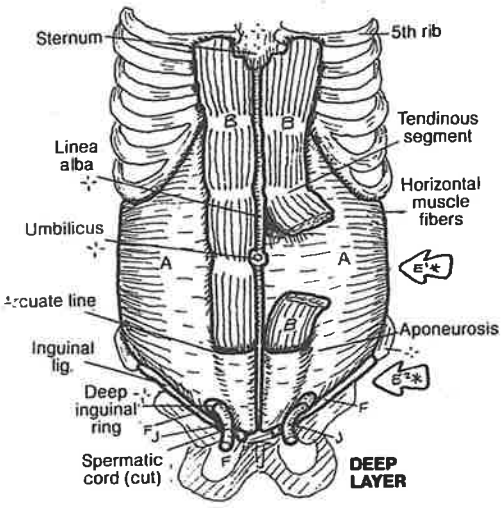
MUSCLES OF ANTERIOR ABDOMINAL WALL & INGUINAL REGION

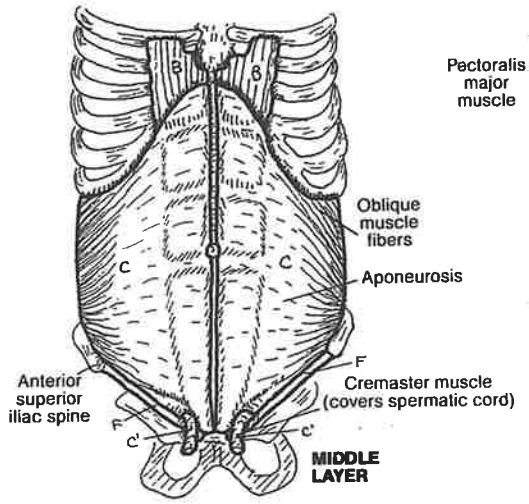
CN: Use a dark color for J and bright ones for B and I. (1) Color the 3 layers of the abdominal wall. (2) Color the sheath of the rectus abdominis in the lower left illustration gray. Color the two locator arrows gray in this and the upper illustration. (3) Beginning with J and K, and followed by H, color the coverings of the spermatic cord.

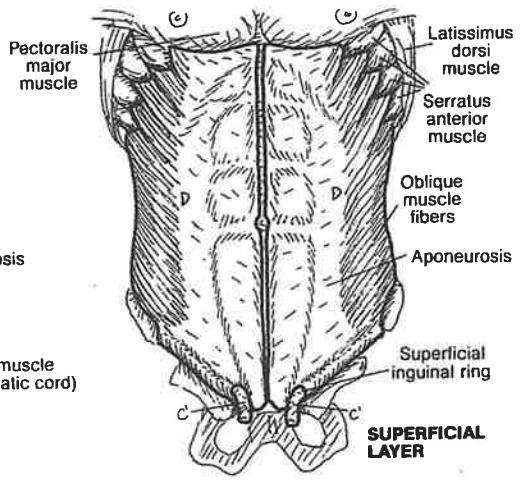
ANTERIOR ABDOMINAL WALL:

- TRANSVERSUS ABDOMINIS A
- RECTUS ABDOMINIS B
- INTERNAL OBLIQUE C
- EXTERNAL OBLIQUE D

The anterior abdominal wall consists of three layers of flat muscles, the tendons (aponeuroses) of which interlace in the midline, and a vertically oriented pair of segmented muscles that are ensheathed incompletely by the aponeuroses of the three flat muscles (*sheath of the rectus abdominis*). The flat muscles arise from the lateral aspect of the torso (inguinal ligament, iliac crest, thoracolumbar fascia, lower costal cartilages, ribs). The lowest fibers of *external oblique* roll inwardly to form the *inguinal ligament*. These three muscles act to compress the abdominal contents during expiration, urination, and defecation. They assist in maintaining pressure on the curve of the low back, resisting "sway back" (excess lumbar lordosis) and extension of the low back.

