The Lower Limb II

Anatomy

RHS 241

Lecture 3

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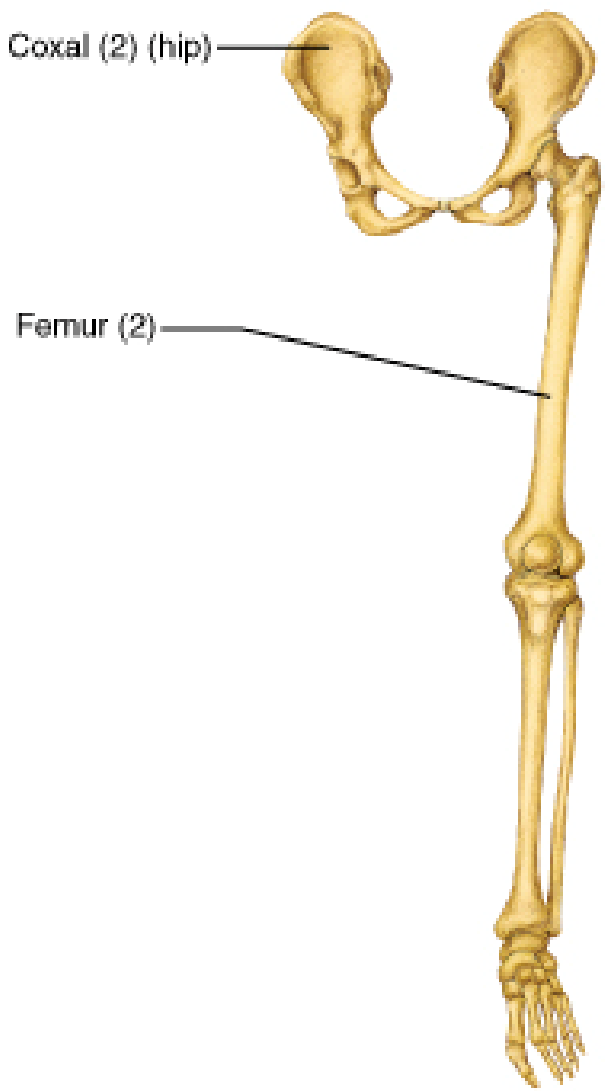
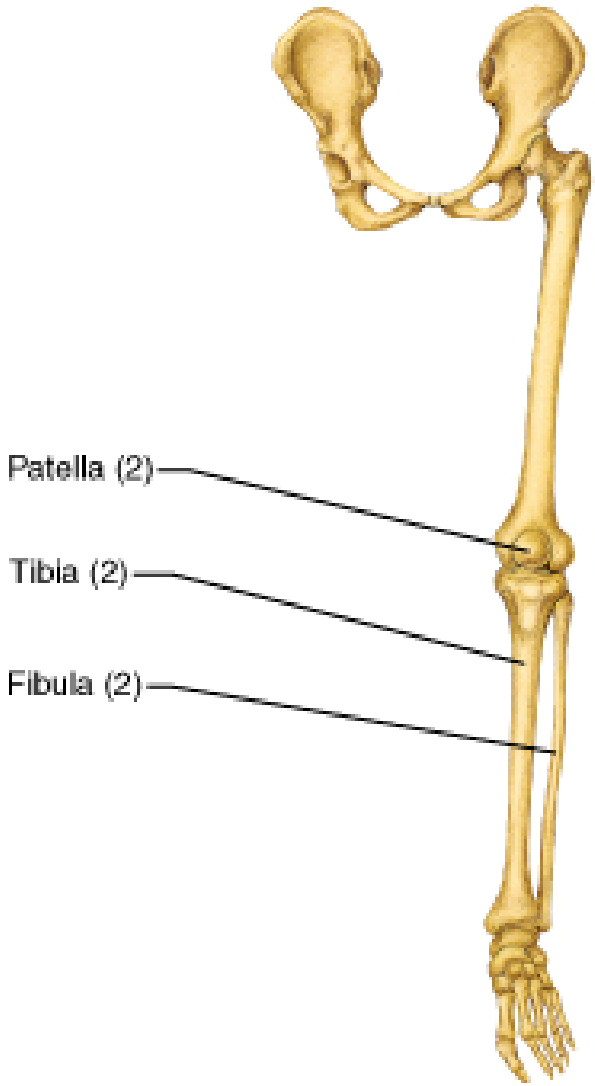
Body Region	Bones*	Illustration	Location	Markings
PART II: BONES OF THE PELVIC GIRDLE AND LOWER LIMB				
Pelvic girdle (Figure 8.7)	Coxal (2) (hip)		Each coxal (hip) bone is formed by the fusion of an ilium, ischium, and pubic bone; the coxal bones fuse anteriorly at the pubic symphysis and form sacroiliac joints with the sacrum posteriorly; girdle consisting of both coxal bones is basin-like	Iliac crest; anterior and posterior iliac spines; auricular surface; greater and lesser sciatic notches; obturator foramen; ischial tuberosity and spine; acetabulum; pubic arch; pubic crest; pubic tubercle
Lower Limb Thigh (Figure 8.9)	Femur (2)		Femur is the sole bone of thigh; between hip joint and knee; largest bone of the body	Head; greater and lesser trochanters; neck; lateral and medial condyles and epicondyles; gluteal tuberosity; linea aspera

Anterior view of pelvic girdle and left lower limb

*The number in parentheses ( ) following the bone name denotes the total number of such bones in the body.

Body Region	Bones*	Illustration	Location	Markings
PART II: BONES OF THE PELVIC GIRDLE AND LOWER LIMB				
Kneecap (Figure 8.9)			Patella is a sesamoid bone lodged in the tendon of the quadriceps (anterior thigh) muscles	
Leg (Figure 8.10)			Tibia is the larger and more medial bone of leg; between knee and foot	Medial and lateral condyles; tibial tuberosity; anterior crest; medial malleolus
			Fibula is lateral bone of leg; sticklike	Head; lateral malleolus



Anterior view of pelvic girdle and left lower limb

*The number in parentheses ( ) following the bone name denotes the total number of such bones in the body.

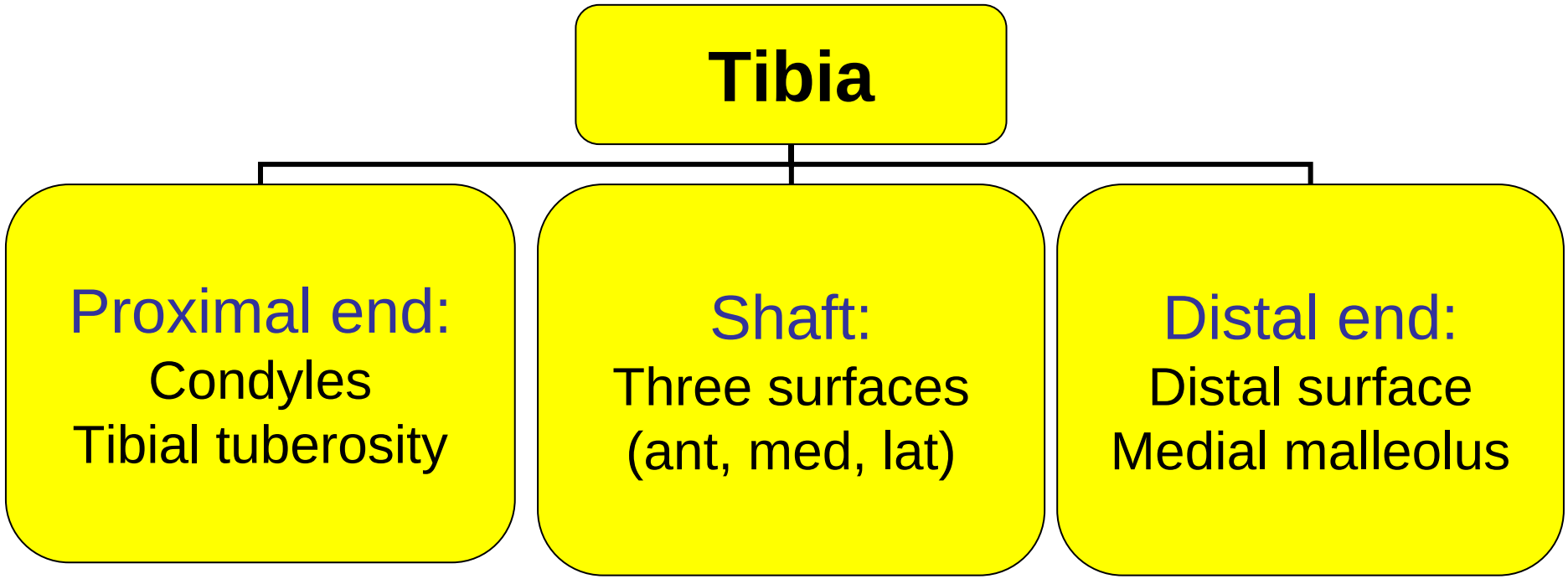
Tibia

- The **larger & medial** bone of the leg

- Functions:
  - Attachment of muscles
  - Transfer of weight from femur to skeleton of the foot
  - Articulations

Articulations

- Only the tibia articulates with the distal end of femur to form the *knee joint*
- Both the tibia & fibula articulate with the talus to form the *ankle joint*
- The proximal & distal ends of the tibia & fibula articulate together to form the *tibiofibular joints*


Tibia
Proximal end:
Condyles
Tibial tuberosity
Shaft:
Three surfaces
(ant, med, lat)
Distal end:
Distal surface
Medial malleolus

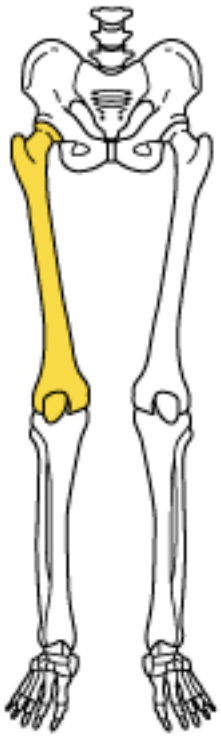
Tibia

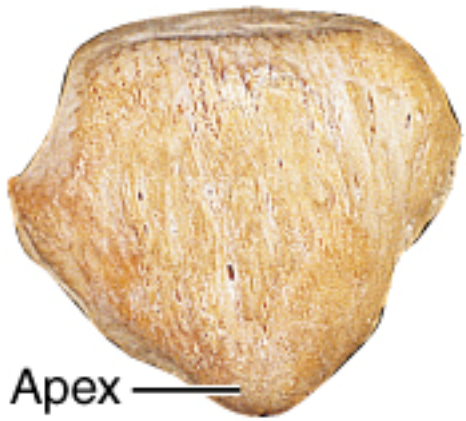
- **Medial & lateral condyles**: articulate with the corresponding condyle of the femur
- **Tibial tuberosity**: the attachment site of the patellar tendon
- Anterior surface of the shaft: **shin bone**
- **Distal end**: articulate with the talus to form part of the ankle joint

Surface Anatomy

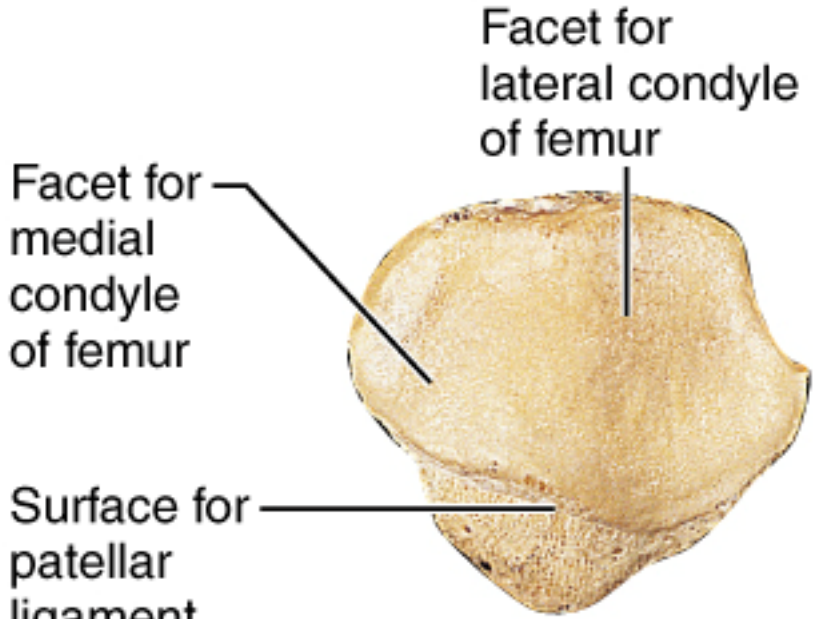
Palpate on a living knee:

- **Patella**: base, margins, apex
- Anterior margins of the **medial & lateral condyles**
- Approximate level of the **“Knee Joint Line”**



