The Skeletal System: Appendicular Division
Objectives:

- Distinguish between Left & Right bones
- Bone markings
- How they fit together
Introduction

The appendicular skeleton includes:

- **Pectoral girdle**
  - Shoulder bones
- **Upper limbs**
- **Pelvic girdle**
  - Hip bones
- **Lower limbs**
Figure 7.1 The Appendicular Skeleton

SKELETAL SYSTEM 206

AXIAL SKELETON 80
(see Figure 6.1)

APPENDICULAR SKELETON 126

Pectoral girdles 4

Upper limbs 60

Pelvic girdle 2

Lower limbs 60

Clavicle 2
Scapula 2

Humerus 2
Radius 2
Ulna 2
Carpal bones 16
Metacarpal bones 10
Phalanges 28

Hip bones 2
Femur 2
Patella 2
Tibia 2
Fibula 2
Tarsal bones 14
Metatarsal bones 10
Phalanges 28

Anterior view of the skeleton highlighting the appendicular components. The numbers in the boxes indicate the total number of bones of that type or category in the adult skeleton.

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The Pectoral Girdle and Upper Limb

- Pectoral girdle consists of:
  - Clavicle
  - Scapula

- Upper limb consists of:
  - Humerus
  - Radius
  - Ulna
  - Carpals
  - Metacarpals
  - Phalanges
The Pectoral Girdle and Upper Limb

• The Clavicle
  • Connects the scapula to the manubrium of the sternum
    • It extends from the manubrium of the sternum, lateral to the acromion process of the scapula
  • It is an S-shaped bone
• Structures:
  • Sternal end
  • Acromial end
  • Conoid tubercle
  • Costal tuberosity
a Right clavicle, superior view

- Acromial end
- Facet for articulation with acromion

b Right clavicle, inferior view

- Acromial end
- Conoid tubercle
- Costal tuberosity
- Sternal facet
- Sternal end
The Pectoral Girdle and Upper Limb

- The Scapula
  - Posterior view
    - Spine
    - Supraspinous fossa
    - Infraspinous fossa
    - Acromion (lateral edge of the spine of the scapula)
  - Lateral border
  - Medial border (nearest the vertebral column)
The Pectoral Girdle and Upper Limb

**The Scapula**
- **Anterior view**
  - **Glenoid cavity** (lateral structure)
  - **Body**
  - **Inferior angle**
  - **Superior angle**
  - **Suprascapular notch**
  - **Coracoid process** (anterior to the acromion process)
The pectoral girdle (clavicle and scapula) holds the upper extremity onto the axial skeleton, and leverages the arm (humerus).
The Pectoral Girdle and Upper Limb

- The Humerus
  - Anterior view (proximal structures)
    - **Head** (medial structure – fits in the glenoid cavity)
    - **Greater tubercle** (lateral structure)
    - **Lesser tubercle** (anterior structure)
    - **Anatomical neck**
    - **Intertubercular sulcus** (between the greater and lesser tubercles)
    - **Deltoid tuberosity**
The Pectoral Girdle and Upper Limb

- The Humerus
  - Anterior view (distal structures)
    - Two condyles (capitulum and trochlea)
    - Capitulum is lateral
    - Trochlea is medial
    - Lateral epicondyle
    - Medial epicondyle
    - Coronoid fossa
The Pectoral Girdle and Upper Limb

• The Humerus
  • Posterior view (distal structure)
    • Olecranon fossa
    • Capitulum and trochlea are best seen from the anterior view
The Pectoral Girdle and Upper Limb

• The Radius and Ulna
  • Radius is lateral to the ulna
  • Posterior view (proximal structures)
  • Radius:
    • Head
    • The head pivots on the capitulum of the humerus
  • Ulna:
    • Olecranon
    • Upon extension of the ulna, the olecranon fits into the olecranon fossa of the humerus
The Pectoral Girdle and Upper Limb

• The Radius and Ulna
  • Posterior view (distal structures)
  • Radius:
    • Styloid process
  • Ulna:
    • Styloid process
The Pectoral Girdle and Upper Limb

• The Radius and Ulna
  • Anterior view (proximal structures)
  • Radius:
    • **Head** ( pivots in the radial notch of the ulna)
    • **Radial tuberosity** (medial structure on the radius)
  • Ulna:
    • **Trochlear notch**
    • **Coronoid process** (upon flexion, it fits into the coronoid fossa of the humerus)
    • **Radial notch of the ulna** (lateral structure on the ulna)
The elbow joint

The elbow can not extend more than 180 degrees (straight).

