Chapter 6
The Elbow and Radioulnar Joints

Manual of Structural Kinesiology

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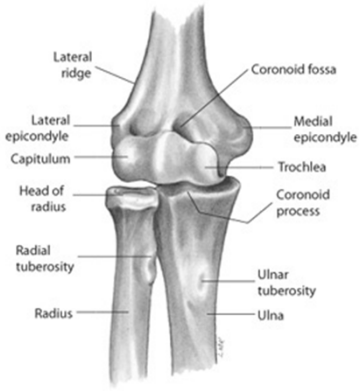
The Elbow & Radioulnar Joints

- Most upper extremity movements involve the elbow & radioulnar joints
- Usually grouped together due to close anatomical relationship
- Elbow joint movements may be clearly distinguished from those of the radioulnar joints
- Radioulnar joint movements may be distinguished from those of the wrist

Bones

- Ulna is much larger proximally than radius
- Radius is much larger distally than ulna
- Scapula & humerus serve as proximal attachments for muscles that flex & extend the elbow
- Ulna & radius serve as distal attachments for these same muscles

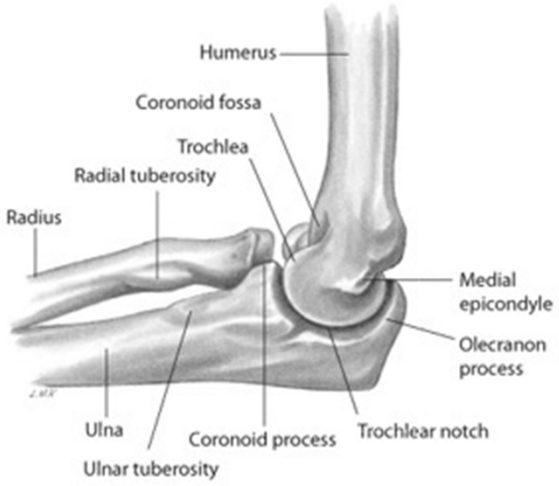


Bones

- Scapula, humerus, & ulna serve as proximal attachments for muscles that pronate & supinate the radioulnar joints
- Distal attachments of radioulnar joint muscles are located on radius

Bones

- Bony landmarks
  - medial condyloid ridge
  - olecranon process
  - coranoid process
  - radial tuberosity



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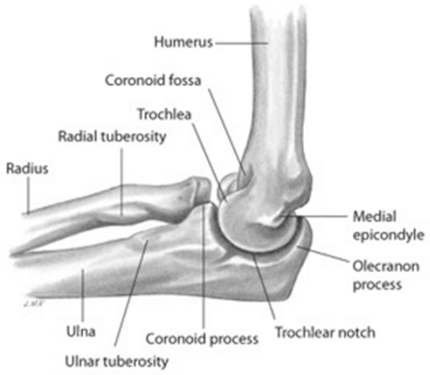
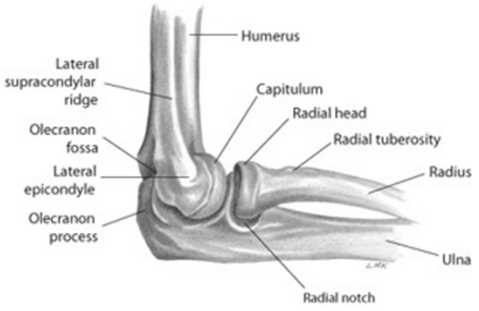
Bones





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Joints

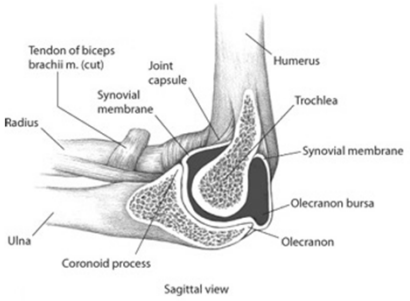
- Ginglymus or hinge–type joint
- Allows only flexion & extension
- 2 interrelated joints
  - humeroulnar joint
  - radiohumeral joints

Joints

- Elbow motions
  - primarily involve movement between articular surfaces of humerus & ulna
  - specifically humeral trochlear fitting into ulna trochlear notch
  - radial head has a relatively small amount of contact with capitulum of humerus
  - As elbow reaches full extension, olecranon process is received by olecranon fossa
    - increased joint stability when fully extended

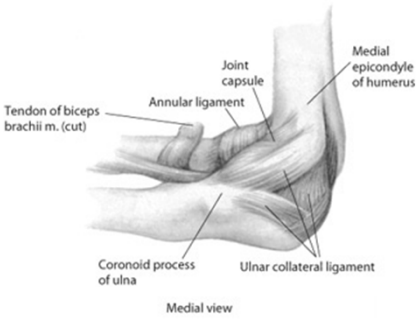
Joints

- As elbow flexes 20 degrees or more, its bony stability is unlocked, allowing for more side–to–side laxity
- Stability in flexion is more dependent on the lateral (radial collateral ligament) & the medial or (ulnar collateral ligament)

