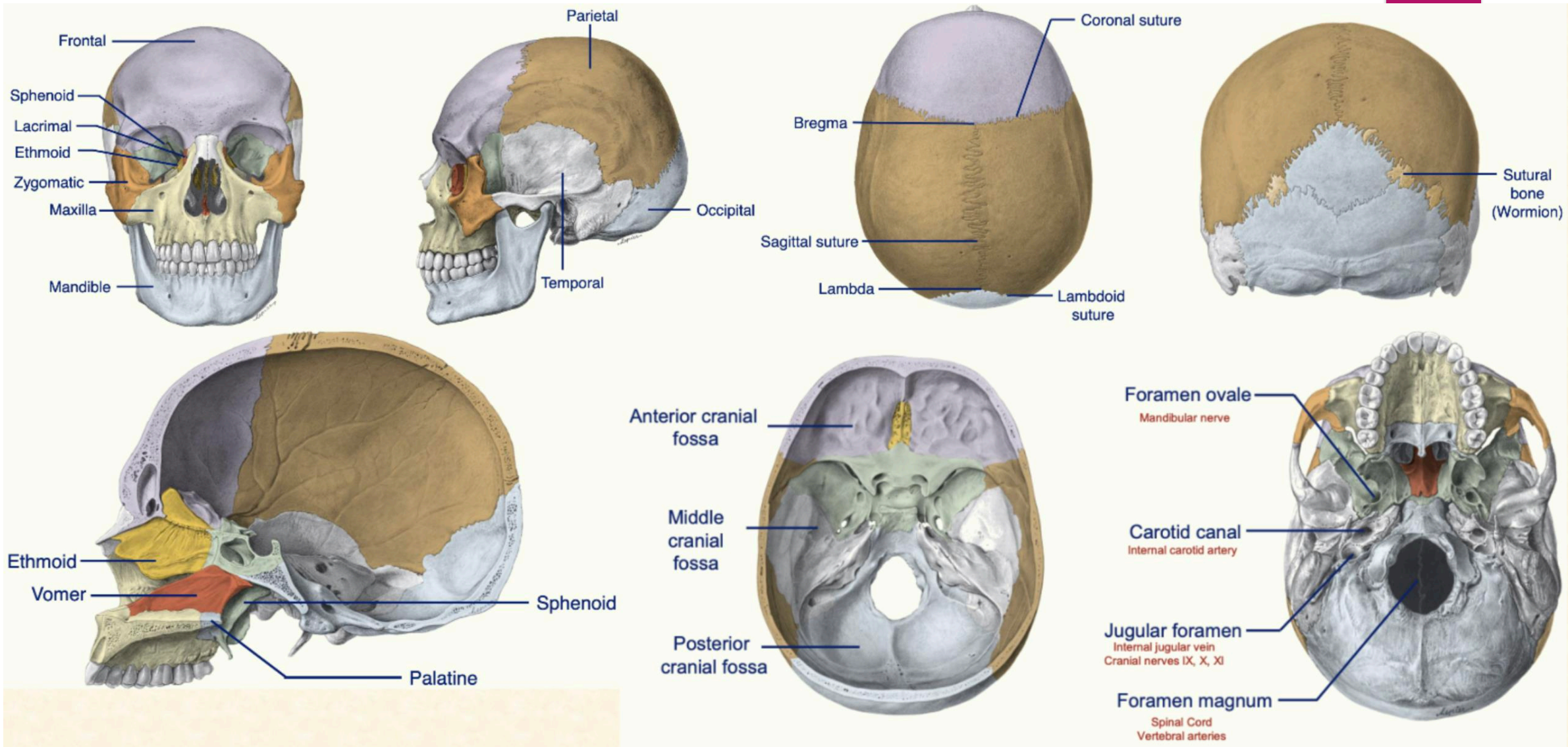
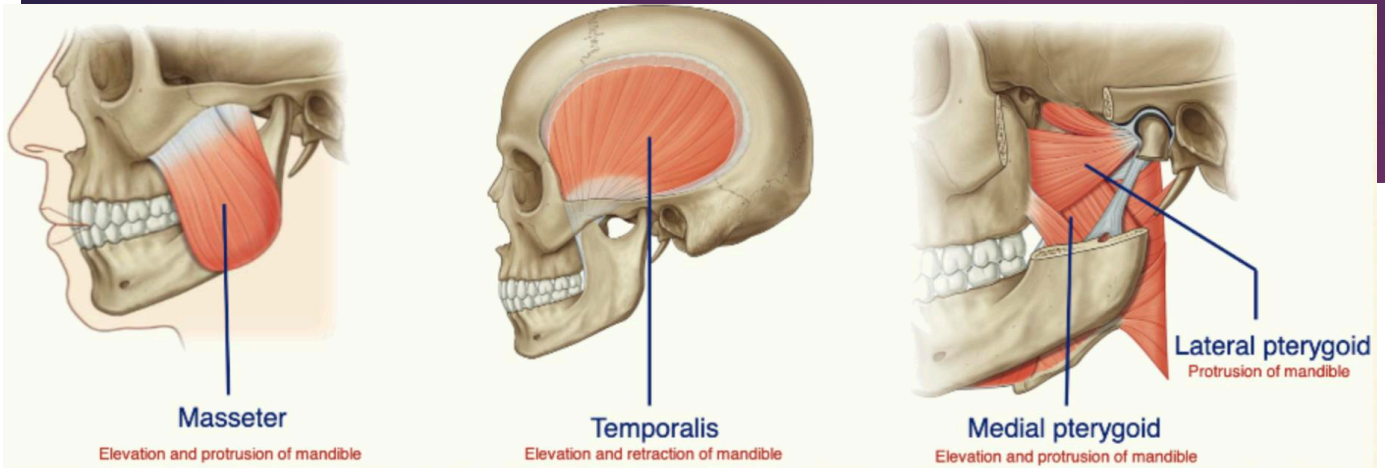
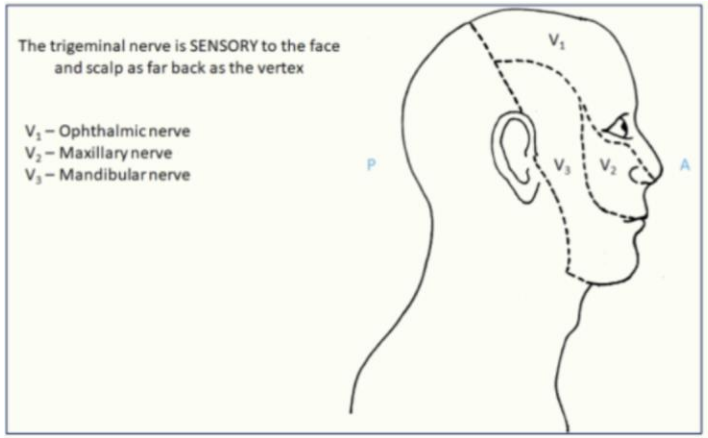
MSK ANATOMY

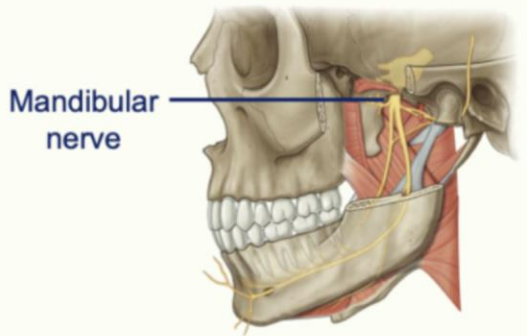
SKULL AND VERTEBRAL COLUMN


Frontal
Sphenoid
Lacrimal
Ethmoid
Zygomatic
Maxilla
Mandible
Parietal
Occipital
Temporal
Coronal suture
Bregma
Sagittal suture
Lambda
Lambdoid suture
Sutural bone (Wormion)
Ethmoid
Vomer
Sphenoid
Palatine
Anterior cranial fossa
Middle cranial fossa
Posterior cranial fossa
Foramen ovale
Mandibular nerve
Carotid canal
Internal carotid artery
Jugular foramen
Internal jugular vein
Cranial nerves IX, X, XI
Foramen magnum
Spinal Cord
Vertebral arteries

Muscles of mastication



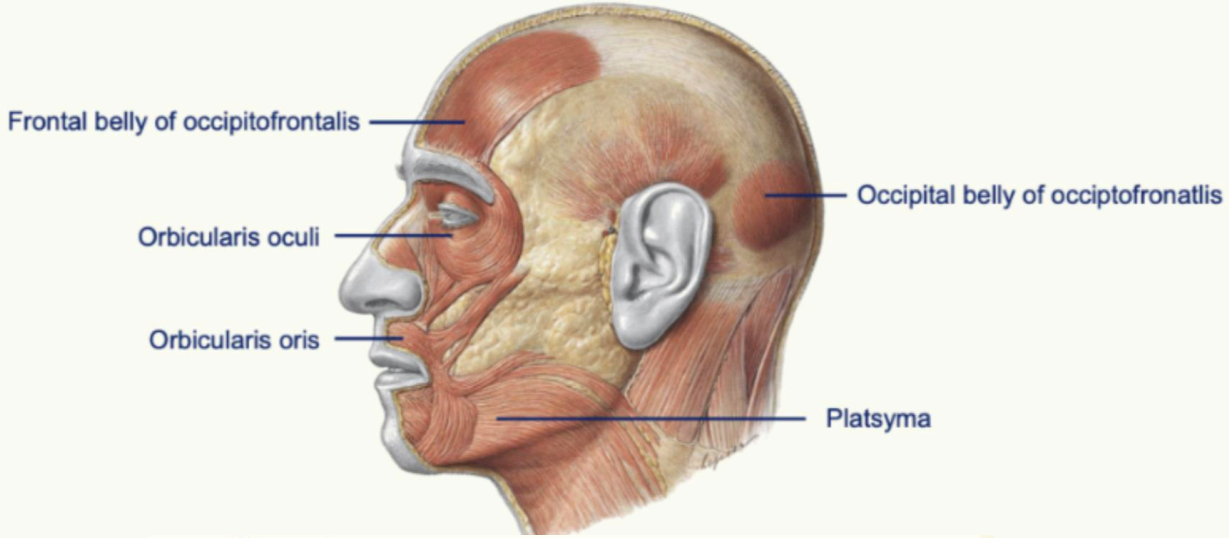


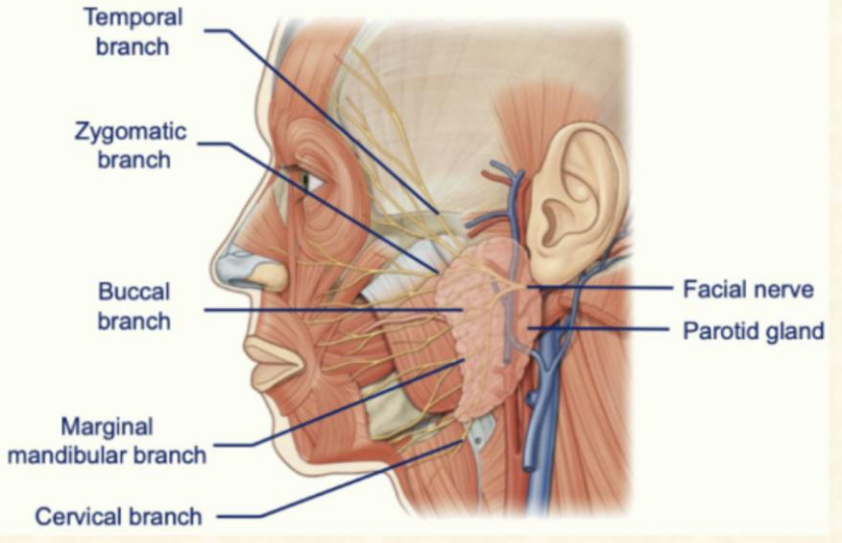


- The muscles of mastication: masseter, temporalis, medial pterygoid and lateral pterygoid
- The muscles of mastication are innervated by the trigeminal nerve (CN V), and are derived from pharyngeal arch 1
- The trigeminal nerve has 3 branches:

- Ophthalmic (V_1)- sensory
- Maxillary (V_2)- sensory
- Mandibular (V_3)- sensory & motor to muscles of mastication

Muscles of facial expression





- The muscles of facial expression: orbicularis oculi, orbicularis oris, platysma, frontal and occipital belly of occipitofrontalis
- The muscles of facial expression are innervated by the facial nerve (CN VII), and are derived from pharyngeal arch 2
- The facial nerve has 5 branches:

- Temporal branch
- Zygomatic branch
- Buccal branch
- Marginal mandibular branch
- Cervical branch

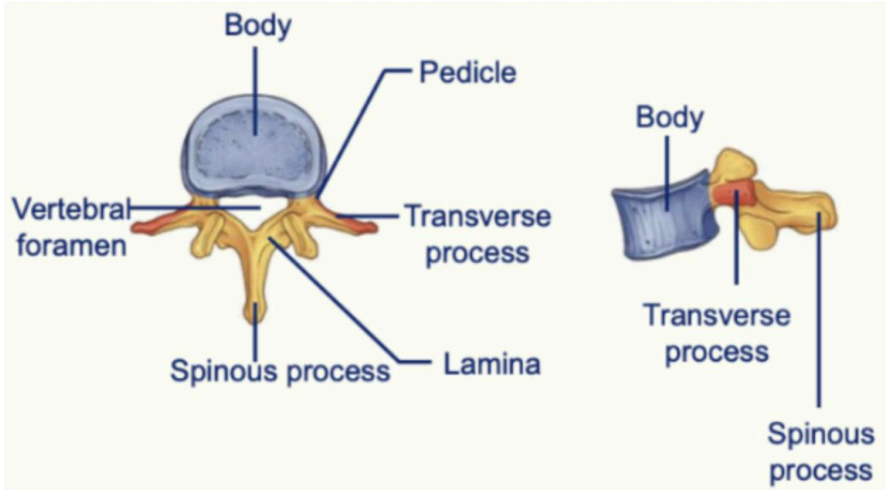
Spinal vertebrae and nerves

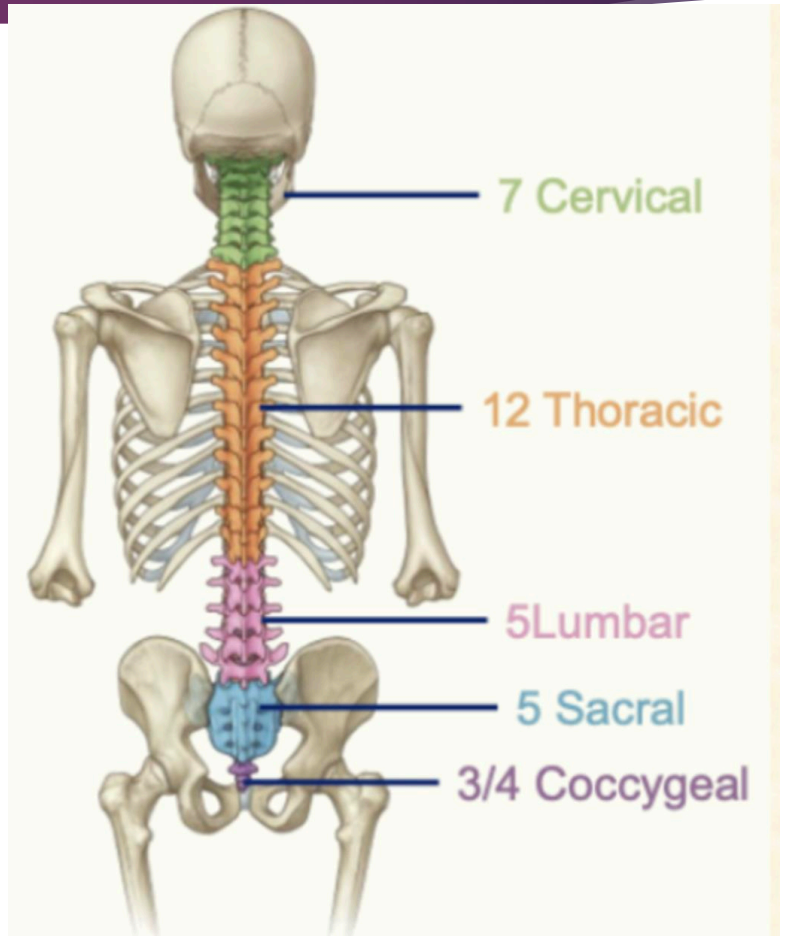
- Spinal vertebrae:

- Cervical = 7
- Thoracic = 12
- Lumbar = 5
- Sacral = 5
- Coccygeal = ¾

5 sacral vertebrae = fused
3/4 coccygeal vertebrae = fused -> forms coccyx

The structure of a vertebra:





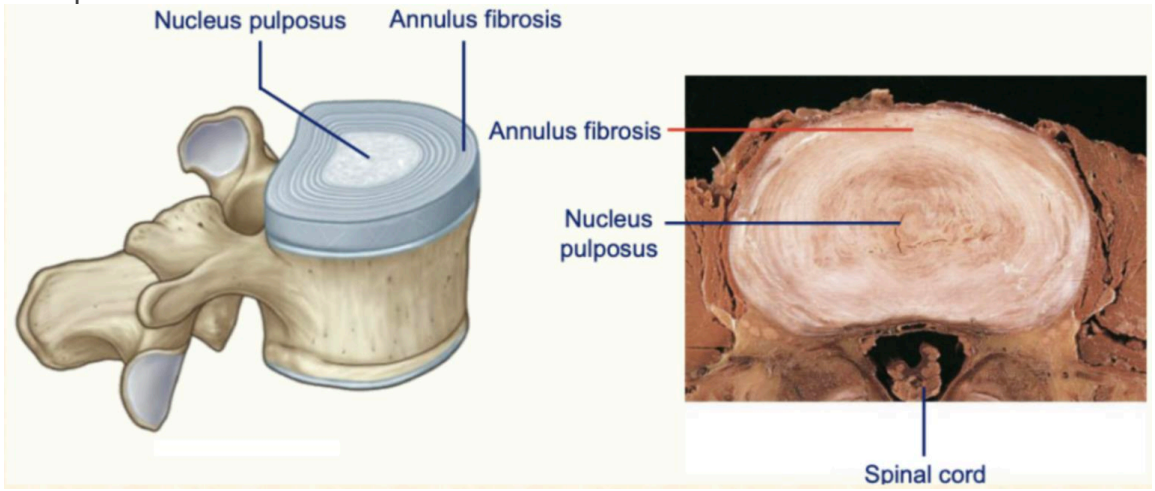
- Spinal nerves:

- Cervical = 8
- Thoracic = 12
- Lumbar = 5
- Sacral = 5
- Coccygeal = 1

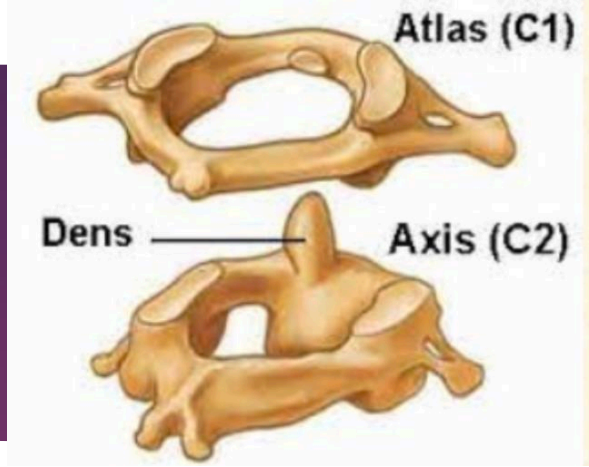
Intervertebral discs

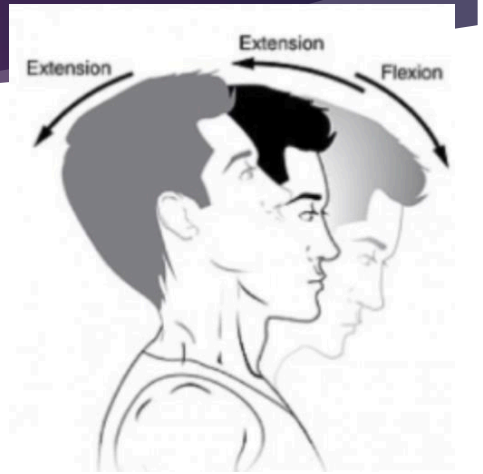
Intervertebral discs = act as shock absorbers by keeping vertebrae separated when there is impact + provide flexibility to the spine, facilitating flexion and extension

- Annulus fibrosis prevents over-rotation of the vertebrae; it is tough and collagenous; made of fibrocartilage
- Nucleus pulposus is jelly-like- mainly composed of water & loose network of collagen; allows the discs to withstand forces of compression and torsion
- Herniation of an intervertebral disc occurs when the nucleus pulposus ruptures through a tear in the annulus fibrosus -> can compress spinal cord



C1 and C2





- Atlas = C1 ; C1 is the only cervical vertebra that has no spinous process
- Axis = C2 ; Bifid spinous process

