

THE VERTEBRAL COLUMN

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THE VERTEBRAL COLUMN

It consists of 33 vertebrae separated by intervertebral discs.

It houses and protects the spinal cord in its spinal canal.

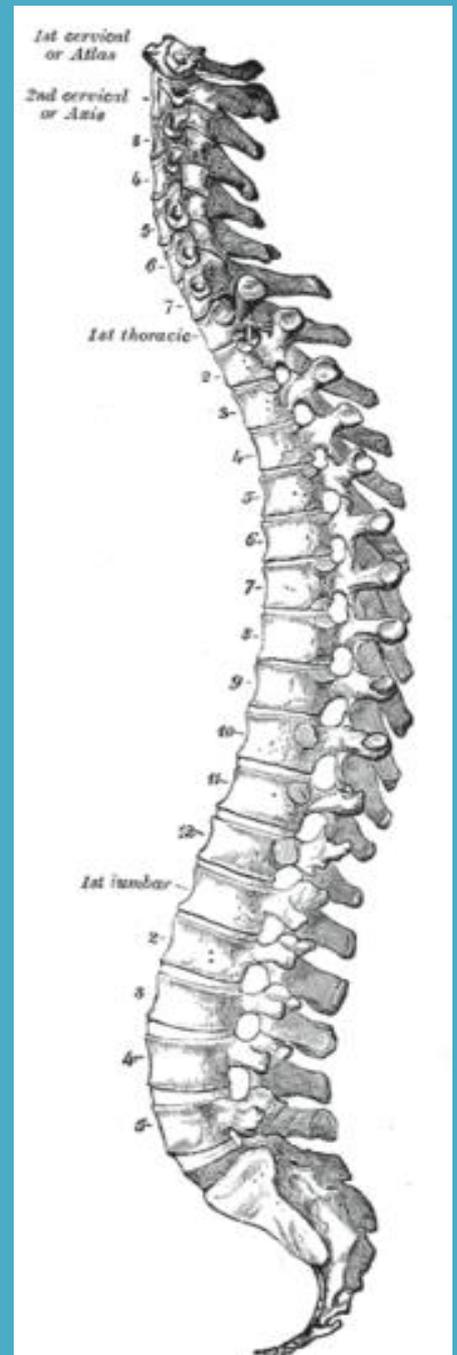
It shows several Curves

The cervical curve: convex forward.

The thoracic curve: concave forward.

The lumbar curve: convex forward. more marked in the female than in the male. convexity of the lower three vertebrae being much greater than that of the upper two. This curve is described as a lordotic curve.

The pelvic curve: begins at the lumbosacral articulation and ends at the point of the coccyx; concave forward.



Regions and Normal Curvatures

A. Curvatures of the spine

1. Cervical and lumbar curvatures

- ▶ *Concave* posteriorly

2. Thoracic and sacral curvatures

- ▶ *Convex* posteriorly

kyphosis – exaggerated curvature in thoracic region (humpback)

lordosis – exaggerated curvature in the lumbar region

scoliosis – S-shaped curvature of the whole vertebral column

Primary and secondary curves

1. primary curves:

present during fetal life.

includes thoracic and pelvic curves.

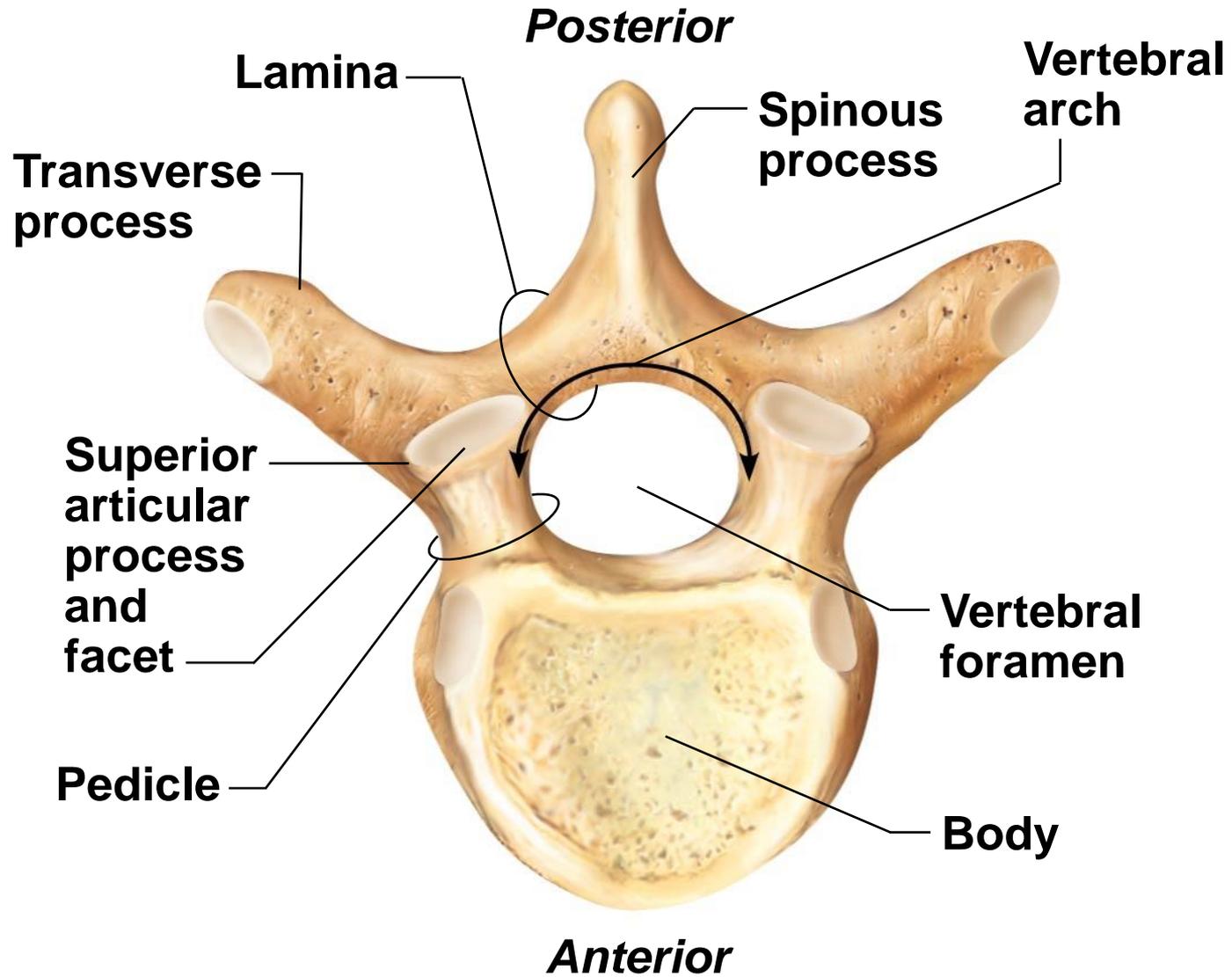
2. Secondary curves:

developed after birth.

Includes cervical and lumbar curves.

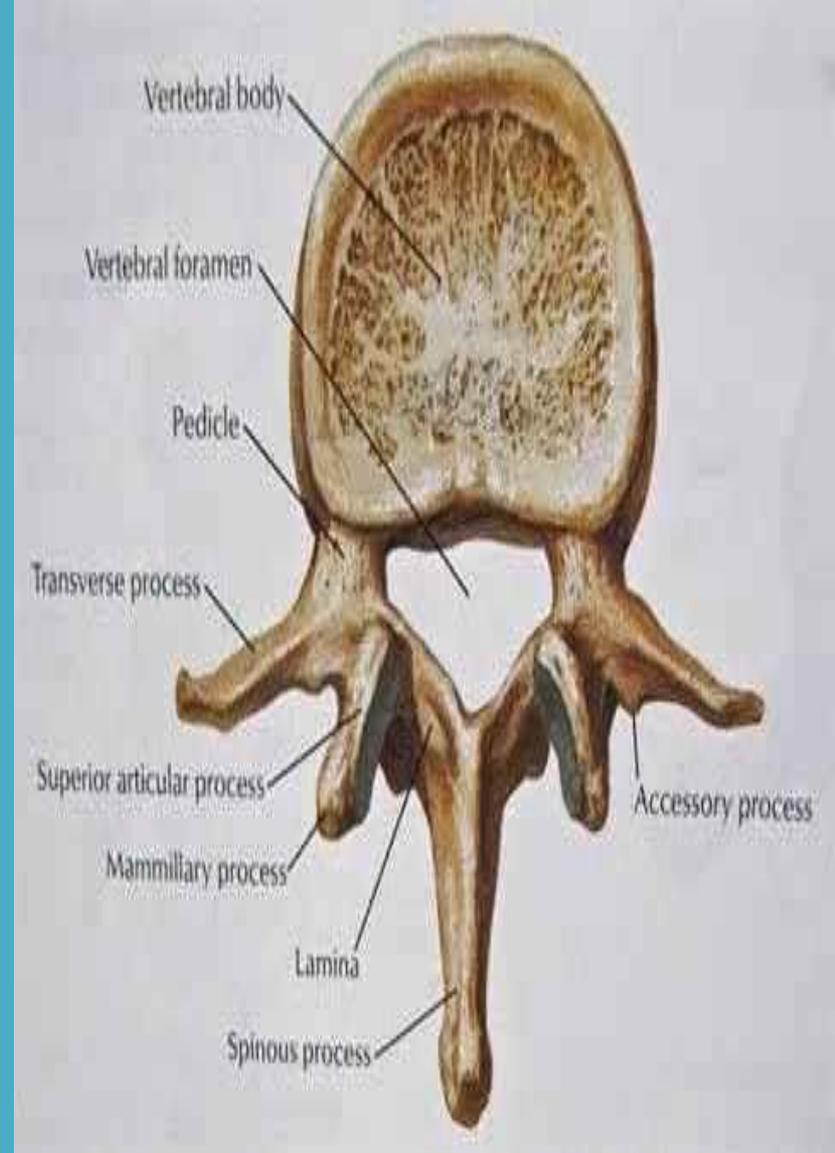
cervical when the child is able to hold up its head (at three or four months) and to sit upright (at nine months)

Lumbar at twelve or eighteen months, when the child
4 begins to walk.

