

Joints of the lower limb

Joints of the lower limb include the joint of the girdle of the lower limb (formed by the sacroiliac joint, pubic ligament, and pelvic ligaments) and the joint of the free lower limb (formed by the hip joint, knee joint, tibiofibular joint, fibrous disc, tibiofibular syndesmosis, and foot joints).

Connection of the girdle of the lower limb (juncturae cinguli membri inferioris)

Articulatio sacroiliaca (sacroiliac joint) [edit | edit source]

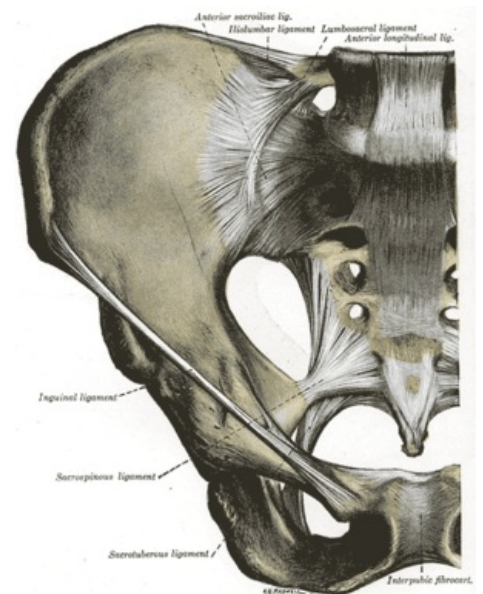
- **type of joint:** amphiarthrosis (stiff joint)
- **contact surfaces:** facies auricularis ossis sacri, facies auricularis ossis ilii
- **characteristics of joint surfaces:** curved, fibrous cartilage on the surface, hyaline cartilage in deeper layers
- **characteristics of the joint capsule:** short, stiff, strengthened by these ligaments:
 - anterior sacroiliac ligament
 - posterior sacroiliac ligament
 - sacroiliac interosseous ligament
 - iliolumbar ligament
- **movements:** anteroposterior, rocking, around the horizontal frontal axis at the level of the S2 vertebra
- **vessels and innervation:**
 - **arteries:** come from the iliolumbar artery, lateral sacral artery, superior gluteal artery, lateral sacral artery
 - **veins:** leave along the supply arteries
 - **nerves:** they come from the nn. sacrales, n. gluteus superior, n. obturatorius

Symphysis pubica (pubic clasp)

- very strong cartilaginous connection
- **contact surfaces:** facies symphysiales of both sides
- **formations:** discus interpubicus (cartilaginous filling of the gap between the facies symphysiales, 45 mm high in women, 50 mm in men)
 - eminentia retropubica - a low edge protruding from the disc backwards
- **ligaments:**
 - superior pubic ligament
 - ligamentum pubicum inferius - very strong

Pelvic ligaments

- fibrous connections
- **ligamentum inguinale:** false ligament, from spina iliaca anterior superior to tuberculum pubicum
- **ligamentum sacrospinale:** strong ligament, from the caudal part of the side of the os sacrum and from the os coccygis to the spina ischiadica
- **ligamentum sacrotuberale:** from the edges of the os sacrum and os coccygis to the tuber ischiadicum
- league sacrospinale and lig. sacrotuberale creates foramen ischiadicum **majus et minus** (passage for blood vessels and muscles)
- The piriformis muscle divides the ischiadicum majus into the suprapiriform **foramen** and the **infrapiriform foramen**
- **the membrana obturatoria** closes the foramen obturatum, for the passage of nerves and blood vessels, a **canal canalis obturatorius is created at the sulcus obturatorius**



Joint of the free lower limb (juncturae membri inferioris liberi)

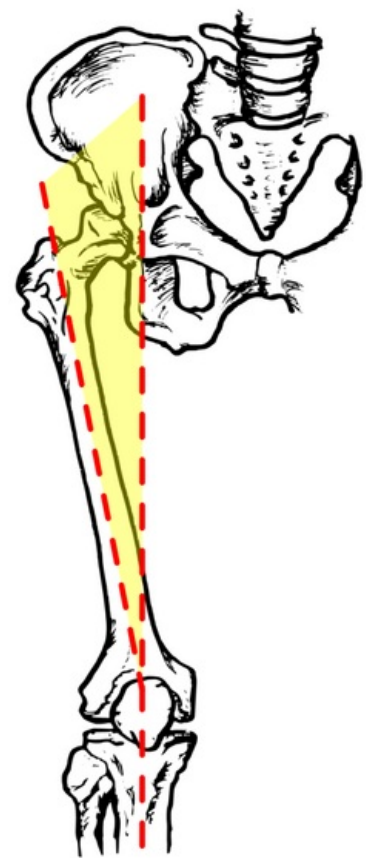
Articulatio coxae (hip joint) [edit | edit source]

