

Marcello Cherchi's notes for Gross Anatomy

EXTREMITIES

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(Please let me know of any errors! mchercl@uic.edu)

References:

- CL CLEMENTE, Carmine, *Anatomy: A Regional Atlas of the Human Body*, 4th ed. Baltimore: Williams & Wilkins, 1997.
- GR WILLIAMS, Peter L. and Roger WARWICK (eds.), *Gray's Anatomy*, 36th ed. Philadelphia: W.B. Saunders Co., 1980.
- Hosford <http://www.ptcentral.com/muscles>
- MA MOORE, Keith L. and Anne M. R. AGUR, *Essential Clinical Anatomy*. Baltimore: Williams & Wilkins, 1995.
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- RY ROHEN, Johannes W. and Chihiro YOKOCHI, *Color Atlas of Anatomy: A Photographic Study of the Human Body*, 2nd ed. New York and Tokyo: Igaku-Shoin, 1988.
- Sapan <http://www.uic.edu/~sdesai4/>

Also see:

The M1 home page for anatomy: http://www2.uic.edu/stud_orgs/prof/M1/

SUPERFICIAL BACK

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Trapezius	<ul style="list-style-type: none">• Spinal accessory n. (CN XI)• Cervical nn. 3-4	Descending scapular artery (=transverse cervical artery)	Ext. occipital protuberance, sup. nuchal line, nuchal lig. from C7 spine, all thoracic lig.	Lateral third of clavicle, spine of scapula, acromion	Elevate, retract and rotate scapula

Latissimus dorsi	Thoracodorsal n. (C6-8)	<ul style="list-style-type: none"> • Thoracodorsal a. • Subscapular a. • Descending scapular a. 	Lower 6 thoracic vertebral spines, lumbodorsal fascia, iliac crest, m. slips from lower 3-4 ribs	Floor of intertubercular groove of humerus	Adduct, extend and medially rotate humerus
Rhomboid major	Dorsal scapular n. (C5, [4])	<ul style="list-style-type: none"> • Dorsal scapular a. • Descending scapular a. 	Spines of thoracic vertebrae 2-5	Medial border of scapula between spine and inferior angle	Adduct and rotate scapula
Rhomboid minor	Dorsal scapular n. (C5, [4])	Ditto	Ligamentum nuchae, spine of C7, thoracic vertebra 1	Root of scapular spine	Adduct and rotate scapula
Levator scapulae	<ul style="list-style-type: none"> • Dorsal scapular n. (C5, [4]) • Cervical nn. 3-4 	Ditto	Transverse process C1-4	Vertebral border of scapula between medial angle and root of spine	Raise scapula or incline neck if scapula is fixed

Clinical correlations

Triangle of auscultation: When a patient folds the arms across the chest, a triangle is formed by the superior border of the latissimus dorsi m., rhomboid major and the trapezius. The 6th intercostal space is subcutaneous, permitting auscultation of the lungs (MA 305; NE 395, 516).

The *lumbar triangle* is formed by the lower lateral border of the latissimus dorsi m., the posterior edge of the external oblique m., and the ilium (of the pelvis).

Fascia

Thoracolumbar aponeurosis (CL 406-7)

Mnemonics

“Lady between two Majors”: the Latissimus dorsi m. passes between the rhomboid Major m. and the teres Major m.

PECTORAL REGION

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
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Pectoralis major	<ul style="list-style-type: none"> • Lateral pectoral n. (C5-7) • Medial pectoral n. (C8, T1) 	Pectoral br. (of thoracoacromial a.)	<i>Clavicular head:</i> anterior surface of medial half of clavicle. <i>Sternocostal head:</i> anterior surface of sternum and first 6 costal cartilages	Lateral lip of intertubercular groove of humerus	Adducts and medially rotates humerus. Draw scapula anteriorly and inferiorly.
Pectoralis minor	Medial pectoral n. (C8, T1)	Pectoral br. (of thoracoacromial a.)	Ribs 3-5 near their costal cartilages	Medial border and superior surface of coracoid process	Stabilize scapula by drawing it inferiorly and anteriorly against thoracic wall
Subclavius	N. to subclavius (C5, 6, [4])	Clavicular br. (of thoracoacromial a.)	Junction of 1st rib and its intercostal cartilage	Inf. surface of the middle third of the clavicle.	Anchor and depress scapula
Serratus anterior	Long thoracic n. (C5-7)	Lateral thoracic a.	External surfaces of lateral parts of 1st to 8th ribs	Anterior surface of medial border of scapula	Protract scapula and hold it against thoracic wall. Rotate scapula.

Notes

Retromammary space in the female contains gland lobules, lactiferous sinus, lactiferous duct, suspensory ligaments (of Cooper) and fat.

Inferior to the clavicle is the costocoracoid ligament (NE 399).

The *deltpectoral triangle* marks the interval between the deltoid m. and pectoralis major m. (MA 305).

The *sternal angle* (between the sternum and manubrium) is at the latitude of the second pair of costal cartilages (MA 34; CL 95).

Clinical correlations

Damage to the serratus anterior m. (or long thoracic n.) causes “winged scapula” (MA 293).

Nerves

The skin which is superior and lateral to the pectoral region is innervated by the intercostobrachial n. (from T2) (MA 290).

The medial pectoral n. pierces the pectoralis minor m. (MA 299).

Fascia

Clavipectoral fascia, costocoracoid membrane, suspensory ligaments of breast (Cooper’s suspensory ligaments; NE 167)

Osteology

The clavicle is the most frequently fractured bone in the body. It generally fractures between its lateral third and medial third.

Mnemonics

“C5, 5, 7 and you go to heaven” because damage to the long thoracic nerve (C5, C6, C7) can denervate the serratus anterior m., resulting in winged scapula (and “angels have wings,” as Sapan is fond of pointing out).

AXILLARY REGION**Nerves**

Brachial plexus. Damage to various nerves (or the muscles they innervate) causes various conditions. See mnemonics below. It is good to remember the following (see e.g. NE 401):

<u>Nerve:</u>	<u>Cord:</u>	<u>Spinal nn.</u>
Musculocutaneous n.	Lateral	C5, 6, 7
Axillary n.	Posterior	C5, 6
Radial n.	Posterior	C5, 6, 7, 8, T1
Median n.	Lateral and medial	C5, 6, 7, 8, T1
Ulnar n.	Medial	C7, 8, T1

Arteries

Subclavian a. (after the lateral border of 1st rib becomes the) *axillary a.*, which (after the lower border of the teres major muscle becomes the) *brachial a.* The axillary a. has three parts; the second part is covered by the pectoralis minor m. (CL 14).

Veins

Axillary v.

Fascia

Suspensory ligament of axilla

Lymphatics

Axillary lymph nodes (NE 452; MA 300). Deltopectoral lymph nodes (infraclavicular lymph nodes) (MA 36).

Mnemonics

- Parts of brachial plexus: “Robert Taylor Drinks Cold Beer” = “Roots, Trunks, Divisions, Chords, Branches”
- Parts of axillary a.: “Suzie Taylor Likes Sex And Pasta” = “Supreme thoracic a., Thoracoacromial a., Lateral thoracic a., Subscapular a., Anterior humeral circumflex a., Posterior humeral circumflex a.”
- Parts of thoracoacromial a.: “Cadavers Are Dead People” = “Clavicular, Acmomial, Deltoid, Pectoral”
- “DR. CUMA”: “wrist Drop is caused by damage to the Radial n.; Clawhand is due to damage to the Ulnar n.; damage to the Median nerve results in Ape hand.” (See MA 301, 333-4.) (Clawhand is also called “hand of benediction” or “main en griffe.”)