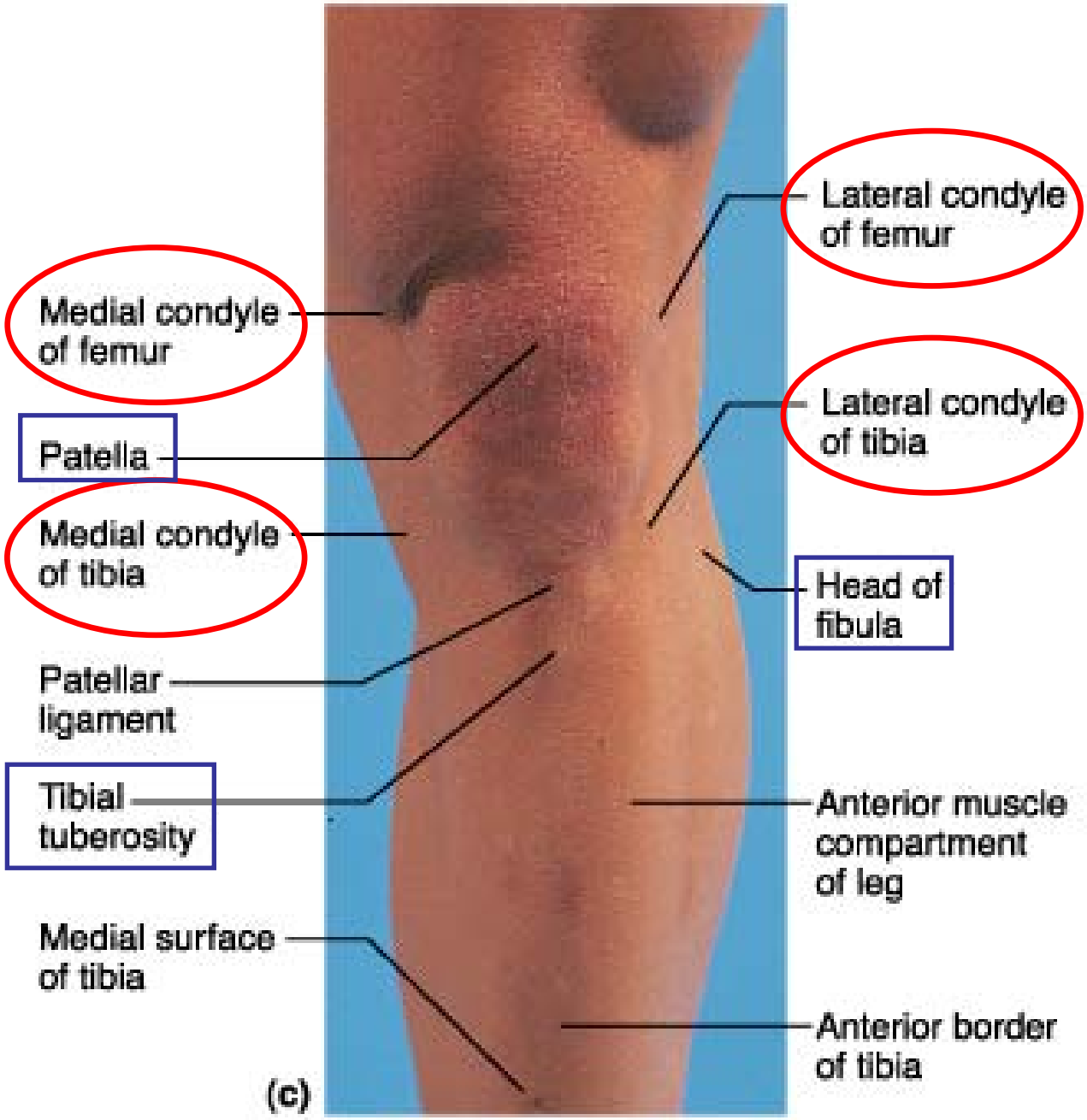


Anterior



Posterior

(a) Patella



Fibula

- Slender
- Lateral bone of the leg
- ***Non-weight bearing***
- Mainly for the attachment of lateral leg muscles

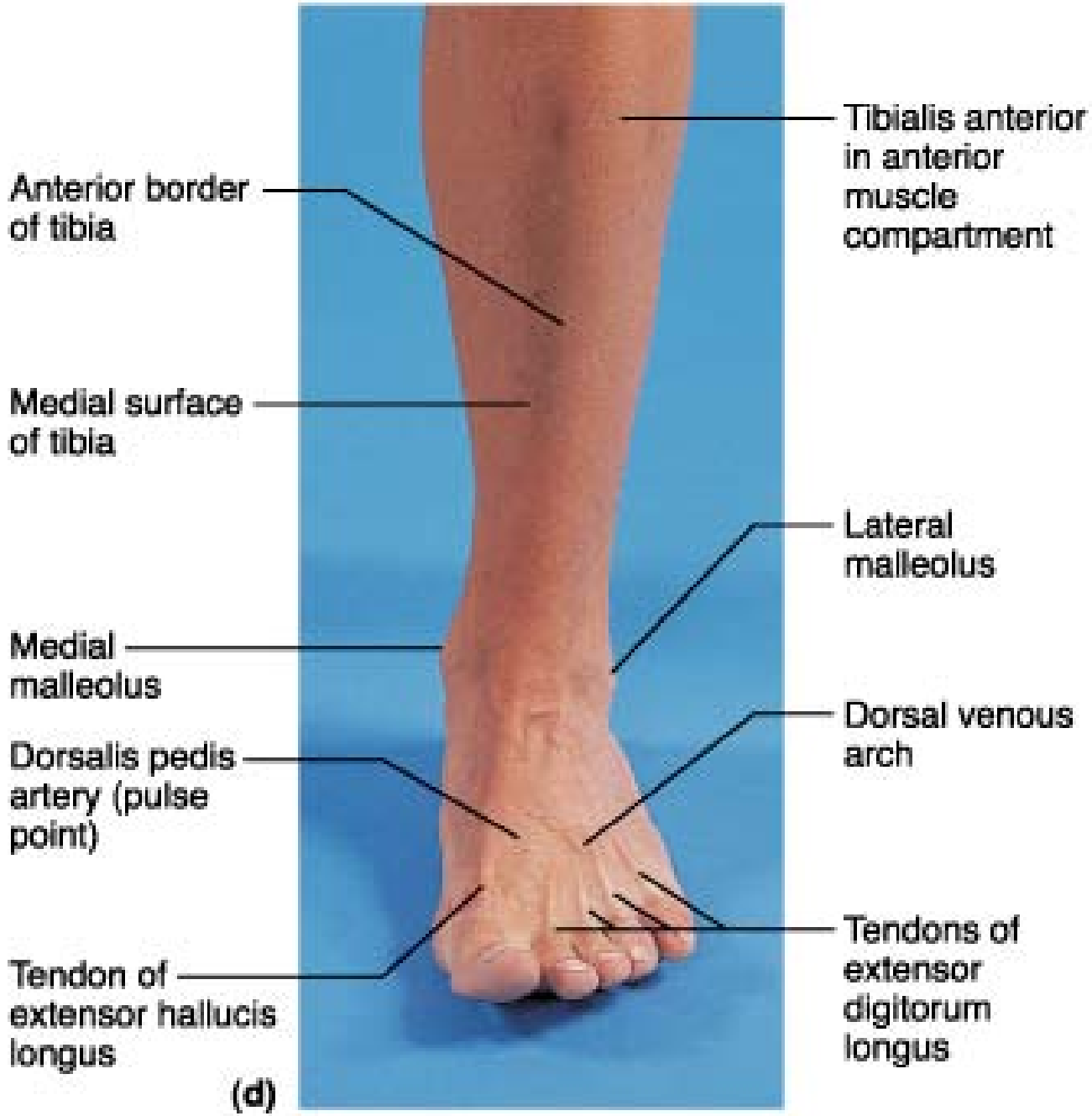
Fibula

- **Head:** articulate with the tibia to form the proximal *tibiofibular joint*
- **Shaft:** for attachment of muscles
- **Latreal malleolus:** articulate with the tibia to form the *distal tibiofibular joint,* and with the talus contributing to the *ankle joint*

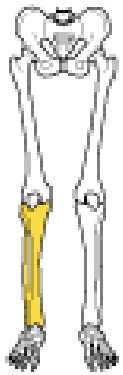
Surface anatomy

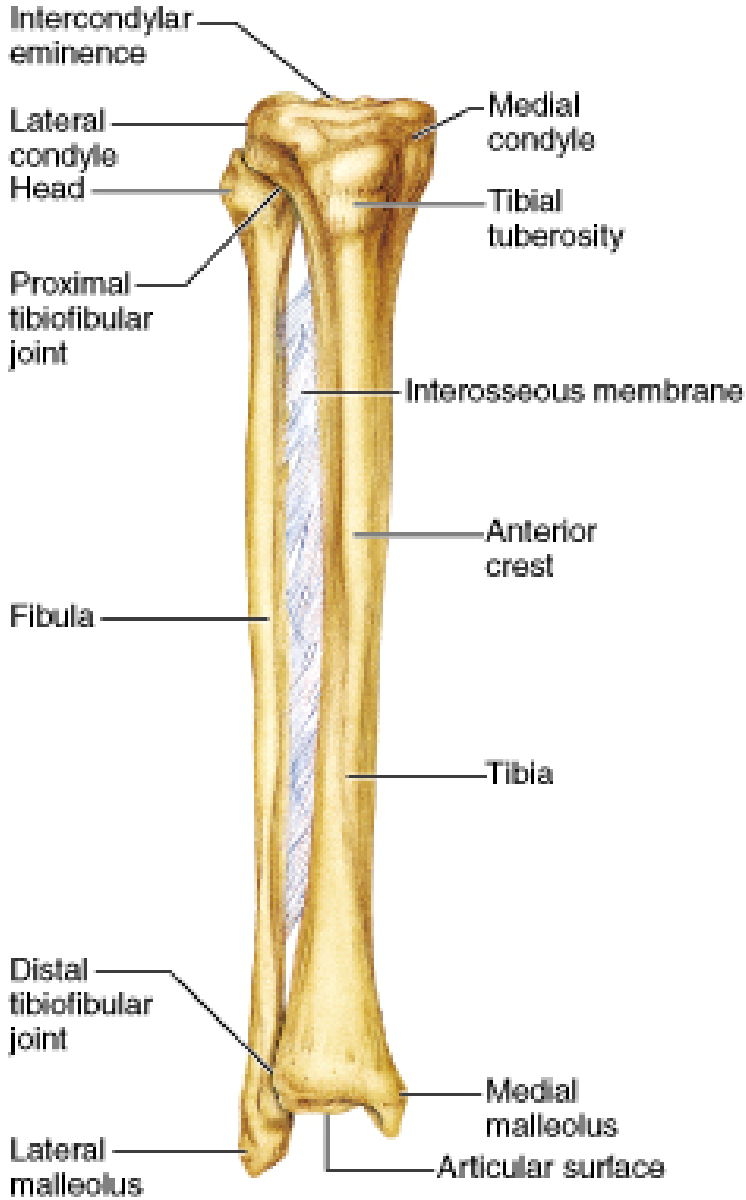
Palpate the following:

- Medial tibial condyle
- Tibial tuberosity
- Head of fibula
- Shin bone
- Medial malleolus
- Lateral malleolus


Tibialis anterior in anterior muscle compartment
Anterior border of tibia
Medial surface of tibia
Lateral malleolus
Medial malleolus
Dorsal venous arch
Dorsalis pedis artery (pulse point)
Tendons of extensor digitorum longus
Tendon of extensor hallucis longus
(d)

