اساسيات علم التشريح

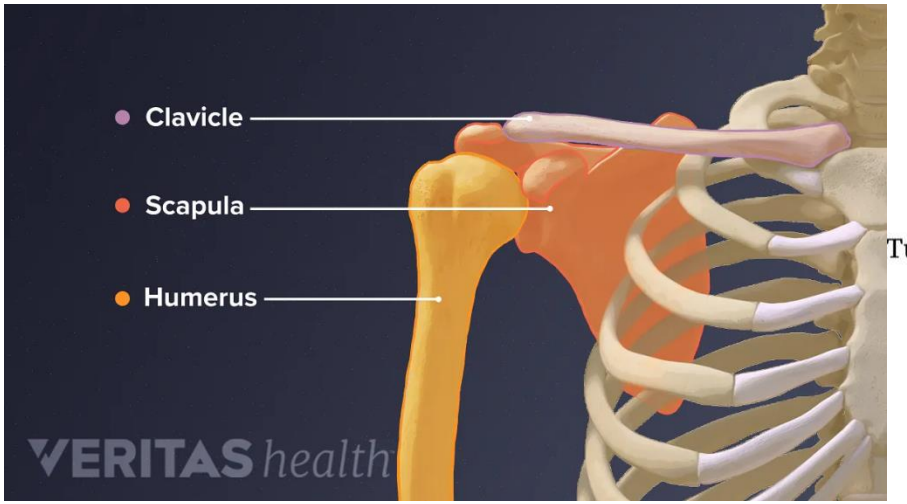
قسم تقنيات العلاج الطبيعي

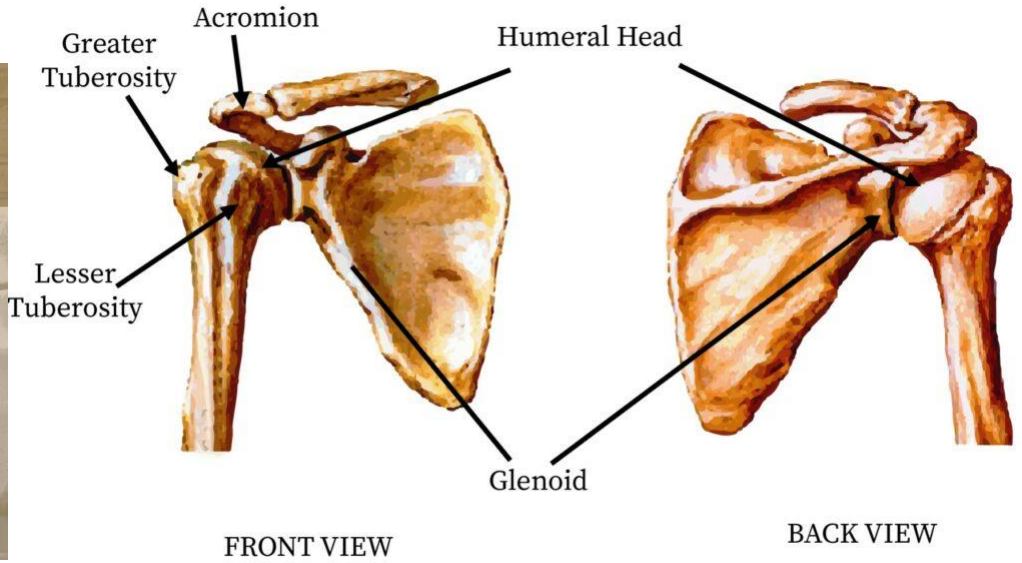
المرحلة الأولى

د. غياث مهند

Shoulder girdle

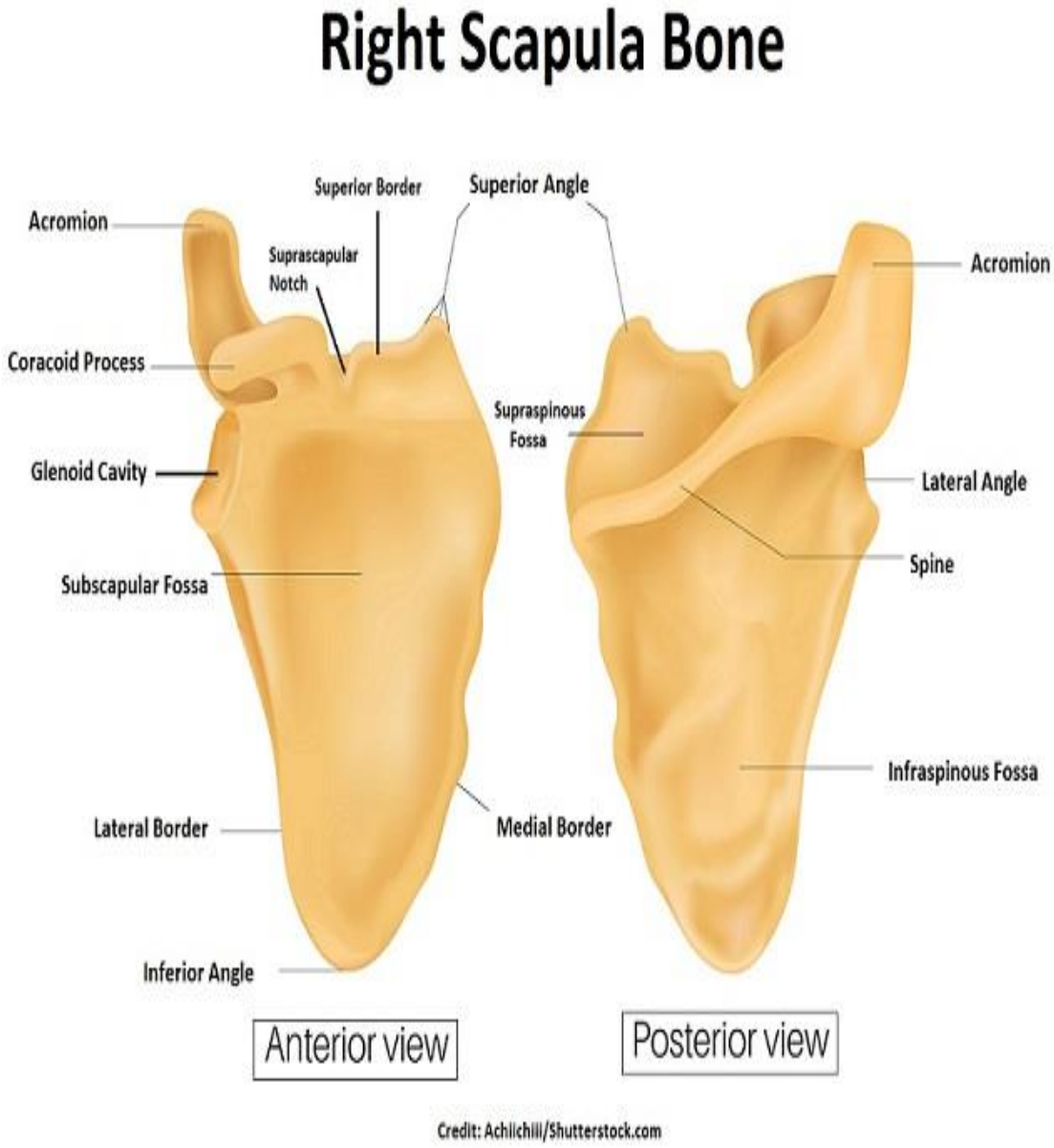
- The bones of the shoulder are the humerus) the upper arm bone), the scapula (the shoulder blade), and the clavicle (the collar bone). The roof of the shoulder is formed by a part of the scapula called the acromion.
- The clavicle articulates at one end with the sternum (chest bone) and with the acromion of the scapula at the other. This articulation between the acromial end of the clavicle and the acromion of the scapula forms the roof of the



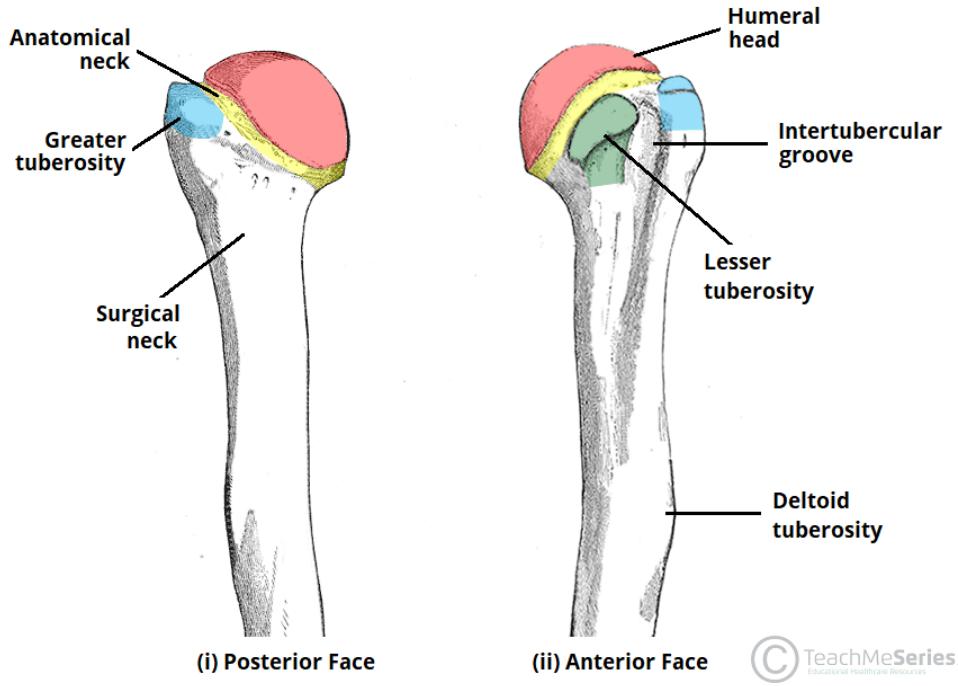


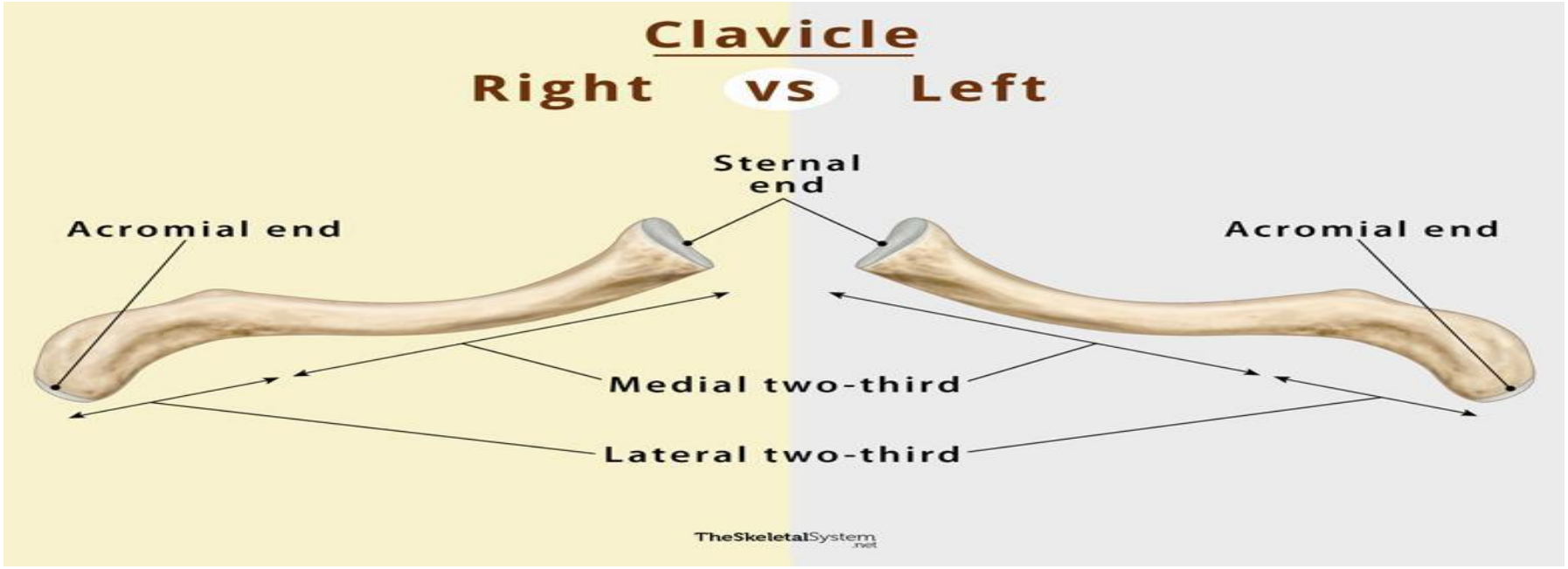
Pectoral girdle (shoulder joint)

The scapula is a large, flat triangular bone with three processes called the acromion, spine and coracoid process The coracoid process is a thick curved structure that projects from the scapula and is the attachment point of ligaments and muscles . The scapula is also marked by a shallow, somewhat comma-shaped glenoid cavity , which articulates with the head of the humerus



The top end of the humerus consists of the head, the neck, the greater and lesser tubercles, and the shaft. The head is half-spherical in shape and projects into the glenoid cavity. The neck lies between the head and the greater and lesser tubercles. The greater and lesser tubercles are prominent landmarks on the humerus and serve as attachment sites for the rotator cuff muscles





There are four joints making up the "shoulder joint"

1. the Glenohumeral joint, (is a ball and socket articulation between the head of the humerus and the glenoid cavity of the scapula)

2. The acromioclavicular (AC) joint (where the clavicle meets the acromion of the scapula)

3. The sternoclavicular (SC) joint (where the clavicle meets the chest bone sternum)

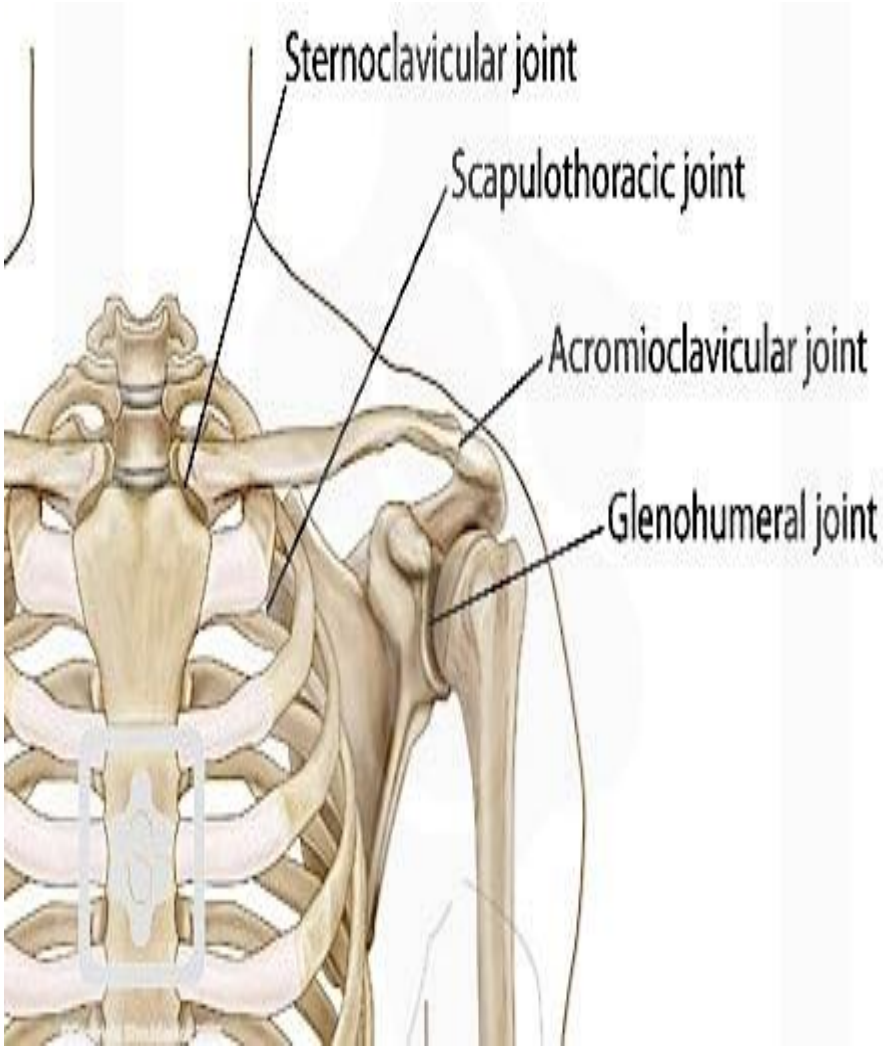
4. The scapulothoracic joint (where the scapula meets with the ribs at the back of the chest)

Blood Supply

The shoulder joint is supplied by the anterior and posterior circumflex humeral arteries – which are both branches of the axillary artery.

Innervation

Sensory innervation to the shoulder joint is from the axillary and suprascapular nerves.



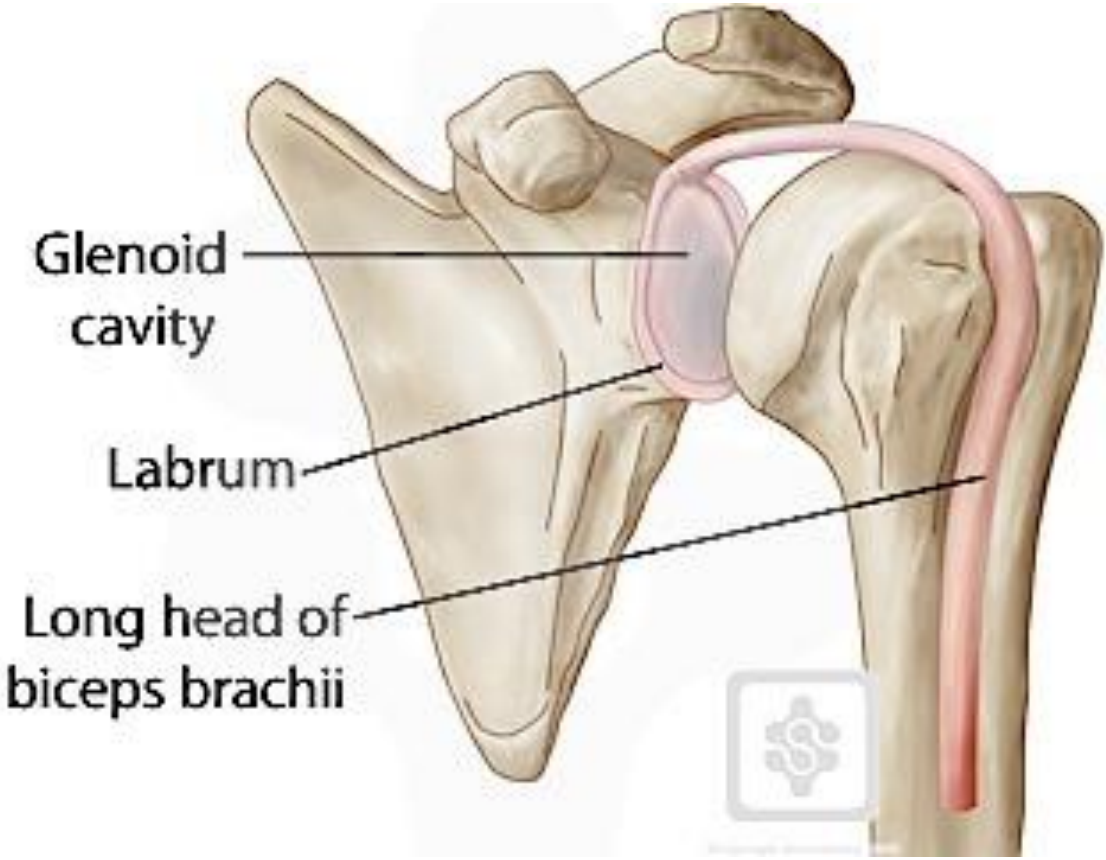
Stability

Rotator cuff muscles – surround the shoulder joint, attaching to the tuberosities of the humerus, whilst also fusing with the joint capsule. The resting tone of these muscles act to compress the humeral head into the glenoid cavity.

Glenoid labrum – a fibrocartilaginous ridge surrounding the glenoid cavity. It deepens the cavity and creates a seal with the head of humerus, reducing the risk of dislocation.

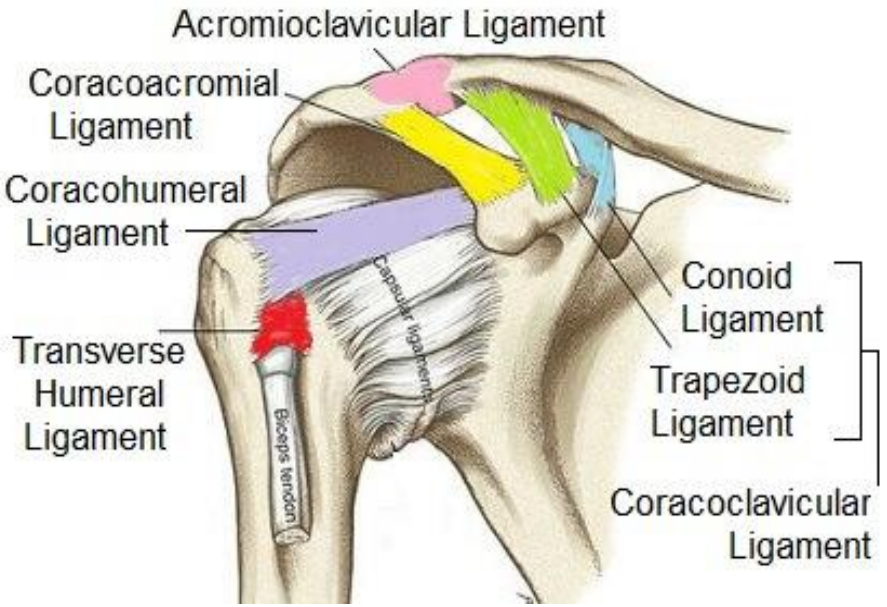
Ligaments – act to reinforce the joint capsule and form the coracoacromial arch.

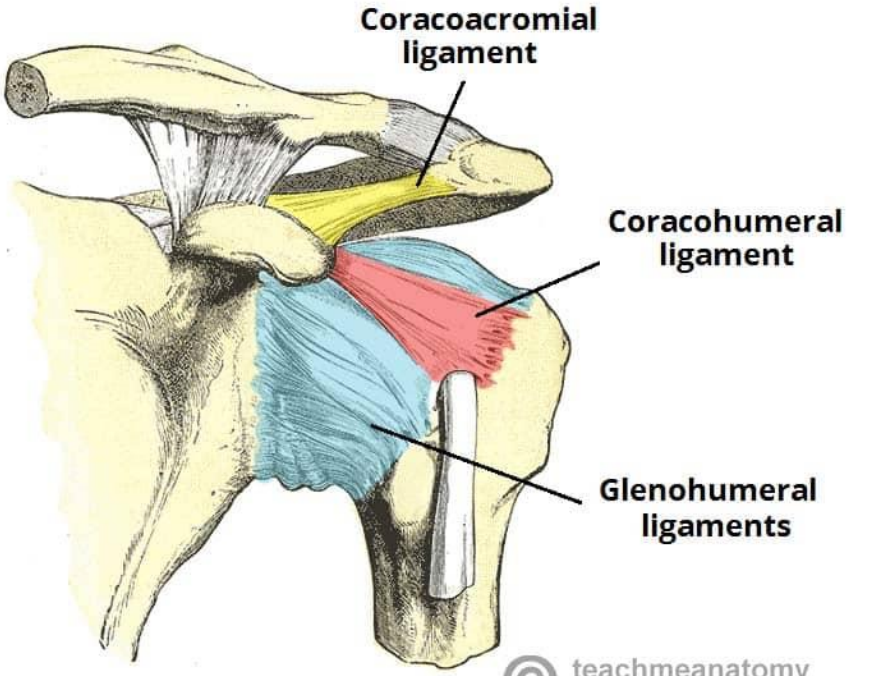
Biceps tendon – it acts as a minor humeral head depressor, thereby contributing to stability.



Ligaments

- a. **Glenohumeral ligaments** (superior, middle and inferior) – extend from the humerus to the glenoid fossa. They act to stabilise the anterior aspect of the joint.
- b. **Coracohumeral ligament** – extends from the base of the coracoid process to the greater tubercle of the humerus. It supports the superior part of the joint capsule.
- c. **Transverse humeral ligament** – extends between the two tubercles of the humerus. It holds the tendon of the long head of the biceps in the intertubercular groove.
- d. **Coracoacromial ligament** – extends between the acromion and coracoid process of the scapula, forming an arch-like structure over the shoulder joint (coracoacromial arch). This resists superior displacement of the humeral head.





