

Anterior Axioappendicular Muscles

Muscle	Proximal Attachment (origin)	Distal Attachment (insertion)	Innervation	Main Action
Pectoralis major	Clavicular head: anterior surface of medial half of clavicle Sternocostal head: anterior surface of sternum, superior six costal cartilages, aponeurosis of external oblique muscle	Lateral lip of intertubercular groove of humerus	Lateral and medial pectoral nerves; clavicular head (C5, C6), sternocostal head (C7, C8, T1)	Adducts and medially rotates humerus; draws scapula anteriorly and inferiorly. Acting alone, clavicular head flexes humerus and sternocostal head extends it from the flexed position.
Pectoralis minor	3 rd -5 th ribs and their costal cartilages	Medial border and superior surface of coracoid process of scapula	Medial pectoral nerve (C8, T1)	Stabilizes scapula by drawing it inferiorly and anteriorly against thoracic wall
subclavius	Junction of 1 st rib and its costal cartilage	Inferior surface of middle 3 rd of clavicle	Nerve to subclavius (C5, C6)	Anchors and depresses clavicle
Serratus anterior	External surfaces of lateral parts of 1 st -8 th ribs	Anterior surface of medial border of scapula	Long thoracic nerve (C5, C6 C7)	Protracts scapula and holds it against thoracic wall; rotates scapula

Posterior Axioappendicular and Scapulohumeral Muscles (continued)

Muscle	Proximal Attachment (origin)	Distal Attachment (insertion)	Innervation	Main Action
Superficial posterior axioappendicular (extrinsic shoulder) muscles				
Trapezius	Medial 3 rd of superior nuchal line; external	Lateral 3 rd of clavicle; acromion and spine of	Accessory nerve (CN XI) (motor fibers) and	Descending part elevates; ascending part depresses; and

	occipital protuberance; nuchal ligament; spinous processes of C7-T12 vertebrae	scapula	C3, C4 spinal nerves (pain and proprioceptive fibers)	middle part (or all parts together) retracts scapula; descending and ascending parts act together to rotate glenoid cavity superiorly
Latissimus dorsi	Spinous processes of inferior 6 thoracic vertebrae, thoracolumbar fascia, iliac crest, and inferior 3 or 4 ribs	Floor of intertubercular groove of humerus	Thoracodorsal nerve (C6, C7, C8)	Extends, adducts, and medially rotates humerus; raises body toward arms during climbing
Deep posterior axioappendicular (extrinsic shoulder) muscles				
Levator scapulae	Posterior tubercles of transverse processes of C1-C4 vertebrae	Medial border of scapula superior to root of spine	Dorsal scapular (C5) and cervical (C3, C4) nerves	Elevates scapula and tilts its glenoid cavity inferiorly by rotating scapula
Rhomboid minor and major	Minor: nuchal ligament; spinous processes of C7 and T1 vertebrae Major: spinous processes of T2-T5 vertebrae	Minor: smooth triangular area at medial end of scapular spine Major: medial border of scapula from level of spine to inferior angle	Dorsal scapular nerve (C4, C5)	Retract scapula and rotate it to depress glenoid cavity; fix scapula to thoracic wall
Scapulohumeral (intrinsic shoulder) muscles				
deltoid	Lateral 3 rd of clavicle; acromion and spine of scapula	Deltoid tuberosity of humerus	Axillary nerve (C5, C6)	Anterior part: flexes and medially rotates arm Middle part: abducts arm Posterior part: extends and laterally rotates arm
supraspinatus	Supraspinous fossa of scapula	Superior facet of greater tubercle of humerus	Suprascapular nerve (C4, C5, C6)	Initiates and assists deltoid in abduction of arm and acts with rotator cuff muscles
infraspinatus	Infraspinous fossa of	Middle facet of greater	Suprascapular nerve	Laterally rotate arm; helps hold

	scapula	tubercle of humerus	(C5, C6)	humeral head in glenoid cavity of scapula*
Teres minor	Middle part of lateral border of scapula	Inferior facet of greater tubercle of humerus	Axillary nerve (C5, C6)	
Teres major	Posterior surface of inferior angle of scapula	Medial lip of intertubercular groove of humerus	Lower subscapular nerve (C5, C6)	Adducts and medially rotates arm
subscapular RIS	Subscapular fossa (most of anterior surface of scapula)	Lesser tubercle of humerus	Upper and lower subscapular nerves (C5, C6, C7)	Medially rotates and adduct arm; helps hold humeral head in glenoid cavity

