Ex. IV-B. The Appendicular Skeleton

DISCUSSION

The skeleton in a typical adult contains 206 bones, although this number can vary. The skeleton is divided into two parts, the appendicular skeleton and the axial skeleton. The appendicular skeleton is composed of the 126 bones of the appendages and the girdles (shoulder and pelvic), which connect the appendages to the axial skeleton.

PROCEDURE

1. Locate each of the illustrated bones (Figure IV-2 to IV-16) on an articulated skeleton.
2. Compare the parts of the bones indicated in each figure with those in your text and other references and on bones of a disarticulated skeleton.
3. Determine the function of each part indicated by using your text or other references.
4. As you study the bones, whenever possible locate them and their parts on yourself.
5. Each of the illustrations may be used as self-tests. Keys are included for each illustration.

KEY TO FIGURE IV-2

1. acromial extremity
2. sternal extremity
3. conoid tubercle (coracoid tuberosity)

Figure IV-2: Right Clavicle (superior surface, tipped forward)
KEY TO FIGURE IV-3

1. superior border
2. supraspinous fossa
3. superior (medial) angle
4. scapular notch
5. spine
6. infraspinous fossa
7. vertebral (medial) border
8. coracoid process
9. acromion process
10. glenoid cavity
11. lateral angle
12. neck
13. axillary border (lateral)
14. inferior angle

Figure IV-3: Posterior View of the Right Scapula
KEY TO FIGURE IV-4

1. head
2. anatomical neck
3. surgical neck
4. deltoid tuberosity
5. groove for radial nerve
6. lateral epicondyle
7. coronoid fossa
8. radial fossa
9. lateral epicondyle
10. capitulum

KEY TO FIGURE IV-5

1. head
2. anatomical neck
3. surgical neck
4. deltoid tuberosity
5. groove for radial nerve
6. lateral epicondyle
7. olecranon fossa
8. trochlea
9. medial epicondyle
10. trochlea

Figure IV-4: Right Humerus (anterior view)
Figure IV-5: Right Humerus (posterior view)
KEY TO FIGURE IV-6

1. head
2. neck
3. radial tuberosity
4. styloid process
5. ulnar notch

KEY TO FIGURE IV-7

1. olecranon process
2. trochlear notch (semilunar notch)
3. coronoid process
4. radial notch
5. head
6. styloid process

Figure IV-6: Right Radius (anterior view)
Figure IV-7: Right Ulna (anterior view)
KEY TO FIGURE IV-8

1. third phalanx
2. second phalanx
3. first phalanx
4. phalanges
5. fifth metacarpal
6. capitate
7. hamate
8. triangular (triquetrum)
9. pisiform
10. lunate (semilunar)
11. navicular (scaphoid)
12. lesser multangular (trapezoid)
13. greater multangular (trapezium)
14. carpals
15. metacarpals

Figure IV-8: Dorsal Surface of Right Hand
KEY TO FIGURE IV-9

1. ilium
2. posterior superior iliac spine
3. posterior inferior iliac spine
4. greater sciatic notch
5. ischial spine
6. lesser sciatic notch
7. ischium
8. ischial tuberosity
9. iliac crest
10. anterior superior iliac spine
11. anterior inferior iliac spine
12. acetabulum
13. crest of pubis
14. pubis
15. obturator foramen

Figure IV-9: Lateral View of the Right Os Coxae
Figure IV-10: The Female Pelvis

17. Pubic arch
16. Obturator foramen
15. Pubic symphysis
13. Pubis
14. Superim. Rami
13. Acetabulum
12. Pelvic inlet
11. Sacral spine
10. Brim of pelvis

9. Coccyx
8. Iliac spine
7. Superior surface
6. Sacrum
5. Anterior sacral foramen
4. Iliac fossa
3. Articular surface
2. Iliac crest
1. Sacral promontory

KEY TO FIGURE IV-10
KEY TO FIGURE IV-11
1. greater trochanter
2. intertrochanteric line
3. lateral epicondyle
4. patellar surface
5. head
6. neck
7. medial epicondyle

KEY TO FIGURE IV-12
1. head
2. greater trochanter
3. neck
4. lesser trochanter
5. linea aspera
6. intercondylar fossa
7. lateral condyle
8. medial condyle

