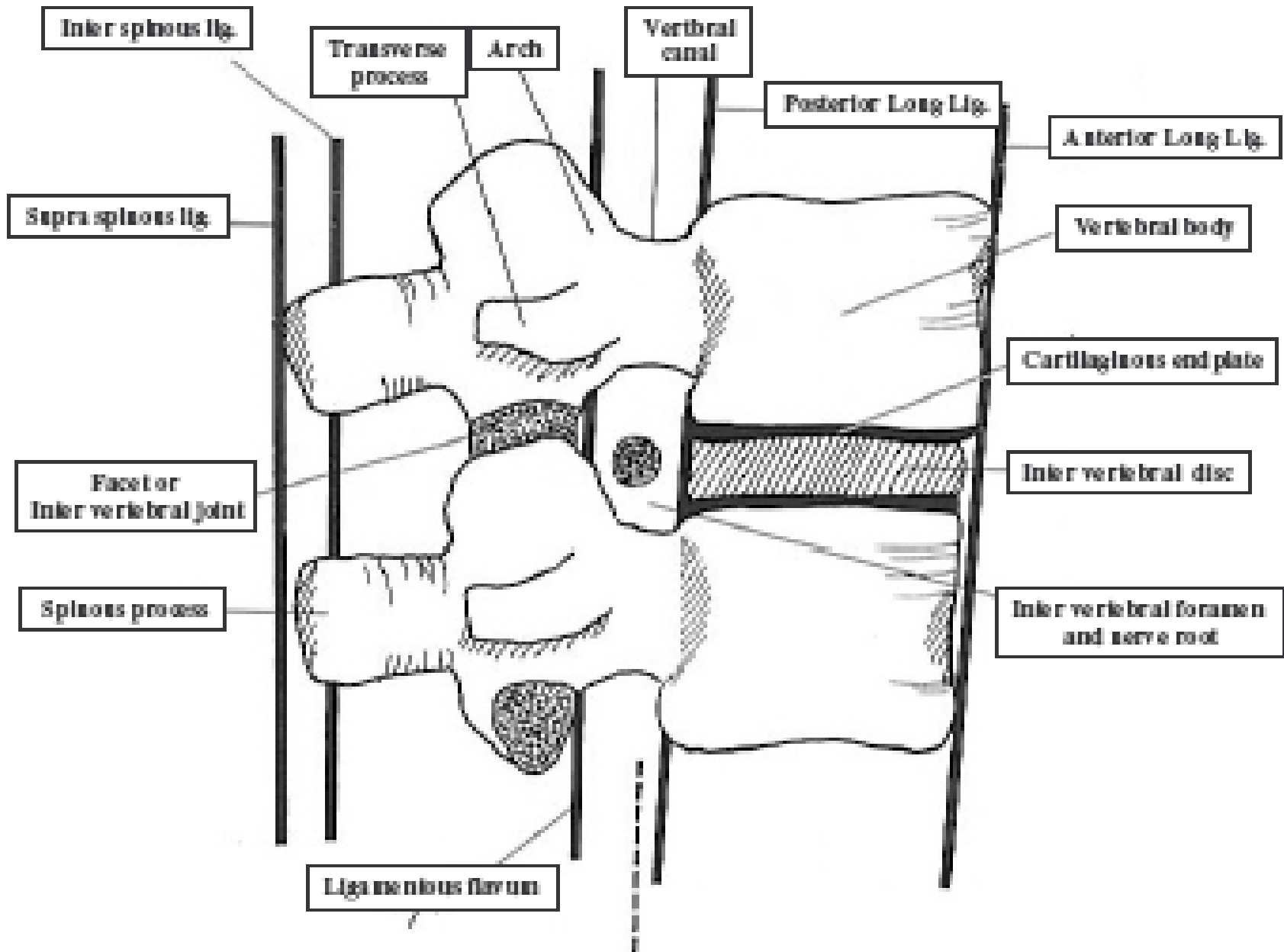
