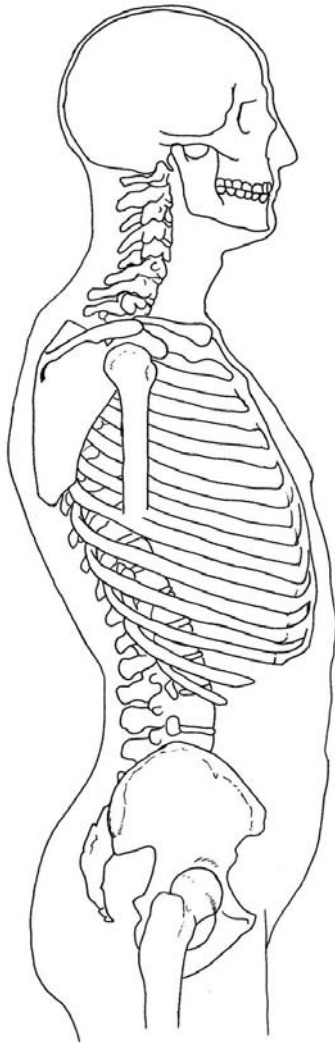


# GROSS ANATOMY

Lecture Syllabus 2008

## Unit #4: Upper and Lower Limbs



ANAT 6010 - Gross Anatomy  
Department of Neurobiology and Anatomy  
University of Utah School of Medicine

G24- Upper Limb Overview, Shoulder, and Axilla

G25- Arm and Elbow

G26- Forearm and Wrist

G27- Hand

G28- Hip and Posterior Compartment of the Thigh

G29- Anterior and Medial Thigh

G30- Leg and Knee

G31- Foot and Ankle

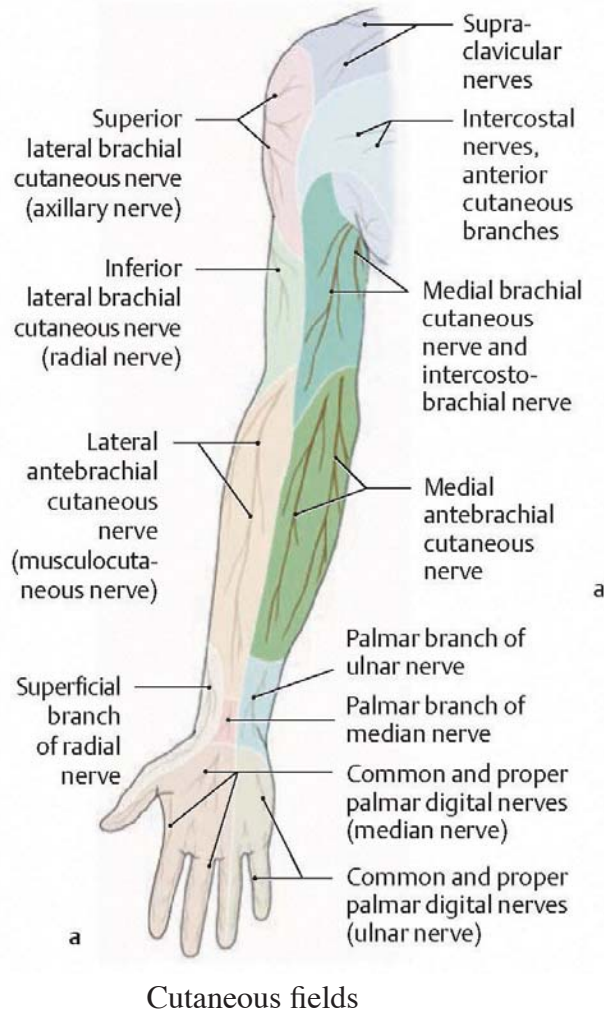
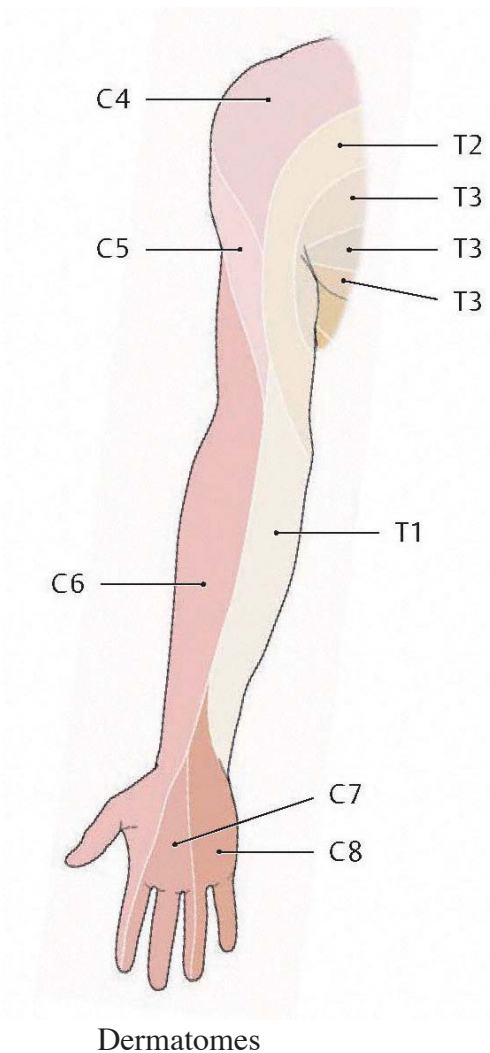
## G24: Upper Limb Overview and Shoulder and Axilla

At the end of this lecture, students should be able to master the following:

### 1) Upper limb overview

#### a) Cutaneous innervation of the upper limb

- Compare and contrast the dermatomes and cutaneous fields of the upper limb
- Dermatome: area of skin supplied by a single spinal cord level
- Cutaneous field: area of skin supplied by a single peripheral nerve branch (multiple spinal cord levels)



b) Major vessels

i) Superficial veins

Describe the location and direction of flow through the major superficial veins of the upper limb

- Cephalic
- Basilic
- Median cubital
- Dorsal veins of the hands

ii) Arteries

Trace the pathway and distribution of the principle arteries through the upper limb

- Subclavian
- Axillary
- Brachial
- Radial and ulnar
- Superficial and deep palmar arches

## 2) Actions of the Upper Limb

a) Describe the structure/action(s) of the following:

- Pectoral girdle (scapula and clavicle)
- Scapula- protraction, retraction, elevation, depression, upward rotation, downward rotation
- Glenohumeral joint- flexion, extension, abduction, adduction, medial rotation, lateral rotation
- Humeroulnar (elbow) joint- flexion, extension
- Proximal and distal radioulnar joints- supnation, pronation
- Wrist joint- flexion, extension, abduction (radial deviation), adduction (ulnar deviation)

### 3) Fascia of the Upper Limb

a) Describe the fascial organization of the upper limb:

Between the skin and bone are two fascial layers in the upper limb termed the superficial and deep fascia:

- Superficial fascia: located deep to the skin and contains superficial veins (cephalic, median cubital, basilic), cutaneous nerves, superficial lymphatics and fat.
- Deep fascia: located deep to the superficial fascia and contains muscles, nerves, vessels and deep lymphatics. The deep fascia is a continuation of the deep fascia covering the deltoid and pectoralis major muscles. As the deep fascia extends distally, intermuscular septa extend to the bone dividing the arm and forearm into anterior and posterior compartments in the arm and forearm. Each compartment contains muscles that perform similar actions and have common innervation and attachments.

#### Arm

- Anterior: Flexors, musculocutaneous nerve
- Posterior: Extensors, radial nerve

#### Forearm

- Anterior: Flexors, medial epicondyle, median and ulnar nerves
- Posterior: Extensors, lateral epicondyle, radial nerve

### 4) Skeletal muscle basics

Skeletal muscles in the limbs:

- attach to at least two separate bones (origin and insertion)
- act on the joint(s) that the muscle crosses between the attachments
- contract when a muscle fiber generates tension through the actin and myosin cross-bridging cycling

The term “contraction” implies a shortening or reduction, however, in reality contraction refers to the generation of tension by muscle fibers with the help of motor neurons.

