

# 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.

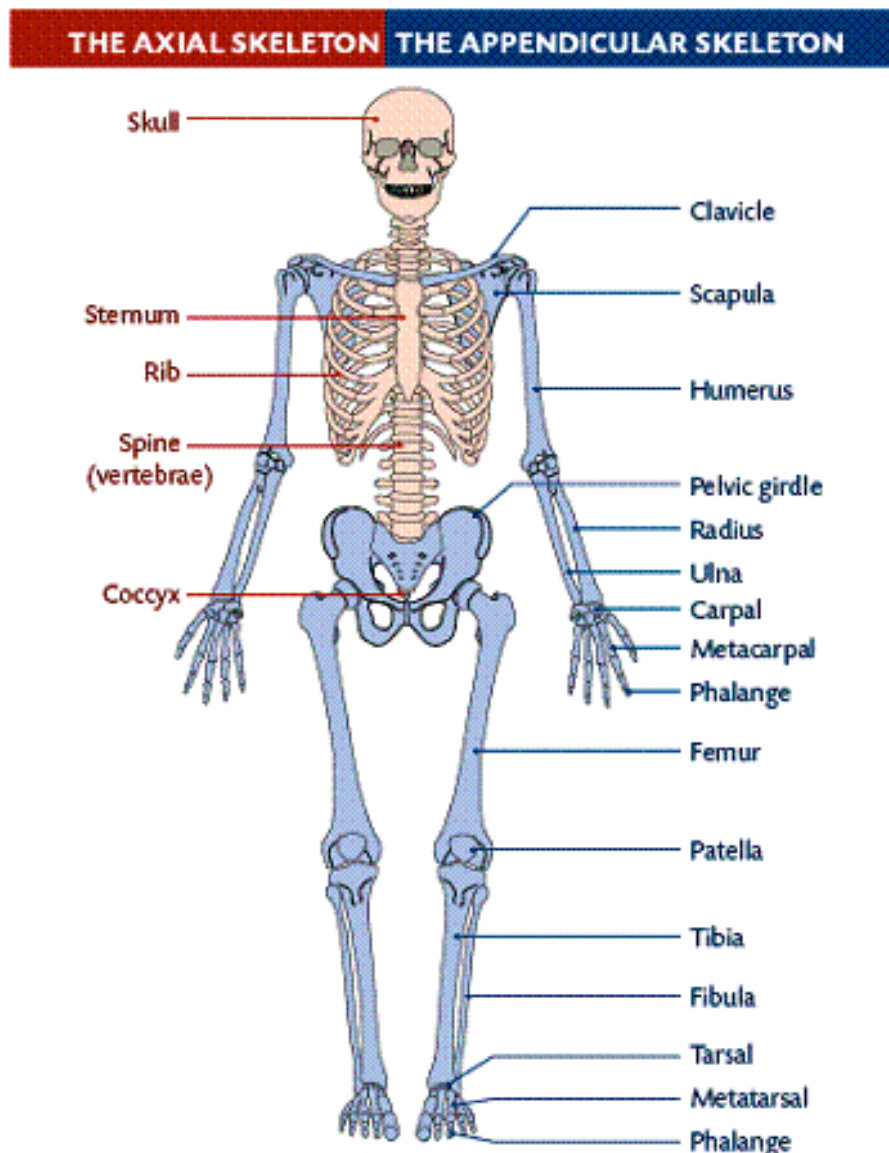
## 1. Number and major subdivisions of bones

**Average # of bones = 206**

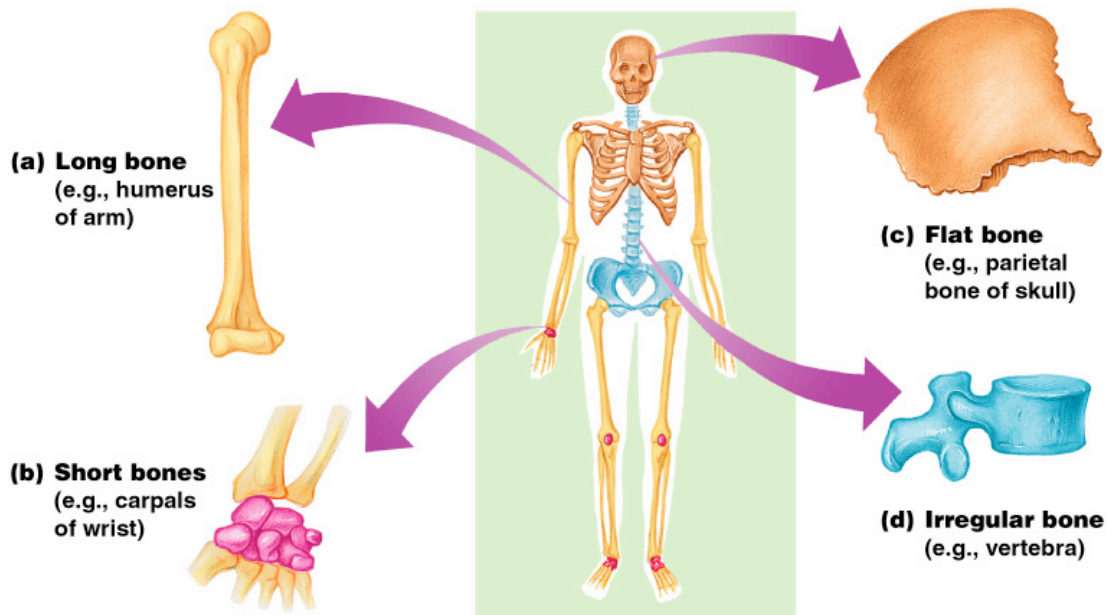
## 2 major subdivisions:

**Axial skeleton**

**Appendicular Skeleton (appendages)**



## 2. Types of bones



### a) long bones

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

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

### b) short bones

- \*bones that are roughly cube shaped or spheroid
- ex) carpals – wrist bones (8 per side)  
tarsals – ankle bones (7 per side)

### c) flat bones

- \*bones that are thin, flattened and somewhat curved
- ex) ribs, sternum, scapula and many bones of the skull

### d) irregular bones

- \*bones that do not fit into the above categories
- ex) vertebrae, hip bones, many bones of face

### e) sesamoid bones

- \*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) distals 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**

**Nasal**

**lacrimal**

**zygomatic**

**planine**

**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. Fontanel

**\*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

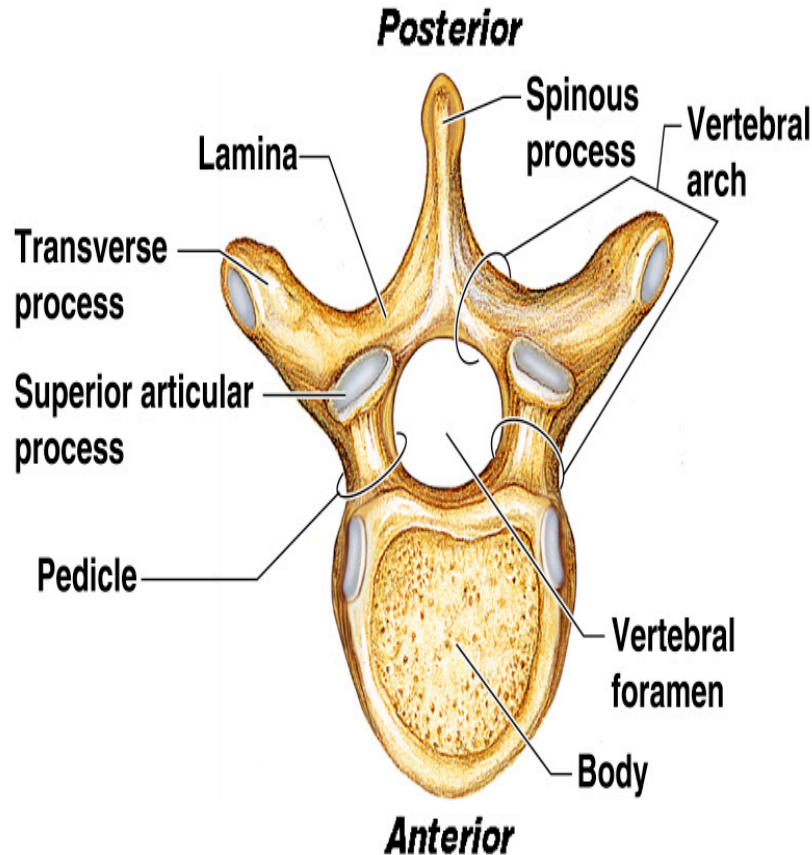
**Subdivided into 5 regions**

- Cervical ( ) 7 bones**
- Thoracic ( ) 12 bones**
- Lumbar ( ) 5 bones**
- Sacral ( ) 5 fused vertebrae**
- Coccygeal ( ) 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**

#### Clavical

**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**

**MALE**

- 1. pelvis tilted slightly posteriorly**
  
- 2. bones thicker, heavier, larger**
  
- 3. subpubic angle narrow (50° -60°)**
  
- 4. coccyx curves anteriorly**
  
- 5 pelvic outlet is narrow**

**FEMALE**

- 1. Pelvis tilted slightly anteriorly**
  
- 2. Bones thinner, lighter, smaller**
  
- 3. Subpubic angle wide (80° -90°)**
  
- 4. Coccyx curves posteriorly**
  
- 5. Pelvic outlet is wide**

## 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.**

<http://www.spinemd.com/operative-treatments/adolescent-scoliosis-correction-reston-va.php>

### 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 meatus (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)

lacrima – 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 foramin
  - atlas **1<sup>ST</sup> 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**
- e) lumbar vertebrae (5 in lower back)
- 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