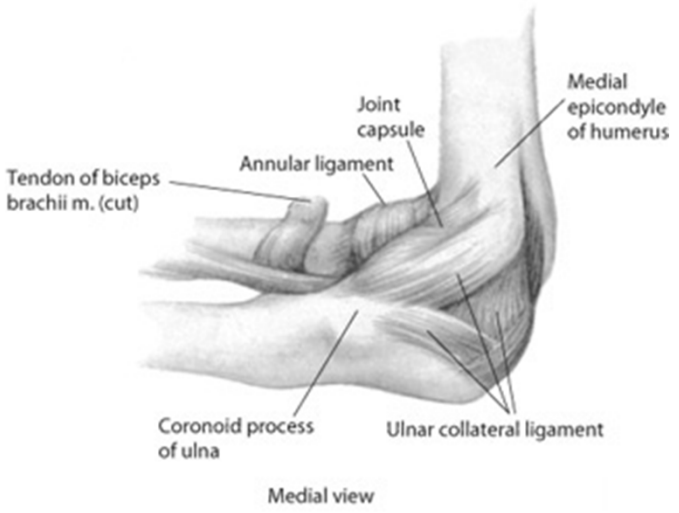


Joints

- Ulnar collateral ligament is critical in providing medial support to prevent elbow from abducting when stressed in physical activity
  - Many contact sports & throwing activities place stress on medial aspect of joint, resulting in injury



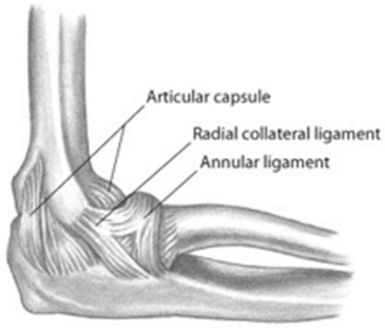
Joints



Medial view

Joints

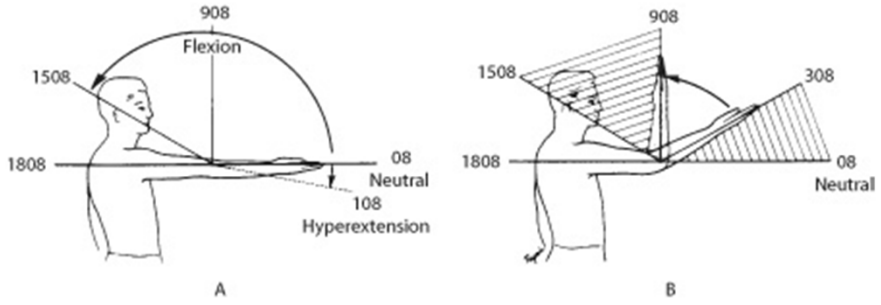
- Radial collateral ligament provides lateral stability & is rarely injured
- Annular ligament provides a sling effect around radial head for stability



Lateral view

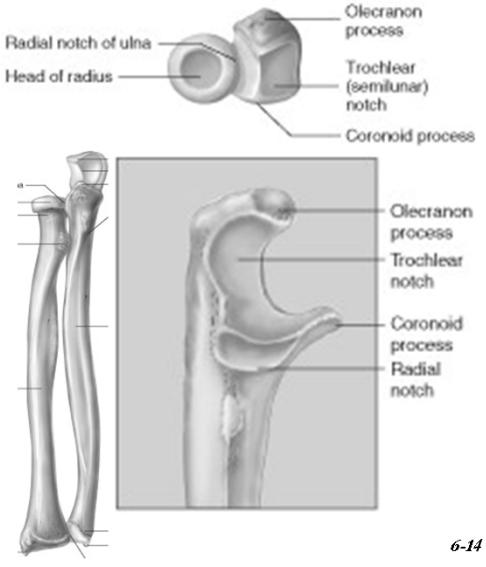
Joints

- Elbow moves from 0 degrees of extension to 145 to 150 degrees of flexion



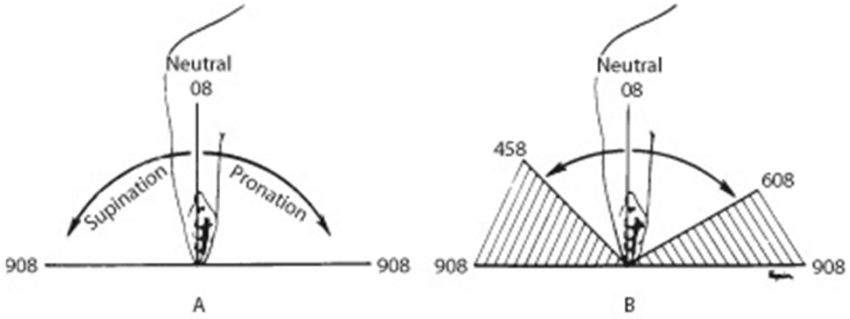
Joints

- Radioulnar joint
  - Trochoid or pivot–type joint
  - Radial head rotates around at proximal ulna
  - Distal radius rotates around distal ulna
  - Annular ligament maintains radial head in its joint



