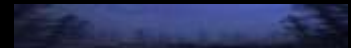


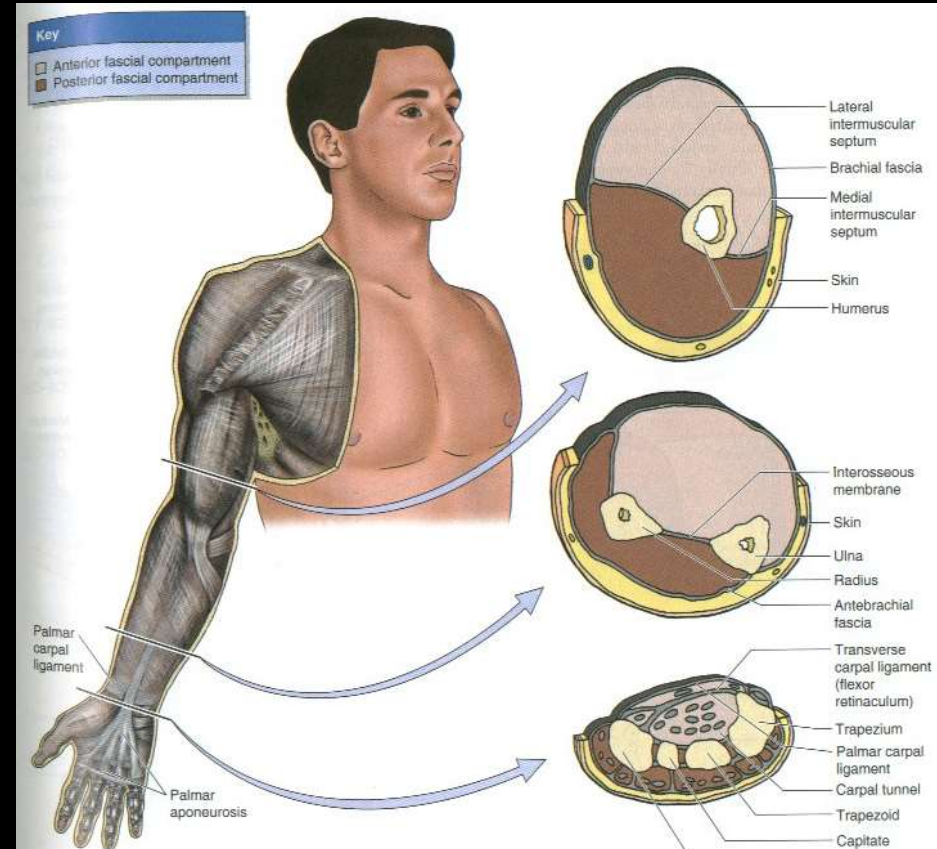
Upper limb- Part III

Muscles and nerves of the forearm



Antebrachial fascia and compartments of the forearm

- ❖ The forearm is enclosed within the antebrachial fascia attached to the posterior border of ulna
- ❖ Interosseous membrane and fibrous intermuscular septa divide the forearm into 2 main compartments:
 - **Anterior** (actually antero- medial) compartment containing **flexors**
 - **Posterior** (actually postero- lateral) compartment containing **extensors**
- ❖ Anterior compartment of forearm communicates with the central compartment of the palm via the carpal tunnel



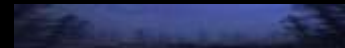
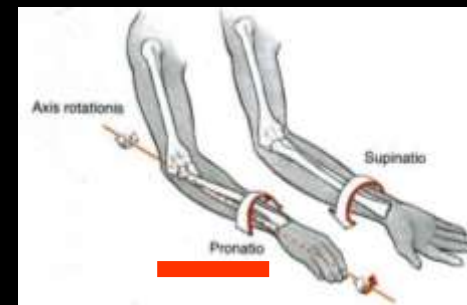
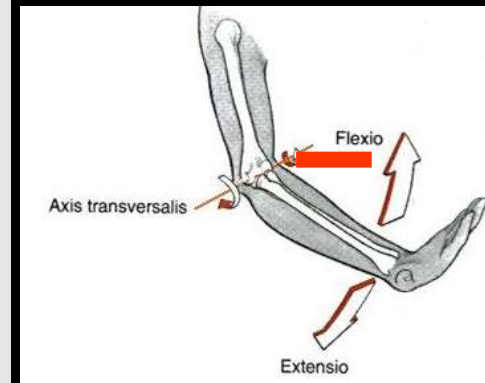
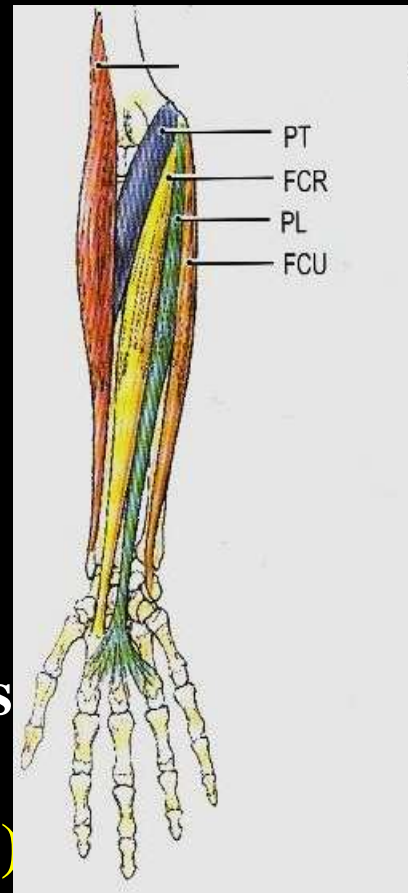
Muscles of the anterior compartment of the forearm-

superficial layer

- ❖ Pronator teres- PT
- ❖ Flexor carpi radialis- FCR
- ❖ Palmaris longus- PL
- ❖ Flexor carpi ulnaris- FCU

Common features

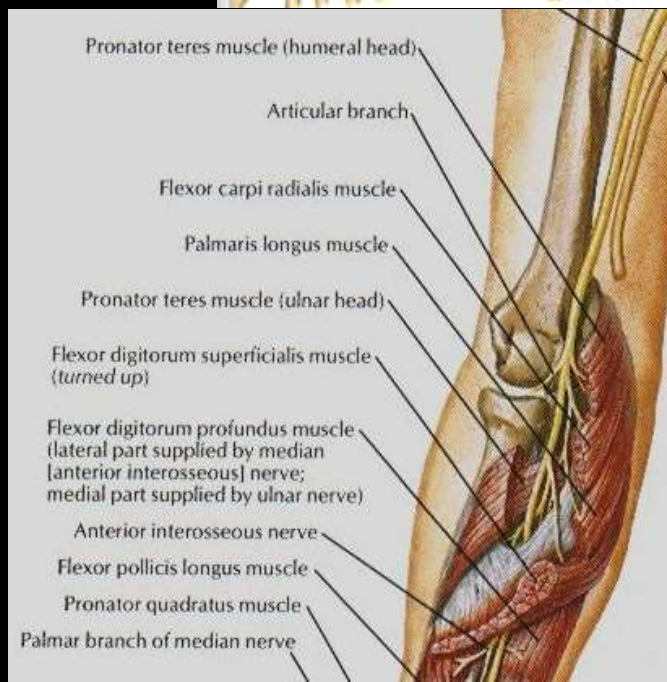
- ❖ Possess origin on the medial epicondyle of humerus
- ❖ Action
 - In elbow joint are weak flexors
 - In radioulnar joints are pronators (medial rotators)
 - In wrist joint are flexors (except pronator teres)
- ❖ Innervation
 - Median and ulnar nerves



Muscles of the anterior compartment of the forearm- superficial layer

Pronator teres

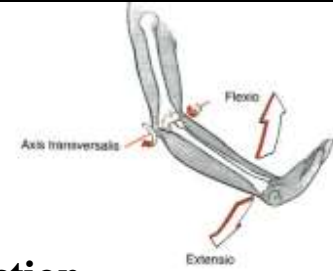
- ❖ **Origin-** has 2 heads in the proximal attachment (**on the medial epicondyle of humerus and coronoid process of ulna**)
- ❖ **Insertion-** middle part of body of radius
- ❖ **In the elbow joint is a weak flexor**
- ❖ **In the radioulnar joints is a pronator**
- ❖ **Is supplied by median nerve which runs between its heads**



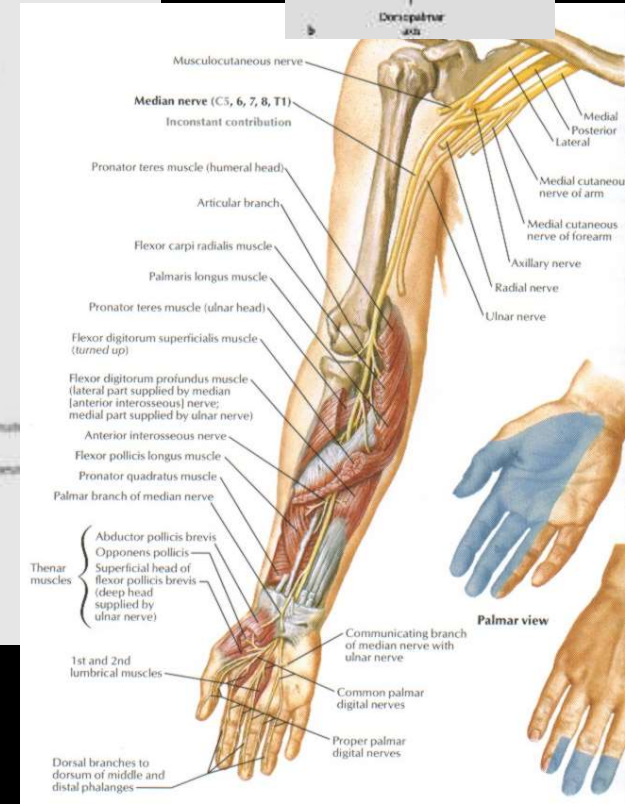
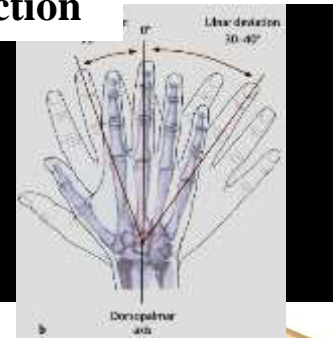
Muscles of the anterior compartment of the forearm- superficial layer

Flexor carpi radialis

- ❖ Origin- medial epicondyle of humerus
- ❖ Insertion- base of the 2nd metacarpal bone
- ❖ In the elbow joint is a weak flexor
- ❖ In the radioulnar joints is a pronator
- ❖ In the wrist joint is flexor and abductor of the hand
- ❖ Is supplied by median nerve



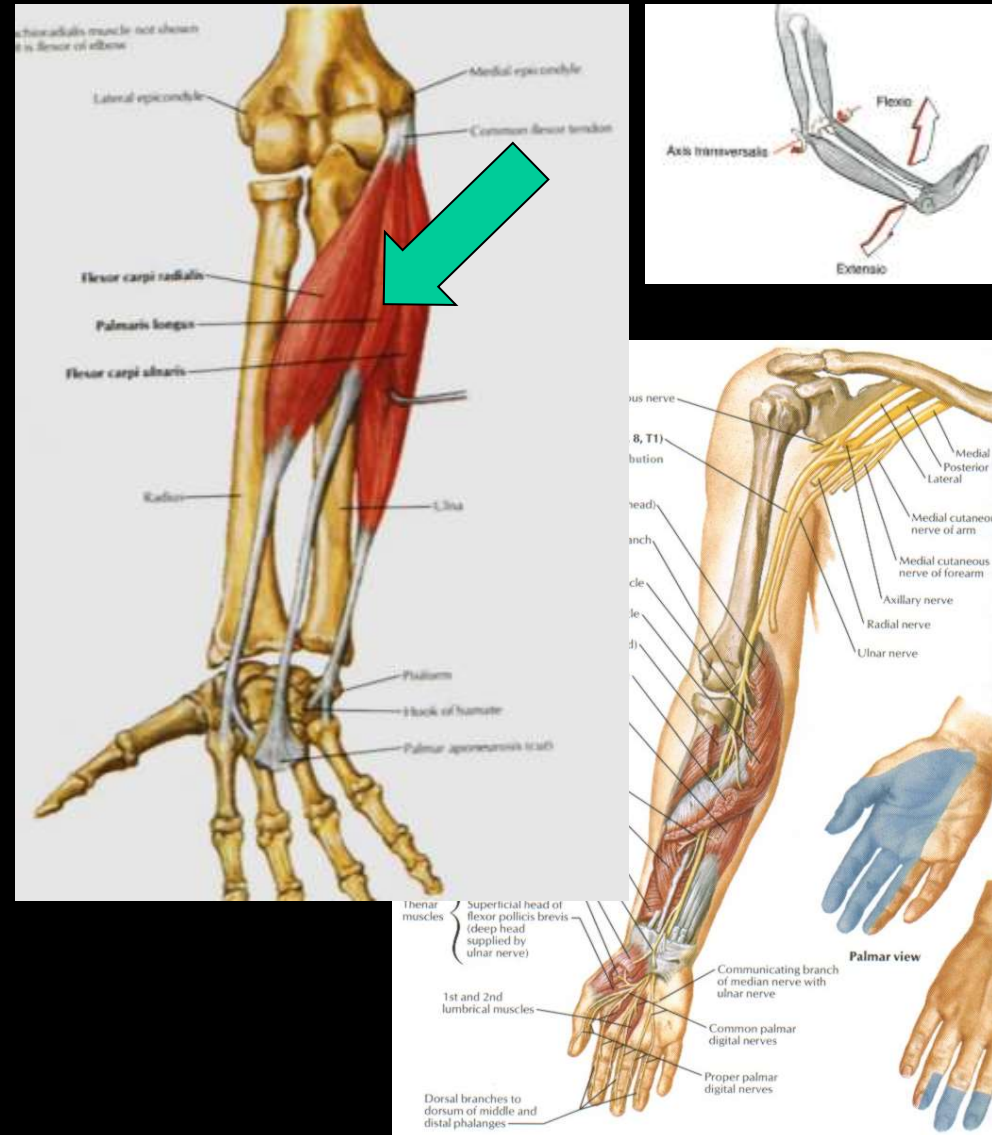
abduction



Muscles of the anterior compartment of the forearm- superficial layer

Palmaris longus

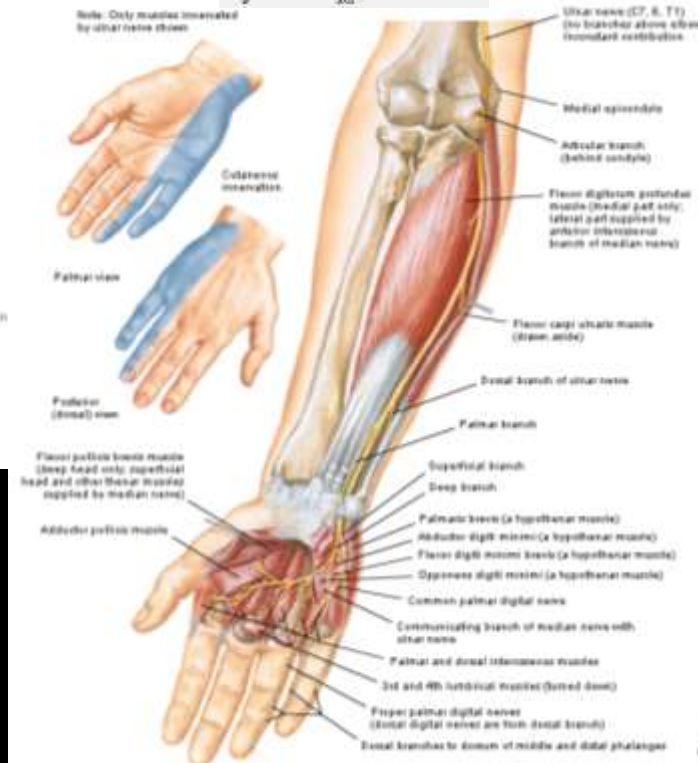
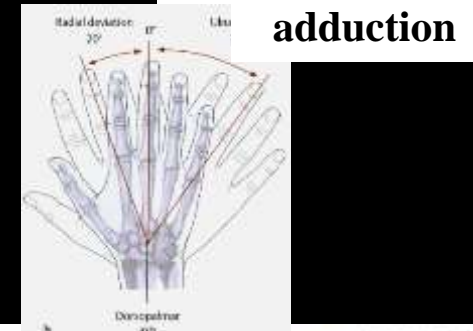
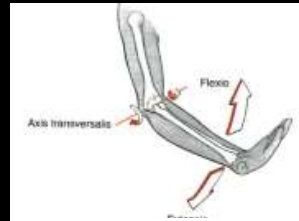
- ❖ **Origin-** medial epicondyle of humerus
- ❖ **Insertion-** palmar aponeurosis
- ❖ **In the elbow joint is a weak flexor**
- ❖ **In the radioulnar joints is a weak pronator**
- ❖ **In the wrist joint is a flexor**
- ❖ **By tension of palmar aponeurosis may flex fingers (digits II- V) in metacarpophalangeal joints**
- ❖ **Is supplied by median nerve**



Muscles of the anterior compartment of the forearm- superficial layer

Flexor carpi ulnaris

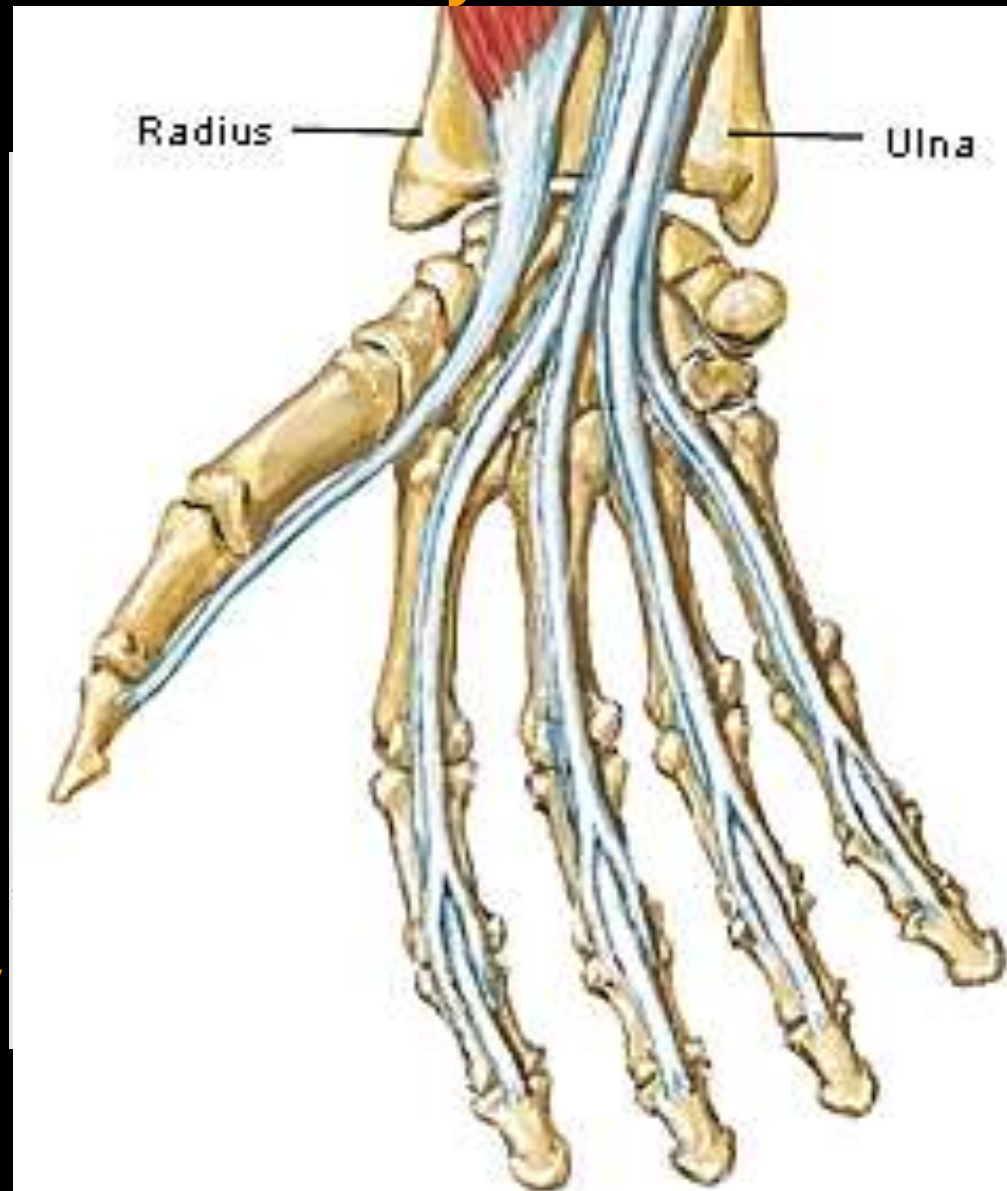
- ❖ Origin- medial epicondyle of humerus
- ❖ Insertion- pisiform bone
- ❖ In the elbow joint is a weak flexor
- ❖ In the wrist joint is a flexor and adductor of the hand
- ❖ Is supplied by ulnar nerve



