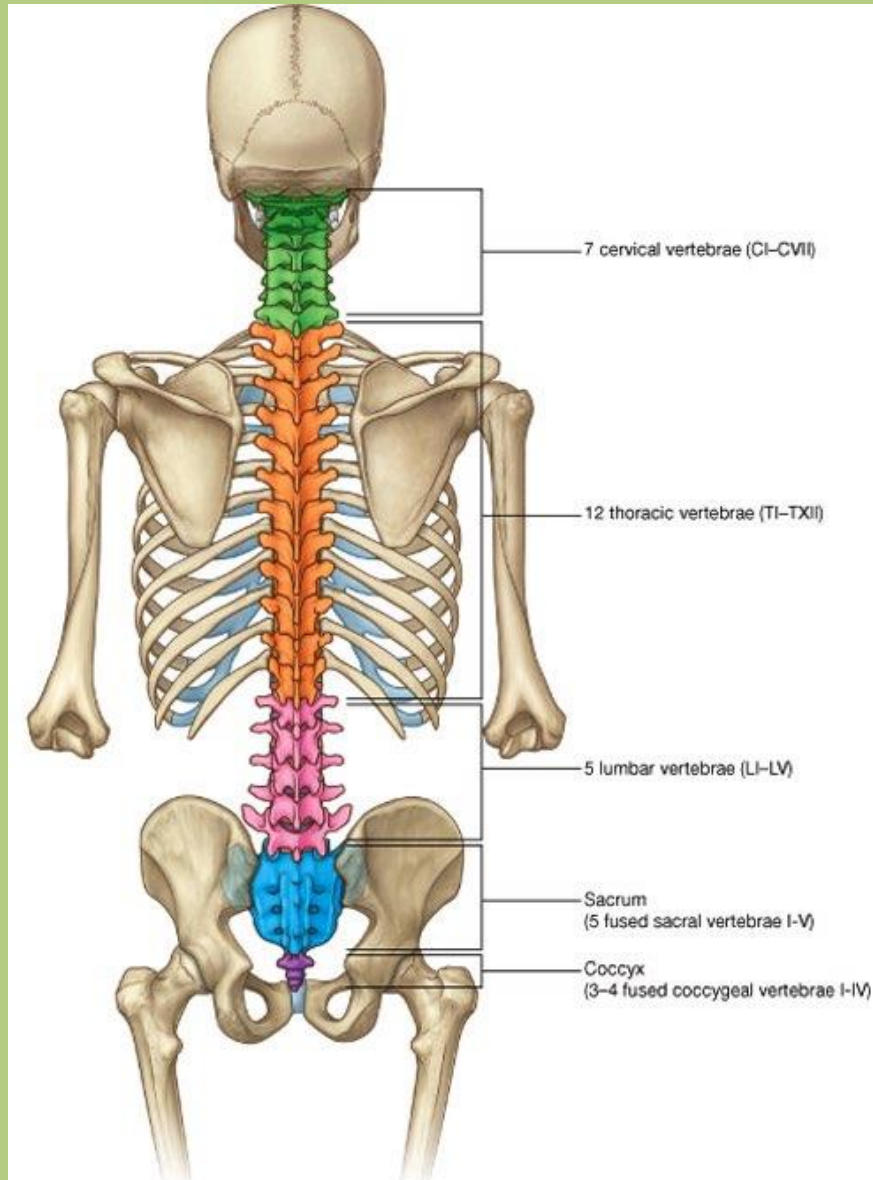




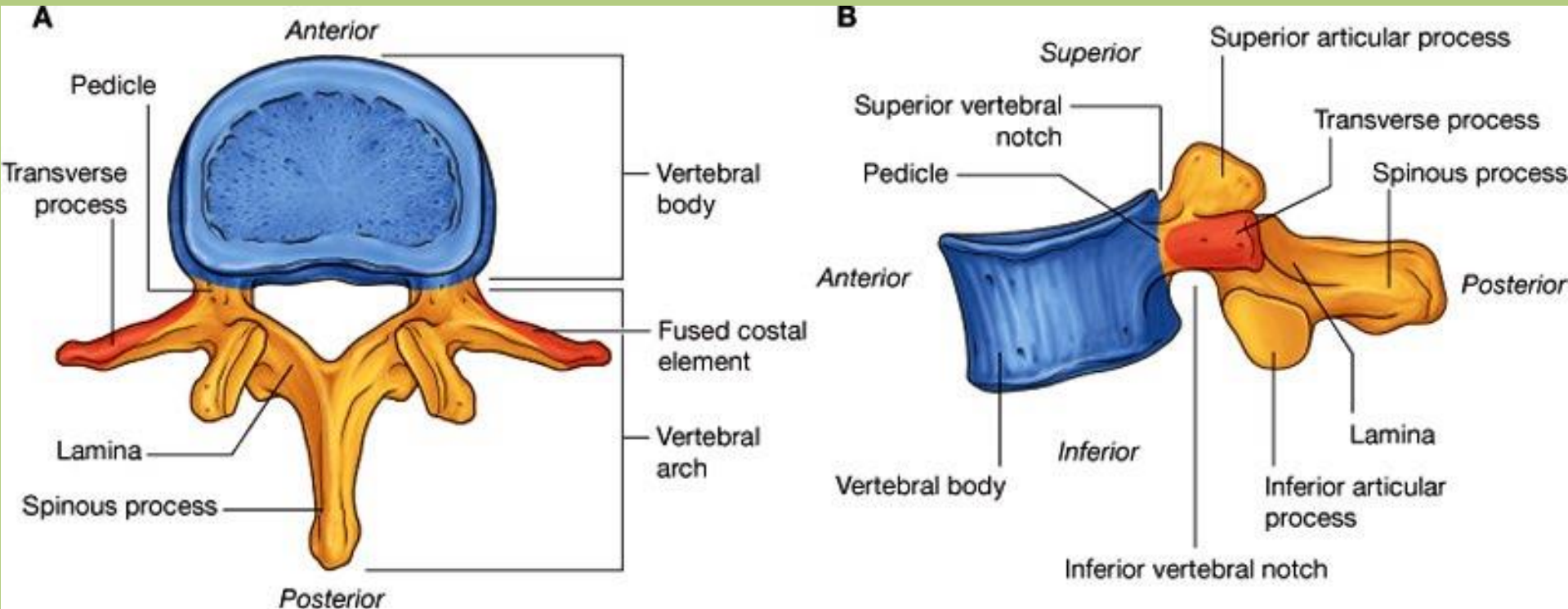
# Gross anatomy and movements of the vertebral column. Back muscles.

Sándor Katz M.D., Ph.D.

# Vertebral column



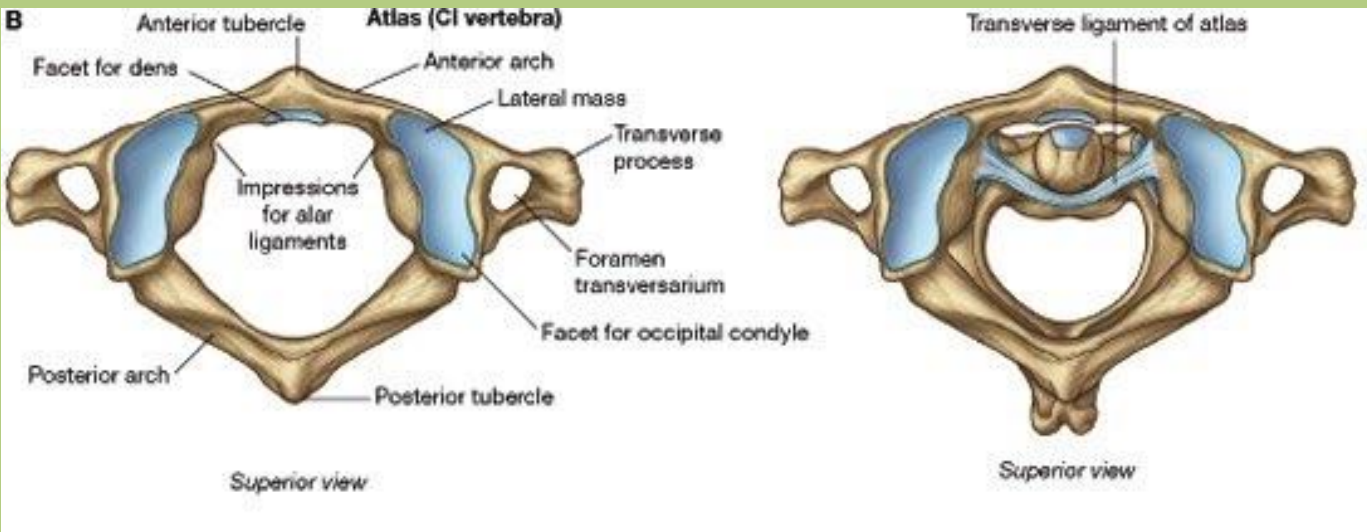
# General vertebral features



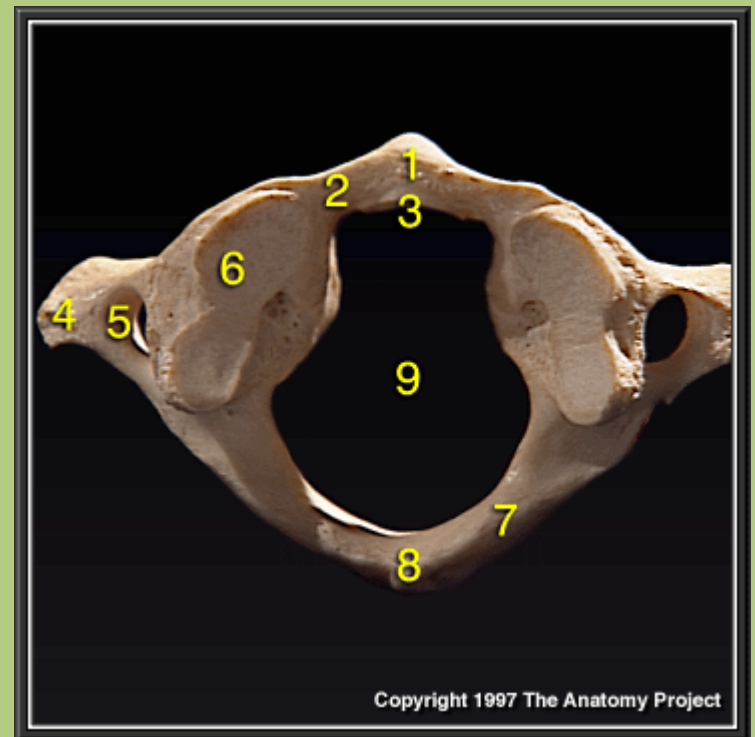
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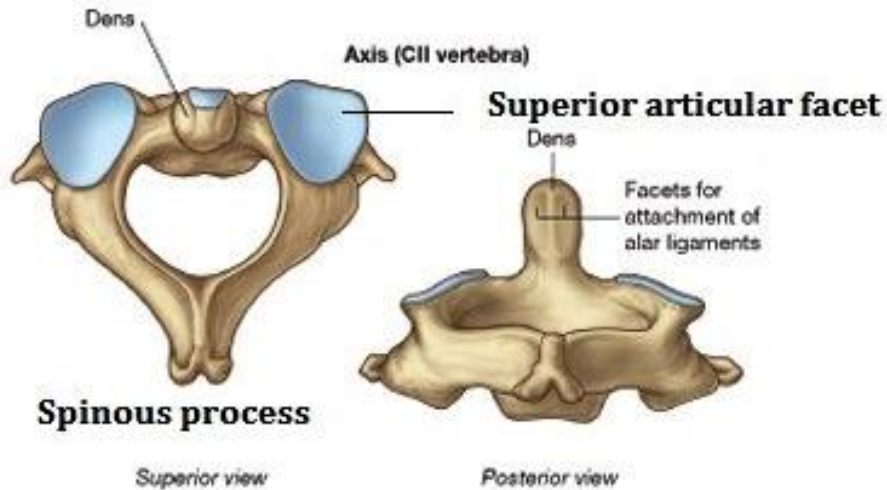
# First cervical vertebra - Atlas



