Academic year 2021- 2022
2nd year (S3)

Module: Musculoskeletal system (MSK)
Session No. 7
Lecture: **1**
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Vertebral Column and Common Injuries

Module staff:

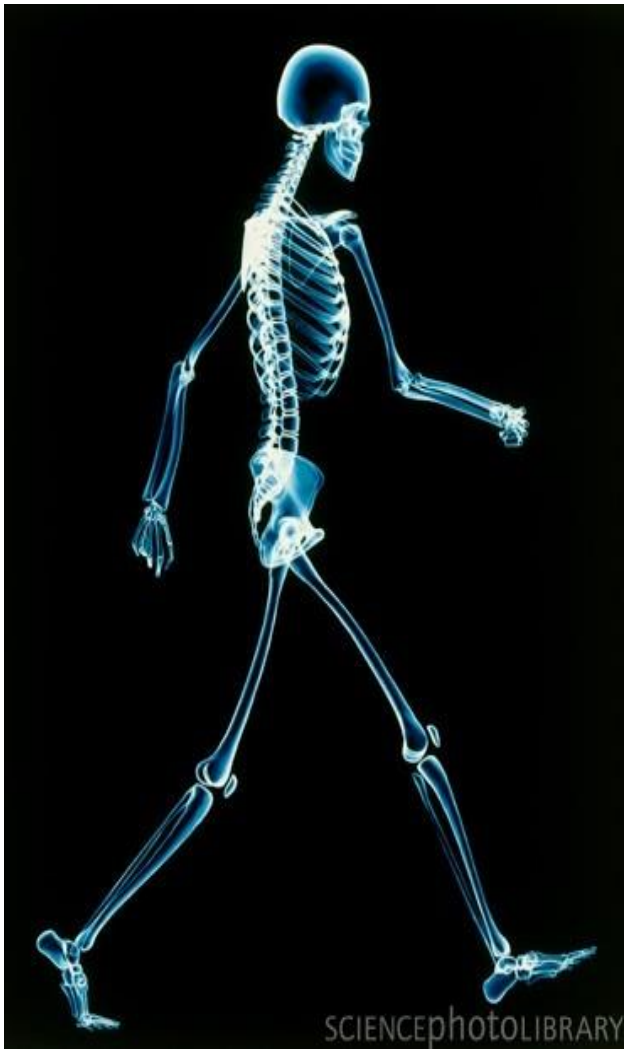
Dr. Falih Waheed Hashim
Dr. Nawal Mustafa
Dr. Waleed Jwad
Dr. Ahmed Ibrahim Habib
Dr. Ahmed Hazim Dahamm
Dr. Raed Jasim Chasib
Dr. Rafid Mousa
Dr. Ahmed Khalaf
Dr. Khalil I. Sadiq
Dr. Mohammed Baqir Abbas

Module Learning Objectives: 23

✓**To describe the general anatomy of the vertebral column, some of its common injuries and causes of back pain:-**

1. State the gross structure and arrangement of the vertebral column
2. Describe the characteristic features of cervical, thoracic and lumbar vertebrae and the sacrum and coccyx
3. Describe the structure and classification of major joints of the vertebral column
4. State how the structure of the various vertebrae and their associated ligaments help to maintain the stability of the vertebral column
5. Describe the effects and pathophysiology of prolapse of intervertebral discs
6. Identify abnormal spine curvatures
7. Briefly, describe the condition of cervical spondylosis

Functions of the Vertebral Column



1. Attachments for Bones: Provides for attachments of the rest of the skeleton

2. Attachments for Trunk muscles

3. Protection: The vertebral column protects the spinal cord on its journey and It allows segmental nerves to leave the cord at specified points to supply their targets

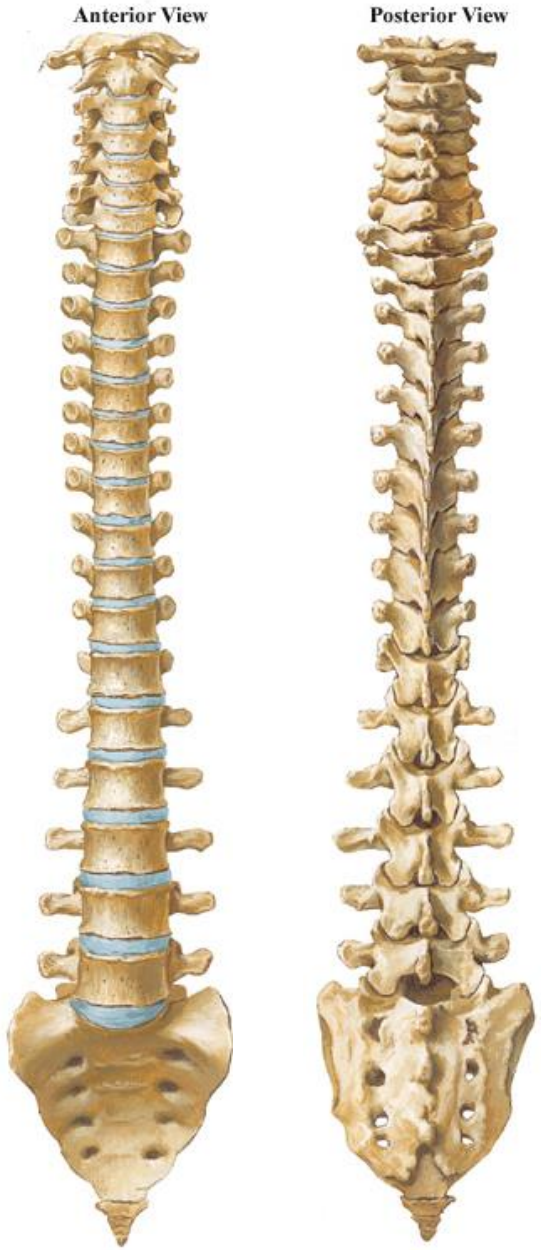
4. Homeostasis of minerals

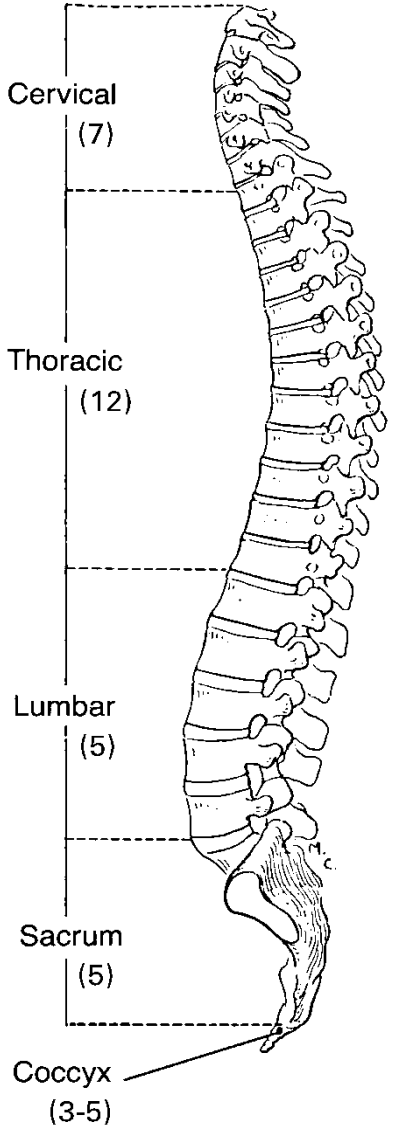
5. cell formation by Bone marrow

Gross Features of the Vertebral Column

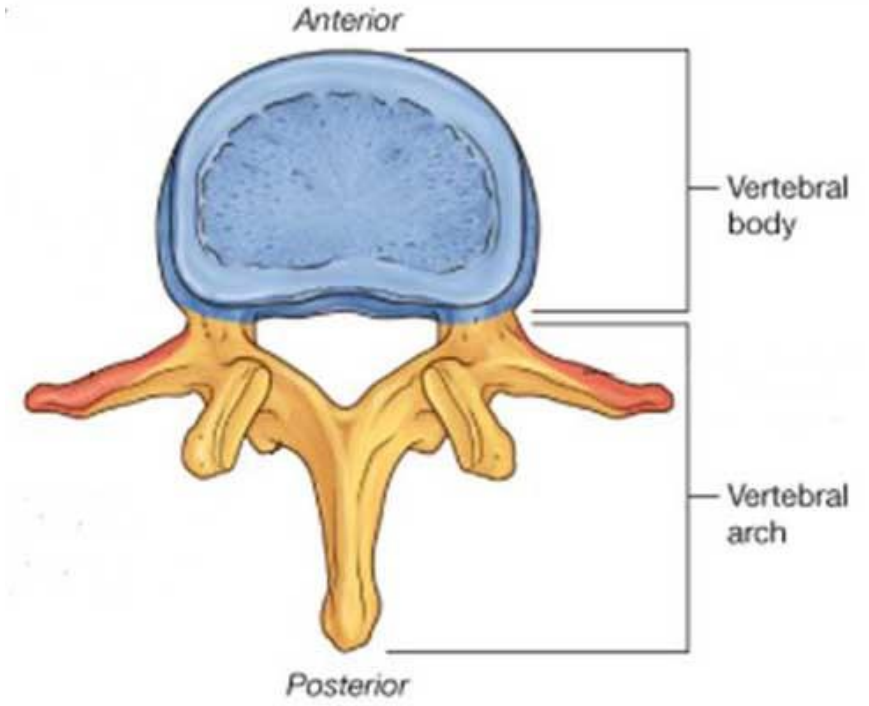
- Forms the central axis of the skeleton

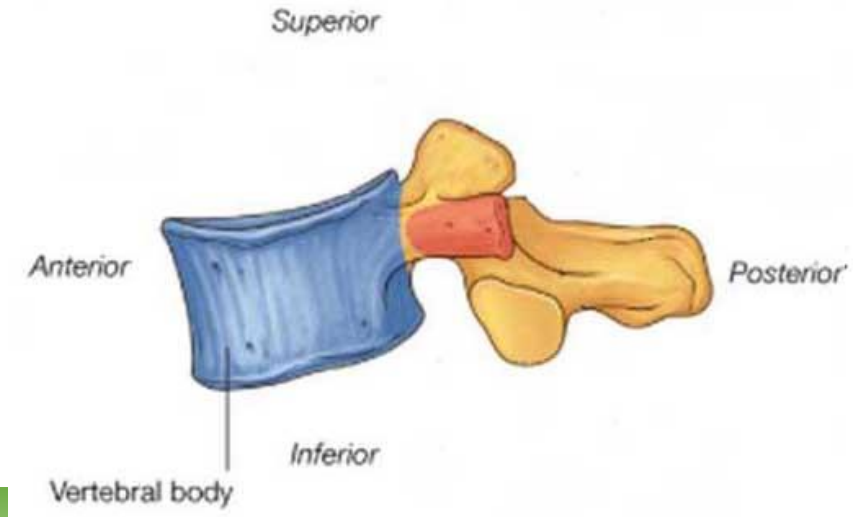
- Made from a series of (32-34) vertebrae joined together:
  - 7 cervical
  - 12 thoracic
  - 5 lumbar
  - 5 sacral
  - 3-5 coccygeal





Features of typical Vertebra



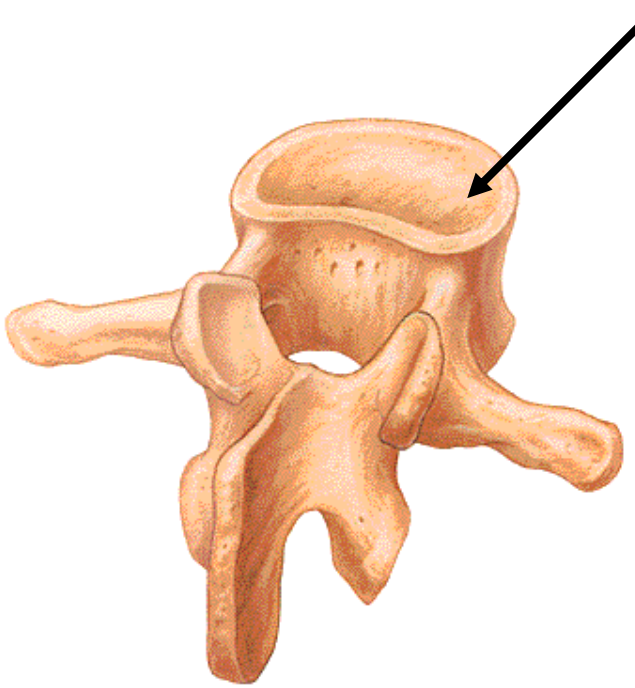


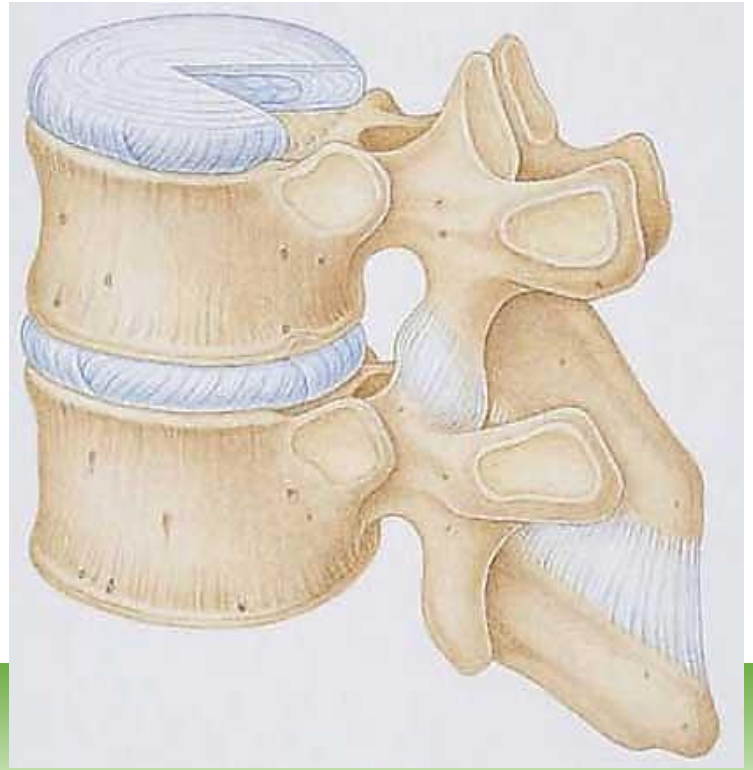
Typical vertebra consists of:

1. Vertebral body (anteriorly)

1. Vertebral arch or Neural arch (posteriorly)

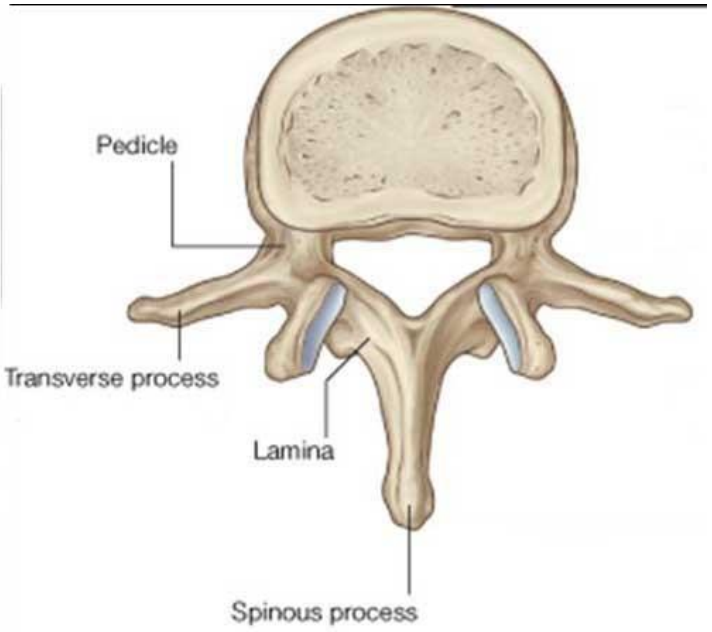
1. Vertebral Body

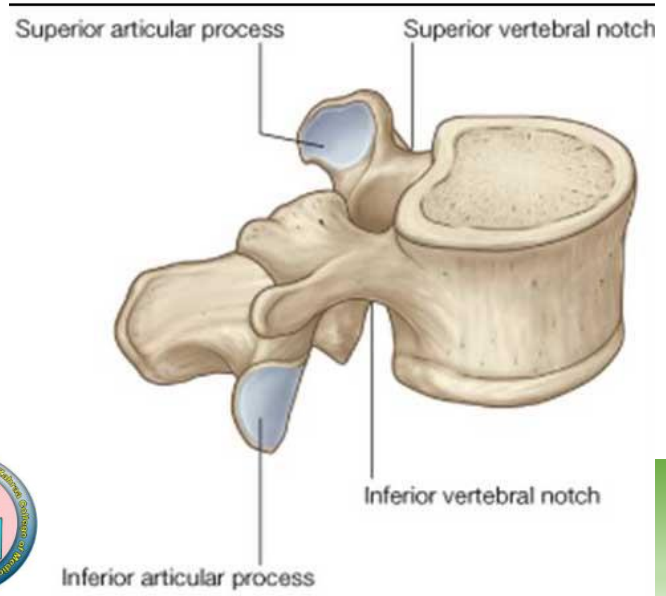




- It is the largest part of the vertebra
- It is the main weight bearing part of the vertebra
- It is lined with hyaline cartilage
- It is linked to adjacent vertebral bodies by way of intervertebral discs

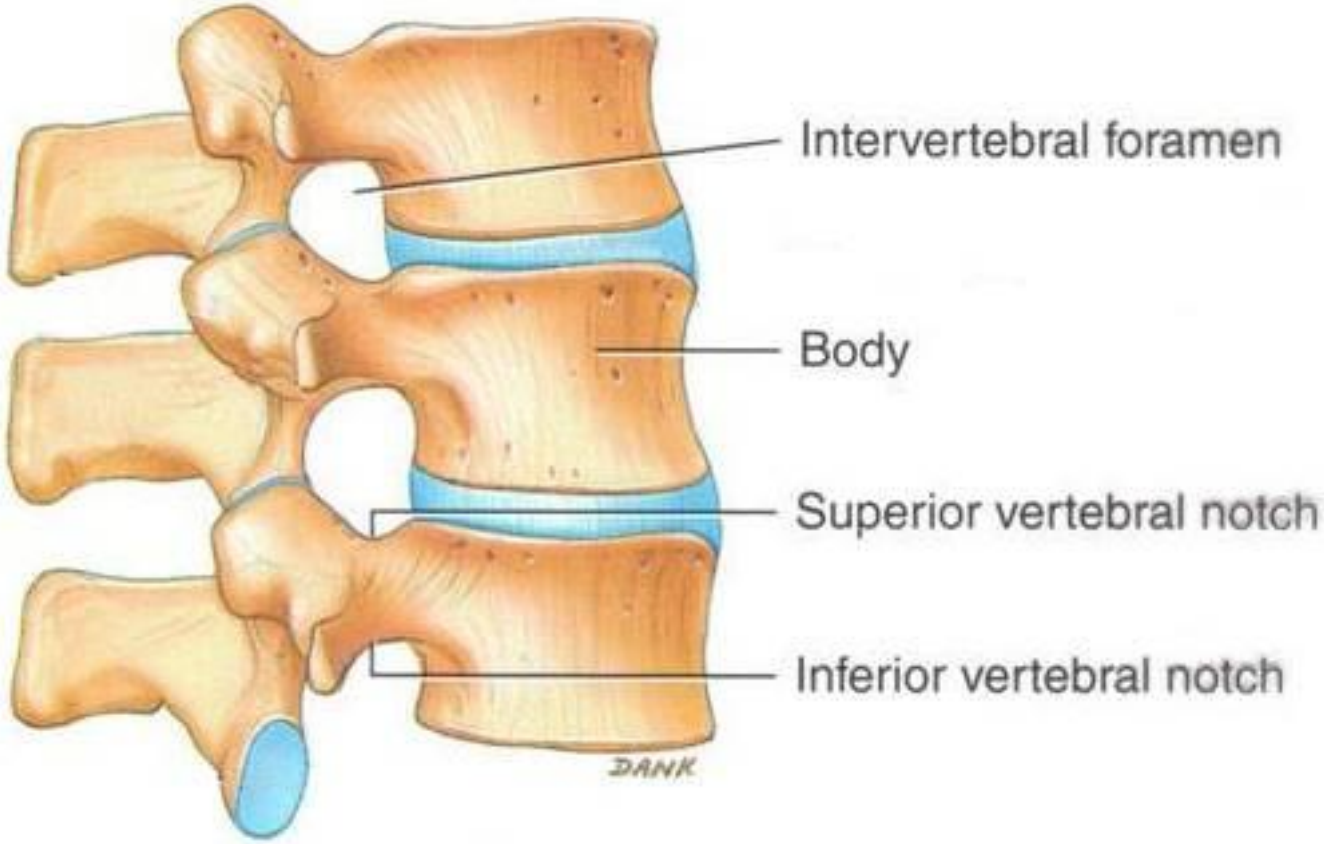
2. Vertebral or Neural Arch: composed from:





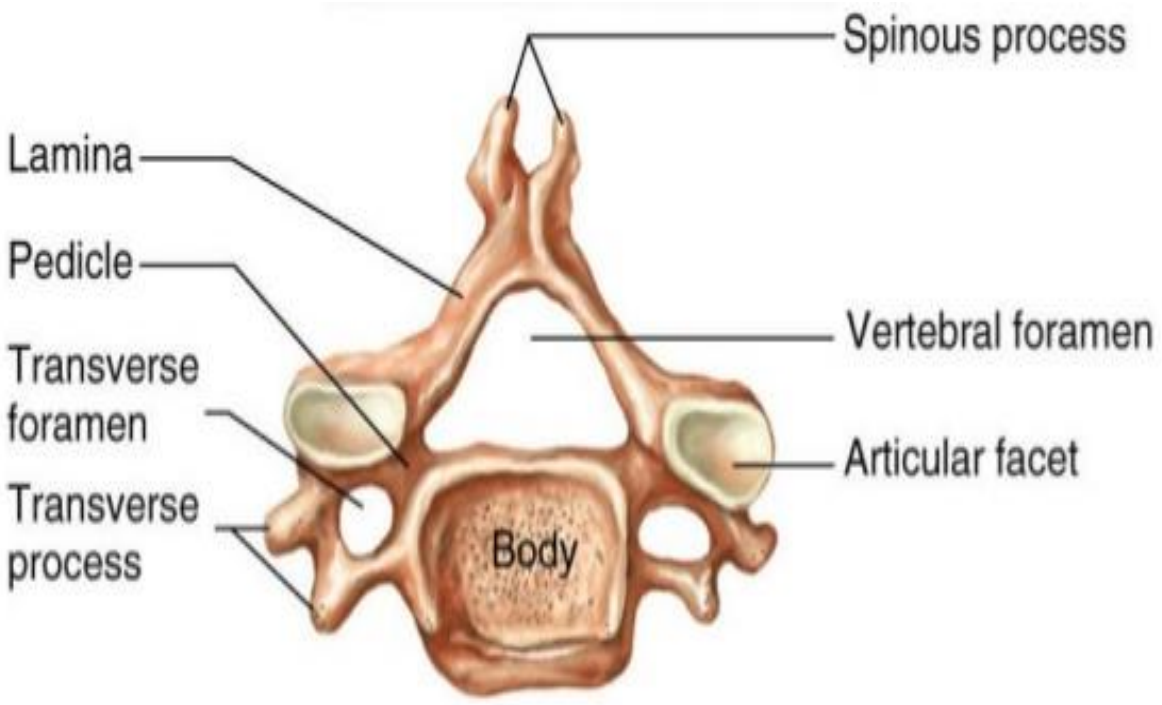
1. **Spinous Process:** Midline, Posterior (1)
2. **Transverse Processes:** Found laterally (2)
3. **The Pedicle** Is the part of the neural arch between the body and the transverse process (2)
4. **The Lamina** Is the part of the neural arch between the transverse process and the spinous process (2)
5. **Articular Processes:** 1 superior and 1 inferior on each side (4)

Intervertebral foramen



- **Between 2 successive pedicles**
- **Spinal nerve pass through this foramen**

Typical cervical vertebra



(c) Cervical vertebra, superior view

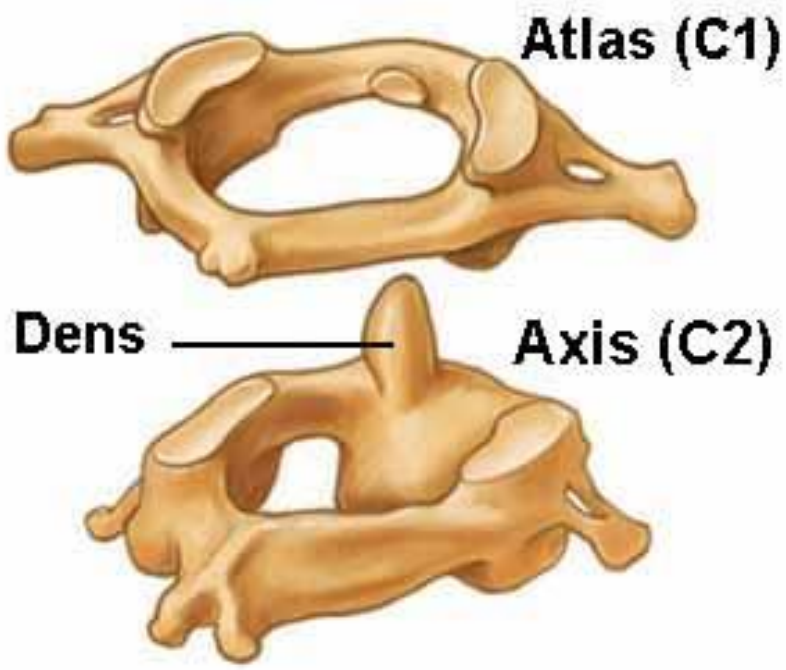
- Cervical vertebrae have **small** bodies

