



Chapter 9 The Hip Joint and Pelvic Girdle

Manual of Structural Kinesiology
R.T. Floyd, EdD, ATC, CSCS

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The Hip Joint and Pelvic Girdle

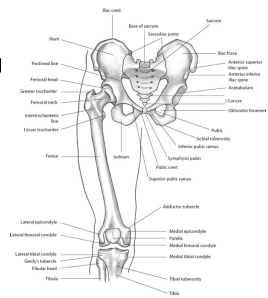
- Hip joint (acetabular femoral)
 - relatively stable due to
 - bony architecture
 - strong ligaments
 - large supportive muscles
 - functions in weight bearing & locomotion
 - enhanced significantly by its wide range of motion
 - ability to run, cross-over cut, side-step cut, jump, & many other directional changes

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Bones

- Ball & socket joint
 - Head of femur connecting with acetabulum of pelvic girdle
 - Pelvic girdle
 - right & left pelvic bone joined together posteriorly by sacrum
 - pelvic bones are ilium, ischium, & pubis
 - Femur
 - longest bone in body

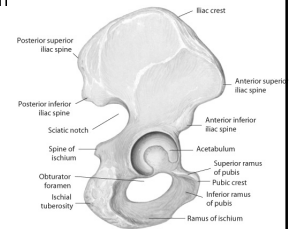


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Bones

- Sacrum
 - extension of spinal column with 5 fused vertebrae
 - extending inferiorly is the coccyx
- Pelvic bone - divided into 3 areas
 - Upper two fifths = ilium
 - Posterior & lower two fifths = ischium
 - Anterior & lower one fifth = pubis

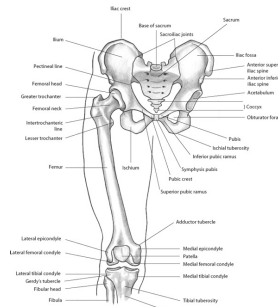


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Bones

- Bony landmarks
 - Anterior pelvis - origin for hip flexors
 - tensor fasciae latae - anterior iliac crest
 - sartorius - anterior superior iliac spine
 - rectus femoris - anterior inferior iliac spine

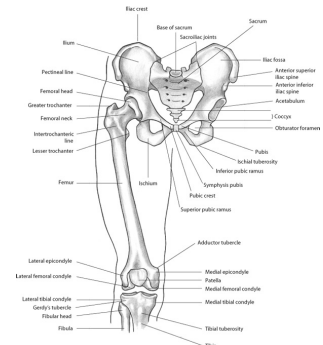


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Bones

- Bony landmarks
 - Lateral pelvis - origin for hip abductors
 - gluteus medius & minimus - just below iliac crest



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Bones

- **Bony landmarks**
 - Medially - origin for hip adductors
 - adductor magnus, adductor longus, adductor brevis, pectineus, & gracilis - pubis & its inferior ramus

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Bones

- **Bony landmarks**
 - Posteriorly - origin for hip extensors
 - gluteus maximus - posterior iliac crest & posterior sacrum & coccyx
 - Posteroinferiorly - origin for hip extensors
 - hamstrings - ischial tuberosity

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Bones

- **Bony landmarks**
 - Proximal thigh - insertion for short muscles of hip
 - gluteal muscles & most of the six deep external rotators - greater trochanter
 - iliopsoas - lesser trochanter
 - Proximal thigh - origin for 3 knee extensors
 - three vasti muscles of quadriceps - anteriorly
 - hip adductors - linea aspera

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Bones

- **Bony landmarks**
 - Patella - insertion for all 4 quadriceps muscles
 - Proximal tibia or fibula - insertion for remainder of hip muscles
 - sartorius, gracilis, & semitendinosus - upper anteromedial tibial surface just below medial condyle after crossing knee posteromedially
 - semimembranosus - posteromedially on medial tibial condyle

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Bones

- **Bony landmarks**
 - Proximal tibia or fibula - insertion for remainder of hip muscles
 - biceps femoris - laterally, primarily on fibula head with some fibers attaching on lateral tibial condyle
 - iliotibial tract of tensor fasciae latae - anterolaterally on Gerdy's tubercle of tibia