*supraspinatus, infraspinatus, teres minor, and subscapularis muscles are referred together as the rotator cuff or SITS muscles. Their primary function during all movements of the glenohumeral joint is to hold the humeral head in the glenoid cavity of the scapula

Muscles of the arm

Muscle	Proximal Attachment (origin)	Distal Attachment (insertion)	Innervation	Main Action
Biceps brachii	Short head: tip of coracoid process of scapula Long head: supraglenoid tubercle of scapula	Tuberosity of radius and fascia of forearm via bicipital aponeurosis	Musculocutaneous nerve (some of brachialis innervated by radial nerve, coracobrachialis innervated by nerve C5, C6, C7)	Supinates forearm and, when it is supine, flexes forearm; short head resists dislocation of shoulder
Brachialis	Distal half of anterior surface of humerus	Coronoid process and tuberosity of ulna		Flexes forearm in all positions
coracobrachialis	Tip of coracoid process of scapula	Middle 3 rd of medial surface of humerus		Helps flex and adduct arm; resists dislocation of shoulder
Triceps brachii	Long head: infraglenoid tubercle of scapula Lateral head: posterior surface of humerus, superior to radial groove Medial head: posterior	Proximal end of olecranon of ulna and fascia of forearm	Radial nerve (C6, C7, C8)	Chief extensor of forearm; long head resists dislocation of humerus; especially important during abduction

	surface of humerus inferior to radial groove			
anconeus	Lateral epicondyle of humerus	Lateral surface of olecranon and superior part of posterior surface of ulna	Radial nerve (C7, C8, T1)	Assists triceps in extending forearm; stabilizes elbow joint; may abduct ulna during pronation

Muscles that make up the Axilla

Anterior wall: pectoralis major, pectoralis minor and subclavius

Posterior wall: subscapularis, teres major, latissimus dorsi

Medial wall: serratus anterior, intercostals muscles

Lateral wall: bicipital groove of humerus (in which lies the tendon of the long head of the biceps)

Brachial Plexus

“Rugby Team Drinks Cold Beer (Nightly → nerves)”

5 roots: C5, C6, C7, C8, T1

3 trunks: superior (union of C5, C6 roots), middle (continuation of C7 root), inferior (union of the C8 and T1 root)

6 divisions: 3 anterior (supply the anterior, flexor, compartments of the upper limb) and 3 posterior (supply the posterior, extensor, compartments of the upper limb)

3 cords: lateral cord (anterior divisions of the superior and middle trunks), medial cord (anterior division of the inferior trunk) and posterior cord (posterior divisions of all 3 trunks) → all relative to position around axillary artery

5 terminal branches: musculocutaneous, axillary, radial, median, ulnar

Brachial Plexus and Nerves of the Upper Limb

Nerve	Origin	Course	Structures Innervated
Supraclavicular branches			
Dorsal scapular	Posterior aspect of anterior ramus of C5	Pierces middle scalene; descends deep to levator scapulae and rhomboids	Rhomboids; occasionally supplies levator scapulae

