بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

ANATOMY

وَلَقَدْ خَلَقْنَا الْإِنسَانَ وَنَعْلَمُ مَا تُوَسْوِسُ بِهِ نَفْسُهُ ۖ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

Final | Lecture 3

Skeletal Muscles Pt.2

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Introduction to Anatomy

1st Year Medical Students

2025-2026
Second Semester

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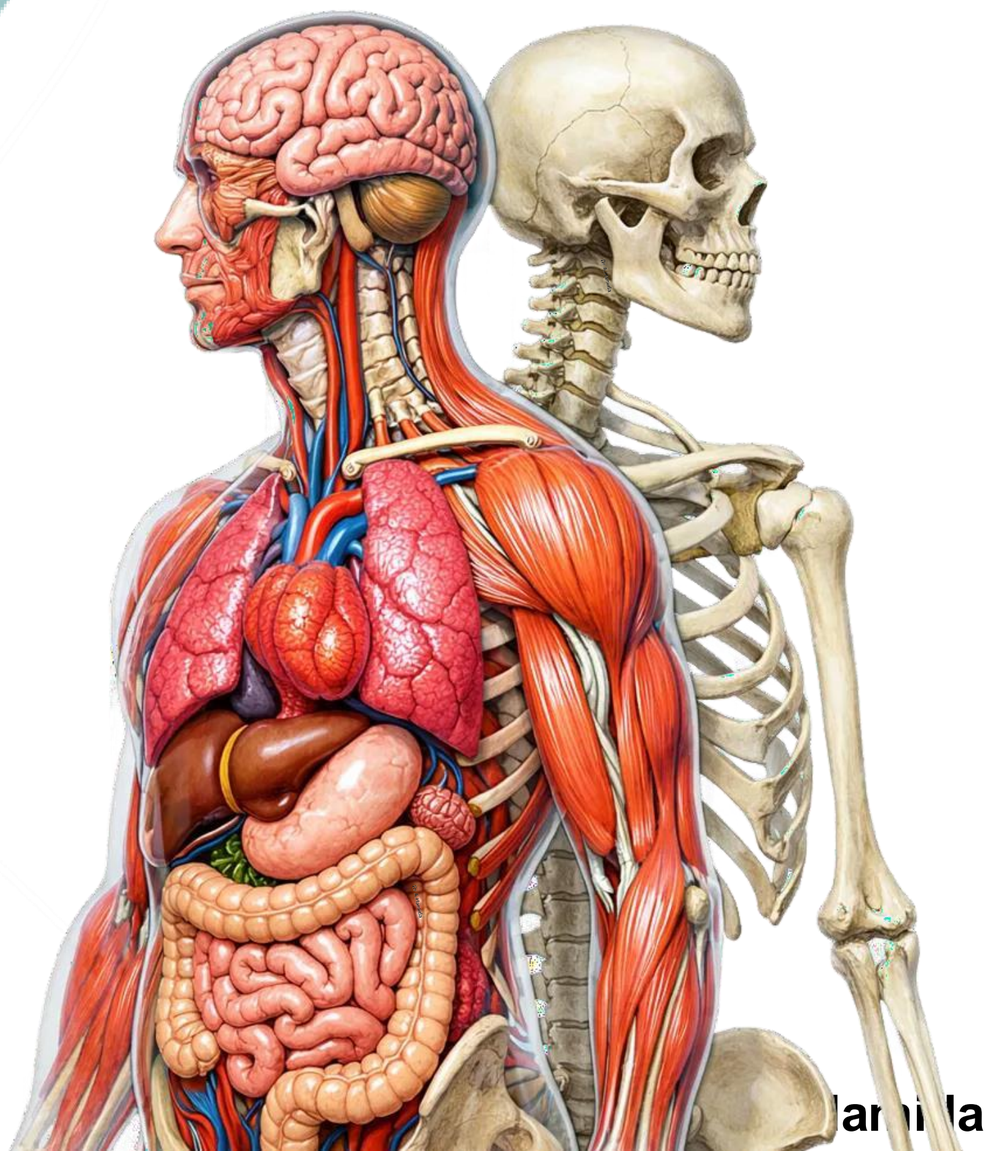


6

Gross lecture 12

Skeletal Muscles-2

Dr A.Hamida

Dr A.Hamida

6 Skeletal Muscles-2

Gross lecture 12

Lecture Outline:

6.5 Muscles of the Upper Limb

6.6 Muscles of the Lower Limb

When studying skeletal muscles, there are two main approaches:
1. Regional (Anatomical) Study
In this method, muscles are studied according to their location in the body.
For example: Muscles of the arm , muscles of the forearm , muscles of the hand

Muscles can also be subdivided into compartments within each region, such as: Anterior compartment of the arm , posterior compartment of the forearm
This approach focuses mainly on where the muscles are located anatomically.

2. Functional Study
In this method, muscles are studied according to the joint they act on and the movements they produce.
For example: Muscles acting on the shoulder joint , Muscles acting on the elbow joint , Muscles acting on the wrist joint
These can be further subdivided based on specific actions, such as:
Muscles responsible for flexion of the shoulder joint
Muscles responsible for extension of the elbow joint
Muscles responsible for flexion of the wrist joint

This approach focuses on:
Which joint the muscle crosses
What action/movement it produces

In this lecture, we will use the functional approach.

Muscles of the Upper Limb

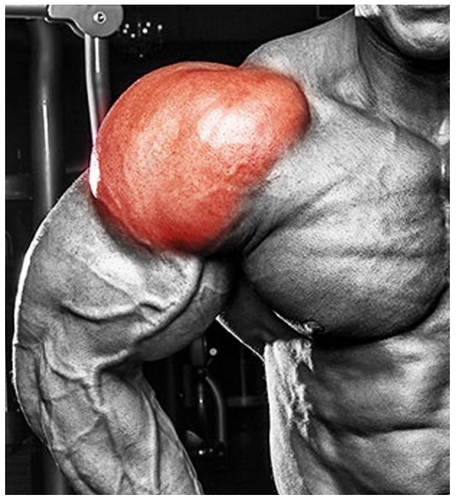
❖ Muscles Acting on the Shoulder Joint

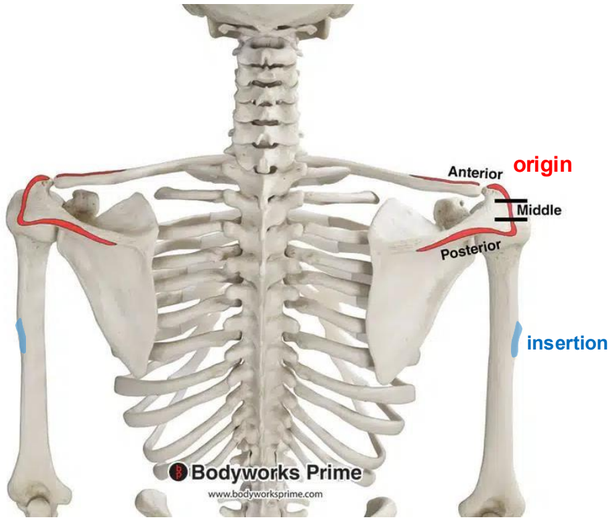
The deltoid muscle has a broad origin with three parts, which is why it is divided into three groups of fibers.
The deltoid originates from: Lateral one-third of the clavicle , acromion of the scapula , spine of the scapula
The muscle starts anteriorly from the lateral part of the clavicle , since the lateral end of the clavicle articulates with the acromion of the scapula, the muscle fibers continue over the acromion and extend posteriorly to the spine of the scapula.
So, the deltoid forms a curved or rounded muscle that wraps around the shoulder:
Starts from the clavicle anteriorly ,Continues over the acromion ,Extends to the spine of the scapula posteriorly