Joints

- Radioulnar joint
  - Supinate 80 to 90 degrees from neutral
  - Pronate 70 to 90 degrees from neutral



Joints

- Radioulnar joint
  - Joint between shafts of radius & ulna held tightly together between proximal & distal articulations by an interosseus membrane (syndesmosis)
    - substantial rotary motion between the bones

Joints

- Synergy between glenohumeral, elbow, & radioulnar joint muscles
  - As the radioulnar joint goes through its ROM, glenohumeral & elbow muscles contract to stabilize or assist in the effectiveness of movement at the radioulnar joints
  - Ex. when tightening a screw with a screwdriver which involves radioulnar supination, we tend to externally rotate & flex the glenohumeral & elbow joints, respectfully

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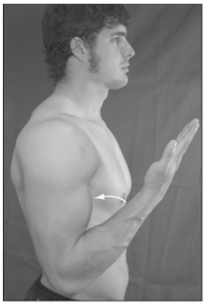
Movements

- Flexion
  - movement of forearm to shoulder by bending the elbow to decrease its angle
- Extension
  - movement of forearm away from shoulder by straightening the elbow to increase its angle



Flexion

Extension B

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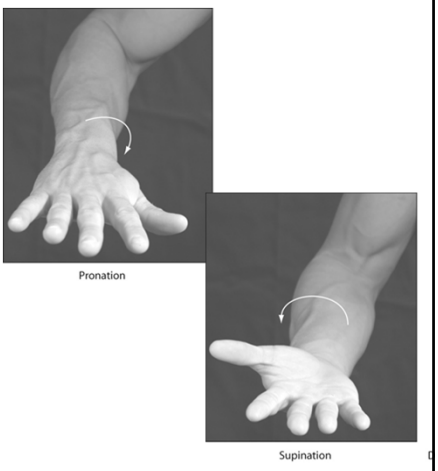
Movements

- Pronation
  - internal rotary movement of radius on ulna that results in hand moving from palm-up to palm-down position
- Supination
  - external rotary movement of radius on ulna that results in hand moving from palm-down to palm-up position



Muscles

- Elbow flexors
  - Biceps brachii
  - Brachialis
  - Brachioradialis
  - Weak assistance from Pronator teres
- Elbow extensor
  - Triceps brachii
  - Anconeus provides assistance

Muscles

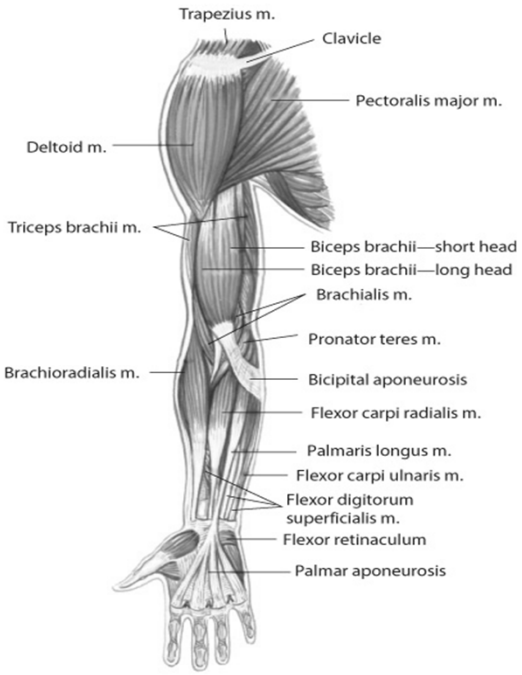
- Radioulnar pronators
  - Pronator teres
  - Pronator quadratus
  - Brachioradialis
- Radioulnar supinators
  - Biceps brachii
  - Supinator muscle
  - Brachioradialis

Muscles

- "Tennis elbow" – common problem usually involving extensor digitorum muscle near its origin on lateral epicondyle
  - known lateral epicondylitis
  - associated with gripping & lifting activities
- Medial epicondylitis
  - somewhat less common
  - known as golfer's elbow
  - associated with medial wrist flexor & pronator group near their origin on medial epicondyle
  - Both conditions involve muscles which cross elbow but act primarily on wrist & hand

Muscles

- **Anterior**
  - Primarily flexion & pronation
    - Biceps brachii
    - Brachialis
    - Brachioradialis
    - Pronator teres
    - Pronator quadratus



