WARD'S Sherlock Bones: Identification of Skeletal Remains Lab Activity Student Study Guide

BACKGROUND



The word skeleton comes from the ancient Greek word *skeletos*, meaning dry.



DID YOU KNOW? The three smallest bones in the human body are located in the ear and are known collectively as the auditory ossicles. Imagine that you are hiking in the woods when suddenly you stumble upon what appears to be a human skull. Upon closer inspection, you notice some other bones in the area. The authorities are called and immediately begin to investigate the scene. You may wonder whose job it is to identify the remains you have just found and how they even go about doing just that.

In this case, a forensic anthropologist would be called on to assess the bones and make that determination. Through careful observations and measurements of key bones, these experts are able to suggest the sex, race, height, and age of the skeleton at the time of death. They may also learn about the deceased's medical history and sometimes even the cause of death! They are able to accomplish all of this by taking advantage of their knowledge of the many bone changes that occur throughout a person's lifetime, including growth, repair, and maturation.

Forensic anthropologists use both metric and non-metric data to assess bones. Most commonly however, they rely on metric data when studying a skeleton. Usually, these experts use costly precision instruments such as sliding calipers, spreading calipers, and osteometric boards to make measurements of the skull and long bones. Nonmetric traits are those that are purely observational in nature. These traits are examined and compared on the basis of frequency of occurrence within certain populations. Due to its inherent subjectivity, the data collection of non-metric traits is not as definitive as metric data collection. However, it is still considered to be a very useful tool in the assessment of skeletal remains.

The job of identifying skeletal remains is, of course, made much easier if the entire skeleton is present. However, many times this is not the case and the scientists must make their assessment based on only a few bones. This will be the case with today's lab activity. You, "Sherlock Bones", will be given only a few bones; all obtained from the same individual. You are the forensic anthropologist assigned to the case and it's up to you to determine as much information as possible about these bones to help identify this individual.

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The word "forensic" is derived from the Latin *forens*, which itself came from the word *forum*: an ancient Roman gathering place for judicial and public business.



DID YOU KNOW?

The tallest person in history was Robert Pershing Wadlow (1918-1940) who stood 8'11". tall. The shortest adult was Gul Mohammed of Delhi, India who stood a mere 22 $\frac{1}{2}$ " tall.

Sex Determination

A number of skeletal indicators are used to determine sex. The more indicators used, the more accurate the results will be. However, it is important to note that there is very little sexual dimorphism in preadolescent skeletons, which makes sex determination in them nearly impossible.

The pelvis is considered to be the best bone with which to estimate sex. This is mainly due to the fact that the female's pelvis is designed to allow for the passage of a child. Consequently, the pelvis of a female is generally larger and wider than that of a male. These differences can be observed in Figures 2-5.

The skull is the second most commonly used bone to determine sex. Many of the skull traits related to sexing are most easily observed when directly compared to a skull of the opposite sex. This is why one's ability to sex a skull, and a skeleton for that matter, improves with experience. Observe the differences between a male and a female skull in Figures 9-12.

Normally, the long bones alone are not used alone to estimate gender. However, if these bones are the only ones present, there are characteristics that can be used for sex determination.

Race Determination

It can be extremely difficult to determine the true race of a skeleton. This is due to several factors: First, forensic anthropologists generally use a three-race model to categorize skeletal traits: Caucasoid (European), Mongoloid (Asian/Amerindian), and Negroid (African). Although there are certainly some common physical characteristics among these groups, not all individuals have skeletal traits that are completely consistent with their geographic origin. Additionally, there is the issue of racial mixing to consider. Often times, a skeleton exhibits characteristics of more than one racial group and does not fit neatly into the three-race model. Also, the vast majority of the skeletal indicators used to determine race are non-metric traits, which, as stated earlier, can be highly subjective. Despite these drawbacks, race determination is viewed as a critical part of the overall identification of an individual's remains.

