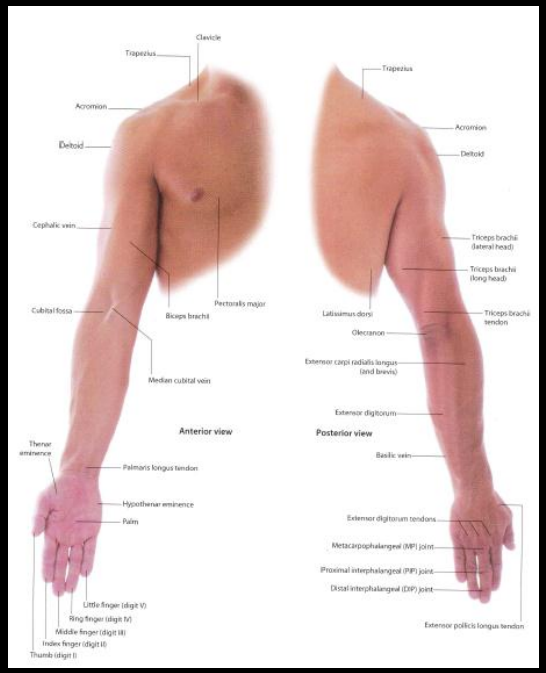
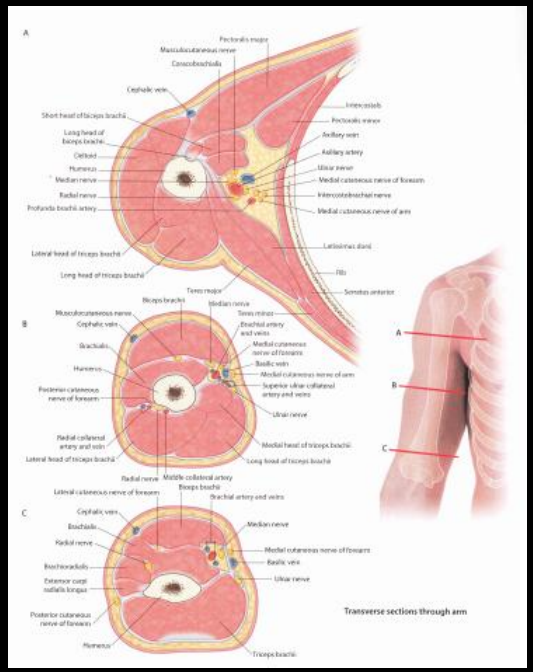
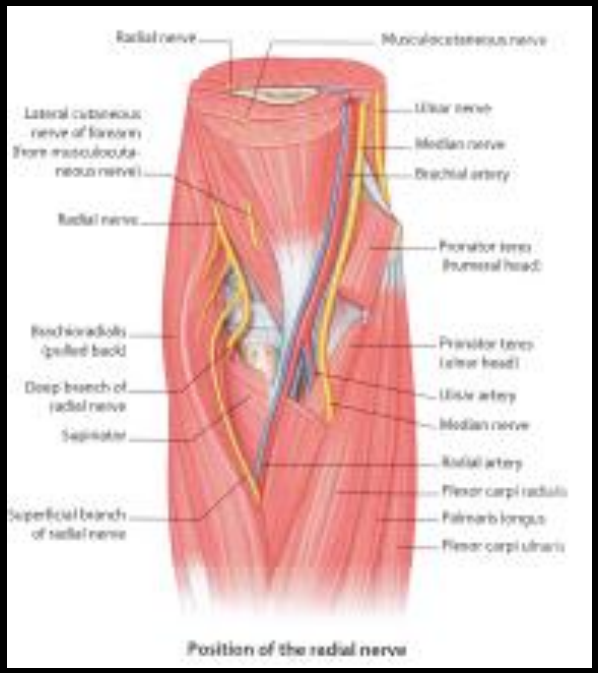
The Arm and Cubital Fossa





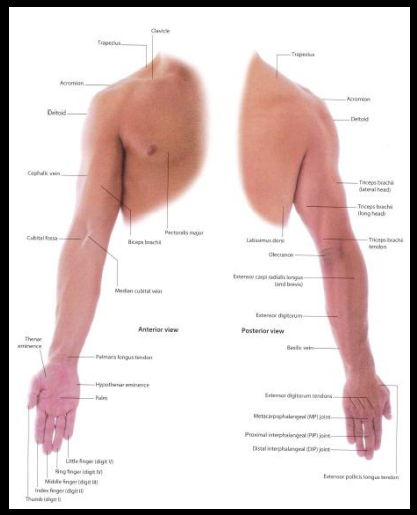


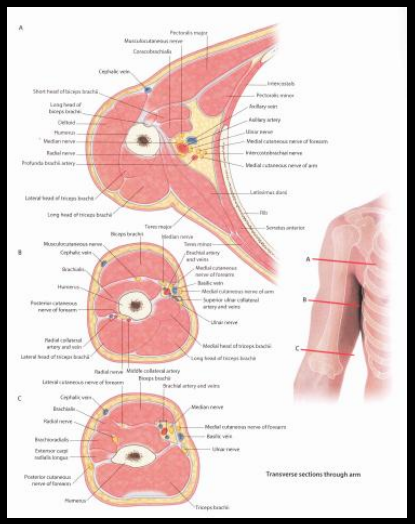
Dr. Andrew Gallagher

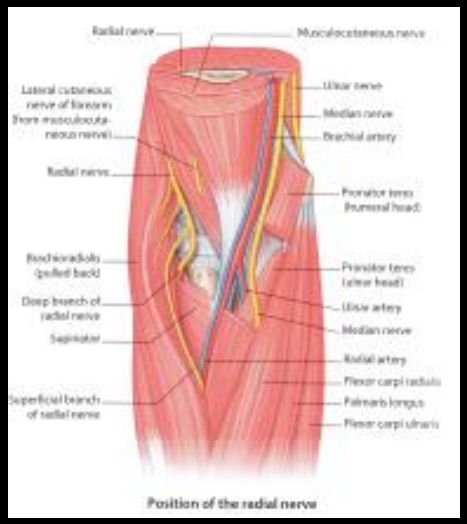
School of Anatomical Sciences

University of the Witwatersrand

Introduction







The ARM (BRACHIUM) is the most proximal segment of the upper limb musculo-skeletal system and articulates with the pectoral girdle at the GLENO-HUMERAL JOINT (Art: Proximal Humerus [Humeral Head], Scapular glenoid fossa, and the ACROMIAL end of the Clavicle).