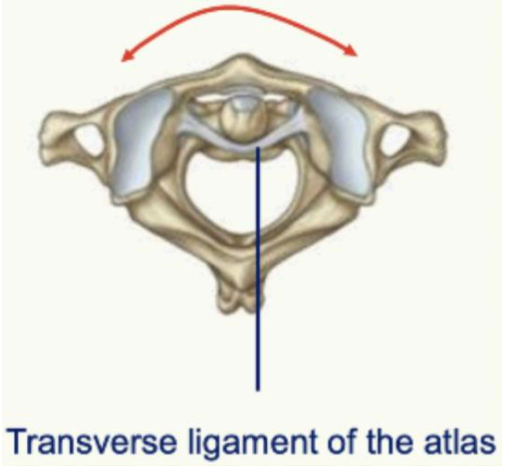
- Atlanto-occipital joint (between skull base & C1):

Flexion & extension occurs at this joint between the skull & C1 (e.g. when you nod & say yes)

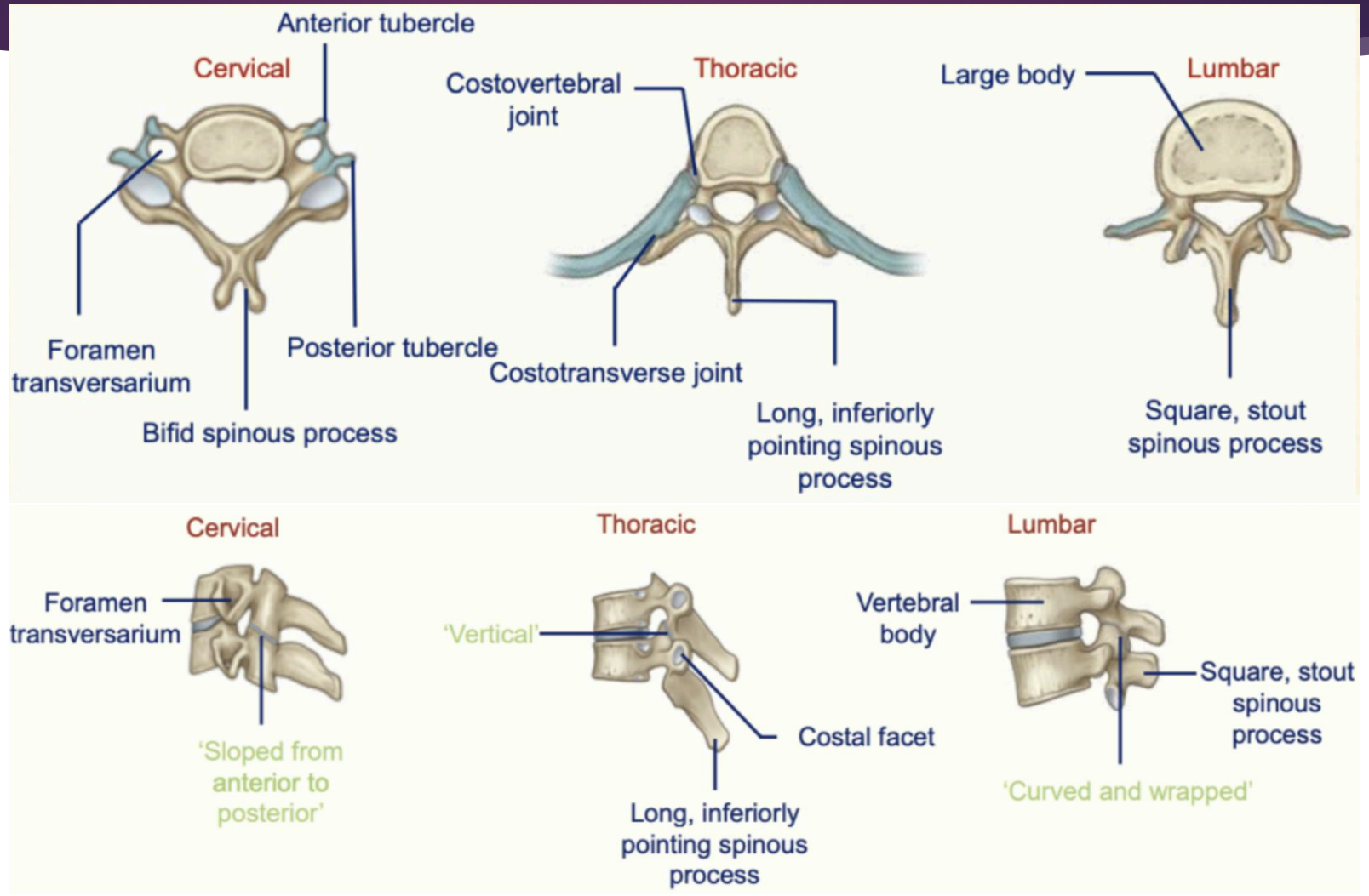
- Atlanto-axial joint (between C1 & C2):

C1 slotted over C2 (anterior arch of C1 slots over the dens process of C2)

→ articulation between the atlas and the axis allows you to shake your head left & right (eg. when you shake your head & say no)



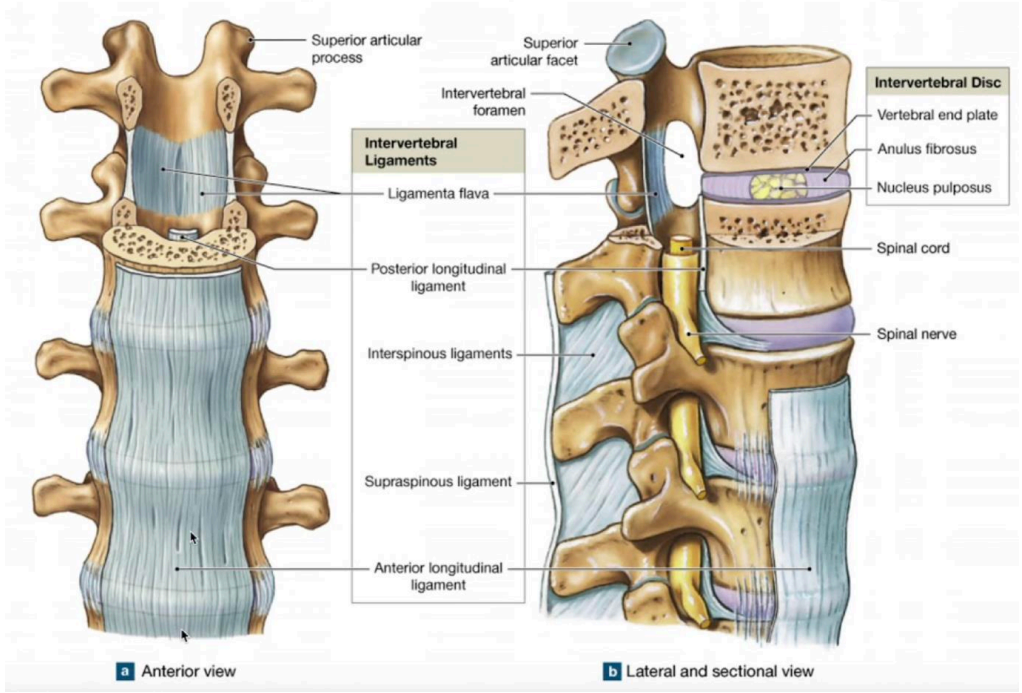
Variation of the vertebrae along the spinal cord

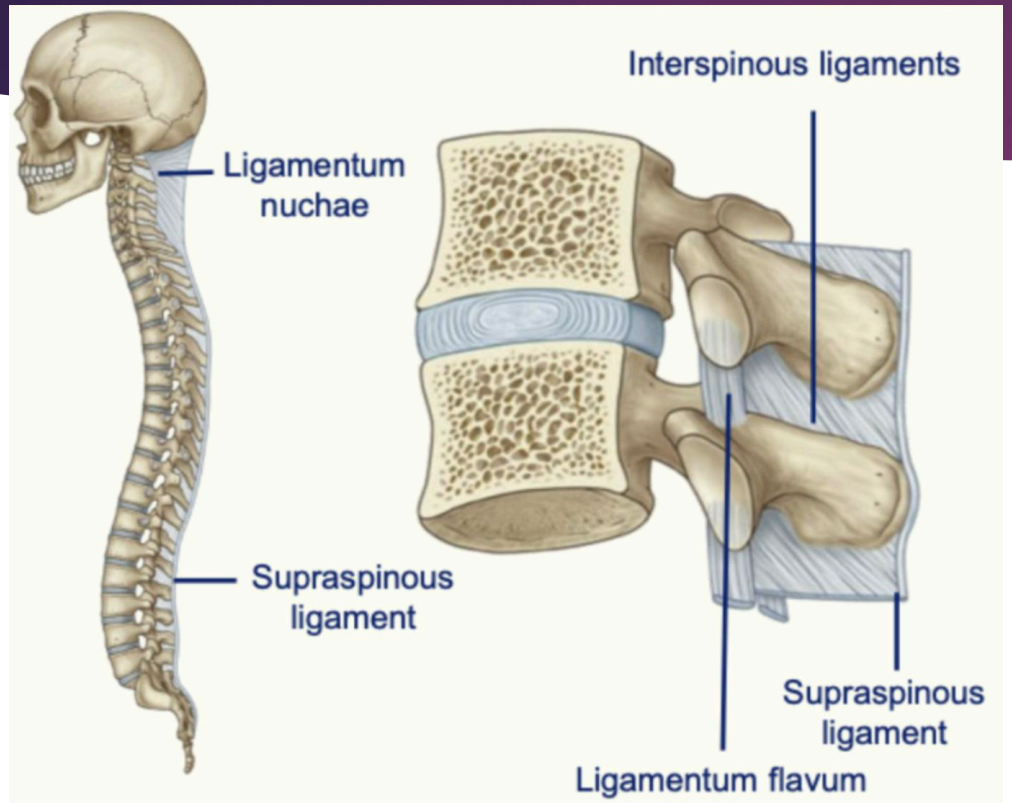


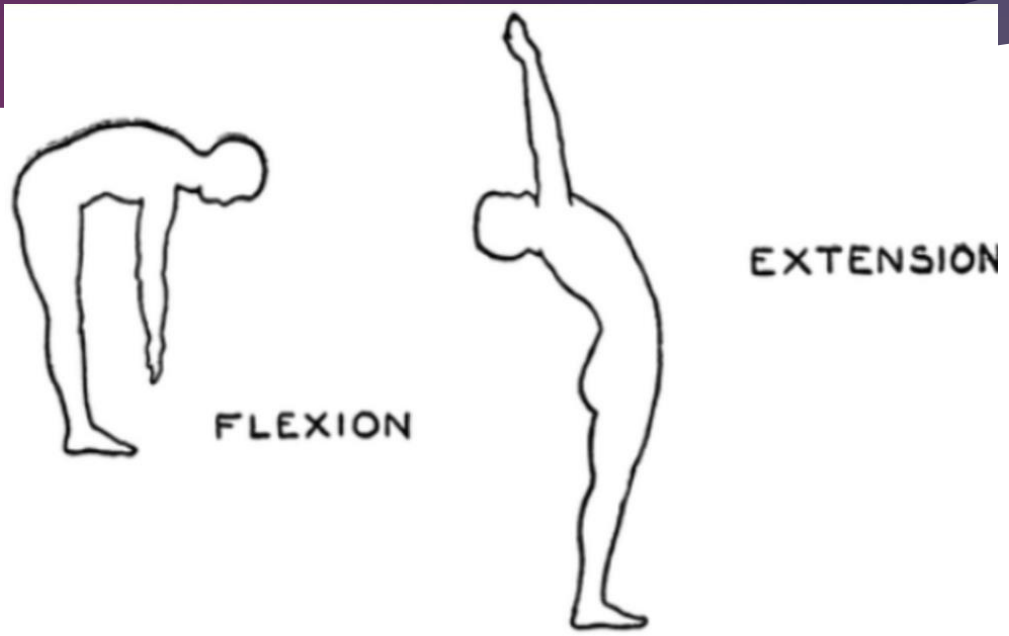
Ligaments of the vertebral column

- Ligamentum nuchae = limits hyperflexion of neck, keeps your head from dropping
- Supraspinous ligament = strong, fibrous cord that helps maintain upright position of head and (limit hyperflexion of the whole vertebral column)
- Interspinous ligament = limit flexion by restricting separation of spinous process
- Ligamentum flavum = maintains upright posture, helps preserve normal curvature and straightens column after flexion (elasticity can reduce with old age)

- Anterior longitudinal ligament = limits EXTENSION
- Posterior longitudinal ligament = limits FLEXION







MOVEMENTS OF THE TRUNK.

Skull and vertebral column Qs

- The temporalis muscle is innervated by which nerve?

- Facial nerve
- Ophthalmic nerve
- Mandibular nerve
- Maxillary nerve
- Superficial temporal nerve

- Which of these structures does NOT pass through the jugular foramen?

- CN IX
- Internal jugular vein
- CN XII
- CN X
- CN XI

Skull and vertebral column Qs

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- CN X
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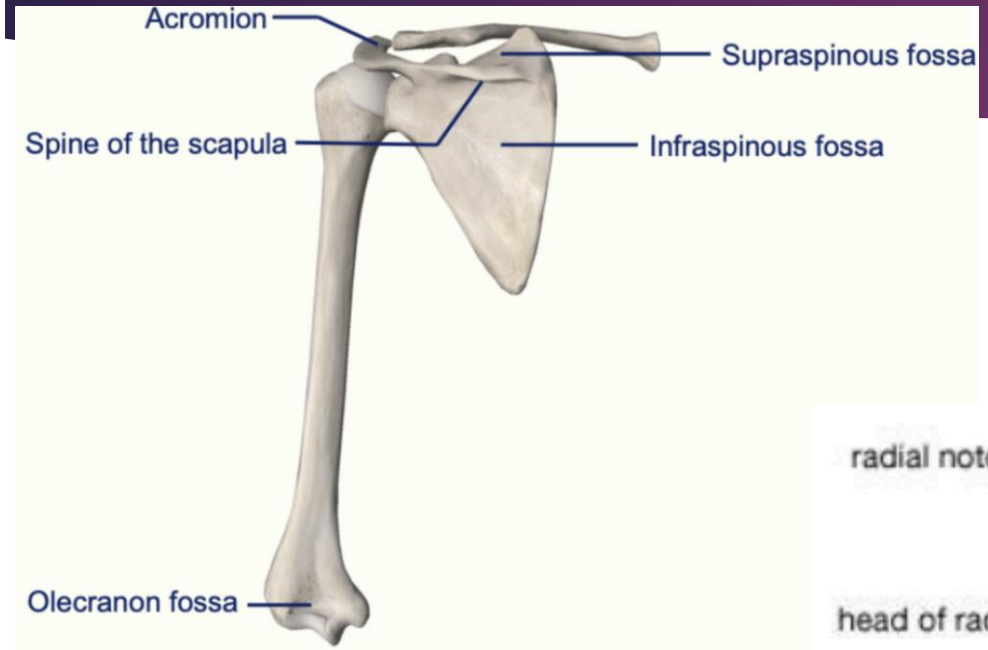
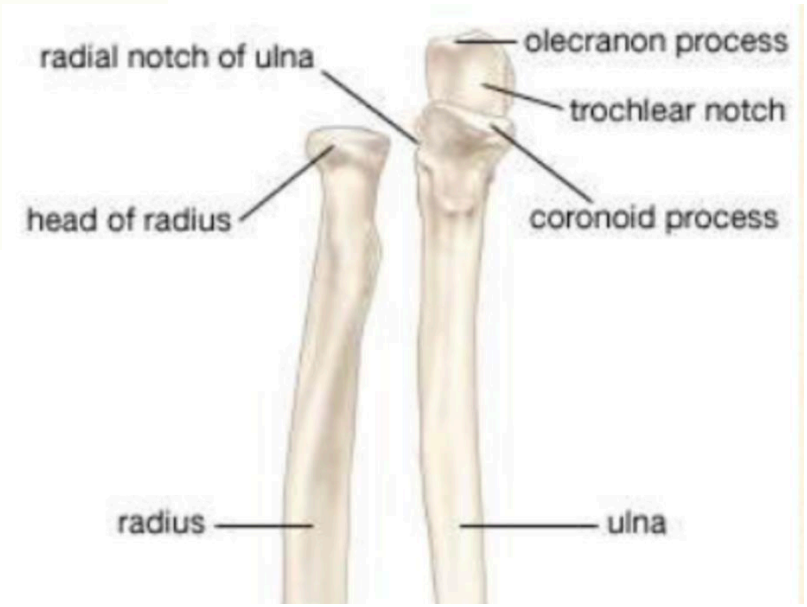
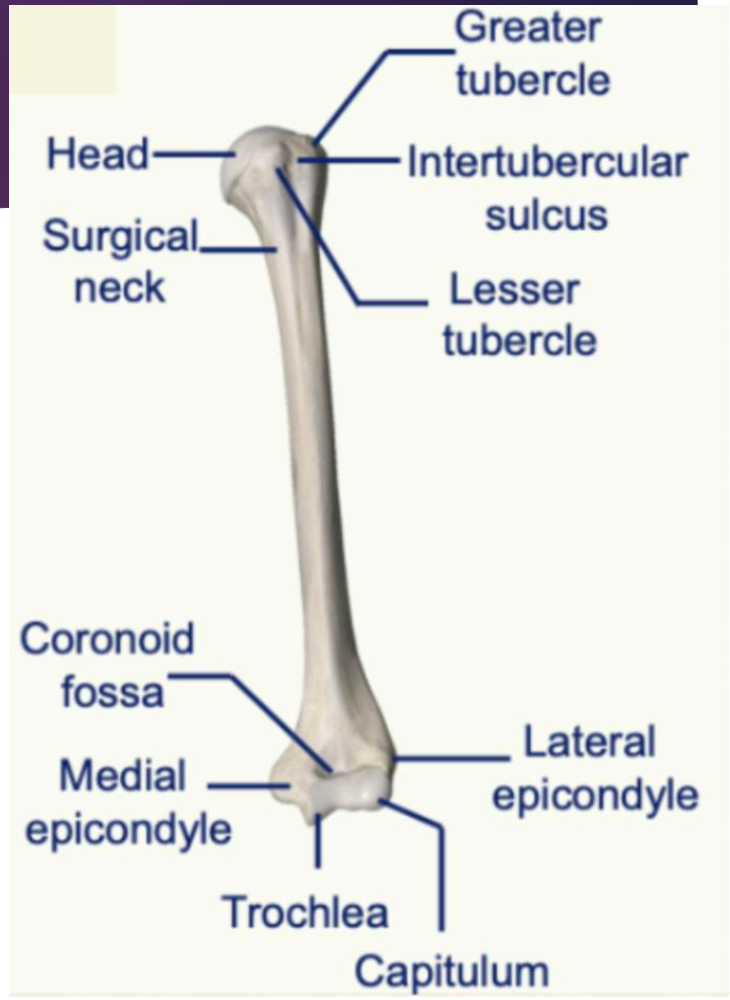
UPPER LIMB

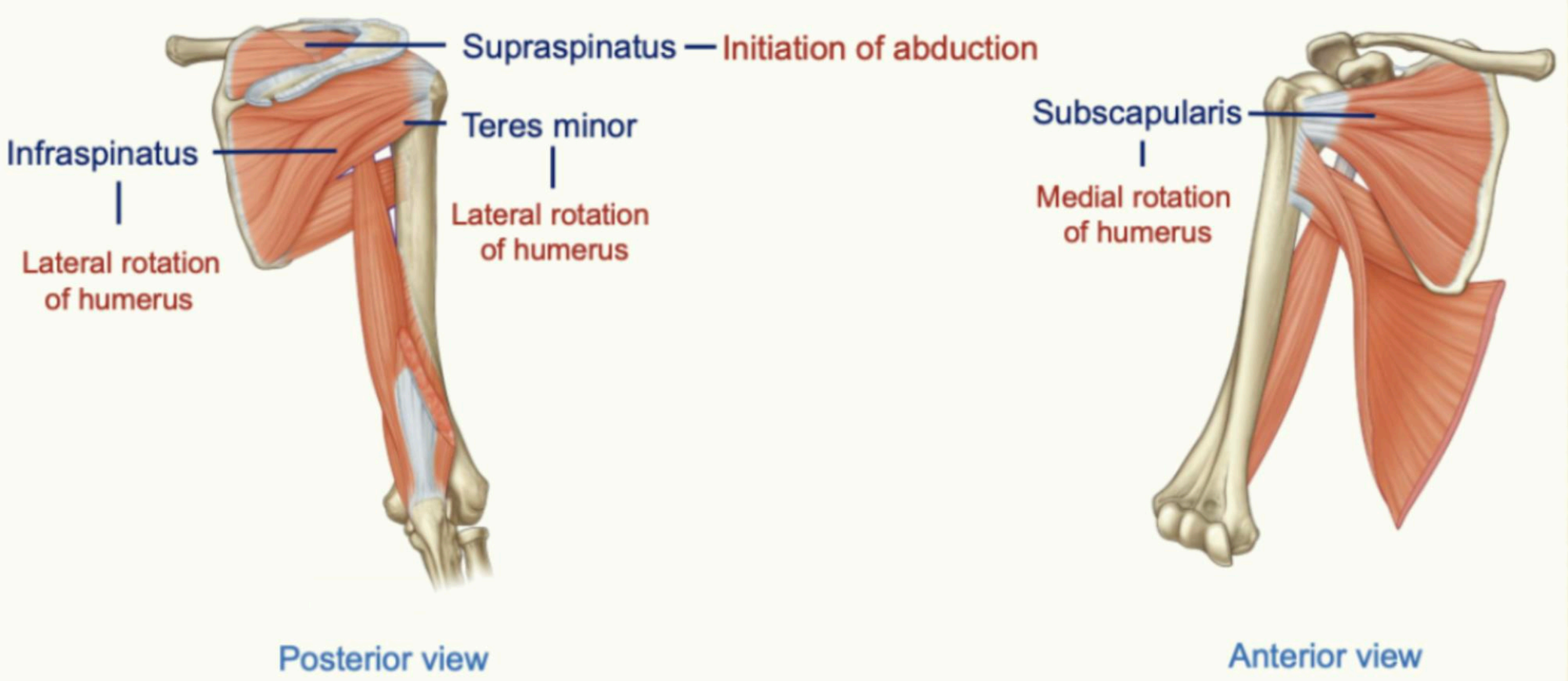
- Capitulum = articulates with radius (round head)
- Trochlea = articulates with ulna







