There are 32 bones found in the lower limb:
- hip bone (1)
- femur (1)
- patella (1)
- tibia (1)
- fibula (1)
- tarsals (8)
- metatarsals (5)
- proximal phalanges (5)
- intermediate phalanges (5)
- distal phalanges (4)

The big toe (hallux) only has 2 phalanges

There are also 2 extra bones in the foot, called sesamoid bones. These small bones develop within the tendon of the flexor hallucis longus muscle to the big toe.
Human Skeleton: hips

- Ilium
- Ischium
- Pubis
- Coccyx
- Sacrum
- Pubic symphysis

Human Skeleton: hips (X-ray)

- Sacroiliac joint
- Greater trochanter
- Head
- Neck
- Lip of acetabulum
- Ilium
- Pubis
- Ischium
- Lesser trochanter
- Pubic symphysis
The hip bone is composed of three elements:
  • the ilium
  • ischium
  • and pubis
which fuse at the acetabulum (the socket of the hip joint).
Connections between axial & appendicular skeletons II  Sacro-iliac joint

SACRUM of axial is wedged into the hip bones of the appendicular pelvic girdle

For stability & the transmission of load via the hip bones to the legs

Ilium

- The ilium is a large flaring bone that forms the superior region of the coxal bone
- It consists of a body and a superior winglike portion called the ala
- The broad posterolateral surface is called the gluteal surface
- The auricular surface articulates with the sacrum (sacroiliac joint)
- Major markings include the iliac crests, four spines, greater sciatic notch, iliac fossa, arcuate line, and the pelvic brim
The ilium has four protuberances:
   i. the anterior superior
   ii. the anterior inferior
   iii. the posterior superior and
   iv. the posterior inferior iliac spines.

The anterior superior iliac spine is an attachment site for the inguinal ligament and the sartorius muscle.

The anterior inferior iliac spine is an attachment site for the capsule of the hip joint, especially the iliofemoral ligament.
Ilium: Lateral View

- Tubercle of the iliac crest
- Anterior gluteal line
- Posterior gluteal line
- Posterior superior iliac spine
- Posterior inferior iliac spine
- Greater sciatic notch
- Ischial body
- Ischial spine
- Lesser sciatic notch
- Ischial tuberosity
- Ischium
- Ilium
- Iliac crest
- Anterior superior iliac spine
- Inferior gluteal line
- Anterior inferior iliac spine
- Acetabulum
- Arcuate line
- Superior ramus of pubis
- Pubic body
- Pubic tubercle
- Pubis
- Pubic crest
- Inferior ramus of pubis
- Articular surface of pubis (at pubic symphysis)
The ischium forms the posteroinferior part of the hip bone. The thick body articulates with the ilium, and the thinner ramus articulates with the pubis. Major markings include the ischial spine, lesser sciatic notch, and the ischial tuberosity.

LOWER APPENDICULAR SKELETON

- Lower appendicular skeleton supports the axial skeleton and upper body & provides locomotion & other activities
- It comprises the lower LIMB BONES & the PELVIC GIRDLE stabilizing them & connecting with the axial skeleton
- The connection is secured by wedging the axial sacrum between the hip bones to create the bony pelvis
Pubis

- The pubic bone forms the anterior portion of the hip bone
- It articulates with the ischium and the ilium
- Major markings include superior and inferior rami, the pubic crest, pubic tubercle, pubic arch, pubic symphysis, and obturator foramen (along with ilium and ischium)
Pubis: Medial View

Comparison of Male and Female Pelvis

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>FEMALE</th>
<th>MALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacrum</td>
<td>Wider; shorter; sacral curvature is accentuated</td>
<td>Narrow; longer; sacral promontory more ventral</td>
</tr>
<tr>
<td>Coccyx</td>
<td>More movable; straighter</td>
<td>Less movable; curves ventrally</td>
</tr>
<tr>
<td>Left lateral view</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pelvic inlet (brim)</td>
<td>Wider; oval from side to side</td>
<td>Narrow; basically heart shaped</td>
</tr>
<tr>
<td>Pelvic outlet</td>
<td>Wider; ischial tuberosities shorter, farther apart and splayed</td>
<td>Narrower; ischial tuberosities longer, sharper and point more medially</td>
</tr>
<tr>
<td>Posteri-inferior view</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7.4.2
Pelvic Girdle (Hip)

- The hip is formed by a pair of hip bones (os coxae, or coxal)
- Together with the sacrum and the coccyx, these bones form the bony pelvis

Pelvic Girdle (Hip)

- The pelvis
  - Attaches the lower limbs to the axial skeleton with the strongest ligaments of the body
  - Transmits weight of the upper body to the lower limbs
  - Supports the visceral organs of the pelvis
Pelvic Girdle (Hip)

Ilium

- The ilium is a large flaring bone that forms the superior region of the coxal bone
- It consists of a body and a superior winglike portion called the ala
- The broad posterolateral surface is called the gluteal surface
Ilium

- The auricular surface articulates with the sacrum (sacroiliac joint)
- Major markings include the iliac crests, four spines, greater sciatic notch, iliac fossa, arcuate line, and the pelvic brim
Ischium

- The ischium forms the posteroinferior part of the hip bone
- The thick body articulates with the ilium, and the thinner ramus articulates with the pubis
- Major markings include the ischial spine, lesser sciatic notch, and the ischial tuberosity
Pubis

