

# The Body Works?

Part of the UVic  
Retirees Association (UVRA)  
**Elder Academy Program**

*Presenters: David Docherty, Ph.D.,  
Chris Pengilly, M.D., and Pat Gunton, M.D.*

# Overall approach:

**Purpose:** To provide some insight into how the body works and what can go wrong so you are able to understand what goes on in your body and communicate more effectively with medical professionals.

# Presentations: two parts

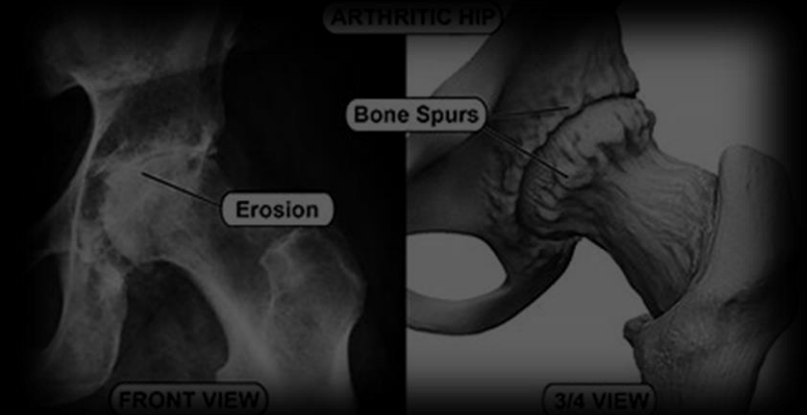
1. The anatomy and function of **four** selected systems
2. Things that can go wrong and the **medical interventions** commonly available

# First 4 Systems:

- ~~The Heart of the Matter (Mar 5<sup>th</sup>)~~
- **What's a bad joint like this doing in a nice person like you ? (March 12<sup>th</sup>)**
- The Control Centre (March 19<sup>th</sup>)
- The War against Invaders (March 26<sup>th</sup>)

# Outline of Session

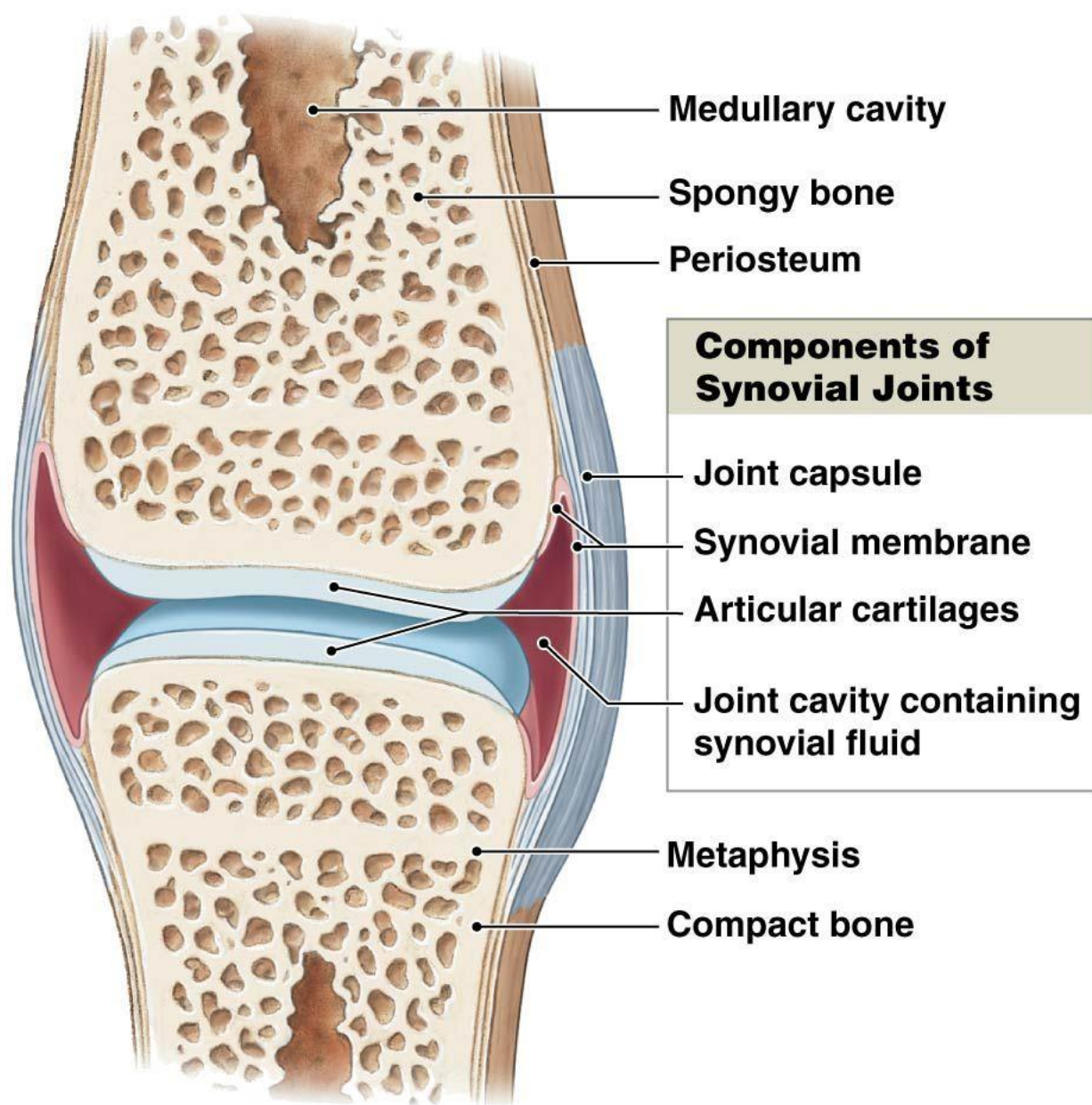
- Structure of typical synovial joint
- The hip joint and function
  - Quick comparison with the shoulder joint
  - Ligaments and muscles
- The knee joint and complexity
  - Ligaments and muscles
- Questions





# Articulations

## *The hip and Knee: Anatomy and Function*



**a** Synovial joint, sagittal section

## Synovial joint

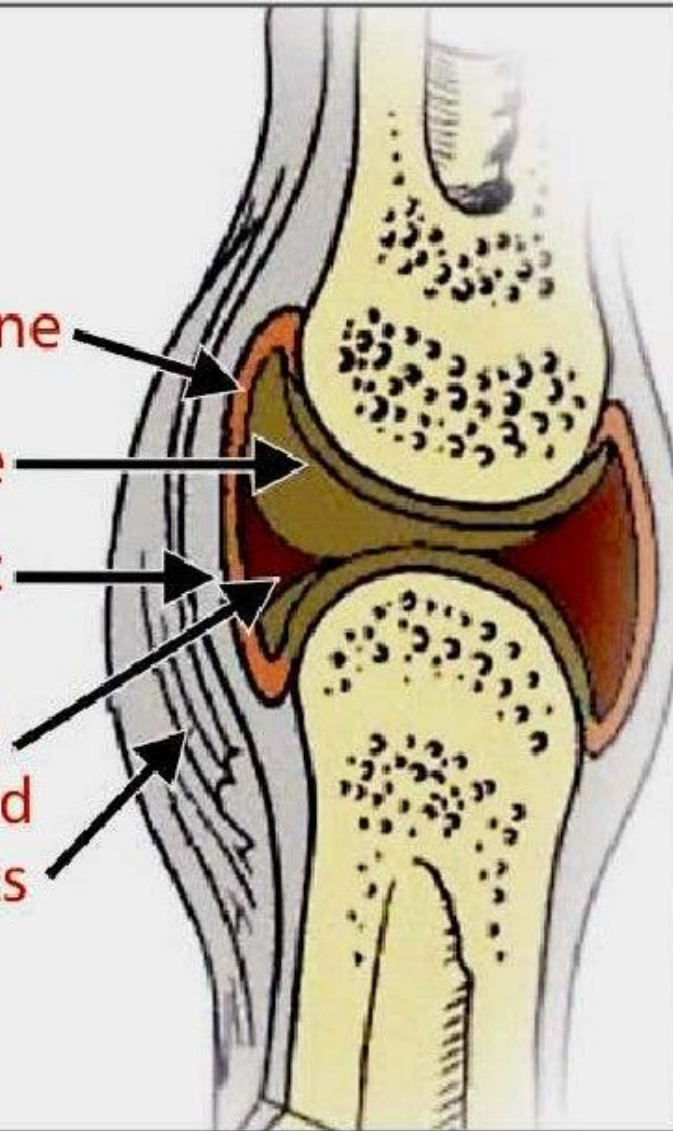
Synovial membrane

Articular cartilage

Fibrous joint  
capsule

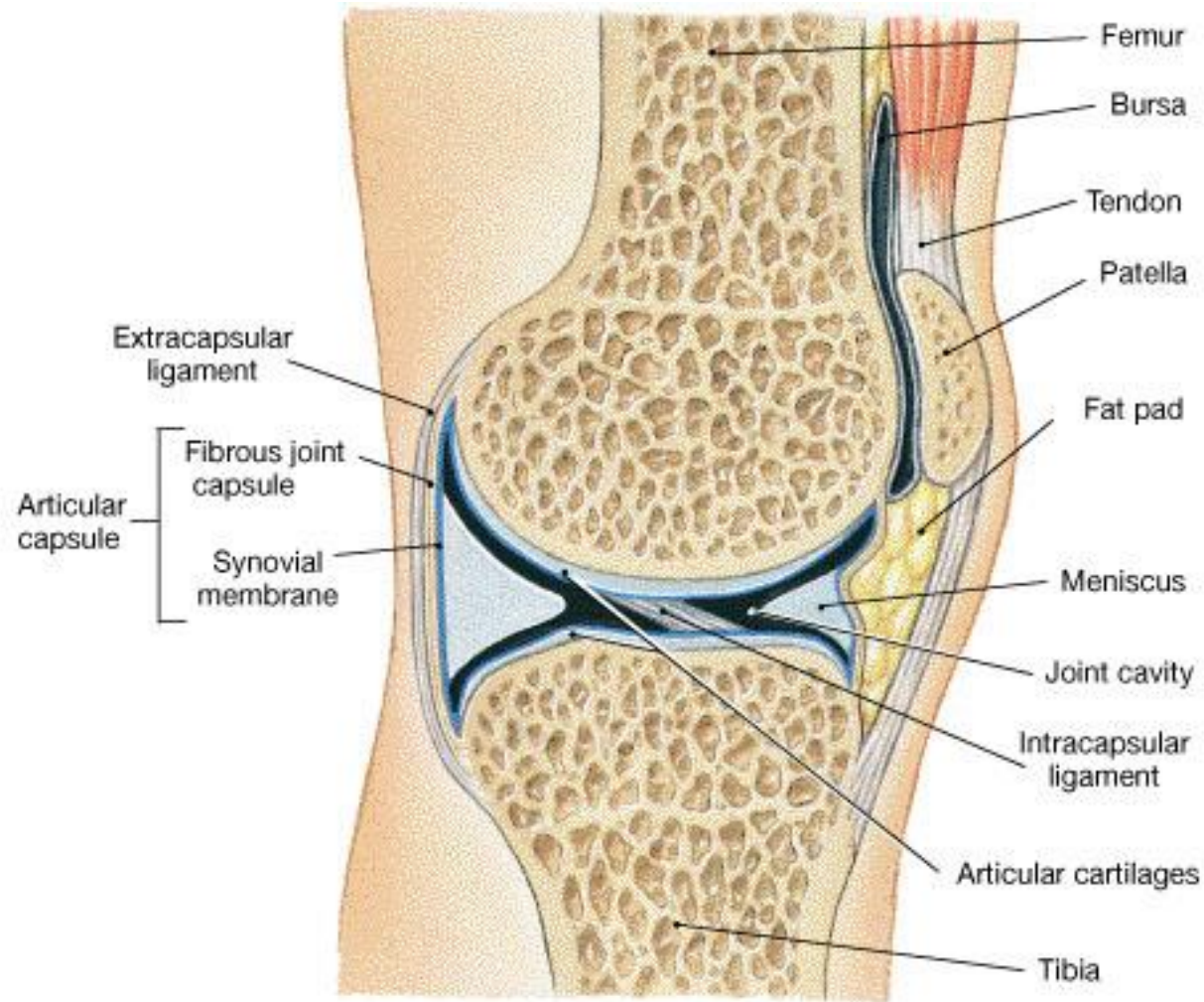
Joint cavity filled  
with synovial fluid

Ligaments



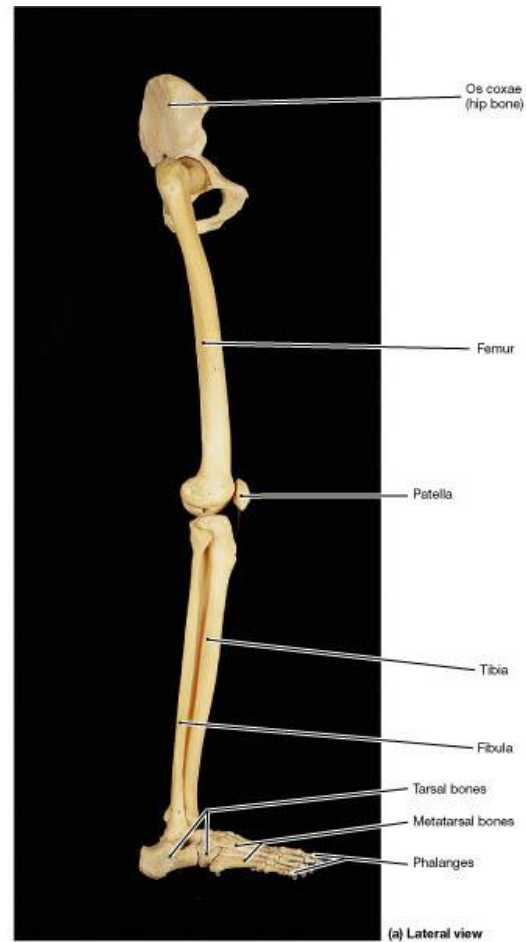


# Synovial joint



**(b) Knee joint, sagittal section**

# Pelvic Girdle and Lower Limb



# Articulations of the Pelvic girdle and lower limb

## Proximal limb

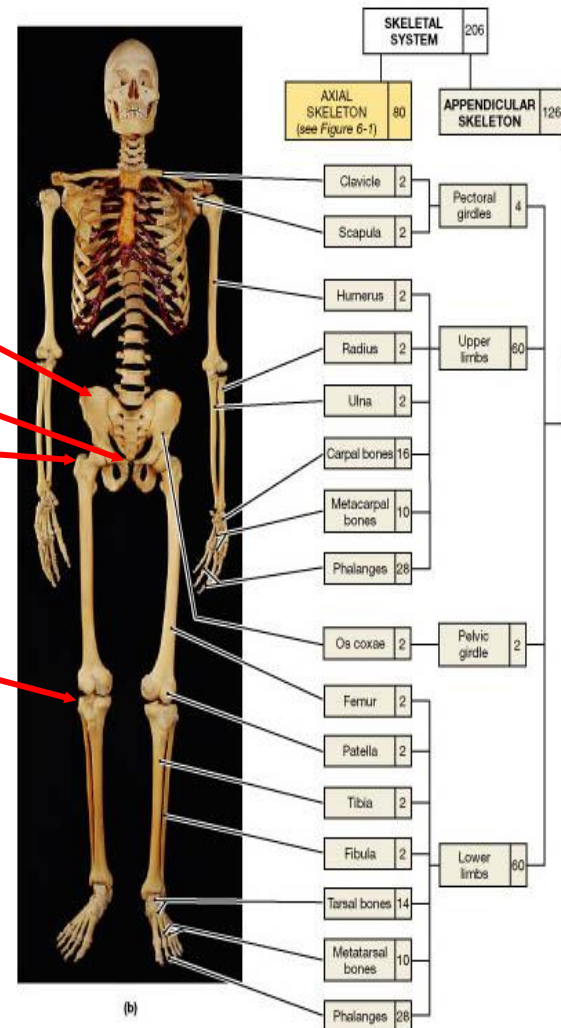
Sacroiliac joint

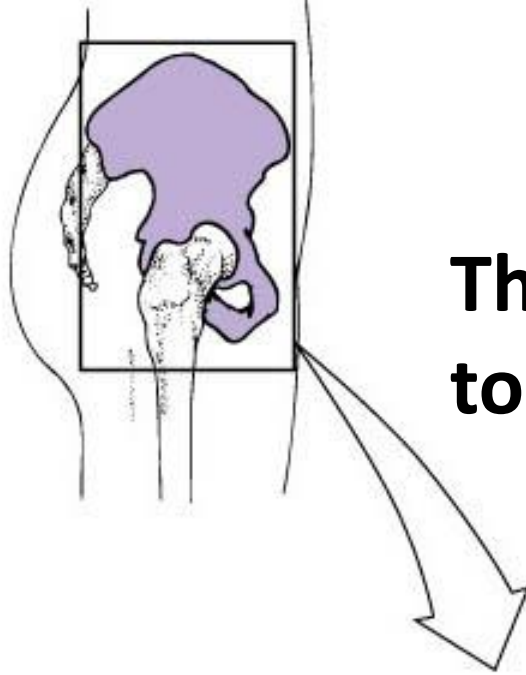
Pubic symphysis

Hip joint

Knee joint

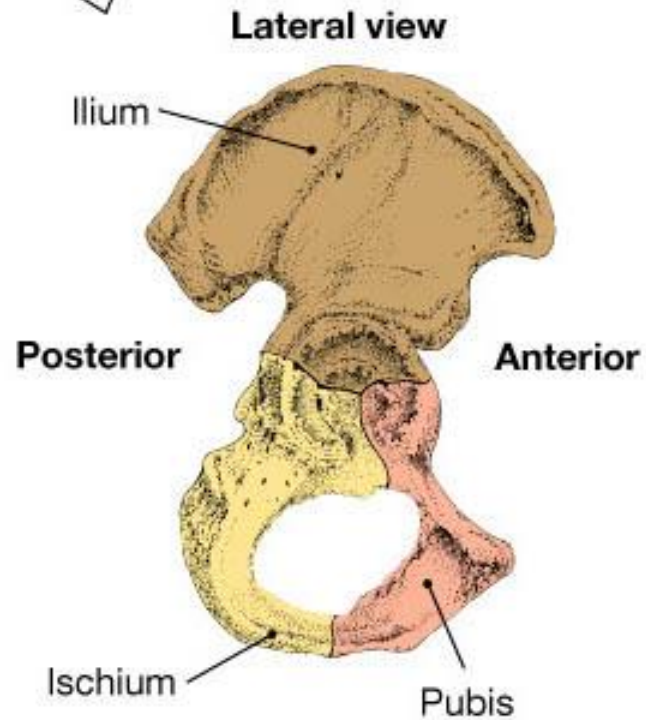
Fig 7.1  
Appendicular  
Skeleton



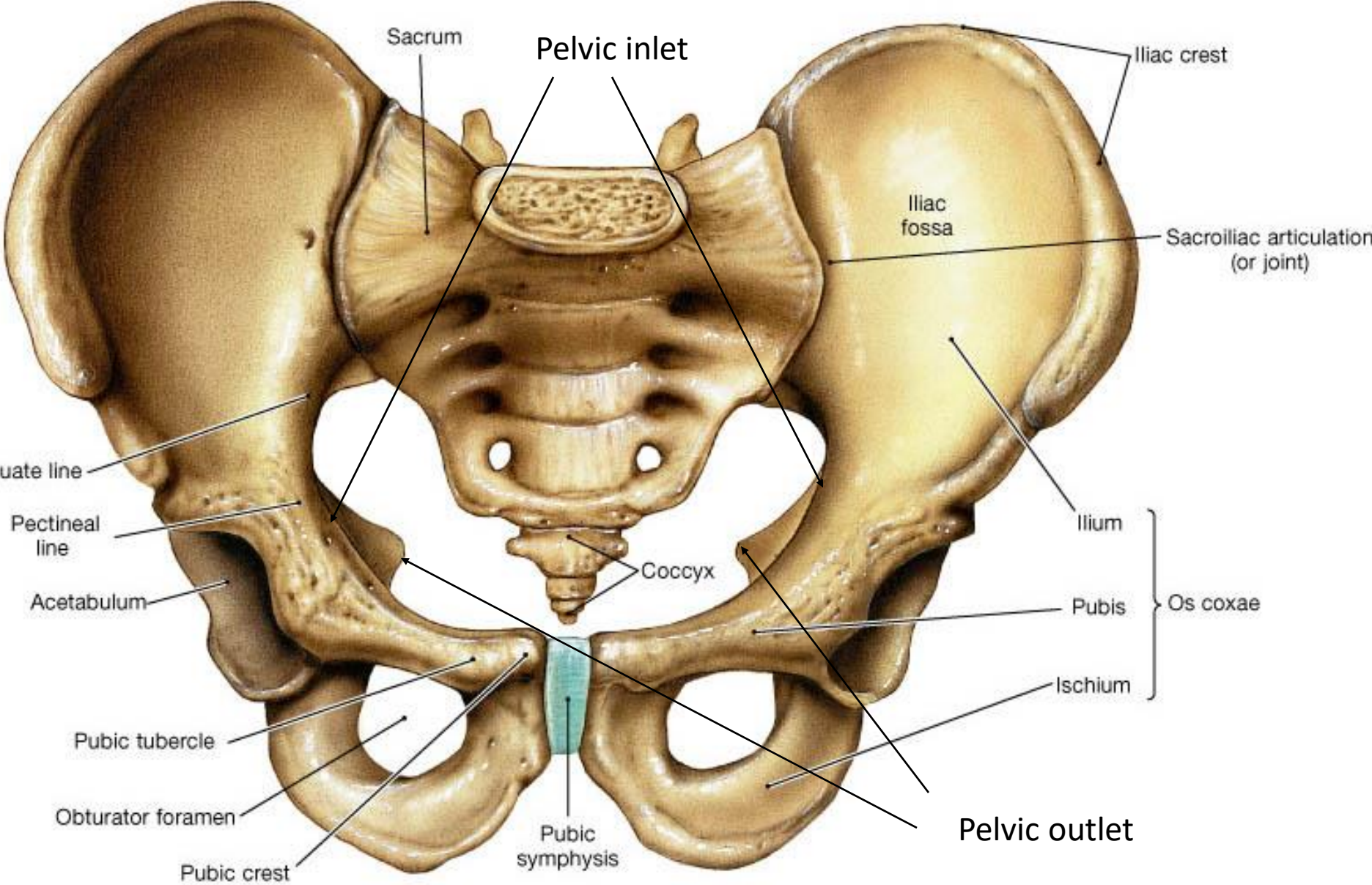


**The three bones that fuse to form the pelvic bone**

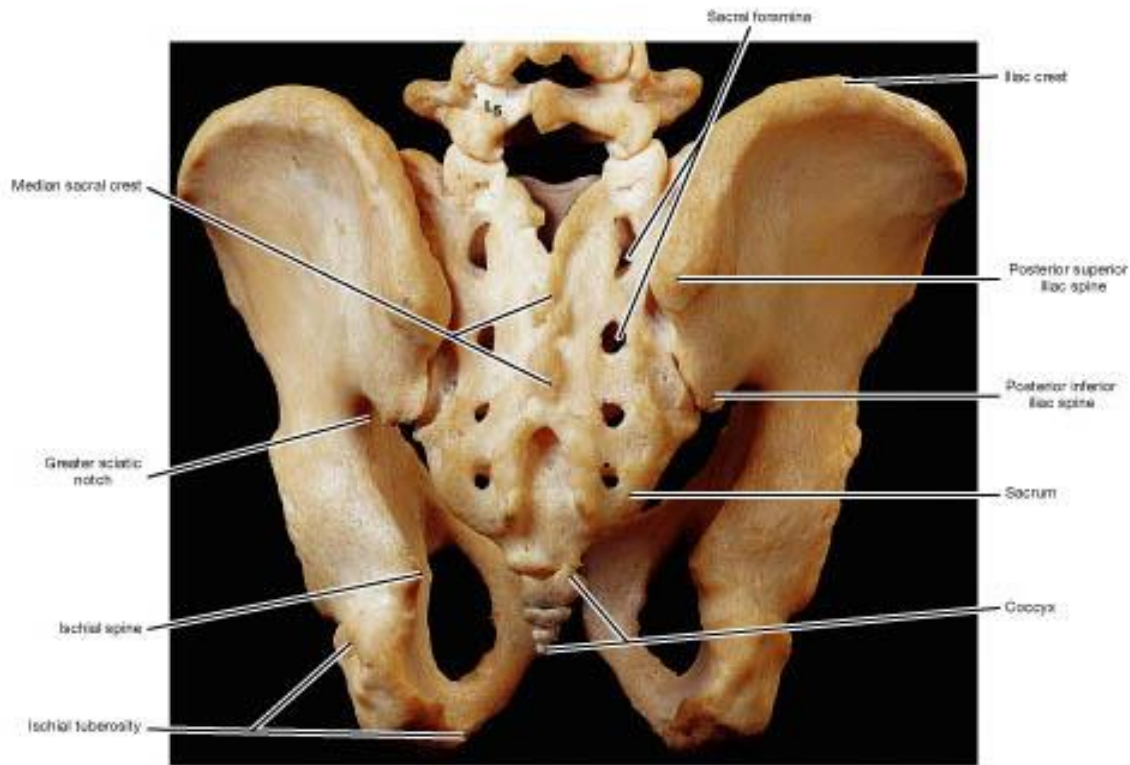
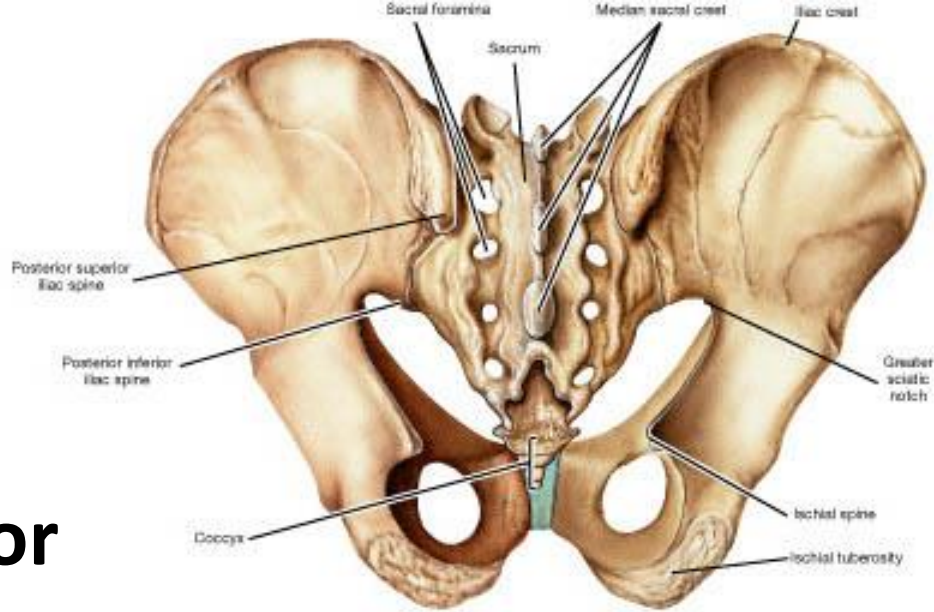
Fig 7-10



# Pelvis, Anterior View

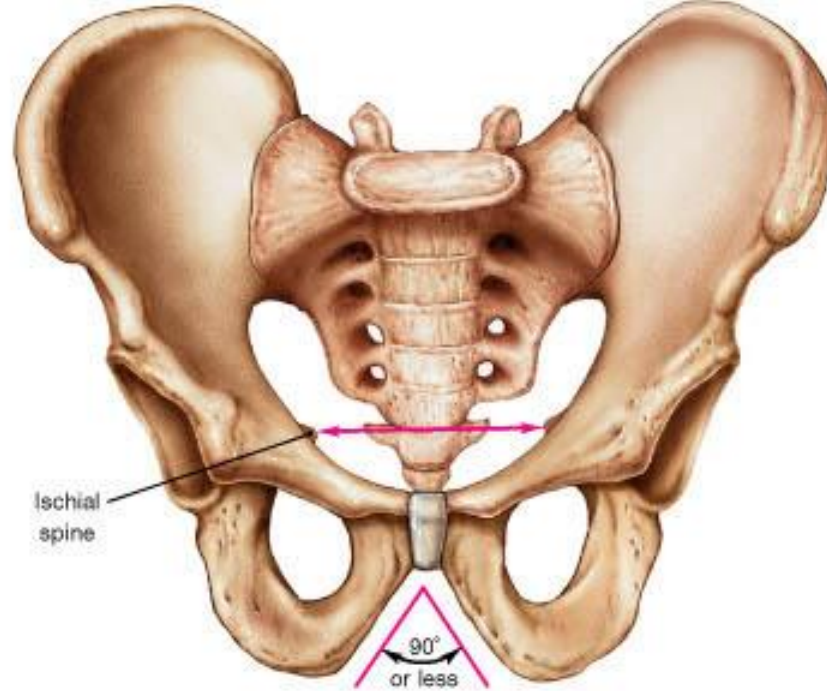


# Pelvis, Posterior View

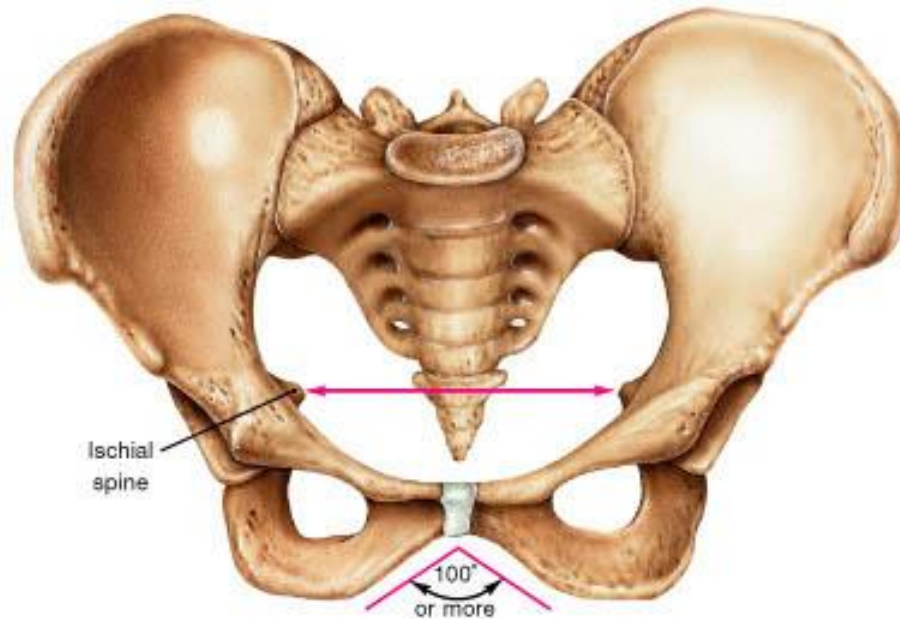


(b) Posterior view

# Gender Differences in Pelvis

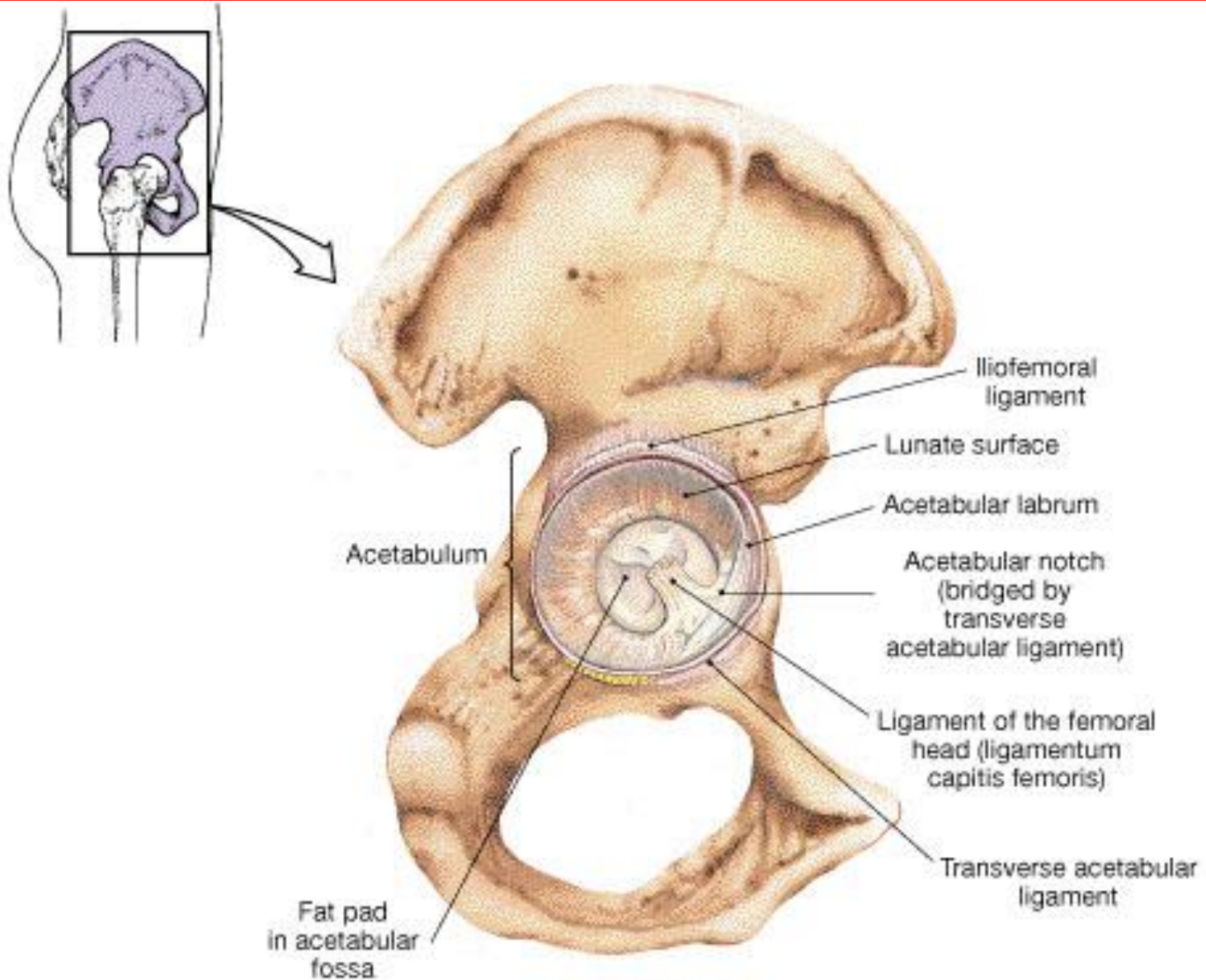


(a) Male



(b) Female

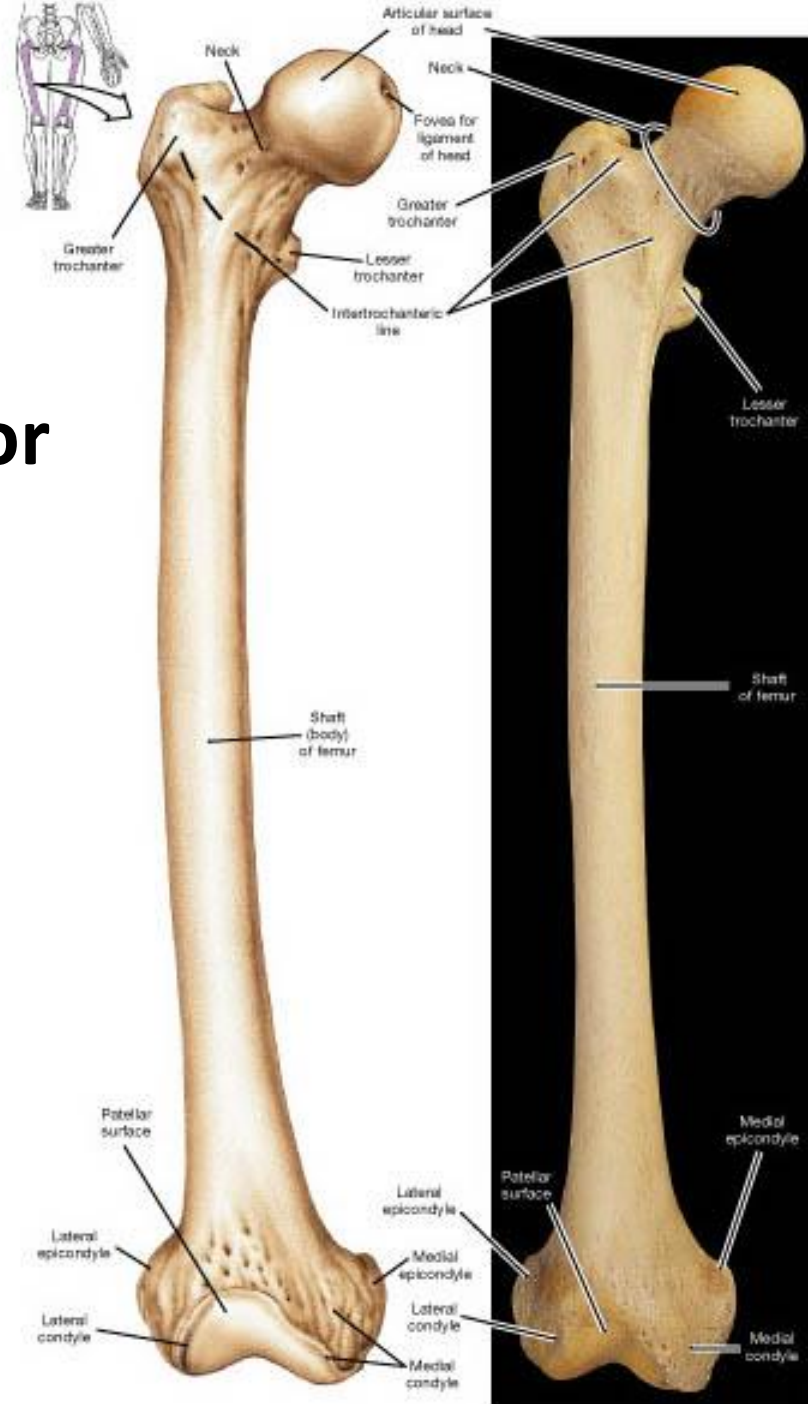
# Hip joint (lateral view)



