

Chapter 6

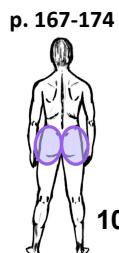
Muscles That Move the Lower Extremity

(excerpt)

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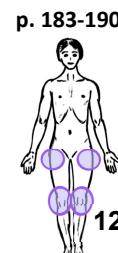
Group 10 – Hip Joint (Part 1)

Gluteus maximus
Gluteus medius
Gluteus minimus
Piriformis (1st lateral rotator)
The other 5 lateral rotators
 Gemellus superior
 Obturator internus
 Gemellus inferior
 Obturator externus
 Quadratus femoris
Iliopsoas
 (Iliacus & Psoas major)



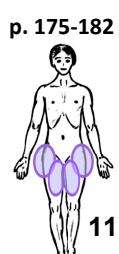
Group 12 – Knee (& Hip Joint, Part 3)

Rectus femoris
Vastus lateralis
Vastus intermedius
Vastus medialis
Biceps femoris
Semitendinosus
Semimembranosus
Popliteus



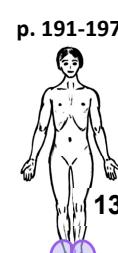
Group 11 – Hip Joint (Part 2)

Sartorius
Tensor fascia latae
Pectenaeus
Adductor brevis
Adductor longus
Adductor magnus
Gracilis



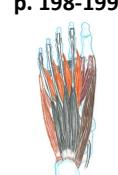
Group 13 – Ankle, Foot, Toes

Gastrocnemius
Plantaris
Soleus
Tibialis posterior
Flexor digitorum longus
Flexor hallucis longus
Fibularis longus (peroneus)
Fibularis brevis (peroneus)
Tibialis anterior
Extensor digitorum longus
Extensor hallucis longus



Bonus Group

Intrinsic Muscles
of the Foot



Introduction

The **lower extremity** is the lower-body portion of the appendicular skeleton (see page 37), and includes the hip bone, thigh, leg, and foot. The sacroiliac joints, where the hip bones articulate with the sacrum, are the joints connecting the lower extremities to the trunk.

This chapter describes the muscles that move the various joints within the lower extremity. The muscles are separated into four functional groups, with some overlap of function between groups for muscles that cross multiple joints:

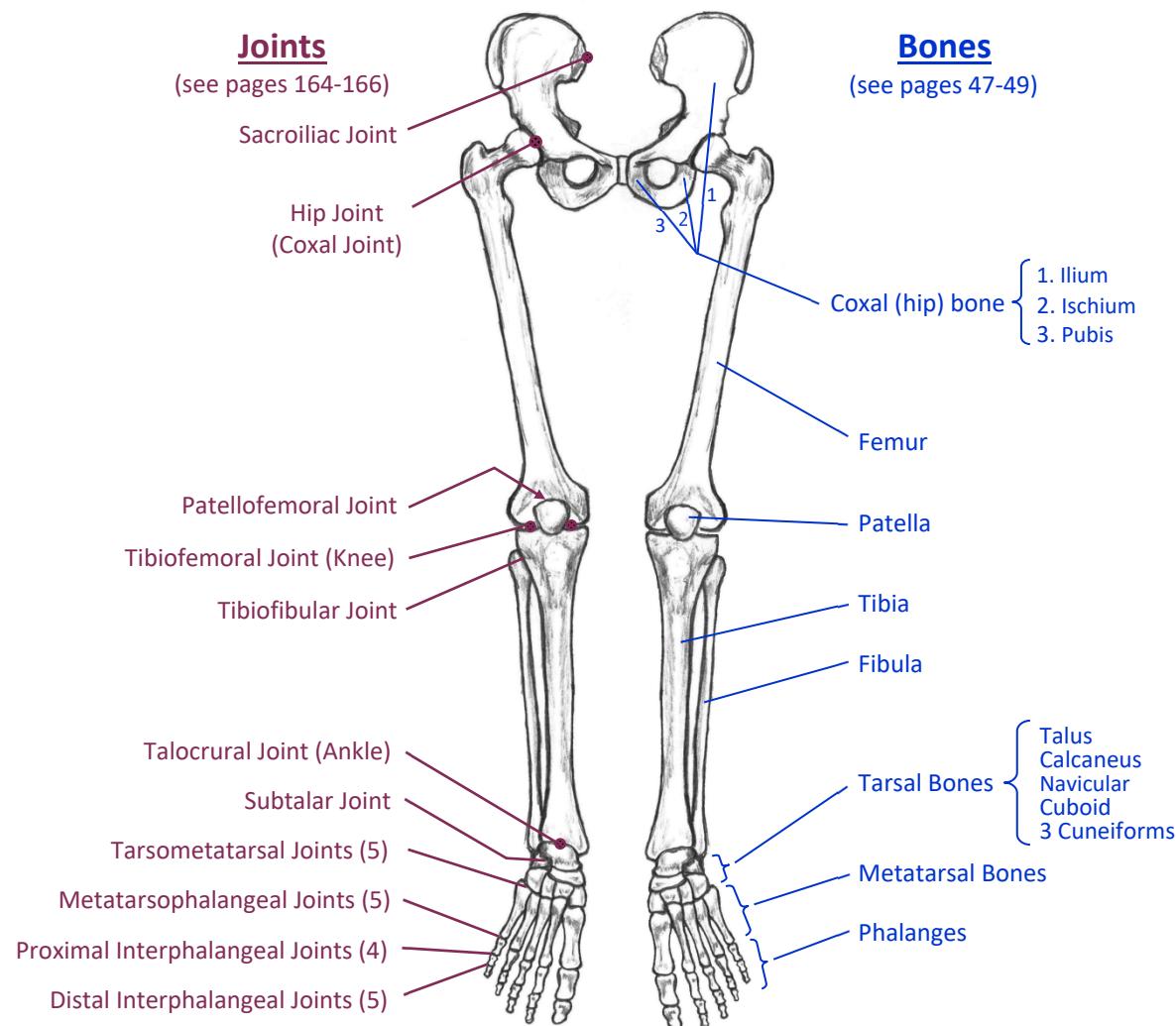
Group 10: Movement of the hip – part 1, which are the “shorter” muscles that move the femur at the hip joint

Group 11: Movement of the hip – part 2, which are the “longer” muscles that move the femur at the hip joint

Group 12: Movement of the knee (which includes multiple-joint muscles that also move the femur at the hip)

