Chapter 12: **Human Remains**

“There is a brief but very informative biography of an individual contained within the skeleton, if you know how to read it…”

—Clyde Snow, Forensic Anthropologist
Human Remains

**Students will learn:**

How anthropologists can use bones to determine whether remains are human; to determine the gender, age, and sometimes race of an individual; to estimate height; and to determine when the death occurred.
Human Remains

Students will be able to:

- Distinguish between a male and a female skeleton
- Give an age range after examining unknown remains
- Describe differences in skull features among the three major racial categories
- Estimate height by measuring long bones
- Describe livor mortis, rigor mortis, and algor mortis
The Pathologist

- Determines the time of death. This can be done most accurately if the body is found within the first 24 hours of death.
- Uses certain indicators such as algor, livor and rigor mortis.
# Rigor Mortis

The rigidity of skeletal muscles after death.

<table>
<thead>
<tr>
<th>Temperature of body</th>
<th>Stiffness of body</th>
<th>Approximate Time Since Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm</td>
<td>Not stiff</td>
<td>Not dead more than 3 hrs</td>
</tr>
<tr>
<td>Warm</td>
<td>Stiff</td>
<td>Dead between 3 and 8 hrs</td>
</tr>
<tr>
<td>Cold</td>
<td>Stiff</td>
<td>Dead 8 to 30 hours</td>
</tr>
<tr>
<td>Cold</td>
<td>Not stiff</td>
<td>Dead more than 30 hours</td>
</tr>
</tbody>
</table>
Livor Mortis

- Livor mortis is the settling of blood, resulting in a reddish or purplish color pattern.
- Lividity can indicate the position of the body after death. When lividity becomes fixed, then the distribution of the pattern will not change even if the body’s position is altered.
- Lividity usually becomes fixed between 10 and 15 hours after death.
Algor Mortis

Algor mortis is the cooling rate of the body after death. At a crime scene, the body temperature is obtained through:

- Rectal temperature
- Liver temperature

Glaister equation:

\[ 98.4°F - \text{internal temperature}/1.5 = \text{hours elapsed since death} \]

Generally the body cools 1 to 1.5 degrees Fahrenheit until it reaches the surrounding temperature
Effects that Influence Algor Mortis

- Temperature of the surrounding environment
- Type of clothing on the body
- Wetness of the clothing
- Air movement
- Layers of clothing
- Size of the individual
Forensic anthropology is a type of applied anthropology that specializes in the changes and variations in the human skeleton for the purpose of legal inquiry.
A forensic anthropologist may provide basic identification information of skeletonized or badly decomposed remains. From a whole bone or part of a bone, the scientist may be able to determine:

- An age range
- Sex
- Race
- Approximate height
- Cause of death, disease, or anomaly
Osteology

Study of bones
206 bones in an adult human

Function of bones:
- Provides structure and rigidity
- Protects soft tissue and organs
- Serves as an attachment for muscles
- Produces blood cells
- Serves as a storage area for minerals
- Can detoxify the body by removing heavy metals and other foreign elements from the blood
Age Determination

Most accurate estimations from:

- Teeth
- Epiphyses or growth plates
- Pubic symphysis
- Cranial sutures: the three major cranial sutures appear as distinct lines in youth and gradually close from the inside out.

Investigators always use an age range because of the variation in people and how they age. The investigator does not want to eliminate any possibilities for identification.
Age Determination Using Cranial Sutures

Sagittal suture completely closed
- Males—26 or older
- Female—29 or older

Sagittal suture is complete open
- Male—less than 32
- Female—less than 35

Complete closure of all three major sutures
- Male—over 35
- Female—over 50
Age Determination Using Basilar Suture

- Basilar Suture
- Technically known as the synchondrosis sphenoorbitalis, closes in females as young as 14 and in males as young as 16. If the suture is open, the individual is generally considered 18 or younger.
Age Determination
Using Epiphysis

<table>
<thead>
<tr>
<th>Stage of Union of Medial Clavicle</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-union without separate epiphysis</td>
<td>21 or younger</td>
<td>20 or younger</td>
</tr>
<tr>
<td>Non-union with separate epiphysis</td>
<td>16-21</td>
<td>17-20</td>
</tr>
<tr>
<td>Partial union</td>
<td>17-30</td>
<td>17-33</td>
</tr>
<tr>
<td>Complete union</td>
<td>21 or older</td>
<td>20 or older</td>
</tr>
</tbody>
</table>
# Age Determination Using Epiphysis

<table>
<thead>
<tr>
<th>Stage of Union of the Iliac Crest</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-union without separate epiphysis</td>
<td>16 or younger</td>
<td>11 or younger</td>
</tr>
<tr>
<td>Non-union with separate epiphysis</td>
<td>13-19</td>
<td>14-15</td>
</tr>
<tr>
<td>Partial union</td>
<td>14-23</td>
<td>14-23</td>
</tr>
<tr>
<td>Complete union</td>
<td>17 or older</td>
<td>18 or older</td>
</tr>
</tbody>
</table>
Gender Differences in Bones

The pelvis of the female is wider. Males have a narrow subpubic angle (A) and a narrow pubic body (B).
Gender Differences

The ribcage and shoulders of males are generally wider and larger than that of females. In addition, about one person in twenty has an extra rib. This is more common in males than in females.
Gender Differences

In males the index finger is sometimes shorter than the third finger. In females, the first finger is sometimes longer than the third finger. This is not often used as an indicator of gender as there are many exceptions.

