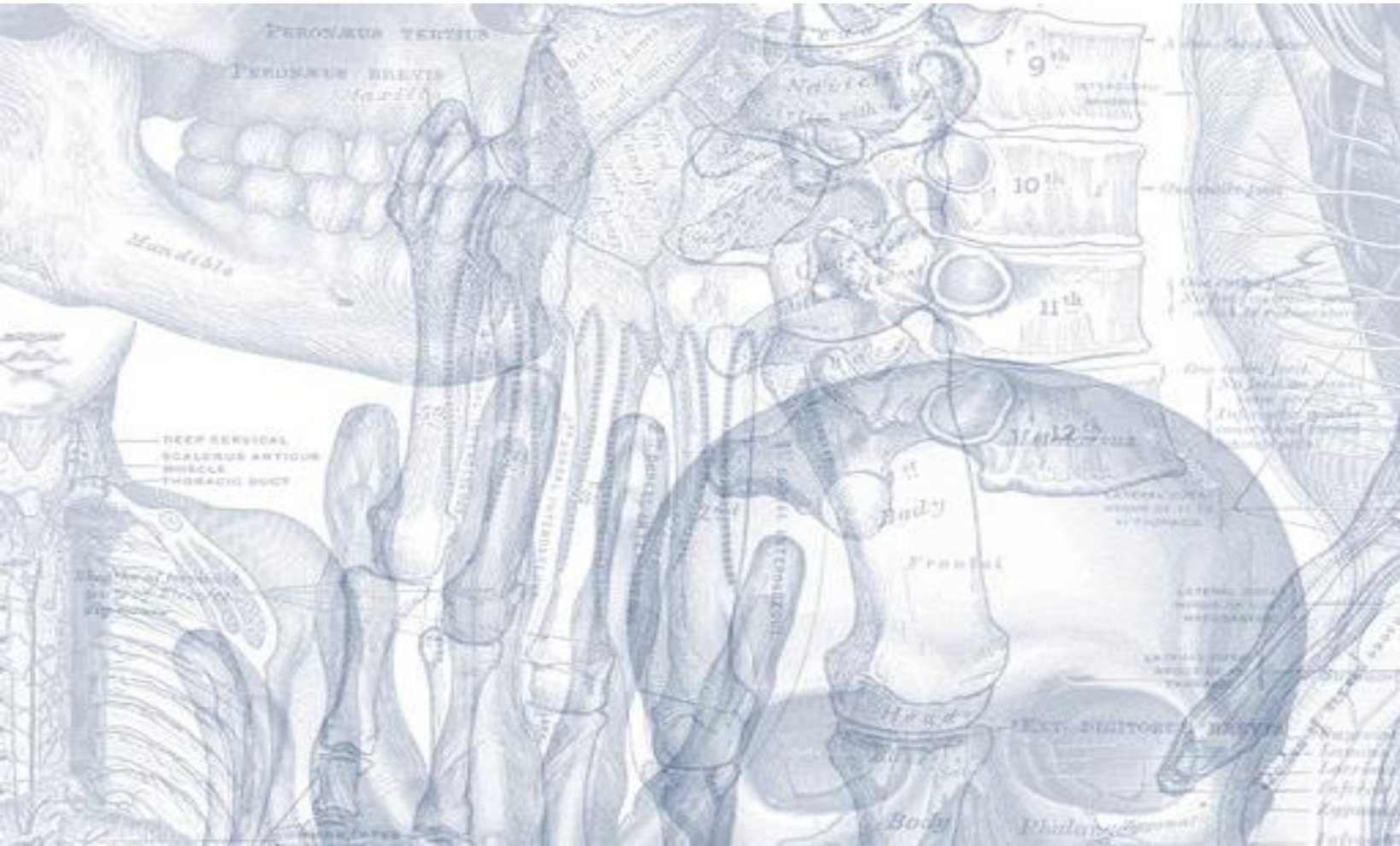


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Thoracolumbar Spine



Biochemistry team 436

By Biochemistry team

[Editing File](#)

Color Code

- Important
- Doctors Notes
- Notes/Extra explanation

Objectives

At the end of the lecture, students should be able to:

- ✓ Distinguish the thoracic and lumbar vertebrae from each other and from vertebrae of the cervical region
- ✓ Describe the characteristic features of a thoracic and a lumbar vertebra.
- ✓ Compare the movements occurring in thoracic and lumbar regions.
- ✓ Describe the joints between the vertebral bodies and the vertebral arches.
- ✓ List and identify the ligaments of the intervertebral joints.

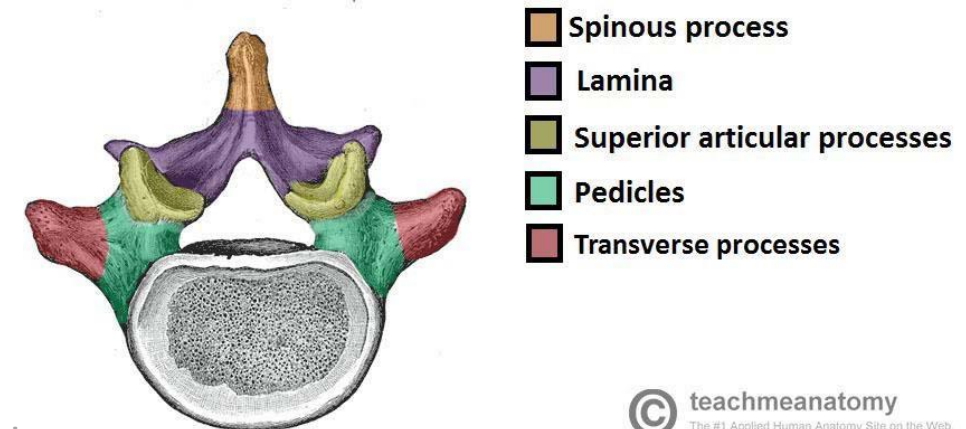
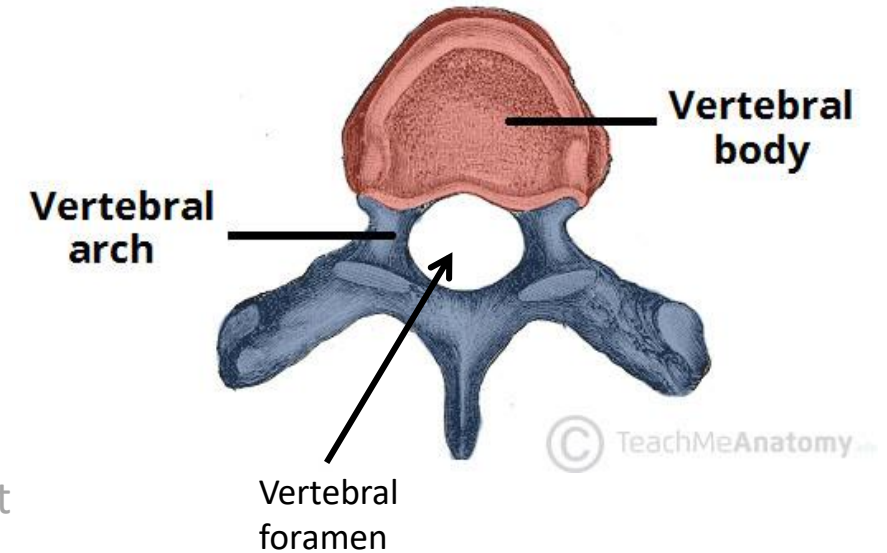
Introduction to Vertebrae

There are approximately 33 vertebrae which are subdivided into 5 groups based on morphology and location: cervical, thoracic, lumbar, sacral, and coccygeal.

Typical Vertebra

All typical vertebrae consist of a vertebral body and a posterior vertebral arch.

- Vertebral body:
 - weight-bearing part. The size increases inferiorly as the amount of weight supported increases.
- Vertebral arch:
 - Extending from the arch are a number of processes for muscle attachment and articulation with adjacent bones.
 - It consists of:
 1. Two pedicles (towards the body)
 2. Two lamina (towards the spine)
 3. Spinous process
 4. Transverse process
 5. Superior and inferior articular processes. (for articulation with adjacent vertebra)



The vertebral foramen is the hole in the middle of the vertebra. Collectively they form the vertebral canal through which the spinal cord passes.

