Suggested Year: 9 or 10

This unit introduces the human skeleton and compares it with the skeletons of other mammals. It explores the structure, shape and name of bones and how this information can be used when investigating crimes. It also explores how this information can be used when looking for clues about remains discovered at an archaeological dig or the lifestyle of a recently deceased person.

The unit is suitable for pupils at the end of Year 9 or in Year 10. Some pupils may find articles or discussions about crimes distressing. Teachers should use their personal and professional knowledge when choosing appropriate activities and resources.

Statutory topic covered in this unit

» Organisms and Health

Unit links to the Big Picture

| Learning for Life and Work | Personal Development |
|                          | Home Economics       |
|                          | Employability        |

| Key Elements             | Personal health      |
|                         | Citizenship          |
|                         | Cultural understanding|
|                         | Media awareness      |

| Cross-Curricular Skills  | Using Mathematics    |
|                         | Communication        |

| Thinking Skills and Personal Capabilities | Thinking, Problem Solving, Decision Making |
|                                           | Working with Others   |

| Learning Experiences | Investigating and problem solving |
|                     | Linked to other curriculum areas – Art and Design |
|                     | Relevant and enjoyable |
|                     | Media rich |
Assessment for Learning
» Clear learning intentions shared with pupils
» Celebrate success against agreed success criteria
» Peer and self-evaluation of learning

Attitudes and Dispositions
» Personal responsibility
» Concern for others
» Curiosity

Classroom Activities

Activity 1: The Structure of the Mammalian Skeleton
Activity 2: Skeleton Features and Identification
Activity 3: Investigating the Structure of a Bone
Activity 4: The Importance of Calcium
Activity 5: Jobs and Careers
Activity 6: Evaluation
Activity 1:
The Structure of the Mammalian Skeleton

Learning Intentions
Pupils are learning to recognise the human skeleton and describe the similarities between it and the skeleton of other mammals.

Suggested Activities
Put the pupils into groups of four or five to start a Know – Want to Know – Learned (KWL) exercise (outlined in the Active Learning and Teaching Methods booklet) about the skeleton. Display the pages for each group in the classroom until the end of the topic.

Using a model skeleton, pupils work in groups to name as many bones as they can. Ask the class the following questions.

» Have you ever broken a bone?
» Can you remember its name?
» Have you ever heard of a sportsperson breaking or damaging a bone?
» What was it called?

Ask the pupils to use a spider diagram to list as many functions of the skeleton as they can. Then ask them the following questions.

» If you broke a bone, what activities were difficult or impossible to do?
» So what is the function of the bone you broke?

The class as a whole can then discuss these spider diagrams and develop a more complete list of the bones and functions of the skeleton. Give the pupils a labelled diagram of the human skeleton. You might find the labelled diagram from www.teachpe.com useful for this activity. The website also includes an unlabelled diagram, which could be useful for testing the pupils’ knowledge of the human skeleton.
Comparisons

Pupils examine the skeleton of a four-legged mammal such as a rabbit or cat. Then ask them, apart from size, in what ways does it differ from a human skeleton? Pupils should explain these differences in terms of function and adaptation.

Pupils should now examine the skeletons of other vertebrates such as a bird, frog and fish. Ask them how do these skeletons differ from each other?

Relate the structure of the skeleton to the kind of life the animal leads. Ask the pupils to identify and research a feature that is similar across all these skeletons. For example, a human hand, ape hand, dog paw, bird wing and whale fin are all pentadactyl limbs. Then ask the pupils:

» Do these limbs have common features and functions?
» Why are there slight differences in structure?

Key Stage 4 Link (Biology/Evolution)
Activity 2:
Skeleton Features and Identification

Learning Intentions
Pupils are learning to identify the features of a skeleton that change according to gender or age, and how this information can help identify a person.

Suggested Activities

Gender: Is the skeleton a Jane Doe or a John Doe?
Ask the pupils the following questions.

» Can a skeleton be male or female?
» What are the clues?
» Why are they different?

It might be useful to show the pupils a crime photograph or a clip from a forensic science programme.

Explain to the pupils that the gender of a skeleton can be determined in several ways by examining different parts. Most of the following differences are due to changes that happen during puberty.

» Hips: male hips are narrower than female hips, as female hips need to allow for childbearing.

» The skull: males have a sloping forehead while females have a straighter forehead.
(Pupils could look at the skulls of their classmates to see if they notice this feature.)

» The jaw: males have a more square jawbone while in females it is more v-shaped.

» Brow bones: male brow bones are more pronounced than female ones.
You might find the following web page and identification activity useful for this topic.

» Male or Female? available at www.anthropology.si.edu
» Is the Skeleton Male or Female? available at www.anthropology.si.edu

Age

Explain to the pupils how the following parts of the body change with age.

