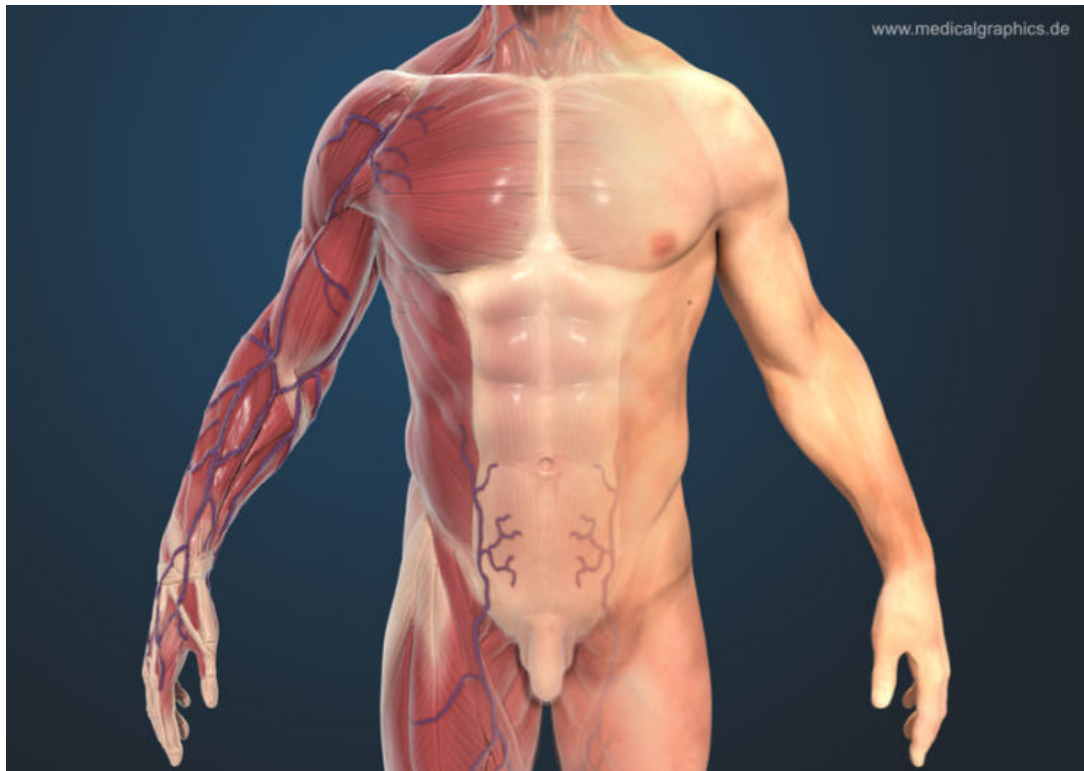


# Anatomy of the Torso: Thoracic and Abdominal Muscles

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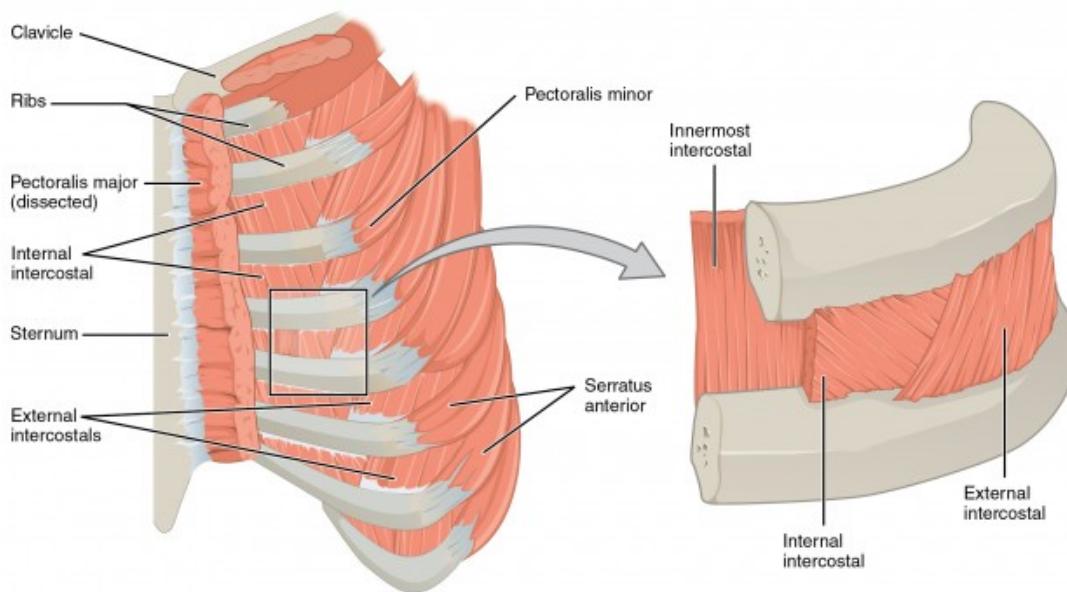
**The complexity of the musculoskeletal system is often a major issue for medical students. To learn about muscles effectively, a clear and logical grouping into systems with unique structures is needed. In this article, in addition to detailed descriptions of the origin, insertion, action, and innervation, medical students will obtain an overview in tabular form for the visualization of the muscle groups. Attention: due to conflicting information in the primary literature about the origin of the muscles and insertions, it is advisable to always consult the latest copies for studying.**