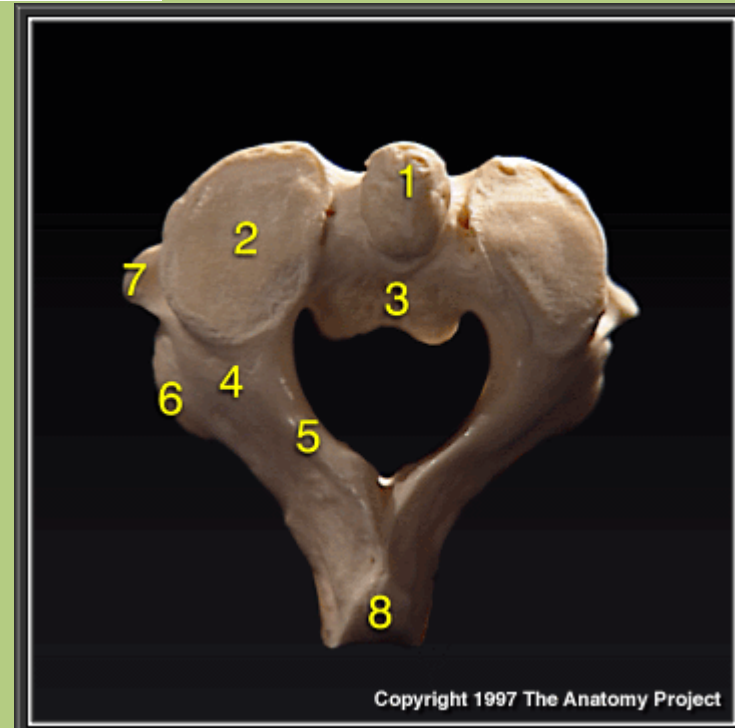
- 1: anterior tubercle
- 2: anterior arch
- 3: fovea dentis
- 4: transverse process
- 5: transverse foramen
- 6: superior articular facet
- 7: posterior arch
- 8: posterior tubercle
- 9: vertebral foramen



# Second cervical vertebra - Axis

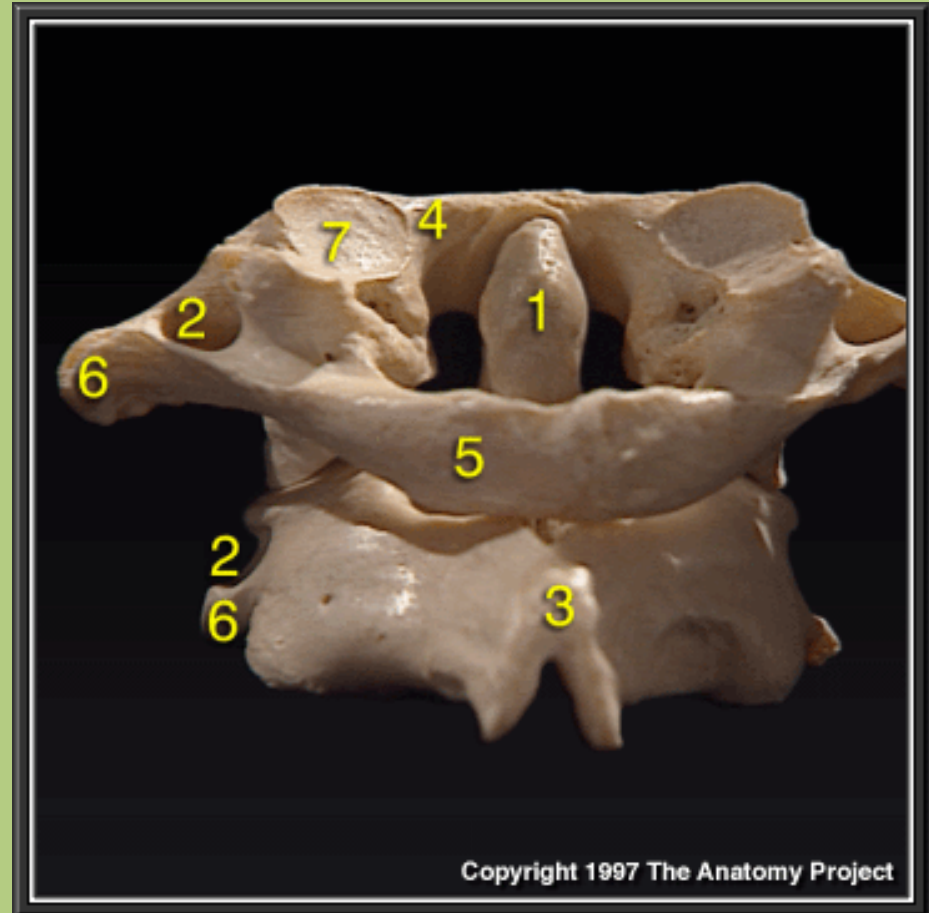


- 1: dens axis
- 2: superior articular process
- 3: vertebral body
- 4: lamina
- 5: vertebral arch
- 6: inferior articular process
- 7: transverse process
- 8: spinous process



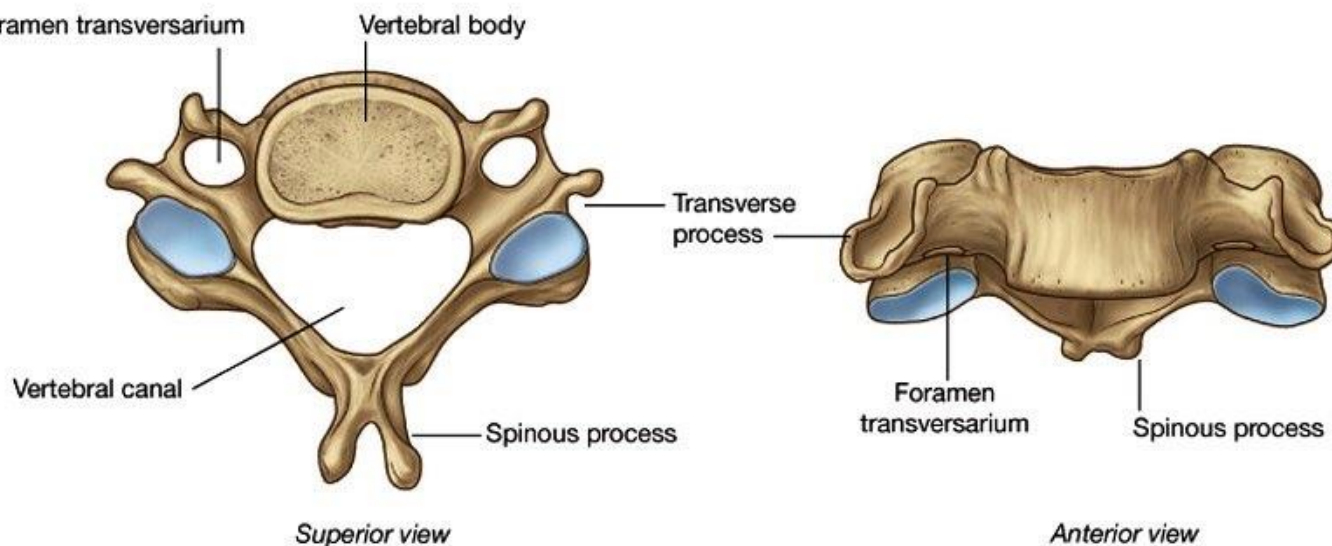
# Atlas and Axis

- 1: dens axis
- 2: transverse foramen
- 3: spinous process
- 4: anterior arch
- 5: posterior arch
- 6: transverse process
- 7: superior articular facet



# Cervical vertebrae

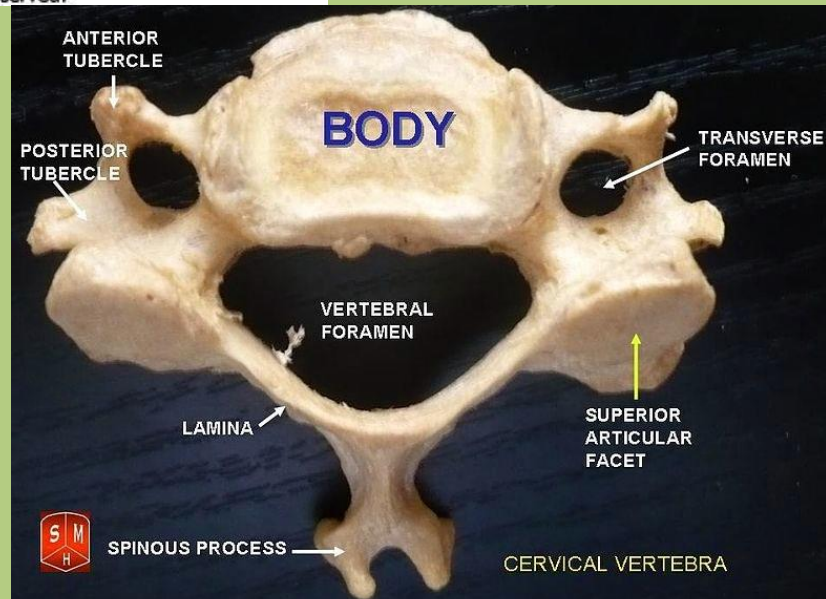
A



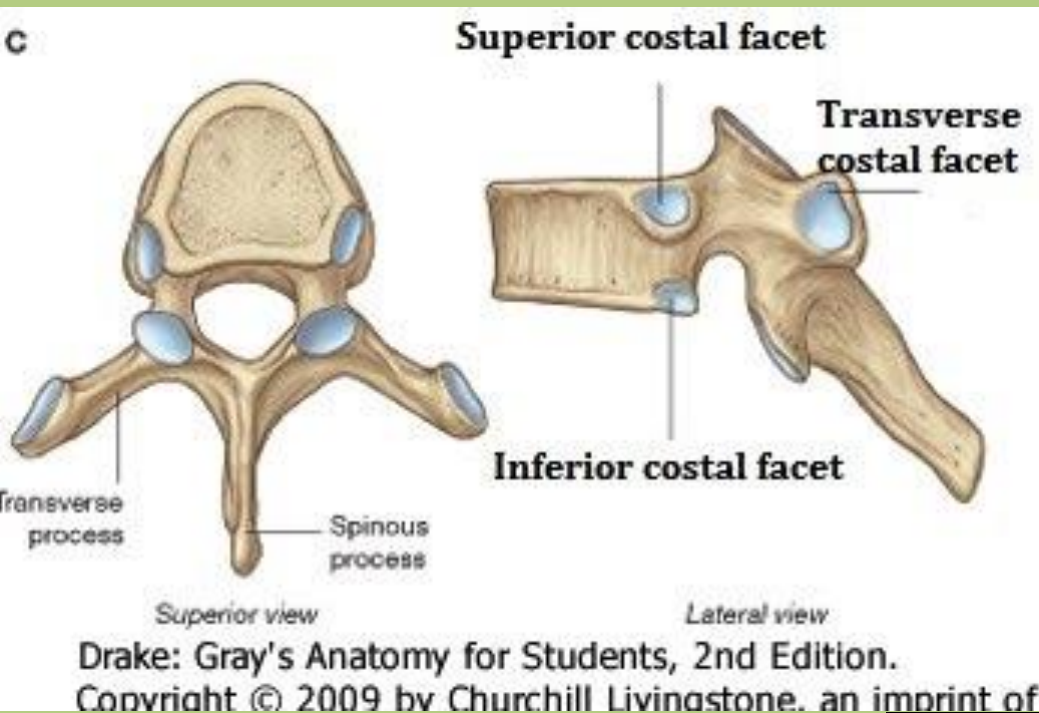
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- small, quadrangular-shaped body
- triangular-shaped foramen
- bifid spinous process
- transverse foramina



