[[LMWBA Lab 6 IM]]Instructor’s Manual

Lab 6 Bones of the Skeleton

**Answers to Lab 6 Concept Review Questions**

1. **Occipital** is the bone that forms the posterior (back) of the cranium.

2. **Incisors, canines, premolars, and molars** are the four types of teeth found in primates.

3. **A. Cervical vertebra** is a bone found in the neck (not sacrum, lumbar, or thoracic vertebra).

4. **D. Thoracic vertebra** articulates with ribs (not sacrum, lumbar, or cervical vertebra).

5. Number of ribs that articulate directly, indirectly, or not at all with the sternum:   
**14 (7 pairs) = direct; 6 (3 pairs) = indirect; 4 (2 pairs) = not at all**

6. **Scapula, radius, and ulna** are the three bones that articulate with the humerus in each arm.

7. **B. 14** is the number of phalanges in a typical human hand (not 8, 15, or 5).

8. **Ilium, ischium, and pubis** are the names of the three fused bones that comprise each side of the ossa coxae.

9. **Os coxa, patella, and tibia** are the names of the three bones that articulate with the femur on each side of the body.

10. **False**; the carpals are *not* found in the ankle area but in the wrist.

**Answers to Lab 6 Exercises**

Exercise 1: Cranium (15 to 20 minutes)

*For this exercise, you could substitute a cast with numbered stickers or labels instead of the image provided in the lab Appendix.*

Part A: Human Cranium (anterior and lateral views)

Refer to the skeletal material provided by your instructor (or the human cranium pictures in the lab Appendix). Some of the major bones of the cranium have been assigned numbers. For each number, provide the appropriate bone name in the space below:

1. **Temporal** 5. **Occipital**
2. **Mandible** 6. **Frontal**
3. **Maxilla** 7. **Zygomatic bone**

4. **Parietal**

*Note that the zygomatic bone (7) fuses with the maxilla anteriorly and with the zygomatic process of the occipital posteriorly, forming a bony zygomatic arch that creates a space for passage of cheek muscles.*

Part B: Human Cranium (lateral and basal views)

Refer to the skeletal material provided by your instructor (or the human cranium pictured in the lab Appendix) and label the following key features of the cranium:

1. External auditory (acoustic) meatus

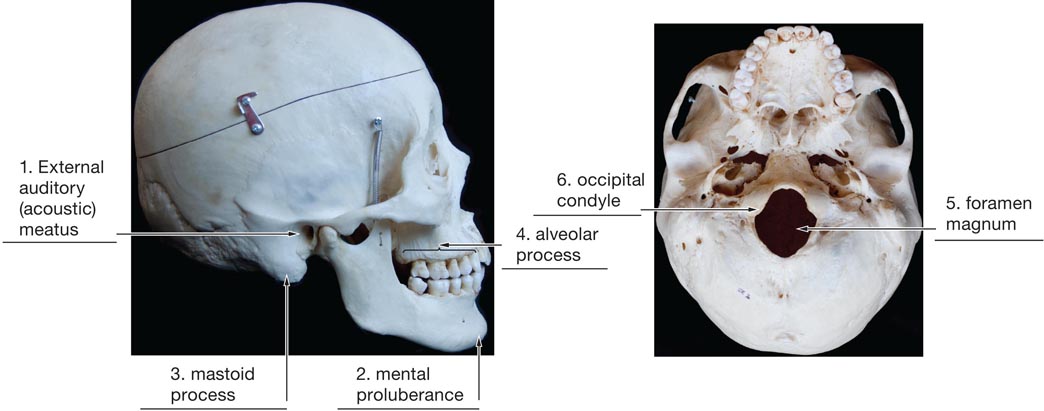
2. Mental protuberance

3. Mastoid process

4. Alveolar process

5. Foramen magnum

6. Occipital condyles



Exercise 2: Dentition (5 minutes)

*For this exercise, you could substitute your own material for the image provided, but be sure to adjust the dental formula answer as needed depending on the material you provide students.*

Refer to the skeletal material provided by your instructor (or the mystery animal dentition picture in the lab Appendix) to calculate the dental formula for the animal and write it in the space provided.

