GLOBAL EDITION

12E FUNDAMENTALS OF ANATOMY & PHYSIOLOGY

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Table 11–7 Muscles of the Anterior Neck (Figure 11–10)

Muscle	Origin	Insertion	Action	Innervation
Digastric	Two bellies: *anterior* from inferior surface of mandible at chin; *posterior* from mastoid region of temporal bone	Hyoid bone	Depresses mandible or elevates larynx	*Anterior belly:* Trigeminal nerve (V), mandibular division *Posterior belly:* Facial nerve (VII)
Geniohyoid	Medial surface of mandible at chin	Hyoid bone	Depresses mandible or elevates larynx and pulls hyoid bone anteriorly	Cervical nerve C_1 by hypoglossal nerve (XII)
Mylohyoid	Mylohyoid line of mandible	Median connective tissue band (raphe) that runs to hyoid bone	Elevates floor of mouth and hyoid bone or depresses mandible	Trigeminal nerve (V), mandibular division
Omohyoid (superior and inferior bellies united at central tendon anchored to clavicle and first rib)	Superior border of scapula near scapular notch	Hyoid bone	Depresses hyoid bone and larynx	Cervical spinal nerves C_2–C_3
Sternohyoid	Clavicle and manubrium	Hyoid bone	Depresses hyoid bone and larynx	Cervical spinal nerves C_1–C_3
Sternothyroid	Dorsal surface of manubrium and first costal cartilage	Thyroid cartilage of larynx	Depresses hyoid bone and larynx	Cervical spinal nerves C_1–C_3
Stylohyoid	Styloid process of temporal bone	Hyoid bone	Elevates larynx	Facial nerve (VII)
Thyrohyoid	Thyroid cartilage of larynx	Hyoid bone	Elevates thyroid, depresses hyoid bone	Cervical spinal nerves C_1–C_2 by hypoglossal nerve (XII)
Sternocleidomastoid	Two bellies: *clavicular head* attaches to sternal end of clavicle; *sternal head* attaches to manubrium	Mastoid region of skull and lateral portion of superior nuchal line	Together, they flex the neck; alone, one side flexes head toward shoulder and rotates face to opposite side	Accessory nerve (XI) and cervical spinal nerves (C_2–C_3) of cervical plexus

Deep to the spinalis muscles, smaller muscles interconnect and stabilize the vertebrae. These muscles include the **semispinalis** group; the **multifidus** (mul-TIF-ih-dus); and the **interspinales, intertransversarii** (in-ter-tranz-ver-SAR-ēī), and **rotatores** (rō-teh-TOR-ēz) (**Figure 11–11**). In various combinations, they produce slight extension or rotation of the vertebral column. They are also important in making delicate adjustments in the positions of individual vertebrae, and they stabilize adjacent vertebrae. If injured, these muscles can start a cycle of pain → muscle stimulation → contraction → pain. Resultant pressure on adjacent spinal nerves can lead to sensory losses and mobility limitations. Many of the warm-up and stretching exercises recommended before athletic activity are intended to prepare these small but very important muscles for their supporting role.

The muscles of the vertebral column include many posterior extensors, but few anterior flexors. Why doesn't the vertebral column have massive **flexor** muscles? One reason is that many of the large trunk muscles flex the vertebral column when they contract. A second reason is that most of the body weight lies anterior to the vertebral column, so gravity tends to flex the spine. However, a few spinal flexors are associated with the anterior surface of the vertebral column. In the neck, the **longus capitis** (KAP-ih-tus) and the **longus colli** rotate or flex the neck, depending on whether the muscles of one or both sides are contracting (**Figure 11–11**). In the lumbar region, the large **quadratus** (kwad-RĀ-tus) **lumborum** flexes the vertebral column and depresses the ribs.

Use the illustrations in **Figure 11–11** along with the details in **Table 11–8** to further your understanding.

