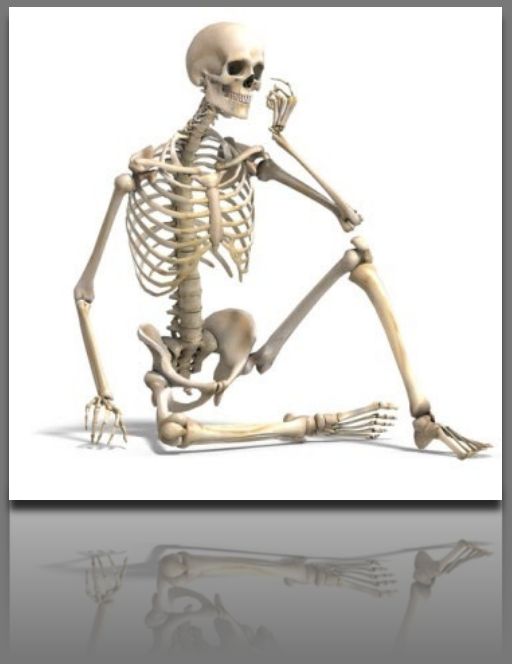
BALANCED BODY
ANATOMY IN THREE DIMENSIONS™



An Introduction to Anatomy for Movers and Movement Educators

Torso to Upper Body

balanced body

Day 2

The Spine and Thorax

Including the bones, muscles and actions of the thorax and spine

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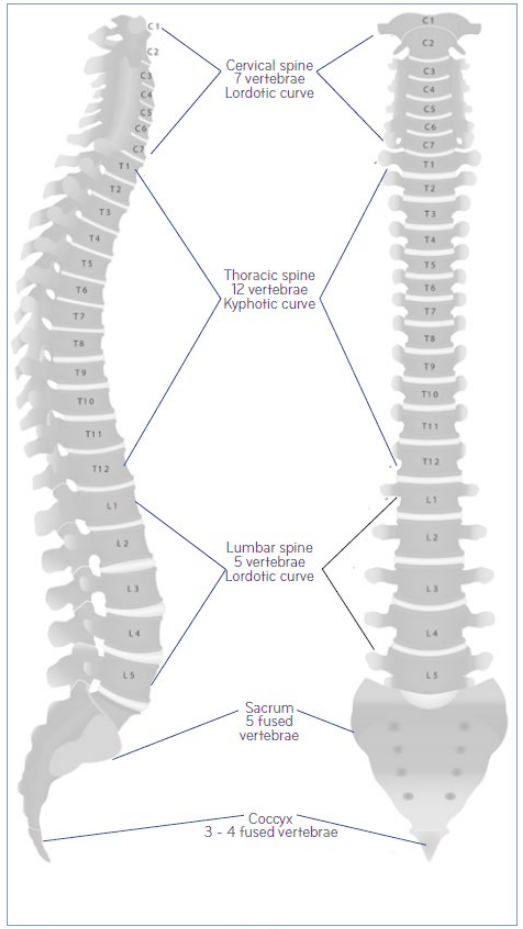
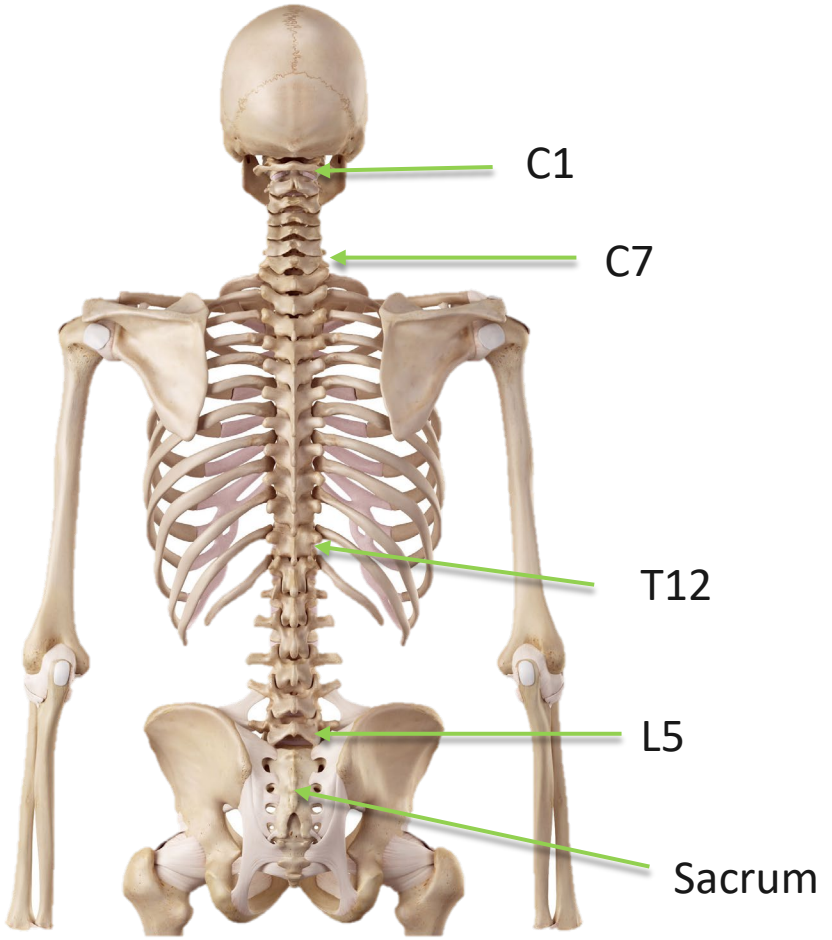
Segments of the Spine

- 7 Cervical vertebrae
- 12 Thoracic vertebrae
- 5 Lumbar vertebrae
- Sacrum (5 fused vertebrae)
- Coccyx (3-4 fused vertebrae)



The Spine



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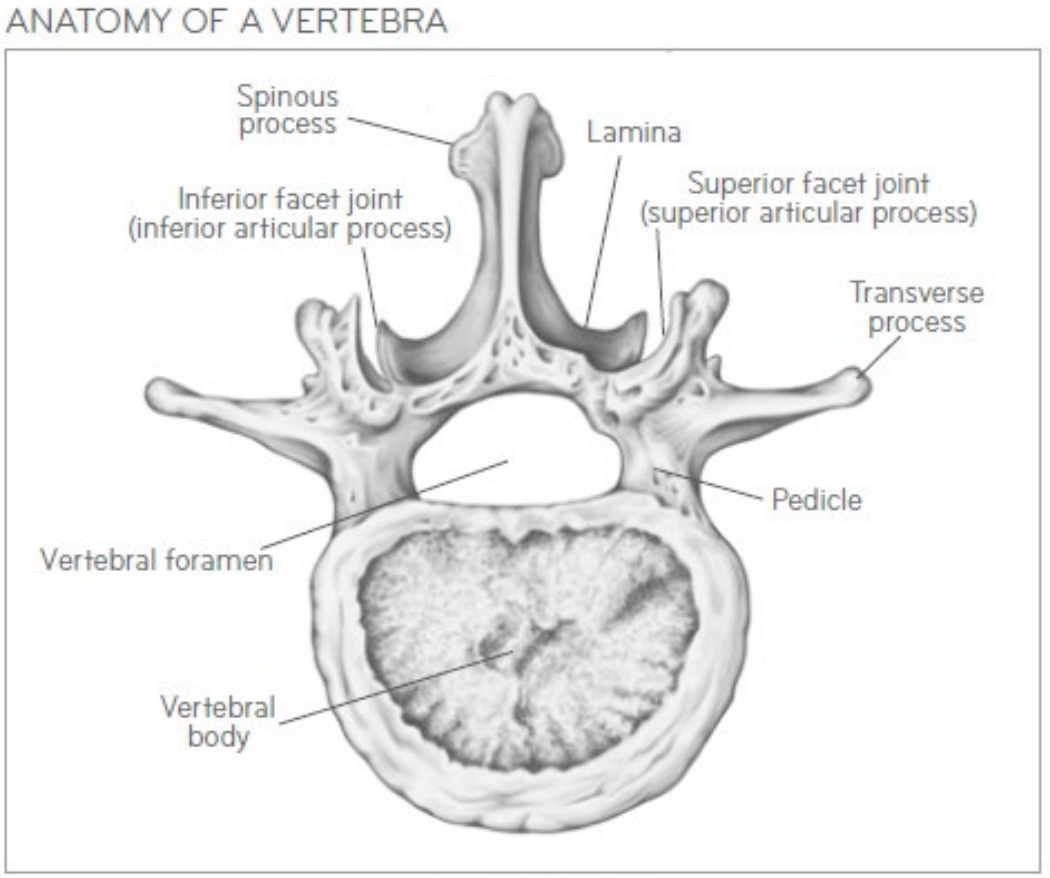
Structure of a Vertebra

