

In the future, DNA could put a face to the crime

An Irish geneticist is pioneering forensic techniques that can estimate a person's appearance from a DNA sample



New DNA tests could identify a person's hair and eye colour, height and facial appearance. Illustration via Getty Images

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What if finding [DNA](#) was all the police needed to know what a suspect looked like? This could become reality. Irish geneticist Dr Susan Walsh has received more than €900,000 from the [US Department of Justice](#) to develop tests to get a picture of physical appearance from DNA.

If [forensic investigators](#) cannot find a match for DNA found at a crime scene, the DNA profile can end up sitting in a computer or in a frozen sample. But DNA has almost everything needed to give some clues about physical appearance.

Walsh, a graduate of [University College Cork](#), developed the first estimation of eye and hair colour from DNA, which is now used by Dutch police in criminal investigations and in Australia for missing persons. She believes her tests could be used to restart cold cases in Ireland.

“If you find a corpse or body part, we can now give some indication of what that individual looked like, and we can test for bio-geographic ancestry too,” says Walsh. “You discover you are looking for someone with blond hair, blue eyes, so you cross off individuals with dark eyes, black hair.” Tests are in the pipeline that will estimate age. These tests are for providing police leads, however, and not evidence for court cases.

Normal DNA fingerprinting relies on repeat sequences of DNA. Like real fingerprints, the strings of DNA say nothing about appearance and are only useful for comparison and confirming whom a crime scene sample belongs to; they don't give police clues on a suspect's appearance. The new DNA tests are different, however.

Walsh is among a select group of scientists studying the genetics behind [facial appearance](#). “I believe it is definitely something we can predict,” says Walsh, although it will take another five to 10 years for real progress to be made. Top forensic geneticists are confident that DNA extracted from a smudge of blood or body fluid stain will ultimately allow them print out a photo reconstruction of a suspect.

Walsh caught the forensic science bug while still in school. Inspiration came from her father, who was a garda in Youghal, Co Cork, and also from a TV programme. “I was really into *The X-Files*,” she says. “I loved the idea of using DNA to solve crime.”

She studied biochemistry in UCC, and went on to do a specialist DNA profiling master's degree in the UK, before landing a job in a DNA sequencing lab in Sydney, Australia.

But she was drawn to research. “This idea of predicting what someone looked like grabbed my interest,” she says, and in 2009 she came across a group led by Prof Manfred Kayser at Erasmus University in Rotterdam, pioneering this work. She completed her PhD in 2013, developing the eye and hair test with Kayser for the Dutch police, and moved to the US as a researcher.

Walsh is now assistant professor at Indiana University – Purdue University Indianapolis,

where she is refining the test for hair and eye colour real-world shades, which will help police, archaeologists and other investigators. With Kayser, she will report on a new test for estimating [skin colour](#) in the coming months.

Snipping us apart

How do such tests work? They rely on SNPs (single nucleotide polymorphisms, or “snips”), places where there is variation at a single letter site in DNA between people. Such SNPs can help tell us apart.

Six SNPs can estimate eye colour with 75-90 per cent accuracy. One of these SNPs has an especially strong effect, because it changes the shape of the DNA, switching eye colour from blue to brown.

This work isn't all about crime; it can tell us something about European prehistory. Lighter skin colour most likely evolved as humans moved north in Europe and needed to top up on their UV rays for vitamin D absorption. Melanin is the pigment that blocks UV, and levels of this pigment evolved downwards.

“Our eye and hair colour changing was basically a by-product of this, because it involves similar pigmentation pathways,” says Walsh. Red hair involves a major change to one gene and is easiest to test for. Estimating facial appearance will be tougher: like height, it involves thousands of genes, each contributing in a small way.

Walsh would love Ireland's own Forensic Science Lab to take up her tests.

“Some cold cases that are very old have DNA samples that could be run using our test to limit down suspects, although first of all Ireland needs to get a DNA database,” she says.

DNA TESTING: FROM RICHARD III TO ANCIENT IRELAND

The remains of King Richard III were tested using a technique developed by Dr Susan Walsh, a UCC graduate and forensic scientist. It showed which painting best matched his physical

appearance, since all the paintings were completed after he died in battle at Bosworth in 1485. But her tests for predicting hair and eye colour from DNA also offer a glimpse of a future where DNA is used to track down suspects.

Hair and eye colour tests might be useful for stranger rapes or when someone is assaulted but has no idea who the offender was, says Dr Stephen Clifford at the Forensic Science Lab in Dublin. “Or it could be used when body parts or just residual body tissue is recovered but we have no idea who the person is.”

The Irish forensic lab, like most labs internationally, uses DNA for what are called STR profiles, more commonly known as DNA fingerprinting. “It is basic but it is robust and stands up in court,” says Clifford.

But the future, Clifford predicts, is next-generation technology that could provide all sorts of tests describing a person’s height, hair colour, eye colour, ancestry and even facial features. “This is the future, but for now it is many years away from being used in a court setting.”

There will also be issues regarding personal privacy to be worked out, since all sorts of health information may be legible from a DNA sequence in future.

Walsh’s tests are also looking back to Ireland’s history. She is collaborating in a project studying the origins of ancient Irish surnames, also involving UCC biochemist Prof Tommie McCarthy and historical geographer Prof Willie Smyth.

This involves collecting DNA from Irish people with names thought to be old Gaelic, such as O’Neill and O’Brien, possible Viking names such as McAuliffe and Cotter, Anglo-Norman names such as Butler and FitzGerald, or new English and Scottish names from the 15th and 16th century such as Dudley and Graham.

“We want to see whether DNA matches the surname or does it challenge what we think about a name’s origins,” says Smyth.