Lecture 7

Anatomy of the Trunk

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Introduction

The trunk forms the central framework of the human body, providing structural support, protection for vital organs, and the foundation for movement. Understanding its anatomy — including the bones that shape the spine and thoracic cage, and the muscles that move and stabilize them — is essential for comprehending posture, respiration, and locomotion. This knowledge is fundamental in sports sciences, where trunk function directly influences performance and injury prevention.

Part I: Osteology

I. The Vertebral Column (Spinal Column)

1. Definition

The vertebral column is the **central axis of the human body**.

It extends from the **skull** to the **pelvis**, supporting the trunk and protecting the **spinal cord**.

2. Functions

- **Support:** holds the head and body upright.
- **Protection:** encloses the spinal cord within the vertebral canal.
- **Movement:** allows flexion, extension, rotation, and lateral bending.
- **Attachment:** serves as a point of attachment for muscles and ribs.
- **Shock absorption:** intervertebral discs act as cushions between vertebrae.

3. Regional Division

Region	Number of Vertebrae	Characteristics	Notes
Cervical	7	Small, with transverse foramina	High mobility
Thoracic	12	Articulate with ribs	Limited movement
Lumbar	5	Large and strong	Support body weight
Sacral	5 (fused)	Form the sacrum	Part of the pelvis
Coccygeal	4 (fused)	Form the coccyx	Tailbone (vestigial)

The vertebral column is divided into five main regions. Each region has a specific number of vertebrae and distinct characteristics.

The **cervical region** allows wide movement of the neck, the **thoracic region** forms the back of the chest and connects with the ribs, and the **lumbar region** is adapted for weight-bearing. The **sacrum** and **coccyx** are fused, providing a solid base for the pelvis and supporting the trunk.

4. General Structure of a Typical Vertebra

- **Body:** weight-bearing anterior part.
- **Vertebral arch:** forms the posterior part of the vertebral foramen.
- **Processes:**
    - *Spinous process* → posterior projection
    - *Transverse processes* → lateral projections
    - *Articular processes* → superior and inferior (for joints)
- **Intervertebral disc:** fibrocartilaginous joint between vertebral bodies (shock absorber).

5. Specific Features by Region

A. Cervical Vertebrae (C1–C7)

- Small body and large vertebral foramen.
- **Foramen transversarium** → passage of the vertebral artery.
- **C1 (Atlas):** supports the skull; allows "yes" movement.
- **C2 (Axis):** has a *dens*; allows "no" rotation.
- **C7:** long spinous process (*vertebra prominens*).

B. Thoracic Vertebrae (T1–T12)

- Each articulates with a pair of ribs.
- Long, downward-pointing spinous process.
- Limited flexion, allows rotation.

C. Lumbar Vertebrae (L1–L5)

- Large, thick body for weight bearing.
- Short, horizontal spinous process.
- Allow flexion and extension.

D. Sacrum and Coccyx

- **Sacrum:** triangular bone made of five fused vertebrae; connects the spine to the pelvis.
- **Coccyx:** four fused small vertebrae; vestigial structure (tailbone).