Body

Vertebral Arch

- Pedicle
- Lamina
- Transverse process
- Spinous process

Vertebral foramen



A Lumbar Vertebra

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Spinal Structure

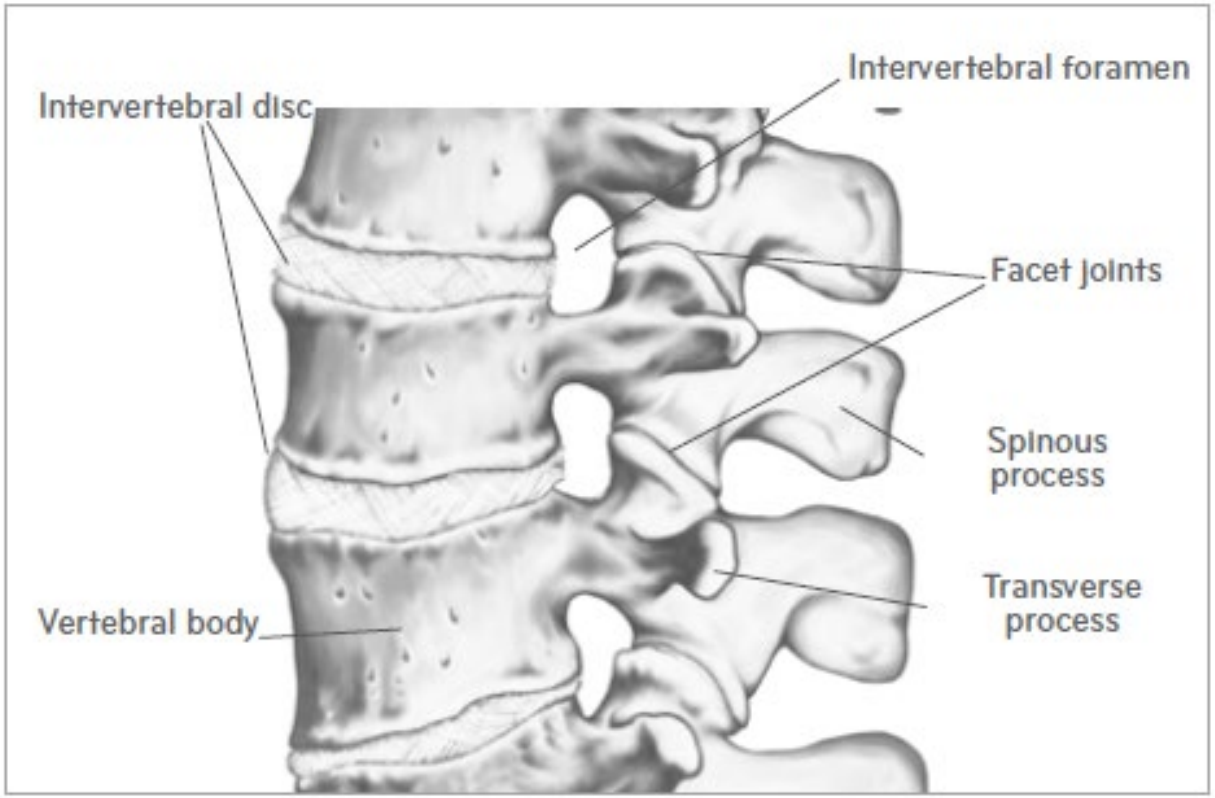
Intervertebral foramen

Facet or zygapophyseal joint

- Inferior articular facet
- Superior articular facet

Intervertebral disc

- Nucleus pulposus
- Annulus fibrosis



Lumbar spine, side view

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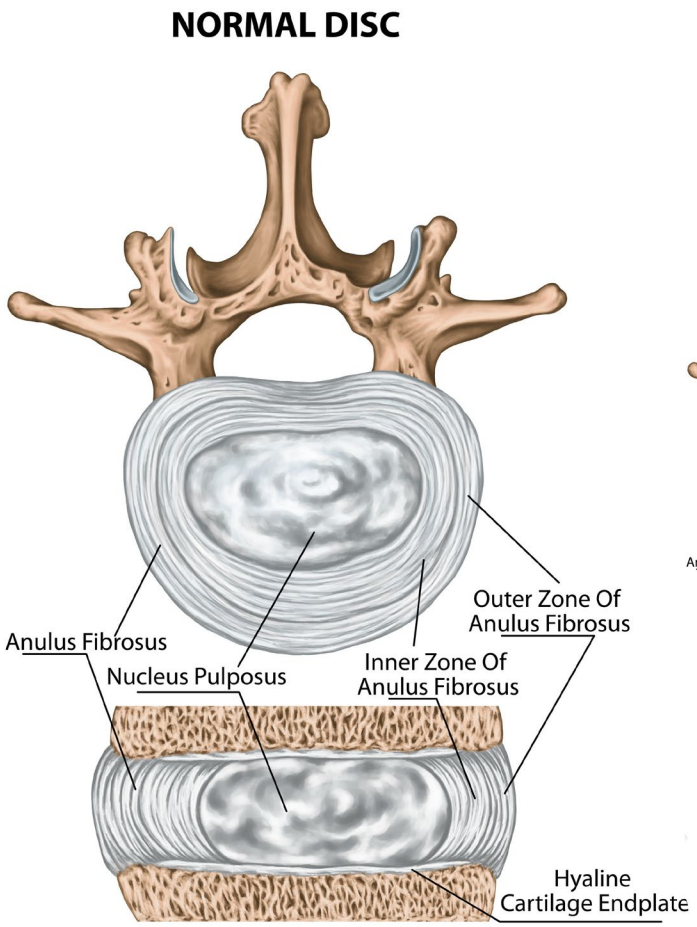
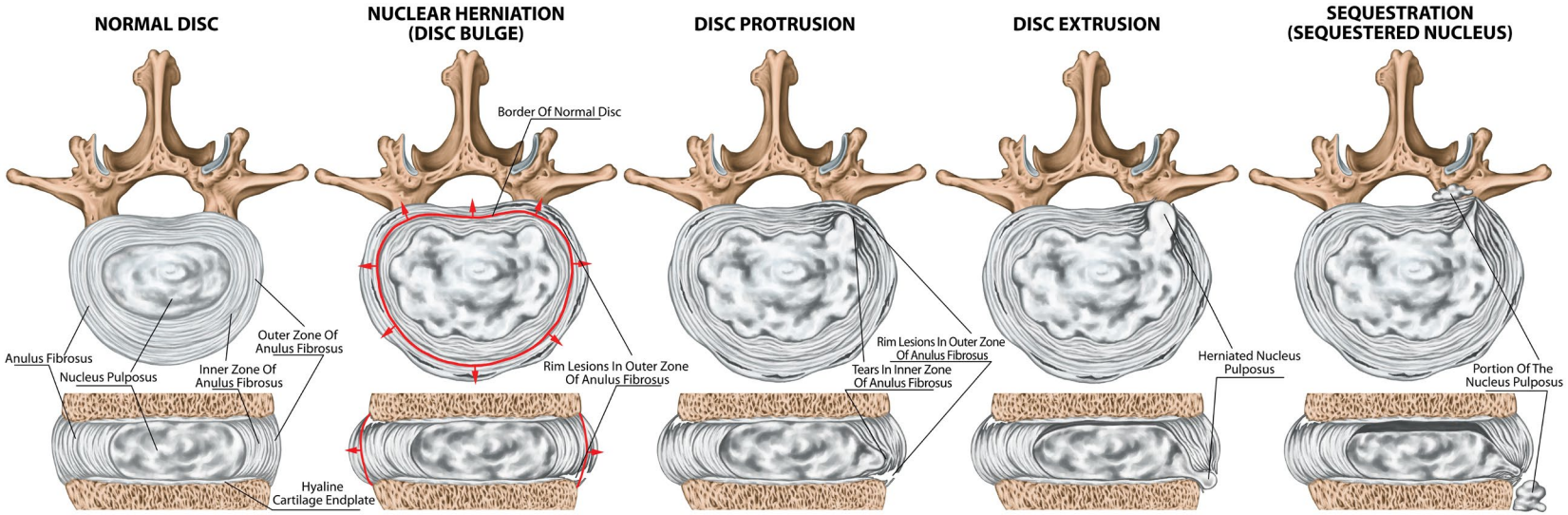
Intervertebral Disc and Disc Pathologies





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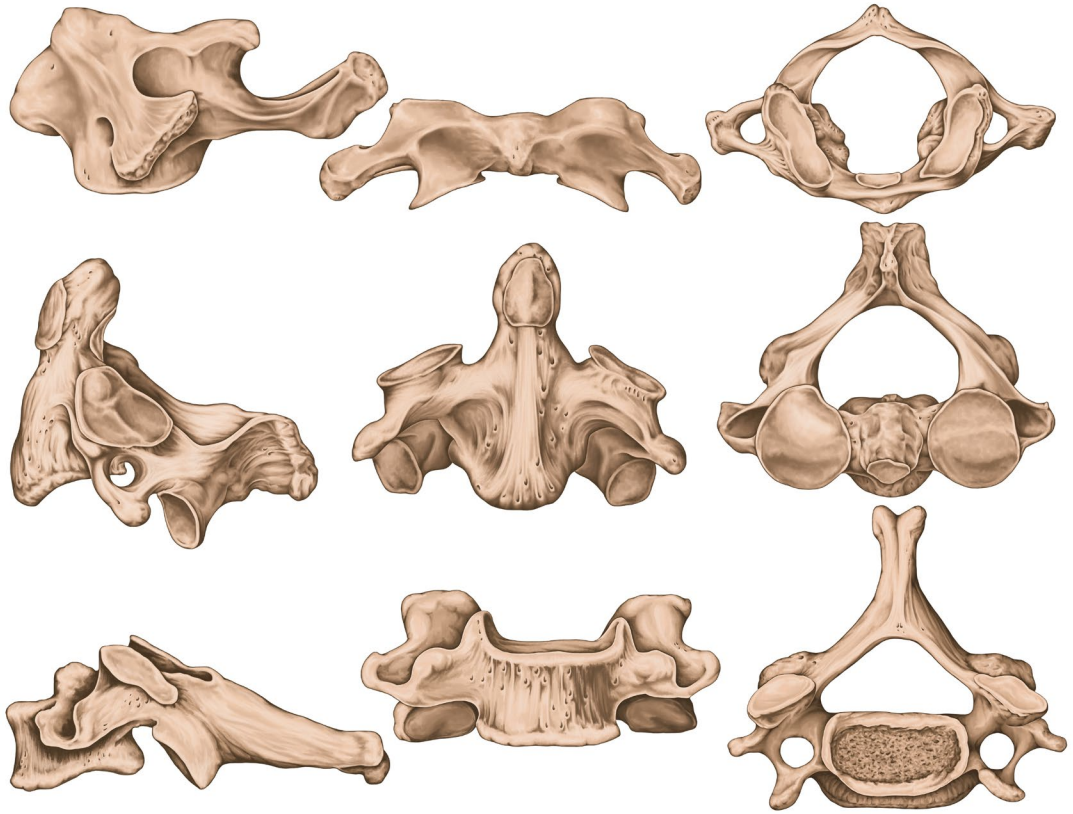
Cervical Vertebrae

