The Reliability of Forensic Science - the jury’s out

Introduction
Despite significant increases in the regulation of forensic science, miscarriages of justice attributed to lapses in the quality of forensic evidence continue to occur. Perhaps a number go un-noticed as a result of a lack of awareness of the problem. General unease within the scientific community [e.g. Nature\textsuperscript{1}, New Scientist\textsuperscript{2}, and the US National Academy of Sciences (NAS) report\textsuperscript{3}] and a number of Court of Appeal rulings in England and Wales\textsuperscript{4,5} indicate that scientific evidence may not be as reliable or as robust as its reputation suggests.

General considerations
In general, the quality of forensic science continues to improve but the recent NAS report has highlighted persistent and widespread weaknesses such as the validation of comparative methods including some very well established areas such as fingerprints. The report raises concerns about the underlying science in some areas and makes recommendations calling for more regulation and research.

Laboratory accreditation to the international standard ISO17025\textsuperscript{6} provides a degree of assurance regarding the quality of scientific evidence but may not prevent scientific evidence derived from non-validated methods and procedures being adduced. While it is a valuable risk reduction measure ISO17025 is no guarantee against unreliable evidence.

Most forensic science may be considered as consisting of two components; the establishment of a link between two things and the assessment of the significance of that link. Establishing a link usually requires some scientific analysis and is therefore dependent on the underlying science of the analytical method. This aspect is the interpretation of the evidence. The assessment of the significance is the evaluation of the weight of the evidence in the context of the case. Each component may or may not have a scientific basis. For the scientific evidence to be reliable both components must be sound.

It is well recognised that courts, and perhaps the legal profession, are not best placed to assess how reliable the forensic evidence may or may not be. A scientist with the requisite expertise can provide invaluable assistance in not only determining whether a challenge exists, but also in providing useful points for cross examination.

While scientists ideally should act in a neutral manner, it would deny a considerable body of research to assert that this actually happens in our adversarial system. That is not to say that the scientist will act unfairly but will adopt a sceptical approach, as is only proper in a scientific endeavour. There are many appeal cases that are the consequence of ineffective or ill-informed defences at trial. Avoiding such errors should be a priority for defence solicitors and barristers. Consulting appropriate experts as a matter of course might be considered best practice.

\textsuperscript{1} Nature \textbf{464}, 325 and 347-348;2010
\textsuperscript{2} New Scientist, 2773, 11 August 2010
\textsuperscript{3} National Research Council, Strengthening forensic science in the United States: a path forward. National Academies Press 2009 referred to as the NAS Report in the text
\textsuperscript{4} George v R [2007] EWCA Crim 2722
\textsuperscript{5} R v T [2010] EWCA Crim 2439
\textsuperscript{6} ISO17025:2005 General requirements for the competence of testing and calibration laboratories
A proper determination of the weight to afford scientific evidence can only be made by ensuring ‘equality of arms’. Applying this principle is essential for a fair trial. In practical terms this means that the defence needs the advice and guidance of a scientist to effectively question and, if necessary, challenge scientific evidence presented by the Crown. Even then, the resources available to the Crown may significantly outweigh those of the individual expert, so an expert with an extensive ‘address book’ may be invaluable.

Where scientific evidence is central to the case the defence should be adequately equipped. This will improve the chances of a fair trial, a true verdict, and increased public confidence in the justice system. In addition, there will be savings for the taxpayer as shorter trials will result from the early exclusion of unreliable scientific evidence. With better verdicts come fewer appeals.

It is worth noting that the only reason DNA evidence (not of the low template variety) is considered to be the ‘gold standard’ is as a result of a multitude of challenges to that evidence since Sir Alec Jeffereies first realised the forensic application of what was then ‘DNA fingerprinting’.

**Comparison evidence**

The reliability of evidence involving comparison and a degree of subjectivity (marks, impressions, fingerprints and handwriting) is in question. For years courts have been accepting such evidence apparently without question. *R v T*, in 2010, was the first time that the fundamental bases of footwear mark comparison was questioned. These fields are criticised for lacking a scientific basis, adequate statistical empirical foundations and proficiency testing.\(^7\)\(^8\) Research is being undertaken to produce random-match probabilities in these areas but it is fair to say that this is not easy and will take some time. The NAS report also highlights the lack of underlying science and the need for validation.

These fields do not yet rely on data and quantitation and courts currently consider experience in observation acceptable (although that may change). Such ‘expertise’ will come under increasing scrutiny and needs to be validated by objective proficiency testing. As Wernher von Braun has famously said, “One experiment is worth a thousand expert opinions”.