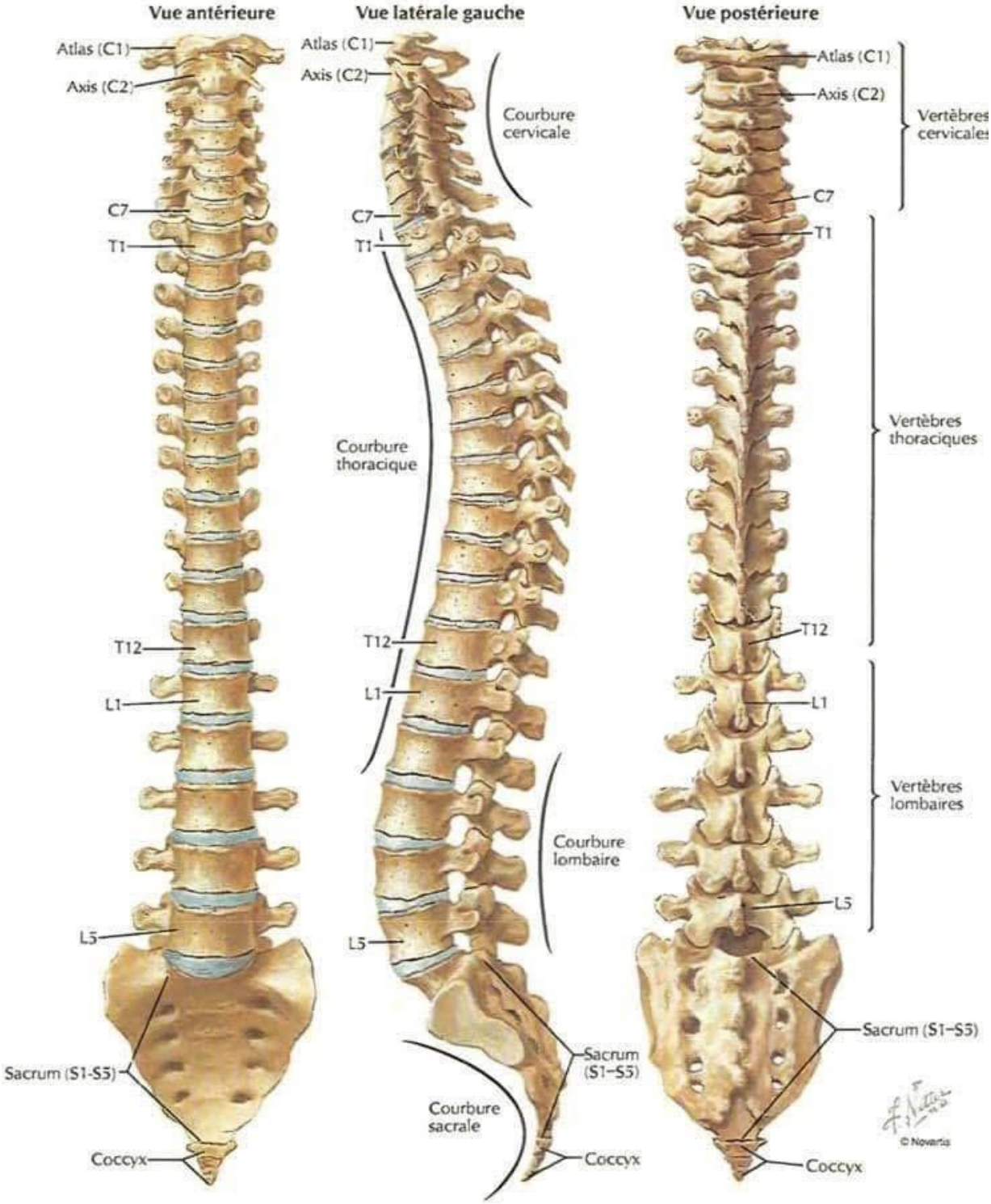
6. Curvatures of the Vertebral Column

Region	Type of Curvature	Direction (Convex/Concave)
Cervical	Lordosis	Convex anteriorly
Thoracic	Kyphosis	Concave anteriorly
Lumbar	Lordosis	Convex anteriorly
Sacral	Kyphosis	Concave anteriorly

The vertebral column is not straight — it has four natural curves that help maintain balance and distribute body weight.

The **lordotic curves** (cervical and lumbar) are forward curves that develop as we lift the head and start walking.

The **kyphotic curves** (thoracic and sacral) are backward curves that are present from birth. Together, these curves act as **shock absorbers** during movement and protect the spine from mechanical stress.