Figure IV-11: Right Femur (anterior view)
Figure IV-12: Right Femur (posterior view)
KEY TO FIGURE IV-13
1. styloid process
2. head of fibula
3. lateral malleolus

KEY TO FIGURE IV-14
1. intercondylar eminence
2. medial condyle
3. lateral condyle
4. tibial tuberosity
5. anterior crest
6. medial malleolus
7. inferior articular surface
8. fibular notch

Figure IV-13: Right Fibula (anterior view)
Figure IV-14: Right Tibia (anterior view)

Superior Border (base)
Apex
Patella (anterior surface)
KEY TO FIGURE IV-15

1. third phalanx
2. second phalanx
3. first phalanx
4. phalanges
5. first metatarsal
6. first (medial) cuneiform
7. navicular
8. talus
9. calcaneus

Figure IV-15: Bones of the Right Foot (medial view)

KEY TO FIGURE IV-16

1. third phalanx
2. second phalanx
3. first phalanx
4. phalanges
5. fifth metatarsal
6. metatarsals (metatarsus)
7. third (lateral) cuneiform
8. second (intermediate) cuneiform
9. first (medial) cuneiform
10. cuboid
11. navicular
12. talus
13. calcaneus
14. tarsals

Figure IV-16: Bones of the Right Foot (dorsal surface)
Ex. IV-C. The Axial Skeleton

DISCUSSION
The axial skeleton, composed of 80 bones, includes the bones of the skull, vertebral column, and the thorax.

PROCEDURE
1. Locate each of the illustrated bones (Figure IV-16 to IV-35) on an articulated skeleton. Follow steps 2-5 of the procedure for Ex. IV-B.
2. Practice identifying the bones of the disarticulated skull until you can distinguish each of the separate bones. Verify your identification of the facial bones with the instructor.
3. The student should determine the characteristics of the vertebrae in each region of the vertebral column. Be prepared to identify the region in which any isolated vertebra may be located.

KEY TO FIGURE IV-17

- sagittal suture
- supraorbital notch
- greater wing of sphenoid
- temporal bone
- optic foramen
- superior orbital fissure
- sphenoid (orbital surface)
- inferior orbital fissure
- middle nasal concha
- infraorbital foramen
- inferior nasal concha
- vomer
- mandible
- coronal suture
- parietal bone
- frontal bone
- superciliary arch

- glabella
- supraorbital margin
- nasal bone
- ethmoid
- lacrimal bone
- zygomatic plate
- perpendicular plate of ethmoid
- maxilla
- mental foramen
Figure IV-17: Anterior View of the Skull
KEY TO FIGURE IV-18

1. parietal bone
2. lambdoidal suture
3. squamosal suture
4. temporal bone
5. wormian bone
6. occipital bone
7. mastoid process
8. styloid process
9. coronal suture
10. frontal bone
11. sphenoid bone
12. nasal bone
13. lacrimal bone
14. ethmoid bone
15. zygomatic bone
16. maxilla
17. zygomatic arch
18. external acoustic (auditory) meatus
19. mandible

Figure IV-18: The Skull (lateral view)
KEY TO FIGURE IV-19

1. frontal bone
2. sella turcica
3. optic foramen
4. frontal sinus
5. nasal bone
6. perpendicular plate of ethmoid
7. sphenoidal sinus
8. vomer
9. palatine process of maxilla
10. alveolar process
11. pterygoid process
12. parietal bone
13. internal auditory (acoustic)
14. temporal bone
15. jugular foramen
16. occipital bone
17. hypoglossal canal
18. occipital condyle
19. styloid process

Figure IV-19: Sagittal Section of the Skull
KEY TO FIGURE IV-20

1. optic foramen
2. sphenoid sinus
3. body
4. sella turcica
5. lesser wing
6. superior orbital fissure
7. greater wing
8. foramen rotundum
9. lateral pterygoid process
10. medial pterygoid process
KEY TO FIGURE IV-22

1. greater wing
2. superior orbital fissure
3. anterior clinoid process
4. foramen rotundum
5. posterior clinoid process
6. foramen ovale
7. foramen spinosum
8. lesser wing
9. optic foramen
10. optic groove
11. sella turcica
12. dorsum sellae

