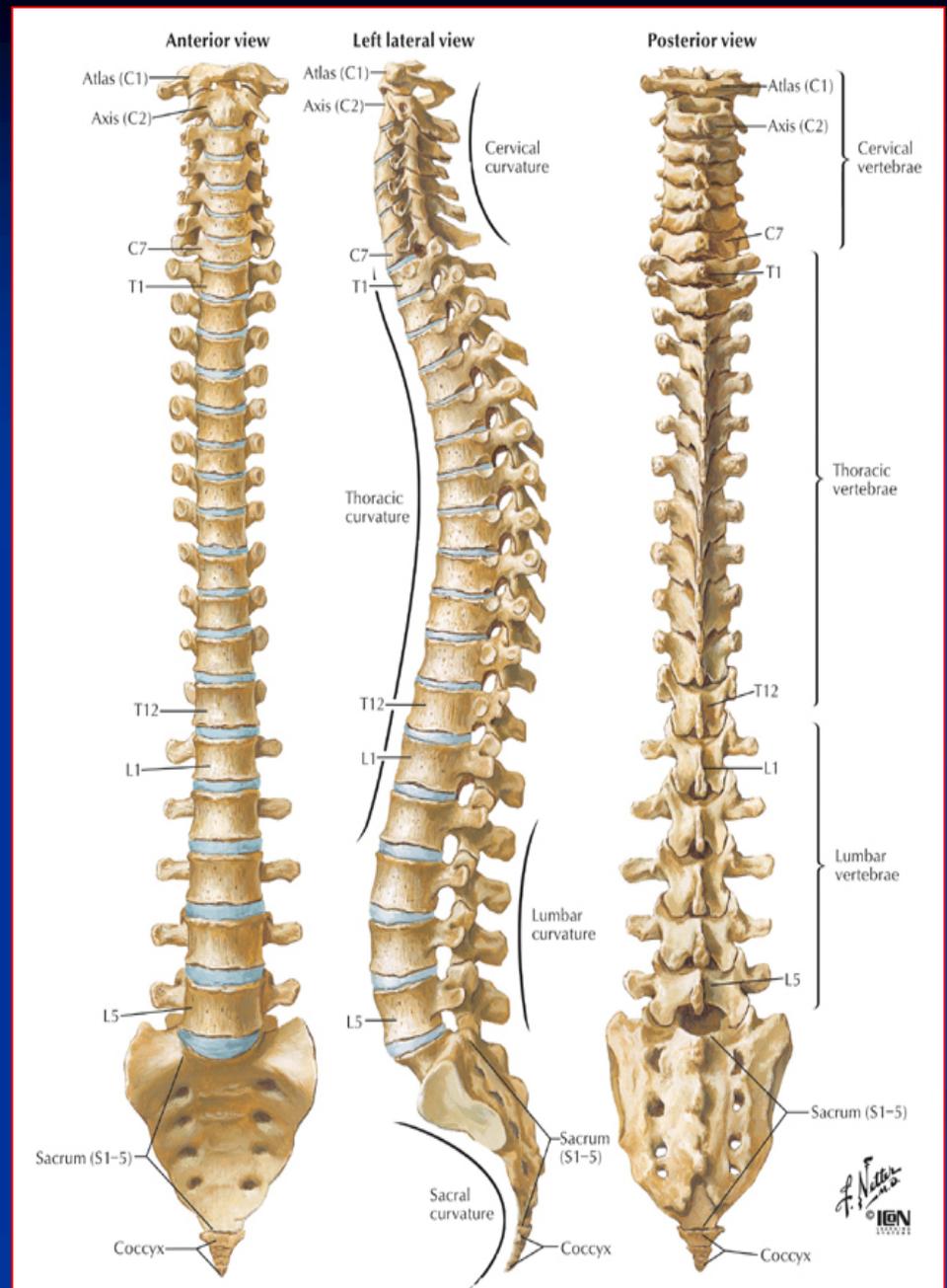


ANATOMY OF THE SPINE

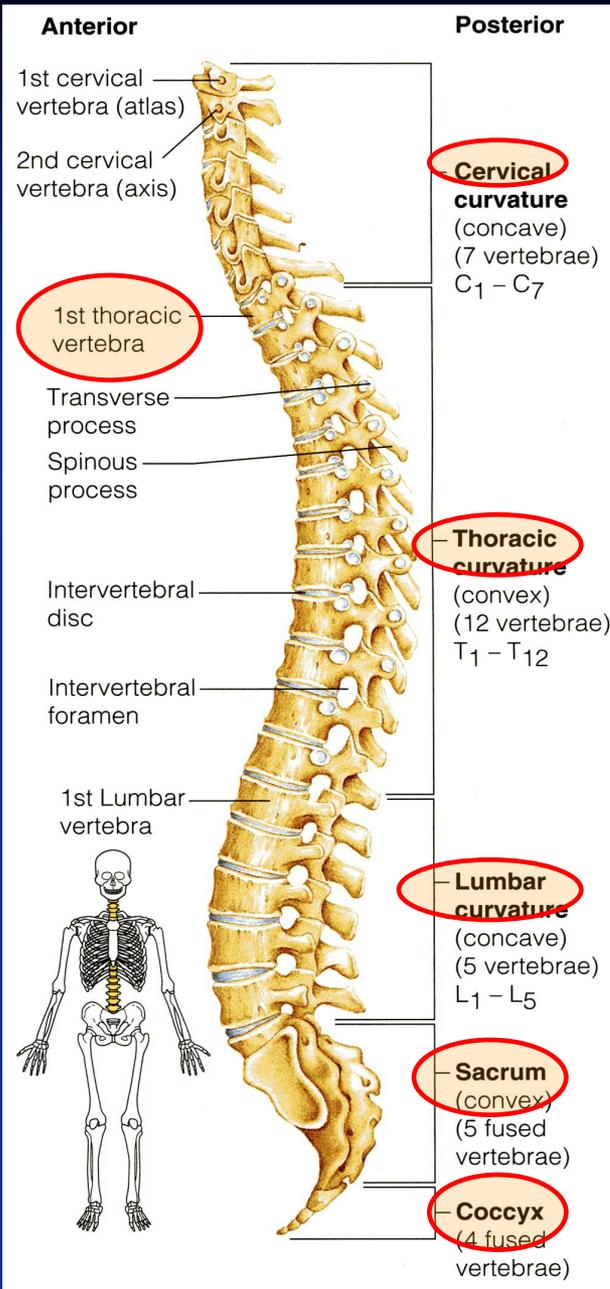


BY DR.SANAA
ALSHAARAWY

Objectives

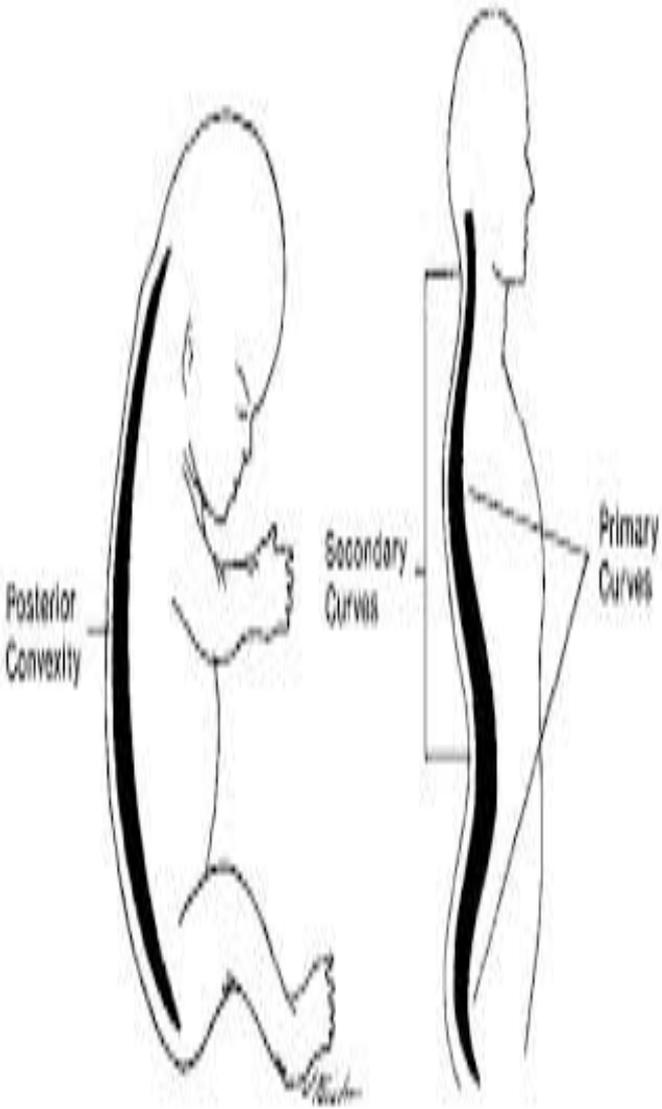
- *By the end of this lecture you should be able to:*
- **Distinguish and describe** the cervical, thoracic, lumbar, sacral and coccygeal **vertebrae**.
- Describe the **vertebral curvatures**.
- Describe the **movement** which occur **in each region** of the vertebral column.
- List the **structures**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