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Joints

- **Anteriorly**
 - Two pelvic bones join to form symphysis pubis, amphiarthrodial
- **Posteriorly**
 - Sacrum is between the 2 pelvic bones & forms the sacroiliac joints
 - Strong ligaments unite these bones to form rigid, slightly movable joints

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Joints

- Large & heavy bones covered by thick, heavy muscles
- Very minimal oscillating-type movements occur in sacroiliac joints, as in walking
- Body movements usually involve entire pelvic girdle & hip joints
- In walking, hip flexion & extension occur with pelvic girdle rotation, forward in hip flexion & backward in hip extension

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Joints

- Jogging & running result in faster movements & greater range of movement
- Pelvic rotation increases the length of stride in running; in kicking it results in a greater distance or more speed to the kick

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Joints

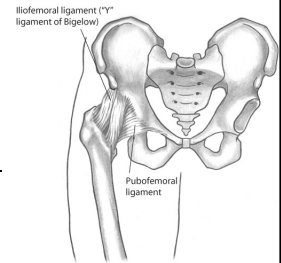
- Acetabulofemoral joint - most mobile joints of body (except glenohumeral)
 - Multiaxial arrangement
 - Bony architecture provides stability
 - relatively few hip joint subluxations & dislocations
 - Enarthrodial-type joint
 - Femoral head inserting into acetabulum
 - Reinforced by extremely strong & dense ligamentous capsule, especially anteriorly

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Joints

- Acetabulofemoral joint
 - Iliofemoral or Y ligament – located anteriorly, prevents hyperextension
 - Pubofemoral ligament - located anteromedially & inferiorly, limits excessive extension & abduction

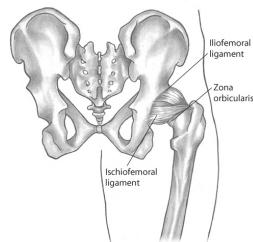


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Joints

- Acetabulofemoral joint
 - Teres ligament - attaches from deep in acetabulum to a depression in femoral head, slightly limits adduction
 - Ischiofemoral ligament – located posteriorly, extends from ischium to trochanteric fossa of femur, limits internal rotation

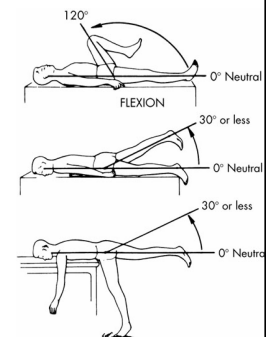


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Joints

- Some disagreement about exact possible range of each movement in hip joint
 - 0 to 130 degrees of flexion
 - 0 to 30 degrees of extension

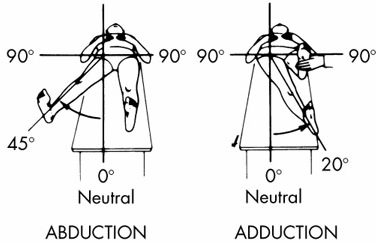


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Joints

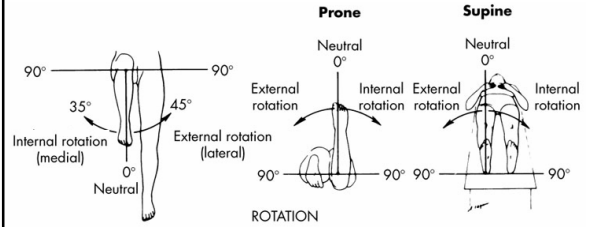
- 0 to 35 degrees of abduction
- 0 to 30 degrees of adduction



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Joints

- 0 to 45 degrees of internal rotation
- 0 to 50 degrees of external rotation



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Joints

- Pelvic girdle moves back & forth within 3 planes for a total of 6 different movements
 - All pelvic girdle rotation results from motion at one or more locations
 - right hip
 - left hip
 - lumbar spine

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Joints

Motions accompanying pelvic rotation

Pelvic Rotation	Lumbar Spine Motion	Right Hip Motion	Left Hip Motion
Anterior rotation	Extension	Flexion	Flexion
Posterior rotation	Flexion	Extension	Extension
Right lateral rotation	Right lateral flexion	Adduction	Abduction
Left lateral rotation	Left lateral flexion	Abduction	Adduction
Right transverse rotation	Left transverse rotation	Internal rotation	External rotation
Left transverse rotation	Right transverse rotation	External rotation	Internal rotation