While the arm incorporates muscles which attach to, and thus act upon, the gleno-humeral joint and pectoral girdle (triceps, biceps brachii, coracobrachialis), the primary function of the ANTERIOR (FLEXOR) and POSTERIOR (EXTENSOR) compartments of the arm is to assist with the various movements of the ELBOW JOINT.

Compartmentalising the Arm

The ANTERIOR (FLEXOR) and POSTERIOR (EXTENSOR) compartments of the arm can be clearly visualised in their relation to the DELTOID (centrally).

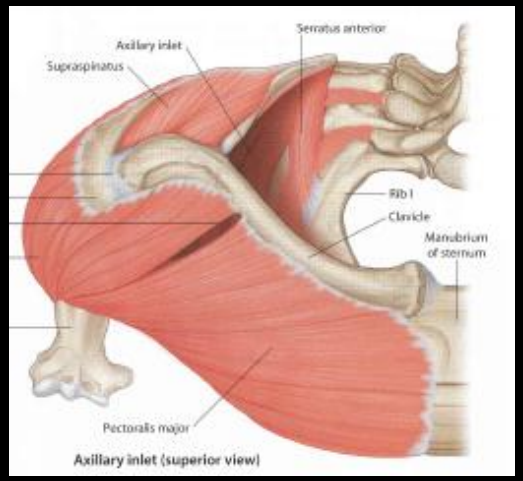
This is a RIGHT arm, with the anterior compartment to the left and the posterior compartment to the right.

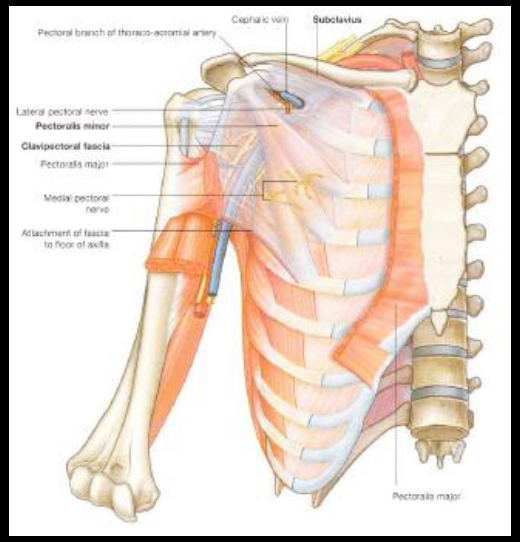
The deltoid muscle is the most obvious topographic structure in visualising the muscular, vascular, and nervous components of the arm.

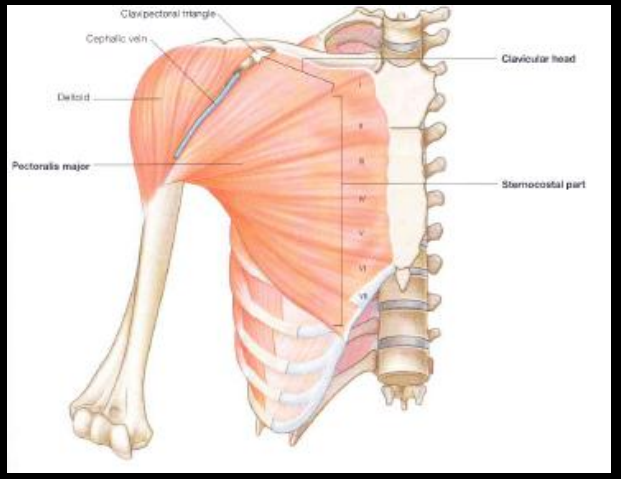
FOUR of the FIVE terminal nerves of the brachial plexus (Musculocutaneous, Median, Radial, and Ulnar nerves) pass through the axilla to enter the upper arm.

The primary arterial supply is via the AXILLARY artery (and its branches) which becomes the BRACHIAL artery upon leaving the axilla proper.

Axilla: Gateway to the Arm







The AXILLA is a musculo-skeletal chamber (ATRIUM) comprising an outlet, inlet, four walls (anterior, posterior, medial and lateral) and a floor, lined with fascia and supported by suspensory ligaments, that allows passage of the primary nervous and vascular structures critical to normal function of the upper limb.

The terminal nerves of the brachial plexus pass within the AXILLARY SHEATH together with the axillary artery and axillary vein. Returning venous blood (deoxygenated) from the tissues of the medial aspect of the arm (SUPINATION) flows through the BASILIC VEIN which is confluent with the AXILLARY VEIN.

