

JB REVISION PROGRAM

ANATOMY EXAM 1 REVIEW – MUSCLES, JOINTS, LIGAMENTS

BACK MUSCLES (11)

Grouping	Muscle	Action	Innervation	Vasculature
Superficial (5)	Trapezius	rotate scapula; elevate, retract shoulder	Accessory n. (CN XI)	Transverse cervical a.
	Latissimus dorsi	extend, ADduct, medially rotate humerus	Thoracodorsal n.	Thoracodorsal a.
	Rhomboideus major	retract and rotate scapula, fix scapula to thoracic wall	Dorsal scapular n.	Dorsal scapular a.
	Rhomboideus minor	“”		
	Levator scapulae	elevate, rotate scapula		
Intermediate (2)	Serratus posterior superior	elevate ribs on inspiration	2 – 5 Intercostal n.	Intercostal a.
	Serratus posterior inferior	ribs down, out on inspiration	VPR T9 – T12	
Deep (4)	Splenius capitis	laterally bend neck to ipsilateral side; extend head, neck in conjunction	Dorsal rami of spinal n.	
	Splenius cervicis	“”		
	Semispinalis	extend neck; rotate head	Dorsal rami of cervical spinal n.	
	Erector spinae: Iliocostalis Lonigissimus Spinalis	extend vertebral column, bend laterally	Dorsal rami of respective spinal n.	

SHOULDER & PECTORAL REGION (11)

Grouping	Muscle	Action	Innervation	Vasculature
Shoulder (7)	Deltoid	flex, extend, ABduct humerus	Axillary n.	Thoracoacromial a. (deltoid branch)
	Supraspinatus	ABduct humerus	Suprascapular n.	Anastomoses from subclavian or axillar a. that include: Suprascapular a. Dorsal scapular a. Circumflex scapular a.
	Infraspinatus	laterally rotate humerus	Suprascapular n.	
	Teres minor	“”	Axillary n.	
	Teres major	ADDuct, extend, medially rotate humerus	Lower subscapular n.	
	Subscapularis	medially rotate humerus	Upper & lower subscapular n.	
	Omohyoid	depress hyoid bone	Cervical n. C1-C3 via ansa cervicalis	
Pectoral region (4)	Pectoralis major	ADduct, medially rotate, extend, flex humerus	Lateral & medial pectoral n.	Thoracoacromial a. (pectoral branches)
	Pectoralis minor	protract, depress scapula	Medial pectoral n.	
	Serratus anterior	protract, rotate scapula	Long thoracic n.	Lateral thoracic a.
	Subclavius	depress scapula	Subclavian n.	Thoracoacromial a. (clavicular branch)

ARM (5)

Grouping	Muscle	Action	Innervation	Vasculature
Anterior (3)	Coracobrachialis	flex, ADduct arm	Musculocutaneous n.	Brachial a. & its branches
	Biceps brachii (long, short)	flex arm, forearm; supinate forearm		
	Brachialis	flex forearm		
	Triceps brachii	extend arm, forearm		

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Posterior (2)	(long, lateral, medial)		Radial n.	Profunda brachii a.
	Anconeus	extend forearm		

FOREARM (20)

Grouping	Muscle	Action	Innervation	Vasculature
Anterior (superficial – 5)	Pronator teres	pronate, flex forearm	Median n.	Ulnar a. & radial a.
	Flexor carpi radialis	flex hand, ABduct wrist		
	Flexor carpi ulnaris	flex, ADduct wrist	Ulnar n.	Ulnar a.
	Flexor digitorum superficialis	flex PIP; flex MP	Median n.	
	Palmaris longus	flex wrist; tighten palmar aponeurosis		
Anterior (deep – 3)	Flexor digitorum profundus	flex DIP of digits	Medial: ulnar n. Lateral: median n.	Anterior interosseus a.
	Pronator quadratus	pronate forearm	Anterior interosseus n. of median n.	
	Flexor pollicis longus	flex IP of thumb		
Posterior (12)	Brachioradialis	flex forearm	Radial n.	Radial recurrent a.
	Extensor carpi radialis longus	extend, ABduct wrist; fist clenching		Radial a.
	Extensor carpi radialis brevis	“”	Deep branch of radial n.	Radial a.
	Supinator	supinate forearm, rotate radius		Radial recurrent a.
	Extensor carpi ulnaris	extend, ADduct wrist	Posterior interosseus n. of radial n.	Ulnar a.
	Extensor digitorum	extend MP of digits; extend IP		Posterior interosseus a. from common interosseous a. branch from ulnar a.
	Abductor pollicis longus	extend IP, ABduct, extend thumb		
	Extensor pollicis longus	extend IP thumb, ABduct, extend thumb		
	Extensor pollicis brevis	extend MP and MCP of thumb, ABduct, extend thumb		
	Extensor indices	extend 2 nd digit		
Extensor digiti minimi	extend MP 5 th digit; extend IP			

HAND (19)

Grouping	Muscle	Action	Innervation	Vasculature
Thenar (3)	Abductor pollicis brevis	ABduct/oppose thumb	Recurrent branch of median n.	Superficial palmar branch of the radial a.
	Flexor pollicis brevis	flex thumb		
	Opponens pollicis	oppose, medially rotate thumb		
Hypothenar (3)	Abductor digiti minimi	ABduct 5 th digit	Deep branch of ulnar n.	Ulnar a.
	Flexor digit minimi brevis	flex MPC of 5 th digit		
	Opponens digiti minimi	oppose 5 th digit to thumb		
Short (Palmar – 9)	Lumbrical 1 + 2	flex MPC joint; extend IP joint	Median n.	Superficial palmar arch Deep palmar arch Common palmar digital a Dorsal digital a.
	Lumbrical 3 + 4	“”	Deep branch of ulnar n.	
	Palmar interossei (1-3)	ADduct digits; flex MCP joint;		

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		extend IP joint		
	Palmaris brevis	improves grip	Superficial branch of ulnar n.	Palmar branches of the ulnar a.
	Adductor pollicis	ADduct thumb	Deep branch of ulnar n.	Deep palmar arterial arch
Short (Dorsal – 4)	Dorsal interossei (1-4)	ABduct digits; flex MCP joint; extend IP joint	Deep branch of ulnar n.	Dorsal metacarpal a. & palmar metacarpal a.

GLUTEAL REGION (8)

Grouping	Muscle	Action	Innervation	Vasculature
Gluteal Region (8)	Gluteus maximus	extend, laterally rotate thigh	Inferior gluteal n.	Superior a. & inferior gluteal a.
	Gluteus medius	ABduct, medially rotate thigh	Superior gluteal n.	Superior gluteal a.
	Gluteus minimus	“”		
	Piriformis	laterally rotate thigh	Ventral rami of S1 and S2	Inferior gluteal a. Internal pudendal a. Superior gluteal a.
	Obturator internus	“”	Nerve to obturator internus	Inferior gluteal a.
	Superior gemellus	“”		
	Inferior gemellus	“”	Nerve to quadratus femoris	
Quadratus femoris	“”			

THIGH (16)

Grouping	Muscle	Action	Innervation	Vasculature
Anterior (7)	Iliopsoas	flex thigh; flex and laterally bend lumbar spine	Femoral n. (for iliacus) & lumbar plexus (psoas)	Lumbar branch of iliopsoas branch of internal iliac a.
	Pectineus	flex, ADduct, laterally rotate thigh at hip	Femoral n. & obturator n.	Medial circumflex femoral branch of femoral a. & obturator a.
	Sartorius	flex, ABduct, laterally rotate hip; flex, medially rotate knee	Femoral n.	Femoral a. branches
	Rectus femoris (<i>quadriceps</i>)	flex hip; extend knee		Medial circumflex femoral a.
	Vastus lateralis (<i>quadriceps</i>)	extend leg at knee		Lateral circumflex femoral a.
	Vastus medialis (<i>quadriceps</i>)	“”		Femoral a. <i>Profunda femoris a.</i> <i>Superior medial genicular branch of popliteal a.</i>
	Vastus intermedius (<i>quadriceps</i>)	“”		Lateral circumflex femoral a.
Medial (5)	Gracilis	flex, ADduct, thigh at hip; flex, medially rotate knee	Obturator n.	Obturator a.
	Obturator externus	laterally rotate, ADduct hip; holds head of femur in acetabulum		
	Adductor longus	flex, ADduct thigh at hip		
	Adductor brevis	flex, extend, ADduct, laterally rotate thigh at hip		
	Adductor magnus	ADduct thigh; adductor – flex thigh; hamstring – extend thigh	Obturator n. & tibial n.	
	Semimembranosus (<i>hamstrings</i>)	extend thigh; flex, medially rotate leg		

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Posterior (3)	Semitendinosus (<i>hamstrings</i>)	“”	Tibial n.	Perforating branches of: Profunda femoris a. Inferior gluteal a. Superior branches of popliteal a.
	Biceps femoris (long head) (<i>hamstrings</i>)	extend thigh; flex, laterally rotate leg		
	Biceps femoris (short head)	flex, laterally rotate leg	Common fibular n.	
N/a	Tensor fasciae latae	ABduct, medially rotate, flex thigh	Superior gluteal n.	Superior gluteal a. <i>Lateral circumflex</i> femoral a.