1. Deltoid

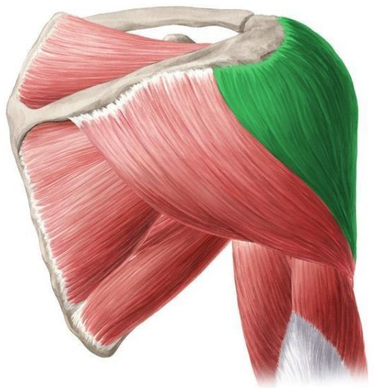
Origin	• Lateral third of clavicle and spine of scapula
Insertion	• Deltoid Tuberosity on the lateral aspect of the midshaft of the humerus — It has one insertion
Action	• Anterior fibers: flexion of the arm — Originate from the lateral one-third of the clavicle • Middle fibers: abduction of the arm — Originate from the acromion of the scapula • Posterior fibers: extension of the arm — Originate from the spine of the scapula

This muscle has three actions : flexion , abduction , extension

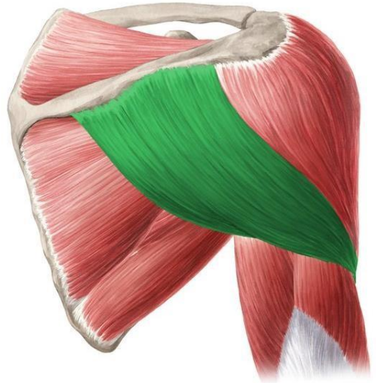




Anterior fibers



Middle fibers



Posterior fibers

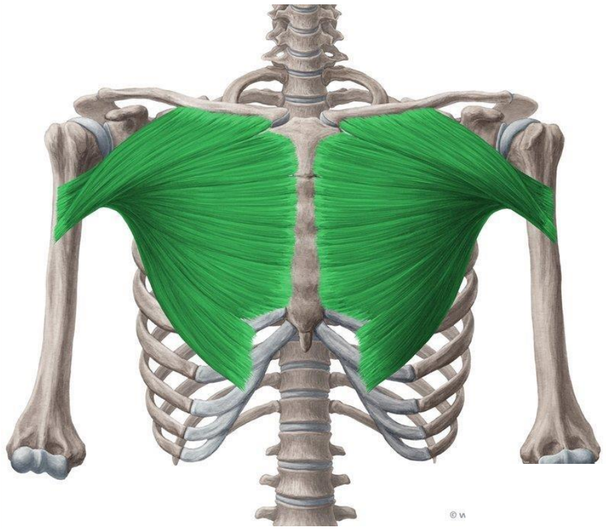
Muscles of the Upper Limb

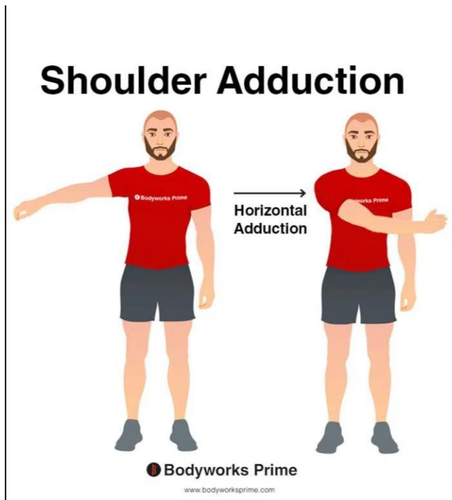
❖ Muscles Acting on the Shoulder Joint

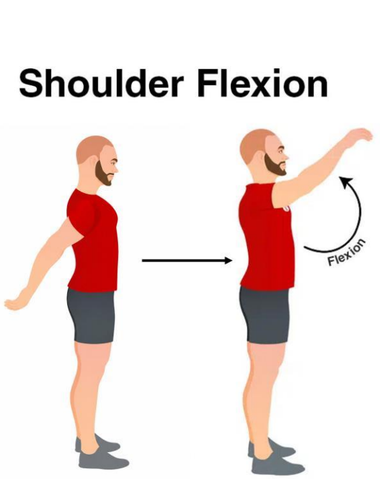
2. Pectoralis major

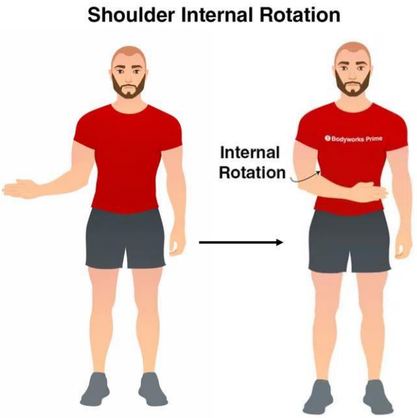
Origin	• Clavicular part: anterior surface of medial half of clavicle • Sternocostal part: anterior surface of sternum and Costal cartilages of ribs 1-6
Insertion	• Lateral lip of intertubercular sulcus (bicipital groove) of humerus
Action	• Adduction, medial rotation, and flexion of the arm

The upper fibers, which arise from the clavicle, produce flexion of the shoulder joint, while the middle fibers mainly produce adduction with medial rotation of the arm.





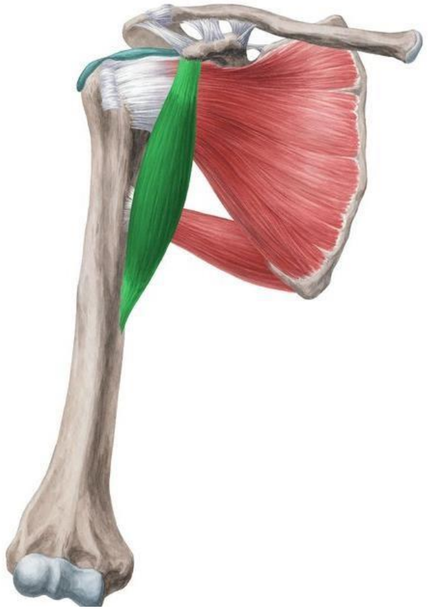




Muscles of the Upper Limb

❖ Muscles Acting on the Shoulder Joint

3. Coracobrachialis	
Origin	• **Coracoid process of scapula** — Coracoid process of the scapula: finger like process
Insertion	• **Shaft of humerus** — Brachial region (Arm) , anterior shaft of humerus
Action	• **Flexion of the arm**



Muscles of the Upper Limb

The scapula has a glenoid cavity on its lateral side, where the head of the humerus articulates. Around this cavity: Supraglenoid tubercle is located on the upper border and infraglenoid tubercle is located on the lower border

Gross lecture 12

❖ Muscles Acting on the Elbow Joint

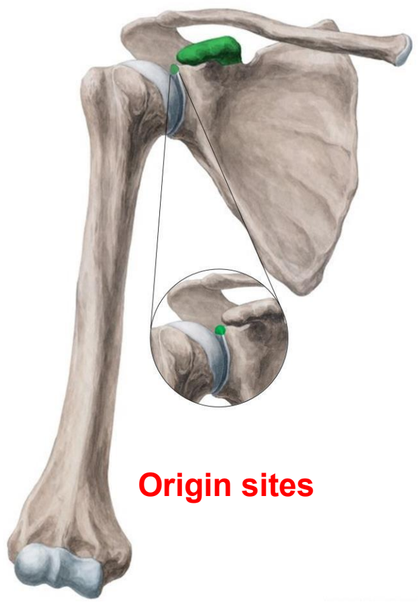
1. Biceps brachii

Two Heads Arm

Origin	• Two heads – Long head: supraglenoid tubercle of scapula – Short head: coracoid process of scapula
Insertion	• Radial tuberosity of radius
Action	• Flexion of the forearm at the elbow joint.

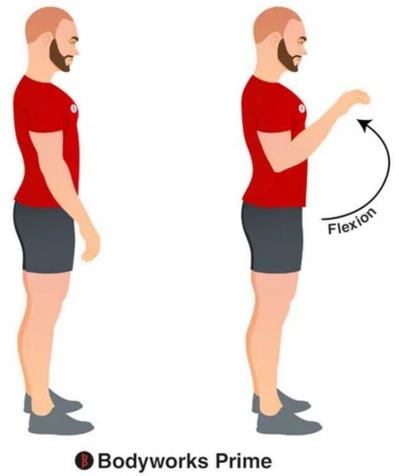
The long head is called long because it originates from a more proximal location and travels a longer distance than the short head.

The long head originates from the supraglenoid tubercle of the scapula. After arising from this point, its tendon passes through the intertubercular groove of the humerus, also called the bicipital groove because the tendon of the long head runs through it.
The short head originates from: Coracoid process of the scapula.
After both heads arise from their origins, they descend and unite to form a single muscle belly
Then, the muscle crosses the elbow joint and inserts into radial tuberosity on the anterior aspect of the radius.



