أهلا وسهلا

الأستاذ الدكتور يوسف حسين

رئيس قسم التشريح والأنسجة والأجنة

كلية الطب - جامعة مؤتة – الأردن

دكتوراة من جامعة كولونيا المانيا

الواتس 00201224904207

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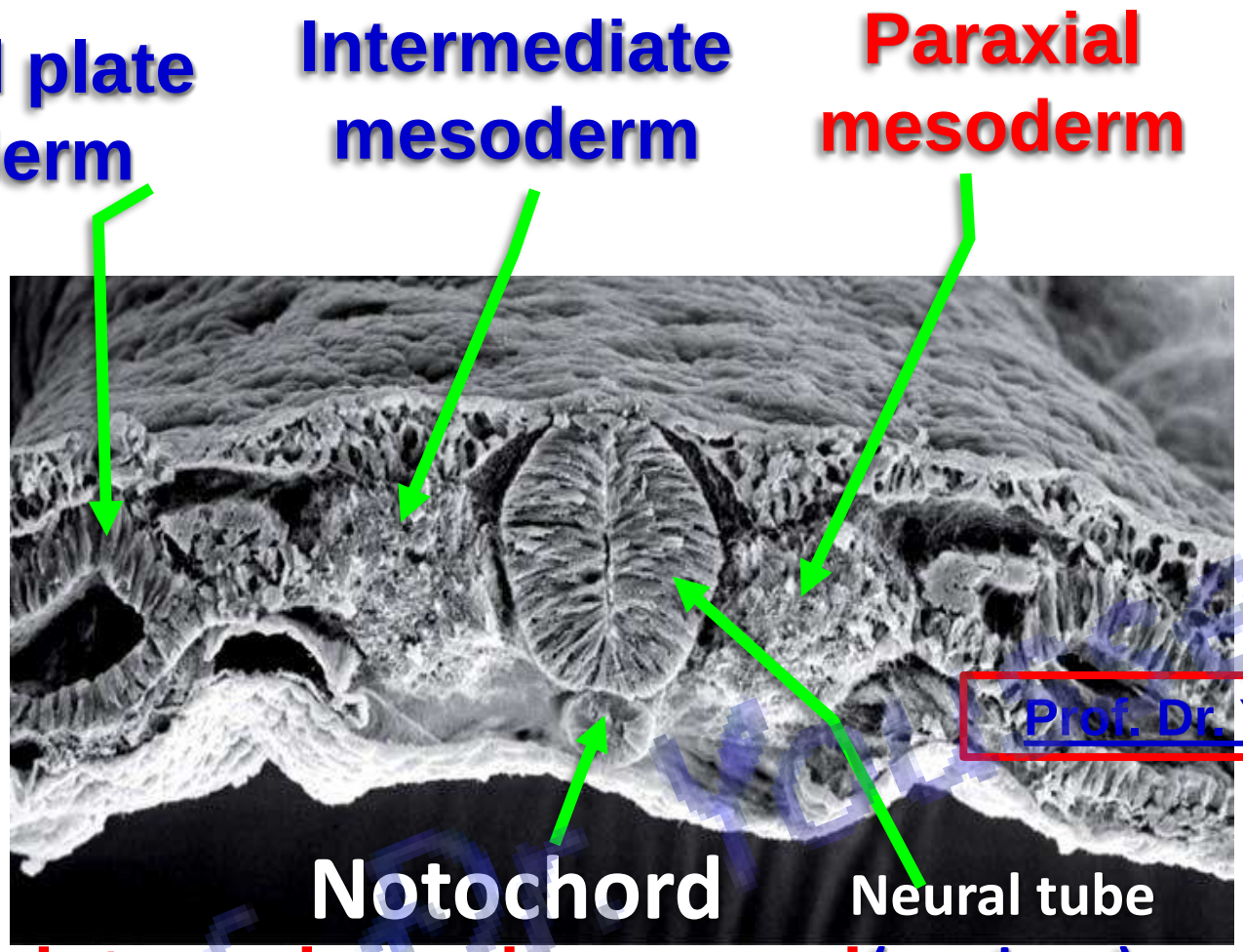
Development of Vertebral Column