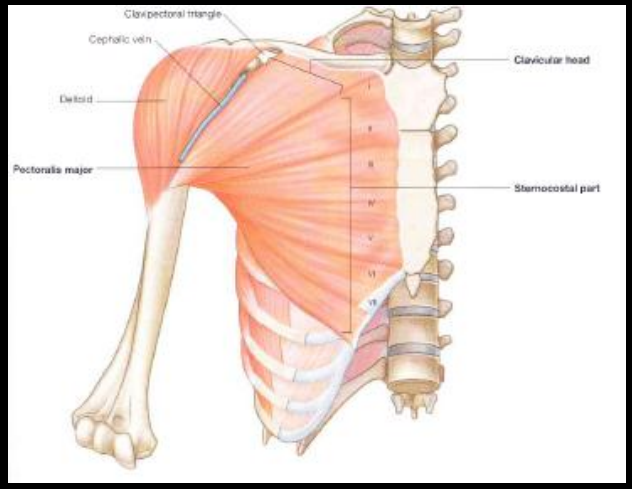
Pectoralis major

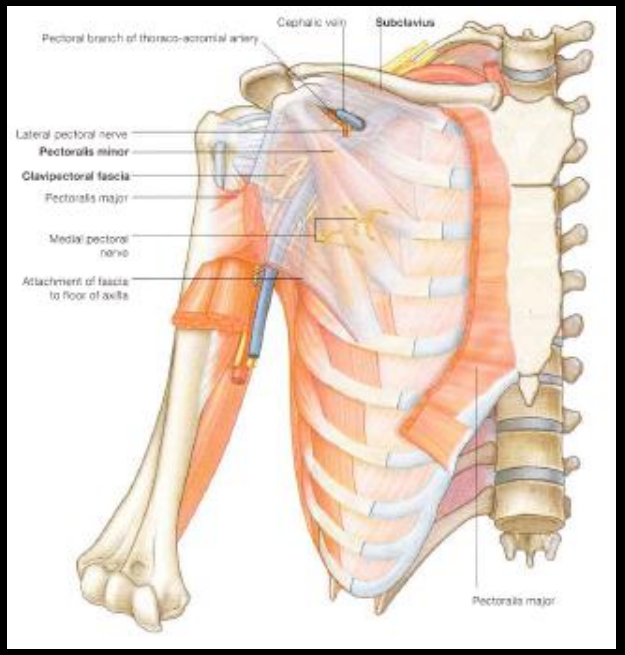
Attachments: Clavicular head: anterior aspect of the medial part of the clavicle Sternocostal head: anterior aspect of the sternum, first 7 costal cartilages, sternal end of rib 6 and the aponeurosis of External oblique (Abdominal part). Inserts in to the lateral margin of the intertubecular (bicipital) groove.

Innervation: Medial and lateral pectoral n.

Vascularisation: Thoracoacromial and lateral thoracic art.

Function: Flexion, adduction and medial rotation of the arm. Flexion of the extended arm





Teres major

Attachments: Inferior angle of the scapula to the medial border of the intertubecular (bicipital) sulcus

Innervation: Lower subscapular nerve

Vascularisation: Subscapular and posterior circumflex humeral art.

Function: Medial rotation and extension of the arm at the gleno-humeral joint

Anterior Compartment: Flexors of the Elbow

The FLEXORS of the GLENO-HUMERAL and ELBOW joints lie in the anterior compartment of the arm and the most obvious (superficially) are the paired bellies of the BICEPS BRACHII.

There are two tendons of the biceps: a LONG HEAD which passes through the intertubecular sulcus [and lesser and greater tubercles] and inserts in to the SUPRAGLENOID TUBERCLE of the scapula.

Deep to biceps brachii, immediately inferior to the insertion of the deltoid tuberosity on the antero-lateral aspect of humeral midshaft (approximately) lies BRACHIALIS, another important flexor of the elbow joint.

The CORACOBRACHIALIS muscle originates (attaches) to the coracoid process of the humerus and acts to FLEX and ADDUCT the arm (gleno-humeral joint)

Coracobrachialis

Attachments: Apex of the coracoid proces to the distal 2/3 of the medial humeral shaft

Innervation: Musculocutaneous nerve

Vascularisation: Axillary art.

Function: Flexor of the gleno-humeral joint, adductor of the arm

Biceps brachii

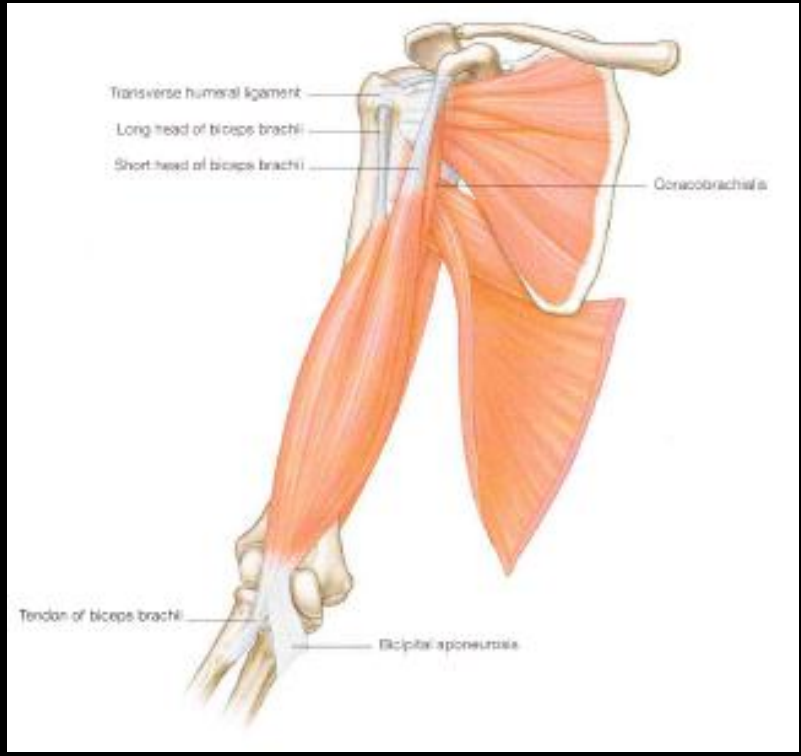
Attachments: LH – Supraglenoid tubercle of the glenoid fossa

SH: Coracoid process. Tendon inserts in to the radial tuberosity

Innervation: Musculocutaneous nerve

Vascularisation: Brachial art.

Function: Flexor of the elbow joint, supinator of the arm, accessory flexor of the gleno-humeral joint



Brachialis

Attachments: Distal 1/3 of the anterior humeral shaft forming a cuff around the insert of deltoid to the brachialis groove (ULNAR TUBEROSITY) on the anterior aspect of the coronoid process of the ulna

Innervation: Musculocutaneous nerve

Vascularisation: Brachial art.

Function: Powerful flexor of the forearm at the elbow joint

Posterior Compartment: Extensors of the Elbow

The EXTENSORS of the GLENO-HUMERAL and ELBOW joints lie in the posterior compartment of the arm and comprises the three heads (proximal attachments) of the TRICEPS BRACHII.

Given that it has attachments on the INFRAGLENOID TUBERCLE (Long Head) and a distal insertion in to the posterior aspect of the OLECRANON PROCESS, contraction of the triceps assists in EXTENSION and ADDUCTION of the gleno-humeral joint (in synergy with CORACOBRACHIALIS.