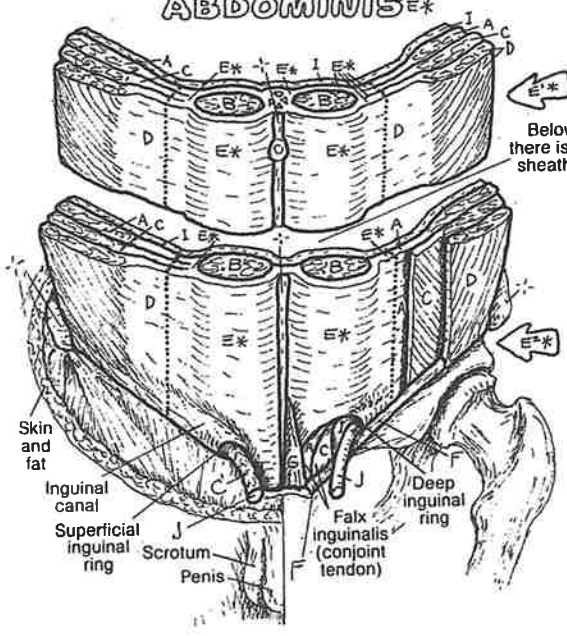




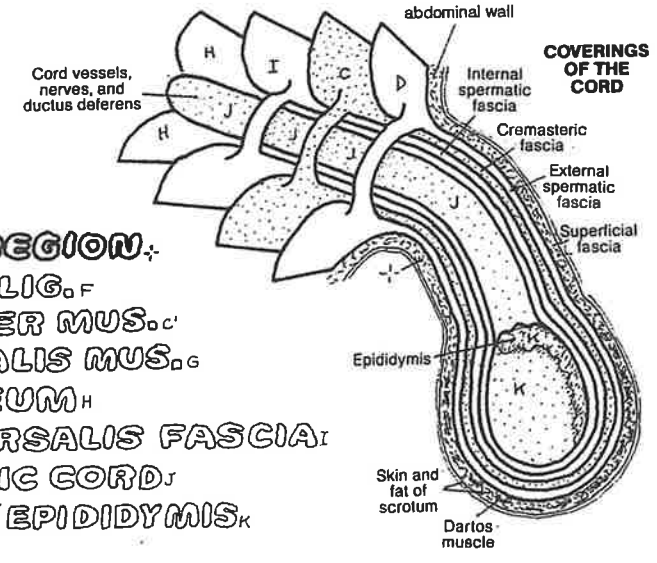


Each segmented rectus abdominis muscle arises from the pubic crest and tubercles and inserts on the lower costal cartilages and xiphoid process (sternum). They are flexors of the vertebral column. The *sheath of the rectus* varies in its extent, running from deep to superficial from below upward, as illustrated. Below the arcuate line, no muscle contributes to its posterior layer (E^{2*}); in the middle, all three flat aponeuroses contribute equally to the sheath (E^{1*}); above, the anterior sheath is formed from external oblique; posteriorly, the rectus contacts the costal cartilages.

SHEATH OF RECTUS ABDOMINIS E*



The inguinal region is the lower medial part of the abdominal wall, characterized by a canal with inner (deep) and outer (superficial) openings or rings. This canal carries the *spermatic cord* (ductus deferens and its vessels, testicular vessels, lymphatics) in the male and the round ligament of the uterus in the female. The testes and spermatic cords "descend" (by differential growth) into outpocketings of the anterior abdominal wall, collectively called the scrotum. In their descent, they push in front of them layers of fibers from the three flat muscles of the abdominal wall and their aponeuroses, much as a finger might push against four layers of latex to form a four-layered finger glove. These are the coverings of the cord: internal, cremasteric, and external spermatic fasciae. The lower fibers of internal oblique are unique in that they continue in loops around the spermatic cord as the cremaster muscle; the two are connected by cremasteric fascia. The canal area is a weak point, subject to protrusions of fat or intestine (hernias) from within the abdominal cavity, either directly through the wall (direct inguinal hernia) or indirectly through the canal (indirect inguinal hernia).



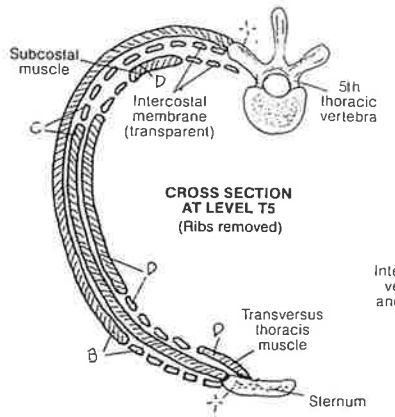
INGUINAL REGION

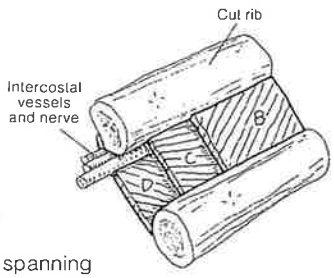
- INGUINAL LIG. F
- CREMASTER MUS. C'
- PYRAMIDALIS MUS. G
- PERITONEUM H
- TRANSVERSALIS FASCIA I
- SPERMATIC CORD J
- TESTIS / EPIDIDYMIS K

See 74, 75, 76, 169

MUSCLES OF THORAX & POSTERIOR ABDOMINAL WALL

CN: Use blue for E and red for G. (1) You may wish to darken the underside of the diaphragm (A) in the anterior view. Do not confuse the arcuate ligaments with the 12th rib. (2) In the cross-sectional view at upper right, color the broken lines that represent transparent, membranous portions of the intercostal muscles.





INTERCOSTAL MUSCLE FIBER ORIENTATION

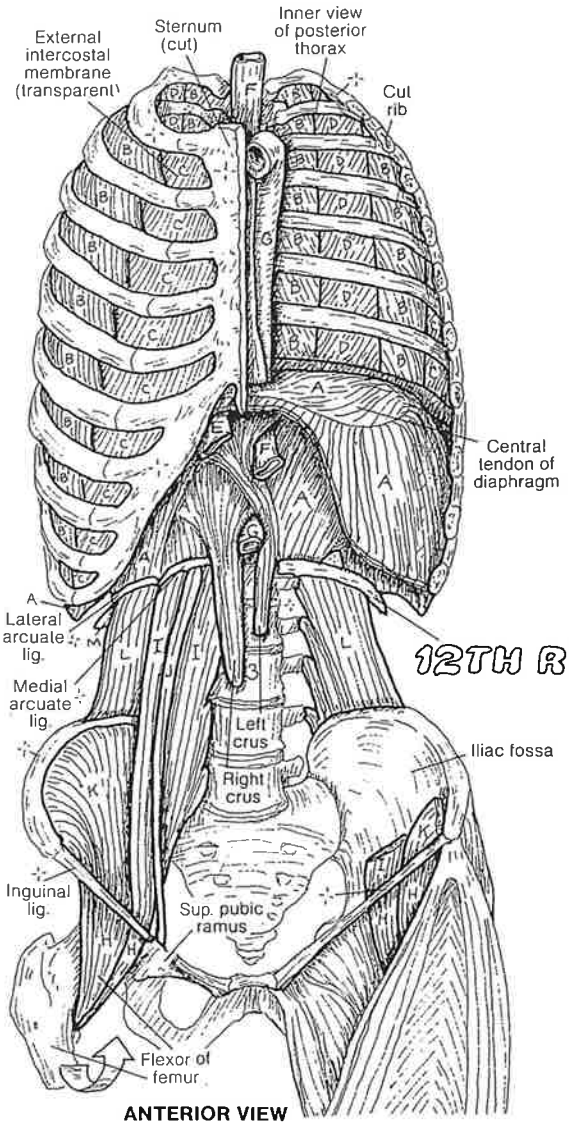
THORAX MUSCLES

THORACIC DIAPHRAGM A
EXTERNAL INTERCOSTAL B
INTERNAL INTERCOSTAL C
INNERMOST INTERCOSTAL D

The thoracic diaphragm is a broad, thin muscle spanning the thoracoabdominal cavity; the illustration shows much of its origin (all except the lower six ribs).