Origin sites

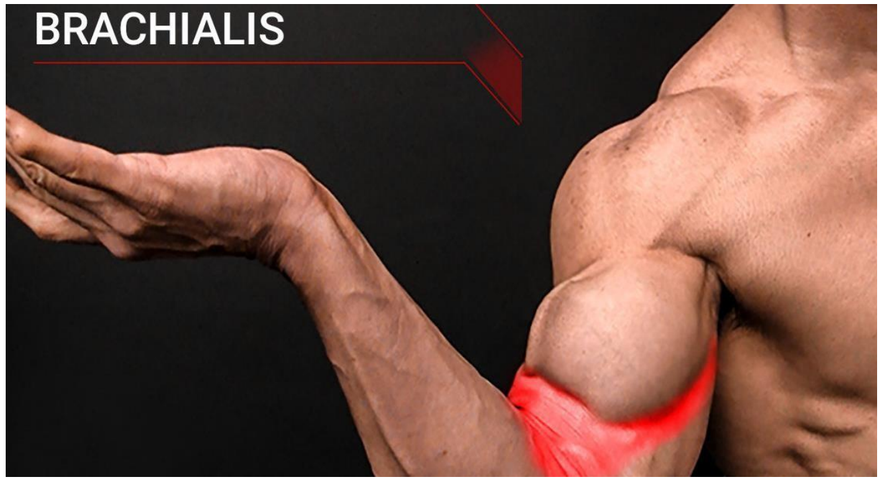
Insertion site



Muscles of the Upper Limb

❖ Muscles Acting on the Elbow Joint

2. Brachialis	
Origin	• Anterior surface of the lower half of humerus
Insertion	• Coronoid process of the ulna
Action	• Flexion of the forearm



Muscles of the Upper Limb

There are no muscles responsible for adduction or abduction at the elbow joint because the elbow joint is a hinge joint, which only allows: Flexion and extension.

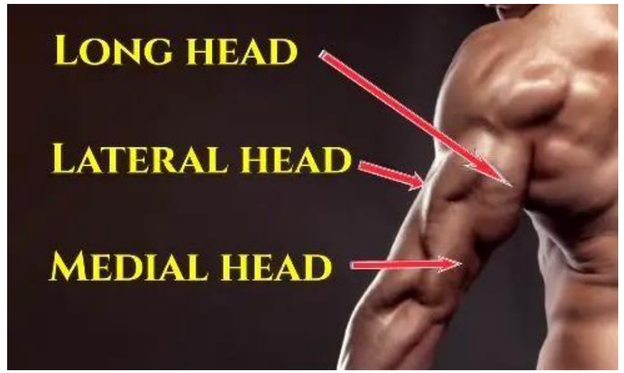
Gross lecture 12

❖ Muscles Acting on the Elbow Joint

3. Triceps brachii

Three heads — Arm

Origin	• Three heads – Long head: infraglenoid tubercle of scapula – Lateral head: posterior surface of shaft of humerus – Medial head: posterior surface of shaft of humerus
Insertion	• Olecranon process of ulna
Action	• Extension of the forearm




Posterior view


Long head


Lateral head


Medial head

Posterior view

6.5

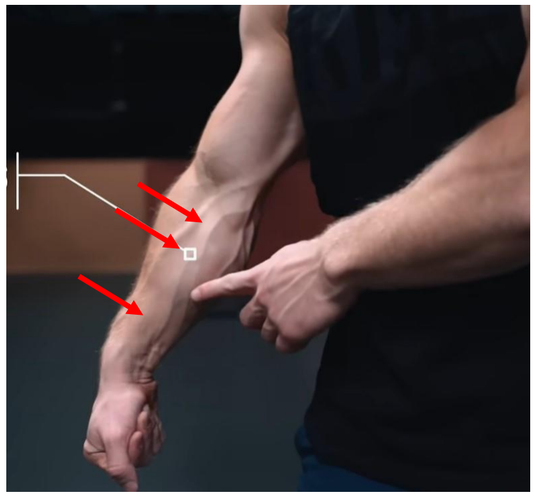
Muscles of the Upper Limb

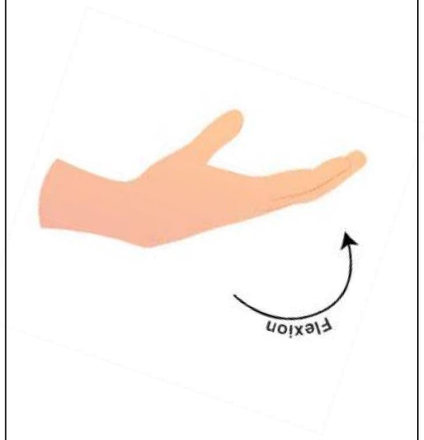
Muscles in the anterior compartment of the forearm that across the wrist joint and make insertion in the hand anteriorly.
The number of muscles in this group around 8 to 10 muscles

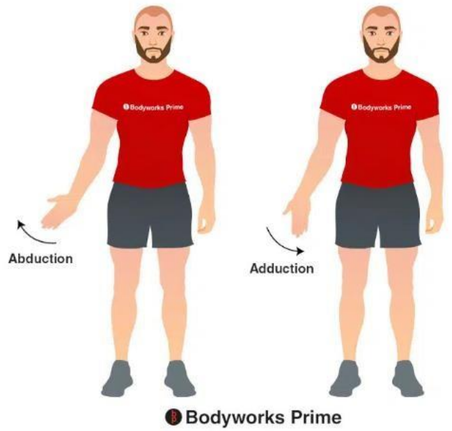
❖ Muscles Acting on the Wrist Joint

Flexor Group (Anterior Compartment of the forearm)	
Common Origin	• **Medial epicondyle of humerus (common flexor tendon)**
General Insertion	Bones : carbals, metacarbals and phalanges • **Bones of the hand anteriorly**
Action	• **Flexion of the wrist** • **Assistance in wrist adduction and abduction.**

Adduction (ulnar deviation): done by the muscles in the medial side
Abduction (radial deviation): done by the muscles in the lateral side







6.5

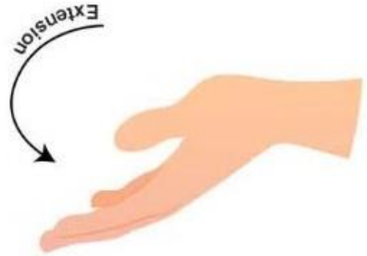
Muscles of the Upper Limb

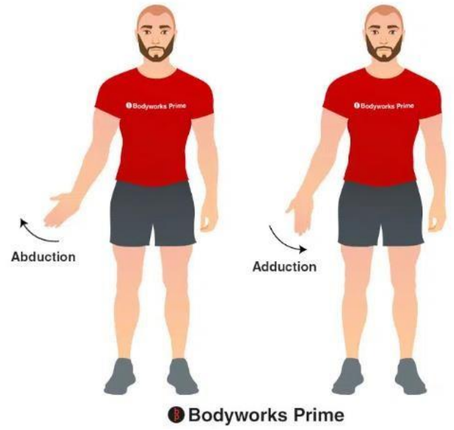
Muscles in the posterior compartment of the forearm that across the wrist joint and make insertion in the hand posteriorly.
The number of muscles in this group around 8 to 10 muscles

❖ Muscles Acting on the Wrist Joint

Extensor Group (Posterior Compartment of the forearm)	
Common Origin	• Lateral epicondyle of humerus (common extensor tendon)
General Insertion	Bones : carbals, metacarbals and phalanges • Bones of the hand posteriorly
Action	• Extension of the wrist • Assistance in wrist adduction and abduction.

Adduction (ulnar deviation): done by the muscles in the medial side
Abduction (radial deviation): done by the muscles in the lateral side





Muscles of the Upper Limb

The movements of pronation and supination occur at: Proximal radioulnar joint and distal radioulnar joint.
These are pivot joints that allow rotation of the radius around the ulna.