Muscles of the anterior compartment of the forearm- intermediate layer

Flexor digitorum superficialis- FDS

- ❖ Possesses 2 heads in the proximal attachment
 - humeroulnar- on the medial epicondyle of humerus and coronoid process of ulna
 - Radial- on the body of radius
- ❖ Insertion- middle phalanges of medial 4 digits (II- V)
- ❖ Its tendons are pierced by the tendons of the flexor digitorum profundus



Muscles of the anterior compartment of the forearm- intermediate layer

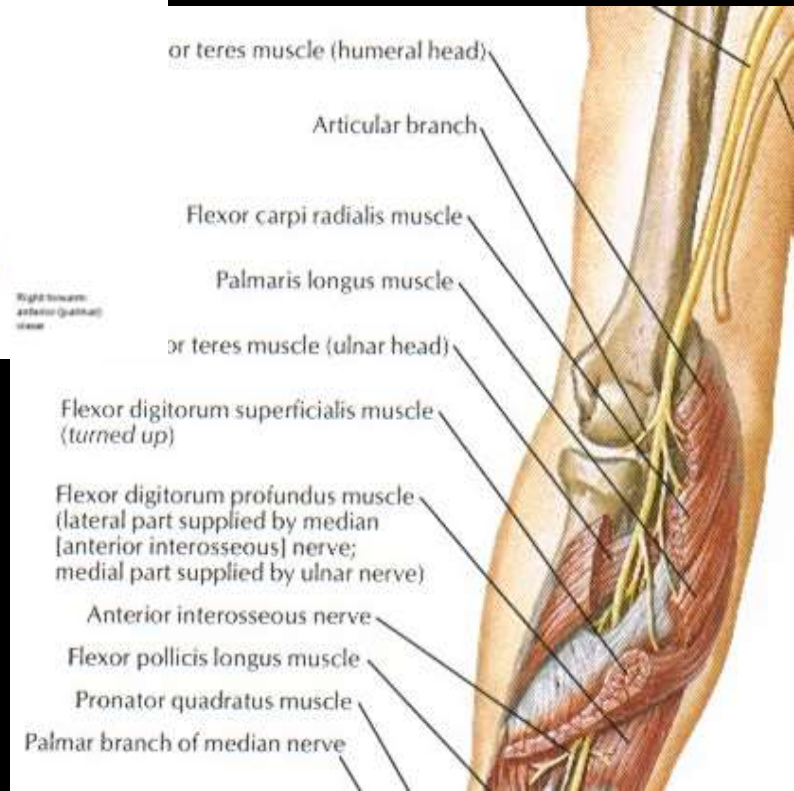
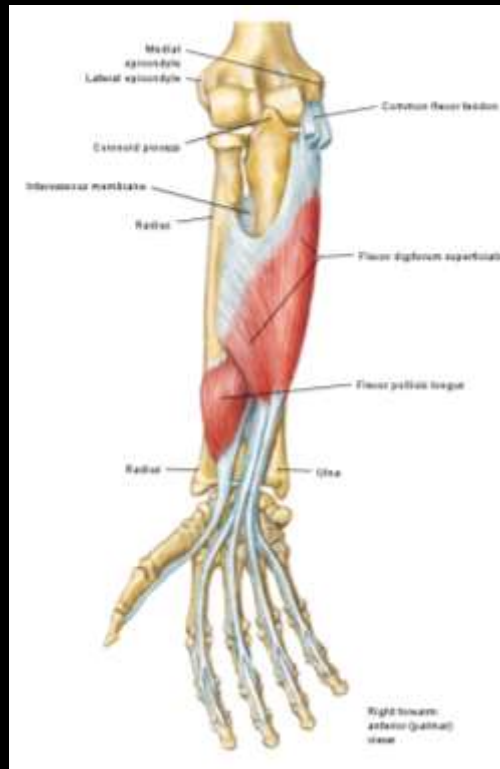
Flexor digitorum superficialis

❖ Action

- In the elbow joint is a weak flexor
- In the wrist joint is a flexor
- flexes fingers in metacarpophalangeal and proximal interphalangeal joints

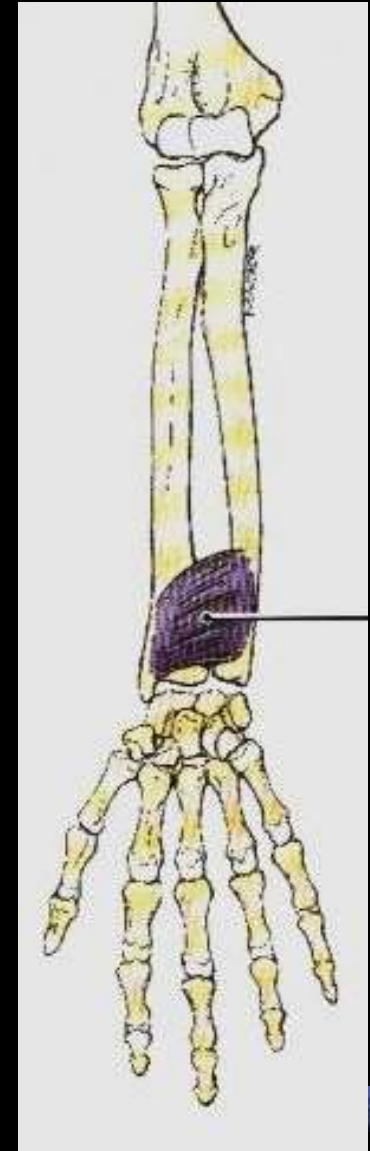
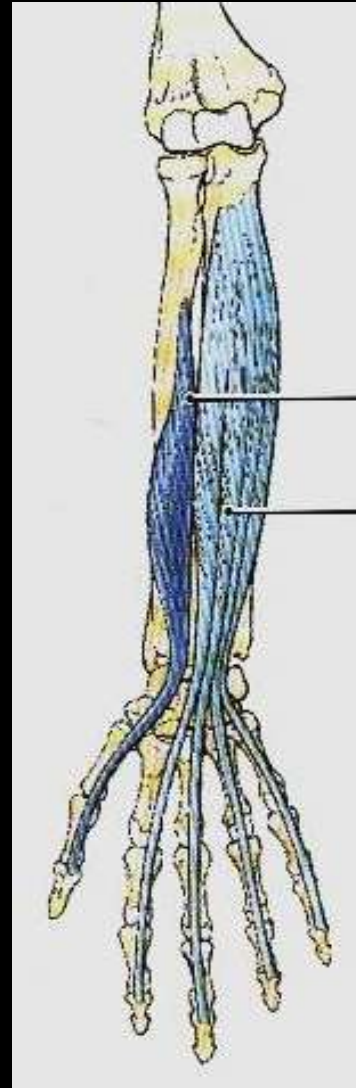
❖ Innervation

- Is supplied by median nerve which runs between its heads



Muscles of the anterior compartment of the forearm- deep layer

- ❖ Flexor digitorum profundus- FDP
- ❖ Flexor pollicis longus- FPL
- ❖ Pronator quadratus-PQ (forms the deepest layer in the anterior compartment)



Muscles of the anterior compartment of the forearm- deep layer

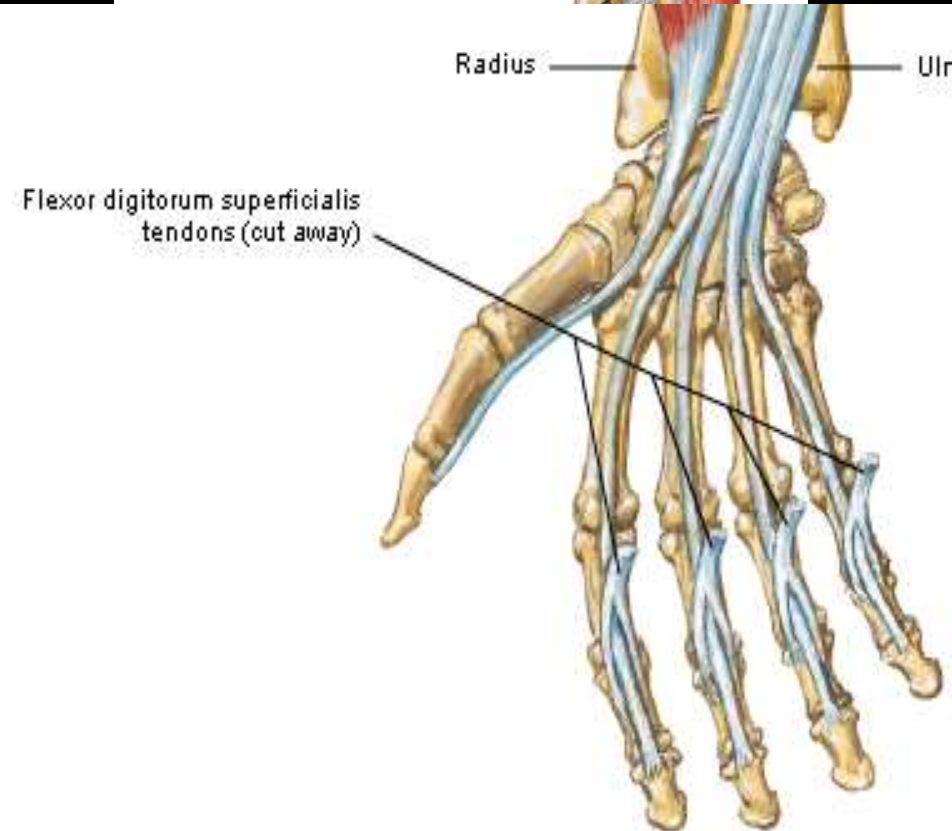
Flexor digitorum profundus

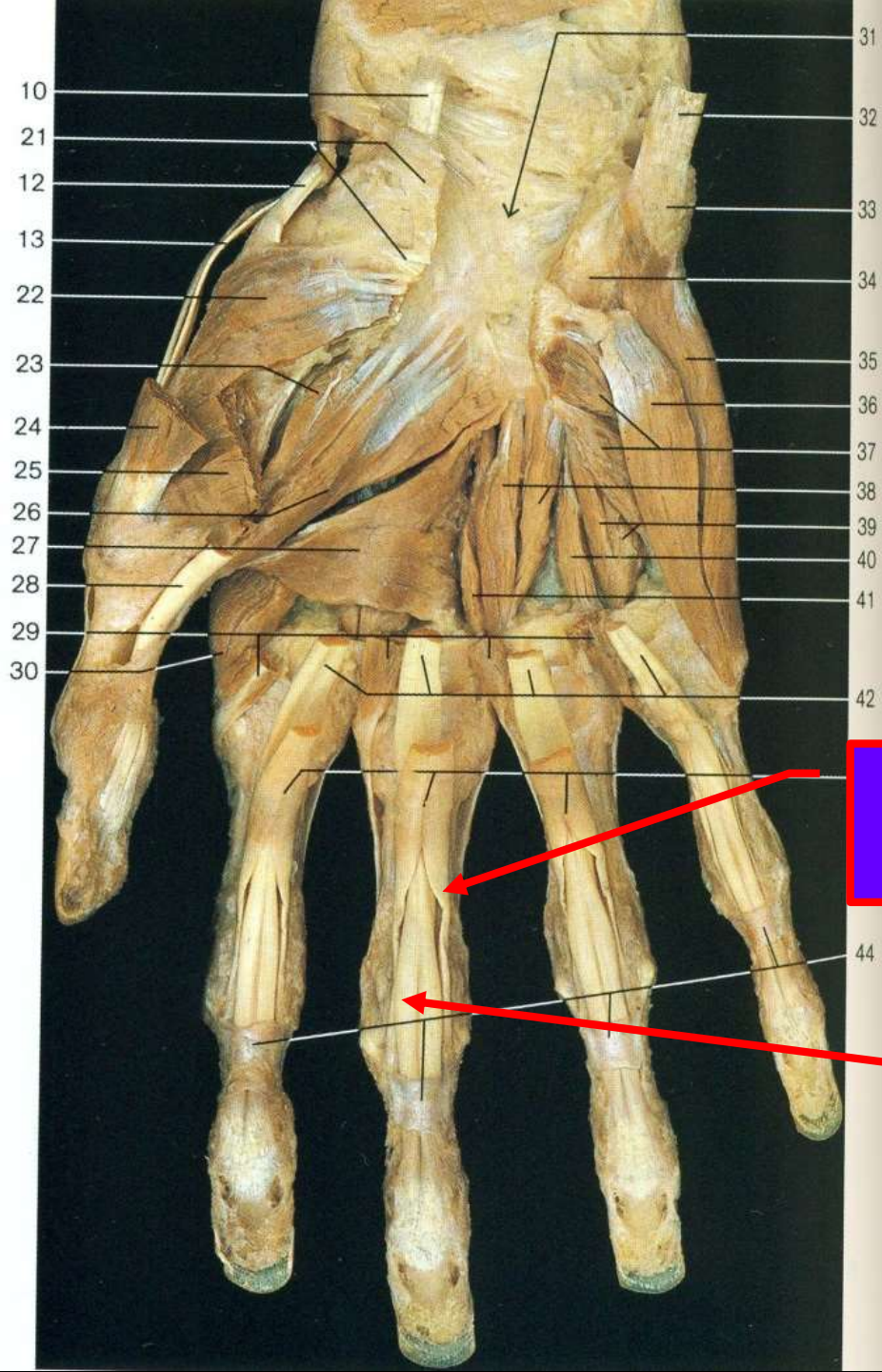
❖ Origin

➤ Anterior surface of ulna and interosseous membrane

❖ Insertion- distal phalanges of medial 4 digits (II- V)

❖ Its tendons pierce the tendons of the flexor digitorum superficialis



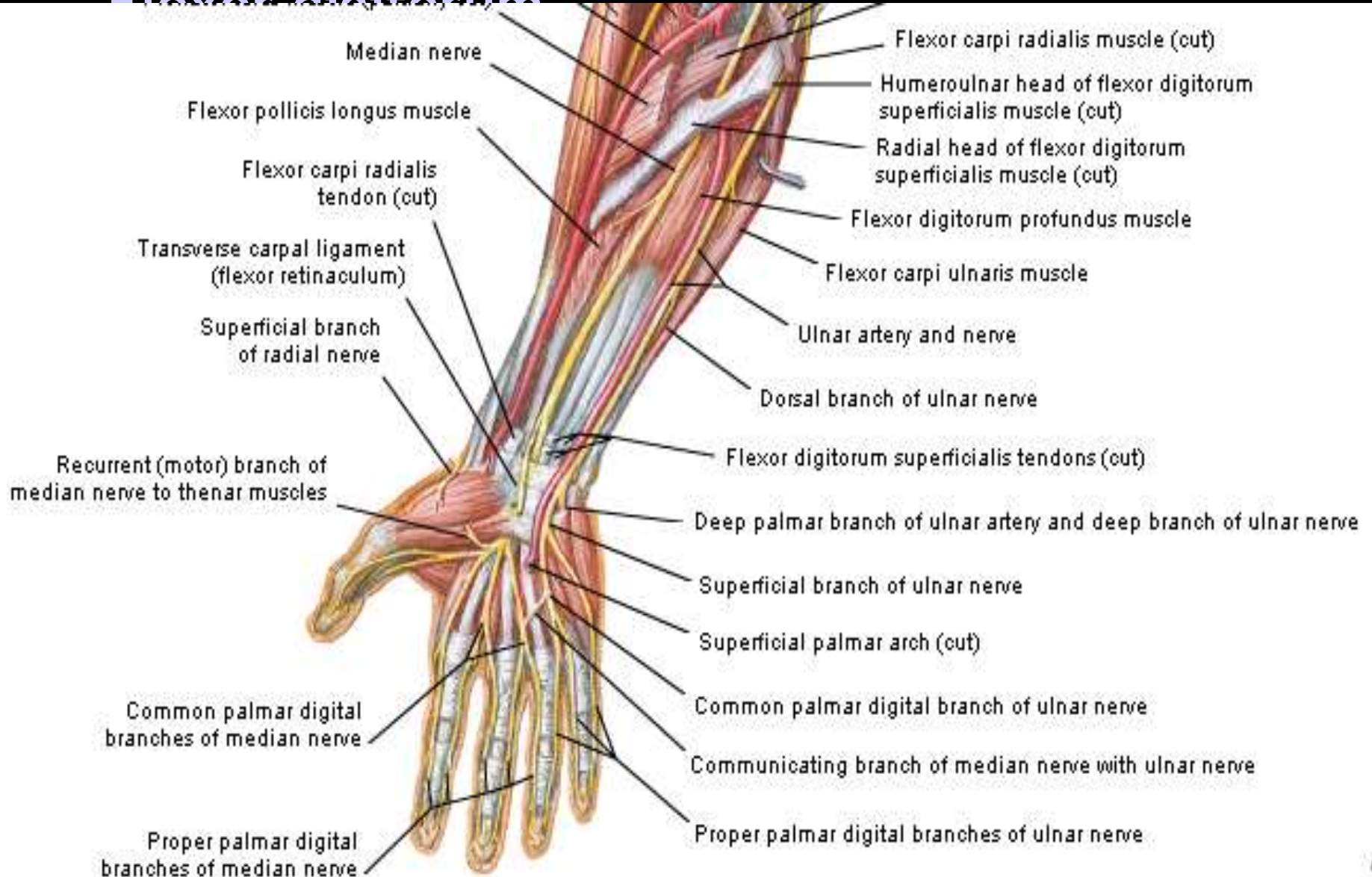


Tendon of
FDS

Tendon of
FDP

Muscles of the anterior compartment of the forearm- deep layer

Flexor digitorum



Muscles of the anterior compartment of the forearm- deep layer

Flexor pollicis longus

❖ Origin

- anterior surface of radius and interosseous membrane

❖ Insertion

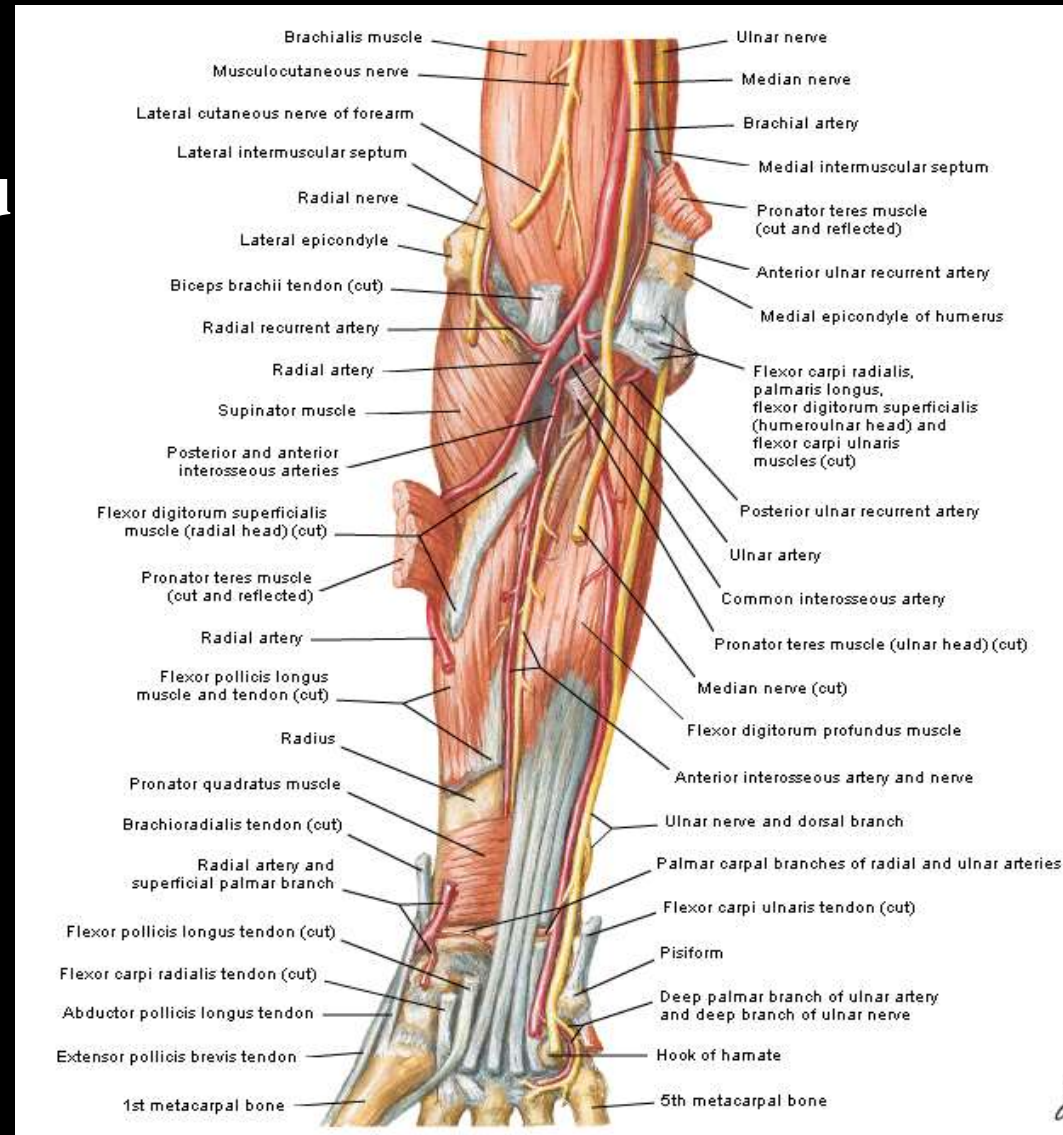
- distal phalanx of thumb

❖ Action

- In carpometarpal joint of thumb- adduction
- In metacarpophalangeal and interphalangeal joints of thumb- flexion