The left and right halves of the diaphragm insert into each other (central tendon). The diaphragm is responsible for 75% of the respiratory air flow. Openings (hiatuses) in the diaphragm provide passage for major transiting structures.

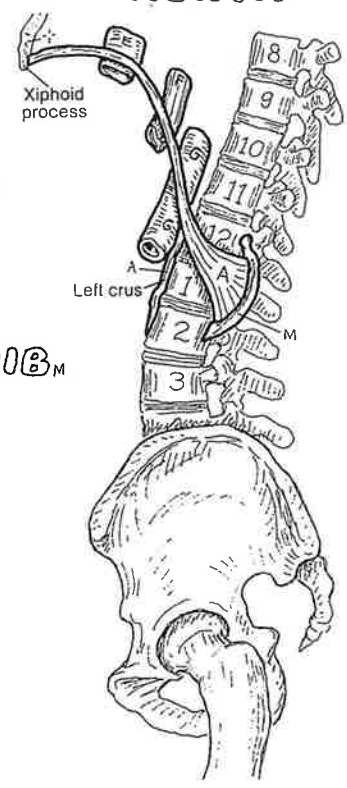
The intercostal muscles alter the dimensions of the thoracic cavity by collectively moving the ribs, resulting in 25% of the total respiratory effort. The specific function of each of these muscles, with respect to fiber orientation, is not understood. The innermost intercostals are an inconstant layer, and here include the transversus thoracis and subcostal muscles.



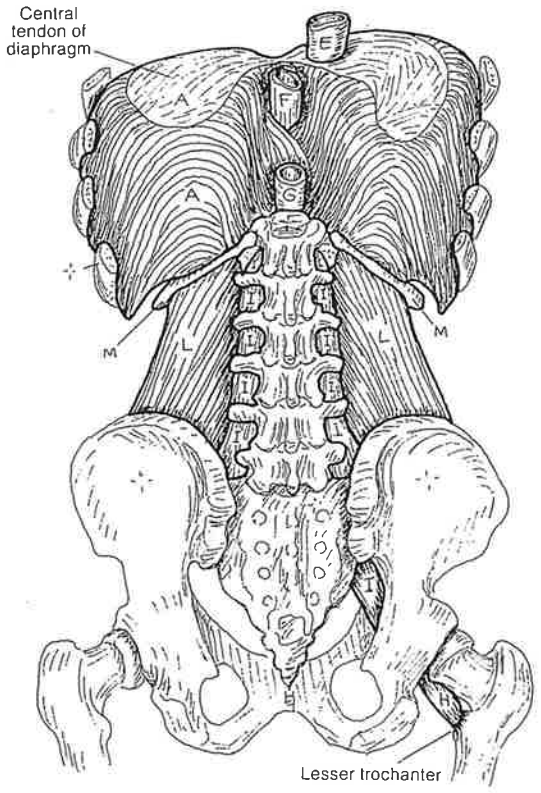
ANTERIOR VIEW

12TH RIB M

INFERIOR VENA CAVA E
ESOPHAGUS F
AORTA G



LATERAL VIEW



POSTERIOR VIEW

POSTERIOR ABDOMINAL WALL MUSCLES

ILIOPSOAS H
PSOAS MAJOR I MINOR J
ILIACUS K
QUADRATUS LUMBORUM L

The tendons of iliacus and psoas major converge to a single insertion (*iliopsoas*). Iliopsoas, a strong flexor of the hip joint, is a powerful flexor of the lumbar vertebrae; a weak psoas may contribute to low back pain. *Quadratus lumborum* is an extensor of the lumbar vertebrae (bilaterally) and a lateral flexor unilaterally. It functions in respiration by securing the 12th rib. Immediately anterior to these muscles is the retroperitoneum (see Plate 147).

See 27

DEEP MUSCES OF BACK & POSTERIOR NECK

CN: Use your lightest colors on the B and C groups. Note that splenius (A) and semispinalis (C^1) represent more than one muscle; the muscle subsets are identified. (1) After coloring the muscles of the back and posterior neck, color the lower right diagram, which describes the location and function of the deep movers of the spine.

The deep muscles of the back and posterior neck extend, rotate, or laterally flex one or more of the 24 paired facet joints and the 22 intervertebral disc joints of the vertebral column. The long muscles move several motion segments (recall Plate 27) with one contraction, while the short muscles can move one or two motion segments at a time (see intrinsic movers).

COVERING MUSCLE

SPLENIUS A

The splenius muscles extend and rotate the neck and head in concert with the opposite sternocleidomastoid muscle. Splenius capitis covers the deeper muscles of the upper spine.

VERTICAL MUSCLES

ERECTOR SPINAE B

SPINALIS B'
LONGISSIMUS B^2
ILIOCOSTALIS B^3

The erector spinae group comprises the principal extensors of the vertebral motion segments. Oriented vertically along the longitudinal axis of the back, they are thick, quadrilateral muscles in the lumbar region, splitting into smaller, thinner separate bundles attaching to the ribs (iliocostalis), and upper vertebrae and head (longissimus, spinalis). Erector spinae arises from the lower thoracic and lumbar spines, the sacrum, ilium, and intervening ligaments.