Gross lecture 12

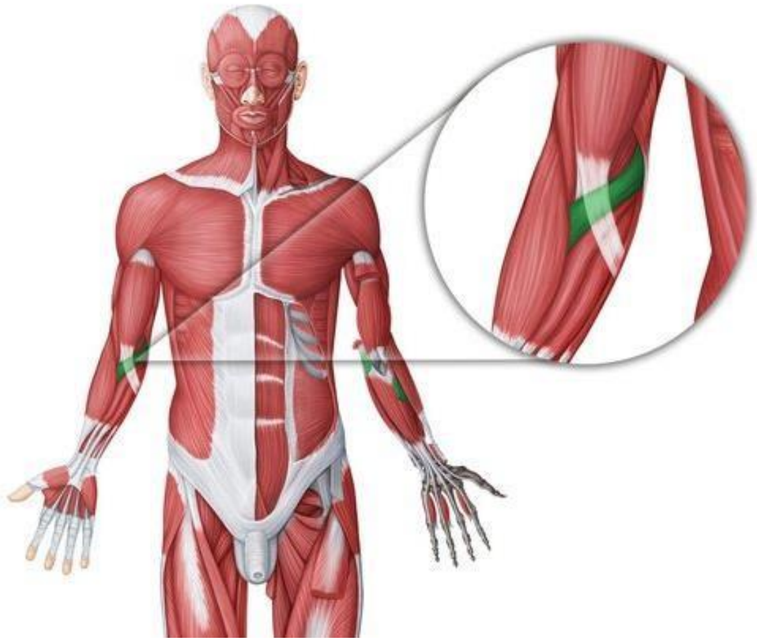
❖ Muscles Acting on the Radioulnar Joints - Pronation Muscles

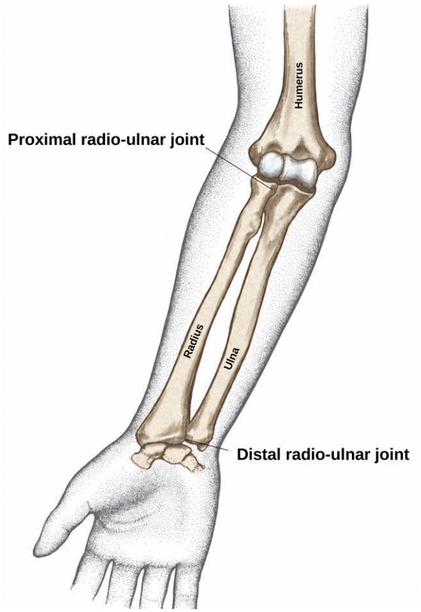
1. Pronator teres

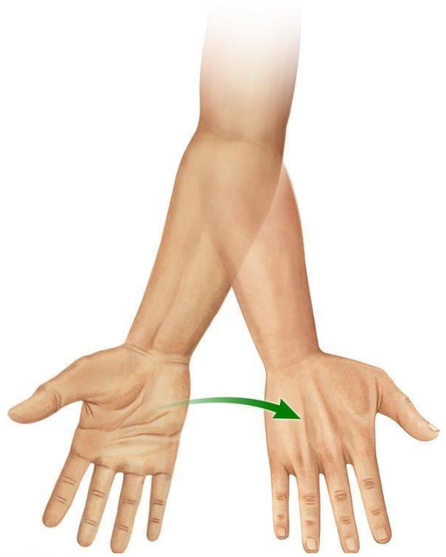
a round/cylindrical shaped

Origin	• Humeral head: medial epicondyle of humerus • Ulnar head: coronoid process of ulna
Insertion	• Lateral aspect of shaft of radius
Action	• Pronation of the forearm at the radioulnar joint.

For pronation, there are two main muscles involved. One of them is Pronator teres, which is located in the proximal part of the forearm.
The pronator teres runs in an oblique direction: From the medial side toward the lateral side.
Because of this oblique orientation, when the muscle contracts, it pulls the forearm medially and produces an internal rotation, resulting in pronation of the forearm.
The pronator teres has two origins:
Medial epicondyle of the humerus and Coronoid process (ulnar head)







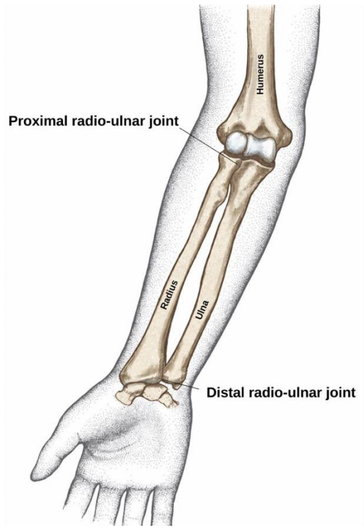
Muscles of the Upper Limb

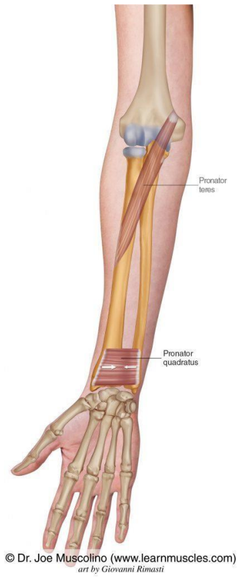
❖ Muscles Acting on the Radioulnar Joints - Pronation Muscles

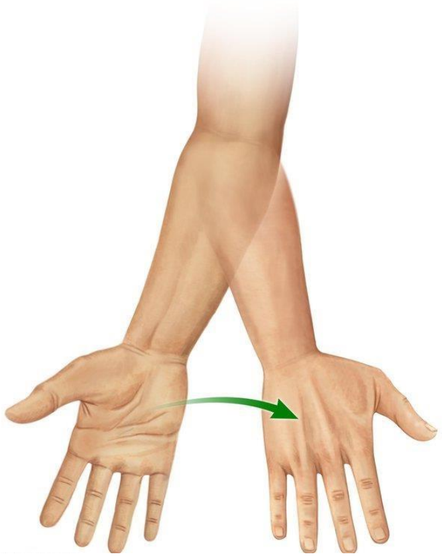
2. Pronator quadratus — Square shaped

Origin	• **Distal anterior surface of ulna**
Insertion	• **Distal anterior surface of radius**
Action	• **Pronation of the forearm at the radioulnar joint.**

The Pronator quadratus is located distally in the forearm, on the anterior aspect near the wrist.
It is called quadratus because it has a quadrangular (square) shape.
The muscle extends horizontally:
From the distal anterior shaft of the ulna to the distal anterior shaft of the radius.
Since it connects the ulna and radius at their distal parts, when the muscle contracts, it pulls the radius over the ulna, producing Pronation of the forearm