Normal Curvature Of The Human's Vertebral Column

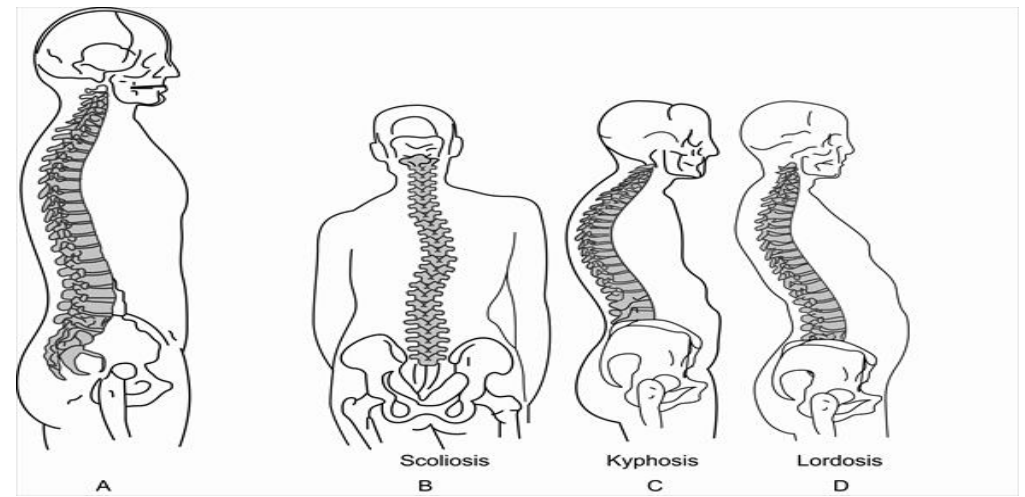
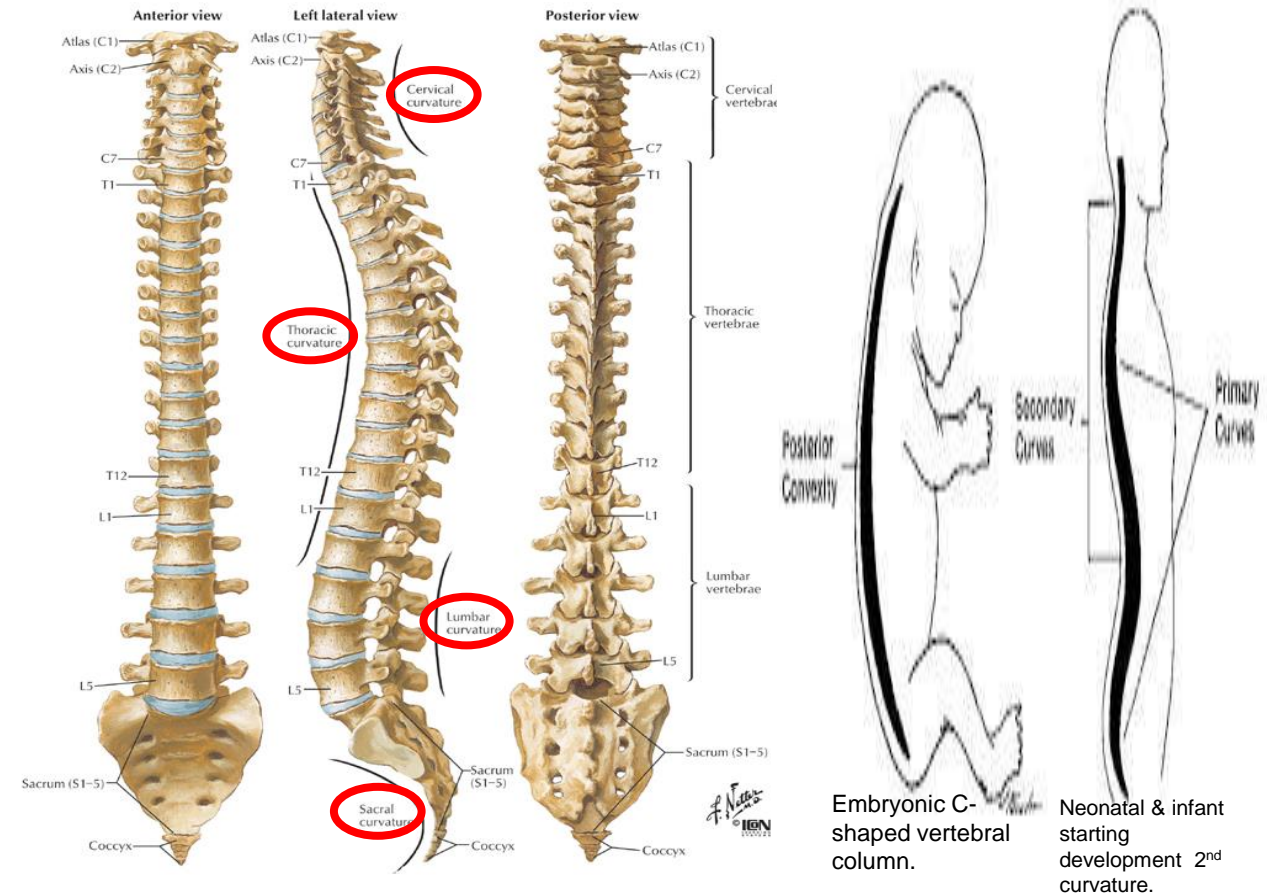
The vertebral column is **not straight**, it only looks straight from the posterior and anterior view. It is **curved** as seen from the lateral views.

- Curves of vertebral column can be divided into:
- **Primary curves: Thoracic & sacral.**
 - **Secondary curves: Cervical & lumbar.**

The primary spine is present during embryo life, then after the baby is born and starts moving his head and walking the secondary curves develop.

Abnormal curvatures of spine:
 Exaggerated Thoracic curvature: **Kyphosis**
 Exaggerated Lumbar curvature: **Lordosis**
Lateral curvature of spine: **Scoliosis**

Kypho means hunchback (the person has a hump on his back and his height is reduced)
 Lordo means curve/swayback (it is derived from Greek describing a person leaning back in a lordly fashion)