LEG (13)

Grouping	Muscle	Action	Innervation	Vasculature
Anterior (4)	Tibialis anterior	dorsiflex ankle; invert foot	Deep fibular n.	Anterior tibial a.
	Extensor hallucis longus	dorsiflex ankle; extend 1 st digit		
	Extensor digitorum longus	dorsiflex ankle; extend 2 – 5 digit		
	Fibularis tertius	dorsiflex ankle; evert foot		
Lateral (2)	Fibularis longus	evert foot; weak plantarflexion of ankle	Superficial fibular n.	Branches of fibular a.
	Fibularis brevis	“”		
Posterior (superficial – 3)	Soleus	plantarflex ankle; raise heel to walk	Tibial n.	Posterior tibial a.
	Gastrocnemius	flex leg; plantarflex foot		
	Plantaris	“”		
Posterior (deep – 4)	Tibialis posterior	plantarflex ankle; invert foot		
	Flexor digitorum longus	flex digits 2 – 5, plantarflex ankle, supports long arch		
	Flexor hallucis longus	flex 1 st digit; plantarflex ankle; support med long arch of foot		
	Popliteus	weakly flex knee; rotate femur on fixed tibia and unlocks leg; medially rotate tibia of unplanted limb		

FOOT (18)

Grouping	Muscle	Action	Innervation	Vasculature
Flexor (layer 1) (3)	Flexor digitorum brevis	flex digits 2 – 5	Medial plantar n.	Medial plantar a.
	Abductor hallucis	ADduct 1 st digit; support transverse arch		
	Abductor digiti minimi	ABduct, flex 5 th digit	Lateral plantar n.	Lateral plantar a.
Flexor (layer 2) (6)	Flexor hallucis brevis	flex proximal phalanx 1 st digit	Medial plantar n.	Medial plantar a.
	Lumbrical 1	flex PIP; extend DIP digit 2 – 4	Lateral plantar n.	Lateral plantar a.
	Lumbrical 2	“”		
	Lumbrical 3	“”		
	Lumbrical 4	“”		
	Quadratus plantae	flex digits 2 – 5		
	Adductor hallucis (transverse head) Adductor hallucis (oblique head)	ADduct 1 st digit; support transverse arch	Deep branch of lateral plantar n.	Lateral plantar a.

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Flexor (layer 3) (2)	Flexor digiti minimi brevis	plex proximal phalanx 5 th digit	Superficial branch of lateral plantar n.
Flexor (layer 4) (7)	Plantar interossei (1-3)	ADduct digits 2 – 4; flex MP	Lateral plantar n.
	Dorsal interossei (1-4)	ABduct digits 2 – 4; flex MP	

MNEUMONICS / STUDY TIPS

THE BACK

- Lateral to medial orientations of erector spinae: **I Love Spine**
 - o Iliocostalis
 - o Longissimus
 - o Spinalis
- Lumbar puncture: **L3, 4, 5, keeps the spinal cord alive**
 - o Insert needle between L3/L4 or L4/L5 during procedure

SHOULDER & PECTORAL REGION

- Venous drainage
 - o Dorsal venous network of hand runs laterally into cephalic vein and medially into basilic vein
 - o Median cubital vein proximally connects basilic and cephalic veins – located in cubital fossa
 - o Dorsal venous network distally connects cephalic and basilic veins
 - o Basilic and cephalic veins drain into axillary vein
- **Quadrangular space** = axillary nerve + posterior circumflex humeral artery (**QAP**)
 - o Borders
 - Lateral and long heads of triceps brachii
 - Teres major
 - Teres minor
- **Triangular Interval** = Radial nerve & profunda brachial artery
 - o Borders
 - Lateral and long heads of triceps brachii
 - Teres major (superior)
 - Humerus (floor)
- **Triangular Space** = circumflex scapular artery
 - o Borders
 - Teres minor
 - Teres major
 - Long head of tricepss brachii
 - Surgical neck of humerus
- Rotator cuff muscles: **SITS**
 - o Supraspinatus
 - o Infraspinatus
 - o Teres minor
 - o Subscapularis
- Scapular anastomoses for collateral circulation in shoulder region – important vessels:
 - o Thyrocervical trunk branches specifically
 - o Dorsal scapular artery
 - o Circumflex scapular artery
 - o Subscapular artery

AXILLA, ARM & CUBITAL FOSSA

- Branches of the axillary artery: **Susie Thompson Likes Salt And Pepper**

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- Superior thoracic artery
- Thoracoacromial artery
- Lateral thoracic artery
- Scapular circumflex artery
- Anterior circumflex humeral artery
- Posterior circumflex humeral artery
- Parts of the brachial plexus: **Randy Travis Drinks Cold Beer**
 - Rami – ventral primary rami (C5 – T1)
 - Trunks – superior, middle, inferior
 - Divisions – anterior, posterior
 - Cords – lateral, posterior, medial
 - Branches
- Radial nerve innervation: **BEST**
 - Brachioradialis
 - Extensors of wrist and fingers
 - Supinator
 - Triceps
- Compartmentalization of **arm**
 - Anterior/Posterior divisions made by humerus and medial and lateral intermuscular septa formed by brachial fascia (continuation of pectoral, axillary, and deep fascia of the latissimus dorsi and deltoids)
 - Anterior
 - Flexors of arm or forearm
 - Musculocutaneous nerve innervates all structures of the arm (not talking about forearm)
 - Posterior
 - Extensors of arm or forearm
 - Radial nerve innervates extensors of arm and forearm
 - Profunda brachii artery
- **The median nerve does not innervate any muscles in the arm** – it gives off the anterior interosseus nerve in the cubital fossa
- Musculocutaneous nerve
 - Innervates all muscles of anterior compartment of arm
 - Pierces supinator
- Ulnar nerve
 - Passes through arm but does not supply any muscles in arm (not talking about forearm)
 - Passes posterior to humerus at medial epicondyle
 - Funnybone – blow to medial epicondyle and hence the ulnar nerve
- Brachial artery
 - Continuation of axillary artery distal to inferior border of teres major
 - Gives rise to profunda brachii, superior & inferior lateral branches, ulnar artery, radial artery, and other muscular branches
- Profunda brachii artery
 - Highest branch of brachial artery
 - Travels with radial nerve
 - Anastomosis with posterior circumflex humeral artery
- Radial nerve
 - Observed also through cubital fossa in plane between brachioradialis and brachialis muscle

FOREARM AND HAND

- Anatomical snuff box
 - Formed by abductor pollicis longus, extensor pollicis brevis and extensor pollicis longus
 - Contents
 - Radial artery
 - Cephalic vein
 - Superficial branch of the radial nerve
 - Actual borders = extensor pollicis brevis and longus
- Radial nerve
 - Supply all muscles of posterior compartment of both arm and forearm

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- Flexor retinaculum
 - o A.k.a. transverse carpal ligament
 - o Roof of the carpal tunnel
 - o Attached to tubercle of scaphoid bone and pisiform bone

GLUTEAL REGION, POSTERIOR THIGH & POPLITEAL FOSSA

- Thigh compartmentalization
 - o Anterior – femoral nerve (exception = iliopsoas – femoral n. & lumbar plexus; pectineus = femoral n. & obturator n.)
 - o Medial – obturator nerve (exception = adductor magnus – obturator n. & tibial n.)
 - o Posterior – sciatic nerve
- Femoral triangle: **NAVL** – anterior view – lateral to medial
 - o Femoral Nerve
 - o Femoral Artery
 - o Femoral Vein
 - o Femoral Lymphatics
- Branches off femoral artery
 - o Anterior tibial artery
 - o Medial/lateral inferior genicular artery
 - o Medial/lateral superior genicular artery
 - o Profunda femoris artery
 - o Popliteal artery
 - o Posterior tibial artery
- Branches of sciatic nerve
 - o Common fibular division
 - Nerve to short head of biceps femoris
 - Articular branch
 - Superficial fibular
 - Deep fibular
 - Lateral sural cutaneous
 - o Tibial division
 - Nerves to hamstrings (4 separate branches, including one to hamstring portion of adductor magnus)
 - Branches to posterior compartment muscles
 - Medial sural cutaneous nerve
 - Sural nerve formed by lateral and medial sural cutaneous nerves

SUPERFICIAL LOWER LIMB, ANTERIOR & MEDIAL THIGH

- Contents of adductor canal
 - o Nerve to vastus medialis
 - o Femoral artery (this only passes through hiatus)
 - o Femoral vein (this only passes through hiatus)
 - o Saphenous nerve
- Patellar ligament is a continuation of the quadriceps femoris tendon
- **Knee-jerk (patellar) reflex L2, 3, 4, lifts your leg off the floor**
 - o Tests L2-L4
- Branches of the femoral nerve (L2, 3, 4)
 - o Anterior cutaneous branches
 - o Nerve to pectineus
 - o Nerve to sartorius
 - o Nerves to quadriceps femoris (4 separate branches)
 - o Saphenous nerve
 - Infrapatellar branch
 - Medial cutaneous nerves of leg
- Neurovascular structures of mid-femoral shaft cross section (**see picture in lab manual**)
 - o Femoral artery & vein
 - o Saphenous nerve
 - o Profunda femoris artery & vein

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- Sciatic (tibial & common fibular) nerve
- The PCL is the **PAIN** ligament
 - Attaches to **P**osterior aspect of tibia
 - Courses **A**nteriorly and **I**Nternally (medially) to attach to medial condyle of femur
- The ACL is the **APEX** ligament
 - Attaches to **A**nterior aspect of tibia
 - Courses **P**osteriorly and **E**xternally (laterally) to attach to medial condyle of femur

LEG AND FOOT

- Tendons passing on medial side of ankle (ventral to dorsal) in flexor retinaculum: **Tom Dick And Nervous Harry**
 - **T**ibialis posterior
 - Flexor **D**igitorum longus
 - Posterior tibial Artery
 - Posterior tibial Nerve
 - Flexor **H**allucis longus
 - Note: flexor digitorum longus and tibialis posterior cross when going from the posterior thigh onto the medial ankle
- Sciatic nerve divisions and actions: **PED TIP**
 - **P**eroneal **E**verts and **D**orsiflexes (if injured results in foot drop)
 - **T**ibial **I**nverts and **P**lantarflexes (if injured can't stand on **TIP**toes)
- Other structures in leg (**see cross section in lab manual**)
 - Fibula (small "feeble" lateral bone)
 - Tibia
 - Great saphenous vein
 - Saphenous nerve
 - Small saphenous vein
 - Lateral sural cutaneous nerve

