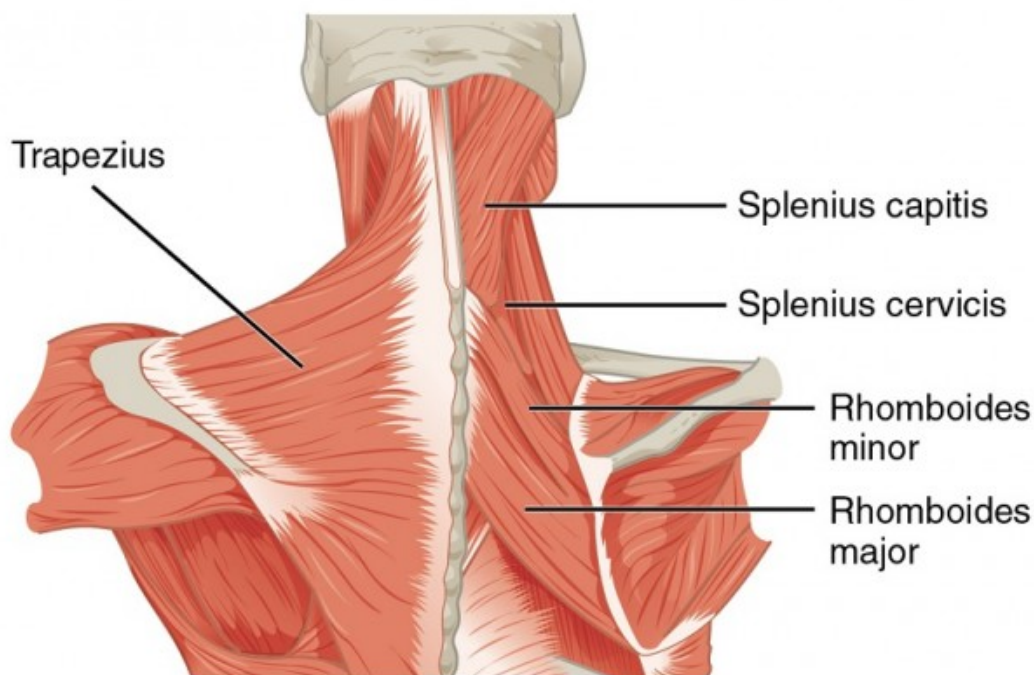


## The Intrinsic Muscles of the Back – Anatomy of the Torso

[See online here](#)

The complexity of the musculoskeletal system is often a great learning challenge for the medical student. To effectively learn muscles, a clear and rational classification of muscle systems with definite structures, is needed. In addition to providing a comprehensive description of the muscle origin, insertion, function, and innervation, this article presents a tabular overview to facilitate visualization of the different muscle groups. Due to conflicting statements reported in the primary literature, it is highly recommended to always refer to the most recent versions available.



Superficial (left side) and deep (right side) muscles of the neck and upper back (posterior view)

### Intrinsic Back Muscles: Overview

The intrinsic back muscles are also referred to as **primary back muscles**. These muscles are also known as **erector spinae** (spinal erectors) or **erector trunci** (truncal erectors) since they specifically describe the primary function: erection of the spine or the torso.

The primary back muscles are divided into **a total of five (5) systems**, each system comprising medial and lateral tracts of various muscles. The systems (muscle groups) carry the points of osseous insertion of the respective muscles, which is a distinct learning advantage.

In the event of specific innervation of a part of the system, secondary movements including lateral flexion and rotation can be induced additionally. Also, the primary back muscles significantly influence the respiratory function by facilitating both inspiration and expiration owing to their insertion at the spine and the ribs.

**Note: Flexion** is the only function that is not performed by the intrinsic back muscles. Without exception, all primary back muscles are innervated by the **dorsal rami** of the spinal nerves.

**Note:** The medial tract supplies the medial part, whereas the lateral tract is associated with the lateral part.

## Sacrospinalis System of the Intrinsic Back Muscles

The sacrospinal system carries the strongest muscle fibers. It belongs to the **lateral tract** and describes the intertransversal muscles. The 2 groups include the **iliocostalis** and the **longissimus group**.