SPINE OR VERTEBRAL COLUMN



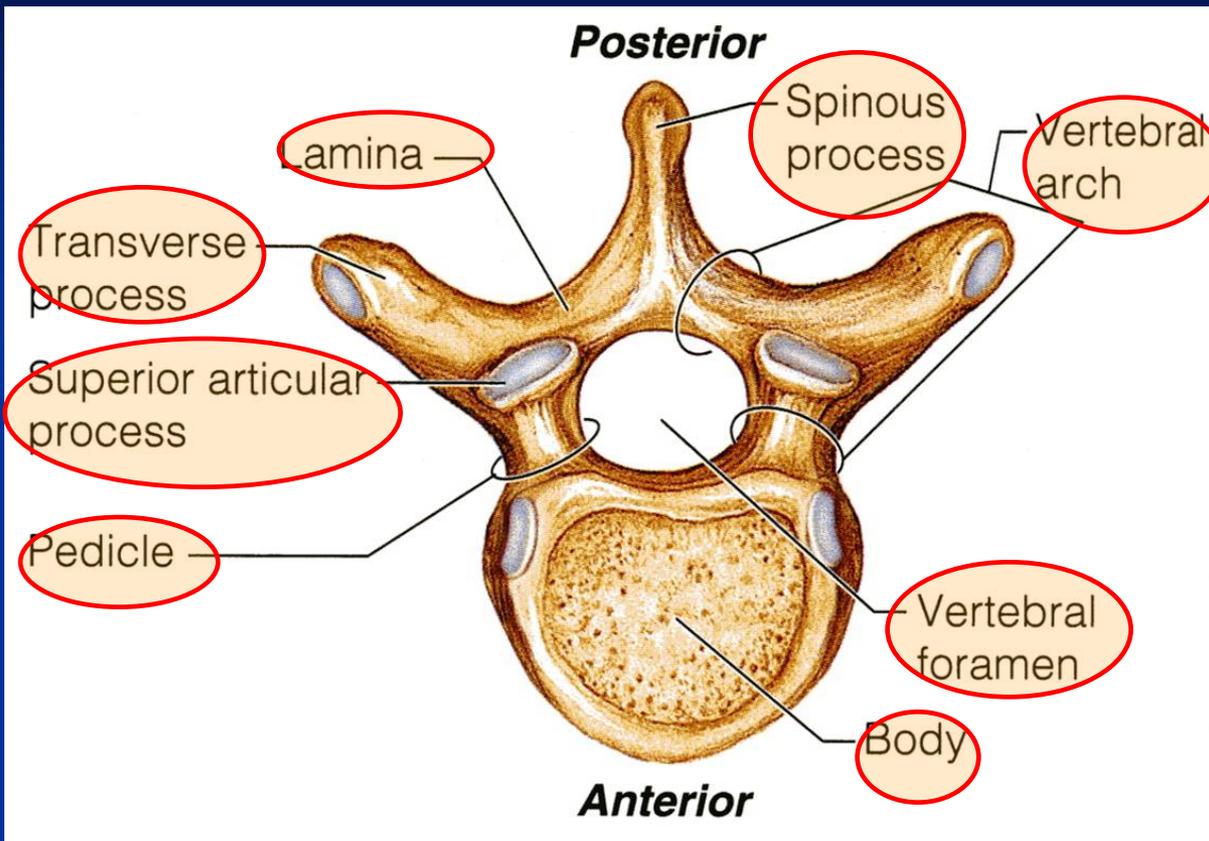
- The **vertebral column** extends from the skull to the pelvis.
- It surrounds and protects the **spinal cord** and supports the whole body.
- It is formed from **33** irregular **vertebrae**.
- It consists of **24 single vertebrae** and **2 bones** :
 - **Sacrum, (5 fused vertebrae).**
 - **Coccyx, (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** (6th month), and the **lumbar curvature** develops when the baby **begins to walk** (around the end of the 1st 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.

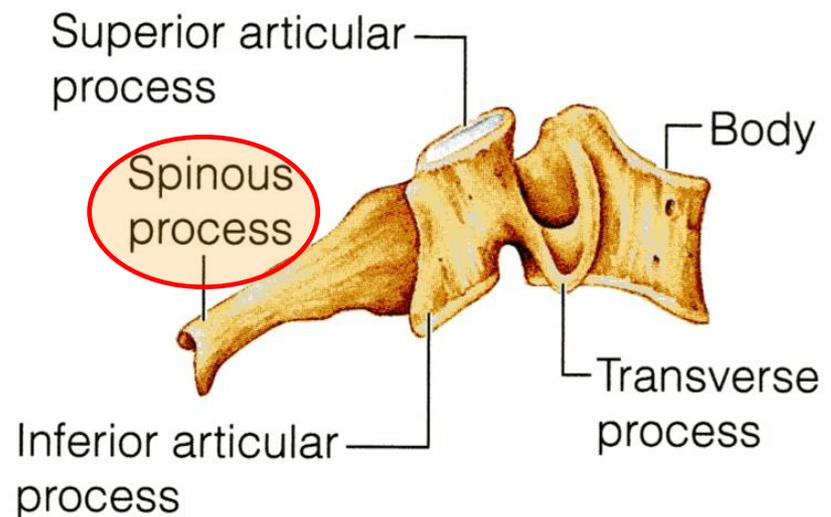
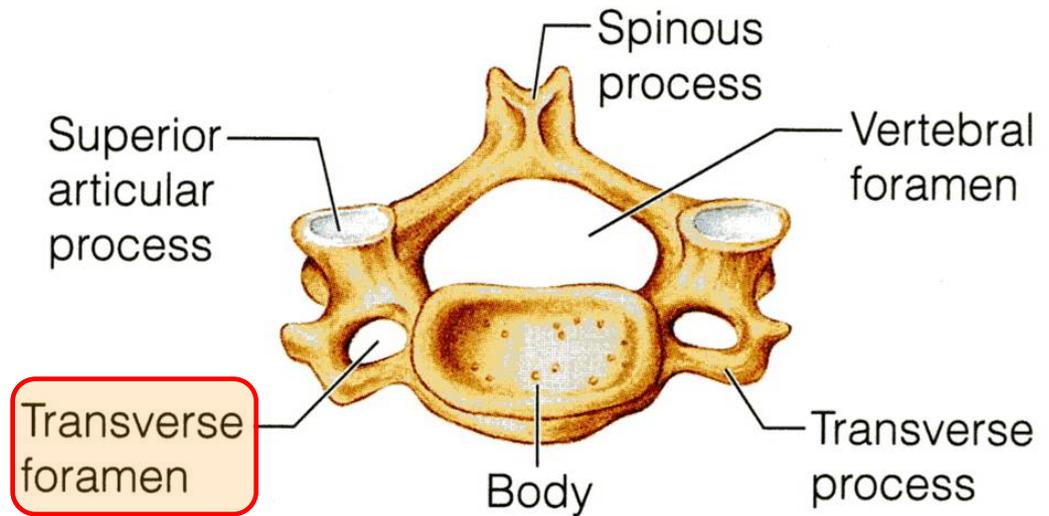
- **The vertebral arch carries 7 process:**

- **2 Transverse processes:**

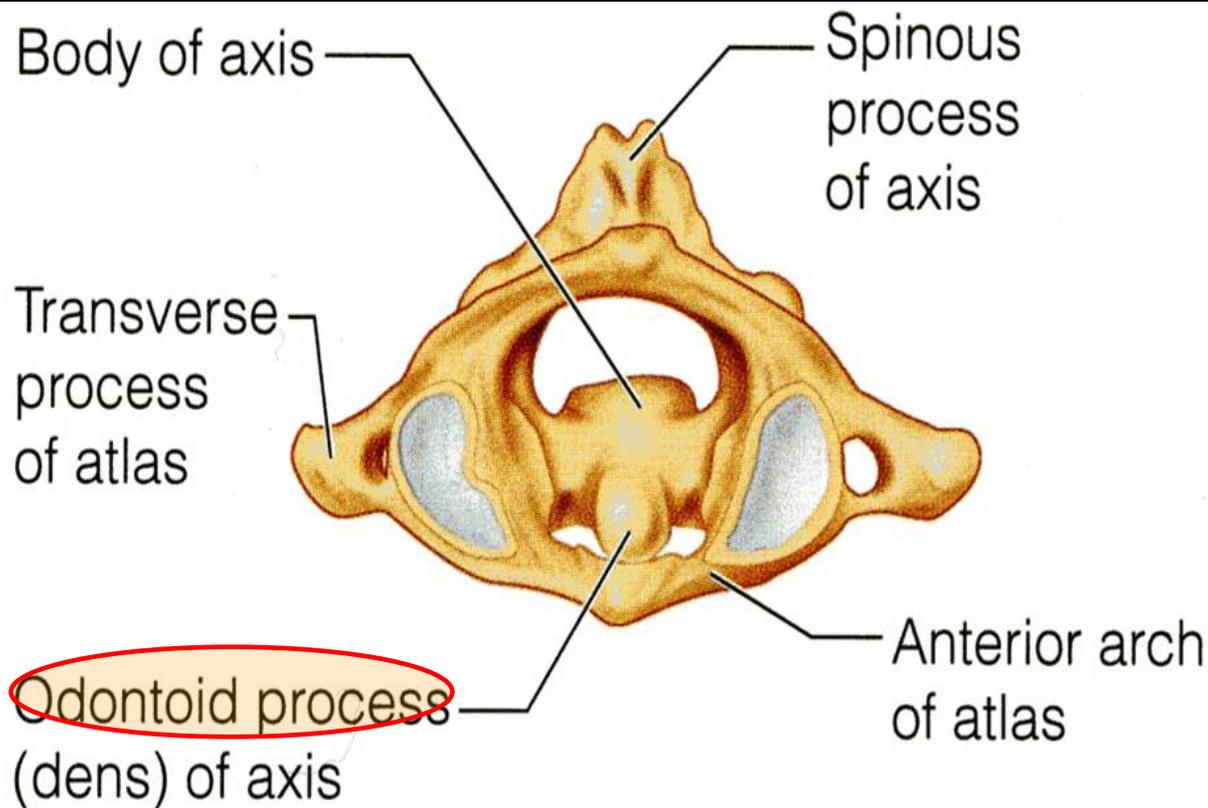
- Lateral projections from the vertebral arch.