Clinical Note Signs of Stroke

A *stroke*, or *cerebrovascular accident*, may manifest in the muscular system. This happens, for example, when a clot in a blood vessel interrupts blood flow to the brain, and a muscle does not receive the signal to contract. Early recognition and treatment of a stroke can make all the difference in the outcome of this threatening disorder. Public service announcements by the National Stroke Association alert the public about stroke by means of a catchy phrase—"Act FAST":

- **F** stands for **F**ace: Ask the person to smile and look for a droop in the facial muscles on the affected side.
- **A** stands for **A**rm: Ask the person to raise both arms and determine whether they have the strength to do this.
- **S** stands for **S**peech: Ask the person to repeat a few words and listen for slurred speech to determine if pharyngeal and laryngeal muscles are affected.
- **T** stands for **T**ime: If you observe any of these signs, it's time to call 9-1-1 for help.

Figure 11–11 Muscles of the Vertebral Column.

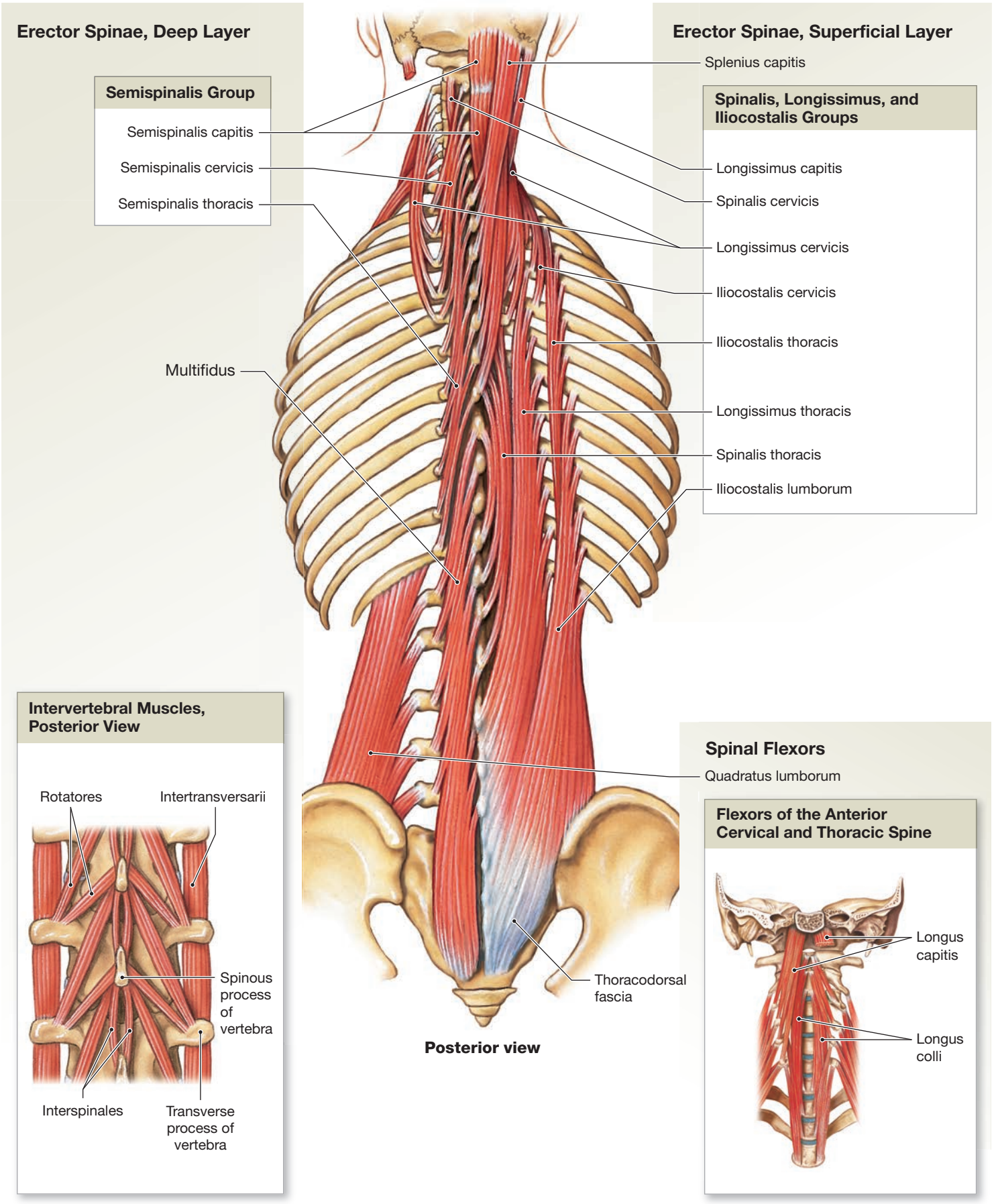


Table 11–8 Muscles of the Vertebral Column (Figure 11–11)

Group and Muscles		Origin	Insertion	Action	Innervation
SUPERFICIAL LAYER					
	Splenius (splenius capitis, splenius cervicis)	Spinous processes and ligaments connecting inferior cervical and superior thoracic vertebrae	Mastoid process, occipital bone of skull, and superior cervical vertebrae	Together, the two sides extend neck; alone, each rotates and laterally flexes neck to that side	Cervical spinal nerves
Erector spinae					
Spinalis group	**Spinalis cervicis**	Inferior portion of ligamentum nuchae and spinous process of C_7	Spinous process of axis	Extends neck	Cervical spinal nerves
	Spinalis thoracis	Spinous processes of inferior thoracic and superior lumbar vertebrae	Spinous processes of superior thoracic vertebrae	Extends vertebral column	Thoracic and lumbar spinal nerves
Longissimus group	**Longissimus capitis**	Transverse processes of inferior cervical and superior thoracic vertebrae	Mastoid process of temporal bone	Together, the two sides extend head; alone, each rotates and laterally flexes neck to that side	Cervical and thoracic spinal nerves
	Longissimus cervicis	Transverse processes of superior thoracic vertebrae	Transverse processes of middle and superior cervical vertebrae	Together, the two sides extend head; alone, each rotates and laterally flexes neck to that side	Cervical and thoracic spinal nerves
	Longissimus thoracis	Broad aponeurosis and transverse processes of inferior thoracic and superior lumbar vertebrae; joins iliocostalis	Transverse processes of superior vertebrae and inferior surfaces of ribs	Together, the two sides extend vertebral column; alone, each produces lateral flexion to that side	Thoracic and lumbar spinal nerves