### Sacrospinalis System: Iliocostalis Group

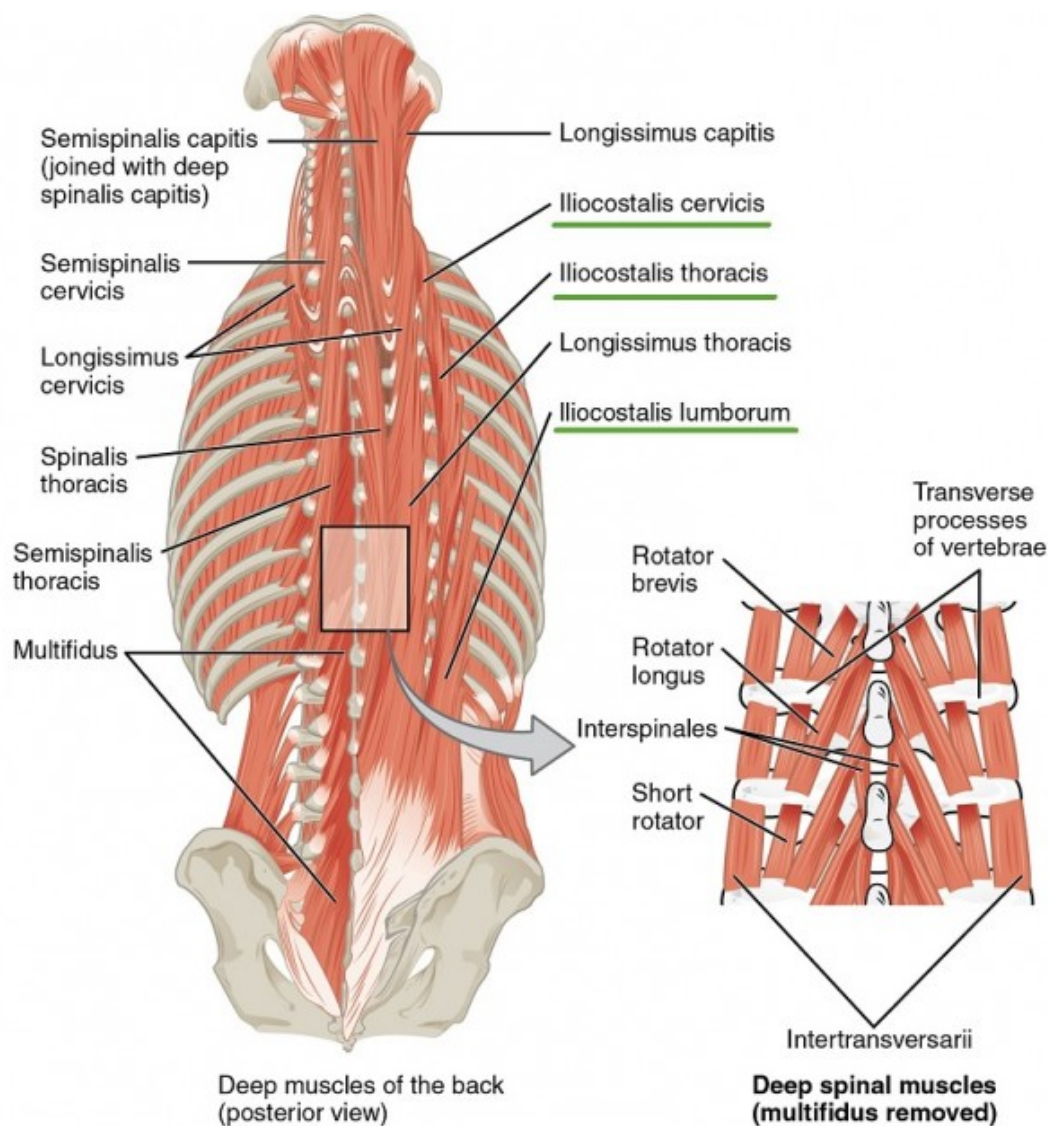


Image: Deep Muscles of the back (posterior view). By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

The iliocostalis group consists of three muscles based on their location: **lumbar iliocostalis**, **thoracic iliocostalis**, and **cervical iliocostalis**.

#### **Lumbar iliocostalis**

The lumbar iliocostalis muscle originates in the **external labium of the iliac crest**, the **dorsal aspect of the sacral bone**, and the **thoracolumbar fascia**. It is inserted at the **costal angle of the lower 6 (7th-12th) ribs** and facilitates the extension of the thoracic and lumbar spine. It is innervated by the **dorsal rami (Th9-L1)**.

**Functional hint:** In addition to its primary function, lumbar iliocostalis is an auxiliary respiratory muscle facilitating expiration and lateral flexion in the thoracic and lumbar spine in the case of unilateral innervation.

#### **Thoracic iliocostalis**

The thoracic portion of the iliocostalis muscle originates in the **costal angle of lower 6 (7th-12th) ribs** and is inserted at the **costal angle of the upper 6 (1st-6th) ribs**. It is innervated by the **dorsal rami (Th2-Th9)** and facilitates the extension of the thoracic spine.

**Unique features:** The thoracic iliocostalis muscle is also innervated by the segments Th1 and Th10 of the dorsal rami.

**Functional hint:** In addition to its primary function, it is an auxiliary respiratory muscle facilitating expiration and lateral flexion in the thoracic spine in case of unilateral innervation.

### Cervical iliocostalis

The cervical iliocostalis muscle originates in the **costal angle of the 3rd-6th ribs** and is inserted at the **posterior tubercle of the transverse processes** of the 3rd-6th cervical vertebrae. It is innervated by the **dorsal rami (Th1-Th2)** and acts as an extensor of the cervical and the upper thoracic spine.

**Special features:** In some individuals, the cervical iliocostalis muscle is also innervated by the dorsal rami of the segments C8 and Th3.

**Functional hint:** In addition to its primary function, it acts as an auxiliary respiratory muscle to facilitate inspiration and lateral flexion in the cervical and the upper thoracic spine in the event of unilateral innervation.

