

HIP BONE, PELVIC GIRDLE & PELVIS

CN: Use very light colors for bones A-D. The sacrum (D) combines with A-C (below) to form the pelvis. (1) Color the diagrammatic representations of the basins of the false and true pelvis. They are shown together in the lower right diagram.

HIP BONE

- ILIUM A
- ISCHIUM B
- PUBIS C

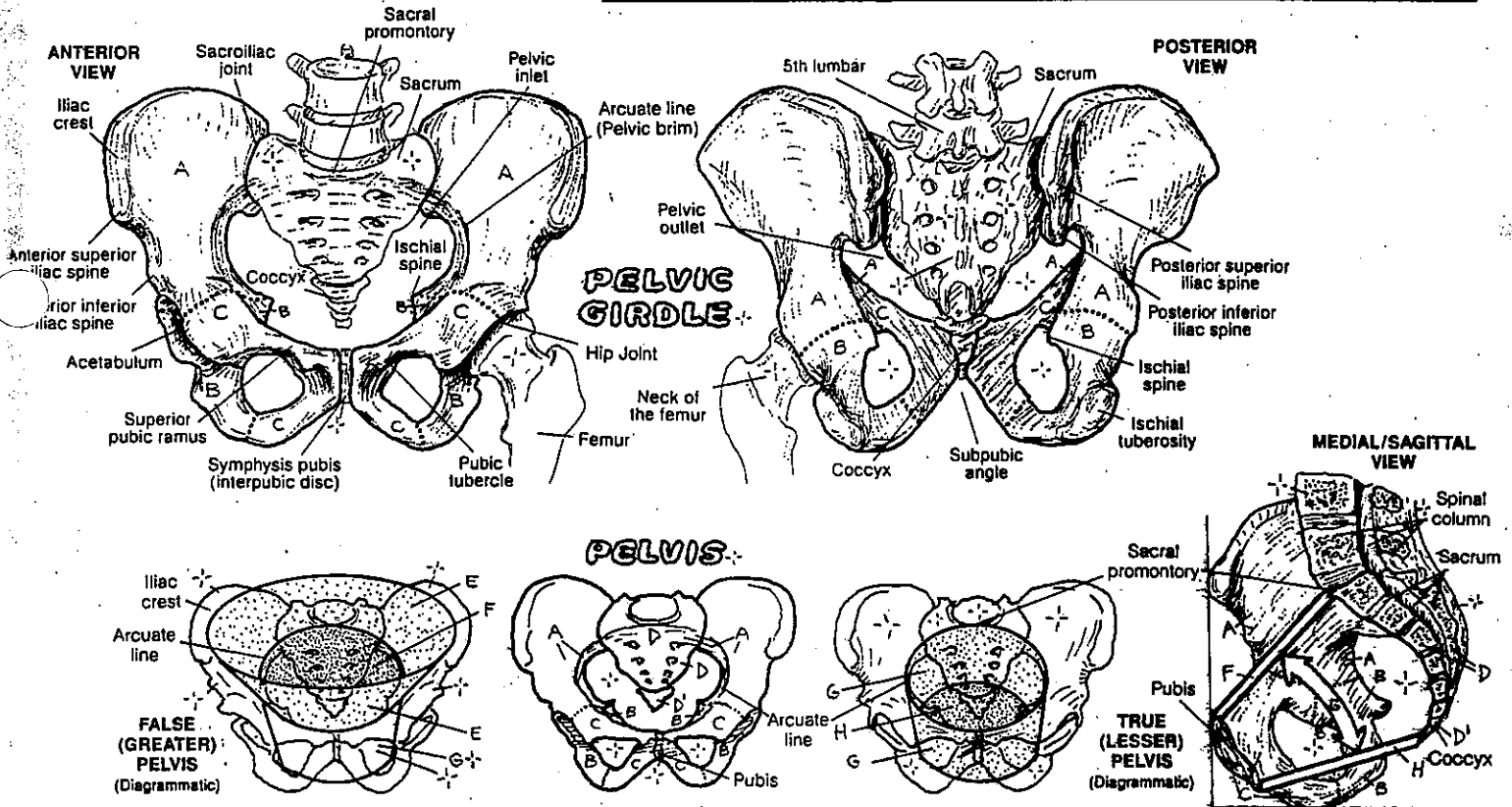
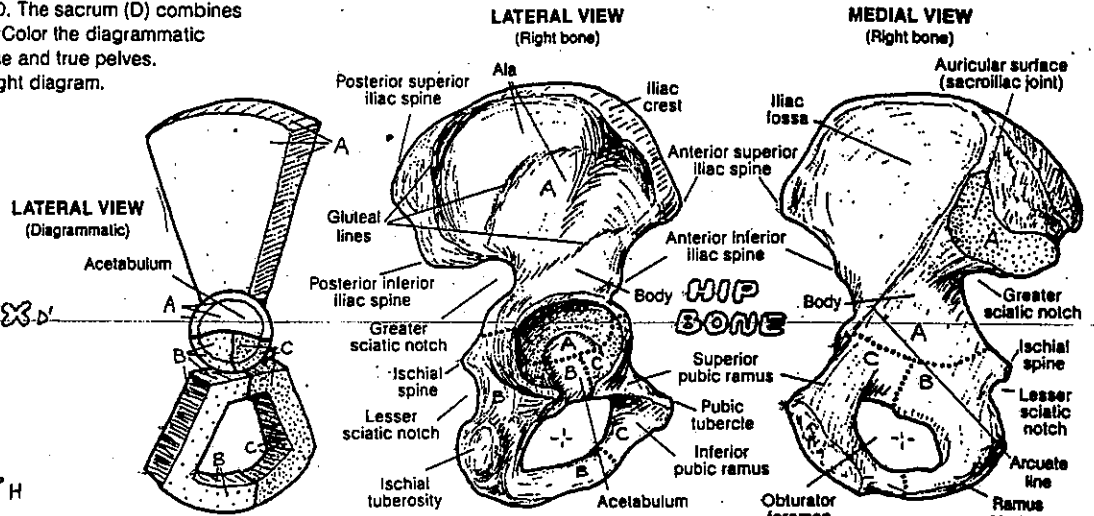
SACRUM, COCCYX, D

