

# Peripheral Nerve of Upper Limb

By : Hermizan Halihanafiah

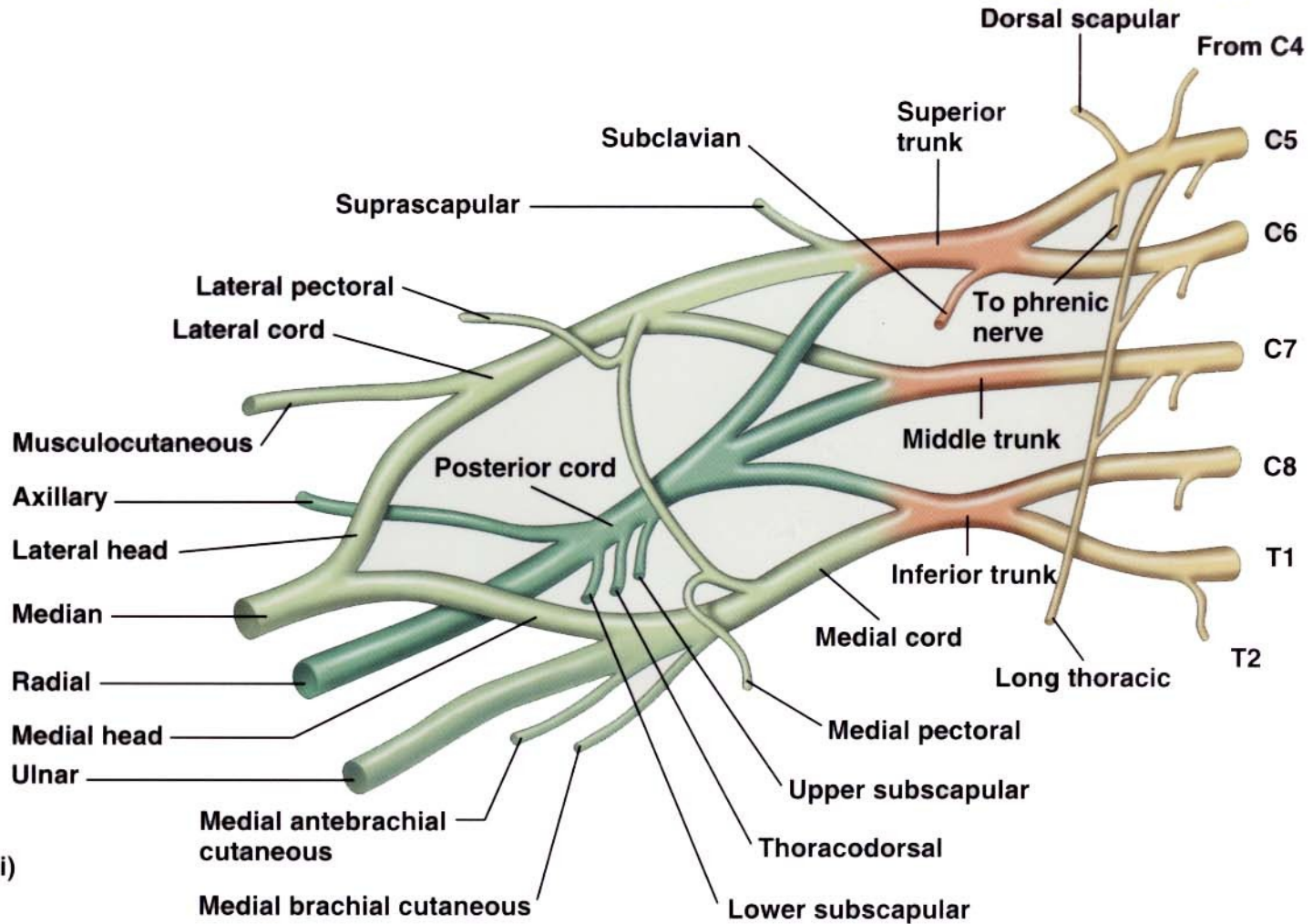
# Brachial Plexus

- Networking of spinal nerves, formed by ventral (anterior rami) of cervical spinal nerves C5-C8 and thoracic spinal nerves T1.
- Brachial plexus is responsible for cutaneous (sensory) and muscular (motor) innervation of the entire upper limb.

# Brachial Plexus

- 5 main nerves arise from brachial plexus:
  2. Axillary nerve
  3. Musculocutaneous nerve
  4. Radial nerve
  5. Median nerve
  6. Ulnar nerve