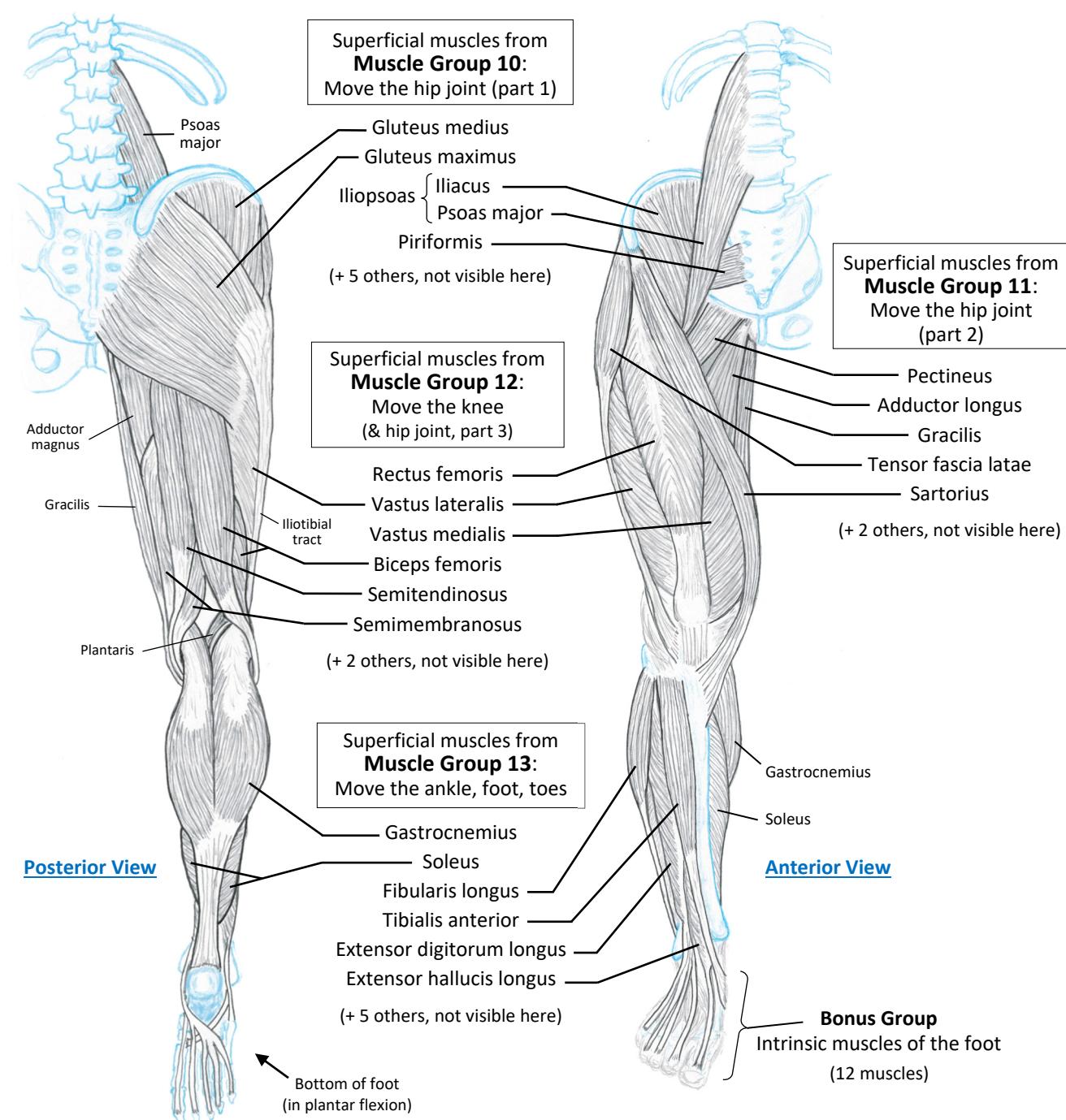
Group 13: Movement of the ankle, foot, and toes

At the end of the chapter, a bonus muscle group presents the intrinsic muscles of the foot.



Overview of Muscles

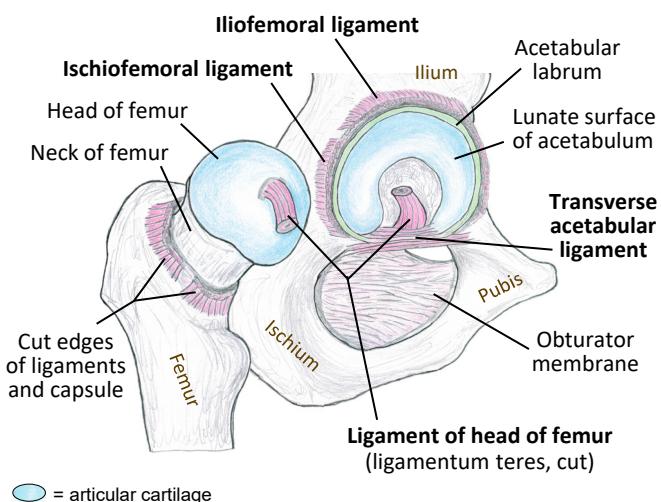
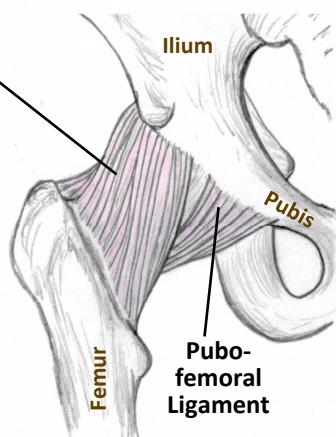
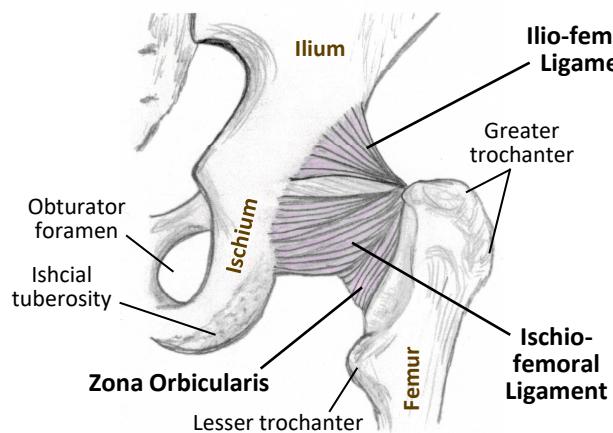
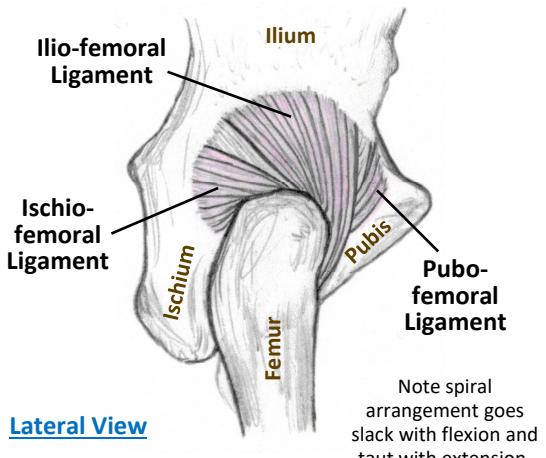
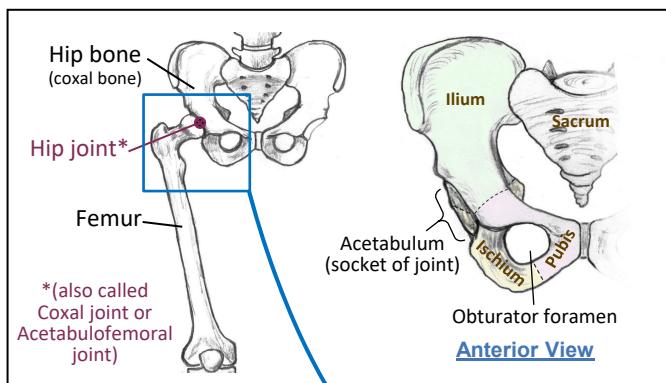
The illustration below shows posterior and anterior views of the superficial muscles from groups 10-13. This gives an idea about the overall organization of muscles involved with moving the lower extremity. Note that only muscles that have superficial exposure can be seen. There are also many other muscles at deeper layers that are hidden beneath the superficial muscles.