## Muscles of the Thorax

In human anatomy, the chest wall muscles are divided into primary and secondary layers. While the primary chest wall muscles specifically include the intercostal region, the secondary, immigrated thoracic muscles correlate with the anterior shoulder and chest muscles.

## Primary chest wall muscles

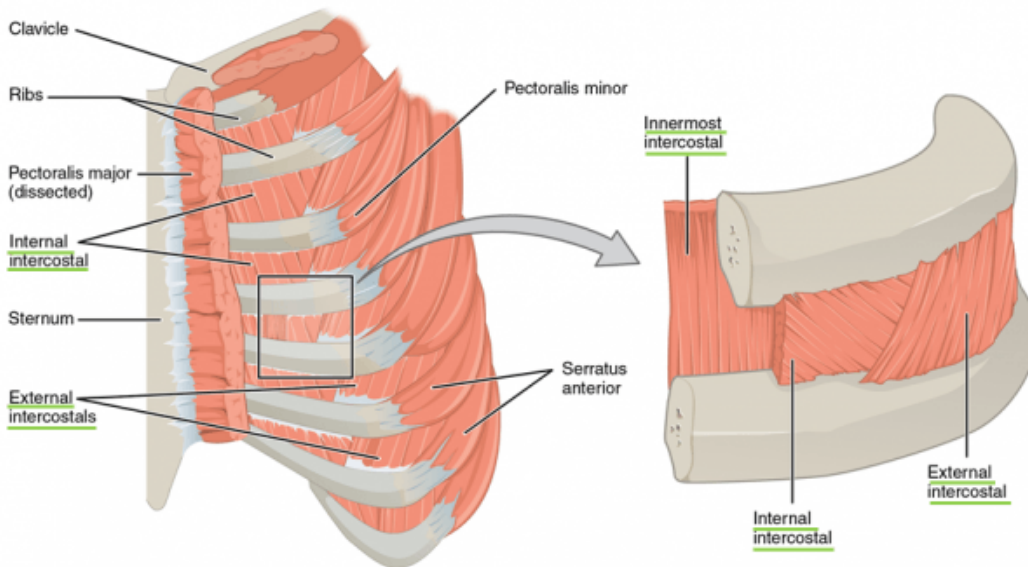


**Image:** 'The external intercostals are located laterally on the sides of the body. The internal intercostals are located medially near the sternum. The innermost intercostals are located deep to both the internal and external intercostals.' By Phil Schatz. License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

The primary chest wall muscles, in turn, are divided into three subcategories. A distinction is made between the intercostals, *serratus* posterior, and an 'other' group.

### Intercostal muscle group

From outside to inside, the intercostal muscle group consists of **external intercostal**, **internal intercostal**, and **innermost intercostal muscles**.



