



High School Science Virtual Learning

**Forensic Science**

**Bones and Age**

April 15, 2020



## High School Forensic Science Lesson: April 15th, 2020

**Objective/Learning Target:** I will be able to identify the major bones in the human body and determine the age of the person using his/her bones.



Go to this [link](#) and answer the following questions.

1. What type of testing is often used to “date” skeletons?
2. Name a couple ways we can identify the age of the person by looking at the teeth.



1. What type of testing is often used to “date” skeletons?- Radio Carbon or Carbon-14 testing
2. Name a couple ways we can identify the age of the person by looking at the teeth.- If there are wisdom teeth, the person was 18 or older. If there significant bone loss, that indicates an older person. If they have all permanent teeth, but no wisdom teeth, it means they were in later childhood.



# Lesson Activity:

**Directions:** Read the following information that can also be found on pages 422-428 at the link below. Then answer the practice questions.

## Link(s):

<https://www.westada.org/site/handlers/filedownload.ashx?moduleinstanceid=8825&dataid=31707&FileName=Chapter%2014.pdf>

## Determining Age

A forensic anthropologist can reasonably estimate an individual's age at the time of death by examining biological changes that took place during that person's life. The investigator can estimate most accurately when teeth are erupting, bones are growing, and **epiphyses**, or growth plates, are forming and uniting. Closure of cranial sutures in the skull is also an age indicator. After this growth period, at around 25 to 30 years old, age estimation becomes more difficult and depends on the degenerative changes in the skeleton.

**epiphyses:** growth plates found at the ends of the long bones. They form in adolescence and fuse to the bone during early adulthood.

**diaphysis:** the shaft of a long bone

**iliac crest:** found on the top of the hip bone

Skeletal changes happen at different ages in different individuals. All estimates are just that: estimates. The forensic anthropologist always gives the investigators an age range to avoid excluding any possibilities in identifying unknown remains. Looking at multiple sites or multiple age indicators can narrow the range of the estimate.

The **diaphysis**, or shaft, makes up most of a long bone's length. Epiphyses are found at both ends of the long bone; their function is to allow for growth. The epiphyses are good places to look for changes in estimating age. Though all people are different and grow at different rates, there are similarities that make generalizations possible in estimating age.

The epiphyses fuse to the bone during adolescence and can be examined in four stages:

*Stage 1:* Nonunion with no epiphysis (there is no growth plate yet).

*Stage 2:* Nonunion with separate epiphysis (the growth plate is formed but not attached).

*Stage 3:* Partial union of the epiphysis (growth plate is beginning to attach to the bone).

*Stage 4:* Complete union of the epiphysis (growth plate is completely attached and smooth).

These stages happen at different ages in different bones and also differ between males and females, as shown in Tables 14.1 and 14.2. A photo of the **iliac crest** is shown in Figure 14.5.



**Figure 14.5** Photograph showing stage 1 of the iliac crest. Notice the line where the growth plate on top is attached, yet not completely smoothed over.



Femur showing partial union of growth plates at each end. Stage 3.



**Table 14.1: General Age Determinations Using Epiphyseal Union of the Medial Clavicle**

Stage of Union	Male	Female
Nonunion without separate epiphysis	21 or younger	20 or younger
Nonunion with separate epiphysis	16–21	17–20
Partial union	17–30	17–33
Complete union	21 or older	20 or older

**Table 14.2: General Age Determinations Using Epiphyseal Union of the Iliac Crest**

Stage of Union	Male	Female
Nonunion without separate epiphysis	16 or younger	11 or younger
Nonunion with separate epiphysis	13–19	14–15
Partial union	14–23	14–23
Complete union	17 or older	18 or older

**clavicle:** also known as the collarbone; its medial ends meet in the center of the body





# Practice

You will use the information from the activity on slides 5-7 to answer the following questions.

## Determining Age Using the Epiphyses



Ci



Cii



Ciii



Civ



Cv

1. Study the medial **clavicle** samples in the photos below (Ci through Cv) and note the differences in the surfaces. How does the epiphyseal surface change with age? Diagram and record your observations or use the handout.
2. Label the stage of epiphyseal union in each sample.
3. Using Table 14.1, determine the approximate age of each specimen.
4. Determine the age of the model skeleton based on the various epiphyses.

Use Civ for #4



# Answer Key

Once you have completed the practice questions check with the work.

1/ 2 As a person ages the epiphysis begins to join to the bone. In Ci it is completely united, which I can tell by the bumpy surface that has attached to the bone. In Cii the epiphysis has formed but is separate from the bone, which I can see as it is separate. In Ciii there is partial union, which I can see from the line/ crevice that part of the growth plate is still moving into place. In Civ there is a partial union, which I can tell because the separate piece is evidently sitting on top of the bone. Finally, in Cv the growth plate has not formed yet, which I can tell by the size of the bone and how smooth it is.