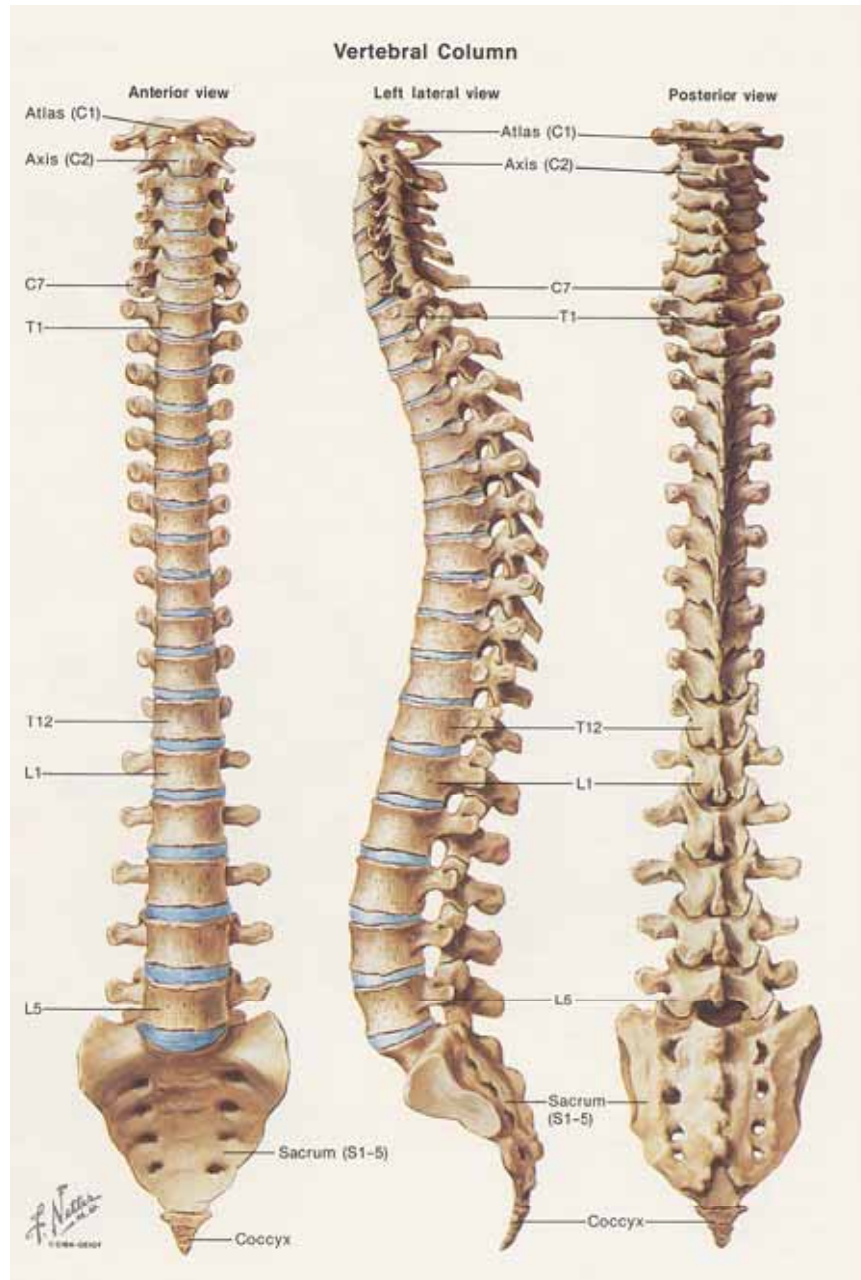