**Image:** 'The external intercostals are located laterally on the sides of the body. The internal intercostals are located medially near the sternum. The innermost intercostals are located deep to both the internal and external intercostals.' By Phil Schatz. License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

### External intercostal muscles

There are 11 external intercostal muscles that originate from the **rib tubercles to the costochondral border** and insert into the **upper border of the lower ribs**. They run dorso-cranial to ventro-caudal. They serve as muscles of inhalation because they ensure the lifting (elevation) of the ribs through the innervation of the **intercostal nerves (1-11)**.

**Functional note:** In addition to their primary function, they serve to tense the intercostal spaces, thus limiting the extent of movement of the ribs.

### Internal intercostal and innermost intercostal muscles

Starting from the **sternum toward the costal angle**, the internal and innermost intercostal muscles extend to the **lower margin of the next higher rib**. Their direction is dorso-caudal to ventro-cranial. They are innervated by the **intercostal nerves 1-11** and act as muscles of exhalation through their rib-lowering function. The fibers of the innermost intercostal muscles cross more than one intercostal space.

**Functional notes:** In addition to their primary function, they serve to tense the intercostal spaces, thus limiting the extent of movement of the ribs.

Furthermore, the part of the internal intercostal muscle that is located between the costal cartilages (interchondral part) acts as an auto-antagonistic inhalation muscle. That is, it elevates the ribs. This part is considered a separate muscle in some medical reference books and is referred to as **intercartilaginous muscle**.

## Serratus posterior group

This group consists of only two muscles and so it bears their name. They are the **serratus posterior superior** and the **serratus posterior inferior** muscles.

### **Serratus posterior superior muscle**

This muscle arises from the **spinous processes of C6-Th2** and starts at the **costal angle of the ribs 2-5**. It is innervated by the **intercostal nerves (Th1-Th4)** and lifts the ribs. Thus, it is a synergist with muscles of inhalation.

### **Serratus posterior inferior muscle**

Beginning at the **spinous processes of vertebrae Th11-L2**, the *serratus posterior inferior* muscle inserts at the **lower margin of the 9th-12th rib**. During active innervation by the **intercostal nerves (T9-T12)**, it fixes the ribs posteriorly and thus acts as an antagonist to the costal diaphragm during inhalation.

## 'Other' Group

The **subcostalis** and **transversus thoracis** are part of the 'other' group of primary chest wall muscles.

### **Subcostalis muscle**

The *subcostalis* muscle originates from the **inner surface of the lower ribs near their angles**. From there, this muscle spreads in the same direction as the internal intercostal muscle, and extends over several ribs, to finally insert on the inside of the **lower ribs**. The intercostal nerves 4-11 provide the neural supply through which the ribs are elevated, and this consequently makes the *subcostalis* an exhalation muscle.

**Special features:** The *subcostalis* muscle is not found in every individual.

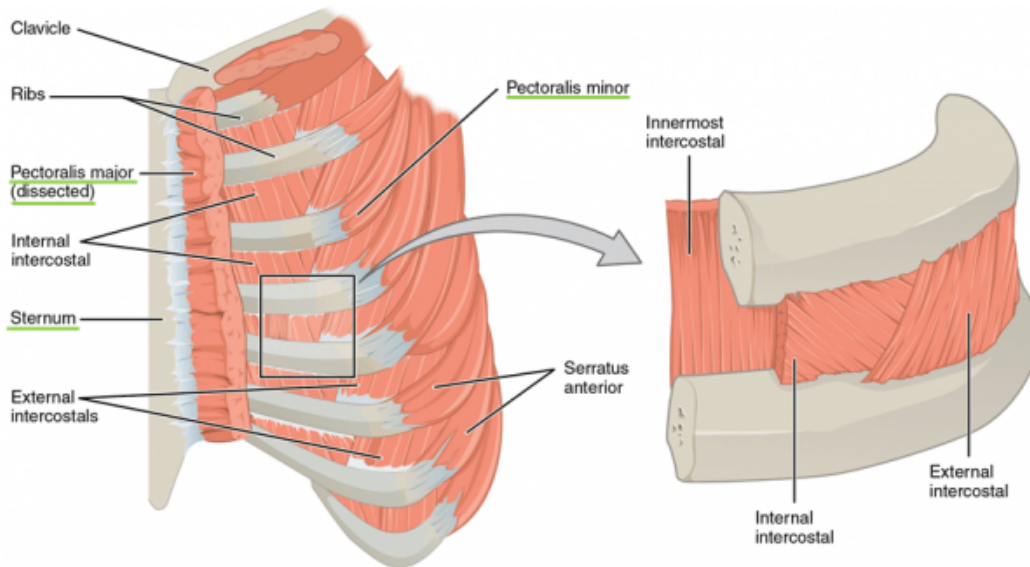
**Functional note:** In addition to its primary function, it serves to tense the chest wall.

