Anatomy of the lower limb

Introduction, bones of pelvic girdle & lumbar plexus

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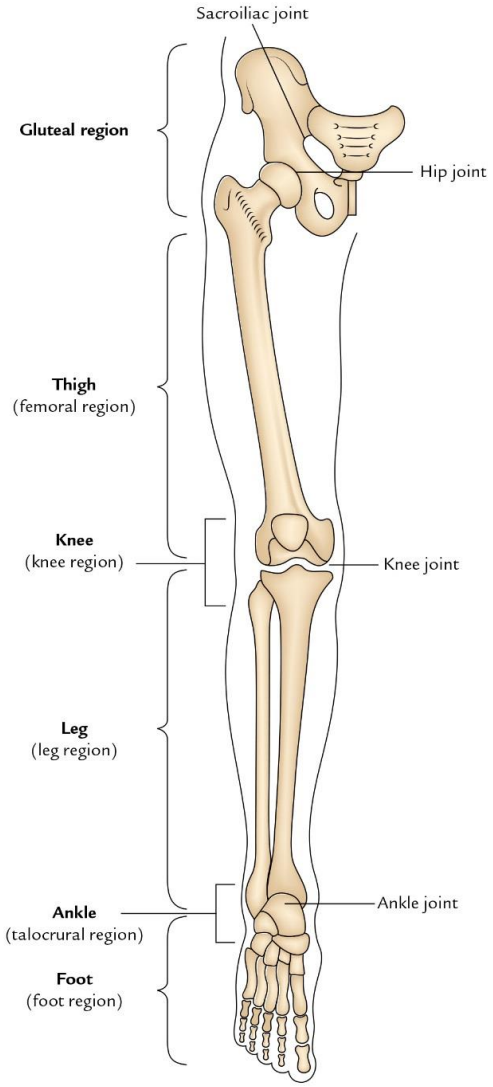
The lower limbs are extremities of the body specialized for transmission of body weight and locomotion. For descriptive purposes, the lower limb is divided into six parts or regions:
Gluteal region (the buttock) extends from iliac crest superiorly to the gluteal skin fold inferiorly on the posterior aspect of the lower limb
Thigh or femoral region bounded superiorly by the inguinal ligament and inferiorly by the knee joint
Knee or knee region
Leg or leg region extends from knee joint proximally to the ankle joint distally
Ankle region
Foot or foot region the most distal region of the lower limb

Region	Bones of the region	Joints of the region
Gluteal	Hip bones and sacrum	Sacroiliac and hip joints
Thigh	Femur	Hip joint
Knee	Femur, tibia & patella	Knee joint
Leg	Tibia & fibula	Proximal & distal tibio-fibular joints
Ankle	Tibia, fibula & talus	Ankle joint
Foot	7 Tarsals, 5 metatarsal & 14 phalanges	Subtalar joints and small joints of foot



The lower limb is attached to the trunk via the pelvic girdle. The sacrum is the bony link between the lower limb skeleton and the vertebral column. Weight is transferred from the vertebral column to the lower limb through the sacroiliac joint and pelvic girdle.

Bones of the pelvic girdle

The pelvic girdle is formed by the two **hip** bones articulating with each other anteriorly at the **symphysis pubis** and posteriorly with the **sacrum** at the **sacroiliac joints** to complete the pelvis. Each hip bone also articulates with the **femur** at the acetabulum to form the **hip** joint. The muscles and ligament attachments to these bones are

discussed later with the sections on the thigh compartments.