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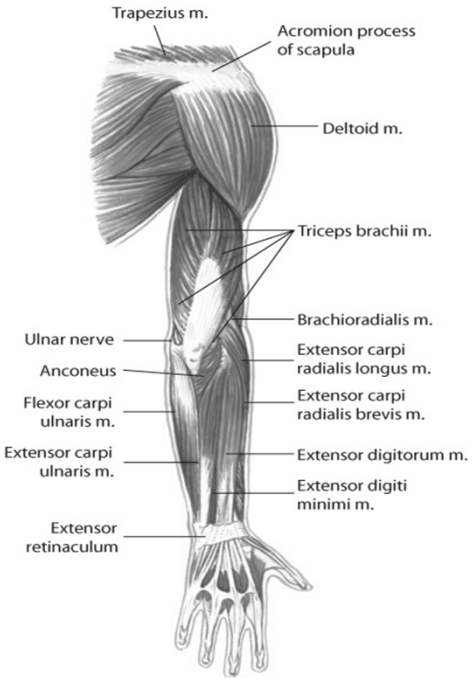
Muscles

- **Posterior**
  - Primarily extension & supination
    - Triceps brachii
    - Anconeus
    - Supinator



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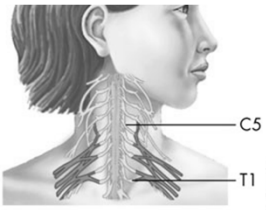
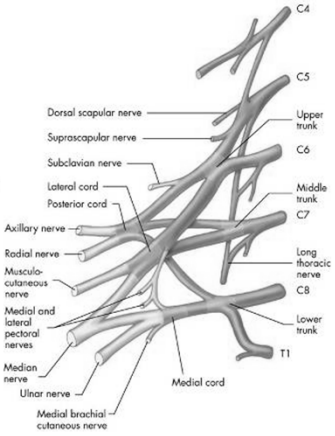
Nerves

- All elbow & radioulnar joints muscles are innervated from median, musculotaneous, & radial nerves of brachial plexus

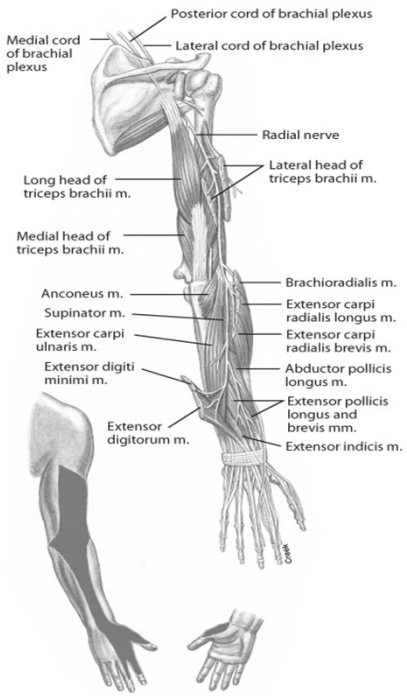
Roots: C5, C6, C7, C8, T1
Trunks: upper, middle, lower
Anterior divisions
Posterior divisions
Cords: posterior, lateral, medial
Branches: Axillary nerve
Radial nerve
Musculocutaneous nerve
Median nerve
Ulnar nerve





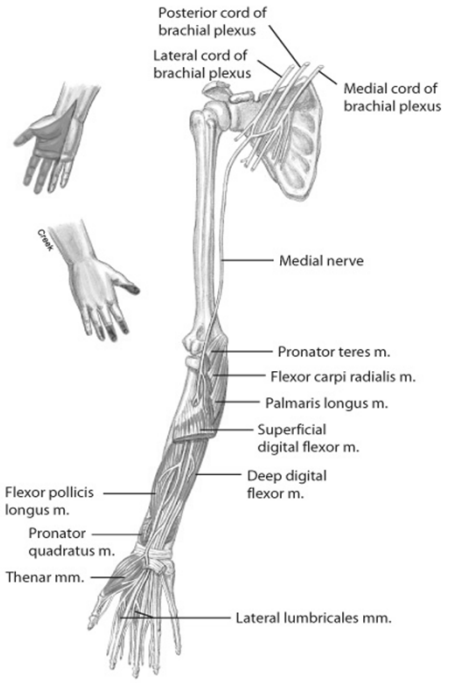
Nerves

- Radial nerve - originates from C5, C6, C7, & C8
  - Triceps brachii
  - Brachioradialis
  - Supinator (posterior interosseous nerve)
  - Anconeus
  - Sensation to posterolateral arm, forearm, & hand