Is this a male or female hand according to the above rule?
Race

Race is difficult to determine from most skeletal remains, especially since pure races are becoming uncommon. An experienced forensic anthropologist can generally place skulls into one of three groups:

- **Caucasian**—European, Middle Eastern, and Indian descent
- **Negroid**—African, Aborigine, and Melanesian descent
- **Mongoloid**—Asian, Native American and Polynesian descent
Race Characteristics

- **Caucasoids**—have a long, narrow nasal aperture, a triangular palate, oval orbits, narrow zygomatic arches and narrow mandibles.

- **Negroids**—have a wide nasal aperture, a rectangular palate, square orbits, and more pronounced zygomatic arches. The long bones are longer, have less curvature and greater density.

- **Mongoloids**—have a more rounded nasal aperture, a parabolic palate, rounded orbits, wide zygomatic arches and more pointed mandibles.
What differences do you notice between these three skulls? Can you determine race?
Estimation of Height

The height of a person can be calculated by using the length of certain long bones, including the femur, tibia, humerus, and radius. Below are the equations to determine average measurements for both male and female. (All measurements are in centimeters)

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>femur x 2.23 + 69.08</td>
<td>femur x 2.21 + 61.41</td>
</tr>
<tr>
<td>tibia x 2.39 + 81.68</td>
<td>tibia x 2.53 + 72.57</td>
</tr>
<tr>
<td>humerus x 2.97 + 73.57</td>
<td>humerus x 3.14 + 64.97</td>
</tr>
<tr>
<td>radius x 3.65 + 80.40</td>
<td>radius x 3.87 + 73.50</td>
</tr>
</tbody>
</table>
The identity of an individual can be determined by comparing a person’s teeth to their dental records. Unusual features including the number and types of teeth and fillings, the spacing of the teeth, and/or special dental work (bridges, false teeth, root canals) help to make a positive identification.
Odontology and Identification

Teeth are often used for body identification because:

- They are the hardest substances in the body
- They are unique to the individual
- X-rays are a good record of teeth
Facial Restoration

After determining the sex, age, and race of an individual, facial features can be built upon a skull to assist in identification. Erasers are used to make tissue depths at various points on the skull. Clay is used to build around these markers and facial features are molded.
Steps in Facial Reconstruction

With a skull:
- Establish age, sex and race
- Plot landmarks for tissue thickness
- Plot origin and insertion points for muscles
- Plot landmarks for facial features
- Select a dataset and mount markers for tissue thickness
- Mount the eyes
- Model muscles on skull
- Add fatty tissue around eyes and lacrimal glands
- Add eyelids
- Add the nose
- Add the parotid gland
- Add the ears
- Cover all with layers of skin
- Detail the face
John List killed his entire family, moved to a new town and assumed a new identity. Seventeen years later, Frank Bender reconstructed what he believed List would look like. It was shown on America’s Most Wanted, and he was turned in by the viewers almost immediately. . . looking very much like the reconstruction.

Check out more about this story on CourtTV’s crime library: www.crimelibrary.com/notorious_murders/family/list/1.html
People in the News

Bill Bass is a forensic anthropologist who has assisted law enforcement with hundreds of cases. He established the world’s first and only laboratory devoted to the study of human decomposition at the University of Tennessee’s Anthropology Research Facility. It is known as “the body farm.”
The Body Farm

The nickname of a two and a half acre research facility in Tennessee developed in 1980 by Bill Bass where bodies are placed in various conditions and allowed to decompose. Its main purpose is to observe and understand the processes and timetable of postmortem decay. Over the years it has helped to improve the ability to determine "time since death" in murder cases.

_Hic locus est ubi mortui viveuntes docent._

This is the place where the dead teach the living.
Anthropologist at Work

This anthropologist is hard at work dusting away material from these imbedded bones.

Picture taken at Chicago’s Museum of Natural History
More Applications

Forensic experts may be called upon to give information on the life and death of humans and animals in unique circumstances, including:

- Mass Murder (Oklahoma bombing, plane crashes, World Trade)
- Earlier man (mummies, Iceman, Lindow man)
- Historical Significance (Holocaust, uncertain death of famous people)
- Prehistoric Animals (Dinosaurs)
Animal Facial Restoration

Determining what T Rex looked like using the bone formation.

From this: To this:
For additional information on Bill Bass and the Body Farm

On forensic artists: