

**Science not sorcery –
DNA in the 21st century**

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SCIENCE NOT SORCERY - DNA IN THE 21ST CENTURY

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Introduction

DNA technology was first used in a murder investigation in England in the mid 1980's.¹ It is 21 years since evidence of DNA testing was first relied upon in an Australian court as evidence in proof of a criminal offence.²

There is no doubt that in 2011 such evidence is of vital importance to the administration of justice. It has the capacity to both exclude potential suspects³ and to provide powerful evidence in a prosecution case. Its use and its significance will only increase with future developments in the science.

Despite the initial challenges to its admissibility on the basis that the technology was not scientifically accepted⁴ or that such evidence was too complex for a jury to understand,⁵ there is now no valid reason why evidence of DNA testing will not generally be admitted. Whether the test for admissibility is based on the common law⁶ or the Evidence Acts, it is well established that DNA testing, the systems adopted by the Australian forensic science laboratories to conduct the testing and the statistical computations as to the weight to be attached to any relevant match, are generally accepted in the scientific community.

This evidence is now frequently relied upon in criminal trials; very often this results in a guilty plea or, if there is a trial, the presence of the DNA said to come from an accused is not

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¹ *"The Bloodings"* Wambaugh J, 1989, Bantam Press. The first offence occurred in 1983, the second in 1985. DNA testing revealed semen on each of the victims was from the same man. A screening of 5000 local men was undertaken. Pitchfork persuaded another man to provide a sample on his behalf. This was discovered and led to further testing which was a match with Pitchfork's DNA. In 1989 he was convicted on two counts of murder.

² The first case was in an ACT court where when an offender was charged with three counts of sexual assault. After the tests were conducted and there was a match between the DNA on the complainant's clothes and that of the offender he changed his defence from "*I was not there*" to "*the complainant consented*": CrimTrac – Key dates in the history of DNA typing. Also in 1989 an offender in Victoria charged with the rape of 16 women confessed to the crimes after being confronted with DNA evidence

³ For example in *R v Jarrett* (1994) 62 SASR 433 the police tested every male who came into contact with the deceased (an elderly woman who had been raped and murdered). Jarrett was the seventeenth man tested. The Innocence Project (US) reports that 266 people have been exonerated since 1989 as a result of post conviction DNA testing.

⁴ *R v Jarrett* (supra); *R v Karger* (2001) 81 SASR 1, (2001) 81 SASR 135; *R v McIntyre* [2001] NSWSC 311; *R v Gallagher* [2001] NSWSC 462

⁵ *R v Tran* (1990) 90 A Crim R 233; *R v Lucas* (1992) 2 VR 109; *R v Percerep* (1993) 2 VR 109 cf: *R v Jarrett* (supra); *R v Lisoff* [1999] NSWCCA 364 and see generally *R v Duke* (1979) 22 SASR 46

⁶ *R v Bonython* (1984) 38 SASR 45 at 46

challenged. Nonetheless the exacting standards which are rightly imposed on crime scene officers and scientists in gathering potential evidence, conducting the tests and presenting evidence must be maintained; so too the responsibility placed on counsel seeking to rely on (or meeting) such evidence.

In the last 12 – 18 months in particular, DNA evidence (and its significance) has been the subject of debate in the media and within the legal and scientific professions. Much of this has stemmed from the overturning of a rape conviction in Victoria and the subsequent inquiry.⁷

It is timely to consider the issues in gathering, interpreting and delivering such evidence, although in many respects the current issues have always existed. However, due to the level of general acceptance that DNA has now reached, not surprisingly, the approach taken to addressing this evidence has altered.

This paper will address those issues from three, obviously interlinked perspectives:

- (1) The preparation and presentation of the evidence;
- (2) The nature of recent appellate court arguments concerning DNA evidence; and
- (3) The future challenges.

Preparation and Presentation

While it is appropriate to consider the current issues relating to DNA evidence it is important for counsel not to lose sight of the necessity to have a proper understanding of this evidence and its significance. Only this will enable them to determine how to appropriately address the evidence in a particular case. So too the importance, if it is to be led, of presenting the evidence in a manner ensuring it is accurate, clear and comprehensible to a judge and jury. Further, judges must have sufficient understanding of the evidence to properly direct the jury on the relevant issues arising from it.⁸

⁷ Also in November 2009 the Victorian Commissioner of Police suspended the interpreting of DNA by the Victorian Police Science Division (VPFSD) due to “*unease*” regarding their interpretation methodologies. A Report was commissioned (The Fraser Report: “*Review of DNA Reporting Practices by the Victorian Police Forensic Services Division*” delivered April 2010, compiled by Fraser, Buckleton and Gill). Problems were identified. They concluded that those problems were not solely due to technical issue, there were a range of factors including issues within the laboratory (unnecessary risk aversion), with the Victorian Police (collection) and the courts primarily the approach taken by defence counsel). Recommendations were made and the issues.