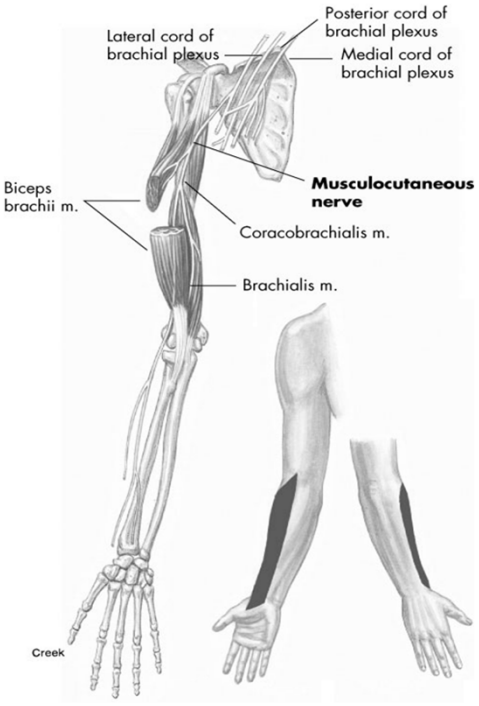
Nerves

- Median nerve - derived from C6 & C7
  - Pronator teres
  - Pronator quadratus (anterior interosseus nerve)
  - Sensation to palmar aspect of hand & first three phalanges, palmar aspect of radial side of fourth finger, dorsal aspect of index & long fingers



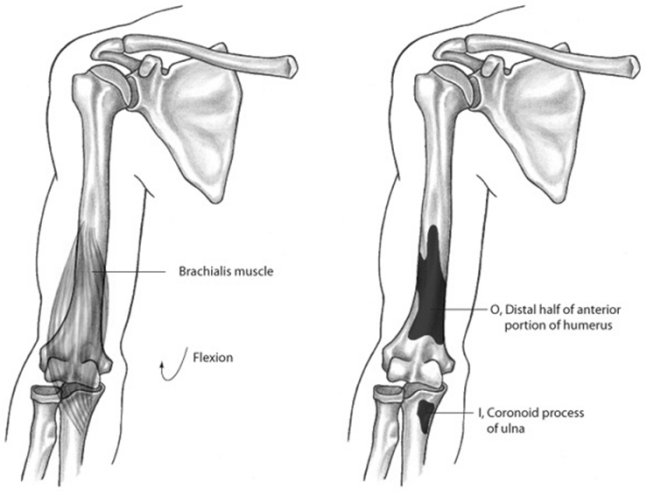
Nerves

- Musculotaneous nerve - branches from C5 & C6
  - Biceps brachii
  - Brachialis



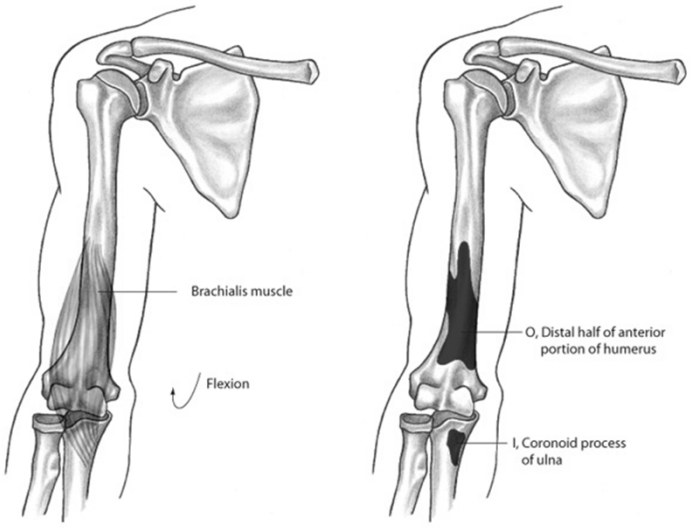
Biceps Brachii Muscle

- Flexion of elbow
- Supination of forearm
- Weak flexion of shoulder joint
- Weak abduction of shoulder joint when externally rotated



Brachialis Muscle

- True flexion of elbow



Brachioradialis Muscle

Flexion of elbow

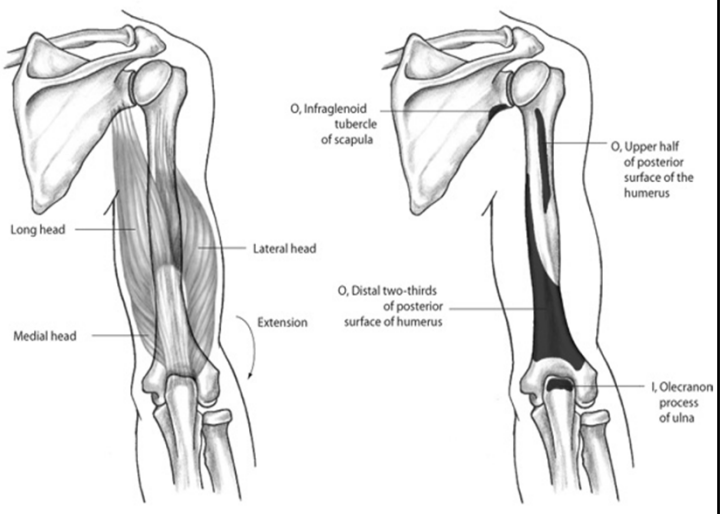
Pronation from supinated position to neutral