While under tension, the muscle may shorten, remain the same or lengthen (muscle cells do not push)

- Concentric contraction: muscle shortens (biceps curl)
- Isometric contraction: no change in length of muscle (muscles of the hand and forearm while gripping an object)
- Eccentric contraction: muscle lengthens while under pressure due to an opposing force being greater than the force generated by the muscle (setting an object down gently)

## 5) Axilla: Muscles of the shoulder girdle

a) Describe the attachments, principle actions, and relations of the muscles of the shoulder girdle as grouped below

**Table – Muscles of the Shoulder Girdle**

Muscle	Proximal Attachment	Distal Attachment	Action	Innervation
<b>Scapular Muscles</b>				
Subclavius	1 <sup>st</sup> rib	Clavicle	Depresses the clavicle	Nerve to the subclavius (C5)
Trapezius	Occipital bone, nuchal ligament, C7-T12 vertebrae	Spine, acromion and lateral clavicle	Elevates, retracts, rotates and depresses the scapula	Spinal accessory n. and C3 and C4 spinal nerves
Levator scapulae	Transverse processes of C1–C4	Superior angle of the scapula	Elevates the scapula	Dorsal scapular n. (C5) and C3 and C4 spinal nerves
Rhomboid minor	C7–T1 vertebrae	Medial margin of the scapula	Retracts the scapula	Dorsal scapular n. (C5)
Rhomboid major	T2–T5 vertebrae			
Serratus anterior	Ribs 1-8		Protracts and rotates the scapula	Long thoracic n. (C5-C7)
Pectoralis minor	Ribs 3-5	Coracoid process of the scapula	Protracts and depresses the scapula	Medial pectoral n. (C8-T1)
<b>Intertubercular Groove Muscles</b>				
Pectoralis major	Clavicle, sternum and costal cartilage	Intertubercular groove of the humerus	Adducts, medial rotates, extends and flexes the humerus	Medial and lateral pectoral nn. (C5-T1)
Latissimus dorsi	T7–T12, sacrum, thoracolumbar fascia	Intertubercular groove of the humerus	Adducts, extends and medial rotates the humerus	Thoracodorsal n. (C6-C8)
Teres major	Inferior angle of the scapula	Intertubercular groove of the humerus	Adducts, extends and medially rotates the humerus	Lower subscapular n. (C6-C7)
Deltoid	Spine, acromion and lateral clavicle	Deltoid tuberosity of the humerus	Flexes, extends and abducts the humerus	Axillary n. (C5-C6)
<b>Rotator Cuff Muscles</b>				
• Supraspinatus	Supraspinous fossa	Greater tubercle of the humerus	Abduction of humerus (first 15°) Laterally rotates the humerus Medially rotates the humerus	Suprascapular n. (C4-C6)
• Infraspinatus	Infraspinous fossa			Suprascapular n. (C5-C6)
• Teres minor	Lateral margin of the scapula			Axillary n. (C5-C6)
• Subscapularis	Subscapular fossa	Lesser tubercle of the humerus		Upper and lower subscapular nn.

## 6) Brachial Plexus- Shoulder

a) Draw and label all parts of the brachial plexus; describe the topographical relations of the plexus as it passes through the neck, shoulder, and axilla; and describe the origin, course and distribution of the branches that supply the shoulder

- **Roots (Randy)** - 5 roots between anterior and middle scalene mm.
- **Trunks (Travis)** - 3 trunks lateral to the interscalene space and superior to the clavicle
- **Divisions (Drinks)** - 6 divisions deep to the clavicle (3 anterior and 3 posterior)
- **Cords (Cold)** - 3 cords in the axilla, deep to the pectoralis minor m. named according to their position to axillary a.
- **Branches (Beer)** - 5 branches to the upper limb (3 anterior division and 2 posterior division)

(See tutorial on DIGANAT on drawing the brachial plexus)

i) **Roots (C5-T1)**- pass between the anterior and middle scalenes with the subclavian a. (subclavian vein courses anterior to the anterior scalene m.)

- Dorsal scapular nerve- (C5) pierces the middle scalene, descends deep to the levator scapulae, rhomboideus mm. along with the deep branch of the transverse cervical a. supplying both rhomboideus mm. and partially the levator scapulae
- Long thoracic nerve- (C5-C7) descends posterior to the roots of the plexus and the axillary a., descends along the lateral surface of the serratus anterior m. with the lateral thoracic a. while supplying the muscle

ii) **Trunks (superior, middle, inferior)**- emerge between anterior and middle scalenes and descend towards the clavicle

- Suprascapular nerve- (C5,C6) branches off the upper trunk, courses across the posterior triangle of neck, through the suprascapular foramen, inferior to the transverse scapular ligament, (suprascapular a. and v. pass superior to the transverse scapular ligament) to supply the supraspinatus m.; continues through the greater scapular notch to supply the infraspinatus m.
- Nerve to the subclavius- (C5, C6) branches off the upper trunk to the subclavius m.
- No branches arise from the middle and inferior trunks

iii) **Divisions (anterior, posterior)**- anterior divisions innervate anterior compartments of the limb (flexor muscles); posterior divisions innervate posterior compartments of the limb (extensor muscles)

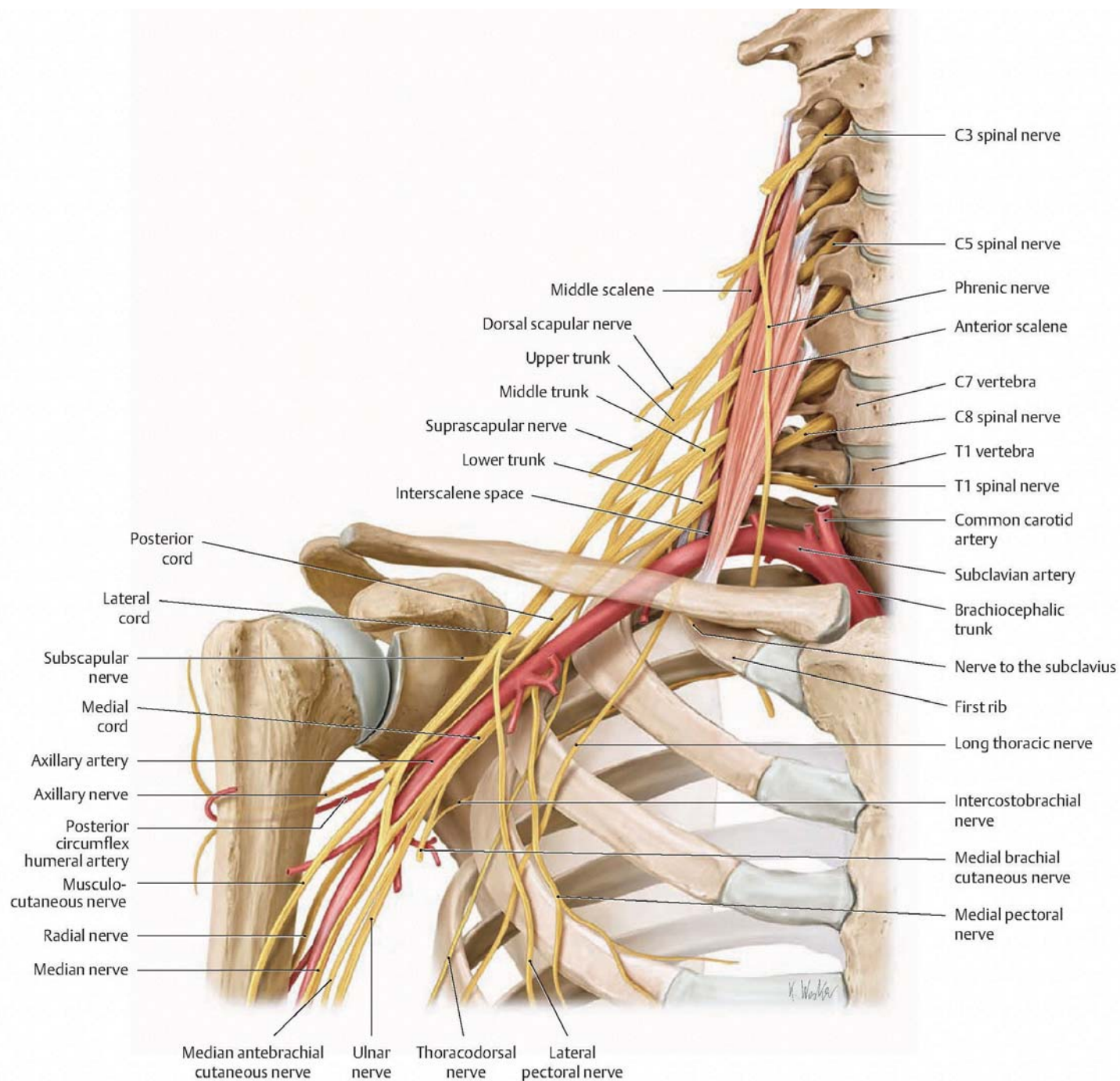
iv) **Cords (medial, lateral, posterior)**- medial and lateral cords arise from the anterior divisions and are named for their relation to the axillary a.; the posterior cord arises from the posterior division and runs posterior to the axillary a.

- Lateral pectoral nerve- (C5-C7) branches off the lateral cord, sends a branch to the medial pectoral n. anterior to the axillary a., passes proximal to the pectoralis minor to reach the pectoralis major m.
- Medial pectoral nerve- (C8, T1) branches off the medial cord, receives a contribution from the lateral pectoral n., pierces the pectoralis minor m., supplying it as it passes, continues deep to the pectoralis m.
- Medial brachial cutaneous nerve (C8-T1)
- Medial antebrachial cutaneous nerve (C8-T1)
- Upper subscapular nerve- (C5, C6) branches off posterior cord, enters anterior surface of the subscapularis m.
- Thoracodorsal nerve (middle subscapular)- (C6-C8) branches off the posterior cord, descends to the posterolateral thorax to supply the latissimus dorsi m.
- Lower subscapular nerve- (C5, C6) branches off the posterior cord, splits to send one branch to the anterior surface of the subscapularis m. and one to the anterior surface of the teres major m.