TYPICAL CERVICAL VERTEBRAE

- The "typical" cervical vertebrae (**C₃ to C₆**) 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 (C₁) 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."**

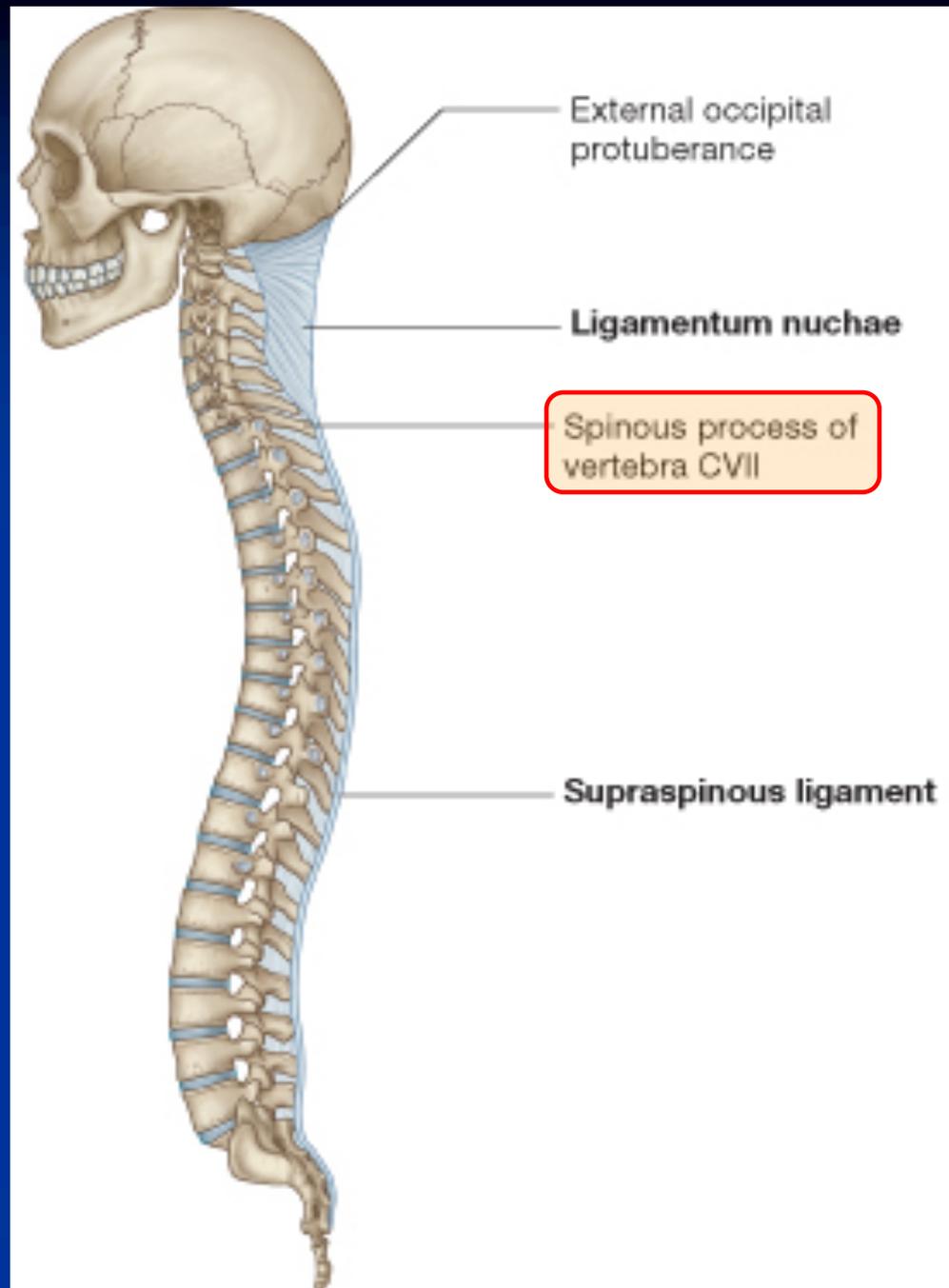
The axis (C₂) acts as a pivot for the rotation of the atlas (and the skull) above.

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

The joint between C₁ & C₂ allows to rotate the head from side to side to say **"no."**

7th CERVICAL VERTEBRA OR Cervica Prominens

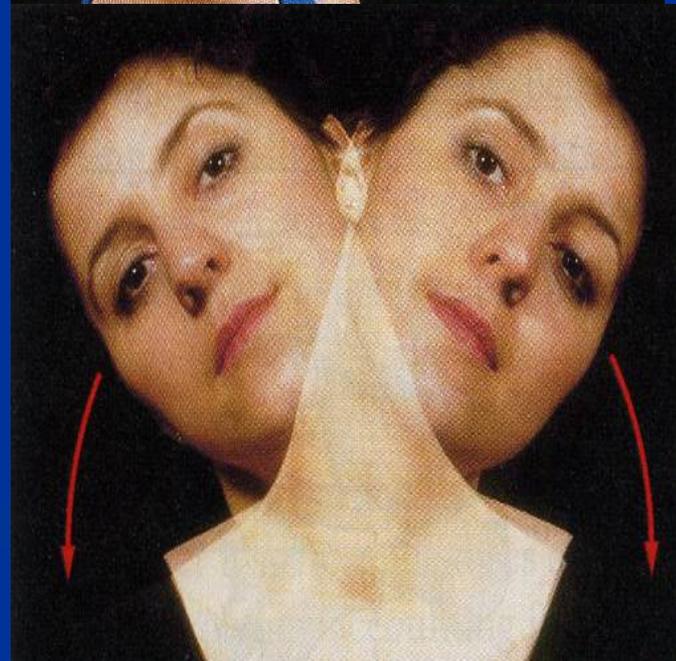
It has the **longest** spinous process which is **not bifid**.
It is the **first spine** to be felt **subcutaneously** in the root of the back of the neck.



MOVEMENTS IN THE **ATLANTO-OCCIPITAL** JOINT

The joints are capable of:

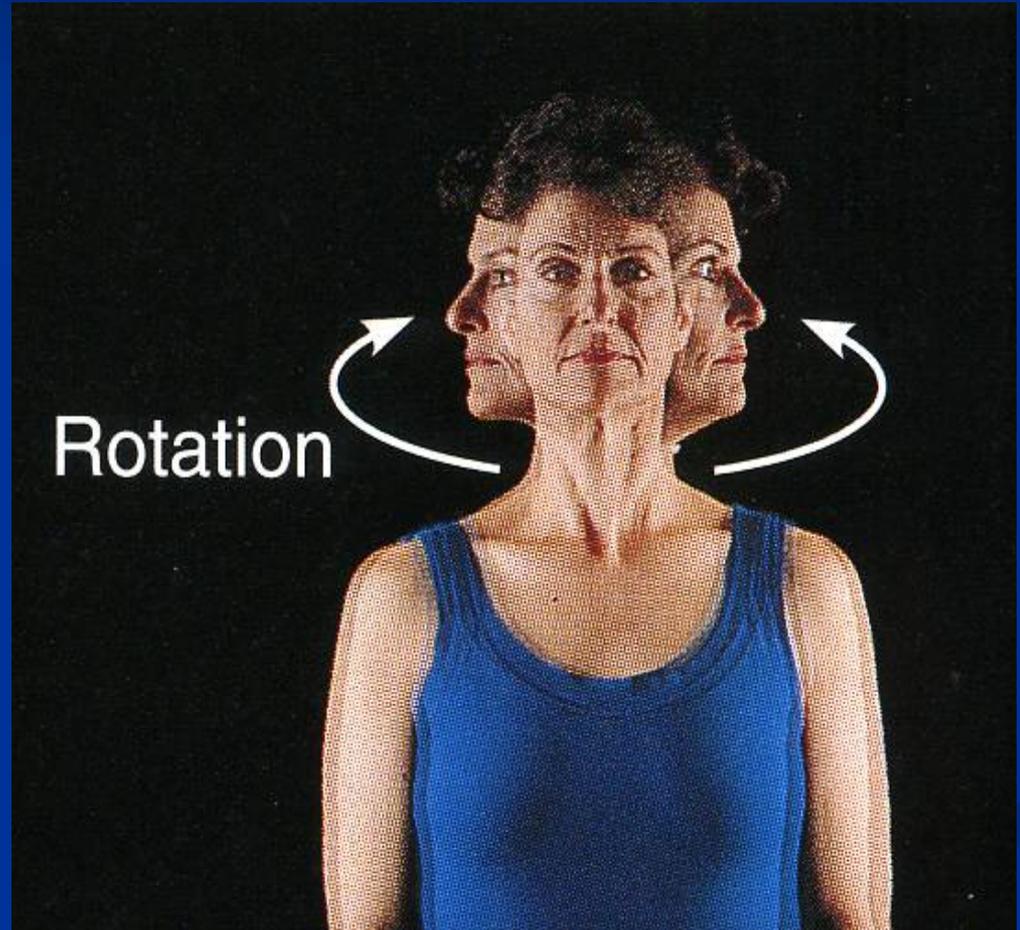
- Flexion,
- Extension, and
- Lateral flexion;
- They do not rotate.