Iliocostalis group	**Iliocostalis cervicis**	Superior borders of vertebrosternal ribs near the angles	Transverse processes of middle and inferior cervical vertebrae	Extends or laterally flexes neck, elevates ribs	Cervical and superior thoracic spinal nerves
	Iliocostalis thoracis	Superior borders of inferior seven ribs medial to the angles	Upper ribs and transverse process of last cervical vertebra	Stabilizes thoracic vertebrae in extension	Thoracic spinal nerves
	Iliocostalis lumborum	Iliac crest, sacral crests, and spinous processes	Inferior surfaces of inferior seven ribs near their angles	Extends vertebral column, depresses ribs	Inferior thoracic and lumbar spinal nerves
DEEP LAYER					
Semispinalis group	**Semispinalis capitis**	Articular processes of inferior cervical and transverse processes of superior thoracic vertebrae	Occipital bone, between nuchal lines	Together, the two sides extend head; alone, each extends and laterally flexes neck	Cervical spinal nerves
	Semispinalis cervicis	Transverse processes of T_1–T_5 or T_6	Spinous processes of C_2–C_5	Extends vertebral column and rotates toward opposite side	Cervical spinal nerves
	Semispinalis thoracis	Transverse processes of T_6–T_{10}	Spinous processes of C_5–T_4	Extends vertebral column and rotates toward opposite side	Thoracic spinal nerves
	Multifidus	Sacrum and transverse processes of each vertebra	Spinous processes of the third or fourth more superior vertebrae	Extends vertebral column and rotates toward opposite side	Cervical, thoracic, and lumbar spinal nerves
	Rotatores	Transverse processes of each vertebra	Spinous processes of adjacent, more superior vertebra	Extends vertebral column and rotates toward opposite side	Cervical, thoracic, and lumbar spinal nerves
	Interspinales	Spinous processes of each vertebra	Spinous processes of more superior vertebra	Extends vertebral column	Cervical, thoracic, and lumbar spinal nerves
	Intertransversarii	Transverse processes of each vertebra	Transverse process of more superior vertebra	Laterally flexes the vertebral column	Cervical, thoracic, and lumbar spinal nerves
SPINAL FLEXORS					
	Longus capitis	Transverse processes of cervical vertebrae	Base of the occipital bone	Together, the two sides flex the neck; alone, each rotates head to that side	Cervical spinal nerves
	Longus colli	Anterior surfaces of cervical and superior thoracic vertebrae	Transverse processes of superior cervical vertebrae	Flexes or rotates neck; limits hyperextension	Cervical spinal nerves
	Quadratus lumborum	Iliac crest and iliolumbar ligament	Last rib and transverse processes of lumbar vertebrae	Together, they depress ribs; alone, each side laterally flexes vertebral column	Thoracic and lumbar spinal nerves