Figure IV-22: Superior View of Sphenoid

KEY TO FIGURE IV-23

1. superior nuchal line
2. condyloid canal
3. occipital condyle
4. hypoglossal canal
5. external occipital protuberance
6. external occipital crest (median nuchal line)
7. inferior nuchal line
8. foramen magnum
9. jugular notch
10. basilar part

Figure IV-23: Inferior View of the Occipital
**KEY TO FIGURE IV-32**

1. coronoid process  
2. mandibular notch  
3. condyloid process  
4. ramus  
5. angle  
6. mandibular foramen  
7. alveolar process  
8. mental foramen  
9. body  
10. mental protuberance

Figure IV-32: The Mandible

**KEY TO FIGURE IV-33**

1. orbital surface  
2. infraorbital groove  
3. zygomatic process  
4. frontal process  
5. infraorbital foramen  
6. anterior nasal spine  
7. alveolar process

Figure IV-33: Lateral View of the Right Maxilla
KEY TO FIGURE IV-34
1. squama
2. external acoustic meatus
3. mastoid process
4. zygomatic process
5. mandibular fossa
6. styloid process

Figure IV-34: The Right Temporal (Lateral Aspect)

KEY TO FIGURE IV-35
1. zygomatic process
2. styloid process
3. external acoustic meatus
4. mastoid process
5. carotid canal
6. petrous portion
7. carotid canal

Figure IV-35: The Right Temporal (basal aspect)
KEY TO FIGURE IV-36
1. anterior arch
2. superior articular surface
3. transverse foramen
4. posterior arch
5. transverse process
6. groove for vertebral artery

KEY TO FIGURE IV-37
1. body
2. dens (odontoid process)
3. superior articular surface
4. transverse foramen
5. transverse process
6. lamina
7. bifid spinous process

Figure IV-36: The Atlas (first cervical vertebra)
Figure IV-37: The Axis (second cervical vertebra)

KEY TO FIGURE IV-38
1. body
2. transverse foramen
3. pedicle
4. transverse process
5. lamina
6. spinous process
7. superior articular process
8. vertebral (spinal) foramen

Figure IV-38: Seventh Cervical Vertebra
KEY TO FIGURE IV-39

1. costal demifacet  4. superior articular process  6. transverse process
2. body (centrum)  5. facet for rib  7. inferior articular process
3. vertebral notch  8. spinous process

Figure IV-39: A Typical Thoracic Vertebra

KEY TO FIGURE IV-40

1. spinous process  4. lamina  7. superior articular process
2. inferior articular process  5. vertebral foramen  8. pedicle
3. mamillary process  6. transverse process  9. body (centrum)

Figure IV-40: A Typical Lumbar Vertebra
KEY TO FIGURE IV-41

1. ala
2. lateral mass
3. pelvic surface
4. articular process
5. auricular surface
6. sacral promontory
7. anterior sacral foramen
8. body of second sacral vertebra (pelvic surface)
9. coccyx

KEY TO FIGURE IV-42

1. articular process (for 5th lumbar)
2. sacral canal
3. middle sacral crest
4. lateral sacral crest
5. posterior sacral foramen
6. hiatus
7. cornu of sacrum
8. cornu of coccyx
9. coccyx

Figure IV-41: The Sacrum and Coccyx (ventral aspect)

Figure IV-42: The Sacrum and Coccyx (dorsal aspect)
KEY TO FIGURE IV-43

A-G = 7 True Ribs
H-L = 5 False Ribs
K-L = 2 Floating Ribs

1. clavicular notch
2. suprasternal notch (jugular notch)

3. sternal angle
4. costal notch
5. manubrium
6. costal cartilage
7. rib

8. body (gladiolus)
9. xiphoid (ensiform) process
10. intervertebral disc
11. 12th thoracic vertebra
12. floating rib

A-E: "TRUE" RIBS
F-L: "FALSE" RIBS
K-L: FLOATING RIBS

Figure IV-43: The Bony Thorax
Ex. IV-D. The Fetal Skeleton

DISCUSSION

The number of separate bones in the fetus and the child is greater than the 206 in the typical adult skeleton. This is due to the fact that many bones in the adult are composed of several parts fused together; these parts are separate bones in the fetus and child. For example, in a child, the three regions of the os coxae bone (the ilium, ischium, and pubis) form separate bones; in the adult these have united to make one hip bone.