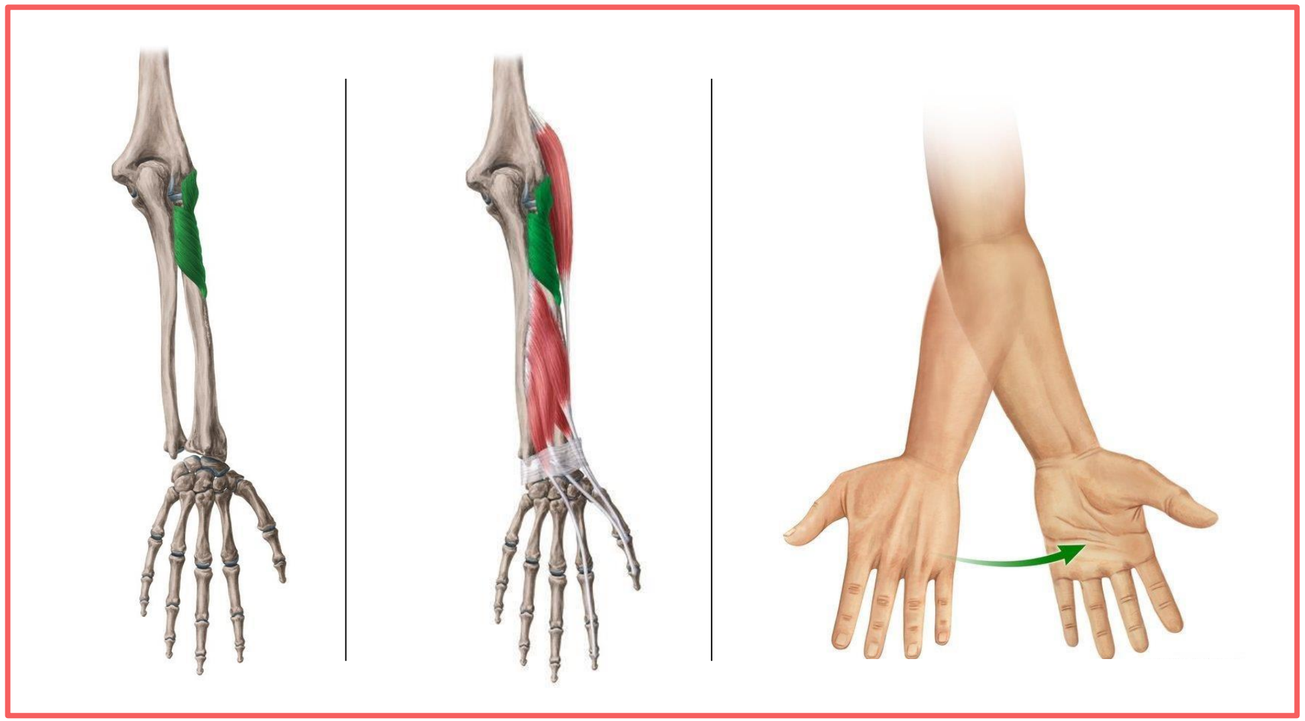
Muscles of the Upper Limb

❖ Muscles Acting on the Radioulnar Joints - Supination Muscle

1. Supinator Muscle

Origin	• **Lateral epicondyle of humerus**
Insertion	• **Neck and shaft of radius**
Action	• **Supination of forearm**

The Supinator muscle acts as the main muscle for supination of the forearm (hence the name).
It works in the opposite direction of the pronator muscles. While pronator muscles run from medial → lateral, the supinator runs from lateral → medial.
The muscle originates from the lateral epicondyle of the humerus from there, its fibers wrap around the proximal radius and attach to the neck and upper part of the shaft of the radius.
When the supinator contracts, it rotates the radius laterally, turning the hand into the supinated position (palm facing upward/anteriorly).



Muscles of the Lower Limb

Hip joint: Head of the femur + acetabulum of the hip bone
- It can do: Flexion/Extension/Adduction/Abduction/ Medial and Lateral Rotation/Circumduction

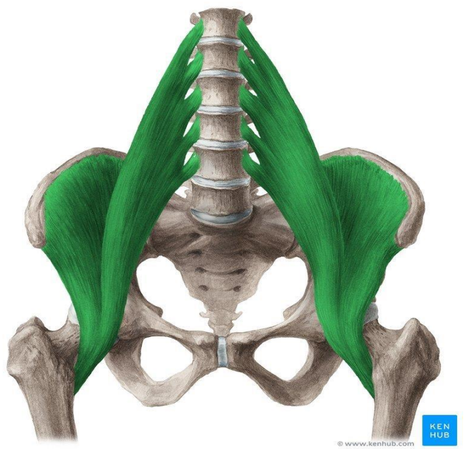
Gross lecture T2

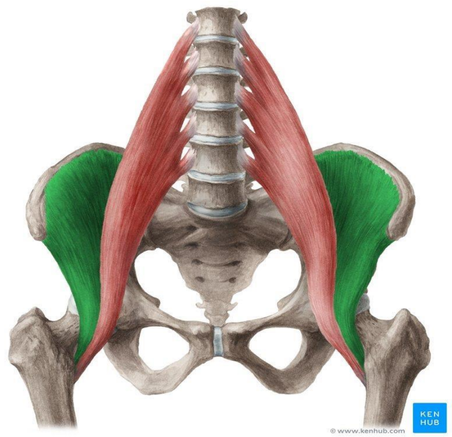
❖ Muscles Acting on the Hip Joint

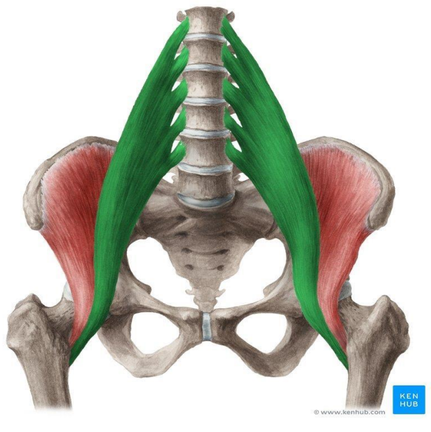
1. Iliopsoas (Iliacus muscle and Psoas muscle)

Origin	• **Iliacus: iliac fossa of hip bone** • **Psoas: T12 and L1 to L5 vertebrae** From the posterior abdominal wall /From the body of all lumbar vertebrae+T12
Insertion	• **Lesser trochanter of femur** Femur consists of head, neck and 2 trochanters(greater and lesser).
Action	• **Flexion of the thigh at the hip joint**

The psoas muscle originates from the vertebral bodies of all lumber vertebrae [L1-L5] + T12 . It descend toward the pelvis , where it unite with the iliacus muscle to form the iliopsoas tendon ,that inserts into the lesser trochanter of the femur .







Remember
Hip bone:
- Ilium
- Ischium
- Pubis

Ilium has 2 surfaces (lateral and medial).
The medial surface consists of the iliac fossa (anteriorly) and the surface (posteriorly) that articulate with the sacrum to make the sacroiliac joint, separated by the medial border, which contains the arcuate line.

Muscles of the Lower Limb

Gluteal region:
- Gluteus maximus
- Gluteus medius
- Gluteus minimus

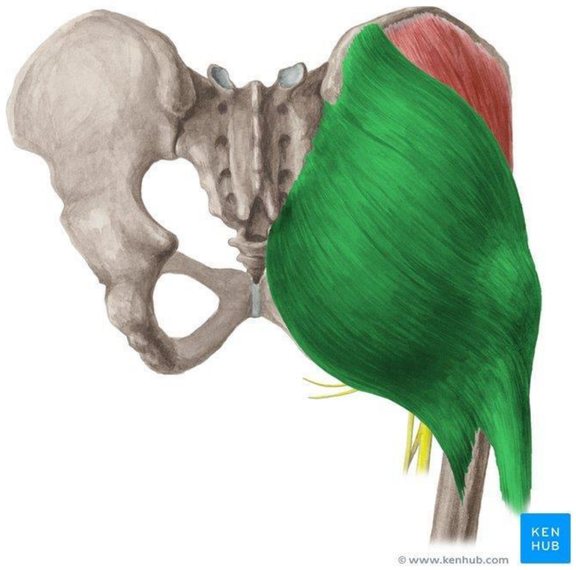
→ From the lateral surface of the hip bone

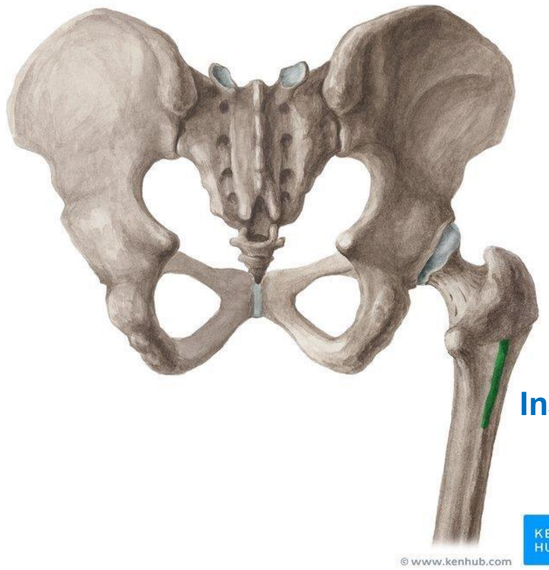
❖ Muscles Acting on the Hip Joint

2. Gluteus maximus

Origin	• **Outer surface of ilium, sacrum, and coccyx**
Insertion	• **Gluteal tuberosity of femur** Posteriorly
Action	• **Extension of the thigh at the hip joint**

The **Linea aspera** is a rough ridge on the posterior part of the femur (shaft) that splits at the top into the **gluteal tuberosity** going toward the greater trochanter and **pectineal line** going toward the lesser trochanter, and at the bottom into two **supracondylar lines**(medial and lateral).