Section 35: Spine – Structural Components

Human Spine

- Functions to protect the spine, transfers loads from head and trunk to pelvis
- 24 vertebrae that permit motion in all 3 planes
- Stability comes from:
 - Intrinsic: intervertebral discs and ligaments
 - Extrinsic: muscles





35-4

From: Yoon

Cervical Spine

- Seven vertebrae
 - C 1-7
- More flexible
- Supports the head
- Wide range of motion
 - Rotation to left and right
 - Flexion
 - Up and down
- Peripheral nerves
 - Arms
 - Shoulder, Chest and diaphragm

Thoracic Spine

- Mid-back or dorsal region
- Twelve vertebrae
 - T 1-12
- Ribs attached to vertebrae
- Relatively immobile
- Peripheral nerves
 - Intercostal

Lumbar Spine

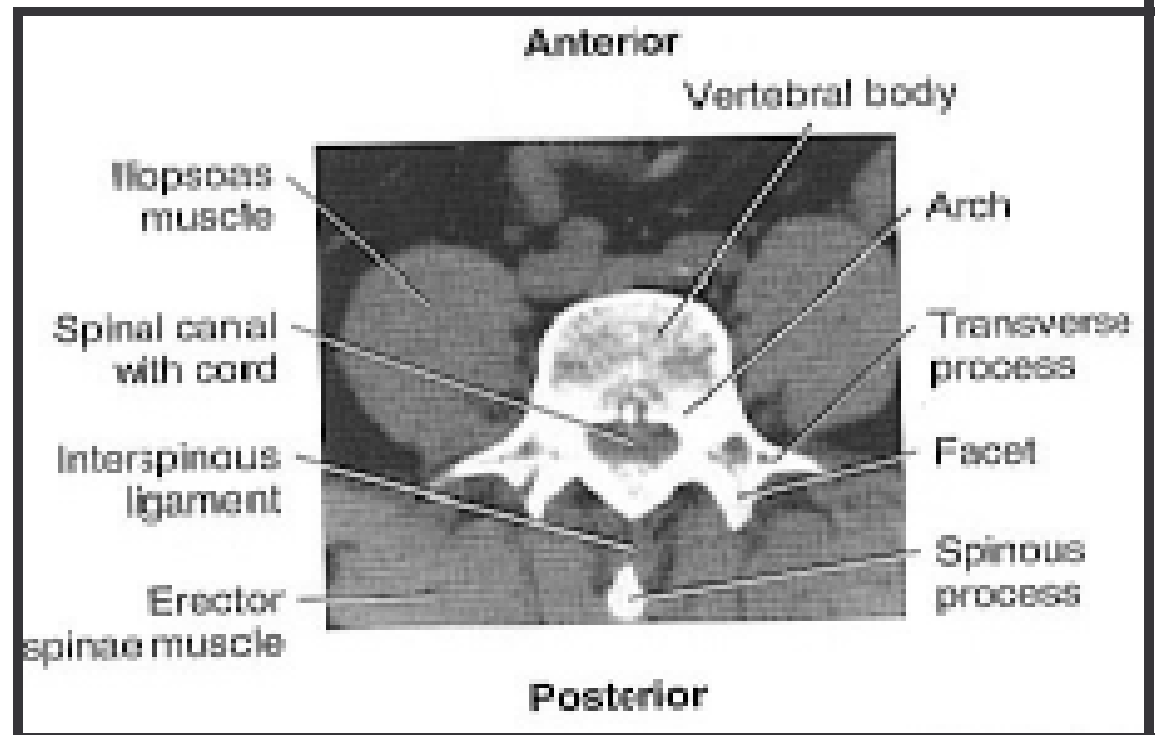
- Lower back
- Five vertebrae
 - L 1-5
- Carries the the weight of the upper body
 - Larger, broader
- Peripheral nerves
 - Legs
 - Pelvis

Sacral and Coccygeal region

- *Sacrum*
 - Triangular structure
 - Base of the spine
 - Connects spine to pelvis
 - Nerves to pelvic organs
- *Coccyx*
 - Few small bones
 - Remnant of tail

