The joints of the upper limb may be dissected on select cadavers. Your instructors will designate the cadavers to be used for joint dissection.

**STERNOCLAVICULAR JOINT**

**PROCEDURE:** Position the cadaver supine. Remove skin from the area covering the anterior surface of the joint.

1. Locate the articulation of the sternal end of the clavicle with the manubrium sterni.
2. Identify the anterior sternoclavicular ligament and the interclavicular ligament.
3. Remove, with a bone saw, a piece of bone approximately 1 inch long from the mid-shaft of the clavicle. This will allow the sternal and acromial ends of the clavicle to be moved about for better viewing of joint surfaces. Save the cut piece of bone for replacing when the study is completed.
4. With the scalpel blade turned horizontally, gently shave off the anterior sternoclavicular ligament until both joint surfaces and the articular disc can be seen.
5. Move the sternal end of the clavicle around in order to view both joint cavities. A few underlying soft tissues may need to be released from the sternal end of the clavicle to allow more flexibility. Leave the posterior sternoclavicular ligament intact.
6. Identify the articular disc and note that it divides the sternoclavicular joint into two cavities. The articular disc can be easily moved with your probe.
7. The costoclavicular ligament is found deep to the subclavius muscle at its costal attachment. Remove portions of this muscle medially to locate the costoclavicular ligament. 
8. Read a description of the movements occurring at this articulation relative to shoulder girdle motion.

**ACROMIOCLAVICULAR JOINT**

**PROCEDURE:** Position the cadaver supine.

1. Release fibers of the anterior and middle deltoid from the lateral end of the clavicle; turn the deltoid distally. Identify the acromioclavicular ligament between the acromial end of the clavicle and the acromion. Read an account
of the role of this ligament during movements of the shoulder girdle.

2. Release any underlying structures restricting movement of the acromial end of the clavicle. Move this piece of bone around to study the motions occurring at the acromioclavicular joint. Release a few fibers of the joint capsule to view the articular surfaces, which consist of fibrocartilage instead of articular cartilage as is usually seen in a diarthrodial joint. Depending on the function of this structure in the individual, there may be an articular disc present consisting of fibrocartilage. 

**Coracoclavicular Ligament**

1. Identify the coracoclavicular ligament, which passes from the coracoid process of the scapula to the clavicle.

2. Distinguish between the two parts of this ligament—i.e., the trapezoid and conoid ligaments. The trapezoid lies more laterally and the conoid is medial. Study the function of this ligament.

**Coracoacromial Ligament**

Identify the coracoacromial ligament, which passes from the coracoid process of the scapula to the acromion. The tendon of the supraspinatus muscle courses deep to this ligament. Read a description of how this ligament aids in protecting the shoulder joint.

**Glenohumeral Joint**

1. With the cadaver supine, identify the coraco-humeral ligament. This ligament may be found at the coracoid process. It passes to the greater tubercle of the humerus, blending with the insertion of the supraspinatus and the fibrous capsule. Review the function of this ligament.

2. Turn the cadaver prone. Place a block under the thorax so the humerus drops toward the dissecting table, giving a clear view of the posterior shoulder.

3. Remove the posterior deltoid, and release the insertions of the supraspinatus, infraspinatus, and teres minor so the posterior wall of the capsule can be viewed.

4. Make a vertical incision through the posterior wall of the joint capsule.
5. Rotate the humerus medially until the anterior wall of the joint capsule can be seen.

6. Identify:
   a. articular cartilage in the glenoid cavity (folds of synovium at its edge)
   b. glenoid labrum (the inferior glenohumeral ligament blends into this labrum)
   c. synovial tissue forming bursa
   d. tendon of the long head of the biceps brachii (It passes through the joint cavity and is enclosed in a tubular synovial sheath formed by the synovial capsule).
   e. glenohumeral ligaments (superior, middle, and inferior).

7. Trace the course of the tendon of the long head of the biceps brachii (Figure 11.4).
   Note its passage through the intertubercular groove (bicipital groove) deep to the transverse humeral ligament.

8. Review the motions that occur at the shoulder joint, and observe the movement of the head of the humerus in the glenoid cavity throughout the range of each motion.

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**Figure 11.4**

Shoulder joint. Long head of the biceps and glenohumeral ligament.

- Long head of the triceps tendon
- Glenohumeral ligament
- Acromion process
- Head of humerus
Elbow Joint (Ulnohumeral and Radiohumeral) and Proximal Radioulnar Joint

PROCEDURE: Position the cadaver supine.

1. Remove the attachments of the pronator teres and the common flexor tendon on the medial epicondyle of the humerus. Release any additional soft tissue that obstructs dissecting in this area.

2. On the lateral surface of the humerus, release the origin of the extensor carpi radialis longus and brachioradialis. Remove the common extensor tendon from the lateral epicondyle, as well as any other soft tissue that interferes with dissection.

3. Cut through the tendon of insertion of the brachialis, if this was not done previously.

4. The insertion of the triceps brachii on the olecranon should be released as well as the humeral attachment of the anconeus. The supinator can now be viewed clearly.

5. Identify:
   a. anular ligament
   b. radial collateral ligament (Note that one portion of this ligament blends with the anular ligament and another portion continues to the radius, blending with fibers of the supinator.)
   c. ulnar collateral ligament (Locate the anterior, posterior, and oblique bands of this ligament [Figure 11.5].)
6. Define the upper and lower limits of the fibrous capsule at the elbow.

7. Make a transverse incision on the anterior surface of the joint capsule. Do not remove pieces of the joint capsule. Leave it intact except for the incision lines because this capsule will need to be repositioned for study.

8. With the joint capsule open, move the elbow into flexion and extension, and note the approximation of the joint surfaces throughout the range of movement.

9. Pronate and supinate the forearm, and study the rotation of the radius in the proximal radioulnar joint.

**DISTAL RADIOULNAR JOINT, WRIST (RADIOCARPAL) JOINT, AND INTERCARPAL JOINTS**

1. Remove flexor and extensor tendons around the wrist. Release any other structures that obstruct dissection in this area.

2. Use your atlas to identify the radial and ulnar collateral ligaments of the wrist joint.

3. Locate the palmar radiocarpal ligaments of the wrist joint. Clip open these ligaments as necessary in order to view the joint surface of the distal radioulnar joint and the wrist joint.