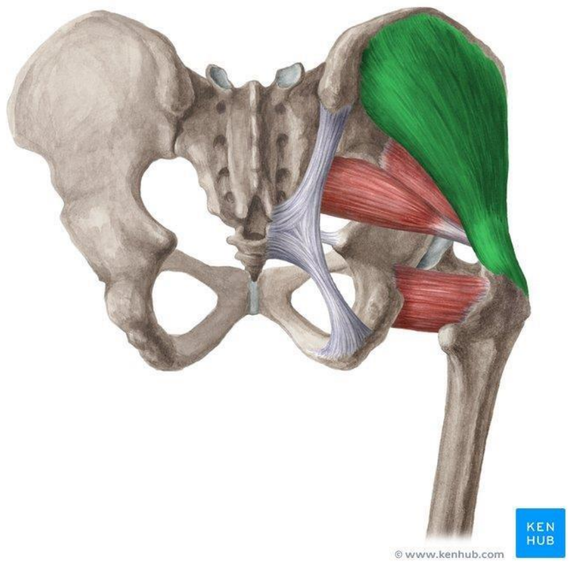


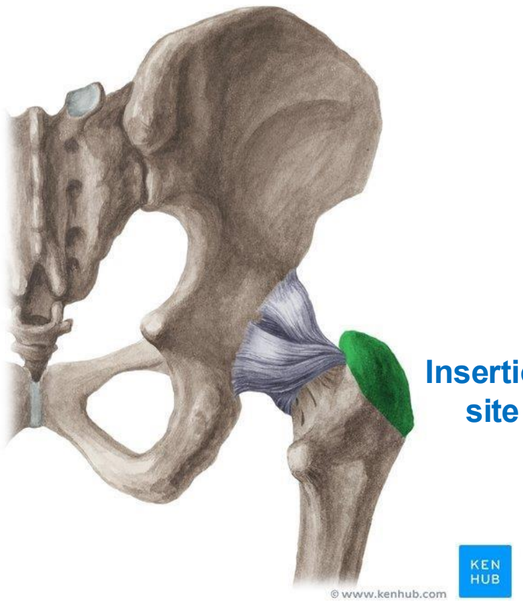
Muscles of the Lower Limb

Outer surface of hip bone= lateral surface

❖ Muscles Acting on the Hip Joint

2. Gluteus medius	
Origin	• **Outer surface of ilium**
Insertion	• **Lateral surface of greater trochanter of femur.**
Action	• **Abduction of the thigh**





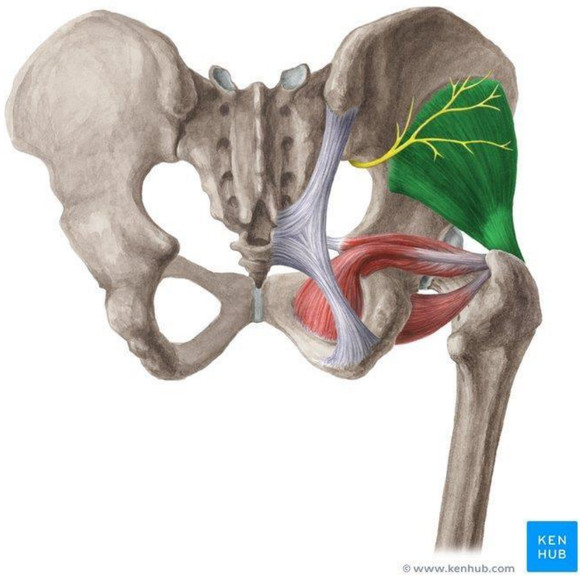
Away from the midline.

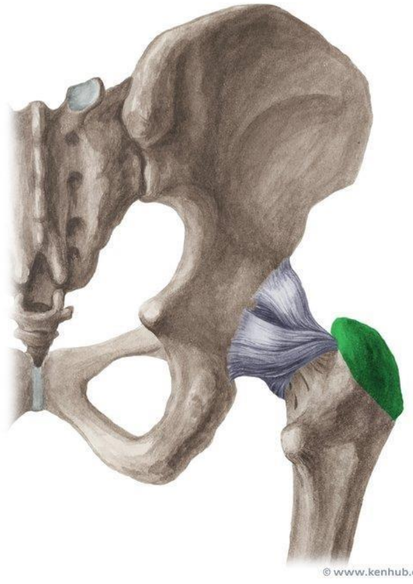
Hip Abduction

Muscles of the Lower Limb

❖ Muscles Acting on the Hip Joint

3. Gluteus minimus	
Origin	• **Outer surface of ilium**
Insertion	• **Anterior surface of greater trochanter of femur.**
Action	• **Abduction of the thigh** Same as the gluteus medius





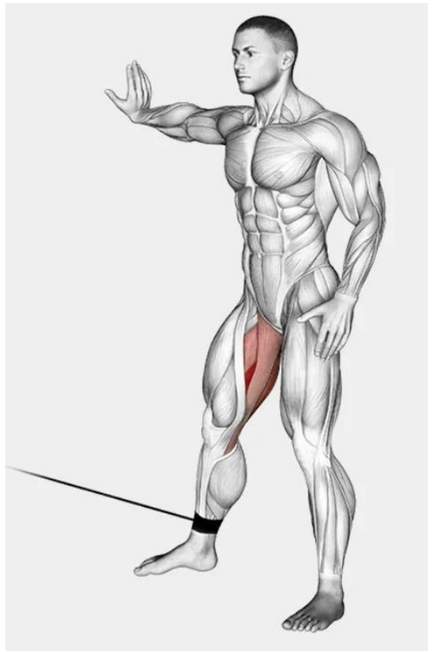
Away from the midline.

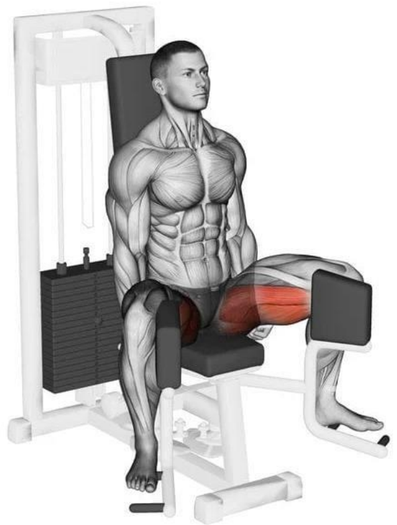
Hip Abduction

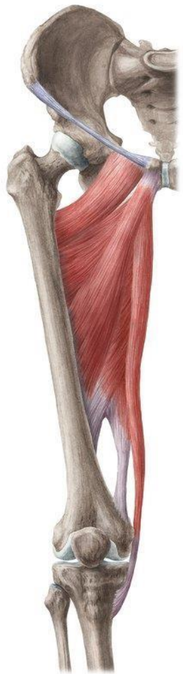
Muscles of the Lower Limb

❖ Muscles Acting on the Hip Joint

4. Adductor muscles of the thigh:	Group of 5 muscles found in the medial compartment of the thigh.
Origin	• **Pubis and ischium**
Insertion	• **Posterior surface of shaft of femur (linea aspera)**
Action	• **Adduction of the thigh**







Muscles of the Lower Limb

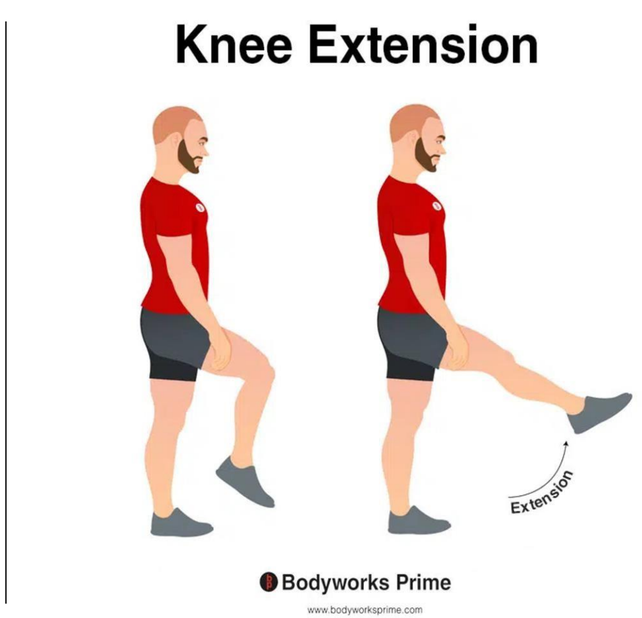
Quadriceps femoris does not cross the knee joint.