The hip

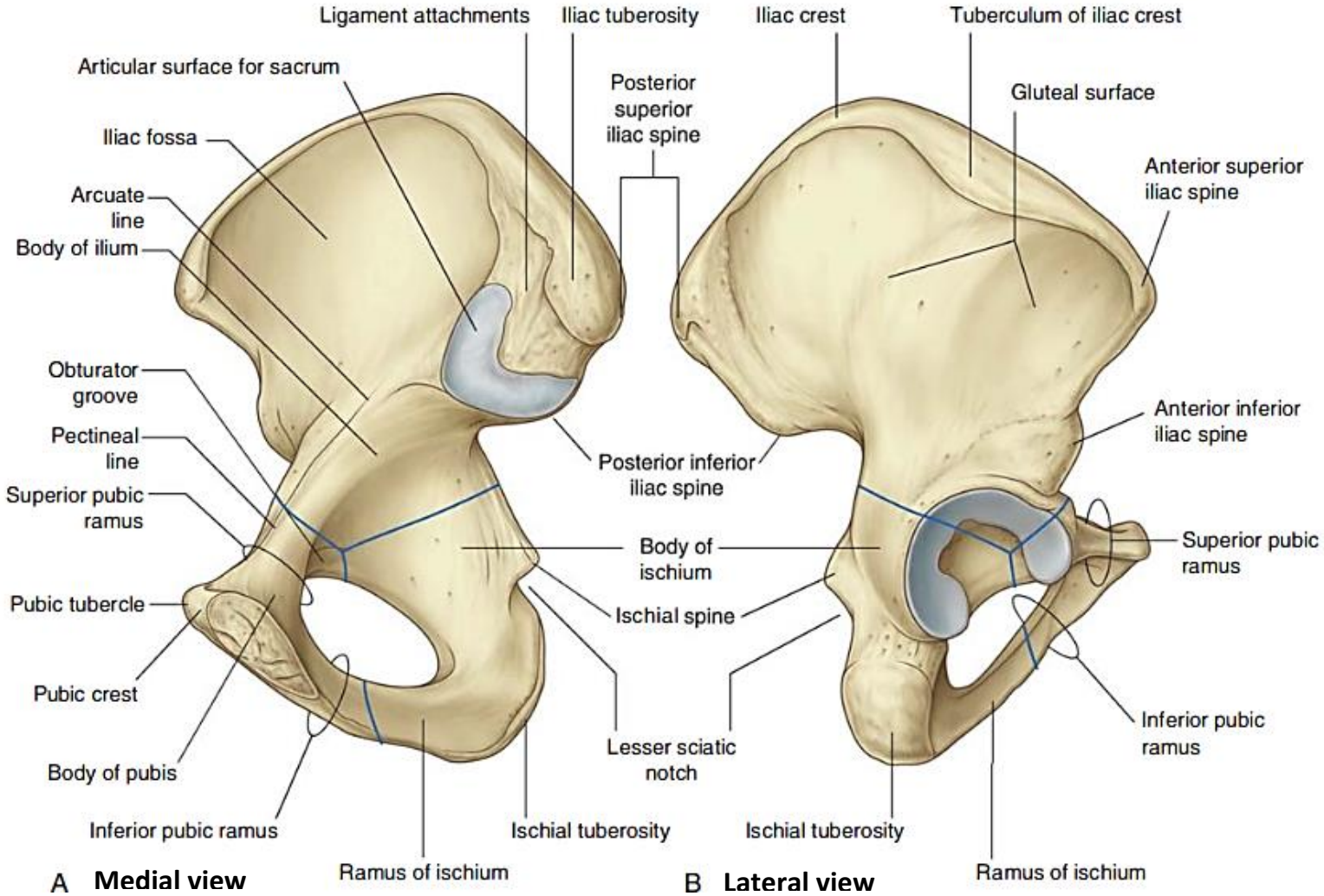
Each hip bone is composed of 3 fused bones at the **acetabulum**. These 3 bones are the **ilium**, **ischium** and **pubis**.

The ilium

The ilium is a more or less flat bone that forms about 3/5th of the acetabulum. It has a superior margin and two surfaces; a medial or **pelvic surface** and a lateral dorsal or **gluteal surface**. The upper margin begins anteriorly at 2 spines; **the anterior superior and anterior inferior iliac spines**. It curves backwards from the anterior superior iliac spine to another pair of spines posteriorly called the **posterior superior and posterior inferior iliac spines**. The iliac margin is roughened by muscular attachments and is thickened as the **iliac crest**. The highest and most lateral part of the iliac crest is enlarged as **the tubercle of the iliac crest**. Below the posterior inferior iliac spine, the posterior aspect of the ilium is notched by a V-shaped defect leading inferiorly to the **ischial spine**. This defect is the **greater sciatic notch**. Another smaller defect extends from the ischial spine to the medial surface of the ischial tuberosity on the posterior surface of the ischium as the **lesser sciatic notch**. These two notches are converted in the living by the attachments of the **sacrotuberous** and **sacrospinous ligaments** into the **greater and lesser sciatic foramina**.