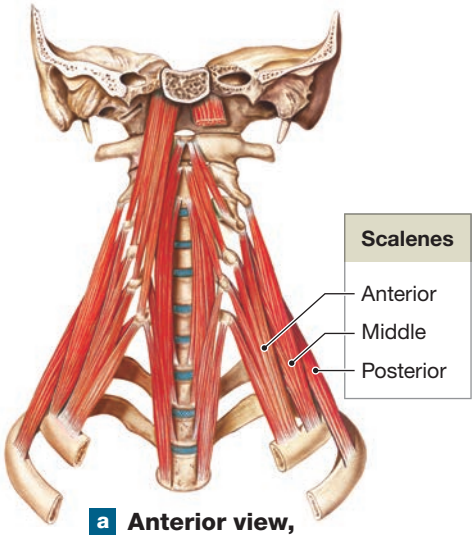
Oblique and Rectus Muscles and the Diaphragm

The oblique and rectus muscle groups of the anterior body wall share developmental origins. We include the diaphragm here because it develops in association with the other muscles of the chest wall.

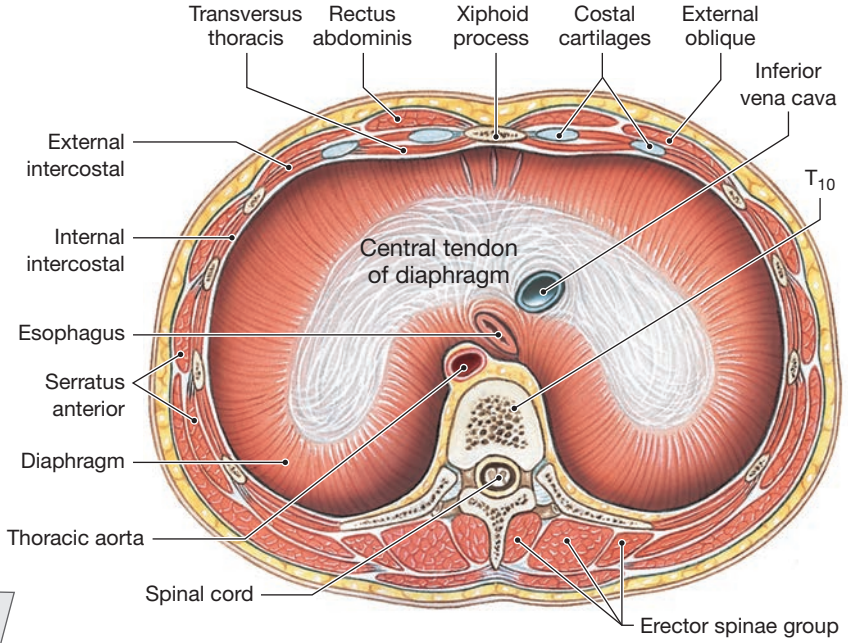
Oblique and Rectus Muscles

The oblique and rectus muscle groups lie within the body wall, between the spinous processes of vertebrae and the ventral midline. (You may want to look back at **Figure 11–4a** for an overview, and then take another look at **Figure 11–12**.) The oblique muscles compress underlying structures or rotate the