» Teeth:
  – young children will not have lost their milk teeth;
  – wisdom teeth start to appear between the ages of 14 and 18; and
  – teeth are worn with age.

» Bone:
  – during the teenage years, bones become thicker and larger and fuse together in a process known as ossification;
  – the collarbone is the last bone to stop growing, usually at age 25; and
  – degeneration starts to happen in the bones of the elderly.

Show the pupils the X-rays of teeth from the Can You Identify the Age? activity, available at www.anthropology.si.edu, then ask them the following questions.

» What age was the person?
» How can we tell?

You might find Young or Old?, available at www.anthropology.si.edu, useful for your background research.
Activity 3: Investigating the Structure of a Bone

Learning Intentions

Pupils are learning to classify bones by their shape.

Explain to the pupils that long bones are found in the limbs and they tend to be long relative to their diameter, with some curvature to give them strength. Each long bone has a shaft (diaphysis) and two enlarged ends (epiphyses).

Safety

Make sure that any bones pupils are going to handle are cleaned and sterilised in advance by you or the lab technician. Remove as much flesh as possible with a sharp knife. Place the bones in a beaker of water with a little sodium carbonate. Simmer (do not boil) until the rest of the flesh is easily removed. Use an old nylon toothbrush or pan scourer to remove the flesh. Return the bones to the beaker and simmer for a few more minutes.

Wear eye protection if you are cutting bones or cartilage, and it is essential that you wash your hands after the investigation. Follow the CLEAPSS Laboratory Handbook guidelines (Section 14) from the CLEAPSS CD-ROM.

Suggested Activities

In this investigation, pupils examine the structure of a long bone. Ask them to:

» list the long bones in the human skeleton; and

» suggest two reasons why the ends might be enlarged.

Show the pupils a long bone cut in half down the middle. Note that the diaphysis encloses the marrow cavity.
Ask the pupils the following questions.

» Why do you think long bones are hollow?

» The diaphysis is composed of dense bone tissue. What is the thickness of this tissue in millimetres? (Pupils could use callipers for measuring the bone.)

» What is the function of dense bone?

» What does the marrow look like?

» What is the function of the marrow?
Activity 4:  
The Importance of Calcium

Learning Intentions
Pupils are learning to explain the importance of calcium to our bone health.

Suggested Activities
Pupils observe what happens when calcium carbonate is placed in vinegar.

Key Stage 4 Link (Biology)

Use clean, whole long bones from chicken wings. Ask the pupils to take a bone and try to break it. Then ask them the following questions.

» Were you able to bend the bone?
» Was it easy or hard to break?

Place a bone into a beaker of vinegar and leave for 5–7 days. Pour off the vinegar and rinse the bone in water. Then ask the pupils to examine it and describe any change in the bone since it was left in the vinegar. Ask them to try bending the bone and then describe what they notice.

Ask the pupils if it is possible to tie a knot in the bone. They should then suggest a hypothesis for the change in the bone.

As an alternative or further activity, use an egg instead of a bone. The vinegar will react with the calcium carbonate in the shell. This would take hours rather than days. (You could use a hard-boiled egg to reduce the risk of messy breakages.)
After completing this investigation, ask the pupils to consider the following questions.

» What substances in the diet are essential for developing healthy bones?
» What foods are good sources of these substances?
» What could make bones unhealthy?
» Are there any diseases that affect bones?

The following websites include information and resources that you might find useful for this lesson.

» Calcium available at [www.healthy-vitamin-choice.com](http://www.healthy-vitamin-choice.com)
» Muscle, joint and bone disorders available at [www.nhs.uk](http://www.nhs.uk)
Activity 5: Jobs and Careers

Learning Intentions

Pupils are learning to research different types of jobs and careers that require knowledge of bones and the skeleton.

The following suggested resources might not be suitable for all pupils, so please use your discretion.

Forensic Scientist

» Unidentified Human Remains Discovered During Search for Missing Texas College Student available at www.people.com/crime
» 1994: West charged as death toll mounts available at www.bbc.co.uk/news

Archaeologist

» Richard III: skeleton is the king available at www.telegraph.co.uk
» Seven Major Archaeological Discoveries of 2015 available at www.news.nationalgeographic.com

Surgeon

» Orthopaedic Surgeons: Who Are They and What Do They Do? available at www7.aaos.org/member/directory/definition.htm

Other Resources

» Skeleton and Bones Facts available at www.sciencekids.co.nz
Activity 6: Evaluation

Learning Intentions

Pupils are learning to:
» evaluate the knowledge they have developed from these activities; and
» identify possible areas of future study.

Suggested Activities

Return to the KWL exercise from the first activity. Pupils go back to their groups and complete the Learned section. Each group then presents their list so the whole class can develop a complete list. Check if the pupils still have questions that you need to answer.

You might find useful resources on CSI: the Experience, available at www.forensics.rice.edu, which will allow pupils to apply some of the knowledge they have developed.