Osteology of the Human Body

Without the skeletal system, you would be unable to engage in activities such as walking or grasping objects in your hand. Since the skeleton forms the internal framework of the body, a familiarity with the names, shapes, and features of individual bones will help you understand some of the movements that the human body can perform.

1. Number and major subdivisions of bones

**Average # of bones = 206**

2 major subdivisions:
- **Axial skeleton**
- **Appendicular Skeleton** (appendages)
2. Types of bones

(a) Long bone
(e.g., humerus of arm)

* bones that are longer than they are wide
* found only in appendicular skeleton
* has a diaphysis and 2 ephipyses

ex) humerus, radius, ulna, metacarpals, phalanges
femur, tibia, fibula, metatarsals, phalanges

(b) Short bones
(e.g., carpals of wrist)

* bones that are roughly cube shaped or spheroid

ex) carpals – wrist bones (8 per side)
tarsals – ankle bones (7 per side)

(c) Flat bone
(e.g., parietal bone of skull)

* bones that are thin, flattened and somewhat curved

ex) ribs, sternum, scapula and many bones of the skull

d) Irregular bone
(e.g., vertebra)

* bones that do not fit into the above categories

ex) vertebrae, hip bones, many bones of face

e) Sesamoid bone
* short bone located within a tendon

ex) patella
f) sutural bones
*small bones within a cranial suture
*variable in number
*may or may not be present

3. Surface features of bones

*bones are not smooth
*have a variety of bumps, depressions and holes.
*Most all features have a function

1. attachment site for ligament or tendon
2. tunnel for blood vessels and nerves
3. articulation to another bone

process: a very general term used for a part of a bone that sticks out or protrudes

a. Depressions or openings on bones

foramen
*a round or oval hole through a bone. Blood vessels and nerves pass through
   ex) foramen magnum)

fossa
*a shallow depression on a bone
   ex) mandibular fossa

groove or sulcus
*a deep scratch or long, narrow depression on a bone

meatus
* a bony passageway through a bone
   ex) external auditory meatus
b. Processes where a bone articulates with another bone

condyle
*a smooth, rounded, knuckle-like projection
   ex) distal femur

*head
a bony expansion at the end of a bone. Often rounded or spherical
   ex) proximal femur and proximal humerus

*trochlea
a pulley-shaped projection of bone
   ex) distal humerus

*facet
a small flat, smooth surface on a bone
   ex) b/t vertebrae where they articulate with each other

c. Processes where a bone attaches to a tendon or ligament

crest
*a narrow, raised ridge of bone, usually quite prominent
   ex) iliac crest

line or linea
*a narrow raised ridge of bone, usually quite subtle
   ex) epiphyseal line

malleolus
*a blunt projection at the end of a bone.
   ex) distal ends of tibia and fibula

spine
*a sharp, slender, often pointed projected
   ex) scapula

trochanter
*a very large, blunt, irregularly-shaped lump of bone
   ex) two of proximal femur
tubercle
* a small, rounded projection of bone
  ex) two at proximal humerus

tuberosity
* a large, rounded projection of bone
  ex) radial tuberosity
  tibial tuberosity

THE AXIAL SKELETON
  - forms the longitudinal axis of the body
  - 80 bones
  - includes: 1) skull, 2) hyoid, 3) vertebral column, and 4) rib cage

4. The skull - (28 bones)
   a) bony regions of skull

* subdivided into 3 regions:
  cranial bones
  facial bones
  auditory ossicles

   b) cranial bones (8) (cranium)

* bones that surround and protect the brain
* either flat or irregular bones
  parietal          occipital
  temporal          sphenoid
  frontal           ethmoid
c) facial bones (14)

*bones that comprise the face
*most are irregular bones

Functions:
  Protect sensory organs (eye, nose, tongue)
  Provide attachment sites for muscles of facial expression

| Maxillary | lacrimal | planum
| Nasal     | zygomatic| nasal conchae
|           |          | Vomer
|           |          | mandible

d) auditory ossicles (3 per side)

*Very small bones located within temporal bone.
*All 3 are irregular bones

Function: transmit sound vibrations in middle ear
  Ex) malleus – hammer
      Incus – anvil
      Stapes - stirrup

5. Hyoid (1 bone)

*a thin, u-shaped bone located interior to tongue.
*Has no articulations to any other bone

Functions: Attachment site for muscles of tongue & neck
  Allows for speech
6. Fontanels

*At birth, cranial bones do not touch one another. This allows flexibility of skull during childbirth. It also allows for rapid growth of brain.