Deep to the MEDIAL HEAD of triceps on the posterior middle of the humeral shaft lies the RADIAL GROOVE. The radial groove (sulcus) spirals from medial to lateral along its course (superior – inferior) across the posterior diaphysis of the humerus and carries the RADIAL NERVE (posterior cord) and the deep branch of the brachial artery, the PROFUNDA BRACHII.

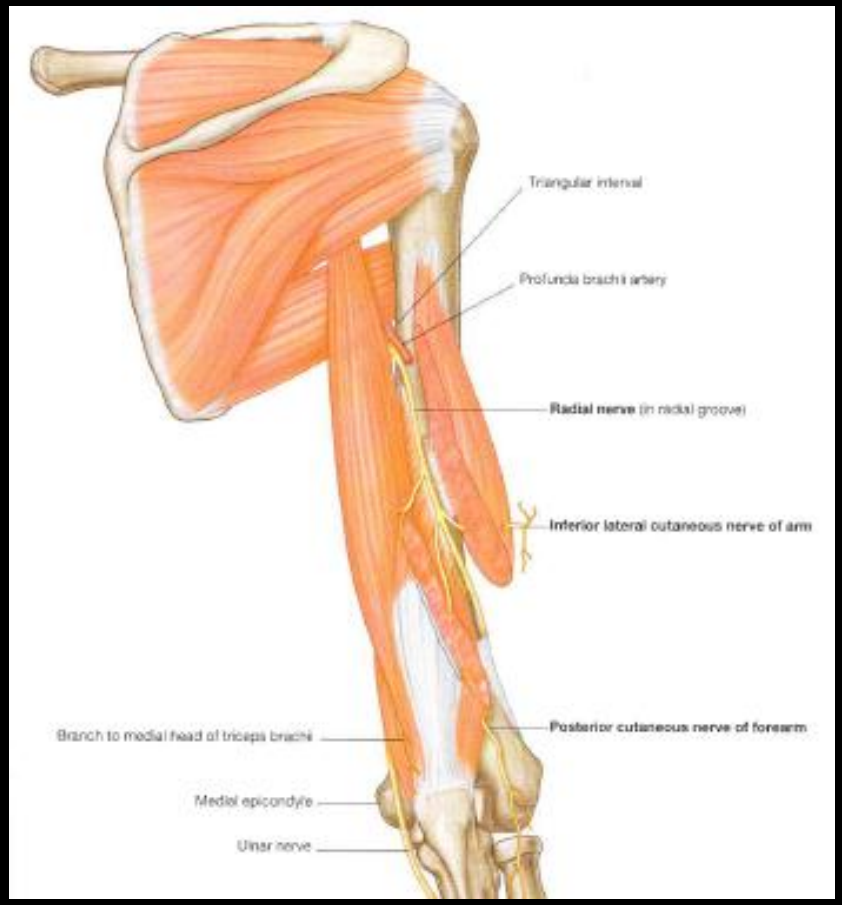
Any serious break of the midshaft of the humerus may potentially jeopardise the artery or the nerve at this point.

Triceps brachii

Attachments: Arises from THREE heads
LH- Infraglenoid tubercle

MH-Medial aspect of the posterior humeral shaft below the spiral groove

LH- Lateral aspect of the posterior humeral shaft below the spiral groove

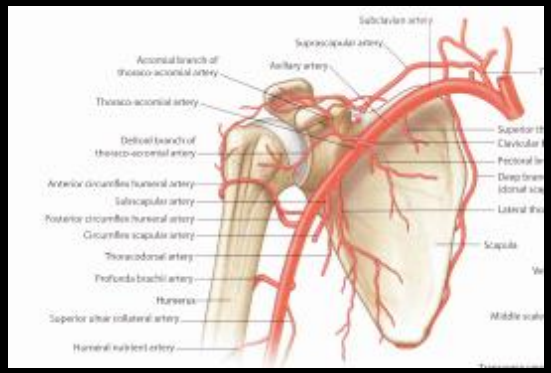


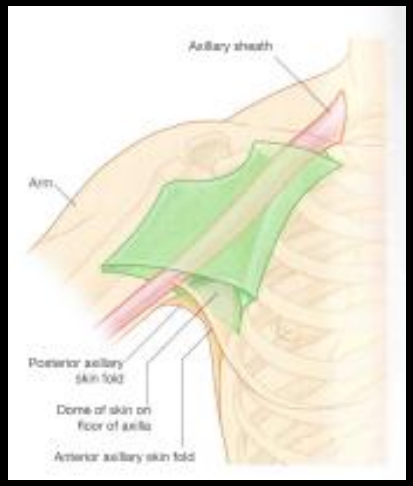
Innervation: Radial nerve

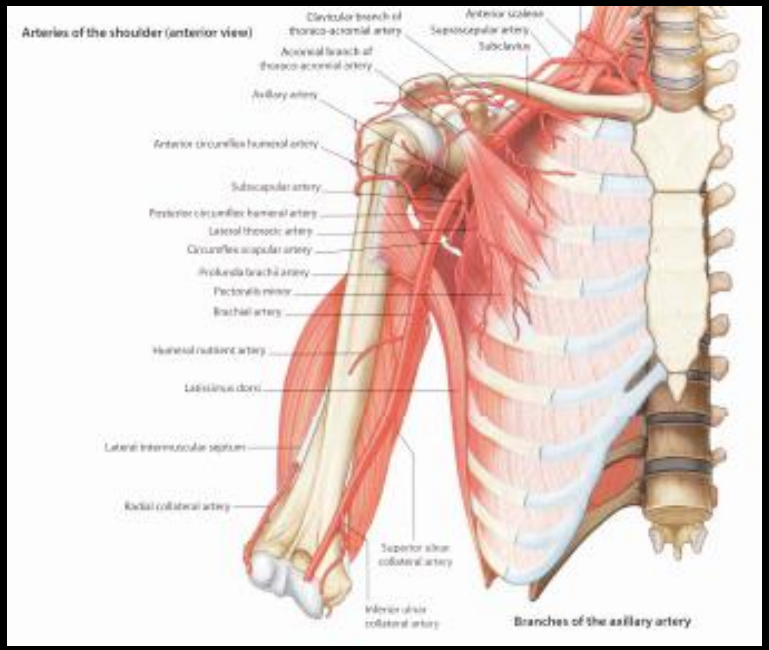
Vascularisation: Profunda brachii

Function: Extensor of the elbow joint. The long head is an extensor and adductor of the gleno-humeral joint