❖ Muscles Acting on the knee Joint

1. Quadriceps femoris	
Origin	• Four heads: one from ilium (AIIS) and three from proximal end of the femur
Insertion	• Patella then via ligamentum patellae into Tibial tuberosity
Action	• Extension of the leg at the knee joint

Tibial tuberosity is on the anterior surface of the tibia.

The four muscle heads converge into a single quadriceps tendon at the distal thigh. This tendon then wraps around the patella (acting as a sesamoid bone) and continues downward as the ligamentum patellae to anchor into the tibial tuberosity of the tibia



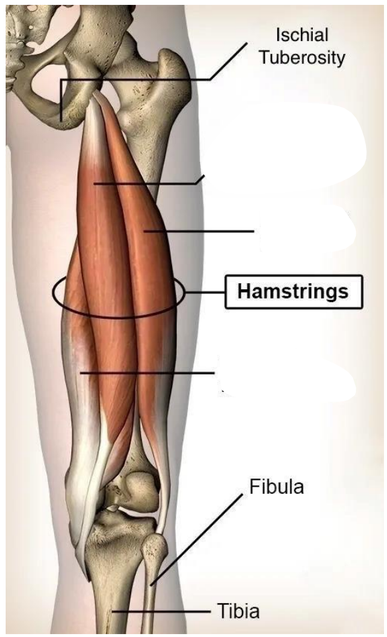
Muscles of the Lower Limb

❖ Muscles Acting on the knee Joint

2. Hamstrings muscles (3 muscles) Posteriorly	
Origin	• Ischial tuberosity of the hip bone
Insertion	• Proximal end of tibia and fibula Posteriorly
Action	• Flexion of the leg at the knee joint

When the knee is flexed you can do internal rotation.

Knee joint is modified hinge.



6.5

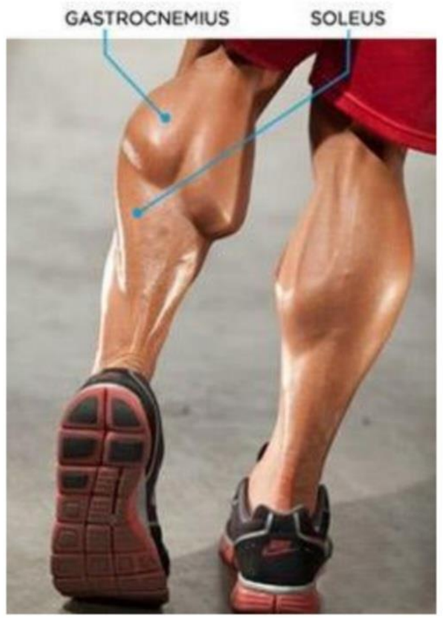
Muscles of the Lower Limb

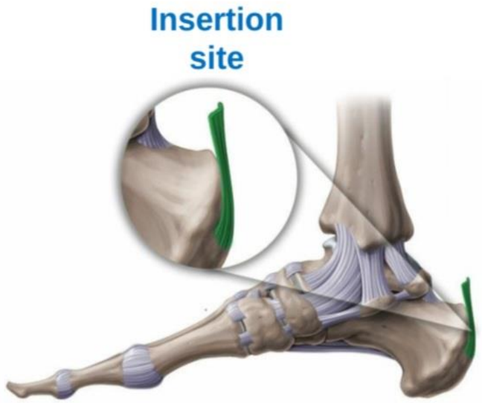
❖ Muscles Acting on the Ankle Joint

The muscle **passes the knee joint** posteriorly to form the calf, then descends to **pass the ankle joint** via the Achilles tendon, finally reaching its destination at the **calcaneus**.

Plantarflexors Muscles (Posterior Compartment of the leg) 1. Gasrtocnemius	
Origin	• **Posterior surface of distal femur (medial and lateral condyles)**
Insertion	• **Calcaneus via the Achilles tendon**
Action	• **Plantarflexion of the foot at the ankle joint** Like standing on your toes.

NBA (basketball) players are highly susceptible to **Achilles tendon** injuries because they are always jumping.



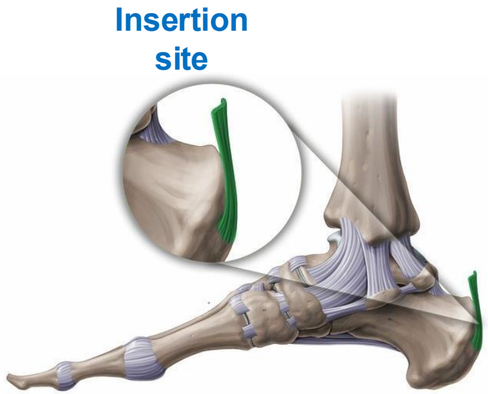


Muscles of the Lower Limb

It's under gastrocnemius and It originates from the surface of the tibia
It joins the gastrocnemius directly through the common tendon known as the Achilles tendon

❖ Muscles Acting on the Ankle Joint

Plantarflexors Muscles (Posterior Compartment of the leg) 2. Soleus	
Origin	• **Posterior surfaces of tibia and fibula**
Insertion	• **Calcaneus via the Achilles tendon**
Action	• **Plantarflexion of the foot at the ankle joint**



6.5

Muscles of the Lower Limb

❖ Muscles Acting on the Ankle Joint

Now instead of plantar flexion, we're talking about dorsiflexion. When you stand on your heels like this, the main muscles involved are the anterior compartment muscles of the leg, especially the tibialis anterior. As the name suggests, it originates from the tibia, then passes across the ankle joint into the bones of the foot. So when the muscle contracts and pulls, it produces dorsiflexion of the foot

Dorsiflexors Muscles (Anterior Compartment of the leg)
1. Tibialis anterior

Origin	• **Lateral condyle and superior anterior surface of tibia**
Insertion	• **Foot bones**
Action	• **Dorsiflexion of the foot at the ankle joint.**

If We want to produce flexion at the hip joint, the main muscle responsible is the iliopsoas muscle, which pulls the thigh forward.
For extension, the main muscle involved is the gluteus Maximus, which pulls the thigh backward.
For abduction, meaning movement away from the midline, the main muscles are the gluteus medius and gluteus minimums.
For adduction, we use the adductor muscles: adductor longus, adductor brevis, adductor magnus, gracilis, and pectineus. These muscles are located in the medial compartment of the thigh, so when they contract and pull medially, they bring the thigh toward the midline, producing adduction

For flexion of the knee joint, the main muscles involved are the hamstrings.
For extension of the knee joint, we use the quadriceps femoris muscle group.
For anterior flexion of the ankle joint, which is dorsiflexion, the main muscle is the tibialis anterior.
For plantar flexion, or dorsal extension of the foot downward, the main muscles are the gastrocnemius and soleus, which together form the calf muscle

Skeletal Muscles-2

Gross lecture 12

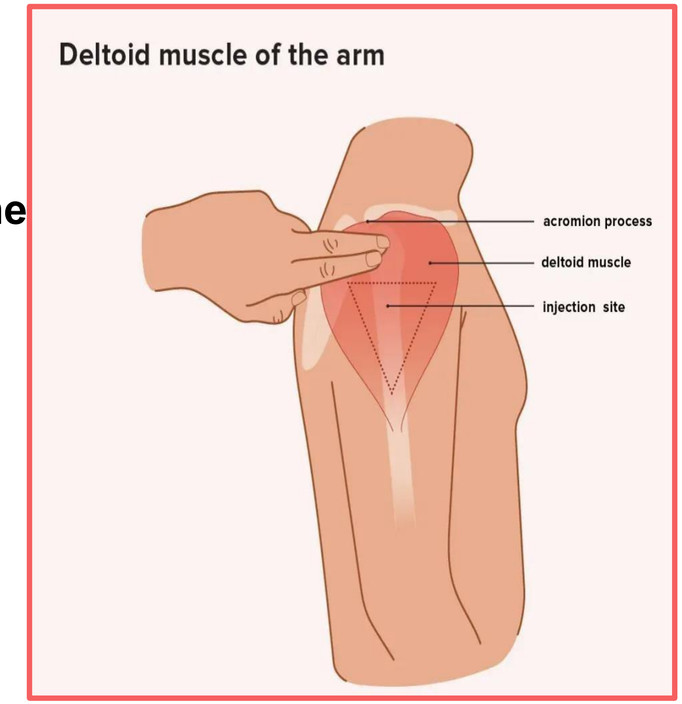
❖ Clinical Notes

➢ Intramuscular Injection (IM)