Joint Details and Ligaments

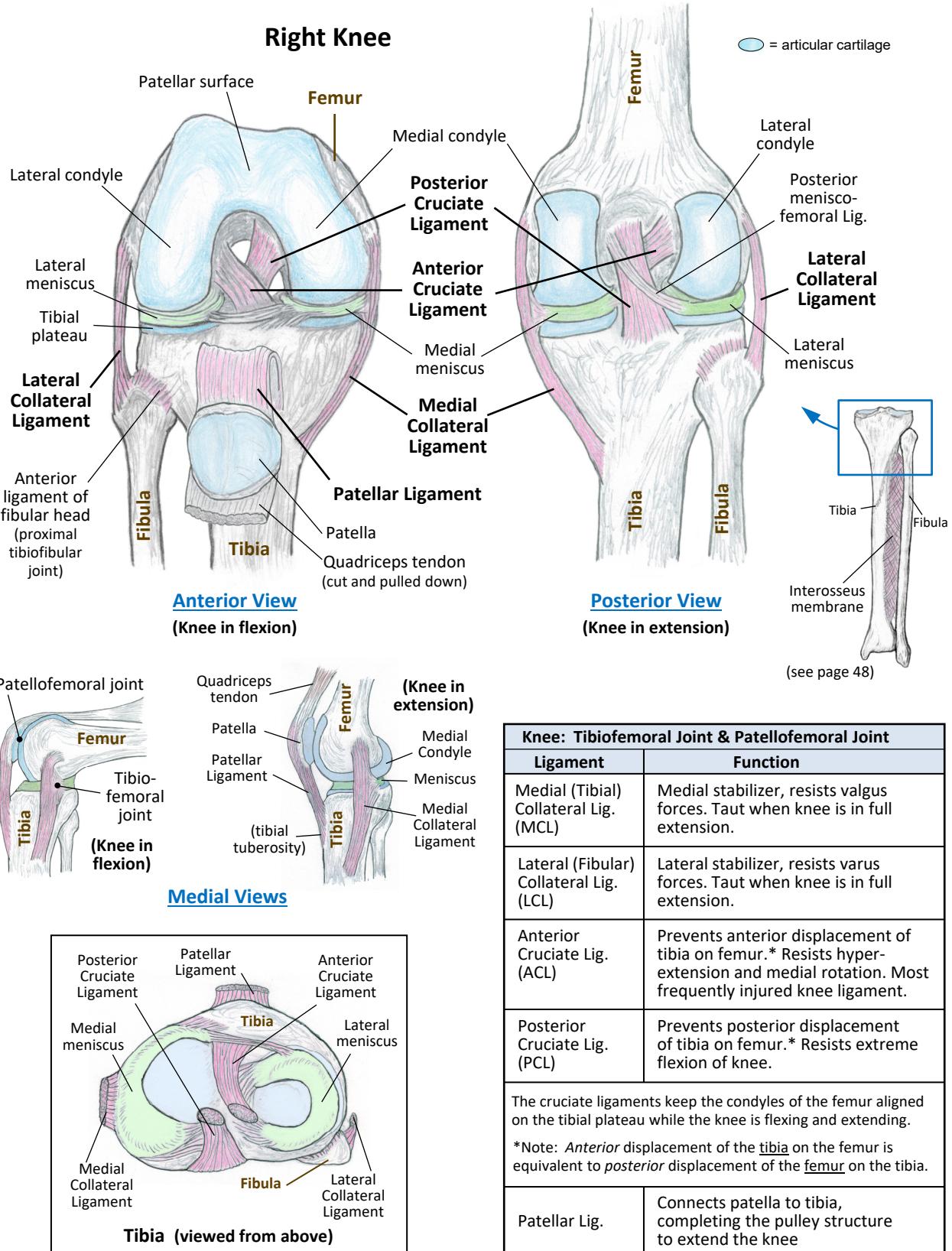
The joints of the lower extremity begin proximally with the sacroiliac joint, which is the connection of the lower extremity to the sacrum of the axial skeleton. Progressing distally, there are numerous joints at the hip, knee, ankle, and foot. The details and ligaments of these joints are described on the following three pages. Also, see page 126 for ligaments of the pelvis.