# Thoracic vertebrae

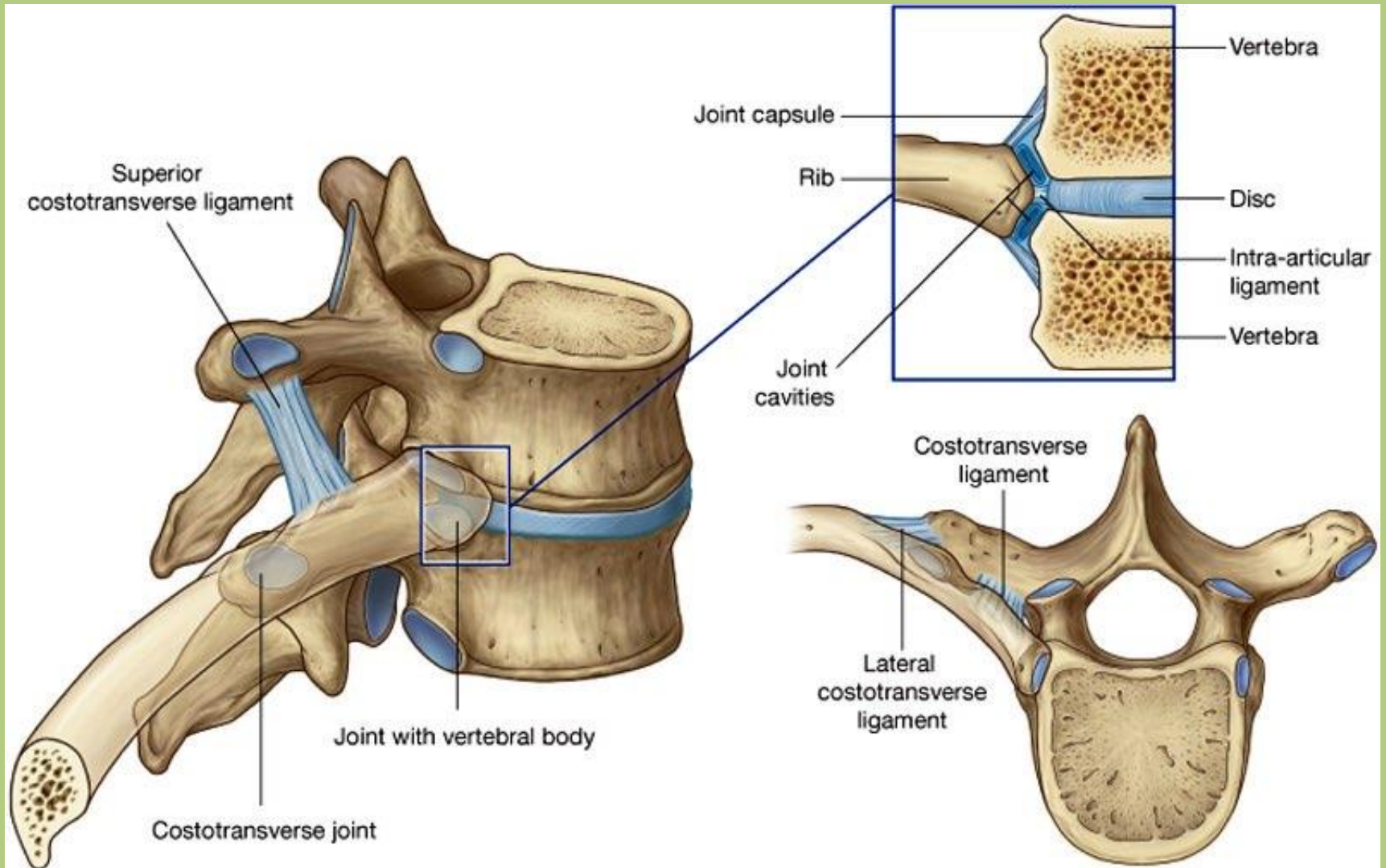


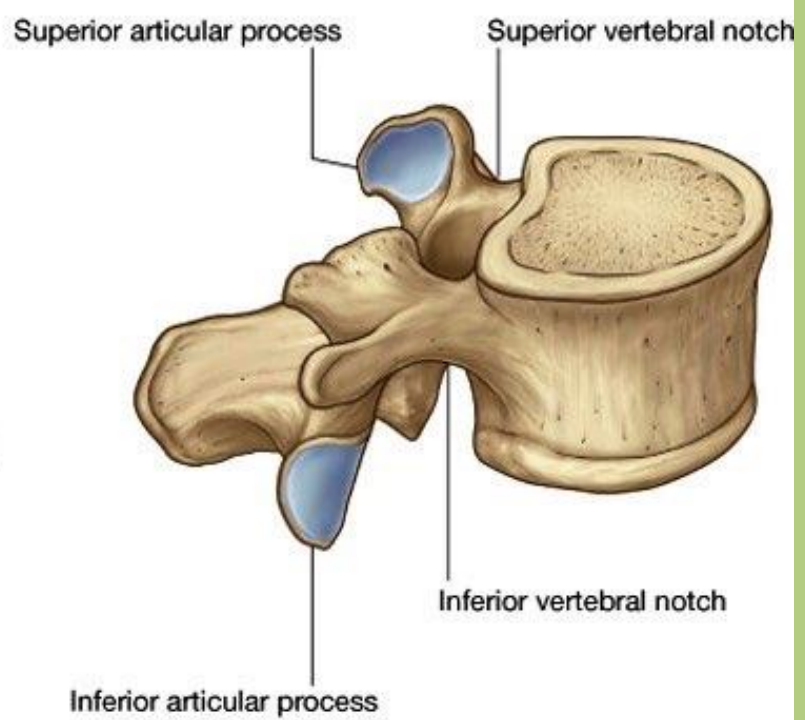
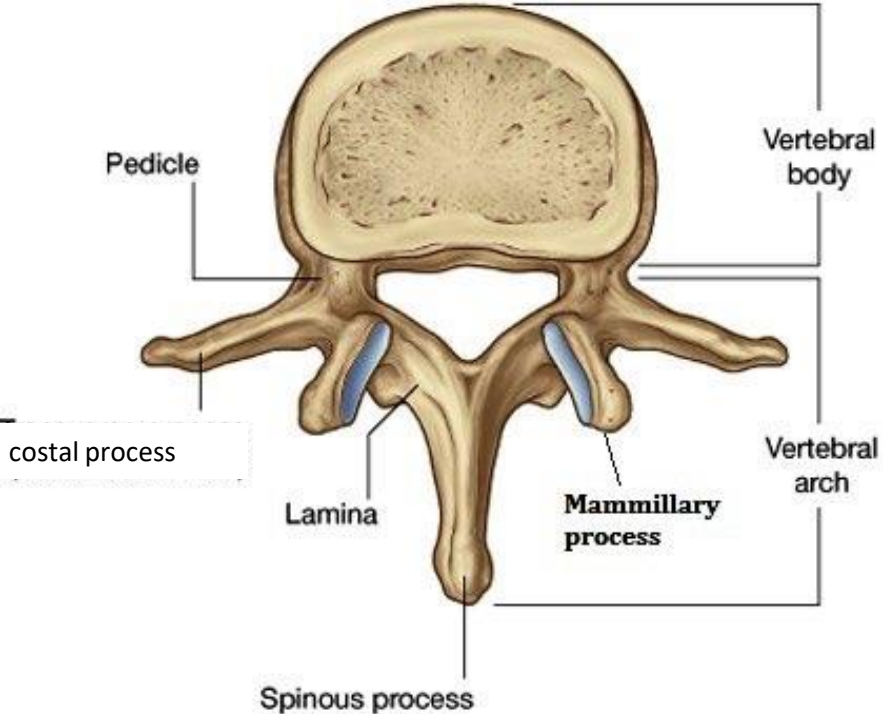
- heart-shaped body
- circular foramen
- almost vertically oriented, long and thin spinous process
- costal articular facets
- superior articular processes face backward
- inferior articular processes face forward





# Costovertebral and costotransverse attachments



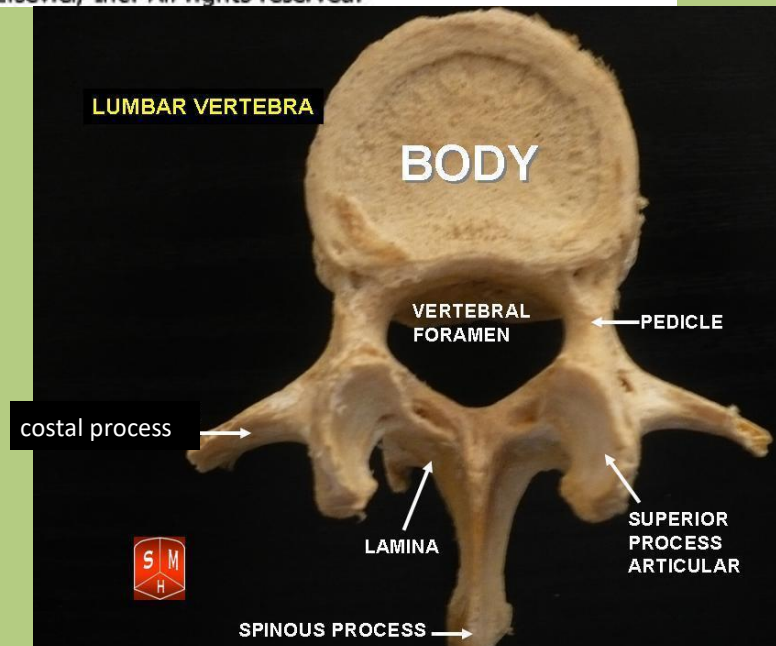


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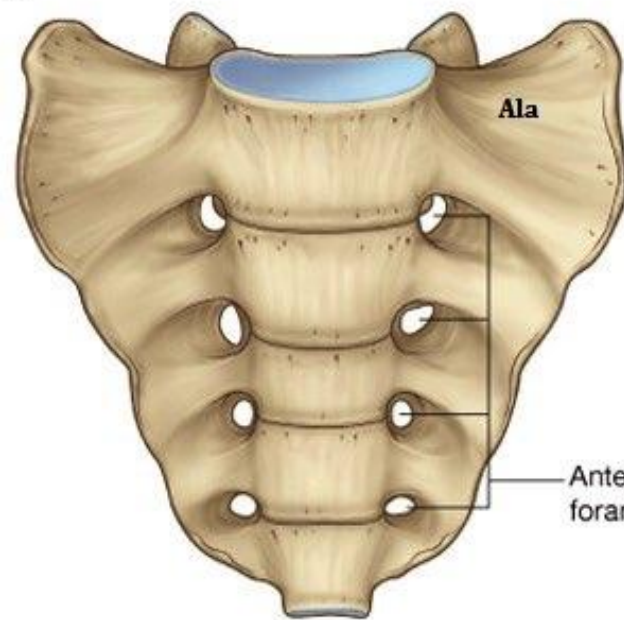
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## Lumbar vertebrae

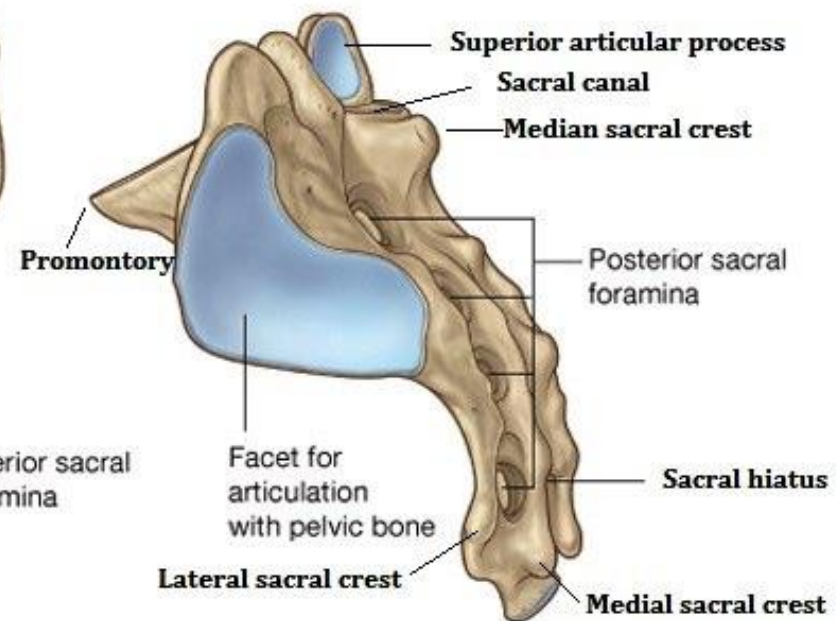
- large, ovoid body
- triangular-shaped foramen
- almost horizontally oriented, short and thick spinous process
- costal processes
- mammillary processes