*These “soft spots” consist of skin and a sheet of connective tissue. Usually bones grow together and fontanel disappears by 1 year of age.

7. Cranial sutures

*Strong union between 2 neighboring cranial bones.
*All involve parietal bone.

a) coronal - parietal bone unites with frontal bone

b) sagittal - 2 parietal bones unite on midline

c) lambdoidal- parietal bone unites with occipital bone.

d) squamosal – parietal one unites with temporal bone.

8. Vertebral column (26 bones) spine/backbone

Subdivided into 5 regions

- Cervical (___________) 7 bones
- Thoracic (___________) 12 bones
- Lumbar (___________) 5 bones
- Sacral (___________) 5 fused vertebrae
- Coccyx (___________) 3-5 fused bones

Functions:

1. protection of spinal cord
2. support weight of head and trunk
3. allows for movement of head, neck and trunk
4. site for many muscle attachments
9. Typical vertebra

10. Rib cage = Thoracic cage (25 bones)

*A cone–shaped bony cage that forms the chest.

*Between adjacent ribs are intercostal muscles

Functions:
1. protection of heart and lungs
2. help process of breathing

a) sternum (1) (________________)

*located on anterior midline of thoracic cage
*articulates with: clavicle and ribs (1-7)

consists of 3 fused bones:
    manubrium (superior)
    body (middle)
    xiphoid process (inferior)
b) ribs (24)

*each rib is a thin, curved strip of bone  
*all are flat bones  
*12 per side

posterior attachment: thoracic vertebrae  
anterior attachment: costal cartilage (___________)

3 types of ribs:  
1. 1-7 are True Ribs (each costal cartilage touches sternum)  
2. 8-10 are False Ribs (each costal cartilage touches another costal cartilage  
3. 11 & 12 Floating Ribs (no costal cartilage) floats in muscle.

QUIZ #1!
THE APPENDICULAR SKELETON
- comprised of the bones of the upper and lower extremities
- 126 bones
- includes: 1) upper extremity, 2) lower extremity, and 3) pectoral and pelvic girdles

11. Pectoral girdle (2 bones per side)

- Attaches upper extremity to ribcage and vertebral column
- forms the shoulder

Calvical
- Anterior bone of girdle
- Medial attachment ➔ sternum
- Lateral attachment ➔ scapula

Scapula
- Posterior bone of girdle
- Medial attachment ➔ muscles to vertebral column
- Lateral Attachment ➔ humerus and clavicle

12. Upper extremity (30 per side)

- Attachment to pectoral girdle forms shoulder joint
  - Head of humerus
  - Glenoid cavity of scapula

- Series of 4 muscles stabilize the shoulder joint and permit movement of humerus
  - Rotator cuff

A. Humerus
   a. Largest and longest in Upper Extremity

B. Radius
   a. Lateral bone of forearm & Ulna – medial bone of forearm
C. Carpals – 8 per side
D. Metacarpals – 5 per side
E. Phalanges – 14 per side
   Thumb (pollex) –
      proximal and distal
         i. Proximal
         ii. Middle
         iii. distal

13. Pelvic girdle (1 per side)

   • attaches lower extremity to vertebral column
   • forms the hips

Hip bone:
  * consists of 3 fused bones: ilium, ischium and pubis
  * each has deep socket on lateral side
     =acetabulum

   • together, the L & R hip bones form the pelvic cavity. Junction of L & R pubis bones on mid-line is the pubic symphysis

Functions: protection of pelvic cavity organs
           Transmits weight of body onto lower extremity
14. Lower extremity (30 per side)

* attachment to pelvic girdle forms *hip joint*
  - head of femur
  - acetabulum of hip bone (socket for head of femur)

* hip joint is very stable but has little range of motion.

