

**FUNCTIONAL ANATOMY
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CRANIOVERTEBRAL JOINTS:**ATLANTO-OCCIPITAL JOINTS:****CONDYLAR JOINT (SYNOVIAL)**

The atlanto-occipital joints exist between the occipital condyles of the occipital bone (just lateral to the foramen magnum) and the superior articular facets of the lateral masses of the C1 atlas vertebra.

This joint is a **condylar** synovial joint, which allows the movements of flexion and extension-nodding **yes**.

ATLANTO-AXIAL JOINT:**PLANE JOINT + PIVOT JOINT (SYNOVIAL)**

The atlanto-axial joints consist of three articulations between the C1 atlas vertebra and the C2 axis vertebra.

The paired articulations of the inferior facets of the lateral masses of the C1 atlas, and the superior articular facets of the C2 axis form plane/gliding synovial joints.

The single articulation between the dens of the C2 axis and the anterior arch of the C1 atlas forms a pivot synovial joint.

The movement of all three joints allows the rotational movement- shaking **no**.

During the rotation of the head the atlas and cranium pivot around the dens of the C2 axis vertebrae.

The dens is held in place on the C1 atlas by the transverse ligament.

MUSCLES OF THE VERTEBRAL COLUMN:

POSTERIOR:

SPLENIUS CAPITIS:

DEEP

O - spinous processes of C7 - T3, and the inferior half of the nuchal ligament.

I - mastoid process of the temporal bone; between the superior and inferior nuchal lines on the lateral-posterior aspect of the occipital bone.

A - **unilaterally** = laterally flexes head and neck to the same side + rotates the head and neck to the same side; **bilaterally** = extends the head and neck.

SPLENIUS CERVICIS:

DEEP

O - spinous processes of T3 - T6.

I - posterior tubercle of C1 - C3.

A - **unilaterally** = laterally flexes head and neck to the same side + rotates the head and neck to the same side; **bilaterally** = extends the head and neck.

ERRECTOR SPINAE SPINALIS COLUMN:

INTERMEDIATE

O – broad tendon that spans the iliac crests, sacrum, sacral and lumbar spinous processes.

I – **spinous processes** of thoracic and lumbar regions.

A – as a group: **unilaterally** = lateral flexion to the same side; **bilaterally** = extension of the vertebral column.

ERRECTOR SPINAE LONGISSIMUS COLUMN:

INTERMEDIATE

O – broad tendon that spans the iliac crests, sacrum, sacral and lumbar spinous processes.

I – **mastoid process** of the temporal bone, and ribs.

A – as a group: **unilaterally** = lateral flexion to the same side; **bilaterally** = extension of the vertebral column. **ILIUM → CRANIUM.**

ERRECTOR SPINAE ILIOCOSTALIS COLUMN:

INTERMEDIATE

O – broad tendon that spans the iliac crests, sacrum, sacral and lumbar spinous processes.

I – **ribs** and cervical transverse processes.

A – as a group: **unilaterally** = lateral flexion to the same side; **bilaterally** = extension of the vertebral column.

ERRECTOR SPINAE = PRIMARY EXTENSOR OF THE VERTEBRAL COLUMN.

DEEP → TRANSVERSOSPINALIS GROUP

PELVIC GIRDLE

Greater (false) pelvis is superior to the pelvic inlet → **NOT completely encased** in **bone**. The greater (false) pelvis supports the intestines (**abdominal viscera**) via the ilia.

Lesser (true) pelvis is inferior to the pelvic inlet → **completely encased** in **bone**. The lesser (true) pelvis supports the **urinary** and **reproductive organs**.

The greater and lesser pelvis are **separated** by the **pelvic diaphragm**.
The **pelvic diaphragm** form the **floor** of the true (**lesser/inferior**) **pelvis**.

The **hip** bone, or coxal bone is formed by the union of three bones: **ilium** (superiorly + laterally), **pubis** (inferiorly + anteriorly), **ischium** (inferiorly + posteriorly).

The **pelvic girdle** is made up of the hip bones (ilium, pubis, ischium) and the **sacrum** (posteriorly).

The sacrum transmits the weight of the body to the pelvic bones, especially the ilium- to which the sacrum articulates.

The two hip bones are joined **anteriorly** at the **pubic symphysis** (secondary cartilaginous), and articulate **posteriorly** with the sacrum at the **sacroiliac joints** (synovial plane + syndesmosis) to form the pelvic girdle.

ILIUM

The ilium is the superior bone of the hip.

The bone is described as fan-shaped, with the **ala** being the *spread of the fan*, and the **body** being the *handle of the fan*.

The body of the ilium contributes to the acetabulum.

On the posterior-medial aspect of the ilium is the **auricular surface** of the ilium, which articulates with the **auricular surface** of the sacrum (lateral).

Anteriorly these bones articulate as a synovial plane joint; posteriorly these bones articulate as a fibrous syndesmosis joint (both functionally amphiarthrosis → some movement).