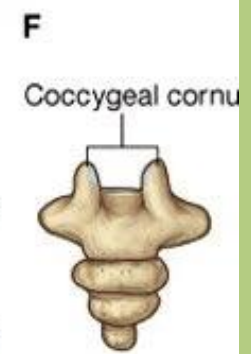
E



Anterior view



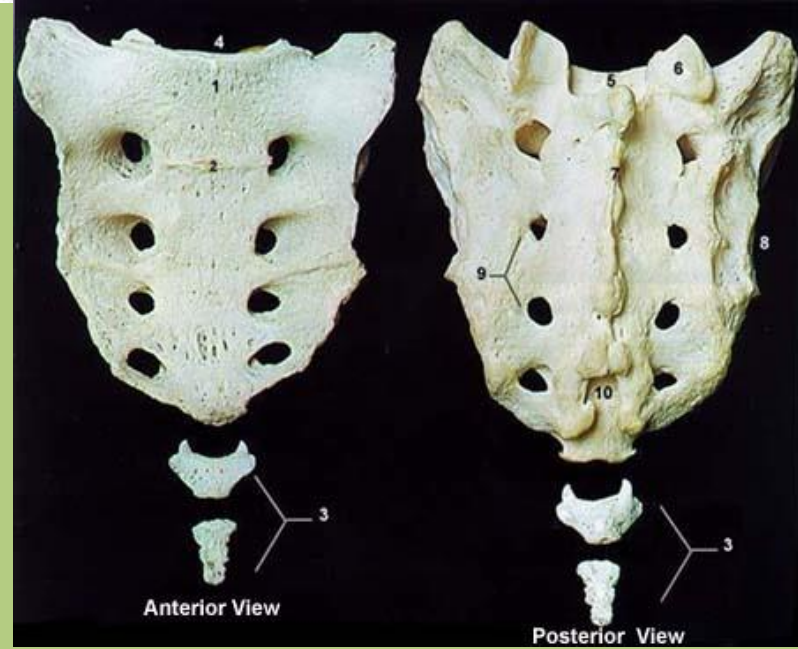
Dorsolateral view



Posterior view

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# Sacrum

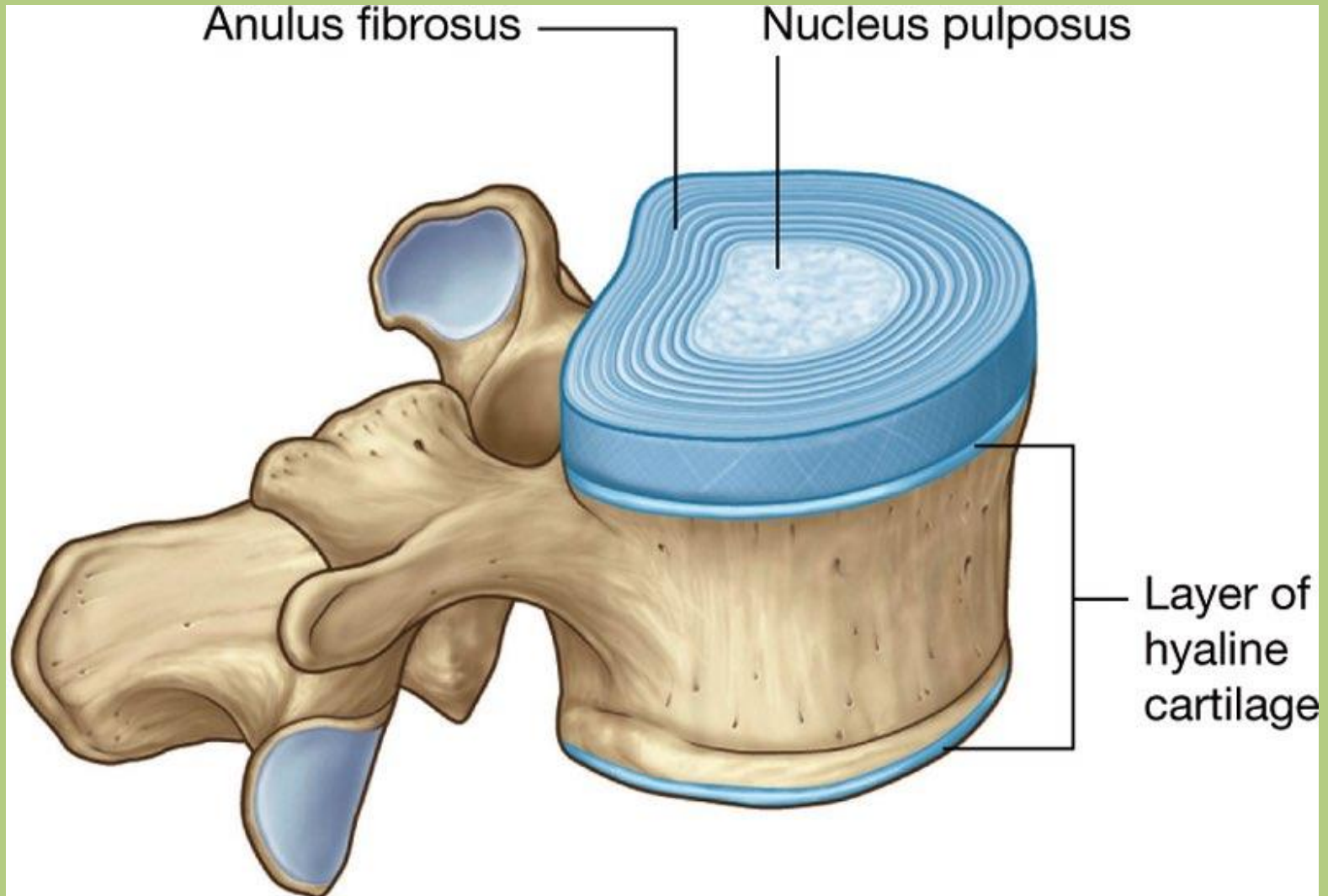


Anterior View

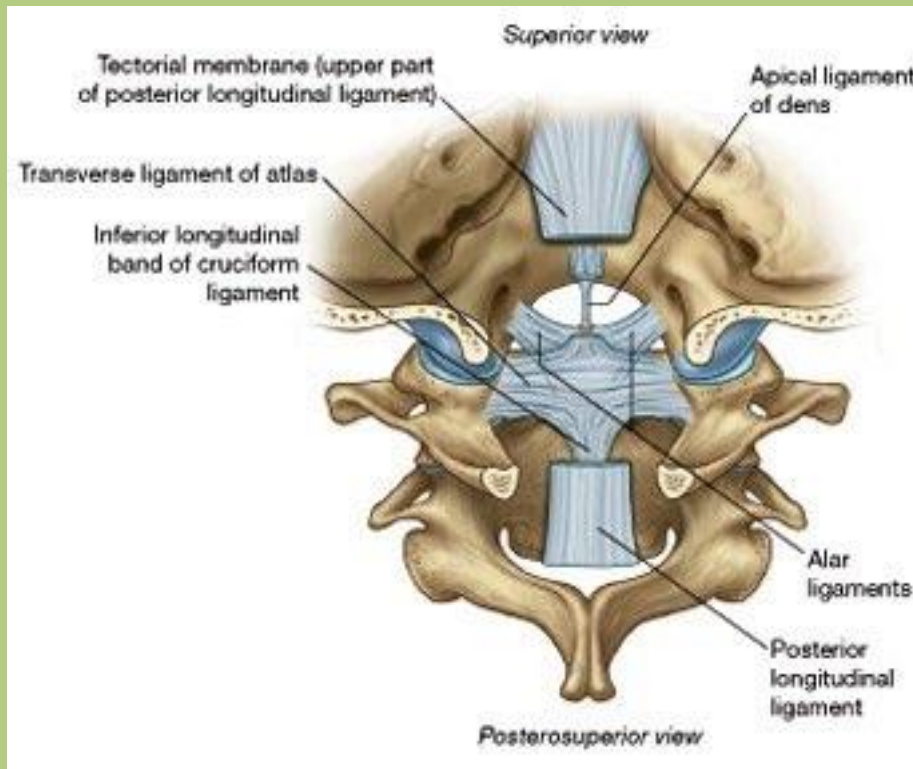
Posterior View

# Intervertebral discs (Synchondroses)

(A type of the continuous bony connections.)



# Atlanto-occipital joint



**Ellipsoid (condylar) joint.**

**Articular surfaces:**

superior articular facets of atlas and occipital condyles

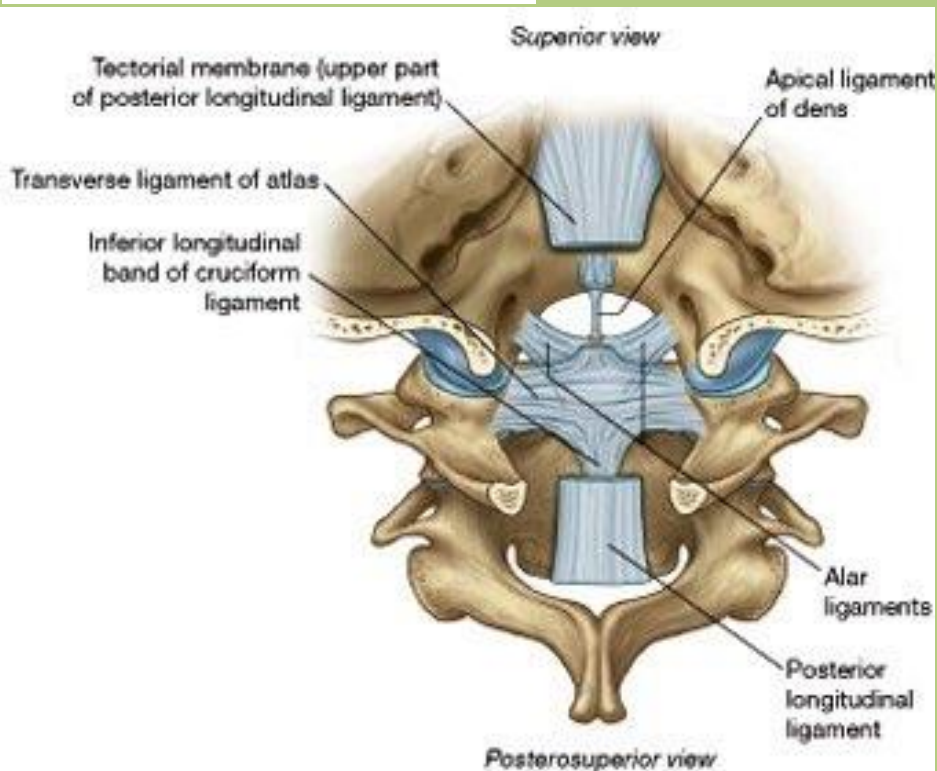
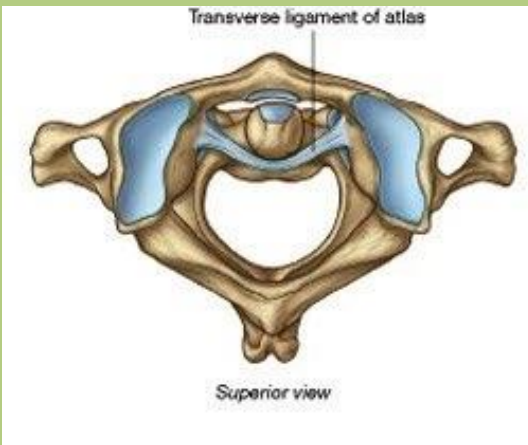
**Ligaments:**

- *posterior and anterior atlanto-occipital membranes*
- *alar ligament (from the dens axis to the occipital condyles)*
- *apical ligament of dens*

**Permitted movements:**

*flexion-extension, slight lateral flexion*

# Atlantoaxial joint



## **PIVOT PART:**

### **Anterior median atlanto-axial joint:**

Between the dens axis (ant. articular facet) and fovea dentis of the atlas.

### **Posterior median atlanto-axial joint:**

Between the dens axis (post. articular facet) and transverse ligament of atlas.

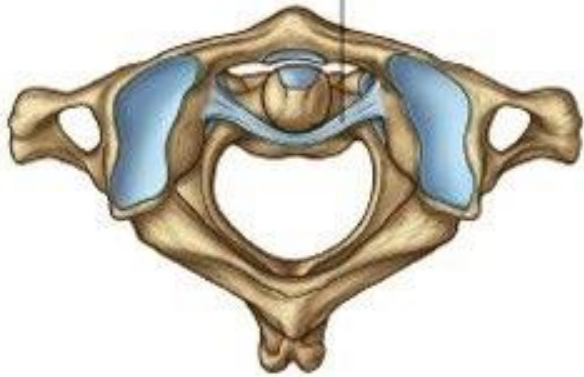
## **PLANE PART:**

### **Lateral atlanto-axial joint:**

Between the inferior articular facets of atlas and superior articular processes of axis.

# Atlantoaxial joint

Transverse ligament of atlas

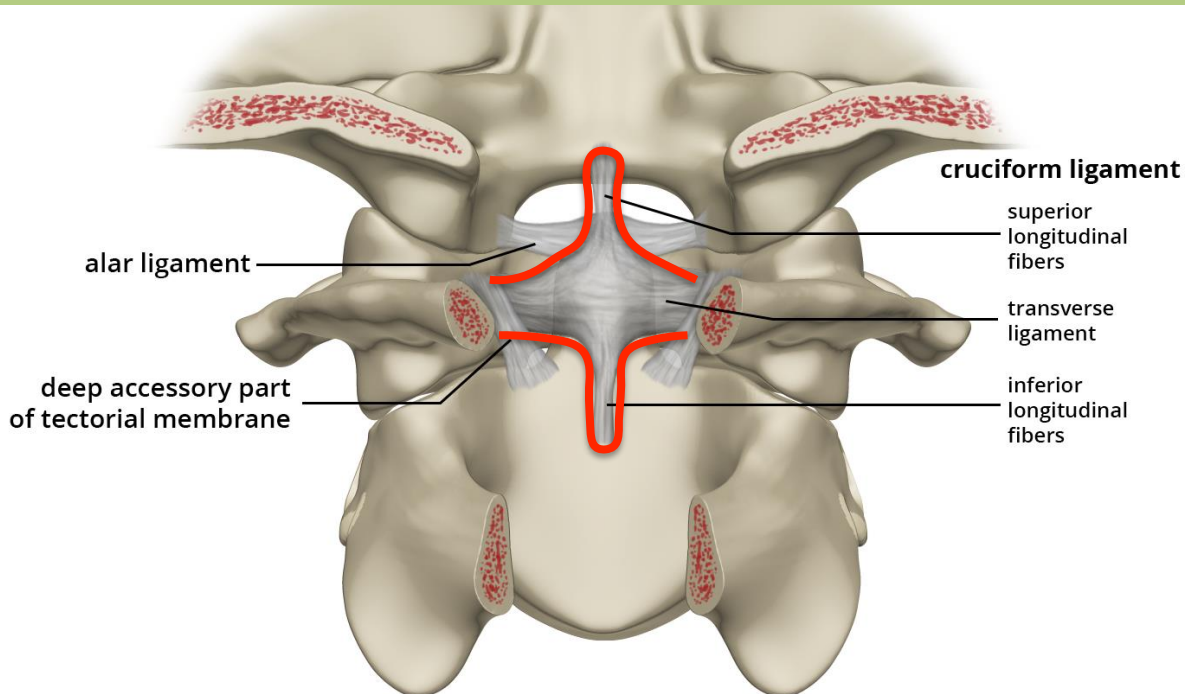


Superior view

## Ligament:

### CRUCIFORM LIGAMENT:

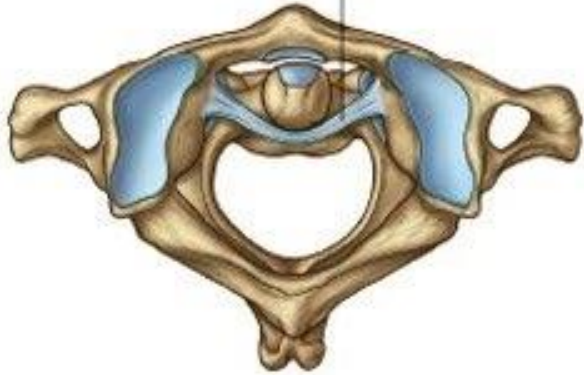
- ***transverse ligament of atlas*** (spans between the two lateral masses of atlas and keeps the dens in the fovea dentis)
- ***longitudinal fascicles***
  - *alar ligament* (from the dens axis to the occipital condyles)
  - *apical ligament of dens*