# Brachial Plexus

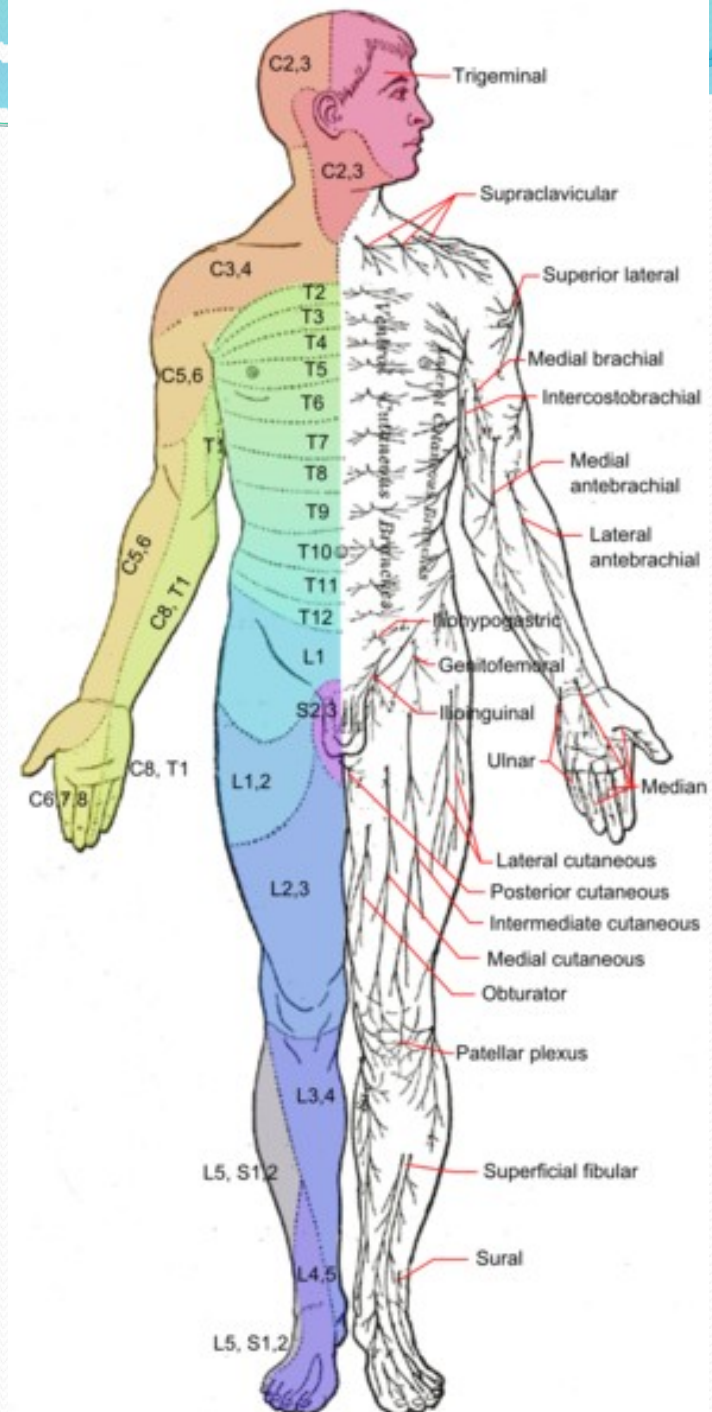


- Roots (anterior rami)
- Trunks
- Anterior divisions
- Posterior divisions

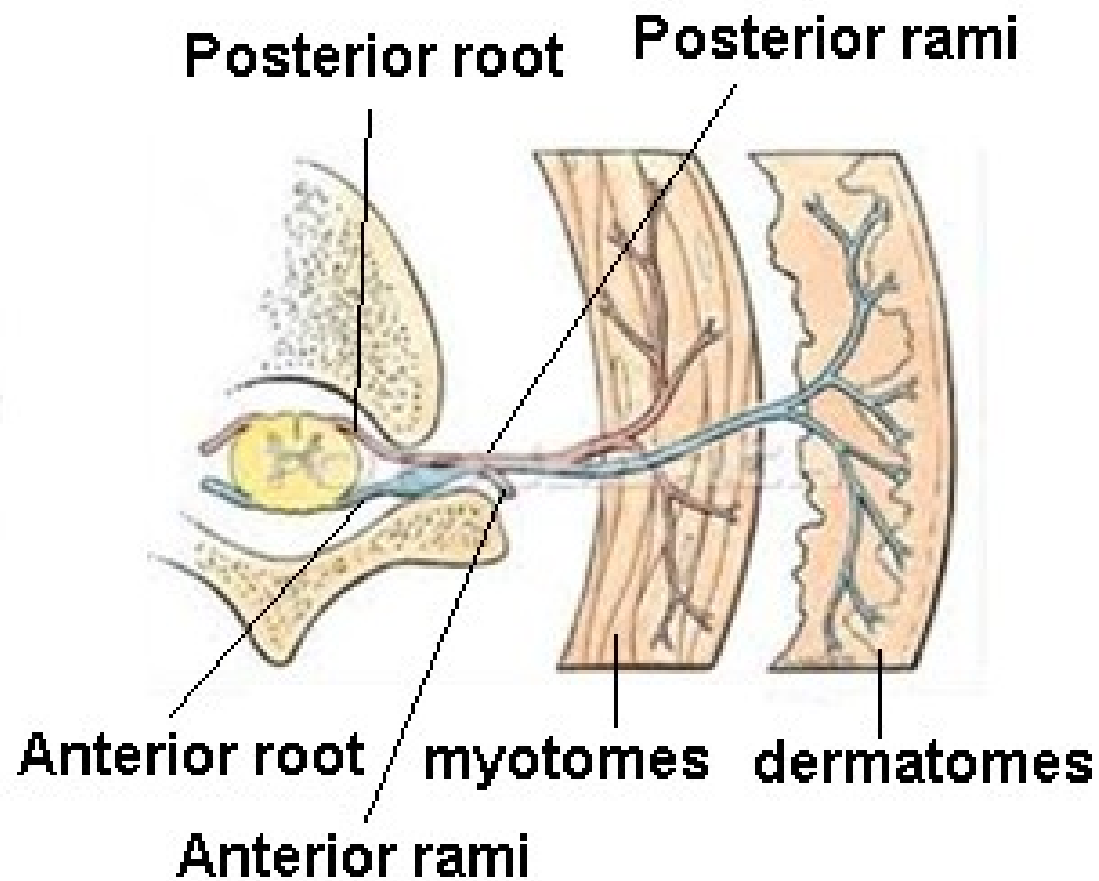
(a) Origin of brachial plexus

# Dermatomes

- Area of the skin that supplied by single spinal nerve.
- the area of the skin that provides sensory input to the dorsal roots of a pair of spinal nerves
- There are 8 cervical, 12 thoracic, 5 lumbar and 5 sacral spinal nerves that relays cutaneous sensation (pain, thermal, itch, touch etc) from particular region of the body to the brain
- Dermatomes are useful in neurology for finding the site of damage to the spine

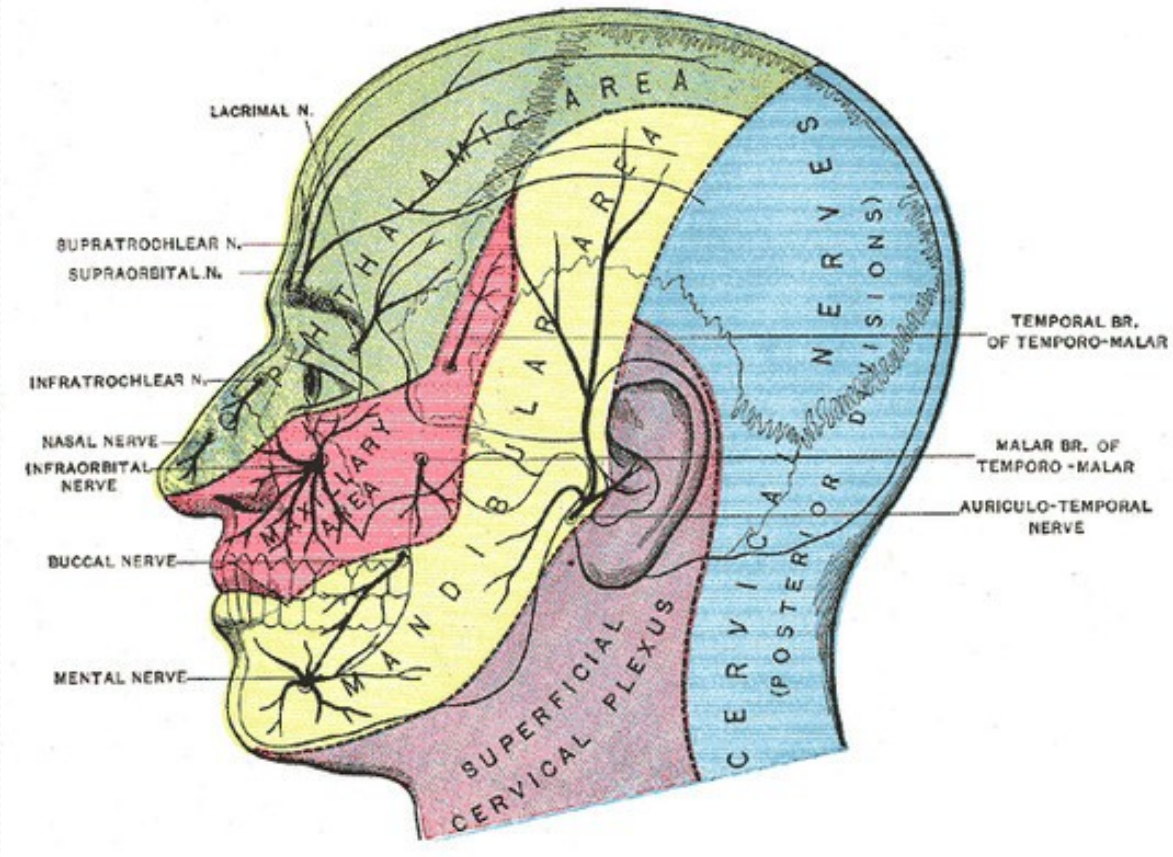


# Dermatomes / myotomes



# Head Dermatomes

- Trigeminal nerve (most of the anterolateral skin of the face)
- Cervical plexus (skin of the neck and pinna)
- Cervical spinal nerve – posterior root (skin posterior of the scalp and neck)

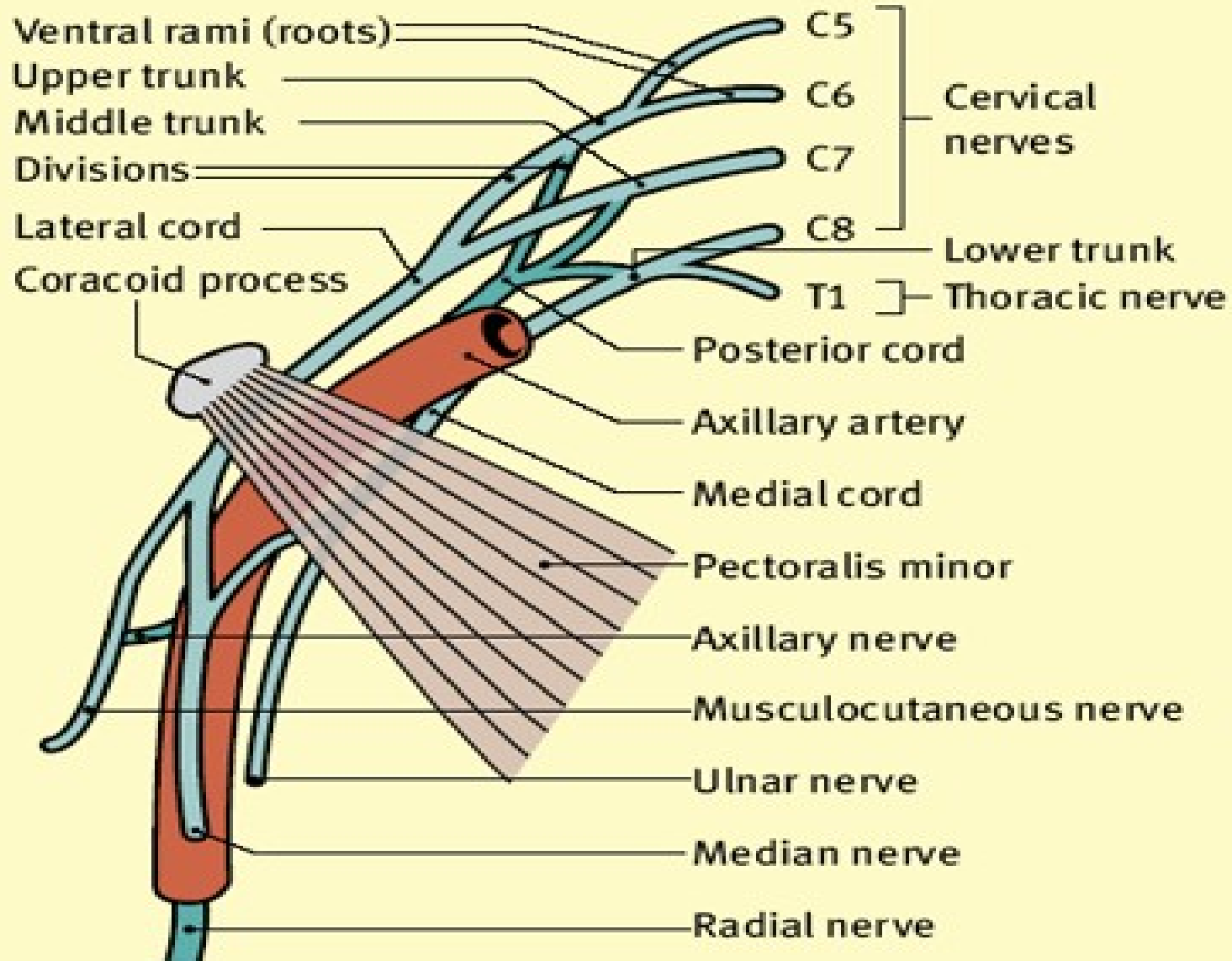


# Axillary Nerve

- From root C<sub>5</sub>-C<sub>6</sub>
- Arise from posterior cord of brachial plexus at the level of axilla.