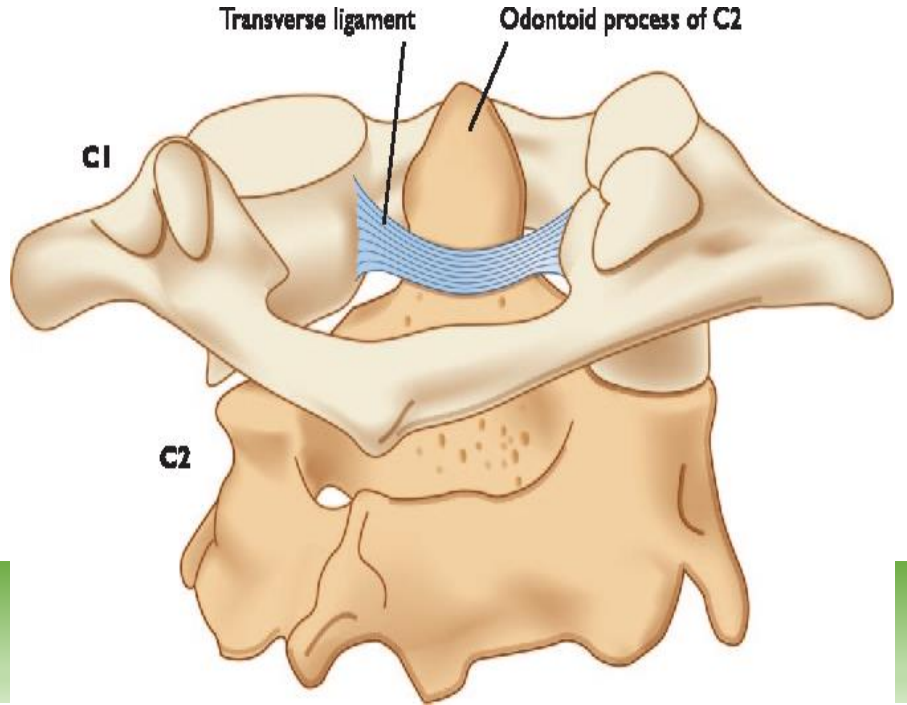
- Are most easily distinguished by

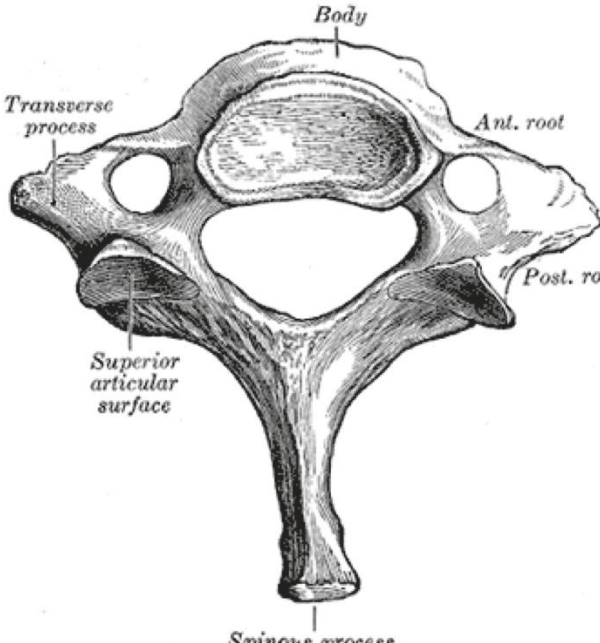
1. The presence of transverse foramen in their transverse processes
2. The spinous process is bifid.

Atypical cervical vertebrae:

- C1 (the atlas) lacks a body
- C2 (the axis) has an extension of its body called the dens or odontoid process, which articulates with the anterior arch of the atlas.
- C7(the vertebra prominence) has single spinous process rather than the bifid spinous process



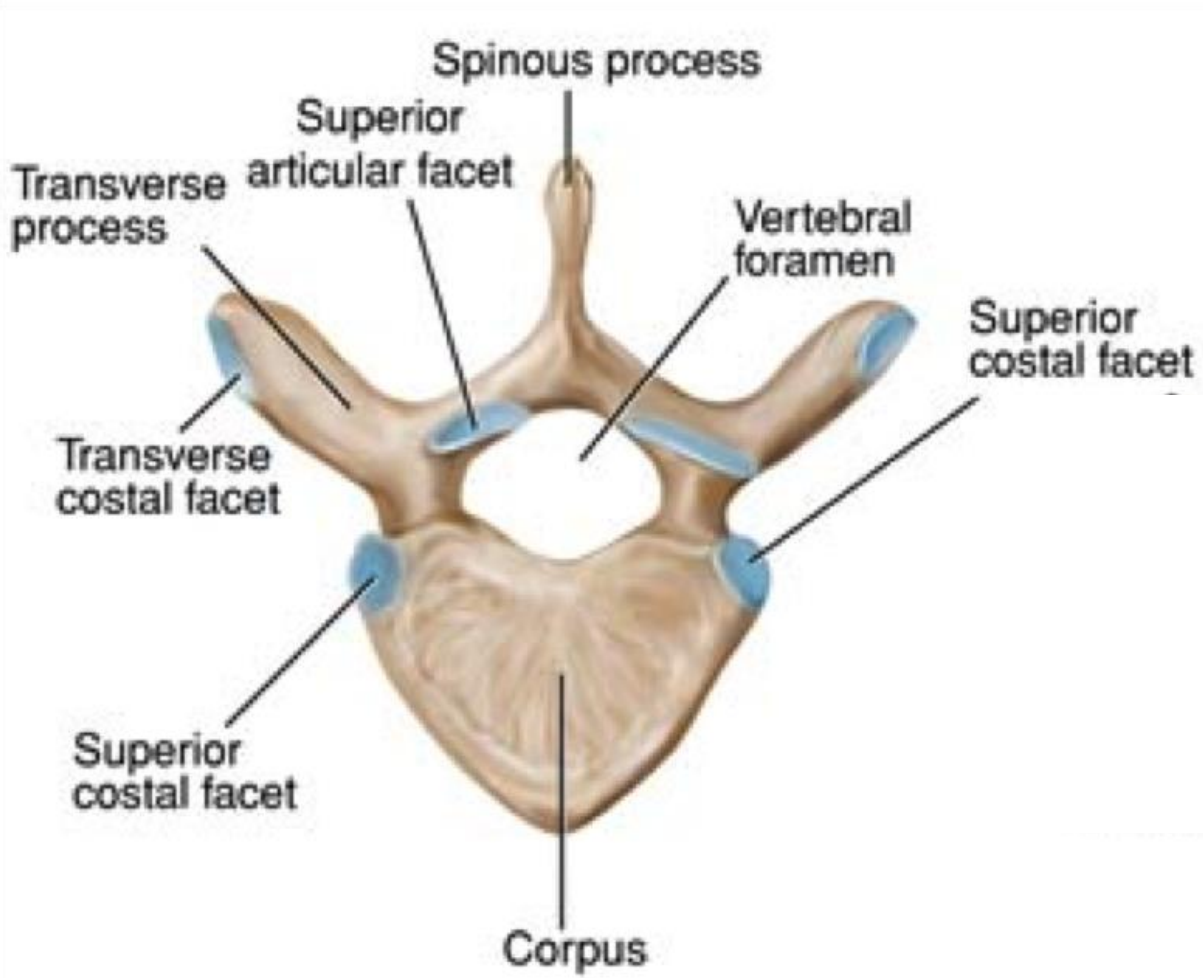




Thoracic vertebra

- Characterized by articular processes for the ribs;

1. On the bodies these articulate with the head of the rib and
2. On the transverse process with the tubercle of the rib.

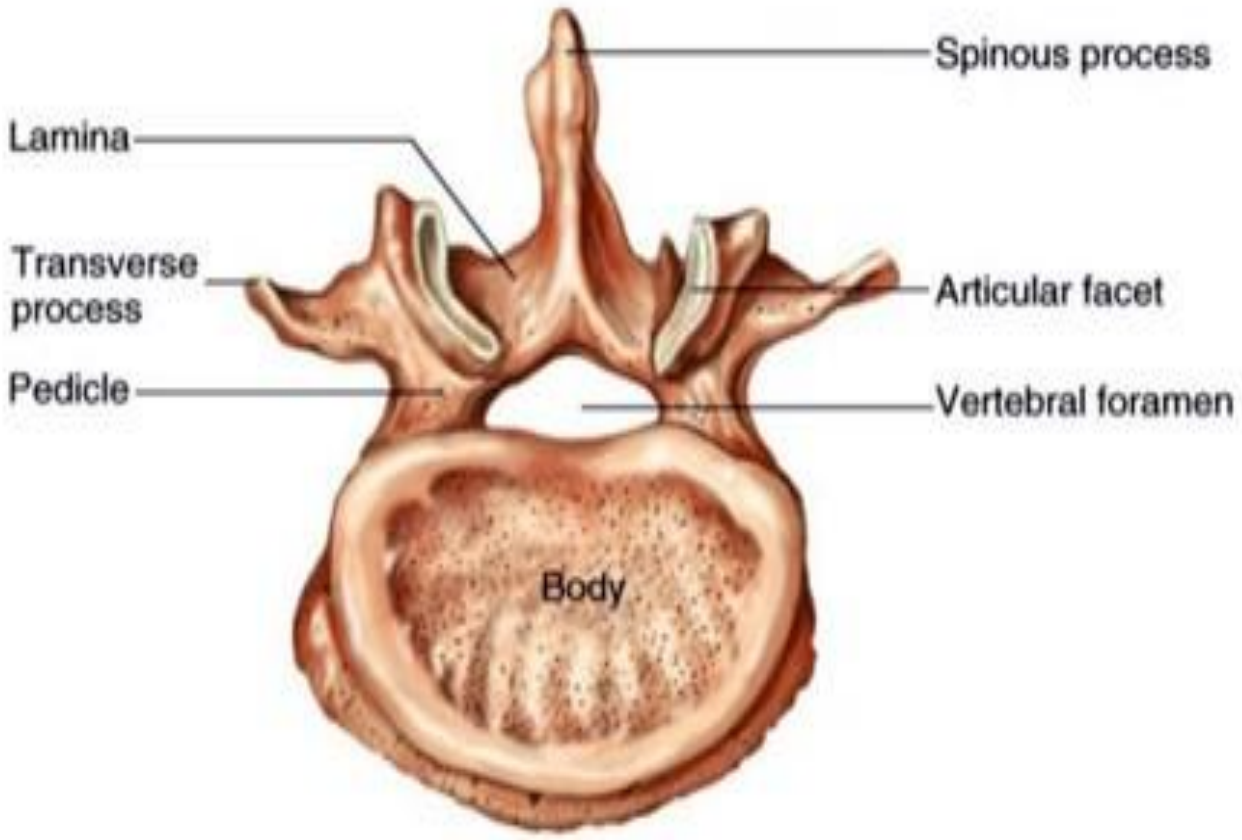


Is there atypical thoracic vertebra?

