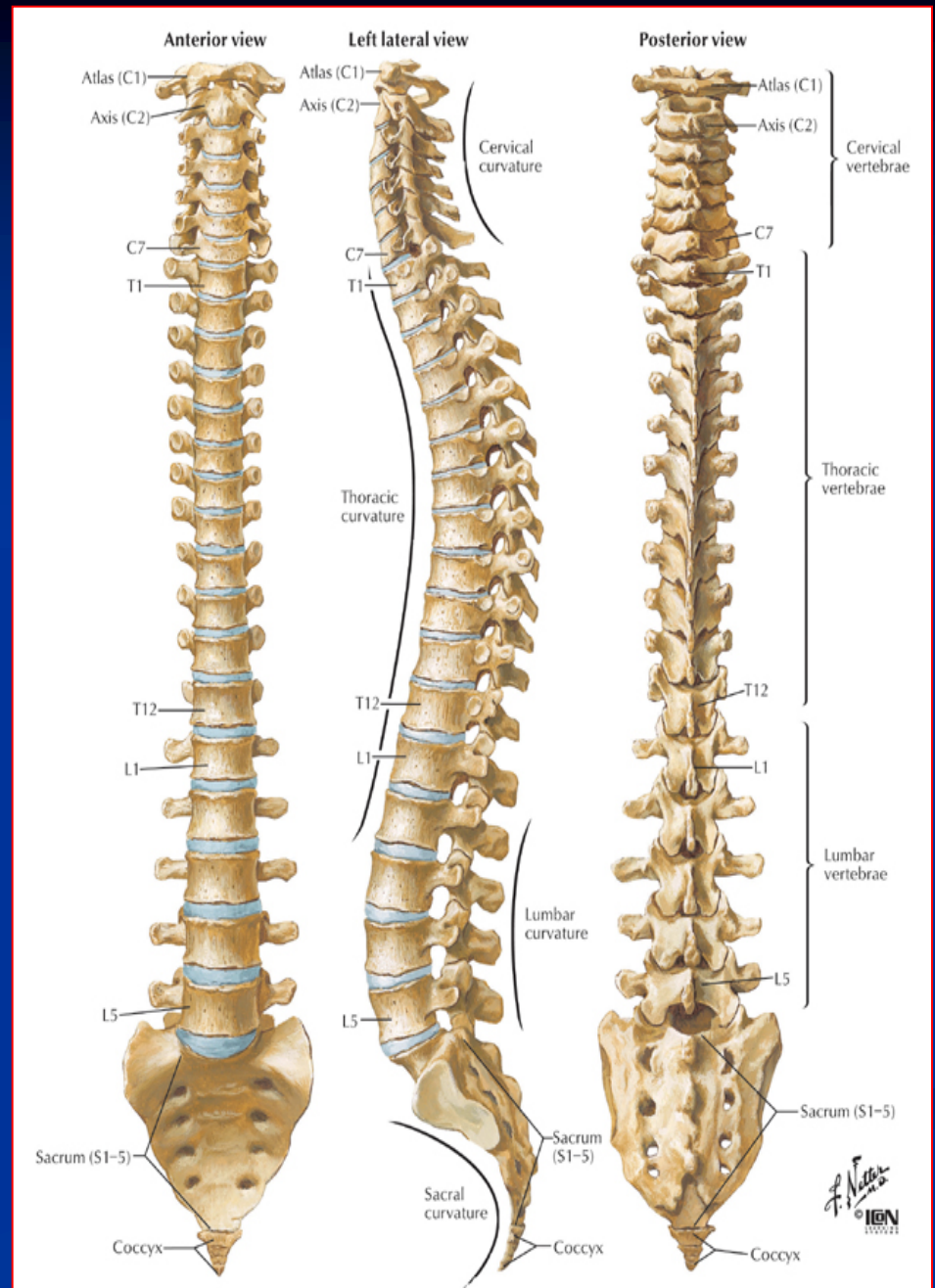


# ANATOMY OF THE SPINE

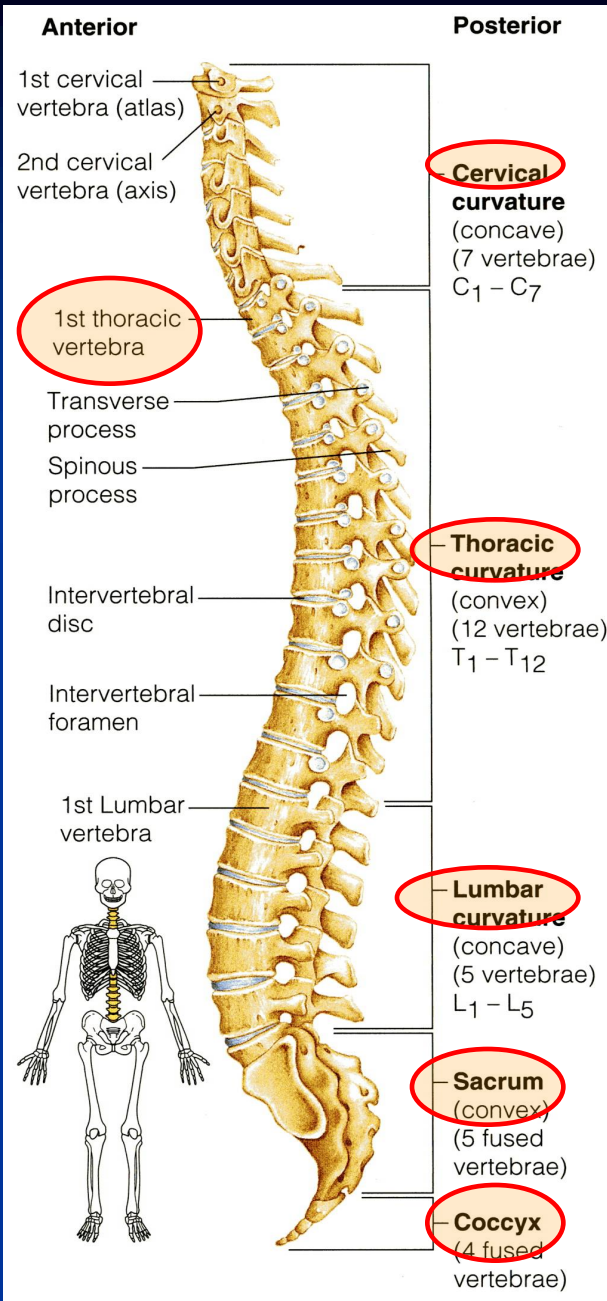


BY DR.SANAA  
ALSHAARAWY

# Objectives

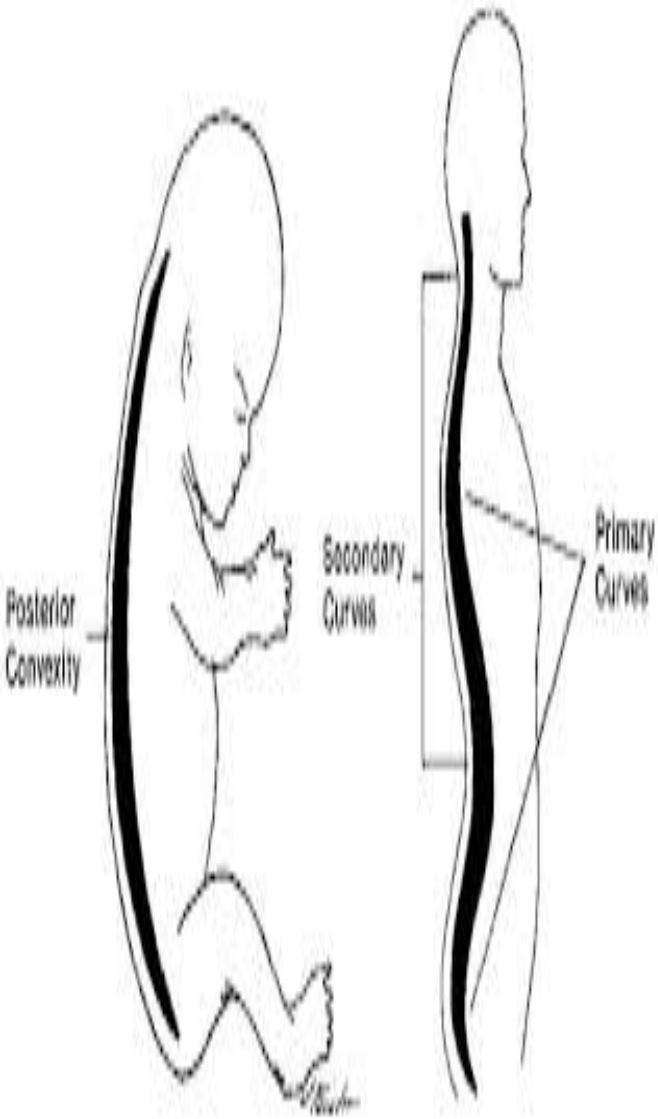
- *By the end of this lecture you should be able to:*
- Distinguish and describe the cervical, thoracic, lumbar, sacral and coccygeal vertebrae.
- Describe the vertebral curvatures.
- Describe the movement which occur in each region of the vertebral column.
- List the structures which connect 2 adjacent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