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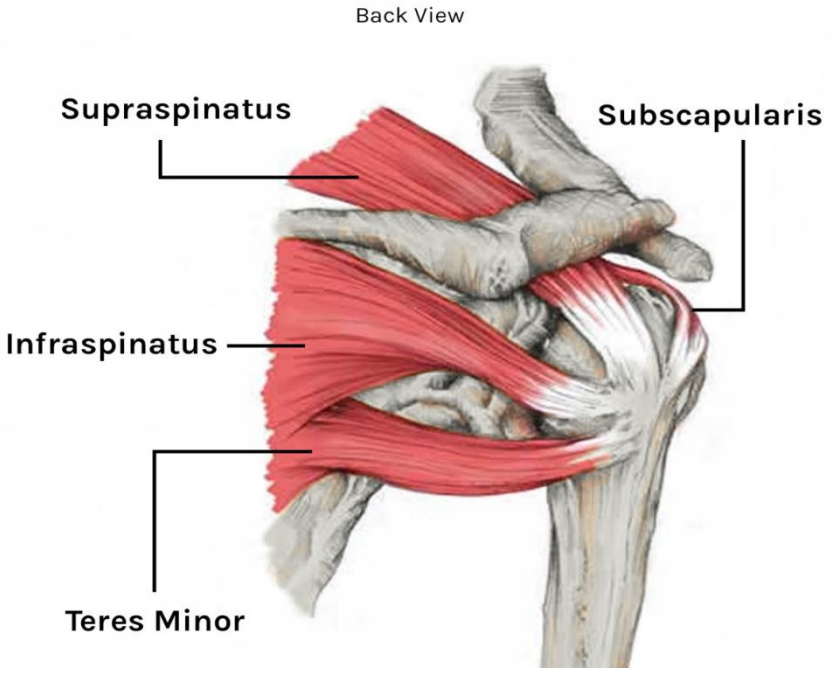
Rotator cuff muscles

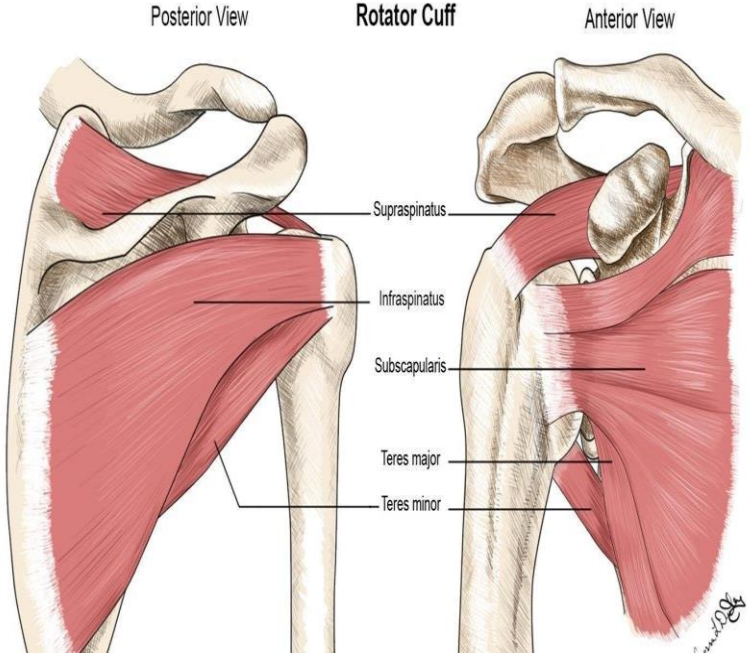
The subscapularis is a large triangular-shaped muscle that lies below the other three. It's the strongest, largest, and most used of the four rotator cuff muscles.
Origin: subscapular fossa of the scapula /Insertion: lesser tubercle of the humerus .
Action: internal rotation of arm .

The supraspinatus muscle is the only muscle of the rotator cuff that is not a rotator of the humerus .
Origin: supraspinous fossa of the scapula Passes above the glenohumeral joint Insertion: greater tuberosity of the humerus. Action: abduction of arm to 15° at glenohumeral joint.

The infraspinatus is a powerful lateral rotator of the humerus. Origin: infraspinous fossa of the scapula / Insertion: greater tuberosity of the humerus, immediately below the supraspinatus .
Action: external rotation of arm at glenohumeral joint .

The teres minor is a narrow and long muscle entirely covered by the deltoid, hardly differentiated from the infraspinatus. Origin: lateral border of the scapula
Insertion: greater tuberosity of the humerus, below the infraspinatus tendon.
Action :external rotation and adduction of arm .





superficial muscles of the shoulder

The trapezius muscle consists of three parts:

Origin and Insertion :

Descending (upper) part: originates from the superior nuchal line and external occipital protuberance and inserts onto the lateral third of the clavicle;

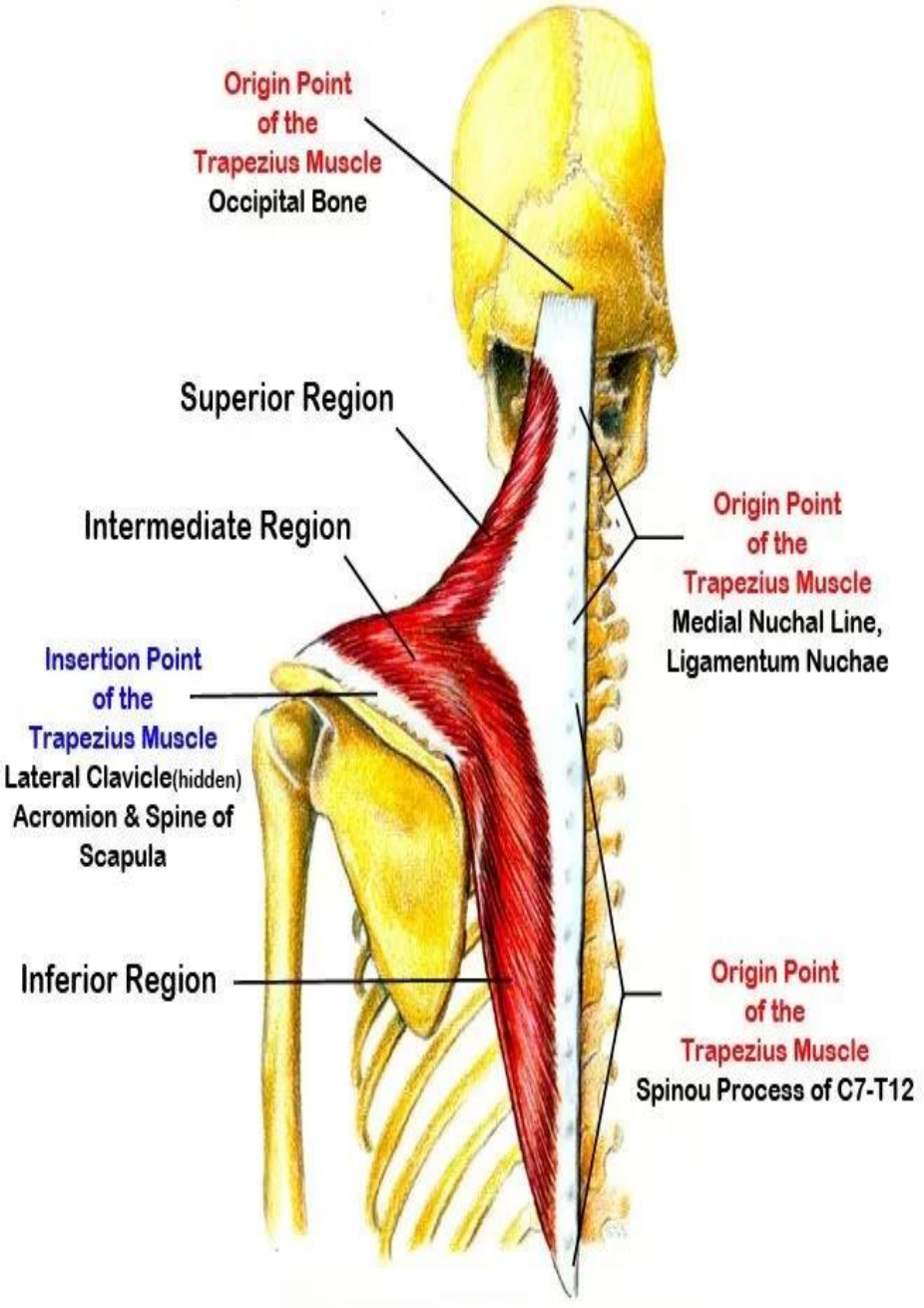
Transverse (middle) part: originates from the spinous processes of the thoracic vertebrae T1-T4 and inserts onto the acromion and spine of the scapula;

Ascending (lower) part: originates from the spinous processes of the thoracic vertebrae T4-T12 and inserts onto the medial part of the spine of the scapula.

ACTION : Abduction of the upper limb at the shoulder (by rotating the scapula). The upper fibers of trapezius also elevate the scapula, the middle fibres retract, and the lower fibers depress. Upward rotation of scapula (upper and middle)

Innervation the accessory nerve (CN XI) .

Blood supply Occipital artery (descending part), transverse cervical artery (transverse part), dorsal scapular artery (ascending part)



Deltoid muscle

The deltoid is a thick, triangular shoulder muscle. It gets its name because of its similar shape to the Greek letter ‘delta’ (Δ).

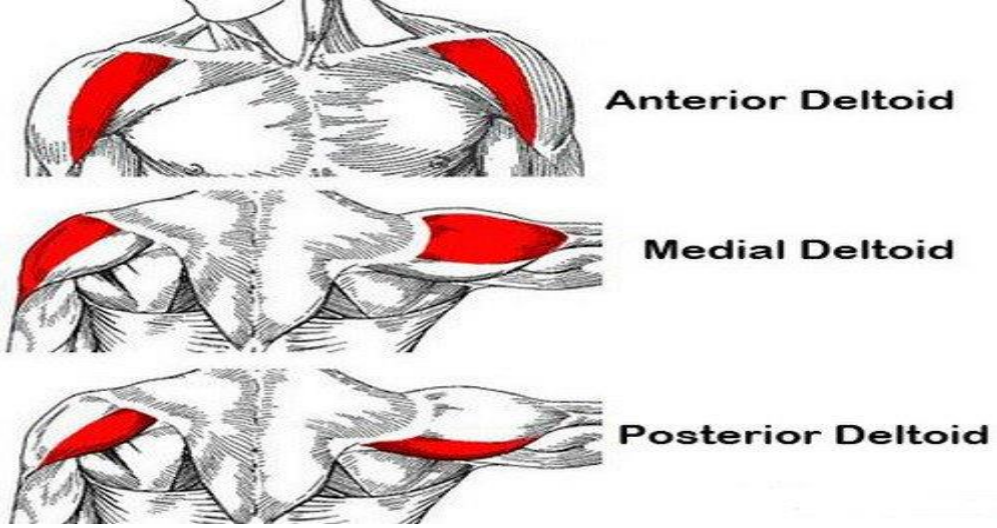
Origin : Lateral 1/3 of Clavicle (clavicular part), Acromion (acromial part), Spine of Scapula (spinal part) . (insertion of trapezius muscle)

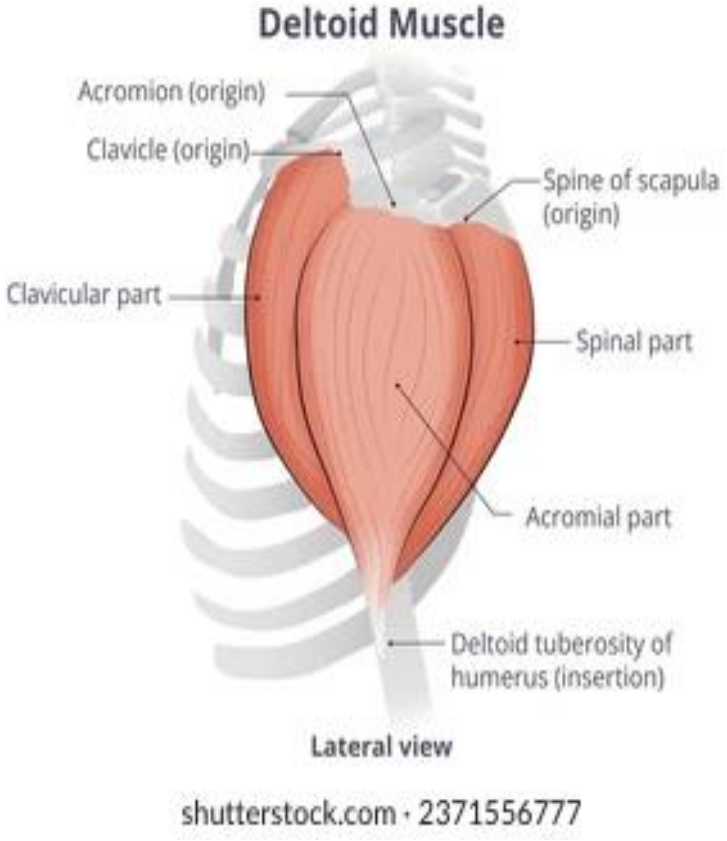
Insertion : Deltoid tuberosity of humerus .

Action : Clavicular part(anterior) : flexion and internal rotation of the arm
Acromial part(middle): abduction of the arm beyond the initial 15°
Spinal part(posterior): extension and external rotation of the arm.

Innervation : The deltoid muscle is innervated by one of the main branches of the brachial plexus, the axillary nerve.

Blood supply : The posterior circumflex humeral artery was the most important artery. It supplied the posterior and middle parts of the deltoid muscle. The anterior circumflex humeral artery supplied the anterior part .





Blood supply

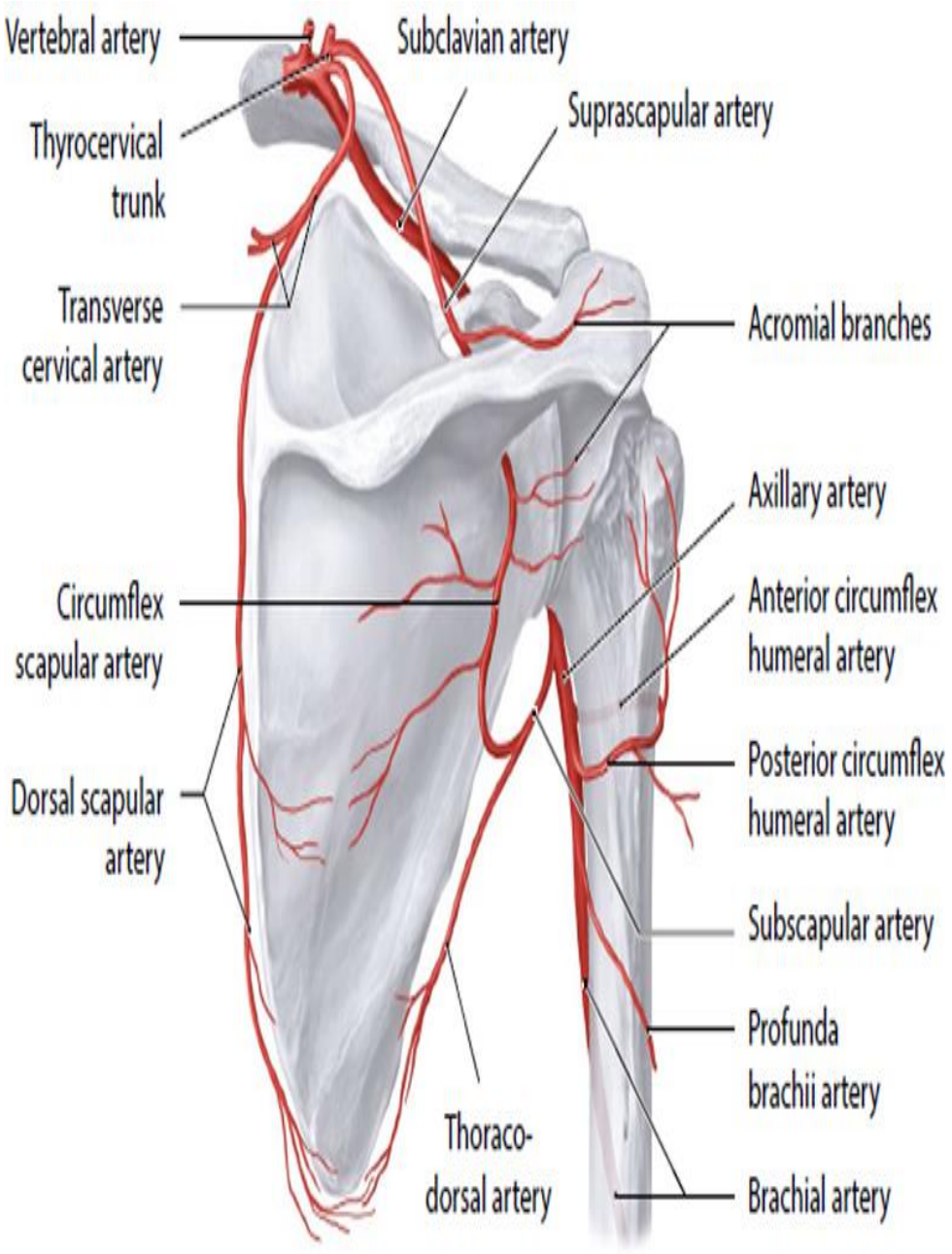
a) **Suprascapular artery-** a branch of the thyrocervical trunk, which in turn arises from the subclavian artery. It runs along the suprascapular nerve and mostly supplies the supraspinatus and infraspinatus muscles.

b) **Posterior circumflex humeral artery** - a branch of the axillary artery supplying the glenohumeral joint

c) **Circumflex scapular artery** - originating from the subscapular artery, which in turn is a branch of the axillary artery

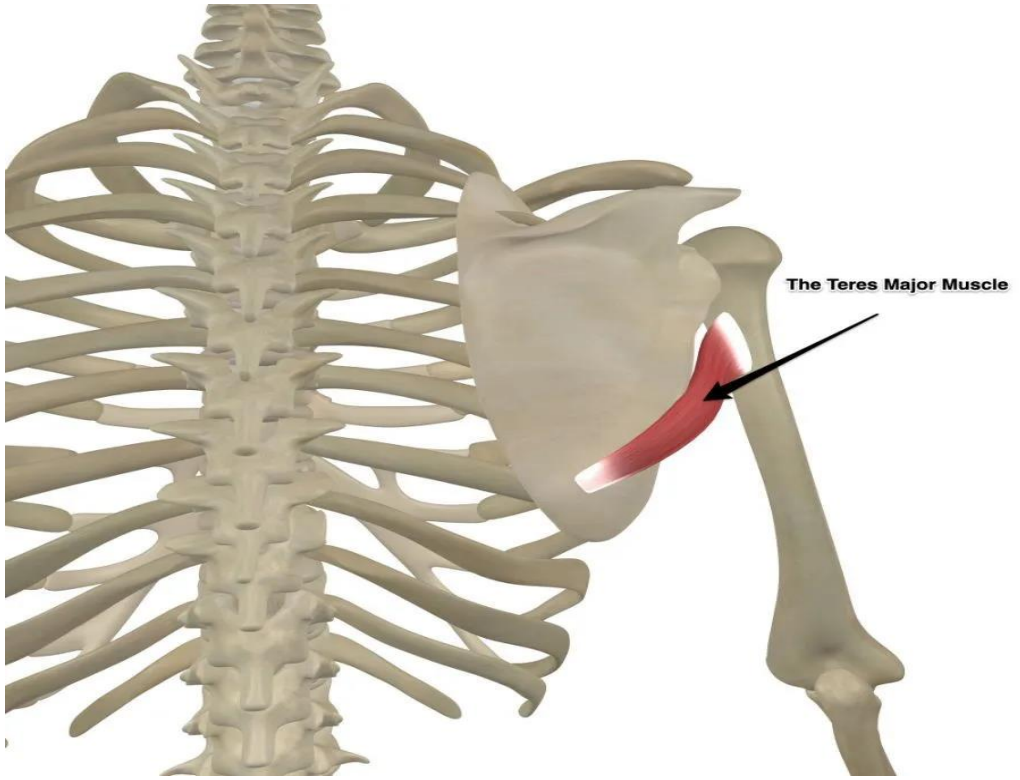
d) **Transverse cervical artery** - a branch of the thyrocervical trunk running along the medial border of the scapula .

e) **The dorsal scapular artery** (or descending scapular artery) is a blood vessel which supplies the levator scapulae, rhomboids, and trapezius. It most frequently arises from the subclavian artery



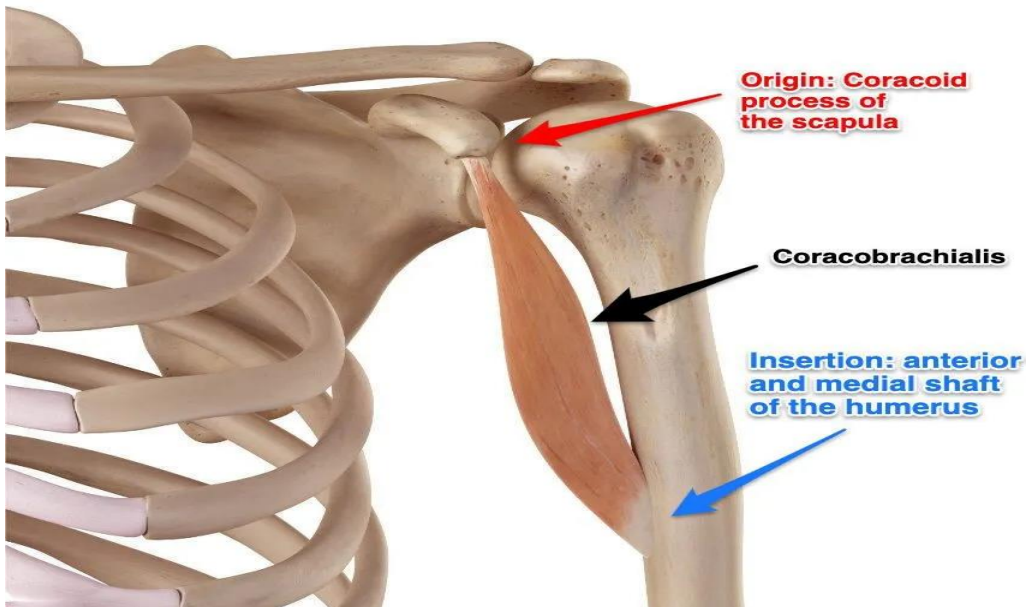
Teres major

Origin: Lower lateral border and inferior angle of the scapula
Insertion: the intertubercular groove of the humerus.
Action :Adducts the arm , Medially rotates the arm, Extends the arm
Innervation :Lower subscapular nerve branch of brachial plexus
Blood supply: supplied by the posterior circumflex humeral artery (branch of axillary artery)and the subscapular artery.



Coracobrachialis is one of the three muscles that comprise the anterior compartment of the arm(with brachialis and biceps muscles) .

Its action is mainly antagonist to the action of the deltoid muscle.
Origin: Coracoid process of scapula.
Insertion: Mid-medial surface of humerus.
Actions: Adduction and flexion of the arm .
Innervation :Musculocutaneous nerve branch from brachial plexus
Blood supply: Muscular branches of brachial artery



Latissimus dorsi : It is large, flat and triangular in shape originating from large parts of the lumbar region and lower thorax to insert on the humerus through a narrow tendon.

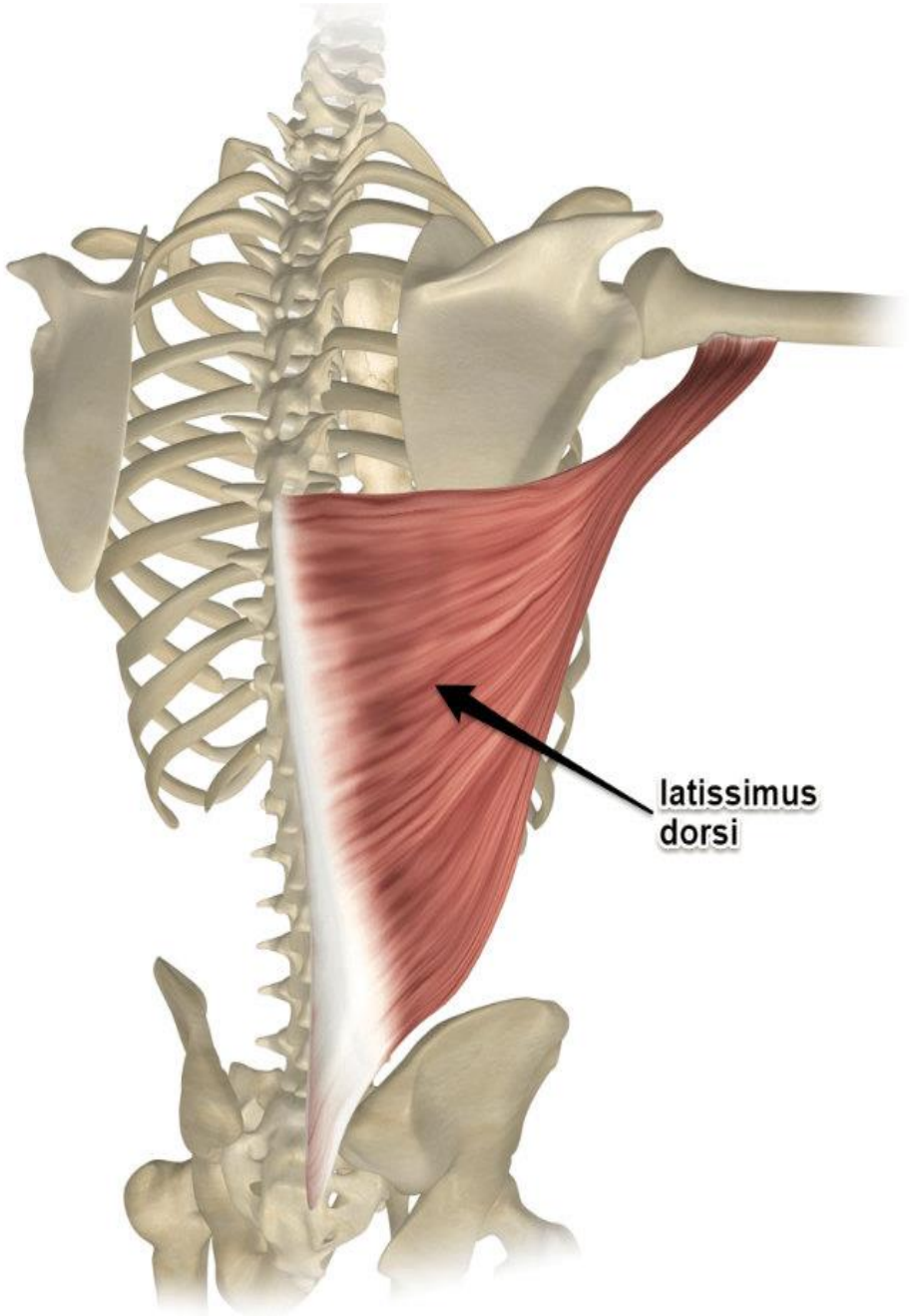
Origin: a. Spinous processes of T7 – L5 vertebrae. b. Iliac crest of sacrum. c. Thoracolumbar fascia d. Inferior angle of the scapula e. Lower three or four ribs.

