RECOGNIZING HUMAN AND NON-HUMAN SKELETAL REMAINS

A Field Guide for Cultural Resource Professionals, Search & Rescue Teams, and Law Enforcement

Updated June 8, 2018

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- IMAGES IN THIS GUIDE ARE NOT TO SCALE -

HSU Anthropology 1 Human Skeleton Field Guide
GENERAL TIPS & GUIDELINES & TIPS

- Always contact the coroner’s office (or local law enforcement) if confirmed or suspected human remains are found, and also include the local tribal office for ancient bone or other bones on tribal lands. If unsure, contact both.

- Avoid removing bones from their context without first documenting in-situ with photographs and mapping/GPS.

- If uncertain, it is best to not guess. It takes years of training and hands-on handling of bones to readily recognize materials in the field without comparative materials. It is recommended to include an anthropologist if skeletal remains are buried, scattered, fragile, or difficult to identify – anthropologists are trained to identify and excavate small and fragile remains that may otherwise be lost or damaged.

- If sending a photograph for expert consultation, include a scale (or an item of known size, like a coin or pen) for reference, and take multiple angles.

- When attempting to differentiate between human bone and nonhuman animal bone, look first for obvious signs that indicate the remains are unlikely to be human:

  Signs of a nonhuman animal:

  - Antlers/horns on the cranium, or nodules where antlers/horns have fallen off (deer remains are often confused with human, and this will help).

  - Teeth that do not look like human teeth (check out your own or those of a partner for visual reference).

  - Large amounts of adherent fur that does not appear to look like human hair.

  - Hoofs or claws on the hands or feet (remains of bears appear very similar to humans, but have distinct claws).

    *Look carefully to ensure nonhuman remains are not comingled with human.*

- Juvenile human remains are more likely to be confused with non-human remains, as they lack development of many of the features readily identifiable as human. If suspected juvenile remains are encountered, it is recommended to contact an expert.

- When looking for human remains, use yourself as a guide – think about the size of the bone and where it might fit in your body.
SUGGESTED REFERENCES

Books:

The Human Bone Manual
Author: Tim White
ISBN: 0120884674
Description: This book includes many detailed photographs with multiple views, tips on identifying any human bone/tooth, and gives a list of referred readings. It is smaller and handy for the field.

Mammalian Osteology
Author: B. Miles Gilbert
ISBN: 0943414717
Description: This is a great quick reference book, with facts about mammal bones, descriptions and precise drawings. The book even has a section for preparing skeletons.

Comparative Osteology: A Laboratory and Field Guide of Common North American Animals
Authors: Bradley Adams and Pam Crabtree
ISBN: 0123884373
Description: This book has excellent diagrams/photos of bones from multiple animals, for easy comparison. It also shows different planes of the body and views of bones. It was designed as a laboratory field guide and is quite practical.

Juvenile Osteology: A Laboratory and Field Manual (Laboratory & Field Manual)
Authors: Sue Black, Maureen C. Schaefer, and Louise Scheuer
ISBN: 0123746353
Description: This book has many images of human skeletons/bones at different stages in life (since the skeleton changes over time). It also has nice charts giving the age and ordinary size of each bone, as well as if it came from a male or female. This is another practical resource.

Websites:

eSkeletons
http://www.eskeletons.org/boneviewer/nid/12537/region/skull/bone/cranium
This link will send you to www.eskeletons.org where you may see bones within the human body from different perspectives (anterior, posterior, inferior, lateral, and superior).

Chico Skull Module
http://www.csuchico.edu/anth/Module/skull.html
This website gives more information in words than in pictures. The pictures here may only be seen from one angle, but the site has some good information on the human skull.

Virtual Bison
http://www.uwyo.edu/reallearning/bisonindex.html
This link gives 3D images of Bison bones that you may rotate 360 degrees.
DISTINGUISHING BONE FROM OTHER MATERIALS

Bone is usually soft and can be easily scratched with metal. Bone will not “tink” when tapped with metal (as would much pottery or ceramic).