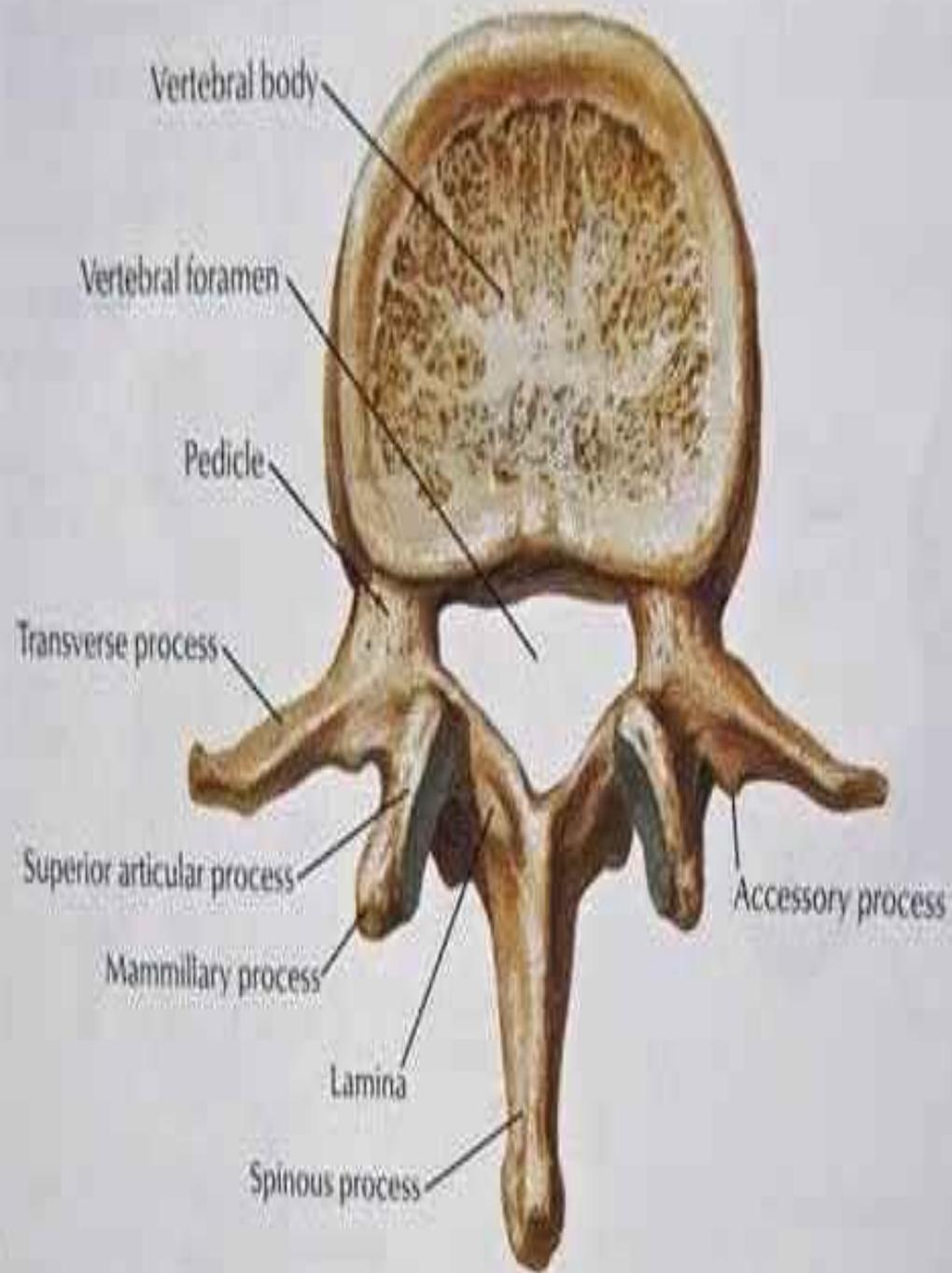


□ Body: thick ventral part. It has upper and lower flat surfaces, that give attachment to the *cartilaginous intervertebral disc*.

- It has anterior and posterior surfaces, give attachment to the *anterior and posterior longitudinal ligaments* respectively.
- The posterior surface contains from one to two foramina.

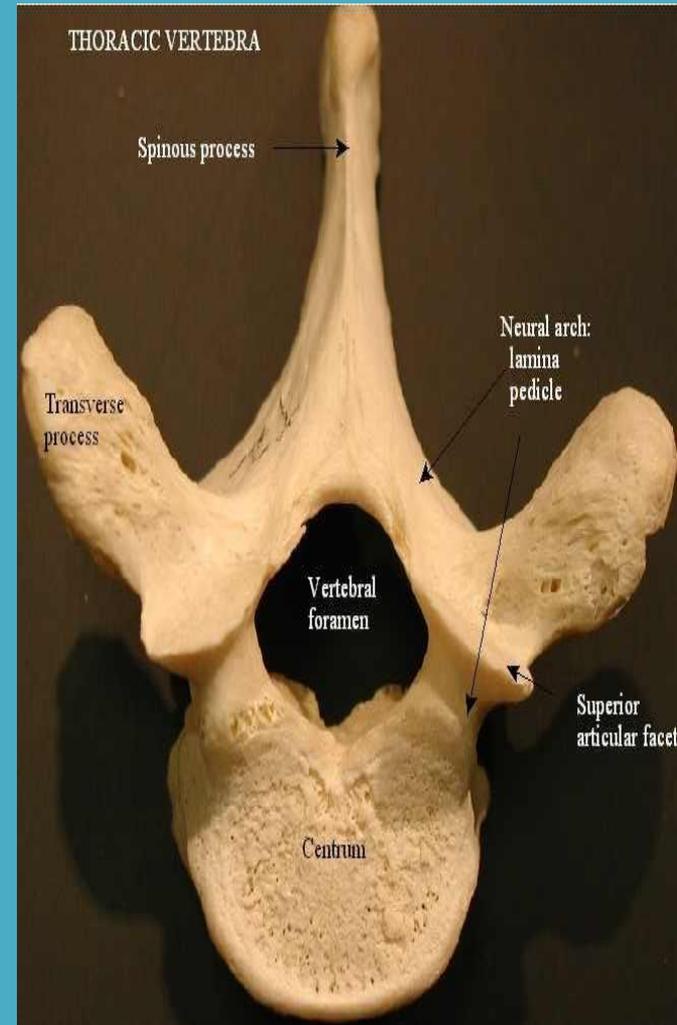


- for the exit of basivertebral vein which drains the body of vertebra to the internal vertebral venous plexus of veins present inside the vertebral arches.
- The body is convex anteriorly and slightly concave posteriorly.



□ **Vertebral arch:** bony arch projecting backward, from the lateral margin of the body's posterior surface.

- encircles a vertebral foramen through which the spinal cord passes.
- From this arch **seven bony** processes project; **two transverse**, **two superior articular**, **two inferior articular** and midline posterior **spine**.
- The superior and inferior articular processes of two adjacent vertebrae articulate together at facet joint.
- In articulated vertebrae, the vertebral foramen of each vertebra forms the vertebral or spinal canal.

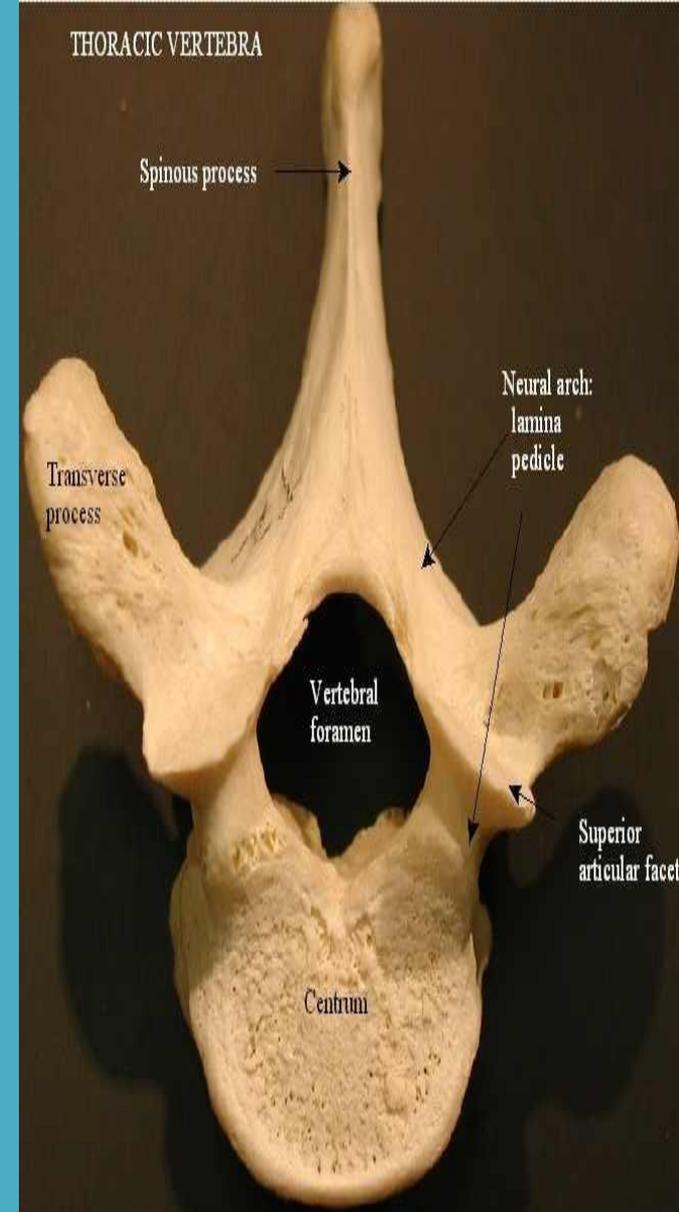


❑ **Pedicle:** the part of arch lying between the body and transverse process.

■ Its upper and lower border form the *superior* and *inferior vertebral notch* respectively.