❖ Innervation-

- branch of median nerve- anterior interosseous nerve



Muscles of the anterior compartment of the forearm- deepest layer

Pronator quadratus

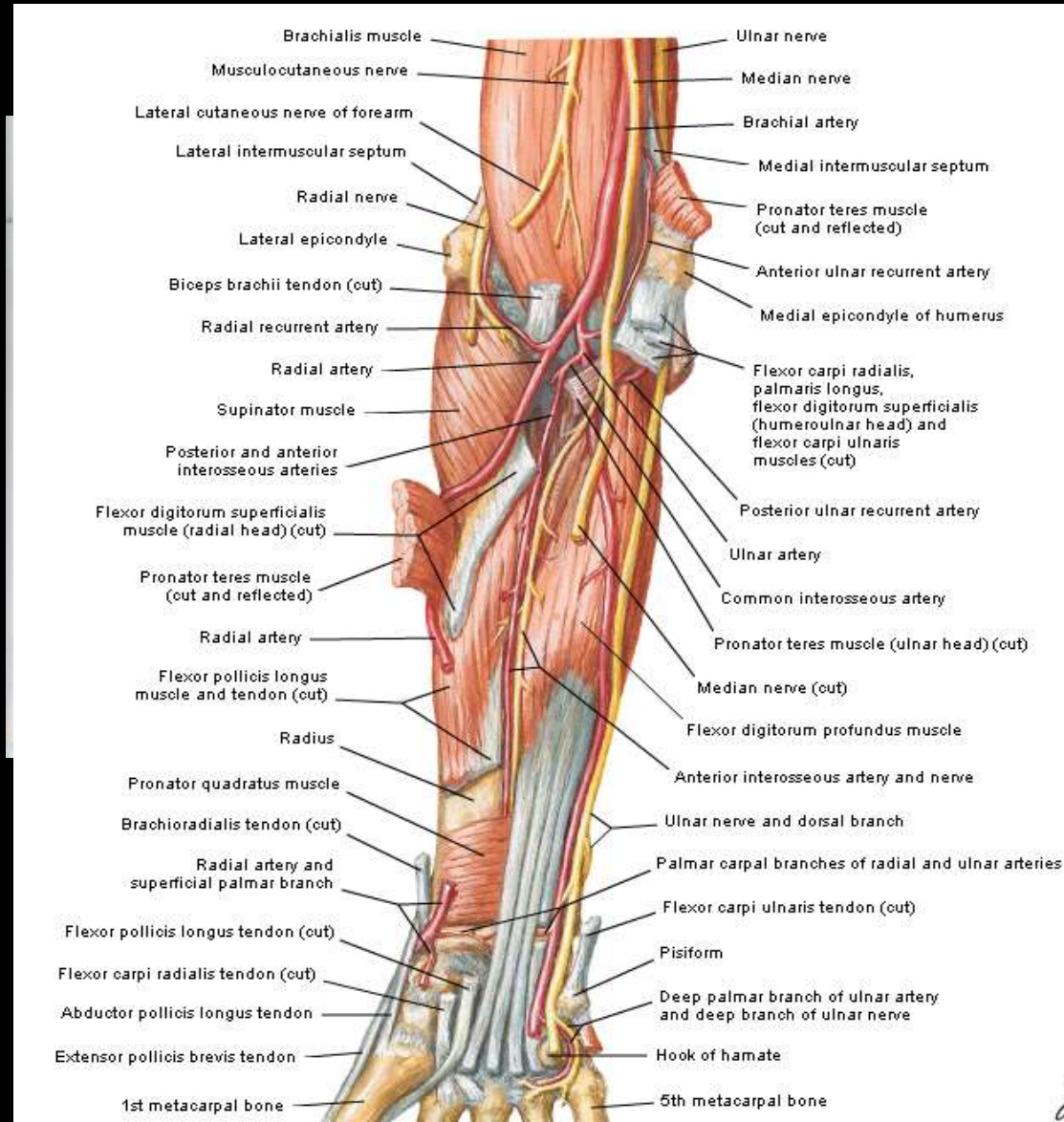
❖ Extended between the distal ends of the radius and ulna

❖ Action

➤ In the radioulnar joints is a pronator

❖ Innervation

➤ branch of median nerve- anterior interosseous nerve



Muscles of the postero- lateral compartment of the forearm

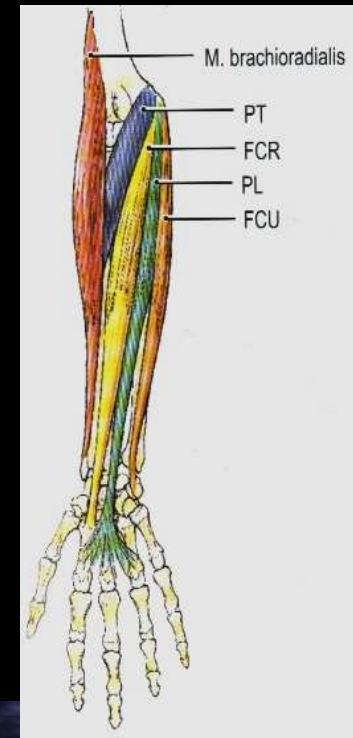
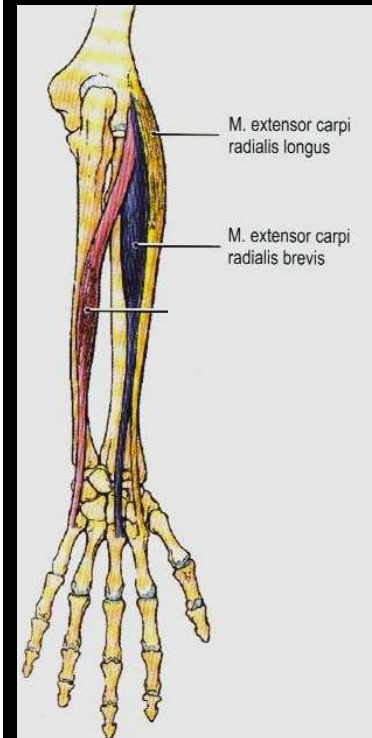
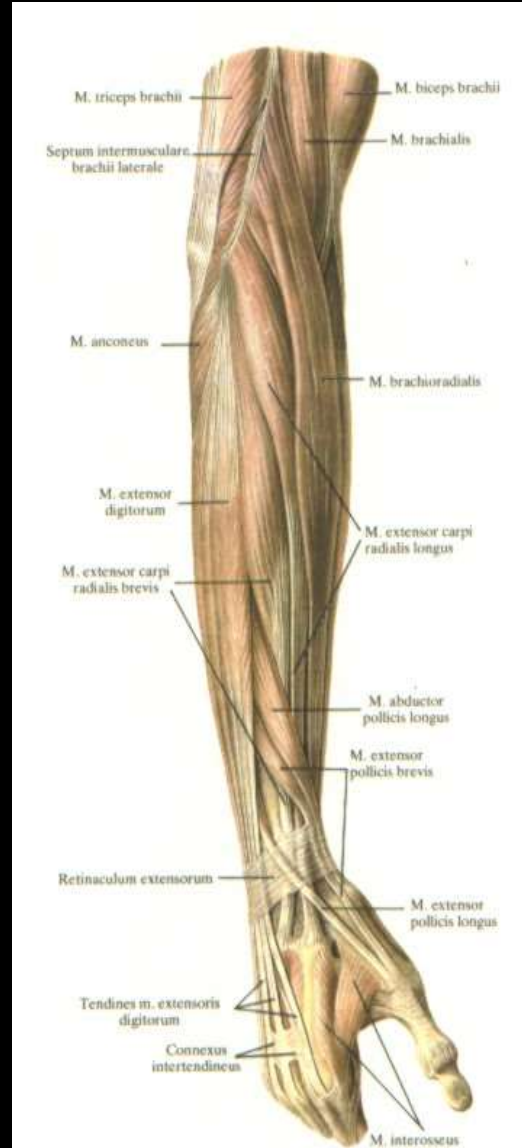
Are innervated by the radial nerve

Have proximal attachments on the lateral epicondyle of humerus

❖ Brachioradialis
BR

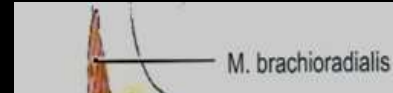
❖ Extensor carpi radialis longus
ECRL

❖ Extensor carpi radialis brevis
ECRB



Muscles of the postero- lateral compartment of the forearm

Brachioradialis



❖ Attachments

➤ Origin

- Lateral supracondylar ridge of humerus

➤ Insertion

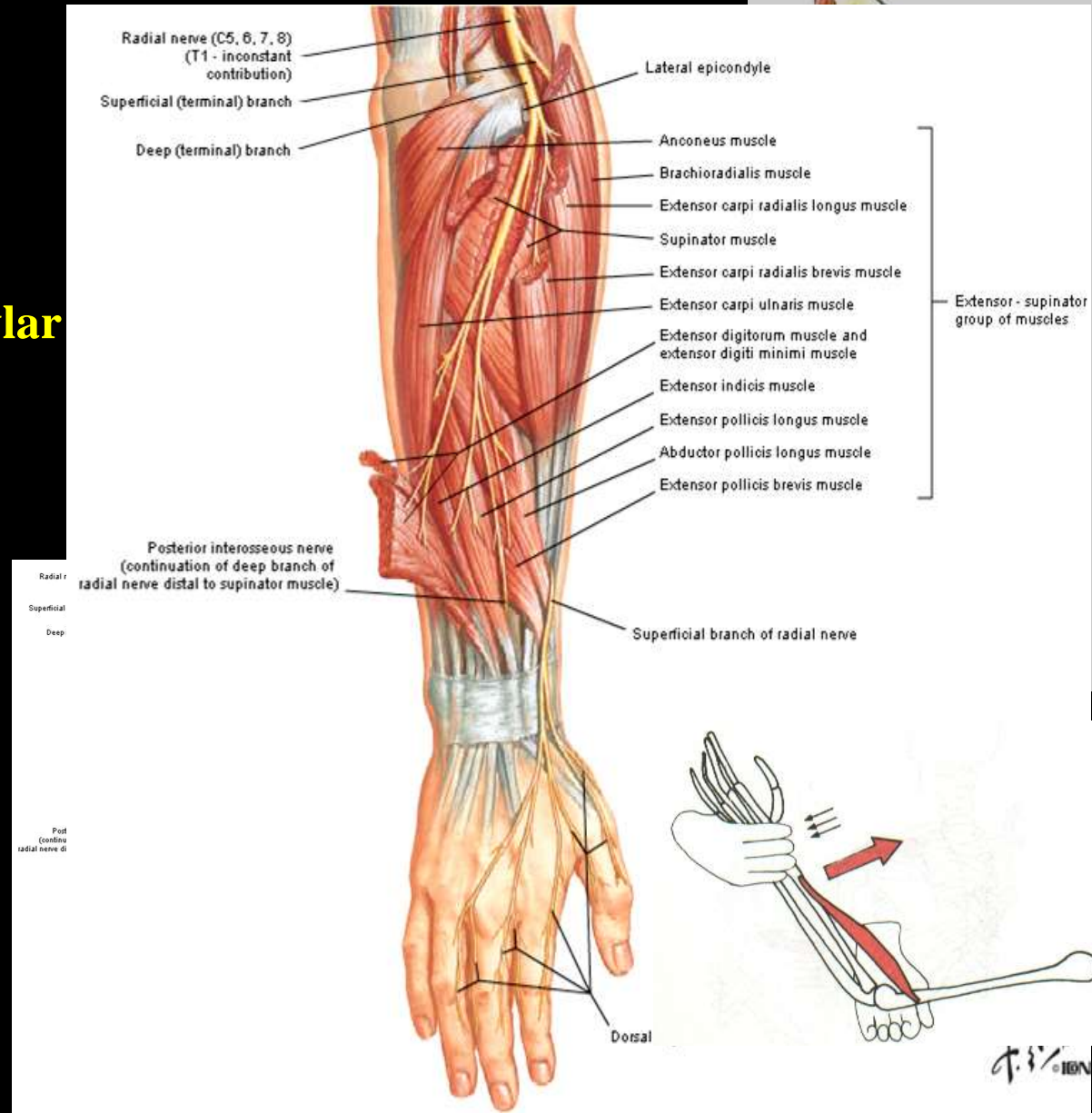
- Distal end of radius

❖ Action

- In the elbow joint is a **flexor**

❖ Innervation

- Radial nerve



Muscles of the postero- lateral compartment of the forearm

Extensor carpi radialis longus

❖ Attachments

➤ Origin

- Lateral supracondylar ridge of humerus

➤ Insertion

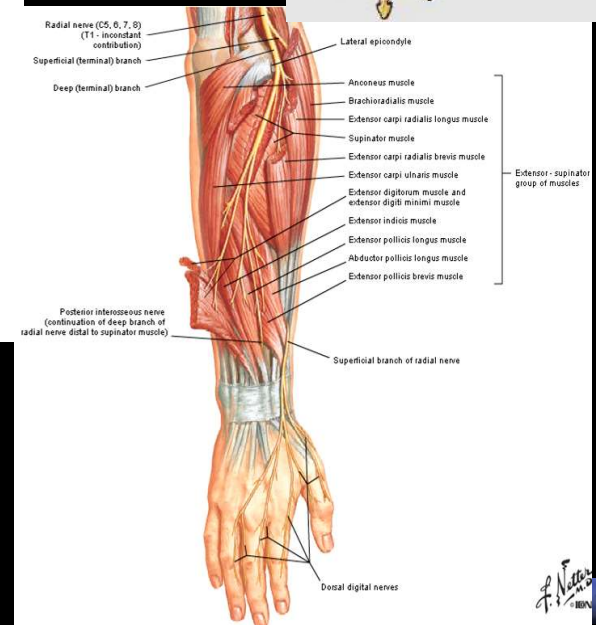
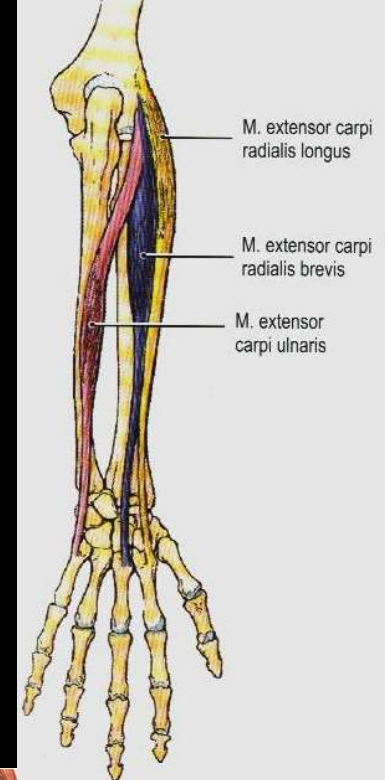
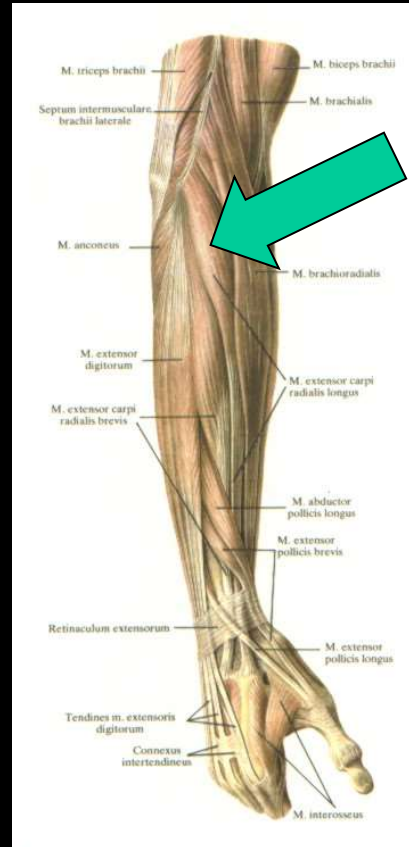
- Base of the 2nd metacarpal bone

❖ Action

- In the **wrist joint** is an **extensor** and **abductor** of the hand

❖ Innervation

- Radial nerve



F. Netter M.D.

Muscles of the postero- lateral compartment of the forearm

Extensor carpi radialis brevis

❖ Attachments

➤ Origin

- Lateral epicondyle of humerus

➤ Insertion

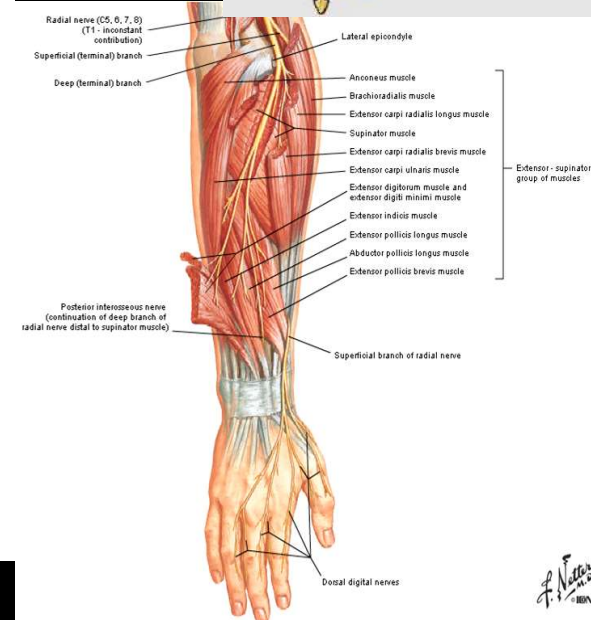
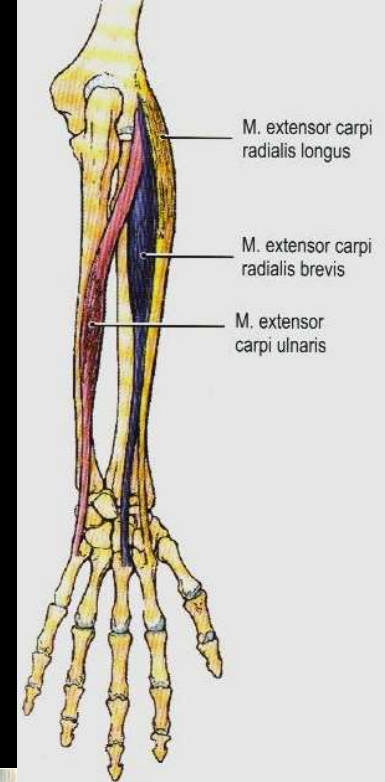
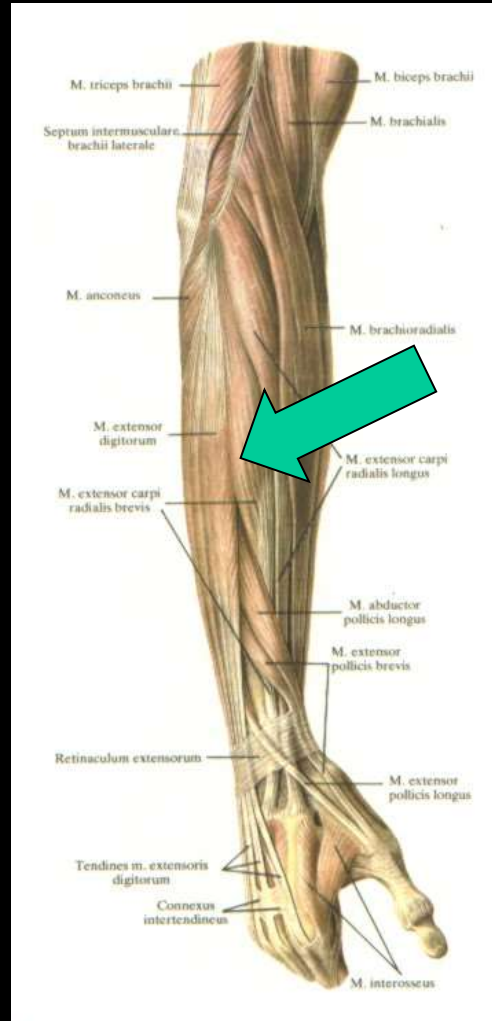
- Base of the 3rd metacarpal bone

❖ Action

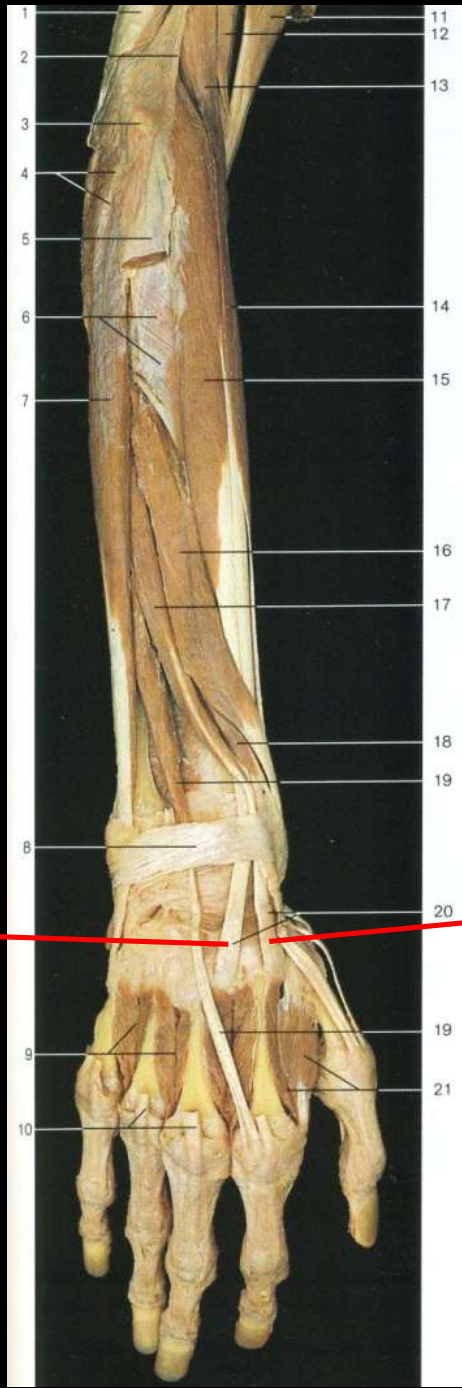
- In the **wrist joint** is an **extensor** and **abductor** of the hand