FALSE PELVIS E

PELVIC INLET F

TRUE PELVIS G

PELVIC OUTLET H



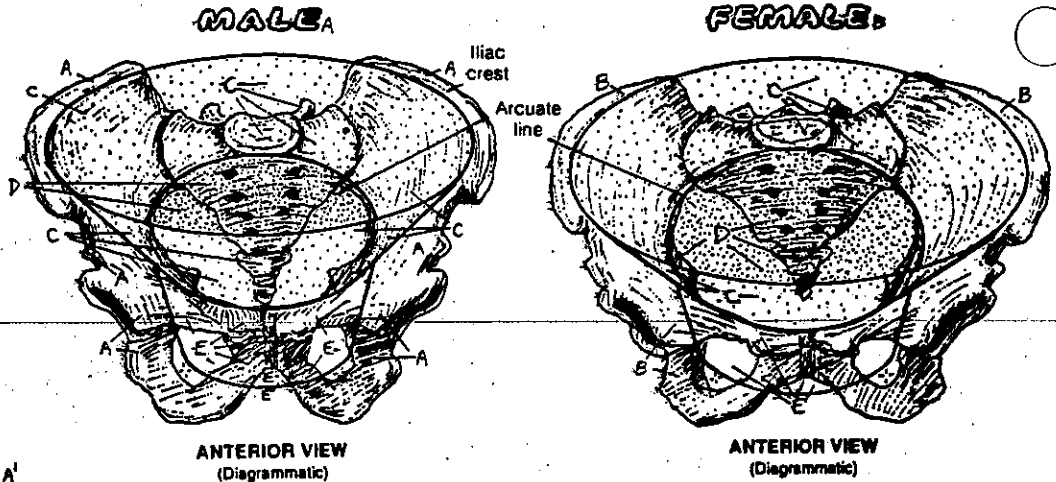
The hip bone (pelvic bone, or coxae) consists of three bones connected by cartilage until the second decade of life, and then bone thereafter: the *ilium*, *ischium*, and *pubis*. The hip bone has been likened to a propeller: the *acetabulum*, the socket for the hip joint where all three bones are fused together, is the hub. The flattened wing (ala) of the ilium would be one blade of the propeller, and the ischiopubic bone would be the other blade. The weight of the torso and upper limbs is transmitted from the sacroiliac joint to the acetabulum through the body of the ilium. The posterior and inferior ischium and the anterior and inferior pubis form a ring of bone with the obturator foramen in the center. The ischium is significant for its ischial tuberosity, upon which one sits. The pubis is easily palpable centrally at the level of the groin.

The two hip bones are connected anteriorly by the *symphysis pubis* (interpubic joint; cartilage/fibrocartilage, with cartilaginous disc). These two bones constitute the pelvic girdle. With respect to the concept of "girdle," the ischiopubic bones are somewhat similar in shape and function to the clavicle, and the iliac bones to the two scapulae. Because of its weight-bearing function, the pelvic girdle is considerably less mobile than its pectoral-counterpart, which had a mobility function.

The two hip bones and the sacrum constitute the pelvis. The cavity of the pelvis (basin) consists of a false (greater) and a true (lesser) pelvis. The orientation of the pelvis can be appreciated by placing a bony pelvis in the laboratory/classroom against a vertical wall such that the anterior superior iliac spine and the pubic tubercle are in contact with the wall simultaneously. That part of the pelvis below an oblique line from the *sacral promontory*, forward and downward along the *arcuate lines* of the ilium, to the *pubic crest* (floor of the pubic tubercle) is the true pelvis. The line just described demarcates the *pelvic inlet* (superior pelvic aperture). The pelvic inlet is continuous above with the abdominal cavity, which includes the greater pelvis. The anterior wall of the greater pelvis is entirely muscular; confirm this on yourself. The true pelvic cavity has both bony and muscular walls and contains numerous structures (Plates 157, 160). The plane of the inferior pelvic aperture (*pelvic outlet*), along a line from the inferior aspect of the pubis to the tip of the coccyx, is much more horizontal than that of the inlet; the floor of the outlet is muscular (Plate 52). The pelvic cavity is continuous below with the perineum (Plate 53).

MALE & FEMALE PELVES

CN: Use very light colors for A and B. Use the same colors on structures C-F as were used on the preceding page where they were labeled E-H. (1) Carefully color the diagrammatic basins representing the false and true pelvis. (2) Color the female pelvis (dotted) superimposed on the dark outline of the male pelvis (not colored). Color the two examples of subpubic angles (G). (3) In the lateral view, note the slightly forward tilt of the female pelvis, which accentuates the curve of sacrum/coccyx and lifts it away from the pelvic outlet (shown from below).



