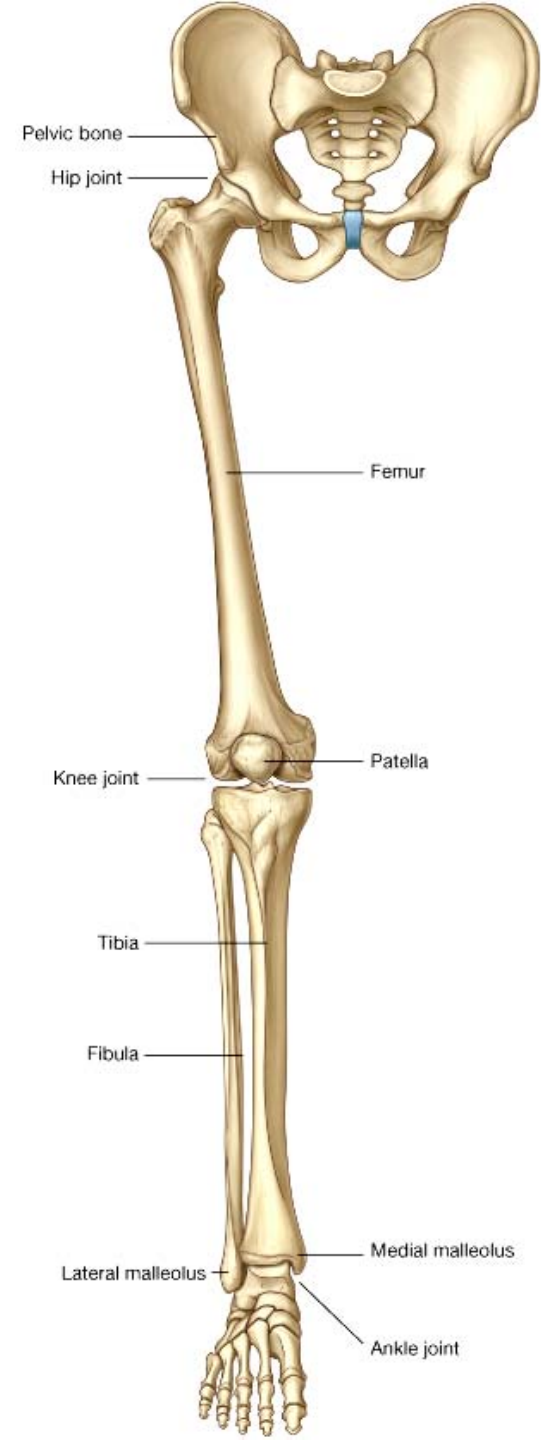


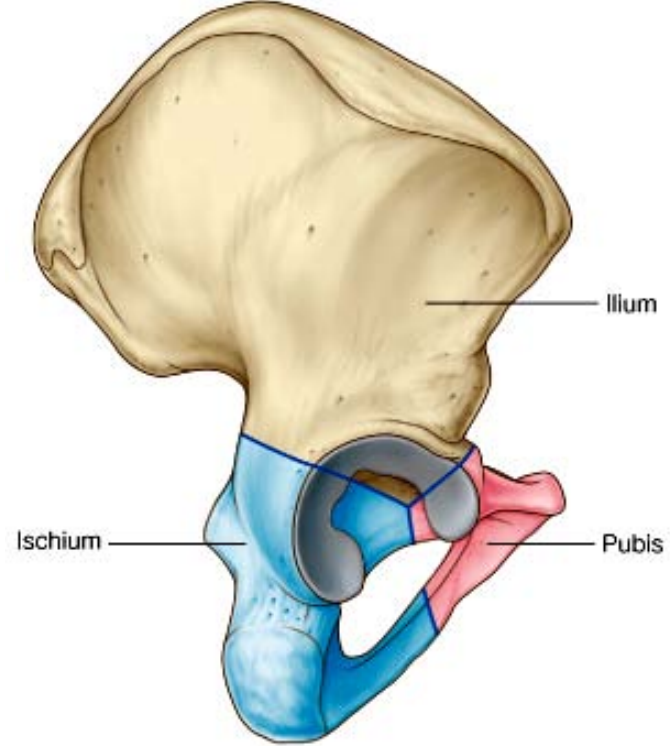
# Bones of lower limbs

- Including bones of pelvic girdle (hip bones) and lower limb
- compared with upper limb
  - no equivalent movements to pronation and supination in upper limb;
  - more stable in lower limb, for weight-bearing

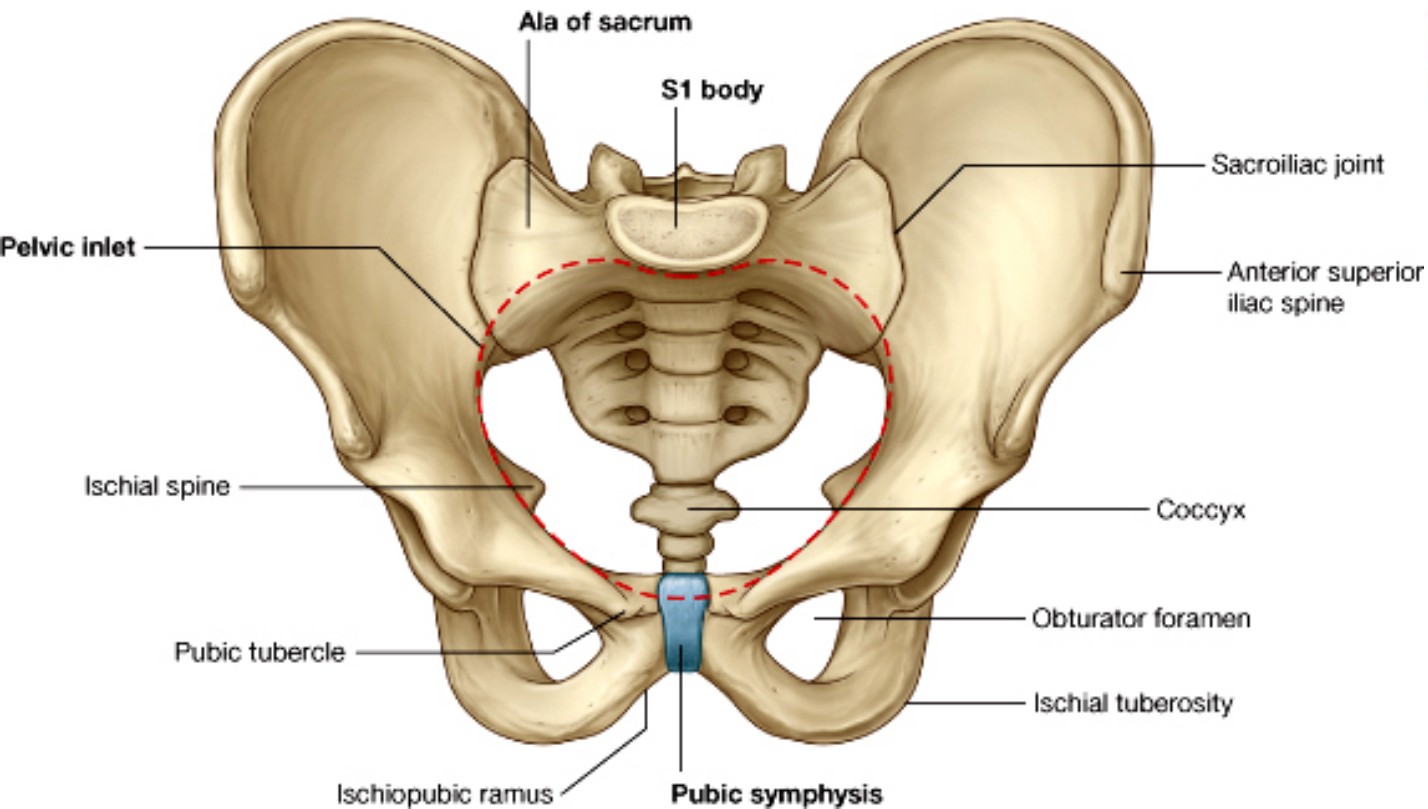


# Bony pelvis

- Ilium
- ischium
- pubis

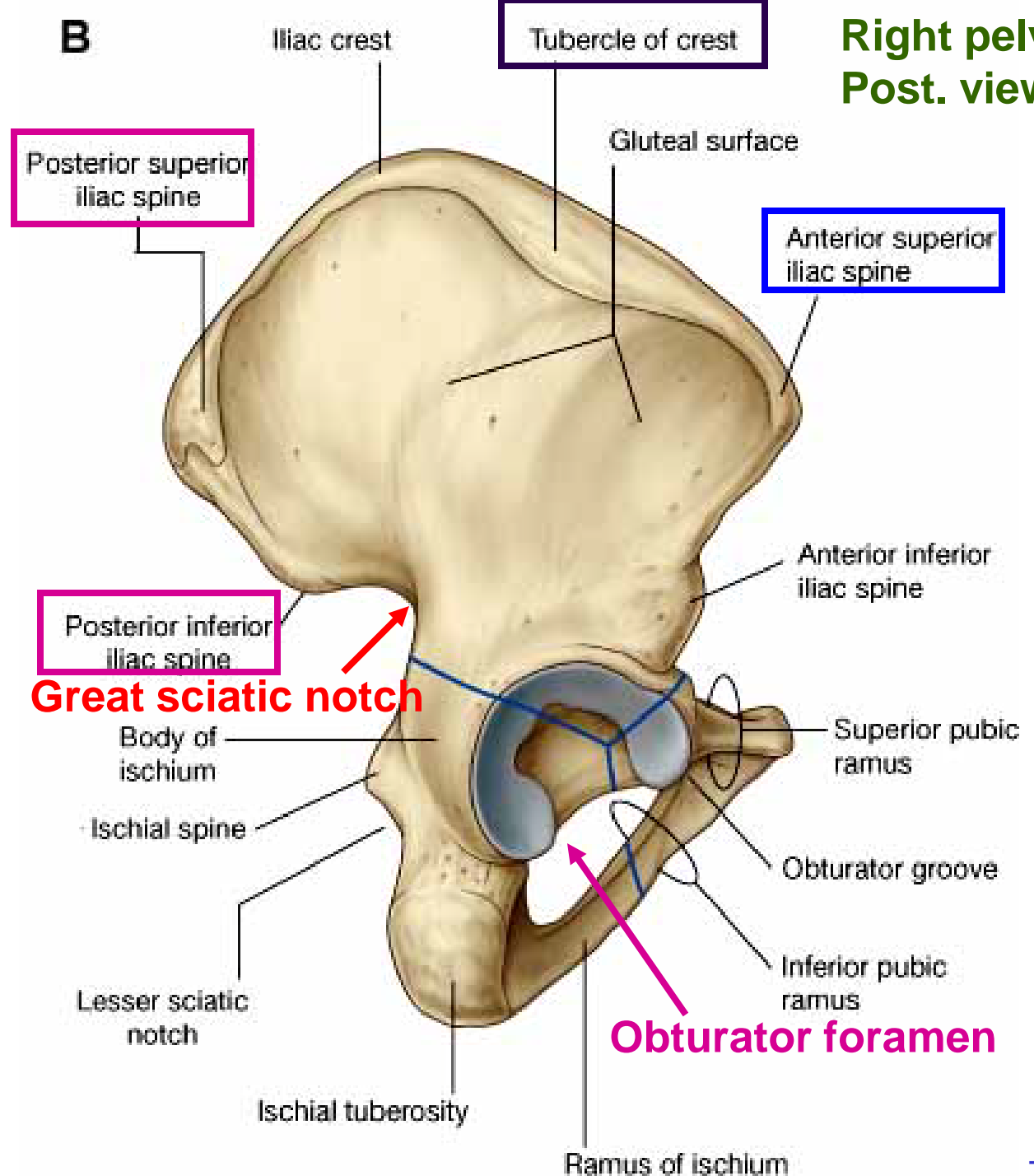


Right pelvis  
Post. view



# Ilium (lateral surface)

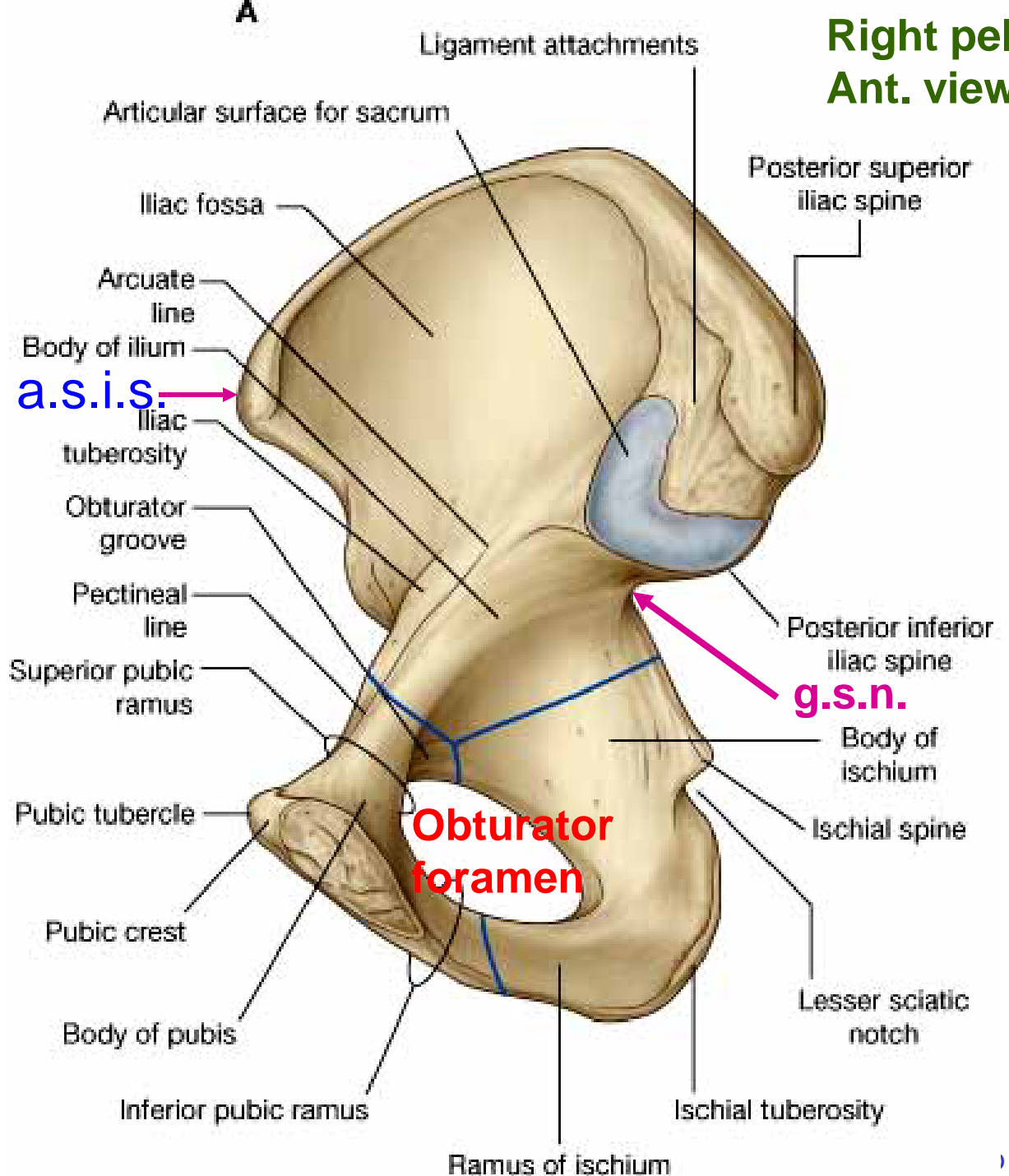
Right pelvis  
Post. view



- ant. sup. iliac spine: a.s.i.s.
- post. sup. iliac spine: p.s.i.s.
- Iliac crest: a.s.i.s. – p.s.i.s.
- tubercle of crest
- ant. inf. iliac spine: a.i.i.s.
- post. inf. iliac spine: p.i.i.s.
- greater sciatic notch
- gluteal surface

# Ilium (medial surface)-1

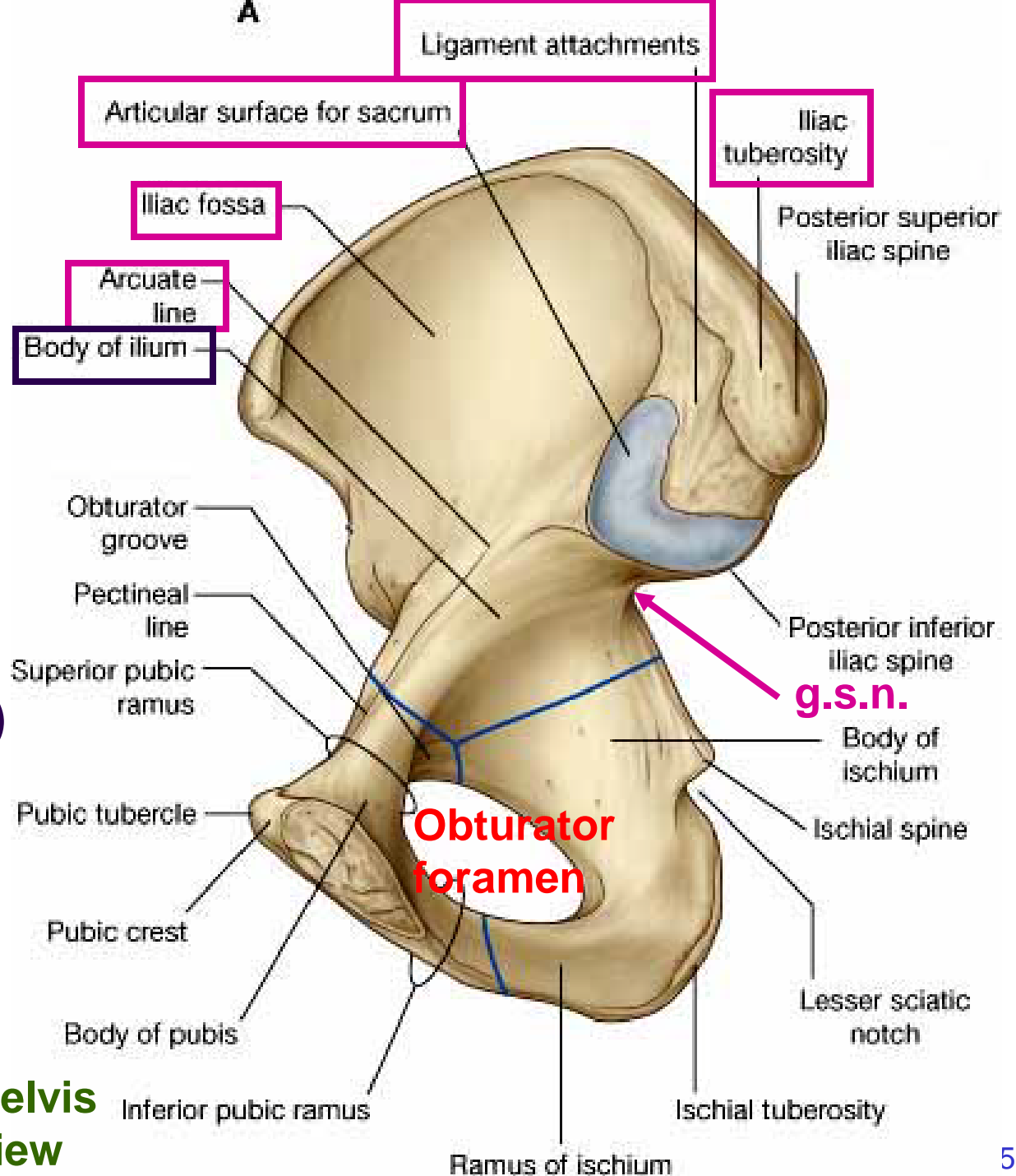
Right pelvis  
Ant. view



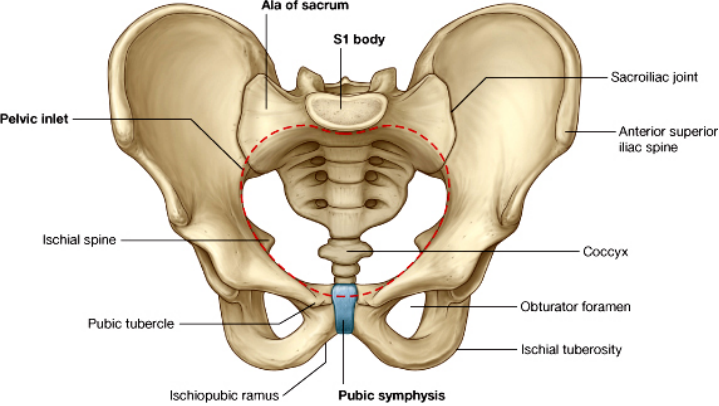
- obturator foramen
- iliac fossa
- a.s.i.s.; p.s.i.s.
- iliac crest: a.s.i.s. – p.s.i.s.
- greater sciatic notch (g.s.n.)

# Ilium (medial surface)-2

- ala (iliac fossa)
- Body of ilium
- ridge between upper and lower part of iliac
  - arcuate line
- articular surface for sacrum (auricular face)
- attachment for ligaments (sacroiliac joint)
- iliac tuberosity

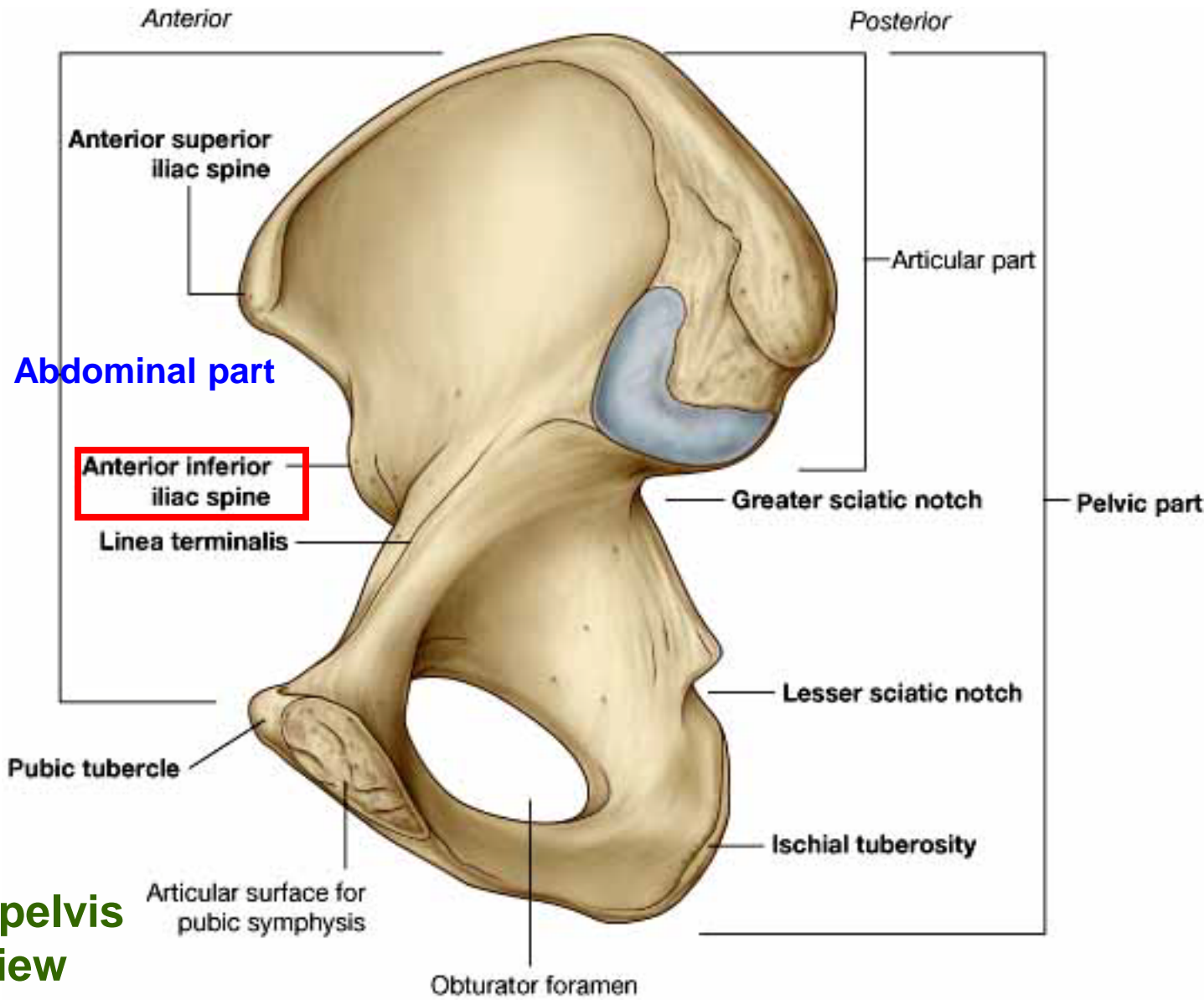


Right pelvis  
Post. view

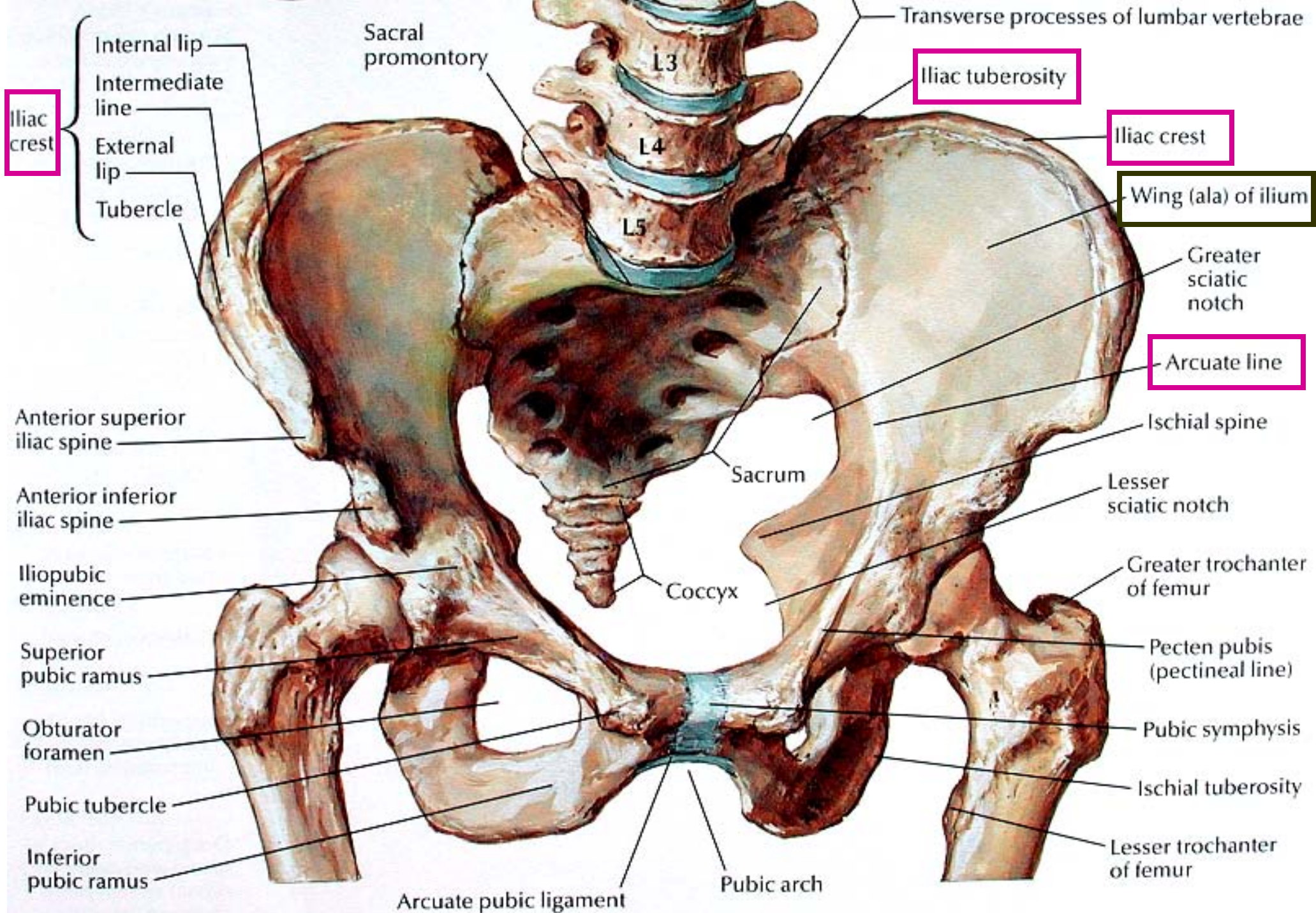


## Ilium (medial surface)-3

- **arcuate line:**  
**linea terminalis**  
**of pelvic brim**
- **below:** pelvic  
**part; lesser/true**  
**pelvis**
- **above:**  
**abdominal part;**  
**greater/false**  
**pelvis**

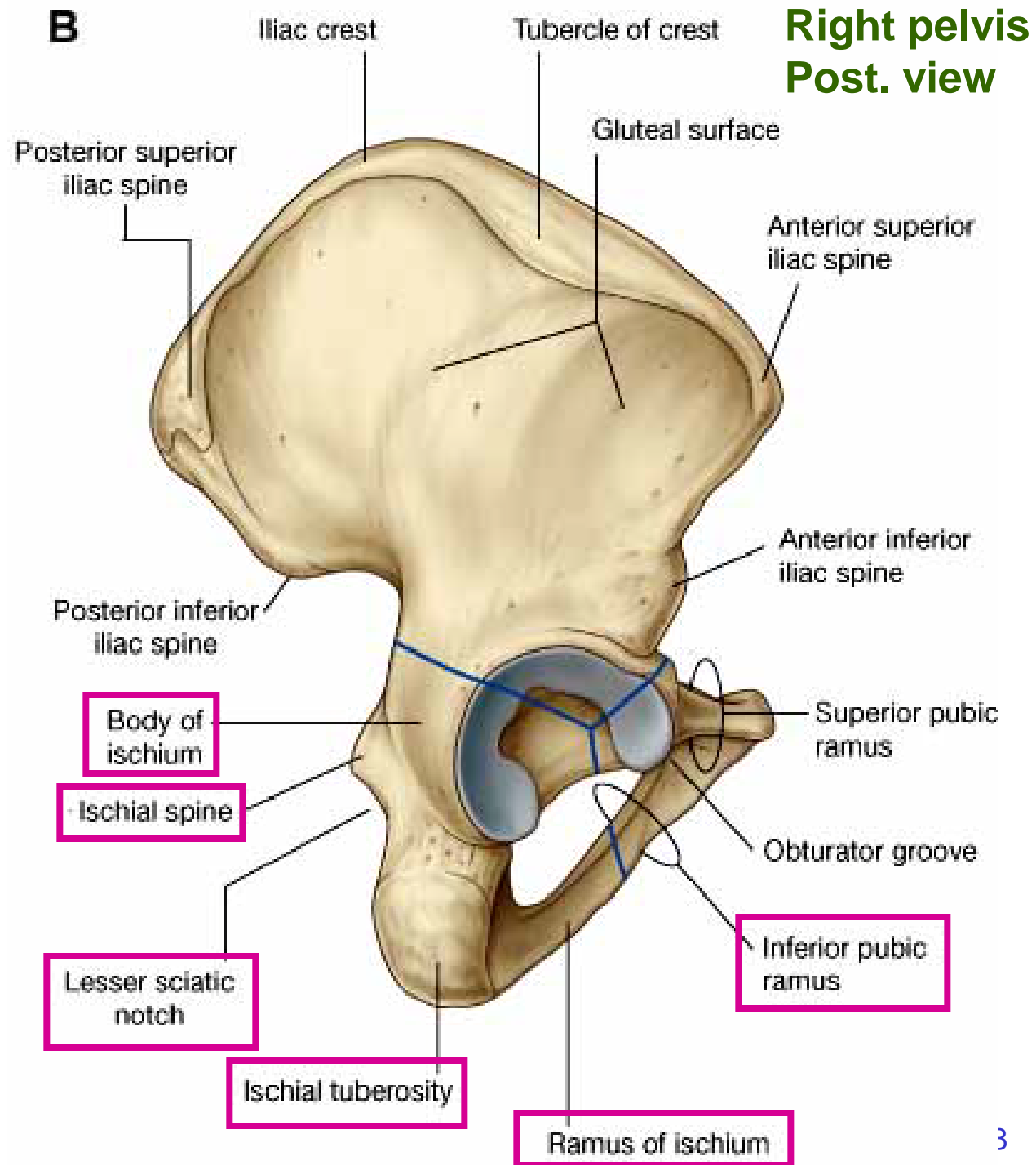


**Right pelvis**  
**Ant. view**



# Ischium

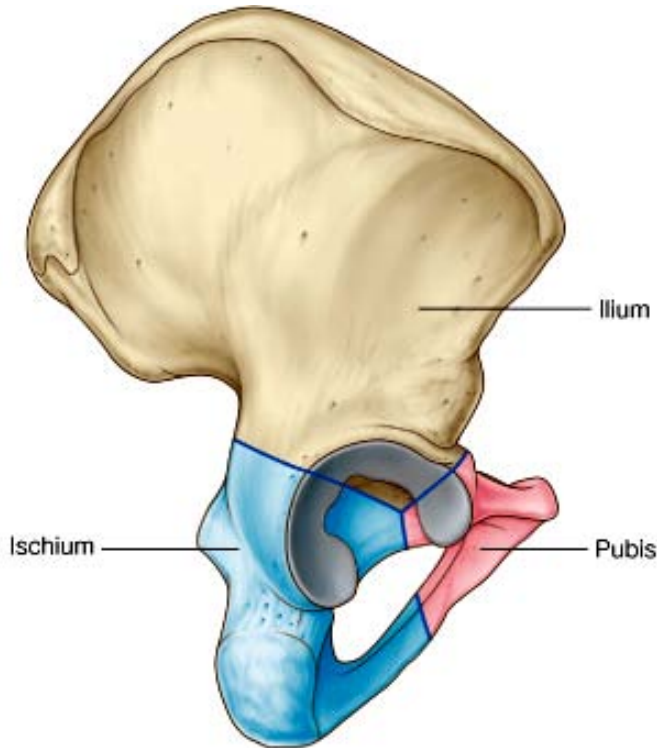
- body of ischium
- lesser sciatic notch
- ischial tuberosity
- ischial spine
- ischial ramus: with inf. ramus of pubis → ischiopubic ramus