## Sacrospinalis System: Longissimus Group

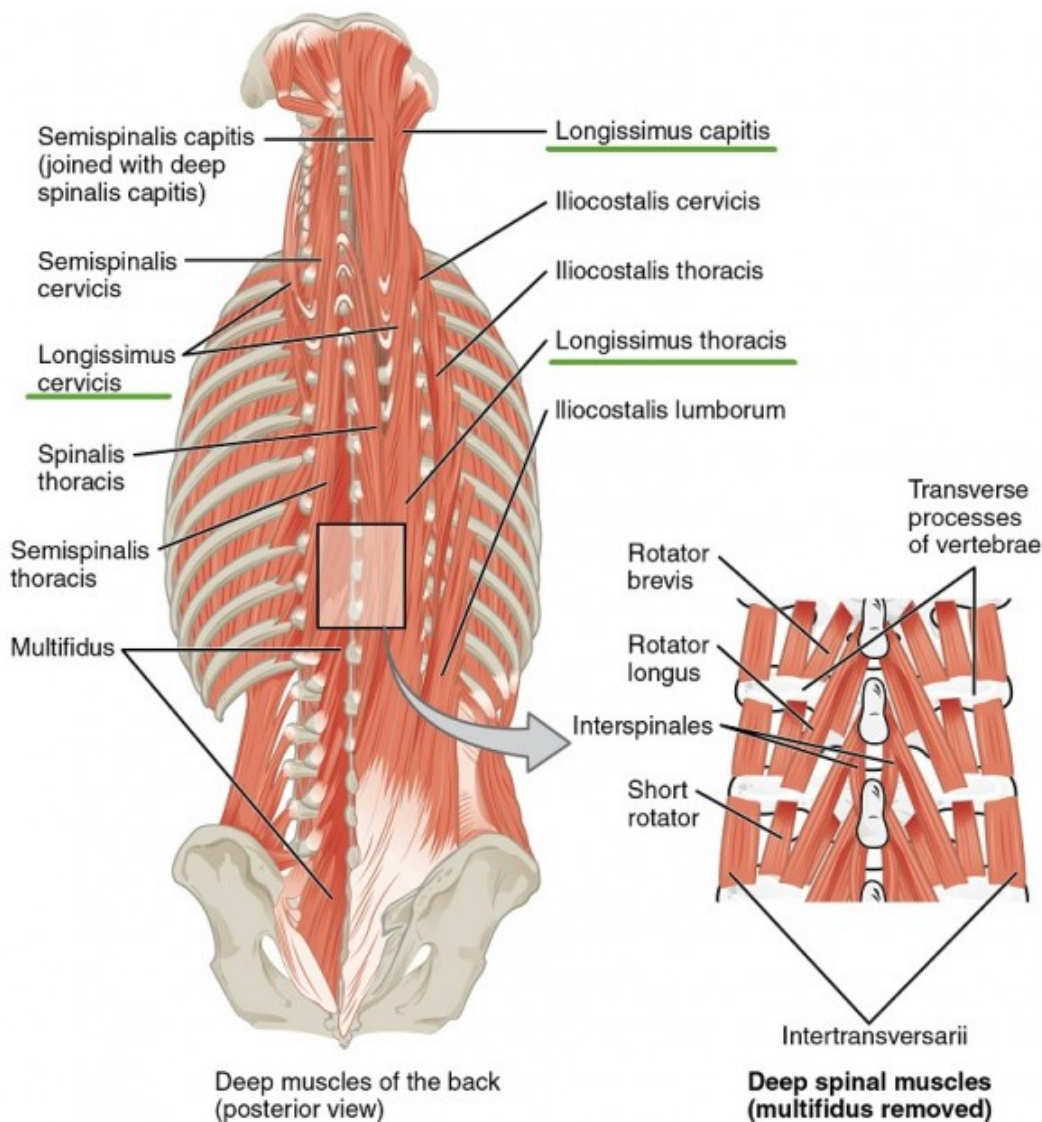


Image: Deep Muscles of the back (posterior view). By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

The longissimus group consists of three different muscles: **thoracic longissimus**, **cervical longissimus**, and **longissimus capitis**.

### **Thoracic longissimus**

This muscle originates in the **dorsal surface of the sacral bone**, the **spinous processes of the lumbar**, and the **inferior thoracic spine**. It is inserted at the **accessory processes of the lumbar spine**, the **transverse processes of the thoracic spine**, and **medially at the costal angle of the 2nd-12th ribs**. It is innervated by the **dorsal rami (Th3-Th5)** and extends the lumbar and the thoracic spine.

**Special features:** In some individuals, the thoracic longissimus muscle is also innervated by the dorsal rami of the segment Th2.

**Functional hint:** In addition to its primary function, it acts as an auxiliary respiratory muscle facilitating expiration and lateral flexion in the lumbar and thoracic spine under unilateral innervation.

### **Cervical longissimus**

The cervical longissimus muscle originates in the **transverse processes of the 1st-6th thoracic vertebrae** and is inserted at the **posterior tubercle of the transverse processes in the 2nd-5th cervical vertebrae**. It is innervated by the **dorsal rami (C3-Th2)** and acts as an extensor of the cervical and the superior thoracic spine.

**Functional hint:** In addition to its primary function, it facilitates lateral flexion of the cervical and superior thoracic spine under unilateral innervation.

### **Longissimus capitis**

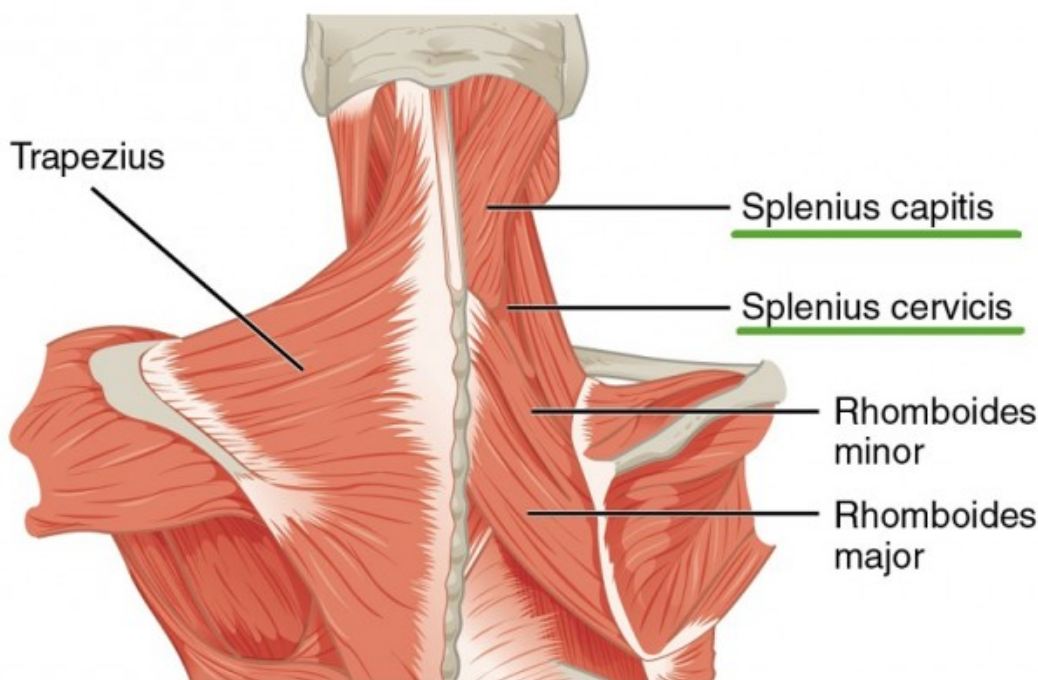
The muscle originates in the **transverse processes of the 3rd thoracic to the 3rd cervical vertebrae** and is inserted at the **mastoid process of the temporal bone**. Its neuronal supply is ensured by the **dorsal rami (C1-C3)** and acts as an extensor of the cervical spine and the head joints.

**Special features:** Longissimus capitis is not present universally. When it is present, it is also innervated by the dorsal rami of the segment C4.

**Functional hint:** In addition to its primary function, it performs lateral flexion and rotation to the innervated side of the cervical spine and the head joints in case of unilateral innervation.

## **Spinotransversalis System of the Intrinsic Back Muscles**

The spinotransversalis system is only present in the superior thoracic and the cervical spine. It consists of only three muscles: the **splenius cervicis**, **splenius capitis**, and the **inferior oblique capitis**. The latter muscle is occasionally listed among the short neck muscles.



Superficial (left side) and deep (right side) muscles of the neck and upper back (posterior view)

[Image:](#) Deep Muscles of the back (posterior view). By Phil Schatz, License: [CC BY 4.0](#)

## Splenius Cervicis

The splenius cervicis muscle originates in the **spinous processes of the 3rd-6th cervical vertebrae** and the **supraspinal ligament**. It is inserted at the **posterior tubercle of the transverse processes of the 1st-3rd cervical vertebral bodies**. It is innervated by the **dorsal rami (C1-C6)** and facilitates the extension of the cervical spine.

**Functional hint:** In addition to its primary function, it facilitates ipsilateral flexion and rotation of the cervical spine in case of unilateral innervation.

