Figure Labels

FIG. 12.1
1. Articular cartilage (hyaline cartilage)
2. Spongy bone (red marrow)
3. Medullary cavity
4. Yellow marrow
5. Compact bone
6. Periosteum
7. Proximal epiphysis
8. Diaphysis
9. Distal epiphysis

FIG. 12.2
1. Spongy bone
2. Compact bone
3. Osteon
4. Periosteum
5. Central canal
6. Perforating canal
7. Blood vessels
8. Nerve
9. Canaliculus
10. Osteocyte

Critical Thinking Application Answers
The closest blood supply to an osteocyte is located in the central canal of an osteon unit. Nutrients and wastes can move from one cell to another via small cellular processes located in minute tubes in the matrix called canaliculi. In this way, all of the osteocytes of one osteon are tied together to a blood source.

Laboratory Report Answers

PART A
1. Flat
2. Short
3. Long
4. Irregular
5. Sesamoid or round
6. Flat
7. Epiphysis refers to the expanded end of a long bone; diaphysis refers to the shaft between the ends of such a bone.

8. Hyaline cartilage covers the articular ends of a long bone.
9. Dense irregular connective tissue comprises the periosteum that encloses the bone except for its articular ends
10. Periosteum composed of irregular dense connective tissue forms the outer covering of a bone, whereas endosteum composed of reticular connective tissue lines its hollow, internal chambers.

PART B
1. Compact bone has osteons closely packed together, and spongy bone has large spaces between thin bony plates called trabeculae.
2. Compact bone provides strength in the shaft and along the borders of the bone. Spongy bone reduces the weight of the bone and provides spaces occupied by red marrow.
3. The marrow of the medullary cavity of an adult is yellow, but marrow in the spaces of spongy bone is red.

PART C (FIG. 12.5 a-b)
1. Epiphysis (distal)
2. Diaphysis
3. Epiphysis (proximal)
4. Medullary cavity
5. Compact bone
6. Spongy bone
Figure Labels

FIG. 3.1a

FIG. 13.1b
18. Ulna 21. Tibia

Critical Thinking Application Answers
The largest foramen in the skull is the foramen magnum in the occipital bone. The largest foramen in the human body is the obturator foramen in the hip bone.

Laboratory Report Answers

PART A

PART B
1. c 3. a 5. g 7. d
2. f 4. e 6. b

PART C
1. c 3. g 5. b 7. f
2. a 4. e 6. d

PART D (FIG. 13.2)
**Instructional Suggestion**

You might want to have the students use colored pencils to color the bones in figures 14.1 and 14.2. They should use a different color for each of the individual bones in the series. This activity should cause the students to observe the figures more carefully and help them to locate the various bones that are shown from different views in the figures. The students can check their work by referring to the corresponding full-color figures in the textbook.

**Figure Labels**

**FIG. 14.1**
1. Parietal bone
2. Frontal bone
3. Coronal suture
4. Temporal bone
5. Perpendicular plate (of ethmoid bone)
6. Infraorbital foramen
7. Vomer bone
8. Mandible
9. Supraorbital foramen
10. Nasal bone
11. Sphenoid bone
12. Zygomatic bone
13. Middle nasal concha (of ethmoid bone)
14. Inferior nasal concha
15. Maxilla
16. Mental foramen

**FIG. 14.2**
1. Parietal bone
2. Squamous suture
3. Lambdoid suture
4. Temporal bone
5. Occipital bone
6. Temporal process (of zygomatic bone)
7. External acoustic meatus
8. Mastoid process
9. Styloid process
10. Mandibular condyle
11. Zygomatic process (of temporal bone)
12. Coronal suture
13. Frontal bone
14. Sphenoid bone
15. Lacrimal bone
16. Nasal bone
17. Zygomatic bone
18. Maxilla
19. Mandible
20. Coronoid process

**FIG. 14.3**
1. Maxilla
2. Zygomatic bone
3. Sphenoid bone
4. Vomer bone
5. Zygomatic arch
6. Styloid process
7. Mastoid process
8. Occipital condyle
9. Temporal bone
10. Palatine process (of maxilla)
11. Palatine bone
12. Foramen magnum
13. Lambdoid suture
14. Occipital bone