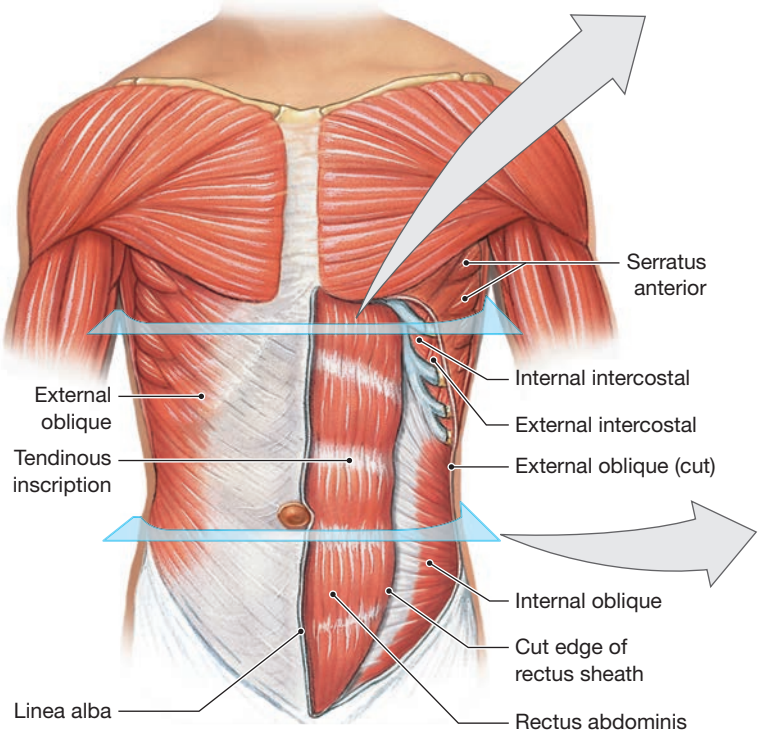
Figure 11–12 Oblique and Rectus Muscles and the Diaphragm.



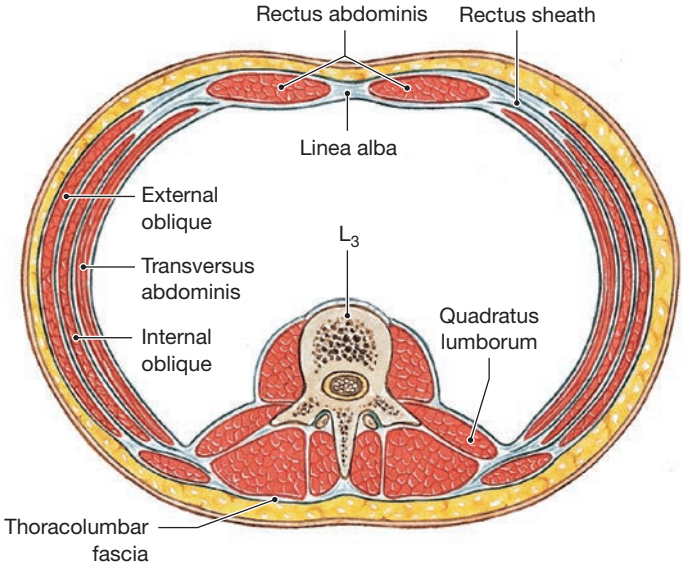
a Anterior view, cervical region



c Superior view of the diaphragm



b Anterior view



d Transverse section through the abdominal cavity

vertebral column, depending on whether one or both sides contract. The rectus muscles are important flexors of the vertebral column, acting in opposition to the erector spinae. We can subdivide each of these groups into cervical, thoracic, and abdominal regions (Table 11–9).