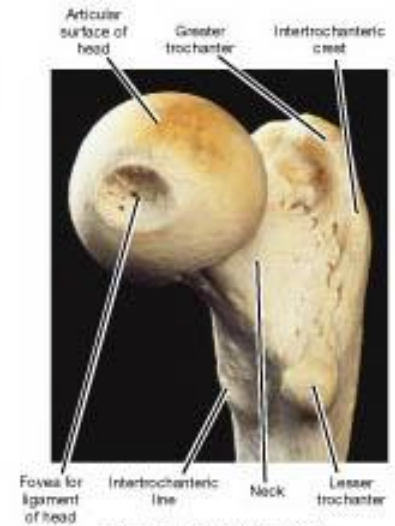
(a) Lateral view



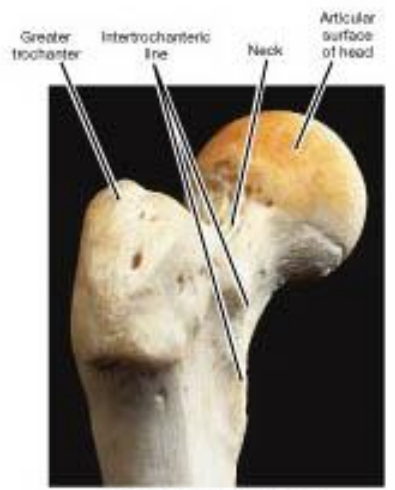
# Femur: Anterior View



(a) Anterior surface

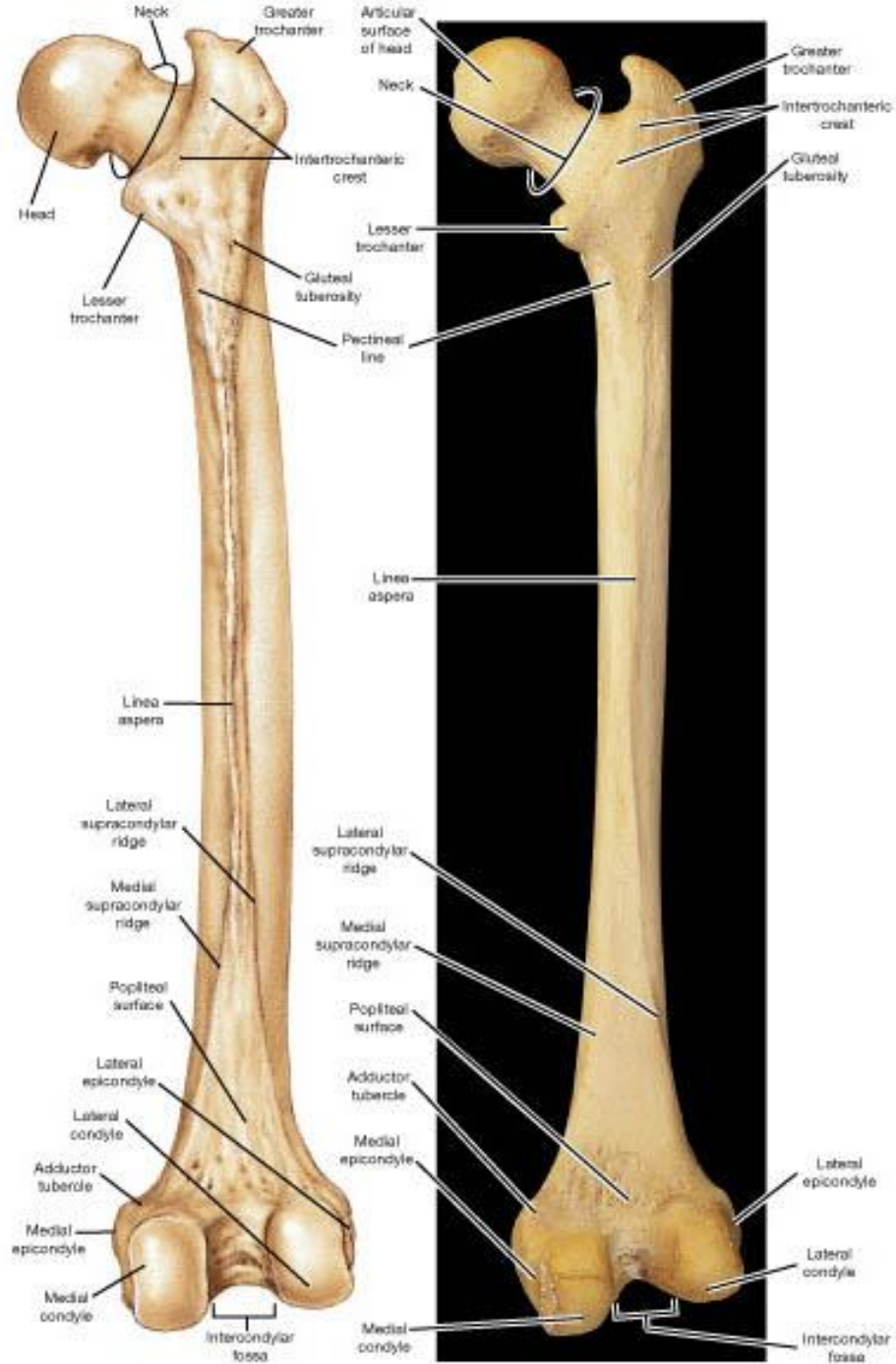


(b) Femoral head, medial view

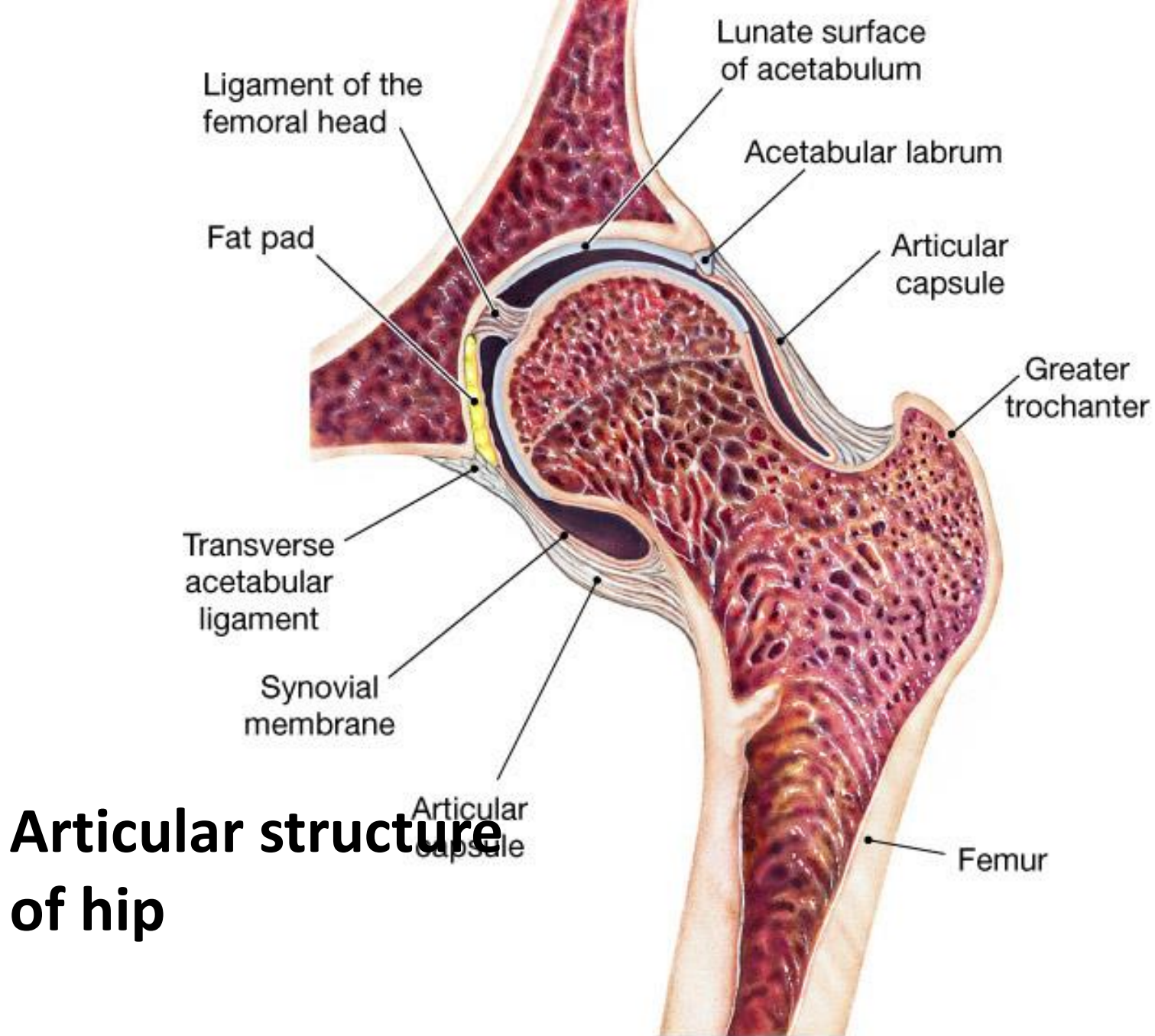


(c) Femoral head, lateral view

# Femur: Posterior View



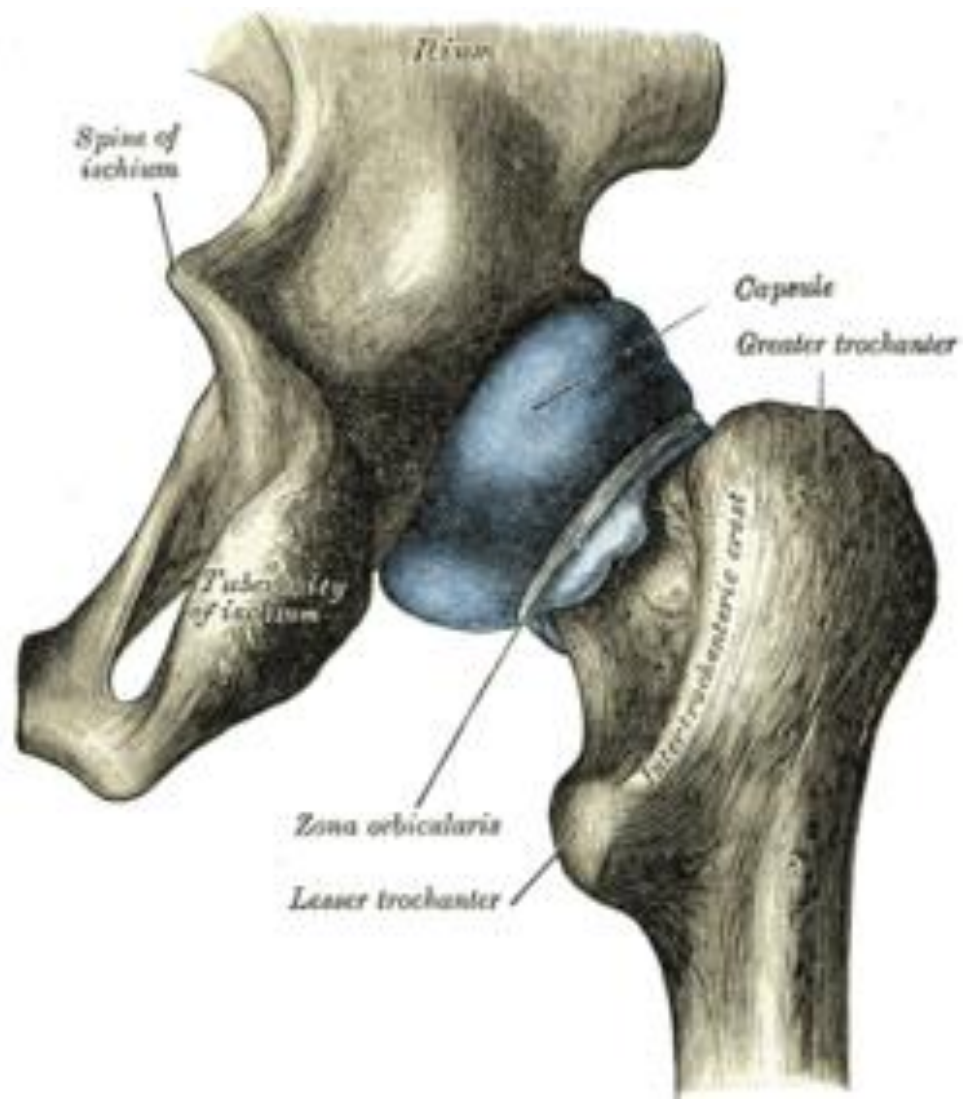
(d) Posterior surface



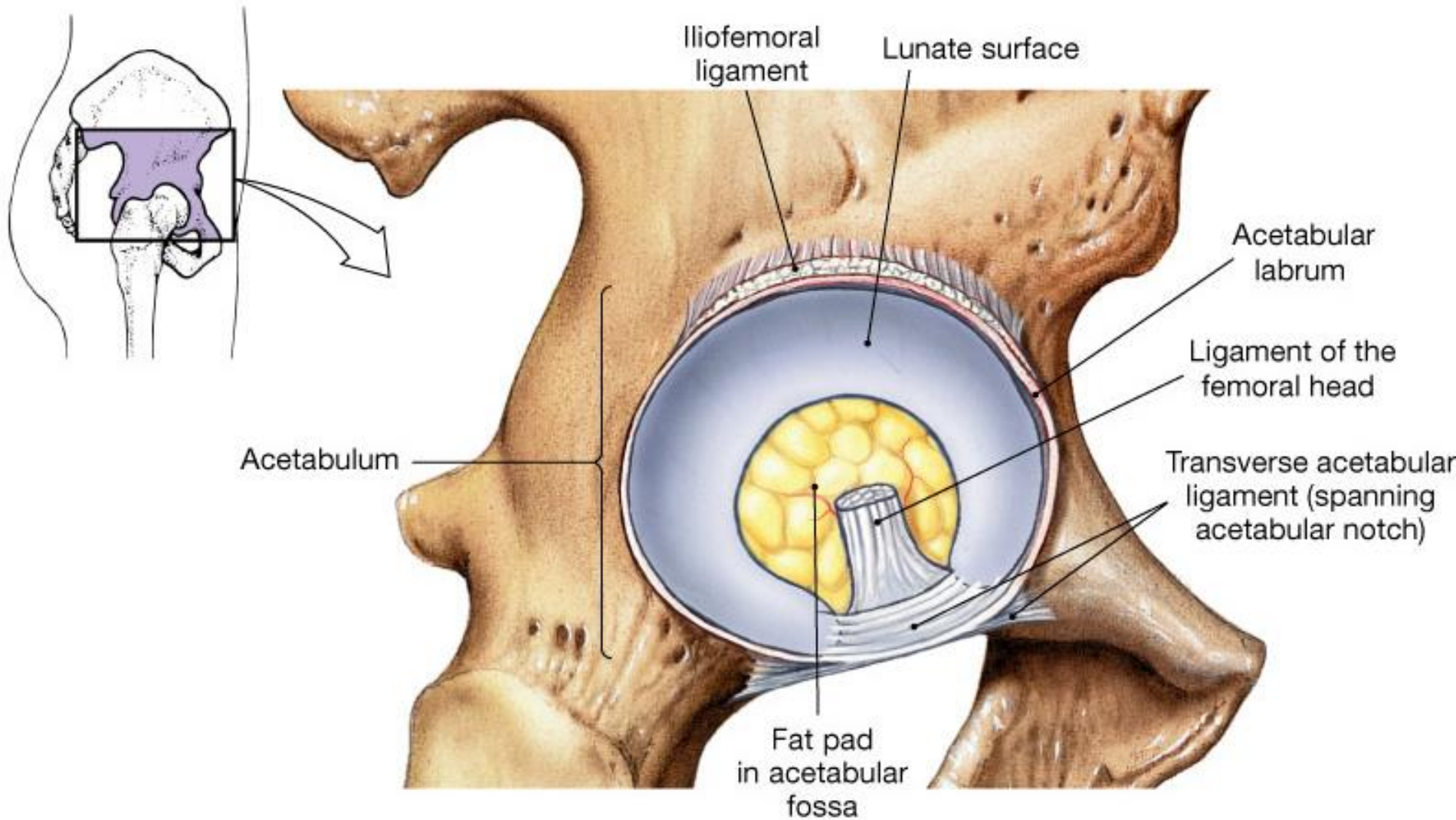
## Articular structure of hip

(a) Sectional view

# Zona Orbicularis

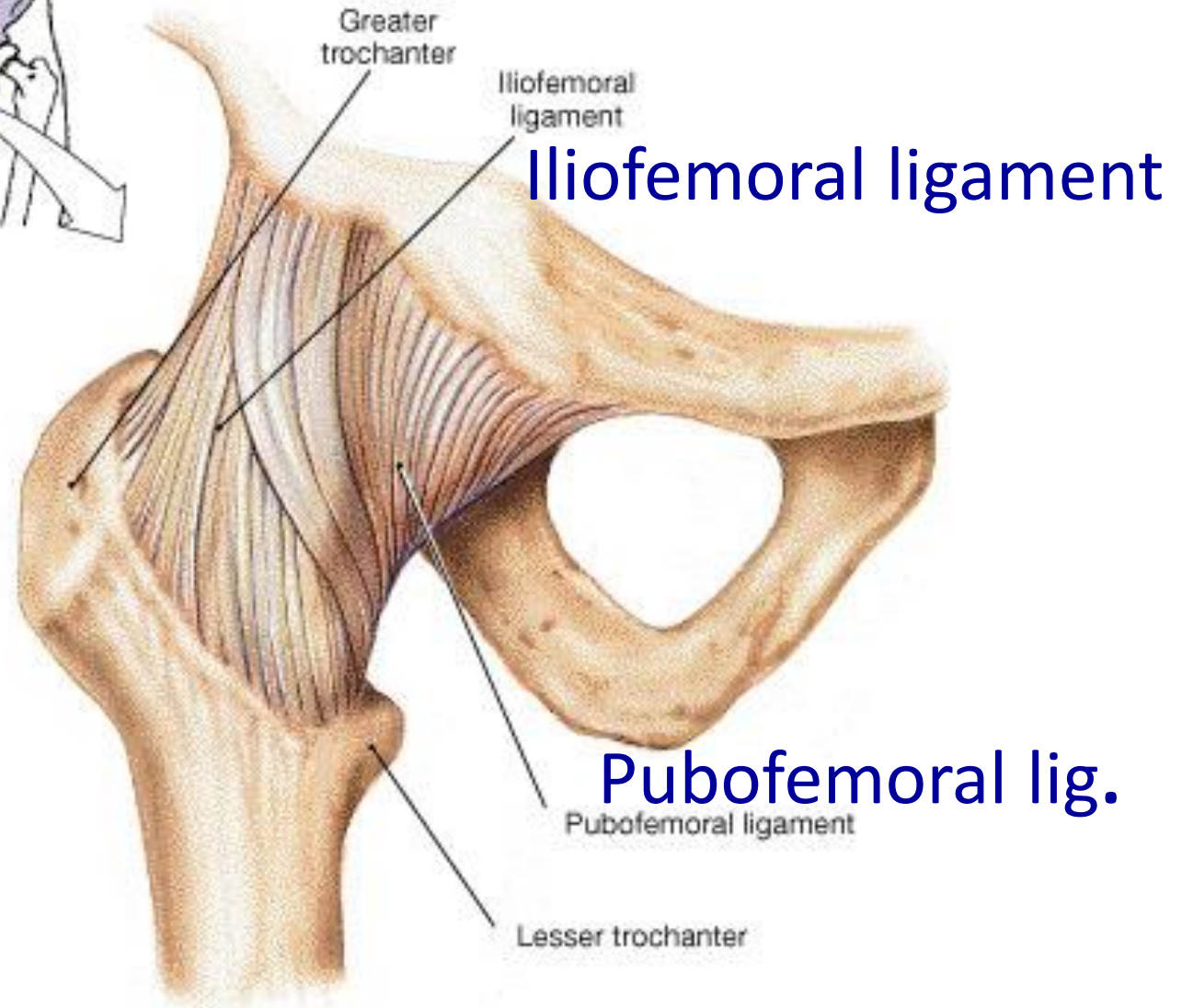
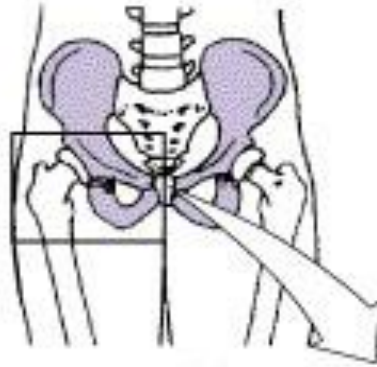


# Structure of Acetabulum



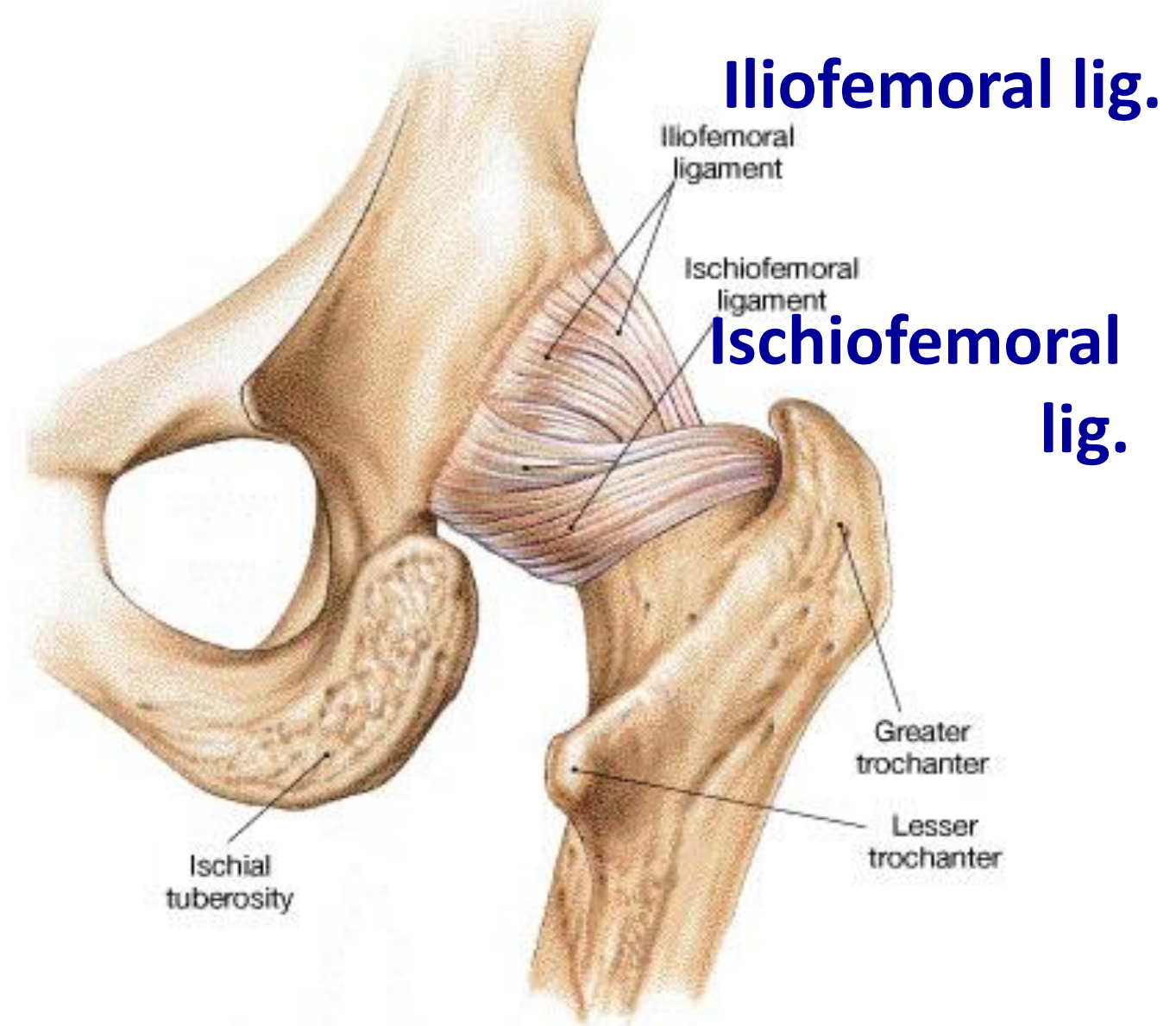
(a) Lateral view

# Hip joint (anterior view)



(b) Anterior view

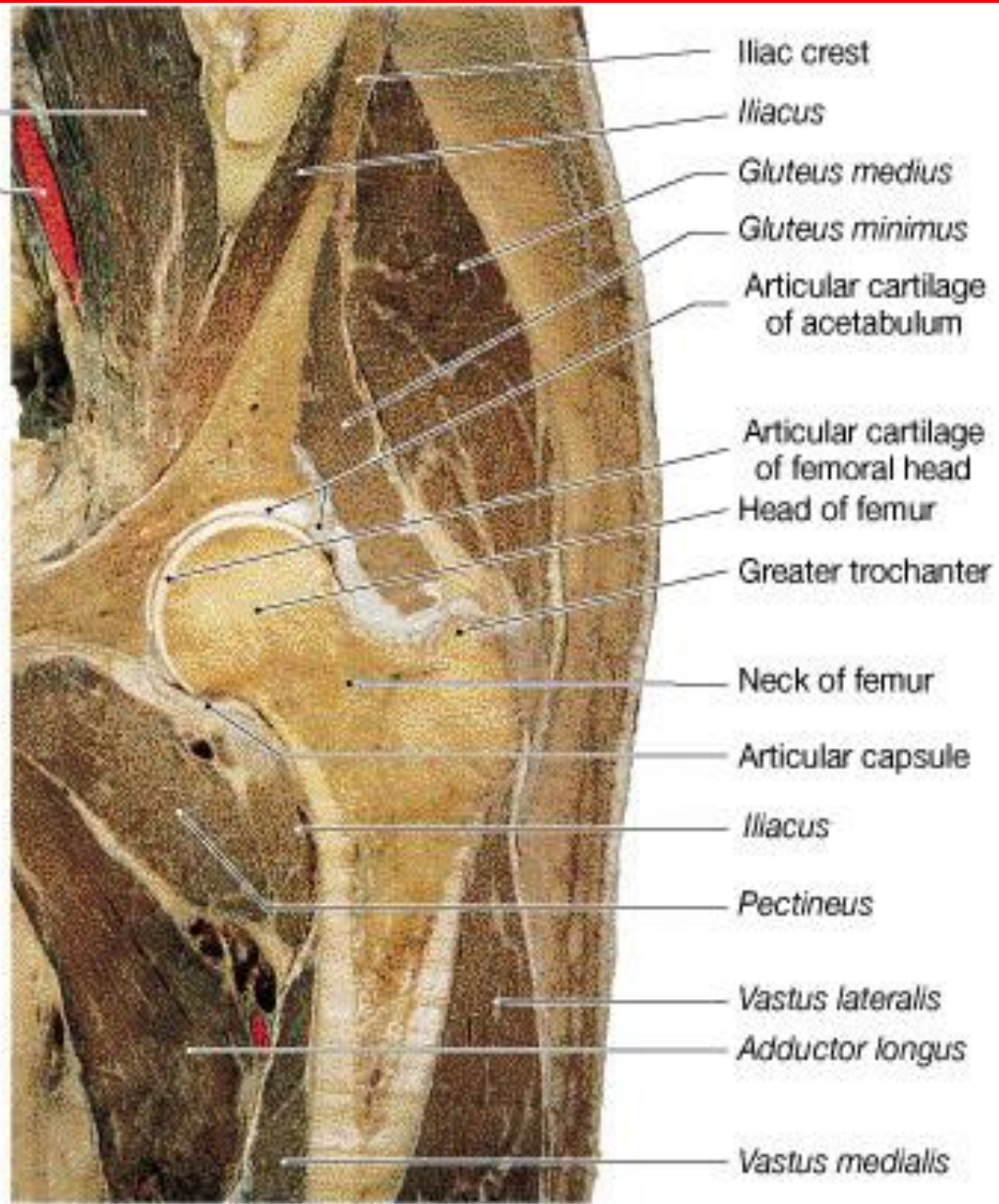
# Hip joint (posterior view)