4. Identify the sacciform recess of the capsule of the distal radioulnar joint extending between the radius and ulna.

5. Locate the articular disc. Note the attachment of this disc to the radius and the ulna. With the wrist in extension, identify the proximal row of carpal bones, which articulate with the radius and the articular disc.

6. Move the wrist joint in flexion, extension, abduction, and adduction. Study the degree of movement of the carpal bones throughout the range of each motion.

7. Locate palmar ligaments and interosseous ligaments on the palmar surface of the carpal bones.

**METACARPOPHALANGEAL JOINTS AND INTERPHALANGEAL JOINTS**

1. Remove the flexor and extensor tendons passing over the metacarpophalangeal and interphalangeal joints of the index finger and the thumb.

2. Identify the palmar ligament (plate) at each joint. Note that the palmar ligament is attached to the hood at the metacarpophalangeal joint.

3. Identify the collateral ligaments of each joint. Flex and extend each joint separately, and observe which motion results in the collateral ligaments becoming taut.

4. Move the metacarpophalangeal joint in flexion, extension, abduction, adduction, and circumduction. Observe these motions with the joint capsule intact.

5. Flex the digit at the metacarpophalangeal joint. Identify the thickened areas of the capsule on the medial and lateral sides of the metacarpophalangeal joints. These are the collateral ligaments. Being careful not to cut through the collateral ligaments, make a transverse incision on the dorsal surface of the metacarpophalangeal joint capsule to expose the head of the metacarpal. Do not remove pieces of the capsule. Leave the capsule intact except for the incision line.

6. Locate and preserve the collateral ligaments of the interphalangeal joints in the same manner.
7. To open the proximal and distal interphalangeal joints of the digit, flex the joint and then make a transverse incision on the dorsal surface. Observe the contact of the joint surfaces when these joints are moved in flexion and extension.

8. Explore the carpometacarpal joint of the thumb by making an incision on the anterior surface of this joint. Locate and preserve the collateral ligaments of this joint. Study the approximation of the joint surfaces as this joint is moved through flexion, extension, abduction, adduction, and opposition.

9. The metacarpophalangeal joint and interphalangeal joint of the thumb may be explored by making an incision on the dorsal surface of the joint capsule.
This section describes dissection of the anterior abdominal wall muscles. Abdominal viscera will be dissected later. The posterior neck is included in the deep back dissection because many of the back muscles have a cervical component.

**PROCEDURE:** Position the cadaver supine.

1. Palpate the following on the cadaver:
   a. xiphoid process
   b. ribs 8, 9, and 10
   c. umbilicus
   d. anterior superior iliac spine
   e. pubis

2. Make a midline incision from the xiphoid process to the pubis. This incision should be made superficially so as not to cut into the muscles lying underneath. Make your cut midline through the umbilicus. Continue the incision from the pubis to the anterior superior iliac spine. Remove skin working laterally, preserving the skin flap as one piece.

   **NOTE TO THE DISSECTOR** Remove skin and fat. Use the blunt edge of the blade at a near horizontal angle to scrape overlying fat off the underlying aponeurosis only. DO NOT remove the aponeurosis of the external oblique that makes up the anterior wall of the rectus sheath; it will appear white and shiny. The anterior wall is to be preserved in its entirety.

3. Identify:
   a. linea alba
   b. anterior wall of the rectus sheath
   c. external abdominal oblique (hereafter referred to as external oblique)

4. Muscular branches from the lower six thoracic nerves innervate the anterior abdominal wall muscles. The cutaneous branches of these nerves are found on the superficial surface of the external oblique. Preserve several cutaneous branches of lower thoracic nerves piercing through the anterior wall of the rectus sheath.
5. Study each muscle attachment of the external oblique, and review the action of this muscle when it is contracting unilaterally and when acting bilaterally.

6. Make an incision in the anterior wall of the rectus sheath approximately 1 inch lateral to the midline. Lift the rectus sheath with forceps and snip open the sheath to lift it off the rectus abdominis muscle, bringing it to the lateral edge of the abdominals. **DO NOT** remove it! Only take the sheath laterally to view the rectus abdominis and **NO** further. Turn aside the anterior wall of the rectus sheath for study, but do not remove it.

7. Identify the rectus abdominis. Observe the muscle attachments on the pubis and the costal cartilages of the fifth, sixth, and seventh ribs. Locate tendinous intersections in the rectus abdominis. Demonstrate the action of this muscle. **Figure 12.3**.

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**Figure 12.2** Anterior abdominal wall. Exposure of the rectus abdominis.
8. Gently work your fingers under the lateral edge of the rectus abdominis between this muscle and the posterior abdominal wall. You will be separating the rectus abdominis muscle from the posterior wall of the rectus sheath. Branches of the lower six thoracic nerves innervating this muscle can be felt.

9. With a probe placed under one section of the rectus abdominis (the lower quarter of the muscle), make a horizontal incision through this muscle. Figure 12.4.

10. Use your finger to probe under the cut section of the rectus abdominis to be able to pull back the muscle and locate the arcuate line (semicircular line) on the posterior wall of the rectus sheath. Use your blade only as necessary because the area deep to the posterior abdominal wall is very delicate. Some fat may need to be carefully removed to clearly view the arcuate line. Locate on the posterior wall of the rectus sheath the arcuate line. The aponeurotic layer of the external oblique and the superficial aponeurotic layer of the internal oblique form the anterior wall of the rectus sheath above the umbilicus. The deep aponeurotic layer of the internal oblique and the layers of the transversus abdominis aponeurosis form the posterior wall of the rectus sheath. Midway between the umbilicus and the symphysis pubis, the aponeuroses of all three muscles pass anterior to the rectus abdominis muscle. The arcuate line marks the lower border of the posterior rectus sheath. See Figure 12.5.
**Figure 12.4** The lower rectus abdominis cut to reveal the posterior abdominal wall and arcuate line.

**Figure 12.5** Anterior and posterior abdominal wall. (a) The *anterior abdominal wall* "above" the umbilicus with the entire aponeurotic layer of EO (external oblique) and half of IO (internal oblique) going above RA (rectus abdominis muscle). The *posterior abdominal wall* "above" the umbilicus is made up of half of the aponeurotic layer of IO and the entire aponeurotic layer of TA (transversus abdominis). (b) The *anterior abdominal wall* "below" the umbilicus with all of the aponeurotic layers of EO, IO, TA going above RA. The *posterior abdominal wall* "below" the umbilicus is made up of peritoneum. The *arcuate line* is the point of demarcation where the aponeurotic layers change.
11. Cut along the lower ribs with an electric saw beginning at the xiphoid process and proceeding laterally to the midaxillary line. Continue cutting the lower ribs moving caudally along the midaxillary line.