JOINTS

BACK			
JOINT & TYPE	LOCATION/ASSOC. STRUCTURES	ARTICULATING SURFACES	MOTION
<u>Atlanto-occipital</u> Synovial – condyloid	Above cervical vertebrae between atlas (C1) and occipital bone	Atlas – superior articulating surfaces for occipital epicondylar Occipital bone	Biaxial motion (flexion/extension of head & lateral flexion away from midline) YES joint
<u>Atlanto-axial</u> Synovial – pivot	Between atlas (C1) and axis (C2) (has dens)	Atlas – articular facet for dens Axis – anterior articular facet for anterior arch of atlas	Rotation NO joint
<u>Symphyses</u> Secondary cartilaginous joints	Between vertebral bodies	Articulating surfaces connected by IV discs and ligaments	Shock absorption and weight bearing Allow movement in spinal column
SHOULDER & PECTORAL REGION			
<u>Sternoclavicular</u> Synovial – saddle	<u>Associated structures</u> <i>Fibrocartilage disc</i> Sternoclavicular ligament Interclavicular ligament Costoclavicular ligament	Clavicle – sternal end Sternum – manubrium	Elevation/depression Protraction/retraction Rotation
<u>Acromioclavicular</u> Synovial – plane	<u>Associated structures</u> <i>Fibrocartilage disc</i> Acromioclavicular ligament Coracoclavicular ligament	Clavicle – acromial end Scapula – acromion process	Rotation (scapula on clavicle)

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<p><u>Glenohumeral</u> Synovial – ball & socket</p>	<p><u>Features</u> Glenoid fossa = ~ 1/3 size of humeral head Noncontractile ligaments and contractile rotator cuff enhance stability</p> <p><u>Associated structures</u> Coracoacromial ligament Superior, middle, & inferior glenohumeral ligaments Coracohumeral ligament Transverse humeral ligament (doesn't provide stability to joint but instead stabilizes biceps tendon between glenoid and humeral tuberosities)</p> <p><i>Glenoid labrum</i> (fibrocartilagenous ring that surrounds glenoid fossa and acts as rim of cartilage to deepen glenoid fossa)</p> <p><i>Subacromial/subdeltoid bursa</i> (between coracoacromial arch and supraspinatus tendon which also extends to deltoid muscle; decreases friction between these 2 structures)</p>	<p>Humeral head Glenoid fossa</p>	<p>Rotation of shoulder</p>
<p><u>Scapulothoracic</u> Not a true synovial joint</p>		<p>Between scapula and thoracic cavity</p>	<p>Elevation/depression (frontal plane motions)</p> <p>Protraction/retraction (transverse plane)</p> <p>downward/upward rotation of shoulder girdle</p>
<p>AXILLA, ARM, & ELBOW</p>			
<p><u>Humeroulnar</u> Synovial – hinge</p>	<p><u>Features</u> Along with humeroradial is considered together as “elbow joint”</p> <p><u>Associated structures</u> Lateral collateral ligament (protects against <u>varus</u> deviation of forearm; blends with annular ligament) Medial collateral ligament (medial epicondyle of humerus to coronoid process and olecranon process; protects against <u>valgus</u> deviation of forearm) Annular ligament of radius (encircles head of radius and attaches to radial notch margins; holds head of radius against ulna and protects against distal dislocation of radius) Ulnar collateral (has 3 bands)</p>	<p>See associated structures</p>	<p>Flexion/extension</p> <p>Prevent abduction of forearm (LCL)</p> <p>Hold radius to ulna (AL)</p> <p>Prevent adduction of forearm (UC)</p>

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<u>Humeroradial</u> Synovial – modified hinge	Along with humerulnar is considered together as “elbow joint”	Supination – radial head spins on fixed capitulum of ulna	Flexion/extension Supination/pronation (does not occur in elbow jt; occurs in forearm)
<u>Proximal radioulnar</u> Synovial – pivot	Annular ligament of radius	Supination – radial head spins on fixed capitulum of ulna	Supination/pronation (does not occur in elbow jt; occurs in forearm) Holds radius to ulna (AL)
<u>Distal radioulnar</u> Synovial – pivot	Anterior and posterior ligaments	Supination – radial head spins on fixed capitulum of ulna	Supination/pronation (does not occur in elbow jt; occurs in forearm) Strengthens fibrous capsule (AL & PL)
HAND			
<u>Radiocarpal</u> Synovial – condyloid		Between distal radius and proximal carpals	Wrist flexion/extension Wrist abduction/adduction
<u>Midcarpal</u> Synovial – plane		Between proximal and distal row of carpal bones	Gliding motions between carpals
<u>Distal radioulnar joint</u> Synovial – pivot		Between distal end of radius and ulna	Supination/pronation of forearm
<u>Carpometacarpal</u> Thumb – saddle Digits – gliding		Between carpals and metacarpals	Adduction/abduction of thumb (perpendicular to plane of palm) Flexion/extension of thumb (parallel to plane of palm) Opposition of thumb
<u>Metacarpophalangeal</u> Thumb – hinge Digits – condyloid	<u>Associated structures</u> Collateral ligament Palmar ligament (plate) (provide lateral stability to joint; medial collateral ligament of each digit prevents lateral deviation)	Between metacarpals and proximal phalanges	Flexion/extension of digits Flexion/extension of thumb AB/Adduction of digits
<u>Proximal interphalangeal</u> Hinge	<u>Associated structures</u> Collateral ligament Palmar ligament (plate) (provide lateral stability to joint; medial collateral ligament of each digit prevents lateral deviation)	Between proximal phalanges and middle phalanges	Flexion/extension of digits
<u>Distal interphalangeal</u> Hinge	<u>Associated structures</u> Collateral ligament Palmar ligament (plate) (provide lateral stability to joint; medial collateral ligament of each digit prevents lateral deviation)	Between middle phalanges and distal phalanges	Flexion/extension of digits
GLUTEAL REGION, THIGH, & HIP JOINT			
<u>Hip joint/Pelvic girdle</u>	<u>Associated structures</u>		All 3 capsular ligaments

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<p>Synovial – ball & socket</p>	<p><u>3 capsular ligaments (external to fibrous capsule):</u> Iliofemoral ligament (anterior; large, stout; attaches pelvis to femur; strongest of the 3) Pubofemoral ligament (anterior; attaches pubic pelvis to femur) Ischiofemoral ligament (posterior; attaches femur to ischio part of pelvis; resists posterior dislocation of femur head)</p> <p>Ligamentum teres (originates from acetabular labrum of the hip bone and inserts into fovea of femoral head)</p>		<p>reinforce hip joint stability</p> <p><u>Ligamentum teres:</u> Little/no role in hipo stability Carries <u>artery of the ligamentum teres</u> to femoral head (important in kids)</p>
<p><u>Sacroiliac joint</u> Synovial</p>	<p><u>Associated structures</u> Sacroiliac ligament (between sacrum and iliac crest) Iliolumbar ligament (between iliac crest on either side to transverse processes of fifth lumbar vertebra) Sacrospinous ligament (ischial spine to sacrum) Sacroterous ligament (ischial tuberosity to sacrum)</p>	<p>Between pelvic girdle and axial skeleton</p>	<p>Strongest and most stable joint in body</p> <p>Prevents great upward movement of inferior end of sacrum</p>
<p><u>Pubic symphysis</u> Secondary cartilaginous joint</p>	<p><u>Associated structures</u> Superior pubic ligament</p>	<p>Between left and right hip bones Anterior</p>	<p>Holds pubic symphysis together</p>
<p>KNEE, LEG, ANKLE, FOOT</p>			
<p><u>Femorotibial – knee joint 1</u> Synovial – hinge</p>	<p><u>Associated structures</u> Medial (tibial) collateral ligament (attached to meniscus posteriorly; extends from medial femoral epicondyle and widens to insert into shaft of tibia below tibial tuberosity level; posterior part fused to joint capsule and attached to medial menisci) Lateral (fibular) collateral ligament (from lateral femoral epicondyle to insert into fibula head; free of joint capsule with no attachment to lateral meniscus) Posterior cruciate ligament (PCL) (attached to posterior tibia and courses anteriorly and medially to attach to medial femur condyle) Anterior cruciate ligament (ACL) (attaches to anterior aspect of tibia and courses posteriorly and laterally to attach to medial femur condyle)</p> <p><u>Remember:</u></p>	<p>Femur, tibia, patella involved (<i>no fibula</i>) <u>3 articular surfaces</u> femoral condyles (menisci fibrocartilage between femoral and tibial condyles; get distorted as knee flexes/extends to distribute weight evenly over joint) tibial plateau patella</p>	<p>Gliding</p> <p>Rotation</p> <p>Mainly flexion/extension</p> <p>Translocation</p> <p>Slight <u>medial</u> rotation of femur in extension (locked)</p> <p>Unlocking is by popliteus (rotates femur <u>laterally</u> relative to tibia for flexion)</p> <p>MCL prevents <u>abduction</u> at knee</p> <p>LCL prevents <u>adduction</u> of leg at knee</p>

