ✓ It is large and concave superior.
- ✓ It is convex in the middle.
- ✓ It is narrow below.
- ✓ Its superior part has an oblique crest.
- ✓ The surface situated superior gives attachment to the *Anconæus* muscle.
- ✓ Another attachment = the *Supinator* muscle.
- ✓ Inferior, this the surface is divided by a crest into two parts.
- ✓ The medial part is covered by the *Extensor carpi ulnaris* muscle.
- ✓ The lateral portion gives origin to the *Supinator*.
- ✓ Also, *Abductor pollicis longus*, *Extensor pollicis longus*, and *Extensor indicis proprius* muscles have attachment here.

The Medial Surface (*facies medialis*)

- ✓ It is concave superior and convex inferior.
- ✓ Its superior 3/4 give origin to the *Flexor digitorum profundus* muscle.
- ✓ Its inferior 1/4 is subcutaneous.

The Lower Extremity (distal extremity)

- ✓ It is small.
- ✓ It presents two elevations.
- ✓ The lateral one is articular, the head of the ulna.
- ✓ The medial, is non-articular, the styloid process.

The Head

- ✓ It presents an articular area.
- ✓ It has an oval or semilunar form.
- ✓ It is directed inferiorly.
- ✓ The rest is directed laterally.
- ✓ It is convex.
- ✓ It is received into the ulnar notch of the radius.

The Styloid Process

- ✓ It extends inferiorly from the medial and posterior aspect of the bone.
- ✓ It goes more inferiorly than the head.
- ✓ It it rounded.
- ✓ It affords attachment to the ulnar collateral ligament of the wrist-joint.
- ✓ It gives attachment of articular disk.
- ✓ Posteriorly, it is separated by a sulcus for the tendon of the *Extensor carpi ulnaris muscle.*

The Radius (*radius*)

Luminioara Maria Roșu

- ✓ It is situated lateral to the ulna.
- ✓ It goes lower than the ulna.
- ✓ Its superior extremity is small.
- ✓ It forms part of the elbow-joint.
- ✓ Its lower end is large.

- ✓ It forms part of the wrist-joint.
- ✓ It has a shaft and two extremities.

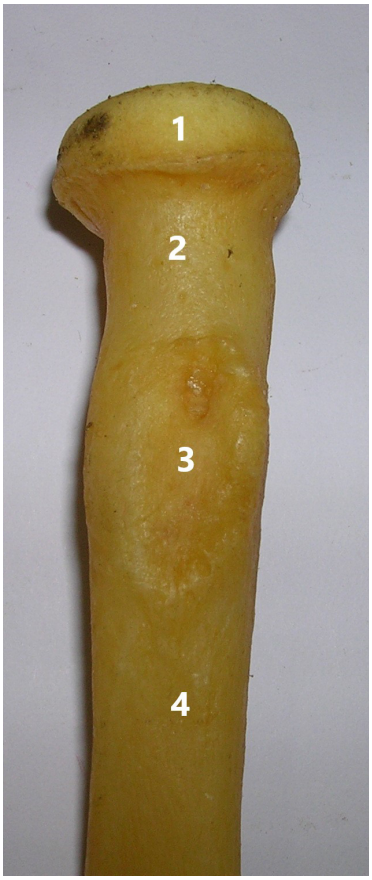

Figure 11: Upper Extremity of the radius. 1. Head, 2. Neck, 3. Tuberosity ,4. Shaft/body.

The Upper Extremity (proximal extremity)

- ✓ It presents a head, neck, and tuberosity.
- ✓ The head is cylindrical.
- ✓ On its superior surface there is a concave area.
- ✓ This is fovea, for articulation with the *capitulum*.
- ✓ The circumference of the head is convex all around.
- ✓ Medially the radial notch.
- ✓ The rest is surrounded by the annular ligament.

- ✓ The head has a constricted part, the neck.
- ✓ On the posterior aspect there is a crest for the insertion of the *Supinator* muscle.
- ✓ On the medial side there is the radial tuberosity.
- ✓ Its surface affords insertion of the *Biceps brachii* muscle.

The Body or Shaft *(corpus radii)*

- ✓ It is prismatic.
- ✓ It is narrower superiorly than inferiorly.
- ✓ It is convex laterally.
- ✓ It presents three borders and three surfaces.

Borders

The Anterior Border (*margo volaris***)**

- ✓ It spreads from the inferior part of the tuberosity superior, to the anterior part of the base of the styloid process inferior.
- ✓ It separates the anterior from the lateral surfaces.
- ✓ Its superior 1/3 is prominent.
- ✓ It named the oblique line of the radius.
- ✓ It gives origin to the *Flexor digitorum superficialis* and *Flexor pollicis longus* muscles.
- ✓ The area superior the line gives insertion to part of the *Supinato*r muscle.
- ✓ The middle 1/3 of the anterior border is utterly seen.
- ✓ The inferior 1/4 gives insertion to the *Pronator quadratus* muscle, and to the dorsal carpal ligament.
- ✓ It presents a tubercle.
- ✓ Here, the *Brachioradialis* muscle is inserted.

The Posterior Border (*margo dorsalis*)

- ✓ It begins superior, at the posterior side of the neck.
- ✓ It finishes inferiorly, at styloid process.
- ✓ It separates the posterior from the lateral surfaces.
- ✓ It is not clearly seen superior and inferior.
- ✓ It is obviosly in the middle 1/3rd.

The Interosseous Crest (*crista interossea*)

- ✓ It begins superior the tuberosity.
- ✓ Its superior part is rounded.
- ✓ It becomes prominent while goes down.
- ✓ Its inferior part is divided into two crests.
- ✓ The posterior part of the two ridges affords insertion of the inferior part of the interosseous membrane.
- ✓ The surface between the crests gives insertion to the Pronator *quadratus muscle.*
- ✓ This crest separates the anterior from the posterior surfaces.
- ✓ It affords insertion to the interosseous membrane.

Surfaces

The Anterior Surface (*facies volaris*)

- ✓ It is concave in its superior 3/4.
- ✓ Inserions: *Flexor pollicis* longus muscle.
- ✓ the *Pronator quadratus* muscle.
- ✓ Inferiorly is the insertion of the *Pronator quadratus* muscle.
- ✓ At the uniting of the superior and middle 1/3rd of the anterior surface is the nutrient foramen.

The Posterior Surface (*facies dorsalis*)

- ✓ It is convex in the superior 1/3.
- ✓ the *Supinator* muscle comes over it.
- ✓ its middle 1/3 is large, concave.
- ✓ It affords origin to the *Abductor pollicis longus muscle* superior, and the *Extensor pollicis brevis* muscle inferior.
- ✓ Its inferior 1/3 is convex.
- ✓ It is covered by the tendons of the muscles.

The Lateral Surface (*facies lateralis*)

- ✓ It is entirelyconvex.
- ✓ Its superior 1/3 affords attachment to the *Supinator* muscle.
- ✓ Close to its middle there is a ridge.
- ✓ This affords insertion of the *Pronator teres* muscle.
- ✓ It is covered by the *Abductor pollicis longus.*
- ✓ Also, *Extensor pollicis brevis* muscles.

The Lower Extremity

- ✓ It is large.
- ✓ It has got two articular surfaces.
- ✓ One is situated inferiorly, for the articulation to the carpus.
- ✓ Another one is situated at the medial side, for articulation with the ulna.
- ✓ It is divided by an antero-posterior ridge into two parts.
- ✓ The lateral, triangular one, articulates with the navicular bone.
- ✓ The medial, is quadrilateral, is articulated with the lunate bone.
- ✓ The articular surface, the ulnar notch.
- ✓ It articulates with the ulnar head.