Dental formula: **2.1.3.3**

Exercise 3: Vertebral Column (10 to 15 minutes)

*For this exercise, you could substitute casts with numbered stickers or labels instead of the images provided.*

Part A: Human Vertebral Column

Refer to the skeletal material provided by your instructor (or the human vertebral column diagram in the lab Appendix). The major bones of the vertebral column have been assigned numbers. For each number, provide the appropriate name in the space below:

1. **Sacrum** 4. **Cervical vertebrae**

2. **Thoracic vertebrae** 5. **Coccyx**

3. **Lumbar vertebrae**

Part B: Typical Human Vertebra (such as L3)

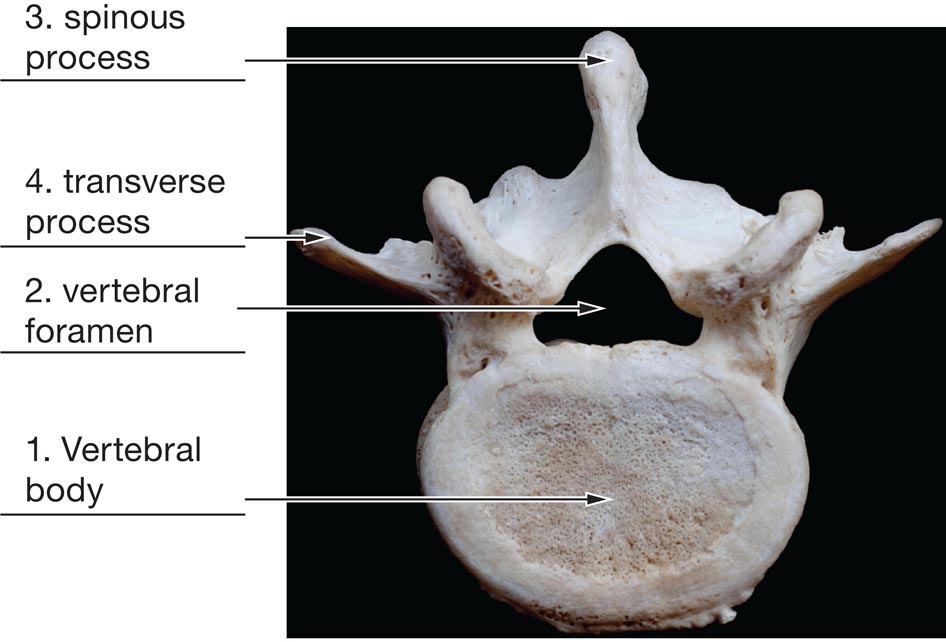
Refer to the skeletal material provided by your instructor (or the typical human vertebra pictured in the lab Appendix) and label the following key features on the vertebra:

1. Vertebral body

2. Vertebral foramen

3. Spinous process

4. Transverse process



Part C: Types of Vertebrae  
Refer to the skeletal material provided by your instructor (or the three vertebrae pictured in the lab Appendix) to answer the following questions.

1. Which mystery vertebra is a cervical vertebra? Describe two features that helped you determine this.

**Cervical vertebra = C (presence of transverse foramina, presence of short spinous process with bifurcated end)**

2. Which mystery vertebra is a thoracic vertebra? Describe two features that helped you determine this.

**Thoracic vertebra = B (presence of costal facets, long spinous process)**

3. Which mystery vertebra is a lumbar vertebra? Describe two features that helped you determine this.

**Lumbar vertebra = A (large vertebral body, short spinous process, absence of special features seen in other vertebrae such as transverse foramina and costal facets)**

Exercise 4: Thoracic Cage (Rib Cage) (5 minutes)

*For this exercise, you could substitute a cast with numbered stickers or labels instead of the image provided.*

Refer to the skeletal material provided by your instructor (or the human rib cage pictured in the lab Appendix) and label the following bones of the rib cage:

1. Manubrium

2. Sternal body

3. Xiphoid process

4. True ribs

5. False ribs

6. Floating ribs

**Answers can be found in Figures 6.28 and 6.29 in text.**

Exercise 5: Upper Limb (10 minutes)

*For this exercise, you could substitute a cast with numbered stickers or labels instead of the image provided.*

Part A: Human Upper Limb   
Refer to the skeletal material provided by your instructor (or the human upper limb picture in the lab Appendix). The major bones have been numbered. For each number, provide the appropriate name in the space provided.