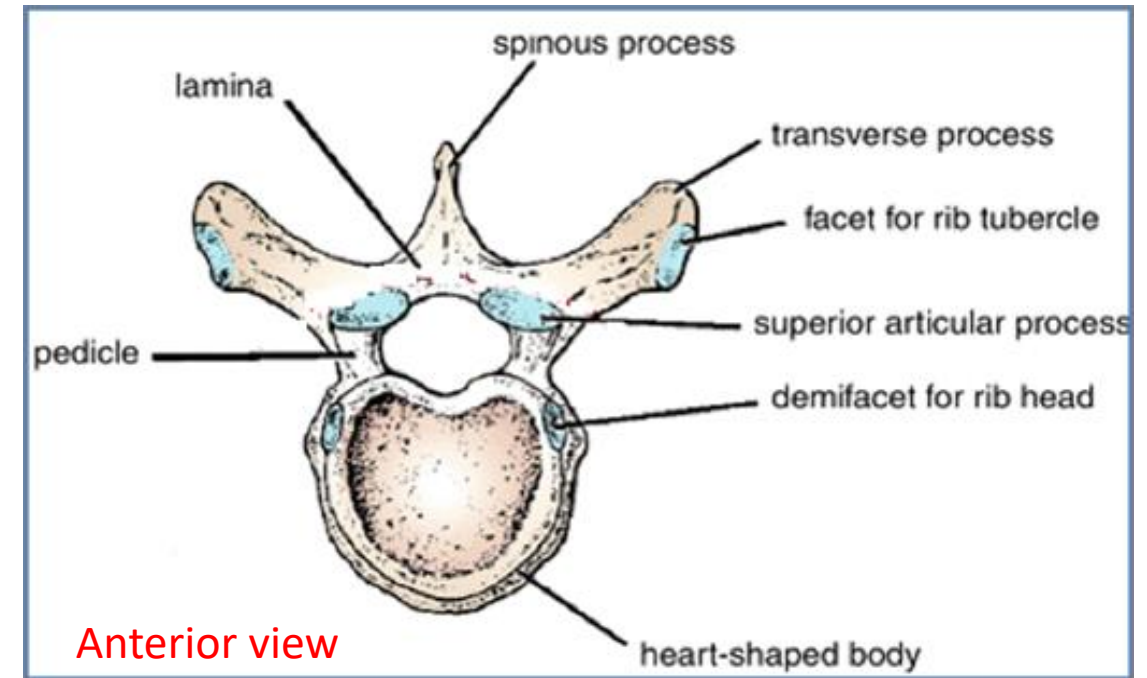
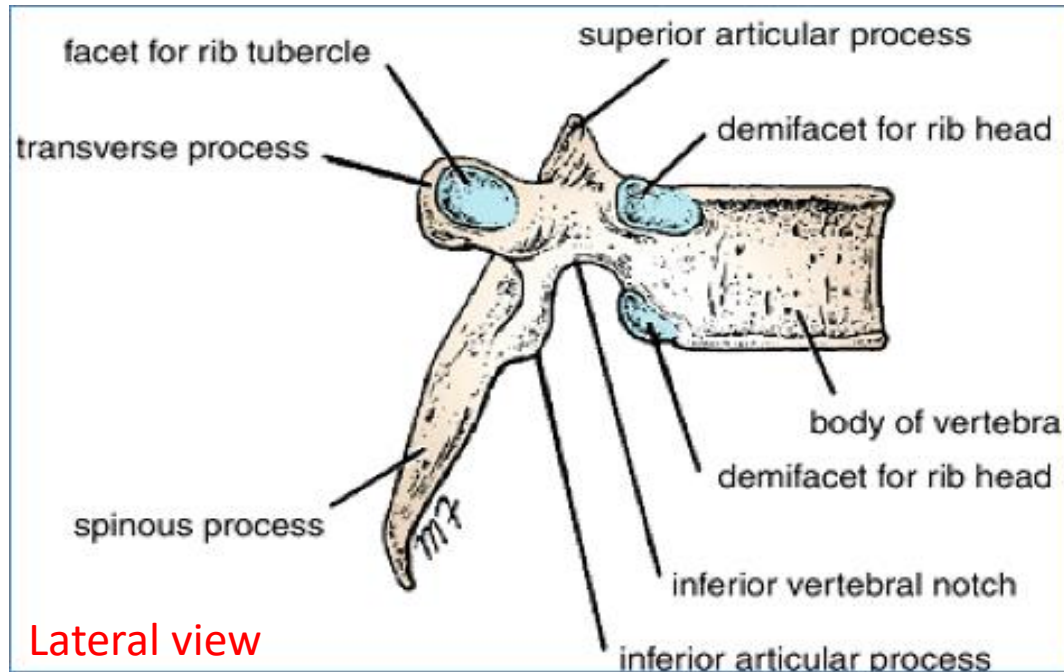


Thoracic Vertebrae



- 2 **Transverse** process
- 2 **Superior articular** process
- 2 **inferior articular** process
- 1 **Spinous** process

- Most thoracic vertebrae are typical, have *bodies*, vertebral *arches* and **seven** processes for muscular and articular connections.



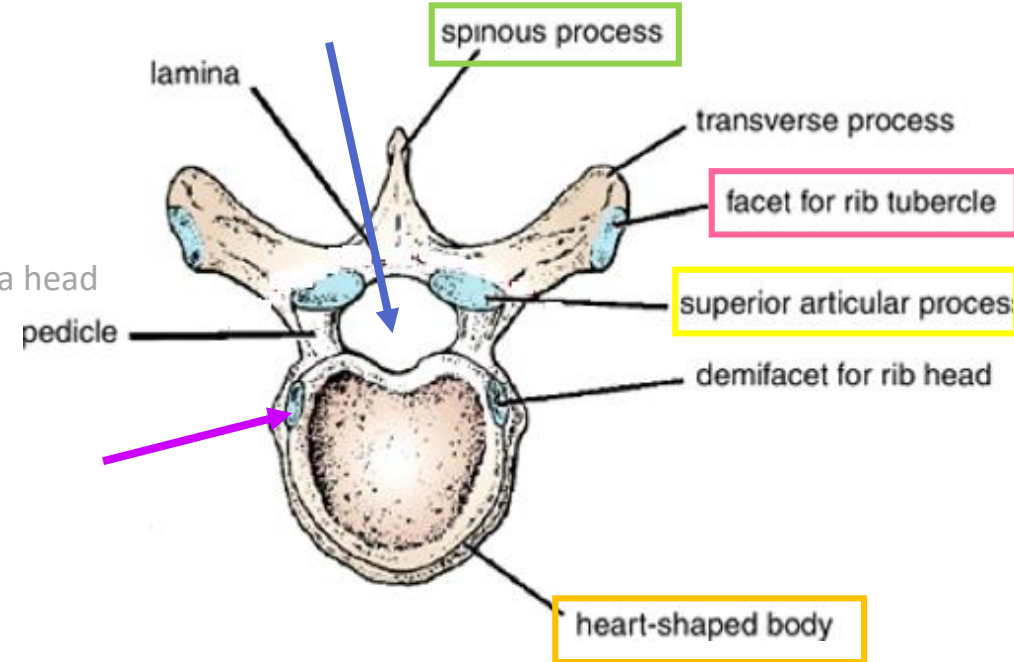
The only vertebrae that have special names are C1 "Atlas", C2 "Axis" and C7 "Prominens", while the rest of the vertebrae are named as "First letter of the region + the number of vertebrae" e.g. Thoracic + number 1 = T1

Characteristics Of Typical Thoracic Vertebra

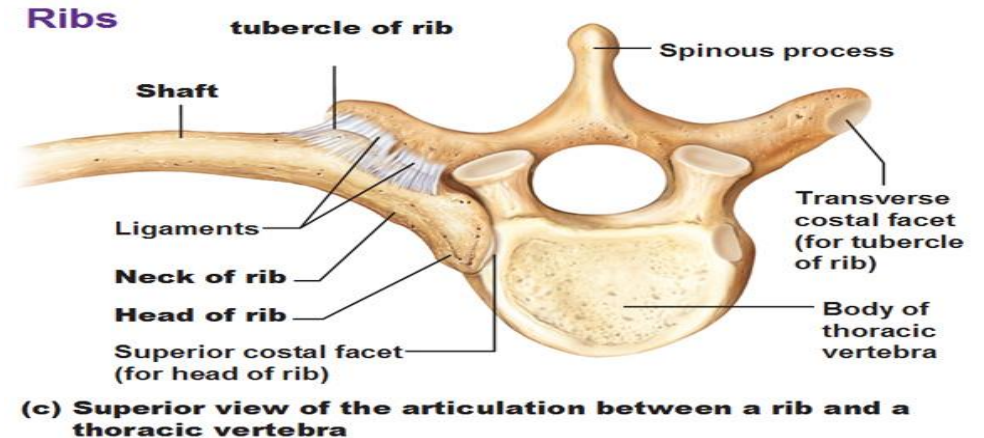
- The **vertebral foramen** is small and circular” الفتحة الي في النص
- The **body** is medium size and heart shaped.
- The **spines** are long and inclined downward.
- **Costal facets** are present on **the sides of the bodies** for articulation with the **heads** of the ribs.
- **Costal facets** are present **on the transverse** processes for articulation with the **tubercles** of the ribs (T11 and 12 have no facets on the transverse processes).
- The **superior articular processes** bear facets that face **backward** and **laterally**, whereas the facets on the **inferior articular processes** face **forward** and **medially**.
- The **inferior articular processes** of the **12th vertebra** face **laterally**, as do those of the lumbar vertebrae.

