The Skeletal System

ASSIGNMENT:
1. Surface anatomy related to the skeletal system *(detailed outline in the Skeletal System Study Guide below)*
2. Histology of the skeletal system
3. Use the study guide which follows to learn the macroscopic anatomy of the Skeletal System. Bones and bone landmarks not listed in the study guide may be offered as bonus questions on the midterm lab practicum (eg. Individual carpals and tarsals).
4. Classification and anatomy of joints, with calf joint demonstration dissection

Learning Objectives:
1. Distinguish between the axial and appendicular skeleton; identify the bones and bony landmarks listed in the lab handout.
2. Identify the anatomy of a typical diarthrotic joint. Be able to name the bones that articulate at particular joints.
3. Explain how joints may be classified (3) either according to the type of movement and/or the type of tissue connections associated with the bone junction.
4. Name and describe the major types of movements at joints.
5. Recognize and name the class of lever (I, II, or III) for a particular movement of the skeleton. Identify the muscle that is producing the movement at that joint (see also: Muscular System).
6. Differentiate between the organic and inorganic constituents of bone in their production and the characteristics they bring to living bone.
7. Describe the macroscopic and microscopic structure of a typical long bone, and list the functions of each feature.

MODELS:
Human skeletons (articulated and disarticulated)
Osteon (picture key included below, and in lab atlas)

DEMONSTRATION:
1. X-rays (PPT slide set in Canvas)
   - Please read the captions and answer the questions posted on each slide. Understand and use the terms correctly. One or more of these x-rays will be on the lab exam.
2. Fresh calf joint
   - Bring handout on the features of a typical diarthrotic joint for use during the demonstration dissection. You are responsible for the features used to describe the anatomy of a typical diarthrotic joint for the lab exam. See also the pictures posted on the course web page.
3. Organic and Inorganic bone preparations
   - Identify calcium hydroxy apatite and osteoid, and describe the chemical components of the matrix that remains in these preparations.
PAL Assignment:
1. Open the Human Cadaver module and select Appendicular Skeleton to begin. You may want to click on Show Labels when you first begin your study of the skeleton. Click on Hide Labels and slide your mouse over a structure to reveal the name. You may also click on a structure or label to hear the pronunciation. (Make sure the volume is turned up on your computer.)

2. Refer to the Skeletal System Study Guide on the next pages, which outlines your study of the skeleton. You are responsible for knowing any structures listed in this manual which may not be labeled in PAL. Use the Search option (if necessary) to find the best view.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition (with one example):</th>
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<tbody>
<tr>
<td>condyle</td>
<td>a rounded process that articulates with another bone eg. occipital condyle</td>
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<tr>
<td>crest</td>
<td>a narrow, ridge-like projection; eg. iliac crest</td>
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<tr>
<td>epicondyle</td>
<td>a projection situated above a condyle eg. medial epicondyle of humerus</td>
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<tr>
<td>facet</td>
<td>a small smooth surface, eg. rib facet of a thoracic vertebra</td>
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<tr>
<td>foramen</td>
<td>an opening for the passage of b.v. &amp;/or nerves eg. foramen magnum</td>
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<tr>
<td>fossa</td>
<td>a relatively deep pit or depression; eg. olecranon fossa</td>
</tr>
<tr>
<td>fovea</td>
<td>a tiny pit or depression; eg. fovea capitis</td>
</tr>
<tr>
<td>head</td>
<td>an enlargement at the end of a bone; eg. femoral head</td>
</tr>
<tr>
<td>linea</td>
<td>a narrow line-like ridge; eg. linea aspera of femur</td>
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<tr>
<td>meatus</td>
<td>a tube-like passageway within a bone eg. external auditory meatus</td>
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<tr>
<td>process</td>
<td>a prominent projection of a bone eg. mastoid process of temporal bone</td>
</tr>
<tr>
<td>ramus</td>
<td>a branch-like process; eg. ramus of mandible</td>
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<tr>
<td>sinus</td>
<td>a cavity within a bone; eg. frontal sinus</td>
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<tr>
<td>spine</td>
<td>a sharp projection; eg. spine of scapula</td>
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<tr>
<td>styloid a</td>
<td>pen-like projection; eg. styloid process of ulna</td>
</tr>
<tr>
<td>suture</td>
<td>interlocking junction between cranial bones; eg. coronal suture</td>
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<tr>
<td>trochanter</td>
<td>a relatively large process; eg. greater trochanter of femur</td>
</tr>
<tr>
<td>tubercle</td>
<td>a small knob-like process; eg. tubercle of rib</td>
</tr>
<tr>
<td>tuberosity</td>
<td>a knob-like process larger than a tubercle; eg. tibial tuberosity</td>
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Skeletal System Study Guide

