



The Back

Anatomy

RHS 241

Lecture 9

Dr. Einas Al-Eisa

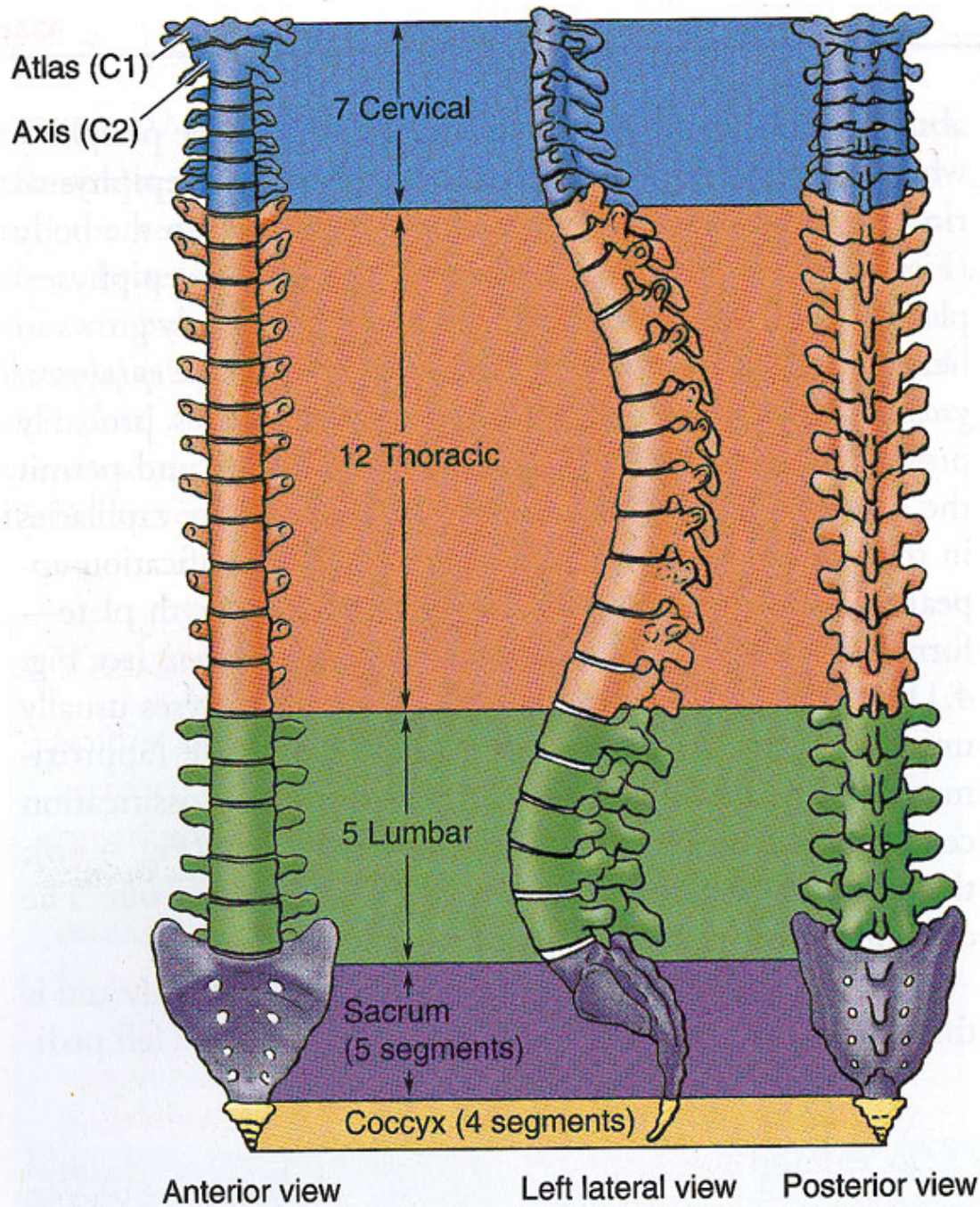


The spine has to meet
2 functions

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graph TD; A[The spine has to meet 2 functions] --> B[Strength]; A --> C[Mobility];
```

Strength

Mobility



Atlas (C1)
Axis (C2)

7 Cervical

12 Thoracic

5 Lumbar

Sacrum
(5 segments)

Coccyx (4 segments)

Anterior view

Left lateral view

Posterior view

Stability of the vertebral column is provided by:

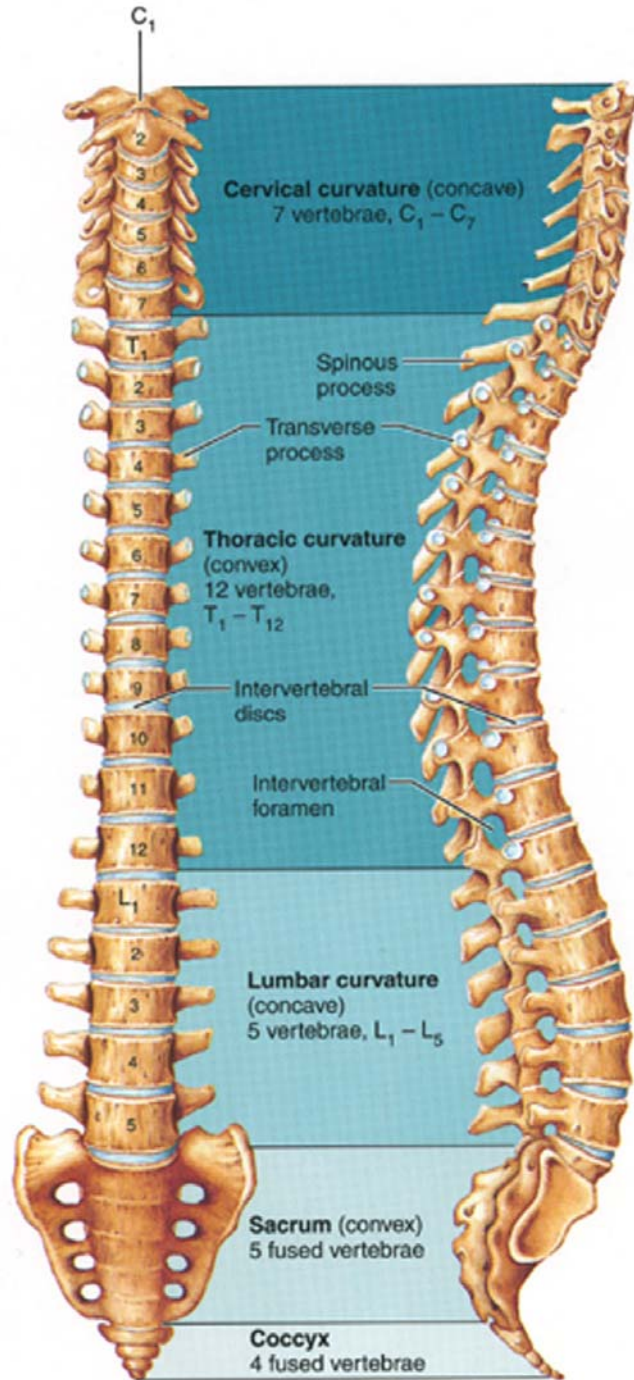
- Deep intrinsic muscles of the back
- Ligaments
- The intervertebral discs
- The curvature of the spine
- The abdominal wall muscles

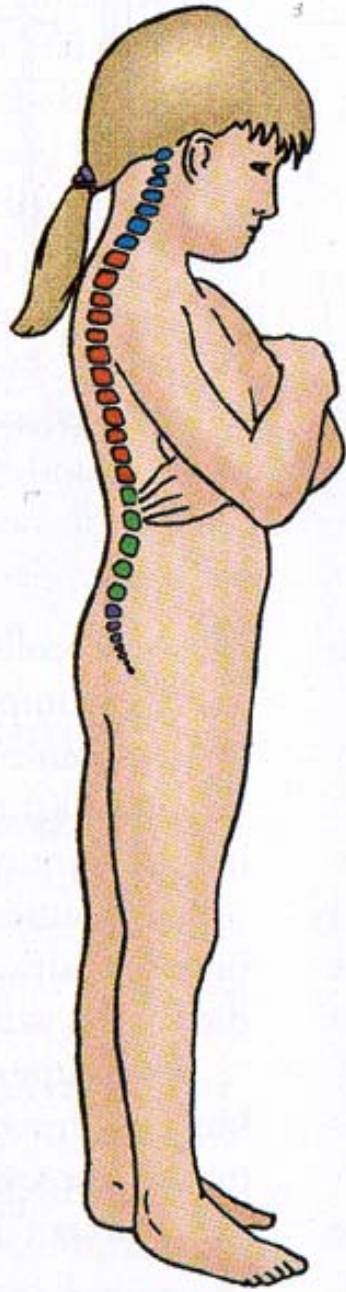
Factors that contribute to the **mobility** of the vertebral column:

- The elasticity of ligaments
- Compressibility and elasticity of the intervertebral discs
- Position and orientation of the intervertebral synovial joints

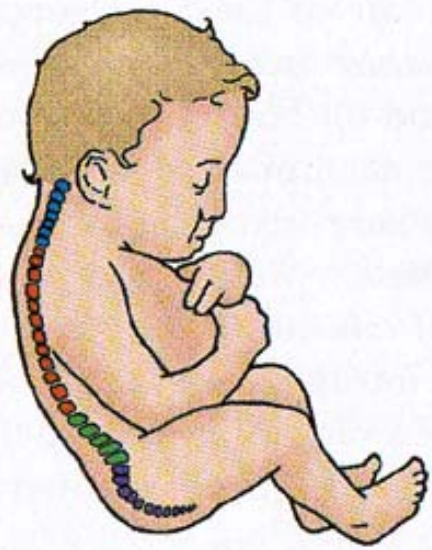
Anatomical constraints of movement