SCAPULAR REGION

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Supraspinatus	Suprascapular n. (C5, 6, [4])	Suprascapular a. (MA 297)	Supraspinous fossa	Upper facet of greater tubercle	Abduct the arm
Infraspinatus	Suprascapular n. (C5, 6, [4])	Suprascapular a.	Infraspinous fossa	Middle facet of greater tubercle	Laterally rotate arm
Subscapularis	<ul style="list-style-type: none"> • Upper subscapular n. (C5, 6) • Lower subscapular n. (C5, 6) 	Subscapular a.	Subscapular fossa	Lesser tubercle	Medially rotate arm
Teres minor	Axillary n. (C5, 6)	Circumflex scapular a.	Lateral border of scapula	Inf. facet of greater tubercle	Laterally rotate arm
Teres major	Lower subscapular n. (C5, 6)	Thoracodorsal a.	Inferior angle of scapula	Crest of lesser tubercle	Adduct and medially rotate arm

Notes

Through the **quadrangular space** there pass (MA 297; CL 22, 32, 36):

- (1) Posterior circumflex humeral a.

(2) Axillary n.

The quadrangular space is bounded (CL 36):

- Medially by the long head of the triceps
- Laterally by the humerus
- Superiorly by the teres minor
- Inferiorly by the teres major

Through the **triangular space** there passes (GR 573; CL 20, 22, 32, 36):

- Circumflex scapular a. (from the subscapular a.)

The triangular space is bounded (CL 36):

- Superiorly by the teres minor
- Inferiorly by the teres major
- Laterally by the long head of the triceps

The **superior transverse scapular lig.** passes over the scapular notch, forming a hole. Over this lig. passes the suprascapular a.; through the hole formed by the ligament and notch there passes the suprascapular n. (“Army over Navy”: Artery over Nerve).

The **inferior transverse scapular lig.** is lower down on the scapula. Here, *both* the suprascapular artery and nerve pass *underneath* the lig.

The **long head of the triceps** passes *anterior* to the teres minor m. and *posterior* to the teres major m. (CL 36; GR 573, 570 fig. 5.61).

Anastomoses

The dorsal scapular, suprascapular and subscapular aa. form extensive anastomoses around the scapula (MA 297).

Mnemonics

The “rotator cuff muscles” are given by “SITS”: Supraspinatus, Infraspinatus, Teres minor, Subscapularis.

“Army over Navy”: Artery over Nerve.

ARM / BRACHIUM: the humerus

Clinical correlations

The **surgical neck** (NE 393) is the most frequently fractured part of the humerus, and such fractures can damage the axillary n.

The **radial n.** runs through the *radial groove*, and fracture of the humerus at this point can damage the radial n.

The **ulnar n.** courses superficially and posteriorly to the medial epicondyle; when bumped it gives us the sensation of “hitting the funny bone.”

The **median n.** passes at the distal end of the humerus.

SHOULDER

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Deltoid	Axillary n.	Deltoid br. (from thoracoacromial a.)	Lat. third of clavicle, lat. third of spine of scapula, acromion	Deltoid tuberosity	<i>Anterior part:</i> flex and medially rotate arm. <i>Middle part:</i> abduct humerus. <i>Post. part:</i> Extend and laterally rotate arm.

ARM / BRACHIUM, anterior compartment

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Coracobrachialis	Musculocutaneous n.	Brachial a.	Coracoid process	Middle third of medial surface of humerus	Flex and adducts arm
Brachialis	Ditto	Ditto	Distal half of the ant. of humerus	Coronoid process, ulnar tuberosity	Flex forearm in all positions

Biceps brachii	Ditto	Ditto	<i>Short head:</i> coracoid process. <i>Long head:</i> supraglenoid tubercle	Radial tuberosity, fascia of forearm	When elbow extended: flex forearm. When elbow not extended: supinate forearm
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ARM / BRACHIUM, posterior compartment

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Triceps brachii	Radial n.	<ul style="list-style-type: none"> • Deep brachial a. • Post. humeral circumflex a. (Sapan) 	<i>Long head:</i> infraglenoid tubercle. <i>Lateral head:</i> Post. surface of humerus. <i>Medial head:</i> Post surface of humerus inferior to radial groove	Olecranon, fascia of forearm	Extend forearm
Anconeus	Ditto	Deep brachial a.	Lat. epicondyle of humerus	Olecranon, post. surface of ulna	Assist triceps in extending forearm

Notes

Brachialis m. is deep to biceps brachii m.

Medial head of triceps brachii is deep to the rest of the muscle.

The long head of the biceps brachii originates at the supraglenoid tubercle; the long head of the triceps brachii originates at the infraglenoid tubercle.

Clinical

The shoulder joint is easily dislocated. *Anterior dislocation of the shoulder joint* can be caused by a hard blow to the humerus when the shoulder joint is fully abducted, which tilts the head of the humerus inferiorly onto the inferior weak part of the articular capsule. This may tear the capsule and dislocate the shoulder so that the humeral head comes to lie inferior to the glenoid cavity (MA 337).

Fascia

Brachial fascia

Bicipital aponeurosis (CL 30, 32, 34)

The *medial intermuscular septum* and *lateral intermuscular septum* divide the arm into anterior and posterior compartments.

The *anterior compartment* is for flexion/supination, and is innervated by the musculocutaneous n.

The *posterior compartment* is for extension and is innervated by the radial n.

There is also a *neurovascular compartment* through which pass the median n., ulnar n., brachial a. and basilic v. (see MA 309 and NE 406).

Nerves

Medial brachial cutaneous n. (C8, T1) innervates skin on the medial side of arm (MA 290, 299; CL 24).

The upper lateral brachial cutaneous n. (from axillary n.) innervates the skin over the deltoid m. (MA 290; CL 24).

The musculocutaneous n. pierces the coracobrachialis m.

The radial n. passes between the long and medial heads of the triceps, courses along the radial groove of the humerus, and passes between the brachialis and brachioradialis mm. (MA 299).

Osteology

The *radial groove* starts at the superior posterior point of the humerus and spirals inferiorly and laterally, coming around towards the anterior face of the humerus. Along the radial groove pass the radial n. and the deep brachial artery (MA 297, 299).

CUBITAL FOSSA

Notes

The *cubital fossa* is the inside of the elbow (MA 310-11). It is bordered:

- Medially by the pronator teres m.
- Laterally by the brachioradialis m.
- Superiorly by an imaginary line between the epicondyles

The floor is formed:

- Proximally by the brachialis m.
- Distally by the supinator m.

The roof is formed by:

- Bicipetal aponeurosis (fascia)
- Superficial fascia and skin

Through the cubital fossa there pass:

- Biceps brachii tendon
- Brachial a. (with radial and ulnar branches)
- Parts of median and radial nn.

Clinical

Lifting a child by one hand can cause *subluxation* (incomplete dislocation) by pulling the head of the radius out of the *anular ligament* (MA 338).

Repeated and forceful flexion and extension at the wrist strain the common tendon attachment and may produce epicondylitis, inflammation of the epicondyle. “Golfer’s elbow” is medial epicondylitis (from golf swing), while “tennis elbow” is lateral epicondylitis (from the backhand stroke in tennis) (MA 315).

Nerves

The *ulnar n.* passes posterior to the medial epicondyle and is fairly superficial. (When hit, we get the “funny bone” sensation.)

The *median n.* passes superficially along the middle of the cubital fossa, though it is covered by the bicipital aponeurosis.

The *radial n.* passes anteriorly to the lateral epicondyle.

(See CL 50.)

Veins

The cephalic v. anastomoses with the basilic v. via the median cubital v. (NE 452). (However, there are variations in this venous pattern; see CL 25.) Blood is commonly drawn from the median cubital v. because it is superficial and easily accessible (MA 289). Although the median n. is in the region of the cubital fossa, it is deep to the bicipital aponeurosis.

Anastomoses

Note the following anastomoses (CL 27; NE 405; RY 369):

Superior ulnar collateral a.	anastomoses with	posterior ulnar recurrent a.	(passing posteriorly to the medial epicondyle).
Inferior ulnar collateral a.	anastomoses with	anterior ulnar recurrent a.	(passing anteriorly to the medial epicondyle).
Radial collateral a.	anastomoses with	the radial recurrent a.	(passing anteriorly to the lateral epicondyle).
Middle collateral a.	anastomoses with	interosseous recurrent a.	(passing poosteriorly to the lateral epicondyle).

