ASSIGNMENT ON

“Upper limb “

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1st SEMESTER ANESTHESIA

MID TERM

UPPER LIMB

The **upper limb** or **upper extremity** is the region in a vertebrate animal extending from the deltoid region up to and including the hand, including the arm, axilla and shoulder.

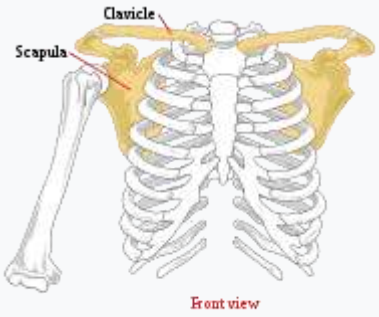
DEFDINITION

In formal usage, the term "arm" only refers to the structures from the shoulder to the elbow, explicitly excluding the forearm, and thus "upper limb" and "arm" are not synonymous. However, in casual usage, the terms are often used interchangeably. The term "upper arm" is redundant in anatomy, but in informal usage is used to distinguish between the two terms.

Structure

In the human body the muscles of the upper limb can be classified by origin, topography, function, or innervation. While a grouping by innervation reveals embryological and phylogenetic origins, the functional-topographical classification below reflects the similarity in action between muscles (with the exception of the shoulder girdle, where muscles with similar action can vary considerably in their location and orientation.

1. SHOULDER GIRDLE



BONES OF THE SHOULDEL GIRDLE

The shoulder girdle or pectoral girdle composed of the clavicle and the scapula, connects the upper limb to the axial skeleton through the sternoclavicular joint (the only joint in the upper limb that directly articulates with the trunk), a ball and socket joint supported by the subclavius muscle which acts as a dynamic ligament. While this muscle prevents dislocation in the joint, strong forces tend to break the clavicle instead. The acromioclavicular joint, the joint between the acromion process on the scapula and the clavicle, is similarly strengthened by strong ligaments, especially the coracoclavicular ligament which prevents excessive lateral and medial movements. Between them these two joints allow a wide range of movements for the shoulder girdle, much because of the lack of a bone-to-bone contact between the scapula and the axial skeleton. The pelvic girdle is, in contrast, firmly fixed to the axial skeleton, which increases stability and load-bearing capabilities.

The mobility of the shoulder girdle is supported by a large number of muscles. The most important of these are muscular sheets rather than fusiform or strap-shaped muscles and they thus never act in isolation but with some fibres acting in coordination with fibres in other muscles.

MUSCLES

of shoulder girdle excluding the glenohumeral joint.

MIGRATED FROM HEAD

Trapezius, sternocleidomastoideus, omohyoideus

POSTERIOR

Rhomboideus major, rhomboideus minor, levator scapulae

ANTERIOR

Subclavius, pectoralis minor, serratus anterior

SHOULDER JOINT

The glenohumeral joint (colloquially called the shoulder joint) is the highly mobile ball and socket joint between the glenoid cavity of the scapula and the head of the humerus. Lacking the passive stabilisation offered by ligaments in other joints, the glenohumeral joint is actively stabilised by the rotator cuff, a group of short muscles stretching from the scapula to the humerus. Little inferior support is available to the joint and dislocation of the shoulder almost exclusively occurs in this direction.

The large muscles acting at this joint perform multiple actions and seemingly simple movements are often the result of composite antagonist and protagonist actions from several muscles. For example, pectoralis major is the most important arm flexor and latissimus dorsi the most important extensor at the glenohumeral joint, but, acting together, these two muscles cancel each other's action leaving only their combined medial rotation component. On the other hand, to achieve pure flexion at the joint the deltoid and supraspinatus must cancel the adduction component and the teres minor and infraspinatus the medial rotation component of pectoralis major. Similarly, abduction (moving the arm away from the body) is performed by different muscles at different stages. The first 10° is performed entirely by the supraspinatus, but beyond that fibres of the much stronger deltoid are in position to take over the work until 90°. To achieve the full 180° range of abduction the arm must be rotated medially and the scapula most be rotated about itself to direct the glenoid cavity upward.