OBLIQUE MUSCLES

TRANSVERSOSPINALIS GROUP C

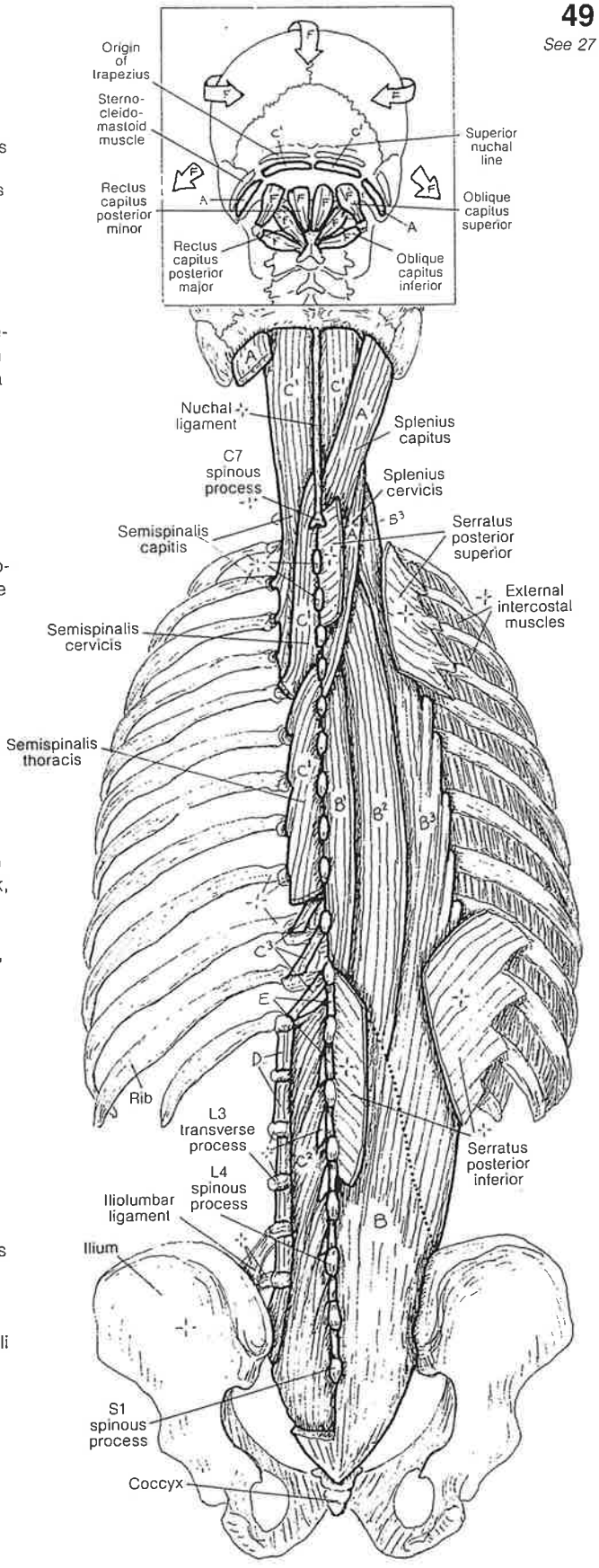
SEMISPINALIS C'
MULTIFIDUS C^2
ROTATORES C^3

The transversospinalis group extends the motion segments of the back, and rotates the thoracic and cervical vertebral joints. These muscles generally run from the transverse processes of one vertebra to the spine of the vertebra above, spanning three or more vertebrae. The semispinales are the largest muscles of this group, reaching from mid-thorax to the posterior skull; the multifidi consist of deep fasciculi spanning 1–3 motion segments from sacrum to C2; the rotatores are well defined only in the thoracic region.

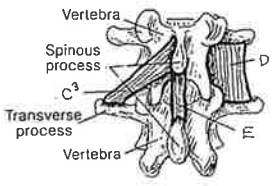
DEEPEST MUSCLES

INTERTRANSVERSARII D
INTERSPINALIS E
SUBOCCIPITAL MUSCLES F

These small, deep-lying muscles cross the joints of only one motion segment. They are collectively major postural muscles. Electromyographic evidence has shown that these short muscles remain in sustained contraction for long periods of time during movement and standing/sitting postures. They are most prominent in the cervical and lumbar regions. The small muscles set deep in the posterior, suboccipital region (deep to semispinalis and erector spinae) rotate and extend the joints between the skull and C1 and C2 vertebrae.



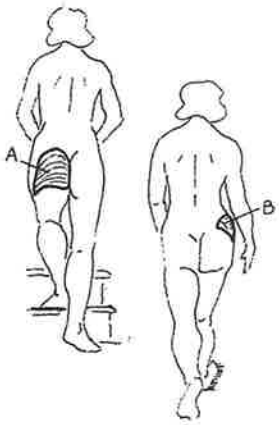
INTRINSIC MOVERS



EXTENSOR E
ROTATOR C^3
LATERAL FLEXOR D

MUSCLES OF THE GLUTEAL REGION

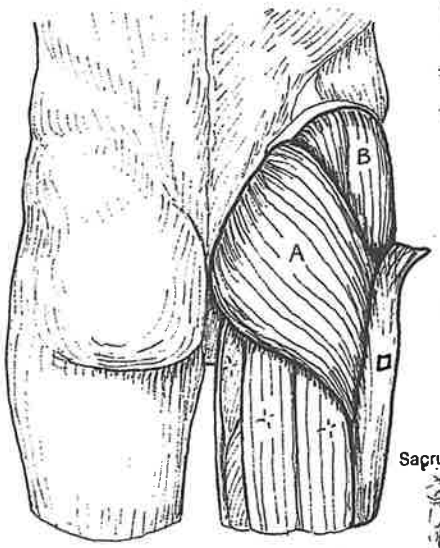
CN: In the posterior and lateral views (superficial dissections), the upper fibers of the iliotibial tract (*[1]) have been cut away, exposing gluteus medius. (1) Color each muscle in all views, including the directional arrows, before going on to the next. The origin of piriformis (E) cannot be seen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