3. Ci- 21 or older, Cii- 16-21, Ciii- 17-33, Civ- 17-33, Cv- under 21

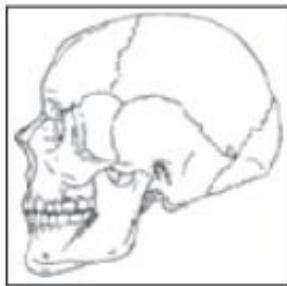
4. 17-33 years old

## Estimating Age Based on Cranial Sutures

Additional important age indicators are the **sutures** located on the skull. The bones of the skull come together or unite along special serrated and interlocking joints known as sutures. The sutures allow for growth of the skull.

**sutures:** immovable joints where bones are joined together. They are visible as seams on the surface.

The *sagittal suture* is located along the top of the skull, dividing right from left, and runs from the top of the skull to the middle of the back of the skull. Locate the sagittal suture on the skeleton.



The *coronal suture* runs from the temporal area on one side over the top of the skull to the other side. Locate the coronal suture on the skull. The *lambdoidal suture* is located on the back of the skull. Find this suture on the skull.

If the sagittal suture is completely closed (not visible at any point):

*Male:* The individual is 26 years of age or older.

*Female:* The individual is 29 years of age or older.

If the sagittal suture is completely open (visible at all points):

*Male:* The individual is younger than 32 years old.

*Female:* The individual is younger than 35 years old.



Human skull showing sagittal and coronal sutures

Looking at these two criteria together, it could be said that the sagittal suture is not likely to be open if a male is older than 32 and not likely to be closed if he is younger than 26. For a female, the suture is not likely to be open after 29 and not likely to be closed if younger than 35 years old.

If the skull shows complete closure of all three major sutures (no visible suture lines):

*Male:* The individual is older than 35.

*Female:* The individual is older than 50.

Determine the age of the model skeleton based on cranial sutures.

## Determining Age Using the Os Pubis

Examining the closing of the epiphyses is a good method to determine age in younger skeletal remains. Once the epiphyses are closed, forensic anthropologists observe degenerative changes to determine age. One of the best areas to determine age in an adult is from the pubic **symphysis**, which is the area where the two hip bones come together in front. As a person ages, the two bones may rub together, producing changes or wear patterns.

**symphysis:** a place where two bones meet and may rub together

The symphyseal face of the pubic bone undergoes a regular metamorphosis, or change, from puberty onward. Basically, the pattern on the symphysis goes from being in regular rows or furrows in younger individuals, to smooth with an oval surface, to a breakdown of the bone in older individuals.



Examining and sorting bones from the church building





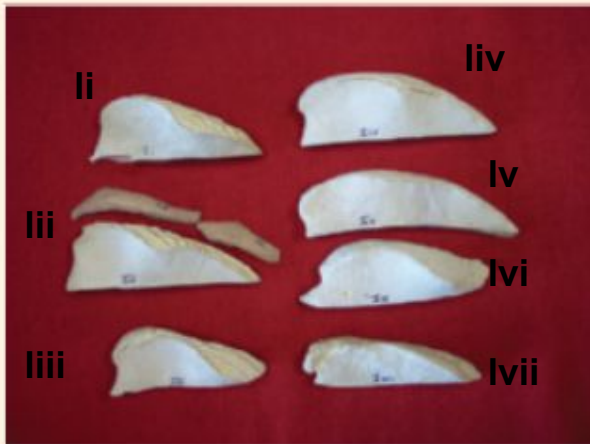
# More Practice

You will use the information from the information on slides 12 and 13 (also found on pages 425-427 at this [link](#)) to answer the following questions

# More Practice Questions

Forensic anthropologists can also use the epiphyseal union of the anterior (front side) iliac crest as an indicator of age. The iliac crest is found on the hip bone. Locate the iliac crest on the skeleton. The four stages of union are the same as for the medial clavicle, though the age range is different.

- Study the samples in the photo below (li through lvii) and note the differences in the surfaces. How does the epiphyseal surface change with age? Diagram and record your observations or use the handout.
- Label the stage of epiphyseal union in each iliac crest sample in the photo.



- Use Table 14.2 to determine the approximate age of each specimen in the photo.
- Samples F1, F2, and F3 in the photo at right are parts of the femur. These epiphyses begin to unite between the ages of 14 and 19 in males. Where is the femur found on the skeleton?
- What is the approximate age of the specimen in the photo?



- Samples H1 and H2 in the photo at right are parts of the humerus. Where is the humerus found?
- What are the stages of epiphyseal union in these two fragments?







## Answer Key

Once you have completed the practice questions check with the work.

5-7 Li is in stage one as there is no epiphysis present. 16 or younger

Lii has fragmented pieces of its unattached growth plate= stage 2 where the epiphysis is formed but not united. 13-19 years old

Liii is in stage one as there is no epiphysis present. 16 or younger

Liv is in stage one as there is no epiphysis present. 16 or younger

Lv is in stage one as there is no epiphysis present. 16 or younger

Lvi is in stage 3 where the epiphysis is partially attached. I see the crevice of separation at the top left of the bone. 14-23 yrs old

Lvii is in stage 3 where the epiphysis is partially attached. I see the crevice of separation at the top right of the bone. 14-23 yrs old

8. Leg, above fibula and tibia

9. These bones show no epiphysis at all, stage 1

10. This is on the arm, above the ulna and radius

11. These bones are partially united, stage 3



# Additional Practice

Go to this [link](#) to read more about the dating of skeletal remains.