**NOTE TO THE DISSECTOR** When using a bone saw to cut ribs, move through until you feel a slight “give,” then withdraw the saw quickly to avoid cutting deeper viscera. After making a few cuts, let the bone saw cool by turning off the switch. When finished using the bone saw, be sure to wipe it clean with a paper towel and return it to the cabinet.

Area above umbilicus

12. With a scalpel, cut the lateral flank (along the midaxillary line) of the external oblique, beginning at its attachment on the lowest rib and continuing to the anterior superior iliac spine. Do not cut too deep, as structures deep to the external oblique are very delicate.

13. Continue the incision from the anterior superior iliac spine to the pubis at the midline, leaving a small section of the external oblique approximately 1⁄2 inch long just proximal to the crease at the front of the hip. The dissection from each side of the cadaver should meet in the midline of the body of the cadaver. This inferior border of the external oblique forms the inguinal ligament.

**Figure 12.6** Incision lines for cutting ribs and midaxillary line of lower abdominals to pubis.
14. Beginning at the cut edge of the lateral flank (along the midaxillary line), remove the fascia overlying the external oblique to reveal muscle fibers. Separate the external oblique from the deeper internal abdominal oblique (hereafter referred to as internal oblique), working medially. Muscle fibers may need to be cut to reveal deeper structures. Be sure to use a probe to separate the structures being cut from underlying tissue. A fascial cleft exists between the different layers of muscle that allows the separation of layers to reveal the underlying muscle. Note the difference in the direction of muscle fibers of these two oblique muscles.

15. Review muscle attachments of the internal oblique. Review the movements accomplished when this muscle acts unilaterally and when it contracts bilaterally.

16. Make an incision through the lateral portion of the internal oblique and the transversus abdominis at the level of the cut edge of the lateral flank (along the midaxillary line) of the external oblique (Figure 12.7). Continue the incision from the anterior superior iliac spine to the pubis (at the midline), meeting the incision line from the other side at the pubis. Separate the internal oblique from the transversus abdominis. The transversus abdominis may be attached to the back of the internal oblique and may need to be carefully separated.

17. When dissectors on both sides of the table have completed the preceding steps, the anterior abdominal wall may be turned toward the thorax by releasing any remaining underlying tissues, such as peritoneum and fascia.
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**Anterior Abdominal Wall**

The abdominal cavity will be full of fluid from the embalming process. If the peritoneum is accidentally pierced, fluid and possible fecal matter from the intestines (if the intestines are pierced) may be encountered. Notify the instructor so the intestines may be tied off to prevent fecal matter from entering the abdominal cavity.

18. Locate on the cadaver muscle attachments of the transversus abdominis. Note the direction of the muscle fibers and the action accomplished by this muscle.

19. The incision lines required in Figure 12.6c and Figure 12.6d severed the iliohypogastric and ilioinguinal nerves as they enter the anterior abdominal wall muscles laterally. Branches of the iliohypogastric nerve and the ilioinguinal nerve may be seen on the lateral aspect of the transversus abdominis muscle and piercing through the internal oblique. It is not necessary to trace these branches.

20. Muscular branches from the lower six thoracic nerves innervate the anterior abdominal wall muscles. The cutaneous branches of these nerves are found on the superficial surface of the external oblique. Find several of the thoracic branches and preserve them.

21. The inguinal ligament is formed by the lower border of the aponeurosis of the external oblique. This ligament is found from the anterior superior iliac spine to the pubic
tubercle. At the medial end of the inguinal ligament, locate the superficial inguinal ring, most easily found in the male (Figure 12.9).

22. On a male cadaver, locate the spermatic cord as it emerges from the superficial inguinal ring. Branches of the ilioinguinal nerve may pass through the superficial inguinal ring along with the spermatic cord. Leave these structures intact. The contents of the spermatic cord will be dissected in more detail when the male pelvis is studied in a later section (Chapter 37).

23. On a female cadaver, the superficial inguinal ring may or may not be discernible. The ilioinguinal nerve and strands of the round ligament of the uterus are sometimes seen in the inguinal canal. These will be studied in more detail in a later section.
PROCEDURE: Position the cadaver prone. Place a block under the thorax for better access to the posterior trunk.

1. Release the latissimus dorsi from its attachment on the spinous processes and reflect this muscle laterally. (Figure 13.1)

2. Turn back the released muscle flaps of the rhomboid major and minor and the latissimus dorsi, and identify the intermediate layer of back muscles—i.e., serratus posterior superior and serratus posterior inferior (Figure 13.1). Often the serratus posterior superior and serratus posterior inferior are adhered to the muscles lying above them: rhomboids and latissimus dorsi. Therefore, it will be necessary to release them from the more superficial muscles. This should be done carefully because the serratus muscles are very thin and can be torn easily. Review the actions of these muscles.

**Figure 13.1** Incision lines preparatory for dissection of the deep back muscles.
3. Make an incision through the serratus posterior superior and inferior at their origins on spinous processes and turn aside these muscles (Figure 13.1). Often this has been done while dissecting the superficial muscles (rhomboids and latissimus dorsi) as they were released from the spinous processes.

4. Remove the trapezius completely from the occipital bone if this was not done previously. Be sure to look carefully at the direction of muscle fibers in this area to be sure the upper trapezius has been removed. The upper trapezius fibers are easily confused with the splenius muscles.

5. Study the splenius capitis and cervicis. Note the separation of the cervicis portion of this muscle from the capitis. Study the differences in the points of insertion—i.e., the splenius capitis attaches to the mastoid process deep to the sternocleidomastoid, whereas the splenius cervicis inserts on the transverse processes of the first three cervical vertebrae deep to levator scapulae. Explain the actions accomplished when these muscles are acting unilaterally and when both sides act together.

6. Release the splenius capitis and cervicis from their origin on the spinous processes.

7. The semispinalis capitis can be seen deep to the splenius muscles.

8. Remove the thoracolumbar fascia and identify the three columns of the erector spinae (sacrospinalis). Observe the general attachments of each portion of these muscles on the cadaver. Columns:
   a. iliocostalis lumborum
      i. thoracis
      ii. cervicis
   b. longissimus thoracis
      i. cervicis
      ii. capitis
   c. spinalis thoracis

9. The erector spinae extends the spine when acting bilaterally. Explain the movements accomplished by each portion of this muscle when acting unilaterally.