Femur – largest in body
Patella - sesamoid bone
Tibia – medial bone of lower leg
Fibula – lateral bone of lower leg
Tarsals – 7 per side
Metatarsals 5 per side
Phalanges -14 per side (proximal, middle and distal)
Hallux (big toe) only proximal and distal

15. Male vs. female pelvis

<table>
<thead>
<tr>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. pelvis tilted slightly posteriorly</td>
<td>1. Pelvis tilted slightly anteriorly</td>
</tr>
<tr>
<td>2. bones thicker, heavier, larger</td>
<td>2. Bones thinner, lighter, smaller</td>
</tr>
<tr>
<td>3. subpubic angle narrow (50°-60°)</td>
<td>3. Subpubic angle wide (80°-90°)</td>
</tr>
<tr>
<td>4. coccyx curves anteriorly</td>
<td>4. Coccyx curves posteriorly</td>
</tr>
<tr>
<td>5. pelvic outlet is narrow</td>
<td>5. Pelvic outlet is wide</td>
</tr>
</tbody>
</table>
16. Disorders
   a) cleft palate

   the bones forming the roof of the mouth fail to unite on midline.
   (Maxillary and palantine)
   commonly associated with cleft lip
   affects ability of infant to nurse leading to malnutrition
   treatment: surgical repair, usually between 1 and 2 years old
   http://www.youtube.com/watch?v=S95xz6901sw

   b) scoliosis

   An abnormal curvature of vertebral column, usually in
   thoracic region.
   *lateral curvature
   *due to
   1. Malformed vertebra or
   2. muscle paralysis on one side

   Treatment: back brace, physical therapy, surgery if severe.

   c) herniated disk

   slipped disk = ruptured disk
   intervertebral disks are made of: fibrocartilage and jelly-like
   material.
   If cartilage tears, jelly leaks out and pushes on spinal cord and
   spinal nerves

   Symptoms: numbness, pain, paralysis

   Treatment: physical therapy, surgical replacement
   http://www.youtube.com/watch?v=jZUwtSXpPgg
Bone Identifications

1. Axial Skeleton

a) skull (Figs. 7.2, 7.3, 7.4, 7.5, 7.7)

frontal - THE FRONT
parietal – LARGE SIDE PLATES
temporal – TEMPLES
- mandibular fossa SHALLOW DEPRESSION @ARTICULATION OF JAW
- mastoid process (breast-like bump, think mastectomy)
- external auditory me a tus (hole)
occipital - BASE OF SKULL
- foramen magnum BIG HOLE FOR SPINAL CORD
- occipital condyles ROUNDED AREA AROUND F. MAGNUM
sphenoid - LARGE SANDWICH PLATE THAT SPANS SKULL
ethmoid – 1 INCH BEHIND NOSE (BETWEEN ORBITS)
nasal ON THE NOSE
maxillary = maxilla ABOVE TEETH
zygomatic (CHEEK – LOWER ORBIT)

mandible (Fig. 7.13) JAW
- body FRONT JAW (SIDE TO SIDE)
- ramus SIDE JAW (UP AND DOWN)
- coronoid process SHARP ANGLE OF U
- condylar process ROUNDED ANGLE (BACK OF JAW)
- mental foramen (MENTAL MEANS CHIN – HOLE IN CHIN)
- mandibular foramen INDENTATION (INSIDE POSTERIOR JAW)
lacrimal – CONTAINS HOLE WHICH DUCTS FOR LIQUIDS
palatine – BACK OF PALATE
vomer STRAIGHT LINE THROUGH NOSE

zygomatic arch CHEEK ARCH
orbit EYE SOCKET

ALL SUTURES INVOLVE THE PARIETAL BONES
- coronal suture BEHIND FRONTAL BONES
- sagittal suture MIDDLE OF SKULL
- lambdoidal suture BEHIND PARIETAL
- squamosal suture AROUND TEMPORAL BONE THINNEST PART OF SKULL. (SQUAM – THIN OR FLAT)
b) hyoid bone  **ONLY BONE NOT ARTICULATING WITH ANOTHER.**

c) cervical vertebrae  
- transverse for amin  
- atlas  **1ST BONE OF VERTEBRAL COLUMN EXTENSIONS TO HOLD UP THE HEAD (YES)**  
- axis  **HAS PIVOT BONE PROJECTION (LIKE AXIS IN EARTH) (NO)**

d) thoracic vertebrae  **(12)**  
connected to ribs  
Parts of a ‘Typical’ Vertebra  (Fig. 7.17)  
- body  **wide part**  
- pedicle verticle  **“goal posts”**

e) lumbar vertebrae  **(5 in lower back)**  
- lamina  **- roof**  
- spinous process  **- spine**

f) sacral vertebrae = sacrum  
- sacral canal  
- transverse lines  **(fused horizontal lines)**  
- median sacral crest  **- bumpy crest of bones**