# SPINE OR VERTEBRAL COLUMN



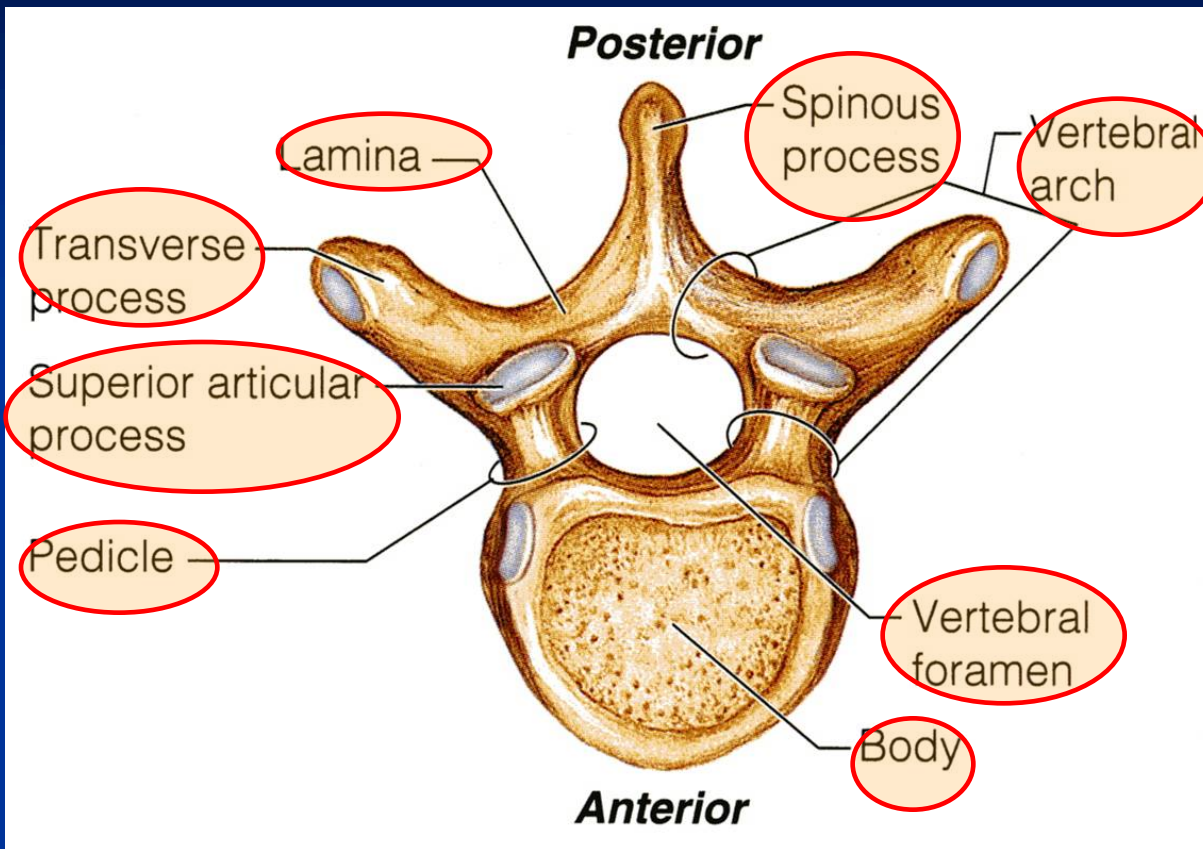
- The **vertebral column** extends from the skull to the pelvis.
- It surrounds and protects the **spinal cord** and supports the whole body.
- It is formed from **33** irregular **vertebrae**.
- It consists of **24 single vertebrae** and **2 bones** :
  - **Sacrum**, (5 fused vertebrae).
  - **Coccyx**,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

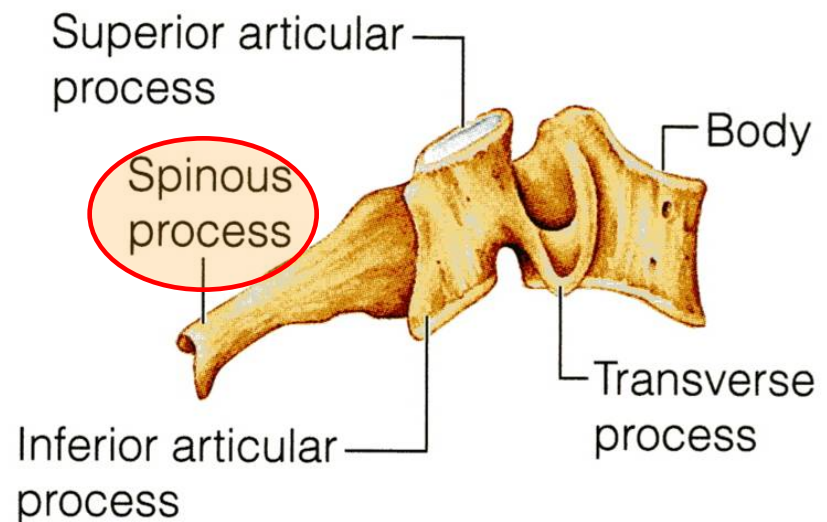
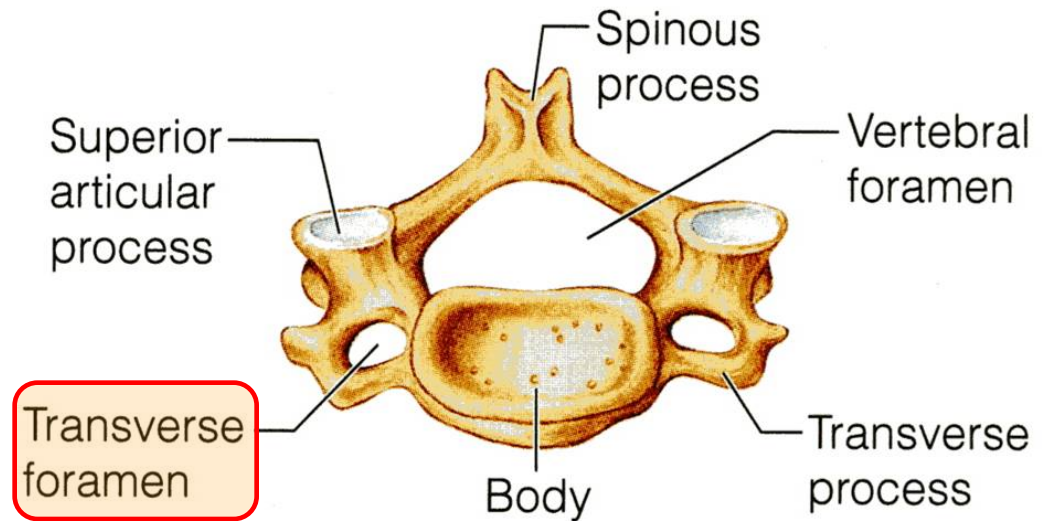
- **The vertebral arch carries 7 process:**

- **2 Transverse processes:**

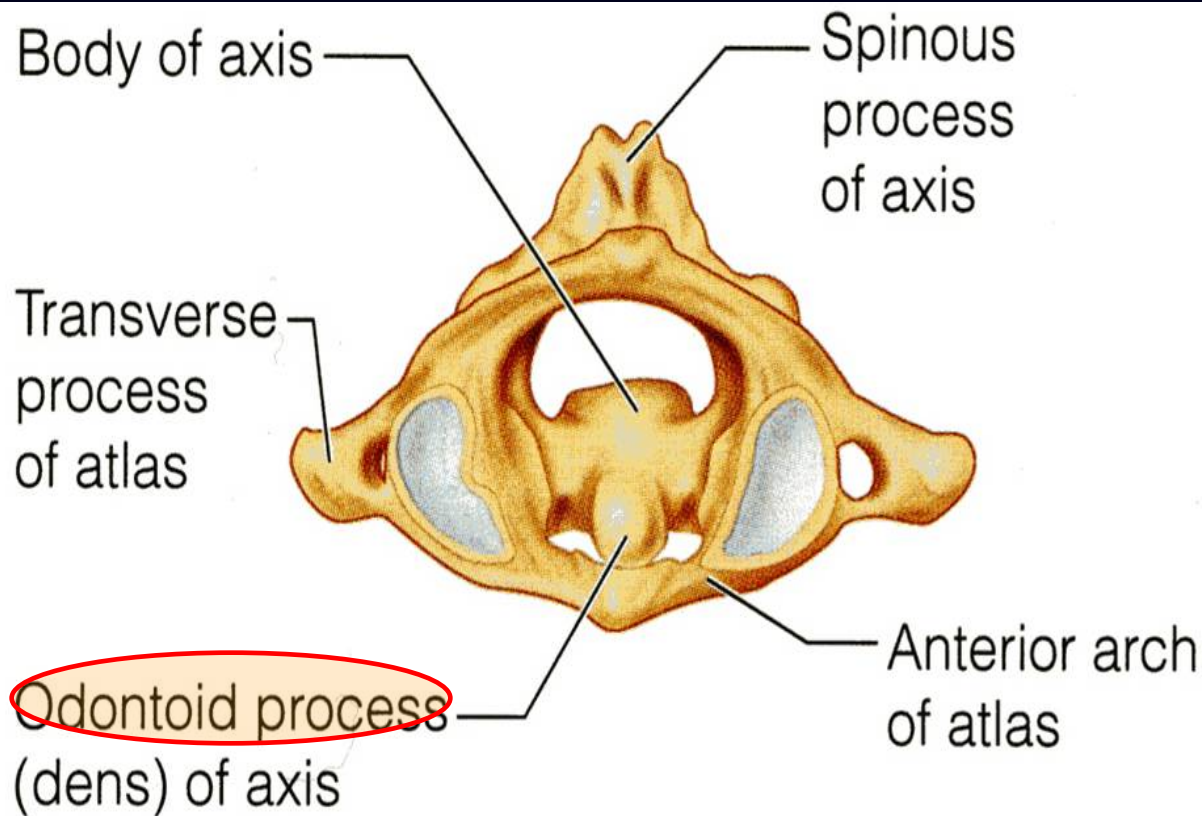
- Lateral projections from the vertebral arch.