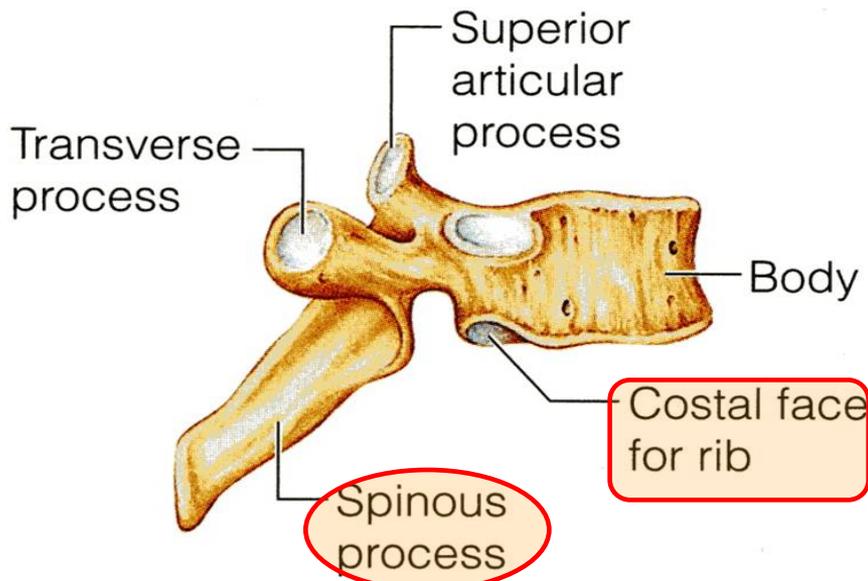
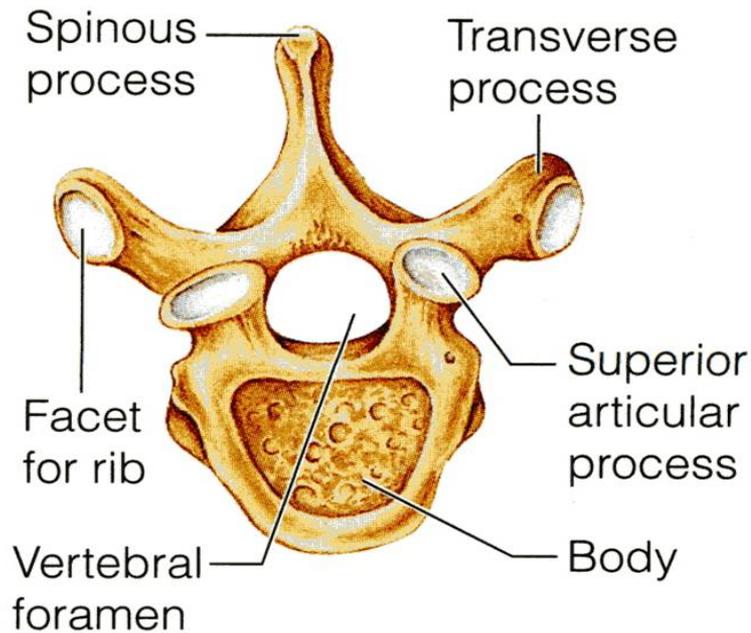
MOVEMENTS IN THE **ATLANTO-AXIAL** JOINT

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

That is to say **“NO”**

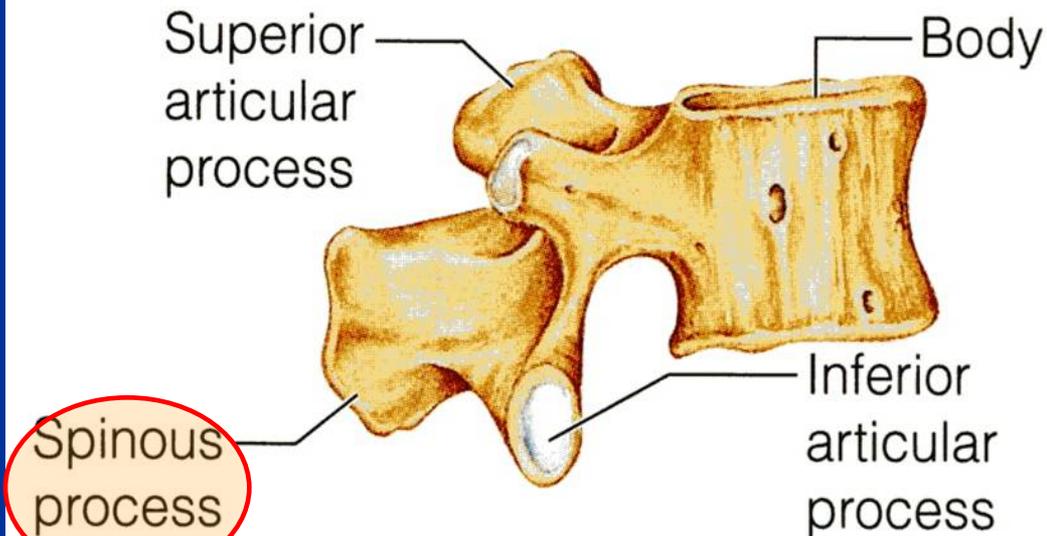
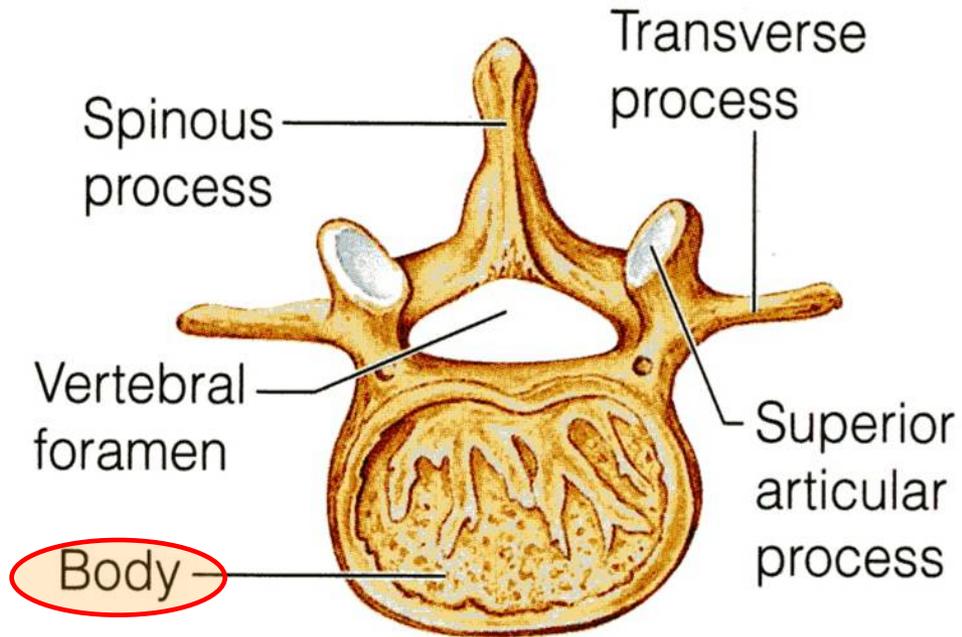


THORACIC VERTEBRAE



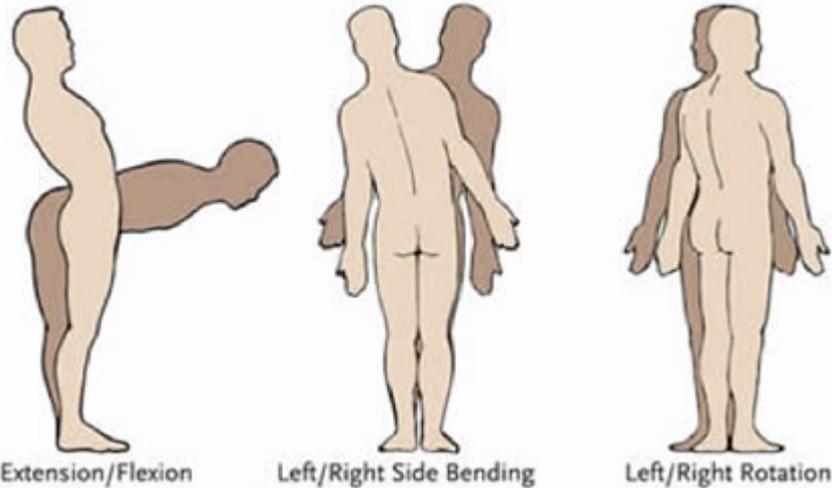
- The **12 thoracic vertebrae** (T₁-T₁₂) are almost typical.
- They are larger than the cervical vertebrae.
- The body is somewhat heart-shaped and has **two costal demifacets** (articulating surfaces) **on each side**, which receive the **heads of the ribs**.
- The **spinous process** is long and **hooks sharply downward**.