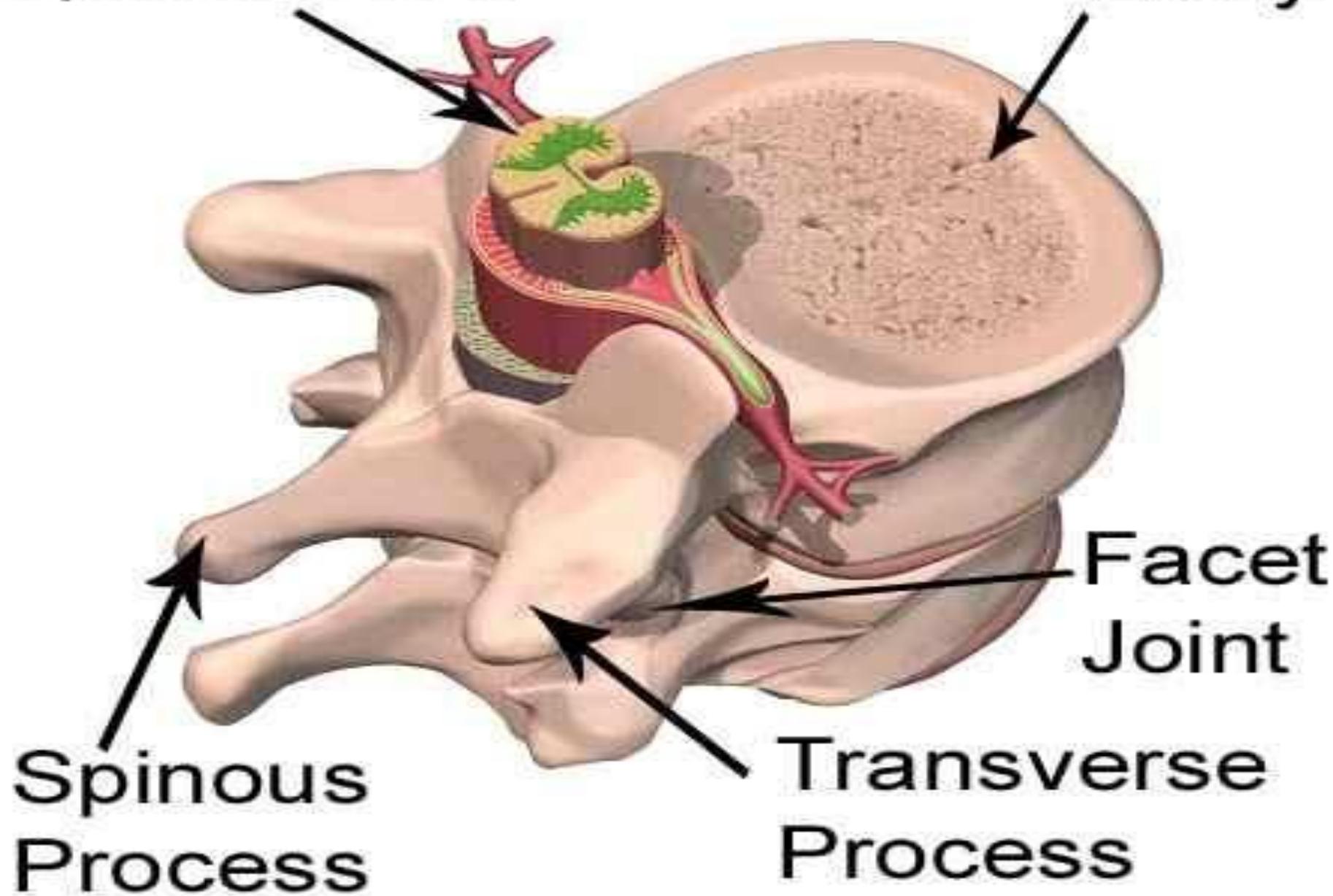
❑ **Lamina:** the part of arch lying between the transverse process and spine.

❑ **Intervertebral foramen:** it is a foramen created in articulated vertebrae and bounded by the *superior* and *inferior vertebral notch* of two adjacent vertebrae. It give exit to the spinal nerve.



Spinal Cord

Body

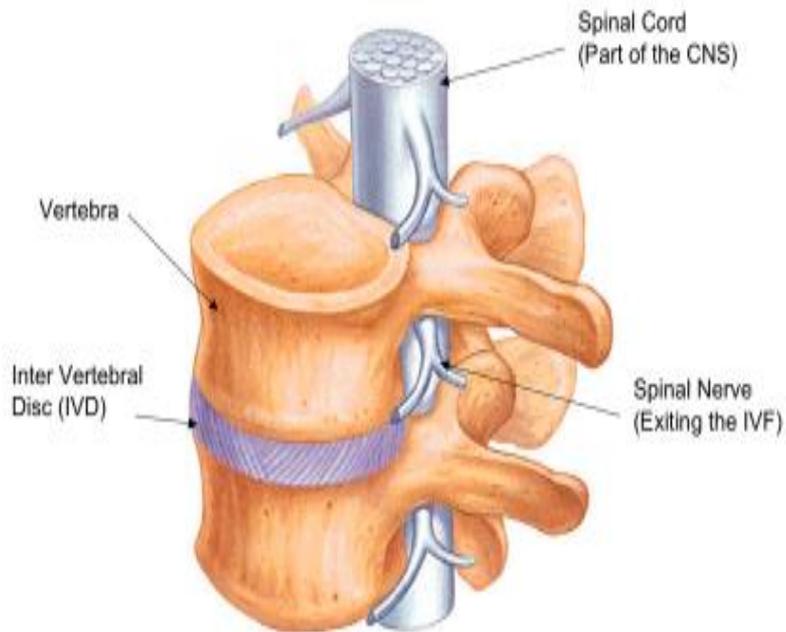


Facet Joint

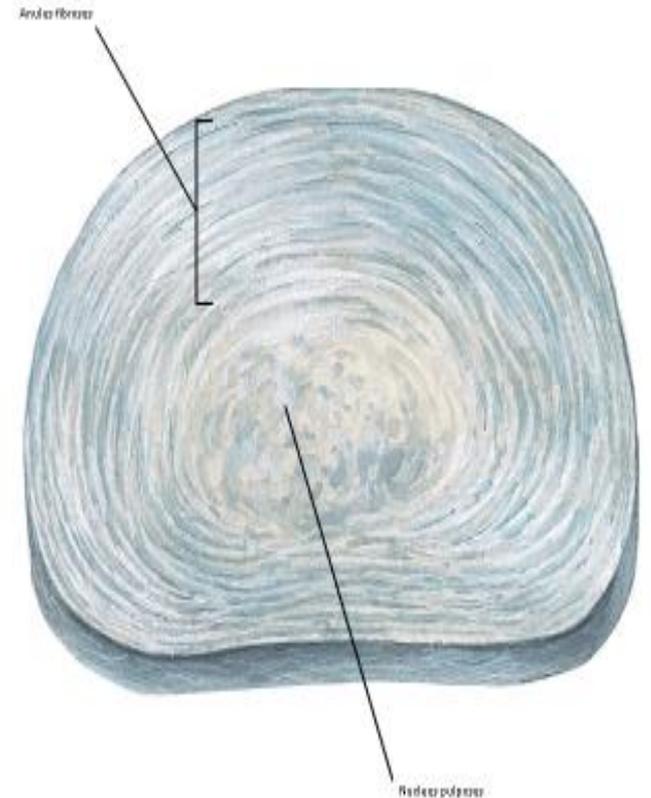
Spinous Process

Transverse Process

The intervertebral disc is formed of annulus fibrosus and nucleus pulposus



Lumbar Intervertebral Disc



Individual vertebrae

- **A. Cervical vertebrae (C1–C7)**
 - C1 is known as "**atlas**" and supports the head, C2 is known as "**axis**", C7 is known as "**vertebra prominens**"
 - C3-6 are typical
 - Possesses bifid spinous processes, which is absent in C1 and C7
 - Only cervical vertebrae have transverse foramen
 - Small-bodied

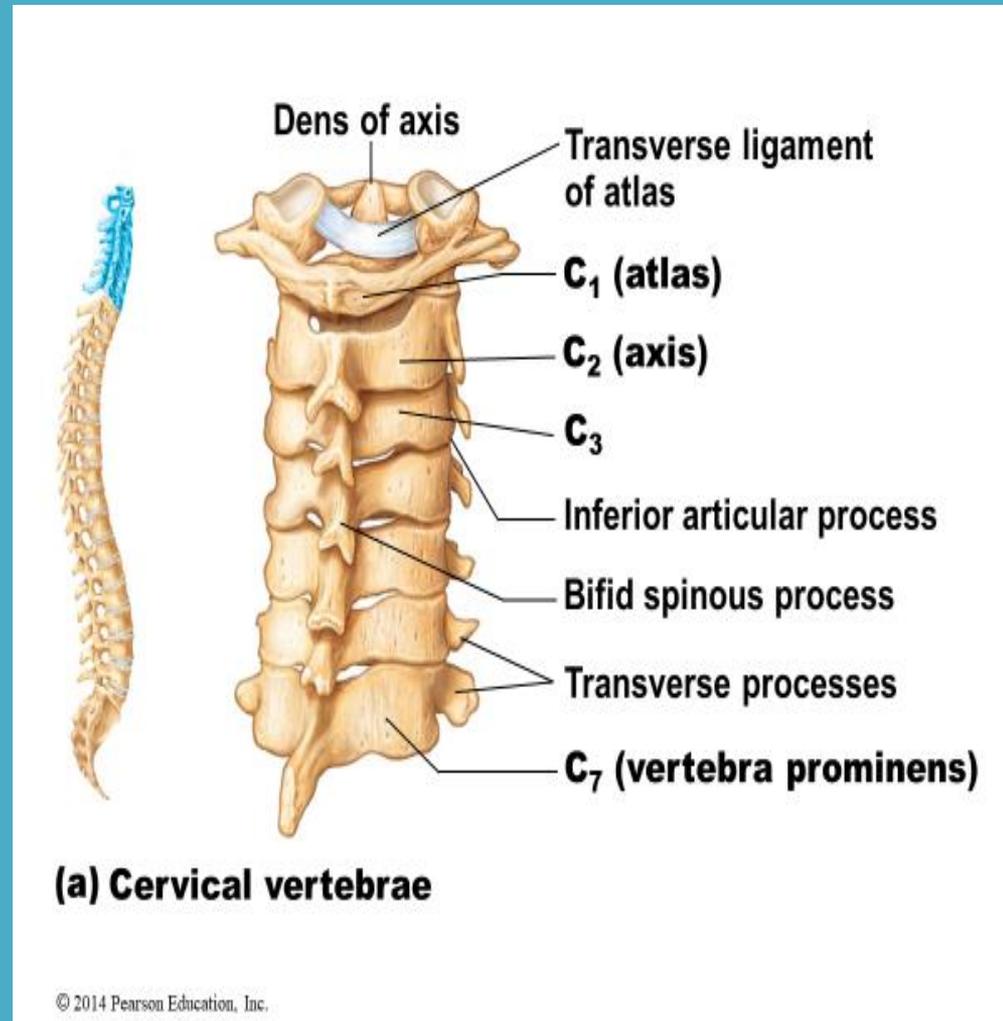
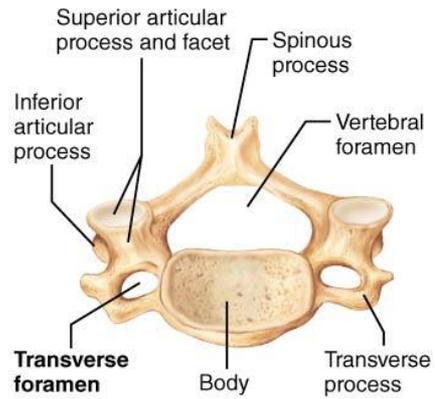