# Relationship of the brachial plexus to the axillary artery



Posterior divisions and their branches dark green

# Branches of Axillary Nerves

- Lies posterior to the axillary artery and anterior to the subscapularis muscles.
- Then axillary nerves will divide into anterior branch (upper branch) and posterior branch (lower branch).
- Anterior branch innervate anterior border of deltoid muscles (anterior and lateral fiber)
- Posterior border supply teres minor and posterior part of the deltoid (posterior fiber). Then it will branch of to formed superior lateral cutaneous nerve of arm (superior lateral brachial cutaneous).

# Innervations of Axillary Nerve

- **Muscular innervations**

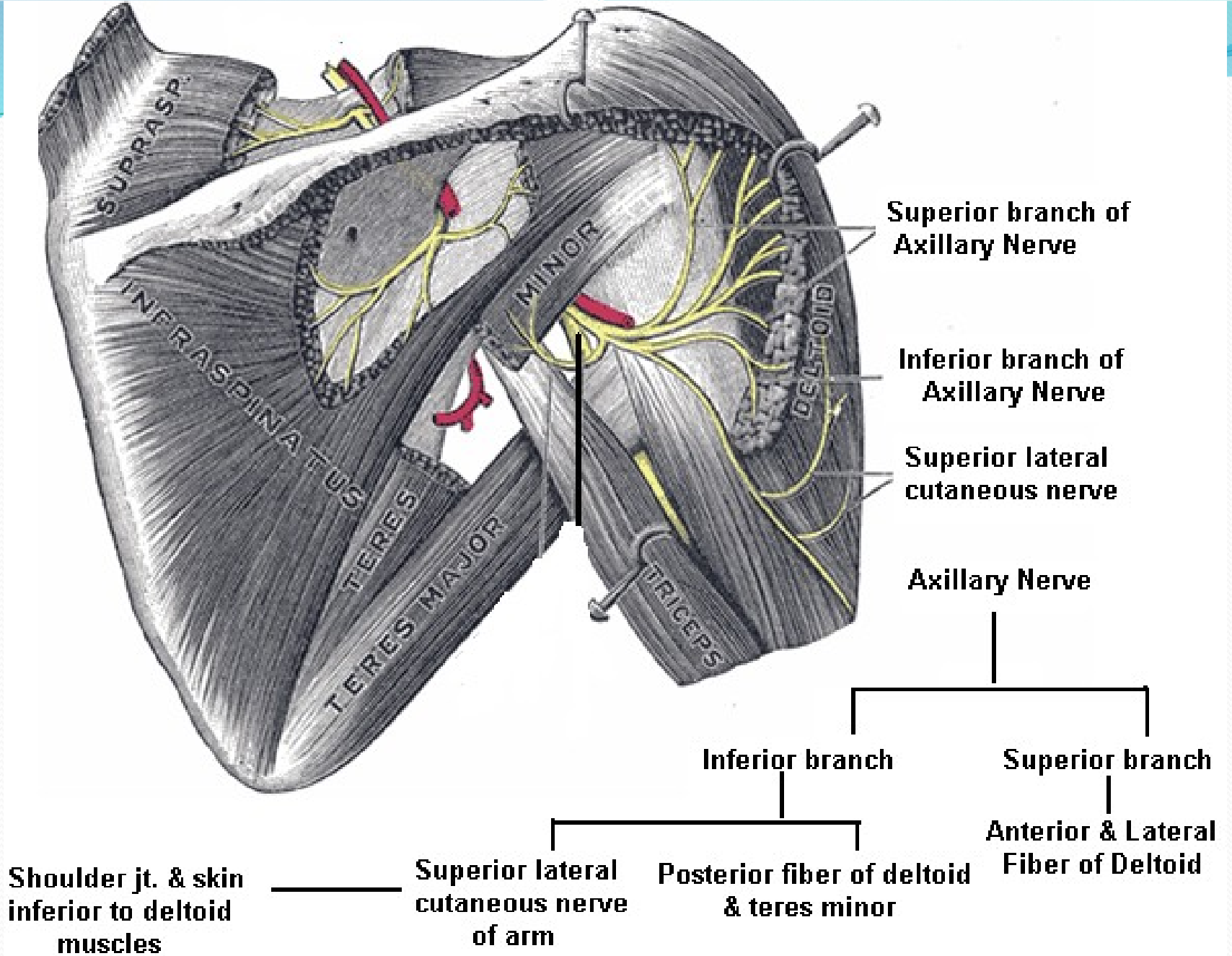
- anterior branch – anterior and lateral fiber of deltoid muscles
- posterior branch – teres minor and posterior fiber of deltoid

- **Cutaneous innervation**

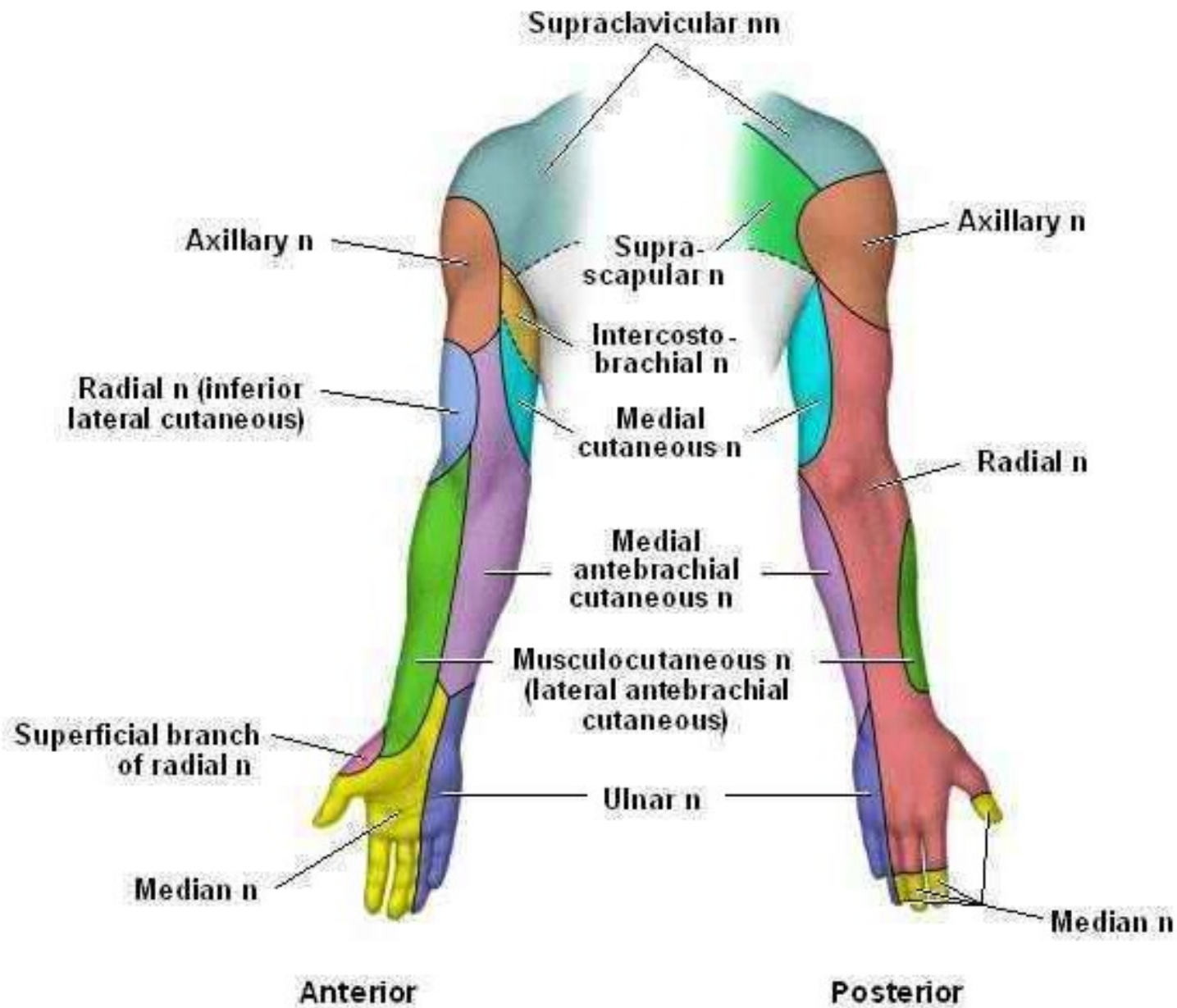
- superior lateral brachial cutaneous nerve
  - carry information from the shoulder joint
  - skin covering inferior region of deltoid muscles.

# Cont..

- Frequently injured due to shoulder dislocation because of the close to the proximity of this joint
- Paralysis of the deltoid and teres minor results
- Inability to abduct the arm beyond that possible by the action of the supraspinatus.