- ✓ There are three non-articular surfaces: anterior, posterior, and lateral.

The Anterior Surface

- ✓ It is rough.
- ✓ It affords attachment = anterior radiocarpal ligament.

The Posterior Surface

- ✓ It is convex.
- ✓ It affords attachment to the posterior radiocarpal ligament.
- ✓ It is marked by three grooves.
- ✓ From the lateral side they are:
  - The first groove is large.
  - Has a crest.
  - The lateral= the *Extensor carpi radialis longus* ,
  - *Extensor carpi radialis brevis*.
  - The second one is deep.
  - It is bounded laterally by a crest.
  - the *Extensor pollicis longus*.
  - The third sulcus is large.
  - It gives passage to the tendons of the *Extensor indicis proprius* and *Extensor digitorum communis* muscles.

The Lateral Surface

- ✓ It is prolonged inferiorly into a strong projection, **the styloid process.**
- ✓ Insertions= the *Brachioradialis* muscle.
- ✓ the radial collateral ligament.

- ✓ The lateral surface of this process is marked by a sulcus.
- ✓ the *Abductor pollicis longus*
- ✓ *Extensor pollicis brevis* muscles.

V. THE SKELETON OF THE HAND

The skeleton of the hand is composed of:

- The *carpus*;
- The *metacarpus*
- The phalanges.

THE CARPUS (*OSSA CARPI)*

THE CARPAL BONES

- ✓ There are eight in number.
- ✓ They are disposed in two rows.
- ✓ In the proximal row, from lateral to medial are named:
  - **the navicular,**
  - **the lunate,**
  - **the triangular,**
  - **the pisiform.**
- ✓ In the distal row, also from lateral to medial, are named:
  - **the greater multangular/ trapezium,**
  - **the lesser multangular/trapezoid,**
  - **the capitate,**
  - **the hamate.**

Common Characteristics

- ✓ Each bone (excepting pisiform) has six surfaces.
- ✓ The anterior and the posterior surfaces are serving for attachement of ligaments.

- ✓ The posterior surface is larger, except in the navicular and lunate.
- ✓ The superior or proximal, and inferior or distal surfaces are articular.
- ✓ The superior is convex, and the inferior is concave.
- ✓ medial and lateral surfaces are articular.

Figure 12: The Carpus/Carpal Bones.1. Scaphoid/navicular, 2. Semilunar/lunate, 3. Triquetrum/triangular/cuneiform, 4. Pisiform, 5. Hamate, 6. Os Magnum, 7. Lesser multangular bone/trapezoid, 8. Greater multangular bone/trapezium.

Bones of the Proximal Row

Codruța Ileana Petrescu

The Navicular Bone /scaphoid bone

- ✓ It is the largest bone of the proximal row.
- ✓ It has resemblance to a boat.
- ✓ It is located at the lateral side of the carpus.

The Superior Surface

- ✓ It is convex and has a triangular shape.
- ✓ It articulates with the inferior end of the radius.

The Inferior Surface

- ✓ It is convex and triangular.
- ✓ It consists of two parts.
- ✓ One lateral that articulates with greater multangular.
- ✓ One that articulates with lesser multangular.

The Posterior Surface

- ✓ It has a groove.
- ✓ For ligamentary attachment.

The Anterior Surface

- ✓ It is concave superiorly.
- ✓ It s lateral part presents a tubercle.
- ✓ It gives insertion to the transverse carpal ligament.

The Lateral Surface

- ✓ It is narrow.
- ✓ It affords insertion to the radial collateral ligament of the wrist.

The Medial Surface

- ✓ It presents two articular facets.
- ✓ It articulates with the lunate bone.
- ✓ The inferior or larger facet is concave.

- ✓ It forms with the lunate a concavity for the head of the capitate bone.
- ✓ The navicular articulates with five bones:
    - It articulates with the radius proximally.
    - It articulates with the greater and lesser multangulars distally.
    - It joints with the capitate and lunate bones medially.

The Lunate Bone (*os lunatum*; semilunar bone)

- ✓ It may be recognized by its deep concavity, moon shape.
- ✓ It is situated in the proximal row of the carpus.
- ✓ Its superior surface is convex and articulates with the radius.
- ✓ Its inferior surface is concave.
- ✓ It joins the head of the os magnum and with the hamate bone.

The Posterior and Anterior Surfaces

- ✓ They are rough.
- ✓ Here, the ligaments are attached.

The Lateral Surface

- ✓ It articulates with the navicular bone.

The Medial Surface

- ✓ It articulates with the triangular bone.
- ✓ The lunate bone articulates with:

- the radius proximally,
- capitate and hamate distally,
- navicular laterally,
- and triangular medially.

The Triangular Bone *(os triquetum)*

- ✓ It is a triangular bone.
- ✓ It can be recognized by its pyramidal shape.
- ✓ It articulates with the pisiform bone.
- ✓ It is situated at the superior and medial side of the carpus.

The Superior Surface

- ✓ It has a medial non-articular portion, and a lateral, articular.
- ✓ The last articulates with articular disk.

The Inferior Surface

- ✓ It is directed laterally.
- ✓ It is concave.
- ✓ It serves for articulation with the hamate bone.

The Posterior Surface

- ✓ It serves for the attachment of ligaments.

The Anterior Surface

- ✓ It presents a facet, for articulation with the pisiform bone.
- ✓ Lateral, the ligaments attach.

The Lateral Surface

- ✓ It articulates with the lunate.

The Medial Surface

- ✓ It is the apex of the pyramid.
- ✓ Attachment=the ulnar collateral ligament of the wrist.
- ✓ The triangular articulates with:
    - the lunate bone laterally,
    - the pisiform boneanteriorly,
    - the hamate bone distally,
    - with the articular disk.

The Pisiform Bone *(os pisiforme)*

- ✓ It can be recognized by its small size.
- ✓ It presents one articular facet.
- ✓ It is situated anterior to the rest carpals.

Its Posterior Surface

- ✓ It presents a facet for articulation with the triangular bone.

The Anterior Surface

- ✓ Attachments= transverse carpal ligament,
- ✓ Attachments=*Flexor carpi ulnaris*
- ✓ Attachments= *Abductor digiti quinti* muscles.

The Lateral and Medial Surfaces

- ✓ They are also rough.
- ✓ The first is concave.
- ✓ The last usually convex.
- ✓ The pisiform articulates with the triangular.

Bones of the Distal Row

Alina Maria Șișu

The Greater Multangular Bone / trapezium

- ✓ It can be recognized by a deep groove on its anterior surface.
- ✓ It is situated laterally in the carpal arangement.
- ✓ It stays between the navicular and the first metacarpal.

The Superior Surface

- ✓ It is directed superior and medial.
- ✓ Medially articulates with the navicular bone.

The Inferior Surface

- ✓ It is concave from side to side, convex from anterior to posterior.
- ✓ It has got a form of a saddle.
- ✓ It articulates with the base of the first metacarpal.

The Posterior Surface is rough.

The Anterior Surface is rough.

- ✓ At its superior part is a deep sulcus.
- ✓ It transmits the tendon of the *Flexor carpi radialis*.

- ✓ Attachment=the *Opponens pollicis*
- ✓ *Attachment=Abductor* and *Flexor pollicis brevis*.
- ✓ attachment = transversal carpal ligament.

The Lateral Surfaces

- ✓ It is large.
- ✓ Attachment=ligaments.