The oblique group includes the **scalene** muscles of the neck (Figure 11–12a) and the **intercostal** and **transversus** muscles of the thorax (Figure 11–12b,c). The scalene muscles (*anterior, middle,* and *posterior*) elevate the first two ribs and assist in flexion of the neck. In the thorax, the oblique muscles extend between the ribs, with the **external intercostal muscles** covering the **internal intercostal muscles**. Both groups of intercostal muscles aid in breathing movements of the ribs. A small **transversus thoracis** (THOR-ah-sis) crosses the posterior surface of the sternum and is separated from the pleural cavity by the parietal pleura, a *serous membrane.* The sternum occupies the place where we might otherwise expect thoracic rectus muscles to be.

The same basic pattern of musculature extends unbroken across the abdominopelvic surface (Figure 11–12b,d). Here, the muscles are the **external oblique, internal oblique, transversus abdominis**, and **rectus abdominis** (commonly called the "abs"). The rectus abdominis inserts at the xiphoid process and originates near the pubic symphysis. This muscle is longitudinally divided by the **linea alba** (white line), a median collagenous partition (Figure 11–12b).

Table 11–9 Oblique and Rectus Muscle Groups (Figure 11–12)

Group and Muscles	Origin	Insertion	Action	Innervation*
OBLIQUE GROUP				
Cervical region				
Scalenes (anterior, middle, and posterior)	Transverse and costal processes of cervical vertebrae	Superior surfaces of first two ribs	Elevate ribs or flex neck	Cervical nerves
Thoracic region				
External intercostals	Inferior border of each rib	Superior border of more inferior rib	Elevate ribs	Intercostal nerves (branches of thoracic nerves)
Internal intercostals	Superior border of each rib	Inferior border of the preceding rib	Depress ribs	Intercostal nerves (branches of thoracic nerves)
Transversus thoracis	Posterior surface of sternum	Cartilages of ribs	Depresses ribs	Intercostal nerves (branches of thoracic nerves)
Serratus posterior superior (*Figure 11–14b*)	Spinous processes of C_7–T_3 and ligamentum nuchae	Superior borders of ribs 2–5 near angles	Elevates ribs, enlarges thoracic cavity	Thoracic nerves (T_1–T_4)
Serratus posterior inferior (*Figure 11–14b*)	Aponeurosis from spinous processes of T_{10}–L_3	Inferior borders of ribs 8–12	Pulls ribs inferiorly; also pulls outward, opposing diaphragm	Thoracic nerves (T_9–T_{12})
Abdominal region				
External oblique	External and inferior borders of ribs 5–12	Linea alba and iliac crest	Compresses abdomen, depresses ribs, flexes or bends spine	Intercostal, iliohypogastric, and ilioinguinal nerves
Internal oblique	Thoracolumbar fascia and iliac crest	Inferior ribs, xiphoid process, and linea alba	Compresses abdomen, depresses ribs, flexes or bends spine	Intercostal, iliohypogastric, and ilioinguinal nerves
Transversus abdominis	Cartilages of ribs 6–12, iliac crest, and thoracolumbar fascia	Linea alba and pubis	Compresses abdomen	Intercostal, iliohypogastric, and ilioinguinal nerves
RECTUS GROUP				
Cervical region	*See muscles in Table 11–6*			
Thoracic region				
Diaphragm	Xiphoid process, cartilages of ribs 4–10, and anterior surfaces of lumbar vertebrae	Central tendinous sheet	Contraction expands thoracic cavity and compresses abdominopelvic cavity	Phrenic nerve (C_3–C_5)
Abdominal region				
Rectus abdominis	Superior surface of pubis around symphysis	Inferior surfaces of costal cartilages (ribs 5–7) and xiphoid process	Depresses ribs, flexes vertebral column, compresses abdomen	Intercostal nerves (T_7–T_{12})

*Where appropriate, spinal nerves involved are given in parentheses.

Figure 11–13 Muscles of the Pelvic Floor.