LUMBAR VERTEBRAE



- The **5 lumbar vertebrae** (L₁-L₅) 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

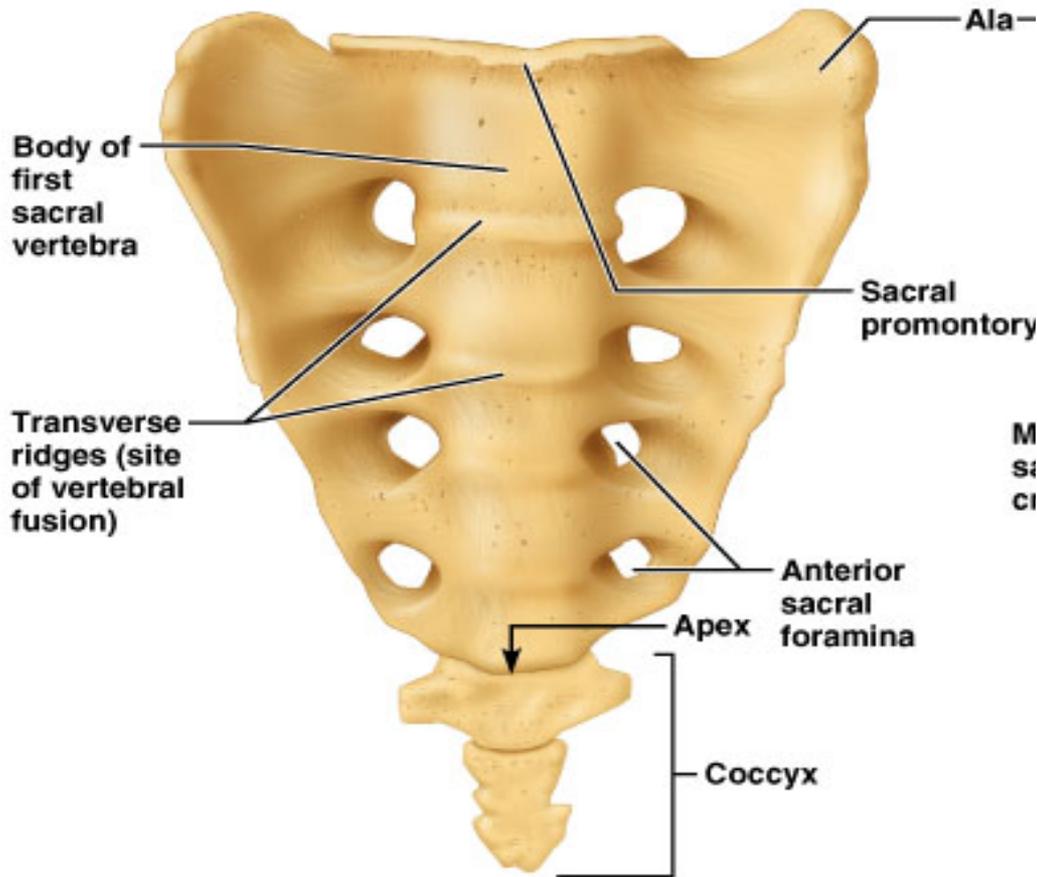


These movements are **extensive** in lumbar spine **But restricted** in thoracic spine.

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.

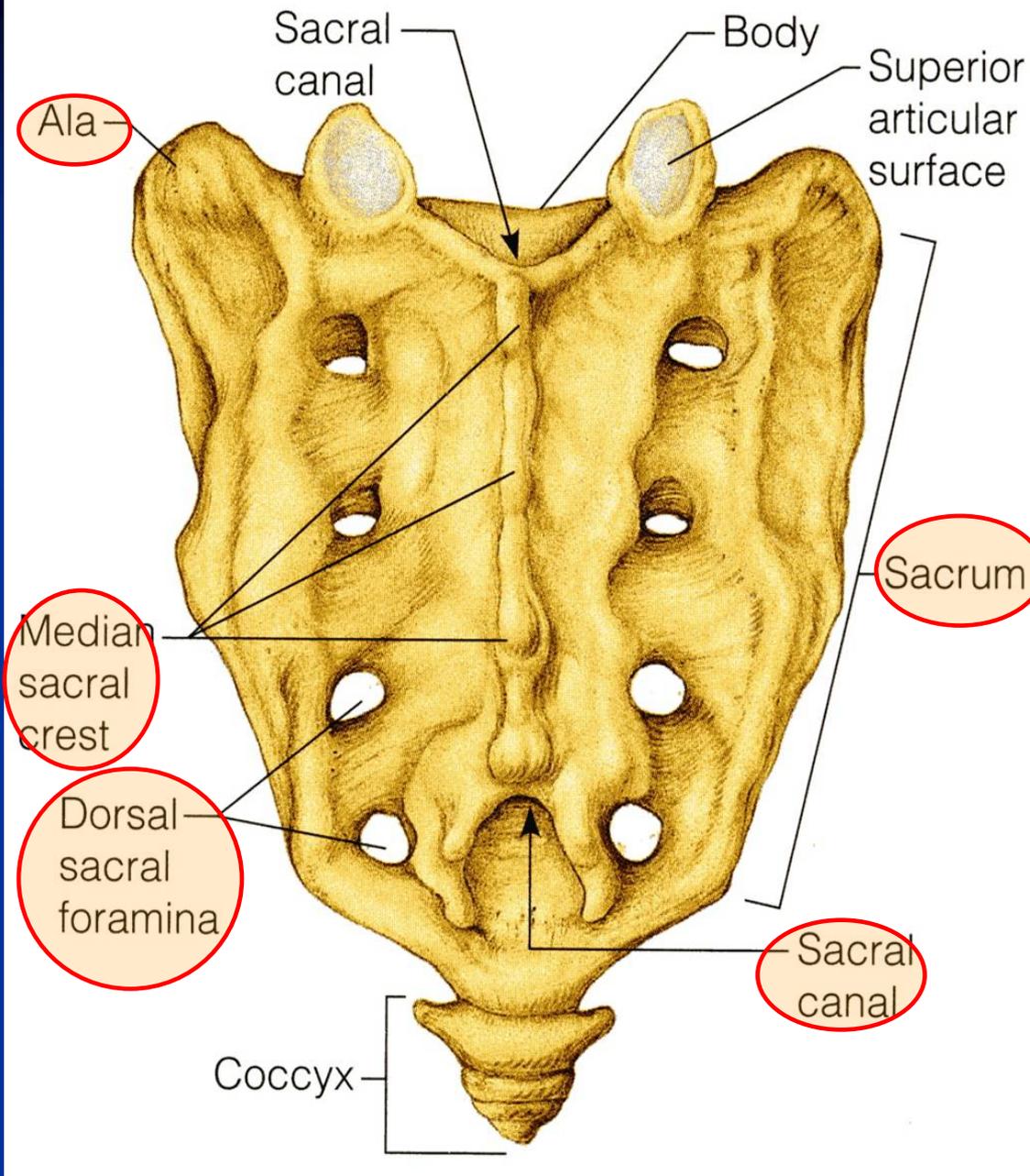
SACRUM



(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 **1st 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**.

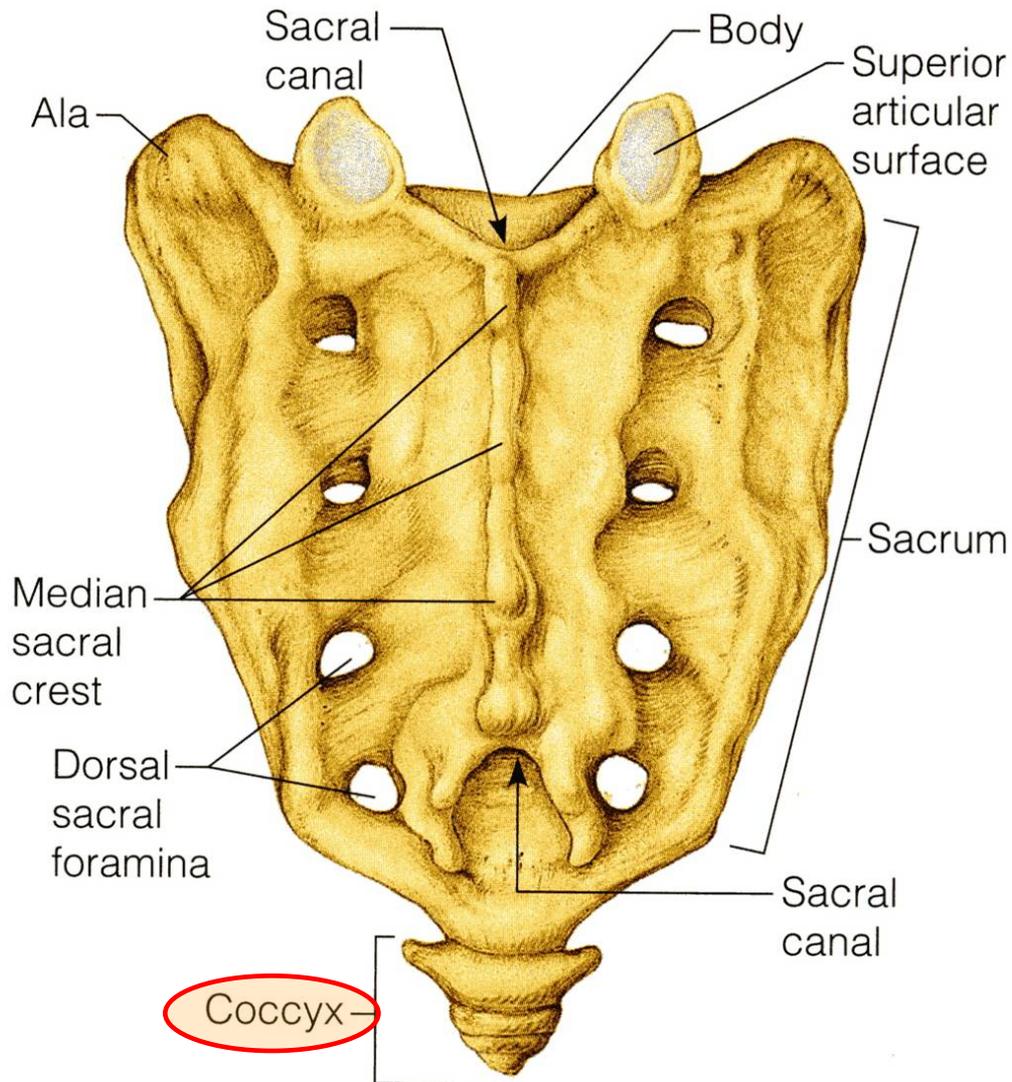
SACRUM



- 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**.

