

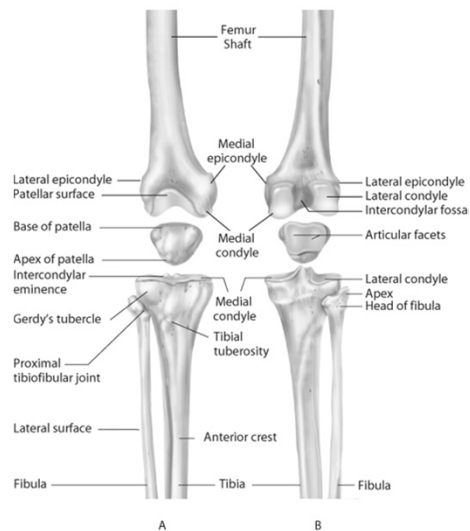


# Chapter 10 The Knee Joint

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

## The Knee Joint

- Knee joint
  - largest joint in body
  - very complex
  - primarily a hinge joint



Modified for Prentice WE:  
*Arnhem's principles of athletic training*, ed 12, New York, 2006, McGraw-Hill;  
from Saladin, KS: *Anatomy & physiology: the unity of forms and function*, ed 2, New York, 2001, McGraw-Hill.

## Bones

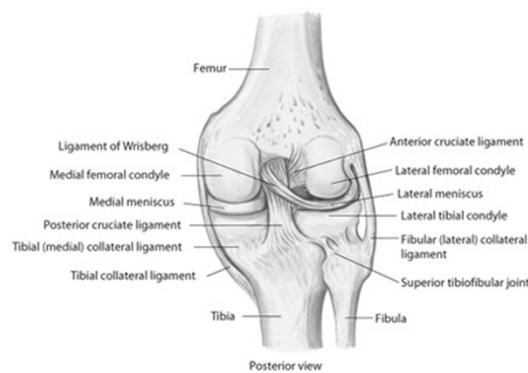
- Enlarged femoral condyles articulate on enlarged tibial condyles
- Medial & lateral tibial condyles (medial & lateral tibial plateaus) – receptacles for femoral condyles
- Tibia – medial
  - bears most of weight

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## Bones

- Fibula – lateral
  - serves as the attachment for knee joint structures
  - does not articulate with femur or patella
  - not part of knee joint



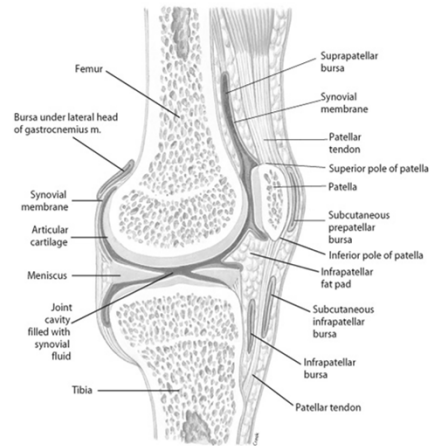
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## Bones

- **Patella**
  - sesamoid (floating) bone
  - imbedded in quadriceps & patellar tendon
  - serves similar to a pulley in improving angle of pull, resulting in greater mechanical advantage in knee extension



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## Joints

- **Knee joint proper (tibiofemoral joint)**
  - classified as a hinglymus joint
    - Sometimes referred to as trochoginglymus joint  
internal & external rotation occur during flexion
    - Some argue for condyloid classification
- **Patellofemoral joint**
  - arthroial classification
  - gliding nature of patella on femoral condyles

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## Joints

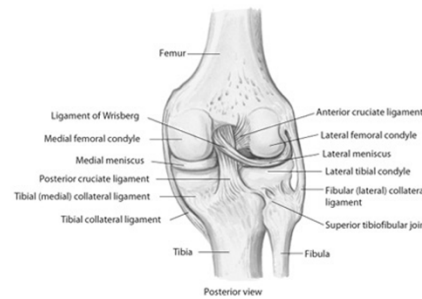
- **Medial meniscus forms receptacle for medial femoral condyle, Lateral meniscus receives lateral femoral condyle**
  - Thicker on outside border & taper down very thin to inside border
  - Can slip about slightly, but held in place by various small ligaments
  - Medial meniscus – larger & more open C appearance
  - Lateral meniscus – closed C configuration