Arteries and Veins of the Upper Arm



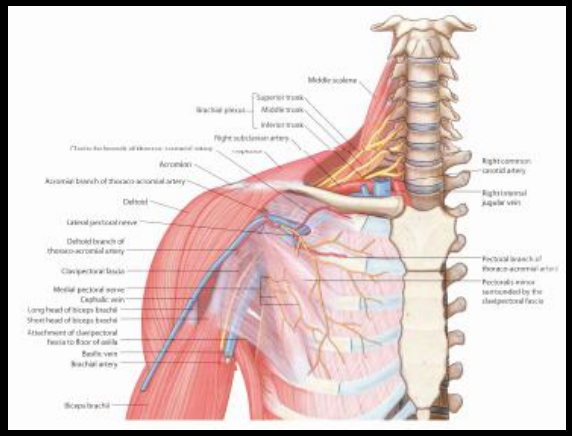


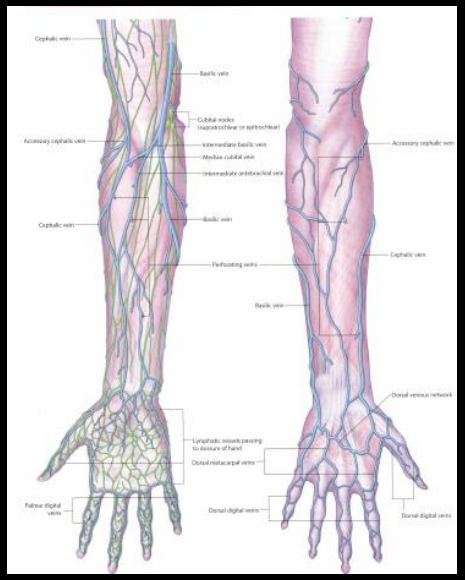


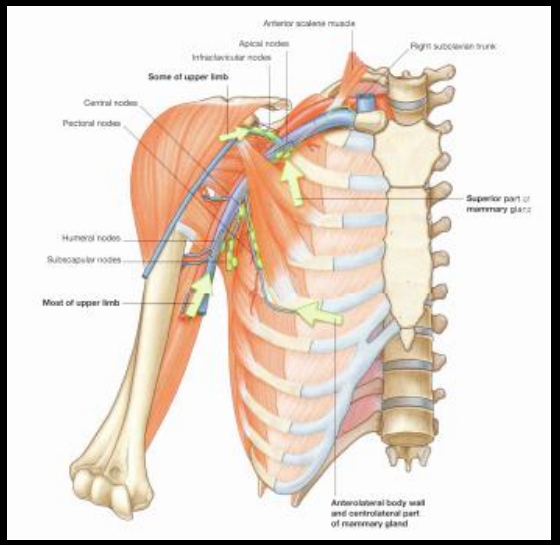
All blood supply to the tissues of the arm, forearm (ANTEBRACHIUM) and hand (MANUS) derives from the BRACHIAL ARTERY. The brachial artery supplies the osteons of humerus via the NUTRIENT ARTERY and the posterior compartment of the arm via the PROFUNDA BRACHII.

The brachial artery follows the MEDIAN NERVE and passes down the medial aspect of the biceps to enter the CUBITAL FOSSA where it bifurcates to form the RADIAL AND ULNAR ARTERIES and their INTEROSSEOUS BRANCHES.