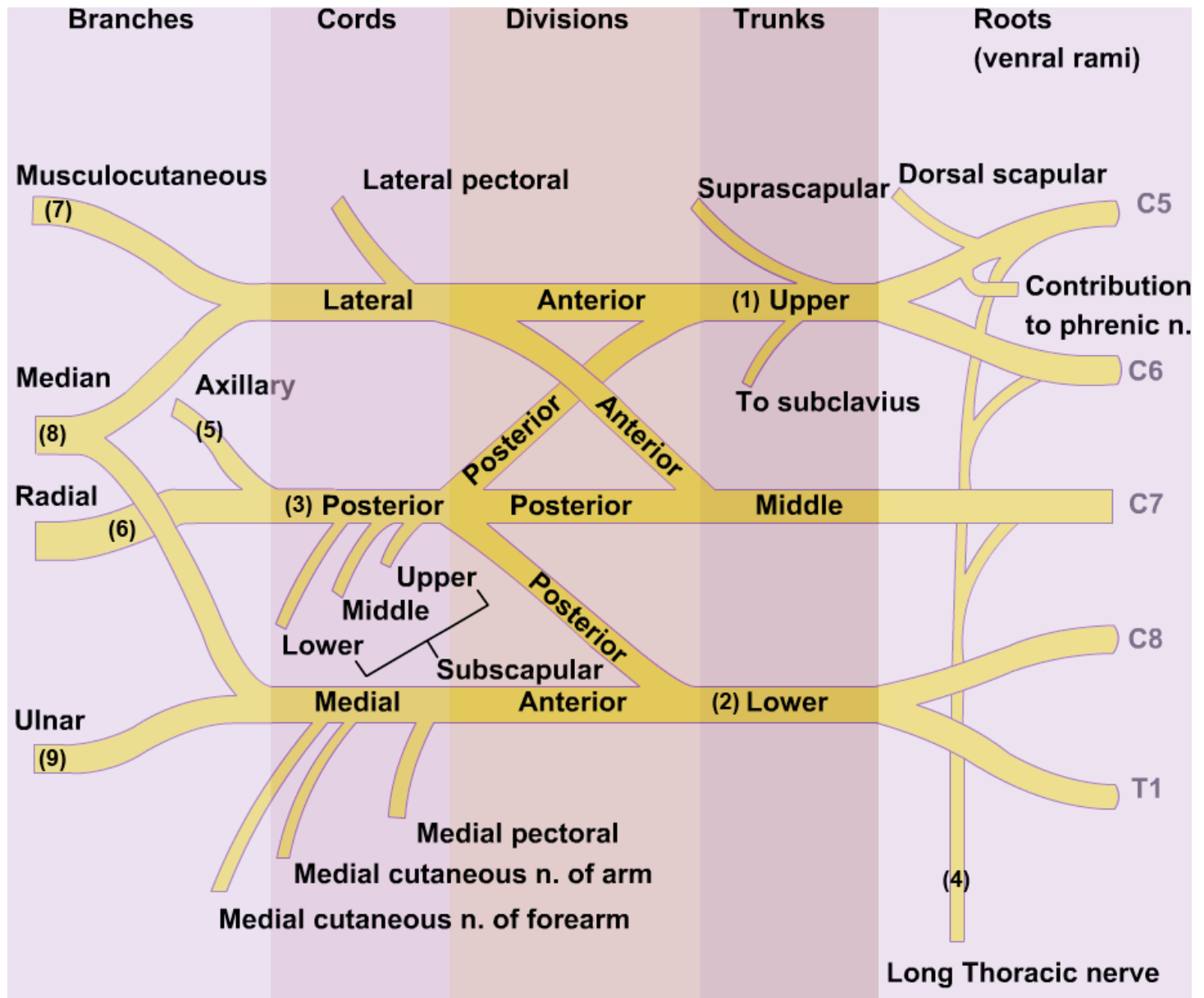
v) **Branches**

- Musculocutaneous nerve (C5-C7)
- Median nerve (C5-T1)
- Ulnar nerve (C7-T1)
- Axillary nerve- (C5, C6) terminal branch of the posterior cord, courses through the quadrangular space then splits, sending one branch to the teres minor m. and the other to the deltoid m.; also contributes to the lateral brachial cutaneous nerve, supplying the glenohumeral joint and the skin over the deltoid m.
- Radial nerve (C5-T1)





## 7) Brachial plexus lesions



1. Waiter's tip
2. Claw hand
3. Wrist drop
4. Winged scapula
5. Deltoid paralysis
6. Saturday night palsy (wrist drop)
7. Difficulty flexing elbow, variable sensory loss
8. Decreased thumb function; Sign of Benediction
9. Intrinsic muscles of hand; claw hand



## 8) Vascularization of the Shoulder

- a) Subclavian artery- branches directly from the aortic arch on the left and from the brachiocephalic artery on the right, passes between the anterior and middle scalenes (subclavian v. is anterior to the anterior scalene)
- i) Describe the origin, course, and destination of the following subclavian artery branches to the shoulder
- (1) Thyrocervical trunk- branches medial to the anterior scalene
- (a) Transverse cervical artery- crosses anterior to the anterior scalene, branches at the lateral border of the anterior scalene into deep and superficial transverse cervical arteries
- Superficial transverse cervical artery- dives deep to the trapezius and descends between the trapezius and the rhomboideus muscles
  - Dorsal scapular artery (deep transverse cervical artery)- dives deep to the trapezius and levator scapulae, descends along the medial border of the scapula deep to the rhomboideus muscles; forms a collateral circuit with the circumflex scapular and suprascapular arteries
- (b) Suprascapular artery- crosses anterior to the anterior scalene as it courses laterally towards the supraspinous fossa (passes superficial to the transverse scapular ligament and suprascapular nerve), then through the greater scapular notch to the infraspinous fossa, forms a collateral circuit with the circumflex scapular and dorsal scapular arteries
- b) Axillary artery- continuation of the subclavian artery from the external border of the first rib to the distal border of the teres major muscle where it gives rise to brachial artery
- ii) Describe the three parts of the axillary artery and the origin, course, and destination of the branches of each part
- (1) First part- (one branch) external border of the first rib to the proximal border of the pectoralis minor muscle
- (a) Superior thoracic artery- supplies the upper part of the anterior and medial axillary walls
- (2) Second part- (two branches) runs posterior to the pectoralis minor muscle
- (a) Thoraco-acromial artery- wraps around the proximal border of the pectoralis minor then branches into the pectoral, acromial, clavicular, and deltoid branches; each are named for the region they supply
- (b) Lateral thoracic artery- runs with the long thoracic nerve along the lateral surface of the thorax supplying the serratus anterior and surrounding tissue; one of very few arteries that runs superficial to the muscle it supplies
- (3) Third part- (three branches) distal border of the pectoralis minor muscle to the distal border of the teres major muscle
- (a) Subscapular artery- runs along the anterior surface of the subscapularis, branches into the circumflex scapular artery and thoracodorsal artery
- Circumflex scapular artery- courses through the triangular space to the posterior side of the scapula and anastomoses with the suprascapular and dorsal scapular (deep transverse cervical) arteries
  - Thoracodorsal artery- runs with the thoracodorsal nerve along the posteriolateral thorax, supplying the latissimus dorsi
- (b) Anterior circumflex humeral artery- courses anteriorly around the surgical neck of the humerus and anastomoses with the posterior circumflex humeral artery supplying surrounding tissue including the deltoid muscle, the glenohumeral joint, and the head of the humerus
- (c) Posterior circumflex humeral- passes through the quadrangular space with the axillary nerve, wraps around the surgical neck of the humerus, and forms anastomoses with the anterior circumflex humeral, profunda brachii, suprascapular, and thoraco-acromial arteries; supplies surrounding muscles and glenohumeral joint
- c) Lymphatics of the shoulder- describe the location and drainage areas of the five groups of axillary lymph nodes
- Humeral (lateral) nodes- posterior to the axillary vein; drain from the brachium
  - Pectoral (anterior) nodes- along distal border of the pectoralis minor muscles; drain abdominal wall, thoracic wall, and mammary gland
  - Subscapular (posterior) nodes- posterior axillary wall; drain posterior axillary wall, neck, shoulder, and upper back
  - Central nodes- embedded in axillary fat; drain humeral, pectoral, and subscapular nodes
  - Apical nodes- proximal to the pectoralis minor, surrounding the axillary vein; drain all other axillary nodes and other lymphatic vessels from the mammary gland; drain into the subclavian trunk

## 9) Axillary Borders and Spaces

- a) Describe the borders of the axillary space
  - Anterior border- pectoralis major and minor muscles and clavipectoral fascia
  - Posterior border- subscapularis, teres major, and latissimus dorsi muscles
  - Lateral border- intertubercular groove of the humerus and coracobrachialis muscle
  - Medial border- serratus anterior (first to fourth ribs)
  - Apex- first rib, clavicle, and proximal edge of the subscapularis
  - Base- skin, subcutaneous tissue and axillary fascia that spans from the arm to the thorax
- b) Describe the borders and anatomical contents of the following anatomical spaces associated with the axilla
  - i) Quadrangular space:
    - Borders- teres major, teres minor, long head of the triceps brachii muscles, and the surgical neck of the humerus
    - Contents- axillary nerve and posterior circumflex humeral artery
  - ii) Triangular interval:
    - Borders- long and lateral heads of the triceps brachii (or humeral shaft) and the teres major muscles
    - Contents- radial nerve and deep brachial artery
  - iii) Triangular space:
    - Borders- teres major, teres minor, and the long head of the triceps brachii muscles
    - Contents- circumflex scapular artery