Lumbar vertebrae

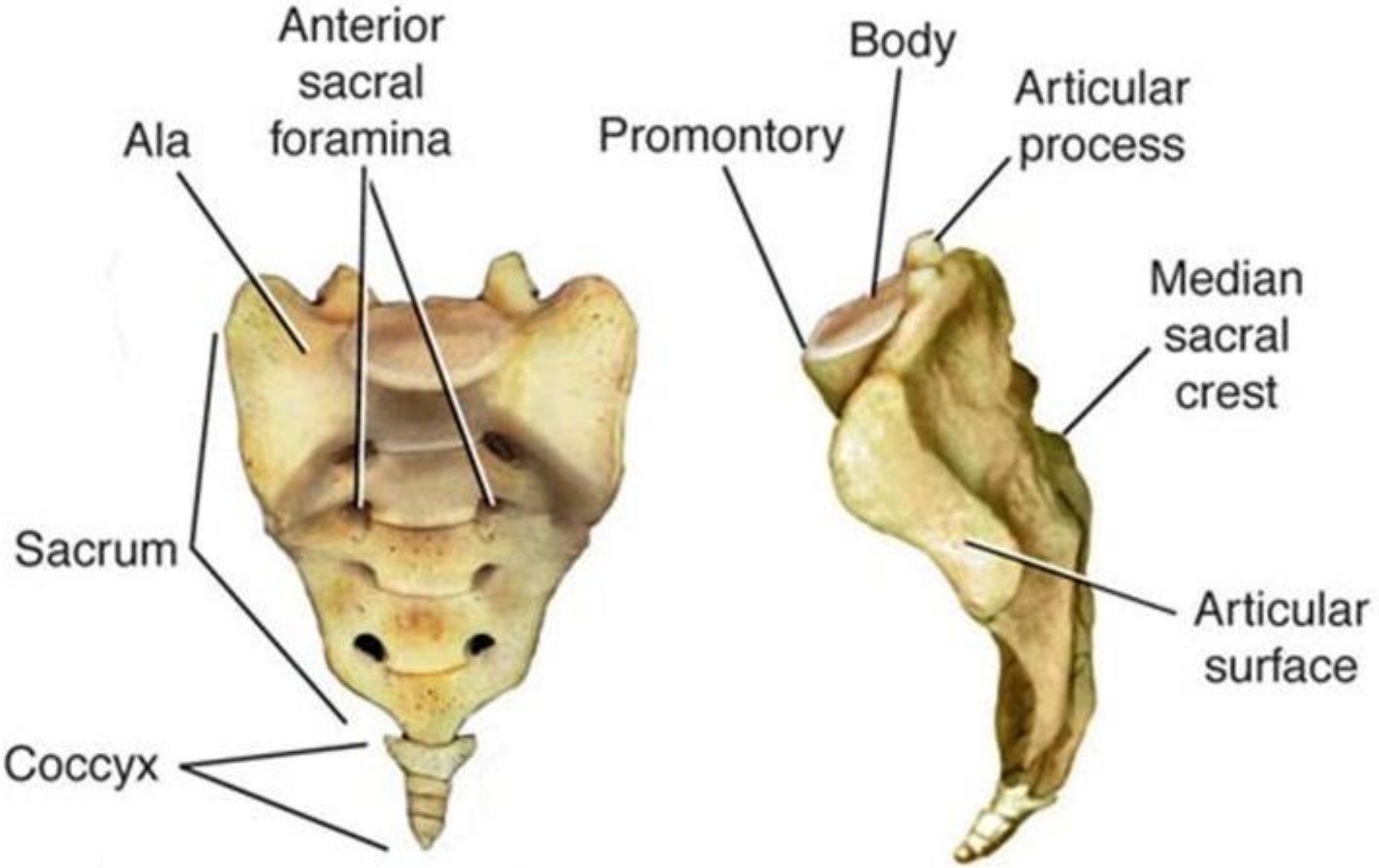
1. Have large bodies

2. No transverse foramen
3. Not bifid spinous process
4. No processes for rib



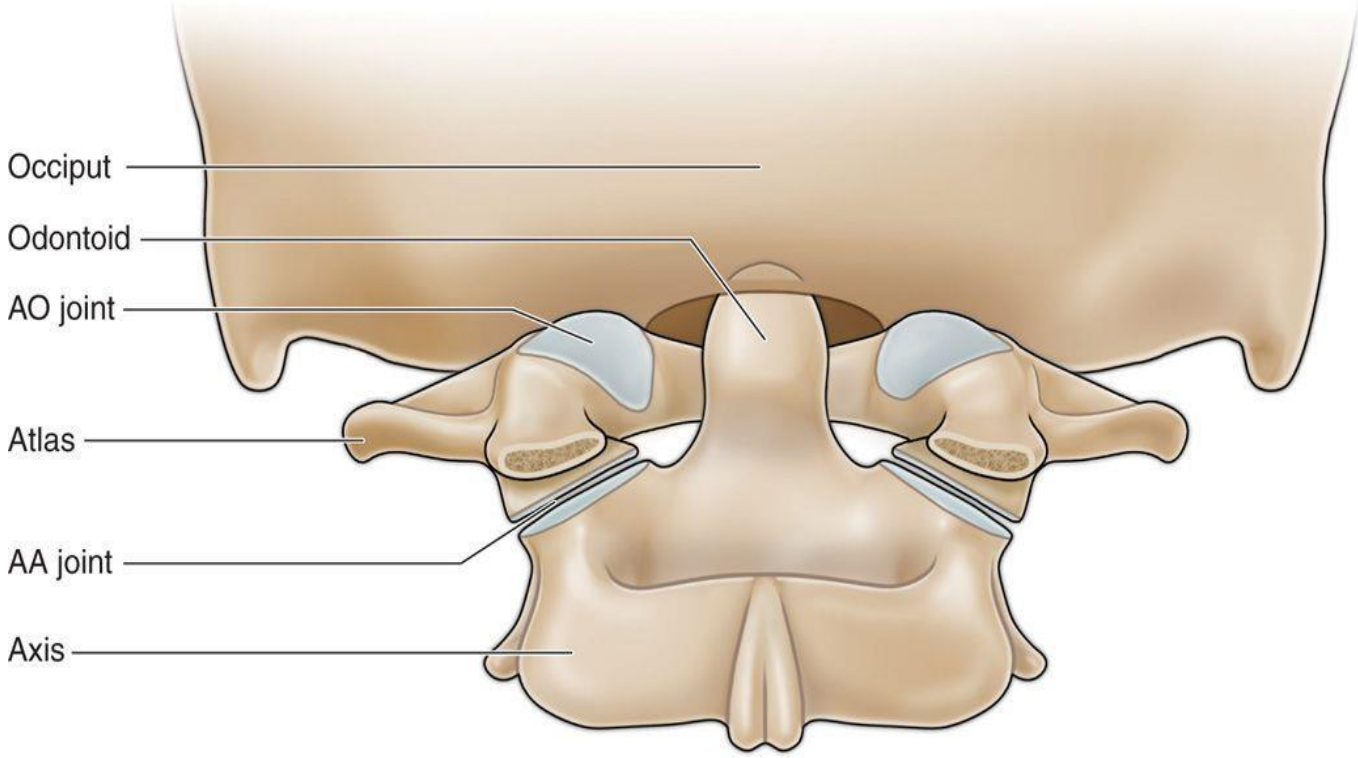
Sacral and coccygeal vertebrae:

- **Fused without disc**
- **They are typical vertebrae**



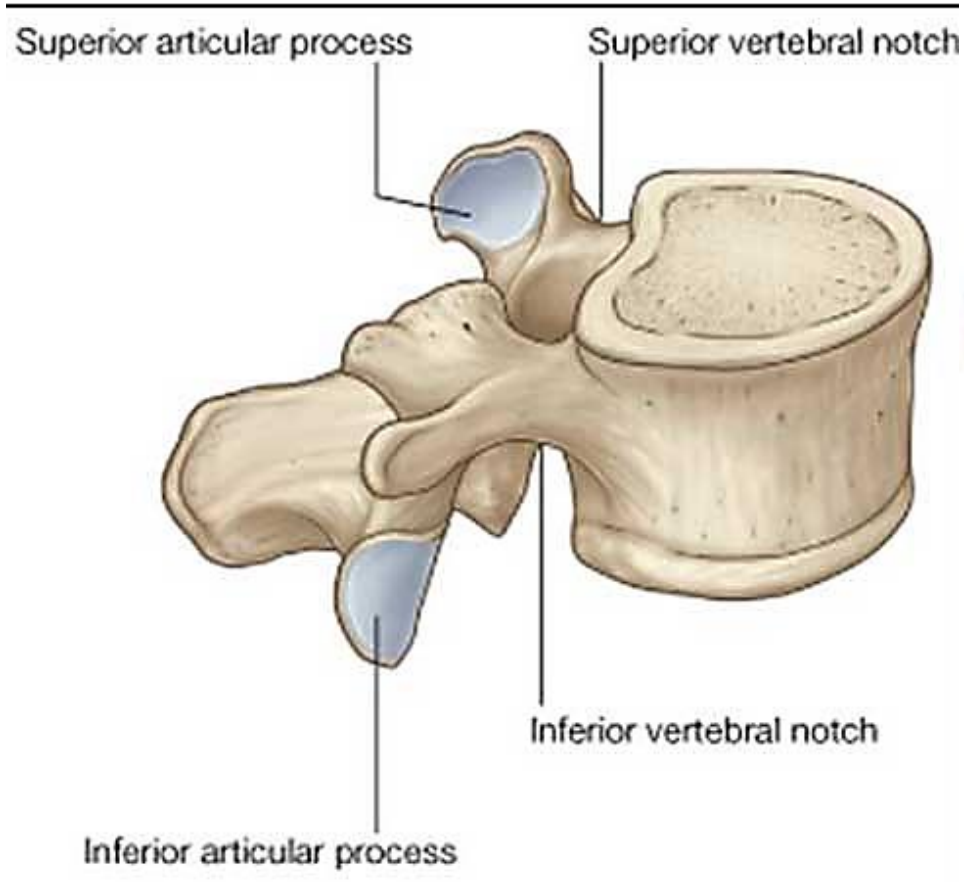
Joints of vertebral column

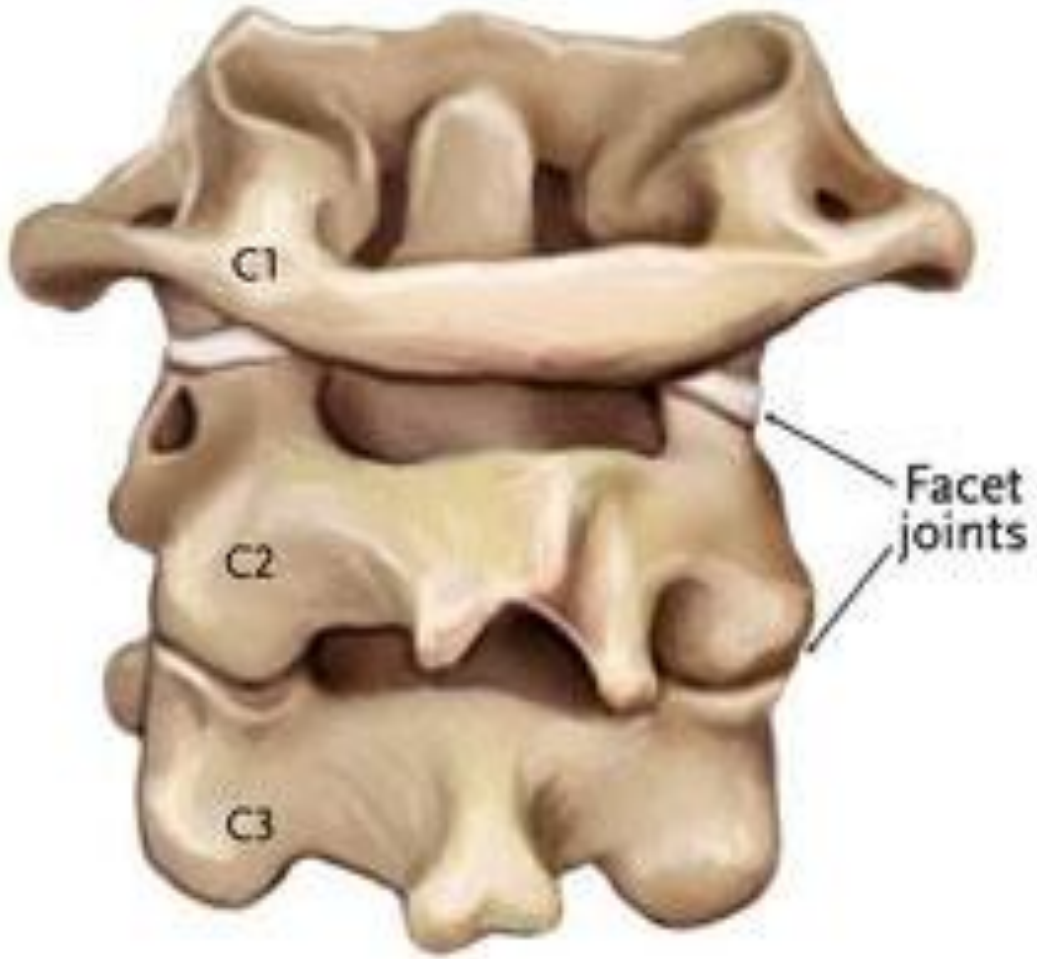
1. **The atlanto-occipital joint** is formed by the condyles of the occiput and the superior articular facets of the atlas; it permits flexion and extension of the head.



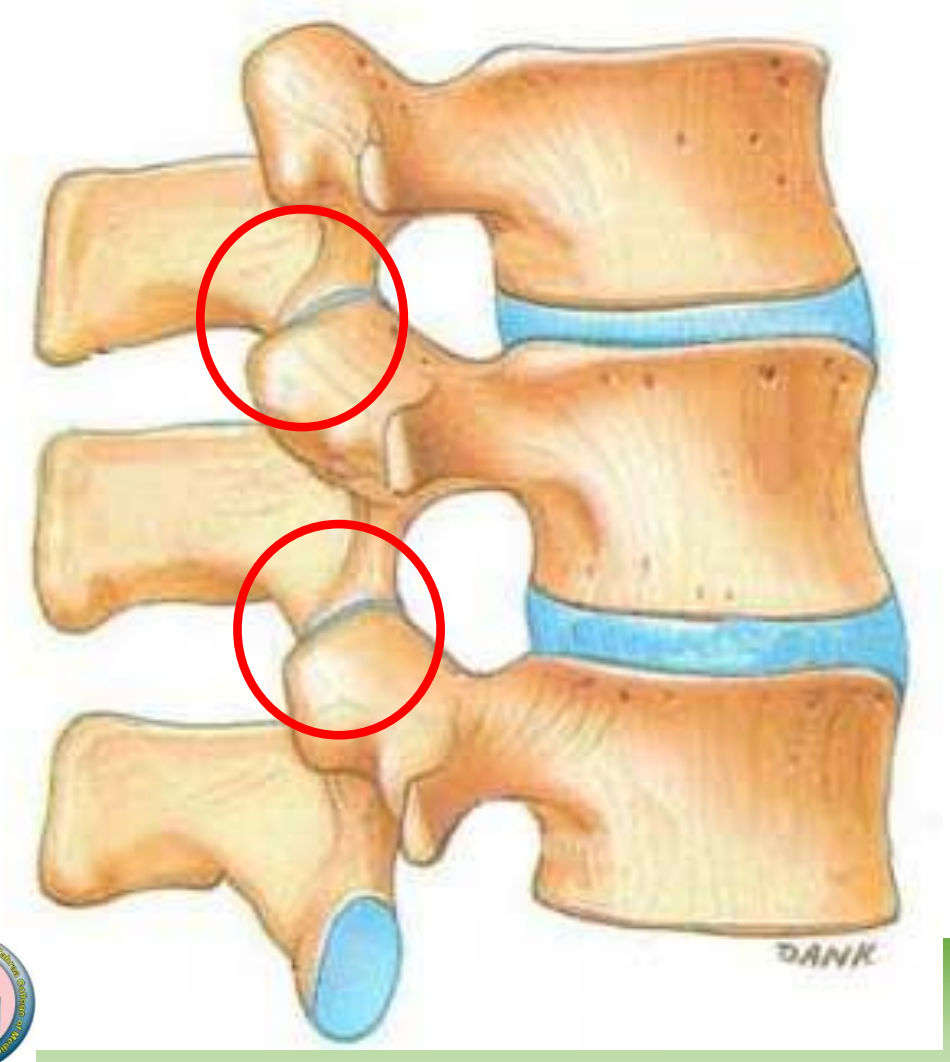
2. **The atlanto-axial joint** between the atlas and axis, permits rotation of the head by allowing rotation between the atlas and axis.