Arteries and Veins of the Upper Arm



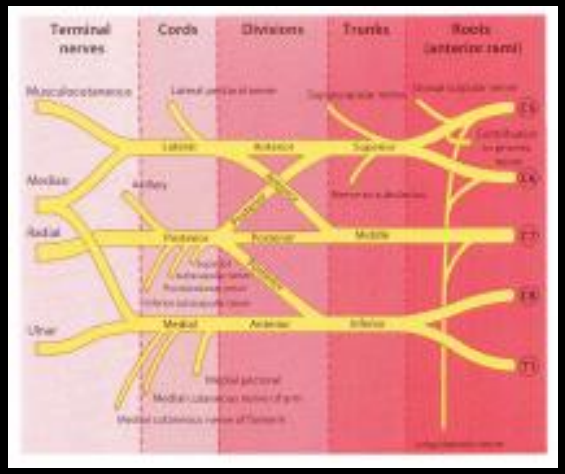


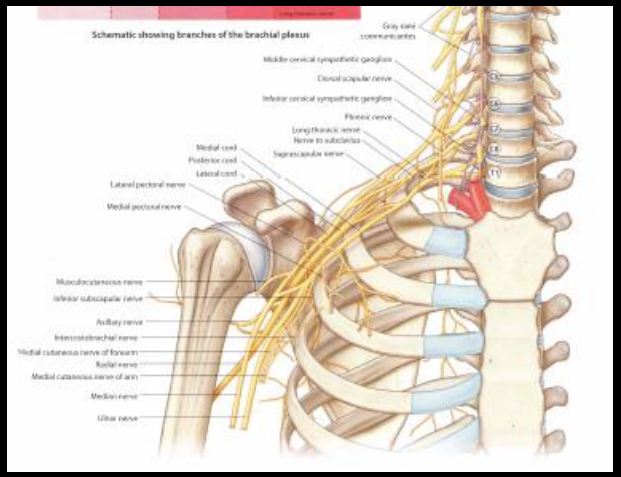


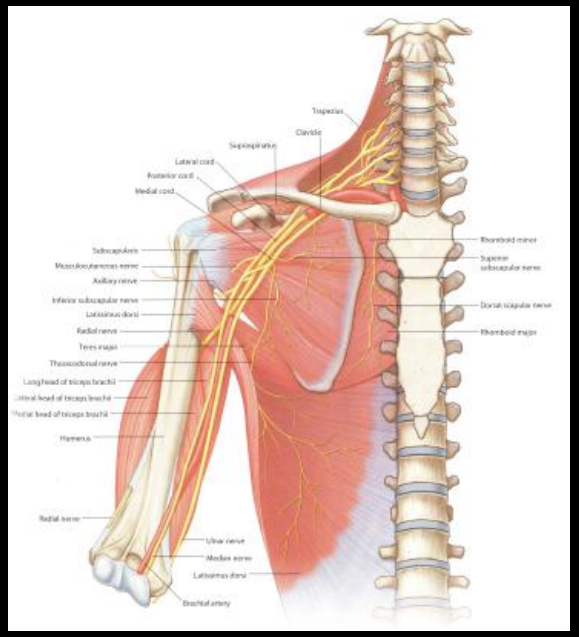
Venous drainage of the tissues of the upper limb is partitioned medially and laterally (in normal anatomical position) by two major veins; the BASILIC (medial) and CEPHALIC (lateral), respectively. The basilic vein and its tributaries drain directly in to the axillary vein within the axillary sheath.

The cephalic vein course up the lateral aspect of the upper arm and the angles along the course of the junction of the DELTOID and PECTORALIS MAJOR and enters the axilla superiorly via the CLAVIPECTORAL TRIANGLE. The junction of the cephalic and axillary veins occurs at the level of the posterolateral curvature of R2.

Nerve Pathways of the Upper Arm







All of the tissues of the upper limb are innervated by the terminal nerves of the brachial plexus. These nerves innervate discreet compartments of muscles of the brachium and antebrachium.

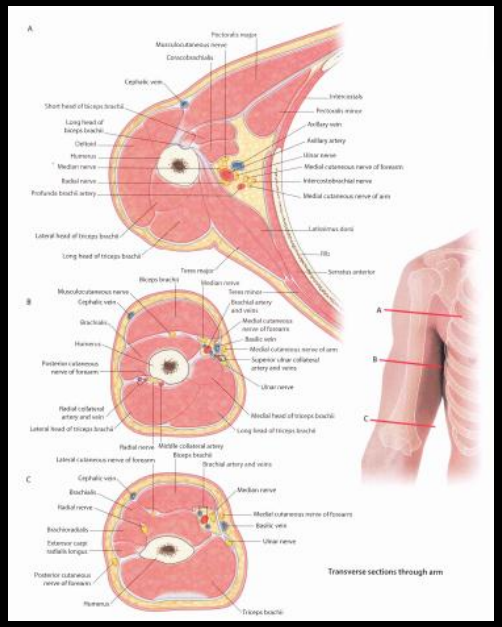
MUSCULOCUTANEOUS – Anterior compartment of the ARM and lateral skin of FOREARM

RADIAL – Posterior compartment of the ARM (Triceps) and forearm (EXTENSORS)

MEDIAN – Anterior compartment of the FOREARM and THENAR muscles of hand

ULNAR – Anterior compartment of the FOREARM (partially) and HYPOTHENAR mucles

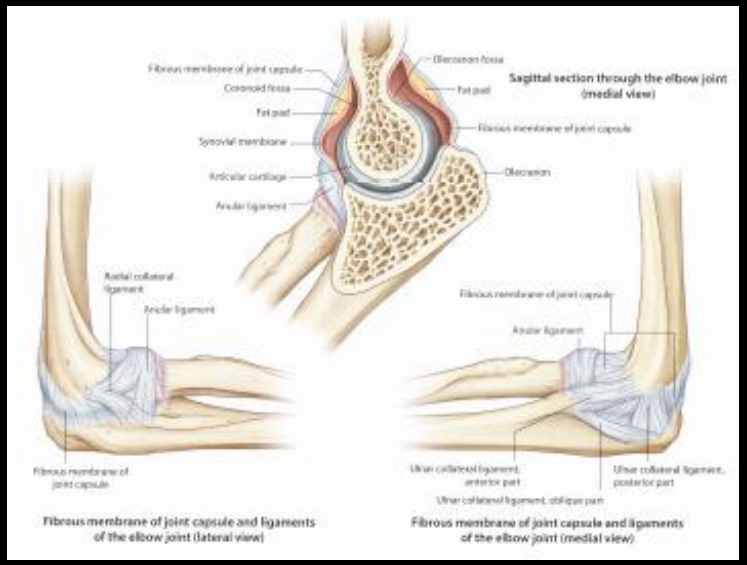
Surface Anatomy of the Elbow and Cubital Fossa

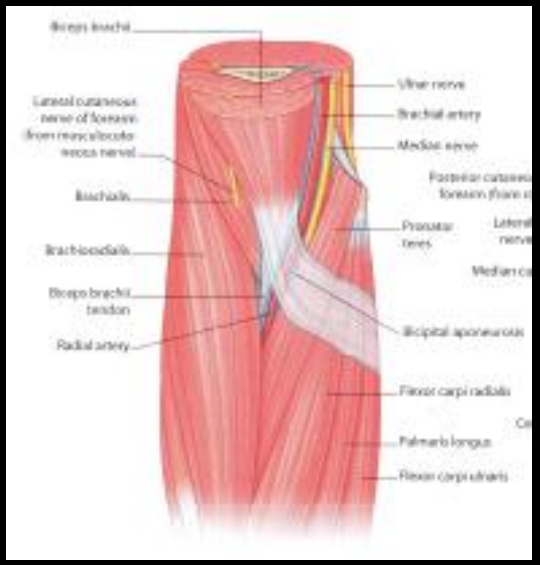


The most obvious surface topographic structure of the ANTERIOR aspect of the elbow joint (in normal anatomical position) is the MEDIAN CUBITAL VEIN which links the CEPHALIC (laterally) and BASILIC (medially) veins.

If the forearm and digits are FLEXED, BRACHIORADIALIS is prominent and gentle palpation of the medial aspect of the raised muscle at the forearm leads to ready identification of the LATERAL margins of the CUBITAL FOSSA.