	with a frequent contribution from C4		
Long thoracic	Posterior aspect of anterior rami of C5, C6, C7	Passes through cervicoaxillary canal (Fig. 6.14), descending posterior to C8 and T1 roots of plexus (anterior rami); runs inferiorly on superficial surface of serratus anterior	Serratus anterior
suprascapular	Superior trunk, receiving fibres from C5, C6 and often C4	Passes laterally across lateral cervical region (posterior triangle of neck), superior to brachial plexus; then through scapular notch inferior to superior transverse cervical ligament	Supraspinatus and infraspinatus muscles; glenohumeral (shoulder) joint
Subclavian nerve (nerve to subclavius)	Superior trunk, receiving fibres from C5, C6, and often C4 (Fig. 6.29)	Descends posterior to clavicle and anterior to brachial plexus and subclavian artery (Fig. 6.29); often giving an <i>accessory root to phrenic nerve</i>	Subclavius and sternoclavicular joint (accessory phrenic root innervates diaphragm)
Infraclavicular branches			
Lateral pectoral	Side branch of lateral cord, receiving fibres from C5, C6, C7	Pierces costocoracoid membrane to reach deep surface of pectoral muscles; a <i>communicating branch to the medial pectoral nerve</i> passes anterior to axillary artery and vein	Primarily pectoralis major; but some lateral pectoral nerve fibres pass to pectoralis minor via branch to medial pectoral nerve (Fig. 6.30A)
musculocutaneous	Terminal branch of lateral cord, receiving fibers from C5-C7	Exits axilla by piercing coracobrachialis (Fig. 6.28); descends between biceps brachii and brachialis (Fig. 6.31), supplying both; continues as <i>lateral cutaneous nerve of forearm</i>	Muscles of anterior compartment of arm (coracobrachialis, biceps brachii and brachialis) (Fig. 6.30B); skin of lateral aspect of forearm
median	Lateral root of median nerve is a terminal branch of lateral cord (C6 C7); medial root of median nerve is a terminal branch of	Lateral and medial roots merge to form median nerve lateral to axillary artery; descends through arm adjacent to brachial artery, with nerve gradually crossing anterior to artery to lie medial to artery in cubital fossa (Fig. 6.32A)	Muscles of anterior forearm compartment (except for flexor carpi ulnaris and ulnar half of flexor digitorum profundus), 5 intrinsic muscles in thenar half of palm and palmar skin (Fig. 6.30B)

	medial cord (C8, T1)		
Medial pectoral	Side branches of medial cord, receiving fibres from C8, T1	Passes between axillary artery and vein; then pierces pectoralis minor and enters deep surface of pectoralis major; although it is called <i>medial</i> for its origin from medial cord, it lies lateral to lateral pectoral nerve	Pectoralis minor and sternocostal part of pectoralis major
Medial cutaneous nerve of forearm		Smallest nerve of plexus; runs along medial side of axillary and brachial veins; communicates with <i>intercostobrachial nerve</i>	Skin of medial side of arm, as far distal as medial epicondyle of humerus and olecranon of ulna
Median cutaneous nerve of forearm		Initially runs with ulnar nerve (with which it may be confused) but pierces deep fascia with basilic vein and enters subcutaneous tissue dividing into anterior and posterior branches	Skin of medial side of forearm, as far distal as wrist
ulnar	Larger terminal branch of medial cord, receiving fibres from C8, T1, and often C7	Descends medial arm; passes posterior to medial epicondyle of humerus; then descends ulnar aspect of forearm to hand (Figs. 6.30C and 6.32A)	Flexor carpi ulnaris and ulnar half of flexor digitorum profundus (forearm); most intrinsic muscles of hand; skin of hand medial to axial line of digit 4
Upper subscapular	Side branch of posterior cord, receiving fibres from C5	Passes posteriorly, entering subscapularis directly	Superior portion of subscapularis
Lower subscapular	Side branch of posterior cord, receiving fibres from C6	Passes inferolaterally, deep to subscapular artery and vein	Inferior portion of subscapularis and teres major
thoracodorsal	Side branch of posterior cord, receiving fibres from C6, C7 , C8	Arises between upper and lower subscapular nerves and runs inferolaterally along posterior axillary wall to apical part of latissimus dorsi	Latissimus dorsi
axillary	Terminal branch of posterior cord, receiving fibres from C5 , C6	Exits axillary fossa posteriorly, passing through quadrangular space with posterior circumflex humeral artery (Fig. 6.31); gives rise to	Glenohumeral joint; teres minor and deltoid muscles (Fig. 6.30D); skin of superolateral arm (over