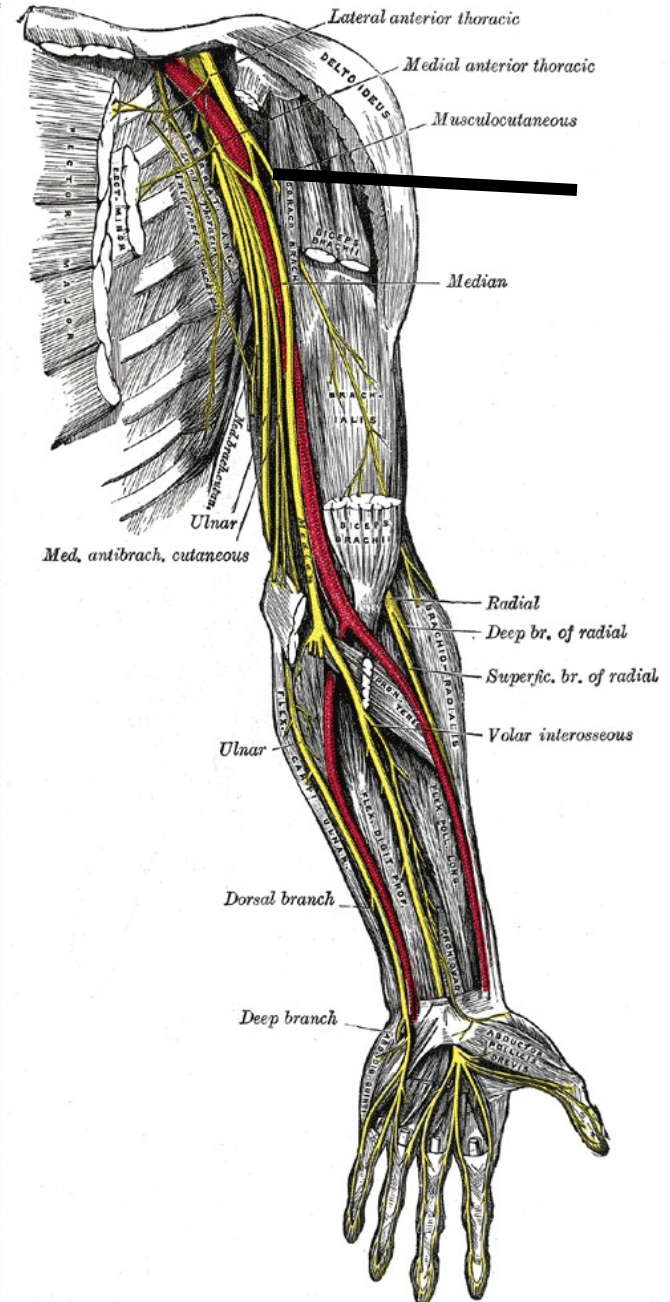


**Posterior View of the Shoulder**



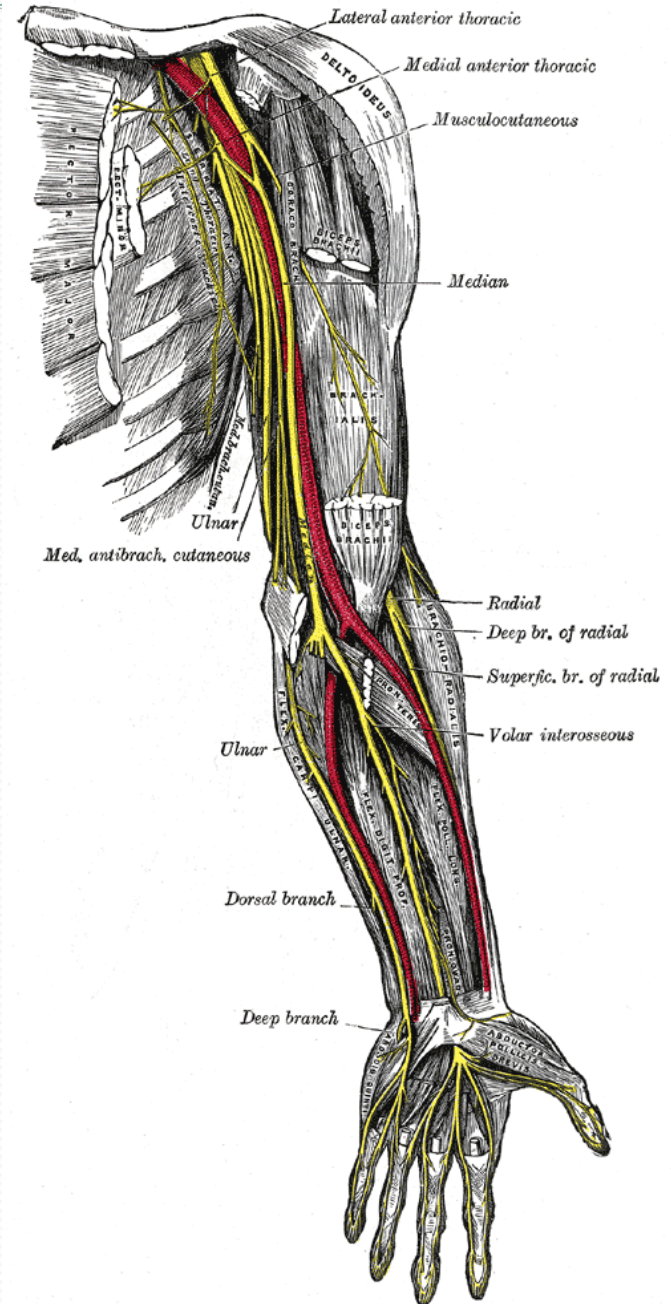
# Musculocutaneous Nerve

- Arise from lateral cord of brachial plexus
- Opposite to the lower border of pectoralis minor
- Arise from root C5, C6 and C7.



# Musculocutaneous Nerve

- Penetrate coracobrachialis and pass obliquely between biceps brachii and the brachialis to the lateral side of the arm.
- Then continue in the forearm as the lateral antebrachial cutaneous nerve.



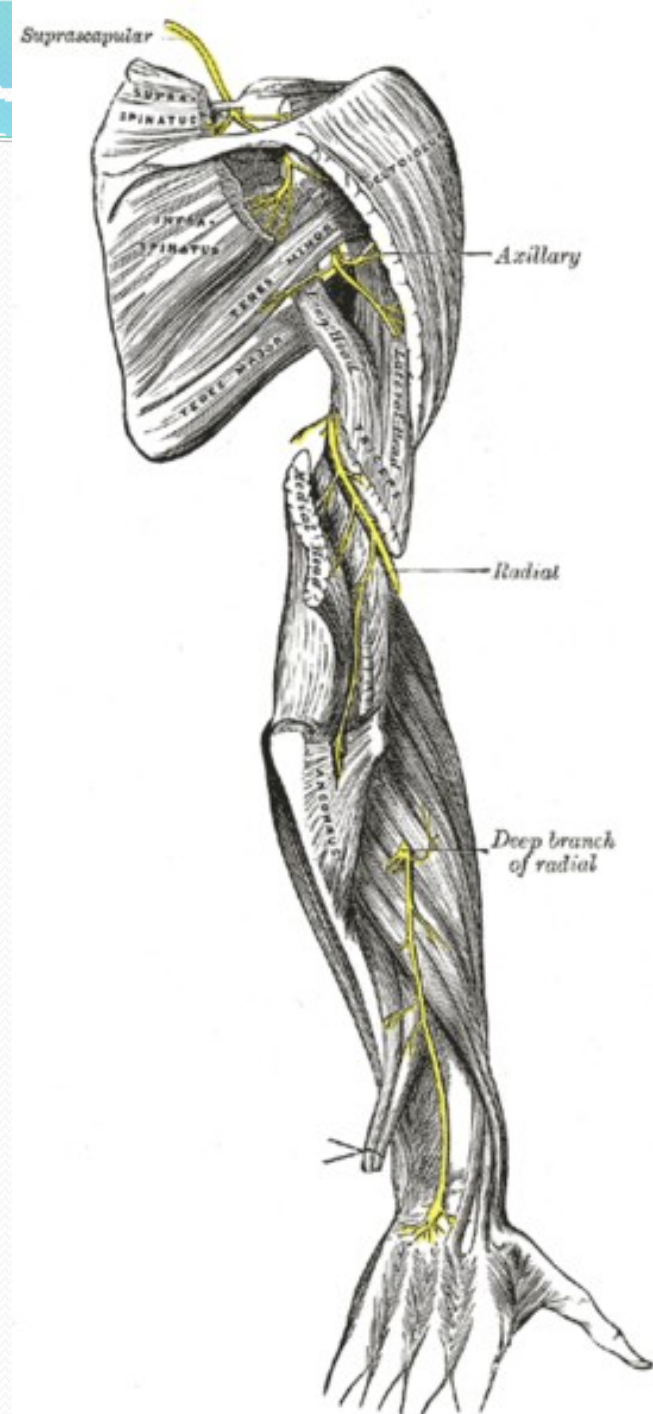


# Innervation of Musculocutaneous Nerve

- Muscular innervation
  - Supply coracobrachialis, biceps brachii and brachialis
- Cutaneous innervation.
  - **Lateral antebrachial cutaneous** nerve divide into anterior and posterior branch.
  - Anterior branch – skin of anterolateral surface of forearm as far as ball of the thumb
  - Posterior branch – skin of posterolateral surface of forearm.