- Intervertebral discs
- Orientation of the facet joints
- Articular capsules of the facet joints
- Ligaments





4 years



Newborn



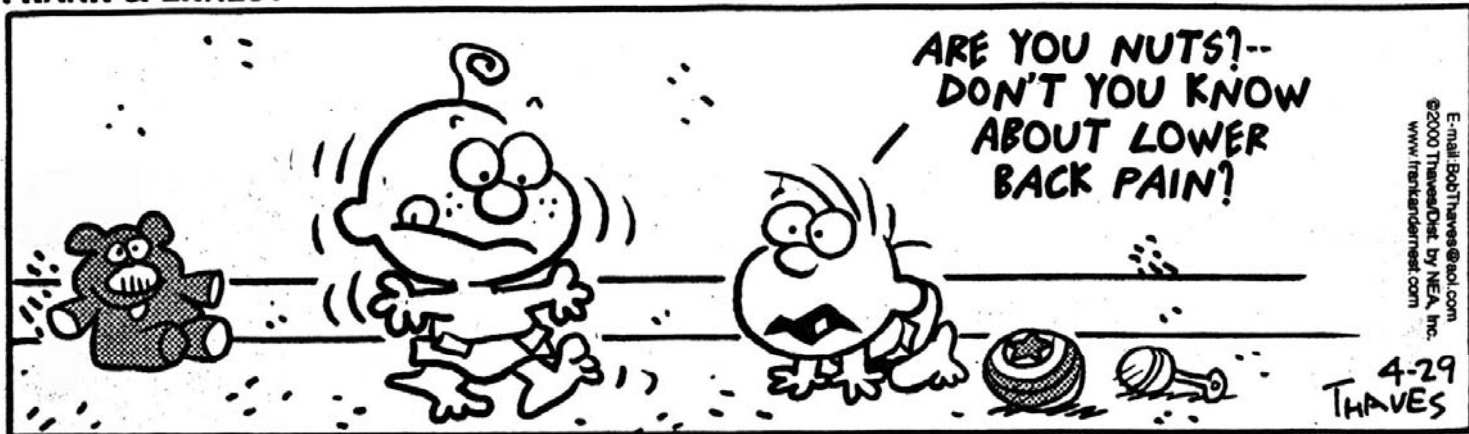
Fetus (2 months)

Spinal curvature

Once the standing position is achieved, the spine has four curves:

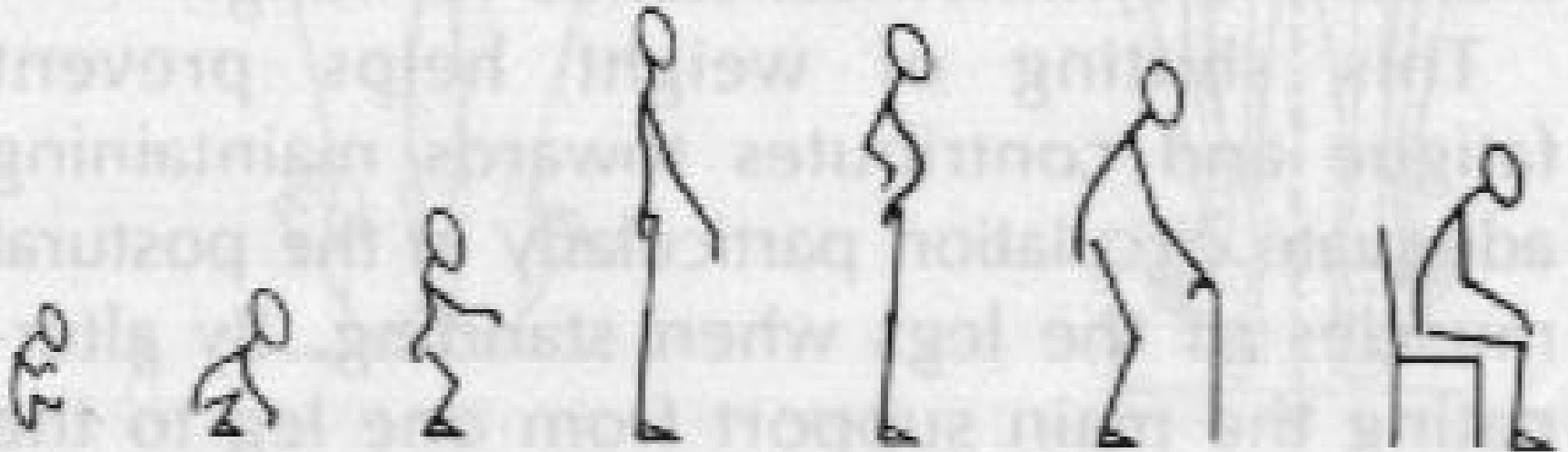
1. **Cervical curvature:** convex anteriorly (secondary)
2. **Thoracic curvature:** convex posteriorly (primary)
3. **Lumbar curvature:** convex anteriorly (secondary)
4. **Sacral curvature:** convex posteriorly (primary)

FRANK & ERNEST

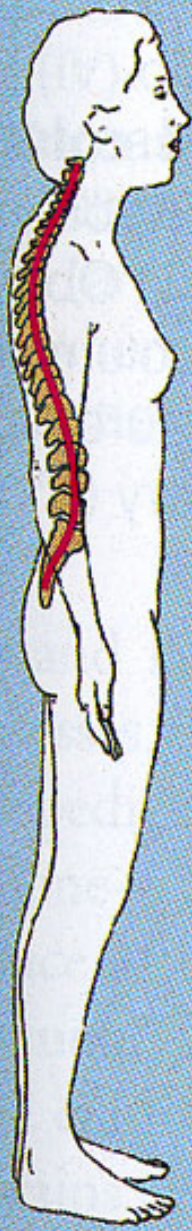


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THAVES

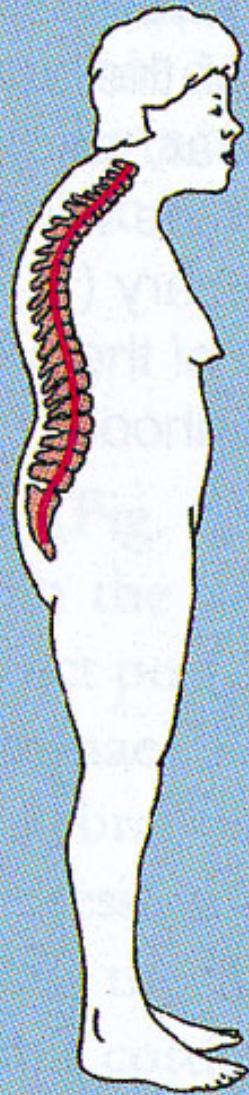


The seven ages of man



Normal

(A)



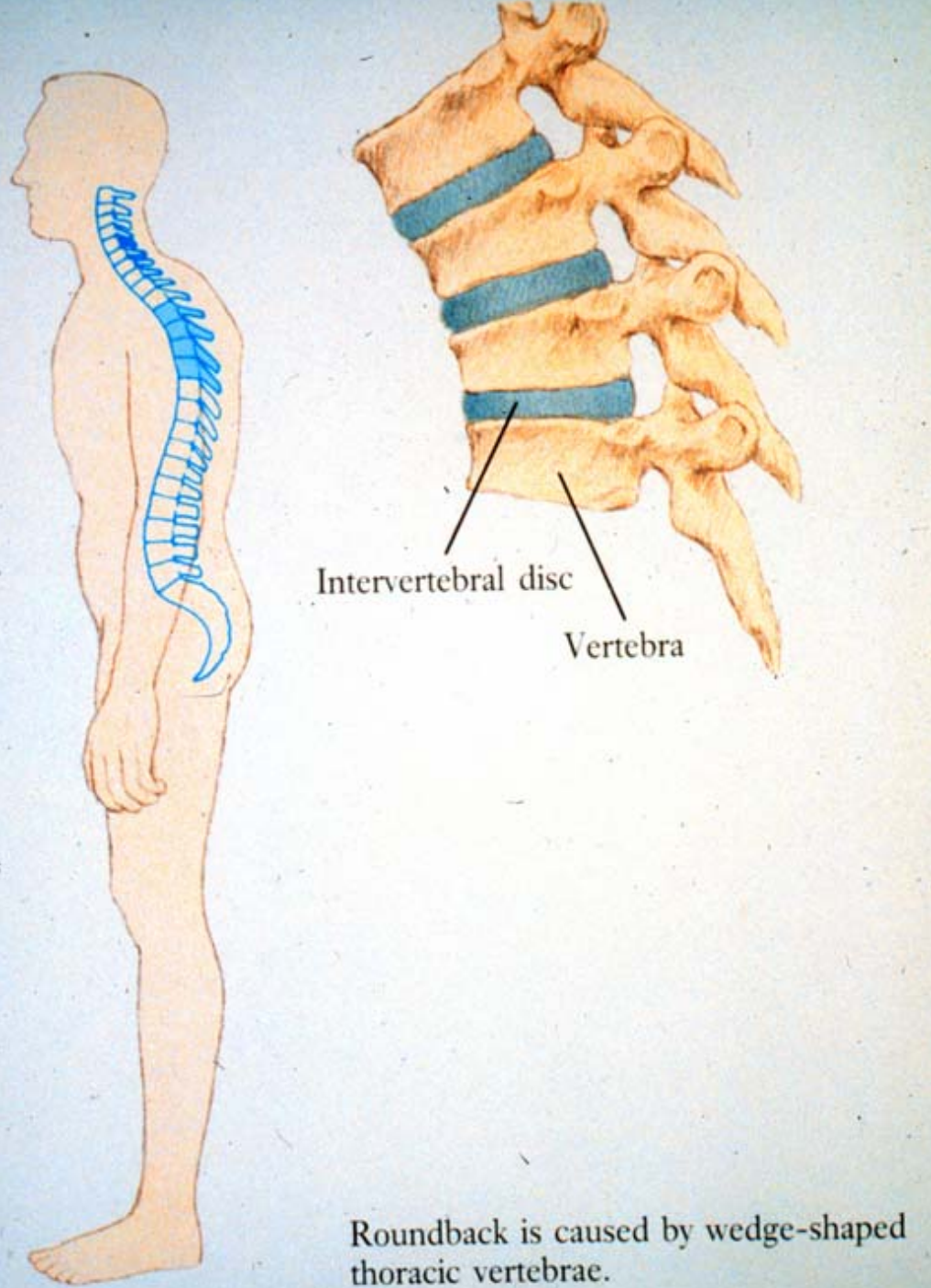
Kyphosis

(B)



Lordosis

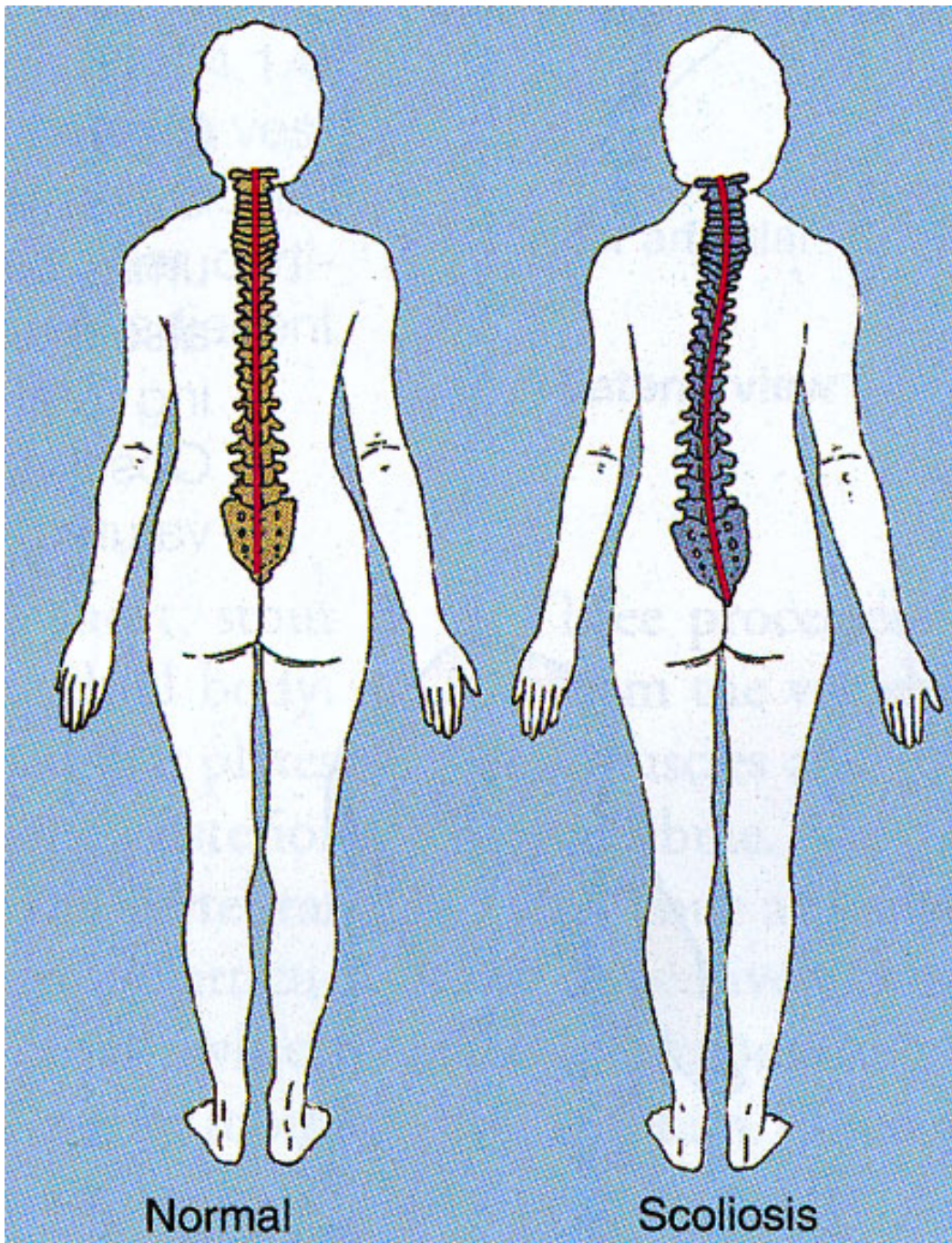
(C)



Intervertebral disc

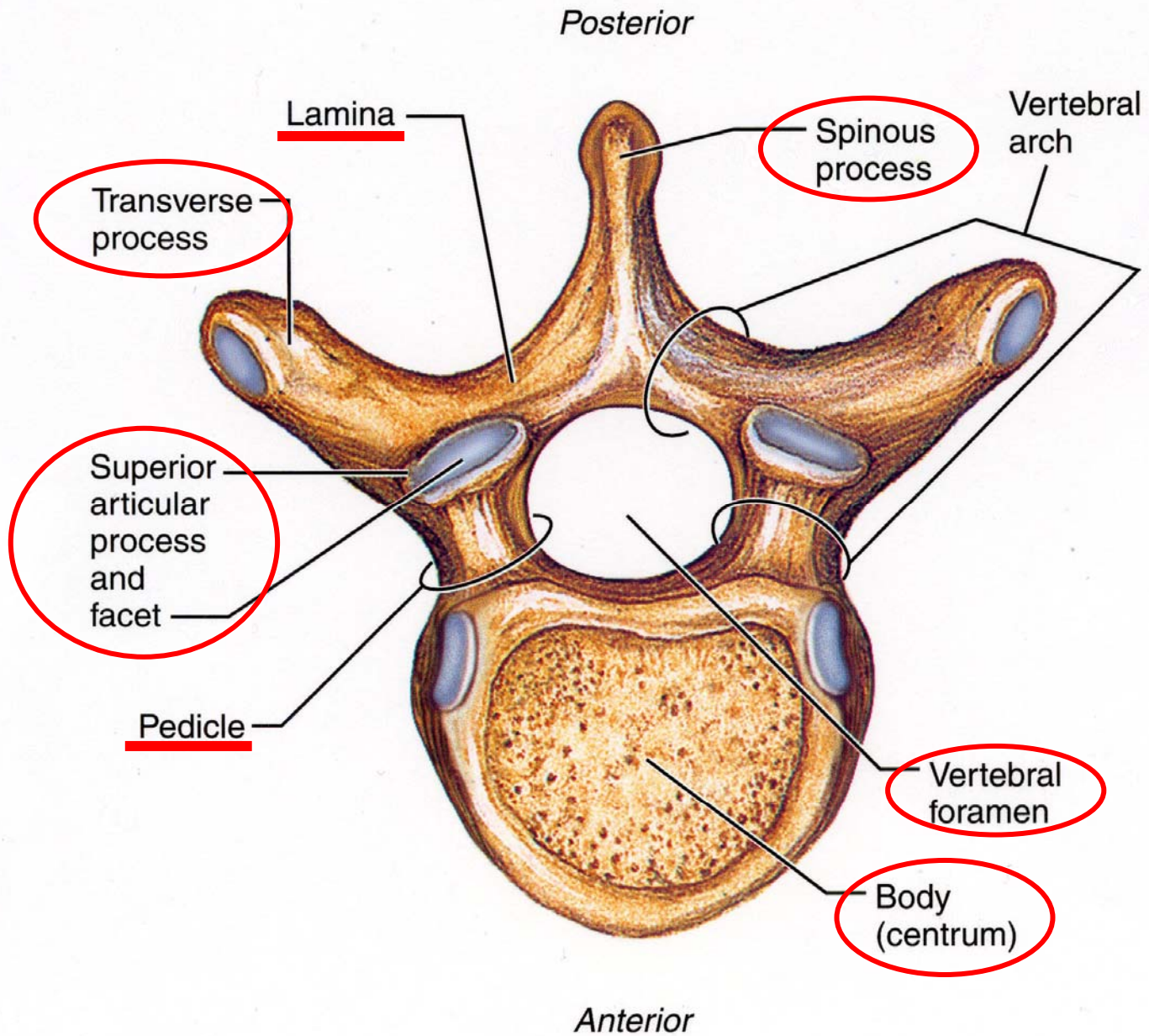
Vertebra

Roundback is caused by wedge-shaped thoracic vertebrae.