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	<p><u>Cruciate</u> ligaments control A/P translation and rotation</p> <p><u>Collateral</u> ligaments control M/L stability and rotation</p>		<p>PCL prevents femur from sliding forward in flexed weight bearing knee (walking down hill)</p> <p>ACL prevents posterior movement of femur on tibial plateau</p> <p><u>Unhappy triad = MCL, ACL, medial meniscus</u></p>
<p><u>Femoropatellar joint – knee joint 2</u></p>	<p><u>Associated structures</u></p> <p>Patellar ligament</p>	<p>Apex of patella to tibial tuberosity</p>	<p>Prepatellar and suprapatella bursa associated; bursitis of suprapatella causes patella to appear to float over femur</p> <p>Lengthens lever arm and increases mechanical advantage of quadriceps femoris muscle</p> <p>Prevents wear and tear on quadriceps tendon as it passes across trochlear groove</p>
<p><u>Ankle joint</u></p> <p>Synovial – hinge</p>	<p><u>Associated structures</u></p> <p>Articular capsule</p> <p>Medial (deltoid) ligament</p> <p>Lateral ligament</p> <p><u>Bones</u></p> <p>Tibia</p> <p>Fibula</p> <p>Talus</p>	<p>Attachments are tibio-fibular mortise and talus</p> <p><u>Dorsiflexion (all anterior leg muscles innervated by deep fibular nerve) = extension:</u></p> <p>Tibialis anterior</p> <p>Ext. digitorum longus</p> <p>Ext. hallucis longus</p> <p>Fibularis tertius</p> <p><u>Plantarflexion (lat innerv by superficial fibular nerve and post muscles innerv by tibial nerve) = flexion:</u></p> <p>Gastrocnemius</p> <p>Soleus</p> <p>Plantaris</p> <p>Tibialis posterior</p> <p>Flex. Digitorum longus</p> <p>Flex. Hallucis longus</p> <p>Fibularis longus</p> <p>Fibularis brevis</p> <p><i>Deep fibular n. – L₄, L₅, S₁)</i></p> <p><i>Tibial n. – L₅, S₁, S₂)</i></p> <p><i>Superficial fibular n. – L₅, S₁)</i></p>	<p>Dorsiflexion (extension)</p> <p>Plantarflexion (flexion)</p>
<p>Tarsal Joint:</p> <p><u>Transverse tarsal</u></p> <p>(midtarsal)</p>	<p><u>2 types of transverse tarsal:</u></p> <p>Talo-calcaneo-navicular</p> <p>(Between talus, calcaneous, and navicular)</p>	<p><u>Inversion</u></p> <p>Tibialis anterior – Deep Fibular n. (L₄, L₅)</p> <p>Tibialis posterior – Tibial n. (L₅, S₁)</p>	<p>Inversion/Eversion</p> <p>Spring ligament –</p>

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AND	Calcaneo-cuboid (between calcaneus and cuboid)	<u>Eversion</u> Fibularis brevis – superficial fib n. (L ₅ , S ₁) Fibularis longus – superficial fib n. (L ₅ , S ₁) Fibularis tertius – deep fibular n. (L ₄ , L ₅ , S ₁)	stabilizes medial longitudinal arch Short & Long plantar ligaments – support longitudinal arches; long also forms tunnel for tendon of peroneus longus
<u>Subtalar</u> (talo-calcaneal)	<u>Associated structures</u> Plantar Calcaneo-navicular (spring) ligament (between calcaneus and navicular) Long plantar ligament Short plantar ligament		

NOTES

[Inguinal ligament](#) – superior border of femoral triangle

OBJECTIVES

LEC 1: TERMINOLOGY & OVERVIEW

- **Relate type of joint to movement that occurs across it**
 - o Synovial joints (articular cartilage, fibrous capsule, synovial membrane, collateral ligaments that unite bones external to capsule and strengthen joint)
 - o Plane – (eg. Intercarpal) – gliding (flat)
 - o Hinge – (eg. Elbow) – flexion/extension
 - o Saddle – (eg. Thumb) – ab/adduction and flexion/extension
 - o Condylloid – (eg. Wrist) – ab/adduction and flexion/extension with movement in one plane greater than in another
 - o Ball and socket – movement in multiple axes and planes
 - o Pivot – rotation around central axis
- **Joints that promote stability vs. joints that promote flexibility – structural differences**
 - o Stability joints
 - Fibrous – bones connected by fibrous tissue (min/no movt)
 - Syndesmoses – eg. Inferior tibiofibular
 - Sutures – eg. skull
 - Cartilaginous – bones connected by cartilage; slight mobility if compressed; no gliding
 - Primary – between epiphysis and diaphysis; disappear with age and unite
 - Secondary – ie. Symphysis; slightly moveable, united by fibrocartilage
 - o Flexibility
 - Synovial – joint cavity lined by synovial membrane
- **Rule for pattern of nerve supply to joints**
 - o Hilton's Law – innervation of joints is generally by branches of nerves that either supply muscles acting at that joint or the skin covering that joint
- **Anatomical origins of some clinical problems**
 - o **Rheumatoid arthritis** – inflammatory; immune system attacks synovial membrane; symmetric symptoms
 - o **Osteoarthritis** – mechanical wear/tear; asymmetrical symptoms; weight bearing joints more at risk

LEC 2: BACK, VERTEBRAL COLUMN, & SPINAL CORD

- **Structural differences and functional implications among different vertebrae**
 - o Adults: 26 vertebrae = 7 cervical + 12 thoracic + 5 lumbar + 1 sacrum + 1 coccyx
 - o Kids: 33 vertebrae = 7C + 12T + 5L + 5S + 4C
 - o Note: CSF is in between pia and arachnoid mater in the sub-arachnoid space
 - o Cervical
 - Atlas (C1) – no body, nor spinous processes
 - Axis (C2) – has dens; strongest cervical vertebrae;
 - Main feature: transverse foramen
 - o Thoracic

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- Main feature: transverse costal facets for rib articulation
- Long spinous processes
- Lumbar
 - Main feature: large vertebral bodies for weight bearing
 - Short spinous processes
- Sacrum
 - Transmits all weight to pelvic girdle
 - Strength and stability transmitted to pelvis
- Coccyx
 - Small triangular bone
 - Rudimentary
- **Abnormal curvatures of the spine**
 - Normal curvatures
 - Primary – concave anteriorly; thoracic and sacral (fetal)
 - Secondary – convex anteriorly; cervical and lumbar (hold up head)
 - **Kyphosis** – hunchback; caused by resorption of anterior thoracic vertebral bodies from osteoporosis
 - **Lordosis** – abnormal increase in anterior curvature; caused by weakening of anterior abdominal wall musculature due to weight gain or pregnancy; lower back pain
 - **Scoliosis** – abnormal lateral curvature; caused by absent half of vertebra, wedge-shaped vertebra, asymmetric weakness in back muscle
- **Joints and ligaments of vertebral column**
 - Anterior longitudinal ligament
 - In front of vertebral bodies and connects them
 - From occipital bone to sacrum; secures intervertebral discs
 - Prevents hyperextension (whiplash = hyperextension)
 - Posterior longitudinal ligament
 - Posterior aspect of vertebral bodies
 - Prevents hyperflexion and posterior protrusion of discs
 - C2 to sacrum and continuous with tectorial membrane (attached superiorly to occipital bone)
 - Supraspinous ligaments
 - Attaches tips of vertebral spinous processes
 - Ligamentum nuchae – thickened supraspinous and interspinous ligaments in cervical region
 - Ligamentum flavum
 - Yellow color
 - Connect vertebral lamina (between transverse and spinous processes)
 - Interspinous ligaments
 - Connect vertebra spines
 - Denticulate ligament
 - Thickening of pia mater on lateral sides between nerve roots
 - Adheres to arachnoid and dura
 - Laterally stabilizes spinal cord
 - Filum terminale
 - Vertical stabilization of spinal cord
 - Elongation off lower end of spinal cord inferior to pia mater
 - Joints
 - Symphyses (cartilaginous) – intervertebral discs between vertebral bodies; weight-bearing and strength
 - Synovial joint between articular processes
 - Cartilaginous and synovial joints between vertebral bodies
- **Actions/innervations of superficial, intermediate, and deep muscles of the back**
- **General organization of venous and arterial blood vessels that drain/supply blood to the vertebral column and spinal cord**
 - Spinal arteries (posterior and anterior) = 3 total
 - Anterior 2/3 of s/c – 1 anterior spinal artery
 - Posterior 2/3 of s/c – 2 posterior spinal arteries
 - Supply vertebral column, nerve roots, and spinal cord
 - Origin from number of arteries (occipital, vertebral, cervical, intercostals, lumbar, sacral etc)
 - **Paresis & Paralysis** – weakness from disrupted blood supply to spinal cord

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- Venous plexuses
 - External vertebral venous plexus – external to vertebral column from skull to coccyx
 - Internal vertebral venous plexus – within vertebral canal
 - Free communication between plexuses – communicate superiorly through foramen magnum with venous sinuses in cranial cavity
 - Drain into vertebral, intercostals, lumbar, and lateral sacral veins
 - **Provide route for infection, cancer metastasis to vertebrae, spinal cord, brain**
- **Relationship of the spinal cord and nerve roots to the vertebral column (newborn & adult)**
 - Adult
 - 31 spinal cord segments (8C, 12T, 5L, 5S, 1C)
 - Cervical and lumbar enlargements for limb innervation
 - Conus medullaris (L1-L2 vertebrae) – spinal column ends before vertebral column
- **Clinical deficits from vertebral fractures and dislocations**
 - Lumbar puncture – above or below L4; passes through skin, fascia, interspinous ligament, ligamentum flavum, fatty tissue, internal vertebral venous plexus, dura mater, and arachnoid mater
- **Pathologies of back, vertebral column, and spinal cord**
 - **Herniation of nucleus pulposus** – sudden increase in compression load on column; annulus fibrosus ruptures and nucleus herniates posteriorly into vertebral canal and can press on spinal roots or cord; common in lower lumbar and lower cervical; disc ruptures laterally to thin PLL where annulus fibrosus is weak
 - **Spinal cord ischemia** – meager blood supply to cord; follows minor damage to arterial supply as a result of regional anesthesia, pain blockage procedures, or aortic surgery
 - **Spondylitis** – inflammation of 1+ vertebrae; results in additional bone growth at margins of vertebral bodies; ALL and sacroiliac joints calcify; patients experience joint stiffening (**ankylosis**)
 - **Spondylolysis** – loosening of firm attachment of contiguous vertebrae; degeneration in discs; additional bone growth at body margins
 - **Spondylolisthesis** – slipping and falling; forward movement of body of lower lumbar vertebra
 - **Spina bifida** – vertebral laminae fail to fuse; lack of spinous process; common in lower lumbar or sacral
 - **Spina bifida occulta** – 1+ spinous processes fail to form at lumbar or sacral levels; asymptomatic; tuft of hair in skin over defect
 - **Spina bifida cystica** – cyst through defect in vertebral arch; results in hydrocephalus and neuro defects
 - **Spina bifida cystica with meningocele** – protrusion of membranes of cord through column defect; cyst lined by the meninges and contains CSF
 - **Spina bifida cystica with meningocele** – protrusion of membranes and cord through vertebral column defect; bladder, bowel, lower limb weakness