Lymphatics

Cubital lymph nodes (NE 452).

FOREARM / ANTEBRACHIUM: anterior compartment**Superficial layer (laterally to medially)**

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Pronator teres	Median n.	<ul style="list-style-type: none"> • Ulnar a. • Radial a. (Sapan) 	Humeral head from medial epicondyle of humerus. Ulnar head from coronoid process of ulna.	Lat. side of radius	Pronate and aid flexion of forearm
Flexor carpi radialis	Ditto	Radial a.	Medial epicondyle of humerus	Base of 2nd and 3rd metacarpals	Flex wrist, abduct hand, aid flexion of forearm
Palmaris longus	Ditto	Post. ulnar recurrent a.	Medial epicondyle of humerus	Palmar aponeurosis	Flex wrist, aid pronation and flexion of forearm
Flexor digitorum superficialis	Ditto	<ul style="list-style-type: none"> • Ulnar recurrent a. • Radial recurrent a. 	Humeral head from medial epicondyle. Ulnar head from coronoid process of ulna.	Sides of second phalanx of 4 fingers	Flex 1st and 2nd phalanges, aid wrist and forearm flexion.
Flexor carpi ulnaris	Ulnar n. (unlike the other mm. in this compartment)	Post. ulnar recurrent a.	Humeral head from medial epicondyle of humerus. Ulnar head from olecranon.	Pisiform, harnate and 5th metacarpal	Flex and adduct wrist, aid flexion of forearm

Deep layer

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
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Flexor digitorum profundis	<i>Lateral side:</i> ant. interosseus br. of median n. <i>Medial side:</i> Ulnar n.	<ul style="list-style-type: none"> • Ant. interosseus of ulnar a. • Ulnar a. 	Interosseus membrane, medial and anterior surface of ulna	Distal terminal phalanges of 4 fingers	Flex all distal phalanges, aid wrist flexion
Flexor pollicis longus	Ant. interosseus br. of median n.	Ant. interosseus of ulnar a.	Interosseus membrane, ant. surface of radius, coronoid process of ulna	Base of distal phalanx of thumb	Flex thumb, flex and adduct first metacarpal
Pronator quadratus	Ditto	Ditto	Anterior distal surface of ulna	Anterior distal surface of radius	Pronate forearm (unlike the other mm. in this compartment)

Notes

Most of the mm. in the anterior compartment are for flexion (except the pronator teres and the pronator quadratus). The mm. of the anterior forearm in the superficial layer have their origin at the medial epicondyle.

Clinical correlations

Suicide attempts made by slashing the wrist usually cause damage to the median n. but leave the arteries intact.

Fascia

Antebrachial fascia

Nerves

Medial antebrachial cutaneous n. innervates skin over medial side of forearm (MA 290, 299, 322-3; CL 24).

Lateral antebrachial cutaneous n. (from musculocutaneous n.) innervates skin on the lateral side of forearm (MA 290, 322-3; CL 24).

The ulnar n. innervates “one and one-half” muscles in the anterior compartment of the forearm, viz. the flexor carpi ulnaris, and the medial half of the flexor digitorum profundis. All the remaining muscles are innervated by the median n.

Veins

Cephalic v. courses on lateral side of forearm. Basilic v. courses on medial side of forearm. The cephalic v. anastomoses with the basilic v. via the median cubital v. (NE 452).

Median antebrachial v.

Anastomoses

Median cubital v.

FOREARM / ANTEBRACHIUM: posterior compartment**Superficial layer** (sort of laterally to medially, except for the anconeus m.)

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Brachioradialis	Radial n.	Radial recurrent a.	Lateral supracondylar ridge of humerus	Lateral side of styloid process of radius	Aid in flexion of forearm (unlike the other mm. in this compartment)
Extensor carpi radialis longus and brevis	Ditto	• Radial a. • Radial recurrent a.	Lateral epicondyle of humerus	Base of 2nd and 3rd metacarpals	Extend wrist, abduct hand
Extensor digitorum (communis)	Deep radial n.	Post. interosseous a. (from ulnar a.)	Lateral epicondyle of humerus	Base of 2nd and 3rd phalanges of 4 fingers	Extend wrist and fingers
Extensor carpi ulnaris	Ditto	Ditto	Lateral epicondyle of humerus, post. border of ulna	Base of 5th metacarpal	Extend wrist, adduct hand
Extensor digiti minimi (CL 55)	Post. interosseous n. (from deep br. of radial n.)	Ditto	Lateral epicondyle of humerus	Dorsal digital expansion of little finger	Extend the little finger and the hand
Anconeus	Radial n.	Deep brachial a.	Lateral epicondyle of humerus	Olecranon, post. surface of ulna	Assist triceps in extending forearm

Deep layer

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
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Supinator	Deep radial n.	<ul style="list-style-type: none"> • Radial recurrent a. • Post. interosseous a. (from ulnar a.) 	Lateral epicondyle, ulna below radial notch	Radial tubercle, oblique line of radius	Supinate forearm
Abductor pollicis longus	Ditto	Post. interosseous a. (from ulnar a.)	Lateral posterior ulna	Lateral side of base of 1st metacarpal	Abduct thumb and wrist
Extensor pollicis brevis	Ditto	Ditto	Interosseus membrane, post. surface of radius	Base of proximal phalanx of thumb	Extend proximal phalanx of thumb
Extensor pollicis longus	Ditto	Ditto	Interosseus membrane, post. surface of ulna	Base of distal phalanx of thumb	Extend terminal phalanx of thumb
Extensor indicis	Ditto	Ditto	Post. surface of ulna, interosseus membrane	Dorsum of proximal phalanx of index finger	Extend and adduct index finger

Notes

Most of the mm. in the posterior compartment are for extension, and have their origin at the lateral epicondyle.

Nerves

All the mm. in the deep layer of the posterior compartment of the forearm are innervated by the deep radial n.

The deep branch of the radial n. pierces the supinator m. (MA 315).

The superficial branch of the radial n. pierces the brachioradialis.

For cutaneous innervation see MA 290, CL 24.

HAND

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Three mm. of thenar eminence: (1) Abductor pollicis brevis	Recurrent br. of median n. (C8, T1)	Superficial palmar br. of radial a.	Flexor retinaculum and tubercles of scaphoid and trapezium bones	Lateral side of base of proximal phalanx of thumb	Abduct thumb and help oppose it
(2) Flexor pollicis brevis	Ditto	Ditto	Flexor retinaculum and tubercle of trapezium bone	Ditto	Flex thumb

(3) Opponens pollicis	Ditto	Ditto	Ditto	Lateral side of first metacarpal bone	Oppose thumb toward center of palm and rotate it medially
Adductor pollicis	Deep br. of ulnar n. (C8, T1)	Deep palmar arch (from radial a.)	<i>Oblique head:</i> bases of 2nd and 3rd metacarpals, capitate, and adjacent carpal bones. <i>Transverse head:</i> anterior surface of body of 3rd metacarpal bone	Medial side of base of proximal phalanx of thumb	Adduct thumb toward middle digit
Three mm. of hypothenar eminence: (1) Abductor digiti minimi	Deep br. of ulnar n. (C8, T1)	Dorsal and deep palmar branches of ulnar a.	Pisiform bone	Medial side of base of proximal phalanx of digit 5	Abduct digit 5
(2) Flexor digiti minimi brevis	Ditto	Ditto	Hook of hamate bone and flexor retinaculum	Ditto	Flex proximal phalanx of digit 5
(3) Opponens digiti minimi	Ditto	Ditto	Ditto	Medial border of 5th metacarpal bone	Draws 5th metacarpal bone anteriorly and rotates it, bringing digit 5 into opposition with thumb
Palmaris brevis	Superficial br. of ulnar n. (C8, T1) (the only one thus innervated!)	Superficial palmar br. (from ulnar a.)	Medial margin of palmar aponeurosis	Skin of ulnar border of palm; may insert on pisiform	Tenses skin on the ulnar side, which is used in a grip action
Lumbricals 1 and 2 (lateral side)	Recurrent branch of the median n. (C8, T1)	<ul style="list-style-type: none"> • Superficial palmar a. (from ulnar a.) • Deep palmar arch (from radial a.) (MA 332) 	Lateral two tendons of flexor digitorum profundis	Lateral sides of extensor expansions of digits 2-5	Flex digits at metacarpophalangeal joints and extend interphalangeal joints
Lumbricals 3 and 4 (medial side)	Deep br. of ulnar n. (C8, T1)	Ditto	Medial three tendons of flexor digitorum profundis	Ditto	Ditto