Hip – Joints and Ligaments

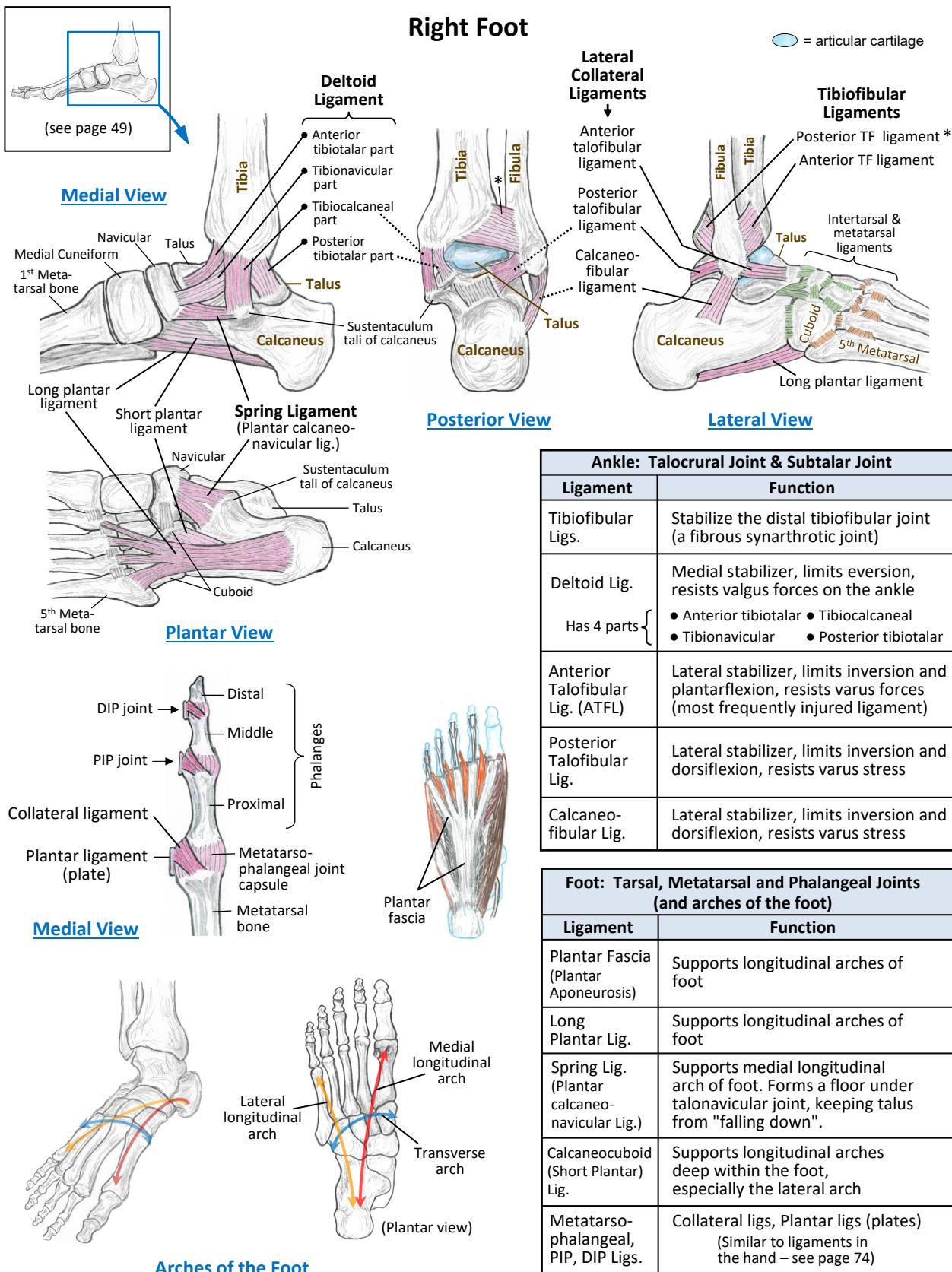


Hip Joint	
Ligament	Function
Iliofemoral Lig.	Limits extension and lateral rotation.
Ischiofemoral Lig.	Limits extension and medial rotation.
Pubofemoral Lig.	Limits extension and abduction.
Zona Orbicularis	Wraps around neck of femur, resists pulling head of femur away from socket.
Ligament of head of femur	Loosely connects head of femur into the acetabulum, carries blood vessel.
Transverse acetabular Lig.	Completes the acetabular labrum ring, and creates a foramen for vessels to enter the joint.

Knee – Joints and Ligaments



Ankle and Foot – Joints and Ligaments



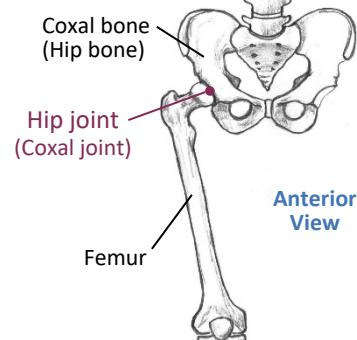
Hip Joint (Part 1)



Movement of the Hip Joint (Part 1)

Muscle Group 10

Gluteus maximus	Piriformis (deep lateral rotator #1 of 6)
Gluteus medius	The other 5 lateral rotators:
Gluteus minimus	Gemellus superior, Obturator internus
Iliopsoas Iliacus & Psoas Major	Gemellus inferior, Obturator externus Quadratus femoris



Joints

(Joint details: p. 164)

This is the first of three groups of muscles that primarily move the femur at the hip joint (coxal joint). This group contains the “shorter” length muscles that mainly originate on the front or back of the ilium bone of the pelvis, and insert on the greater or lesser trochanter of the femur.

Hip Joint (Coxal Joint) (also called coxofemoral joint or acetabulofemoral joint)

Head of Femur $\blacktriangleleft\triangleright$ Acetabulum of the Hip Bone

Ball and Socket Joint

Movements Available:

- Flexion
- Extension
- Abduction
- Adduction
- Lateral Rotation (External Rotation)
- Medial Rotation (Internal Rotation)

Other Joints

(Joint details: p. 124, 126)

Postural effects and small movements of the following joints are also created by the muscles in this group:

Sacroiliac Joint

Lateral Sacrum $\blacktriangleleft\triangleright$ Posterior Ilium

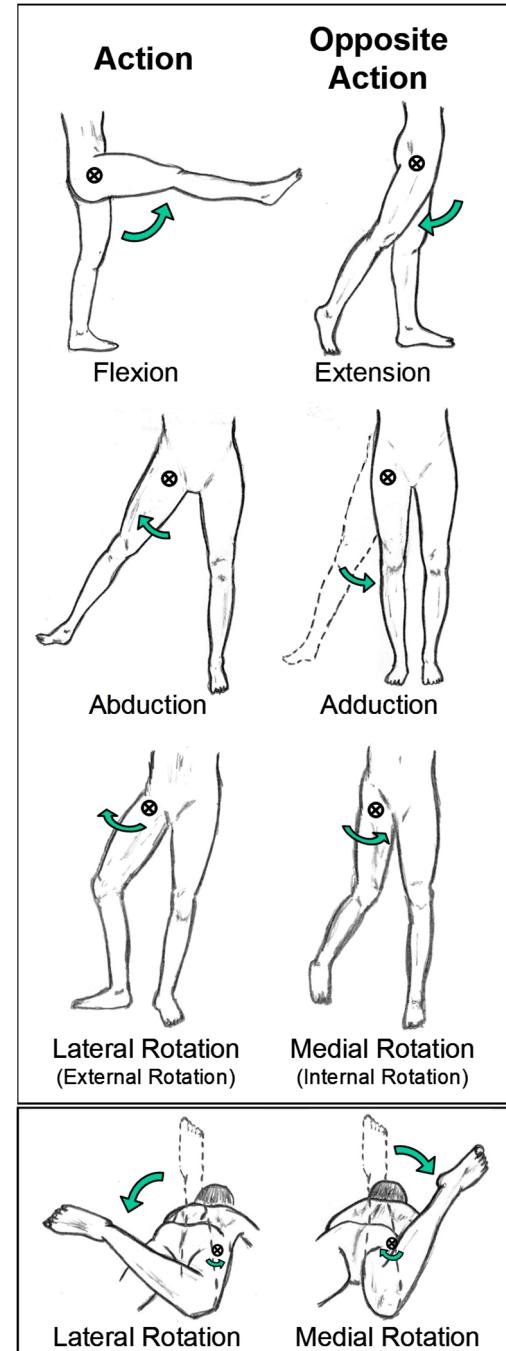
Part gliding, part fibrocartilagenous

(affected by piriformis and iliopsoas in this muscle group)

Intervertebral Joints of lumbar vertebrae

Facets and discs

(affected by psoas major in this muscle group)





Hip Joint (Part 1)

10

Bones, Bony Landmarks, Other Structures

The “short” muscles that move the hip joint mainly have attachments on the pelvis and the femur. Review the bony landmarks and other structures listed below, referring to the diagrams in Chapter 2, pages 47-48.

Hip Bone (Coxal Bone, Os Coxae) (p. 47)

(Made up of 3 bones fused: Ilium, Ischium, Pubis)

Landmarks on the Ilium:

- Iliac Fossa
(anterior-medial surface of wing)
- Iliac Crest
- Posterior Superior Iliac Spine (PSIS)
- Gluteal surface
(posterior-lateral surface of wing)
- Anterior Gluteal Line
(a ridge on the gluteal surface,
between the origins of gluteus
medius and gluteus minimus)

Acetabulum) (p. 164)

All 3 hip bones (ilium, ischium, pubis)
intersect in the cavity of this socket

Obturator foramen

Hole encircled by pubis and ischium

Femur (p. 48)

- Head
- Neck
- Greater trochanter
- Lesser trochanter
- Gluteal tuberosity

Sacrum (p. 45)

Muscles attach on both the posterior and
anterior surfaces.