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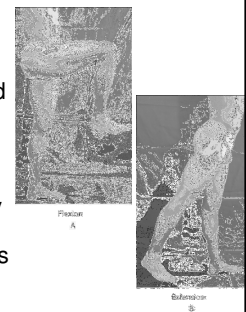
Movements

- Anterior & posterior pelvic rotation
 - sagittal or anteroposterior plane
- Right & left lateral rotation
 - lateral or frontal plane
- Right transverse (clockwise) rotation & left transverse (counterclockwise) rotation
 - horizontal or transverse plane of motion

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Movements

- Hip flexion
 - movement of femur straight anteriorly toward pelvis
- Hip extension
 - movement of the femur straight posteriorly away from the pelvis; sometimes referred to as hyperextension



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Movements

- Hip abduction
 - movement of femur laterally to side away from midline
- Hip adduction
 - movement of femur medially toward midline



Abduction
E

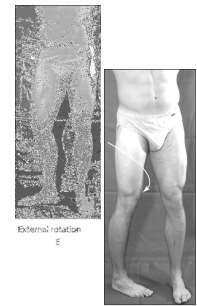
Adduction
D

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Movements

- Hip external rotation
 - rotary movement of femur laterally around its longitudinal axis away from midline; lateral rotation
- Hip internal rotation
 - rotary movement of femur medially around its longitudinal axis toward to midline; medial rotation



External rotation
E

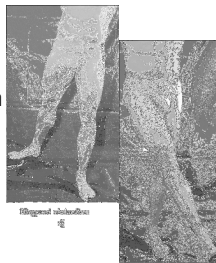
Internal rotation
F

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Movements

- Hip diagonal abduction
 - movement of femur in a diagonal plane away from midline of body
- Hip diagonal adduction
 - movement of femur in a diagonal plane toward midline of body



Diagonal abduction
G

Diagonal adduction
H

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Movements

- Anterior pelvic rotation
 - anterior movement of upper pelvis; iliac crest tilts forward in a sagittal plane; anterior tilt
- Posterior pelvic rotation
 - posterior movement of upper pelvis; iliac crest tilts backward in a sagittal plane; posterior tilt



Anterior pelvic rotation
A

Posterior pelvic rotation
B

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Movements

- Left lateral pelvic rotation
 - in frontal plane left pelvis moves inferiorly in relation to right pelvis; either left pelvis rotates downward or right pelvis rotates upward; left lateral tilt
- Right lateral pelvic rotation
 - in frontal plane right pelvis moves inferiorly in relation to left pelvis; either right pelvis rotates downward or left pelvis rotates upward; right lateral tilt



Left lateral pelvic rotation
C

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Movements

- Left transverse pelvic rotation
 - in horizontal plane pelvis rotates to body's left; right iliac crest moves anteriorly in relation to left iliac crest, which moves posteriorly
- Right transverse pelvic rotation
 - in horizontal plane pelvis rotates to body's right; left iliac crest moves anteriorly in relation to right iliac crest, which moves posteriorly



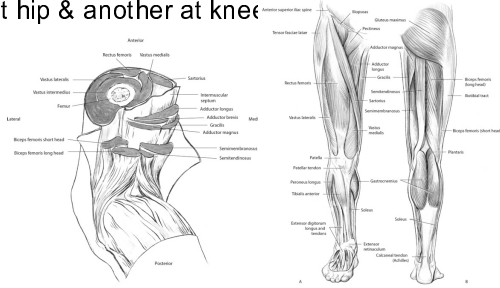
Right transverse pelvic rotation
D

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Muscles

- Seven two-joint muscles have one action at hip & another at knee



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Modified from Anthony CP, Kohloff NJ. *Textbook of anatomy and physiology*, ed 9, St. Louis, 1975, Mosby. 9-31

Muscles

- Muscles involved in hip & pelvic girdle motions depend largely on direction of movement and position of body in relation to earth & gravitational forces
- Body part that moves most will be the part least stabilized
 - Standing on both feet & contracting hip flexors, the trunk & pelvis rotate anteriorly
 - Lying supine & contracting hip flexors, the thighs move forward into flexion on the stable pelvis