Table 7.2 Regional Character

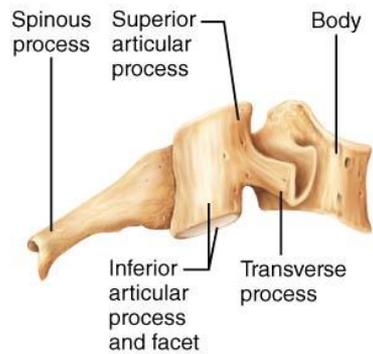
Characteristic Cervical (3-7)

SUPERIOR VIEW



(a) Cervical

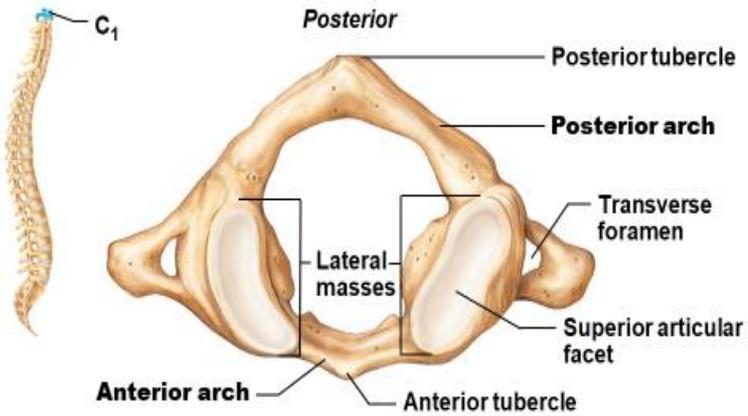
RIGHT LATERAL VIEW



(a) Cervical

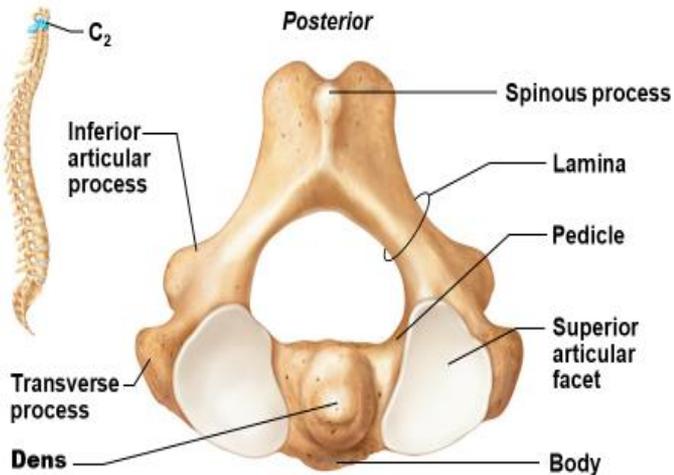


C1 – The Atlas

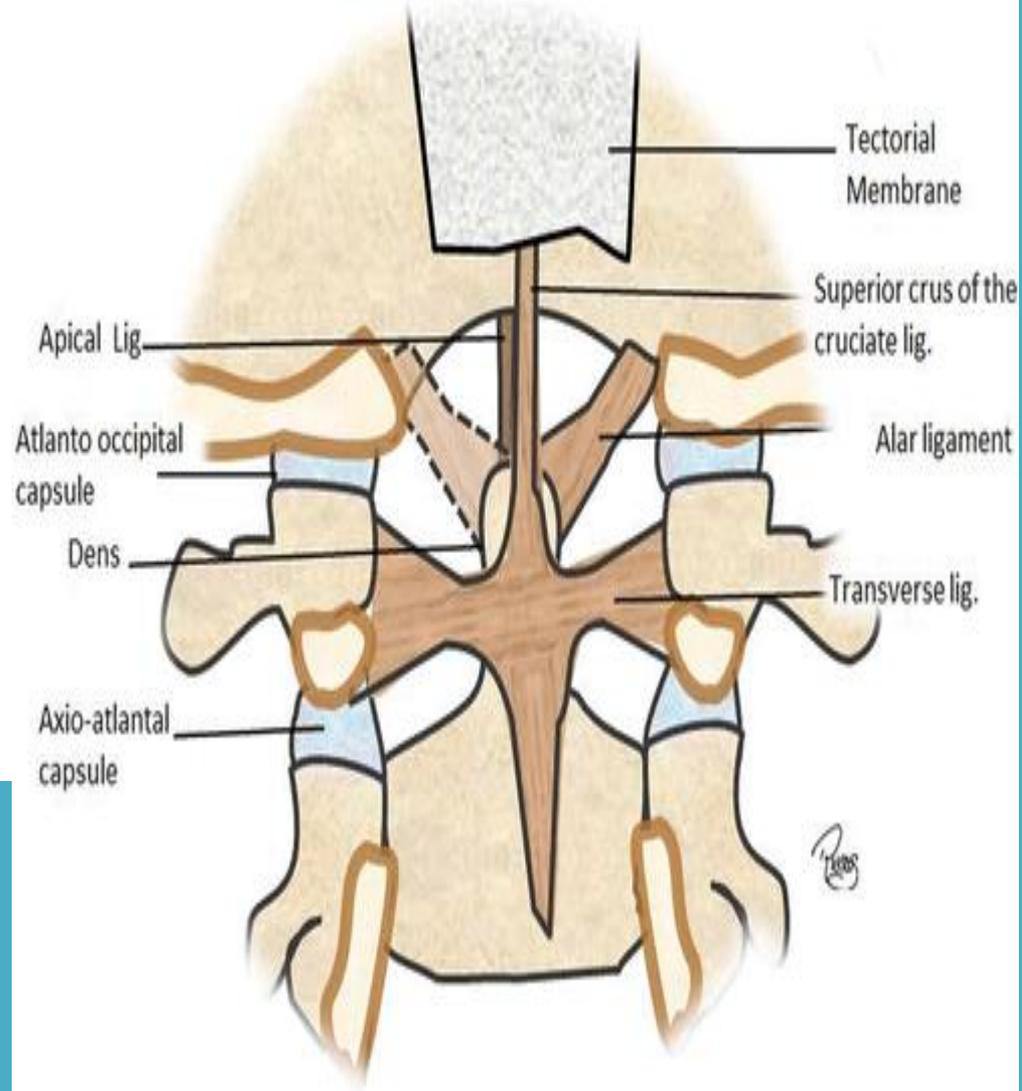


(a) Superior view of atlas (C₁)