(c) Posterior view

# Hip joint (coronal section)

*Psoas major*  
*External iliac artery*

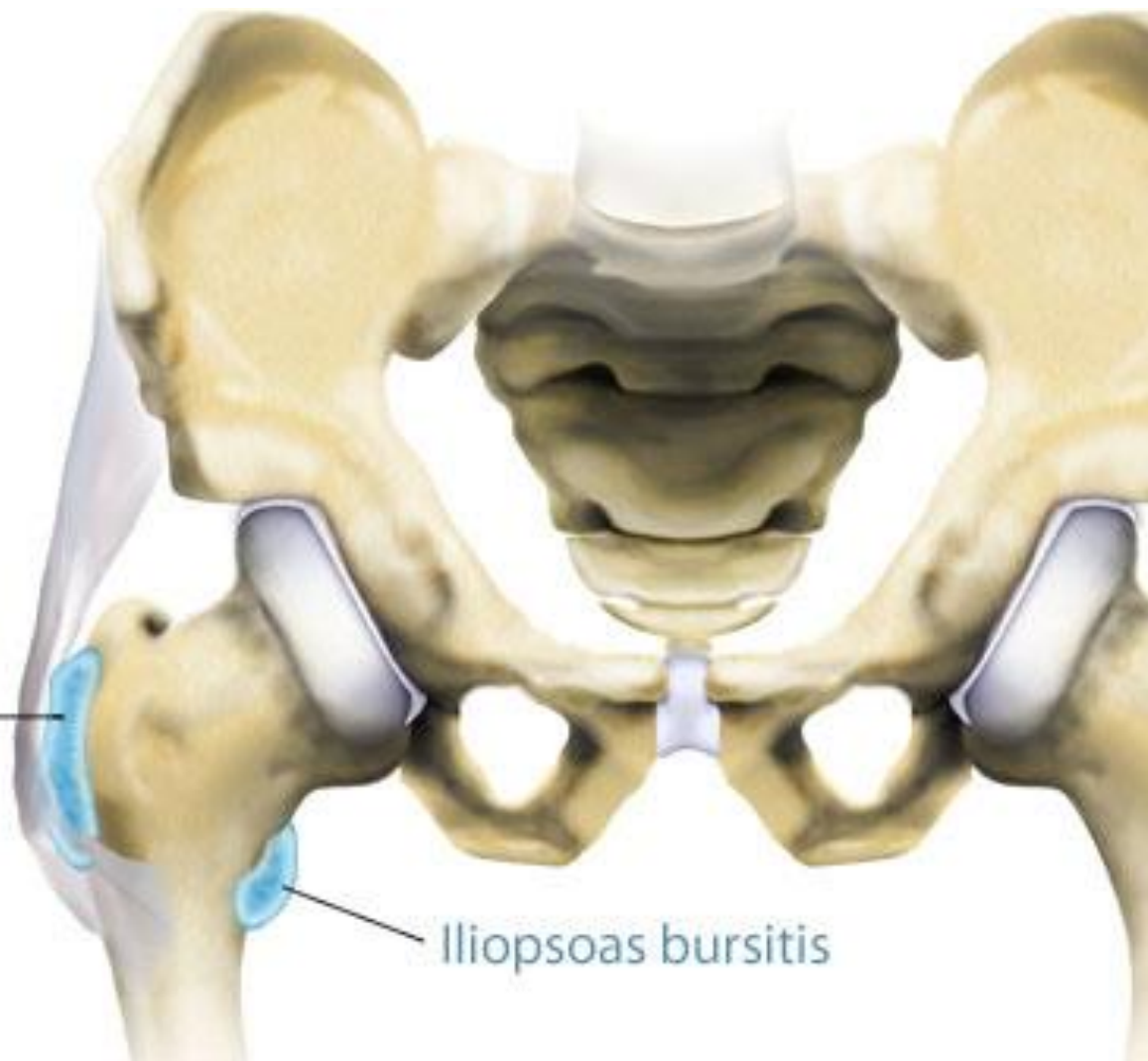


(b) Hip joint, coronal section



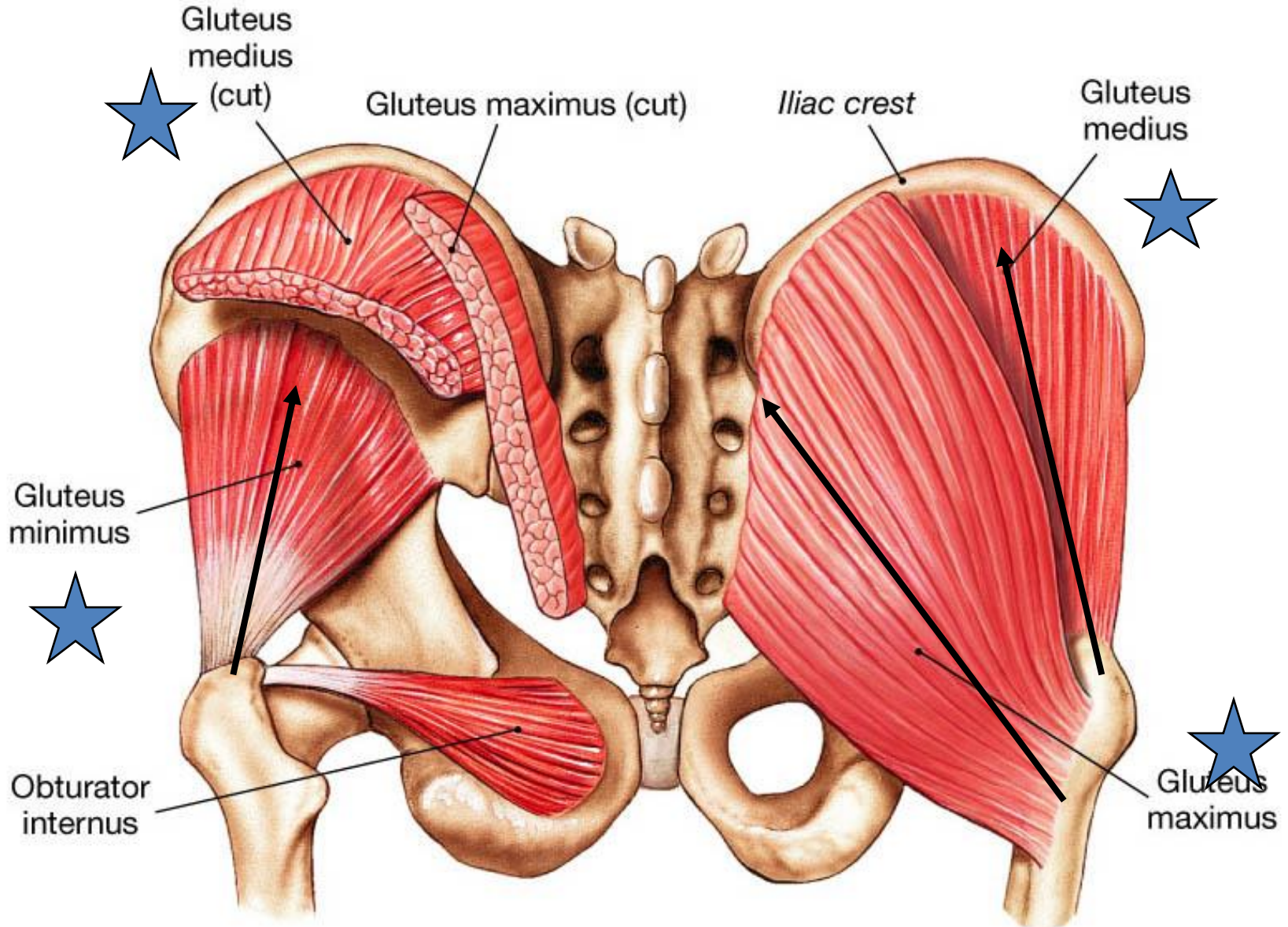


Trochanteric bursitis

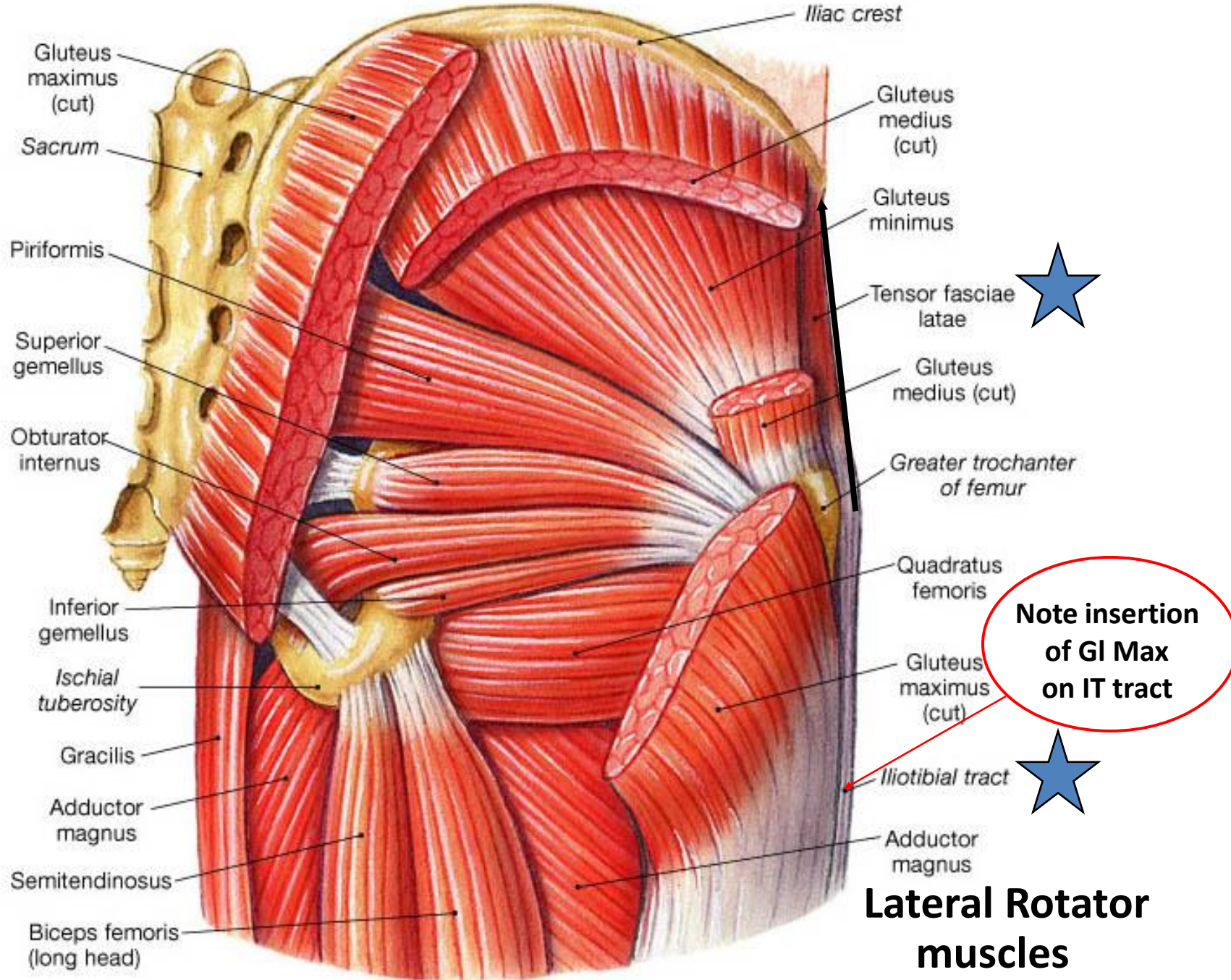


Iliopsoas bursitis

# Gluteal muscles (posterior)

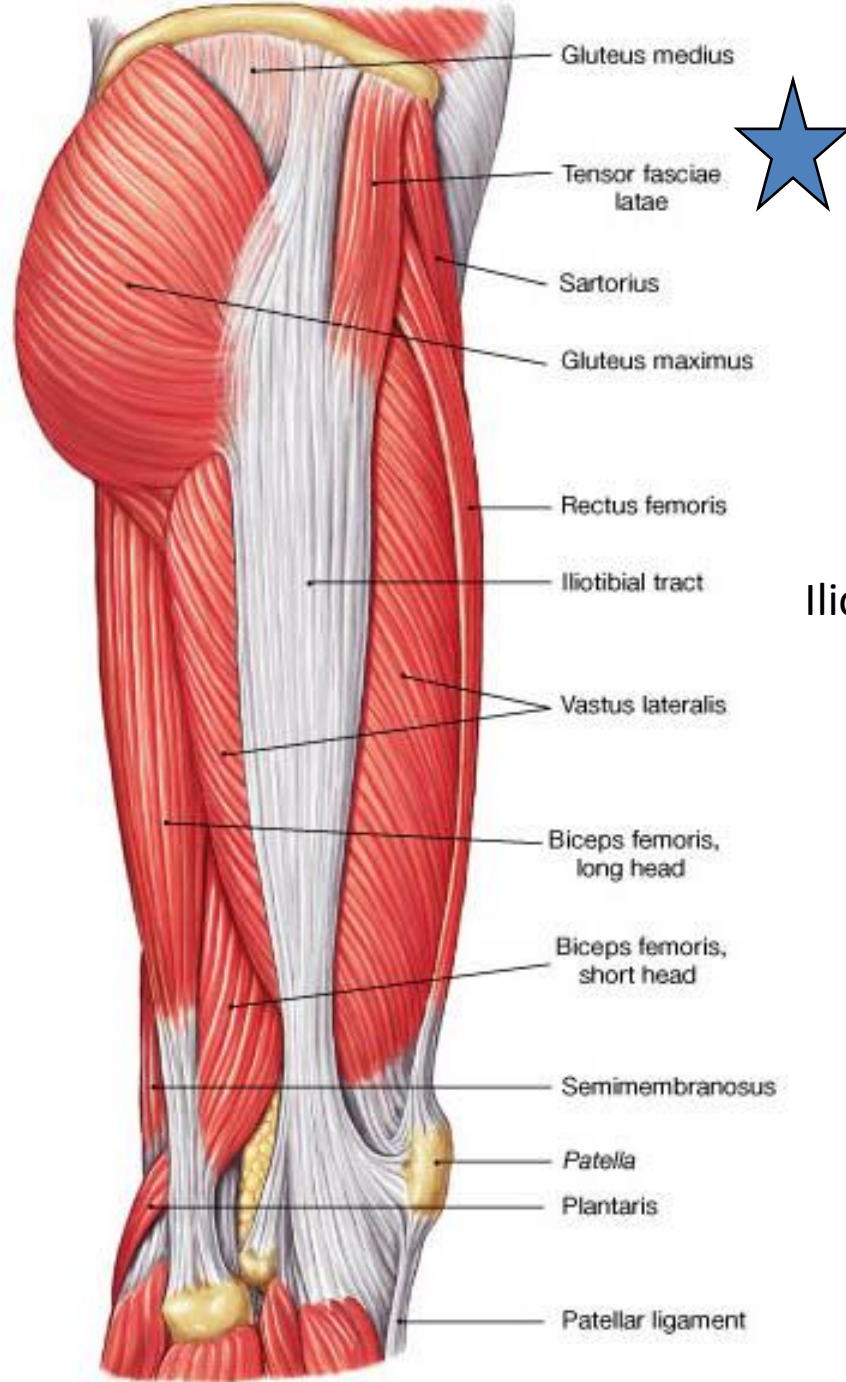


(c) Gluteal and lateral rotators, posterior view



(a) Posterior view, deep muscles

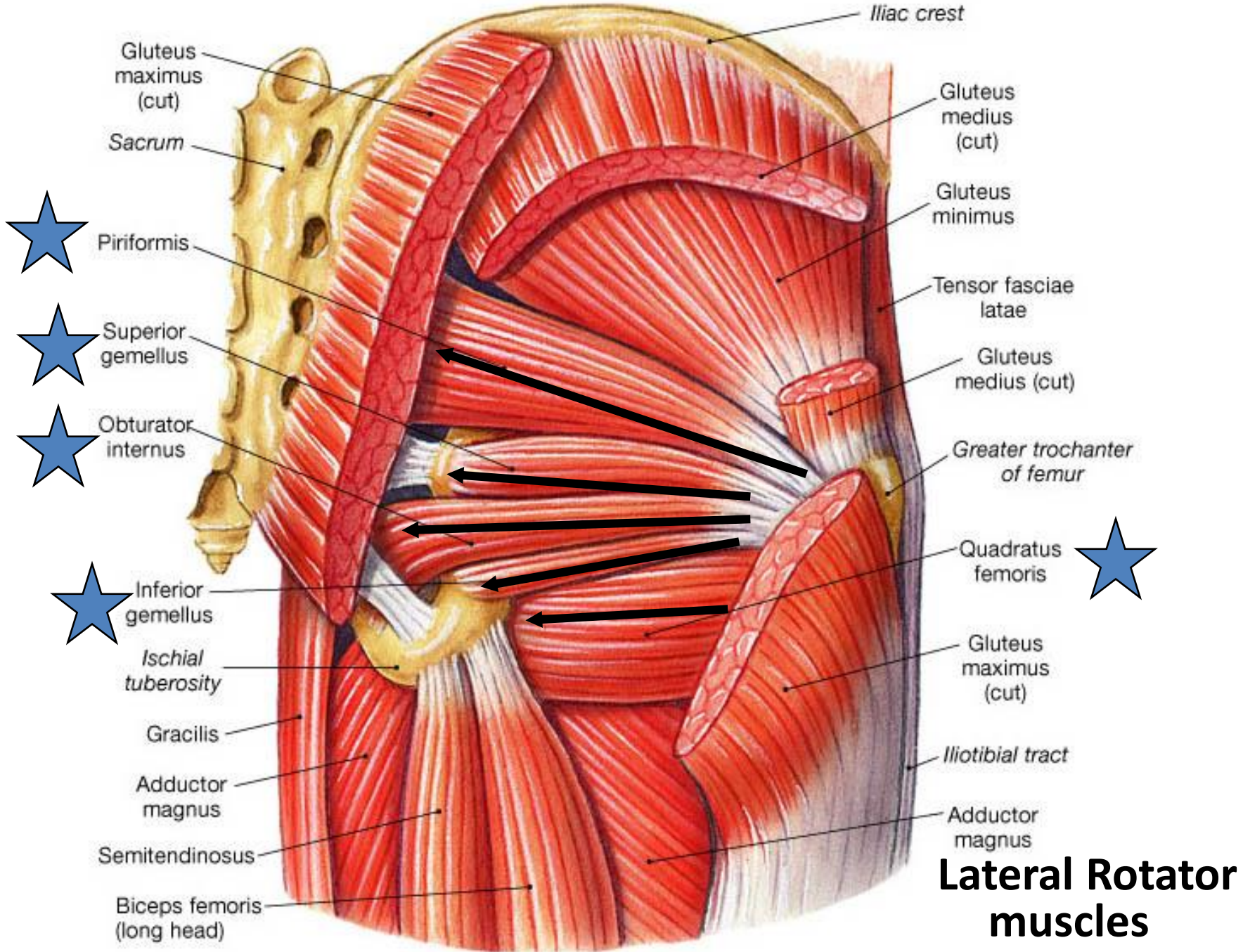
# Lateral view



Tensor Fasciae Latae\*

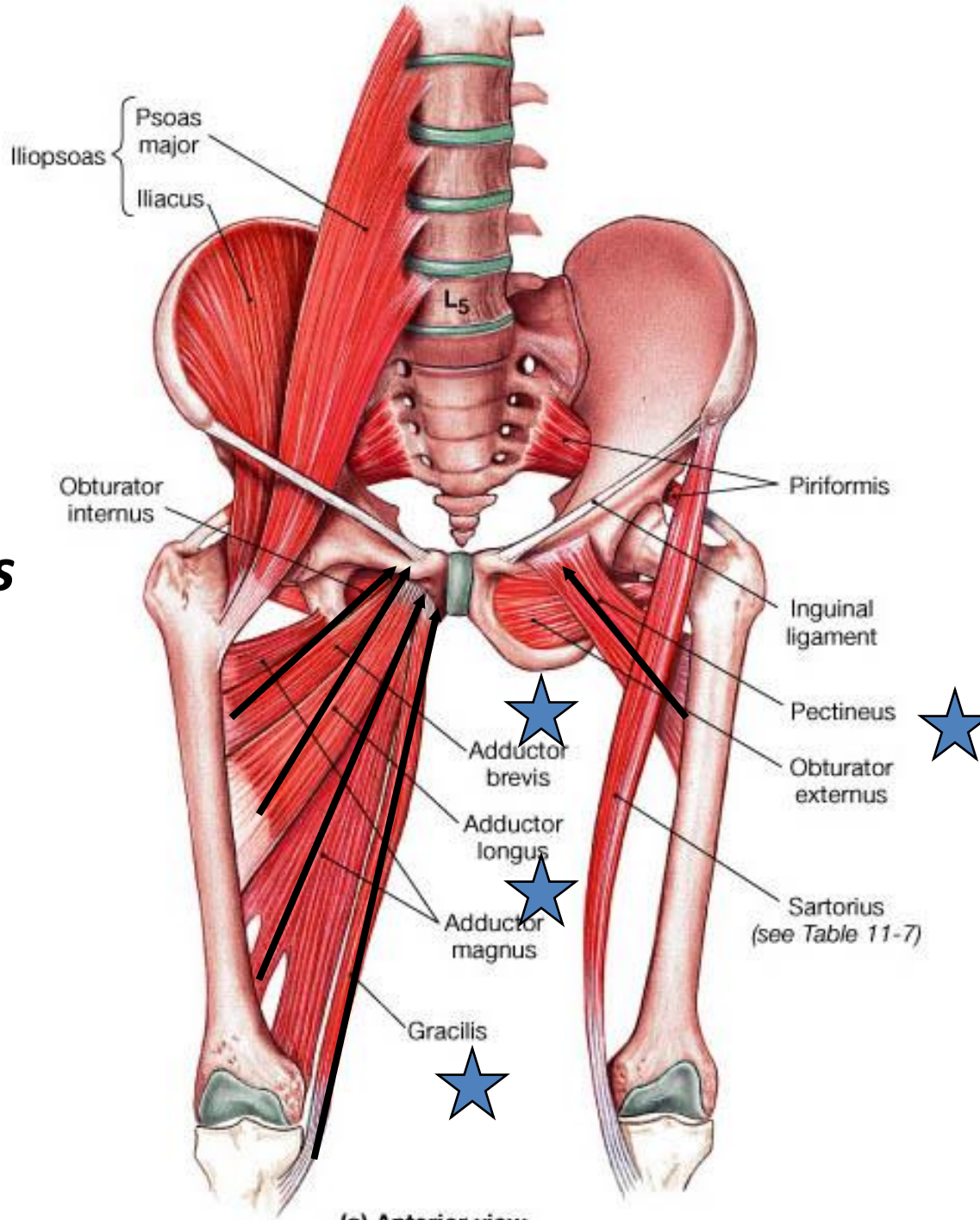
Iliotibial Tract

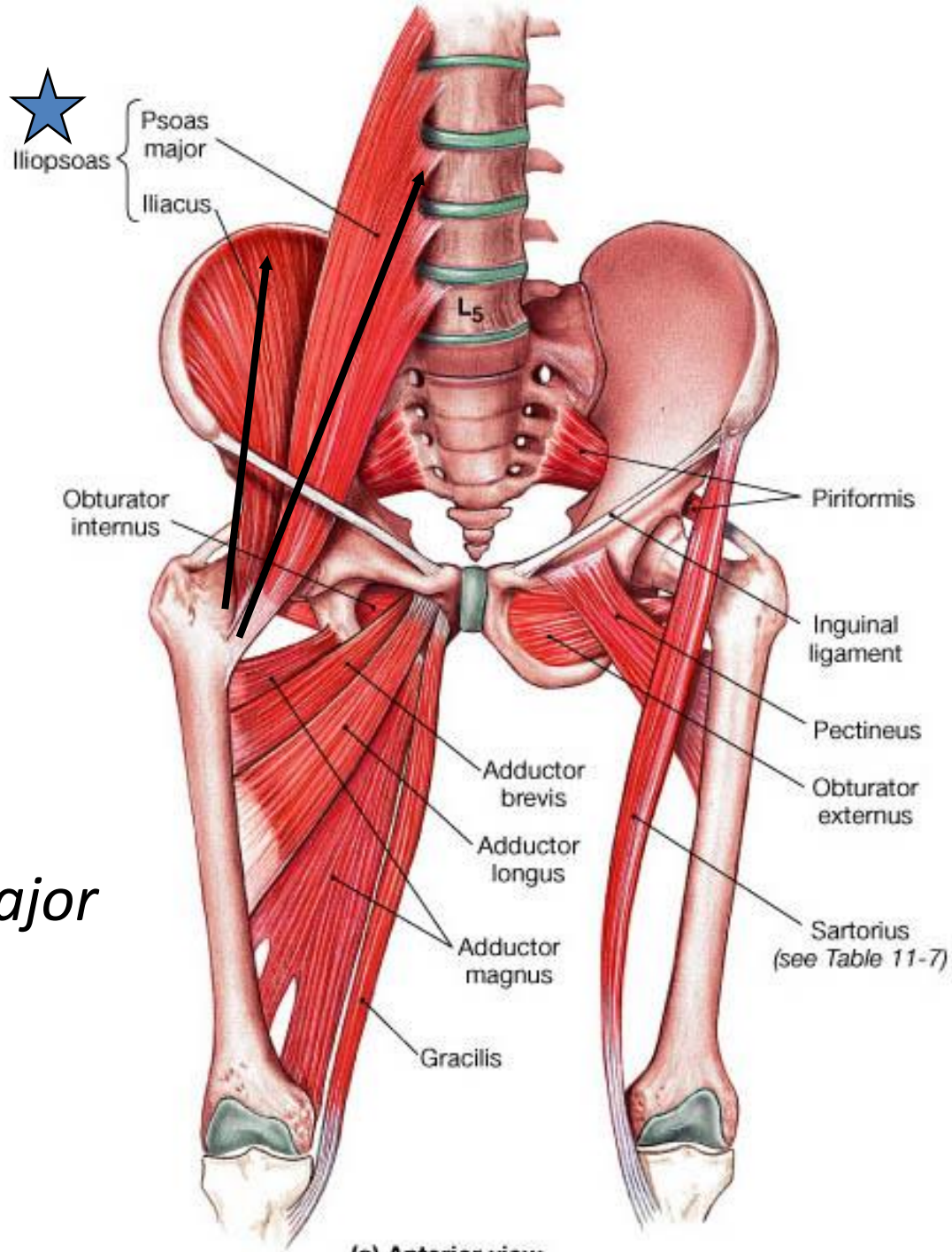
(a) Lateral view



(a) Posterior view, deep muscles

**Adductors:**  
***A. Brevis***  
***A. Longus***  
***A. Magnus***  
***Gracilis* \***  
***Pectineus***





# Iliopsoas

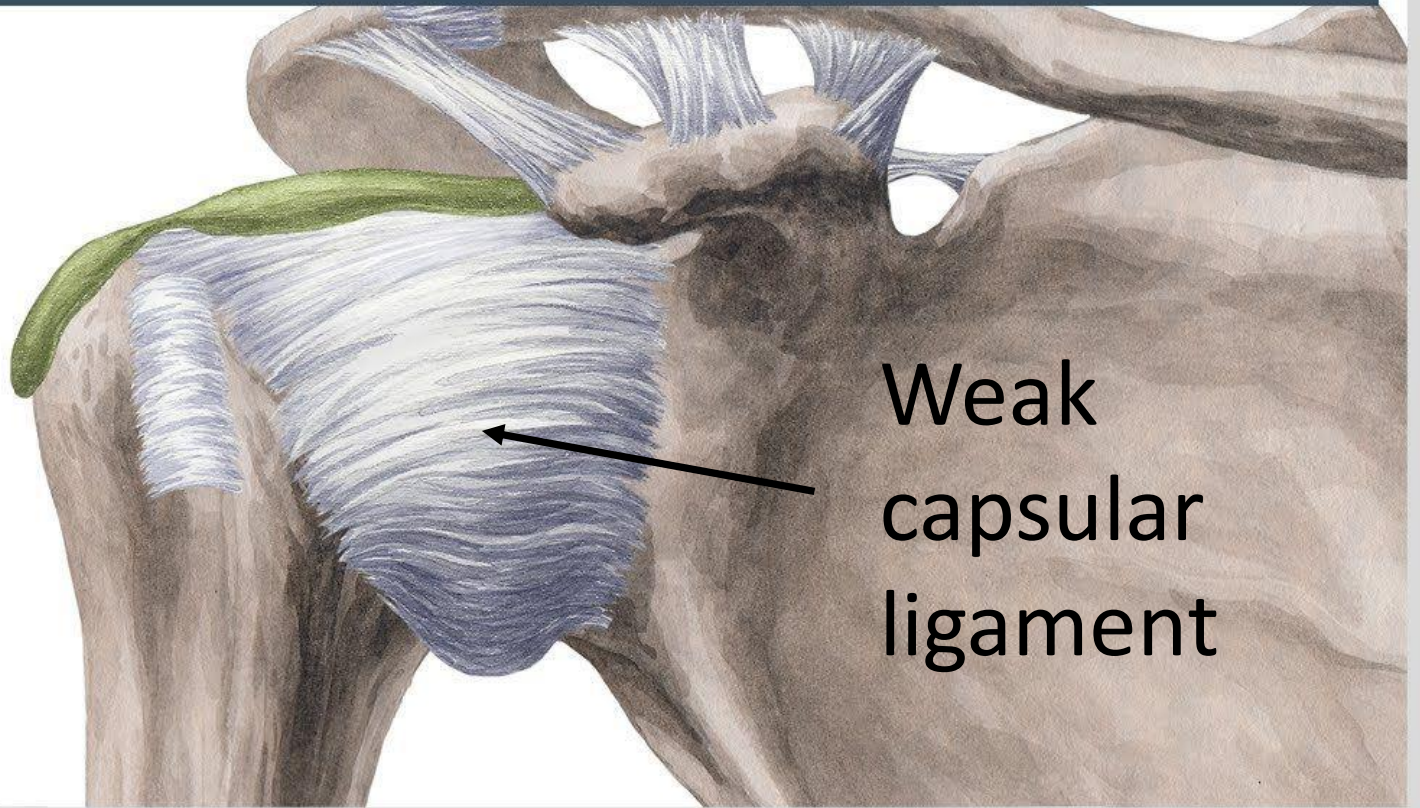
- *Iliacus*
- *Psoas Major*

Contrast to the shoulder joint!





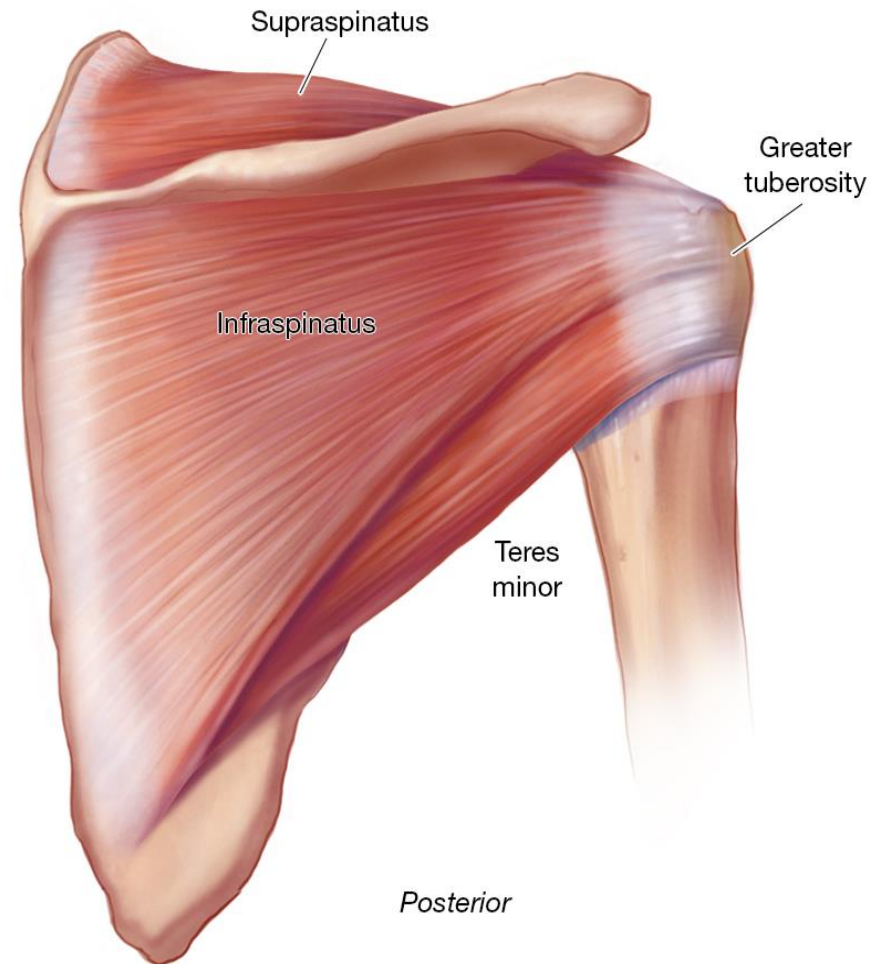
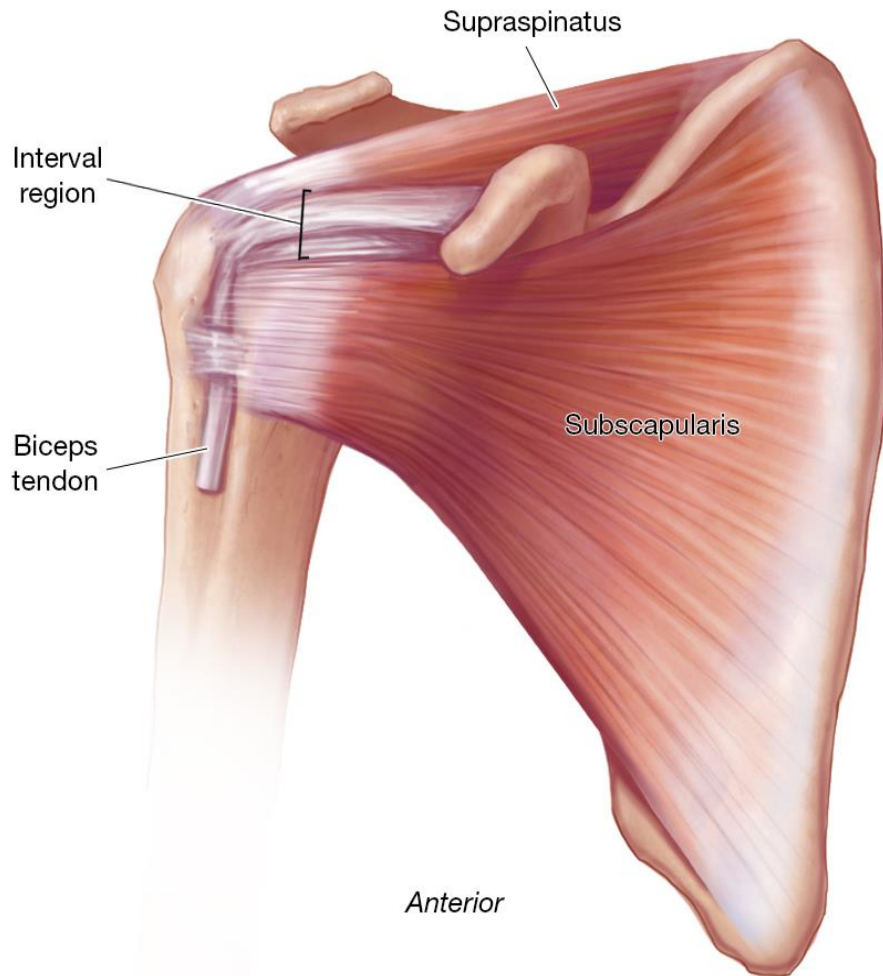
# Shoulder Joint