The Medial Surface

- ✓ It presents two facets:
    - One is superior concave.
    - Articulation= lesser multangular.
    - The inferior articulates with the base of the second metacarpal bone.
- ✓ **The greater multangular articulates:**
    - The navicular proximally,
    - The first metacarpal distally,
    - The lesser multangular and second metacarpal medially.

The Lesser Multangular Bone/ trapezoid

- ✓ Is the smallest bone, distally.
- ✓ It can be recognized by its wedge-shaped form.
- ✓ It has four articular facets.

The Superior Surface

- ✓ It is quadrilateral and concave.
- ✓ It articulates with the navicular bone.

The Inferior Surface

- ✓ Articulation= second metacarpal bone.
- ✓ It is convex from side to side.
- ✓ It is concave from anterior to posterior.

The Posterior and Anterior Surfaces

- ✓ They are affording the attachment of ligaments.

The Lateral Surface

- ✓ It is convex.
- ✓ It articulates with the greater multangular bone.

The Medial Surface

- ✓ It is concave anterior.
- ✓ Articulation= the capitate bone.
- ✓ The lesser multangular articulates:
    - the navicular proximally,
    - the 2nd metacarpal distally,
    - the greater multangular laterally,
    - the capitate medially.

The Capitate Bone *(os magnum)*

- ✓ It is the largest of the carpal bones.
- ✓ It presents superiorly the head.
- ✓ It has got a neck.
- ✓ Inferior to the neck is the body.

The Superior Surface

- ✓ It articulates with the lunate bone.

The Inferior Surface

- ✓ It has 3 facets.
- ✓ They articulate with the second, third, and fourth metacarpal bones.

The Posterior Surface

- ✓ It is wide.

The Anterior Surface

- ✓ The *Adductor pollicis obliquus* muscle attaches here.

The Lateral Surface

- ✓ Articulation=the lesser multangular.

The Medial Surface

- ✓ It articulates with the hamate bone.
- ✓ The capitate articulates with seven bones:
  - the navicular and lunate proximally,

- 2nd, 3rd, 4th metacarpals distally,
- the lesser multangular laterally,
- the hamate medially.

The Hamate Bone (*os hamatum*)

- ✓ It has a wedge-shaped form.
- ✓ It has a hook-like process.
- ✓ It is situated:
  - at the medial and inferior parts of the carpus,

The Superior Surface

- ✓ It is narrow, convex.
- ✓ It articulates with the lunate bone.

The Inferior Surface

- ✓ It articulates with the 4th and 5th metacarpal bones.

The Posterior Surface

- ✓ It affords attachment of ligaments.

The Anterior Surface

- ✓ It presents inferiorly the hamulus.
- ✓ It is directed anterior and lateral.
- ✓ Attachment= transverse carpal ligament
- ✓ Attachment= *Flexor carpi ulnaris* muscle.

- ✓ Attachment= *Flexor brevis*
- ✓ *Attachment= Opponens digiti quinti*.

The Medial Surface

- ✓ It articulates with the triangular bone.

The Lateral Surface

- ✓ It articulates with the capitate bone.
- ✓ The hamate bone articulates with:
    - the lunate bone proximally,
    - the 4th, 5th metacarpals distally,
    - the triangular medially,
    - the capitate bone laterally.

The Metacarpus

Laura Andreea Ghenciu

- ✓ It consists of five long bones.
- ✓ from lateral to medial (*ossa metacarpalia* I-V);
- ✓ Each has a body and two extremities.

Common Characteristics

The Body (*corpus*)

- ✓ It is prismatic.
- ✓ It is convex in the lenght posteriorly, concave anteriorly.
- ✓ It presents 3 surfaces: medial, lateral, and posterior.

The Medial and Lateral Surfaces

- ✓ They are concave.
- ✓ Attachment= the *Interossei* muscles.
- ✓ Presents an anterior crest.

The Posterior Surface

- ✓ It presents in its distal 2/3 an area covered by the tendons of the Extensor muscles.
- ✓ Attachment=the *Interossei dorsales* muscles.
- ✓ Attachment=collateral ligaments of the metacarpophalangeal joints.

The Base or Carpal Extremity (*basis)*

- ✓ It is cuboid form.
- ✓ Articulation=carpus
- ✓ Articulation= the metacarpals.

The head or digital extremity (*capitulum)*

- ✓ It presents a surface convex from anterior posterior.
- ✓ It articulates with the proximal phalanx.
- ✓ It spreads superiorly, on the anterior than on the posterior aspect.
- ✓ Attachment= collateral ligament of the metacarpophalangeal joint.

The Posterior Surface

- ✓ It affords the Extensor muscles tendons.

The Anterior Surface

- ✓ It is grooved in the middle line for the passage of the Flexor tendons.

Characteristics of the Metacarpals-

Dăescu Ecaterina

The First Metacarpal Bone (*os metacarpale I*)

- ✓ It is shorter than the rest metacarpals.
- ✓ Its anterior surface is directed toward the palm.
- ✓ The body is broad on its posterior aspect.
- ✓ It does not present the ridge.
- ✓ In the other metacarpal bone this crest exists.
- ✓ Its anterior surface is concave from superior to inferior.
- ✓ On its lateral border is inserted the *Opponens pollicis* muscle.
- ✓ Attachment=first *Interosseus dorsalis* muscle.

The Base

- ✓ It articulates with the greater multangular bone.
- ✓ Attachment=the *Abductor pollicis longus*.

The Head

- ✓ It is less convex than those of the other metacarpal bones.
- ✓ On its anterior surface there are two articular elevations.

The Second Metacarpal Bone (*os metacarpale II*)

- ✓ It is the longest.
- ✓ Its base goes superiorly and medially.
- ✓ It presents four articular facets.
- ✓ The intermediate one is the largest.
- ✓ It is concave from side to side, convex from anterior to posterior.
- ✓ articulation=the lesser multangular bone.
- ✓ The lateral is small.
- ✓ Articulation= the greater multangular bone.
- ✓ The medial is long.
- ✓ Articulation=the capitate bone.
- ✓ Medially, with the 3rd metacarpal.
- ✓ The *Extensor carpi radialis longus* muscle is inserted on the posterior surface and the *Flexor carpi radialis* muscle.

The Third Metacarpal Bone (*os metacarpale III*)

- ✓ The posterior aspect of its base presents the styloid process.
- ✓ Distally, attaches the *Extensor carpi radialis brevis* muscle.
- ✓ Articulation=the capitate bone.
- ✓ Laterally, articulates with the 2nd metacarpal.
- ✓ On the medial side there are two areas for the uniting with the fourth metacarpal bone.

The Fourth Metacarpal Bone (*os metacarpale IV*)

- ✓ It is shorter and smaller than the third.
- ✓ The base is quadrilateral.
- ✓ Its superior surface presents two facets.
- ✓ The medial is for articulation with the hamate bone, and the lateral for the capitate bone.
- ✓ On the lateral part there are two facets, for articulation with the 3rd metacarpal bone.
- ✓ On the medial part there is a facet for the uniting with the 5th metacarpal bone.

The Fifth Metacarpal Bone (*os metacarpale V*)

- ✓ It presents on its base a facet.
- ✓ This articulates with the hamate bone.
- ✓ It has, on its lateral side, a surface.
- ✓ This articulates with the fourth metacarpal bone.
- ✓ On its medial side is the insertion of the *Extensor carpi ulnaris* muscle.
- ✓ On the lateral part is the attachment of the 4th *Interosseus dorsalis* muscle.