⁸ ALRC Report: “*Essentially Yours: The Protection of Human Genetic Information in Australia*” 2003 at [44.35]

The consequences of a failure to have that necessary degree of understanding were starkly highlighted in the recent Victorian case of *Jama* and the subsequent inquiry into his conviction conducted by the Hon Frank Vincent QC.⁹

There are clear lessons to be learned from that case – for those involved in the collection of evidence, the scientists involved in the DNA process and for lawyers involved in proceedings where DNA evidence is to be relied upon.

Mr Jama was convicted by a jury of the offence of rape. The only evidence of identification relied upon by the prosecution was DNA analysis of a sample taken from the complainant, which was said to be a match with the DNA of Mr Jama. Shortly before his appeal was to commence the prosecution became aware that the same medical officer who had taken the sample from the complainant had, the day before, at the same location taken a sample from Mr Jama in an unrelated matter. The prosecution conceded the appeal and the Vincent Inquiry ensued. It concluded that the most likely source of the DNA on the sample said to be from the complainant was contamination and that a miscarriage of justice had occurred. He observed that *“I have been left with the deep impression that at virtually every point, and by almost everyone involved, [DNA evidence] was handled with so little insight into issues which presented that no need was seen to explore further or conduct research into them.”*¹⁰ Not surprisingly, one of his recommendations arising from the inquiry focused on the need for courses to be conducted to educate lawyers and judges involved in areas where DNA evidence is used, about the technology and its appropriate use.¹¹

The Report highlights the importance of having in place, at every step of the process, proper systems to reduce any risk of contamination and which would expose any such issue if it were to occur. Recommendations were made addressing those aspects. It also highlights the importance of knowledge on the part of lawyers and investigating authorities to ensure they are in a position to properly assess the evidence, its significance and are alert to the issues that may accompany its use.

This case is considered under the auspices of preparation and presentation although most commonly it would be referred to in the context of the risks of contamination. This is not to

⁹ Report: *“Inquiry into the Circumstances that Led to the Conviction of Mr Farah Abdulkadir Jama”* 2010 (the *“Vincent Report”*)

¹⁰ Vincent Report at p. 11

¹¹ Vincent Report R 10. This was also recommended by the ALRC in its 2003 Report: *“Essentially Yours: The Protection of Human Genetic Information in Australia”* R 44.41

downplay that aspect, but rather, given this forum, to focus on the role of the legal profession (including judges) in utilising this evidence.

What is clear is that the problem in *Jama* was human error which was not exposed, at least in part, due to a failure by those investigating and prosecuting to properly question the validity of the evidence.

While issues of contamination were addressed in the evidence, this was solely from the perspective of what occurred in the laboratory and from that, the conclusion of a lack of contamination was extrapolated. This failed to recognise the underlying proposition that the testing is only as good as the sample obtained.

Worryingly, this was a case where alarm bells should have been ringing loudly. DNA was only obtained from one of the four swabs taken. Not only was that the only evidence relied on, but the nature of the case was such that other evidence might have been expected and its absence noted. Mr Jama was a 19 year old man of Somali origin (a thin, dark skinned man of African appearance) who was alleged to have committed the offence in a club promoted as an over 28's venue. No one saw a person of that description at the club where one might assume if a person of that description had been, his presence would have been noticed and memorable. Mr Jama was not seen on the video surveillance camera and therefore would have had to have entered and left the premises at a time it was not operating. Mr Jama had an alibi. Finally, he would have had to have moved a heavy semi-conscious woman some distance across the nightclub.¹²

None of the issues raised by the review of this case are new or novel, rather the consequences of a failure to address them have been starkly illustrated. It demonstrates why preparation, or lack thereof, is unfortunately still a live issue.

The fact that the science is now generally accepted does not relieve counsel of the need to gain the necessary understanding.¹³ Indeed it is more critical than ever that they do so.