10. Dorsal rami of spinal nerves innervate the muscles of the deep back. Locate several branches of these nerves entering muscle. These nerves are seen piercing through the back muscles as they course their way to the skin. The cutaneous branches of dorsal rami of spinal nerves are cutaneous innervation for the skin on the back.

11. Make a transverse incision through the belly of the longissimus thoracis at the level of the upper thoracis vertebrae (Figure 13.3). Turn aside the released muscle flaps to view the semispinalis thoracis, which is deep to the longissimus thoracis. Semispinalis thoracis will look very tendinous with little muscle fiber visible.
The semispinalis cervicis will be seen when the suboccipital region is dissected.

12. Review the attachments of the semispinalis capitis and thoracis. Explain how the semispinalis thoracis rotates the vertebral column when acting unilaterally. Demonstrate the actions of the semispinalis capitis on the head and cervical spine when acting unilaterally and bilaterally.

13. With the cut portion of longissimus thoracis held aside, identify levator costae muscles coursing from an angle of a rib to the transverse process above (Figure 13.3).

14. In the lumbar area, with your finger or a probe, try to move the erector spinae away from the spinous processes to view the multifidus muscle. This muscle is triangular. Be sure to review a picture of it in the atlas. An alternative approach to viewing this muscle is to make a horizontal incision across the erector spinae for a short distance and pull it laterally to see the multifidus just lateral to the spinous processes. Read a description of the actions of the multifidus and look at its multiple attachments.
NOTE TO THE DISSECTOR  The rotatores, intertransversarii, and interspinales muscles will be seen when the spinal cord is dissected.
PROCEDURE: Position the cadaver prone. Place a block under the thorax so the head falls into flexion, allowing access to the posterior neck.

1. Review in an atlas the structures to be found deep to the semispinalis capitis before proceeding with dissection.

2. Remove splenius capitus from the occipital bone, leaving the muscle attached to the mastoid process. Be sure to palpate the base of the skull before cutting the attachment of the semispinalis. Make an incision across the occipital attachment of the semispinalis capitis as shown in Figure 14.1. Now reflect this muscle laterally.

3. A dense layer of fibrous and fat tissue is located deep to the semispinalis capitis. Within this fascia, the dissector will need to locate dorsal rami of the second to fourth

Figure 14.1 Incision lines for the semispinalis capitis.
cervical nerves as these nerves pierce the deep surface of the semispinalis capitis. Continue to remove this fascia carefully, raking through it with a probe prior to removing any tissue until the semispinalis cervicis and suboccipital muscles can be seen. The semispinalis cervicis inserts on the spine of the axis. The rectus capitis posterior major and the inferior oblique take origin from the spine of the axis.

4. Identify the insertion of the semispinalis cervicis on the spine of the axis. Review attachments of this muscle. Explain how this muscle rotates the vertebral column when acting unilaterally.

5. Find the dorsal rami of the second cervical nerve (also referred to as the greater occipital nerve) as it emerges at the inferior border of the obliquus capitis inferior where it divides. This is the largest of the cervical dorsal rami and is located on the deep surface of semispinalis capitis. This nerve then pierces through the semispinalis capitis, innervating this muscle.

6. Locate several branches of the dorsal primary division of the third and fourth cervical nerves on the deep surface of the semispinalis capitis.

7. Carefully remove fascia to locate the rectus capitis posterior major, obliquus capitis inferior, and obliquus capitis superior. Note the triangle formed by the position of these three muscles.

8. The muscles forming the suboccipital triangle receive their nerve supply from branches of the dorsal primary division of the first cervical nerve (also referred to as the suboccipital nerve—C1). Attempt to locate several small branches of this nerve as they emerge in the suboccipital triangle.

**NOTE TO THE DISSECTOR** In some cadavers, the small branches of the C1 nerve may not be discernible as it emerges in the fascia. The student may only be able to indicate the area in which the nerve emerges.

9. Identify the rectus capitis posterior minor that is deep and medial to the major.

10. Branches of the occipital artery supply the suboccipital area. This artery enters the area between the lateral border of the obliquus capitis superior and the insertion of longissimus capitis. Study a picture in your atlas showing the location of this artery. Numerous small branches of this artery are found throughout the suboccipital region. Often a cut portion of this artery is found coursing toward the skull.

11. Study the angle of pull of each of the small occipital muscles, and demonstrate the movement in which they participate.

12. Upon completion of dissection of the suboccipital region, the neck muscles can be studied in their entirety. Trace each of these portions of the erector spinae muscle into the cervical region: iliocostalis cervicis, longissimus cervicis, and longissimus capitis.

13. Study the layers of muscles in the posterior neck beginning superficially and progressing deeper. The upper portion of the trapezius overlies the splenius capitis and cervicis. Deep to the splenii is the semispinalis capitis. The semispinalis cervicis and suboccipital muscles are found deep to the semispinalis capitis. **Figure 14.2**

14. Review the dermatome distribution for the anterior and posterior aspects of the trunk as well as the posterior neck.
Figure 14.2 Suboccipital muscles.

- Superior oblique
- Rectus capitis posterior minor
- Rectus capitis posterior major
- Inferior oblique
- Spinous process axis
- Semispinalis capitis
- Semispinalis cervicis
- C2 cervical plexus
Laminectomy—The Spinal Cord

Refer to DVD Disc 1

CHAPTER 15

The instructors will select the cadaver(s) for the laminectomy and dissection of the spinal cord.

PROCEDURE: Position the cadaver prone. Place a block under the thorax.

1. Cut the deep back muscles away from the spinous processes and laminae from the upper cervical area to the superior border of the sacrum. Leave at least a 2-inch clean area down to the bone on either side of the spinous processes.

2. With an electric bone saw, cut through the lamina on each side of the spinous processes beginning at the upper cervical vertebrae and progressing to the fifth lumbar vertebra Figure 15.1. Keep the blade of the bone saw at the junction of the lamina and the base of the spinous process where the bone mass is thin. Work cautiously, using a rubber mallet and chisel to loosen the laminae and spinous processes from the underlying spinal cord (be well aware of the spinal cord deep to the laminae).