## Splenius Capitis

The splenius capitis muscle originates in the **spinous processes of the 3rd cervical vertebrae** and **1st-3rd thoracic vertebrae**, and the **supraspinal ligament**. It is inserted at the **lateral half of the superior nuchal line** and the **mastoid process**. In the event of active innervation via **dorsal rami (C1-C6)**, it acts as an extensor of the cervical spine and the head joints.

**Functional hint:** In addition to its primary function, it facilitates ipsilateral flexion and rotation in the cervical spine and the head joints in case of unilateral innervation.

## Inferior Oblique Capitis

The inferior oblique capitis muscle originates in the **spinous process of the axis (2nd cervical vertebra)** and is inserted at the **transverse process of the atlas (1st**

**cervical vertebra**). It is innervated by the **major occipital nerve (dorsal ramus C2)** and serves as the primary stabilizer of the atlantoaxial joint.

**Special features:** In some individuals, the inferior oblique capitis muscle is additionally innervated by the suboccipital nerve (dorsal ramus C1).

**Functional hint:** In addition to its primary function, it facilitates the ipsilateral rotation of the atlas in unilateral innervation.

## Intertransversalis System of the Intrinsic Back Muscles

The muscles of the intertransversalis system connect the transverse processes of the spine with each other. The system is divided into **2 categories: intertransversal** and **'others'**.

### Intertransversalis System: Intertransversal Group

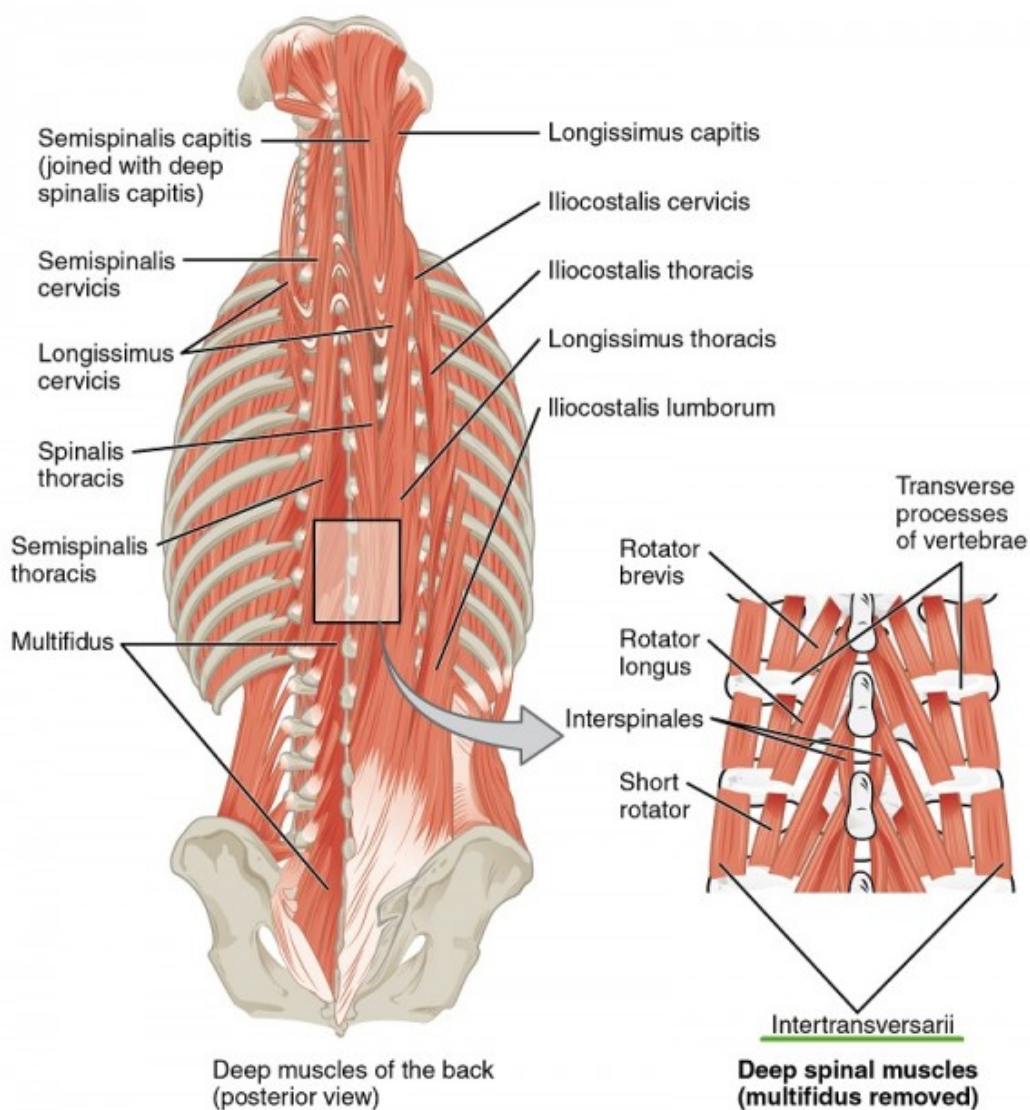


Image: Deep Muscles of the back (posterior view). By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

The intertransversarii are the small group of muscles that connect the transverse

processes of the spine. These muscles include: **medial lumbar intertransversarii**, **thoracic intertransversarii**, and **posterior cervical intertransversarii**.

### Medial lumbar intertransversarii

The medial lumbar intertransversarii muscles originate in the **mammillary processes** and **accessory processes of all lumbar vertebrae**. They are inserted on the respective **adjoining osseous structures of the lumbar spine**. They are innervated by the **dorsal rami (L1-L5)** and facilitate lateral flexion in the lumbar spine.

### Thoracic intertransversarii

The thoracic intertransversarii muscles originate in the **transverse processes of the 10th-12th thoracic vertebrae** and are inserted at the **transverse processes of the 11th-12th thoracic vertebrae** and at the **mammillary and accessory processes of the 1st lumbar vertebra**. Following active innervation via **dorsal rami (Th10-Th12)**, they act as lateral flexors of the thoracic spine.

**Special features:** These muscles are not universally present in all individuals.

### Posterior cervical intertransversarii

These small muscles originate in the **posterior tubercle of the transverse processes of the 1st-7th cervical spine** and are inserted at the **posterior tubercles of the respective adjoining cervical vertebra**. They are innervated by the **dorsal rami (C2-C7)** and perform lateral flexion in the cervical spine.