Appropriate presentation of this evidence is equally fundamental. Evidence of DNA testing and its significance can be complex, giving counsel in particular prosecutors, a responsibility

¹² Vincent Report at 33 - 34

¹³ For a summary of the science, the testing procedures and issues that may result there from and the statistical analysis of the result see: *R v Karger* (2002) 83 SASR 1. This is a first instance decision after a three month voir dire which addressed the issues of admissibility in relation to all aspects. The only challenge on appeal in this regard was as to the direction in relation to the statistical evidence: *R v Karger* (2002) 83 SASR 135

to lead the evidence (or agree to it) in a manner which enables the jury to obtain sufficient understanding to evaluate it, to decide whether they are prepared to accept it and if so, what weight to attach to it.¹⁴ Judges must be vigilant to ensure this occurs; as ultimately it is their responsibility to direct the jury appropriately as to its use.¹⁵

These aspects can only be achieved when there is proper interaction between counsel and the witness. As Drs Evatt and Weir observed from a scientist's perspective "*This can be an excruciatingly difficult time for the scientist, particularly if the time available for consultation with the lawyer who is leading the questioning is scant or worse, if a scientist is faced with a lawyer who is not prepared to gain any sort of understanding of the principles.*"¹⁶

There are suggestions that lawyers now need to exercise particular caution in dealing with DNA evidence due to the so-called "CSI" effect. That is, a juror (and counsel) may have certain preconceptions about DNA evidence and its significance, as a result of watching fictional crime scene television shows. Primarily it is argued that as a result of a preconceived view about DNA, a juror may attach undue weight to the evidence.¹⁷ On the other hand, it is argued that this phenomenon may result in a juror expecting forensic evidence to be led and being reluctant to convict without it.¹⁸ Regardless, there can be no doubt that jurors, before entering the courtroom, are now more exposed to the concept of DNA testing.¹⁹

Whether such an effect exists does not alter the responsibility on lawyers relying on such evidence – that responsibility has always existed.

While there are various time constraints on a barrister/solicitor and witness, in this area particular care must be taken with preparation.

¹⁴ *Lewis v R* (1987) 29 A Crim R 267

¹⁵ For example in *Keir v The Queen* (2002) 127 A Crim R 198 the prosecutor had inaccurately described for the jury the statistical evidence (the prosecutor's fallacy was committed). The erroneous description was repeated by the trial judge.

¹⁶ Evatt and Weir, "*Interpreting DNA Evidence: Statistical Genetics for Forensic Scientists*" published 1998 (Sinauer and Associates Publishers) at p. 226

¹⁷ Goodman-Delahunty J and Tate D, "*DNA and the Changing Face of Justice*" (2006) 38 A J of Forensic Science 97

¹⁸ Haesler; "*DNA in the Local Court – the CSI effect*" 2008

¹⁹ A study provided by the Australian Institute of Criminology concluded that if "*jurors are given clear and well sequenced complex information, they dealt competently with it*": "*Enhancing Forensic DNA in Jury Trials*" Trends and Issues in Criminal Justice no. 392, March 2010. In a report to Criminology Research Council: "*Improving Jury Understanding and Use of DNA Expert Evidence*" Goodman-Delahunty J, Hewson L, June 2009, it is concluded that mock trials conducted by them provided no evidence that CSI viewing influenced verdicts. The authors of the study note that this replicates previous studies conducted by others.

As with all evidence it is necessary to identify its strengths and limitations – for all expert evidence that involves a knowledge base. This takes time.

A foolhardy or ill prepared challenge – or a challenge in circumstances where there is abundant other evidence implicating an accused in an offence - will simply lose credibility before a jury.

As the reliability of the DNA evidence is now typically not in issue, where an accused pleads not guilty the approach is more likely to focus on whether there is an innocent explanation for the presence of the DNA accepted to be from the accused. Obviously the significance of any DNA match in proof of a crime will be dependent on, amongst other things, the nature of the crime and crime scene, where the DNA was located and what form it took.

For example, in a homicide case finding DNA on the body of the victim or on the murder weapon at the crime scene may inextricably link that DNA with the commission of the crime. On the other hand if the DNA is found on an item at the scene (depending on the item and form of DNA) that link may not necessarily be so obvious, particularly if the crime scene is a public area. Similarly, the presence of DNA on items found after the event said to have been used in the commission of the offence or removed from the crime scene may not necessarily link that person to the commission of the crime.