Articulations:

The metacarpal bones articulate with:

- 1st = the greater multangular;

- 2nd = the greater multangular, lesser multangular, capitate, 3rd ;
- 3rd=the capitate, 2nd, 4th;
- 4th=the capitate, hamate, 3rd, 5th ;
- 5th= hamate, 5th.

The Hand Phalanges
(Phalanges Digitorum Manus)

Sorin Lucian Bolintineanu

- ✓ The phalanges are fourteen in number, three for each finger, and two for the thumb.
- ✓ Each consists of a body and two extremities.
- ✓ The body is convex posteriorly, concave anteriorly from superior to inferior.
- ✓ Attachment= Flexor muscles tendons.
- ✓ The distal extremities are smaller than the proximal.
- ✓ Each end in two condyles separated by a groove.
- ✓ The articular surface extends toward the anterior surface.
- ✓ The ungual phalanges are convex posteriorly.
- ✓ They are recognized by an elevated surface of a horseshoe.
- ✓ Each supports the sensitive pulp of the finger.
- ✓ In the four fingers the phalanges of the first row articulate with those of the second row and with the metacarpals.
- ✓ Articulation=phalanges of the second row with phalanges of the first and third rows.

- ✓ The ungual phalanges articulate with those of the second row.
- ✓ In the thumb the first phalanx articulates by its proximal extremity with the metacarpal bone.
- ✓ By its distal extremity articulates with the ungual phalanx.

Figure 13: The Hand, posterior view

VI. THE JOINTS

Humeral Articulation or Shoulder-Joint
(Articulatio Humeri)

Alexandra Corina Faur

- ✓ The shoulder-joint is an enarthrodial joint.
- ✓ It is also called ball-and-socket joint.
- ✓ The bony surfaces which form the joint are the hemispherical head of the humerus and the shallow glenoid cavity of the scapula.
- ✓ The humerus can be set up to a distance from the glenoid cavity.
- ✓ The joint is protected superiorly by an arch.
- ✓ This is formed by:
    - the coracoid process,
    - the acromion,
    - the coracoacromial ligament.

The ligaments of the shoulder are:

- ✓ The Articular Capsule
- ✓ The Glenohumeral Ligaments
- ✓ The Coracohumeral Ligament
- ✓ The Transverse Humeral Ligament
- ✓ The Glenoidal Labrum

The Articular Capsule (*capsula articularis)*

- ✓ The articular capsule wraps the joint.

- ✓ It is attached superior to the circumference of the glenoid cavity, and beyond the glenoidal *labrum.*
- ✓ Inferiorly, it is attached to the anatomical neck of the humerus.
- ✓ It is strengthened,
    - superior, by the *Supraspinatus* muscle;
    - inferior, by the long head of the *Triceps brachii* muscle;
    - posterior, by the tendons of the *Infraspinatus* and *Teres minor* muscle;
    - anterior, by the tendon of the *Subscapularis* muscle.
- ✓ There are three openings in the capsule.
- ✓ One anteriorly, inferior to the coracoid process.
- ✓ The second is at the posterior part.
- ✓ The third is between the tubercles of the humerus.
- ✓ the long tendon of the *Biceps brachii* muscle goes through it.

The Coracohumeral Ligament (*ligamentum coracohumerale*)

- ✓ This ligament is a large band.
- ✓ It is coming from the lateral border of the coracoid process.
- ✓ It passes inferior and lateral to the anterior aspect of the greater tubercle.

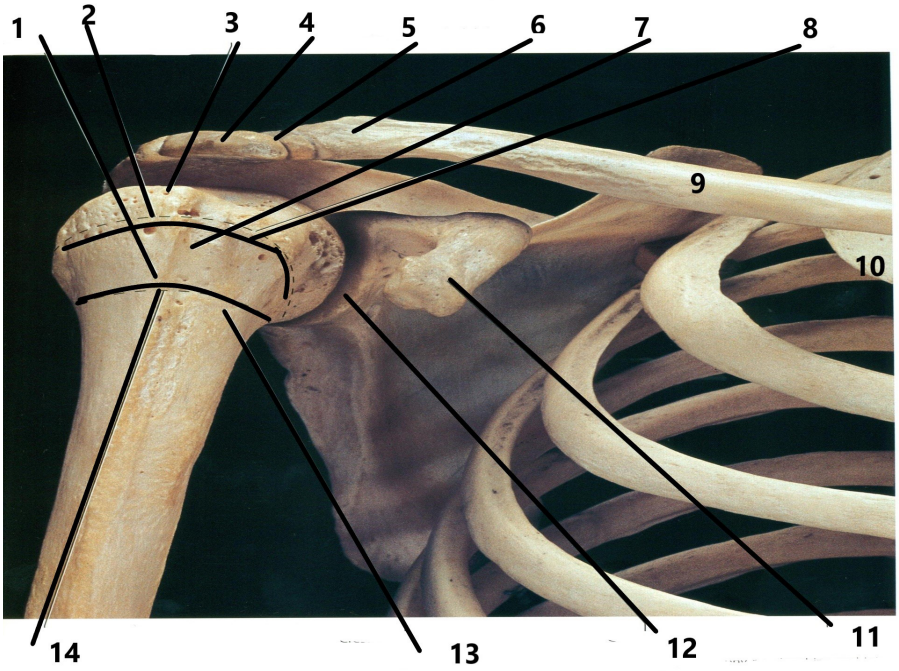

Figure 14: Scapulohumeral joint, anterior aspect. 1. Greater tubercle of humerus/crest, 2. Anatomical neck of humerus, 3. Greater tubercle of humerus, 4. Acromion, 5. Acromioclavicular joint, 6. Acromial end of clavicle, 7. Intertubercular sulcus, 8. Lesser tubercle, 9. Clavicle, 10. First rib, 11. Coracoid process of scapula, 12. Glenoid cavity, 13. Lesser tubercle/crest. 14. Surgical neck of humerus.

Glenohumeral Ligaments

- ✓ They are 3 strips named the **glenohumeral ligaments.**
- ✓ They reinforced the capsule.
- ✓ One,on medial side,passes from the glenoid cavity to the lesser tubercle.
- ✓ A second, inferior, goes from the glenoid cavity to the anatomical neck of humerus.
- ✓ A third, superior, goes to the apex of the glenoid cavity.
- ✓ It passes inferiorly, along the medial border of the *Biceps brachii* muscle.
- ✓ It is attached superior to the lesser tubercle.

The Transverse Humeral Ligament

- ✓ It is a large strip, extending from the lesser to the greater tubercles of the humerus.
- ✓ It transforms the intertubercular sulcus into a canal.

The Glenoidal Labrum (*labrium glenoidale)*

- ✓ It is a fibrocartilaginous rim.
- ✓ It is attached on the border of the glenoid cavity.
- ✓ The base is fixed to the circumference of the cavity.
- ✓ The free border is sharp.
- ✓ It is continuous superior with the tendon of the long head of the *Biceps brachii* muscle.

Synovial Membrane

- ✓ The synovial membrane lasts from the glenoid cavity above the *labrum glenoidale.*
- ✓ It is then reflected over the internal surface of the capsule.
- ✓ It covers the inferior part and sides of the anatomical neck of the humerus.
- ✓ The tendon of the long head of the *Biceps brachii* muscle passes through the capsule.

The muscles

- ✓ In relation with the joint are
  - superior, the *Supraspinatus* muscle;
  - inferior, the long head of the *Triceps brachii* muscle;
  - anterior, the *Subscapularis* muscle;

- posterior, the *Infraspinatus* and *Teres minor* muscles;
- inside, the tendon of the long head of the *Biceps brachii* muscle.