Insertion: Floor of intertubercular groove of humerus.

Actions: Adducts the arm, Medially rotates the arm, Extends the arm

Innervation: Thoracodorsal nerve branch of brachial

Blood supply: supplied by the thoracodorsal artery, a continuation of the subscapular artery, which is a branch of the the axillary artery. plexus.



Biceps brachii is one of the main arm muscles which acts on both the shoulder joint and the elbow joint. It derives its name from the fact that it consists of two parts (heads).

Origin: a. Long head: supraglenoid tubercle of the scapula.

b. Short head: coracoid process of the scapula.

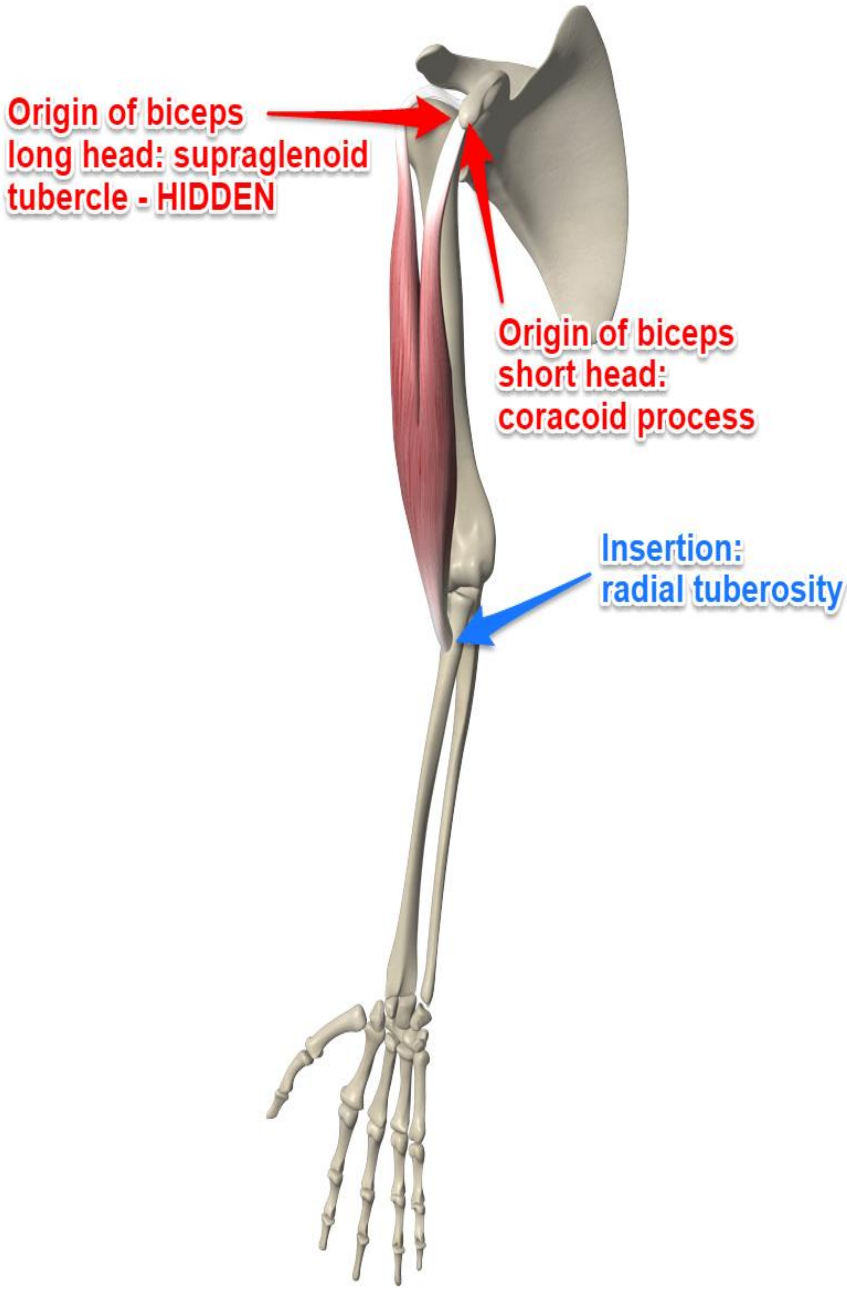
Insertion: a. Radial tuberosity.

b. Bicipital aponeurosis to the fascia on the medial side of the forearm.

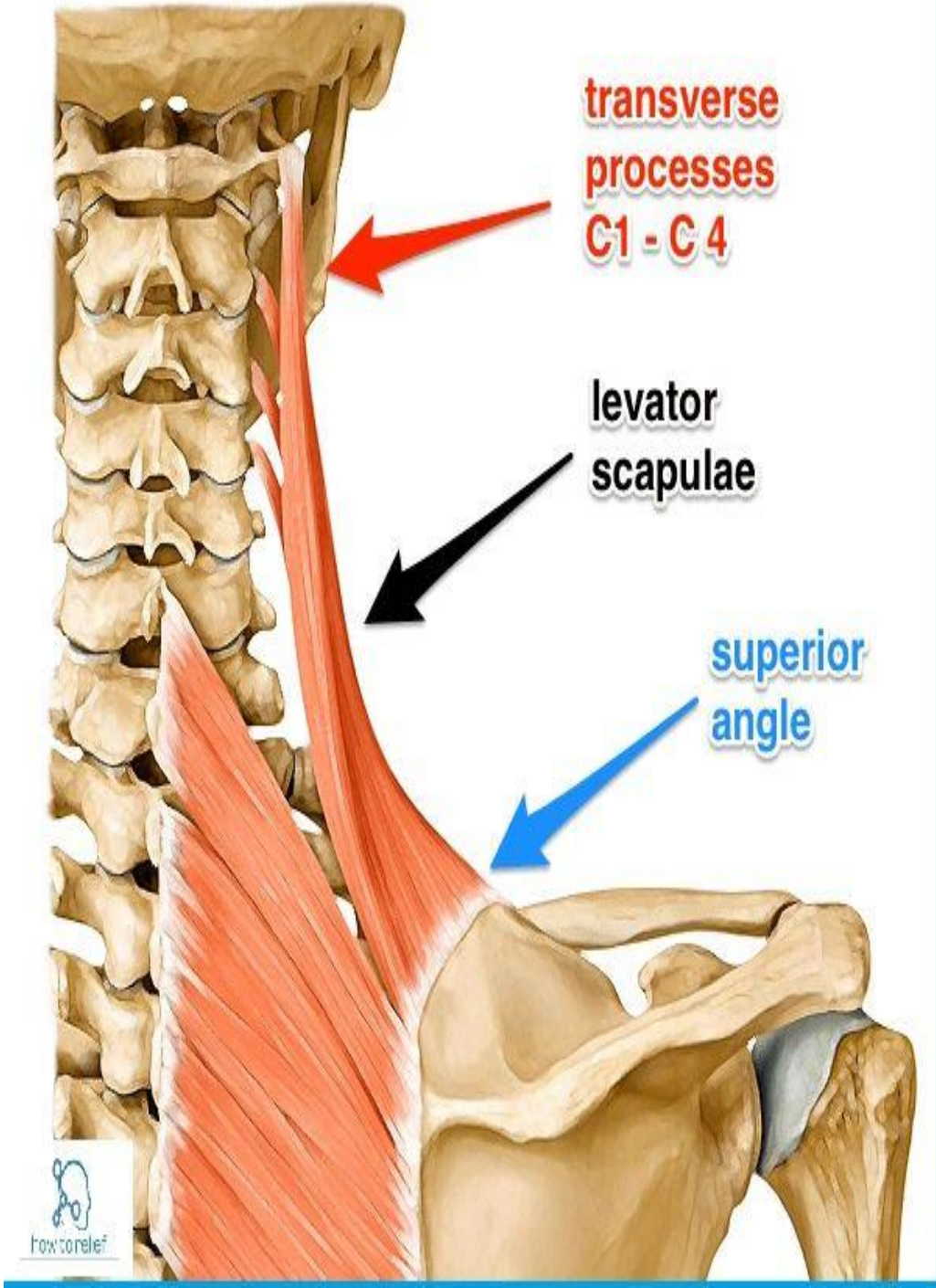
Actions : Flex the arm (weakly) . / flexion & supination the forearm / Flexeion forearm at elbow.

Innervation: Musculocutaneous nerve.

Blood supply: The blood supply of the biceps is the brachial artery .

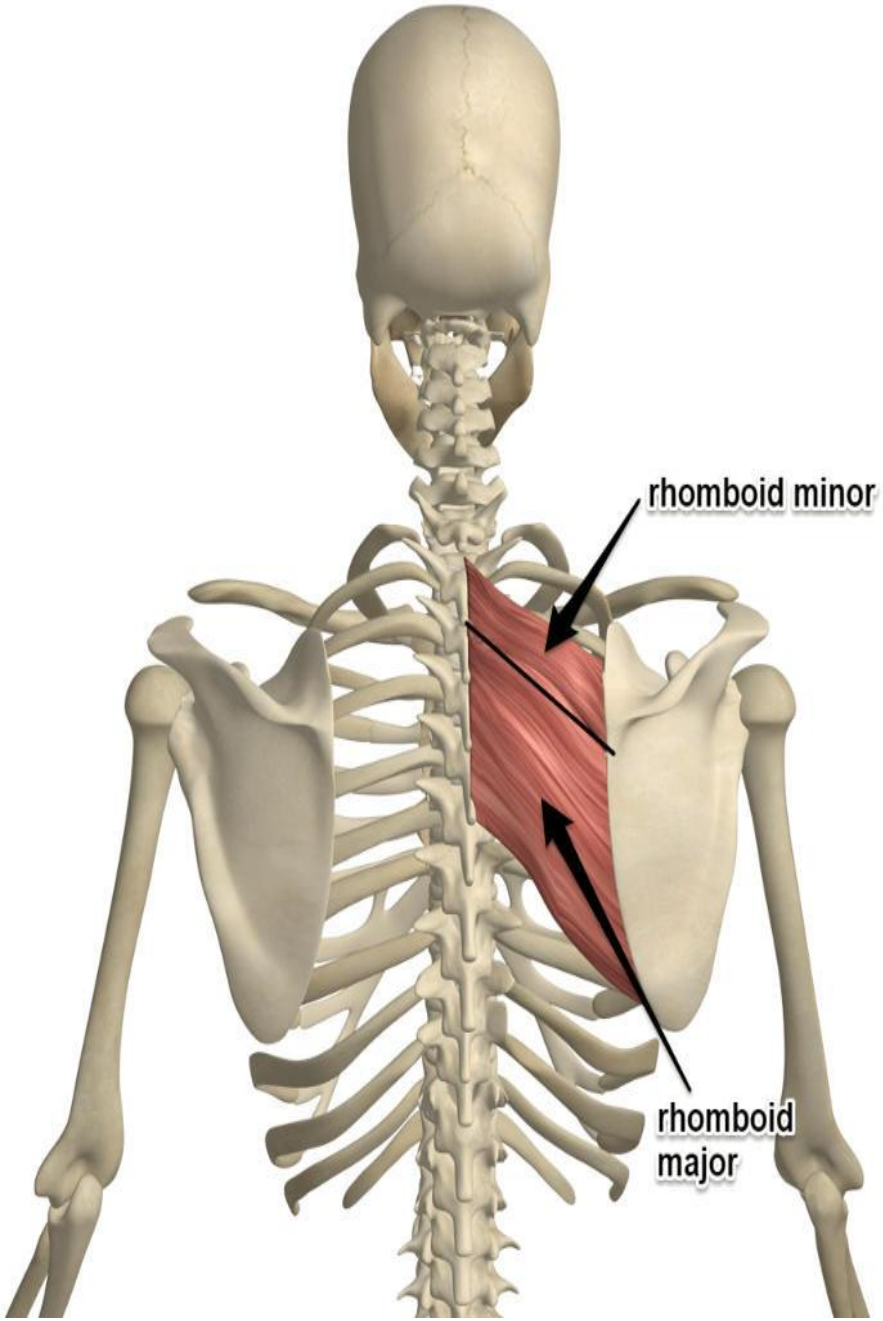


levator scapulae is a shoulder muscle on the side of the neck and upper back.
Origin: Transverse processes of the C1-C4 vertebrae.
Insertion: superior angle of scapula
Actions : elevation medial border of the scapula while downwardly rotating lateral angle. pull scapula upward and medially / Bends neck laterally.
Innervation: Dorsal scapular nerve and anterior rami of spinal nerve .
Blood supply : dorsal scapular artery.

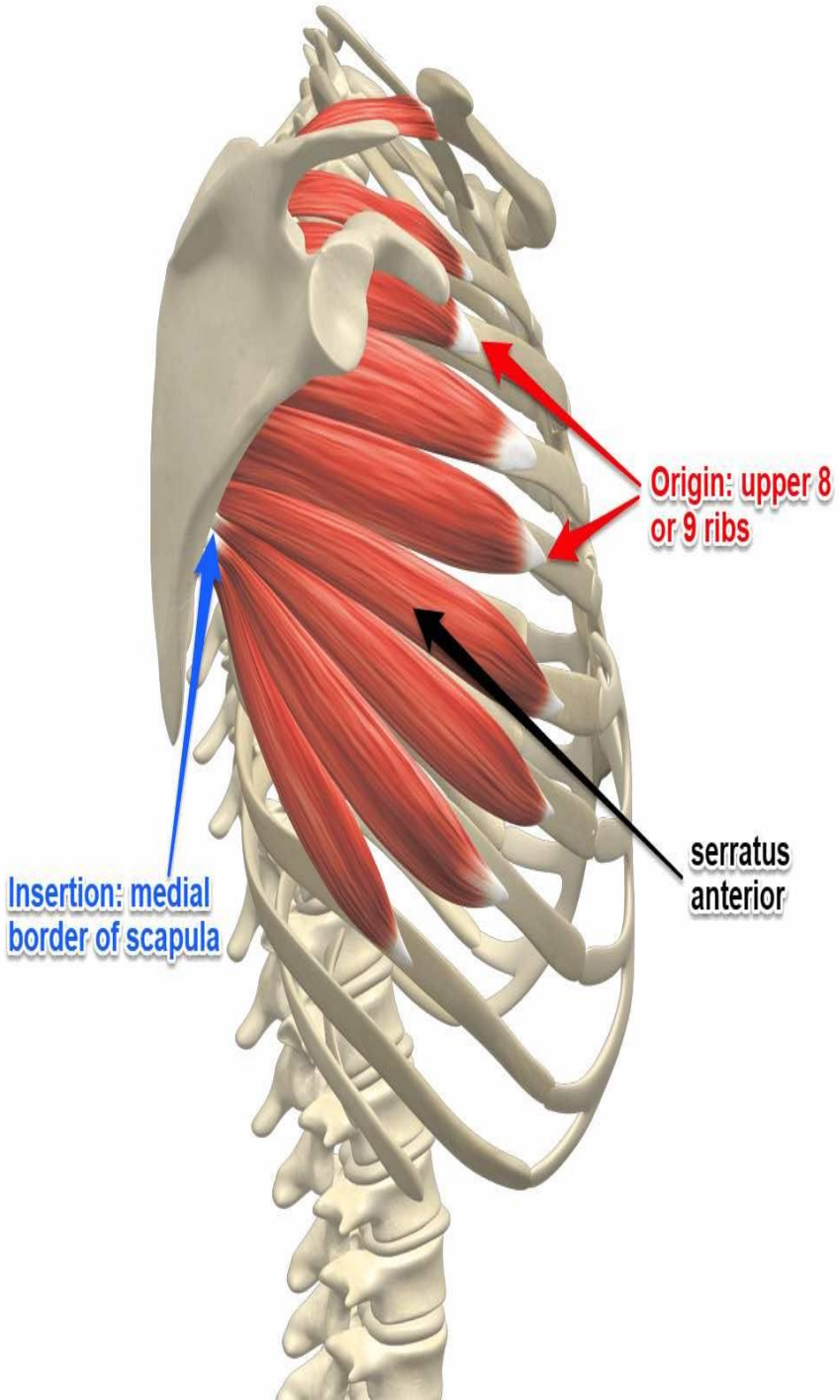


Rhomboid Minor : Originates from the spinous processes of C7-T1 vertebrae. Attaches to the medial border of the scapula superior to spin of scapula .
Actions: Retracts and rotates the scapula.
Innervation: Dorsal scapular nerve.
Blood Supply: Dorsal scapular artery

The rhomboid major is a shoulder muscle that helps move and stabilize the scapula during movements.
Origin: Spinous process of T2-T5 vertabrae.
Insertion: Medial border of scapula inferior to spin of scapula. Actions: Retracts and rotates the scapula.
Innervation: Dorsal scapular nerve.
Blood Supply: Dorsal scapular artery

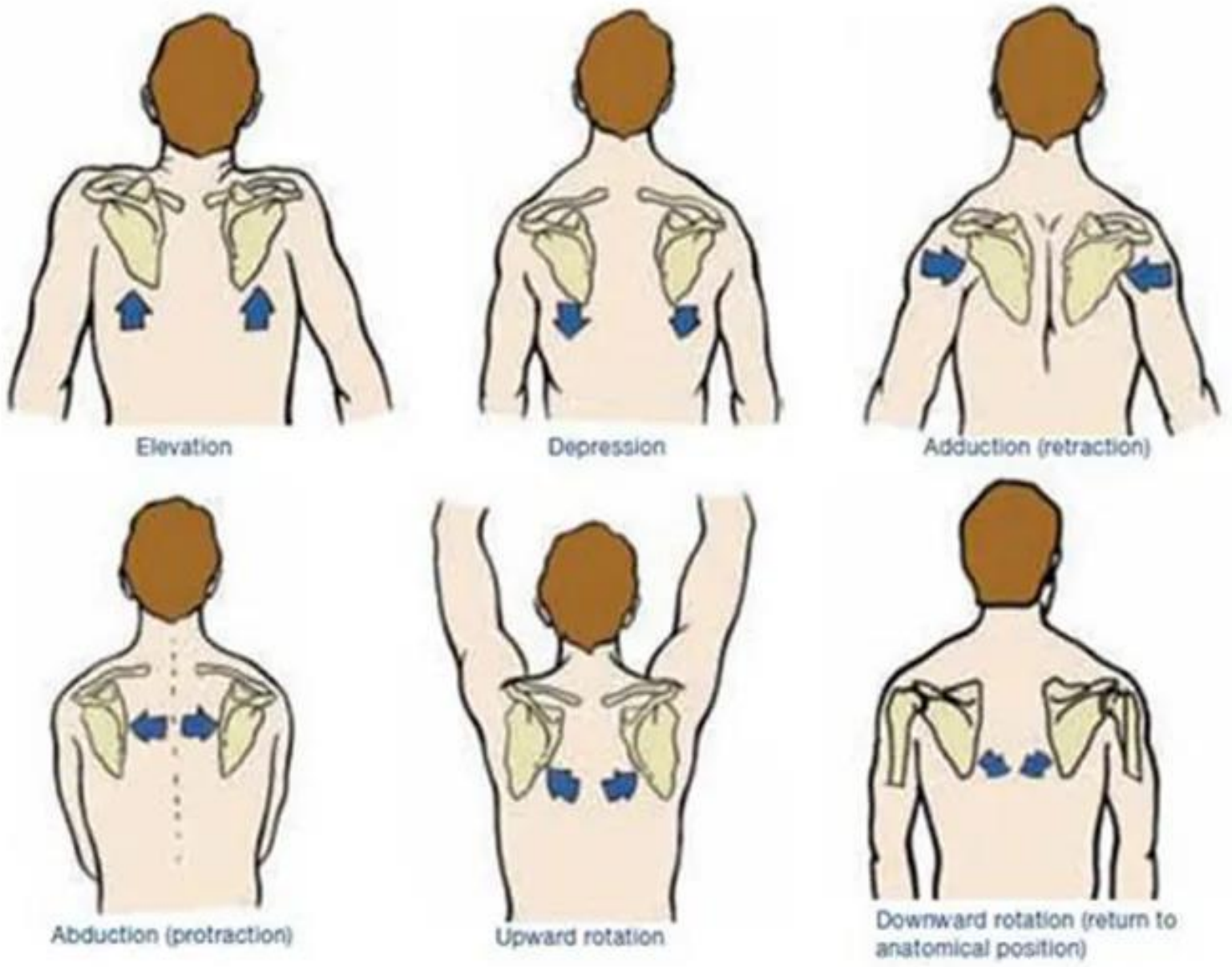


The serratus anterior muscle is a fan-shaped muscle at the lateral wall of the thorax.
Origin: Anterior surfaces of the first 8 or 9 ribs.
Insertion: Anterior surface of medial border of scapula.
Action: abduct (protracts) scapula / rotates scapula upward while abducting the arm.
Innervation: Long thoracic nerve.
Blood supply: Thoracodorsal artery, superior thoracic artery, lateral thoracic artery.



Scapula movements

Figure 3-34
Scapular movements

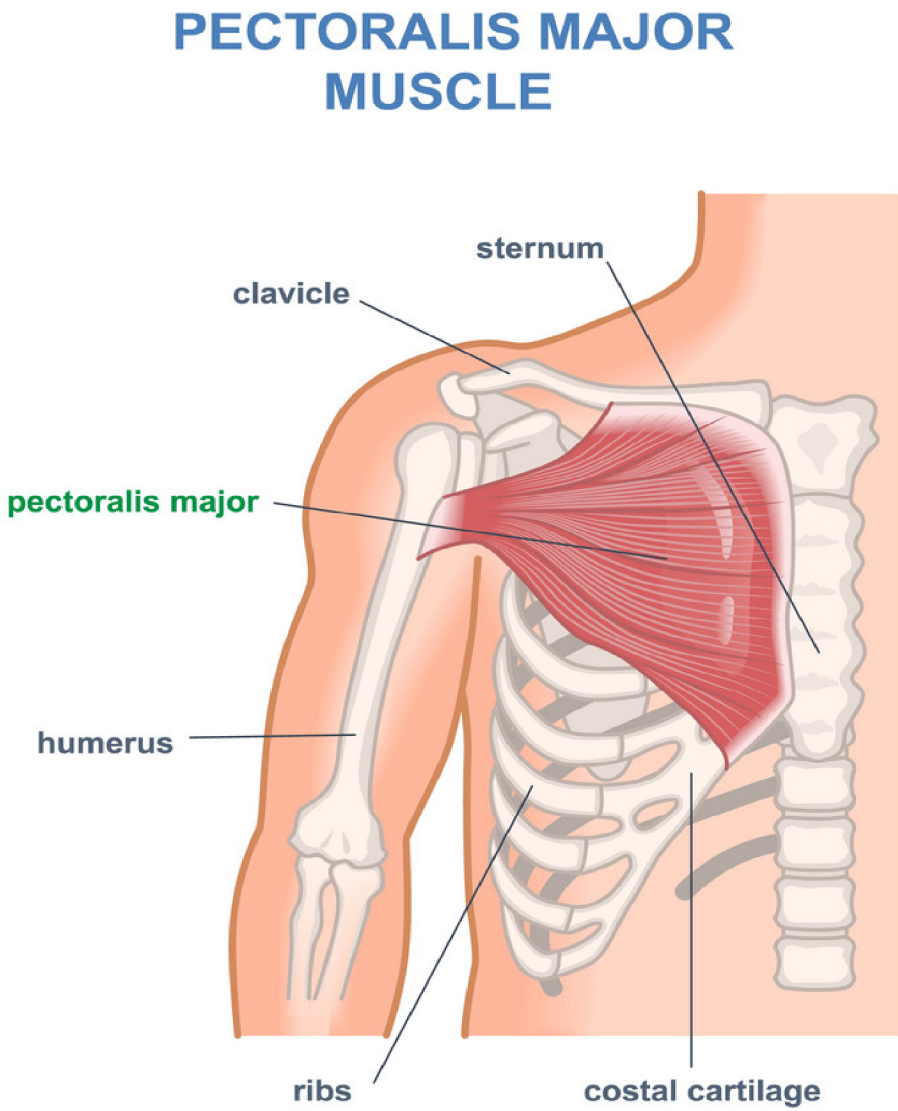


• Pectoral region

The pectoral region is located on the anterior chest wall. It contains four muscles that exert a force on the upper limb: the pectoralis major, pectoralis minor, serratus anterior and subclavius .