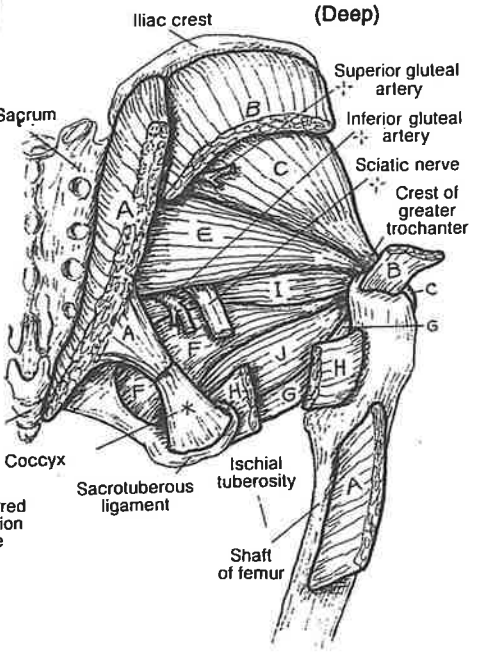
3 GLUTEAL MUSCLES:

- * 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 uphill, 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.



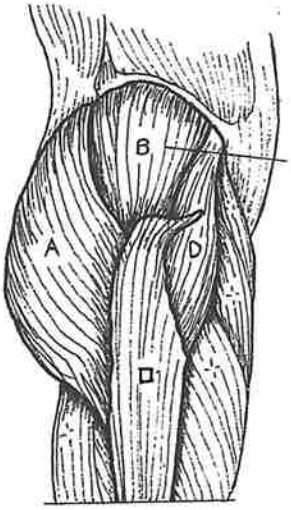
(Superficial)



6 DEEP, LATERAL ROTATORS:

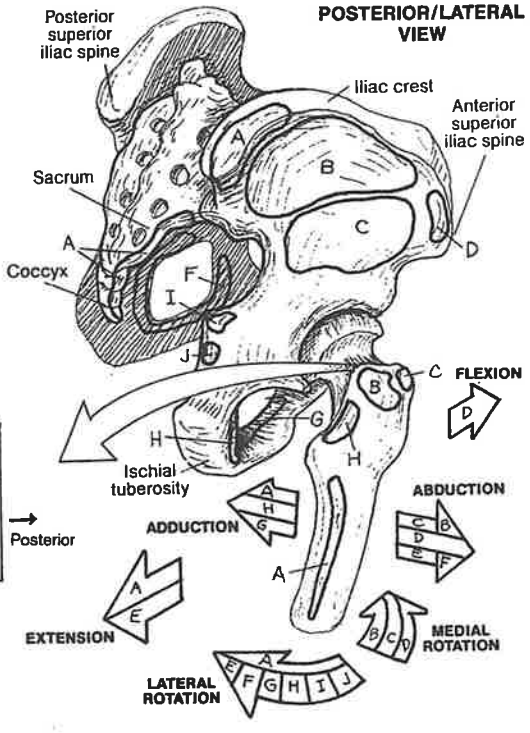
- * PIRIFORMIS E
- OBTURATOR INTERNUS F
- OBTURATOR EXTERNUS G
- QUADRATUS FEMORIS H
- GEMELLUS SUPERIOR I
- GEMELLUS INFERIOR J

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.



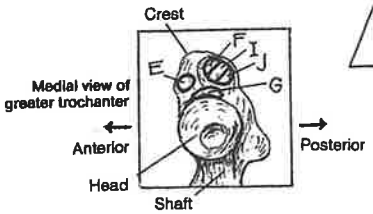
LATERAL VIEW

(Superficial)



* ILIOTIBIAL TRACT D

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.