✓ The *Deltoideus* muscle covers the articulation anteriorly, posteriorly, and laterally.

✓ The **arteries** supplying the joint are coming from the anterior and posterior humeral circumflex arteries.

✓ The **nerves** are coming from the axillary and suprascapular nerves.

Movements

✓ The shoulder-joint is capable of a large range of movements,such as flexion, extension, abduction, adduction, circumduction, and rotation.

✓ The mobility of the scapula is very large.

✓ It assists the movements of the arm at the shoulder-joint.

✓ When lifting the arm from the side, the *Deltoideus* and *Supraspinatus* muscles lift it to a right angle with the trunk.

✓ The next elevation of the limb is made by the *Trapezius* and *Serratus anterior* muscles.

✓ They are moving the scapula on the chest walls.

✓ The movements of this bone compensating to a very great extent for the immobility of the joint.

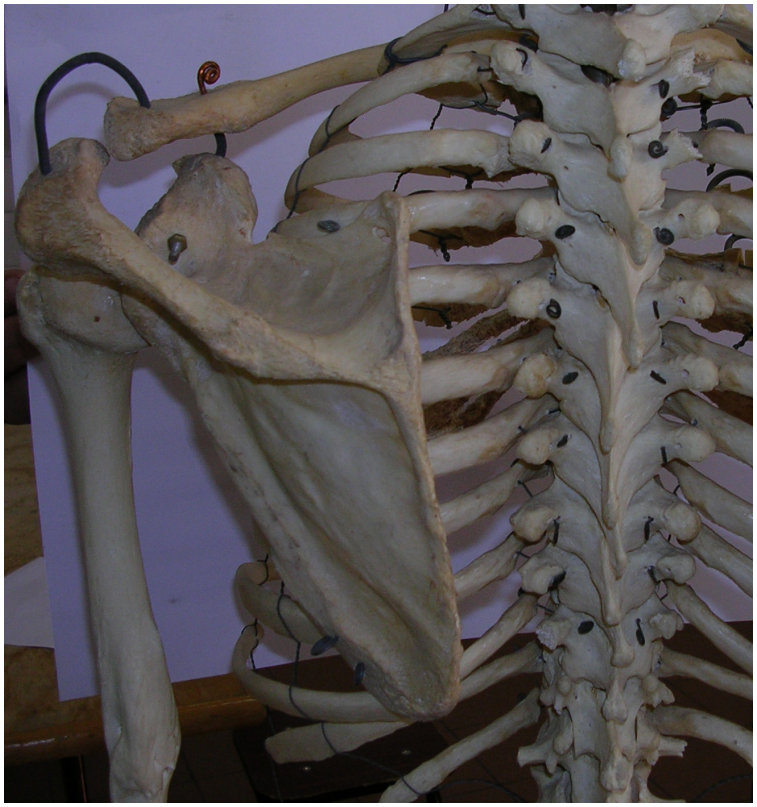

Figure 15: Scapulohumeral Joint, posterior view.

Elbow-joint (*Articulatio Cubiti*)

Alina Maria Șișu

- ✓ The elbow-joint is a ginglymus or hinge-joint.
- ✓ The trochlea of the humerus is received into the semilunar notch of the ulna.
- ✓ The *capitulum* of the humerus articulates with the fovea on the head of the radius.
- ✓ The articular surfaces are connected together by a capsule.

The ligaments of the elbow joint are:

- ✓ The Anterior.
- ✓ The Posterior.
- ✓ The Ulnar Collateral
- ✓ The Radial Collateral

The Anterior Ligament

- ✓ The anterior ligament is a large and thin.
- ✓ It covers the anterior aspect of the joint.
- ✓ It is attached to the anterior aspect of the medial epicondyle and to the anterior aspect of the humerus.
- ✓ Also, is attached to the anterior surface of the coronoid process of the ulna and to the annular ligament.
- ✓ It is continuous on either side with the collateral ligaments.
- ✓ Its superficial fibers pass from the medial epicondyle of the humerus to the annular ligament.
- ✓ The middle fibers are vertical.
- ✓ They pass from the superior part of the coronoid depression.
- ✓ They are inserted into the anterior surface of the coronoid process.
- ✓ The deep or transverse fibers intricate with the rest.
- ✓ This ligament is in relation, anteriorly, with the *Brachialis* muscle.

The Posterior Ligament

- ✓ This posterior ligament is membranous.
- ✓ Superior it is attached to the humerus posterior to the *capitulum,* close to the medial border of the trochlea, and the olecranon fossa.
- ✓ Posteriorly, is attached of the lateral epicondyle.

The Ulnar Collateral Ligament (*ligamentum collaterale ulnare*)

- ✓ The ligament is a thick band, having 2 parts, anterior and posterior.
- ✓ They are united by an intermediate portion.
- ✓ The anterior portion is directed anteriorly.
- ✓ It is attached superiorly to the anterior part of the medial epicondyle of the humerus.
- ✓ It is attached, inferiorly, to the medial border of the coronoid process.
- ✓ The posterior portion is attached to the inferior and posterior part of the medial epicondyle.
- ✓ It is attached inferiorly to the medial border of the olecranon.
- ✓ It gives origin to the *Flexor digitorum superficialis* muscle.

The Radial Collateral Ligament (*ligamentum collaterale radiale*)

- ✓ This ligament is a short and fibrous.
- ✓ It is attached, superiorly, to the lateral epicondyle of the humerus.
- ✓ It is attached inferior to the annular ligament.
- ✓ Some fibers are inserted into the lateral border of the ulna.

Synovial Membrane

- ✓ The synovial membrane is wide.
- ✓ It spreads from the articular surface of the humerus.
- ✓ It lines the coronoid, radial and olecranon fossæ on that bone.
- ✓ it is reflected over the deep surface of the capsule.

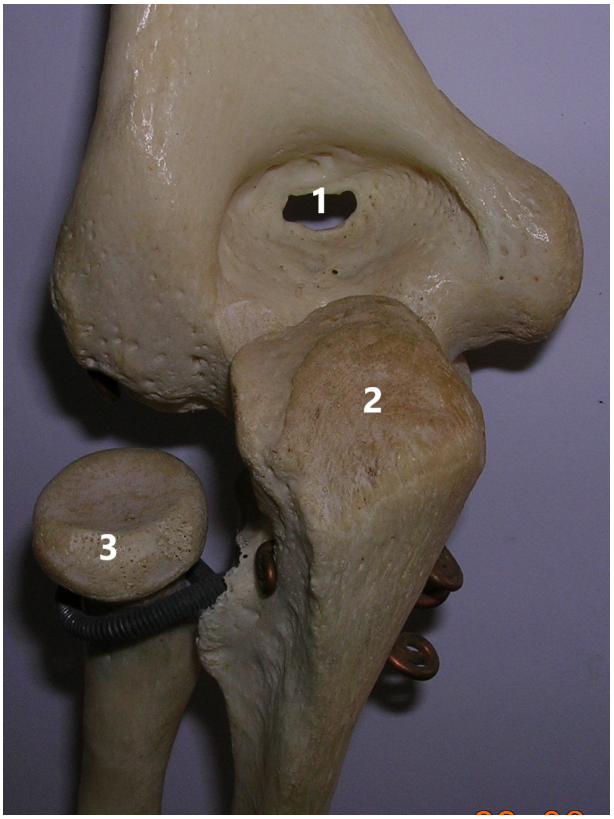

Figure 16: Elbow Joint, posterior view.