C1, The Atlas

C2, The Axis

C7, Typical Cervical Vertebrae



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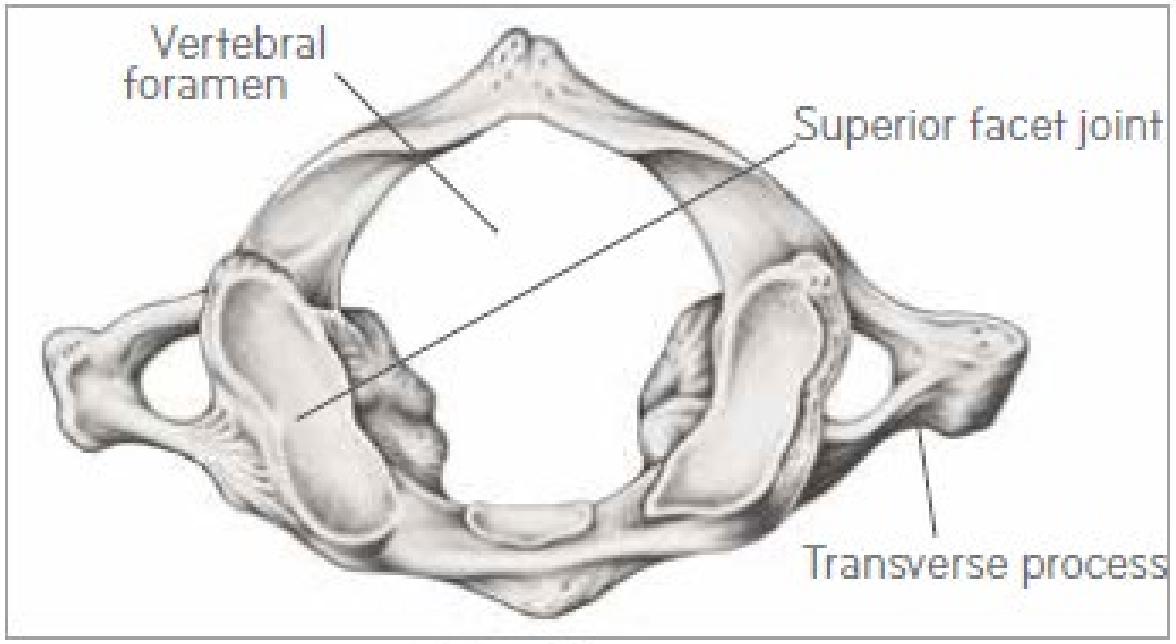
Atlas

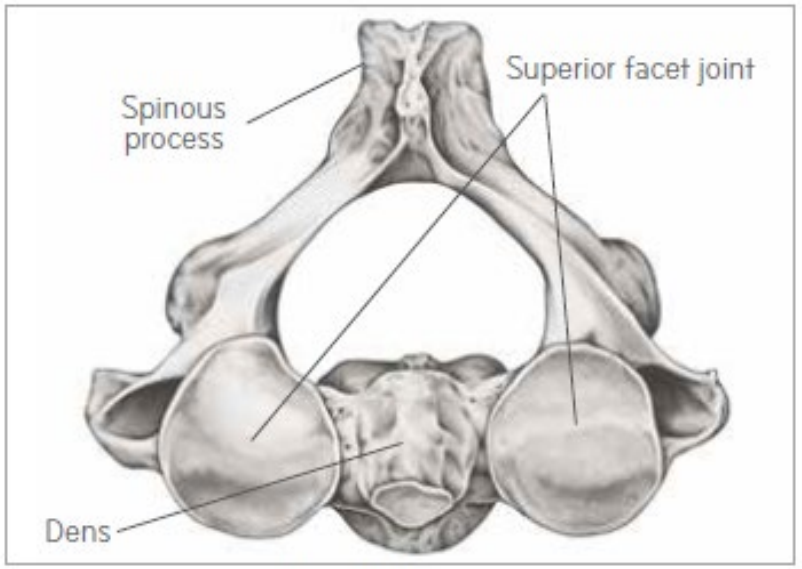


Atlas, C1 top view

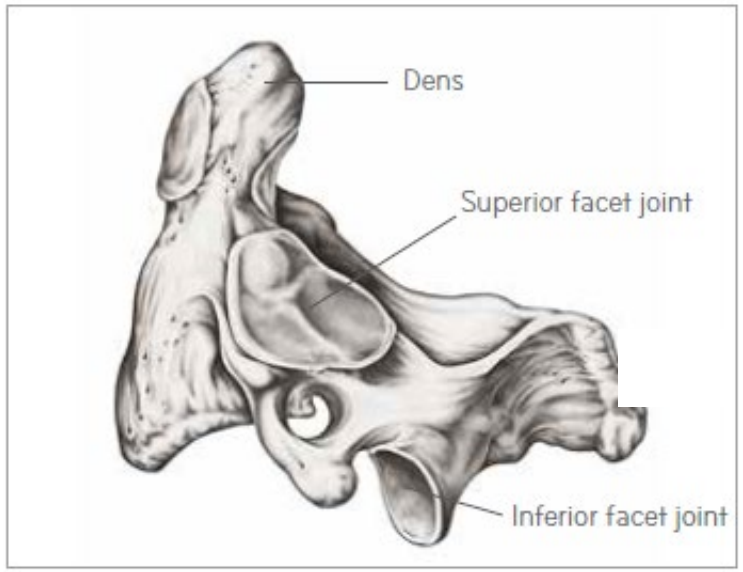
C1 - Atlas

- The atlas is the first cervical vertebra. In classical Greek mythology Atlas held up the world. In our spine the Atlas holds up our head! Sort of the same thing, really.
- The atlas looks very different. It is broader and flatter and it is missing a body. This shape reflects the job of the Atlas which is to interact with the base of the skull.

Axis



Axis, C2 top view



Axis, C2 Side view

C2 - Axis

- Remember we said the Atlas was missing the body. Well, here it is.
- The Axis (C2) has a unique part called the dens or the odontoid process.
- Can you imagine how the dens will interact with the Atlas?

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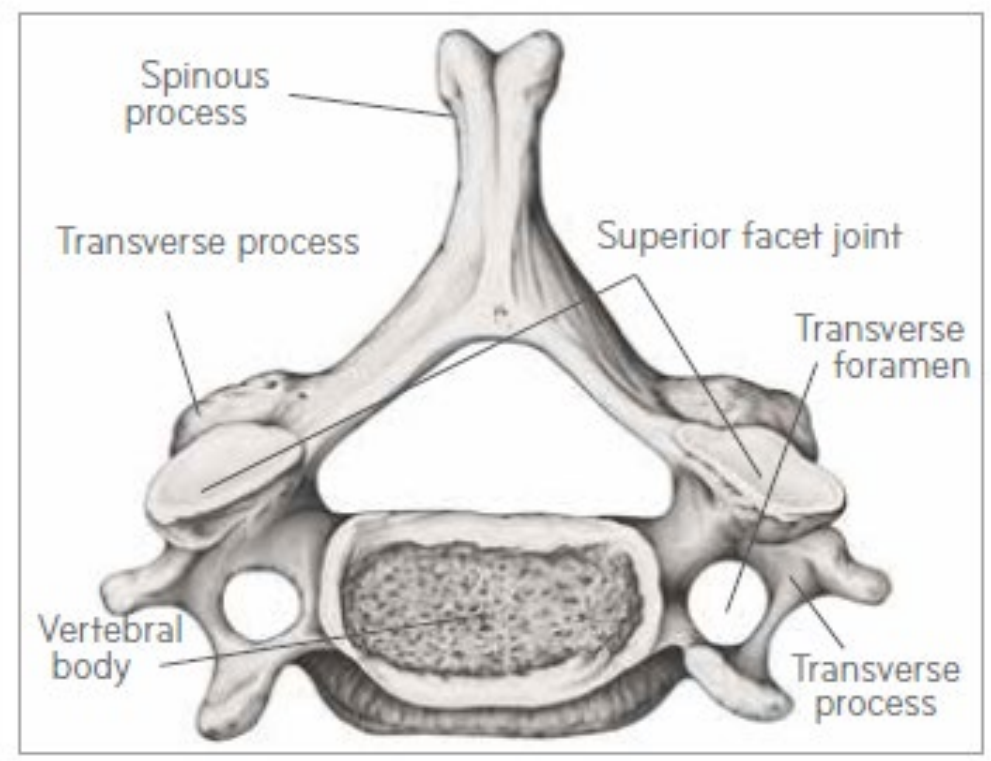
Cervical Vertebrae 2-7



Cervical vertebra top view

C2 – C7

- Small bodies
- Notice the Transverse foramen, vertebral artery and vein pass

Vertebral artery supplies blood to upper spinal cord, brainstem, cerebellum and brain

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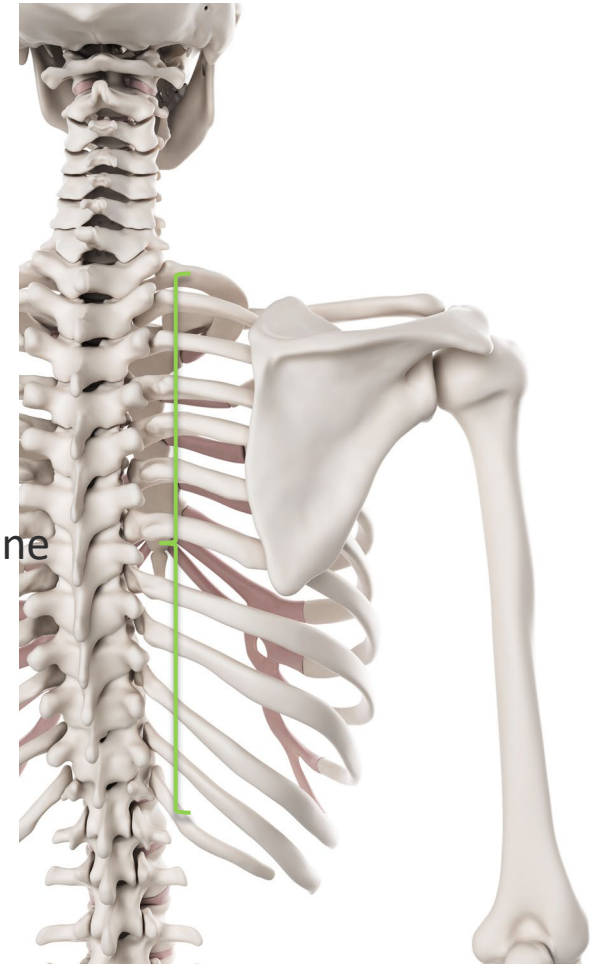
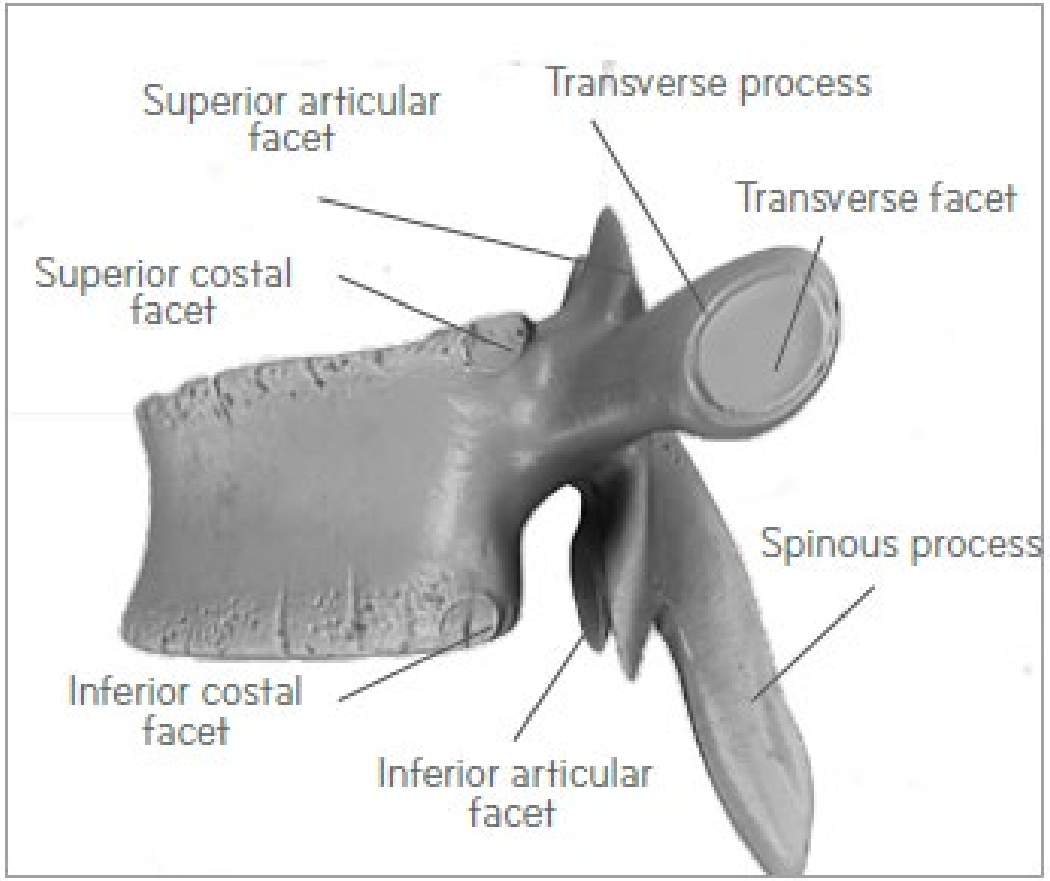
Thoracic Spine