**FIG. 14.4**
1. Ethmoid bone
2. Foramen magnum
3. Crista galli
4. Cribriform plate (olfactory foramina)
5. Frontal bone
6. Sphenoid bone
7. Temporal bone
8. Sella turcica
9. Parietal bone
10. Occipital bone

**FIG. 14.5**
1. Coronal suture
2. Frontal bone
3. Sphenoid bone
4. Frontal sinus
5. Nasal bone
6. Maxilla
7. Parietal bone
8. Temporal bone
9. Squamos suture
10. Lambdoid suture
11. Occipital bone
12. Sella turcica
13. Styloid process
14. Sphenoidal sinus
15. Vomer bone
16. Mandible
Critical Thinking Application Answers

The cribriform plate of the ethmoid bone with numerous olfactory foramina is a weak location of the cranium. Excessive pressure on the cribriform plate could result in a skull fracture.

Laboratory Report Answers

PART A
1. d  4. f  7. f  10. c
2. a  5. e  8. a  11. f
3. a  6. f  9. c  12. b

PART B
1. Coronal
2. Sagittal
3. Lambdoid
4. Squamous
5. Frontal, ethmoid, sphenoid
6. Maxillary bone

PART C
1. e  4. h  7. h  10. c
2. c  5. d  8. a  11. f
3. c  6. g  9. d  12. b

PART D
1. c  3. g  5. d  7. c
2. a  4. f  6. b

PART E (FIG. 14.8-14.12)

FIG. 14.8
1. Frontal bone 6. Mandible
2. Nasal bone
3. Zygomatic bone 7. Middle nasal concha (of ethmoid bone)
4. Infraorbital foramen 8. Inferior nasal concha
5. Maxilla 9. Mental foramen

FIG. 14.9
1. Parietal bone 8. Mandibular condyle
2. Squamous suture 9. Coronal suture
3. Temporal bone 10. Frontal bone
4. Lambdoid suture 11. Zygomatic process (of temporal bone)
5. Occipital bone 12. Zygomatic bone
7. Mastoid process 14. Mandible

FIG. 14.10
1. Maxilla 7. Palatine process of maxilla
2. Zygomatic bone 8. Palatine bone
4. Temporal bone 10. Occipital condyle
5. Occipital bone 11. Foramen magnum
6. Incisive foramen

FIG. 14.11
1. Frontal bone 5. Ethmoid bone
2. Temporal bone 6. Sphenoid bone
3. Parietal bone 7. Sella turcica
4. Occipital bone 8. Foramen magnum

FIG. 14.12
1. Parietal bone 5. Maxilla
2. Sphenoid bone 6. Frontal bone
3. Temporal bone 7. Mandible
4. Zygomatic bone
LABORATORY EXERCISE 16
VERTEBRAL COLUMN AND THORACIC CAGE

Figure Labels

FIG. 15.1
1. Cervical vertebrae
2. Thoracic vertebrae
3. Lumbar vertebrae
4. Sacrum
5. Coccyx
6. Intervertebral foramina
7. Intervertebral discs

FIG. 15.2 a-b
8 1
3 6
4 5
7 2

FIG. 15.3 a-c
6 1
7 9
3 2
5 8
4

FIG. 15.4
1. Superior articular process
2. Anterior sacral foramen
3. Coccyx
4. Sacral canal
5. Superior articular process
6. Tubercles of median sacral crest
7. Posterior sacral foramen
8. Sacral hiatus

Critical Thinking Application Answers
The four curvatures allow more resiliency and flexibility, which will enable the vertebral column to function more like a spring instead of a rigid rod.

FIG. 15.5
1. True ribs
2. False ribs
3. Thoracic vertebra
4. Manubrium
5. Body
6. Xiphoid process
7. Sternum
8. Costal cartilage
9. Floating ribs

Laboratory Report Answers

PART A
1. Spinal cord
2. Cervical
3. Dorsal
4. Lumbar
5. Sacral
6. Coccygeal
7. Vertebral arteries
8. Atlas
9. Axis
10. Dens
11. Body
12. Process
13. Vertebrae
14. Sacral hiatus
PART B