- ✓ The **arteries** are exiting from the *Profunda brachii* artery and the superior and inferior ulnar collateral artery.
- ✓ They are branches of the brachial artery.
- ✓ Also, the anterior, posterior, and interosseous recurrent branches of the ulnar artery participate.
- ✓ The radial recurrent artery of the radial artery is coming at this arterial circle.
- ✓ These vessels form complete arterial epicondylar circles.
- ✓ The **nerves** of the joint are a filets from the ulnar nerve.
- ✓ A twig from the musculocutaneous, and two from the median nerves innervate the joint.

Movements

- ✓ The elbow-joint comprises three different joints
  - the joint between the ulna and humerus,
  - that between the head of the radius and the humerus,
  - and the proximal radioulnar joint.
- ✓ All these articular surfaces are wraped by a synovial membrane.
- ✓ The movements of the whole joint are seen as a unit.
- ✓ The movements are: flexion and extension of the forearm, and pronation and supination of the hand.

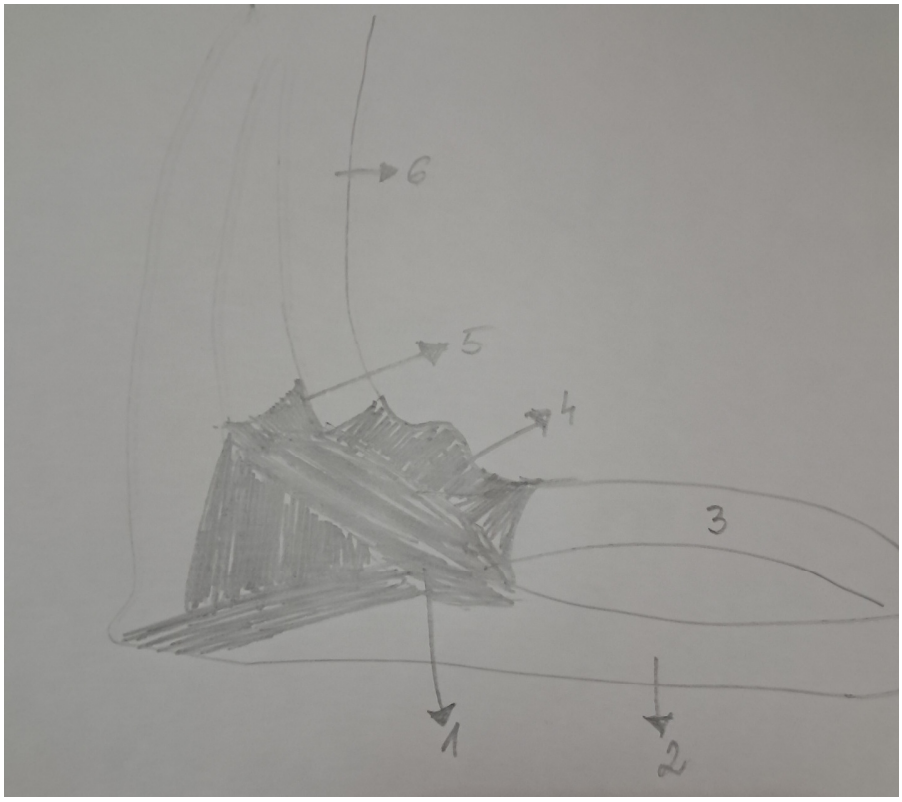

Figure 17: Ligaments of the Elbow Joint, lateral view. 1. Ulnar collateral ligament, 2. Ulna, 3. Radius, 4. Orbicular ligament, 5. Lateral epicondyle of humerus, 6. Humerus.

VII. NERVES OF THE UPPER LIMB
Brachial Plexus

Ecaterina Dăescu

A. From the roots there are small branches to the back muscles.

- ✓ **The long thoracic nerve** passes posteriorly to the medial wall of the axilla to supply *serratus anterior* muscle.
- ✓ It is also called the respiratory nerve of Charles Bell.
- ✓ **Nerve to *Subclavius* muscle.**
- ✓ **Nerve to *Rhomboidei* muscles** (the only one that did not enter the axilla).

B. From the upper trunk arises **the suprascapular nerve,** which crosses the root of the neck to supply *Supraspinatus* and *Infraspinatus* muscles.

C. From the lateral cord branches arise

- ✓ **The lateral head of the median nerve,**
- ✓ **The lateral pectoral nerve** that supplies *Pectoralis major* muscle,
- ✓ **The musculocutaneous nerve** that supplies *Coracobrachialis, Biceps brachii* and *Brachialis* muscles before becoming the **lateral cutaneous nerve of the arm.**

D. From the medial cord:

- ✓ **The medial pectoral nerve** supplies *Pectoralis minor* muscle.

- ✓ **The ulnar nerve** supplies flexor muscles in the forearm, small muscles in the hand and the skin of the medial side of the hand.
- ✓ **The medial head of median nerve,**
- ✓ **The medial cutaneous nerves of the arm**, which supplies skin on the medial side of the arm,
- ✓ **The medial cutaneous nerve of the forearm**, which supplies the skin of the medial side of the forearm.

E. From the posterior cord arise

- ✓ **The subscapular nerves, inferior and superior**, as descending the posterior axillary wall to supply *Subscapularis* and *Teres major* muscles.
- ✓ **The thoracodorsal nerve** supplies *Latissimus dorsi* muscle by entering its upper border.

The axillary nerve

- ✓ Descends on *Subscapularis* muscle and turns posteriorly around the surgical neck of the humerus.
- ✓ It supplies the *Deltoideus*, *Teres minor* muscles and the shoulder joint before ending as the superior lateral cutaneous nerve of arm, which supplies skin over the insertion of *Deltoideus* muscle.

The radial nerve

- ✓ It is a terminal branch of the posterior cord.
- ✓ It descends through the posterior compartment of the arm.
- ✓ It is supplying *Triceps, Brachioradialis* and *Extensor carpi radialis longus* and *brevis* muscles and sensory branches to the skin on the posterior and medial sides of the limb and the posterior surface of the lateral three and a half fingers.
- ✓ The radial nerve descends posterior to the axillary artery.
- ✓ It passes posteriorly in the spiral groove of the humerus between the long and medial heads of *Triceps brachii* muscle.
- ✓ In the lower third of the arm it re-enters the anterior compartment, lateral to the humerus.
- ✓ It then crosses the elbow anterior to the lateral epicondyle deep to *Brachioradialis* muscle.
- ✓ Its muscular branches to the forearm extensors are all conveyed in **the posterior interosseous nerve**.
- ✓ Its cutaneous branches, supplying the radial side of the dorsal surface of the hand, are conveyed in **the superficial radial nerve**.
- ✓ It emerges posterior to *Brachioradialis* muscle tendon above the wrist.

Median nerve

- ✓ The median nerve descends deep to the axillary artery to reach its medial side midway down the arm.

- ✓ It crosses the elbow deep to the common flexors origin, anterior to the medial epicondyle of the humerus.
- ✓ Here, the point it is accessible for regional anaesthesia.
- ✓ Through the forearm it descends deep to *Flexor digitorum superficialis (sublimis)* muscle.
- ✓ At the wrist it becomes superficial and accessible for regional anaesthesia, in the midline on the ulnar side of *Flexor carpi radialis* muscle.
- ✓ Then, enters the hand deep to the *Flexor retinaculum.*
- ✓ It gives cutaneous supply to the radial side of the palm, and the palmar, and to the dorsal surface of the radial three and a half digits

Ulnar nerve

- ✓ The ulnar nerve descends medial to the axillary artery.
- ✓ Then, it pierces the medial intermuscular septum and crosses the elbow behind the medial epicondyle.
- ✓ It descends the forearm deep to *Flexor carpi ulnaris* muscle and on the ulnar side of the ulnar artery.
- ✓ About 5 cm above the wrist **a dorsal cutaneous nerve** emerges to supply the dorsal aspects of the ulnar, one and a half digits.
- ✓ The main nerve crosses superficial to the *Flexor retinaculum* to supply intrinsic muscles of the hand and the palmar one and a half digits.