# TYPICAL CERVICAL VERTEBRAE

- The "typical" cervical vertebrae (**C<sub>3</sub> to C<sub>6</sub>**) 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.



# 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."**

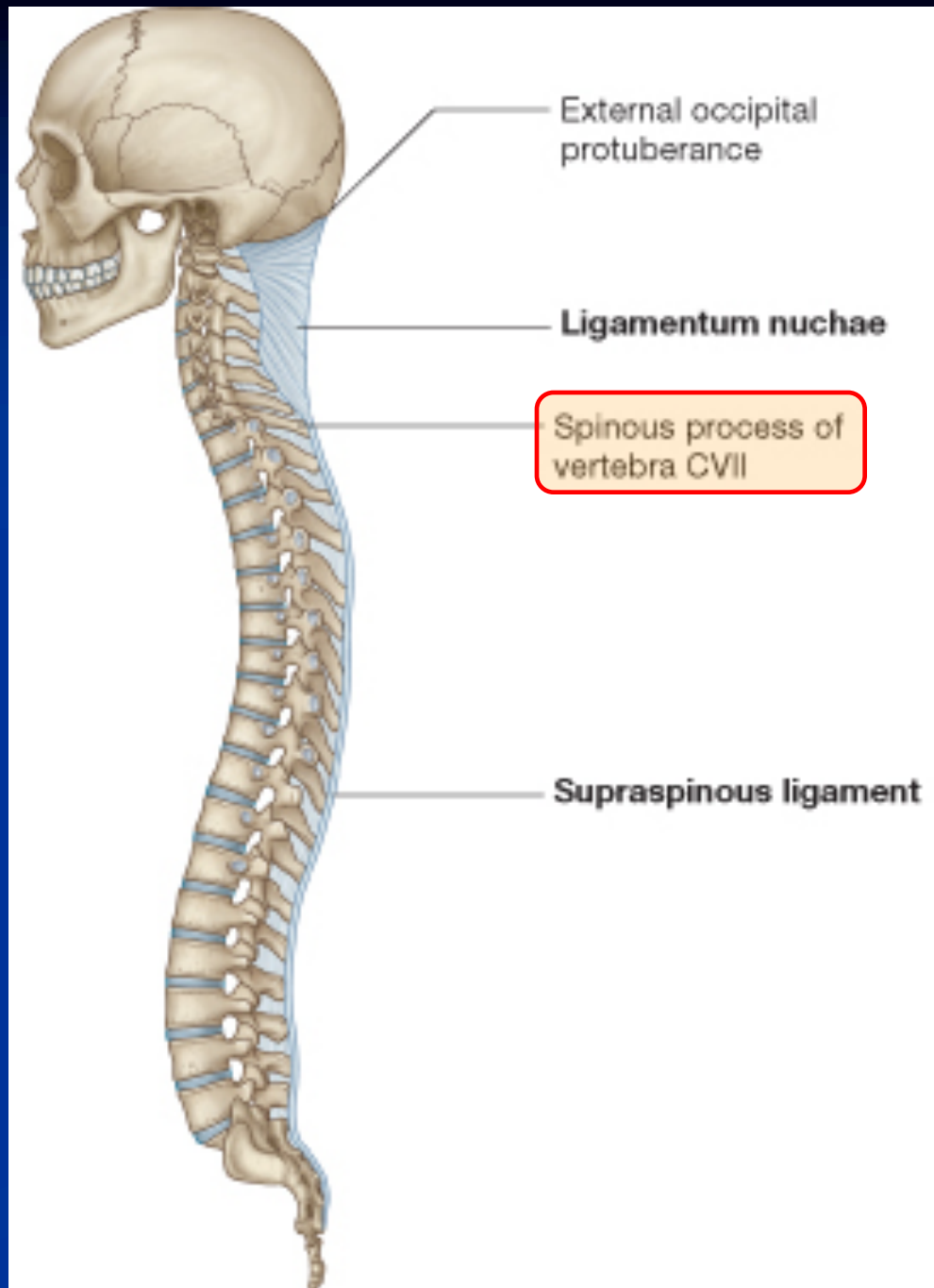
**The axis (C<sub>2</sub>)** acts as a pivot for the rotation of the atlas (and the skull) above.

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."

# 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.

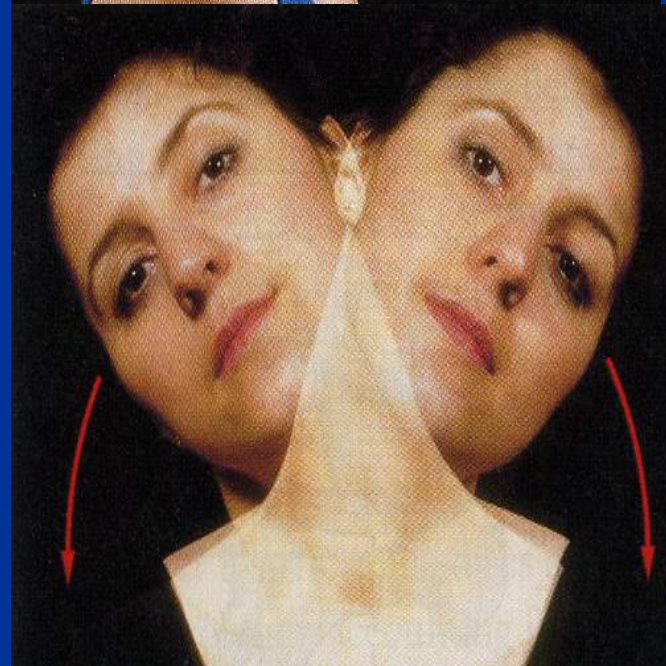
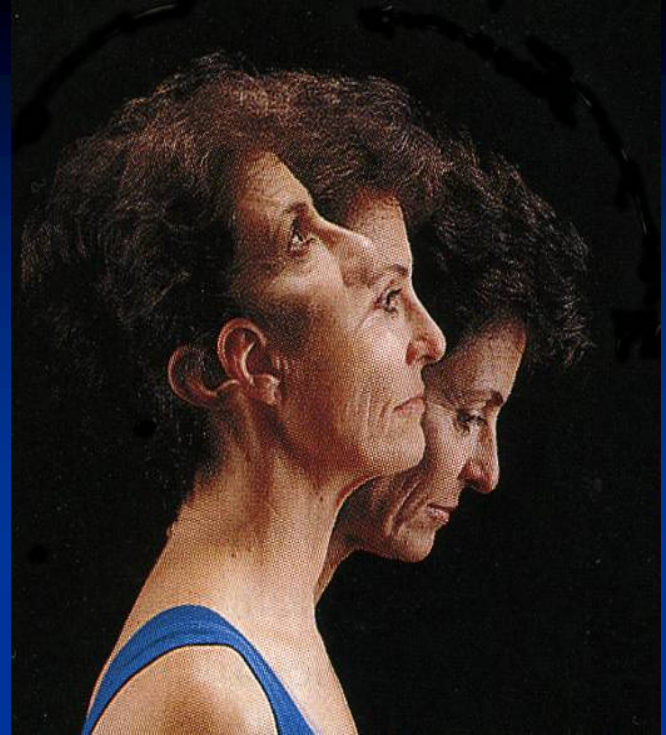