Supination from pronated position to neutral

Triceps Brachii Muscle

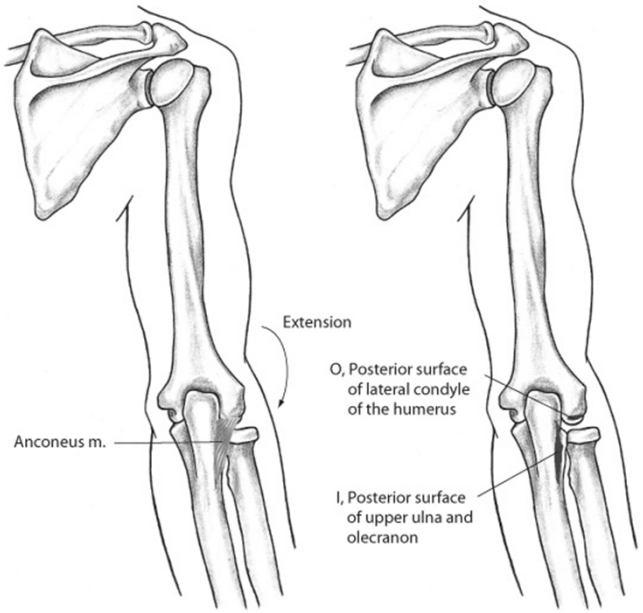
All heads: extension of elbow

Long head: extension of shoulder joint; adduction of shoulder joint; horizontal abduction



Anconeus Muscle

Extension of elbow



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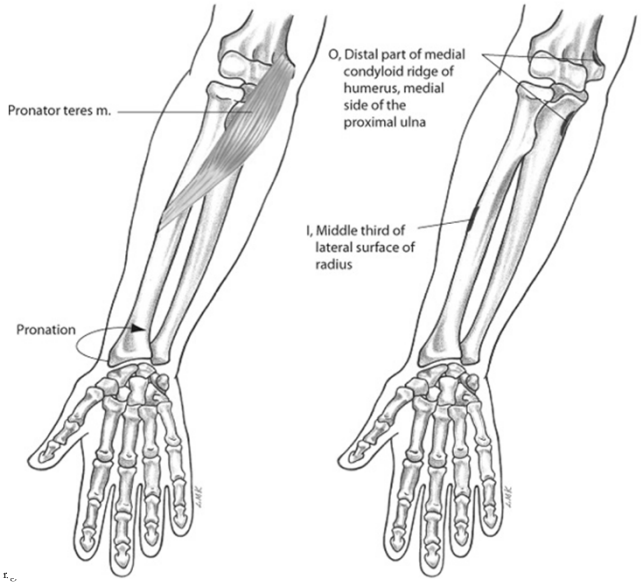
Pronator Teres Muscle

Pronation of forearm

Weak flexion of elbow



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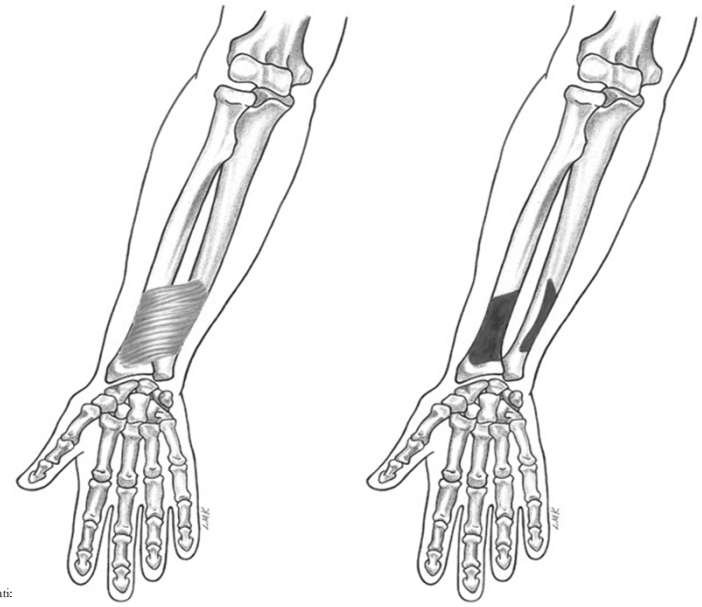
Pronator Quadratus Muscle