Case courtesy of Dr Matt Skalski, Radiopaedia.org, rID: 45136

# Atlantoaxial joint

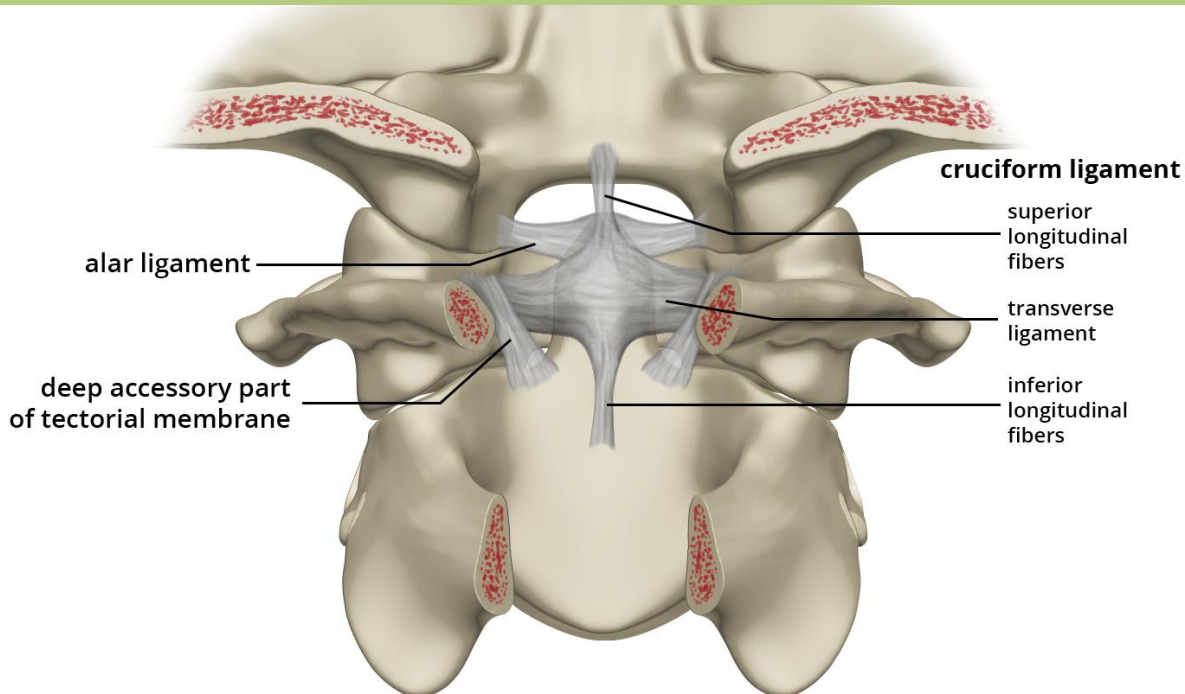
Transverse ligament of atlas



Superior view

## MOVEMENTS:

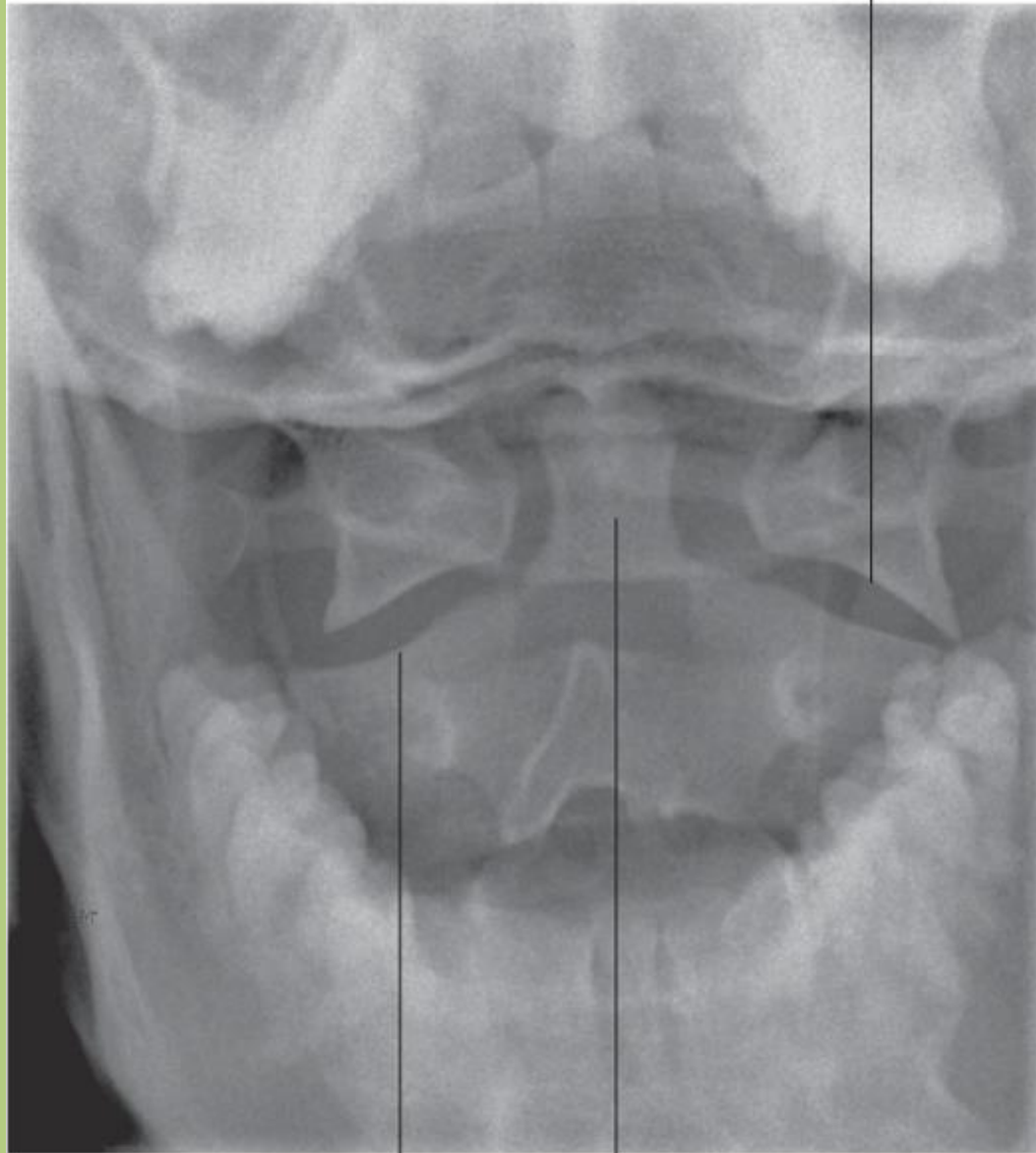
- 50% of the *cervical rotation* (50°) comes from the atlanto-axial joint.
- **Flexion:** 10°.
- Extension is really limited.



Case courtesy of Dr Matt Skalski, Radiopaedia.org, rID: 45136



Inferior articular facet  
on lateral mass of C1



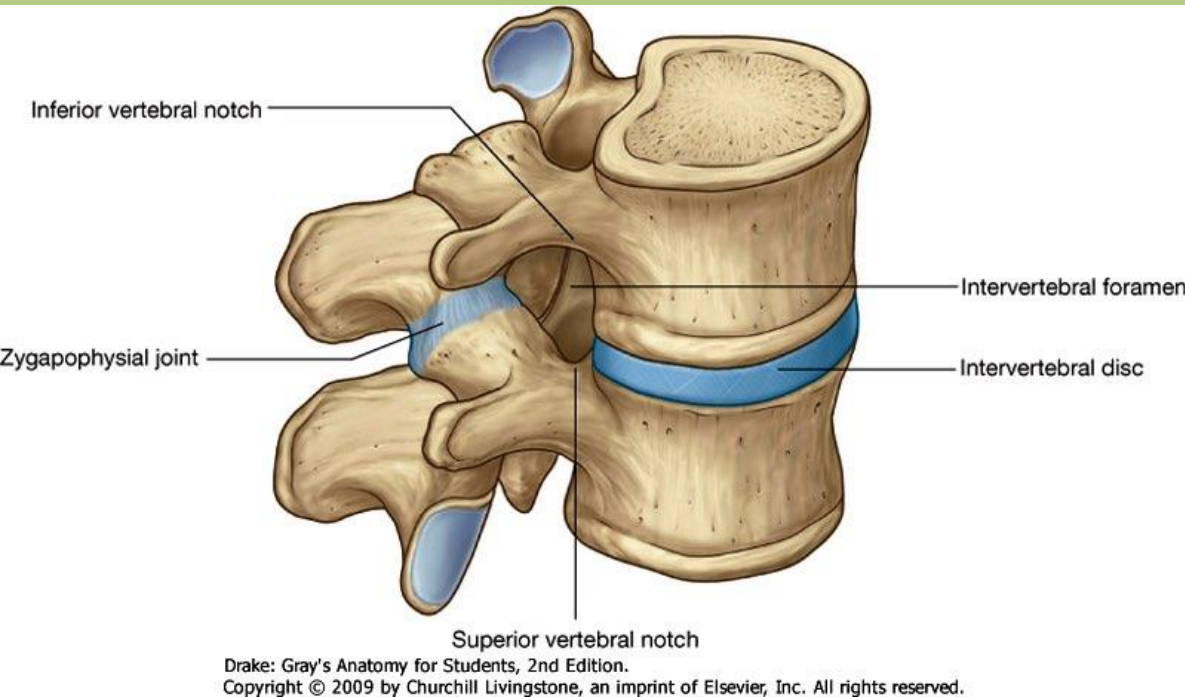
Superior articular  
facet of C1

Dens

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# Zygapophysial (facet) joints



## **Cervical region:**

All movements are possible such as flexion, extension, lateral flexion and rotation.

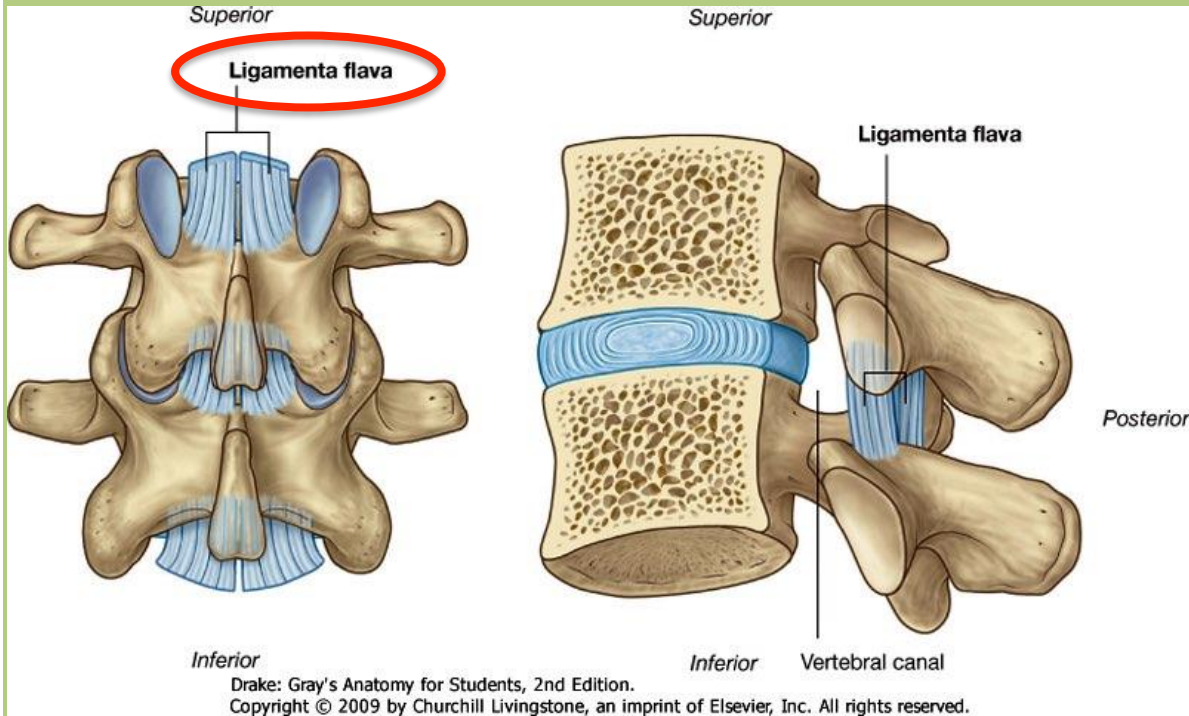
## **Thoracic region:**

Lateral flexion and rotation.  
No flexion/extension.