Vue antérieure
Atlas (C1)
Axis (C2)
C7
T1
T12
L1
L5
Sacrum (S1-S5)
Coccyx
Vue latérale gauche
Atlas (C1)
Axis (C2)
Courbure cervicale
C7
T1
Courbure thoracique
T12
L1
Courbure lombaire
L5
Sacrum (S1–S5)
Courbure sacrale
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Vue postérieure
Atlas (C1)
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Vertèbres cervicales
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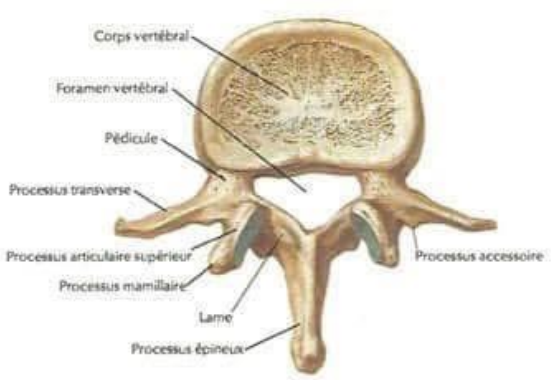
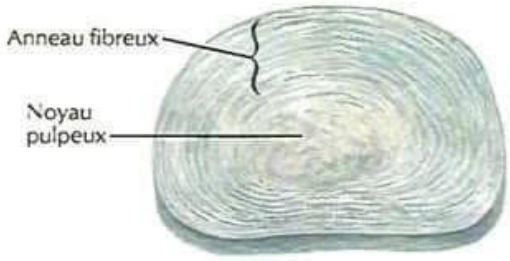
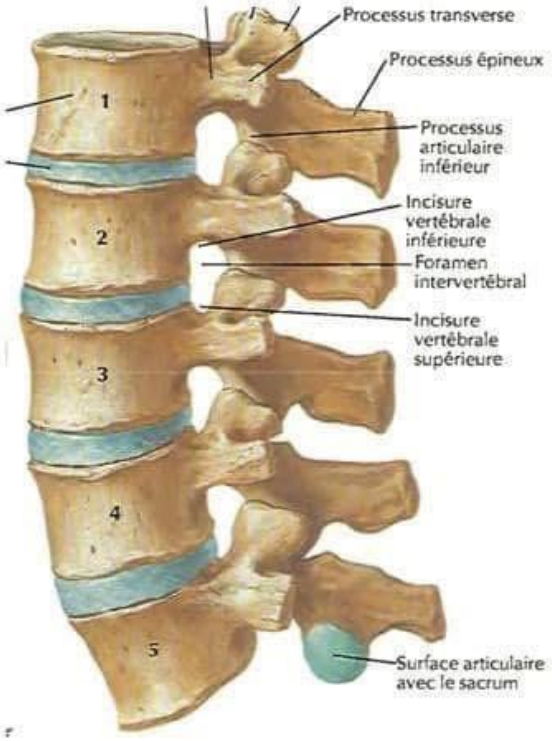
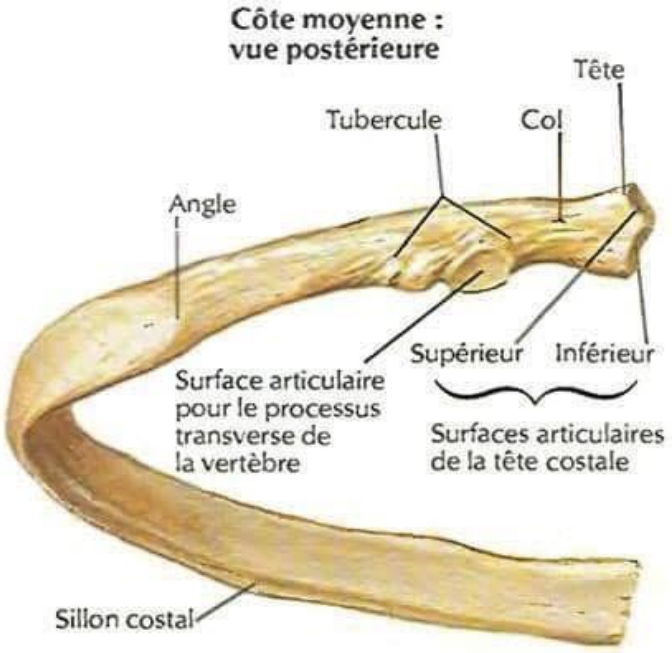




Disque intervertébral





II. The Thoracic Cage (Rib Cage)

1. Definition

The thoracic cage is the **bony framework of the chest**. It protects vital organs and assists in breathing movements.

2. Components

- **Sternum** (breastbone):
  - *Manubrium*
  - *Body*
  - *Xiphoid process*

- **12 pairs of ribs:**
  - *True ribs (1–7):* directly attached to the sternum
  - *False ribs (8–10):* indirectly attached via costal cartilage
  - *Floating ribs (11–12):* no anterior attachment
- **Costal cartilages:** connect ribs to the sternum and allow flexibility.
- **Thoracic vertebrae:** posterior attachment points for ribs.