The outside (“cortical” bone) is relatively solid and uniform with small pits/holes. Fresh bone with flesh still decomposing may have a greasy feel, and when soft tissue is more decomposed and dried, there may be pieces of sinewy material adhering to the bone (this is a membrane called “periosteum” that covers the bone during life). Compared to other materials, bones also have short, dark (from soiling) porous cracks in the surface running the same direction. Bone that has been exposed to elements may also be sun-bleached, have surface exfoliation/peeling that may resemble wood, and may have roots growing through it.

Bone with carnivore chew marks

The inside of human bone ("cancellous" or "trabecular" bone) looks similar to a sponge or fine honeycomb inside of the outer hard cortical bone. Larger long bones (like the larger bones of the arms and legs) have a fairly distinct hollow space in the middle for carrying nutrients. In some bone fragments, this spongy bone may be worn off or not present.

In human long bones, the outer (cortical) bone is thin (total of about ¼ of shaft diameter) and inner trabecular (spongy) bone is present (although may be minimal or lost over time). In nonhuman animals, the cortical bone is thicker (about ½ of shaft diameter), and trabecular bone is absent. Nonhuman animal bone is also less porous than human bone.
MODERN VS. ARCHAEOLOGICAL BONE

If human skeletal remains are identified, one challenge is to determine if they are recent or ancient. Note: Always contact the coroner’s office (or local law enforcement) for any bone, and also include the local tribal office for ancient bone or other bones on tribal lands. If unsure, contact both. Avoid removing bones from their context without first documenting in-situ with photographs and mapping/GPS. It is recommended to include an anthropologist if skeletal remains are buried, scattered, fragile, or difficult to identify (anthropologists are trained to identify and excavate small and fragile remains that may otherwise be lost).

- **Modern (recent) bone:**
  - Modern bone is likely to be heavier compared to ancient bone.
  - Adherent soft tissue under “normal” circumstances generally indicates degradation for less than approximately 5 years. However, these things may be absent, and soft tissue can degrade quickly in some environments.
  - Soapy texture of the surface indicates less than a few decades degradation.
  - Evidence of modern medical intervention (e.g., dental fillings, surgical plates or sutures).
  - Cultural artifacts are also useful (clothing, jewelry, etc…).

- **Ancient bone:**
  - Older bone (older than a few years), usually has no adherent tissue.
  - Older bone tends to be stained by the color of the surrounding soil, although staining can diminish with exposure, and recent bone can also be stained.
  - Ancient bone is likely to be more degraded, drier, and more pitted, resulting in a lighter weight.
  - A crumbling texture generally indicates a century or more of decomposition.
  - Like modern bone, it is useful to notice the context of the remains and cultural artifacts.

- **Ancestry & ancient bone:** It is important to distinguish if bone is modern or ancient, particularly because ancient remains in the US are ancestral to modern Native American peoples, who have jurisdiction over the remains. It is very difficult and often impossible to identify ancestry by looking at skeletal remains. This is especially difficult when it comes to postcranial remains and bone fragments, but an expert osteologist may be able to estimate ancestry within a margin of error. In many cases, it may be more reliable to estimate ancestry by the context of the remains and associated cultural artifacts, and also behavioral evidence such as in the dentition (see dentition section of this guide).
ANATOMICAL TERMS OF LOCATION
- to help understand images on following pages -

Anterior/Posterior: Anterior refers to the front of an organism; posterior refers to the back. For example, the nose is anterior to the rest of the face, and therefore the rest of the face is posterior to the nose.

Superior/Inferior: Superior means ‘above’ and inferior means ‘below.’ The chest is therefore superior to the pelvis and both the chest and the pelvis are inferior to the head.

Medial/Lateral: Medial refers to the middle of an organism; lateral means ‘away from the middle.’ For example, the spinal column is medial to the ribs, and therefore the ribs are lateral to the spinal column.

Proximal/Distal: Proximal means ‘close to the body,’ and distal means ‘toward the extremity’ or ‘away from the body.’ The forearm is therefore proximal to the hand, and the hand is distal to the forearm. Both are distal to the shoulder.