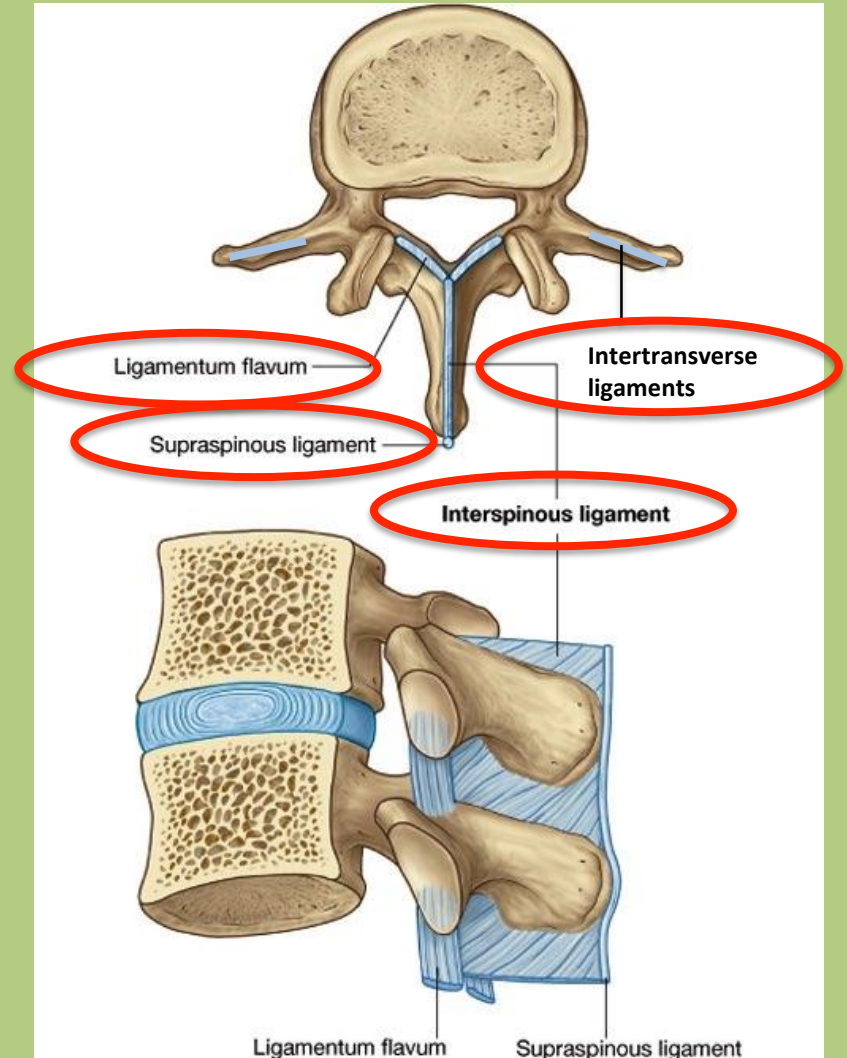
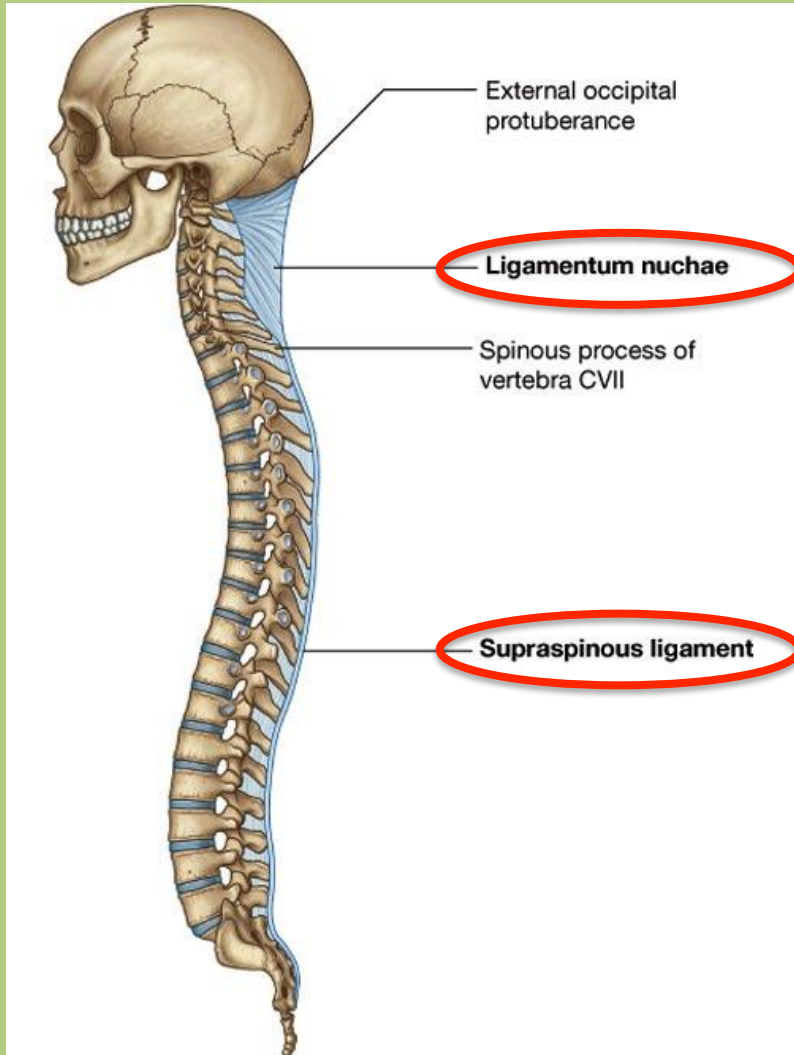
## **Lumbar region:**

Flexion and extension.

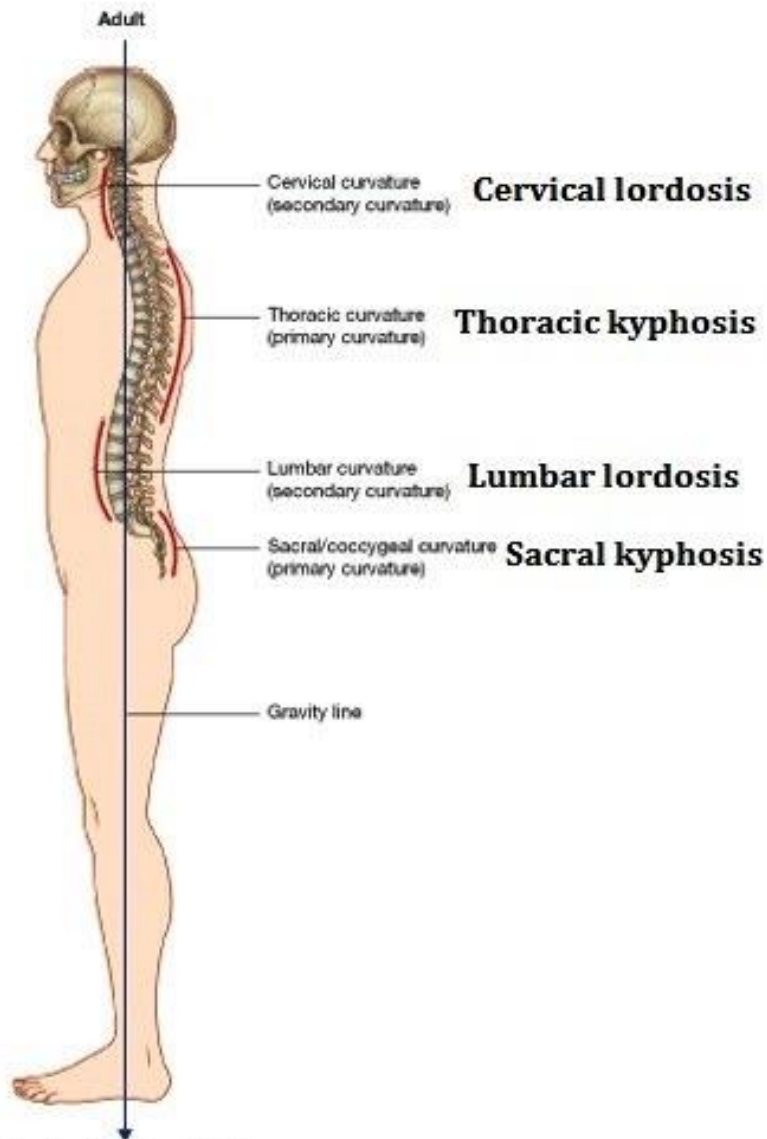
# Ligaments of the spine



# Ligaments of the spine



# Spinal curvatures



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# Scoliosis

(S-shaped deformity of the spine)