Prof. Dr. Youssef Hussein Anatomy - YouTube



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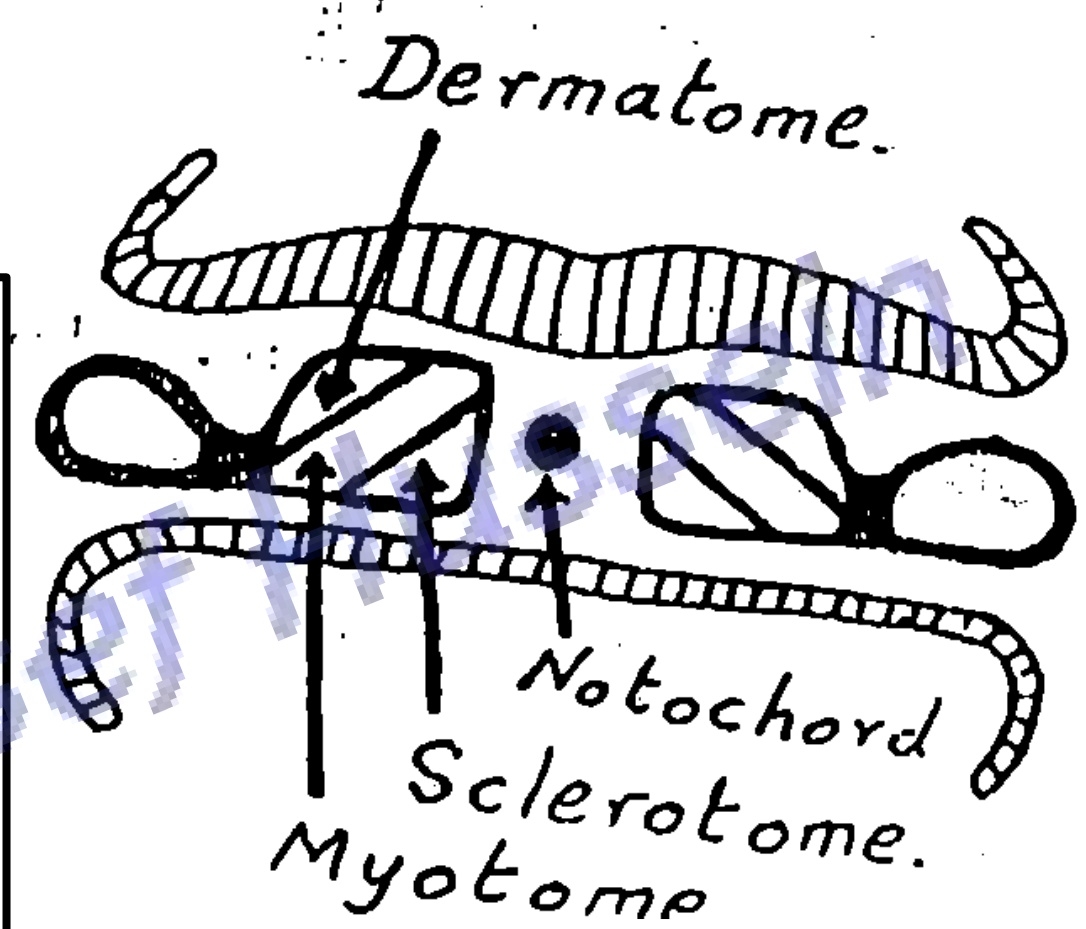
Prof. Dr. Youssef Hussein Anatomy - YouTube

- The intraembryonic mesoderm on each side of the notochord is differentiated into 3 parts: medial (paraxial mesoderm, somite), intermediate mesoderm and lateral plate mesoderm

▪ Medial (paraxial) mesoderm (Somites)

- **Each somite divides into 3 parts:**
  1. **Medial (sclerotome):** gives bones of the axial skeleton (vertebrae, and ribs) and bones of the base of the skull.
  2. **Intermediate part (myotome):** gives rise to the skeletal muscles of the trunk, limbs and (occipital myotomes gives muscles of the tongue).
  3. **Lateral part (dermatome):** gives rise to the dermis and subcutaneous tissue of the skin.



- **Development of the vertebral column (3rd - 4th weeks)**

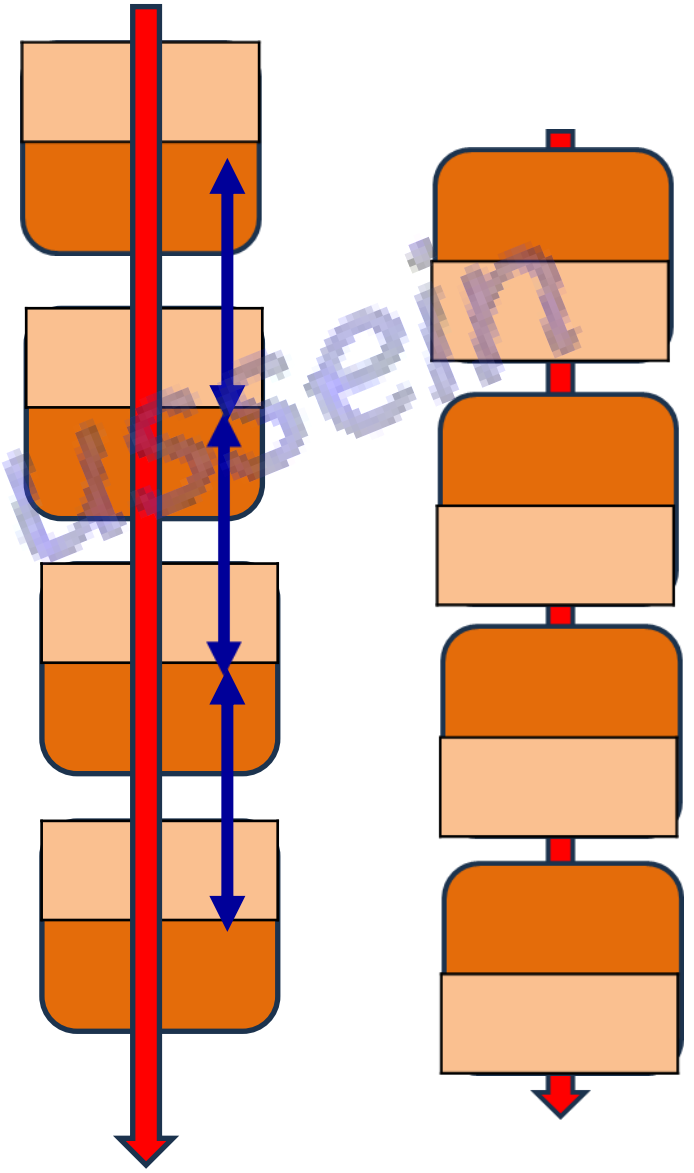
- The vertebra develops from the sclerotomes of the somites during the 3rd week.