Dorsal interossei 1-4	Ditto	Deep palmar arch (from radial a.)	Adjacent sides of two metacarpal bones	Extensor expansions and bases of proximal phalanges of digits 2-4	Adduct digits and assist lumbricals
Palmar interossei 1-3	Ditto	Ditto	Palmar surfaces of 2nd, 4th, 5th metacarpal bones	Extensor expansions of digits and bases of proximal phalanges of digits 2, 4, 5	Ditto

Notes

None of the palmar interosseus mm. are attached to the middle finger.

There are NO MUSCLES in the dorsum of the hand.

Between the flexor tendons and the fascia covering the deep palmar muscles are two potential spaces, the *thenar* and *midpalmar* spaces (MA 326).

The nomenclature of the actions of the thumb is somewhat counterintuitive (see the illustrations in MA 326). Abduction and adduction move the thumb *out of and into* the plane of the hand, respectively. Flexion and extension move the thumb *within* the plane of the hand.

The borders of the *anatomical snuff box* are formed by the tendons of the extensor pollicis brevis m., abductor pollicis longus m. (anterolaterally) and extensor pollicis longus m. (posteromedially) (MA 321). Along the floor of the anatomical snuff box passes the radial a.

Most of the flexor tendons are enclosed in the common flexor sheath formed by the *ulnar bursa*. The exception is the tendon of the flexor pollicis longus m., which is enclosed by the *radial bursa* (NE 429-431; CL 63).

Clinical correlations

Carpal tunnel syndrome results from any lesion that significantly reduces the size of the carpal tunnel and compresses the median n. (MA 333). (Remember, the median n. passes *deep to* the flexor retinaculum, while the ulnar n. passes *superficially* to the flexor retinaculum.)

The scaphoid and the trapezium lie at the floor of the anatomical snuff box (MA 321). The scaphoid is the most frequently fractured bone of the hand (MA 285). Tenderness of the anatomical snuff box is a clinical sign of fracture of this bone (MA 285).

Dupuytren's contracture is a progressive fibrosis of the palmar aponeurosis, resulting in shortening and thickening of the digital bands (MA 326).

Fascia

Fascia of the palm is continuous proximally with the antebrachial fascia and with the fascia of the dorsum of the hand. The palmar fascia is thin over the thenar (thumb) and hypothenar (little finger) eminences, but it is thick centrally where it forms the fibrous *palmar aponeurosis* and in the digits where it forms the fibrous digital sheaths (MA 325).

Fascial septa separate the interior of the hand into (1) the thenar compartment (for the thumb), (2) the central compartment, (3) the hypothenar compartment (for the little finger), and (4) the adductor compartment (MA 325).

The *extensor retinaculum* is a thick strip of fascia overlying the extensor tendons on the dorsum of the wrist. This retinaculum prevents “bowing” of the tendons when their muscles contract. On the anterior aspect of the wrist is the *palmar carpal ligament* which is continuous with the extensor retinaculum (NE 416).

The tendons of the extensors pass through six “tunnels” in the wrist (NE 414, 415).

Nerves

For cutaneous innervation of the hand see MA 290, CL 24.

Dermatomes (NE 451): C6 = thumb, C7 = index finger and middle finger, C8 = ring finger and little finger.

The intrinsic hand mm. are innervated mostly by the ulnar n. Only five intrinsic hand mm. are innervated by the ulnar n., viz. the three mm. of the thenar eminence (abductor pollicis brevis, flexor pollicis brevis, opponens pollicis) are innervated by the recurrent br. of the median n., and lumbricals 1 and 2 are innervated by the median n.

The ulnar n. passes superficially to the flexor retinaculum (MA 322) and is thus frequently damaged by slashing the wrist. The ulnar n. passes through *Guyon’s canal*, an osseofibrous tunnel between the hook of hamate and the pisiform. Compression of the ulnar n. at this point may result in hypoesthesia in the medial one and one half digits, and weakness of the intrinsic muscles of the hand (MA 333-4).

Arteries

The radial and ulnar aa. and their branches provide all the blood to the hand. The *superficial palmar arch* is formed mainly by the ulnar a. The *deep palmar arch* is formed mainly from the radial a.

The ulnar a. passes superficially to the flexor retinaculum (MA 324).

The pollicis muscles are supplied by the superficial and deep palmar arches (from the radial a.).

The digiti minimi muscles are supplied by dorsal and deep palmar branches (from the ulnar a.).

Veins

Superficial palmar venous arch, Deep palmar venous arch

Osteology

There are several sesamoid bones in the digits (CL 78, 84).

Mnemonics

PAD: “Palmar interosseus muscles ADduct.”

DAB: “Dorsal interosseus muscles ABduct.”

For bones of the wrist (lateral to medial, then proximal to distal): “Surgeons Like Trying Positions That They Can’t Handle”:
Scaphoid, Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate.”

For palmar arches: DR. US: “The Deep palmar arch is primarily from the Radial a.; the deep branch of the Ulnar a. contributes primarily to the Superficial palmar arch.”

PELVIC REGION**Notes**

The head of the femur fits into the acetabulum.

Nerves

Sacral plexus

Veins

The great saphenous v. is a tributary to the femoral v., flowing thereinto at the saphenous opening in the fascia latae (CL 319).

Osteology

Each hemipelvis (=half of the pelvis) is composed of three bones: the ilium (superior), the ischium (inferior posterior) and the pubis (inferior anterior) (CL 249-50; NE 453). The three are fused by triradiate cartilage (which is no longer visible in adults). The two halves of the pelvis are connected posteriorly at the sacrum. Anteriorly and inferiorly the two hemipelves are connected by the pubic symphysis.

Ligaments

The **sacrotuberous lig.** connects the sacrum and the ischial tuberosity, forming the **greater sciatic foramen** (whose bony part is the greater sciatic notch). Through the greater sciatic foramen there pass numerous structures:

- Piriformis m. (CL 330)
- Major branches of the sacral plexus (MA 152)
- Sciatic n. (L4-S3) (MA 239)
- Posterior femoral cutaneous n. (S2, S3) (MA 243)
- Pudendal n. (S2-S4) (MA 243)
- N. to quadratus femoris (L4-S1) (MA 243)
- N. to obturator internus (L5-S2) (MA 243)
- Superior and inferior gluteal n. (MA 243)
- Superior and inferior gluteal vv. (MA 242)
- Superior and inferior gluteal aa. (MA 242, 245)
- Internal pudendal a. and v. (MA 245)

The **sacrospinous lig.** connects the sacrum and the ischial spine, forming the **lesser sciatic foramen** (whose bony part is the lesser sciatic notch). Through the lesser sciatic foramen there pass only:

- Obturator internus m. (MA 149)
- Pudendal n. (S2-S4) (MA 239) (Yes, it passes through *both* the greater and lesser sciatic foramina)
- Internal pudendal a. and v. (CL 331) (Yes, they pass through *both* the greater and lesser sciatic foramina)

(Note that the obturator externus m. originates on the outer side of the pelvis (viz. from the anterior part of the ischium and pubis), and hence does not pass through any foramen; see MA 230.) See CL 254-7 for good illustrations of the pelvis.