Pectoralis Major

Origin
Clavicular head: FromMedial ½ of the front of the clavicle.
Sternocostal head: From Sternum / Upper 6 costal cartilages / Aponeurosis of the external oblique muscle.
Insertion Lateral lip of bicipital groove (humerus)
Action Adduction and medial rotation of the arm. Only the clavicular head helps in flexion of arm.
Nerve Supply medial & lateral pectoral nerves.
Blood supply Pectoral branch of

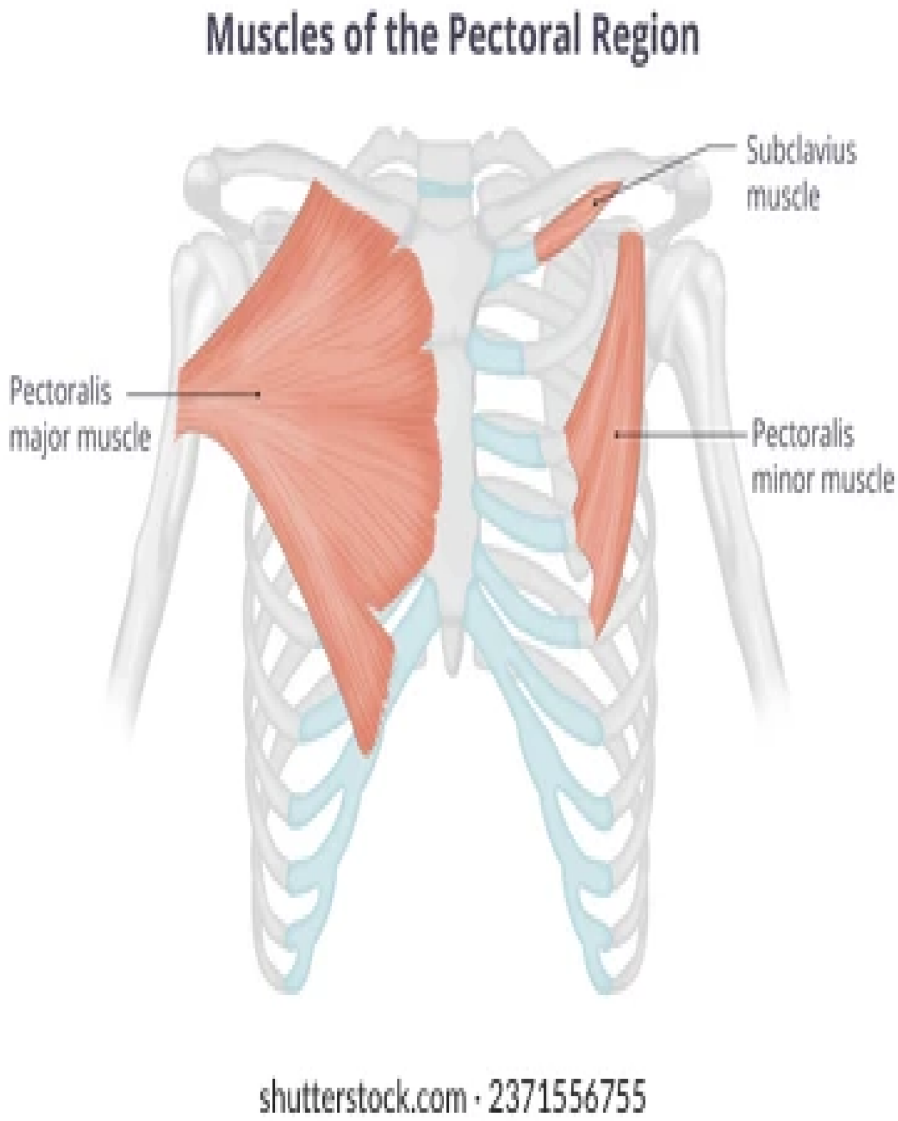


Pectoralis Minor

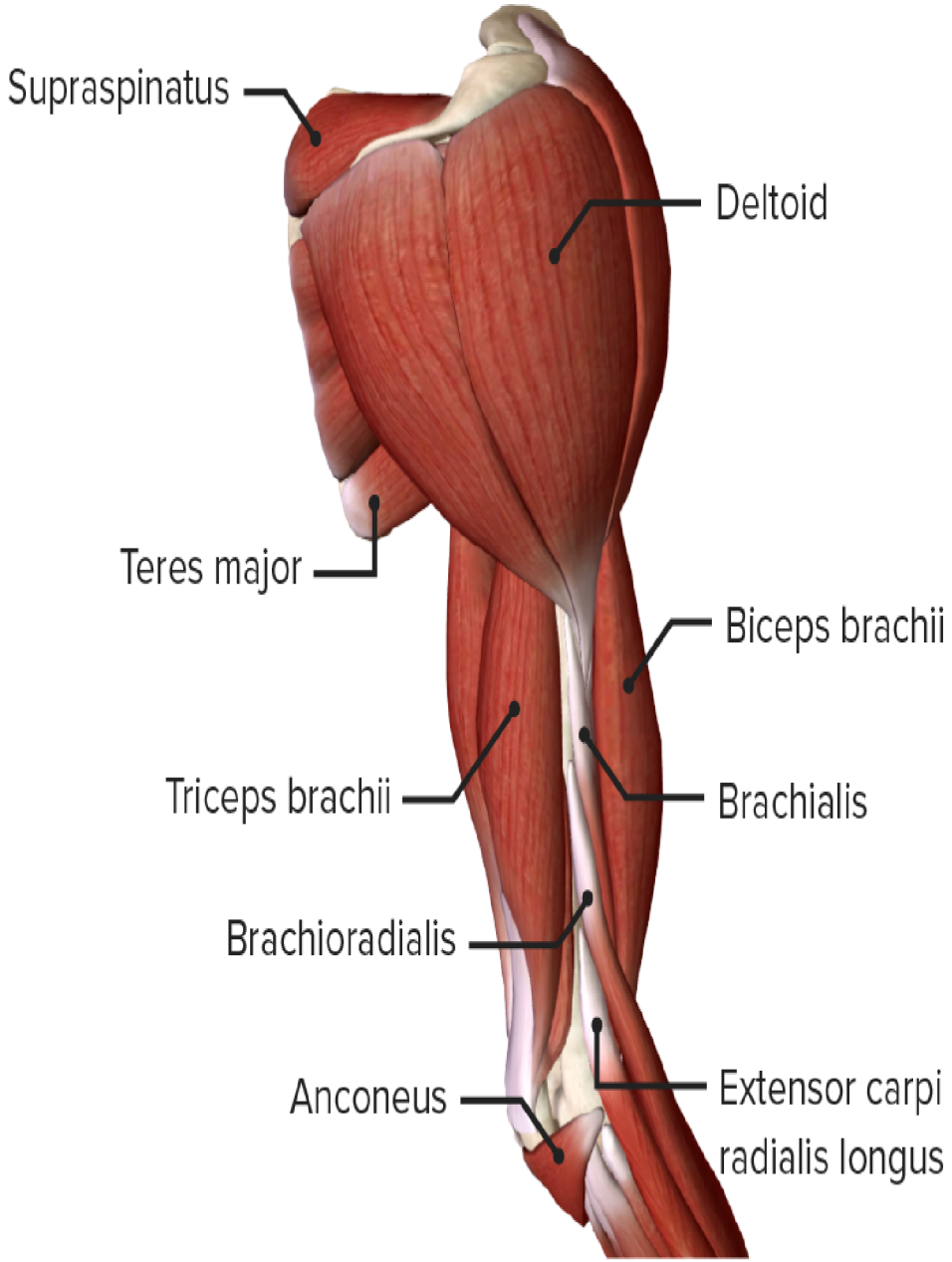
Origin From 3rd ,4th, & 5th ribs close to their costal cartilages.
Insertion Coracoid process (scapula)
Nerve Supply Medial pectoral nerve.
Action Depression of the shoulder .
Blood supply Pectoral branch of thoracoacromia artery.

Subclavius

Origin From 1st rib at its junction with the 1st costal cartilage
Insertion Subclavian groove in the middle 1/3 of the inferior surface of clavicle.
Nerve Supply Nerve to subclavius from upper trunk of brachial plexus
Action Fixes the clavicle during movement of shoulder joint, depression of shoulder
Blood supply Clavicular branch of thoracoacromial artery.

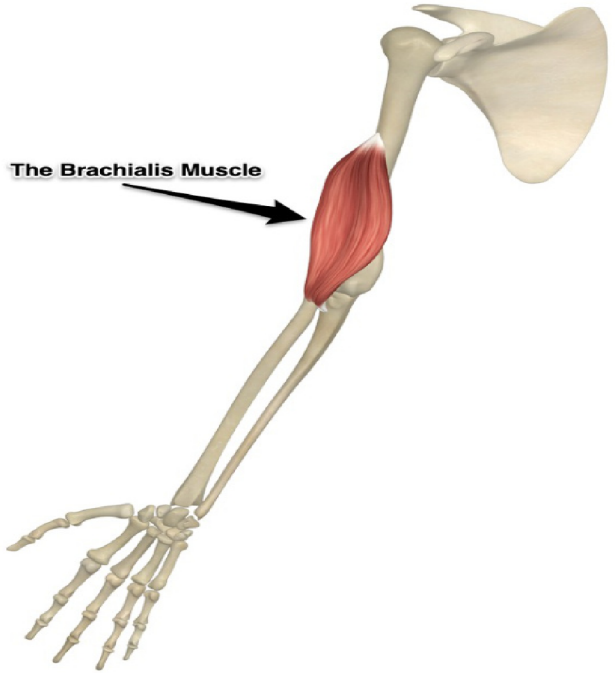


- **The Arm muscles**
  are a group of five muscles located in the region between the shoulder and elbow joints. They are divided into two distinct compartments,The anterior (flexor) compartment contains the biceps brachii, coracobrachialis and brachialis muscles. The posterior (extensor) compartment contains only the triceps brachii muscle .



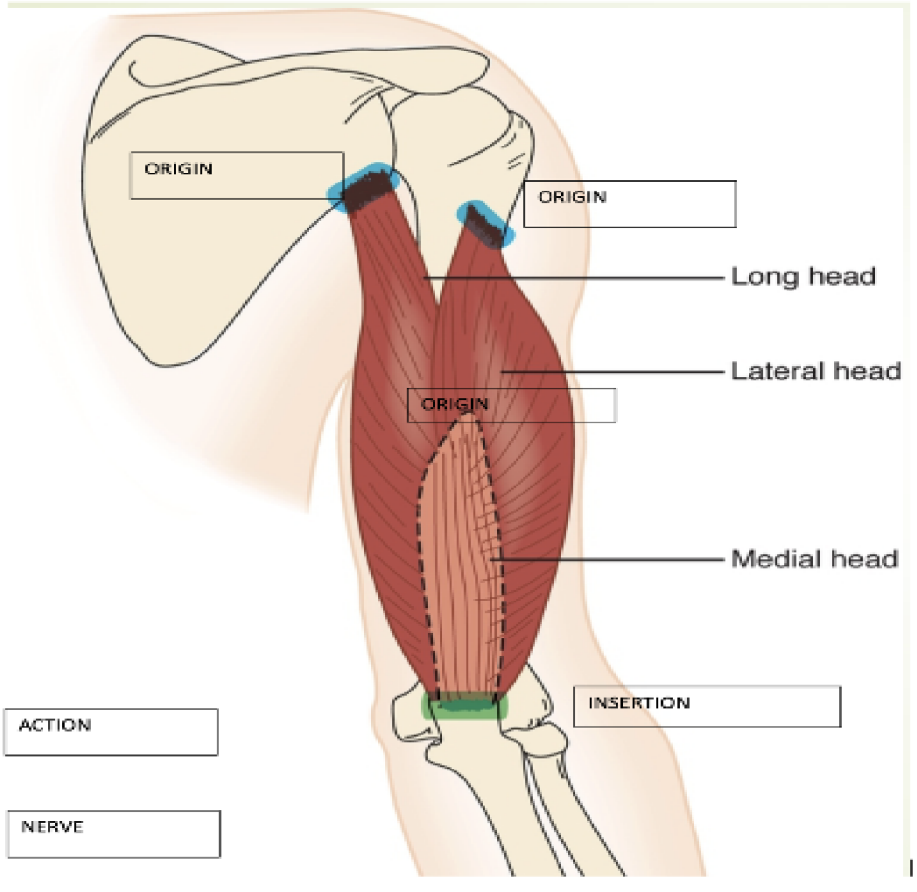
- Brachialis muscle

origin from the distal half of the anterior surface of the humerus
insertion the tuberosity of ulna.
innervation from the musculocutaneous and radial nerves .
blood supply from the brachial artery and radial recurrent arteries.
Action Brachialis is the main flexor of the forearm .



- Triceps brachii

origin The long head arises from the infraglenoid tubercle of scapula while the medial and posterior head from the posterior surface of the humerus
insertion the olecranon of ulna .
innervation by the radial nerve .
blood supply from the deep brachial artery and superior ulnar collateral arteries
Action extension of the forearm Additionally, due to its attachment on the scapula, it can also act as a weak extensor and adductor of the arm .



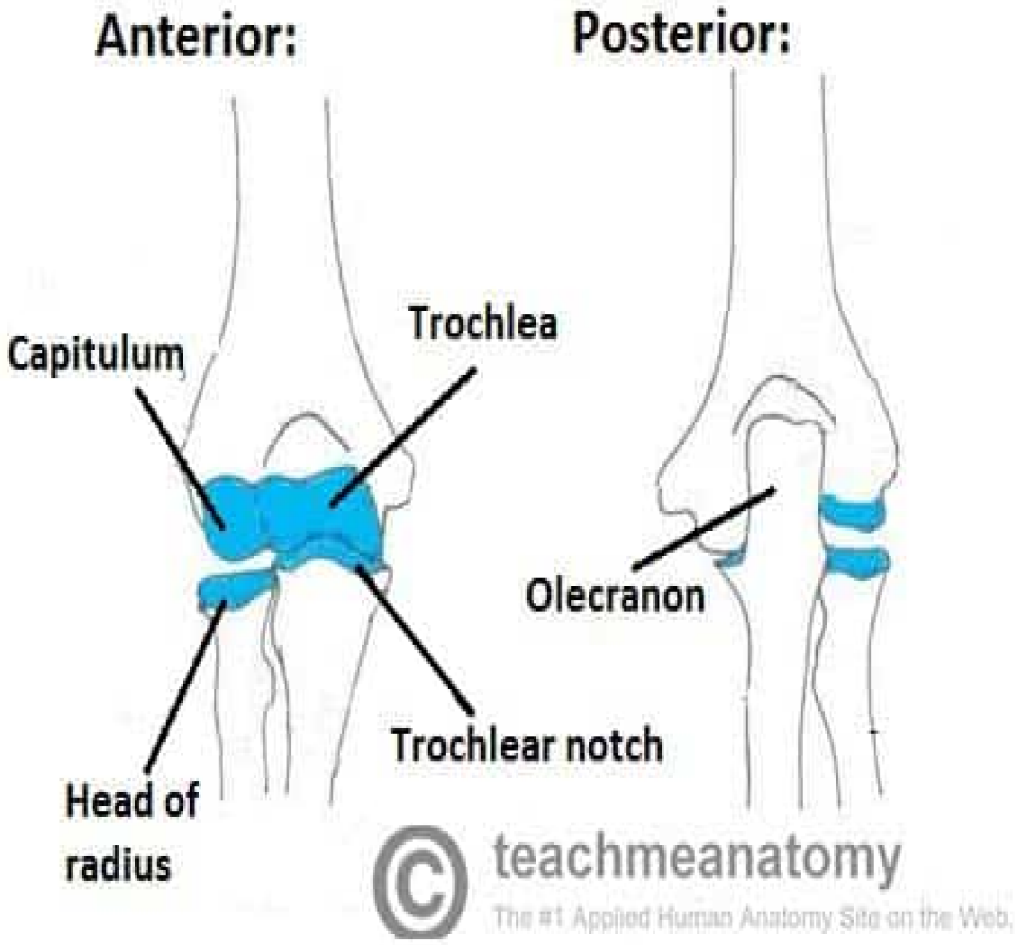
The elbow joint

the joint connecting the upper arm to the forearm. There are three bones that comprise the elbow joint: the humerus, the radius ,the ulna.These bones give rise to twojoints:

Humeroulnar joint is the joint between the trochlea on the medial aspect of the distal end of the humerus and the trochlear notch on the proximal ulna.
Humeroradial joint is the joint between the capitulum on the lateral aspect of thedistal end of the humerus with the head of the radius.

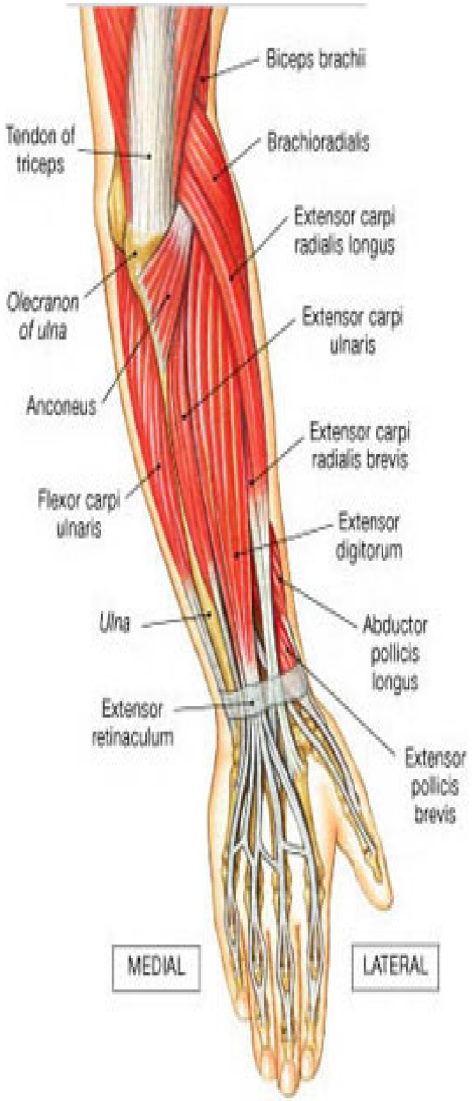
Movements

Extension – triceps brachii .
Flexion – brachialis, biceps brachii, brachioradialis
Note – pronation and supination do not occur at the elbow – they are produced at the nearby radioulnar joints.
supination -- Supinator and Biceps brachii .
Pronation -- Pronator teres, Pronator quadratus and Brachioradialis muscle .



The Forearm

Extending from the wrist to the elbow joint is the region of the upper extremity called the forearm (antebrachium). The forearm consists of two long bones; the radius and the ulna. These forearm bones articulate with each other in two locations The head of the radius forms a joint with the radial notch of the ulna proximally (proximal radioulnar joint), while the heac of the ulna forms a joint with th ulnar notch of the radius distall (distal radioulnar joint .



(d) Posterior view, superficial

Sports Medicine

Understanding the

Forearm

the Radioulnar Joint

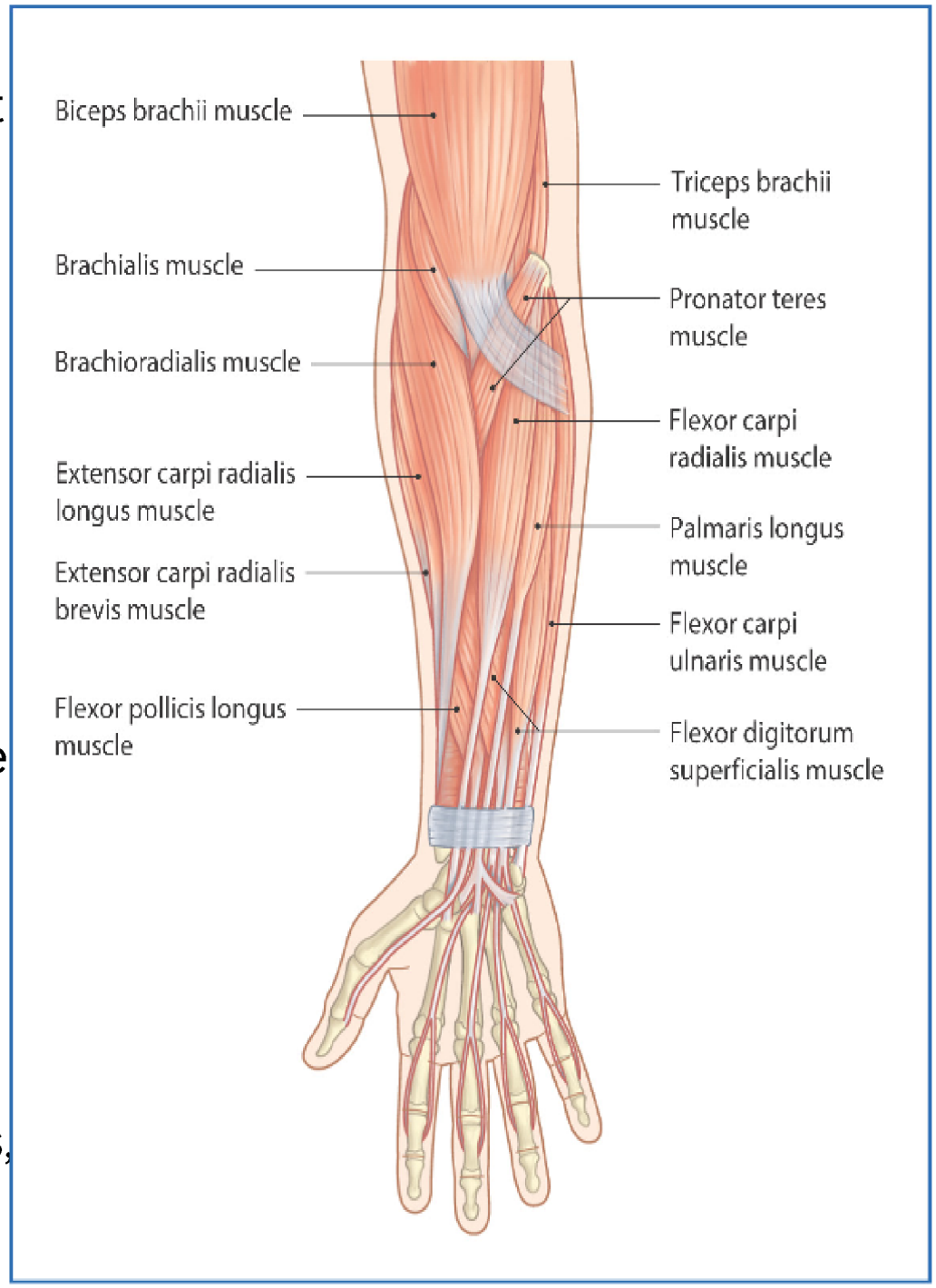
The anterior compartment of the forearm

The muscles in the anterior compartment of the forearm are organised into three layers :

Superficial: flexor carpi ulnaris, palmaris longus, flexor carpi radialis, pronator teres **Intermediate**: flexor digitorum superficialis.

Deep: flexor pollicis longus, flexor digitorum profundus and pronator quadratus. **Action** This muscle group is associated with pronation of the forearm, flexion of the wrist and flexion of the fingers.

Blood supply and innervation They are mostly innervated by the median nerve (except for the flexor carpi ulnaris and medial half of flexor digitorum profundus, which are **innervated** by the ulnar nerve), and they receive arterial supply from the



The posterior compartment of the forearm

The muscles in this compartment are organised into two layers; deep and superficial. These two layers are separated by a layer of fascia and are commonly known as the extensor muscles .

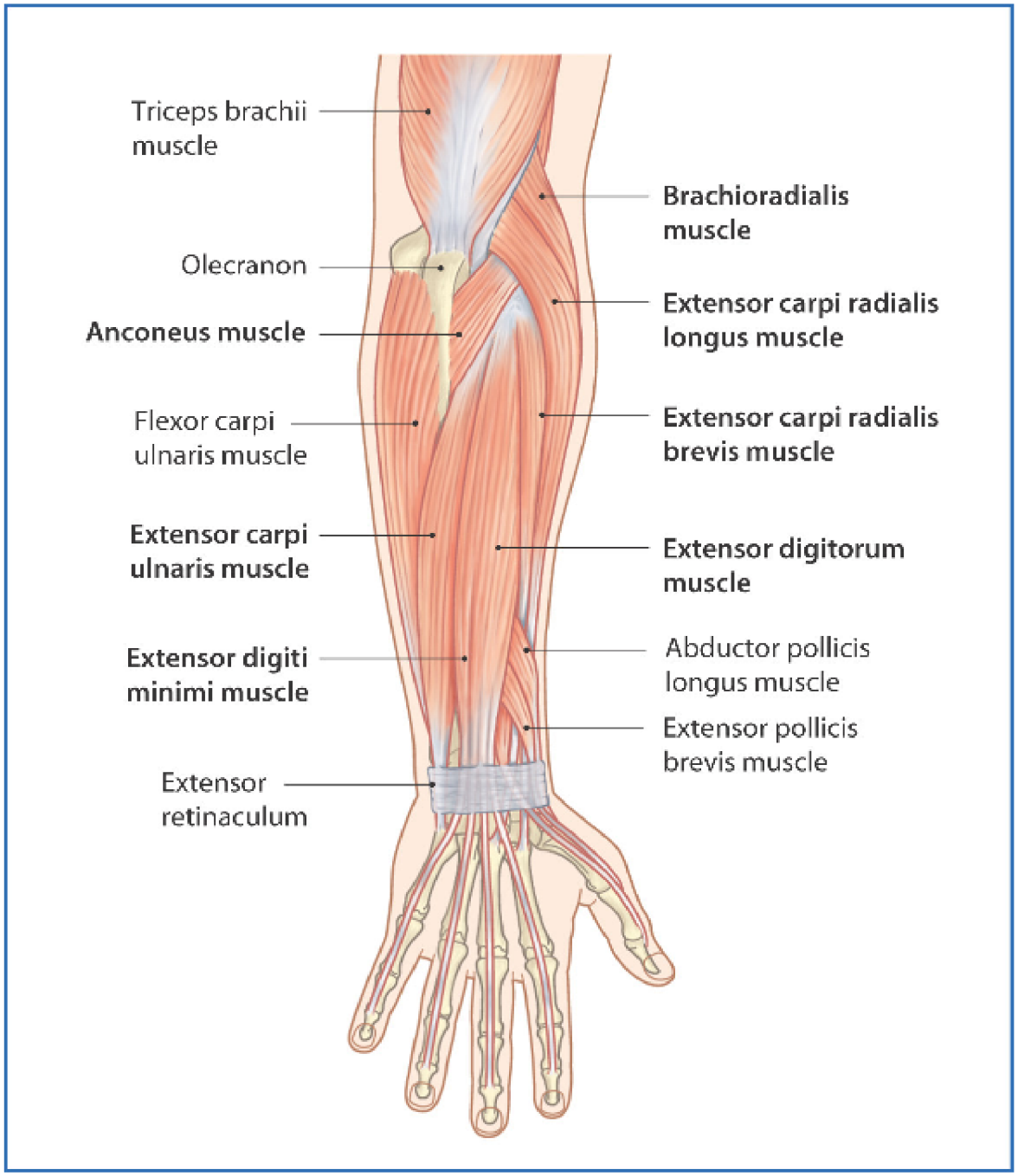
Superficial (brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris, and the anconeus)

Deep (supinator, abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, and extensor indicis)

Action The general function of these muscles is to produce extension at the wrist and fingers.