LEC 3: INTRO TO NERVOUS SYSTEM

- **Structural features of multipolar, bipolar, and unipolar neurons**
 - Multipolar – 1 axon, many dendrites from cell body
 - Bipolar – 1 axon, dendrites come off of cell body via single common dendritic process
 - Unipolar – lack dendrites; cell body yields 1 neuronal process that divides (inverted “T”) into 2 axonal processes
- **Terminology**
 - CNS – brain + spinal cord
 - **Fiber tracts** – bundles of neuronal processes
 - **Nerve nuclei** – are neuronal cell body clusters
 - PNS – neurons outside of brain and spinal cord
 - **Peripheral nerves** – PNS bundles of neuron processes
 - Spinal nerves – carry fibers to/from spinal cord and emerge between adjacent vertebrae
 - Cranial nerves – fibers to/from brain; emerge through foramina (holes) in skull
 - **Ganglion** – groups of peripheral nerve cell bodies; enlargements along peripheral nerves
 - **Ganglion cell** – neuron whose soma is situated in PNS
- **Synapse and events *briefly***
 - Neurotransmitters released from presynaptic neuron due to local depolarization of cell membrane
 - NT diffuse across synaptic cleft and bind specific receptor molecules in postsynaptic membrane to produce local change in transmembrane electrical potential
 - Electrical potential difference across post-membrane is increased (hyper – inhibition; depol – excitation)

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- Axon hillock responds to synaptic input sum and if transmembrane potential difference falls below threshold, action potential (traveling wave of depol) spreads along axon length
- NT release at synapse point with other neurons or at muscle and gland endings
- **Basic functional distinction between afferent and efferent neurons**
 - Afferent – sensory; signals from periphery into CNS
 - Primary afferent neurons
 - Unipolar
 - Cell bodies in sensory ganglia of spinal and cranial nerves
 - Send peripheral axonal process to contact sensory receptors
 - Extend central axonal process to end on 2nd order afferent neurons (sensory receiving cells) in dorsal portion of spinal cord or brain stem
 - No synapses in sensory ganglia
 - 1 nerve cell bridges peripheral sensory ending with CNS
 - Sensory dorsal root ganglion – sensory axons in spinal nerve go to spinal cord via dorsal (posterior) root; ganglion stands for their cell bodies
 - Efferent – motor; commands issued from CNS to periphery
 - Multipolar motor neurons in ventral spinal cord and brain stem send axons out through spinal and cranial nerves
 - These cells respond to sensory input to CNS
 - 1 or 2 neurons bridge CNS and effector organ (Depends on tissue type)
 - Ventral(anterior) root – where motor axons in spinal nerve pass out from spinal cord
- **Features of somatic and visceral nervous systems and sympathetic/parasympathetic divisions of visceral nervous system**
 - Somatic
 - Sensory return from skin and muscles
 - Motor outflow to voluntary striated muscles via 1-neuron path
 - Visceral/autonomic
 - Sensory return from wall/lining of organs (viscera)
 - Motor outflow to cardiac muscle and involuntary smooth muscle and glands
 - Indirect innervation: 2-neuron path: neuron #1 cell body in CNS → axon synapses with motor ganglion cell in PNS → ganglion cell sends axon to target
 - Sympathetic – thoracolumbar division; axons enter/leave thoracic and lumbar regions of s/c (T1-L2)
 - Parasympathetic – craniosacral division; axons enter/leave via cranial nerves or sacral (S2-S4)
- **Four general neural modalities – include: qualitative description of basic function, number of neurons (1 or 2) needed to carry signal between CNS and periphery, location of nerve cell bodies, basic course of fibers in generic pathway**
 - **General somatic efferent fibers (GSE)**
 - Carry motor outflow to voluntary striated muscle
 - Single-neuron path
 - Originates with large multipolar alpha-motor neurons in ventral s/c (aka. Final motor neurons b/c axons are sent out the ventral roots and spinal nerves to directly end on striated muscle)
 - **General somatic afferent fibers (GSA)**
 - Carry inflow from sensory endings in non-visceral tissue
 - Single-neuron path
 - Unipolar cells in dorsal root ganglia send central axons through dorsal roots into dorsal s/c
 - Peripheral axons extend out through spinal nerves to skin endings and musculoskeletal endings
 - Somatic sensation reaches level of consciousness
 - Exteroception – perception of external environment (temp, touch, pressure, pain); conveyed from skin sensory receptors
 - Proprioception – self-perception; returned from stretch, acceleration, muscle/joint/tendon receptors; provides info about position/movt of limbs and joints; important in voluntary muscle control
 - **General visceral efferent (GVE)**
 - Carry motor outflow to cardiac muscle, involuntary smooth, and glands
 - 2-neuron path

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- Originates with multipolar cells in ventral s/c (**pre-ganglionic neurons** – send axons through peripheral nerves to end on motor ganglion neurons) → then they extend post-ganglionic axons outward to reach ultimate targets
- Rarely under voluntary control – symp and parasymp (no parasymp innervation in back/limbs)
- Sympathetic
 - Multipolar pre-ganglionic neurons (in ventrolateral cell column of s/c from T1-L2) send preganglionic axons via ventral roots into T1-L2 spinal nerves
 - Preganglionic fibers leave each nerve as a little bundle (**white ramus communicans** = communicating branch) → through this bundle, they reach chain of symp motor ganglia that lie parallel to vertebral column (aka. sympathetic chain/trunk – from base of skull to coccyx; contains motor ganglion cells that serve all body levels)
 - Preganglionic axons that pass through white rami from the T1-L2 spinal nerves fan out into symp chain going above/below/or at level of entry
 - All ganglionic cells in chain get synaptic input from pregang neurons in T1-L2 region
 - Every spinal nerve receives **gray ramus communicans** (bundle of postgang axons from gang cells in chain) whose fibers fuse with spinal nerve and complete visceral motor path by going to sweat glands, arrector pili muscles, and involuntary smooth muscle in BV walls
 - All spinal nerves get postgang gray rami from symp chain BUT only T1-L2 spinal nerves provide pregang white rami to chain
- **General visceral afferent (GVA)**
 - Carry inflow from sensory endings of viscera and BV
 - Single-neuron path
 - Unipolar nerve cells in DRG send central axons through dorsal roots into dorsolateral cell column of s/c
 - Their peripheral axons reach out along paths taken by visceral motor fibers
 - Visceral pain fibers – retrace symp motor outflow paths to organs
 - Visceral monitoring afferents – follow parasymp motor paths
 - GVA fibers NOT in back/limbs
 - Just know: DRG of T1-L2 and S2-S4 spinal nerves contain GVA neuron cell bodies and the central processes of these cells pass through dorsal roots to enter corresponding s/c segments
- **Preganglionic vs. postganglionic neurons**
 - Preganglionic – from cells in ventrolateral part of T1-L2 whose axons go through ventral root and spinal nerve to reach ventral primary ramus
 - Leave VPR in white ramus communicans to enter symp chain
 - Postganglionic – from chain gang cells that pass through gray ramus communicans into VPR of all segments of spinal nerve
 - Some postgang fibers are with VPR while others go back into dorsal primary ramus for distribution
 - DPR – smaller primary rami that turns dorsally and supplies deep muscles of back and skin over them
 - VPR – larger PR that runs as intercostals nerve and supplies voluntary muscle of thoracic wall; lateral and anterior cutaneous branches
- **Describe/draw/label typical spinal nerve**
- **Relationships between sympathetic motor outflow and thoracic spinal nerve**
- **White ramus communicans vs. Gray ramus communicans (see GVE)**
 - **Spinal nerves with white rami** – T1-L2
 - **Spinal nerves with gray rami** – all segments: C1-Coccyx1
 - **Spinal nerves with both white and gray rami** – T1-L2
- **Dermatome vs. Myotome**
 - Dermatome – area of skin whose dermis is innervated by a DRG; sensory return from dermatome carried by segmental spinal nerve into corresponding cord segment via dorsal root
 - Myotome – all striated muscle fibers innervated by specific cord segment via corresponding spinal nerve segment and its ventral root
- **Nerve plexus**
 - Interwoven network of nerves created by nerve fibers in VPR of spinal nerves that grow out into limb and take paths to targets
 - Inputs to plex by segment (VPR)
 - Output carried by terminal branches (multisegmental) – bundles of fibers arranged according to regional destination in limb