Lumbar vertebrae L1-L5, and thoracic T12 (p. 44)

Anterior bodies and TVP's – (for psoas major)

Other Structures

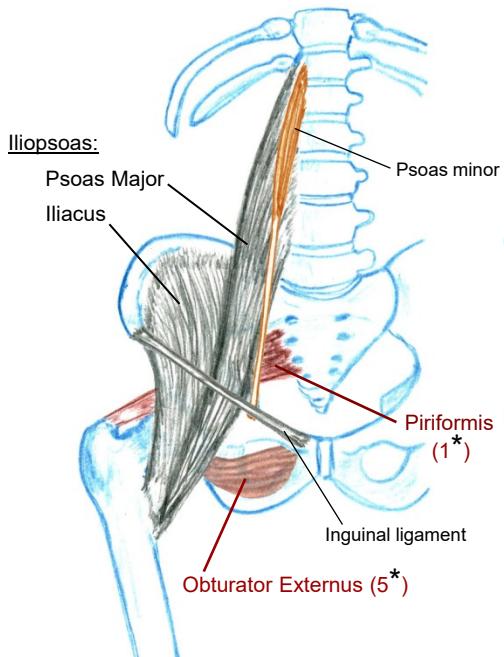
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|--|----------|
| Sacrotuberous Ligament | (p. 126) |
| Inguinal Ligament | (p. 126) |
| Iliotibial Tract / Iliotibial Band (ITB) | (p. 177) |

Notes

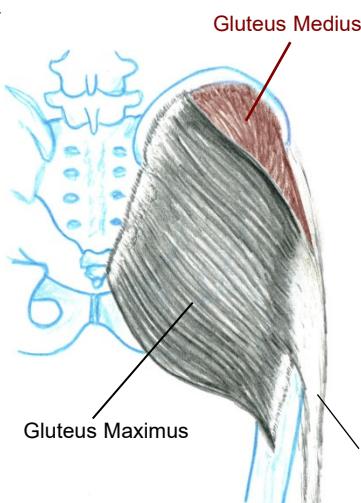


Muscle Group 10 - The first of three groups of muscles that move the hip joint are

illustrated as a group on this page. The following four pages have tables and figures that describe each muscle individually, and provide many ways of comparing and contrasting the muscles to each other.

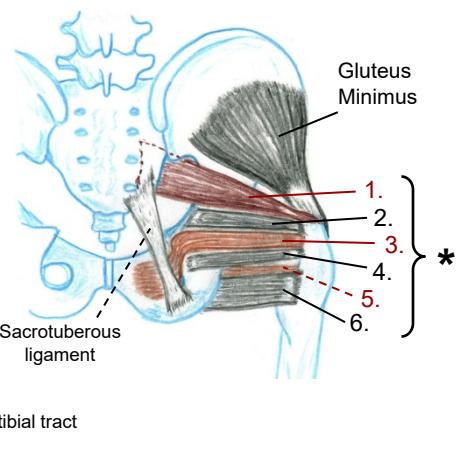


Anterior View

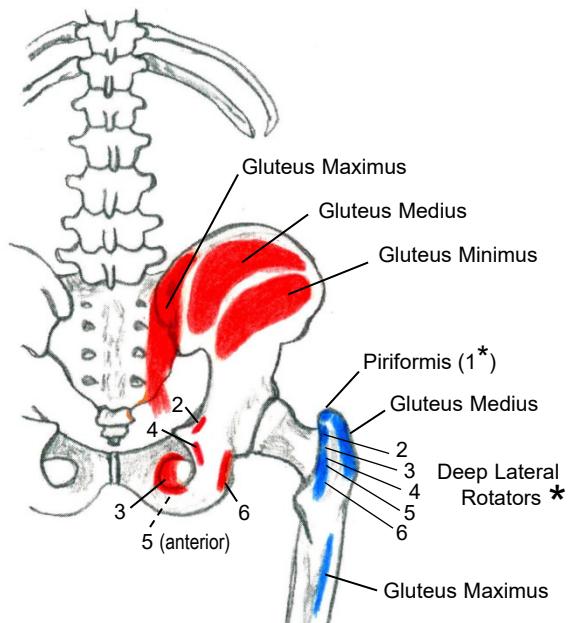
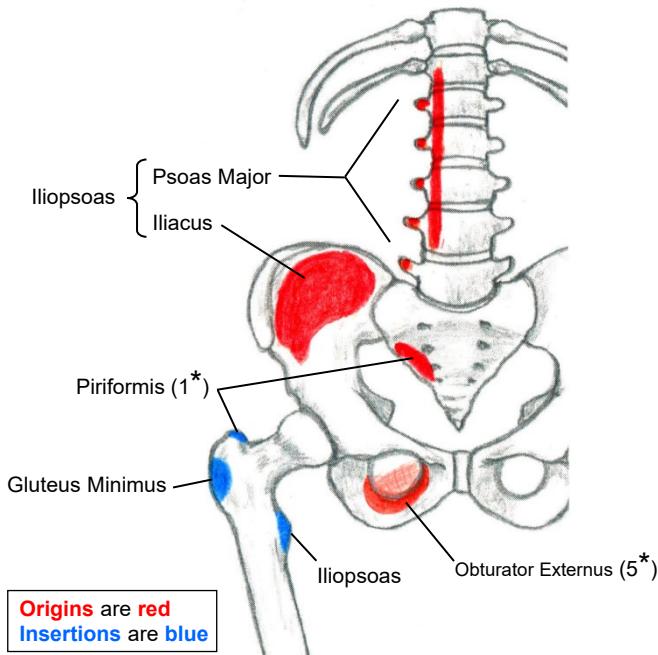


* The Deep Six lateral hip rotators

- 1. Piriformis
- 2. Gemellus Superior
- 3. Obturator Internus
- 4. Gemellus Inferior
- 5. Obturator Externus
- 6. Quadratus Femoris



Posterior Views



Attachment sites for all muscles in Group 10



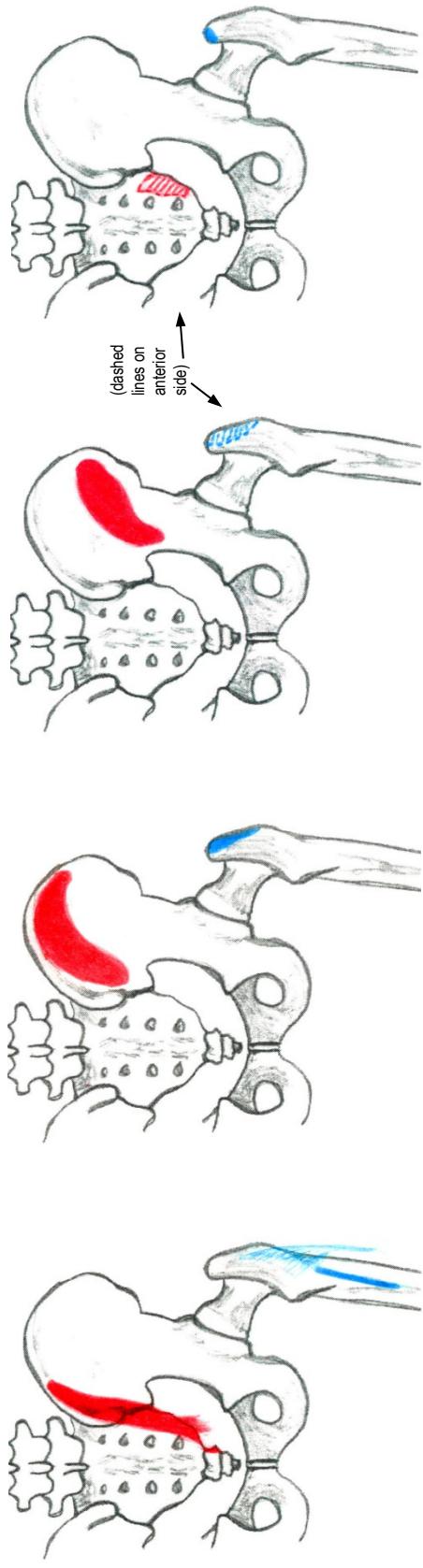
Hip Joint (Part 1)