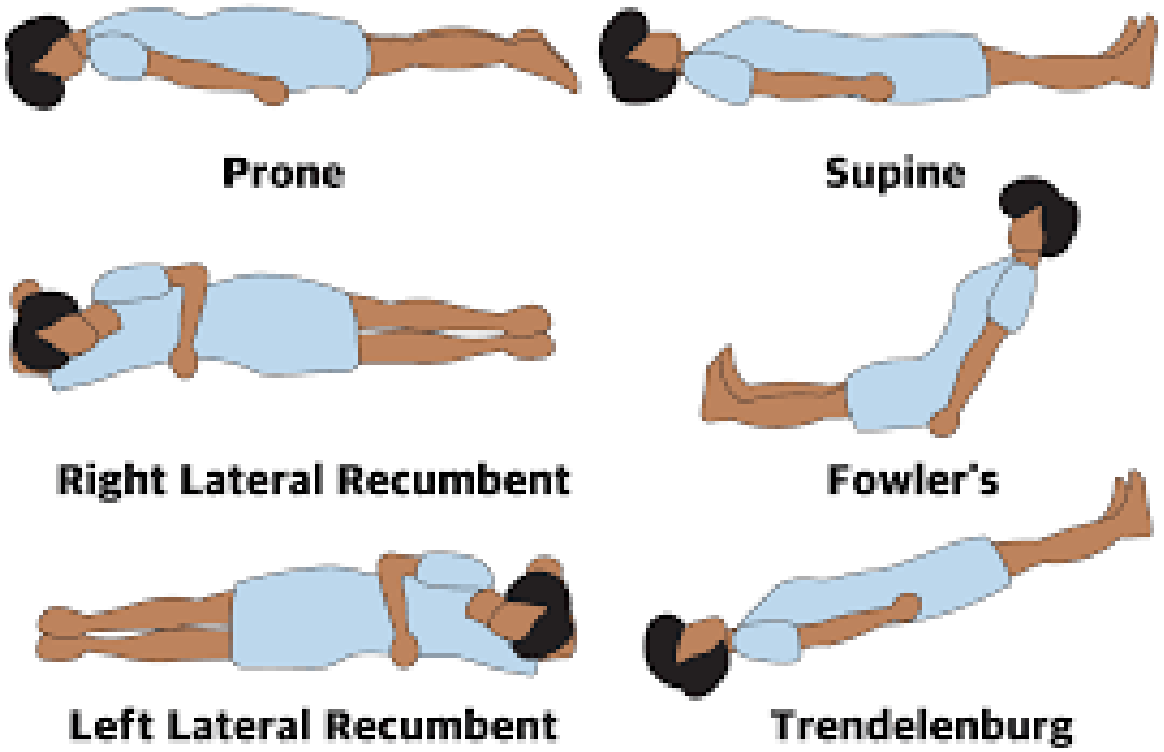
Innervation They are all innervated by the radial nerve.

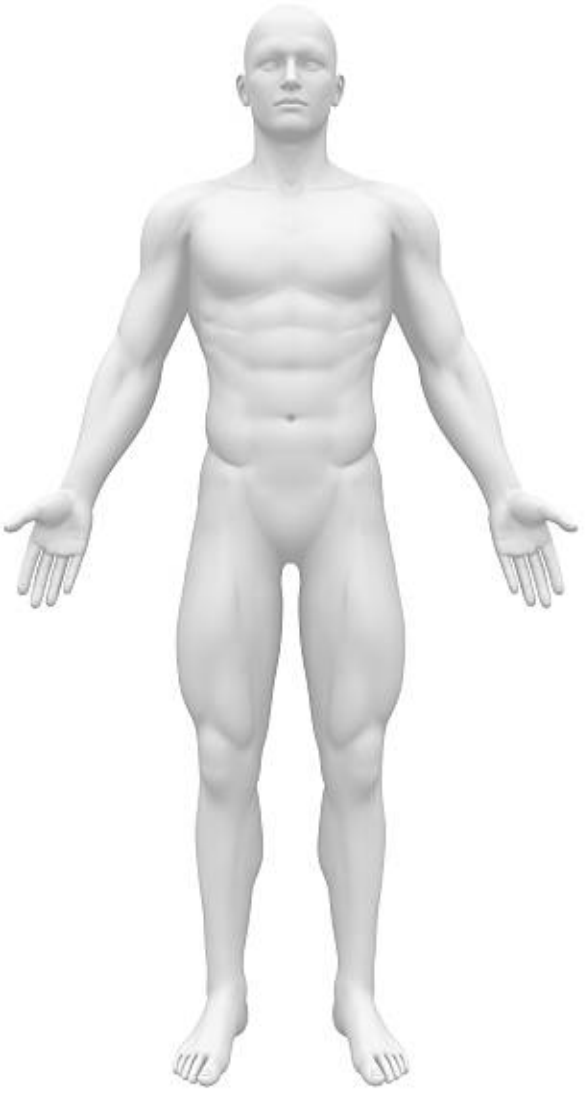
Blood supply they receive arterial supply from the ulnar artery and radial artery.



ANATOMICAL POSITIONS

the body is erect and the face forward. The feet are together, flat on the floor and the toes pointing forward. The arms are down at the sides with the palms turned forward with the thumb side of the hand away from the body.

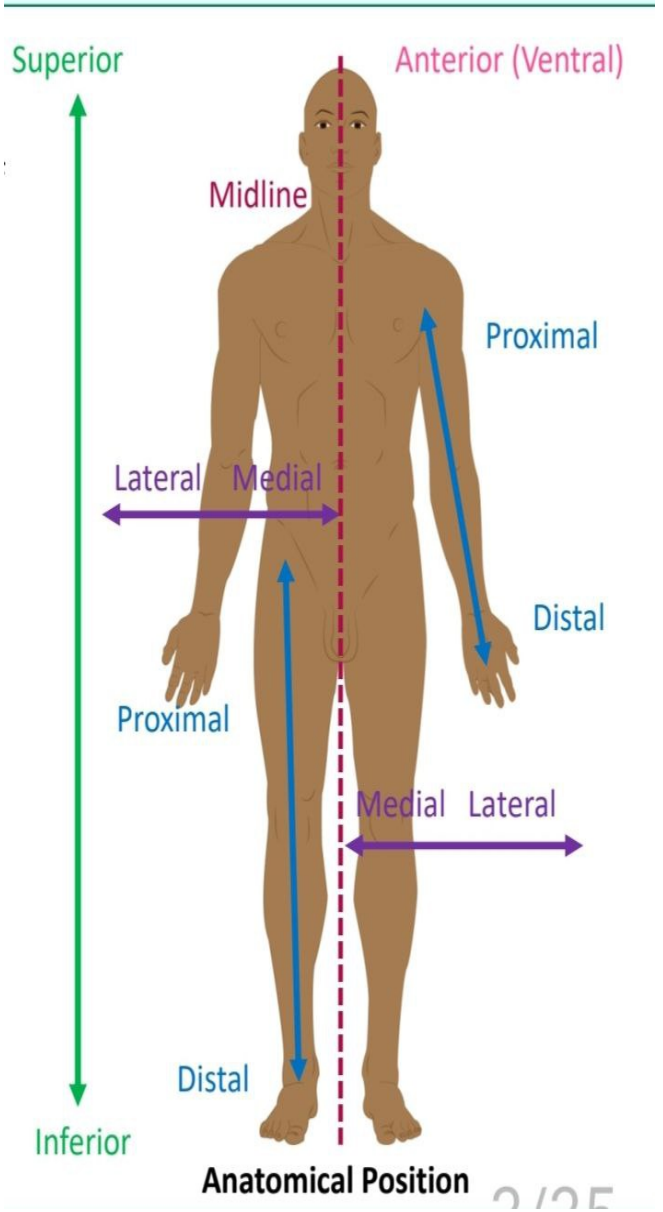




Anatomical Directions

Superior: Above; towards the head
Inferior: Below; towards the feet
Proximal: Closer to an attached area, or the trunk
Distal: Further from an attached area, or the trunk
Medial: Toward the midline
Lateral: Away from the midline
Intermediate: in between
Anterior (Ventral): Front of the body
Posterior (Dorsal): Back of the body (not shown)

External: Closer to the surface
Internal: Further from the surface
Superficial: Closer to the skin
Deep: Further from the skin



Planes

Frontal (Coronal) plane : Divides front (anterior) from back (posterior)
Sagittal plane: Divides left from right
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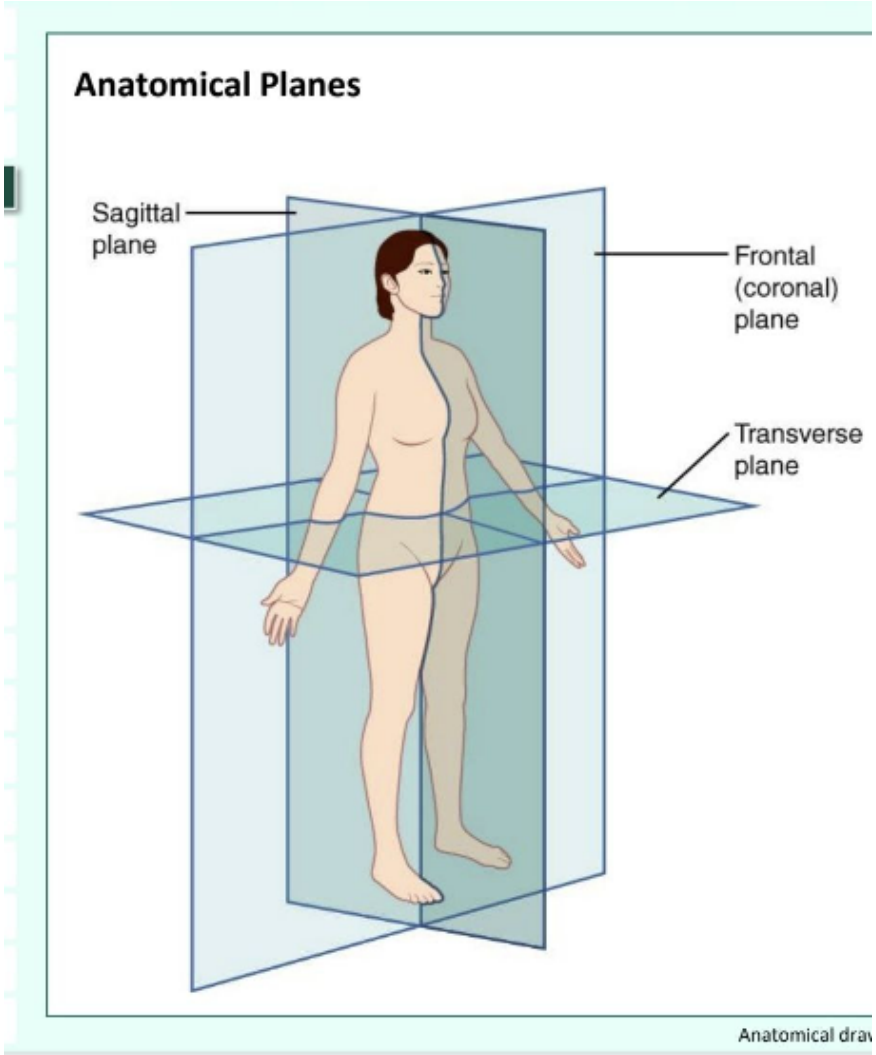
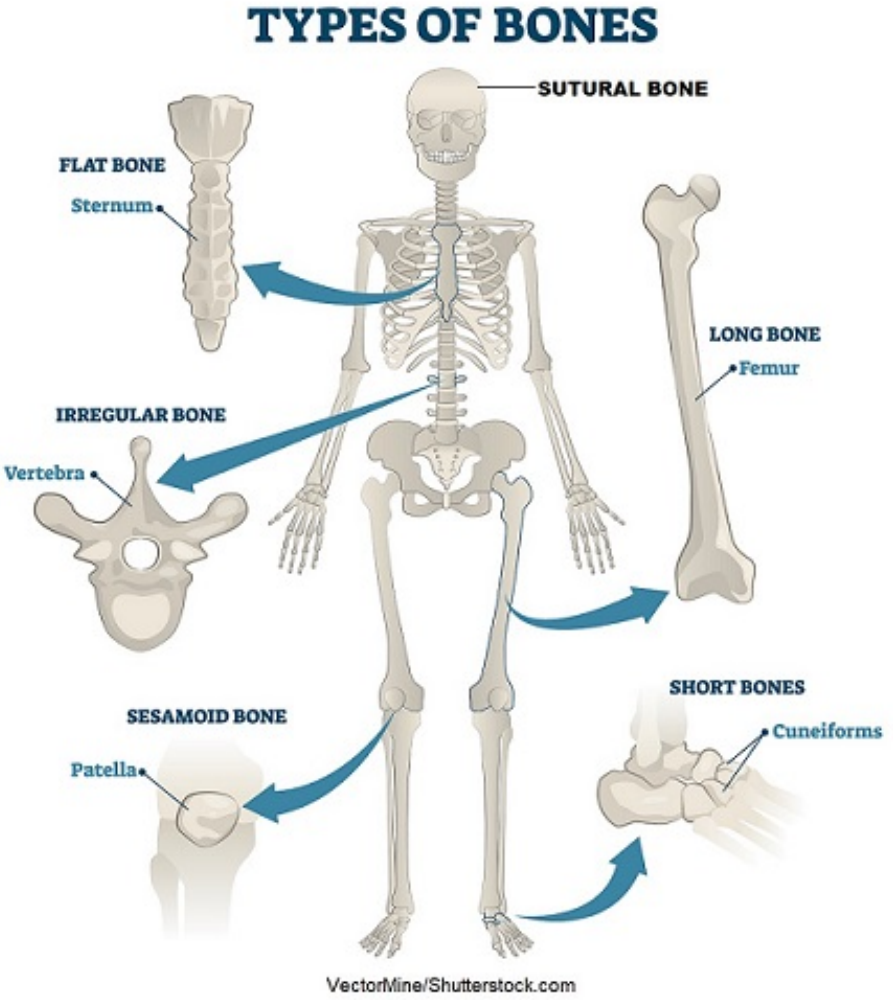


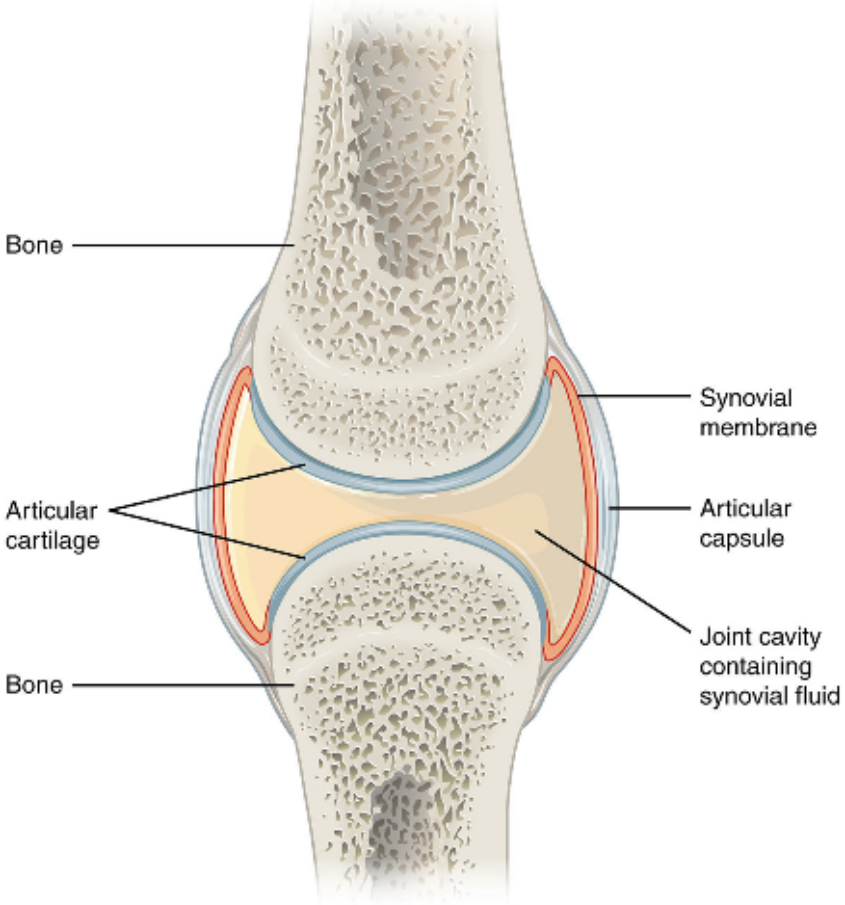
Anatomical types of bone

Long bone – has a two ends and shaft at middle. Examples include the bones of the arms and legs.
Short bone – cubed shape. Examples include the bones that make up the wrists and the ankles.
Flat bone – has a flattened, broad surface. Examples include ribs and skull bones.
Irregular bone – has a shape that does not conform to the above three types. Example the vertebrae, sacrum, maxilla, mandible,
Sesamoid bone -- are bones embedded in tendons. These small, round bones. The patella is an example of a sesamoid bone.



joints

also known as an articulation or articular surface, is a connection that occurs between bones to provide the means for movement.



Classification of joints

1. Structural classification of joints .

Fibrous Joints

Fixed joints, also called immovable joints, are found where bones are not flexible . example of a fixed joint is the skull, upper jaw, rib cage, and pelvic bone

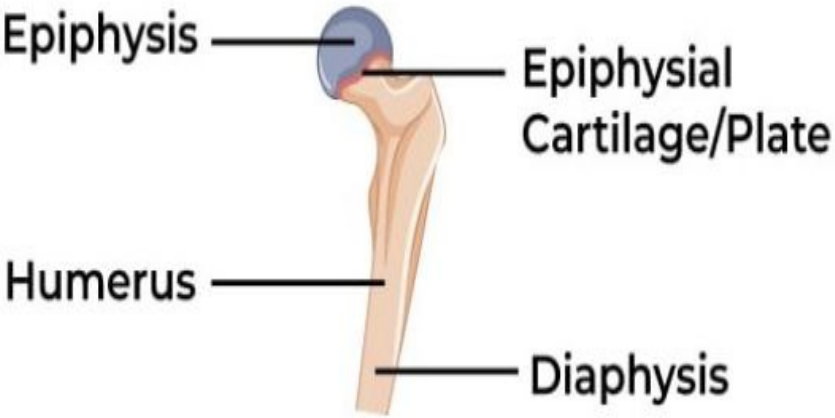
Cartilaginous joints

are a type of joint where the bones are entirely joined by cartilage. These joints generally allow more movement than fibrous joints but less movement than synovial joints.

the epiphyseal plate (growth plate) of a growing long bone. The epiphyseal plate is the region of growing hyaline cartilage that unites the diaphysis (shaft) of the bone to the epiphysis (end of the bone) Bone lengthening involves growth of the epiphyseal plate cartilage and its replacement by bone, which adds to the diaphysis.

Synovial Joints

The synovial joints are the most common type of joint because this joint helps us to perform a wide range of motion such as walking, running, typing and more. These joints are found in our shoulder joint, neck joint, knee joint, wrist joint.



2. Functional classification of joints.

Hinge permits movement in one plane usually flexion and extension .E.g. elbow joint, ankle joint, knee joint .

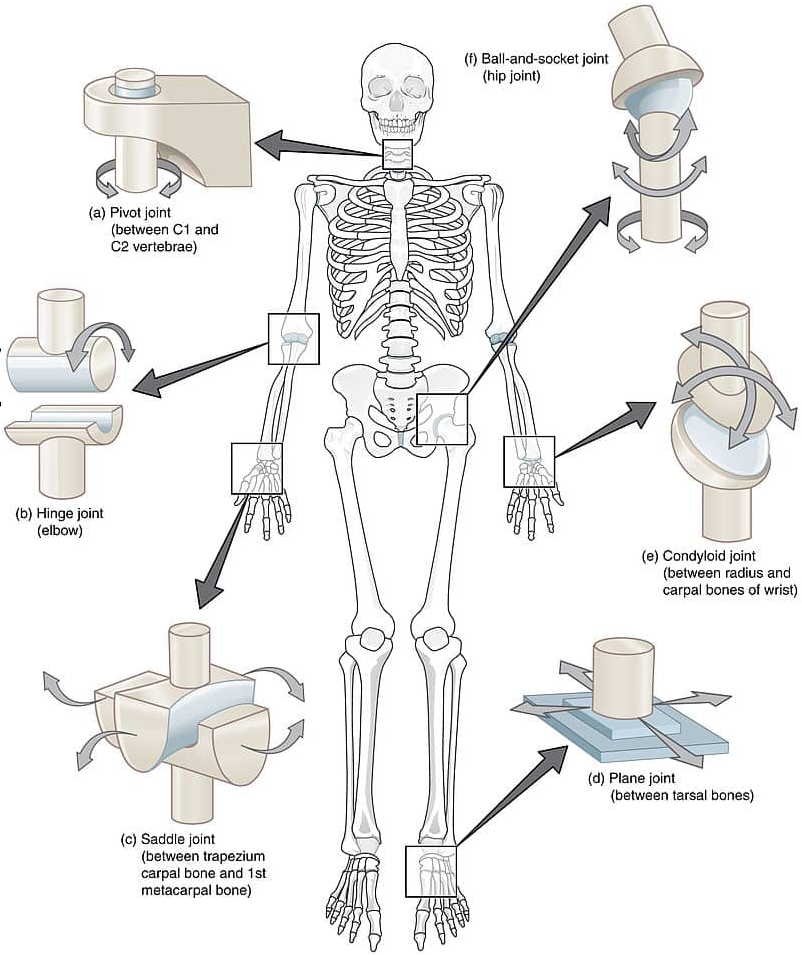
Saddle named due to its resemblance to a saddle on a horse's back. It is characterized by opposing articular surfaces with a reciprocal concave-convex shape. E.g. carpometacarpal joints.

Plane (gliding) the articular surfaces are relatively flat, allowing the bones to glide over one another E.g. acromioclavicular joint.

Pivot allows for rotation only. It is formed by a central bony pivot, which is surrounded by a bony-ligamentous ring E.g. proximal and distal radioulnar joints, atlantoaxial joint.

Condyloid – contains a convex surface which articulates with a concave elliptical cavity. They are also known as ellipsoid joints. E.g. wrist joint, metacarpophalangeal joint, metatarsophalangeal joint.

Ball and Socket where the ball-shaped surface of one rounded bone fits into the cup-like depression of another bone. It permits free movement in numerous axes. E.g. hip joint, shoulder joint.



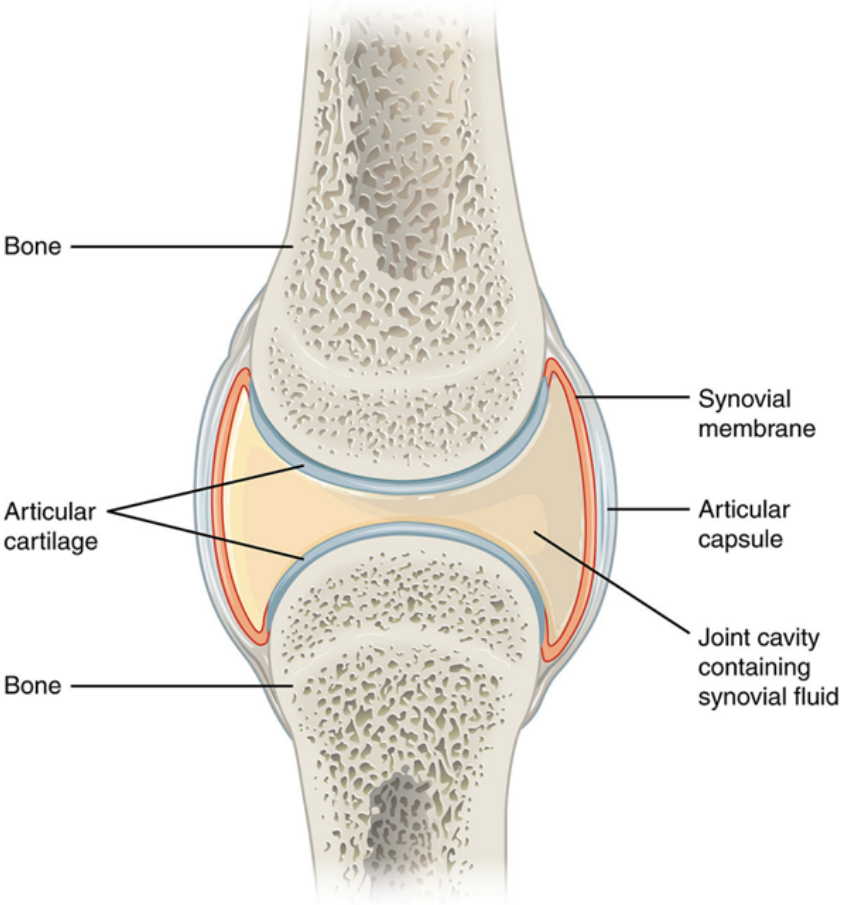
Structure of joints

- The articular capsule surrounds the joint and is continuous with the periosteum of articulating bones . It consists of two layers:

Fibrous layer (outer) – consists of white fibrous tissue, known the capsular ligament. It holds together the articulating bones and supports the underlying synovium.

