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)

- ant. sup. iliac spine: a.s.i.s.
- post. sup. iliac spine: p.s.i.s.
- Iliac crest: a.s.i.s. – p.s.l.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

- 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
• **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)
Pubis: 1

- body of pubis
- pubic crest
- public 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.)
Iliopubic eminence

Right pelvis
Ant. view
Pubis: external

- acetabulum: acetabular notch, limbus
- Gluteal line
  - Anterior
  - Posterior
  - Inferior

Right pelvis
Post. view
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
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 foramen

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

Greater sciatic foramen
Sacrospinous ligament
Lesser sciatic foramen

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: 135°
Angle of inclination in adult: 126°
Angle of inclination in old age: 120°

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
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

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![Diagram of right leg bone (fibula/tibia) with labels for medial malleolus and grooves for tendons](image-url)
Tibia: with Talus

- **inferior articular facet for talus (trochlea)**
Fibula: head

- Surface anatomy of fibular head
- Articular surface with tibia
- Apex of head (styloid process)
Fibula: distal end

- lateral malleolus
- articular facet for talus

Right fibula
Ant. view
Acetabulum

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

Right pelvis
Post. view
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; aiis, 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

(前外後內)
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

A. Fibular collateral ligament
   - Tendon of popliteus muscle
   - Biceps femoris
   - Iliotibial tract
   - Patellar tendon

B. Tibial collateral ligament
   - Attaches to medial meniscus
   - Patellar tendon
   - Gracilis
   - Sartorius
   - Semitendinosus
   - Attaches to capsule
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 ↔ Calcaneum
- **Posterior part**: 1 large facet ↔ Calcaneus (post. talocalcaneal joint)

![Right talus Inf. view](Bone: Lower limb - 55)
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

Right calcaneus
Inf. view
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\textsuperscript{nd}-5\textsuperscript{th} 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