

ANATOMY AND PHYSIOLOGY FOR PILATES

Purchase College CE Class

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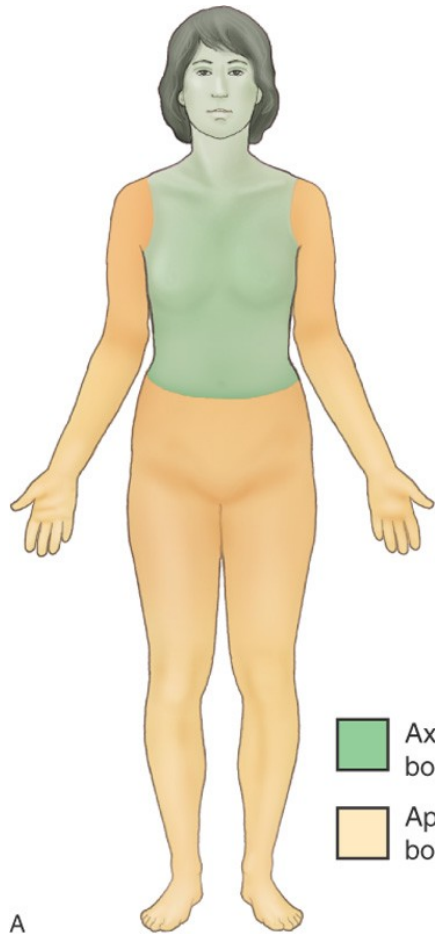
Week One



- Basic Kinesiology Terminology

Anatomy and Physiology

- Anatomy is Structure
- Physiology is Function

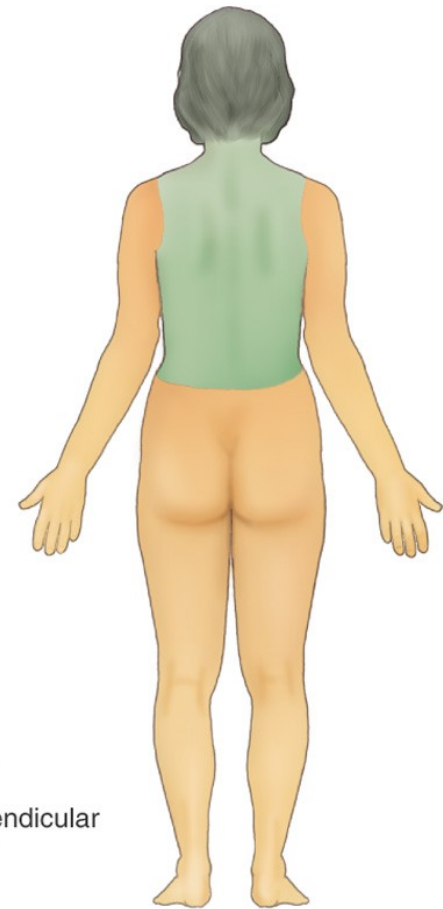
Axial / Appendicular Body





 Axial body
 Appendicular body

A

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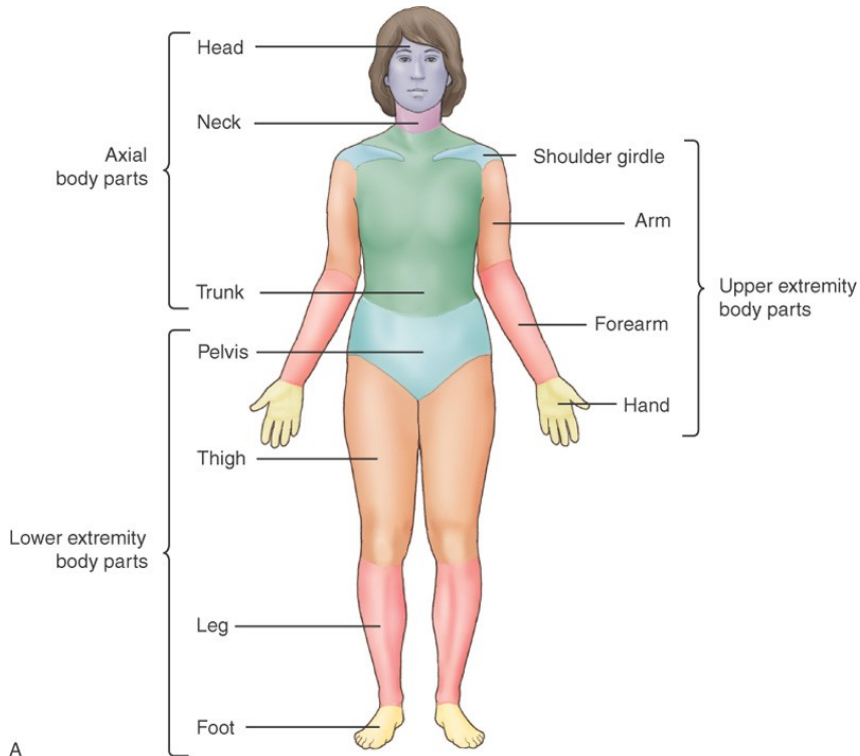


 Axial body
 Appendicular body

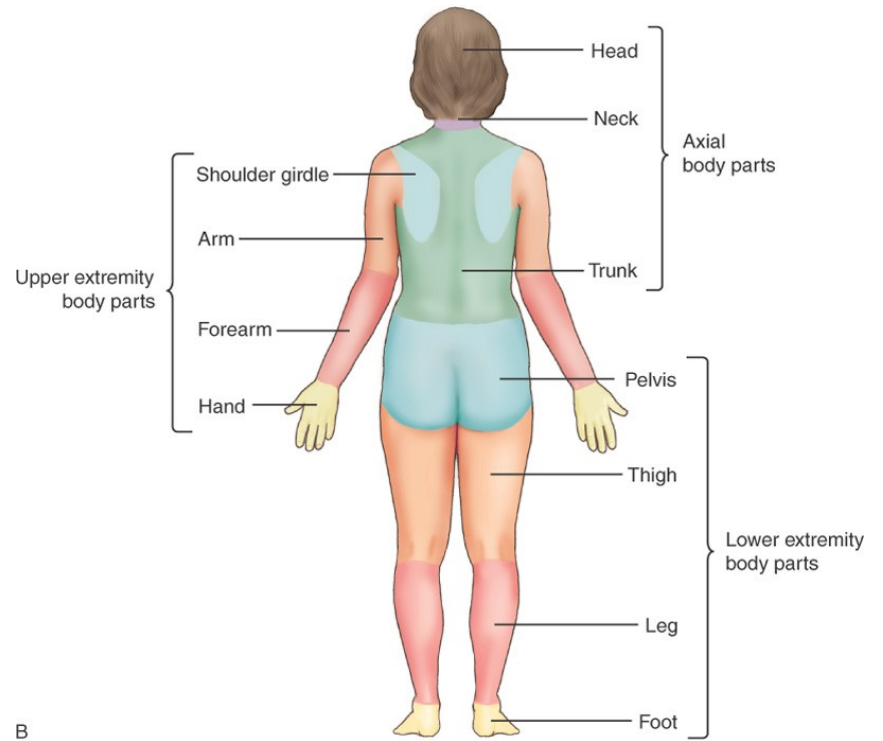
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Body Parts



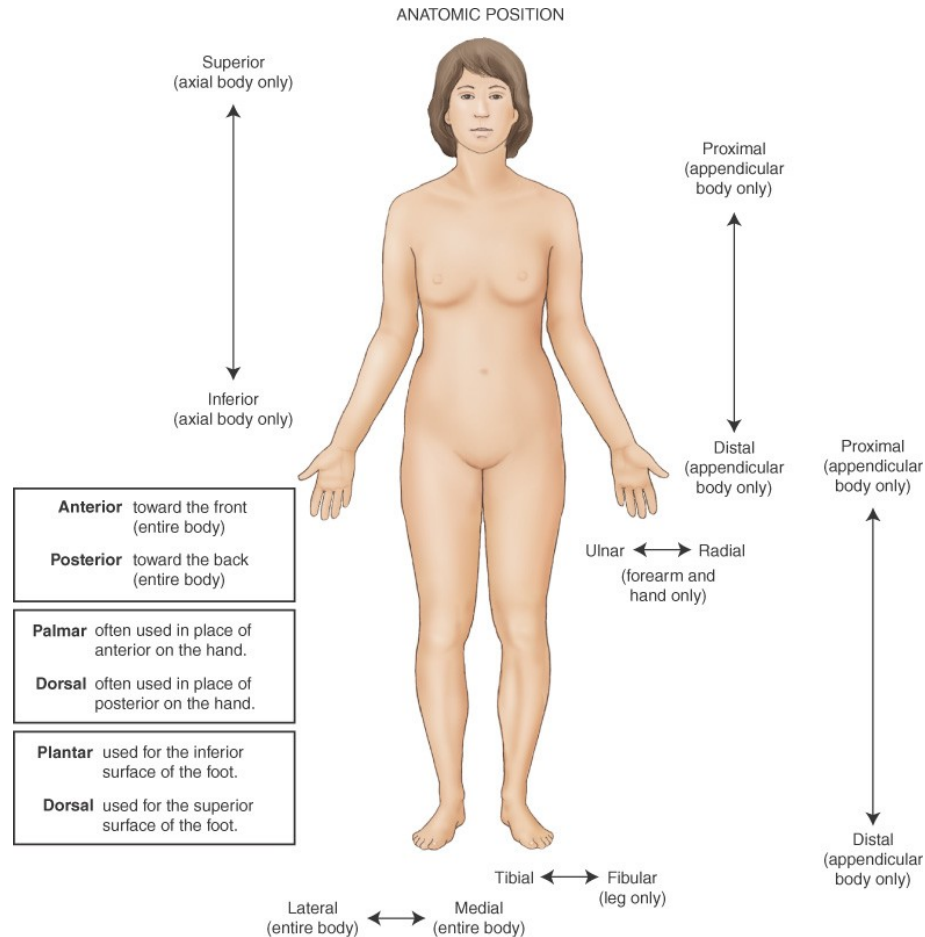
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Static Positional Terms



Pairs of Terms

- Anterior/posterior
- Medial/lateral
- Superior/inferior
- Proximal/distal
- Superficial/deep

Movement Terms - Pairs

- Flexion / extension
- Abduction / adduction
- Right lateral flexion / left lateral flexion
- Medial rotation / lateral rotation
- Right rotation / left rotation

Movement Terms – Pairs

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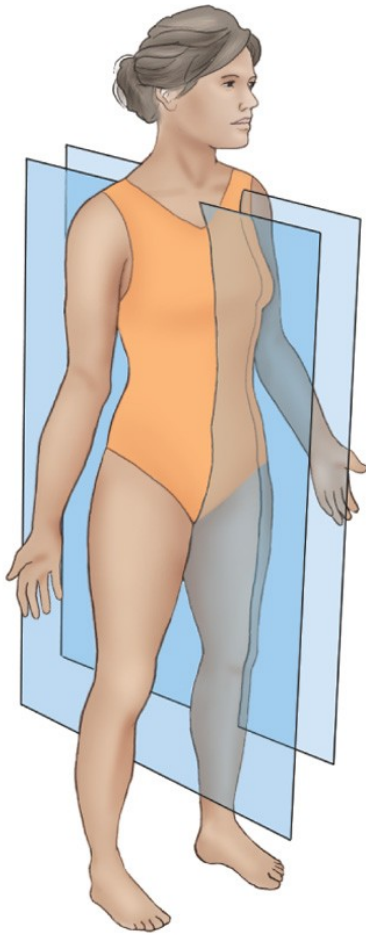
- Pronation / supination
- Dorsiflexion / plantarflexion
- Protraction / retraction
- Elevation / depression
- Upward rotation / downward rotation

- Extension vs. hyperextension
- Circumduction

Planes

- A plane is a 2-D flat surface that divides space.
- Movements occur within planes.
- There are three cardinal planes:
 - Sagittal
 - Frontal
 - Transverse
- Oblique planes...

Planes – Sagittal and Frontal



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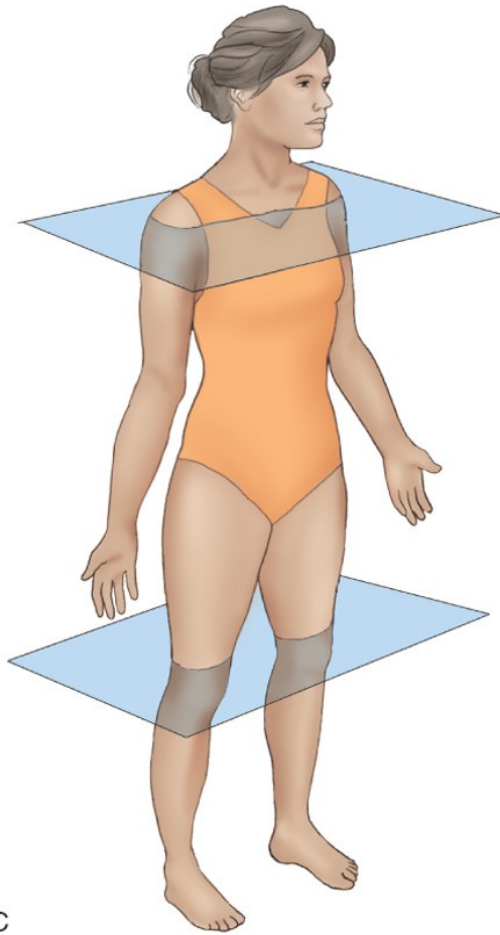
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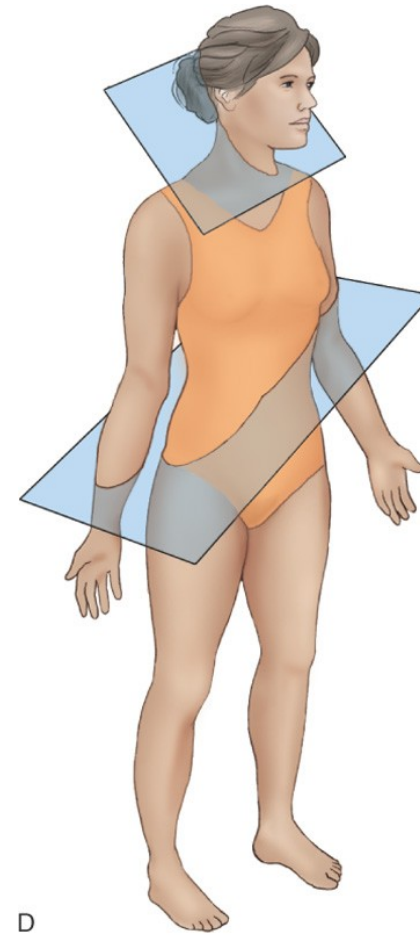
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Planes – Transverse and Oblique



C

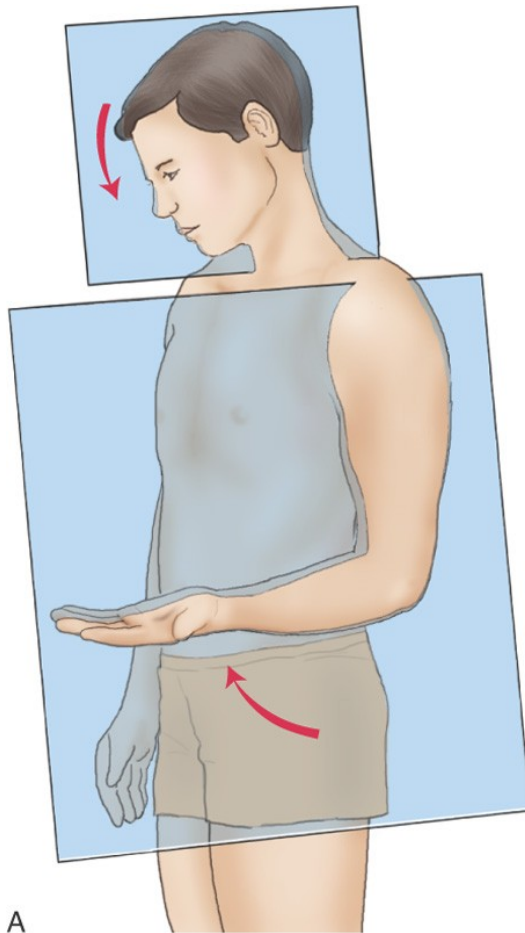
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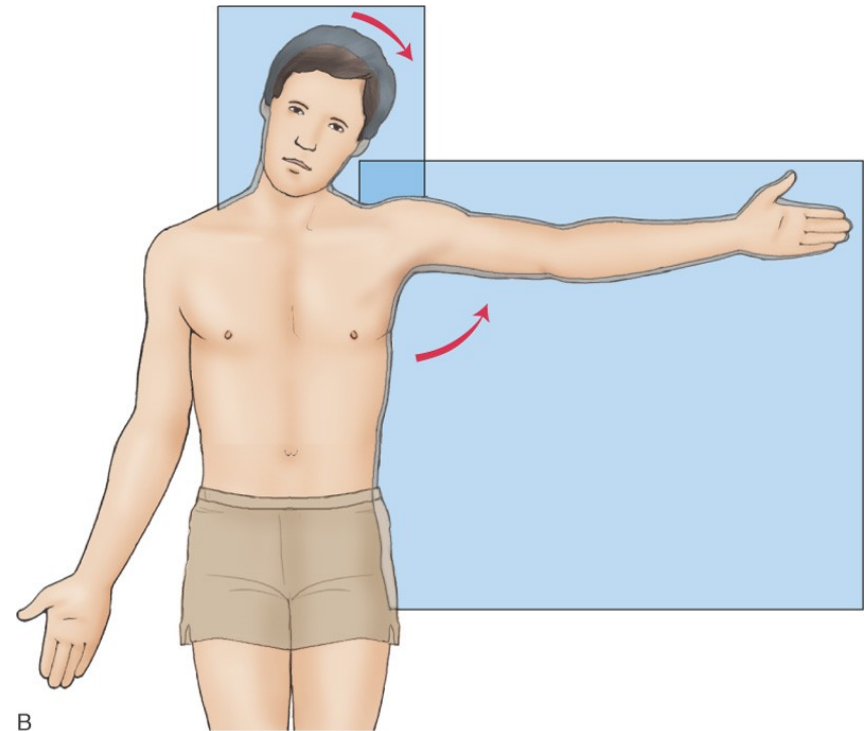
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Movement in Planes – Sagittal and Frontal



A

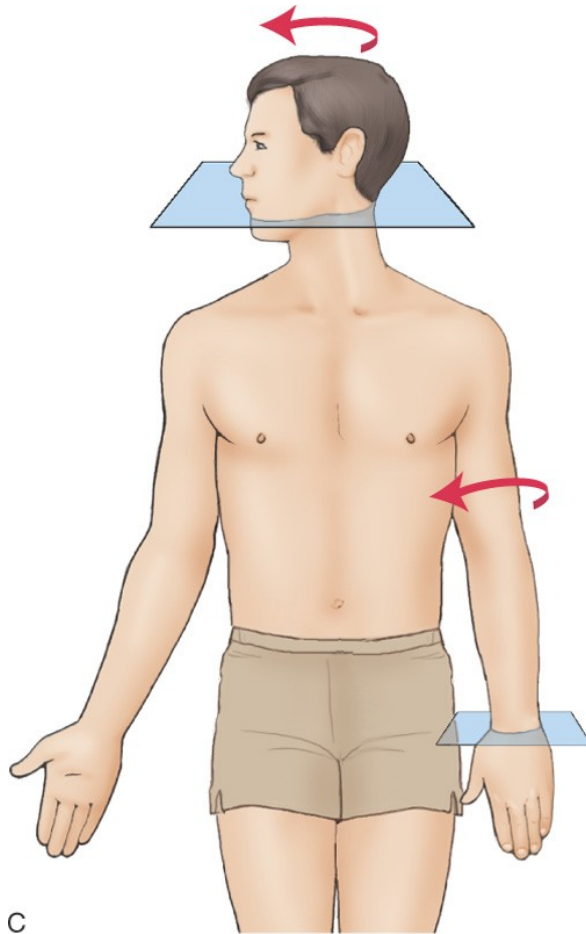
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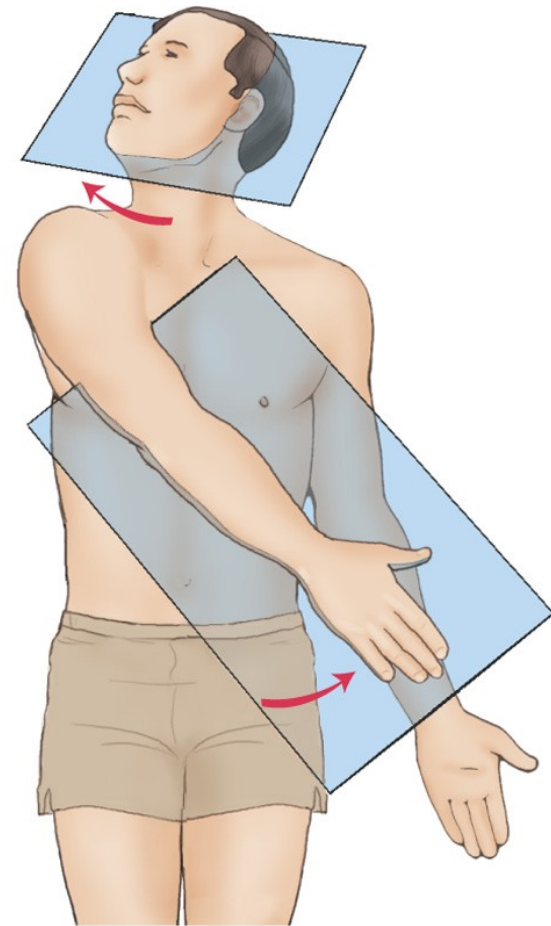
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Movement in Planes – Transverse and Oblique



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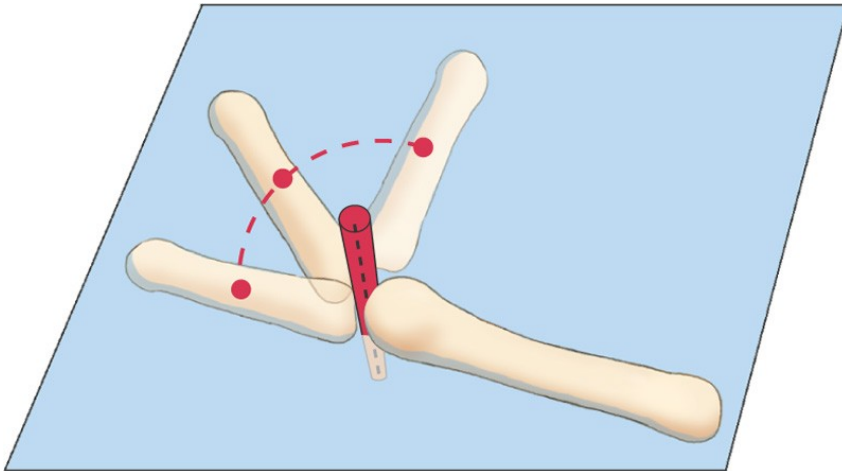


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Axes

- An axis (plural: axes) is an imaginary line around which movement occurs.

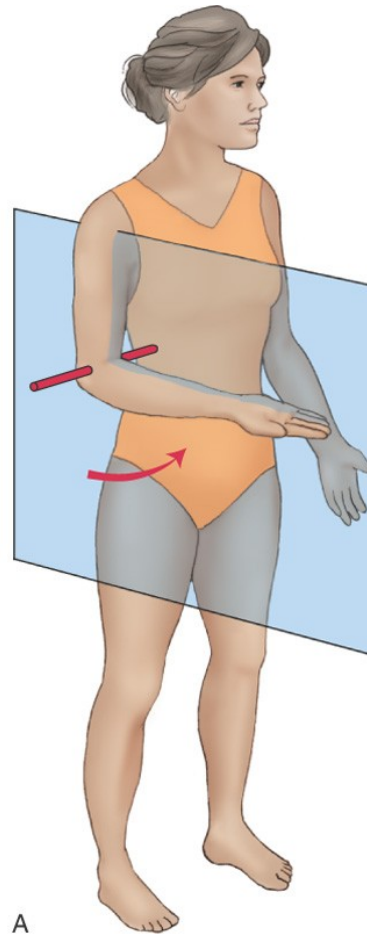


Axes – cont' d

- For each plane, there is a corresponding axis
- Sagittal – mediolateral
- Frontal – anteroposterior
- Transverse – vertical (superoinferior)

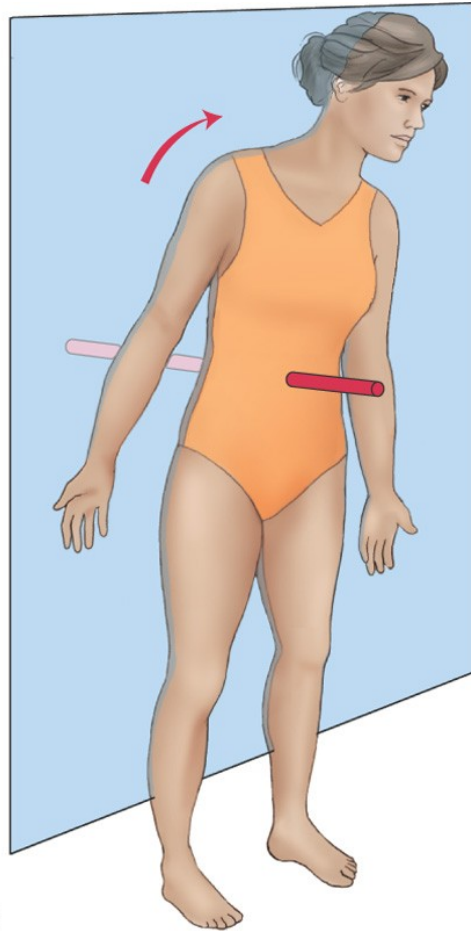
- Oblique - oblique

Mediolateral Axis



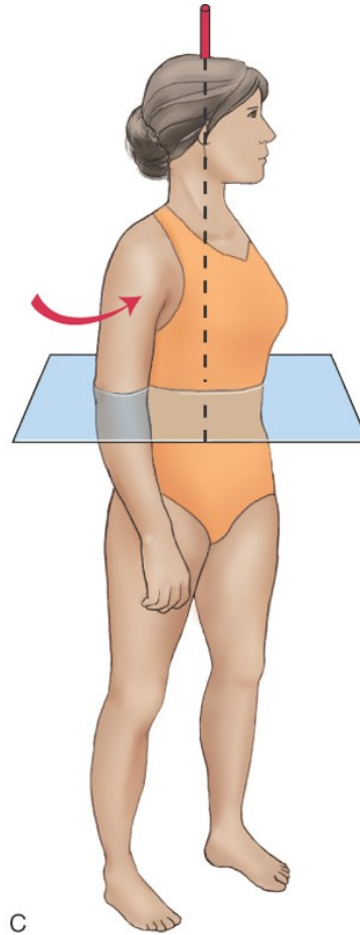
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Anteroposterior Axis



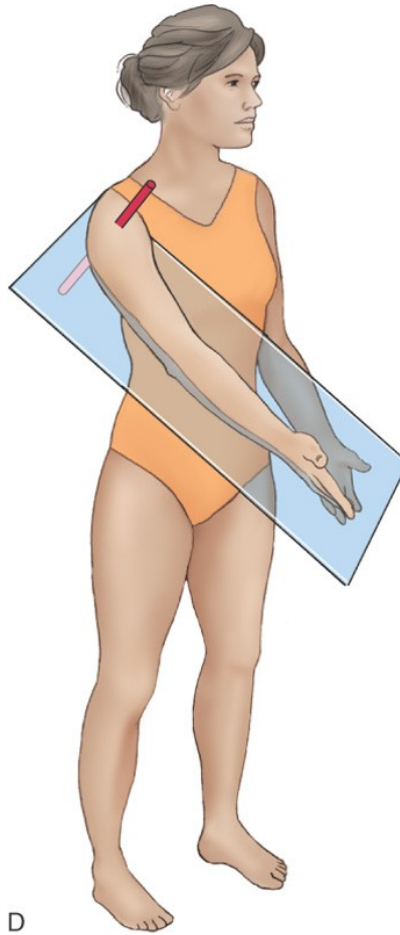
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Vertical Axis



C

Oblique Axis



D

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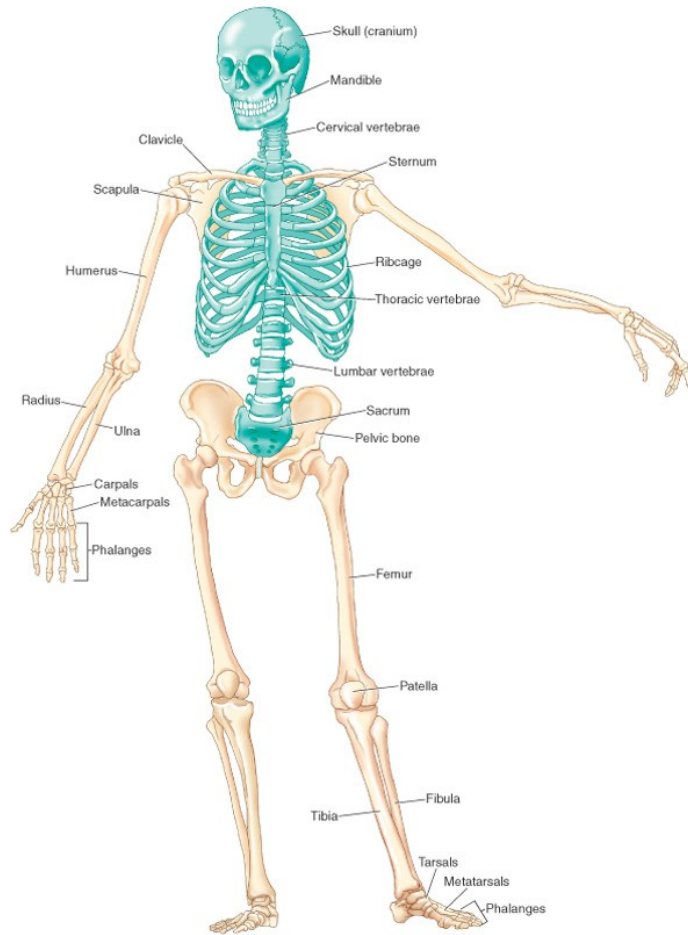
Naming Joint Actions