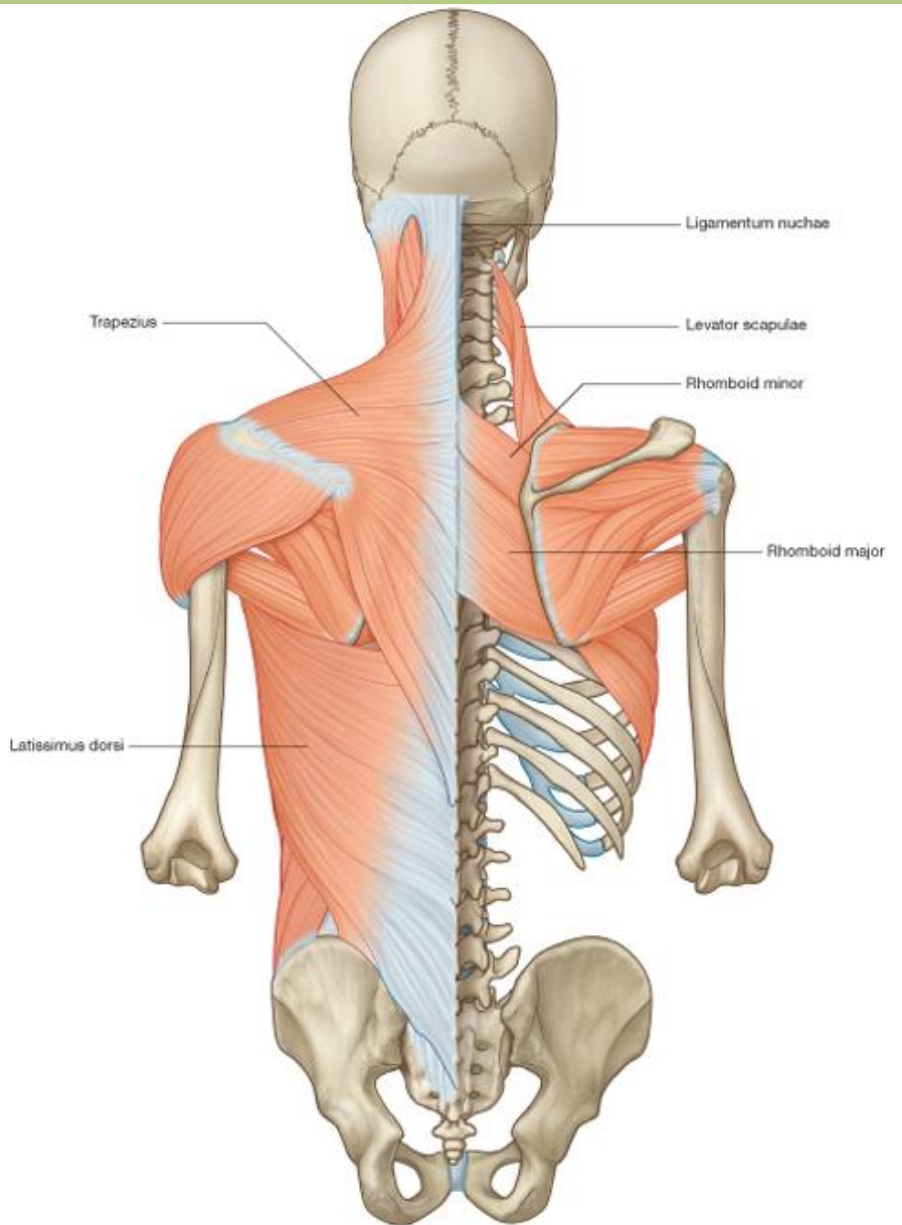


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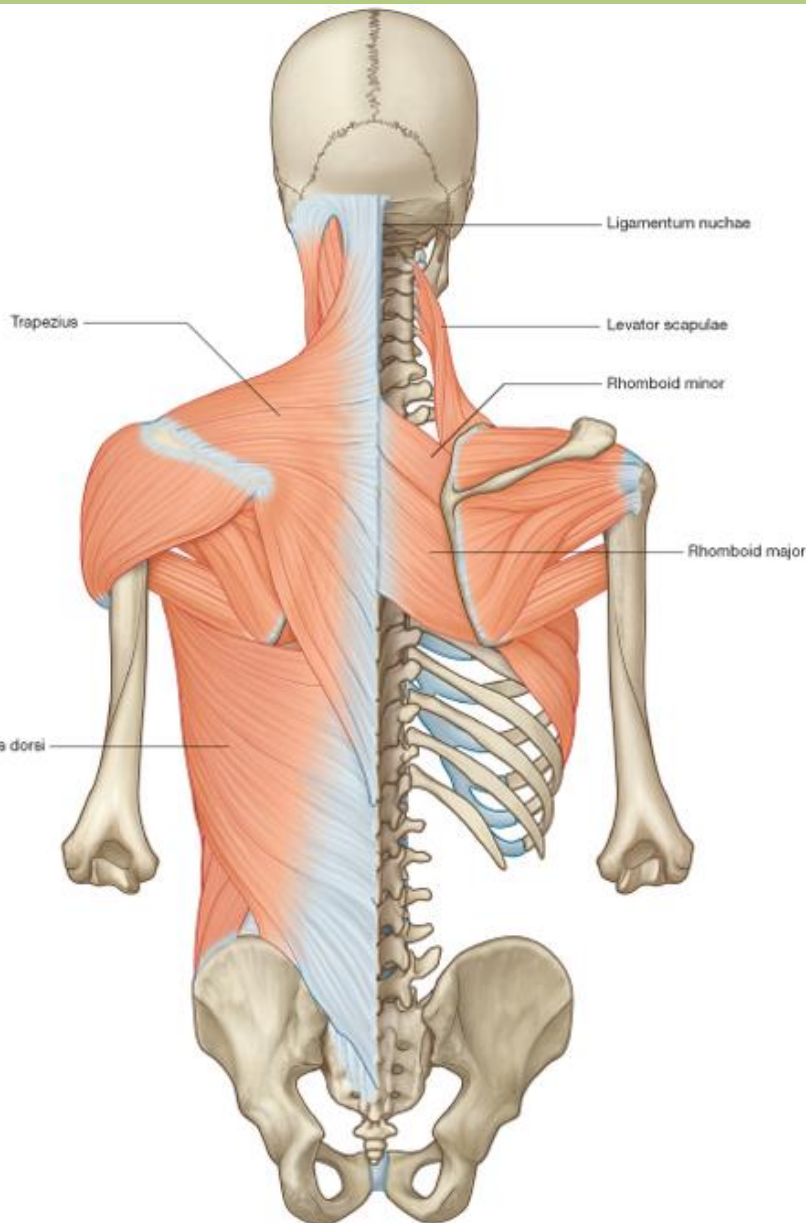
# Superficial back muscles - spinohumeral muscles



## Trapezius

- **Origin:** external occipital protuberance, spinous processes of the C7-T12 vertebrae, nuchal ligament
- **Insertion:** acromial third of clavicle, acromion, spine of scapula
- **Action:** retraction, elevation and depression of the scapula
- **Innervation:** axillary nerve

# Superficial back muscles - spinohumeral muscles

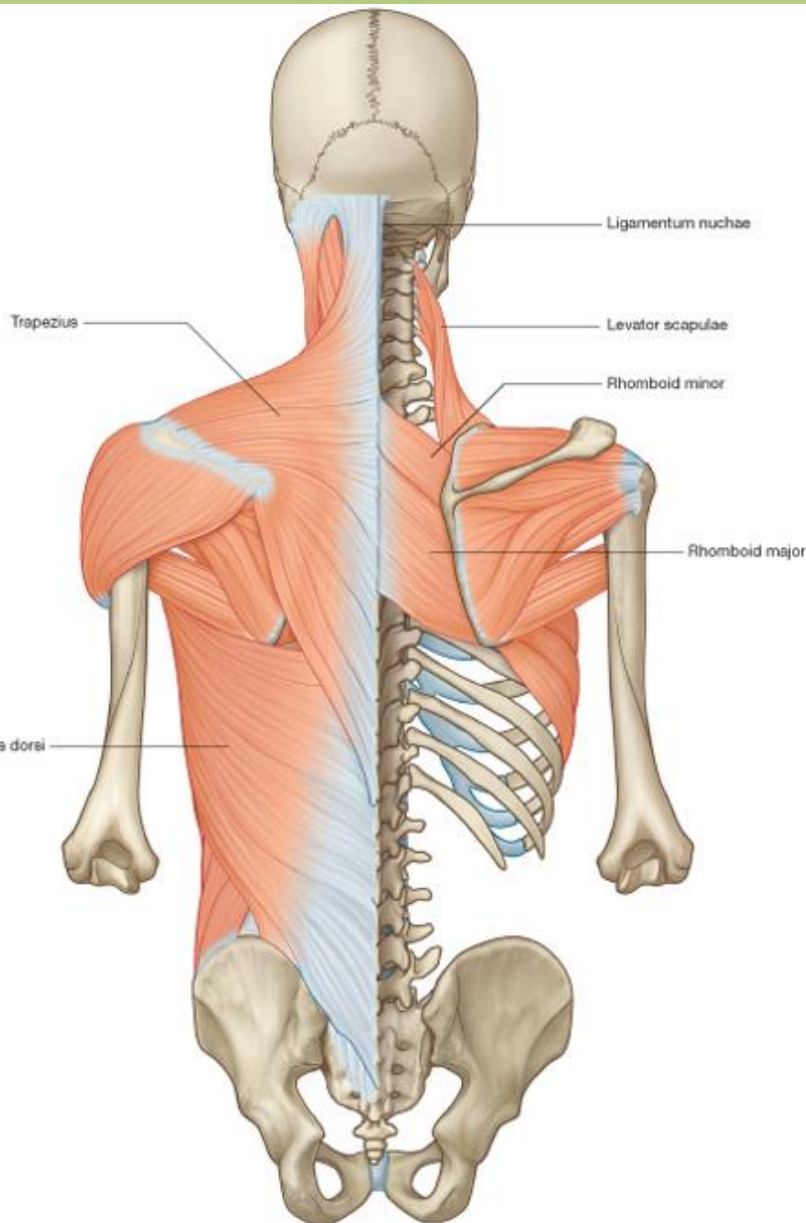


## Levator scapulae

- **Origin:** transverse processes of C1-C4 vertebrae
- **Insertion:** superior part of scapula
- **Action:** elevation of the scapula
- **Innervation:** dorsal scapular nerve



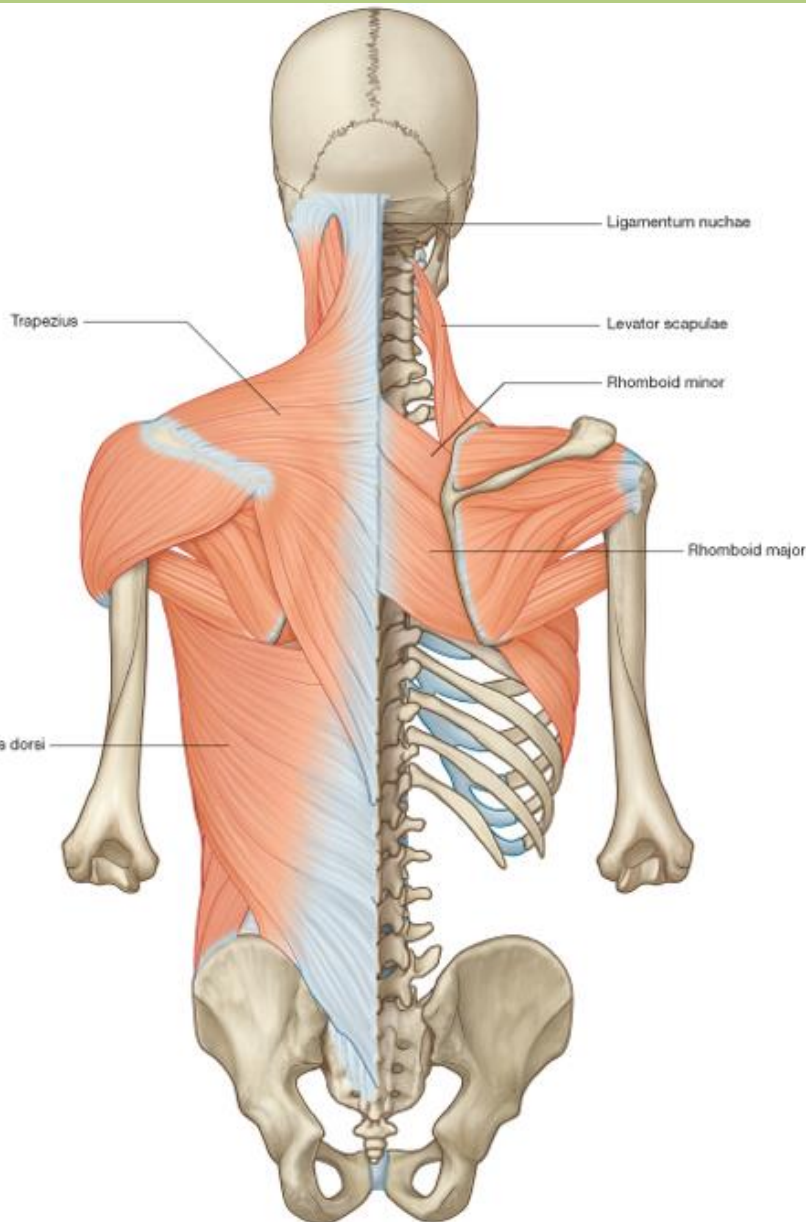
# Superficial back muscles - spinohumeral muscles



## Rhomboid major and minor

- **Origin: minor:** spinous processes of C7-T1 vertebrae; **major:** spinous processes of T2-T5 vertebrae
- **Insertion: minor:** medial border of scapula over the spine, **major:** medial border of scapula under the spine
- **Action:** retraction of the scapula
- **Innervation:** dorsal scapular nerve

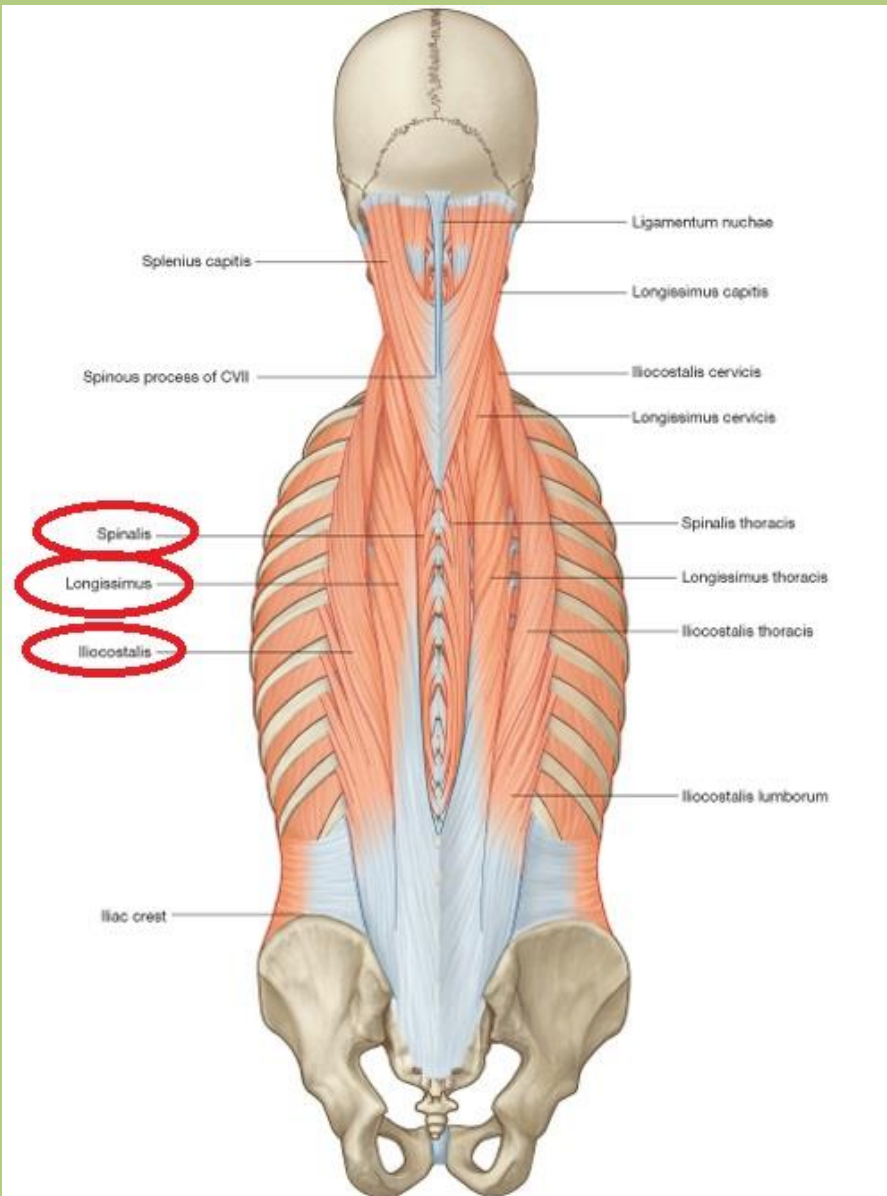
# Superficial back muscles - spinohumeral muscles