The skull is considered to be the most important bone for race determination because without it, the origin of race cannot accurately be determined. Forensic anthropologists use lengths, widths, and shapes of skull features along with population-specific dental traits to aid them in reaching a conclusion. Compare the skulls in Figures 16-21 to assess the racial variation between them. The femur bone can also be used to aid in the race determination of a skeleton but is only used to eliminate either the Caucasoid or Negroid race.



Height Determination

The height, or stature, of a skeleton is most commonly determined by examining the long bones of that individual (femur, tibia, fibula, humerus, ulna, and radius). If a complete set of these bones is not available, the accuracy in height determination is improved if two or more bones are used. The femur and the humerus bones are excellent skeletal indicators for height when used together.

Age Determination

The best bone to use in determining a person's age at the time of death is the pelvis. Many changes can be observed on the face of the pubic symphysis and the auricular surface of the ilium over time that are good indicators of a person's age. The extent of suture closure on the skull can also be used as an indicator. However, these changes are best viewed on a natural skeleton rather than on a plastic one.

For this lab we will look at another indicator of age, the process known as epiphyseal union. At birth, humans have about 450 bones. These bones will eventually fuse together to form just 206 adult bones. During the course of development, the ends of each bone are separated from the shaft by a layer of cartilage (as seen in the example below). This layer remains throughout the bone's development and forms a very distinct line of fusion in the bone. This line becomes increasingly faint until the bone is fully formed (ossified) and then completely disappears. Because the lines created by epiphyseal unions remain for a definite amount of time, they are a useful trait in aging individuals, especially juveniles.

Development of Coxal (Hip) Bone





DID YOU KNOW? The last bone to fuse is the collarbone, which occurs around the age of 25.



Vernier calipers were invented in 1631 by French mathematician Pierre Vernier. This invention was inspired by Vernier's interest in cartography and surveying. You will be asked to use a Vernier caliper (Figure 1) to obtain metric data in this lab. All measurements, with the exception of one, will be made from the outside of the bone, using the outside measuring scale. This means that you will use the inside of the movable portion of the caliper to lightly squeeze the bone you are measuring and then read the outside scale located at the top of the caliper. Only the nasal cavity will be measured from inside the cavity, using the inside measuring scale. The whole number is read at the "0" of the appropriate scale (outside or inside) and the decimal reading is made at the point at which the appropriate scale lines up exactly with a millimeter mark in the center of the caliper. For example, in Figure 1 below, the outside measurement reads 12.5 mm, whereas the inside measurement reads 25.1 mm. Be sure not to read the inside scale when taking an outside measurement.

How to Use Your Vernier Caliper

Figure 1





DID YOU KNOW? Of the 206 bones in the adult human body, 106 are found in the hand (54 bones) and feet (52 bones).



Alphonse Bertillon (1853-1914), considered to be the father of criminal identification, devised a systematic procedure of taking body measurements to distinguish one individual from another.

DID YOU KNOW?

In 1892, Sir Arthur Conan Doyle wrote "The Adventures of Sherlock Holmes", The original name of the nowfamous detective was Sherrinford, the name of a character in one of Doyle's earlier short stories.

OBJECTIVES

- Become familiar with tools and key skeletal features used by forensic anthropologists
- Utilize qualitative observations and quantitative measurements to determine the sex, race, height, and approximate age of an individual at the time of death

MATERIALS

MATERIALS NEEDED PER GROUP

- 1 Vernier caliper
- 1 Protractor
- 1 Metric ruler
- 1 Calculator

SHARED MATERIALS

Skull, humerus, pelvis, and femur Large caliper

PRE LAB EXERCISE

1. In the Analysis section, write a list of skeletal traits that you believe could be used to help identify an individual.

PROCEDURE

Scenario

Your local police department has been searching for three individuals who have been reported missing within the last two years. Recent news of the discovery of human bones in the area has given rise to new hope of identifying one of these individuals. As Sherlock Bones, the lead forensic anthropologist on the case, it is your job to provide the authorities with a physical description of the individual. Good Luck!





