



## Forensic Discovery Sheets

Everything in these discovery sheets is on the exhibit floor. Locate the exhibits described below, and after you explore the cases, feel free to answer the question(s). Please do not write on the exhibit or lean against the display cases. Borrow a writing board from the Information Desk and use only pencils. Have fun and enjoy your museum experience.

### HUMAN BODY, HUMAN BEING

#### Fingerprints

Since 1901 fingerprinting has been used as a method of positively identifying an individual. Because no two people have the same fingerprints, a good print can help to solve a crime. Fingerprints are impressions created by ridges on the tips of fingers, palms of hands, and soles of feet. The purpose of the ridges is to help us grip things. Fingerprints are formed before a baby is born and maintain their pattern throughout life. As you grow, the pattern gets larger, but it does not change. Even if the skin on the fingers is damaged, the fingerprints grow back in the original pattern.

When a person touches an object, the perspiration, oils, and amino acids on the skin are transferred to that object. Sometimes an impression of the pattern is left in the deposit. These “fingerprints” are usually not visible to the naked eye, so they are called “latent,” or hidden, prints. Fingerprints have general patterns of ridges that allow them to be classified and compared. All fingerprints are divided into three large groups: (1) loops are found in 65% of the population; (2) whorls are found in 35% of the population; (3) arches are found in 5% of the population.

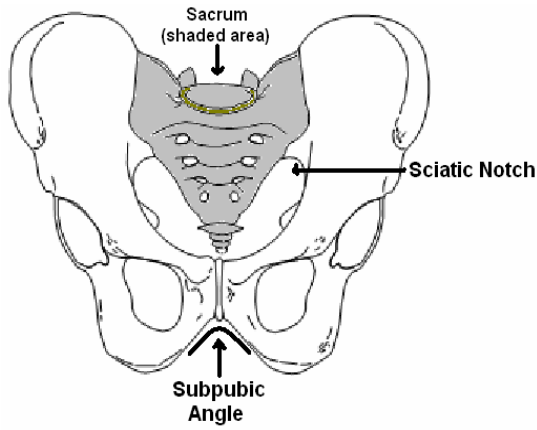
**Activity:** *Look at your fingerprints and compare them to the ones pictured in the fingerprint display in the “Skin” section of the “Human Body/Human Being” exhibit. Can you identify the patterns on your fingers? Name the types found on your thumbs.*

#### Sex Determination: Pelvis

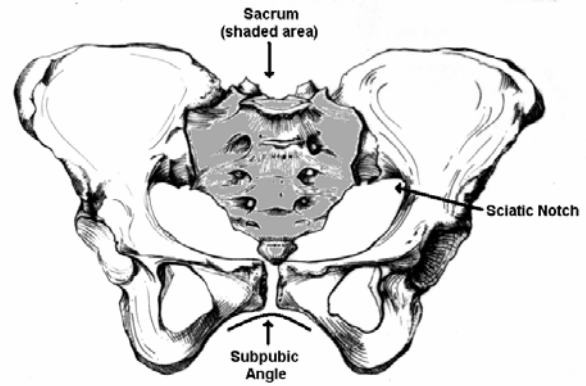
To assist in identify a missing person, forensic anthropologists are able to look at traits of the pelvis to determine whether an individual is male or female.

**Male:** In general the male pelvis appears to be more rugged with marked muscle attachments. The subpubic angle is V-shaped, and the greater sciatic notch is smaller. The sacrum is longer and narrower, and often has more than five segments. The pelvic inlet is heart-shaped.

**Female:** The female pelvis is smoother and more delicate. The subpubic angle is U-shaped, and the greater sciatic notch is wider and larger. The sacrum is shorter, broader, and more curved. The pelvic inlet is circular or elliptical.



**Male Pelvis**



**Female Pelvis**

**Activity:** Examine the two pelves on display in the “Human Body/Human Being” exhibit. Compare them with the pelvis of the skeleton in the center of the “Muscles and Skeleton” exhibit (in the cylindrical case) to determine the sex of the skeleton. Which traits led you to your conclusion?