The gluteal surface of the ilium; **dorsum ilii**; gives attachments to the gluteal muscles and its surface is marked by 3 palpable lines; the **anterior, posterior and inferior gluteal lines** which indicate the attachment of the septa intervening between the gluteal muscles. The pelvic surface of the ilium is concave as the large **iliac fossa**. Its posterior part is applied to the sacrum to form the sacroiliac joints. This irregular posterior part is called the **auricular surface**.

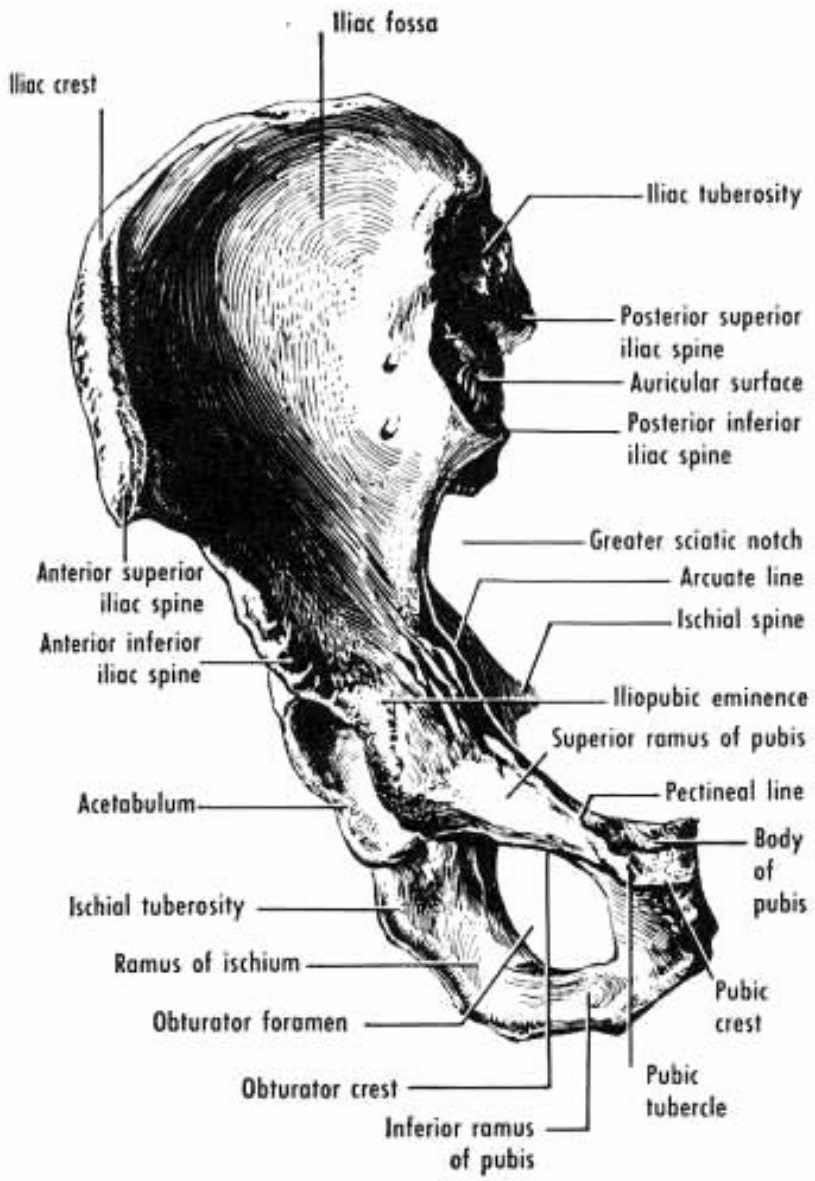
The ischium

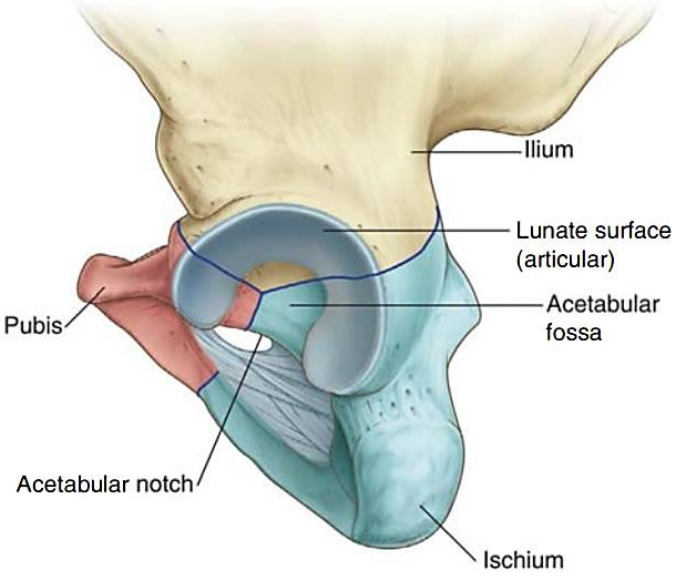


The pubis

The pubis is also composed of three parts;

- The **body** is roughly square and joins the opposite side at the symphysis pubis. The medial part of the upper border is called the **pubic crest**. About a fingerbreadth lateral to the midline, the pubic crest is interrupted by the **pubic tubercle** which is one end attachment of the inguinal ligament; the other end being the anterior superior iliac spine.
- The **inferior pubic ramus** is a bony bar passing inferolaterally from the body to join the ischial ramus. The two inferior pubic rami diverging from beneath the symphysis pubis from the **subpubic arch**.
- The **superior pubic ramus** passes laterally and horizontally from the body to join the ilium at the elevated **iliopubic eminence** and form the last of the acetabulum. The posterior margin of the superior surface of this ramus near the pubic tubercle is sharp and is called the **pecten pubis**. From the pecten, the posterior margin continues towards the inner surface of the ilium as the **iliopectineal line**. The anterior margin of the superior surface of the ramus is thickened as the **obturator crest** which continues as the spiral margin of the obturator foramen.

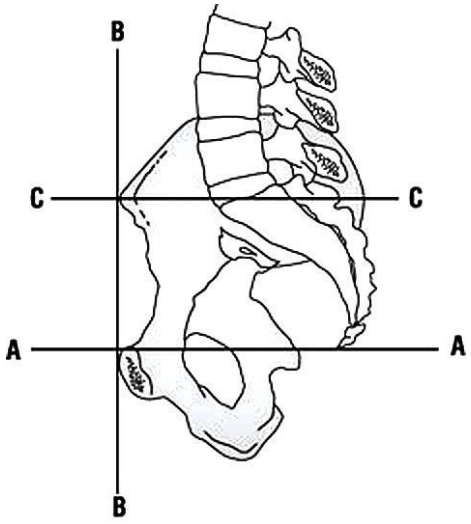




The acetabulum

The acetabulum is the cupped part where the 3 hip bones unite. The articular surface is C-shaped and articulates with the head of the femur at the hip joint. The acetabulum articulates with the periphery of the head of the femur only. The tip of the head of the femur does not reach the depth of the acetabulum and is isolated from it by a pad of fat. There is a defect in the articular surface of the acetabulum above the obturator foramen called the **acetabular notch** which is completed in life by the transverse ligament.

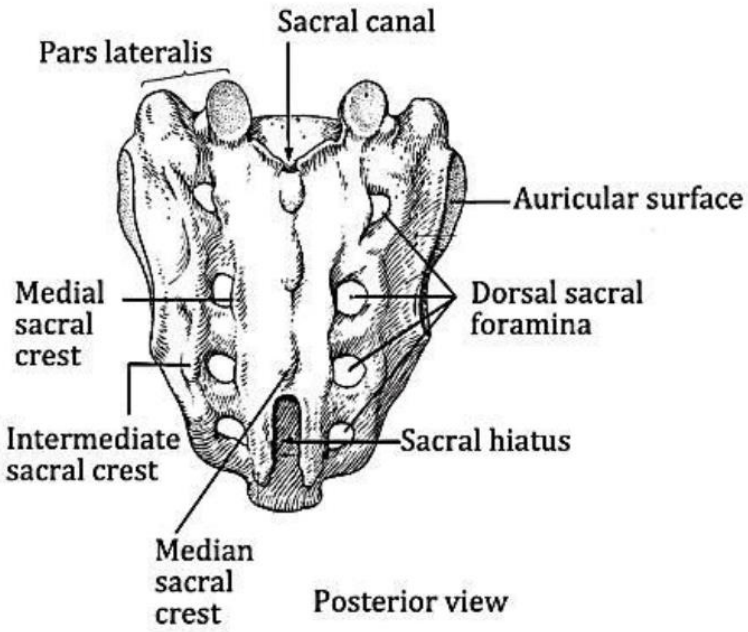
The **pelvic tilt** refers to the orientation of the pelvis. During standing; i.e. neutral anatomical position, the pelvis is tilted forwards and downwards so that when viewed from the side, the anterior superior iliac spine and the upper part of the symphysis pubis both lie in the same anterior vertical plane and the coccygeal tip is at the horizontal line passing at the top of the symphysis pubis or the upper ½ of the pubic body. In the sitting position, this tilt will be reversed so that the anterior superior iliac spine lies at a vertical plane posterior to that of the symphysis pubis and the whole pelvis rests on the ischial tuberosity.

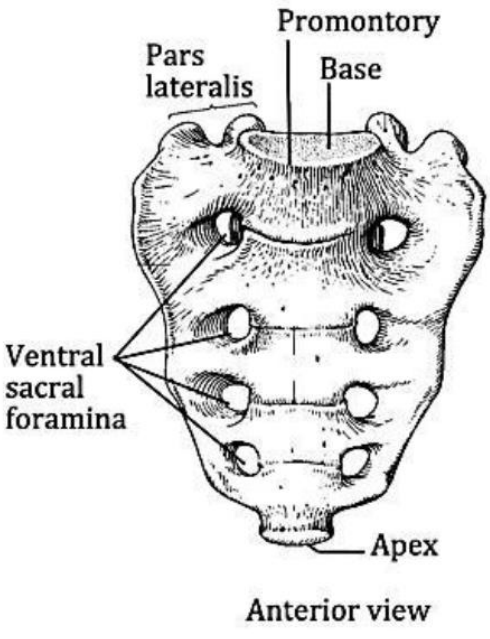


The pelvic tilt in the erect position. The A-A line is the horizontal level of the pubic symphysis, B-B line is the anterior vertical plane,

The sacrum

The sacrum is composed of 5 fused vertebrae forming a triangular bony mass with the base directed superiorly and the apex inferiorly. The median part of the base is the oval superior surface of S1 vertebral body with the **sacral promontory** as its anterior margin. Its posterior margin marks the entrance of the **sacral canal**. The right and left parts of the base are called the **alae** and represent the fused transverse processes. Each ala is crossed by (from medial to lateral) the sympathetic trunk, the lumbosacral trunk, iliolumbar artery, obturator nerve and psoas major tendon. The anterior surface of the sacrum is concave with **horizontal ridges** representing the intervertebral discs and the anterior sacral foramina on the sides for the emergence of the ventral rami of S1-S4. The mass of the bone lateral to the foramina is called the **pars lateralis**. The sides of the upper 3 pieces articulate with the auricular surfaces of the ilia at the sacroiliac joints. The sides of the lower 2 pieces give attachments for the sacrotuberous and sacrospinous ligaments. The posterior surface has the dorsal sacral foramina for the emergence of the dorsal rami of S1-S4. The spines of the sacral pieces fuse to form the **median sacral crest**. Inferior to S1, the articular processes fuse together to form the **intermediate sacral crests** medial to the dorsal foramina. Also inferior to S1, the transverse processes fuse to form the **lateral sacral crests** lateral to the dorsal foramina.