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- **Brief description on how to assess injury to roots, trunk, and rami of spinal nerve**
 - o Damage to ventral root of spinal nerve → motor deficit with monosegmental pattern of distribution
 - o Damage to dorsal root of spinal nerve or to its DRG → sensory deficit with monosegmental...
 - o Damage to spinal nerve trunk → motor and sensory deficits with monosegmental...
 - o Damage across course of DPR or VPR (beyond trunk) → various deficits (motor and/or sensory) with mono or multisegmental deficits depending on axons present in nerve at site of injury
 - Fibers going beyond injury site = compromised
 - Fibers that branched from nerve proximal to injury (closer to CNS) = unaffected
 - Fibers from other segments that have joined nerve proximal to injury = damaged
 - o Damage to s/c → cord segments directly involved are destroyed
 - Segments above lesion = normal
 - Segments below = normal but are cut off from communication with brain so sensory info will reach cord but won't be perceived; striated muscles can't be used at will but can be activated from local sensory input (reflexes will work)

LEC 4: SKELETAL MUSCLE ACTION

- **"Sliding filament" mechanism of contraction in skeletal muscle**
 - o Breaking/reforming cross-bridges between myosin heads and actin molecules along thin filaments
 - o Thin filaments slide past thick filaments towards M line
 - o Each sarcomere shortens by 0.6 micrometers
- **Attachments of a muscle and how force of contraction is transmitted to attachments**
 - o Attached to bone, cartilage, fascia, skin, mucous membranes
 - o Origin – most stable attachment
 - o Insertion – most mobile attachment
 - o Lateral/medial
 - o Anterior/posterior
 - o Superior/inferior
 - o Proximal/distal
 - o Elements of muscle function
 - 2 points of attachment
 - Somatic stimulation
 - Tension generated
 - Shortened muscle → attachments brought closer together → movement results
 - o Remember: muscle must cross joint to produce motion at the joint
 - o Force transmission to attachments
 - Actin filaments anchored in proteins under cell membrane that is then linked with basal lamina and CT matrix
 - Z discs are adjacent to membrane and tied in
 - Contractile apparatus mesh = prot of sarcomere + subsurface prot network + transmembrane linking prot + matrix prot + collagen
 - Skeletal muscle compressed at active contraction
 - Stretched by opposing muscle or gravity across joint
 - Energy stored in muscle and tendon – recoil upon removal of force
- **Three modes of contraction**
 - o To contract, tension must override:
 - Tendency of muscle/tendon to resist change in shape
 - Inertial resistance to motion at joint
 - Intrinsic load (weight of limb)
 - External (applied) load
 - o Isometric contraction – tension generated < opposing forces → motion does NOT take place at joint
 - Muscle length is constant
 - o Isotonic/concentric contraction – tension generated > total resistance → shortening at movement at joint
 - Muscle length shortens
 - o Eccentric/decontraction contraction – activation → tension generated in muscle while muscle length is increasing
 - Muscle length increases
 - Eg. Biceps – lower a heavy serving dish onto dinner table that has delicate glassware on it
- **Motor unit and graded contraction or independent use**
 - o Summation – individual muscle fibers restimulated before they have had time to relax

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- Alpha motor neurons – in ventral gray matter of s/c; send out axons to skeletal muscle fibers
- 1 nerve fiber innervates 1 muscle fiber
- Motor units – alpha MN + all muscle fibers it innervates
 - Graded control of tension as number of activated units is increased/decreased
 - Allows independent use of different parts of one muscle
- **Afferent control of muscle function – reflexes**
 - Exteroception and proprioception
 - Proprioception – supplemental return by muscle spindles; receive special motor innervation from gamma-efferents; spindles monitor muscle condition
 - Reflex – involuntary skeletal action mediated by reflex arc (connection between sensor and motor neurons that do not involve cerebral cortex)
 - Spinal reflexes
 - Segmental reflex arcs – just 1 s/c segment involved; primary sensory neuron in spinal nerve sends info directly or through interneuron to alpha-MN on same side of appropriate segment (ipse)
 - Knee-jerk
 - Intersegmental reflex arc – info from primary sensory neuron to alpha-MN in several cord segments
 - Interneurons cross midline and initiate activity on contra-side (lifting foot but bracing with foot on ground when you step on something sharp)
- **Structural factors that determine muscle action at joint**
 - Angular – change in joint angle
 - Shunt – end of bone moves toward/away from joint
 - Shear – end of bone displaced within joint
 - Spin – bone rotates about long axis
- **How muscles work together (include gravity)**
 - Protagonists – prime movers to initiate specific motion
 - Antagonists – oppose the initiated motion with an opposite movement
 - Fixators – protagonists/prime movers and antagonists work together to stabilize joint
 - Synergists – eliminate unwanted parts of movement or assist in producing specific movement
 - Gravity – can act in place of prime movers, antagonists and fixators

LEC 5: PECTORAL REGION & SHOULDER

- **Female mammary gland structure, innervation, blood supply, venous and lymph drainage**
 - Structure
 - 2/3 bed = pectoral fascia over pec major
 - 1/3 = fascia over serratus anterior
 - Retrommary space between breast and pectoral fascia
 - Axillary process/tail = mam gland extending to armpit
 - Attached to skin by suspensory ligaments of Cooper
 - Blood supply
 - Subclavian a. → medial mammary branches of perforating branches
 - Thoracic aorta → posterior intercostals arteries
 - Axillary a. → lateral thoracic and thoracoacromial arteries
 - Venous drainage – to axillary vein and internal thoracic vein
 - Lymphatic drainage
 - Most lymph drains to pectoral nodes and back to venous system
 - Small percent goes parasternal to opposite side
 - Axillary nodes = most common site of metastasis
- **Metastasis routes from breast**
 - Parasternal
 - Axillary (most common)
- **Bones/landmarks of shoulder**
 - Sternum
 - Clavicle
 - Scapula
 - Proximal humerus

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- Shoulder complex joints, movement, ligaments

- Sternoclavicular joint
 - Sternum/clavicle
 - Saddle
 - Elevation/depression, protraction/retraction, rotation
 - Ligaments: ant/post sternoclavicular ligaments; costoclavicular ligament
- Acromioclavicular joint
 - Acromion/clavicle
 - Plane
 - Scapula rotation on clavicle
 - Ligaments: acromioclavicular, coracoclavicular (conoid + trapezoid parts) ligaments
- Glenohumeral joint
 - Scapula with humerus
 - Ball and socket
 - Flexion/extension, AB/AD, med/lat rotation
 - Ligaments: glenohumeral, coracohumeral, transverse humeral, coracoacromial
 - Coracobrachialis – primary function at GH joint
- Scapulothoracic joint (not a true synovial joint)
 - Ventral scapula and thoracic wall
 - Elev/depression, pro/retract, up/down rotation

- Scapulohumeral rhythm

- GH vs. ST
- 30 degrees = all GH movement
- 60 degrees = 1:2 ST vs GH
- 180 degrees (120 = GH, 60 = ST)
- Greater than 90 = 1:1 GH to ST

- Movements at glenohumeral joint, corresponding muscles and attachments, innervations

- Non-contractile ligaments and contractile muscles control stability at this joint
- Transverse humeral ligament over bicipital groove doesn't enhance stability; just stabilizes bicep tendon
- Glenoid labrum – fibrocartilage ring in glenoid cavity that deepens the cavity
- Subacromial/subdeltoid bursa – between coracoacromial arch and supraspinatus tendon and decreases friction between these 2 locations

- Rotator cuff muscles, attachment, innervation and contribution to GH stability

- SITS muscles (subscapularis, infraspinatus, teres minor, supraspinatus)
- All but supraspinatus depress the humerus (supraspinatus = abductor) to keep it from upwardly translating during abduction – prevents head of humerus from hitting acromion or coracoacromial ligament
- Lateral rotation of teres minor and infraspinatus prevent greater tubercle from hitting acromion
- Stabilize GH joint
- Keep head in joint

LEC 6: AXILLA, ARM AND ELBOW

- Boundaries of axilla and contents

- Boundaries
 - Anterior – pec major and minor
 - Posterior – scapula, subscap, lat, teres major
 - Medial – 1-4 ribs
 - Lateral – intertubercular groove of humerus
 - Base – skin/fascia of armpit
 - Apex – 1st rib/clavicle/upper border of scapula
- Contents (includes all branches of structures)
 - Axillary artery
 - Axillary vein
 - Brachial plexus
 - Axillary lymph nodes
 - Biceps brachii
 - coracobrachialis

- Distal humerus, radius, ulna bony landmarks

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- Humerus – 1 condyle (capitulum-trochlea), 2 epicondyles (M/L), 3 fossae (radial, coronoid, olecranon)
- **Humeroradial, humeroulnar, proximal and distal radioulnar joints – movements and structures**
 - Elbow joint = humeroulnar + humeroradial
 - Annular ligament – around radius head and holds it in place against ulna to prevent anterior dislocation of radius
 - Medial and lateral collateral ligaments – prevent varus and valgus (respectively)
 - Bursa – intratendinous, subtendinous, subcutaneous; decrease friction and pressure
 - Interosseus membrane – connects radius and ulna
 - Humeroulnar – hinge, F/E
 - Humeroradial – modified hinge, F/E, Sup/Pron
 - Proximal radioulnar – pivot, sup/pron
 - Distal radioulnar – pivot, sup/pron
- **Muscles acting on all joints**
 - On elbow (HU and HR joints) = 5 muscles of arm
 - Biceps brachii
 - Brachialis
 - Triceps brachii
 - Anconeus
 - Coracobrachialis
 - PR and DR joints (radioulnar) = 3 – pronate and supinate!
 - Pronator teres
 - Pronator quadratus
 - Supinator
- **Cubital fossa contents and border**
 - Border
 - Superior imaginary border (line between lateral and medial epicondyles)
 - Brachioradialis (lateral)
 - Pronator teres (medial)
 - Brachialis and supinator (floor)
 - Biceps aponeurosis (roof) is NOT the same thing as biceps tendon
 - Contents – **TAN**
 - Biceps Tendon
 - Brachial Artery
 - Median Nerve
 - Bicipital aponeurosis
 - Roof
 - Cephalic vein
 - Basilic vein
 - Median cubital vein