3. Facet joints found between cervical, thoracic and lumbar vertebrae





- Articular processes are hyaline cartilage- lined
- Allow for Zygapophyseal joint (facet joint) to be formed between neural arches of adjacent vertebrae

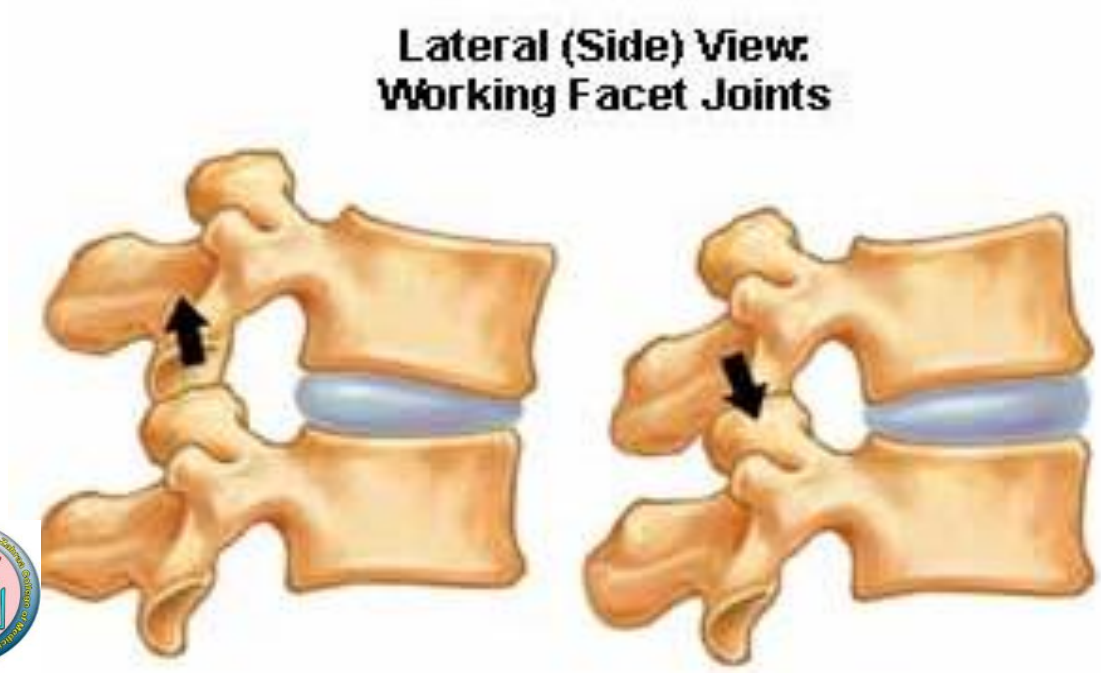


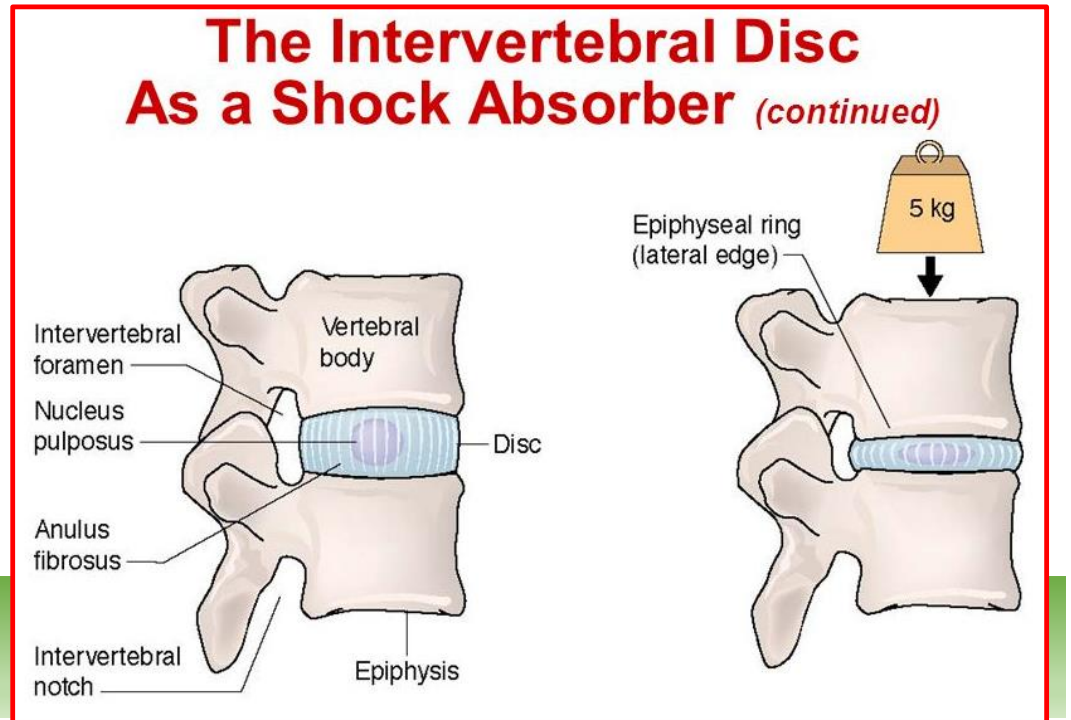
Facet Joints

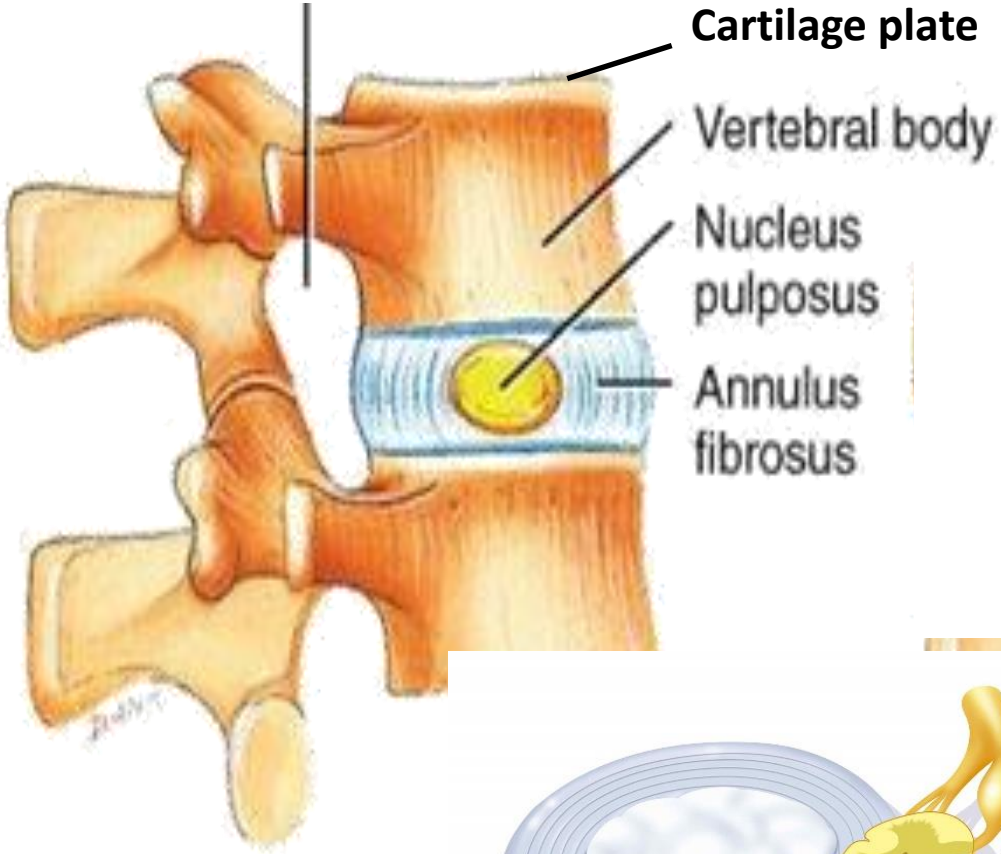
- They are of the synovial variety
- Formed between inferior articular process of the vertebra above and superior articular process of the below vertebra.

4. The Intervertebral Disc

- A disc of tissue separating successive vertebrae between C2/3 to L5/S1 intervertebral levels. **Why no disc between C1-C2?**
- It forms the joint between the vertebral bodies
- These joints are **secondary cartilaginous joint**
- The discs permit tilting movements between adjacent vertebrae and act as shock absorbers.







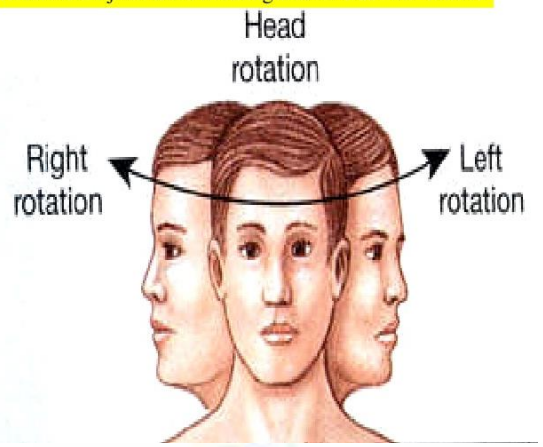
- Each intervertebral disc consists of:

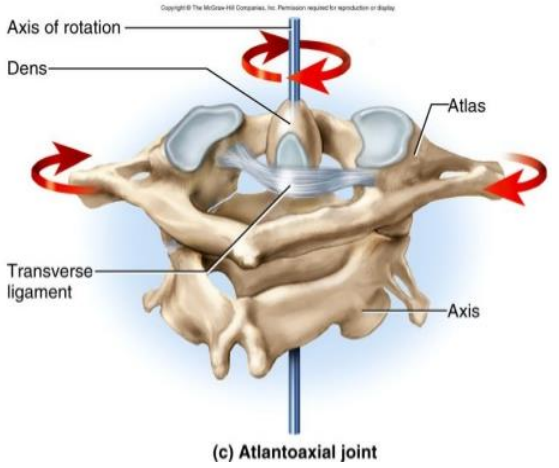
1. An outer **annulus fibrosus** which are attached to the cartilaginous plates covering the bodies of the vertebrae.
2. The **nucleus pulposus** is a central mucoid portion which is enclosed in the annulus fibrosus.

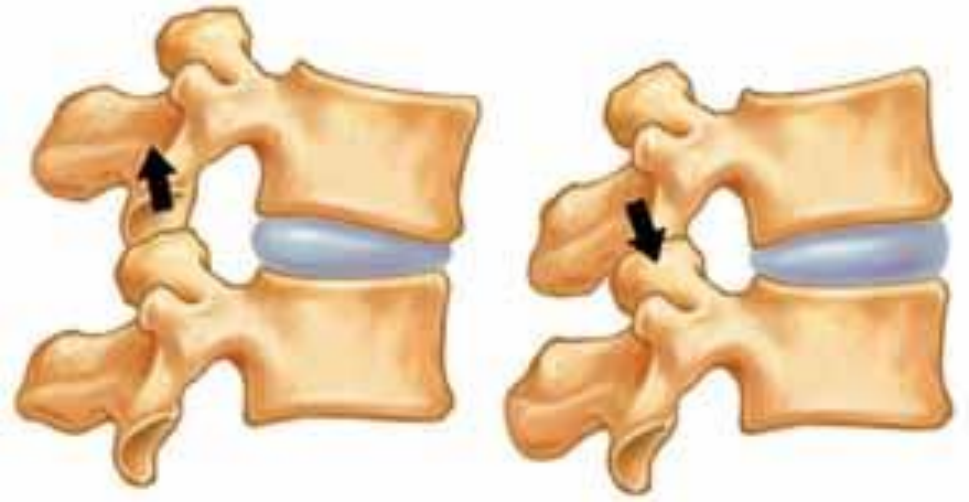
Movement of the vertebral column

1. The atlanto-occipital joint: it permits flexion and extension of the head.
2. The atlanto-axial joint: allowing rotation between the atlas and axis.
3. Facet joints: permit varying degrees of flexion, extension, lateral bending and rotation.
4. The intervertebral discs permit varying degrees of flexion, extension, lateral bending and rotation.

Atlantoaxial joint demonstrating side-to-side "no" motion







Ligaments of the vertebral column

Ligaments help to maintain the stability of the vertebral column:

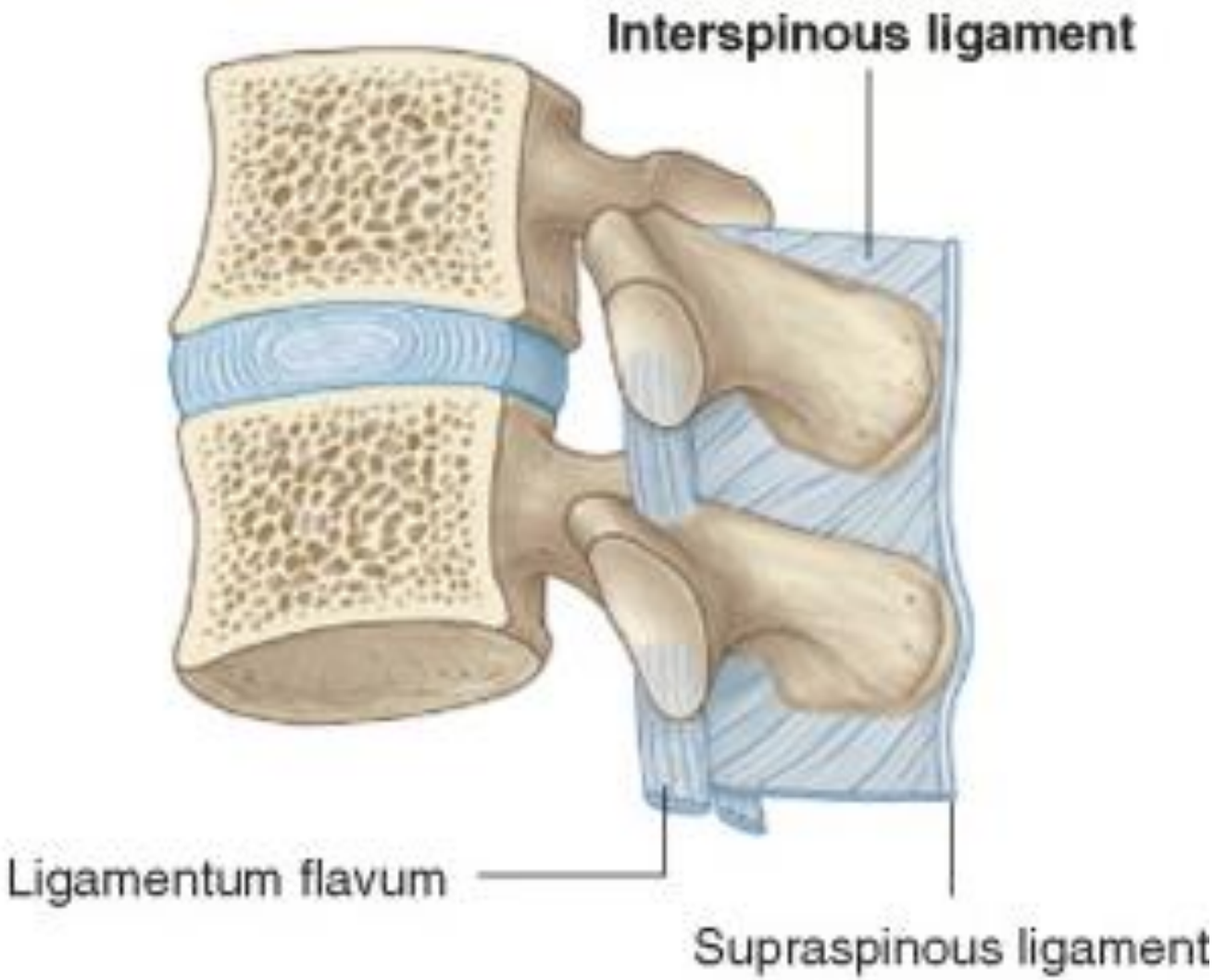
1. The largest are the anterior and posterior longitudinal ligaments which extend along the entire length of the vertebral column.