Rotator cuff muscles



Innervation of the upper limb (Brachial Plexus)

- Read That Damn Cadaver Book = roots -> trunks -> divisions -> cords -> branches (terminal nerves)
- Cords are arranged around 2nd part of axillary artery
- Median nerve is formed by lateral & medial cords
- LPM – lateral, posterior, medial
- Musculocutaneous nerve = lateral cord
- Radial nerve = posterior cord
- Ulnar nerve = medial cord

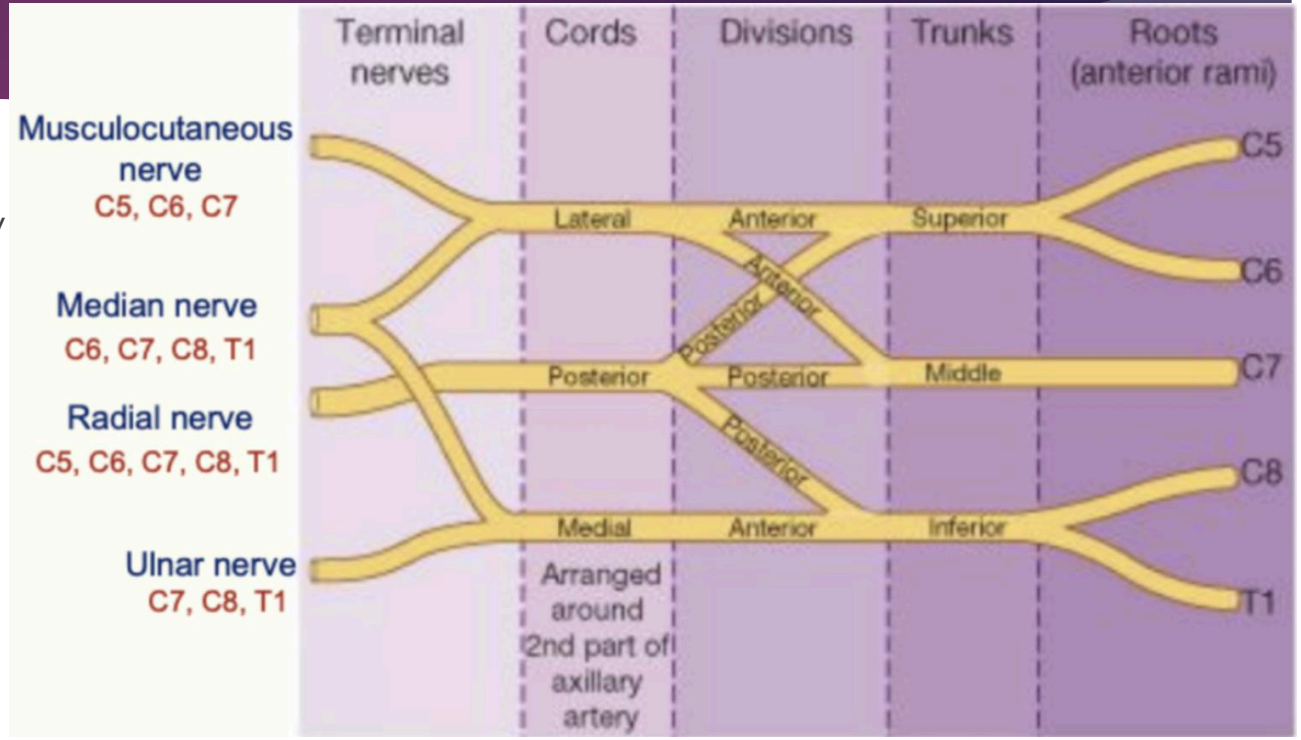
- MMRU, 3 4 5 3- Measles Mumps Rubella Umbrella

-> Musculocutaneous = C5, C6, C7

-> Median = C6, C7, C8, T1

-> Radial = C5, C6, C7, C8, T1

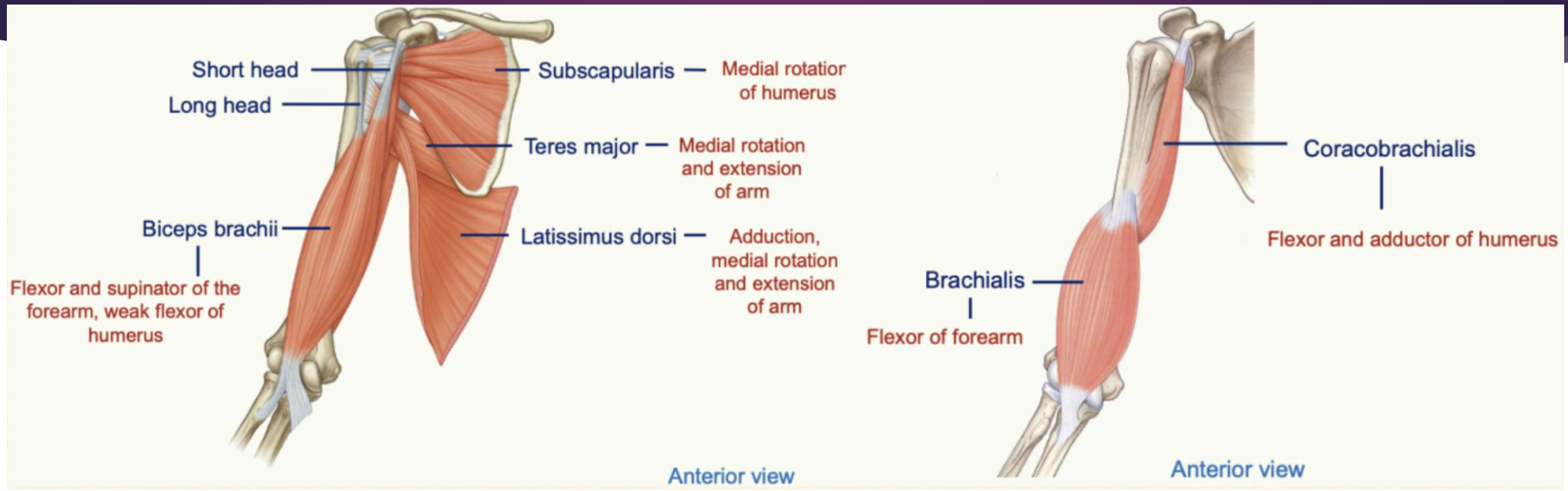
-> Ulnar = C7, C8, T1



T1 is present in all EXCEPT musculocutaneous

Nerve roots are ALWAYS in order

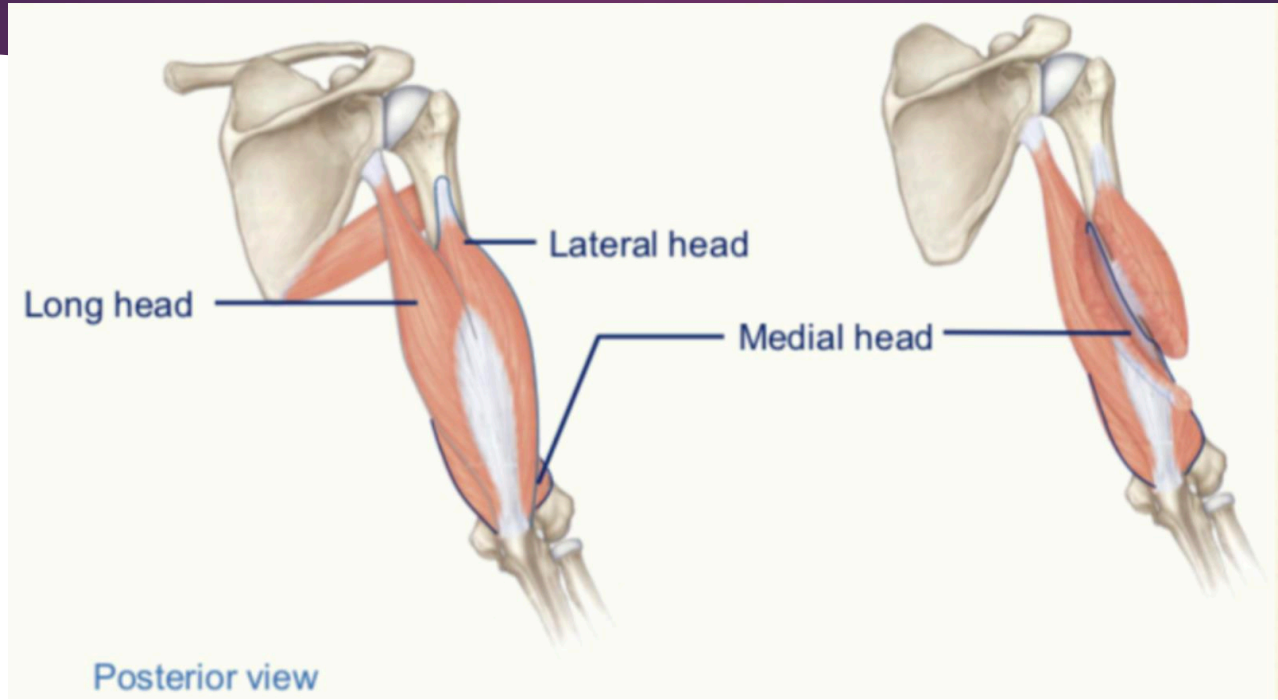
Anterior compartment of arm



BBC (biceps brachii, brachialis, coracobrachialis)

- Innervated by musculocutaneous nerve
- Biceps brachii (long and short heads) – flexor & supinator of the forearm + weak flexor of humerus
- Brachialis - flexor of forearm
- Coracobrachialis – flexor and adductor of humerus

Posterior compartment of arm

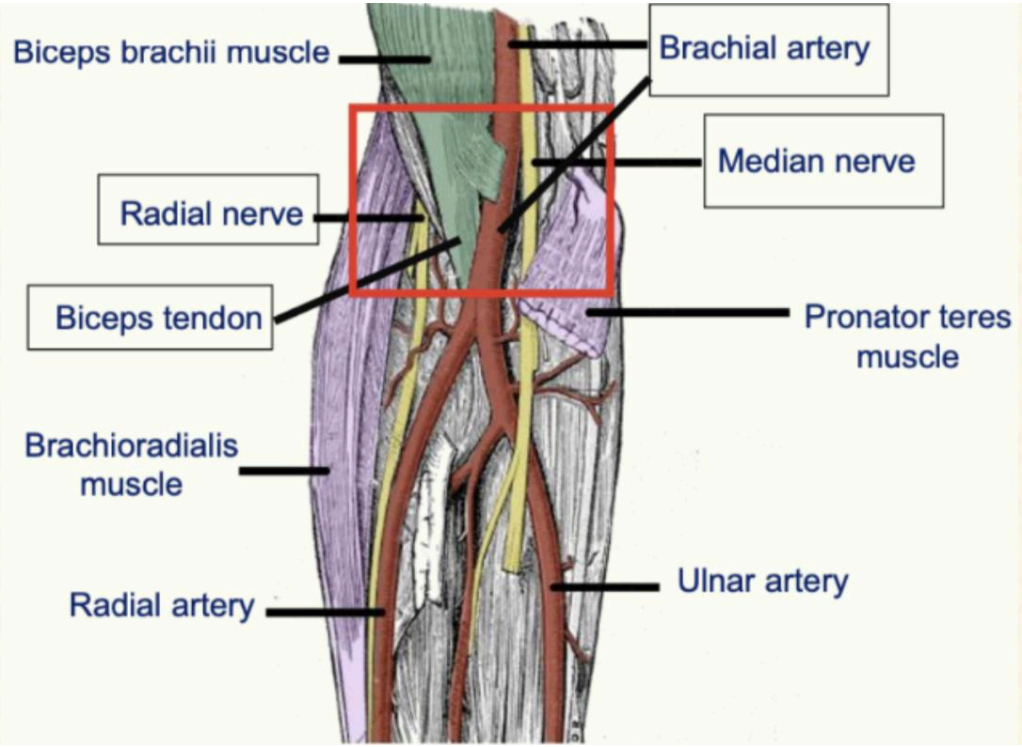


Medial, lateral & long heads of triceps brachii

- Innervated by radial nerve -> innervates posterior compartment of forearm too
- Triceps brachii – extension of forearm

Cubital fossa

- From lateral to medial: Radial nerve, Biceps brachii tendon, Brachial artery, Median nerve



Ligaments of elbow joint:

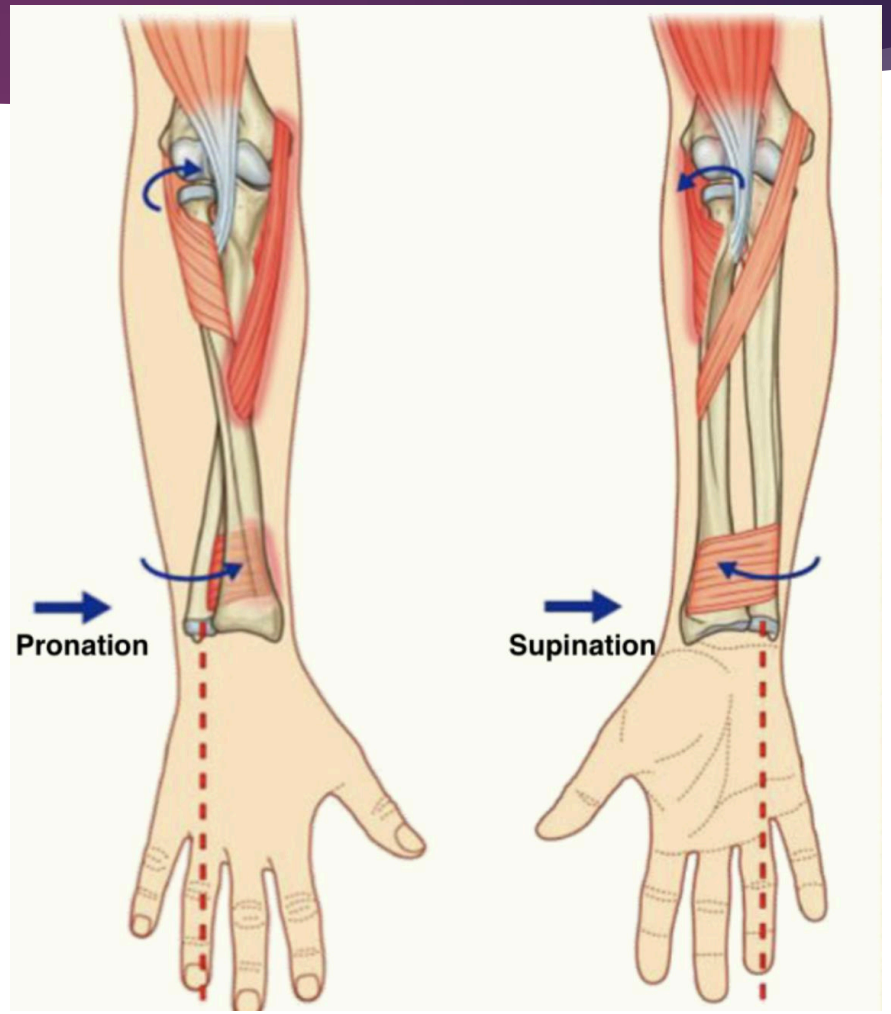
Muscles of pronation and supination

Primary muscles of supination:

- Biceps brachii
- Supinator (posterior- deep layer)

Primary muscles of pronation:

- Pronator quadratus (anterior- deep layer)
- Pronator teres (anterior- superficial layer)



Muscles of the forearm

- Anterior compartment of forearm (flexors) =
- Deep, middle & superficial layers
- Innervated by median nerve
- EXCEPT for flexor carpi ulnaris & medial
- half of flexor digitorum profundus (innervated
- by ulnar nerve)

Deep (3):

- Pronator quadratus
- Flexor digitorum profundus
- Flexor pollicis longus

Middle (1):

- Flexor digitorum superficialis

Superficial (4):

- Pronator teres
- Palmaris longus
- Flexor carpi ulnaris
- Flexor carpi radialis

- Posterior compartment of forearm (extensors) =
- Deep & superficial layers
- Innervated by radial nerve

Superficial (7): BEEEEEA

- Brachioradialis
- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Extensor carpi ulnaris
- Extensor digitorum
- Extensor digiti minimi
- Anconeus

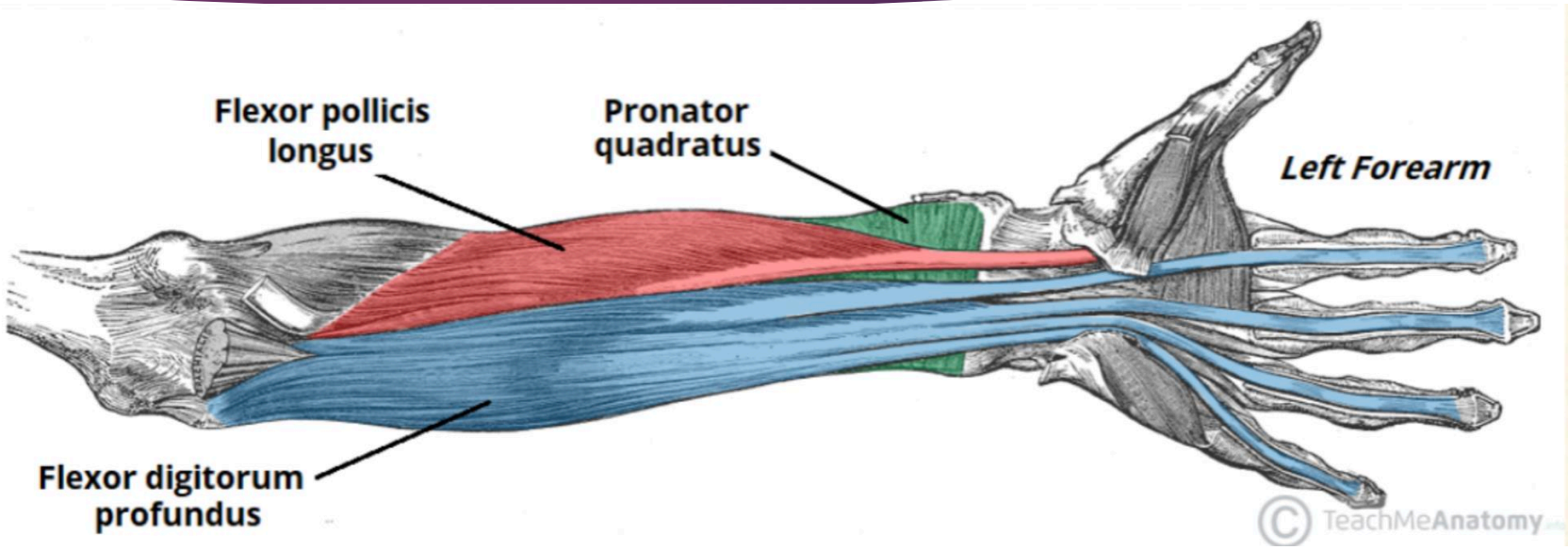
Deep(5): SEEEA

- Supinator
- Extensor pollicis brevis
- Extensor pollicis longus
- Extensor indicis
- Abductor pollicis longus

Anterior compartment of forearm (flexors)

Deep (3):

- Pronator quadratus
- Flexor digitorum profundus
- Flexor pollicis longus



- Flexor digitorum profundus

-> inserts on distal phalanges

-> flexes distal interphalangeal joints

- Flexor digitorum superficialis (in middle layer)