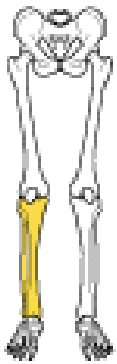
Right Tibia & Fibula
Anterior view

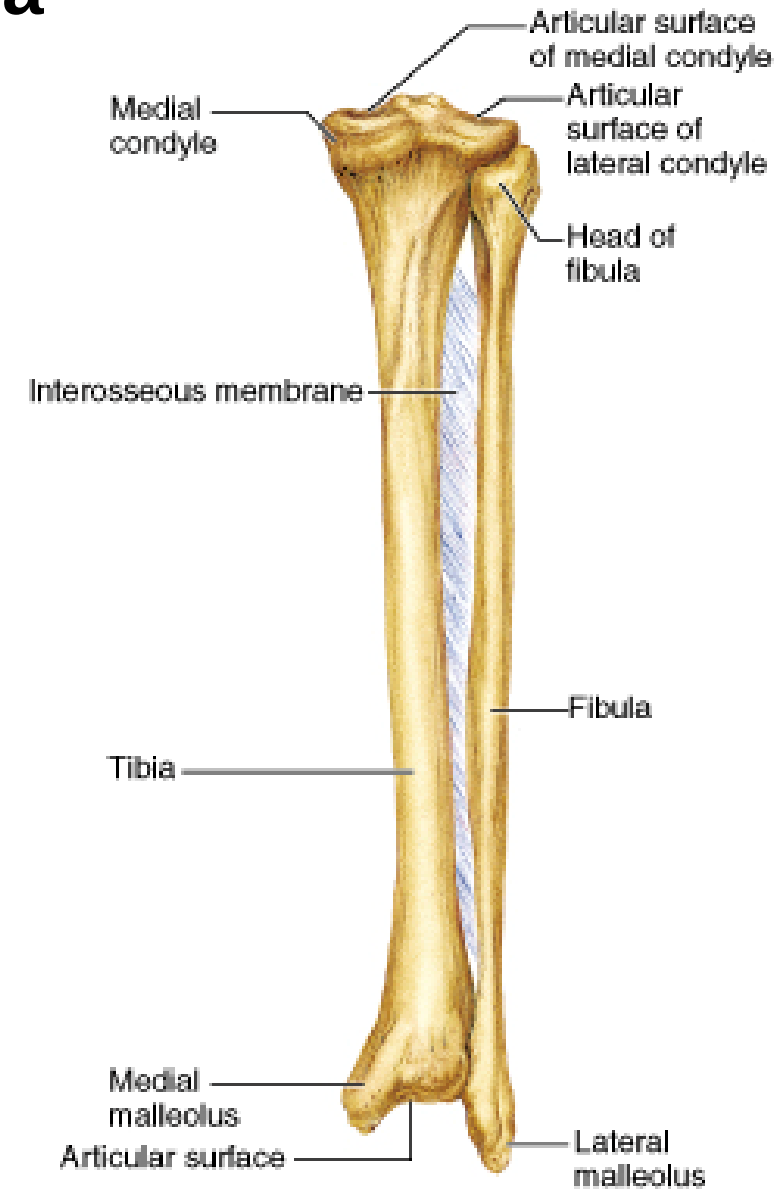




(a) Anterior view

Right Tibia & Fibula
Posterior view

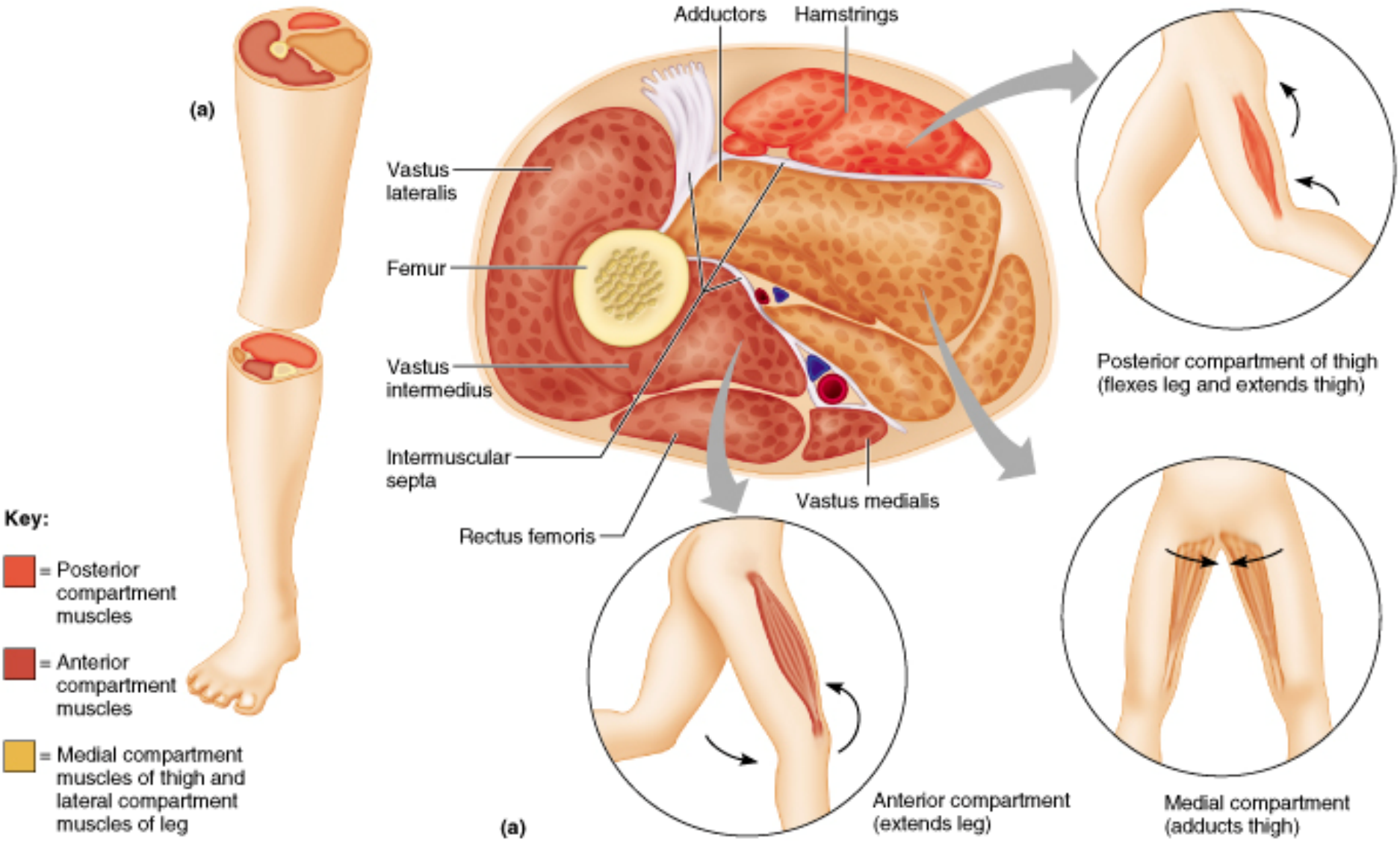




(b) Posterior view

Muscles of the thigh

- **Anterior compartment:** primary *extensors of the knee* joint
- **Medial compartment:** *adductors* of the thigh
- **Posterior compartment:** assist *flexion of the knee* and *extension of the hip*

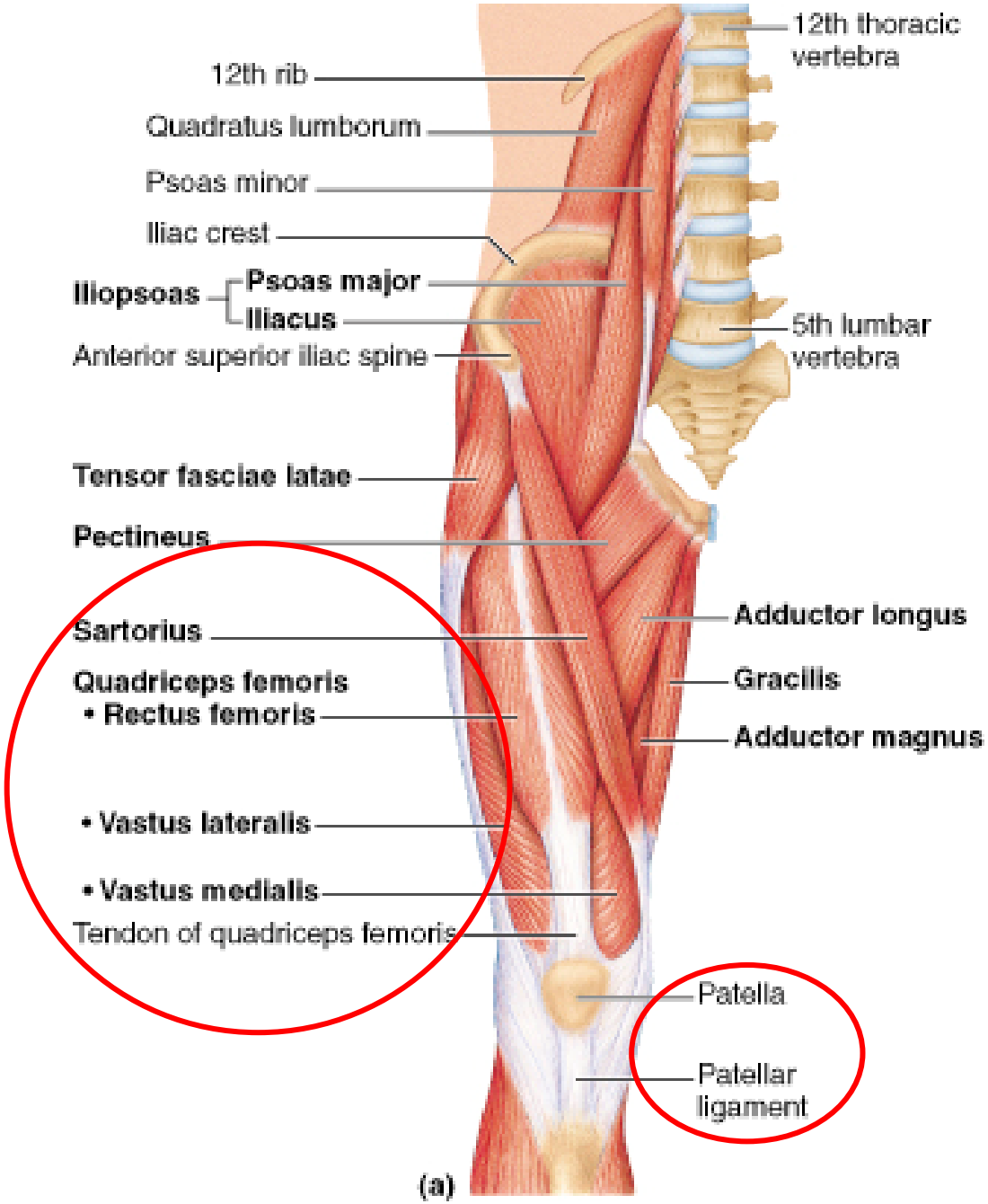


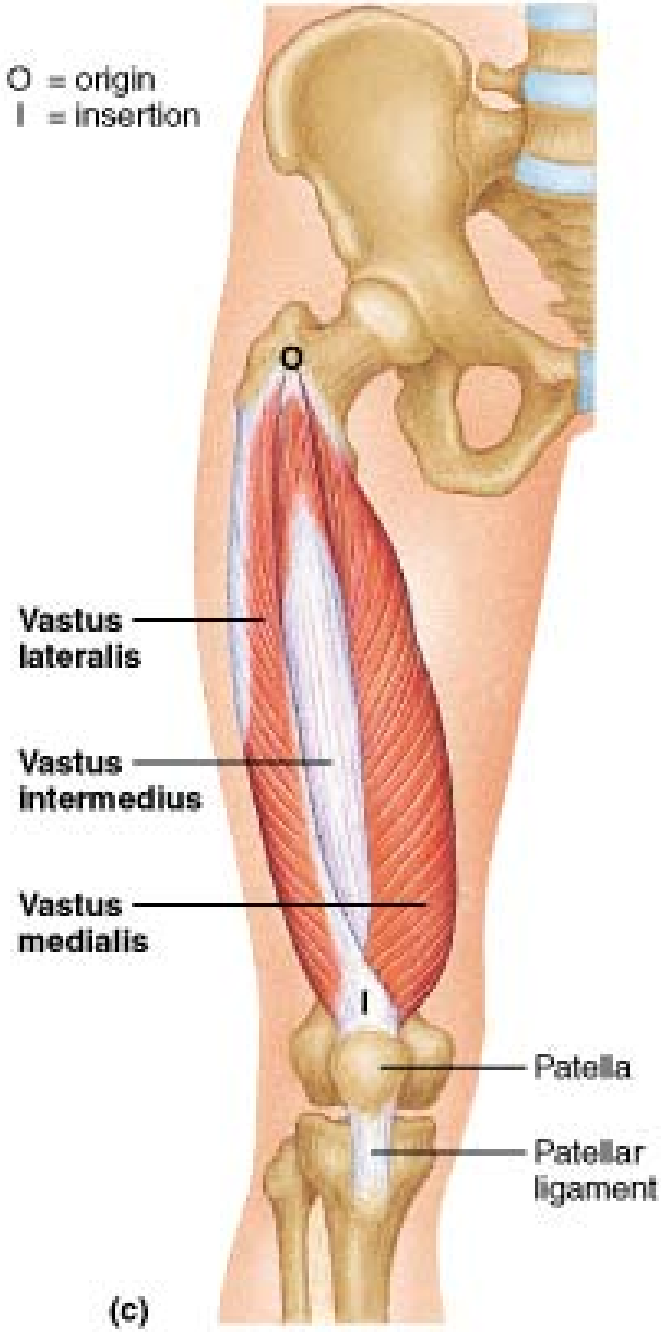
Anterior compartment

Quadriceps femoris:

- Vastus medialis (from intertrochanteric line)
- Vastus lateralis (from greater trochanter)
- Vastus intermedius (ant & lat surface of femur)
- Rectus femoris (from AIIS)

Sartorius (ASIS to sup med surface of tibia)