<table>
<thead>
<tr>
<th>Vertebra</th>
<th>Number</th>
<th>Size</th>
<th>Body</th>
<th>Spinous Process</th>
<th>Transverse Foramina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>7</td>
<td>Smallest</td>
<td>Smallest</td>
<td>C2 through C5 are</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>forked</td>
<td></td>
</tr>
<tr>
<td>Thoracic</td>
<td>12</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Pointed and angled</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>downward</td>
<td></td>
</tr>
<tr>
<td>Lumbar</td>
<td>5</td>
<td>Largest</td>
<td>Largest</td>
<td>Short, blunt, and</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>nearly horizontal</td>
<td></td>
</tr>
</tbody>
</table>

PART C
1. 206
2. Floating
3. Seven
4. Hyaline cartilage
5. Clavicles
6. Supports shoulder girdle and upper limbs
   a. Protects visceral organs
   b. Functions in breathing

PART D (FIG. 15.6)
1. Spinous process
2. Atlas
3. Axis
4. Transverse process
5. Intervertebral disc
6. Body (of sixth cervical vertebra)
LABORATORY EXERCISE 16
PECTORAL GIRDLE AND UPPER LIMB

Figure Labels

FIG. 16.1
1. Clavicle
2. Rib
3. Sternum
4. Costal cartilage
5. Scapula
6. Humerus
7. Ulna
8. Radius
9. Acromion process
10. Head of humerus
11. Coracoid process

FIG. 16.2
1. Acromion process
2. Coracoid process
3. Spine
4. Supraspinous fossa
5. Infraspinous fossa
6. Glenoid cavity
7. Acromion process
8. Coracoid process
9. Glenoid cavity

Critical Thinking Application Answers
The clavicles brace the freely movable scapulae, helping to hold the shoulders in place. If an excessive lengthwise force occurs on this structurally weak bone, as when a person breaks a fall with an outstretched rigid upper limb, it is likely to fracture.

FIG. 16.3a-b
1. Head
2. Lesser tubercle
3. Deltoid tuberosity
4. Coracoid fossa
5. Lateral epicondyle
6. Capitulum
7. Trochlea
8. Greater tubercle
9. Medial epicondyle
10. Olecranon fossa

FIG. 16.4
1. Head of radius
2. Radial tuberosity
3. Styloid process of radius
4. Olecranon process
5. Trochlear notch
6. Coronoid process
7. Head of ulna

FIG. 16.5
1. Olecranon process
2. Humerus
3. Olecranon fossa
4. Head of radius
5. Radius
6. Ulna

FIG. 16.6
1. Seaphoid
2. Capitate
3. Trapezoid
4. Trapezium
5. Carpals (carpus)
6. Metacarpals (metacarpus)
7. Phalanges
8. Lunate
9. Proximal phalanx
10. Middle phalanx
11. Distal phalanx

Laboratory Report Answers

PART A
1. Scapulae
2. Manubrium (clavicular notch)
3. Acromion processes
4. Clavicle
5. Spine
6. Acromion process
7. Coracoid process
8. Head
PART B
1. a  4. b  7. b
2. b  5. c  8. a
3. b  6. d  9. b
10. e
11. a
12. f

PART C (FIGS. 16.7, 16.8, and 16.9)
FIG. 16.7  FIG. 16.8  FIG. 16.9
1. Humerus  1. Acromion process  1. Phalanges
3. Head of radius  3. Humerus  3. Carpals
5. Ulna  5. Scapula  5. Proximal phalanx
6. 6

PART D (FIG. 16.10)
6 12
5
2
9
11
4
10
1
8
7
3
Lab Answer Key – 12e
BIO 141
Dr. Wolfe

LABORATORY EXERCISE 17
PELVIC GIRDLE AND LOWER LIMB

Figure Labels

FIG. 17.1
1. Hip bone (coxa; pelvic bone; innominate)
2. Sacrum
3. Coccyx

FIG. 17.2a
1. Ilium
2. Greater sciatic notch
3. Ischial spine
4. Ischium
5. Iliac crest
6. Anterior superior iliac spine
7. Acetabulum
8. Pubis
9. Obturator foramen

FIG. 17.2b
10. Anterior superior iliac spine 1
11. Ilium
12. Pubis
13. Iliac crest
14. Ischial spine
15. Ischium

Critical Thinking Application Answers
All of the features examined are wider in the female pelvis which will result in a larger pelvic cavity and must also serve as a birth canal for a vaginal delivery.