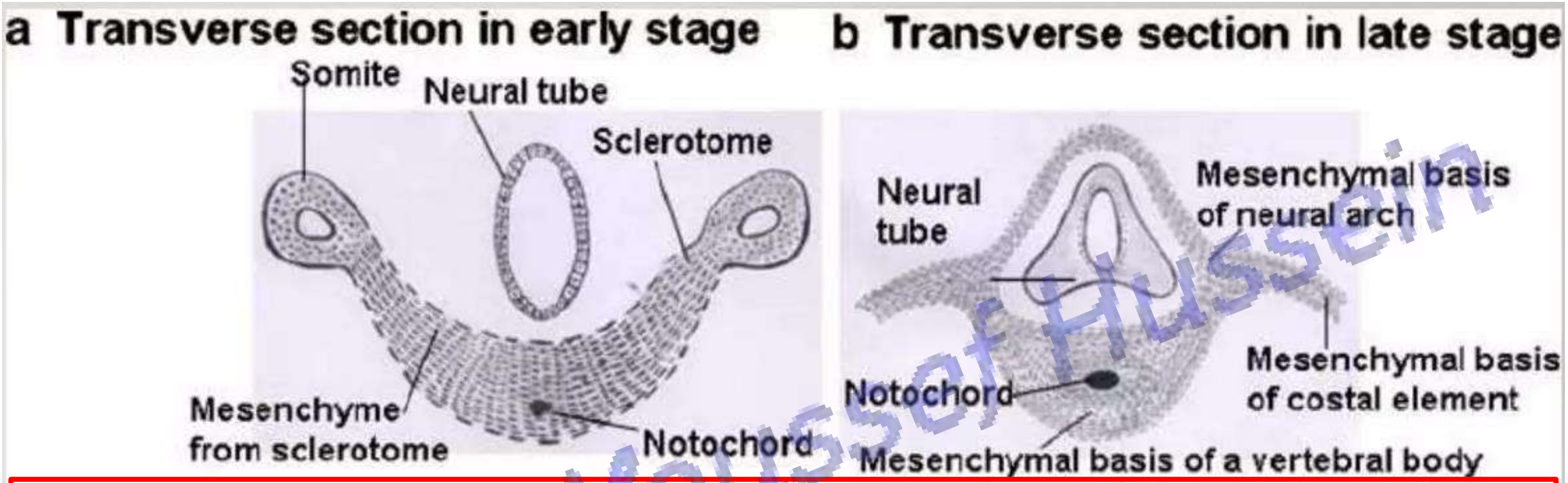
- The developing sclerotomes surround the notochord (A).

- Each sclerotomic segment is divided by a transverse fissure (sclerotomic fissure) into:

- **Cranial part less dense.**
- **Caudal part dense due to proliferation of its cells**.

* The caudal dense part of each sclerotomic segment fuses with the cranial less dense part of the next segment to form the **body of the vertebrae** (called centrum).
* Thus, each vertebra develops from adjacent two sclerotomic segments





* **Two Dorsal (neural) processes develop** to surround the neural tube.
* The 2 processes fuse with each other behind the neural tube and form the **neural arch**.
* Each neural arch extends dorsally to form the **spine**.
* 2 processes grow laterally from each neural arch,

- **Transverse (posterior) process.**
- **Costal (anterior) process;**

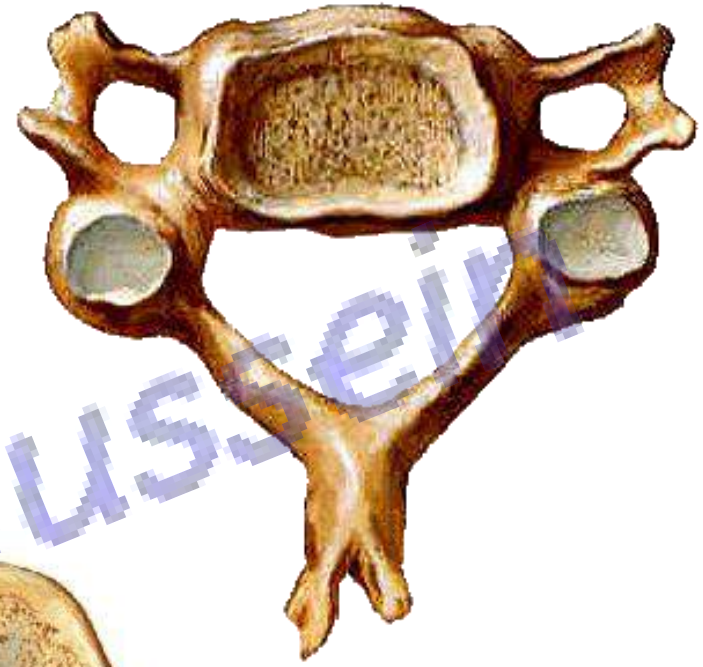
** Fate of the costal process;

a- In the cervical region: the costal process fuses with the transverse process around the vertebral vessel to form foramen transversarium in each cervical vertebrae.

b- In the thoracic region: they elongate to form the ribs and their cartilages.

b- In the lumbar and sacral vertebrae: it fuses with the transverse process.