## Intertransversalis System: 'Others'

The intertransversalis group includes muscles belonging to the intertransversalis system, but do not represent an original group of functional muscles. They include the **long and short levatores costarum muscles** and the **superior oblique capitis muscle**, the latter is also often listed under short neck muscles.

### Long and short levatores costarum

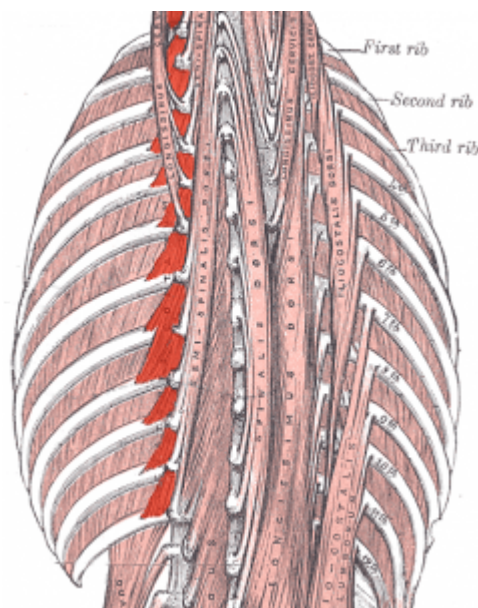


Image: Levatores costarum. By Uwe Gille, License: Public domain

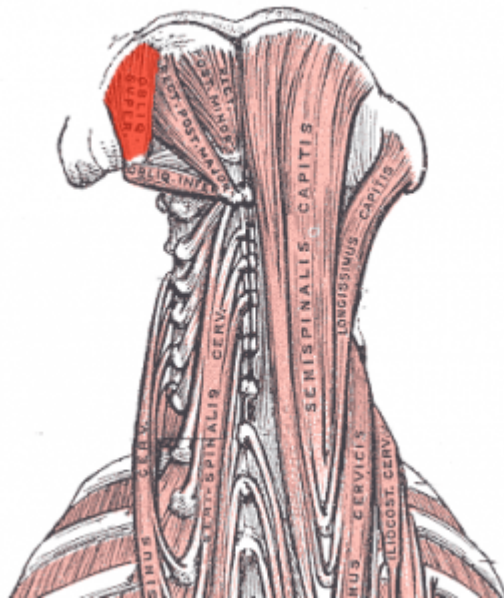
The **12** long and short levatores costarum muscles originate in the **transverse processes of the 7th cervical vertebra and 1st-11th thoracic vertebrae**. Each



muscle is inserted at the rib below its origin. The short fibers are inserted at the ribs lying **one (1) to two (2) segments below** the long fibers, respectively. They facilitate the extension of the thoracic spine under active innervation via **dorsal rami (C8-Th11)**.

**Special features:** In some individuals, the long and short levatores costarum muscles are also partially innervated by the ventral rami (C8–Th11).

**Functional hint:** In addition to its primary function, these muscles act as auxiliary respiratory muscles for inspiration and as rib elevators. Also, they facilitate lateral flexion of the thoracic spine.



[Image:](#) Superior oblique capitis muscle. By Uwe Gille, License: Public domain

### **Superior oblique capitis**

The superior oblique capitis muscle originates in the **transverse process of the atlas** and is inserted at the **lateral third of the inferior nuchal line of the occipital bone**. It is innervated by the **suboccipital nerve (dorsal ramus C1)** and extends the atlantooccipital joint.

**Functional hint:** In addition to its primary function, it facilitates ipsilateral flexion and contralateral rotation under unilateral innervation.

## Transversospinalis System of the Intrinsic Back Muscles

The transversospinalis system represents the largest muscle group of the primary back muscles (medial tract). It consists of the **semispinalis**, the **multifidi**, and the **rotator groups**. The muscles connect the transverse processes (homologs) with the spinous processes. Thus, they run obliquely in the caudo-lateral to the craniomedial direction.