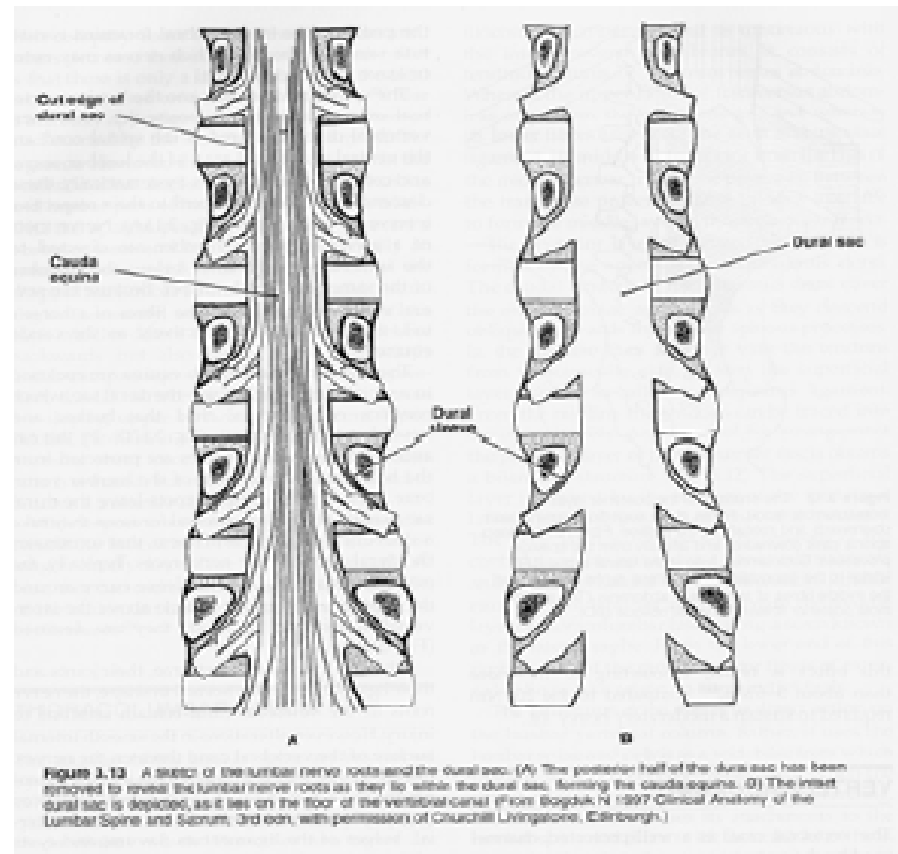
Muscles of the Spine - Flexors

- Abdominal muscles – (rectus & transverse abdominal, internal / external oblique)
- Psoas muscles



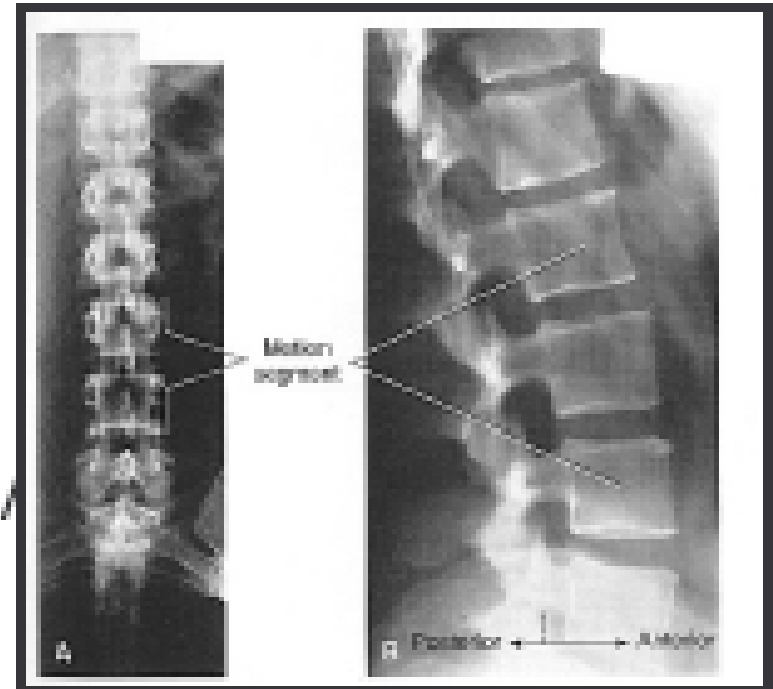
Spinal nerves

- Vertebral canal
 - Fits cauda equina inside dural sac
- Also spinal nerves coming through foramina lying in intervertebral foramina



Motion Segment

- Functional unit of the spine
- Consists of 2 adjacent vertebrae & soft tissue.
- Results in segmental motion
- Can lead to areas of hyper and hypo mobility
- Anterior portion – Stability
- Posterior portion - Mobility



Role of the facet joints

- Sagittal anatomy of the spine
- Ligamentous structure supports tensile loading
- Adams et al., 2002