- The vertebrae undergo chondrification and later ossification.



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- **Congenital anomalies of the spinal cord**

Spina bifida: failure of fusion of neural arch of vertebra around the spinal cord.

**** Types of spina bifida:**

a- Spina bifida occulta: bifid spines of the vertebra but no herniation. Dura is intact. Usually seen at lower vertebral levels. Associated with tuft of hair or skin dimple at level of bony defect. No increase AFP.

b- Meningocele; bulge of the meninges through the spina bifida (increase AFP).

c- Meningomyelocele; bulge of the meninges and spinal cord through the spina bifida. (increase AFP).

d- Myelocele; the spinal cord is exposed directly to the spina bifida. (increase AFP).

Spina bifida occulta

Meningocele

Meningomyelocele

Myelocele

Abnormal curves of the vertebrae

Due to unequal growth of the parts of the vertebra

* **Scoliosis (Hemivertebra)**: abnormal lateral flexion of the vertebra due to failure of one chondrification center to appear leading to neurological problems.
* **Kyphosis:** increased backward convexity of the vertebral curves
* **Lordosis**: increased forward convexity of the vertebral curves

Abnormal number of the vertebra (more or less than normal).

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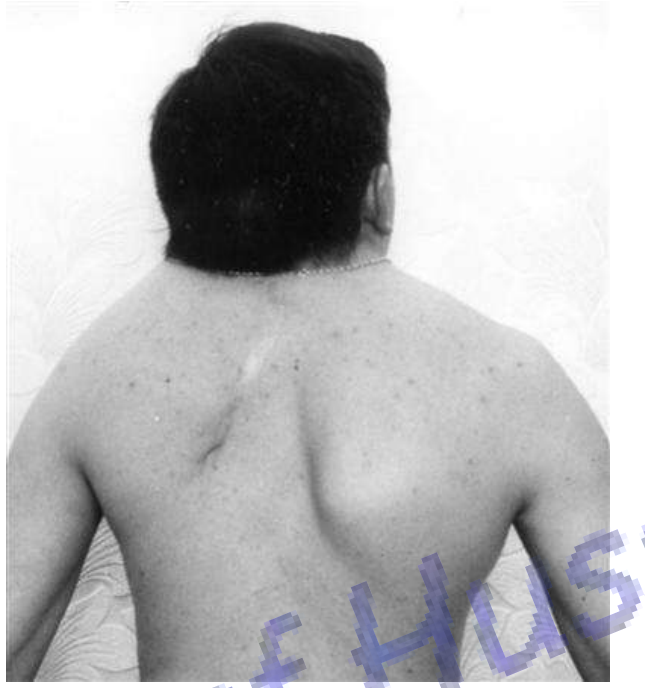
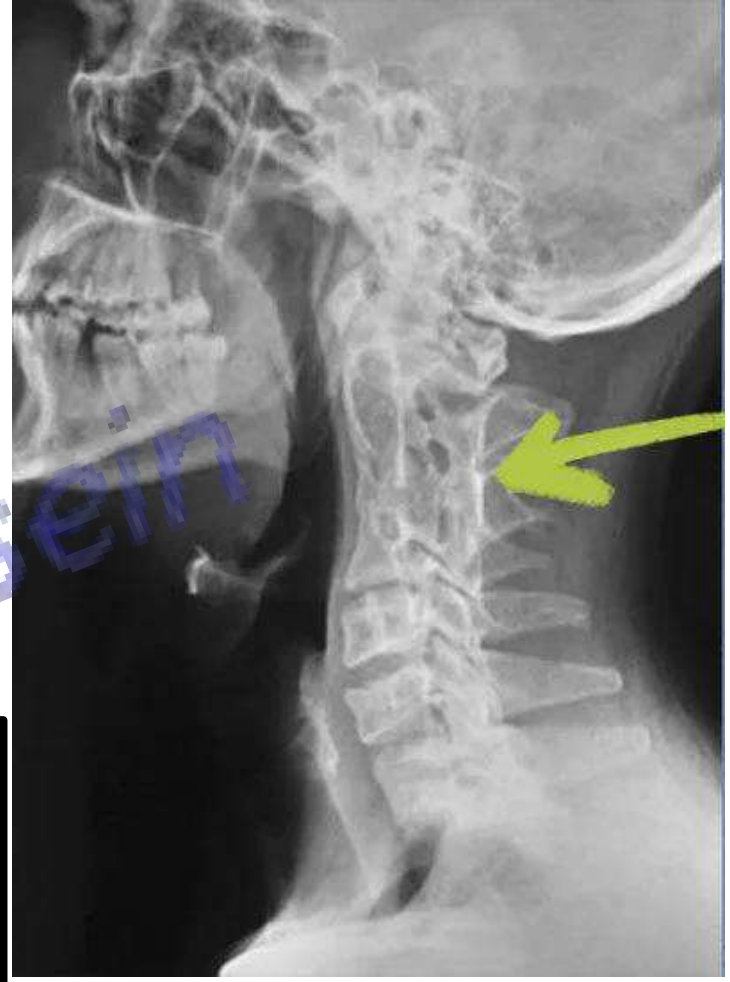
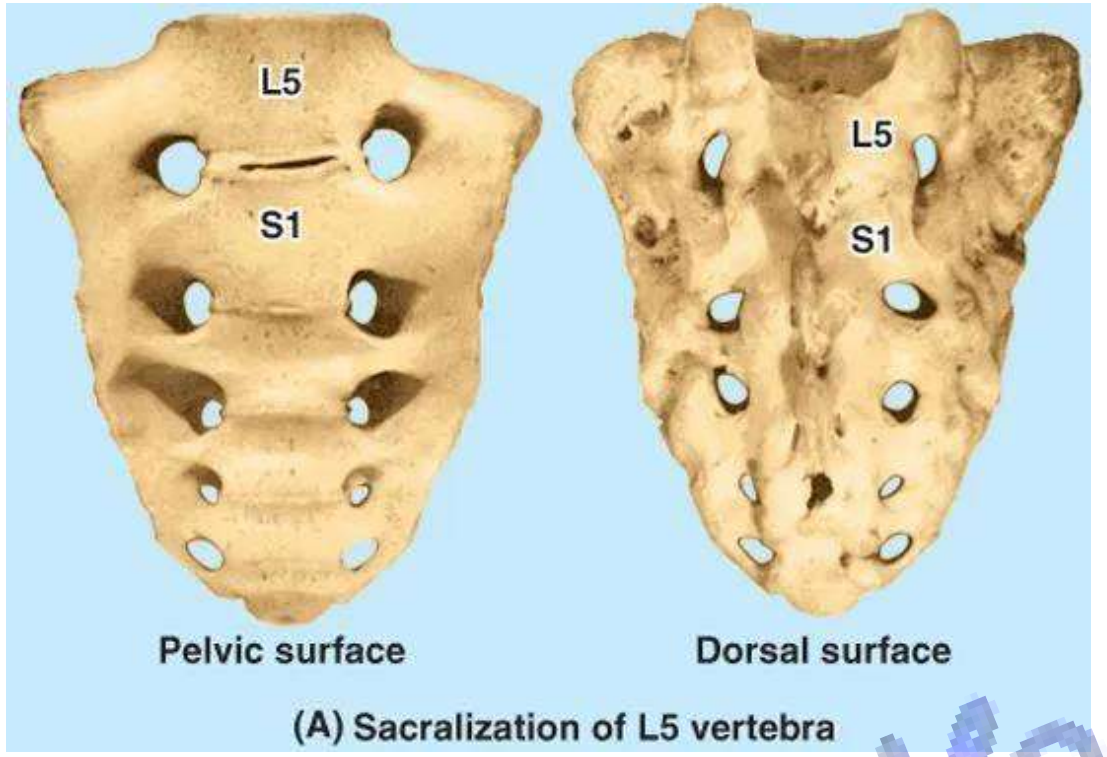
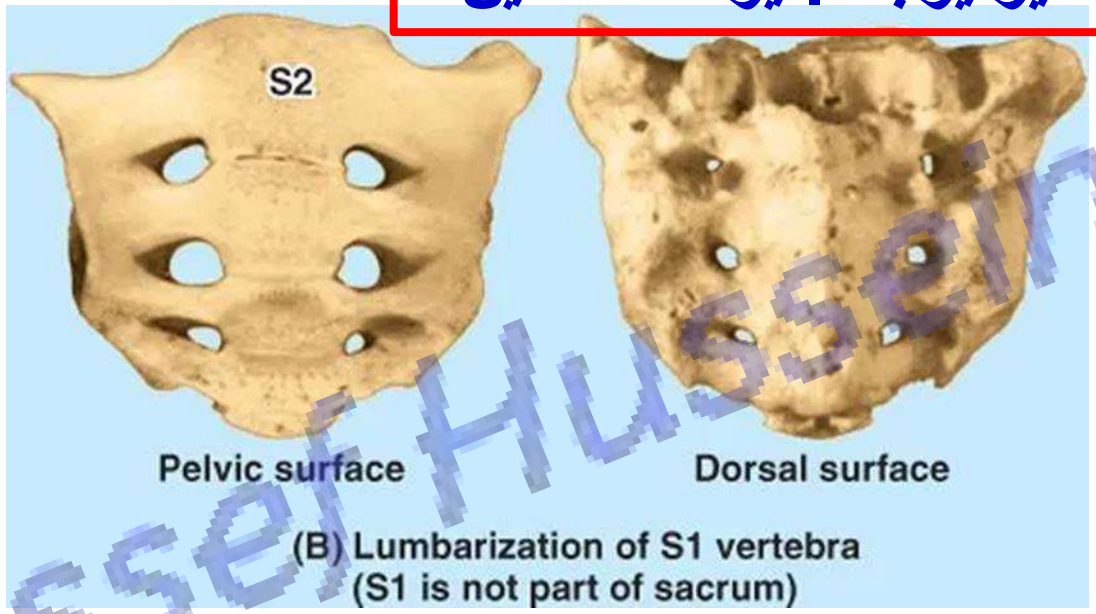




Klippel-Feil syndrome

- Presents with an abnormal fusion of 2 or more bones in the cervical spine.
- This creates a characteristic appearance of a short neck with resulting facial asymmetry, low hairline, and limited neck mobility





Sacralization of L5: the lowest lumbar vertebra (L5) becomes abnormally fused to the sacrum.