The term "pelvis", from the Latin word for basin, refers to the two coxal (hip) bones, the sacrum and the coccyx. During childhood each coxal bone consists of the ilium, the ischium, and the pubis.

Key Directional Terms

Anterior (ventral) - Situated in front of; the front of the body Posterior (dorsal) - Situated in back of; the back of the body Superior - Toward the head; relatively higher in position Inferior - Away from the head; relatively lower in position Medial - Toward the midline of the body Lateral - Away from the midline of the body Proximal - Closer to any point of reference on the body Distal - Farther from any point of reference on the body

PELVIS

Refer to Figures 2-8 when assessing the pelvis.

Sex Determination

1. Determine the sub-pubic angle (Figure 6, no. 1) by using the method described below and the sidebar photo:

Situate your protractor so that the black dot located at the base of the protractor, is positioned at the midline of the pubic symphysis (Figure 6, no. 2) where the ramus of each ischium (Figure 6, no. 4) would meet if the bones continued onward. Align the "0" baseline with the ramus of the left ischium and determine the degree of the angle formed by the two rami of the ischium bones. Record your result in Table 1 in the Analysis section.

- 2. Use the Vernier caliper to measure the pubis body width (Figure 6, no. 10). Start at the middle of the lateral edge of the pubic symphysis and measure across to the medial edge of the obturator foramen (Figure 6, no. 6). Record your result in Table 1.
- 3. Locate the greater sciatic notch (Figure 8, no. 11) and use the following method to measure its angle: Place the pelvis posteriorside down on a piece of paper and turn it in such a way that the greater sciatic notch is closest to the paper. Trace the angle of the sciatic notch onto the piece of paper. Use a straight edge to go over the lines you have just made and extend those lines until they meet to form an angle. Use your protractor to measure the angle you have just drawn by following the same technique listed in Step 1. Record your result in Table 1.
- 4. Locate the sacrum and the coccyx (Figures 7 and 8, nos. 8 and 9 respectively). Hold the pelvis in such a way that the pubic symphysis (Figure 6, no. 2) is facing down and parallel to the tabletop (as shown in Figure 7). Hold the pelvic cavity (Figure 7, no. 12) at eye level in order to observe its shape properly. Is the opening circular and wide, showing mainly the coccyx (as shown in Figure 5), or is it more heart-shaped, showing a large portion of the sacrum and the coccyx (as shown in Figure 3)? Record your result in Table 1.



Whenever you sit down, your coccyx flexes and acts as a shock absorber.



DID YOU KNOW?

Your skull is made up of 29 different bones, only one of which moves, the mandible.

Age Determination

- 1. Refer to Table 8 in the Analysis section to determine the approximate age when each bone will have fused and/or completely ossified (i.e., there is no evidence of an epiphysis or cartilaginous line).
- 2. Inspect the entire pelvis carefully. Pay close attention to any evidence of epiphyseal unions. In Table 8, draw a circle around each age or age group in which the specified developmental occurrence has already taken place.

SKULL

Refer to Figures 9-24 when assessing the skull.



When viewing from the front or the side, always have the skull oriented so that it is anatomically correct (i.e., the eye sockets should be parallel to the table top as shown in Figures 10 and 12, and not directed upwards). This is known as the Frankfort Horizontal Plane. To keep the skull in this position, a textbook, or the like, may be used to prop the skull up.