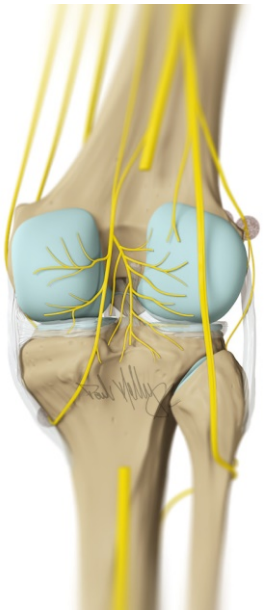
Synovial layer (inner) – a highly vascularised layer of serous connective tissue. It absorbs and secretes synovial fluid, and is responsible for the mediation of nutrient exchange between blood and joint. Also known as the synovium.

- ents that may damage the joint. Articular Cartilage The articulating surfaces of a synovial joint (i.e. the surfaces that directly contact each other as the bones move) . The articular cartilage has two main roles: minimis friction upon joint movement and absorbing shock. The synovial fluid is located within the joint cavity of a synovial joint. It has three primary functions: Lubrication,Nutrient distribution, Shock absorption. Ligaments bundles of dense regular connective tissue, which is highl adapted for resisting strain. This resists any extreme movem



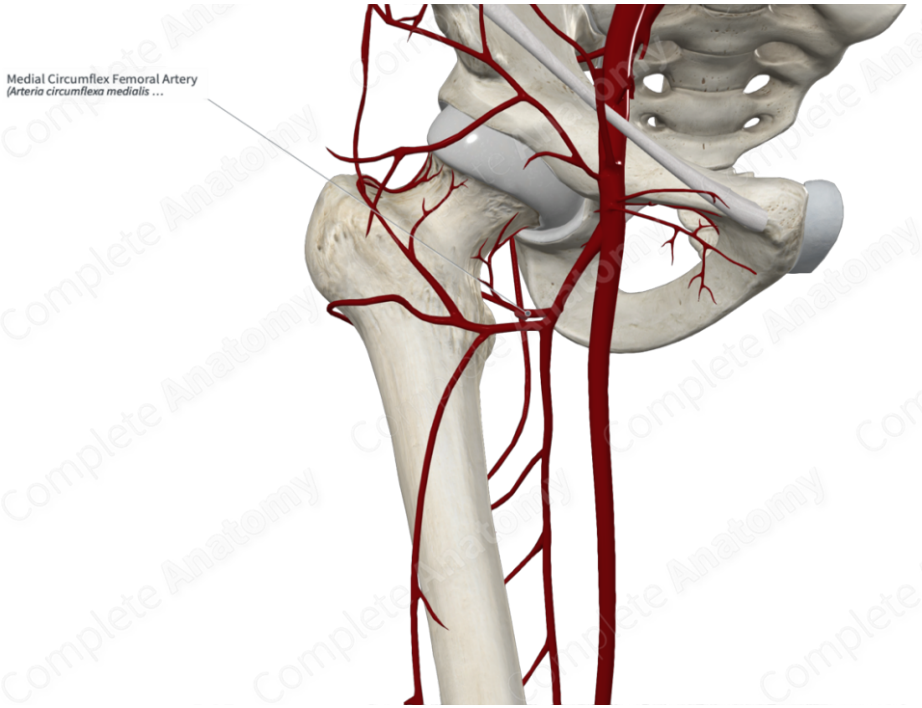
- Innervation

Synovial joints have a rich supply from articular nerves.. Articular nerves transmit afferent impulses, including joint position and pain sensation.



- Vasculature

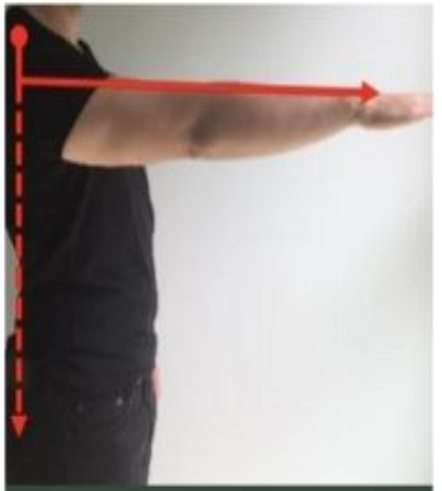
Arterial supply to synovial joints is via articular arteries, which arise from the vessels around the joint. A common feature of the articular arterial supply is frequent anastomoses (communications) in order to ensure a blood supply to and across the joint regardless of its position. The articular veins accompany the articular arteries and are also found in the synovial membrane.



Joints movements

Flexion: Movement that ***decreases*** the angle between two bones or parts of the body

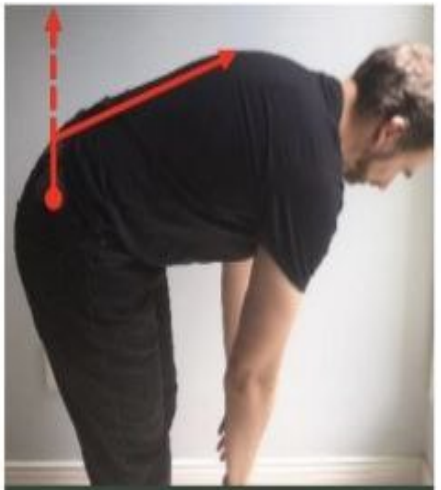
Flexion of the head at the neck



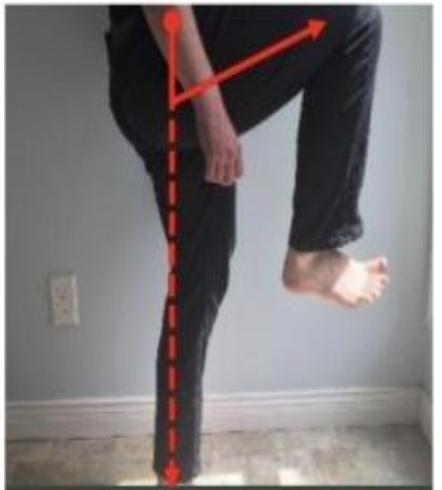
Flexion of the arm at the shoulder

Flexion of the forearm at the elbow

Flexion of the hand at the wrist



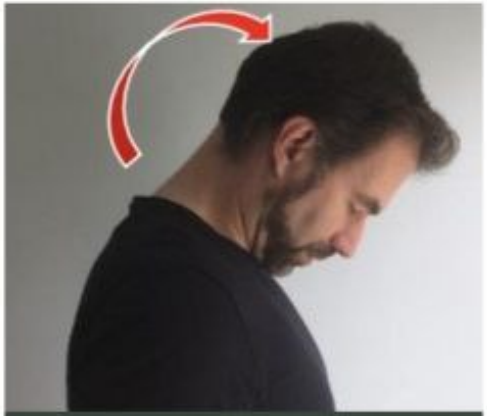
Flexion of the spine



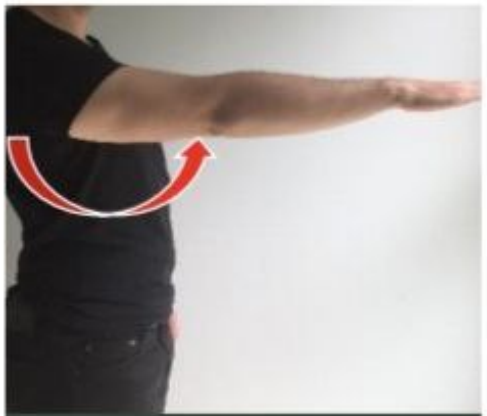
Flexion of the thigh at the hip*

Flexion of the leg at the knee

Flexion: Movement that ***decreases*** the angle between two bones or parts of the body

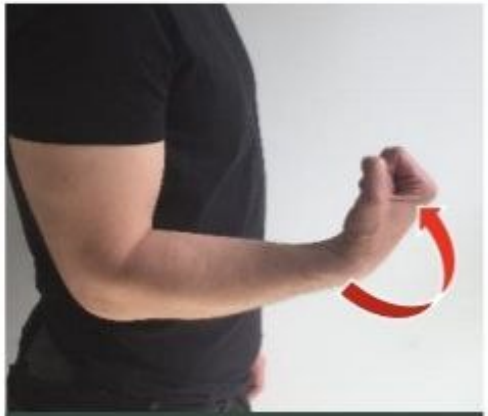


Flexion of the head at the neck



Flexion of the arm at the shoulder

Flexion of the forearm at the elbow



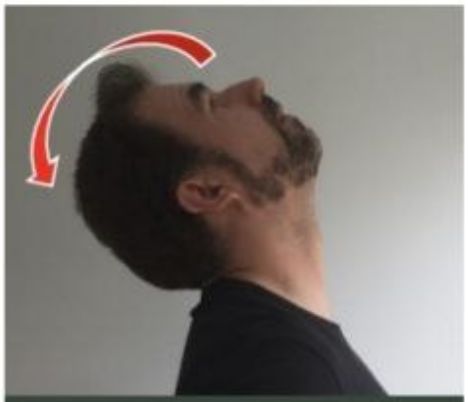
Flexion of the hand at the wrist

Flexion of the spine

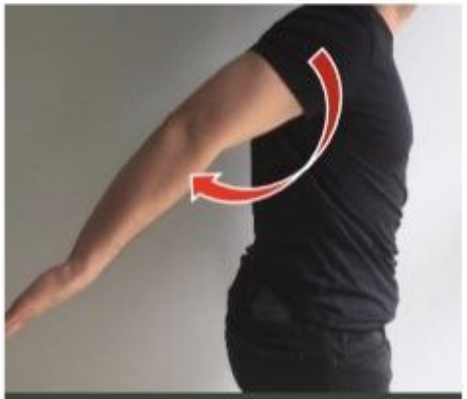
Flexion of the thigh at the hip*

Flexion of the leg at the knee

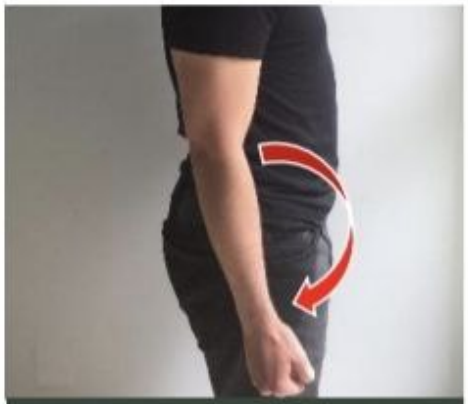
Extension: Movement that ***increases*** the angle between two bones of parts of the body



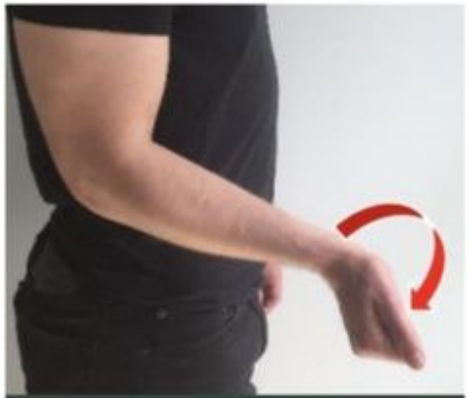
Extension of the head at the neck



Extension of the arm at the shoulder



Extension of the forearm at the elbow



Extension of the hand at the wrist

Extension of the spine

Extension of the thigh at the hip

Extension of the leg at the knee*

Abduction: Movement of the limb/digit ***away*** from the midline ***(laterally)***

Adduction: Movement of the limb/digit ***towards*** the midline ***(medially)***

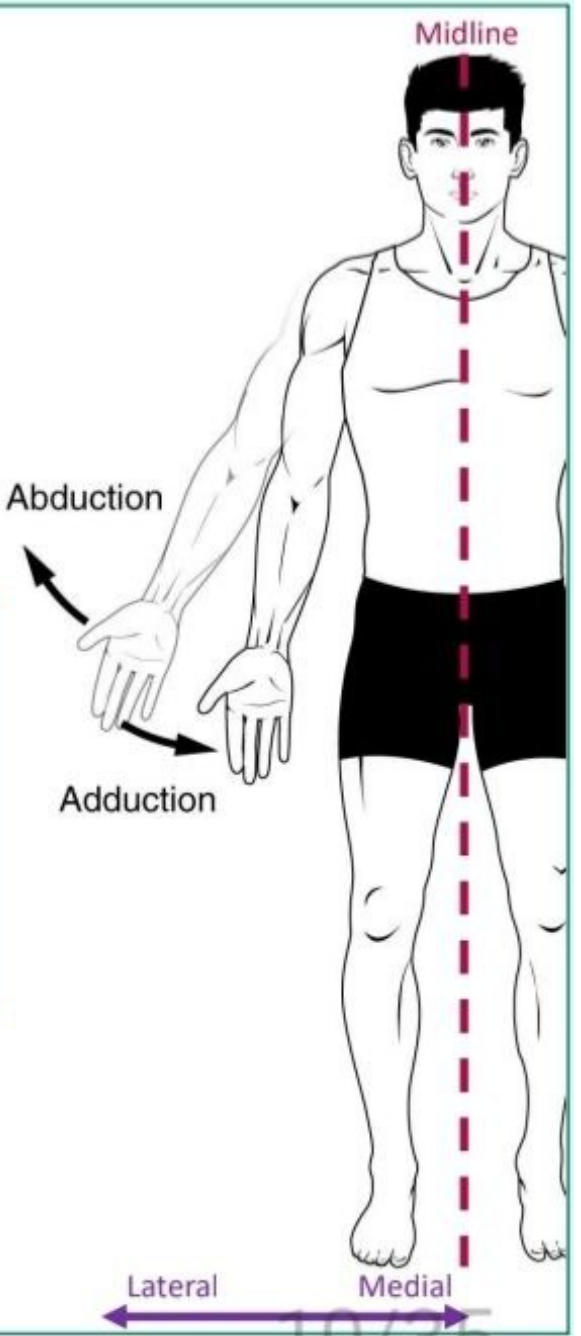
Plane of movement: ***Frontal plane***

Where it happens: Arm at the shoulder, digits, thigh at the hip

Memorization Hint:
To remember **ABduction**, imagine something being taken away

Memorization Hint:
To remember **ADduction**, think of things being brought together and added up

Memorization Hint:
ABduction and **ADduction** are the same movements you make when you do jumping jacks

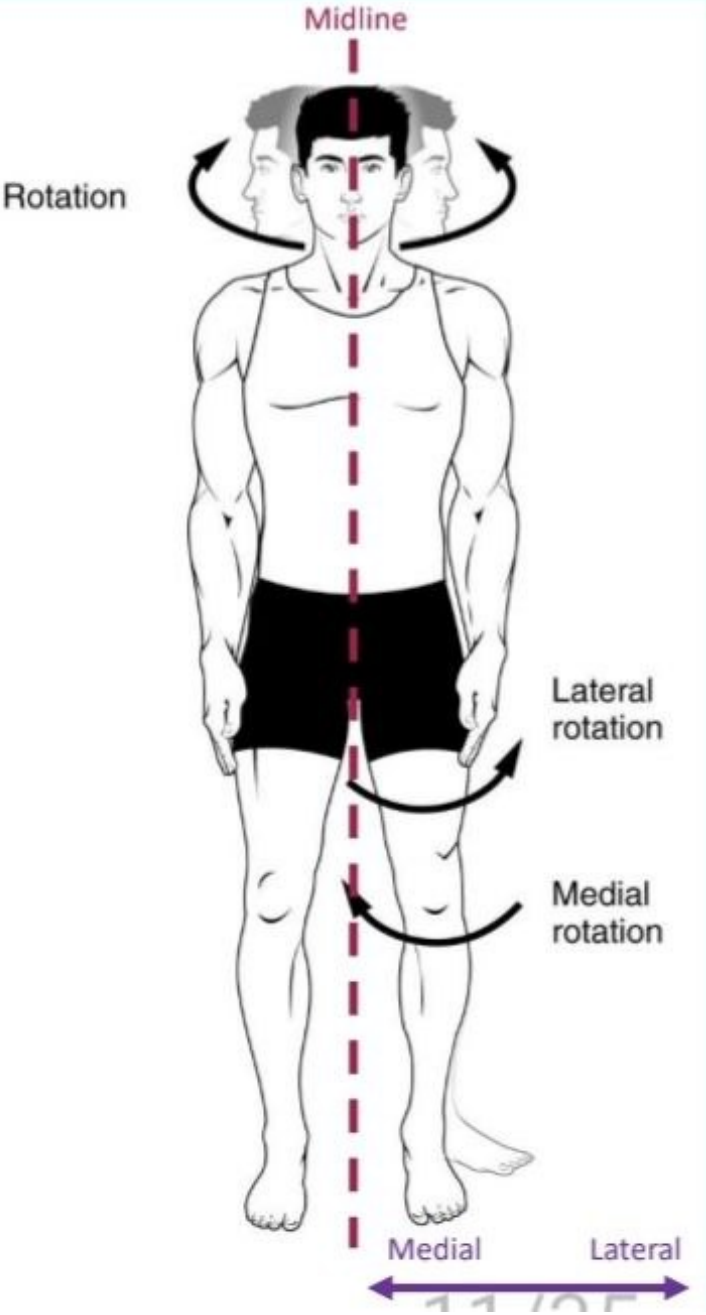


Rotation: ***Turning*** around a central longitudinal axis

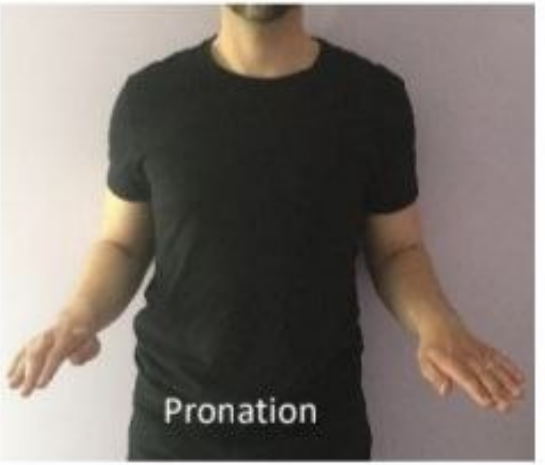
The head can be rotated to the ***left*** and the ***right*** (i.e., shaking the head "no")

Rotation of the limbs occurs when the forward-facing (anterior) surface is turned ***internally (medially)*** towards the midline, or ***externally (laterally)***, away from the midline

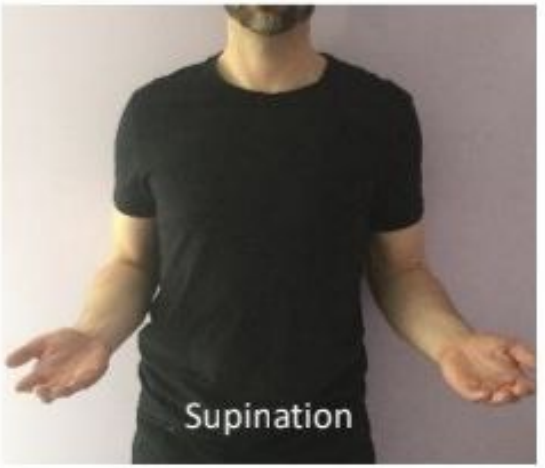
Where it happens: Head, arm at the shoulder, thigh at the hip



Pronation: ***Rotation*** of the forearm (radius bone) ***inwards (medially)***, causing the palm to face ***downwards***



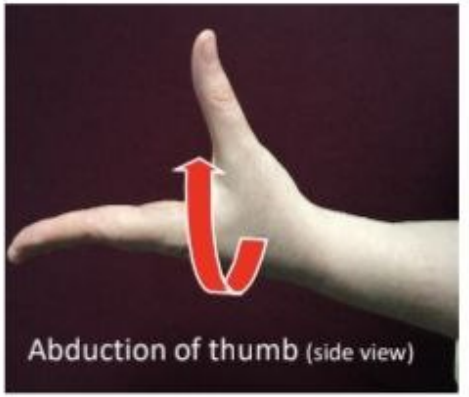
Supination: ***Rotation*** of the forearm (radius bone) ***outwards (laterally)***, causing the palm to face ***upwards***



Abduction of the thumb: Moving the thumb to a position that is ***90 degrees perpendicular*** to the palm

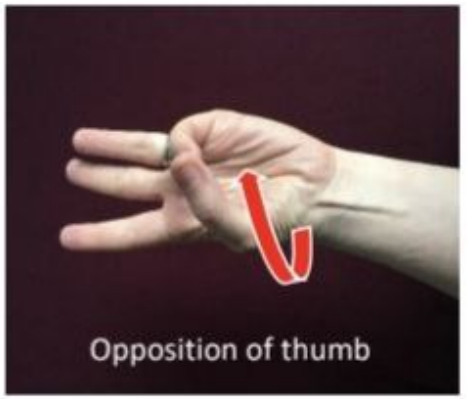
Adduction of the thumb: ***Reversal*** of abduction (returning the thumb to neutral position)

Memorization Hint:
Imagine holding a stack of plates, with your thumb raised to support them. In this position, the thumb is **ABducted**.



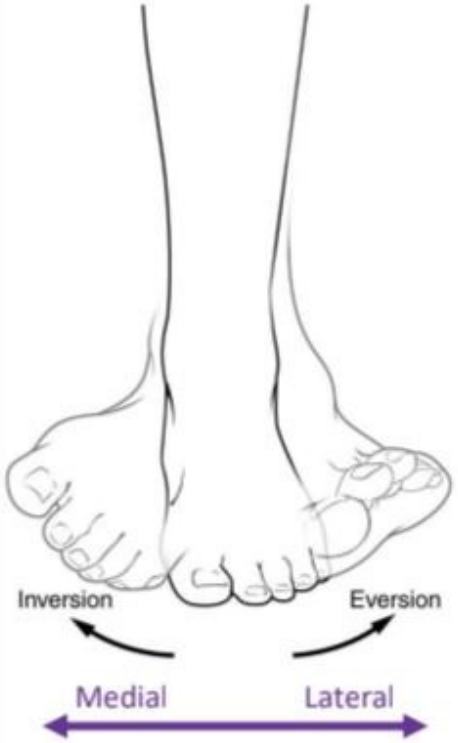
Opposition: Movement of the pad of the thumb to ***touch another finger***

Reposition: ***Reversal*** of opposition (returning thumb to neutral position)



Plantar Flexion: Pushing or pointing the toes and the ball of the foot ***down*** towards the ground (i.e., standing on "tip toes")

Dorsiflexion: Standing on the heel of the foot, with the toes ***pointing up*** towards the sky



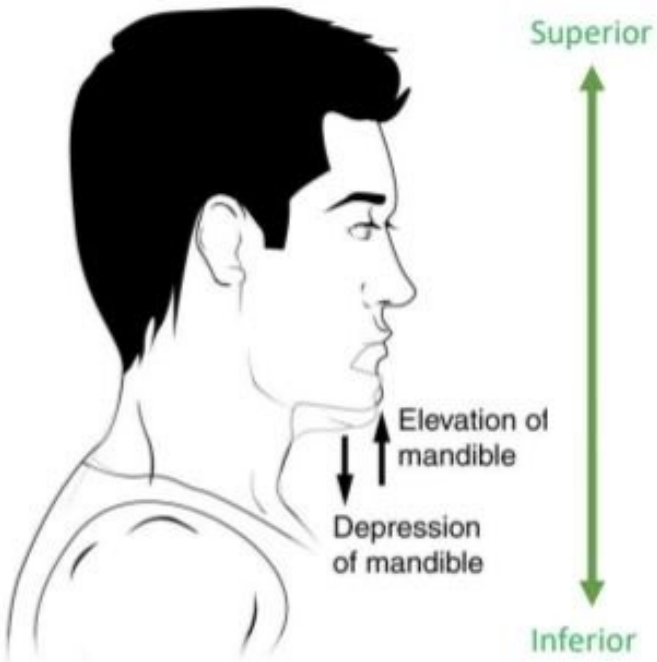
Inversion: Moving the foot to turn the sole ***inwards (medially)***

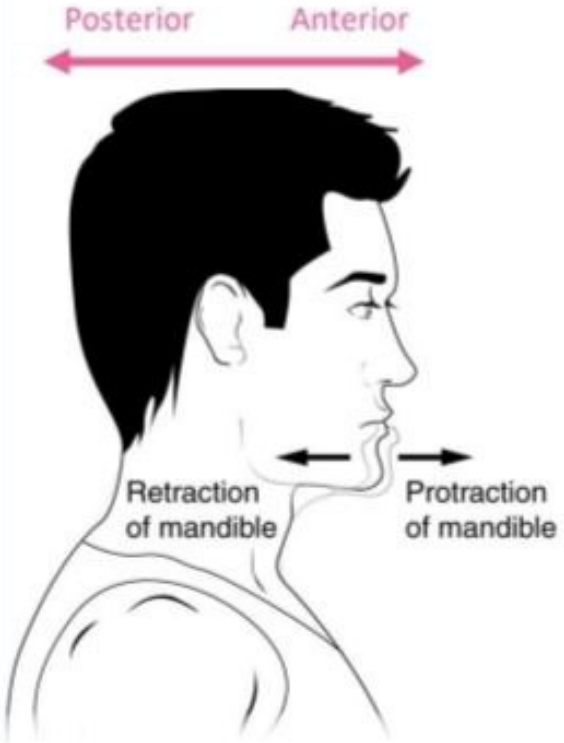
Eversion: Moving the foot to turn the sole ***outwards (laterally)***

Elevation: Moving a body part ***upwards (superiorly)***

Depression: Moving a body part ***downwards (inferiorly)***

Where it happens: Eyelid, jaw (mandible), shoulder





Protraction: Moving a body part ***forwards (anteriorly)***

Retraction: Moving a body part ***backwards (posteriorly)***

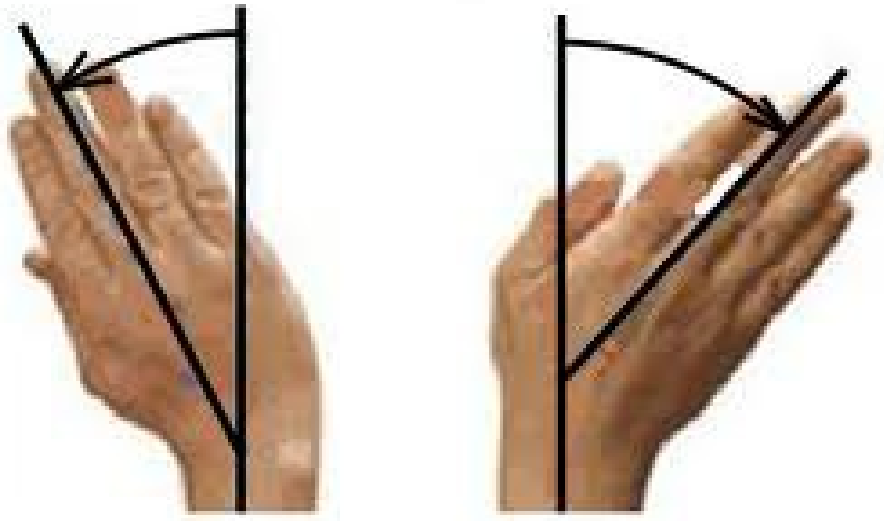
Where it happens: Jaw (mandible), scapula

Lateral Flexion: Bending the vertebral column (spine) ***to the side***

Where it happens: Neck (cervical spine), upper back (thoracic spine)

Lateral flexion at the spine

Radial Deviation: Movement of the wrist towards the radius or lateral side.
Ulnar Deviation: Movement of the wrist towards the ulna or medial side.