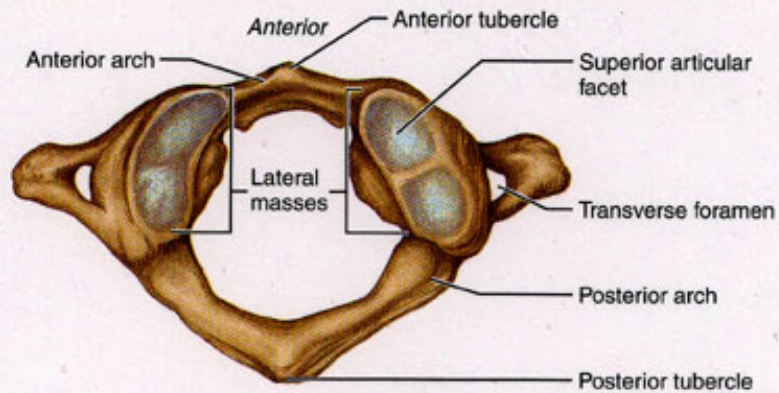
Normal

Scoliosis

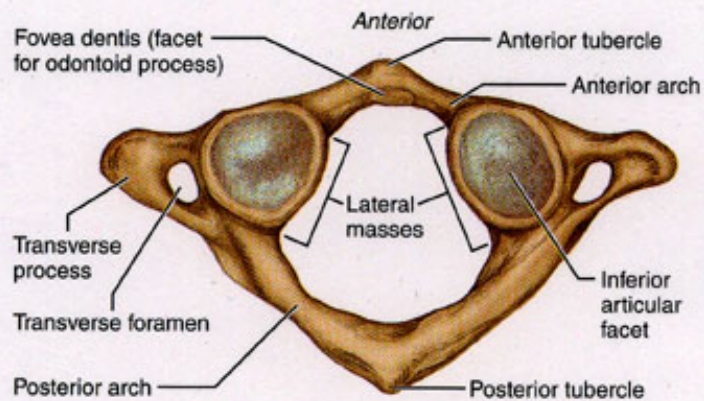


Identify:

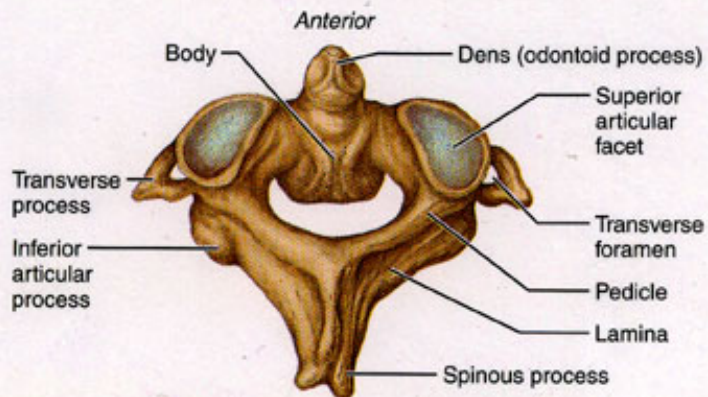
- The intervertebral foramen (between adjacent vertebrae)
- Atlas (C1)
- Axis (C2)



(a) Superior view of atlas (C_1)



(b) Inferior view of atlas (C_1)



(c) Superior view of axis (C_2)

Inter-vertebral joints

- **inter-vertebral disc** (fibrocartilagenous joint / symphyses): between the bodies of adjacent vertebra
- **2 facet joints** (synovial joints / diarthrosis): between the articular processes of adjacent vertebral arches (zygapophysial joints)

Joints

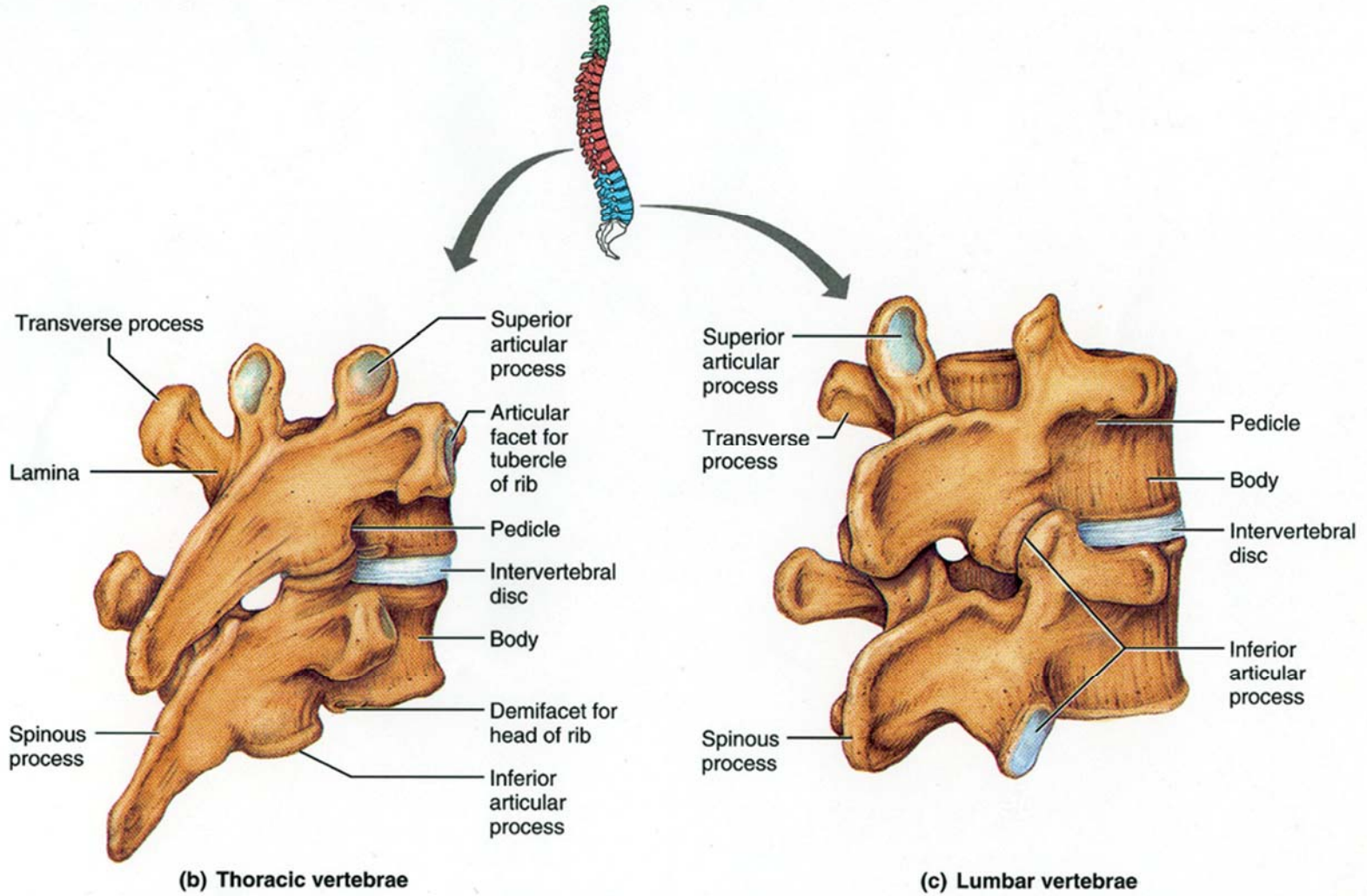
1. Between the bodies:

Intervertebral discs (fibrocartilaginous)

2. Between the arches:

Facet joints (synovial)

Posterolateral views of articulated vertebrae



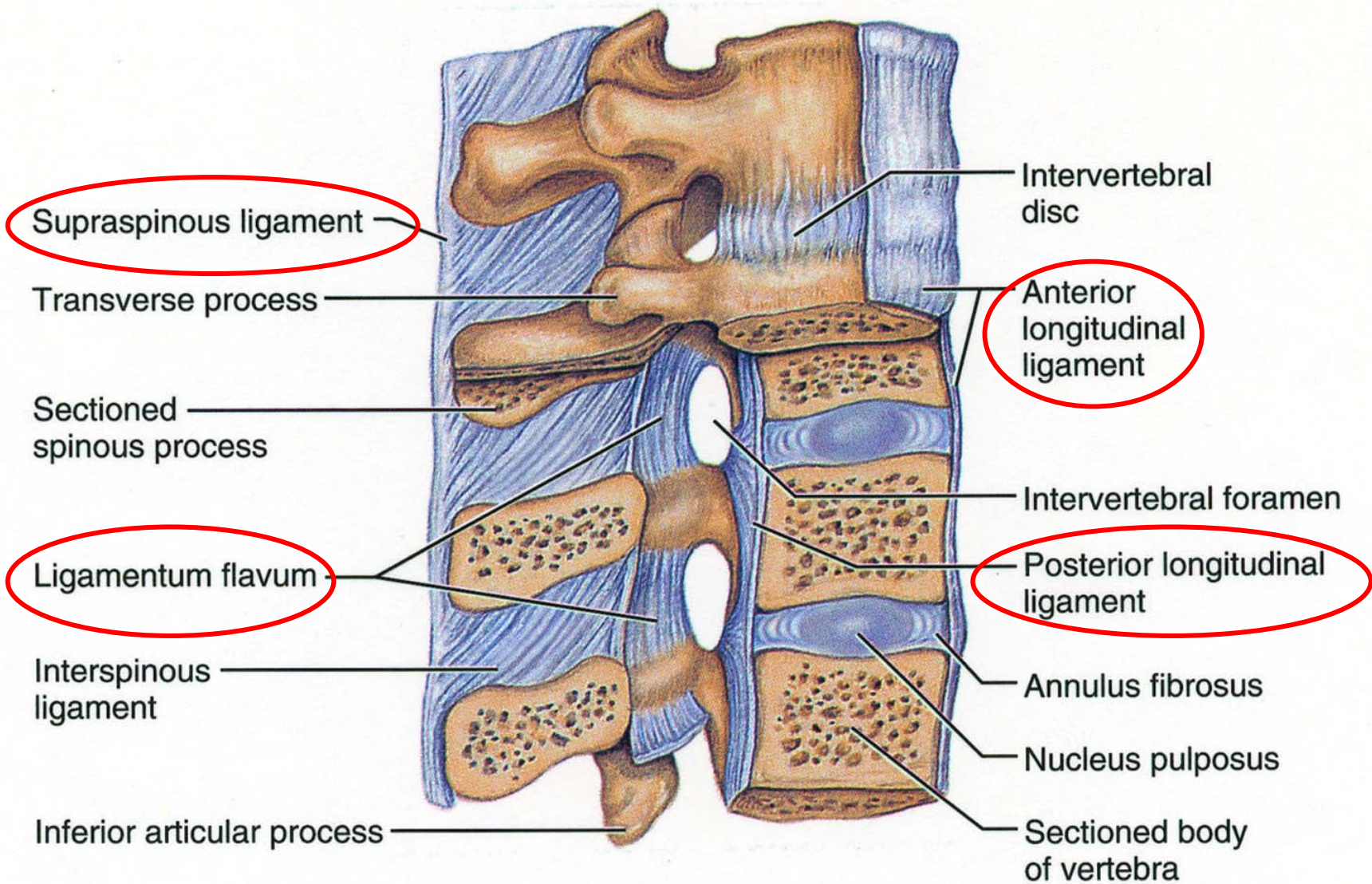
Ligaments

- **Anterior & posterior longitudinal ligaments:** between the vertebral bodies (from mid-sacral levels to C1)