		<i>superior lateral brachial cutaneous nerve</i> ; then winds around surgical neck of humerus deep to deltoid (Fig. 6.30D)	inferior part of deltoid
radial	Larger terminal branch of posterior cord (largest branch of plexus), receiving fibres from C5-T1	Exits axillary fossa posterior to axillary artery; passes posterior to humerus in radial groove with deep brachial artery, between lateral and medial heads of triceps; perforates lateral intermuscular septum; enters cubital fossa, dividing into <i>superficial</i> (cutaneous) and <i>deep</i> (motor) <i>radial nerves</i> (Fig. 6.30D)	All muscles of posterior compartments of arm and forearm (Fig. 6.30D); skin of posterior and inferolateral arm, posterior forearm, and dorsum of hand lateral to axial line of digit 4

Cubital Fossa

Superior boundary: imaginary line connecting the medial and lateral epicondyle

Lateral boundary: brachioradialis (mass of extensor muscles of the forearm arising from the lateral epicondyle and supraepicondylar ridge)

Medial boundary: pronator teres (mass of flexor muscles of the forearm arising from the common flexor attachment on the medial epicondyle)

Floor: brachialis and supinator

Roof: continuity of the brachia and antebrachial (deep) fascia reinforced by the bicipital aponeurosis

Contents

- **TAN**: tendon (biceps tendon), artery (brachial artery), nerve (median nerve)
- Brachial artery (braches into radial and ulnar artery)
- Median nerve
- Biceps brachii tendon
- Radial nerve (deep **between** the muscles forming the lateral boundary of the cubital fossa, namely the **brachioradialis** and the **brachialis**, dividing into its superficial and deep branches)
- Accompanying veins of the arteries

- Superficially in the subcutaneous tissue overlying the fossa are the median cubital vein (lying anterior to the brachial artery) and the medial and lateral antebrachial cutaneous nerves (related to the basilica and cephalic veins)

Arteries and Veins

From head to arm

Arteries: subclavian → (at 1st rib) axillary → (begins at inferior border of teres major) brachial (at cubital fossa → ulnar and radial arteries)

From arm to head

Veins: basilic → (at the inferior border of teres major) axillary → (as it leaves axilla superiorly) subclavian

Cephalic vein: (starts as dorsal venous network in hand) joins with the median cubital vein to become the basilic vein

Basilica vein: (as dorsal venous network in hand) merges with other veins to become the axillary vein (see above)

Movements of the scapula

Retraction: trapezius (middle part), latissimus dorsi, rhomboid major and minor

Protraction: serratus anterior, pectoralis minor (pectoralis major)

Elevation: trapezius (superior part, descending fibres), levator scapulae, rhomboid major and minor

Depression: trapezius (inferior part, ascending fibres), serratus anterior, pectoralis minor, latissimus dorsi, subclavius (pectoralis major, fibres of the inferior sternocostal head)

Upward rotation: trapezius (superior and inferior parts, upper and lower/descending and ascending fibres), serratus anterior

Downward rotation: latissimus dorsi, pectoralis minor, levator scapulae, rhomboid minor and major (pectoralis major, inferior fibres of sternocostal head)

Movements of the Humerus

Flexion: deltoid, pectoralis major

Extension: deltoid, latissimus dorsi, teres major

Abduction: deltoid, supraspinatus (and some biceps)

Adduction: deltoid, latissimus dorsi, teres major, (and some coracobrachialis)

Medial rotation: subscapularis, latissimus dorsi, teres major, pectoralis major, deltoid

