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ISD

INDEPENDENCE SCHOOL DISTRICT

High School Science Virtual Learning

Forensic Science
Bones and Height

April 13, 2020

High School Forensic Science
Lesson: April 13th, 2020

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

1. Bell ringer 1: Watch this video.
2. Bell ringer 2: Write a paragraph on how the human skeleton provides support, movement, storage, blood production and homeostasis.

Bellringer Answer: Answers will vary

Example: The human skeleton is made of bones that contain compact bone on the outside, spongy bone underneath that, and then either red or yellow marrow in the center. Red marrow allows for blood flow and yellow marrow stores fatty acids and calcium, for when we might need to tap into it. The amount of blood to calcium our body receives is actually controlled by the bones as they are connected to the circulatory system and let our body know when that ratio is too low or too high.The compact bone is attached to muscles and tendons that use the bone for structure. Without those bones, they would not be placed in the correct location. Muscles and tendons respond to nerve firings and move, causing the bones to also move in response. The bones of the appendicular skeleton have various joints that allow the body to move in various directions.

Lesson Activity:

Directions: Read through the following slides and answer the questions. You will need a calculator for this. If you do not have one at home, you can use the Google calculator

Link(s):

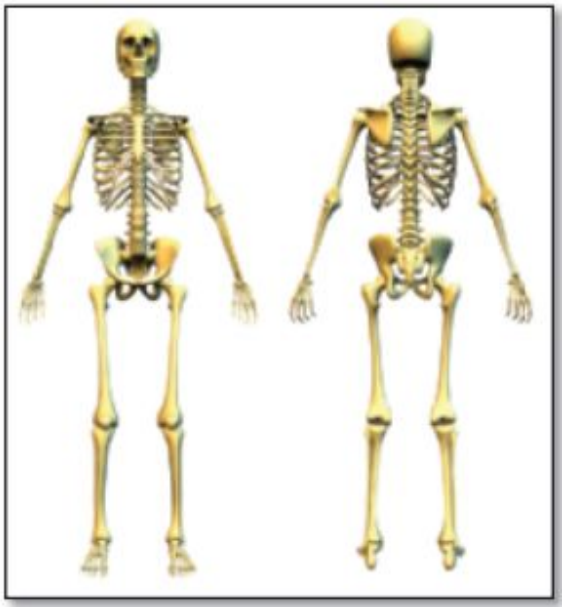
https://www.westada.org/site/handlers/filedownload.ashx?moduleinstanceid=8825&dataid=31707&FileName=Chapter%2014.pdf

The Skeleton

An adult human has 206 bones. In younger humans, bones vary in number with age as the bones develop and grow. Ossification sites (where growth takes place) are found on many bones. Most bones of the body have a similar structural pattern.

The skeleton performs many vital functions. It provides structure and rigidity for the body. It shelters and protects soft tissue and internal organs. The skull surrounds and protects the brain; the sternum and rib cage encase the heart and lungs. The skeleton provides sites for the attachment of the muscles, tendons, and ligaments that allow the body to move. The skeleton stores minerals and houses sites that produce red blood cells.

X ray of human hand; note the short, square bones in the wrist



The body moves through the interaction of muscles and the skeleton. Tendons and ligaments are structurally similar but function differently. Muscles are connected to the bones by tendons. Bones are connected to each other or to joints with ligaments. Joints are points where a muscle is connected to two different bones and contracts to pull them together.

The marrow located in some bones produces blood cells. An average of 2.6 million red blood cells are

produced each second by the bone marrow to replace those worn out and destroyed by the liver. The marrow also produces the cells of the immune system.

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GO TO www.scilinks.org
TOPIC skeletal system
CODE forensics2E414

Bones serve as a storage area for minerals such as calcium and phosphate. When an excess of these minerals is present in the blood, buildup will occur within the bones. When the supply of these minerals within the blood is low, they are withdrawn from the bones to replenish that supply. Bone tissue can also clean the body by removing heavy metals and other foreign elements from the blood. It stores them and releases them slowly for excretion, lessening any ill effects on nervous tissue.