# Radial Nerve

- Arise from posterior cord of brachial plexus
- Arise from root C5, C6, C7, C8 & T1.



# Radial Nerve

- It goes descending obliquely through the arm, first in the posterior compartment of the arm, and later in the anterior compartment of the arm, and continues in the posterior compartment of the forearm.
- The radial nerve enter the arm behind the axillary artery and then travel posteriorly on the medial side of the arm.

# Radial Nerve

- Then radial nerve will innervate triceps brachii.
- Radial nerve then enter the radial groove.
- Radial nerve emerge from radial groove and enter the anterior compartment of the arm.
- It continue the journey between brachialis and brachioradialis.
- When the radial nerve reaches the distal part of the humerus, it passes anterior to the lateral epicondyle and continue to the forearm.

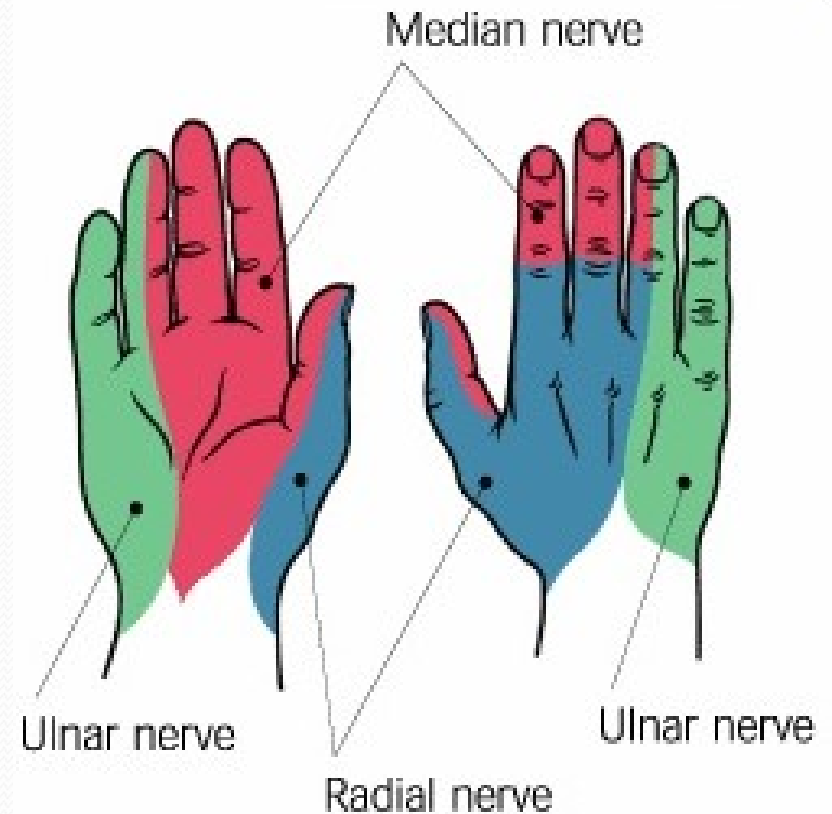
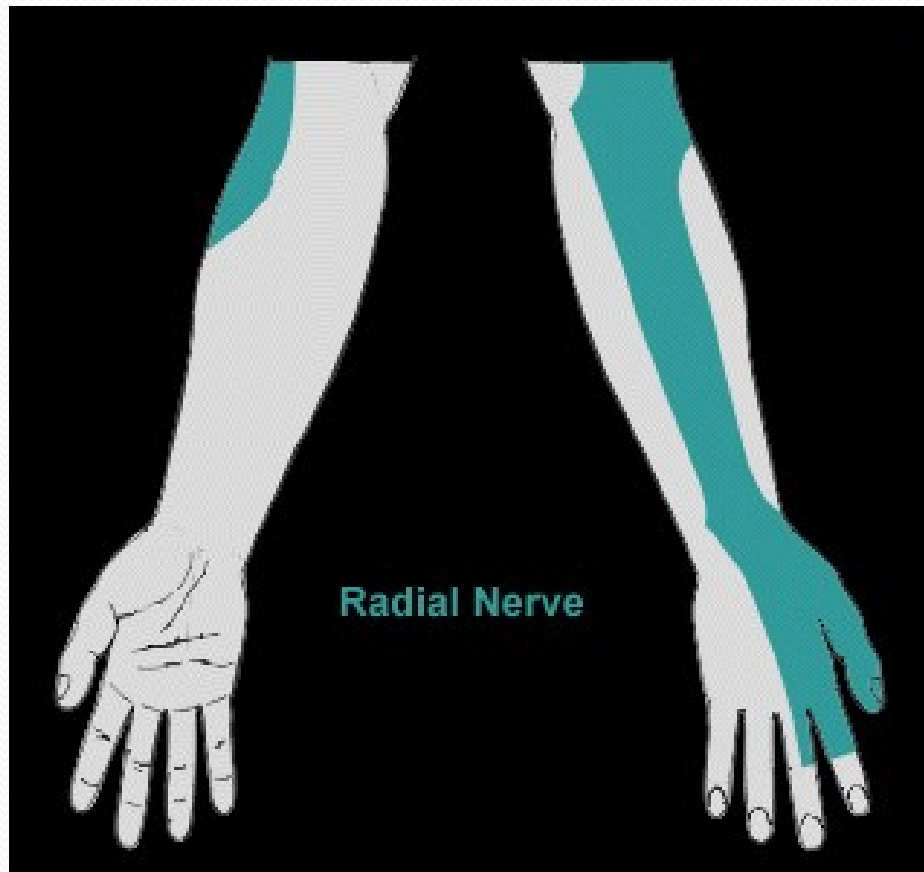
# Radial Nerve

- In the forearm, it will branch of to superficial branch (mainly sensory) and deep branch (mainly motor).
- **Cutaneous innervation** is provided by nerve that arise from radial nerve.
  - Posterior brachial cutaneous nerve
  - Inferior lateral brachial cutaneous nerve
  - Posterior antebrachial cutaneous nerve
  - Superficial branch of radial nerve

# Radial Nerve

- Posterior cutaneous nerve of arm (posterior brachial cutaneous) - provides sensory innervations for much of the skin on the back of the arm.
- Inferior lateral cutaneous nerve of arm (inferior lateral brachial cutaneous) - provides sensory and vasomotor innervation to the lower, lateral aspect of the arm.
- Posterior cutaneous nerve of forearm (posterior antebrachial cutaneous).-skin of the posterior of the forearm
- Superficial branch – back of the hand

# Radial Nerve Dermatomes



# Radial Nerve

- **Motor innervations**
- Triceps brachii, anconeus, brachioradialis, supinator and mostly posterior compartment extrinsic hand muscles.



# Cont...

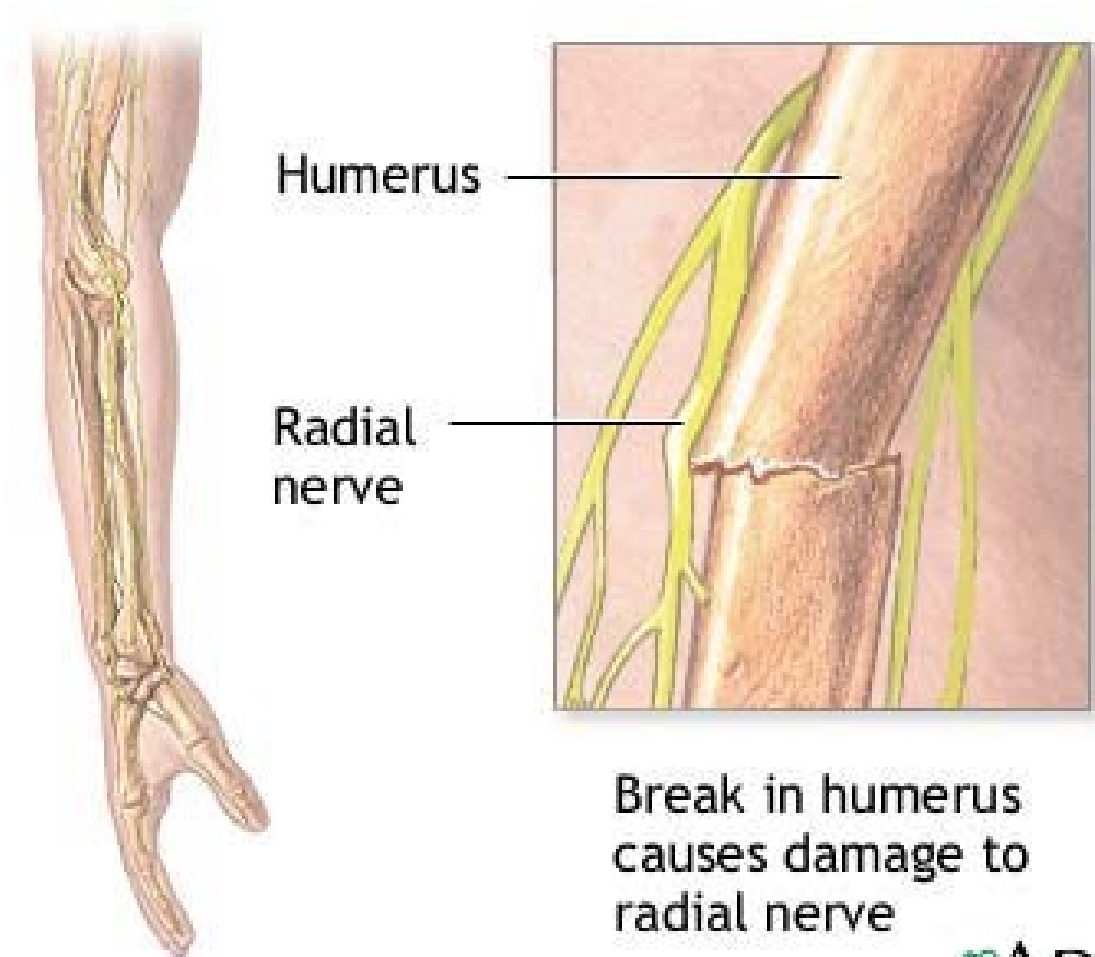
- The radial nerve is often injured in its course close to the humerus, either from fracture or pressure from direct blow to the humerus (incorrect use of a crutch)
- Triceps usually escapes because derivation of the nerve giving off high in arm, but total paralysis of the extensor of the wrist and digits leads to the **dropped wrist deformities**.