Sex Determination

- 1. Run your finger over the upper edge of the eye orbit (Figure 13, no. 13). Is it rounded or sharp? Record your result in Table 2 in the Analysis section.
- 2. Observe the shape of the eye orbit. Is it closer to being square or round? Record your result in Table 2.
- 3. Locate the zygomatic process (Figure 14, no. 15). Is this ridge expressed beyond the external auditory meatus (Figure 14, no. 16)? Record your results in Table 2.
- 4. Observe the occipital region of the skull (Figure 14, no. 17). The nuchal crest is a ridge that runs along the base of the occipital bone (Figure 15, no. 18). Is this area smooth (similar to the rest of the skull) or rough and bumpy? Record your result in Table 2.
- 5. Is there a single bump, known as the external occipital protuberance, present in this region? (Figure 15, no. 19). Record your result in Table 2.
- 6. Observe the frontal bone from the side (Figure 14, no. 20). Is it low and slanting (as in Figure 10) or rounded and globular (as in Figure 12)? Record your result Table 2.
- 7. Observe the mandible from the inferior view (as shown in Figure 15, no. 21). Does it look squared and U-shaped or rounded and V-shaped? Record your result in Table 2.

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The Babanki people of the Cameroon grasslands place so much importance on the human skull that it decorates almost all utilitarian items. In addition, the skulls of deceased ancestors are kept by the eldest male of a lineage because the ancestral spirits are believed to be embodied within them. 8. Observe the ramus of the mandible (Figure 14, no. 22). Draw an imaginary vertical line down from the external auditory meatus (Figure 14, no. 16) to the floor (being sure to keep the skull in the Frankfort Horizontal Plane). Is this line fairly parallel with the ramus, indicating that it is straight, or does the ramus slant away from the imaginary line as your eye moves down it? Record your result in Table 2.

Race Determination

- 1. Using your Vernier caliper, determine the nasal width by taking an inside measurement of the widest portion of the nasal cavity (Figure 13, no. 23). Determine the nasal height by placing one end of your caliper on the nasion (Figure 13, no. 24) and the other end on the nasal spine (Figure 13, no. 25). Determine the nasal index by dividing the nasal width by the nasal height and record your result in Table 5.
- 2. To demonstrate racial differences among skulls, use your metric ruler to determine the nasal width and height of each of the skulls in Figures 22, 23, and 24. Record this information in the space provided below Table 5. Determine the nasal index of each skull and record your results in the space provided. Answer the question that follows these results.
- 3. The nasal spine is located medially at the base of the nasal cavity (Figure 14, no. 25). To assess the prominence of this protrusion, rest your pencil, sideways, across the maxilla (Figure 13, no. 27). Try to run the pencil gently onto the nasal cavity. Is the nasal spine so prominent that it completely blocks your pencil from reaching the nasal cavity, or does your pencil run over a small protrusion in order to reach the cavity, or is the spine so small that your pencil can easily glide into the opening? Record your result in Table 5.
- 4. Feel the base of the nasal cavity, on either side of the nasal spine (Figure 13, no. 26). Do you feel sharp ridges (nasal silling), rounded ridges, or no ridges at all (nasal guttering)?
- 5. A jaw is considered to be prognathic if it juts out away from the face. To assess prognathism, hold your pencil in a vertical position against the nasal spine (Figure 14, no. 25) and lower the pencil towards the face and attempt to touch the chin. Does the pencil touch, or come close to touching, both the anterior nasal spine and the chin at the same time or does the pencil angle out too far due to a protruding jaw? Record your result in Table 5. See Figures 17, 19, and 21 to compare prognathism between races.
- 6. Observe the shape of the eye orbits (Figure 13, no. 13). Are they rounded and somewhat square, rounded and circular, or fairly rectangular? Record your result in Table 5.



Ounce for ounce, the human femur has a greater pressure tolerance and bearing strength than an equivalent sized rod cast in steel.

FEMUR

Refer to Figures 25-26 when assessing the femur.

Sex Determination

- 1. Using your Vernier caliper, measure the vertical diameter of the femoral head (Figure 26, no. 35) and record your result in Table 3 in the Analysis section.
- 2. Using your Vernier caliper, determine the bicondylar width by measuring the distance from the most lateral portion of the internal condyle (Figure 25, no. 34) and the most lateral portion of the external condyle (Figure 25, no. 33). Record your result in Table 3.
- 3. Using your large caliper, obtain the maximum length of the femur by measuring from the most superior portion of the femoral head (Figure 25, no. 28) to the most inferior portion of the internal condyle (Figure 25, no. 34). Record your result in Table 3 and in the space provided above Table 6.