✓The Anterior longitudinal Ligament is much stronger than the Posterior Longitudinal ligament.

✓Excessive extension of the vertebral column is prevented by the anterior longitudinal ligament while excessive flexion is prevented by all of the other ligaments.

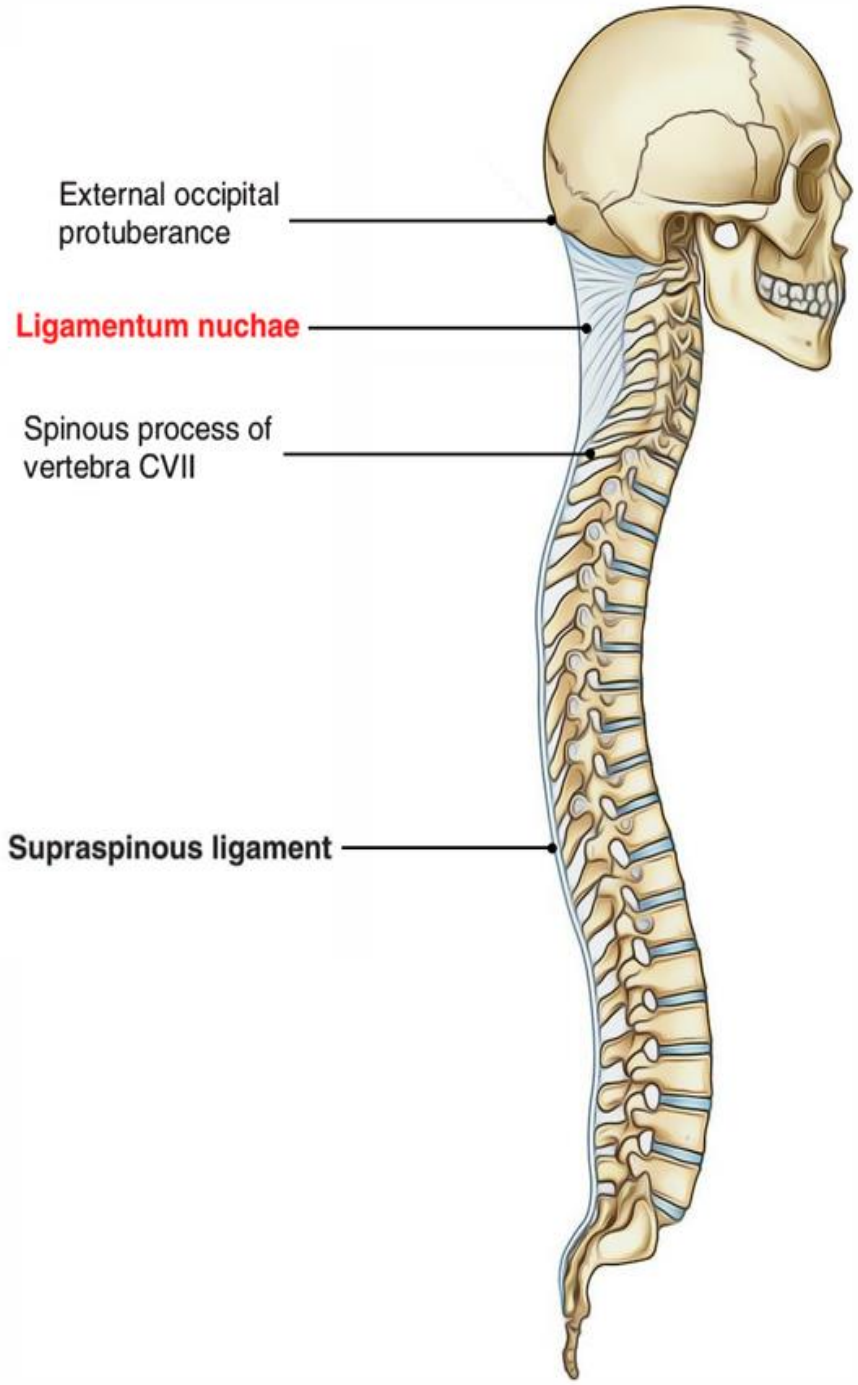
Ligaments of the vertebral column

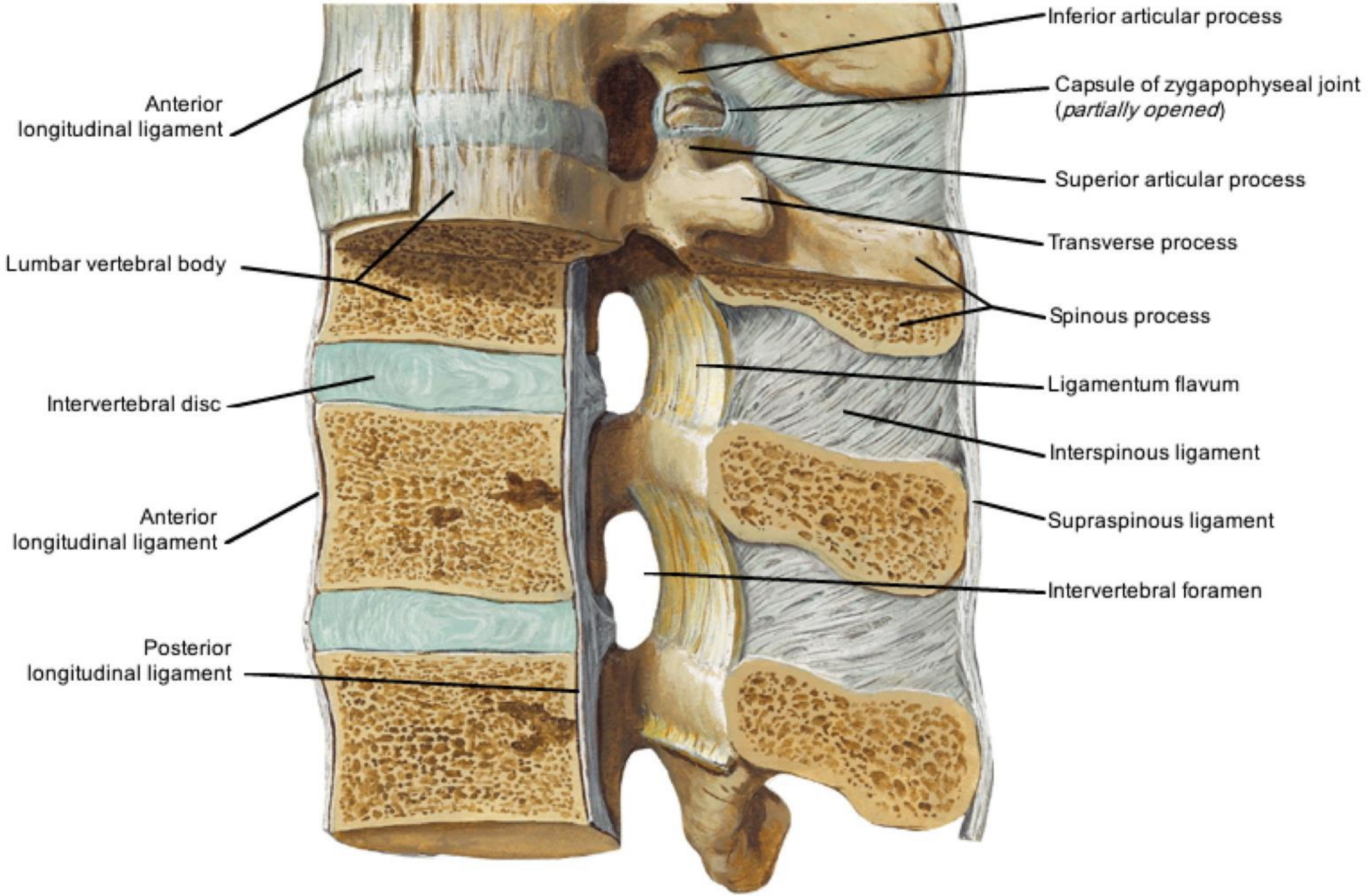
2. Additional ligaments connect the tips of the spinous processes (supraspinous ligament),between spinous processes (interspinous ligament), the transverse processes (intertransverse ligaments) and the laminae of adjacent vertebrae (ligamentum flavum).



Ligaments of the vertebral column

3. In the cervical region the supraspinous ligament is known as the ligamentum nuchae and is highly elastic.

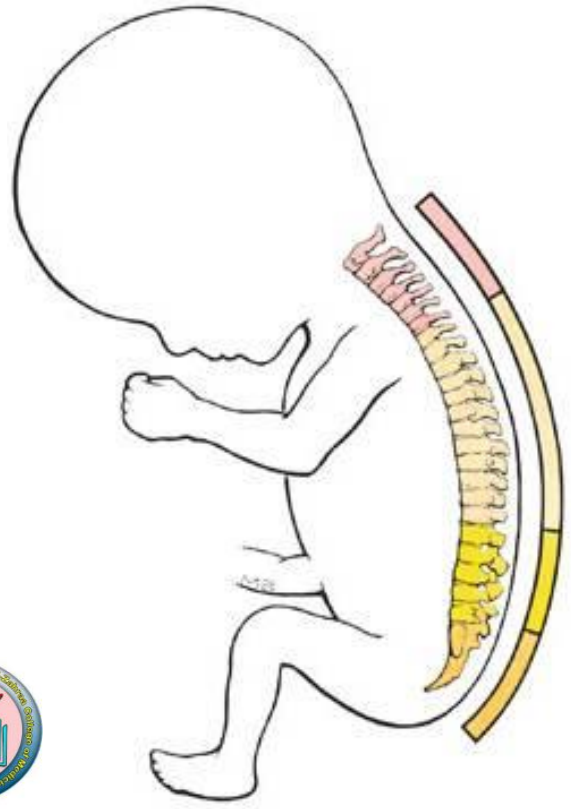



Inferior articular process
Capsule of zygapophyseal joint (*partially opened*)
Superior articular process
Transverse process
Spinous process
Ligamentum flavum
Interspinous ligament
Supraspinous ligament
Intervertebral foramen
Anterior longitudinal ligament
Lumbar vertebral body
Intervertebral disc
Anterior longitudinal ligament
Posterior longitudinal ligament

The Vertebral Column in the Foetus

- During development the vertebral column forms a C-shaped curve known as the **primary curvature**.

- It is concave anteriorly
- It is also known as a Kyphosis



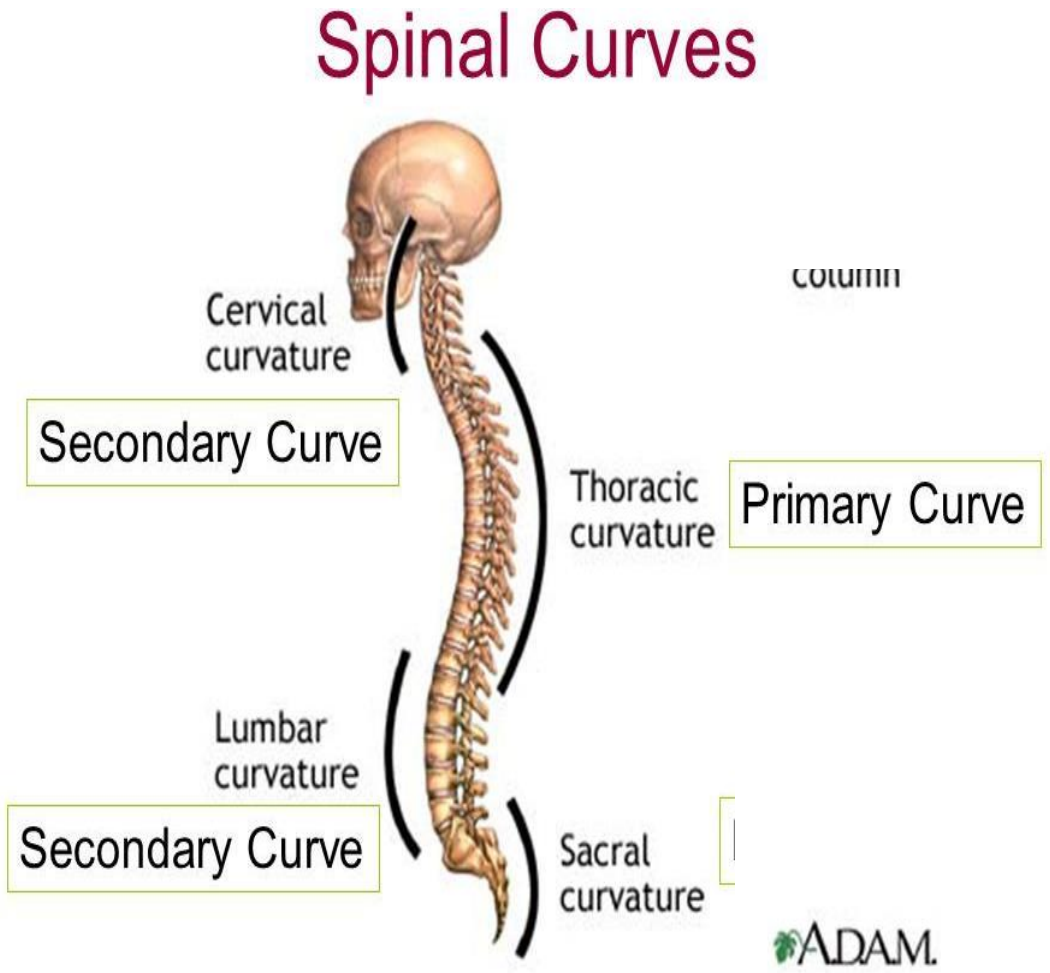
During development from the fetus

- The cervical spine develops the first posterior convexity when a young child begins to lift its head

- The lumbar spine also opens up during crawling until the child begins to stand-up and walk.