ANTERIOR:**Quadriceps femoris**

O -

Rectus femoris: anterior inferior iliac spine.**Vastus medialis: linea aspera** (medial lip) of the **femur**.**Vastus lateralis: linea aspera** (lateral lip) of the **femur**, **gluteal tuberosity**, **greater trochanter**.**Vastus intermedius: anterior** and lateral shaft/body of the **femur**.I - **tibial tuberosity** via the patella and patella ligament.A - as a **group** they all **extend** the **knee**, only rectus femoris assists in hip flexion (as it is the only muscle of the quadriceps femoris group to cross the hip joint).N - **femoral nerve**.**Sartorius:**

O – anterior superior iliac spine.

I – proximal, medial shaft of the tibia.

A – flexes the knee, medially rotates the flexed knee.**A – flexes the hip, laterally rotates hip, abducts hip.**

N – femoral.

ANTERIOR:**Psoas**

O – lumbar vertebrae.

I – **lesser trochanter** of the femur.

A – flexes the hip.

N – lumbar plexus.

Iliacus

O – iliac fossa of the ilium (internal surface).

I – **lesser trochanter** of the femur.

A – flexes the hip.

N – femoral.

ILIOPSOAS = LUMBAR PLEXUS.

KNEE JOINT:

TIBIOFEMORAL JOINT:

The KNEE is the LARGEST DIARTHROSIS JOINT in the BODY. FUNCTIONALLY a HINGE JOINT, thus CAPABLE of FLEXION and EXTENSION MOVEMENTS, HOWEVER, when the KNEE is FLEXED it is also CAPABLE of ROTATION and LATERAL GLIDING.

PROXIMALLY the PATELLA is connected to/contained within the QUADRICEPS FEMORIS TENDON → CONNECTING the PATELLA to the 'QUARDICEP MUSCLES.'
DISTALLY the PATELLA is connected to/contained within the PATELLA LIGAMENT → CONNECTING the PATELLA to the TIBIA.

As with the ELBOW the KNEE has TWO ARTICULATIONS:

[1] the TIBIOFEMORAL JOINTS → BETWEEN the CONDYLES [MEDIAL + LATERAL] of the FEMUR and the TIBIA.

[2] the PATELLOFEMORAL JOINT → BETWEEN the PATELLA and the PATELLA SURFACE of the FEMUR.

Synergists in knee flexion:**Gastrocnemius:**

- O – condyles of the femur.
- I – calcaneus via the calcaneal tendon.
- A – flexes the knee.
- N – tibial branch of the sciatic nerve.

Gracilis

- O – inferior ramus of the pubis.
- I – proximal, medial shaft/ body of the **tibia anteriorly**.
- A – flexes the knee, medially rotates the flexed knee.**
- A – adduct the hip, medially rotate hip.
- N – obturator.

Sartorius:

- O – anterior superior iliac spine.
- I – proximal, medial shaft of the tibia.
- A – flexes the knee, medially rotates the flexed knee.**
- A – flexes the hip, laterally rotates hip, abducts hip.
- N – femoral.

Popliteus:

- O – lateral condyle of the femur.
- I – proximal, posterior aspect of the tibia.
- A – flexes the knee, medially rotates the flexed knee.
- N – tibial branch of the sciatic nerve.

Plantaris:

- O – lateral condyle of the femur.
- I – calcaneus via the calcaneal tendon.
- A – weak flexion of the knee, weak plantarflexion of the ankle.
- N – tibial branch of the sciatic nerve.

ARTICULATIONS OF THE TIBIA + FIBULA:

The tibia and fibula articulate with each other are two junctions.

1. Proximal tibiofibular joint, which is classified as a **synovial plane joint**.
2. Distal tibiofibular joint, which is classified as a **fibrous syndesmosis** (interosseous membrane).

JOINT CAPSULE:

The capsule is thin anteriorly and posteriorly; supported by strong **lateral** and **medial collateral ligaments**.

LIGAMENTS:

LATERAL

The ankle joint is reinforced laterally by **lateral ligaments of the ankle**:

ANTERIOR TALOFIBULAR LIGAMENT:

Flat, weak band.

POSTERIOR TALOFIBULAR LIGAMENT:

Thick, **STRONGEST**.

CALANEOFIBULAR LIGAMENT:

Round + cord-like

These ligaments stabilise the lateral aspect of the ankle during inversion.
These lateral ligaments are much weaker than the medial deltoid ligament, therefore, inversion injuries are much more common than eversion injuries.

MEDIAL

The joint capsule is reinforced medially by the large, strong **DELTOID LIGAMENT**.
The deltoid ligament is the merger of 4 ligaments.

These ligaments stabilise the ankle joint during **eversion**.

SPRAIN = LIGAMENT

STRAIN = MUSCLE

LATERAL COMPARTMENT

The muscles of the lateral compartment of the leg share the common **ACTIONS** of **EVERSION** (PRONATION) of the subtalar joint, and **PLANTARFLEXION** of the talocrural joint.