- A joint action is a cardinal plane joint motion.
- Three parts to fully describe a joint motion:
 - Direction of motion
 - Body part that moves
 - Joint at which motion occurs
- Example: Flexion of the arm at the shoulder joint

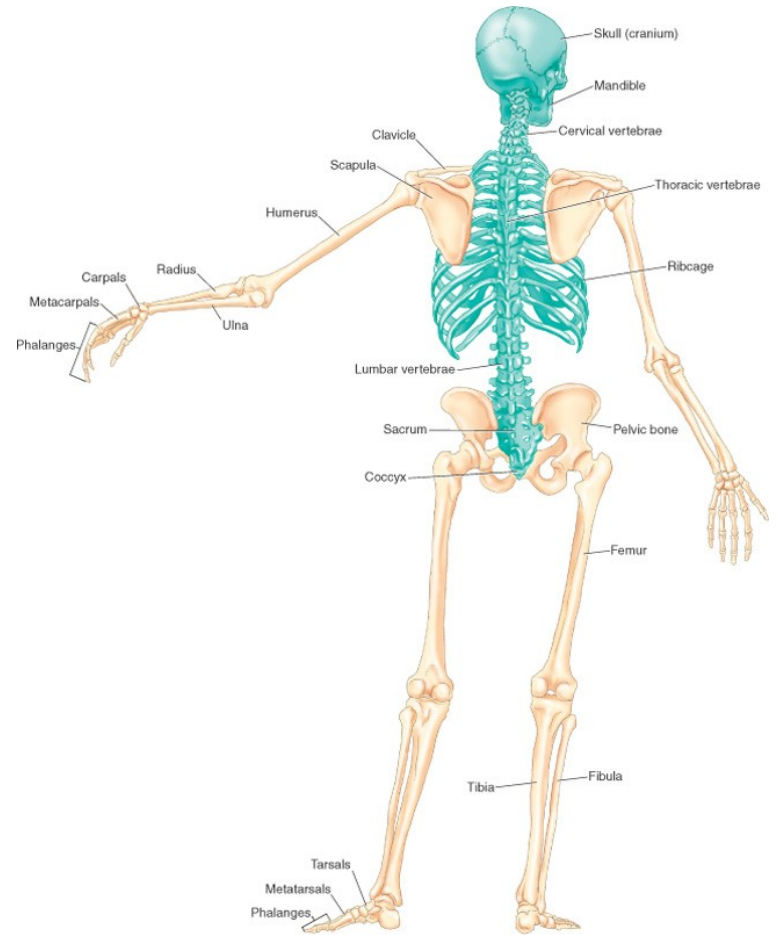
Week Two

- The Skeletal System

Bones of the Skeleton



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Bones – Upper Extremity

- Scapula / clavicle
- Humerus
- Radius / ulna
- Carpals
- Metacarpals
- Phalanges

Bones – Lower Extremity

- Pelvic bone (ilium, ischium, pubis)
- Femur
- Tibia / Fibula
- Tarsals
- Metatarsals
- Phalanges

Bones – Axial Body

- Cranium (frontal, temporal, occipital...)
- Vertebrae
- Sacrum /coccyx
- Hyoid bone
- Sternum
- Rib cage

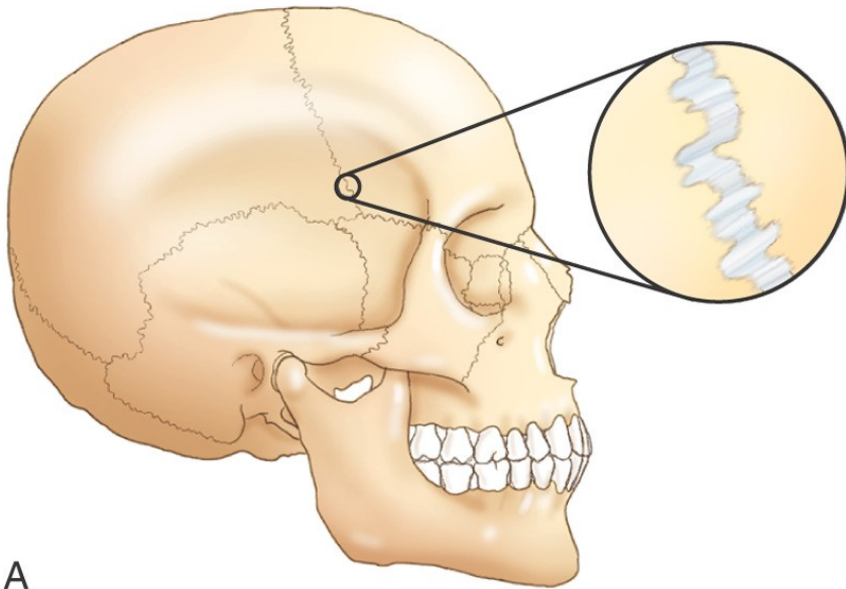
Bony Landmarks

- Anterior superior iliac spine (ASIS)
- Posterior superior iliac spine (PSIS)
- Iliac crest
- Medial border of scapula
- Inferior angle of scapula
- Spinous processes (SPs)

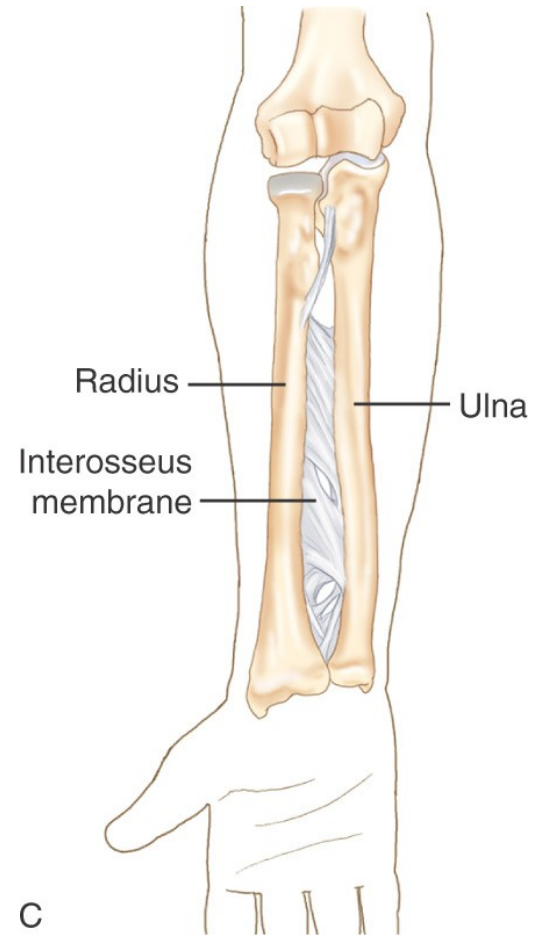
Joint Classification

- Structural:
 - Fibrous
 - Cartilaginous
 - Synovial (joint cavity)

Fibrous Joint Examples

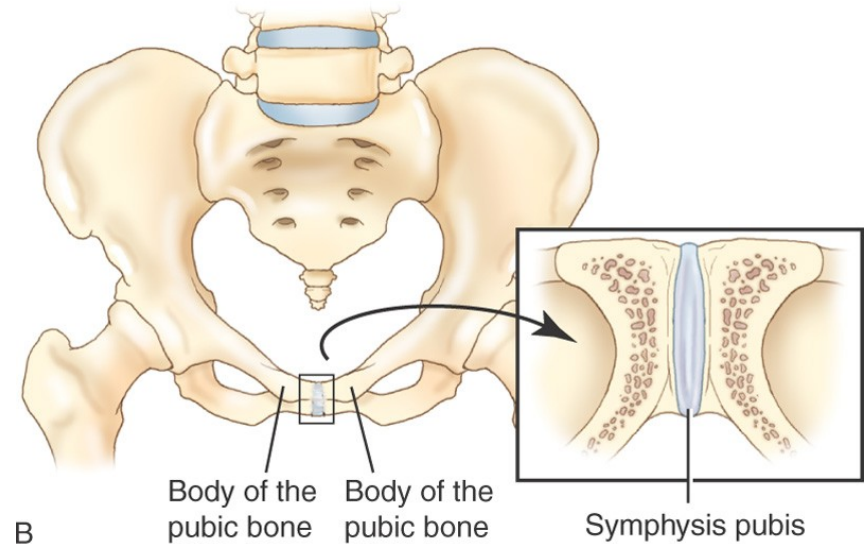
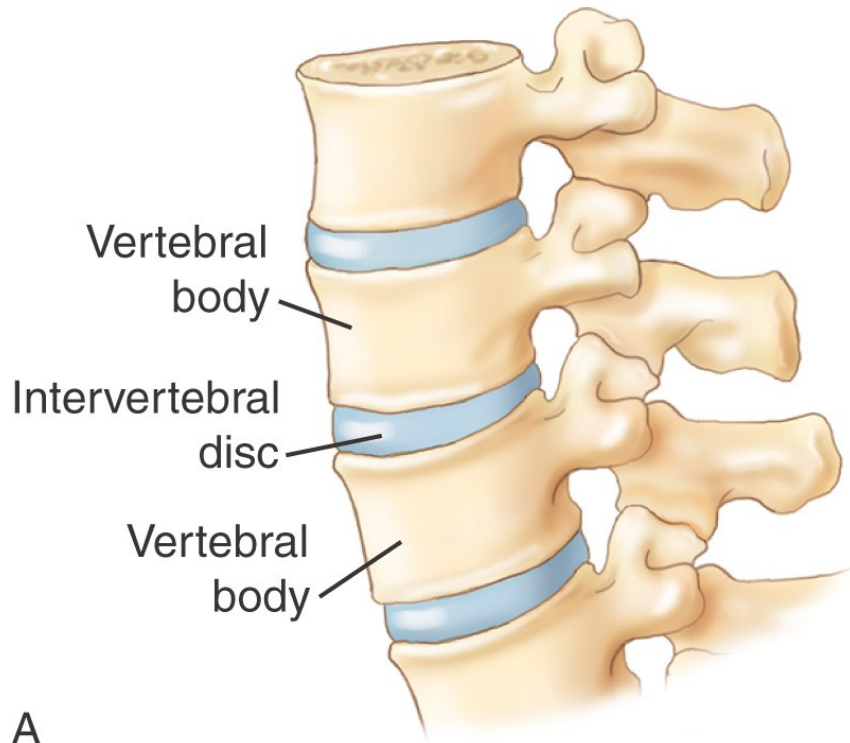


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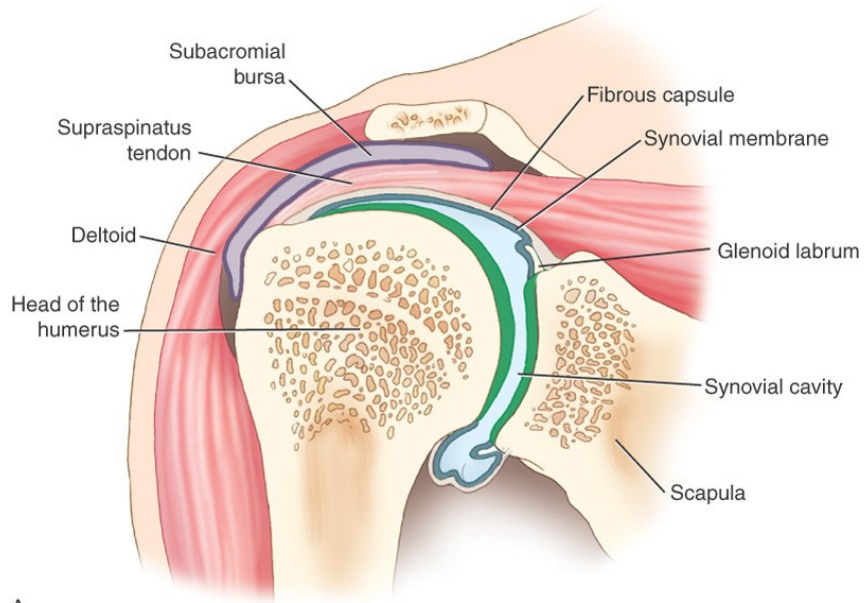
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Cartilaginous Joint Examples



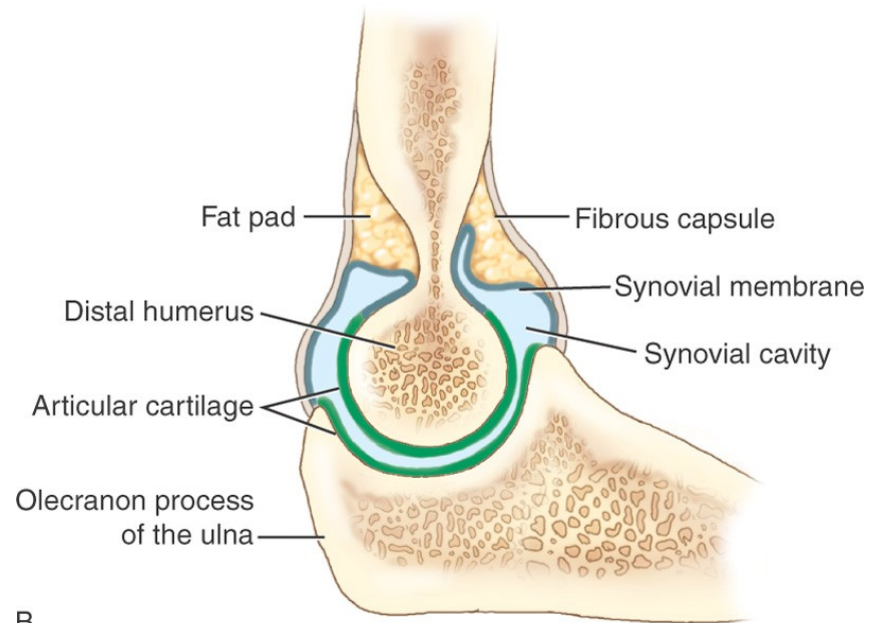
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Synovial Joint Examples



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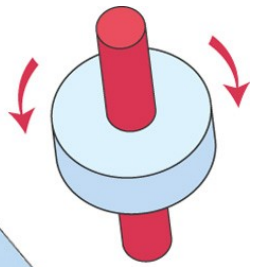
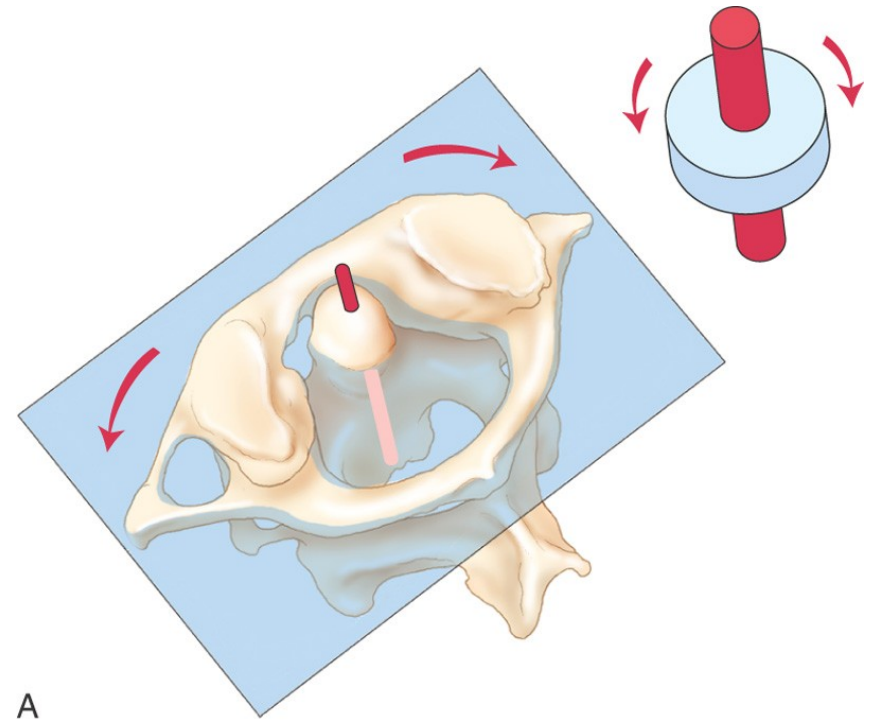
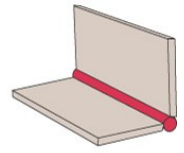
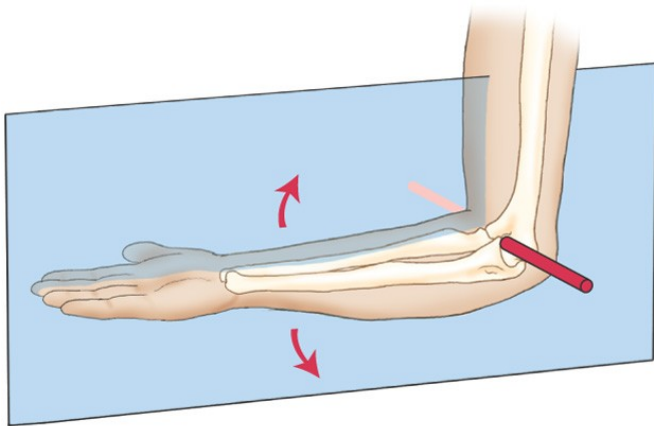
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Synovial Joint Categories

- Uniaxial (hinge and pivot)
- Biaxial (condyloid and saddle)
- Triaxial (ball and socket)
- Nonaxial

Uniaxial Joints



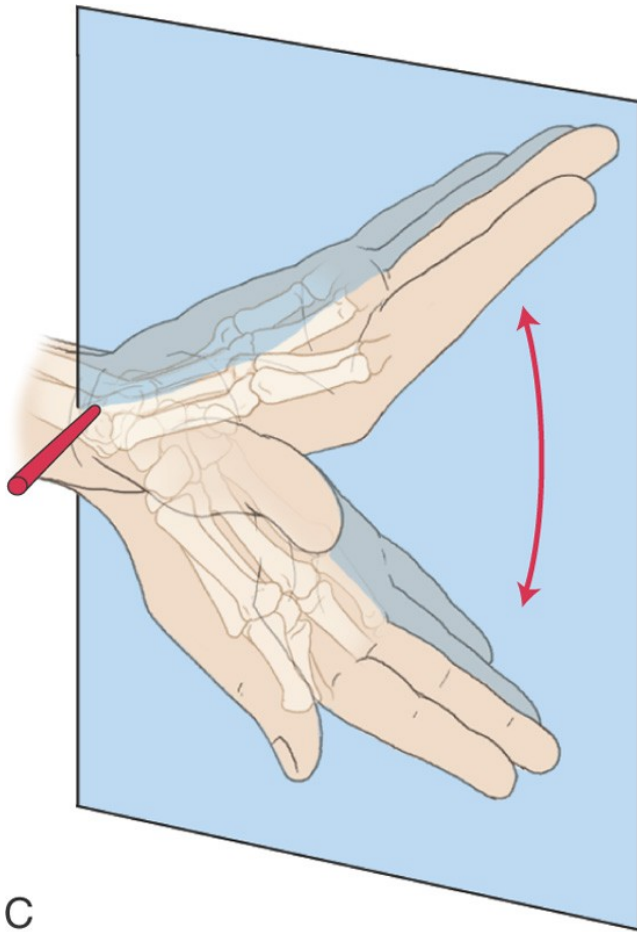
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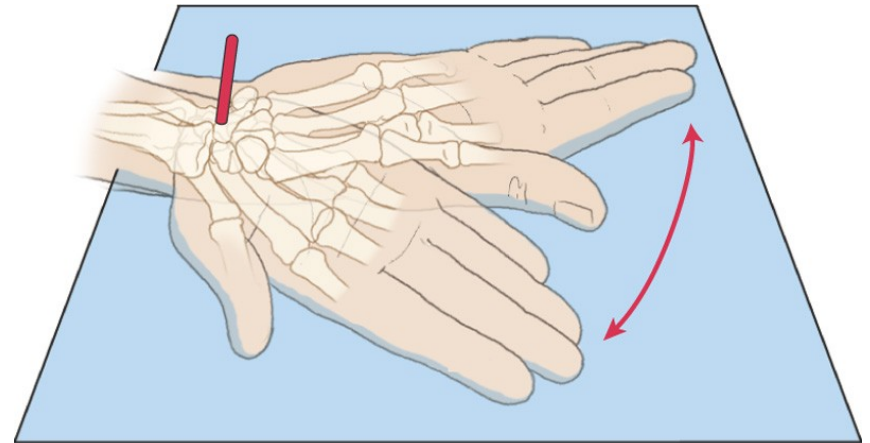
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Biaxial Joints



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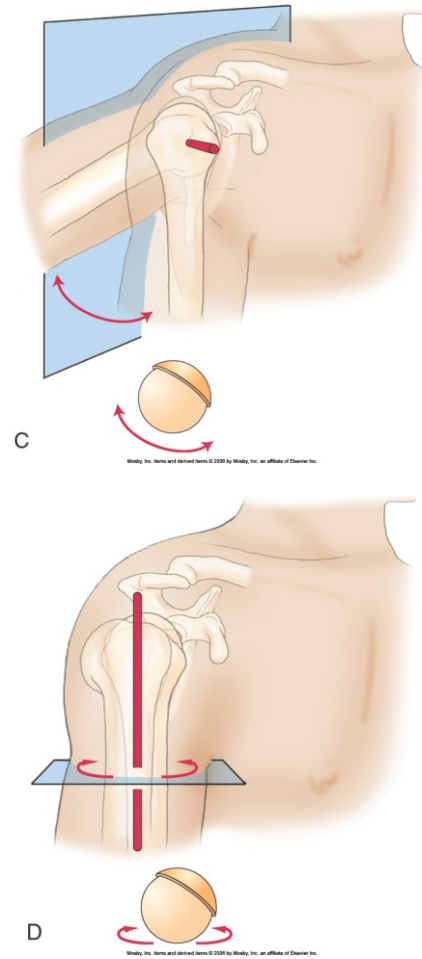
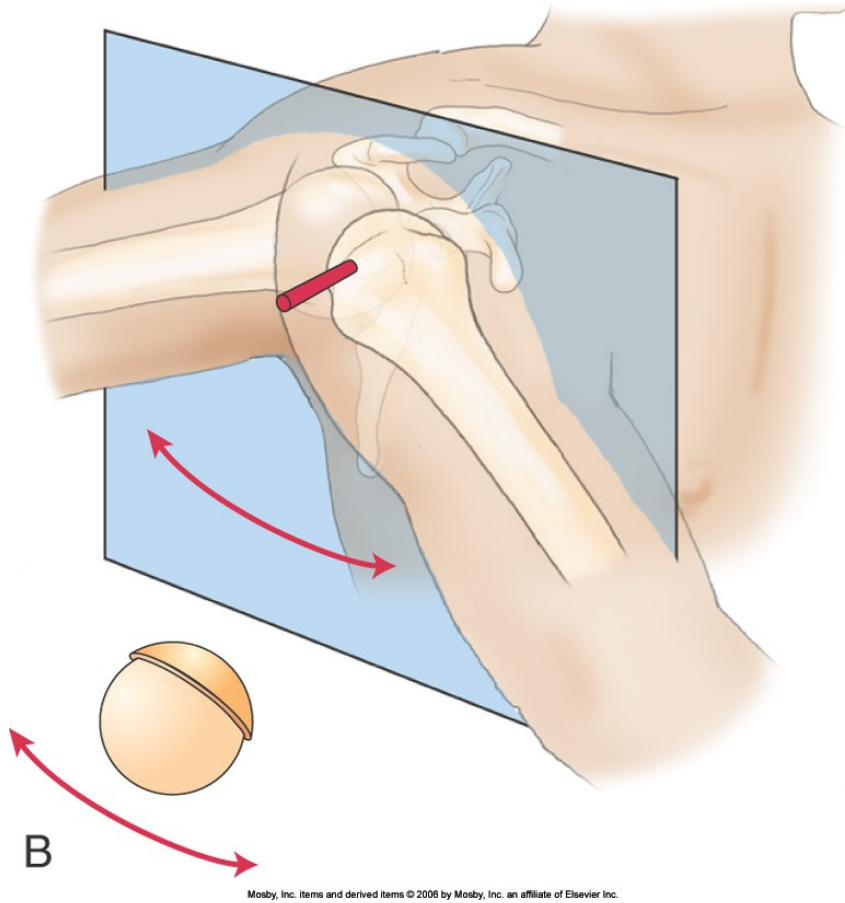
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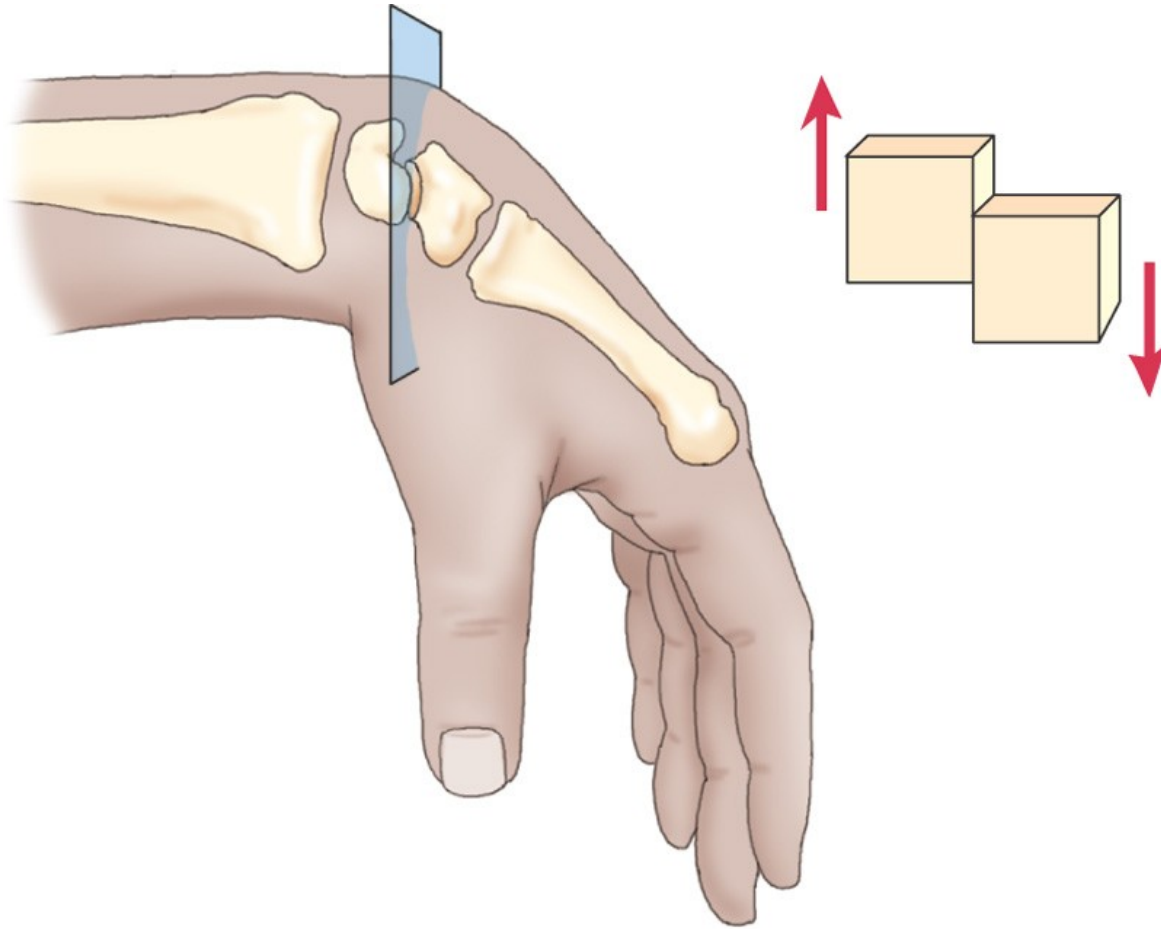
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Triaxial Joints



Nonaxial Joints



Upper Extremity Joints

- Shoulder
- Shoulder Girdle: (scapulocostal, sternoclavicular, acromioclavicular)
- Elbow
- Radioulnar
- Wrist
- Saddle of thumb
- Metacarpophalangeal
- Interphalangeal

Lower Extremity Joints

- Hip
- Knee
- Ankle
- Subtalar
- Metatarsophalangeal
- Interphalangeal

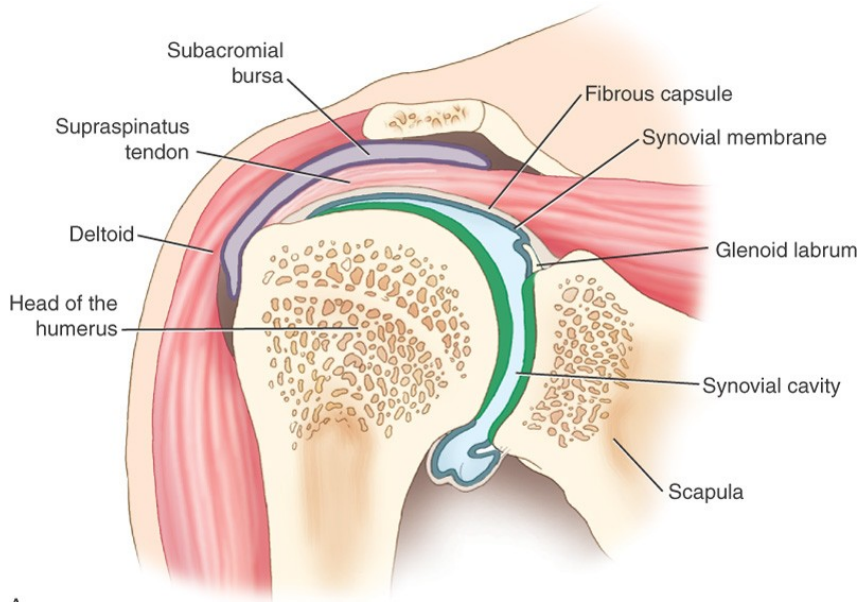
Axial Body Joints

- Disc
- Facet
- Sacroiliac
- Temporomandibular (TMJ)