### Transversospinalis System: Semispinalis Group

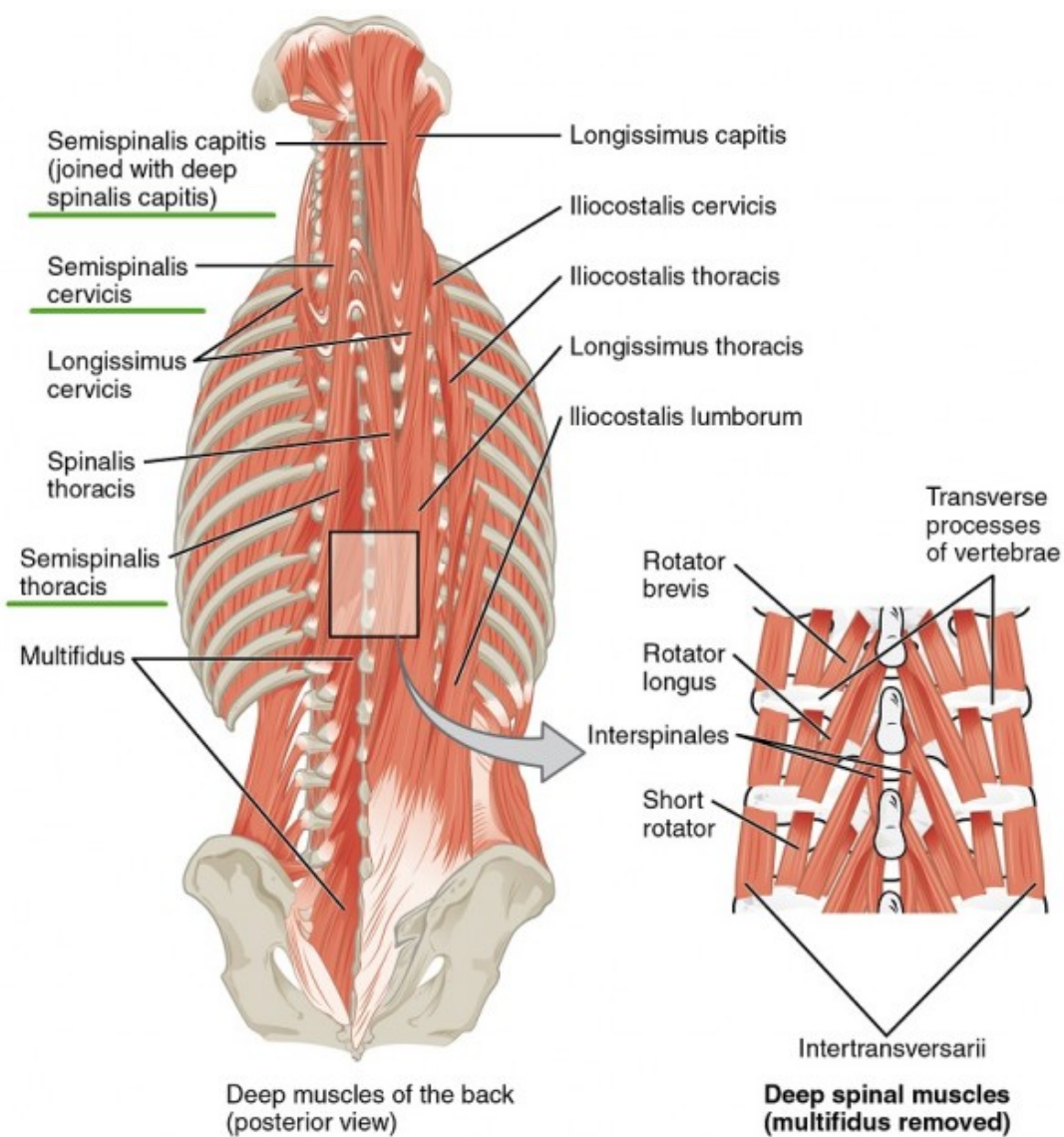


Image: Deep Muscles of the back (posterior view). By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

The semispinalis group includes three muscles: **thoracic semispinalis**, **cervical semispinalis**, and **semispinalis capitis**.

### Thoracic semispinalis

The thoracic semispinalis muscle originates in the **transverse processes of the lower 6 thoracic vertebrae (7th-12th)** and is inserted at the **spinous processes of the 6th cervical vertebrae to the 4th thoracic vertebrae**. It is innervated by the **dorsal rami (Th3-Th6)**, and acts as an extensor of the thoracic spine.

**Functional hint:** In addition to its primary function, it induces contralateral rotation of the thoracic spine under unilateral innervation.

### Cervical semispinalis

The cervical semispinalis muscle originates in the **transverse processes of the upper 6 thoracic vertebrae (1st-6th)** and is inserted at the **spinous processes of the 2nd-7th cervical vertebrae**. It is innervated by the **dorsal rami (C3-C7)** and extends the cervical and the superior thoracic spine.

**Functional hint:** In addition to its primary function, it facilitates contralateral rotation of the cervical and superior thoracic spine under unilateral innervation.

### Semispinalis capitis

The semispinalis capitis muscle originates in the **transverse processes of the 3rd cervical to 6th thoracic vertebrae**. It runs from the cervical and thoracic vertebrae to the **occipital bone** and is inserted between the **superior and inferior nuchal lines**. It is innervated by the **dorsal rami (C1-C4)**, and extends the superior thoracic spine, the cervical spine, and the head joints.

**Functional hint:** In addition to its primary function, it can facilitate contralateral rotation and lateral flexion of the superior thoracic spine, the cervical spine, and the head joints.

## Transversospinalis System: Multifidi Group

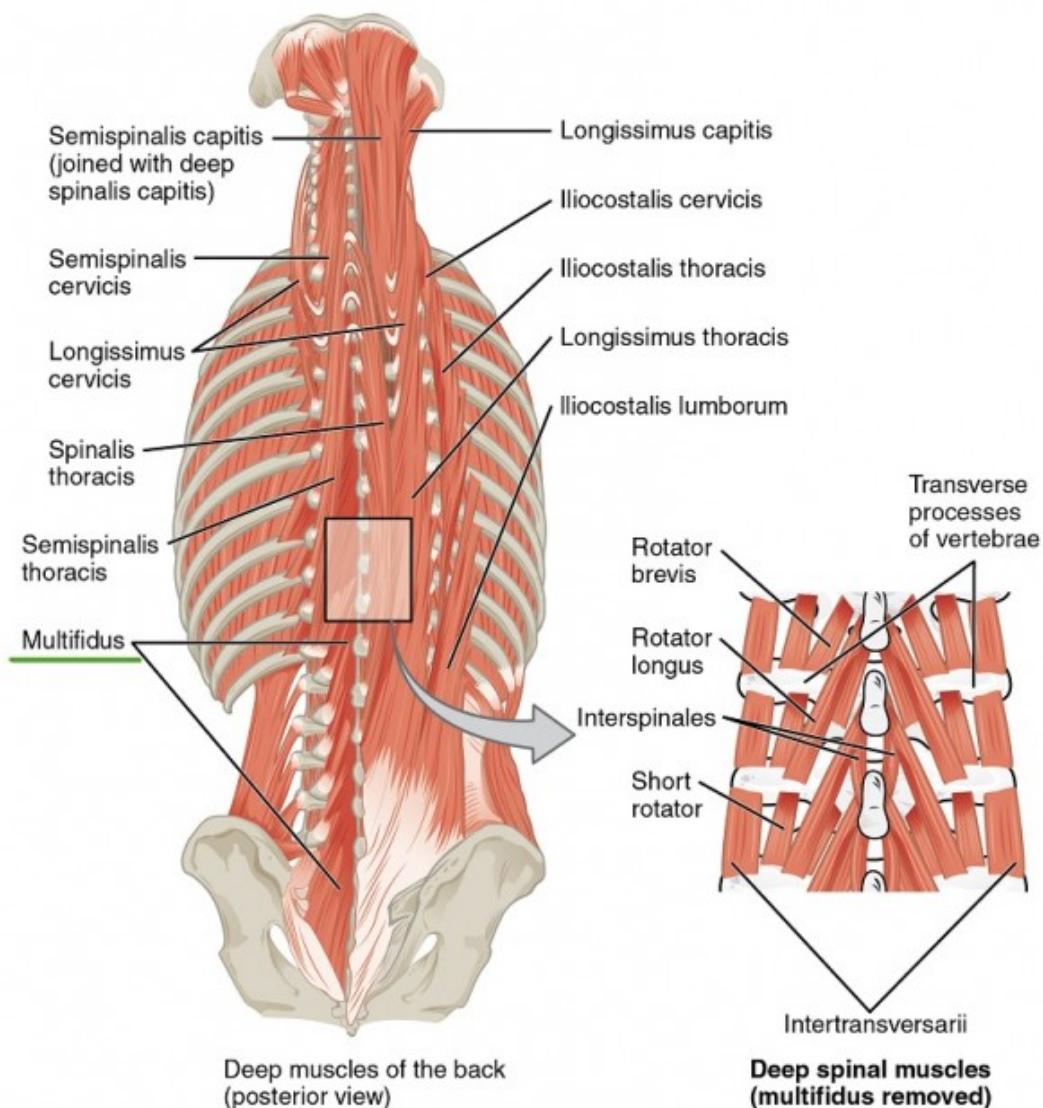


Image: Deep Muscles of the back (posterior view). By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