## 10) Glenohumeral joint

- a) Describe the articulations of the glenohumeral joint:
  - Head of the humerus
  - Glenoid cavity of the scapula
  - Glenoid labrum
- b) Describe the location and function of the ligaments of the glenohumeral joint:
  - Capsular ligaments (superior, middle, and inferior glenohumeral)
  - Coracohumeral
  - Posterior capsular)
  - Coracoacromial ligaments
- c) Describe the muscles that support the glenohumeral joint
  - Rotator cuff (supraspinatus, infraspinatus, teres minor, subscapularis)
  - Biceps brachii
  - Triceps brachii)
- d) Describe the function of the bursae associated with the glenohumeral joint

## G25: Arm and Elbow

At the end of this lecture, students should be able to master the following:

### 1) Muscles of the Arm

- a) Describe the attachments, actions, and relations of the muscles of the brachium (see muscle table)

**Table – Muscles of the Arm**

Muscle	Proximal Attachment	Distal Attachment	Action	Innervation
Anterior Compartment				
Coracobrachialis	Coracoid process of the scapula	Medial surface of the humerus	Flexes and adducts the humerus	Musculocutaneous n. (C5-C7)
Biceps brachii	Long head: supraglenoid tubercle Short head: coracoid process	Radial tuberosity	Flexes and supinates the elbow	Musculocutaneous n. (C5-C6)
Brachialis	Distal, ventral surface of the humerus	Coronoid process of the ulna	Flexes the elbow	
Posterior Compartment				
Triceps brachii	Long head: infraglenoid tubercle Lateral head: posterior humerus Medial head: posterior humerus	Olecranon process of the ulna	Extends the elbow	Radial n. (C6-C8)

### 2) Brachial plexus- Arm

- a) Describe the pathway and distribution of the branches of the brachial plexus that supply the muscles of the brachium
- Musculocutaneous nerve- arises from lateral cord, pierces the coracobrachialis m. innervating it as it passes, descends through the brachium between the biceps brachii and brachialis, supplying both muscles; pierces the deep fascia just distal to the elbow to become the lateral antebrachial cutaneous nerve
  - Radial nerve- arises from the posterior cord, courses through the triangle interval with the deep brachial a. supplying the triceps brachii and the posterior and lateral skin of the brachium (inferior lateral and dorsal brachial cutaneous nerves), laterally pierces the intermuscular septum to enter the anterior compartment, descends between the brachialis and brachioradialis m.
  - Medial brachial cutaneous nerve- branches from the medial cord, supplies anteromedial skin of arm

#### Arm

- Anterior: Flexors, musculocutaneous nerve
- Posterior: Extensors, radial nerve

#### Forearm

- Anterior: Flexors, medial epicondyle, median and ulnar nerves
- Posterior: Extensors, lateral epicondyle, radial nerve

### 3) Vascularization of the arm

a) Brachial artery- the axillary artery becomes the brachial artery at the distal border of the teres major muscle; courses through the medial side of anterior brachial compartment, terminates in the cubital fossa as it bifurcates into the ulnar and radial arteries

i) Describe the course and distribution of the following branches of the brachial artery

- Profunda brachii (deep brachial) artery- travels with the radial nerve through triangular interval and through the radial groove; forms an anastomosis with the posterior circumflex humeral artery; bifurcates mid brachium into the radial and middle collateral arteries
- Superior ulnar collateral artery- courses posterior to the medial epicondyle of the humerus; forms an anastomosis with the posterior ulnar recurrent artery
- Inferior ulnar collateral artery- splits around the medial epicondyle of the humerus; forms an anastomosis with the anterior recurrent ulnar artery and the middle collateral artery

b) Ulnar artery- passes through the cubital fossa, courses through the anterior antebrachium between the flexor carpi ulnaris and the flexor digitorum profundus muscles supplying the medial muscles of the anterior antebrachium; terminates as the deep and superficial ulnar palmar arches

i) Describe the course and distribution of the following branches of the ulnar artery

- Ulnar recurrent artery- splits into anterior and posterior branches which anastomose with the inferior and superior ulnar collateral arteries respectively
- Common interosseous artery- courses towards the interosseous membrane and splits into anterior and posterior interosseous branches
  - Anterior interosseous artery- travels along the anterior surface of the interosseous membrane
  - Posterior interosseous artery- travels along the posterior surface of the interosseous membrane, contributes to the recurrent interosseous artery

c) Radial artery- travels through the cubital fossa, courses deep to the brachioradialis supplying lateral antebrachial muscles; terminates as deep and superficial radial palmar arches

i) Describe the course and distribution of the following branches of the radial artery

- Radial recurrent artery- anterior to lateral epicondyle of the humerus to anastomose with the radial collateral a.

#### **4) Joints of the Arm and Forearm**

##### **a) Elbow joint**

###### **i) Describe the classifications and articulations of the elbow joint complex**

- Humeroulnar joint- synovial hinge; trochlea of the humerus and trochlear notch of the ulna
- Humeroradial joint- synovial gliding; capitulum of the humerus and head of the radius
- Proximal radioulnar- synovial pivot; head of the radius and the radial notch of the ulna

###### **ii) Describe the location and function of the ligaments of the elbow joint complex**

- Capsular
- Ulnar collateral
- Radial collateral
- Annular ligaments

###### **iii) Describe the function of bursae associated with the elbow joint complex**

- Describe the location of the olecranon bursa

##### **b) Distal radioulnar joint**

###### **i) Describe the classification and articulation of the distal radioulnar joint:**

- Synovial pivot
- Head of the ulna
- Ulnar notch of the radius
- Triangular fibrocartilage complex (TFCC)
- Triangular articular disc

###### **ii) Describe the relation between the elbow complex, distal radioulnar joint, and interosseous membrane during movement**

## G26: Forearm and Wrist

At the end of this lecture, students should be able to master the following:

### 1) Muscle of the antebrachium

- a) Describe the attachments, actions, and relations of the forearm muscles (see muscle table)

### Muscle Table: Forearm Muscles

Muscle	Proximal Attachment	Distal Attachment	Action	Innervation
Forearm Flexors (anterior compartment of forearm)				
Pronator teres	Medial epicondyle of the humerus	Middle of the radius	Pronates and flexes the elbow	Median n. (C6-C7)
Flexor carpi radialis		2 <sup>nd</sup> metacarpal	Flexes and abducts the wrist	
Palmaris longus		Flexor retinaculum and the palmar aponeurosis	Flexes the wrist and tightens the palmar aponeurosis	Median n. (C7-C8)
Flexor carpi ulnaris		Pisiform, and 5 <sup>th</sup> metacarpal	Flexes and adducts the wrist	Ulnar n. (C7-C8)
Flexor digitorum superficialis	Medial epicondyle, coronoid process of the ulna and anterior border of the radius	Lateral surfaces of the middle phalanx of digits 2-5	Flexes the wrist, metacarpophalangeal and proximal interphalangeal joints	Median n. (C7-T1)
Flexor digitorum profundus	Medial surfaces of the proximal ulna and interosseous membrane	Distal phalanx of digits 2-5	Flexes joints from the wrist to the distal interphalangeal joints	Medial part: ulnar n. (C8-T1) Lateral part: median n. (C8-T1)
Flexor pollicis longus	Radius	Distal phalanx of digit one	Flexes the thumb	Anterior interosseous n. from the median n. (C8-T1)
Pronator quadratus	Distal anterior ulna	Distal anterior radius	Pronates the elbow	
Forearm Extensors (posterior compartment of forearm)				
Brachioradialis	Lateral supracondylar ridge of the humerus	Styloid process of the radius	Flexes the elbow	Radial n. (C5-C7)
Extensor carpi radialis longus		2 <sup>nd</sup> metacarpal	Extends and abducts the wrist	Radial n. (C6-C7)
Extensor carpi radialis brevis	Lateral epicondyle of the humerus	3 <sup>rd</sup> metacarpal	Extends the wrist	Posterior interosseous n. (C7-C8), the continuation of the deep branch of the radial n.
Extensor digitorum		Extensor expansion of digits 2-5	Extends the wrist and fingers	
Extensor digiti minimi		Extensor expansion of digit 5	Extends digit 5	
Extensor carpi ulnaris		5 <sup>th</sup> metacarpal	Extends and adducts the wrist	
Supinator	Lateral epicondyle and supinator crest of the ulna	Distal to the radial tuberosity	Supinates the forearm	Deep branch of the radial n. (C5-C6)
Abductor pollicis longus	Ulna, radius and interosseous membrane	1 <sup>st</sup> metacarpal	Abducts and extends the thumb	Posterior interosseous n. (C7-C8), the continuation of the deep branch of the radial n.
Extensor pollicis brevis	Radius and interosseous membrane	Proximal phalanx of digit 1	Extends the thumb at the carpometacarpal joint	
Extensor pollicis longus	Ulna and interosseous membrane	Distal phalanx of digit 1	Extends the thumb	
Extensor indicis	Lateral epicondyle of the humerus	Extensor expansion of digit 2	Extends digit 2	
Anconeus		Olecranon process of the ulna	Extends the elbow	Radial n. (C7-T1)