The radius allows rotation

The humerus and ulna have a hinge action (flex and extend)
The Wrist and Hand

- **Carpal bones**
  - 8 bones of the wrist

- **Metacarpal bones (I-V)**
  - 5 metacarpals (make up the “back of the hand”)

- **Phalanges**
  - Thumb has 2 phalanges
  - All other digits of the hand have 3 phalanges
The Pectoral Girdle and Upper Limb

- The Wrist and Hand
  - Carpal bones
    - Capitate
    - Hamate
    - Pisiform
    - Triquetrum
    - Lunate
    - Scaphoid
    - Trapezium
    - Trapezoid

"Stop Letting The Professor Touch The Cadaver's Hand"
The Pelvic Girdle and Lower Limb

• The adult pelvis is composed of four bones: the sacrum, the coccyx, and the right and left pelves.
• Supports and protects the lower viscera and developing fetus in females.
• Males have a deeper and narrower pelvis vs. Females have a shallower and flatter pelvis (for childbearing).
Pelvic Girdle and Lower Limbs

- Pelvic girdle consists of:
  - Two coxal bones
  - Each coxal bone consists of:
    - Ilium
    - Ischium
    - Pubis
The Pelvic Girdle and Lower Limb

- **Coxal bones**
  - medial and anterior view (anterior edge)
  - **Anterior superior iliac spine**
  - **Anterior inferior iliac spine**
  - **Pubic symphysis**
  - **Arcuate line**
The Pelvic Girdle and Lower Limb

- Coxal bones
  - Lateral and posterior view (posterior edge)
    - Posterior superior iliac spine
    - Posterior inferior iliac spine
    - Greater sciatic notch
    - Ischial spine
    - Lesser sciatic notch
    - Ischial tuberosity
Pelvic Girdle and Lower Limbs

- Coxal bones
  - Lateral view
    - Acetabular fossa (femur fits in this fossa)
    - Obturator foramen
    - Anterior gluteal line
The Pelvic Girdle and Lower Limb

• The Pelvis
  • Consists of:
    • 2 coxal bones
    • Sacrum
    • Coccyx

• Subdivided into:
  • True pelvis (spans the distance from left ischial spine to right ischial spine)
    • Encloses the pelvic cavity
    • Houses the pelvic organs
  
  • False pelvis (spans the distance from left iliac crest to right iliac crest)
    • Forms the inferior region of the abdominal cavity
    • Houses the abdominal organs
The Pelvic Girdle and Lower Limb

• The Pelvis
  • Consists of two pelvic spaces:
    • Pelvic inlet (superior space between the brim of each coxal bone)
    • Pelvic outlet (inferior space between the ischial spine of each coxal bone)
The Pelvic Girdle and Lower Limb

- Male vs. Female Pelvis
  - The main anatomical difference is in regard to childbearing:
    - Female Pelvis:
      - Enlarged pelvic outlet
      - Less curvature of the sacrum
      - Wider pelvic inlet
      - Broader pubic angle
# Comparison of the Male and Female Pelves

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvic inlet (brim)</td>
<td>Wider; oval from side to side</td>
<td>Narrow; basically heart-shaped</td>
</tr>
<tr>
<td>Pelvic outlet</td>
<td>Wider; ischial tuberosities shorter, farther apart, and everted</td>
<td>Narrower; ischial tuberosities longer, sharper, and point more medially</td>
</tr>
<tr>
<td>Posteroinferior view</td>
<td><img src="image1.png" alt="Female Pelvis" /></td>
<td><img src="image2.png" alt="Male Pelvis" /></td>
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</tbody>
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<table>
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<tr>
<th>Characteristic</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacrum</td>
<td>Wider; shorter; sacral curvature is accentuated</td>
<td>Narrow; longer; sacral promontory more ventral</td>
</tr>
<tr>
<td>Coccyx</td>
<td>More movable; straighter</td>
<td>Less movable; curves ventrally</td>
</tr>
<tr>
<td>Greater sciatic notch</td>
<td>Wide and shallow</td>
<td>Narrow and deep</td>
</tr>
<tr>
<td>Left lateral view</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Pelvic Girdle and Lower Limb

The Lower Limb
- Responsible for transferring the body weight to the ground
- Consists of:
  - **Femur** - carries the weight of the body medially and inferiorly
  - **Patella**
  - **Tibia** - the weight is carried to the tibia
  - **Fibula**
  - **Tarsal bones**
  - **Metatarsal bones**
  - **Great toes and other phalanges**
The Pelvic Girdle and Lower Limb