Pronation of forearm



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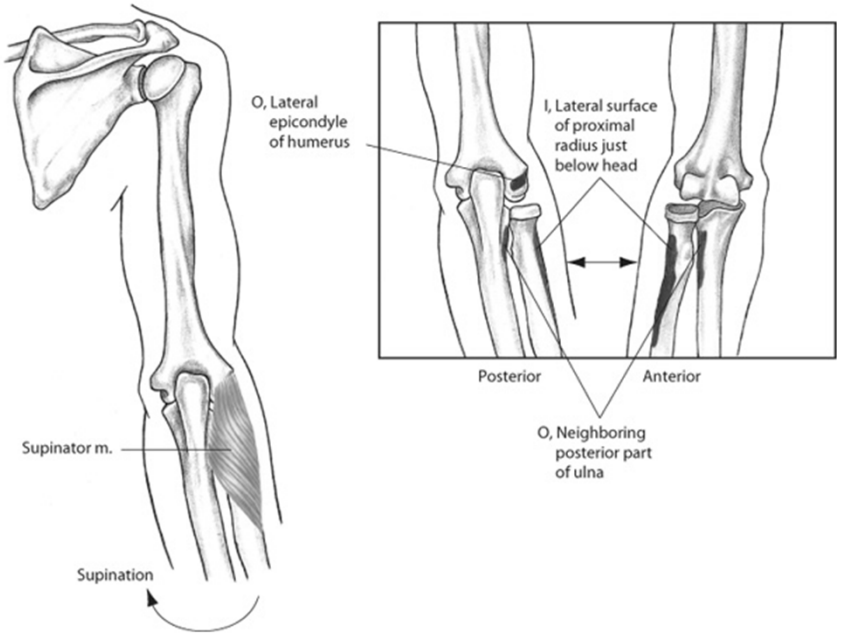
Supinator Muscle



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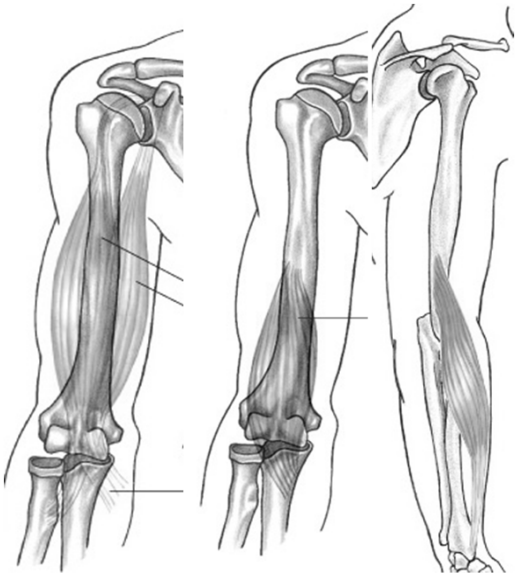
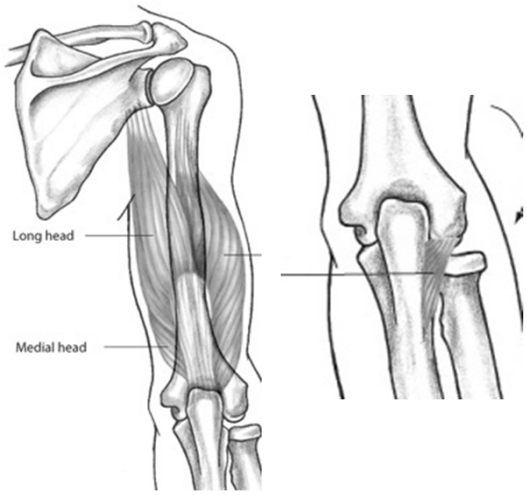
Elbow Flexion

- Ex. Biceps curl
- Agonists
  - Biceps brachii
  - Brachialis
  - Brachioradialis