3. Once the laminae have been cut, remove the strip of spinous processes. Attempt to remove this piece as one.

4. On the strip of the spinous processes, identify (using an atlas for assistance):
   a. ligamentum flavum
   b. supraspinous ligaments
   c. interspinous ligaments
   d. interspinales muscles (found in the cervical and lumbar areas)

5. Locate the dura mater, then clip the dura open with scissors.

6. Identify the spinal cord and cauda equina. Note the vertebral level of the cauda equina.

7. Locate dorsal roots entering the spinal cord Figure 15.2.

8. At the level of the upper cervical vertebrae, transect the spinal cord and dura mater.

9. Lift the cut portion of the spinal cord in order to see the ventral roots emerging.
10. Trace dorsal and ventral roots into an intervertebral foramen where these roots join to form a spinal nerve.

11. Lift the cut portion of the dura mater to reveal the posterior longitudinal ligament, which is located on the posterior surface of the vertebral body in the vertebral foramen.

12. Note the increase in size of the spinal cord in the cervical area and the lumbar regions where plexi emerge.

**Figure 15.2** Laminectomy.
1. Fold the anterior abdominal wall toward the thorax, and secure it using rope to reveal the peritoneum covering the abdominal contents. With your fingers and a probe, begin gently working loose the peritoneum of the lower abdomen and posterior wall of the abdomen; turn the peritoneum proximally to expose the abdominal contents from the intestines. The mesentery will need to be released at those sites where there is attachment to the body wall. To avoid piercing the intestines, DO NOT use a scalpel in this area. If you have difficulty releasing the mesentery, contact the instructor.

2. Push aside the ascending colon, descending colon, and ileum as needed to proceed to the sigmoid colon. Release folds of peritoneum that prevent movement of these structures.

3. Be careful when handling the sigmoid colon, as it can tear easily. NEVER use a scalpel in this area.

4. Gently, pull the sigmoid colon up from the sigmoid cavity until it is straight.

5. If a tear in the colon does occur, tie off with string above and below the two adjoining areas of the torn sigmoid colon as shown in Figure 16.1. Remove any fecal matter in the torn area. This is essential because fecal matter will lead to mold.

Figure 16.1 Tying off the sigmoid colon.
NOTE TO THE DISSECTOR  A considerable amount of fluid may be found in the abdominal area. DO NOT use the vacuum to suck up the fluid! Use paper towels to soak up and remove excess fluid.

6. Take time to study the lumbar plexus in an atlas to become familiar with the location of each nerve of this plexus before proceeding with dissection. It is very easy to destroy these nerves when performing steps 8 and 9. Look carefully to see if the nerves are visible under the psoas and iliac fasciae. Figure 16.2.

7. The intestines will need to be held aside while dissection of the lumbar plexus proceeds. Secure them with a rope tied to each side of the dissection table.

8. Work loose the psoas fascia, being careful not to injure the anterior surface of the psoas major where some of the nerves lie. This is best done by lifting the fascia with your forceps and clipping it open so as not to injure the nerves that lie underneath the fascia.

9. Cautiously remove the iliac fascia on the surface of the iliacus muscle, being careful not to injure the nerves of the lumbar plexus below. Lifting the fascia as in step 8 will assist with the removal of the iliac fascia and prevent injury to nerves that lie under it.

10. Locate the quadratus lumborum. This muscle lies proximal to the iliac crest.

Figure 16.2 Lumbar plexus.

- Genitofemoral
- Obturator lies deep to medial border of psoas major
- Femoral nerve
- Iliohypogastric
- Ilioinguinal
- Femoral cutaneous
- Inguinal ligament
- Lateral femoral cutaneous
- Psoas major
- Obturator lies deep to medial border of psoas major
11. Identify the following nerves:  
   a. Iliohypogastric (crosses the belly of the quadratus lumborum, then continues along the crest of the ilium)  
   b. Ilioinguinal (emerges just inferior to the iliohypogastric nerve and crosses the belly of the quadratus lumborum and the iliacus muscles to enter the inguinal canal)  
   c. Lateral femoral cutaneous (crosses the iliacus and travels to the lateral thigh)  
   d. Femoral nerve (emerges along the lateral border of the psoas major)  

12. Pull the psoas major laterally in order to locate the obturator nerve, which is found deep on the medial border of the psoas major.  

13. Study the direction of the fibers of the psoas major. This muscle receives its nerve supply from branches of the anterior rami of the first and second lumbar nerves (L1 and L2). Observe the origin of the iliacus in the iliac fossa. Branches of L2 and L3 from the femoral nerve innervate the iliacus. Read an account of the course of these muscles and their common insertion. The psoas major and iliacus are frequently referred to as one muscle—i.e., iliopsoas—although they are distinct muscles. Demonstrate the action achieved by the iliopsoas if the trunk is stabilized. Demonstrate the action accomplished by the iliopsoas when the thigh is stabilized.  

14. Note the attachment of the quadratus lumborum on the iliac crest. Demonstrate the action of this muscle.
PROCEDURE: Position the cadaver supine. Place a block lengthwise between the ankles so the lower limb is held in slight abduction. This will facilitate removal of skin in the adductor region.

1. Palpate on the cadaver the following:
   a. greater trochanter of the femur
   b. patella
   c. medial and lateral condyles of the femur
   d. medial condyle of the tibia
   e. head of the fibula

2. Review in an atlas the position of the great saphenous vein on the medial thigh. As steps 3 and 4 are done, be careful to preserve this large vein because it is deep to the skin.

3. Make a midline incision on the thigh to the level just below the knee. A horizontal incision should also be made from the medial condyle of the tibia to the head of the fibula. DO NOT extend the incision over the head of the fibula or any further posteriorly, as the common peroneal nerve is located just posterior to the head of the fibula.

4. Remove skin and superficial fascia from the anterior thigh working laterally.

   **NOTE TO THE DISSECTOR** The great saphenous vein should be preserved in its entirety from the dorsum of the foot to where it enters the femoral vein at the anterior thigh. Tributaries should be clipped so deeper structures can be viewed.

5. Preserve several of the anterior femoral cutaneous branches from the femoral nerve on the anterior thigh.

6. Identify the fascia lata. Note the extent of this external investing fascia. Be aware of branches of the lateral femoral cutaneous nerve piercing the fascia lata just below the anterior superior iliac spine. This cutaneous nerve may need to be dissected from the fascia lata using a probe to rake through the deep fascia just below the anterior superior iliac spine. The lateral femoral cutaneous nerve is confirmed by gently pulling on the...
distal end (lying superficial on the thigh) and observing it move in the pelvis as it comes off the lumbar plexus. Save branches of this nerve for later study.