(g) coccygeal vertebrae = coccyx  **(between 3-5 fused bones) tail bone**

h) sternum  (Fig. 7.22)  
- manubrium  **UPPER PART MIGRATES 2 DIRECTIONS**  
- body  
- xiphoid process  **END MADE OF CARTILAGE?**

i) rib  (Figs. 7.22, 7.23)  
- head  **FACETED END ARTICULATES W/SPINE**  
- neck  **NEXT TO HEAD**  
- tubercle  **bump near neck of rib**  
- costal cartilage  **ATTACHMENT TO STERNUM**  
- true ribs  **(#1-7) ATTACH TO STERNUM**  
- false ribs  **(#8-10) INDIRECT ATTACHMENT TO STERNUM OR NOT AT ALL**  
- floating ribs  **(#11-12) ONLY ATTACH TO VERTEBRAE**

2. **Appendicular Skeleton**

a) clavicle  (Fig. 8.2)  **COLLAR BONE**  
- sternal extremity  **TOWARD STERNUM (LARGER END)**  
- acromial extremity  **SMALLER END**
b) **scapula** (Fig. 8.3)
- spine **SHARP**
- body **LARGE PLATE**
- glenoid cavity **FACETED PART**
- acromion **TIP OF SPINE (LARGER)**
- coracoid process **TIP OF SPINE (SMALLER)**

c) **humerus** (Fig. 8.4)
- head **PROXIMAL**
- greater tubercle **LARGER BUMP**
- lesser tubercle **SMALLER BUMP**
- body **DIAPHYSIS**
- trochlea **PULLEY**
- capitulum **ROUNDED**

d) **ulna** (Fig. 8.5) **HAS U SHAPE**
- olecranon **TOP OF U**
- coronoid process **BOTTOM OF U**
- styloid process **BUMP AT DISTAL END**

e) **radius** (Fig. 8.5) **HAS CIRCLE AT PROXIMAL END**
- head **LOOK FOR CIRCLE**
- radial tuberosity **LARGER LUMP**
- styloid process **THE BUMP AT DISTAL END**

f) **carpals** **WRIST**

g) **metacarpals** (Fig. 8.6) **PALM**
- base **(TOWARD CARPAL END)**
- shaft
- head

h) **phalanges** (Fig. 8.6) **FINGERS**
- proximal
- middle
- distal **THUMB ONLY HAS PROXIMAL AND DISTAL**

i) **pelvis** (Fig. 8.7)
- ilium, ischium, and pubis – **ilium (top), ischium (swelling), pubis (thin front)**
  - iliac crest **top line**
- acetabulum socket
- greater sciatic notch top notch. Most obvious
- lesser sciatic notch lower
- ischial spine part that separates 2 notches
- obturator foramen hole

j) femur (Fig. 8.10)
   - head ball
   - neck narrow part under the ball
   - greater trochanter (larger and toward the top)
   - lesser trochanter (smaller lower down)
   - body (diaphysis)
   - medial condyle on side with head – be sure to position anatomically correct position
   - lateral condyle

k) patella

l) tibia (Fig. 8.12)
   - medial condyle - same side as medial malleolus
   - lateral condyle – looking anterior, to the left
   - tibial tuberosity large bump
   - medial malleolus bump on side of shoe (same side as medial condyle)

m) fibula (Fig. 8.12)
   - head – more round part
   - lateral malleolus – more spatula-like part

n) tarsals (Fig. 8.13) 7 bones
   - calcaneus heel
   - talus – round part articulates with tibia

o) metatarsals (Fig. 8.13)
   - base – toward proximal end
   - shaft
   - head – toward distal end

p) phalanges (Fig. 8.13)
   - proximal
   - middle
   - distal