### **Transversus thoracis muscle**

The transversus thoracis muscle starts at the **posterior surface of the lower sternum** and **xiphoid process**, ascends in the latero-cranial direction and inserts at the **lower margin of the costal cartilages 2-6**. During active innervation by the **intercostal nerves 2-6**, the muscle lowers the ribs, and thus, acts as an exhalation muscle.

**Functional note:** In addition to its primary function, it serves to tense the chest wall.

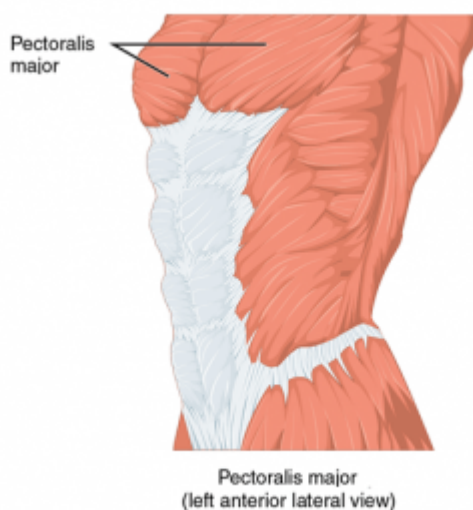
## The secondary chest wall muscles



**Image:** 'The external intercostals are located laterally on the sides of the body. The internal intercostals are located medially near the sternum. The innermost intercostals are located deep to both the internal and external intercostals.' By Phil Schatz. License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

The secondary chest wall muscles correspond with the ventral shoulder and chest muscles. This is important to mention because it confuses many medical and physical therapy students because muscle group assignments not play a decisive role while studying. Origin, insertion, innervation, and function should be labeled. The group of secondary chest wall muscles includes the **pectoralis major**, the **pectoralis minor**, and the **sternalis muscles**.

### **Pectoralis major**



**Image:** 'Pectoralis major (left anterior lateral view)-revised.' By Phil Schatz. License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

This large breast muscle consists of two main parts: **clavicular** and **sternocostal**. They are jointly innervated by the **lateral and medial pectoral nerves (C5-Th1)** and their joined insertion is at the **lateral lip of intertubercular groove of the humerus**.

The origin of the clavicular part is from the **medial half of the clavicle**, while the sternocostal has its origin from the **sternum and upper sixth rib cartilage**.

The *pectoralis* major muscle carries out adduction and internal rotation of the upper arm. Furthermore, the clavicular part, especially, ensures for anteversion of the arm. Additionally, the *pectoralis* major can move the shoulder girdle anteriorly, cranially, and caudally.

**Functional note:** In addition to its numerous primary functions, the *pectoralis* major is also an auxiliary respiratory muscle of inhalation.

### ***Pectoralis minor***

The small *pectoralis* muscle arises from the **third to fifth ribs**, lateral to the bone-cartilage interface, and inserts at the **coracoid process** of the scapula. During active innervation by the **medial and lateral pectoral nerves** (C6-Th1), it depresses the scapula.

**Functional note:** In addition to its primary function, the *pectoralis* minor is also an auxiliary respiratory muscle of inhalation.

### ***Sternalis***

This is a very small muscle. Its points of origin and insertion vary greatly but are always found along the **sternum**. Its function is not clearly described in the available literature. Functionally, the muscle is (generally) not verified to have vital importance.

**Special feature:** The *sternalis* muscle is only found in 5–7% of the human population.

## Muscles of the Abdomen

The muscles of the abdominal wall are divided into three different groups, according to their location: **ventral, lateral, and dorsal abdominal muscles**.

### Ventral abdominal muscles: *Rectus abdominis* and external oblique

From a muscular view, the ventral abdomen consists of the ***rectus abdominis*** and the **pyramidal** muscles.