7. Trace the great saphenous vein to where it enters the femoral vein. The femoral sheath is located in this area and contains the femoral artery and femoral vein. Cut open the femoral sheath and identify the femoral artery and vein.

8. Continue to remove fascia lata and the deeper fascia lateral to the femoral sheath until the femoral nerve is reached. Locate the femoral nerve at the lateral border of the psoas major. Note that the femoral nerve passes deep to the inguinal ligament to enter the anterior thigh. Structures within the femoral sheath lateral to medial are the femoral nerve, femoral artery, and femoral vein.

9. Read a description of the relationship of the tensor fasciae latae and the iliotibial tract to the fascia lata.

10. Cut through the fascia lata using the incision lines shown in (Figure 17.1). As the fascia lata is turned laterally, preserve a 1-inch strip from the distal portion of the tensor fasciae latae muscle to the lateral condyle of the tibia. This strip is referred to as the iliotibial tract (IT band) Figure 17.2. The remaining fascia lata may now be removed.

11. Identify:
   a. sartorius (Anterior intermediate femoral cutaneous branches pierce through this muscle in many cadavers. These cutaneous nerves come off the femoral nerve.)
   b. rectus femoris
   c. pectineus
   d. adductor longus
   e. gracilis

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**Figure 17.2** Iliotibial band.
12. Locate the femoral triangle (Scarpa’s triangle), and identify the boundaries formed by the sartorius, adductor longus, and inguinal ligament. Note that the pectineus and insertion of the iliopsoas form the floor of this triangle. The femoral vein, femoral artery, and femoral nerve are found in the triangle from medial to lateral.

13. Locate the continuation of the lateral femoral cutaneous nerve into the thigh. It passes over the iliacus below the inguinal ligament and emerges just inferior to the origin of the sartorius on its lateral aspect.

14. Study the proximal and distal muscle attachments of the sartorius. Pull on the muscle belly of the sartorius and observe the action accomplished.

15. As the femoral nerve emerges deep to the inguinal ligament, note its division into numerous branches. Probe carefully with your fingers to find the branch to the sartorius. Cut through the belly of the sartorius distal to the entrance of the femoral nerve.

16. With the sartorius turned aside, the femoral artery and vein can now be found deep to the sartorius in the adductor (Hunter’s) canal. These structures are surrounded by a sheath, which also includes the saphenous nerve (a cutaneous branch of the femoral
nerve to the medial leg) and the nerve to the vastus medialis. The sheath will need to be clipped open to study the femoral artery and vein and these nerves.

17. The femoral vein can now be removed to allow viewing of deeper structures in the upper thigh. Where the great saphenous vein enters, leave a 1-inch piece of the femoral vein attached to fascia as a reminder of the location of the femoral vein.

18. Study the relationship of the origins of the sartorius and the rectus femoris.

19. Locate the insertion of the rectus femoris into the tendon of the quadriceps femoris. Demonstrate the action of this muscle at both the hip joint and knee joint.

20. Cut through the rectus femoris at its insertion into the tendon of the quadriceps femoris (Figure 17.4). Locate the branch of the femoral nerve to the rectus femoris as it enters the proximal portion of this muscle on its deep surface.

21. With the sartorius muscle reflected, identify:
   a. vastus lateralis
   b. vastus medialis
   c. vastus intermedius
Review both proximal and distal attachments of these muscles. Study the direction of fibers at the insertion of each muscle. Demonstrate the action of this muscle group.

**NOTE TO THE DISSECTOR** The articularis genu will be viewed when the knee joint is dissected.

22. Trace the branches of the femoral nerve to the following muscles:
   a. rectus femoris (enters the proximal portion of this muscle on its deep surface)
   b. vastus medialis (accompanies the saphenous nerve and femoral artery on the medial border of this muscle)
   c. vastus intermedius (enters the anterior surface of this muscle)
   d. vastus lateralis (passes laterally to enter the substance of this muscle along with the lateral circumflex artery)
   e. pectineus (arises at the inguinal ligament and passes deep to the femoral artery and vein)

23. Follow the saphenous branch of the femoral nerve along the medial border of the vastus medialis as it enters the adductor canal. Find this nerve as it emerges from the adductor canal and continues to the medial aspect of the leg as the saphenous nerve.

24. The femoral artery gives off several branches, which need to be dissected.
   a. Locate the deep femoral artery (profunda femoris artery), which arises from the femoral artery a short distance below the inguinal ligament. It is found just lateral and posterior (deep) to the femoral artery.
   b. The medial and lateral femoral circumflex arteries are a major blood supply to the capsule of the hip joint.
      i. Find the medial femoral circumflex artery as it branches medially from the femoral artery to pass deep to the femoral vein and pectineus muscle. *This artery may come off the deep femoral artery instead of the femoral artery in some cadavers.*
      ii. Locate the lateral femoral circumflex artery, which, in most cadavers, branches from the deep femoral artery and passes laterally. A branch of this artery accompanies the femoral nerve to the vastus lateralis.
   c. Trace the course of the femoral artery along the medial border of the vastus medialis. This artery then passes posteriorly through an opening in the adductor magnus (adductor canal/Hunter's canal), where it enters the popliteal region to become the popliteal artery.

25. Review muscle attachments of the following:
   a. pectineus
   b. adductor longus
   c. adductor brevis
   d. adductor magnus
   e. gracilis

Demonstrate the actions of each of these muscles.

26. The obturator nerve divides into an anterior and posterior division in the pelvis. The anterior division emerges from under the pectineus at its medial border. It then passes deep to the adductor longus. Locate with your fingers the anterior division of the obturator nerve as it enters the deep surface of the adductor longus. Make an incision
through the adductor longus distal to where the nerve enters this muscle. Turn aside the proximal portion to better view the adductor brevis and the anterior division of the obturator nerve lying on top of the muscle (Figure 17.5).

27. Trace branches of the obturator nerve to the adductor longus, adductor brevis, and gracilis.

28. With your fingers, probe deep to the adductor brevis to find the posterior division of the obturator nerve. Cut through the adductor brevis distal to the location of this nerve, and turn the proximal portion aside to view the adductor magnus and the posterior division of the obturator nerve lying on top of this muscle.