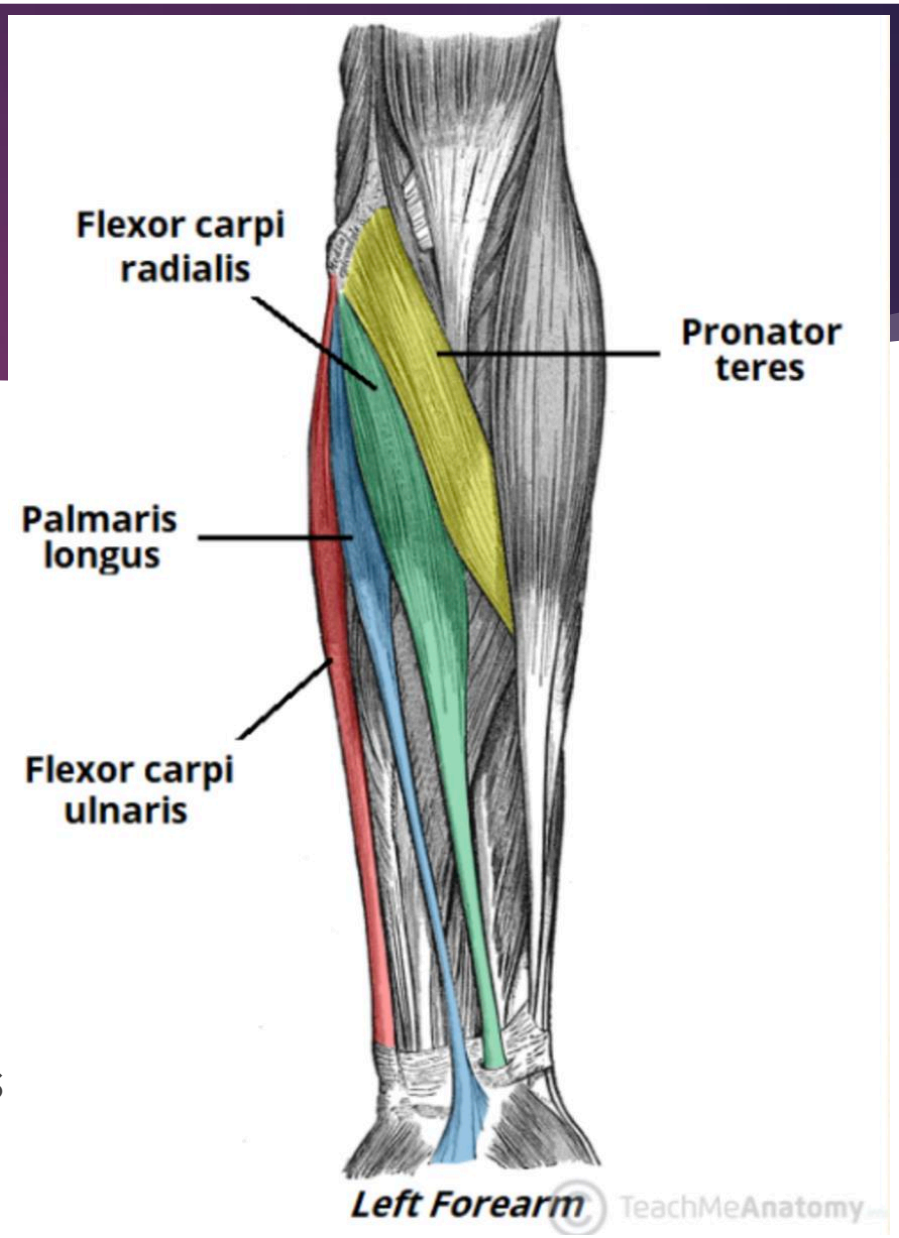
-> inserts on middle phalanges

-> flexes proximal interphalangeal joints

Superficial (4):

- Pronator teres
- Palmaris longus
- Flexor carpi ulnaris
- Flexor carpi radialis

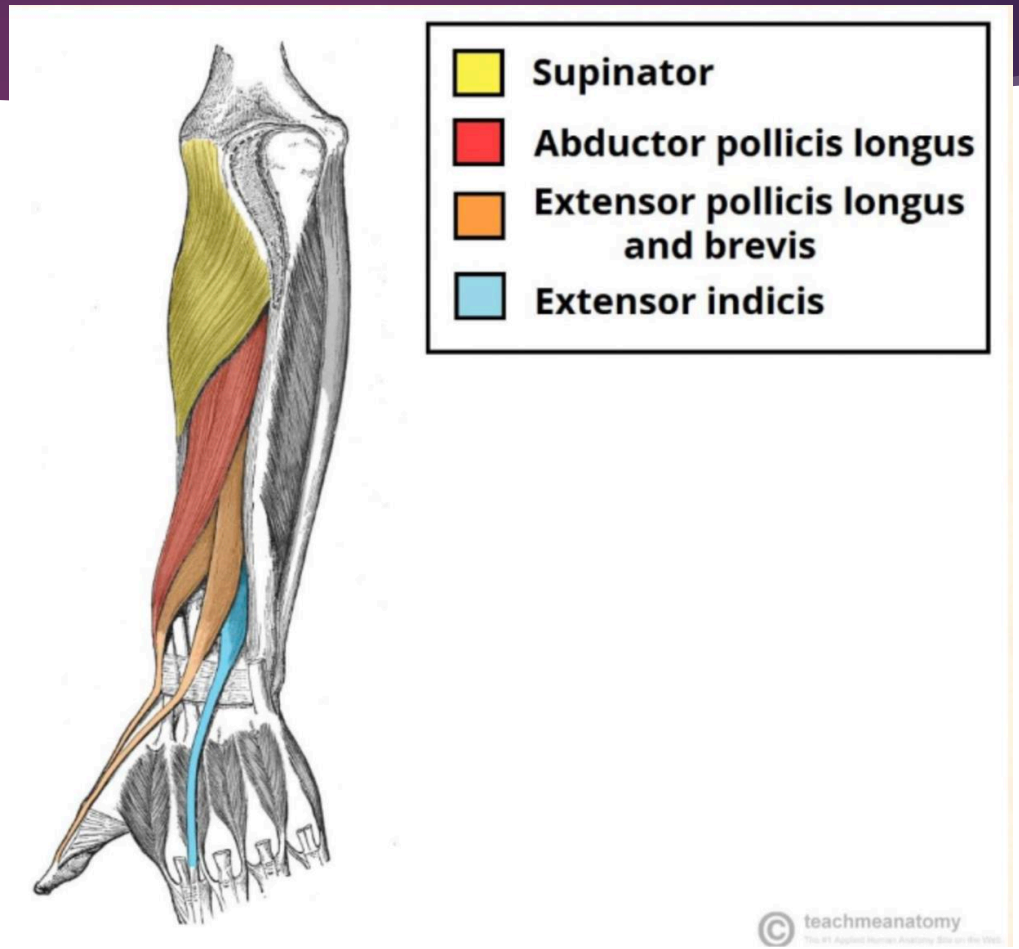
Common origin on medial epicondyle of humerus

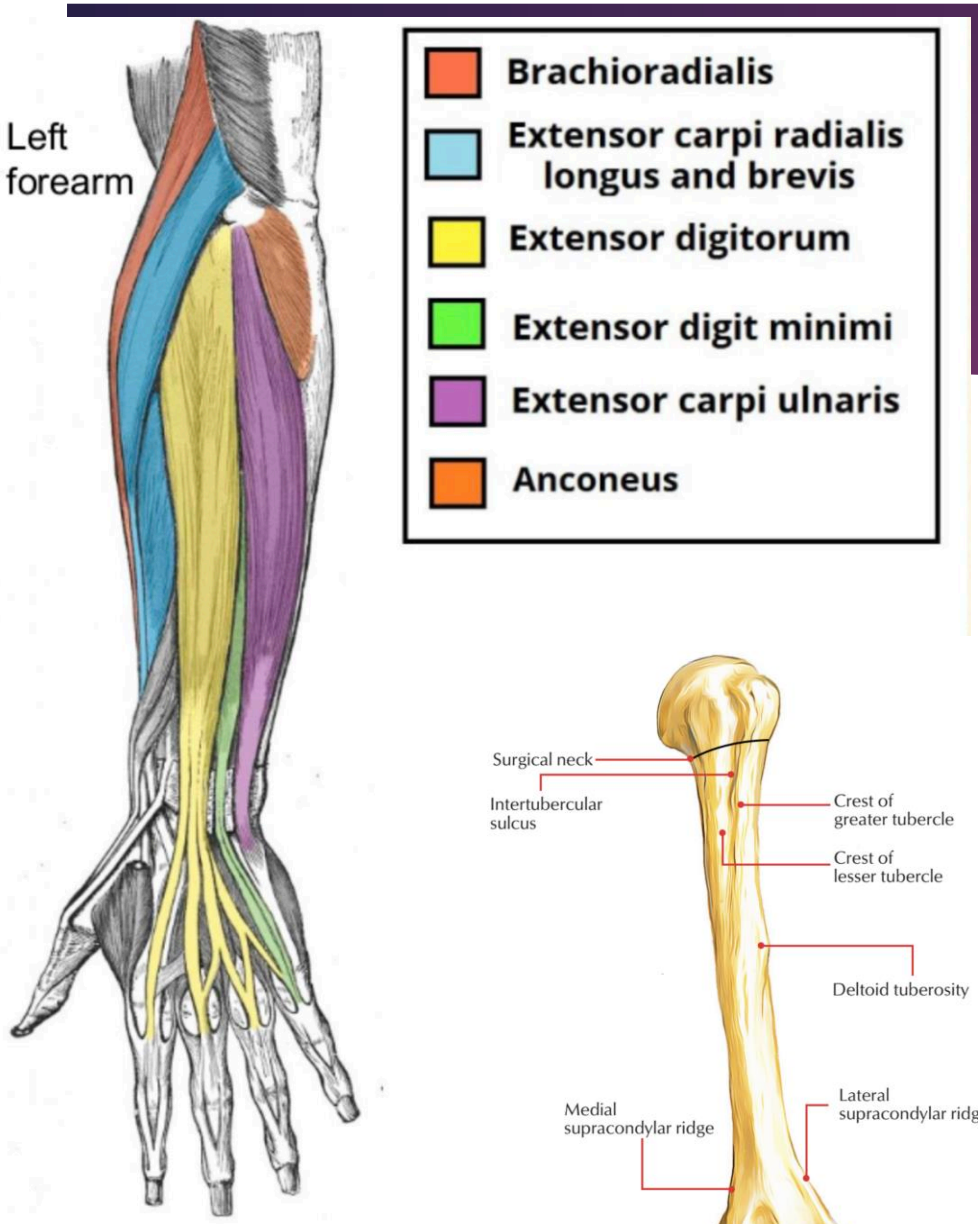


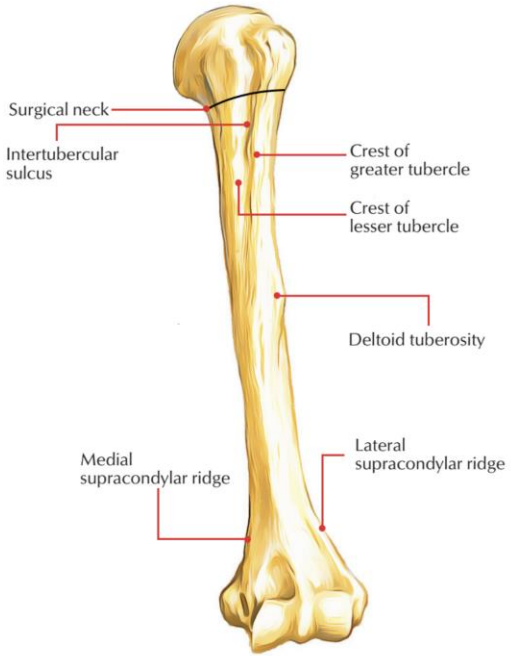
Posterior compartment of forearm (extensors)

Deep (5): SEEEA

- Supinator
- Extensor pollicis brevis
- Extensor pollicis longus
- Extensor indicis
- Abductor pollicis longus







Superficial (7): BEEEEEA

- Brachioradialis -> accessory extensor of elbow (it is anterior to joint)
- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Extensor carpi ulnaris
- Extensor digitorum
- Extensor digiti minimi
- Anconeus

- Common origin on lateral epicondyle of humerus

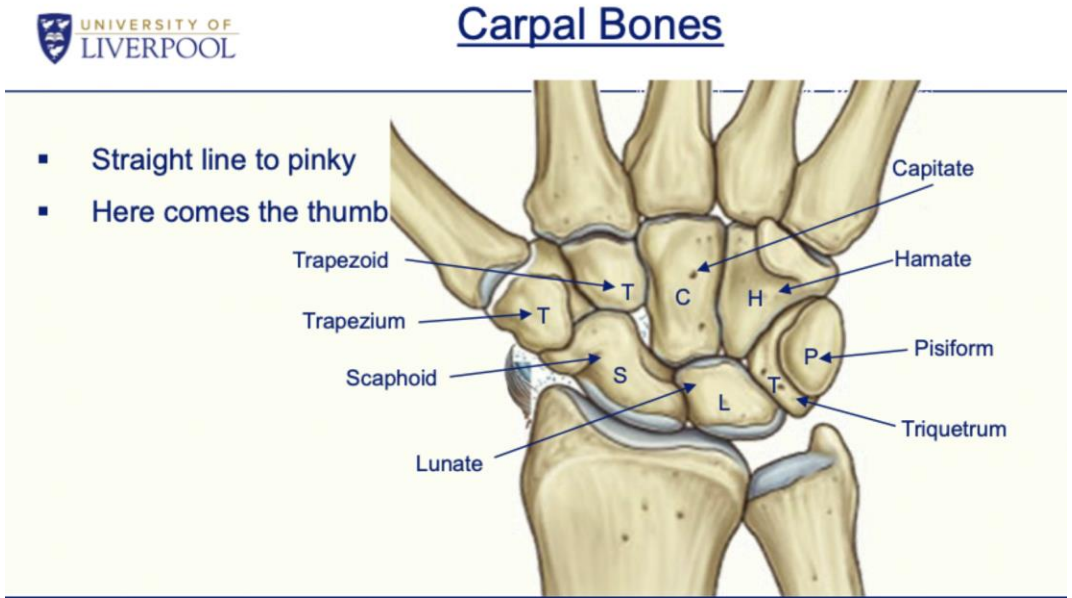
Apart from…

- Brachioradialis (originates from lateral supracondylar ridge of humerus)
- Extensor carpi radialis longus (originates from supracondylar ridge of humerus)

Carpal bones

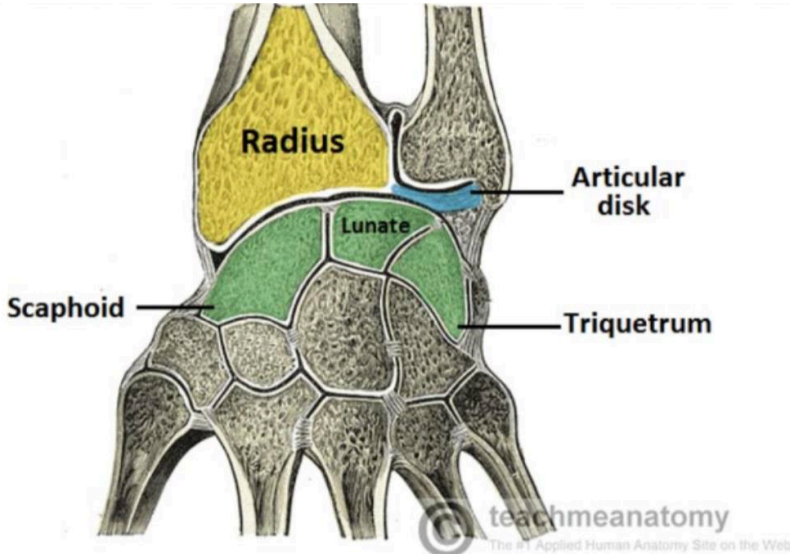
- Straight Line To Pinky Here Comes The Thumb

- Capitate = largest carpal bone
- Hamate has a hook (hook of Hamate)
- Pisiform is a sesamoid bone



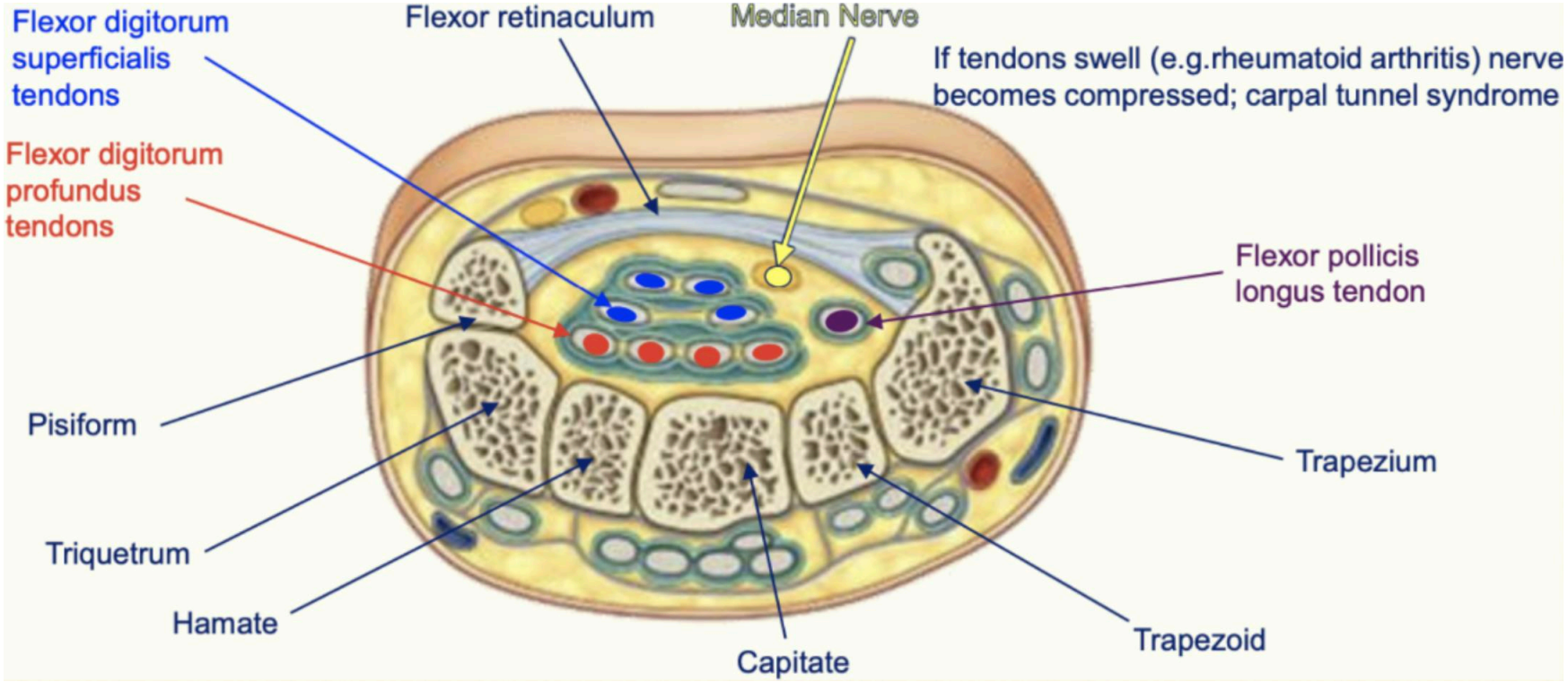
Wrist joint = condyloid joint

- Articulation between 4 bones: radius, scaphoid, lunate + triquetrum
- Articular disc overlies distal end of ulna -> ulna IS NOT part of wrist joint
- Carpal bones form a convex surface, which articulates with the concave surface of the radius and articular disc