- **Interspinous ligaments:** between adjacent vertebral spines

Ligaments

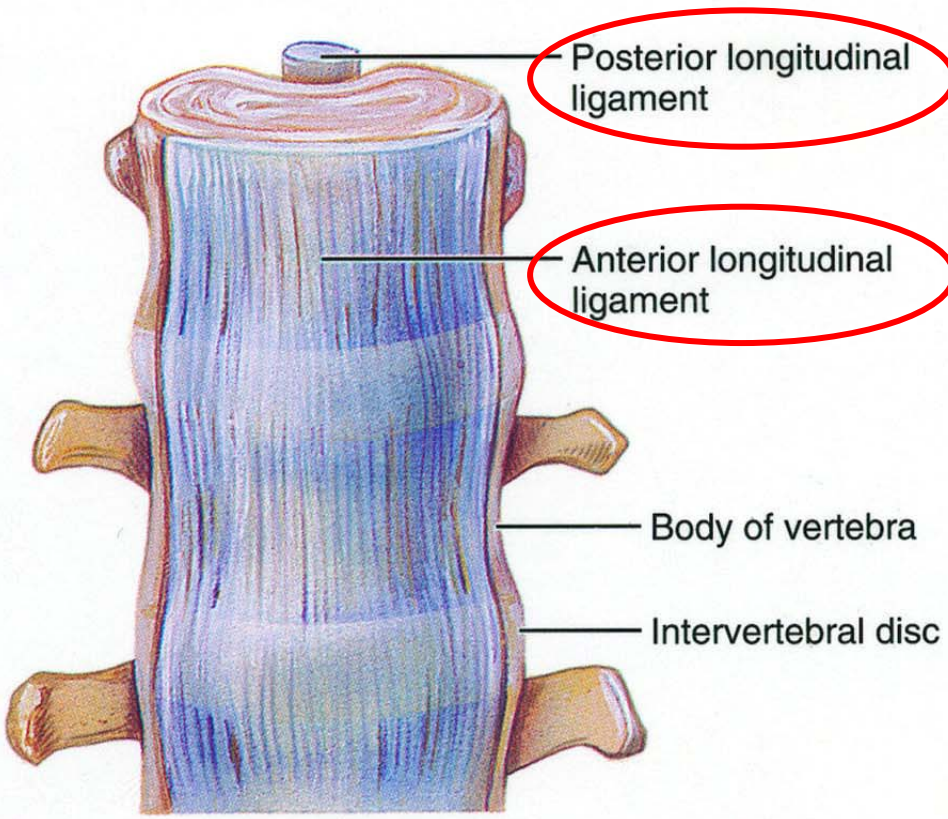
- **Ligamenta flava:**

- between adjacent vertebral arches (from one level to the next)
- reinforces the facet joints capsules
- thickening (hypertrophy) of this elastic ligament can impinge a spinal nerve root

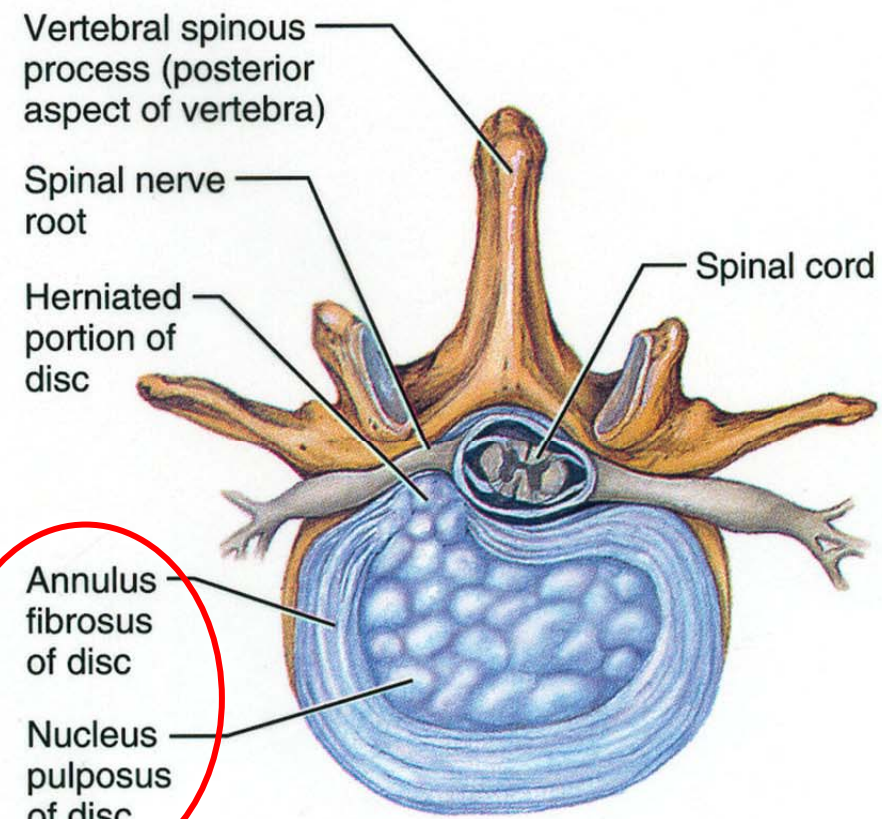


(a)

Lateral view



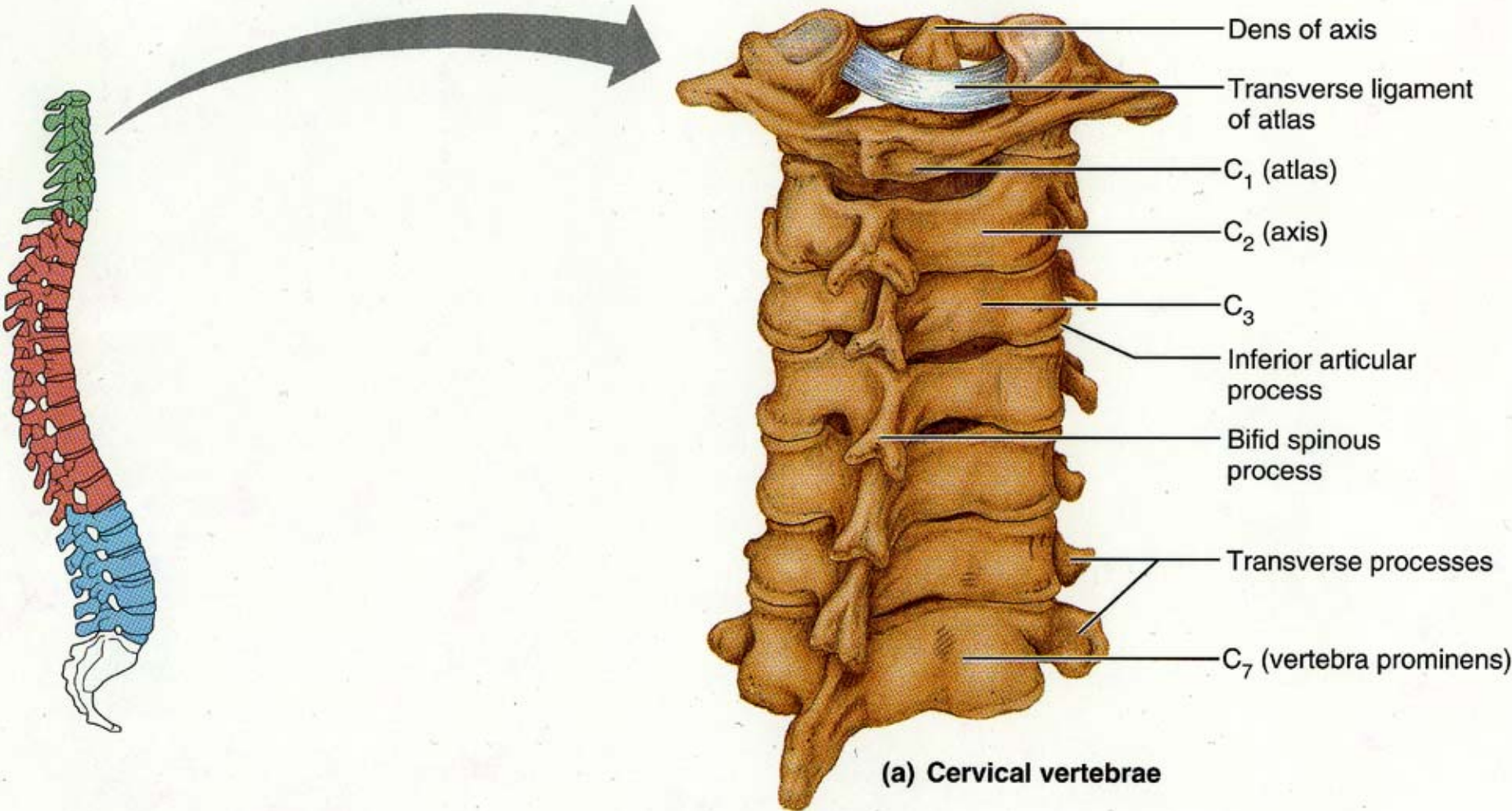
(b) Anterior view



(c)

Movement of the spine is checked
mainly by ligaments (not by muscles)

Whiplash injury??



“ Does it hurt when I do this? ”



Movements of the vertebral column

- **Flexion & Extension:**
in the **cervical** & **lumbar** regions
- **Lateral flexion:**
in the **cervical** & **lumbar** regions
- **Rotation:**
in the **cervical** & **thoracic** regions

Back muscles

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graph TD; A[Back muscles] --> B[Extrinsic group]; A --> C[Intermediate group]; A --> D[Intrinsic group];