للربط:

- 1) Tubercle with Transverse
- 2) Humans have a head and a body



In THORACIC VERTEBRA from 1-10 the articulation of head of the rib called demicostal facet . Because the head of the rib articulates with 2 VERTEBRA



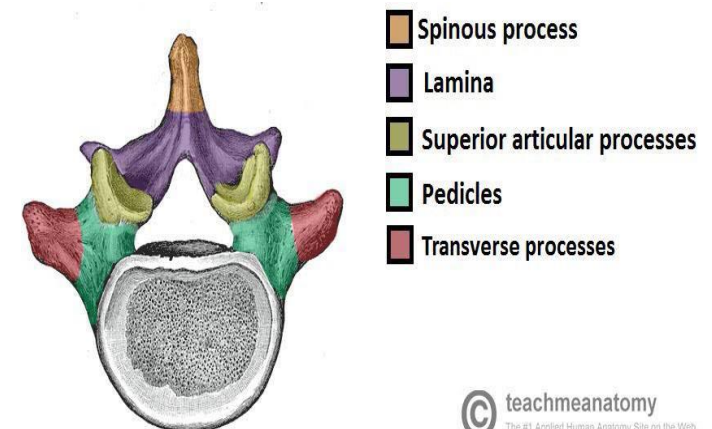
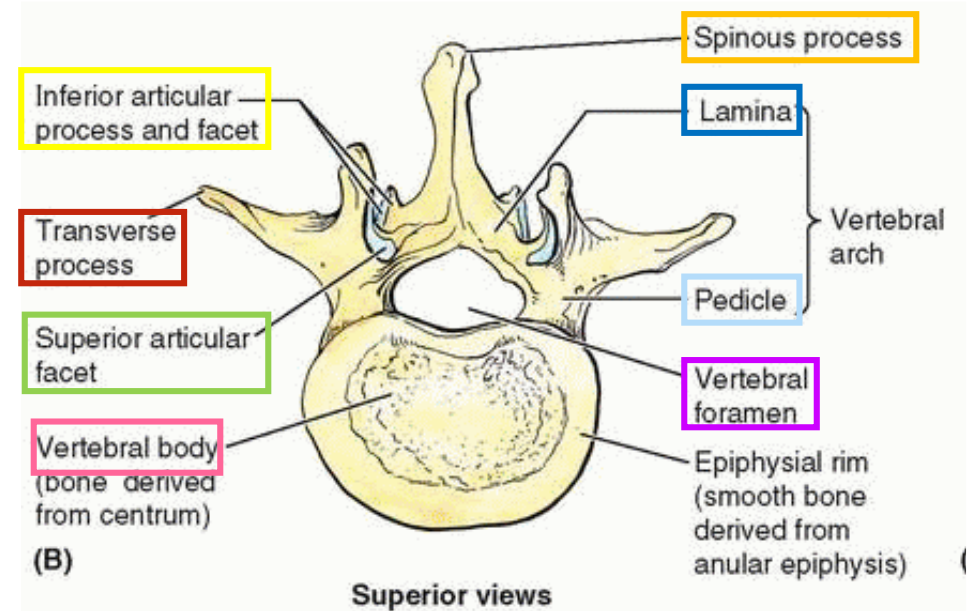
Extra picture to understand rib articulation

(c) Superior view of the articulation between a rib and a thoracic vertebra

Characteristics Of Typical Lumbar Vertebra

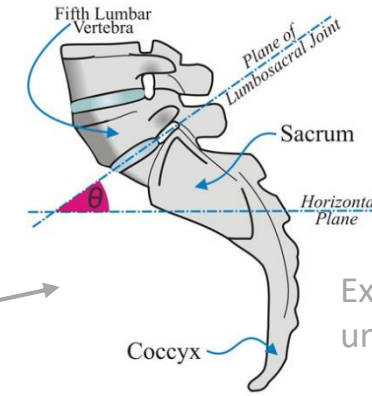


- The spinous processes are **short, flat, & quadrangular** and project backward.
- The laminae are **thick**.
- The transverse processes are **long and slender**.
- The pedicles are strong and directed backward.
- The vertebral foramina are **triangular**.
- The body is large and **kidney shaped**.
- The articular surfaces of the superior articular processes face **medially**, and those of the inferior articular processes face **laterally**.



Vertebrae L5

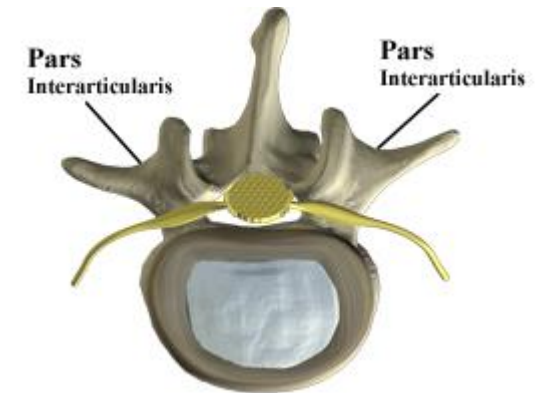
- The **largest** Vertebra.
- Distinguished by its **massive body** and **thick transverse processes**.
- Carries the weight of whole upper body.
- L5 **body** is **responsible for the lumbosacral angle** between the long axis of the lumbar region of the vertebral column and that of the sacrum.
- Body weight is transmitted from L5 to the base of the sacrum formed by the superior surface of S1 vertebra.
- The most common site of:
 - **Spondylolysis** which is a defect in the pars interarticularis of the vertebral arch.
 - **Spondylolisthesis** which is the forward displacement of a vertebra (over a lower vertebra).