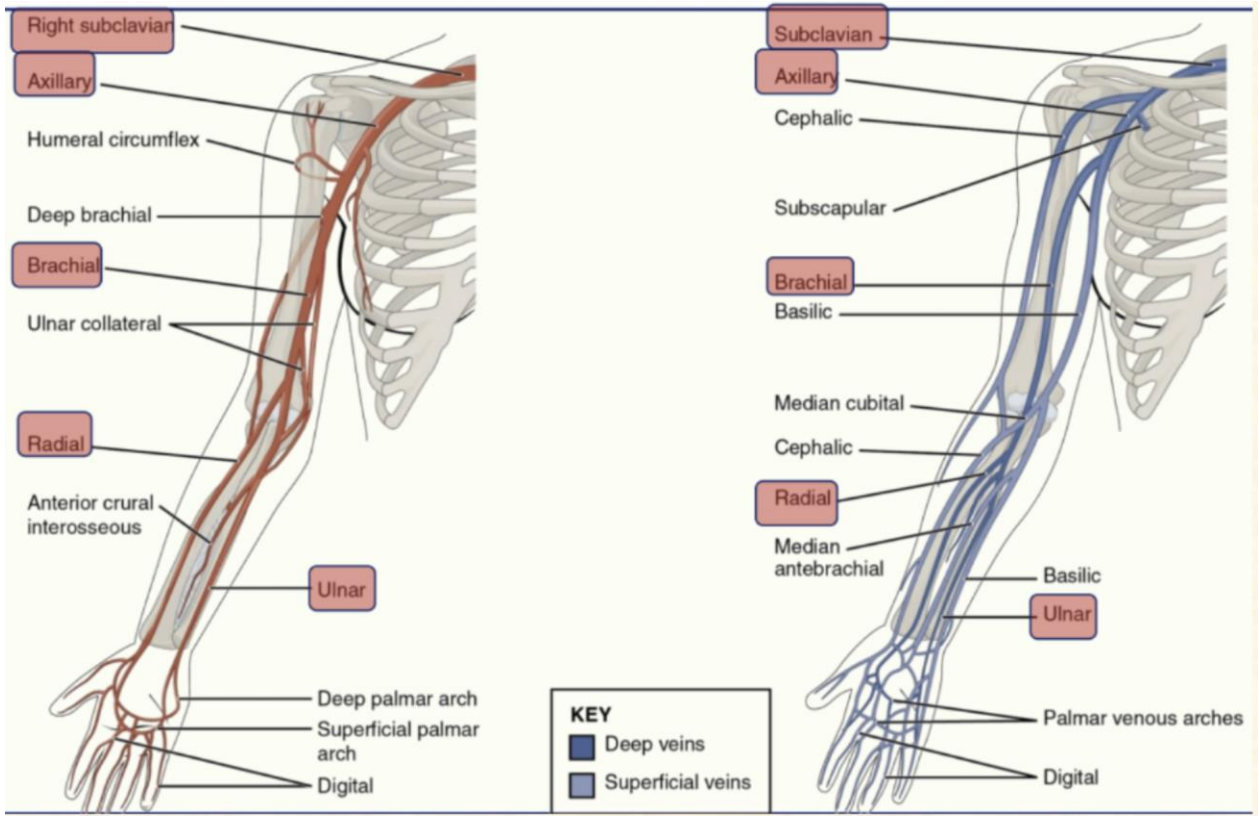
Carpal Tunnel

- Roof formed by flexor retinaculum
- Carpal tunnel syndrome = caused by compression of median nerve



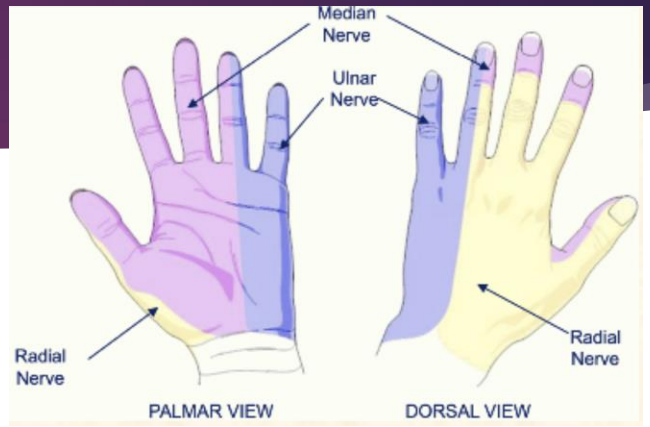
Vasculature of upper limb

- Median cubital vein = common site of venepuncture
- Formed by cephalic & basilic veins



Sensory innervation of the hand

- Dorsum of hand (posterior) = mainly radial
- Palm of hand (anterior) & tips of digits = mainly median
- Ulnar side (5th digit & medial half of 4th) = ulna



Radial nerve:
- Motor to muscles in posterior compartment of arm & forearm
- Supplies no intrinsic muscles of hand
- Damage to radial nerve = wrist drop

Median nerve:
- Motor to muscles in anterior compartment of forearm EXCEPT flexor carpi ulnaris & medial half of flexor digitorum profundus
- Motor to thenar muscles in hand
- When severed in the elbow region -> can't flex 2nd & 3rd digits (Benediction sign)

Ulna nerve:
- Motor to flexor carpi ulnaris & medial half of flexor digitorum profundus
- Supplies all intrinsic muscles of hand EXCEPT thenar muscles
- Ulna nerve injury commonly occurs when the medial epicondyle fractures

Upper Limb Qs

Which cord of the brachial plexus gives rise to the radial nerve?

- Lateral
- Posterior
- Medial
- Median
- Anterior

Which of these muscles causes medial rotation of the humerus?

- Biceps brachii
- Teres minor
- Supraspinatus
- Subscapularis
- Deltoid

Which of these muscles is NOT innervated by the radial nerve?

- Brachioradialis
- Abductor pollicis brevis
- Medial head of triceps brachii
- Extensor digitorum
- Supinator

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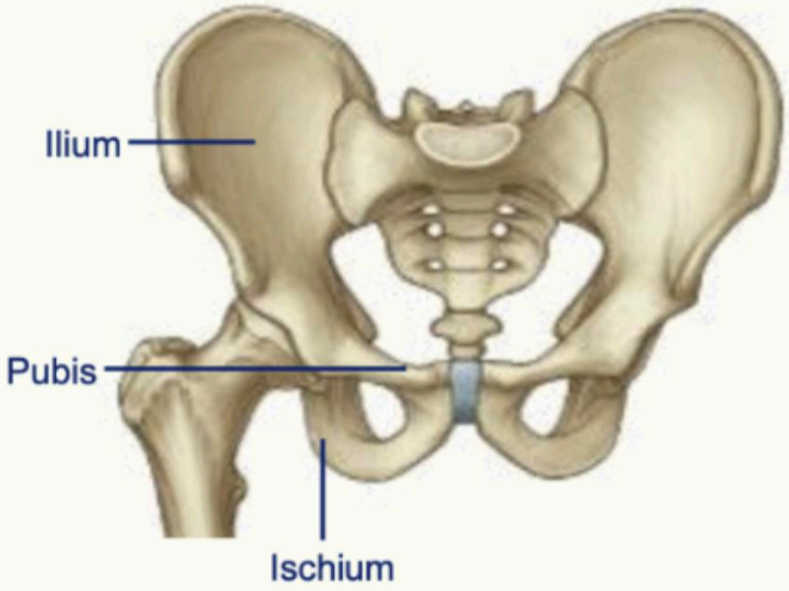
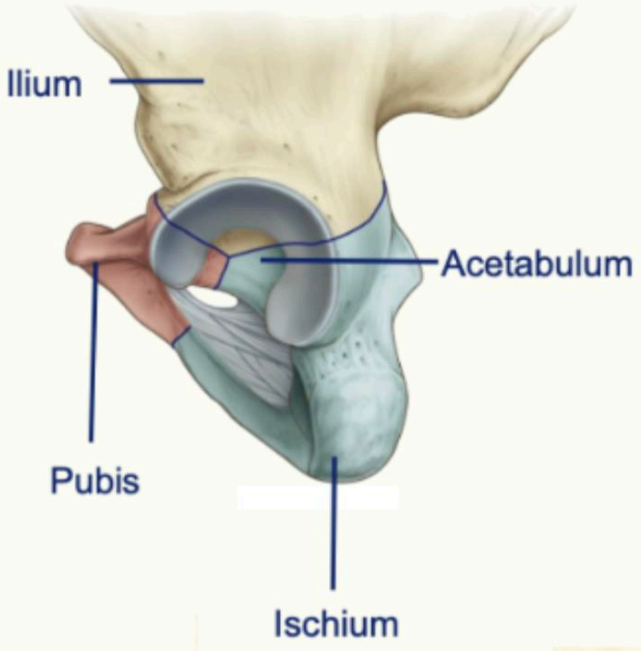
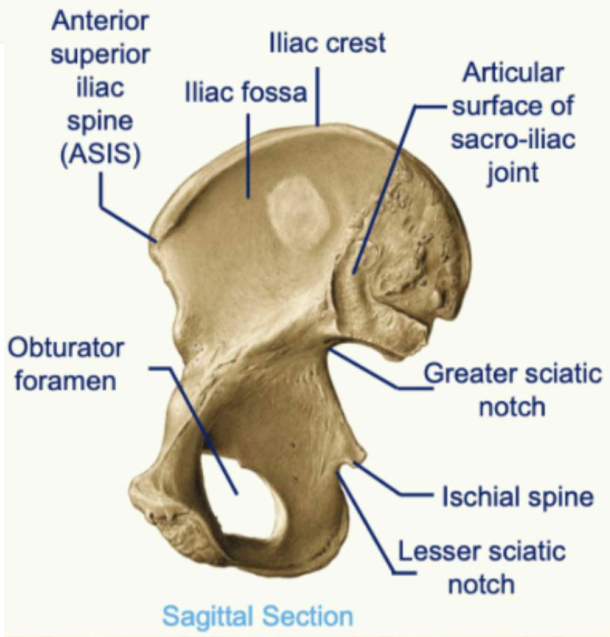
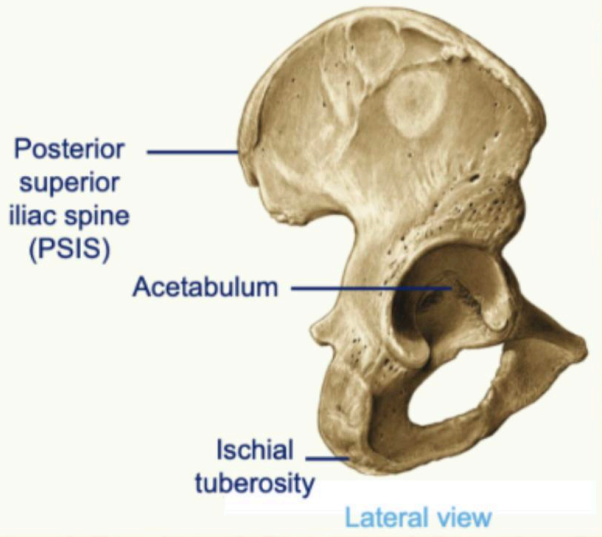
LOWER LIMB


Ilium
Pubis
Ischium

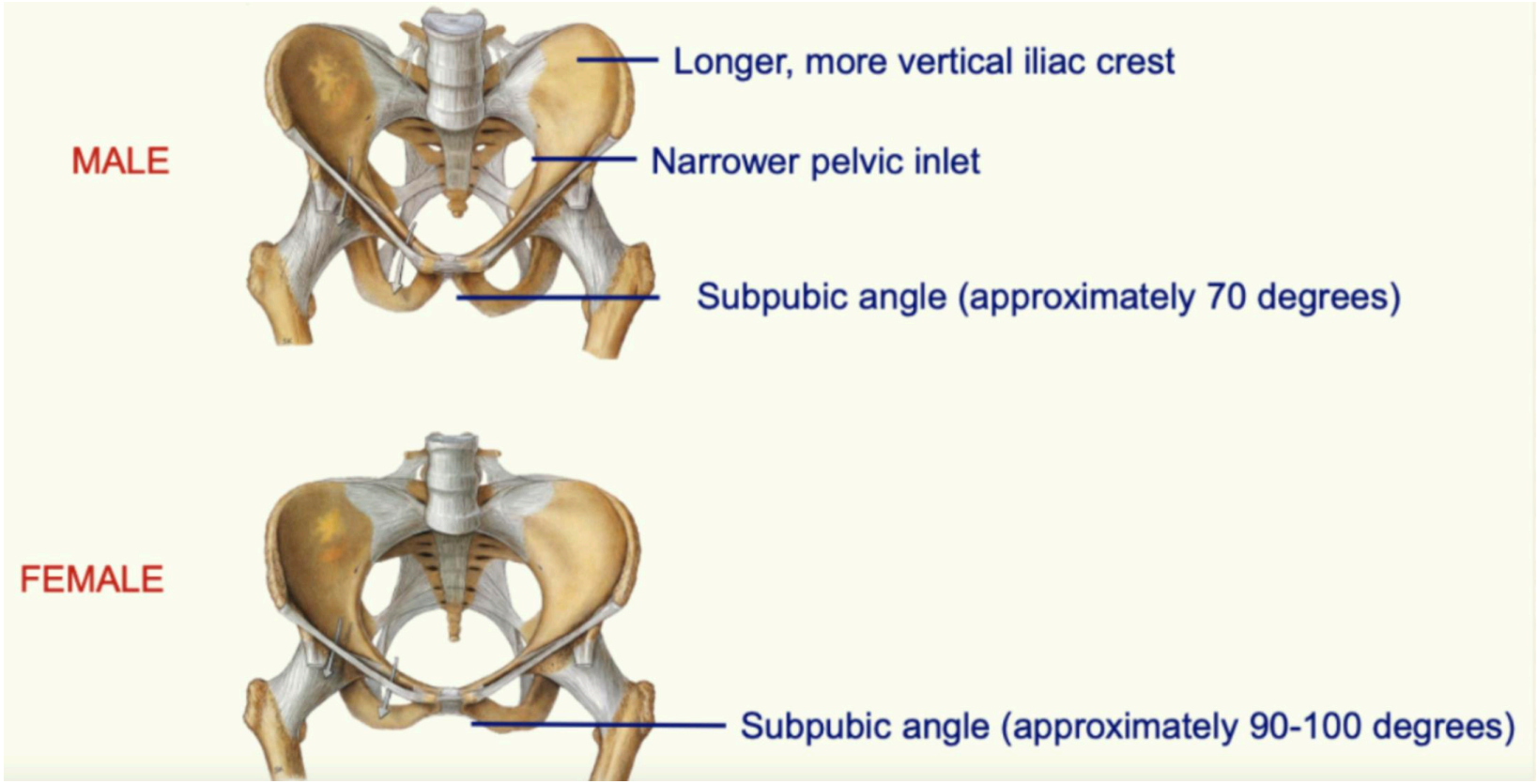

Ilium
Acetabulum
Pubis
Ischium


Anterior superior iliac spine (ASIS)
Iliac crest
Iliac fossa
Articular surface of sacro-iliac joint
Obturator foramen
Greater sciatic notch
Ischial spine
Lesser sciatic notch
Sagittal Section


Posterior superior iliac spine (PSIS)
Acetabulum
Ischial tuberosity
Lateral view

Male vs Female Pelvis

- Larger sub-pubic angle in female pelvis & wider pelvic inlet -> adapted for childbirth

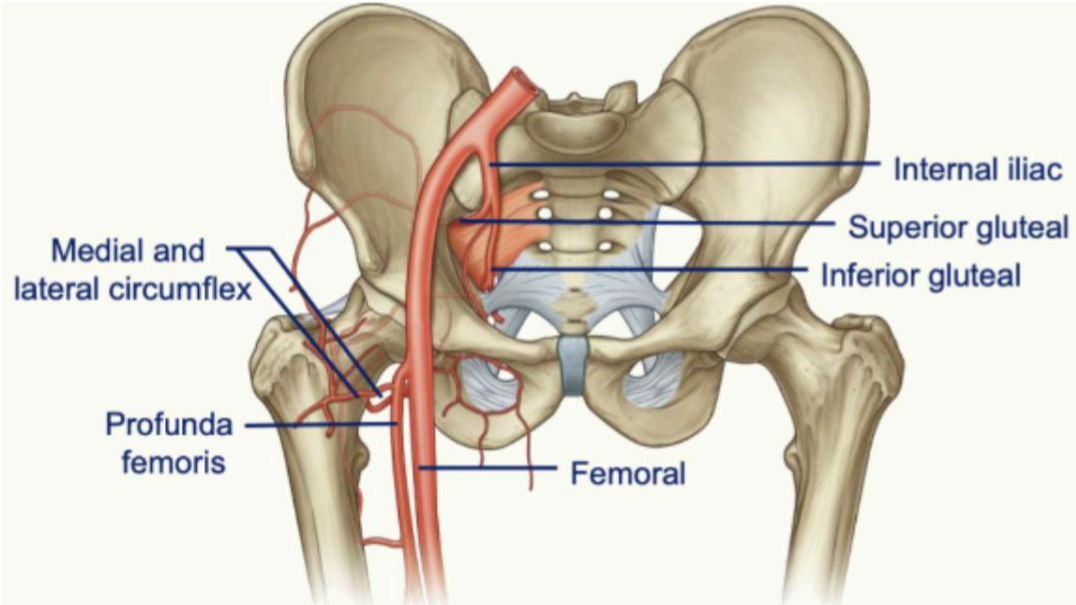


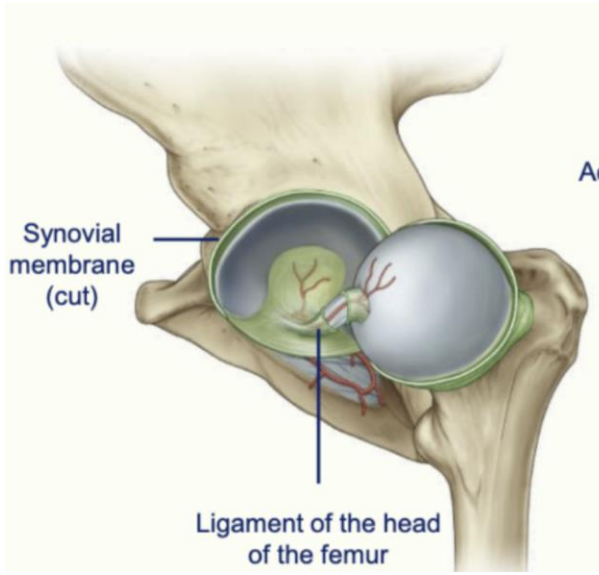
The Hip Joint

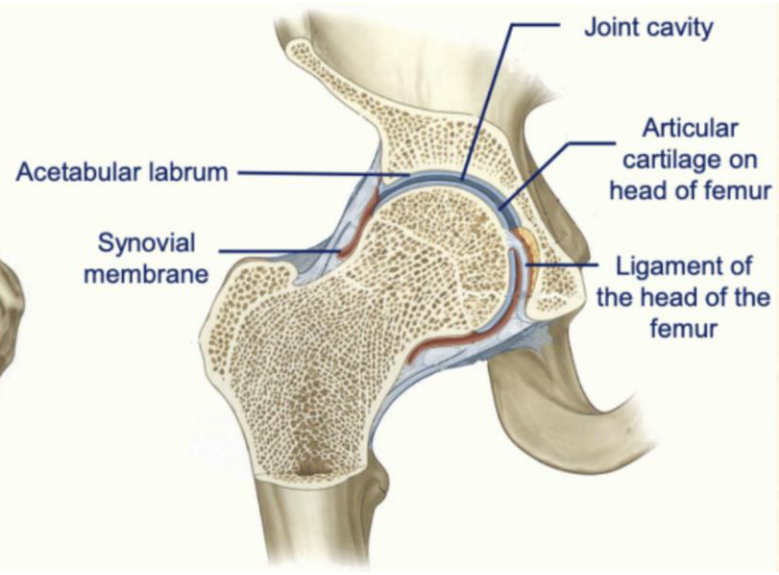
Ball-and-socket joint

- Acetabulum = socket
- Head of femur = ball

- Blood supply to the femoral head comes from the medial & lateral circumflex branches (of the profunda femoris)
- The lateral epiphyseal artery is the main blood supply of the femoral head.