The **inguinal lig.** runs from the anterior superior iliac spine to the pubic tubercle. Superior to this lig. is the external abdominal oblique m.; inferior to the lig. is the fascia latae.

GLUTEAL REGION

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
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Gluteus maximus	Inferior gluteal n. (L5, S1, S2)	Superior gluteal a. (superficial br.) and inferior gluteal a.	Ilium posterior to posterior gluteal line, dorsal surface of sacrum and coccyx, and sacroteruberous ligament	Most fibers end in iliotibial tract, some insert on gluteal tuberosity of femur	Extend thigh
Gluteus medius	Superior gluteal n. (L5, S1)	Superior gluteal a. (deep br.)	External surface of ilium between anterior and posterior gluteal lines	Lateral surface of greater trochanter of femur	Abduct and medially rotate thigh. Steady belvis on leg when opposite leg is raised.
Gluteus minimus	Ditto	Ditto	External surface of ilium between anterior and inferior gluteal lines	Anterior surface of greater trochanter of femur	Ditto
Piriformis	Branches of ventral rami of S1, S2	• Inferior gluteal a. • Lateral sacral a. (superior and inferior) (MA 159)	Anterior surface of sacrum and sacroteruberous ligament	Superior border of greater trochanter of femur	Laterally rotate extended thigh and abduct flexed thigh. Steady femoral head.
Superior gemellus	N. to obturator internus	Inferior gluteal a. (Hosford)	Ischial spine	Medial surface of greater trochanter	Ditto
Obturator internus	Ditto	Ditto	Pelvic surface of obturator membrane and surrounding bones	Ditto	Ditto
Inferior gemellus	N. to quadratus femoris	Ditto	Ischial tuberosity	Ditto	Ditto
Quadratus femoris	Ditto	Ditto	Lateral border of ischial tuberosity	Quadratus tubercle on intertrochanteric crest of femur and inferior to it	Laterally rotate thigh. Steady femoral head on acetabulum.
Tensor fasciae latae	Superior gluteal n.	Superior gluteal a. (superficial br.)	Anterior superior iliac spine and anterior part of iliac crest	Iliotibial tract that attaches to lateral condyle of tibia	Abduct, medially rotate and flex thigh

Notes

The sciatic n. supplies no muscles in the gluteal region (MA 243).

Clinical correlations

Trendelenburg sign: If the gluteus medius and minimus mm. are injured (or their innervator, the superior gluteal n.) on a given side, then when the person is standing on the leg of that side, his pelvis will tilt towards the contralateral side (this is the Trendelenburg sign), resulting in what is known as a “gluteal gait” (MA 242) when walking.

Intragluteal injections must be done in the superolateral part of the buttock in order to avoid damaging the sciatic nerve (MA 242; CL 333).

Nerves

For cutaneous innervation see MA 226, CL 310-11.

The *sciatic n.* derives from L4, 5, S1, 2, 3 (see NE 465).

Fascia

Gluteal fascia. Continues superiorly as the thoracolumbar fascia, laterally as the iliotibial tract and inferiorly as the fascia latae.

THIGH: femur**Clinical correlations**

The *head of the femur* can fracture intracapsularly (more grave) or extracapsularly (less grave). Fracture of the head of the femur can damage vessels of the cruciate anastomosis.

Arteries

The *cruciate anastomosis* is formed by (1) the inferior gluteal a., (2) the ascending br. of the 1st perforating br. of the deep femoral a., (3) the lateral circumflex femoral a., (4) the medial circumflex femoral a. This anastomosis supplies various muscles in this region, as well as the head of the femur (NE 470).

THIGH, anterior compartment

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
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Iliacus (of the iliopsoas)	Femoral n. (L2, 3)	Medial femoral circumflex a. (Hosford)	Iliac crest, iliac fossa, ala of sacrum, anterior sacroiliac lig.	Tendon of psoas major, lesser trochanter and femur distal to it	Flex thigh at hip joint; stabilize hip joint
Psoas major (of the iliopsoas)	Lumbar nn. (L1, 2, 3)	Medial femoral circumflex a. (Hosford)	Sides of T12-L5 vertebrae; transverse processes of all lumbar vertebrae	Lesser trochanter of femur	Ditto
Tensor fasciae latae	Superior gluteal n.	Superior gluteal a. (superficial br.)	Anterior superior iliac spine and anterior part of iliac crest	Iliotibial tract that attaches to lateral condyle of tibia	Abduct, medially rotate and flex thigh
Sartorius	Femoral n. (L2, 3)	<ul style="list-style-type: none"> • Profunda femoris a. • Saphenous br. of descending genicular a. (Hosford)	Anterior superior iliac spine and superior part of notch inferior to it	Superior part of medial surface of tibia	Flex, abduct and laterally rotate thigh at hip; flex leg at knee
Quadratus femoris consists of the following four muscles:	Femoral n. (L2, 3, 4)				
(1) Rectus femoris	Ditto	Lateral femoral circumflex a. (Hosford)	Anterior inferior iliac spine and ilium superior to acetabulum	Base of patella and by patellar lig. to tibial tuberosity	Extend leg at knee joint; rectus femoris also steadies hip joint and helps iliopsoas to flex thigh
(2) Vastus lateralis	Ditto	Ditto	Greater trochanter and lateral lip of linea aspera of femur	Ditto	Extend leg at knee joint
(3) Vastus intermedius	Ditto	Ditto	Anterior and lateral surfaces of body of femur	Ditto	Ditto

(4) Vastus medialis	Ditto	<ul style="list-style-type: none"> • Profunda femoris a. • Saphenous br. of descending genicular a. (Hosford) 	Intertrochanteric line and medial lip of linea aspera of femur	Ditto	Ditto
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Notes

The iliacus m. and psoas major m. fuse inferiorly into a single muscle (viz. the iliopsoas m.); see NE 462 for a good illustration.

Fascia

The thigh is divided into three compartments by lateral and medial septa.

The deep fascia which envelop the entire thigh is known as the fascia latae.

The tensor fasciae latae m. inferiorly draws upon the *iliotibial tract* (i.e. the fascia along the lateral side of the thigh, which is a continuation of the gluteal fascia).

Nerves

Most of the muscles in the ant. compartment are innervated by the femoral n. The exceptions are the psoas major and the tensor fasciae latae mm.

For cutaneous innervation see MA 226, CL 310-11.

Arteries

The *external iliac a.* passes through the pelvis and at the thigh becomes the *femoral a.* (from which pass several branches: the *profunda femoris a.* (or deep femoral a.) that passes posteriorly; the *lateral circumflex femora a.* and the *medial circumflex femoral a.*). At the knee the femoral a. in turn becomes the *popliteal a.* (also anastomosing to supply the knee), which at the leg splits into the *anterior tibial a.* and the *posterior tibial a.*

Tendons

On the anteromedial side of the proximal head of the tibia there are the insertions for three muscles. Laterally to medially these are the insertions for the Sartorius, Gracilis and semiTendinosus mm. (which can be remembered by “Say Grace before Tea.”). These tendons form the *pes anserinus* (CL 323, 349, 358).

Mnemonics

“Say Grace before Tea” for the pes anserinus.

