In the year 2000, two ten year old boys searching for bags of disused copper wire in the industrial suburb of Darnell in Sheffield, England, made a gruesome discovery. They found a large bag discarded on the road verge. To their horror they discovered it contained, not copper wire, but mummified human remains.

The body was delivered to the Sheffield Medico-legal Centre where Dr Martin Evison, Adjunct Professor of Forensic Science at Murdoch University and Director of the Forensic Science Centre at Northumbria University conducted an osteological examination. He needed to construct an osteobiography.....that is, he needed to tell the life story of this individual from information written on the bones. From that, clues might emerge as to the identity of the person and the circumstances surrounding the death.

Several things were immediately apparent. Firstly, the body was that of a male. Secondly it was what is known as an adipocerous mummy. This is a type of mummification where the skin, instead of becoming hard and leathery, becomes waxy and soap like due to the body having been “stored” in a cool moist environment rather than under hot dry conditions. The extent of the mummification suggested that he had died several years ago. But who was he? Why did he die? Where had the body been stored all of this time? Was he murdered, and if so, by whom?

Dr Evison removed the mummified flesh and laid the bones out in their correct anatomical positions.
It soon became apparent that there was a wealth of information to be gleaned from the man’s skeleton. From the length of the long bones, the femur, tibia and fibula in the leg and the radius, ulna and humerus in the arm, it was estimated that, in life, he had been about 168 cm in height, a fairly short man. His craniofacial dimensions, particularly the width of his nasal aperture and width of his nasal bridge fell within the Indo-European average suggesting that he was either European, Middle Eastern or from the Indian Subcontinent. A partial DNA profile was obtained which suggested that he was three times more likely to have originated outside the United Kingdom.

Age can be estimated from a skeleton in many ways. Dental eruption is particularly important in attempting to age the skeleton of a child, but in adulthood, the extent of tooth wear can provide clues. One of the best approaches is to measure tooth root translucency. As we age, we lose density in our teeth and by taking thin sections of the roots and measuring the amount of light that passes through them, an estimate of age can be made. Another approach involves taking X-rays of the necks of the femurs (thigh bones) and measuring their bone density.

Looking at the auricular surface of the ileum (where the pelvis joins the sacrum at the base of the spine) and at the surface of the pubic symphyses (where the two halves of the pelvis join together) can also provide useful clues. In youth, these surfaces appear highly organised, but as we age they become more disorganised in appearance and are often pitted. Dr Evison applied all of these techniques and suggested that the man was at least middle aged. He could have even been over 60.

The pubic symphysis surfaces and the auricular surfaces of the ileum were pitted and disorganised

From the size of the muscle attachments on the two sides of his body, like 90% of the population, he was clearly right handed.

If diseases carried during life have left a mark on the skeleton, some indication of a person’s medical history can be obtained from an osteological examination. There was clear evidence that the man had suffered from moderately severe arthritis of his lumbar spine (lower back) and cervical spine (neck) to the extent that he would have had difficulty walking and turning his head. He also had arthritis of the knuckle joint of the middle finger of both hands. Normally there is a fluid-filled capsule that separates the two halves of the joint, but the capsule had degenerated in his case causing bone-on-bone contact which had worn the bone on both sides of the knuckle, smooth. This is known as ebonation. Clearly the man would have sought medical attention for these painful conditions, but who was his doctor and where were those medical records?

His feet were interesting. He had bunions on both big toes. This is a painful inflammatory condition that causes swelling of the metatarsal phalangeal joint. Treatment in severe cases involves fusing the joint by inserting a screw. An X-ray of his feet revealed that the metatarsal phalangeal joint on his left big toe had been fused….there was screw present. Furthermore, it was a Sherman screw…a type of screw that had not been used for this purpose for about 30 years, suggesting that the treatment had been performed many years before he died. The metatarsal phalangeal joint on his right big toe
was not fused, but there was a facet in the bone that indicated that at one time it had been fused and for some reason, at a later time, the screw had been removed.

The most intriguing thing gleaned from his “osteological medical history” was derived from an examination of his fifth right rib. There was a small ridge of bone that had become attached to the underside of the rib. Dr Evison and his team concluded that this bony ridge had originated from the vessels and nerves that ran beneath the rib. For some reason, they had, themselves, turned to bone. The most likely cause of this unusual finding is a reaction to surgery. At some time in his life, a surgeon had opened up his chest (had performed a thoracotomy), most likely to treat a serious lung condition.

At some stage during life he had also lost the tip of a finger, long enough ago for the bone to have remodelled beneath the missing joint.

Sometimes it is possible to glean information about habitual behaviours performed many times during life, which can be related to a person’s occupation. This is done by looking for unusual wear and tear in particular parts of the skeleton. This man had what is known as an enthesopathy at the proximal end of the ulna bone in his right arm (elbow). Muscles attach to bone via tendons and if a particular muscle is over used, the tendon that attaches that muscle to the bone can, itself, turn to bone. This is termed an enthesopathy. In the case of the body in the bag, the tendon that had once attached the triceps muscle to the ulna had tuned to bone, generating a little bony projection at the elbow. This indicated that during life he had flexed his right arm constantly, probably hundreds of times a day, for many years. What was he doing? Almost certainly something related to his occupation.

Another unusual habitual activity had worn his molars down and had caused some of his tooth enamel to dissolve. He had clearly chewed something regularly that was causing both physical and chemical abrasion of his teeth. Did he constantly chew tobacco or something similar?
The mystery man’s skeleton had revealed many of its secrets, but now Dr Evison and his PhD students put the icing on the cake. Working with clay, they performed a “facial approximation” of the mystery man and the reconstructed head was televised on a BBC Crime Watch programme broadcast to some 9 million viewers.

Soon after the programme, a viewer gave the police a name. Perhaps the facial approximation was recognisable, or maybe the programme simply jogged the viewer’s memory and set him thinking. The name given was that of an elderly Middle Eastern man from Yemen who had lived in Sheffield for many years. The investigative team then tracked down the named man’s medical records. Everything corresponded perfectly. He had been treated for arthritis of his lumbar and cervical spine; his metatarsal phalangeal joints on both big toes had been fused to treat bunions, but at a later time one of the screws had become infected and had been removed; he had been surgically treated for lung cancer and he regularly chewed Khat, a narcotic plant common in Yemen.

What was particularly intriguing was his occupation. He worked for many years as a “buffer” in a Sheffield cutlery factory, manually polishing knives, forks and spoons on a buffing wheel. This required constant flexion of his right arm, and one day he got too close to the wheel and it lopped off a fingertip! At the time of his death he was 73 years old.

Armed with a wealth of information, the police soon charged his 43 year old son and 18 year old grandson with murder. They admitted that, after a dispute, they cut his throat and stored his body in a “sand tomb” in the basement of their house...a cool moist, secure environment which encouraged adipocerous mummification. However, two years later, they decided to sell the house and discarded the body in a bag in Darnell believing no one would ever be able to figure out who he was. But they badly underestimated the power of forensic anthropology and the quality of the sleuthing of Dr Evison’s team!

You can hear more about this remarkable story from Dr Evison, himself, in the Murdoch unit Bodies of Evidence which is the “capstone unit” for our Forensic Biology and Toxicology degree. In that unit you will also perform your own forensic facial approximation, in just the same way that Dr Evison’s team did!