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Extrinsic
group

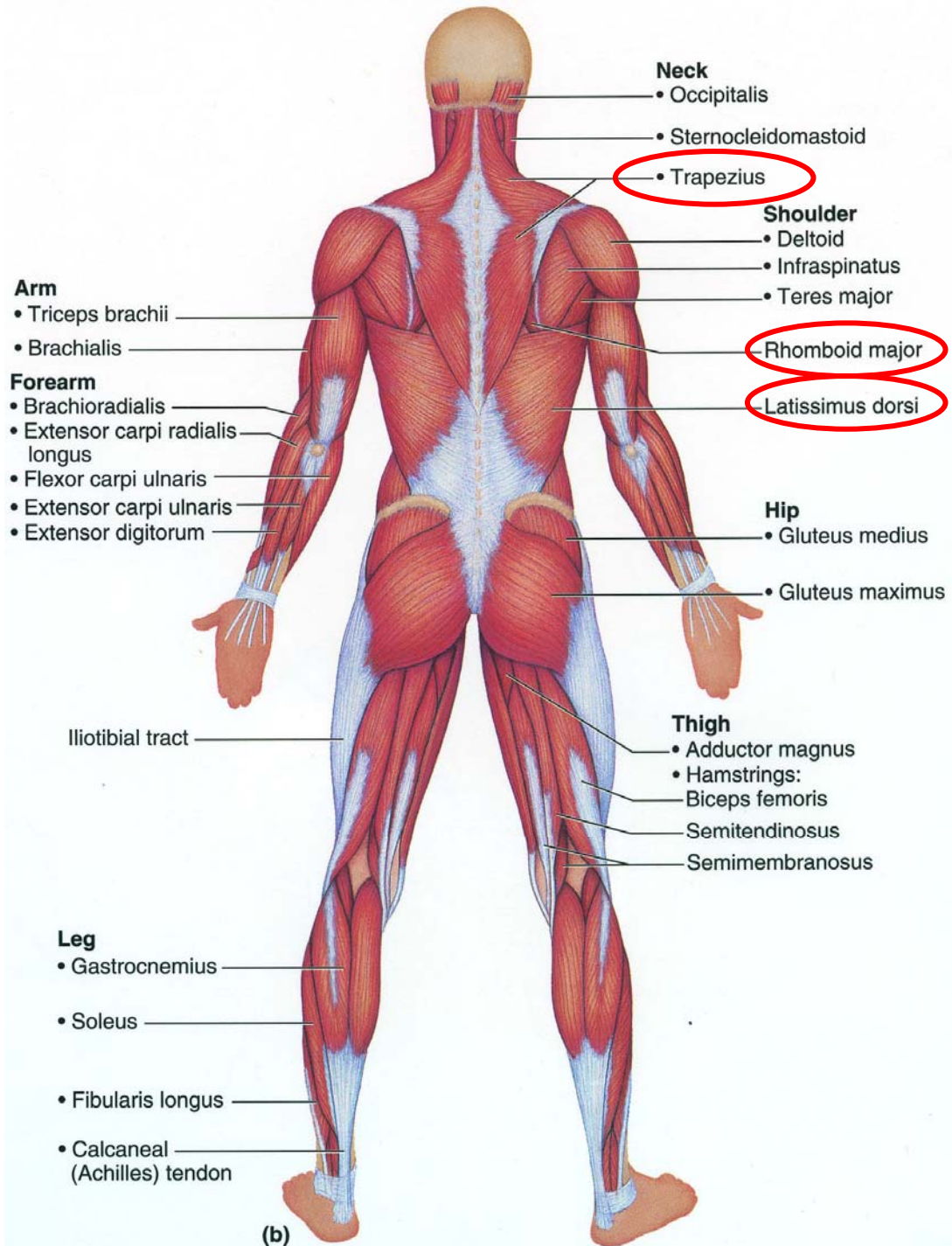
Intermediate
group

Intrinsic
group

1. Extrinsic back muscles

Attach U.L. to trunk:

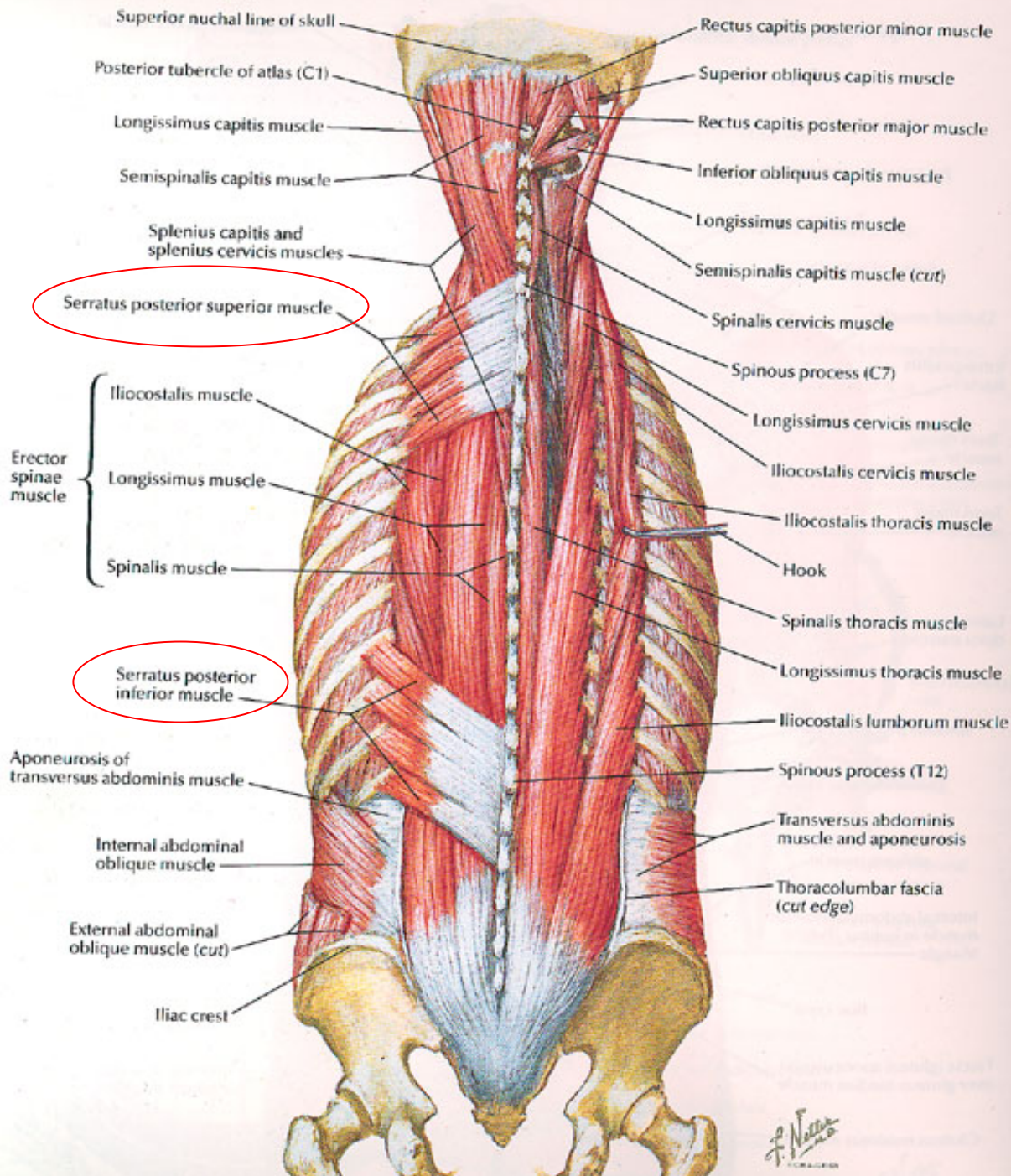
- **Trapezius**
- **Latissimus dorsi** (widest muscle on the back)
- **Levator scapulae** (deep to trapezius)
- **Rhomboids**



2. Intermediate group

Accessory muscles of respiration

- Serratus posterior superior
- Serratus posterior inferior



Serratus posterior superior muscle

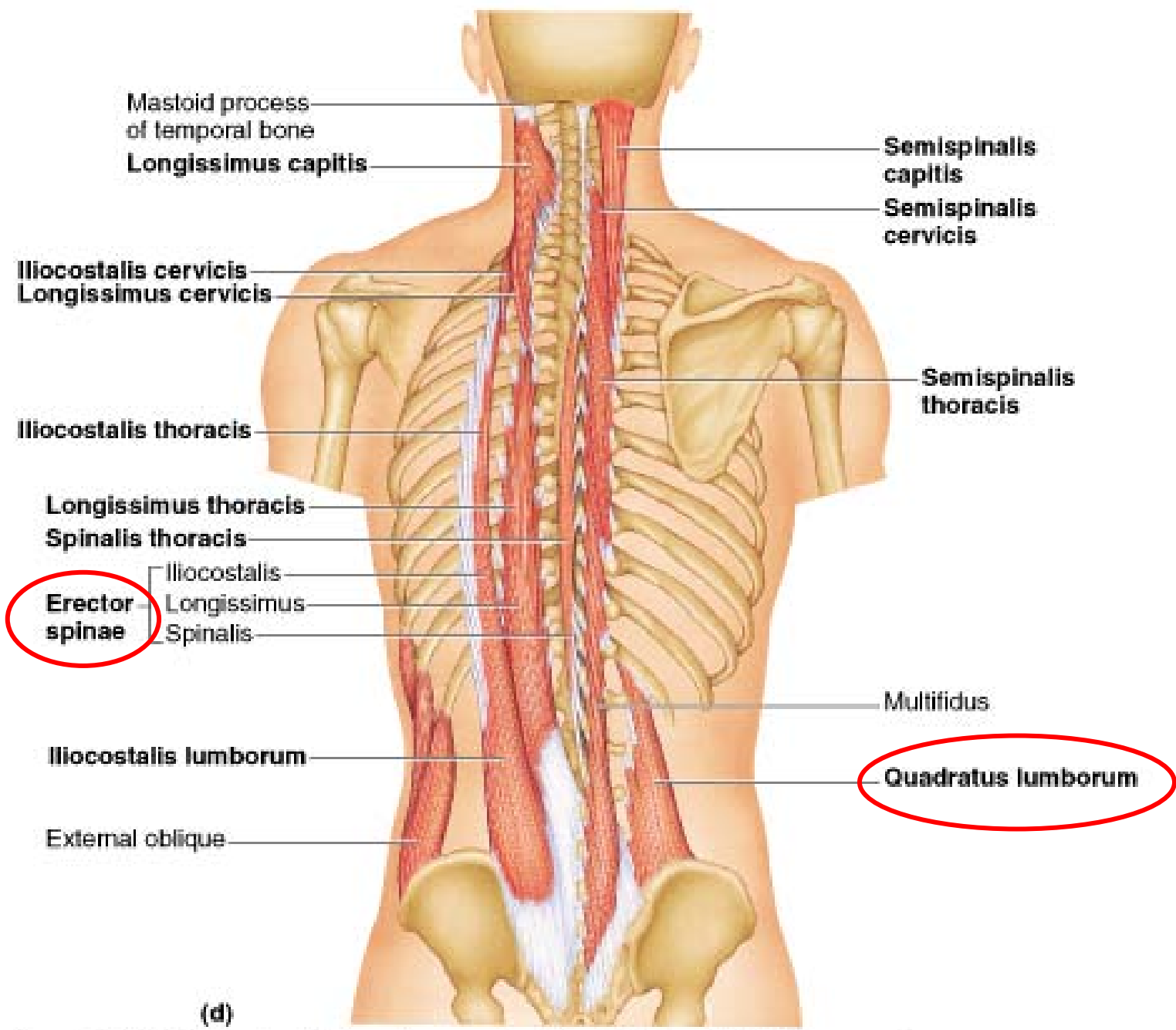
Erector spinae muscle

Serratus posterior inferior muscle

3. Intrinsic back muscles

Control movement of the vertebral column

- Superficial layer (**Erector spinae**)
- Deep layer (**Transversospinalis**)
- All innervated by segmental **dorsal rami**



(d)

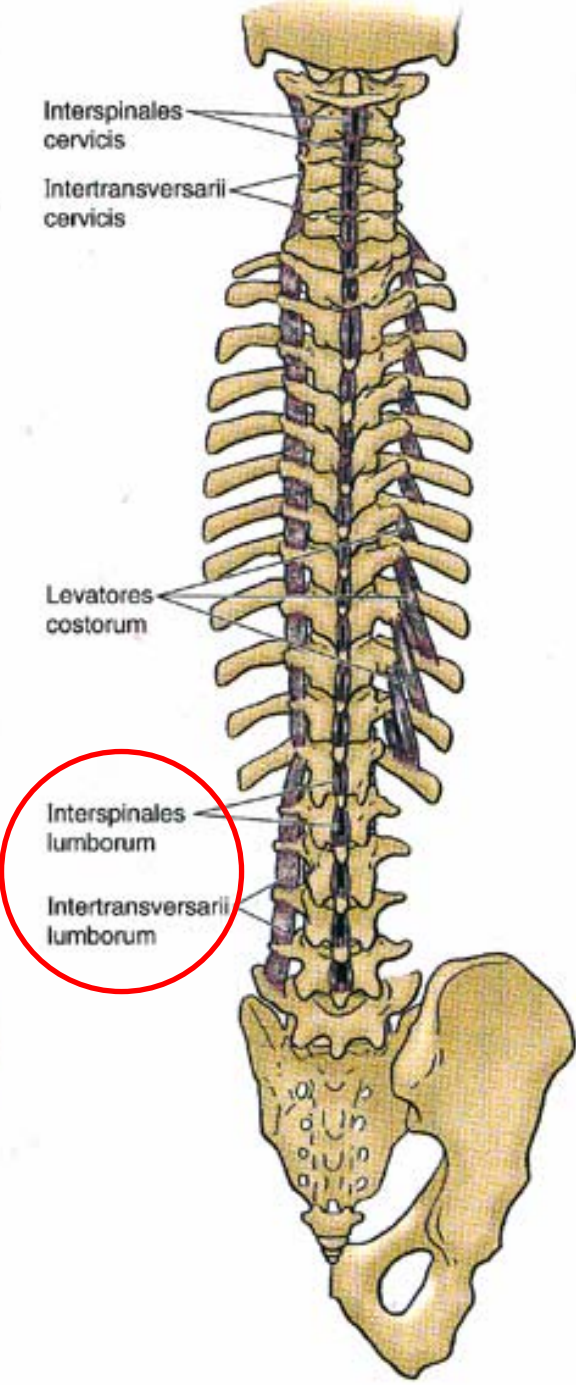
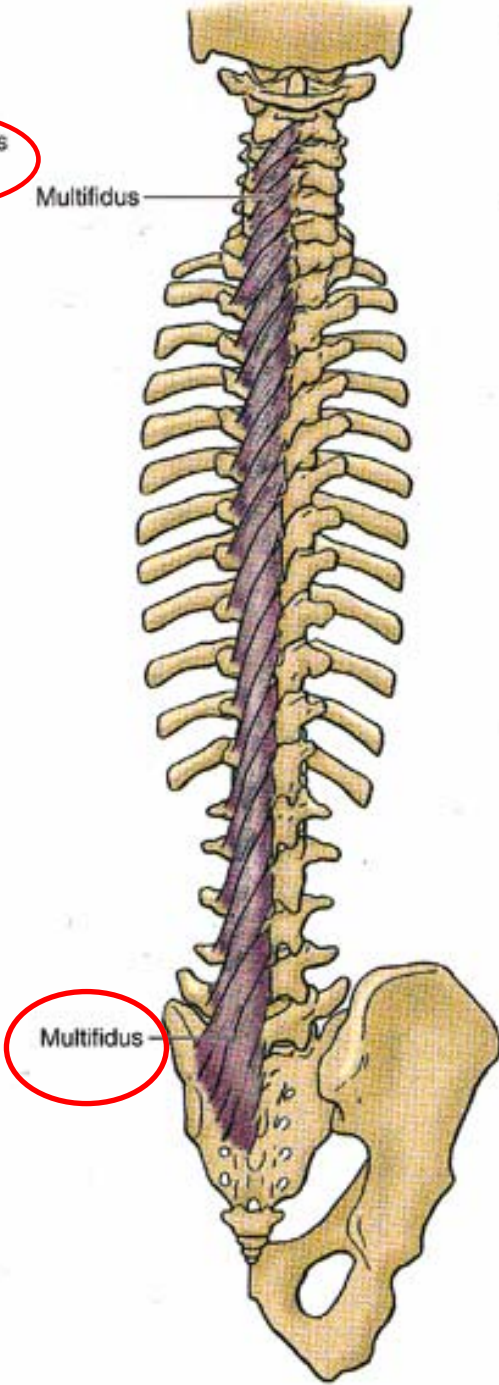
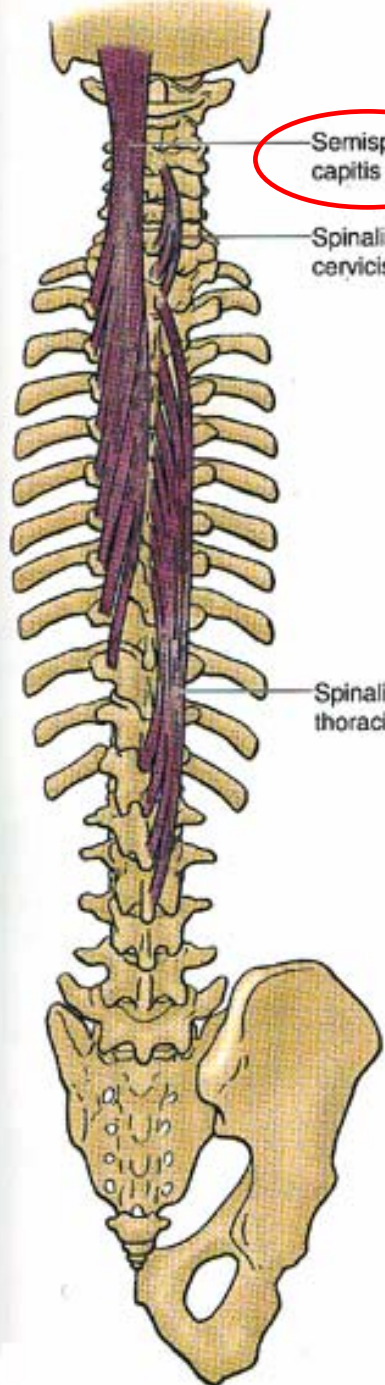
Erector spinae

1. **Spinalis** (most medial)