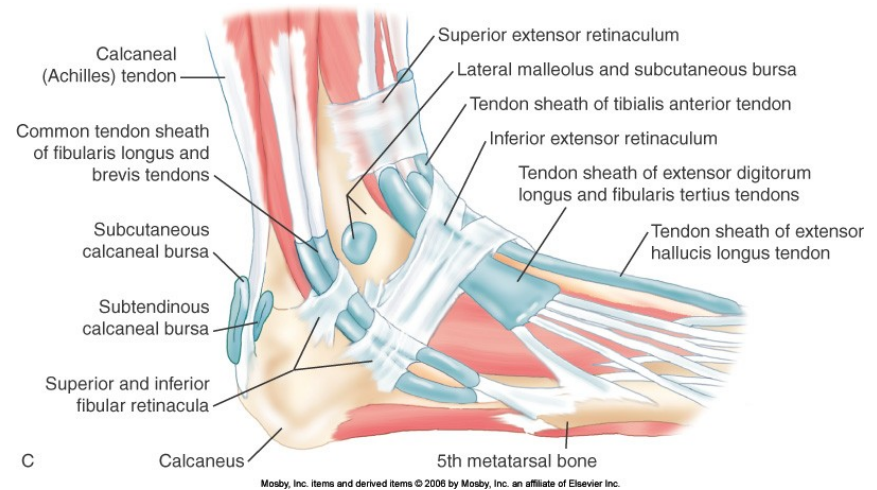
Other Skeletal Tissues

- Cartilage
- Bursa
- Tendon sheath

Other Skeletal Tissues - Figures



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Week Three

- Pathologic Conditions
- Myofascial Tissue

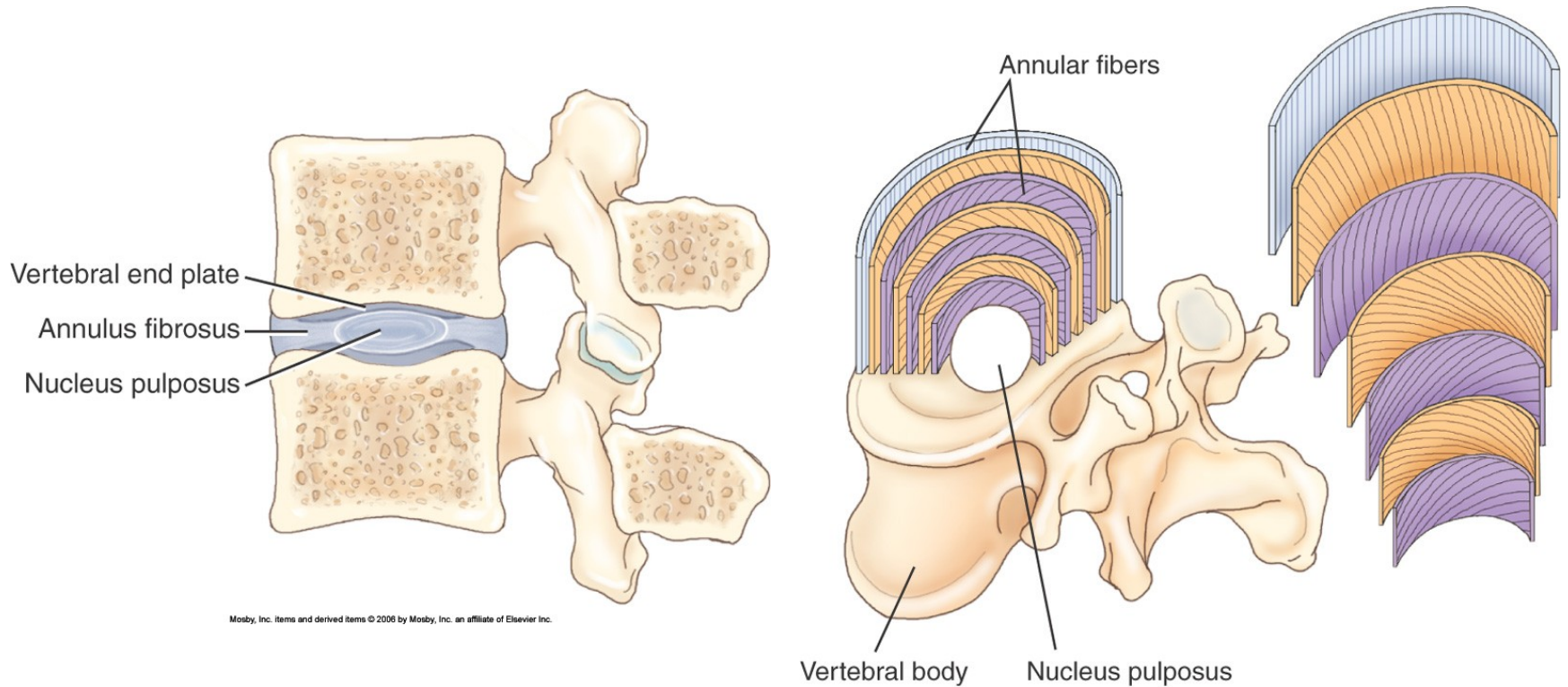
Overview of Blood Flow

- Systemic circulation:
- Heart to arteries to capillaries
 - Tissue exchange with the cells of the body
- To veins to the heart

Pathologic Conditions

- Disc bulge / herniation
- Sciatica
- Hyper-hypo kyphosis/lordosis
- Scoliosis
- Spondylolisthesis
- Degenerative joint disease (DJD, osteoarthritis, OA)
- Sprain
- Carpal tunnel syndrome
- Meniscus damage
- Foot hyperpronation
- Hip replacement

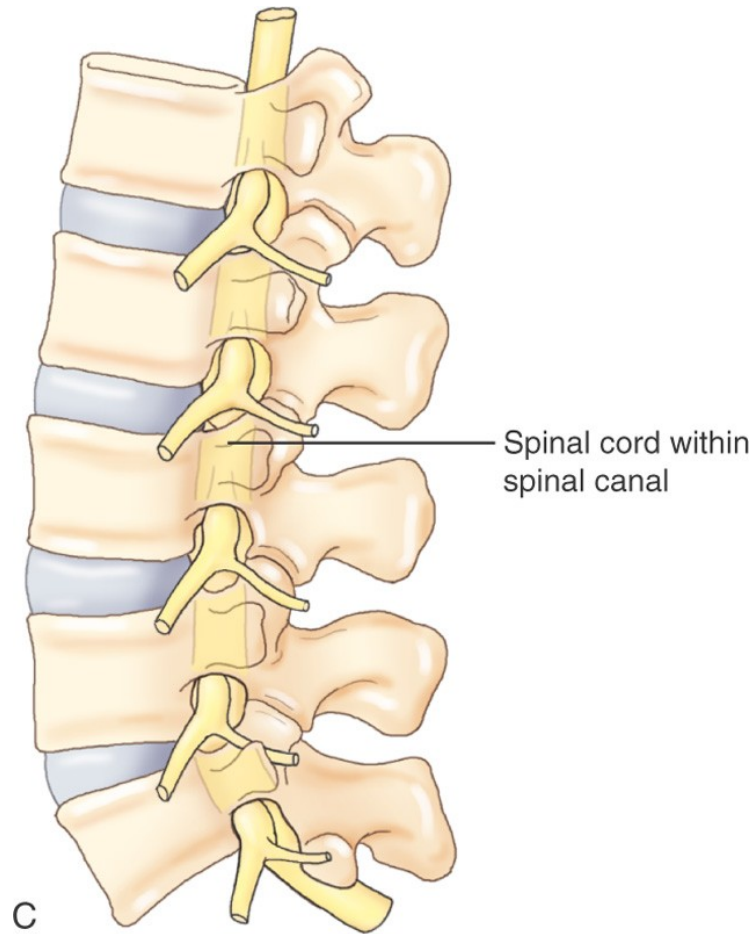
Pathologic Disc



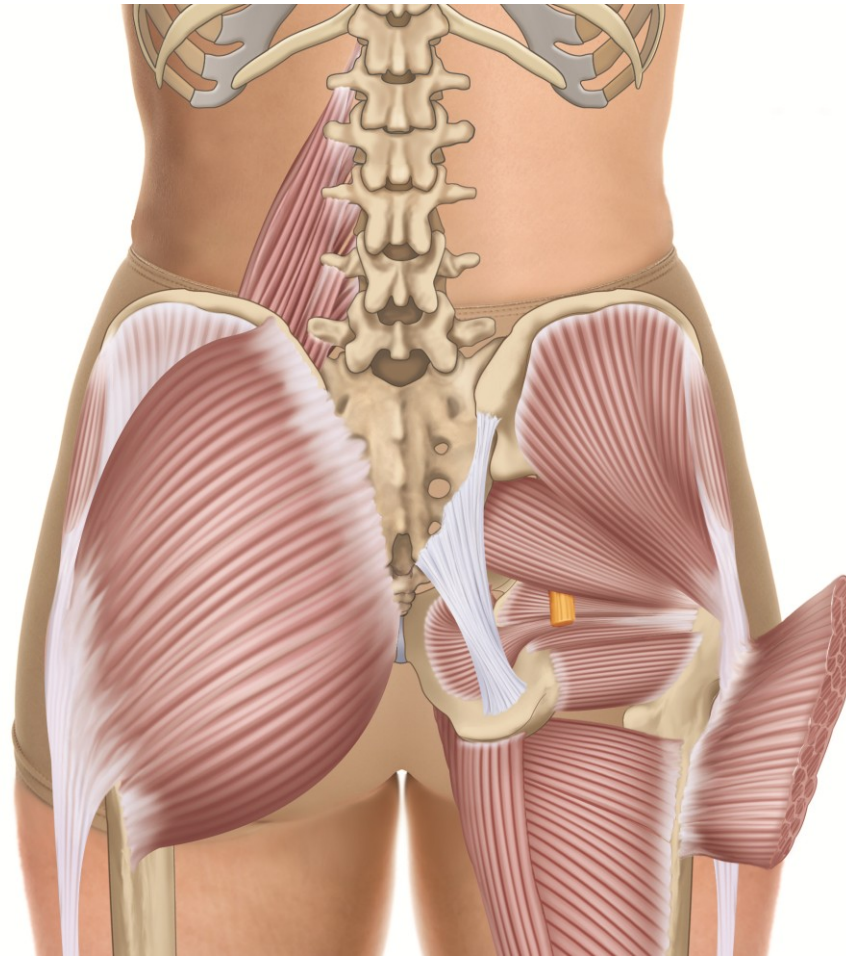
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(Modeled after Kapandji IA: *Physiology of the joints: the trunk and the vertebral column*, ed. 2, Edinburgh, 1974, Churchill Livingstone.)

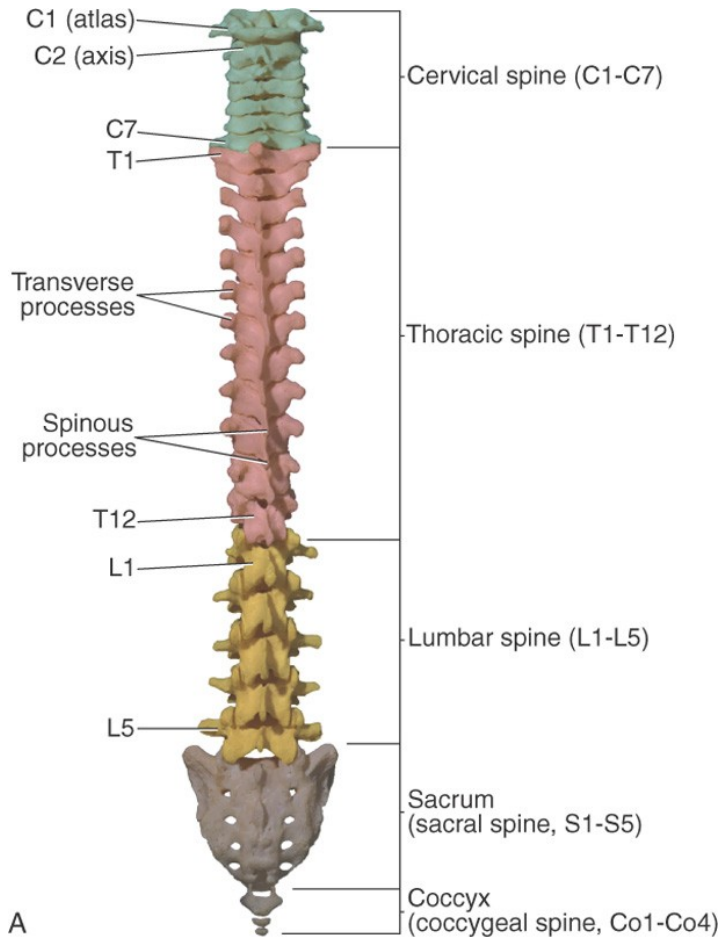
Pathologic Disc



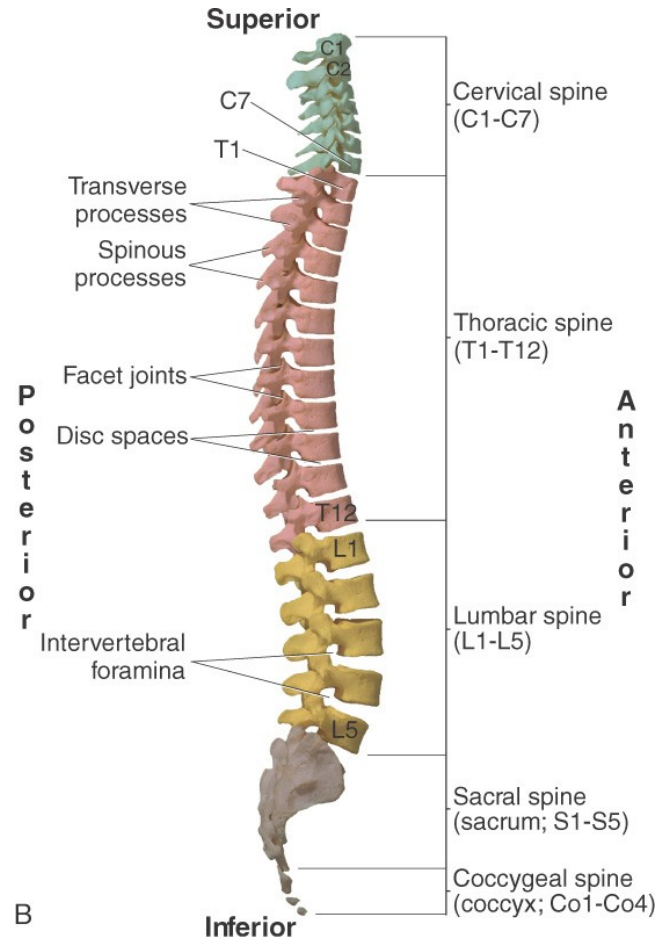
Sciatica



Spinal Curves



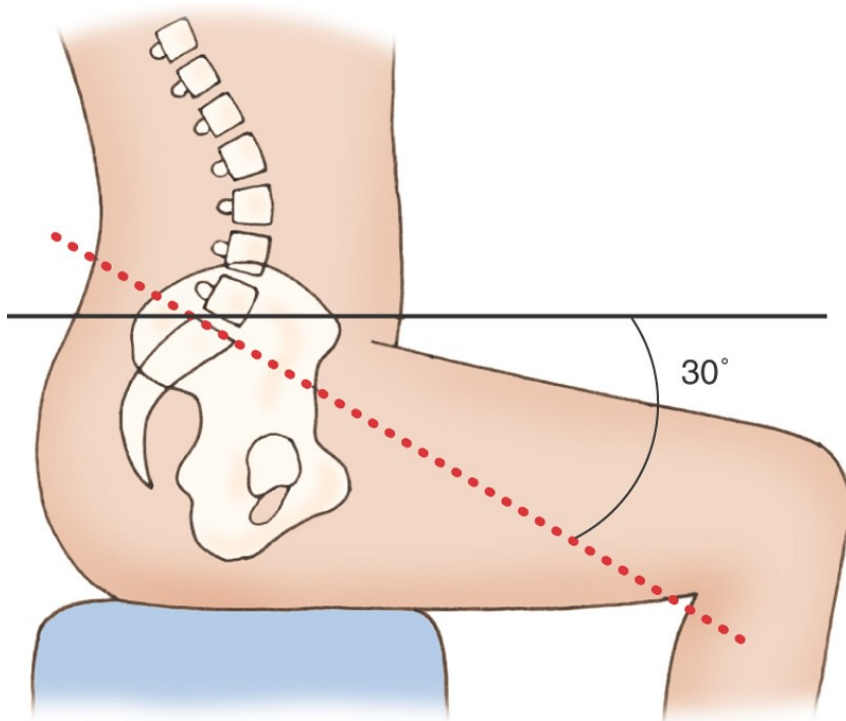
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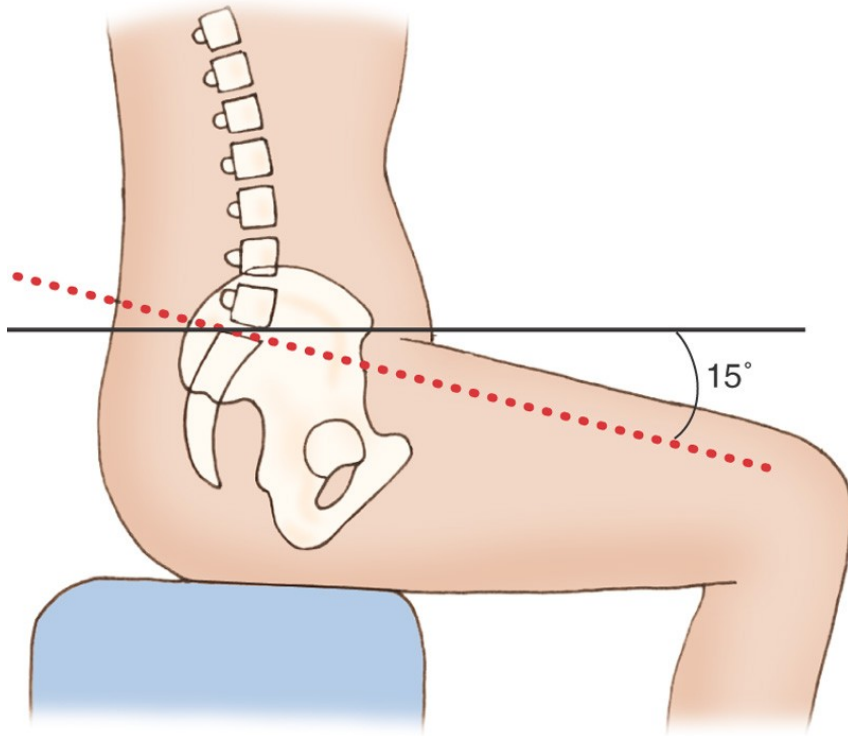
Pelvic Tilt

- Notice the relationship between the sacral base angle and the lordosis of the lumbar spine.



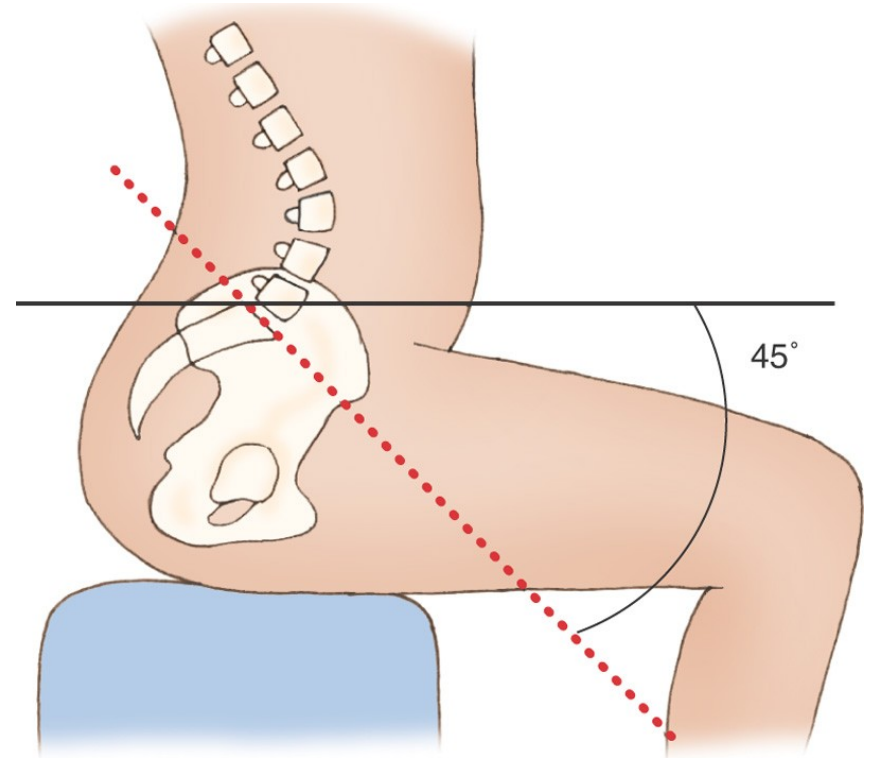
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Hypolordosis / Hyperlordosis



A

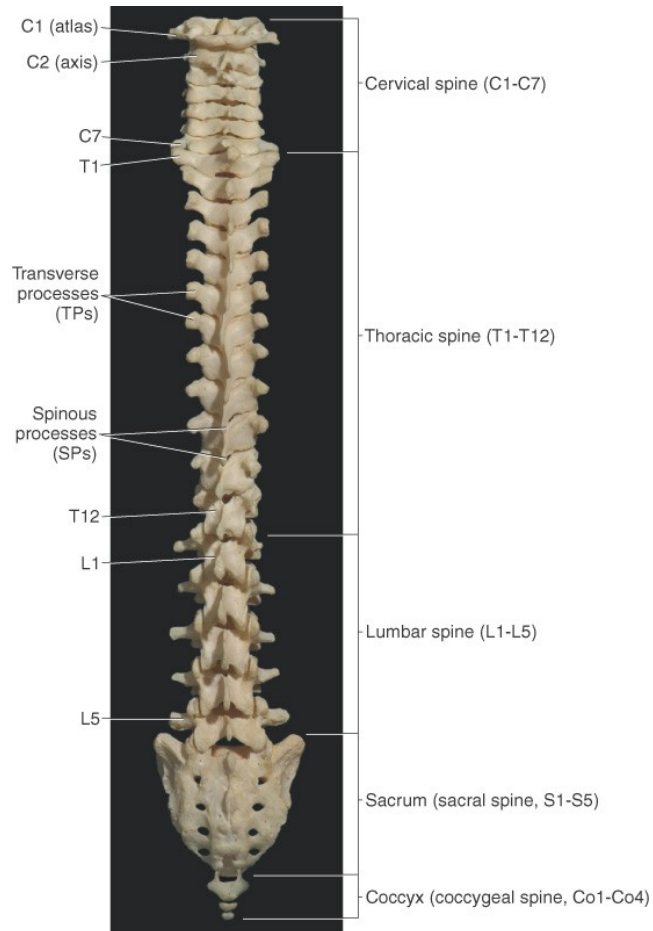
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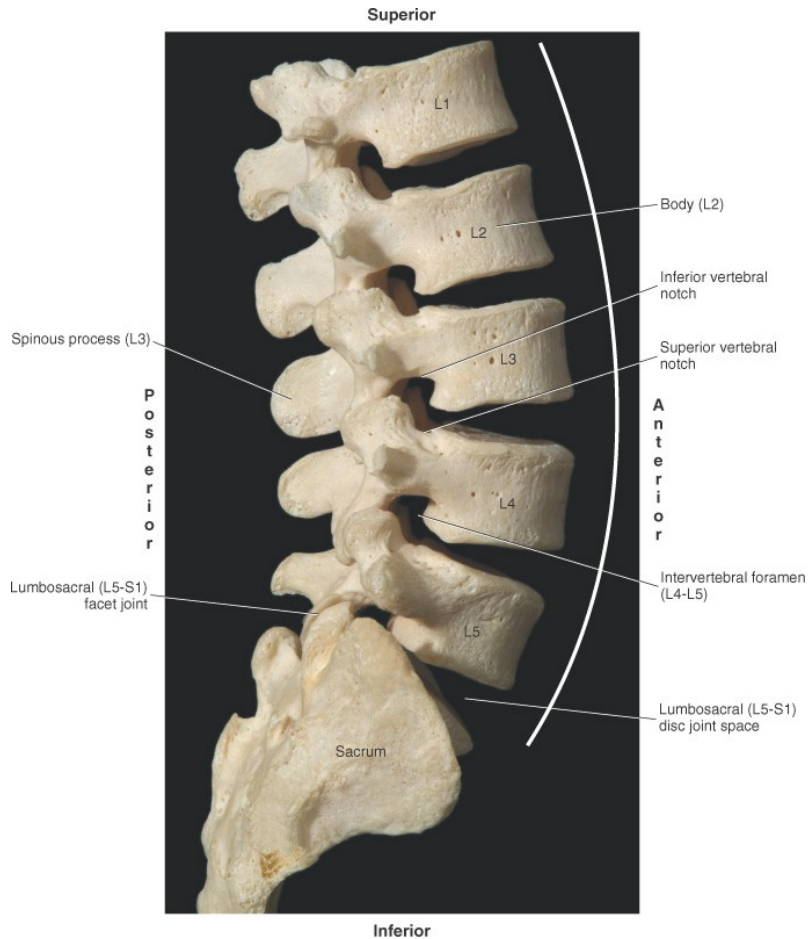
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Scoliosis

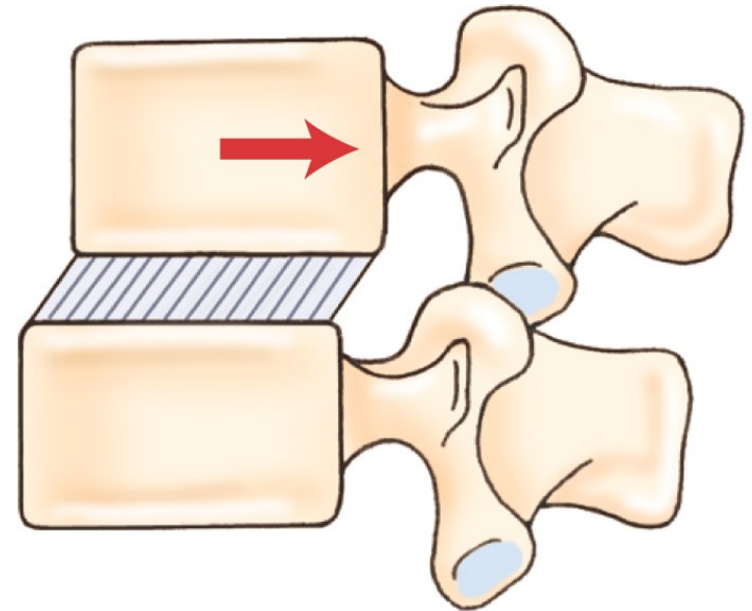


Spondylolisthesis



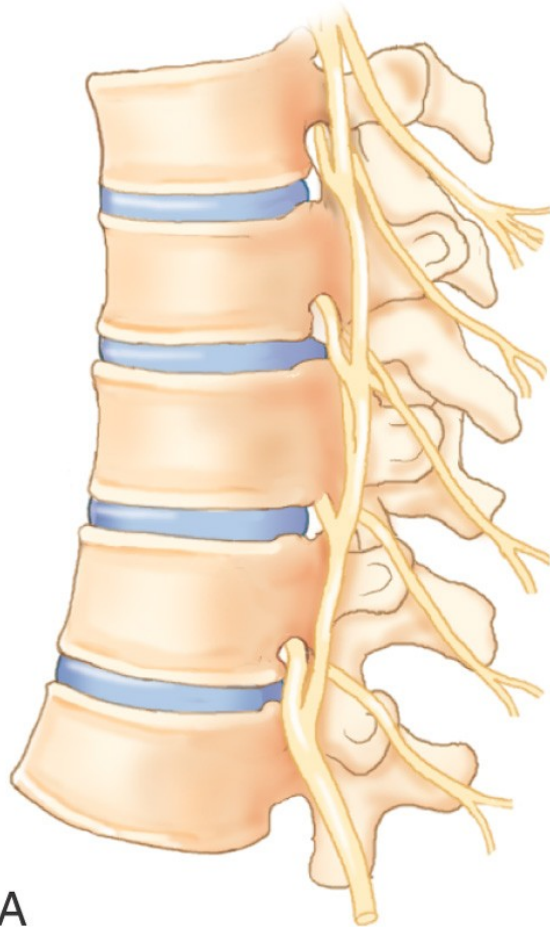
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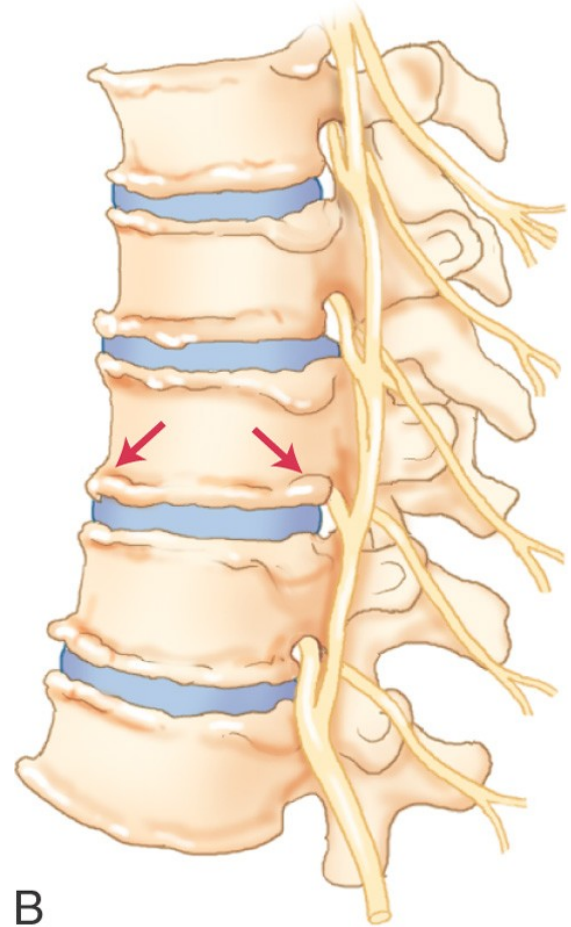
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DJD/OA