❖ Innervation

- Radial nerve



F. Netter M.D.



ECRB

ECRL

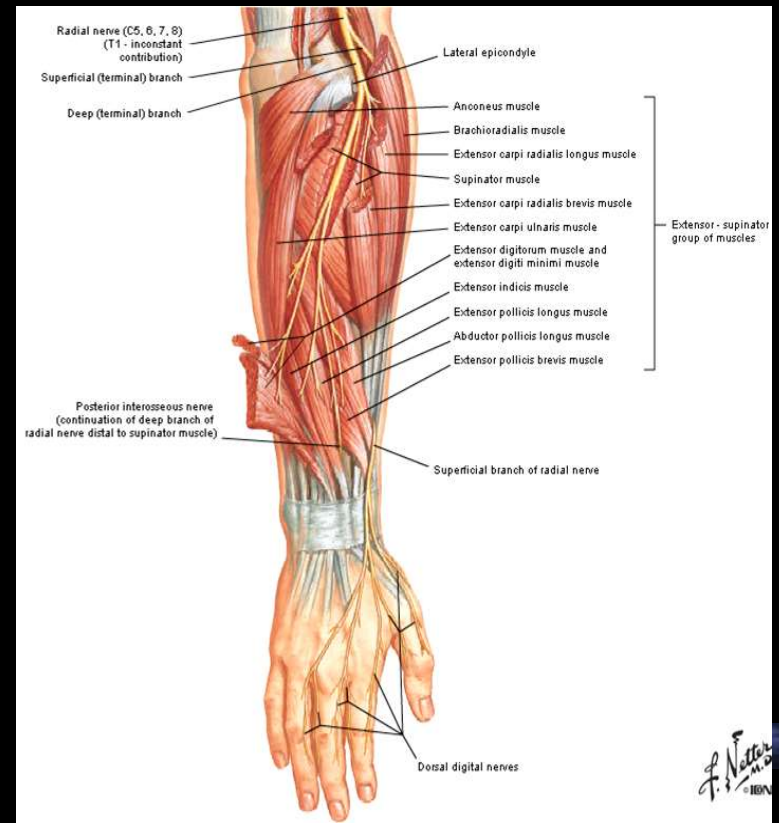
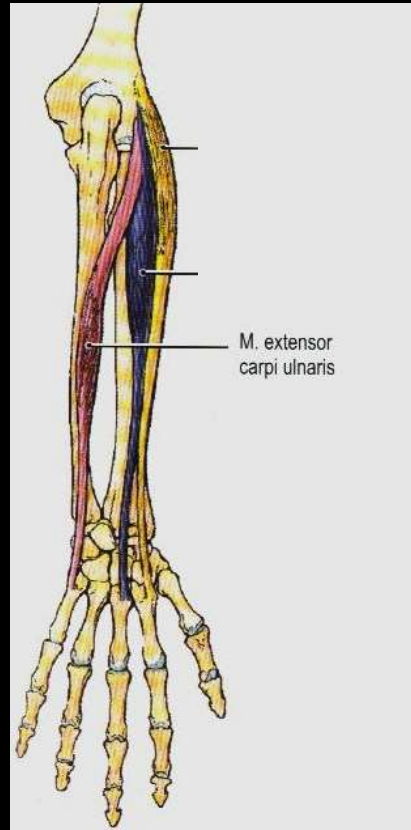
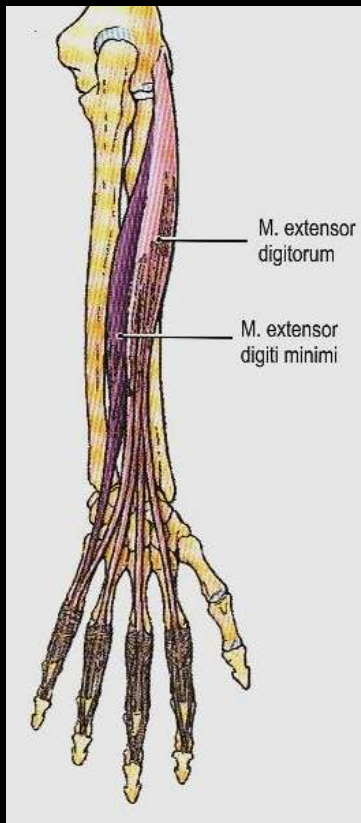


Muscles of the posterior compartment of the forearm- superficial layer

Are innervated by the radial nerve

Have proximal attachments on the lateral epicondyle of humerus

- ❖ Extensor digitorum- ED
- ❖ Extensor digiti minimi- EDM
- ❖ Extensor carpi ulnaris- ECU



Muscles of the posterior compartment of the forearm- superficial layer

Extensor digitorum

❖ Attachments

➤ Origin

- Lateral epicondyle of humerus

➤ Insertion- tendons are linked by intertendinous connections

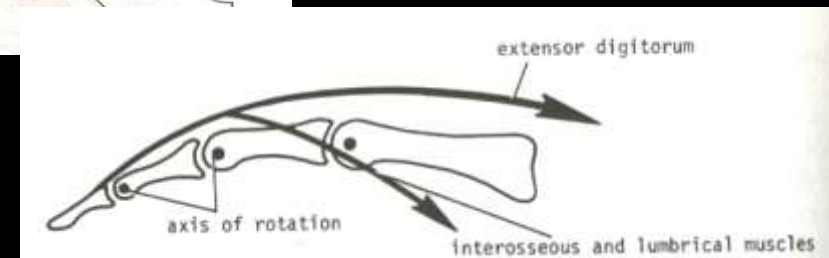
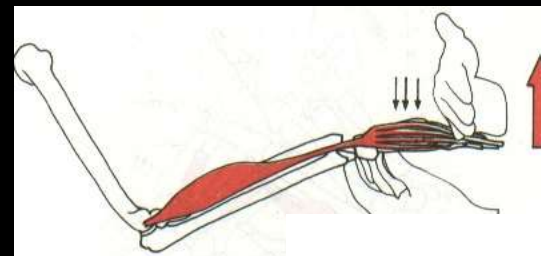
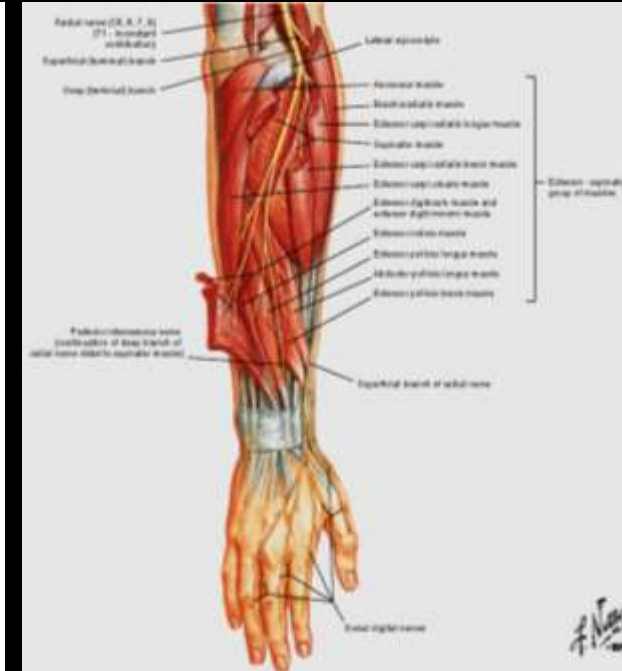
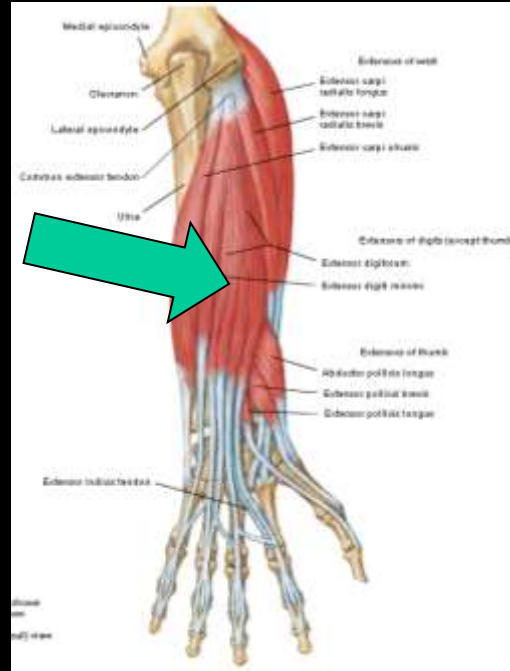
- Extensor expansion of medial 4 digits

❖ Action

- In the **wrist joint** is an **extensor** of the hand
- In the **metacarpophalangeal joints** is an **extensor** of 4 medial digits (II- V)

❖ Innervation

- **Radial nerve- deep branch**



Muscles of the posterior compartment of the forearm- superficial layer

Extensor digiti minimi

❖ Attachments

➤ Origin

- Lateral epicondyle of humerus

➤ Insertion

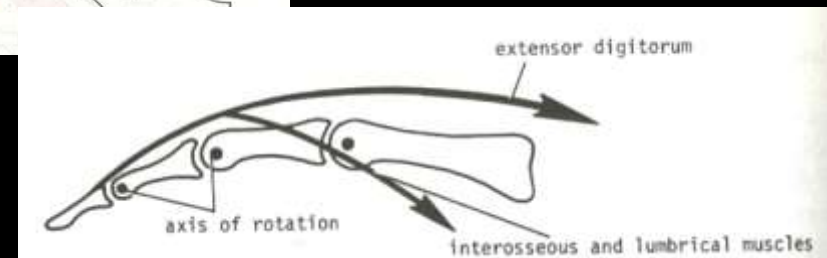
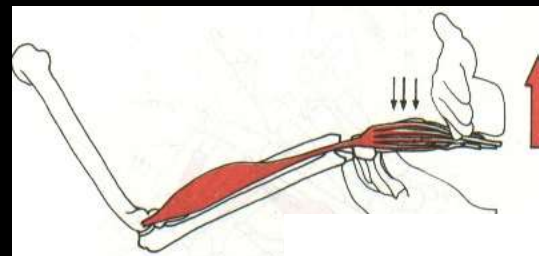
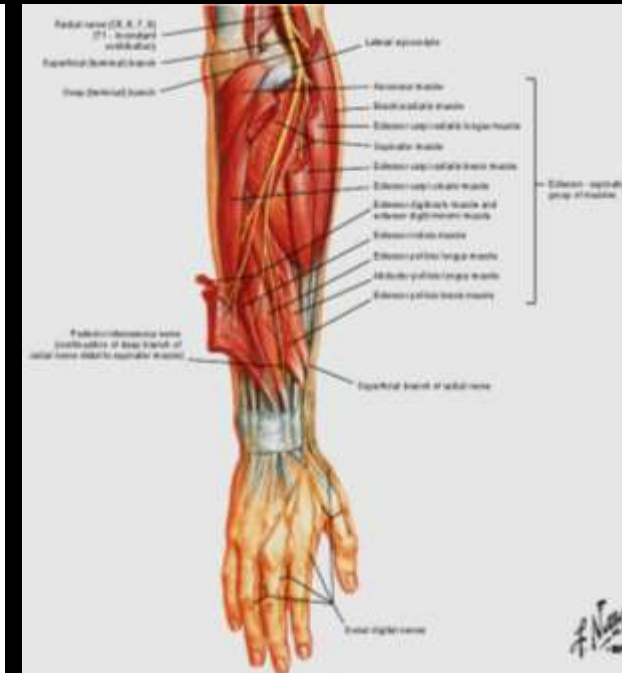
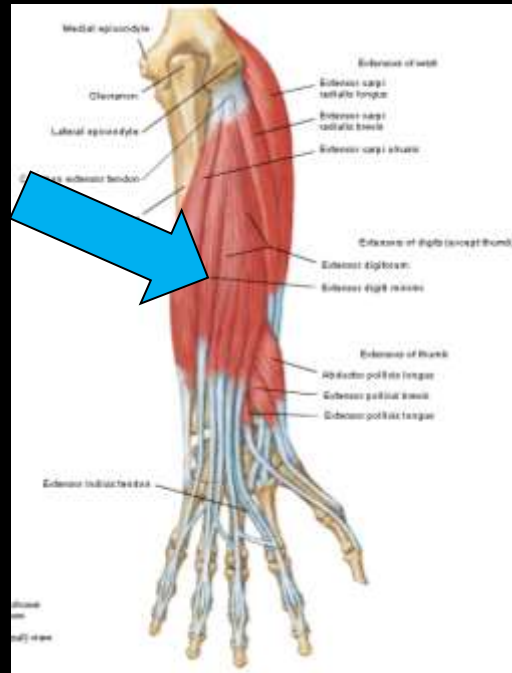
- Extensor expansion of the 5th digit

❖ Action

- In the wrist joint is an **extensor** of the hand
- In the metacarpophalangeal joint of the 5th digit is an **extensor**

❖ Innervation

- Radial nerve- deep branch



Muscles of the posterior compartment of the forearm- superficial layer

Extensor carpi ulnaris

❖ Attachments

➤ Origin

- Lateral epicondyle of humerus and ulna

➤ Insertion

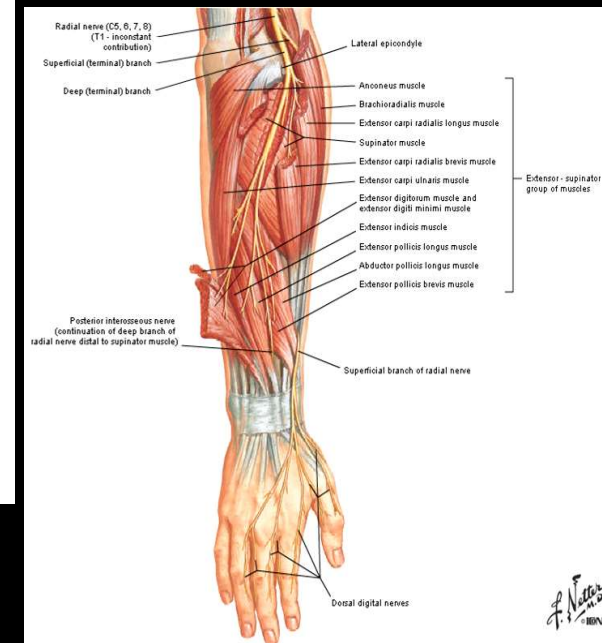
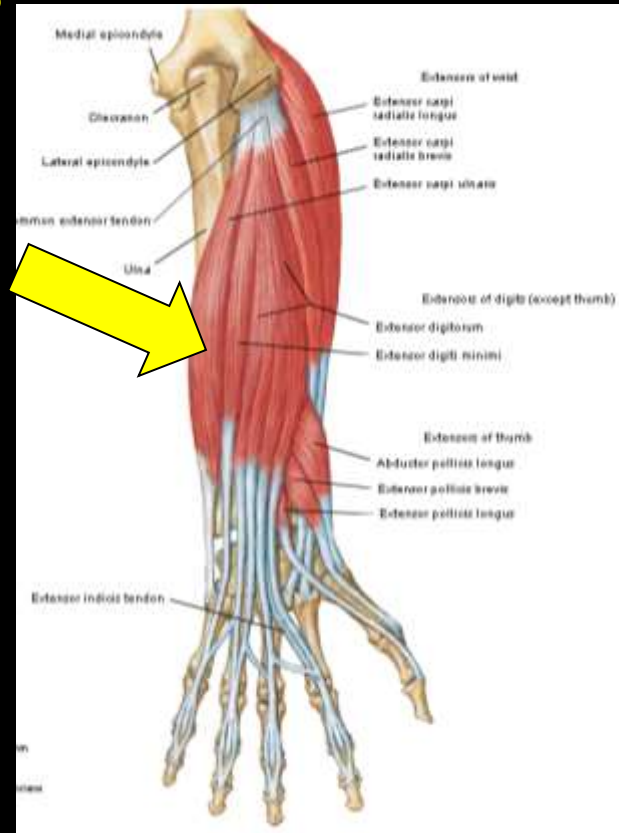
- Base of the 5th metacarpal bone

❖ Action

- In the **wrist joint** is an **extensor** and **adductor** of the hand

❖ Innervation

- **Radial (!!!) nerve - deep branch**

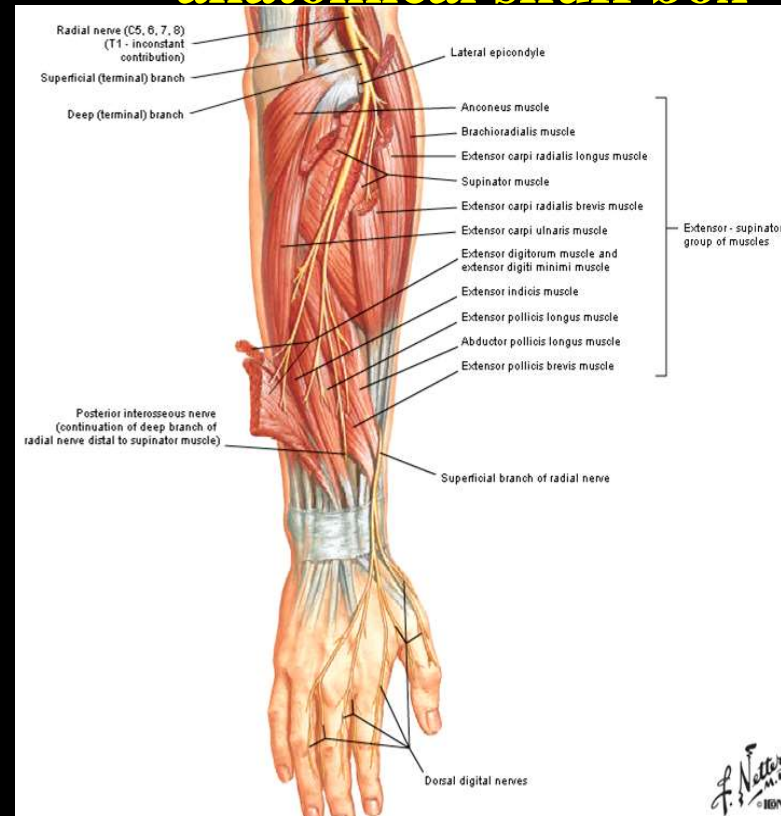
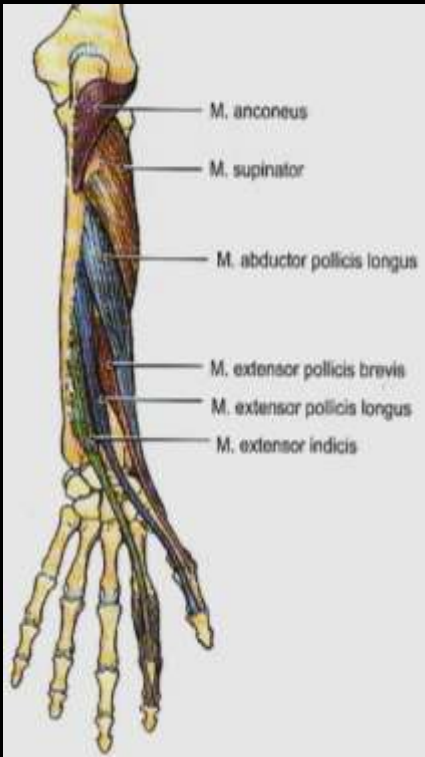


Muscles of the posterior compartment of the forearm- deep layer

- ❖ Abductor pollicis longus- APL
- ❖ Extensor pollicis brevis- EPB
- ❖ Extensor pollicis longus- EPL
- ❖ Extensor indicis- EI
- ❖ Supinator

Innervated by the posterior interosseous nerve- continuation of the deep branch of radial nerve