**Likelihood Ratio**

As a former member of the board of the Association of Forensic Science Providers (AFSP) I was part of the team that developed and documented a set of standards for the formulation of evaluative forensic science expert opinion.\(^9\) This set of standards, collectively known as the AFSP Standard, is considered so important for the delivery of reliable forensic science opinion that the European Union is funding a project to develop and implement the standard throughout Europe. At the heart of the AFSP Standard is the likelihood ratio approach to the evaluation of scientific evidence. The approach is simply assessing the likelihood of the scientific evidence in the light of both the prosecution and defence case or hypothesis. So, for example, if the scientific evidence is equally likely under either hypothesis then the likelihood ratio is close to 1 and the scientific evidence supports neither the prosecution nor defence case. In such a circumstance the scientific evidence is not probative, and, as in the case of Barry George, the evidence might be considered prejudicial and ruled inadmissible.

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\(^7\) Haber L. & Haber R.N. Law Probability and Risk 143 (2008)


\(^9\) Science and Justice 2009 49:131-164
While \( R \times T \) suggests that the judiciary in England and Wales remain unconvinced of its wider applicability, the likelihood ratio approach was crucial in the appeal and eventual acquittal of Barry George and appears to have been permitted in relation to transfer evidence in \( R \times Reed and Reed \)\(^{10}\). The AFSP Standard was most certainly not complied with by the footwear expert referred to in \( R \times T \). Among other things, his evidence lacked the transparency required by the Standard (the non-disclosure identified was also of concern). Application of the AFSP Standard ensures a balanced, logical, transparent and therefore robust approach to the evaluation of scientific evidence. It guards against the logical error, now known as the ‘prosecutor’s fallacy’, and the expert usurping the role of the jury \(^{11}\).

\( R \times T \) and my own experience in New Zealand suggests that there may be some forensic scientists who are using a likelihood ratio approach for the evaluation of evidence without having a full understanding or, having a full understanding, lack competence in its application. This is surprising as the ESR, here in New Zealand, and the Forensic Science Service in England and Wales are rightly considered world leaders in the application of this approach. Nevertheless, there is clear evidence of problems in the ESR and FSS and one wonders what action the regulating authorities will take.

**Low Template DNA**

Despite the recent New Zealand Court of Appeal judgement\(^{12}\) the debate regarding the reliability of Low Copy Number (LCN), or more generally Low Template DNA (LTDNA), continues among scientists.

As eloquently set out in the judgement, the controversy began with \( R \times Hoey \)\(^{13}\) when doubts about the validity of LCN DNA, a commercial product provided by the Forensic Science Service, caused the trial judge to question and reject LCN evidence presented by experts employed by that forensic science provider.

The complexities of the issues around the use of LTDNA are beyond the scope of this short article but reading the judgement of Mr Justice Weir [\( R \times Hoey \)] is essential to a proper understanding as is a realisation that changes to the procedure were made as a result of the review by Professor Caddy. However, stutter, allele imbalance, contamination, transfer and the interpretation of mixed profiles remain issues. Neutral observers recognise the need for more research to address the remaining questions and set the limits for this evidence type. It is interesting to note that the ‘inventor’ of LCN, Dr Peter Gill, now claims there is no such thing as low template DNA \(^{14}\).

Readers wishing to learn more are directed to an excellent and fairly comprehensive legal review by Don Mathias \(^{15}\) and the following link may be of interest; [http://www.lawgazette.co.uk/in-practice/practice-points/working-dna-evidence](http://www.lawgazette.co.uk/in-practice/practice-points/working-dna-evidence).

**Conclusion**

Although major improvements in quality have been made during the last decade or so and accepting that forensic science does make a significant contribution to law enforcement and justice, the quality of forensic science remains in question. In order to ensure a fair trial and guard against

\(^{10}\) \( R \times Reed and Reed [2009] \)EWCA Crim 2698

\(^{11}\) \( R \times Doheny and Adams [1996] \)EWCA Crim 728

\(^{12}\) \( R \times Wallace [2010] \)NZCA 46

\(^{13}\) \( R \times Hoey [2007] \)NICC 49

\(^{14}\) 20\(^{th}\) International Symposium on the Forensic Sciences, Sydney, September 2010, panel discussion

potential miscarriages of justice the principle of ‘equality of arms’ should be applied. All scientific evidence should be reviewed, including the methods and procedures used and how the opinion was derived. The expert must employ a balanced, logical and transparent approach to the evaluation of scientific evidence and thereby avoid logical errors. While forensic science can do much to improve its quality outside the legal arena the main driver for progress has been, and always will be, challenge in the courts. For forensic science the jury will always be out and, for the effective delivery of justice, that is no bad thing.

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