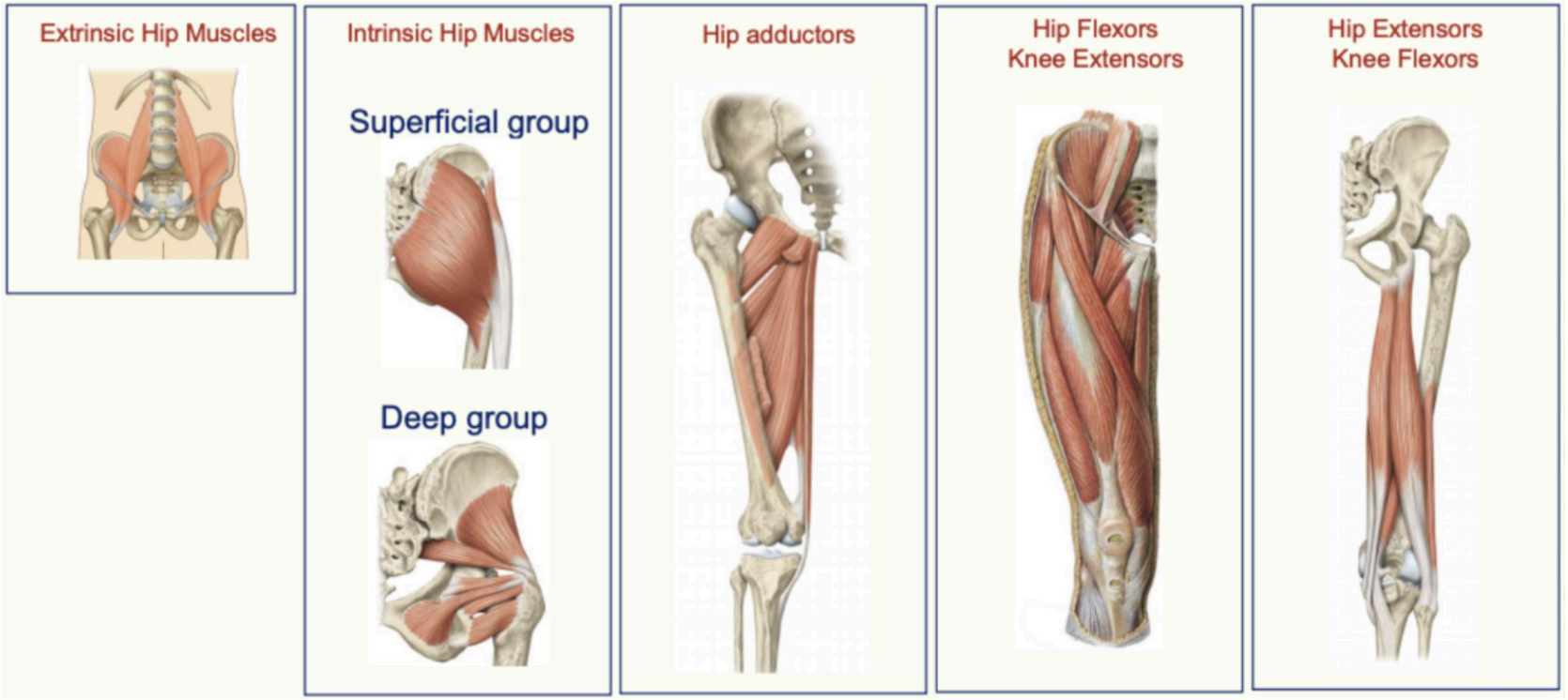


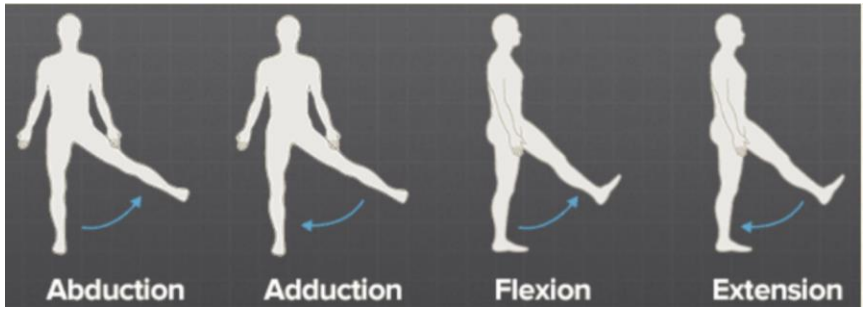




Classification of hip muscles

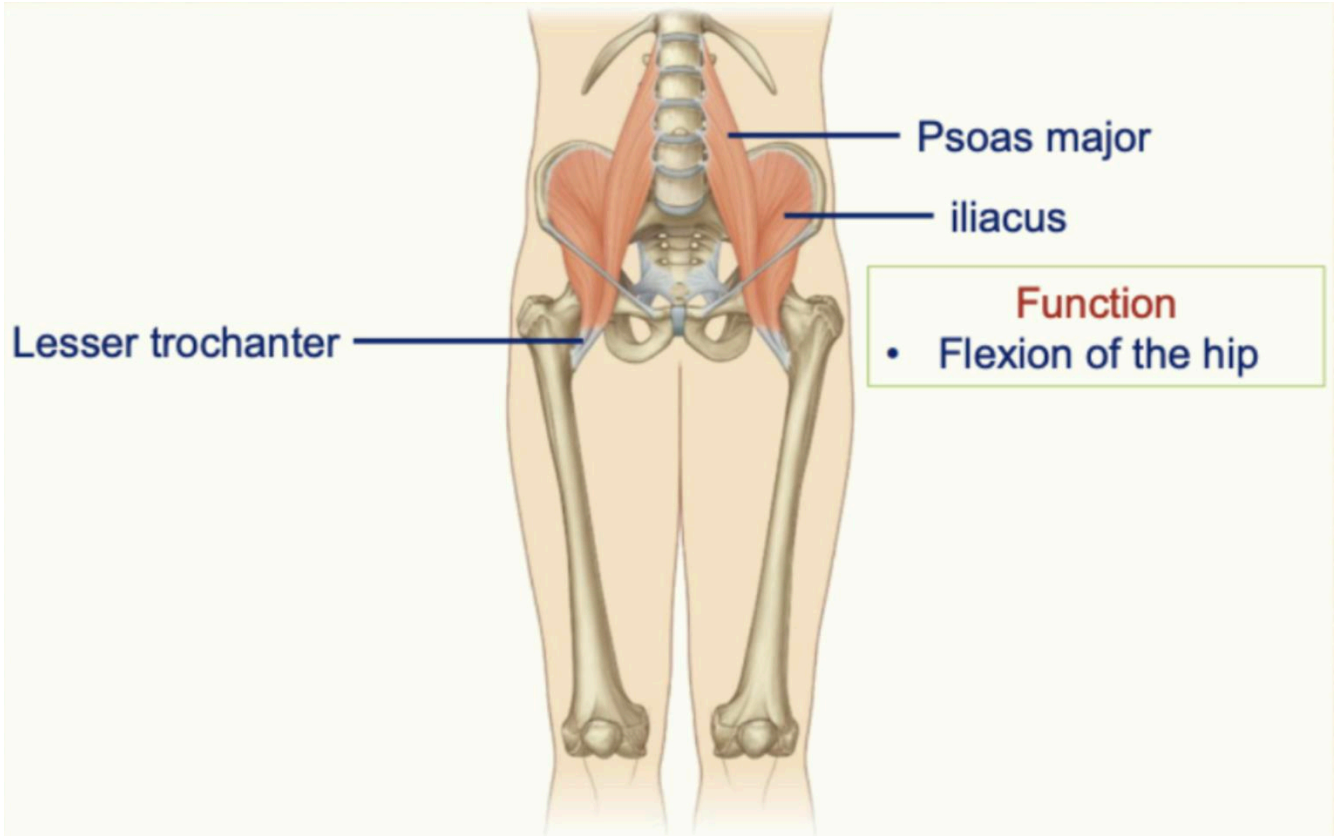
- Innervation - lumbosacral plexus gives rise to femoral, sciatic & obturator nerves





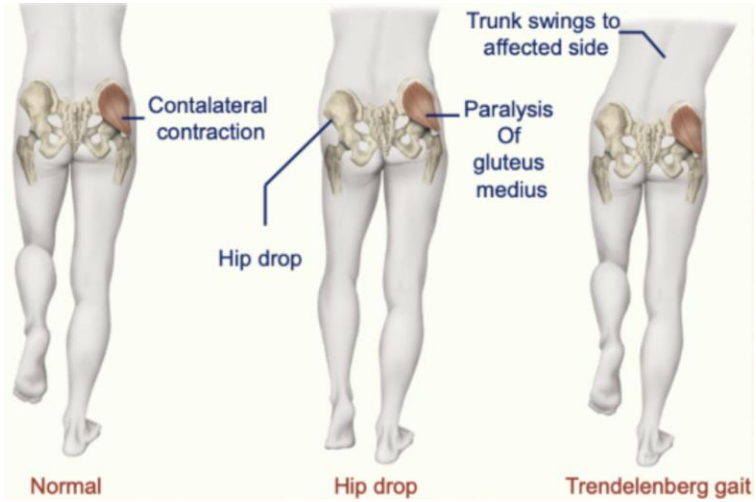
Extrinsic hip muscles

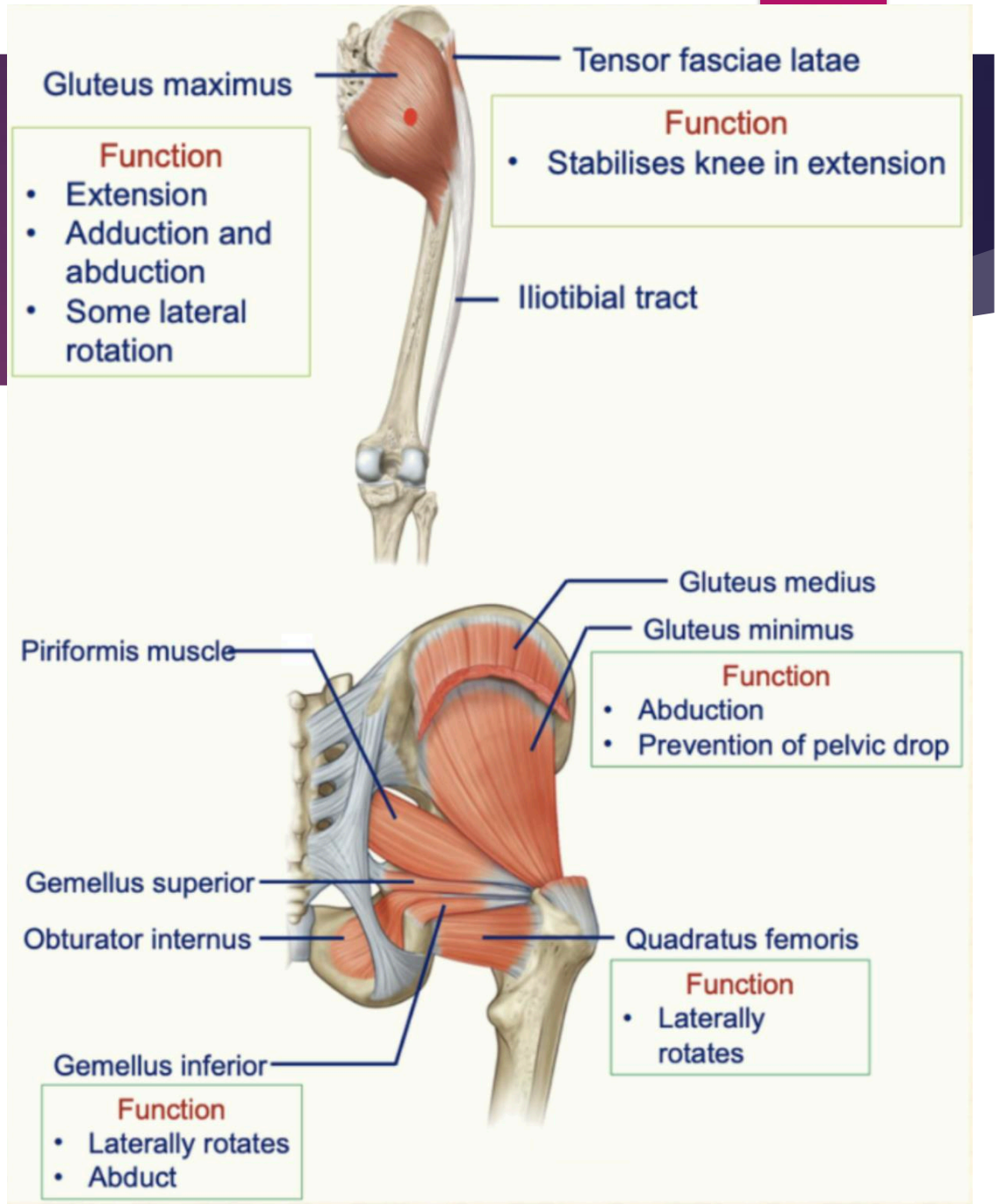
- Iliacus + psoas major muscles -> iliacus
- Allows hip flexion



Intrinsic hip muscles

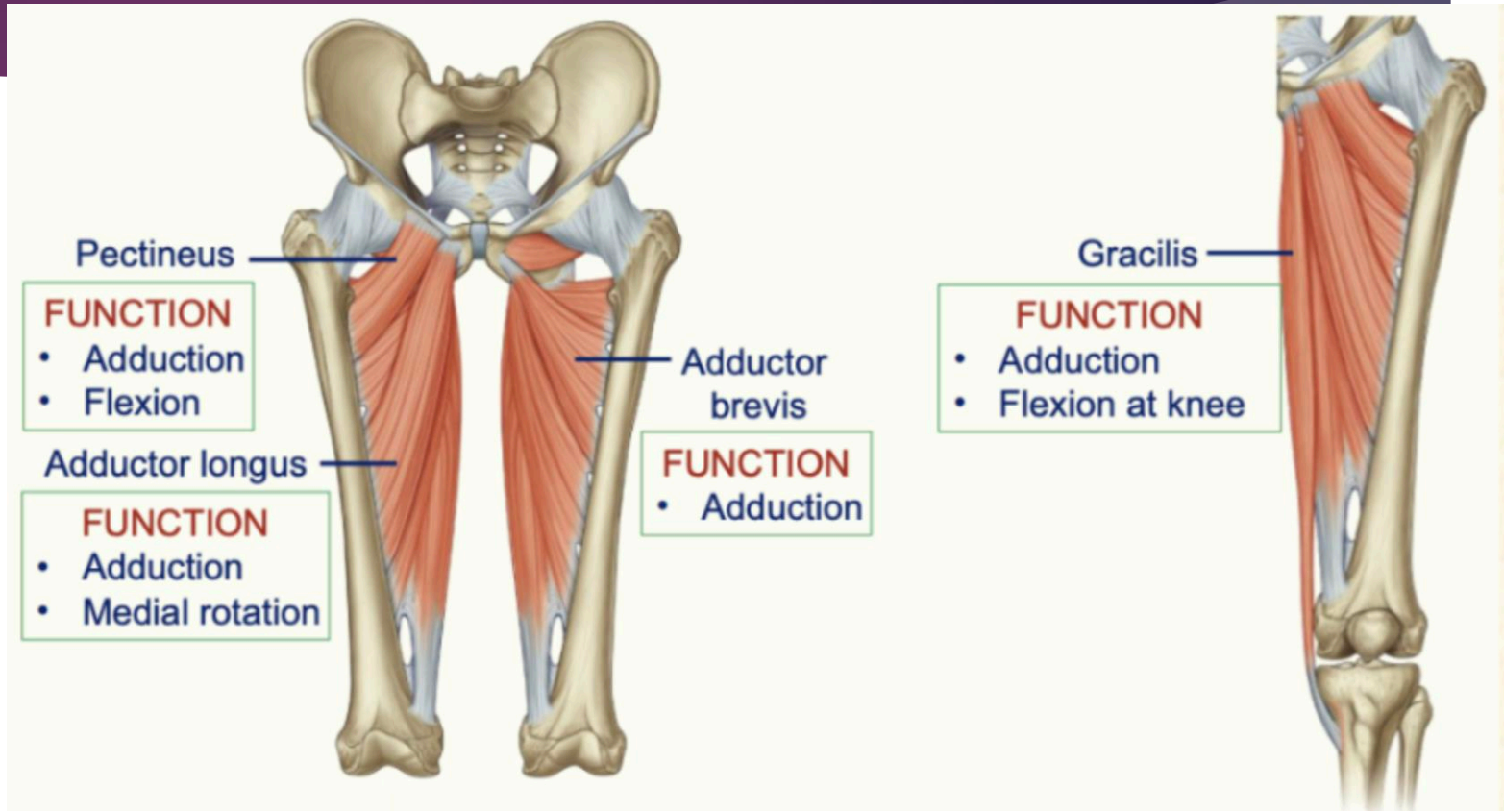
- Superficial = gluteus maximus -> most powerful hip extensor
- Deep = gluteus medius & gluteus minimus -> both abduct hip
- Excessive hip drop is primarily a result of weakness in the gluteus medius





Hip adductors

- Thigh has three compartments- anterior, posterior & medial
- Hip adductors = medial compartment
- Adductor magnus = most powerful adductor
- Innervated by obturator nerve (L2 – L4); motor to hip adductors

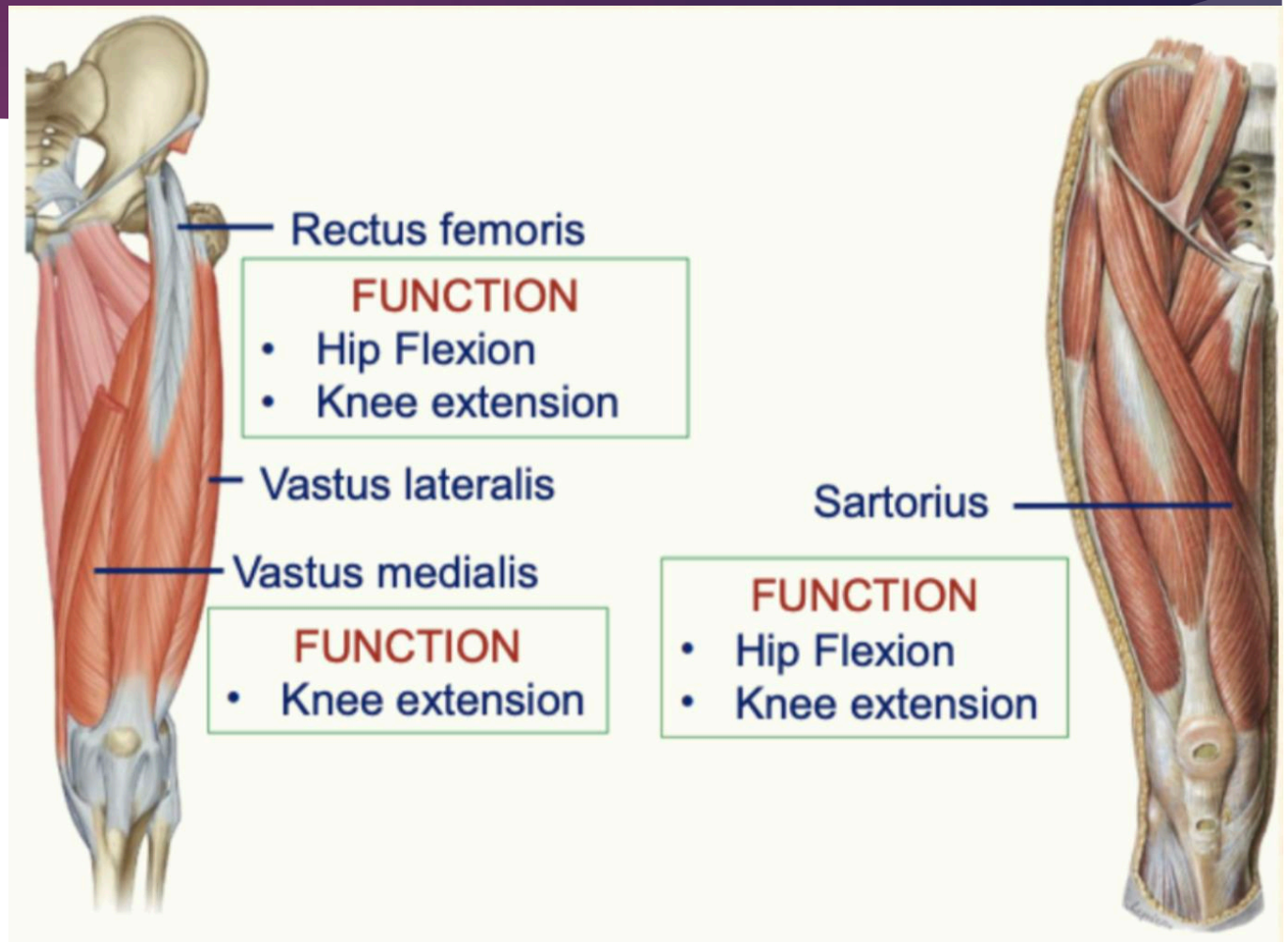


Hip flexors

Hip flexors/knee extensors = anterior compartment

4 muscles (quadriceps):

- Rectus femoris
- Vastus lateralis
- Vastus medialis
- Vastus intermedius (located underneath rectus femoris)
- Innervated by femoral nerve (L2 – L4); motor to quadriceps & sartorius