- The Femur
  - Anterior view (proximal structures)
    - **Head** (medial structure that fits into the acetabulum of the coxal bone)
    - **Greater trochanter** (lateral structure)
    - **Lesser trochanter** (medial structure)
    - **Fovea**
    - **Neck**
    - **Intertrochanteric line**
Landmarks on the anterior surface of the right femur:

- Articular surface of head
- Neck
- Fovea for ligament of head
- Greater trochanter
- Intertrochanteric line
- Lesser trochanter
- Shaft (body) of femur
- Patellar surface
- Lateral epicondyle
- Medial epicondyle
- Lateral condyle
- Medial condyle
The Pelvic Girdle and Lower Limb

• The Femur
  • Posterior view (distal structures)
    • Linea aspera
    • Lateral and medial condyles
    • Intercondylar fossa
Figure 7.14d The Femur

- Greater trochanter
- Articular surface of head
- Neck
- Lesser trochanter
- Intertrochanteric crest
- Greater trochanter
- Gluteal tuberosity
- Pectineal line
- Linea aspera
- Lateral supracondylar ridge
- Medial supracondylar ridge
- Lateral epicondyle
- Popliteal surface
- Lateral condyle
- Adductor tubercle
- Medial epicondyle
- Medial condyle
- Intercondylar fossa

Landmarks on the posterior surface of the right femur
The Pelvic Girdle and Lower Limb

• The Patella
  • This is a large **sesamoid bone**
  • Protects the knee joint
  • Anterior surface is rough for strong tendon attachment
  • Posterior surface has **concave facets** for the femoral condyles
The Pelvic Girdle and Lower Limb

• The Tibia and Fibula
  • Anterior view (proximal structures)
  • Tibia (medial to the fibula)
    • Tibial tuberosity
    • Lateral tibial condyle
    • Medial tibial condyle
  • Fibula
    • Head
The Pelvic Girdle and Lower Limb

• The Tibia and Fibula
  • Anterior view (distal structures)
    • Tibia
      • Medial malleolus
    • Fibula
      • Lateral malleolus
Figure 7.16a The Tibia and Fibula

Anterior views of the right tibia and fibula

- Lateral tibial condyle
- Medial tibial condyle
- Head of fibula
- Superior tibiofibular joint
- Tibial tuberosity
- Head of fibula
- Interosseous border of fibula
- Anterior margin
- Shaft of fibula
- Interosseous border of tibia
- Shaft of tibia
- Interosseous membrane of the leg
- Inferior tibiofibular joint
- Medial malleolus (tibia)
- Lateral malleolus (fibula)
- Lateral malleolus (fibula)
- Inferior articular surface
The Pelvic Girdle and Lower Limb

• The Tibia and Fibula
  • Posterior view
  • Tibia
    • Tubercles of the intercondylar eminence
Figure 7.16d The Tibia and Fibula

Posterior views of the right tibia and fibula

Articular surface of medial tibial condyle

Medial tibial condyle

Tubercles of intercondylar eminence

Articular surface of lateral tibial condyle

Medial tubercle of intercondylar eminence

Articular surface of medial tibial condyle

Medial tibial condyle

Intercondylar eminence

Lateral tubercle of intercondylar eminence

Lateral tibial condyle

Head of fibula

Soleal line

Interosseous membrane of the leg

TIBIA

FIBULA

Medial malleolus (tibia)

Articular surfaces of tibia and fibula

Lateral malleolus (tibia)

Articular surfaces of tibia and fibula

Lateral malleolus (fibula)
The Pelvic Girdle and Lower Limb

• The Ankle and Foot
  • **Tarsal bones**
    • 7 bones of the ankle
  • **Metatarsal bones (I-V)**
    • 5 metatarsals (make up the “arch of the foot”)
  • **Phalanges**
    • Great toe has 2 phalanges
    • All other digits of the foot have 3 phalanges
The Pelvic Girdle and Lower Limb

• The Ankle and Foot
  • Tarsal bones
    • Calcaneus
    • Talus
    • Navicular
    • Cuboid
    • Medial cuneiform
    • Intermediate cuneiform
    • Lateral cuneiform

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Arches of the Foot

- The sole of the foot does not rest flat on the ground.
- Helps to support the weight of the body
- Ensures that the blood vessels and nerves on the sole of the foot are not pinched when standing
Medial Longitudinal arch extends from the heel to the great toe. Lateral Longitudinal arch is not as high as the medial longitudinal arch. Transverse arch runs perpendicular to the longitudinal arches.
Individual Variation in the Skeletal System

• The skeleton can reveal important information about an individual
• Information such as:
  • Racial differences
  • Medical history
  • Body size
  • Muscle mass
  • Age
  • Sex