Thoracic spine





Thoracic Vertebrae

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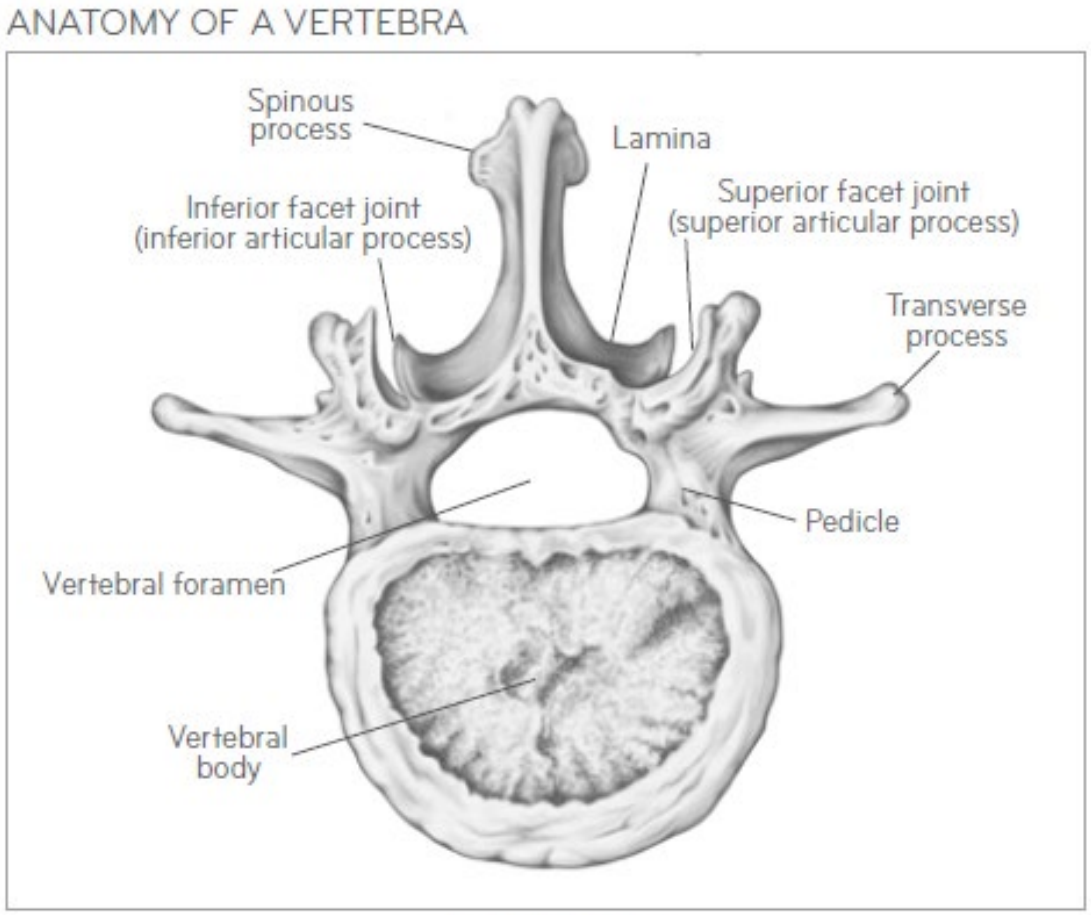
Lumbar Spine



A Lumbar Vertebra

This is a typical lumbar vertebra

Are there any distinguishing characteristics?

Notice the shape of the spinous process and the facets

What movements will be limited in the lumbar spine?

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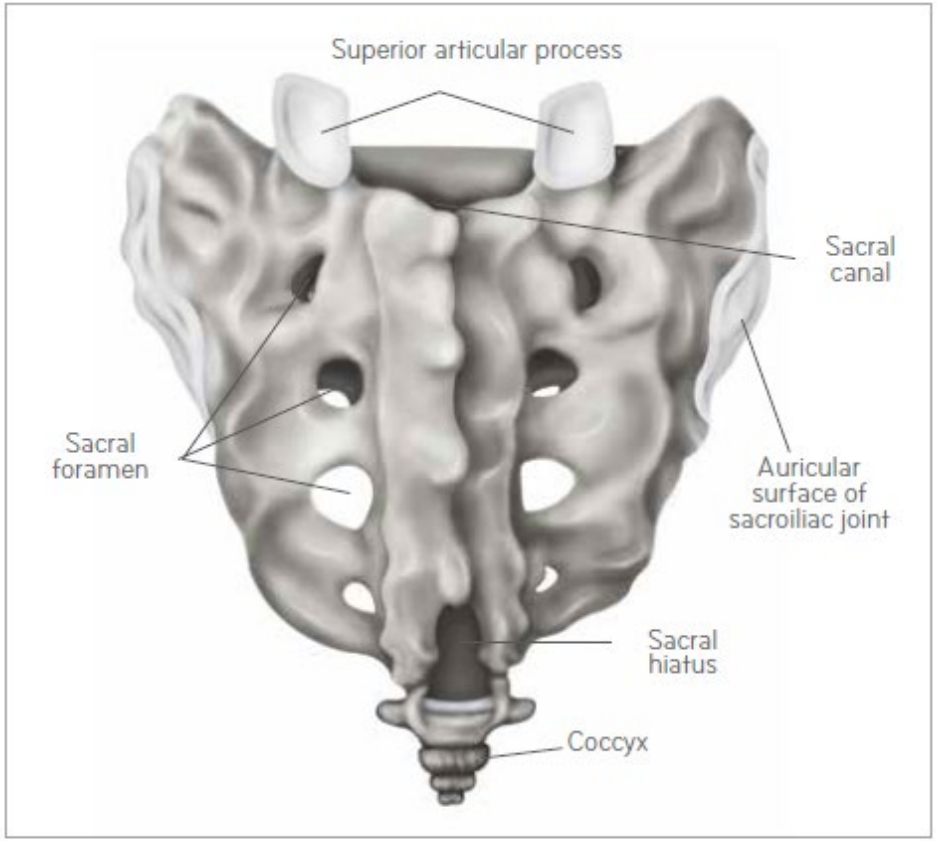
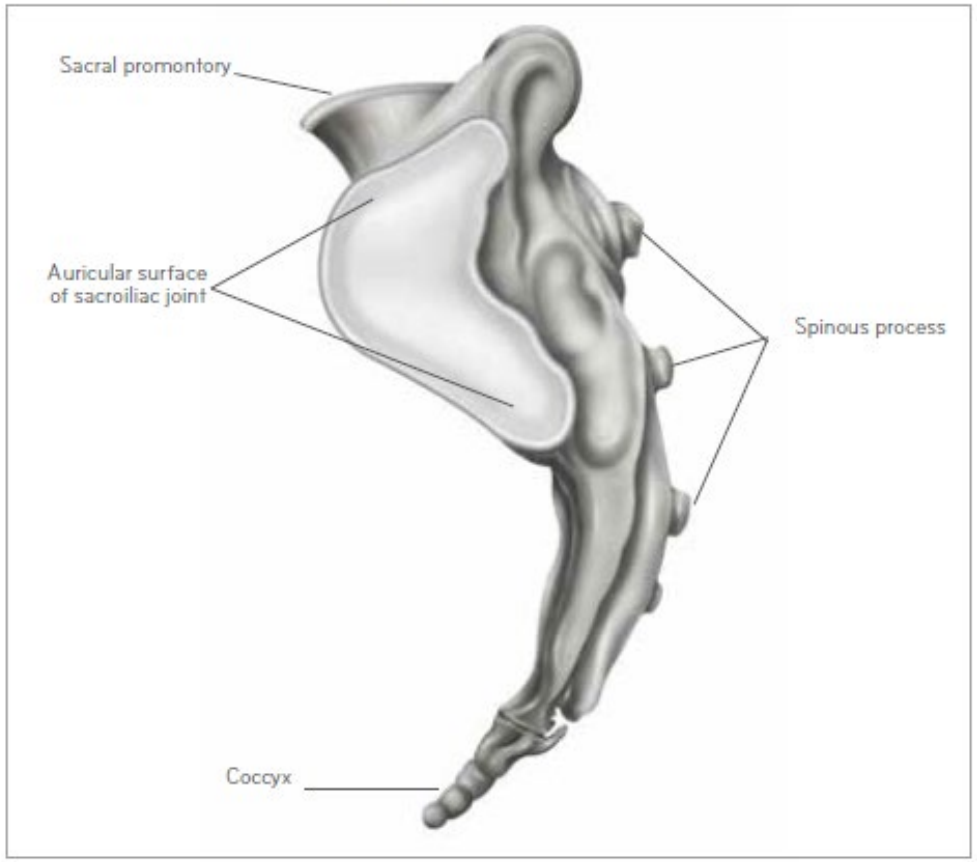
Sacrum



Sacrum, Back View



Sacrum, Side view

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Movements of the Spine

Flexion

Extension

Lateral Flexion

Rotation

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Average Ranges of Motion in the Spinal Segments

	A-O Joint Occiput-C1	A-A Joint (C1-C2)	Cervical	Thoracic	Lumbar
Flexion	20º		45 - 50º 45º 60º 65º	30 - 40º 80º 50º 35º	40 - 45º 60º 60º 50º
Extension	10º		45 - 75º 45º 75º 40º	20 - 30º 45º 25º	30 - 40º 25º 25º 35º
Lateral flexion	5º		45º 45º 45º 35º	20 - 25º 40º 20º	20º 35º 25º 20º
Rotation		35º	65 - 75º 60º 80º 50º	35º 30º 35º	10 – 15º 45º 18º 5º

Brown – ACE, Blue – American Academy of Orthopedic Surgeons, Red – AMA, Black – Thieme,

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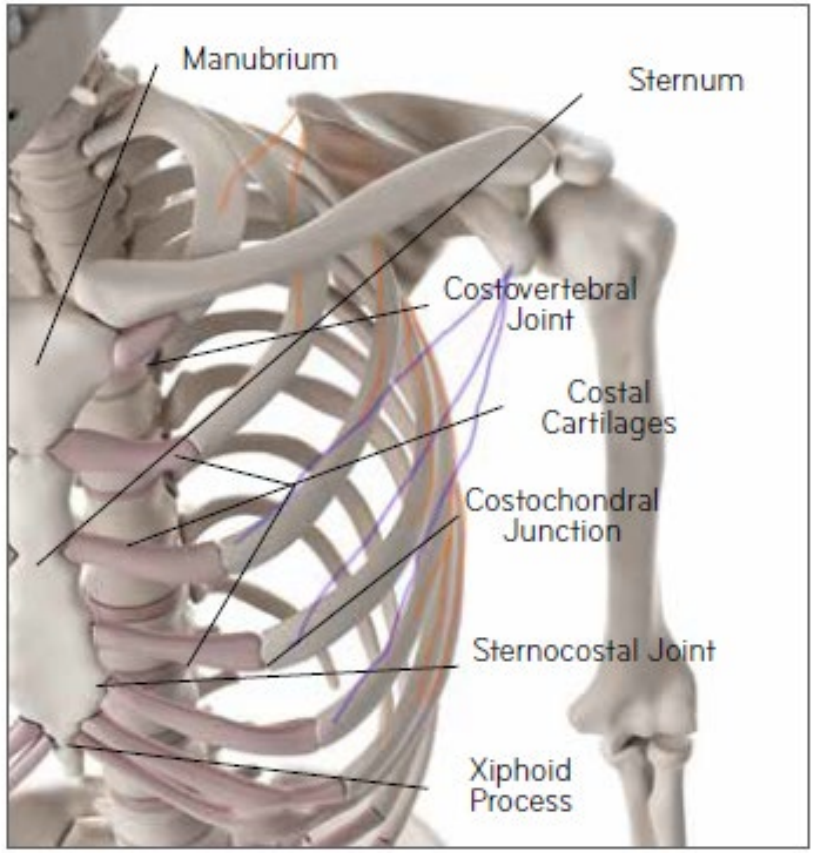
Ribs



The Thorax, anterior view

Twelve pairs of ribs

Ribs 1-7 are true ribs

- Each rib has a separate costal cartilage joining it to the sternum

Ribs 8-10 are false ribs

- These ribs share a costal cartilage as they attach to the sternum

Ribs 11 and 12 are floating ribs

- They do not have a costal cartilage attachment to the sternum

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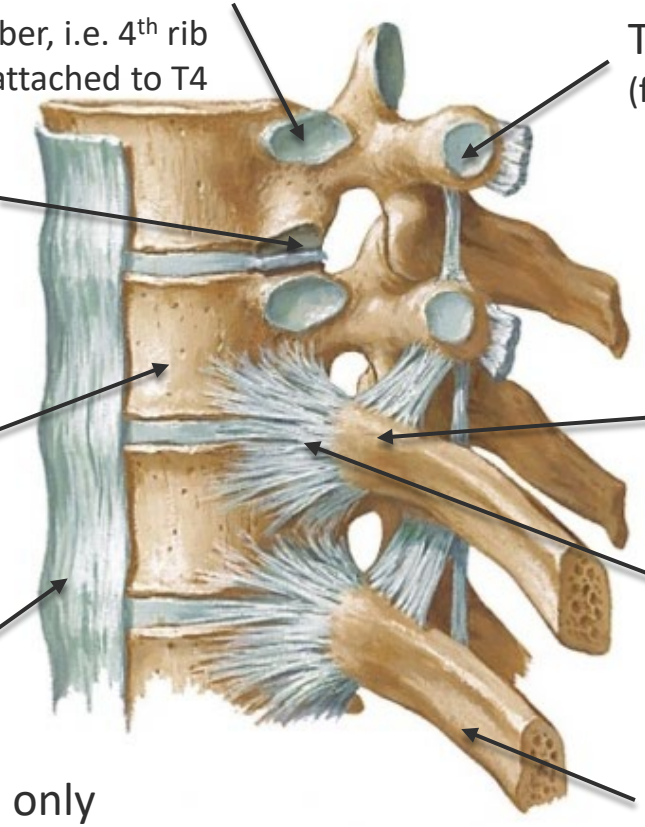
The Costovertebral and Costotransverse Joints



The posterior joints of the ribs attach to the superior costal facet and the transverse costal facet on one vertebra and the inferior costal facet on the vertebra one level above.

The ribs move by rotating slightly down in the back at the costovertebral joints which lifts the ribs up and forward to expand the diameter of the ribcage.

Note: Ribs 1, 11 and 12 attach to only one vertebrae

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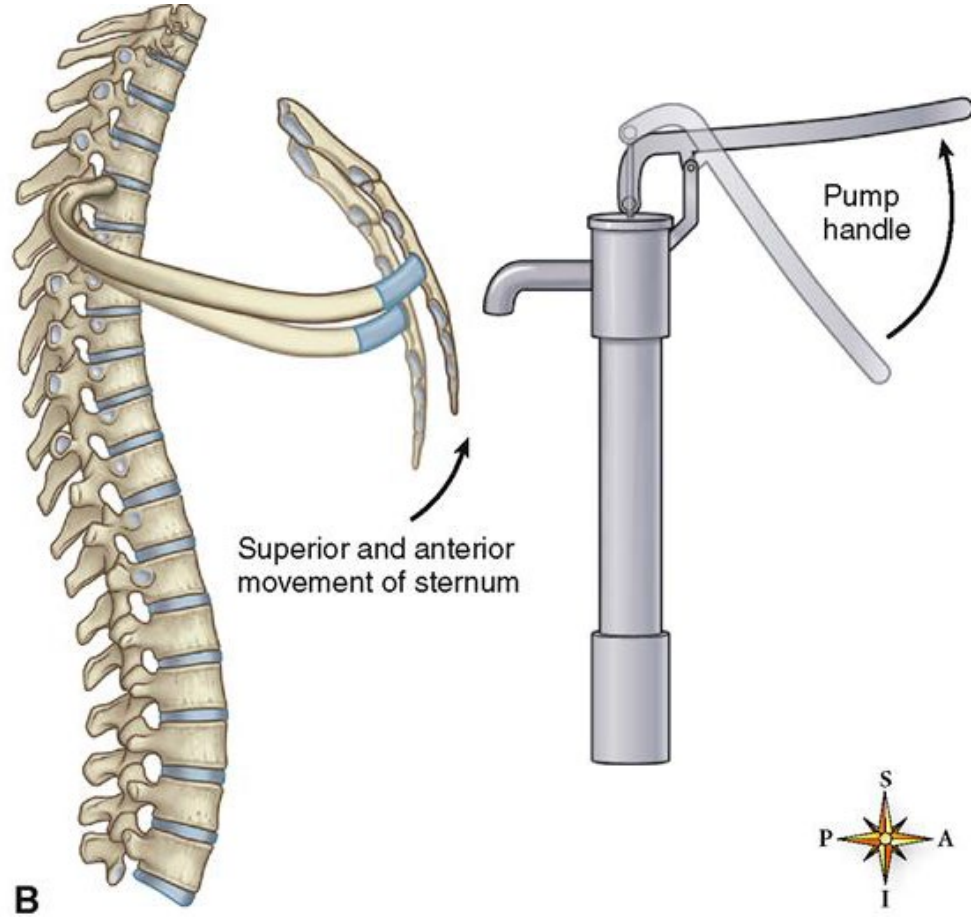
Movement of the Ribs during Respiration



Upper Ribs (Pump Handle)

- Ribs 2-6 (vertebrosternal ribs) raise and lower the sternum in a Pump-handle like motion.
- The posterior attachments of the ribs to the spine glide down to lift the sternum up and forward.
- During inhalation, the ribs move up and push the sternum forward increasing the anterior and posterior diameter of the thorax