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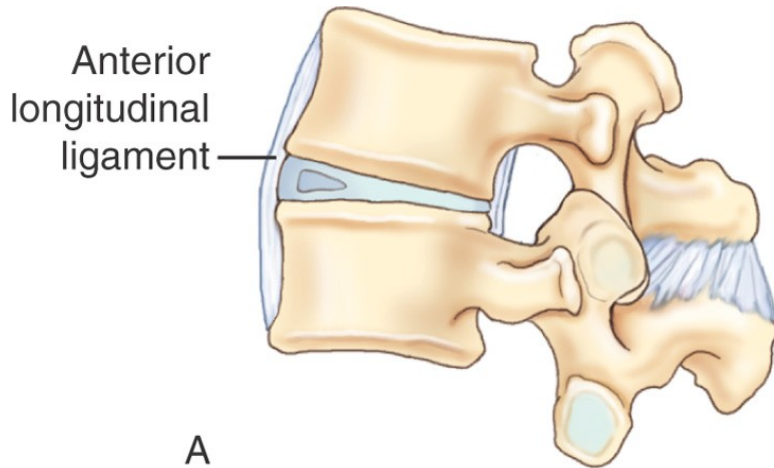
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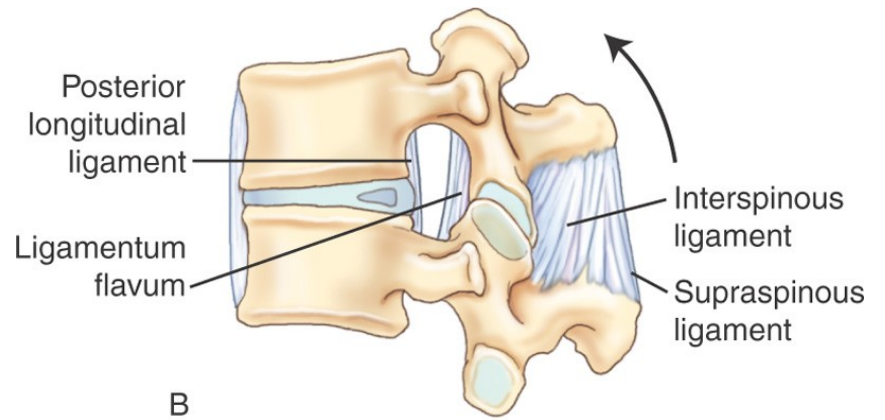
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Sprain

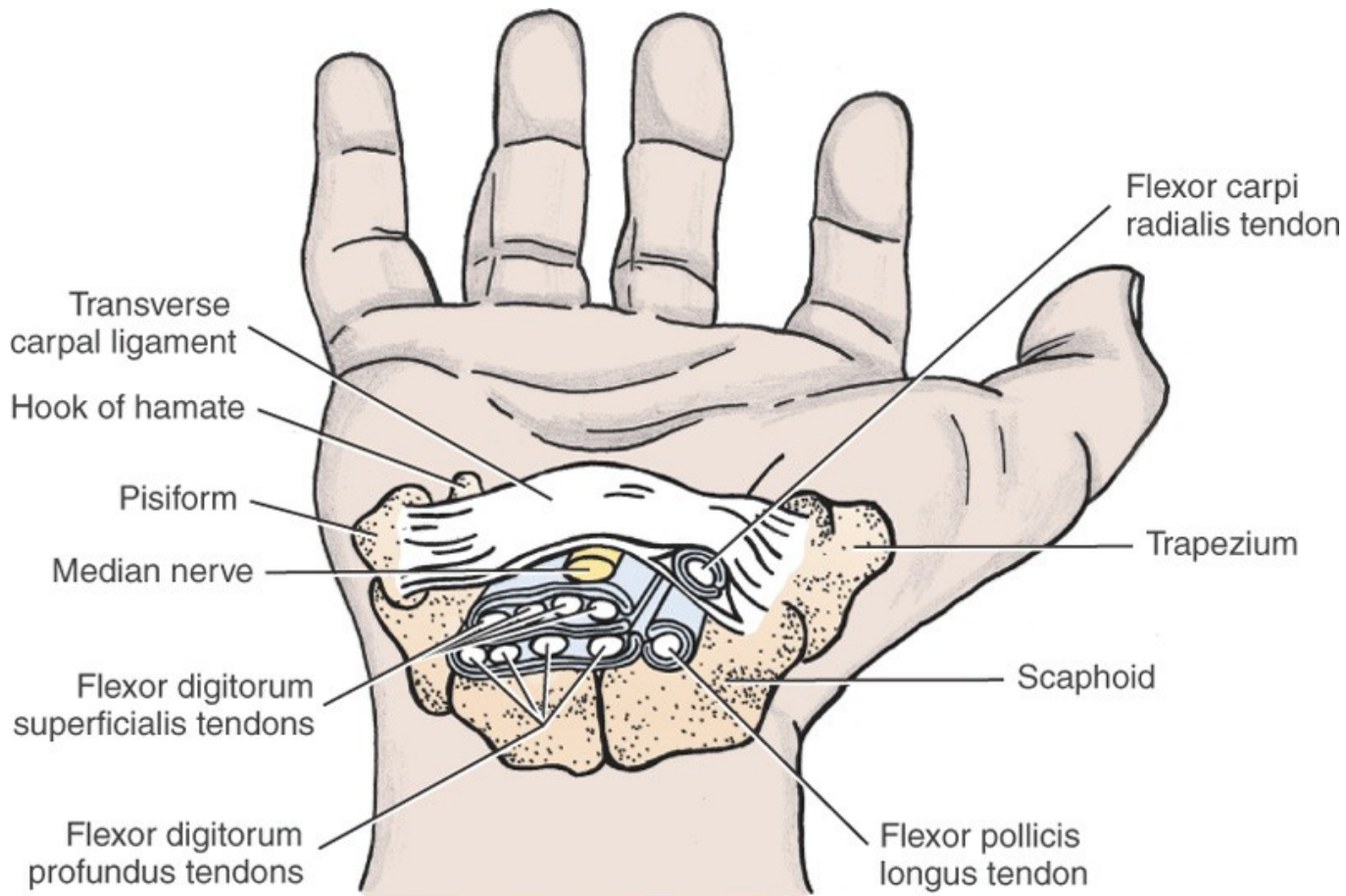


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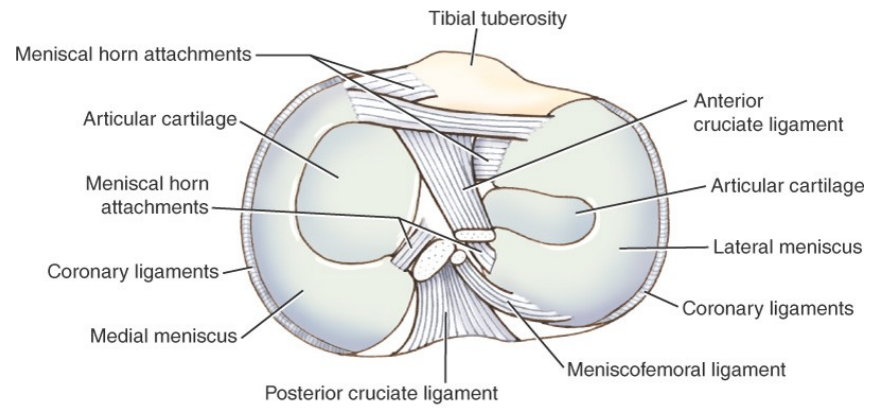
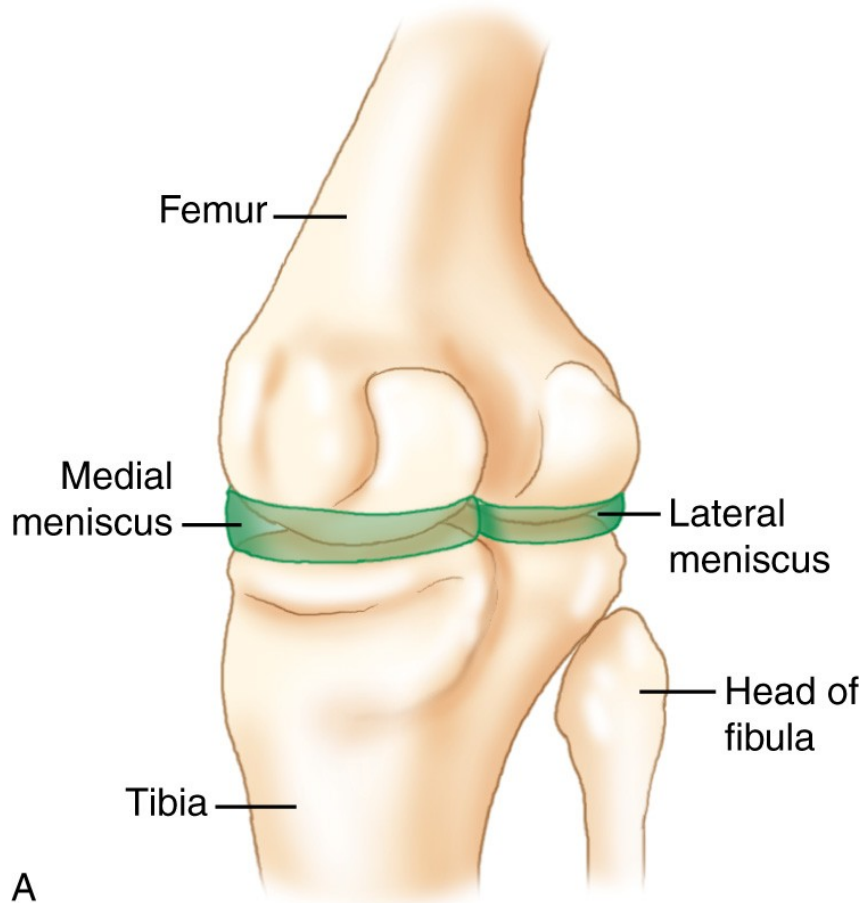
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Carpal Tunnel Syndrome



(Courtesy Joseph E. Muscolino.)

Meniscus Damage



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Foot Hyperpronation

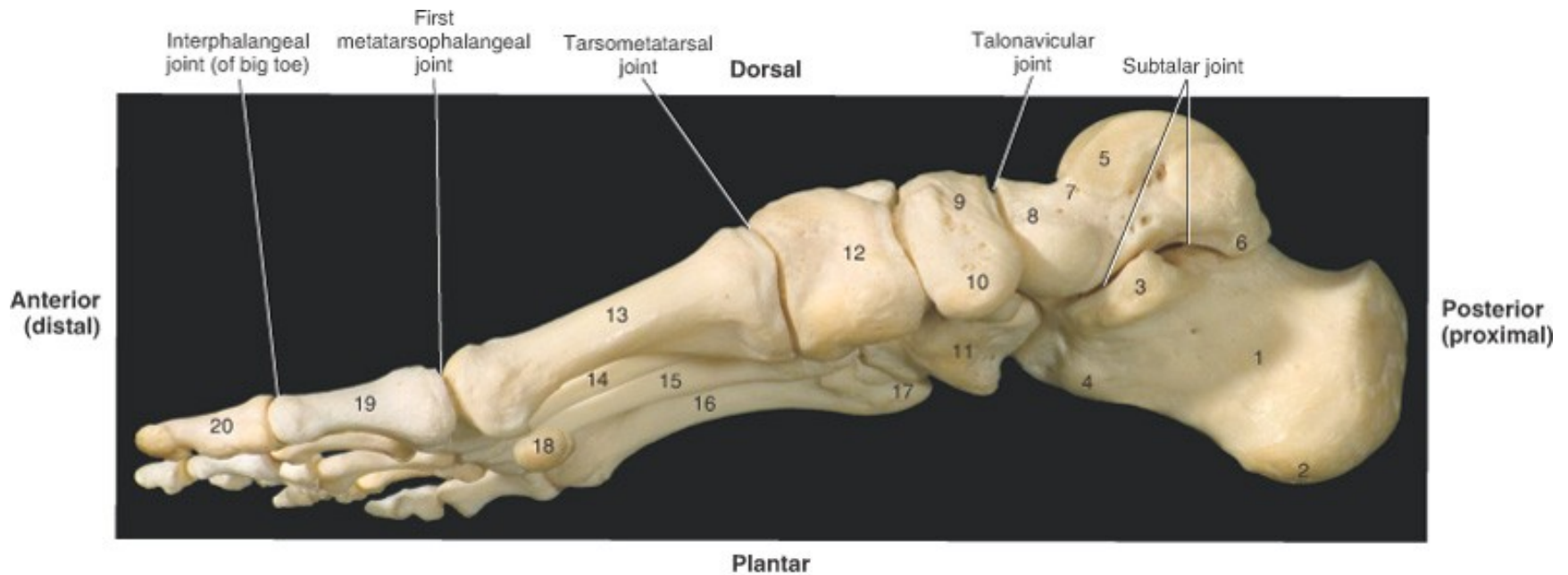


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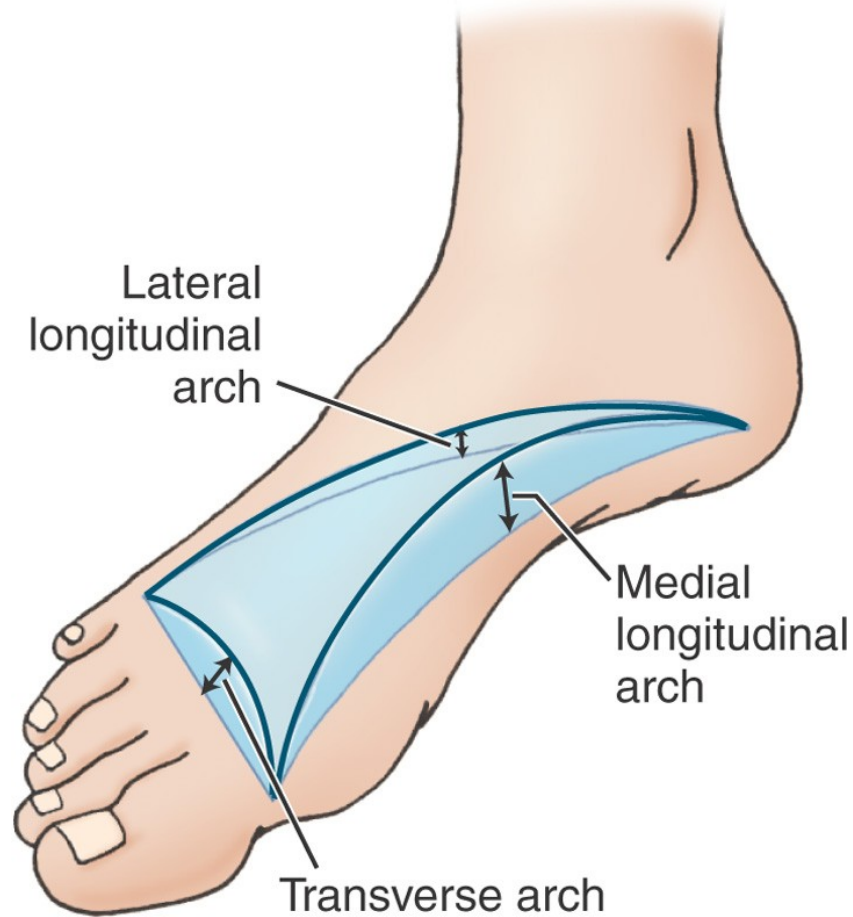
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Foot Hyperpronation – cont' d



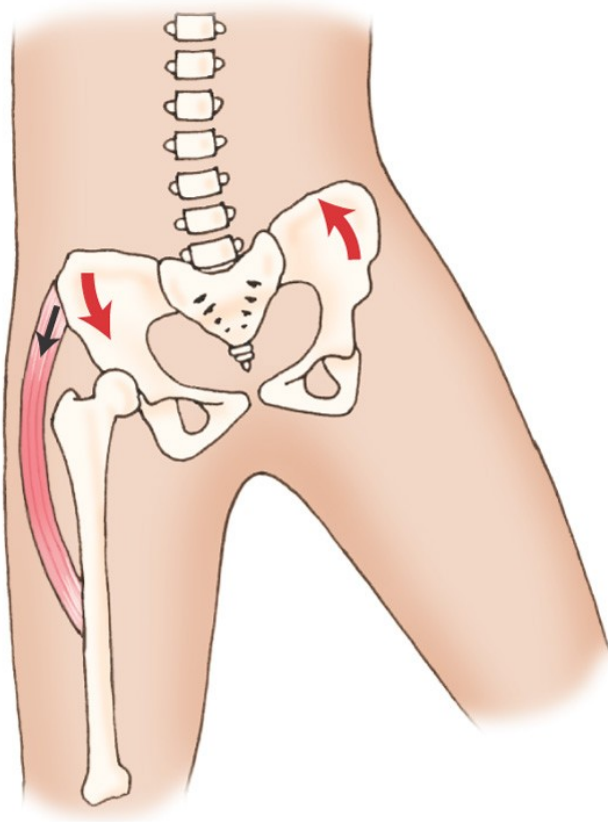
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Foot Hyperpronation – cont' d



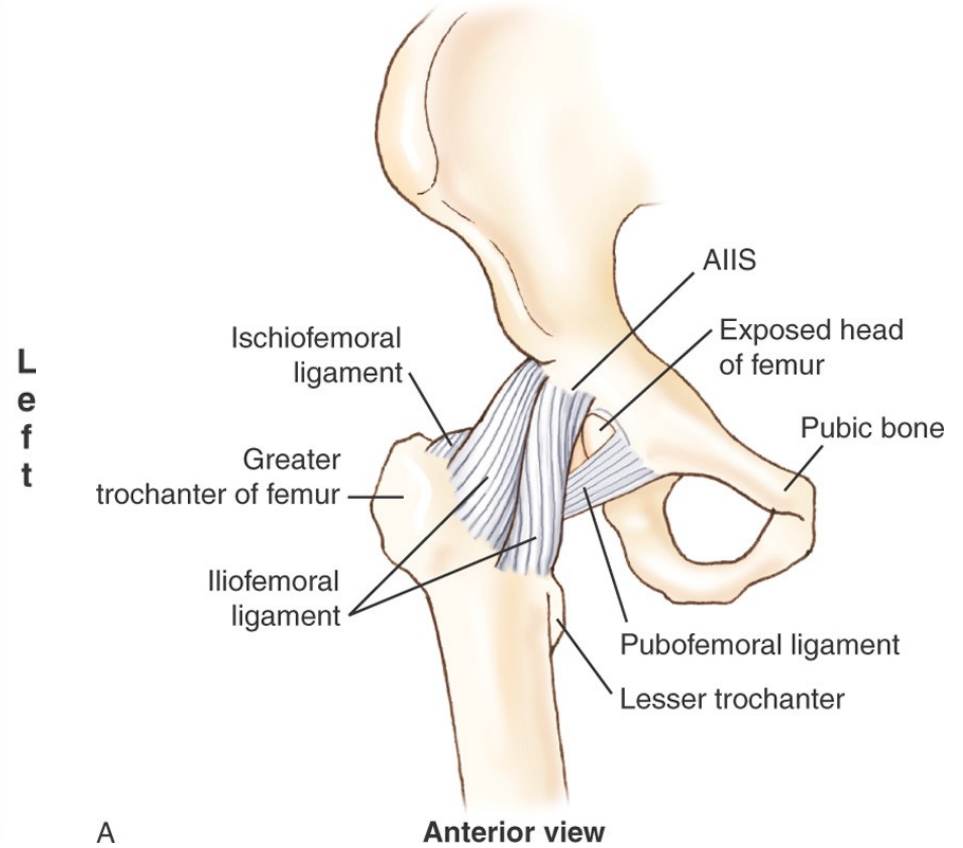
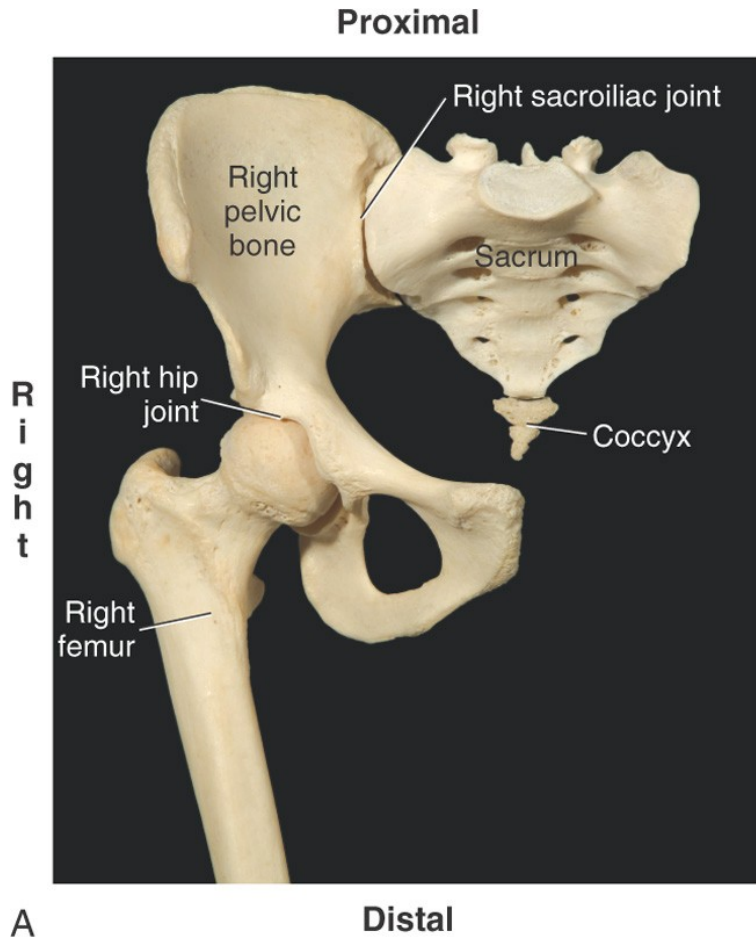
Tight 'hip joint abductors'

- Notice the effect upon the spine

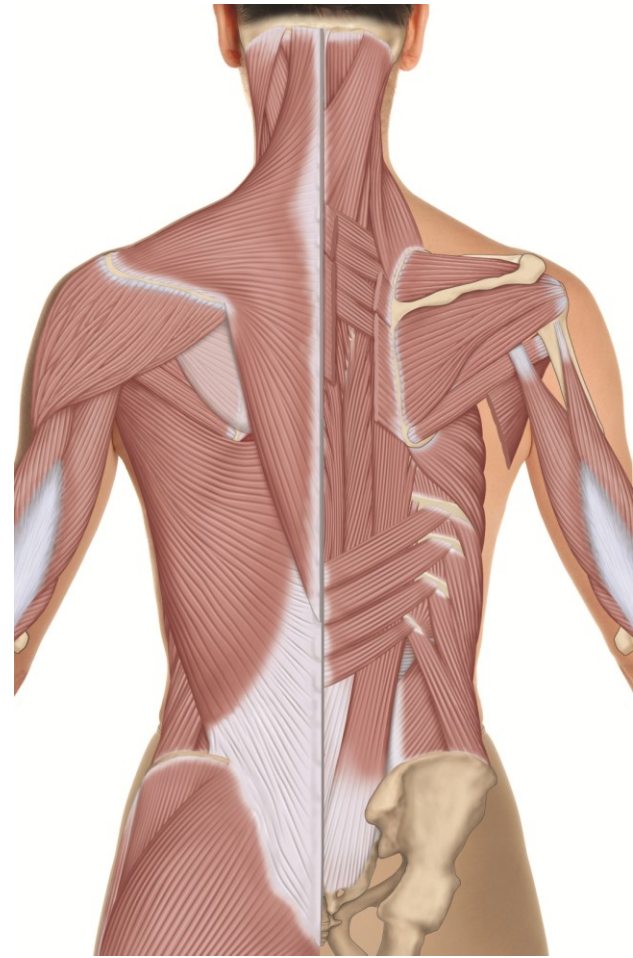
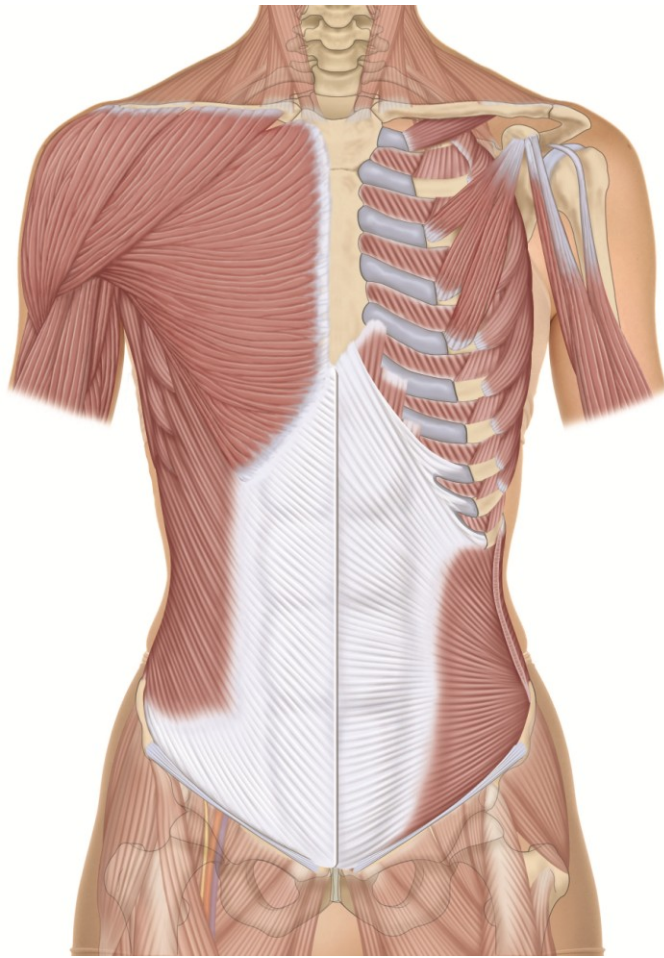


B Depression of the right pelvis
(and elevation of the left pelvis)

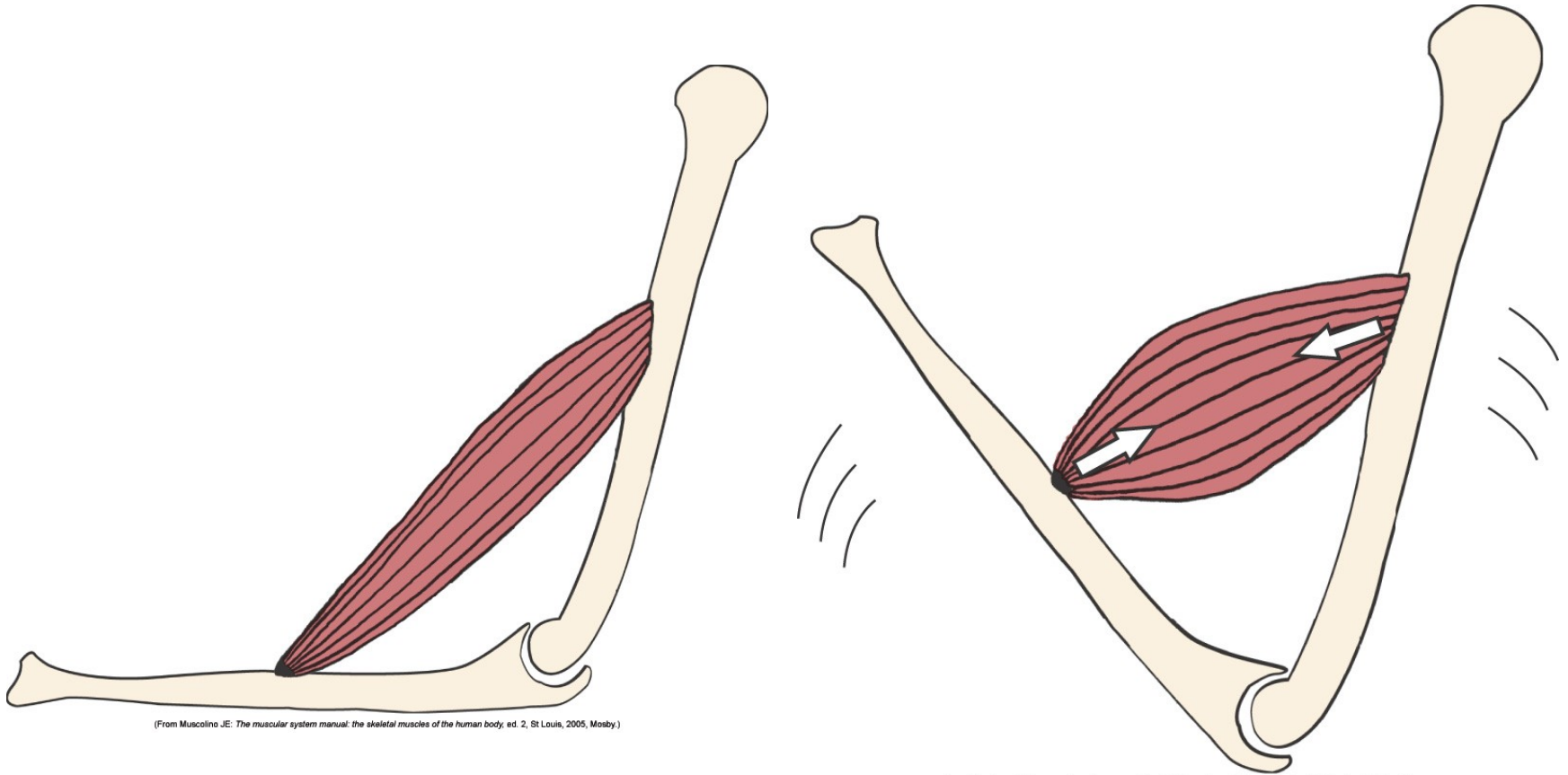
Hip Replacement



Myofascial Tissue



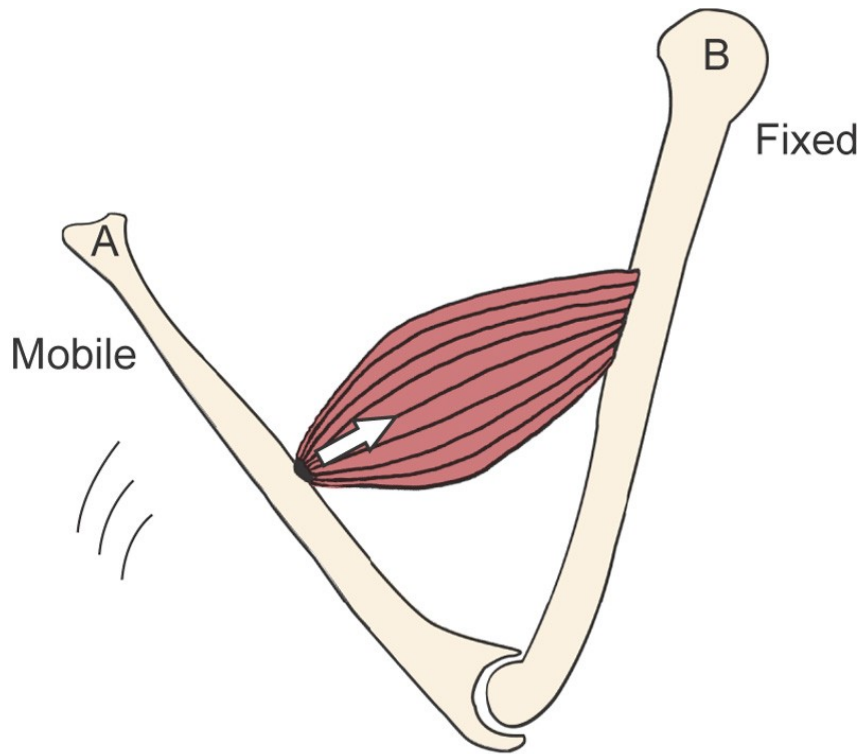
Typical Muscle



(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)