THIGH, medial compartment

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Pectineus	Femoral n. (L2, 3)	Medial femoral circumflex a. (Hosford)	Superior ramus of pubis	Pectineal line of femur, just inferior to lesser trochanter	Adduct and flex thigh; assist with medial rotation of thigh
Adductor longus	Obturator n. (anterior br.), (L2, 3, 4)	Femoral a. (Hosford)	Body of pubis inferior to pubic crest	Middle third of linea aspera of femur	Adduct thigh
Adductor brevis	Obturator n. (L2, 3, 4)	Femoral a. (Hosford)	Body and inferior ramus of pubis	Pectineal line and proximal part of linea aspera of femur	Adduct thigh and to some extent flexes it
Adductor magnus	<i>Adductor part:</i> obturator n. (L2, 3, 4) <i>Hamstring part (inferior fibers):</i> tibial part of sciatic n. (L4)	Profunda femoris a. (Hosford)	Inferior ramus of pubis, ramus of ischium (adductor part), ischial tuberosity (hamstring part)	Gluteal tuberosity, linea aspera, medial supracondylar line (adductor part), adductor tubercle of femur (hamstring part)	Adductor part flexes thigh. Hamstring part extends thigh.
Gracilis	Obturator n. (L2, 3)	Obturator a. (Hosford)	Body and inferior ramus of pubis	Superior part of medial surface of tibia	Adduct thigh, flex leg, helps rotate leg medially
Obturator externus	Obturator n. (L3, 4)	Anterior br. of obturator a.	Margins of obturator foramen and obturator membrane	Trochanteric fossa of femur	Laterally rotate thigh; steady head of femur in acetabulum

Notes

The **femoral triangle** is a triangular fascial space in the superomedial third of the thigh. It is bordered:

- superiorly by the inguinal lig.
- medially by the adductor longus m.
- laterally by the sartorius m.

The floor of the femoral triangle is formed (laterally to medially) by the iliopsoas, pectineus and adductor longus mm. The roof of the femoral triangle is formed by fascia lata and cribriform fascia (MA 233).

In the femoral triangle are found (laterally to medially) the following structures: femoral Nerve, femoral Artery, femoral Vein, an Empy space which usually contains a deep inguinal Lymph node (cf. the mnemonic “N.A.V.E.L.”). The femoral n. is outside the **femoral sheath** and femoral ring (MA 238). The femoral canal is divided into three little passages (by *adventitia*, intervening sheets of fascia); in the lateral passage passes the femoral a., in the middle passage passes the femoral v., and the most medial passage is empty (except for the deep inguinal lymph node) and is known as the **femoral canal** (NE 510; CL 319).

The **adductor canal** (also called **Hunter’s canal** or the **subsartorial canal**) begins where the sartorius m. crosses over the adductor longus m. and ends at the **adductor hiatus** in the tendon of the adductor magnus. Through the adductor canal there pass the femoral a., femoral v., and the saphenous n. and the n. to the vastus medialis (MA 239; CL 320-1).

Clinical correlations

The femoral v. is not usually palpable, but its position can be located by feeling the pulsations of the femoral a., which lies just lateral to it (MA 238).

The **femoral canal** is enclosed by the **femoral sheath** of fascia, and is the usual site of femoral hernias (MA 238) when the small intestine falls into it.

Fascia

Femoral ring, femoral sheath

Nerves

Most of the muscles in the medial compartment are innervated by the obturator n. The exceptions are the pectineus m. and the hamstring part of the adductor magnus m.

For cutaneous innervation see MA 226, CL 310-11.

Lymphatics

Superficial inguinal nodes (CL 243, 315). Deep inguinal nodes (CL 315). External iliac nodes (CL 243; NE 510).

Mnemonics

N.A.V.E.L. = structures in the femoral triangle.

THIGH, posterior compartment

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Semitendinosus	Tibial division of sciatic n. (L5, S1, S2)	<ul style="list-style-type: none"> • Perforating branches of profunda femoris a. • Inferior gluteal a. (Hosford) 	Ischial tuberosity	Medial surface of superior part of tibia	Extend thigh, flex leg and rotate it medially
Semimembranosus	Ditto	Ditto	Ditto	Posterior part of medial condyle of tibia	Ditto
Biceps femoris	<i>Long head:</i> tibial division of sciatic n. (L5, S1, S2). <i>Short head:</i> common fibular (peroneal) division of sciatic n. (L5, S1, S2).	Ditto	<i>Long head:</i> ischial tuberosity. <i>Short head:</i> linea aspera and lateral supracondylar line of femur.	Lateral side of head of fibula; tendon is split at this site by fibular collateral ligament of knee.	Flex leg and rotate it laterally. Extend thigh (e.g. when starting to walk).

Notes

The “hamstring” muscles are the semitendinosus, semimembranosus and biceps femoris mm. (MA 242-3).

Nerves

Sciatic n. (composed of the tibial n. and common fibular (peroneal) n. (L4, L5, S1, S2, S3) (NE 465).

For cutaneous innervation see MA 226, CL 310-11.

Arteries

There are NO ARTERIES in the posterior compartment of the thigh. The muscles are supplied by the four “perforating branches” (which come from the profunda femoris a.; MA 237).

KNEE**Notes**

The posterior aspect of the knee is the diamond-shaped *popliteal fossa* (MA 247).

From superficial to deep in the popliteal fossa are found: tibial n., popliteal v., popliteal a. (CL 338).

Superficial to the patella is the *prepatellar bursa* (MA 224).

Clinical correlations

The “unhappy triad of the knee” is an injury resulting in tears of (1) the medial collateral lig., (2) the medial meniscus, and (3) the anterior cruciate lig. (see MA 272). This injury can be caused by a blow to the knee from its posterolateral side, or by stopping quickly when running.

If the *anterior cruciate ligament* is damaged, the tibia can be displaced anteriorly (with respect to the femur) more than normal; this is known as the “positive anterior drawer sign.” If the *posterior cruciate ligament* is damaged, the tibia can be displaced posteriorly (with respect to the femur) more than usual; this is known as the “positive posterior drawer sign.”

Prepatellar bursitis is inflammation of the prepatellar bursa (MA 272).

Fascia

Deep popliteal fascia

Arteries

Popliteal a., superior medial geniculate a., superior lateral geniculate a., inferior medial geniculate a., inferior lateral geniculate a., middle geniculate a., sural a. (CL 309, 340).

Veins

The lesser saphenous v. courses superficially along the posterior aspect of the leg, but then pierces the popliteal fascia and courses deeply (NE 509).

Anastomoses

The branches of the genicular arteries join to form the *genicular anastomosis* (MA 250).

Osteology

The patella (kneecap) is a “sesamoid bone” (viz. in the shape of a sesame seed).

Ligaments

On the medial side of the knee is the **tibial collateral ligament**. On the lateral side is the **fibular collateral ligament**. There is also a **medial collateral ligament** (which *is* attached to the medial meniscus) and a **lateral collateral ligament** (which is *not* attached to the lateral meniscus) (CL 383).

The tendons of all four quadriceps muscles (rectus femoris, vastus lateralis, vastus medialis and vastus intermedius) converge at the base (=the superior part) of the patella in a ligamentation called a *retinaculum*. From the inferior part of the patella there passes (inferiorly) the patellar ligament.

Lymphatics

Superficial popliteal nodes (CL 338; NE 510).

LEG, anterior crural region

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Tibialis anterior	Deep fibular (peroneal) n. (L4, L5, S1)	Anterior tibial a.	Lateral condyle and superior half of lateral surface of tibia	Medial and inferior surfaces of medial cuneiform and base of first metatarsal	Dorsiflex ankle, invert foot
Extensor hallucis longus	Deep fibular (peroneal) n. (L5, S1)	Ditto	Middle part of anterior surface of fibula and interosseous membrane	Dorsal aspect of base of distal phalanx of great toe (hallux)	Extend great toe, dorsiflex ankle
Extensor digitorum longus	Ditto	Ditto	Lateral condyle of tibia and superior three-fourths of anterior surface of interosseous membrane	Middle and distal phalanges of lateral four digits	Extend lateral four digits, dorsiflex ankle

Fibularis (peroneus) tertius	Ditto	Ditto	Inferior third of anterior surface of fibula and interosseous membrane	Dorsum of base of fifth metatarsal	Dorsiflex ankle, aid in eversion of foot
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Clinical correlations

The *anterior compartment syndrome* (“shin splints”) is a painful swelling of the muscles in this compartment which can follow vigorous exercise (MA 251).

Severance of the common fibular (peroneal) n. results in paralysis of all the dorsiflexor muscles of the ankle and eversion muscles of the foot. The loss of eversion of the foot and dorsiflexion of the ankle causes the foot to hang down, a condition known as *foot drop* (MA 251). Trauma to the head and neck region of the fibula can cause this nerve damage.