Weak  
capsular  
ligament

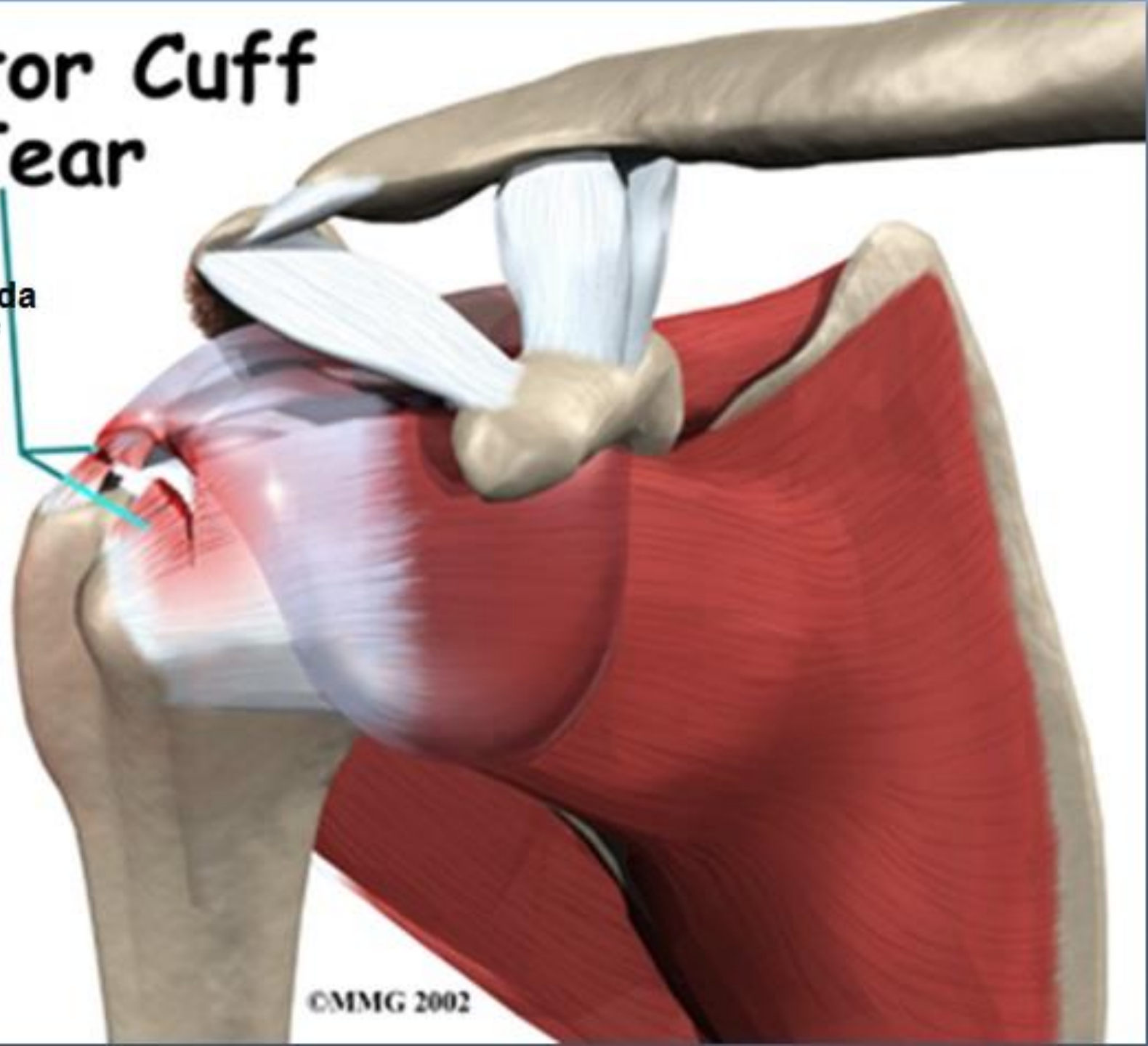
K

# Rotator cuff muscles



# Rotator Cuff Tear

Robekan pada Rotator Cuff





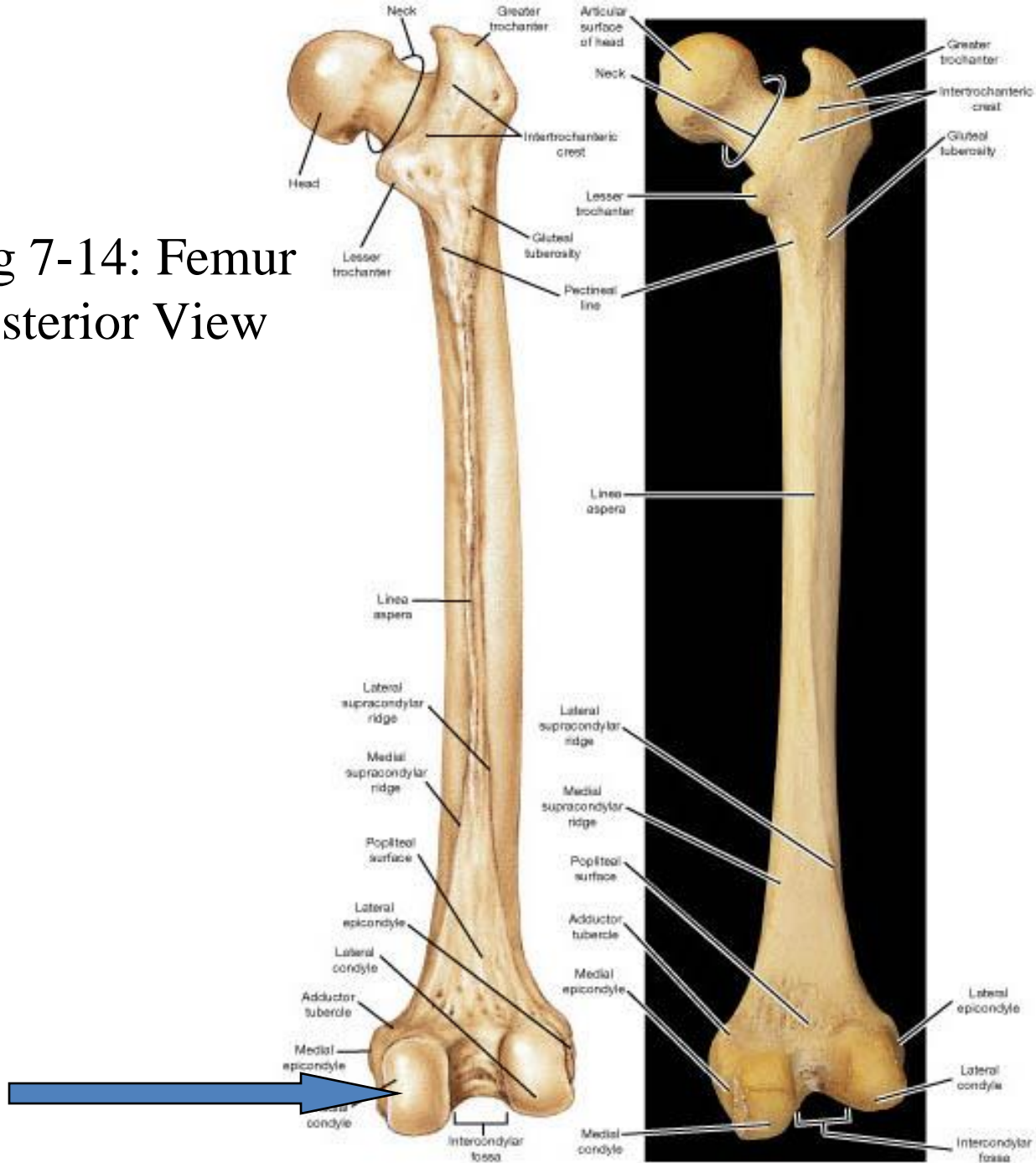
***“Running is bad for my knees.  
Not running is bad for everything else!”***

# The knee joint

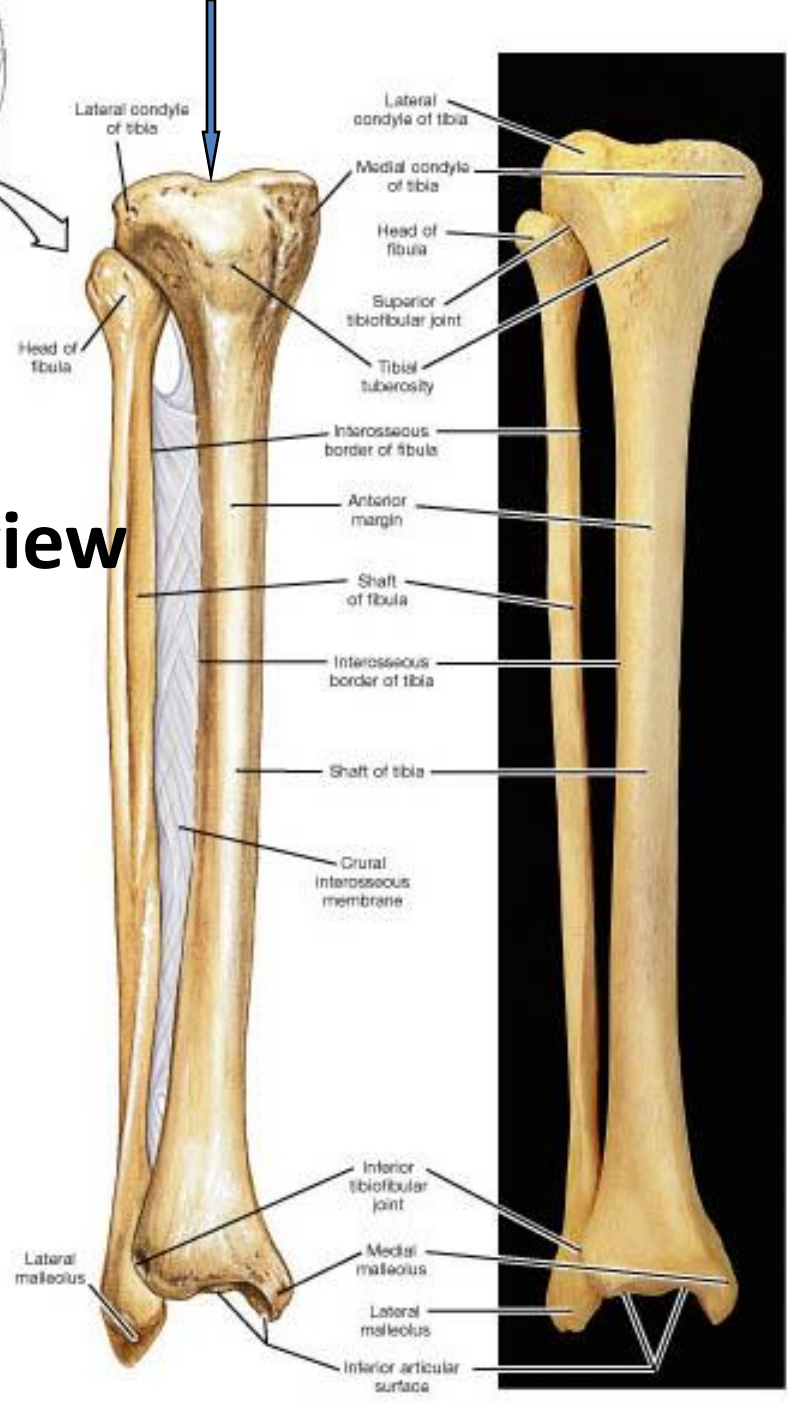
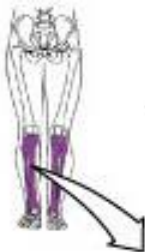


**"I still think I'd like a second opinion."**

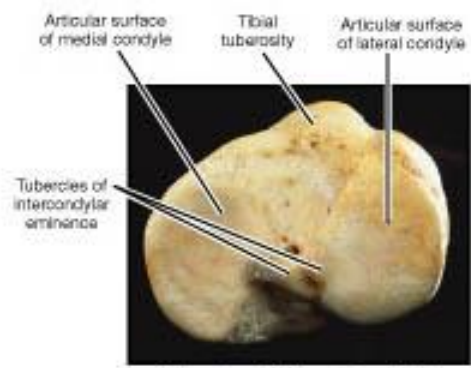
Fig 7-14: Femur  
Posterior View



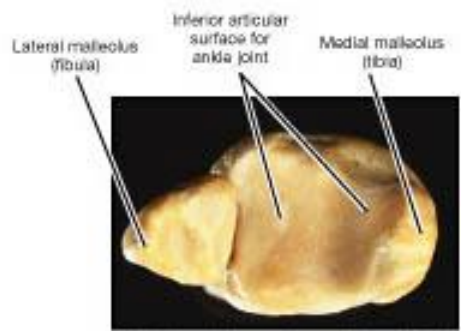
(d) Posterior surface



(a) Anterior views



(b) Superior articular surface of tibia



(c) Inferior articular surface of tibia and fibula

# Anterior view



**(c) X-ray, extended knee**

Femur  
Patella  
Medial epicondyle  
Femoral condyle  
Intercondylar eminence  
Tibial condyles  
Head of fibula  
Tibia

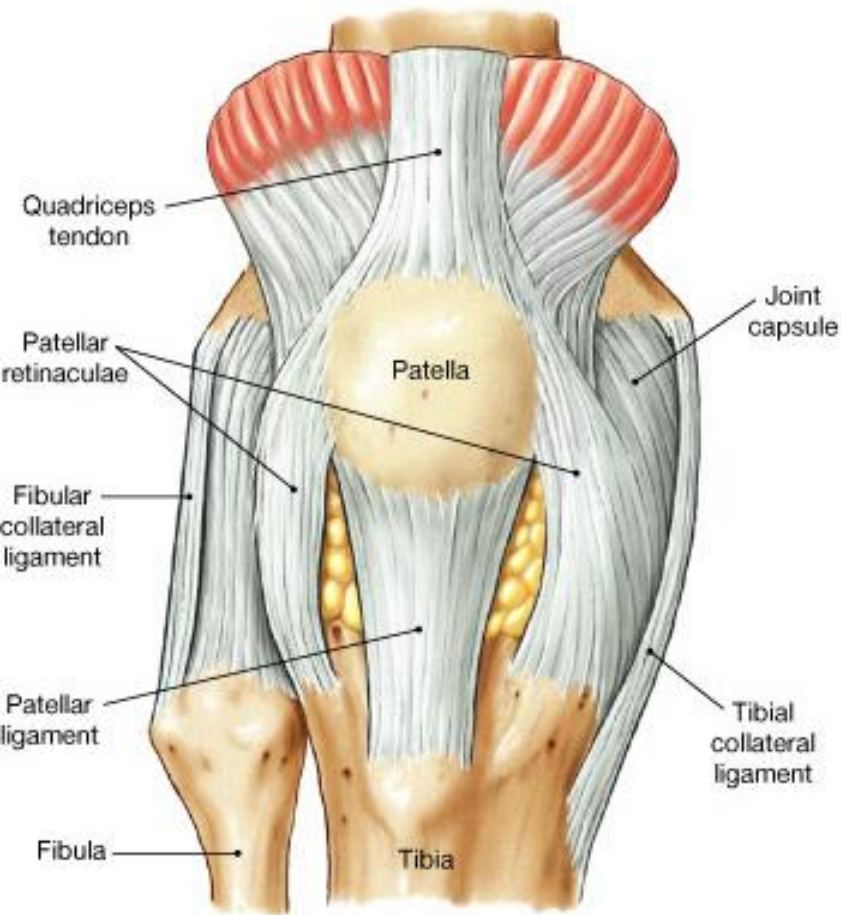
Quadriceps femoris  
Suprapatellar bursa  
Patella  
Patellar ligament



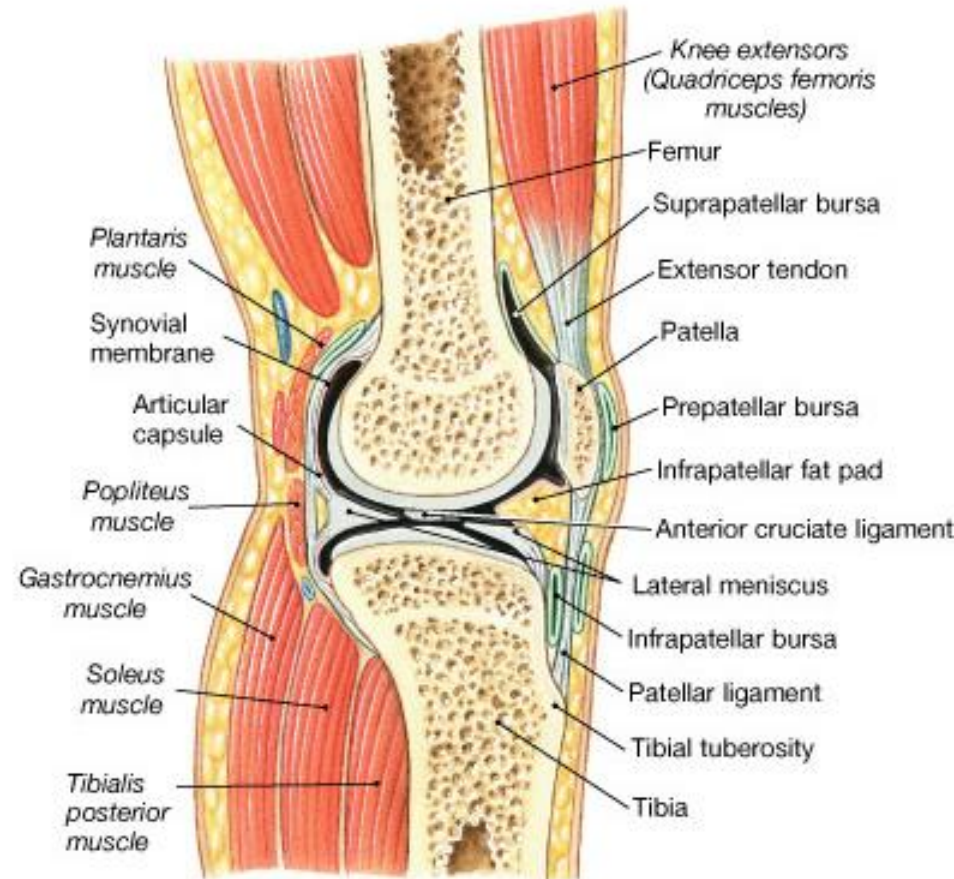
**(d) X-ray, partially flexed knee**



# The Knee Joint

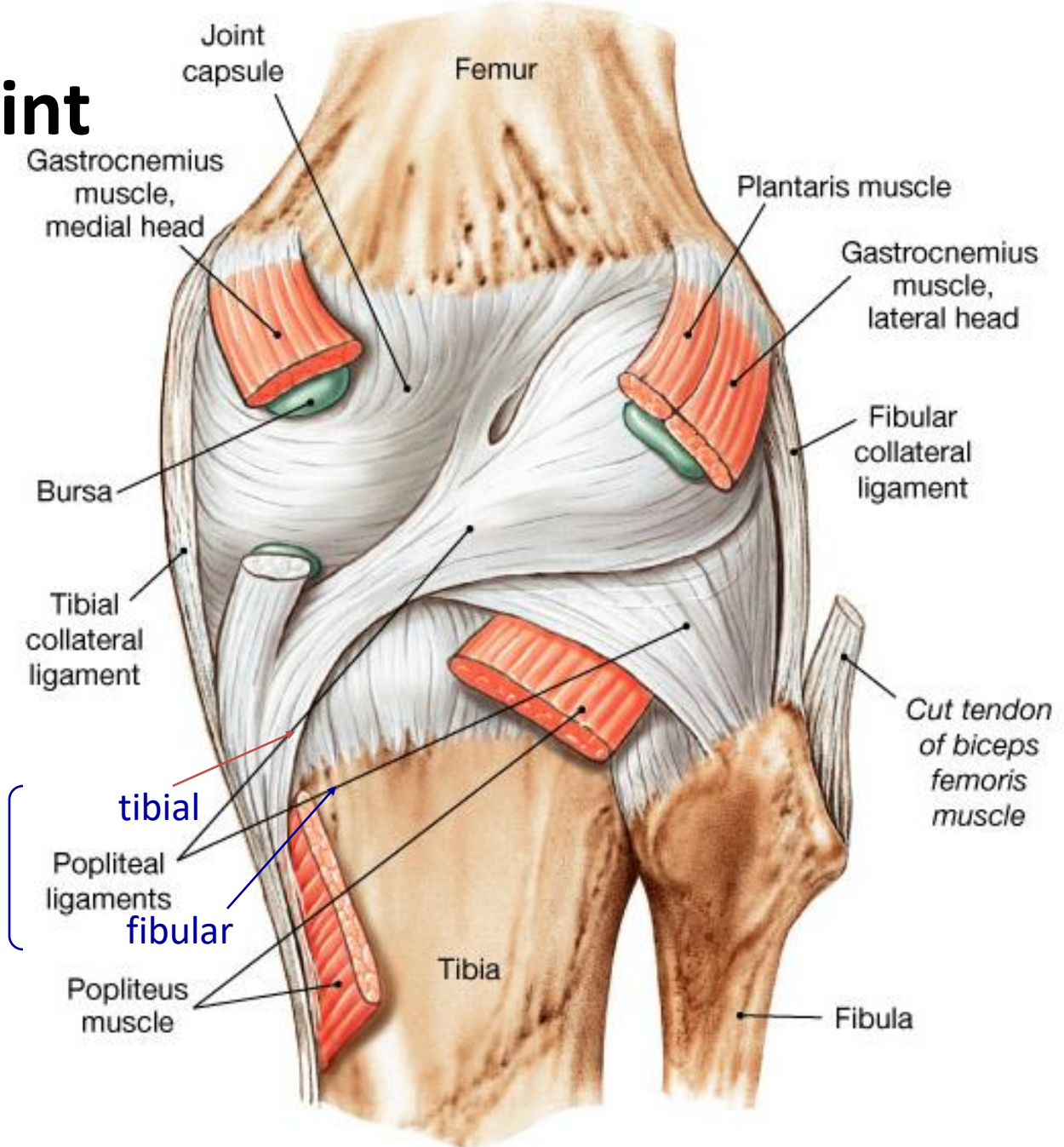


(a) Anterior view, superficial layer



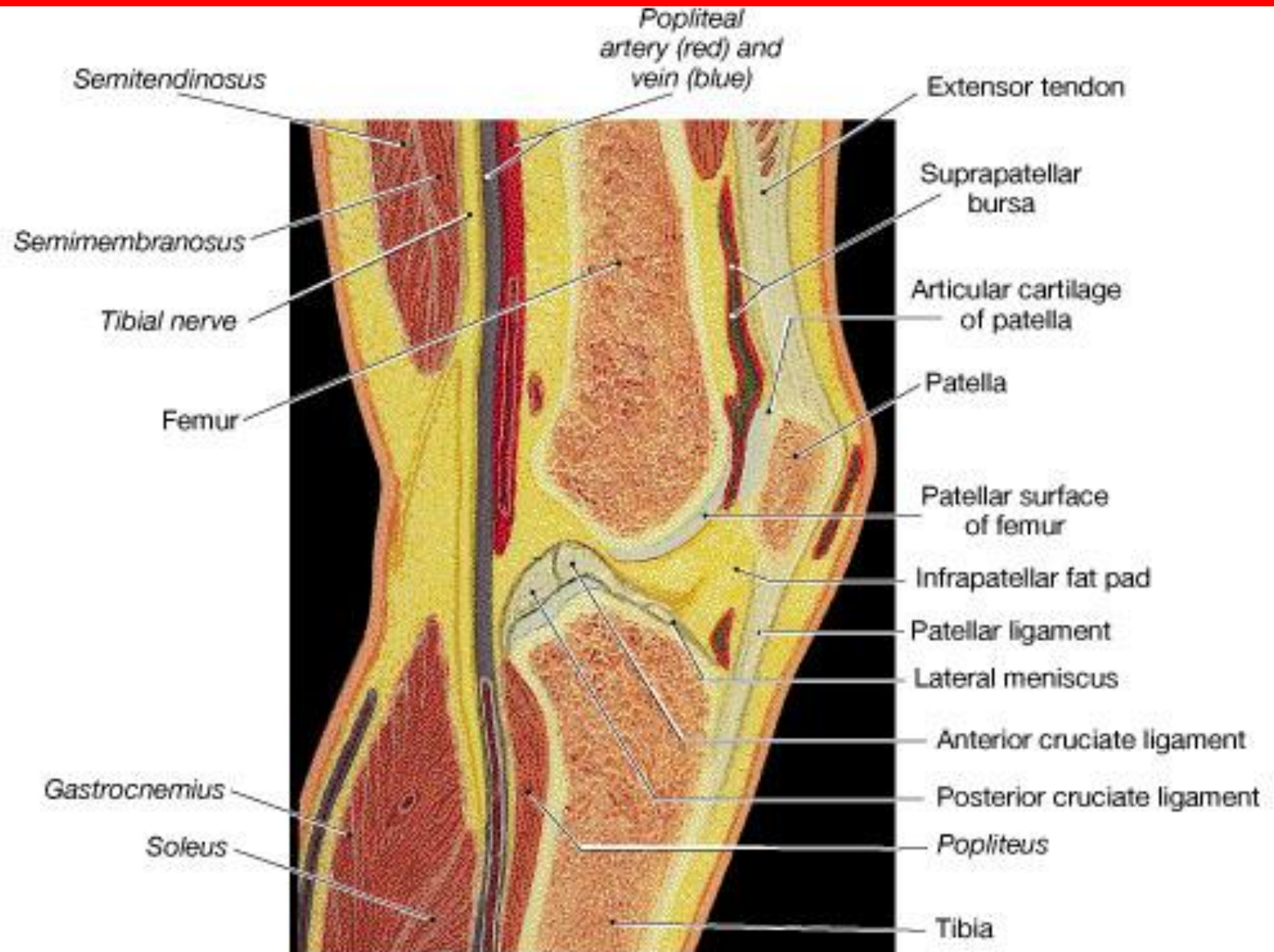
(b) Parasagittal section

# Knee Joint

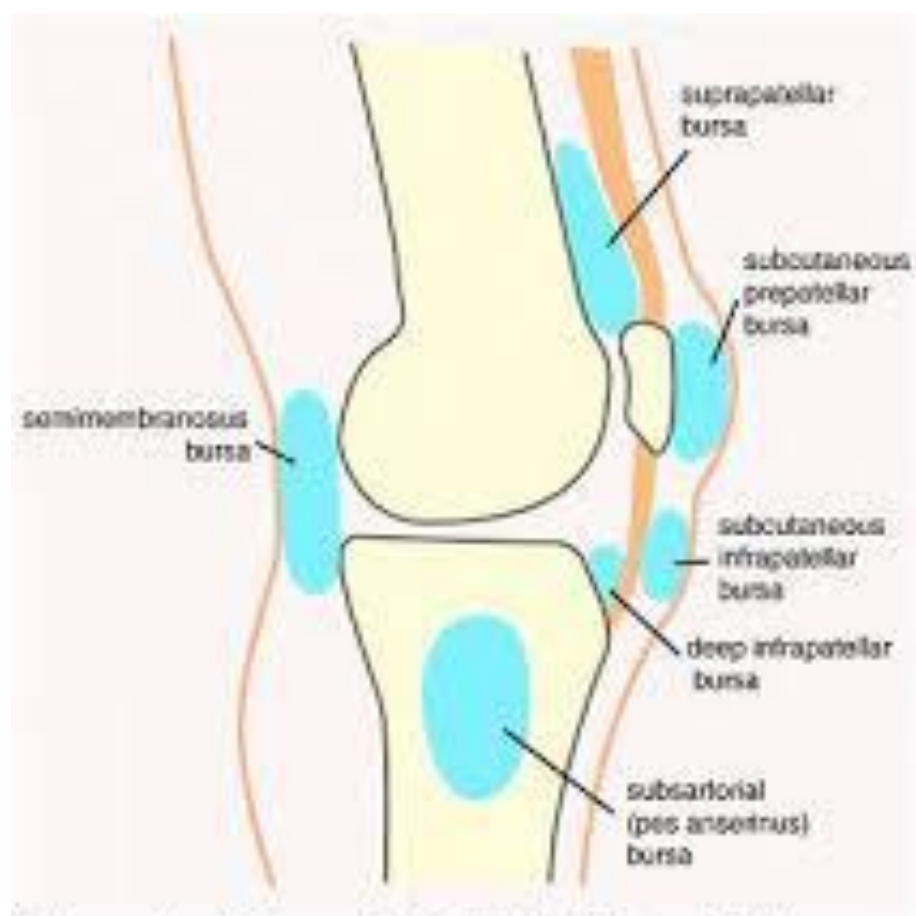


(a) Posterior view, superficial layer

# Midsagittal section

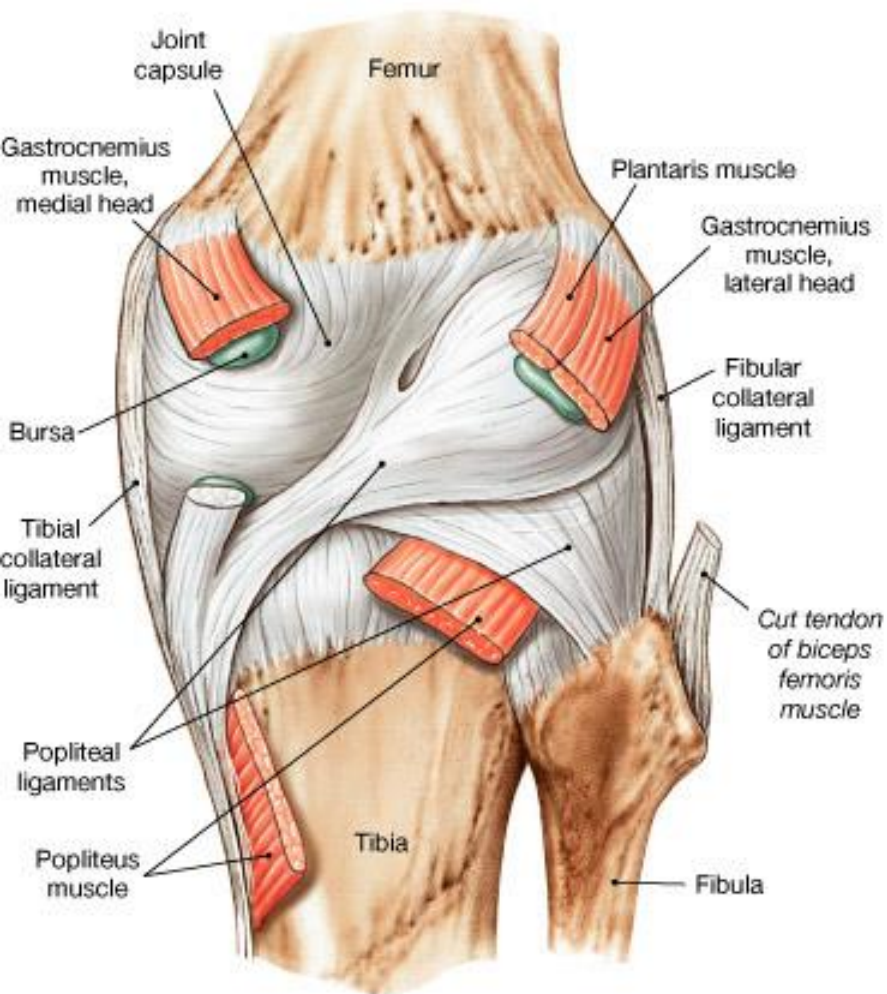


(b) Midsagittal section

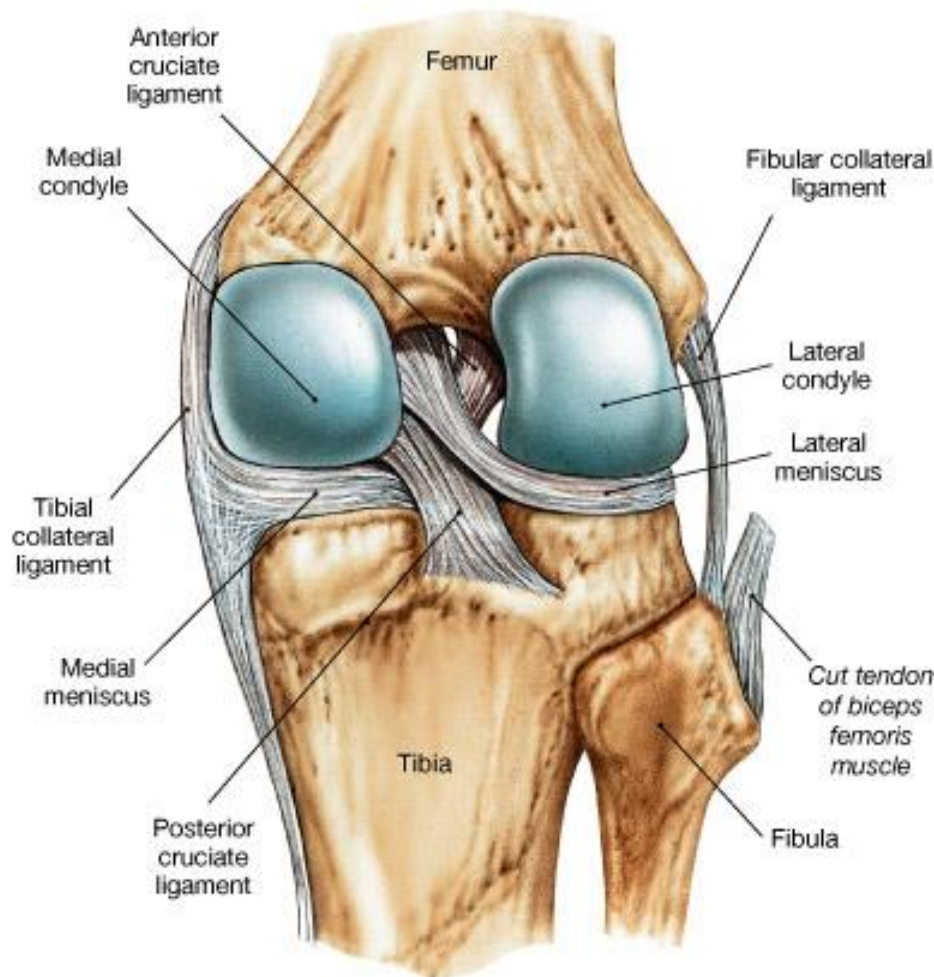


Interactive Knee 1.1 © 2000 Primal Pictures Ltd.