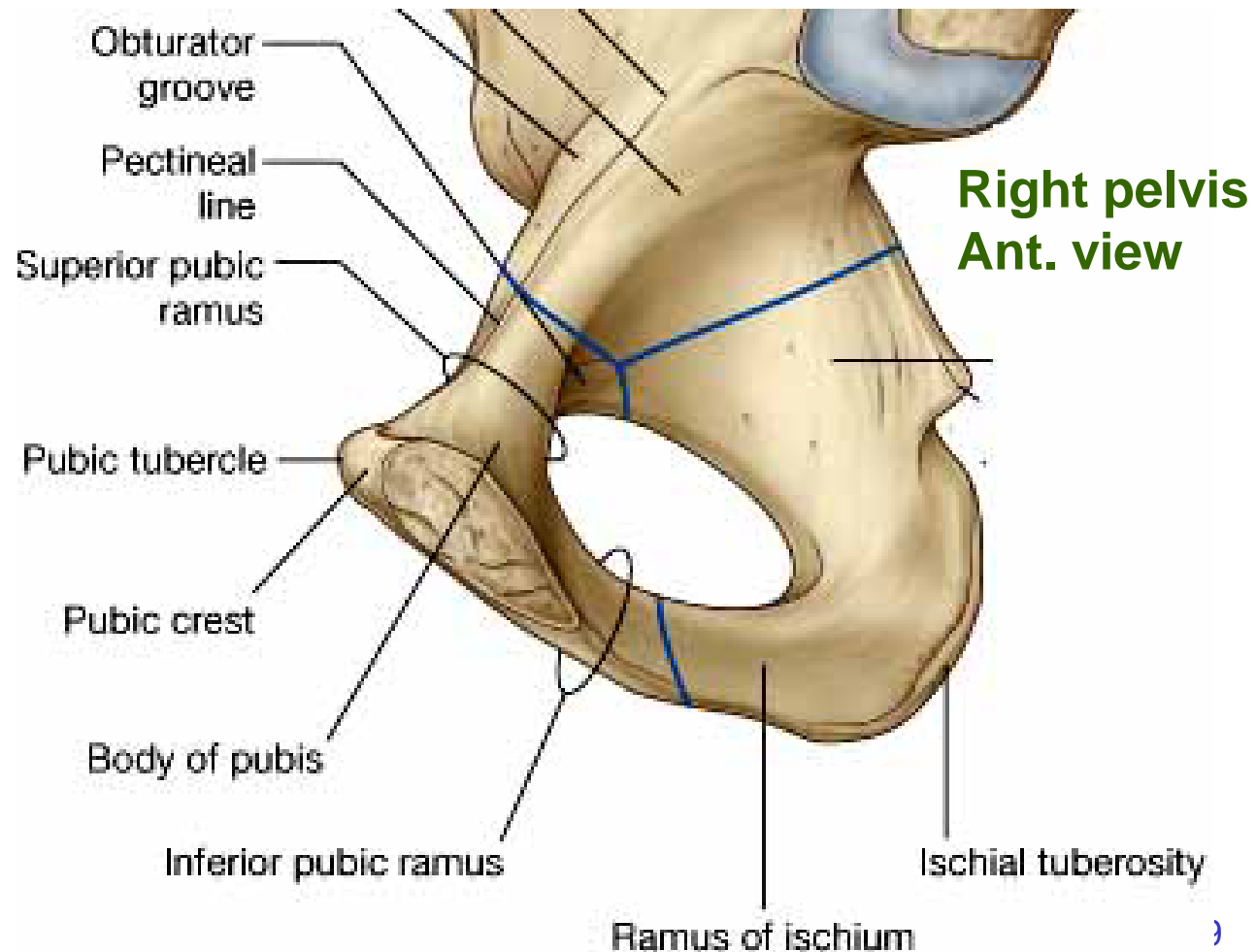


## Pubis: rami

- **sup. ramus** → contribute to acetabulum
- **inf. ramus** → join ischium (ischial ramus)

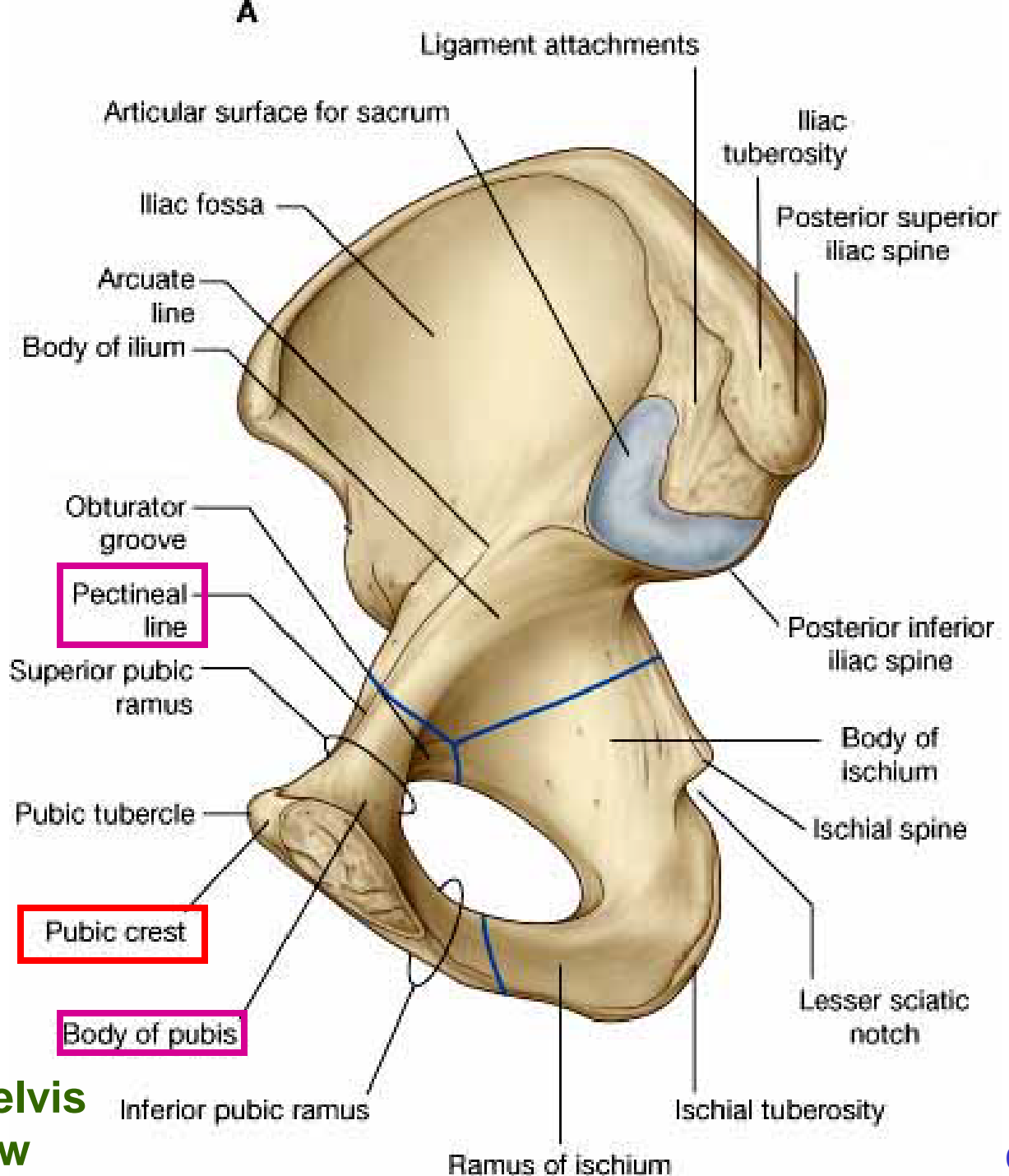


**Right pelvis  
Post. view**



# Pubis:1

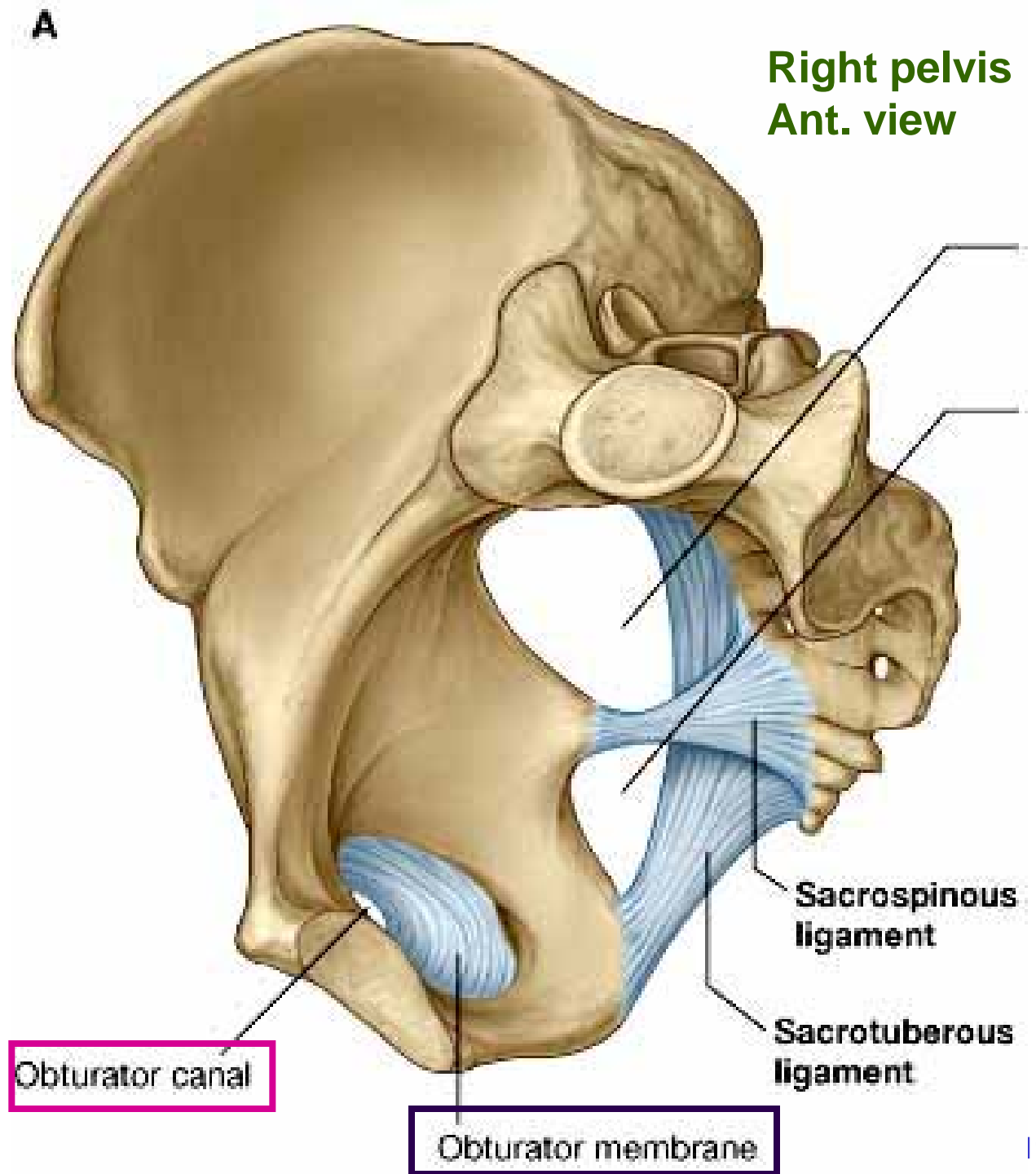
- body of pubis
- **pubic crest**
- **pubic tubercle**
- sup. pubic ramus:  
**pectineal line** on its  
sup. border, continues  
into **arcuate line**
- **inf. pubic ramus**
- **obturator foramen**



Right pelvis  
Ant. view

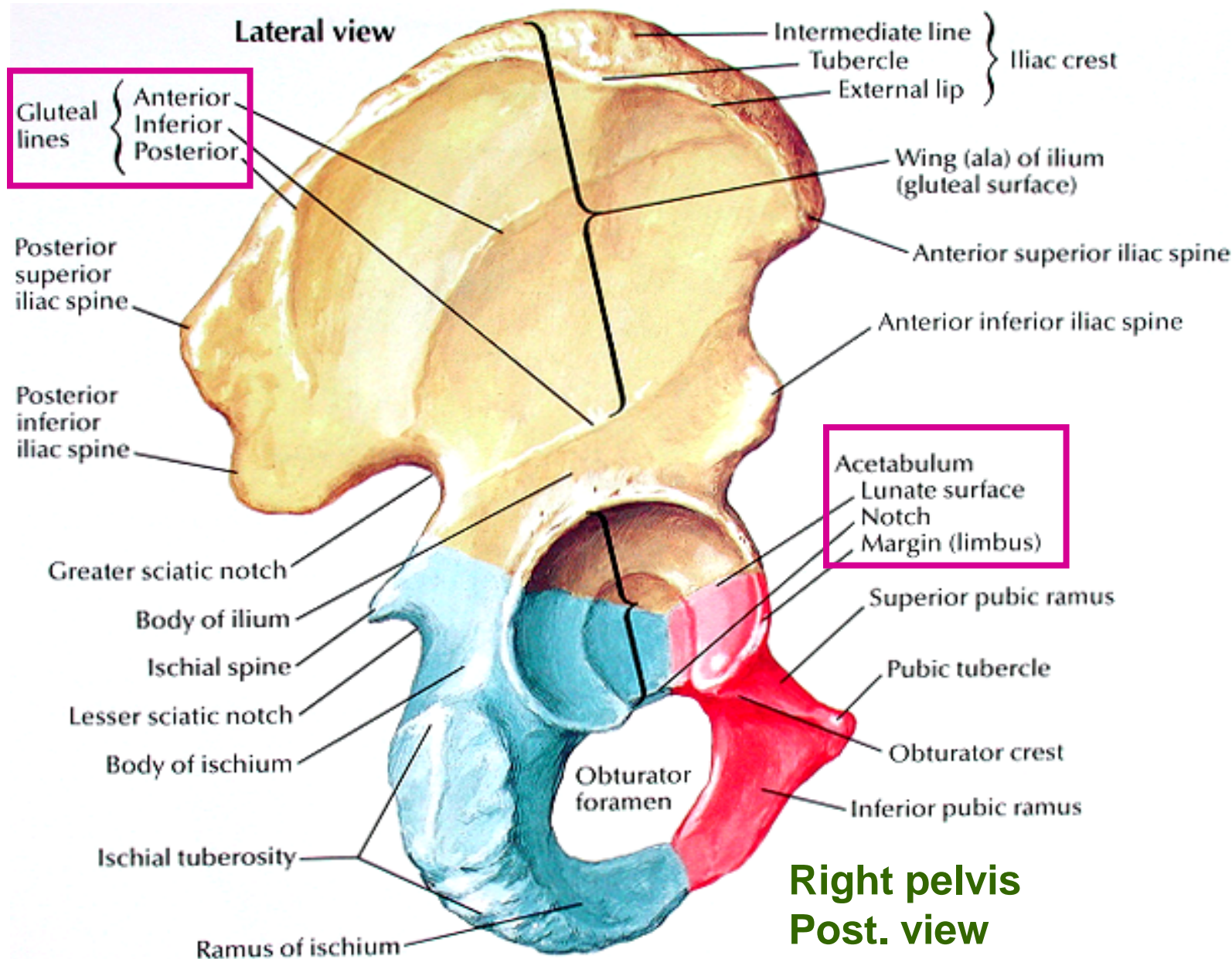
# Obturator canal

- **obturator canal:**  
at the upper,  
posterior angle of  
obturator foramen  
(obturator n.,a.,v.)





# Pubis: external



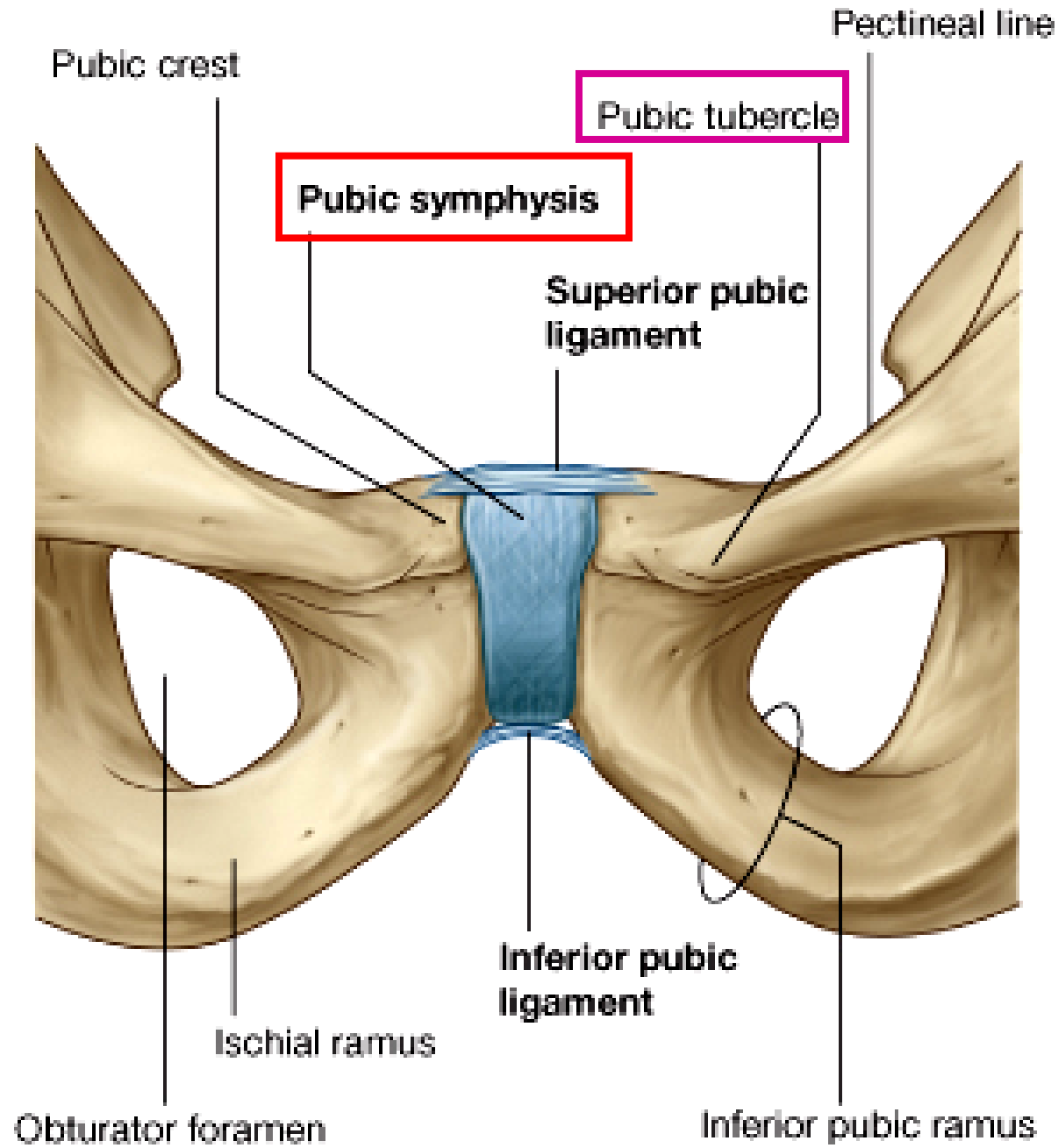
- acetabulum:  
acetabular  
notch, limbus

## ● Gluteal line

- Anterior
- Posterior
- Inferior

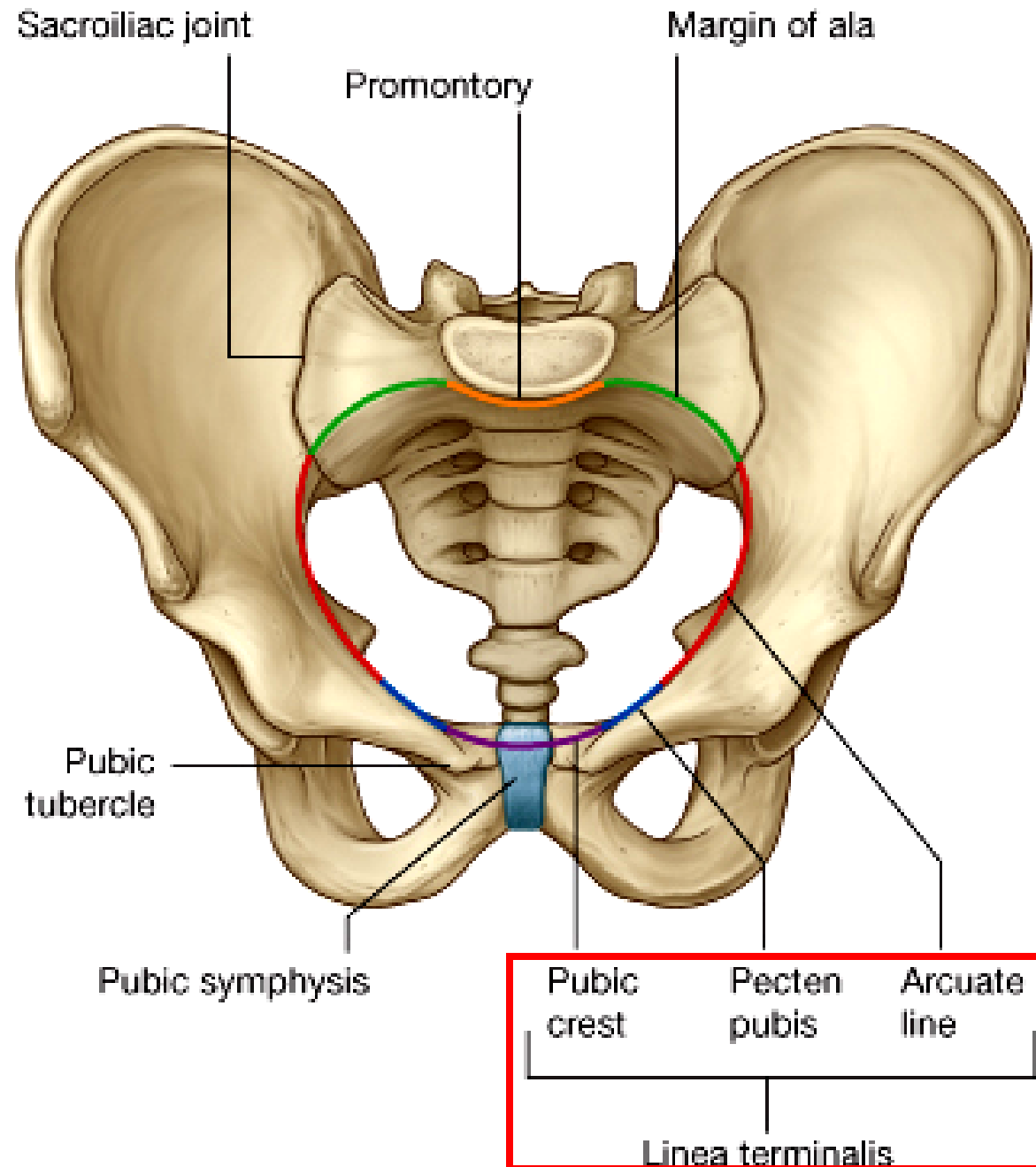
# Pubic symphysis

- cartilaginous joint (fibrous cartilage)
- as a landmark of pelvic cavity



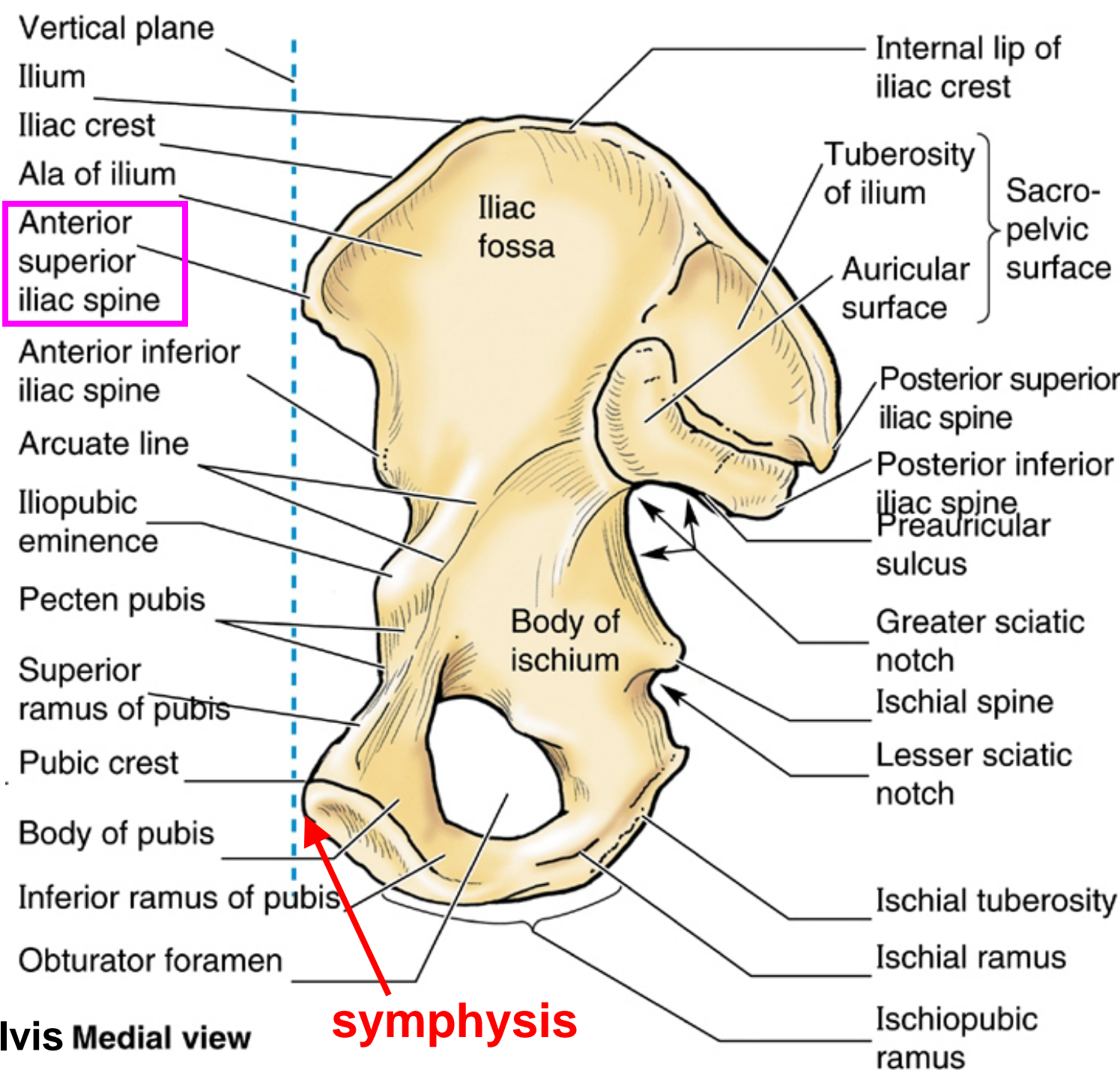
# Pelvis

- The complete pelvis:
- the line (pelvic inlet) from **promontory of sacrum** -- arcuate line -- pectineal line -- pubic crest separates
- **false pelvis** and **true pelvis**
- **sacrum + linea terminalis + pubis symphysis**



# Pelvis: anatomical position

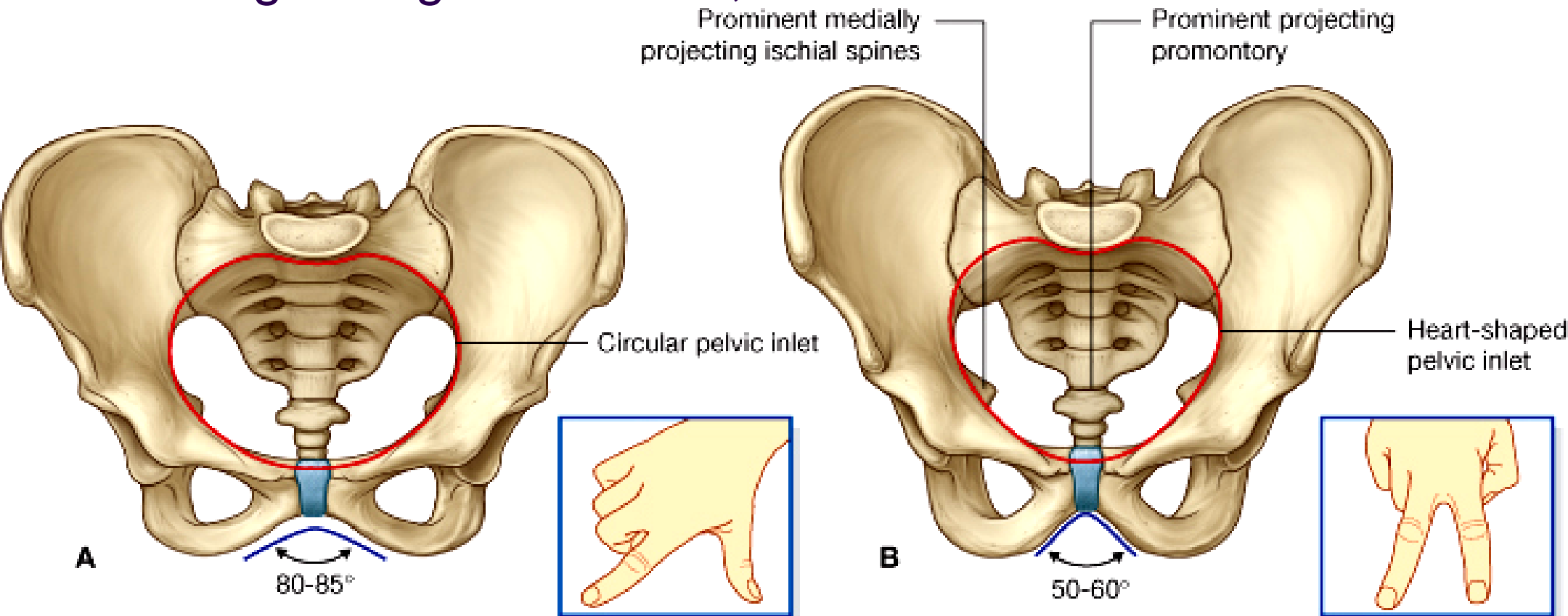
- a.s.i.s. and symphysis pubis on the same coronal plane





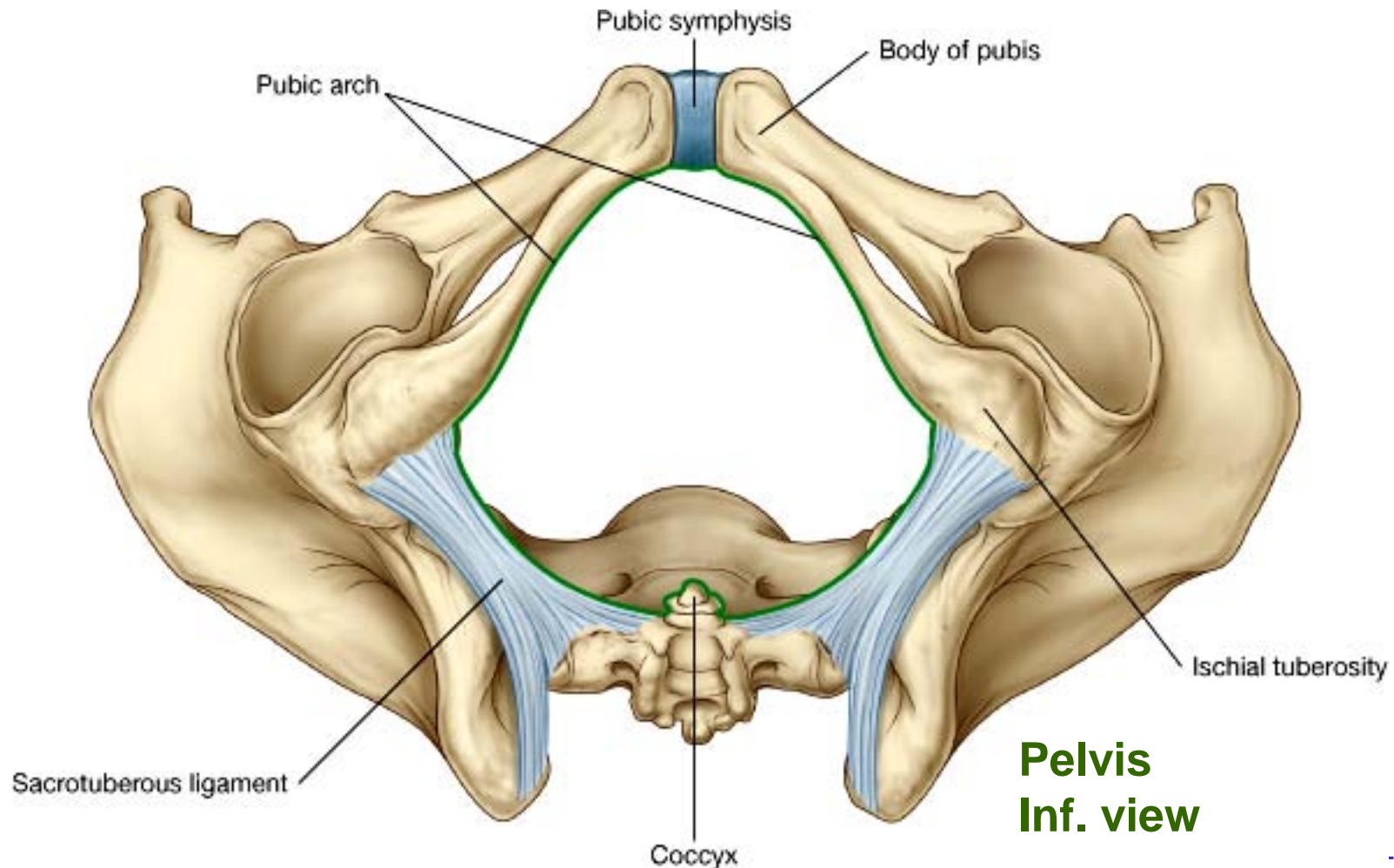
# Pelvis: female vs. male

- Shape: circular in female (less distinct promontory, broader alae); heart-shaped in male
- Angle: larger in female; smaller in male