- These are **secondary curvature**

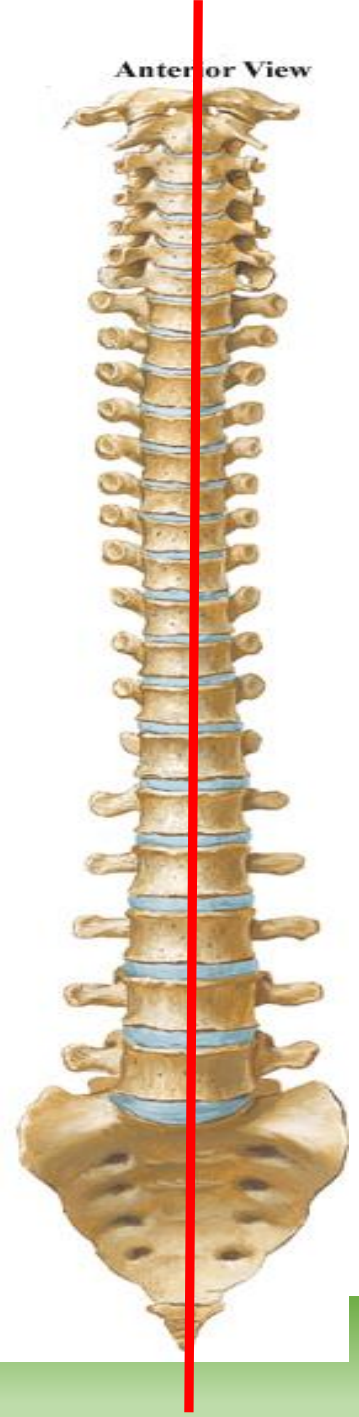
The Vertebral Column after walking



- Postnatally, cervical and lumbar curvatures (the secondary curvatures) develops.
- Its shape approximates the figure of S- shaped
- It has 4 distinct curvatures
- 2 anterior flexion (kyphosis): thoracic and sacrum
- 2 Posterior flexion (lordosis): cervical and lumbar

The Vertebral Column after walking

- In coronal view: straight without curve



Abnormalities of curvature are common

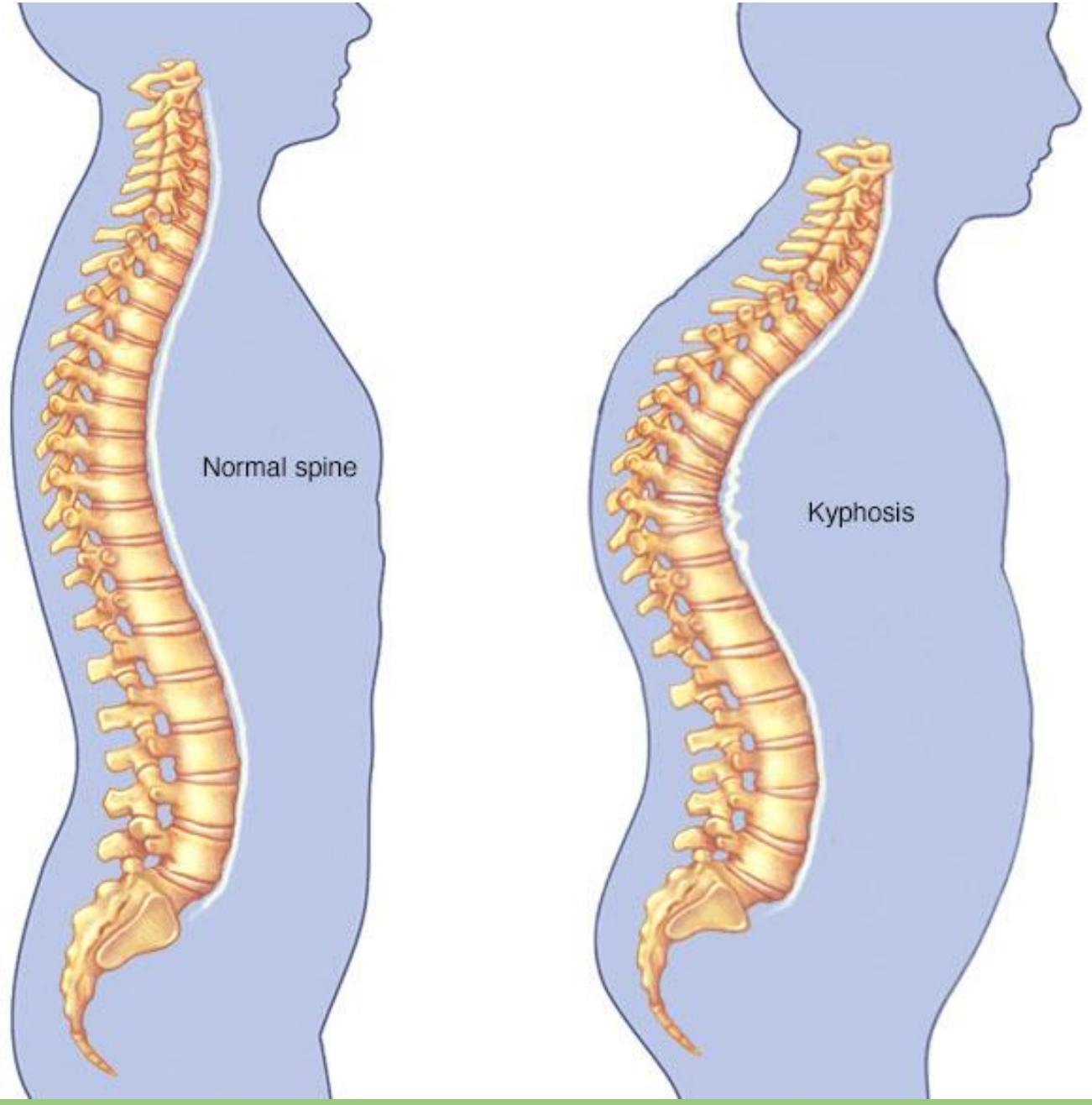
- Exaggeration of the **thoracic** curvature is known as kyphosis
- Exaggeration of the **lumbar** curvature is known as lordosis.

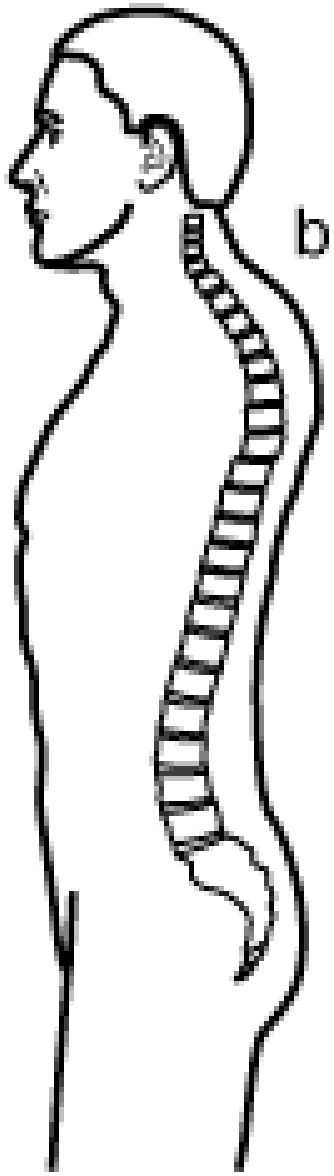
- Scoliosis is a lateral deviation of the vertebral column.

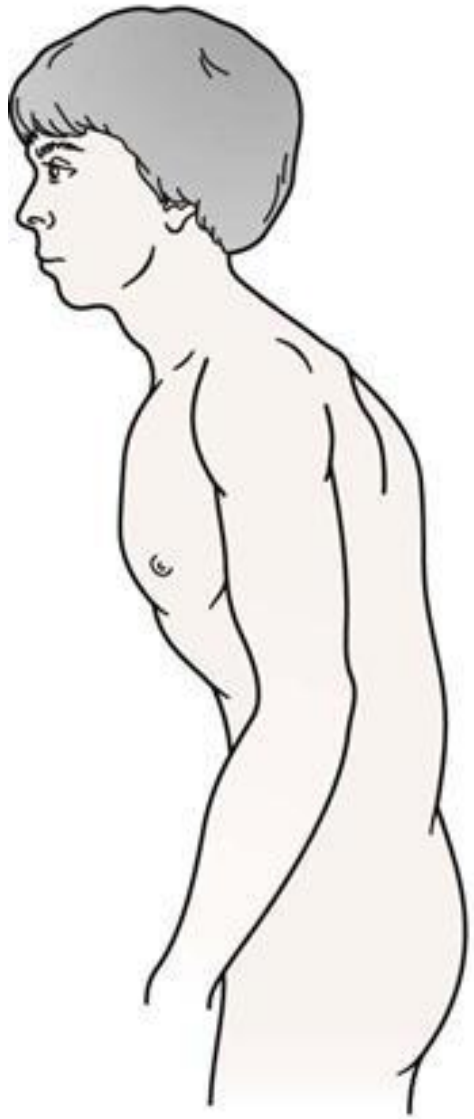
Kyphosis

- Exaggeration of the **thoracic** curvature is known as kyphosis.