**The multifidi muscles originate at multiple points:** the dorsal surface of the sacral bone, the posterior sacroiliac ligaments, the iliac crest, the mammillary processes (lumbar vertebrae 1-5), the transverse processes (thoracic vertebrae 1-12), and the articular processes (cervical vertebrae 4-7). They are inserted at the **spinous processes of the 2nd cervical to the 5th lumbar vertebrae**. They extend the complete spine as long as they are innervated by the **dorsal rami (C3-S3)**.

**Functional hint:** In addition to their primary function, they are capable of contralateral rotation of the whole spine following unilateral innervation.

## Transversospinalis System: Rotator Group

The rotator group is comprised of three muscles: **lumbar, thoracic, and cervical rotators**.

### Lumbar rotators

The lumbar rotators originate in the **mammillary processes of the lumbar spine** and are inserted at the **base of the spinous processes in the adjoining superior vertebra**. They are innervated by the **dorsal rami (L1-L5)** and extend the lumbar spine.

**Special features:** These muscles are not universal.

**Functional hint:** In addition to their primary function, lumbar rotators act as weak contralateral rotators of the lumbar spine.

### Thoracic rotators

The thoracic rotators originate in the **transverse processes of the thoracic spine**. They are inserted at the **spinous processes of the adjoining superior vertebra**. They are innervated via **dorsal rami (Th1-Th12)**, and extend the thoracic spine.

**Functional hint:** Besides their primary function, they act as contralateral rotators of the thoracic spine.

### Cervical rotators

The cervical rotators originate in the **transverse and articular processes of the cervical spine**, and are inserted at the **spinous processes of the adjoining superior vertebra**. They receive their neuronal supply through the **dorsal rami (C2-C8)**, and are extensors of the cervical spine.

**Special features:** These muscles are inconsistent, and thus are not universal.

**Functional hints:** In addition to their primary function, they also act as contralateral rotators of the cervical spine.

## Spinalis and Interspinalis System of the Intrinsic Back Muscles

The muscles of the spinal and interspinal systems constitute the deep layer of the medial tract. They lie directly on the osseous structures. The three different groups include: **interspinal, spinal** and **recti-capitis**, which connect the spinous processes of the spine along its vertical course.

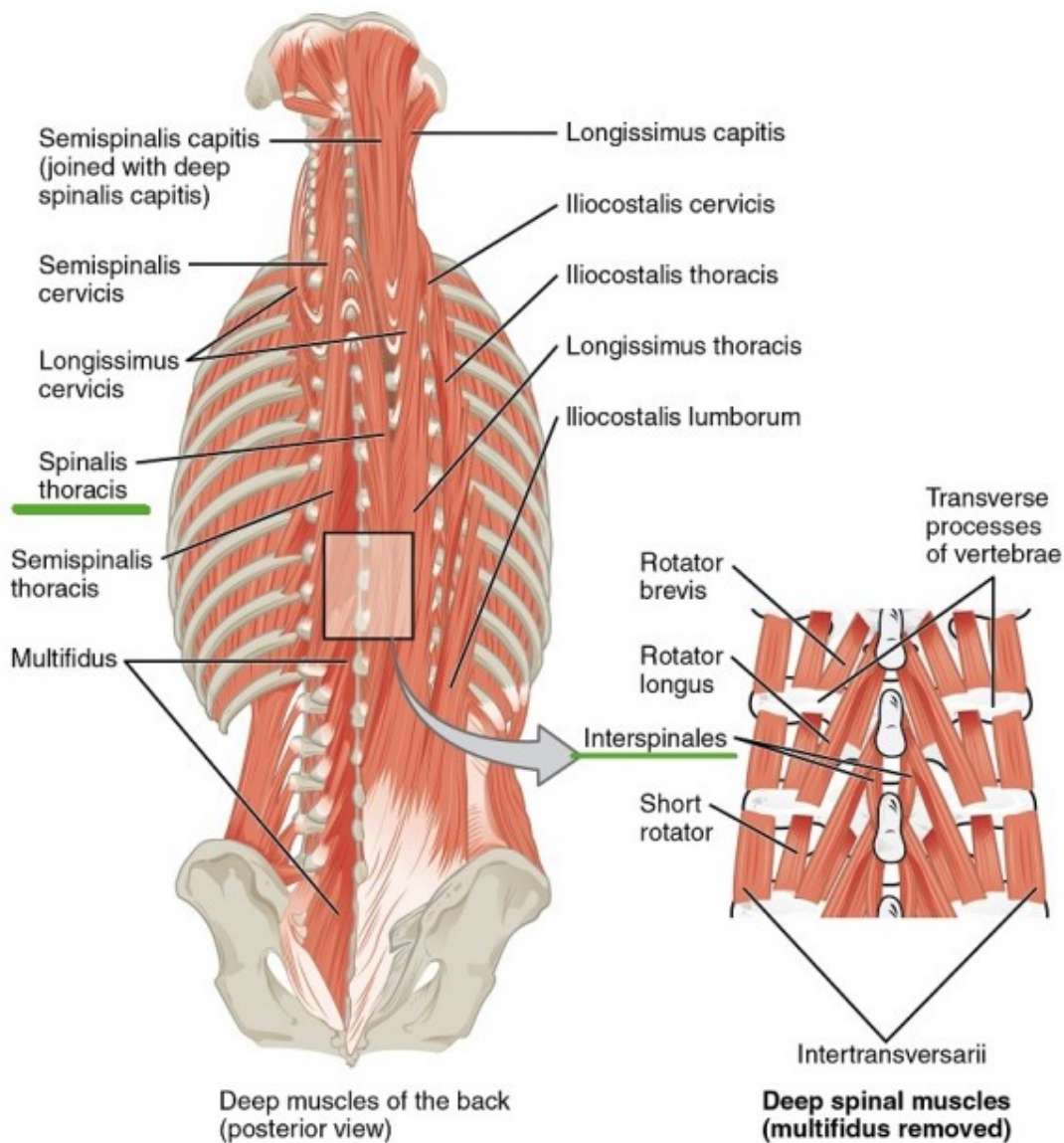


Image: Deep Muscles of the back (posterior view). By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

## Spinal and Interspinal System: Interspinal Group

The interspinal group comprises three muscles: **lumbar interspinales**, **thoracic interspinales**, and **cervical interspinales**.