## 2) Brachial plexus- Forearm

a) Describe the course and distribution of the branches of the brachial plexus that supply the antebrachium

i) Ulnar nerve- arises from the medial cord, travels with the brachial artery along the medial side of the brachium, pierces the intermuscular septum mid brachium to enter the posterior compartment, courses posterior to the medial epicondyle of the humerus in the osseous groove, then enters the anterior compartment of the antebrachium passing between the two heads flexor carpi ulnaris; descends through the anterior antebrachium supplying the flexor carpi ulnaris and the ulnar half of the flexor digitorum profundus, continues into the hand superficial to the carpal tunnel

ii) Median nerve- arises from the medial and lateral cords, travels with brachial artery along the medial side of the brachium, courses through the cubital fossa deep to the bicipital aponeurosis and between the two heads of the pronator teres to enter the anterior antebrachium; descends through the antebrachium between the flexor digitorum superficialis and profundus supplying the anterior antebrachial muscles less the ulnar half of flexor digitorum profundus and flexor carpi ulnaris then travels through the carpal tunnel to enter the hand

iii) Radial nerve- arises from the posterior cord, courses through the triangle interval with the deep brachial artery supplying the triceps brachii, laterally pierces the intermuscular septum to enter the anterior compartment, descends in the radial groove between the brachialis and brachioradialis; along the way gives rise to the inferior lateral brachial cutaneous and dorsal brachial cutaneous nerves; the radial nerve then splits into a superficial and deep branch

- Deep branch of the radial nerve- travels posterior to the lateral epicondyle of the humerus piercing the anconeus to enter the posterior antebrachium supplying the muscles of the posterior antebrachium
- Superficial branch of the radial nerve- runs along the brachioradialis muscle then through the anatomical snuff box

iv) Medial antebrachial cutaneous nerve- branches from the medial cord, supplies the medial skin of the antebrachium

### Arm

- Anterior: Flexors, musculocutaneous nerve
- Posterior: Extensors, radial nerve

### Forearm

- Anterior: Flexors, medial epicondyle, median and ulnar nerves
- Posterior: Extensors, lateral epicondyle, radial nerve

## 3) Radiocarpal joint

a) Describe the classification and articulations of the radiocarpal joint- synovial condyloid; distal end of the radius, triangular fibrocartilage cartilaginous complex, scaphoid, lunate, and triquetrum

b) Describe the location and function of the ligaments of the radiocarpal joint (capsular, palmar and dorsal radiocarpal, ulnocarpal, radial collateral, ulnar collateral)

## **G27: Hand**

**At the end of this lecture, students should be able to master the following:**

### **1) Fascia of the hand and the carpal tunnel**

- a) Describe the location and relations of the fascial layers of the palm (palmar aponeurosis, fibrous digital sheaths, transverse carpal ligament)
- b) Describe the boundaries and anatomical contents of the carpal tunnel:
  - Boundaries- carpal bones and transverse carpal ligament (flexor retinaculum)
  - Contents- four tendons of the flexor digitorum superficialis, four tendons of the flexor digitorum profundus, tendon of the flexor pollicis longus, and the median nerve

### **2) Actions of the fingers and thumb**

- a) Describe the actions of the following joints:
  - i) Carpometacarpal joint of the thumb- flexion, extension, abduction, adduction, opposition, reposition
  - ii) Metacarpophalangeal (MP) joints of the thumb and fingers- flexion, extension, abduction, adduction for fingers; flexion and extension for the thumb
  - iii) Interphalangeal (IP) joints of the fingers and thumb- flexion and extension

### 3) Muscles of the hand

a) Describe the attachments, actions, and relations of the hand muscles (see muscle table)

**Muscles Tables- Hand Muscles**

Muscle	Proximal Attachment	Distal Attachment	Action	Innervation
Palmaris brevis	Palmar aponeurosis and flexor retinaculum	The dermis on the ulnar side of the hand	Tenses the skin over the hypothenar muscles	Ulnar n., superficial branch (C8-T1)
<b>Thenar muscles</b>				
Abductor pollicis brevis	Flexor retinaculum, scaphoid and trapezium	Proximal phalanx of digit 1	Abducts and opposes the thumb	Median n., recurrent branch (C8-T1)
Flexor pollicis brevis			Flexes digit 1	
Opponens pollicis		1 <sup>st</sup> metacarpal	Opposes the thumb to the other digits	
<b>Adductor compartment</b>				
Adductor pollicis	Oblique head: 2 <sup>nd</sup> and 3 <sup>rd</sup> metacarpals and capitate Transverse head: 3 <sup>rd</sup> metacarpal	Proximal phalanx of digit 1	Adducts the thumb	Ulnar n., deep branch (C8-T1)
<b>Hypothenar muscles</b>				
Abductor digiti minimi	Pisiform bone	Proximal phalanx of digit 5	Abducts digit 5	Ulnar n., deep branch (C8-T1)
Flexor digiti minimi brevis	Hook of the hamate and flexor retinaculum		Flexes the proximal phalanx of digit 5	
Opponens digiti minimi			5 <sup>th</sup> metacarpal	
<b>Central compartment</b>				
Lumbricals 1 and 2	Lateral 2 tendons of the flexor digitorum profundus	Lateral sides of the extensor expansion for digits 2-5	Flexes the metacarpophalangeal joints and extends the interphalangeal joints	Median n. (C8-T1)
Lumbricals 3 and 4	Medial 2 tendons of the flexor digitorum profundus			Ulnar n. (C8-T1)
Dorsal interossei 1-4	Adjacent sides of 2 metacarpals	Extensor expansion and base of the proximal phalanges of digits 2-4	Abducts the digits (DAB)	Ulnar n., deep branch (C8-T1)
Palmar interossei 1-3	2 <sup>nd</sup> , 4 <sup>th</sup> and 5 <sup>th</sup> metacarpals	Extensor expansion proximal phalanges 2, 4 and 5	Adducts the digits (PAD)	

#### 4) Brachial Plexus- Hand

a) Describe the pathway and distribution of the brachial plexus branches to the muscles of the hand

i) Ulnar nerve- enters the hand superficial to the carpal tunnel, lateral to the pisiform bone accompanying the ulnar artery dividing into a deep and superficial branch

- Deep branch: crosses the palm in a fibro-osseous tunnel (Guyon's tunnel) supplying the hypothenar compartment, adductor pollicis, dorsal interossei, palmar interossei, and the two medial lumbricals
- Superficial branch: supplies the palmaris brevis then splits into palmar digital branches to travel along the fifth digit and the medial side of the fourth digit to supply the surrounding skin

ii) Median nerve- after passing through the carpal tunnel, branches into a recurrent branch and palmar digital branches

- Recurrent branch: innervates the thenar muscles of the hand
- Palmar digital branches: travel along the first three digits and the lateral side of the fourth supplying the lateral two lumbricals, the palmar skin of the first three digits, and lateral side of the fourth digit

iii) Radial nerve- the superficial branch enters the hand by passing superficial to the anatomical snuff box, supplies skin on the dorsal side of the first three digits (provides no motor supply to the hand muscles)

b) Review ulnar, median and radial nerve contributions to the dermatomes of the hand

- Thumb (C6)
- Middle finger (C7)
- Pinky (C8)

#### 5) Vascularization of the hand

a) Ulnar artery- enters the hand lateral to the pisiform with the ulnar nerve, principle contributor to the superficial palmar arch

i) Describe the course and distribution of the branches of the ulnar artery that supply the hand

- Superficial palmar arch- just deep to the palmar aponeurosis, anastomoses with the palmar branch of the radial artery; gives rise to the common palmar digital arteries to supply the digits
- Deep palmar branch- curves medially around the hook of the hamate to the deep layer of the palm; anastomoses with the deep palmar arch of the radial artery

b) Radial artery- passes through the anatomical snuff box then dives anteriorly deep into the hand, principle contributor to the deep palmar arch

i) Describe the course and distribution of the branches of the radial artery that supply the hand