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Muscles

- Hip flexor muscles used in moving thighs up toward trunk
- Hip extensor muscles used eccentrically when pelvis & trunk move downward slowly on the femur and concentrically when trunk is raised on femur (rising to standing position)
- In downward phase of knee-bend exercise, movement at hips & knees is flexion
 - muscles primarily involved - hip & knee extensors in eccentric contraction

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Muscles

- Hip joint & pelvic girdle muscles
 - Anterior - primarily hip flexion
 - Iliopsoas
 - Pectineus
 - Rectus femoris
 - Sartorius



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Muscles

- Medial - primarily hip adduction
 - Adductor brevis
 - Adductor longus
 - Adductor magnus
 - Gracilis

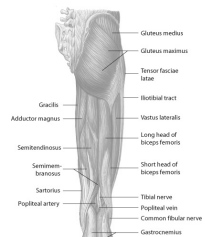


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Muscles

- Posterior - primarily hip extension
 - Gluteus maximus
 - Biceps femoris
 - Semitendinosus
 - Semimembranosus
 - External rotators



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Muscles

– Lateral - primarily hip abduction

- Gluteus medius
- Gluteus minimus
- External rotators
- Tensor fasciae latae



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Muscles

• Pelvic muscles acting on hip joint
– Iliac region - iliopsoas muscle flexes hip

- Iliacus
- Psoas major
- Psoas minor

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Muscles

• Pelvic muscles acting on hip joint
– Gluteal region - extend & rotate hip

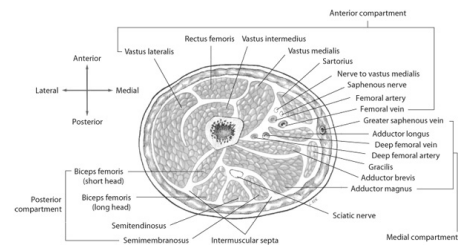
- Gluteus maximus
- Gluteus medius
- Gluteus minimi
- Tensor fascia latae
- Six deep external rotators - piriformis, obturator externus, obturator internus, gemellus superior, gemellus inferior, & quadratus femoris

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Muscles

• Thigh - divided into 3 compartments by intermuscular septa



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Muscles

– Anterior compartment – primarily knee extensors

- Rectus femoris
- Vastus medialis
- Vastus intermedius
- Vastus lateralis
- Sartorius

– Posterior compartment - hamstring group

- Biceps femoris
- Semitendinosus
- Semimembranosus

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Muscles

– Medial compartment - primarily adductors

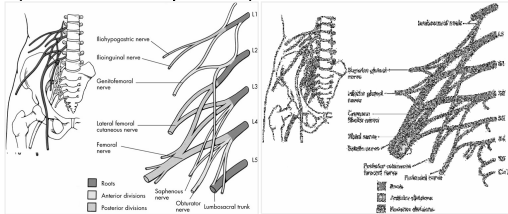
- Adductor brevis
- Adductor longus
- Adductor magnus
- Pectineus
- Gracilis

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Nerves

- All hip & pelvic girdle muscles - innervated from lumbar & sacral plexus (lumbosacral plexus)

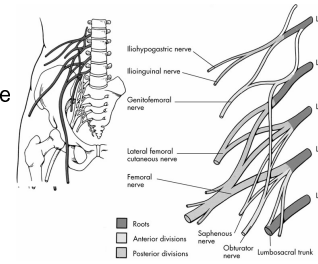


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Nerves

- Lumbar plexus - formed by anterior rami of spinal nerves L1 through L4 & some fibers from T12
- Lower abdomen and the anterior & medial portions of lower extremity

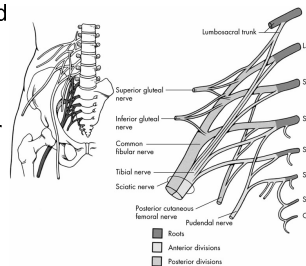


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Nerves

- Sacral plexus - formed by anterior rami of L4, L5, & S1 through S4
- Lower back, pelvis, perineum, posterior surface of thigh & leg, and dorsal & plantar surfaces of foot