## Joints

- **Anterior & posterior cruciate ligaments**
  - cross within knee between tibia & femur
  - vital in respectively maintaining anterior & posterior stability, as well as rotatory stability
- **Anterior cruciate ligament (ACL) injuries**
  - one of most common serious injuries to knee
  - mechanism often involves noncontact rotary forces associated with planting & cutting, hyperextension, or by violent quadriceps contraction which pulls tibia forward on femur

## Joints

- **Posterior cruciate ligament (PCL) injuries**
  - not often injured
  - mechanism of direct contact with an opponent or playing surface
- **Fibular (lateral) collateral ligament (LCL)**
  - infrequently injured



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## Joints

- **Tibial (medial) collateral ligament (MCL)**
  - maintains medial stability by resisting valgus forces or preventing knee from being abducted
  - injuries occur commonly, particularly in contact or collision sports
  - mechanism of teammate or opponent may fall against lateral aspect of knee or leg causing medial opening of knee joint & stress to medial ligamentous structures

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# Joints

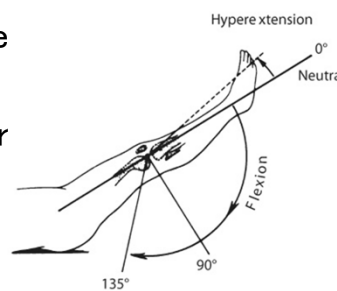
- Bursae
  - more than 10 bursae in & around knee
  - some are connected to synovial cavity
  - they absorb shock or prevent friction

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# Joints

- Extends to 180 degrees (0 degree of flexion)
- Hyperextension of 10 degrees or not uncommon
- Flexion occurs to about 140 degrees
- With knee flexed 30 degrees or >
  - internal rotation 30 degrees occurs
  - external rotation 45 degrees occurs

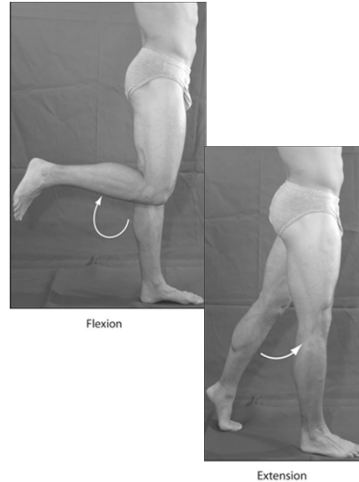


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## Movements

- Flexion
  - bending or decreasing angle between femur & leg, characterized by heel moving toward buttocks
- Extension
  - straightening or increasing angle between femur & lower leg



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## Movements

- External rotation
  - rotary movement of leg laterally away from midline
- Internal rotation
  - rotary movement of lower leg medially toward midline
- Neither will occur unless flexed 20-30 degrees or >



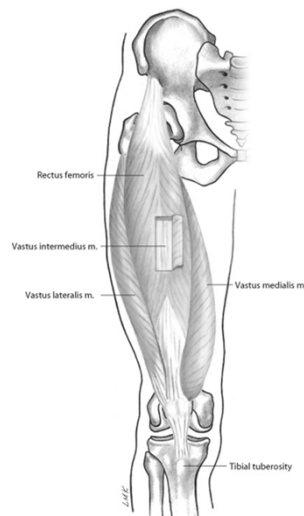
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## Muscles

### Knee joint muscles location

- Anterior – primarily knee extension
  - Rectus femoris
  - Vastus medialis
  - Vastus intermedius
  - Vastus lateralis



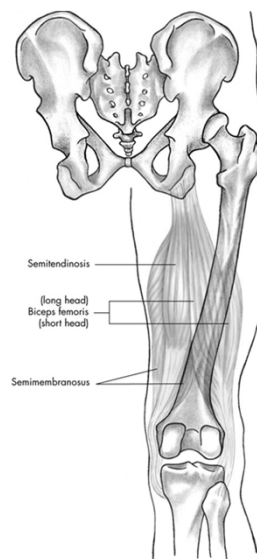
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## Muscles

### Knee joint muscles location

- Posterior – primarily knee flexion
  - Biceps femoris
    - Sartorius
    - Gracilis
    - Popliteus
    - Gastrocnemius
  - Semimembranosus
  - Semitendinosus