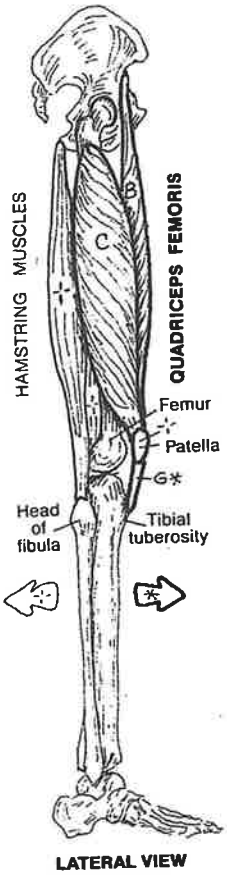


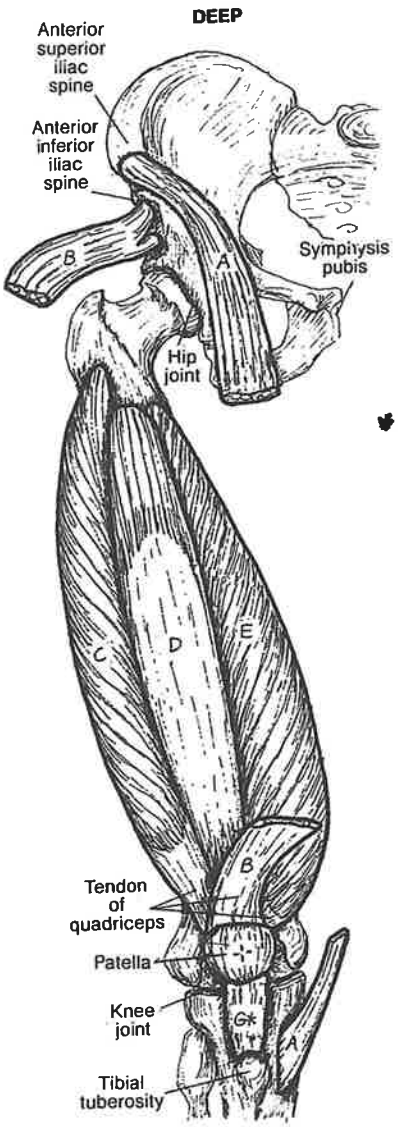
MUSCLES OF THE ANTERIOR THIGH

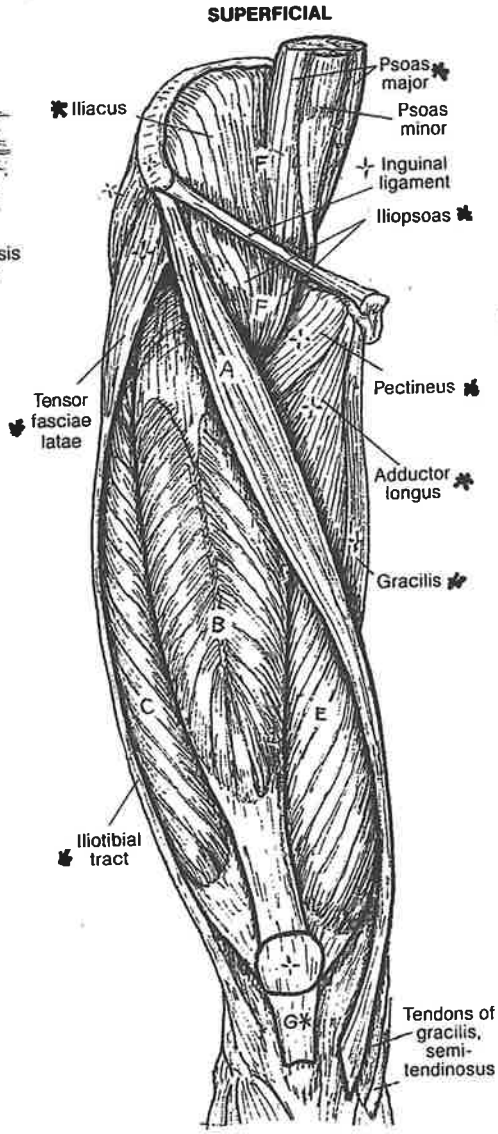
- *SARTORIUS A
- QUADRICEPS FEMORIS:
  - *RECTUS FEMORIS B
  - *VASTUS LATERALIS C
  - *VASTUS INTERMEDIUS D
  - *VASTUS MEDIALIS E
- *ILIOPSOAS F

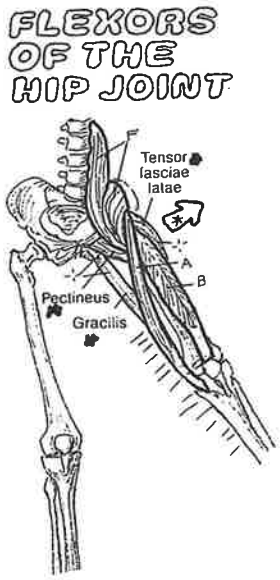
PATELLAR LIGAMENT G*

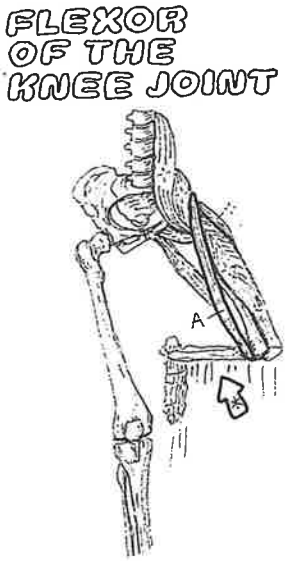
CN: The patellar ligament (G*) is colored gray but the patella is left uncolored. (1) Begin with the deep view of the thigh and then complete the superficial view. (2) On the far left, color the visualized portions of the quadriceps that are antagonists to the hamstring group. (3) Complete the action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

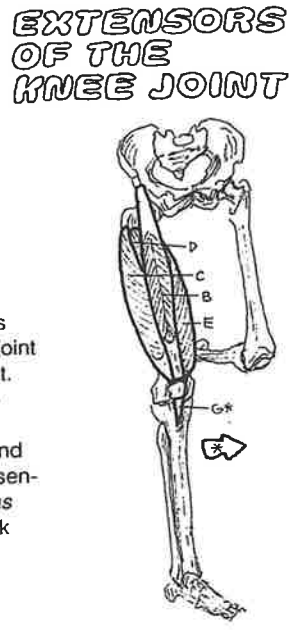












The sartorius ("tailor's" muscle; so-called because of the role of this muscle in enabling a crossed-legs sitting posture) is a flexor and lateral rotator of the hip joint and a flexor of the knee joint, as you can infer from its illustrated attachments. *The quadriceps femoris* muscle arises from four 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.

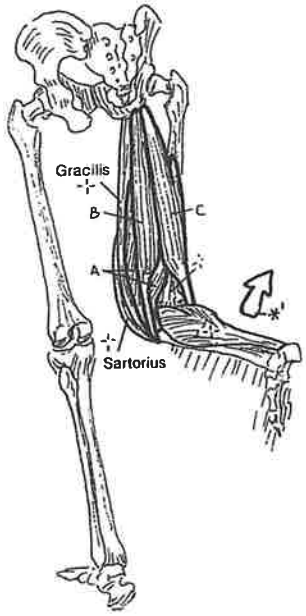
MUSCLES OF THE POSTERIOR THIGH

HAMSTRINGS:

