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

Right pelvis
Post. view
• arcuate line: linea terminalis of pelvic brim
• below: pelvic part; lesser/true pelvis
• above: abdominal part; greater/false pelvis
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
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
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.

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

Right femur
Post. view
Right femur
Post. view

Femur: shaft

- gluteal tuberosity
- linea aspera (post. surface)
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
Tibia: distal end

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

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Right leg bone (fibula / tibia)
Ant. view

Right leg bone (fibula / tibia)
Post. view
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
Acetabulum

- Acetabular fossa
- Acetabular notch
- Articular (lunate) surface
- Ligaments
  - Transverse acetabular ligament
  - Ligament of femroal 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 $\rightarrow$ fovea of the head of femur

- surrounded by synovial sheath; conveys vessels in childhood

- minimal effect for strength
Acetabulum: Ligaments-1

- Iliofemoral lig.
  - inverted Y; alis, 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

Right foot
Upper view
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)
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$^{nd}$-5$^{th}$ 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