Race Determination

1. Lay the femur down on the table in such a way that the lesser trochanter is closest to the table. Place the palm of your hand flat on the table and try sliding your fingers underneath the curvature of the shaft (Figure 25, no. 32). Do they fit? If so, the Negroid race can be eliminated. If not, the Caucasoid race can be eliminated.

Age Determination

- 1. Refer to Table 9 to determine the approximate age when each bone initially appears or joins the shaft of the femur.
- 2. Inspect the femur bone carefully. In Table 9, draw a circle around each age or age group in which the specified developmental occurrence has already taken place.



Jeanne Louise Calment, of Arles, France, holds the title of the world's oldest person. She was 122 years old when she died in 1997.

HUMERUS

Refer to Figures 27-29 when assessing the humerus.

Sex Determination

- 1. With your Vernier caliper, measure the transverse diameter of the humeral head (Figure 28, no. 43) and record your result in Table 4.
- 2. With your Vernier caliper, measure the vertical diameter of the humeral head (Figure 29, no. 44) and record your result in Table 4 in the Analysis section.
- 3. Using your large caliper, obtain the maximum length of the humerus by measuring from the most superior portion of the humeral head (Figure 27, no. 36) to the most inferior portion of the trochlea (Figure 27, no. 40). Record your result in Table 4 and in the space provided above Table 7.
- 4. Using your Vernier caliper, obtain the epicondylar width by measuring from the most lateral portion of the internal condyle (Figure 27, no. 39) to the most lateral portion of the external condyle (Figure 27, no. 42). Record your result in Table 4.

Age Determination

- 1. Refer to Table 10 in the Analysis section to determine the approximate age when each bone joins or unites with the shaft of the humerus.
- 2. Inspect the humerus bone carefully. In Table 10, draw a circle around each age or age group in which the specified developmental occurrence has already taken place.

WARD'S Sherlock Bones: Identification of Skeletal Remains Lab Activity

Name:	
Group:	
Date:	

ANALYSIS

Pre-Lab Exercise

1. List skeletal traits that you believe could be used to help identify an individual.

Final Determinations

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Remember that all of the bones used to assess any given trait should be looked at as a whole. For example, if the majority of the bones used to determine the sex indicate that the individual was male, then your final determination of sex should be male.

- 1. Based on your results entered in Tables 1-4, make a final determination as to the sex of this individual. Write this answer in the space provided below Table 4.
- 2. Based on your results entered in Table 5 and the results of the femur curvature test, make a final determination as to the race of this individual. Write this answer in the space provided at the bottom of that page.
- 3. Now that you have determined the sex and race of this individual, you can now determine the height by following the steps below:
 - a. In the space provided just above Table 6, convert the data for the maximum length of the femur (MLF) from millimeters to centimeters. In Table 6, locate the regression formula that corresponds to the sex and race of the skeleton as you have determined them to be. Insert the converted (MLF) into this formula and calculate. Record the height in centimeters to the right of this formula. Use the corresponding confidence interval to calculate the height range.
 - b. Repeat the above step for the maximum length of the humerus (MLH) in order to complete Table 7.
 - c. To determine the probable height range of this individual, refer to Tables 6 and 7 and record the minimum value and the maximum value of the calculated height ranges in the space provided below Table 7. Convert each value to feet and inches by following the instructions provided below Table 7.
- 4. Based on the ages circled in Tables 8, 9, and 10, determine the minimum age of this individual at the time of death. Write this answer in the space provided below Table 10.
- 5. Report your final conclusion to your instructor.