- Deep palmar arch- travels deep to the adductor pollicis, anastomoses with deep palmar branch of ulnar artery
- Dorsal carpal arterial arch- courses along the dorsal side of wrist, gives rise to the dorsal metacarpal arteries

c) Veins of the hand

i) Describe the drainage pathway from the dorsal venous network of the hand

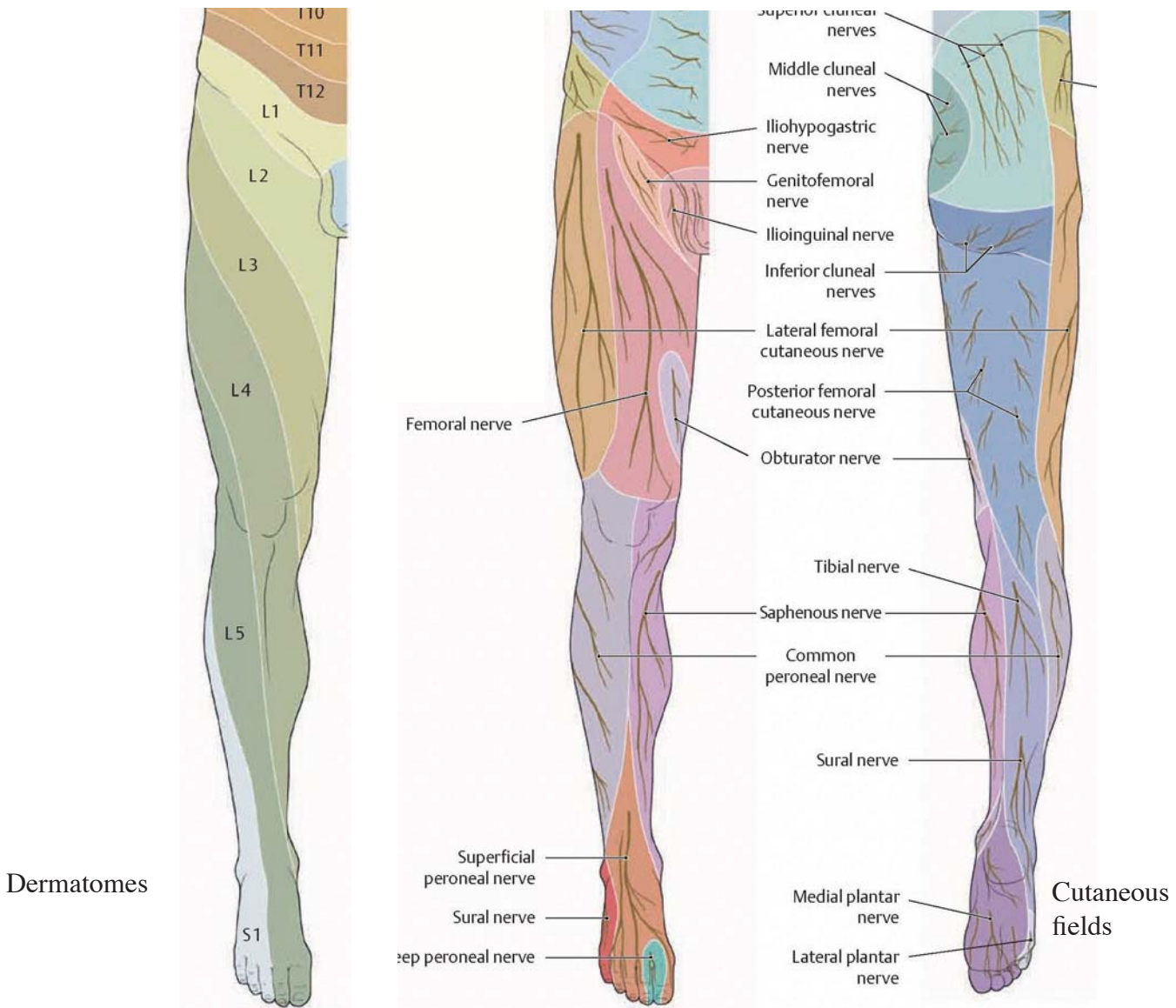


## G28: Lower Limb Overview, Hip, and Posterior Thigh

At the end of this lecture, students should be able to master the following:

### 1) Cutaneous innervation of the lower limb

- a) Compare and contrast the dermatomes and cutaneous fields of the lower limb



### 2) Fascia of the Lower Limb

- a) Describe the fascial organization of the lower limb:

Between the skin and bone are two fascial layers in the lower limb termed the superficial and deep fascia:

- Superficial fascia: located deep to the skin and contains superficial veins (great and lesser saphenous), cutaneous nerves, superficial lymphatics and fat.
- Deep fascia: located deep to the superficial fascia and contains muscles, nerves, vessels and deep lymphatics. As the deep fascia extends distally, intermuscular septa extend to the bone dividing the thigh and leg into the following compartments:
  - Thigh: Anterior and Posterior
  - Leg: Anterior, lateral and posterior

Each compartment contains muscles that perform similar actions and have common innervation and attachments.



### 3) Actions of the Lower Limb

a) Describe the actions of the following joints:

- Hip joint- flexion, extension, abduction, adduction, lateral rotation, medial rotation
- Knee joint- flexion, extension, medial rotation, lateral rotation
- Ankle joint (talocalcaneal joint) -plantar flexion, dorsal flexion
- Inertarsal joints (talocalcaneonavicular and subtalar joints)- inversion and eversion of the foot

### 4) Muscles of the hip and posterior thigh

a) Describe the attachments, actions, and relations of the muscles of the hip and posterior thigh (see muscle table)

Muscle	Prox. attachment	Distal attachment	Action	Innervation
<b>Gluteal region mm.</b>				
Gluteus maximus	Ilium, sacrum, coccyx and sacrotuberous ligament	Iliotibial tract and gluteal tuberosity of femur	Extends hip, lateral hip rotation and steadies hip	Inferior gluteal n. (L5-S2)
Gluteus medius	Ilium	Greater trochanter	Abducts and medially rotates hip	Superior gluteal n. (L5-S1)
Gluteus minimus				Anterior rami S1-S2
Piriformis	Anterior sacrum		External hip rotation Stabalizes pelvis during gait	Anterior rami L5-S1
Superior gemellus	Ischial spine			
Inferior gemellus	Ischial tuberosity			
Obturator internus	Obturator membrane			
Quadratus femoris	Ischial tuberosity			

Muscle	Prox. attachment	Distal attachment	Action	Innervation
<b>Thigh mm. (posterior)</b>				
Semitendinosus	Ischial tuberosity	Medial to the tibial tuberosity	Extend thigh and flex knee	Tibial division of sciatic n. (L5, S1-S2)
Semimembranosus		Medial condyle of tibia (posteriorly)		
Biceps femoris	Long head: ischial tuberosity Short head: linea aspera	Head of fibula		Long head: tibial division of sciatic n. (L5-S2) Short head: common peroneal n. of sciatic n. (L5-S2)

Posterior compartment:

- Common muscles
- Common attachment
- Common action
- Common innervation
- Common blood supply

## 5) Lumbosacral plexus- hip and posterior thigh (Table 5-4 GAFS good reference pg. 422)

### a) Lumbar plexus- draw, label (DIGANAT tutorial)

i) T12-L4 Ventral rami- course through the psoas major muscle

ii) Branches:

- Subcostal (T12), iliohypogastric, and ilioinguinal (T1) nn.- supply abdominal body wall mm. and skin
- Genitofemoral n. (L1-L2)- supplies skin over the femoral triangle
- Lateral femoral cutaneous n. (L2-L3)- pierces body wall near the ASIS to supply skin of the lateral thigh
- Femoral nerve (L2-L4) - emerges lateral to the psoas major muscle, between the psoas and the iliacus mm., deep to the inguinal ligament to supply the anterior compartment thigh muscles
- Obturator nerve (L2-L4) - emerges medial to the psoas major m., travels through the obturator foramen to enter medial compartment of the thigh

### b) Sacral plexus- draw, label (DIGANAT tutorial)

i) Lumbosacral trunk- (L4 and L5) descends along the sacrum to join the sacral components of the plexus

ii) S1-Co1 Ventral rami- enter the pelvis anterior to the piriformis and pelvic floor mm., join the lumbosacral trunk to form the sacral plexus

iii) Branches:

- Superior gluteal nerve (L4-S1) - travels superior to the piriformis m. with the superior gluteal artery to supply the gluteus medius, gluteus minimus, and tensor fasciae latae mm.
- Inferior gluteal nerve (L5-S2) - travels inferior to piriformis m. with the inferior gluteal artery to supply the gluteus maximus m.
- Nerve to quadratus femoris (L4-S1) - supplies quadratus femoris and inferior gemellus
- Nerve to the obturator internus (L5-S2) - travels inferior to the piriformis m., then between the sacrotuberous and sacrospinous ligaments to supply the obturator internus and superior gemellus
- Nerve to the piriformis (L5-S2) - sends fibers directly into the piriformis muscle
- Pudendal nerve (S2-S4) - travels inferior to the piriformis m., then between the sacrotuberous and sacrospinous ligaments to enter the ischioanal fossa supplying the pelvic floor and perineum
- Perforating cutaneous nerve (S2-S3) - travels inferior to the piriformis m., perforates the sacrotuberous ligament, curves around the inferior border of the gluteus maximus m. to supply skin of the gluteal fold
- Posterior femoral cutaneous nerve (S1-S3) - travels inferior to the piriformis m. just medial to the sciatic nerve, deep to the gluteus maximus m.; supplies the skin of the posterior thigh
- Sciatic nerve (L4-S3) - (common peroneal and tibial nerves) travels inferior to the piriformis m., descends deep to the gluteus maximus m., enters the posterior thigh deep to the biceps femoris, splits into the tibial and common peroneal nerves