#### ***Rectus abdominis***

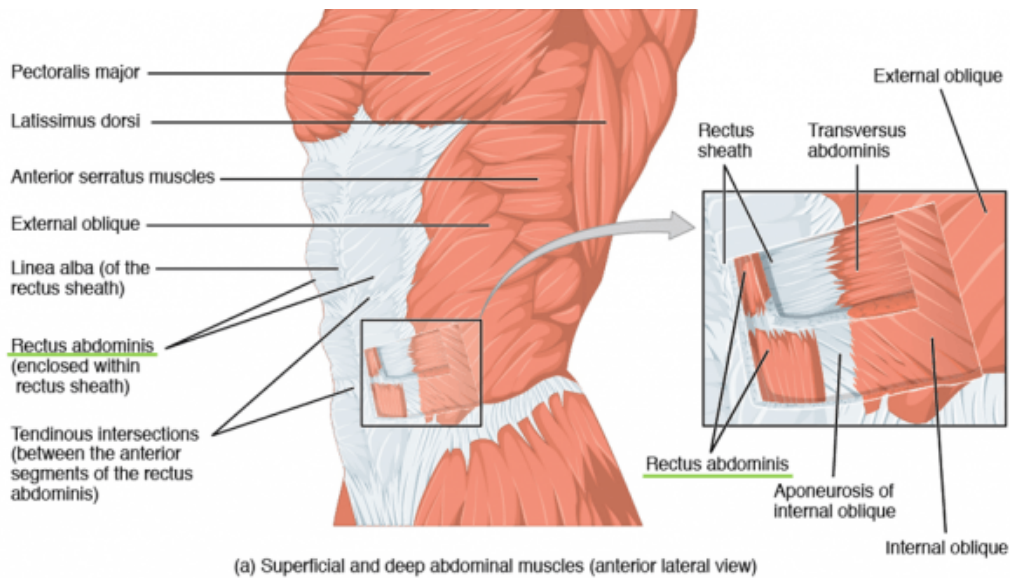


Image: 'Superficial and deep abdominal muscles (anterior lateral view).' By Phil Schatz. License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

The *rectus abdominis* originates from the **pubic crest** and **pubic symphysis**, while it is inserted at the ventral surface of the thorax that includes the **cartilage of the fifth to seventh rib** and **xiphoid** process of the sternum. It receives its innervation through the **intercostal nerves Th7-Th11**, and **subcostal nerve (Th12)**. This muscle dorsally tips the pelvis, ventrally flexes the torso, and lowers the ribs.

**Special features:** In some people, the muscle is also innervated by the segments T5-T6.

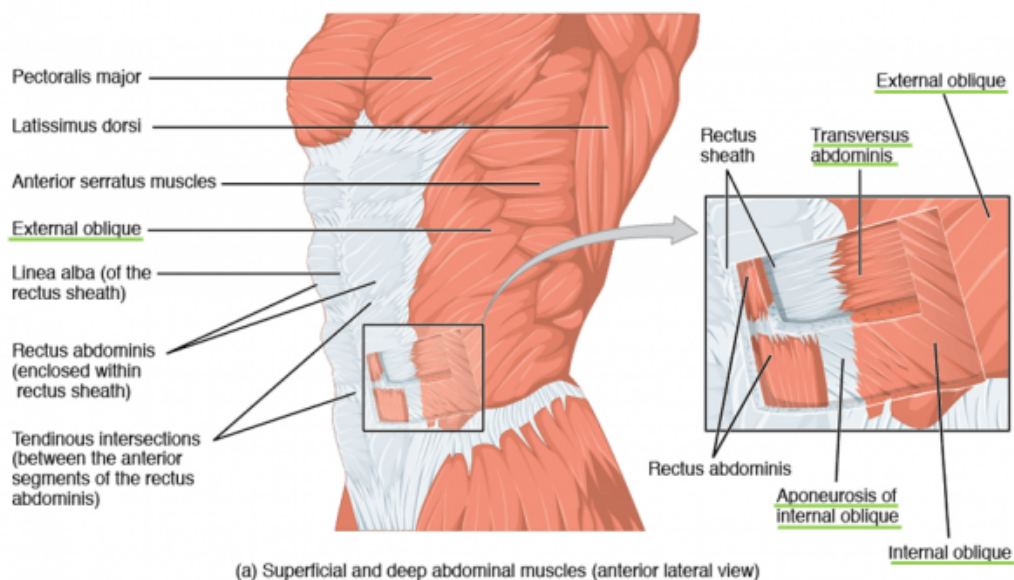
**Functional note:** If unilateral innervation of the *rectus abdominis* muscle occurs, it is also capable of lateral flexion of the torso.