## Latissimus dorsi

- **Origin:** spinous processes of T7-L5 vertebrae, thoracolumbar fascia, iliac crest
- **Insertion:** crest of less tubercle
- **Action:** adduction of upper limb
- **Innervation:** thoracodorsal nerve

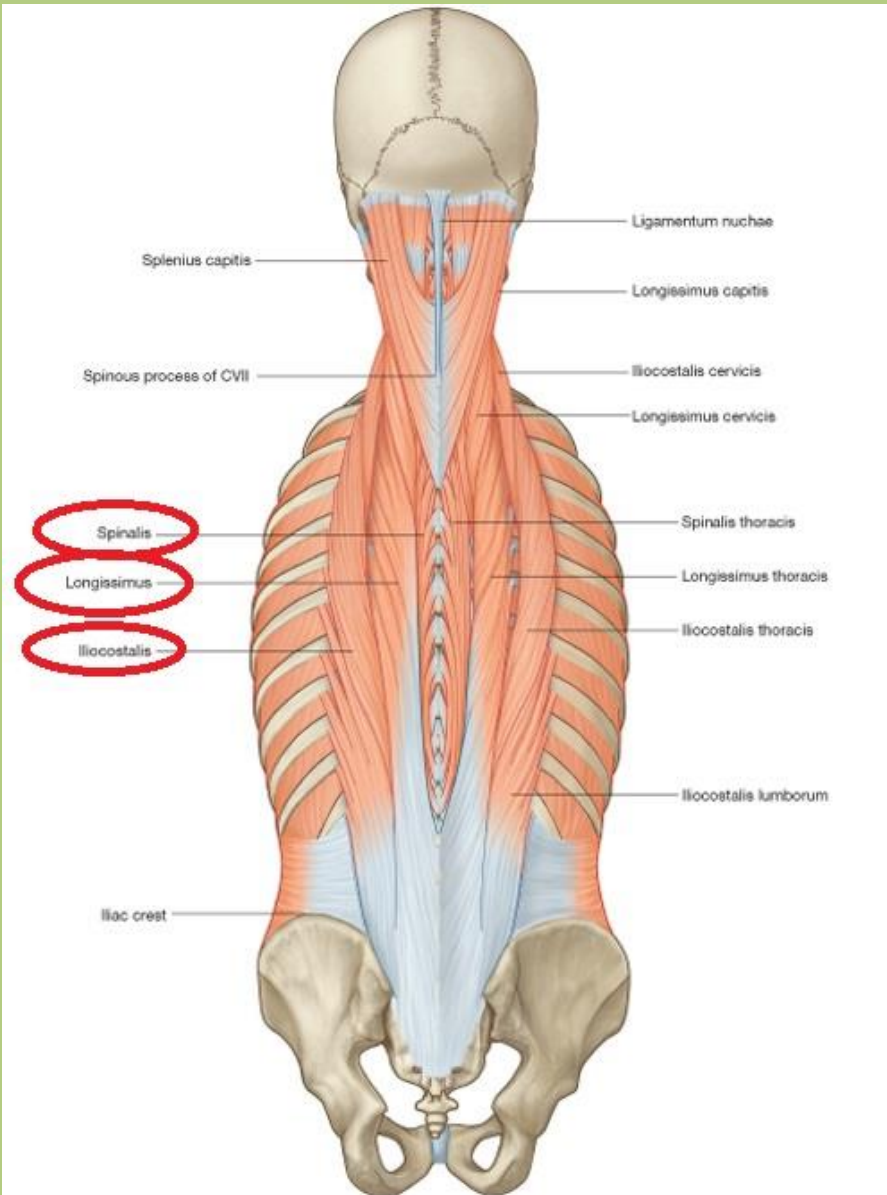
# Deep (axial) muscles - erector spinae



## Longissimus thoracis, cervicis and capitis

- **Origin-insertion:** from sacrum to skull involving spinous and transverse processes of vertebrae
- **Action:** extension of vertebral column
- **Innervation:** posterior branches of spinal nerves

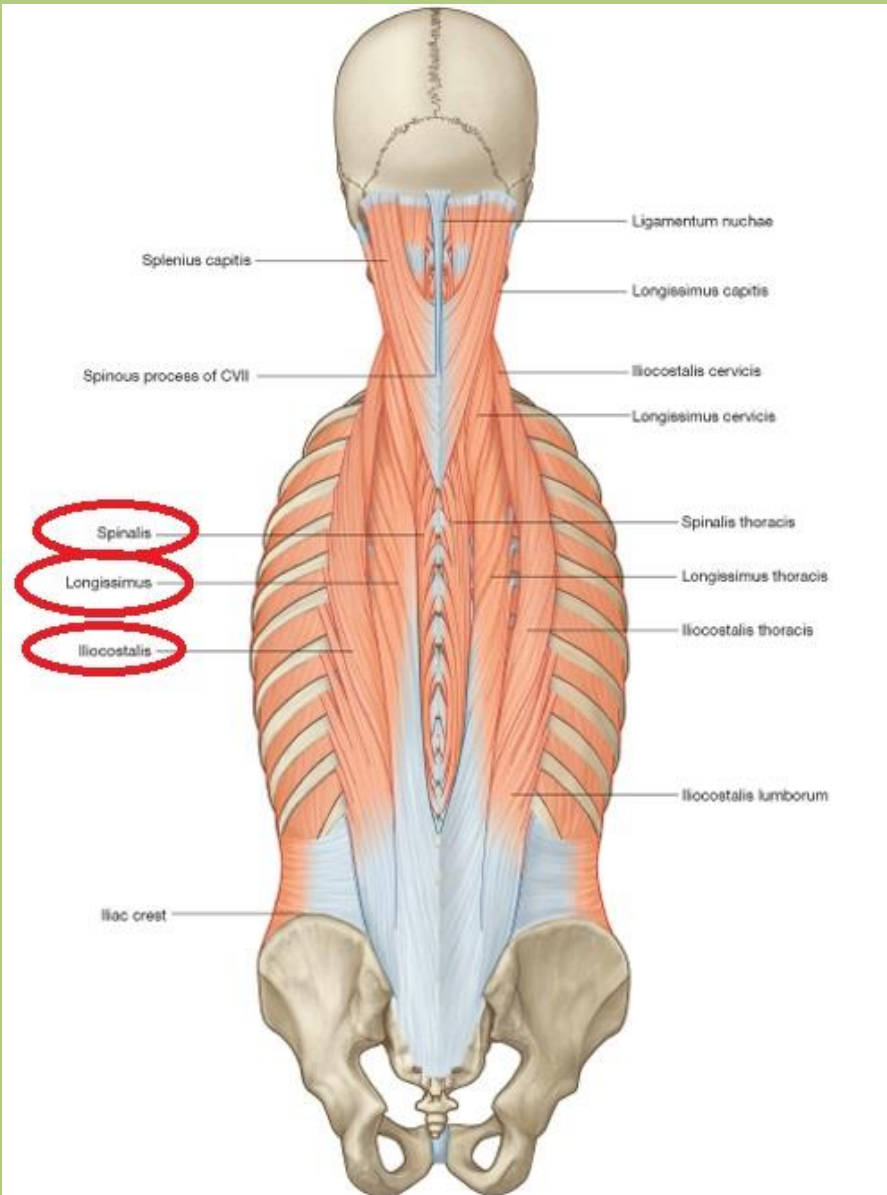
# Deep (axial) muscles - erector spinae



## Iliocostalis lumborum, thoracis and cervicis

- **Origin-insertion:** from sacrum and iliac crest to cervical spine involving ribs
- **Action:** extension of vertebral column
- **Innervation:** posterior branches of spinal nerves

# Deep (axial) muscles - erector spinae

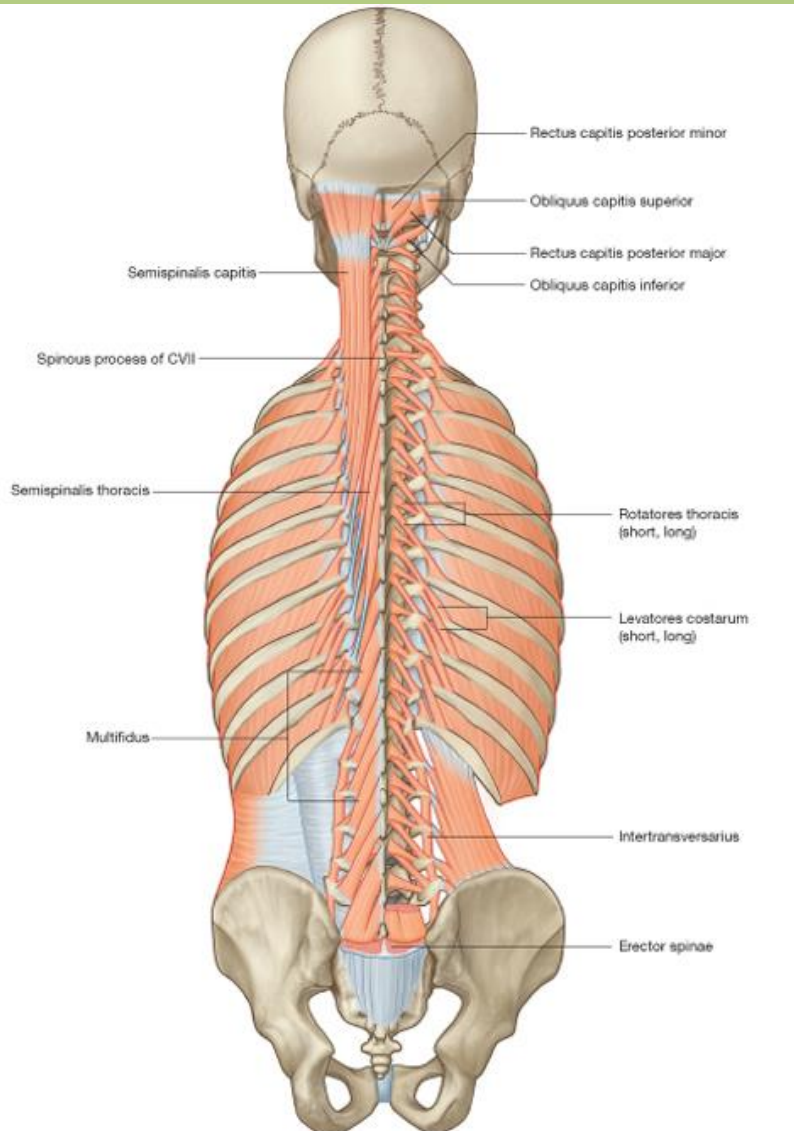


## Spinalis thoracis, cervicis and capitis

- **Origin-insertion:** from lumbar vertebrae to skull involving spinous processes of vertebrae
- **Action:** extension of vertebral column
- **Innervation:** posterior branches of spinal nerves

# Transversospinal muscles

(from transverse processes to spinous processes)



## **Semispinalis muscles:**

Cover 5-6 vertebrae.

## **Multifidi muscles:**

Cover 3-4 vertebrae.

## **Rotatores muscles:**

Cover 1-2 vertebrae.

## **Functions:**

Unilateral innervation: lateral flexion.

Bilateral innervation: extension.

Thank you for your attention.

Reference:

Gray's Anatomy for Student

Thieme Atlas of Anatomy

[radiopaedia.org](http://radiopaedia.org)