Peroneus (fibularis) longus → (SUPERFICIAL)

O – head of the fibula

I – first metatarsal and the medial cuneiform bone

A – **evert** the foot (subtalar joint), **plantarflexion** of the ankle (talocrural joint)

N – superficial peroneal nerve

Peroneus (fibularis) brevis → (DEEP)

O – lower 2/3rds lateral fibula shaft

I – tuberosity of the 5th metatarsal

A – **evert** the foot, **plantarflexion** of the ankle (talocrural joint)

N – superficial fibular nerve

THE **TENDON** OF FIBULARIS **BREVIS** PASSES **CLOSEST**
TO THE **LATERAL** MALLEOLUS.

THE TENDON OF FIBULARIS LONGUS SITS POSTERIOR TO THE
TENDON OF FIBULARIS BREVIS AS THEY PASS THE LATERAL
MALLEOLUS.

JOINTS OF THE PECTORAL GIRDLE

STERNOCLAVICULAR JOINT:**SADDLE JOINT**

Articulation between the medial end of the clavicle and the manubrium of the sternum.

CONNECTS THE UPPER LIMB TO THE AXIAL SKELETON.

Anterior + posterior sternoclavicular ligaments;
Costoclavicular ligament (first rib);
Interclavicular ligaments.

ACROMIOCLAVICULAR JOINT:**PLANE JOINT**

Articulation between the two bones of the shoulder girdle; the lateral end of the clavicle and the acromion process of the scapula.

Acromioclavicular ligament;
Coracoclavicular ligament.

SCAPULOTHORACIC JOINT:**PHYSIOLOGICAL JOINT**

Not a true joint.

Articulation between muscle and muscle.

Articulation between the convex surface of the posterior thoracic cage and the concave surface of the anterior scapula surface.

MOVEMENTS OF THE PECTORAL GIRDLE

PROTRACTION

RETRACTION

ELEVATION

DEPRESSION

UPWARD ROTATION

DOWNWARD ROTATION

NOTE: the movements of upward and downward rotation refer to the position of the **GLENOID FOSSA** during the movements.

MUSCLES OF THE PECTORAL GIRDLE

ANTERIOR:

Pectoralis minor;

Subclavius;

Serratus anterior.

POSTERIOR:

Trapezius;

Levator scapulae;

Rhomboids.

SCAPULOHUMERAL MUSCLES:**DELTOID:**

O- lateral clavicle, acromion and spine of the scapula.

I- deltoid tuberosity of the humerus.

A- all fibres (anterior, lateral, posterior) **ABDUCT** the shoulder.

ANTERIOR FIBRES:

Flex and medially rotates the shoulder.

POSTERIOR FIBRES:

Extend and laterally rotates the shoulder.

N- axillary.

CORACOBRACHIALIS:

O- coracoid process of the scapula.

I- lower half of the shaft of the humerus.

A- flexes and adducts the arm.

N- lower subscapular.

ROTATOR CUFF

SUPRASPINATUS =

abducts arm.

SUPERIOR INSERTION.

INITIATES ABDUCTION.

TERES MINOR =

laterally rotates arm.

LATERAL INSERTION

INFRASPINATUS =

laterally rotates arm.

LATERAL INSERTION

SUBSCAPULARIS =

medially rotates arm.

MEDIAL INSERTION on the anterior aspect.

ELBOW FLEXION

BRACHIALIS =

flexes elbow.

PRIME MOVER OF ELBOW FLEXION.

BICEPS BRACHII =

supinates forearm + flexes elbow.

SYNERGIST IN ELBOW FLEXION.

BRACHIORADIALIS =

flexes elbow.

SYNERGIST IN ELBOW FLEXION.

ELBOW EXTENSION

TRICEPS BRACHII =

extends elbow.

PRIME MOVER IN ELBOW EXTENSION.

JOINTS OF THE ARM

PROXIMAL RADIOULNAR JOINT:**PIVOT JOINT**

The articulation between the **head** of the **radius** and the **radial notch** of the **ulna**.

Supported by the **annular ligament**.

Movements = rotation → **PRONATION + SUPINATION**.

DISTAL RADIOULNAR JOINT:**PIVOT JOINT**

The radius pivots around the ulna.

The proximal radioulnar joint is capable of greater rotation than the distal joint.

Supported by the **articular disc**.

Movements = rotation → **PRONATION + SUPINATION**.

The **DISTAL RADIOULNAR** joint is **LESS** capable of **ROTATION**, due to the **STRONG JOINT CAPSULE** attaching the **HAND** to the forearm.

**THE RADIUS PIVOTS AROUND THE
ULNA**

MYOTOMES			
ANTERIOR		POSTERIOR	
NERVE	ACTION	NERVE	ACTION
C5	SHOULDER FLEXION	C6 + C7 + C8	SHOULDER EXTENSION
C5 - C6	ELBOW FLEXION	C6 - C7	ELBOW EXTENSION
C6 - C7	WRIST FLEXION	C6 - C7	WRIST EXTENSION
C7 - C8	DIGIT FLEXION	C7 - C8	DIGIT EXTENSION