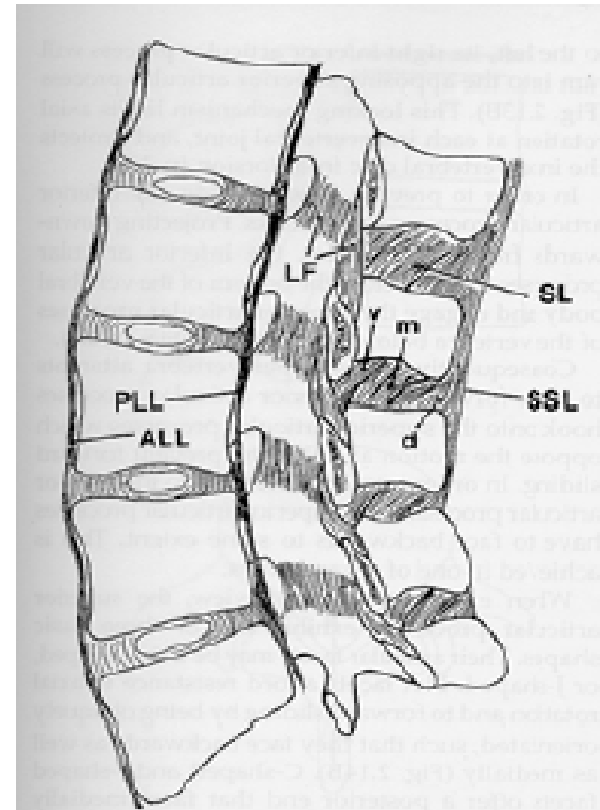
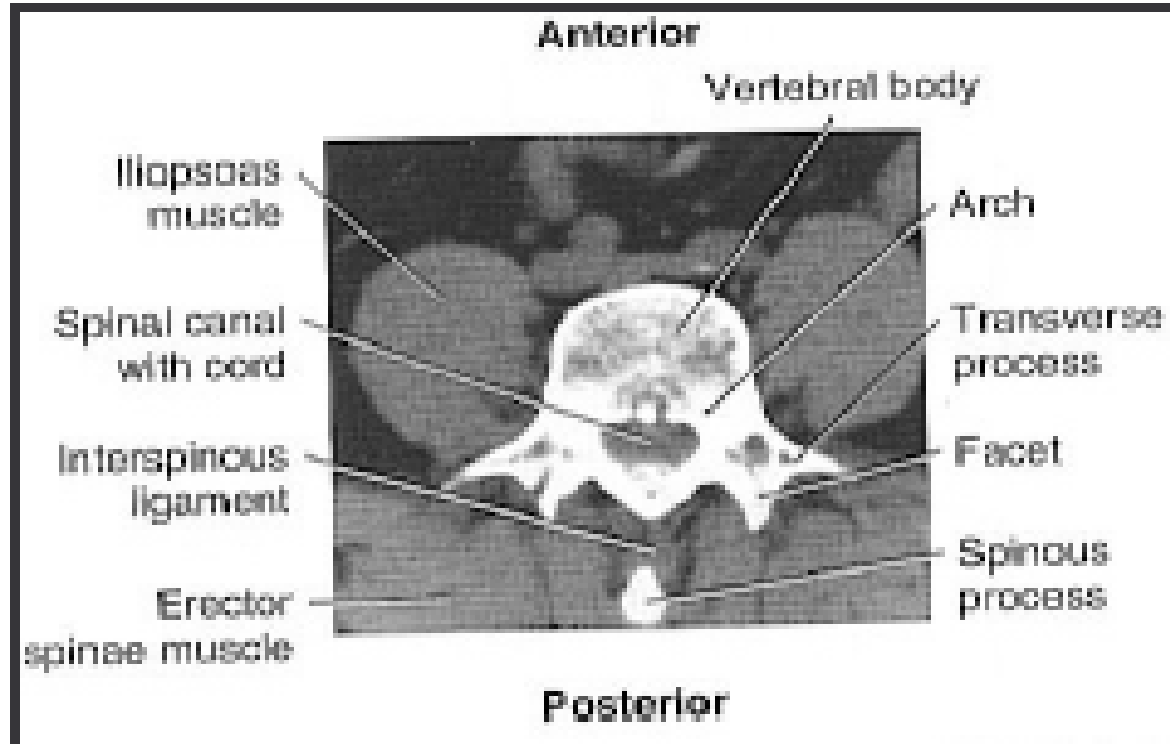


Figure 2.12 A median sagittal section of the lumbar spine to show its various ligaments. ALL: anterior longitudinal ligament; PLL: posterior longitudinal ligament; SSL: supraspinous ligament; ISL: interspinous ligament; v: ventral part; m: middle part; d: dorsal part; LF: ligamentum flavum, viewed from within the vertebral canal, and in sagittal section at the midline. (From Bogduk N 1997 Clinical Anatomy of the Lumbar Spine and Sacrum, 3rd edn, with permission of Churchill Livingstone, Edinburgh.)