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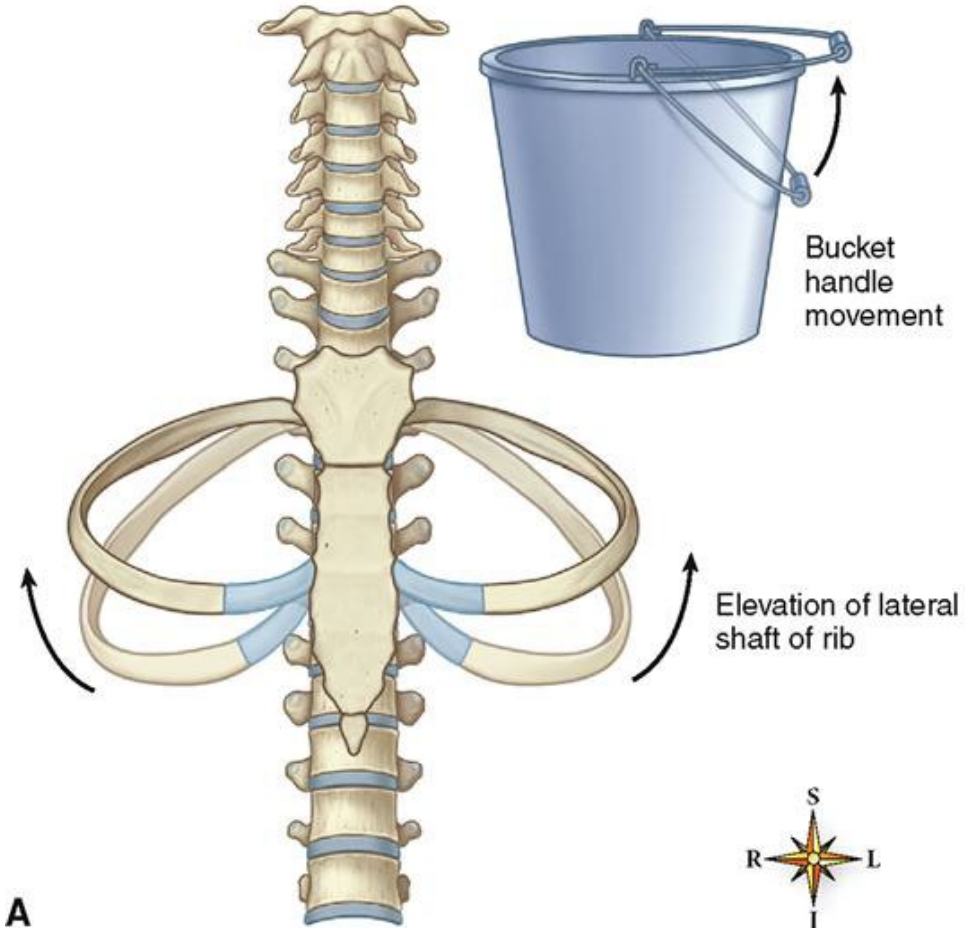
Movement of the Ribs during Respiration



Bucket Handle (middle ribs)

- During inhalation, the middle ribs rise and increase the diameter of the ribcage.
- The attachment of the ribs to the sternum in front and the vertebrae in back

- As ribs 7-10 move the middle of the rib raises and lowers, creating a Bucket-handle like movement.
- Increases transverse diameter of thorax.

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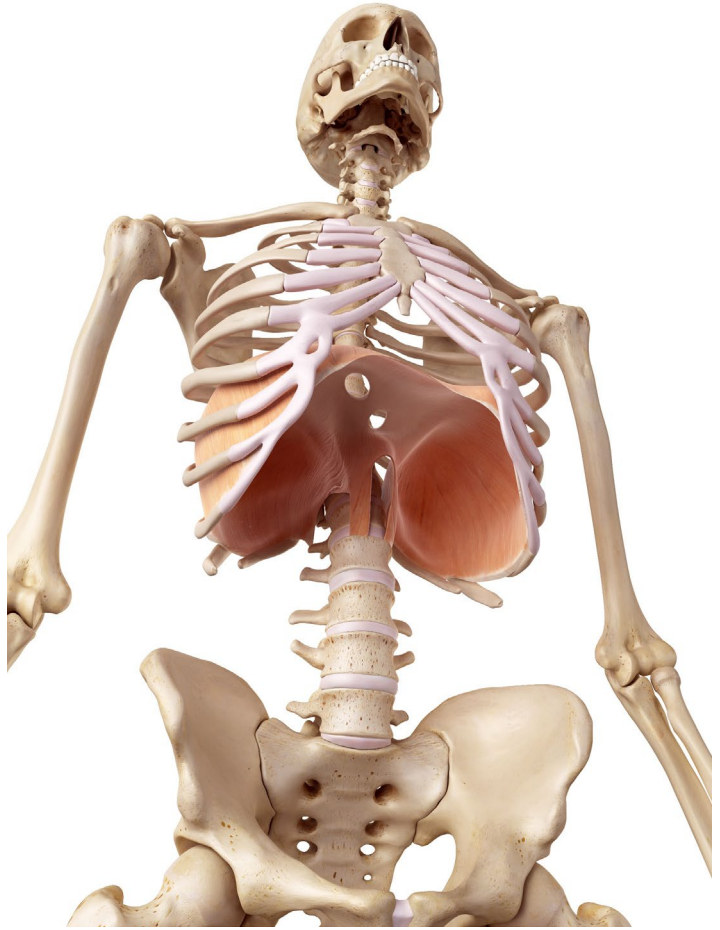
Lets Build! Muscles of the Spine and Thorax

Muscles of Breathing

- Diaphragm
- Intercostals
- Scalenes



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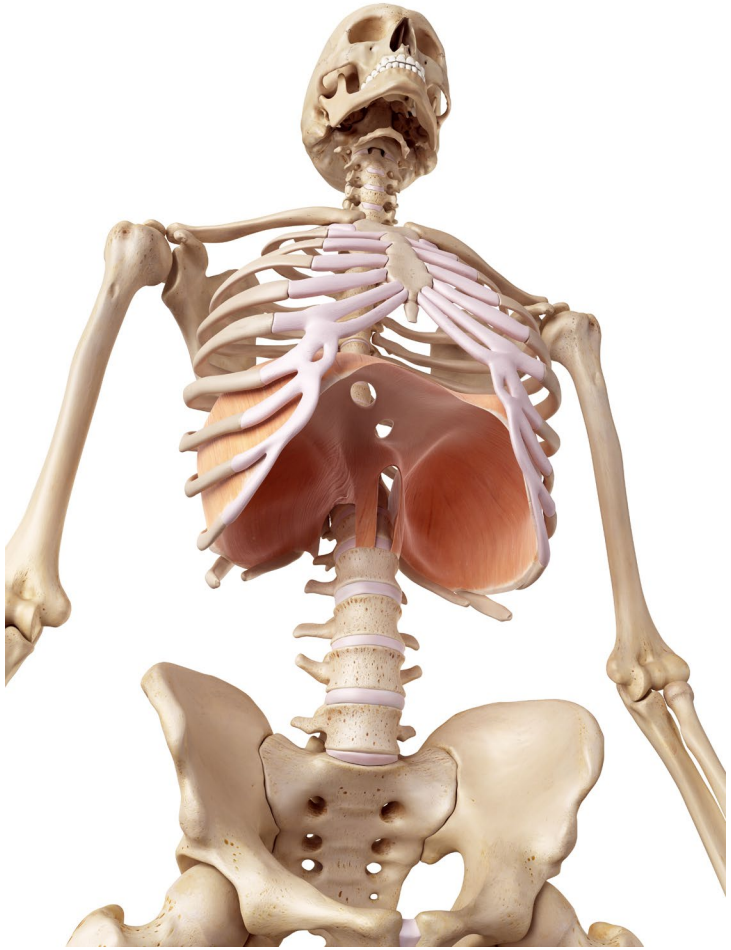
Diaphragm – Primary muscle of respiration

The Purpose of Breathing

- Respiration
- Enhancing the mind body connection.
- Creating a rhythm for movement.



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Breathing

On the Inhale

- The diaphragm contracts.
- The dome moves down.
- The volume of the lungs increases and draws air in.
- Abdominal pressure increases.
- Pelvic floor responds.

On the Exhale

- The diaphragm relaxes.
- The dome moves up.
- The volume of the lungs decreases and air flows out.
- Abdominal pressure decreases.
- Transversus abdominis contracts.
- Pelvic floor responds.

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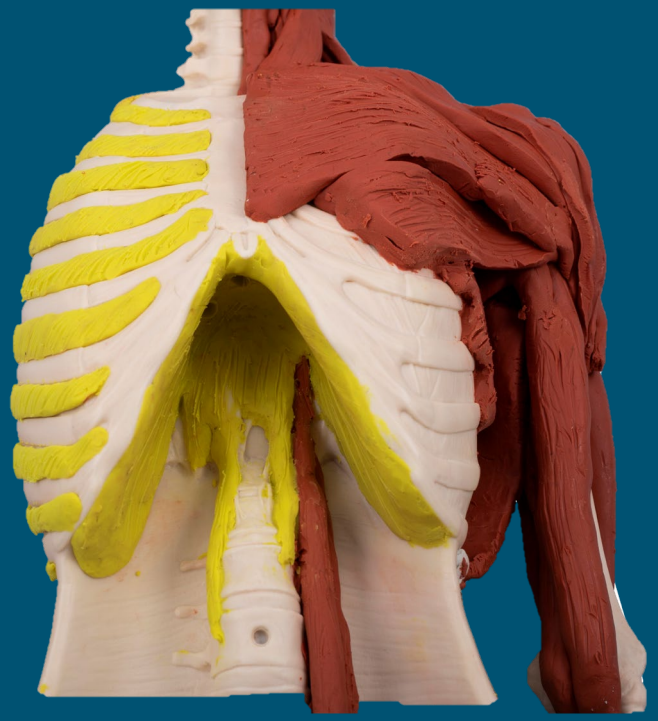
Diaphragm



Origin:

- Inferior border of ribcage.
- Including the costal cartilages and the 12th rib,
- bodies of L1, 2 and 3 and inner face of xiphoid process.