Conceptualising the Cubital Fossa



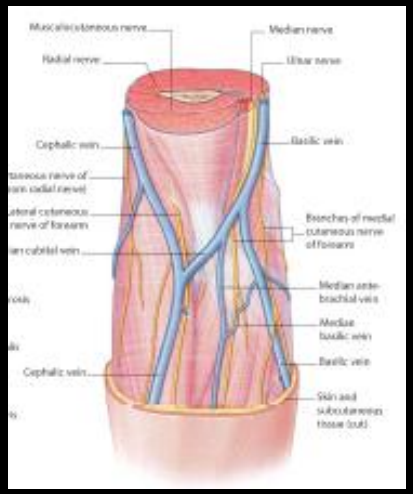


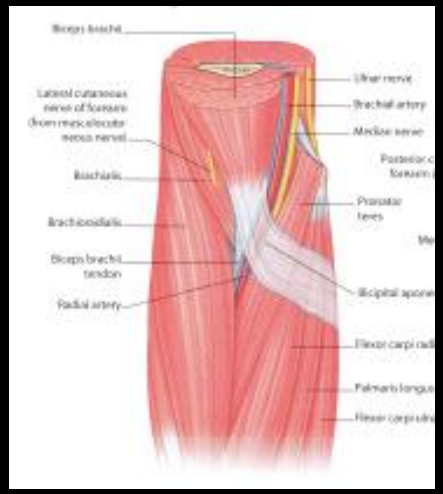
The CUBITAL FOSSA is formed by the articulations of the DISTAL HUMERUS, PROXIMAL RADIUS, and PROXIMAL ULNA.

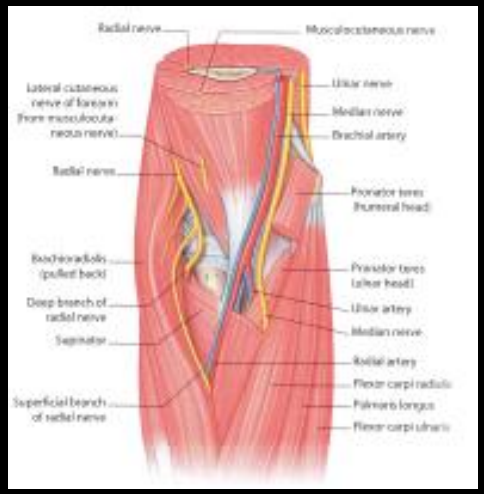
When the joint is flexed (to an angle of ~ 90°), we can easily envisage a space between the attachments of the flexors (medial) and extensors (lateral) which is like a rectangular prism with its greatest dimension spanning the entire articular surface of the distal radius.

The cubital fossa is critical as it is the locus of the divergence of the BRACHIAL ARTERY in to its discreet forearm vessels, the RADIAL (lateral) and ULNAR (medial arteries, their RECURRENT, and INTEROSSEOUS (deep, perforating) branches.

Borders of the Cubital Fossa







The cubital fossa is only rectangular in the region of its BASE and angulates sharply forwards to form a distinct TRIANGULAR structure with distinct MEDIAL and LATERAL borders, which are muscular. There is also a muscular floor.

BASE – An imaginary line transecting the midpoints of the MEDIAL and LATERAL EPICONDYLES of the distal humerus (common flexor and extensor attachments)

MEDIAL – The LATERAL border of the PRONATOR TERES muscle

LATERAL – The MEDIAL border of the BRACHIORADIALIS muscle

FLOOR – BRACHIALIS muscle

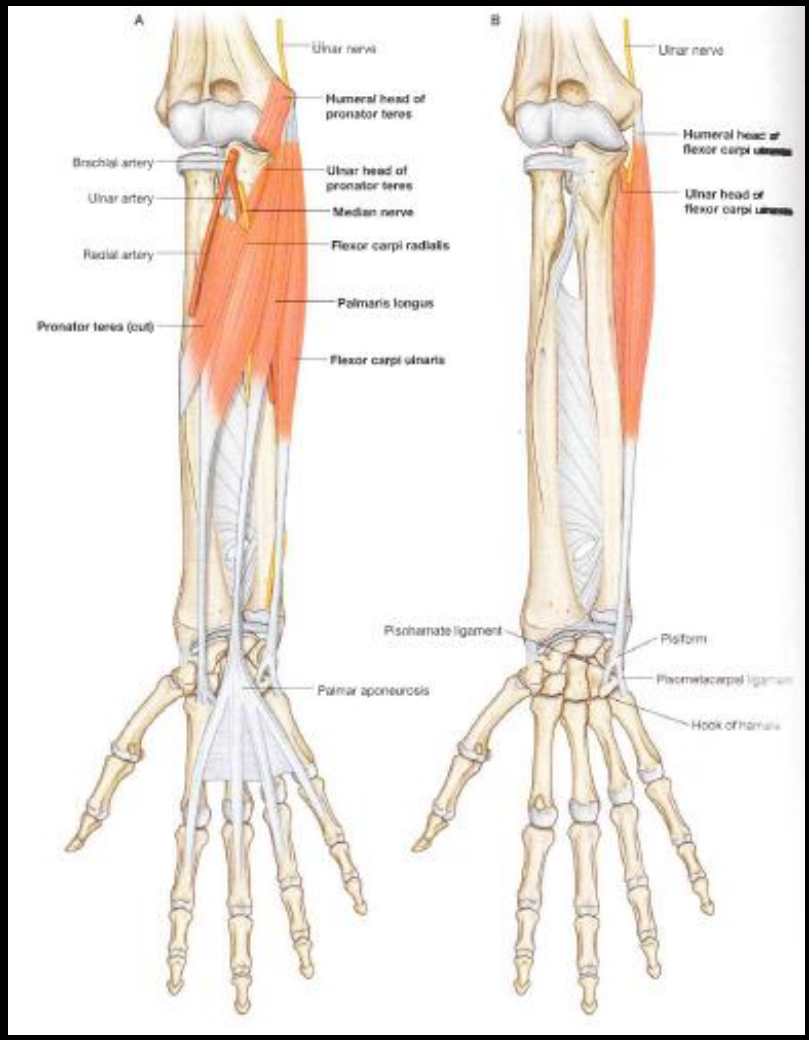
Pronator teres

Attachments: Humeral head – Medial epicondyle and intermuscular septum
Ulnar head – Medial border of proximal ulna
Inserts in to the middle of the lateral border of the radius

Innervation: Median nerve

Vascularisation: Inferior ulnar collateral, anterior ulnar recurrent, common interosseouss art.