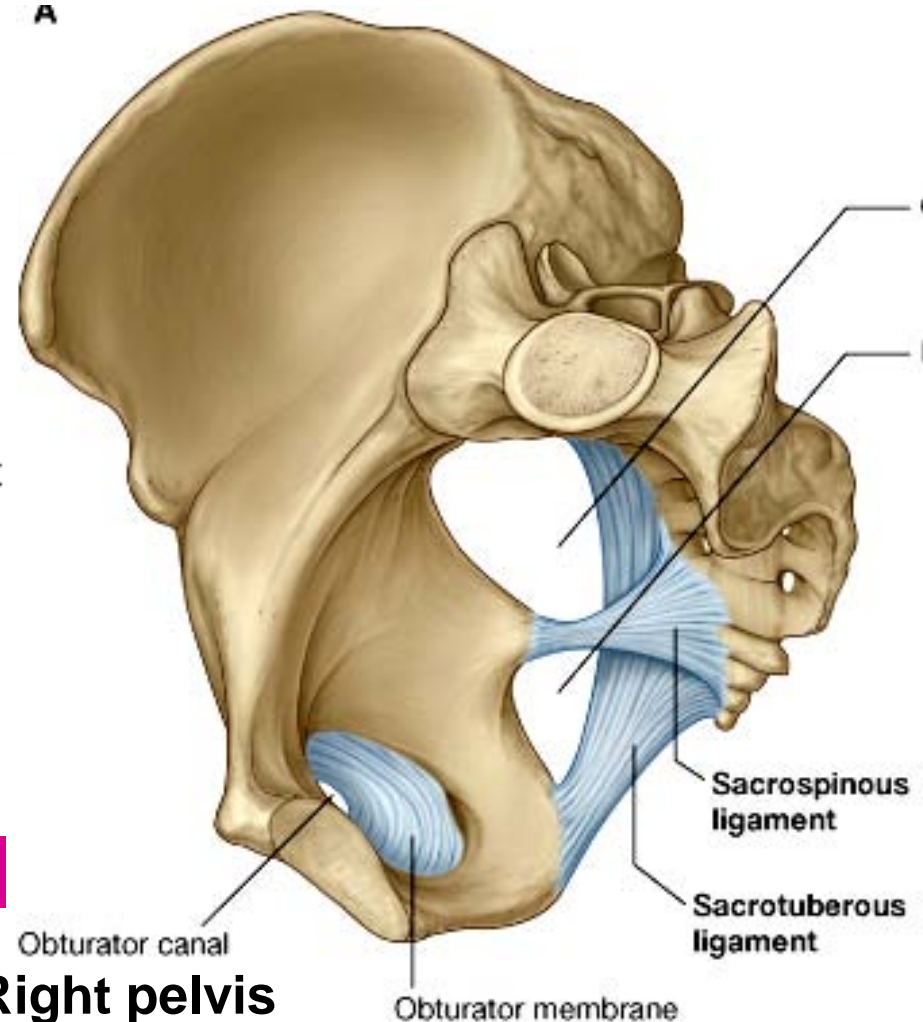
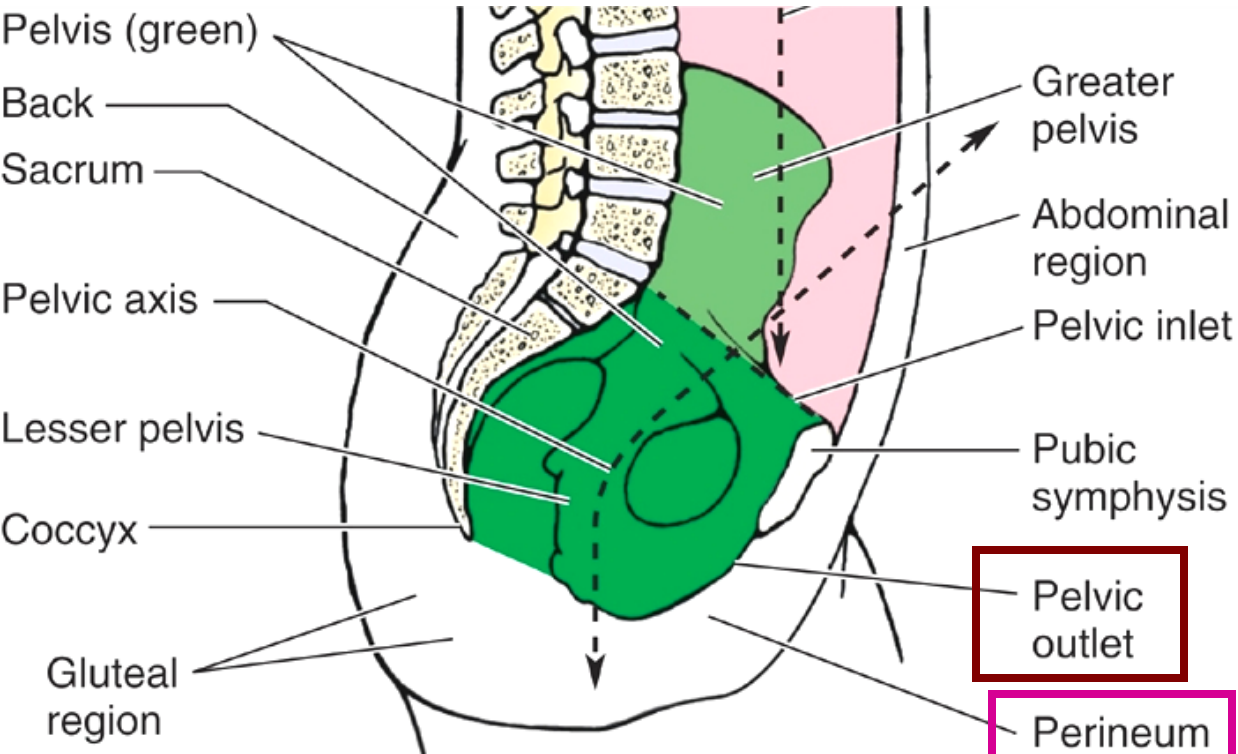
# Pelvis: pelvic outlet

- bounded by symphysis pubis - ischiopubic rami - ischial tuberosity - sacrotuberous lig. - coccyx



# Pelvic outlet

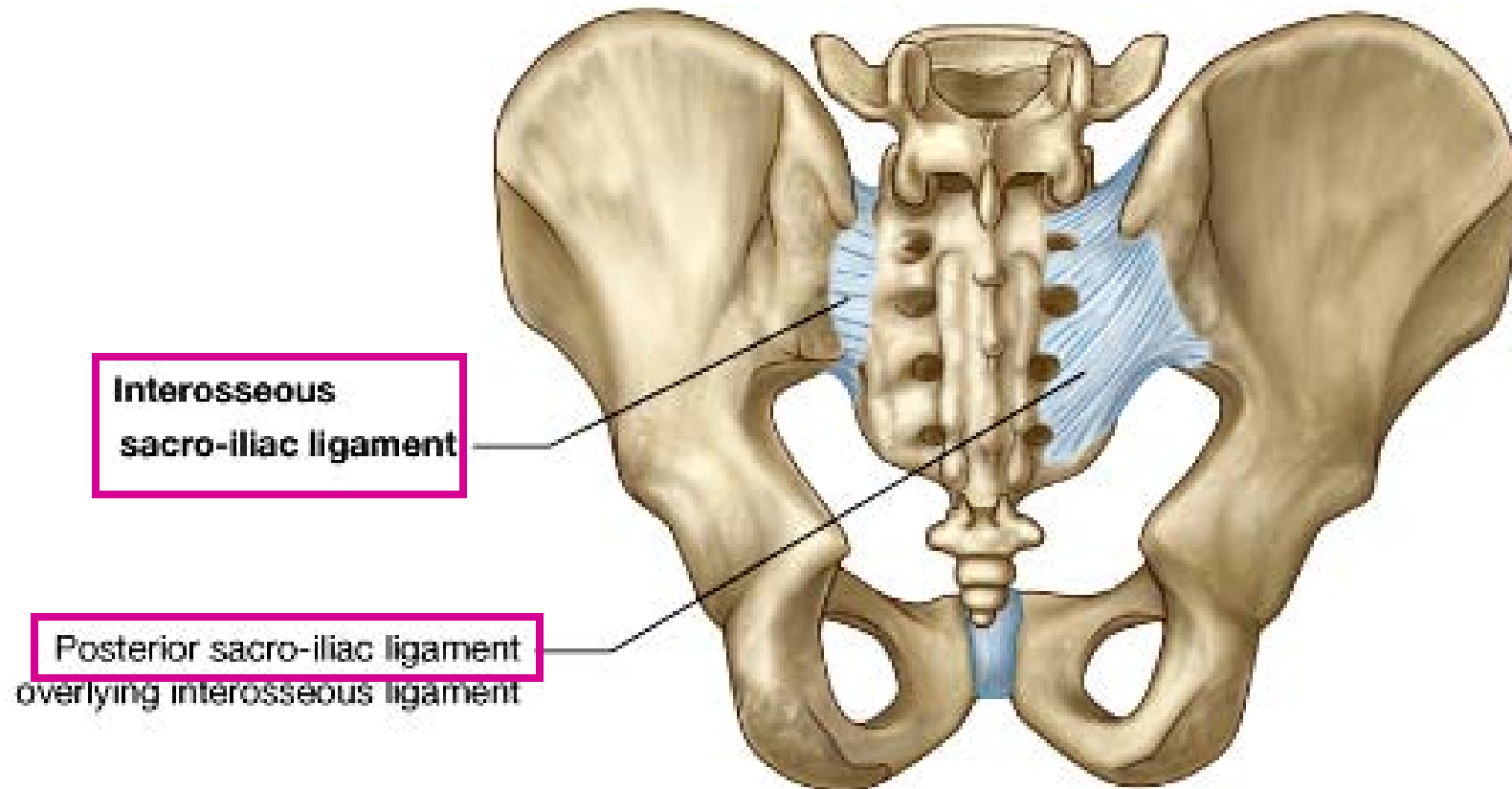
- not on the same plane; line joining the ischial tuberosities of both sides divides it into two parts



**Right pelvis  
Ant. view**

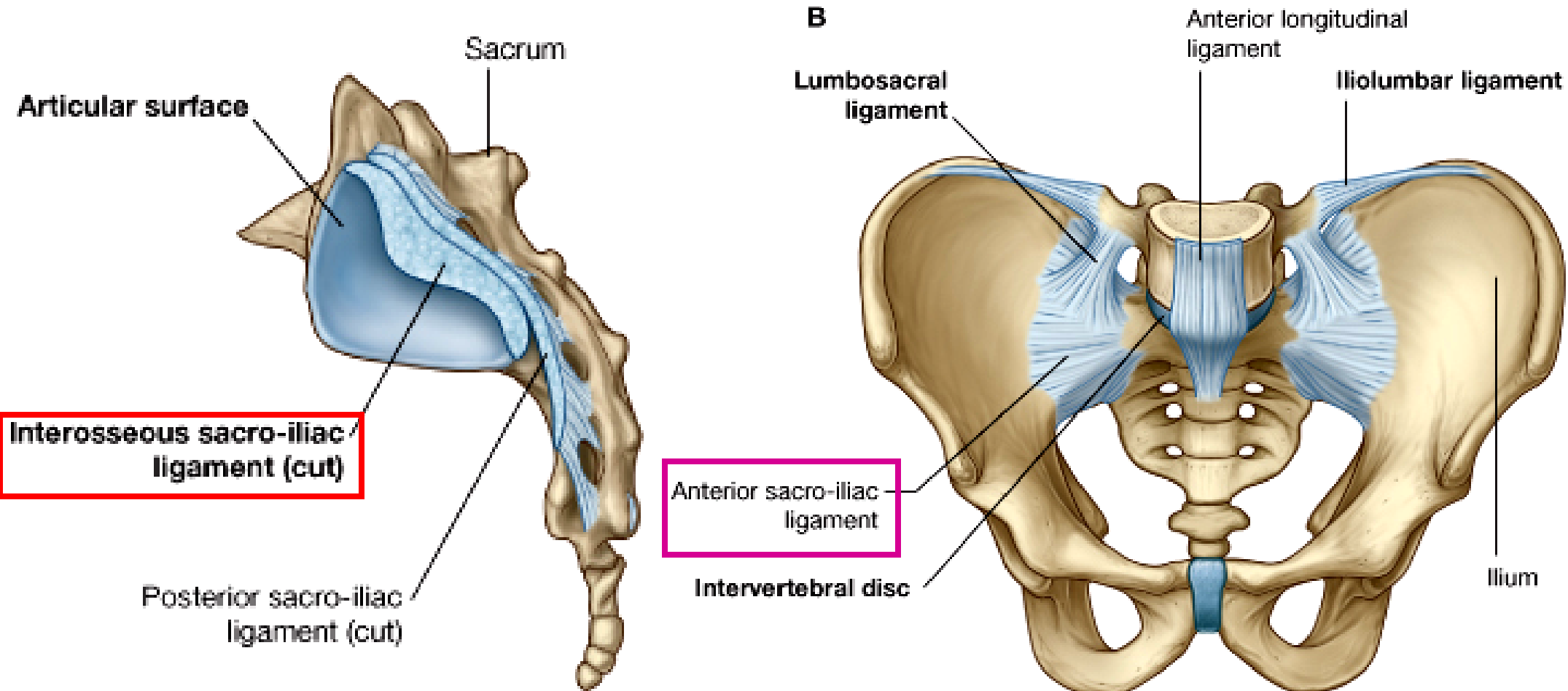
# The sacro-iliac joint-1

- synovial joint in childhood; fibrous bands in joints of adult;
- > 50 years old, completely fibrous
- supported by many tough ligaments including:
- interosseous lig., ant.& post. sacroiliac lig., **sacrospinous lig.** , **sacrotuberous lig.**



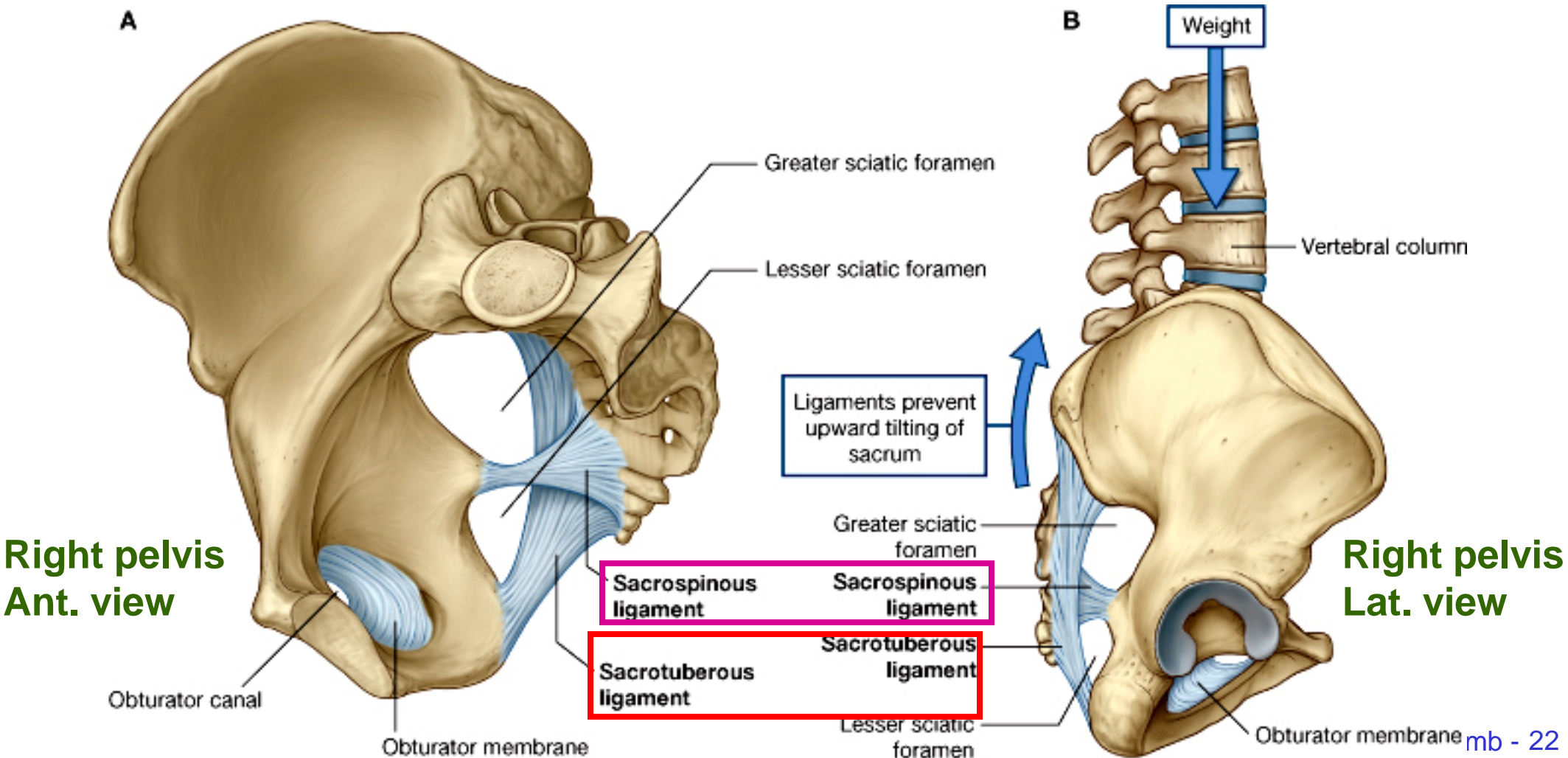
# Sacro-iliac joints-2

- interosseous lig., ant. and post. sacroiliac lig.

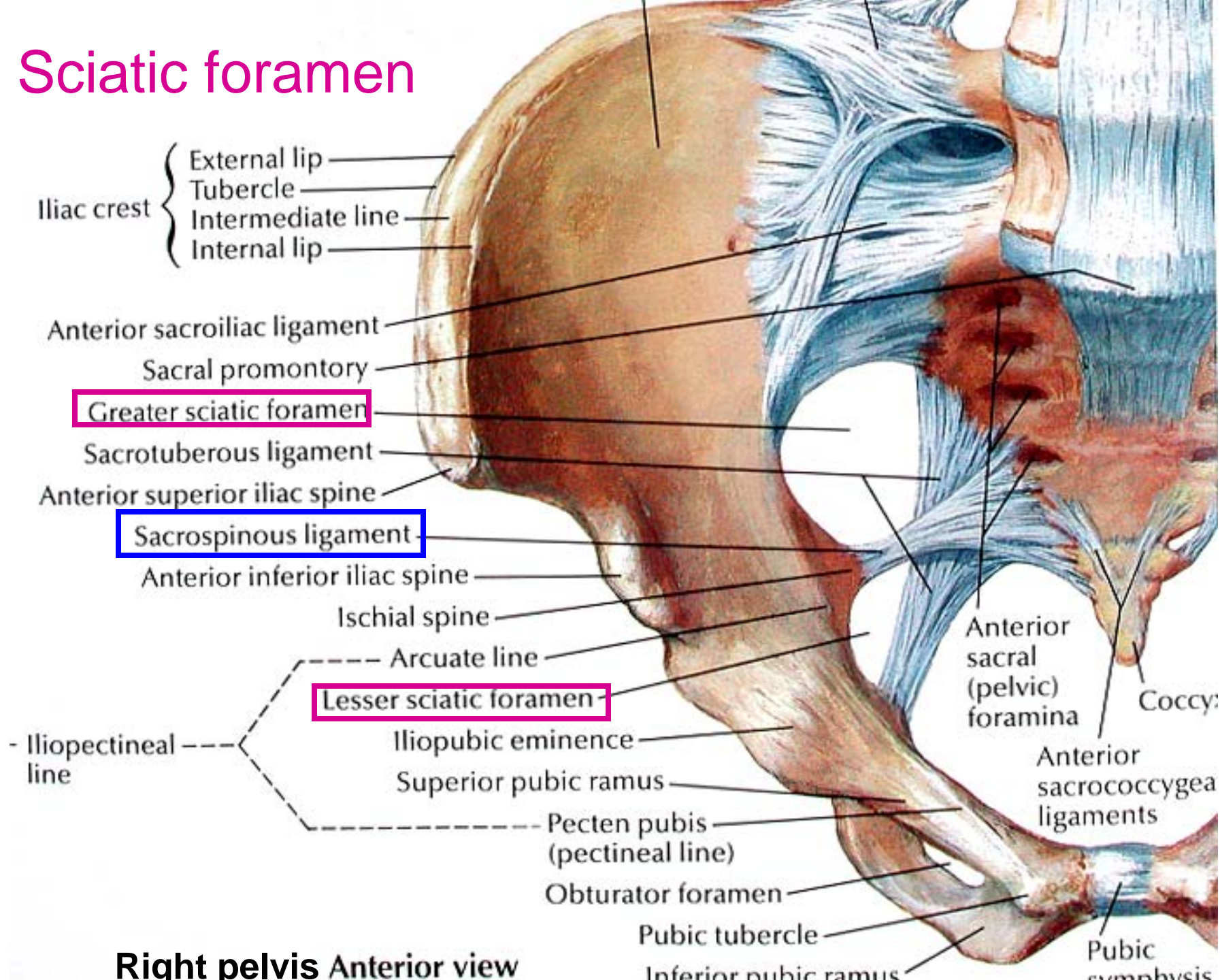


# Sacroiliac joints and Sciatic foramens

- greater sciatic foramen; lesser sciatic foramen
- \*posterior aspect of joint heavily armed with ligaments (to counter body weight)



# Sciatic foramen



Iliac crest {  
 External lip  
 Tubercle  
 Intermediate line  
 Internal lip

Anterior sacroiliac ligament  
 Sacral promontory  
**Greater sciatic foramen**  
 Sacrotuberous ligament  
 Anterior superior iliac spine

**Sacrospinous ligament**  
 Anterior inferior iliac spine  
 Ischial spine

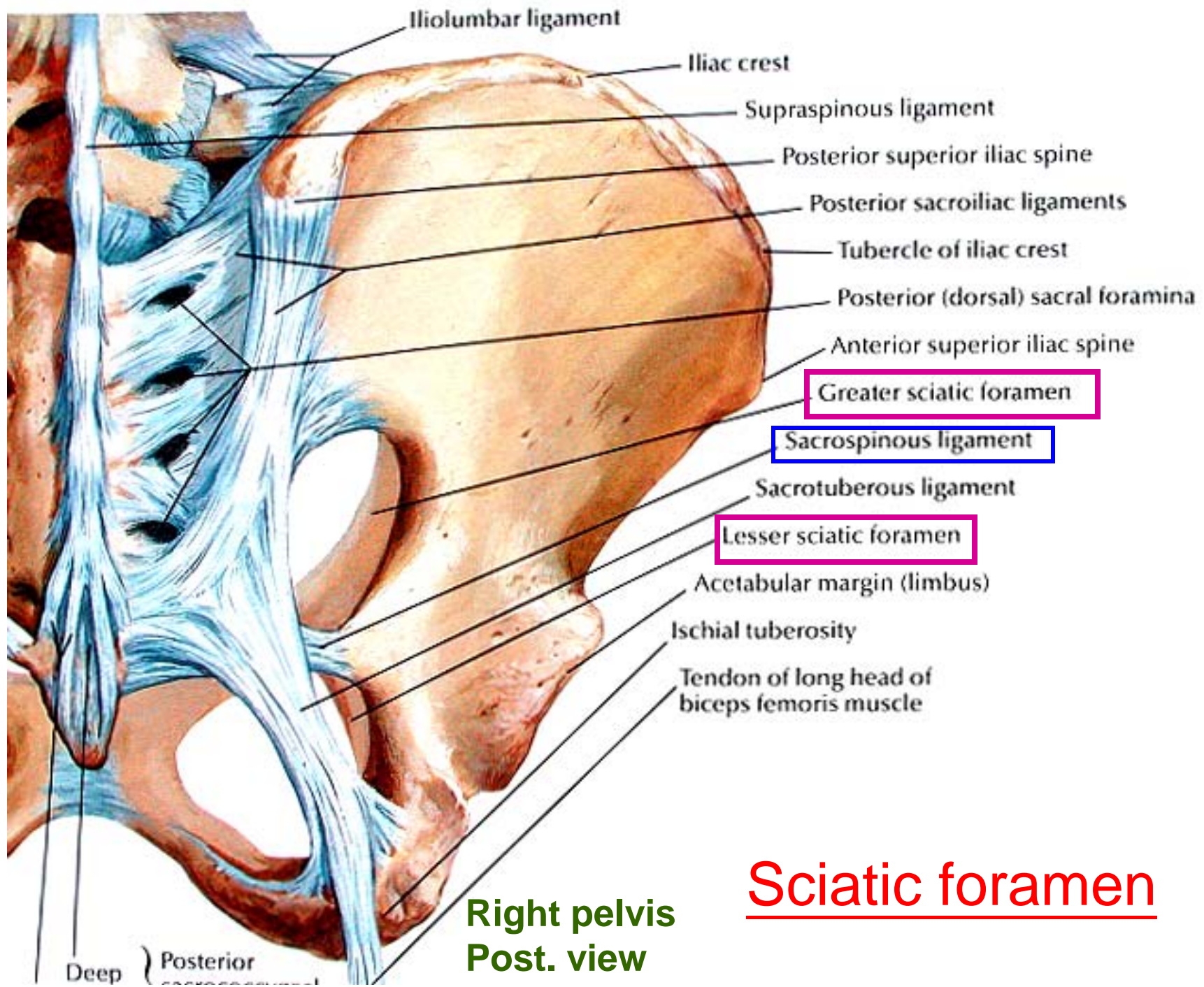
Arcuate line  
**Lesser sciatic foramen**

Iliopectineal line

Iliopubic eminence  
 Superior pubic ramus  
 Pecten pubis (pectineal line)  
 Obturator foramen  
 Pubic tubercle  
 Inferior pubic ramus

Anterior sacral (pelvic) foramina  
 Coccyx  
 Anterior sacrococcygea ligaments

**Right pelvis Anterior view**



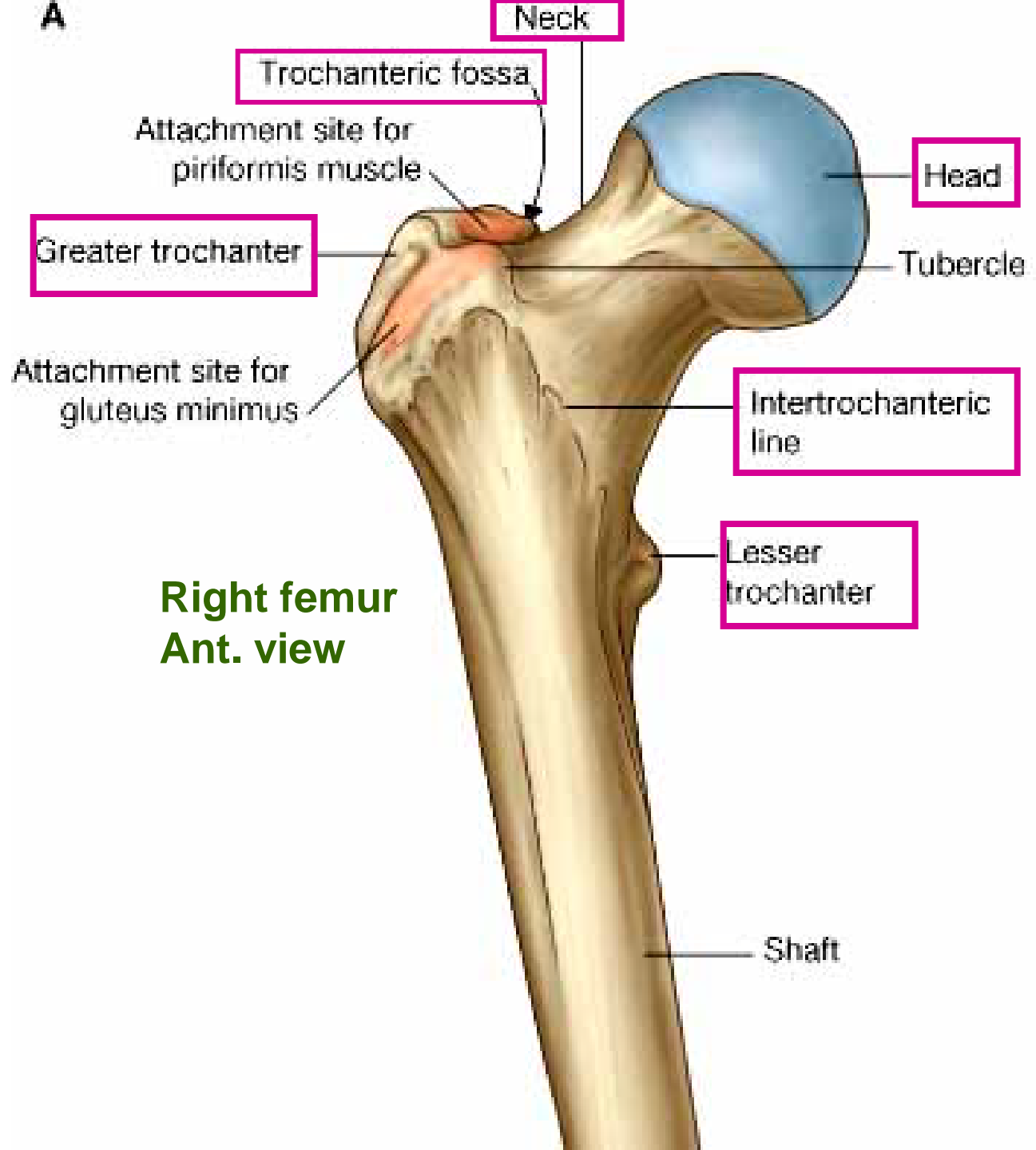
**Right pelvis  
Post. view**

## Sciatic foramen

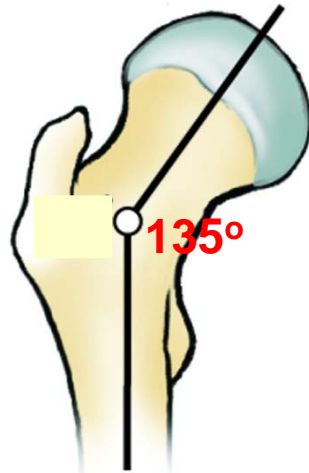
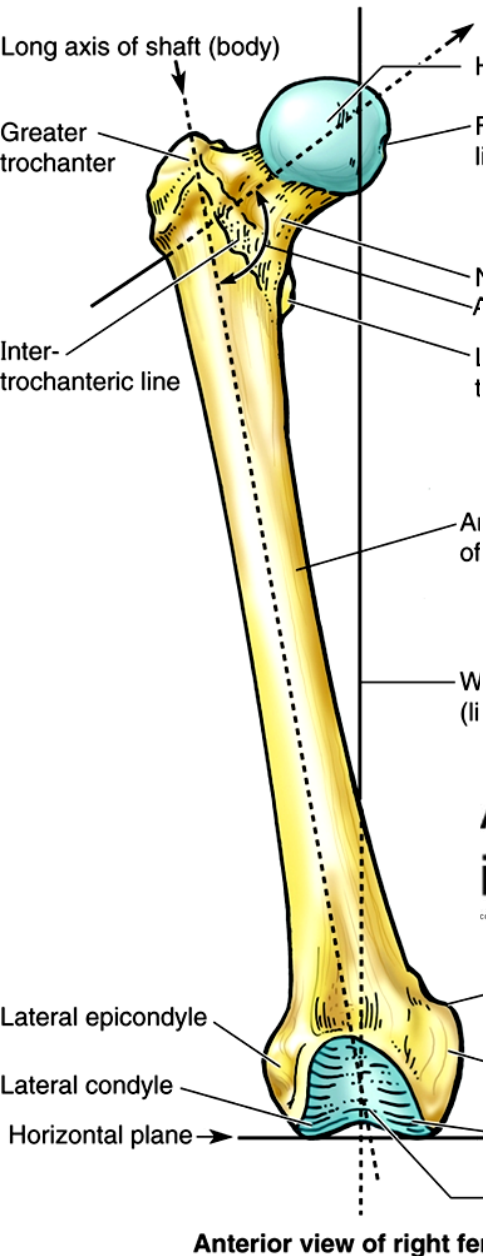


# Femur: proximal end (anterior Surface)

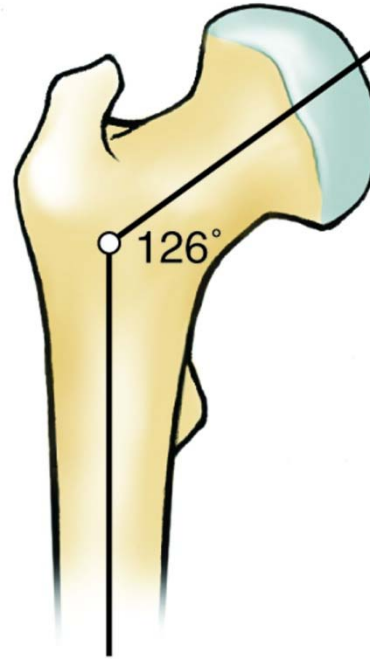
- head: faces upward, medially, slightly forward; **fovea**; neck:
- **greater trochanter**; **trochanteric fossa** (obturator internus attachment)
- intertrochanteric line
- lesser trochanter