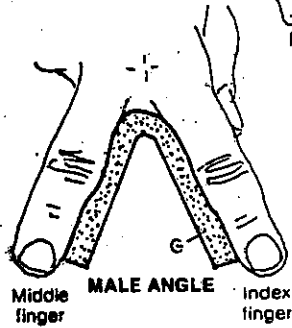
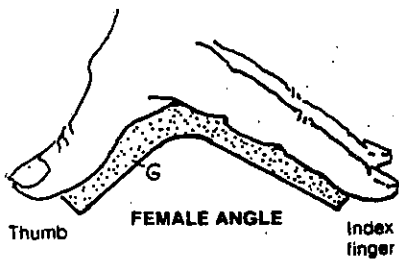
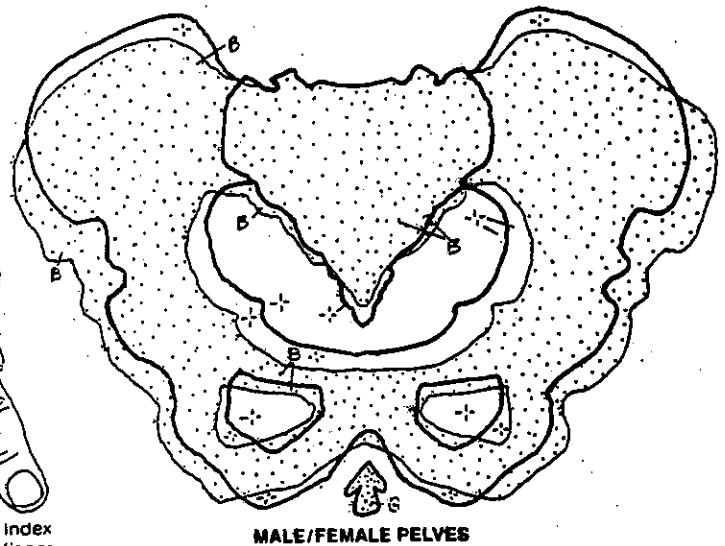
MALE PELVIS A
SACRUM / COCCYX A'

FEMALE PELVIS B
SACRUM / COCCYX B'

FALSE PELVIS C
PELVIC INLET D

TRUE PELVIS E
PELVIC OUTLET F

SUB-PUBIC ANGLE G

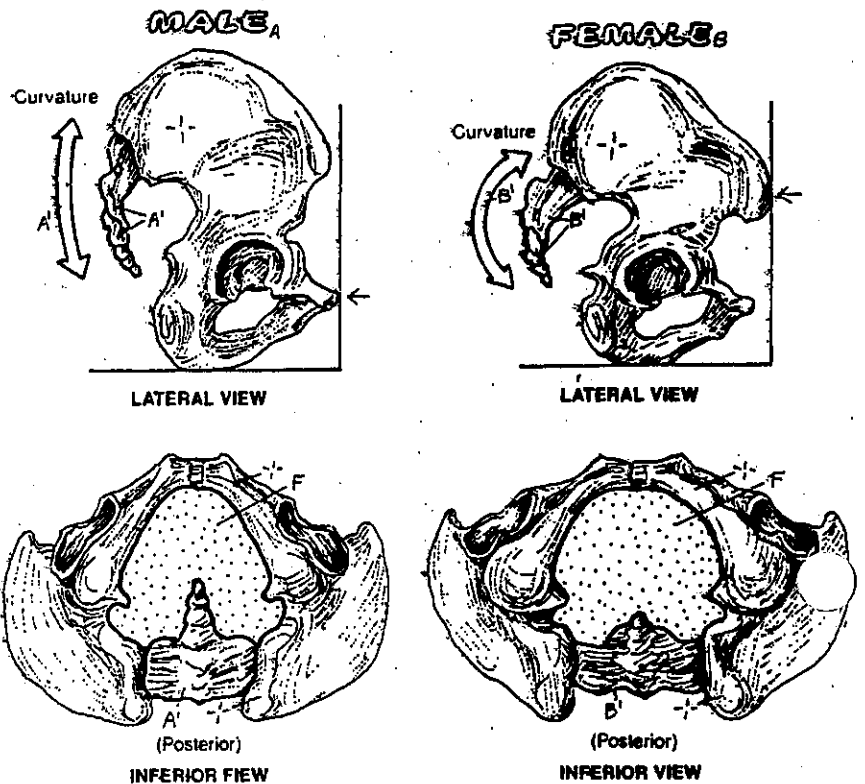


Female and male bony pelvises often differ. These differences have been investigated and analyzed for many reasons, including forensic identification of bodies, gynecologic evaluations, and anthropologic research. A primary interest of pelvic dimensions and physical characteristics is in the clinical prenatal examination. It is obviously important that the birth canal be unimpeded for the fetus at birth. Obstetric-related measurements of pelvic diameters are accomplished radiologically (pelvimetry).

In general, female pelvises are wider than male pelvises in all dimensions. Females have a wider *subpubic angle* than males. This angle can be measured easily on a laboratory skeleton by placing the hand against the pubis such that the thumb covers one inferior pubic ramus and the index finger covers the other. If the angle created by these two digits is superimposed rather precisely over the subpubic angle of the pelvis being measured, it is probably a female pelvis. If the subpubic angle fits between index and middle fingers, it is probably a male pelvis.

When two different pelvises are compared side by side, female pelvises tend to have broader *true* and *false* pelvises than male pelvises. The pelvic inlet and outlet is generally larger in women. The space between the ischial tuberosities is greater in females, as is the space between ischial spines and the ischial spine and the sacrum. There tends to be a larger *sacral curvature* in females, as well as a larger sciatic notch.

Posture, bone conditions such as osteomalacia, and a number of other factors can influence pelvic shape and pelvic capacities.