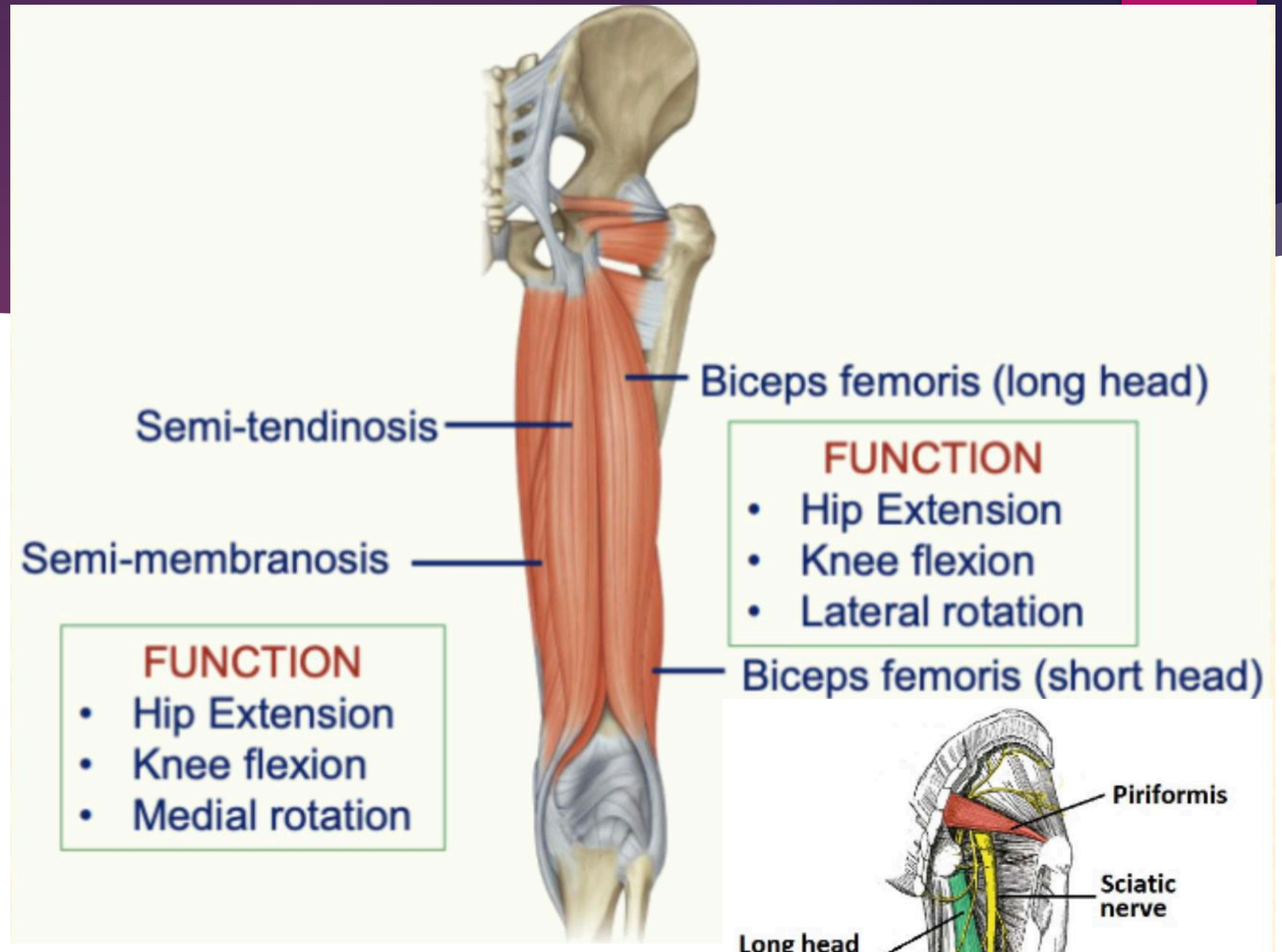
Hip extensors

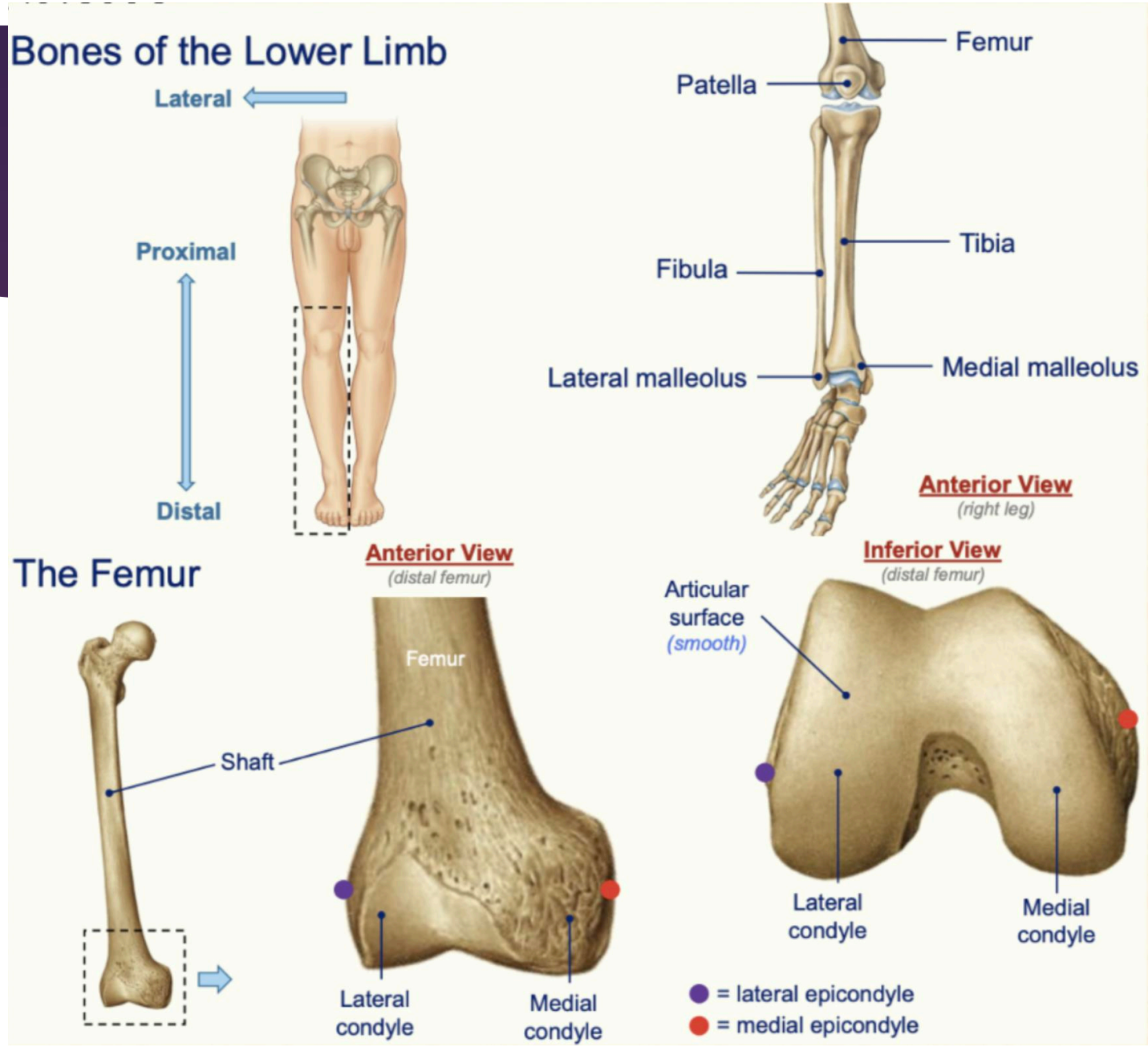
Hip extensors/knee flexors = posterior compartment (aka hamstrings)

3 muscles:

- Biceps femoris (long & short heads)
- Semi-tendinosis
- Semi-membranosis
- Innervated by sciatic nerve (L4 – S3); motor to hamstrings and ALL muscles of leg & foot

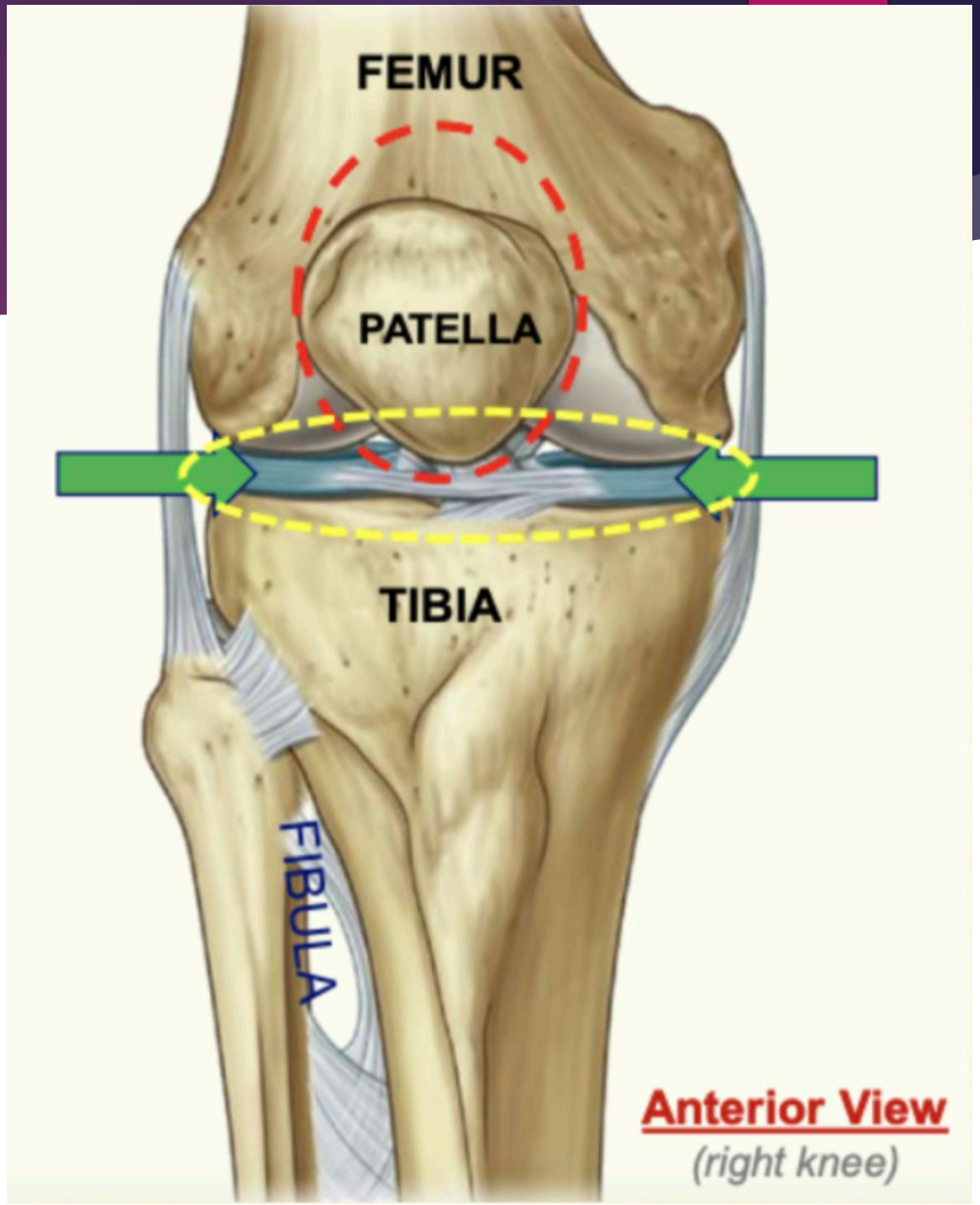
-> sciatic nerve splits into common peroneal & tibial nerves in popliteal fossa

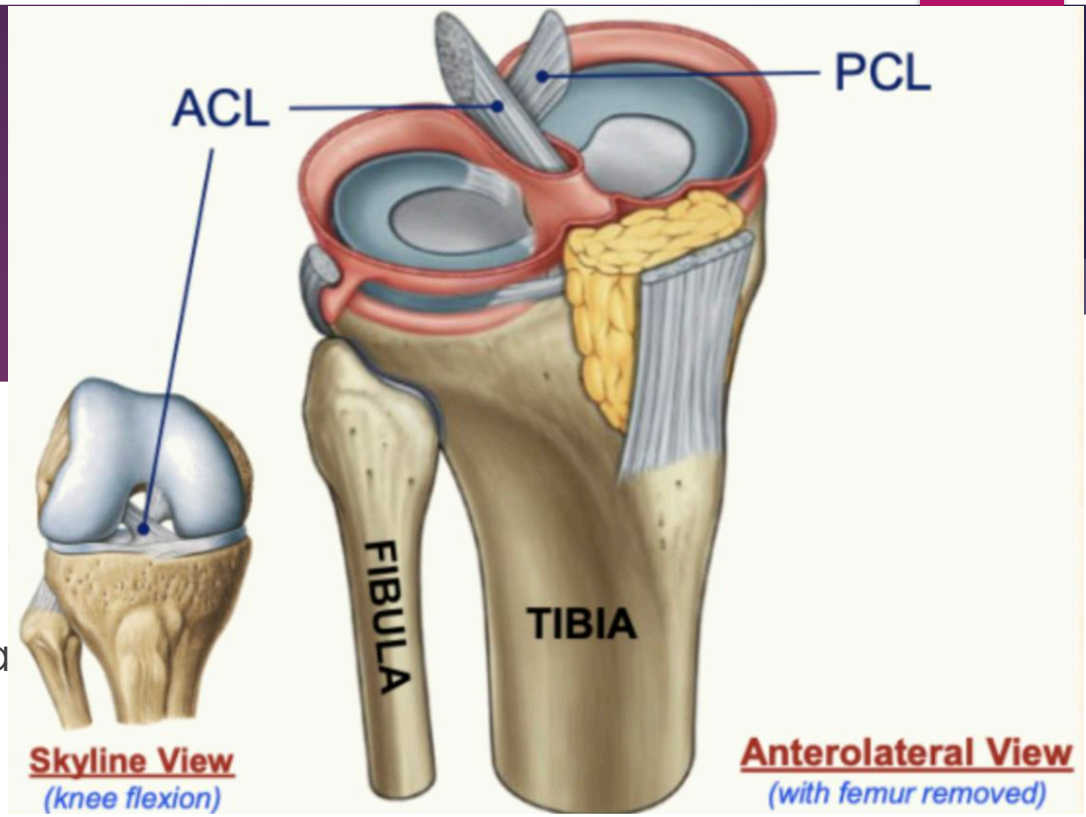



Bones of the Lower Limb
Lateral
Proximal
Distal
Femur
Patella
Tibia
Fibula
Lateral malleolus
Medial malleolus
Anterior View
(right leg)
The Femur
Anterior View
(distal femur)
Femur
Shaft
Lateral condyle
Medial condyle
Inferior View
(distal femur)
Articular surface
(smooth)
Lateral condyle
Medial condyle
= lateral epicondyle
= medial epicondyle

Knee Joint

- Synovial hinge joint; mostly flexion/extension but some rotation but some rotation and translation
- Composed of 3 bones – femur, tibia and patella
- 2 articulations- tibiofemoral joint & patellofemoral joint
- Lots of stabilising features- menisci, ligaments and muscles
- NB: Fibula NOT part of knee joint



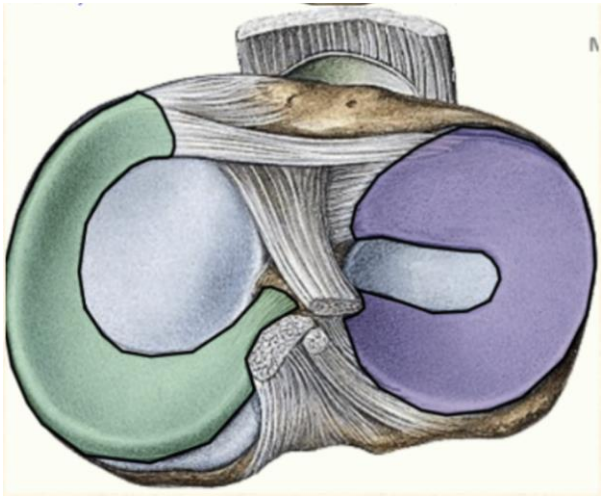


Ligaments are primary stabilisers, muscles are secondary:

- ACL (anterior cruciate ligament) – resist anterior tibial translation OR 'resist posterior femoral translation'
- PCL (posterior cruciate ligament) – resist posterior tibia translation OR 'resist anterior femoral translation'
- Also medial and lateral collateral ligaments

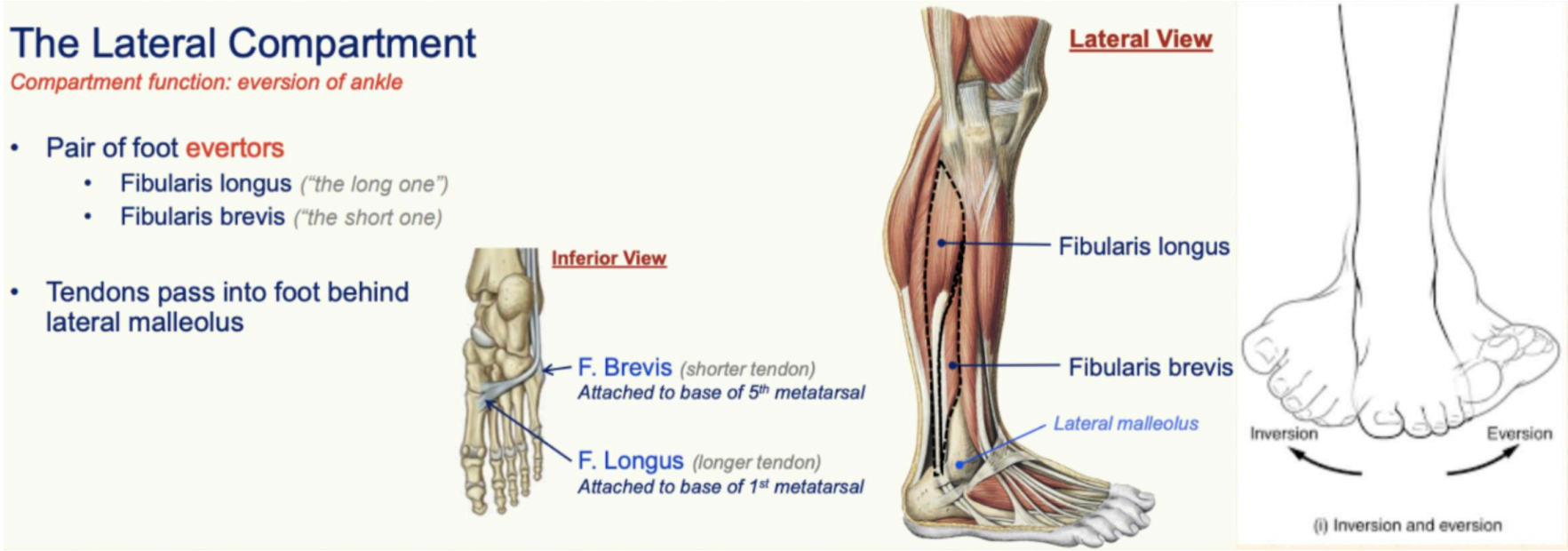
Menisci: function is to increase bony contact area, act as shock absorbers & also proprioception

- Medial= C-shaped, less mobile -> more risk of injury
- Lateral = almost O-shaped, more mobile -> less risk of injury



Lateral compartment of Leg

- Leg is split in 3 compartments- anterior, posterior & lateral
- Lateral component = eversion of foot
- Innervated by superficial fibular nerve
- - Fibularis longus & brevis



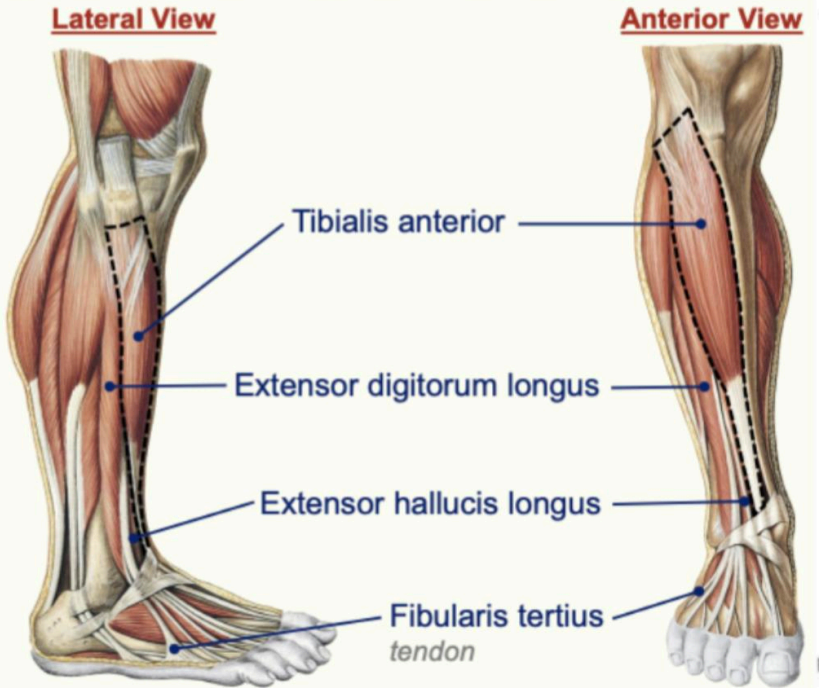
Anterior compartment of Leg

- Anterior component = dorsiflexion, inversion, extension of toes
- Innervated by deep fibular nerve
- Tibialis anterior, fibularis tertius (3rd evertor) & toe extensors

The Anterior Compartment

Compartment function: – dorsiflexion & inversion of ankle
– extension of toes

- **Tibialis anterior**
  - Primary dorsiflexor
  - Primary invertor *(because attached to medial surface of foot)*
- Fibularis tertius *("the third evertor")*
- Pair of toe extensors
  - Extensor hallucis longus *(big toe only)*
  - Extensor digitorum longus *(digits 2-5)*