Fascia

The deep investing fascia of the lower leg is known as crural fascia.

This compartment is delimited by the deep (investing) fascia, the anterior intermuscular septum, and the interosseus membrane (which is really ligamentation, not fascia) (NE 487; CL 344).

Nerves

All the mm. in this compartment are innervated by the deep fibular (peroneal) n., which in turn arises from the common fibular (peroneal) n.

For cutaneous innervation see MA 226, CL 310-11.

Arteries

All of the mm. in this compartment are supplied by the anterior tibial a., which originates from the popliteal a. (The anterior tibial a. passes into the anterior compartment through a hiatus in the superior part of the interosseous membrane and descends along this membrane between the tibialis anterior and extensor digitorum longus mm.)

LEG, lateral crural region

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
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Fibularis (peroneus) longus	Superficial fibular (peroneal) nerve (L5, S1, S2)	Perforating branches of the fibular (peroneal) a.	Head and superior two-thirds of lateral surface of fibula	Base of first metatarsal and medial cuneiform	Evert foot and weakly plantarflex ankle
Fibularis (peroneus) brevis	Ditto	Ditto	Inferior two-thirds of lateral surface of fibula	Dorsal surface of tuberosity on lateral side of base of 5th metatarsal	Ditto

Notes

The muscles in this compartment evert the foot (viz. point the sole laterally).

Clinical correlations

Severance of the superficial fibular (peroneal) n. results in loss of eversion (since it supplies the mm. of the lateral compartment).

Severance of the common fibular (peroneal) n. results in paralysis of all the dorsiflexor muscles of the ankle and eversion muscles of the foot. The loss of eversion of the foot and dorsiflexion of the ankle causes the foot to hang down, a condition known as *foot drop* (MA 251).

Fascia

This compartment is delimited by the deep (investing) fascia, the anterior intermuscular septum and the posterior intermuscular septum (NE 487; CL 344).

Nerves

The mm. of this compartment are innervated by the superficial fibular (peroneal) n., which in turn arises from the common fibular (peroneal) n.

For cutaneous innervation see MA 226, CL 310-11.

Arteries

There is no artery in the lateral compartment of the leg; the mm. are supplied by perforating branches of the fibular (peroneal) a. (MA 255).

LEG, superficial posterior compartment

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Gastrocnemius	Tibial n. (S1, S2)	<ul style="list-style-type: none"> • Sural br. of popliteal a. • Peroneal a. • Posterior tibial a. (Hosford) 	<i>Lateral head:</i> lateral aspect of lateral condyle of femur. <i>Medial head:</i> popliteal surface of femur, superior to medial condyle	Posterior surface of calcaneus via calcaneal tendon	Plantarflex ankle, raise heel during walking, flex leg at knee joint
Soleus	Ditto	Ditto	Posterior aspect of head of fibula, superior fourth of posterior surface of fibula, soleal line and medial border of tibia	Ditto	Plantarflex ankle, steady leg on foot
Plantaris	Ditto	Ditto	Inferior end of lateral supracondylar line of femur and oblique popliteal ligament	Calcaneus, medial to calcaneal tendon or blending therewith	Weakly assist gastrocnemius in plantarflexing ankle and flexing knee

Clinical correlations

Rupture of the calcaneal tendon usually results in abrupt pain in the posterior aspect of the leg. The patient cannot use the limb, and a lump in the calf appears due to the shortening of the triceps surae muscle. After rupture of the calcaneal tendon, the foot can be dorsiflexed to a greater extent than normal but cannot be plantarflexed at all (MA 259).

Fascia

This compartment is delimited by the deep (investing) fascia and by the transverse intermuscular septum (NE 487; CL 344).

Veins

The greater saphenous v. begins on the foot, courses superoanteriorly to the medial malleolus and courses on the medial aspect of the leg (CL 342).

The lesser saphenous v. courses superficially along the posterior aspect of the leg, but then pierces the popliteal fascia and courses deeply (NE 509).

Nerves

The mm. of this compartment are innervated by the tibial n., which in turn arises from the sciatic n.

The *sural n.* (from the tibial n. and common fibular [peroneal] n.) descends between the heads of the gastrocnemius m. (MA 251) and provides cutaneous innervation of the lateral side of the foot (MA 226, 265).

LEG, deep posterior compartment

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Popliteus	Tibial n. (L4, L5, S1)	Sural branches of popliteal a. (Hosford)	Lateral surface of lateral condyle of femur and lateral meniscus	Posterior surface of tibia, superior to soleal line	Weakly flex knee and unlock it
Flexor hallucis longus	Tibial n. (S2, S3)	<ul style="list-style-type: none"> • Peroneal a. • Posterior tibial a. (Hosford) 	Inferior two-thirds of posterior surface of fibula and inferior part of interosseous membrane	Base of distal phalanx of great toe	Flex great toe at all joints; plantarflex ankle; support medial longitudinal arch of foot
Flexor digitorum longus	Ditto	Ditto	Medial part of posterior surface of tibia inferior to soleal line, and by a broad tendon to fibula	Bases of distal phalanges of lateral four digits	Flex lateral four digits and plantarflex ankle; support longitudinal arches of foot
Tibialis posterior	Tibial n. (L4, L5)	Ditto	Interosseous membrane, posterior surface of tibia inferior to soleal line, and posterior surface of fibula	Tuberosity of navicular, cuneiform, and cuboid and bases of 2nd, 3rd and 4th metatarsals	Plantarflex ankle and invert foot

Notes

When standing on a fully extended leg, the knee is locked. The popliteus m. is responsible for unlocking the knee, which is necessary before flexing it (CL 362).

Fascia

This compartment is delimited by the transverse intermuscular septum and by interosseous membrane (the latter of which is really ligamentation, not fascia) (NE 487; CL 344).

Nerves

The mm. in this compartment are innervated by the tibial n.
For cutaneous innervation see MA 226, CL 310-11.

FOOT**First layer** (most superficial, most inferior)

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Abductor hallucis	Medial plantar n. (S2, S3)	Medial plantar a. (Hosford)	Medial tubercle of tuberosity of calcaneus, flexor retinaculum and plantar aponeurosis	Medial side of base of proximal phalanx of 1st digit	Abduct and flex 1st digit (great toe)
Flexor digitorum brevis	Ditto	Ditto	Medial tubercle of tuberosity of calcaneus, plantar aponeurosis, and intermuscular septa	Both sides of middle phalanges of lateral 4 digits	Flex lateral 4 digits
Abductor digiti minimi	Lateral plantar n. (S2, S3)	Lateral plantar a. (Hosford)	Medial and lateral tubercles of tuberosity of calcaneus, plantar aponeurosis, and intermuscular septa	Lateral side of base of proximal phalanx of 5th digit	Abduct and flex 5th digit

Second layer

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Quadratus plantae	Lateral plantar n. (S2, S3)	Lateral plantar a. (Hosford)	Medial surface and lateral margin of plantar surface of calcaneus	Posterolateral margin of tendon of flexor digitorum longus	Assist flexor digitorum longus in flexing lateral 4 digits

Lumbricals (4)	<i>Medial one:</i> medial plantar n. (S2, S3). <i>Lateral three:</i> lateral plantar n. (S2, S3)	<i>Medial one:</i> medial plantar a. <i>Lateral three:</i> lateral plantar a. (Hosford)	Tendons of flexor digitorum longus	Medial aspect of expansion over lateral 4 digits	Flex proximal phalanges and extend middle and distal phalanges of lateral 4 digits
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Third layer