- **IM injections deliver medications deep into muscle tissue, allowing for steady absorption.**
- **Proper site selection, and appropriate needle length are essential to minimize complications such as nerve injury, or hematoma formation.**
- **Safe sites:**

1. Deltoid Muscle:

- **The injection is administered in the thickest central portion of the deltoid, approximately 2.5–5 cm below the acromion process.**
- **This site is commonly used for vaccinations and small-volume medications (≤2 mL) due to its accessibility and good absorption rate.**



Regarding the previous slide

Usually when we administer a drug, it might be in the form of a fluid. We can either give it intravenously (IV), meaning directly into the vein. From there, it enters the venous circulation, goes to the heart, and then the heart distributes it rapidly throughout the body.

Or, we can inject it directly into the muscle itself, which is called an intramuscular (IM) injection.

So what's the difference between the two routes? Which one is faster? Obviously the IV route, because the drug enters the blood directly. We mainly use the IV route when we want rapid absorption and rapid distribution of the drug.

However, not all drugs are safe to distribute that quickly. At the end of the day, most medications are chemically toxic substances to some degree. Some drugs, if given IV and sent immediately to the heart and circulation, may cause toxic reactions or unwanted side effects because they spread too fast.

That's why in some cases we use intramuscular injection instead. When the drug is injected into the muscle, its absorption is slower and more controlled. The drug gets absorbed gradually through the capillaries at a steady rate, then enters the circulation, goes to the heart, and is distributed more slowly and steadily throughout the body.

Of course, we cannot inject into just any muscle. Since the needle is a sharp instrument, injecting into the wrong place can injure blood vessels or nerves. So we must choose a safe area with a thick muscle and without major nerves or vessels underneath it. Thick muscles are also preferred because the injection is less painful.

For now, you only need to know two important IM injection sites. The first is the deltoid region. The deltoid muscle is thick, but not thick enough for large volumes of drugs. That's why vaccines, like the COVID vaccine, are commonly given there since they require small volumes. The safe area is in the middle or lateral fibers coming from the acromion. Place your finger on the acromion process, then place two fingers below it ,this is considered the safe injection area. If the injection is given too high, the axillary nerve may be injured.

Skeletal Muscles-2

❖ Clinical Notes

➢ Intramuscular Injection (IM)

- **Safe sites:**

2. Gluteal Region:

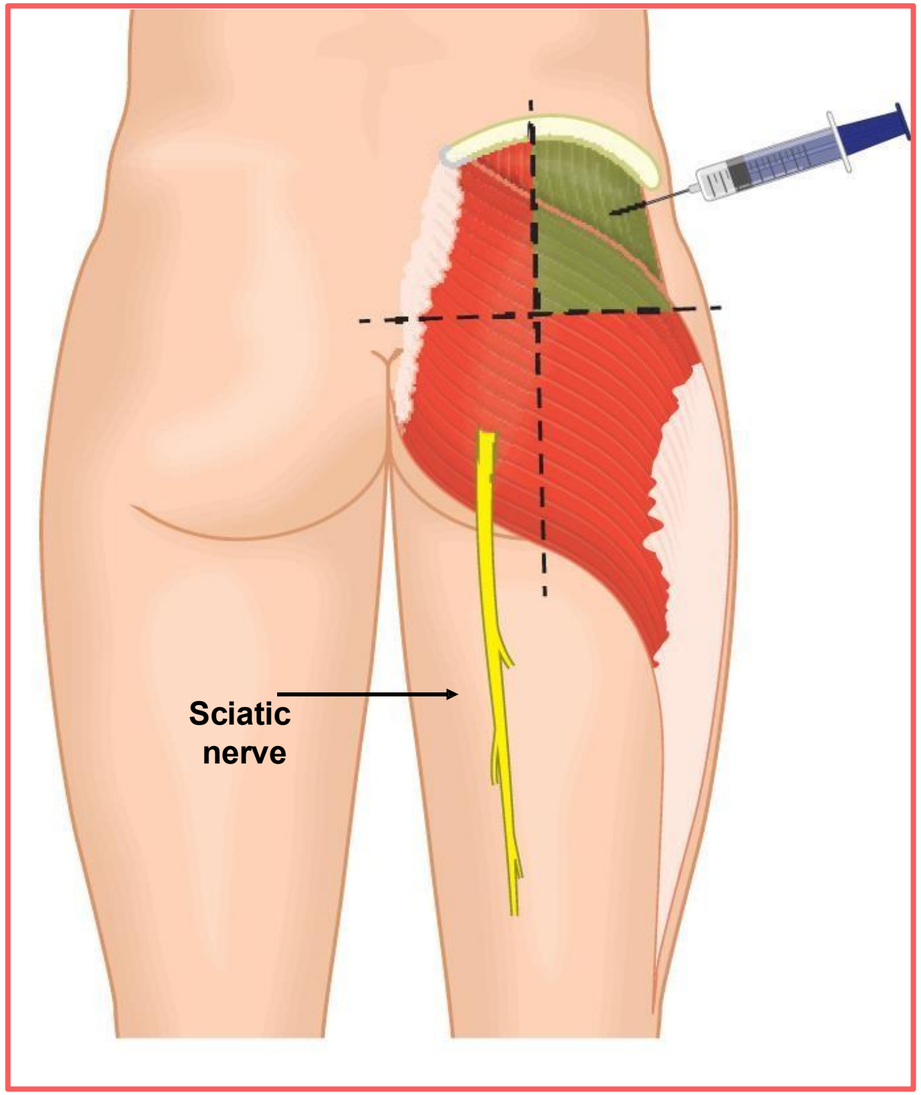
- **The injection is given in the upper outer quadrant of the buttock.**

- **To locate this area, the buttock is visually divided into four quadrants by drawing an imaginary horizontal line through the highest point of the gluteal cleft and a vertical line through the midpoint of the buttock.**

- **The upper outer quadrant is selected because it provides a large muscle mass suitable for larger-volume injections and reduces the risk of injury to the sciatic nerve and major blood vessels.**

The second and most commonly used site is the gluteal region because the gluteus maximus and gluteus medius are very thick muscles. The gluteal region is divided into four quadrants, and the injection is given in the upper lateral quadrant. This area is considered safe and can handle larger drug volumes, around 5–10mL injected slowly. It also avoids major nerves and arteries.

In contrast, the lower medial quadrant contains the sciatic nerve, which is a very large nerve , almost two fingers thick ,so injecting there can cause serious nerve injury



Test yourself by this quiz

https://forms.gle/gXSmY3Yaoyc2q4HM6

رسالة من الفريق العلمي:

الشيطان يمنعكَ عَنِ المحاولة دائمًا، ويبذل جهده؛ ليجعل اليأس يتملككَ!

تذكر قوله تعالى:
﴿لَا يُكَلِّفُ اللَّهُ نَفْسًا إِلَّا وُسْعَهَا﴾.

لم تُكلف فوق طاقتكَ كما تقول؛ إنَّ اللَّه يعلمكَ أكثر من نفسكَ، ولو علم سبحانه أنَّ الأمور الَّتي على عاتقكَ فوق طاقتكَ ما كلفكَ بها؛ إنَّ اللَّه رحيم؛ فقُمْ وحاولْ مرةً أُخرى؛ إنَّ الأُمةَ بحاجتك.

لو كُنت وحدكَ لهَانت؛ لكنها أُمَّة يا فتى!

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			