Take part in boundaries of the anatomical snuff box



Muscles of the posterior compartment of the forearm- deep layer

Abductor pollicis longus

❖ Attachments

➤ Origin

- Posterior surfaces of the forearm bones and interosseous membrane

➤ Insertion

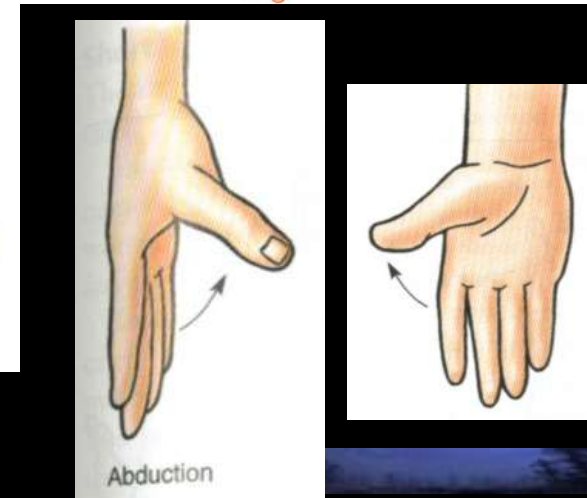
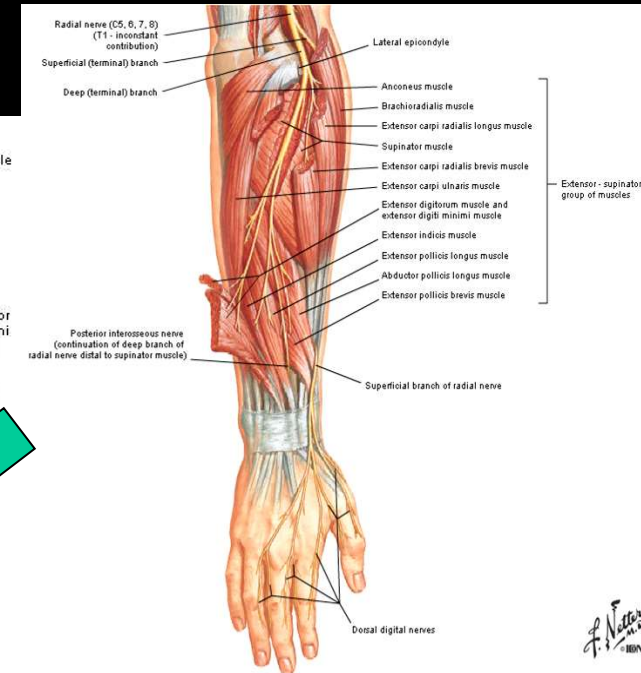
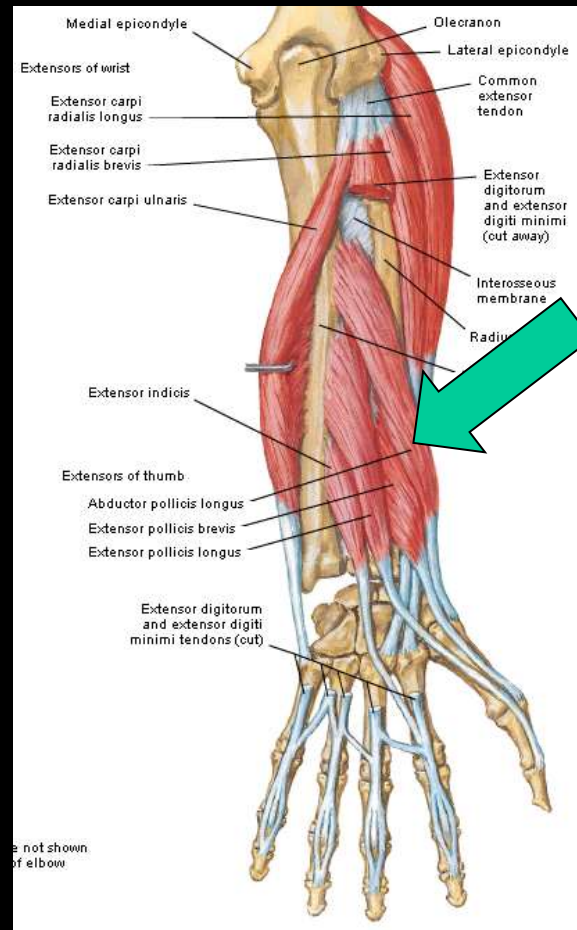
- Base of the 1st metacarpal bone

❖ Action

- In the **wrist joint-abduction** of hand
- In the **carpometacarpal joint of thumb** is an **abductor**

❖ Innervation

- posterior interosseous nerve- **continuation of the deep branch of radial nerve**



Abduction

Muscles of the posterior compartment of the forearm- deep layer

Extensor pollicis brevis

❖ Attachments

➤ Origin

- **Posterior surfaces of the radius and interosseous membrane**

➤ Insertion

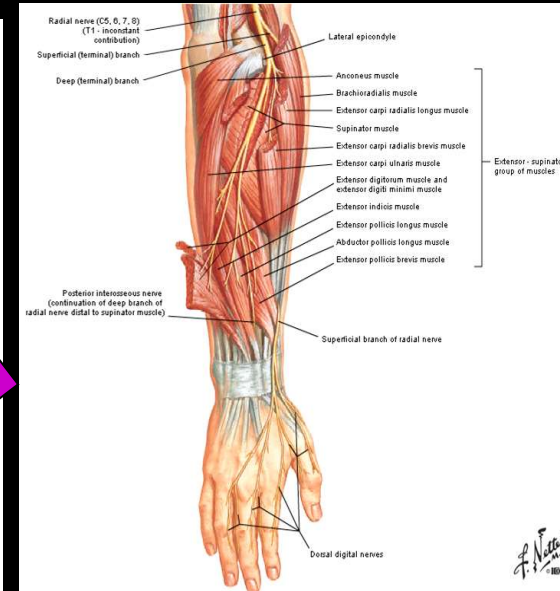
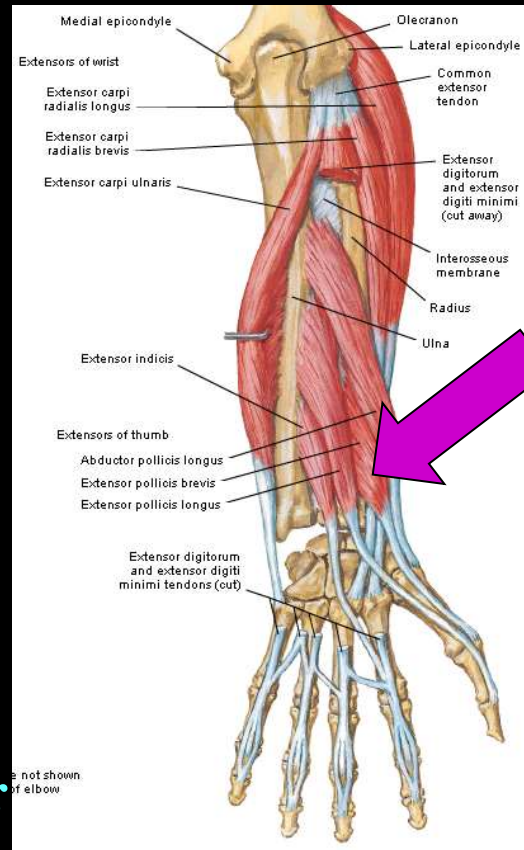
- **Base of the proximal phalanx of thumb**

❖ Action

- In the **wrist joint- extension** and **abduction** of hand
- In the **carpometacarpal joint of thumb** is an **extensor**

❖ Innervation

- **posterior interosseous nerve- continuation of the deep branch of radial nerve**



Muscles of the posterior compartment of the forearm- deep layer

Extensor pollicis longus

❖ Attachments

➤ Origin

- Posterior surfaces of the ulna and interosseous membrane

➤ Insertion

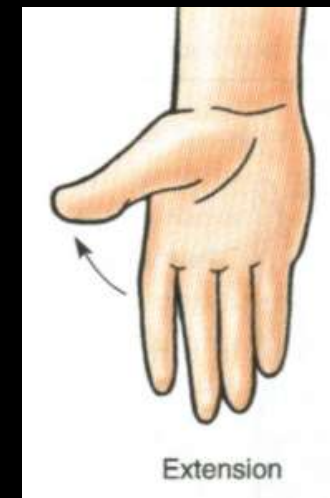
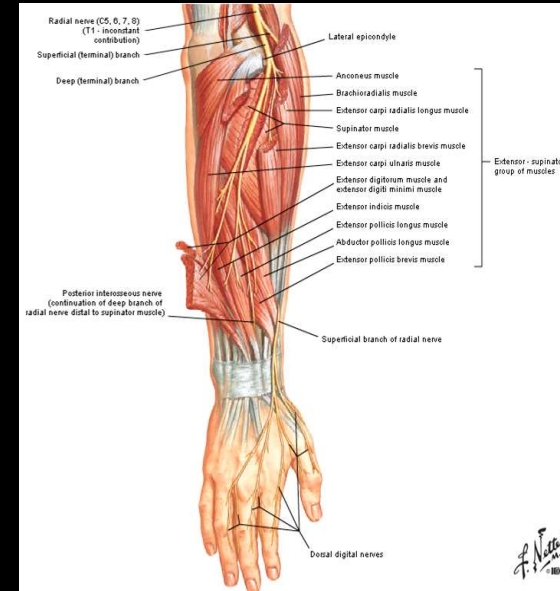
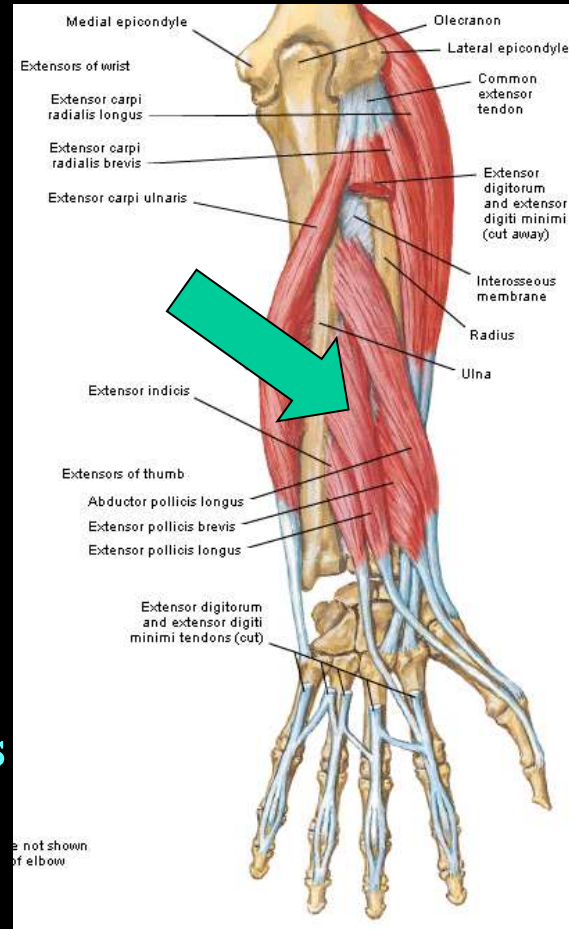
- Base of the distal phalanx of thumb

❖ Action

- In the wrist joint- **extension** and **abduction** of hand
- In the carpometacarpal and interphalangeal joints of thumb is an **extensor**

❖ Innervation

- posterior interosseous nerve- **continuation of the deep branch of radial nerve**





Muscles of the posterior compartment of the forearm- deep layer

Extensor indicis

❖ Attachments

➤ Origin

- Posterior surfaces of the ulna and interosseous membrane

➤ Insertion

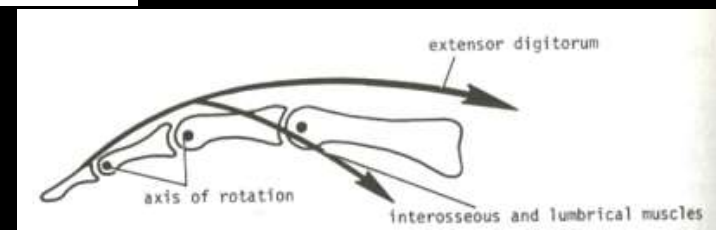
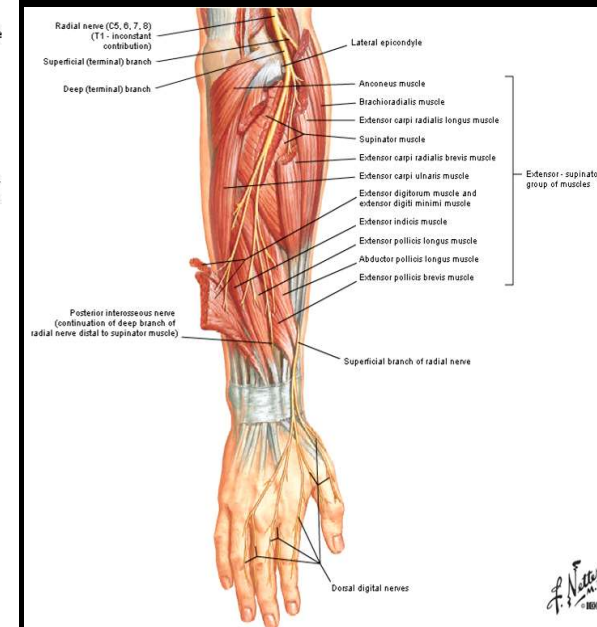
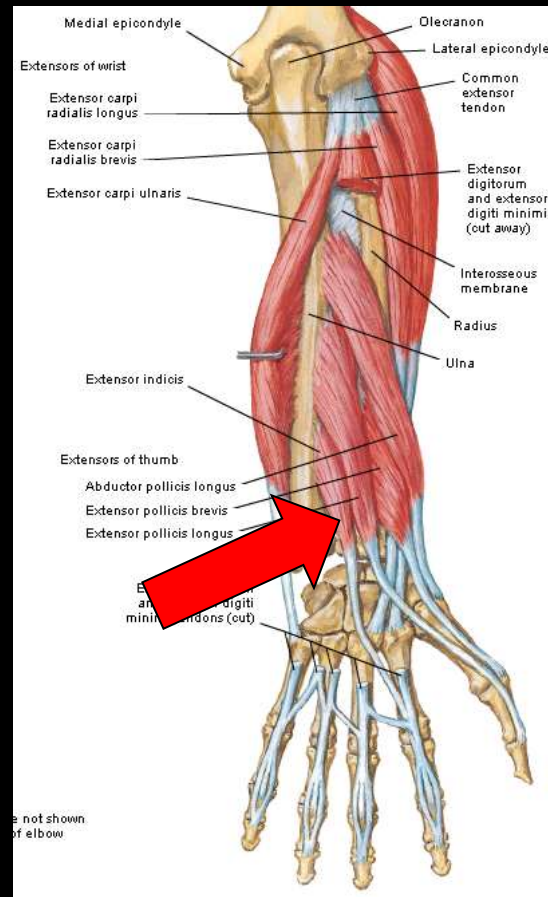
- Extensor expansion of the 2nd digit

❖ Action

- In the wrist joint- **extension** of hand
- In the metacarpophalangeal joint of the 2nd digit is an **extensor**

❖ Innervation

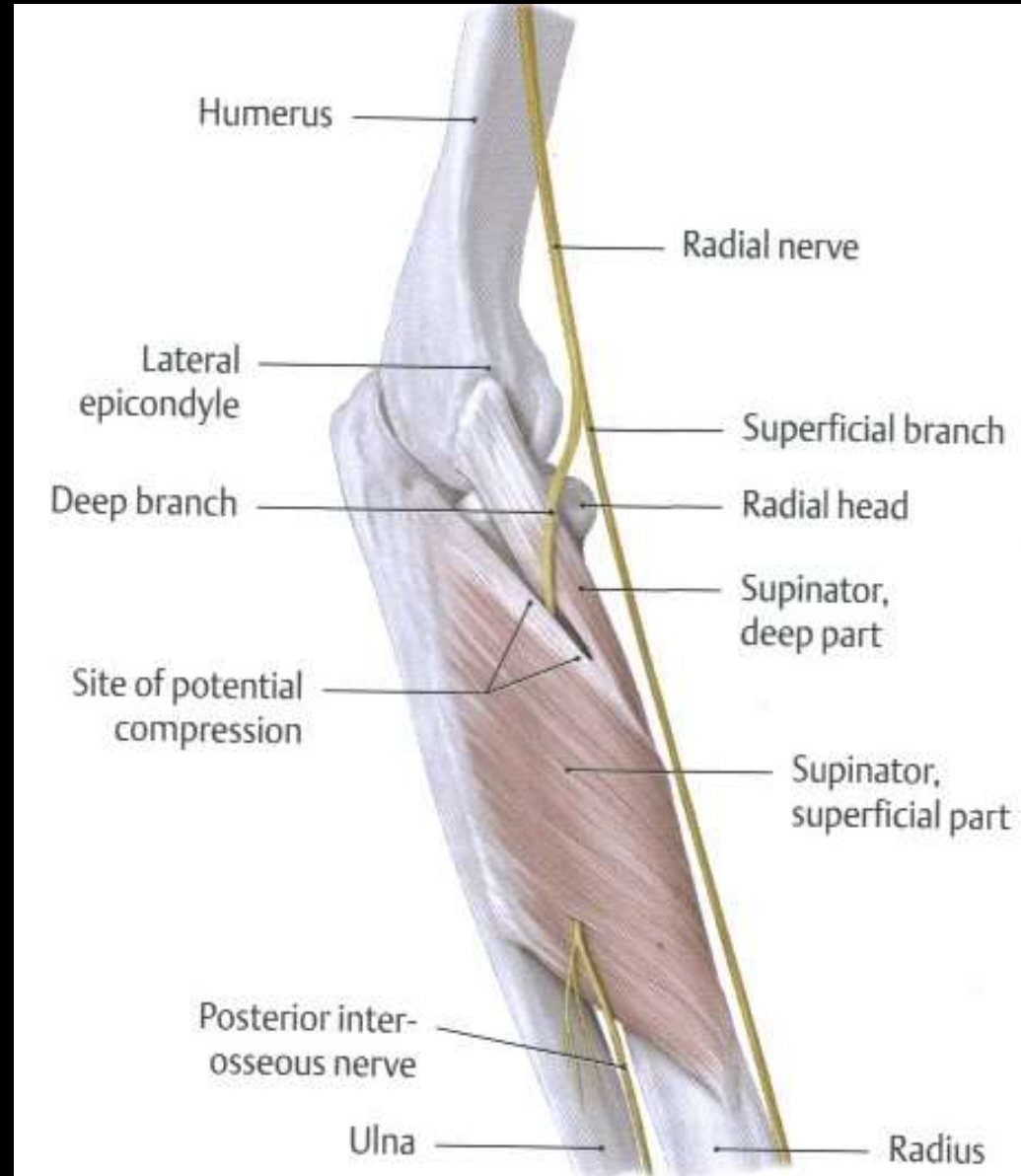
- posterior interosseous nerve- **continuation of the deep branch of radial nerve**



Muscles of the posterior compartment of the forearm- deep layer

Supinator

- ❖ Situated in the floor of the cubital fossa
- ❖ Attachments
 - Origin
 - Lateral epicondyle of humerus, anular ligament and crest of ulna
 - Insertion
 - Surrounds proximal end of radius
- ❖ Action
 - In radioulnar joints is a **supinator** (lateral rotator of forearm)
- ❖ Innervation
 - Radial nerve- its deep branch which pierces supinator



Anatomical snuff box

Situated on the lateral side of the wrist, visible in position of abducted thumb

Boundaries

❖ Anterior (palmar)

- Tendons of abductor pollicis longus and extensor pollicis brevis

❖ Posterior (dorsal)

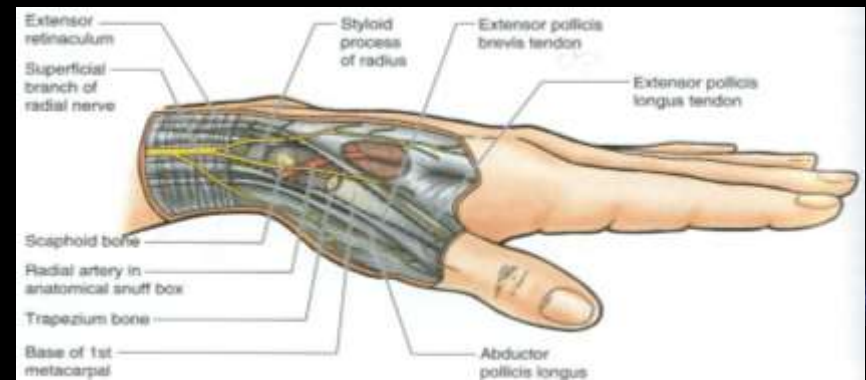
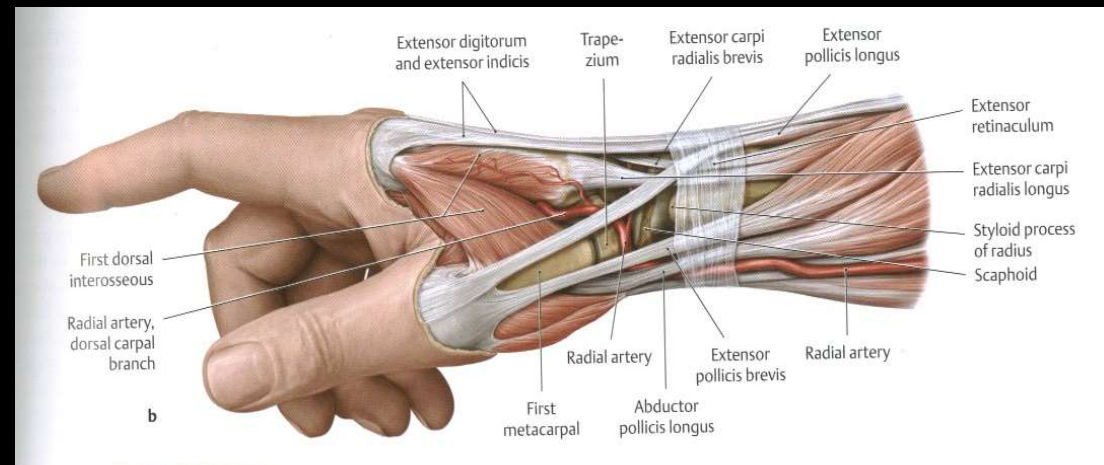
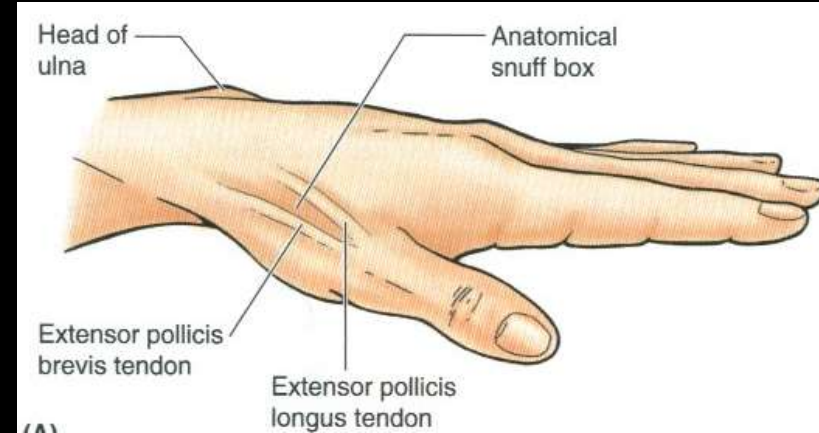
- Tendon of extensor pollicis longus