Posterior portion - Mobility

- Guides movement
- Determined by region & orientation of facets



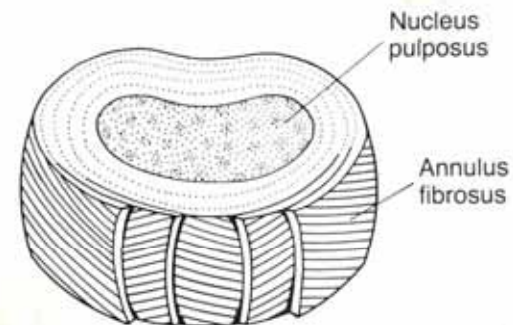
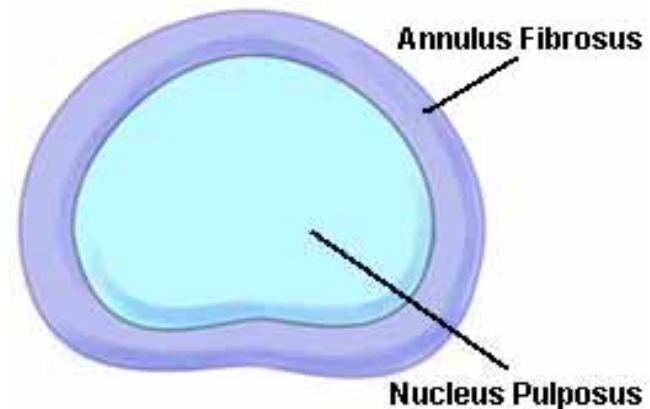
Intervertebral Disc

- Soft fibro-cartilaginous cushions
 - Between two vertebra
 - Allows some motion
 - Serve as shock absorbers
- Total – 23 discs
- $\frac{1}{4}$ th of the spinal column's length
- Avascular
- Nutrients diffuse through end plates

Intervertebral Disc Anatomy

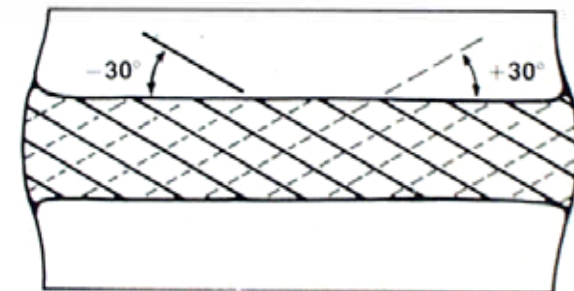
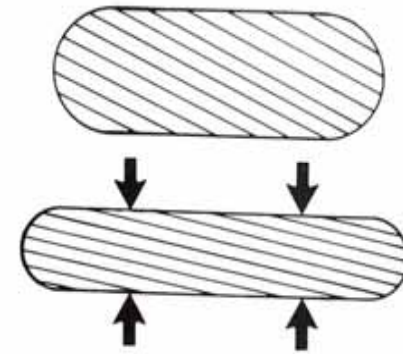
- Spongy center
 - *Nucleus pulposus*
- Surrounded by a tougher outer fibrous ring
 - *Anulus fibrosus*