# MOVEMENTS IN THE **ATLANTO-OCCIPITAL** JOINT

## The joints are capable of:

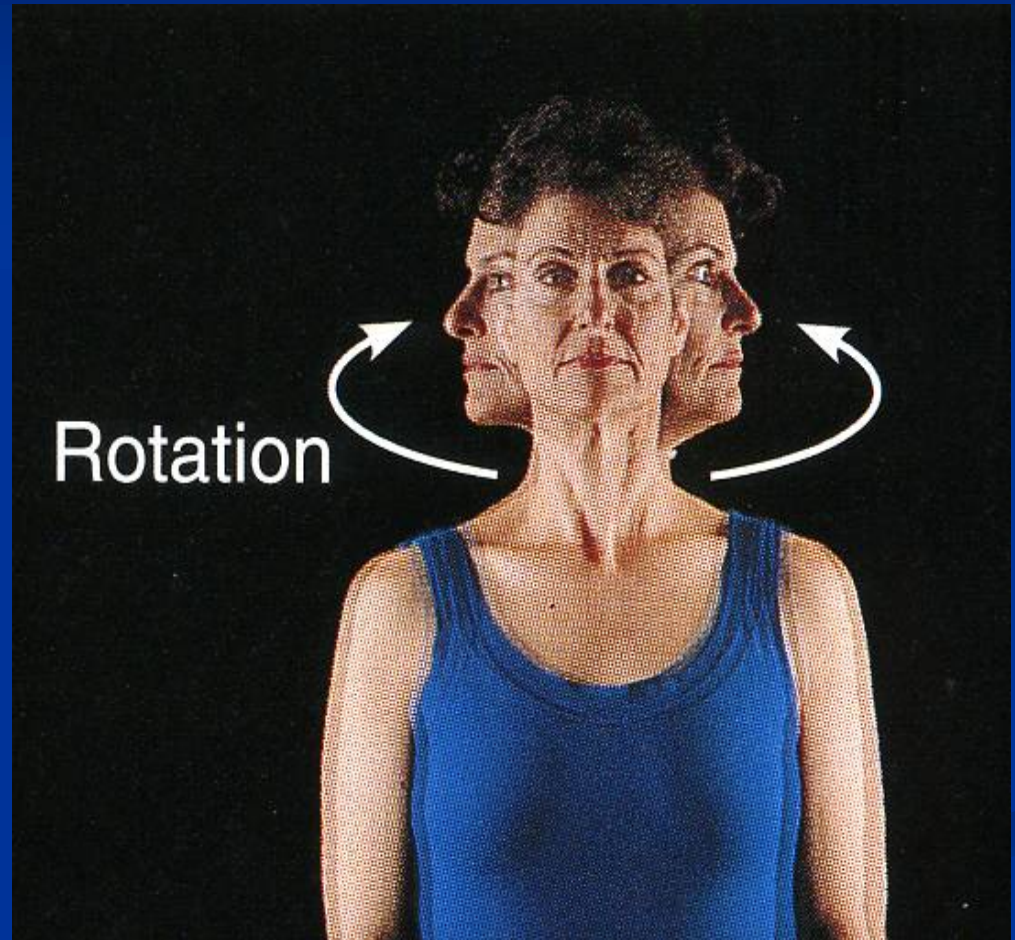
- Flexion,
- Extension, and
- Lateral flexion;
- They do not rotate.



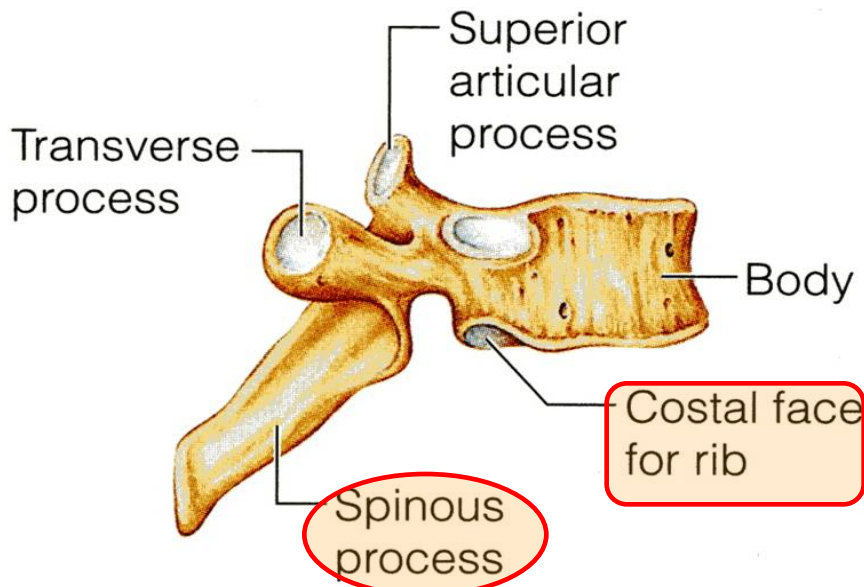
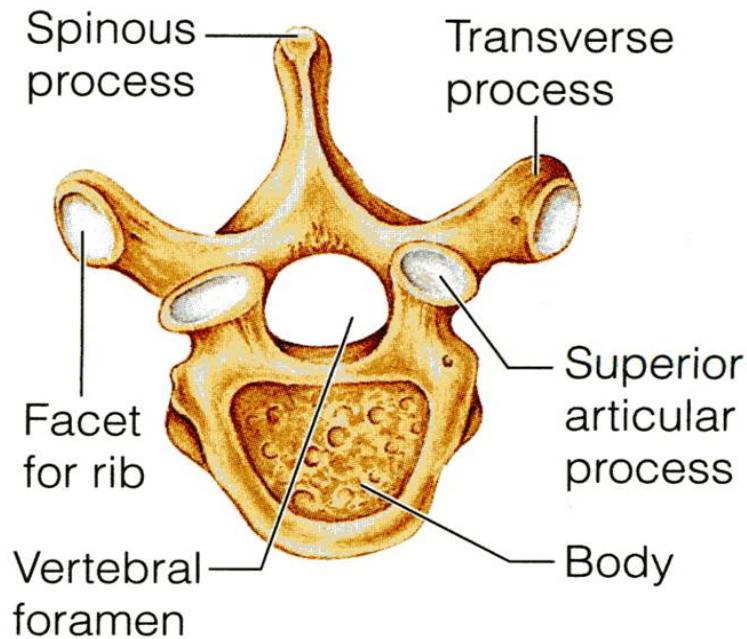
# MOVEMENTS IN THE **ATLANTO-AXIAL** JOINT

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

That is to say **“NO”**

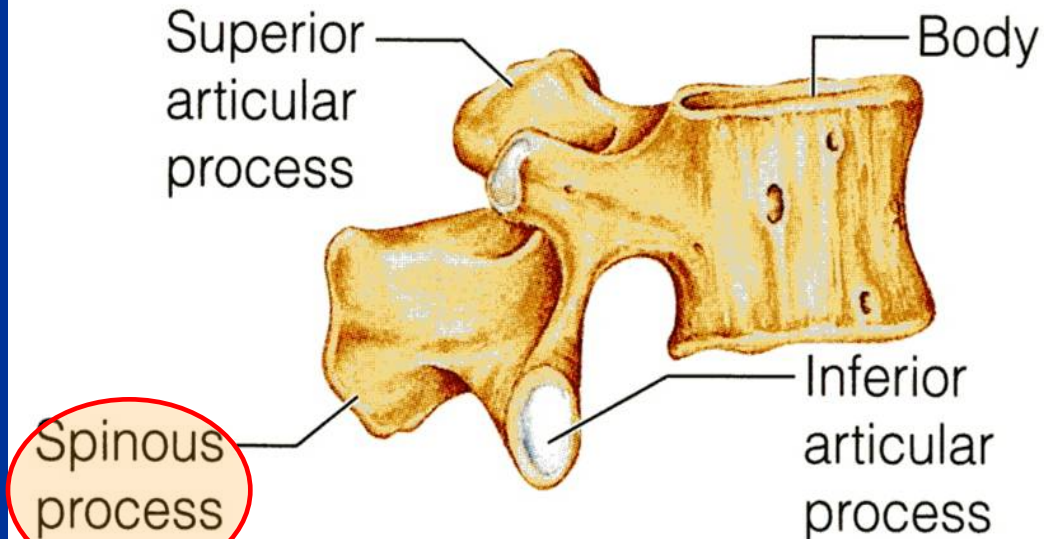
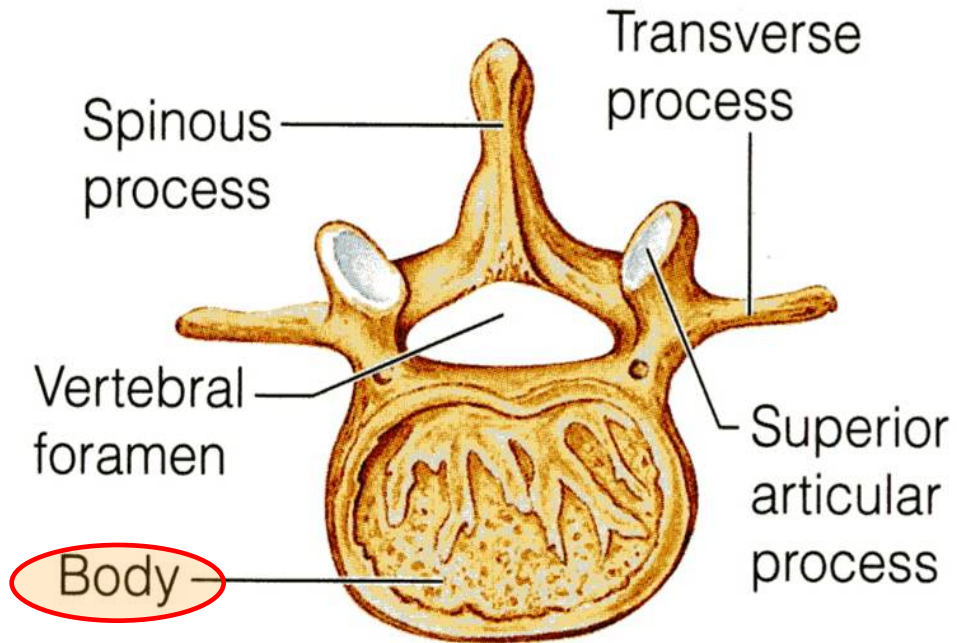


# THORACIC VERTEBRAE



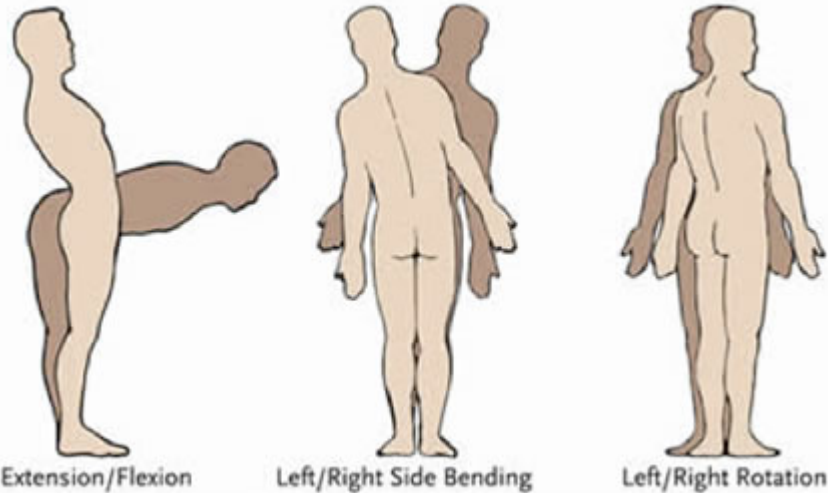
- The **12 thoracic vertebrae** (T<sub>1</sub>-T<sub>12</sub>) are almost typical.
- They are larger than the cervical vertebrae.
- The body is somewhat heart-shaped and has **two costal demifacets** (articulating surfaces) **on each side**, which receive the **heads of the ribs**.
- The **spinous process**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



These movements are **extensive** in lumbar spine **But restricted** in thoracic spine.

This rotation is **extensive** in thoracic spine **But least extensive** in Lumbar 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.

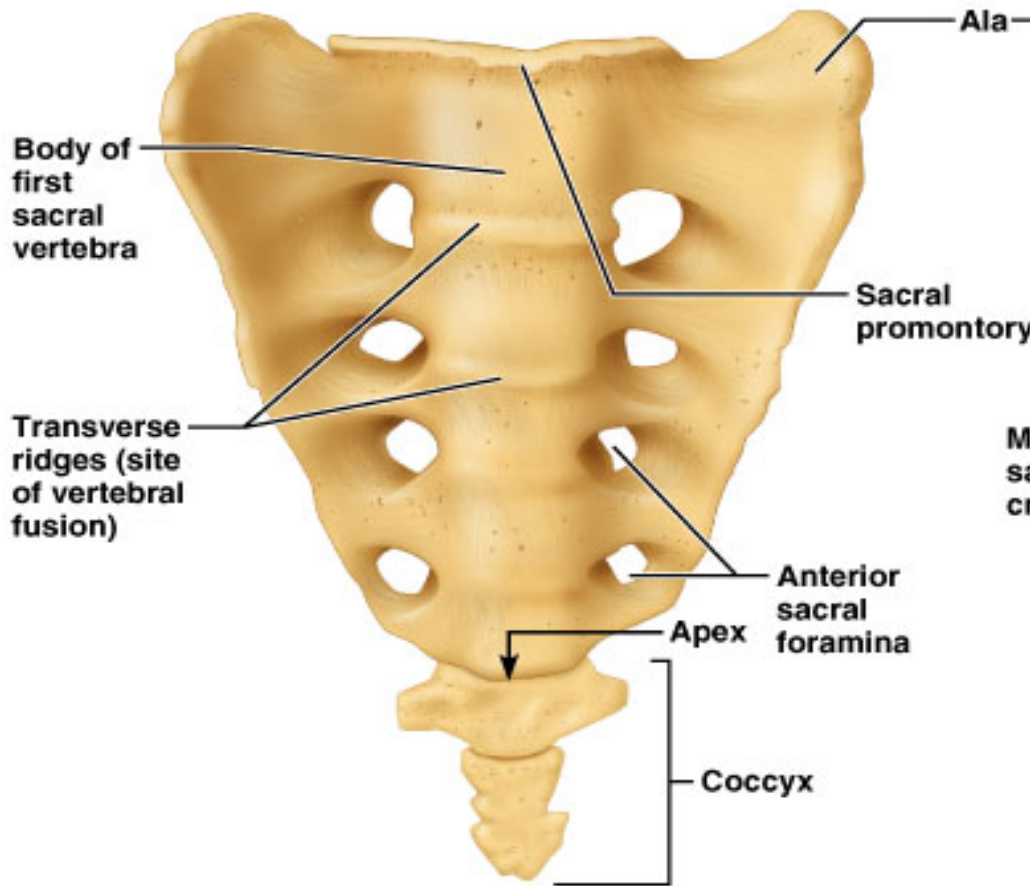
**Flexion, extension and lateral flexion :**

Are **extensive** in the **lumbar regions** but restricted in the thoracic region.

**Rotation :**

Is **extensive** in **thoracic spine** and **least extensive** in the lumbar region.

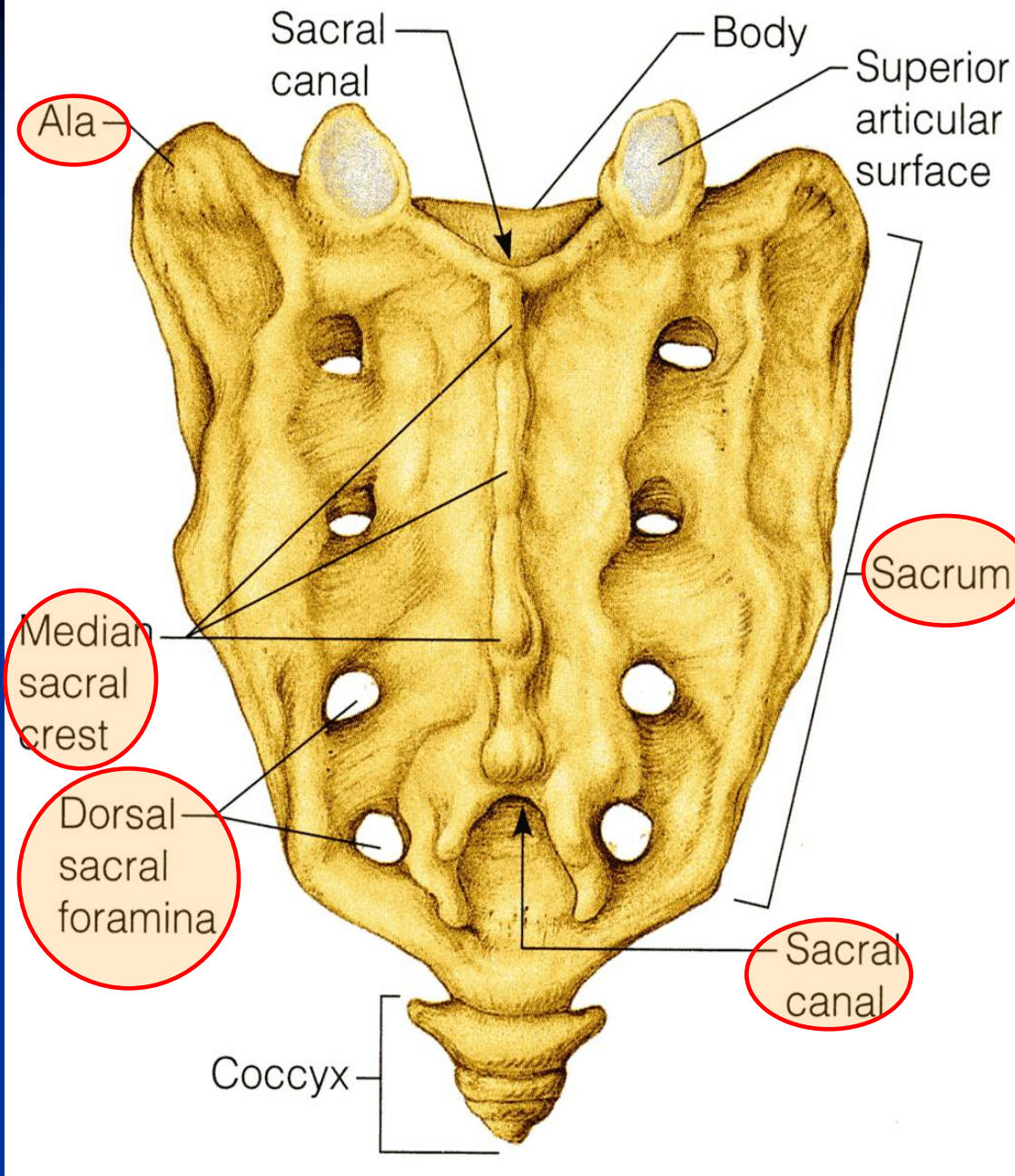
# SACRUM



(a) Anterior view

- 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 **1<sup>st</sup> 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**.

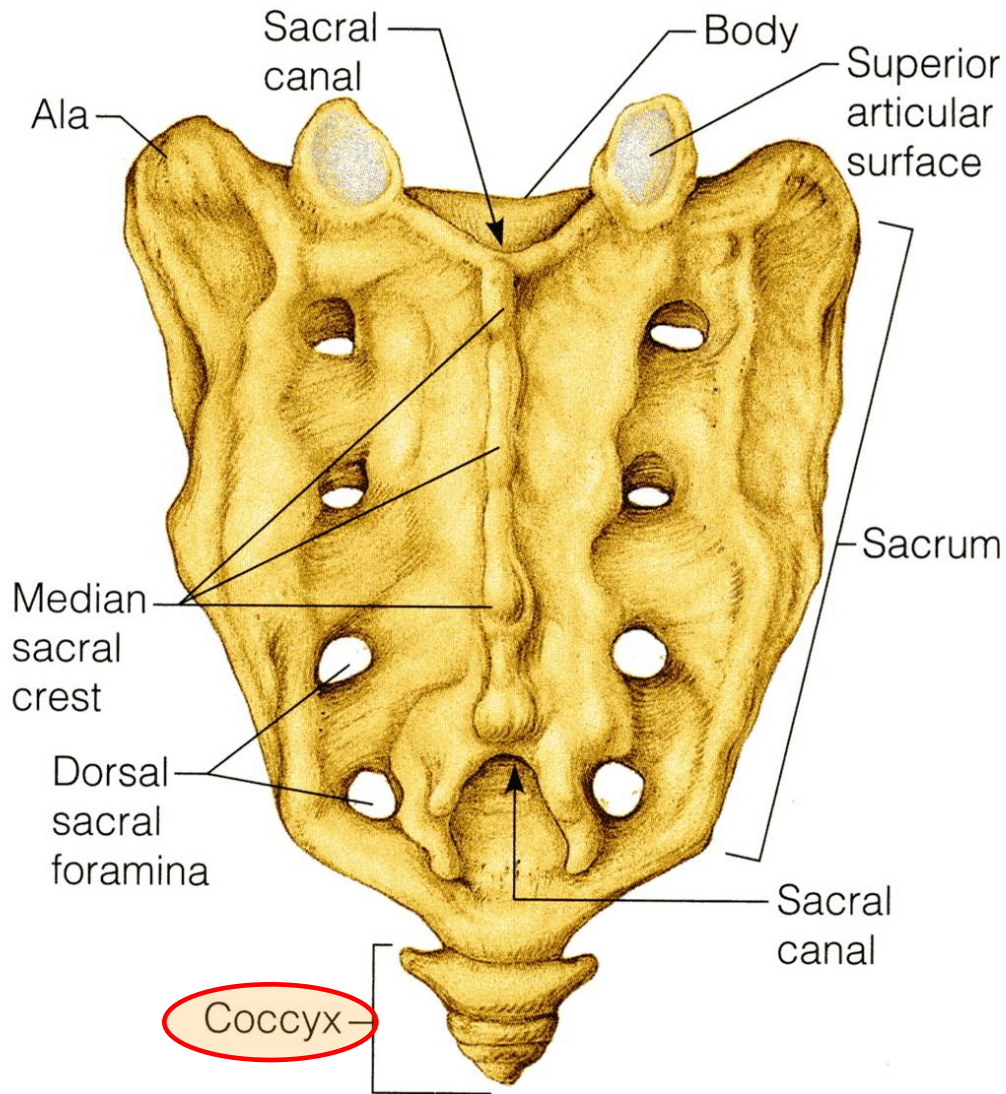
# SACRUM



- 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 canal opens inferiorly in what is called **sacral hiatus**.

# COCCYX

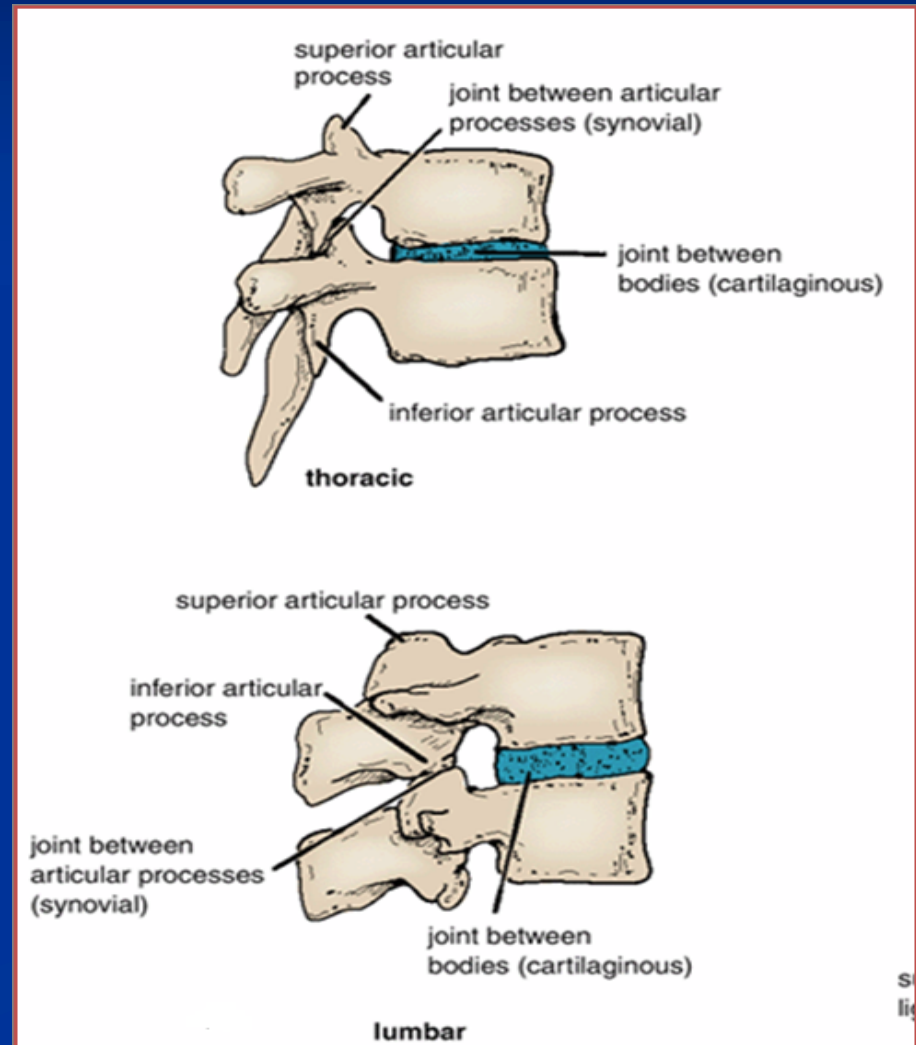
The **coccyx** is formed from the fusion of 4 tiny, irregularly shaped vertebrae.





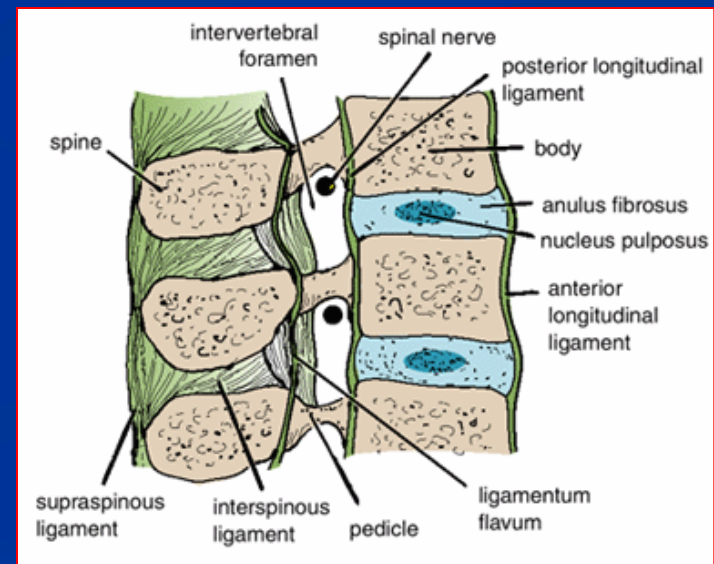
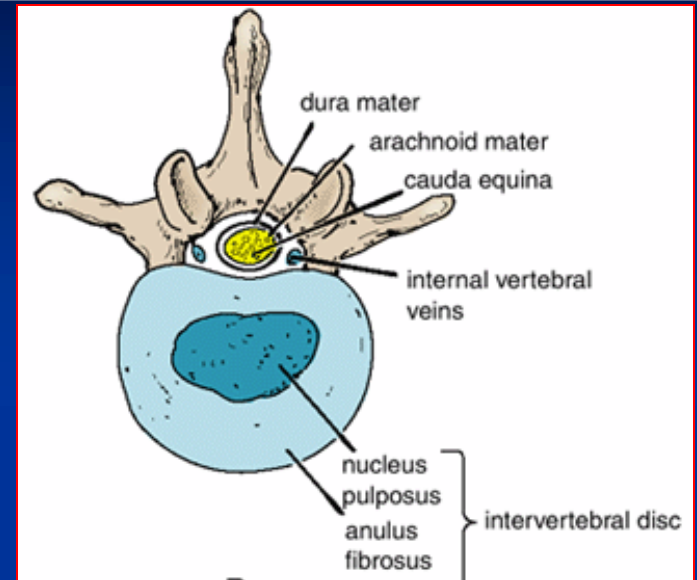
# JOINTS BETWEEN TWO VERTEBRAL BODIES