MUSCLES

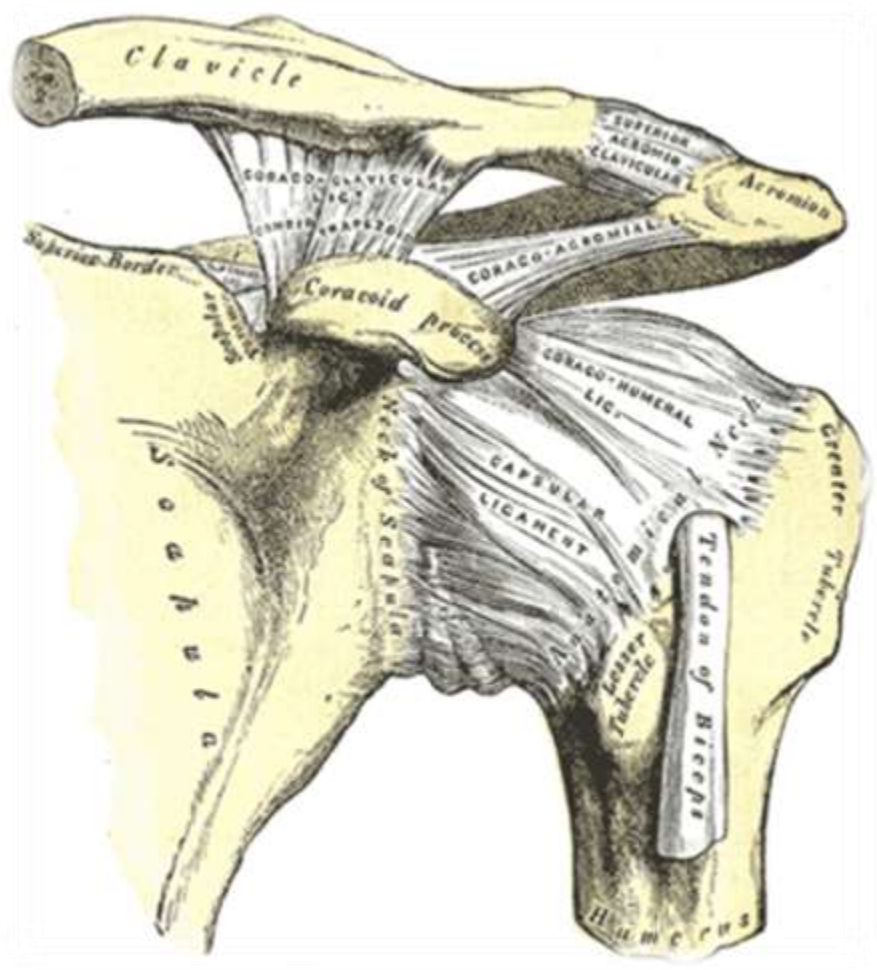
of shoulder joint proper

POSTERIOR

Supraspinatus, infraspinatus, teres minor, subscapularis, deltoideus, latissimus dorsi, teres major

ANTERIOR

Pectoralis major, coracobrachialis



Shoulder joint with ligaments

2. WRIST

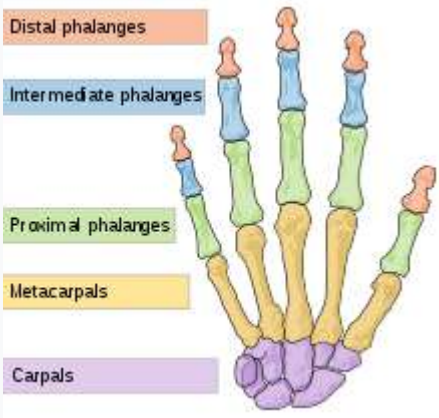
The wrist (Latin: *carpus*), composed of the carpal bones, articulates at the wrist joint (or radiocarpal joint) proximally and the carpometacarpal joint distally. The wrist can be divided into two components separated by the midcarpal joints. The small movements of the eight carpal bones during composite movements at the wrist are complex to describe, but flexion mainly

occurs in the midcarpal joint whilst extension mainly occurs in the radiocarpal joint; the latter joint also providing most of adduction and abduction at the wrist.

3D Medical Animation still shot of Human Wrist

How muscles act on the wrist is complex to describe. The five muscles acting on the wrist directly — flexor carpi radialis, flexor carpi ulnaris, extensor carpi radialis, extensor carpi ulnaris, and palmaris longus — are accompanied by the tendons of the extrinsic hand muscles (i.e. the muscles acting on the fingers). Thus, every movement at the wrist is the work of a group of muscles; because the four primary wrist muscles (FCR, FCU, ECR, and ECU) are attached to the four corners of the wrist, they also produce a secondary movement (i.e. ulnar or radial deviation). To produce pure flexion or extension at the wrist, these muscle therefore must act in pairs to cancel out each other's secondary action. On the other hand, finger movements without the corresponding wrist movements require the wrist muscles to cancel out the contribution from the extrinsic hand muscles at the wrist.

HAND



Bones of the hand

The hand (Latin: *manus*), the metacarpals (in the hand proper) and the phalanges of the fingers, form the metacarpophalangeal joints (MCP, including the knuckles) and interphalangeal joints (IP).

Of the joints between the carpus and metacarpus, the carpometacarpal joints, only the saddle-shaped joint of the thumb offers a high degree of mobility while the opposite is true for the metacarpophalangeal joints. The joints of the fingers are simple hinge joints.