Axial (Overhead) View
of Intervertebral Disc

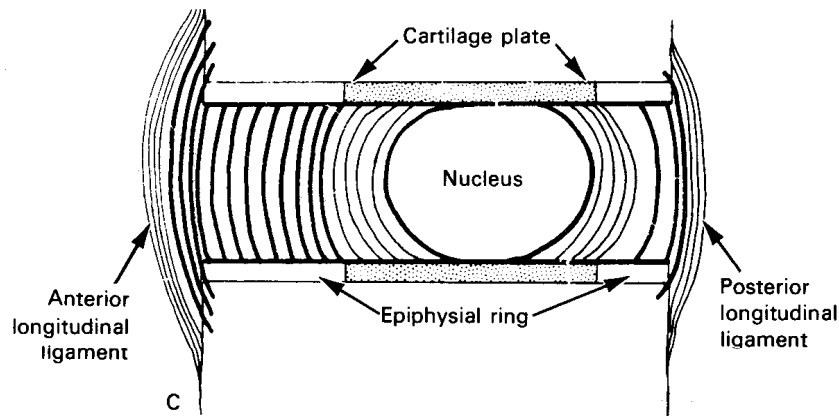
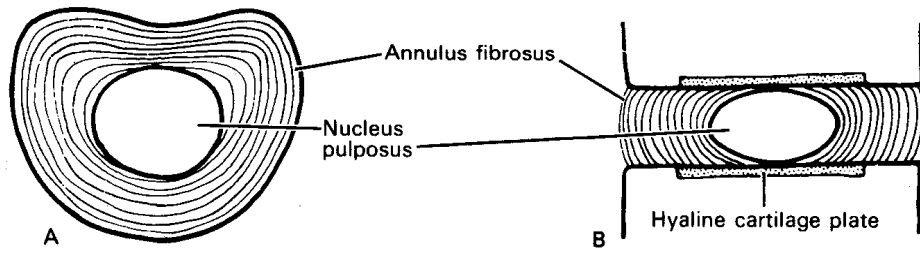
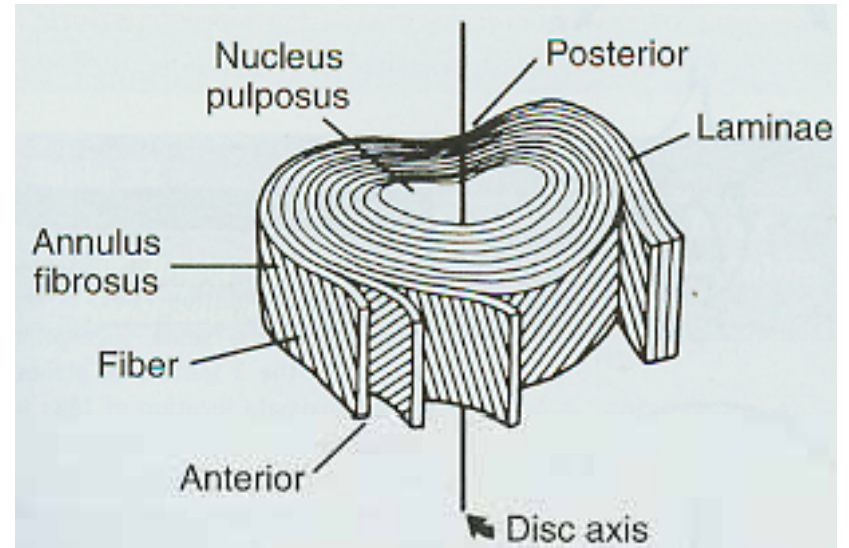
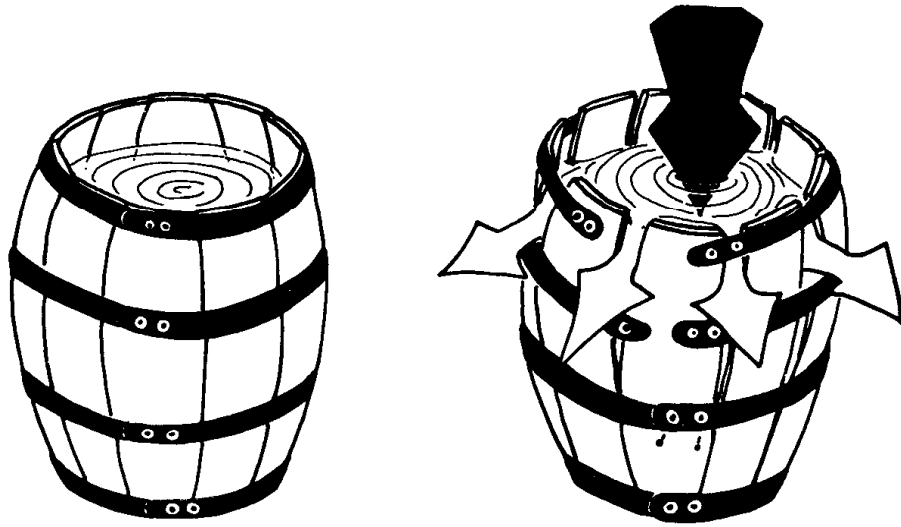


Anulus Fibrosus

- Strong radial tire–like structure
- Series of lamellae
- Concentric sheets of collagen fibers
 - Connected to end plates
 - Orientated at various angles
 - Under compression
 - Become horizontal
- Encloses nucleus pulposus