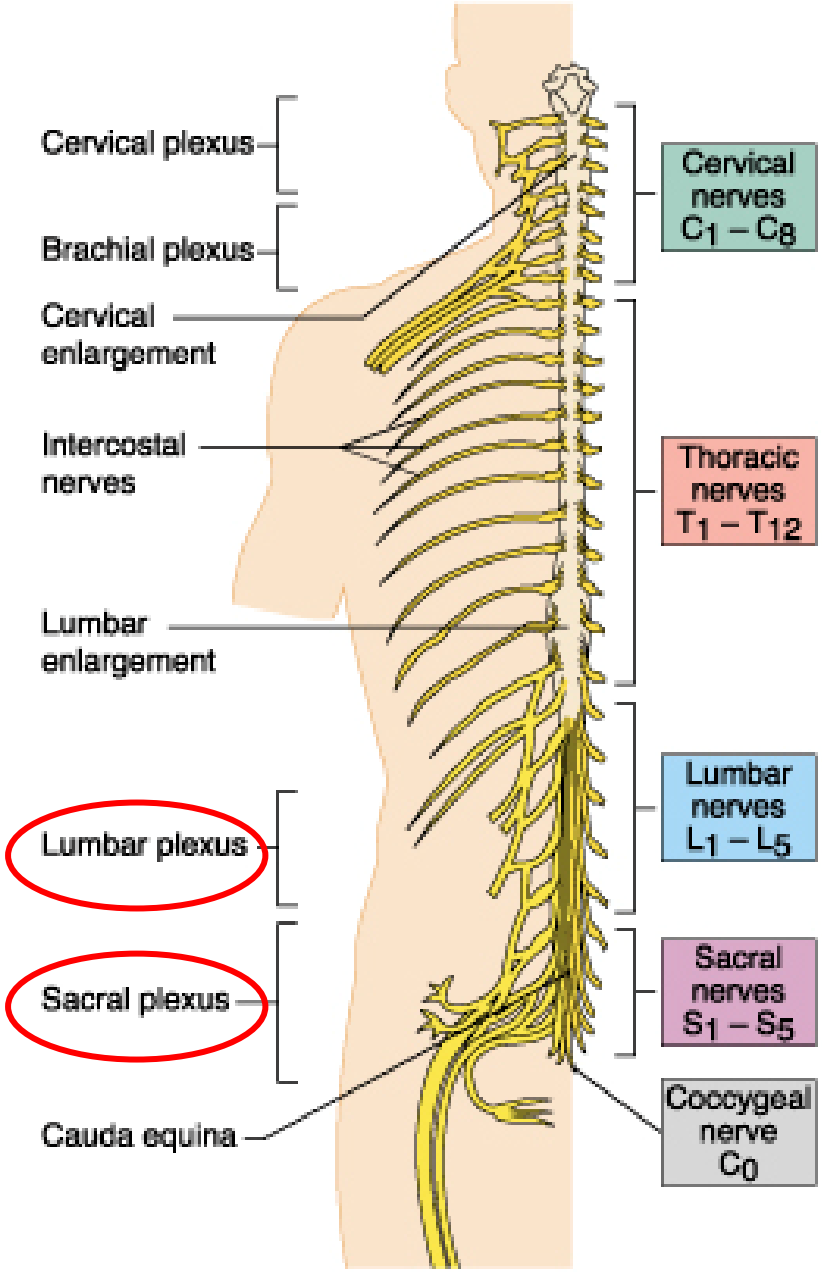
Anterior compartment

- **Quadriceps femoris insertion**: to base of the patella, then by patellar ligament to tibial tuberosity

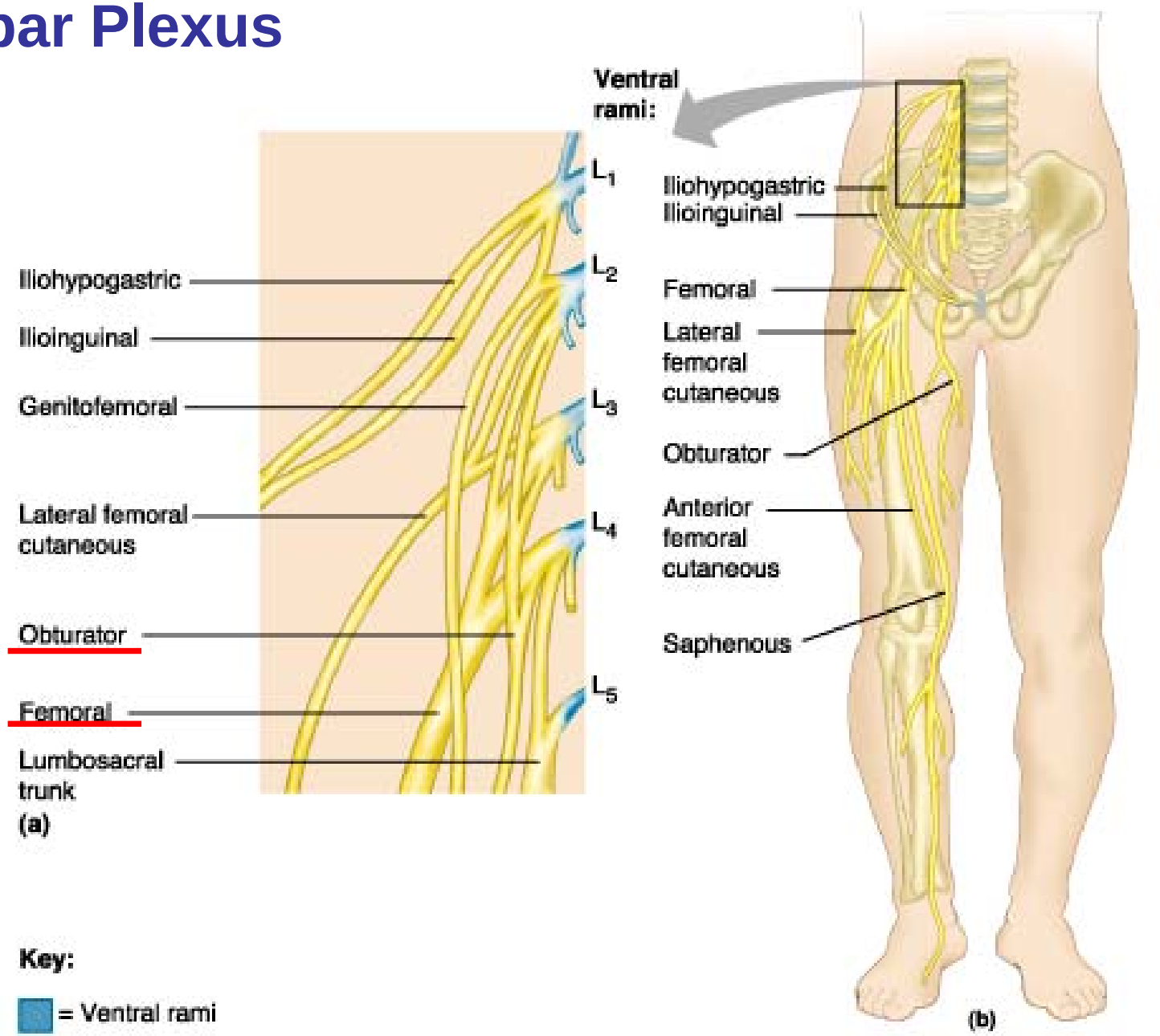
- Innervation: FEMORAL NERVE (L2-L4)

Femoral nerve

- Arises from the lumbar plexus
- Descends within the groove between the psoas major and iliacus muscles
- Lateral to the femoral artery as it enters the thigh



Lumbar Plexus



Femoral nerve entrapments

- Herniation of intervertebral discs (L2/L3 or L3/L4)
- At the level of inguinal ligament (femoral nerve neuropathy)

This may result in:

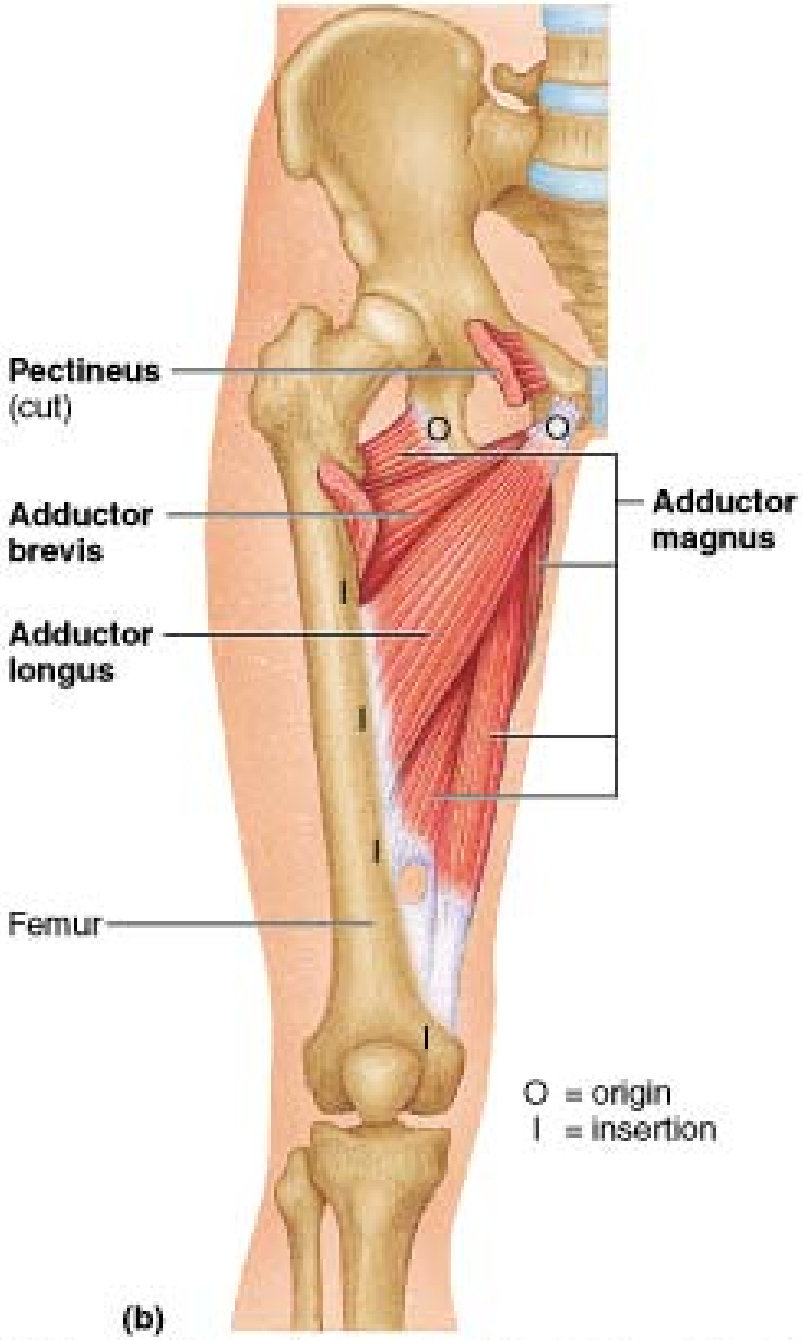
- Weak extension of the knee
- Weak patellar tendon reflex (L4 level reflex)
- Cutaneous sensory changes (anterior thigh & L4 dermatome)

Medial compartment

- From pubis to linea aspera of the femur:
  - **Adductor longus**
  - **Adductor brevis**
  - **Adductor magnus**
  - **Gracilis**
- Innervation: OBTURATOR NERVE (L2-L4)

Obturator nerve

- Arises from the lumbar plexus
- Courses medial to the psoas major muscle
- Enters the thigh through the obturator canal
- Sensory: medial skin of thigh (cutaneous)



