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LCN DNA: proof beyond reasonable doubt? — a response

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In the article by McCartney (LCN DNA: proof beyond reasonable doubt? *Nature Rev. Genet.* **9**, 325 (2008))[1], it is argued that the Omagh trial had exposed serious flaws in the DNA evidence. However, much of the evidence was not reported by the media, neither did it feature in the judgement itself. The scientist's role is to dispassionately advise the court on the meaning of evidence. Consequently, failure to convict does not translate into failure of science. This correspondence is an attempt to place the verdict into context.

Forensic samples are often less than pristine — they might be degraded, or the DNA might be present as low-template DNA (LT-DNA). This results in partial profiles, with 'missing' alleles. If a sample is a mixture of two or more contributors then additional alleles are present. The sample might concurrently be a mixture and LT-DNA. It follows that a well represented (matching) profile can be interpreted without difficulty, regardless of the method used, whereas mixtures and LT-DNA are interpreted using different principles[2,3]. To improve sensitivity of the test, different 'enhancement' methods might be used by laboratories to increase the signal. Increased PCR cycle number is one such method, but LT-DNA can be analysed without using any specific enhancement method[4]; in practice, all forensic laboratories encounter and report such profiles.

A misleading impression has been given that all of the DNA profiles in the Omagh case were poor quality. However, some were high-quality conventional profiles that unambiguously matched the suspect. Others did fall into the LT-DNA category. Regardless of the quality of the profile, there are two mutually exclusive questions to consider: whose DNA is it and how did it get there?

A full 'conventional' DNA profile will have a match probability of approximately 1 in 1 billion. With the LT-DNA profile, the strength of evidence can be considerably reduced so that adventitious matches can occur, but this is well known and is accommodated by a reduced statistic[5,6]. Consequently, the question of whether the DNA profiling evidence is beyond reasonable doubt never arises — this statement confuses the strength of the evidence of the DNA profile with the ultimate issue of guilt versus innocence (which is outside the province of the scientist).

The prosecution hypothesis, that the DNA transfer occurred during the crime event, must be considered in conjunction with alternatives — for example, innocent transfer and laboratory contamination. If the presence of a DNA profile cannot definitively be attributed to a criminal act, it does not invalidate the statistic that associates the DNA profile with the suspect[5]. The question becomes purely one of relevance of the evidence. Bayesian networks are powerful methods to describe the probabilistic relationships between DNA and non-DNA evidence[7] but, so far, courts have not embraced this thinking.

Partial profiles, mixtures, and complex questions on the mode transfer of evidence are not specific or peculiar to LT-DNA. It is the philosophy of the interpretation methodology that is important, not the method of analysis. The International Society of Forensic Genetics (ISFG) has described and agreed guidelines to interpret mixtures, including partial profiles associated with LT-DNA[3,4,8].

Following an extensive independent review, the UK forensic science regulator has concluded that methods used by agencies within the UK are 'fit for purpose'[9]. Reporting of LT-DNA profiles within the UK continues within the framework described in this paper.

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