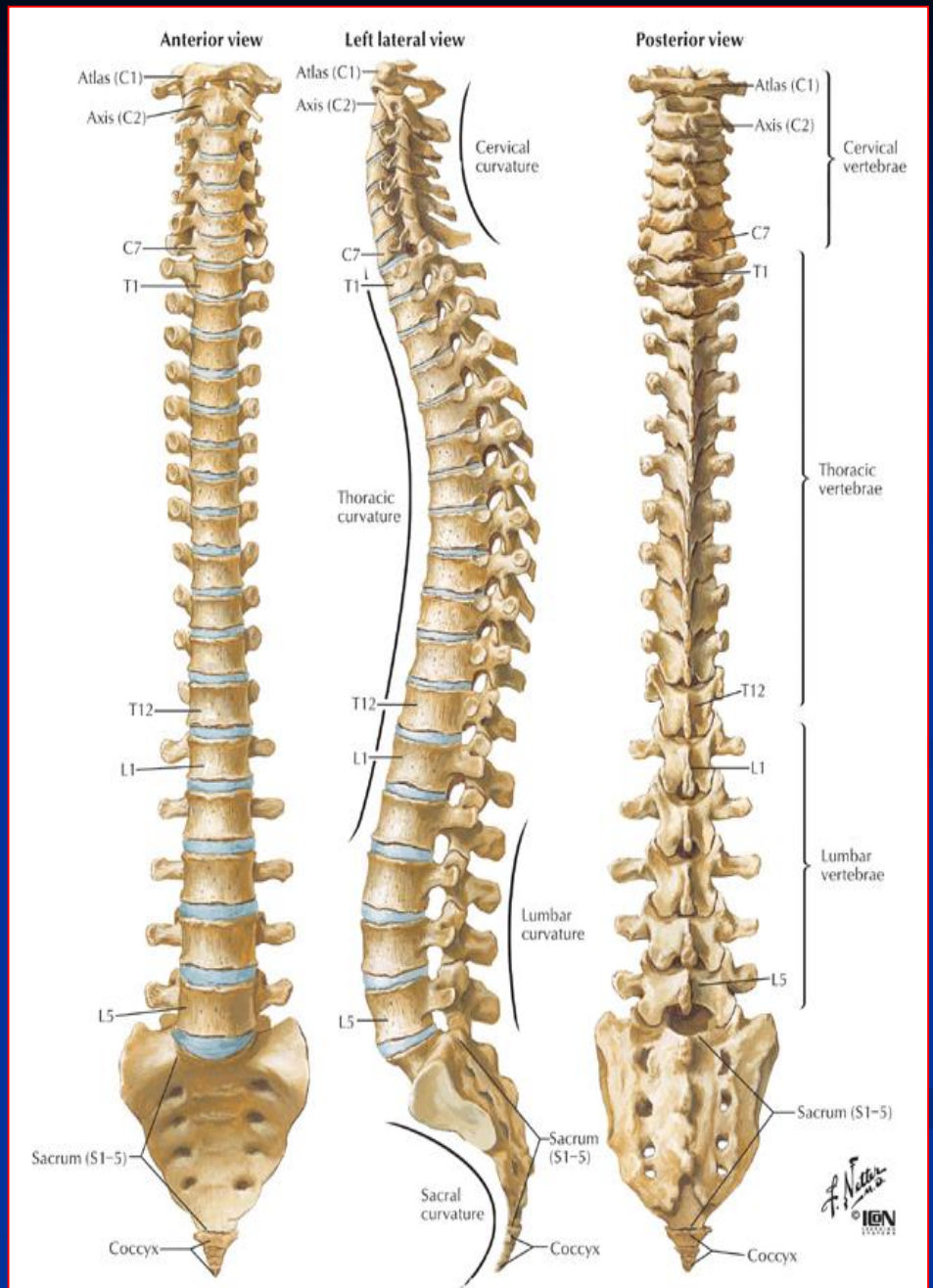


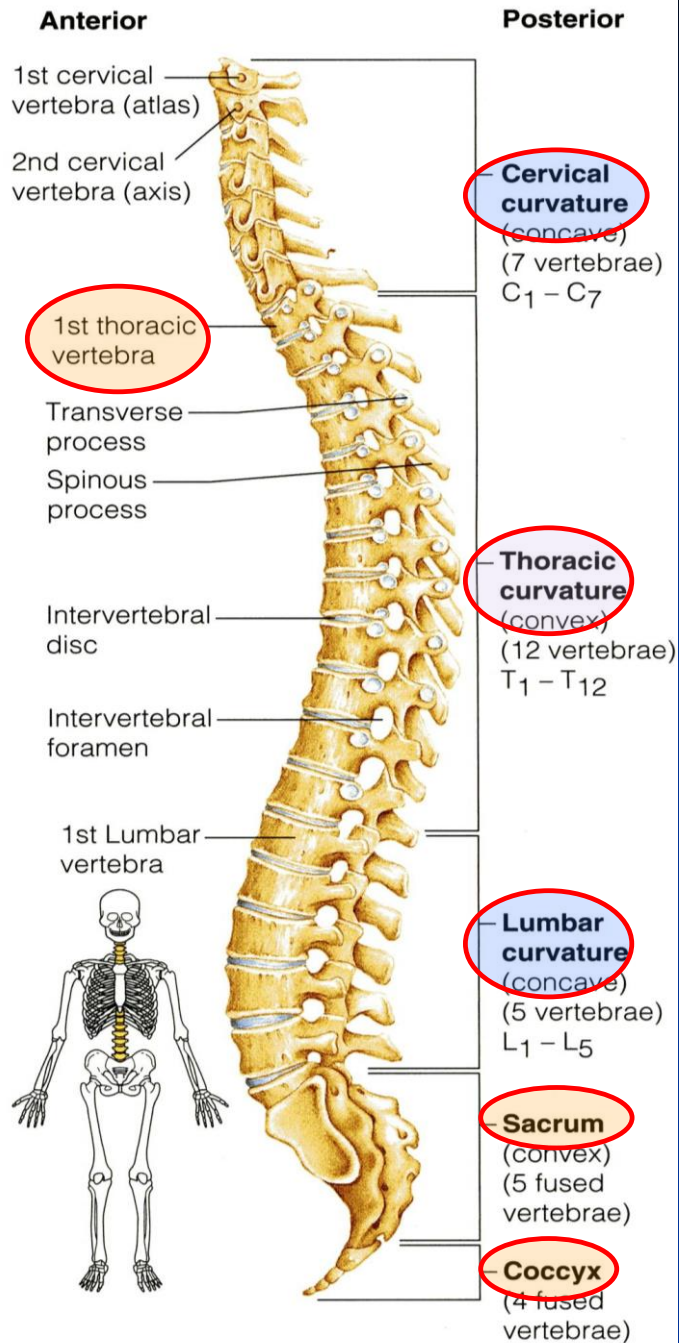
# ANATOMY OF THE SPINE



# Objectives

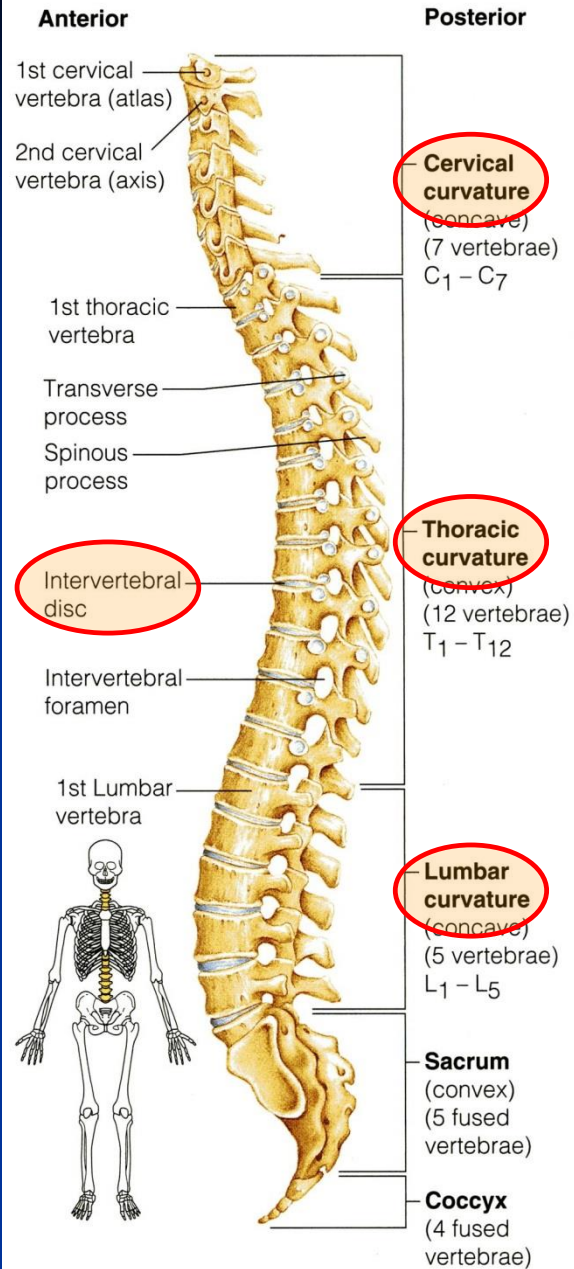
- By the end of this lecture you should be able to:
- Distinguish and describe the cervical, thoracic, lumbar, sacral and coccygeal vertebrae.
- Describe the vertebral curvatures.
- Describe the movement which occur in each region of the vertebral column.
- List the structures which connect **2** adjacent vertebrae together.
- List and identify the ligaments of the intervertebral joints.