2. **Longissimus** (intermediate)
3. **Iliocostalis** (most lateral)

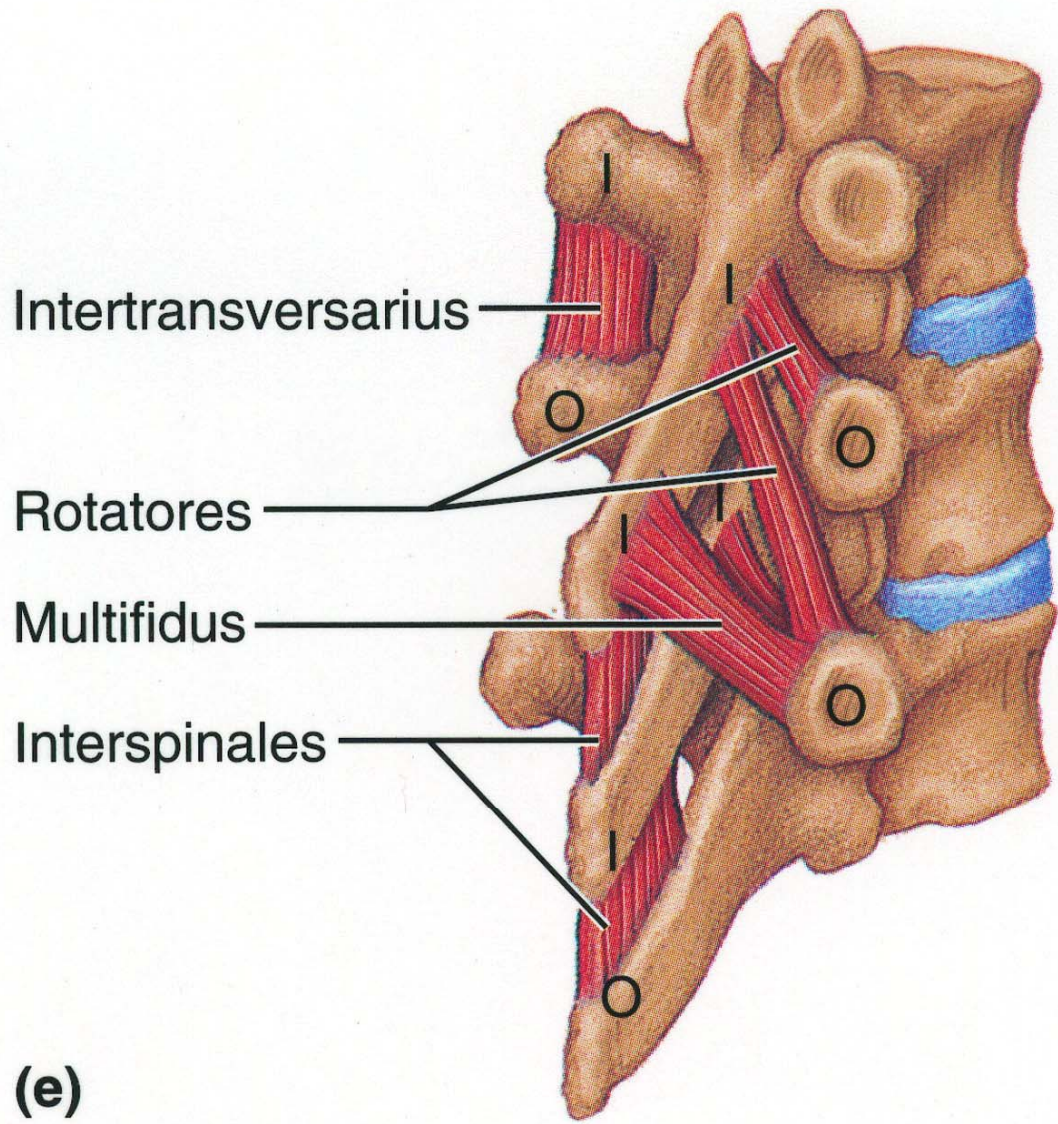
Transversospinales

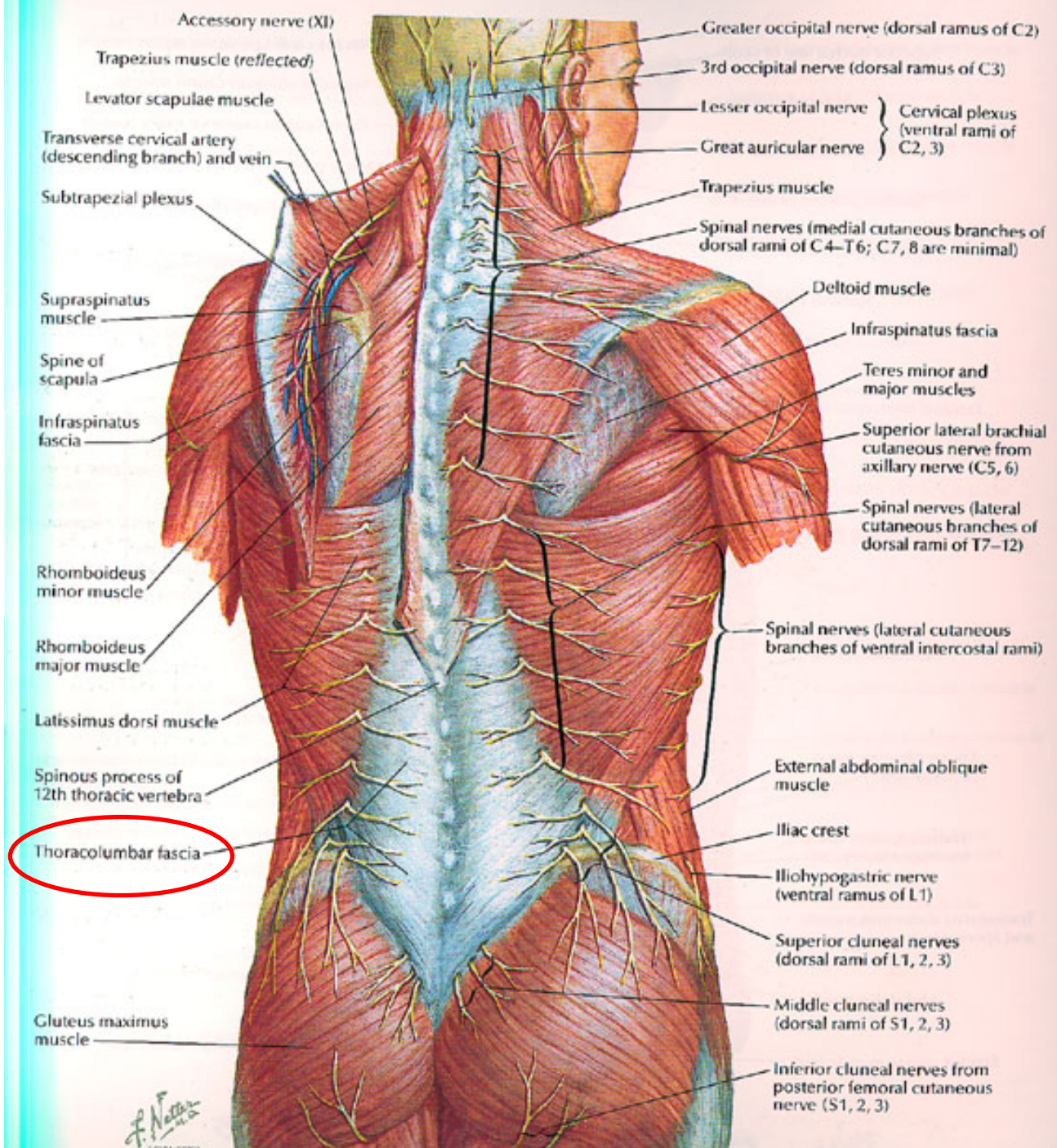
Run from transverse process to spinous process
above:

- **Semispinalis** (superficial)
- **Multifidus** (deeper)
- Rotatores (deepest)
- Interspinales (between spinous processes)
- Intertransversarii (between transverse processes)



O = origin
I = insertion





Thoracolumbar fascia

An extensive sheet of fascia which **covers the deep muscles of the back:**

- **Thoracic region**: separates deep muscles of back from muscles to upper limb

Thoracolumbar fascia

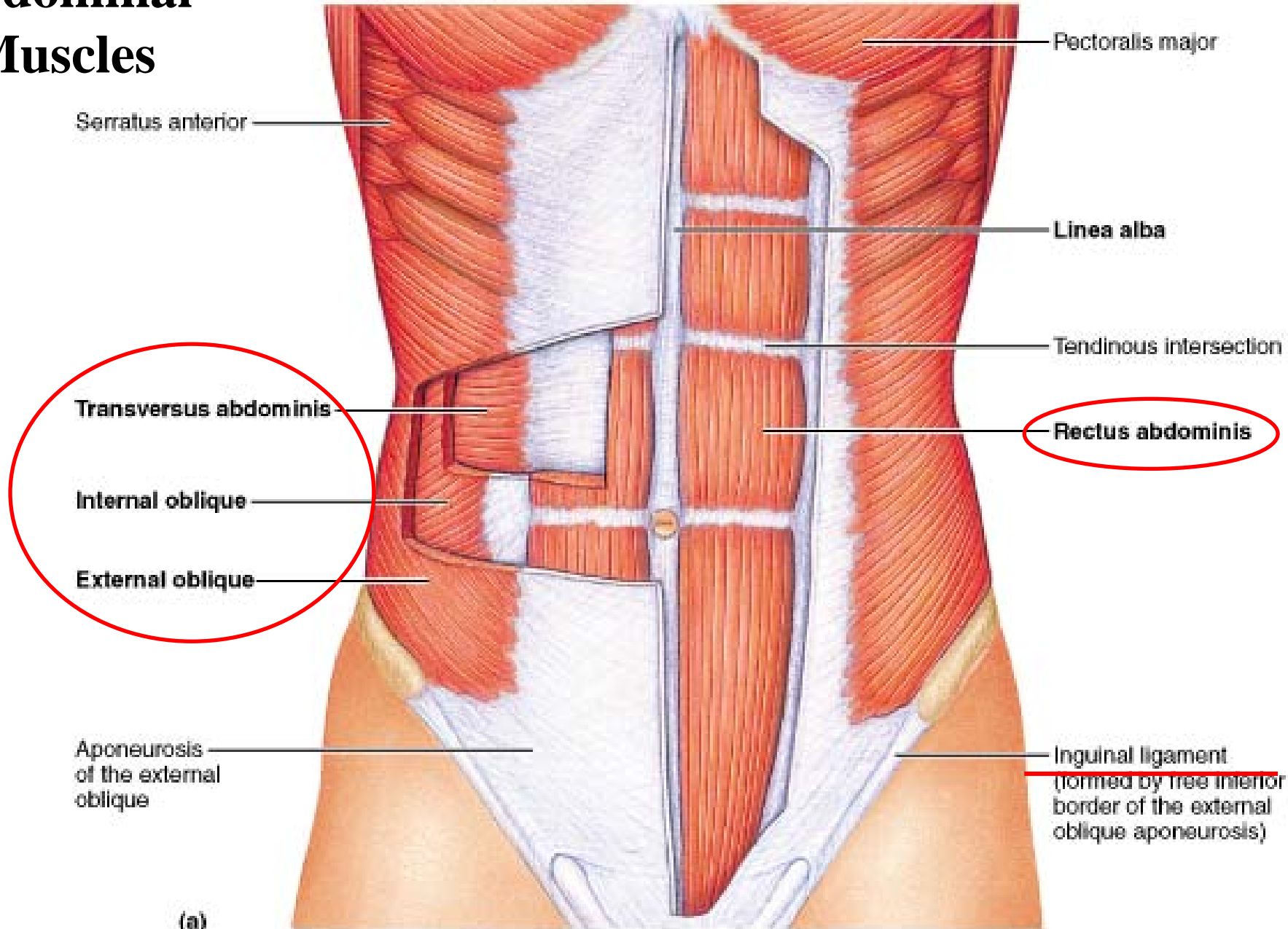
An extensive sheet of fascia which **covers the deep muscles of the back:**

- **Lumbar region:** splits into 3 layers (posterior – attached to spinous processes, middle & anterior – attached to transverse processes)
- **Inferiorly:** attached to iliac crest & sacrum

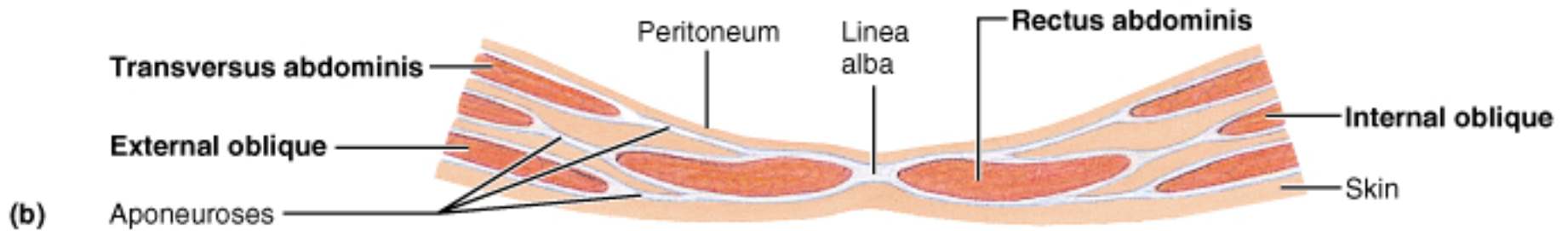