MUSCLES OF THE POSTERIOR THIGH

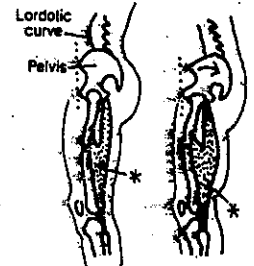
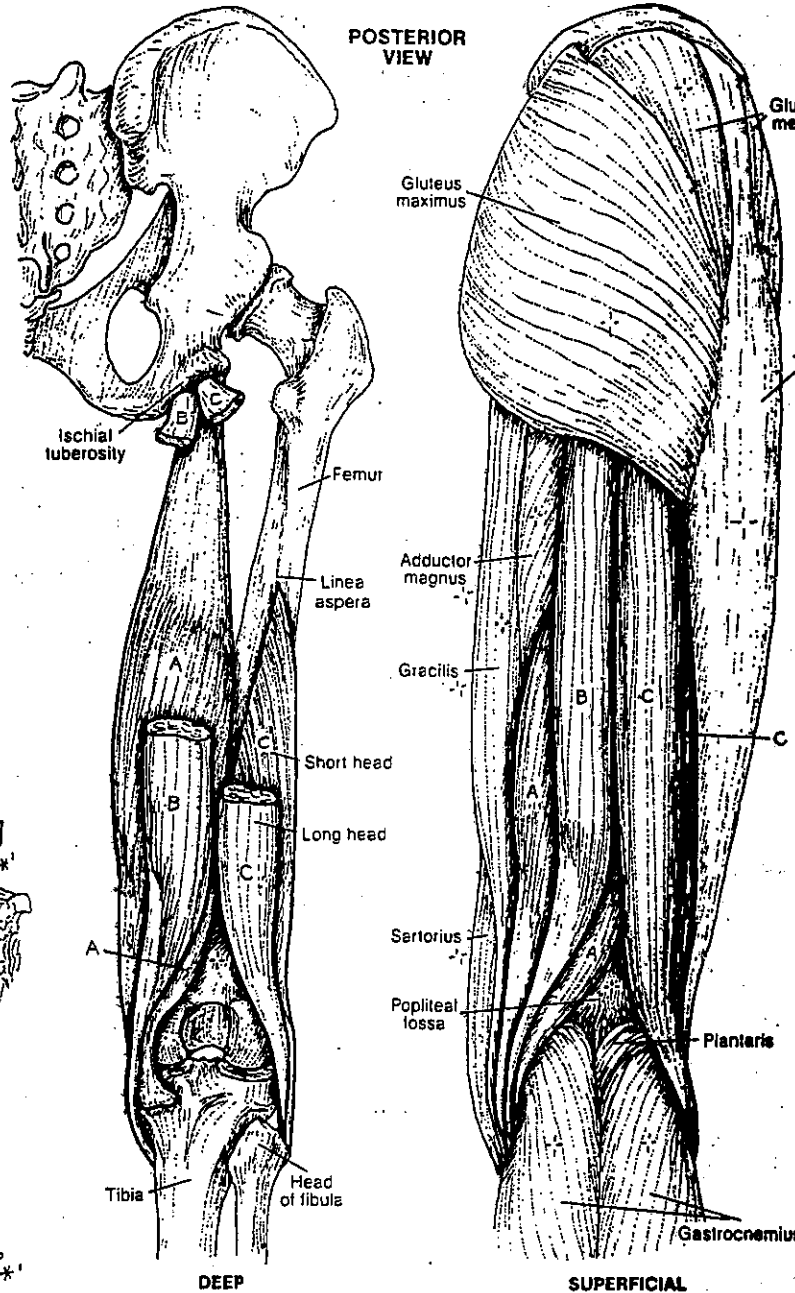
HAMSTRINGS*

- SEMIMEMBRANOSUS,
- SEMITENDINOSUS,
- BICEPS FEMORIS.

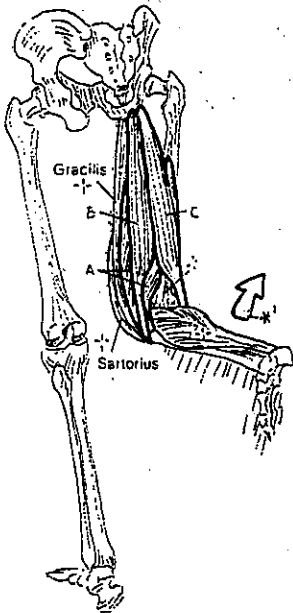


Tight hamstrings limit flexion of hip when knee joint is extended.

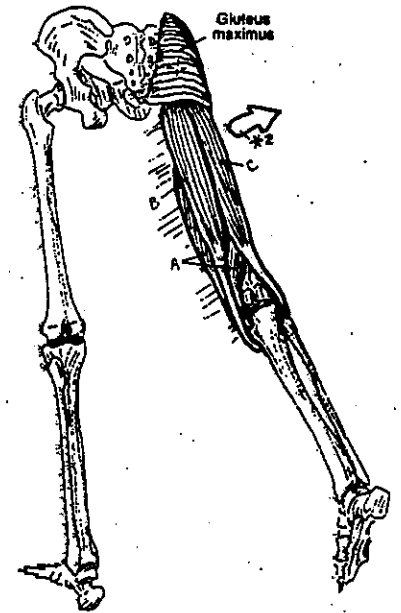
*CN: (1) Color each hamstring muscle in the deep view before going on to the superficial. Then color the diagrams of flexion and extension. (2) Color gray the outline of the muscles in the drawings at upper right.



Tight hamstrings (at right) tilt pelvis backwards, flattening lordotic curve of lower back.