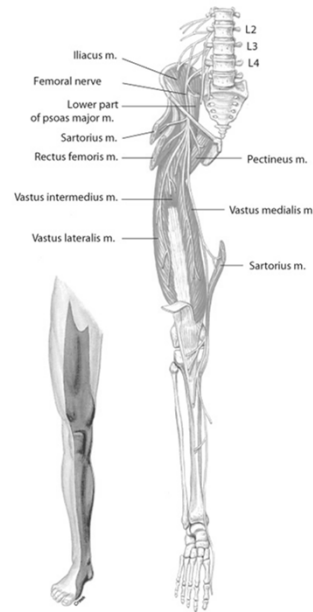
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## Nerves

- Femoral nerves innervates the knee extensors (quadriceps)
  - rectus femoris
  - vastus medialis
  - vastus intermedius
  - vastus lateralis

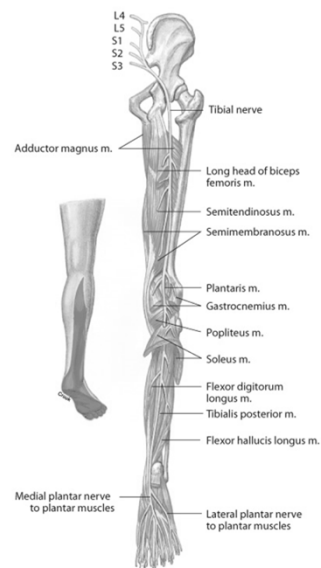


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## Nerves

- Sciatic nerve
  - tibial division
    - semitendinosus, semimembranosus, biceps femoris (long head)
  - common peroneal (fibular) division
    - biceps femoris (short head)



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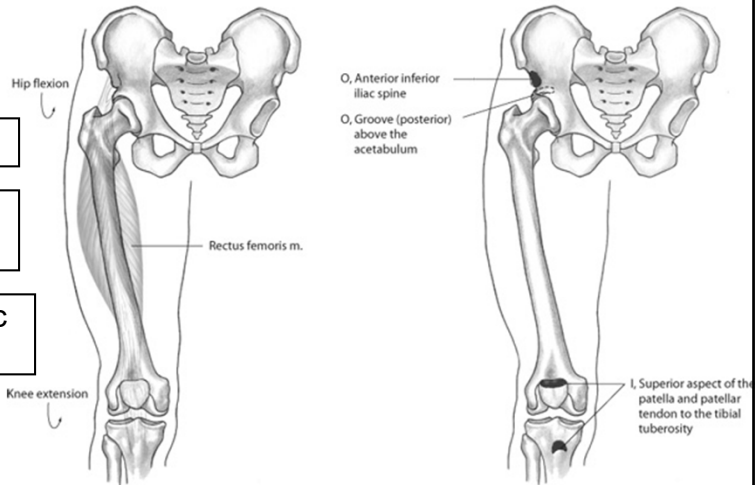
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# Rectus Femoris Muscle