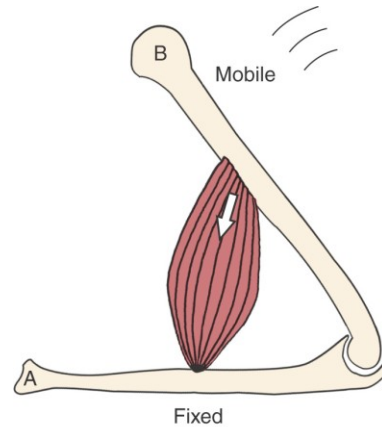
(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)

Concentric (Shortening) Contractions



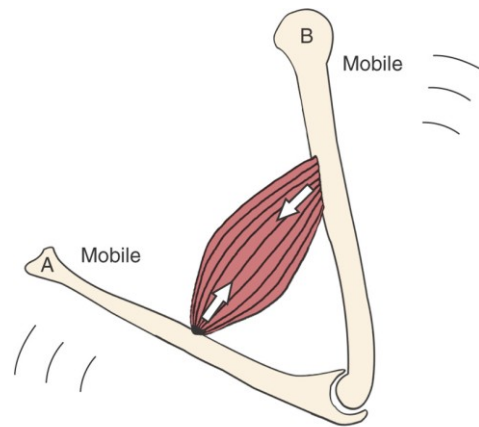
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(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)



B

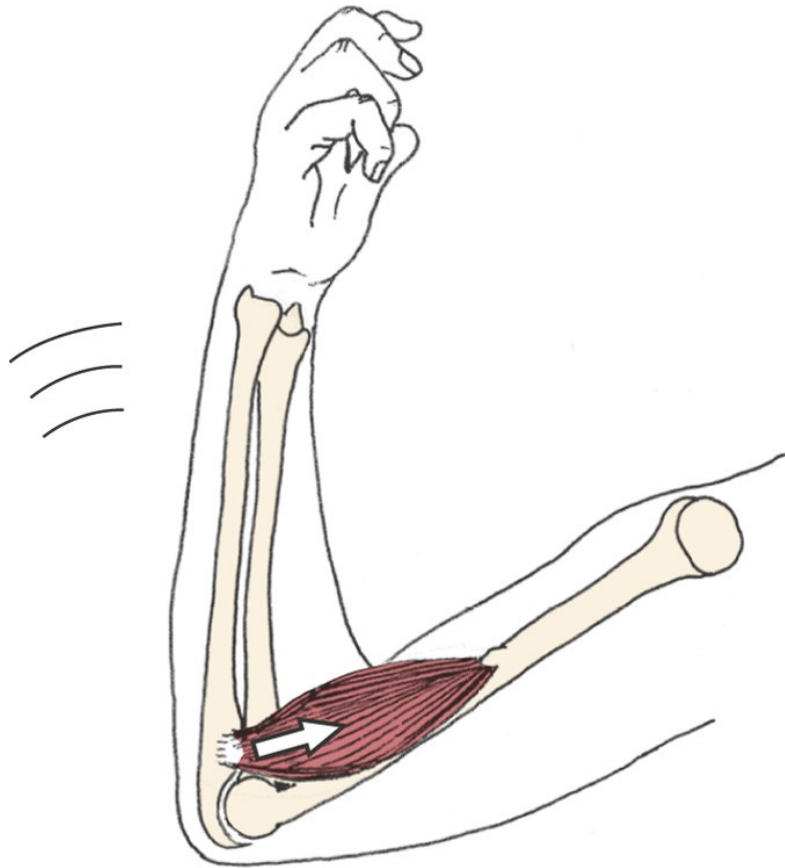
(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)



C

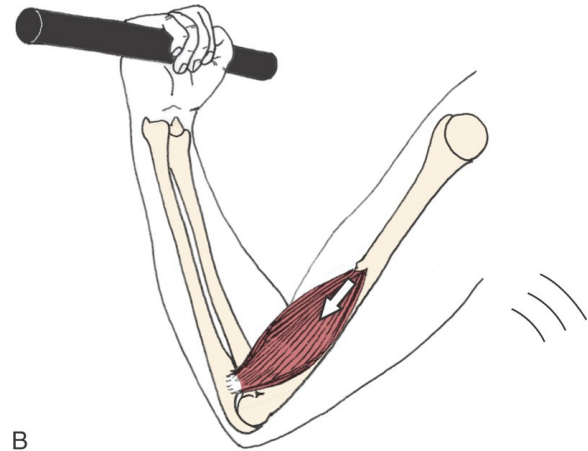
(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)

Concentric (Shortening) Contractions - Brachialis



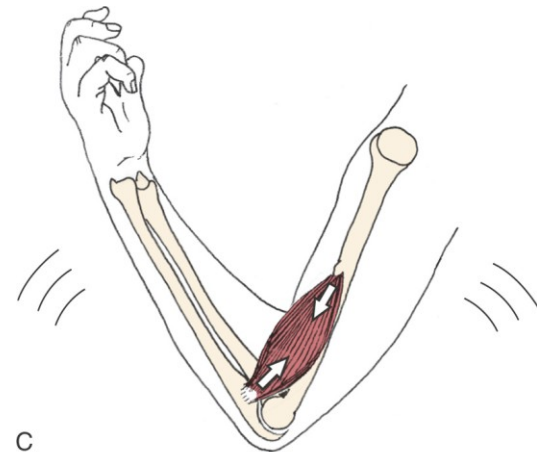
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(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)



B

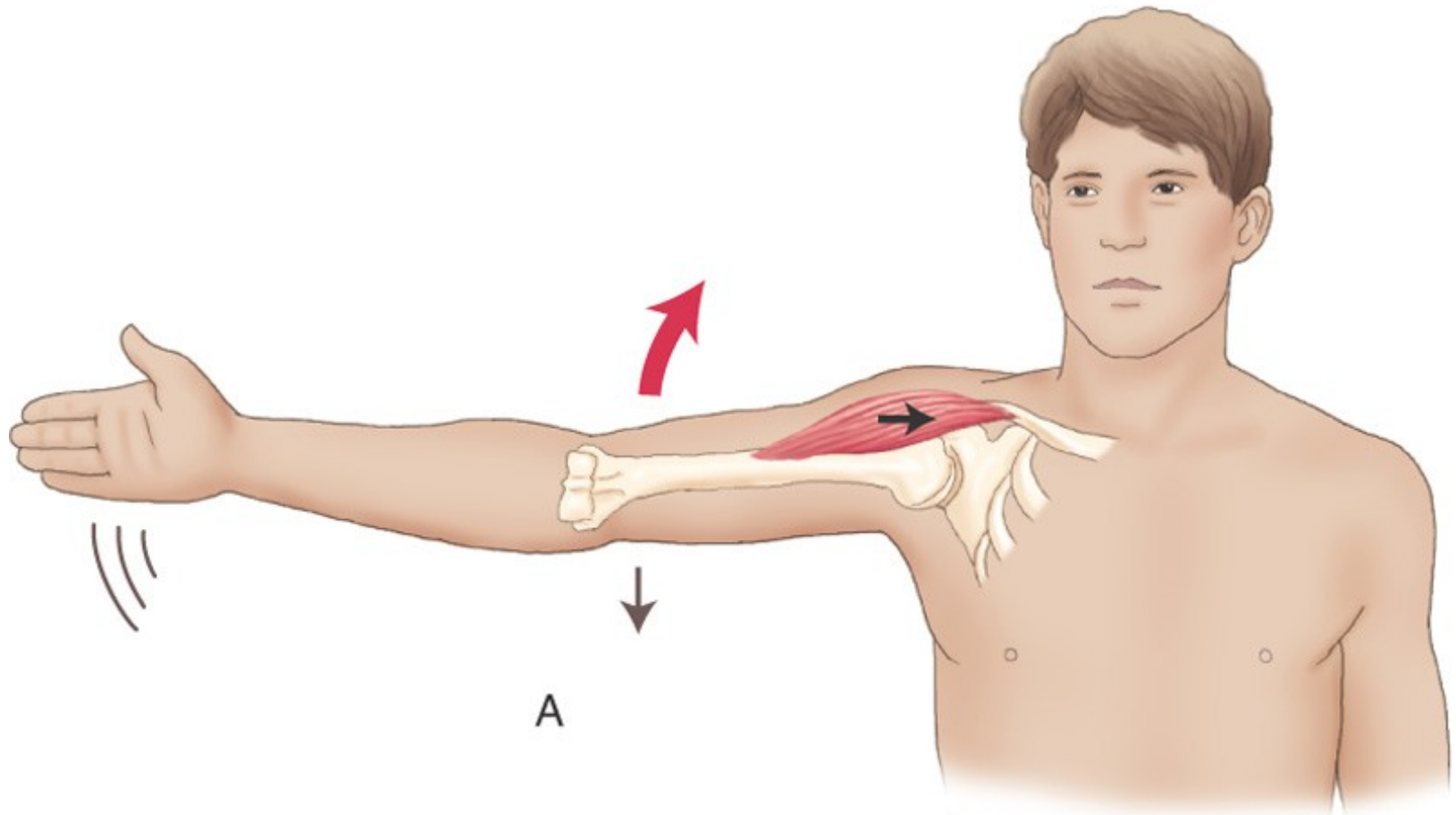
(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)



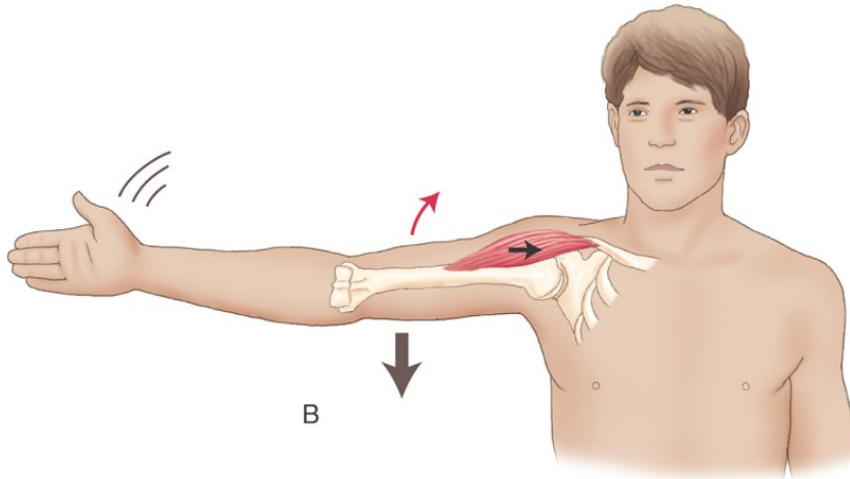
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(From Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, ed. 2, St Louis, 2005, Mosby.)

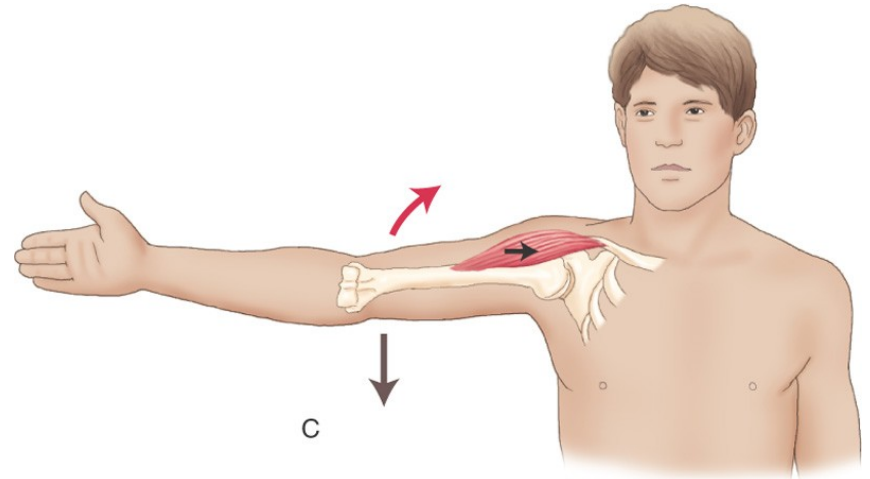
Concentric Contraction



Eccentric and Isometric Contractions

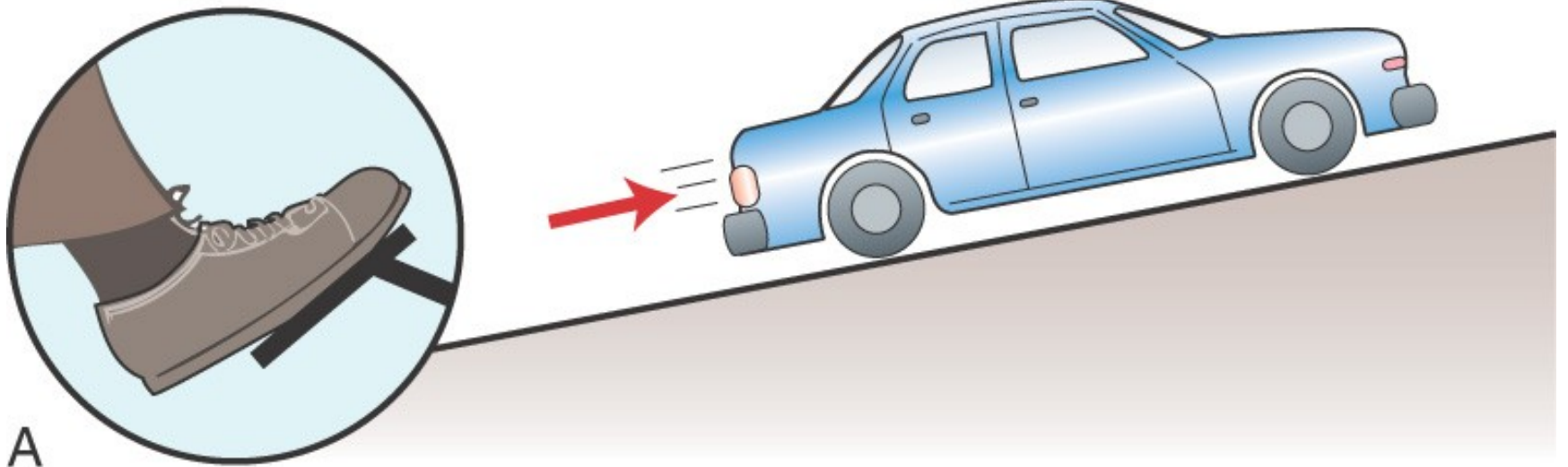


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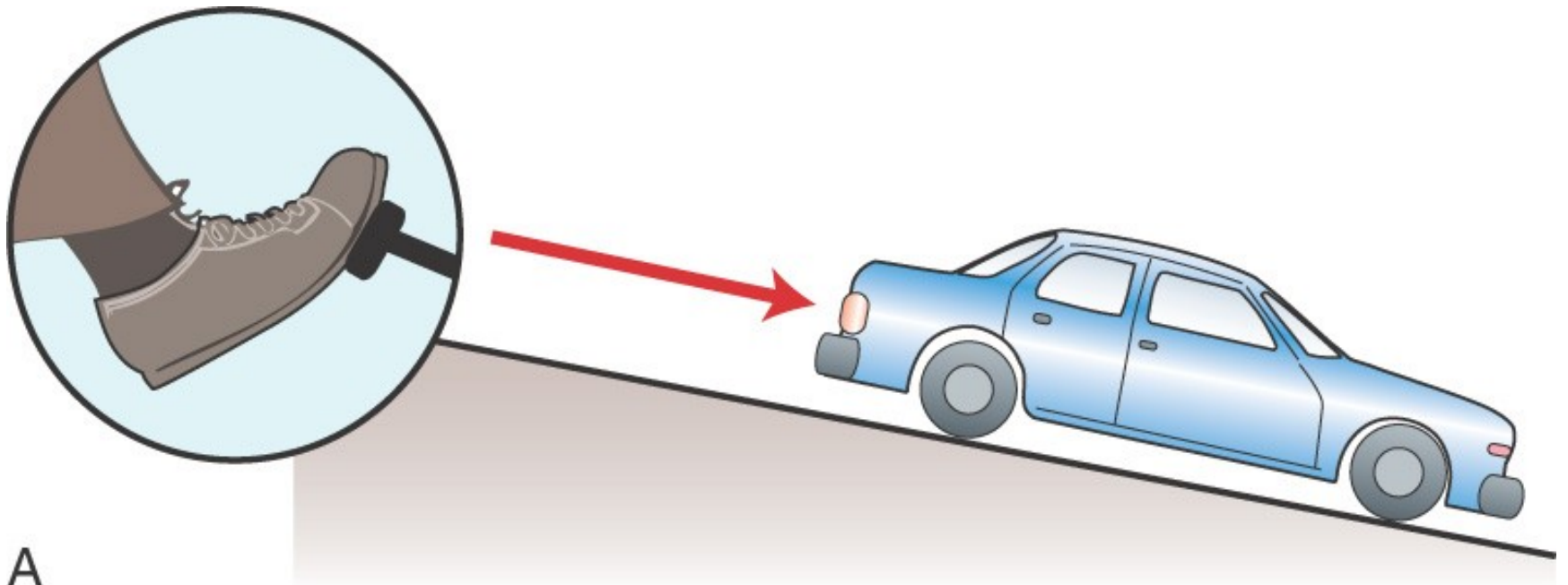
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Concentric Contraction Analogy



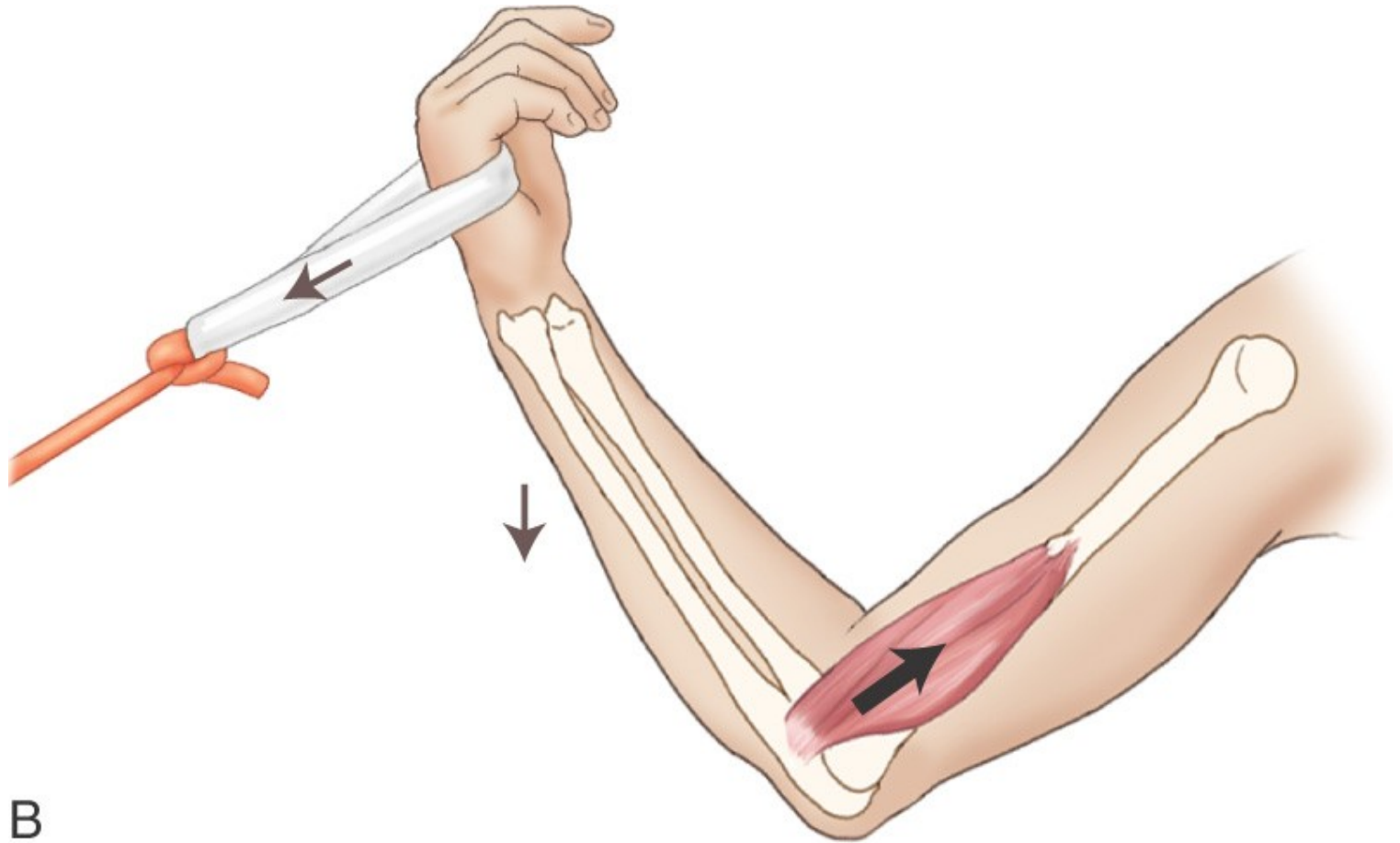
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Eccentric Contraction Analogy



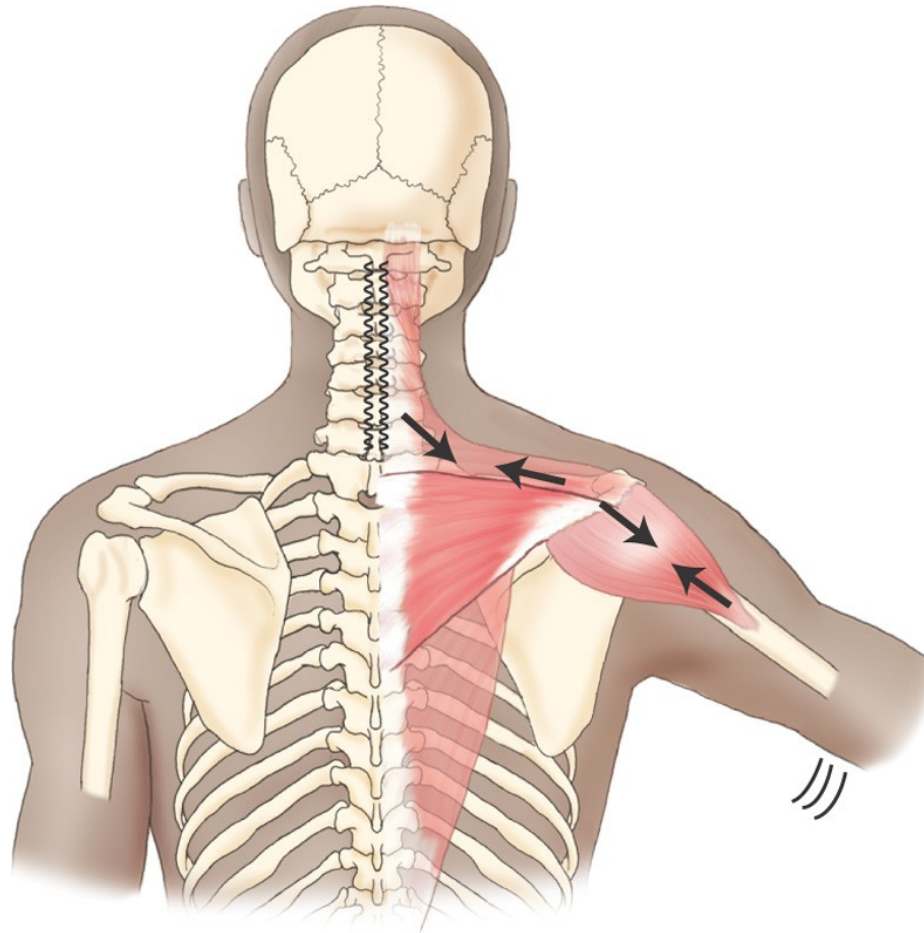
A

Adding Resistance

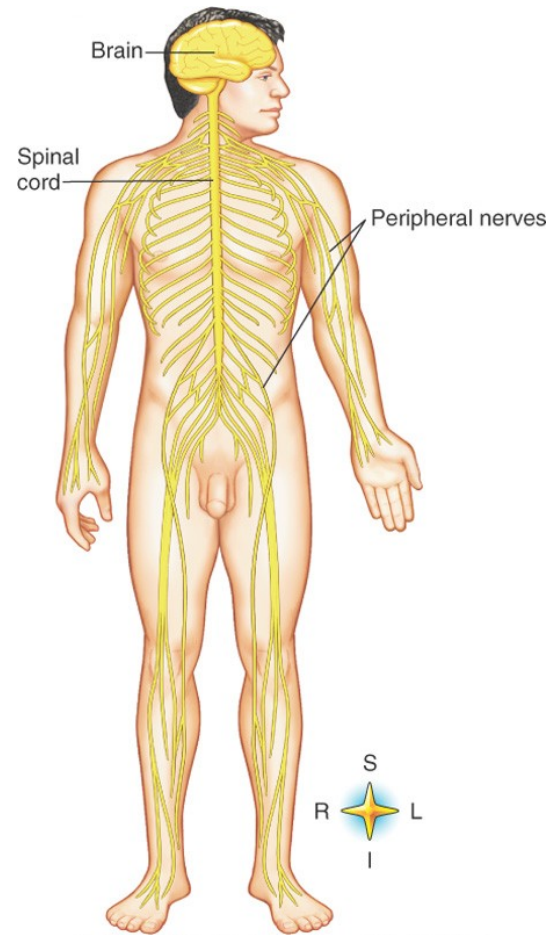


B

Stabilization - Scapula

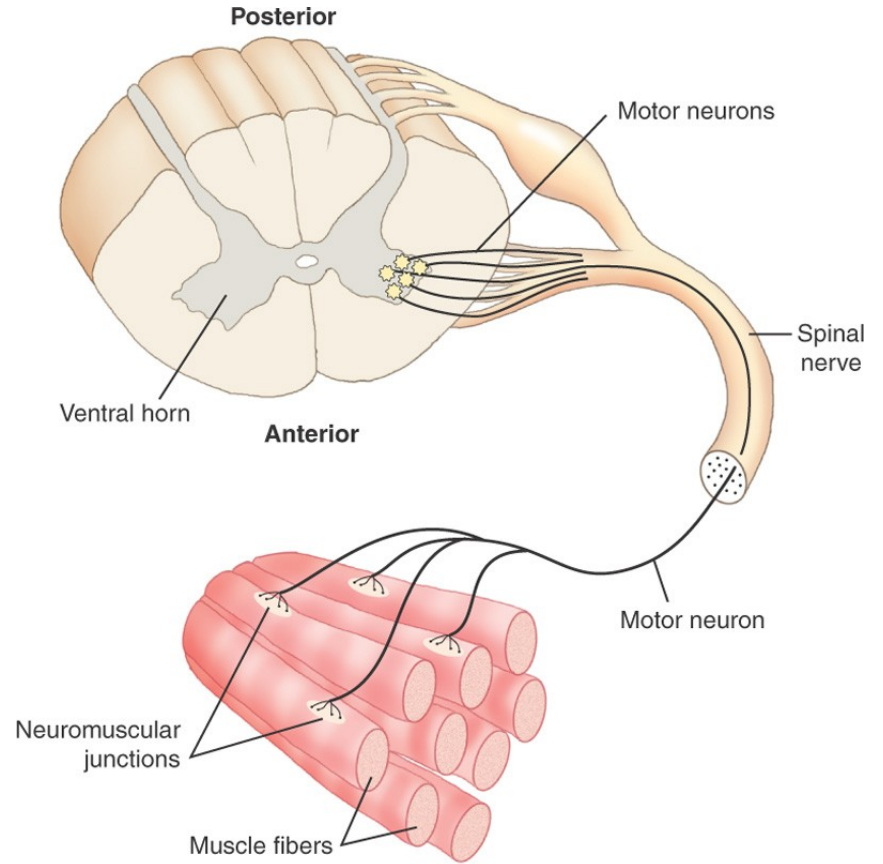
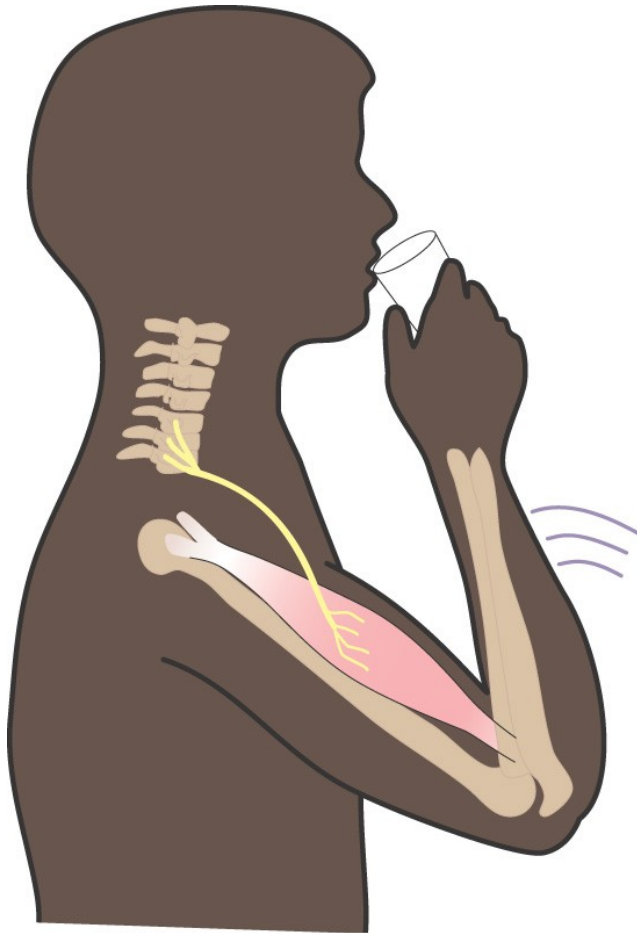