1. **Radius**

2. **Carpals** (specifically, capitate)

3. **Metacarpals** (specifically, MC5)

4. **Ulna**

5. **Humerus**

6. **Hand phalanges** (specifically, the intermediate phalanx of digit 5)

*Note that some students may name the general bone groups or specific bones within the wrist, hand, or fingers.*

Part B: Human Humerus  
Refer to the skeletal material provided by your instructor (or the human humerus pictured in the lab Appendix) and label the following key features of the humerus:

1. Head

2. Lesser tubercle

3. Greater tubercle

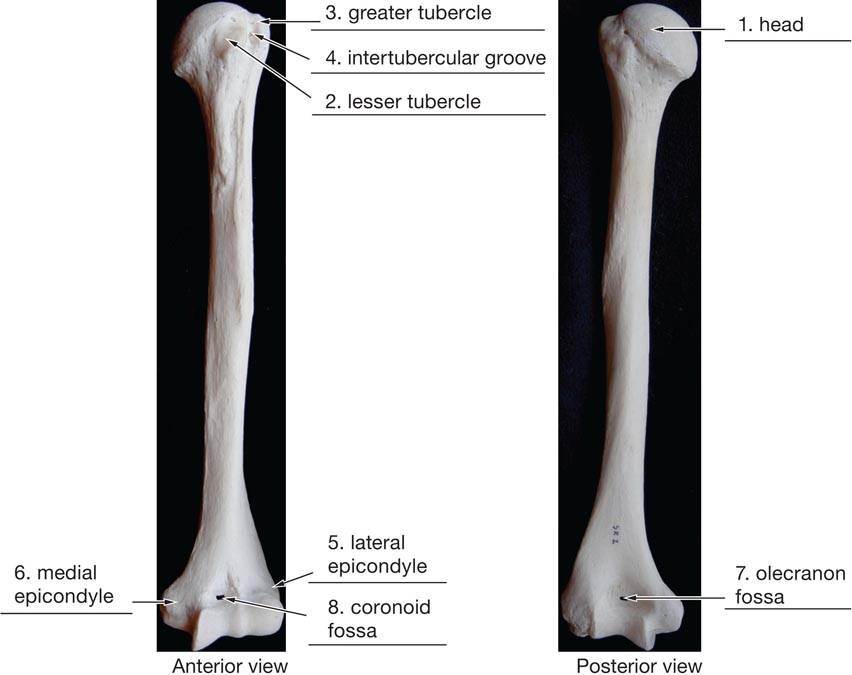
4. Intertubercular groove

5. Lateral epicondyle

6. Medial epicondyle

7. Olecranon fossa

8. Coronoid fossa



Part C: Human Hand  
Review the bones of the hand provided by your instructor or depicted in Figure 6.38. Describe two things that make the first finger (the thumb) different from the other fingers.

**Compared to the other fingers, the first finger (thumb) is shorter, has fewer phalanges, has shorter bones (metacarpal and phalanges), and is positioned away from the other fingers.**

Exercise 6: Lower Limb (15 minutes)

*For this exercise, you could substitute a cast with numbered stickers instead of the image provided.*

Part A: Human Pelvis (articulated with sacrum)   
Review the skeletal material provided by your instructor (or the human pelvis pictured in the lab Appendix). The major bones and features have been numbered. For each number, provide the appropriate name in the space provided.

1. **Ischium**

2. **Pubis**

3. **Ilium**

4. **Sacrum**

5. **Acetabulum**

6. **Pubic symphysis joint**

7. **Sacroiliac joint**

Part B: Human Lower Limb   
Refer to the skeletal material provided by your instructor (or the human lower limb picture in the lab Appendix). The major bones have been numbered. For each number, provide the appropriate bone name in the space provided.

1. **Femur**

2. **Fibula**

3. **Metatarsals** (specifically, MT1)

4. **Toe phalanges** (specifically, proximal phalanx of digit 4)

5. **Tibia**

6. **Tarsals** (specifically, talus)

Part C: Human Femur  
Review the skeletal material provided by your instructor (or the human femur pictured in the lab Appendix) and label the following key features of the femur:

1. Head

2. Neck

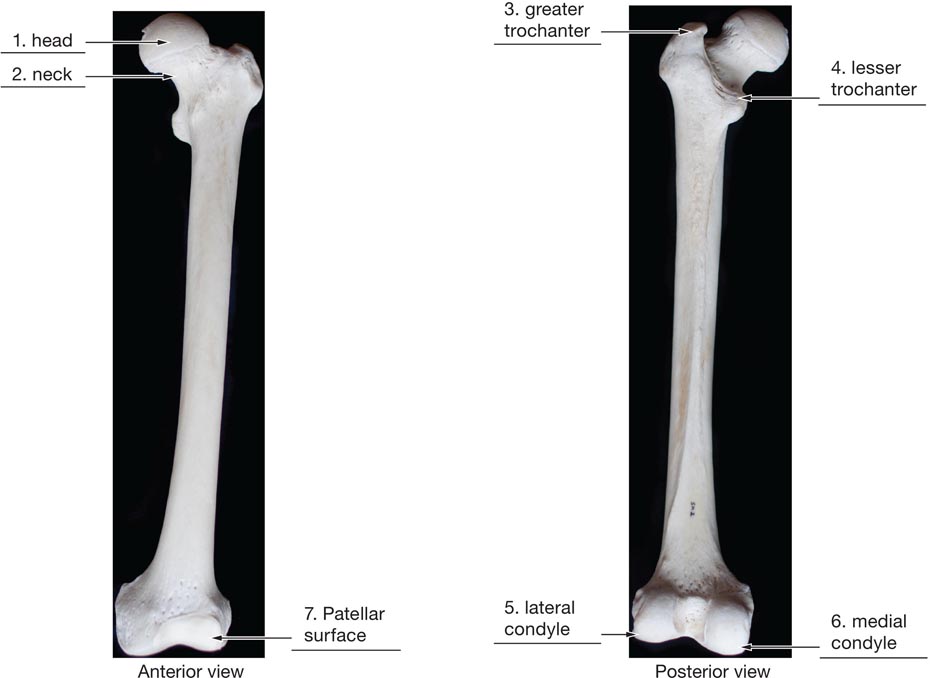
3. Greater trochanter

4. Lesser trochanter

5. Lateral condyle

6. Medial condyle

7. Patellar surface



Part D: Human Foot  
Review the bones of the foot provided by your instructor or depicted in Figure 6.50. Describe two things that make the first toe (the big toe) different from the other toes.

**Compared to the other toes, the first toe is much thicker, or more robust (larger and denser), and has fewer phalanges.**

**Answers to Lab 6 Critical Thinking Questions**

1. Why are there so many cranial bones, which fuse during life? The cranium must form a round, protective shell for the brain. Many smaller bones must come together to create this rounded shape. These bones are separate at birth to allow for our brains to grow. If we were born with the bones already fused, our brains could not grow larger.

2. Similar features of vertebrae: All have same basic parts (body, vertebral arch, vertebral foramen, transverse processes, spinous processes) because they all have the same protective function for the spinal cord and need to stack together to form the vertebral column. Differences: They vary in size (larger the lower they are); vary in specific shapes (rib attachment areas, orientation of spinous process, presence or absence of transverse foramen, presence or absence of bifurcated spinous process) because different types have additional functions, provide different amounts of weight-bearing support, etc. Answers regarding caudal vertebrae will vary, but students should note that caudal vertebrae also vary in size (smaller as they get more distal in the body) and have similar overall shapes, likely lacking prominent projections. Students’ estimations of features of caudal vertebrae may or may not be accurate.

3. It is important that much of the anterior rib cage is made of cartilage because this cartilage allows the ribs to move when we breathe. If the ribs articulated more directly (with less cartilage), they would have less mobility, and lung expansion and diaphragm mobility would be restricted.

4. Similar features of shoulder and elbow: Humerus is part of both joints. Differences: More bones are involved in the elbow than in the shoulder. The shoulder is more mobile because fewer bones are involved and the joint is a type called ball and socket. The elbow is more restricted because it is a hinge joint, not ball and socket, and more bones are involved.

5. Similar types of bones and layout of upper and lower limbs: Same general types of bones are involved (long, short), same relative numbers of bones (one upper arm/leg bone, two lower arm/leg bones, numerous wrist/ankle bones, five digits), similar placement of similar joints (e.g., shoulder and hip are both ball and socket). Differences: Bone sizes are different (e.g., femur bigger than humerus), specific bone features are different. The limbs have a similar overall layout and body plan with similar types and numbers of bones and similar types of joints. This suggests the limbs have some similarities in overall function and mobility. For example, the limb overall is fairly mobile due to the shoulder/hip, but the particular joints in the limb are more restricted, as in the elbow/knee and wrist/ankle. The fact that the limb bones vary in some details, such as bone features and size, suggests that the bones perform slightly different functions and probably attach to muscles of different sizes and shapes.

6. Differences in physical features of hands and feet: Feet have an arch and short toes. Hands do not have an arch, and the fingers are long. Hands are for grasping and fine motor skills, so they are long and lean. Feet are for weight bearing and helping us walk, so they are larger overall and don’t need lean toes. Other primates probably have hands and feet that are more similar to each other because their hands and feet perform more similar functions than ours do.