This handout is organized in outline format, such that:

A. Skeletal region
   1. Principle component or individual bone, and features of that component or bone are listed here

Using your textbook, laboratory atlas, and PAL, start by learning the whole bones first, and then learn the special features of each bone. Be able to recognize the whole bones and landmarks listed on both the articulated and disarticulated skeletons. Be able to identify bones from the left or right side, anterior and posterior surfaces, etc.

Study the x-rays of various bones (in PPT file posted in Canvas) for a view of bones in situ, with a special emphasis on joints, fractures, differences in the appearance of young and old bones, sutures, sinuses, etc.

APPENDICULAR SKELETON

A. Pectoral Girdle

   1. Clavicle
      Acromial extremity*
      Sternal extremity
      Conoid tuberosity

   2. Scapula  (*Palpate the AC joint of your left shoulder…find it on your partner.)
      Acromion process*
      Coracoid process
      Glenoid cavity
      Spine
      Supraspinous fossa
      Infraspinous fossa
      Medial border
      Lateral border
      Subscapular fossa

Identify the whole bone and the bony landmark labeled ____10____.
B. Upper Appendages (arms)

1. Humerus (funny bone!)
   - Greater tubercle
   - Lesser tubercle
   - Intertubercular groove
   - Medial epicondyle
   - Lateral epicondyle
   - Olecranon fossa (*articulates with______________*)
   - Head
   - Anatomical neck
   - Surgical neck (*Which of these two necks are more likely to break? Why?______________*)
   - Trochlea (*articulates with______________*)
   - Capitulum (*articulates with______________*)
   - Coronoid fossa
   - Deltoid tuberosity (*Why this name?______________*)

2. Ulna
   - Olecranon process
   - Trochlear notch
   - Coronoid process
   - Radial notch (*Which end of the radius articulates here – proximal or distal?______________*)
   - Styloid process (*Find this on your own wrist…on your partner’s wrist.*)

3. Radius
   - Radial head
   - Radial neck
   - Radial tuberosity
   - Styloid process
   - Ulnar notch (at distal end)

4. Carpals (8, = wrist)

5. Metacarpals (1-5, = hand)
   *Where is the PIP joint of the 2nd digit?______________*
   *Where is the MP joint of the 5th digit?______________*

6. Phalanges (1-5, = fingers)
   - Proximal phalanx
   - Middle phalanx
   - Distal phalanx
C. Pelvic Girdle

1. Innominate (Os Coxa)
   - Ilium
     - Iliac fossa
     - Iliac crest
     - Anterior inferior iliac spine
     - Anterior superior iliac spine
       (Find this landmark on your left side...on your partner.)
     - Posterior inferior iliac spine
     - Posterior superior iliac spine

   - Ischium
     - Ischial tuberosity (on which you sit!)
     - Ischial spine

   - Pubis
     - Pubic crest
     - Pubic symphysis
     - Superior pubic ramus (ascending)
     - Ischiopubic ramus (inferior or descending)

   Acetabulum

    Obturator foramen (with membrane)

2. Sacrum
   - Median sacral crest
   - Sacral foramina (What structures pass through these foramina?
     ________________________________)

3. Coccyx

D. Lower Appendages (legs)

1. Femur
   - Femoral head
   - Greater trochanter
   - Lesser trochanter
   - Intertrochanteric crest
   - Femoral neck
   - Linea aspera
   - Medial condyle
   - Lateral condyle
   - Medial epicondyle
   - Lateral epicondyle

   Where does a “hip fracture” most often occur?
   ________________________________
Fovea capitis

2. Patella
   Patellar ligament
   Patellar tendon
   *(What is the difference between a tendon and a ligament?)*

3. Fibula
   Head of fibula
   Lateral malleolus *(Find this on your right ankle…on your partner.)*

4. Tibia
   Medial condyle
   Lateral condyle
   Intercondylar eminence (or spine)
   Tibial tuberosity
   Medial malleolus *(What bones are broken in a tri-malleolar fracture?)*
   Anterior border (or crest)