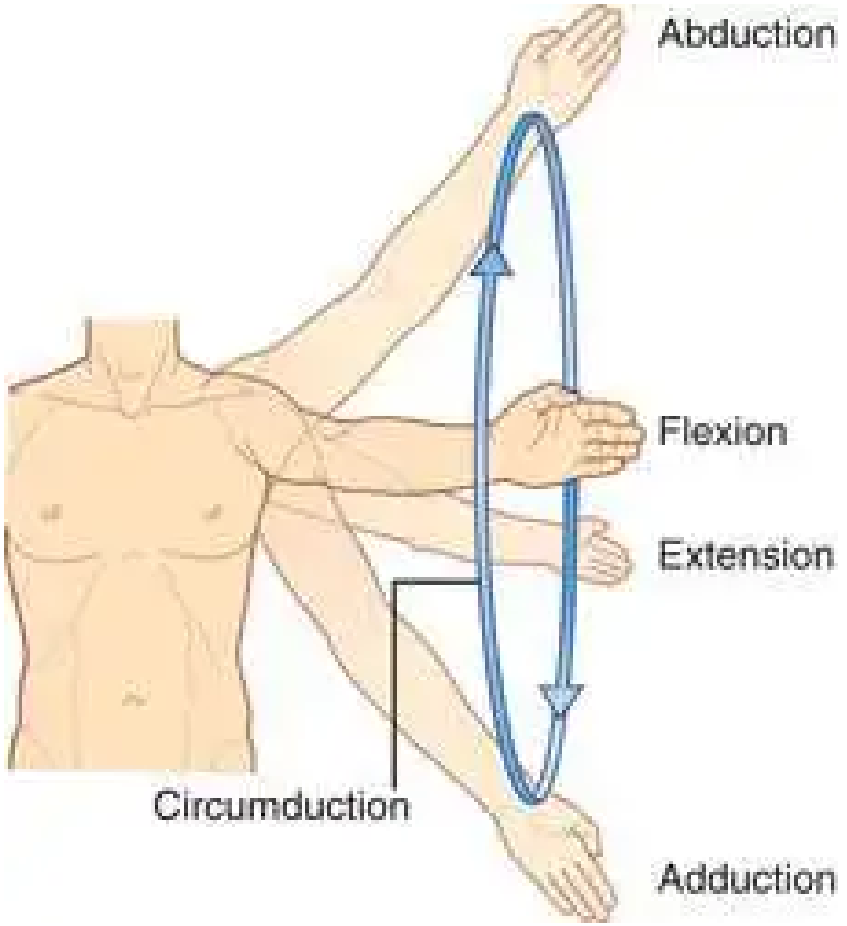


Radial Deviation Ulnar Deviation

Circumduction:

Movement at the joint that causes the limb to move in a circle.

Note: Circumduction is a compound movement that involves abduction, adduction, extension, and flexion.



LECTURE 2

OSTEOLOGY AND ARTHROLOGY

DR. ALI HUSSEIN

Osteology

- ANATOMICAL POSITIONS

In this position, the body is erect and the face forward. The feet are together, flat on the floor and the toes pointing forward. The arms are down at the sides with the palms turned forward with the thumb side of the hand away from the body. Prone position Lying face down Supine position Lying face up

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Superior: Above; towards the head Inferior: Below; towards the feet Proximal: Closer to an attached area, or the trunk
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Intermediate: in between
Anterior (Ventral): Front of the body
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Superficial: Refers to a structure being closer to the surface of the body than another structure.
Deep:Refers to a structure being closer to the core of the body than another structure.
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  Frontal (Coronal) plane: Divides front (anterior) from back (posterior)
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Arthrology

- ***Joints***

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- ***Classification of joints***

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Pivot allows for rotation only. It is formed by a central bony pivot, which surrounded by a bony-ligamentous ring E.g. proximal and distal radioulnar joints, atlantoaxial joint.

Condyloid – contains a convex surface which articulates with a concave elliptical cavity. They are also known as ellipsoid joints. E.g. wrist joint, metacarpophalangeal joint, metatarsophalangeal joint.

Ball and Socket where the ball-shaped surface of one rounded bone fits into the cup-like depression of another bone. It permits free movement in numerous axes. E.g. hip joint, shoulder joint.

- ***Structure of joints***

The articular capsule surrounds the joint and is continuous with the periosteum of articulating bones . It consists of two layers:
Fibrous layer (outer) – consists of white fibrous tissue, known the capsular ligament. It holds together the articulating bones and supports the underlying synovium.

Synovial layer (inner) – a highly vascularised layer of serous connective tissue. It absorbs and secretes synovial fluid, and is responsible for the mediation of nutrient exchange between blood and joint. Also known as the synovium.

Articular Cartilage The articulating surfaces of a synovial joint (i.e. the surfaces that directly contact each other as the bones move) . The articular cartilage has two main roles: minimis friction upon joint movement and absorbing shock.
The synovial fluid is located within the joint cavity of a synovial joint. It has three primary functions: Lubrication, Nutrient distribution, Shock absorption. Ligaments bundles of

dense regular connective tissue, which is highl adapted for resisting strain. This resists any extreme movements that may damage the joint.

- *Innervation*

Synovial joints have a rich supply from articular nerves.. Articular nerves transmit afferent impulses, including joint position and pain sensation.

- *Vasculature*

Arterial supply to synovial joints is via articular arteries, which arise from the vessels around the joint. A common feature of the articular arterial supply is frequent anastomoses (communications) in order to ensure a blood supply to and across the joint regardless of its position. The articular veins accompany the articular arteries and are also found in the synovial membrane.

- *Joints movements*

Flexion: Movement that decreases the angle between two bones or parts of the body.
Extension: Movement that increases the angle between two bones of parts of the body.
Abduction: Movement of the limb/digit away from the midline (Laterally)
Adduction: Movement of the limb/digit towards the midline (medially)
Rotation: Turning around a central longitudinal axis.
The head can be rotated to the left and the right .
Rotation of the limbs occurs internally (medially) or externally (laterally).
Pronation: Rotation of the forearm inwards (medially) causing the palm to face downwards
Supination: Rotation of the forearm outwards) laterally), causing the palm to face upwards.
Opposition: Movement of the pad of the thumb

to touch another finger.
Radial Deviation: Movement of the wrist towards the radius or lateral side.
Ulnar Deviation: Movement of the wrist towards the ulna or medial side.
Reposition: Reversal of opposition (returning thumb to neutral position).
Plantar Flexion: Pushing or pointing the toes and the ball of the foot down towards the ground .
Dorsiflexion: Standing on the heel of the foot, with the toes pointing up.
Inversion: Moving the foot to turn the sole inwards (medially).
Eversion: Moving the foot to turn the sole outwards (laterally) .
Elevation: Moving a body part upwards (superiorly).
Depression: Moving a body part downwards (inferiorly).
Protraction: Moving a body part forwards (anteriorly)
Retraction: Moving a body part backwards (posteriorly)
Lateral Flexion: Bending the vertebral column (spine) to the side .
Circumduction: Movement at the joint that causes the limb to move in a circle.
Note: Circumduction is a compound movement that involves abduction,
adduction, extension, and flexion.

LECTURE 3

SHOULDER GIRDLE AND SCAPULAR REGION

Shoulder girdle

- is formed by an articulation between the head of the humerus and the glenoid cavity (or fossa) of the scapula. This gives rise to the alternate name for the shoulder joint – the glenohumeral joint .

• Bones

The bones of the shoulder are the humerus) the upper arm bone), the scapula (the shoulder blade), and the clavicle (the collar bone). The roof of the shoulder is formed by a part of the scapula called the acromion.

The clavicle articulates at one end with the sternum (chest bone) and with the acromion of the scapula at the other. This articulation between the acromial end of the clavicle and the acromion of the scapula forms the roof of the shoulder.

The scapula is a large, flat triangular bone with three processes called the acromion, spine and coracoid process . The coracoid process is a thick curved structure that projects from the scapula and is the attachment point of ligaments and muscles . The scapula is also marked by a shallow, somewhat comma-shaped glenoid cavity , which articulates with the head of the humerus

The top end of the humerus consists of the head, the neck, the greater and lesser tubercles, and the shaft. The head is half-spherical in shape and projects into the glenoid cavity. The neck lies between the head and the greater and lesser tubercles. The greater and lesser tubercles are prominent landmarks on the humerus and serve as attachment sites for the rotator cuff muscles.

- **There are four joints making up the "shoulder joint"**

1. *the Glenohumeral* joint, (is a ball and socket articulation between the head of the humerus and the glenoid cavity of the scapula)
2. *The acromioclavicular (AC)* joint (where the clavicle meets the acromion of the scapula)

3. *The sternoclavicular (SC)* joint (where the clavicle meets the chest bone sternum)
4. *The scapulothoracic* joint (where the scapula meets with the ribs at the back of the chest)

- ## Stability

Rotator cuff muscles – surround the shoulder joint, attaching to the tuberosities of the humerus, whilst also fusing with the joint capsule. The resting tone of these muscles act to compress the humeral head into the glenoid cavity.

Glenoid labrum – a fibrocartilaginous ridge surrounding the glenoid cavity. It deepens the cavity and creates a seal with the head of humerus, reducing the risk of dislocation.

Ligaments – act to reinforce the joint capsule and form the coracoacromial arch.

Biceps tendon – it acts as a minor humeral head depressor, thereby contributing to stability.

- ## Ligaments

a. *Glenohumeral ligaments* (superior, middle and inferior) – extend from the humerus to the glenoid fossa. They act to stabilise the anterior aspect of the joint.
b. *Coracohumeral ligament* – extends from the base of the coracoid process to the greater tubercle of the humerus. It supports the superior part of the joint capsule.
c. *Transverse humeral ligament* – extends between the two tubercles of the humerus. It holds the tendon of the long head of the biceps in the intertubercular groove.
d. Coracoacromial ligament – extends between the acromion and coracoid process of the scapula, forming an arch-like structure over the shoulder joint (coracoacromial arch). This resists superior displacement of the humeral head.

- ## Blood Supply

The shoulder joint is supplied by the anterior and posterior circumflex

humeral arteries – which are both branches of the axillary artery.

- ## Innervation

Sensory innervation to the shoulder joint is from the axillary and suprascapular nerves.

- ## Rotator cuff muscles

The subscapularis is a large triangular-shaped muscle that lies below the other three. It's the strongest, largest, and most used of the four rotator cuff muscles.
Origin: subscapular fossa of the scapula /Insertion: lesser tubercle of the humerus .
action: internal rotation of arm .

The supraspinatus muscle is the only muscle of the rotator cuff that is not a rotator of the humerus .
Origin: supraspinous fossa of the scapula Passes above the glenohumeral joint Insertion: greater tuberosity of the humerus.
Action: abduction of arm to 15° at glenohumeral joint.

The infraspinatus is a powerful lateral rotator of the humerus. Origin: infraspinous fossa of the scapula / Insertion: greater tuberosity of the humerus, immediately below the supraspinatus . external rotation of arm at glenohumeral joint .

The teres minor is a narrow and long muscle entirely covered by the deltoid, hardly differentiated from the infraspinatus. Origin: lateral border of the scapula Insertion: greater tuberosity of the humerus, below the infraspinatus tendon. external rotation and adduction of arm .

- ## superficial muscles of the shoulder

The two most superficial muscles of the shoulder are the deltoid and the trapezius muscles. These muscles provide the shoulder with its characteristic contour.

1. ***The trapezius muscle*** consists of three parts:

Origin and Insertion *: Descending (upper) part*: originates from the superior nuchal line and external occipital protuberance and inserts onto the lateral third of the clavicle;

Transverse (middle) part: originates from the spinous processes of the thoracic vertebrae T1-T4 and inserts onto the acromion and spine of the scapula;

Ascending (lower) part: originates from the spinous processes of the thoracic vertebrae T4-T12 and inserts onto the medial part of the spine of the scapula.

ACTION : Abduction of the upper limb at the shoulder (by rotating the scapula). The upper fibers of trapezius also elevate the scapula, the middle fibres retract, and the lower fibers depress. Upward rotation of scapula (upper and middle)

Innervation the accessory nerve (CN XI) .

Blood supply Occipital artery (descending part), transverse cervical artery (transverse part), dorsal scapular artery (ascending part)

2. ***Deltoid muscle*** The deltoid is a thick, triangular shoulder muscle. It gets its name because of its similar shape to the Greek letter 'delta' (Δ).

Origin : Lateral 1/3 of Clavicle (clavicular part), Acromion (acromial part), Spine of Scapula (spinal part) **.** (insertion of trapezius muscle)

Insertion : Deltoid tuberosity of humerus **.**

Action : *Clavicular part*(anterior) : flexion and internal rotation of the arm
Acromial part(middle): abduction of the arm beyond the initial 15°
Spinal part(posterior): extension and external rotation of the arm.

Innervation : The deltoid muscle is innervated by one of the main branches of the brachial plexus, the axillary nerve**.**

Blood supply : The posterior circumflex humeral artery was the most important artery. It supplied the posterior and middle parts of the deltoid muscle. The anterior circumflex humeral artery supplied the anterior part .

Scapular Region

The scapular region is on the superior posterior surface of the trunk and is defined by the muscles that attach to the scapula (shoulder blade).

- ***Blood supply***

a) ***Suprascapular artery***- a branch of the ***thyrocervical trunk***, which in turn arises from the ***subclavian artery***. It runs along the suprascapular nerve and mostly supplies the supraspinatus and infraspinatus muscles.

b) ***Posterior circumflex humeral artery*** - a branch of the ***axillary artery*** supplying the glenohumeral joint

c) ***Circumflex scapular artery*** - originating from the ***subscapular artery***, which in turn is a branch of the ***axillary artery***

d) ***Transverse cervical artery*** - a branch of the ***thyrocervical trunk*** running along the medial border of the scapula .

e) ***The dorsal scapular artery*** (or descending scapular artery) is a blood vessel which supplies the levator scapulae, rhomboids, and trapezius. It most frequently arises from the subclavian artery (the second or third part), but a quarter of the time it arises from the transverse cervical artery.

- ***Muscles (***trapezius, deltoid, infraspinatus , supraspinatus , supscapularis , teres minor ***)***

Teres major : *Origin*: Lower lateral border and inferior angle of the scapula *Insertion*: the intertubercular groove of the humerus.
Action :Adducts the arm , Medially rotates the arm, Extends the arm
Innervation :Lower subscapular nerve branch of brachial plexus
Blood supply: supplied by the posterior circumflex humeral artery (branch of axillary artery)and the subscapular artery.

Latissimus dorsi : It is large, flat and triangular in shape originating from large parts of the lumbar region and lower thorax to insert on the humerus through a narrow tendon.
Origin: a. Spinous processes of T7 – L5 vertebrae. b. Iliac crest of sacrum. c. Thoracolumbar fascia d. Inferior angle of the scapula e. Lower three or four ribs. ***Insertion***: Floor of intertubercular groove of humerus. ***Actions***: Adducts the arm, Medially rotates the arm, Extends the arm ***Innervation***: Thoracodorsal nerve

branch of brachial plexus. *Blood supply*: supplied by the thoracodorsal artery, a continuation of the subscapular artery, which is a branch of the the axillary artery.

Coracobrachialis is one of the three muscles that comprise the anterior compartment of the arm(with brachialis and biceps muscles) .

Its action is mainly antagonist to the action of the deltoid muscle.
Origin: Coracoid process of scapula.
Insertion: Mid-medial surface of humerus.
Actions: Adduction and flexion of the arm .
Innervation :Musculocutaneous nerve branch from brachial plexus
Blood supply: Muscular branches of brachial artery

Biceps brachii Biceps brachii is one of the main arm muscles which acts on both the shoulder joint and the elbow joint. It derives its name from the fact that it consists of two parts (heads).
Origin: a. Long head: supraglenoid tubercle of the scapula.
b. Short head: coracoid process of the scapula.
Insertion: a. Radial tuberosity.
b. Bicipital aponeurosis to the fascia on the medial side of the forearm.
Actions : Flex the arm (weakly) . / flexion & supination the forearm / Flexeion forearm at elbow.
Innervation: Musculocutaneous nerve.
Blood supply: The blood supply of the biceps is the brachial artery .

levator scapulae is a shoulder muscle on the side of the neck and upper back. *Origin*: Transverse processes of the C1-C4 vertebrae.
Insertion: Medial border of the scapula between spine and superior angle.

Actions : elevation medial border of the scapula while downwardly rotating lateral angle. pull scapula upward and medially / Bends neck laterally.
Innervation: Dorsal scapular nerve and anterior rami of spinal nerve .
Blood supply : dorsal scapular artery.

Rhomboid Minor : *Originates* from the spinous processes of C7-T1 vertebrae. *Attaches* to the medial border of the scapula superior to spin of scapula . Actions: Retracts and rotates the scapula. Innervation: Dorsal scapular nerve.
Blood Supply: Dorsal scapular artery

The rhomboid major is a shoulder muscle that helps move and stabilize

the scapula during movements.
Origin: Spinous process of T2-T5 vertabrae.
Insertion: Medial border of scapula inferior to spin of scapula.
Actions: Retracts and rotates the scapula.
Innervation: Dorsal scapular nerve.
Blood Supply: Dorsal scapular artery

The serratus anterior The serratus anterior muscle is a fan-shaped muscle at the lateral wall of the thorax.
Origin: Anterior surfaces of the first 8 or 9 ribs.
Insertion: Anterior surface of medial border of scapula.
Action: abduct (protracts) scapula / rotates scapula upward while abducting the arm.
Innervation: Long thoracic nerve.
Blood supply: Thoracodorsal artery, superior thoracic artery, lateral thoracic artery.

Scapula movement

Protraction is accomplished by the actions of the serratus anterior and Pectoralis minor muscles.
Retraction is accomplished by the actions of the middle part of trapezius, rhomboids muscles.

Elevation is accomplished by the upper trapezius, levator scapulae.

Depression is accomplished through the force of gravity and the actions of the trapezius muscles(lower part).

Upward rotation is accomplished by the trapezius(upper and middle) and serratus anterior muscles.

Downward rotation is accomplished by the force of gravity as well as the rhomboids muscles.

Shoulder joint movements

Extension (upper limb backwards in sagittal plane) – posterior deltoid, latissimus dorsi and teres major, long head of triceps brachii , pectoralis major

Flexion (upper limb forwards in sagittal plane) – pectoralis major, anterior deltoid and coracobrachialis. Biceps brachii weakly assists in forward flexion.

Abduction (upper limb away from midline in coronal plane(

The first 0-15 degrees of abduction is produced by the supraspinatus.

The middle fiber of the deltoid are responsible for the next 15-90 degrees.

Past 90 degrees, the scapula needs to be rotated to achieve abduction – that is carried out by the trapezius and serratus anterior.

Adduction (upper limb towards midline in coronal plane) – pectoralis major, latissimus dorsi and teres major, Coracobrachialis .

Internal rotation (rotation towards the midline) – subscapularis, pectoralis major, latissimus dorsi, teres major and anterior deltoid.

External rotation (rotation away from the midline) – infraspinatus and teres minor, posterior deltoid .

Circumduction (moving the upper limb in a circle) – produced by a combination of the movements described above.

Pelvic Girdle

The bony pelvis consists of the two hip bones (also known as innominate or pelvic bones), the sacrum and the coccyx.

There are four articulations within the pelvis:

- Sacroiliac joints (x2) – between the ilium of the hip bones, and the sacrum
- Sacrococcygeal symphysis – between the sacrum and the coccyx.
- Pubic symphysis – between the pubis bodies of the two hip bones.

Functions of the Pelvis

- Transfer of weight from the upper axial skeleton to the lower
- Provides attachment for a number of muscles and ligaments.
- Contains and protects the abdomen and pelvic organs .

Blood supply of hip girdle

The *femoral artery* forms as a continuation of the *external iliac artery* . The femoral artery runs to the lower thigh and ends behind the knee. At the knee, the femoral artery becomes the *popliteal artery*.

BRANCHES :
Descending genicular artery, Profunda femoris artery, Superficial epigastric, Superficial circumflex iliac, Superficial external pudendal, Deep external pudendal arteries .

Gluteal region

The gluteal region is an anatomical area located posteriorly to the pelvic girdle . The important muscles of the gluteal region are :

The gluteus Maximus is the largest of the gluteal muscles. It is also the most superficial, producing the shape of the buttocks.

Origin: Originates from the gluteal (posterior) surface of the ilium, sacrum and coccyx.
Insertion: onto the iliotibial tract and gluteal tuberosity of the femur.
Actions: It is the main extensor of the thigh, and assists with lateral rotation.
Innervation: Inferior gluteal nerve.
Blood supply: Inferior gluteal and superior gluteal arteries

The Gluteus Medius

Origin: from the gluteal surface of the ilium

Insertion: into the lateral surface of the greater trochanter.
Actions: Abduction and internal rotation of the thigh .
Innervation: Superior gluteal nerve.
Blood supply: Superior gluteal artery.

The Gluteus Minimus

Origin: Gluteal surface of ilium .
Insertion: Anterior aspect of greater trochanter of femur .
Action: Abduction and internal rotation of thigh .
Innervation: Superior gluteal nerve .
Blood supply: Superior gluteal artery .

The Piriformis

Origin: from the anterior surface of the sacrum.
Insertion: onto the greater trochanter of the femur.
Actions: Lateral rotation and abduction.
Innervation: Nerve to piriformis.
Blood Supply: Superior and inferior gluteal artery

The hip joint

is a ball and socket synovial joint, formed by an articulation between the pelvic acetabulum and the head of the femur.

Neurovascular Supply

The arterial supply to the hip joint is largely via the medial and lateral circumflex femoral arteries – branches of the profunda femoris artery (deep femoral artery).

The hip joint is innervated primarily by the sciatic, femoral and obturator nerves. These same nerves innervate the knee, which explains why pain can be referred to the knee from the hip and vice versa.

Stability of hip joint

1.Deep acetabulum enhanced by the labrum acetabulare
2. Thick strong capsule
3. Ligaments :Iliofemoral ligament, Ischiofemoral ligament, Pubofemoral ligament
4. Muscles sorrounding the joint e.g. gluteus medius, gluteus maximus, piriformis and deep core muscles .

Ligaments

The ligaments of the hip joint act to increase stability. There are three main ligaments:
Iliofemoral ligament – arises from the anterior inferior iliac spine and then

bifurcates before inserting into the intertrochanteric line of the femur. Pubofemoral – spans between the superior pubic rami and the intertrochanteric line of the femur, reinforcing the capsule anteriorly and inferiorly. Ischiofemoral– spans between the body of the ischium and the greater trochanter of the femur, reinforcing the capsule posteriorly.