# Wrist Dropped



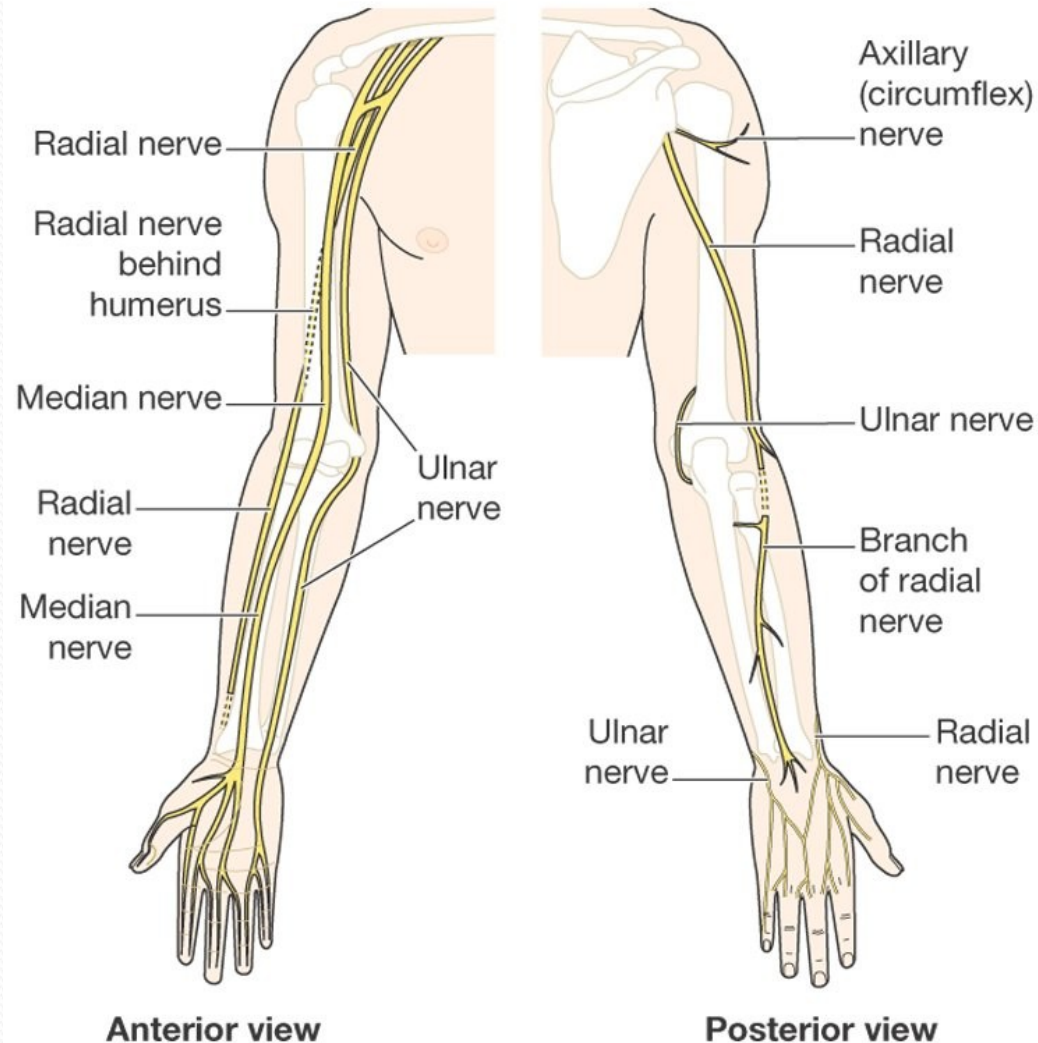
*Paralysis*  
**Wrist Extensors**

# Fracture of the humerus



# Ulnar Nerve

- Arise from medial cord of brachial plexus
- Root C8 and T1 (mostly C7)
- Descend on the posteromedial of the humerus.
- Then it goes posterior to the medial epicondyle.

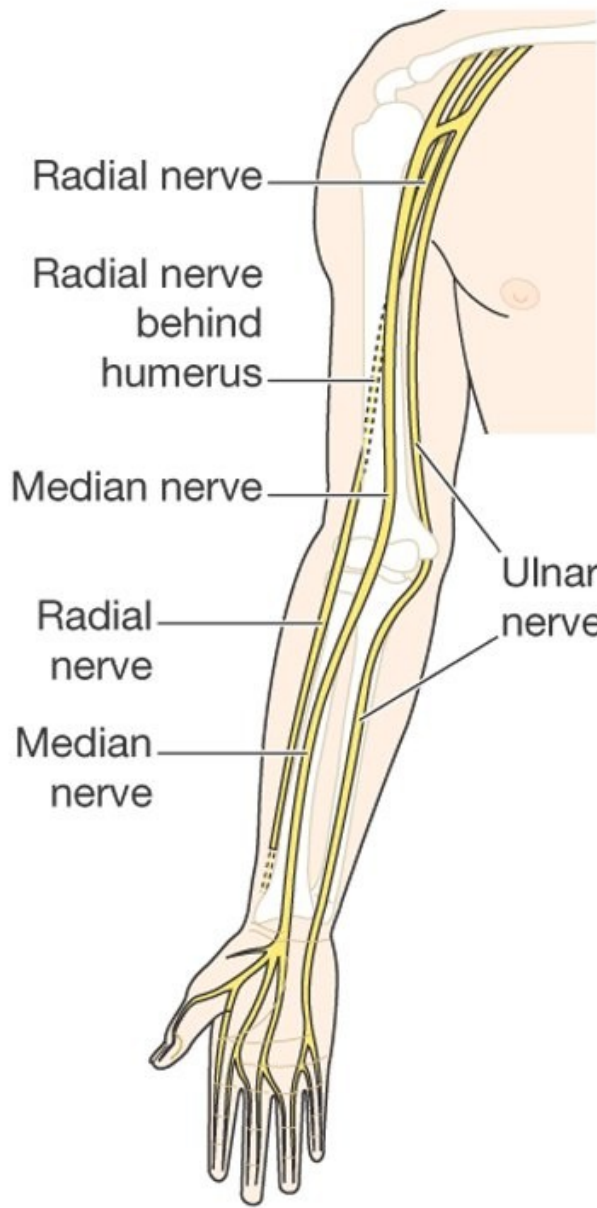


# Ulnar Nerve

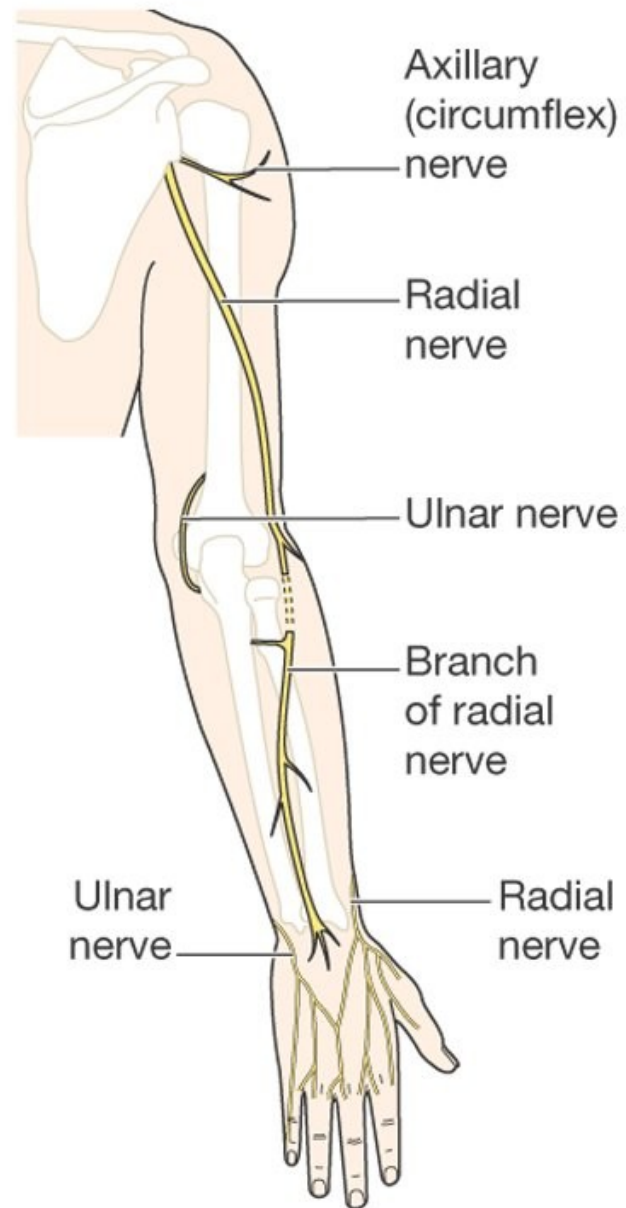
- Enter anterior compartment muscles of forearm and supplies flexor carpi ulnaris and medial half flexor digitorum profundus.
- Then ulna nerve enter palm of the hand and branch off to the **superficial branch** and **deep branch**.
- Deep branch innervate hypothenar muscles, intermediate hand muscles and thenar hand muscles (adductor pollicis, flexor pollicis brevis (rare))