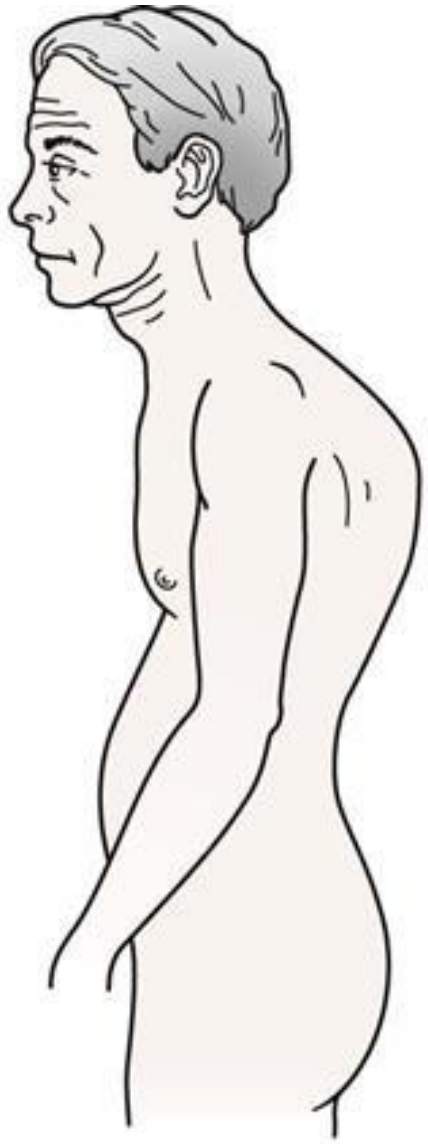
- Gibbus is a sharp kyphosis

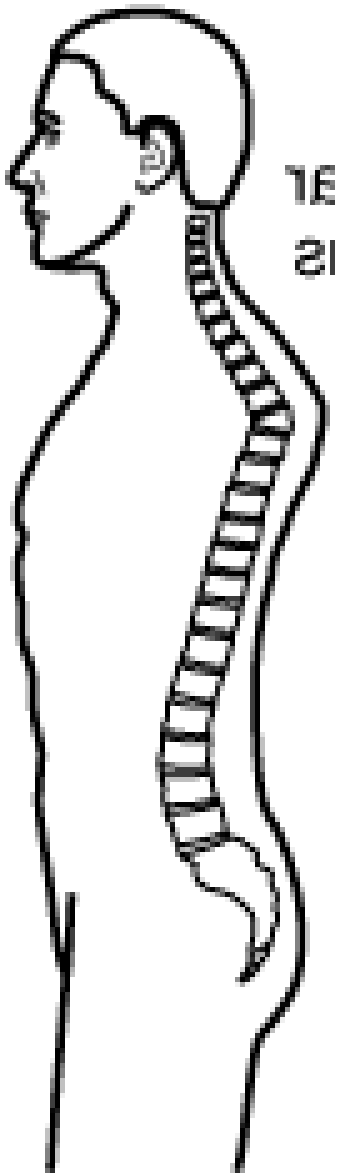






KYPHOSIS

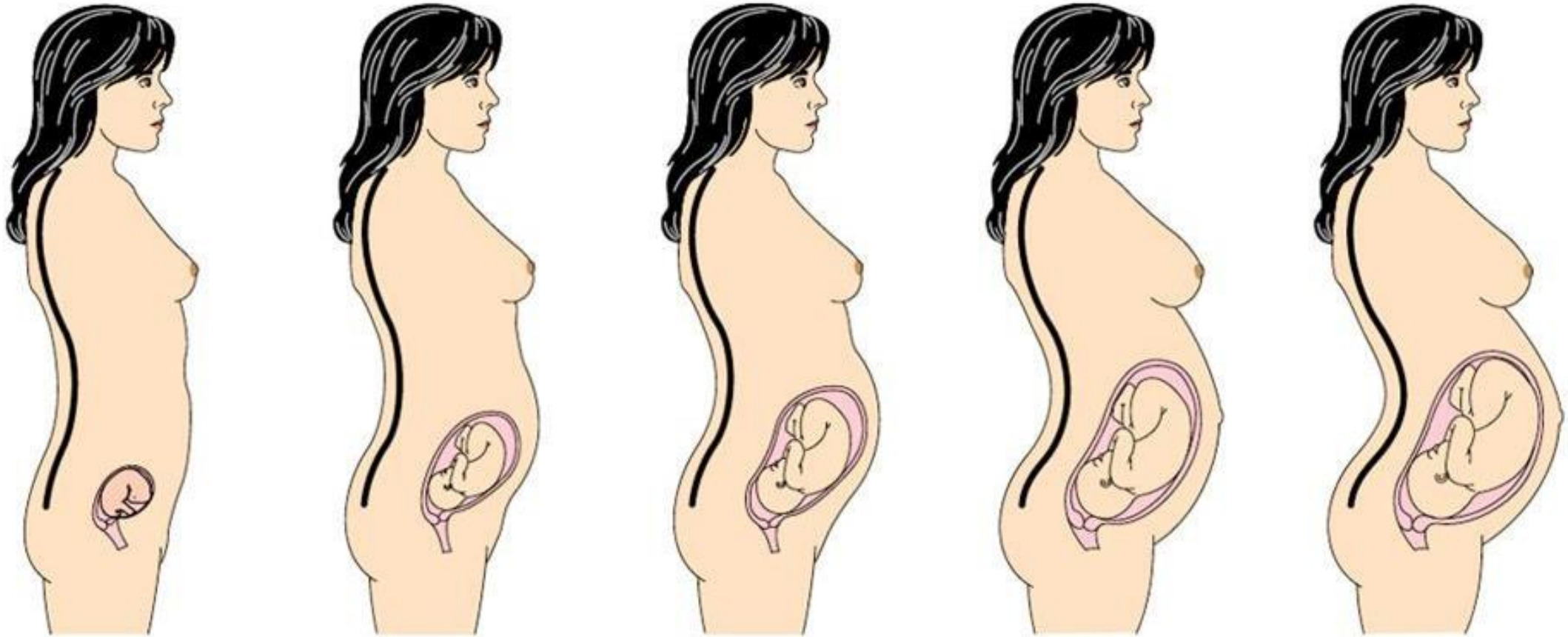




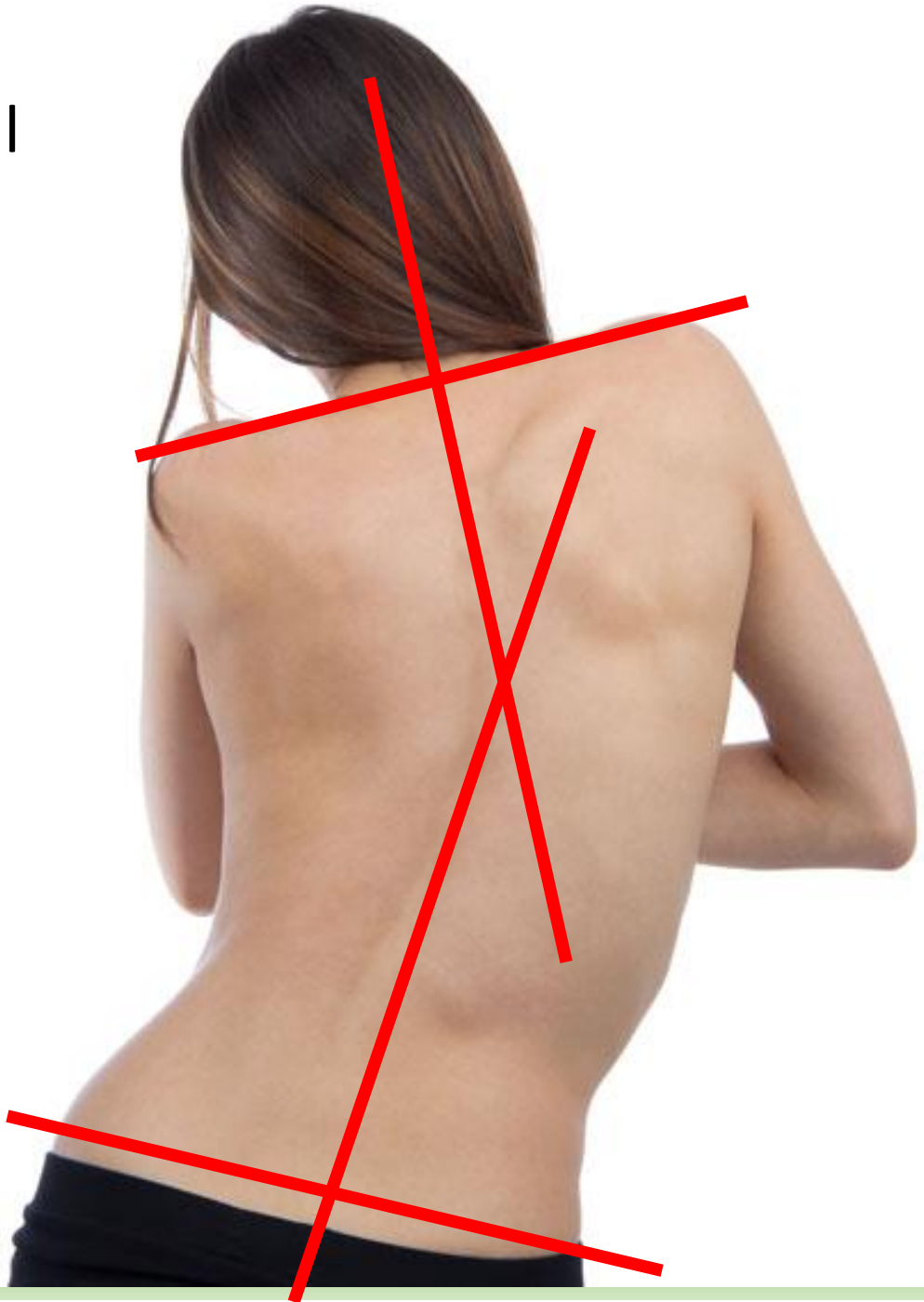
GIBBUS

- Exaggeration of the **lumbar** curvature is known as lordosis.

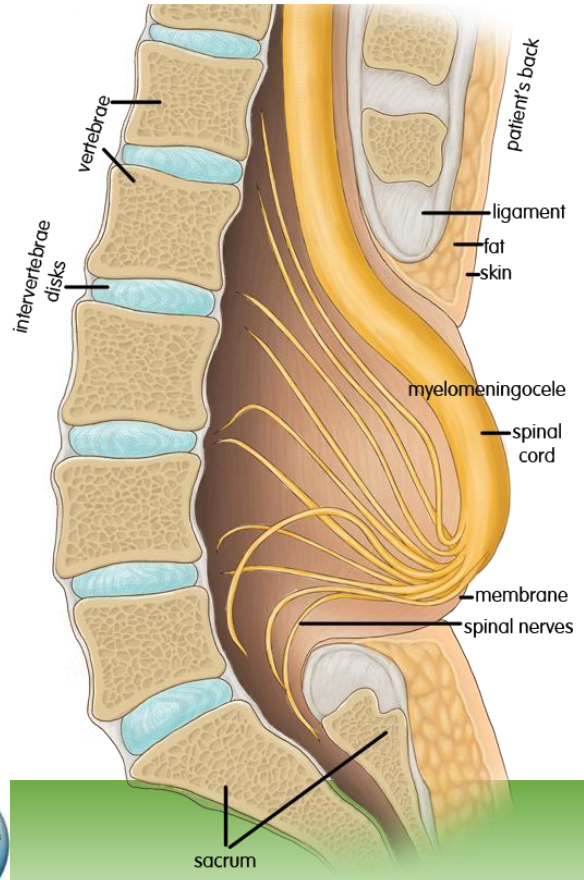
- In pregnancy, women develop a lumbar lordosis as a means of compensating for the additional weight of the fetus.



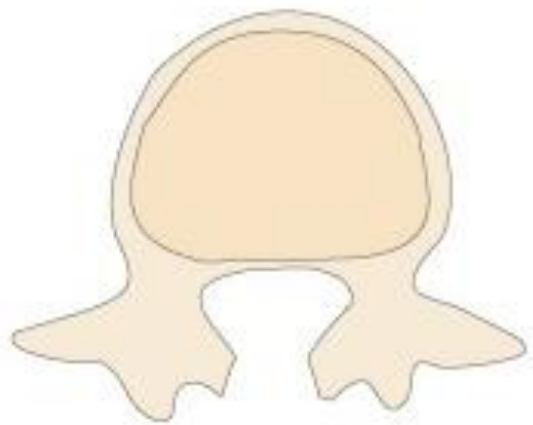
Scoliosis is a lateral deviation of the vertebral column.



Spina bifida: defect in the formation of posterior arch of vertebra



normal vertebra



not completely closed vertet

Intervertebral Disc Prolapse (herniation):

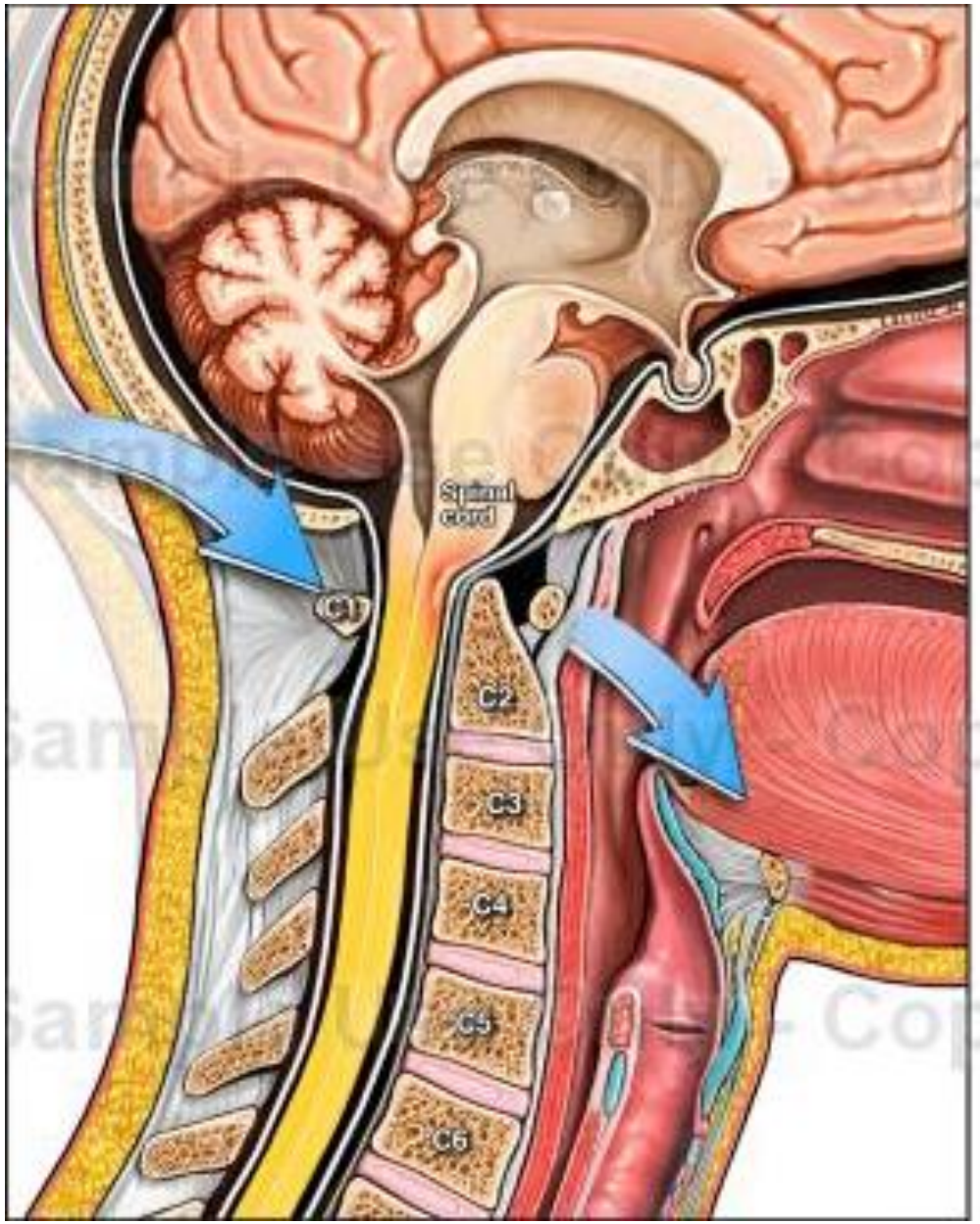
- With increasing degeneration of the annulus fibrosus, it softens permitting herniation of nucleus pulpous through fissures in annulus fibrosus.
- Occur most commonly, postero-laterally
- Result in compression of spinal nerve root

Cervical spondylosis

- With age: loss of disc hydration and ligaments elasticity
- Disc height decreased
- Disc bulges outside anteriorly and posteriorly
- Osteoarthritis of facet joints and intervertebral disc degeneration
- It is progressive process

Arthritis:

- The joints of the vertebral column are also subject to arthritic change.
- Rheumatoid arthritis particularly affects the atlanto-axial joint because of the complex arrangement of the synovium around the transverse ligament of this joint.
- Stretching of the transverse ligament permits the head and atlas to slip forwards leading to the odontoid peg compressing the cervical cord.



Spine trauma


ThankYou