Flexion of hip

Extension of knee

Anterior pelvic rotation

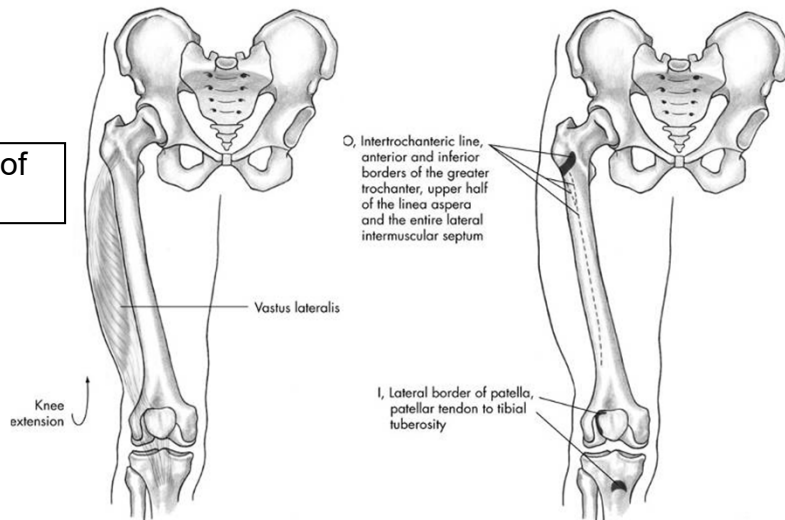


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# Vastus Lateralis Muscle

Extension of knee

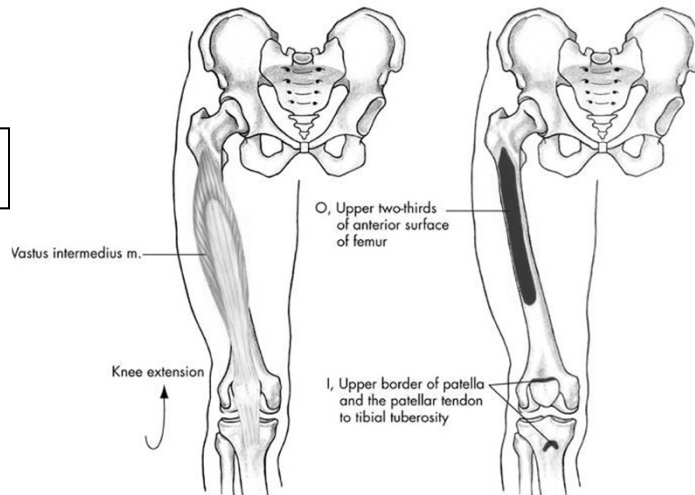


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## Vastus Intermedius Muscle

Extension of knee

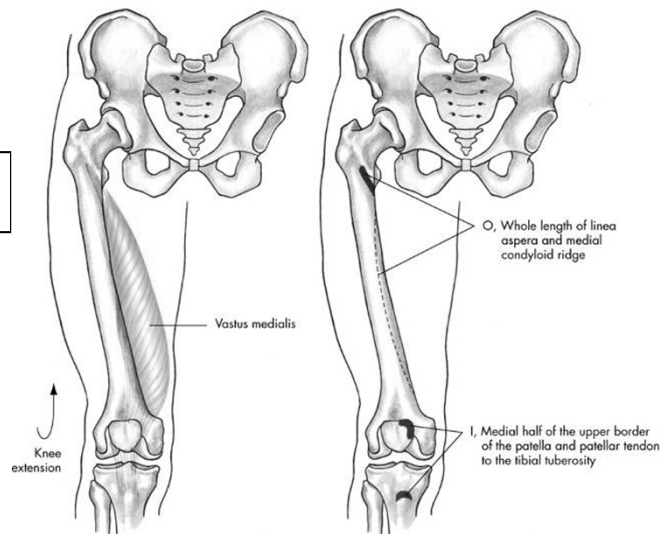


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## Vastus Medialis Muscle

Extension of knee

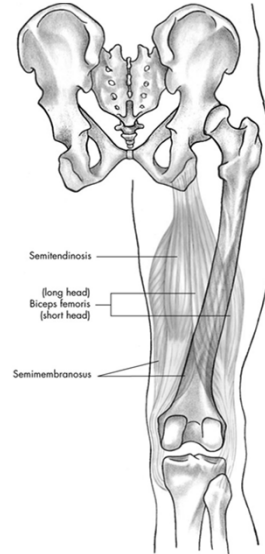


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## Hamstring Muscles

- Hamstring muscle group
  - Semitendinosus
  - Biceps femoris
  - Semimembranosus



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## Hamstring Muscles

- Hamstring muscle strains very common
- “Running muscles” function in acceleration
- Antagonists to quadriceps muscles at knee
- Named for cordlike attachments at knee
- All originate on ischial tuberosity of pelvis
- Semitendinosus inserts on anteromedial tibia
- Semimembranosus inserts on posteromedial tibia
- Biceps femoris inserts on lateral tibial condyle & head of fibula