# SPINE OR VERTEBRAL COLUMN



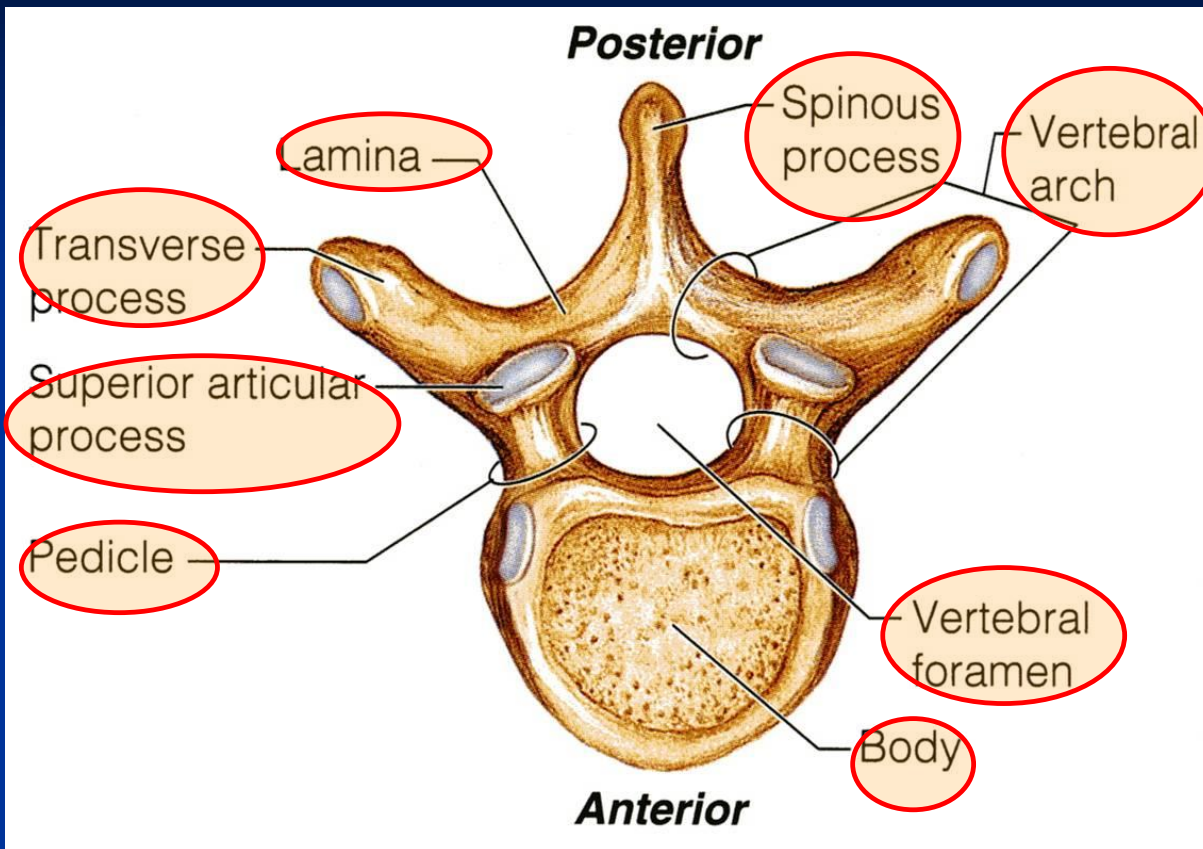
- The **vertebral column** extends from the skull to the pelvis.
- It surrounds and protects the spinal cord and supports the whole body.
- It is formed from **33** irregular **vertebrae**.
- It consists of **24** single vertebrae and **2** bones:
  - **Sacrum, (5 fused vertebrae).**
  - **Coccyx, (4 fused vertebrae).**
- Of the 24 single bones,
  - **7 Cervical vertebrae,**
  - **12 Thoracic vertebrae,** and
  - **5 Lumbar vertebrae.**

# VERTEBRAL COLUMN



- The single vertebrae are separated by pads of flexible fibrocartilage called the **intervertebral disc**.
- The **intervertebral discs** cushion the vertebrae and absorb shocks.
- The discs and the **S-shaped curvatures** of the vertebral column work together to prevent shock to the head when we walk or run.
- They also make the body trunk flexible.
- The **spinal curvatures** in the **thoracic** and **sacral** regions are referred to as **primary curvatures**, because they are present when we are born.
- Later, the **secondary curvatures** develop.
- The **cervical curvature** appears when a baby begins to hold his head (6<sup>th</sup> month), and the lumbar curvature develops when the baby begins to walk (around the end of the 1<sup>st</sup> year).

# TYPICAL VERTEBRA



- One **spinous process**: single projection arising from the posterior aspect of the vertebral arch.
- 2 **Superior and 2 inferior articular processes**: Paired projections lateral to the vertebral foramen, allowing a vertebra to form joints with adjacent vertebrae.

• **Any vertebra is formed from body and arch.**

## • **Body or Centrum:**

• Disc like, weight-bearing part of the vertebra that lies anteriorly.

## ▪ **Vertebral arch:**

▪ Formed from fusion of

• **2 Pedicles,**

• **2 Laminae**

## ▪ **Vertebral foramen:**

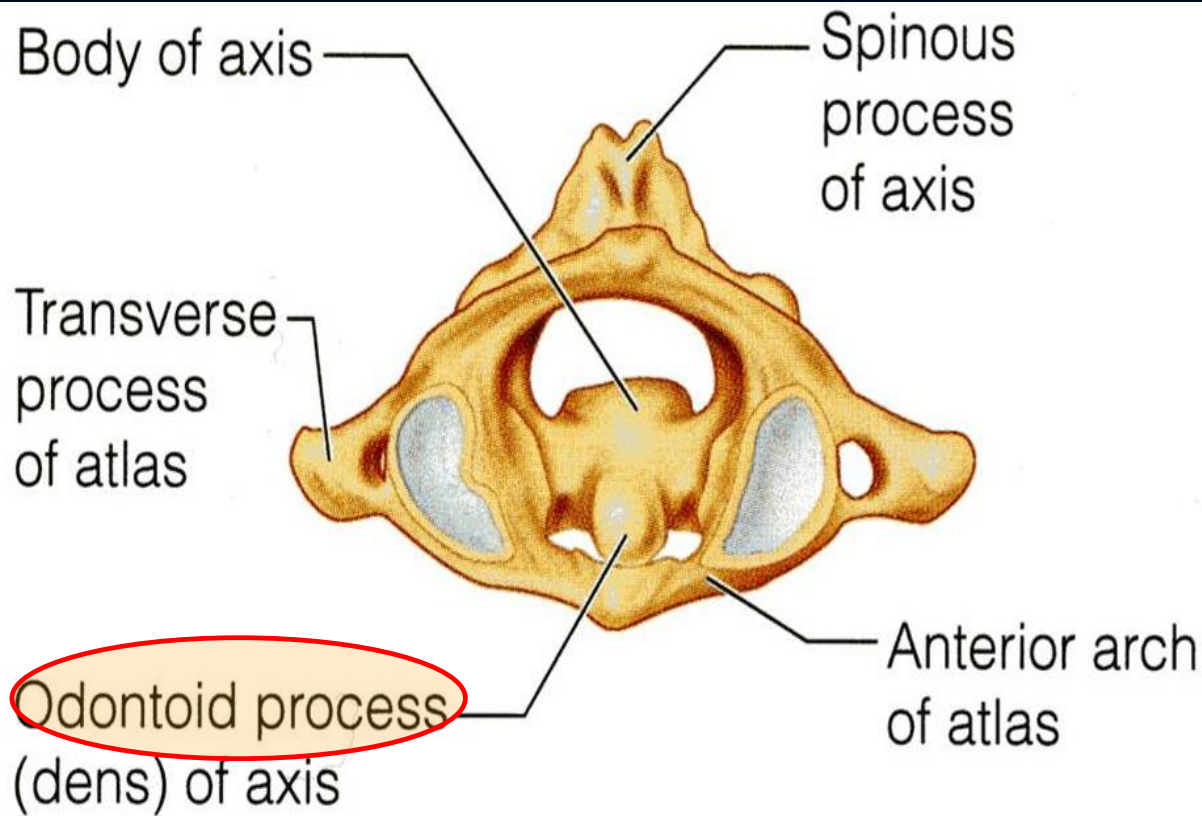
▪ **Lies between the body and the arch,** through which the spinal cord passes.

▪ **The vertebral arch carries 7 process:**

• **2 Transverse processes:**

Lateral projections from the vertebral arch.

# ATLAS & AXIS



- The 7 **cervical vertebrae** (identified as C1 to C7) form the neck region of the spine.
- The first two vertebrae (**atlas** and **axis**) are different because they perform functions not shared by the other cervical vertebrae.

The **atlas** (C<sub>1</sub>) has no body, formed of 2 lateral masses.