Hip and thigh muscles

The muscles of the **anterior compartment of the thigh** are a group of muscles that (mostly) act to extend the lower limb at the knee joint. They are collectively innervated by the femoral nerve (L2-L4), and recieve arterial supply from the femoral artery.

- ***Iliopsoas muscle***

The iliopsoas is comprised of two separate muscles; the psoas major and iliacus. Attachments: The psoas major originates from the lumbar vertebrae, and the iliacus originates from the iliac fossa of the pelvis.
Insertion: together onto the lesser trochanter of the femur.
Actions: Flexion of the the thigh at the hip joint.

- ***Quadriceps Femoris***

The quadriceps femoris consists of four individual muscles – the three vastus muscles and the rectus femoris. It forms the main bulk of the anterior thigh, and is one of the most powerful muscles in the body.
The four muscles collectively insert onto the patella via the quadriceps tendon. The *patella*, in turn, is attached to the *tibial tuberosity* by the patella ligament.

Vastus Lateralis
attachment: Originates from the greater trochanter
Actions: Extension of the knee joint. Its secondary function stabilising the patella **Vastus Intermedius**
attachment: Originates from the anterior and lateral surfaces of the femoral shaft. *Actions*: Extension of the knee joint. Its secondary function stabilising the patella .
Vastus Medialis
attachment: Originates from the intertrochanteric line of the femur.
Actions: Extension of the knee joint. Its secondary function stabilising the patella.
Rectus Femoris
Attachments: Originates from the anterior iliac spine and the ilium of the pelvis.
Actions: Extension of the knee joint and flexion of the hip joint (it is the only muscle of the quadriceps group to cross both the hip and knee joints).

- ***Sartorius muscle*** The sartorius is the longest muscle in the body.

Attachments: Originates from the anterior superior iliac spine.
Insertion: to medial surface of the tibia.
A*ctions*: it is a flexor, abductor and lateral rotator of the hip joint and flexion of knee joint .

- **Pectineus muscle**
  Attachments: Originates from the pectineal line of the pubis bone.
  Insertion: the pectineal line on the posterior aspect of the femur.
  Actions: Adduction and flexion at the hip joint

The muscles in the **posterior compartment of the thigh** are collectively known as the hamstrings. These muscles are innervated by the sciatic nerve ; with arterial supply from the inferior gluteal artery and perforating branches of the deep femoral artery. The muscles located within the posterior compartment of the thigh are the biceps femoris, semitendinosus and semimembranosus(The hamstring muscles).

- ***Biceps Femoris muscle***

The biceps femoris has two heads (long head and short head
Attachments: The long head originates from the ischial tuberosity of the pelvis. The short head originates from the posterior surface of the femur.
Inseryion :Together, the heads form a tendon, inserts into the head of the fibula. Actions: Main action is flexion at the knee. It also extends the thigh at the hip, and laterally rotates at the hip and knee.

The muscles in the **medial compartment of the thigh** are collectively known as the hip adductors. There are five muscles in this group; gracilis, obturator externus, adductor brevis, adductor longus and adductor magnus. All the medial thigh muscles are innervated by the obturator nerve, Arterial supply is through the obturator artery.

- ***Adductor Magnus muscle*** The adductor magnus is the largest muscle in the medial compartment of the thigh. It is comprised of two parts – an adductor component and a hamstring component.
  Origin: Adductor – Originates from the inferior rami of the pubis and the rami of ischium, attaches to the linea aspera of the femur.
  Hamstring part – Originates from the ischial tuberosity, attaches to the adductor tubercle and medial supracondylar line of the femur.
  Actions: Adductor – Adduction and flexion of the thigh / Hamstring – Adduction and extension of the thigh.

- **Obturator Externus muscle**

Originates from the membrane of the obturator foramen and adjacent bone. It passes under the neck of femur and attaches onto the posterior aspect of the greater trochanter.
Actions: Adduction and lateral rotation of the thigh.

- **Obturator internus** is a muscle of the gluteal region in the lower limb. Attachments: Originates from the pubis and ischium at the bony boundaries of the obturator foramen .
Insertion: onto the greater trochanter of the femur.
Actions: Lateral rotation and abduction of the lower limb.
Innervation: Nerve to obturator internus.
Blood Supply: Obturator artery

The knee joint

Is a hinge type synovial joint, It is formed by articulations between the patella, femur and tibia.

- **Neurovascular Supply**
The blood supply to the knee joint is through genicular branches of the femoral and popliteal arteries. The nerve supply, according to Hilton's law, is by the nerves which supply the muscles which cross the joint. These are the femoral, tibial and common fibular nerves.

- **Ligaments** The major ligaments in the knee joint are:
Patellar ligament – a continuation of the quadriceps femoris tendon distal to the patella. It attaches to the tibial tuberosity.
Collateral ligaments – They act to stabilise the hinge motion of the knee, preventing excessive medial or lateral movement
A: Medial collateral ligament – found on the medial side of the joint. Proximally, it attaches to the medial epicondyle of the femur, distally it attaches to the medial condyle of the tibia.
B: Lateral collateral ligament – It attaches proximally to the lateral epicondyle of the femur and distally to a depression on the lateral surface of the fibular head.
Cruciate Ligaments – these two ligaments connect the femur and the tibia. In doing so, they cross each other, hence the term 'cruciate' (Latin for like a cross)
A: Anterior cruciate ligament – attaches at the anterior intercondylar region of the tibia AND It ascends posteriorly to attach to the femur in the intercondylar fossa. It prevents anterior dislocation of the tibia onto the femur.

B: Posterior cruciate ligament – attaches at the posterior intercondylar region of the tibia and ascends anteriorly to attach to the anteromedial femoral condyle. It prevents posterior dislocation of the tibia onto the femur.

The muscles of the leg

The muscles in the ***anterior compartment*** of the leg are a group of four muscles that act to dorsiflex and invert the foot. These muscles are collectively innervated by the deep fibular nerve. The arterial supply is through the anterior tibial artery. The muscles are Tibialis Anterior, Extensor Digitorum Longus , Extensor Hallucis Longus and Fibularis Tertius .

There are two muscles in the ***lateral compartment*** of the leg; the fibularis longus and brevis . The common function of the muscles is eversion and They are both innervated by the superficial fibular nerve and blood supply by fibular artery .

The **posterior compartment** of the leg contains seven muscles and can be subdivided into superficial and deep compartments. The muscles in this compartment act to plantarflexion and invertion the foot. They are innervated by the tibial nerve (a branch of the sciatic nerve). Blood supply chiefly from the posterior tibial artery.

A: Superficial Compartment There are three muscles(Gastrocnemius,Soleus and Plantaris) within the superficial compartment of the posterior leg. They all insert onto *the calcaneus* (heel bone) of the foot, via the calcaneal tendon.

- **Gastrocnemius muscle** The gastrocnemius is the most superficial of all the muscles in the posterior leg. It has medial and lateral heads and forms the characteristic "calf" shape of the leg with the soleus muscle. Attachments:
  The lateral head originates from the lateral femoral condyle.
  The medial head originates from the medial femoral condyle.
  The two heads combine to inserts onto the calcaneus.
  Actions: Plantarflexion at the ankle joint and flexion at the knee joint.
- **Soleus muscle**
  Attachments: Originates from the soleal line of the tibia and fibula.

inserts onto the calcaneus.
Actions: Plantarflexion of the foot at the ankle joint.

B: Deep Muscles There are four muscles in the deep compartment of the posterior leg. One muscle, the popliteus, acts only on the knee joint. The remaining three muscles (tibialis posterior, flexor hallucis longus and flexor digitorum longus) act on the ankle and foot.

The ankle joint

Is a synovial joint located in the lower limb. It is formed by the bones of the leg (tibia and fibula) and the foot (talus). Functionally, it is a hinge type joint, permitting dorsiflexion and plantarflexion of the foot.

Ligaments

There are two main sets of ligaments, which originate from each malleolus.
Medial Ligament The medial ligament (or deltoid ligament) is attached to the medial malleolus (a bony prominence projecting from the medial aspect of the distal tibia) It consists of four ligaments, which fan out from the malleolus, attaching to the talus, calcaneus and navicular bones. The primary action of the medial ligament is to resist over-eversion of the foot.
Lateral Ligament The lateral ligament originates from the lateral malleolus (a bony prominence projecting from the lateral aspect of the distal fibula(

It resists over-inversion of the foot, and is comprised of three distinct and separate ligaments:
Anterior talofibular – spans between the lateral malleolus and lateral aspect of the talus. Posterior talofibular – spans between the lateral malleolus and the posterior aspect of the talus.
Calcaneofibular – spans between the lateral malleolus and the calcaneus.

Neurovascular Supply

The arterial supply to the ankle joint is derived from the malleolar branches of the anterior tibial, posterior tibial and fibular arteries.
Innervation is provided by tibial, superficial fibular and deep fibular nerves.

LECTURE 1

INTRODUCTION TO ANATOMY AND GENERAL HISTOLOGY

DR . ALI HUSSEIN

Anatomy

is the study of structures that make up the body and how those .structures relate with each other

- :Division of the anatomy

1. **GROSS ANATOMY**: A type of anatomy that can be undertaken without a . microscope

2. . **MICROSCOPIC ANATOMY**: Requires the use of a MICROSCOPE

3. **REGIONAL ANATOMY**: Studies specific REGIONS of the body. e.g. HEAD and NECK

4. **SYSTEMIC ANATOMY**: Study of specific SYSTEM. e.g. digestive and cardiovascular **.** .system

5. .**RADIOGRAPHIC ANATOMY**: Study of the structure of the body using X -RAYS

6. .**EMBRYOLOGICAL ANATOMY**: Study of PRENATAL DEVELOPMENT

7. **PATHOLOGICAL ANATOMY:** Study of STRUCTURAL CHANGE associated with .DISEASE

- Anatomical regions

Head Region

The cranial region or cephalic region is the head and skull

The forehead is referred to as the frontal region

.The eyes are referred to as the orbital or ocular region

.The cheeks are referred to as the buccal region

.The ears are referred to as the auricle or otic region

.The nose is referred to as the nasal region

.The mouth is referred to as the oral region

.The chin is referred to as the mental region

,The trunk region of the body contains, from superior to inferior

The thoracic region encompassing the chest

The mammary region encompassing each breast

the pectoral region encompassing the muscles of the chest

the sternal region encompassing the sternum

the abdominal region encompassing the stomach area

the umbilicus, or navel of the abdomen

.the pubic region encompassing the area above the genitals

,**The pelvis and legs region contain, from superior to inferior**

the inguinal is the groin region between legs and genitals

,the pubic region surrounding the genitals

,the femoral region encompassing the thighs

,the tarsal region encompassing the ankle

the pedal region encompassing the foot

.the digital/phalangeal region encompassing the toes

The regions of the upper limbs, from superior to inferior, are

.the axillary region encompassing the armpit

the antecubital region encompassing the front of the elbow

the carpal region encompassing the wrist

the palmar region encompassing the palm

.the digital/phalangeal region encompassing the fingers

The upper posterior shows the following regions

.the lumbar region is the lower back

the sacral region is at the end of the spine, directly above the buttocks

The head area is the cephalic region

The lower posterior part of the body shows the following regions

the gluteal region includes the buttocks

the popliteal region region is the back of the knee

the sural region is the calf area

The heel is in the calcaneal region

- Body cavities:

Body cavities are areas in the body that contain our vital organs. The dorsal and ventral cavities are the two main cavities. The dorsal cavity is on the posterior (back side) of the body and contains the cranial and spinal cavities. The ventral cavity is on the front (anterior) of the body and is divided into the thoracic (chest) and abdominopelvic cavities.

: **Dorsal Cavity**: The dorsal cavity is further divided into the following

1. The cranial cavity contains the brain.

2. The spinal (or vertebral cavity) contains the spinal cord.

Ventral Cavity

The ventral cavity is on the front of the trunk. The diaphragm (the main muscle of breathing) divides the ventral cavity into two simple subcavities: thoracic and abdominopelvic cavities.

1. *Thoracic cavity* is superior (above) to the diaphragm . It is lined by the ribs and chest wall. It is further divided into the

pleural cavities (left and right) which contain the lungs, bronchi.

Pericardial cavity: Contains the HEART. It is lined by the PERICARDIUM

The mediastinum cavity: Region or space between the lungs, the thoracic inlet, and the diaphragm. It contains the esophagus, trachea, bronchi, thymus gland, heart (pericardial cavity), large blood vessels and lymphatic vessels .

2. *Abdominopelvic cavity* is further divided into the *abdominal* and *pelvic* cavities.

The *abdominal* cavity is between the diaphragm and the pelvis. It contains many of the gastrointestinal organs such as the stomach, intestines

(except the *sigmoid colon* and *rectum*), spleen, liver, gallbladder, pancreas, .adrenal glands, kidneys and ureters

The *pelvic* cavity contains the bladder, some of the reproductive organs .sigmoid colon and the rectum

- :Systems of the body

1. **Skeletal system** : The skeletal system is composed of bones and .cartilages

2. **Muscular system**: The muscular system consists of all the body .muscles

3. **Cardiovascular system**: The cardiovascular system is comprised of the .heart and the circulatory system of blood vessels

4. **Respiratory system**: consists of a series of organs; the nasal cavity, . pharynx, larynx, trachea, bronchi, bronchioles and lungs

5. **Nervous system**: organs are the brain, spinal cord{central} and **.** .{nerves{peripheral

6. **Digestive system**: organs spread from the mouth to the anal canal. So it's actually a tube consisting of the mouth, pharynx, esophagus, stomach, small intestine, large intestine, and anal canal. Accessory digestive organs assist with the mechanical and chemical food breakdown, these are the .tongue, salivary glands, pancreas, liver and gallbladder

7. **Urinary system**: It consists of the kidneys, ureters, urinary bladder and .urethra

8. **Endocrine system** :The endocrine system is a collection of specialised .(organs (endocrine glands

9. **lymphatic system**: consists of lymph, lymphatic plexuses, lymphatic .vessels, lymph nodes and lymphoid organs

10. **Reproductive system {Genital system}:**external female genital organs are the vulva (the labia, clitoris, and vaginal opening). The internal organs .are the ovaries, fallopian tubes, uterus and vagina

The external male genital organs are the testes and penis, while the .internal are the epididymis, ductus deferens and accessory glands

Integumentary system: The integumentary system is the set of organs .11 that forms the external covering of the body. It includes the skin, skin .appendages, sweat glands and sensory receptors

Histology

.is the science of the microscopic structure of cells, tissues and organs

- **Cells and tissues**

A cell is the smallest functional unit of an organism. All cells of the human body are organized into cytoplasm, , nucleus, organelles and Cell membrane

The cytoplasm contains specialized subunits called organelles which work like 'little organs'. Organelles can be membranous (mitochondria, Golgi apparatus, endoplasmic reticulum) or non-membranous (ribosomes, (nucleolus, centrioles

The nucleus is considered to be the brain of the cell. It houses information about each and every structure and process of the cell and organism, in the form of DNA (deoxyribonucleic acid). DNA is condensed and coiled up .into chromosomes

All cells are enveloped by a semipermeable two-layered membrane,. Kind of like border police, it controls everything that comes in or out of the .cell

Tissue is a unity of cells with a similar structure that as a whole express a .definite and unique function

Cells come together with extracellular matrix (a jelly-like fluid) to form the four types of tissues found in the human body: epithelial, .connective,muscle and nervous

Tissues join together in different arrangements to form our body organs. .Organs work together in systems

A. Epithelial tissue

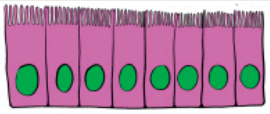
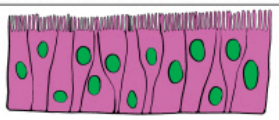
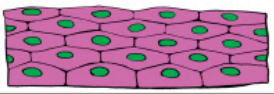
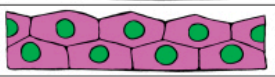
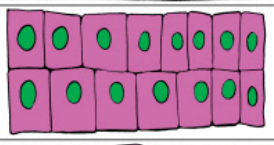
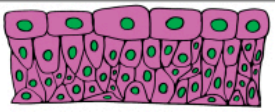
cover external surfaces (skin), line the inside of hollow organs (intestines) or form glands. . It is a selective barrier that protects tissues and is often involved in absorption or secretion. A basement membrane separates an epithelium from the underlying connective tissue.

Epithelia are classified based on three criteria:

Number of cell layers (simple or compound)

Shape of surface cells (squamous, cuboidal or columnar)

1. Simple Squamous Epithelium: Simple squamous epithelium consists of a single layer of flattened cells. The thinness of these cells facilitates the transfer of materials (e.g., gases, fluids or nutrients) across the epithelium.
2. Simple Cuboidal Epithelium: Simple cuboidal epithelium consists of a single layer of cuboidal cells. This epithelium is often associated with absorption, secretion, or excretion of waste matter.
3. Simple Columnar Epithelium: Simple columnar epithelium consists of a single layer of cells that are taller than they are wide. This epithelium is often associated with absorption or secretion.
4. Pseudostratified Columnar Epithelium: appears to be stratified because the nuclei of the epithelial cells are at different levels. However, every cell is in contact with the basement membrane, but not all cells reach the lumen.
5. Stratified squamous epithelium: has multiple layers of cells becoming flattened as they move from the basal layer to the apical layers. It provides protection from abrasion and is keratinized on the external surface of the bod.
6. Stratified cuboidal epithelium: has multiple layers of cells with an outermost layer of cuboidal cells. Limited distribution - found in the lining of larger ducts.
7. Stratified columnar epithelium is a rare type of epithelial tissue composed of column-shaped cells arranged in multiple layers.
8. Transitional epithelium (urothelium) is adapted for extensibility and is restricted to the urinary tract. It has multiple layers of cells with an outermost layer of much larger, dome-shaped cells (umbrella cells) that change shape during contraction and distention.

Epithelial Cells		Location	Function
Simple squamous		Lungs, lining of heart, blood vessels, lymphatic vessels	Semi-permeable. Secretes lubricating substance
Simple cuboidal		Ducts, secretory portions of glands in kidneys	Secretes, absorbs
Simple columnar		Ciliated: bronchi, uterine tubes, uterus Smooth: digestive tract, bladder	Absorbs. Secretes mucous and enzymes
Pseudostratified columnar		Lining of trachea, upper respiratory tract	Secretes mucus; cilia move mucus
Stratified squamous		Lining of esophagus, mouth, vagina	Protection from abrasion
Stratified cuboidal		Sweat glands, salivary glands, mammary glands	Protective tissue
Stratified columnar		Male urethra, glandular ducts	Secretes, protects
Transitional		Lining of bladder, urethra, ureters	Expansion and stretch of organs

Connective tissue B.

Connective tissue connects, separates and supports the body organs. It consists of a few cells and an abundance of extracellular matrix. The ECM contains different protein fibers (collagen, reticular, elastic) embedded in .ground substance

:Example of connective tissue cells

Fibroblasts produce and maintain the extracellular matrix. They are the .most common cell type in connective tissue

:*Adipocytes* There are two types of adipose tissue

White fat - long-term storage of energy

(Brown fat - generation of heat (thermogenesis

Macrophages are phagocytic cells that engulf and digest microbes and .foreign substances

Mast cells release molecules that dilate blood vessels and recruit more .immune cells to a site of mast cell activation

TRANSIENT CELLS : Transient cells are leukocytes (white blood cells) that circulate in the bloodstream and migrate into connective tissue at sites of an immune response. These include neutrophils, eosinophils, .basophils, lymphocytes, and monocytes

Plasma cells are mature B lymphocytes that produce large quantities of antibodies. They are abundant wherever antigens may enter the body, .such as the gastrointestinal tract and the respiratory system

Eosinophils are involved in many inflammatory processes, including parasitic infections and allergic diseases

C. Nervous tissue

Nervous tissue constitutes the primary building block of the nervous .system. Comprising of neurons and glial cells and extracellular matrix

nervous tissue is designed for the rapid transmission of electrical impulses. Neurons are specialized cells that contain a body (soma) and one or more processes (dendrites, axons). Based on the number of processes, neurons are classified into multipolar, bipolar and unipolar. Neuronal processes form connections (synapses) with each other and with other cell types to exchange electrical signals. Glial cells, such as astrocytes, oligodendrocytes, Schwann cells and others, provide support, .nourishment, myelination and protection to neurons

D. Muscle tissue

Muscle tissue maintains synthesis and contractile functions. It is categorised as skeletal or smooth. Based on their functional properties, these are described as either voluntary (skeletal) or involuntary (cardiac and smooth muscle). Despite their differences, they all have one thing in common; specialized elongated muscle cells, called muscle fibers. These cells contain contractile filaments (myofibrils) called actin (thin) and myosin (thick). Under light microscopy, skeletal and cardiac muscles appear striated due to the parallel arrangement of their contractile filaments into repeating units called sarcomeres. Smooth muscle tissue appears non-striated because of the less orderly arrangement of their filaments. these features give muscles the ability to contract and perform various functions, such as movement of the extremities (skeletal muscle), peristalsis of the gastrointestinal tract (smooth muscle) and beating of the (heart (cardiac muscle

- Cartilage and bone

specialized connective tissues that provide support to other tissues and organs. Cartilage occurs where flexibility is required, while bone resists deformation.

1. Crtilage is composed of cells, fibers, and a highly-hydrated ground substance. The fibers provide tensile strength.

Three types of cartilage are recognized based on differences in fiber composition:

Hyaline cartilage - type II collagen

Elastic cartilage - elastic fibers and type II collagen

Fibrocartilage - type I and II collagens

Cartilage is avascular and its cells depend on diffusion for nutrients. Because of this, damaged cartilage heals poorly after injury.

Hyaline cartilage contains type II collagen fibers and a highly-hydrated ground substance. It is the most common cartilage and is found on articular surfaces of bone, walls of the respiratory system (trachea and bronchi), and epiphyseal plates.

Elastic cartilage is similar to hyaline cartilage but also contains elastic fibers. It occurs where flexibility is required, such as the external ear, and auditory tubes.

Fibrocartilage contains a mixture of hyaline cartilage and dense regular connective tissue. It combines the tensile strength of collagen fibers with the resistance to compression of cartilage. It is found where tendons attach to bones such intervertebral discs.

2. Bone provides support and protection for the organs of the body. It is hard and rigid because of mineralization of the extracellular matrix. Bone also serves as a reservoir for calcium.
(Bone has a rich vascular supply (unlike cartilage

Bone tissue is classified morphologically into two types:

Spongy bone and Compact bone

Most bones are composed of both compact and spongy bone.

Spongy bone forms a network of anastomosing trabecula (spicules) that form interconnecting spaces containing bone marrow.

Compact bone forms a dense layer on the outside of bones. It is composed of cylindrical units, known as osteon (Haversian systems).

- Circulatory system
  1. Arteries:
  . Large or Elastic Artery and Medium sized or Muscular Artery
  2. Arterioles
  3. Capillaries: Continuous capillary, Fenestrated capillary and Sinusoidal
  4. Venules
  5. Veins: Medium sized Vein and Large Vein

All blood vessels except capillaries composed of (from inner to outer):

Tunica Intima

Tunica Media

Tunica Adventitia

- Lymphatic system

Lymphoid tissue, cells and organs that make up the lymphatic system, such as white blood cells (leukocytes), bone marrow, and the thymus, spleen, and lymph nodes.

Lymphoid tissue has several different structural organizations related to its particular function in the immune response. The most highly organized lymphoid tissues are in the thymus and lymph nodes, which are well-defined encapsulated organs with easily identifiable architectures. In the spleen the lymphoid tissue is a cylinder of loosely organized cells surrounding small arteries. In the bone marrow this tissue is mixed with the blood-forming cells, and no organization is apparent.

The most common cell type in the lymphoid tissue is the lymphocyte. Like macrophages, lymphocytes are formed from stem cells in the bone marrow and then circulated in the blood to the lymphoid tissue. T lymphocytes mature in the thymus before proceeding to the other lymphoid organs, such as the spleen. B lymphocytes mature in the bone marrow and proceed directly to the lymphoid organs. Both kinds play a key role in immune responses to infectious microorganisms.

- the integumentary system

The integumentary system includes: Skin,Hair ,Nails,Exocrine glands , Sensory nerves

Skin

The skin is the largest and heaviest organ of the body.There are two layers of the skin. The epidermis: The outer layer of the skin that makes up its strong protective covering. The dermis: Located under the epidermis; most of the structures of the skin are located in the dermis (such as various types of glands and hair follicles).

The fatty layer of the skin is a layer of subcutaneous (under the skin) tissue, also known as the hypodermis.

Glands

A. Sweat glands are hollow, cylindrical structures under the skin; they excrete sweat via very small openings at the skin's surface. The purpose of sudoriferous glands is to help cool the body off when the body temperature rises.

B. Sebaceous glands: Very small tubular-shaped glands, located in the dermis, which are responsible for releasing oil into the hair follicle to help protect the hair shaft, keeping it from becoming hard and brittle.

C. Ceruminous glands: Located in the ear canal, its function along with sebaceous glands to produce ear wax .

D. Mammary glands: There are two mammary glands located one at each side of the front of the chest wall. People of all sexes have mammary glands, but in males, these glands are underdeveloped. In females, the glands function to produce breast milk after giving birth.

Hair

Hair is primarily comprised of a fibrous protein and contains a very small amount of lipids (fats) and water. Hair comes from follicles at the derms.