29. Review the attachments and actions of each of the following muscles:
   a. iliopsoas
   b. tensor fasciae latae
   c. sartorius
   d. rectus femoris
   e. vastus medialis
f. vastus intermedius
g. vastus lateralis
h. pectineus
i. adductor longus
j. adductor brevis
k. adductor magnus
l. gracilis

30. Trace each branch of the femoral nerve and obturator nerve to the appropriate muscles, noting the point where the nerve enters each muscle.
PROCEDURE: Position the cadaver prone.

1. Palpate on the cadaver:
   a. crest of the ilium
   b. sacrum
   c. ischial tuberosity
   d. greater trochanter

2. Review in an atlas the location of cutaneous branches of dorsal rami of the upper three lumbar and sacral nerves (cluneal nerves).

NOTE TO THE DISSECTOR: The posterior cutaneous nerve of the thigh emerges from under the gluteus maximus at the gluteal fold and then pierces the deep fascia in the posterior thigh. As dissection proceeds in the upper thigh, be aware of this nerve, which will need to be preserved.

3. Make an incision laterally along the crest of the ilium until the skin flap from the anterior trunk is encountered. A vertical incision should be made on the midline of the sacrum. Continue the incision line across the posterior thigh several inches inferior to the gluteal fold. Note that when taking the skin flap laterally from the sacrum, you will encounter less subcutaneous fat medially as compared to laterally.

4. Identify the gluteus maximus. Find each attachment of this muscle. Look at the direction of the muscle fibers and explain the actions of this muscle.

5. The sciatic nerve is located deep to the gluteus maximus. With your probe, gently work your way through the belly of the gluteus maximus, running parallel with the fibers of the muscle. Cautiously work deeper until the sciatic nerve is reached, being careful not to tear the muscle unnecessarily. Be sure to locate this nerve in the atlas prior to looking for it on the cadaver.

6. Place a probe under this nerve in order to be well aware of its location.

7. Release the gluteus maximus from the iliotibial tract. Turn the muscle medially...
toward the insertion, and locate the large trochanteric bursa situated between the greater trochanter and the tendon of insertion of the gluteus maximus. Release any fascia in the trochanteric area that interferes with turning the muscle medially. The sciatic nerve can now be identified.

8. Review in an atlas the location of the superior and inferior gluteal arteries and nerves. Be careful not to destroy these arteries and nerves as you clean the surface of the gluteus maximus of fascia.

a. The superior gluteal artery and nerve pass through the greater sciatic foramen to enter the gluteal area at the upper proximal border of the piriformis muscle. It can be found located between the gluteus medius and gluteus minimus, lying underneath the gluteus medius and on top of the gluteus minimus. Some branches of the artery supply the gluteus maximus.

b. The inferior gluteal artery and nerve enter the gluteal area through the lower part of the greater sciatic foramen and are found at the lower distal border of the piriformis along with the sciatic nerve. The artery and nerve send major branches into the gluteus maximus.

9. Keeping these arteries and nerves well in view, release the gluteus maximus from the crest of the ilium and at the sacrum ONLY if you cannot view the structures in the area. Cut through the sacral attachment only a few fibers at a time, working lat-
erally so the superior and inferior gluteal arteries and nerves are protected and carefully preserved. These arteries and nerves are seen just lateral to the sacrotuberous ligament.

10. Lift the gluteus maximus, working it loose with the fingers. Trace branches of the inferior gluteal nerve and artery into the belly of the gluteus maximus. Leave these branches intact where they enter on the deep surface of this muscle, because the inferior gluteal nerve and artery will now be the only structures holding the gluteus maximus to the cadaver.

11. Numerous veins will be encountered in the gluteal area. The veins may be removed.

12. With the gluteus maximus held aside, identify:
   a. piriformis
   b. gemellus superior
   c. tendon of the obturator internus (lying between the gemellus muscles)
   d. gemellus inferior
   e. quadratus femoris

Study the insertions for each of these and demonstrate the action achieved by this group of muscles.
13. The tendon of insertion of the obturator externus is found between the tendon of the obturator internus and gemelli and the insertion of the quadratus femoris at the greater trochanter. It can be felt by passing a finger deep between these tendons. The muscle belly of obturator externus cannot be seen at this time and will be dissected during the pelvic dissection.

14. Find the gluteus medius and carefully study the attachments of this muscle and direction of its fibers. Read an account of the actions of the gluteus medius and the role of this muscle in stabilization of the pelvis.

15. Cut through the insertion of the gluteus medius just superior to the greater trochanter, and hold aside this muscle to view deep structures Figure 18.4.

16. At the upper proximal border of the piriformis, the superior gluteal artery and nerve can be found. Find branches of the superior gluteal nerve to the gluteus medius and gluteus minimus. A branch of this nerve to the tensor fasciae latae crosses the belly of the gluteus minimus. This branch may be traced to its termination in the tensor fasciae latae at this time.

17. Locate and review the attachments of the gluteus minimus. Note the direction of the muscle fibers, and demonstrate this muscle’s actions.
1. Just inferior to the piriformis, find the posterior cutaneous nerve of the thigh located between the sciatic nerve and the inferior gluteal artery. It often runs with the sciatic nerve. Continue to trace the posterior femoral cutaneous nerve to the inferior border of the gluteus maximus where it enters the posterior thigh. Preserve cutaneous branches in the posterior thigh as the skin is removed.

2. Make a midline incision on the posterior thigh through the popliteal fossa to the area just distal to the knee. A horizontal incision should also be made to meet the incision line on the anterior leg. Avoid severing the common peroneal nerve posterior to the head of the fibula. Work the skin loose until the flap from the anterior thigh is encountered.

3. As superficial and deep fascia are removed, preserve branches of the posterior cutaneous nerve of the thigh that pierce through the deep fascia.

4. Identify:
   a. long head of the biceps femoris
   b. semitendinosus
   c. semimembranosus

   Note the common origin of these “hamstring” muscles on the ischial tuberosity. Find the origin of the short head of the biceps femoris on the lateral lip of the linea aspera. Pull on the tendons of each of these muscles to demonstrate their actions.

   **NOTE TO THE DISSECTOR** The insertions of these muscles will be observed when the posterior leg and popliteal fossa are dissected.