The superior surfaces of each lateral mass contain kidney shaped facet that receive the occipital condyles of the skull. This joint allows you to **nod "yes."**

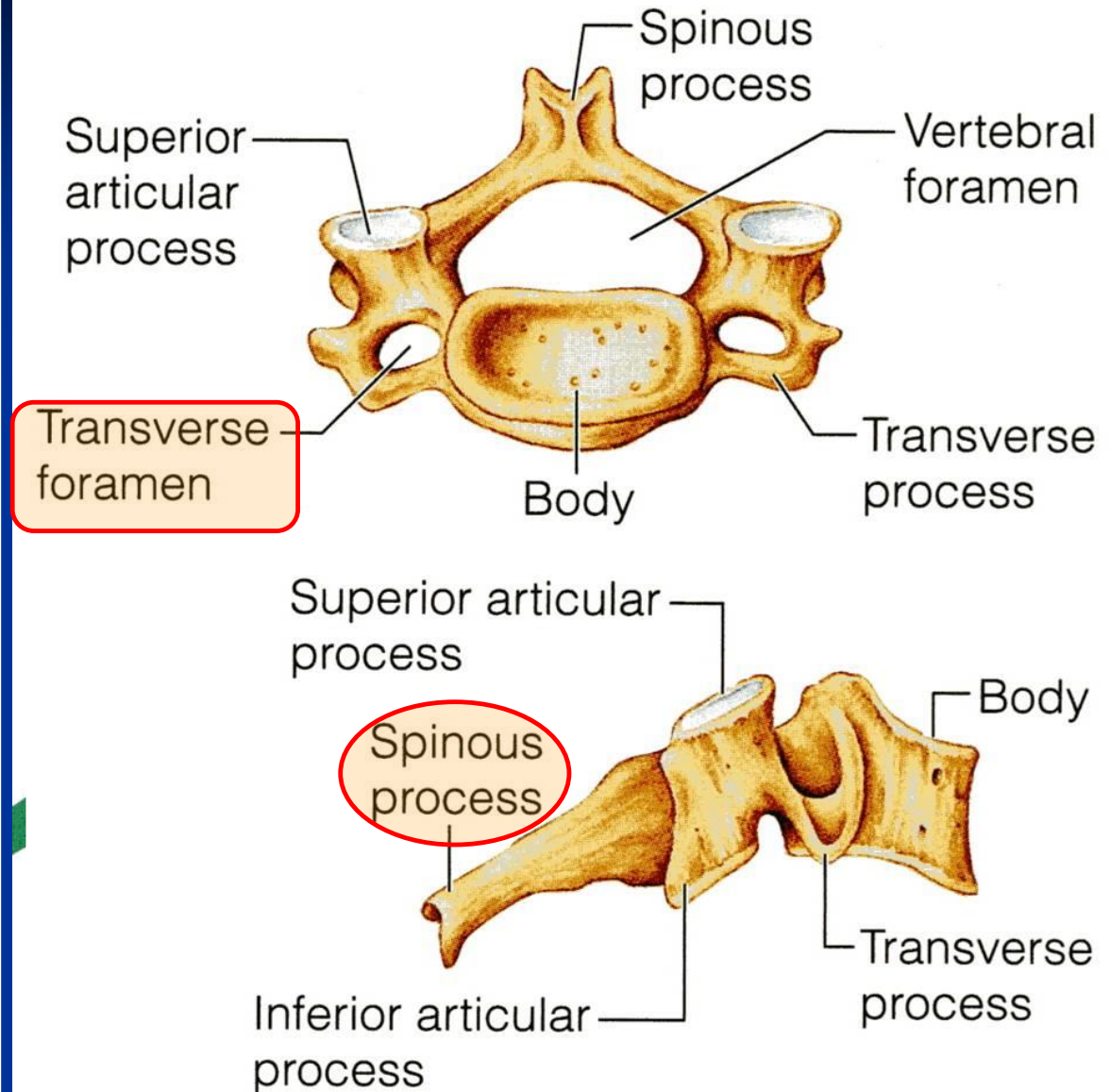
The **axis** (C<sub>2</sub>) acts as a pivot for the rotation of the atlas (and the skull) above.

It has a large upright process, the **odontoid process**, or **dens**, which acts as a pivot .

The joint between C<sub>1</sub> & C<sub>2</sub> allows to rotate the head from side to side to say **"no."**

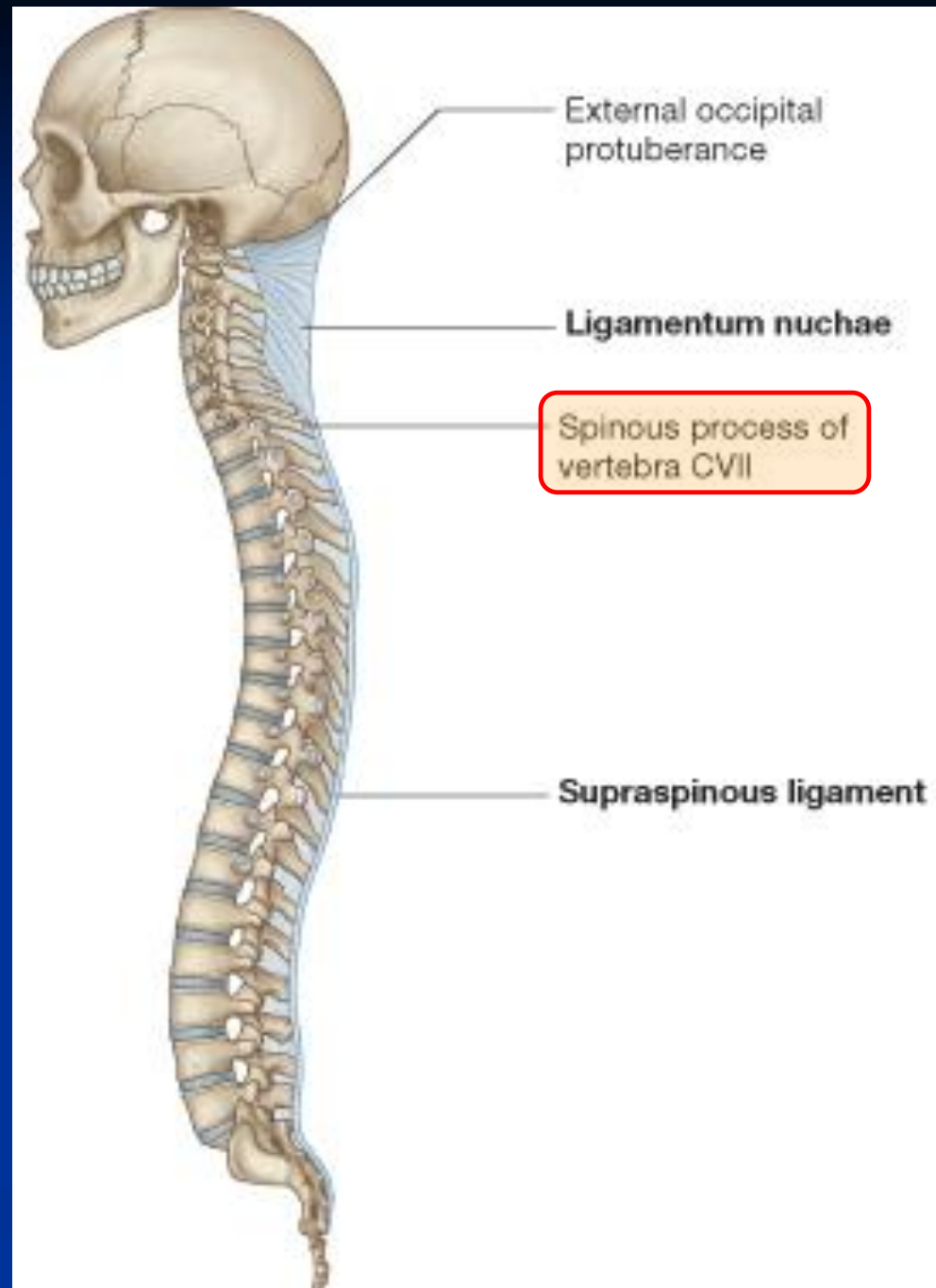
# TYPICAL CERVICAL VERTEBRAE

- The "typical" cervical vertebrae ( $C_3$  to  $C_6$ ) are the smallest, lightest vertebrae, and their **spinous processes** are short and bifid.
- The transverse processes of the cervical vertebrae contain **foramina** through which the vertebral **arteries** pass on their way to the brain above.



# 7<sup>th</sup> CERVICAL VERTEBRA OR Cervica Prominens

It has the **longest** spinous process which is **not bifid**.  
It is the **first spine** to be felt **subcutaneously** in the root of the back of the neck.





# MOVEMENTS IN THE **ATLANTO-OCCIPITAL** JOINT

## The joints are capable of:

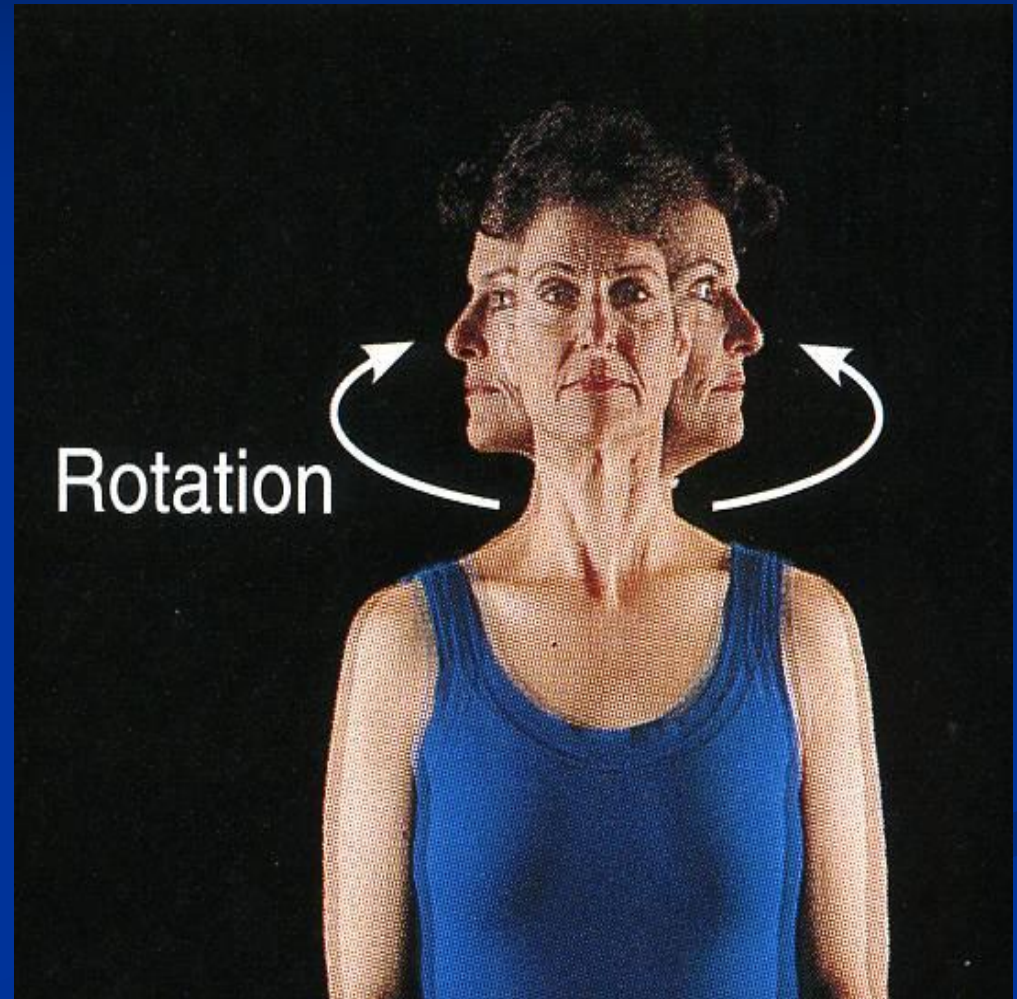
- Flexion,
- Extension, and
- Lateral flexion;
- They do not rotate.



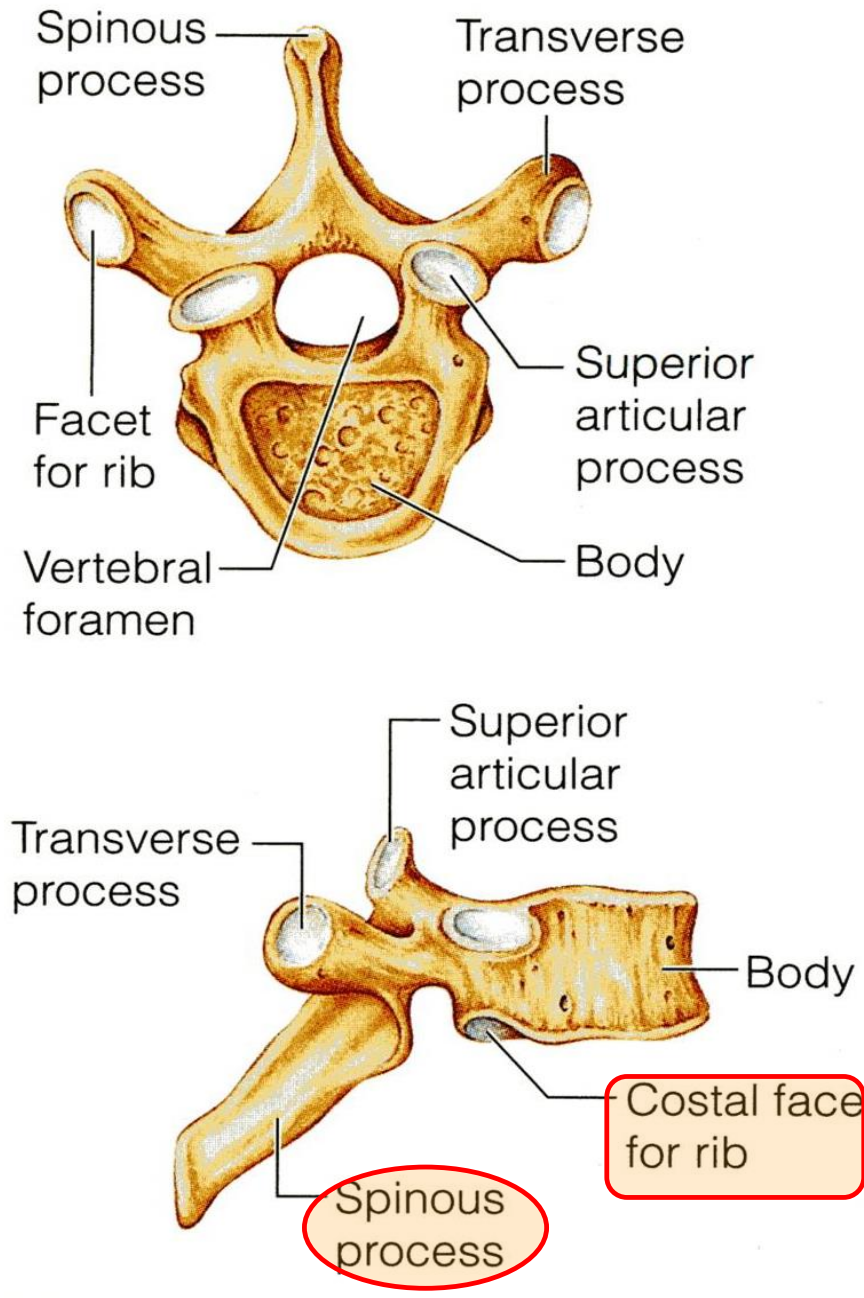
# MOVEMENTS IN THE **ATLANTO-AXIAL** JOINT

**Extensive rotation** of the atlas and the skull (and thus of the head on the axis).

That is to say **“NO”**

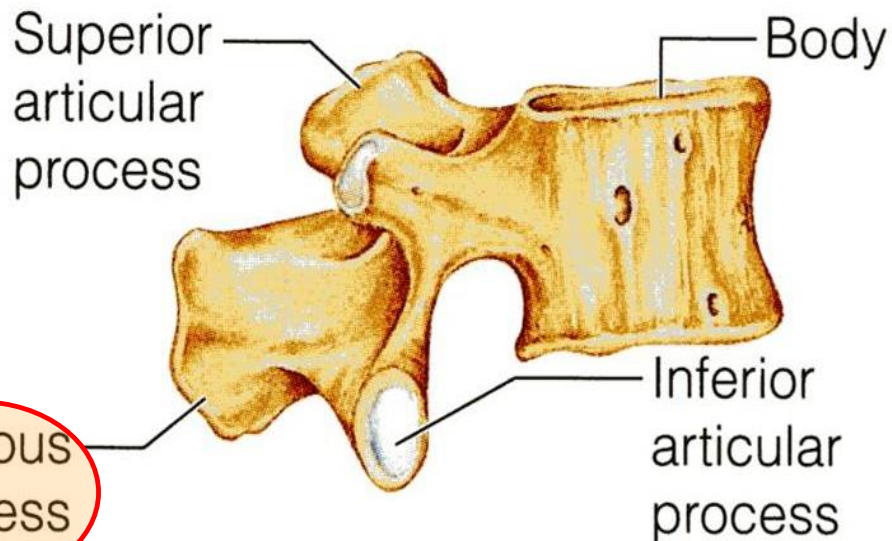
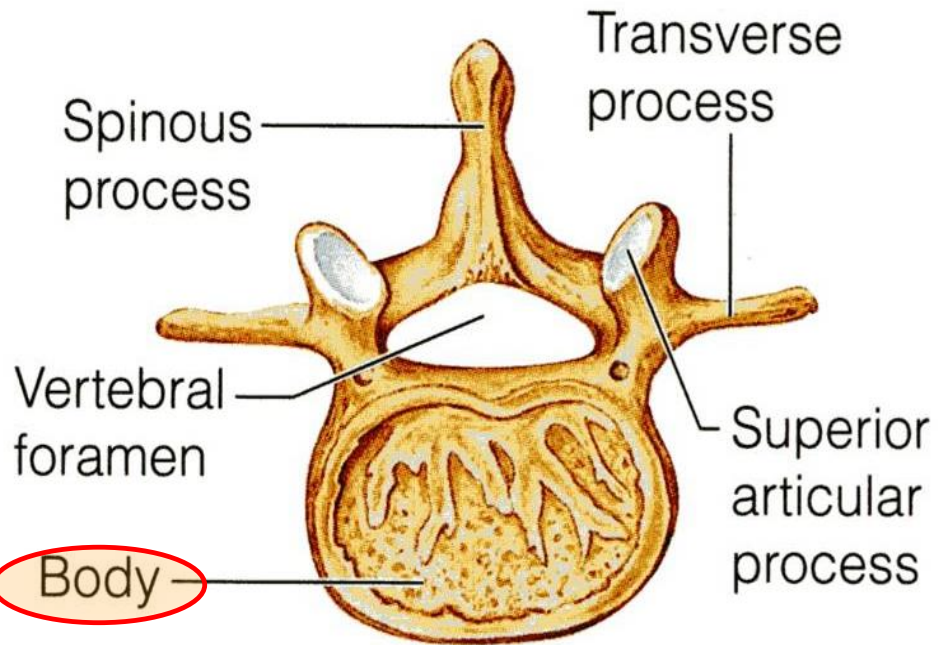


# THORACIC VERTEBRAE



- The 12 **thoracic vertebrae** (T<sub>1</sub>-T<sub>12</sub>) are almost typical.
- They are larger than the cervical vertebrae.
- The body is somewhat heart-shaped and has two **costal demifacets** (articulating surfaces) on each side, which receive the heads of the ribs.
- The **spinous process** is long and hooks sharply downward.

# LUMBAR VERTEBRAE



- The 5 **lumbar vertebrae** (L<sub>1</sub>-L<sub>5</sub>) have massive, block like bodies.
- They have short, hatchet-shaped **spinous processes**.
- They are the most solid of all vertebrae.

# MOVEMENTS OF THE THORACOLUMBAR SPINE



**The following movements are possible on the spine:**

Flexion, extension, lateral flexion and rotation.

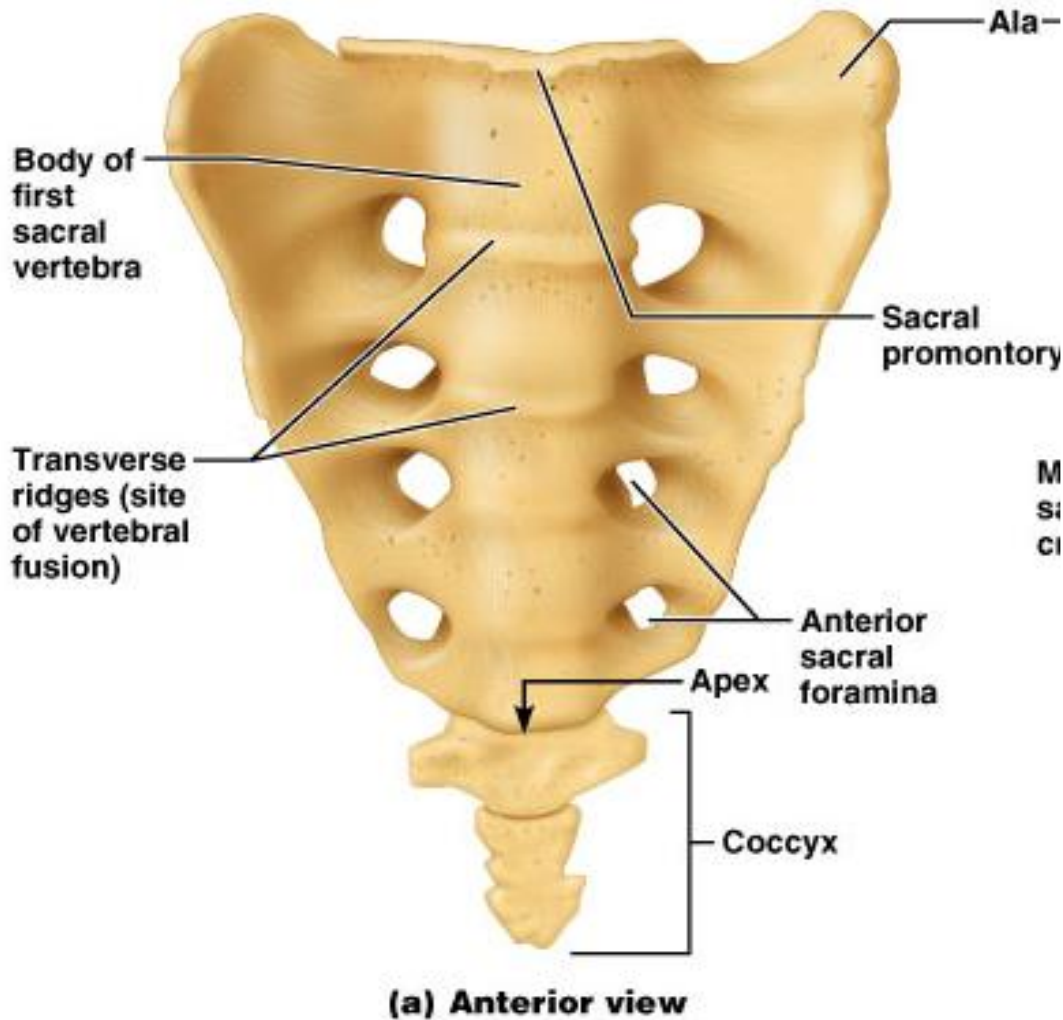
**In the thoracic region**, the ribs, the costal cartilages, and the sternum severely restrict the range of movement.

**Flexion, extension and lateral flexion:** are extensive in the lumbar regions but restricted in the thoracic region.

**Rotation:**

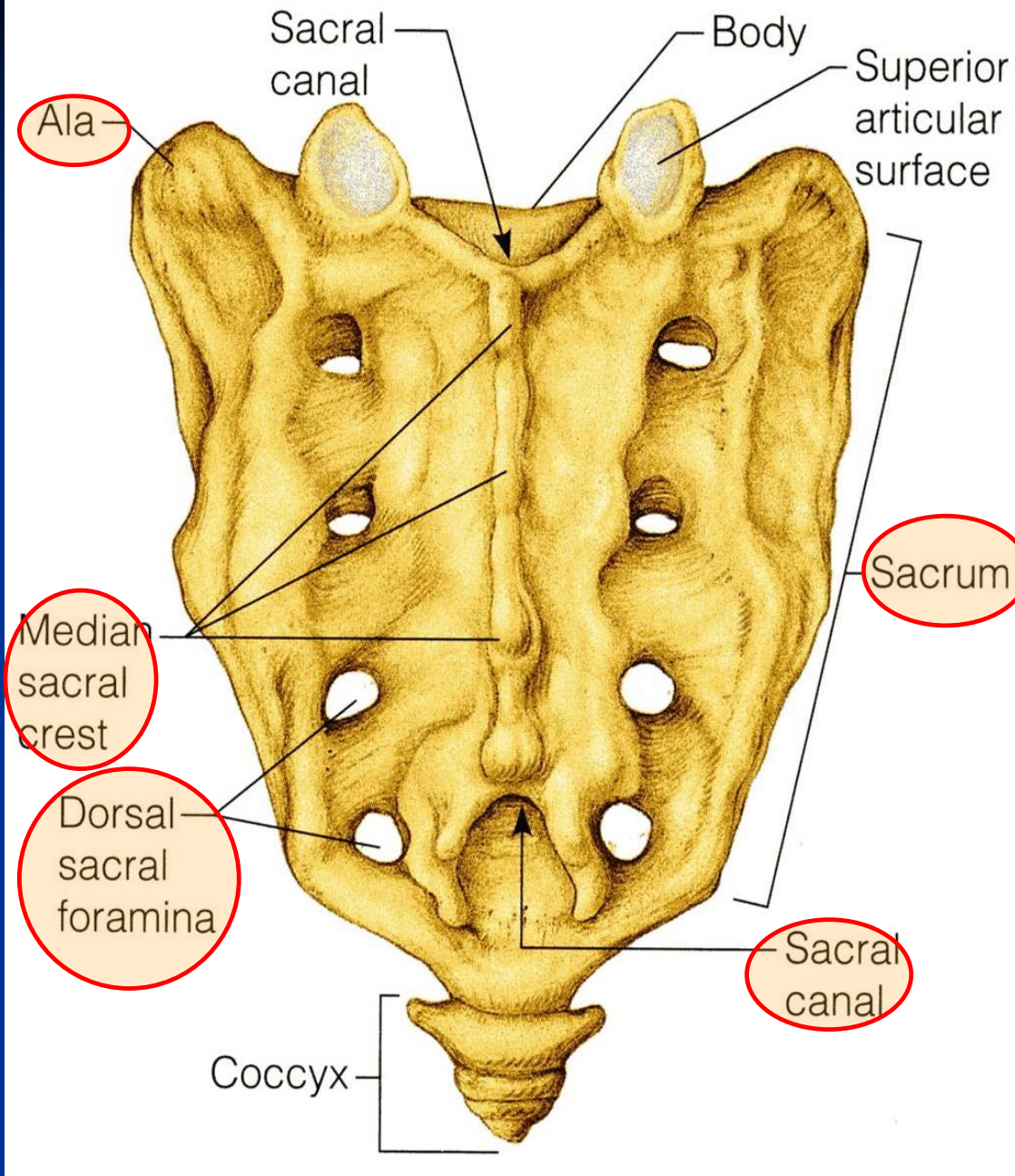
It is extensive in thoracic spine and least extensive in the lumbar region.

# SACRUM



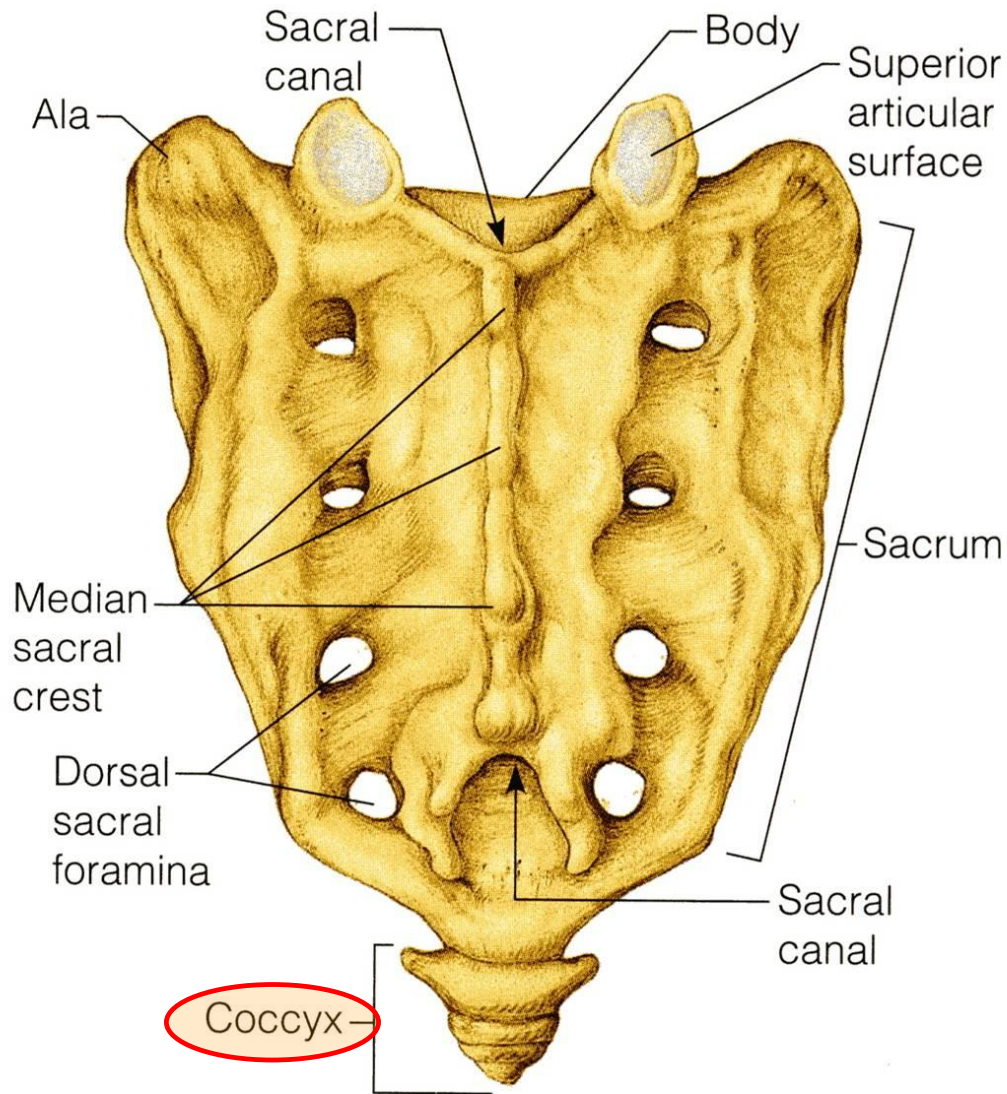
- The **sacrum** is formed by fusion of 5 vertebrae.
- Superiorly it articulates with L5, and inferiorly it connects with the coccyx.
- **Sacral Promontory:**
- The anterior and upper margin of the first sacral vertebra.
- The wing like **ala** articulate laterally with the hip bones, forming the sacroiliac joints.
- The sacrum forms the posterior wall of the pelvic cavity.

# SACRUM



- Its dorsal midline surface is roughened by the **median sacral crest**, (the fused spinous processes of the sacral vertebrae).
- This is flanked laterally by the **dorsal sacral foramina**.
- The vertebral canal continues inside the sacrum as the **sacral canal**.
- The sacral canal opens inferiorly in what is called sacral hiatus.

# COCCYX

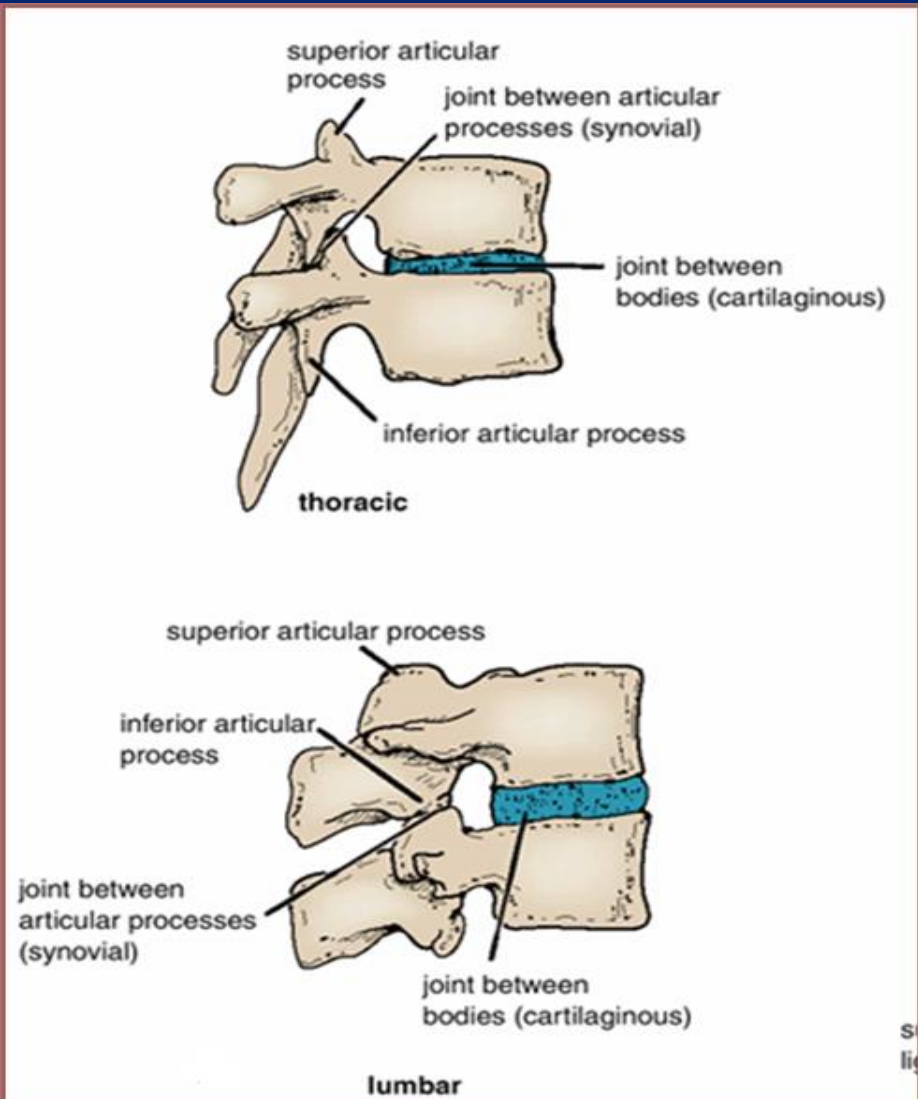


The **coccyx** is formed of fusion of **4** tiny, irregularly shaped vertebrae.



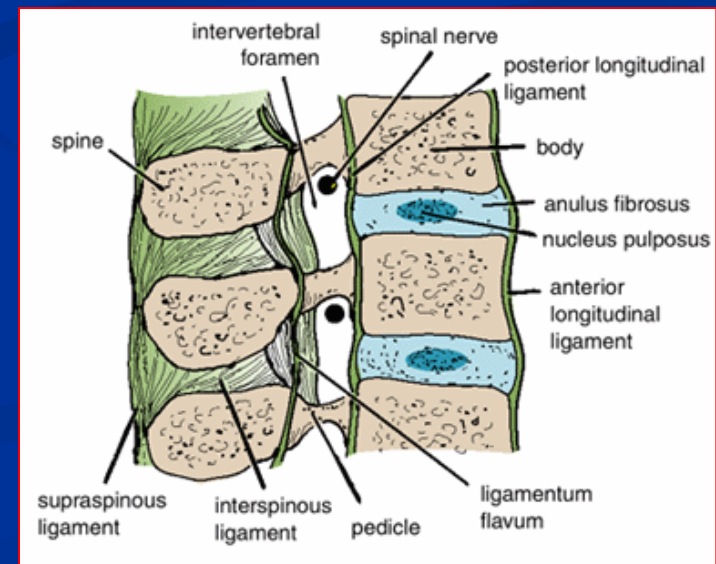
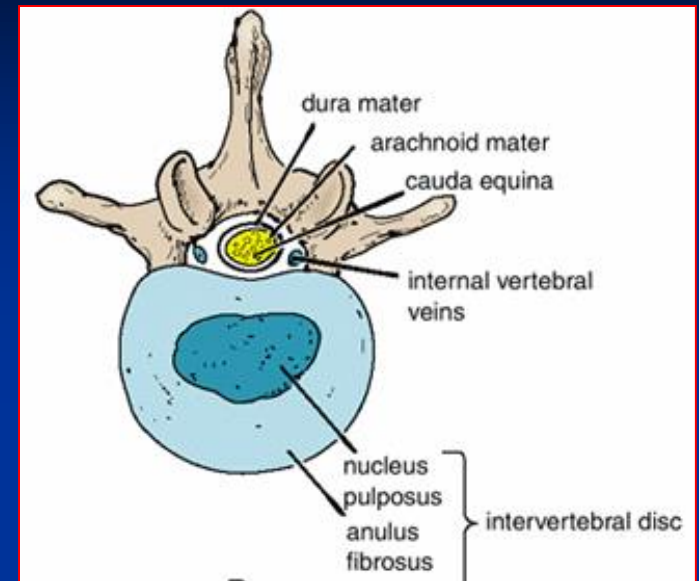
# JOINTS BETWEEN TWO VERTEBRAL BODIES

- It is a secondary cartilaginous joint.
- The **upper** and **lower** surfaces of the **bodies** of 2 adjacent vertebrae are covered by **thin plates** of **hyaline cartilage**.
- Sandwiched between the plates of hyaline cartilage is an **intervertebral disc** of **fibrocartilage**.



# INTERVERTEBRAL DISCS

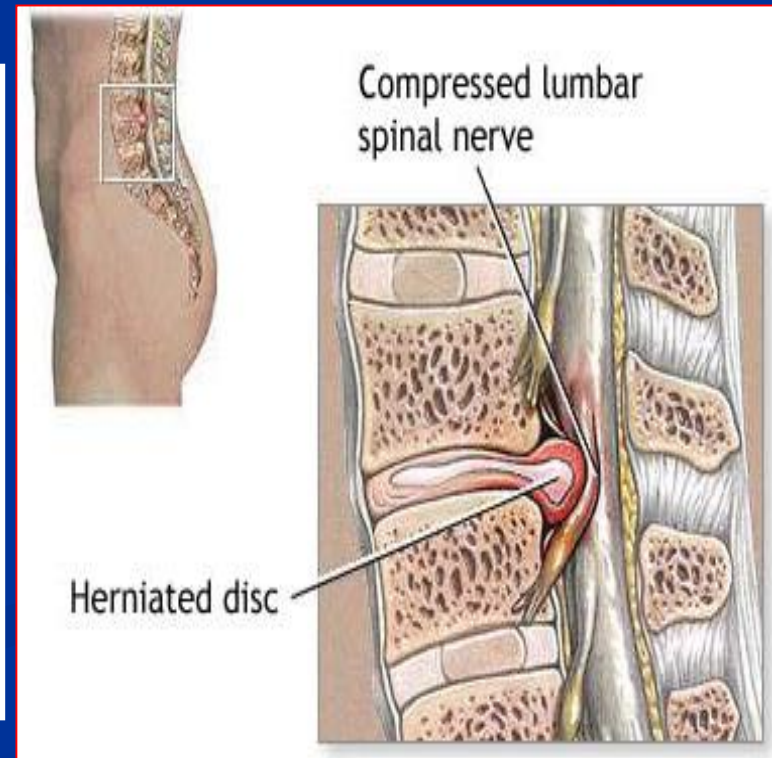
- The intervertebral discs form about one **fourth** of the whole length of the vertebral column.
- They are **thickest** in the **cervical** and **lumbar** regions, where the movements of the vertebral column are greatest.
- Each disc consists of a:
  - **Peripheral part, called the annulus fibrosus**, composed of fibrocartilage.
  - **Central part, called the nucleus pulposus**, a mass of gelatinous material.
  - The nucleus pulposus formed of:
    1. Large amount of water,
    2. Small number of collagen fibers,
    3. Few cartilage cells.
- **No discs** are found between the first & second cervical vertebrae or in the sacrum or coccyx.

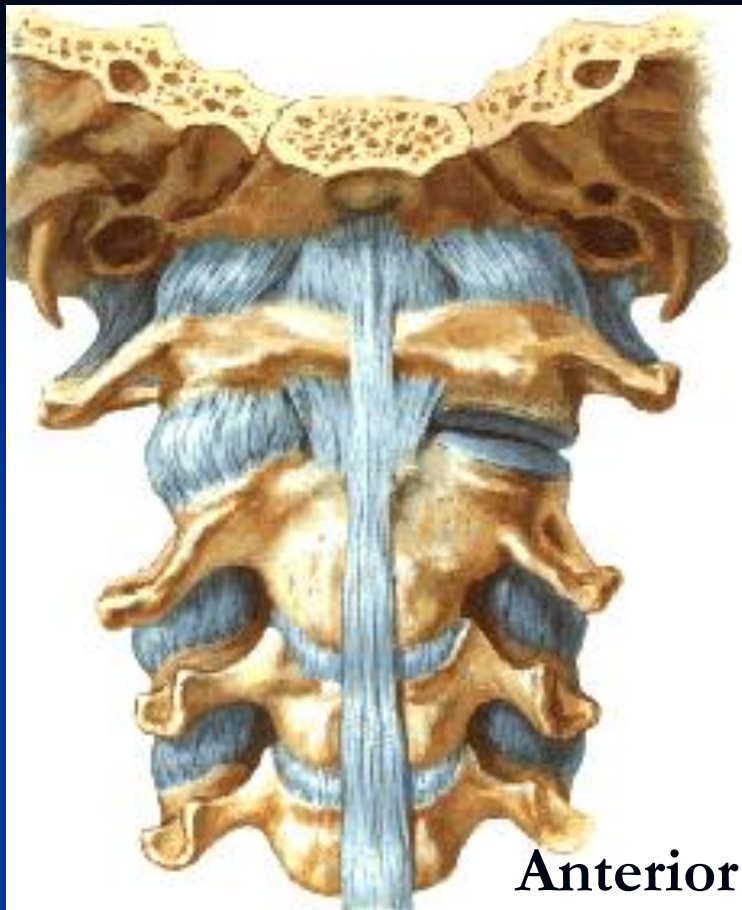


# FUNCTION OF INTERVERTEBRAL DISCS

- **Allow** one vertebra to rock forward or backward on another, as in **flexion and extension of vertebral column**.
- **Serve as shock absorbers** when the load on the vertebral column is suddenly increased, as **when one is jumping**.

- Sometimes, the **annulus fibrosus** ruptures, allowing the **nucleus pulposus** to herniate and protrude into the vertebral canal, where it may press on the spinal nerve roots, or the spinal nerve, or even spinal cord itself.





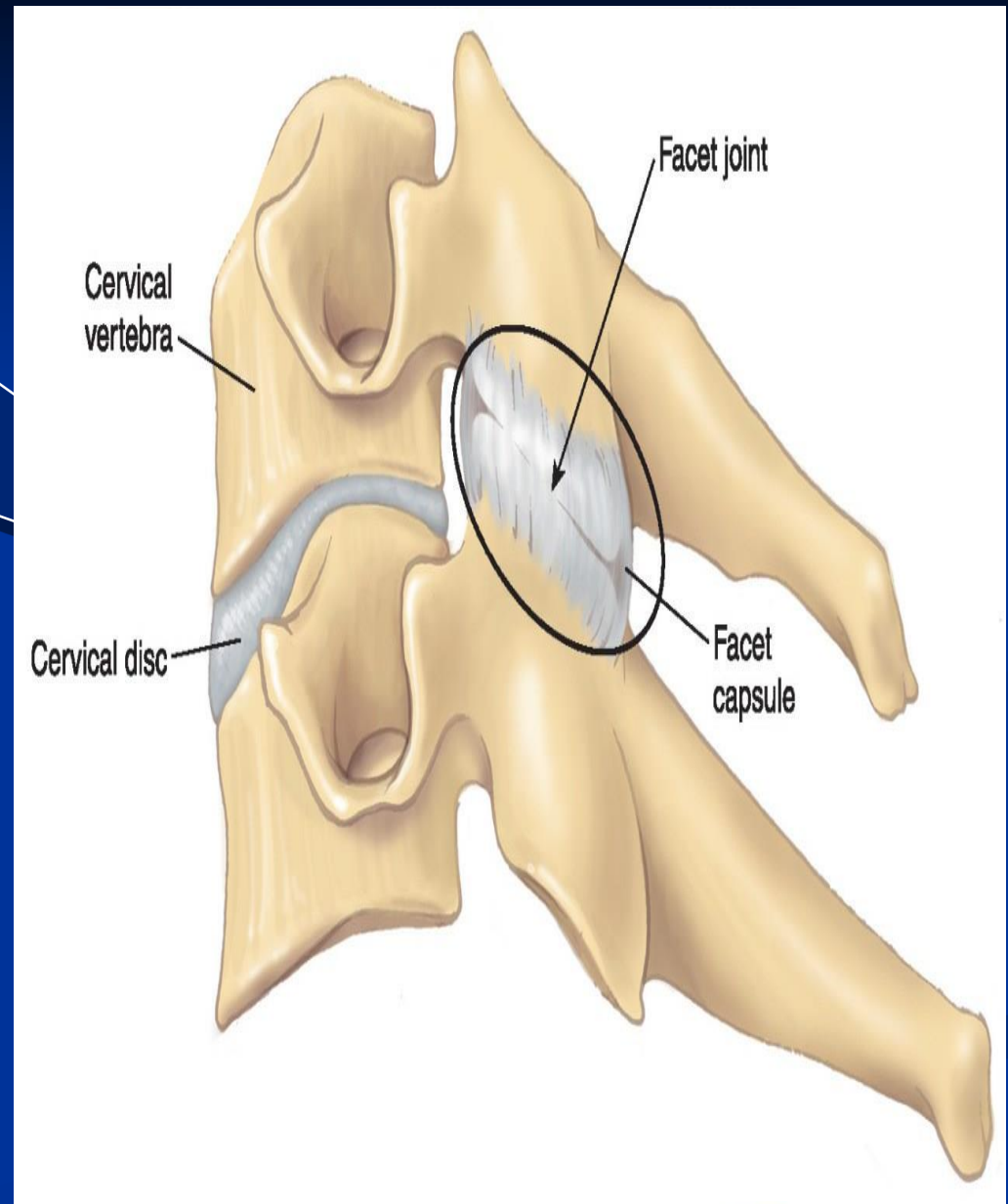
# L I G A M E N T S



- The anterior and posterior longitudinal ligaments run as continuous bands along the anterior & posterior surfaces of the vertebral bodies.
- These ligaments hold the vertebrae firmly together but at the same time permit a small amount of **movement** to take place.

The joints between two vertebral arches consist of synovial joints between the superior and inferior articular processes of 2 adjacent vertebrae.

The articular facets are covered with hyaline cartilage, and the joints are surrounded by a fibrous capsule.



# OTHER LIGAMENTS

## Supraspinous ligament:

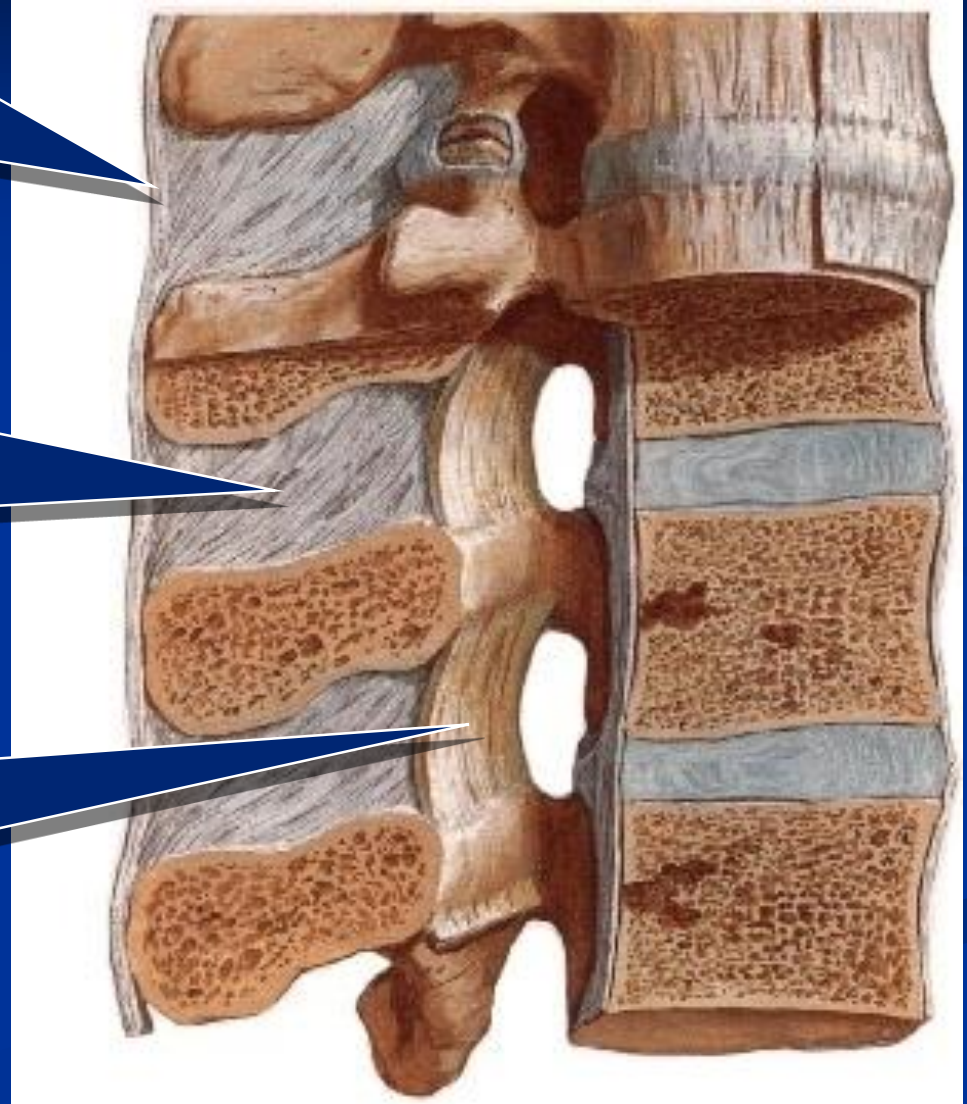
It runs between the tips of adjacent spines.

## Interspinous ligament:

It connects adjacent spines.

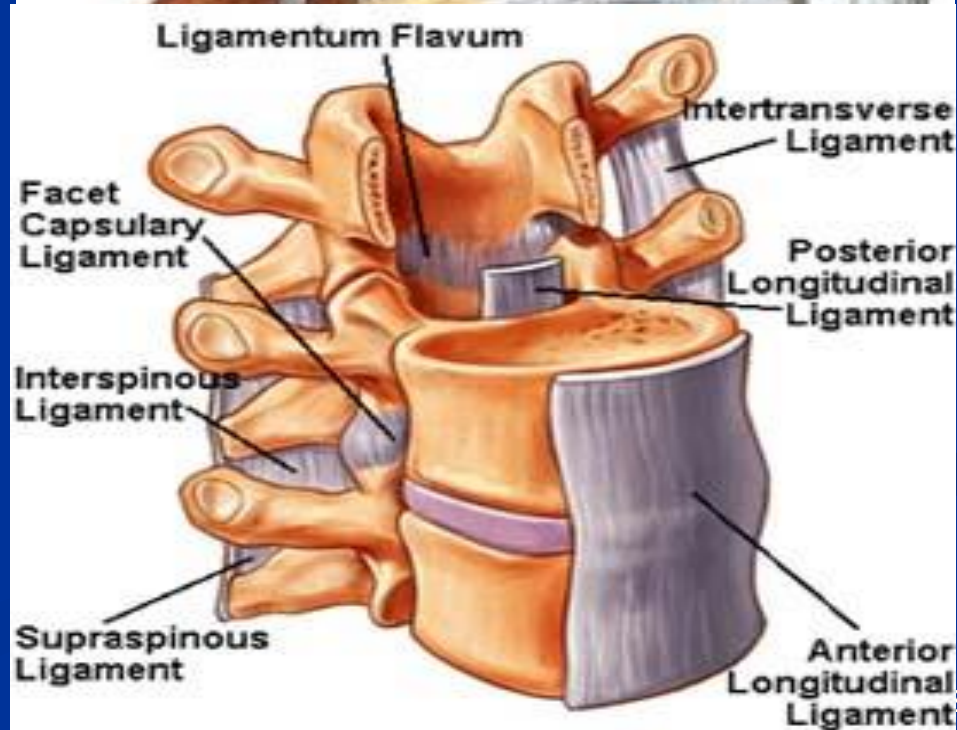
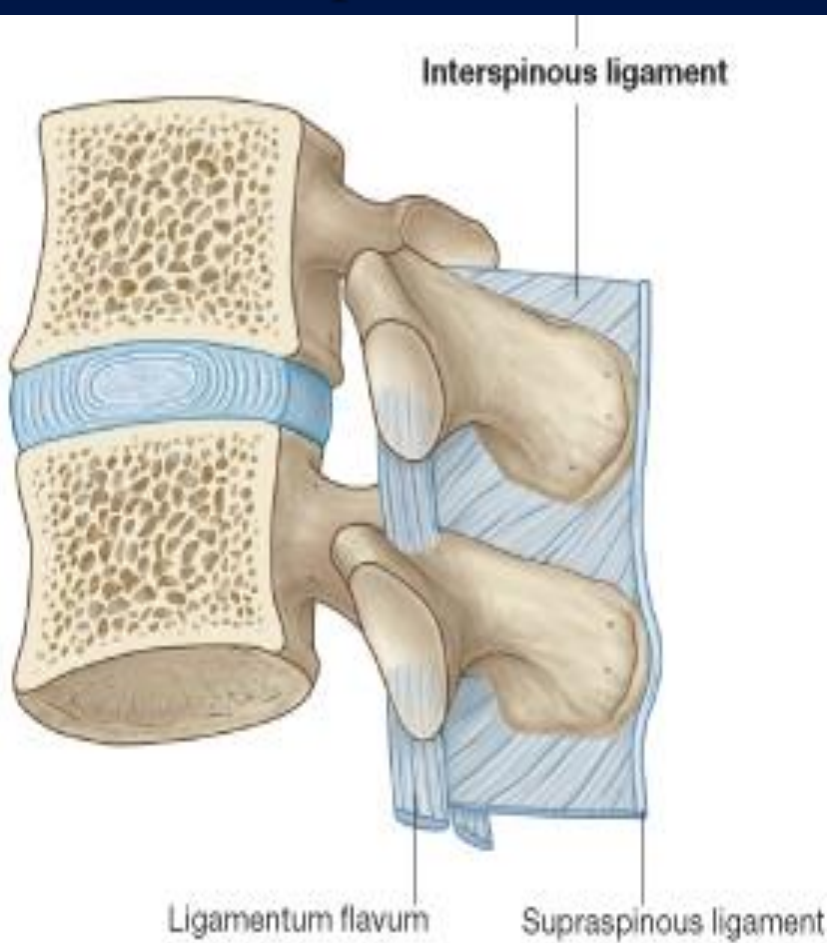
## Ligamentum flavum:

It connects the laminae of adjacent vertebrae.



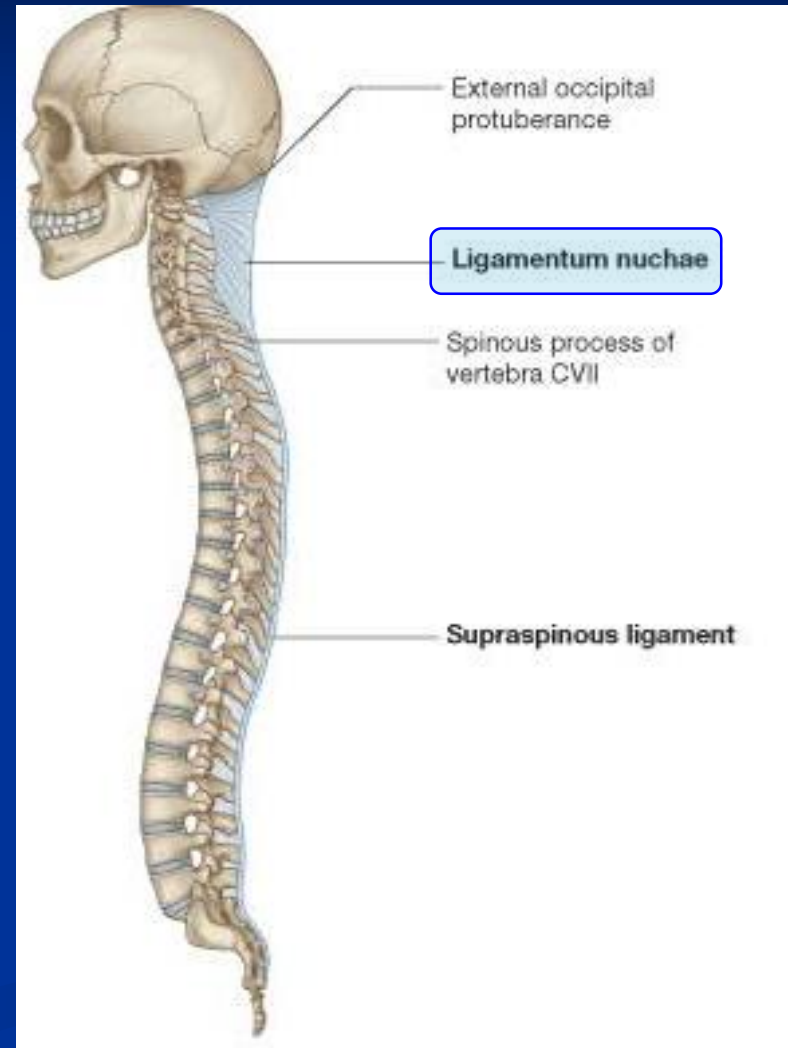
# Intertransverse ligaments

It connects 2 adjacent transverse processes.



# LIGAMENTUM NUCHAE

- In the cervical region, the **Supraspinous** and **Interspinous** ligaments are thickened to form the strong **ligamentum nuchae**.
- It extends from the external occipital protuberance of the skull to the spine of the **seventh** cervical vertebra.
- Its anterior border is strongly attached to the cervical spines in between.





THANK YOU  
AND  
GOOD LUCK