# Ulnar Nerve

- Superficial branches of Ulnar nerve will innervate palmaris brevis and skin anterior and posterior of the hand (medial aspect of the hand/ one and half digits)

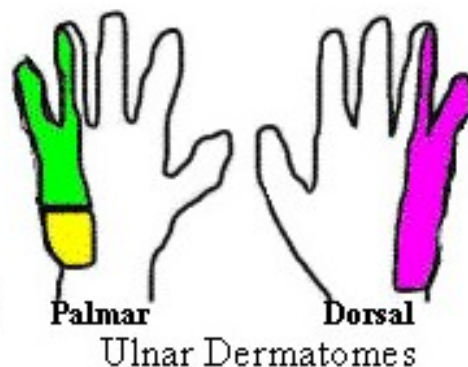
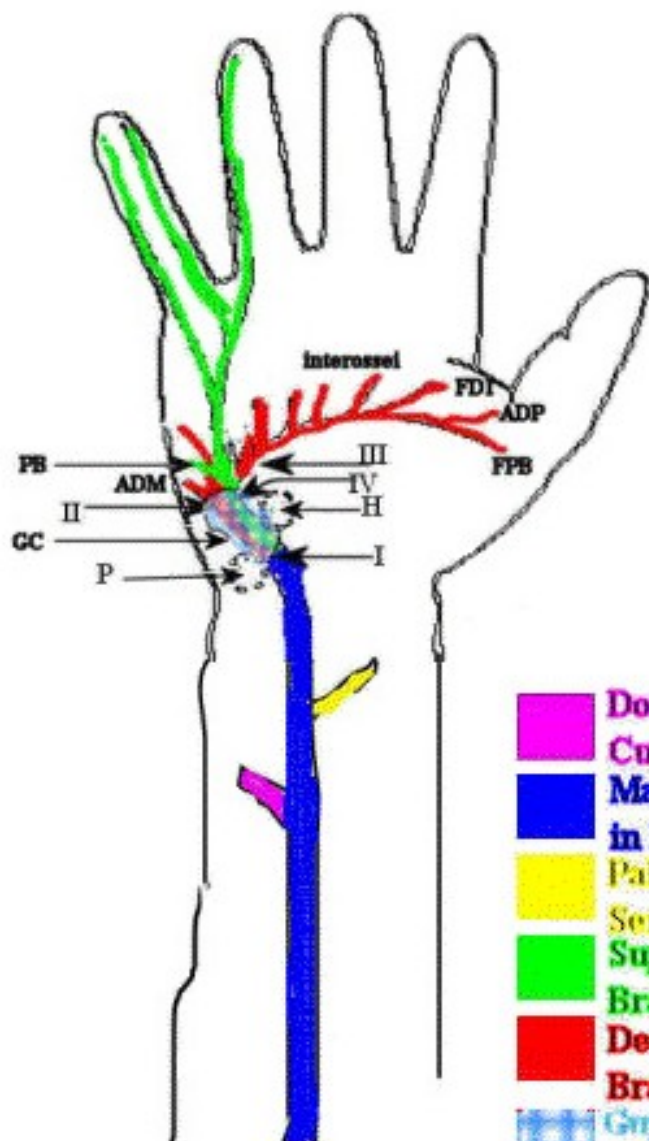


**Anterior view**



**Posterior view**

# Ulnar Nerve: Forearm, Guyon's Canal, and Hand



## Common Ulnar Impingement Sites: Guyon's Canal Region

- I. At the very entrance of Guyon's canal or just within it, potential impacting all terminal branches (red and green).
- II. Right after the nerve comes out of the canal, impacting the deep terminal motor branch (red). No sensory loss.
- III. The deep motor branch after the branch to the hypothenar muscles has taken off. Motor loss except in hypothenar area. No sensory loss.
- IV. The superficial terminal branch (green). All sensory except for a small branch (PB) to the palmaris brevis muscle. Sensory loss on the fifth and the ulnar half of the 4th digit.

### Abbreviations

M. - Muscle

PB-Branch to Palmaris Brevis M.

ADM-Adductor Digiti Minimi M., also represents other hypothenar muscle including flexor and Opponens digiti minimi

FDI-First Dorsal Interosseus M.

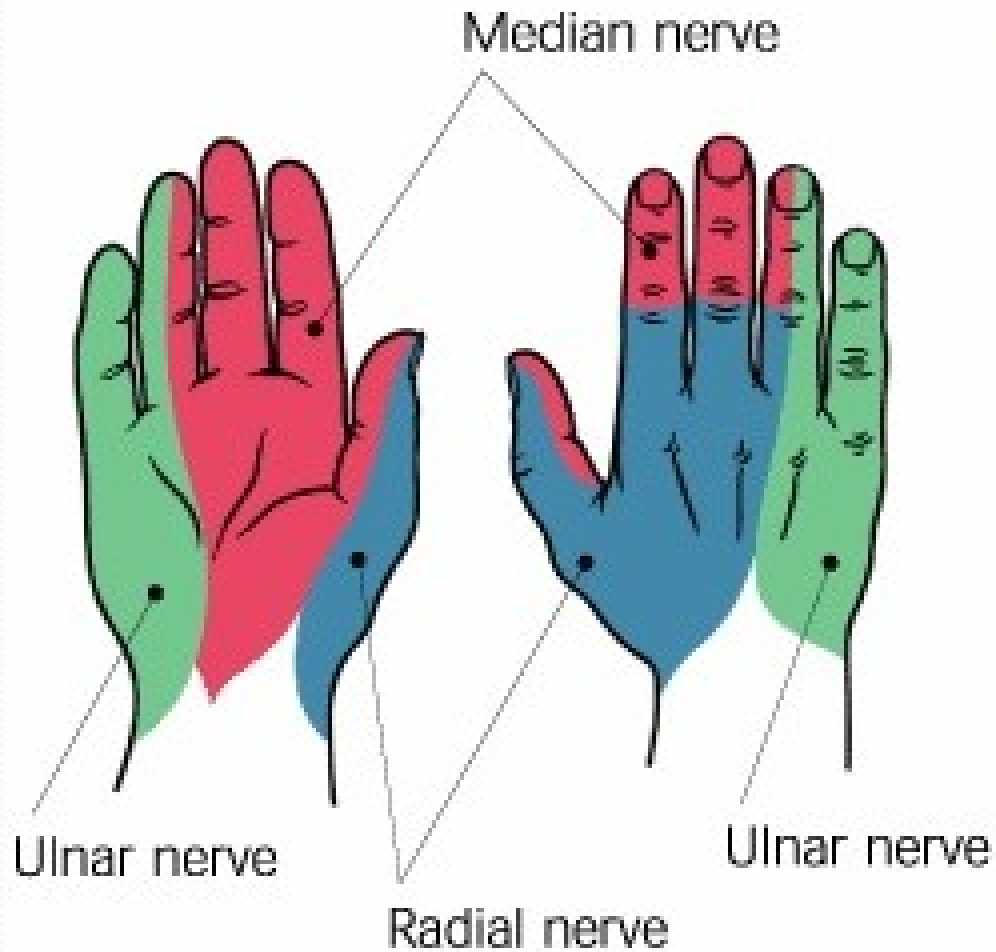
ADP-Adductor Pollicis M.

FPB-Flexor Pollicis Brevis M.