Left/Right: Left and right always refers to the subject’s left or right, just like when we talk about somebody being left or right handed.

Here are some useful terms for describing things on the skeleton:
- **Fossa**: A dip/cavity. “Depression” is also a good anatomical term.
- **Foramen**: A hole where nerves/blood vessels pass.
- **Ridge**: A longish raised area (e.g., brow ridge, nuchal ridge).
- **Crest**: A sharp projection that is long.
- **Process**: A bump where muscle attaches.
- **Other useful terms**: Robust, gracile, projecting, sloping, protruding, sharp.
HUMAN SKELETON (*Homo sapiens*)

- Frontal
- Temporal
- Nasal
- Orbit
- Maxilla
- Mandible
- Cervical Vertebrae
- Clavicle
- Sternum
- Costal cartilages
- Xiphoid Process
- Floating rib
- Lumbar vertebrae
- Ilium
- Sacrum
- Coccyx
- Pubis
- Ischium
- Femur
- Patella
- Tibia
- Fibula
- Talus
- Metatarsals
- Phalanges
- True ribs
- Humerus
- False ribs
- Radius
- Ulna
- Carpals
- Metacarpals
- Phalanges

IDENTIFYING HUMAN BONES

HUMAN CRANIUM

Human cranium - anterior (front) view NOT TO SCALE

Images modified from eSkeletons.org, copyright eSkeletons, John Kappelman, or the University of Texas at Austin, and licensed by Creative Commons https://creativecommons.org/licenses/by-nc-sa/2.0/
Human cranium - posterior (back) view NOT TO SCALE

Images modified from eSkeletons.org, copyright eSkeletons, John Kappelman, or the University of Texas at Austin, and licensed by Creative Commons https://creativecommons.org/licenses/by-nc-sa/2.0/
Human cranium - inferior (bottom) view, mandible (jaw) removed NOT TO SCALE

Image modified from eSkeletons.org, copyright eSkeletons, John Kappelman, or the University of Texas at Austin, and licensed by Creative Commons https://creativecommons.org/licenses/by-nc-sa/2.0/
AGE & CRANIAL SUTURES
The joints between the cranial bones are known as sutures. In newborns, there is an anterior and a posterior fontanelle (“soft spot”) where the bones are not joined. The cranial sutures are generally easily visible in young adults. As individuals age, the sutures gradually become less distinct. Some tend to fully fuse and disappear (“obliterate”) at known average ages, including:

- **Sagittal suture** (between two parietal bones): 22 years
- **Coronal suture** (between frontal and parietals): 24 years
- **Squamosal suture** (between temporal and parietal bone): 60 years
HUMAN MANDIBLE ("Lower jaw")

Mandible - lateral (side) view NOT TO SCALE

Mandible - occlusal (superior) view NOT TO SCALE

Images modified from eSkeletons.org, copyright eSkeletons, John Kappelman, or the University of Texas at Austin, and licensed by Creative Commons https://creativecommons.org/licenses/by-nc-sa/2.0/
HUMAN DENTITION

Mammals have four types of teeth. The number of each type in each quadrant (quarter) of the mouth in a species is the dental formula, with a line between the maxillary (top) and mandibular (bottom) teeth. The adult human dental formula is 2:1:2:3 / 2:1:2:3 - in each quadrant of the mouth we have (as adults) 2 incisors, 1 canine, 2 premolars, and 3 molars. The third molar is the “wisdom” tooth. Humans variably have missing teeth due to pathology or dental work.

Deciduous teeth: Humans have two sets of teeth, the permanent (shown above) and the deciduous (aka “baby”). Teeth form in the bone before they erupt. Deciduous teeth begin to erupt starting as early as a few months old, completing around age 2-3. The full deciduous dental formula is 2:1:0:2 (5 teeth in each quadrant). Deciduous teeth begin to fall out around age 6 years, when the permanent teeth come in behind (molars) or under deciduous teeth.