Abdominal muscles

- **Rectus abdominis**
- **Internal & external oblique**
- **Transversus abdominis**

Abdominal Muscles

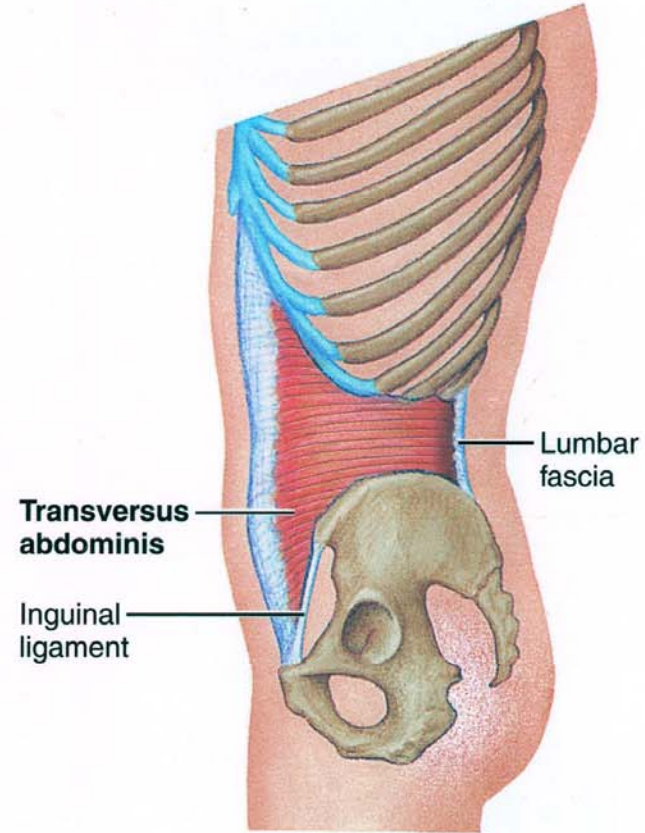
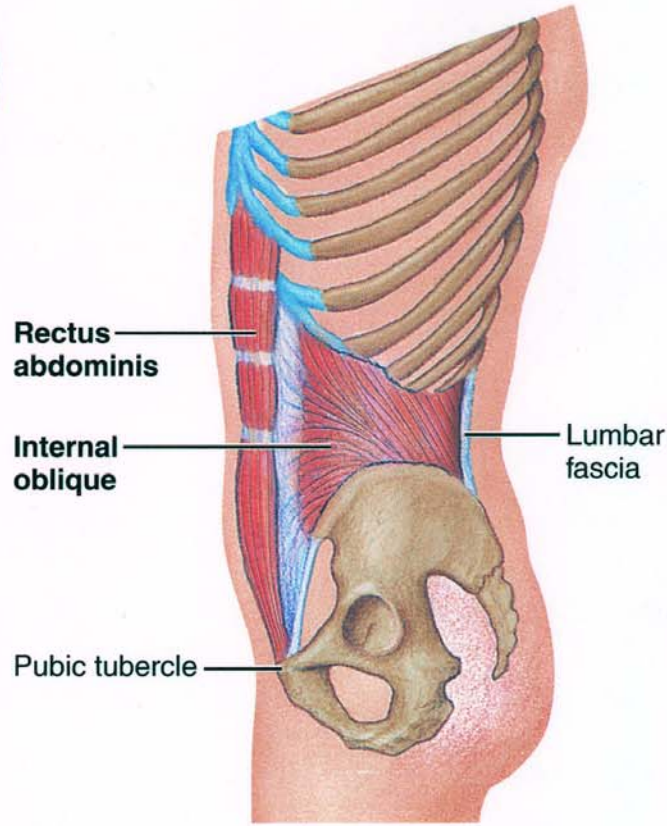
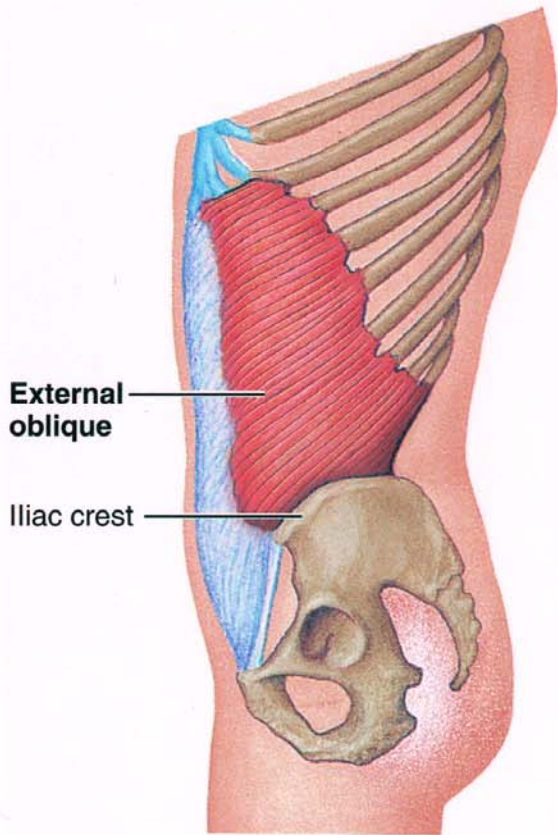


Abdominal Muscles



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Abdominal Muscles





Movement of the back

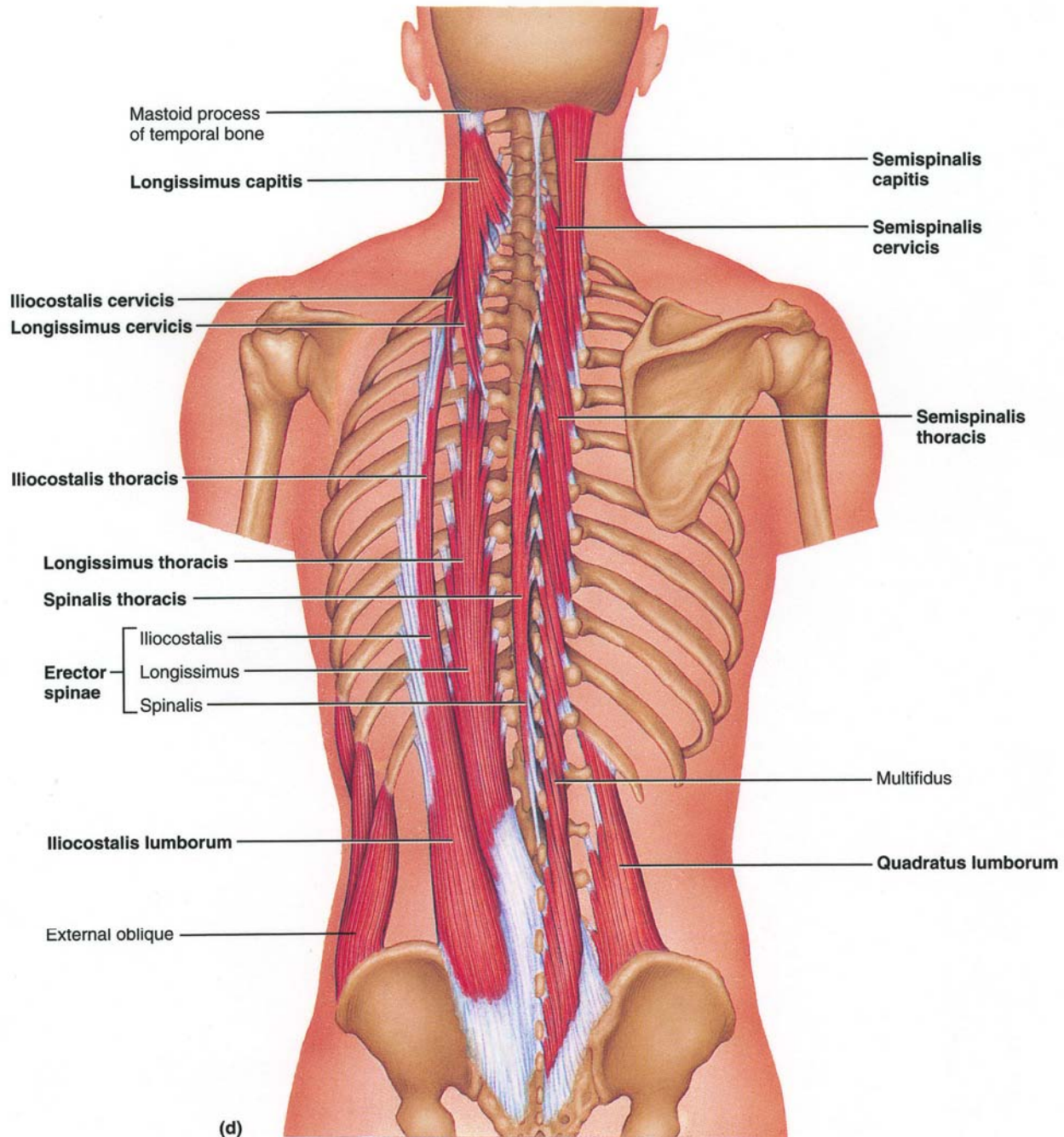
- **Flexion:**

- **Rectus abdominis** (flex the spine)

- **Psoas major**

- **Extension:**

- **Erector spinae** muscles functioning as one (spinalis, iliocostalis, longissimus)



Movement of the back

- **Lateral flexion:**

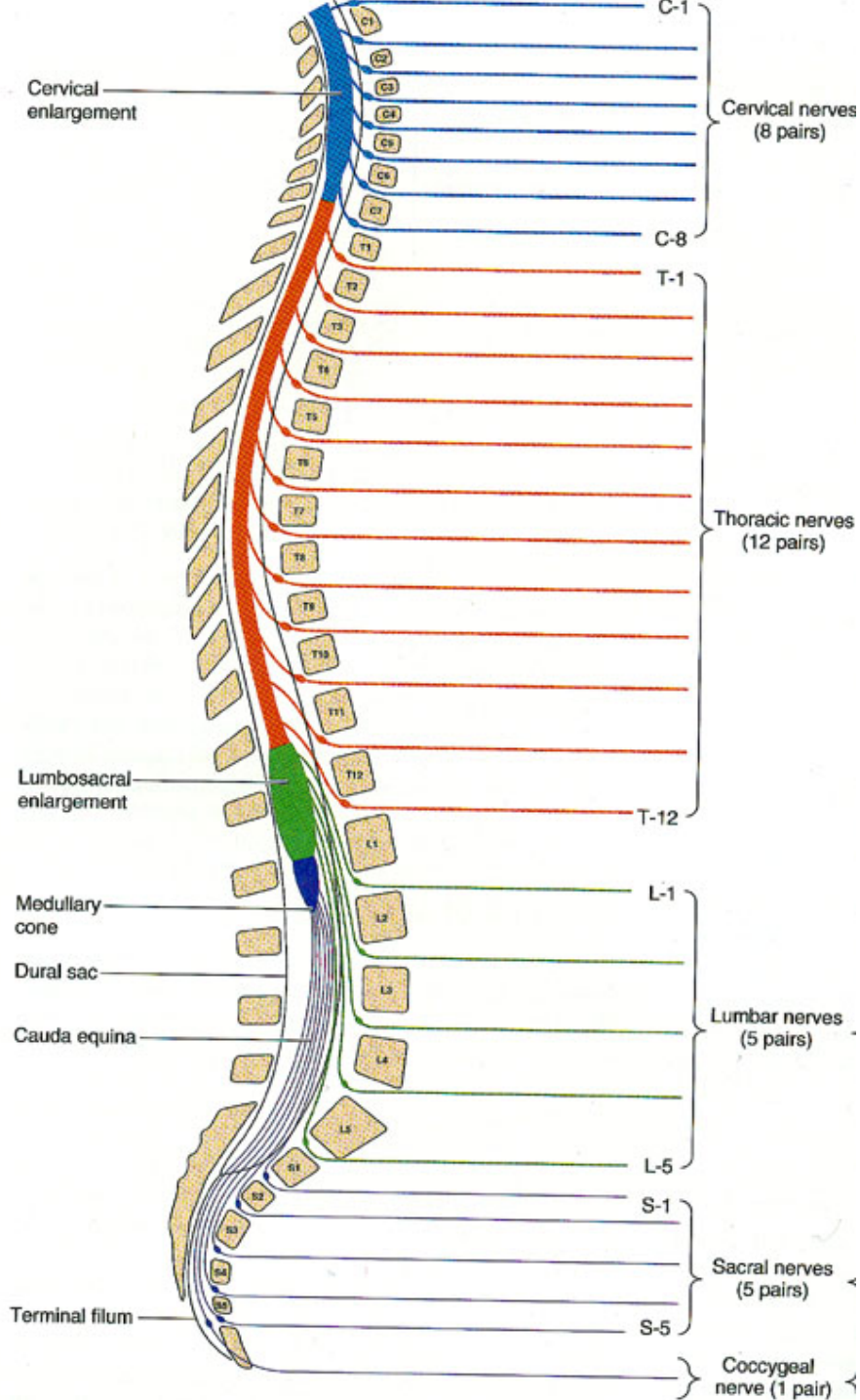
- Muscles working on one side more than the other (e.g., **quadratus lumborum**)

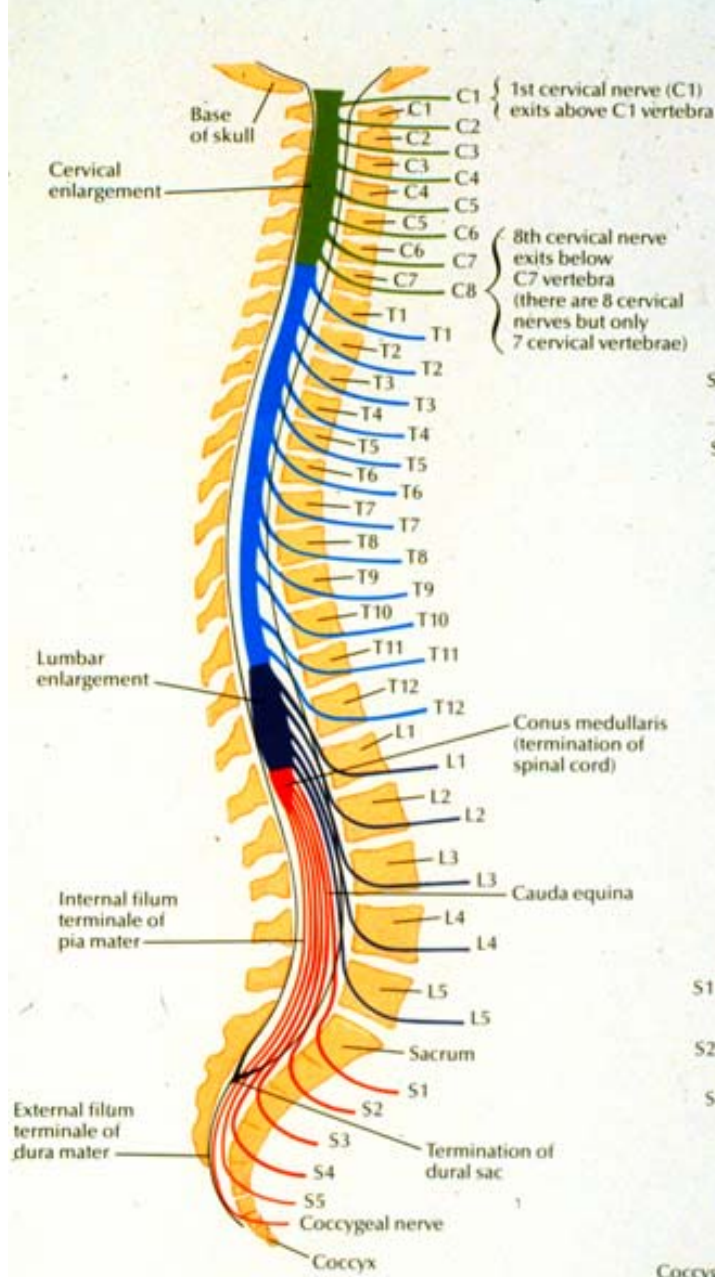
- **Rotation:**

- **External & internal obliques**
- **Transversospinalis group** (semispinalis, multifidus, rotatores)

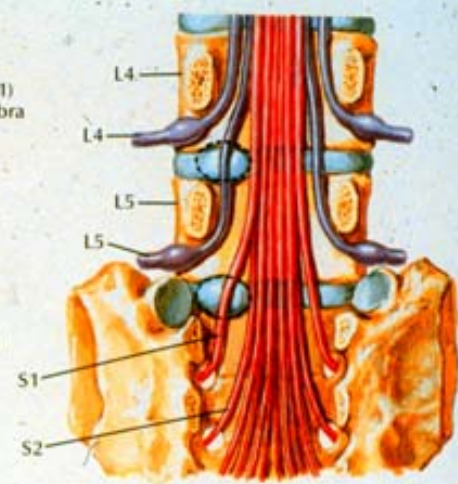


“This shouldn’t take too long !”

