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The kneebone's connected to the…

We are investigating using formula to describe relationships between measurements of various body parts.

Exercise 1:

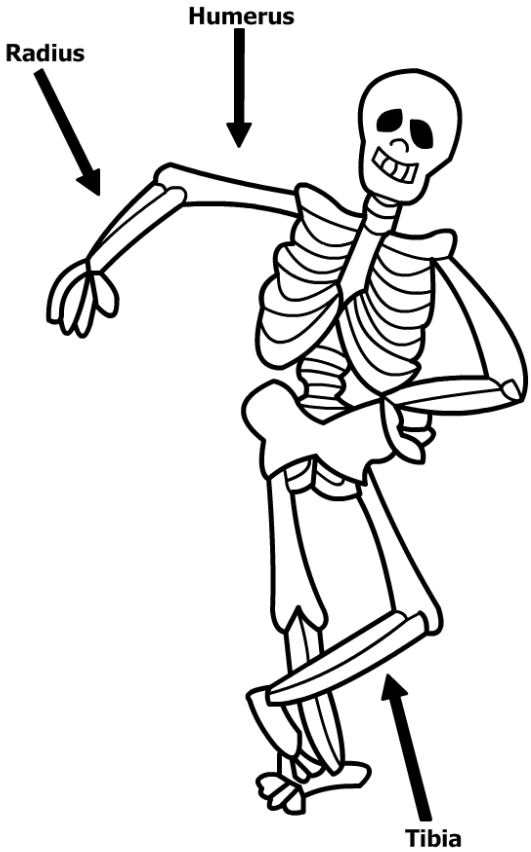
In groups

Equipment: Ruler / Measuring tape.

Your bones tell a lot about your body. Archaeologists and forensic scientists study bones to estimate a person's height, build, and age. For example, the lengths of major bones such as the humerus, radius, or tibia can be used to find a person's height.

In this project, you will collect bone measurements in order to explore relationships that can be used to predict the height of a person.

The diagram below shows three major bones:



- Measure your height to the nearest centimetre.
- Measure the length of your tibia, humerus and radius bones to the nearest centimetre.
- Record the above information for your group in a table.
- Explore the data you have collected. Can you see any patterns / relationships? Explain.
- Share your ideas with the members of your group.

Exercise 2: Using measurements to predict height.

Scientists use the formulas below to approximate a person's height *H*, in centimetres, where *t* is the length in centimetres of the tibia, *h* is length of the humerus, and *r* is the length of radius.

Male	Female
$H = 81.788 + 2.4t$	$H = 72.64 + 2.5t$
$H = 73.66 + 3.0h$	$H = 65.024 + 3.1h$
$H = 80.518 + 3.7r$	$H = 73.406 + 3.9r$

- Why do you think there are different formulas for males and females?
- Use your tibia, humerus, and radius bone lengths to calculate your height. Are the calculated heights close to your actual height? Explain your answer.

In your group:

- Compare your results.
- Can any differences be explained?
- Is one of these bones a better predictor of height than the others? Explain your answer.
- What are the limitations and / or justifications for using bone length measurements to predict height?

Exercise 3:

- A West Coast farmer found a 457mm tibia on her farm. Do you think it belonged to a man or a woman? Why?
- Choose one of the radius measurements for someone else in your group; this was collected in Exercise 2. Calculate the height of the person using the formula. Can you tell whose radius measurement you have using the height you have calculated? Explain.
- Design a method for finding the accuracy of a formula.

Exercise 4:

Below is a formula which uses a person's foot length to predict their height:

$(f \times 100) \div 15 = \text{height}$.

- What does this formula say about the relationship between foot length and height?
- How accurate is this formula? Use your method designed in Exercise 3 to estimate the accuracy of this formula.

Exercise 5:

Sarah has suggested that the formulas should change with age.

- Investigate her conjecture.

Exercise 6:

In your group generate formulas that could use a person's height to predict the length of specific bones.

Exercise 7:

Select another bone in your body and take measurements which enable you to find the relationship between that bone's length and your height.

Using other members of your group, test the accuracy of your formula.

Exercise 8:

- Compare the length of a bone in your hand with your radius measurement. How many times bigger is it? Can you write this as a formula?
- How could you adjust the radius formula used to predict height to use the measurement of the bone in your hand instead?
- Test your formula on other members of your group.

Design a poster to clearly explain how you generated your new formula and discuss its accuracy.