Permanent Tooth Eruption

| Age     |)
|---------|)
| 6-8 years| l1 l2 |
| 7-9 years| C |
| 9-12 years| P1 |
| 10-12 years| P2 |
| 6-7 years| M1 |
| 11-13 years| M2 |
| 17-21 years| M3 |

Deciduous Tooth Eruption

| Age     |)
|---------|)
| 7-12 months| d1 d2 |
| 7-12 months| d |
| 2 years | d |
| 3 years | d |

KEY
I Incisor
C Canine
P Premolar (bicuspids)
M Molar
d Deciduous

HUMAN MALE VS. FEMALE SKULL

With substantial practice and comparative specimens to reference, it is sometimes possible to visually estimate if a cranium belongs to a male or female, but it is also common for crania to display a combination of traits that do not clearly indicate biological sex. This analysis is often more accurate with use of metric analysis performed by an anthropologist. In general, male skulls tend to be more robust, with more prominent features such as brow ridges, mastoid processes, and neck muscle ("nuchal") attachments, and the mandible makes a more acute (smaller) angle closer to 90 degrees.

Example female skull (Source: Smithsonian Institution)

Example male skull (Source: Smithsonian Institution)
Example male skull

Example female skull

NATIVE AMERICAN ANCESTRY (SKULL & DENTITION)

Although still very difficult and often impossible, it is more plausible to determine ancestry from the skull and dentition versus other bones. Some comparative data on the skull and dentition is included here in case it is useful in helping to distinguish early Native American and European skeletons/burials that professionals might encounter. However, these characteristics are inconsistent across time and ancestral groups. Whereas an overall consideration of these characteristics may be useful in some cases, they should not be taken as conclusive. It is often more useful to consider how old the bone looks (see modern vs. archaeological bone previously discussed), the context of the remains, associated cultural artifacts, and a close inspection of the dentition for traits that would suggest early Native American heritage.

If working with a complete or nearly complete skull that you suspect may not be recent, these characteristics may indicate Native American versus of European ancestry (characters below are Native American compared to European ancestry) (seek expert consultation):

- Heavier brow ridges (on frontal bone beneath the eyebrows) (not as evident in females).
- Heavy glabellar region (on frontal bone between eyebrows) (not as evident in females).
- Wider face and shorter, broader cranial vault. Cranium elongated anteriorly to posteriorly.

- **Shovel shaped incisors (Native American ancestry)** (may also be present in those with a small % of Native American ancestry, and may not be present in all Native American individuals)

Below: NOT shovel-shaped incisors (European ancestry)
- **Worn teeth** suggesting working materials or a consumption of abrasive foods, **no dental work/fillings**

- **Physical alterations to dentition.** Once a tooth crown is fully developed, enamel and dentine are subject only to physicochemical changes. Interest here is with alterations of the tooth crown, which indirectly reflect four classes of human behavior: (1) dietary, (2) implemental, (3) incidental cultural, and (4) intentional cultural.

1. **Dietary** - Wear occurs on the chewing (“occlusal”) surfaces of teeth as teeth rub together and on food. Accumulated wear with age and consumption of abrasive foods cause greater occlusal “attrition.” Some Native American cultures consumed more abrasive foods, such as shellfish, and some tough plants, or foods with grit from grinding stones.

   Image: Pronounced crown wear in a medieval Norwegian (Scott)

2. **Implemental** - Tooth wear and loss from using teeth as tools to hold, pry, scrape, etc

3. **Incidental cultural behavior** – this includes behaviors such as pipe smoking (can create oval notches).

4. **Intentional cultural modification** – Intentional tooth modifications take several forms, including chipping/filing of incisors and canines, engraving patterns, drilling small holes to embed metals (e.g., gold) or stones (e.g., turquoise) (images below from Scott).
HUMAN POSTCRANIA
(IMAGES NOT TO SCALE)

HYOID – A u-shaped bone in the throat (the “wishbone”) (IMAGES NOT TO SCALE)


VERTEBRAE – The human skeleton has 24 total vertebrae connecting the cranium to the pelvis. Occasionally humans have a missing or extra vertebrae, and in some cases vertebrae are fused to each other or to the cranium or pelvis.