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Group 10: Muscles Acting On Hip Joint (Part 1)				
Hip Joint	Origin	Insertion	Action	
Gluteus Maximus moves the hip joint	Posterior iliac crest, ilium, and sacrum (also lateral coccyx and sacrotuberous ligament)	Gluteal tuberosity of femur, and the iliotibial tract (ITB)	Extension and lateral rotation at the hip joint (also lower fibers assist adduction, and upper fibers may assist abduction)	
Gluteus Medius moves the hip joint	Upper lateral surface of the ilium (upper half of the wing of the ilium, starting just below the iliac crest)	Greater trochanter of femur (lateral aspect)	All fibers: Abduction at the hip joint. Ant. fibers: Assist flexion and medial rotation Post. fibers: Assist extension and lateral rotation	
Gluteus Minimus moves the hip joint	Lower lateral surface of the ilium (lower half of the wing of the ilium, inferior to the origin of gluteus medius)	Greater trochanter of femur (anterior aspect)	Abduction and medial rotation at the hip joint. (Also may assist flexion)	
Piriformis (Deep Lateral Rotator #1) moves the hip joint	Anterior surface of sacrum	Greater trochanter of femur (superior aspect)	Lateral rotation at the hip joint	
The Other 5 Deep Lateral Rotators (#2 - #6) Gemellus superior Obturator internus Gemellus inferior Obturator externus Quadratus femoris	Gemelli & Quad.Fem.: Ischium Obturators: Obturator foramen (ischium & pubis) All Deep 6 Collective: Sacrum, Ischium, and Pubis	Greater trochanter of femur (posterior-medial aspect)	Lateral rotation at the hip joint	
Iliopsoas: Iliacus and Psoas Major Moves the hip joint and the spine	Iliacus: Anterior iliac fossa Psoas Major: Bodies & TVP's of T12 and L1-L5	Both: Lesser trochanter of the femur	Flexion at the hip joint. (May assist lateral rotation at the hip joint) If the femur is fixed (in a standing position): Pulls on lumbar spine, increasing lordosis and anterior pelvic tilt.	

(larger illustrations
on page 173)

Table 10 (A) - Hip Joint (Part 1) - Origin, Insertion, Action



Gluteus Maximus

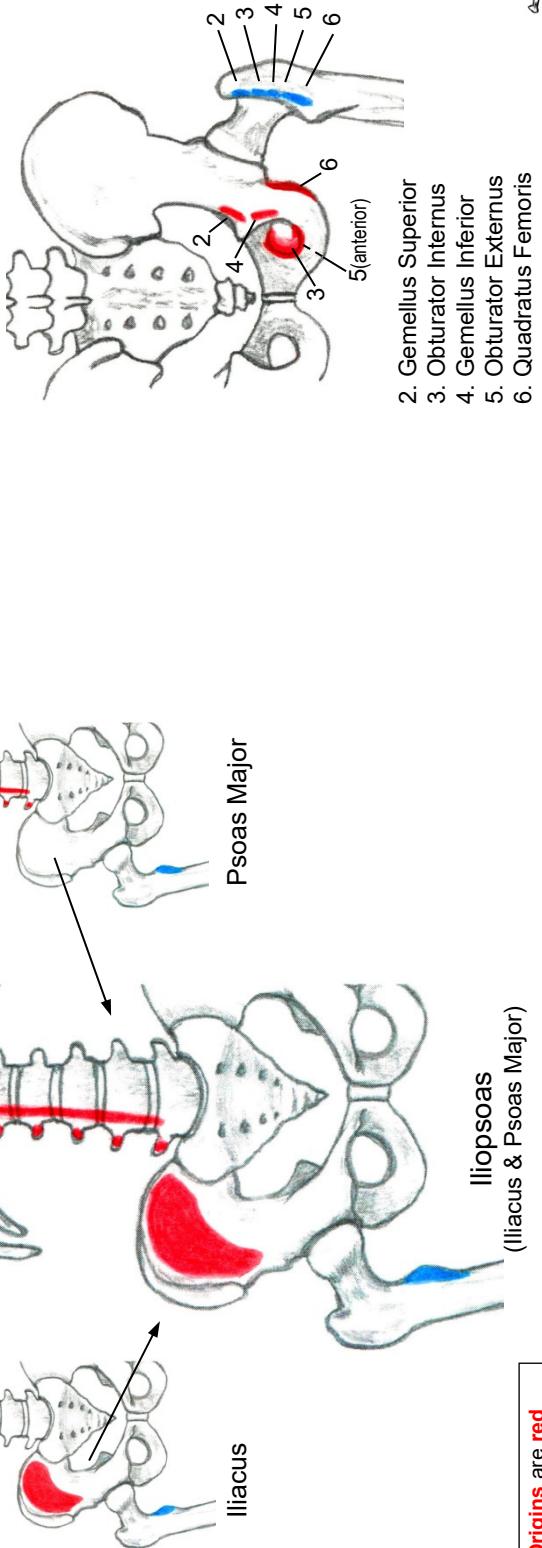
Gluteus Medius

Gluteus Minimus

Piriformis

All illustrations are posterior view
(except Iliopsoas is anterior view)

The Deep Six Lateral Rotators { - Piriformis (see above)
- The other 5 (see 2.-6. below)



Origins are red
Insertions are blue

↙ Lift page to see muscle pictures ↘

Hip Joint (Part 1)



Figure 10 (A) - Hip Joint (Part 1) - Muscle Attachments

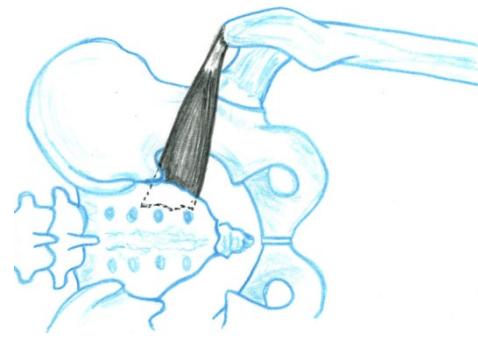


Hip Joint (Part 1)