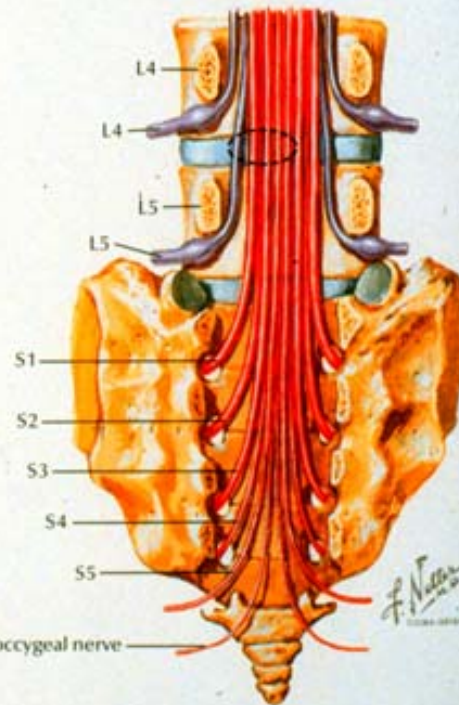




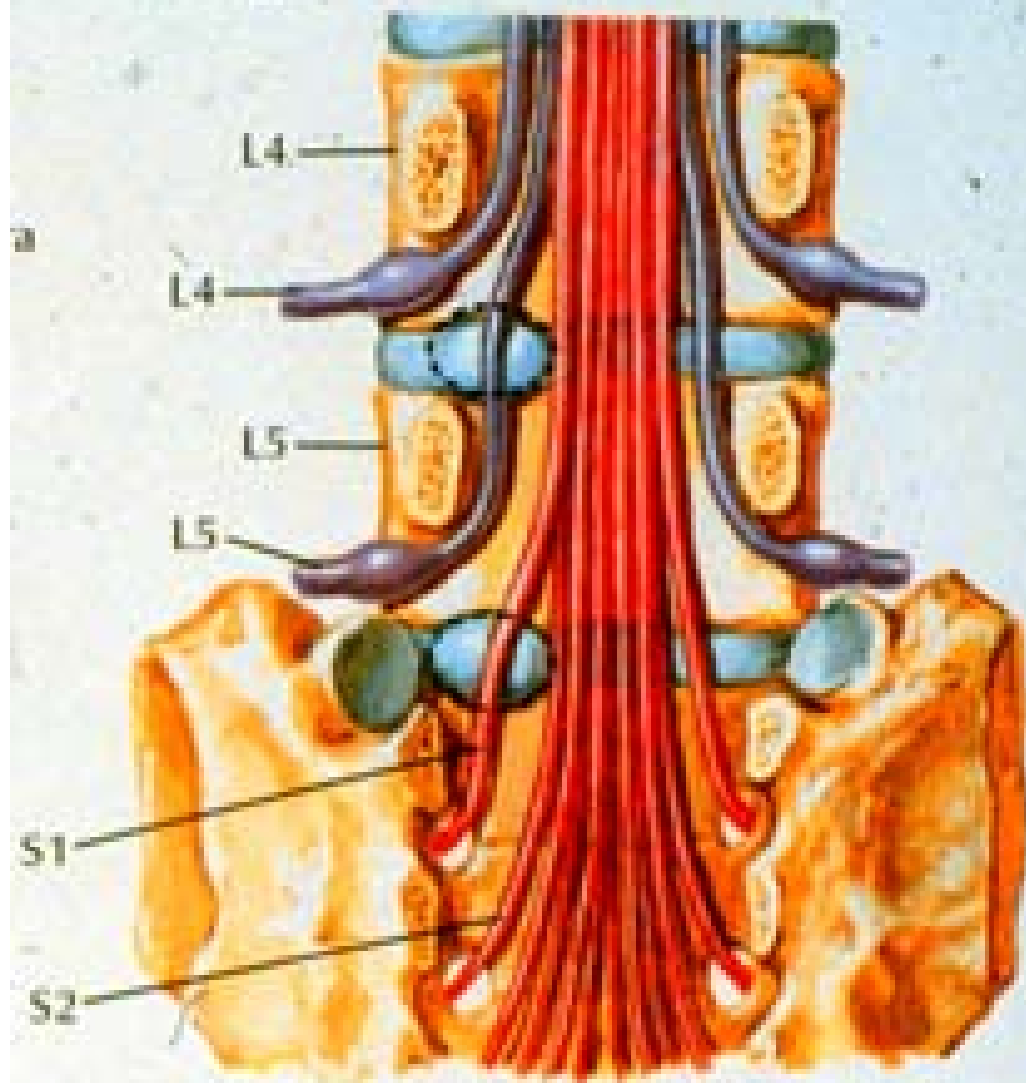
- Cervical nerves
- Thoracic nerves
- Lumbar nerves
- Sacral and coccygeal nerves



Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4-5 affects 5th lumbar nerve, not 4th lumbar nerve. Protrusion at disc level L5-S1 affects 1st sacral nerve, not 5th lumbar nerve.

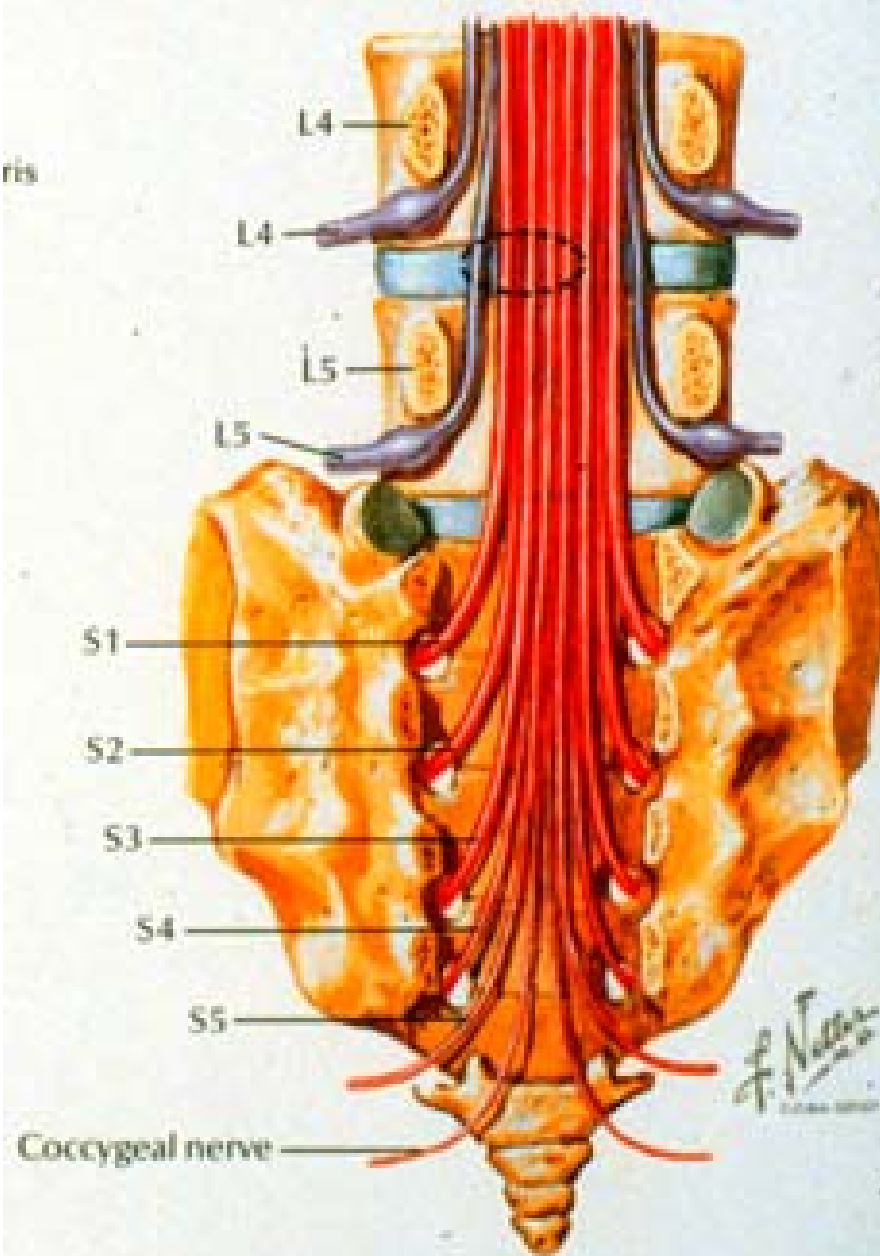


Medial protrusion at disc level L4-5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st-4th sacral nerves

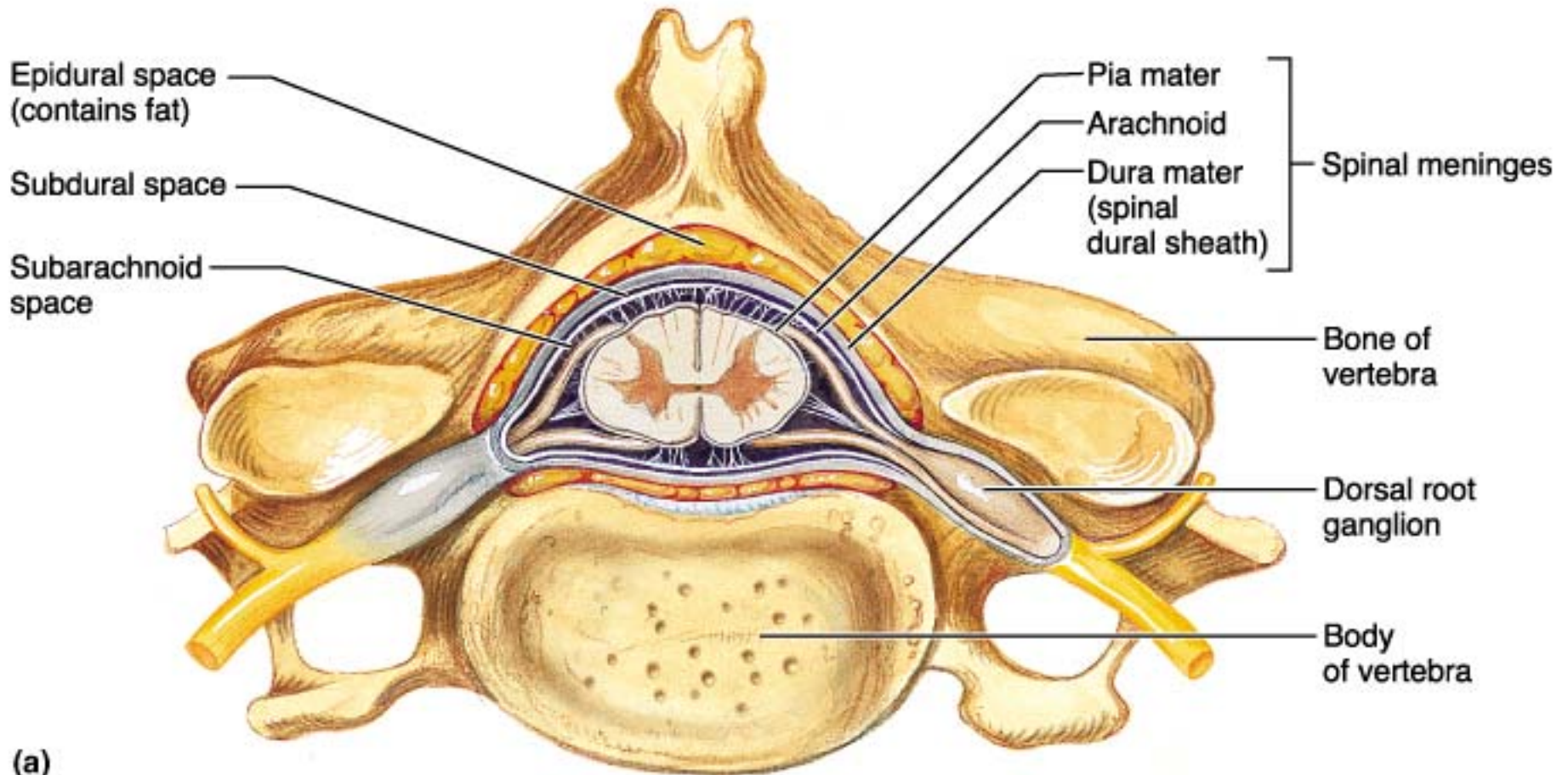


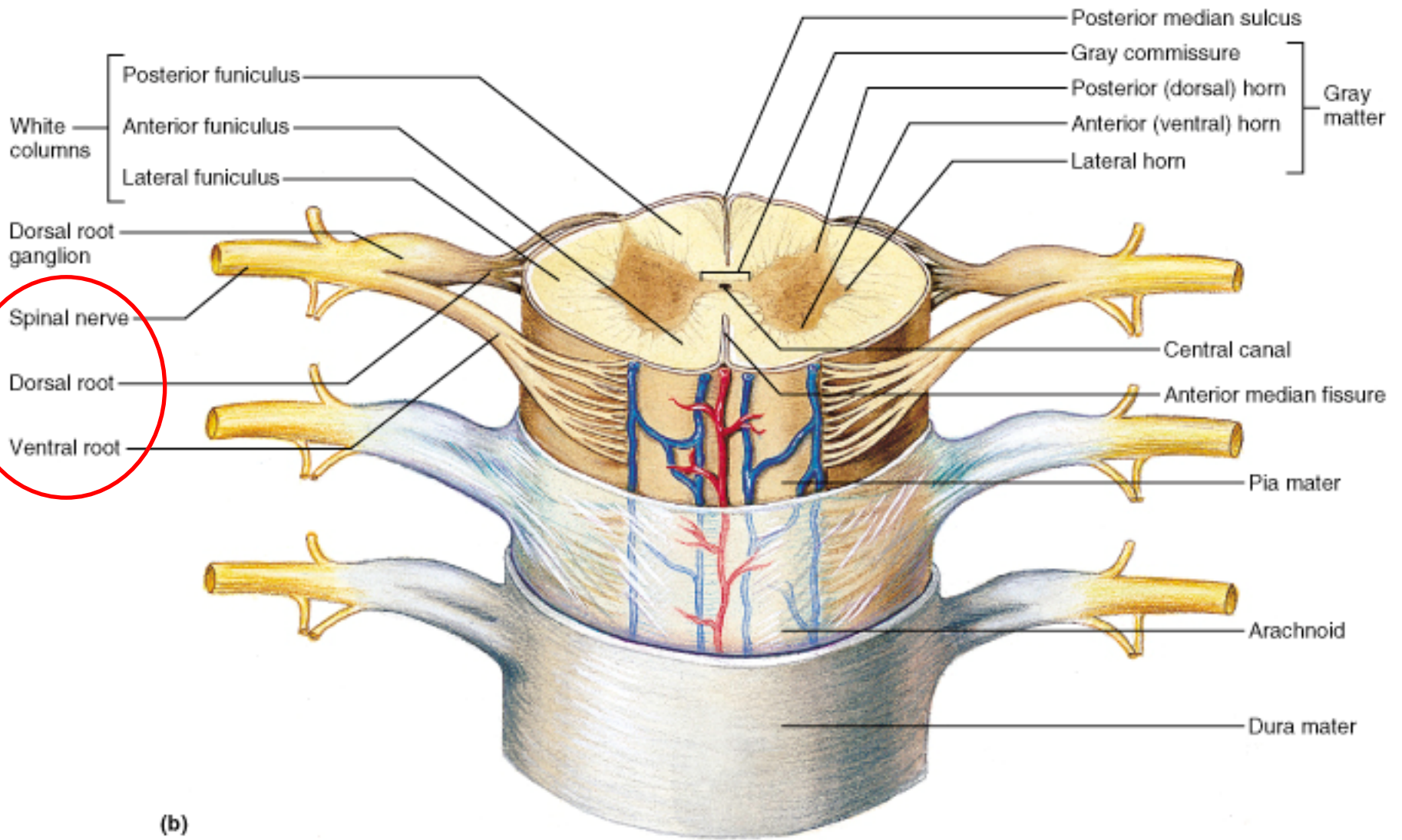
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ris



Medial protrusion at disc level L4-5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st-4th sacral nerves





Group discussion

- What is the structure (composition) of an **intervertebral disc**?
- What is the contribution of the intervertebral discs to the height & movement of the spine?
- What are the components and general distribution of the **dorsal & ventral rami** of spinal nerves?