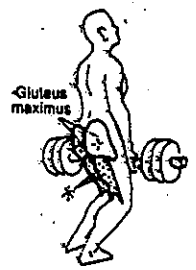
FLEXORS OF THE KNEE JOINT*



EXTENSORS OF THE HIP JOINT*2

The hamstring muscles are equally effective at both extension of the hip joint and flexion of the knee joint. Unlike the hip extensor gluteus maximus, the hamstrings are active during normal walking. In relaxed standing, both gluteus maximus and the hamstrings are inactive. In knee flexion, the hamstrings act in concert with sartorius, gracilis, and gastrocnemius (Plates 63 and 66). Long tendons of the hamstrings can be palpated just above the partially flexed knee on either side of the midline.

Reduced hamstring stretch ("tight hamstrings") limits hip flexion with the knee extended; flexion of the knee permits increased hip flexion. Try this on yourself. Tight hamstrings, by their ischial origin, pull the posterior pelvis down, lengthening the erector spinae muscles and flattening the lumbar lordosis, potentially contributing to limitation of lumbar movement and back pain. Tight hamstrings often cause posterior thigh pain on straight leg raise testing (subject is supine, lower limbs horizontal; one heel is lifted, progressively flexing the hip joint with knee extended). This pain from muscle stretch may be confused with sciatic nerve/nerve root pain, which normally shoots into the leg and foot.



Powerful extensors of the hip joints.

MUSCLES OF THE GLUTEAL REGION

CN: In the posterior and lateral views (superficial dissections), the upper fibers of the iliotibial tract (x¹) have been cut away, exposing gluteus medius. (1) Color each muscle in all views, including the directional arrows, before going on to the next. The origin of piriformis (E) cannot be seen in these views, but see Plate 52. A better view of the origin of obturator internus (F) also can be seen on Plate 52.

- 2 GLUTEAL MUSCLES:
 - GLUTEUS MAXIMUS_A
 - GLUTEUS MEDIUS_B
 - GLUTEUS MINIMUS_C

TENSOR FASCIAE LATAE_D

The gluteal muscles are arranged in three layers: the most superficial is *gluteus maximus*. The large sciatic nerve runs deep to it, as every student nurse has learned well. Its thickness varies. *Gluteus maximus* extends the hip joint during running and walking up-hill, but does not act in relaxed walking. The intermediately placed, more lateral *gluteus medius* is a major abductor of the hip joint and an important stabilizer (leveler) of the pelvis when the opposite lower limb is lifted off the ground.

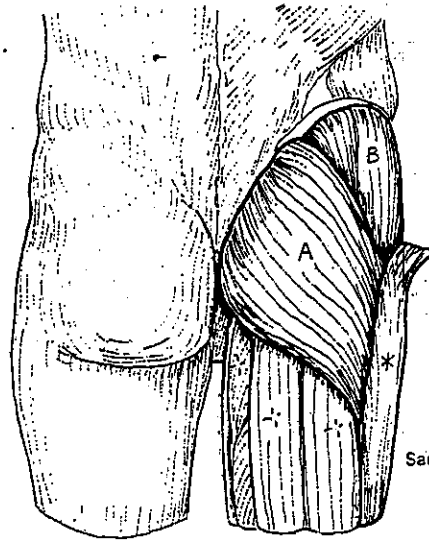
6 DEEP, LATERAL ROTATORS:

- PIRIFORMIS_E
- OBTURATOR INTERNUS_F
- OBTURATOR EXTERNUS_G
- QUADRATUS FEMORIS_H
- GEMELLUS SUPERIOR_I
- GEMELLUS INFERIOR_J

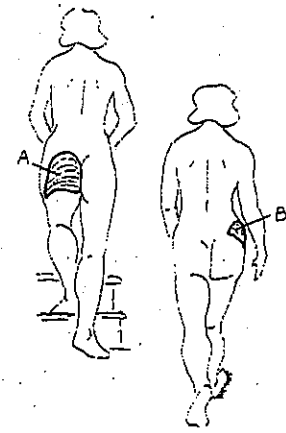
The deepest layer of gluteal muscles is the *gluteus minimus* and the *lateral rotators* of the hip joint. They cover up/fill the greater and lesser sciatic notches. These muscles generally insert at the posterior aspect of the greater trochanter of the femur. The gluteal muscles (less *gluteus maximus*) correspond to some degree with the rotator cuff of the shoulder joint: lateral rotators posteriorly, abductor (*gluteus medius*) superiorly, medial rotators (*gluteus medius* and *minimus*, *tensor fasciae latae*) anteriorly.

ILIOTIBIAL TRACT*

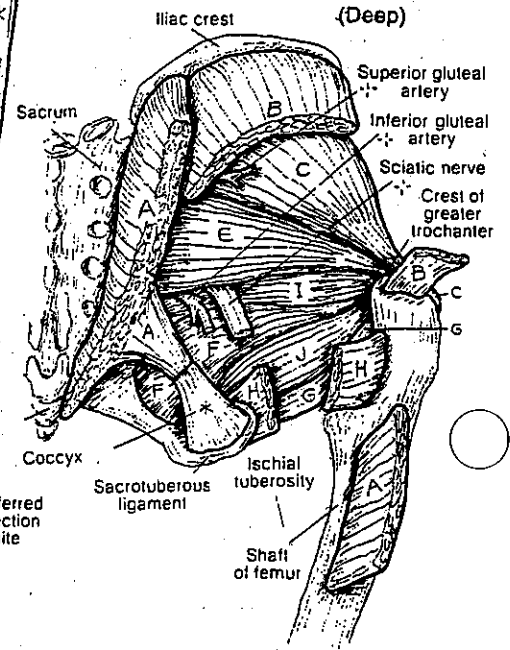
The iliotibial tract, a thickening of the deep fascia (*fascia lata*) of the thigh, runs from ilium to tibia and helps stabilize the knee joint laterally. The muscle *tensor fasciae latae*, a frequently visible and palpable flexor and medial rotator of the hip joint, inserts into this fibrous band, tensing it. Despite its major flexor function, this anterolaterally-placed muscle is considered a part of the more posterior gluteal group; it shares its insertion into the iliotibial tract with *gluteus maximus*, and it is supplied by the superior gluteal nerve and artery.