7 cervical (neck) vertebrae. have two extra foramina (holes) (IMAGES NOT TO SCALE)

Typical cervical vertebra

First cervical vertebra (C1) – it has no “body:

Second cervical vertebra (C2) – it has an extra process

Image Source: eSkeletons
12 thoracic vertebrae correspond with the ribs in the upper back (IMAGES NOT TO SCALE)

Superior view  Lateral view

Image Source: eSkeletons

5 lumber vertebrae in the lower back (IMAGES NOT TO SCALE)

Superior view  Posterior view

Image Source: eSkeletons

Vertebrae of infants are unfused and may be found in pieces (IMAGES NOT TO SCALE)

Infant C1  Adult C1  Infant C2  Adult C2


Adults over approx. 40 years old may show arthritic lipping / bony growth.
THORAX: STERNUM and RIBS (IMAGES NOT TO SCALE)

**Sternum**: The bone in the middle of the chest (the “breast bone”). It has two main parts – the manubrium at the top, and the body. A smaller piece at the bottom is the xiphoid process.

![Sternum](image-source)
**Ribs:** Humans have 24 ribs (12 on each side). They are about as wide as a finger, but flat. (IMAGES NOT TO SCALE)
SHOULDER (CLAVICLE & SCAPULA) (IMAGES NOT TO SCALE)

**Clavicle:** An s-shaped bone at the top of the chest (aka “collar bone”)

![Clavicle Image](image-source)

**Scapula** (aka “shoulder blade”)

![Scapula Image](image-source)
Scapula (aka “shoulder blade”) (IMAGES NOT TO SCALE)
(lateral view – arm socket)

Image Source: eSkeletons
ARM (HUMERUS, RADIUS, ULNA) (IMAGES NOT TO SCALE)

**Humerus** – The upper arm bone.

Anterior view

Anterior view (superior aspect)

Posterior view (inferior aspect)

Image Source: eSkeletons
Radius & Ulna – Two lower arm bones. (IMAGES NOT TO SCALE)

<table>
<thead>
<tr>
<th>Radius (anterior view)</th>
<th>(anterior view, superior aspect)</th>
<th>Ulna (anterior view)</th>
<th>Lateral view (superior aspect)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Radius Image" /></td>
<td><img src="image" alt="Radius Image" /></td>
<td><img src="image" alt="Ulna Image" /></td>
<td><img src="image" alt="Ulna Image" /></td>
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<tr>
<td><img src="image" alt="Radius Image" /></td>
<td><img src="image" alt="Radius Image" /></td>
<td><img src="image" alt="Ulna Image" /></td>
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<td><img src="image" alt="Radius Image" /></td>
<td><img src="image" alt="Ulna Image" /></td>
<td><img src="image" alt="Ulna Image" /></td>
</tr>
</tbody>
</table>

Image Source: eSkeletons

Posterior view (inferior aspect)
Juvenile – Arm bones of juveniles. Notice the ends (epiphyses) are not attached, making it difficult to identify the elements. The elbow fuses at ~ 15 years, and the shoulder ~ 20 years. (IMAGES NOT TO SCALE)
HAND – Unless held together by soft tissue, the hand will disarticulate into 27 separate bones: 14 finger bones (phalanges), 5 in the palm (metacarpals), and 8 wrist (carpals).

(IMAGES NOT TO SCALE)

(below: left hand, anterior (palmar) view)

Image modified from eSkeletons.org, copyright eSkeletons, John Kappelman, or the University of Texas at Austin, and licensed by Creative Commons https://creativecommons.org/licenses/by-nc-sa/2.0/
PELVIS: SACRUM, COCCYX, INNOMINATES (OS COXAE) (IMAGES NOT TO SCALE)

Innominate (os coxae) - The two “hip bones” that make up the sides of the pelvis. Without soft tissue, they disarticulate from the sacrum. The pelvis can be used to help determine sex. In a female, the pelvis inlet is rounder and larger, the sacrum is flatter (less curved in), broader, and shorter, the angle made by the bottom of the two innominates is broader.