### Lumbar interspinales

The lumbar interspinales originate in the **spinous processes of 2nd lumbar to 1st sacral vertebrae**. They are inserted at the **spinous processes of the 1st-5th lumbar vertebrae**. They are innervated via **dorsal rami (L1-L5)** and extend the lumbar spine.

### Thoracic interspinales

The thoracic interspinales originate in the **spinous processes of 2nd thoracic to 1st lumbar vertebrae**. However, they are often absent in the middle thoracic spine. They are inserted at the **spinous processes of the thoracic vertebrae 1-12** and extend the thoracic spine as long as they are actively innervated by the **dorsal rami (Th1-Th12)**.

### Cervical interspinales

These muscles originate in the **spinous processes of 3rd cervical to 1st thoracic vertebrae**. They are inserted at the **spinous processes of the 2nd-7th cervical vertebrae**. They are innervated by the **dorsal rami (C3-C8)**, and extend the whole cervical spine.

## Spinalis and Interspinalis System: Spinal Group

The spinal group includes the **thoracic spinalis, cervical spinalis, and spinalis capitis muscles**.

### Thoracic spinalis

The thoracic muscle originates in the **spinous processes of 10th thoracic to the 3rd lumbar vertebrae** and is inserted at the **spinous processes of the thoracic vertebrae 2-8**. It is innervated by the **dorsal rami (Th1-Th12)**, and is an extensor of the thoracic spine.

**Functional hint:** In addition to its primary function, it can facilitate lateral flexion of the thoracic spine following unilateral innervation.

### Cervical spinalis

The cervical spinalis originates in the **spinous processes of the 6th cervical to the 2nd thoracic vertebrae** and is inserted at the **spinous processes of the 2nd-4th cervical vertebrae**. It is innervated by the **dorsal rami (C2-C4)** and extends the cervical spine.

**Functional hint:** In addition to its primary function, it is capable of lateral flexion of the cervical spine following unilateral innervation.

### Spinalis capitis

Originating in the **spinous processes of the inferior cervical spine and the superior thoracic spine**, the spinalis capitis muscle is inserted **between the superior and the inferior nuchal lines in the occipital bone**. It is innervated via the **dorsal rami (C1-C2)**, and facilitates extension of the cervical spine and the head joints.

**Special features:** This muscle is not present universally.

**Functional hint:** In addition to its primary function, it serves as a contralateral rotator of the cervical spine and the head joints following unilateral innervation.

## Spinalis and Interspinalis System: Recti-Capitis-Group

The **major posterior rectus capitis** and the **minor posterior rectus capitis muscles** constitute the rectus-capitis-group in the spinal and interspinal system. Both muscles are also included within the short neck muscles.

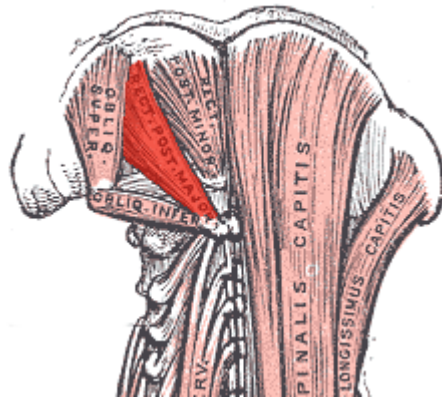


Image: Major posterior rectus capitis. By Uwe Gille, License: Public domain

### Major posterior rectus capitis

The major posterior rectus capitis originates in the **spinous process of the axis** and is inserted at the **middle third of the inferior nuchal line of the occipital bone**. It is innervated by the **suboccipital nerve (dorsal ramus C1)** and is an extensor of the upper and lower head joints.

**Functional hint:** In addition to its primary function, it also facilitates ipsilateral rotation and lateral flexion of the upper and lower head joint in case of unilateral innervation.

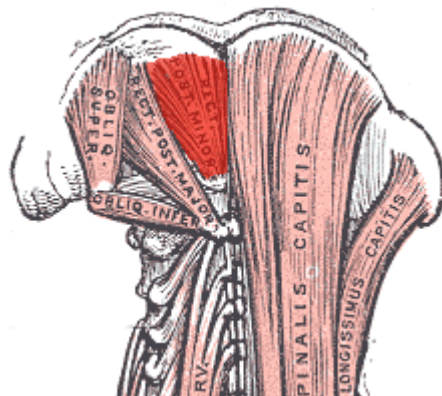


Image: Minor posterior rectus capitis. By Uwe Gille, License: Public domain

### Minor posterior rectus capitis

The 'little brother' of the major posterior rectus capitis muscle originates in the **posterior arch and the posterior tubercle of the atlas**. It is inserted at the **medial third of the inferior nuchal line of the occipital bone** and extends the atlantooccipital joint under active innervation via **suboccipital nerve (dorsal ramus C1)**.

**Functional hint:** In addition to its primary function, it can facilitate rotation and lateral flexion of the atlantooccipital joint ipsilaterally, if it is innervated. unilaterally.

## Intrinsic Back Muscles: Tabular Overview

Muscle System	Muscle Groups	Muscles
Sacrospinalis	Iliocostalis Longissimus	Lumbar iliocostalis Thoracic iliocostalis Cervical iliocostalis Thoracic longissimus Cervical longissimus Longissimus capitis

Spinotransversalis	(none)	Splenius cervicis Splenius capitis Inferior oblique capitis
Intertransversalis	Intertransversarii 'Others'	Medial lumbar intertransversarii Thoracic intertransversarii Posterior cervical intertransversarii Long and short levators Superior oblique capitis
Transversospinalis	Semispinalis Multifidi Rotator	Thoracic semispinalis Cervical semispinalis Semispinalis capitis Multifidi Lumbar rotators Thoracic rotators Cervical rotators
Interspinalis and spinalis	Interspinal Spinal Recti capitis	Lumbar interspinales Thoracic interspinales Cervical interspinales Thoracic spinalis Cervical spinalis Spinalis capitis Major posterior rectus capitis Minor posterior rectus capitis

You can learn everything about the [extrinsic back muscles](#) in a separate article.

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Notes