# Posterior Knee Joint



(a) Posterior view, superficial layer



(b) Posterior view, deep layer

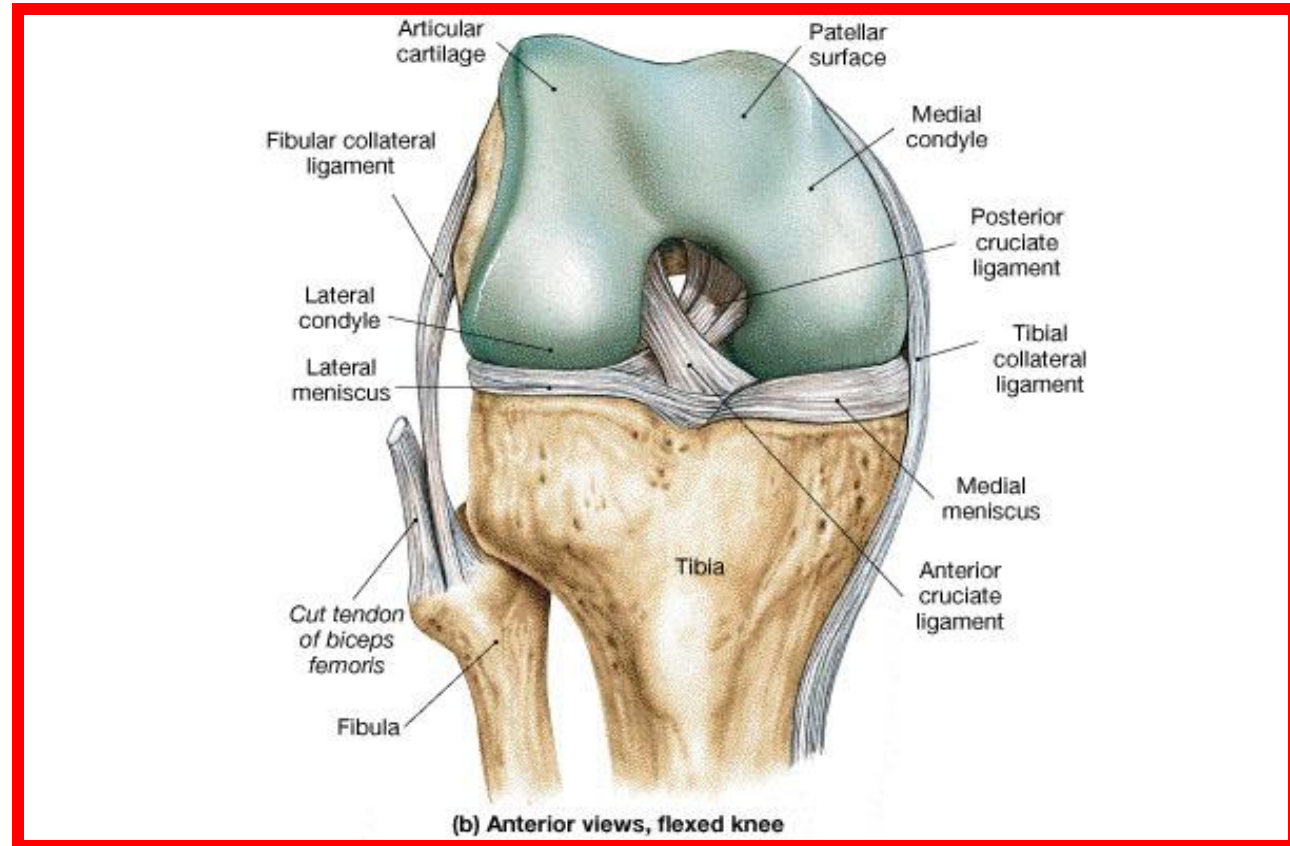
# Support Structures for Knee Joint

*(Ligaments)*

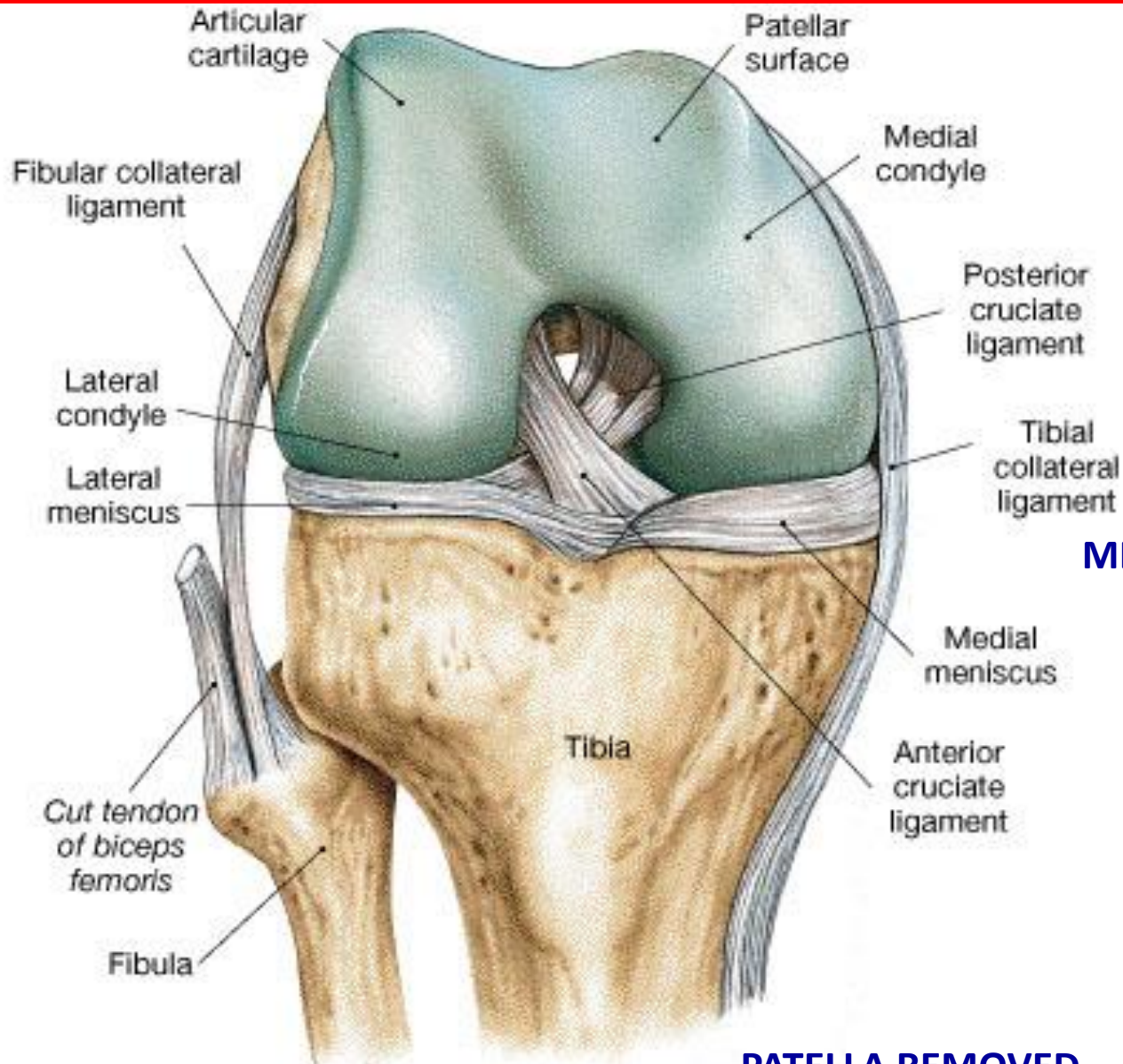
Bursae

Menisci (us)

Muscles



# Knee joint- fully flexed



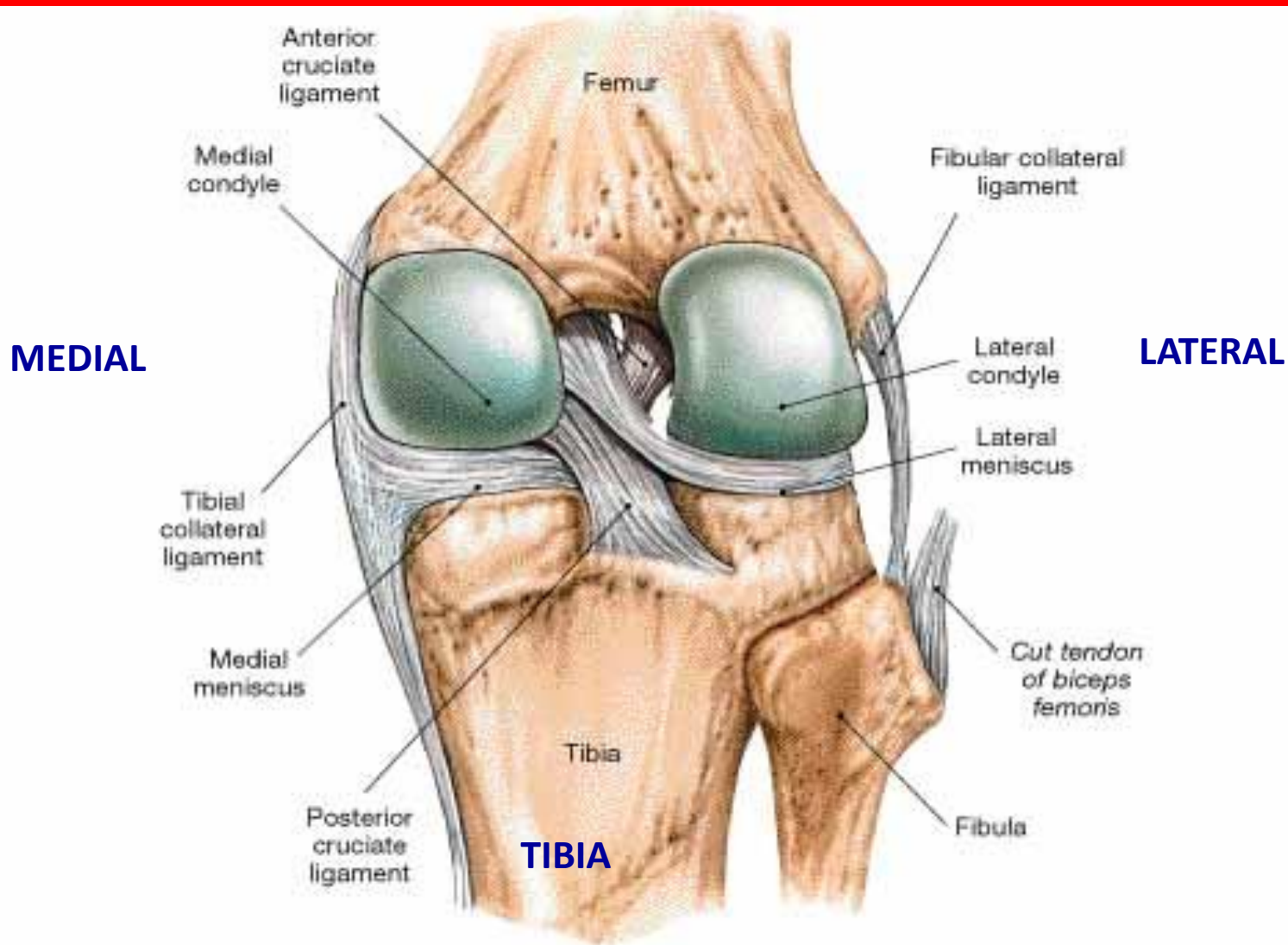
LATERAL

MEDIAL

PATELLA REMOVED

(b) Anterior views, flexed knee

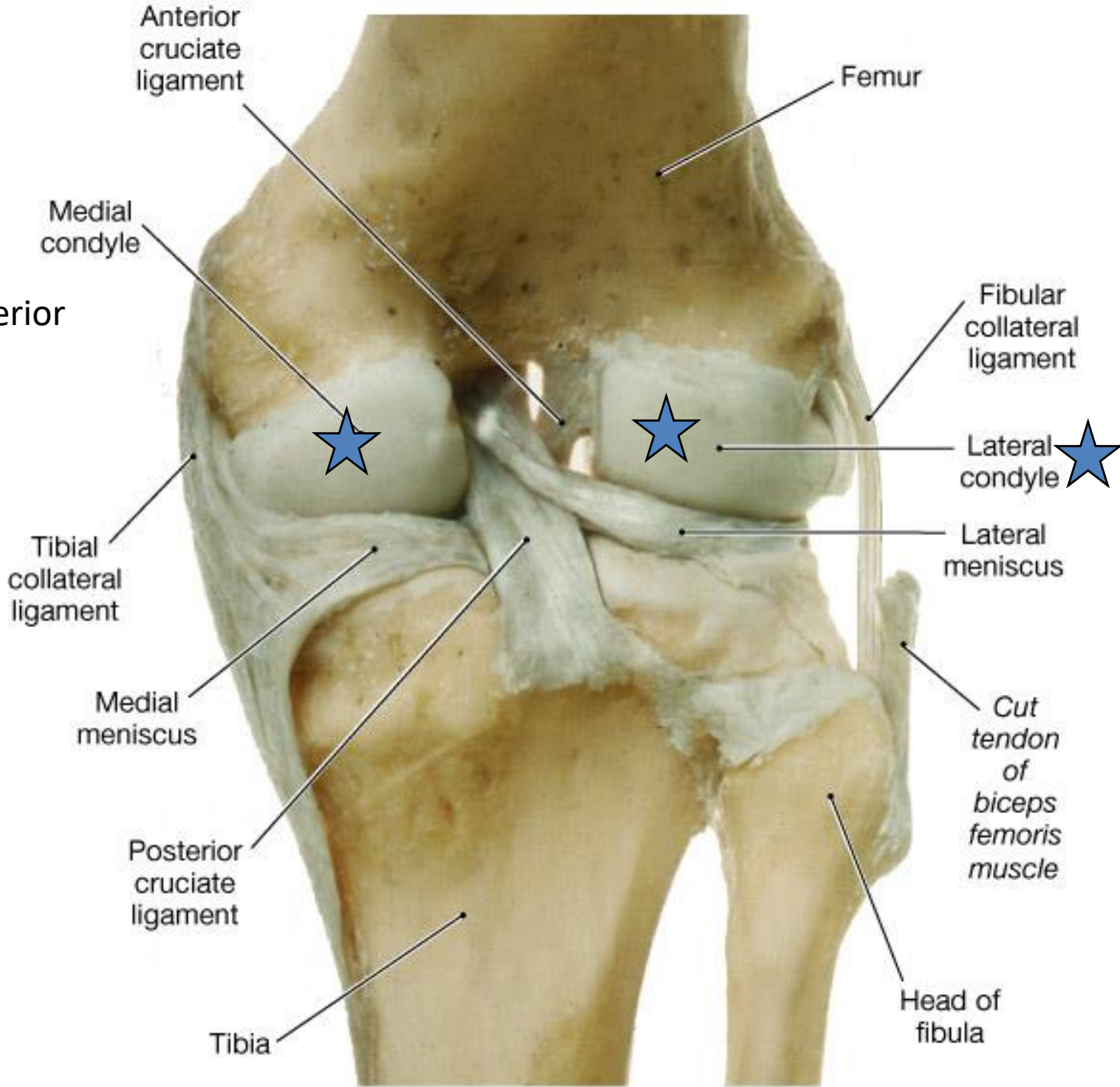
# Knee joint (posterior-extension)



(a) Posterior view, extended knee



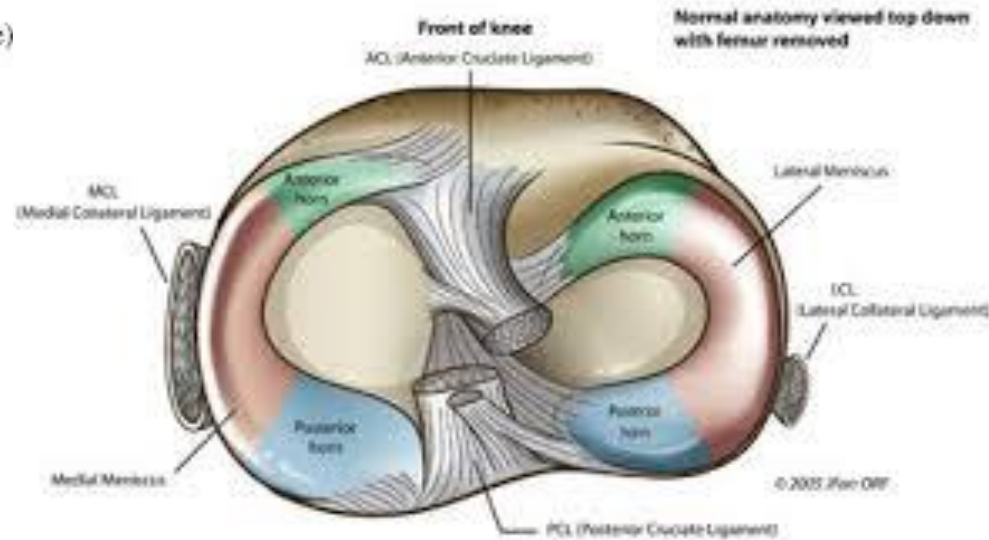
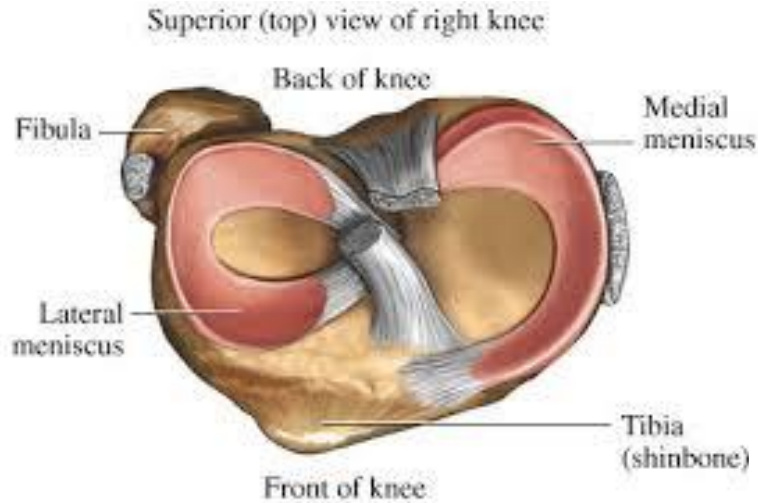
Fig 8-17 Posterior Knee



(c) Posterior view, deep layer



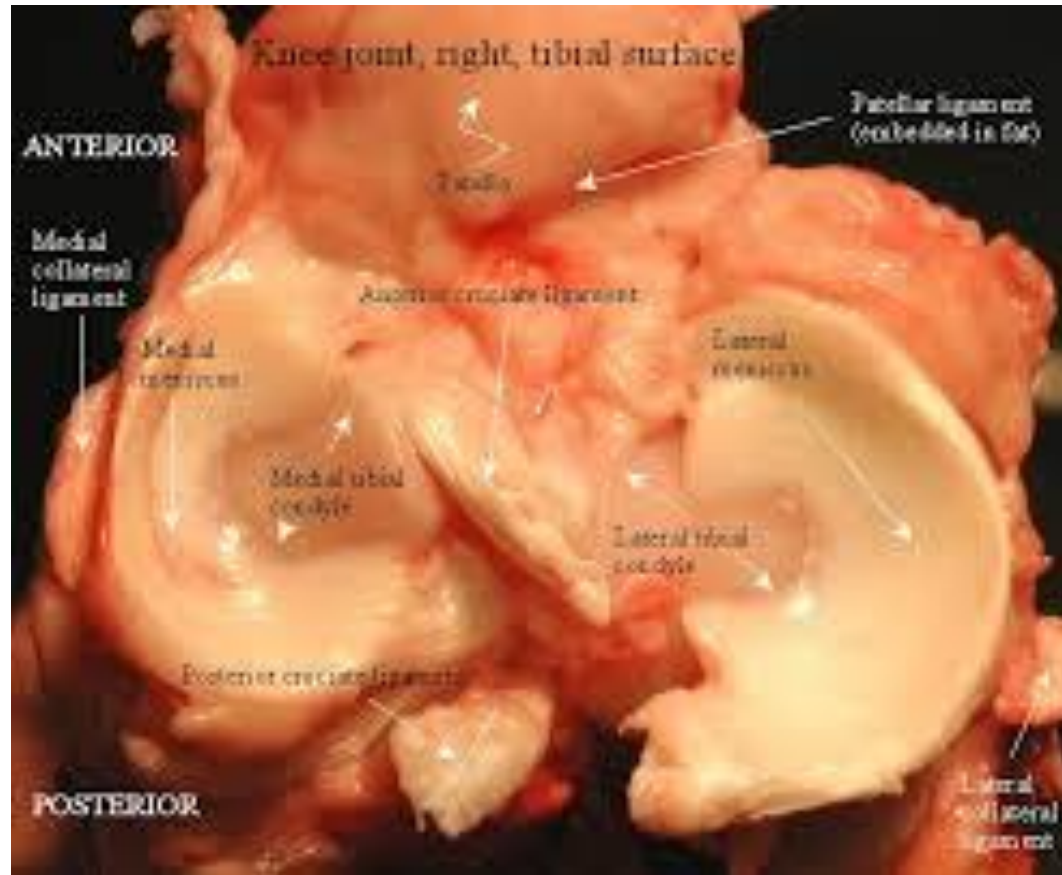
# Looking down!



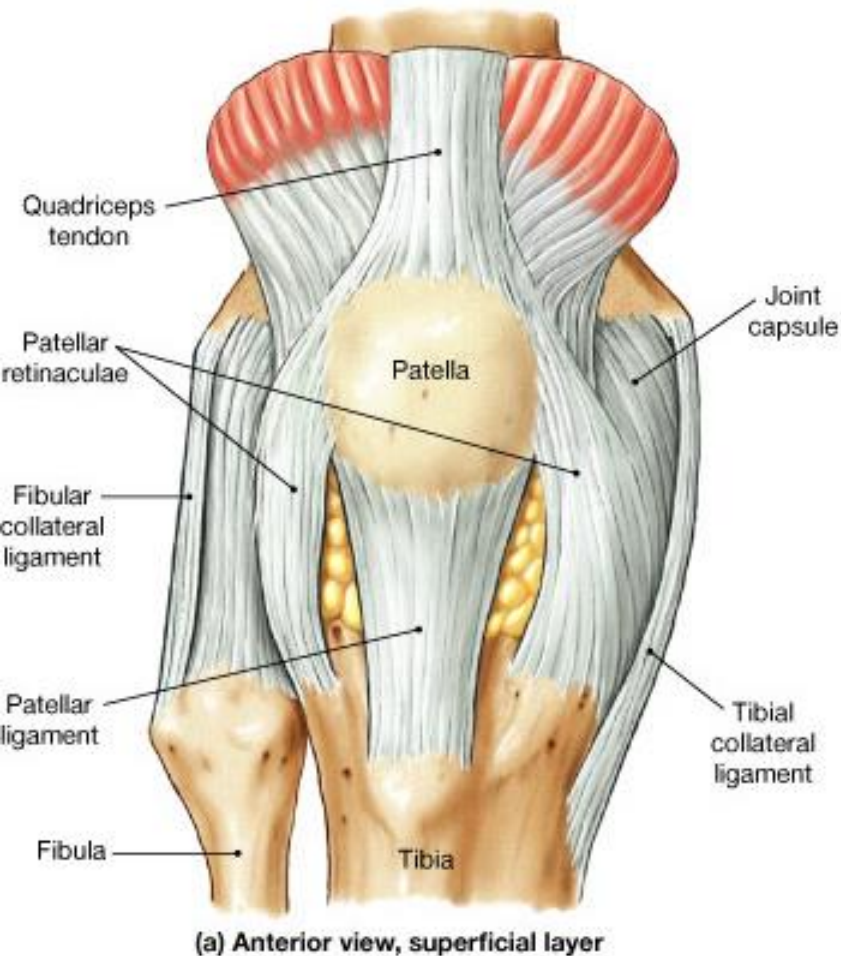


Notice  
lunar  
shape  
of the  
menisci

# What menisci really look like!



# Knee Joint



Quadriceps Muscle  
Group:

Vastus Medialis

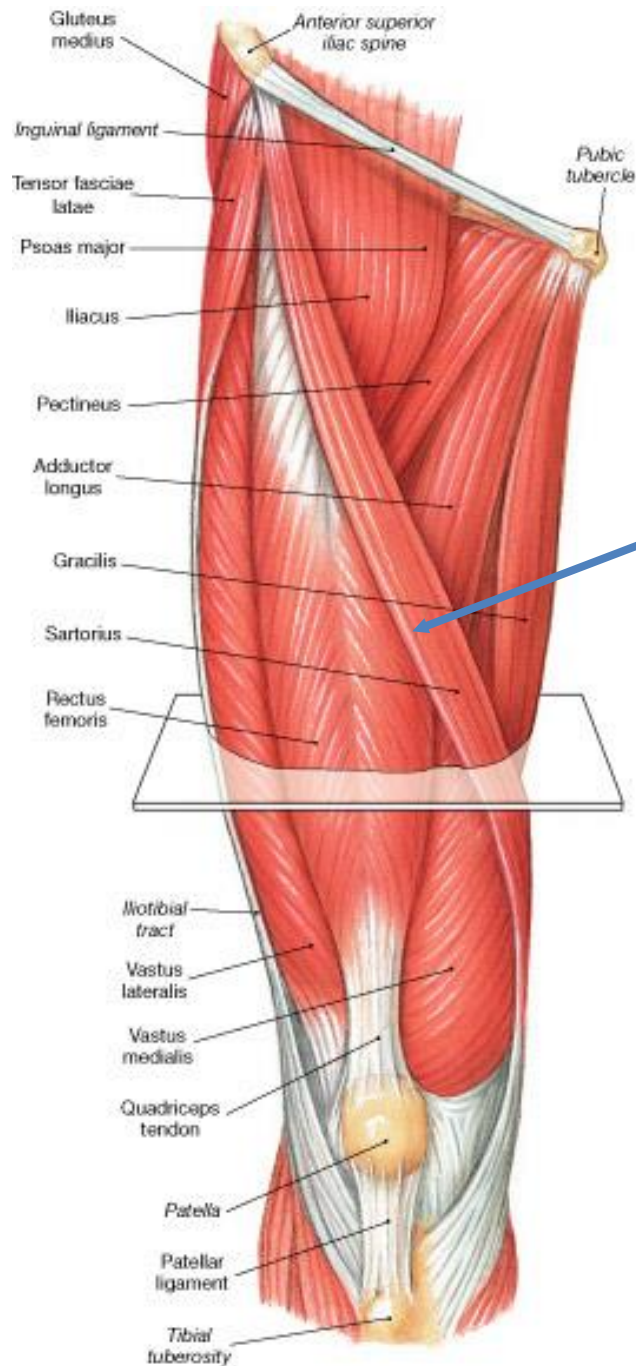
Vastus Lateralis

Vastus Intermedius

Rectus Femoris

*All fit into Quadriceps  
Tendon → Patellar Lig.*

# Anterior thigh muscles

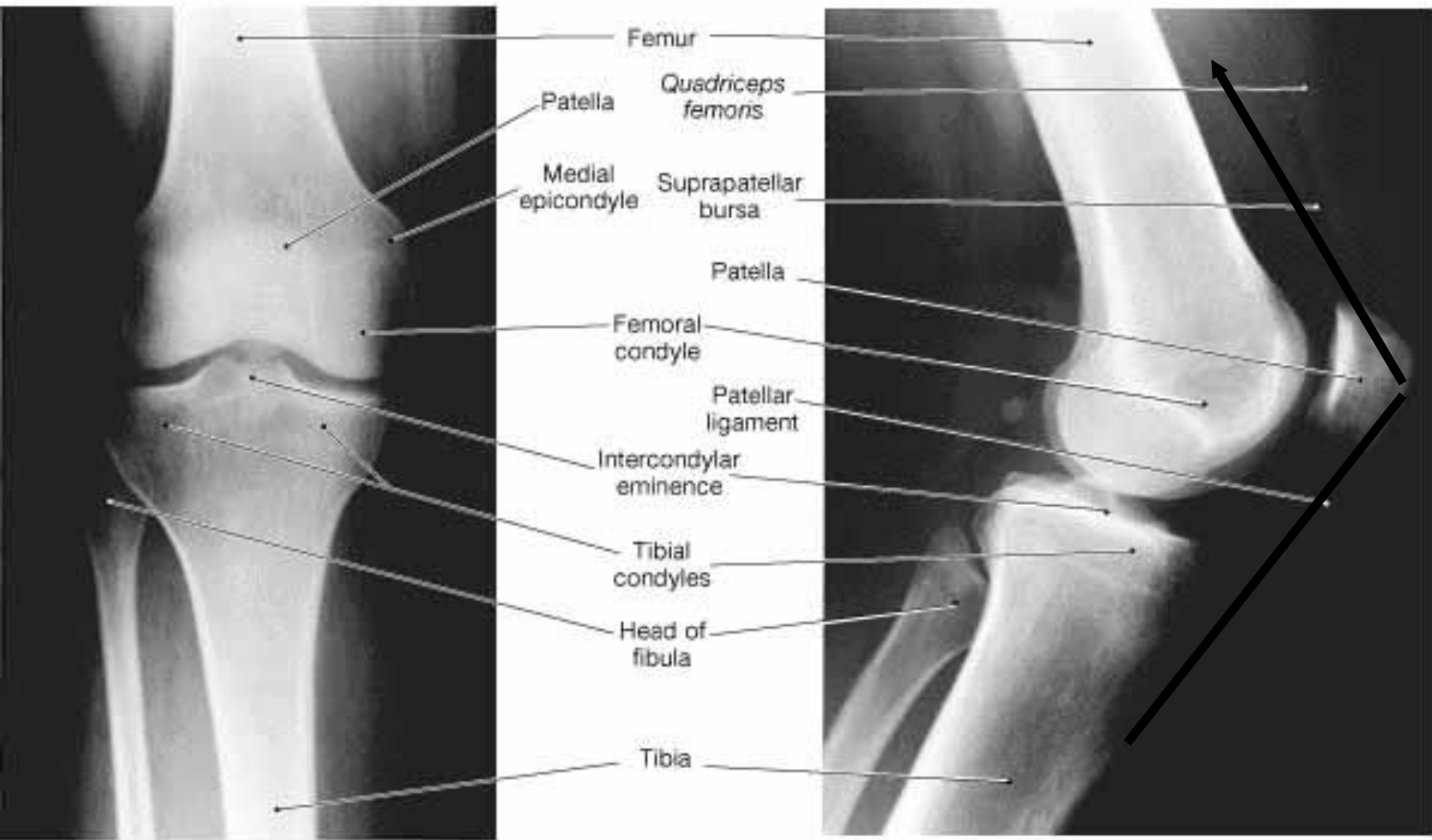


Sartorius Muscle:  
Action @ Hip &  
Knee

How does this  
differ from gracilis  
m.?

(a) Quadriceps and thigh muscles, anterior view

# X-ray of knee

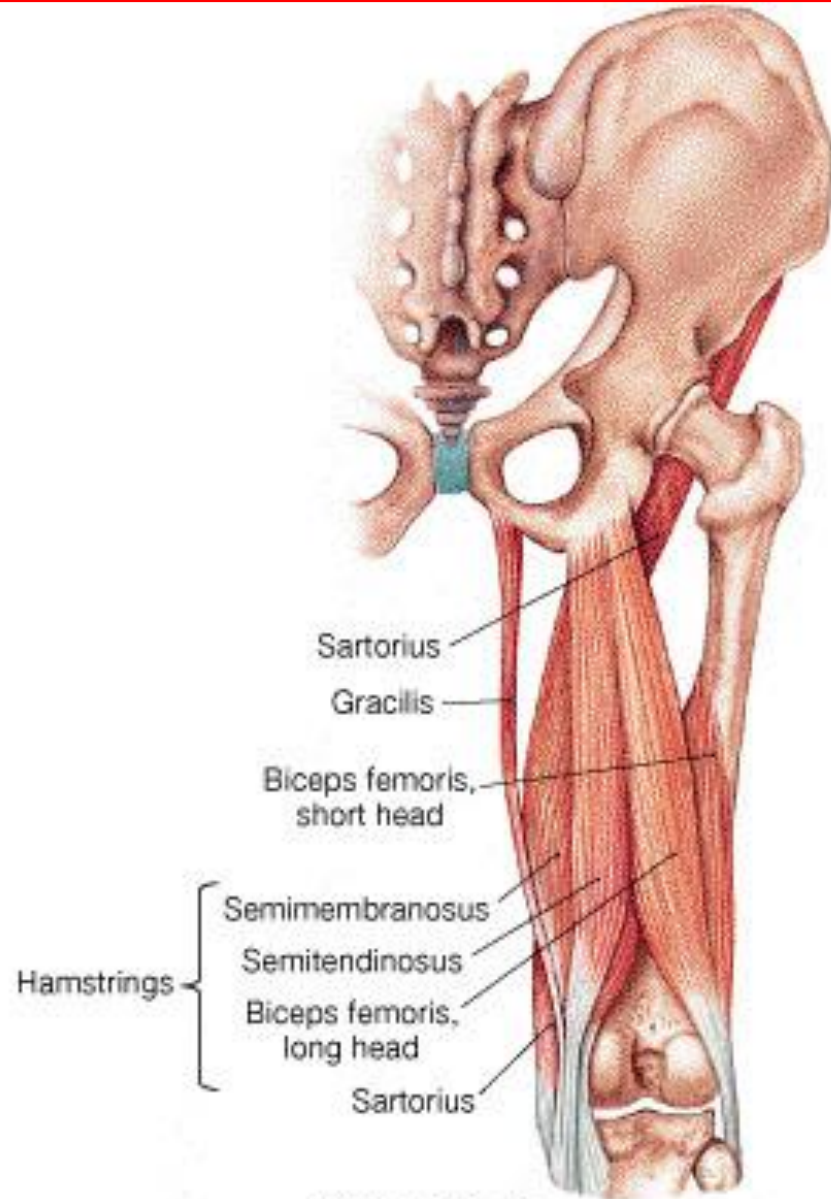


(c) X-ray, extended knee

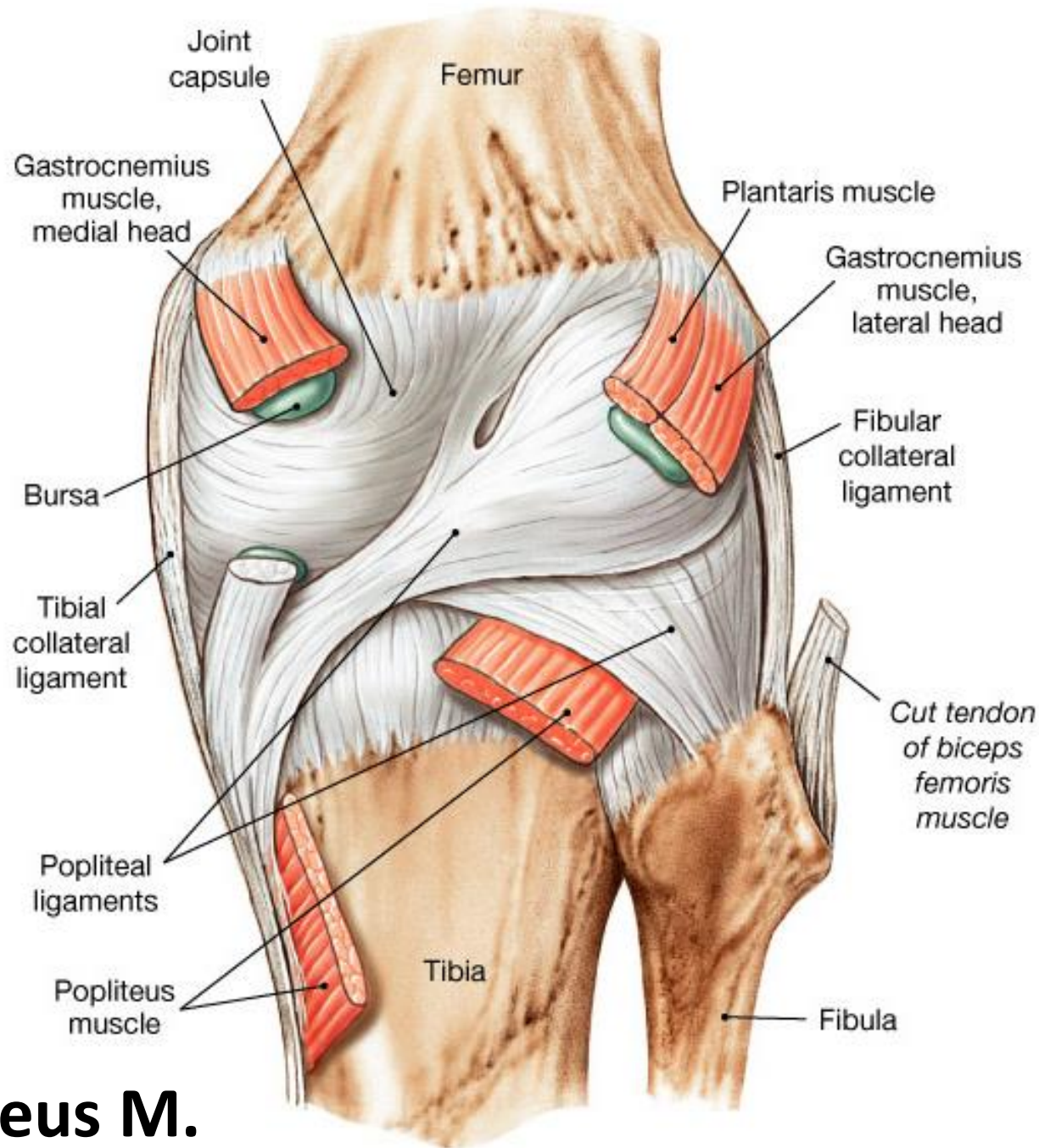
(d) X-ray, partially flexed knee



# Thigh Posterior view



(d) Posterior view



# Popliteus M.

(a) Posterior view, superficial layer

# LOWER LIMB JOINTS: HIPS & KNEES

## MEDICAL ISSUES & FIXES

Dr. Pat Gunton

March 12, 2022



# Presentation Outline

**HIP**

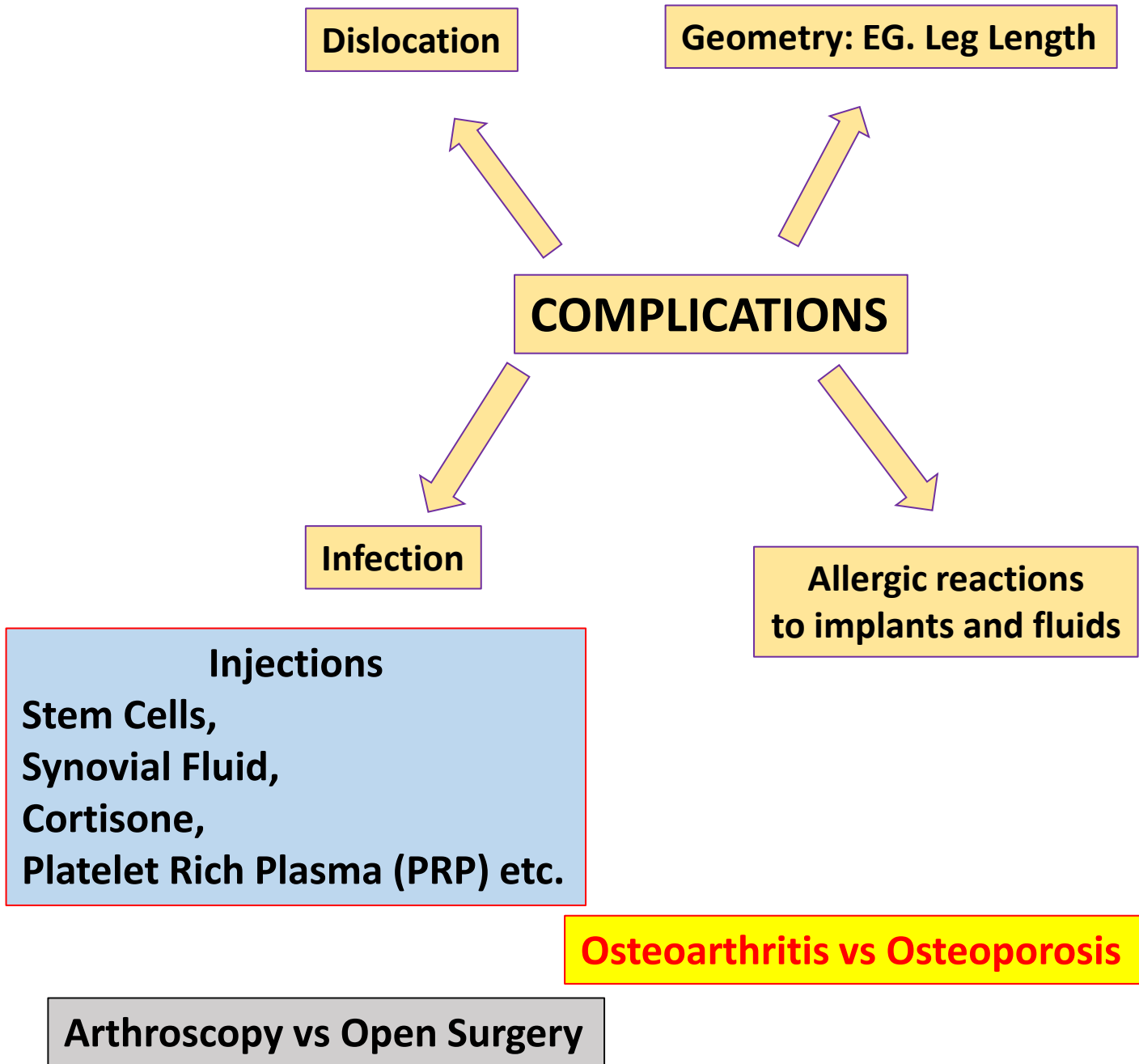
Bone  
Fracture  
Osteoporosis/ Osteonecrosis

Soft Tissue  
Cartilage Erosion  
Acetabular Tear  
Iliofemoral Ligament  
Bursitis

**KNEE**

Bone  
Fracture  
Osteoporosis

Soft Tissue  
Cartilage Erosion  
Meniscus  
Anterior Cruciate Ligament  
Bursitis



# OSTEOPOROSIS VS OSTEOARTHRITIS

“OSTEO” = Bone

## OSTEOPOROSIS

- Is a bone disease: porous bones.
- Decreased bone strength due to reduced bone quantity and quality.
- Increased risk of breaking a bone (fracturing) easily.
- “the silent thief” because it can progress without symptoms until a broken bone occurs.
- Produces **no pain** or other symptoms unless a fracture has occurred.
- Treatment Options
  - lifestyle changes, medications, diet (calcium and vitamin D intake), regular physical activity
  - Weight-bearing and strength training exercises fall prevention
- Broken hips caused by osteoporosis are repaired surgically by use of specialized “pins and plates,” or replacement surgery.