- **joint type:** enarthrosis (restricted spherical joint)
- **articular surfaces:**
 - **head:** part of caput femoris with articular cartilage
 - **socket:** acetabulum of the pelvic bone (contact surface - facies lunata only)

- **special formations of the socket:** pulvinar acetabuli ("fat cushion"), labrum acetabuli, ligamentum transversum acetabuli
- **characteristics of the joint capsule:** beginning at the edges of the acetabulum, attachment to the collum femoris (in front, the linea intertrochanterica outside, behind the crista intertrochanterica outside the joint capsule), strengthened by the following ligaments:
 - ligamentum iliofemorale (strongest ligament in the body; terminates the extensor in the joint)
 - ligamentum pubofemorale (restricts abduction and external rotation)
 - ligamentum ischiofemorale (limits adduction and internal rotation)
 - zona orbicularis (ring of ligaments)
 - ligamentum capitis femoris
- **other formations:** bursa iliopectinea (between the iliopsoas muscle and the os coxae)
- **basic joint position:** upright posture
- **medium joint position:** medium flexion with slight abduction and little external rotation
- **movements:** flexion and extension, abduction and adduction, rotation
- **vessels and innervation:**
 - **arteries:** hl. branches from a. glutea superior et inferior, a. obturatoria, aa. circumflexae femoris, medialis et lateralis, a. pudenda interna, a. iliaca externa, a. femoralis, a. profunda femoris, a. perforans I
 - **veins:** leave along the supply arteries
 - **nerves:** from n. femoralis, n. obturatorius, n. ischiadicus, n. n. gluteus superior

Articulatio genus (knee joint)

- **joint type:** compound
- **articular surfaces:**
 - **head:** condyles femoris
 - **fossa:** facies articularis superior on the condyles of the tibia + meniscus
 - **other contact surfaces:** facies articularis patellae with two facets, facies patellaris femoris
- **characteristics of joint surfaces:**
 - **condyli femoris:** characteristic curvature, greater curvature than the articular surfaces of the tibiae
 - **condyli tibiae:** almost flat
- **characteristics of the joint capsule:** firm, distinct fibrous and synovial layer; attachment at the edges of the articular surfaces on the tibia and patella and farther from the edges of the articular surfaces on the femur, the epicondyles of the femur lie extra-articularly
 - **recessus suprapatellaris** - allows the capsule to bend anteriorly above the patella
 - strengthened by these ligaments:
 - **collateral ligaments (ligamenta collateralia)** - stabilization of the joint during extension and partial flexion
 - ligamentum collaterale tibiale - flat ligament, leads from the medial epicondyle of the femur to the outer surface of the condyle of the tibia
 - ligamentum collaterale fibulare - leads from the lateral epicondyle of the femur to the head of the fibula
 - **ligaments in front:**
 - ligamentum patellae (continuation of the quadriceps femoris tendon)
 - retinacula patellae (on the sides of the patella)
 - **ligaments at the back:**
 - ligamentum popliteum obliquum
 - popliteal arcuate ligament
 - **intra-articular ligaments:**
 - ligamenta cruciata genus (crossed knee ligaments) - an important role for fixation and stabilization of the joint, connects the femur to the tibia
 - anterior cruciate ligament
 - ligamentum cruciatum posterius - stronger than anterior
 - ligamentum transversum genus - connects the menisci to each other, is located in the fatty plica alaris
 - ligamentum meniscomemorale posterius et anterior - attach the menisci to the surrounding structures
 - **other formations:** near the joint there are a lot of weight pouches, **bursae mucosae**, because there is a lot of friction and pressure in many places (e.g. bursa infrapatellaris profunda, bursa subcutanea tuberositas tibiae); weight pouches also communicate directly with the joint cavity (e.g. bursa suprapatellaris)
 - **characteristics of the joint cavity:**
 - spacious; complicated shape
 - **synovial membrane:** covers the inner surface of the fibrous capsule, the cruciate ligaments and the fat body under the patella (**corpus adiposum infrapatellare** ("Hoff's body")); it progresses from the back of the capsule to the tip of the patella, thus creating a sagittal septum - plica synovialis **infrapatellaris**, which extends in front to the sides in the **plicae alares**



