SCIENCE

From paternity to criminal cases DNA fingerprinting has been 30 years of 'eureka'

It's 30 years since Sir Alec Jeffreys discovered DNA Fingerprinting, sparking a revolution in crime investigation. But three decades on, are we guilty of relying too much on DNA evidence?

There is no doubt it was a "eureka" moment. And one that would change the world.

Exactly thirty years ago, Sir Alec Jeffreys was working in his laboratory at the University of Leicester when he discovered DNA fingerprinting.

Within months he was helping to solve immigration and paternity cases.

But his discovery has had the most far reaching impact in forensic science.

DNA fingerprinting has revolutionised the way crime investigations are carried out and has been key in helping to establish guilt or innocence in many cases.

Only last week, two half brothers were declared innocent of the rape and murder of a girl in 1983 in the American state of North Carolina - based on DNA evidence. One of the brothers, Henry Lee McCollum, has spent 30 years on death row.

1984: "Unbelievably quick in science!"

Their freedom - and the careers of many scientists the world over - are thanks in part to Sir Alec's discovery on 10 September 1984.

Henry Lee McCollum, one of two brothers exonerated 30 years after their wrongful conviction of rape and murder

"It was a real eureka moment. Thirty seconds which literally changed my life," says Sir Alec.

"It was really exciting, and we did it so quickly," adds Sir Alec. "We went from a basic discovery and the world's first horrible messy, smudgy DNA fingerprint to something of real practical utility. From first discovery in September 1984 [to the] first case in April 1985, it was less than half-a-year later. Unbelievably quick in science!"

1985: The first case

Think of DNA fingerprinting and you're most likely to think of a crime show - that DNA was used to link a suspect to a murder weapon, or to place them at a location.

It happens in real life too. But that's not what the first real case was about.

"A lawyer was stuck with a difficult immigration dispute. She wrote and asked if there was any chance she could use this DNA fingerprinting 'whatever it is,' because no one understands it, to see if you can establish a relationship between this family and a boy, who was being threatened with deportation," recalls Sir Alec. "So we took it on and we showed beyond any reasonable doubt that the boy was a genuine member of the family. End result: DNA appears in an immigration tribunal and they drop the case against the boy. The science beating bureaucracy and reuniting the little boy with his family."

DNA fingerprinting was soon solving not only immigration cases but also paternity disputes, and crimes, such as murder and rape.

Alec Jeffreys outside the University of Leicester, where he is still based

"It was all so quick, but at the start we really didn't know if anyone would take any notice. The one sensible thing I did was to call it DNA Fingerprinting. Technically, the more appropriate name would have been 'idiosyncratic mini satellite southern blot hybridisation profiling.' If we'd have called it that, it would have killed it dead in the water. No one would have understood it. But calling it DNA Fingerprinting got the message over. Brand is everything," says Sir Alec.

The evidence in context

Films and TV programmes such as CSI began to celebrate and mythologize the application of DNA fingerprinting.

And it's true, even in real life, there are countless stories of DNA evidence either proving a person's guilt or innocence.

But DNA evidence is not enough on its own - as Sir Alec says, DNA "has context."

"For example, I could shake your hand, leave my DNA on you. You could then visit a crime scene and leave my DNA, and I've never been anywhere near it. So there are ways of transferring DNA [with] innocent explanations, which at face value look like a pretty damning bit of guilty evidence. DNA says nothing about guilt or innocence. It only seeks to establish whether sample A came from person B, or not. It can do that with exquisite accuracy. But it's up to the court to decide innocence or guilt on all the evidence, not simply on DNA."

And deciding innocence or guilt is not as simple as going on gut feeling. There are significant factors that need to be considered in conjunction with DNA fingerprinting, or any evidence, for that matter.

DNA evidence taken from a crime scene can be misinterpreted

Professor Allen Jamieson is the former head of the police forensic science laboratory of Scotland. "Even if someone says the finding is 'consistent with' someone touching this gun, for example...That phrase 'consistent with' can be very misleading. If I take a pathologist, for example, who says the wound is consistent with a 6 inch knife because it's a 6 inch deep wound, it would also be consistent with a 12 inch knife which has gone half the way in, or an 18 inch knife which has only gone a third of the way in. So people need to remember it really means 'this is one possible explanation' - and with DNA, there are many, many explanations as to how DNA can come to be on an item."

2011: a crime he didn't commit

This was almost exactly the case with Michael Morton, who in 1987 was sentenced to life in prison for the murder of his wife.

Christine Morton was raped and murdered in their bed one morning, after Michael had gone to work.

"DNA was always a possibility in my case. I was convicted in 1987. It was truly in its infancy then and nearly non-existent in crime investigations and in the world of criminal justice," says Morton. "But as the years piled up and time past I became convinced that it had real potential for me. Because there was hard evidence at the crime scene which was either ignored or not exploited because of the state of technology."

Morton's long fight to clear his name through the use of DNA evidence began in 1990 when a sample of semen taken from the bed was first examined.

Michael Morton, freed after 25 years, was convinced DNA would help him

Unsurprisingly, the sample matched his own DNA profile, which it was likely to do since the crime occurred in his bed.

More testing took place in 2005 and was again considered useless in his appeal.

But all the while prosecutors wouldn't allow one piece of evidence to be examined.

Crucial piece of evidence

"When my wife was murdered," says Morton, "the man that killed her wiped the gore off of himself onto a bandana and dropped it, or discarded it, when he left the scene."

Police had recovered the bandana at a construction site located about 100 yards from the Mortons' home.

But it wasn't until 2010 that Michael was granted permission to have it examined.

DNA testing revealed that it contained Christine Morton's blood and hair. It also contained the DNA of a man - but not Michael. The profile was run through a DNA databank and matched that of a man from California, who had lived in Texas at the time of Christine's murder.

Technology keeps evolving

After 25 years jailed for a crime he did not commit, estranged from his son, and having never been able to properly grieve for his wife, Michael Morton was finally a free man... but, he believes, also a very lucky man.

In 2011, there were moves to reopen and use DNA evidence in the case of the 1987 death of German politician Uwe Barschel

"DNA, like other young sciences, is evolving and one of the things that I learnt was that the particular process that was used to extract DNA and identify my wife's murderer had only become acceptable a few short weeks before the lab had begun testing this bandana," says Morton.

"The tool that got me out was brand new. So I had to have all these disappointments and failures to be successful at the tail end. Had I won any of the legal bouts earlier on the results would have been negative and I'd still be wallowing in a penitentiary."

2014: millions of "untold stories"

Pivotal to Morton's exoneration was the support he got from the lawyers and scientists working with The Innocence Project in the United States, a group very familiar to Sir Alec Jeffreys, the man who discovered DNA Fingerprinting in September 1984.

Sir Alec Jeffreys is in no doubt about the technology's impact over the past 30 years.

"How many people worldwide have had their lives touched by DNA testing?" asks Sir Alec. "If we start at around 50 million and work up rapidly from there you get some scale of the impact, and every application is a human drama. So there are 50 million stories to be told out there."

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