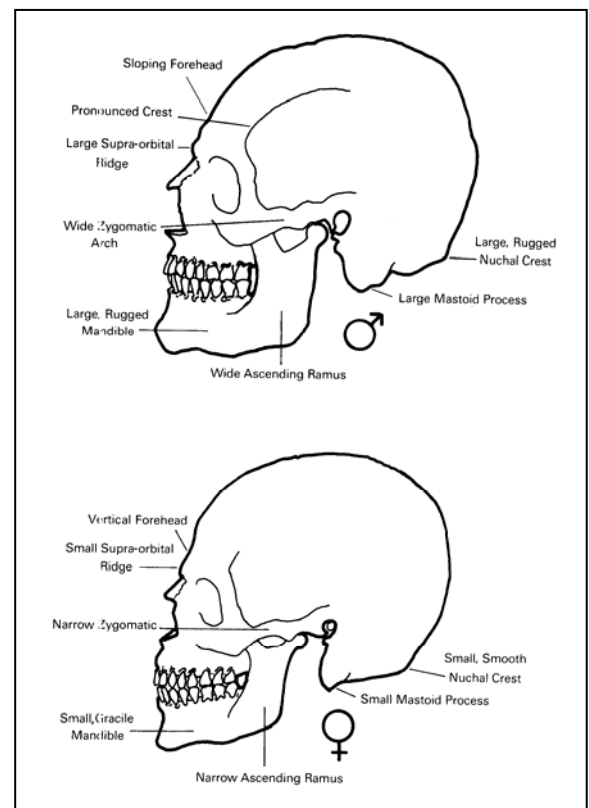
### Sex Determination: Cranium

Male and female crania have distinct traits that aid forensic anthropologists in determining sex. In general, males have larger muscles than males. On male skulls, areas where muscles attach tend to be larger and rougher than those of females.

**Male:** The male cranium has sloping forehead with a large supra-orbital ridge (brow bone). Males have a wide zygomatic arch, a larger mastoid process and a large, rugged nuchal crest.

**Female:** The female cranium has a vertical forehead with a small supra-orbital ridge (brow bone). Females have a narrow or thin zygomatic arch, a smaller mastoid process and a small, smooth nuchal crest.

**Activity:** Examine the skull of the skeleton seated in the exhibit about arthritis in the “Human Body/Human Being” exhibit. Using the diagram to the right, determine if this skeleton is male or female?



### Estimating Height

Height increases until adulthood and decreases as you get older. Within a population, stature can vary greatly. On average, female stature is smaller than male stature. The stature reported by an individual, for example that reported on the driver’s license, is notoriously inaccurate. Self-reported height is usually significantly higher than measured height. Males are more likely than females to distort their stature.

By measuring long bones from different populations and determining the average differences between them, forensic anthropologists developed a mathematical formula that can be used to determine the estimated height of an individual.

**Activity:** The “tall” skeleton in the center of the “Muscles and Bones” section of the “Human Body, Human Being” exhibit appears to be about 7 feet tall. The left ulna of the skeleton is 23 cm in length. Use the following formula to calculate approximately how tall the skeleton actually is.

Length of ulna in centimeters: \_\_\_\_\_

Times 3.70 = \_\_\_\_\_

Plus 74.05 = \_\_\_\_\_

± 4.32 = \_\_\_\_\_

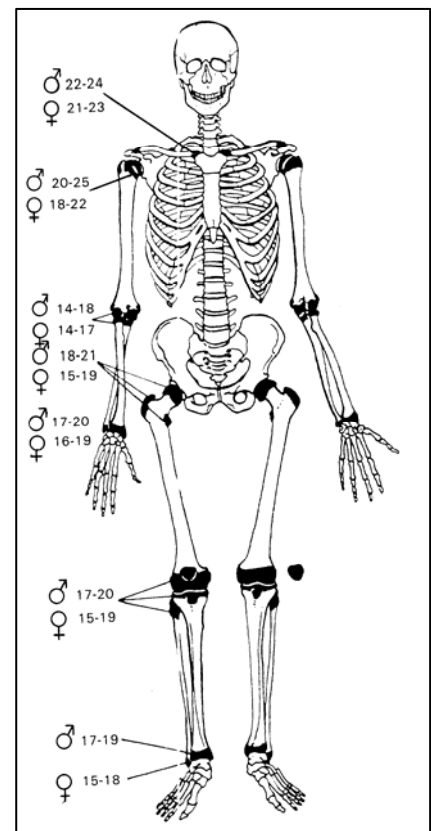
What is the height of the unknown person in centimeters? Between \_\_\_\_\_ and \_\_\_\_\_

To convert to inches, multiply by 0.39 = Between \_\_\_\_\_ and \_\_\_\_\_

To convert to feet, divide by 12 = Between \_\_\_\_\_ and \_\_\_\_\_

## Estimating Age

Go to the section about growth in “Bones and Muscles” in the “Human Body/Human Being” exhibit. You will see a femur (thigh bone) that appears to be broken--the distal or knee end is separate from the rest of the bone. It’s not broken; it just hasn’t grown together yet. When a person is young, the long parts (“shafts”) of their bones have not “fused” or grown together with the ends, or the epiphyses. We grow by having the shafts of the bone continue to lengthen until they “catch” the epiphyses. Once the shaft has fused to the epiphysis, that bone cannot get any longer, and growth is complete. (The chart to the right shows the location of the epiphyses and when growth is complete for men and women.) Different bones complete their growth at different ages, and even different epiphyses on the same bone will fuse at slightly different ages. Also, usually, females will finish growing a little earlier than males. By looking at whether or not the ends are fused (grown together), you can tell approximately how old this person was. The following chart will tell you when males and females stop growing.