Neural Control

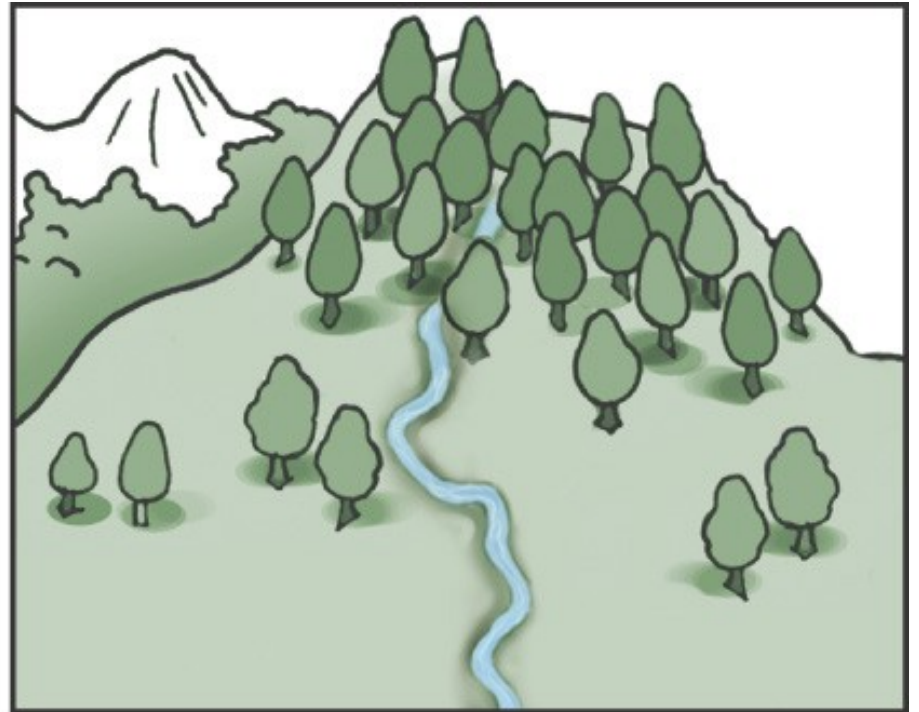
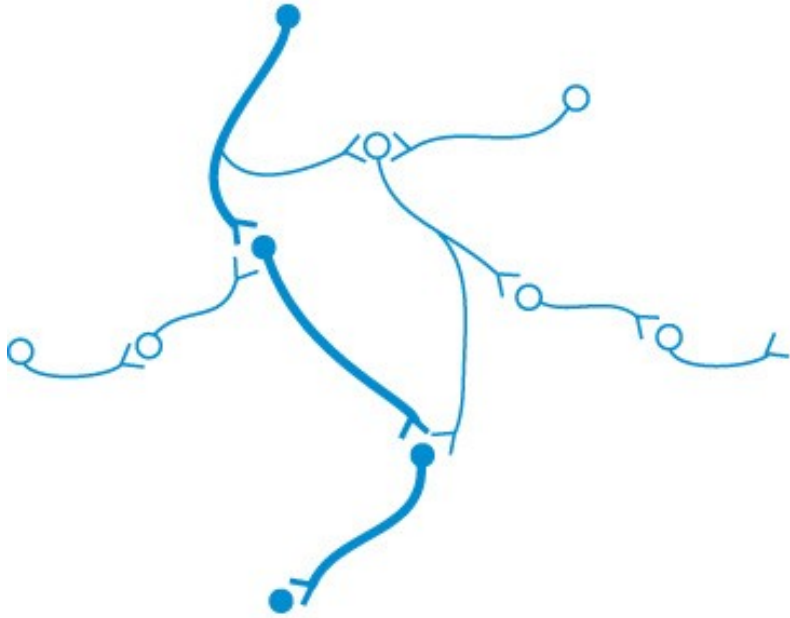


(From Thibodeau GA, Patton KT: *Anatomy and physiology*, ed 5. St Louis, 2003, Mosby.)

Neural Control – cont' d

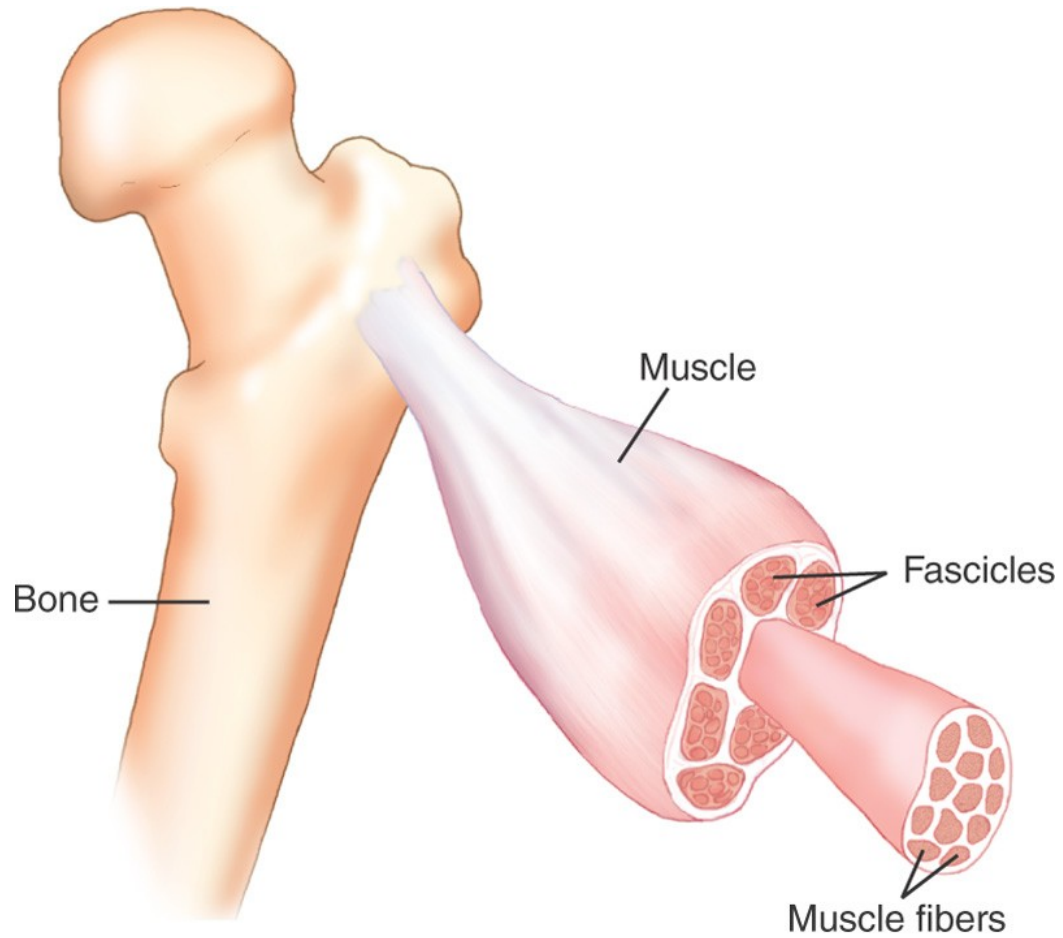


Muscle Memory



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Strain / Tendinitis



Week Four

- Muscles / Muscle Groups
- Functional Groups...

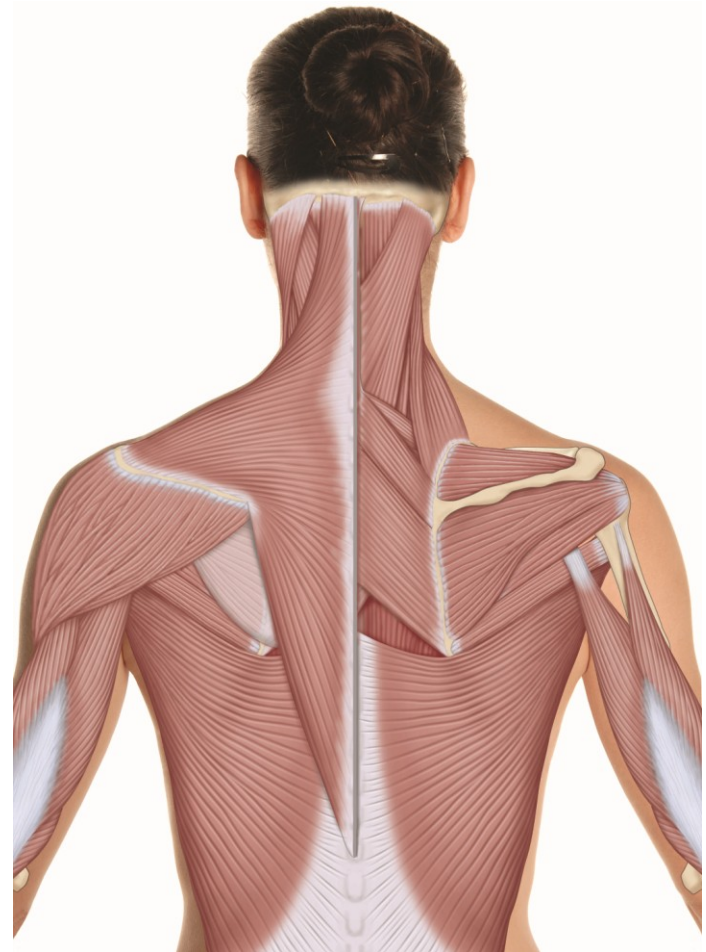
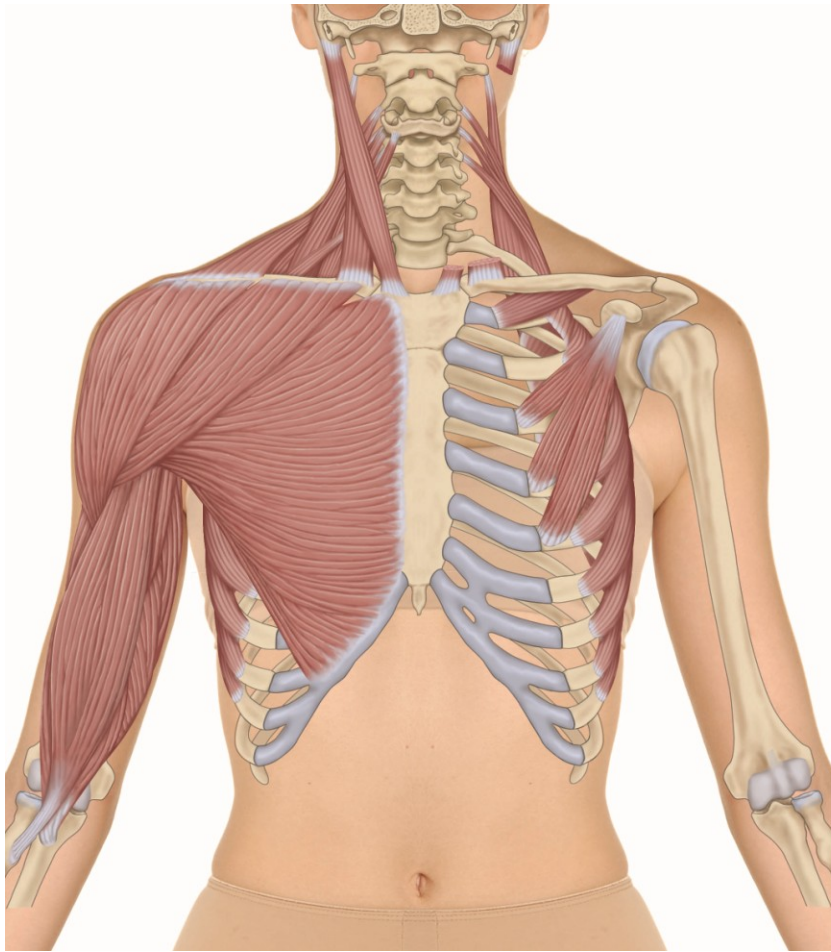
Upper Extremity

- Shoulder joint
- Shoulder girdle
- Elbow joint
- Radioulnar joints
- Wrist joint
- Finger joints

Shoulder Joint

- Flexors (anterior deltoid)
- Extensors (posterior deltoid)
- Abductors (middle deltoid)
- Adductors (pectoralis major, latissimus dorsi)
- Medial rotators (pectoralis major, latissimus dorsi)
- Lateral rotators (rotator cuff...)

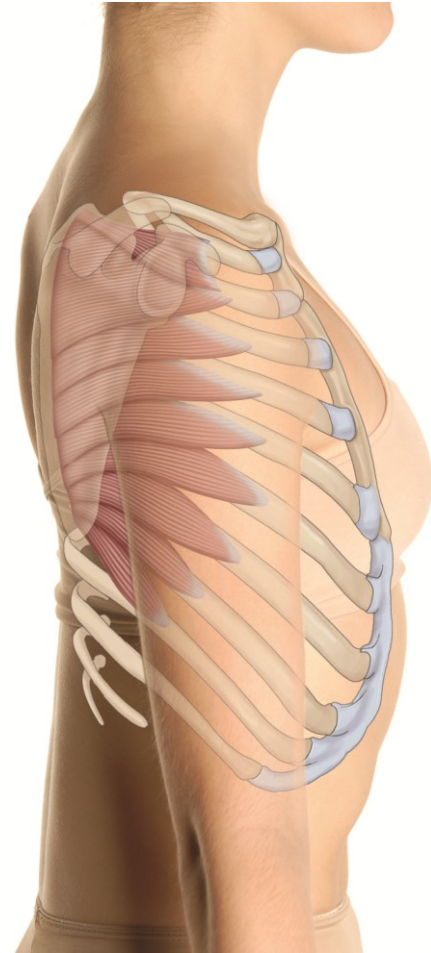
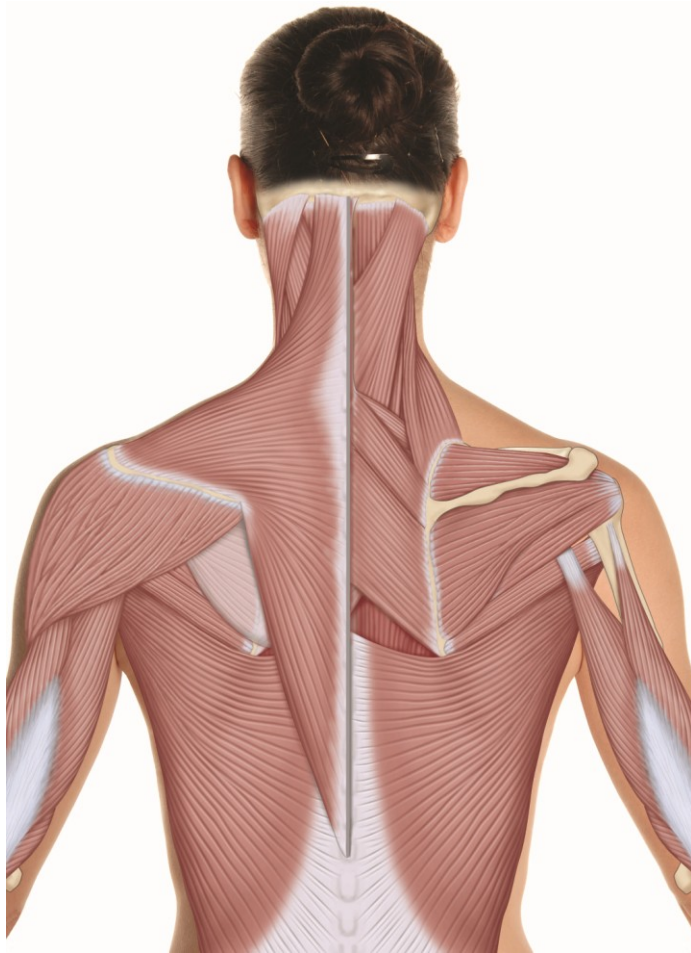
Shoulder Joint - Figures



Shoulder Girdle

- Protractors (pectoralis muscles)
- Retractors (rhomboids, middle trapezius)
- Elevators (upper trapezius, levator scapulae)
- Depressors (lower trapezius, pectoralis minor)
- Upward rotators
- Downward rotators

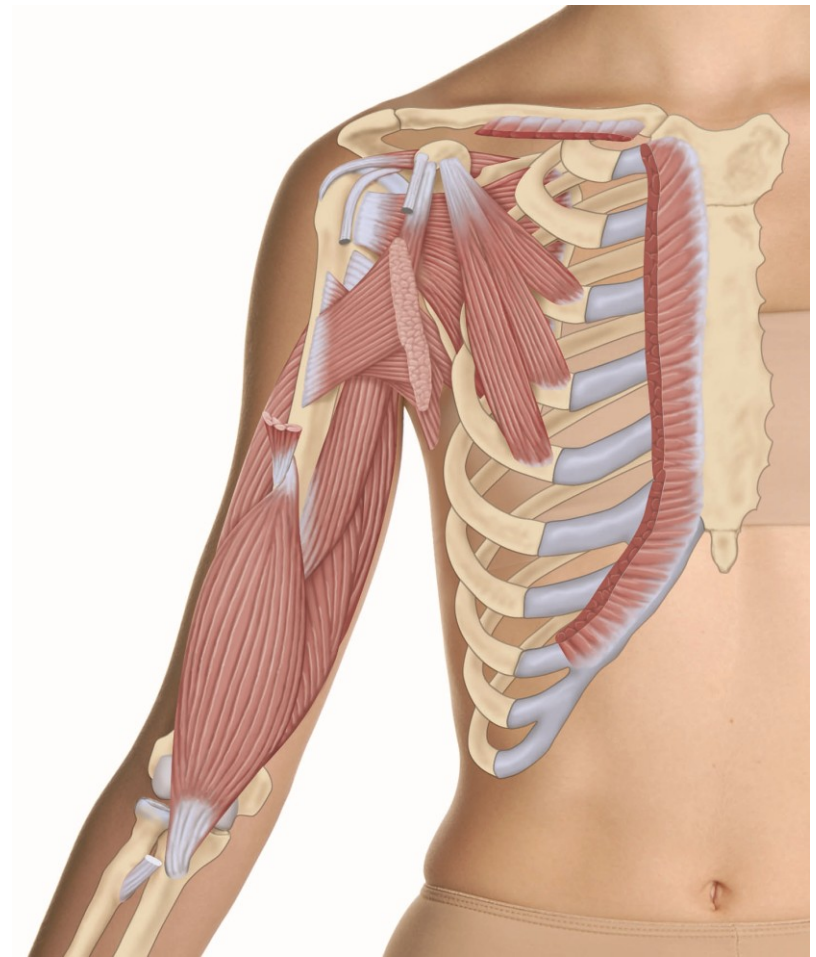
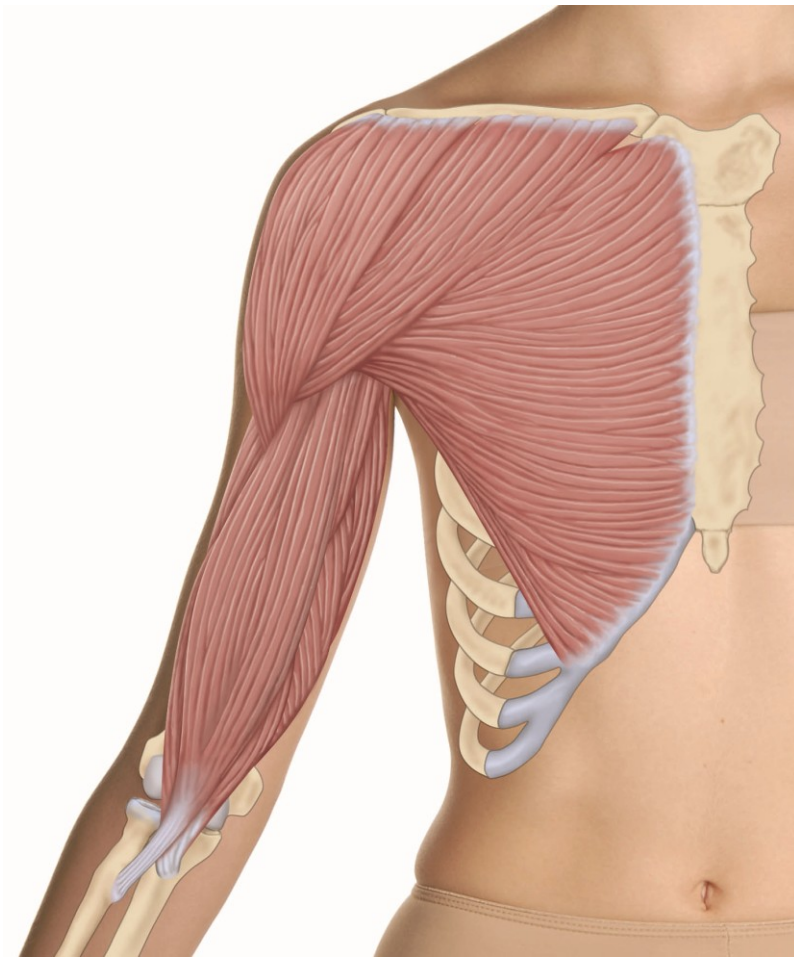
Shoulder Girdle Figures



Elbow Joint

- Flexors (biceps brachii, brachialis)
- Extensors (triceps brachii)

Elbow Joint Figures



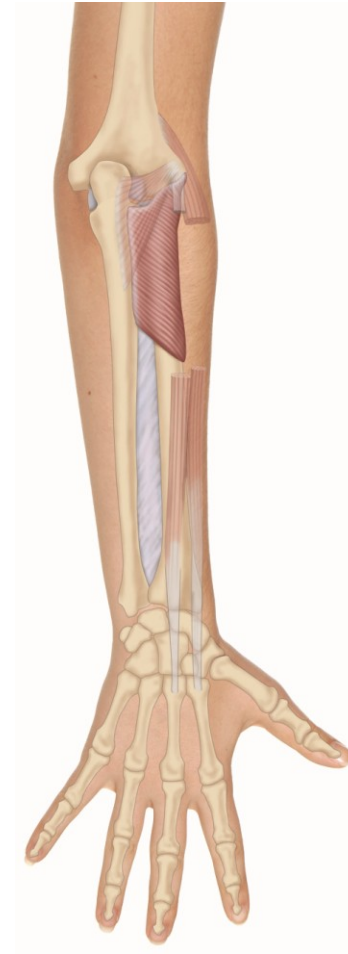
Elbow Joint Figures – cont' d



Radioulnar Joints

- Pronators
- Supinators

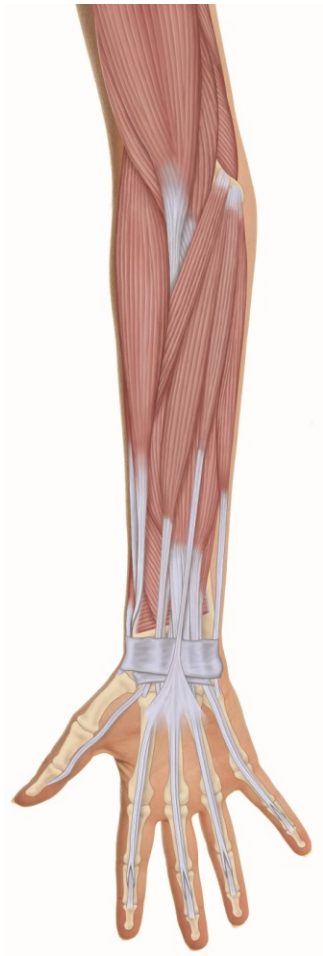
Radioulnar Joints Figures



Wrist Joint

- Flexors (wrist flexor group)
- Extensors (wrist extensor group)
- Radial deviators
- Ulnar deviators

Wrist Joint Figures



Finger Joints

- Flexors
- Extensors
- Abductors
- Adductors

Finger Joints Figures



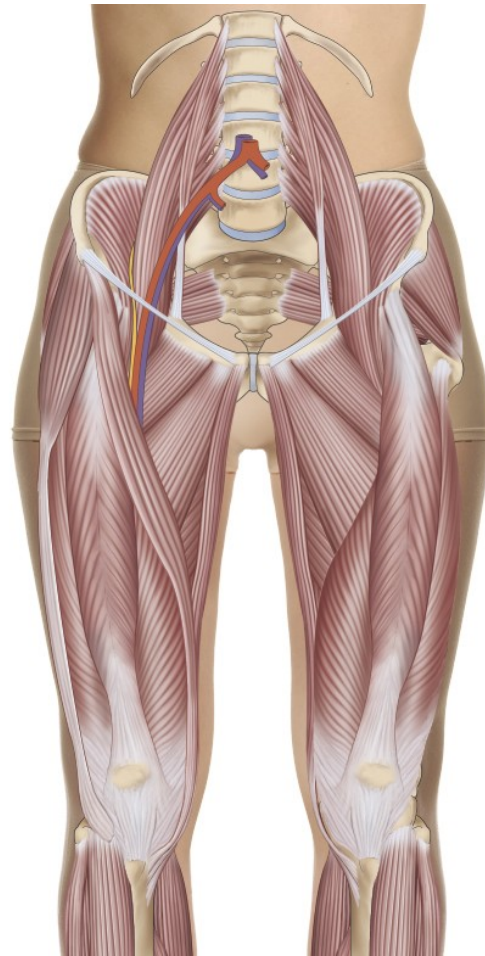
Lower Extremity

- Hip joint
- Pelvis
- Knee joint
- Ankle joint
- Subtalar joint
- Toe joints

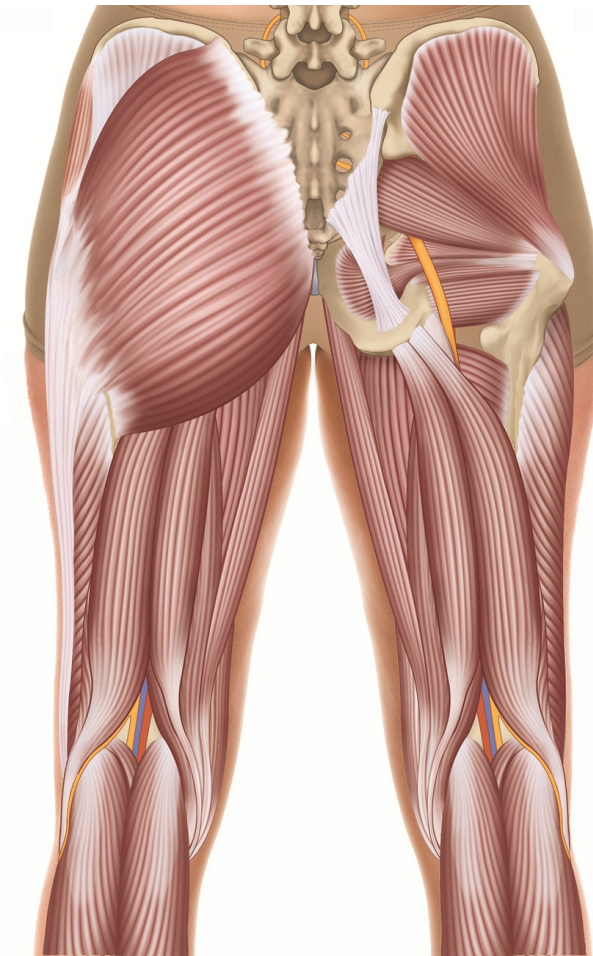
Hip Joint

- Flexors (iliopsoas)
- Extensors (gluteal muscles, hamstrings)
- Abductors (gluteal muscles)
- Adductors (adductor group)
- Medial rotators
- Lateral rotators (gluteal muscles, deep lateral rotators)

Hip Joint Figures



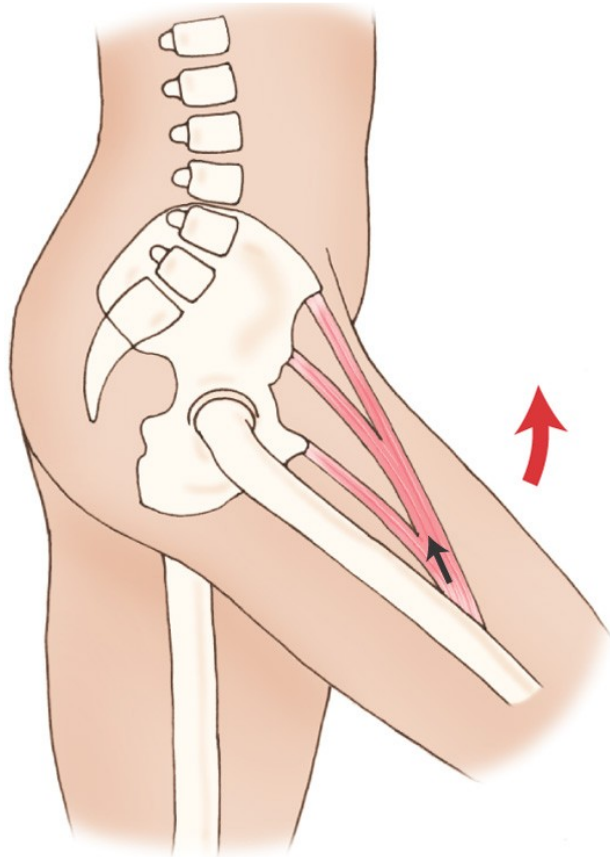
Hip Joint Figures – cont' d



Pelvis (at the hip joint)