LEC 7: UPPER EXTREMITY BLOOD SUPPLY AND INNERVATION (BRACHIAL PLEXUS)

- **Arteries/veins that can be compressed to control bleeding in UE**
- **Key arteries for pulse, heart rate**
 - Brachial artery – for BP
 - Median cubital – venipuncture
 - Conducting arteries – largest vessels of body with greatest amount of elastic tissue
 - Femoral
 - Radial
 - Carotid
- **Anastomoses of upper limb for collateral blood flow**
 - Arterial anastomoses – allow pressures to equalize and provide alternative routes
 - Joint region
 - Arteriovenous anastomoses – direct transfer of blood from artery to vein bypassing capillaries
- **Subcutaneous veins for venipuncture**
 - Cephalic vein (lateral) – in snuff box; drains into axillary vein
 - Basilic vein (medial) – drains into brachial vein to help form axillary vein

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- Join together at median cubital v. (tributary)
- **Lymphatic system**
 - Eventual drainage into venous system
 - Major route by which carcinoma metastasizes
- **Brachial plexus and clinical deficits**
 - Thyrocervical trunk → suprascapular and transverse cervical arteries
 - Suprascapular artery – above superior transverse scapular ligament
 - Supraclavicular – rami, trunk
 - Retroclavicular (behind clavicle)– divisions
 - Infraclavicular – cord, branch
 - Supraclavicular branches = long thoracic n, suprascapular n, dorsal scapular n, subclavian n
 - Infraclavicular branches = all branches of all cords
 - C5, C6 nerves – innervate proximal muscles in upper limb (shoulder, pec girdle)
 - C8-T1 nerves – innervate distal muscles (hand)
 - C6-C8 nerves – innervate muscles acting on elbow and wrist
 - Flexors – innervated by anterior division fibers
 - Extensors – innervated by posterior division fibers
 - Musculocutaneous nerve becomes lateral antebrachial cutaneous nerve when it emerges lateral to biceps tendon – supplies lateral forearm skin
 - Median n → AIN branch in cubital fossa → median n. goes through carpal tunnel → recurrent branch to thenars → branch to index and middle finger lumbricals → common and proper palmar digit n. → palmar cutaneous branch
 - Found between flexor digitorum superficialis and profundus
 - Ulnar n → passes over medial epicondyle (groove between med epicondyle and olecranon) → under flexor carpi ulnaris with the ulnar artery → canal of Guyon → 4-5 digits → hypothenars
 - Radial n → lateral epicondyle of humerus → superficial and deep branch
- **Nerve lesion site vs. deficits**
- **Pathologies**
 - **Erb's paralysis** – upper BP damage – C5, C6
 - **Klumpke's paralysis** – lower BP damage – C8, T1
 - **Winged scapula** – damage to long thoracic nerve
 - **Crutch paralysis** – radial nerve palsy – wrist drop (no extension), axillary n affected so no shoulder abduction
 - **Collateral circulation if axillary artery blocked** – scapular anastomosis

LEC 9: FOREARM, WRIST, AND HAND

- **Landmarks of radius and ulna**
 - Radius articulates with proximal wrist bones
- **Wrist complex joints, types, surfaces, motions**
 - Ulnar side of hand – grasping
 - Radial side – object manipulation
 - Joints
 - Radiocarpal
 - Between distal radius and proximal carpals
 - Condylloid
 - F/E and Ab/Ad of wrist
 - Midcarpal
 - Between prox and distal carpals
 - Complex plane
 - Gliding in 2 planes
 - Intercarpal
 - Between individual carpals in each row
 - Plane joints – minimal movement
 - For full range of motion, there must be movement at both radiocarpal and midcarpal joints
- **Wrist and hand bones**
- **Wrist and hand supportive structures**
 - Flexor retinaculum (transverse carpal ligament)
 - Palmar surface

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- Roof of carpal tunnel
 - Prevents bowstringing of long flexor tendons
- Extensor retinaculum
 - Dorsal surface
 - Prevents bowstringing of extensor tendons
- Radial and ulnar collateral ligaments
 - Lateral stability to wrist and joint
- Articular disc
 - Between distal end of ulna and proximal carpals
 - Provides gliding surface across distal forearm bones and cushions forces
- Digit articulation
 - CMC – plane (thumb is saddle)
 - MP – condyloid
 - PIP and DIP – hinge and F/E
- Palmar aponeurosis – over long flexor tendons and where palmaris brevis inserts
- Flexor sheaths – fibrous digital and synovial sheaths
- Ligaments and joints of hand
 - Medial and lateral collateral ligaments of MP and IP joints – flexion, reinforce lateral aspects
 - Palmar ligament of MP – supports volar surface
 - Transverse metacarpal ligament – at heads of metacarpals to hold them together
 - Cleland’s and Graysons ligaments – cutaneous stability to skin of digits
- **Intrinsic vs. extrinsic hand muscles**
 - Intrinsic = lumbricals and interossei
- **Muscles that act on wrist, digits, thumb, attachments, innervations**
 - Muscles that act on wrist
 - Ext carpi radialis longus
 - ECR brevis
 - Ext carpi ulnaris
 - Flexor carpi radialis
 - Flexor carpi ulnaris
 - Act on digits
 - FD superficialis
 - FD profundus
 - E digitorum
 - E indicis
 - E digiti minimi
 - Thumb
 - E pollicis longus
 - EP brevis
 - Abductor pollicis longus
 - F pollicis longus
- **Extensor mechanism and function**
 - Triangular aponeurosis that wraps around dorsum and sides of metacarpal and proximal phalange heads to hold extensor tendon in middle of digit
 - Has median band going to base of mid phalanx, two lateral bands to base of distal phalanges
 - Intrinsic hand muscles are attached to lateral bands and to ED tendon
 - When extensor digitorum (ED) contracts, hood pulled proximally → no MP flexion → intrinsic extend PIP and DIP simultaneously (mechanical coupling via extensor hood)
 - When ED relaxed, lumbricals generate tension from point volar to MP joint and then can flex MP while extending PIP and DIP
- **Carpal tunnel, associated structures and clinical significance**
 - Carpal tunnel
 - Palmar surface of carpal bones
 - Transmits tendons and median nerve from forearm into hand
 - Base = all carpals
 - Roof = flexor retinaculum
 - Guyon’s tunnel

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- Tunnel formed by pisiform, hamate hook and pisohamate ligament
- Transmits ulnar nerve and artery
- **Nerve and orthopedic injuries**
 - **Wrist drop** – radial nerve injury in upper arm; paralysis of extensors
 - **Epicondyle fracture – cubital tunnel syndrome** – ulnar nerve injury at level of elbow
 - **Hand of benediction** – median nerve injury at level of elbow; impaired PIP and DIP at first 3 fingers so no flexion
 - **Claw hand** – ulnar nerve injury at wrist; impaired intrinsic so no PIP and Dip extension
 - **Simian hand** – medial nerve compression in carpal tunnel; impaired sensation to lateral 3.5 digits
 - Orthopedic injuries
 - **Colle's fracture** – distal radius fracture
 - **Scaphoid fracture** – fall on palm
 - **Skier's thumb** – ulnar collateral ligament sprain; forced radial deviation of MCP of thumb

LEC 10: LOWER EXTREMITY BLOOD SUPPLY & INNERVATION

- **Proximal origin of major vessels supplying LE**
 - Common iliac arteries at level of iliac crests
 - Internal and external iliac arteries on each side
- **LE arteries and branches**
 - Perforating branches from the femoral artery form anastomoses and supply posterior compartment of thigh
 - Popliteal artery ends in knee region by dividing into anterior and posterior tibial arteries
 - Anterior tibial a. changes names at the ankle joint and becomes dorsalis pedis – in first interosseous space divides into dorsal metatarsal and deep plantar a.
 - Posterior tibial artery gives rise to medial and lateral plantar arteries (name change at plantar foot)
- **Genicular anastomosis**
 - Five genicular branches off the popliteal artery supply knee capsule
 - Collateral circulation
 - Other contributors
 - Descending genicular branch of femoral a.
 - Descending branch of lateral femoral circumflex a.
 - Anterior tibial recurrent branch of anterior tibial a.
- **Superficial and deep veins**
 - Subject to venous thrombosis after fractures and surgery
 - Deep veins – beneath deep fascia; usually paired and flank artery
 - Medial and lateral plantar veins
 - Posterior tibial and fibular veins
 - Dorsal venous arch forms anterior tibial vein
 - Ant tib + post tib + fib v = popliteal v → then becomes femoral v
 - Termination in deep v of thigh → joins femoral vein → to external iliac v
 - Superficial veins – in subcutaneous tissue
 - Great saphenous and small saphenous v
 - Great – medial; dorsal vein of great toe + dorsal venous arch → goes to femoral v
 - Small – lateral; dorsal v of little toe + dorsal venous arch → goes to popliteal v
- **Venous return from foot to external iliac vein**
- **Lumbar and sacral plexus origins and major nerves derived**
 - Lumbar plexus (L1-L4)
 - Femoral n → saphenous n
 - Obturator n
 - Ilioinguinal and iliohypogastric nerves
 - Genitofemoral n
 - Lateral cutaneous n of thigh
 - Lumbosacral trunk
 - Sacral plexus (L4-S3/S4)
 - Sciatic nerve → tibial n and common fibular (sciatic is just these two nerves adhered to each other)
 - Sural n (from tibial)
 - Superficial and deep fibular n (from common fibular)
 - Posterior cutaneous femoral n

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- Sup and inf gluteal n
- N to quadratus femoris
- N to obturator internus
- **Clinical intervention related to major vessels of LE**
 - Angiograms – cannulate femoral artery with a slender catheter going up to the external iliac artery, common iliac artery, to aorta and left ventricle of heart
 - Pulmonary thromboembolism – obstruction of pulmonary artery; when thrombus from lower limb vein breaks free and goes to lungs