Q angle

- **musculus articularis genus** : prevents the joint capsule from tightening
- **position of the femur in relation to the tibia (or vertical):**
 - **physiological abduction angle** (externally open, from vertical): 170-175°
 - **Q-angle** (to the vertical): max. 15° for women, max. 10° for men
- **basic joint position:** full extension ("locked knee")
- **medium position:** slight flexion (20-30°)
- **movements:** basic movement – flexion and extension
 - **flexion:**
 - **initial rotation:** "unlocking the knee" by loosening the cruciate ligaments
 - **rolling motion**
 - **sliding movement:** the condyles of the femur move backwards along the tibia together with the menisci
 - **extension:** same movements as flexion in reverse order
 - **combined rotation**
 - **slight independent rotation:** possible in partial flexion; internal and external
- **vessels and innervation:**
 - **arteries:** they come from the femoral artery, the popliteal artery and also the supply from the rete patellare network
 - **veins:** form a periarticular plexus, leave along the supply arteries
 - **nerves:** they come from the nerve trunks of the femoral nerve, the tibial nerve and the obturator nerve

Articulatio tibiofibularis

- **joint type:** articulatio plana (flat joint)
- **articular surfaces:**
 - facies articularis fibularis on the tibia
 - facies articularis capitis fibulae
- **characteristics of the joint capsule:** strong and short, reinforced by the following ligaments:
 - ligamentum capitis fibulae anterius
 - ligamentum capitis fibulae posterius
- **movements:** small-scale sliding movements
- **vessels and innervation:**
 - **arteries:** they come from the tibialis anterior artery, the popliteal artery
 - **veins:** along the supply arteries
 - **nerves:** they come from the common fibularis nerve

Membrana interossea cruris

- fibrous plate
- **connects:** margo interosseus tibia with margo interosseus fibula
- **function:**
 - the beginning of the deep muscles of the lower leg
 - mechanical prevention of mutual displacement of the lower leg bones

Syndesmosis tibiofibularis

- fibrous connection
- **connects:** distal ends of tibia and fibula
- articular cleft in front
- **strengthening:** ligamentum tibiofibulare anterius et posterius
- **meaning:** participates in the proper function of the ankle joint
- **vessels and innervation:**
 - **vessels:** they come from the anterior tibialis artery, the fibularis artery
 - **veins:** into the venous network of the external ankle and further along the supply arteries
 - **nerves:** they come from the fibularis profundus nerve, the tibial nerve

Articulatio talocruralis - ankle joint (upper tarsal joint)

Articulatio talocruralis (*upper tarsal joint, ankle joint*) is the joint in which the lower leg bones (tibia and fibula) articulate with the talus .

Joint type: compound pulley joint

Articulating surfaces: the fork-shaped fossa is formed by the articular surfaces on the distal part of the fibula and tibia , the head is formed by the trochlea tali and the articular surfaces on the sides of the talus

Joint sheath: it is clamped along the edge of the joint surfaces, the outer surfaces of the ankles are outside the joint + in front and behind it is weak and loose so that the movements of the joint are sufficient.

Lateral ligaments: they strengthen the sides of the case, they are fan-shaped, and in each position of the joint, at least one of the strips of the lateral ligament is stretched on both sides, thus ensuring the correct guidance of movement.

Ligamentum collaterale mediale (deltoideum) – has the shape of a triangle

- pars tibiotalaris anterior and posterior
- pars tibionavicularis
- pars tibiocalcanearis

Lateral collateral ligament

- ligamentum talofibulare anterior and posterior
- calcaneofibular ligament

Moves:

The trochlea tali is wider in front, so it tends to push the ankles apart when moving. The basic position is occupied by the joint while standing, from which plantar flexion (30–35°) and dorsiflexion (up to 20–25°) movements are possible. The range of movements on the live is increased by the movements of other joints in the forefoot. The middle position of the joint corresponds to the basic position.

Vessels and nerves of the joint:

- arteries from the rete articulare;
- n. fibularis profundus et superficialis, n. tibialis, possibly. n. plantaris medialis.

Lower phalanx joint

It consists of a posterior compartment (articulatio subtalaris) and an anterior compartment, which has a medial part (articulatio talocalcaneonavicularis) and a lateral part (articulatio calcaneocuboidea).