❖ Floor

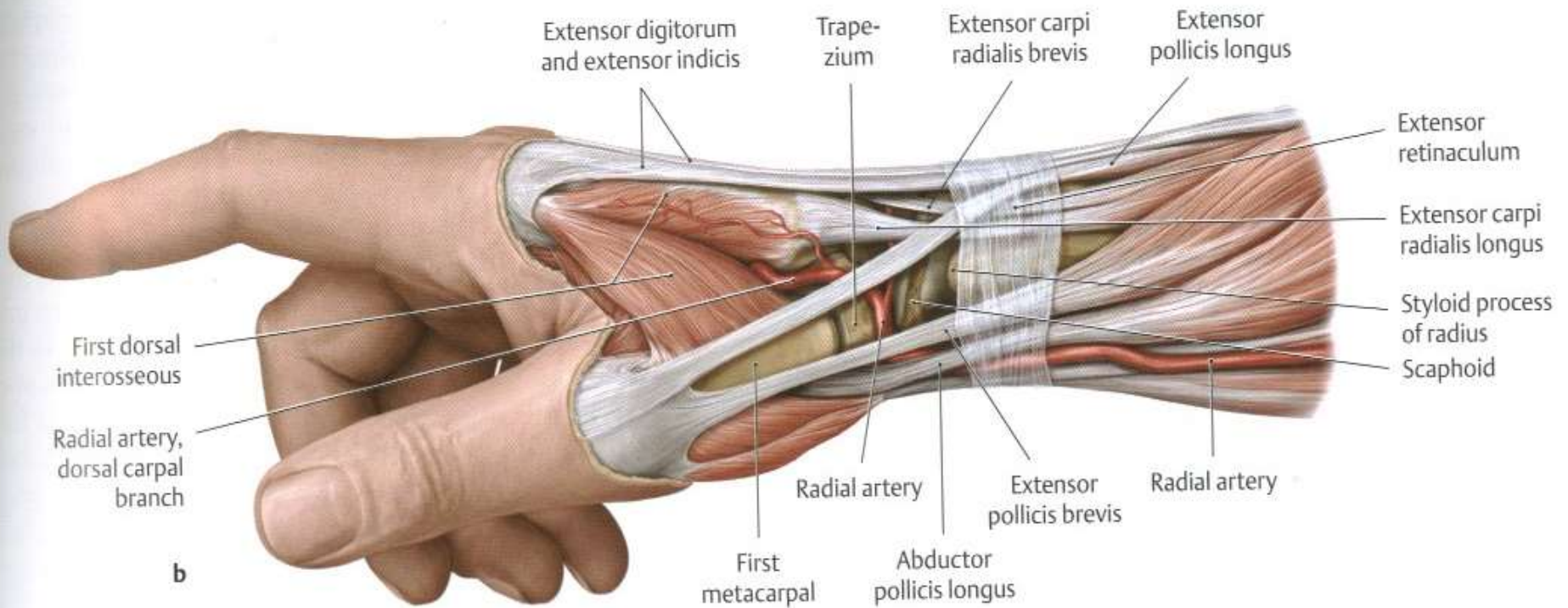
- Scaphoid and trapezium bones

Contents

- Radial artery and vein
- Tendons of extensor carpi radialis longus (and extensor carpi radialis brevis)
- Superficial branch of the radial nerve
- Cephalic vein

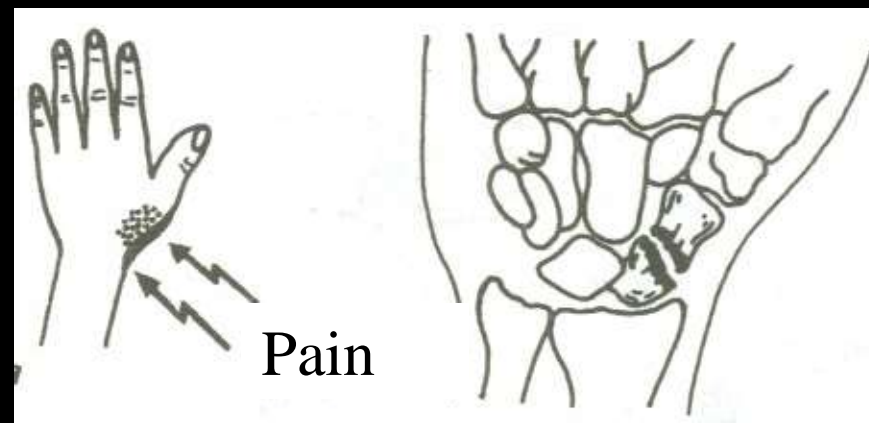


Anatomical snuff box



Clinical significance

Fracture of the scaphoid bone results in pains in region of anatomical snuff box

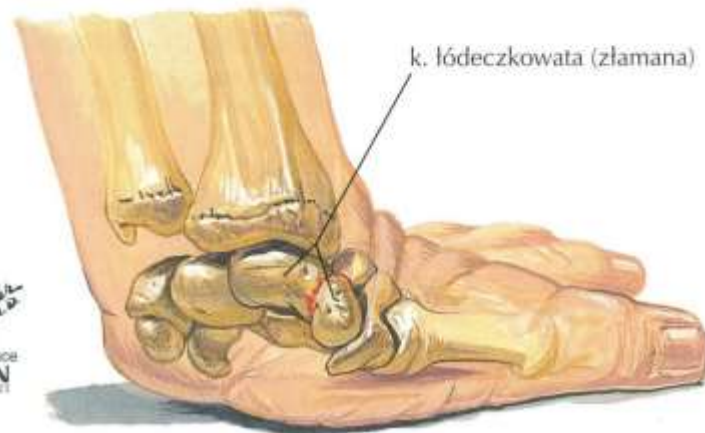


Fracture of the scaphoid bone



Złamanie k. łódeczkowatej

zwykle spowodowane przez upadek na wyciągniętą rękę z uderzeniem w kłąb kciuka



Fracture of the radius of Colles type

Złamanie Collesa

najczęściej spowodowane upadkiem na wyciągniętą kończynę górną z ręką ustawioną w zgięciu grzbietowym



Nastawienie złamania Collesa

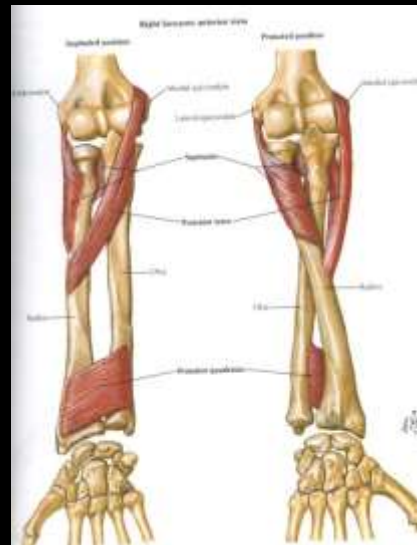
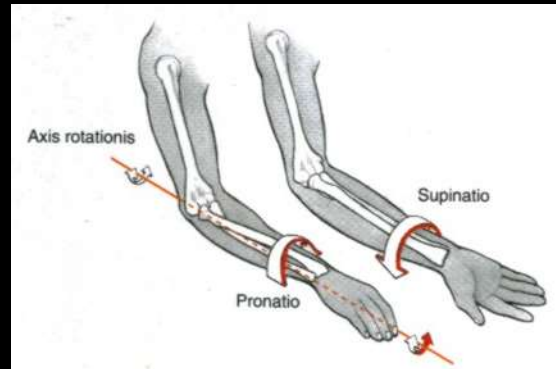
Złamanie udaje się zwykle ustawić/ modyfika-
 cja zamknięta; napięcie ustawić się nadgarstek
 w zgięciu grzbietowym; po modyfikacji
 odłamów spycha się dłońowo odłam utworzo-
 wy kości*



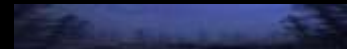
Kontynuacja: ucisk i pociąganie ostrożnie
 wyprostować się nadgarstek

Muscles influencing on the movements of the radioulnar joints

Supination

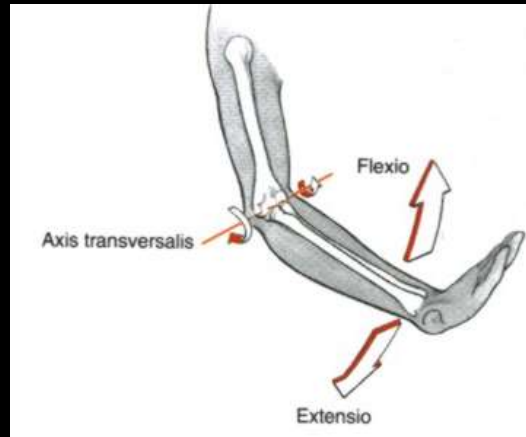


Pronation



Muscles influencing on the movements of the wrist joint

Flexion

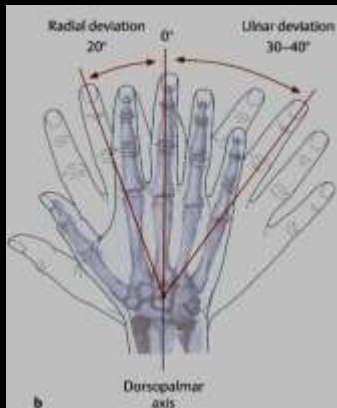
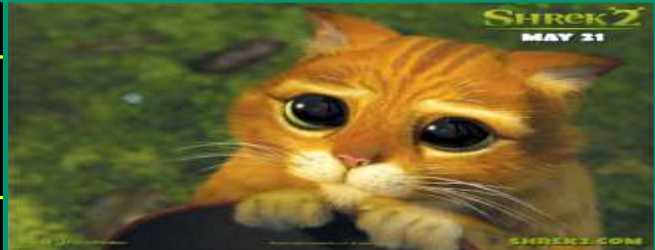


Extension

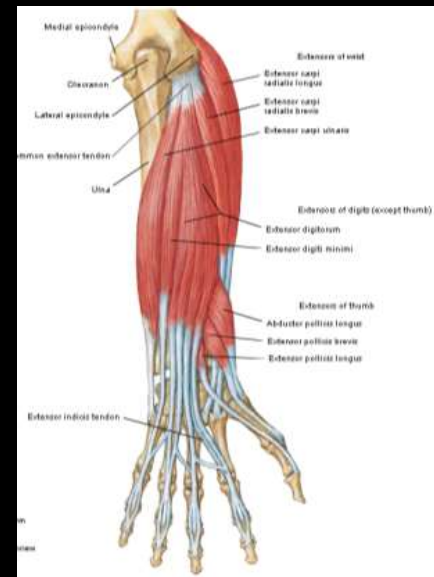
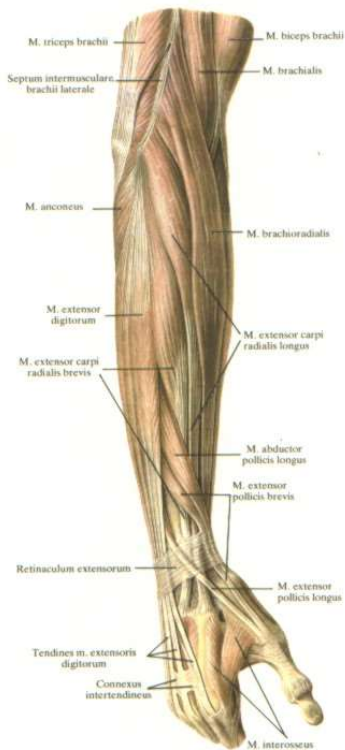


Muscles influencing on the movements of the wrist joint

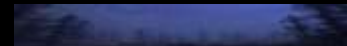
Abduction

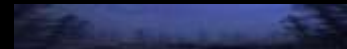
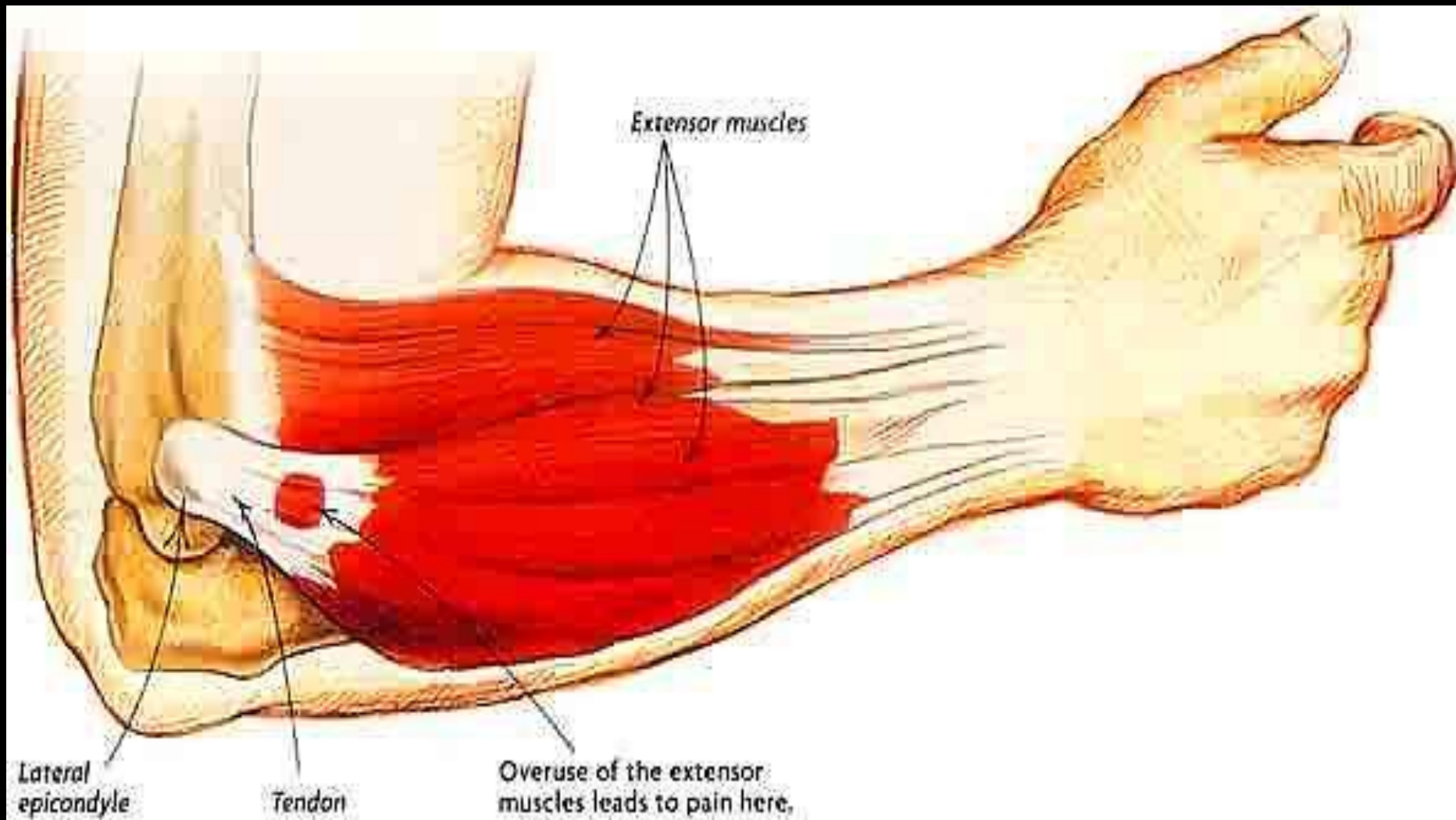


Adduction



Tennis elbow and Golfer's elbow

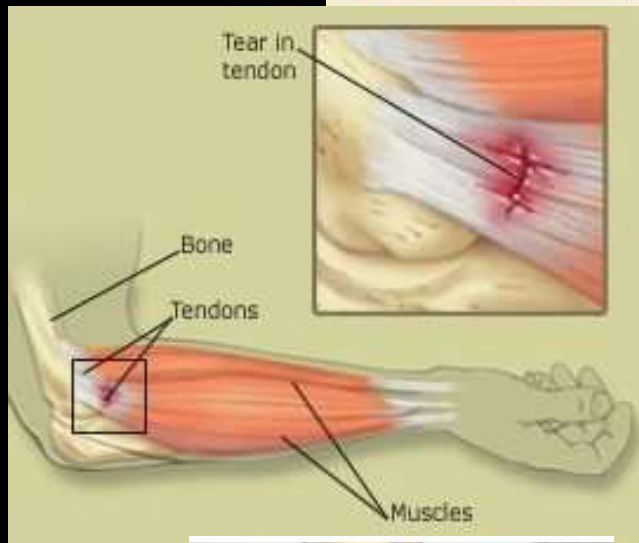




Tennis elbow



Tennis elbow, tenderness over the common extensor origin on the lateral epicondyle at the elbow, is caused by any repetitive movement (tennis serves, computer entries) which involves the extensor group of muscles. A useful diagnostic trick is to ask the person to grip something tightly—this will cause pain as in a power grip the wrist synergistically extends and pulls on the affected muscles and tendons. The inflamed common extensor origin can calcify **(A)** and may be injected with steroid with good symptomatic relief **(B)**.





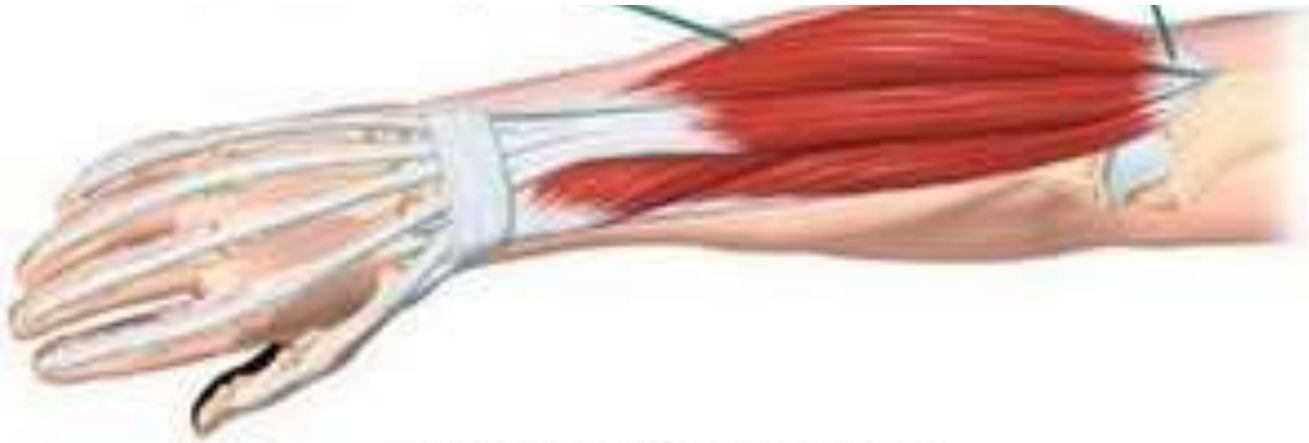
Golfer's elbow

Golfer's elbow. Similar to tennis elbow, this relatively uncommon problem presents as pain and inflammation over the medial epicondyle and is aggravated by extension of the elbow in a supinated forearm. It is due to repetitive strain from any of the common flexor origin muscles. Steroid injection can give good symptomatic relief.