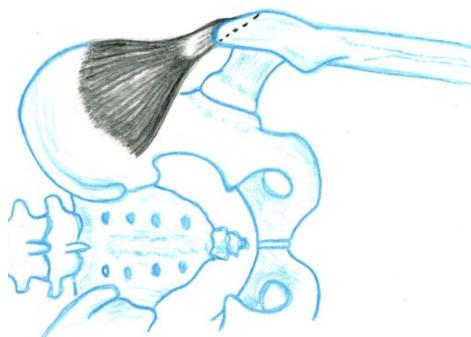
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Table 10 (B) - Hip Joint (Part 1) - Synergists & Antagonists

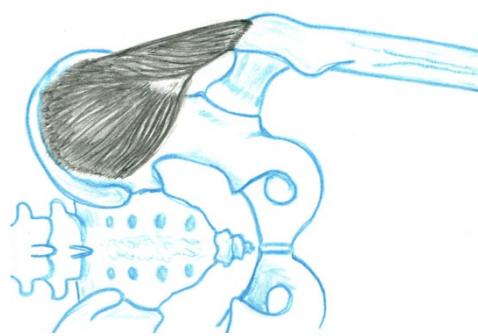
Hip Joint (Part 1)



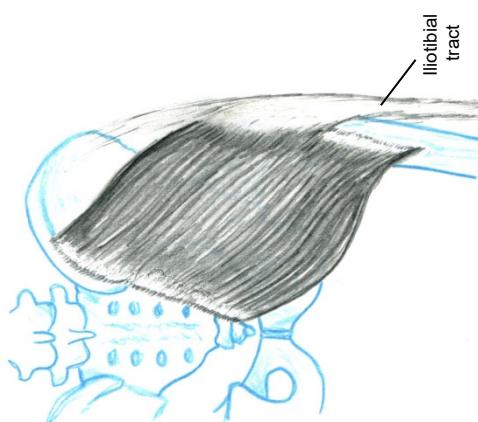
Piriformis
(also shown #1 below) ↗



Gluteus Minimus

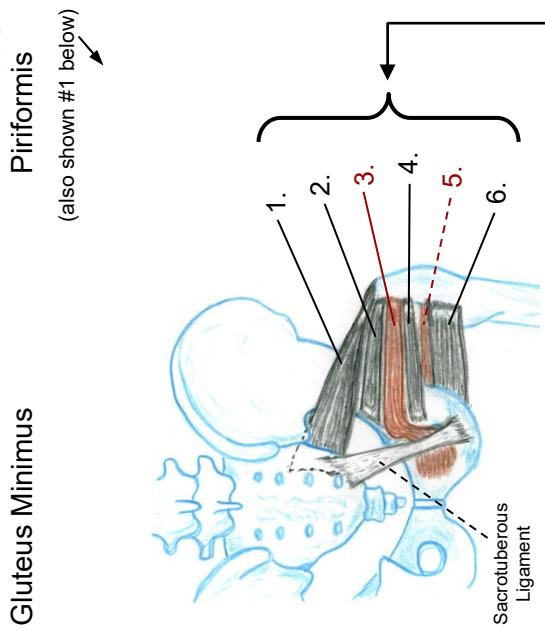
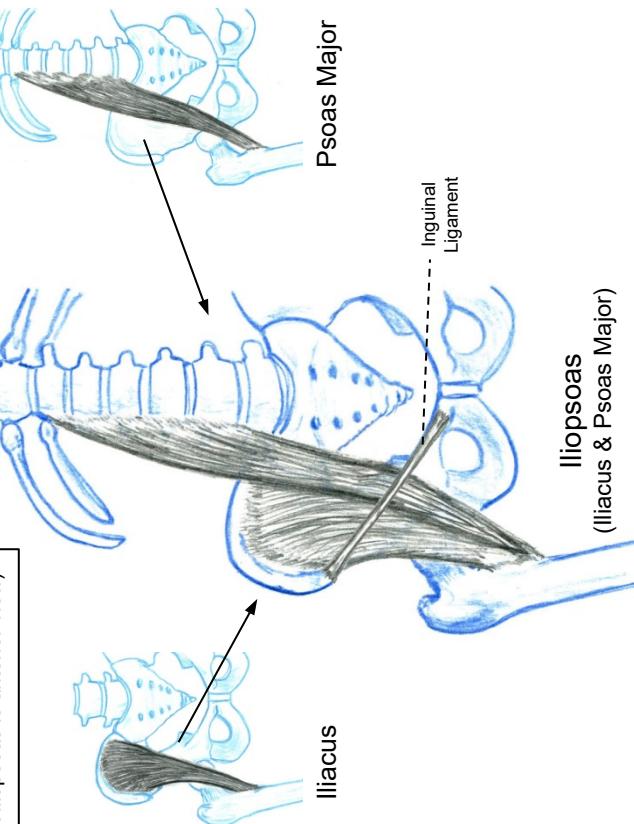


Gluteus Medius



Gluteus Maximus
Iliotibial tract

All illustrations are posterior view
(except iliopsoas is anterior view)



The Deep Six lateral hip rotators

1. Piriformis
2. Gemellus Superior
3. Obturator Internus
4. Gemellus Inferior
5. Obturator Externus
6. Quadratus Femoris

Figure 10 (B) - Hip Joint (Part 1) - Muscle Pictures



Hip Joint (Part 1)

Note-taking page ~ (palpation, how to lengthen/shorten, cautions, common uses, etc.)

10

Muscle Group 10 - Muscles Acting on the Hip Joint (Part 1)

1. Gluteus Maximus



2. Gluteus Medius



3. Gluteus Minimus



4. Piriformis

(Deep Lateral Rotator #1)



5. The Other 5 Deep Lateral Rotators

#2 - #6 (*Piriformis is lateral rotator #1*)



- #2. *Gemellus superior*
- #3. *Obturator internus*
- #4. *Gemellus inferior*
- #5. *Obturator externus*
- #6. *Quadratus femoris*

6. Iliacus

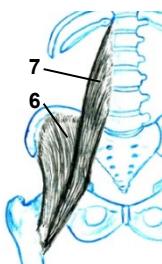


7. Psoas Major



6. + 7. Iliopsoas

Iliacus + Psoas Major
(treated as one muscle)



(pages 175-197 are not included in this excerpt)



Foot – Intrinsic (Bonus Group)

13b

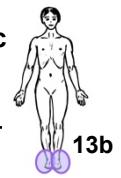
Intrinsic Muscles of the Foot – Plantar Aspect