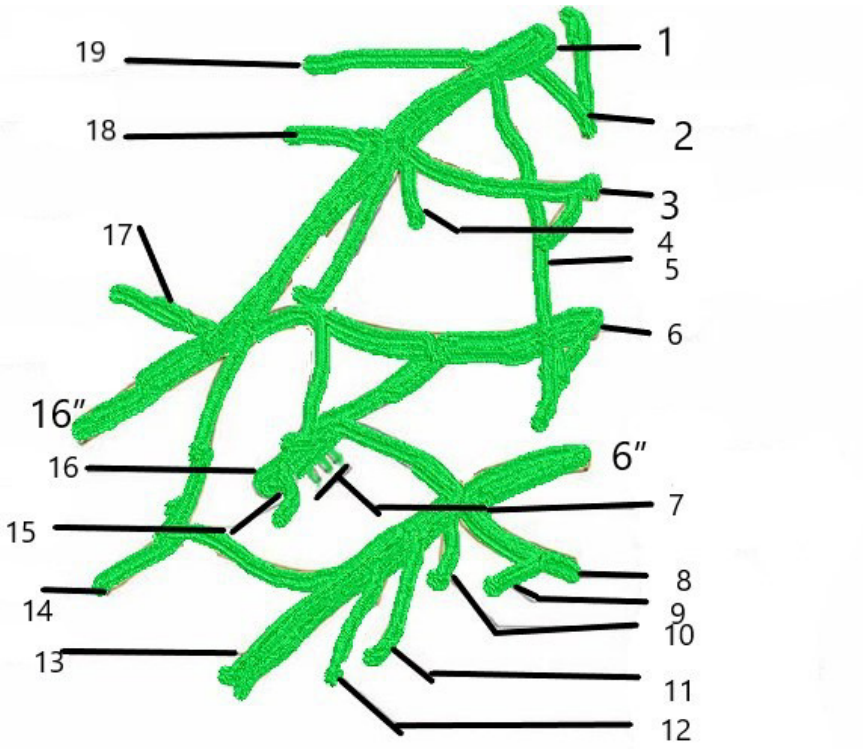

Figure 18: Brachial Plexus. 1. C5 root, 2. Phrenic nerve, 3. C6 root, 4. Nerve to Subclavius muscle, 5. Nerve to Serratus Anterior muscle, 6. C7 root, 6”. C8 root, 7. Nerve to Latissimus dorsi muscle (thoracodorsal nerve), between two subscapular nerves, 8. T1 root, 9. First intercostal nerve, 10. Medial pectoral nerve, 11. Medial cutaneous nerve of arm, 12. Medial cutaneous nerve of forearm, 13. Ulnar nerve, 14. Median nerve, 15. Axillary nerve, 16. Radial nerve, 16”. Musculocutaneous nerve, 17. Lateral pectoral nerve, 18. Subscapular nerve, 19. Nerve to Rhomboidei muscles.

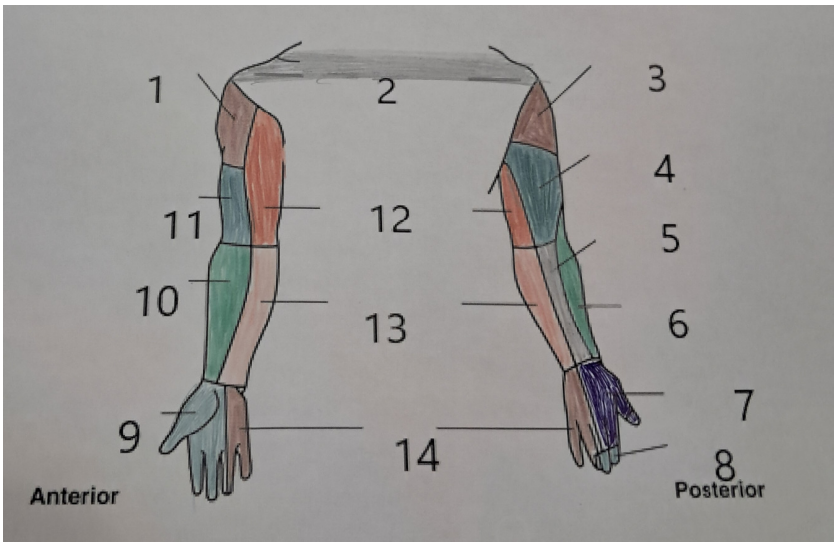

Figure 19: Brachial Plexus, Sensitive Innervation of the Skin. 1. Upper lateral brachial cutaneous (axillary) nerve, 2. Supraclavicular nerve, 3. Upper lateral brachial cutaneous (axillary) nerve, 4. Posterior brachial cutaneous (radial) and lower lateral brachial cutaneous nerves, 5. Posterior antebrachial cutaneous (radial) nerve, 6. Lateral antebrachial cutaneous (musculocutaneous) nerve, 7. Radial nerve, 8. Median nerve, 9. Median nerve, 10. Lateral antebrachial cutaneous (musculocutaneous) nerve, 11. 4. Posterior brachial cutaneous (radial) and lower lateral brachial cutaneous nerves, 12. Medial brachial cutaneous and intercostobrachial nerves, 13. Medial antebrachial cutaneous nerve, 14. Ulnar nerve.

Nerves injury

Alina Maria Șișu

1. **Axillary nerve:** performs the upper limb abduction nerve *(Deltoideus* muscle).
    - ✓ It gives the shape of the shoulder.
    - ✓ "The coat" signis seen in the scapulohumeral periarthritis.

2. Radial nerve: makes extension of the forearm, hand and digits nerve.

- ✓ “Swan neck” and “bell tongue” signs are seen when the nerve is injuried.

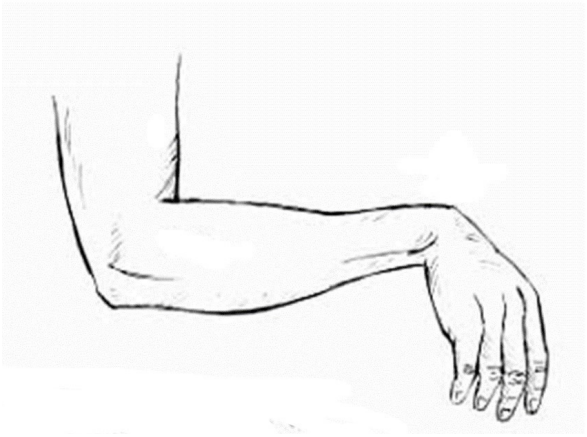

Figure 20: Ulnar nerve injury, wrist drop.

3. Musculocutaneous nerve: performes flexion of the forearm to arm.

- ✓ Its lesion leads to a weak supination and flexion.

4. Ulnar nerve: makes hand and digits flexion.

- ✓ The interossei muscles are atrophied, leading to the “claw hand”.