### Pyramidal muscle

The pyramidal muscle originates from the **superior margin of the pubic bone** and the **symphysis**, and is located anterior to the *rectus abdominis* muscle. It is inserted in the **linea alba** and runs within the *rectus* sheath. During active innervation by the **subcostal nerve (T12)**, it tenses the *linea alba*.

**Special features:** This muscle is not found in every individual. It can get additional innervation from the segments Th11 and L1-L2.

## Lateral abdominal muscles



[Image:](#) 'Superficial and deep abdominal muscles (anterior lateral view).' By Phil Schatz. License: [CC BY 4.0](#).

The **external oblique**, **internal oblique**, **transverse abdominal**, and **cremaster muscles** form the lateral abdominal muscle group.

### External oblique

This muscle arises from the outer surface of the **5th-12th ribs** and alternates here with the origin edges of the *serratus* anterior muscle. It inserts at the **iliac crest**, as well as the **inguinal ligament**, the **ventral blade of the rectus sheath**, and the **linea alba**. The **intercostal nerves (T5-T12)** ensure the neural supply. The muscle performs ventral flexion of the thoracic and lumbar spine, pelvic alignment, and lowering of the ribs.

**Special features:** It can also be innervated by segment L1.

**Functional note:** In addition to its numerous primary functions, it is an accessory respiratory muscle of exhalation. During unilateral innervation, it rotates contralaterally and performs an ipsilateral lateral flexion of the torso.

### Internal oblique

The internal oblique abdominal muscle has numerous points of origin: the deep blade of the **thoracolumbar fascia**, **anterior superior iliac spine**, and the lateral two-thirds of the **inguinal ligament**. Its insertions are equally various: the caudal edges of the **9th-12th rib**, **linea alba** and the front and rear blades of the **rectus sheath**, and the cranial aspect of the **linea arcuata**. During active innervation by the **intercostal (Th7-Th11)**, **subcostal (Th12)**, **iliohypogastric**, and **ilioinguinal nerves**, it performs ventral flexion of the thoracic and lumbar spine, pelvic alignment, and lowers the ribs.

**Functional note:** During unilateral innervation, it acts as an ipsilateral rotator and lateral flexor of the torso.

### Transversus abdominis

Similar to previously mentioned muscles, the transverse abdominal muscle has multiple