5. Tarsals (7, = ankle)
   Which bone is the calcaneus?

6. Metatarsals (1-5, = foot)

7. Phalanges (1-5, = toes)
   Proximal phalanx
   Middle phalanx
   Distal phalanx

**AXIAL SKELETON**

A. Cranium

**Unpaired bones of the Cranium**

1. Occipital
   External occipital protuberance
   Foramen magnum *(What structure passes through here?)*
   Occipital condyles *(These articulate with)*
   Superior nuchal line
   Inferior nuchal line

2. Frontal
   Frontal sinus
   Supraorbital margin
   Supraorbital foramen

3. Sphenoid
   Greater wings
(Sphenoid, cont’d)

Lesser wings
Sella turcica (*Which gland lies here?_______________*)

Medial pterygoid processes
Lateral pterygoid processes

4. Ethmoid
Cribiform plate (*What pair of structures is found here?_______________*)
Perpendicular plate of the Ethmoid
Crista galli
Ethmoid sinuses (cells)
Middle nasal conchae (aka turbinates)
Superior nasal conchae

5. Vomer

6. Mandible
Mandibular head (condyle) (*articulates with _________________*)
Coronoid process
Mandibular notch (b/w coronoid process and condyle)
Ramus
Angle
Alveolar process (margin of mandible which holds teeth)
Mental foramen

7. Hyoid

*Paired bones of the Cranium*

8. Parietal

9. Zygomatic bone (aka Zygoma)
Infraorbital margin

10. Nasal (*Differentiate between the zygomatic arch and the zygomatic bone.______________________________*)

11. Temporal
Squamous portion
Zygomatic process
Mastoid process
External acoustic (auditory) meatus
Styloid process
Mandibular fossa
12. Lacrimal
   Lacrimal groove *(What structure lies here?)*

13. Inferior Nasal Conchae

14. Palatine
   Horizontal plate

15. Maxilla
   Palatine process
   Alveolar process
   Sinus (there are two of these…)
   Infraorbital foramen
   Anterior nasal spine

16. Other features of the Skull:
   **Sutures:**
   Coronal (frontal)
   Lambdoidal
   Squamosal
   Sagittal

   **Fontanels:** (in fetus & neonate)
   Sphenoid (anterolateral)      Mastoid (posterolateral)
   Anterior                    Posterior

   Find the **optic foramina** & list the bones that make up the **orbit**.

B. **Vertebral Column**

1. Types of vertebrae
   Cervical (C1-C7)       …*breakfast at 7*
   Thoracic (T1-T12)     …*lunch at 12*
   Lumbar (L1-L5)        …*dinner at 5*
   Sacral (5, fused to form sacrum)
   Coccygeal (4, fused to form coccyx)

2. Parts of a typical vertebrae
   Vertebral foramen
   Transverse processes
   Spinous process
   Lamina
   Body
   Pedicle
   Superior and Inferior articulating facets
   Intervertebral foramina *(b/w vertebrae; significance?)*
3. Be able to identify by name the first two cervical vertebrae
   C1: Atlas
   C2: Axis
   Dens (odontoid process of axis)
4. Be able to distinguish between the types of vertebrae
   **Cervical** - by the presence of transverse foramina
   *(what structures pass through these foramina?)*
   **Thoracic** - by the presence of facets that articulate with
   the rib head and rib tubercle
   **Lumbar** - by the absence of the above characteristics, and
   by the thickness of the body and processes
5. Vertebral Curves *(which of these are concave, and which are convex?)*
   Primary (present at birth)
   Thoracic ________________
   Sacral ________________
   Secondary *(when do these develop? at different times?)*
   Cervical ________________ Lumbar ________________

6. Sacrum
   Median sacral crest
   Sacral foramina

7. Coccyx

C. **Thoracic (Rib) Cage**

1. Sternum
   Manubrium
   Body (Gladiolus)
   Xiphoid process
   Clavicular notch
   Jugular notch

2. Ribs
   Vertebrosternal (7)
   Vertebrochondral (3)
   Vertebral (2)
   *(features:)*
   costal cartilage
   head of rib
   tubercle of rib

Identify the type of vertebra, and the landmark beneath the tip of the pointer.