Extra picture for understanding

© 2011 Jake Pett, Stuart Pett

Pars interarticularis is the space between the 2 articular processes/facets



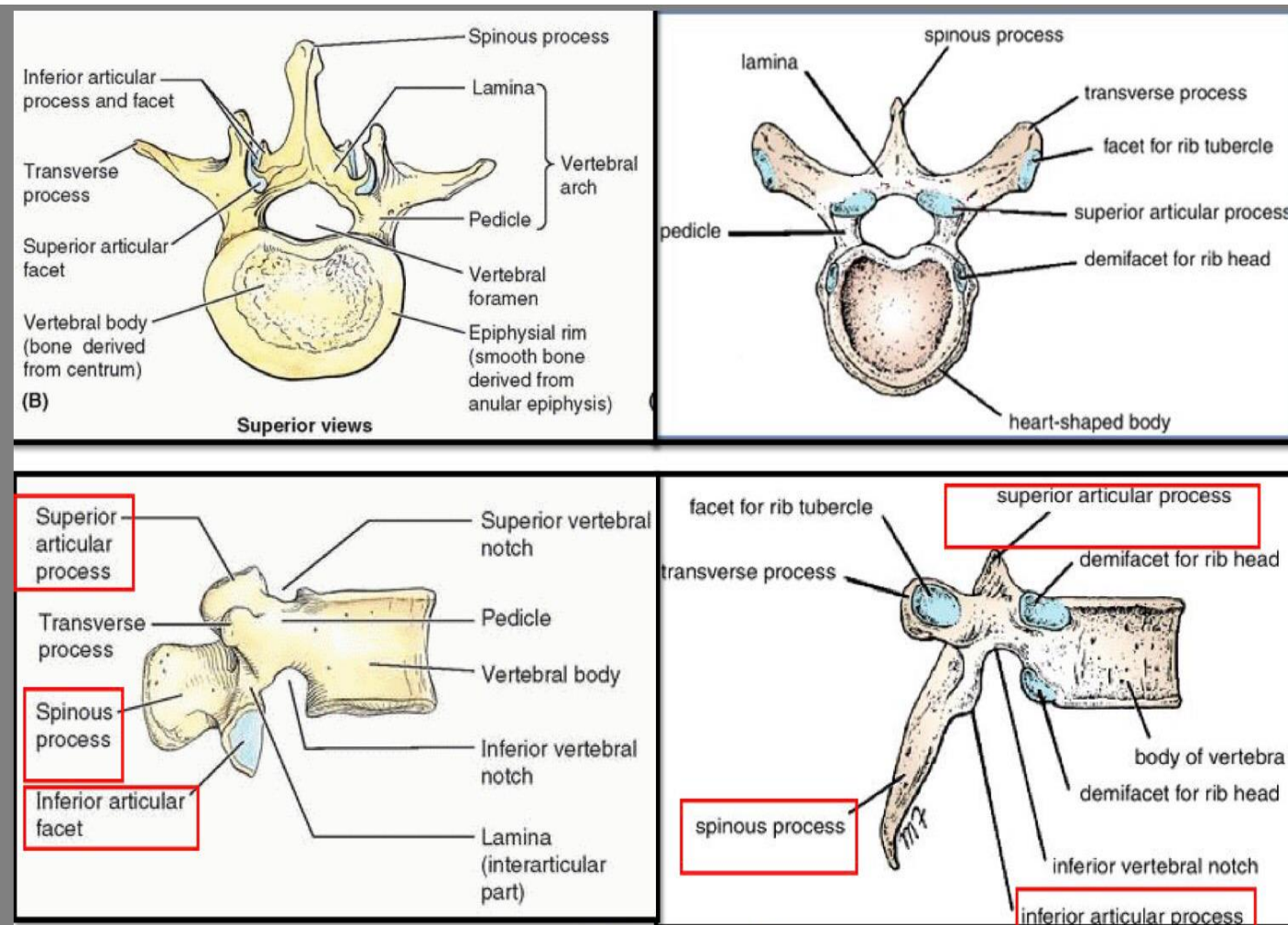
Extra picture for understanding

Differentiation between thoracic and lumbar vertebrae



Lumbar

Thoracic

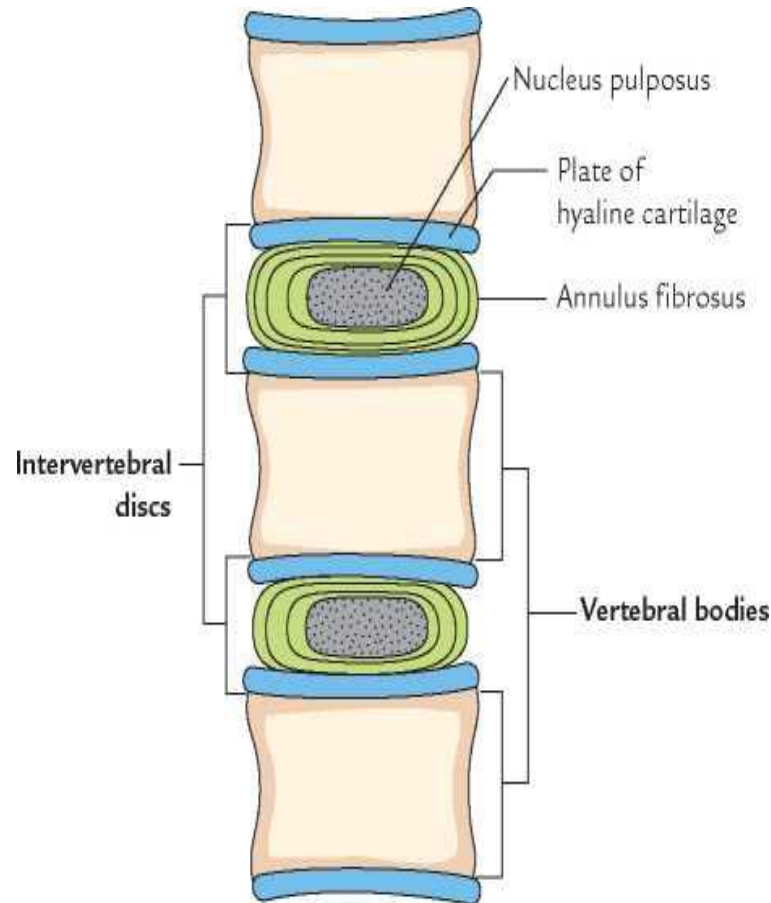


Characteristics	Thoracic	Lumbar
Body	Medium sized and heart shaped	Massive size and Kidney shaped
Vertebral foramen	Circular	Triangular
Spinous Process	Long, sharp and projects inferiorly	Short, blunt And projects posteriorly
Transverse Process	Bear facets for ribs (except T11-T12)	Long and slender

Joints Between Vertebrae :

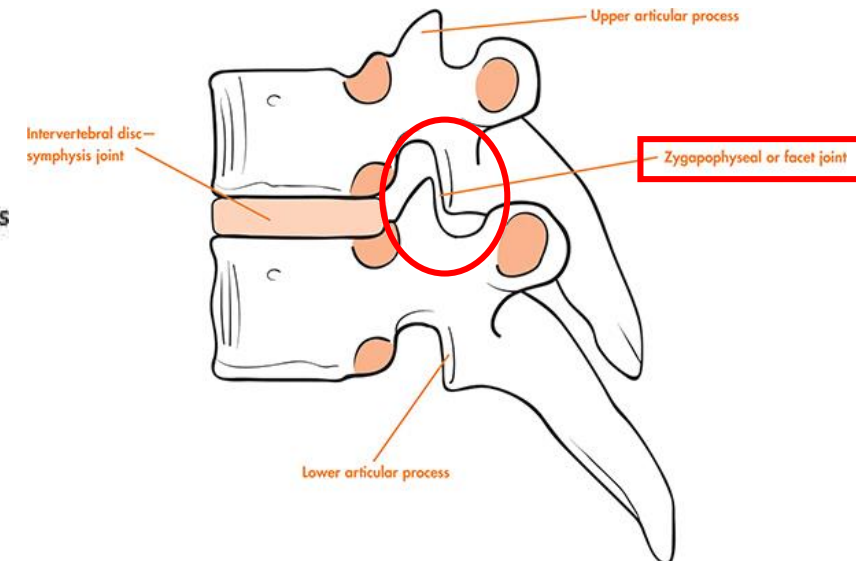
Joints between two vertebral bodies :

- It is a **cartilaginous joint**.
(غضروفي)
- The upper and lower surfaces of the bodies of adjacent vertebrae are covered by thin **plates hyaline cartilage**.
- Sandwiched between the plates of hyaline cartilage is an **intervertebral disc** of fibrocartilage .
- Collagen fibers of the disc strongly unite the bodies of the two vertebrae.



Joints between two vertebral arches:

- Superior and inferior articular process are joined by a **synovial joint**.



Intervertebral Discs:

- The intervertebral discs are responsible for (1/4) of vertebral column **length** .
- They are **thickest** in the **cervical and lumbar regions**, where the **movements** of the vertebral column are greatest. unlike the thoracic region which is LESS THICK and has less movement .
- There are **No discs** between the : **first & the second cervical vertebrae nor the sacrum & coccyx.**