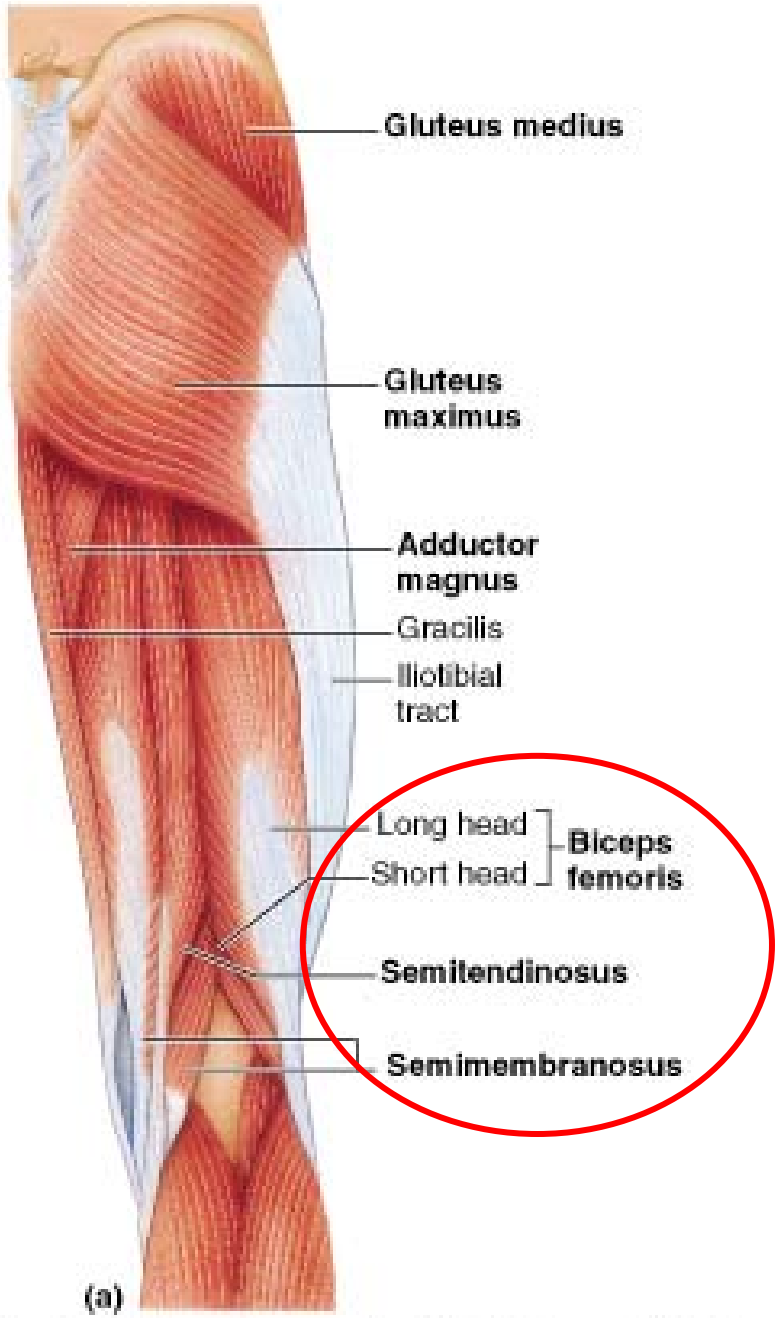
Posterior compartment

Hamstrings:

- Semitendinosis
- Semimembranosus

(Ischial tuberosity to tibia)

- Biceps femoris: long head (ischial tuberosity to fibula)
- Biceps femoris: short head (femur to fibula)



Posterior compartment

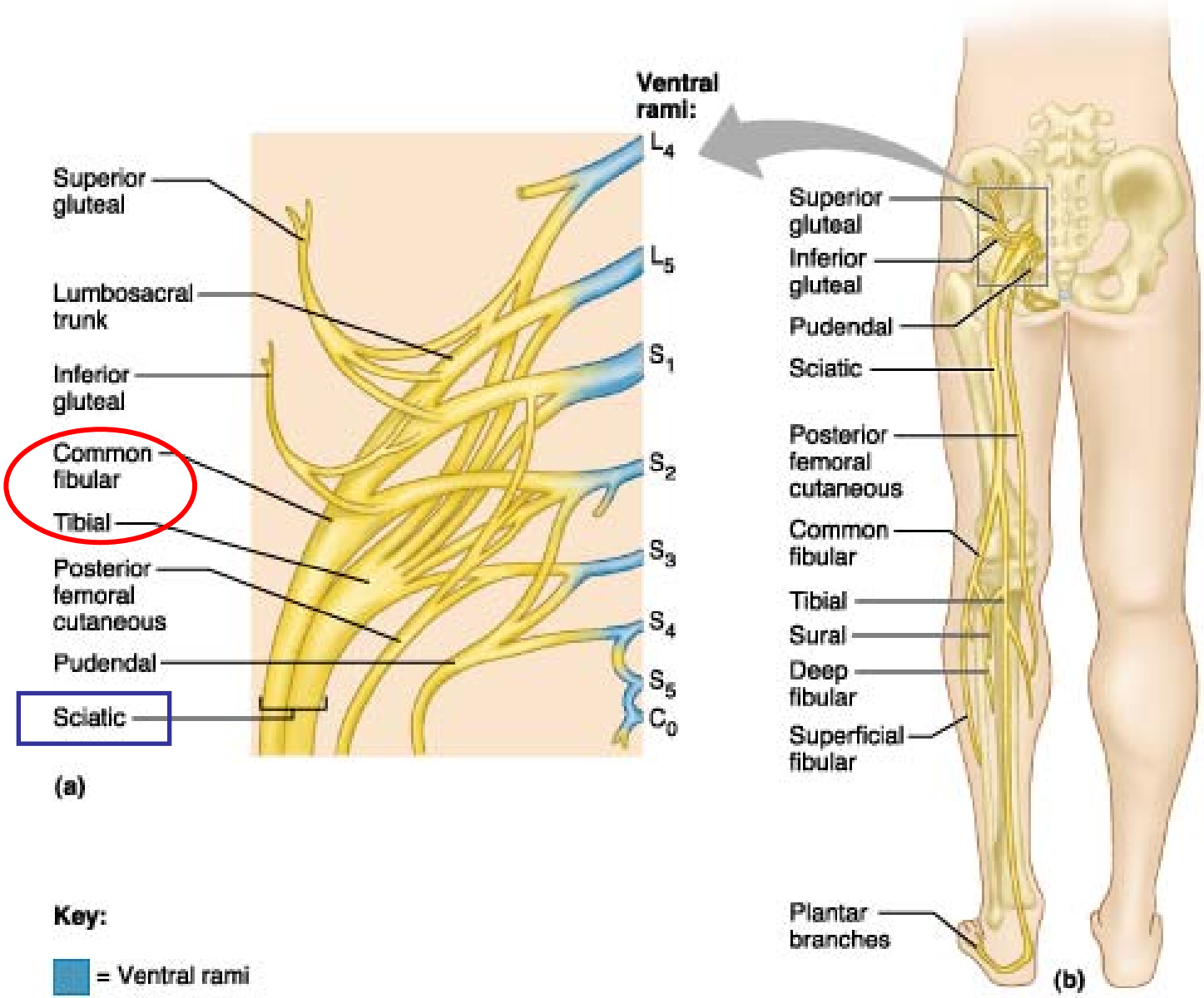
- Act across the hip and knee joints except the short head of biceps femoris

- Innervation: SCIATIC NERVE (L4-S3)

Sciatic nerve

- Arises from the sacral plexus
- Leaves the gluteal region at a point approximately half-way along a line joining the ischial tuberosity and greater trochanter
- Terminates 12-15 cm above the knee by dividing into the **tibial nerve** and **common peroneal nerve**

Sacral Plexus

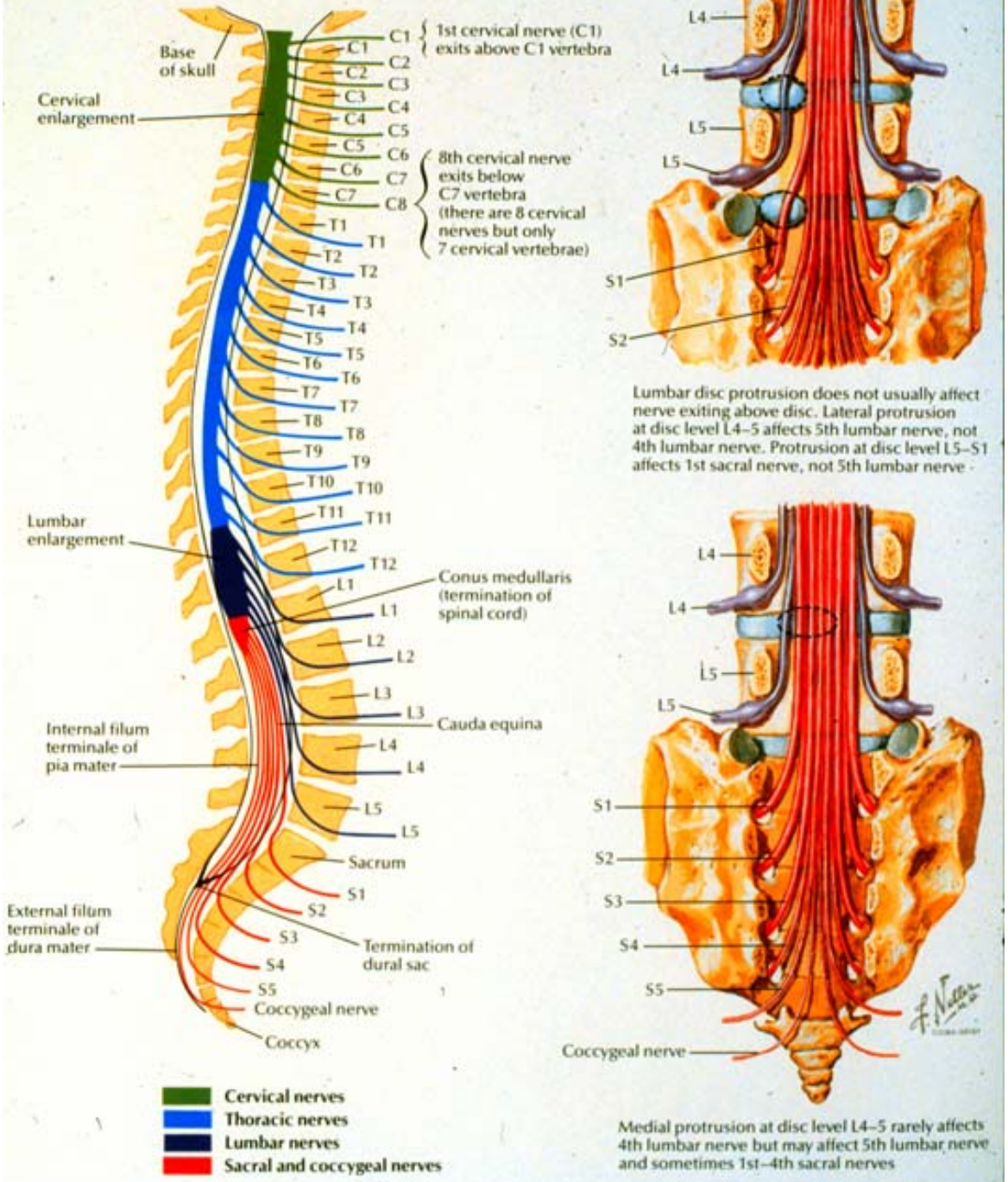


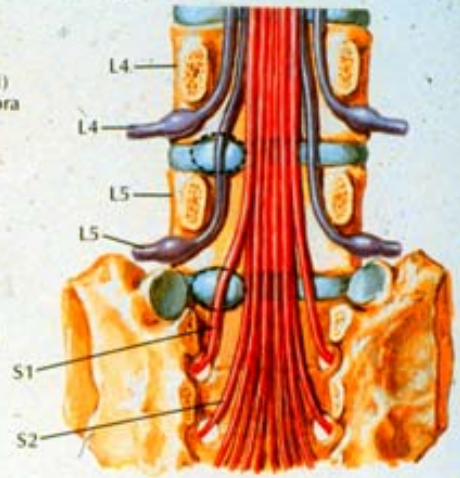
Sciatic nerve entrapments

- Posterolateral ***herniation*** of the intervertebral discs (nerve root entrapment)
- Misplaced needle when attempting injections in the gluteal region