Ends of the Femur	Male	Female
Proximal (hip end)	Fuses between 18-21 years of age	Fuses between 15-19 years of age
Distal (knee end)	Fuses between 17-20 years of age	Fuses between 15-19 years of age

**Activity:** Look at the femur (thigh bone) bone on display. Which end has grown together and which hasn't?

Femur (Upper Leg Bone)	End grown together or not?
Proximal (hip end)	
Distal (knee end)	

This person is between \_\_\_\_\_ years and \_\_\_\_\_ years old if it is a male.

This person is between \_\_\_\_\_ years and \_\_\_\_\_ years old if it is a female.

## Muscle Markings

When forensic anthropologists see muscle markings on bones, they can make suggestions about activities or circumstances that might have caused the wear and irregularity on the bone's surface.

**Activity:** Locate the humerus in the exhibit panel about "Taking Care of Your Bones and Muscles" in the "Muscles and Skeleton" section of the Human Body, Human Being" exhibit. At the proximal end of the bone, you will notice markings and irregular bone growth as a result of strong muscle contractions pulling on the bone when performing certain activities. Since forensic anthropologists know which muscles attach to certain areas of different bones, we can make predictions about the activities that might have caused these muscle markings to develop. The arrow on your right is indicating the muscle attachment for the pectoralis major muscle while the arrow on your left is pointing to the attachment of the teres major muscle. These muscles help to flex, extend, and rotate the humerus (upper arm). Since we know that this humerus came from a soldier from the War of 1812, we think that he may have developed these muscles because he was carrying a heavy load over a long period of time. Can you think of any other activities that may result in the overdevelopment of these muscles?

## FROM A SINGLE CELL

### Forensic Odontology

Odontology is the scientific study of the teeth. Baby teeth can reveal a record of childhood health. When forensic anthropologists examine the teeth of infants and children, they sometimes observe hypoplasia. This condition is caused by nutritional deficiency, disease or stress. When children have hypoplasias, the formation of enamel is interrupted, and the tooth does not develop properly.

**Activity:** In the case of fetal and infant skeletons in “From A Single Cell,” observe the teeth of the last three skeletons. All three of these children suffered from hypoplasias of their enamel. What do you notice about their teeth that provides evidence of hypoplasia?

## HISTORY OF THE NATIONAL MUSEUM OF HEALTH AND MEDICINE, AFIP

### Race Determination

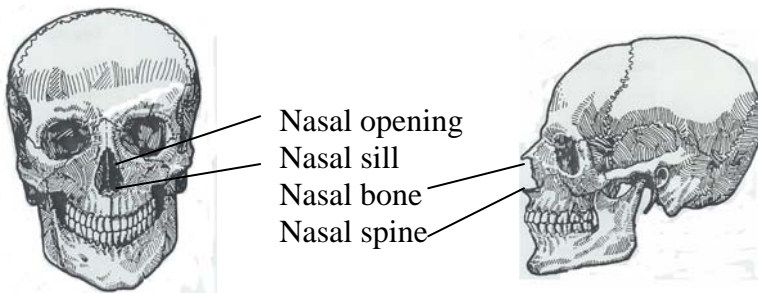
Forensic anthropologists assess race based on certain skeletal features and measurements. Race can be very difficult to determine due to interracial mixing. To increase accuracy in race determination, forensic anthropologists make visual observations and take mathematical measurements. Three races or populations are considered:

1. Caucasian/Caucasoid: Europeans, W. Asian, Mediterranean, and Americans from this ancestry
2. Mongoloid: Asiatics, Native Americans
3. Negroid: Africans and African-Americans

Nasal features offer clues to the race of an individual.

Nasal features	Caucasoid	Mongoloid	Negroid
<b>opening</b>	narrow & tall	medium & short	wide & short
<b>bone</b>	high	low	medium
<b>spine</b>	projecting	n/a	n/a
<b>sill</b>	sharp	dull	guttering

**Activity:** In the exhibit “History of the Medical Museum,” locate the skull in the case about “The Museum Today.” Examine the nasal features of the skull and determine the race of the individual. What feature(s) led to your conclusion?