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## Semitendinosus Muscle

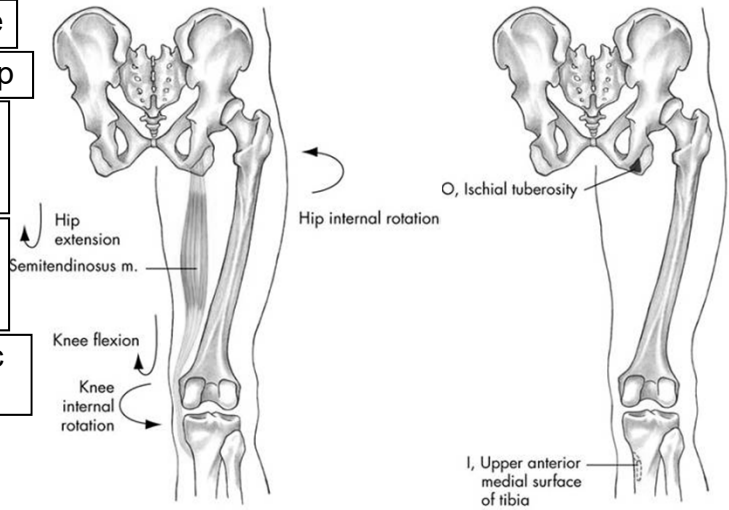
Flexion of knee

Extension of hip

Internal rotation of hip

Internal rotation of flexed knee

Posterior pelvic rotation



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## Semimembranosus Muscle

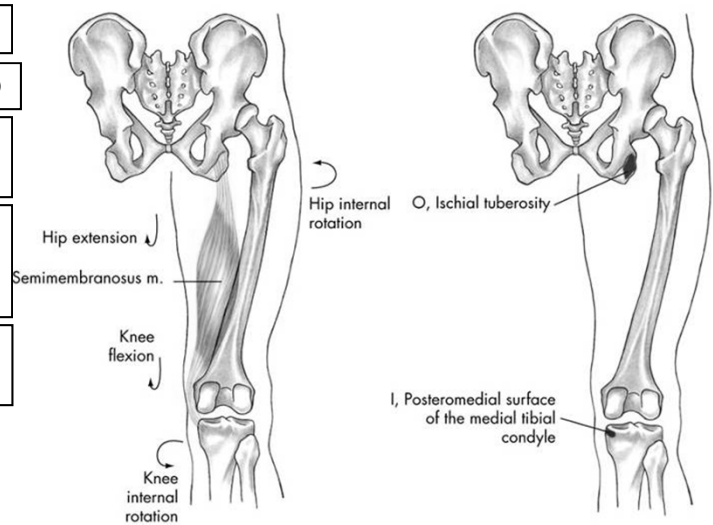
Flexion of knee

Extension of hip

Internal rotation of hip

Internal rotation of flexed knee

Posterior pelvic rotation

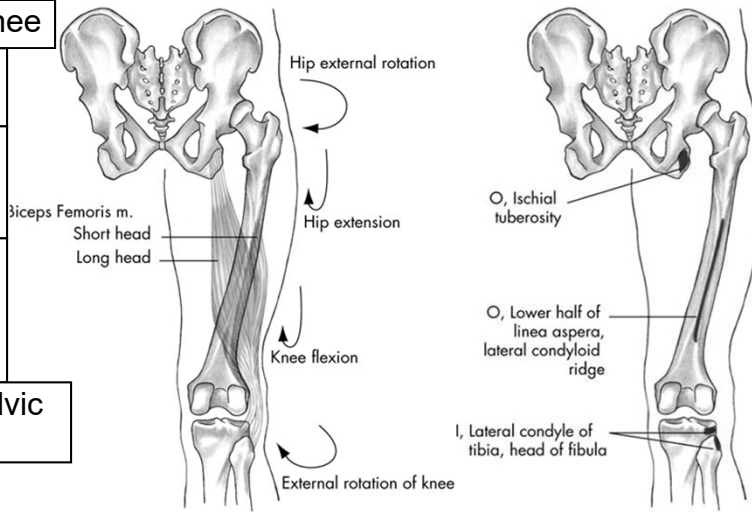


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# Biceps Femoris Muscle

- Flexion of knee
- Extension of hip
- External rotation of hip
- External rotation of flexed knee
- Posterior pelvic rotation