FIG. 17.3a-b
1. Head
2. Fovea capitis
3. Greater trochanter
4. Neck
5. Lateral epicondyle
6. Lesser trochanter
7. Lateral condyle
8. Medial condyle

FIG. 17.4
1. Head of fibula
2. Fibula
3. Lateral malleolus
4. Medial condyle
5. Tibial tuberosity
6. Tibia
7. Medial malleolus

FIG. 17.5
1. Medial condyle
2. Femur
3. Lateral condyle
4. Fibula
5. Tibia

FIG. 17.6
1. Calcaneus
2. Talus
3. Cuboid
4. Navicular
5. Lateral cuneiform
6. Intermediate cuneiform
7. Medial cuneiform
8. Proximal phalanx
9. Middle phalanx
10. Distal phalanx
11. Tarsals (tarsus)
12. Metatarsals (metatarsus)
13. Phalanges

Laboratory Report Answers

PART A
1. Hip bones
2. Acetabulum
3. Ilium
4. Ischial spines
5. Symphysis pubis
6. Iliac crest
7. Tuberosity
8. Pubic arch
9. Obturator foramen
10. Sacroiliac
PART B
1. e
2. a
3. g
4. a
5. f
6. f

7. g
8. f
9. a
10. b
11. d
12. c

PART C (FIGS. 17.7, 17.8, and 17.9)

FIG. 17.7
1. Obturator foramen
2. Symphysis pubis
3. Ilium
4. Sacrum
5. Head of femur
6. Pubis

FIG. 17.8
1. Lateral epicondyle
2. Lateral condyle
3. Head of fibula
4. Fibula
5. Femur
6. Tibia

FIG. 17.9
1. Metatarsal
2. Proximal phalanx
3. Distal phalanx
4. Tibia
5. Talus
6. Calcaneus

PART D (FIG. 17.10)
1. Distal phalanges
2. Proximal phalanges
3. Metatarsals
4. Medial cuneiform
5. Intermediate cuneiform
6. Lateral cuneiform

7. Navicular
8. Talus
9. Middle phalanges
10. Cuboid
11. Calcaneus
Critical Thinking Application Answers
Maximum flexion of body parts can occur when in fetal position or performing a cannon ball into a swimming pool.

Laboratory Report Answers

PART A
1. b
2. c
3. d
4. e
5. a

PART B (FIG. 18.4)
1. Fibrous (suture); synarthrosis
2. Cartilaginous (symphysis); amphiarthrosis
3. Cartilaginous (symphysis); amphiarthrosis
4. Synovial (plane); diarthrosis
5. Synovial (hinge); diarthrosis
6. Synovial (pivot); diarthrosis
7. Synovial (condylar); diarthrosis
8. Synovial (saddle); diarthrosis
9. Synovial (ball-and-socket); diarthrosis

PART C
1. a
2. b
3. d
4. c
5. e
6. a
7. c
8. f
9. e
10. c

PART D

<table>
<thead>
<tr>
<th>Type of Joint</th>
<th>Bones Included</th>
<th>Types of Movement Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball-and-socket</td>
<td>Humerus, scapula</td>
<td>Movements in all planes and rotation</td>
</tr>
<tr>
<td>Hinge, plane, and pivot</td>
<td>Humerus, radius, ulna</td>
<td>Flexion and extension between humerus and ulna; twisting movements occur between radius and humerus; rotation between radius and ulna</td>
</tr>
<tr>
<td>Ball-and-socket</td>
<td>Femur, hip bone</td>
<td>Movements in all planes and rotation</td>
</tr>
<tr>
<td>Hinge (modified), condylar, and plane</td>
<td>Femur, tibia, patella</td>
<td>Flexion and extension between femur and tibia and slight rotation when flexed; sliding (gliding) movements occur between femur and patella</td>
</tr>
</tbody>
</table>

PART E (FIG. 18.5)
1. Rotation
2. Elevation
3. Depression
4. Supination
5. Pronation
6. Abduction
7. Adduction
8. Flexion
9. Extension
10. Abduction
11. Adduction
12. Circumduction
13. Protraction
14. Retraction
15. Extension
16. Flexion
17. Extension
18. Flexion
19. Flexion
20. Extension
21. Flexion
22. Extension
23. Flexion
24. Extension
25. Flexion
26. Extension
27. Dorsiflexion
28. Plantar flexion