3. Functions

- **Protection:** heart, lungs, and great vessels.
- **Respiration:** expands and contracts during breathing.
- **Support:** attachment for muscles of the upper limbs, neck, and back.
- **Shape:** maintains the structure of the thoracic cavity.

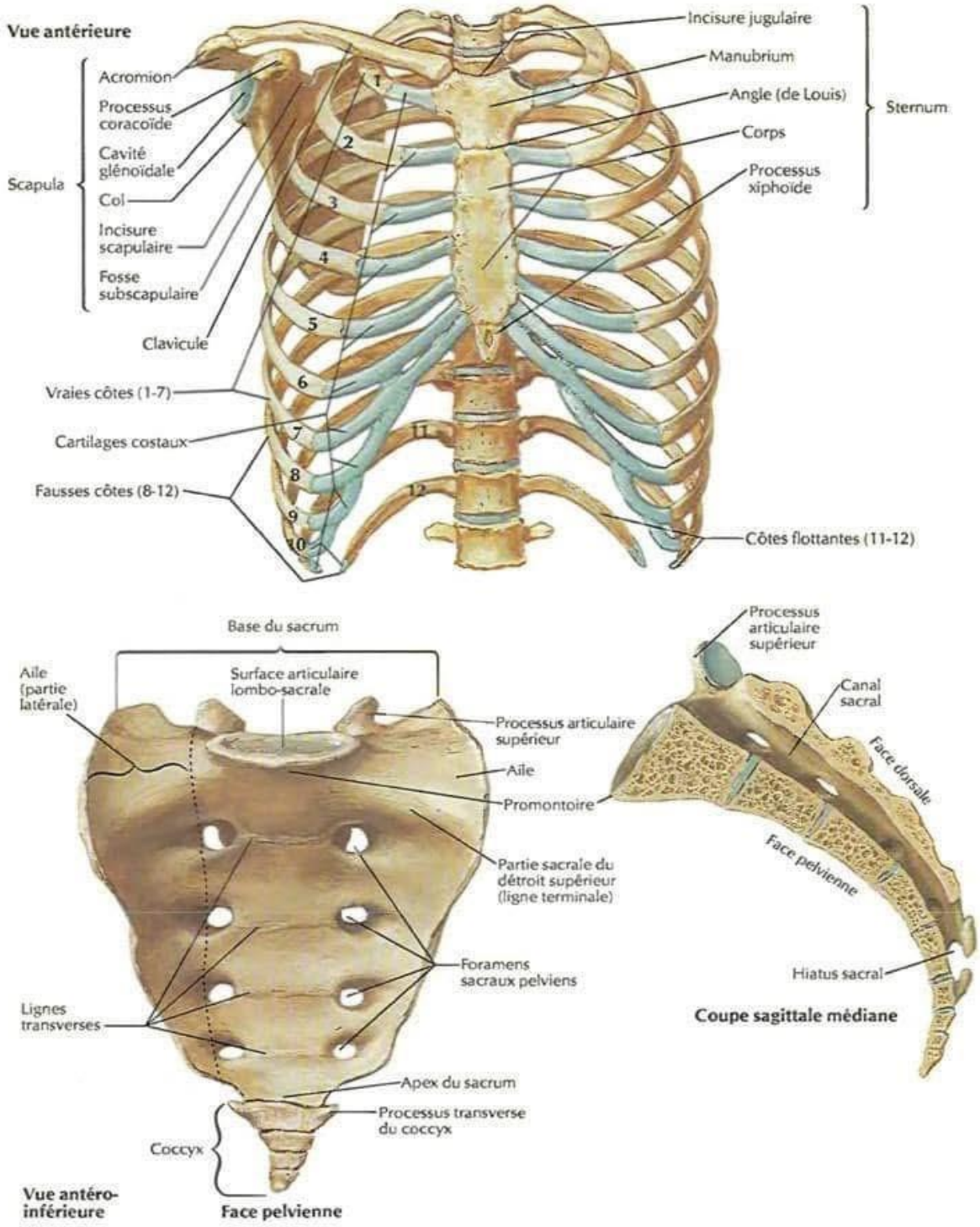
4. Summary Table

Structure	Function	Remarks
Vertebral column	Support and protect spinal cord	33 vertebrae in 5 regions
Ribs	Protect thoracic organs	12 pairs, true/false/floating
Sternum	Central bone of chest	Manubrium, body, xiphoid
Costal cartilage	Flexibility	Helps thoracic expansion