## OSTEOARTHRITIS

- Is a degenerative joint disease
  - ✓ thinning or destruction of the smooth cartilage that covers the ends of bones
  - ✓ changes to the bone underlying the joint cartilage.
- Osteoarthritis is the most common form of arthritis
- Affects different joints differently: often caused by overuse or joint immobility
- Produces **pain, stiffness and reduced movement of the affected joint**
- Ultimately affects doing physical activities, reducing quality of life.
- Managed with the use of joint protection (decreasing the amount of work the joint has to do), exercise, pain relief medication, heat and cold treatments, and weight control.
- Severe cases are treated by joint replacement surgery

# OSTEOPOROSIS VS OSTEOARTHRITIS

## OSTEOPOROSIS

### Where to get help

- Osteoporosis Canada (OC) counsellors  
1-800-463-6842.  
<https://osteoporosis.ca/>

## OSTEOARTHRITIS

### Where to get help

- The Arthritis Society (TAS) counsellors  
1-800-321-1433  
<https://arthritis.ca>

## PHYSIOTHERAPY

- A specially trained physiotherapist can help ensure exercises are safe and beneficial for **both** conditions.
- It is possible to have **both osteoporosis** and **osteoarthritis** at the same time.
- Regular weight-bearing exercise is usually recommended for individuals with **osteoporosis**, but may be difficult to follow in the presence of significant hip or knee **osteoarthritis**.
- Keeping joints mobile requires a special approach to exercise and movement.

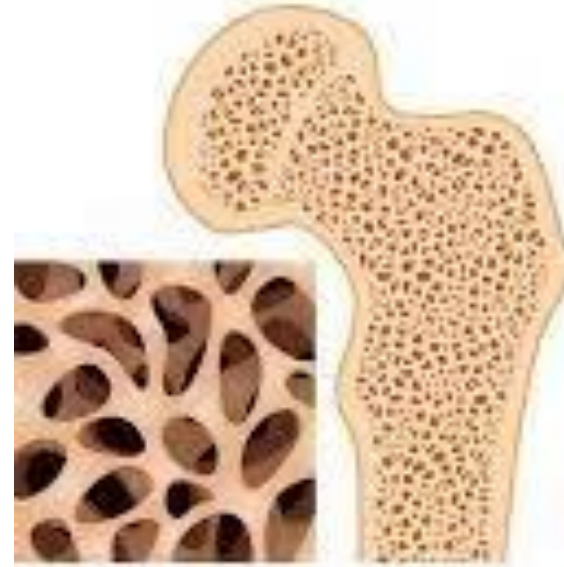
# Osteoporosis



Normal



Osteoporosis

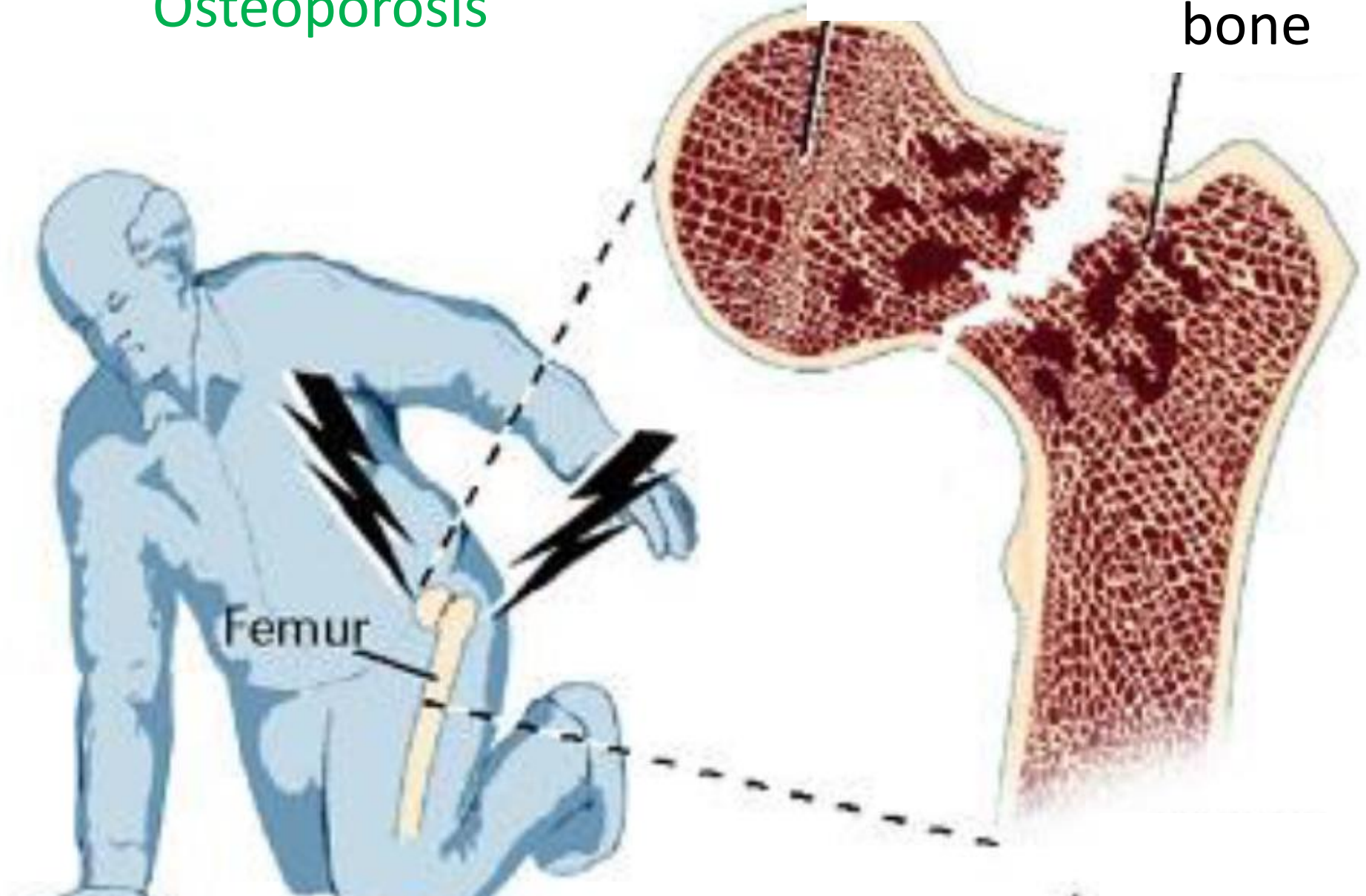


Healthy bone



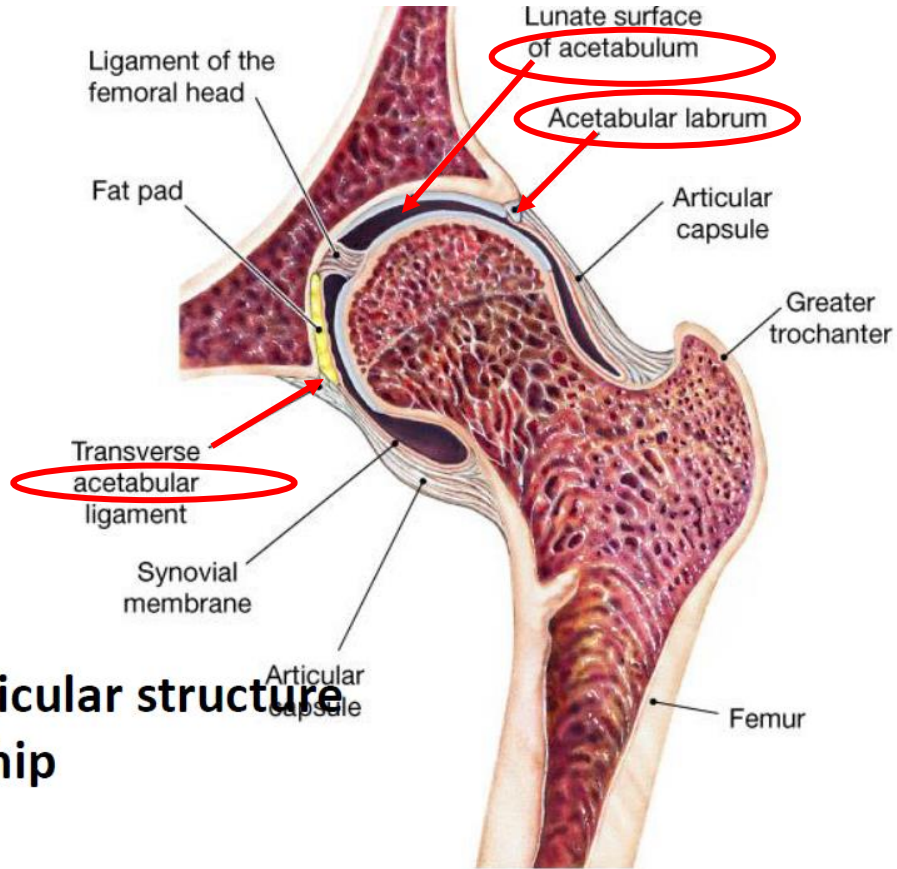
Osteoporosis

# Hip Fracture due to Osteoporosis





## Articular structure of hip

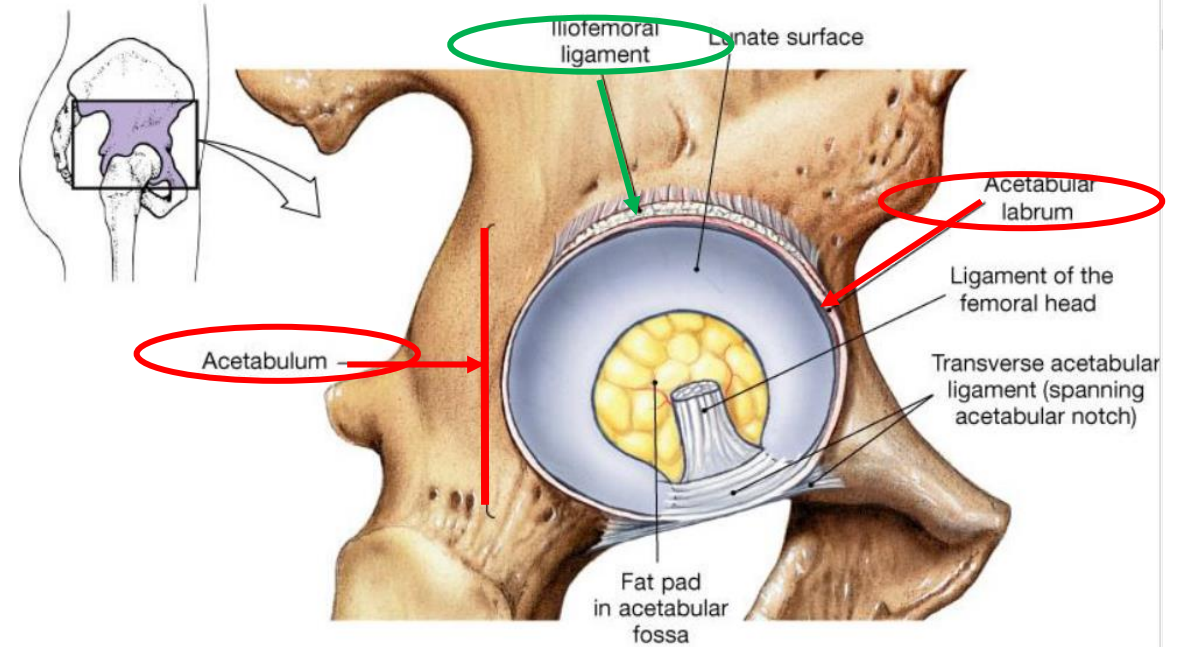


(a) Sectional view

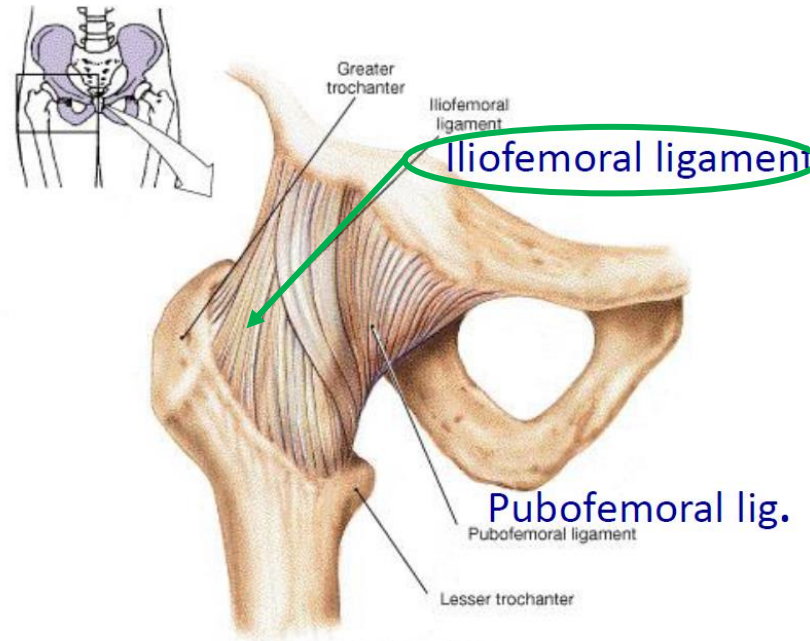
## Soft Tissue Problems of the Hip

- Acetabular
- Iliofemoral

## Structure of Acetabulum



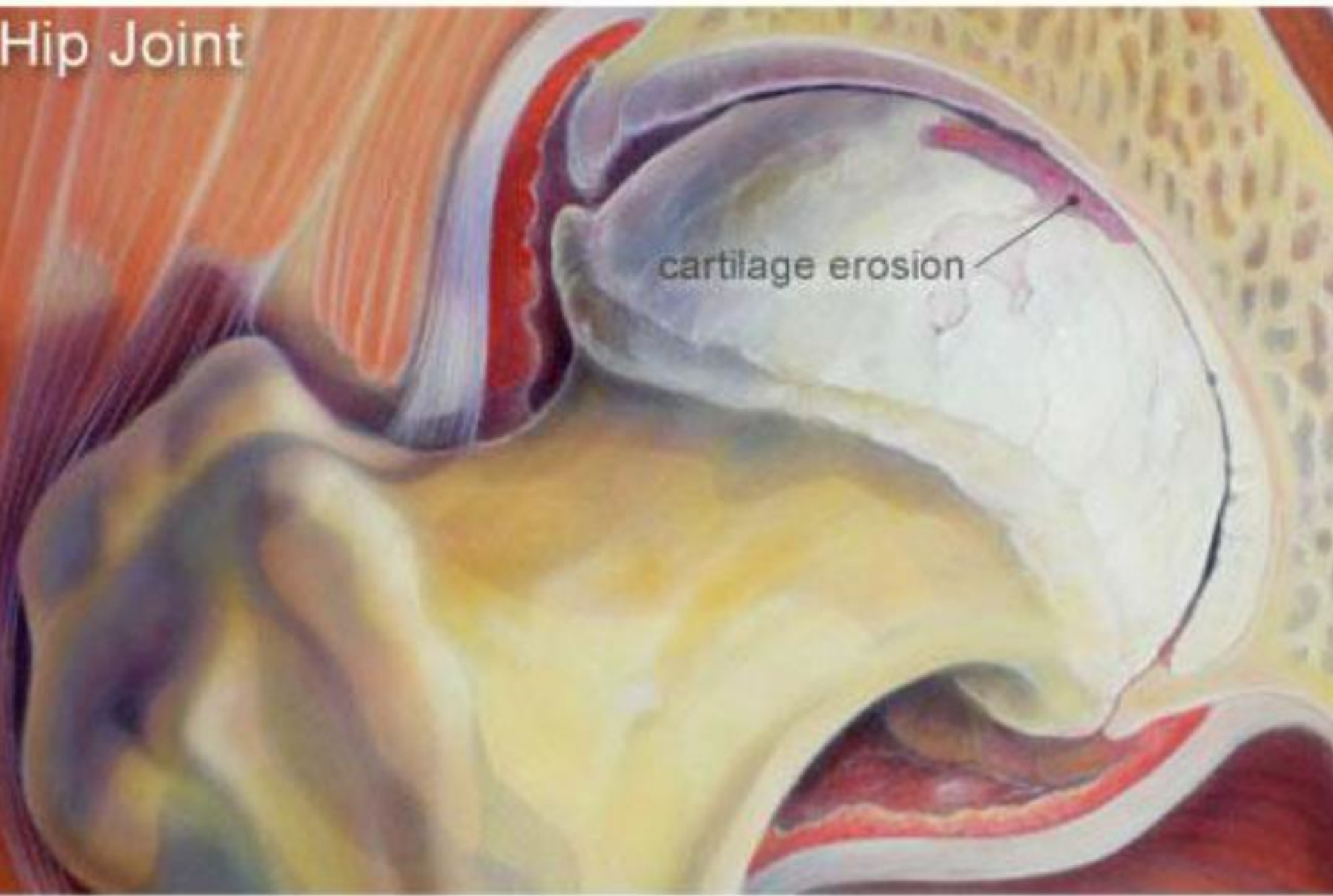
(a) Lateral view



(b) Anterior view

# Osteoarthritis

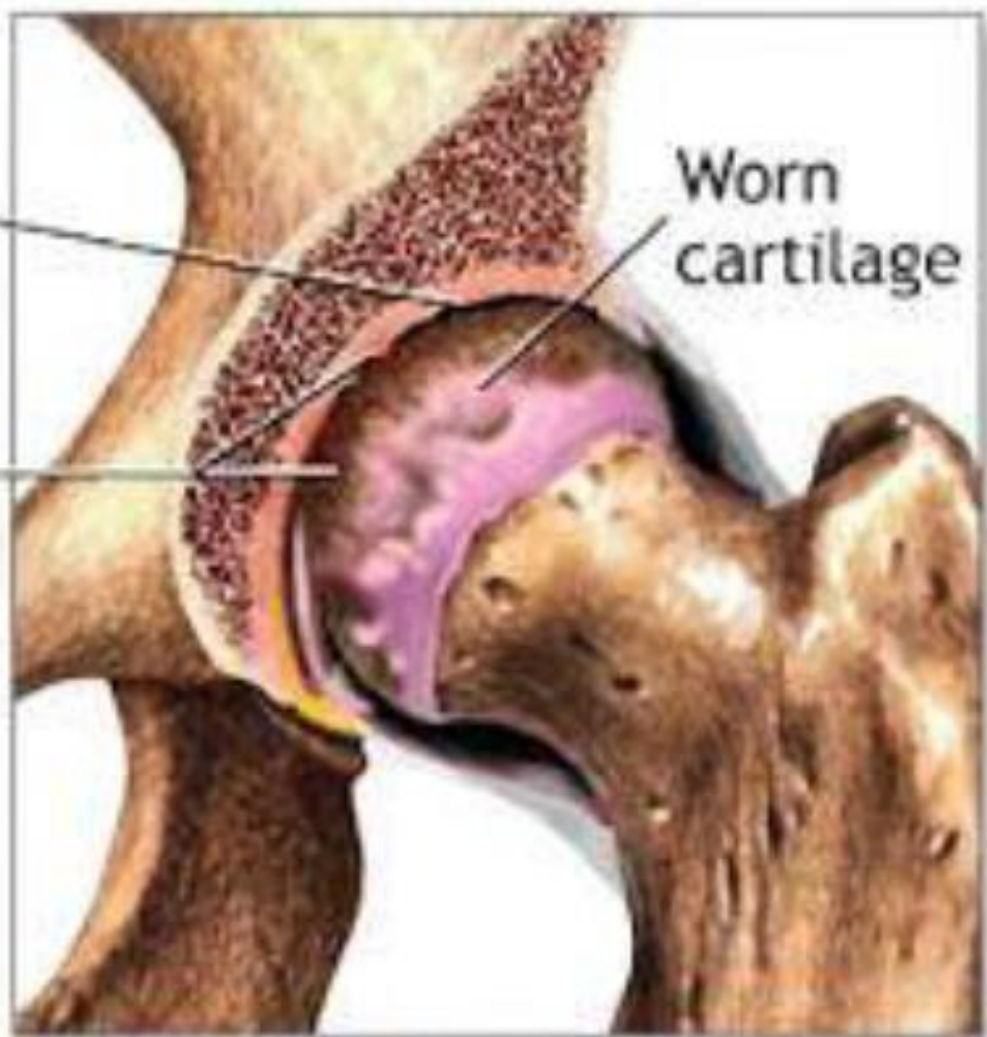
Hip Joint



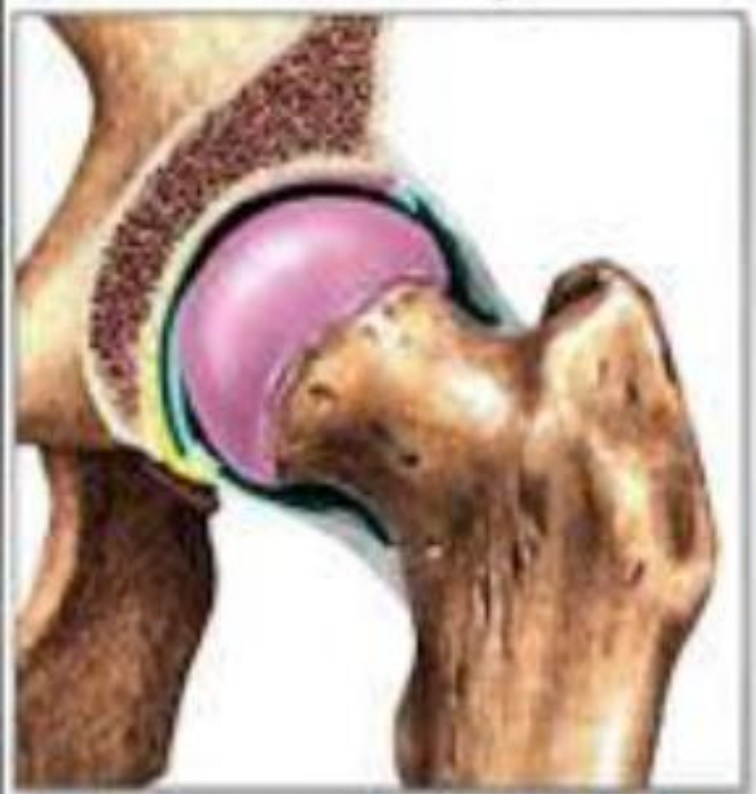
Decreased joint space

Worn cartilage

Rough bone



Arthritic hip joint



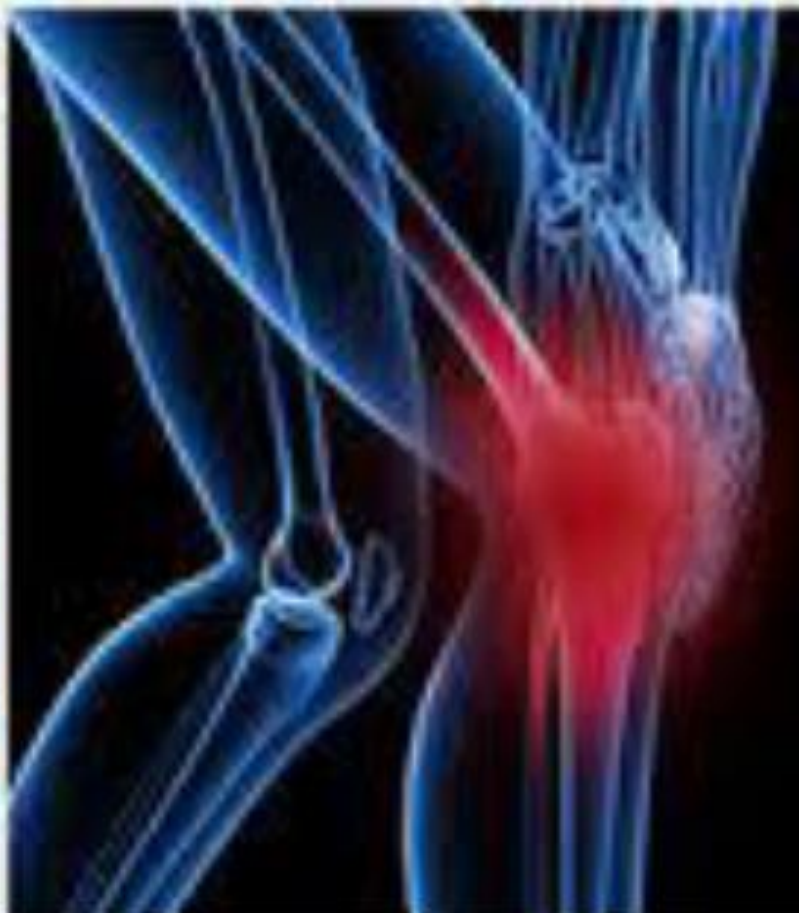
Normal hip joint

# INFLAMMATORY ARTHRITIS

HIP



KNEE



## Causes & Types of Inflammatory Arthritis

- Rheumatoid
- Lupus
- Psoriasis

NB:

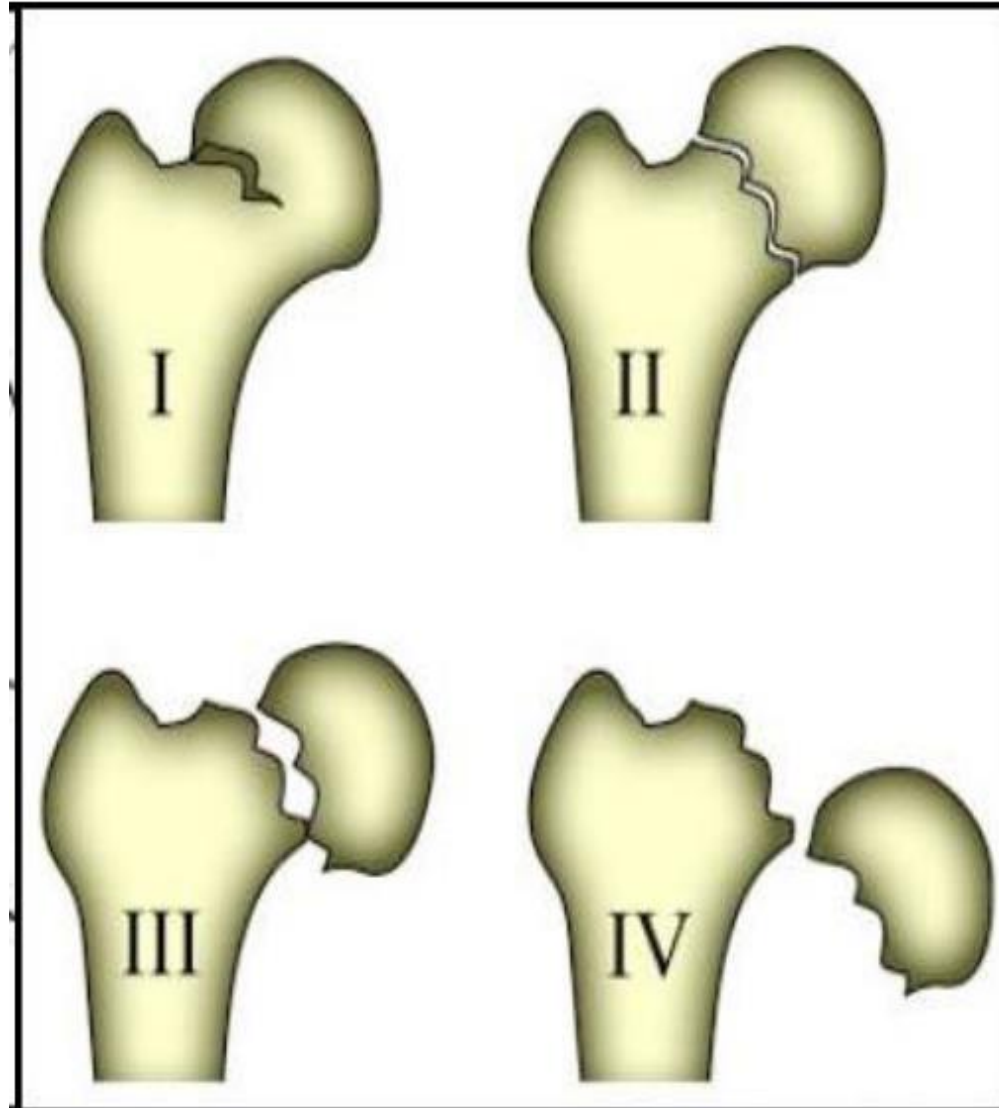
These are systemic diseases meaning they can affect other parts of the body

## Treatments

- Gold
- Methotrexate
- Biologics
  - ✓ Humira
  - ✓ Enbrel
  - ✓ Remicade

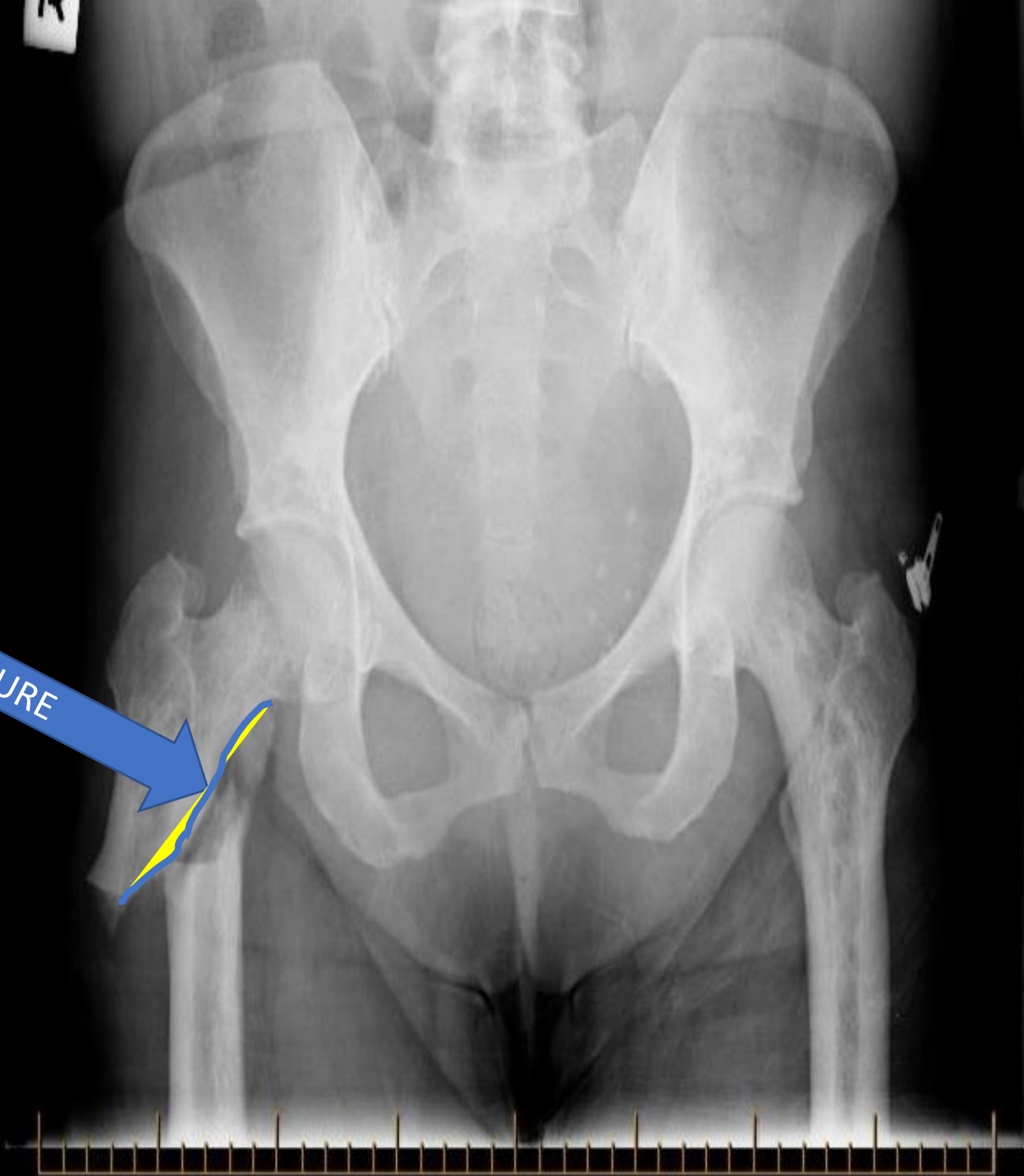
Suppress tumour necrosis factor/T Cells

# Grades of Fractures



DX PELTS & ONE HIP 8547  
PELVS  
Se: Sep 19, 2005 11:05:49 PM  
Ac: #694A091905  
Se: CR #1001 - 1  
Im: 1/1

Nanaimo Regional General Hospital



Can You Spot  
the Hip  
Fracture?