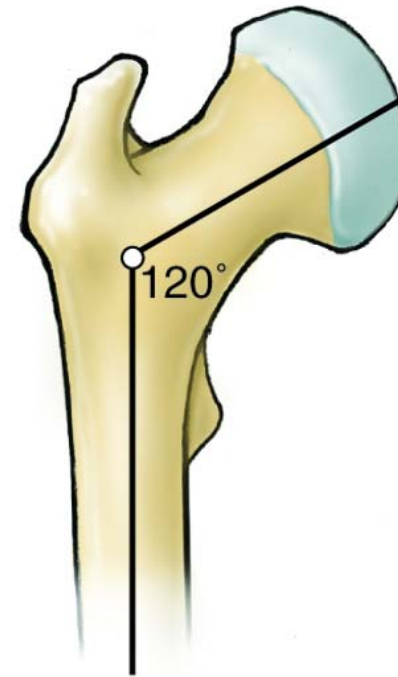
# Femur: angle of inclination



Angle of inclination in 3-year-old child



Angle of inclination in adult



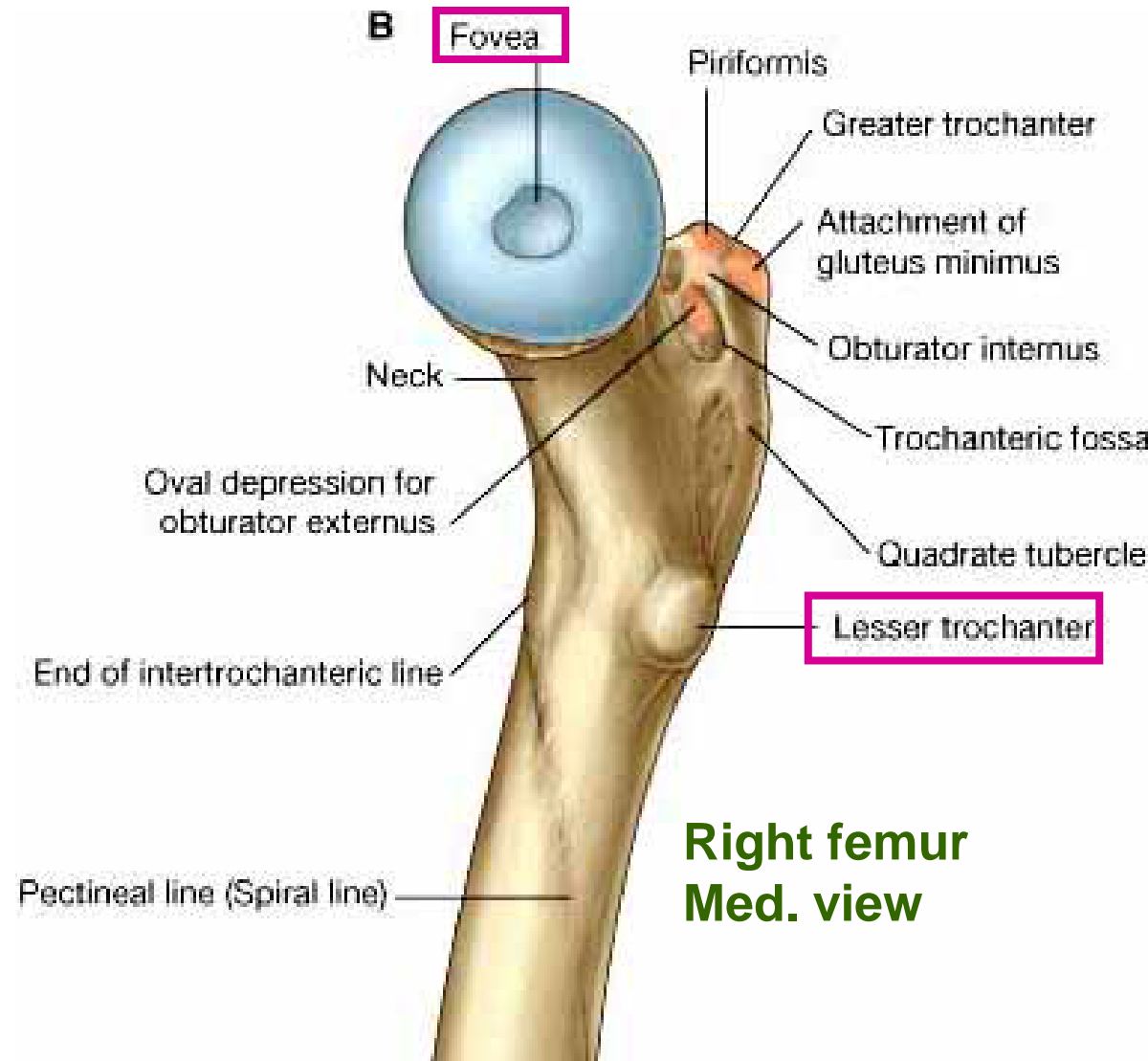
Angle of inclination in old age

Axis of femoral head ar

Right femur  
Ant. view

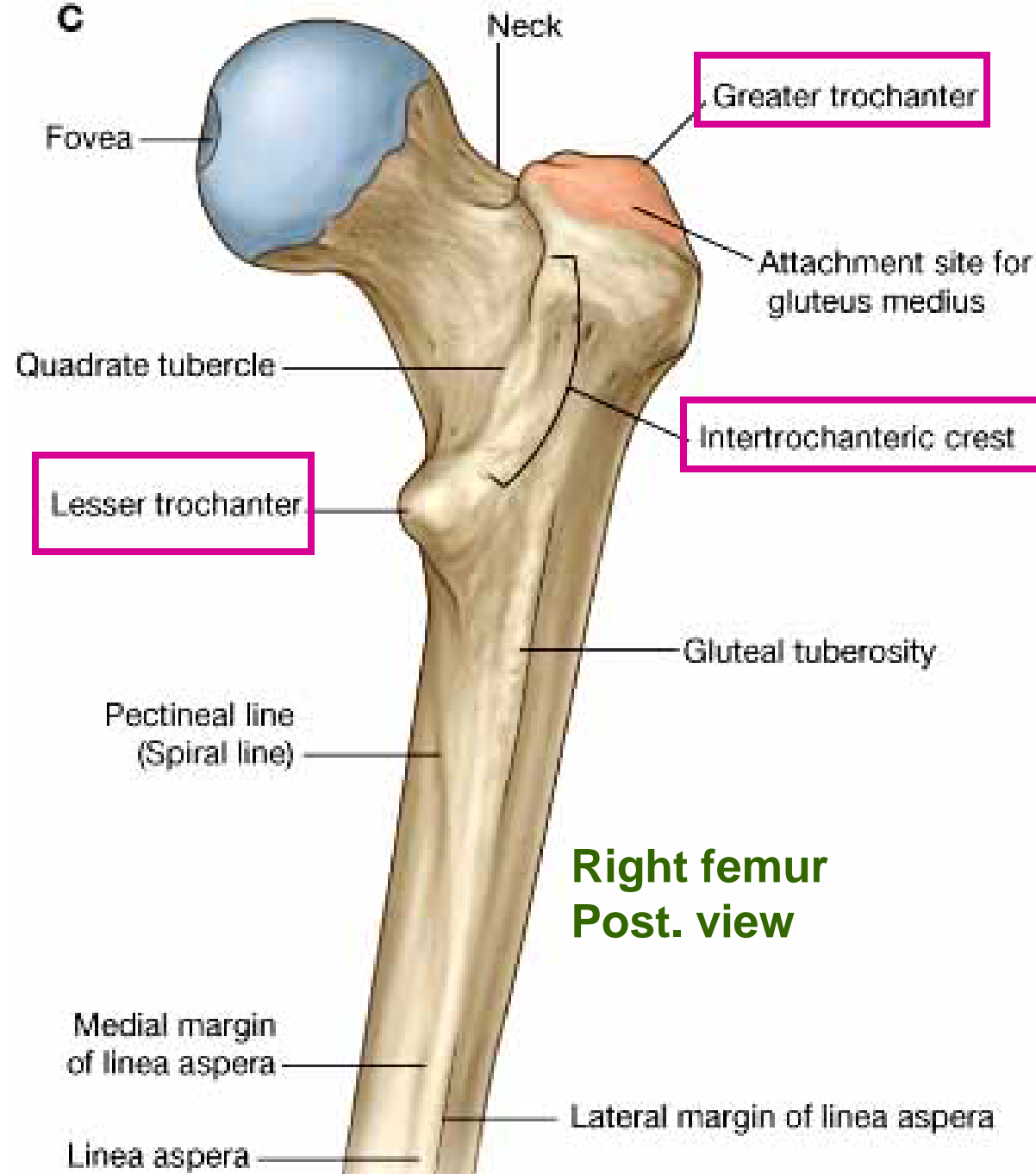
## Femur: proximal end (medial surface)

- head; **fovea**; neck:
- **greater trochanter**; **trochanteric fossa**
- **lesser trochanter**: (iliopsoas inserts here): on posterior aspect of femur;
- **intertrochanteric crest**: posterior surface
- **intertrochanteric line**: anterior surface



# Femur: proximal end (posterior surface)

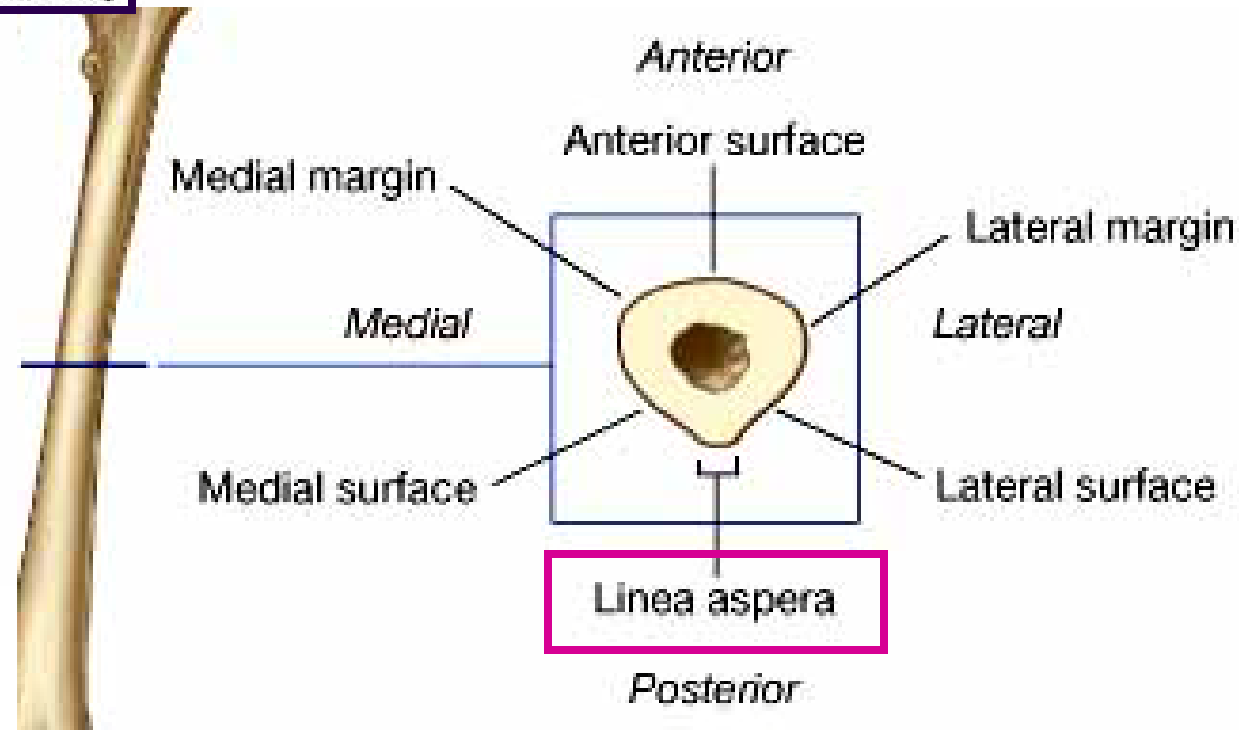
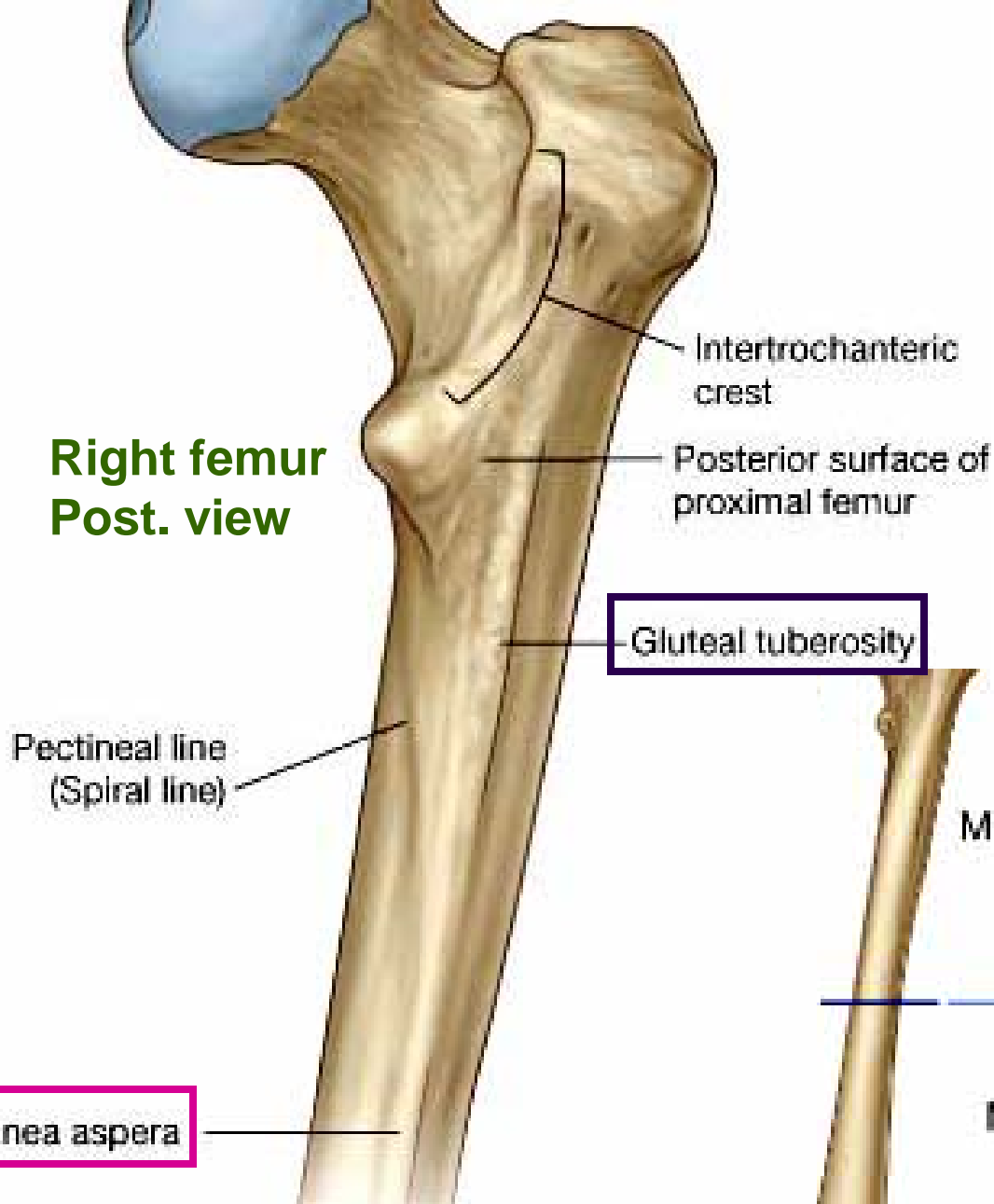
- head; **fovea**; neck:
- **greater trochanter**
- **lesser trochanter**:  
(iliopsoas inserts here):  
on posterior aspect of femur
- **intertrochanteric crest**:  
posterior surface



## Femur: shaft

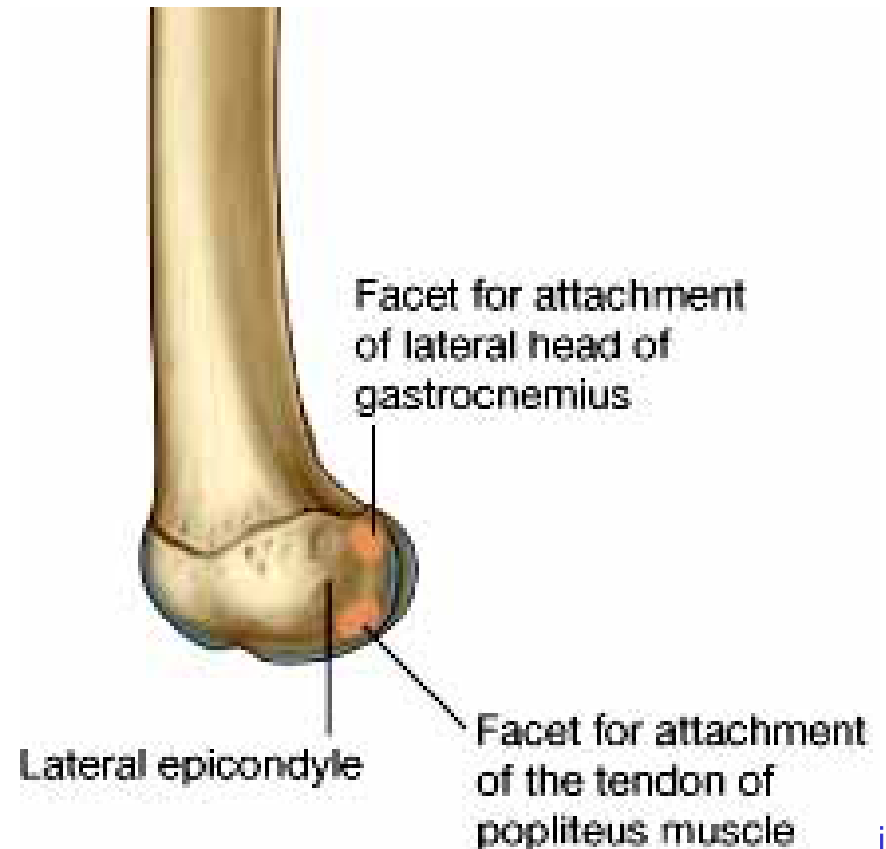
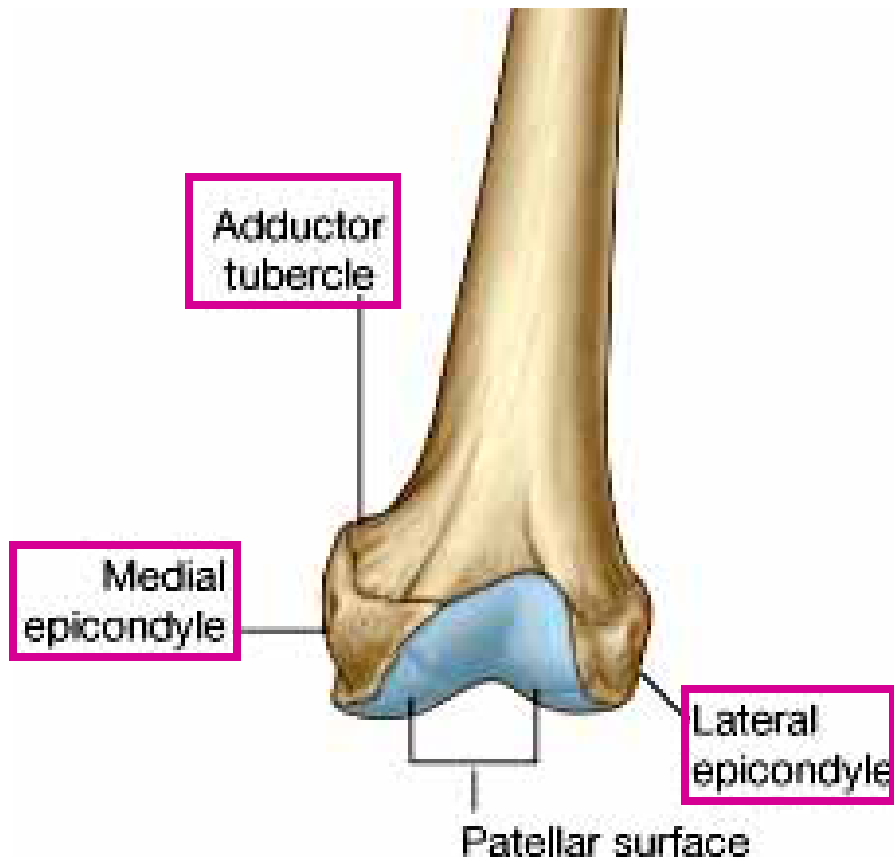
- gluteal tuberosity
- linea aspera (post. surface)

Right femur  
Post. view



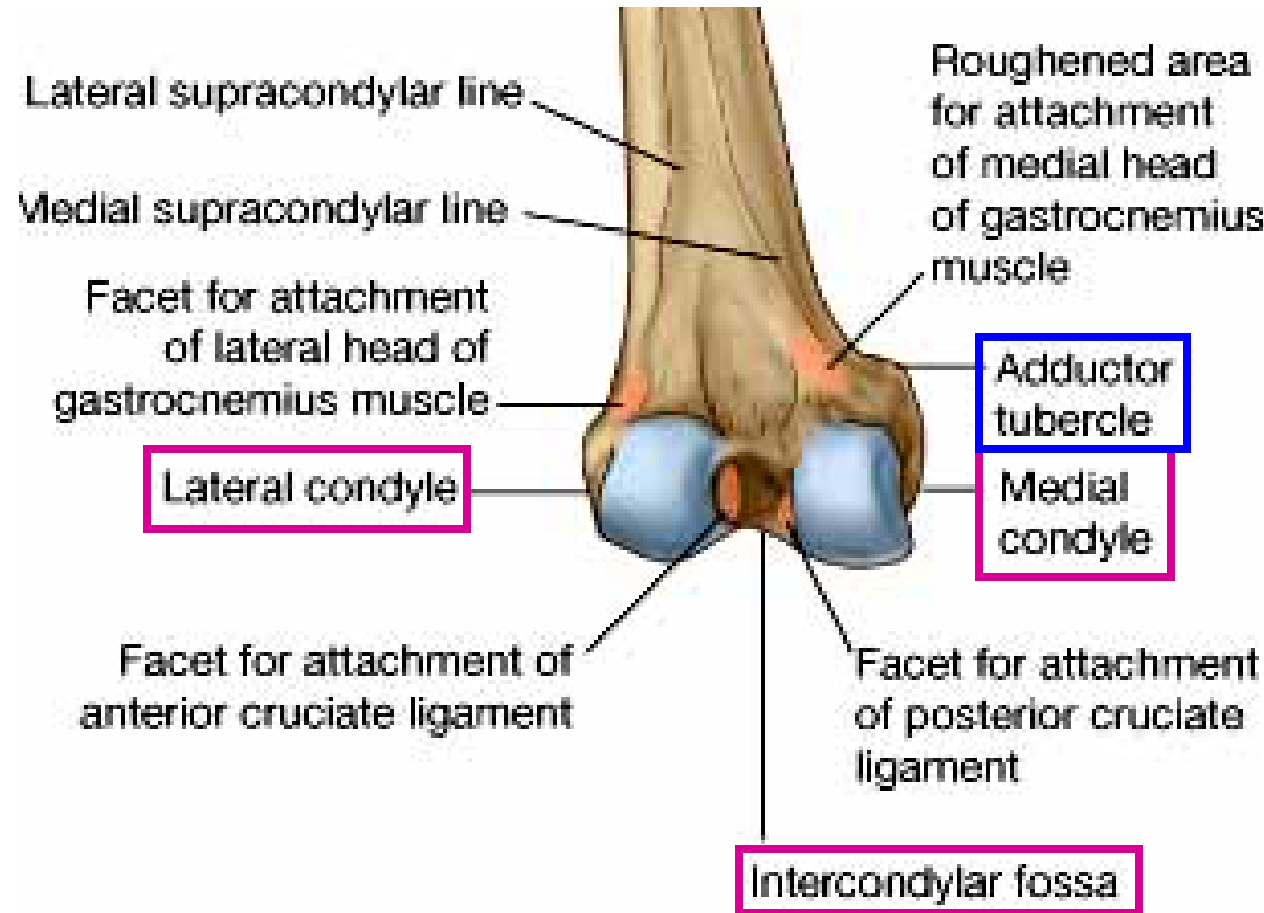
## Femur: distal end-1

- medial epicondyle; adductor tubercle (adductor magnus m.)
- lateral epicondyle
- intercondylar notch (fossa): deep, posteriorly located
- articular cartilage: tibial surface; patellar surface



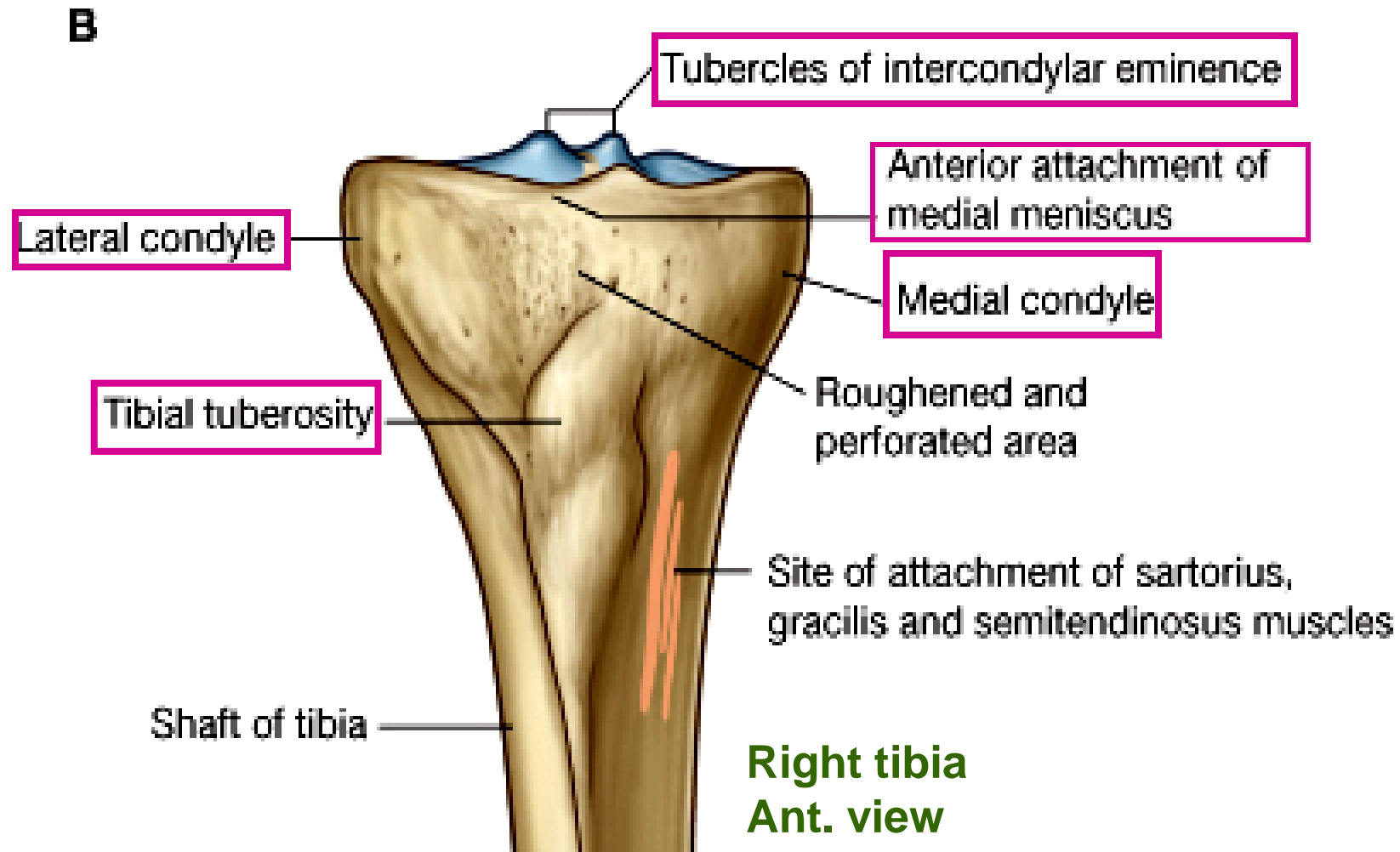
## Femur: distal end-2

- medial condyle
- adductor tubercle (adductor magnus m.)
- lateral condyle
- intercondylar notch (fossa): deep, posteriorly located
- articular cartilage: tibial surface; patellar surface



## Tibia: proximal end-1

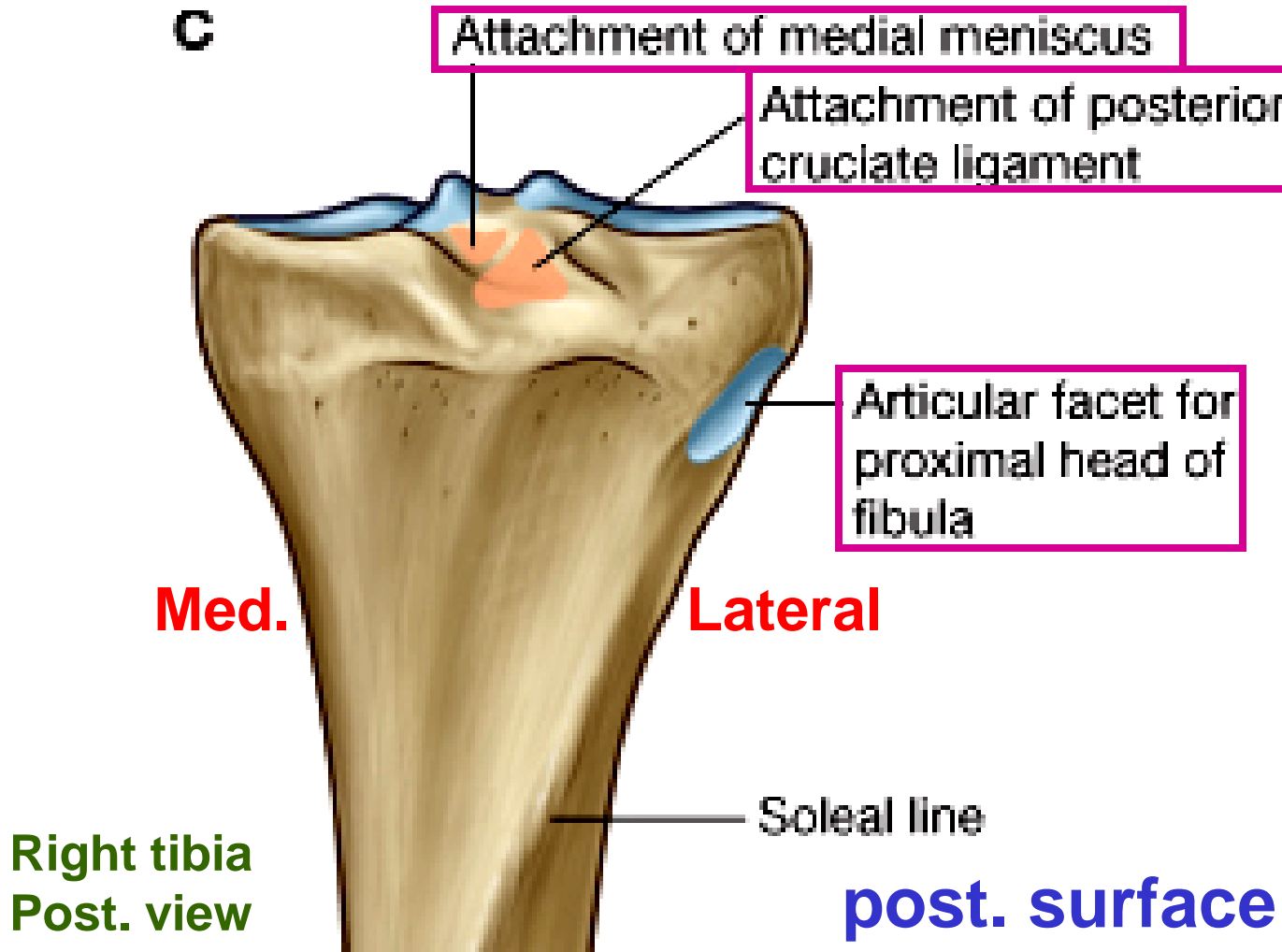
- medial condyle, lateral condyle; intercondylar area (intercondylar tubercles) for meniscus and lig.
- tibial tuberosity (tubercle): ligamentum patellae attachment





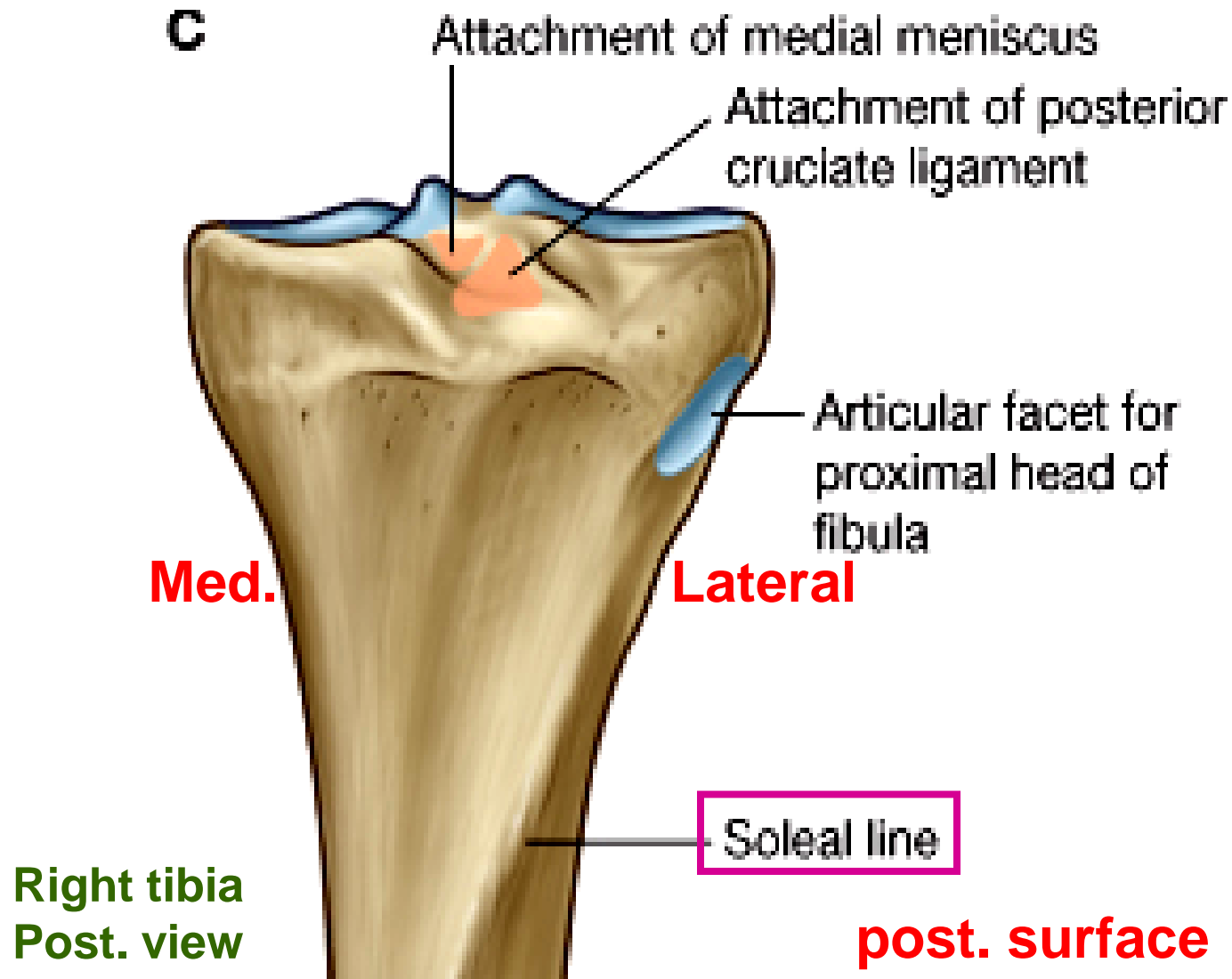
# Tibia: proximal end-2

- intercondylar area (intercondylar tubercles): medial and lateral attachment of cruciate lig. & horns of med. and lat. menisci
- articular surface for head of fibula



# Tibia: shaft

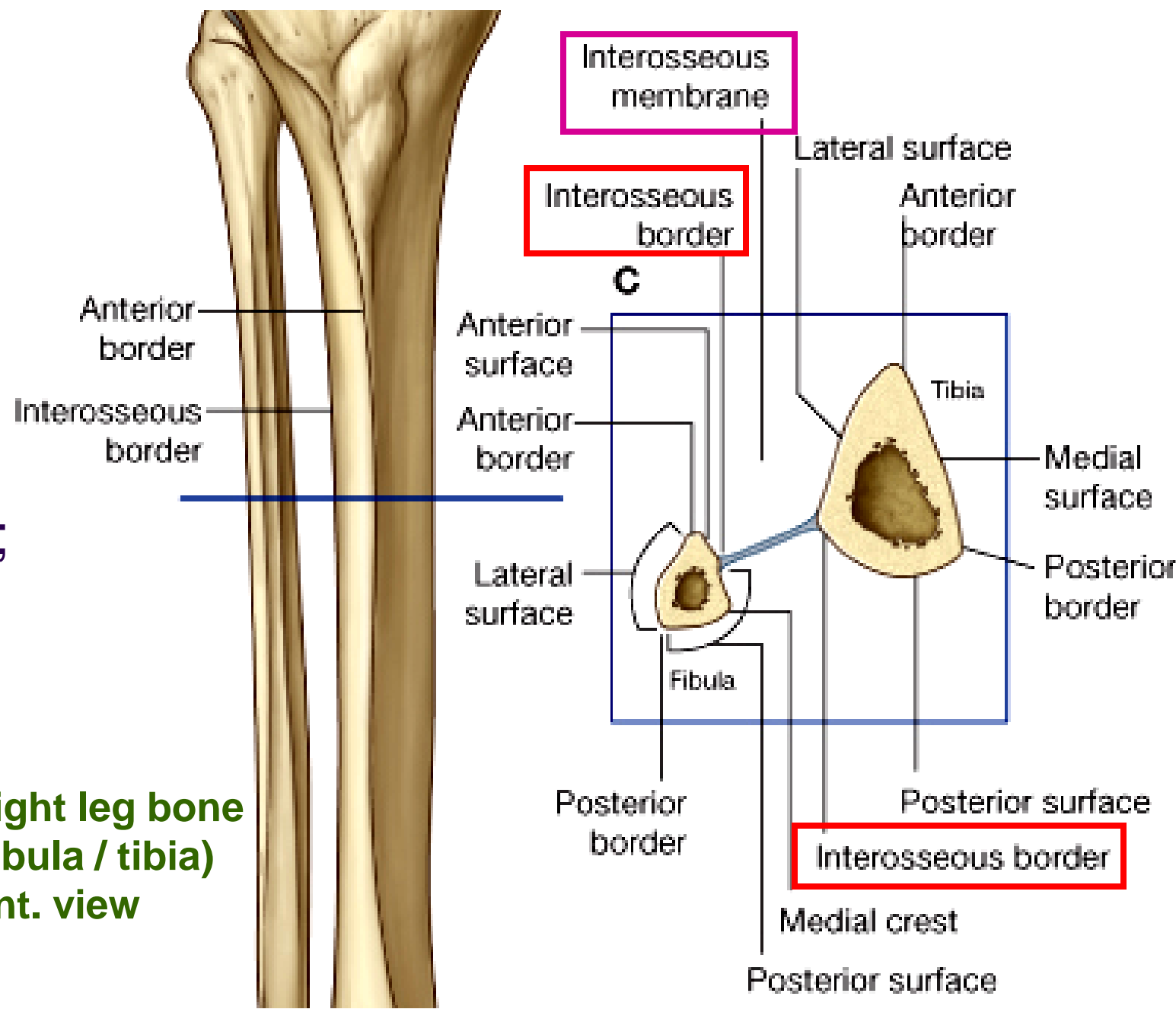
- **soleal line** (oblique line): on upper 1/3 of post. surface