Female pelvis (os coxae + sacrum) (superior view)

Male pelvis (os coxae + sacrum) (superior view)
• In the anterior view, notice the large hip socket (acetabulum) where the femur articulates.

Female pelvis (os coxae + sacrum) (anterior view)

Male pelvis (os coxae + sacrum) (anterior view)
Sacrum – posterior, center of the pelvis (base of spinal column) (IMAGES NOT TO SCALE)

Juvenile innominate (os coxae) – The innominate bones are formed by the fusion of three separate bones, which are unfused in juveniles. Below is a lateral view of all three:

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year old</td>
<td></td>
</tr>
<tr>
<td>6 years old</td>
<td></td>
</tr>
</tbody>
</table>

Coccyx – the “tail bone” (articulates at the bottom of the sacrum)

LEG: FEMUR, TIBIA, FIBULA, PATELLA (IMAGES NOT TO SCALE)

**Femur** – The upper leg bone (aka “thigh bone”) is the largest bone in the human body.

Image Source: eSkeletons
**Tibia, fibula, and patella** – two lower leg bones and “knee cap” (IMAGES NOT TO SCALE)

<table>
<thead>
<tr>
<th><strong>Tibia</strong> (anterior view)</th>
<th><strong>Tibia</strong> (superior view)</th>
<th><strong>Fibula</strong> (anterior view)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Tibia (anterior view)" /></td>
<td><img src="image2" alt="Tibia (superior view)" /></td>
<td><img src="image3" alt="Fibula (anterior view)" /></td>
</tr>
<tr>
<td><img src="image4" alt="Tibia (inferior view)" /></td>
<td><img src="image5" alt="Tibia (inferior view)" /></td>
<td></td>
</tr>
<tr>
<td><img src="image6" alt="Patella (anterior view)" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Image Source: eSkeletons*
**Juvenile** – Leg bones of juveniles are still growing, so the ends (epiphyses) are not fused. (The femur completes fusing around age 18). (IMAGES NOT TO SCALE)

<table>
<thead>
<tr>
<th></th>
<th>Femur</th>
<th>Tibia</th>
<th>Fibula</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year</td>
<td>6 years</td>
<td>1 year</td>
<td>6 years</td>
</tr>
</tbody>
</table>

FEET – Unless held together by soft tissue, the foot will disarticulate into 26 separate bones: 14 toe bones (phalanges), 5 in the arch (metatarsals), and 7 in the ankle (tarsals).

(IMAGES NOT TO SCALE)

(Left foot, superior view)
# DISTINGUISHING HUMAN AND NONHUMAN CRANIA

<table>
<thead>
<tr>
<th></th>
<th>Human</th>
<th>Nonhuman animal (will vary)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Braincase</strong></td>
<td>Large, round, high forehead (about size of a large grapefruit or small melon)</td>
<td>Small braincase, large muscle attachments (bumps and ridges)</td>
</tr>
<tr>
<td><strong>Face</strong></td>
<td>Flat, smooth</td>
<td>Long snout, large face</td>
</tr>
<tr>
<td><strong>Chin</strong></td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td><strong>Dental formula</strong></td>
<td>2:1:2:3 (but varies, often teeth are missing)</td>
<td>Varies – should never be 2:1:2:3 unless pathological</td>
</tr>
<tr>
<td><strong>Canine teeth</strong></td>
<td>Small (similar in size to other teeth)</td>
<td>Carnivores: Large</td>
</tr>
<tr>
<td><strong>Premolar and molar cusps (chewing surface)</strong></td>
<td>Low, rounded cusps separated with obvious grooves</td>
<td>Carnivores: Sharp, pointed. Herbivores: Broad, flat, parallel furrows &amp; ridges</td>
</tr>
<tr>
<td><strong>Foramen magnum</strong></td>
<td>Under center</td>
<td>Towards the back (posterior)</td>
</tr>
<tr>
<td><strong>Eye orbits</strong></td>
<td>Facing forward and above the nasal aperture (nose hole)</td>
<td>Diagonal or towards sides, behind the nasal aperture</td>
</tr>
<tr>
<td><strong>Mandible (lower jaw)</strong></td>
<td>U-shaped, one piece</td>
<td>V-shaped, with separation at the midline</td>
</tr>
</tbody>
</table>

## COMMON CONFUSIONS - CRANIA

**Fragmentary turtle shell.** Turtle shell has very “busy” sutures. Human cranial bones have more subtle sutures, and also make a “sandwich” of cortical bone and inner “spongy” trabecular bone.