• The pubic bone forms the anterior portion of the hip bone
• It articulates with the ischium and the ilium
• Major markings include superior and inferior rami, the pubic crest, pubic tubercle, pubic arch, pubic symphysis, and obturator foramen (along with ilium and ischium)
Comparison of Male and Female Pelvic Structure

- Female pelvis
  - Tilted forward, adapted for childbearing
  - True pelvis defines birth canal
  - Cavity of the true pelvis is broad, shallow, and has greater capacity
Comparison of Male and Female Pelvic Structure

• Male pelvis
  – Tilted less forward
  – Adapted for support of heavier male build and stronger muscles
  – Cavity of true pelvis is narrow and deep
Comparison of Male and Female Pelvis

**Table 7.4** Comparison of the Male and Female Pelves

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>FEMALE</th>
<th>MALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>General structure and functional modifications</td>
<td>Tilted forward; adapted for childbearing; true pelvis defines the birth canal; cavity of the true pelvis is broad, shallow, and has a greater capacity</td>
<td>Tilted less far forward; adapted for support of a male’s heavier build and stronger muscles; cavity of the true pelvis is narrow and deep</td>
</tr>
<tr>
<td>Bone thickness</td>
<td>Less; bones lighter, thinner, and smoother</td>
<td>Greater; bones heavier and thicker, and markings are more prominent</td>
</tr>
<tr>
<td>Acetabula</td>
<td>Smaller; farther apart</td>
<td>Larger; closer</td>
</tr>
<tr>
<td>Pubic arch angle</td>
<td>Broader (80°–90°); more rounded</td>
<td>More acute (50°–60°)</td>
</tr>
</tbody>
</table>

• Female pelvis
  – Tilted forward, adapted for childbearing
  – True pelvis defines birth canal
  – Cavity of the true pelvis is broad, shallow, and has greater capacity
### Comparison of Male and Female Pelvic Structure

- **Male pelvis**
  - Tilted less forward
  - Adapted for support of heavier male build and stronger muscles
  - Cavity of true pelvis is narrow and deep

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone thickness</td>
<td>Lighter, thinner, and smoother</td>
<td>Heavier, thicker, and more prominent markings</td>
</tr>
<tr>
<td>Pubic arch/angle</td>
<td>80°–90°</td>
<td>50°–60°</td>
</tr>
<tr>
<td>Acetabula</td>
<td>Small; farther apart</td>
<td>Large; closer together</td>
</tr>
<tr>
<td>Sacrum</td>
<td>Wider, shorter; sacral curvature is accentuated</td>
<td>Narrow, longer; sacral promontory more ventral</td>
</tr>
<tr>
<td>Coccyx</td>
<td>More movable; straighter</td>
<td>Less movable; curves ventrally</td>
</tr>
</tbody>
</table>
Comparison of Male and Female Pelvic Structure

Human Skeleton: Thigh, Leg, and Foot

- Femur
- Patella
- Tibia
- Fibula
- Calcaneous (heel bone)
- Tarsals
- Metatarsals
- Phalanges
The Lower Limb

- The three segments of the lower limb are the thigh, leg, and foot
- They carry the weight of the erect body, and are subjected to exceptional forces when one jumps or runs
Femur

- The sole bone of the thigh is the femur, the largest and strongest bone in the body
- It articulates proximally with the hip and distally with the tibia and fibula
- Major markings include the head, fovea capitis, greater and lesser trochanters, gluteal tuberosity, lateral and medial condyles and epicondyles, linea aspera, patellar surface, and the intercondylar notch
Femur

Figure 7.28b
Leg

- The tibia and fibula form the skeleton of the leg
- They are connected to each other by the interosseous membrane
- They articulate with the femur proximally and with the ankle bones distally
- They also articulate with each other via the immovable tibiofibular joints

Tibia

- Receives the weight of the body from the femur and transmits it to the foot
- Major markings include medial and lateral condyles, intercondylar eminence, the tibial tuberosity, anterior crest, medial malleolus, and fibular notch
Tibia and Fibula

Fibula

- Sticklike bone with slightly expanded ends located laterally to the tibia
- Major markings include the head and lateral malleolus
Foot

- The skeleton of the foot includes the tarsus, metatarsus, and the phalanges (toes)
- The foot supports body weight and acts as a lever to propel the body forward in walking and running

Tarsus

- Composed of seven bones that form the posterior half of the foot
- Body weight is carried primarily on the talus and calcaneus
- Talus articulates with the tibia and fibula superiorly, and the calcaneus inferiorly
- Other tarsus bones include the cuboid and navicular, and the medial, intermediate, and lateral cuneiforms
Calcaneus

- Forms the heel of the foot
- Carries the talus on its superior surface
- Point of attachment for the calcaneal (Achilles) tendon of the calf muscles

Metatarsus and Phalanges

- Metatarsals
  - Five (1-5) long bones that articulate with the proximal phalanges
  - The enlarged head of metatarsal 1 forms the “ball of the foot”
- Phalanges
  - The 14 bones of the toes
  - Each digit has three phalanges except the hallux, which has no middle phalanx
Arches of the Foot

- The foot has three arches maintained by interlocking foot bones and strong ligaments
- Arches allow the foot to hold up weight
- The arches are:
  - Lateral longitudinal – cuboid is keystone of this arch
  - Medial longitudinal – talus is keystone of this arch
  - Transverse – runs obliquely from one side of the foot to the other
Arches of the Foot

Figure 7.32

- Medial longitudinal arch
- Transverse arch
- Lateral longitudinal arch