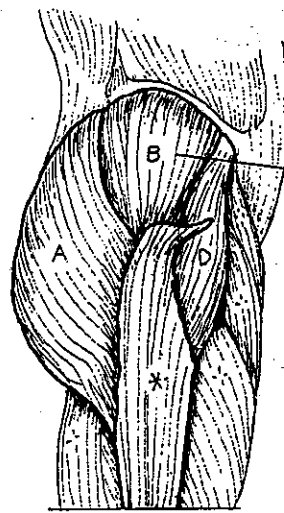
(Superficial)



POSTERIOR VIEW

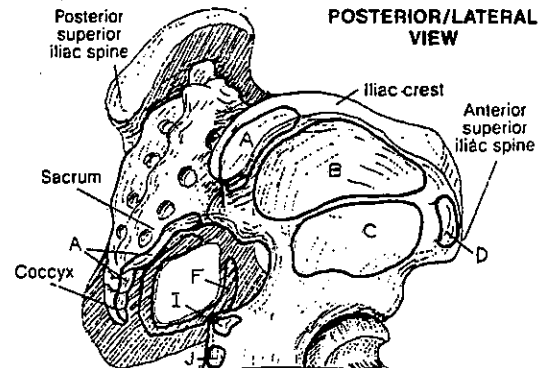


(Deep)

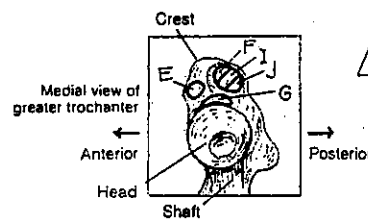


LATERAL VIEW

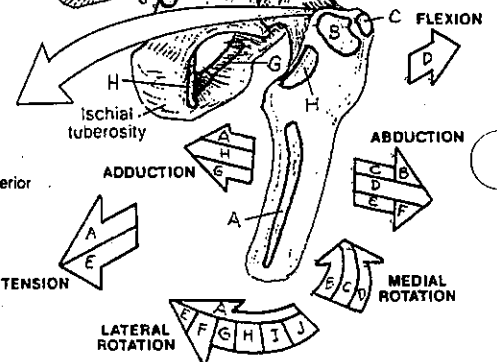
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POSTERIOR/LATERAL VIEW



Medial view of greater trochanter



C FLEXION
D
ABDUCTION
C B
D E F
ADDUCTION
A H
G
A
EXTENSION
A E
LATERAL ROTATION
A B C
E F G H I J

MUSCLES OF THE ANTERIOR THIGH

SARTORIUS_A

QUADRICEPS FEMORIS₊

RECTUS FEMORIS_B

VASTUS LATERALIS_C

VASTUS INTERMEDIUS_D

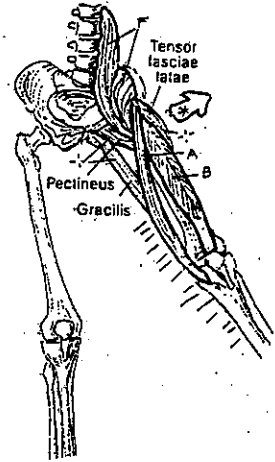
VASTUS MEDIALIS_E

ILIOPSOAS_F

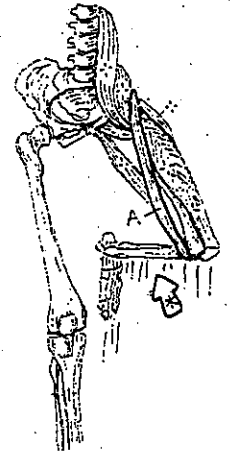
PATELLAR LIGAMENT_{G*}

CN: The patellar ligament (G*) is colored gray but the patella is left uncolored.
 (1) Begin with the deep view of the thigh and then complete the superficial view. (2) On the far left, color the visualized portions of the quadriceps that are antagonists to the hamstring group. (3) Complete the action diagrams along the right margin.

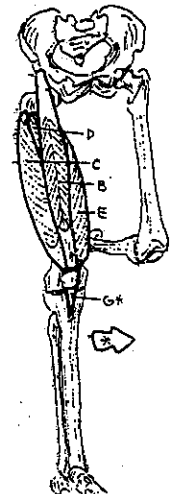
FLEXORS OF THE HIP JOINT.



FLEXOR OF THE KNEE JOINT.