PROCEDURE

1. Use Figure IV-44 and IV-45, two views of the skull at birth, as self-tests.

**KEY TO FIGURE IV-44**

1. frontal bone 4. sagittal suture 7. lambdoidal suture
2. frontal suture 5. parietal bone
3. anterior (frontal) fontanel 6. posterior (occipital) fontanel 8. occipital bone

**KEY TO FIGURE IV-45**

1. coronal suture 3. anterolateral fontanel 5. posterolateral fontanel
2. lambdoidal suture 4. squamosal suture

Figure IV-44: Fetal Skull
(Superior surface)  
Figure IV-45: Fetal Skull (lateral view)
Figure IV-46: Anterior View of Knee Joint

Figure IV-47: Lateral View of Knee Joint
(sagittal section)

Figure IV-48: Anterior view of shoulder joint
SELF-TEST: THE SKELETAL SYSTEM

DIRECTIONS: See Chapter 1, Self-Test, p. 12

1. The malleus is attached to the tympanic membrane.
2. Bones lack blood vessels.
3. The periosteum is the membrane responsible for nourishing the bone.
4. A green-stick fracture is one wherein the bone breaks the skin.
5. The pelvic girdle is actually several bones joined together for the protection of organs in the pelvic region.
6. The floating ribs provide protection for the heart.
7. The toes contain a greater number of bones than do the fingers.
8. The bones of the appendicular skeleton and those of the thorax are formed by the process of endochondral ossification.
9. Ossification begins at the epiphyses and extends to the diaphysis.
10. Spongy bone is found in flat bones as well as in long bones.
11. The two types of bone formation involve the same processes, except that in endochondral ossification there is an initial period of destruction of cartilage.
12. The function of the trochlea is to articulate with the ulna.
13. Haversian systems are responsible for nutrition in compact bony tissue.
14. Haversian systems are characteristic of spongy bone.
15. Red bone marrow is found in the medullary cavity of some long bones of the adult.
16. The constricted portion of a long bone is called the shaft.
17. Epiphyses of bones tend to be rounded into condyles, trochanter, heads.
18. The acetabulum is the socket in which the head of the humerus articulates.
19. The long bones of the extremities continue to grow during childhood at the epiphyseal cartilage.
20. Most of the cranial and facial bones develop by intramembranous ossification.
21. Hemopoiesis may occur in the adult in the ribs and sternum.
22. The lining of the medullary cavity is called periosteum.
23. The primary curves of the vertebral column are the thoracic and lumbar.
24. Bending the elbow is an example of flexion.
25. Styloid processes are found upon the radius, ulna, and temporal bones, but not on the femur.
26. The fusion time of the anterior fontanel of the baby's skull is approximately 18 months.
27. The longitudinal arch extends from the heel to the base of the toes.
28. Touching the little finger with the thumb is called opposition.
29. The iliopectineal line is found in the skull.
30. The sella turcica contains the pituitary gland.
31. The male pelvis has a circular pelvic inlet.
32. The female pelvis includes wide, flared ilia.
33. Spinal nerves are transmitted by way of intervertebral foramina.
34. The spinal cord is located in the neural arches.
35. The nasal septum is comprised of the ethmoid and vomer bones, as well as hyaline cartilage.
36. The air sinuses which open directly into the nasal cavity do not include the mastoid sinus.
37. The secondary curves of the vertebral column are the cervical and lumbar.
38. Movement of the ankle to turn the sole outward is called eversion.
39. When the long strands formed by mesenchymal cells become invested with bone matrix they are called trabeculae.
40. The condyles of the occipital bone and the depressions of the atlas allow for nodding movements of the head.
41. In turning the head from side to side the atlas rotates around a process of the axis called the dens.
42. A foramen is a tube-shaped passageway.
43. A hollow or depression is called a cavity.
44. A small, rounded projection is a tuberosity.
45. The viscosity of synovial fluid is independent of changes in temperature.
46. Synchondroses are freely movable joints.
47. Circumduction combines several types of joint movement.
48. Both prominent bursae and articular capsules may be present in ball and socket and hinge joints.
49. A symphysis joint occurs between bodies of vertebrae.
50. The elbow is an example of a ball and socket joint.
51. Swinging the arms around at the shoulder is an example of circumduction.
52. The position of the foot when standing on the toes is known as plantar flexion.
53. Nodding the head involves both flexion and extension.
54. Moving the arms straight out from the sides is called adduction.
55. Bending the trunk backwards is an example of extension.
56. Moving the thigh forward, as in marching, is an example of flexion.
57. Spreading the fingers apart is adduction.
58. Turning the palm of the hand up is pronation.
59. Shaking the head is rotation.
60. A major function of the bony rib cage is to protect the soft organs within the abdomen.
61. A sulcus is a groove or furrow.
62. Lateral curvature of the spine is called kyphosis.
63. A sprain is a joint injury with stretching or tearing of the ligaments.
64. Wearing high-heeled shoes is a common cause of lordosis in young women.
65. Moving a bone backwards is known as **retraction**.
66. A child was diagnosed as having a green-stick fracture, left femur. The difference between this and an ordinary fracture is that this is a **clean break**.
67. Judging from the diagnosis the patient is a child, because children have more organic matter in their bones than adults, so the bones are more likely to break **clean**.
68. The x-rays showed obvious bands of cartilage near the epiphyses, which meant that this patient's bones were **still growing**.
69. The **periosteum** is important during healing of a fracture because it nourishes the bone and promotes growth and repair.
70. The elbow is actually the **olecranon process**.
71. A depressed skull fracture is a bone **below** normal level that may press on the brain.
72. A simple skull fracture is usually a **shattered** bone.
73. A **craniotomy** was performed on a patient. This is an opening in the cranium to elevate the depressed bone fragment.
74. A **deviated nasal septum**, which means the partition between the nasal cavities is bent to one side, may obstruct breathing.
75. An increase in the thoracic curvature is called **lordosis** or **swayback**.
76. In a sternal puncture yellow marrow is obtained from the sternum.
77. A baby is born who has a **spina bifida**. This congenital defect is caused by a failure of the **vertebral lamina** to unite.
78. **Spina bifida** is most likely to occur in the **cervical and thoracic** region.
79. A hole in a bone through which blood vessels or nerves pass is called a **fossa**.
80. A **fovea** is a narrow slit.
81. A long and pointed process is known as a **styloid process**.
82. A **tubercle** is a large roughened process.
83. A rounded polished process for articulation is called a **condyle**.
84. A saddle or spool shaped articular surface is called a **trochanter**.