# Tibia: shaft (cross-section)

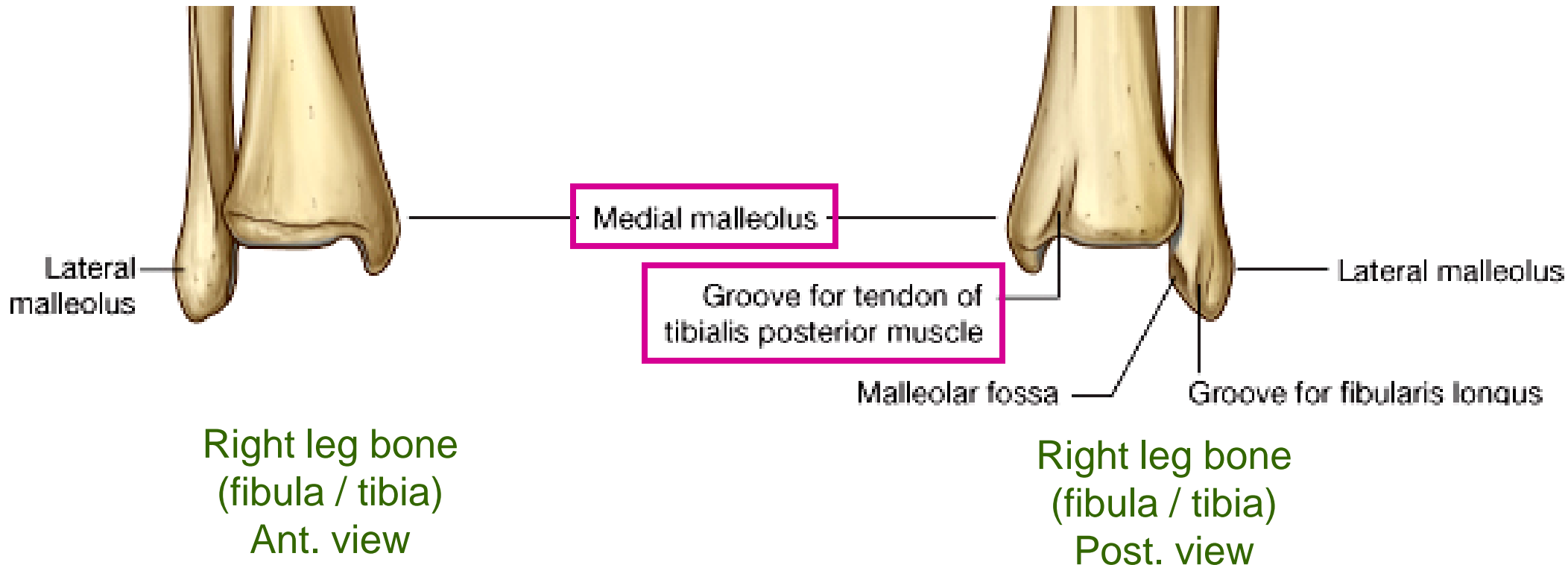
- quadrangular in cross section
- med., lat., post. surfaces
- ant. (subcutaneous); interosseous, posteromedial borders

Right leg bone  
(fibula / tibia)  
Ant. view



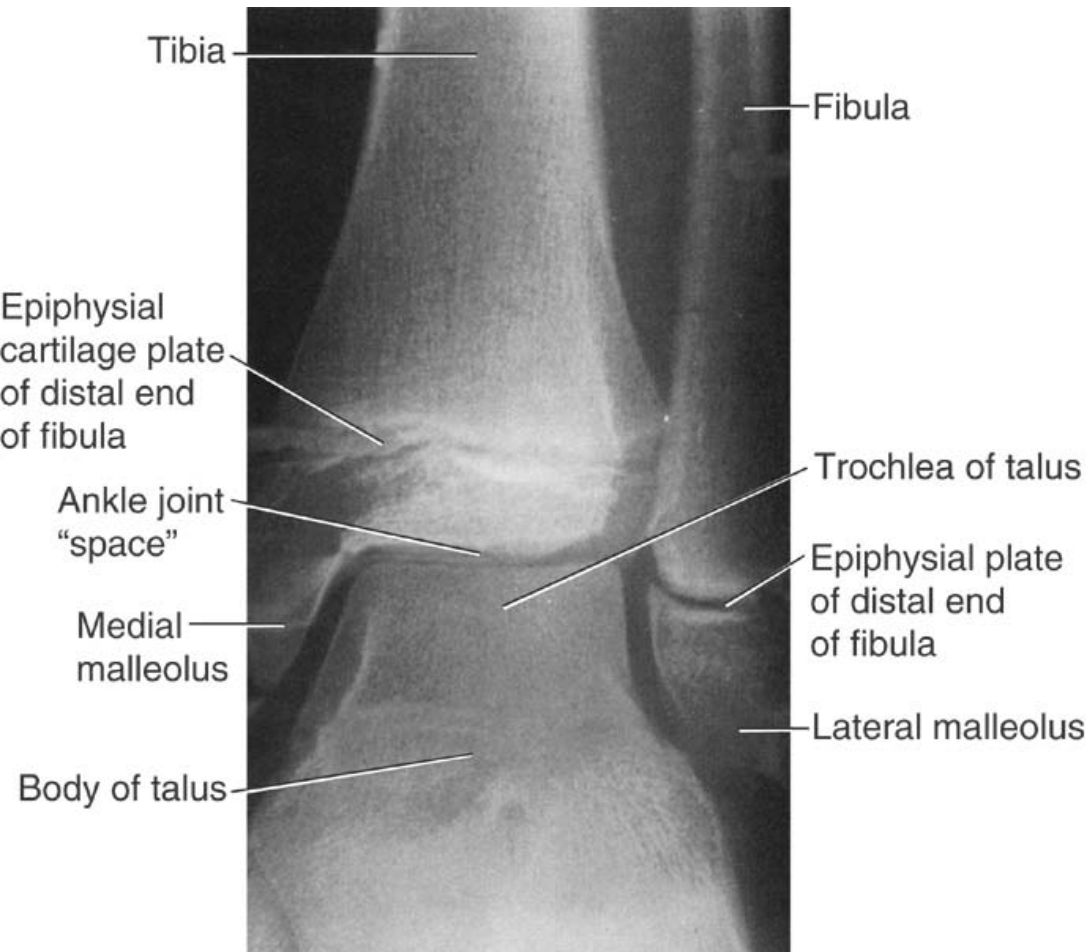
# Tibia: distal end

- **medial malleolus**: groove for tibialis posterior



# Tibia: with Talus

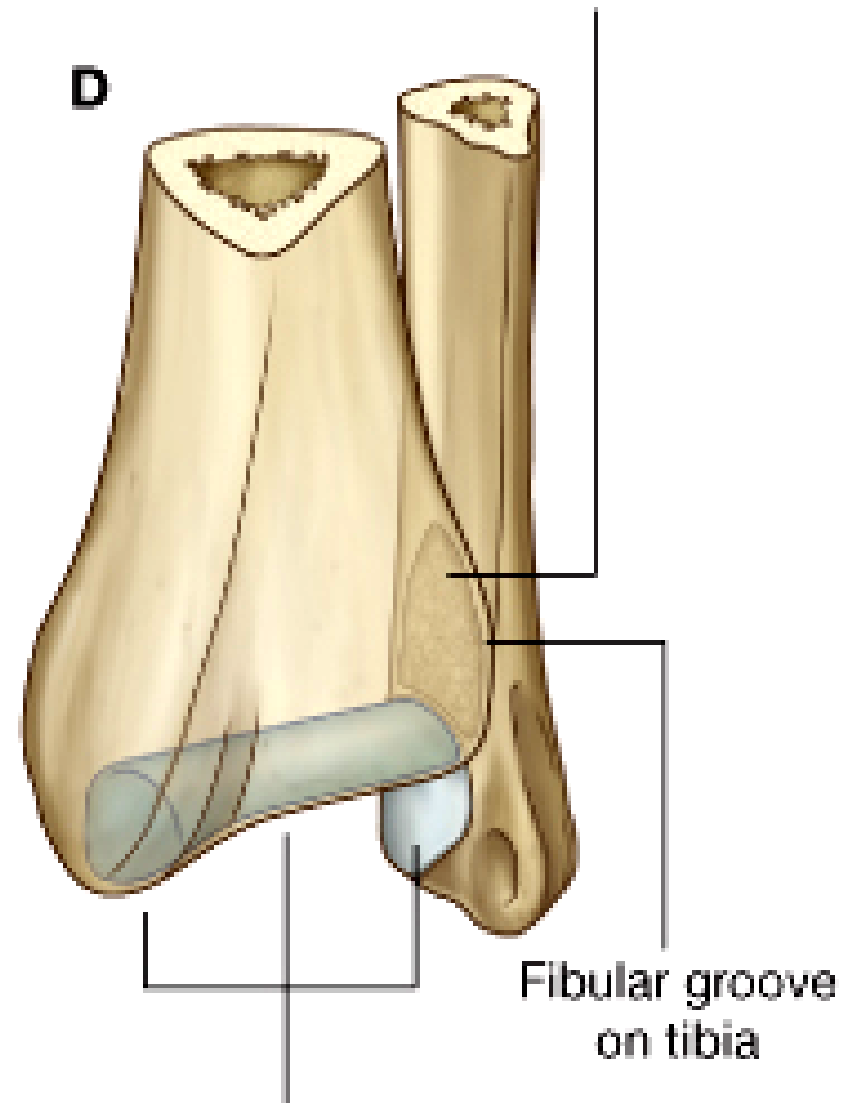
- inferior articular facet for talus (trochlea)



Posteroanterior view (slightly oblique)

Roughened triangular area that fits into fibular groove of tibia

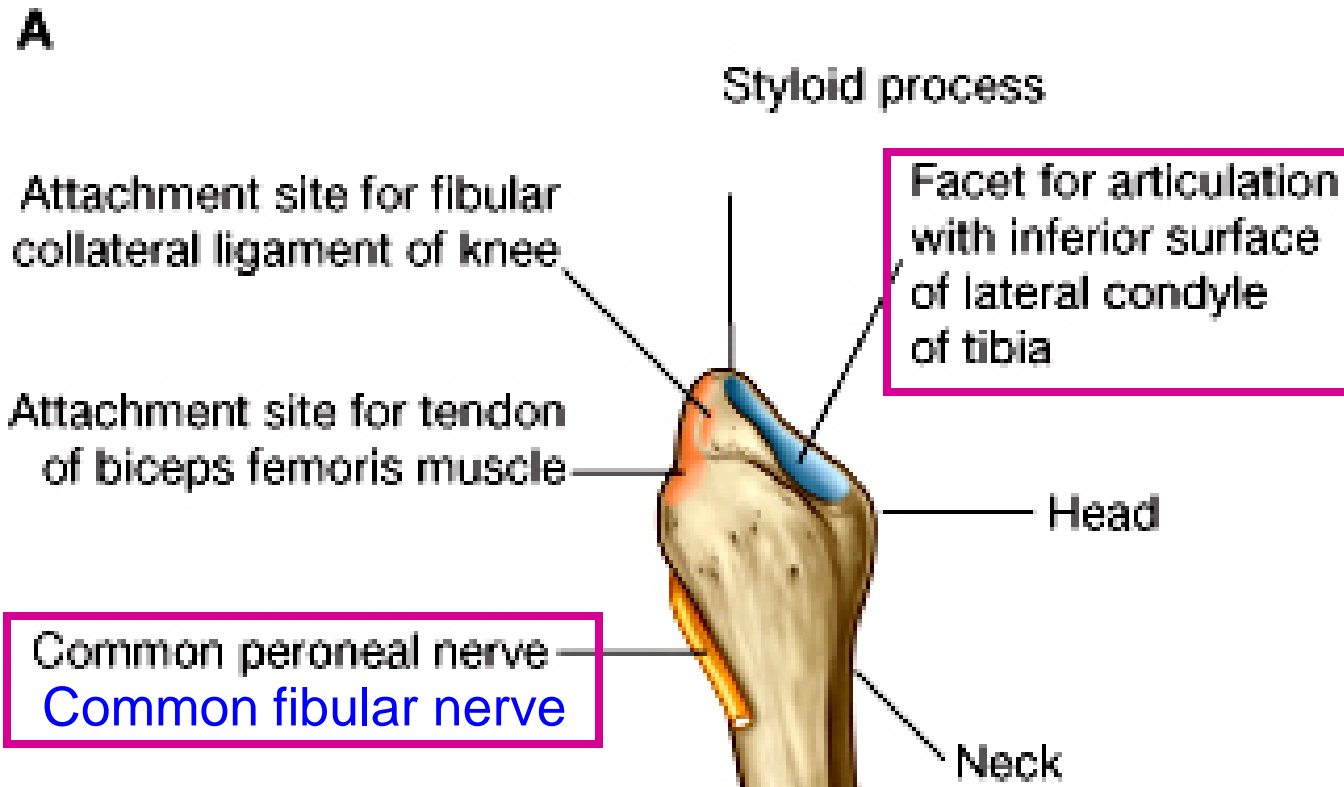
D



Articular surfaces for talus

## Fibula: head

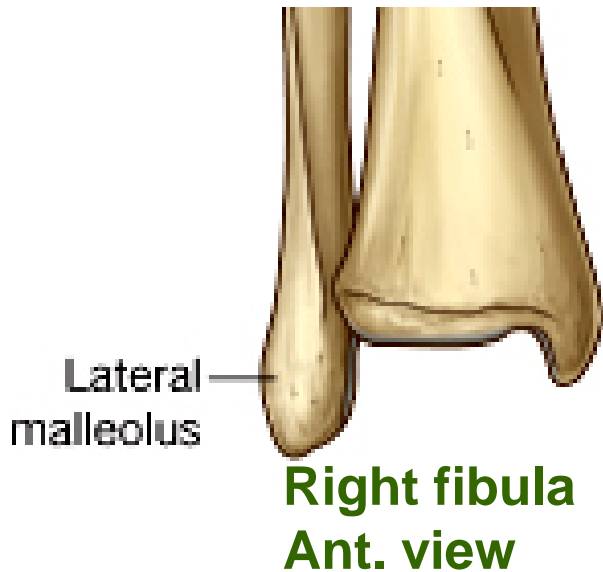
- Surface anatomy of fibular head
- Articular surface with tibia
- apex of head (styloid process)



**Right fibula  
Ant. view**

## Fibula: distal end

- lateral malleolus
- articular facet for talus



Medial malleolus

Groove for tendon of tibialis posterior muscle

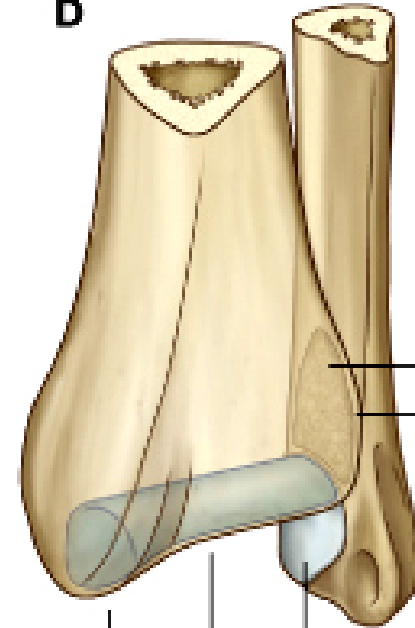
Malleolar fossa

Articular surfaces for talus

Fibular groove on tibia

Roughened triangular area that fits into fibular groove of tibia

D

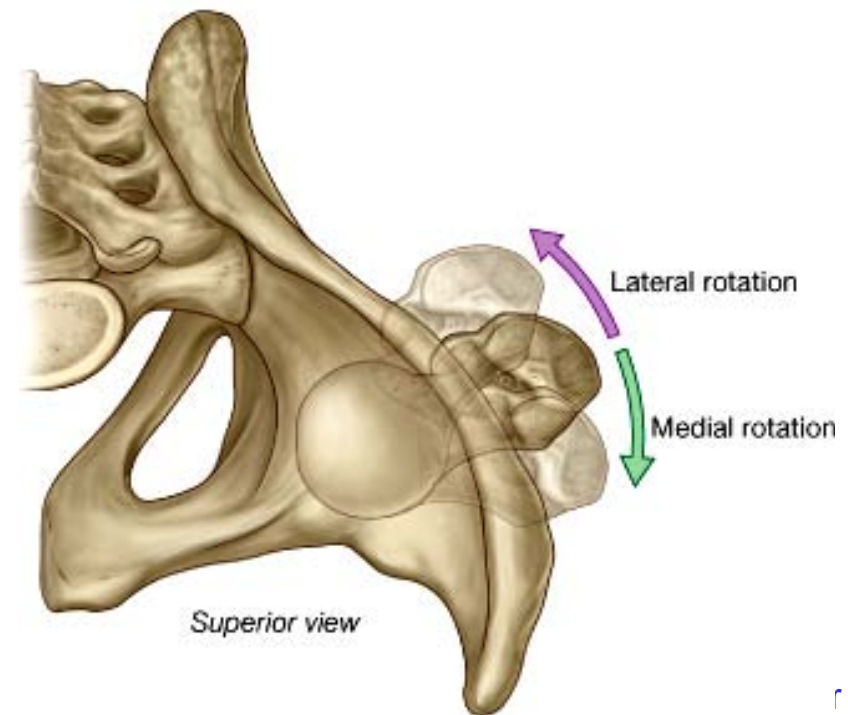
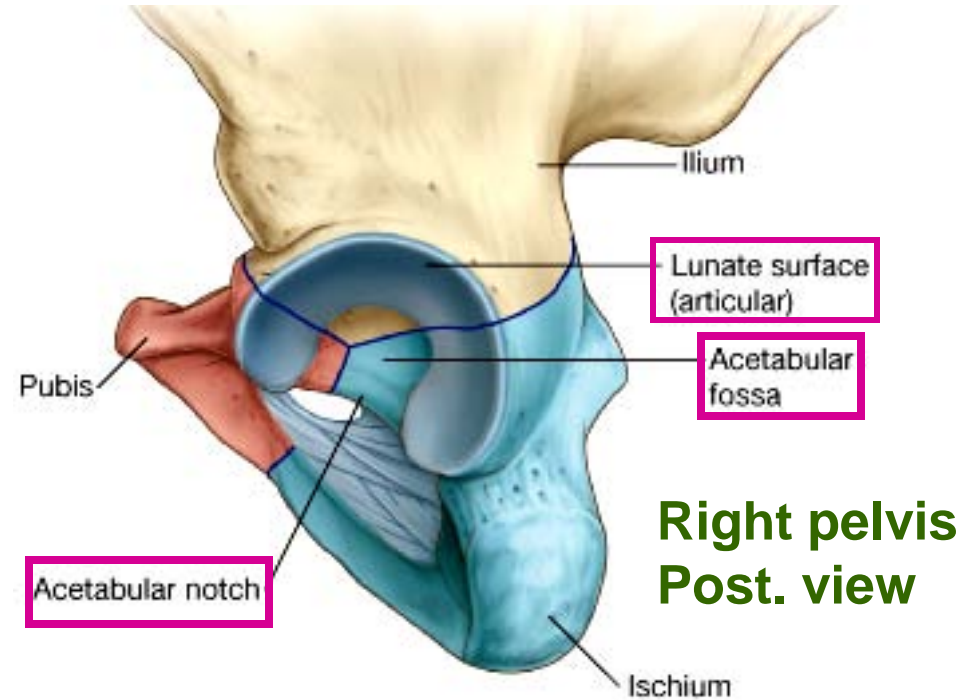


Lateral malleolus

Groove for fibularis longus

# Acetabulum

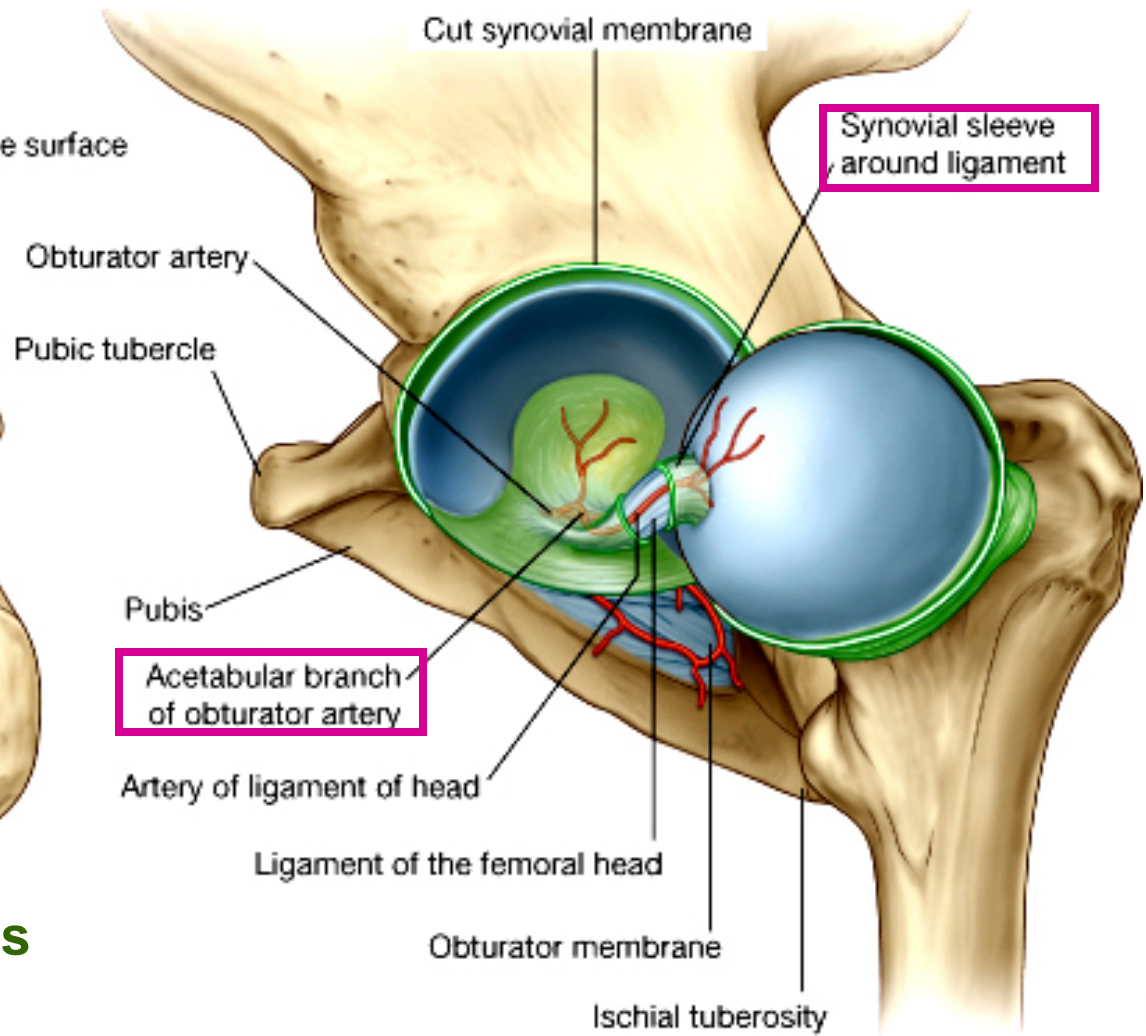
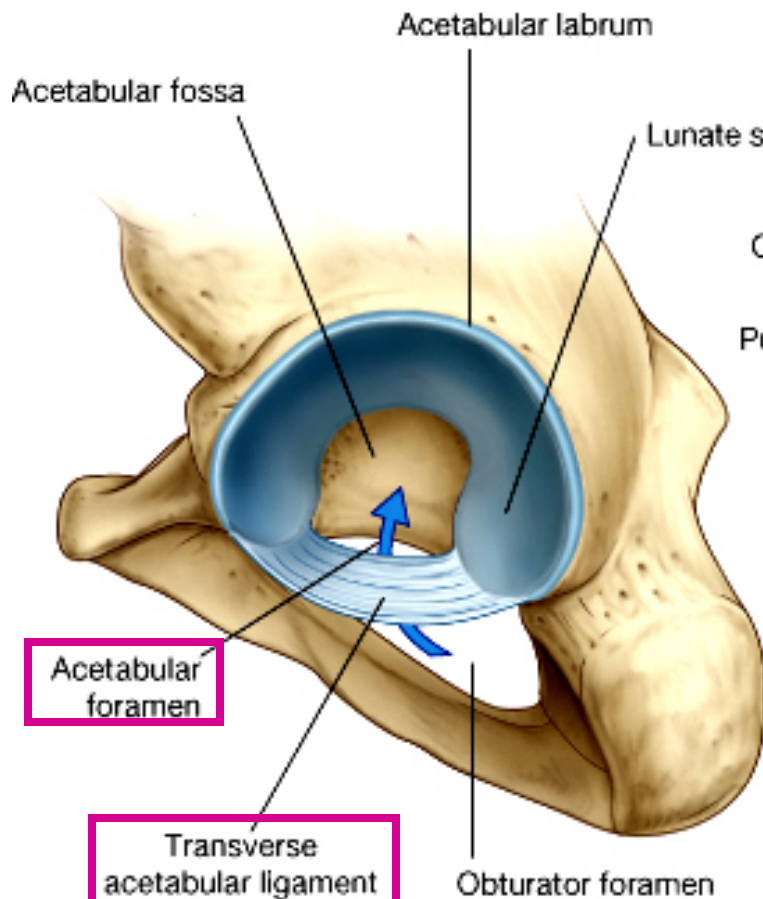
- Acetabular fossa
- Acetabular notch
- Articular (lunate) surface
- Ligaments
  - Transverse acetabular ligament
  - Ligament of femoral head
  - Iliofemoral ligament
  - Ischiofemoral ligament
  - Pubofemoral ligament





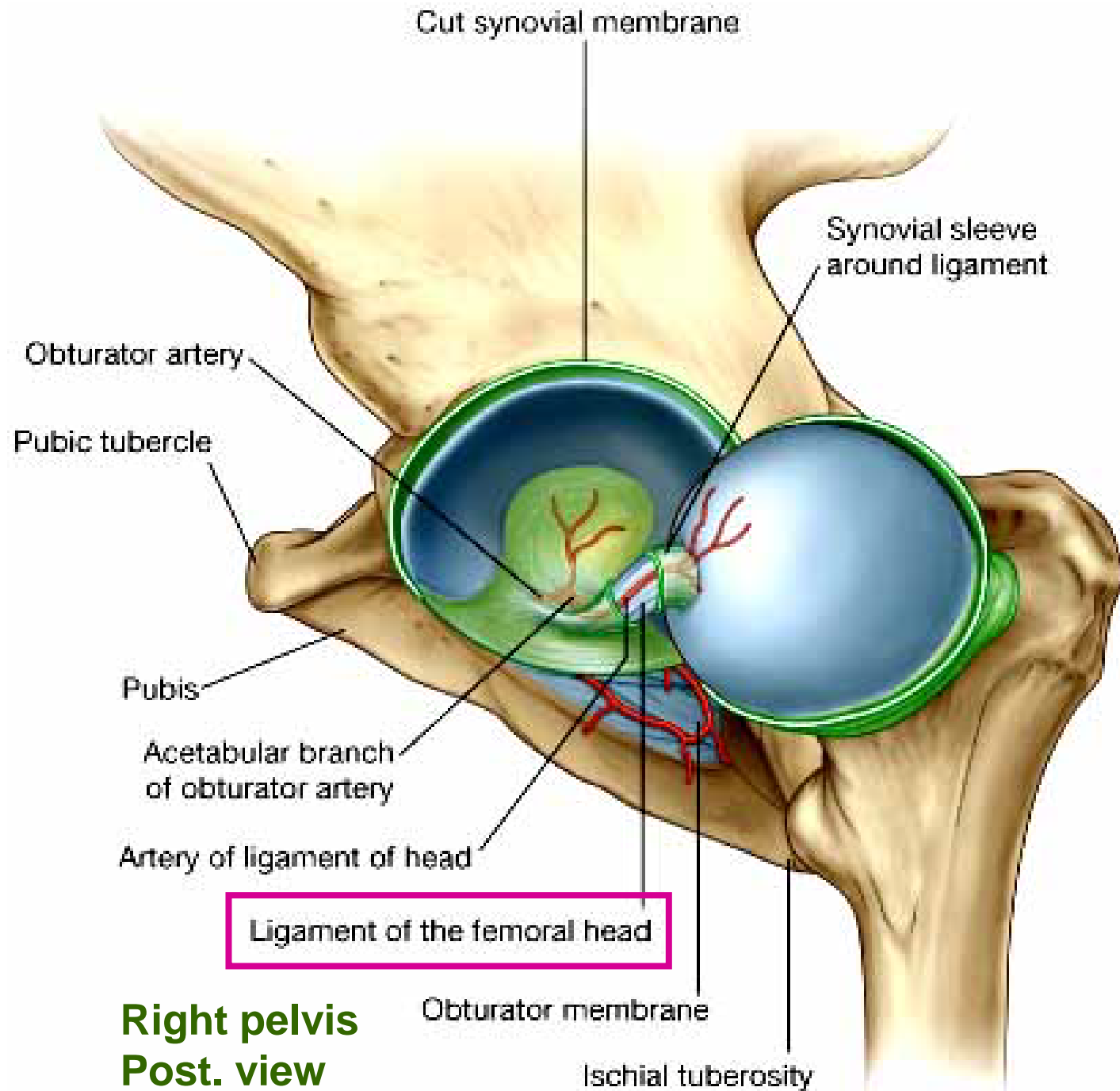
# Transverse acetabular ligament

- **transverse acetabular lig.:** connecting the ant.& post. ends of the articular cartilage
- vessels, n. to head run deep to this lig.



# Ligament of femoral head

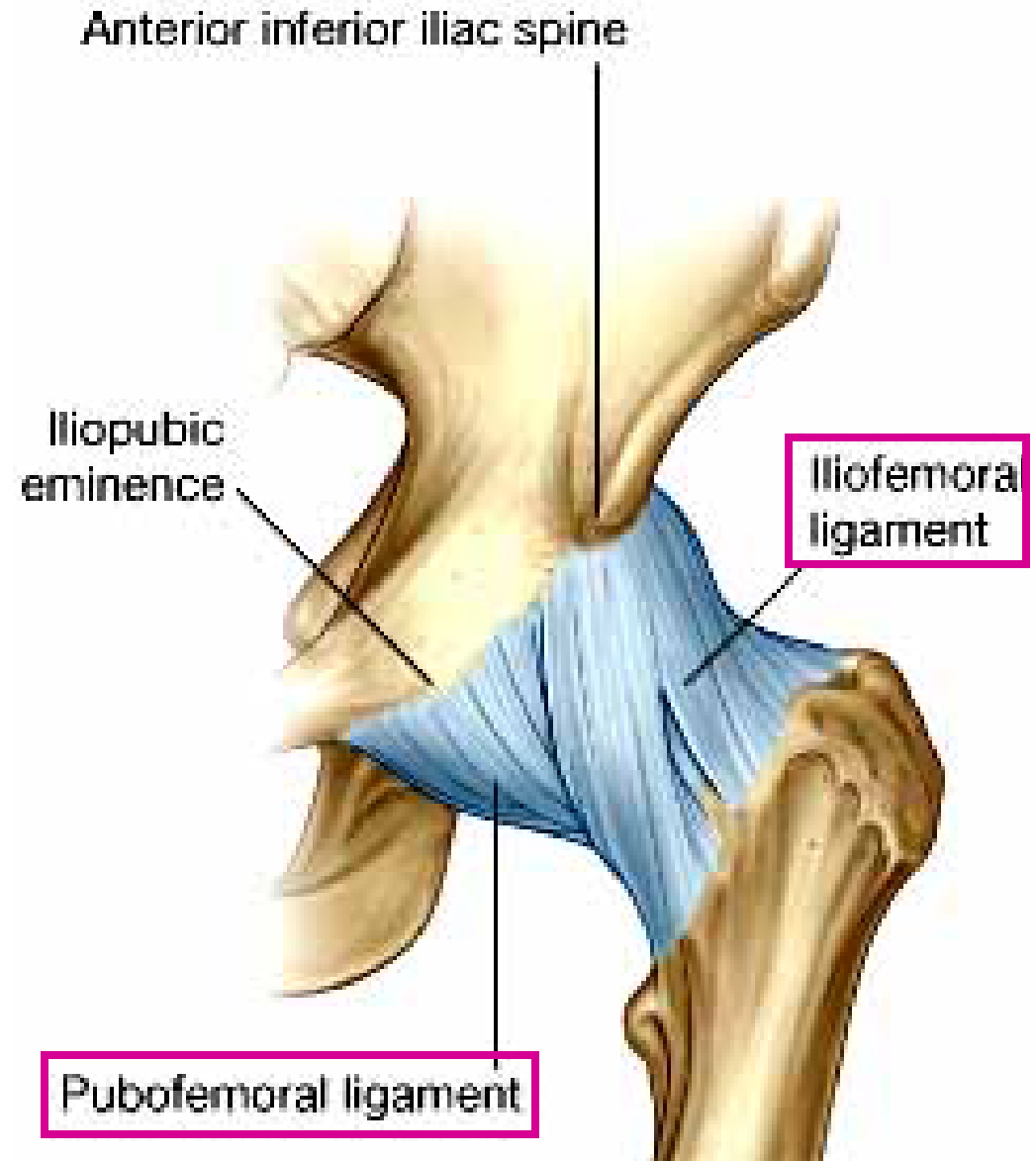
- **lig. of the head of the femur:**  
acetabular notch → fovea of the head of femur
- surrounded by synovial sheath; conveys vessels in childhood
- minimal effect for strength



**Right pelvis**  
**Post. view**

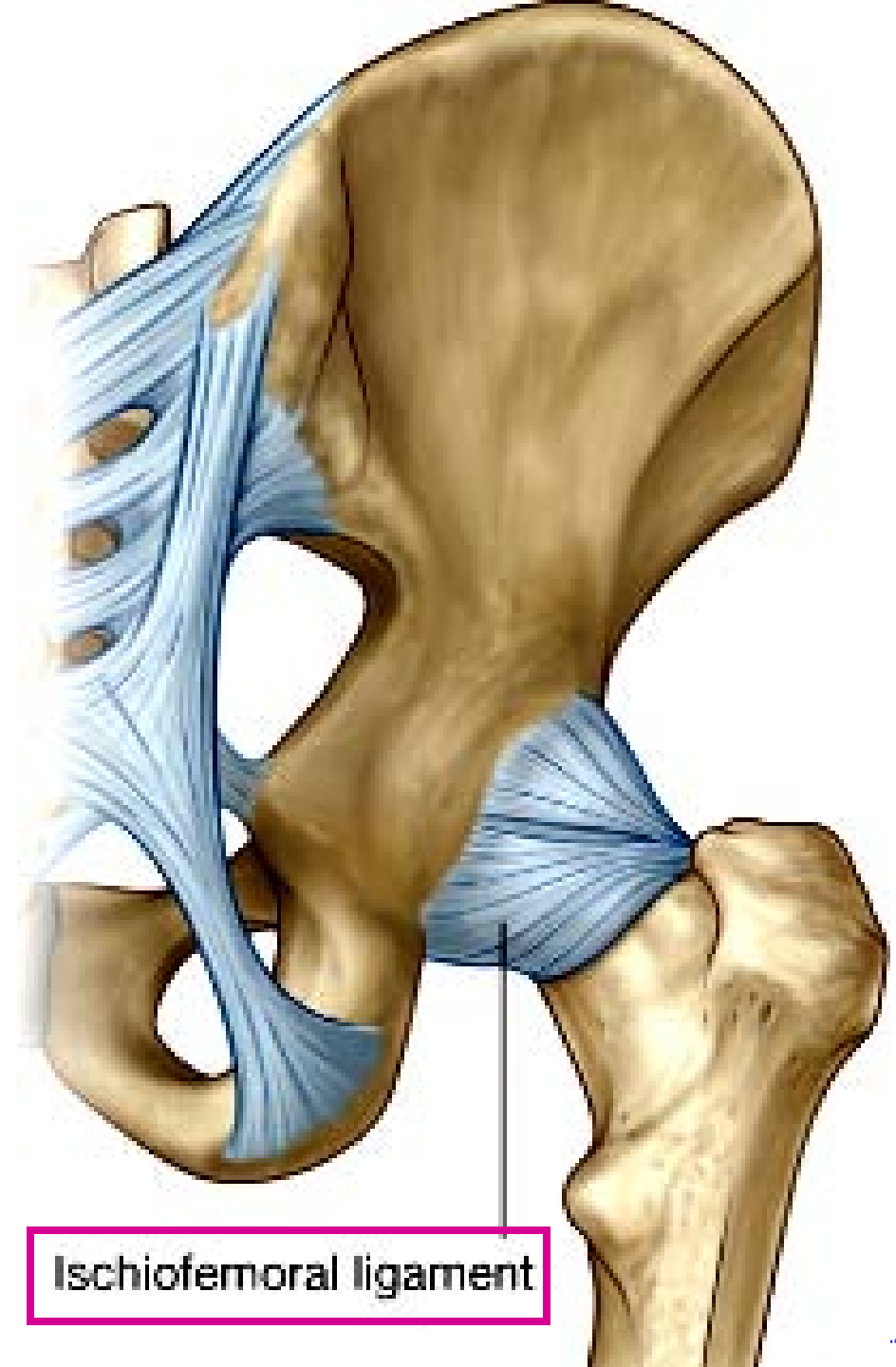
# Acetabulum: Ligaments-1

- **Iliofemoral lig.**
  - inverted Y; aais, ilium → intertrochanteric line
- **Pubofemoral lig.**
  - Iliopubic eminence → iliofemoral lig.



