The Skeleton: Part B

Vertebral Column
- Transmits weight of trunk to lower limbs
- Surrounds and protects spinal cord
- Flexible curved structure containing 26 irregular bones (vertebrae)
  - Cervical vertebrae (7)—vertebrae of the neck
  - Thoracic vertebrae (12)—vertebrae of the thoracic cage
  - Lumbar vertebrae (5)—vertebra of the lower back
  - Sacrum—bone inferior to the lumbar vertebrae
  - Coccyx—terminus of vertebral column

Vertebral Column: Curvatures
- Increase the resilience and flexibility of the spine
  - Two posteriorly concave curvatures
    - Cervical and lumbar
  - Two posteriorly convex curvatures
    - Thoracic and sacral
- Abnormal spine curvatures
  - Scoliosis (abnormal lateral curve)
  - Kyphosis (hunchback)
  - Lordosis (swayback)

Ligaments
- Anterior and posterior longitudinal ligaments
  - From neck to sacrum
- Ligamentum flavum
  - Connects adjacent vertebrae
- Short ligaments
  - Connect each vertebra to those above and below

Intervertebral Discs
- Cushionlike pad composed of two parts
  1. Nucleus pulposus
    - Inner gelatinous nucleus that gives the disc its elasticity and compressibility
  2. Anulus fibrosus
    - Outer collar composed of collagen and fibrocartilage
General Structure of Vertebrae

• Body or centrum
  • Anterior weight-bearing region

• Vertebral arch
  • Composed of pedicles and laminae that, along with centrum, enclose vertebral foramen

• Vertebral foramina
  • Together make up vertebral canal for spinal cord

• Intervertebral foramina
  • Lateral openings between adjacent vertebrae for spinal nerves

General Structure of Vertebrae

• Seven processes per vertebra:
  • Spinous process—projects posteriorly
  • Transverse processes (2)—project laterally
  • Superior articular processes (2)—protrude superiorly inferiorly
  • Inferior articular processes (2)—protrude inferiorly

Cervical Vertebrae

• C₁ to C₇: smallest, lightest vertebrae
• C₃ to C₇ share the following features
  • Oval body
  • Spinous processes are bifid (except C₇)
  • Large, triangular vertebral foramen
  • Transverse foramen in each transverse process

Cervical Vertebrae

• C₁ (atlas) and C₂ (axis) have unique features
• Atlas (C₁)
  • No body or spinous process
  • Consists of anterior and posterior arches, and two lateral masses
  • Superior surfaces of lateral masses articulate with the occipital condyles

Cervical Vertebrae

• Axis (C₂)
  • Dens projects superiorly into the anterior arch of the atlas
  • Dens is a pivot for the rotation of the atlas

Thoracic Vertebrae

• T₁ to T₁₂
• All articulate with ribs at facets and demifacets
• Long spinous process
• Location of articular facets allows rotation of this area of spine

**Lumbar Vertebrae**
• L₁ to L₅
• Short, thick pedicles and laminae
• Flat hatchet-shaped spinous processes
• Orientation of articular facets locks lumbar vertebrae together so as to prevent rotation

**Sacrum and Coccyx**
• Sacrum
  • 5 fused vertebrae (S₁–S₅)
  • Forms posterior wall of pelvis
  • Articulates with L₅ superiorly, and with auricular surfaces of the hip bones laterally
• Coccyx
  • Tailbone
  • 3–5 fused vertebrae
  • Articulates superiorly with sacrum

**Thoracic Cage**
• Composed of
  • Thoracic vertebrae
  • Sternum
  • Ribs and their costal cartilages
• Functions
  • Protects vital organs of thoracic cavity
  • Supports shoulder girdle and upper limbs
  • Provides attachment sites for many muscles, including intercostal muscles used during breathing

**Sternum (Breastbone)**
• Three fused bones
  • Manubrium
    • Articulates with clavicles and ribs 1 and 2
  • Body
    • Articulates with costal cartilages of ribs 2 through 7
  • Xiphoid process
    • Site of muscle attachment
    • Not ossified until ~ age 40
Ribs and Their Attachments
• 12 pairs
• All attach posteriorly to thoracic vertebrae
• Pairs 1 through 7
  • True (vertebrosternal) ribs
  • Attach directly to the sternum by individual costal cartilages

Ribs and Their Attachments
• Pairs 8 through 12
  • False ribs
  • Pairs 8–10 also called vertebrochondral ribs
    • Attach indirectly to sternum by joining costal cartilage of rib above
  • Pairs 11–12 also called vertebral (floating) ribs
    • No attachment to sternum

Structure of a Typical Rib
• Main parts:
  • Head
    • Articulates posteriorly with facets (demifacets) on bodies of two adjacent vertebrae
  • Neck
  • Tubercle
    • Articulates posteriorly with transverse costal facet of same-numbered thoracic vertebra
  • Shaft