Lateral rotation: infraspinatus, teres minor, deltoid

Muscles of the Anterior compartment of the Forearm

Muscle	Proximal Attachment (origin)	Distal Attachment (insertion)	Innervation	Main Action
Superficial (first) layer				
Pronator teres		Middle of convexity of lateral surface of radius	Median nerve (C6, C7)	Pronates and flexes forearm (at elbow)
Ulnar head	Coronoid process			
Humeral head	Medial epicondyle of humerus (common flexor origin)	Base of 2 nd metacarpal		Flexes and abducts hand (at wrist) [radial deviation]
Flexor carpi radialis (FCR)				
Palmaris longus (absent in 14% of people)		Distal half or flexor retinaculum and apex of palmar aponeurosis	Median nerve (C7, C8)	Flexes hand (at wrist) and tenses palmar aponeurosis
Flexor carpi ulnaris (FCU)				
Humeral head	Olecranon and posterior border (via aponeurosis)	Pisiform, hook of hamate, 5 th metacarpal	Ulnar nerve (C7, C8)	Flexes and adducts hand (at wrist) [ulnar deviation]
Ulnar head				
Intermediate (second) layer				
Flexor digitorum superficialis (FDS)	Medial epicondyle (common flexor origin) and coronoid process	Shafts (bodies) or middle phalanges of medial 4 digits (note: 2 splits)	Median nerve (C7, C8, T1)	Flexes middle phalanges at proximal interphalangeal joints of middle 4 fingers; acting more strongly, it also flexes proximal phalanges at metacarpophalangeal joints
Humeral head				
Radial head	Superior half of anterior border			
Deep (third) layer				
Flexor digitorum	Proximal $\frac{3}{4}$ or medial	Bases of distal	Ulnar nerve (C8,	Flexes distal phalanges 4 and 5

profundus (FDP)	and anterior surfaces of ulna and interosseous membrane	phalanges of the four fingers	T1)	at distal interphalangeal joints
Medial part				
Lateral part				
Flexor pollicis longus (FPL)	Anterior surface of radius and adjacent interosseous membrane	Base of distal phalanx of thumb	Anterior interosseous nerve, from median nerve (C8, T1)	Flexes distal phalanges 2 and 3 at distal interphalangeal joints
				Flexes phalanges of 1 st digit (thumb)
Pronator quadratus	Distal ¼ of anterior surface of ulna	Distal ¼ of anterior surface of radius		Pronates forearm; deep fibres bind radius and ulna together

Muscles of the Posterior Compartment of the Forearm

Muscle	Proximal Attachment (origin)	Distal Attachment (insertion)	Innervation	Main Action
brachioradialis	Proximal two thirds of supraepicondylar ridge of humerus	Lateral surface of distal end of radius proximal to styloid process	Radial nerve (C5, C6, C7)	Relatively weak flexion of forearm, maximal when forearm is in midpronated position
Extensor carpi radialis longus (ECRL)	Lateral supraepicondylar ridge of humerus	Dorsal aspect of base of 2 nd metacarpal	Radial nerve (C6, C7)	Extend and abduct hand at the wrist joint; ECRL active during fist clenching
Extensor carpi radialis brevis (ECRB)	Lateral epicondyle of humerus (common extensor origin)	Dorsal aspect of base of 3 rd metacarpal	Deep branch of radial nerve (C7, C8)	
Extensor digitorum		Extensor expansions of medial 4 fingers	Posterior interosseous nerve (C7, C8), continuation of deep branch of radial nerve	Extends medial 4 fingers primarily at metacarpophalangeal joints, secondarily at interphalangeal joints
Extensor digiti		Extensor expansion		Extends 5 th finger primarily

minimi (EDM)		of 5 th finger		at metacarpophalangeal joint, secondarily at interphalangeal joint
Extensor carpi ulnaris (ECU)	Lateral epicondyle of humerus; posterior border of ulna via a shared aponeurosis	Dorsal aspect of base of 5 th metacarpal		Extends and adducts hand at wrist joint (also active during fist clenching)
Deep Layer				
Supinator	Lateral epicondyle of humerus; radial collateral and annular ligaments; supinator fossa; rest of ulna	Lateral posterior, and anterior surfaces of proximal third of radius	Deep branch of radial nerve (C7, C8)	Supinates forearm; rotates radius to turn pal anteriorly or superiorly (if elbow is flexed)
Extensor indicis	Posterior surface of distal third of ulna and interosseous membrane	Extensor expansion of 2 nd finger	Posterior interosseous nerve (C7, C8), continuation of deep branch of radial nerve	Extends 2 nd finger (enabling its independent extension); helps extend hand at wrist
Outcropping muscles of deep layer (all extrinsic hand muscles)				
Abductor pollicis longus (APL)	Posterior surface of proximal halves of ulna, radius, and interosseous membrane	Base of 1 st metacarpal	Posterior interosseous nerve (C7, C8), continuation of deep branch of radial nerve	Abducts thumb and extends it at carpometacarpal joint
Extensor pollicis longus (EPL)	Posterior surface of middle third of ulna and interosseous membrane	Dorsal aspect of base of distal phalanx of thumb		Extends distal phalanx of thumb at interphalangeal joint; extends metacarpophalangeal and carpometacarpal joints
Extensor pollicis	Posterior surface of	Dorsal aspect of		Extends proximal phalanx of