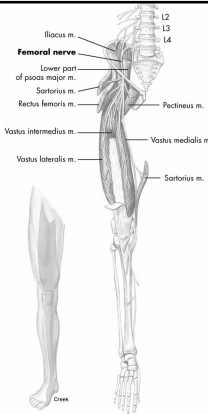


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Nerves

- Lumbar plexus - major nerves
- Femoral n. - anterior muscles
 - Arises from posterior division of lumbar plexus
 - Iliopsoas
 - Rectus femoris
 - Vastus medialis
 - Vastus intermedius
 - Vastus lateralis
 - Pectineus
 - Sartorius
 - Sensation to anterior & lateral thigh and medial leg & foot

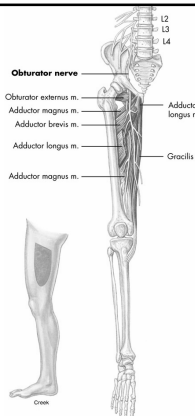


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Nerves

- Lumbar plexus - major nerves
- Obturator nerve
 - Arises from anterior division of lumbar plexus
 - Adductor brevis
 - Adductor longus
 - Adductor magnus
 - Gracilis
 - Obturator externus
 - Sensation to medial thigh



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Nerves

- Sacral plexus
- Superior gluteal nerve
 - arises from L4, L5, & S1 to innervate gluteus medius, gluteus minimus, & tensor fasciae latae
- Inferior gluteal nerve
 - arises from L5, S1, & S2 to supply gluteus maximus
- Branches from sacral plexus
 - piriformis (S1, S2), gemellus superior (L5, S1, S2), gemellus inferior & obturator internus (L4, L5, S1, S2), & quadratus femoris (L4, L5, S1)

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Nerves

- Sacral plexus
 - Sciatic nerve
 - tibial division
 - semitendinosus, semimembranosus, biceps femoris (long head) & adductor magnus
 - sensation for posterolateral lower leg & plantar aspect of foot
 - common peroneal (fibular) division
 - sensation to anterolateral lower leg & dorsum of foot

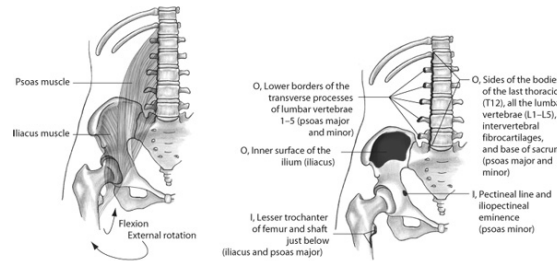


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Iliopsoas Muscle

- Flexion of hip
- External rotation of femur
- Transverse pelvic rotation contralaterally when ipsilateral femur is stabilized

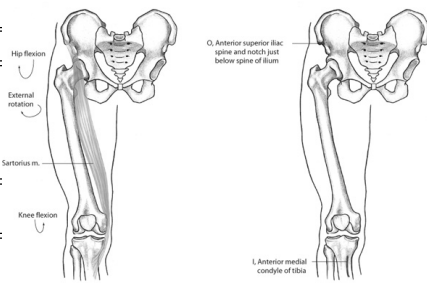


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Sartorius Muscle

- Flexion of hip
- Flexion of knee
- External rotation of thigh as it flexes hip & knee
- Abduction of hip
- Anterior pelvic rotation

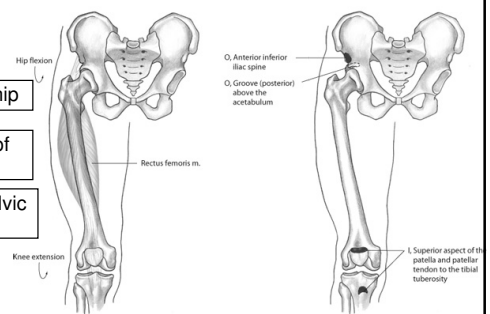


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Rectus Femoris Muscle

- Flexion of hip
- Extension of knee
- Anterior pelvic rotation

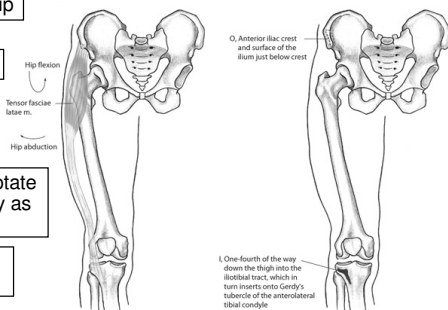


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Tensor Fasciae Latae Muscle

- Abduction of hip
- Flexion of hip
- Tendency to rotate hip internally as it flexes
- Anterior pelvic rotation