LEC 11: GLUTEAL REGION, THIGH & HIP JOINT

- **Surface features**
 - Greater trochanter attachments
 - Piriformis
 - Gluteus maximus
 - Gluteus minimus
 - Lesser trochanter
 - Iliopsoas
- **Bony landmarks on femur and hip**
 - Hip
 - Iliac crest
 - Ant/sup iliac spine
 - Inguinal ligament
 - Pubic tubercle
 - Pubic symphysis
 - Ischiopubic ramus
 - Ischial tuberosity
 - Ischial spine
 - Post/sup iliac spine
 - Thigh
 - Femoral head
 - Greater trochanter
 - Femoral shaft
- **Ligaments that stabilize hip and function**
 - Sacroiliac joint – strong, immobile between pelvic girdle and axial skeleton
 - Sacroiliac ligament
 - Iliolumbar ligament
 - Sacrospinous ligament
 - Sacrotuberous ligament
 - Ligaments make this joint the strongest and most stable in body
 - Hip joint
 - Range of motion sacrificed for stability
 - Ab/Ad
 - F/E
 - Rotation
 - Circumduction not as great as shoulder b/c muscles stabilize shoulder joint whereas ligaments and bones stabilize hip joint
 - Capsular ligaments (3)
 - Iliofemoral ligament – strongest
 - Pubofemoral ligament
 - Ischiofemoral ligament – resists posterior dislocation of femoral head
 - Ligamentum teres – originates from acetabular labrum and inserts into fovea of femoral head; little role in stability; but carries artery of ligamentum teres which is important
- **Arterial anastomoses source around hip**
 - Inferior gluteal artery anastomoses with branches of profunda femoris artery
 - The two circumflex femoral (med/lat) arteries anastomose with each other and with inferior gluteal artery
- **Gluteal region muscles, innervations, actions**

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- **Thigh compartmentalization**
 - Anterior – flexors – femoral a.
 - Medial – abductors – obturator a.
 - Posterior – extensors (ex. Glut max) – tibial n.
 - Deep gluteal – external (lateral) rotators – piriformis, gemelli
 - Internal (medial) rotators – glut med, minimus, tensor fascia latae; weaker than lateral rotators
 - Fascia septae divides thigh into anterior and posterior compartments
 - Popliteal fossa
 - Boundaries
 - Biceps femoris (superolaterally)
 - Semimembranosus (superomedially)
 - Gastrocnemius (inferomedially and inferolaterally by medial and lateral heads respectively)
 - Contents
 - Termination of small saphenous vein
 - Popliteal artery
 - Popliteal vein
 - Tibial nerve
 - Common fibular nerve
 - Posterior cutaneous femoral nerve
 - Popliteal lymph nodes
 - Popliteal fat
- **Thigh muscles, innervations, blood supply**
 - Semitendinosus tendon joins pes anserinus with the sartorius and gracilis tendons to insert distal to medial tibial condyle
 - Adductor canal – entered by:
 - Femoral artery (emerges as popliteal artery)
 - Femoral vein
 - Saphenous nerve
 - Nerve to vastus medialis
- **Arterial and venous supply for LE, thigh, gluteal**
 - Nutrient artery off of profunda femoris artery supplies shaft of femur
 - Great saphenous vein penetrates fascia lata in the femoral triangle through the saphenous hiatus
- **Pathology and procedures**
 - **Avascular necrosis of femur head** – due to fall b/c medial circumflex femoral artery (main source of blood supply around head and neck) is disrupted
 - **Fracture of femur** – due to fall
 - **Occlusion of femoral artery**
 - **Hip dislocation** – fracture acetabulum; hip joint least stable in flexed position b/c fibrous capsule ligaments are slack
 - Posterior dislocation – sciatic nerve damage
 - Articular capsule torn → could damage blood supply to femoral head
 - **Trendelenburg gait** – superior gluteal nerve damage – hip drop; when contralateral foot raised, can't keep pelvis level; hip drop on foot in the air so use a cane on that side; on the hip drop side, abduction not occurring (glut med and min b/c of superior gluteal n. damage)
 - **Intragluteal injection** – upper lateral quadrant to avoid sciatic nerve
 - Superior glut neurovascular bundle, piriformis, inferior gluteal neurovascular bundle, sciatic nerve, internal pudendal vessels, and pudendal nerve leave deep pelvis through greater sciatic notch
 - Inferior gluteal n. damage – weak hip extension (glut max affected)
- **Cross section of thigh**

LEC 12: EMBRYOGENESIS I

- **Ovulation and fertilization processes**
- **Zygote development into morula and then blastocyst**
- **Process of normal implantation**
- **Development of bilaminar embryo, including amnion development and primary and secondary yolk sac development**
- **Formation of extraembryonic mesoderm and extraembryonic coelom**

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- How early embryo is nourished
- Ectopic implantations and consequences

LEC 13: KNEE, LEG, ANKLE JOINT AND FOOT

- **Leg and foot bones with ligaments**
 - o Linea aspera – attachment for septa on distal femur to which posterior compartment attaches
 - o Adductor tubercle on femur – where adductor magnus attaches
 - o Proximal (superior) tibiofibular joint – fibula doesn't contact femur; instead tibial head articulates laterally with fibula via interosseus membrane; shock absorption
 - o Femortibial (knee) joint – menisci distort as F/E occurs ; distributes weight evenly over joint
 - Patella – sesamoid bone
 - Patellar tendon/ligament – has bursa (prepatellar and suprapatellar)
 - Suprapatellar bursa – between quad tendon and femur
 - Prepatellar – under patella
 - Femoropatellar joint – puts wear on quad tendon; lengthens lever arm and advantage of quads
 - Lateral menisci = o-shaped; attached to lateral collateral ligament (fibular)
 - Medial meniscus = C-shaped; attached to medial collateral ligament (tibial)
 - Lateral tibial rotation – leg extension
 - Medial tibial rotation – unlocks knee; popliteus contracts
 - Medial rotation of femur = locked knee; lateral femur rotation = unlocked
 - o PCL – posterior aspect of tibia, courses anteriorly and internally – PAIN – attached to medial condyle of femur
 - o ACL – anterior, courses posteriorly and externally – APEX – attached to medial condyle of femur
 - **Anterior drawer sign** – pull tibia forward with ACL tear
 - o **Unhappy triad** – medial collateral ligament, ACL, and medial meniscus all torn with violent abduction and lateral rotation
- **Location of superficial veins in leg and foot**
 - o Great saphenous v – drains into femoral v
 - o Small saphenous v – drains into popliteal v
- **Superficial cutaneous nerves of leg and foot and regions they supply, segmental origins**
 - o Saphenous n – terminal branch of femoral n
 - o Sural n – branch of tibial n
 - o Superficial fibular n – supplies skin of dorsum foot and lateral leg muscles
- **Three fascial compartments of leg and muscles in each, innervation, arterial supply**
 - o Anterior – extensor – deep fibular n – anterior tibial a
 - o Lateral – fibular – superficial fibular n – branches of fibular a
 - o Posterior – flexor – tibial n – posterior tibial a
 - Superficial and deep layers divided by transverse fascial septum
 - Superficial – gastroc, soleus, plantaris
 - Deep – popliteus, flexor digitorum longus, flexor hallucis longus, tibialis posterior
- **Dorsalis pedis artery and palpation of this pulse point via landmarks**
 - o Continuation of anterior tibial artery post-cross at extensor retinaculum
- **Foot muscles, innervations, actions, functional deficits upon injury**
 - o Compartments
 - Dorsal – extensor – deep fibular n (ext digitorum brevis, hallucis brevis)
 - Plantar – flexor – lateral and medial plantar n (4 layers of flexors)
- **Muscles, vessels, nerves in sole and analogy to hand**
- **Ankle joint structure and corresponding muscle movement**
- **Bony foot arches – plantar aponeurosis, ligaments, muscles that support arches**
 - o Arches formed by bones and tightness of ligaments holding them together
 - o Support body weight and act as levers in forward propulsion
 - Medial longitudinal part of arch – most mobile and shock absorbing; calcaneus, talus, all cuneiforms, and 1,2,3 metatarsals
 - Lateral longitudinal – calcaneus, cuboid, 4,5 metatarsals; weight bearing
 - Transverse – posterior arch; distal row of tarsals, bases of metatarsals
 - o Plantar calcaneonavicular (spring) ligament – stabilizes medial longitudinal arch
 - o Long and short plantar ligaments – support longitudinal arches; form tunnel for tendon of fibularis longus

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- Plantar aponeurosis – divides foot into medial, lateral, central compartments
- **Pathologies**
 - **Varicose veins**
 - **Blockage of popliteal artery and collateral circulation**
 - **Damage of common fibular nerve** – foot drop due to paralysis of dorsiflexors
 - **Compartment syndromes and anatomical explanation** – results in pressure on muscles, vessels, nerves
 - **Pott's fracture around ankle** – excessive eversion of foot causing over stretching of medial ligament of ankle and resulting in fracture of medial malleolus
 - **Deformities of foot (flat foot, talipes)** – flat foot = fall of the plantar arch due to weak muscles and ligaments

LEC 14: EMBRYOGENESIS II

- **Three germ layers and which body tissues are derived from each**
- **Regional specializations within intraembryonic mesoderm**
- **Neurulation and clinical problems which occur when process is flawed**
- **General structures that have formed in embryo during each weekly stage of development**
- **Gastrulation**

LEC 15: INTRO TO RADIOLOGY

- **Principles of radiological methods and imaging**
- **Principles of interpreting radiological images**
- **Meaning of density differences in tissues and how that is used to interpret medical images**

BY JB