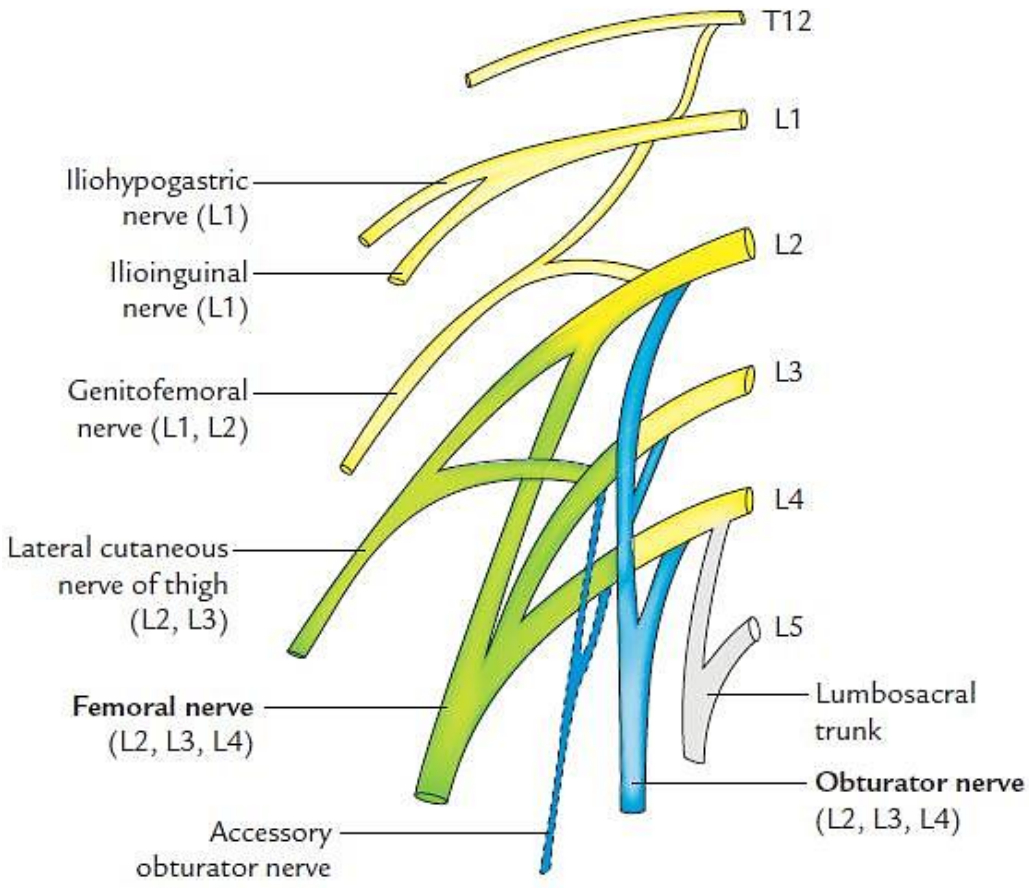




The lumbar plexus

This plexus is formed within the substance of the psoas major muscle by the ventral rami of L1, L2 and L3 spinal nerves, a part of the ventral ramus of L4 and a small contribution of the subcostal nerve (T12 spinal nerve). The ventral ramus of L1 receives a small twig from T12 while the ventral ramus of L4 gives a branch that unites with L5 ventral ramus to form the lumbosacral trunk that joins the sacral plexus. The ventral rami of L1 and L4 each divide into 1 ventral and 1 dorsal divisions. The ventral rami of L2 and L3 each divide into 1 ventral and 2 dorsal divisions; dorsomedial and dorsolateral.

- The ventral division of L1 forms the **ilioinguinal nerve** while the dorsal division forms the **iliohypogastric nerve** which usually carries the T12 contribution.
- The ventral divisions of L2, L3 and L4 unite to form the **obturator nerve**.
- The dorsolateral divisions of L2 and L3 unite to form the **lateral cutaneous nerve of the thigh**
- The dorsomedial divisions of L2 and L3 with the dorsal division of L4 unite to form the **femoral nerve**; the largest branch of the lumbar plexus.
- In addition to these terminal branches, three sets of branches arise from the ventral rami directly;
  - ✓ The **genitofemoral nerve** arises from the ventral surface of L1 and L2.
  - ✓ The **accessory obturator nerve**; is an occasional branch that arises from the ventral surface of L3 and L4.
  - ✓ Segmental muscular branches arise from the ventral rami of L1-L4 to quadratus lumborum muscle and from L2 and L3 to psoas major muscle.



Branches of the lumbar plexus and their distribution			
Nerve	**Root value**	**Motor branches**	**Sensory branches**
Illo-hypogastric	L1	Internal oblique & transversus abdominis	Posterolateral gluteal skin & skin in pubic region
Illio-inguinal	L1	Internal oblique & transversus abdominis	Skin in the upper medial thigh, and the skin over the root of the penis and anterior scrotum (or the mons pubis and labium majus in females)
Genitofemoral	L1, L2	*Genital branch*-male cremasteric muscle	*Genital branch*-skin of anterior scrotum or skin of mons pubis and labium majus; *Femoral branch*-skin of upper anterior thigh
Lateral cutaneous nerve of thigh	L2, L3	None	Skin on anterior and lateral thigh to the level of the knee
Obturator	L2, L3, L4	Muscles in medial compartment of thigh	Skin on medial aspect of the thigh
Femoral	L2, L3, L4	muscles of the anterior compartment of thigh	Skin on anterior thigh and medial surface of leg