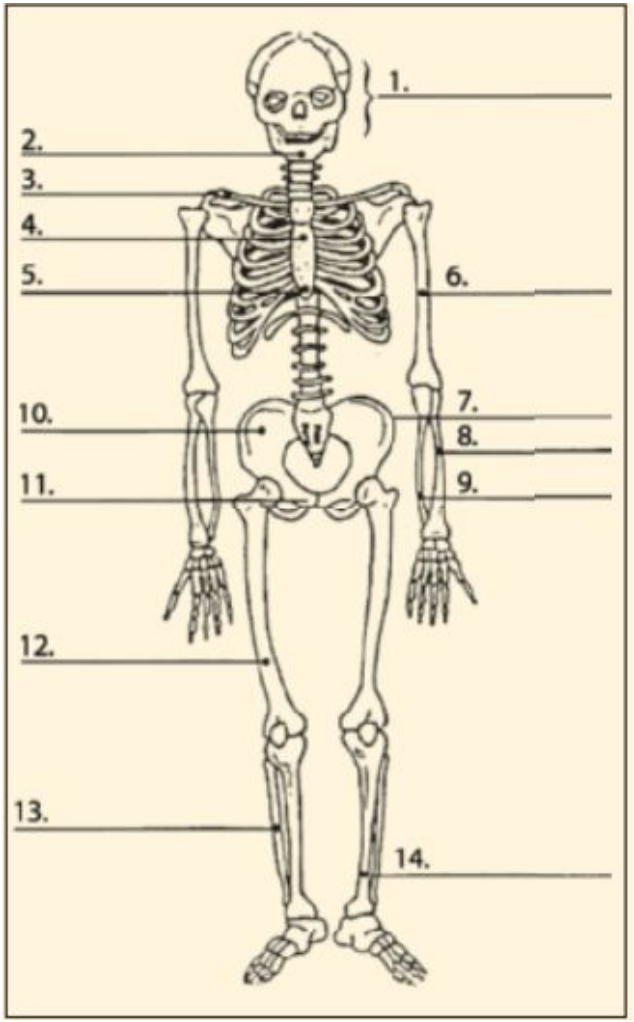
Irregular bone; lumbar vertebra

Bones can be classified as long, short, flat, or irregular:

- The long bones are longer than they are wide; they include bones in the arms, legs, hands, and feet.
- The short bones are approximately as long as they are wide; they are found in the wrist and ankle.
- The flat bones are flat and enclose soft organs; they include most bones in the skull and the scapula, sternum, hip bone, and ribs.
- The irregular bones are irregularly shaped; they include the vertebrae and some of the bones in the skull.

Practice

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



Identifying Bones

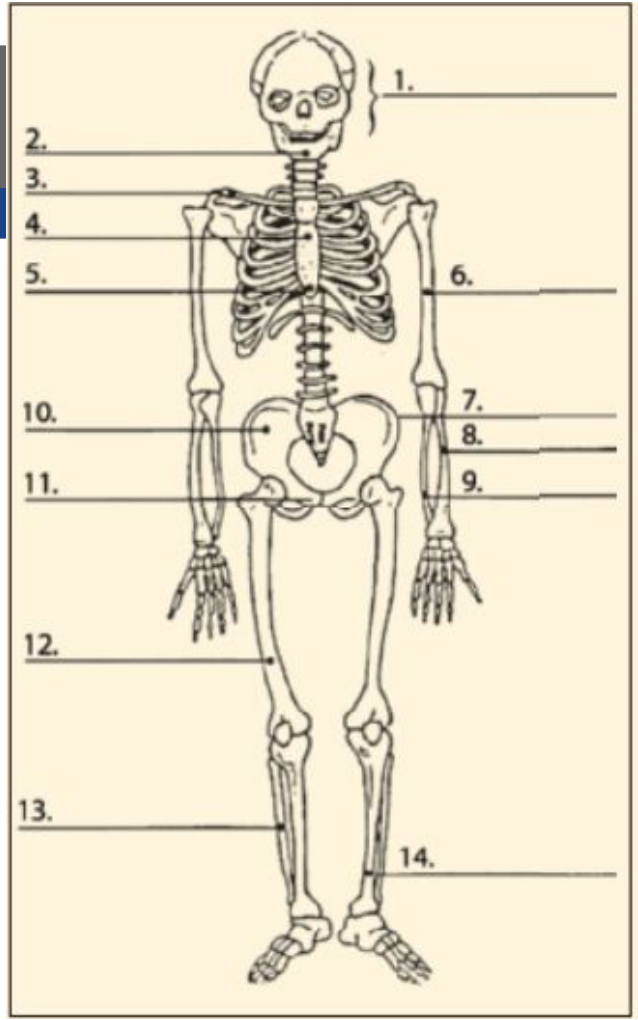
Use the library, the Internet, or an anatomy book to identify the following human bones. In your notebook, identify the bones numbered 1–14.