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**Snapping turtle shell**

http://www.skullsunlimited.com/record_variant.php?id=4150

**Human cranial bone fragment**
**Dog mandible/cranium**—dogs have an elongated, narrow jaw with large canines, large molars, and a different dental pattern (3:1:4:2 / 3:1:4:2)

**Dog maxilla** (IMAGES NOT TO SCALE)

![Dog maxilla](http://www.vivo.colostate.edu/hbooks/pathphys/digestion/pregastric/dentalanat.html)

Source: http://www.vivo.colostate.edu/hbooks/pathphys/digestion/pregastric/dentalanat.html

**Dog cranium** (IMAGES NOT TO SCALE)

![Dog cranium](http://www.taxidermy.net)

Image source: http://www.taxidermy.net
**Raccoon** – cranium has a long snout and low forehead. It is too small to be an adult human. A small child cranium would be disarticulated, or if articulated would have a rounded cranial vault. Raccoon dental formula – 3:1:4:2 / 3:1:4:2 (IMAGES NOT TO SCALE)

![Raccoon skull](http://www.skullsite.co.uk/racoon/racoon.htm)

**Bear skull** - Adult dental formula 3:1:4:2 / 3:1:4:3 (IMAGES NOT TO SCALE)

![Bear skull](http://www.skullsite.co.uk/racoon/racoon.htm)
Fox cranium & mandible – Dental formula 3:1:4:2 / 3:1:4:3 (IMAGES NOT TO SCALE)

Cat cranium & mandible - Dental formula 3:1:3:1 / 3:1:2:1 (IMAGES NOT TO SCALE)

Deer cranium – Dental formula 0:1:3:3/3:1:3:3 (IMAGES NOT TO SCALE)

Male:

Female:

Image source: http://www.skullsite.co.uk
Deer/Moose/Cow dentition – Dental formula - 0:0:3:3 / 3:1:3:3 (IMAGES NOT TO SCALE)

Horse maxilla – Dental formula 3:1:3:3 / 3:1:3:3 (IMAGES NOT TO SCALE)

Pig cranium – Dental formula: 3:1:4:3 / 3:1:4:3 (IMAGES NOT TO SCALE)
**Fur seal cranium** – Dental Formula: 3:1:4:2 / 2:1:4:1 (IMAGES NOT TO SCALE)

![Fur seal cranium](http://www.skullsite.co.uk)

**Grey seal cranium** - 3:1:5-6 / 2:1:5 (IMAGES NOT TO SCALE)

![Grey seal cranium](http://www.skullsite.co.uk)

Image source: http://www.skullsite.co.uk

**Rabbit cranium** – Dental formula 2:0:3:3 / 1:0:3:3 (IMAGES NOT TO SCALE)

![Rabbit cranium](http://www.skullsite.co.uk)

Image source: http://www.skullsite.co.uk
### How to Distinguish Human Postcranial from Animal Postcranial

