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# Forensic DNA evidence is not infallible

*As DNA analysis techniques become more sensitive, we must be careful to reassess the probabilities of error, argues* **Cynthia M. Cale**.

Earlier this month, the Texas Forensic Science Commission raised concerns about the accuracy of the statistical interpretation of DNA evidence, and it is now checking whether convictions going back more than a decade are safe.

Despite how it is often portrayed, in the media and in courts, the forensic science of DNA is far from infallible. Particularly concerning is that police and prosecutors now frequently talk of 'touch DNA' — genetic profiles of suspects and offenders that have been generated in a laboratory from just a handful of skin cells left behind in a fingerprint.

Research done by me and others at the University of Indianapolis in Indiana has highlighted how unreliable this kind of evidence can be. We have found that it is relatively straightforward for an innocent person's DNA to be inadvertently transferred to surfaces that he or she has never come into contact with. This could place people at crime scenes that they had never visited or link them to weapons they had never handled.

Such transfer could also dilute the statistics generated from DNA evidence, and thereby render strong genetic evidence almost insignificant. (The issue of statistics is reportedly the focus of the Texas investigation.)

We urgently need to review how DNA evidence is assessed, viewed and described. Everyone in the medico-legal community — forensic scientists and technicians, DNA analysts, potential jurors, judges and lawyers for both the prosecution and defence— must know and understand the potential for mistakes.

The term 'touch DNA' conveys to a courtroom that biological material found on an object is the result of direct contact. In fact, forensic scientists have no way of knowing whether the DNA was left behind through such primary, direct transfer. It could also have been deposited by secondary transfer, through an intermediary. (If I shake your hand then I could pass some of your skin cells onto something that I touch next.)

Contamination from secondary DNA transfer was raised as a possible problem in *Nature* in 1997 (R. A. H. van Oorschot and M. K. Jones *Nature* **387,** 767; 1997). It is known to happen, but has largely been dismissed by legal experts as being rare outside the conditions of a laboratory. Experiments done in real-world conditions seemed to support this, and concluded that secondary DNA transfer would have little impact on interpretation of the genetic profile.

It is important to recognize that DNA amplification kits have become much more sensitive than they were in the past. As a result, the types of samples being analysed have expanded. Investigators no longer need to identify and request analysis of body fluids such as blood, semen and saliva. They can swab surfaces for otherwise invisible cells left behind, on the handle of a weapon or on a windowsill, perhaps, and ask labs to generate a DNA profile from them. The new kits can generate a full genetic profile of a suspect from as little as 100 picograms (trillionths of a gram) of DNA.

These subtleties are not usually explained in court. Instead, a jury is told that there is a one-in-a-quadrillion chance that the evidence retrieved from the crime scene did not come from a defendant. Naturally, the jurors assume that the defendant must have been there.

Given the power of modern forensic techniques to pull a DNA profile from a smudge of cells, secondary DNA transfer is no longer a purely theoretical risk. In California in 2013, a man called Lukis Anderson was arrested, held for four months and charged with murder after his DNA was found under the fingernails of a homicide victim.

Anderson had never met the victim and was severely intoxicated and in hospital when the man was killed. The same paramedics who took Anderson to hospital responded to the murder. Most likely, the paramedics were covered in Anderson's DNA, which they then inadvertently transferred. The charges were dropped.

Experiments in our labs, under the supervision of forensic anthropologist Krista Latham, show how easily DNA can be transferred to an object.

We asked pairs of people to shake hands for two minutes and then each individual handled a separate knife. In 85% of cases, the DNA of the other person was transferred to the knife and profiled. In one-fifth of the samples, the DNA analysis identified this other person as the main or only contributor of DNA to the 'weapon' (C. M. Cale *et al. J. Forensic Sci.* http://doi.org/8j2; 2015).

How significant is the result of a single study? Other analyses have shown that DNA transfer can be unpredictable and can depend on environmental conditions. We need more research on when and how secondary transfer can occur.

At the very least, the results highlight again that samples at crime scenes must be gathered with great care. DNA can persist on latex gloves, so they must be changed — or bleached — before and after handling evidence.

Even apparently rigorous evidence such as DNA profiles can be interpreted in multiple ways, some of which will be incorrect. As the technology to generate these profiles continues to accelerate, so must our efforts to sift out possible mistakes. ■

**WE NEED MORE RESEARCH ON WHEN AND HOW SECONDARY TRANSFER CAN OCCUR.**

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