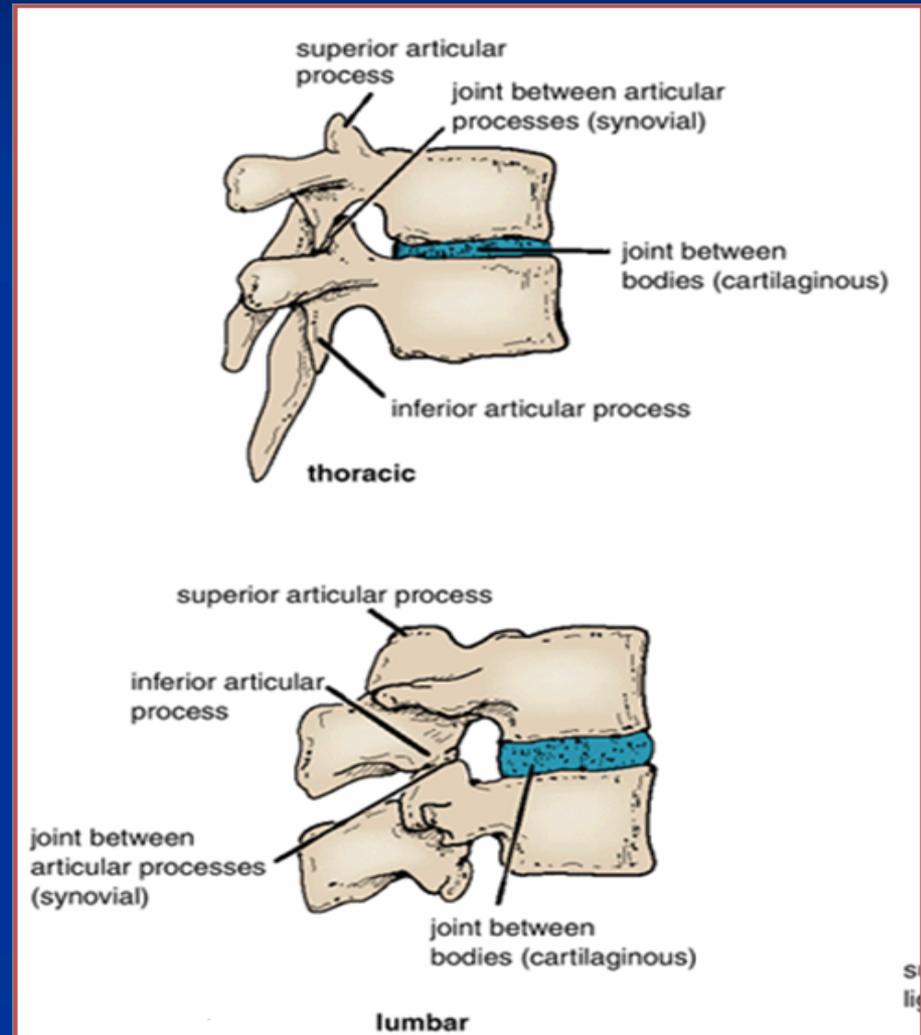
COCCYX

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



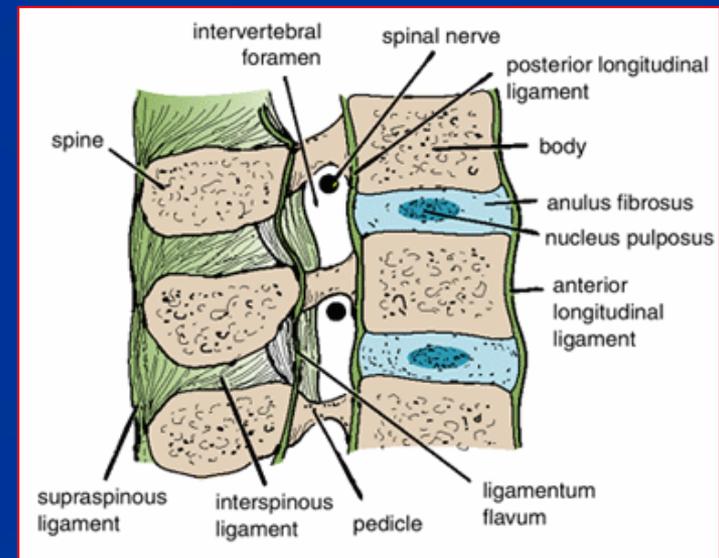
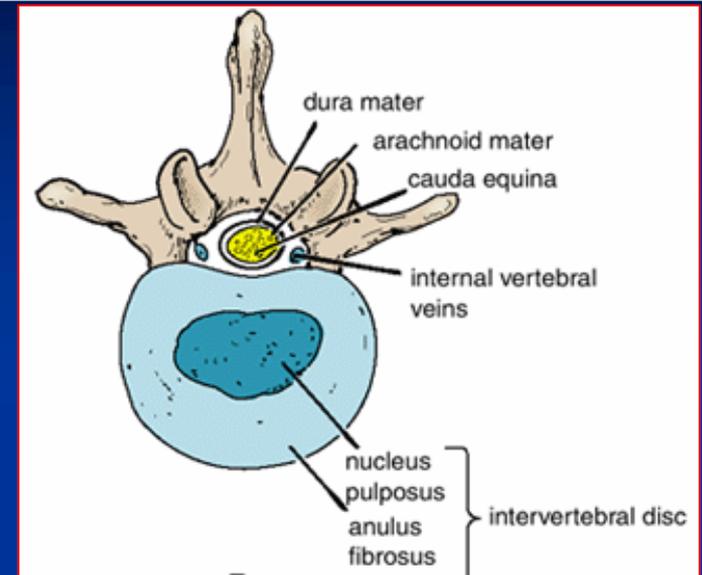
JOINTS BETWEEN TWO VERTEBRAL BODIES

- 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

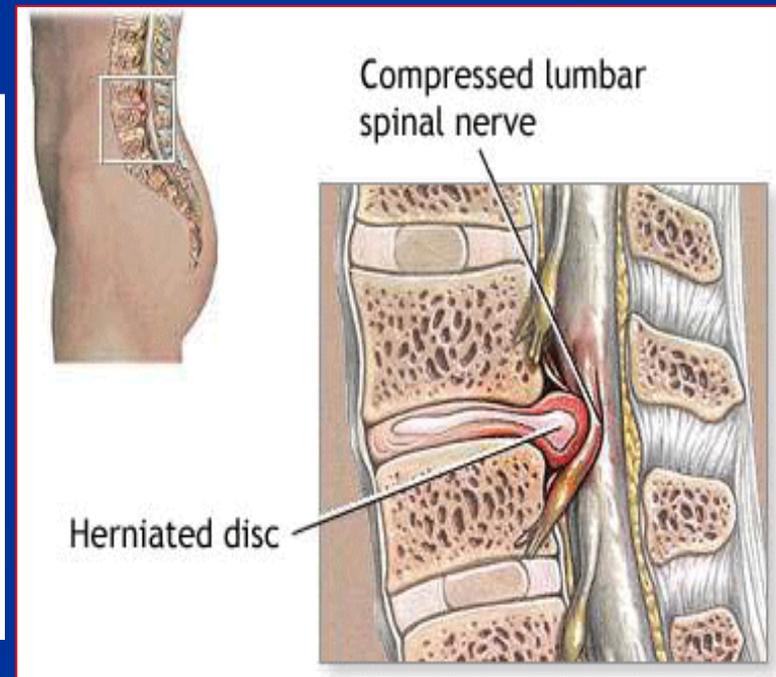
- The **intervertebral discs** forms about **one fourth** of the whole length of the vertebral column.
- They are **thickest** in the **cervical** and **lumbar** regions, **where the movements** of the vertebral column are **greatest**.
- Each disc consists of a:
 - **Peripheral part**, called the **anulus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