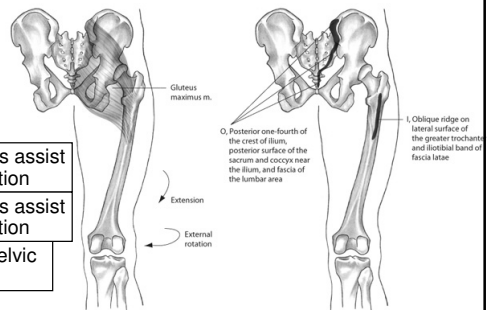


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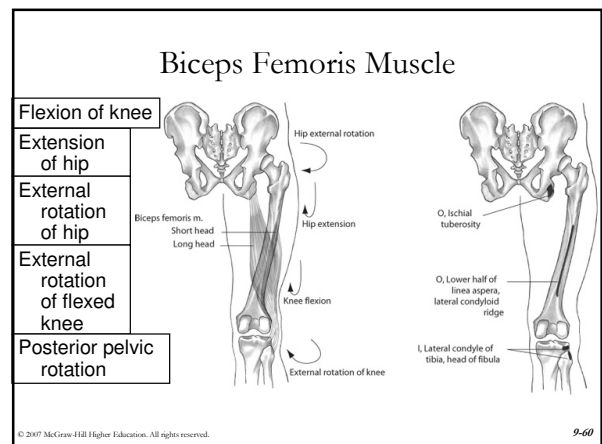
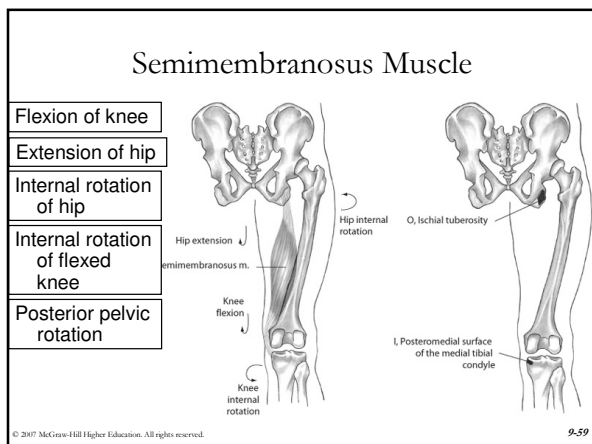
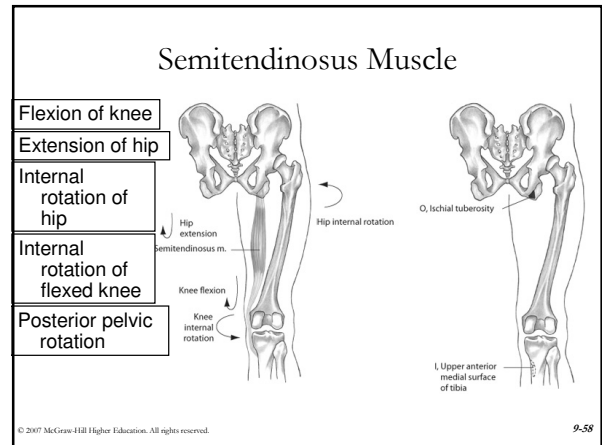
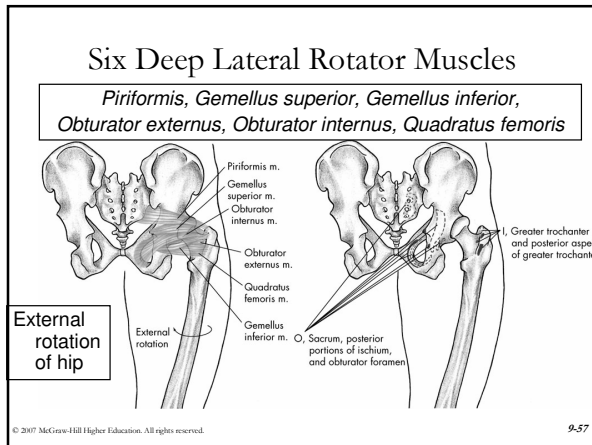
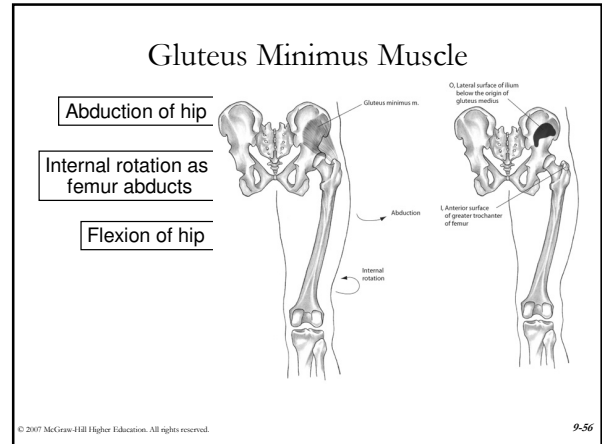
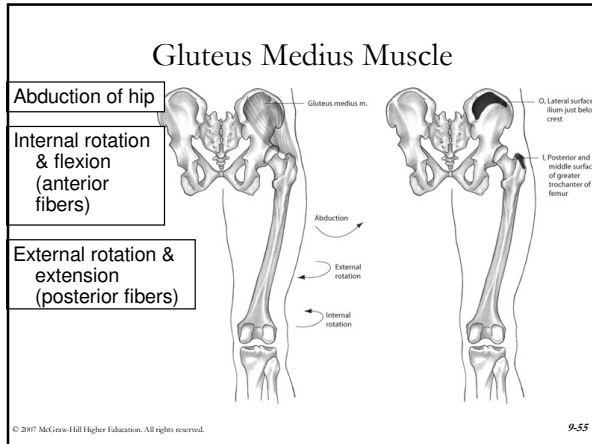
Gluteus Maximus Muscle