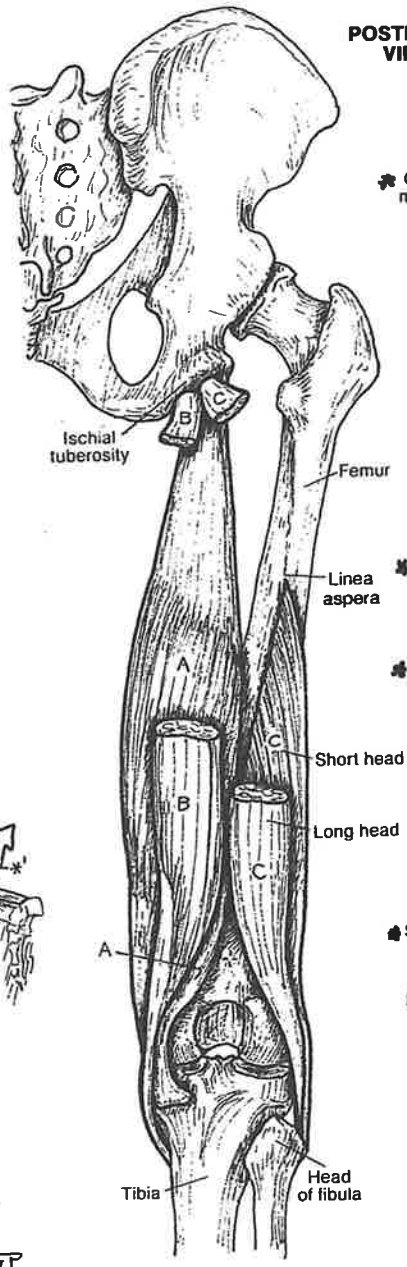
- SEMIMEMBRANOSUS A
- SEMITENDINOSUS B
- BICEPS FEMORIS C

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

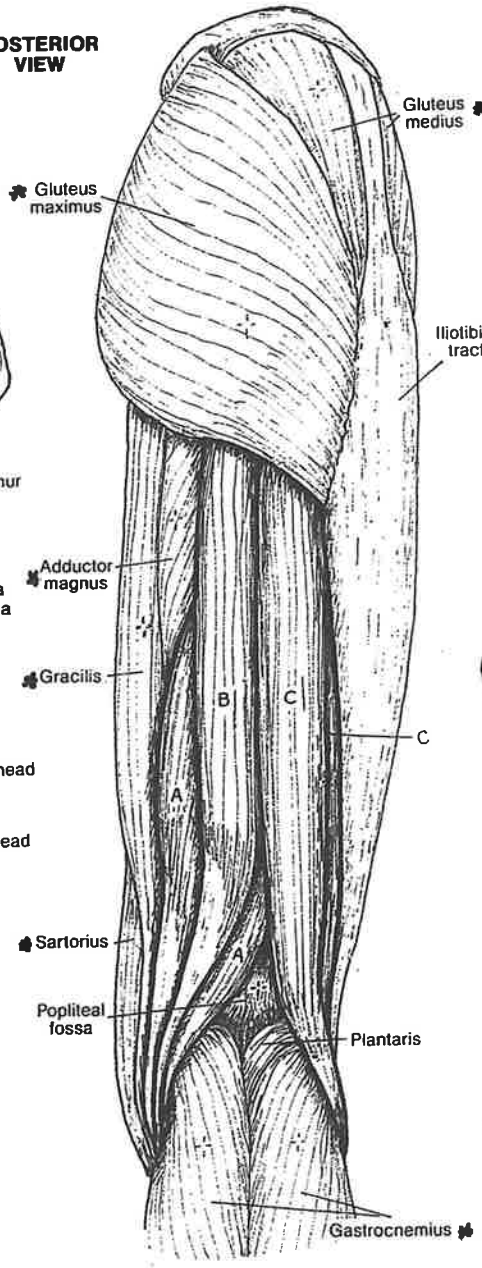
CN: (1) Color each hamstring muscle in the deep view before going on to the superficial. Then color the diagrams of flexion and extension. (2) Color gray the outline of the muscles in the drawings at upper right.



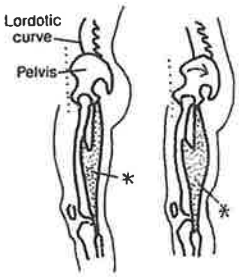
FLEXORS OF THE KNEE JOINT



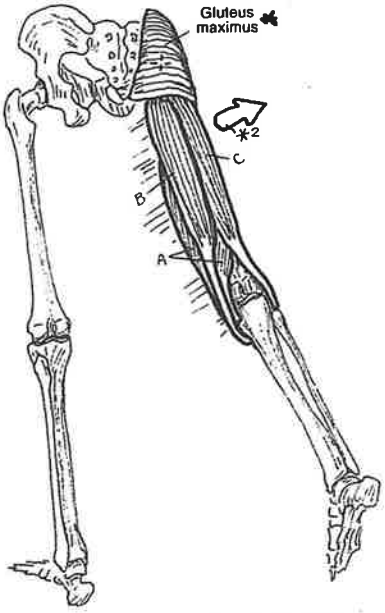
DEEP



SUPERFICIAL



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



EXTENSORS OF THE HIP JOINT

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.

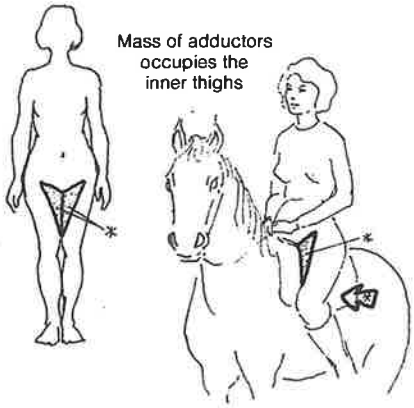
Reduced hamstring stretch ("tight hamstrings") limits hip flexion with the knee extended; flexion of the knee permits increased hip flexion. Try this on yourself. Tight hamstrings, by their ischial origin, pull the posterior pelvis down, lengthening the erector spinae muscles and flattening the lumbar 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 MEDIAL THIGH