Wrist extensors

Lateral epicondyle of humerus
and
tennis elbow syndrome



Wrist flexors



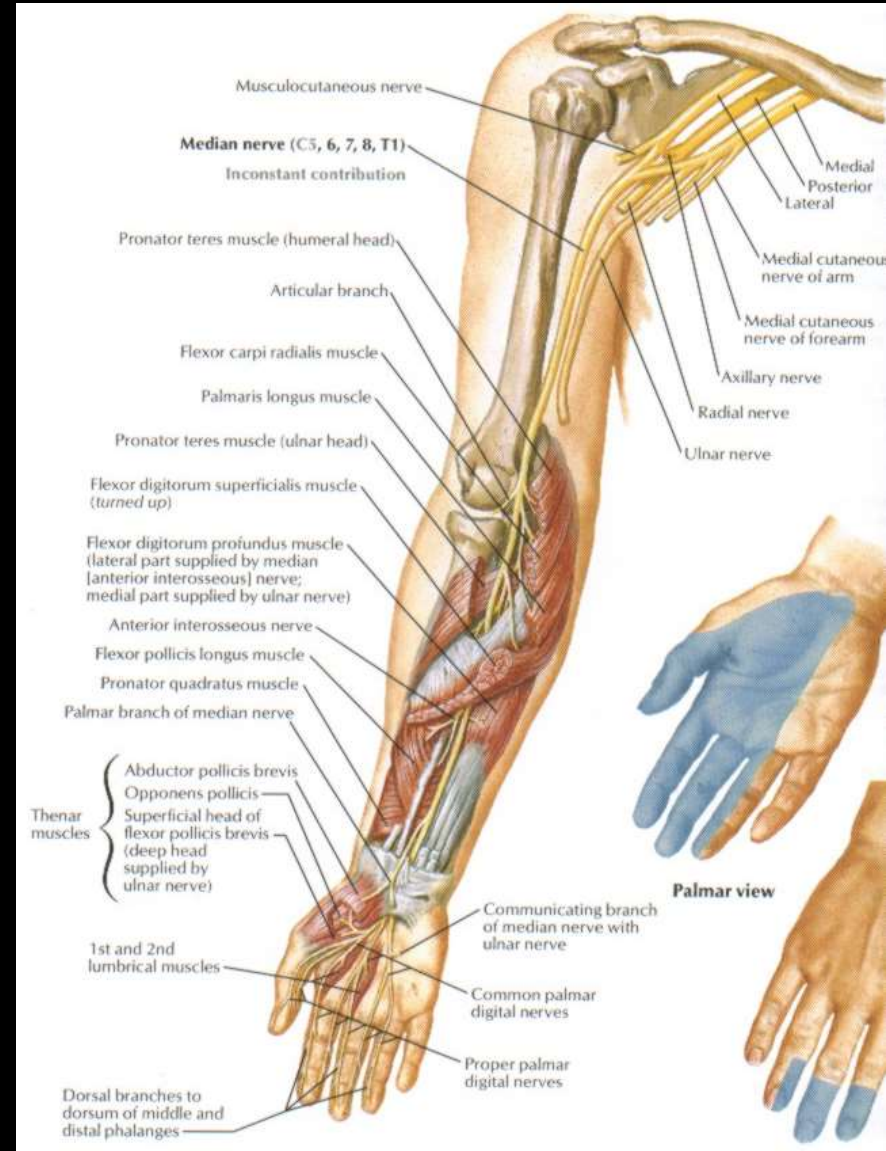
Medial epicondyle of humerus and
golfer's elbow syndrome



Median nerve- antebrachial section

❖ Course

- From the **cubital fossa** passes to the anterior compartment of the forearm
- Passes between the heads of the pronator teres
- Descends between the flexor digitorum superficialis **and** flexor digitorum profundus
- Gives rise to the anterior interosseous nerve (to the deep muscles of anterior group)
- Via the carpal tunnel runs to the palm of hand



Median nerve

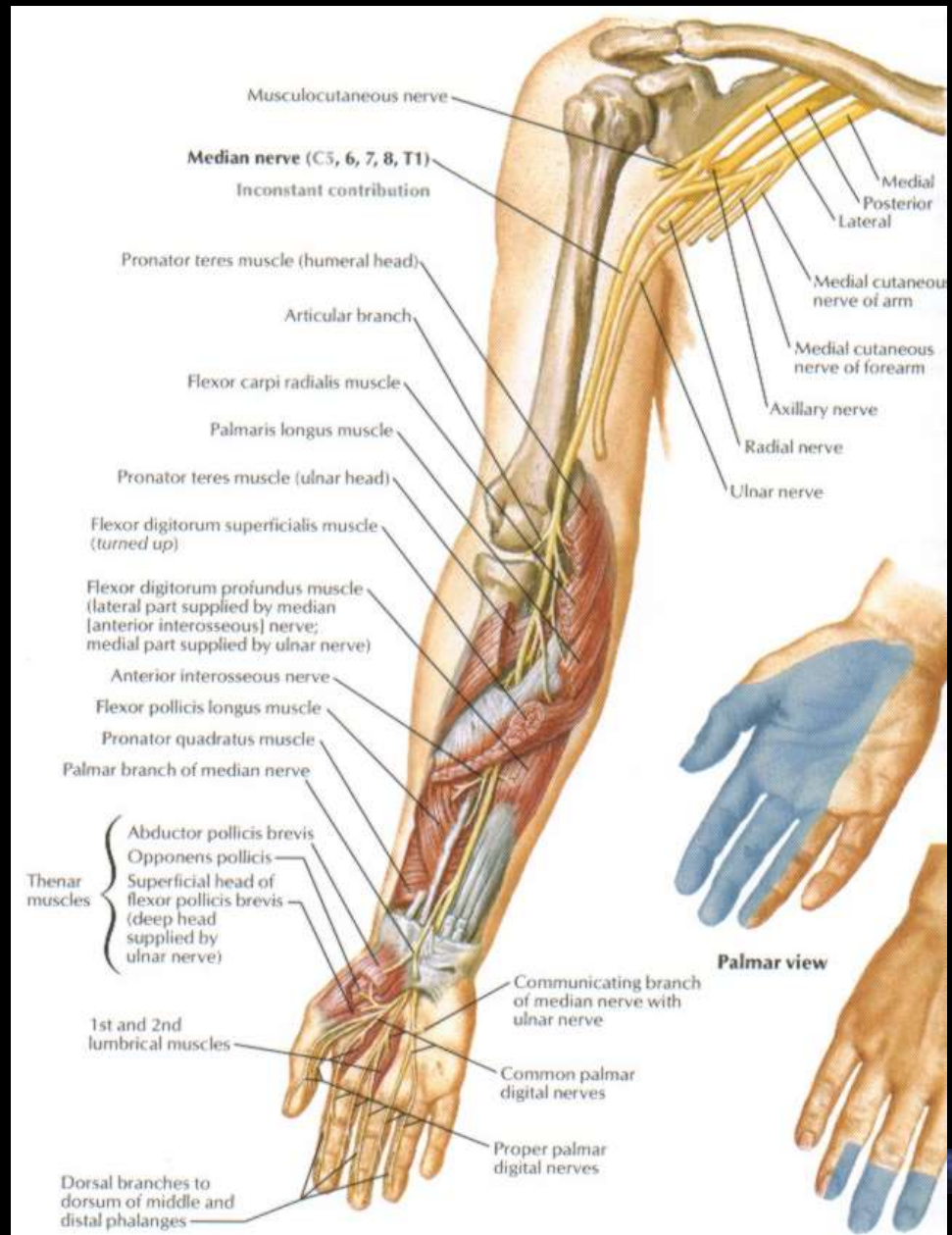
❖ Range of motor innervation

- Muscles of the anterior compartment of the forearm (apart from flexor carpi ulnaris and medial half of the flexor digitorum profundus innervated by the ulnar nerve)

- Most of the muscles of the thenar of hand

❖ Range of sensory innervation

- Lateral two third of the palm of hand



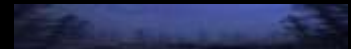
Potential places of compression or injury of the median nerve



❖ Potential places of compression or injury of the median nerve



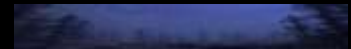
**Anterior
dislocation
of the distal
part of
humerus in
the elbow
joint**



❖ Potential places of compression or injury of the median nerve

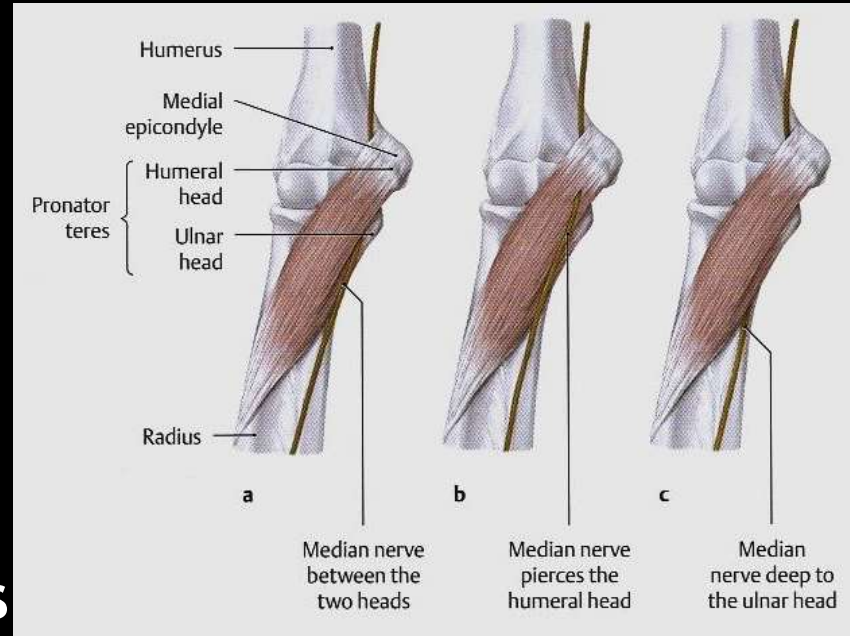


**Too deep
venipuncture
in the region
of the cubital
fossa**

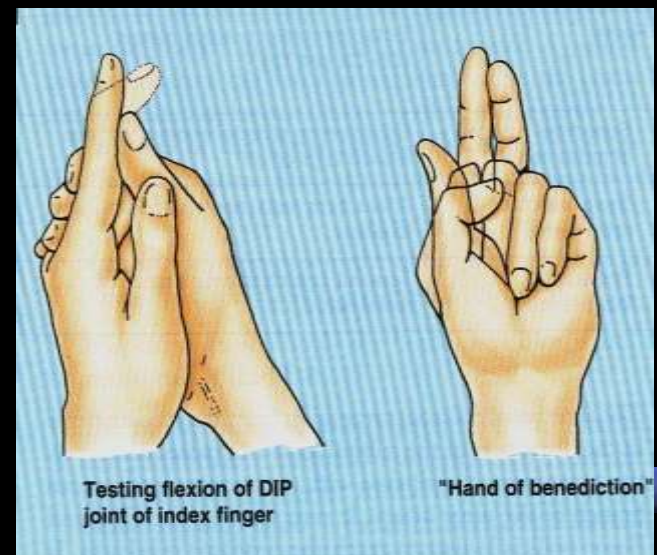


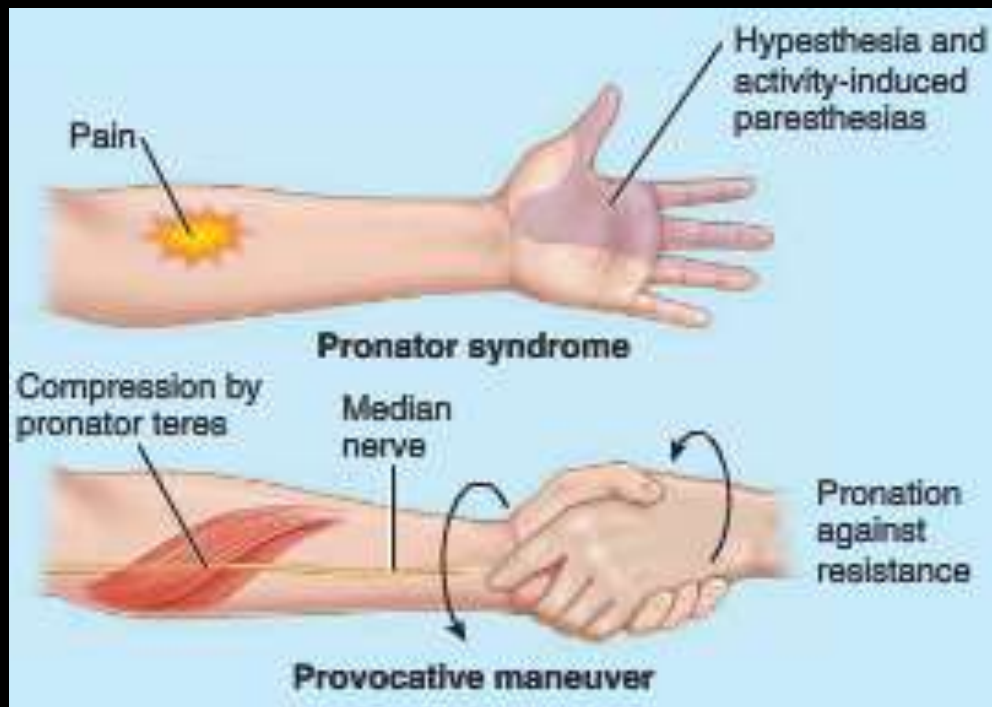
Potential places of compression or injury of the median nerve

- ❖ Place of passage between the heads of pronator teres
- ❖ Injury above the forearm results in palsy of the anterior muscles of forearm (flexors) **apart from** medial part of flexor digitorum profundus which flexes 4th and 5th digits



- ❖ Hand has image similar to the „hand of benediction” because of inability of flexion of digits apart from 4th and 5th digits





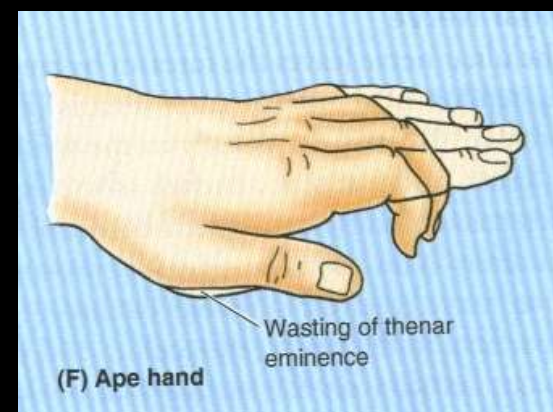
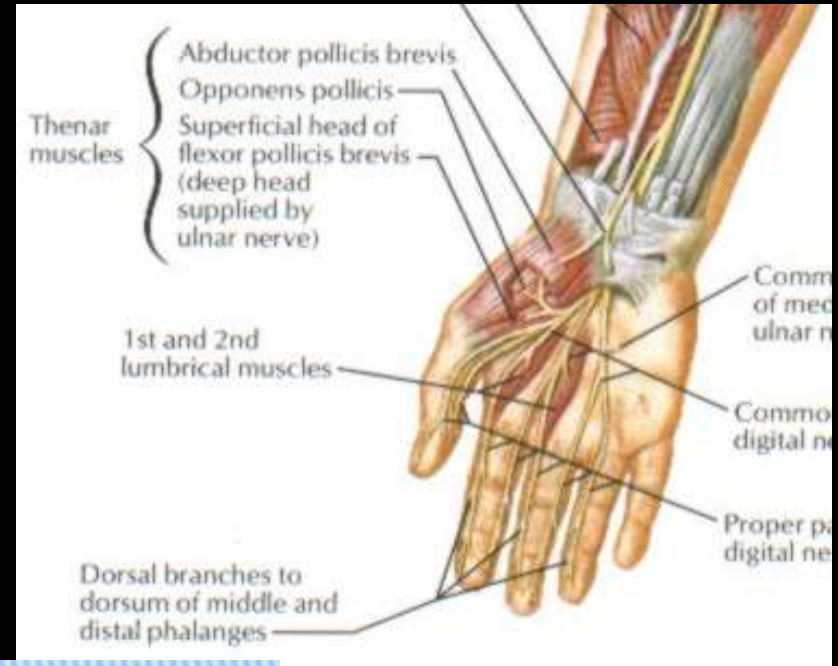
Pronator Syndrome



Pronator syndrome, a nerve entrapment syndrome, is caused by compression of the median nerve near the elbow. The nerve may be compressed between the heads of the pronator teres as a result of trauma, muscular hypertrophy, or fibrous bands. Individuals with this syndrome are first seen clinically with pain and tenderness in the proximal aspect of the anterior forearm, and *hypesthesia* (decreased sensation) of palmar aspects of the radial three and half digits and adjacent palm (Fig. B6.25). Symptoms often follow activities that involve repeated pronation.

Potential places of compression or injury of the median nerve

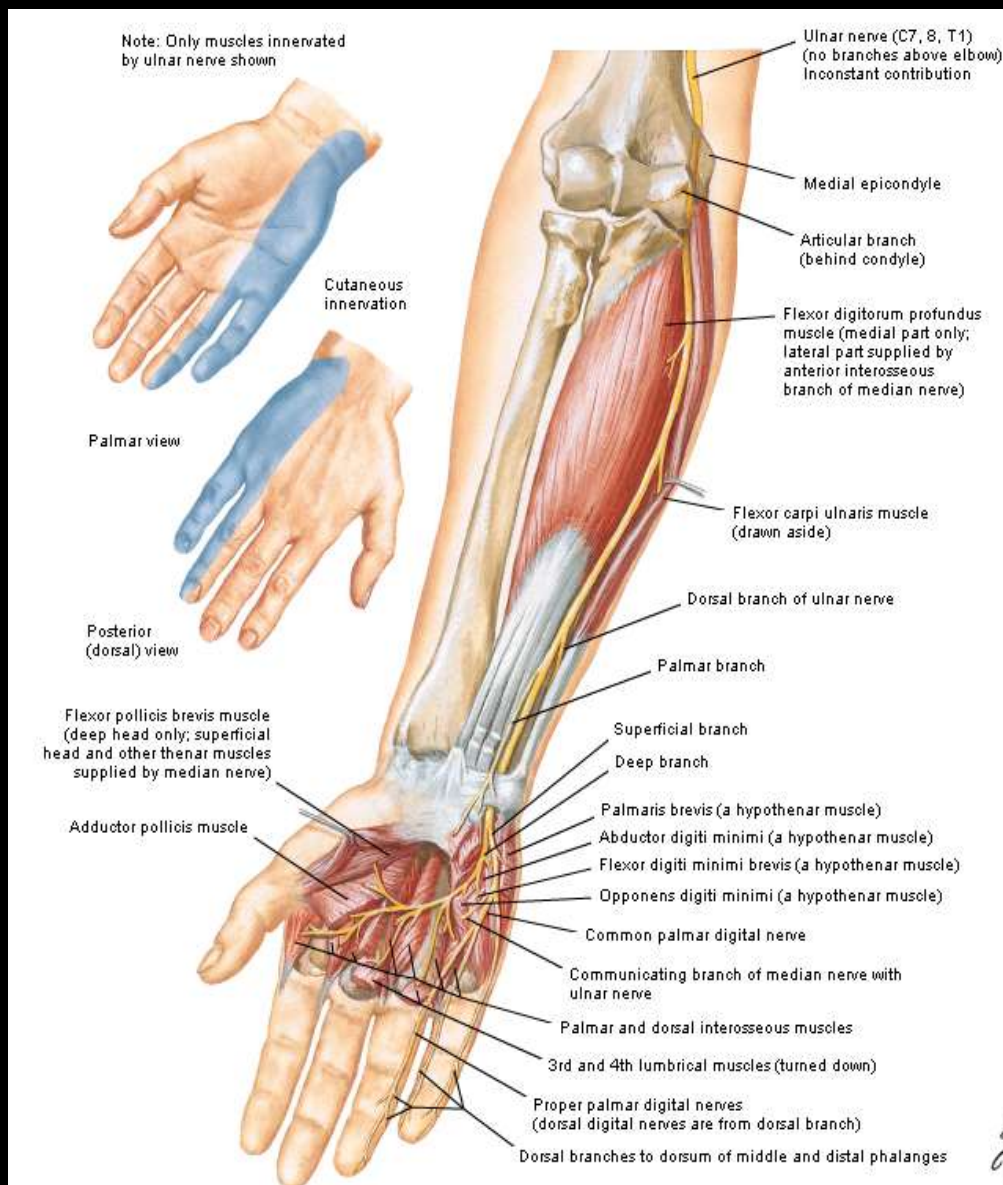
- ❖ Place of passage by the carpal tunnel
- ❖ Injury in the carpal tunnel does not affect the anterior muscles of forearm (flexors)
- ❖ Carpal tunnel syndrome is characterized by the sensory disturbances of the hand
- ❖ Hand has image similar to the „ape hand” because of atrophy of the muscles of thenar and loss of opposition of the thumb



❖ Course

- Passes behind the medial epicondyle of the humerus
- Enters the forearm and passes between the heads of the flexor carpi ulnaris
- Descends between the flexor carpi ulnaris and flexor digitorum profundus together with ulnar artery
- Gives rise to the dorsal and palmar cutaneous branches
- Above the carpal tunnel (in its own ulnar tunnel-canal of Guyon) runs to the palm of hand