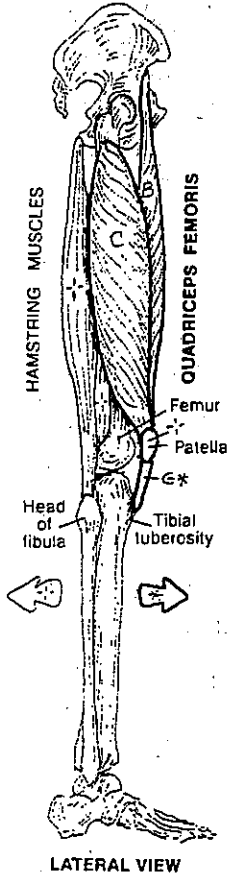
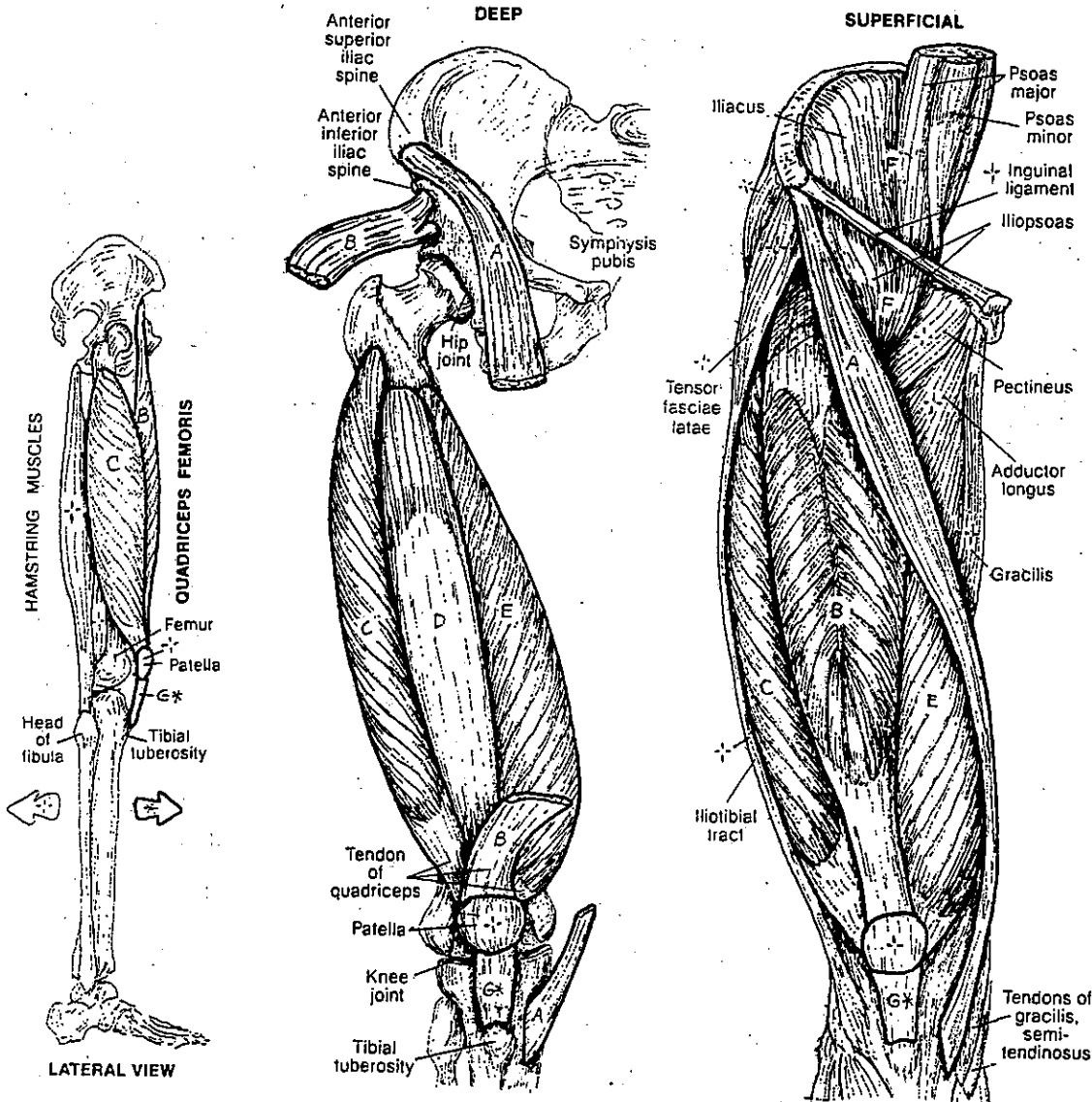
EXTENSORS OF THE KNEE JOINT.



ANTERIOR VIEW

DEEP

SUPERFICIAL



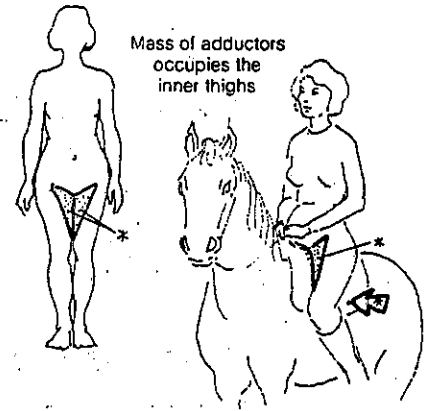
The sartorius ("tailor's" muscle; so-called because of the role of this muscle in enabling a crossed-legs sitting posture) is a flexor and lateral rotator of the hip joint and a flexor of the knee joint, as you can infer from its illustrated attachments. The quadriceps femoris muscle arises from four heads. The vastus medialis and lateralis arise from the linea aspera on the posterior aspect of the femur; the vastus intermedius arises from the anterior femoral shaft. All four converge onto the superior aspect (base) of the patella to form the patellar tendon. Some tendon fibers continue over the patellar surface to join the ligament below. At the inferior aspect (apex) of the patella, the tendinous fibers continue to the tibial tuberosity.