- Anterior tilt (hip flexors)
- Posterior tilt (hip extensors)
- Depression (hip abductors)
- Elevation
- Right rotation
- Left rotation

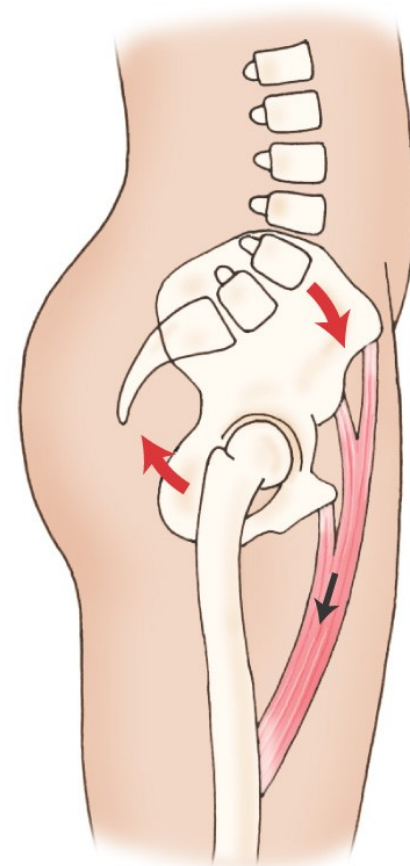
Pelvis Figures



C

Flexion of the thigh

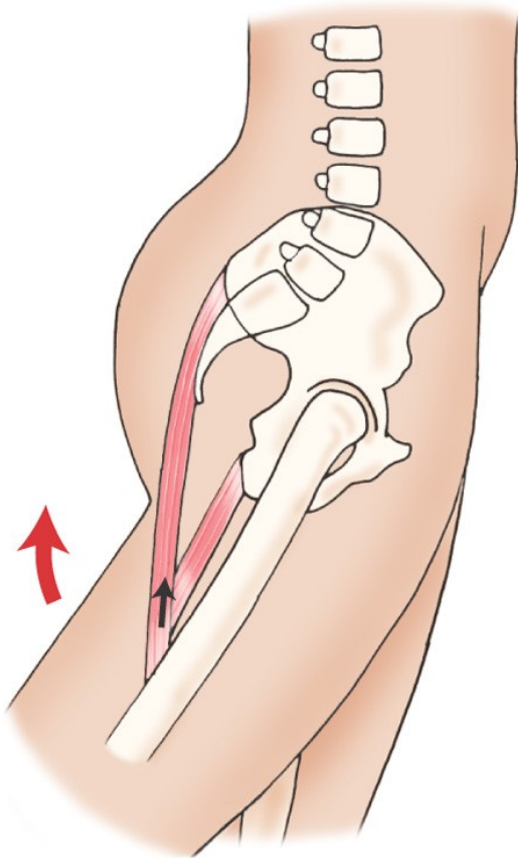
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B Anterior tilt of the pelvis

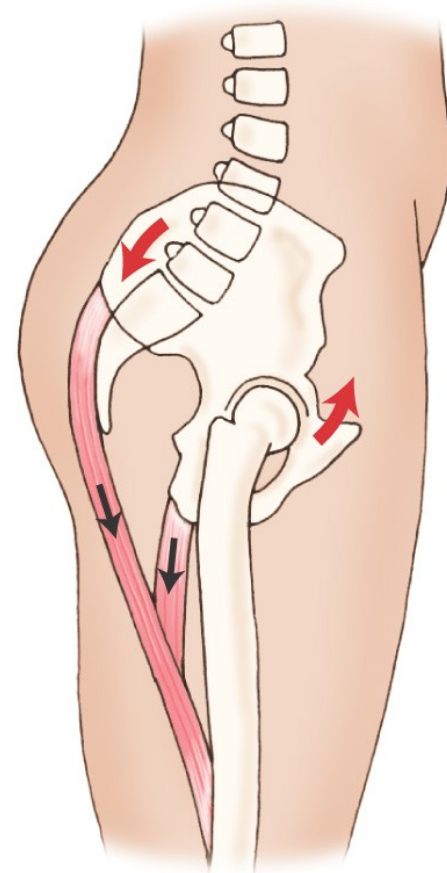
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Pelvis Figures – cont' d



E Extension of the thigh

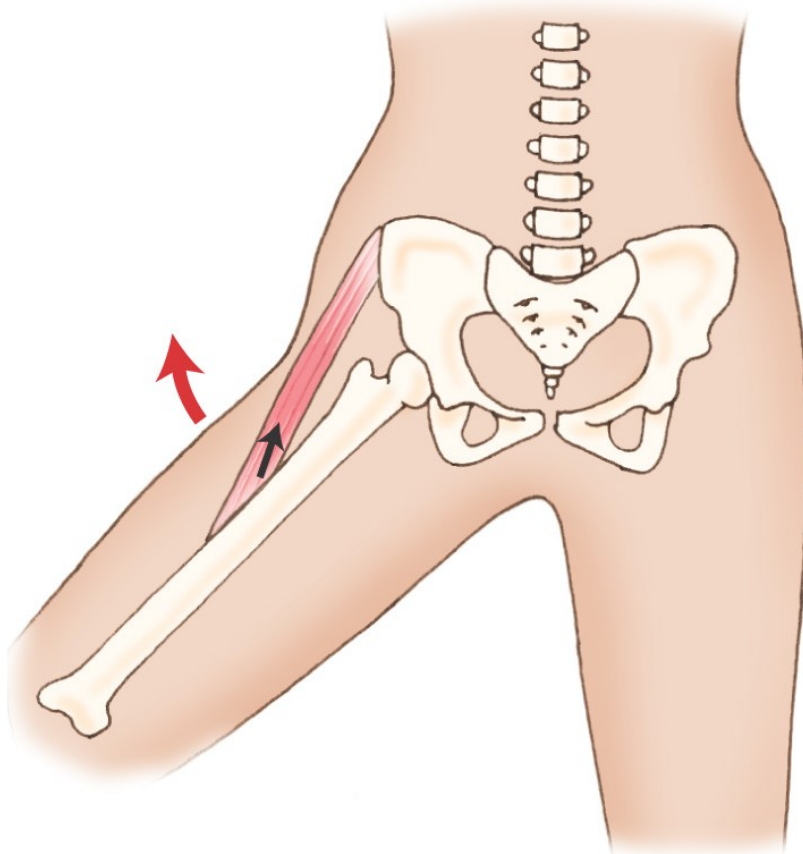
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D Posterior tilt of the pelvis

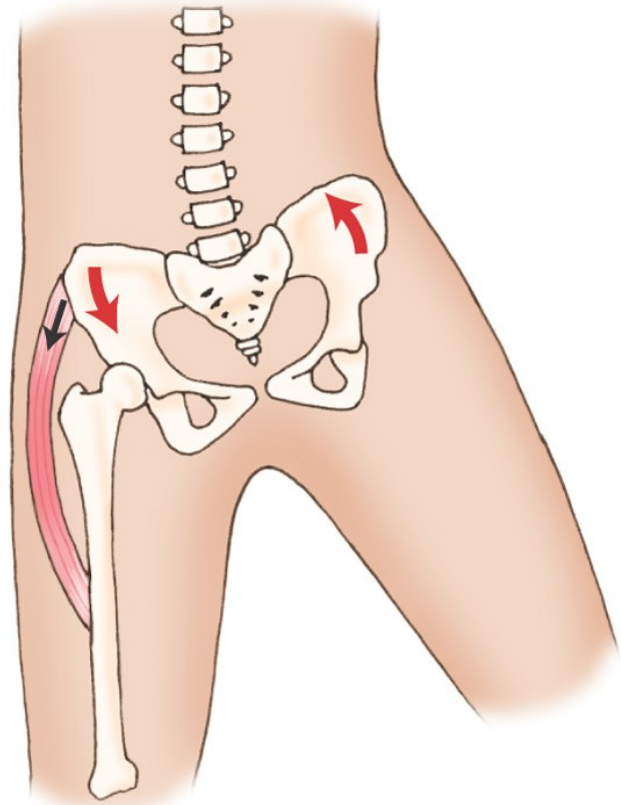
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Pelvis Figures – cont' d



C Abduction of the right thigh

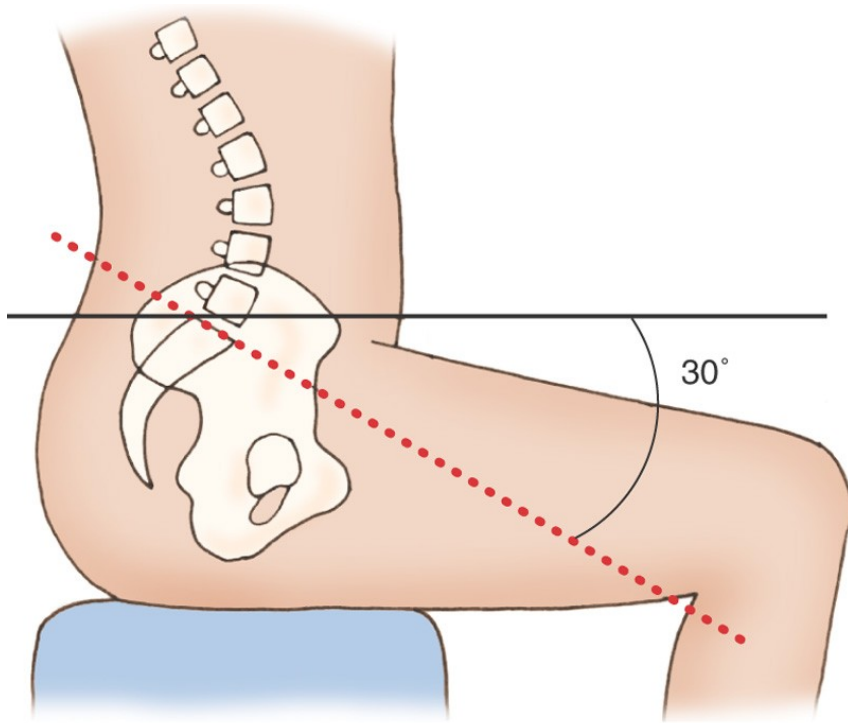
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B Depression of the right pelvis
(and elevation of the left pelvis)

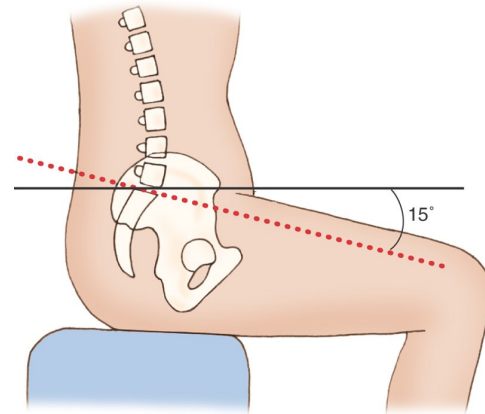
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Pelvic Posture and the Spine



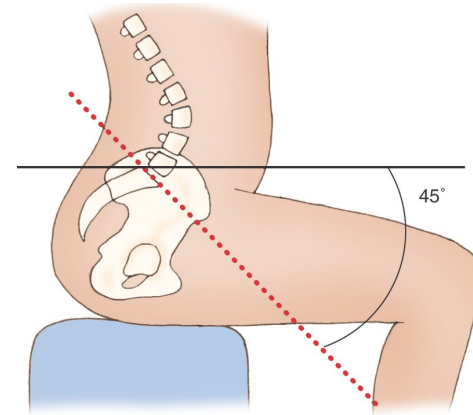
B

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A

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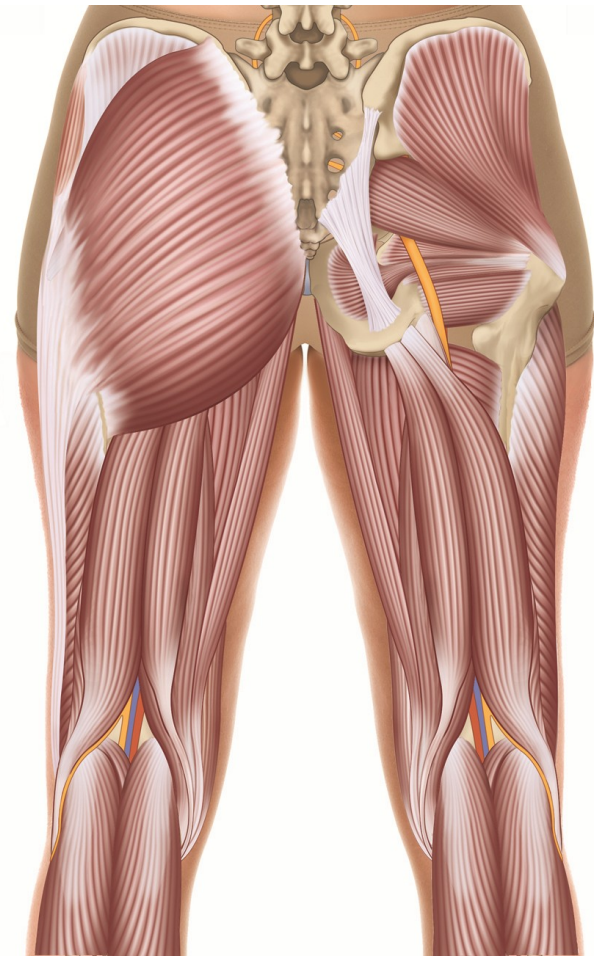
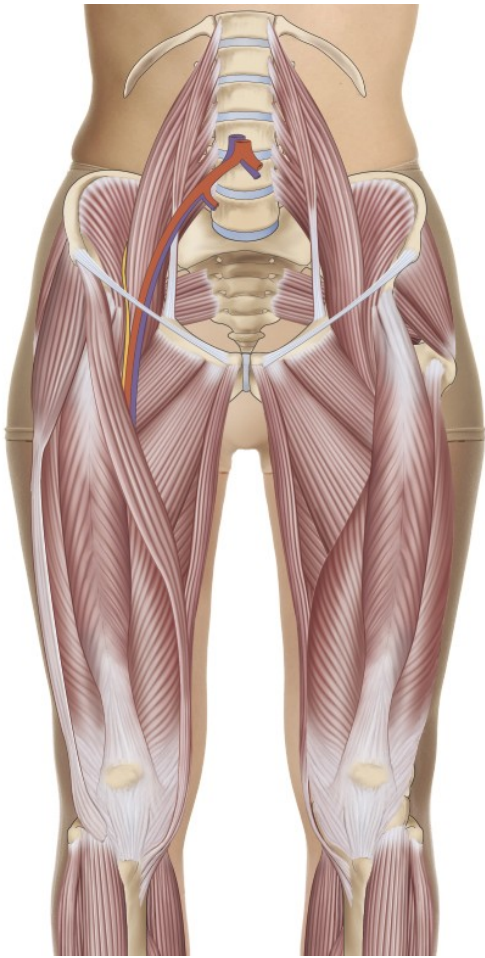
C

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Knee Joint

- Extensors (quadriceps femoris group)
- Flexors (hamstring group)

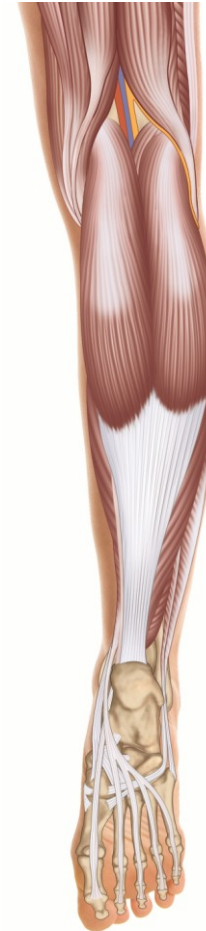
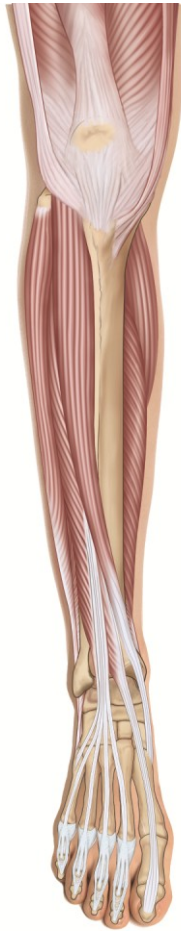
Knee Joint Figures



Ankle Joint

- Dorsiflexors
- Plantarflexors (gastrocnemius, soleus)

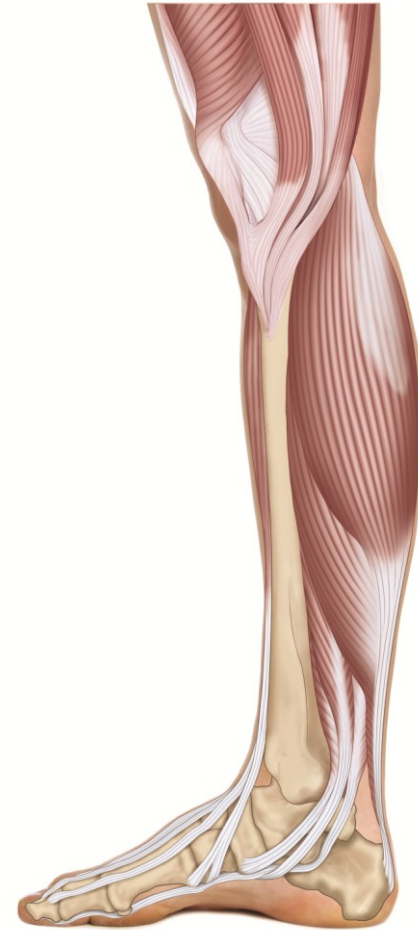
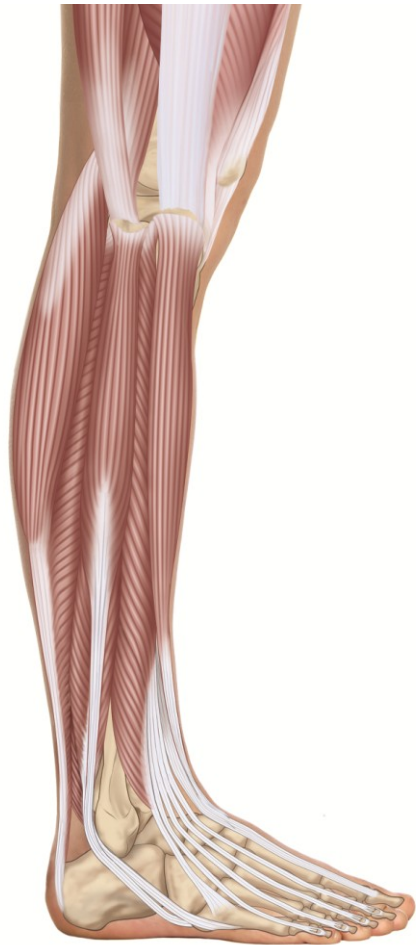
Ankle Joint Figures



Subtalar Joint

- Pronators / Evertors (fibularis muscles)
- Supinators / Invertors (tibialis anterior and posterior)

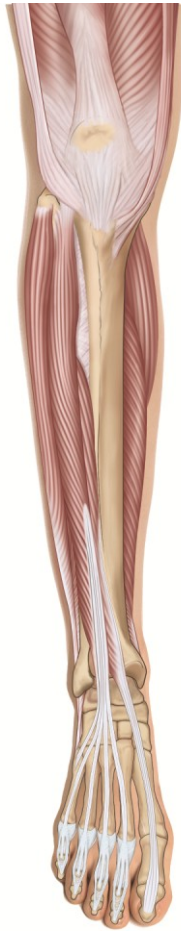
Subtalar Joint Figures



Toe Joints

- Extensors
- Flexors
- Abductors
- Adductors

Toe Joint Figures



Axial Body

- Spinal Joints
- Pelvis
- Temporomandibular joints (TMJs)

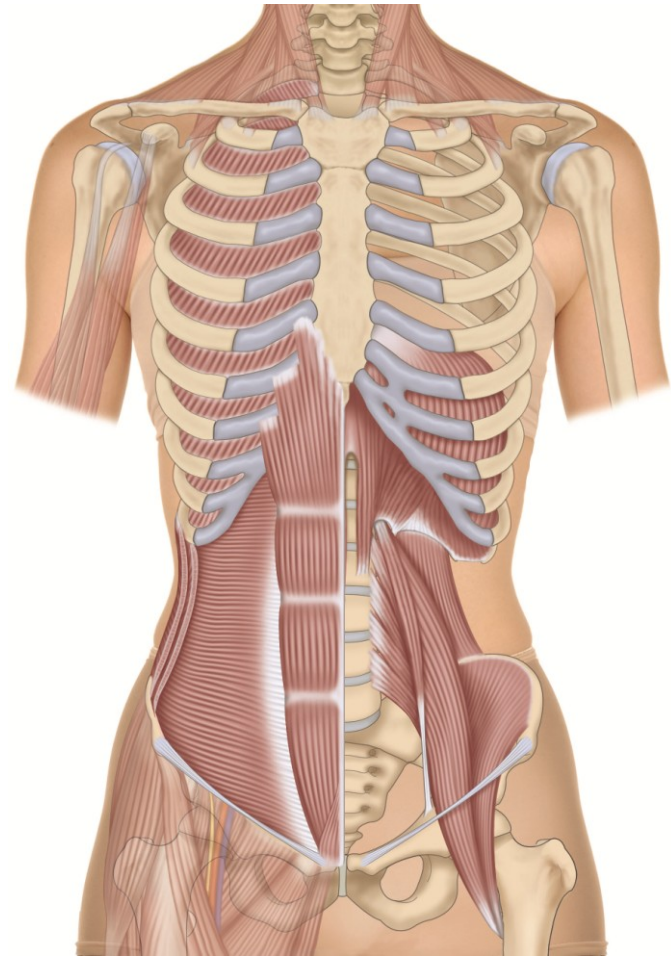
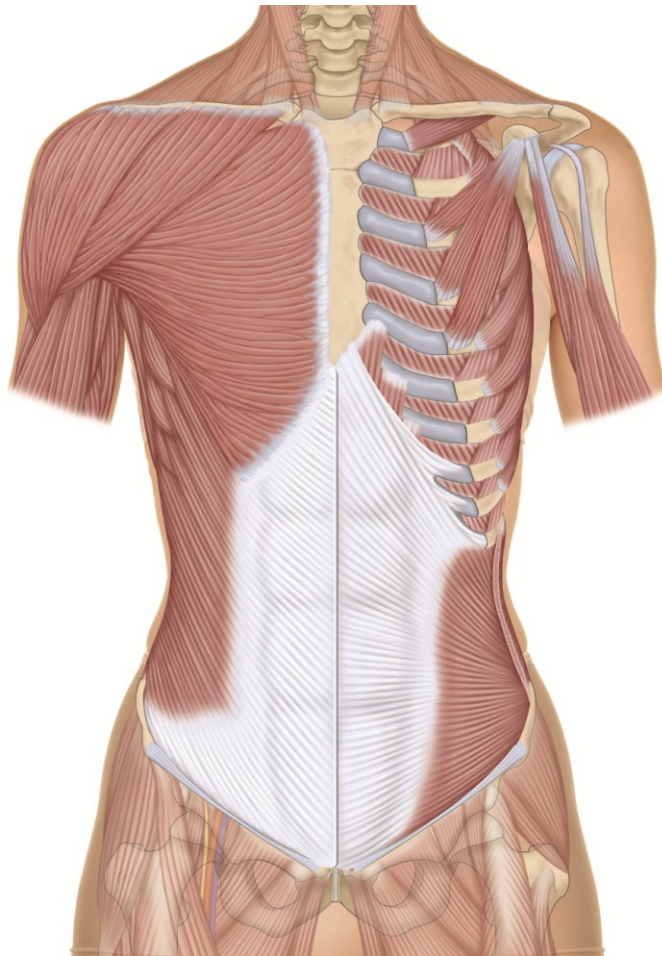
Spinal Joints - Trunk

- Flexors (abdominals: rectus abdominis, external and internal abdominal obliques)
- Extensors (erector spinae)
- Right lateral flexors
- Left lateral flexors
- Right rotators (abdominal obliques)
- Left rotators (abdominal obliques)

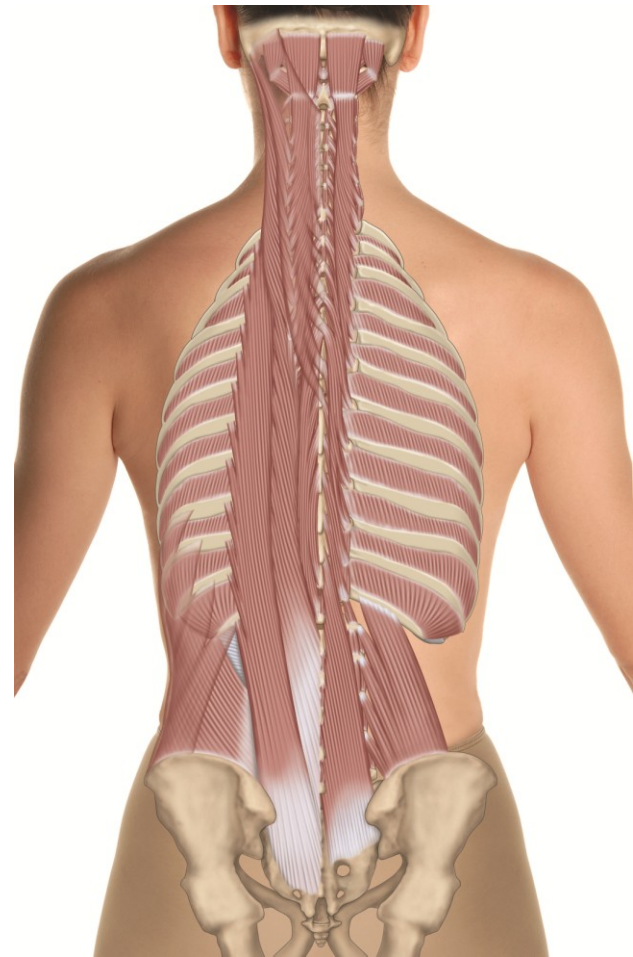
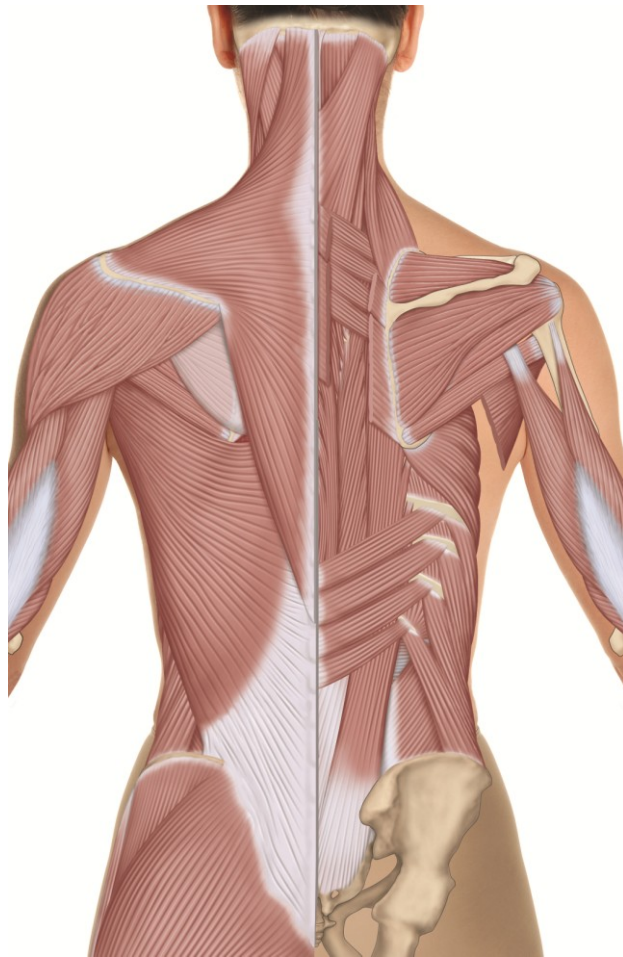
Spinal Joints - Neck

- Flexors (sternocleidomastoid [SCM], scalenes, longus muscles)
- Extensors (upper trapezius, levator scapulae, semispinalis capitis)
- Right lateral flexors
- Left lateral flexors
- Right rotators (upper trapezius, SCM)
- Left rotators (upper trapezius, SCM)

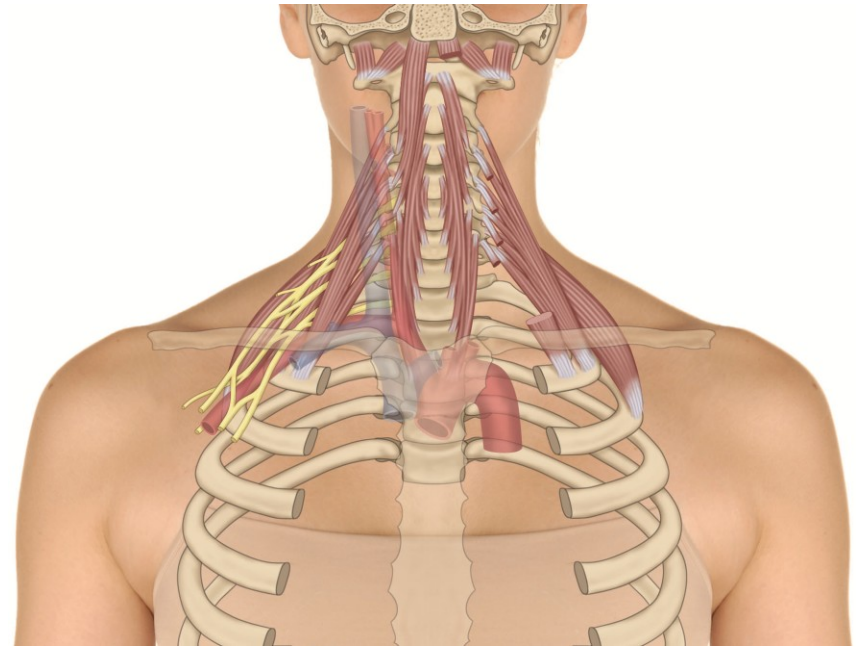
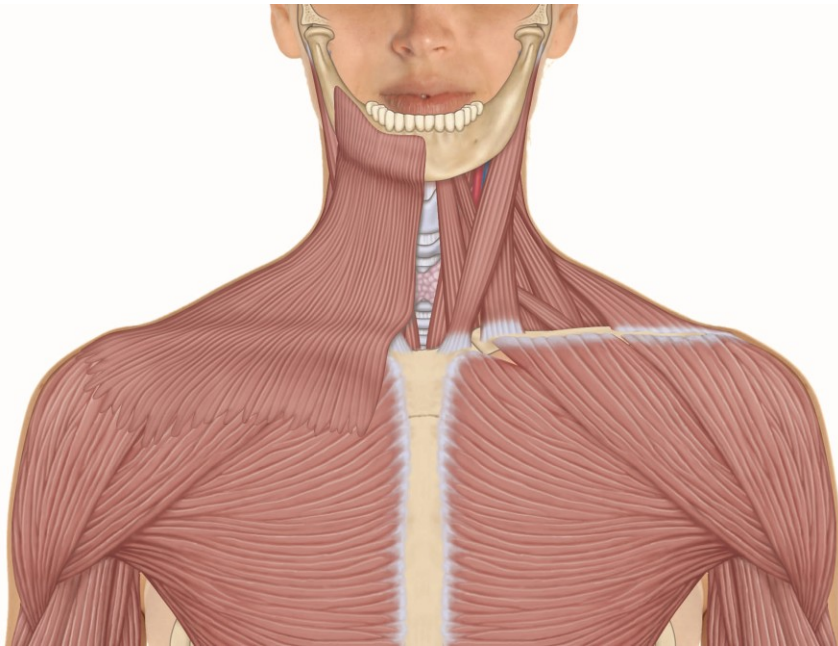
Spinal Joints Figures