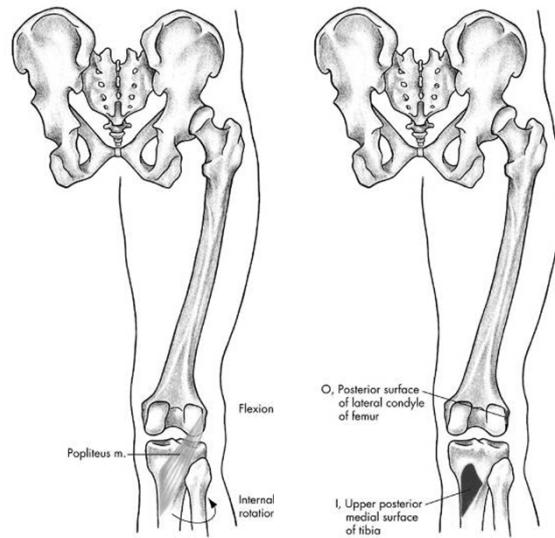


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# Popliteus Muscle

- Flexion of knee
- Internal rotation of flexed knee

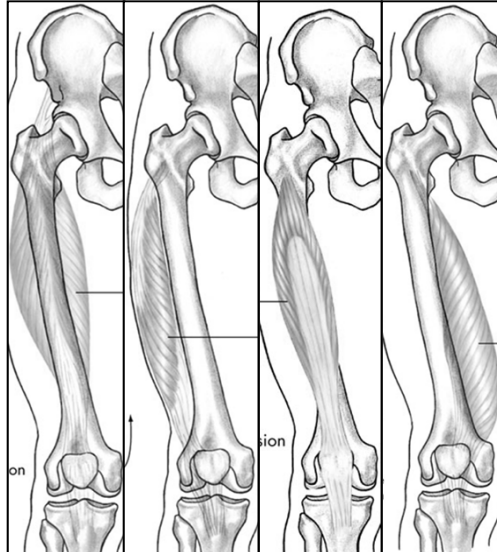


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## Knee Extension

- Agonists
  - Rectus Femoris
  - Vastus Lateralis
  - Vastus Intermedius
  - Vastus Medialis

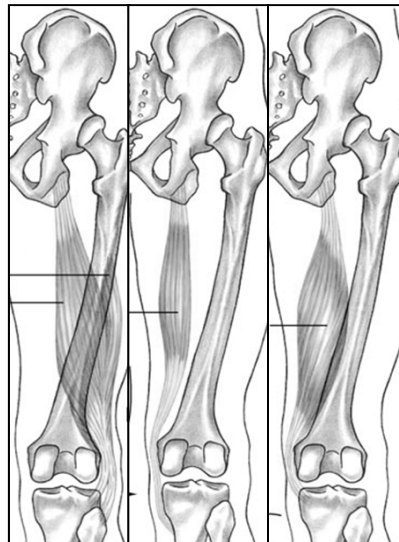


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## Knee Flexion

- Agonists
  - Biceps Femoris (Long & Short Head)
  - Semitendinosus
  - Semimembranosus

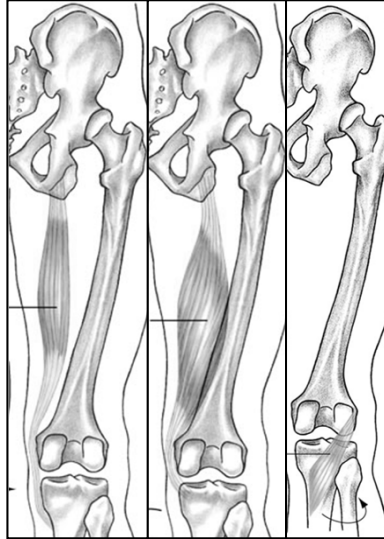


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## Knee Internal Rotation

- Agonists
  - Semitendinosus
  - Semimembranosus
  - Popliteus

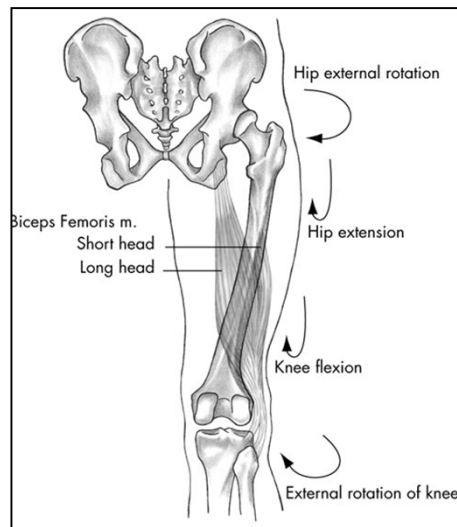


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## Knee External Rotation

- Agonists
  - Biceps Femoris



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