Ulnar nerve-antebrachial section



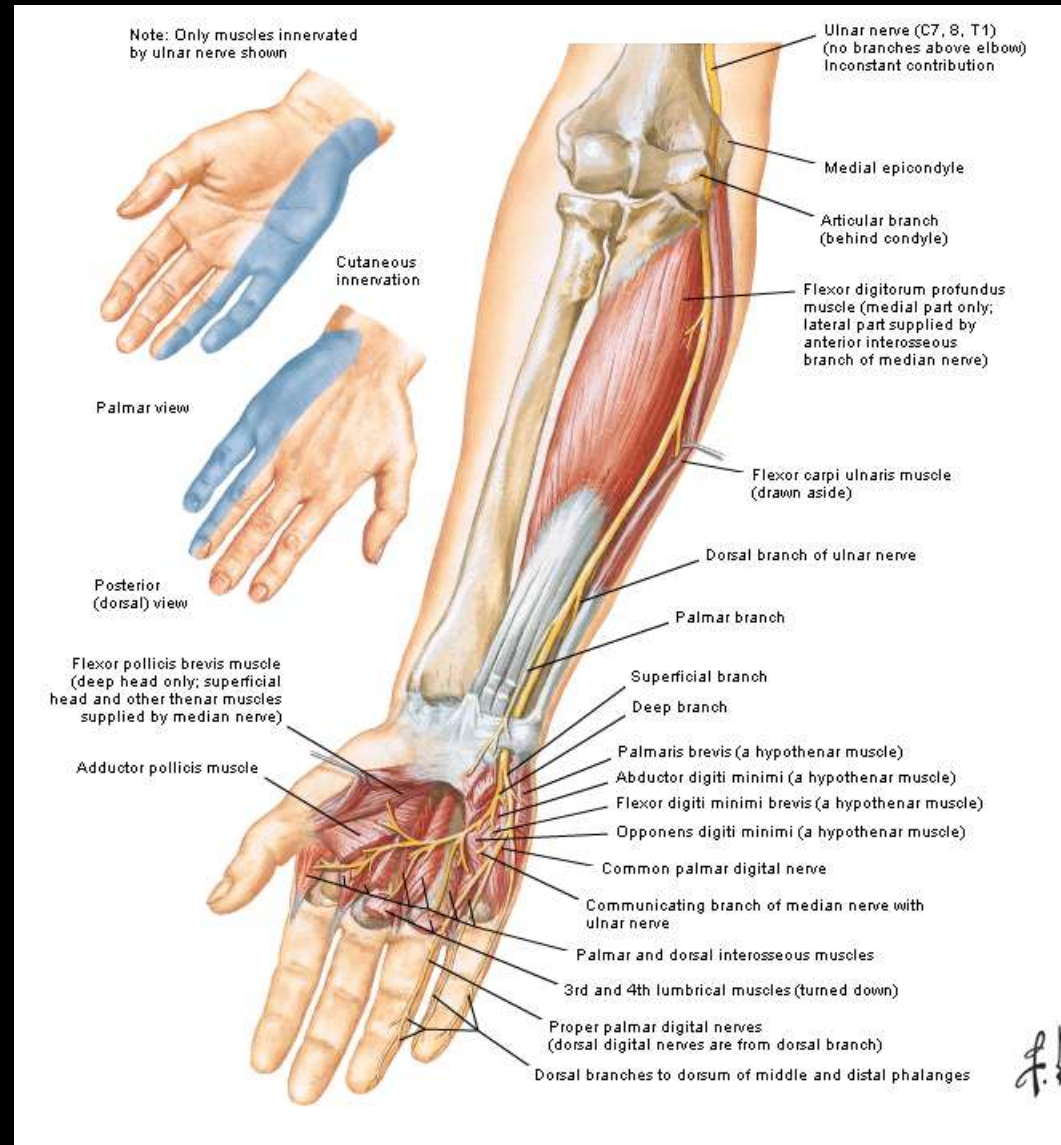
Ulnar nerve

❖ Range of motor innervation

- Muscles of the anterior compartment of the forearm
-flexor carpi ulnaris and medial half of the flexor digitorum profundus
- Some muscles of the thenar of hand
- Muscles of the hypothenar
- Short muscles of the hand

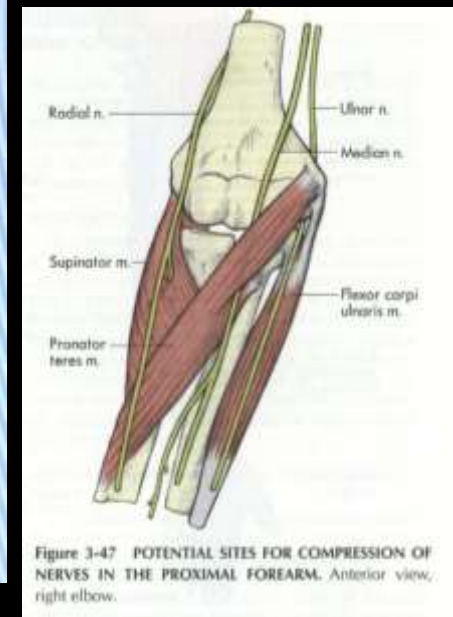
❖ Range of sensory innervation

- Medial one third of the palm of hand
- Medial half of the dorsum of hand



Potential places of compression or injury of the ulnar nerve

- ❖ Place of passage behind the medial epicondyle of humerus
- ❖ Place of passage above the carpal tunnel (canal of Guyon)
- ❖ Hand has image similar to the „clawhand” because of atrophy of the short interosseus muscles of hand and inability of extension of digits at the interphalangeal joints and contracture of flexors of digits

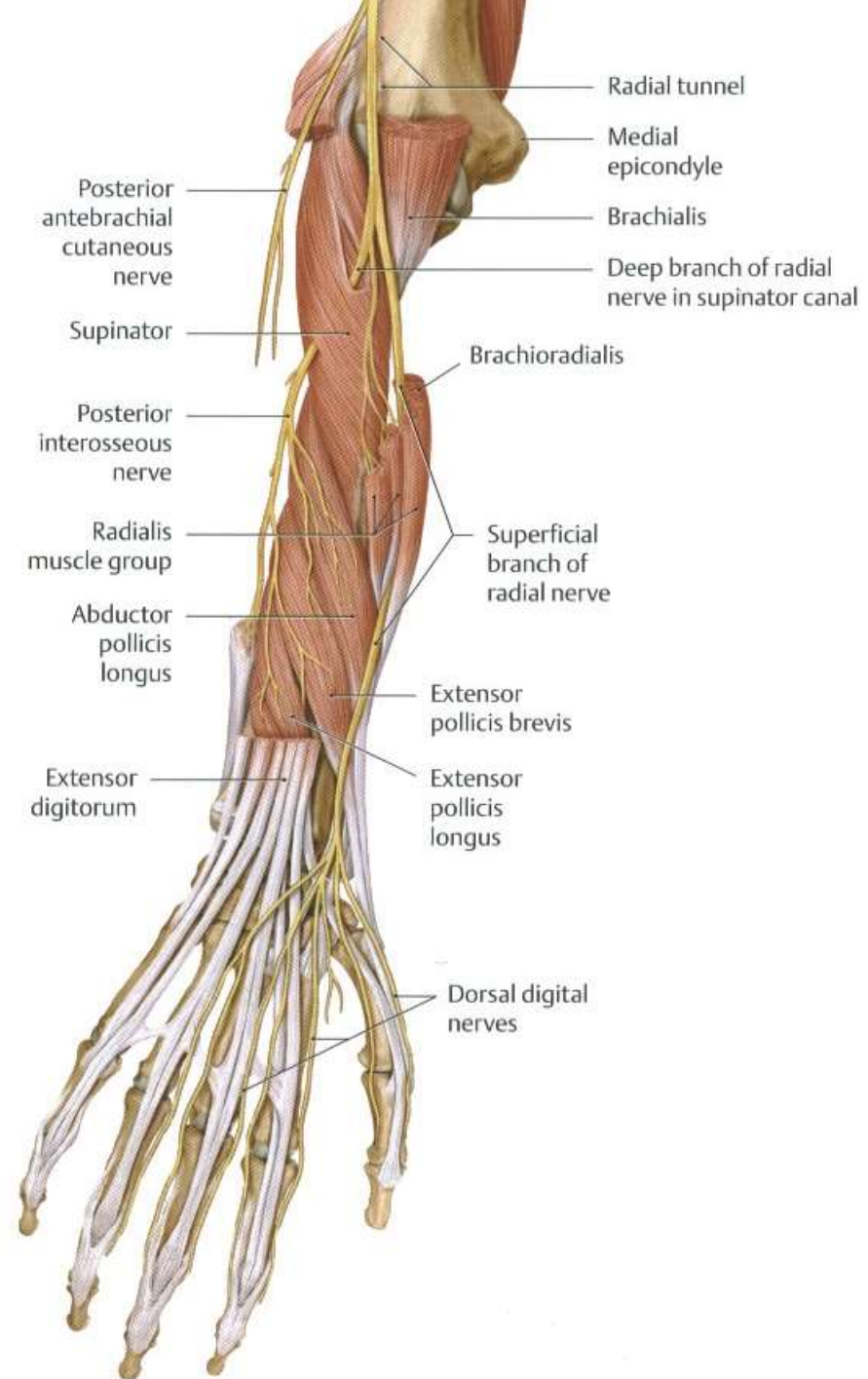


Radial nerve- antebrachial section

❖ Course

➤ In the cubital fossa, at the level of lateral epicondyle of the humerus divides into

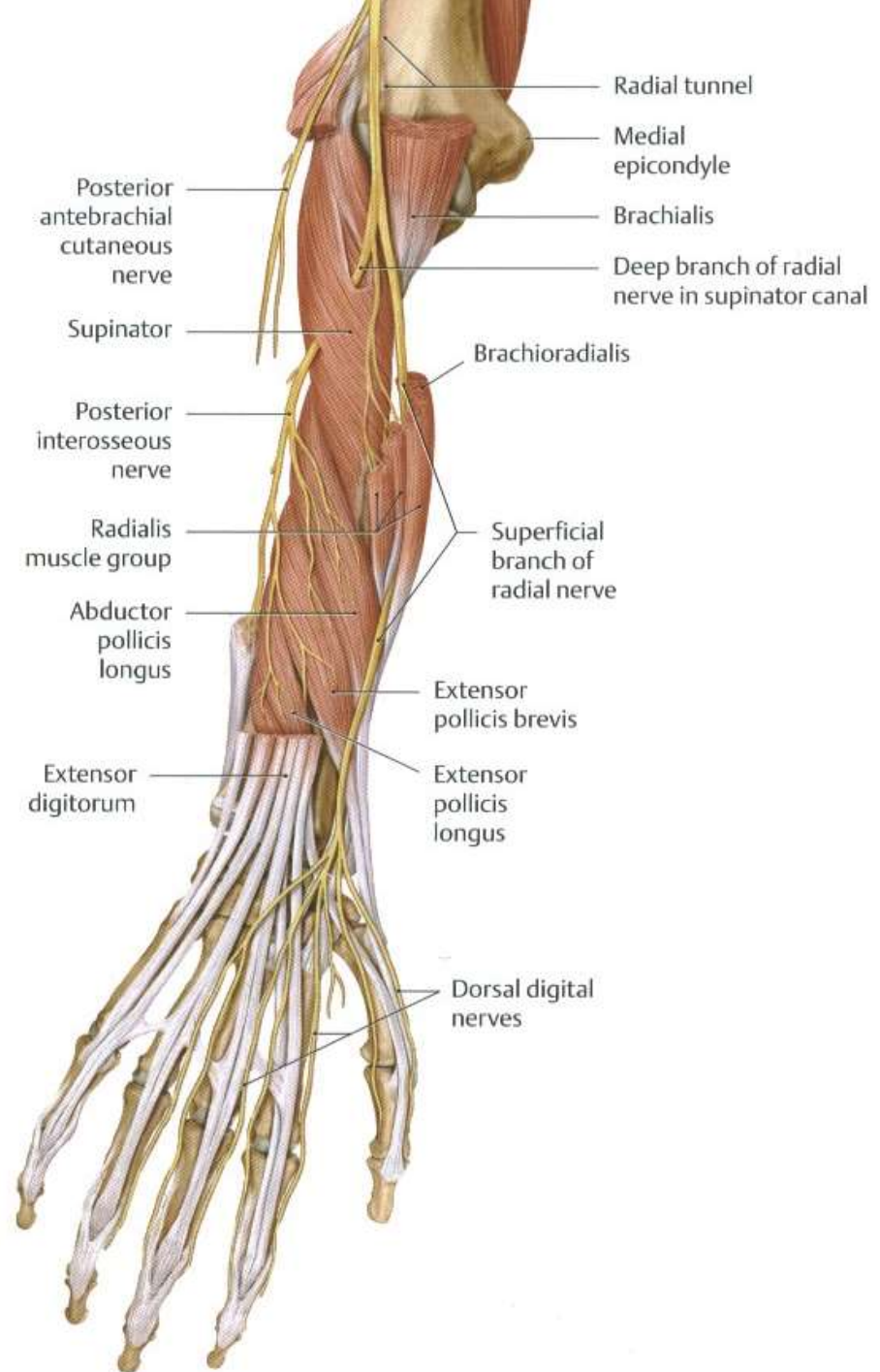
- Superficial branch
- Deep branch



Radial nerve- antebrachial section

❖ Course of the superficial (sensory) branch of radial nerve

- Descends along the brachioradialis, together with the radial artery
- Pierces the antebrachial fascia
- Passes onto dorsum of the hand

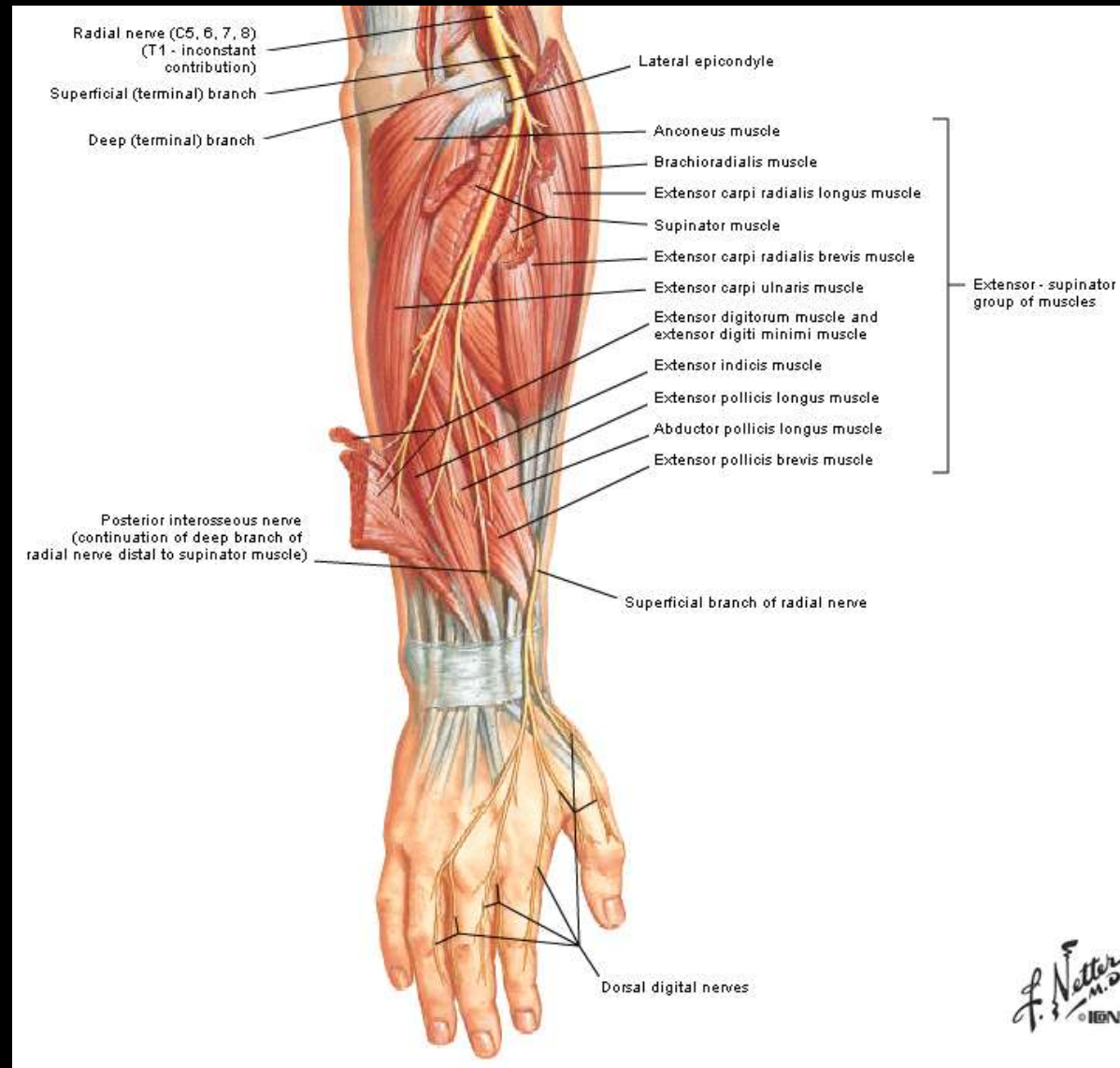


Radial nerve- antebrachial section

❖ Course of the deep (motor) branch of radial nerve

➤ In the cubital fossa pierces the supinator, surrounds the neck of radius and passes into the posterior compartment of forearm

➤ Gives rise to its terminal branch- posterior interosseous nerve



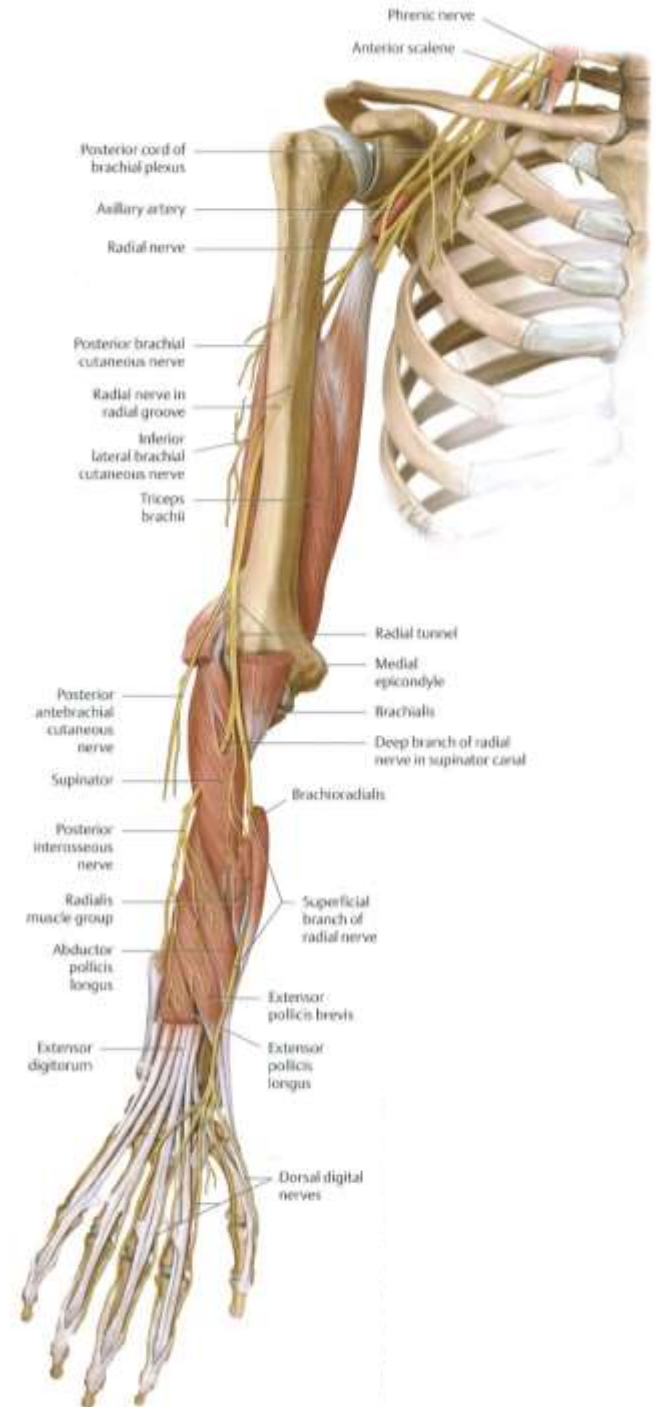
Radial nerve

❖ Range of motor innervation

- All muscles of the posterior compartments of the arm and forearm

❖ Range of sensory innervation

- Lateral half of the dorsum of hand

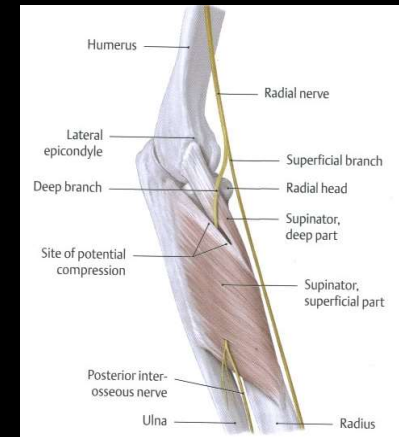
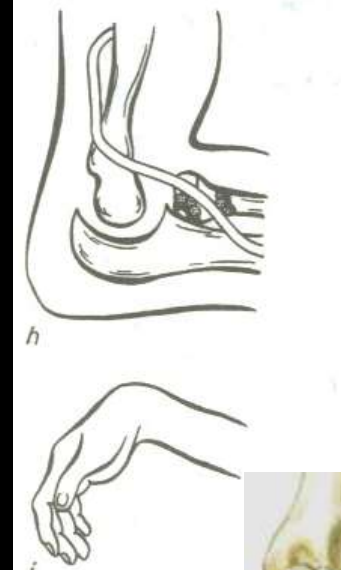


Potential places of compression or injury of the radial nerve

❖ Place of passage between the heads of triceps brachii in the radial groove of humerus



❖ Place of passage around the neck of radius



❖ Hand has image of „wrist drop” because of palsy of the posterior forearm muscles which results in inability of extension hand and digits in the metacarpophalangeal joints



Innervation of the skin of forearm

❖ Medial surface

- Medial cutaneous antebrachial nerve (from medial cord of brachial plexus)

❖ Lateral surface

- Lateral antebrachial cutaneous nerve (from musculocutaneous nerve)

❖ Posterior surface

- Posterior antebrachial cutaneous nerve (from radial nerve)