Spinal Joints Figures – cont' d



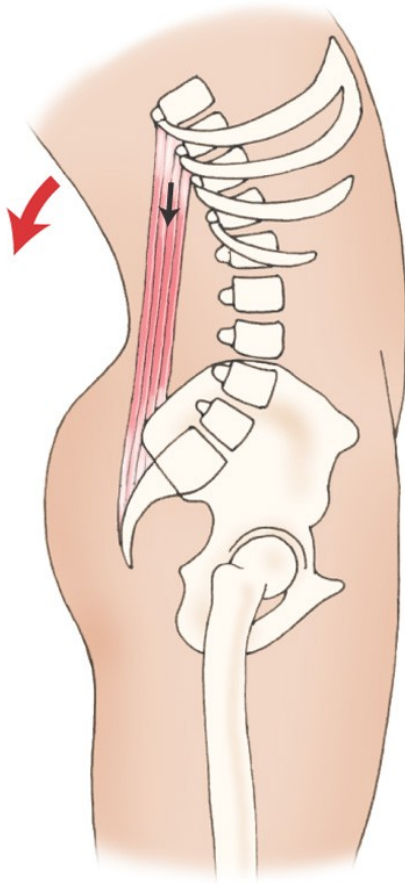
Spinal Joints Figures – cont' d



Pelvis (at the lumbosacral joint)

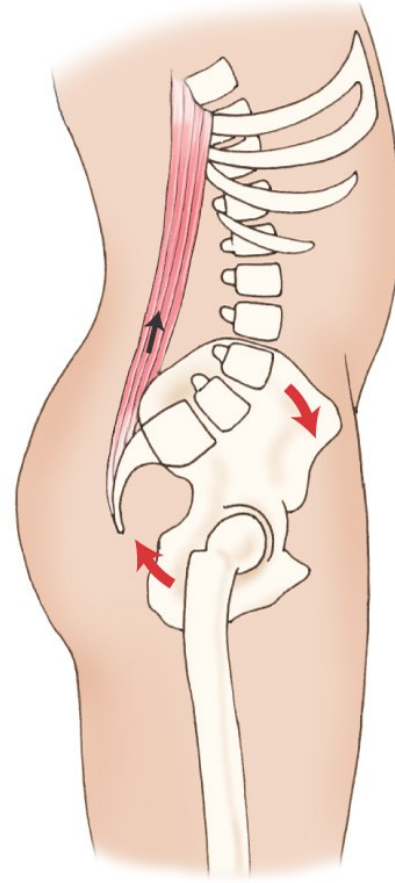
- Anterior tilt (back extensors)
- Posterior tilt (abdominals)
- Depression
- Elevation (lateral flexors)
- Right rotation
- Left rotation

Pelvis Figures



E Extension of the trunk

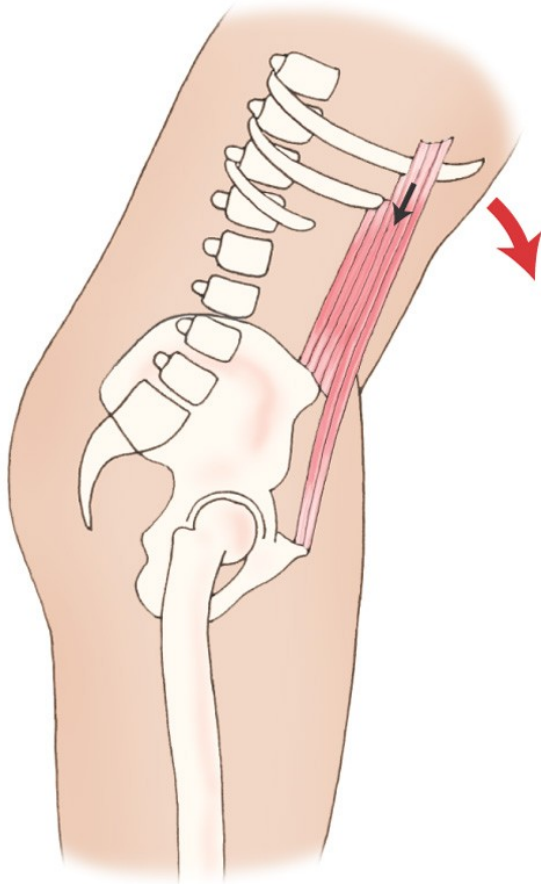
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D Anterior tilt of the pelvis

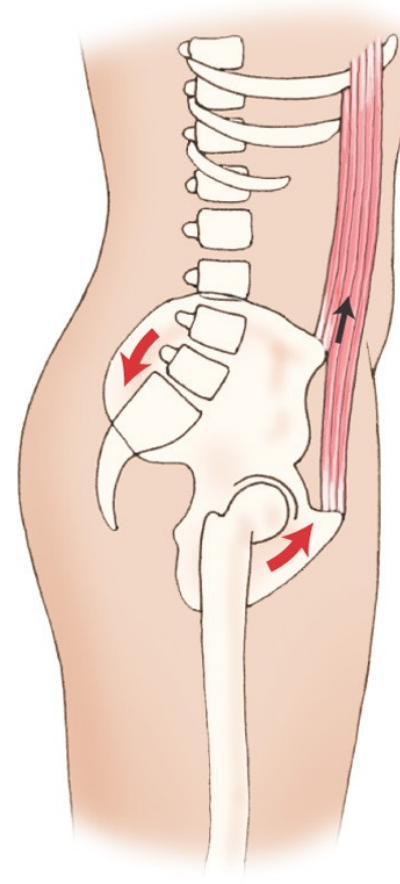
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Pelvis Figures – cont' d



C Flexion of the trunk

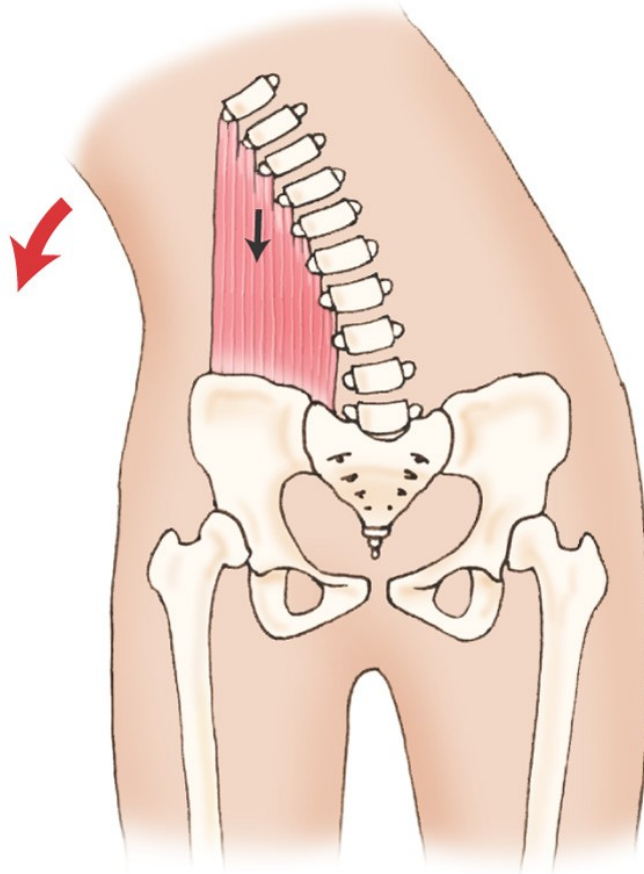
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B Posterior tilt of the pelvis

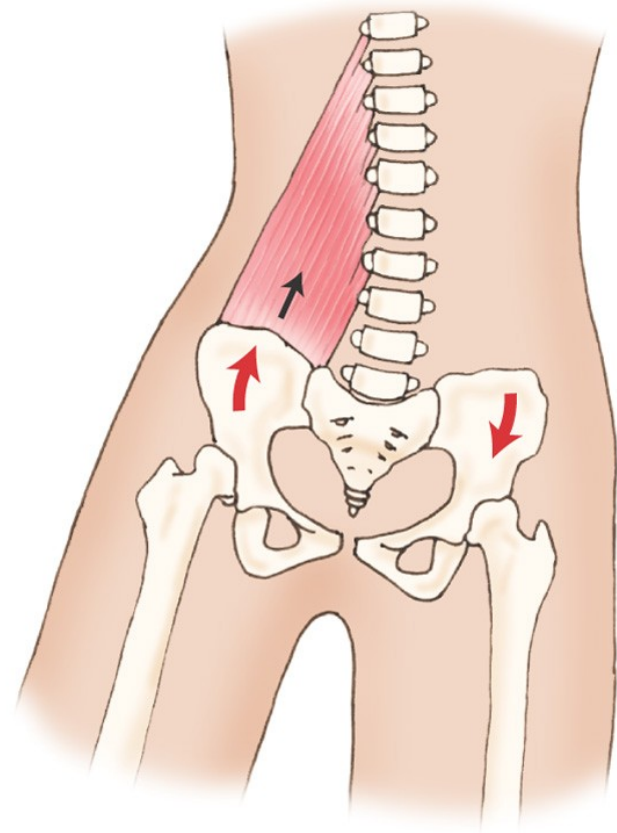
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Pelvis Figures – cont' d



C Right lateral flexion of the trunk

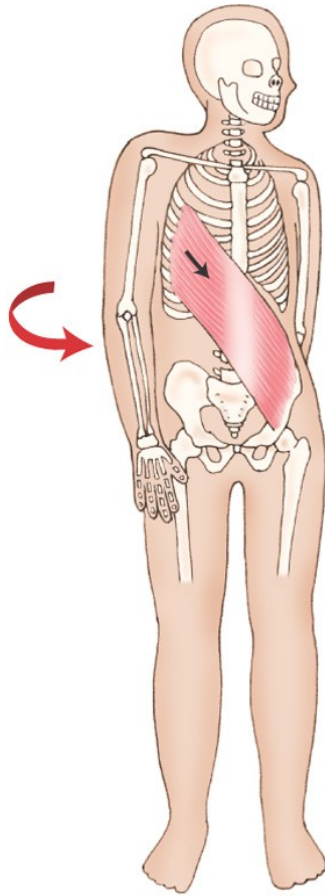
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B Elevation of the right pelvis
(and depression of the left pelvis)

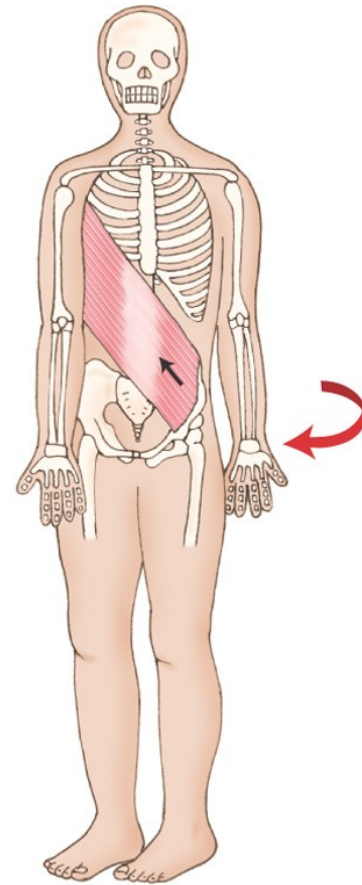
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Pelvis Figures – cont' d



B Right rotation of the trunk

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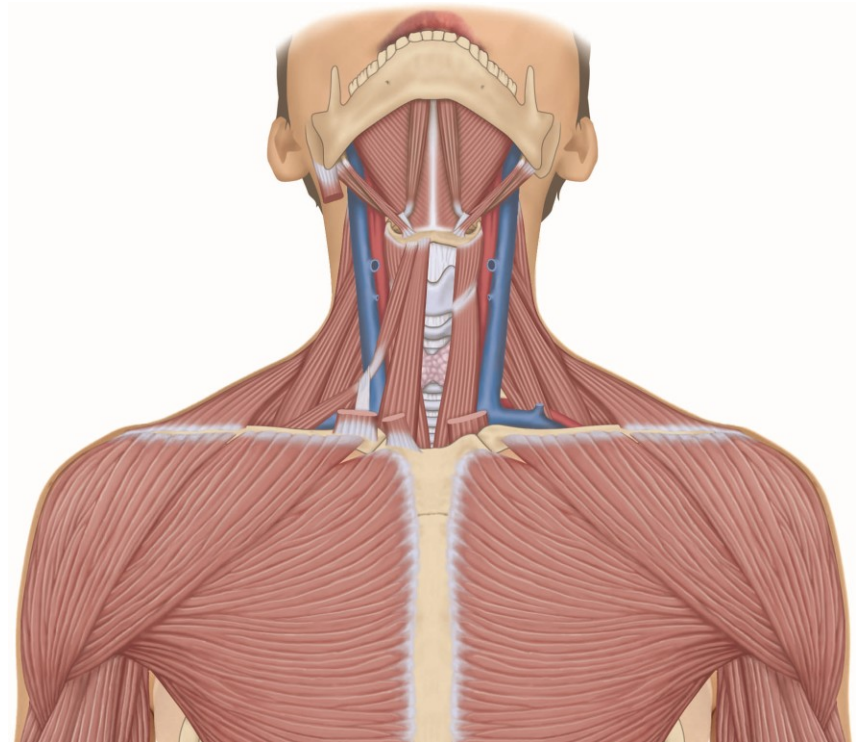
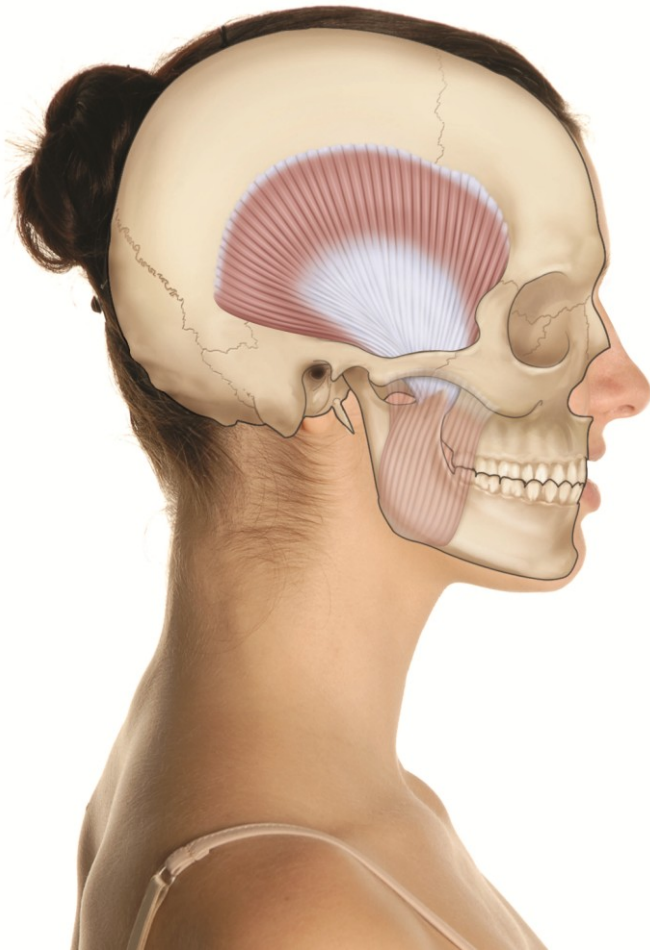
A Right rotation of the pelvis

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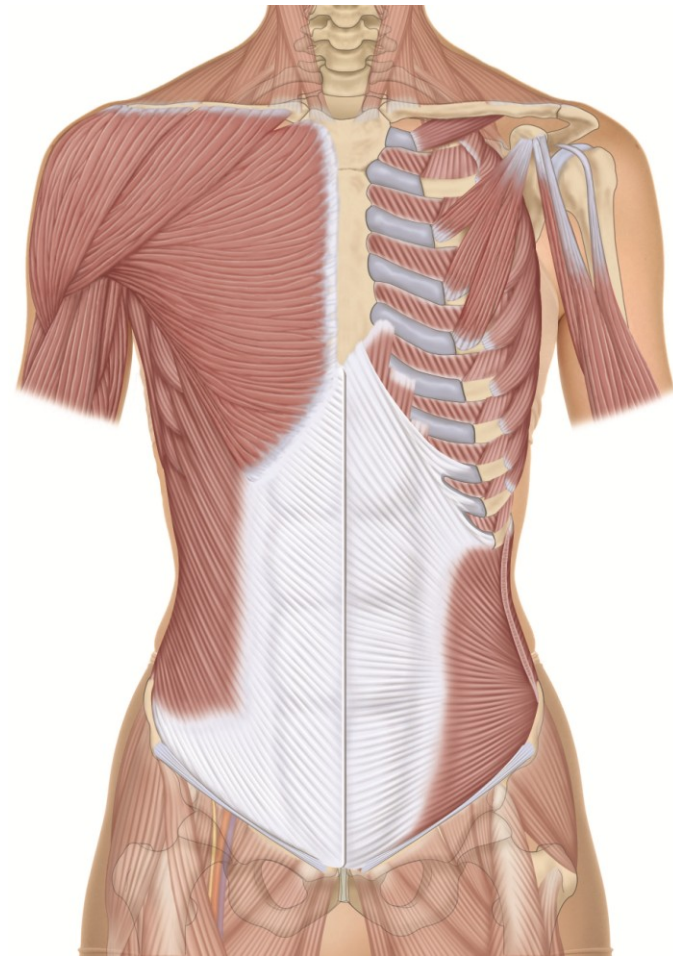
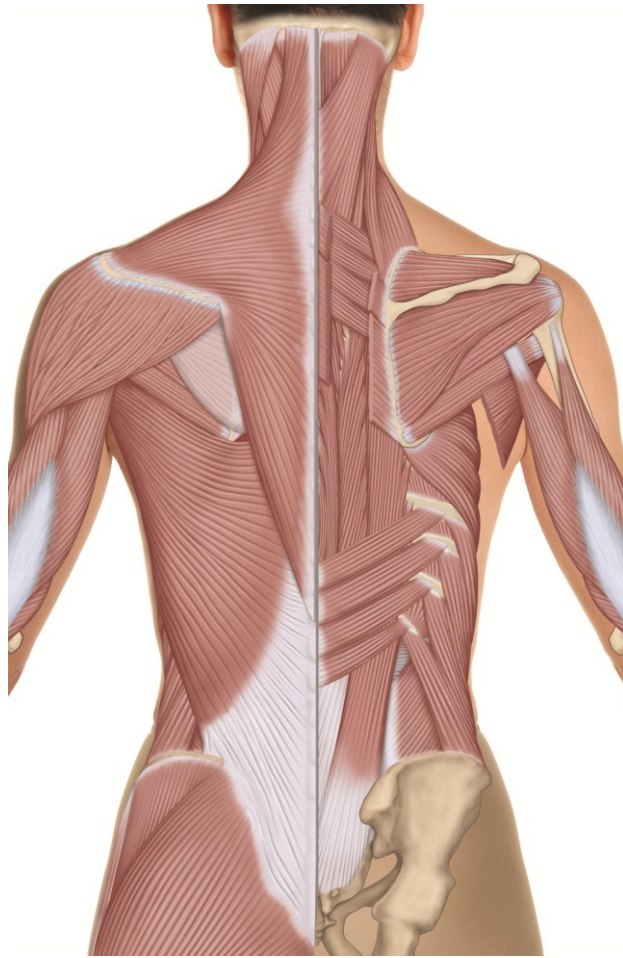
Temporomandibular Joints (TMJs)

- Elevators
- Depressors
- Right lateral deviators
- Left lateral deviators

Temporomandibular Joints (TMJs) Figures



Fasciae



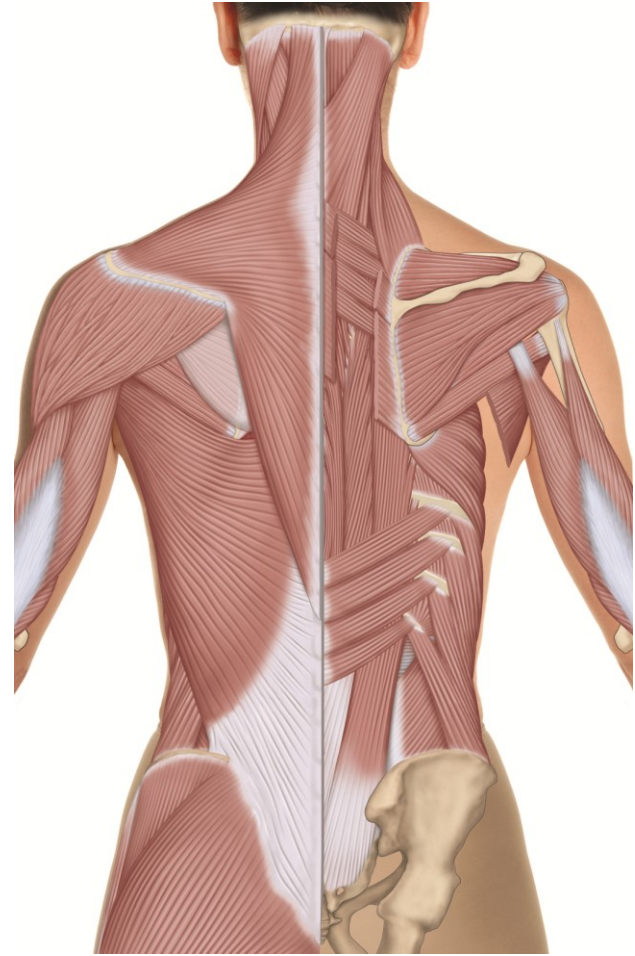
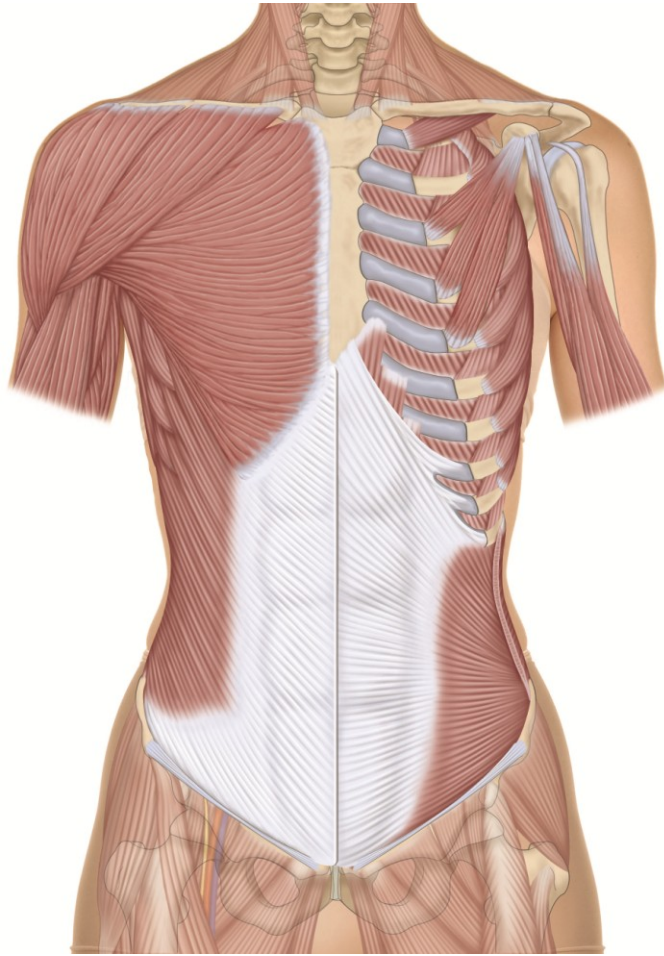
Fasciae – cont' d



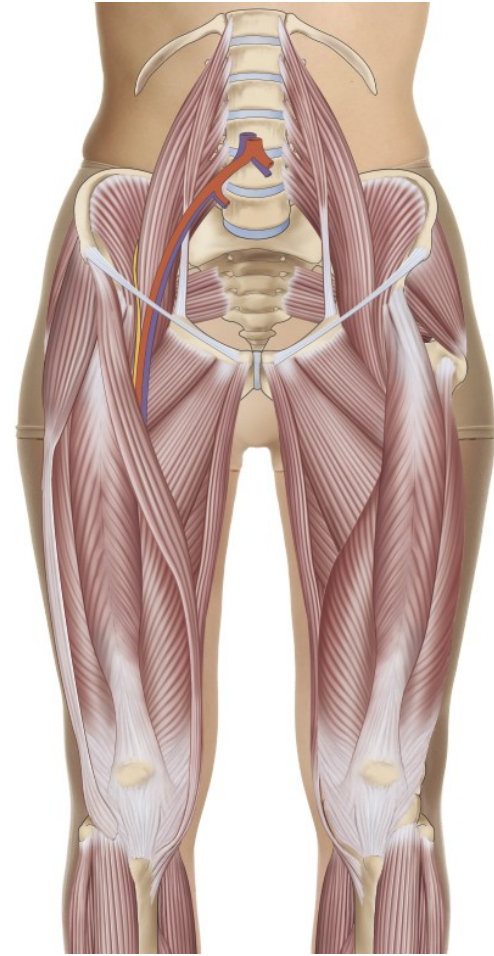
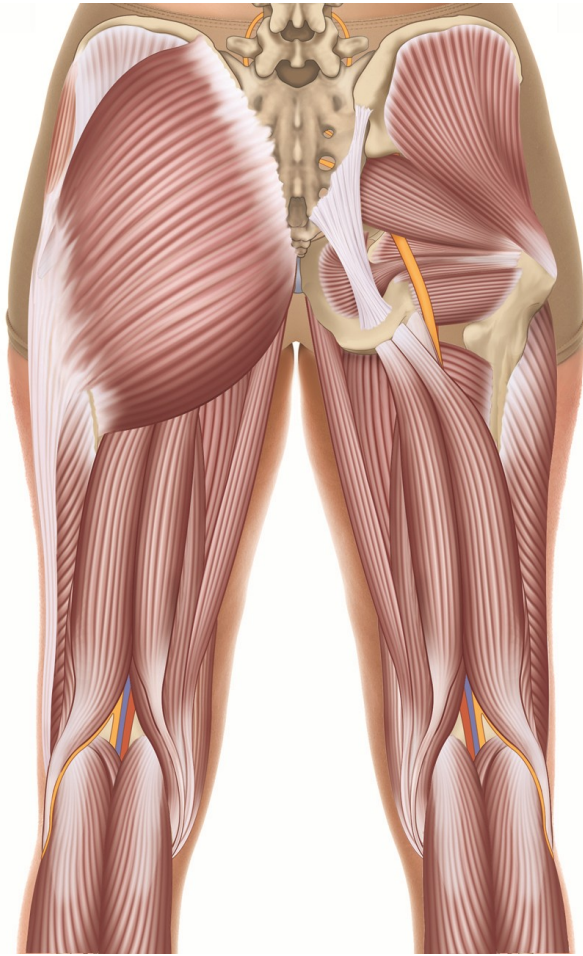
Powerhouse

- The “core”
- Pelvis and Trunk
- Hip joints and Spinal joints

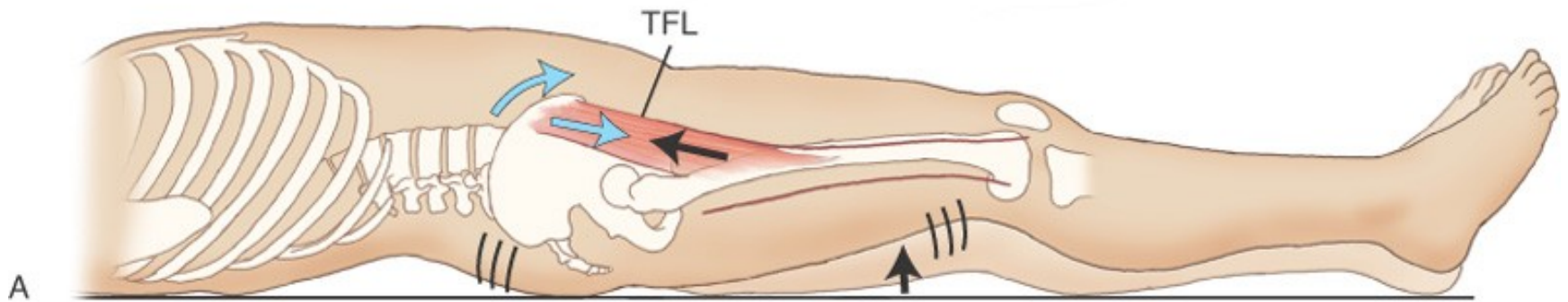
Powerhouse cont' d



Powerhouse cont' d



Core Stabilization



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