→ **Sciatica**

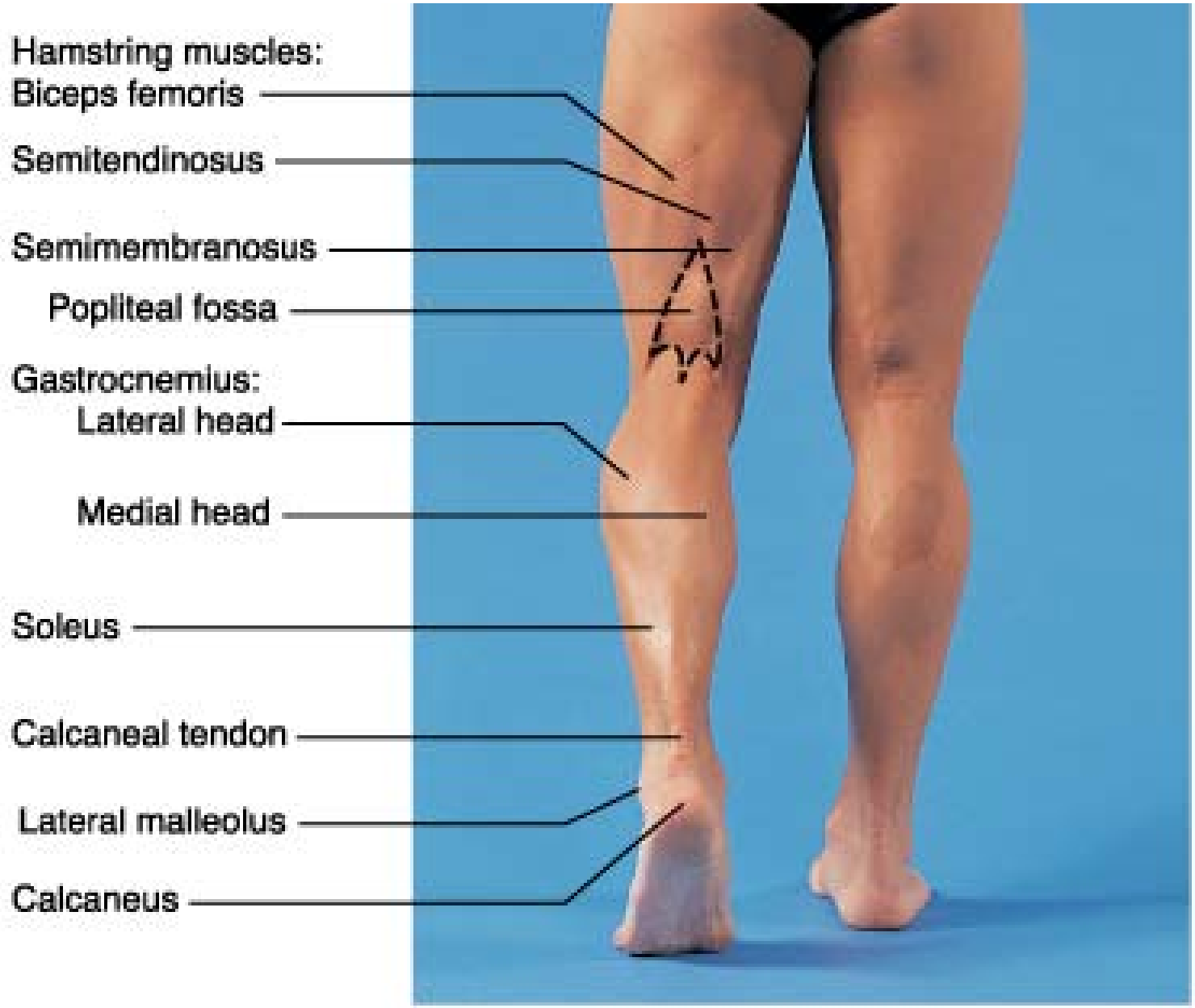
- Radiating, deep pain within the buttocks, posterior thigh, and often below the knee
- Paresthesia or anesthesia (dermatomal in distribution)

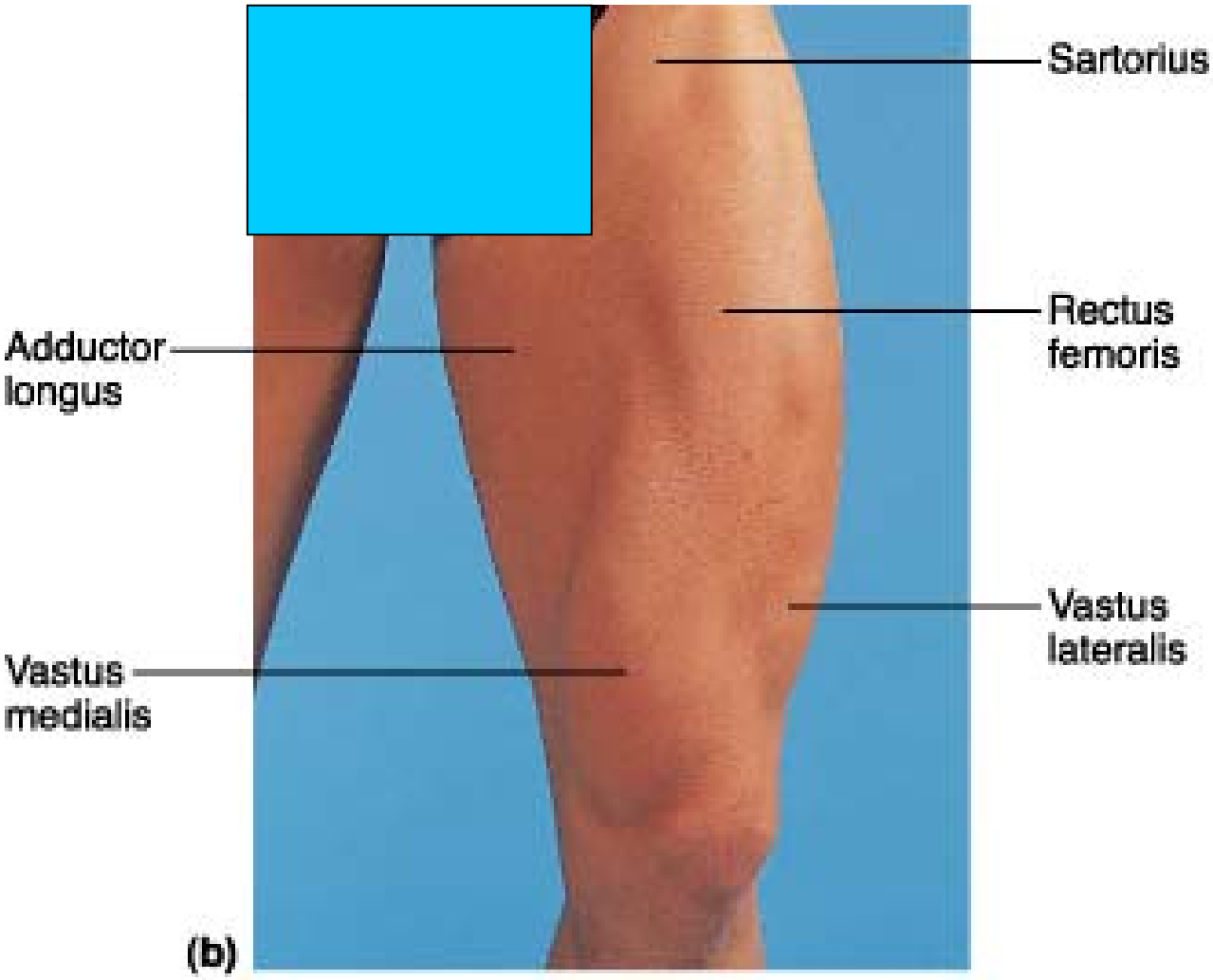




Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4–5 affects 5th lumbar nerve, not 4th lumbar nerve. Protrusion at disc level L5–S1 affects 1st sacral nerve, not 5th lumbar nerve

Medial protrusion at disc level L4–5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st–4th sacral nerves




Sartorius
Rectus femoris
Adductor longus
Vastus lateralis
Vastus medialis
(b)

Which bony points of the lower limb are reliable landmarks for measuring the length of the lower limb?

Ligaments of the knee joint

- The knee depends heavily on ligaments for stability……Why?

- Ligament injuries of the knee have more serious long term implications than a fracture of the femur or tibia…….Why?

Ligaments of the knee joint

- **Anterior and posterior cruciate ligaments:** prevent anteroposterior displacement of the tibia

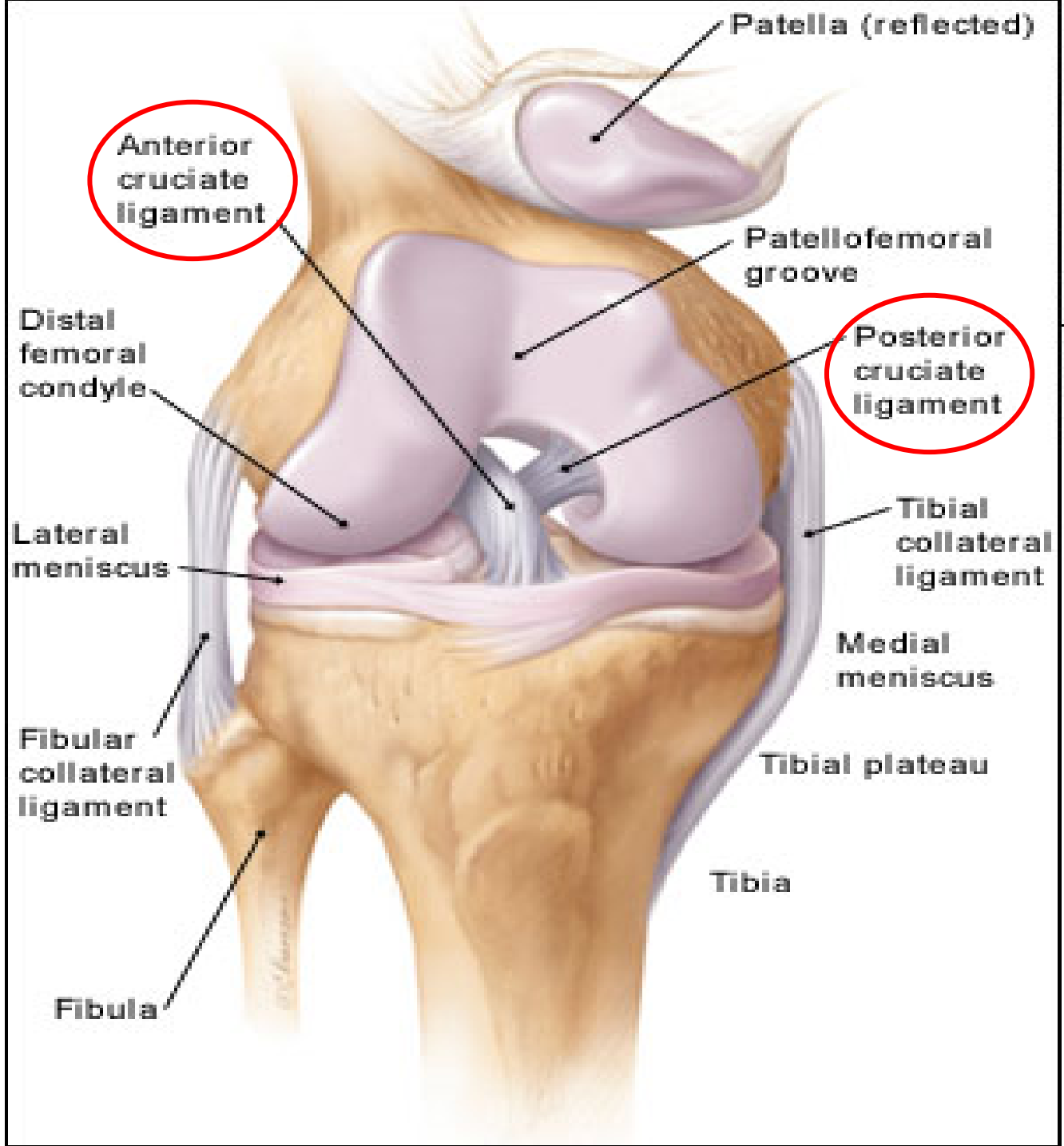
- **Medial and lateral collateral ligaments:** restrain rotation and lateral movement at the knee