GC-Guyon's Canal; P Pisiform bone; H hamate bone  
Interossei-Interosseous muscle of the hand. Other ulnar Intrinsic hand muscles are also similarly innervated



# Hand Dermatomes



# Cont...

- Ulnar nerve may be damaged in the groove behind the medial epicondyle either by trauma or entrapment.
- Leads to partial or completely lost of muscular and sensory innervations.
- The results of the ulna nerve lesion leads to the typical '**claw hand**' deformities.
- Due to lost of the power in the intrinsic hand muscles and unopposed actions of antagonistic muscles group.
- Wasting of hypothenar eminence.
- There are 'guttering between metacarpals, inability to abduct the fingers or adduct the thumb.
- Sensory lost

# Claw Hand Deformities



# Median Nerve

- Arise from lateral root of lateral cord (C<sub>5,6,7</sub>) and medial root and medial cord (C<sub>8,T1</sub>) of brachial plexus.
- Passes down the midline of the arm in close association with the brachial artery.
- Passes in front of elbow joint (cubital fossa) then down to supply the muscles of the anterior of forearm.
- Then it continue into the hand through carpal tunnel where it supply intrinsic hand muscles and skin of

- At the cubital fossa the anterior interosseous nerve arises from the median nerve
- Descend through the forearm and end at the wrist by giving the articular branch to the radiocarpal and intercarpal joint.
- It supplies flexor pollicis longus, lateral half flexor digitorum profundus and pronator quadratus

# Median Nerve

- Motor – all anterior (flexor) compartment of forearm (except flexor carpi ulnaris and ulnar half of the flexor digitorum profundus ), pronator teres & quadratus, intrinsic hand muscles (LOAF; 1,2 lumbricals, OP, FPB, APB)
- Sensory – skin of the palmar aspect of the thumb and the lateral 2 ½ fingers and the distal ends of the same fingers and skin of distal phalanx on same finger

# Median nerve dermatomes



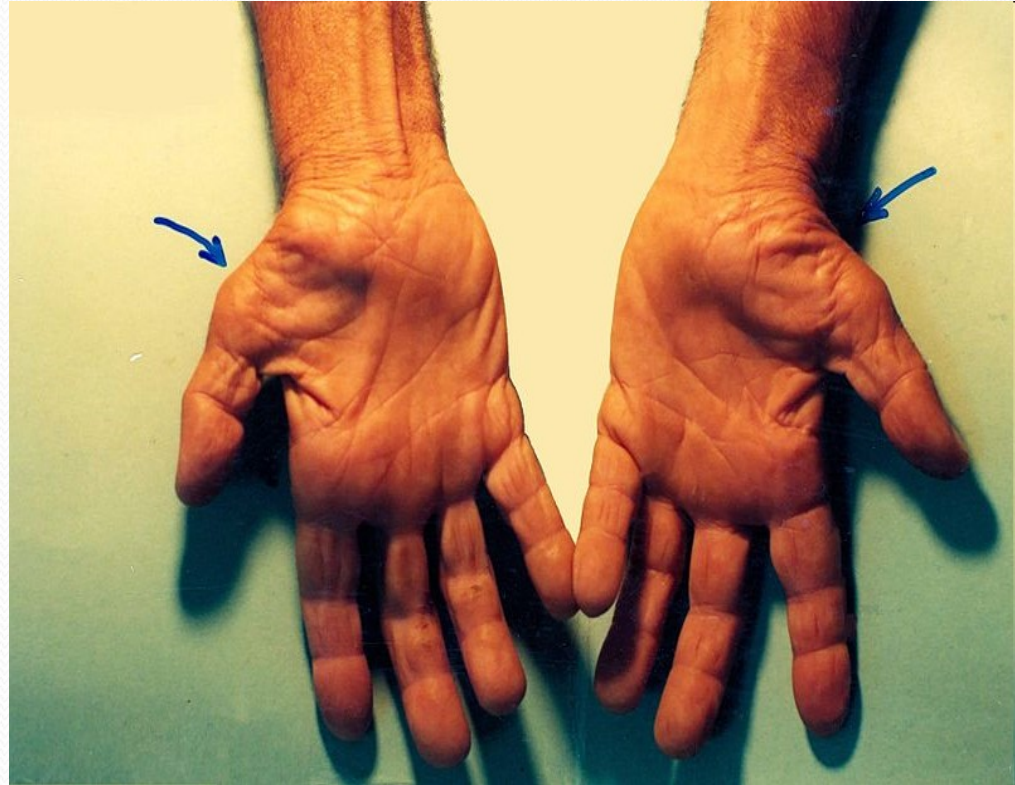
# Cont...

- Median nerve can be injured by deep cut with resultant lost of flexion at all IP joint except the distal ones in the ring and little finger.
- MCP still can be flexed at this fingers ( lumbricals)
- In the hand thumb is extend and adducted, lost of ability to abduct and oppose.
- Compression at the carpal tunnel give rise the carpal tunnel syndrome (CTS)



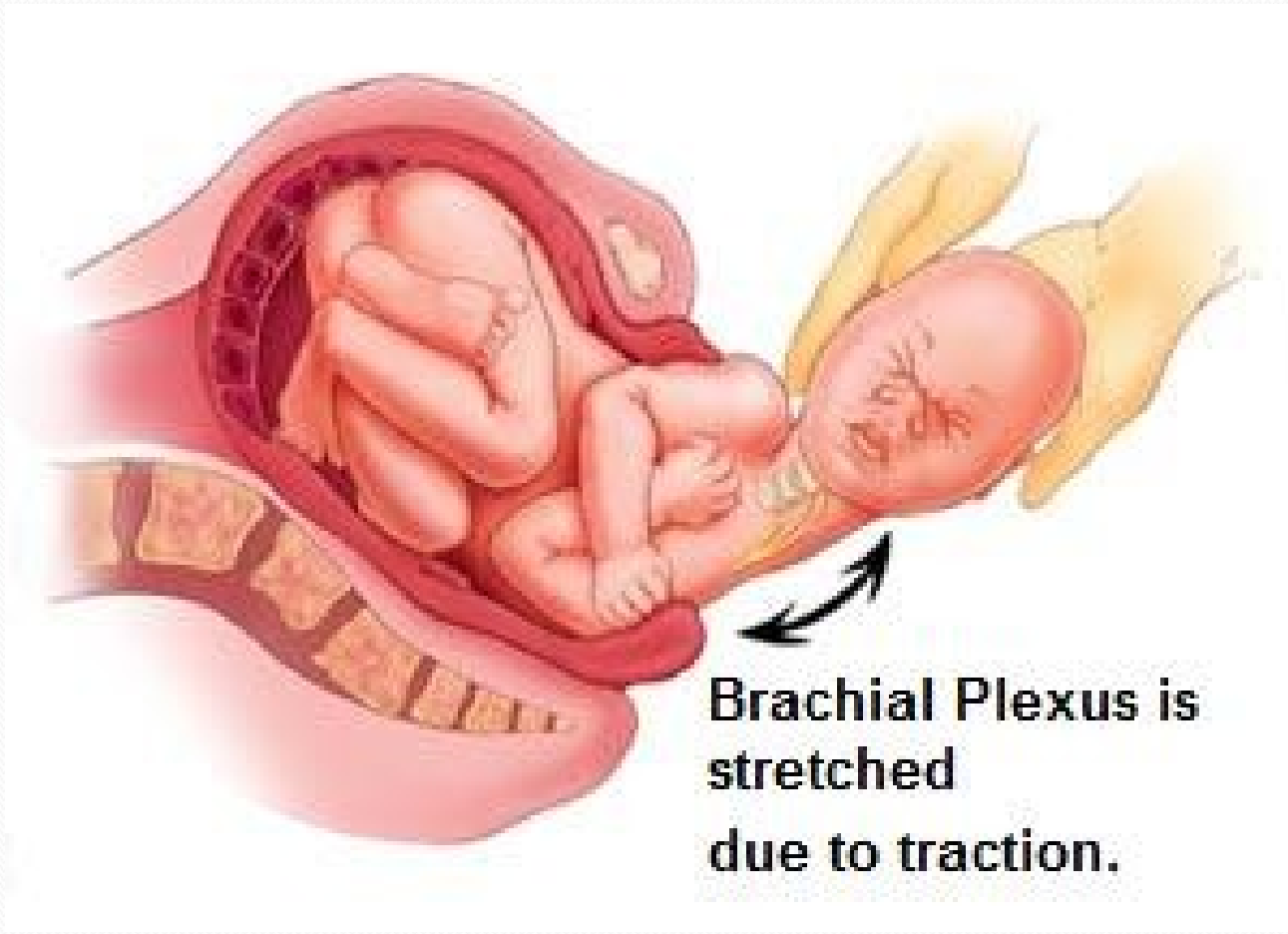
# Carpal Tunnel Syndrome

- Compression median nerve at the carpal tunnel
- Patient will experience numbness, tingling, or burning sensation at the thumb, index, middle and radial half of the ring finger.
- If untreated – weakness or atrophy of the thenar muscles.



# Brachial Plexus Injury

- Obstetric brachial plexus palsy
- Injury to all or portion of a child brachial plexus occurring at that time of the delivery.
- Excessive lateral traction on the head so that the head is pulled away from the shoulder.
- Divide into :
- Erb's Duchenne Palsy
- Klumpke's Palsy



**Brachial Plexus is stretched due to traction.**

# Erb's Duchenne Palsy

- Involving upper roots (C5, C6 and C7)
- Affecting the musculature of the upper arm
- Shows the “waiter tips” posture of the paralyzed limb.
- The arm lies medial rotation at the side of the chest
- The elbow is extended (paralyzed C5, C6)
- Forearm is pronated
- Wrist and digits are flexed

# Erb's Duchenne Palsy



- This posture occurs because of paralysis and atrophy of:
- Deltoid
- Biceps brachii
- Brachialis
- brachioradialis

# Klumpke's Palsy

- Rare
- Involving lower root (C8 and T1)
- Affecting forearm and hand
- Characterize by paralysis and atrophy of the small hand muscles and flexor of the wrist.
- Claw hand