5. Move aside the “hamstring” muscles to view the deeper adductor magnus. Identify the extensor head and the adductor head of this muscle. Refer to an atlas to determine the difference in these two heads.

6. Trace the course of the sciatic nerve through the posterior thigh.

   **NOTE TO THE DISSECTOR** If the sciatic nerve is manipulated (handled) a lot, it will begin to separate in the mid thigh. Be careful to preserve this nerve as you locate the various innervations to the following muscles.
a. Locate a branch of the tibial portion of the sciatic nerve to the long head of the biceps femoris, semitendinosus, semimembranosus, and extensor head of the adductor magnus. These nerves arise from the medial side of the sciatic nerve in the upper thigh several inches below the ischial tuberosity. The nerves to the semimembranosus and adductor magnus are often from the same branch.

b. Trace the branch of the peroneal portion of the sciatic nerve to the short head of the biceps femoris. It arises from the lateral side of the sciatic nerve in the upper thigh and may have a long course distally before entering the muscle.

c. After sending branches to the “hamstring” muscles, the sciatic divides into a common peroneal nerve and a tibial nerve in the lower thigh. Follow these two divisions to where they enter the leg. Note that the common peroneal nerve passes along the medial border of the biceps femoris, then winds around the neck of the fibula. At this point, the common peroneal nerve is *superficial* in its location.

7. Perforating branches of the deep femoral artery are seen piercing through the adductor magnus. These branches are a major source of blood supply for the posterior thigh muscles. It is important that branches from the sciatic nerve be located first in step 6 before clipping any of the arteries or veins for better viewing of the area.

8. Veins may now be removed in the posterior thigh.
9. Look at the distal attachments of the adductor magnus, and explain the action achieved by the entire muscle as well as those actions attributed to the adductor and extensor heads.

10. The femoral artery of the anterior thigh becomes the popliteal artery as it passes through the opening (hiatus) in the adductor magnus to enter the popliteal region. Locate the opening in the distal portion of the adductor magnus and identify the popliteal artery. A large amount of fat may be encountered in this area and should be removed carefully. Be careful not to tear the adductor magnus as you locate the hiatus.
1. Demonstrate on a skeleton the movements that occur at the ankle joint. Review the motions that are allowed by the intertarsal joints.

2. Palpate on the cadaver:
   a. head of the fibula
   b. tibial tuberosity
   c. medial malleolus
   d. lateral malleolus

3. The common peroneal nerve was identified in the dissection of the posterior thigh (Chapter 19) as it coursed around the head of the fibula. Review the location of this nerve as it winds around the neck of the fibula. Carefully remove skin and fascia superficial to this nerve on the lateral side of the knee and the area posterior to the head of the fibula in order to follow this nerve to the anterior leg.

4. Place a probe under the common peroneal nerve as it winds around the neck of the fibula in order to remain well aware of the location of this nerve.

5. Make a midline incision on the anterior leg from below the knee to the ankle. Make a superficial transverse incision across the front of the ankle so as not to cut through the retinaculum. Remove skin, keeping the skin flap in one piece.

6. On the medial aspect of the leg, continue to trace and preserve branches of the saphenous nerve (a cutaneous branch of the femoral nerve) to the skin of the medial leg. Follow the great saphenous vein in the medial leg. Tributaries may be clipped and removed.

7. The superficial peroneal nerve pierces through the deep fascia on the lateral aspect of the lower leg and sends numerous branches to the skin on the dorsum of the foot. It becomes superficial at the lower border of the peroneus longus between this muscle and the extensor digitorum longus. Preserve cutaneous branches of this nerve as the deep fascia is removed.

8. The deep fascia (fascia cruris) may be excised using the same incision lines. In some areas
where the muscle fibers are attached to this deep fascia, such as the proximal portion of the tibialis anterior, the deep fascia may need to be removed in small pieces to view the muscle. **DO NOT** destroy the muscle when removing this fascia. All of the deep fascia may not be removable.

9. Review the attachment of the quadriceps femoris to the patella. Locate the ligamentum patella, which is the continuation of the central portion of the quadriceps tendon from the patella to the tuberosity of the tibia.

10. Read a description of the contents of the anterior and lateral compartments of the leg.

11. Identify:
   a. tibialis anterior
   b. extensor digitorum longus
   c. extensor hallucis longus
   d. peroneus longus (fibularis longus)
   e. peroneus brevis (fibularis brevis)
   f. peroneus tertius (fibularis tertius)

   Observe the proximal attachments for each of these muscles. Pull on the tendon of each muscle and study the action accomplished.

12. Note the location of the superior extensor retinaculum (transverse crural ligament). The tendons of the tibialis anterior, extensor digitorum longus, extensor hallucis longus, and peroneus tertius are bound down by this retinaculum.

13. Place one prong of a pair of forceps under the fascia and muscle covering the common peroneal nerve so that the nerve is under the forceps. Clip fascia and muscle a little at a time as needed to follow the course of the common peroneal nerve around the head of the fibula and into the tibialis anterior muscle. Continue to release fibers of the extensor digitorum longus and peroneus longus superficial to the nerve until the division of the common peroneal nerve into a superficial peroneal and a deep peroneal nerve can be seen.

14. Trace the superficial peroneal nerve as it passes distally. The branch to the peroneus longus is found immediately after the division of the common peroneal nerve. A nerve to the peroneus brevis is seen coursing between the peroneus longus and brevis to innervate this muscle midway down the leg. Locate these branches to these muscles. The superficial peroneal nerve then emerges between the peroneus longus and brevis and the extensor digitorum longus, and divides into cutaneous branches supplying the lateral leg and dorsum of the foot.

15. Trace the deep peroneal nerve distally. Branches enter the proximal portion of the tibialis anterior immediately after the division of the common peroneal nerve. The nerve to the extensor digitorum longus is found on the deep surface of this muscle. This branch continues a considerable distance down the muscle to its termination in the peroneus tertius. The nerve to the extensor hallucis longus innervates this muscle on its deep surface approximately midway down the leg. Locate these muscular branches to these muscles. The deep peroneal nerve then continues along the anterior surface of the interosseous membrane to the ankle.

16. Separate the tendon of the tibialis anterior from the tendon of the extensor hallucis longus to find the anterior tibial artery. This artery is accompanied by the deep peroneal nerve on its course along the anterior surface of the interosseous membrane and the tibia. Both the artery and nerve pass under the superior extensor retinaculum and can be found on the front of the ankle.