2140x1760  
Zoom: 29 %  
Compression: 20:1  
W: 2462 L: 1414

DX HIP 8630  
PELVIS  
Se: Oct 13, 2005 1:12:09 PM  
Acq #302A-101305  
Se: CR #1001 - 1  
Im: 1/1



FIXED  
Screwed &  
Pinned

# Osteonecrosis

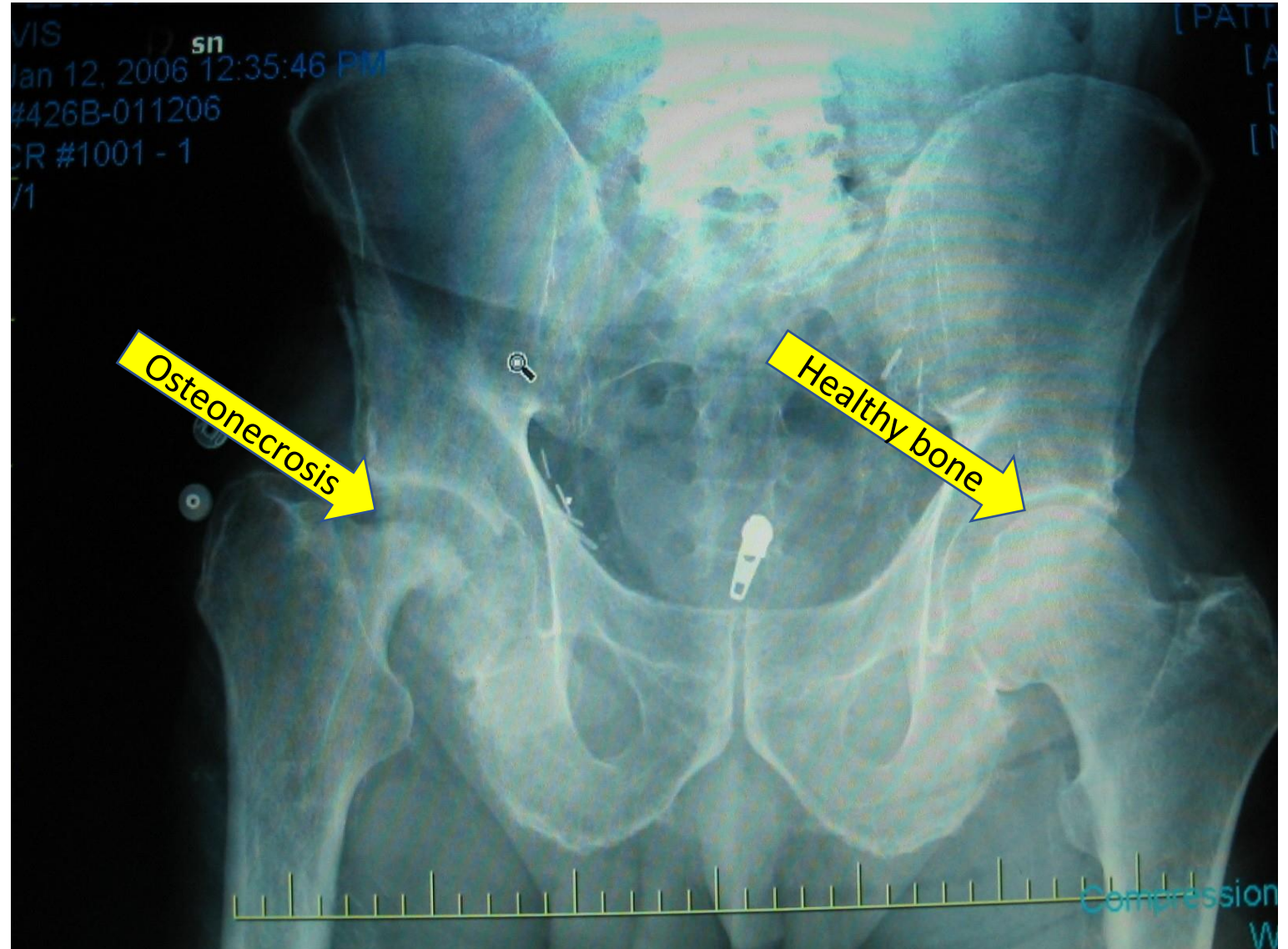
Death of bone tissue due to lack of blood supply

“tiny breaks in the bone and the bone's eventual collapse”

## Causes:

- Fracture or dislocation
- Excessive alcohol
- Cortisone medications
- Deep sea divers

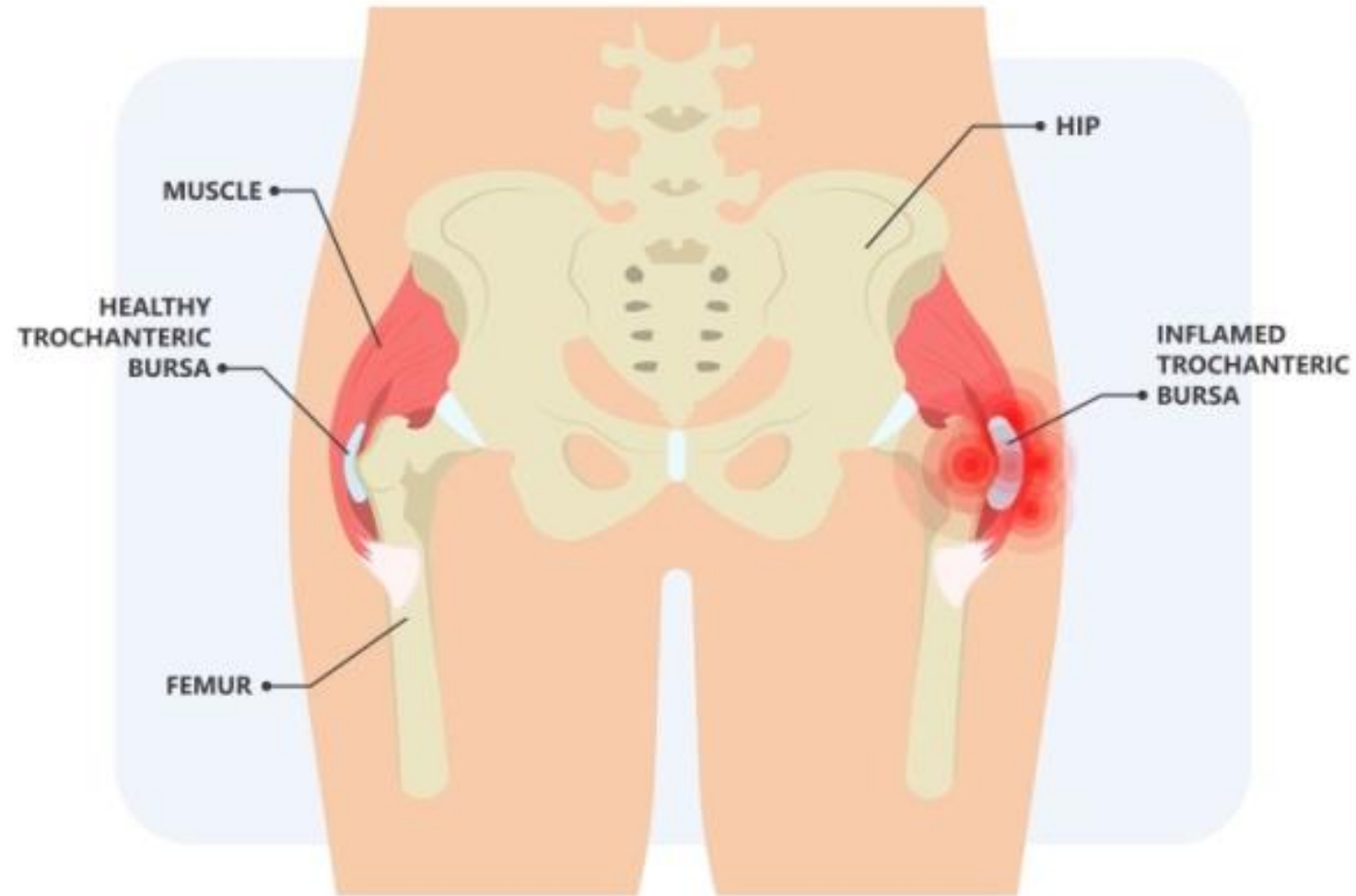
Can also occur without trauma or disease. This is called idiopathic -- meaning it occurs without any known cause



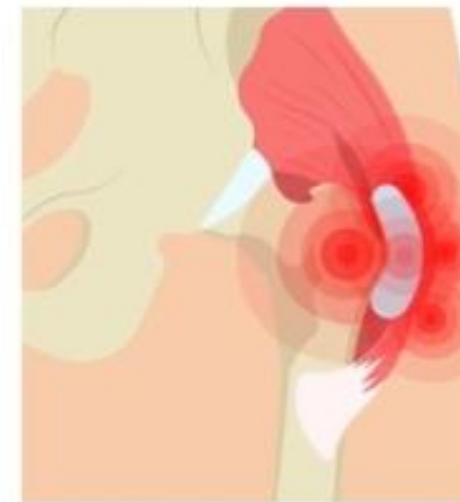


# BURSITIS

## Trochanteric Bursitis



HEALTHY

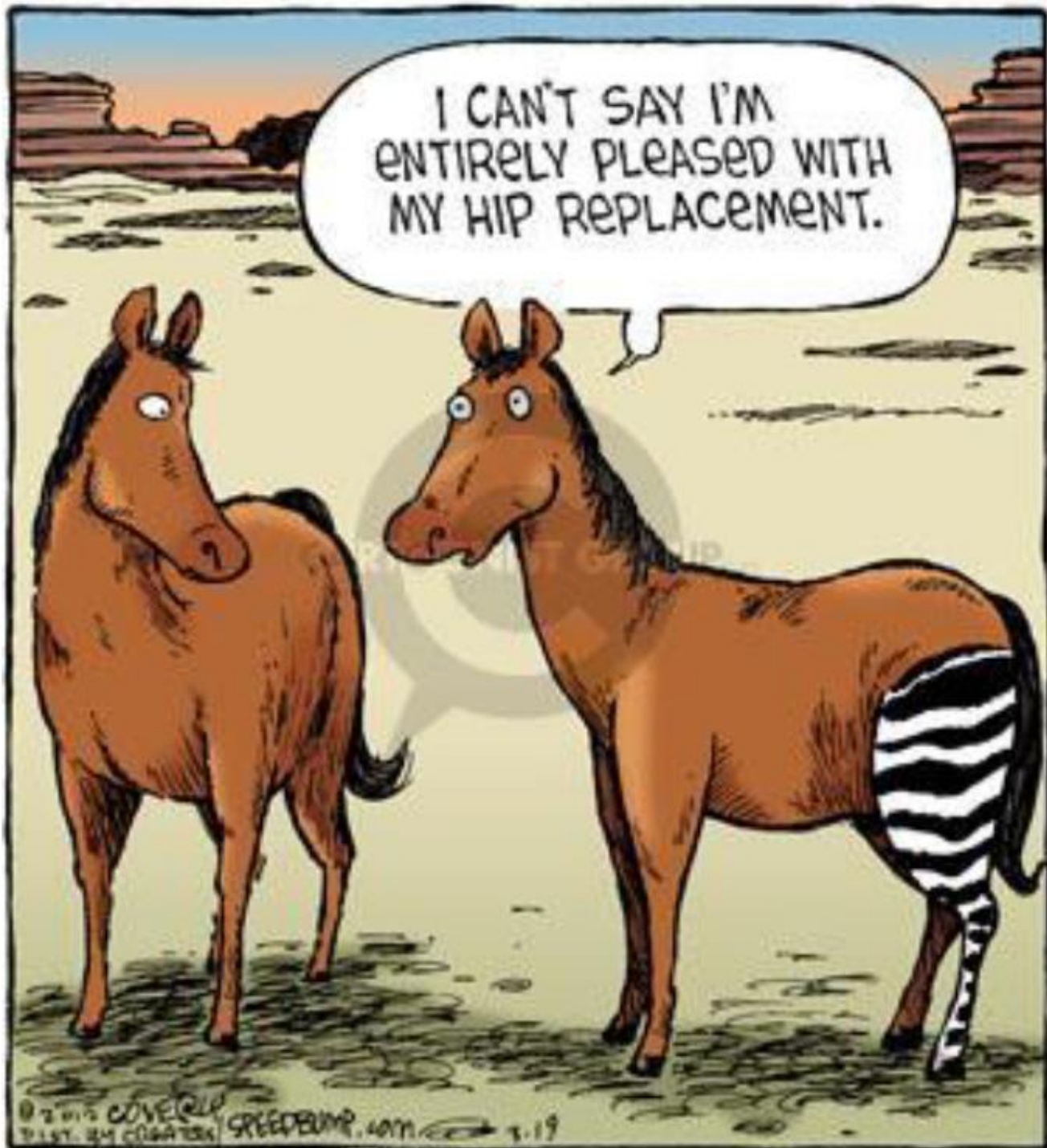


BURSITIS

Trochanteric bursitis is inflammation of the bursa at the part of the hip called the greater trochanter. When this bursa becomes irritated or inflamed, it causes pain in the hip.

### Treatment

- Ibuprofen
- Ice, Heat, Ultrasound.
- Stretching the iliotibial band
- Cortisone injections



# Materials used in Joint Replacements

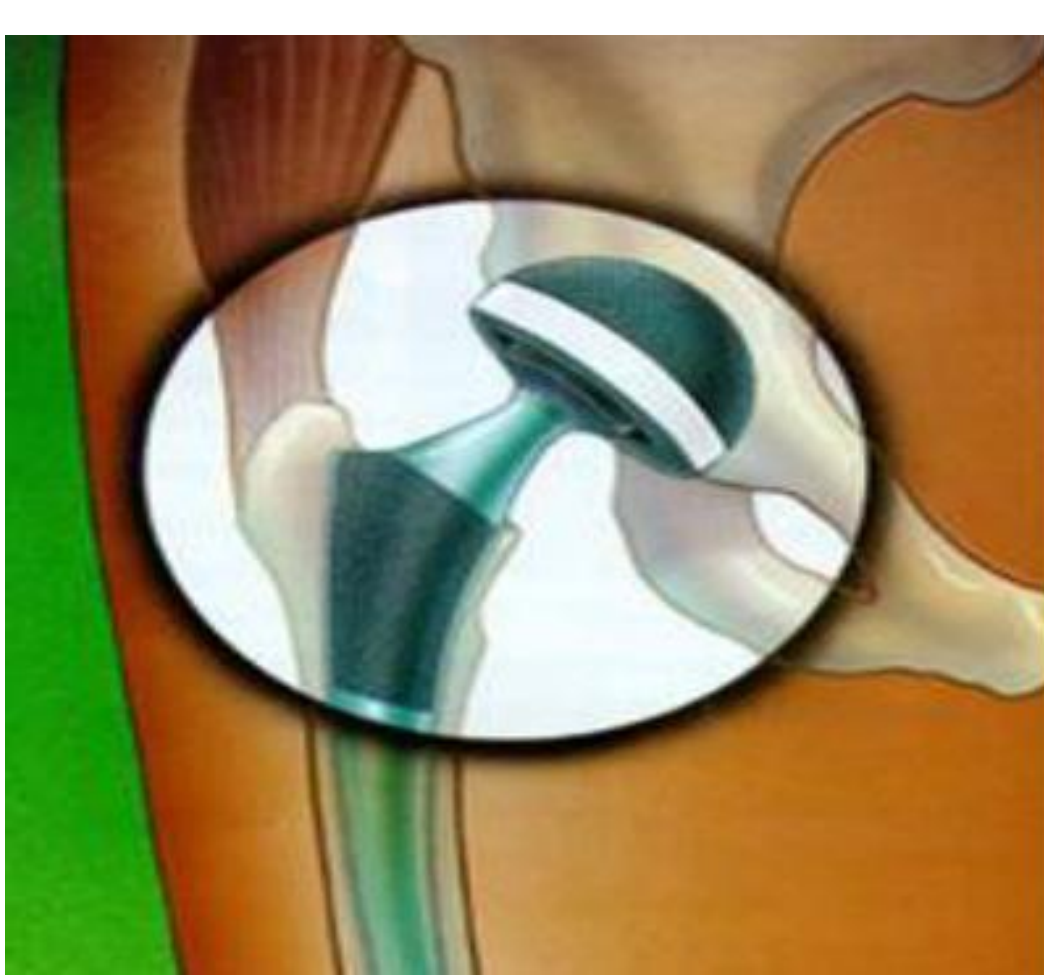
- Must have high strength, good corrosion resistance, excellent wear resistance, and outstanding **biocompatibility**
- Joint materials include:
  - Metal - Stainless steel, Cobalt alloy and Titanium alloy
  - Polymer - Polyethylene
  - Ceramics – Silicon carbide
- **Biocompatibility** can be an issue with risk of metal flakes, allergies, metallosis and Cobalt ions

# Arthroplasty: Lots of options



## Successful Total Hip replacement





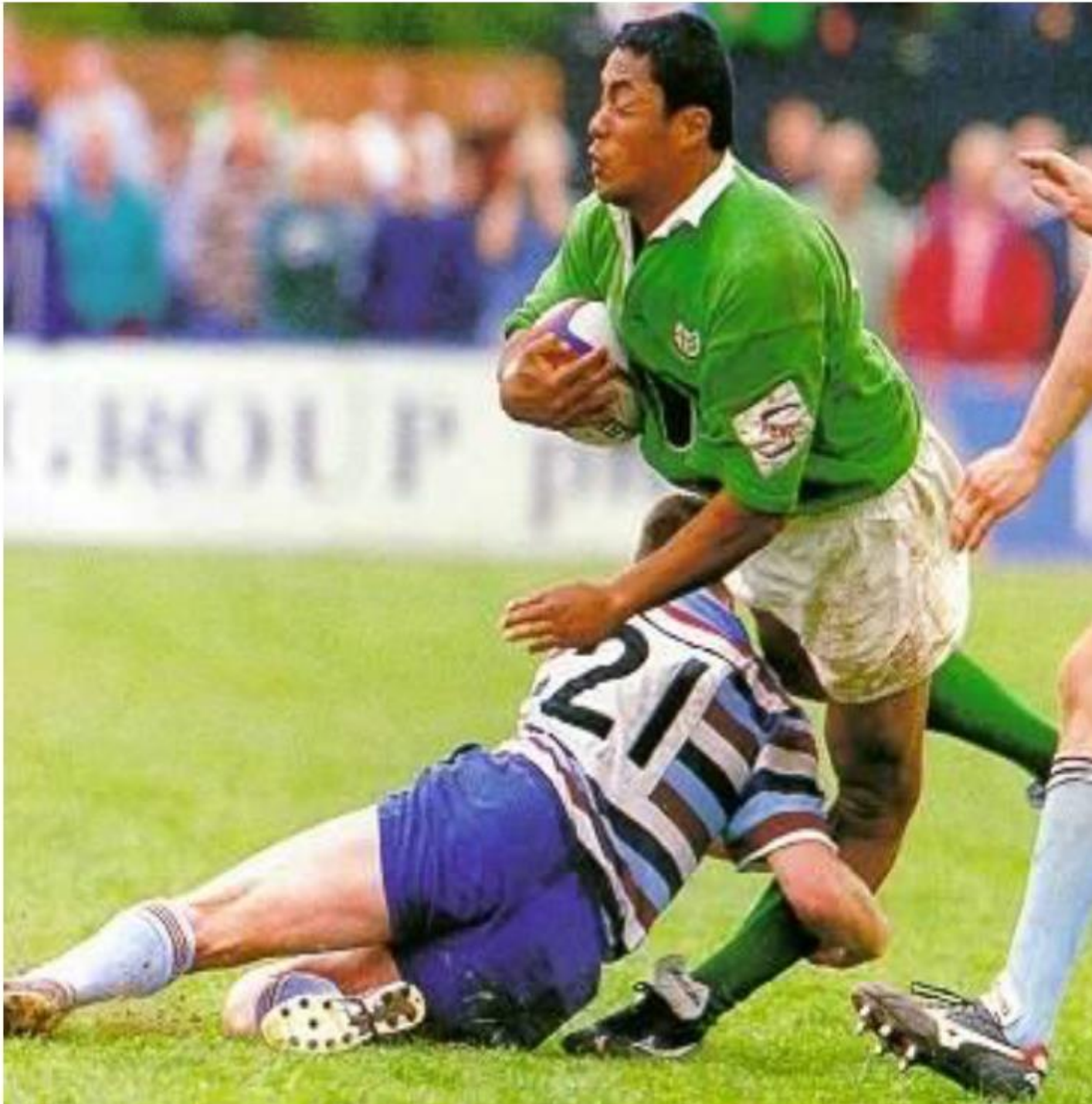
Unfortunately the artificial hips are not as stable and can dislocate