SEX DETERMINATION

Pelvis	Tab	le 1	
Trait	Result	Female	Male
Sub-Pubic Angle		>90°	<90°
Pubis Body Width		~40 mm	25-30 mm
Greater Sciatic Notch		>68°	<68°
Pelvic Cavity Shape		Circular and wide, showing mainly coccyx	Heart-shaped, showing sacrum and coccyx

Skull

Table 2

Trait	Result	Female	Male
Upper Edge of Eye Orbit		Sharp	Blunt
Shape of Eye Orbit		Round	Square
Zygomatic Process		Not expressed beyond external auditory meatus	Expressed beyond external auditory meatus
Nuchal Crest (Occipital Bone)		Smooth	Rough and bumpy
External Occipital Protuberance		Generally absent	Generally present
Frontal Bone		Round, globular	Low, slanting
Mandible Shape		Rounded, V-shaped	Square, U-shaped
Ramus of mandible		Slanting	Straight

Femur		Table 3		
Trait	Result	Female	Indeterminate Sex	Male
Vertical (Maximum) Diameter of Femoral Head (mm)		<43.5	43.5-44.5	>44.5
Bicondylar Width (mm)		<74	74-76	>76
Maximum Length (mm)		<405	405-430	>430

Humerus	

Table 4

Trait	Result	Average Fe- male	Average Male
Transverse Diameter of Humeral Head (mm)		37.0-39.0	42.7-44.7
Vertical Diameter of Humeral Head (mm)		42.7	48.8
Maximum Length (mm)		305.9	339.0
Epicondylar Width (mm)		56.8	63.9

Final sex determination

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RACE DETERMINATION

Skull

Nasal width mm

Nasal height <u>mm</u>

Table 5

Trait	Result	Caucasoid	Mongoloid	Negroid
Nasal Index		<.48	.4853	>.53
Nasal Spine		Prominent spine	Somewhat prominent spine	Very small spine
Nasal Silling/Guttering		Sharp ridge (silling)	Rounded ridge	No ridge (guttering)
Prognathism		Straight	Variable	Prognathic
Shape of Orbital Openings		Rounded, somewhat square	Rounded, somewhat circular	Rectangular or squared

Caucasoid skull:

Nasal width ____mm ÷ Nasal height ____mm = Nasal index_____

Mongoloid skull:

Nasal width ____mm ÷ Nasal height ____mm = Nasal index_____

Negroid skull:

Nasal width _____mm ÷ Nasal height ____mm = Nasal index_____

Are the nasal indexes of each racial group close to the ones that appear in Table 5? If not, what could account for this inconsistency?

Femur

Caucasoid - fingers can fit under curvature of femur

Negroid - fingers cannot fit under curvature of femur

Final race determination _____

HEIGHT DETERMINATION

Femur

Maximum Length of Femur (MLF) _____ mm = ____ cm

Table 6

	Male				Female			
	Regression formula	Height (cm)	Confidence interval	Height range (cm)	Regression formula	Height (cm)	Confidence interval	Height range (cm)
Caucasoid	2.32 (MLF) + 65.53		±3.94		2.47 (MLF) + 54.10		±3.72	
Mongoloid	2.15 (MLF) + 72.57		±3.80		2.38 (MLF) + 56.93 **		± 3.57	
Negroid	2.10 (MLF) + 72.22		±3.91		2.28 (MLF) + 59.76		±3.41	

** Practitioners' formula extrapolated from Caucasoid and Negroid regression formulae for females.

Table 7

Humerus

Maximum Length of Humerus (MLH) _____mm = ____cm

			1					
	Male				Female			
	Regression formula	Height (cm)	Confidence interval	Height range (cm)	Regression formula	Height (cm)	Confidence interval	Height range (cm)
Caucasoid	2.89 (MLH) + 78.10		±4.57		3.36 (MLH) + 57.97		±4.45	
Mongoloid	2.68 (MLH) + 83.19		±4.16		3.22 (MLH) + 61.32 **		± 4.35	
Negroid	2.88 (MLH) + 75.48		±4.23		3.08 (MLH) + 64.67		±4.25	
Minimum va Maximum v	alue =c	cm ÷ 2.54 cm ÷ 2.54	=inch	es = es =	feet ir	nches	≥ 24	in. = 2 ft.