- 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

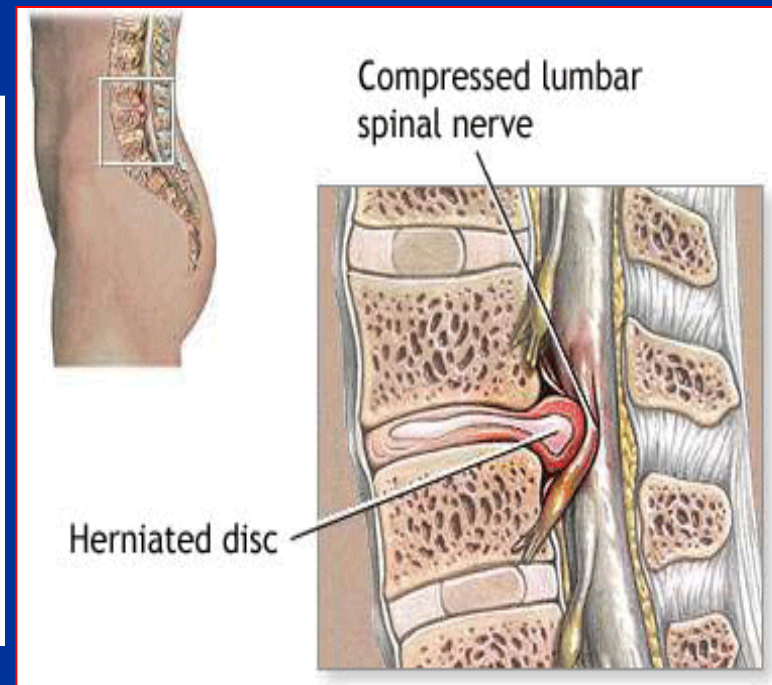
- The **intervertebral discs** forms about **one fourth** of the whole length of the vertebral column.
- They are **thickest** in the **cervical** and **lumbar** regions, **where the movements** of the vertebral column are **greatest**.
- **Each disc consists of a:**
  - **Peripheral part**, called the **anulus fibrosus**, composed of fibrocartilage.
  - **Central part**, 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**.

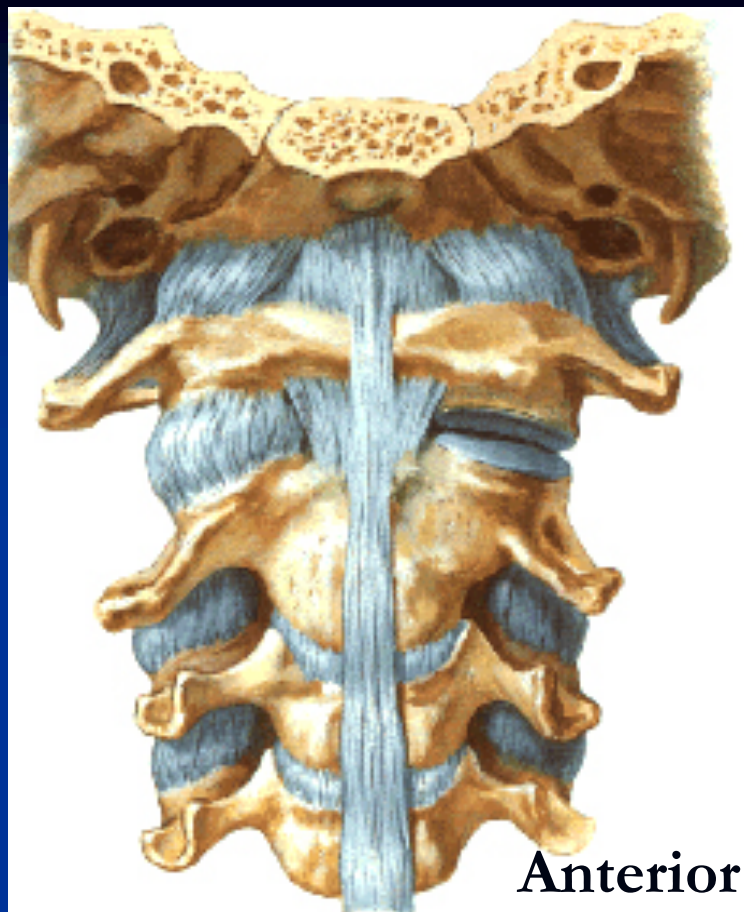


# INTERVERTEBRAL DISCS FUNCTION

- **Allow** one vertebra to rock forward or backward on another, as in **flexion and extension of the 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 the **spinal cord** itself.





# LIGAMENTS



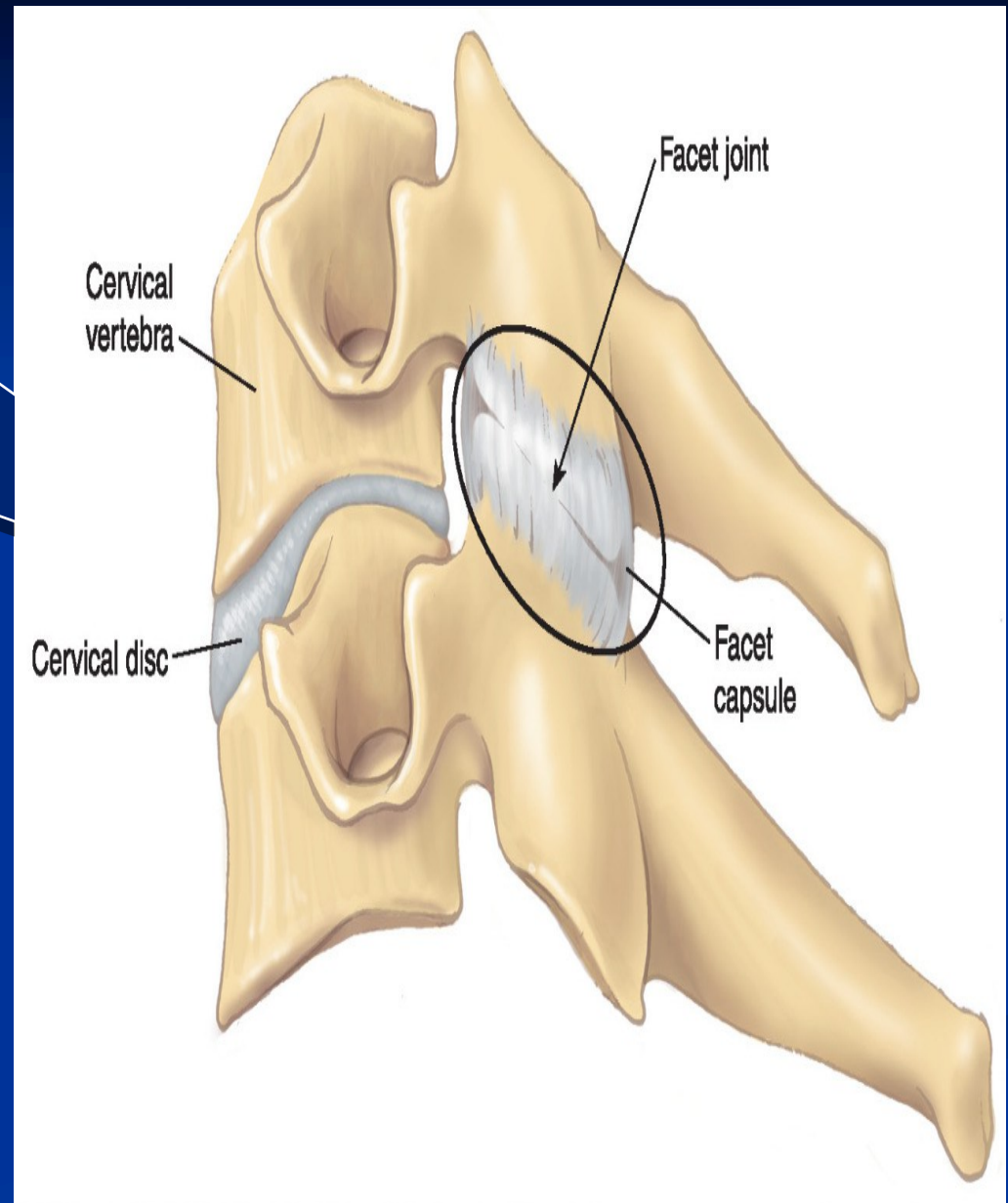
Anterior

POSTERIOR

- 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:

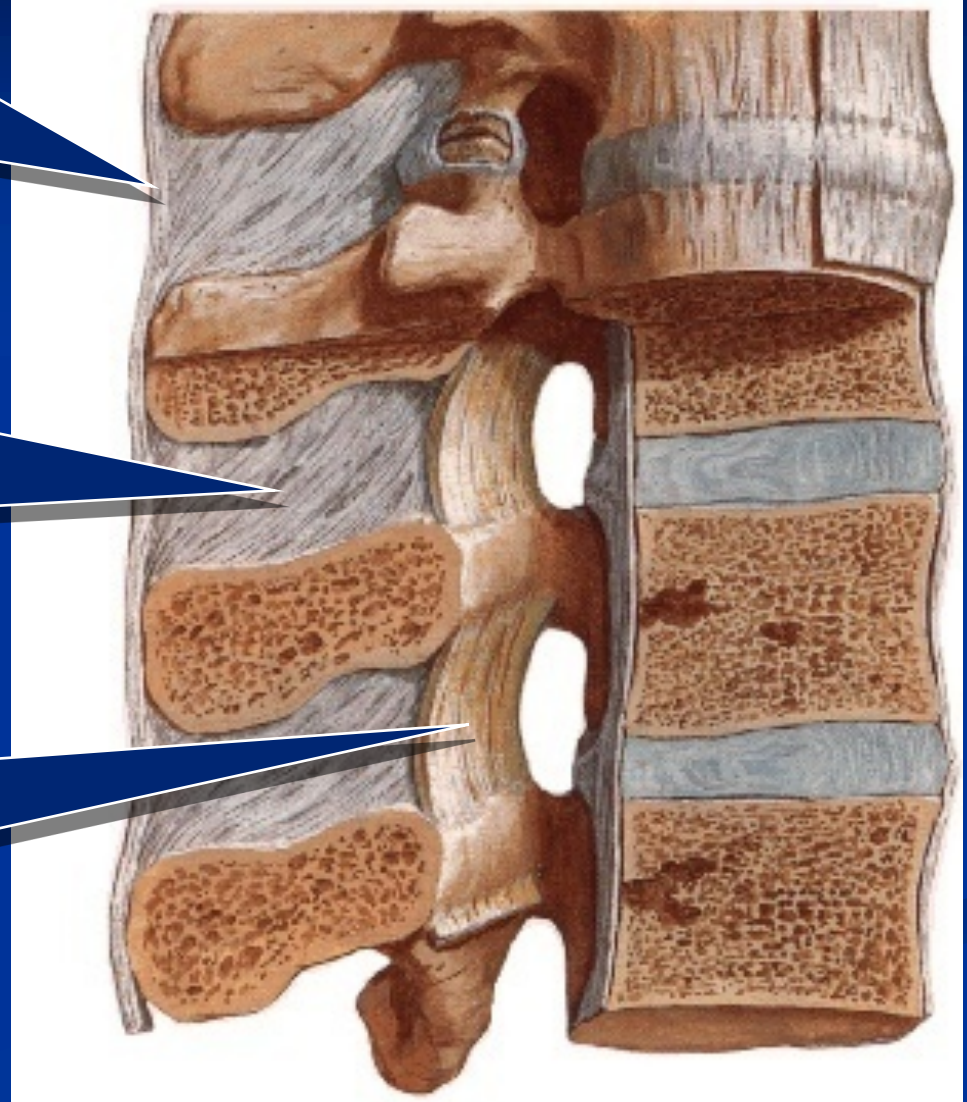
It runs between the **tips** of adjacent spines.

## Interspinous ligament:

It connects adjacent spines.

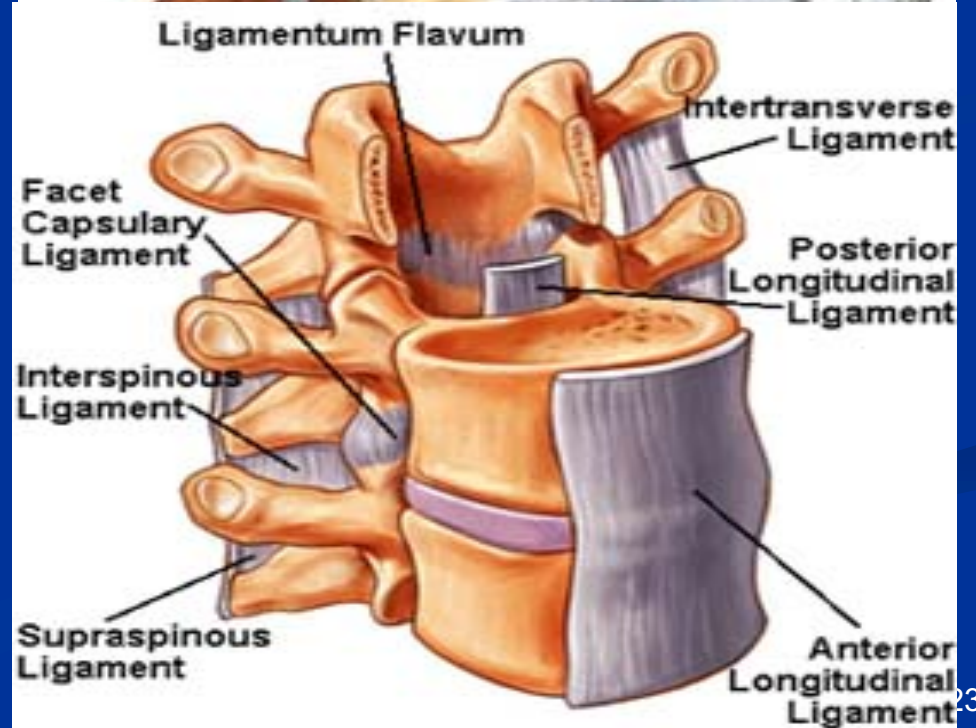
## Ligamentum flavum:

It connects the **laminae** of adjacent vertebrae.



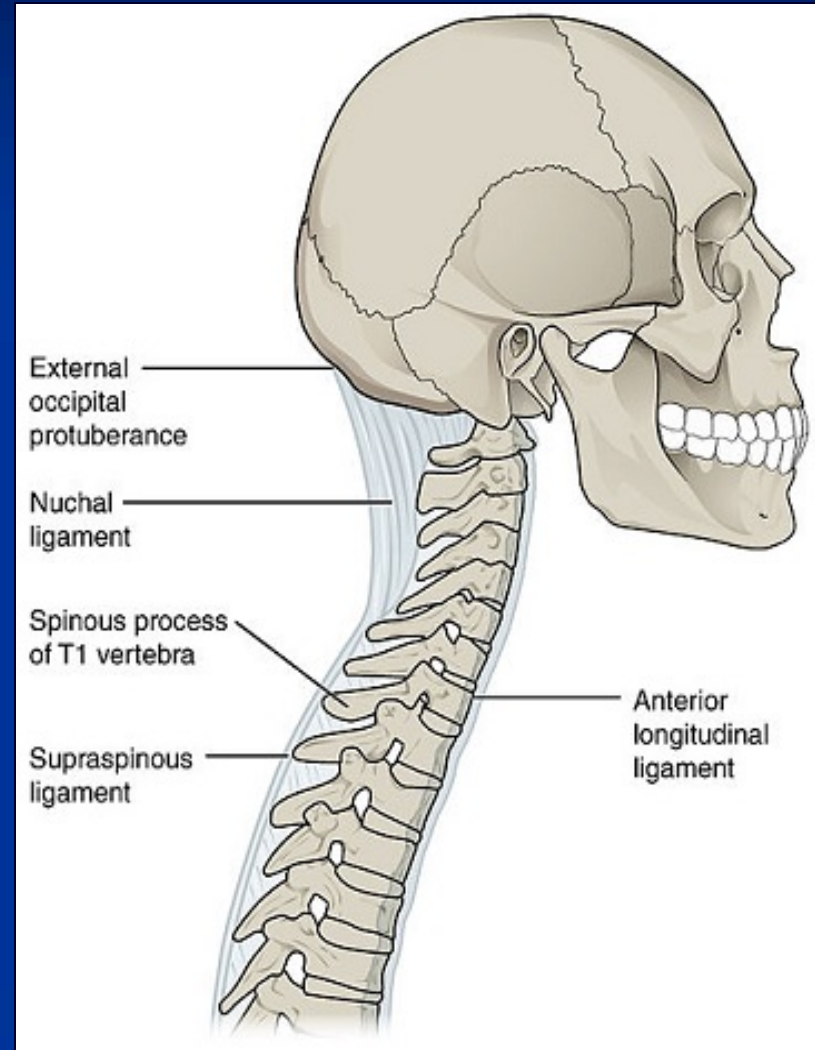
# Intertransverse ligaments

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

# FOR THE STUDENTS

**1. Which one of the following head movements contributes in the atlanto-axial joint?**

Flexion.

Extension.

Lateral flexion.

Lateral rotation.

**2. Which one of the following ligaments contributes in ligamentum nuchae ?**

Ligamentum flavum.

Intertransverse ligament.

Supraspinous ligament.

Anterior longitudinal ligament.

**3. In which vertebral region the extensive rotation of the spine occurs?**

Cervical.

Thoracic.

Lumbar.

Sacral.

**4. To which spine the ligamentum nuchae is attached ?**

T 12

C5.

C7.

S1.