The primary role of the hand itself is grasping and manipulation; tasks for which the hand has been adapted to two main grips — power grip and precision grip. In a power grip an object is held against the palm and in a precision grip an object is held with the fingers, both grips are performed by intrinsic and extrinsic hand muscles together. Most importantly, the relatively strong thenar muscles of the thumb and the thumb's flexible first joint allow the special opposition movement that brings the distal thumb pad in direct contact with the distal pads of the other four digits. Opposition is a complex combination of thumb flexion and abduction that also requires the thumb to be rotated 90° about its own axis. Without this complex movement, humans would not be able to perform a precision grip.

In addition, the central group of intrinsic hand muscles give important contributions to human dexterity. The palmar and dorsal interossei adduct and abduct at the MCP joints and are important in pinching. The lumbricals, attached to the tendons of the flexor digitorum profundus (FDP) and extensor digitorum communis (FDC), flex the MCP joints while extending the IP joints and allow a smooth transfer of forces between these two muscles while extending and flexing the fingers.

MUSCLES

of the hand

METACARPAL

Lumbricals, palmar introssei, dorsal interossei

THENAR

Abductor pollicis brevis, adductor pollicis, flexor pollicis brevis, opponens pollicis

HYPOTHENAR

Abductor digiti minimi, flexor digiti minimi, opponens digiti minimi, palmaris brevis

3. ELBOW JOINTS

The **elbow** is the visible joint between the upper and lower parts of the arm. It includes prominent landmarks such as the olecranon, the elbow pit, the lateral and medial epicondyles, and the **elbow joint**. The elbow joint is the synovial hinge joint between the humerus in the upper arm and the radius and ulna in the forearm which allows the forearm and hand to be moved towards and away from the body.

JOINT CAPSULE

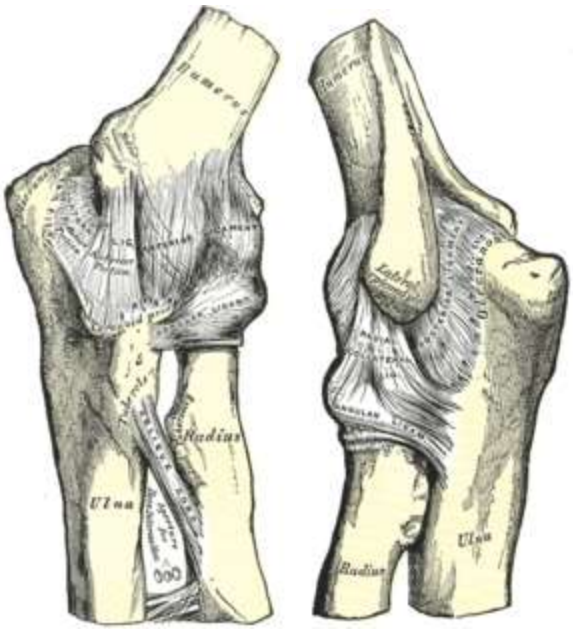
Capsule of elbow-joint (distended). Anterior and posterior aspects.

The elbow joint and the superior radioulnar joint are enclosed by a single fibrous capsule. The capsule is strengthened by ligaments at the sides but is relatively weak in front and behind.

On the anterior side, the capsule consists mainly of longitudinal fibres. However, some bundles among these fibers run obliquely or transversely, thickening and strengthening the capsule. These bundles are referred to as the capsular ligament. Deep fibres of the brachialis muscle insert anteriorly into the capsule and act to pull it and the underlying membrane during flexion in order to prevent them from being pinched.

On the posterior side, the capsule is thin and mainly composed of transverse fibres. A few of these fibres stretch across the olecranon fossa without attaching to it and form a transverse band with a free upper border. On the ulnar side, the capsule reaches down to the posterior part of the annular ligament. The posterior capsule is attached to the triceps tendon which prevents the capsule from being pinched during extension.

LIGAMENTS



Left elbow-joint

Left: anterior and ulnar collateral ligaments

Right: posterior and radial collateral ligaments

MUSCLES

FLEXION

There are three main flexor muscles at the elbow:[10]

- Brachialis acts exclusively as an elbow flexor and is one of the few muscles in the human body with a single function. It originates low on the anterior side of the humerus and is inserted into the tuberosity of the ulna.
- Brachioradialis acts essentially as an elbow flexor but also supinates during extreme pronation and pronates during extreme supination. It originates at the lateral supracondylar ridge distally on the humerus and is inserted distally on the radius at the styloid process.

- Biceps brachii is the main elbow flexor but, as a biarticular muscle, also plays important secondary roles as a stabiliser at the shoulder and as a supinator. It originates on the scapula with two tendons: That of the long head on the supraglenoid tubercle just above the shoulder joint and that of the short head on the coracoid process at the top of the scapula. Its main insertion is at the radial tuberosity on the radius.