****To convert your answers to feet and inches:** assign the "feet" value according to the chart that follows, then subtract the appropriate whole number (in inches) from your answer to calculate the "inches" portion of the number (e.g., 63.78 in. is >60 in. therefore, the person is at least 5 ft. tall; 63.78 - 60 = 3.78 in. to give a final answer of 5'3.78" tall.

\geq 24 in. = 2 ft.
\geq 36 in. = 3 ft.
\geq 48 in. = 4 ft.

 $\geq 60 \text{ in.} = 5 \text{ ft.}$ $\geq 72 \text{ in.} = 6 \text{ ft.}$

HEIGHT DETERMINATION

Tibia

Maximum Length of Tibia (MLT) _____mm = ____cm

	Table 6								
			М	ale			Fei	male	
		Regression formula	Height (cm)	Confidence interval	Height range (cm)	Regression formula	Height (cm)	Confidence interval	Height range (cm)
Cau	ucasoid	2.42 (MLT) + 81.93		± 4.00		2.90 (MLT) + 61.53		± 3.66	- 1
Мо	ongoloid	2.39 (MLT) + 81.45		± 3.27		2.68 (MLT) + 67.05 **		± 3.68	
N	egroid	2.19 (MLT) + 85.36		± 3.91		2.45 (MLT) + 72.56		± 3.70	

** Practitioners' formula extrapolated from Caucasoid and Negroid regression formulae for females.

Group Members:

Skeleton #: _____

The summary results for our skeleton are:

Gender:

Race:_____

Approximate Height:_____

Age:_____

AGE DETERMINATION

Pelvis

Table 8

Developmental Occurrence	Approximate Age
The pubis bone and ischium are almost completely united by bone (Figure 6)	7-8
The ilium, ischium, and pubis bones are joined together (Figure 6)	13-14
The two lowest segments of the sacral vertebrae become joined together (Figure 8)	18
The ilium, ischium, and pubis bones become fully ossified with no evidence of epi- physeal unions (indicated by cartilaginous lines)	20-25
All segments of the sacrum are united with no evidence of epiphyseal unions	25-30

Femur

Table 9

Developmental Occurrence	Approximate Age
The greater trochanter first appears	4
The lesser trochanter first appears	13-14
The head, greater trochanter, and lesser trochanter first join the shaft	18
The condyles first join the shaft	20

Humerus

Table 10	
Developmental Occurrence	Approximate Age
The head and tuberosities join to become a single large epiphysis	6
The radial head, trochlea, and external condyle blend and unite with the shaft	16-17
The internal condyle unites with the shaft	18
The upper epiphysis unites with the shaft	20

Final minimum age determination (range) ______years

WARD'S	Name:	
Sherlock Bones	Group:	
Lab Activity	Date	
	ASSESSMENT	
1. From the answers you have given this activity a surprise to you? If s	in the pre-laboratory exercise, were any of the steps performed in so, describe the step(s) below.	
2. After you have completed your in provided you with descriptions of your findings, which of the three identification and why?	hspection and assessment of the skeletal remains, the police have the three missing persons they have been investigating. Based on individuals listed below could you safely eliminate as a positive	
Kim Lee – A 15 year old, Asian fe	emale, standing 5'2" tall.	
Anthony Woods – A 45 year old, African American male, standing 6'0 tall.		
Johnathan Parker – A 24 year old,	Caucasian male, standing 5'5" tall.	
3. You have been asked to testify in court on the evidence you have found in this case. Will you testify that the remains you have examined were in fact those of any one of the individuals listed above? Why or why not?		
4. What information about the remains	you have examined could you safely discuss in your testimony?	