Lumbarization of S1: the top of the sacrum (S1) can be separated from the sacrum and the lumbar spine appears to have 6 vertebrae, not 5

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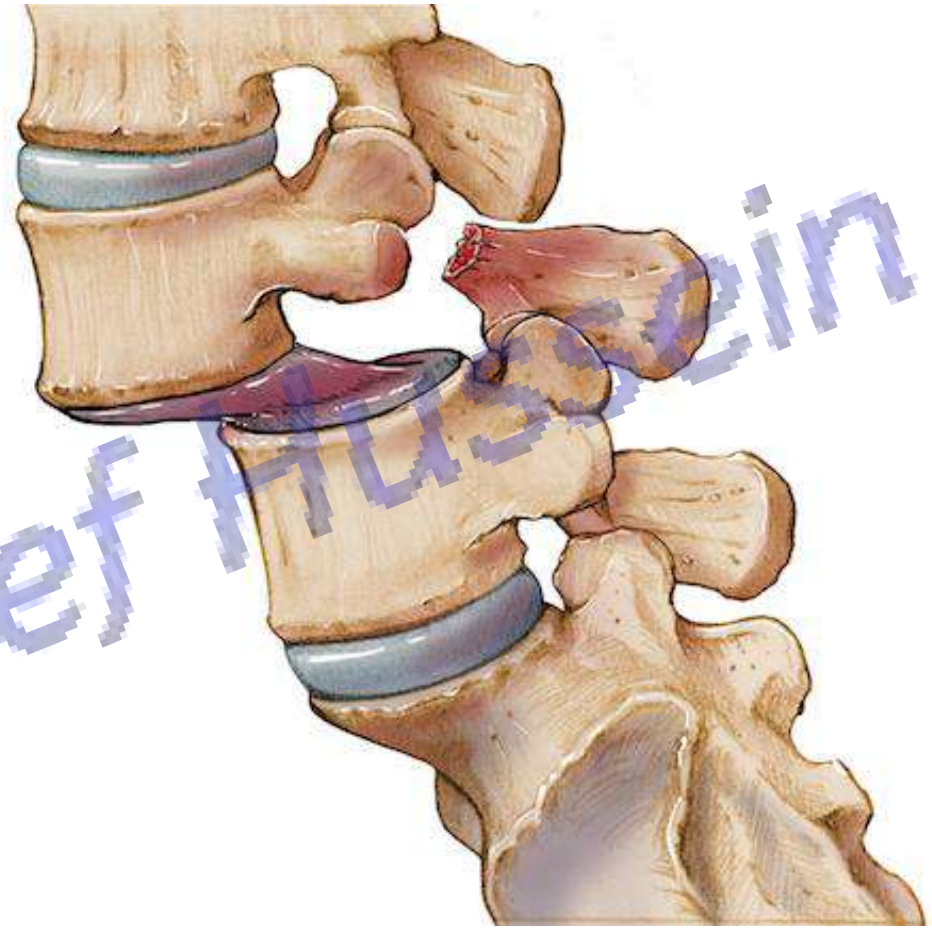
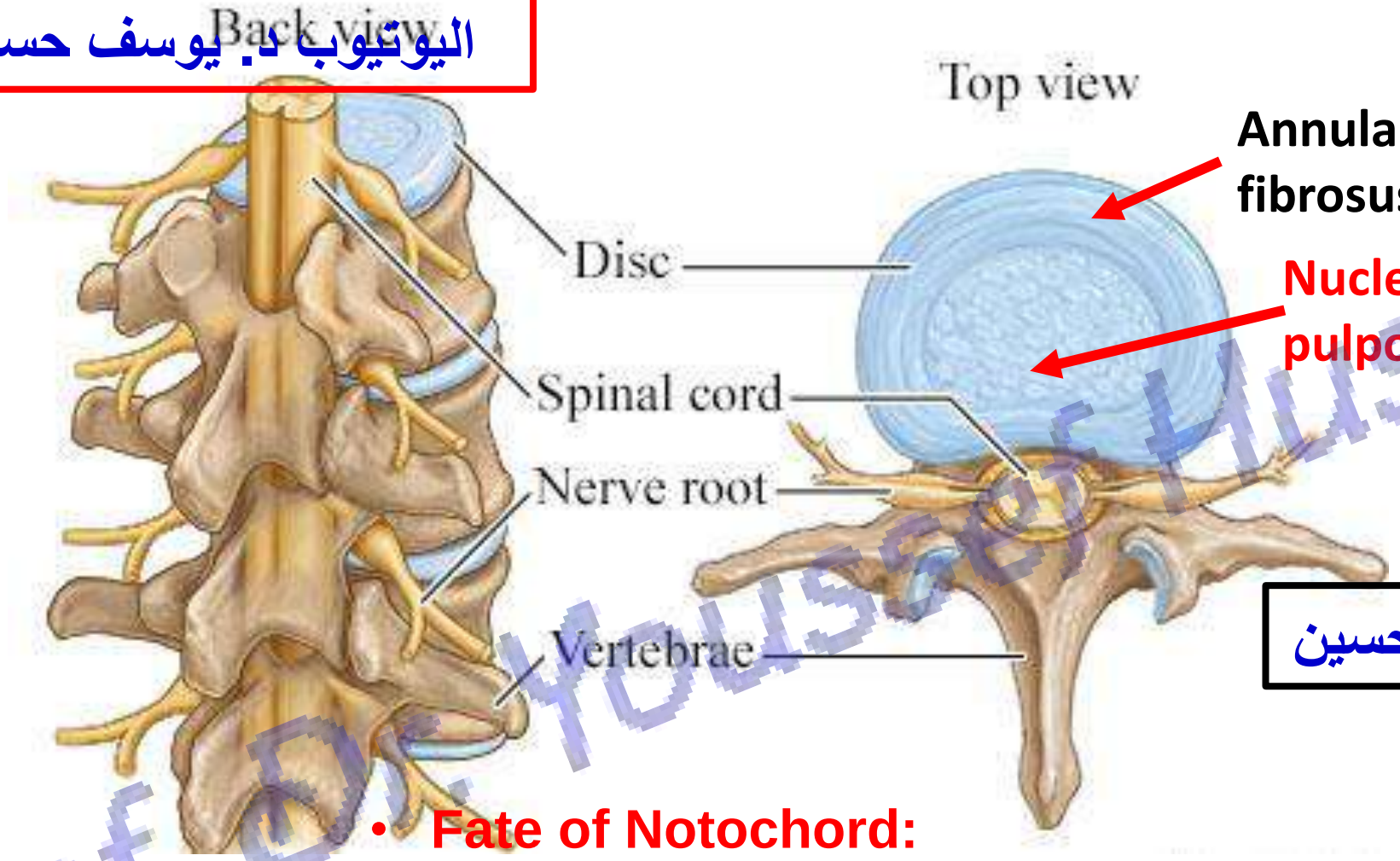
Spondylolisthesis, abnormal movement of the lower lumbar vertebrae forward on the body of the vertebra below.