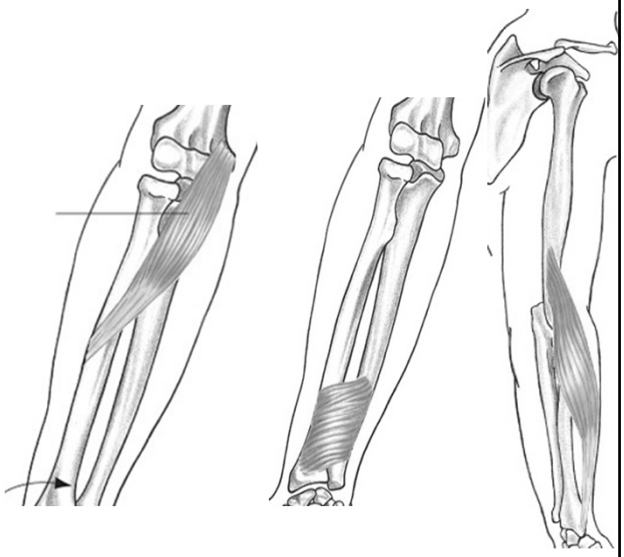
Elbow Extension

- EX. Push-up
- Agonists
  - Triceps brachii
    - Anconeus



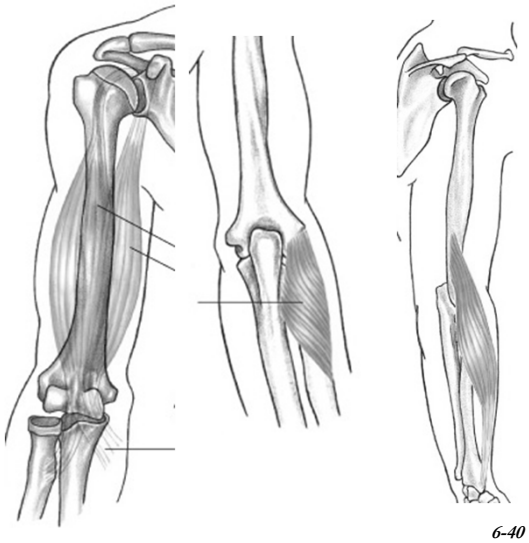
Radioulnar Pronation

- Agonists
  - Pronator teres
  - Pronator quadratus
  - Brachioradialis



Radioulnar Supination

- Ex. Tightening a screw
- Agonists
  - Biceps brachii
  - Supinator muscle
  - Brachioradialis



Web Sites

American Family Physician
- http://www.aafp.org/afp/20000201/691.html
  - Evaluation of Overuse Elbow Injuries

Medical Multimedia Group
- www.healthpages.org/AHP/LIBRARY/HLTHTOP/CTD/
  - A Patient's Guide to Cumulative Trauma Disorder(CTD)

Lecture Topics in Kinesiology
- http://moon.ouhsc.edu/dthompso/namics/elbow.htm
  - Describes motions caused by the muscles.

Huei Ming Chai
- www.pt.ntu.edu.tw/hmchai/Kines04/KINupper/Elbow.htm
  - Functions, stability and joint structure of elbow complex; kinematics, muscle action and common injuries of the elbow.

Southern California Orthopedic Institute
- www.scoi.com/teniselb.htm
  - Tennis elbow information

Web Sites

National Aeronautics and Space Administration
- http://rehabworks.ksc.nasa.gov/education/protocols/basicwristelbow.php
  - Basic Wrist and Elbow Rehabilitation

UpToDate
- http://patients.uptodate.com/topic.asp?file=bone_joi/7086
  - Physical Therapy for Elbow Tendinitis

American Sports Medicine Institute
- www.asmi.org/asmiweb/mpresentations/mmp.htm
  - Biomechanics of the Elbow during Throwing

American Academy of Orthopaedic Surgeons
- http://orthoinfo.aaos.org/category.cfm?topcategory=Hand
  - Patient Education Library on the Elbow

Web Sites

American Physical Therapy Association

http://www.apta.org/AM/Template.cfm?Section=Home&CONTENTID=20403&TEMPLATE=/CM/HTMLDisplay.cfm

– Taking Care of Your Hand, Wrist, and Elbow

The Physician and Sportsmedicine

http://www.physsportsmed.com/issues/1996/05_96/nirschl.htm

– Assessment and Treatment Guidelines for Elbow Injuries

The Physician and Sportsmedicine

http://www.physsportsmed.com/issues/1999/06_99/whiteside.htm

– Elbow Injuries in Young Baseball Players

Radiologic Anatomy Browser

http://radlinux1.usuf1.usuhs.mil/rad/iong/index.html

– This site has numerous radiological views of the musculoskeletal system.

Web Sites

University of Arkansas Medical School Gross Anatomy for Medical Students

http://anatomy.uams.edu/anatomyhtml/grossresources.html

– Dissections, anatomy tables, atlas images, links, etc.

Loyola University Medical Center: Structure of the Human Body

www.meddean.luc.edu/lumen/MedEd/GrossAnatomy/GA.html

– An excellent site with many slides, dissections, tutorials, etc., for the study of human anatomy

Wheeless' Textbook of Orthopaedics

www.wheelessonline.com/

– This site has an extensive index of links to the fractures, joints, muscles, nerves, trauma, medications, medical topics, lab tests, and links to orthopedic journals and other orthopedic and medical news.

Arthroscopy.Com

www.arthroscopy.com/sports.htm

– Patient information on various musculoskeletal problems of the upper and lower extremity

Web Sites

Premiere Medical Search Engine

http://www.medsite.com/Default.asp?bhcp=1

- This site allows the reader to enter any medical condition and it will search the net to find relevant articles.

Virtual Hospital

www.vh.org

- Numerous slides, patient information, etc.