- Extension of hip
- External rotation of hip
- Upper fibers assist in abduction
- Lower fibers assist in adduction
- Posterior pelvic rotation



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Adductor Brevis Muscle

Adduction of hip

External rotation as it adducts hip

Assists in flexion of hip

O, Front of the inferior pubic ramus just below the origin of the longus

I, Lower two-thirds of the posterior line of the femur and the upper half of the medial lip of the linea aspera

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Adductor Longus Muscle

Adduction of hip

Assists in flexion of hip

O, Anterior pubis just below its crest

I, Middle third of linea aspera

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Adductor Magnus Muscle

Adduction of hip

External rotation as hip adducts

Extension of hip

O, Edge of entire ramus of the pubis and the ischium and ischial tuberosity

I, Whole length of linea aspera, lesser condylar ridge and adductor tubercle

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Pectineus Muscle

Flexion of hip

Adduction of hip

External rotation of hip

O, Space 1-inch wide on front of pubis above crest

I, Rough line leading from lesser trochanter to linea aspera

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Gracilis Muscle

Adduction of hip

Weak flexion of knee

Internal rotation of hip

Assists with flexion of hip

O, Anterior medial edge of pubis

I, Anterior medial surface of tibia below condyle

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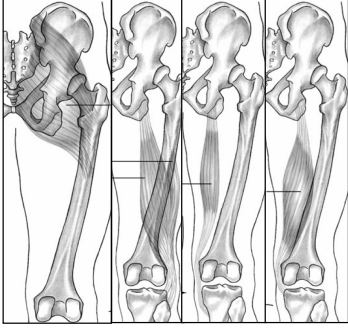
Hip Flexion

- **Agonists**
- Psoas
- Iliacus (Iliopsoas)
- Rectus Femoris
- Pectineus
 - Sartorius
 - Tensor Fasciae Latae

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Hip Extension

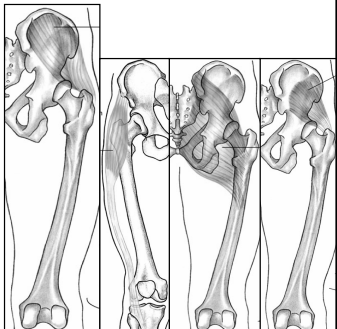
- **Agonists**
 - Gluteus Maximus
 - Biceps Femoris (Long Head)
 - Semitendinosus
 - Semimembranosus