(a) Tibial nerve (L4-S3) - supplies the long head of the biceps femoris, semimembranosus, semitendinosus mm. as well as the hamstring part of adductor magnus; passes through the popliteal fossa between the two heads of the gastrocnemius m. to enter the posterior leg

(b) Common fibular (peroneal) nerve (L4-S2) - supplies the short head of the biceps femoris and the lateral skin of the crus (lateral sural cutaneous field), travels between the lateral head of the gastrocnemius and the insertion of the biceps femoris, curves around the neck of the fibula then branches into the deep and superficial fibular (peroneal) nerves as it enters the leg

## 6) Vascularization of the hip

- a) Internal iliac artery- describe the origin, course, and destination of the branches of the internal iliac artery that supply the hip
  - i) Superior gluteal artery- travels superior to the piriformis m. with the superior gluteal nerve to supply the gluteus medius, gluteus minimus, and tensor fasciae latae
  - ii) Inferior gluteal artery- travels inferior to the piriformis m. with the inferior gluteal nerve to supply the gluteus maximus
  - iii) Internal pudendal artery- travels inferior to the piriformis with the pudendal nerve, between the sacrotuberous and sacrospinous ligaments to the ischioanal fossa to supply the pelvic floor and perineum
- b) External iliac artery- describe the origin, course, and destination of branches of the external iliac artery that supply the posterior thigh
  - i) Femoral artery- courses deep to the inguinal ligament, through the femoral triangle to the adductor canal
    - (1) Deep artery of the thigh (Profunda femoris artery)- branches posteriorly between the pectineus and adductor longus muscles, descends through the thigh between the adductor longus and adductor magnus, gives rise to the perforating arteries
      - (a) Perforating arteries- perforate the adductor magnus to supply the posterior compartment of the thigh

## 7) Hip joint

Describe the classification and articulations of the hip joint- synovial ball-and-socket; head of the femur, acetabulum of the os coxa, acetabular labrum

Describe the location and function of the ligaments of the hip joint:

- Iliofemoral
- Pubofemoral
- Ischiofemoral
- Ligamentum teres

Describe the vascularization of the hip joint- circumflex femoral arteries and foveolar arteries

Describe the function of the bursae associated with the hip joint (subtendinous iliac bursa, synovial protrusion)

## G29: Anterior and Medial Thigh

At the end of this lecture, students should be able to master the following:

### 1) Fascia of the thigh

- a) Describe the location and relations of the fascia of the thigh (fascia lata and medial, lateral, and posterior intermuscular septa)

### 2) Muscles of the anterior and medial thigh

- a) Describe the attachments, actions, and relations of the muscles of the anterior and medial thigh (see muscle table)

Muscle	Prox. Attachment	Distal Attachment	Action	Innervation
Thigh mm. (anterior)				
Pectineus	Superior ramus of pubis	Pectineal line of femur	Adduction and flexion of hip	Femoral n. (L2-L3)
Iliopsoas				
• Psoas major	T12-L5	Lesser trochanter of femur	Flexing thigh at hip joint	Anterior rami of L1-L3
• Iliacus	Iliac fossa and crest			Femoral n. (L2-L3)
Tensor fascia lata	Anterior iliac crest	Iliotibial tract	Abducts, medially rotates, and flexes hip	Superior gluteal n. (L4-L5)
Sartorius	ASIS	Medial to the tibial tuberosity	Flexes, abducts and laterally rotates hip; flexes knee	Femoral n. (L2-L3)
Quadriceps femoris				
• Rectus femoris	AIIS	Base of patella and by the patellar ligament to the tibial tuberosity	Extend leg at knee joint	Femoral n. (L2-L4)
• Vastus lateralis	Linea aspera			
• Vastus medialis				
• Vastus intermedius	Anterior femoral shafts			
Thigh mm. (medial)				
Adductor longus	Pubis	Linea aspera	Adducts hip	Obturator n. (L2-L4)
Adductor brevis				
Adductor magnus	Adductor division: ischial ramus Hamstring division: ischial tuberosity	Adductor division: linea aspera Hamstring division: Adductor tubercle	Adductor division: adducts hip Hamstring division: extends hip	Adductor division: obturator n. (L2-L4) Hamstring division: tibial n. of sciatic (L4)
Gracilis	Pubis	Medial to the tibial tuberosity	Adducts hip, flexes leg	Obturator n. (L2-L3)
Obturator externus	Obturator membrane	Trochanteric fossa of femur	Lateral hip rotation	Obturator n. (L3-L4)

Anterior compartment:

- Common muscles
- Common attachment
- Common action
- Common innervation
- Common blood supply

Medial compartment:

- Common muscles
- Common attachment
- Common action
- Common innervation
- Common blood supply

### 3) Lumbar plexus- thigh

a) Describe the origin course and distribution of the branches of the lumbar plexus that supply the anterior and medial muscles of the thigh

- Femoral nerve (L2-L4)- enters the anterior thigh deep to the inguinal ligament, muscular branches supply the muscles of the anterior thigh except the psoas major; cutaneous branches perforate the fascia to supply the anterior skin of the thigh and knee; the saphenous branch travels in the adductor canal just deep to the sartorius to become cutaneous on the medial side of the knee, crus, and foot
- Obturator nerve (L2-L4)- enters the medial thigh through the obturator canal then splits into an anterior and posterior branch, named for their relation to the adductor brevis muscle; supplies the medial compartment of the thigh except the pectineus and the skin of the medial thigh

### 4) Vascularization of the anterior and medial thigh

a) Describe the anatomical contents and relations of the femoral triangle (femoral Nerve, Artery, Vein, and Lymphatics)

b) External iliac artery- describe the origin, course, and destination of branches of the external iliac artery that supply the anterior and medial thigh

i) Femoral artery- courses deep to the inguinal ligament, through the femoral triangle to the adductor canal

(1) Deep artery of the thigh (Profunda femoris artery)- branches posteriorly between the pectineus and adductor longus muscles, descends through the thigh between the adductor longus and adductor magnus, gives rise to the medial circumflex femoral, lateral circumflex femoral, and perforating arteries

(a) Medial circumflex femoral artery- wraps medially around the femur between the iliopsoas and pectineus, courses over the superior margin adductor magnus, forms anastomoses with the lateral circumflex femoral branches, perforating arteries, and the inferior gluteal artery

(b) Lateral circumflex artery- travels deep to sartorius and rectus femoris, divides into three branches

(i) Ascending branch- ascends deep to the tensor fasciae latae, anastomoses with the medial circumflex femoral artery to supply the femoral neck and head

(ii) Descending branch- descends deep to the vastus lateralis to anastomose with popliteal branches

(iii) Transverse branch- perforates the vastus lateralis to anastomose with the medial circumflex femoral, inferior gluteal, and perforating arteries around the hip joint

c) Internal iliac artery- describe the origin, course, and destination of branches of the internal iliac artery that supply the anterior and medial thigh

i) Obturator artery- travels through the obturator canal with the obturator nerve, but splits inside the canal into an anterior and posterior branch; both branches supply medial thigh muscles and form anastomoses with medial circumflex femoral and inferior gluteal arteries; the posterior branch helps supply the femoral head

d) Superficial veins- trace blood flow through the superficial veins of the of the lower limb (dorsal venous arch, small saphenous, great saphenous, accessory saphenous veins)

### G30: Leg and Knee

At the end of this lecture, students should be able to master the following:

#### 1) Muscles of the leg

a) Describe the attachments, actions and relations of the muscles of the leg (see muscle table)

Muscle	Prox. Attachment	Distal Attachment	Action	Innervation
<b>Leg mm. (anterior)</b>				
Tibialis anterior	Lateral condyle of tibia	1 <sup>st</sup> metatarsal	Dorsal flexion and inversion	Deep peroneal n. (L4-L5)
Extensor digitorum longus	Lateral condyle of tibia and medial fibula	Middle and distal phalanges of digits 2-5	Extends digits 2-5; dorsal flexion	Deep fibular n. (L5-S1)
Extensor hallucis longus	Anterior fibula	Great toe (digit 1)	Extends great toe; dorsal flexion	
Fibularis (peroneus) tertius	Inferior third of fibula	5 <sup>th</sup> metatarsal	Dorsal flexion and eversion	
<b>Leg mm. (lateral)</b>				
Peroneus (fibularis) longus	Upper fibula	Metatarsal 1	Eversion and plantarflexion	Superficial fibular (peroneal) n. (L5-S2)
Peroneus (fibularis) brevis	Lower fibula	Metatarsal 5		
<b>Leg mm. (posterior)</b>				
Gastrocnemius	Medial and lateral condyles of femur	Calcaneus via the calcaneal tendon	Plantar flexion and knee flexion	Tibial n. (S1-S2)
Soleus	Posterior tibia and fibula		Plantar flexion	
Plantaris	Lateral supracondylar line		Plantar flexion and knee flexion	
Popliteus	Lateral condyle of femur	Tibia	Knee flexion/unlocks extended knee	Tibial n. (L4-S1)
Flexor hallucis longus	Posterior surface of fibula	Distal phalanx of great toe	Flexes great toe	Tibial n. (S2-S3)
Flexor digitorum longus	Posterior surface of tibia and fibula	Distal phalanges of digits 2-5	Flexes digits 2-5	
Tibialis posterior	Posterior surface of tibia and fibula	Navicular, cuneiform, cuboid, and metatarsals 2-4	Plantar flexion and inversion	Tibial n. (L4-L5)