The tendon between the patella and the tibial tuberosity is called the patellar ligament. Rectus femoris, a strong hip joint flexor, is the only member of quadriceps to cross that joint. Quadriceps femoris is the only knee extensor. The significance of its role becomes crystal clear to those having experienced a knee injury; the muscles tend to atrophy and weaken rapidly with disuse, and "quad" exercises are essential to maintain structural stability of the joint. The iliopsoas is the most powerful flexor of the hip, having a broad thick muscle belly and attaching at the lesser trochanter at the proximal end of the femoral shaft. Recall Plate 50 for its posterior abdominal origin.

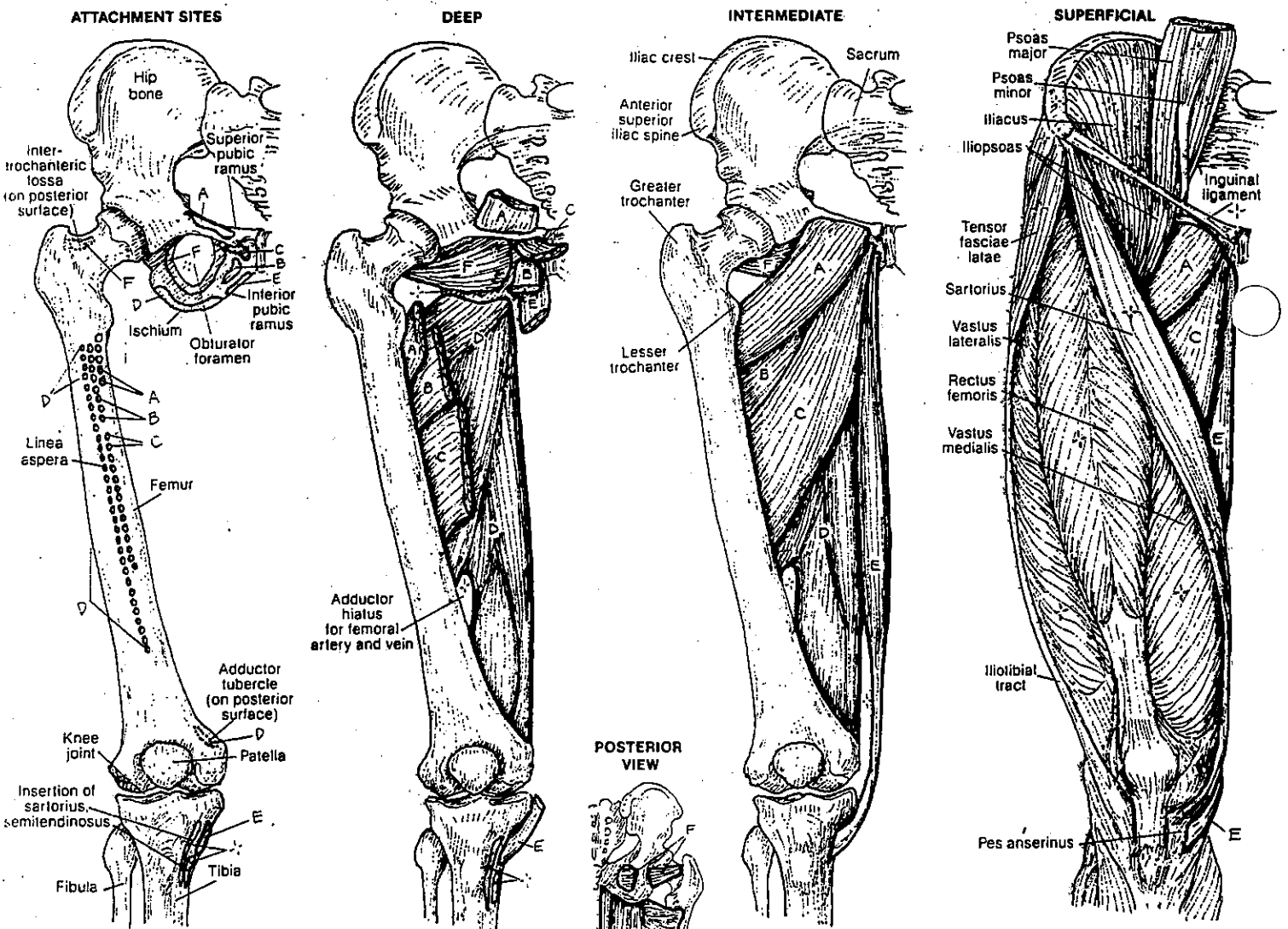
MUSCLES OF THE MEDIAL THIGH

CN: Color one muscle at a time in the five main views before going to the next one. Note that the attachment sites on the posterior surface of the femur are represented by dotted lines.

- PECTINEUS_A
- ADDUCTOR BREVIS_B
- ADDUCTOR LONGUS_C
- ADDUCTOR MAGNUS_D
- GRACILIS_E
- OBTURATOR EXTERNUS_F



ANTERIOR VIEW



The medial thigh muscles consist of the hip joint *adductors* (A through E) and *obturator externus*, a lateral rotator of that joint. The latter was colored on Plate 61 as one of the deep gluteal muscles, as its tendon passes into that region. However, it is compartmentalized by fasciae in the medial thigh, covers the external surface of the obturator foramen in the deep upper medial thigh, and receives the same innervation as the adductors. The *gracilis* is the longest of the adductor group, crosses the medial knee

(flexing it), and inserts only on the medial tibia; its tendon joins the tendons of sartorius and semiteudinosus to form an insertion shaped like a goose's foot (hence called the pes anserinus). The *adductor magnus* is the most massive of the group (see posterior view). In its lower half, adductor magnus fibers give way to the passage of the femoral vessels (adductor hiatus). All the adductors, except *gracilis*, insert on the vertical rough line (linea aspera) on the posterior surface of the femur.