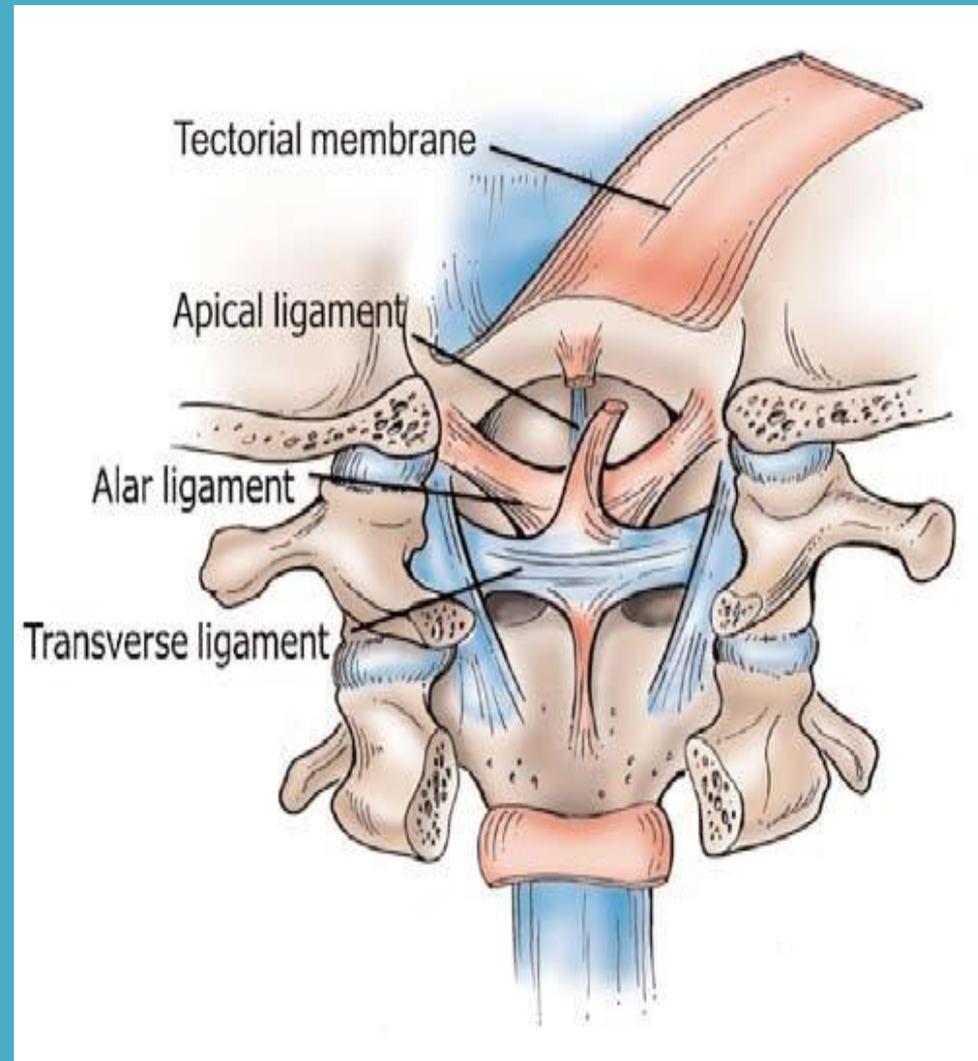
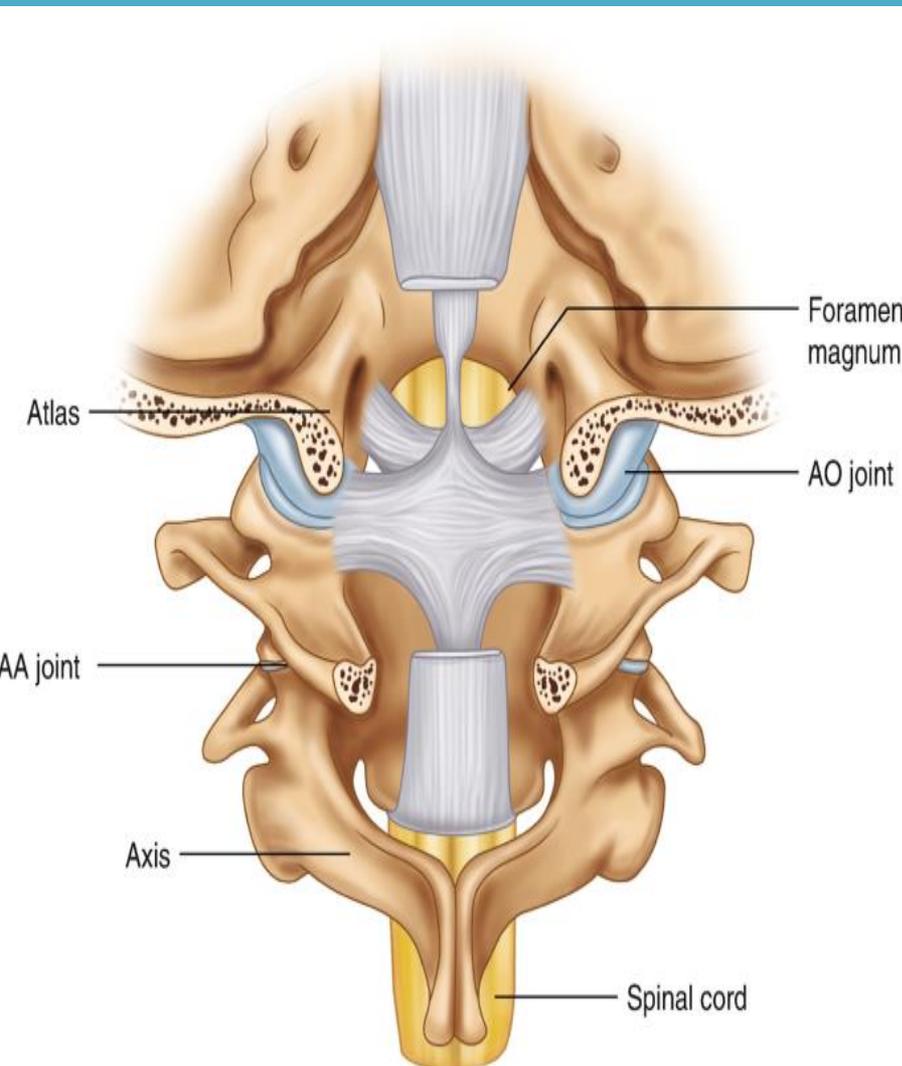
C2 – Axis



(c) Superior view of axis (C₂)

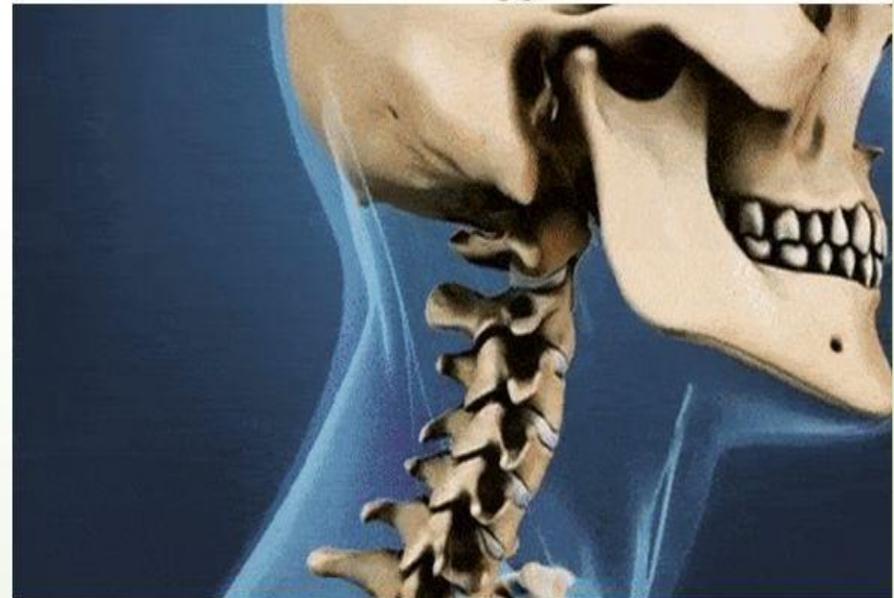
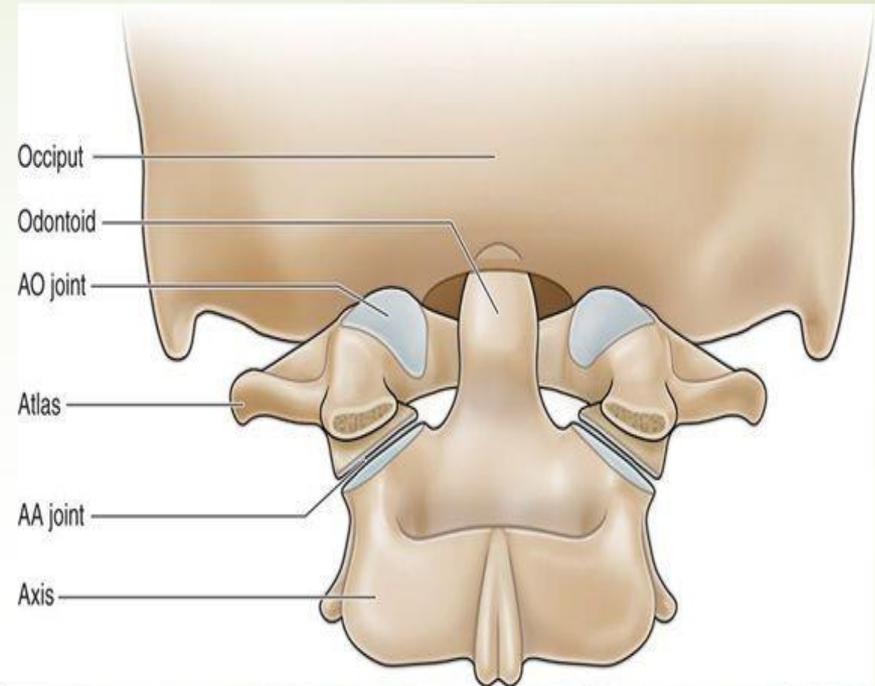


Cranio cervical articulations



C1 - C2 Complex

- **Atlanto – Occipital Joint** (O-C1 Joint) permits primarily flexion and extension
- **Atlanto – Axial joint** (C1-C2 Joint) is primarily responsible for rotation in the cervical spine



Thoracic Vertebrae

A. Thoracic

1. long, inferior-directed spinous processes
2. transverse processes are long and heavy
3. T1 superior whole facet : inferior demifacet
4. T2-8 two demifacets; superior large / inferior small
5. T9 single superior demifacet
6. T10-12 whole facet for individual rib articulation