**This is what it should look like**

# Medical issues of the knee

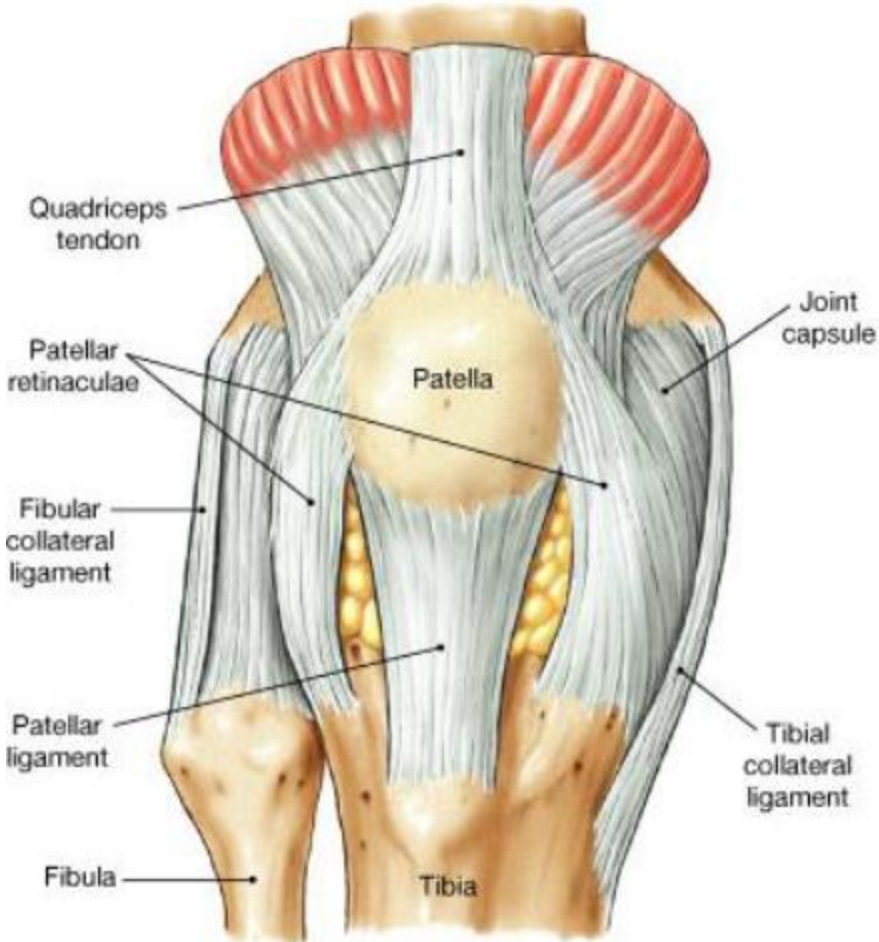


**Now  
that's  
got to  
hurt!!**

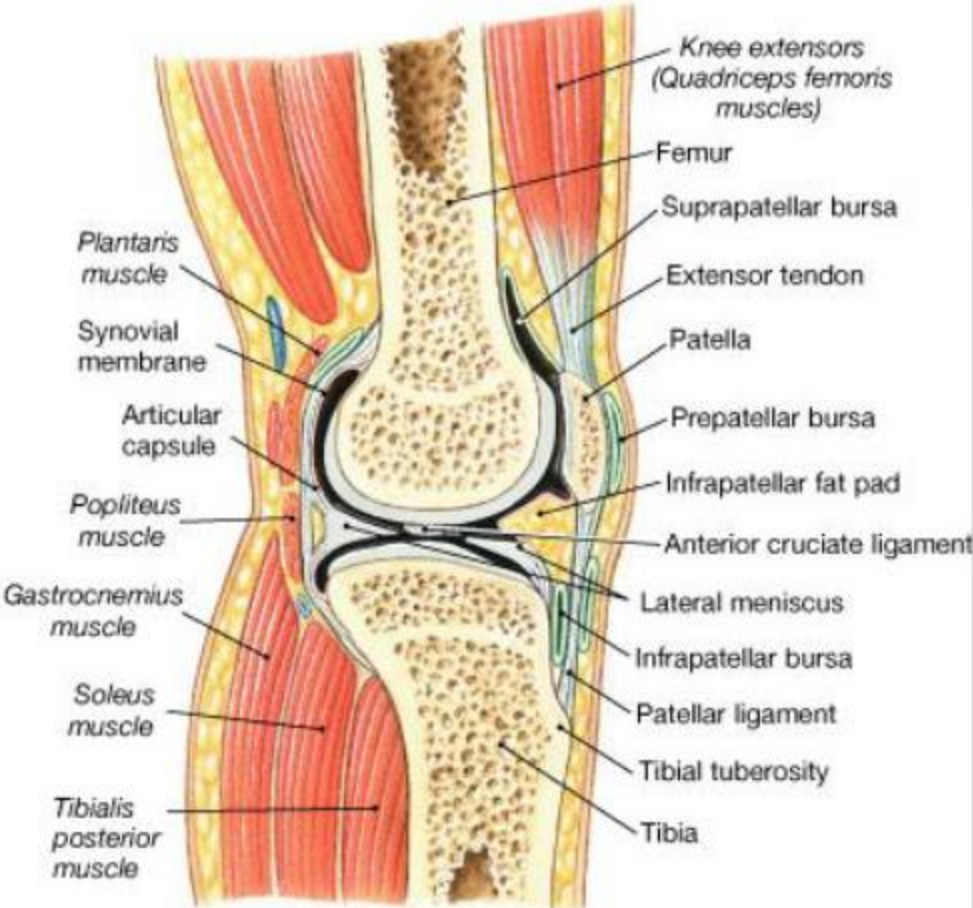




# The Knee Joint

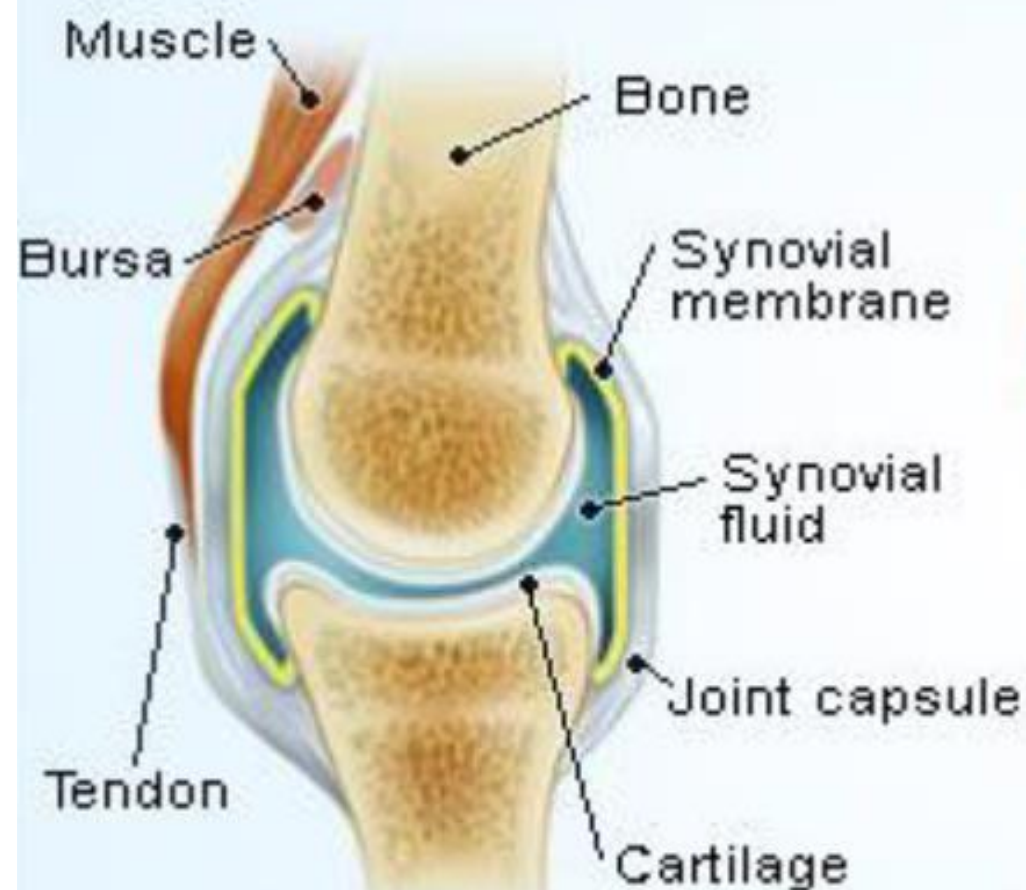


(a) Anterior view, superficial layer

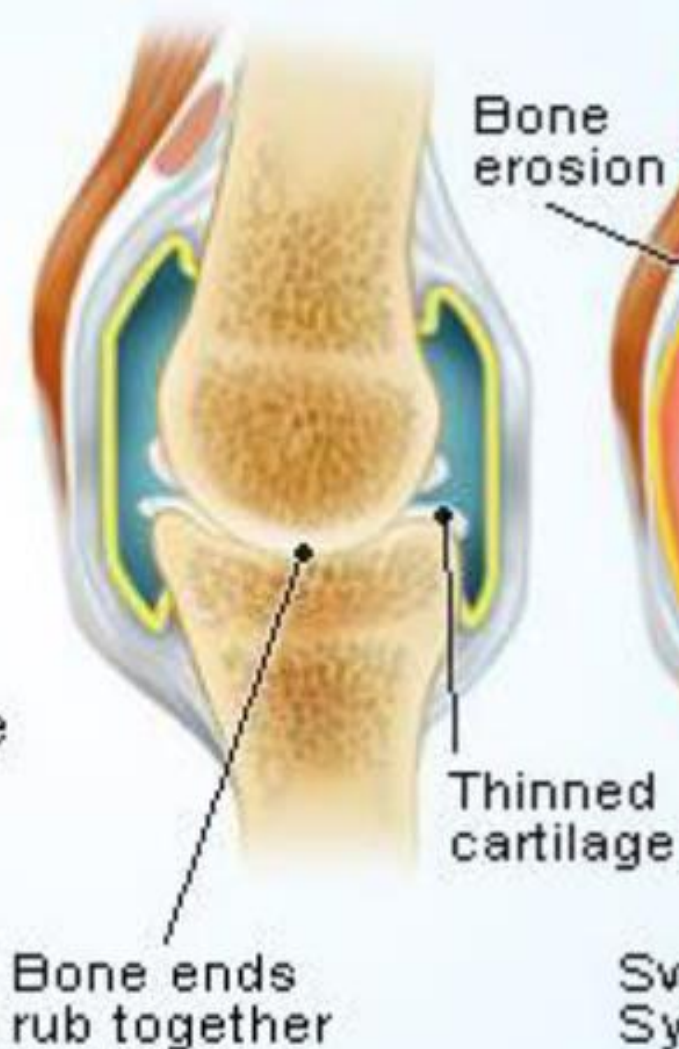


(b) Parasagittal section

## Normal Joint



## Osteoarthritis



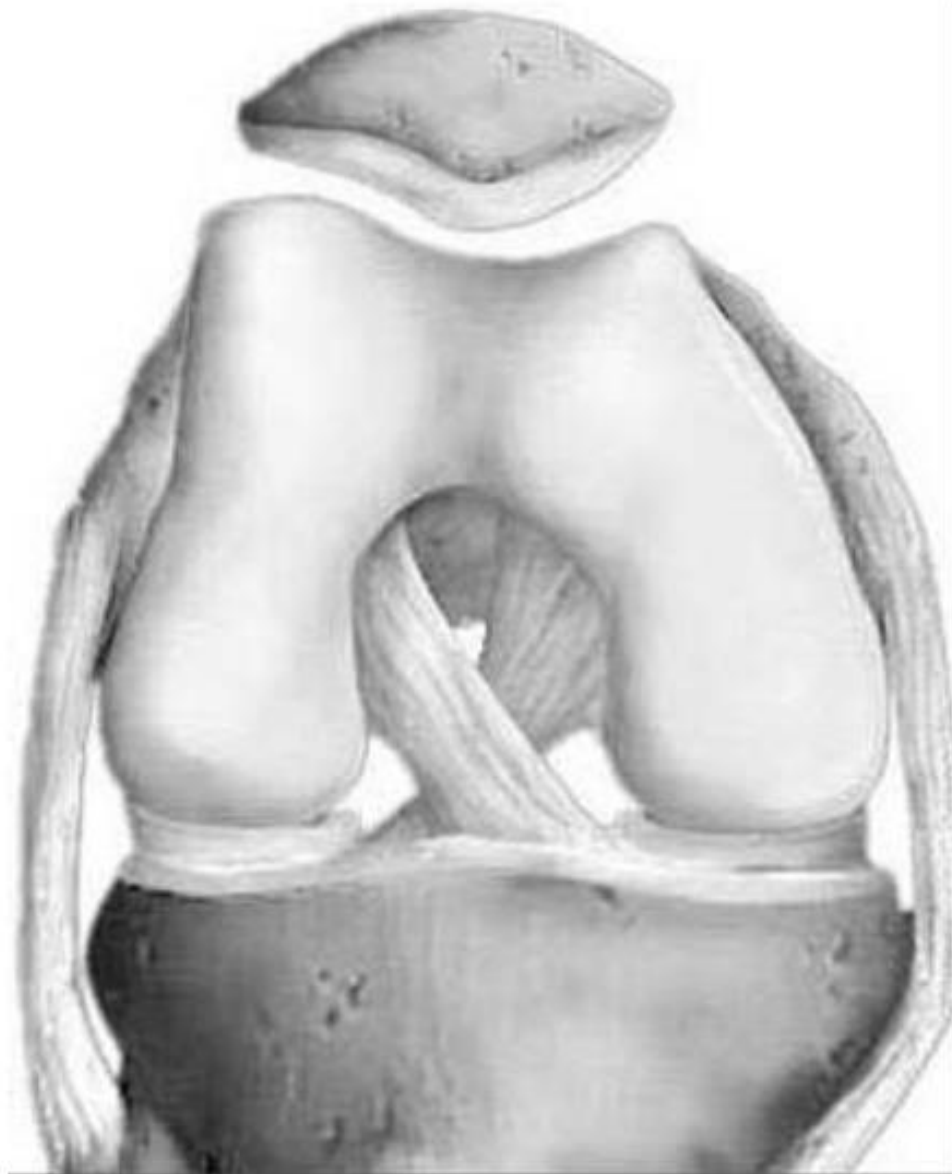
## Rheumatoid Arthritis



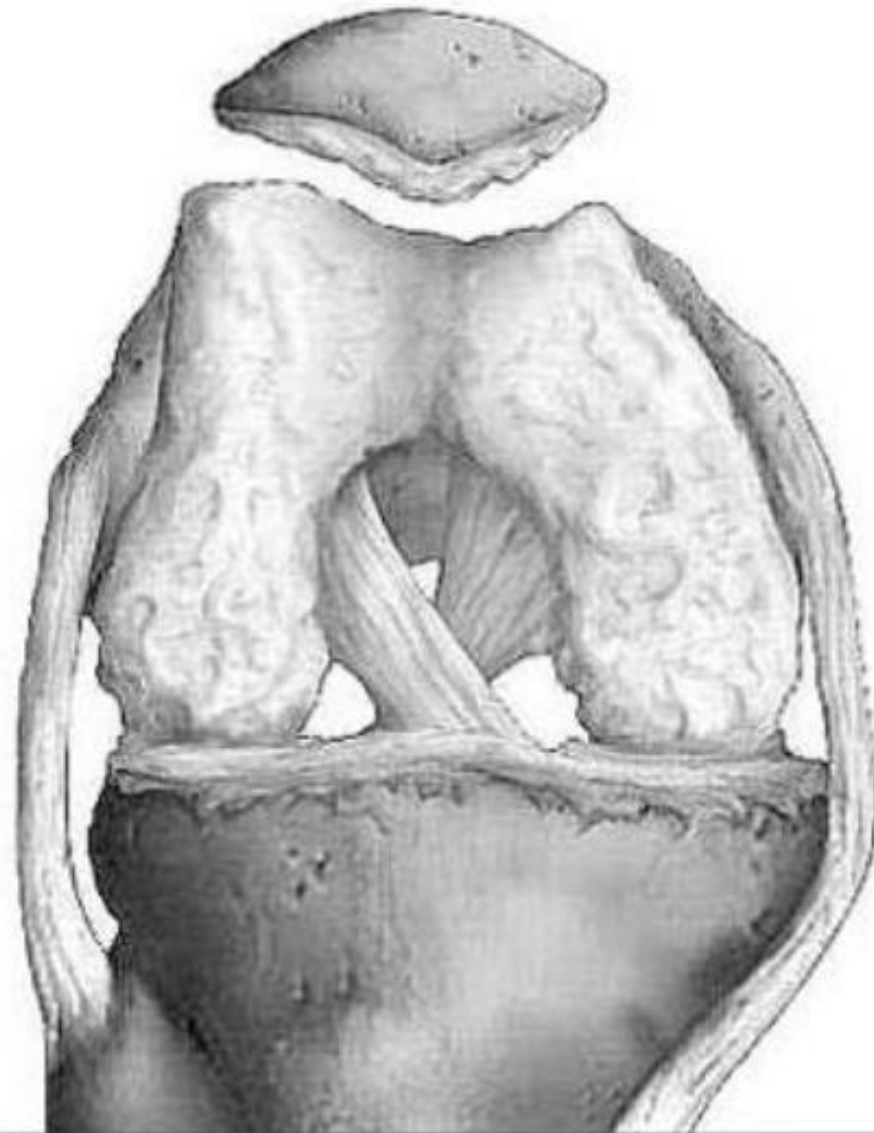
**Mind the gap!**



# Osteoarthritis of the knee



Normal, smooth articular cartilage in knee joint.



Osteoarthritis in articular cartilage in knee joint.

# Osteoarthritis

Degenerative  
osteoarthritis

Cartilage worn  
away

Bone spurs

©MMG 2001



# Stem Cell Treatment for Osteoarthritic Knees

- The most common side effects are joint stiffness and pain at the injection site as well as swelling, according to the results of one study.
- For knee injections, stem cells are taken from the patient's bone marrow, fat tissue, or blood.
- Doctors who do the treatments cite anecdotal evidence as validation that the treatments work
- The FDA also notes that stem cell treatments potentially have other safety concerns, such as causing tumors to grow.
- The only stem cell-based product approved by the FDA is for umbilical cord blood-derived stem cells for blood cancers and other disorders
- *The New England Journal of Medicine*\_Mar 16, 2017, FDA officials warned the lack of evidence for unapproved stem cell treatments is "worrisome."
- Fees vary, but \$2,000 per treatment for knee arthritis is about average. Insurance companies usually deny coverage

# Viscosupplementation SYNVISC vs Cortisone

- A gel-like fluid called hyaluronic acid is injected into the knee joint. Hyaluronic acid is a naturally occurring substance found in the synovial fluid surrounding joints.
- Hyaluronic acid (HA) **injections** often are used when corticosteroid **injections** don't work.
- If the injections are effective they may be repeated after a period of time, usually 6 months. You will receive one to five shots over several weeks.
- Although some patients report relief of arthritis symptoms with viscosupplementation, the procedure has never been shown to reverse the arthritic process or re-grow cartilage.

# Platelet-rich Plasma Injection (PRP)

- Regenerative medicine for damaged or diseased tissue.
- Helps the body heal itself and create new, healthy tissue.
- It may help delay or even prevent the need for surgery in some patients.
- Withdraw blood from an arm and centrifuge to spin down the platelets
- 45 minute office procedure



## **Potential Applications**

- Arthritis
- Tendonitis
- Cartilage damage
- Meniscus damage
- Muscle tears
- Plantar fasciitis
- Osteoarthritis



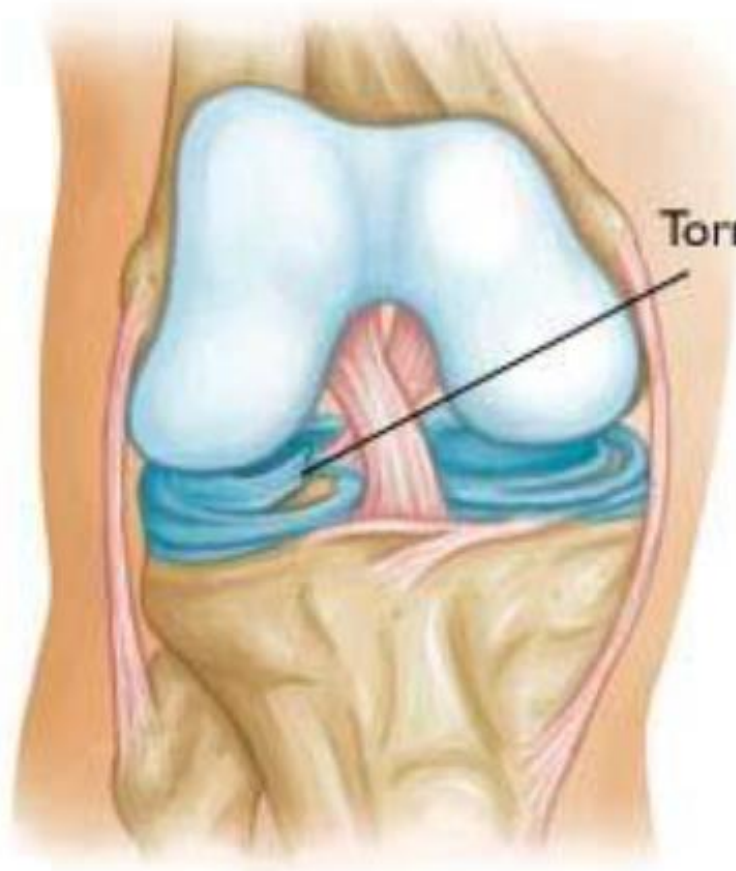
# Dislocation (subluxation) of the patella



# Meniscus Degeneration



# Types of meniscal tears



Torn Meniscus

## Meniscal Tears



Normal Meniscus



Longitudinal



Bucket Handle



Flap

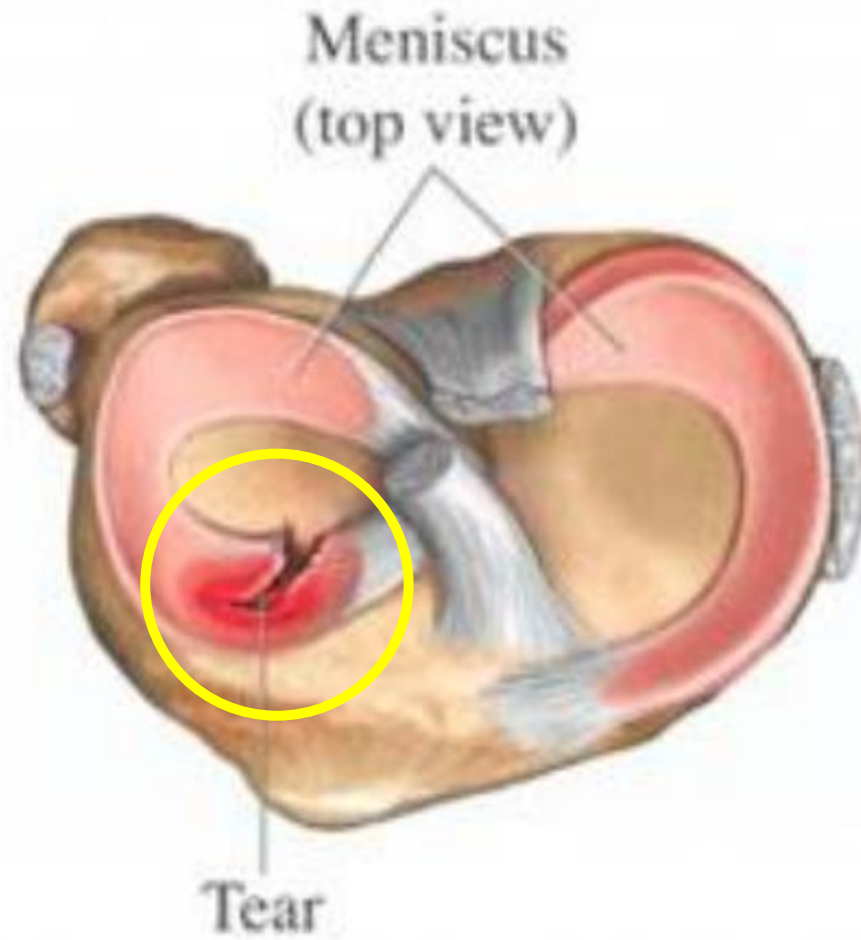


Transverse



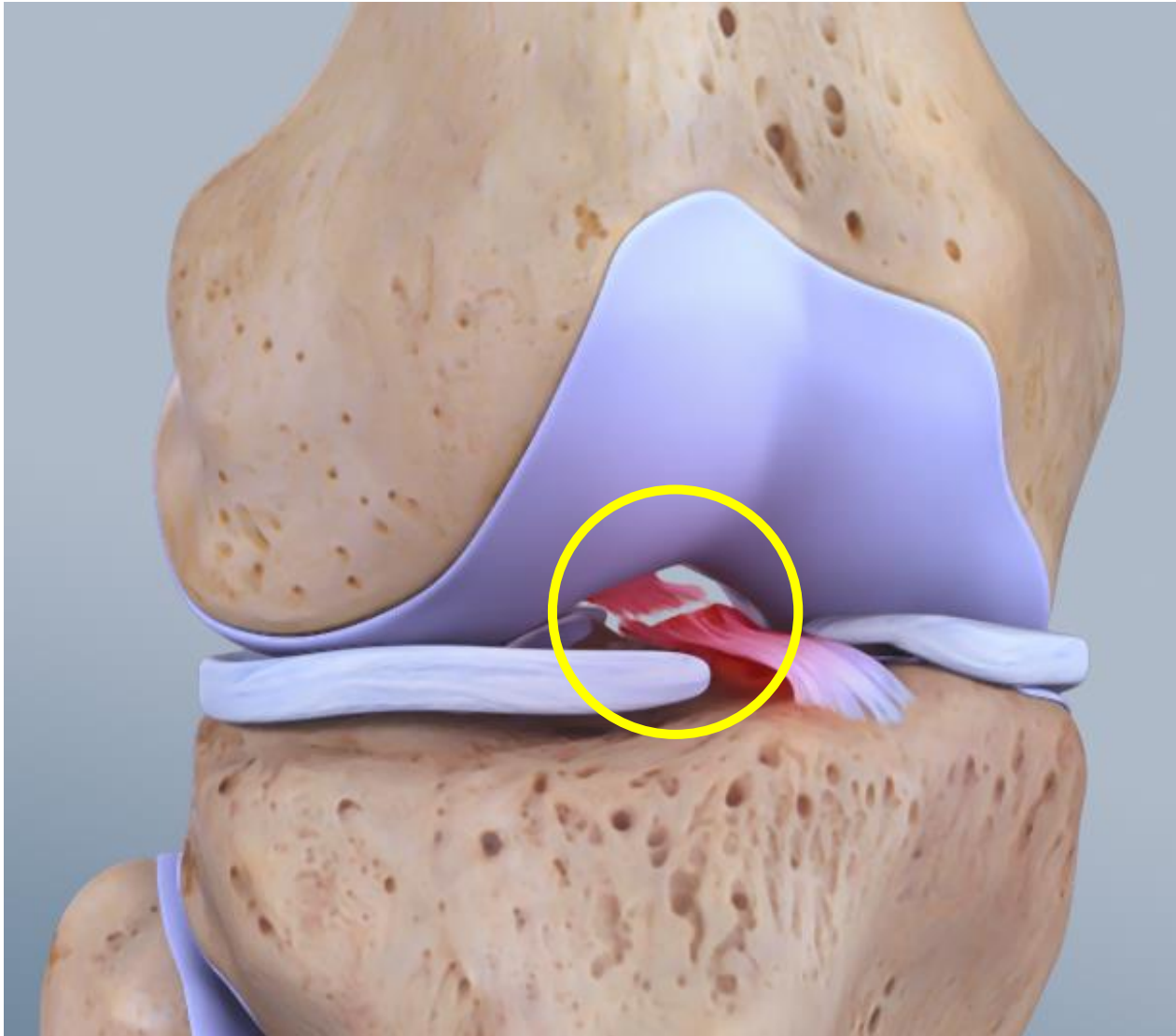
Torn Horn

# Torn meniscus

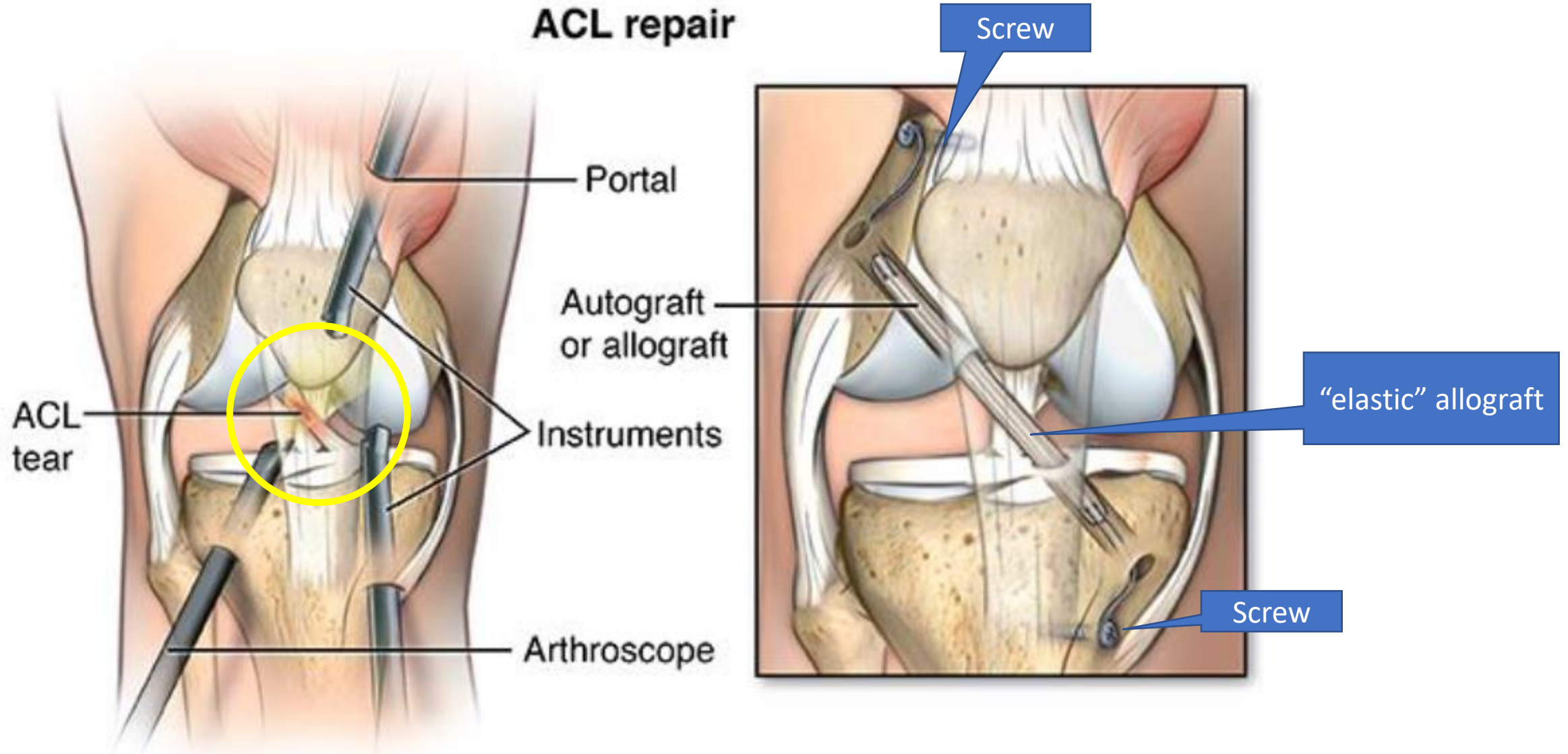


# Anterior Cruciate Ligament (ACL)

Arthroscopic Repair of ACL Tear



# Ligament repair

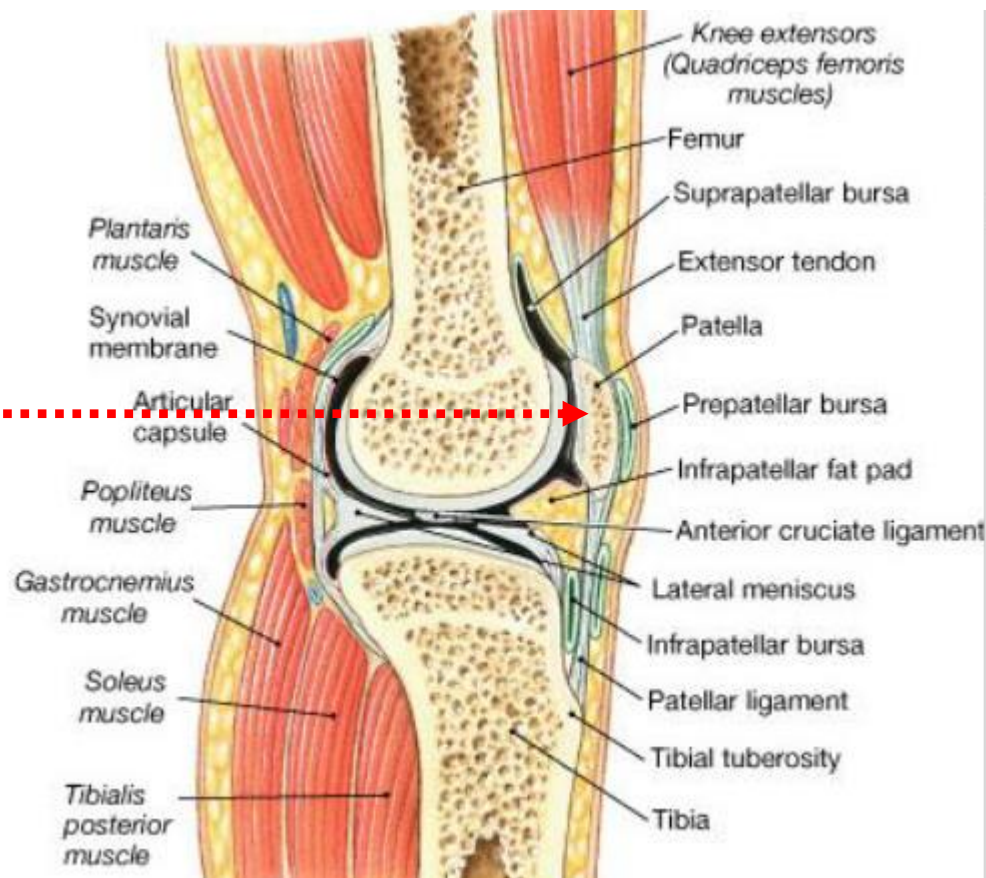
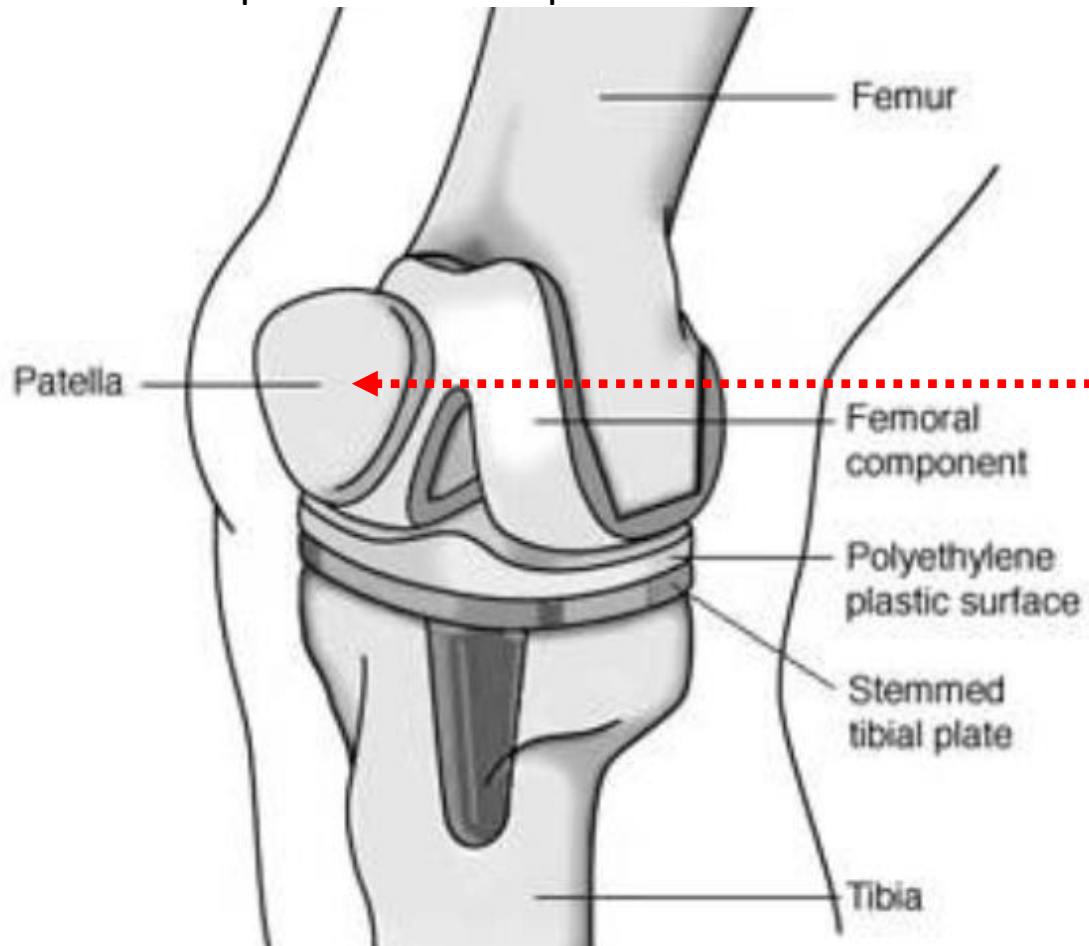




# ARTHROPLASTY

The Muscles & Tendons Get in the Way!

## Replacement Components

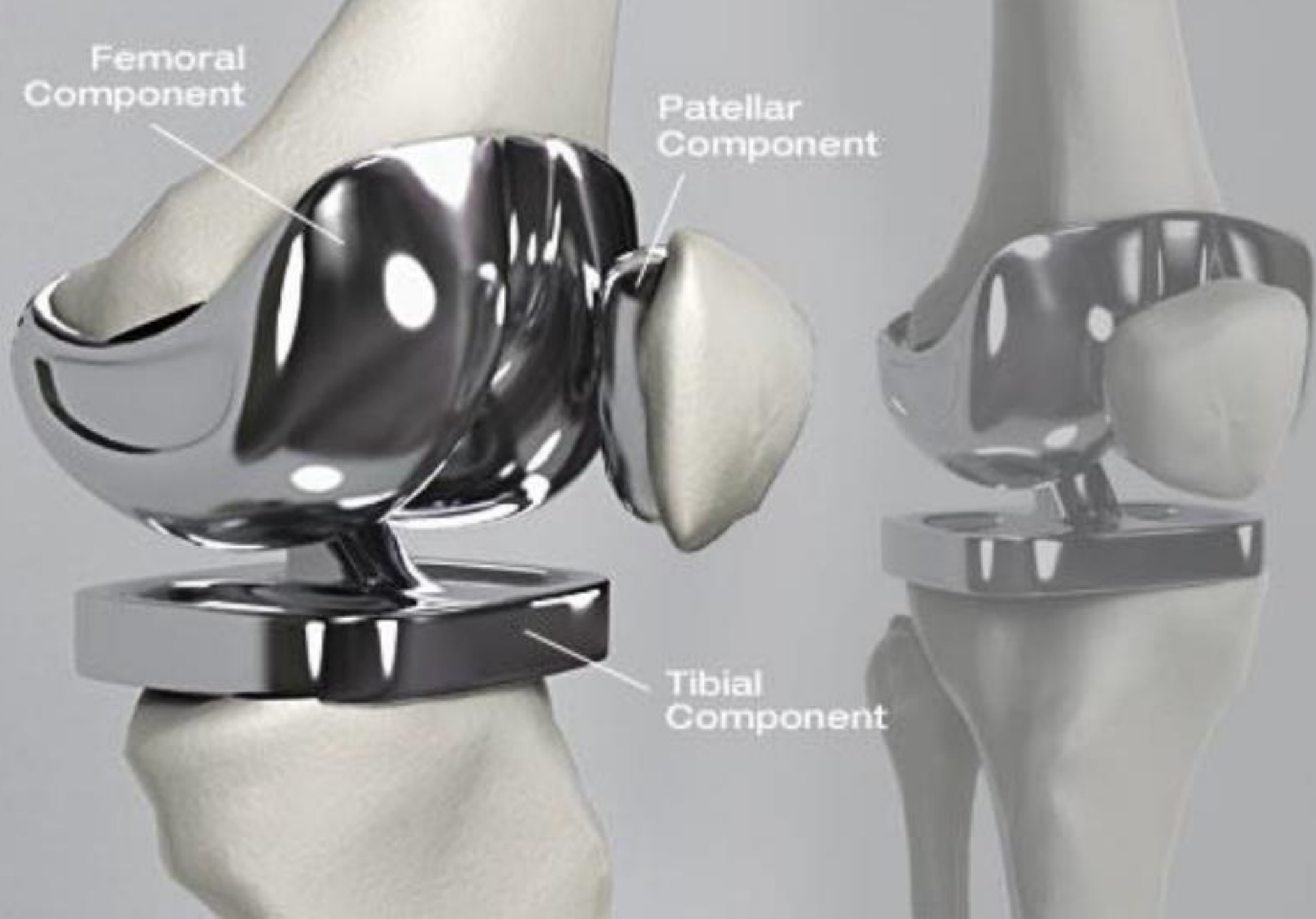




Femoral  
Component

Patellar  
Component

Tibial  
Component



# GOUT

A VERY PAINFUL CONDITION

Precipitation  
of uric acid  
crystals within  
the joint.



Often  
associated  
with the foot



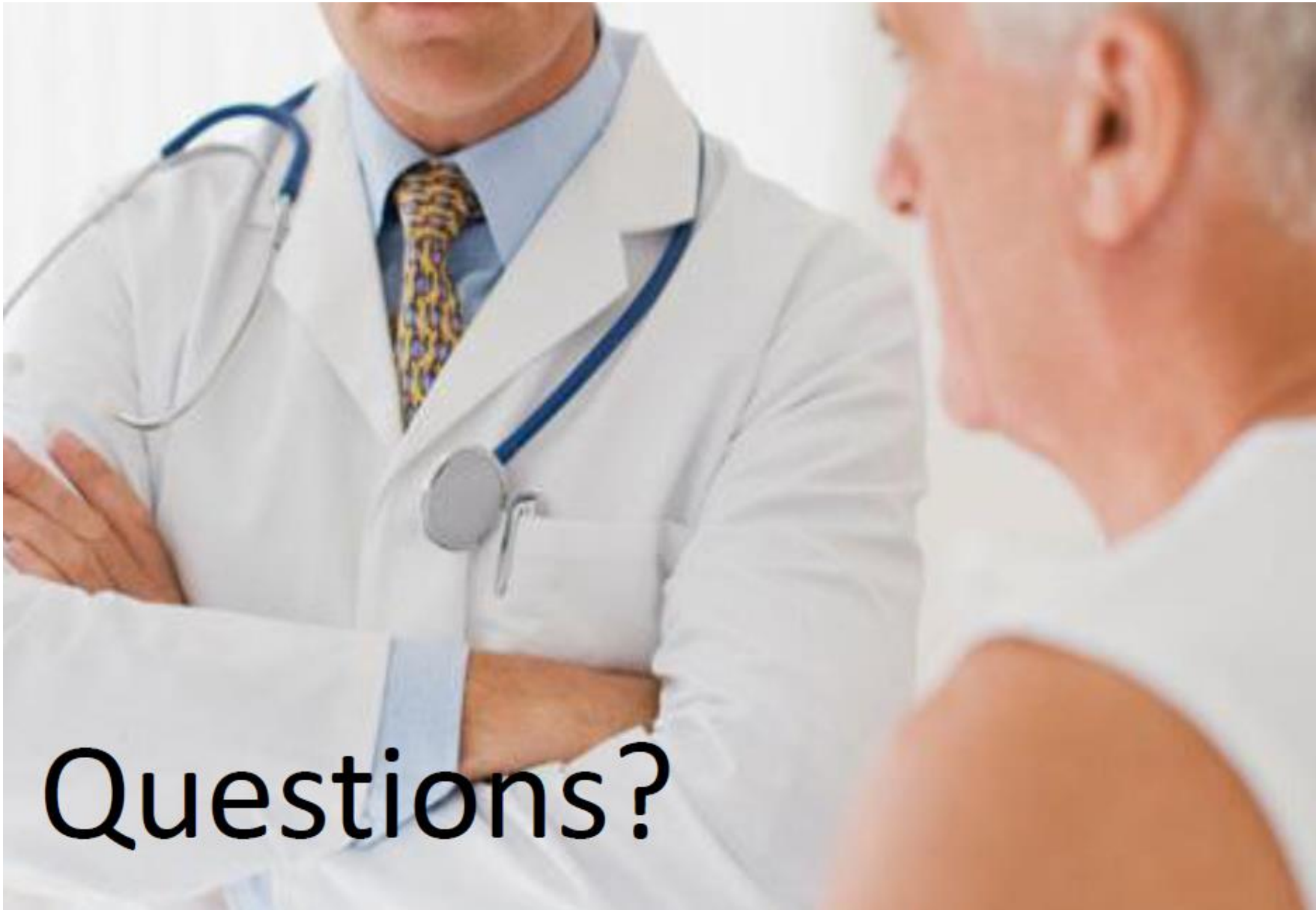
## Treatment –

- Ibuprofen, indomethacin, butazolidine or diclofenac.
- Ice and rest.
- Low purine diet.
- Probenecid (Allopurinol) As a long term preventative

# GOUT

## Foods to AVOID

- Beer and grain liquors (like vodka and whiskey)
- Red meat, lamb, and pork
- Organ meats (< 4 ounces), such as liver, kidneys, and glandular meats like the thymus or pancreas (you may hear them called sweetbreads)
- Seafood, especially shellfish like shrimp, lobster, mussels, anchovies, and sardines
- High-fructose products like soda and some juices, cereal, Ice cream, candy, and fast food



Questions?