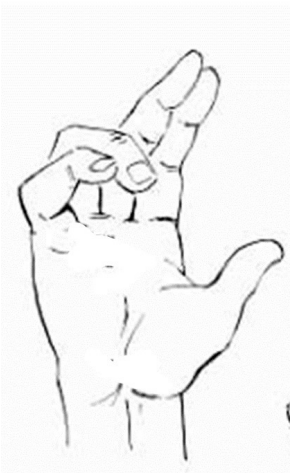

Figure 21: Claw Hand, Ulnar nerve injury.

5. Median nerve: makes pronation and hand and digits flexion nerve.

- ✓ The lesion is called “ape hand”, because the thenar eminence is atrophied.
- ✓ The thumb is in adduction, indicis and medius in extension.
- ✓ This sign is called the “gynaecologist or benediction hand”.
- ✓ There is no opposition of the *Pollicis brevis* muscle, and the condition is called “the newspaper sign” (cannot do the pronation).

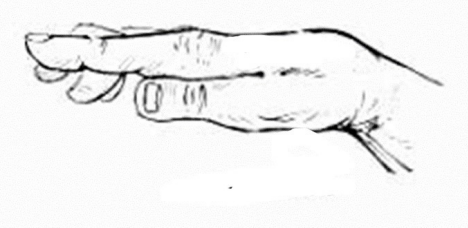

Figure 22: Median nerve injury, Thenar eminencve atrophy.

VIII. *NOMINA ANATOMICA* TRANSLATED INTO ENGLISH

Alina Maria Șișu

Os longum=long bone
Os breve=short bone
Os planum=flat bone
Os pneumaticum=pneumatic bone
Epiphysis=epyphisis
Diaphysis =diaphysis
Cartilago epiphysialis=epiphysal cartilage
Linea epiphysialis=epiphysal line
Synostosis=synostosis
Apophysis=apophysis
Facies articularis =articulate surface
Substantia compacta=compact substance
Substantia corticalis=cortical substance
Substantia spongiosa=spongy substance
Cavum medullare=medular cavity
Medulla ossium flava=white medullary bone
Medulla osium rubra=red medullary bone
Foramen nutricium=nutrient hole
Foramen intervertebrale=intervertebral hole
Sulcus n. spinalis=spinal nerve groove
Processus spinosus=spinous process
Processus transverses=transverse process
Fovea costalis transversalis=transversal costal facet

Tuberculum anterius vertebrarum cervicalium=anterior tubercle of cervical vertebra

Tuberculum caroticum vertebrae cervicalis VI=carotic tubercle of VI cervical vertebra

Foramen transversarium=transveral foramen

Tuberculum posterius vertebrarum cervicalium=posterior tubercle of cervical vertebra

Processus articularis superior=superior articular process

Canalis nutricius=nutrient canal

***OSSA MEMBRI SUPERIORIS*=upper limb bones**

***Cingulum membri superioris*=upper limb girdle**

***Scapula*=scapula**

Facies costalis=costal surface

Fossa subscapularis=subscapular fosa

Facies dorsalis=dorsal surface

Spina scapulae=spine of scapula

Fossa supraspinata=supraspinatus fossa

Fossa infraspinata=infraspinatus fossa

Acromion=acromion

Facies articularis acromii=acromion articular surface

Angulus acromialis=acromial angle

Margo medialis=medial border

Margo lateralis=lateral border

Margo superior=superior border

Incisura scapulae=scapular incisure

Angulus inferior=inferior angle

Angulus lateralis=lateral angle

Angulus superior=superior angle

Cavitas glenoidalis=glenoid cavity

Collum scapulae=neck of scapula

Tubercuum infraglenoidale=infraglenoid tubercle

Tuberculum supraglenoidale=supraglenoid tubercle

Processus coracoideus=coracoid process

***Clavicula*=clavicle**

Extremitas sternalis=sternal extremity

Facies articularis sternalis=sternal articular surface

Impressio lig. Costoclavicularis=costoclavicular ligament impression

Extremitas acromialis=acromial extremity

Facies articularis acromialis=acromial articular surface

Tuberculum conoideum=conoid tubercle

Linea trapezoidea=trapezoid line

***Skeleton membri superioris liberi*=skeleton of the free upper limb**

***Humerus*=humerus**

Caput humeri=humeral head

Collum anatomicum=anatomical neck

Collum chirurgicum=surgical neck

Tuberculum majus=greater tubercle

Tuberculum minus=lesser tubercle

Sulcus intertubercularis=intertubercular groove

Crista tuberculi majoris=greater tubercle crest

Crista tuberculi minoris=lesser tubercle crest

Corpus humeri=humeral body

Facies anterior medialis=medial anterior surface

Facies anterior lateralis=lateral anterior surface

Facies posterior=posterior surface

Margo medialis=medial border

Margo lateralis=lateral border

Tuberositas deltoidea=deltoid tuberosity

Sulcus n. radialis=radial nerve groove

Condylus humeri=humeral condyle

Capitulum humeri=humeral capitulum

Trochlea humeri=humeral trochlea

Fossa olecrani=olecranon fossa

Fossa coronoidea=coronoi fossa

Fossa radialis=radial fossa

Epicondylus medialis=medial epicondyle

Sulcus n. ulnaris=ulnar nerve groove

Epicondylus lateralis=lateral epicondyle

Processus supracondylaris=supracondylar process

***Radius*=radius**

Caput radii=radial head

Circumferentia articularis=articular circumference

Colum radii=radial neck

Corpus radii=radial body

Tuberositas radii=radial tuberosity

Margo interosseus=interosseous border

Facies posterior=posterior surface

Facies anterior=anterior surface

Facies lateralis=lateral surface

Margo posterior=posterior border

Margo anterior=anterior border

Processus styloideus=styloid process

Incisura ulnaris=ulnar incisure

Facies articularis carpea=carpal articular surface

***Ulna*=ulna**

Olecranon=olecranon

Processus coronoideus=coronoid process

Tuberositas ulnae=ulnar tuberosity

Incisura trochlearis=trochlear incisure

Incisura radialis=radial incisure

Corpus ulnae=ulnar body

Facies posterior=posterior surface

Facies anterior=anterior surface

Facies medialis=medial surface

Margo interosseus=interosseous border

Margo posterior=posterior border

Margo anterior=anterior border

Crista m. supraspinatoris=crest of supraspinatus muscle

Caput ulnae=ulnar head

Circumferentia articularis=articular circumference

Processus styloideus=styloid process

***Carpus*=carpus**

***Ossa carpi*=carpal bones**

Os centrale=central bone

Os schapoideum=scaphoid

Tuberculum oss. schapoidei=scaphoid bone tubercle

Os lunatum=lunate

Os triquetrum=triqetrum

Os pisiforme=pisiform

Os trapezium=trapezium

Tuberculum oss. trapezii=tubercle of trapezoid bone

Os trapezoideum=trapezoid

Os capitatum=capitate

Os hamatum=hamate

Hamulus oss. hamati=the hook-like process of hamate

Sulcus carpi=carpal groove

***Metacarpus*=metacarpus**

Ossa metacarpalia I-V=I-V metacarpal bones

Basis=base

Corpus=body

Caput=head

Os metacarpale III=III metacarpal bone

Processus styloideus=styloid process

***Ossa digitorum manus*=bones of the hand digits**

Phalanx proximalis=proximal phalange

Phalanx media=middle phalange

Phalanx distalis=distal phalange

Tuberositas phalangis distalis=tuberosity of distal phalange

Basis phalanges=base of phalange

Corpus phalanges=body of phalange

Caput phalanges=head of phalange

Ossa sesamoidea=sesamoid bones

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