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Hip Abduction

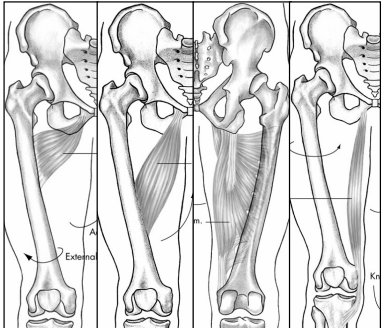
- **Agonists**
 - Gluteus Medius
 - Tensor Fasciae Latae
 - Gluteus Maximus
 - Gluteus Minimus



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Hip Adduction

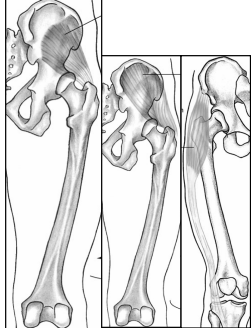
- **Agonists**
 - Adductor Brevis
 - Adductor Longus
 - Adductor Magnus
 - Gracilis



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Hip Internal Rotation

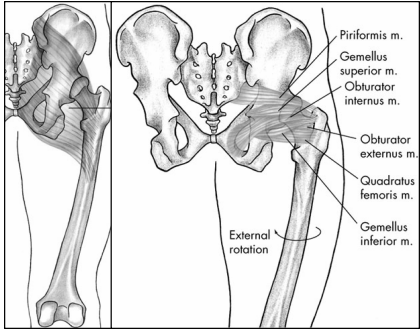
- **Agonists**
 - Gluteus Minimus
 - Gluteus Medius
 - Tensor Fasciae Latae



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Hip External Rotation

- **Agonists**
 - Gluteus Maximus
 - Six Deep External Rotators



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Web Sites

Radiologic Anatomy Browser
<http://radlinux1.usuf1.usuhs.mil/rad/long>
 – This site has numerous radiological views of the musculoskeletal system.

University of Arkansas Medical School Gross Anatomy for Medical Students
<http://anatomy.uams.edu/anatomyhtml/gross.html>
 – Dissections, anatomy tables, atlas images, links, etc.

Loyola University Medical Center: Structure of the Human Body
www.meddean.luc.edu/lumen/meded/grossanatomy/index.htm
 – An excellent site with many slides, dissections, tutorials, etc. for the study of human anatomy

Wheless' Textbook of Orthopaedics
www.whelessonline.com/
 – This site has an extensive index of links to the fractures, joints, muscles, nerves, trauma, medications, medical topics, lab tests, and links to orthopedic journals and other orthopedic and medical news.

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Web Sites

Premiere Medical Search Engine

www.medsite.com

- This site allows the reader to enter any medical condition and it will search the net to find relevant articles.

Virtual Hospital

www.vh.org

- Numerous slides, patient information, etc.

Arthroscopy.com

www.arthroscopy.com/sports.htm

- Patient information on various musculoskeletal problems of the lower extremity

Human Anatomy Online

www.innerbody.com/image/musc08.html

- Interactive musculoskeletal anatomy

The Hip and Knee Institute

www.hipsandknees.com/hip/contents.htm

- Arthritis of the Hip Joint

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Web Sites

Adam Healthcare Center

<http://adam.about.com/surgery/100006.htm>

- Hip joint replacement

American Academy of Orthopaedic Surgeons

<http://orthoinfo.aaos.org/category.cfm?topcategory=Hip>

- Patient education library on the hip

Sports Injury Bulletin

www.sportsinjurybulletin.com/archive/1054-groin-strain.htm

- Groin strain causes

HealthGate Data Corp

<http://healthgate.partners.org/browsing/browseContent.asp?fileName=11822.xml&title=Groin%20Strain>

- Groin Strain

The Physician and Sportsmedicine

www.physsportsmed.com/issues/2004/0104/meislin.htm

- Symptomatic Snapping Hip

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Web Sites

Neurography Institute

www.neurography.com/Images/Piriformis/Piriformis1.htm

- Piriformis Syndrome

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