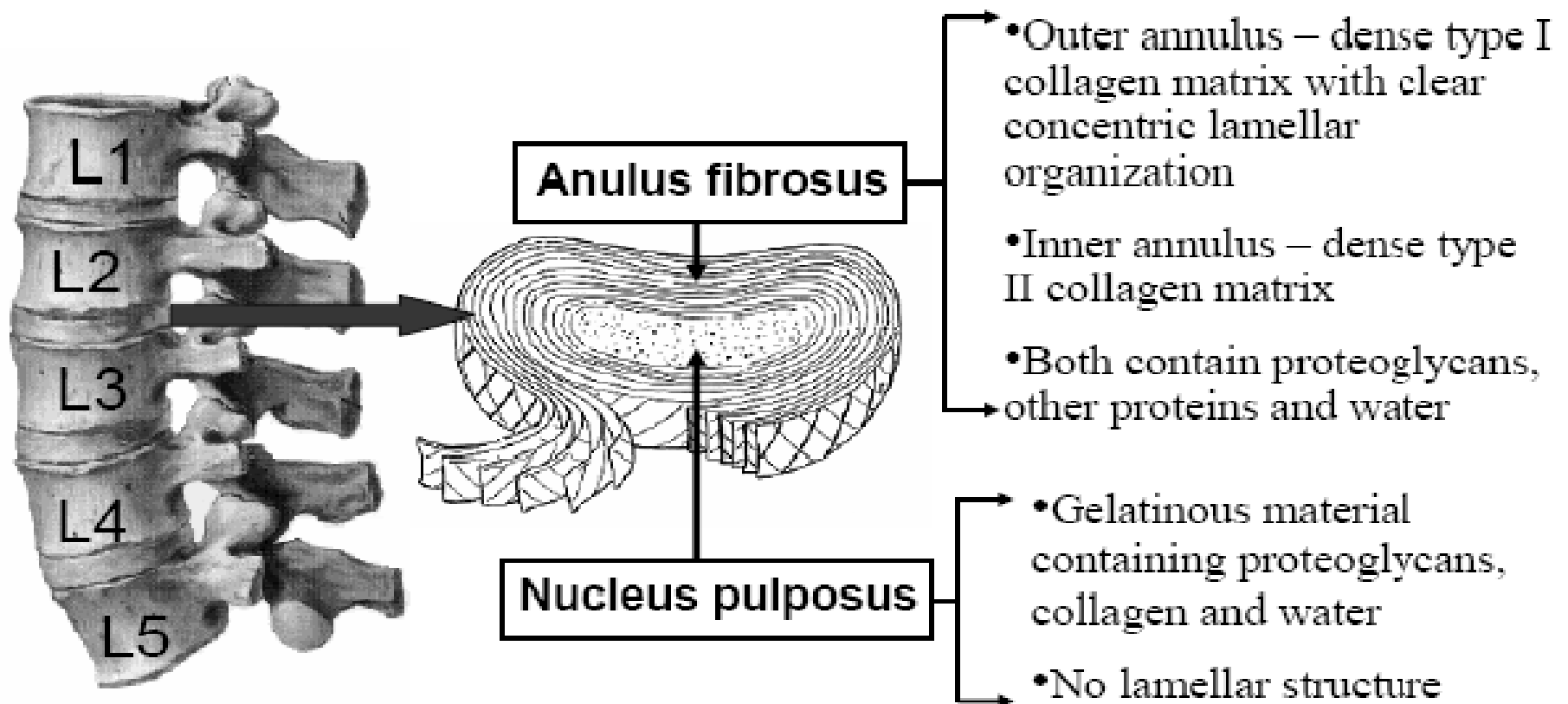
ANNULAR FIBERS



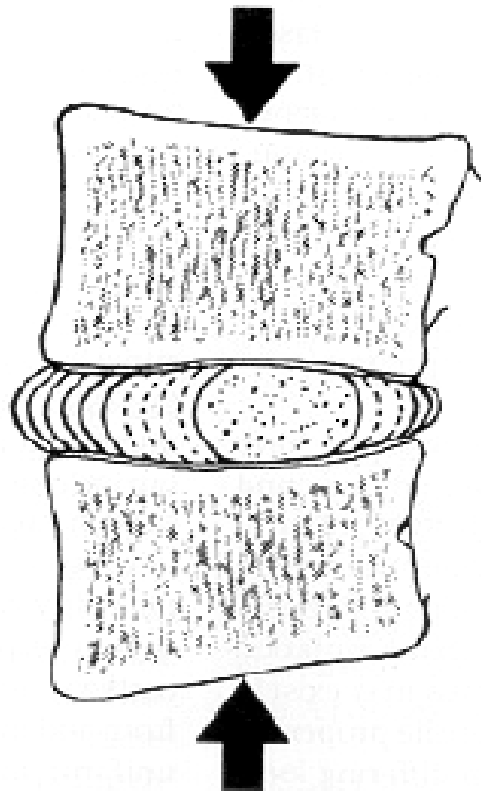
35-17

From: Yang

Intervertebral disc structure: A closer look



Spine Mobility



- **Bending**
- **Torsional shear**
- **Compression**

Hydrostatic pressures

- **0.1 MPa lying down**
- **0.5 MPa standing/sitting up-right**
- **1-2.5 MPa lifting**

[Wilke, et al., 2001]