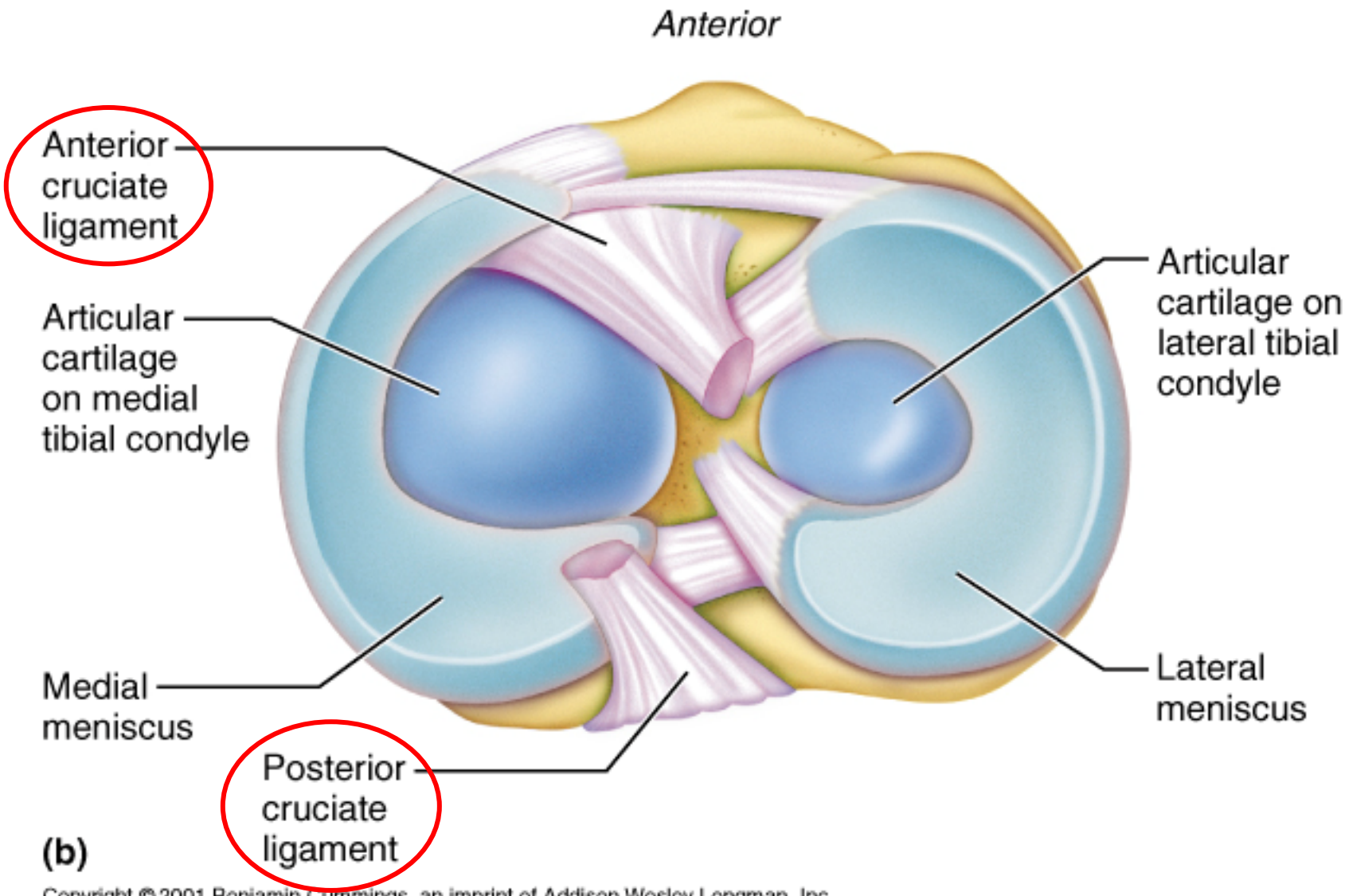
Ligaments of the knee joint

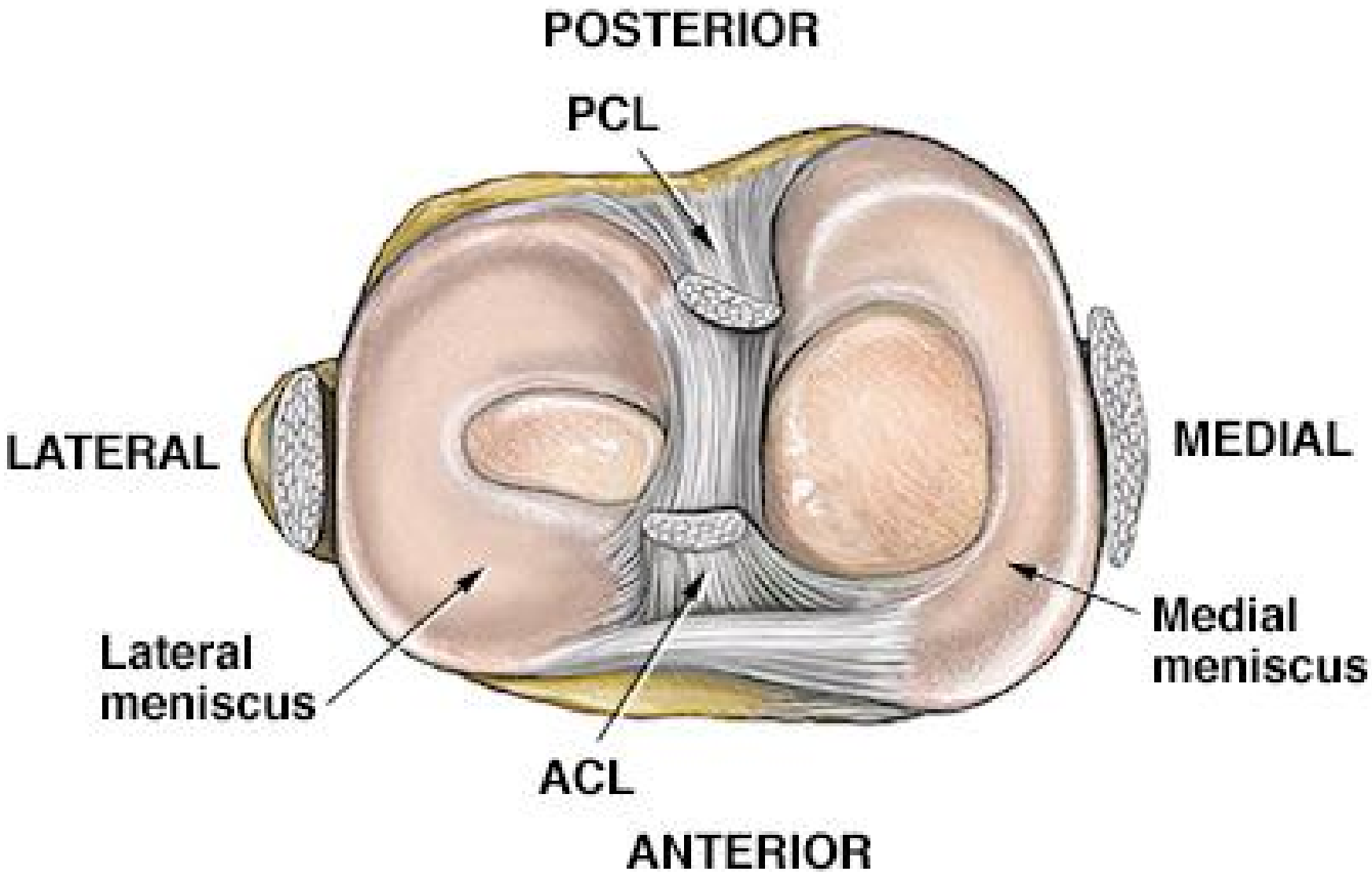
- **Anterior cruciate ligament (ACL):**
  - arises from the anterior intercondylar area of the tibia
  - runs posteriorly and laterally
  - attaches to the back of the medial side of the lateral femoral condyle

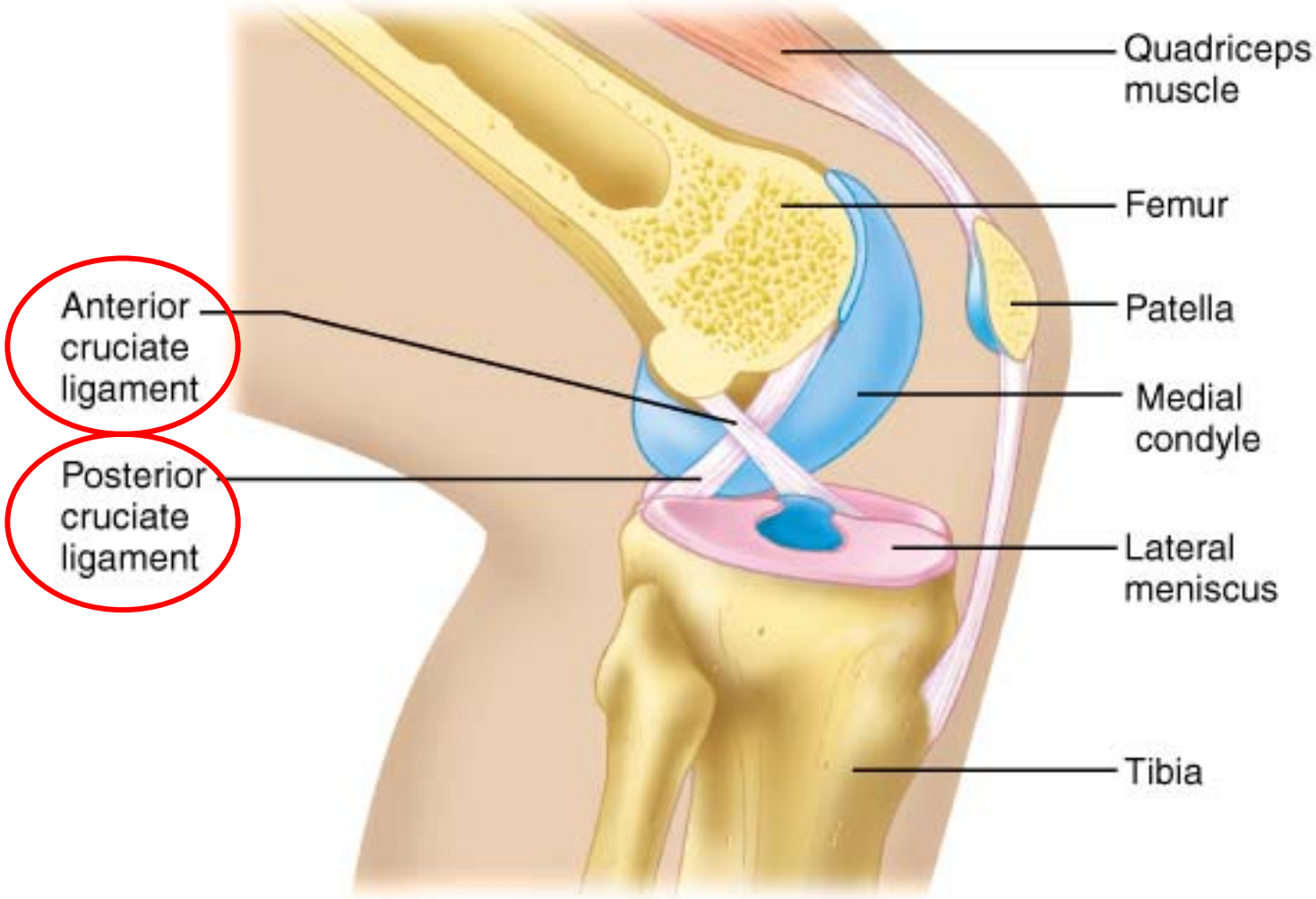
Ligaments of the knee joint

- **Posterior cruciate ligament (PCL):**
  - arises from the posterior intercondylar area of the tibia
  - extends anteriorly and medially
  - attaches to the lateral side of the medial femoral condyle

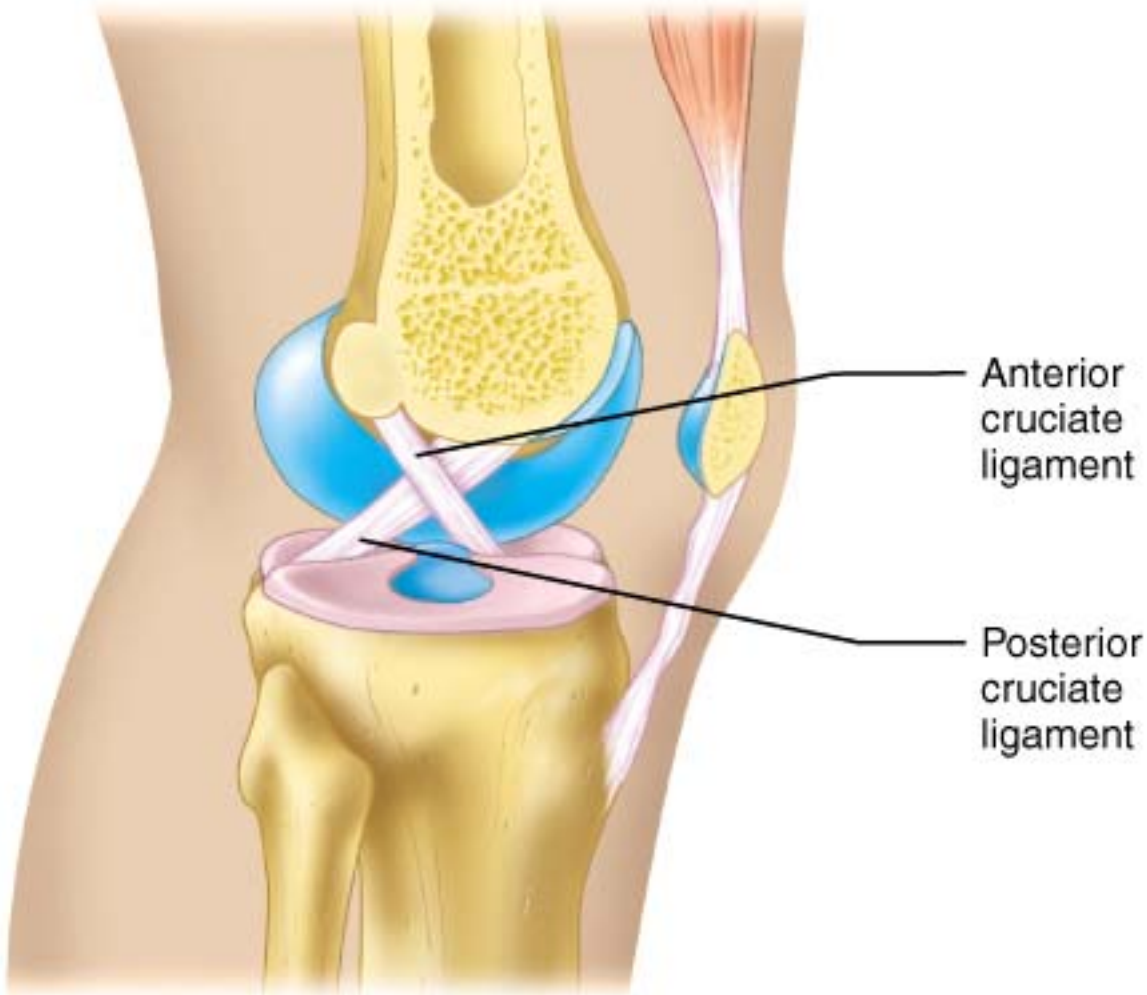








(a)