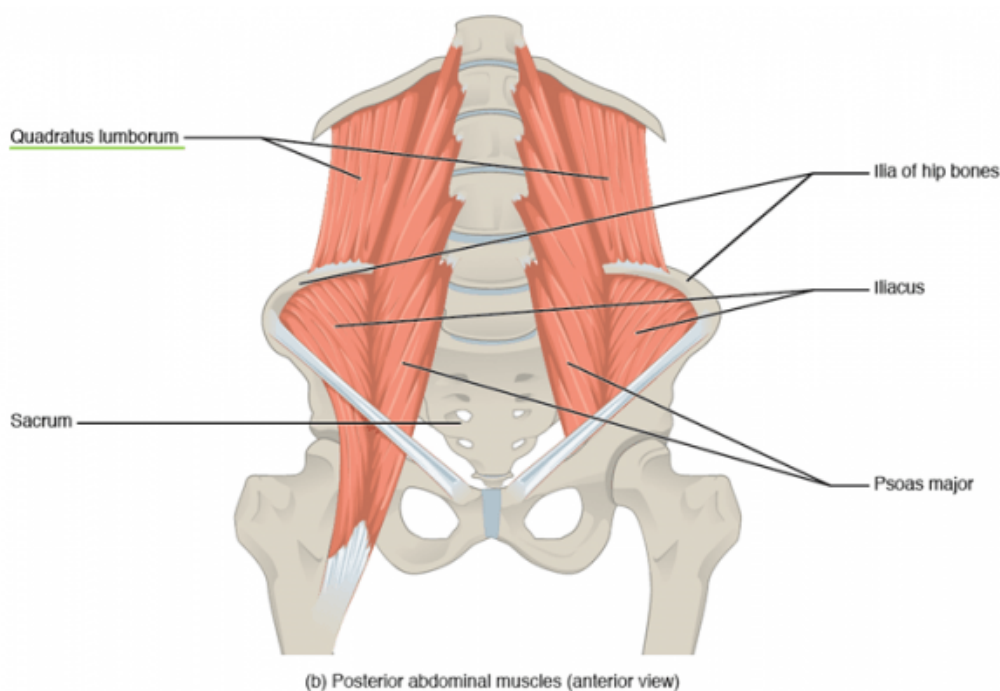
origins, which include **lower six costal cartilages**, **anterior superior iliac spine**, the lateral third of the **inguinal ligament**, and the **thoracolumbar fascia**. It is inserted at the rear blade of the **rectus sheath**, the **linea alba**, and the cranial side of the **linea arcuata**. Its innervation corresponds to the internal oblique muscle: **intercostal (Th7-Th11)**, **subcostal (Th12)**, **iliohypogastric**, and **ilioinguinal nerves**. It sucks in the stomach and can cause a minimum flexion of the torso.

**Functional note:** In addition to its primary function, it is an auxiliary muscle of exhalation and rotates the torso ipsilaterally during unilateral innervation.

### Cremaster

The cremaster muscle is originated from the **inguinal ligament** and the lower border of the **internal oblique** muscle, while it is inserted at the **pubic crest** and **pubic tubercle**. It is wrapped around the spermatic cord and serves as its protective sheath but can also lift the testicles during active innervation by the **genitofemoral nerve (L1-L3)**. The nerve function can be examined via the **cremasteric reflex** (in some textbooks this is spelled with a 'K').

## Dorsal abdominal muscles



*Image:* 'Superficial and deep abdominal muscles (anterior lateral view).' By Phil Schatz. License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

Only one muscle forms the group of posterior abdominal muscles. It is the **quadratus lumborum muscle**.

### Quadratus lumborum

This muscle mainly originates from the **iliolumbar ligament** and **iliac crest**, while it is inserted at the **transverse processes of L3-L5**. It receives its neural supply from the **subcostal nerve (Th12)** and via the direct branches of the **lumbar plexus (Th12-L3)**. This muscle is responsible for lordosis of the lumbar spine. It also fixes the 12th rib and serves as a countertraction to the diaphragm during breathing functions.

**Functional note:** During unilateral innervation, the *quadratus lumborum* muscle acts as a lateral flexor of the lumbar spine.

## Thoracic and Abdominal Muscles: Summary Table

Muscle group	Muscles
Primary chest wall: intercostals group	<ul style="list-style-type: none"> <li>• External intercostal</li> <li>• Internal intercostal</li> <li>• Innermost intercostal</li> </ul>
Primary chest wall: <i>serratus</i> posterior group	<ul style="list-style-type: none"> <li>• <i>Serratus</i> posterior superior</li> <li>• <i>Serratus</i> posterior inferior</li> </ul>
Primary chest wall: 'other' group	<ul style="list-style-type: none"> <li>• <i>Subcostalis</i></li> <li>• <i>Transversus thoracis</i></li> </ul>
Secondary thoracic wall	<ul style="list-style-type: none"> <li>• <i>Pectoralis</i> major</li> <li>• <i>Pectoralis</i> minor</li> <li>• <i>Sternalis</i></li> </ul>
Ventral abdominal muscles	<ul style="list-style-type: none"> <li>• <i>Rectus abdominis</i></li> <li>• Pyramidal</li> </ul>
Lateral abdominal muscles	<ul style="list-style-type: none"> <li>• External oblique</li> <li>• Internal oblique</li> <li>• Transverse abdominal</li> <li>• Cremaster</li> </ul>
Dorsal abdominals	<ul style="list-style-type: none"> <li>• <i>Quadratus lumborum</i></li> </ul>

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