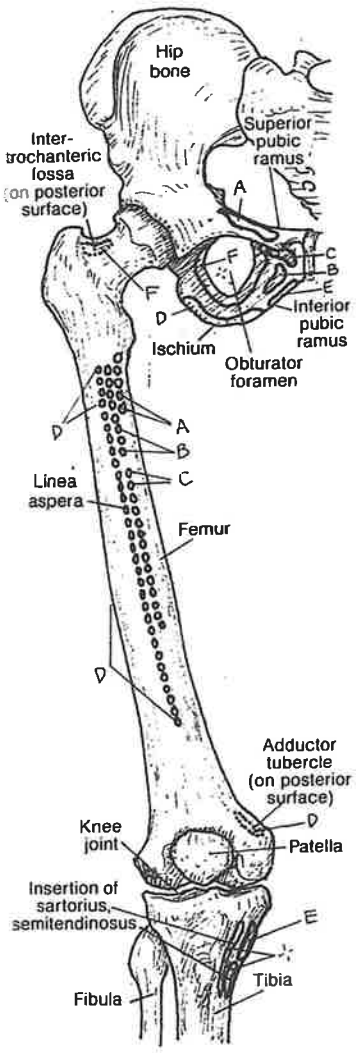
CN: Color one muscle at a time in the five main views before going to the next one. Note that the attachment sites on the *posterior* surface of the femur are represented by dotted lines.

*PECTINEUS A
*ADDUCTOR BREVIS B
*ADDUCTOR LONGUS C
*ADDUCTOR MAGNUS D
*GRACILIS E
OBTURATOR EXTERNUS F

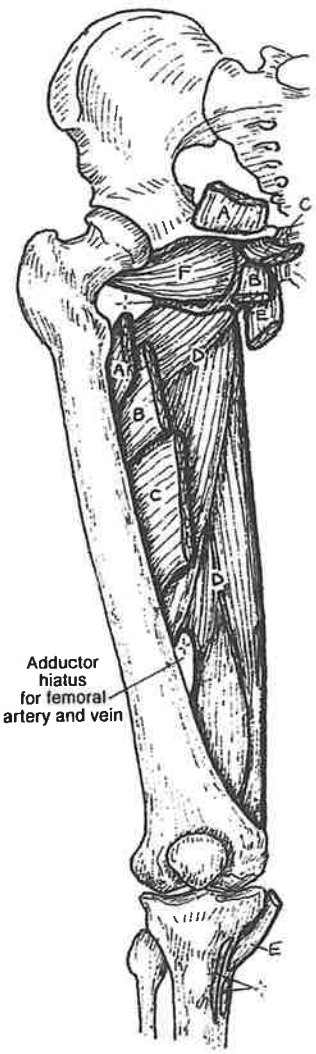


ANTERIOR VIEW

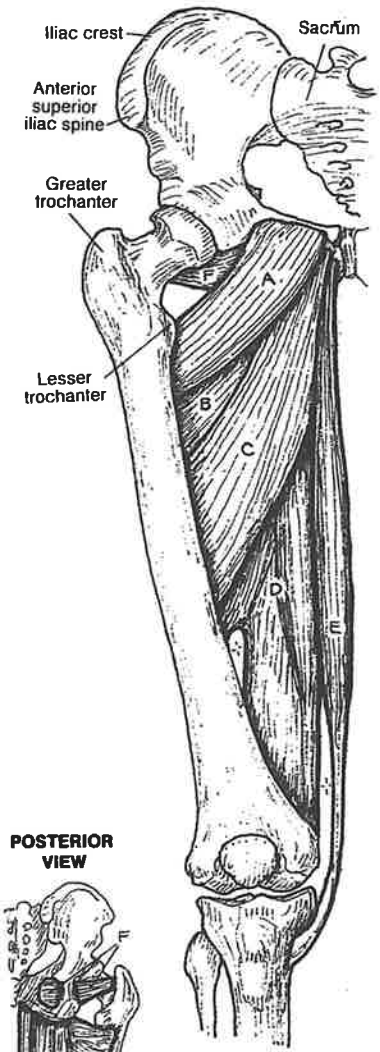
ATTACHMENT SITES



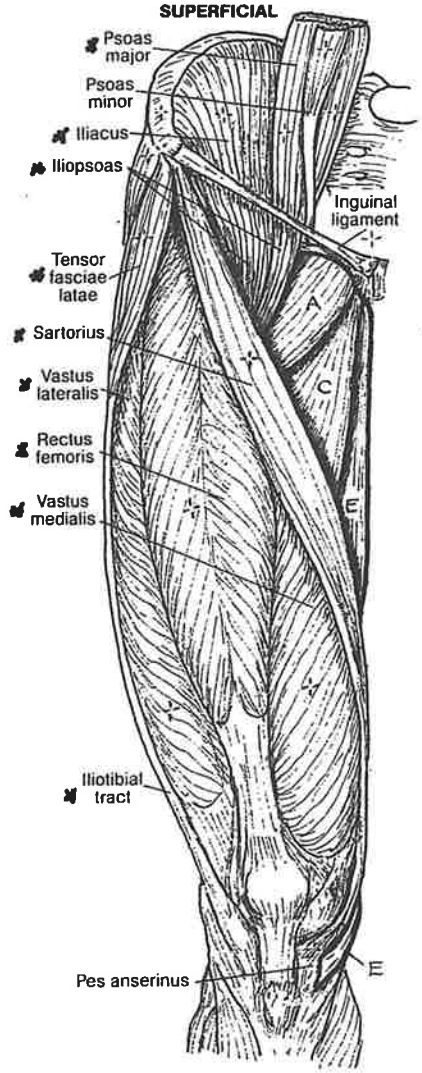
DEEP



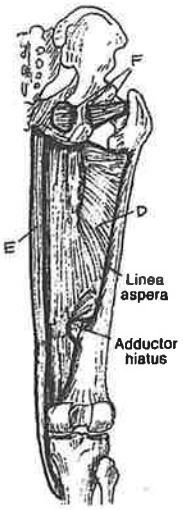
INTERMEDIATE



SUPERFICIAL



POSTERIOR 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 semitendinosus 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.