(b)

Anterior cruciate injury

- The ACL limits forward movement of the tibia on the femur
- Often ruptured in sports by sharp twisting movement (very common injury)

Posterior cruciate injury

- PCL can be torn in 2 ways:
  - A blow to the upper end of the tibia when the knee is flexed (e.g., head on collision while seated on a motor cycle)
  - Hyperextension

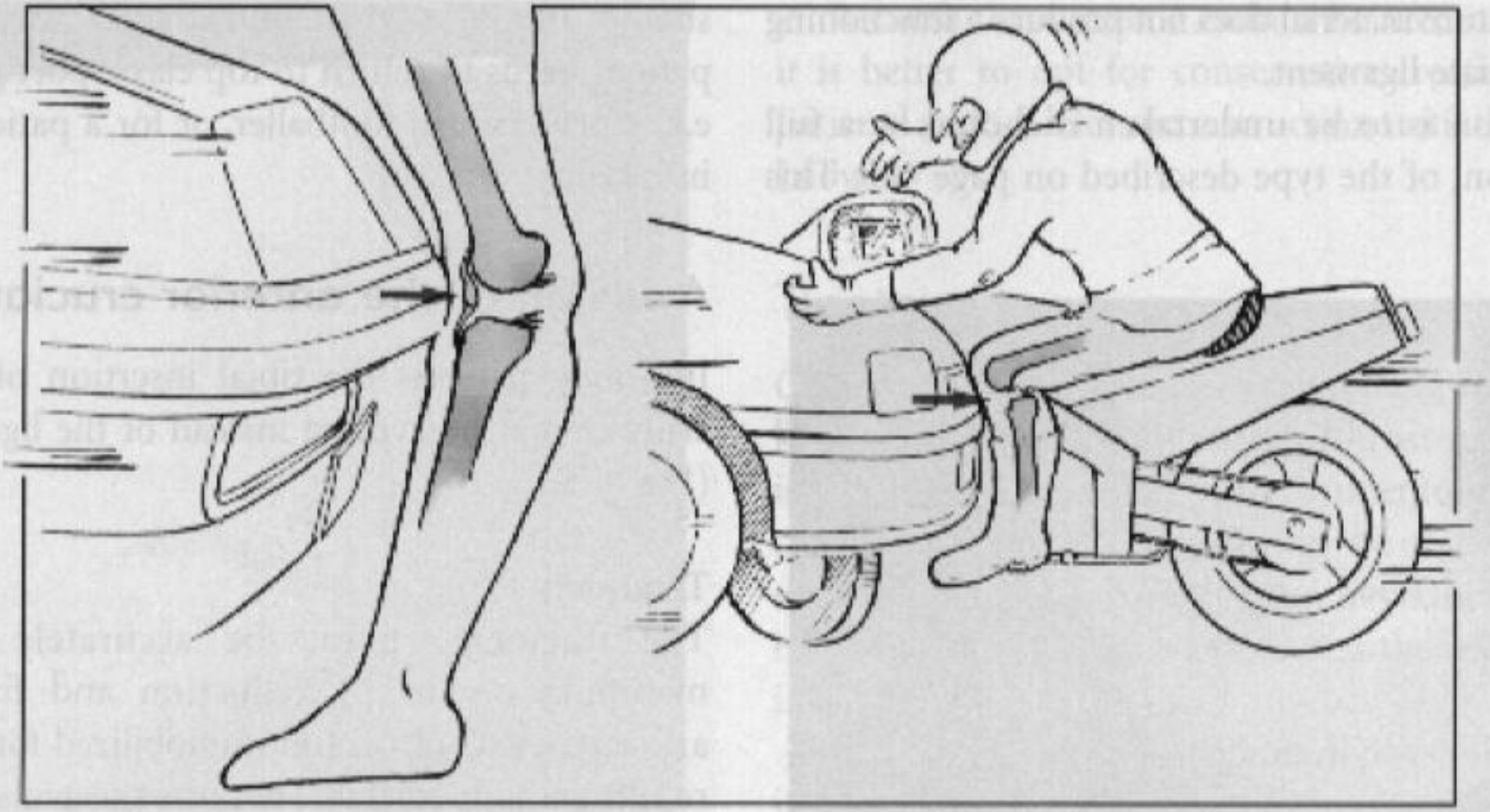


Fig. 14.38 Mechanism of rupture of the poterior cruciate ligament by (a) hyperextension: (b) impact to the upper end of the tibia with the knee flexed.

Posterior cruciate injury

- Assessment: **posterior drawer sign** with the knee flexed to 90^{o} and the tibia is passively pushed posteriorly on the femur

Ligaments of the knee joint

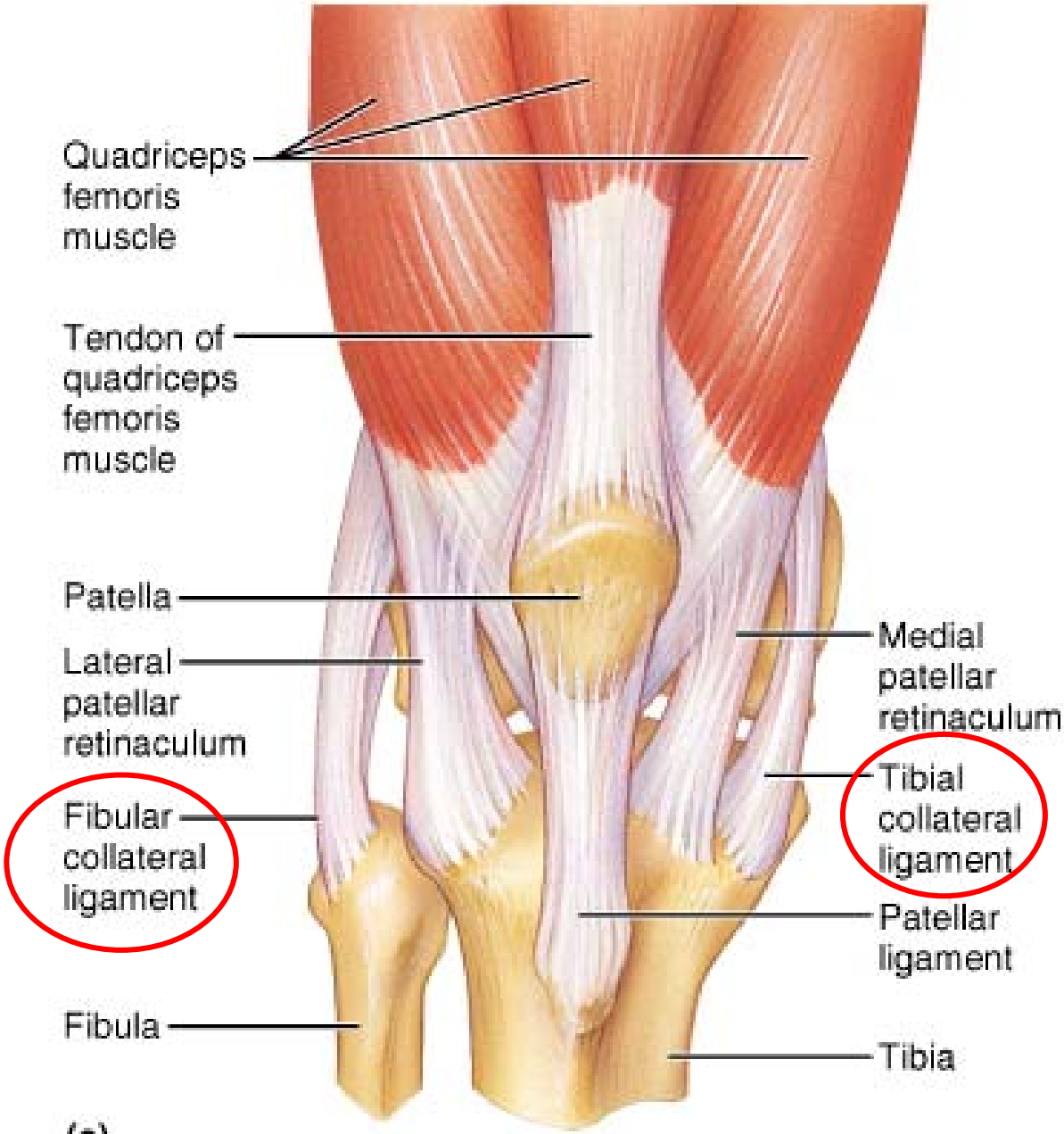
- **Medial (tibial) collateral ligament:** pass from the medial epicondyle of the femur to the medial surface of the proximal end of tibia

- Fused posteriorly with the capsule of the knee joint

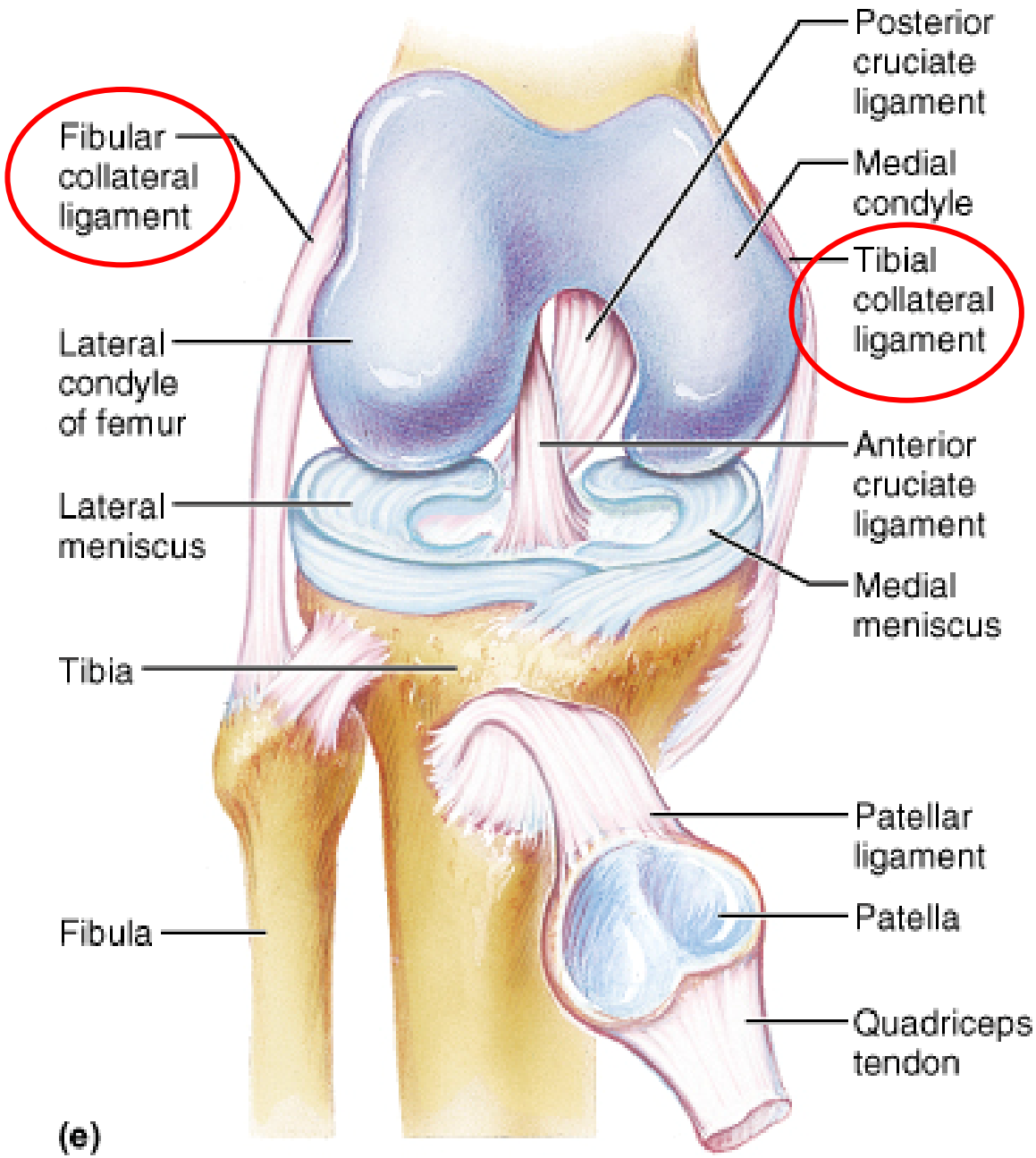
Ligaments of the knee joint

- **Lateral (fibular) collateral ligament:** pass from the lateral epicondyle of the femur to the head of fibula

- Lateral to- and free of- the joint capsule



(c)



Medial collateral injury

- Usually associated with tear of the ACL
- Caused by valgus strain

Lateral collateral injury

- Rarely injured on its own, except in lacerations
- Not as important as the other ligaments
- If injured, there is a high incidence of injury to the common peroneal nerve