This table summarizes the main skeletal structures of the trunk and their functions. The **vertebral column** serves as the backbone and protects the spinal cord. The **ribs** and **sternum** form the chest wall and safeguard vital organs such as the heart and lungs. The **costal cartilages** ensure elasticity of the thoracic cage during respiration, allowing expansion and contraction with each breath.

5. Key Vocabulary

- **Foramen transversarium** – hole in cervical vertebra for vertebral artery
- **Intervertebral disc** – fibrocartilage between vertebrae
- **Manubrium** – upper part of sternum
- **Lordosis / Kyphosis** – natural spinal curvatures
- **Costal cartilage** – cartilage connecting ribs to sternum



Part II : Myology of the Trunk

I. Introduction

The **muscles of the trunk** form the central part of the human body. They ensure **postural stability**, **movement of the spine and limbs**, and **respiratory function**. They are organized into four major groups:

1. **Back muscles** – control posture and movements of the vertebral column and shoulder girdle.
2. **Thoracic muscles** – assist in respiration.
3. **Abdominal muscles** – protect internal organs and produce trunk movements.
4. **Lumbar region muscles** – stabilize the lower back and connect trunk to lower limb.

II. Muscles of the Back

The back muscles are arranged in **three layers** according to their depth and function:

- **Superficial (extrinsic)** – connect the upper limb to the trunk.
- **Intermediate** – assist respiration.
- **Deep (intrinsic)** – act directly on the vertebral column.

1. Superficial (Extrinsic) Back Muscles

Muscle	Origin	Insertion	Main Function
Trapezius	Occipital bone, ligamentum nuchae, spinous processes of C7–T12	Lateral clavicle, acromion, and spine of scapula	Elevates, retracts, and rotates the scapula
Latissimus dorsi	Spinous processes of T7–L5, thoracolumbar fascia, iliac	Intertubercular groove of humerus	Extends, adducts, and medially rotates the

	crest		arm
Levator scapulae	Transverse processes of C1–C4	Superior angle of scapula	Elevates the scapula
Rhomboid minor	Spinous processes of C7–T1	Medial border of scapula (above spine)	Retracts and stabilizes scapula
Rhomboid major	Spinous processes of T2–T5	Medial border of scapula (below spine)	Retracts and rotates scapula downward

These muscles primarily **move and stabilize the scapula** and shoulder. The *trapezius* coordinates scapular movement; the *latissimus dorsi* is a powerful arm extensor and adductor; the *rhomboids* and *levator scapulae* stabilize and elevate the scapula.

2. Intermediate Back Muscles

Muscle	**Origin**	**Insertion**	**Function**
Serratus posterior superior	Spinous processes of C7–T3	Upper ribs (2–5)	Elevates ribs during inspiration
Serratus posterior inferior	Spinous processes of T11–L2	Lower ribs (9–12)	Depresses ribs during expiration

These muscles are thin and serve as **accessory muscles of respiration**, adjusting the rib cage during breathing.

3. Deep (Intrinsic) Back Muscles

(a) Superficial Deep Group – Splenius Muscles

Muscle	**Origin**	**Insertion**	**Function**
Splenius	Ligamentum nuchae, spinous	Mastoid process,	Extends head, rotates

capitis	processes of C7–T4	occipital bone	head to same side
Splenius cervicis	Spinous processes of T3–T6	Transverse processes of C1–C3	Extends and rotates neck

The *splenius* muscles work together to **extend the neck** and **rotate the head** toward the same side.