**KEY**

2. **have** 31. female 66. not a clean break
4. compound 34. vertebral canal 67. splinter
6. true 42. meatus 72. a crack in the
7. the same 43. fossa 75. kyphosis or hunchback
9. diaphysis; 44. tubercle 76. red
epiphyses 45. varies with 78. lumbar and sacral
14. compact 46. diarthroses 79. foramen
15. proximal 50. hinge 80. fissure
epiphyses 54. abduction 82. tuberosity
16. neck 57. abduction 84. trochlea
18. femur 58. supination
22. endosteum 60. thorax
23. sacral 62. scoliosis
29. pelvis
KEY TO FIGURE V-1

1. platysma
2. serratus anterior
3. iliopsoas
4. inguinal ligament
5. pectineus
6. adductor longus
7. gracilis
8. rectus femoris
9. vastus medialis
10. vastus lateralis
11. gastrocnemius
12. tibialis anterior
13. sternocleidomastoid
14. deltoid
15. pectoralis major
16. biceps brachii
17. brachialis
18. external oblique
19. superficial inguinal ring
20. sartorius
21. adductor longus
22. rectus femoris
23. gracilis
24. patella

Figure V-1: Anterior View of the Muscles
KEY TO FIGURE V-2

1. adductor magnus
2. gracilis
3. semimembranosus
4. semitendinosus
5. deltoid
6. trapezius
7. triceps brachii
8. latissimus dorsi
9. lumbodorsal fascia
10. gluteus medius
11. gluteus maximus
12. biceps femoris
13. popliteal fossa
14. gastrocnemius
15. soleus
16. Achilles tendon

Figure V-2: Posterior View of the Muscles
KEY TO FIGURE V-3

1. frontalis  
2. temporalis  
3. corrugator  
4. orbicularis oculi  
5. occipitalis  
6. quadratus labii superioris  
8. masseter  
9. buccinator  
10. orbicularis oris  
11. sternocleidomastoid

Figure V-3: Lateral View of Major Muscles of Head and Neck
Figure V-4: Anterior View of Major Muscles of the Head and Neck