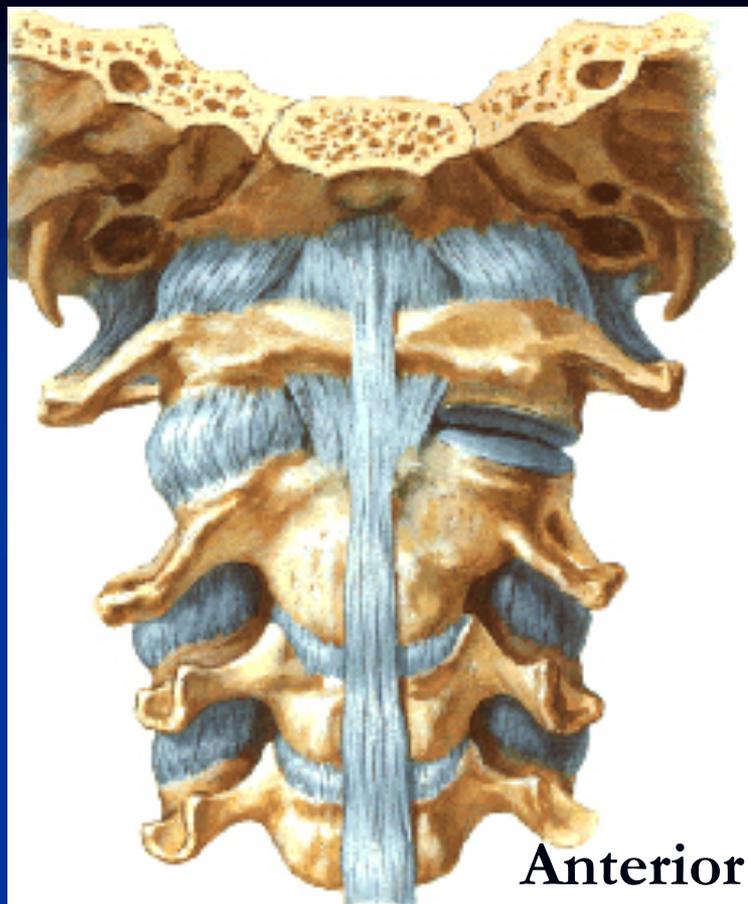


INTERVERTEBRAL DISCS FUNCTION

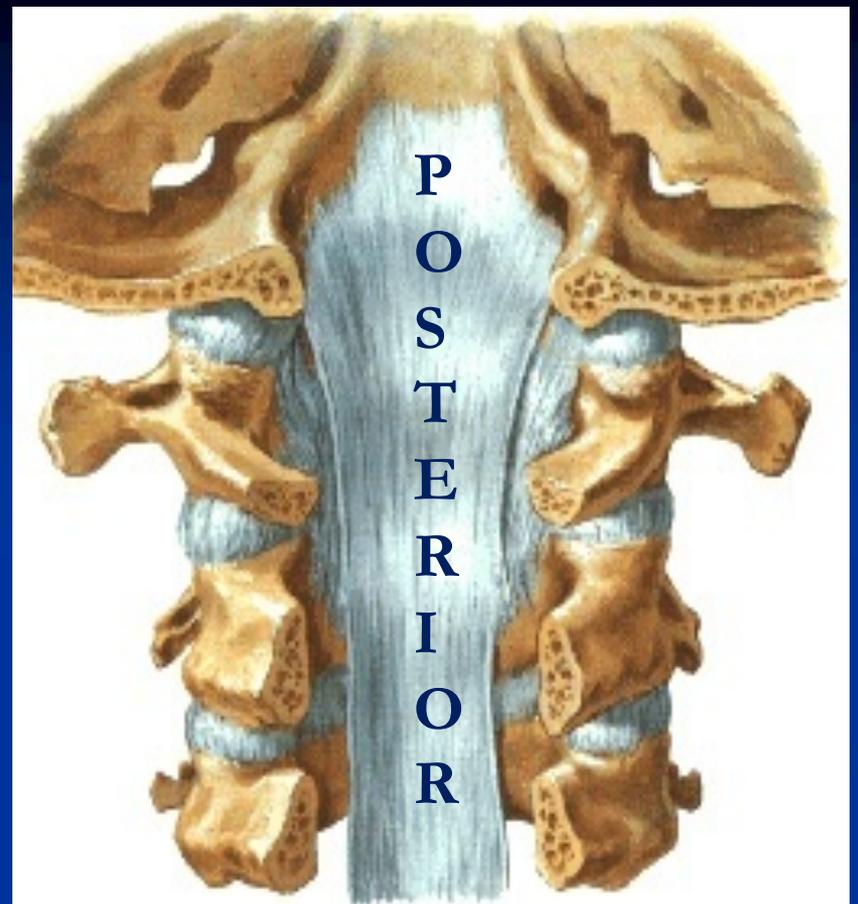
- **Allow** one vertebra to rock forward or backward on another, as in **flexion and extension of the vertebral column.**
- **Serve as shock absorbers** when the load on the vertebral column is suddenly increased, **as when one is jumping.**

- 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



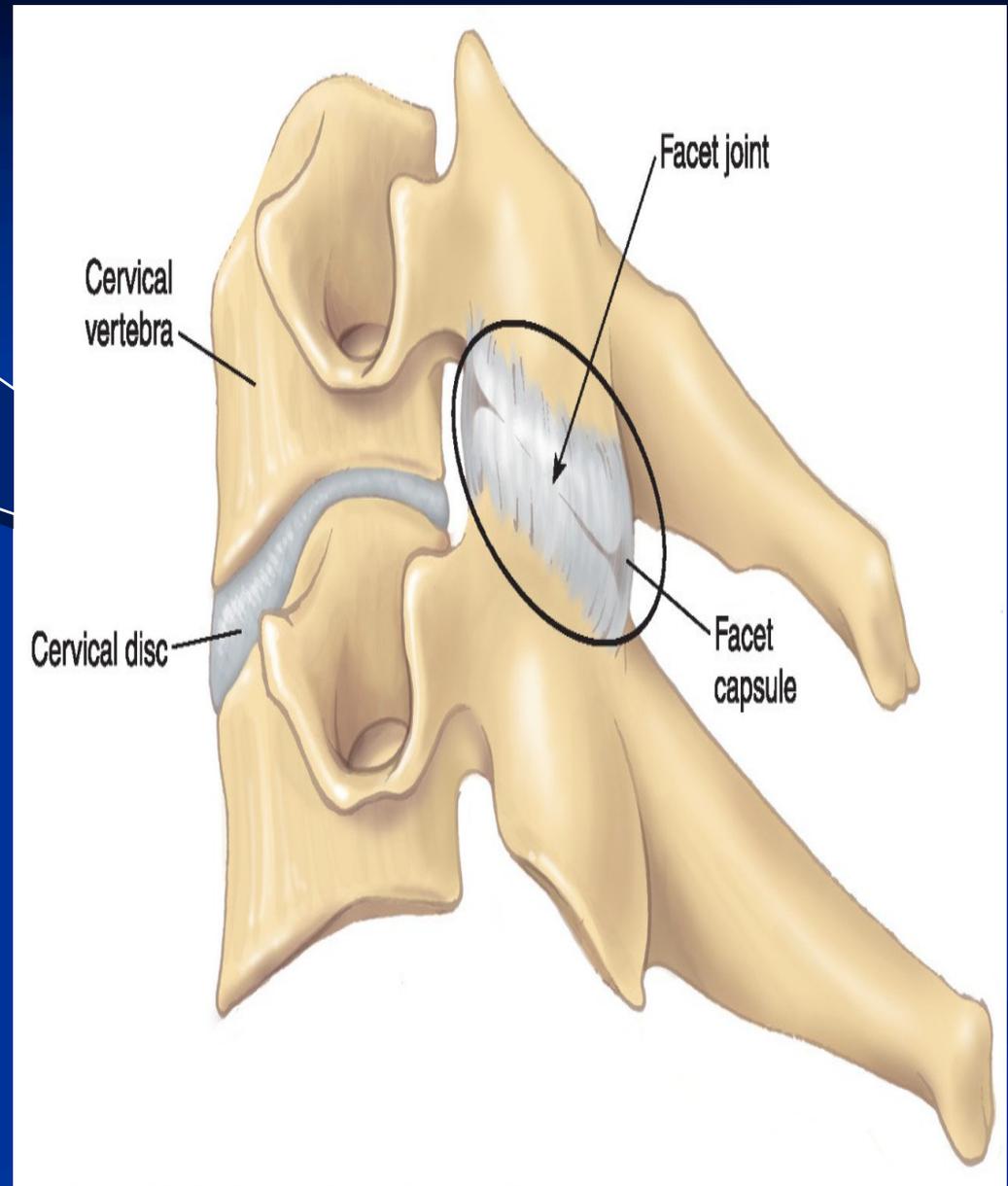
Anterior

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:

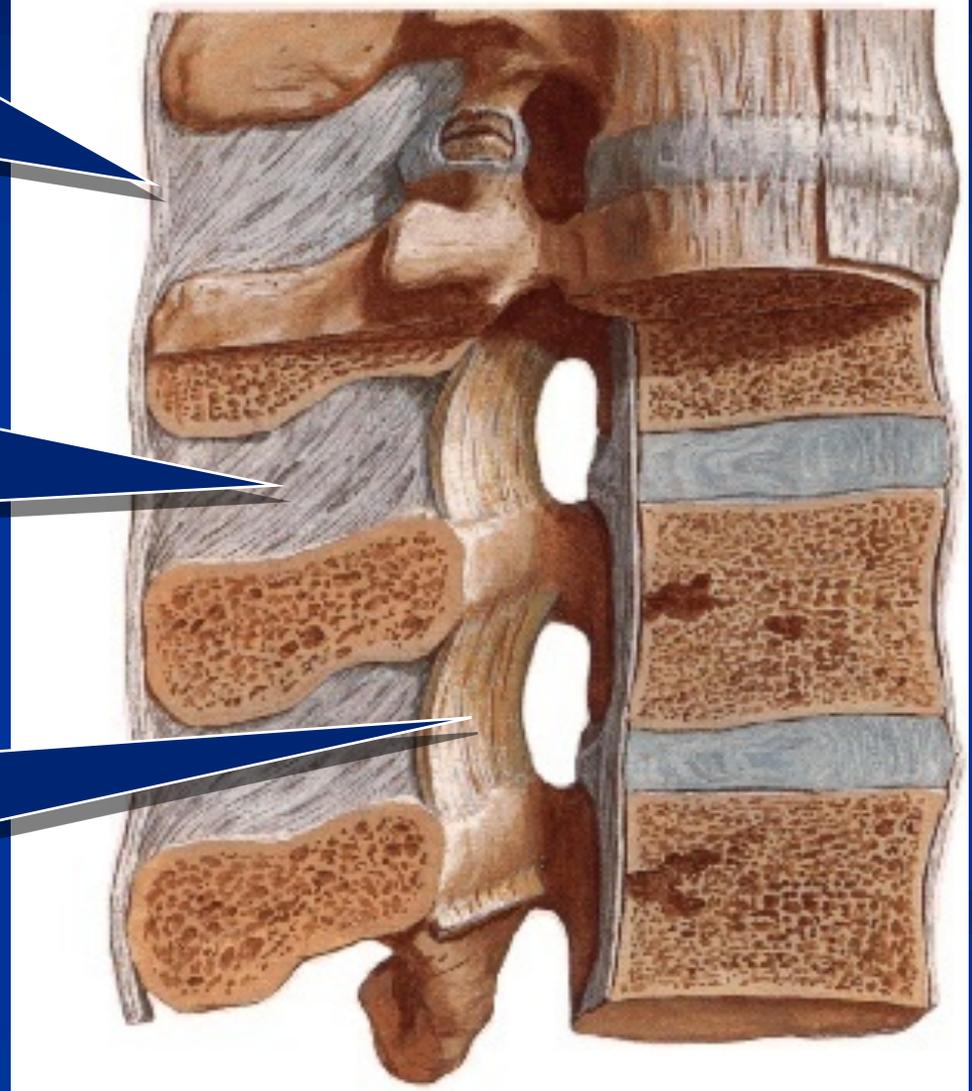
It runs between the **tips** of adjacent spines.

Interspinous ligament:

It connects adjacent spines.

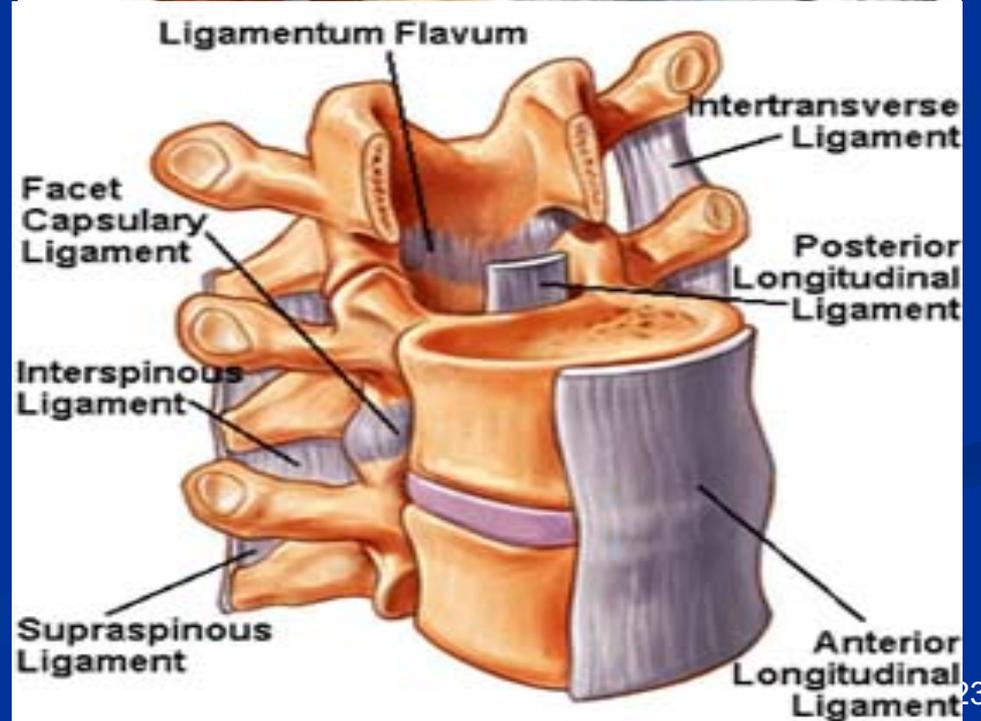
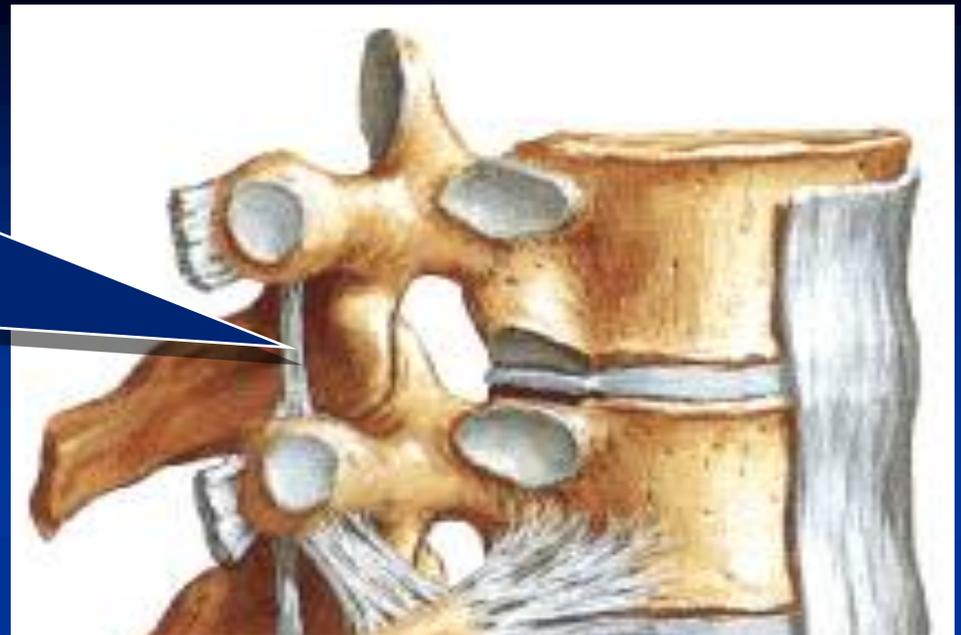
Ligamentum flavum:

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



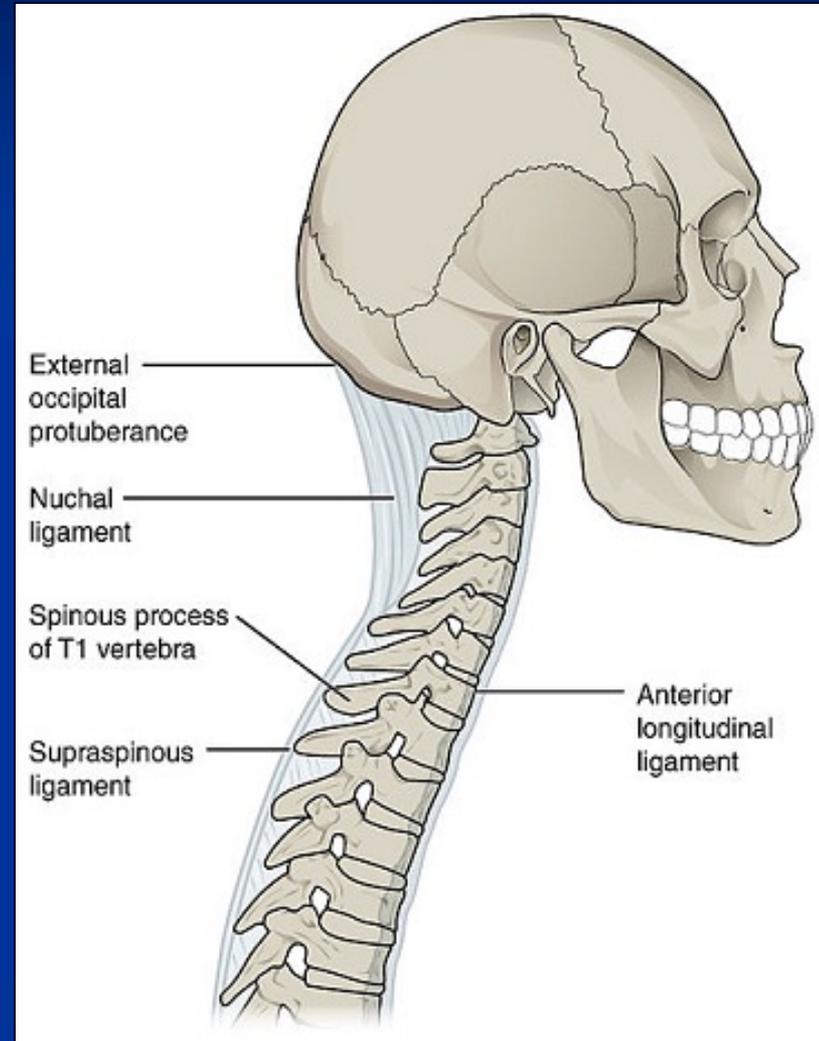
Intertransverse ligaments

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.