brevis (EPB)	distal third of radius and interosseous membrane	base of proximal phalanx of thumb		thumb at metacarpophalangeal joint; extends carpometacarpal joint
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Median and ulnar nerve summary

	forearm	hand	Sensation
Median	Most flexors	Just 5 muscles (APB, FPB, opponens pollicis, 1 st and 2 nd lumbricals)	Sensation 3.5 digits
ulnar	Only 1.5 flexors (FCU and medial half of FDP)	All the rest	Sensation 1.5 digits (medial 1.5 → pinky and half of ring finger)

Intrinsic Muscles of the Hand

Muscle	Proximal Attachment (origin)	Distal Attachment (insertion)	Innervation	Main Action	
Thenar Muscles					
Opponens pollicis	Flexor retinaculum and tubercles of scaphoid and trapezium	Lateral side of 1 st metacarpal	Recurrent branch of medial nerve (C8,T1)	To oppose thumb, it draws 1 st metacarpal medially to centre of palm and rotates it medially	
Abductor pollicis brevis		Lateral side of base of proximal phalanx of thumb		Deep branch of ulnar	Abducts thumb; helps oppose it
Flexor pollicis brevis					Flexes thumb
Superficial head					
Deep head					

Adductor pollicis	Bases of 2 nd and 3 rd metacarpals capitate, adjacent carpals	Medial side of base of proximal phalanx of thumb	nerve (C8, T1)	Adducts thumb toward lateral border of palm
Oblique head	Anterior surface of shaft of 3 rd metacarpal			
Transverse head				
Hypothenar muscles				
Abductor digiti minimi	pisiform	Medial side of base of proximal phalanx of 5 th finger	Deep branch of ulnar nerve (C8, T1)	Abducts 5 th finger; assists in flexion of its proximal phalanx
Flexor digiti minimi brevis	Hook of hamate and flexor retinaculum	Medial border of 5 th metacarpal		Flexes proximal phalanx of 5 th finger
Opponens digiti minimi				Draws 5 th metacarpal anterior and rotates it, bringing 5 th finger into opposition with thumb
Short muscles				
lumbricals	Lateral two tendons of flexor digitorum profundus (as unipennate muscles)	Lateral sides of extensor expansions of 2 nd -5 th fingers	Median nerve (C8, T1)	Flex metacarpophalangeal joints; extend interphalangeal joints of 2 nd -5 th fingers
1 st and 2 nd	Medial three tendons of flexor digitorum profundus (as bipennate muscles)			
3 rd and 4 th			Deep branch of ulnar nerve (C8, T1)	
Dorsal interossei, 1st-4th	Adjacent sides of two metacarpals (as bipennate muscles)	Bases of proximal phalanges; extensor expansions of 2 nd -4 th fingers		Abduct 2 nd -4 th fingers from axial line; act with lumbricals in flexing metacarpophalangeal joints and extending interphalangeal joints

Palmar interossei, 1st-3rd	Palmar surfaces of 2 nd , 4 th , and 5 th metacarpals (as unipennate muscles)	Bases of proximal phalanges; extensor expansions of 2 nd , 4 th , and 5 th fingers	Adduct 2 nd , 4 th , and 5 th fingers toward axial line; assist lumbricals in flexing metacarpophalangeal joints and extending interphalangeal joints; extensor expansions of 2 nd -4 th fingers
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Intrinsic muscles summary

	At MP joint	At IP joint	Plus
Lumbricals	Flex	Extend	<u>Coordinate</u> flex and extend
Dorsal interossei	Flex	Extend	Abduct
Palmar interossei	Flex	Extend	adduct