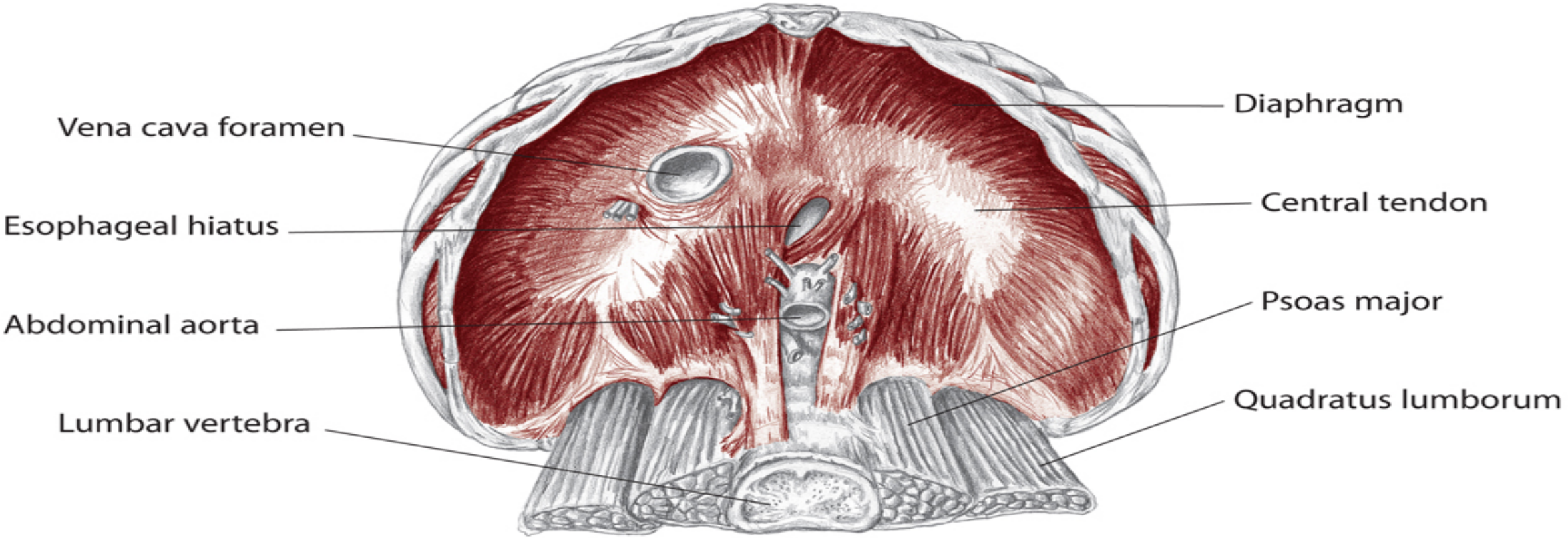
Insertion:

- Central tendon.

Actions:

- Draws central tendon down increasing the volume of thoracic cavity during inhalation

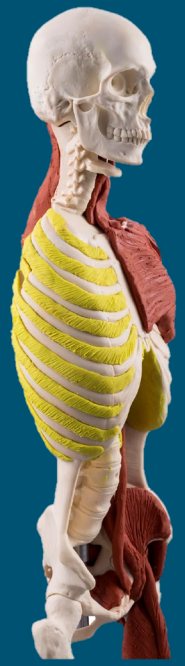
Diaphragm



(4.98) Inferior view of the diaphragm

TGB, p.219

Intercostals



Internal Intercostals

External Intercostals

Origin and Insertion

Internal

- Inferior border of ribs 1 – 11 filling the space from the sternum to the edge of the erector spinae.
- Fibers run from lateral and posterior on the lower rib to medial and anterior on the superior rib. (mountain fibers).

External

- Inferior border of ribs 1 – 11 filling the space from the costochondral junction posteriorly to the edge of the erector spinae.
- Fibers run from medial and anterior on the lower rib to lateral and posterior on the upper rib.

Actions:

External

- Facilitates inhale.

Internal

- Facilitates exhale.

Both

- Maintain the structure and stability of the rib cage.

Muscles of Breathing

Muscle	Inhale	Exhale	Head and Neck Flexion	Head and Neck Lateral Flexion	Head and Neck Rotation	Supports Ribs and Chest	Stabilizes Lumbar Vertebrae
Diaphragm	X					X	X
External Intercostals	X					X	
Serratus Posterior Superior	X						
Scalenes	X		X	X	X		
External Intercostals		X				X	
Serratus Posterior Superior		X					

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Lets Build! Muscles of the Spine and Thorax

Deep Muscles of the Back

- Quadratus Lumborum

Sub Occipitals (optional)

- Rectus Capitis Posterior Major and Minor
- Obliquus Capitis Superior
- Obliquus Capitis Inferior

Deep Muscles of the Back and Spine

- Intertransversarii and Interspinalis
- Rotatores
- Multifidi

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Deep Muscles of The Back

Quadratus Lumborum

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Quadratus Lumborum

Origin:

- Inferior border of 12th rib.
- Transverse processes of L1 – L5.

Insertion:

- Superior border of iliac crest.

Actions:

- Bilaterally: Spinal extension.
- Unilaterally: Lateral spinal flexion and pelvic upslip.

Deep Muscles of the Back and Spine

- Intertransversarii
- Interspinales
- Rotatores Longus and Brevis
- Multifidi

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Intertransversarii

Origin and Insertion

- Connect one transverse process to the one above.
- Runs in pairs on either side of the spine from C1-C7; L1-L5.

Actions:

- Bilaterally: Support the vertebrae and extend the spine.
- Unilaterally: Lateral flexion to the same side.

Interspinales

Origin and Insertion

- Connect one spinous process to the one above.
- Runs in pairs on either side of the spinous processes from C1-C7; L1-L5.

Actions:

- Bilaterally: Support the vertebrae and extend the spine.
- Unilaterally: Lateral flexion.

Rotatores Brevis and Longus

Rotatores Brevis

Rotatores Longus

Rotatores Brevis

- Connect one transverse process to the spinous process one vertebra above.

Rotatores Longus

- Connect one transverse process to the spinous process two vertebrae above.

Both the Brevis and Longus most prominent in the thoracic spine

Actions:

- Bilaterally: Support the vertebrae and extend the spine
- Unilaterally: Rotates the spine to the opposite side

Multifidi

Origin:

- Superior border of transverse process of all vertebrae from the sacrum to C2 (axis).

Insertion:

- Inferior border of spinous process 3 to 5 levels above.

Actions:

- Bilaterally: Spinal extension.
- Unilaterally: Lateral spinal flexion to same side and spinal rotation to opposite side.

Semispinalis (optional)

Semispinalis Capitis

Origin and Insertion

- Transverse processes of C4 – T7 to the occiput between superior and inferior nuchal lines.

Semispinalis Cervicis

Origin and Insertion

- Transverse processes of T1 - T6 to the spinous processes of C2 – C5.

Semispinalis Thoracis

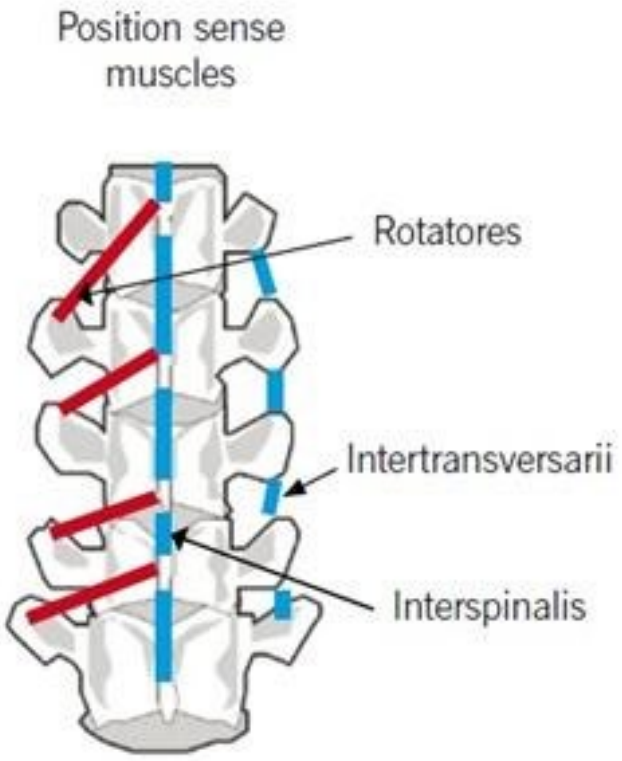
Origin and Insertion

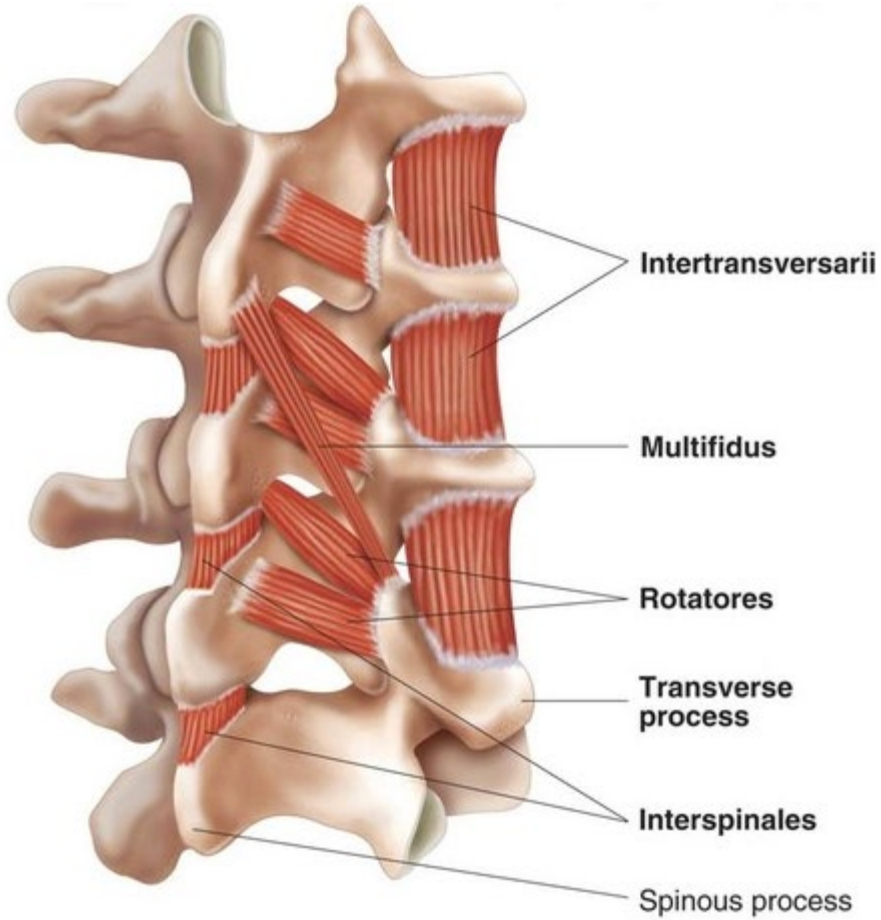
- Transverse processes of T6 – T12 to the spinous processes of C6 – T4.