Muscle	Origin	Insertion	Action	Innervation
Plantar Layer #1 (superficial)				
Abductor Digiti Minimi	Tuberosity of the calcaneus	Proximal phalanx of the little toe (lateral base)	Abduction and flexion of the little toe	Lateral plantar N. (S2, S3)
Flexor Digitorum Brevis	Tuberosity of the calcaneus	Middle phalanges of toes #2-5 (sides)	Flexion of toes #2-5	Medial plantar N. (L5, S1)
Abductor Hallucis	Tuberosity of the calcaneus	Proximal phalanx of the big toe (medial base)	Abduction and flexion of the big toe	Medial plantar N. (L5, S1)
Plantar Layer #2 (intermediate)				
Lumbrical Muscles (4)	The four tendons of the flexor digitorum longus	The four tendons of the extensor digitorum longus (attach via the medial side of the dorsal digital expansions)	Flexion of toes #2-5 at the metatarsophalangeal joints, Extension of toes #2-5 at the interphalangeal joints	<u>Lumbrical 1:</u> Medial plantar N. (L5, S1) <u>Lumbriicals 2-4:</u> Lateral plantar N. (S2, S3)
Quadratus Plantae	Plantar surface of the calcaneus	Tendon of the flexor digitorum longus (lateral margin, before it goes to the 4 toes)	Flexion of toes #2-5 (assists the FDL)	Lateral plantar N. (S2, S3)
Plantar Layer #3 (almost deepest)				
Flexor Digiti Minimi	Base of 5th metatarsal (& peroneus longus tendon)	Proximal phalanx of the little toe (plantar base)	Flexion of the little toe (at the MP joint)	Lateral plantar N. (S2, S3)
Adductor Hallucis	Oblique head: Bases of metatarsals #2-4, Transverse head: Metatarsophalangeal ligaments #3-5	Proximal phalanx of the big toe (lateral base)	Adduction of the big toe	Lateral plantar N. (S2, S3)
Flexor Hallucis Brevis	Cuboid and lateral cuneiform (plantar surfaces)	Proximal phalanx of the big toe (sides of base)	Flexion of the big toe (at the MP joint)	Medial plantar N. (L5, S1)
Plantar Layer #4 (deepest)				
Plantar Interossei (3)	3rd, 4th and 5th metatarsal bones (bases and medial side of shafts)	Bases of the proximal phalanges of toes #3-5 (and the dorsal digital expansions of toes #3-5)	Adduction of toes #3-5, Assist flexion of toes #3-5 at the metatarsophalangeal joints, Assist extension of toes #3-5 at the interphalangeal joints	Lateral plantar N. (S2, S3)

Intrinsic Muscles of the Foot – Dorsal Aspect

Muscle	Origin	Insertion	Action	Innervation
Dorsal Layer #1 (superficial)				
Extensor Digitorum Brevis	Dorsal surface of the calcaneus	Toes #2-4, via the tendons of the extensor digitorum longus (attach to the lateral side of the EDL tendons)	Extension of toes #2-4	Deep fibular N.* (L5, S1)
Extensor Hallucis Brevis	Dorsal surface of the calcaneus	Proximal phalanx of the big toe (dorsal surface of the base of the phalanx)	Extension of the big toe	Deep fibular N.* (L5, S1)
Dorsal Layer #2 (deep) Note: This layer is sometimes considered to be part of plantar layer #4				
Dorsal Interossei (4)	Shafts of metatarsal bones #1-5 (each muscle arises from the sides of two adjacent metatarsal bones)	Bases of the proximal phalanges of toes #2-4 (and the dorsal digital expansions of toes #2-4)	Abduction of toes #2-4, Assist flexion of toes #2-4 at the metatarsophalangeal joints, Assist extension of toes #2-4 at the interphalangeal joints	Lateral plantar N. (S2, S3)

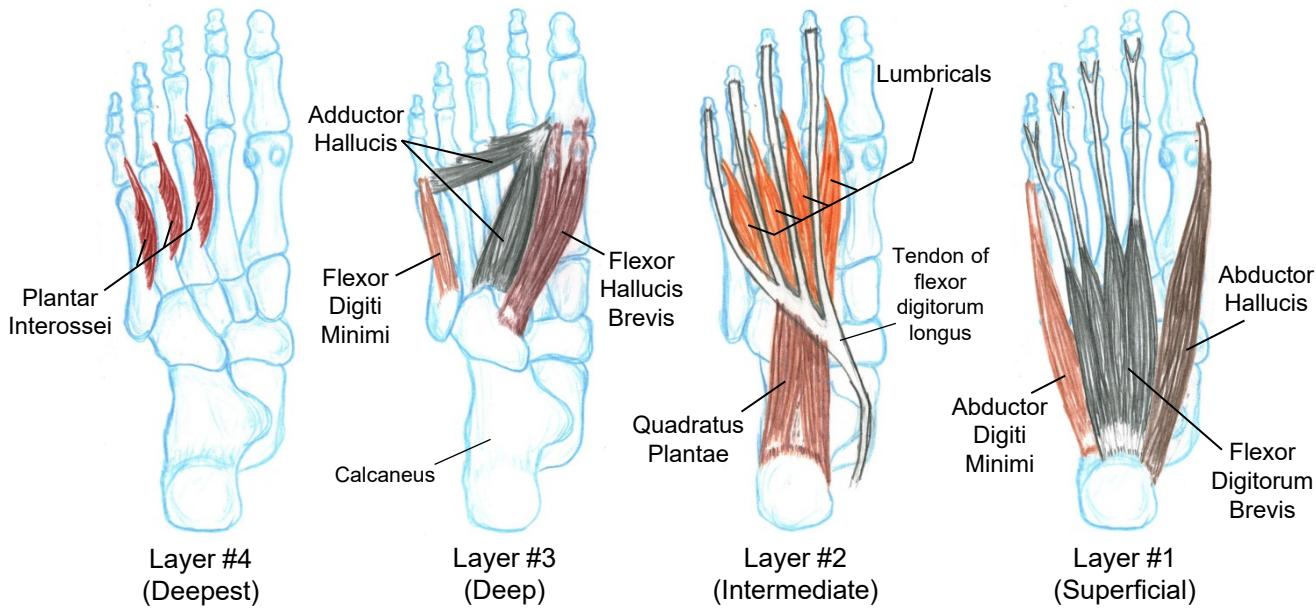
* (formerly called peroneal N.)



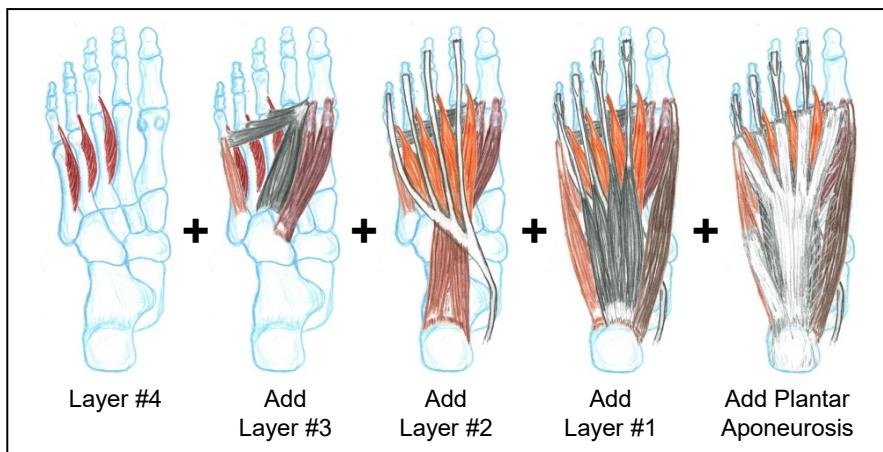
13b

Intrinsic Muscles of the Foot

Right Foot – Layers of the Plantar Aspect



**Building the
Plantar Muscles
One Layer at a Time**



Right Foot – Dorsal Aspect