Function: Pronator of forearm, weak flexor of the elbow joint



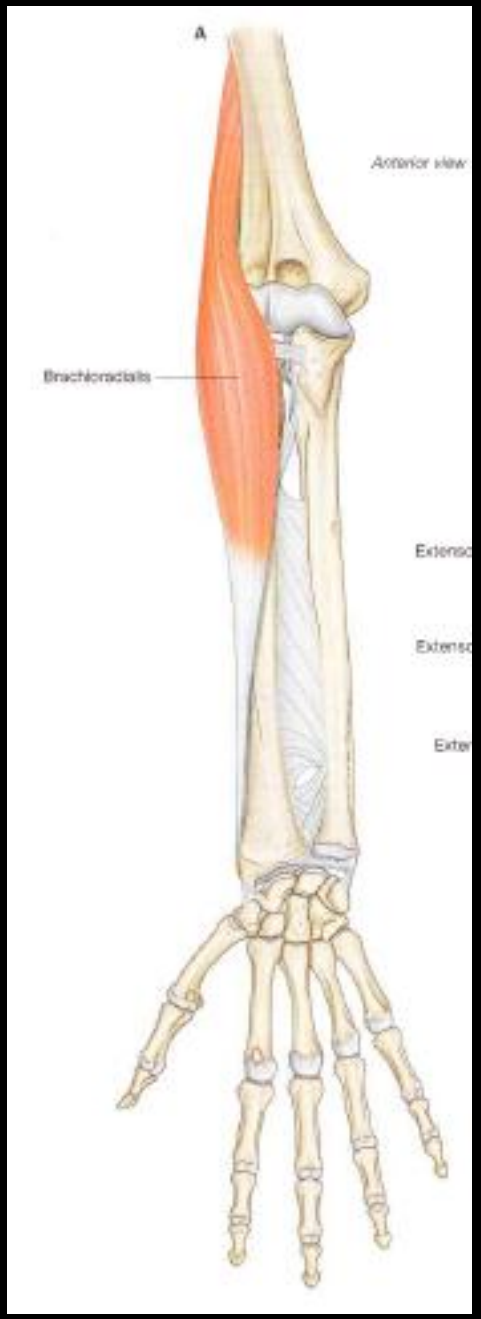
Brachioradialis

Attachments: Superior aspect of the lateral supracondylar ridge of the humerus and adjacent intermuscular septum to the lateral aspect of the distal radius

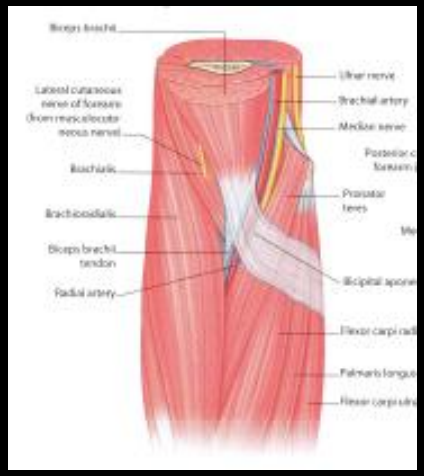
Innervation: Radial nerve

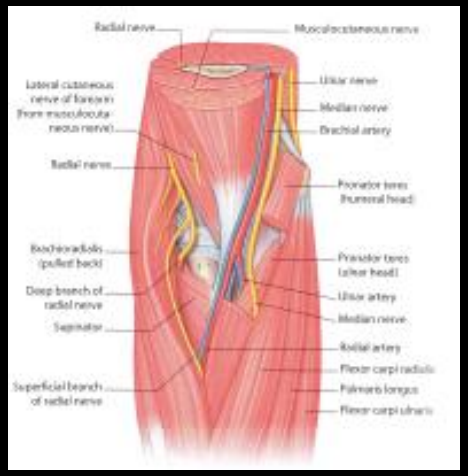
Vascularisation: Radial recurrent art.

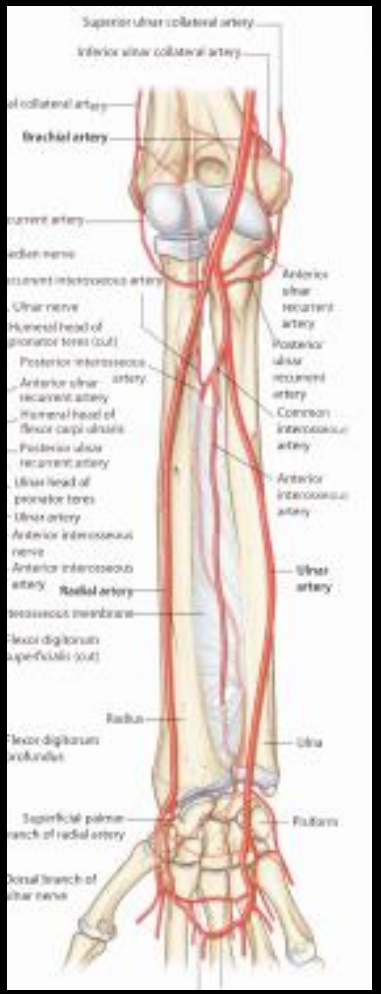
Function: Accessory flexor of the elbow joint during mid-pronation



Contents of the Cubital Fossa







Both the RADIAL (laterally) and MEDIAN (medially) nerves pass centrally to enter the cubital fossa. The ULNAR NERVE deviates posteriorly (superior to the common flexor origin) and passes close to the inferior margins of the medial epicondyle (“funny bone”).

The BRACHIAL ARTERY also enters the cubital fossa and bifurcates in to the RADIAL (laterally) and ULNAR (medially) arteries with their respective RECURRENT branches. The ulnar nerve gives rise to the ANTERIOR and POSTERIOR INTEROSSEOUS BRANCHES.

The paired BRACHIAL VEINS also enter the cubital fossa and give rise to deep branches which follow the radial and ulnar arteries. The tendon of biceps brachii is considered a content of the cubital fossa