(b) Intermediate Deep Group – Erector Spinae (Sacrospinalis)

Division	**Muscles**	**Function**
Lateral column	Iliocostalis (lumborum, thoracis, cervicis)	Extends and laterally flexes the spine
Intermediate column	Longissimus (thoracis, cervicis, capitis)	Extends the vertebral column and head
Medial column	Spinalis (thoracis, cervicis, capitis)	Assists extension and posture maintenance

The **erector spinae** is the **main extensor of the spine**, responsible for keeping the trunk erect. It provides dynamic control during lifting, bending, or running.

(c) Deepest Group – Transversospinalis

Subgroup	**Muscles**	**Function**
Semispinalis	Thoracis, cervicis, capitis	Extends and rotates the spine and head
Multifidus	Along the vertebral column	Stabilizes vertebrae during movement
Rotatores	Between transverse and spinous processes	Aid rotation and proprioception

These small muscles provide **fine control and stabilization** of the vertebrae. They are essential for balance and coordination of spinal motion.

(d) Minor Deep Muscles

- **Interspinales** – between spinous processes; assist extension.
- **Intertransversarii** – between transverse processes; assist lateral flexion.
- **Levatores costarum** – elevate ribs; assist in respiration.

III. Muscles of the Thorax

Muscle	**Origin / Insertion**	**Function**
External intercostals	Between ribs (outer layer)	Elevate ribs – inspiration
Internal intercostals	Between ribs (inner layer)	Depress ribs – expiration
Innermost intercostals	Deepest intercostal layer	Assist respiration
Diaphragm	Lower ribs, sternum, lumbar vertebrae → central tendon	Principal muscle of inspiration
Transversus thoracis	Inner surface of sternum → costal cartilages	Weakly depresses ribs
Subcostales	Inner surface of ribs → next or second rib below	Depress ribs during expiration

Thoracic muscles move the **rib cage** and control **breathing mechanics**. The **diaphragm** is the key inspiratory muscle, while **intercostals** regulate thoracic volume during respiration.

IV. Muscles of the Abdomen

Muscle	Fiber Direction	Function
Rectus abdominis	Vertical	Flexes the trunk; stabilizes pelvis
External oblique	Downward and inward	Rotates and flexes trunk
Internal oblique	Upward and inward	Rotates and flexes trunk (opposite side)
Transversus abdominis	Horizontal	Compresses abdominal contents; stabilizes trunk
Pyramidalis	Front of pubis → linea alba	Tenses linea alba (small triangular muscle)

Abdominal muscles protect viscera, generate intra-abdominal pressure, and move the trunk. Together, they form a **muscular wall** essential for **core stability**, respiration, and movements in sports.

V. Muscles of the Posterior and Lumbar Region

Muscle	Origin / Insertion	Function
Quadratus lumborum	Iliac crest → 12th rib, transverse processes of L1–L4	Lateral flexion and stabilization of lumbar spine
Psoas major	Lumbar vertebrae → lesser trochanter of femur	Flexes hip; stabilizes trunk
Psoas minor***(variable)***	T12–L1 vertebrae → pubic bone	Weak trunk flexor
Iliacus	Iliac fossa → joins psoas major	Flexes hip and trunk

These muscles link the **spine, pelvis, and lower limbs**, stabilizing the lumbar region during movement.

They are essential for **posture, gait, and athletic actions** like sprinting and jumping.

VI. Summary Table

Region	Main Muscles	Primary Functions
Superficial back	Trapezius, Latissimus, Rhomboids, Levator scapulae	Move and stabilize scapula/shoulder
Deep back	Erector spinae, Multifidus, Rotatores	Extend and stabilize spine
Thorax	Intercostals, Diaphragm	Respiration
Abdomen	Rectus, Obliques, Transversus	Flexion, rotation, core stability
Lumbar region	Quadratus lumborum, Psoas, Iliacus	Stabilization, lateral bending, hip flexion

All trunk muscles act together to maintain **posture**, control **respiration**, and generate **movement**.

A balanced trunk musculature ensures efficient motion and **injury prevention** in athletes.

Conclusion

The trunk's osteology and myology together ensure stability, mobility, and protection of vital structures. Through coordinated action, the spinal column, thoracic cage, and muscular system maintain posture, enable breathing, and allow complex movements. A well-balanced trunk is key to efficient motion and core strength, forming the foundation for all physical activity and athletic performance.