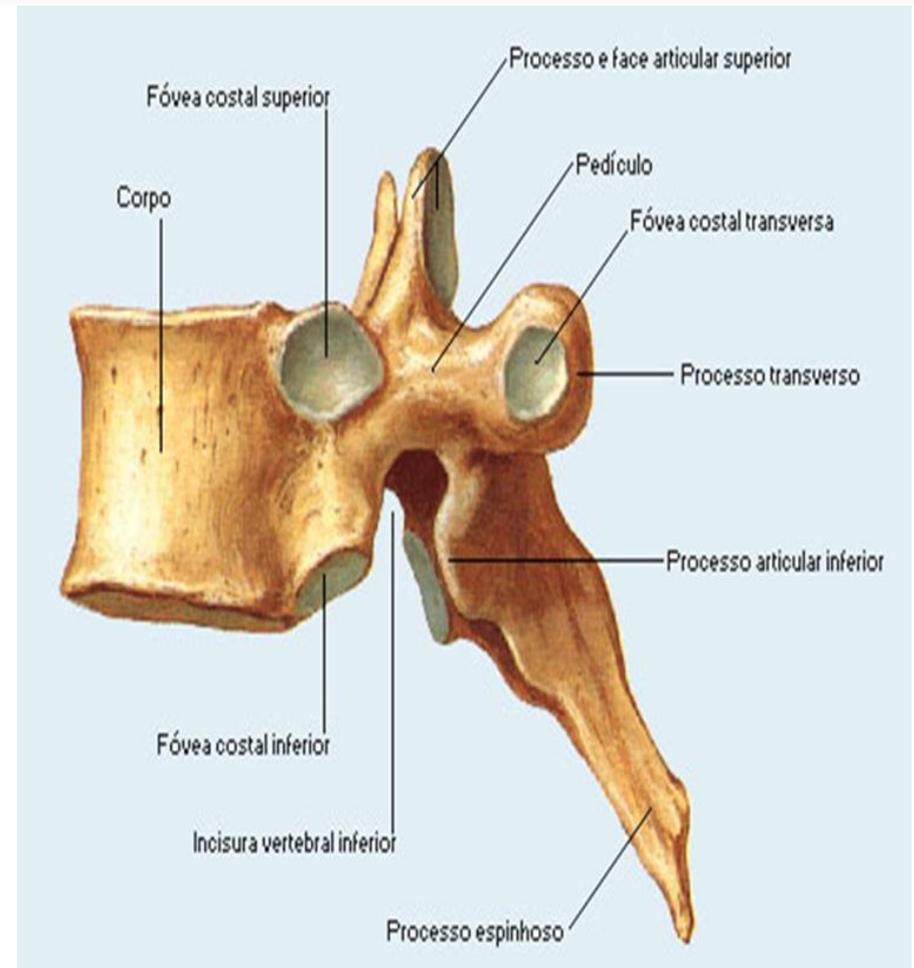


Table 7.2

Regional Characteristics of Cervical, Thoracic, and Lumbar Vertebrae

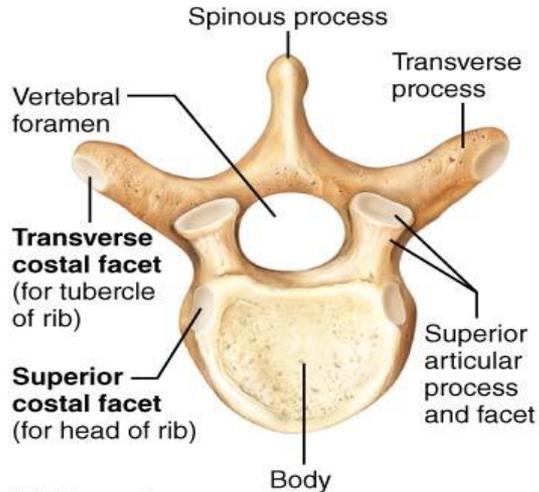
Characteristic

Cervical (3–7)

Thoracic

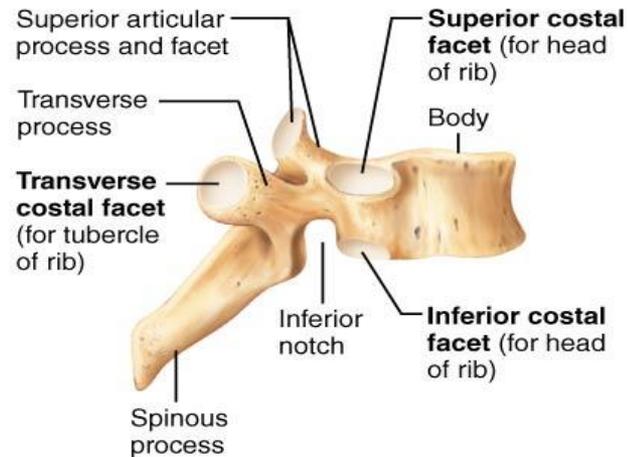
Lumbar

SUPERIOR VIEW



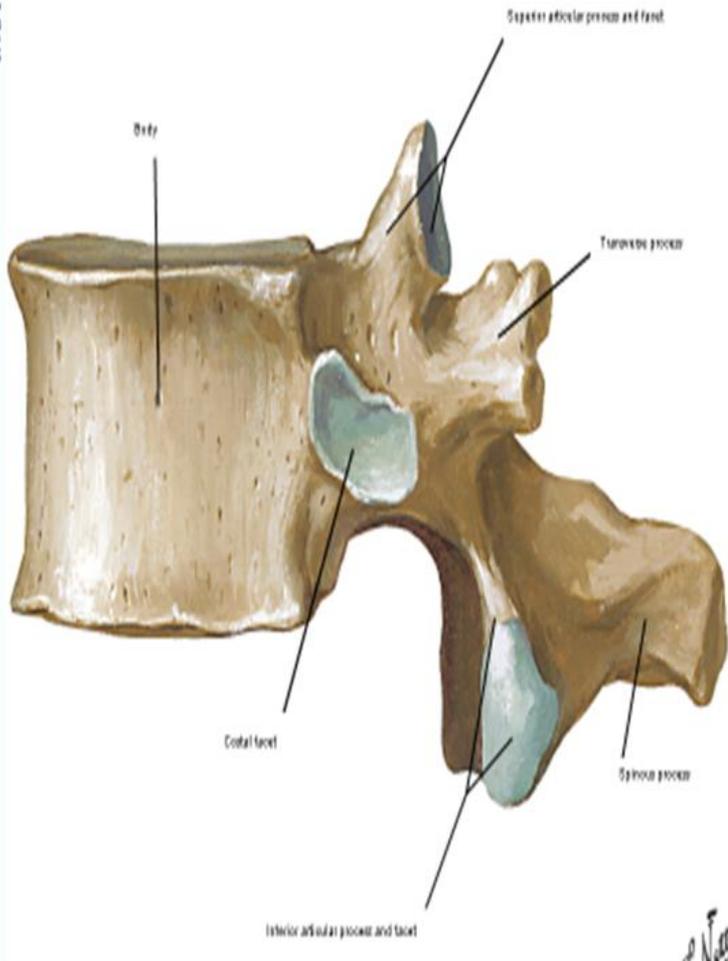
(b) Thoracic

RIGHT LATERAL VIEW

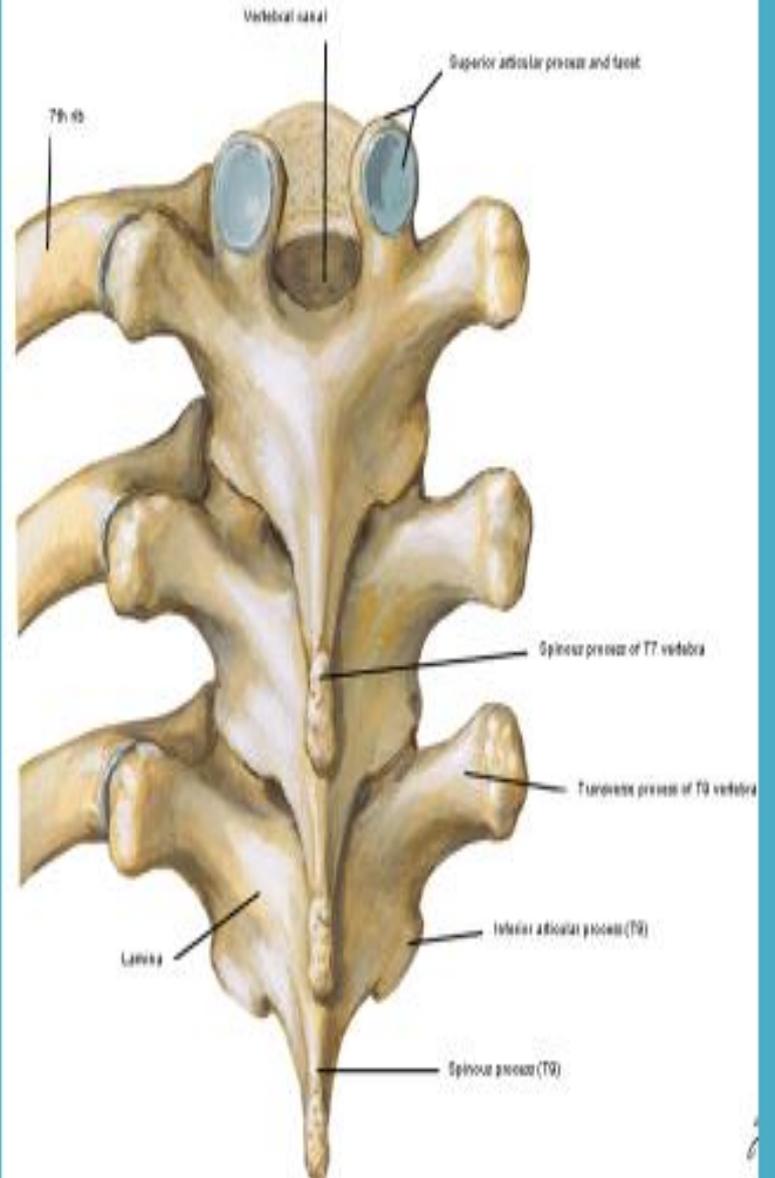


(b) Thoracic

Thoracic Vertebra (T12)
Lateral View



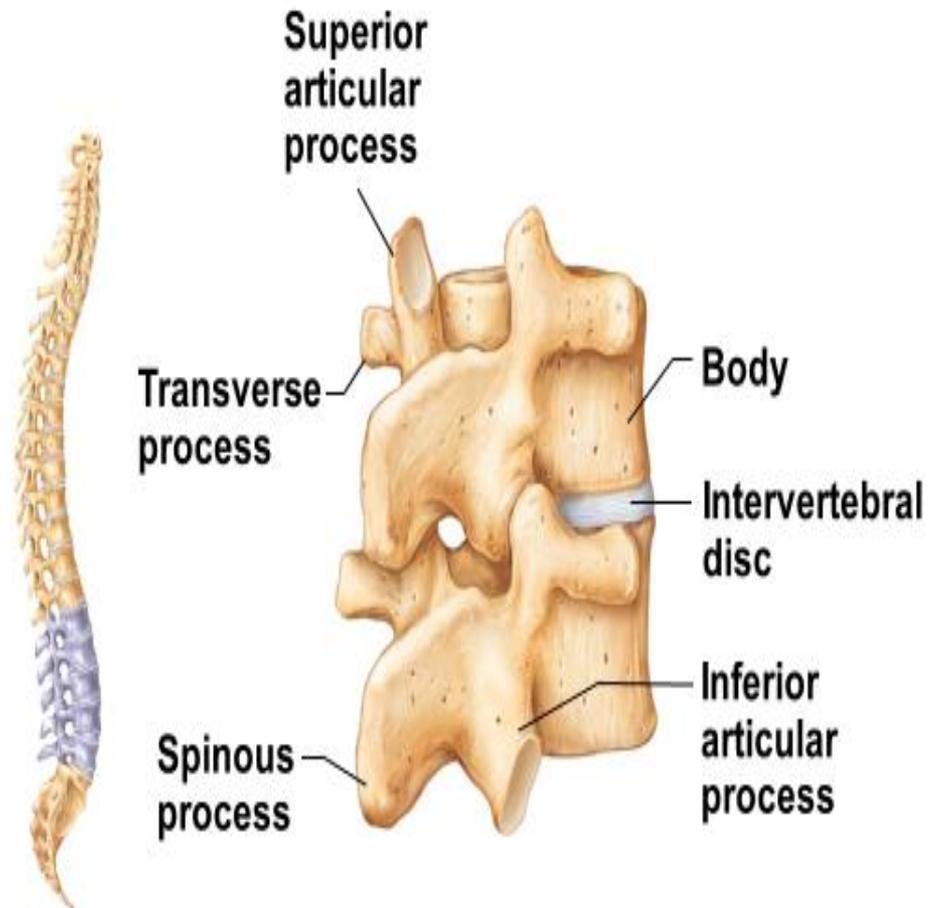
Thoracic Vertebrae (T7-9) - Assembled
Posterior View



Lumbar Vertebrae

A. Lumbar

1. all have largest, thickest bodies
2. spinous processes are oblong and heavy



(c) Lumbar vertebrae

Table 7.2

Regional Characteristics of Cervical, Thoracic, and Lumbar Vertebrae

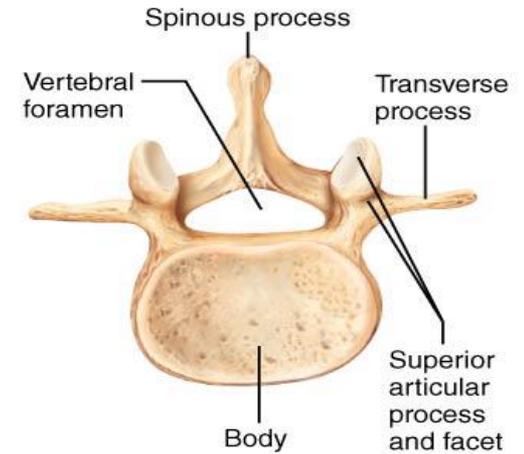
Characteristic

Cervical (3–7)

Thoracic

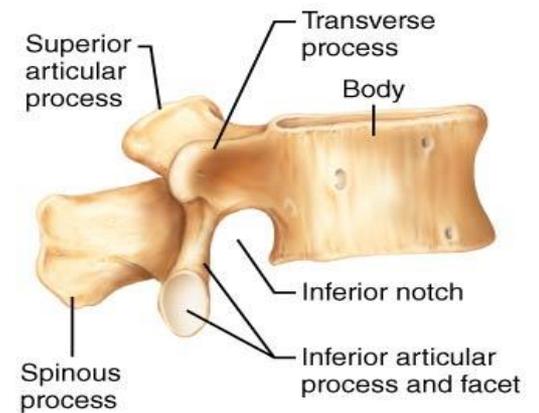
Lumbar

SUPERIOR VIEW



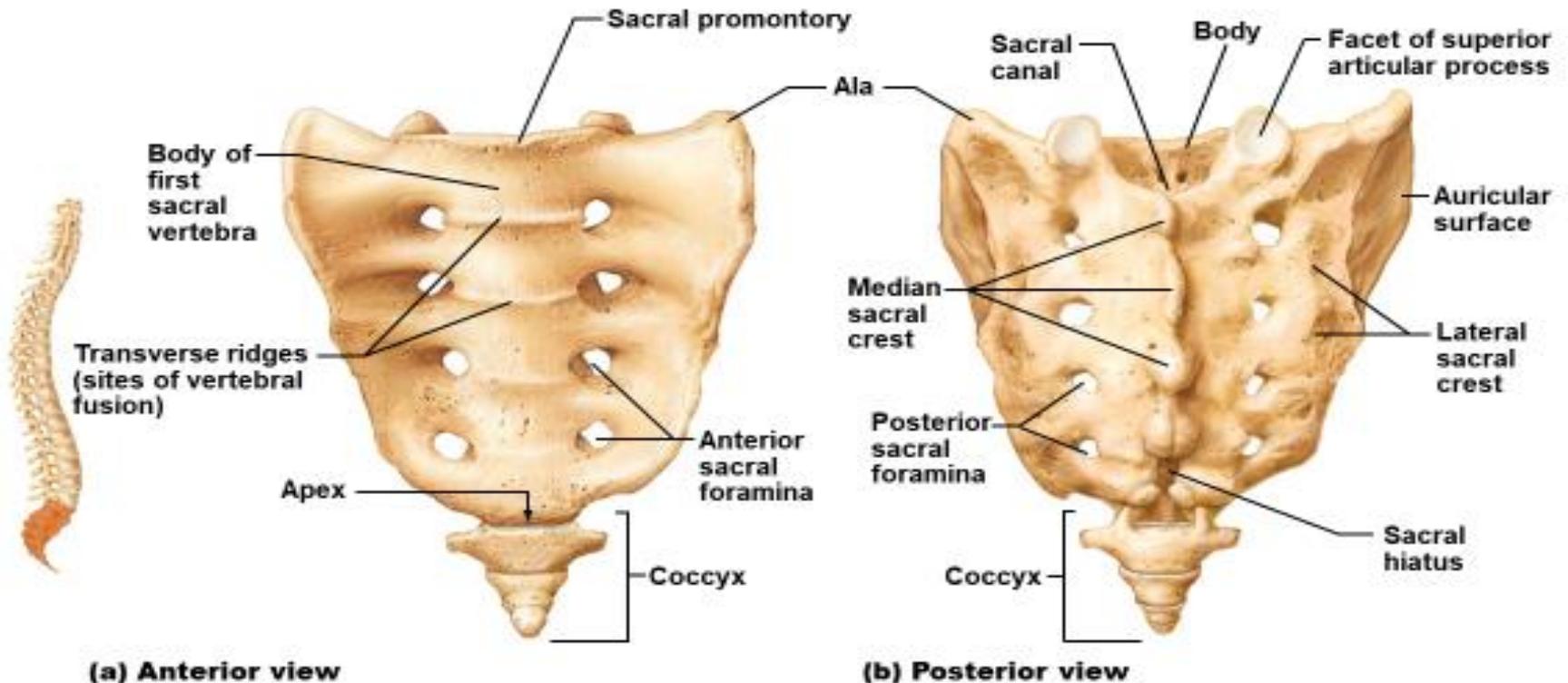
(c) Lumbar

RIGHT LATERAL VIEW



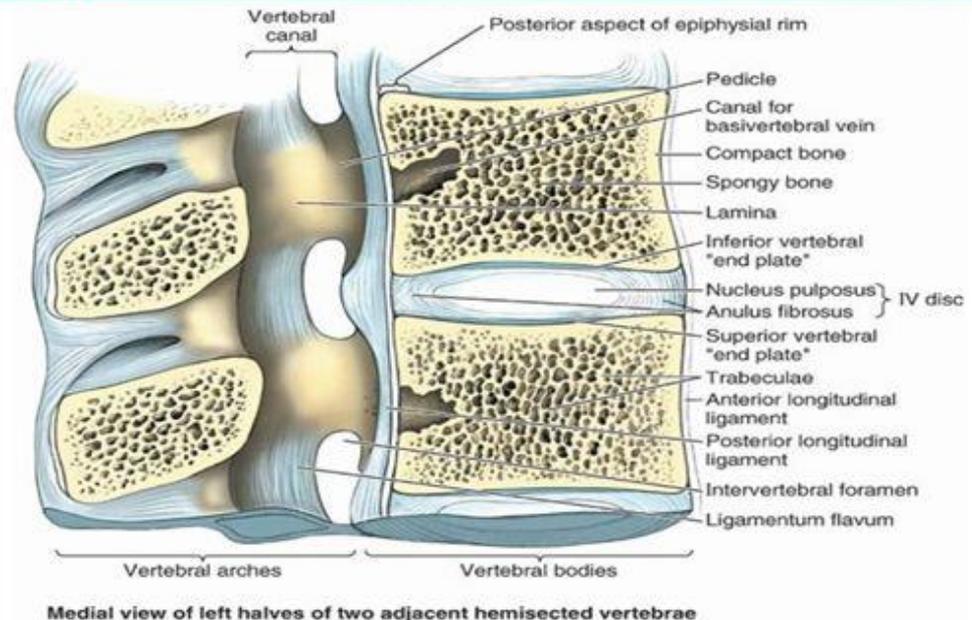
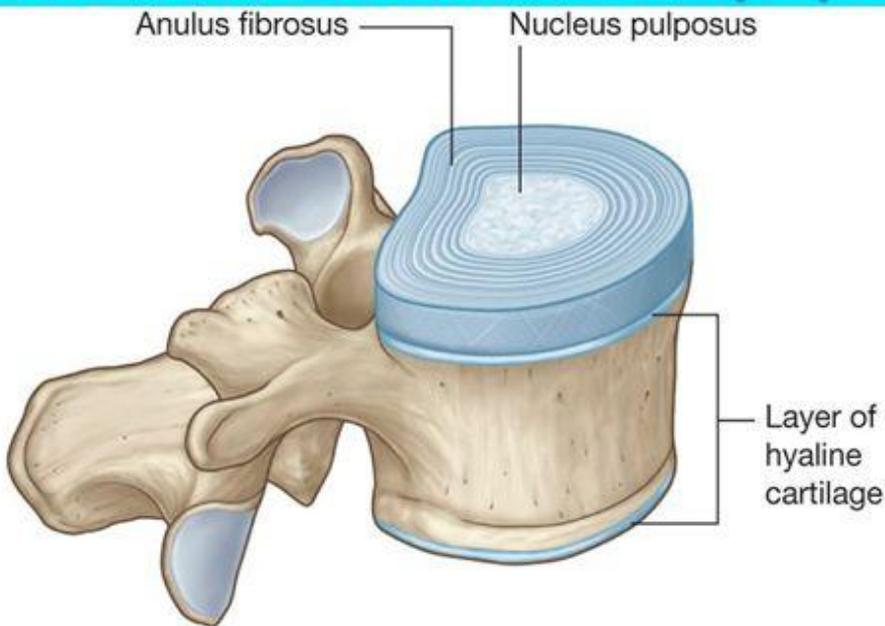
(c) Lumbar

Sacral: 5 (fused) vertebrae (S1–S5)
Coccygeal: 4 (3–5) (fused) vertebrae (Tailbone)



JOINTS OF VERTEBRAL BODIES

- **Symphyses** (Secondary cartilaginous joints)
- Designed for weight-bearing and strength.
- The articulating surfaces of adjacent vertebrae are connected by intervertebral discs and ligaments.
- The intervertebral disc consists of an outer **anulus fibrosus**, which surrounds a central **nucleus pulposus**.

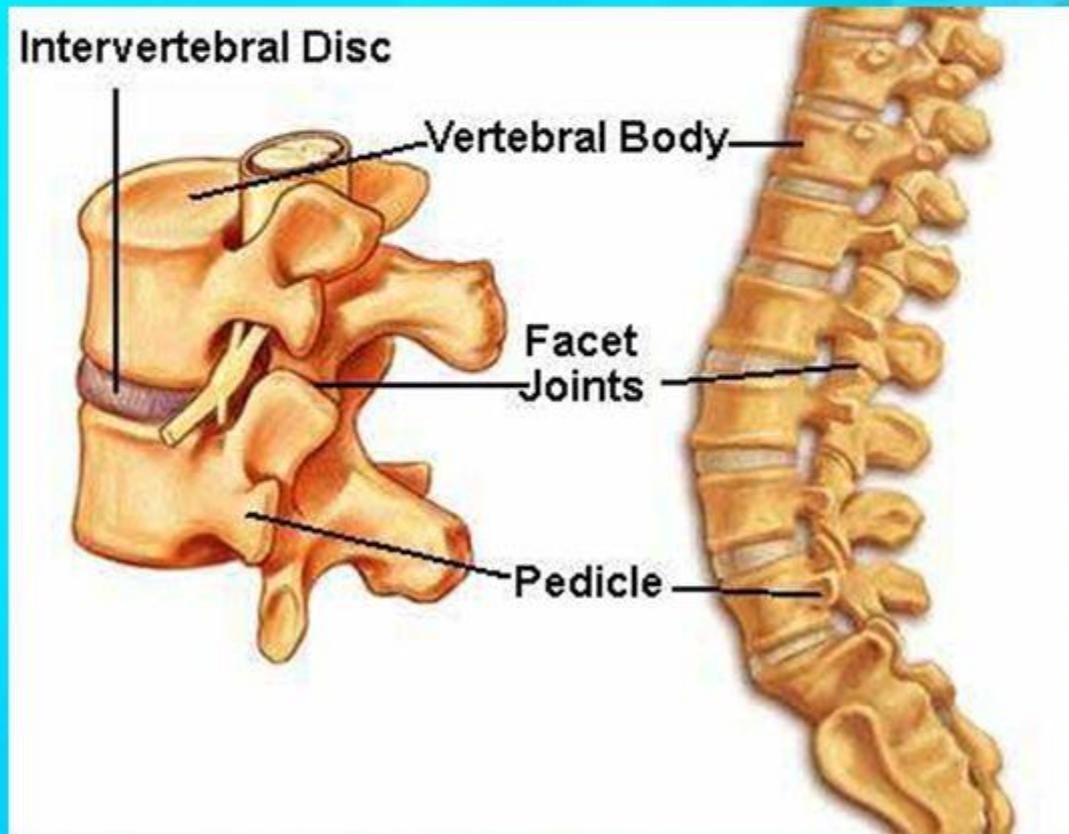


A typical vertebra has **6 joints** with adjacent vertebrae.

■ 4 synovial joints (2 above & 2 below)

■ 2 symphyses (1 above & 1 below)

Each symphysis includes an intervertebral disc.

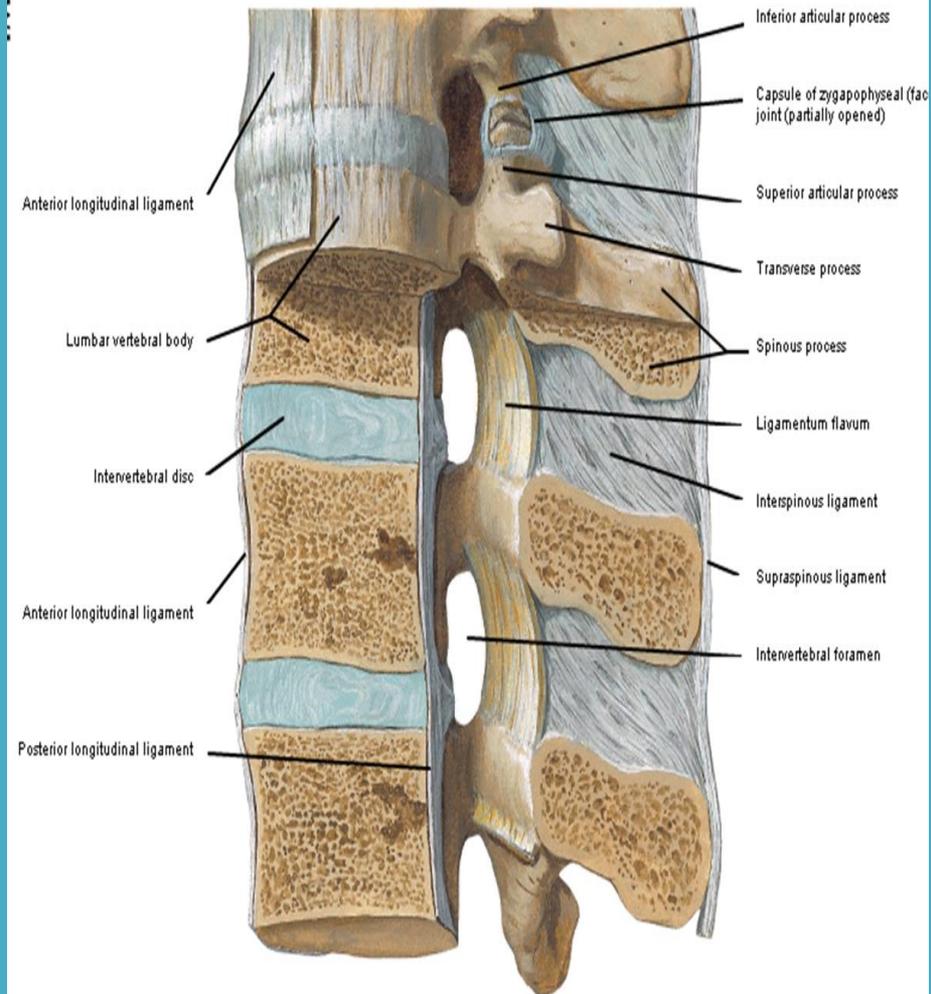


Ligaments and Joint Capsules.

- The ligamentous system of the vertebral column is extensive and exhibits considerable regional variability. There are 6 main ligaments associated with the intervertebral and zygapophyseal joints.

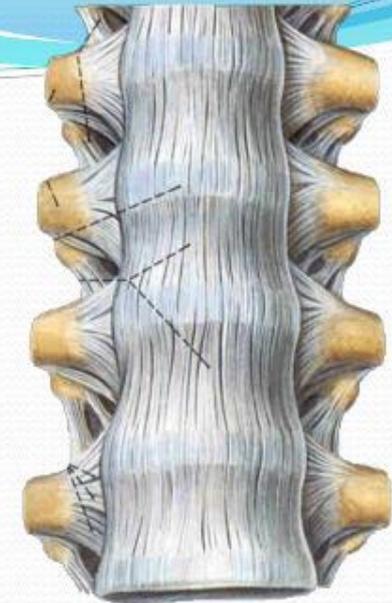
- I. Anterior longitudinal ligaments
- II. Posterior longitudinal ligaments
- III. ligamentum flavum
- IV. Interspinous
- V. Intertransverse
- VI. Supraspinous ligaments

Vertebral Ligaments of Lumbar Region
Left Lateral View - Partially Sectioned in Median Plane



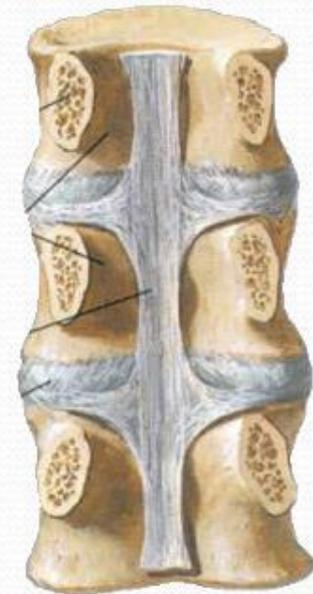
Anterior longitudinal ligament

- Strong band covering the anterior part of the vertebral bodies and intervertebral discs running from the anterior margin of foramen magnum to the S1~S2
- Maintains stability of the intervertebral disc and prevents hyperextension of the vertebral column



Posterior longitudinal ligament

- Attached to the posterior aspect of the intervertebral discs and posterior edges of the vertebral bodies from C2 vertebra to sacrum
- Prevents hyperflexion of the vertebral column and posterior protrusion of the discs



Ligaments

1-Supraspinous ligament:

This runs between the tips of adjacent spines.

2-Interspinous ligament:

This connects adjacent spines.

3-Intertransverse ligaments:

These run between adjacent transverse processes.

5-Ligamentum flavum:

This connects the laminae of adjacent vertebrae.

In the cervical region,

the supraspinous and interspinous ligaments are greatly thickened to form

the strong *ligamentum nuchae*.

The latter extends from the spine of the seventh cervical vertebra to the external occipital protuberance of the skull