(i) Inversion and eversion

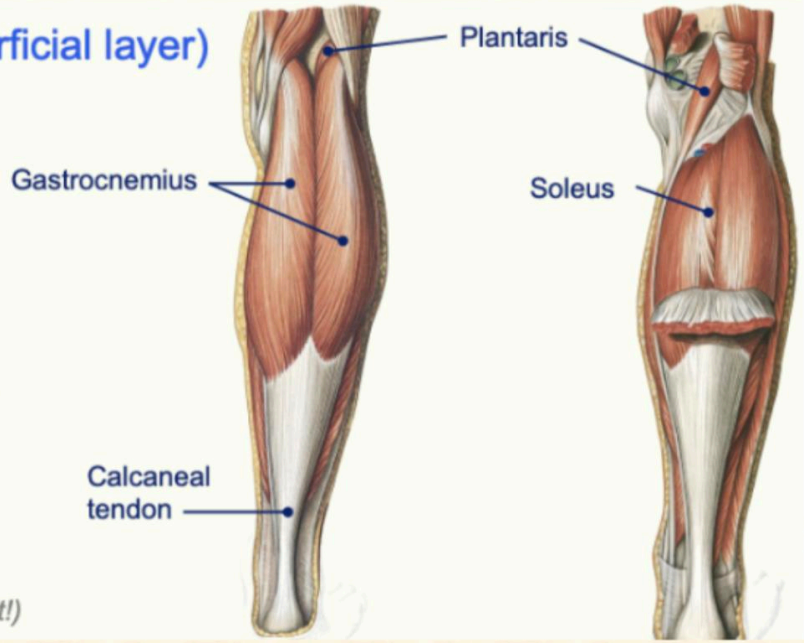
Posterior compartment of Leg

- Posterior component = plantarflexion, inversion, flexion of toes
- Innervated by tibial nerve
- Superficial layer = triceps surae (gastrocnemius + soleus) & plantaris
- Deep layer = tibialis posterior, popliteus & toe flexors

The Posterior Compartment (superficial layer)

Compartment function: – plantarflexion of ankle
– flexion of knee

- Triceps surae = "3 headed muscle of calf"
  - Gastrocnemius *(2 heads)*
  - Soleus *(1 head)*
  - Distally fuse as calcaneal tendon *("Achilles")*
  - The powerful plantarflexors
  - Gastrocnemius attaches to posterior femur – also a knee flexor
- Plantaris
  - Plantarflexor & knee flexor
  - Inserts NEXT to calcaneal tendon *(not part of it!)*



(i) Inversion and eversion

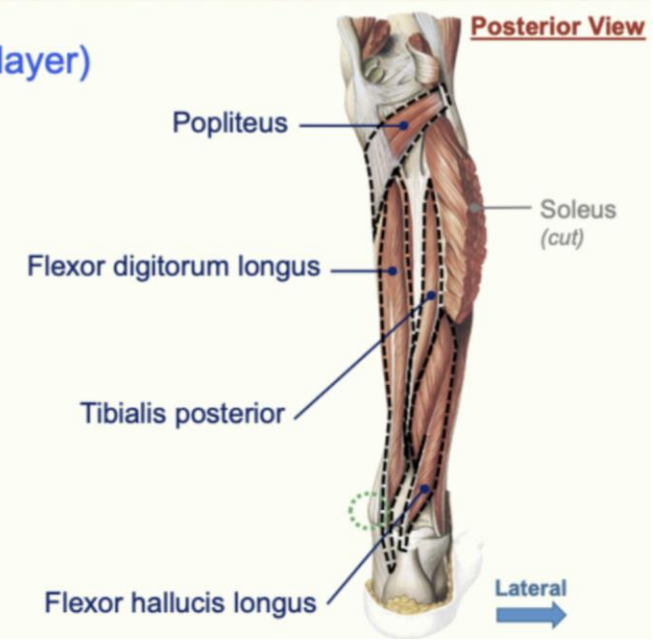
Posterior compartment of Leg

- Posterior component = plantarflexion, inversion, flexion of toes
- Innervated by tibial nerve
- Superficial layer = triceps surae (gastrocnemius + soleus) & plantaris
- Deep layer = tibialis posterior, popliteus & toe flexors

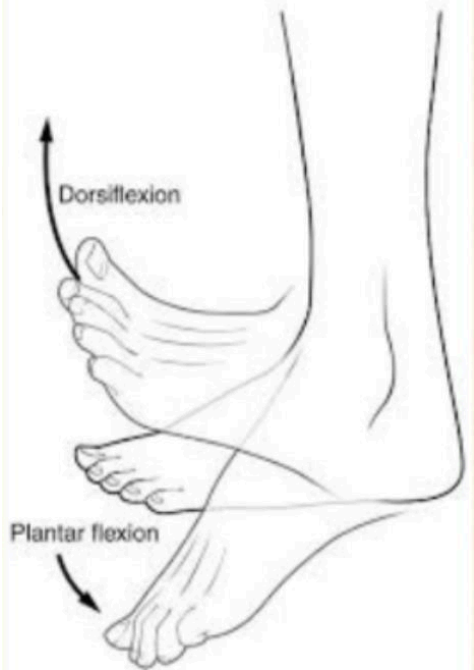
The Posterior Compartment (deep layer)

Compartment function: – plantarflexion & inversion of ankle
– flexion of toes

- Tibialis posterior *(homologous to tib. ant.)*
  - Plantarflexion & inversion of ankle
- Pair of toe flexors
  - Flexor hallucis longus *("big toe only")*
  - Flexor digitorum longus *(digits 2-5)*
  - Tendons enter foot behind medial malleolus *(tarsal tunnel)*
- Popliteus *("back of the knee")*
  - Medial rotation of knee

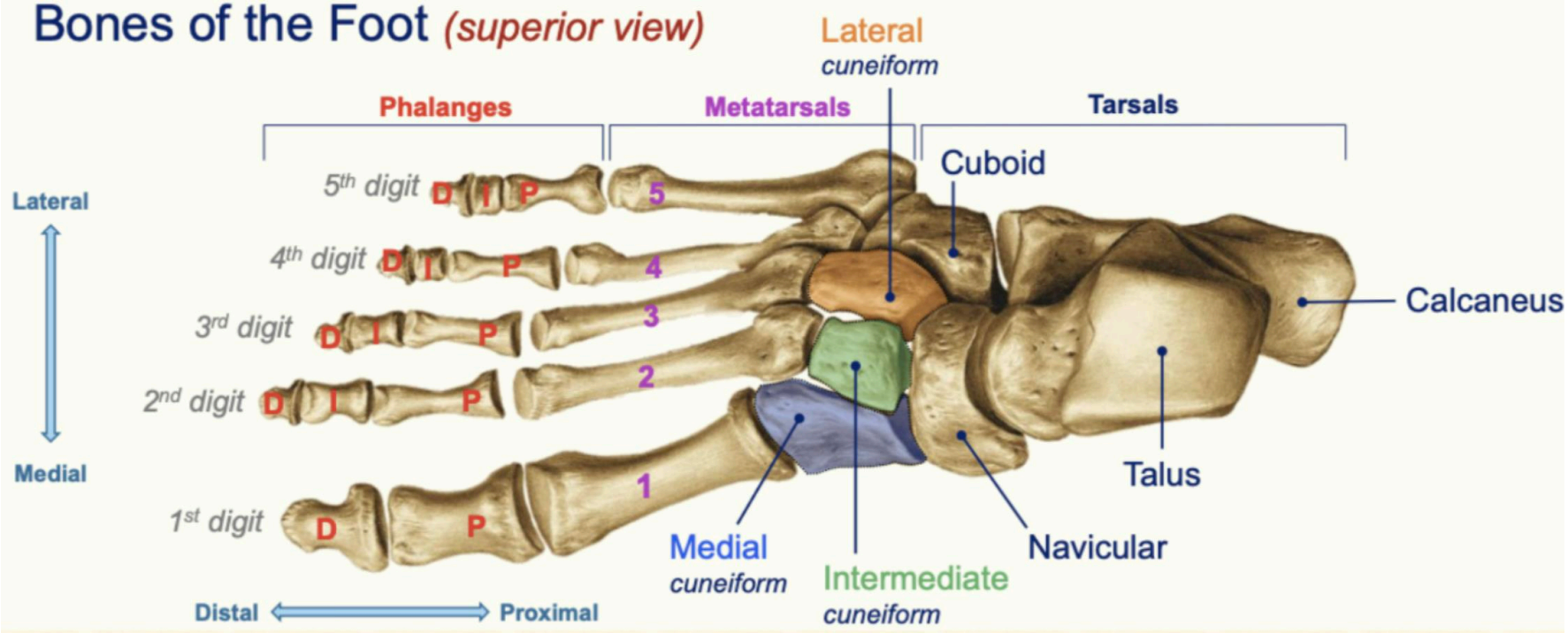


(i) Inversion and eversion



Bones of the Foot

- Tiger Cubs Need MILC



Ankle Joint

2 major joints

- Talocrural joint = between talus & leg
- Subtalar joint = between talus & other bones

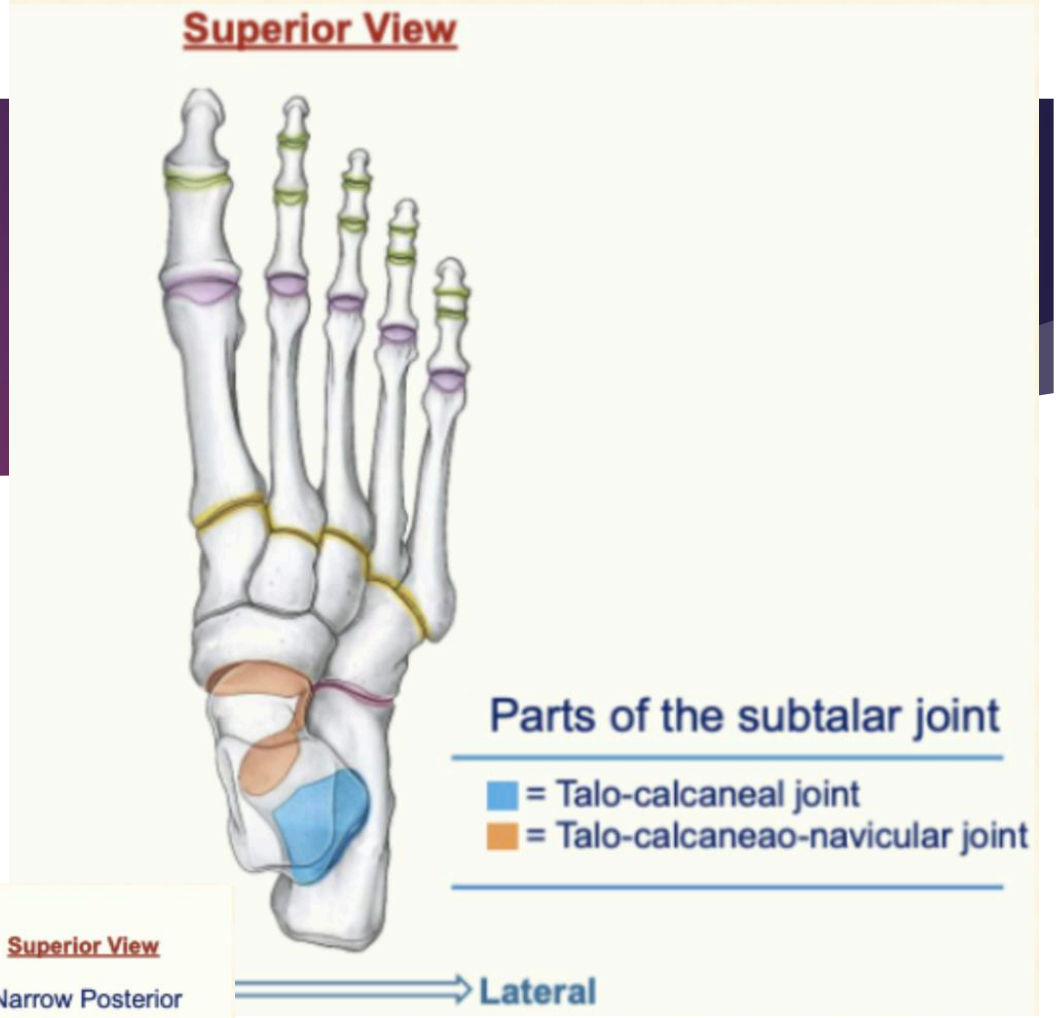
Talocrural joint:

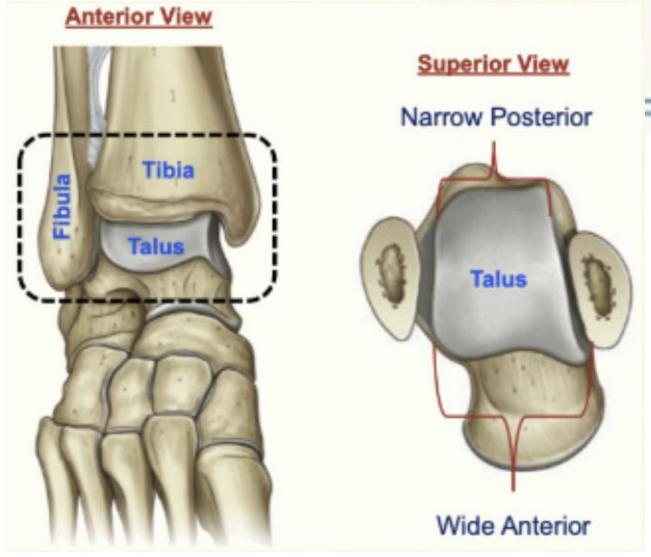
- Synovial hinge between talus and crus (bones of the leg)
- Uniaxial – one movement only, these movements are dorsi and plantar flexion
- Dorsiflexion = Extension
- Plantarflexion = Flexion

Irregular shape of talus means bones are more congruent in dorsiflexion than plantarflexion

-> more stable in dorsiflexion

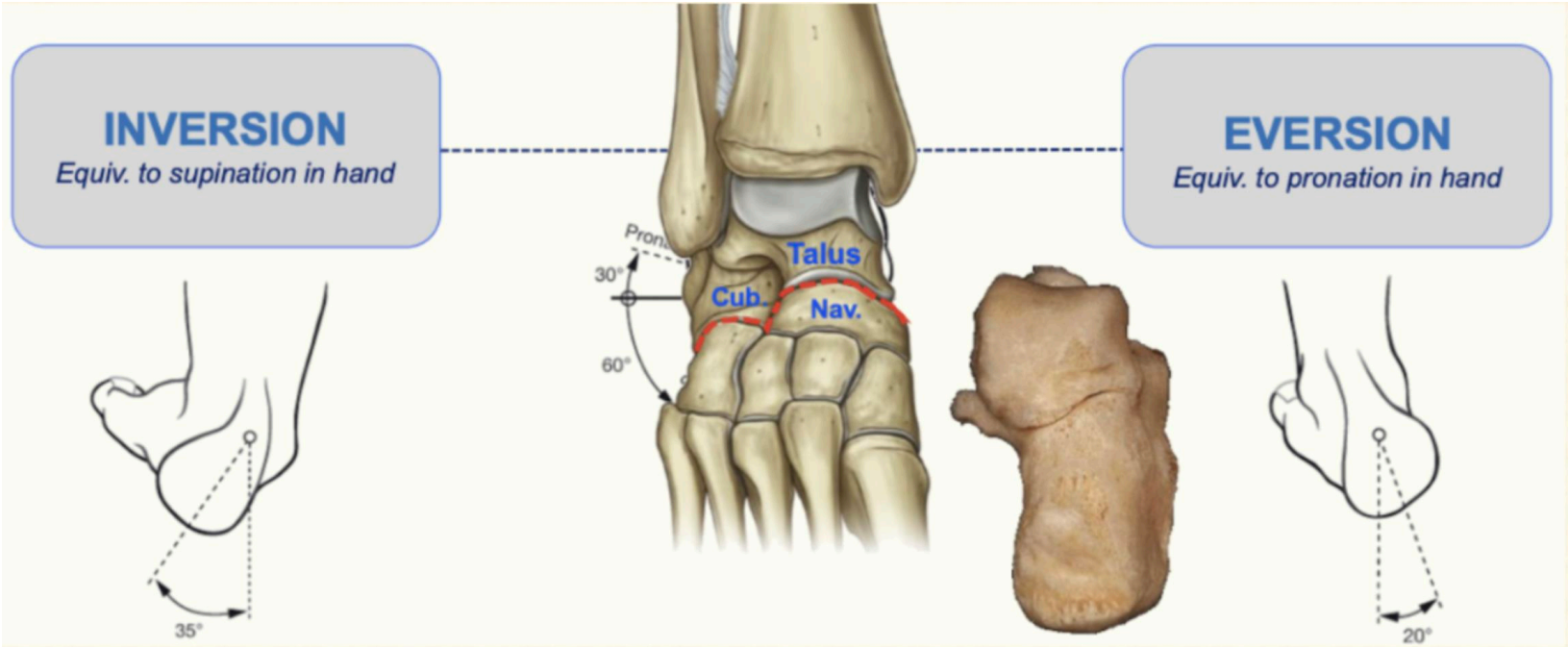
-> more risk of injury in plantarflexion



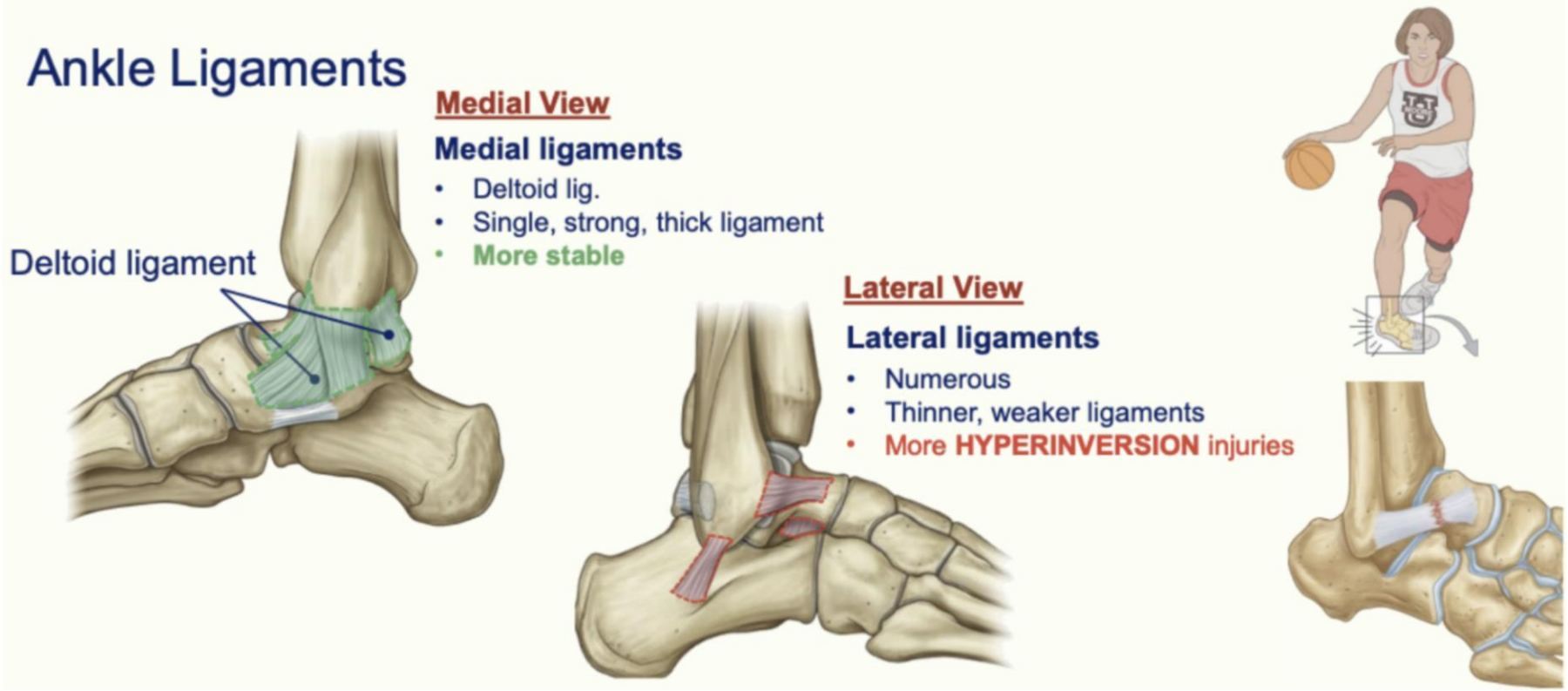


Subtalar joint:

- Consists of the talus bone and calcaneus
- Allows eversion & inversion
- Inversion – 35 degrees; equivalent to supination of hand
- Eversion – 20 degrees; equivalent to pronation of hand



Ankle Ligament



Lower Limb Qs

Which muscle is the most powerful hip extensor?

- Gluteus medius
- Rectus femoris
- Biceps femoris
- Gluteus medius
- Gluteus maximus

Which of the following structures resists posterior tibial translation?

- Medial collateral ligament
- PCL
- Lateral collateral ligament
- ACL
- Sartorius

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Which of the following structures resists posterior tibial translation?

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- **PCL**
- Lateral collateral ligament
- ACL
- Sartorius