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Flexor hallucis brevis	Medial plantar n. (S2, S3)	Medial plantar a. (Hosford)	Plantar surfaces of cuboid and lateral cuneiforms	Both sides of base of proximal phalanx of 1st digit	Flex proximal phalanx of 1st digit
Adductor hallucis	Deep br. of lateral plantar n. (S2, S3)	Lateral plantar a. (Hosford)	<i>Oblique head:</i> bases of metatarsals 2-4. <i>Transverse head:</i> plantar ligaments of metatarsophalangeal joints	Tendons of both heads attach to lateral side of base of proximal phalanx of 1st digit	Adduct 1st digit; assist in maintaining transverse arch of foot
Flexor digiti minimi brevis	Superficial branch of lateral plantar n. (S2, S3)	Ditto	Base of 5th metatarsal	Base of proximal phalanx of 5th digit	Flex proximal phalanx of 5th digit, thereby assisting with its flexion

Fourth layer (most deep)

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Plantar interossei (3)	Lateral plantar n. (S2, S3)	Lateral plantar a.	Bases and medial sides of metatarsals 3-5	Medial sides of bases of proximal phalanges of 3rd to 5th digits	<u>A</u> dduct digits (2-4) and flex metatarsophalangeal joints
Dorsal interossei (4)	Ditto	Ditto	Adjacent sides of metatarsals 1-5	<i>First:</i> medial side of proximal phalanx of 2nd digit. <i>Second to fourth:</i> lateral sides of 2nd to 4th digits	<u>A</u> bdact digits (2-4) and flex metatarsophalangeal joints.

Dorsal layer (see CL 353)

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Extensor digitorum brevis	Deep peroneal n.	Dorsalis pedis a.	Dorsal and lateral aspect of the calcaneus bone	Lateral side of the tendons of the extensor digitorum longus m. for the 2nd, 3rd and 4th toes	Help extend the proximal phalanx of the great toe
Extensor hallucis brevis	Ditto	Ditto	Ditto	Lateral side of the base of the proximal phalanx of the great toe	Ditto

Notes

The *arches* of the feet (CL 399; MA 279) provide support in four manners: (1) the shapes of the bones themselves, viz. they are in the form of a keystone in that the dorsal facet is larger than the plantar facet; (2) ligamentation; (3) short muscles of the foot; (4) long tendons.

Clinical correlations

Contusion and tearing of the muscles on the dorsum of the foot (the extensor digitorum brevis and extensor hallucis brevis mm.) result in a *hematoma* which produces a swelling anteromedial to the lateral malleolus. This is frequently mistaken for a sprained ankle (MA 264).

A *sprained ankle* is almost always due to inversion (MA 276).

Fascia

The *inferior extensor retinaculum* is an “X”-shaped band of fascia over the dorsal side of the ankle which prevents the extensor tendons from bowing when their muscles contract. (See figures in CL 345 ff.)

The *plantar fascia* is the deep fascia of the sole of the foot. The central part of this fascia is thick and constitutes the *plantar aponeurosis* (MA 261).

Septa divide the foot into medial compartment (for the hallux, great toe), central compartment, and lateral compartment (for the digiti minimi, little toe) (MA 261, 264).

The *flexor retinaculum* (CL 352) is a thick band of fascia that passes from the medial malleolus to the calcaneus. Beneath it pass (superoanteriorly to inferoposteriorly) the Tendon of the tibialis posterior m., the flexor Digitorum longus, the posterior tibial Artery and nerve, and the flexor Hallucis longus (which can be remembered by the mnemonic “Tom, Dick And Harry”).

Nerves

The medial and lateral plantar nn. (which are branches of the tibial n.) supply the intrinsic muscles of the foot.

The *medial plantar n.* passes distally in the foot between the abductor hallucis and flexor digitorum brevis (MA 265).

The *lateral plantar n.* passes laterally in the foot between the quadratus plantae and the flexor digitorum brevis (MA 265).

For cutaneous innervation see MA 226, CL 310-11.

Dermatomes (see NE 507): L4 = medial half of big toe, L5 = middle three toes and lateral half of big toe, S1 = little toe.

Concerning the nn. to the mm. on the plantar surface of the foot: the four mm. on the medial side are innervated by the medial plantar n.: (1) abductor hallucis, (2) flexor hallucis brevis, (3) flexor digitorum brevis, (4) first lumbrical. All the remaining mm. (including the adductor hallucis and all the interossei) are innervated by the lateral plantar n.

Arteries

The aa. in the sole of the foot are derived from the posterior tibial a. The *plantar arch* begins opposite the base of the 5th metatarsal bone as the continuation of the lateral plantar a. (MA 264).

On the dorsum of the foot, the anterior tibial a. becomes the dorsalis pedis a., which then (by the toes) becomes the arcuate a. (CL 355, 372).

Osteology

There are two small sesamoid bones on the distal plantar surface of the 1st metatarsal bone (CL 391). They are subject to irritation and inflammation.

Mnemonics

“Tom, Dick And Harry” (Note that this is *only* relevant at the medial malleolus, not superiorly in the leg!)

Partial systemic summary of innervation of the extremities

The foregoing sections of this study guide constitute a description which can be classified as “**regional anatomy**,” i.e. a description which takes a particular region (e.g. the forearm) and examines all the different aspects of it (e.g. innervation, arterial supply, venous drainage, cutaneous innervation).

In contrast, **systemic anatomy** examines a particular “system” (e.g. arterial supply) and follows it over one or more regions. The advantage to this approach is that it may allow you to see generalizations which are otherwise obfuscated by a regional approach. The following tables constitute a systemic analysis of the innervation to the extremities.

Region	Primary innervation	Exceptions
Arm		
Anterior compartment	Musculocutaneous n.	
Posterior compartment	Radial n.	
Forearm		
Anterior compartment, superficial mm.	Median n.	Flexor carpu ulnaris m. (ulnar n.)
Anterior compartment, deep mm.	Anterior interosseous branch of median n.	Medial side of flexor digitorum profundis m. (ulnar n.)
Posterior compartment, superficial and deep mm.	Radial n.	
Hand		
• Muscles of thenar eminence • Lumbricals 1 and 2 (lateral)	Recurrent branch of median n.	
• Muscles of hypothenar eminence • Lumbricals 3 and 4 (medial) • Dorsal and palmar interossei • Adductor pollicis	Deep branch of ulnar n.	
Palmaris brevis	Superficial branch of ulnar n.	

Region	Primary innervation	Exceptions
Thigh		
Anterior compartment	Femoral n.	Psoas major m. (lumbar n.) Tensor fasciae latae (superior gluteal n.)
Medial compartment	Obturator n.	Pectineus m. (femoral n.)
Posterior compartment	Tibial n.	Short head of biceps femoris m. (common fibular [peroneal] division of sciatic n.)
Leg		

Anterior compartment	Deep fibular (peroneal) n.	
Lateral compartment	Superficial fibular (peroneal) n.	
Posterior compartment, superficial and deep mm.	Tibial n.	

Region	Medial plantar n.	Lateral plantar n.	Deep peroneal n.
Foot			
First layer (plantar)	<ul style="list-style-type: none"> • Abductor hallucis • Flexor digitorum brevis 	Abductor digiti minimi	
Second layer (plantar)	One medial lumbrical	<ul style="list-style-type: none"> • Three lateral lumbricals • Quadratus plantae 	
Third layer (plantar)	Flexor hallucis brevis	<ul style="list-style-type: none"> • Adductor hallucis (deep branch of lateral plantar n.) • Flexor digiti minimi (superficial branch of lateral plantar n.) 	
Fourth layer (plantar)		<ul style="list-style-type: none"> • Plantar interossei • Dorsal interossei 	
Dorsal layer			<ul style="list-style-type: none"> • Extensor digitorum brevis • Extensor hallucis brevis

Other interesting bits of information about which Dr. Lieska likes to ask:

Nerve:

Medial pectoral n.
 Musculocutaneous n.
 Lateral pectoral n.
 Deep branch of radial n.
 Superficial branch of radial n.

Pierces the following structure:

Pectoralis minor m. (MA 299)
 Coracobrachialis m. (MA 299)
 Clavipectoral fascia (MA 299)
 Supinator m. (MA 315)
 Brachioradialis m. (MA 315)