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- **Fate of Notochord:**

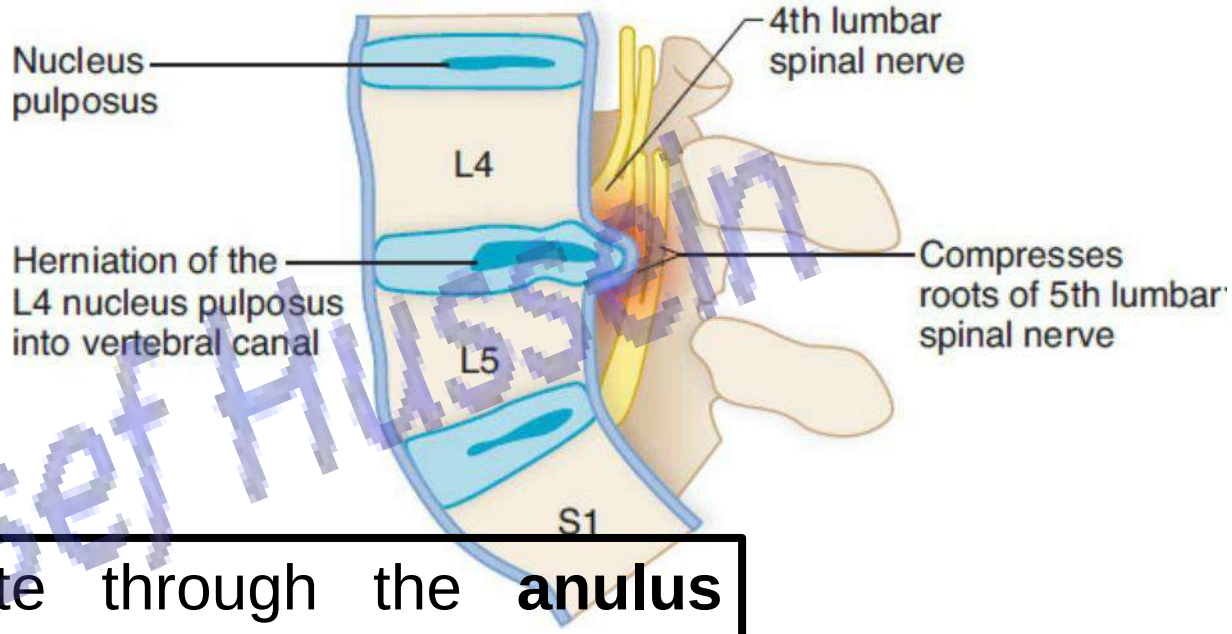
- **In the bodies of vertebrae**: It degenerates
- **Between bodies of vertebrae:** It forms the central part of the intervertebral discs, **'nucleus pulposus'.**
- **Annulus fibrosus** part of the intervertebral discs is formed by the mesoderm surrounding the notochord.