Bones in a man running

Answer Key

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

1. cranium
2. mandible
3. clavicle
4. sternum
5. ribs
6. humerus
7. pelvis/ iliac crest
8. radius
9. ulna
10. illium
11. coccyx
12. femur
13. fibia
14. tibia



Stature: Estimating Height

Forensic scientists can estimate a person's stature (height) by examining one or more of the long bones. The long bones you will consider here are the **femur**, **tibia**, **humerus**, and **radius**. Men and women have different proportions of long bones to total height, so separate formulas have been developed for each. If complete long bones are available, the following formulas may be used to estimate height within a range of ±7.5 centimeters:

Estimated height of a female (centimeters):

H = femur length × 2.21 + 61.41

H = tibia length × 2.53 + 72.57

H = humerus length × 3.14 + 64.97

H = radius length × 3.87 + 73.50

Estimated height of a male (centimeters):

H = femur length × 2.23 + 69.08

H = tibia length × 2.39 + 81.68

H = humerus length × 2.97 + 73.57

H = radius length × 3.65 + 80.40

femur: long bone found in the leg extending from the hip to the knee

tibia: long bone found in the leg extending from the knee to the ankle

humerus: long bone found in the arm extending from the shoulder to the elbow

radius: long bone found in the arm extending from the elbow to the wrist

Link:

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

From top: radius, humerus, femur

More Practice

You will use the information from the activity on slide 11 to answer the following questions.

More Practice Questions

Measuring the length of a femur to determine height

Estimating Height

Using the equations on page 416, calculate the following long bone lengths and heights. Show all of your work, measurements, and calculations. Remember that 2.5 cm = 1 inch. Be sure to include a range of ±7.5 centimeters.

1. One of the male skeletons found in Gorman that you read about at the beginning of the chapter had a humerus 34.9 cm long. Approximately how tall would that person have been?
2. The body found in the sewer system that you read about in the beginning of the chapter was found to have a tibia 34.8 cm in length. What would the approximate height be if the body were female? If it were male?
3. Using your own height (in centimeters), what would you expect the length of your femur to be?
4. If you have a skeleton for observation in your class, measure one of its long bones. Calculate the height for a male.
5. Measure two more of the bones on the skeleton. Calculate the approximate height, assuming the skeleton is male.
6. Using the same bones from question 5, calculate the approximate height, assuming the skeleton is female.
7. Measure the height of the skeleton. Based on these measurements, would you assume the skeleton is male or female?

4. Male radius length 30.3 cm

5. Tibia 36.6 cm
Femur 45.6 cm

7. 63.2 inches tall

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

1 . He would have been about 5 ft 10 inches. Work: 34.9cm x 2.97 + 73.57= 177.223cm / 2.5cm per inch = 70.8 inches or about 5 ft 10 inches

2. If it were a male, 34.8 cm x 2.39 + 81.68= 164.85 cm/ 2.5 cm per inch= 65.94 inches or 5ft 5 inches

If it were a female, 34.8cm x 2.53 + 72.57= 160.61 cm/ 2.5 cm per inch= 64.25 inches or 5 ft and 4 inches

3. My height is 65 inches and I am a female. Use your height and sex, then I use that in the femur equation. 65 in= 162.5cm
162.5cm = femur length cm x 2.21 + 61.41 101.09cm = femur length x 2.21 45.74 cm = femur length for me.

4. For radius 30.3 cm x 3.65 + 80.4 = 191 cm / 2.5 cm per inch = 76.4 inches or about 6 ft 4 inches to 6 ft 5 inches

5. For tibia 36.6cm x 2.39 + 81.68 = 169.15 cm/ 2.5cm per inch = 67.66 inches which is about 5 ft 7 inches - 5 ft 8 inches
For femur 45.6 cm x 2.23 + 69.08 = 170.77 cm / 2.5 cm per inch = 68.31 inches which is 5 ft 8 inches

6. For tibia 36.6cm x 2.53 + 72.57 = 165.17 cm/ 2.5cm per inch = 66.1 inches which is about 5 ft 6 inches
For femur 45.6 cm x 2.21 + 61.41 = 162.19 cm / 2.5 cm per inch = 64.87 inches which is 5 ft 5 inches

7. Female, shorter stature helps us assume that, but we could look at the hips and cranium to confirm

Additional Practice

Go to this link to test your skills and improve your memory of the different bones in the human body.