<table>
<thead>
<tr>
<th></th>
<th>Human</th>
<th>Nonhuman Animal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upper limbs</strong></td>
<td>Gracile (smaller/shorter than legs)</td>
<td>Often similar to hind limbs</td>
</tr>
<tr>
<td><strong>Radius and ulna</strong></td>
<td>Separate bones</td>
<td>Often fused together</td>
</tr>
<tr>
<td><strong>Vertebrae</strong></td>
<td>Large, flat bodies with short processes</td>
<td>Small bodies with convex/concave surfaces, and long spines</td>
</tr>
<tr>
<td><strong>Sacrum</strong></td>
<td>Short and broad with 5 fused vertebra. No tail (small coccyx)</td>
<td>Long and narrow with 3-4 fused vertebrae, with tail extending off the end</td>
</tr>
<tr>
<td><strong>Pelvis</strong></td>
<td>Bowl-shaped, broad and short</td>
<td>Flat, long and narrow</td>
</tr>
<tr>
<td><strong>Femur</strong></td>
<td>Longest bone in body, single ridge on the back (linea aspera)</td>
<td>Similar to other bones, double or “plateau” linea aspera</td>
</tr>
<tr>
<td><strong>Tibia and fibula</strong></td>
<td>Separate bones</td>
<td>Often fused. Fibula may be reduced to a remnant</td>
</tr>
<tr>
<td><strong>Foot</strong></td>
<td>Long and narrow</td>
<td>Broad</td>
</tr>
<tr>
<td><strong>Metapodials</strong></td>
<td>No central groove and “spindle”</td>
<td>Some (deer, pig, sheep…) have “spindle on distal end and deep midline groove</td>
</tr>
<tr>
<td>(metacarpals and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>metatarsals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Long bone shafts</strong></td>
<td>The outer (cortical) bone is thin (total of about ( \frac{1}{4} ) of shaft diameter) and inner trabecular (spongy) bone is present.</td>
<td>Cortical bone is thicker (about ( \frac{1}{2} ) of shaft diameter), and trabecular bone is absent. Nonhuman animal bone is also less porous than human bone.</td>
</tr>
</tbody>
</table>
COMMON CONFUSIONS - POSTCRANIA

**Pig ribs and femora.** These are often isolated from other bones, and contain butcher marks (e.g., clean flat saw cuts, spiral cut from spiral cut ham).

**Pig skeleton (wild boar)** (IMAGES NOT TO SCALE)

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**Cow ribs.** These bones usually have butcher marks. Cow ribs are much thicker than human: (IMAGES NOT TO SCALE)
**Cow vertebrae.** These bones usually have butcher marks. They have sharp processes (if not broken off), and the vertebral bodies (the round flat part) are convex or concave on the superior or inferior rather than flat like in humans. (IMAGES NOT TO SCALE)

Lateral views of thoracic vertebrae:

Bird (especially chicken, turkey, and gull) – bird bones have unique shapes, and the long bones are hollow and very light. Below is a chicken skeleton. (IMAGES NOT TO SCALE)
**Fish vertebrae** – fish vertebrae look much different than human (see vertebrae section). (IMAGES NOT TO SCALE)

![Fish vertebrae image](image)

**Dog leg bones** – Unless it is a huge dog, the leg bones should be much shorter yours. Child limb bones would be missing the ends. (IMAGES NOT TO SCALE)

![Dog skeleton image](image)
Bear paws – notice the distinct claws, robust joints, and larger wrist bones.

**Human hand** (IMAGES NOT TO SCALE)

Bear paw (IMAGES NOT TO SCALE)
**Deer metapodials (metatarsal and metacarpals).** These are often left behind when hunters field dress game - they usually have cut marks on them. To distinguish them from human, notice the long midline groove that runs down the long axis of the bone. Also, the bottom (inferior aspect) is spindle-like. These features are also present in similar animals (e.g., cow, pig, horse), and are not present in any human bone.

**Red deer:** metacarpal (IMAGES NOT TO SCALE)

**Red deer** (hind limb) (IMAGES NOT TO SCALE)
**Red deer** (forelimb & vertebrae) (IMAGES NOT TO SCALE)

The calcaneus **(heel bone)** is very different in humans compared to some animals like deer, cow, and pig. In these animals, the end is arrow-shaped and pointy. (IMAGES NOT TO SCALE)
**Raccoon** limbs/whole skeleton – look for claws. Also, a child (infant) this size would have unfused bones with detached ends (epiphyses) (IMAGES NOT TO SCALE)

![Raccoon skeleton diagram](http://www.raccoonworld.com/images/web/raccoonskeletonum1.jpg)

**REFERENCES**

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