Articulatio subtalaris (talocalcanea)

Articular surfaces: between facies articularis talaris posterior calcanei and facies articularis calcanea posterior tali

Joint capsule: reinforced by external and interosseous ligaments

Articulatio talocalcaneonavicularis

Articular surfaces: the head consists of the caput tali and two articular surfaces on the lower surface of the talus, the socket consists of the navicular axis and two surfaces on the calcaneus

Strengthening ligaments:

- ligamentum calcaneonaviculare plantare
- ligamentum talonaviculare dorsale

Articulatio calcaneocuboidea

Low mobility joint.

Articular surfaces: between the calcaneus and cuboid

Combo moves:

- foot inversion – plantar flexion + adduction + supination
- leg eversion – dorsiflexion + abduction + pronation

Chopart's joint (articulatio tarsi transversa)

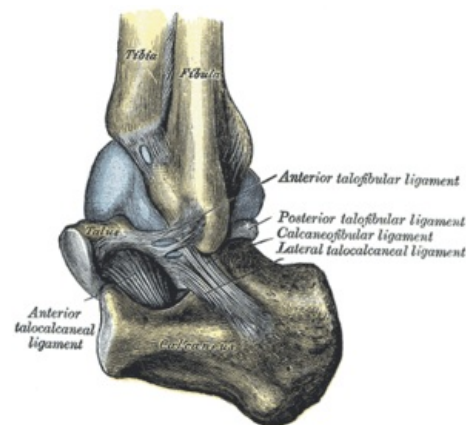
Functional and clinical unit of the lower ankle joint. It has the shape of the letter S. It is composed of the articulatio talonavicularis and calcaneocuboidea.

Amputation of the distal part of the leg is performed in it.

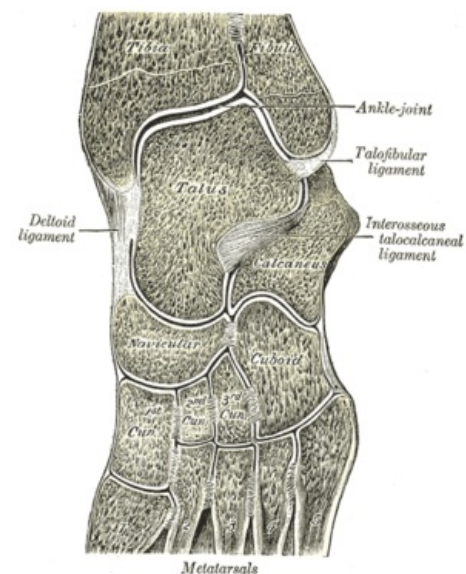
Ligaments:

- ligamentum plantare longum
- ligamentum bifurcatum – it is composed of the ligamentum calcaneonaviculare and calcaneocuboideum (= the key of Chopart's joint – after cutting, it will allow the joint to open)

Articulatio cuneonavicularis



Articulatio talocruralis



Tarsometatarsal and intertarsal joints

Joint type: rigid joint

Articular surfaces: between ossa cuneiformia and os naviculare

Similar joints:

- articulatio cuneocuboidea – between os cuneiforme laterale and os cuboideum
- articulationes intercuneiformes – between ossa cuneiformia

They are connected by interosseous and plantar ligaments that help hold the transverse arch of the foot (eg ligamentum cuneonaviculare plantare, dorsale and ligamenta intercuneiformia).

Articulationes tarsometatarsales

Joint type: rigid joint

Articular surfaces: between the distal surfaces of the sphenoid bones and the 1st-3rd metatarsal and between the cuboid bone and the 4th and 5th metatarsals

Together with the articulationes intermetatarsales, it forms the Lisfranc joint (functional and clinical unit – in leg amputations).

Articulationes metatarsophalangeales

Articular surfaces: between the bones of the metatarsals and the heads of the proximal phalanges

The joints are strengthened by collateral ligaments and supported by ligamenta plantaria.

The heads of the metatarsals are connected to each other by **the ligamentum metatarsale transversum profundum** .

Movements: flexion, extension and mild duction (extension only)

Articulationes interphalangeales pedis

Joint type: pulley joints

Ligaments: ligamenta collateralia and plantaria

Movement: flexion and extension

Links

Related Articles

- Joints of the upper limb
- Biomechanics of the knee joint
- Bones of the lower limb
- Joints

References

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- GRIM, Miloš and Rastislav DRUGA. *FUNDAMENTALS OF ANATOMY 1. General anatomy and movement system*. 1.. edition. Prague: Galén, 2006. ISBN 80-7262-112-2 .
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