Notice the plaster facial reconstruction to the left of the skull. Before a forensic anthropologist is able to reconstruct an individual’s appearance based on skull structure, race must be determined since skin thickness is unique for each race

## TO BIND UP THE NATIONS WOUNDS: MEDICINE DURING THE CIVIL WAR

### Trauma

When investigators are trying to determine the path of a bullet that enters the skull, they look for entry and exit marks. The skull is made up of a hard inner and outer surface with a soft, spongy layer in between. When a bullet enters the outer layer of bone, the impact leaves a clean break on the outer surface of the bone due to its hardness, but it leaves beveling on the inner bone due to its softness. Therefore, a bullet entry point

shows a clean break on the outside with beveling on the inside. In reverse, the exit wound leaves a clean break on the inside and beveling on the outside of the skull.

**Activity:** In “To Bind a Nation’s Wounds,” find the skull of Private J. Luman in the exhibit case about head wounds. Examine the hole made by the minie ball. Is this the entry or exit point of the bullet? What led to this conclusion?

## **Bone Infection**

Forensic anthropologists can look at osteomyelitis (bone infection) to better understand how a bone responds to infection. When a bone becomes infected, it will show signs of efforts to regenerate or grow new bone to replace the bone that is diseased and dying.

**Activity 1:** Examine the diseased bones in the case about “Trauma and Surgery” in the Civil War Medicine exhibit. How long did the soldiers live with their injuries before amputation took place?

Private J. Potter: \_\_\_\_\_

Corporal H. L. Pinney: \_\_\_\_\_

Private Julius Fabry: \_\_\_\_\_

Pvt. W. F. Faucett: \_\_\_\_\_

**Activity 2:** Find the bones of Private John Reardon, Private W. S. Williams, and Private N. Horner. These soldiers had amputations shortly after their injuries. Compare the diseased bones with these bones and describe the differences.

## **EVOLUTION OF THE MICROSCOPE**

### **Forensic Microscopy**

A side-by-side comparison microscope is used to examine evidence from crime scenes. A comparison microscope consists of two compound microscopes joined by a bridge with a series of mirrors and lenses to join two independent objects so that they can be viewed at the same time. When you look into the eyepiece, you see a circle divided into two parts—the image from microscope on the left is on the left side, and the image from the microscope on the right is on the right side.

The comparison microscope on display was used by the FBI in the 1950s for ballistic studies. Bullets fired through the same rifling barrel will display comparable rifling markings on their surfaces. By matching the striations on each bullet, forensic scientists are able to conclude that both bullets traveled through the same barrel.

**Activity:** Name at least five other forms of trace evidence that might be examined with a comparative microscope.

- 1.
- 2.
- 3.
- 4.
- 5.

# WALTER REED'S LAST OCULARIST / HUMAN BODY, HUMAN BEING / BATTLEFIELD SURGERY 101: FROM THE CIVIL WAR TO VIETNAM

## **Victim Identification: Prosthetics**

Prosthetics can offer clues to a person's identity, since modern prosthetics are stamped with a serial number and logo from the manufacturer. When prosthetics are sold to doctors and hospitals, manufacturers keep a record to whom they are sold. If prosthetics are recovered during an investigation, the manufacturer can be contacted to identify the doctor or hospital that purchased the prosthetic. Then the doctor or hospital can be contacted to reveal the identity of the owner of the prosthetic.

**Activity 1:** Visit “Walter Reed’s Last Ocularist” and notice the artistry involved in replicating the eyes of soldiers treated by Dr. Vincent Pryzybela. He was occasionally asked by soldiers to paint flags or military symbols on their prosthetic eyes. If such a prosthetic were recovered during an investigation of unidentified remains, it might be possible to trace the prosthetic back to its creator, who in turn, might provide clues to the identity of the owner of the prosthetic. Now, turn around and look in “The Museum Today” case and locate the photograph from the flood in Hardin, Missouri. DMORT (Disaster Mortuary Operational Response Team) volunteers, including one of the museum’s forensic anthropologists, was activated for the first time in 1993 to respond to this incident and to assist in the identification of the displaced bodies. Of 119 bodies that were positively identified, one of them was identified based on the presence of a glass eye. Why was the glass eye helpful in the identification of this body?

**Activity 2:** Visit the “Heart” and “Muscles and Bones” sections of the “Human Body, Human Being” exhibit to locate at least six examples of prosthetics that offer clues toward the identification of their owners. Are you able to identify the manufacturers or serial numbers on any of them? List below.

**Activity 3:** Visit “Battlefield Surgery” and examine the different examples of prosthetic limbs on display? Where is the serial number located on the C-leg?