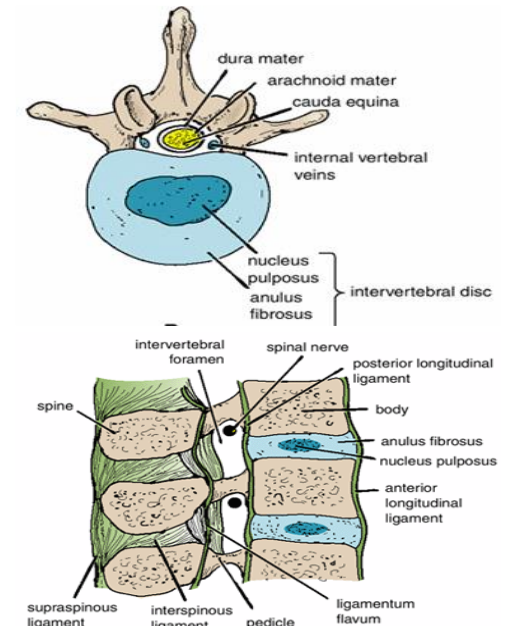
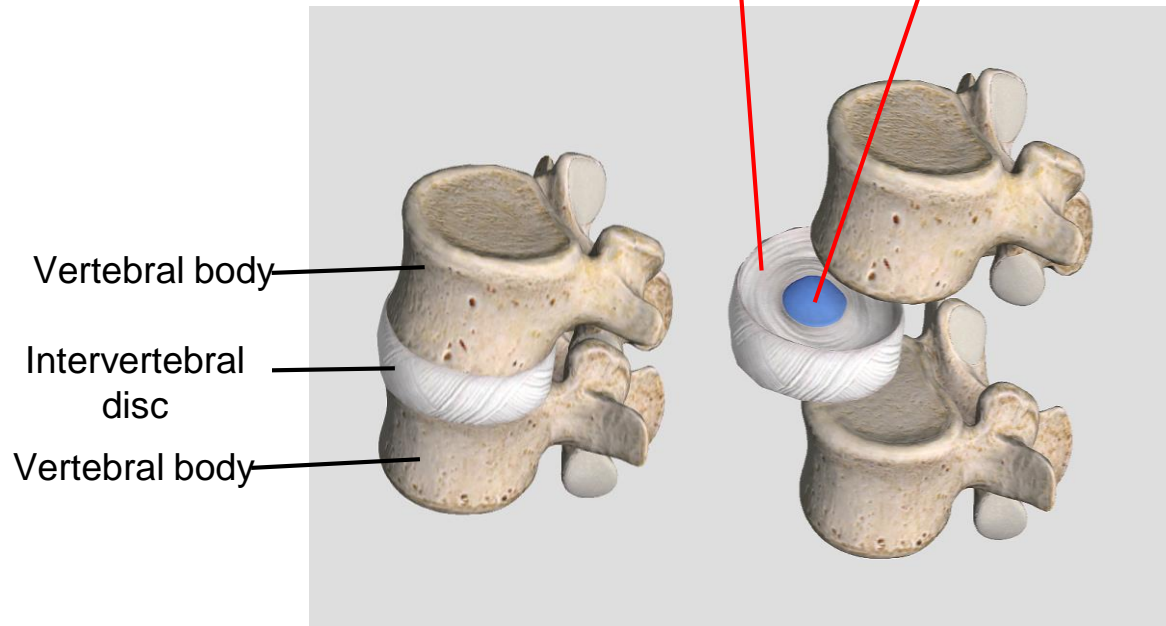
Each disc consist of :

- **Peripheral part:** the **annulus fibrosus**, composed of **fibrocartilage** .

(annulus= a: no or out, nulus: like nucleus so its not the nucleus or outside it 😊)
(fibrosus= because it's composed of fibrocartilage)

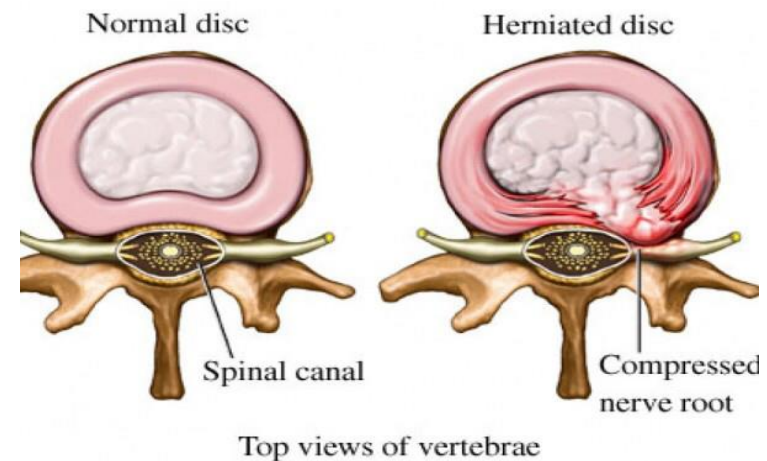
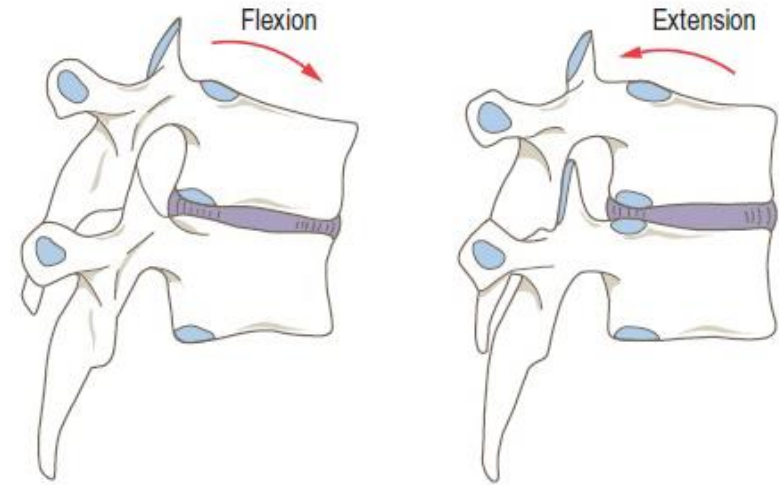
- **Central part :** the **nucleus pulposus**, a gelatinous material, a lot of water, few collagen fibers & cartilage cells.

(nucleus= نواة بما انها في المنتصف)
(pulposus= زي البؤبؤ في وسط العين)



Function of the Intervertebral Discs:

- **Allow** vertebra to rock forward or backward on another like **flexion and extension of vertebral column**.
- **Serve as shock absorbers** when the load on the vertebral column increased, as **when one is jumping from a height**.
- Sometimes, the **annulus fibrosus** ruptures, **allowing the nucleus pulposus to herniate and protrude into the vertebral canal**, where it may press on spinal nerve roots, spinal nerve, or even spinal cord.

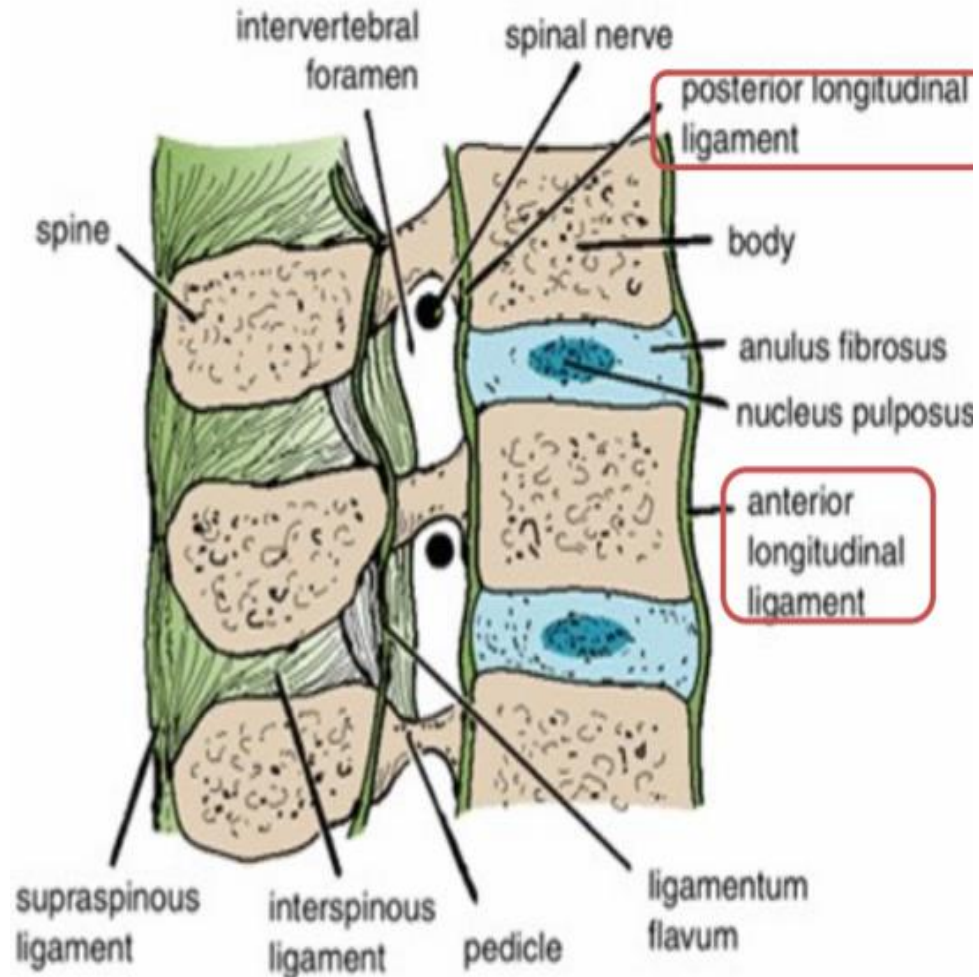


Ligaments

✓ The anterior and posterior longitudinal ligaments run as continuous bands down the anterior and posterior surfaces of the vertebral column from the skull to the sacrum

✓ The anterior longitudinal ligament is wide and is strongly attached to the front and sides of the vertebral bodies and to the intervertebral discs.

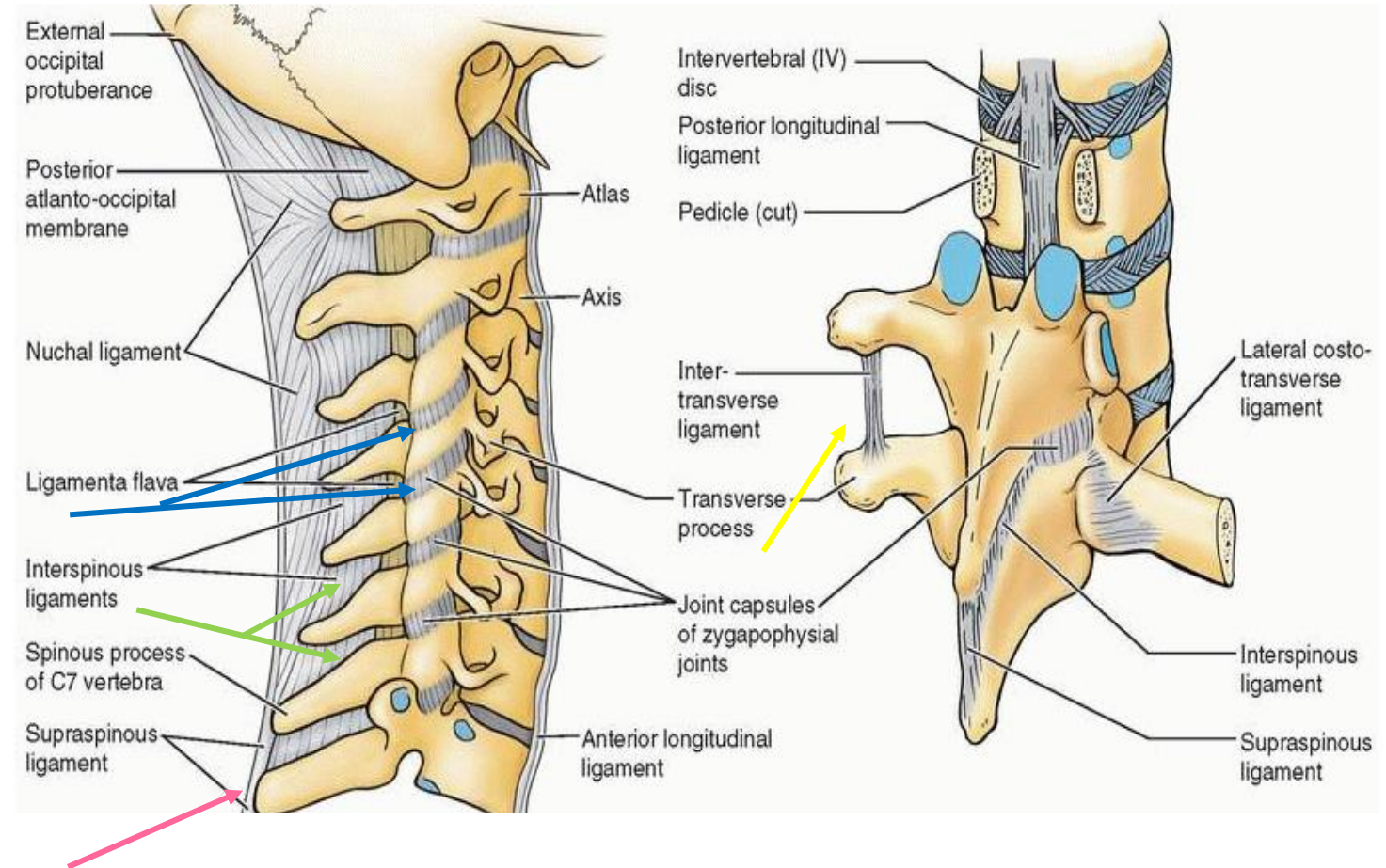
✓ The posterior longitudinal ligament is weak and narrow and is attached to the posterior borders of the discs.



These ligaments **hold the vertebrae firmly together** hold the vertebrae firmly together but at the same time permit a **small amount of movement** to take place between them.

Ligaments

- Ligamentum flavum: connects the laminae of adjacent vertebrae.
- Interspinous ligament: connects adjacent spines.
- Supraspinous ligament: runs between the tips of adjacent spines.
- Intertransverse ligaments: run between adjacent transverse processes



Movements Of The Thoracolumbar Spine

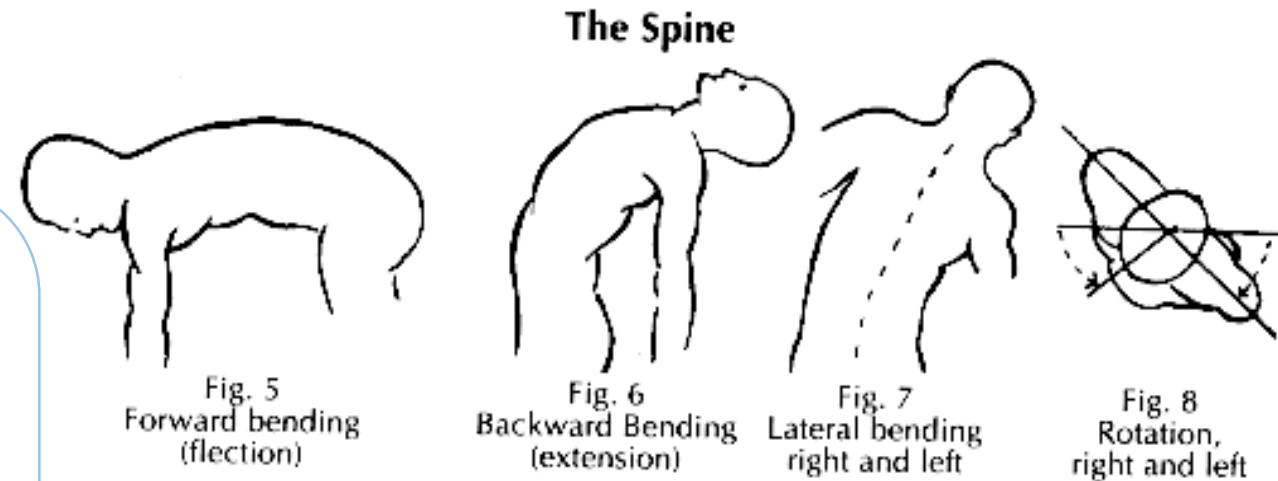
The following movements are possible on the spine:

- flexion
- extension
- lateral flexion
- Rotation
- Circumduction = circular movement

The type and range of movements depend on:

- Thickness of the intervertebral discs
- Shape and direction of the articular processes.

In the **thoracic region**, the ribs, the costal cartilages, and the sternum **severely restrict** the range of movement.



Flexion & Extension Lateral flexion

Extensive in the lumbar regions
Restricted in the thoracic regions

Rotation

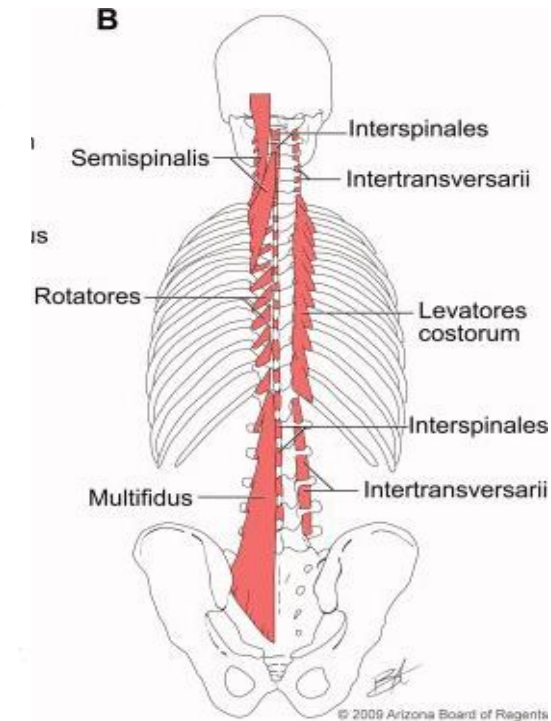
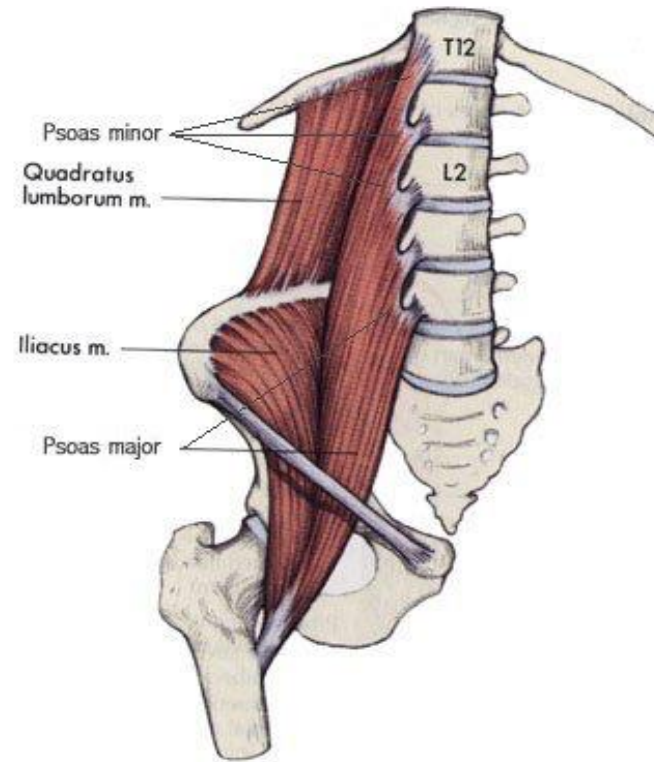
Extensive in the thoracic regions
Less extensive in the lumbar regions

Muscles Producing Movements

Thoracic Region :

Rotation produced by **semispinalis** and **rotator muscles**, assisted by the oblique muscles of the anterolateral abdominal wall.

Lumbar region :



Flexion	produced by the (1) rectus abdominis and the (2) psoas muscles .
Extension	produced by (1) the postvertebral muscles .
Lateral Flexion	produced by (1) the postvertebral muscles , the (2) quadratus lumborum , and the (3) oblique muscles of the anterolateral abdominal wall . The (4) psoas <u>may also</u> play a part in this movement.
Rotation	produced by the (1) rotator muscles and the (2) oblique muscles of the anterolateral abdominal wall .

MCQs

Q1: Which of the following is a distinctive mark for T11 and T12.

- A- Presence of facets on transverse process.
- B- Absence of facets on transverse process.
- C- Presence of costal facets on body.
- D- Absence of costal facets on body.

Q2: The type of cartilage which is present on the surface of the vertebrae bodies is.

- A- hyaline cartilage.
- B- Elastic cartilage.
- C- Fibrocartilage.
- D- Regular cartilage.

Q3: anterior longitudinal ligament is.

- A- wide and strongly attached.
- B- narrow and strongly attached.
- C- wide and weakly attached.
- D- Narrow and weakly attached.

Q4: Which region of the thoracolumbar spine is most movable.

- A- thoracic.
- B- lumbar.
- C- a,b
- D- none of the above.

Q5: which one of these movements will be most weakened if the motor neuron supplying psoas muscle is damaged.

- A- Flexion.
- B- Lateral Flexion.
- C- Circumduction.
- D- Extension.

Q6: Psoas muscle is a major muscle in the flexion of lumbar region.

- A- True.
- B- False.

Q7: Which one of the following contributes in lordosis of the spine?

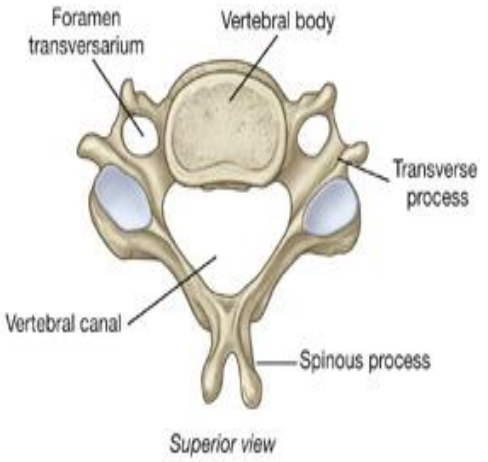
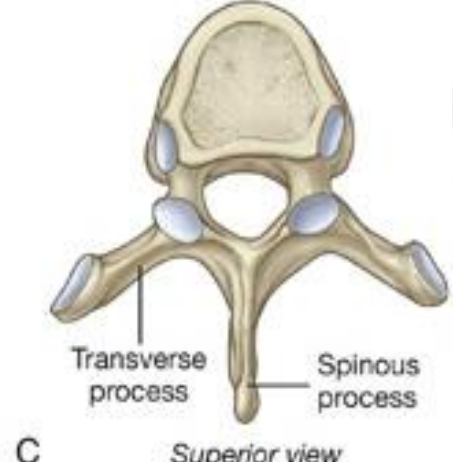
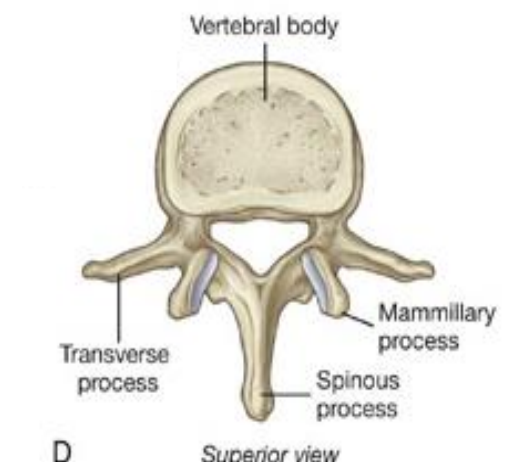
- A- Exaggerated cervical curvature.
- B- Exaggerated thoracic curvature.
- C- Exaggerated lumbar curvature.
- D- Lateral curvature.

Q8: Which one of the following muscles specifically contributes in lateral flexion of lumbar spine?

- A- Semispinalis
- B- Quadratus lumborum
- C- Psoas major
- D- Rectus abdominis

Answers

1. B, 2. A, 3. A, 4. B, 5. A, 6. A, 7. C 8. B

	Cervical	Thoracic	Lumbar
<i>Number</i>	7	12	5
<i>Body</i>	Small, Longer horizontally	Medium, heart shaped	Large, kidney shaped
<i>Vertebral foramen</i>	Triangular	Circular	Triangular
<i>Spinous process</i>	Short, bifid	Long, inclined downward	Short, flat, quadrangular, projects backward
<i>Transverse process</i>	Has transverse foramen		Long and slender
<i>Superior articular process</i>	Upward & backward	Backward & laterally	Medially
<i>Inferior articular process</i>	Downward & forward	Forward & medially	Laterally
	 <p>A Superior view</p>	 <p>C Superior view</p>	 <p>D Superior view</p>