- 5. How did your findings compare with the rest of the class and with the actual data? What could account for this (if any) variation?
- 6. List five attributes that a quality forensic anthropologist must possess and give reasons as to why these traits would be important to the profession.

- 7. As Sherlock Bones, you were able to analyze skeletal remains in order to determine four particular traits of an individual. In a real life situation, scientists could provide a more detailed description of this individual based on additional information that can be acquired from the bones of this person. Research three other identifying traits that can be gleaned from a person's skeletal remains. Report your findings below.
- 8. Forensic anthropology is just one specialty area in the field of forensic science. Below is a short list of other disciplines in forensics. Research one of these disciplines and write a paragraph that briefly describes the responsibilities of an individual who specializes in that branch of forensics.

Forensic odontology Forensic entomology Forensic pathology Forensic serology

9. Can you determine which side of the body the humerus of this skeleton is from? How about the femur?

10. Create a Venn diagram to compare and contrast the skeletal remains of a typical 5'8" 14-year-old Caucasoid male and a typical 5'8" 18-year-old Caucasoid male. (HINT: refer to your tables in the Analysis section).

11. Circle the correct true or false response to the following statements. Explain

- T F When assessed individually, the femur bone is slightly less accurate in determining height than the humerus bone.
- T F The skull is the best indicator of an individual's sex.
- T F It is not possible to determine the height of an individual if the race and sex of the remains have not yet been determined.
- T F It is not uncommon for a skeleton to exhibit characteristics of more than one racial group.
- T F In relation to the skull, the humerus bones are inferior, lateral, and distal.
- 12. What was the most difficult aspect of this lab? Why?

Key to Anatomical Photos

- 1 Sub-Pubic Angle
- 2 Pubic Symphysis
- 3 Ischium
- 4 Ramus of Ischium
- 5 Illium
- 6 Obturator Foramen
- 7 Illiac Spine (Crest)
- 8 Sacrum (Sacral vertebrae)
- 9 Coccyx
- **10** Pubis
- **11** Greater Sciatic Notch
- **12** Pelvic Cavity
- **13** Eye Orbit
- 14 Zygomatic Bone
- **15** Zygomatic Process
- 16 External Auditory Meatus
- 17 Occipital Crest
- 18 Nuchal Crest
- **19** External Occipital Protuberance
- 20 Frontal Bone
- 21 Mandible
- 22 Ramus of Mandible
- 23 Nasal Cavity
- 24 Nasion

- 25 Nasal Spine
- 26 Nasal Sill or Dam
- 27 Maxilla
- 28 Head of Femur
- 29 Neck of Femur
- **30** Greater Trochanter
- 31 Lesser Trochanter
- 32 Shaft of Femur
- 33 External Condyle of Femur
- 34 Internal Condyle of Femur
- 35 Vertical Diameter of Femoral Head
- **36** Head of Humerus
- **37** Greater Tuberosity
- **38** Shaft of Humerus
- **39** Internal Condyle of Humerus
- 40 Trochlea
- 41 Radial Head
- 42 External Condyle of Humerus
- **43** Transverse Diameter of Humeral Head
- 44 Vertical Diameter of Humeral Head

MALE





Figure 2





Figure 3





Figure 6



Figure 7





MALE



Figure 9

FEMALE



Figure 11



Figure 10



Figure 12









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С A U С А S 0 Ι

D



Figure 16





Figure 17

Photo Courtesy of The American Museum of Natural History







Ν Е G R 0

Ι





Photo Courtesy of The American Museum of Natural History



Figure 19



Figure 21

Photo Courtesy of The American Museum of Natural History

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CAUCASOID



Figure 22

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MONGOLOID



Figure 23

NEGROID



Figure 24

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Figure 25

FEMUR



Figure 26

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Figure 27

HUMERUS



Figure 28



Figure 29