Intervertebral Discs

- The **intervertebral disks** contribute to about 25% of the length of the vertebral column.
- They form the cartilaginous joints between the vertebral bodies and provide limited movements between the individual vertebrae.
- Each intervertebral disk is numbered by the vertebral body **above** the disk.
- **Each intervertebral disc is composed of the following:**
- — **Anulus fibrosus** consists of the outer concentric rings of fibrocartilage and fibrous connective tissue. They connect the adjacent bodies and provide limited movement between the individual vertebrae.
- — **Nucleus pulposus** is an inner soft, elastic, compressible material that functions as a shock absorber for external forces placed on the vertebral column. The nucleus pulposus is the postnatal remnant of the **notochord.**

• Herniated Disc

- The herniation of a nucleus pulposus is most commonly in a **posterolateral** direction due to the strength and position of the posterior longitudinal ligament



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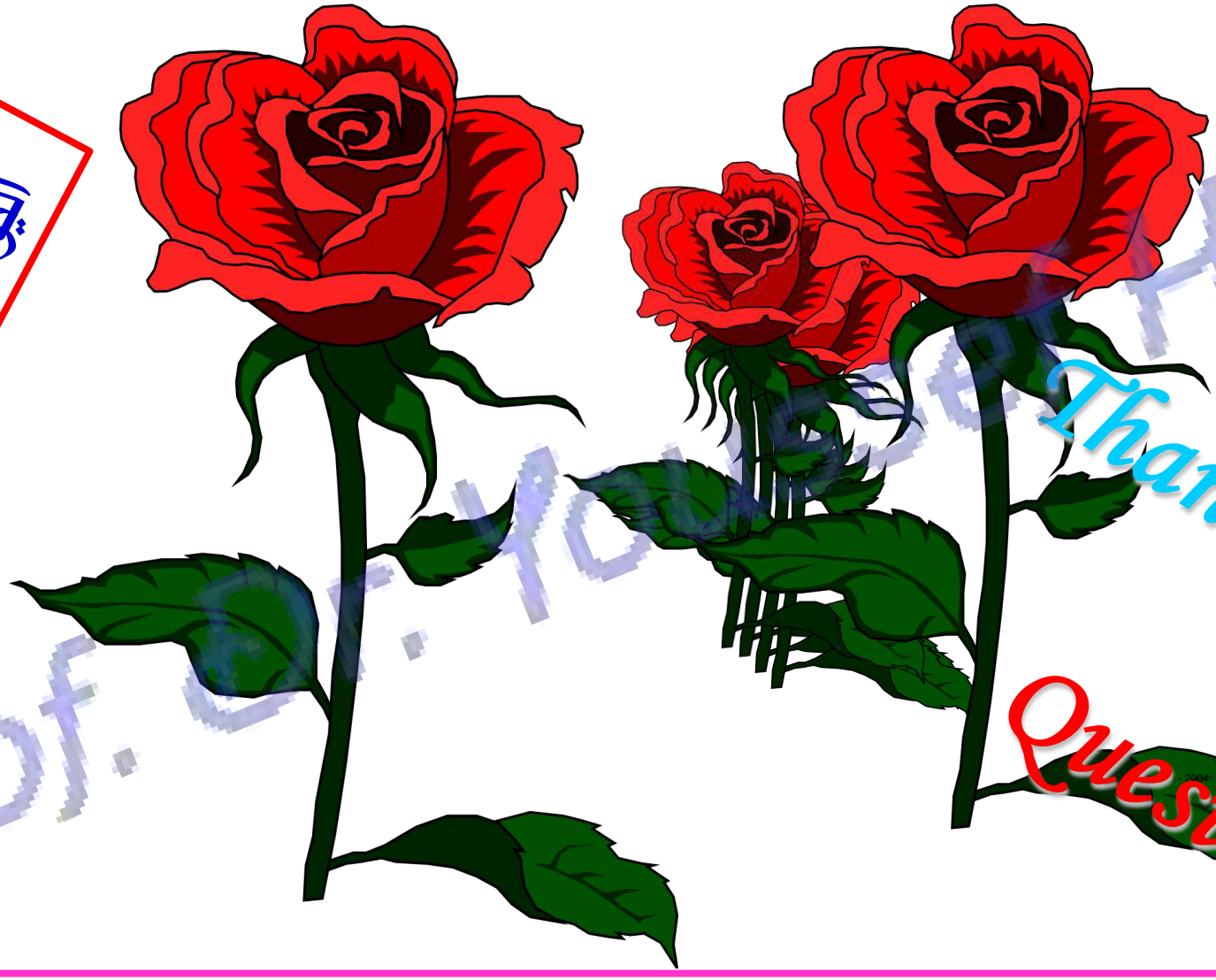
- The **nucleus pulposus** may herniate through the **anulus fibrosus**. The herniated nucleus pulposus may compress the spinal nerve roots, resulting in pain, weakness, numbness, or tingling along the involved spinal nerve (**sciatica**).
- Herniation usually occurs in the lower lumbar **(L4/L5 or L5/S1)** or lower cervical **(C5/C6 or C6/C7)** parts of the vertebral column.
- The herniated disc will usually compress the spinal nerve roots **one number below** the involved disk (e.g., the herniation of the L4 disk will compress the L5 roots, or herniation of the C7 disk will compress the C8 nerve roots).

https://www.youtube.com/channel/UCVSNqbibj9UWYaJdd_cn0PQ



Thank you

Questions

https://www.youtube.com/@ProfDrYoussefHusseinAnatomy/playlists