# FORENSIC SCIENCE Ш USING MATHS IN

# SUMMER PROJECTS

HOW BONES ARE USED IN FORENSICS



HEART OF WORCESTERSHIRE COLLEGE

# KICK START YOUR STUDY AT HOW COLLEGE WITH ONE OF OUR CURRICULUM BRIDGING PROJECTS

# Background

In applied science and forensics numeracy skills are essential to analyse data and form valid conclusions. In this task you will be investigating what information can be obtained from bones and how individuals can be distinguished using information from bones. You will develop and demonstrate numeracy skills such as determining multiplication factors and creating scatter plots and interpreting the correlation.

What you should hand-in: You will need to read over the information and complete the tasks in The L3 Forensics Maths Booklet- How bones are used in Forensics.

**Resources:** The L3 Forensics Maths Booklet- How bones are used in Forensics.

#### **Objective:**

Understand how bones are used in Forensics .

#### Outcomes:

MUST:

State what information can be obtained (Pass).

SHOULD:

Describe how individuals can be distinguished using information from bones (Merit).

COULD:

Explain why analysing bones in Forensics is useful (distinction).

Want a career in Forensic anthropology? /www.discoveranthropology.org.uk/career-paths/what-do-anthropologists-do.html







#### Flat Bones

Flat bones are as they sound, strong, flat plates of bone with the main function of providing protection to the bodies vital organs and being a base for muscular attachment.



 An example of the flat bone is the Scapula (shoulder blade). The Sternum (breast bone), Cranium (skull), Os Coxae (hip bone) Pelvis and Ribs are also classified as flat bones.

#### Short bones

 Short bones are defined as being approximately as wide as they are long and have a primary function of providing support and stability with little movement.



Examples of short bones are the Carpals and Tarsals - the wrist and foot bones.

#### Long Bones

Long bones are some of the longest bones in the body, such as the Femur, Humerus and Tibia but are also some of the smallest including the Metacarpals, Metatarsals and Phalanges.



 The classification of a long bone includes having a body which is longer than it is wide, with growth plates (epiphysis) at either end, having a hard outer surface of compact bone and a spongy inner known an cancellous bone containing bone marrow.





LABELED DIAGRAM OF SKELETON

#### Using bones to determine age

#### Teeth

- Teeth develop from the appearance and loss of he 20 milk teeth by age 12
- Up to 32 permanent teeth develop by age 18, when wisdom teeth may appear
- In adults, the wear patterns of teeth can be taken into account



Jaw of teething child







## Using bones to determine height

- Sometimes bones will be missing- usually in mass graves, and then anthropologists are tasked with matching up bones for each individual victims.
  - > The victims' height (and the size of missing bones) can be calculated from the length of other bones

#### Using bones to determine Activity of person

- Bones become thicker with use. So right or left handedness and features associated with work habits are assessed
- Bones may have been damaged by disease or injuries from physical abuse

# Using bones to determine cause of death

- · Bullets may leave holes
- Sharp weapons may cut or chip bones
- Unhealed fractures also indicate violence



# Using bones to determine ethnicity

- Skulls of different ethnic groups have distinctive features
- Asian skull is tall with a broad, flat face and projecting cheek bones
- Afro-Caribbean skulls have a wide nose opening and larger teeth than other groups
- Caucasians/European skulls are high and wide. Cheek bones and jaw do not project. The jaw falls behind a vertical line from the forehead

# Using bones to estimate person's build

- The skull can be used to attempt facial reconstruction
- The bones can be used to determine the size and shape of muscles that attach to them
- The shape of the face can be approximated by working out the muscle distribution.
- Eye colour, structure of the eyelids, skin colour and style of hair have to be best guess

#### **Section 1: Measuring bones**

Osteology is a detailed study of the structure of bones and skeletal elements. An osteologist may be asked to produce a profile of a person using skeletal remains.

#### Investigate body proportions of different parts of the skeleton

|        | Length |      |          |      |       |      |                       |
|--------|--------|------|----------|------|-------|------|-----------------------|
| Person | Height | Ulna | Arm span | Hand | Femur | Foot | Head<br>circumference |
| 1      | 184    | 29   | 182      | 20   | 48    | 27   | 57                    |
| 2      | 168    | 27   | 168      | 17   | 45    | 23   | 56                    |
| 3      | 164    | 27   | 170      | 19   | 44    | 23   | 56                    |
| 4      | 170    | 28   | 167      | 18   | 46    | 25   | 56                    |
| 5      | 180    | 28   | 176      | 19   | 48    | 24   | 57                    |



#### Conclusion

- 1. Produce the following graphs using excel:
- a. Height (x axis) against arm span (y axis)
- b. Height (x axis) against ulna (y axis)
- c. Height (x axis) against hand (y axis)
- d. Height (x axis) against femur (y axis)
- e. Height (x axis) against foot (y axis)
- f. Height (x axis) against head (y axis)

#### How to create a scatter plot on excel

- 1. Enter your data. A line graph requires two axes in order to function. Enter your data into two columns. For ease of use, set your X-axis data (time) in the left column and your recorded observations in the right column.
- 2. Select your data. Click and drag your mouse from the top-left cell in the data group to the bottom-right cell in the data group. This will highlight all of your data. Make sure you include column headers if you have them.
- Click the Insert tab. It's on the left side of the green ribbon that's at the top of the Excel window. This will open the Insert toolbar below the green ribbon.
- Click the "scatter plot" icon. It's the box with dots drawn on it in the Charts group of options. A drop-down menu will appear.
- 5. Select a graph style. Hover your mouse cursor over a line graph template in the drop-down menu to see what it will look like with your data.
- Change the graph title by clicking on the title of the graph. You can also add in axes titles
- Add a trend line- hover over the right top corner of the graph and a plus sign appears, click on the trend line option.





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2. Which parts of the skeleton can be used to estimate height? Give the multiplication factor needed in each case (how many times larger or smaller than the height).

| Part of<br>skeleton   | Multiplication factor to give height |
|-----------------------|--------------------------------------|
| Arm span              |                                      |
| Ulna                  |                                      |
| Hand                  |                                      |
| Femur                 |                                      |
| Foot                  |                                      |
| Head<br>circumference |                                      |

**3.** What relationship did you find between the length of the ulna and the length of the foot?

**4.** Search on the internet for a picture of Leonardo Da Vinci's drawing "Proportional Study of Man in the Manner of Vitruvius". Do you agree with the proportions?

Copy and paste your graphs here



# Indicative time for this project:

Up to 3 hours.

## Instructions on how to submit this:

Please submit all work to:

Neil Tabram Curriculum, Resource & Quality (CRQ) Leader – Hospitality and Applied Science

e. science@howcollege.ac.ukt. 01905 743515

# How will I benefit from this project:

The project will help you understand what to expect when you come to College and also give you a head start in working on topics and content that will be relevant when you begin your journey with us.

# What can I expect to get back after I submit my project work:

The receipt of your work will be acknowledged and a member of the team will give you some feedback.

## Key information you should include:

Your name Your email address A contact telephone number