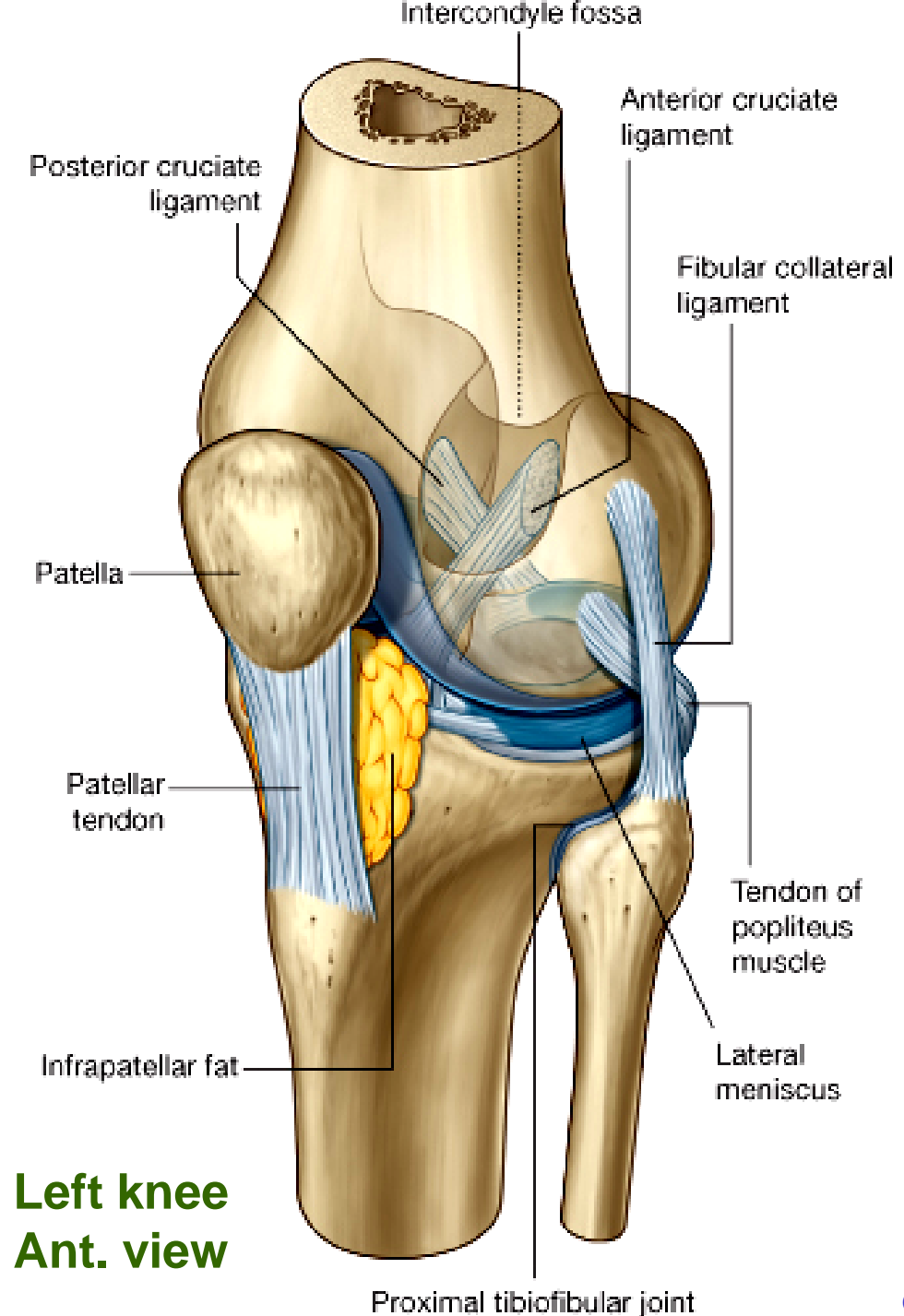
## Acetabulum: ligaments-2

- **Ischiofemoral lig.**
  - ischium of acetabulum rim → med. aspect of greater trochanter



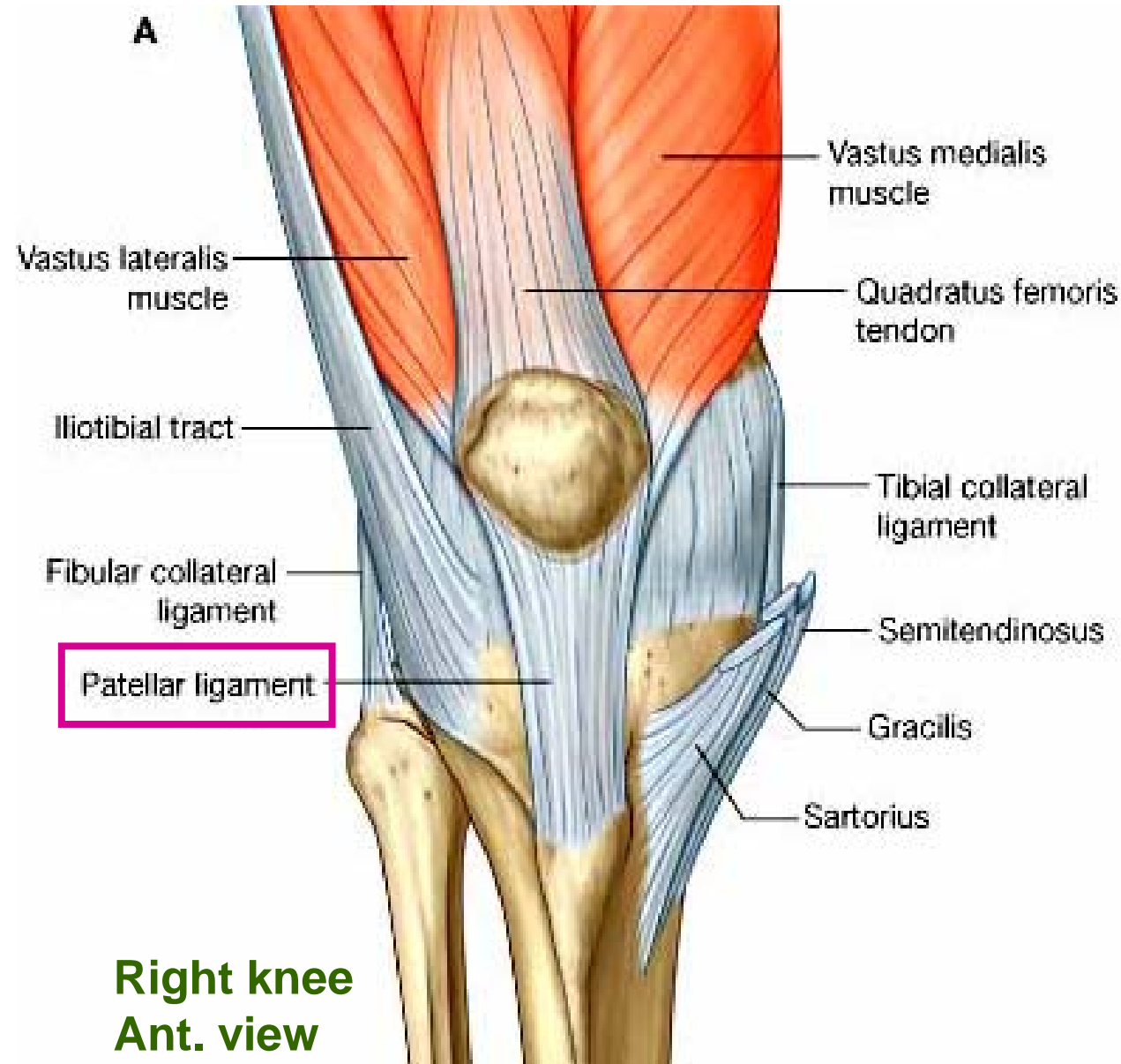
# Knee Joint

- Weight-bearing
- 3 joint compartments:
- 1) medial compartment: medial condyle (femur) + tibia
- 2) lateral compartment: lateral condyle (femur) + tibia
- 3) patella + femur



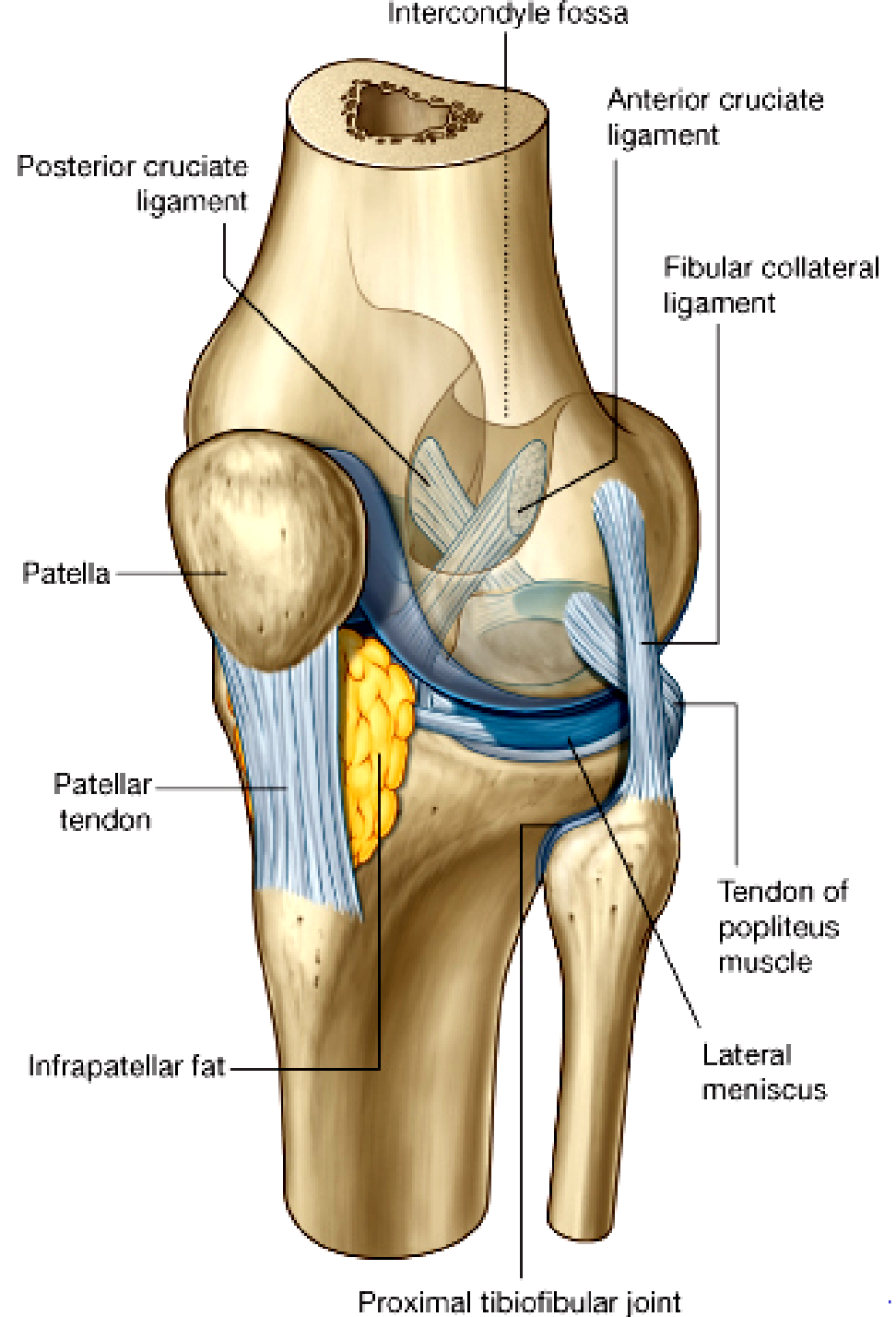
# Patella

- ligamentum patellae (patellar lig.)
- Continuation of quadriceps femoris tendon above to apex of patella, below to tibia tuberosity



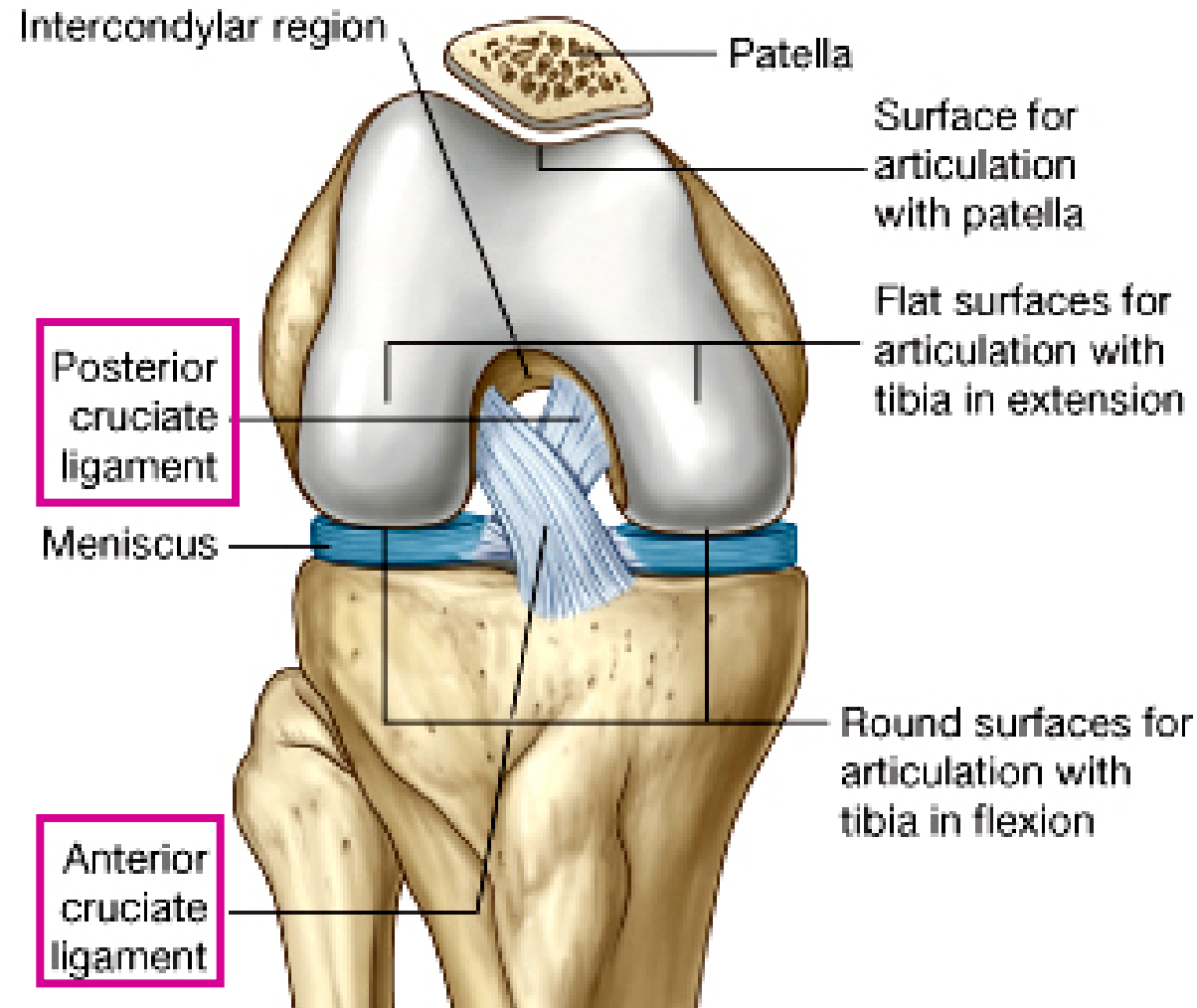
# Tibio-femoral joint compartment

- 4 ligaments:
- 1) **medial (tibial) collateral lig.**
- 2) **lateral (fibular) collateral lig.**
- 3) **ant. cruciate lig.**
- 4) **post. cruciate lig.**



# Cruciate ligaments (anterior view)

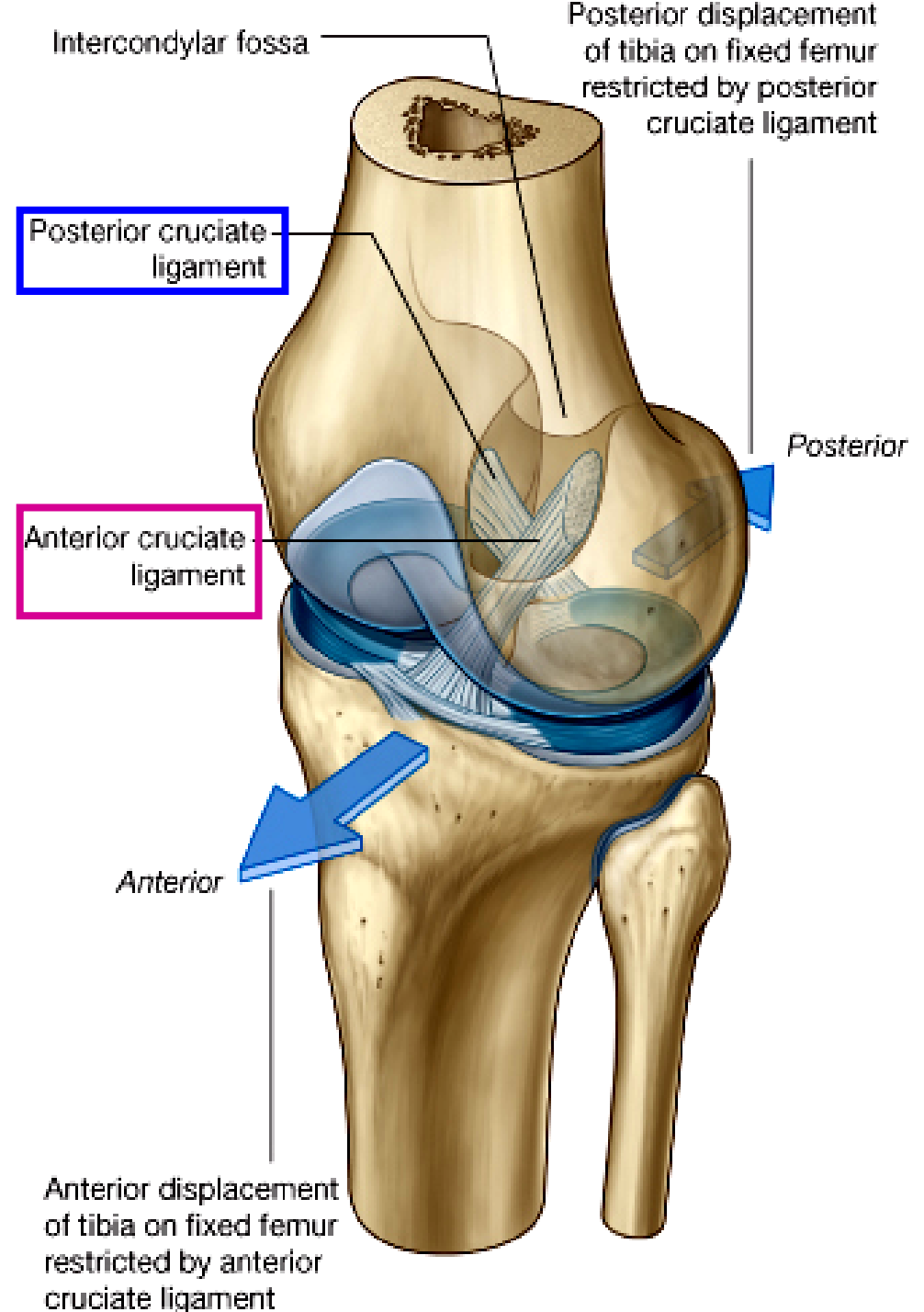
- ant. cruciate: ant. intercondylar area of tibia to lateral wall of intercondylar fossa of femur
- post. intercondylar area of tibia to medial wall of intercondylar fossa of femur
- (前外後内)



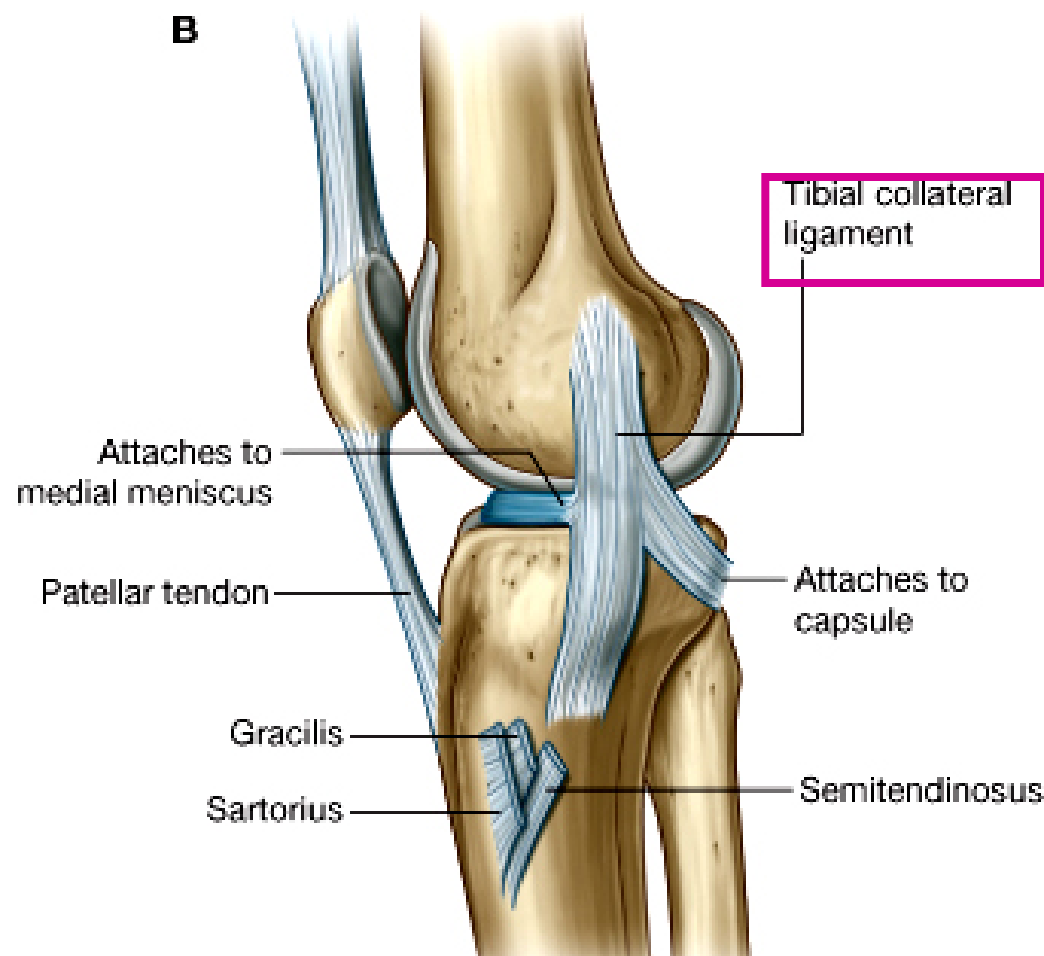
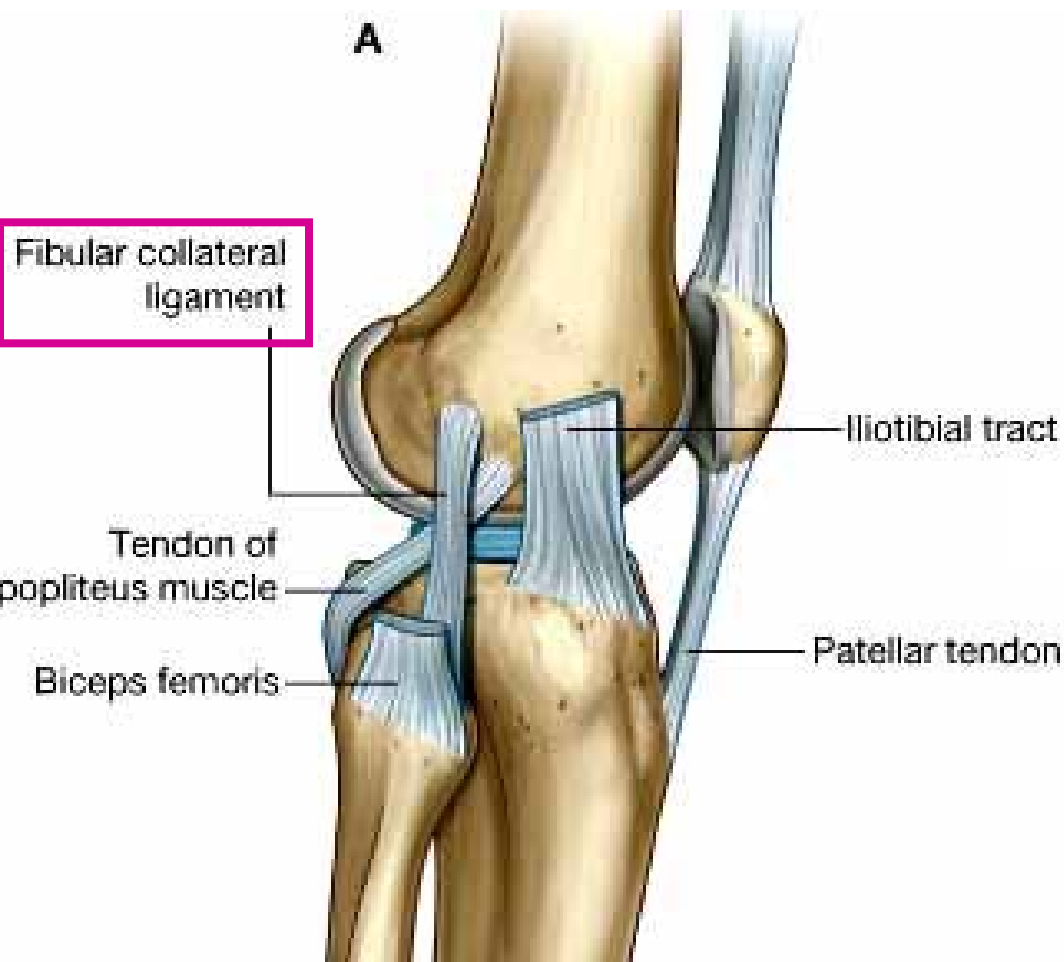


# Knee: cruciate ligaments

- interconnect femur and tibia
- ant. cruciate: ant. intercondylar area of tibia to lateral wall of intercondylar fossa of femur
- post. intercondylar area of tibia to medial wall of intercondylar fossa of femur
- limitations of extreme anterior and posterior displacements of tibia on fixed femur

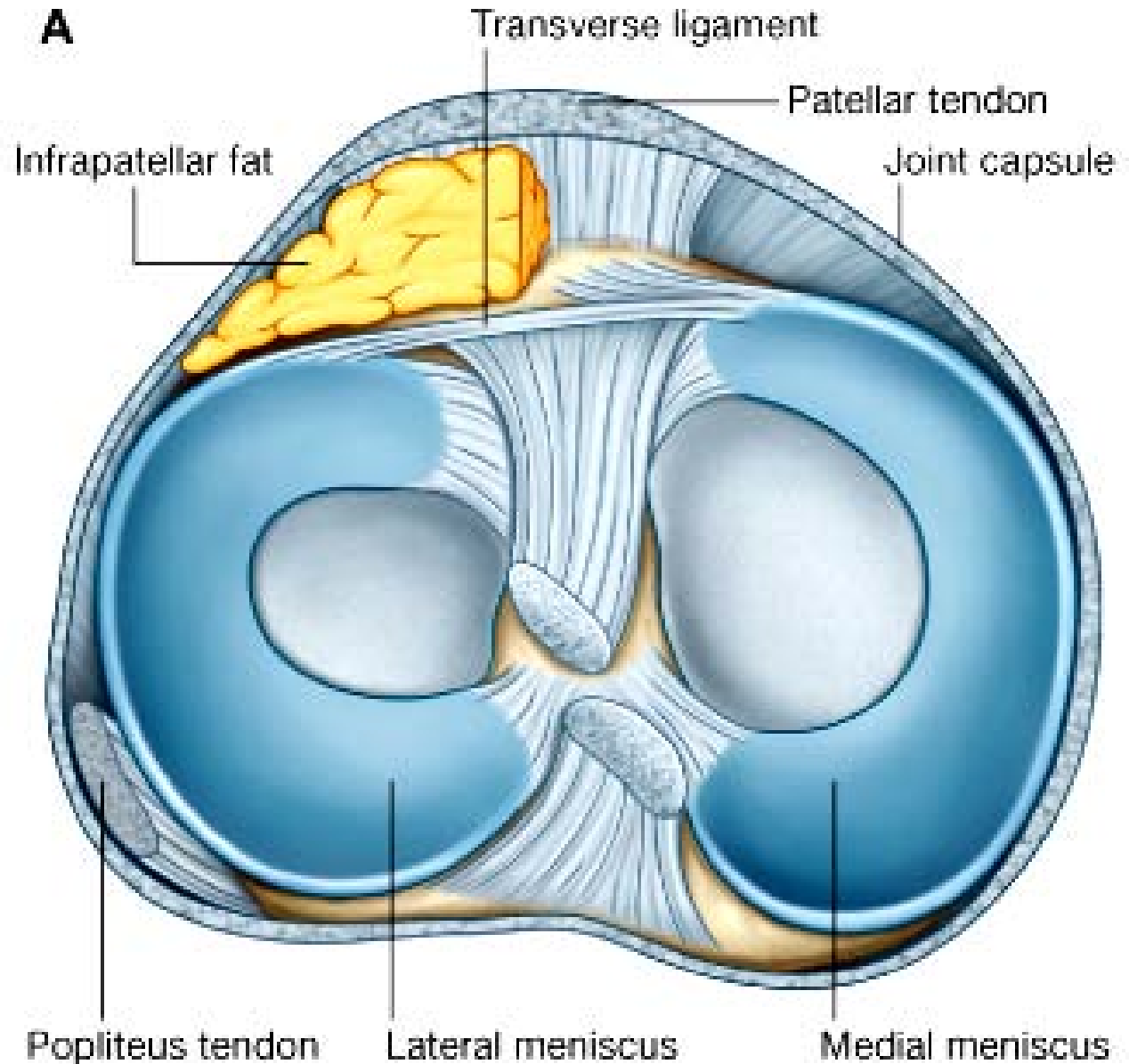


# Knee: collateral ligaments



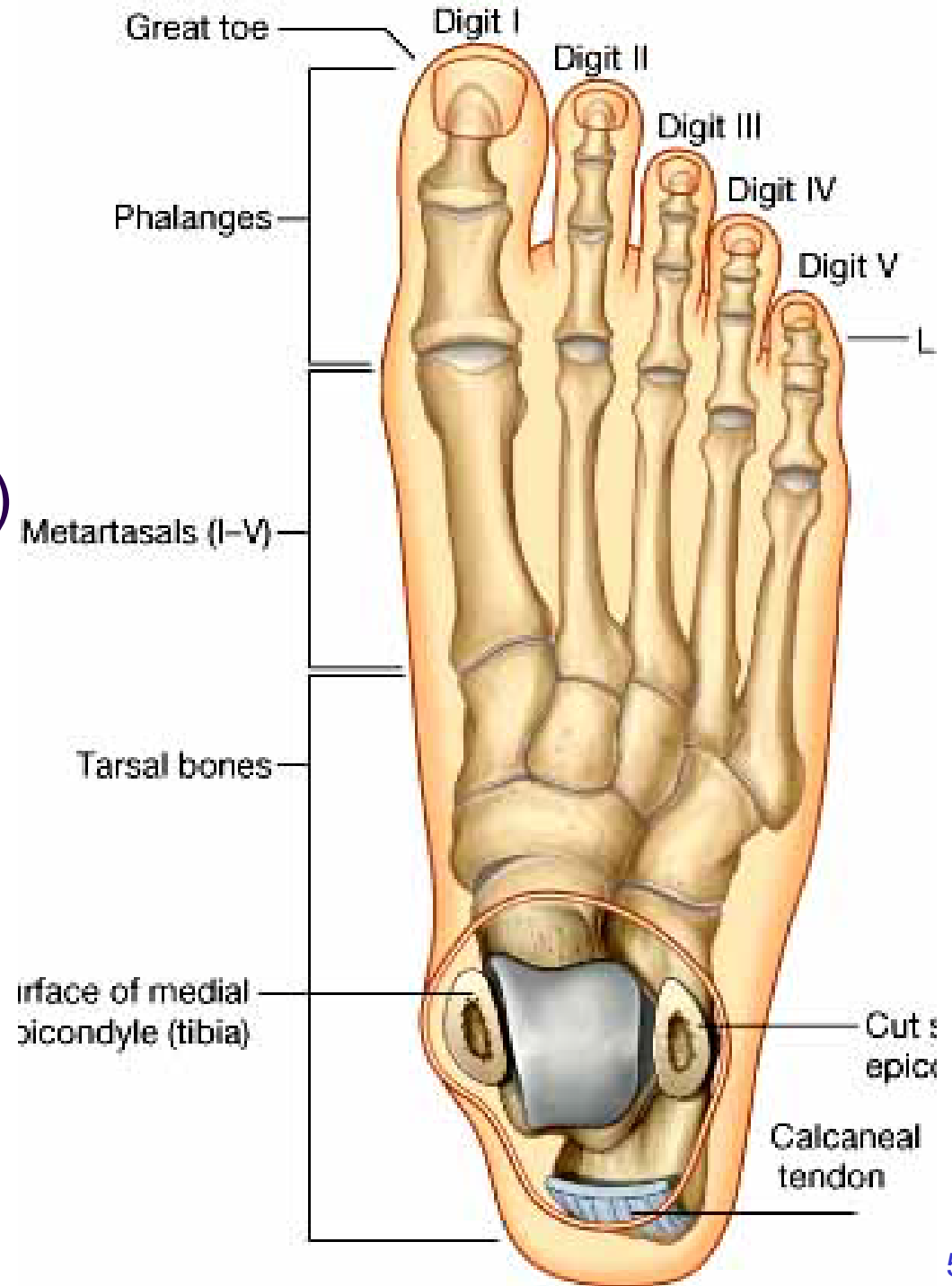
# Meniscus

- **Medial meniscus:** fibrocartilage; wide-C shaped; periphery attaches to joint capsule
- **Lateral meniscus:** more circular in shape



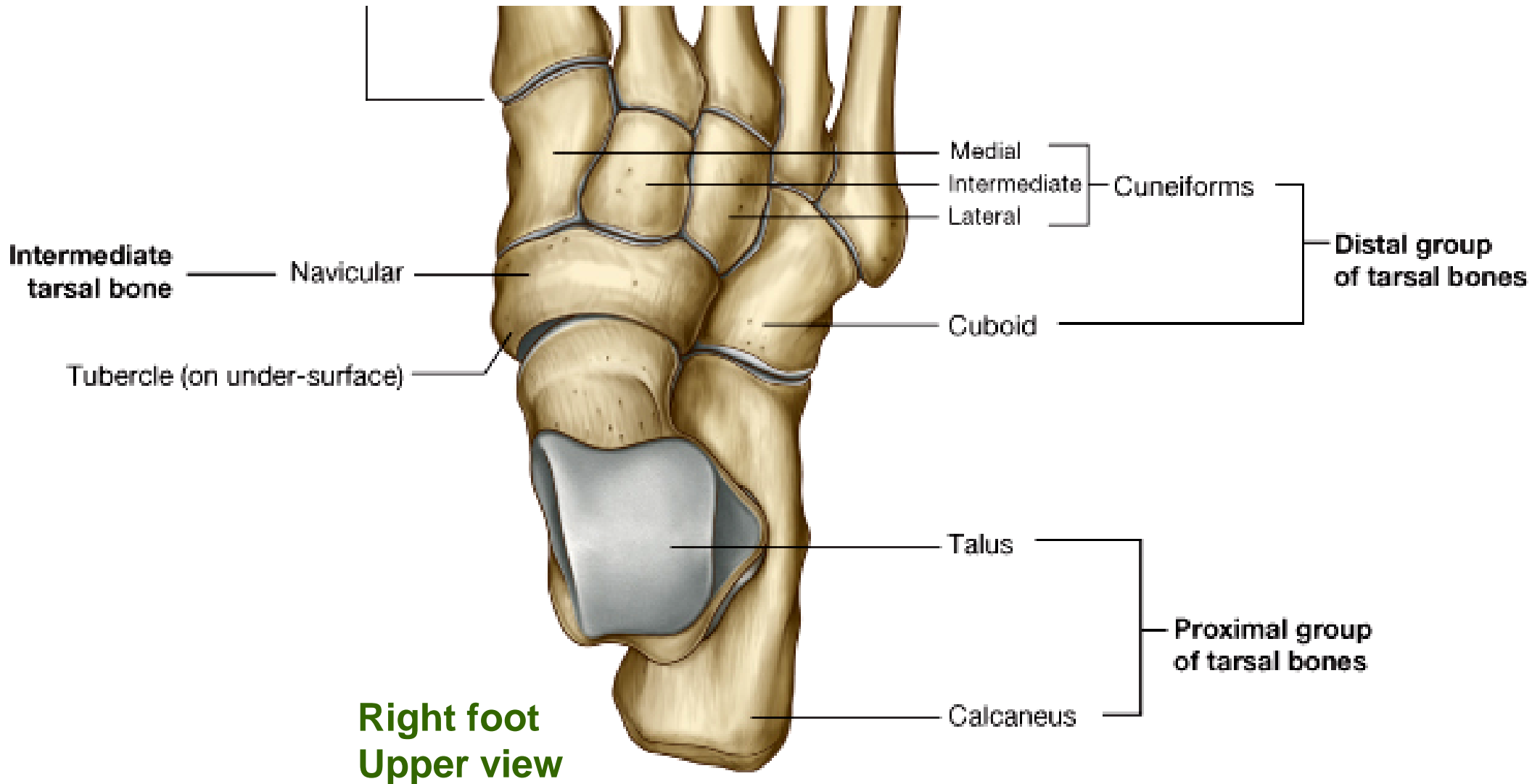
# Bones of the foot

- Tarsal bones
- Metatarsal bones
- Phalanges (pl. of phalax)



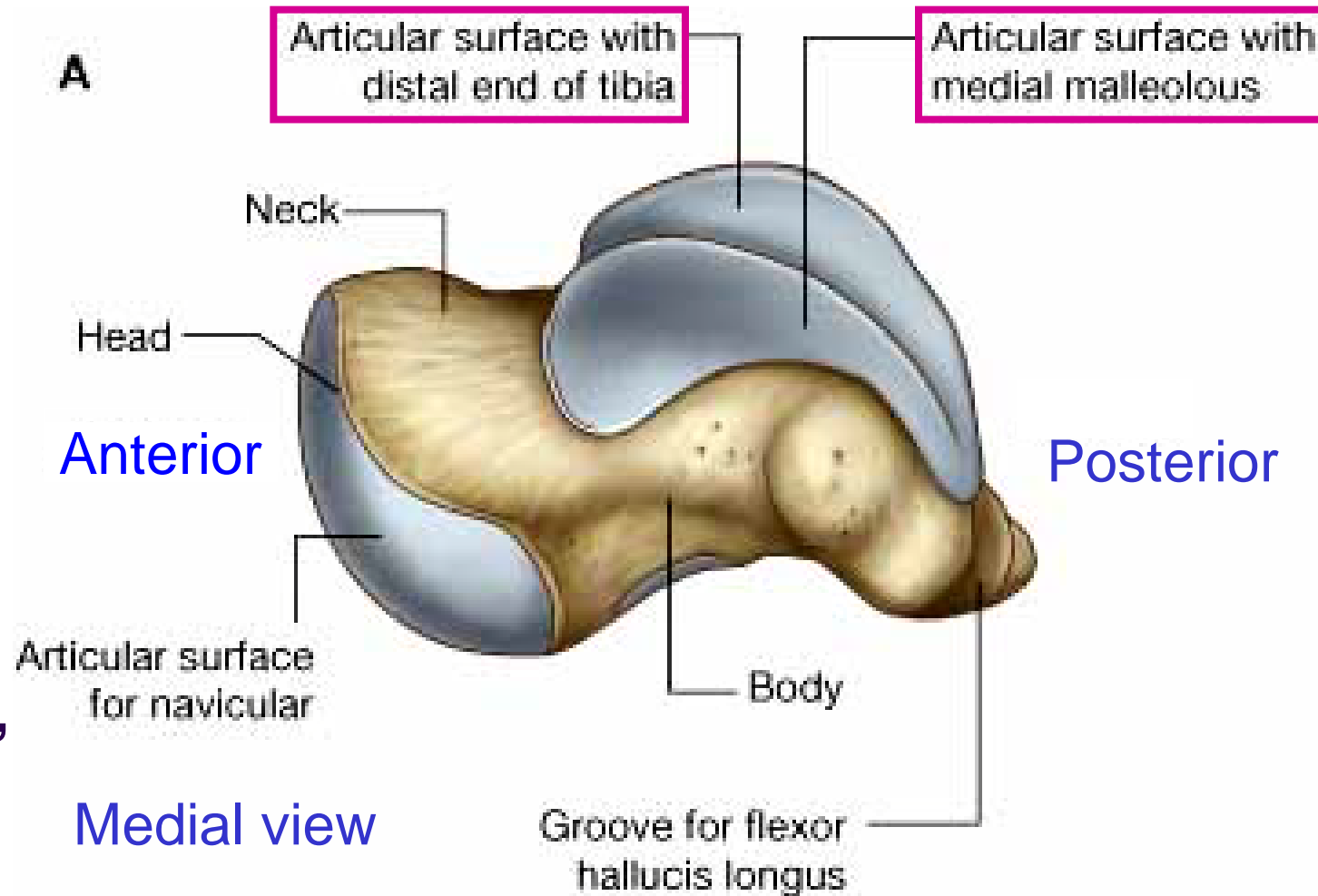
# Tarsal bones: proximal row

- Proximal row: Talus, Calcaneus (Calcaneum), Navicular



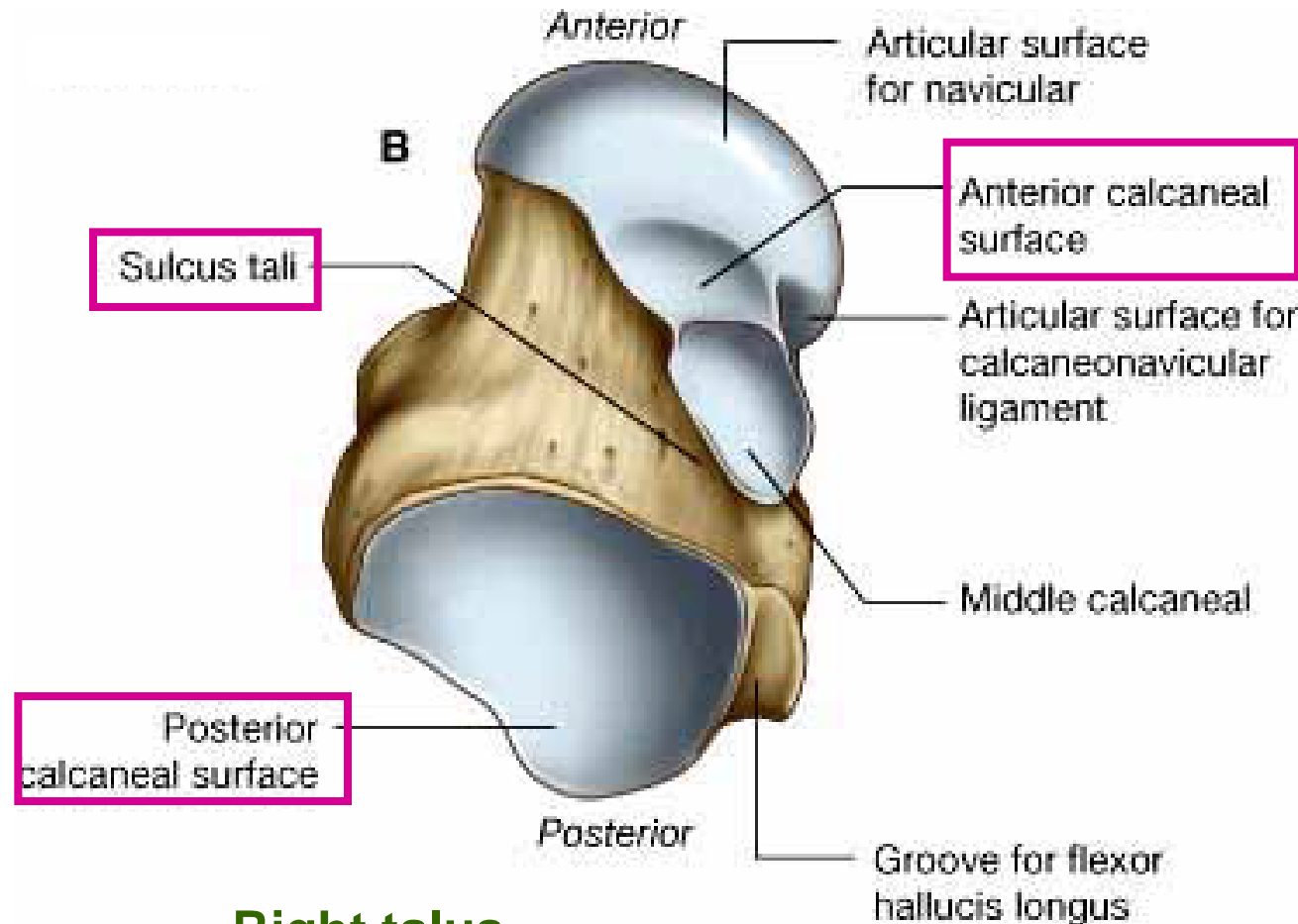
# Talus-1

- Head: articulate with Navicular
- Body
  - superior articular facet (trochlear) ↔ tibia
  - medial facet: smaller, comma-shaped ↔ medial malleolus
  - lateral facet: larger, triangular shape ↔ lateral malleolus



## Talus-2

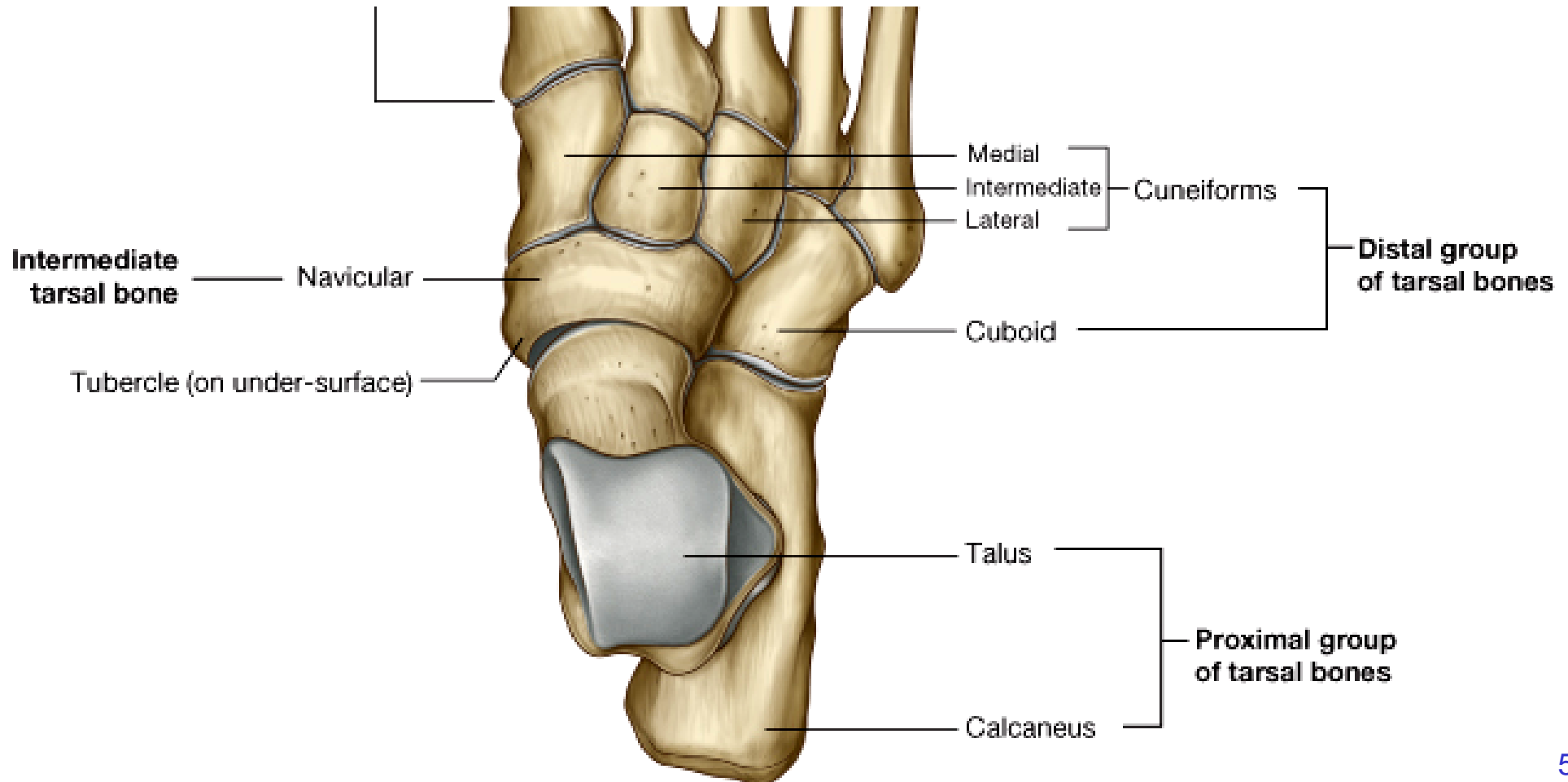
- Inferior surface: divided by **sulcus tali** (for interosseous lig.) into ant. & post. parts
- anterior part: 2 smaller facet  $\leftrightarrow$  Calcaneum
- posterior part: 1 large facet  $\leftrightarrow$  Calcaneus (**post. talocalcaneal joint**)



**Right talus  
Inf. view**

# Talus-3

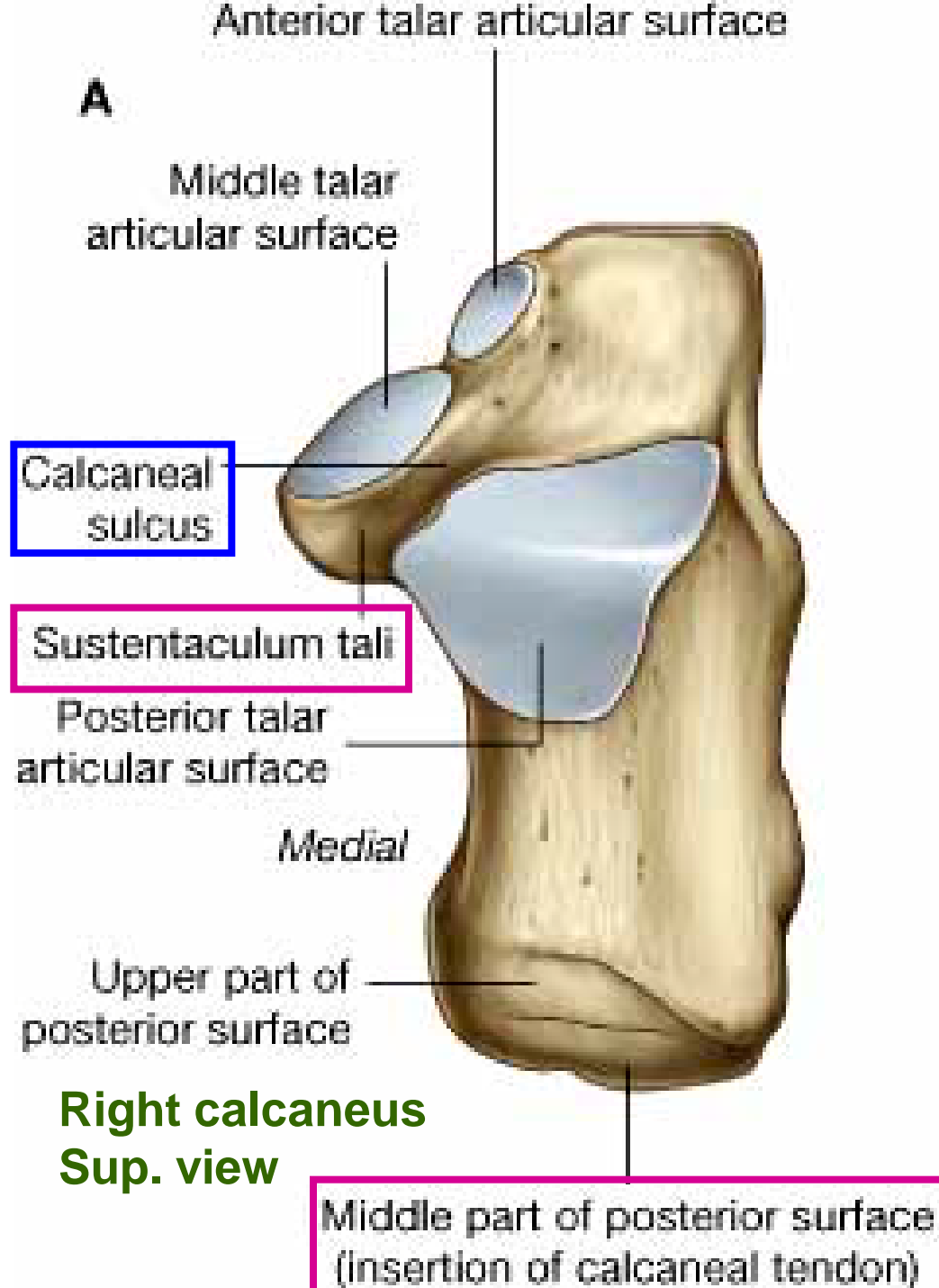
- transfers body weight
- postero-inferiorly to calcaneum which relays it to ground
- antero-inferiorly to calcaneum and navicular, through which to distal row of tarsus and metatarsus





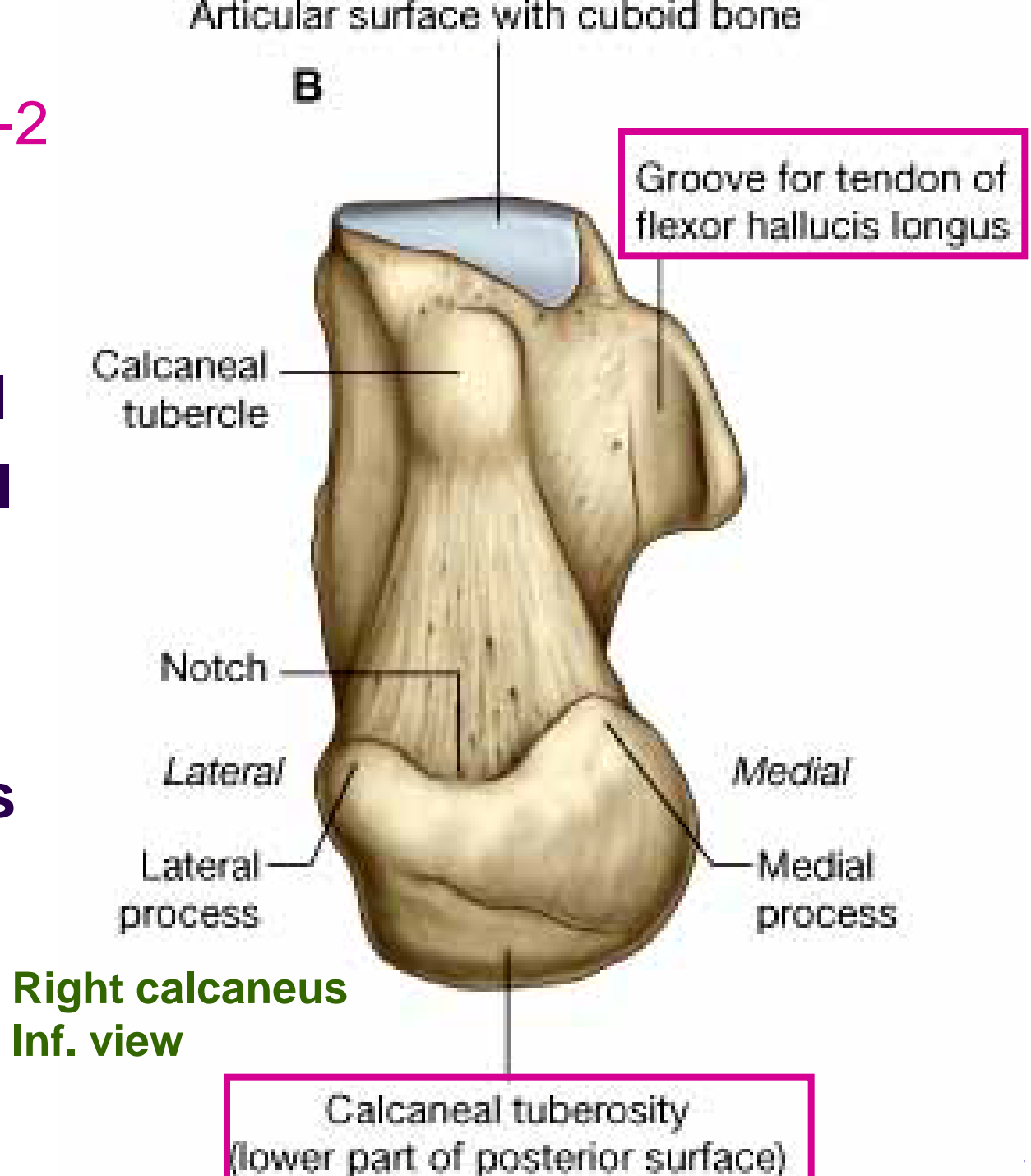
# Calcaneus (Calcaneum)-1

- heel of foot, transfer weight to ground
- **Talar shelf (sustentaculum tali):** projection on medial side
- superior surface:
  - **posteriorly: large facet for post. talocalcaneal joint**
  - **middle and anterior facets for talus (in front of sulcus calcanei)**
- ant. surface for Cuboid
- **insertion of calcaneal tendon (Achilles tendon)**
- **groove for tendon of flexor hallucis longus** on its undersurface



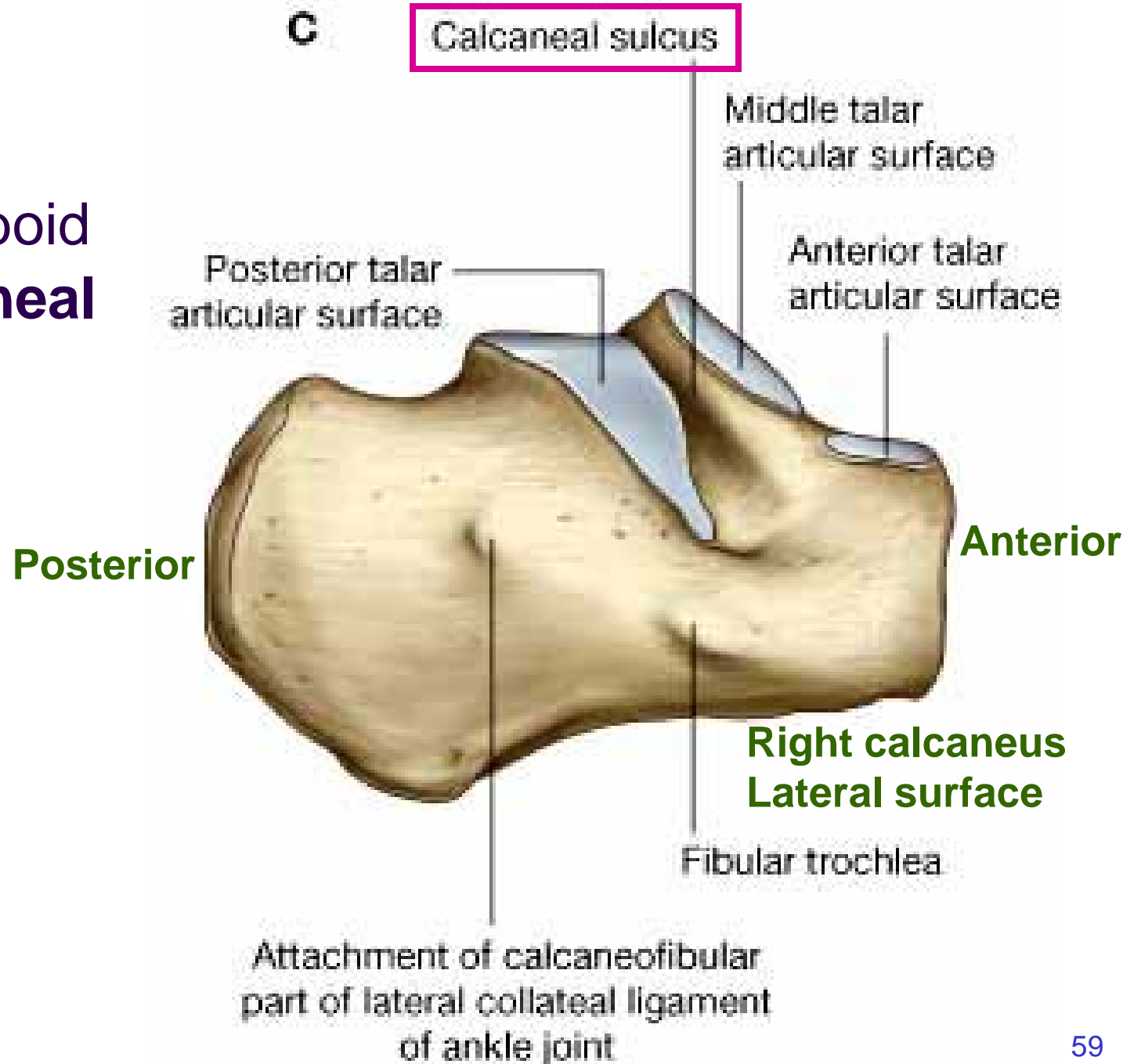
## Calcaneus (Calcaneum)-2

- **calcaneal tuberosity**
- ant. surface for Cuboid
- **insertion of calcaneal tendon (Achilles tendon)**
- **groove for tendon of flexor hallucis longus** on its undersurface



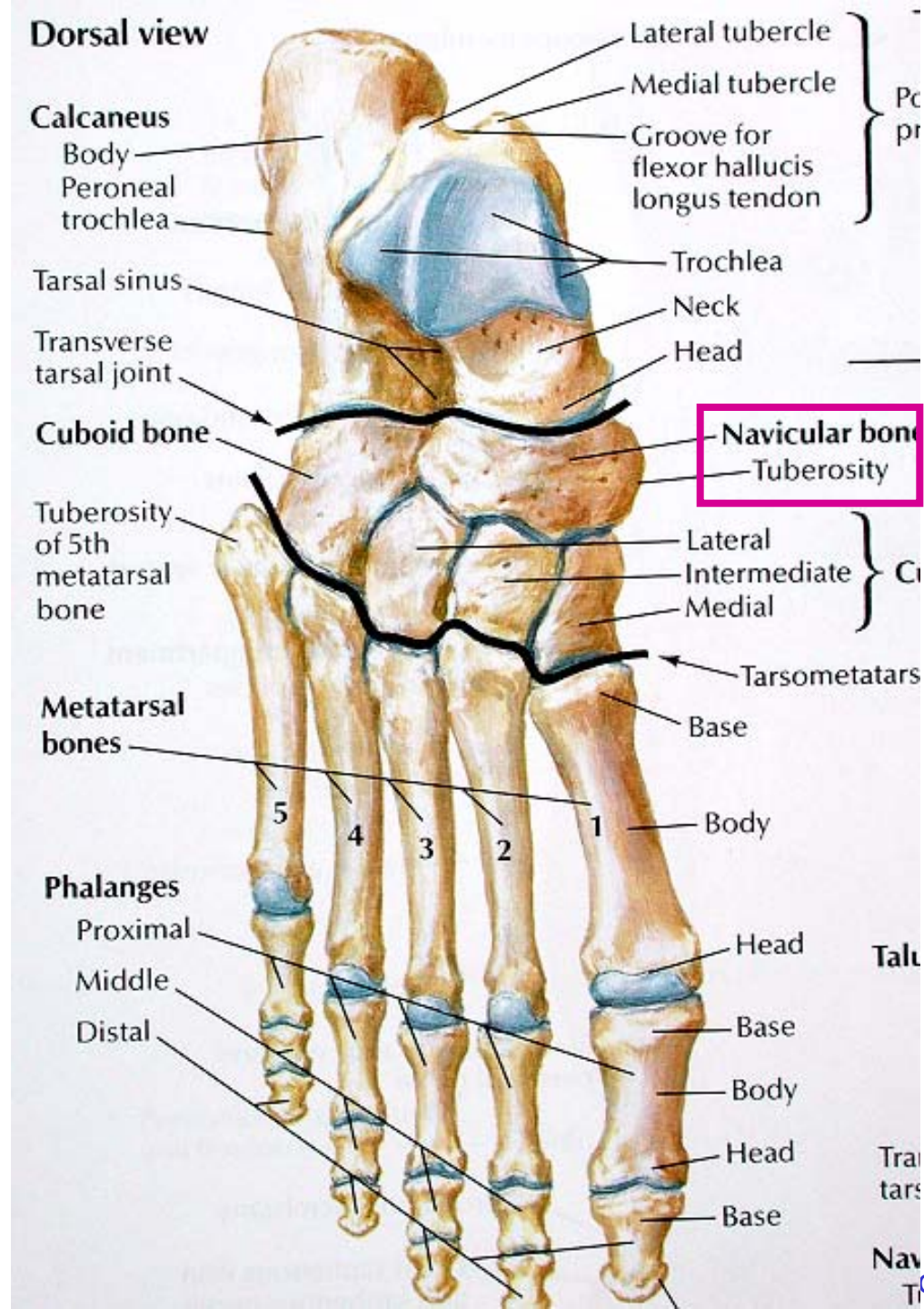
# Calcaneus-3

- Calcaneal sulcus
- ant. surface for Cuboid
- **insertion of calcaneal tendon (Achilles tendon)**



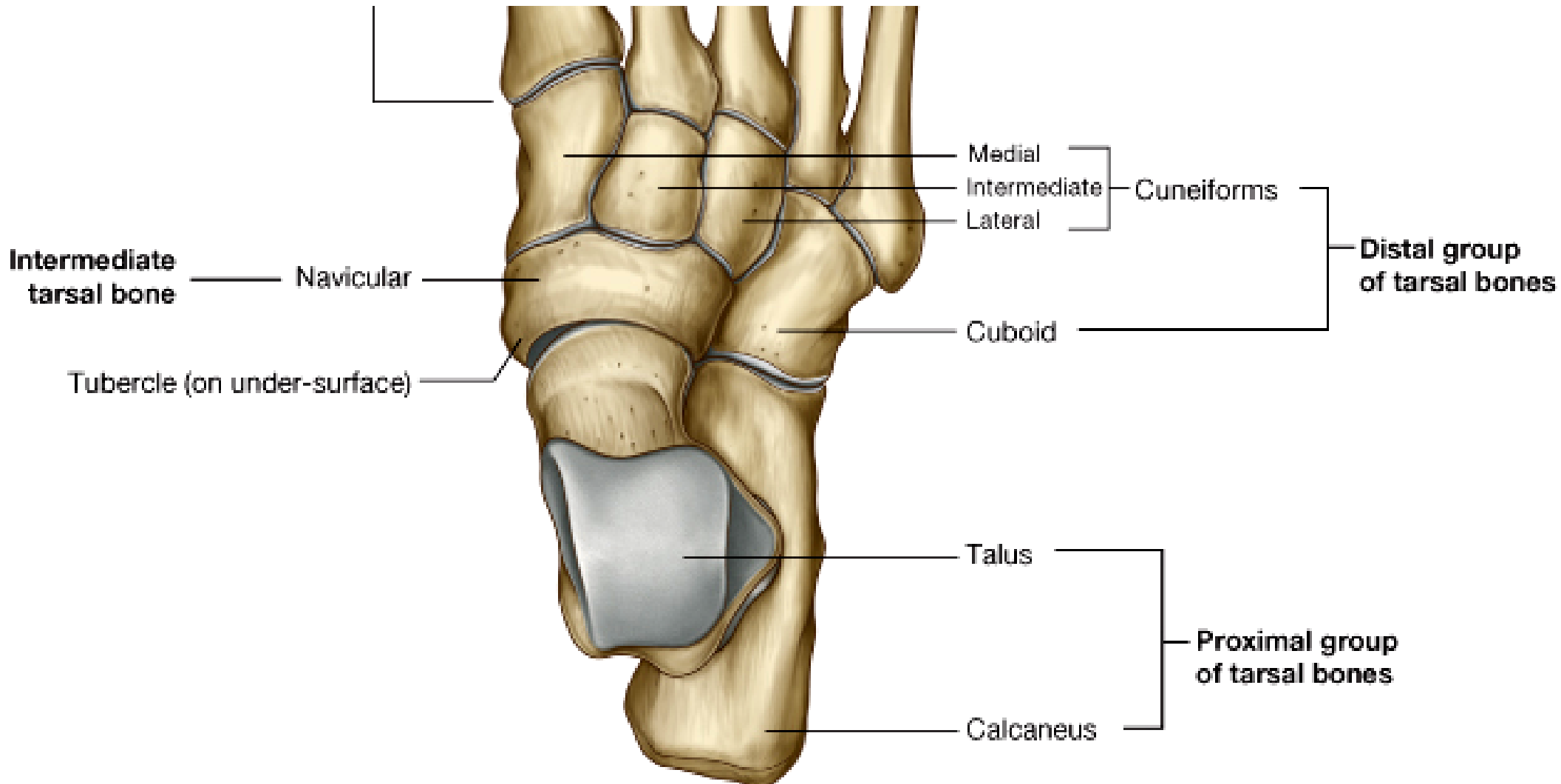
# Navicular bone

- between head of talus and distal row of 3 cuneiform bones
- **tuberosity:** attachment of Tibialis posterior



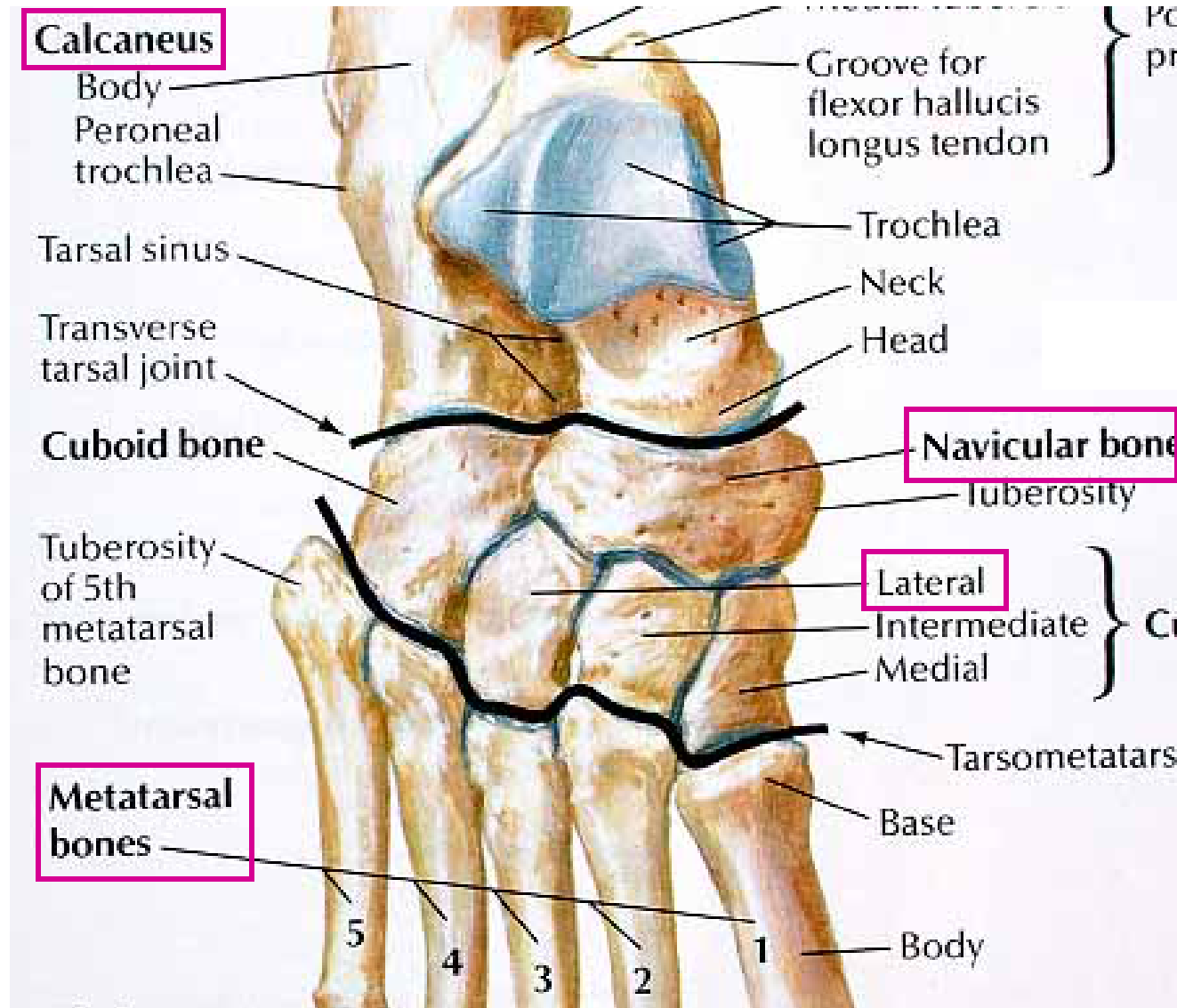
# Tarsal bones: distal row-1

- Distal row: Cuboid + 3 Cuneiform bones



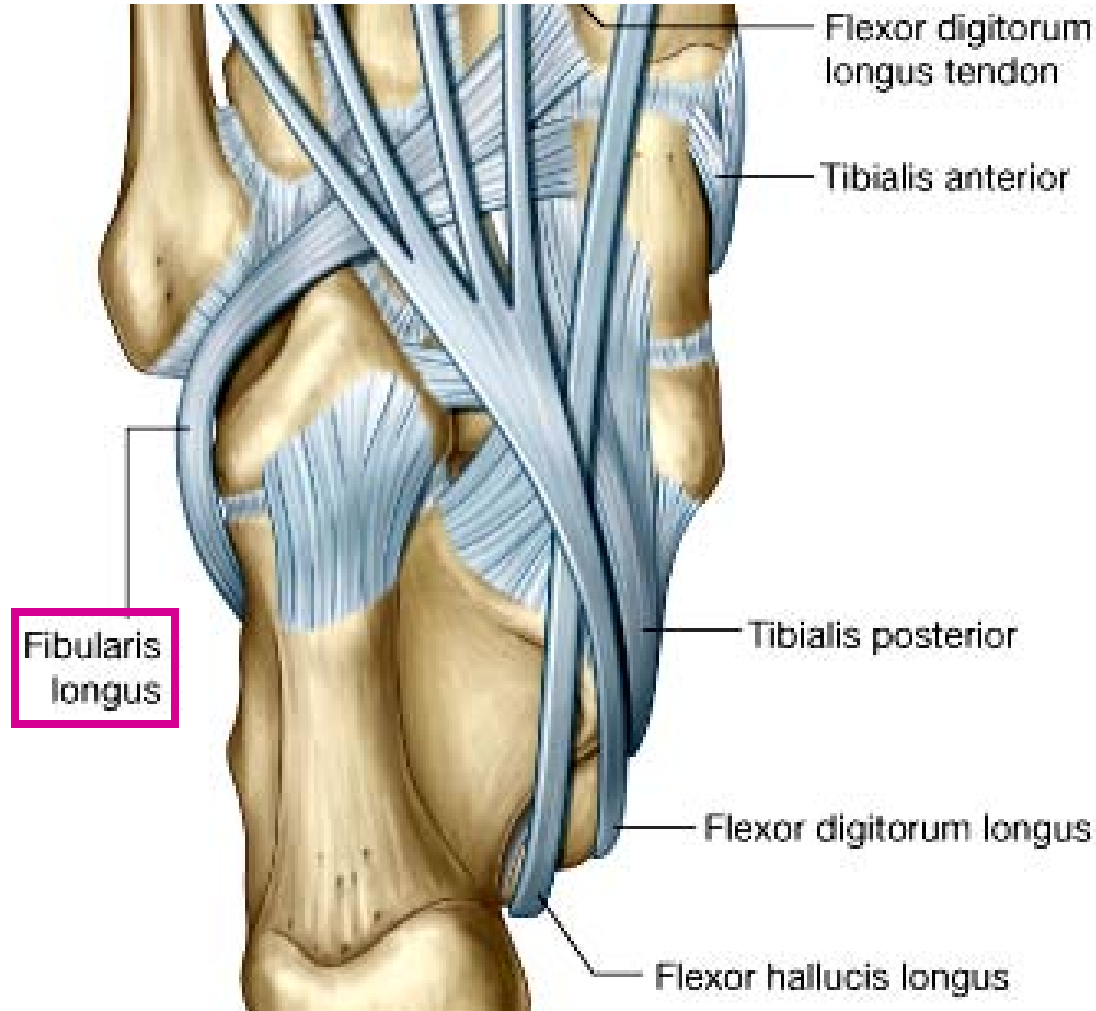
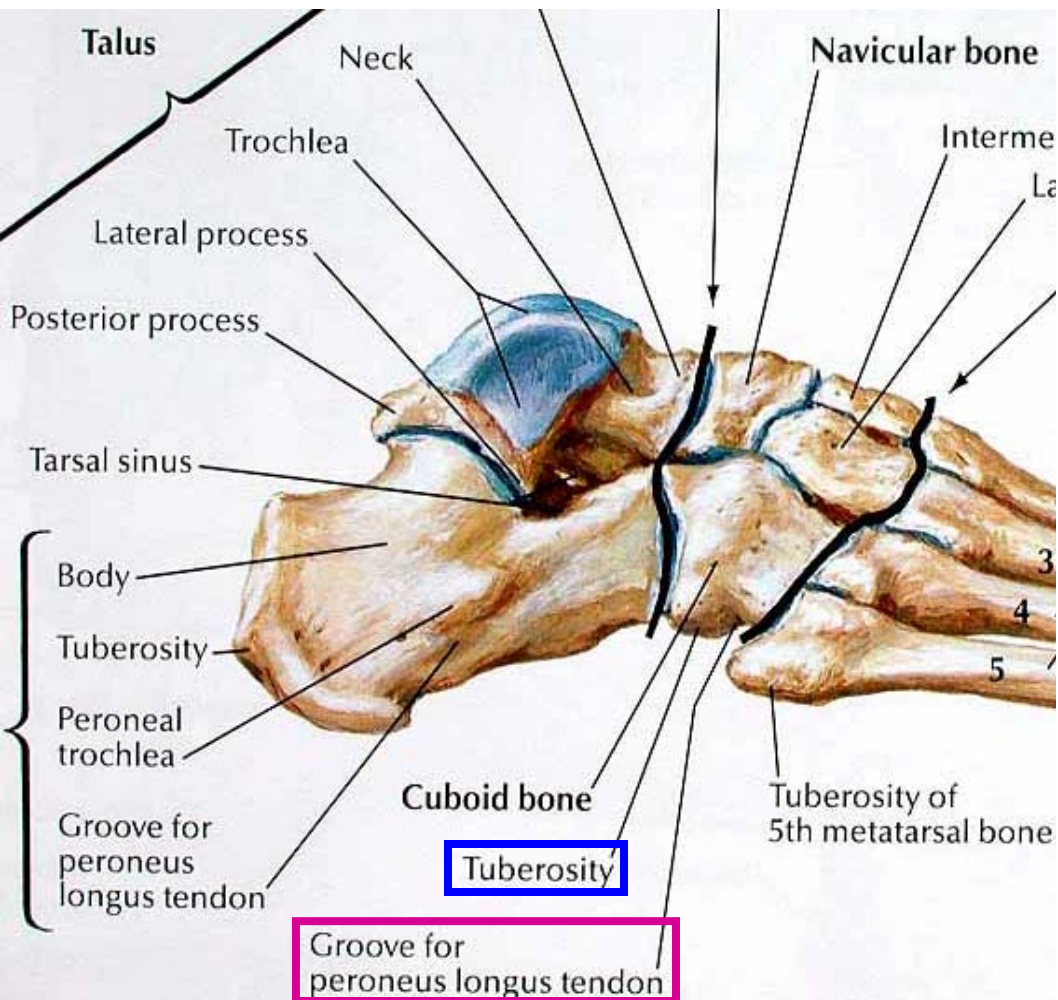
# Cuboid

- ant. surface: for 4th, 5th metatarsals
- proximal: articulate with calcaneum
- medial: with navicular & lateral cuneiform



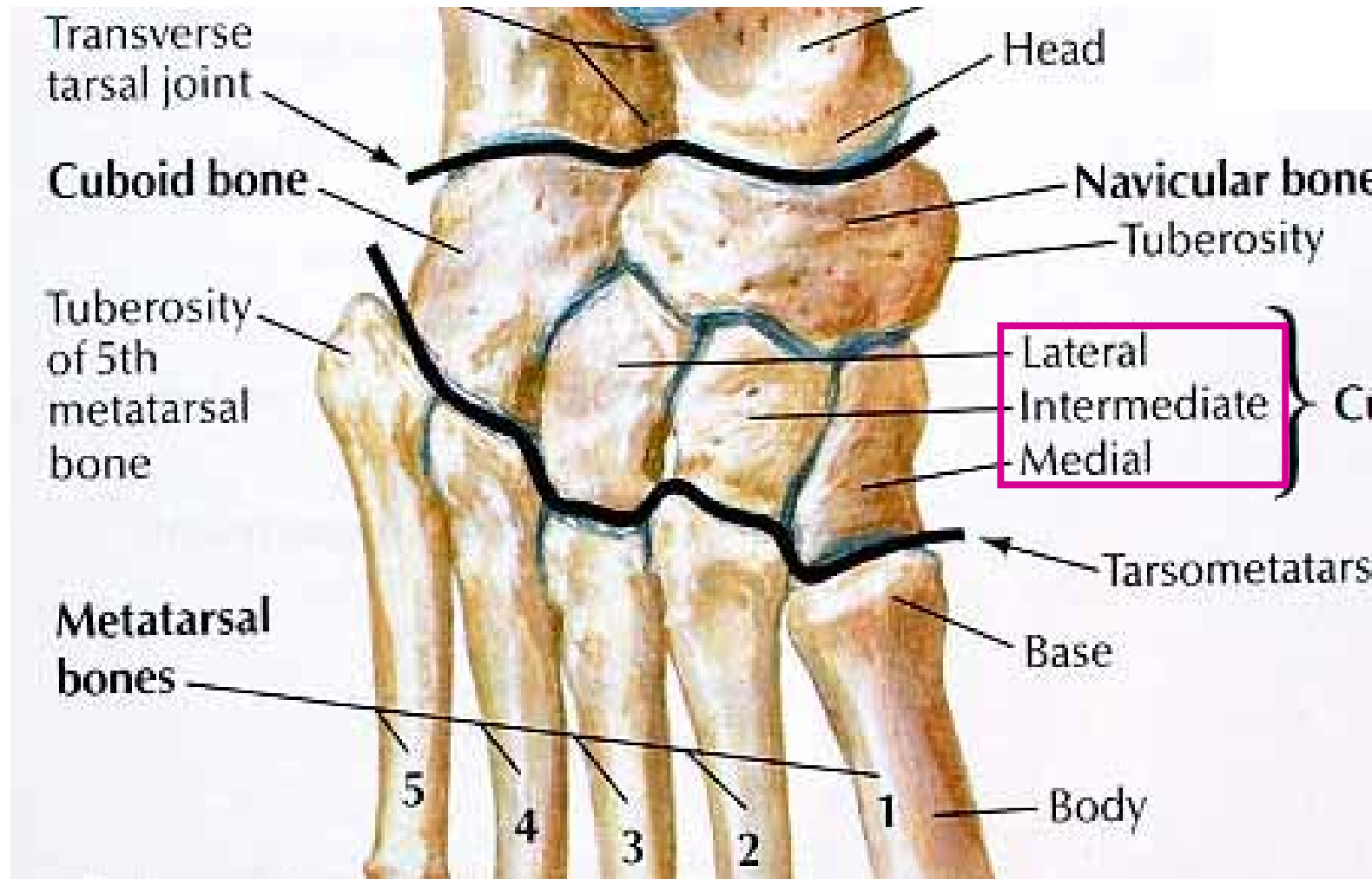
# Cuboid-2

- Lateral surface: tuberosity
- groove for fibularis (peroneus) longus tendon on underside



# Cuneiforms (Latin: wedge)

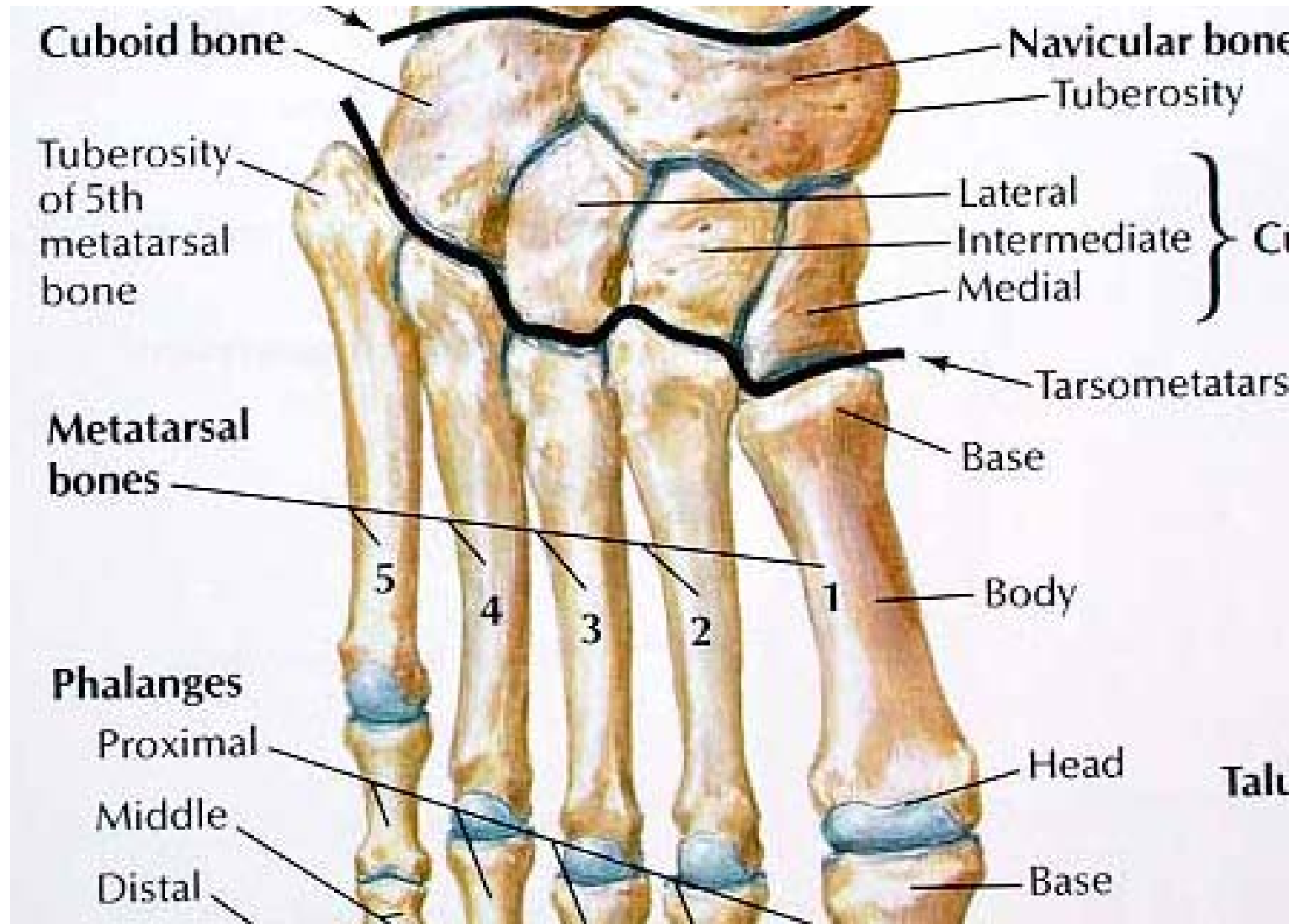
- cuneiforms:
  - med.
  - Intermediate
  - lat.
- medial: largest
- proximal: navicular bone
- distal: metatarsus 1-3





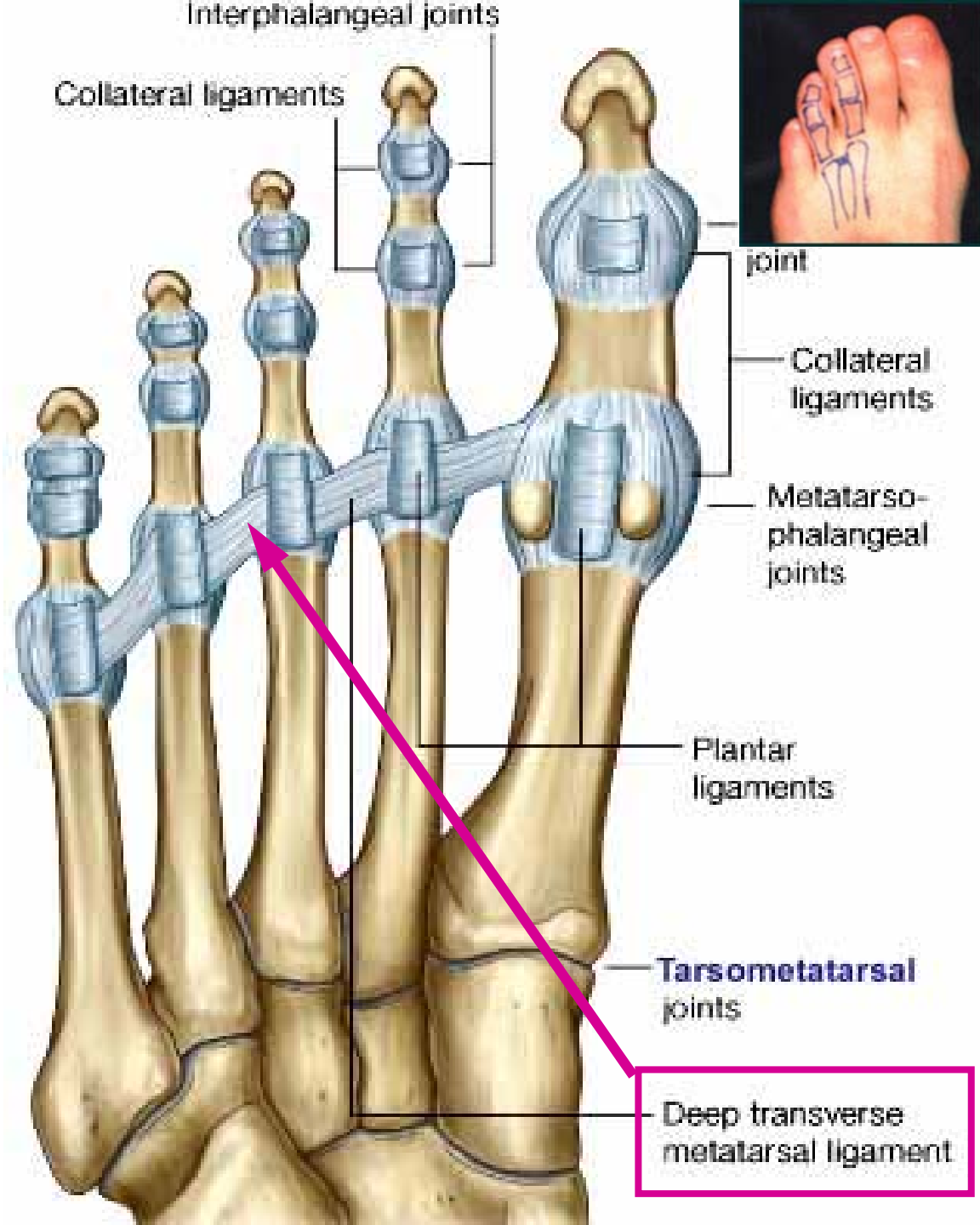
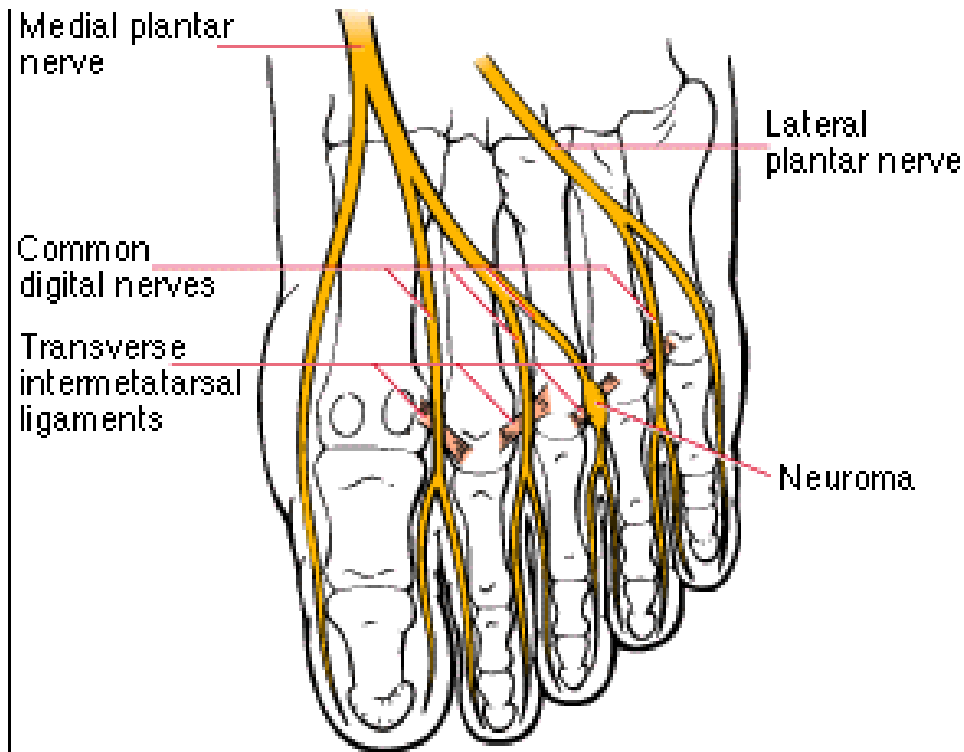
# Metatarsus-1

- all metatarsals in the same plane (different from hand)?
- Base
- Body
- Head (distal end)



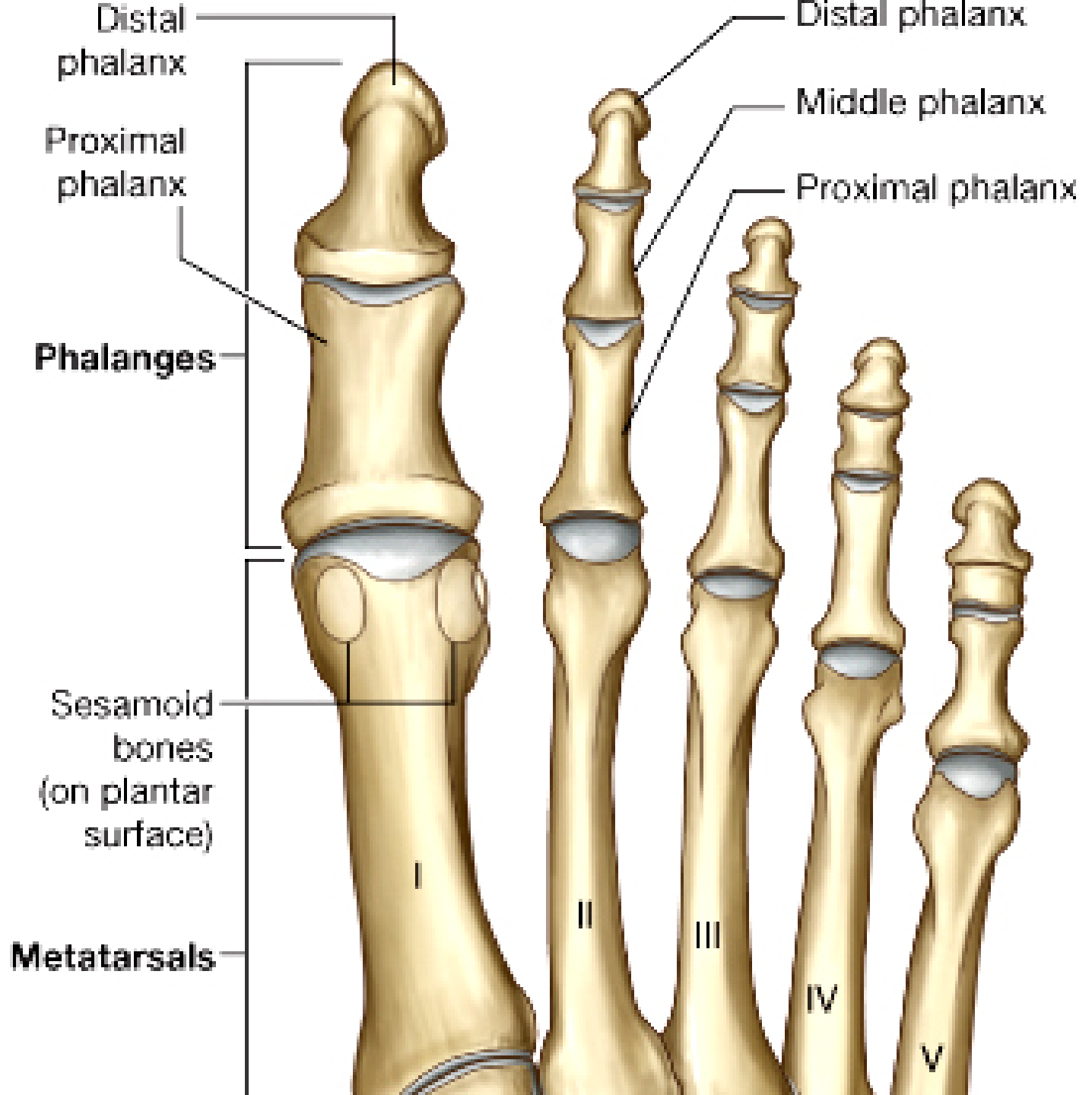
# Metatarsus-2

- (deep) transverse (inter)metatarsal lig. links heads (distal end) of metatarsals



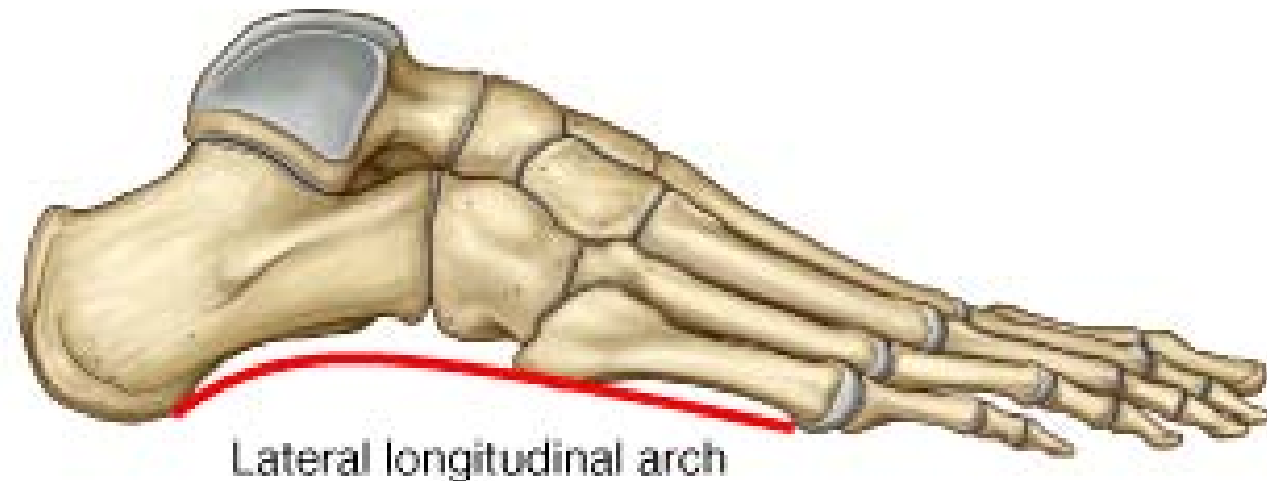
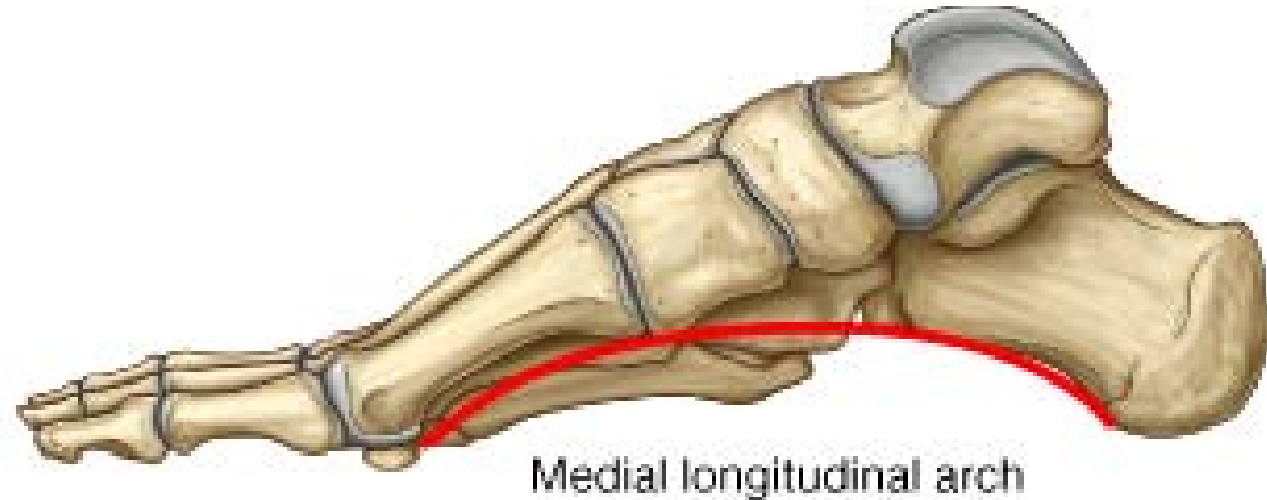
# Phalanges

- Big toe: proximal and distal phalanx
- 2<sup>nd</sup>-5<sup>th</sup> toe: proximal, middle, distal phalanx



# The arches of the foot: longitudinal arch

- medial view:
  - ant.: head of metatarsals on the ground
  - post.: calcaneal tuberosity (tuber calcanei) on the ground
- lateral view: lower longitudinal arch; apex at the ant. part of calcaneum



## The arches of the foot: transverse arch

- obvious at the distal row of tarsal bones,
- cuboid (laterally) close to ground; medially, medial cuneiform off the ground
- movement (of foot at ankle): dorsiflexion/plantar flexion; inversion/eversion



Transverse arch