Actions:

- Bilaterally: Stabilizes head and neck and extends cervical and thoracic spine.
- Unilaterally: Lateral flexes head, cervical and thoracic spine. Rotates head, cervical and thoracic spine to opposite side

Deep Spinal Muscles Overview





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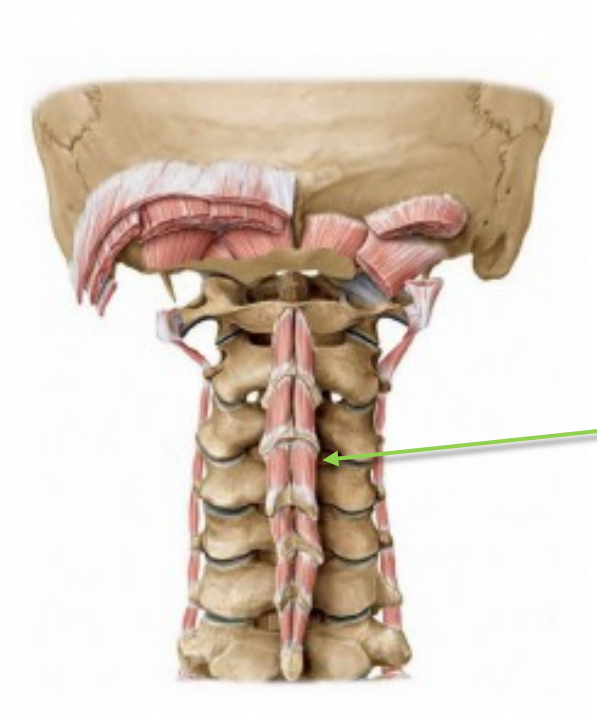
Interspinalis – Spinal Extension

Interspinalis Cervicis

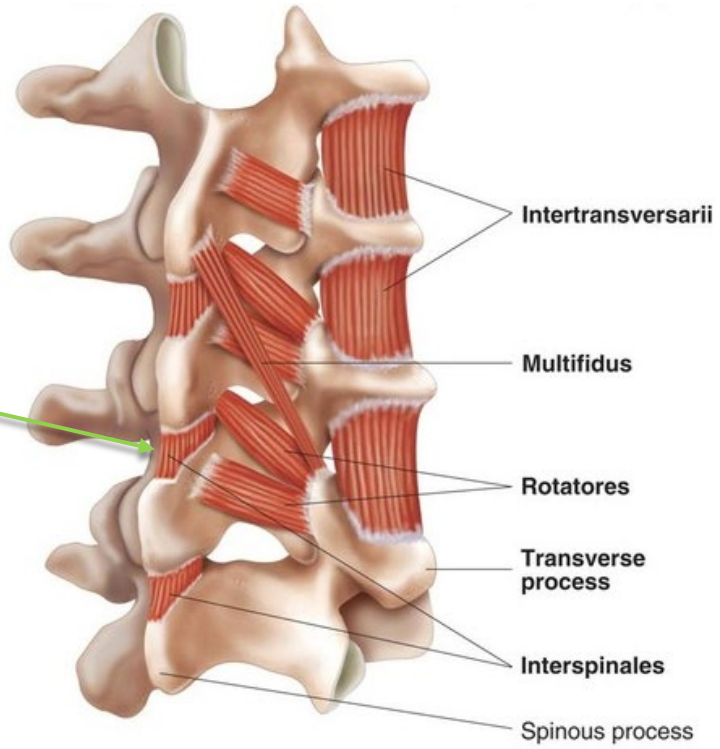
Spans C2 – T3



Interspinalis

Interspinalis Lumborum

Spans T12 – L5



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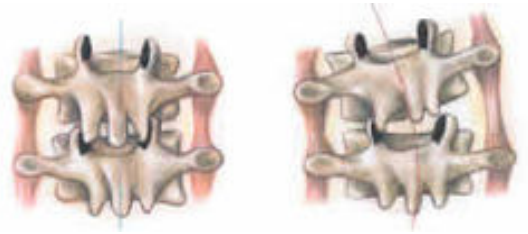
Intertransversarii

Lateral Flexion unilaterally; Extension bilaterally

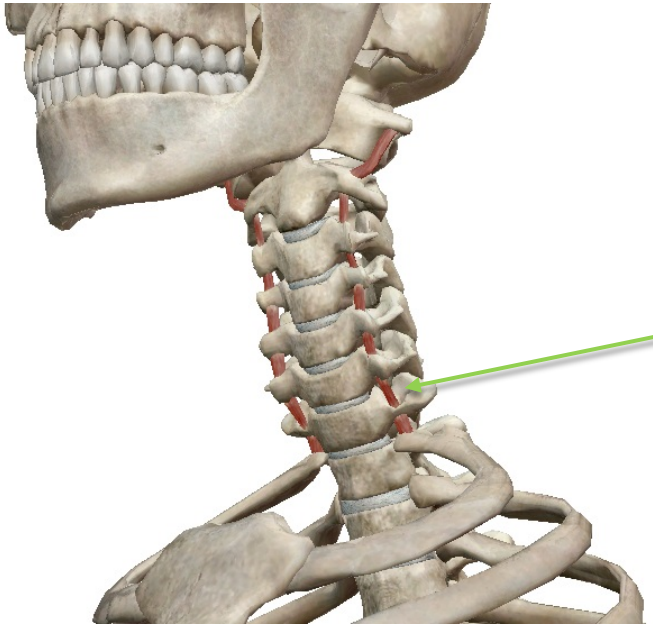


Intertransversarii Cervicis

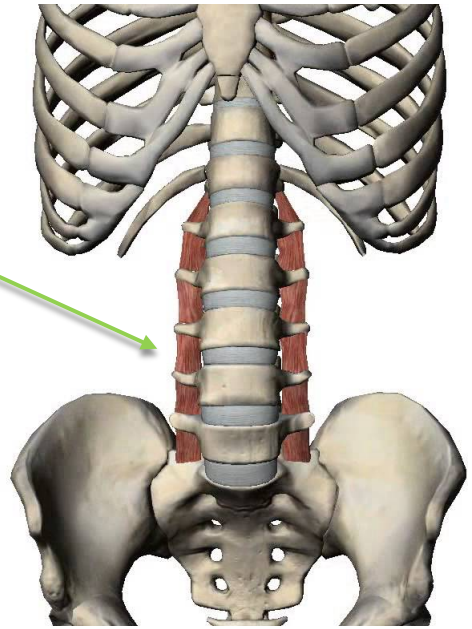
Spans C2 – C7

Intertransversarii Lumborum

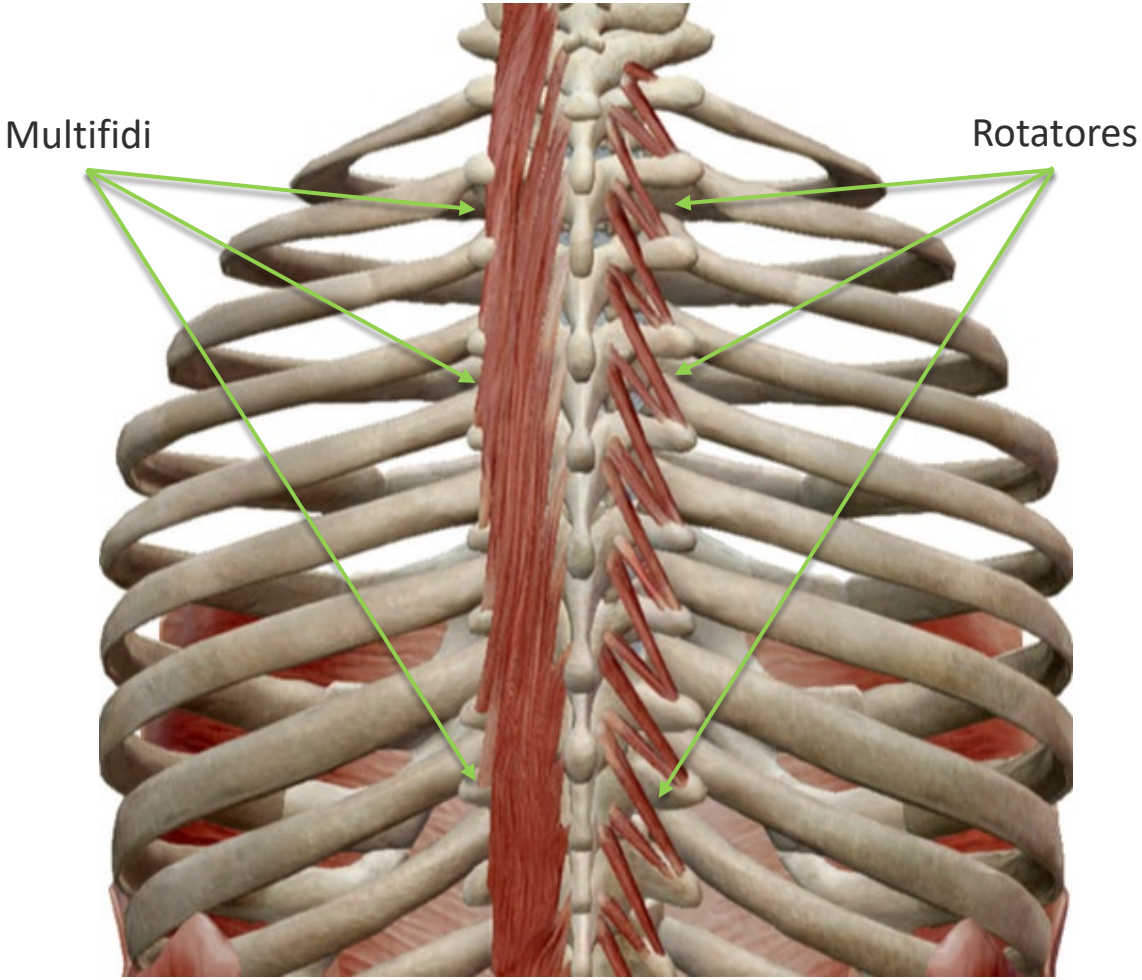
Spans T12; L1 – L5



Intertransversarii



Rotatores



- Spans lumbar through C2, some sources say Rotatores are only in the thoracic spine.
- Lie beneath Multifidi
- Connect superior and inferior part of transverse processes to the lamina and root of the spinous process.
- The Rotatores have a high density of proprioceptors and are presumed to play a role in postural control.

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Deep Spinal Muscles and Quadratus Lumborum

Muscle	Extension	Lateral Flexion	Contralateral Rotation	Ipsilateral Rotation	Spinal Stability
Interspinales	X				X
Intertransversarii	X	X			X
Rotatores	X				X
Multifidi	X	X	X		X
Semispinalis					
Quadratus Lumborum	X	X			X

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