Anterior compartment of Leg:

- Common muscles
- Common attachment
- Common action
- Common innervation
- Common blood supply

Posterior compartment of Leg:

- Common muscles
- Common attachment
- Common action
- Common innervation
- Common blood supply

Lateral compartment of Leg:

- Common muscles
- Common attachment
- Common action
- Common innervation
- Common blood supply



## 2) Sacral plexus- leg

a) Describe the origin, course and distribution of the branches of the sacral plexus that supply the leg

i) Sciatic nerve:

- Tibial nerve- (L4-S3) passes through the popliteal fossa between the two heads of the gastrocnemius to enter the posterior crus, sends off the sural nerve to supply the skin of the posterior leg, then continues through the posterior crus, deep to the soleus supplying all of the posterior crural muscles, travels posterior to the medial malleolus in the tarsal tunnel, giving rise to the cutaneous medial calcaneal nerve, then continues to the plantar surface of the foot where it terminates as the medial and lateral plantar nerves
- Common fibular (peroneal) nerve (L4-S2)- courses laterally through the popliteal fossa between the lateral head of the gastrocnemius and the insertion of the biceps femoris, gives rise to the lateral sural nerve to supply the skin of the lateral crus before wrapping around the neck of the fibula and dividing into the deep and superficial fibular nerves
  - Superficial fibular (peroneal) nerve- descends through the lateral compartment of the leg between the fibularis longus and brevis innervating both muscles, travels anterior to the lateral malleolus to the dorsal side of the foot
  - Deep fibular (peroneal) nerve- passes through the intermuscular septum to enter the anterior compartment of the leg, descends deep to the extensor digitorum longus to the dorsal side of the foot, supplies all the muscles of the anterior compartment of the leg

### 3) Vascularization of the leg and knee

- Femoral artery- describe the origin, course, and distribution of the branches of the femoral artery that supply the knee and leg
- Popliteal artery- arises from femoral artery after passing through the adductor hiatus to the popliteal fossa
  - Superior and inferior medial geniculate arteries- wrap anteriorly around the medial side of the knee to the anastamotic network of arteries on the anterior side of the knee
  - Superior and inferior lateral geniculate arteries- wrap anteriorly around the lateral side of the knee to join the anastamotic network of arteries on the anterior side of the knee
- Anterior tibial artery- travels through the aperture of the interosseous membrane to enter the anterior compartment of the leg, gives rise to the recurrent branch which joins the anastamotic network around the knee, then descends through the anterior compartment of the leg anterior to the interosseous membrane supplying anterior leg muscles, travels anterior to the medial malleolus to the dorsal side of the foot as the dorsal pedis artery
- Posterior tibial artery- descends through the deep plane of the posterior leg supplying the posterior leg muscles, gives rise to the fibular artery just distal to the knee, courses posterior to the medial malleolus in the tarsal tunnel to enter the plantar surface of the foot
  - Fibular (peroneal) artery- descends along the lateral border of the posterior compartment of the leg supplying the lateral compartment, courses posterior to the lateral malleolus

### 4) Knee joint

Describe the classification and articulations of the knee joint- synovial hinge (double condyloid); medial and lateral femoral condyles, medial and lateral tibial condyles

- Menisci: fibrocartilaginous C-shaped cartilages, in the knee joint one medial and one lateral
  - Medial meniscus: attached to the tibial collateral ligament
  - Lateral meniscus: unattached to the joint capsule and is therefore more mobile

Describe the synovial membrane and bursae associated with the knee joint

Describe the location and function of the ligaments of the knee:

- Patellar
- Collateral ligaments: stabilize the hing-like motion of the knee
  - Fibular collateral: separated from fibrous membrane by a bursa
  - Tibial collateral: attached to the fibrous membrane, which is attached to the medial meniscus
- Cruciate ligaments: named according to their attachment on the tibia
  - Anterior cruciate: prevents anterior displacement of the tibia relative to the femur
  - Posterior cruciate: prevents posterior displacement of the tibia relative to the femur

Describe the muscular support for the knee joint (vastus medialis, vastus lateralis, posterior thigh muscles, medial thigh muscles)

### G31: Foot and Ankle

At the end of this lecture, students should be able to master the following:

#### 1) Plantar Aponeurosis

- a) Describe the attachments and function of the plantar aponeurosis

#### 2) Actions of the toes

- a) Describe the actions of the following joints:
- Metatarsalphalangeal joints- flexion, extension, abduction, adduction
  - Interphalangeal joints- flexion, extension

#### 3) Muscles of the foot

- a) Describe the attachments, actions, and relations of the muscles of the foot (see muscle table)

Foot Muscles				
Muscle	Origin	Insertion	Action	Innervation
Dorsal muscles				
Extensor dig. brev	Calcaneus bone	Digits 1-5	Extension of digits	Deep fibular n. (S1-S2)
Plantar muscles				
First layer				
Adductor hallucis	Calcaneus bone	Digit 1	Adduct, flex digit 1	Med plantar n. (S2-S3)
Flexor dig brevis		Digits 2-5	Flex digits 2-5	
Abd digiti minimi		Digit 5	Abduct digit 5	Lat plantar n. (S2-S3)
Second layer				
Quadratus plantae	Calcaneus bone	Tendon of flexor digi-torum longus	Flex digits 2-5	Lat plantar n. (S1-S3)
Lumbricals	Tendon of flexor digi-torum longus	Expansion over digits 2-5	Flex prox. pha-langes, extend mid and distal IP	1: Med plant (S2-S3) 2-4: Lat plant (S2-S3)
Third layer				
Flex halluc brevis	Cuboid and lateral cuneiform bones	Digit 1	Flex digit 1	Med plant (S1-S2)
Adductor hallucis	Oblique: Metatars 2-4 Transv: MP joints	Digit 1	Adduct digit 1	Lat plant (S2-S3) deep branch
Flex dig minimi	5th metatarsal	Digit 5	Flex digit 1	Lat plant (S2-S3) superficial branch
Fourth layer				
Plant interossei	Metatarsals 3-5	Digits 3-5	Adduct digits 2-4; flex MP joints	Lat plant (S2-S3)
Dorsal interossei	Metatarsals 1-5	Dorsal expansion of digits 2-4	Abduct digits 2-4; flex MP joints	

#### **4) Lumbosacral plexus- foot**

##### **a) Common fibular (peroneal) nerve (L4-S2)**

- Superficial fibular (peroneal) nerve- courses anterior to the lateral malleolus to supply skin of the dorsum of the foot
- Deep fibular (peroneal) nerve- enters the dorsal side of the foot deep to the extensor hallucis longus to supply the extensor digitorum brevis and the skin between the first two toes

##### **b) Tibial nerve- enters the foot from the tarsal tunnel, splits into the medial and lateral plantar nerves**

- Medial plantar nerve- supplies the first lumbrical, abductor hallucis, flexor hallucis brevis, flexor digitorum brevis (1LAFF), and the medial plantar skin
- Lateral plantar nerve- supplies the second through fourth lumbricals, adductor hallucis, abductor digiti minimi, flexor digiti minimi, quadratus plantae, dorsal interossei (DAB), plantar interossei (PAD), and the lateral plantar skin

#### **5) Vascularization of foot and ankle**

##### **a) Anterior tibial artery**

###### **i) Describe the origin, course, and distribution of the branches of the anterior tibial artery that supply the foot and ankle**

- (1) Anterior lateral and anterior medial malleolar arteries- wrap posteriorly around the malleoli
- (2) Dorsal pedis artery- continuation of the anterior tibial artery onto the dorsal surface of the foot, gives rise to the arcuate artery
  - (a) Arcuate artery- arches across the metatarsals to supply the toes

##### **b) Posterior tibial artery**

###### **i) Describe the origin, course, and distribution of the branches of the posterior tibial artery that supply the foot and ankle**

- (1) Medial plantar artery- travel along medial arch towards the first digit
- (2) Lateral plantar artery- courses laterally along the plantar surface of the foot, forms the deep plantar arch which supplies the digits

## 6) Ankle and foot joints

### a) Ankle (talocrural) joint

Describe the classification and articulations of the ankle joint- synovial joint; distal ends of tibia and fibula, trochlear surface of the talus

Describe the muscular support for the ankle joint (anterior, posterior, and lateral compartments of the leg)

Describe the location and function of the ligaments of the ankle:

- Medial/deltoid ligament (tibionavicular, tibiocalcaneal, posterior tibiotalar, anterior tibiotalar)
- Lateral ligament (anterior talofibular, posterior talofibular, calcaneofibular)

### b) Foot joints

- Describe the location and function of the intertarsal joints- transverse tarsal joint, subtalar joint; inversion, eversion of the foot

### c) Arches of the foot

- Describe the location and function of the three arches of the foot- lateral longitudinal, medial longitudinal, transverse arches