It is obvious that the preparation by both parties must include full knowledge of factually what was found, where and what aspect(s) were tested. This includes knowledge of the nature of the deposit (for example from blood, semen, saliva etc). These matters might not be apparent on the face of the relevant witness statements. If there is any issue at all about the DNA, the relevant files and records of the samples and testing processes must be obtained and assessed.

For example, in *R v Button*²⁰ where the conviction for rape was overturned on appeal, the issue was the selective nature of the testing. Prior to trial DNA testing was conducted on a vaginal swab taken from the complainant; no male DNA profile was obtained. Bed clothing taken from the crime scene was not tested. Mr Button's trial proceeded without any DNA evidence and he was convicted. Before the appeal at the defence request samples from the bed sheet were tested, and a DNA profile was obtained which did not match Mr Button. His conviction was quashed. The profile obtained from the later testing matched another person

²⁰ [2001] QCA 133

who was then in prison for rape and who was known to the complainant. If the appropriate testing had been conducted at the outset this would have been revealed.

The weight to be attached to any DNA evidence and the inferences to be drawn from it depends on all the circumstances. Just as with cases where the prosecution relies on evidence of a fingerprint at a scene or on a stolen item, DNA cases are now more frequently approached on the basis that the prosecution cannot establish the DNA was left at the time of the crime; that, as a matter of fact there may be an innocent explanation.

In relation to an innocent explanation, the arguments range from the accused having legitimate contact with the item in question through to “the sample is contaminated”. These arguments are clearly matters for the jury to decide on the evidence.²¹

As to the former, it might be as simple as an accused saying “I was at the scene earlier”, “it was not rape but by consent”, “I lent my car to X”.

As to the latter, contamination could be innocent or otherwise and can occur at the crime scene or at any stage in the process.²² There have been cases of contamination as *Jama* itself illustrates. While the incidents have been few in number, because of the consequences or potential consequences of this occurring, not surprisingly these cases have been notorious.

The more samples tested relating to a crime which have resulted in the same profile being obtained, the less the risk that there has been contamination in the process. Similarly the more reliable the interpretation of the profile.

To state the obvious, a result is only as good as the quality of the sample taken. Crime scene samples by their very nature may be degraded, they may have been innocently contaminated, tests may be unable to yield a result, or a mixed or partial profile may be obtained.

The collection of evidence, and its chain of custody, should be subject to close examination. It involves an examination of when, where and how the samples were collected through to each stage of the DNA testing process. The integrity of the process at each step is essential.

²¹ *R v DG* [2010] VSCA 173; *R v Berry* (2007) 176 A Crim R 195

²² It has been argued that samples had been mixed up (*R v Butler* (2010) 1 Qd R 325); inadequacy in the collection process (*R v Garrett* [2009] QCA 300); the evidence had been planted (*R v Griffiths* [2004] QCA 116). And see: *R v Abisaab* [2006] SASC 349; [2004] SASC 337

The sample must be identified, DNA extracted and quantified, amplified, tested and the results interpreted.²³ At each stage there must be quality control measures in place to reduce any risk of contamination.²⁴ This extends to the process of interpretation, with more than one scientist involved, each undertaking the task separately.

If it is decided to seek advice from an expert ensure it is from someone suitably qualified in the field – with no agenda to push.²⁵ Simply because a person claims to be an expert does not make them one. Critical features of an expert are impartiality and objectivity.²⁶ Formal or academic qualifications alone might not be sufficient - experience with the processes involved is necessary. The first step, if questions arise, is to speak to the scientist who will be giving evidence of the tests undertaken.

A DNA profile can be obtained from minute quantities of DNA; it is highly mobile and may be transferred.

It follows that secondary transference may also provide an innocent explanation for the presence of a person's DNA. That is, where the accused may have come into contact with someone or something at an earlier point in time and left a trace of DNA on it/them, that person or item then transfers the accused's DNA to the crime scene (or relevant item).²⁷ Transferring DNA by handshaking or sneezing are examples which are often given to illustrate this concept. When secondary transference is relied upon it will be important to consider, amongst other things, the type of sample tested (saliva, blood etc), whether DNA profiles from persons other than the accused have also been detected, whether the sample with the DNA of the accused is a mixture of more than one DNA profile and if so, which is the major and minor typing. It will also be necessary to determine how many samples were taken, the locations from which they were taken and where the sample(s) which contained the DNA profile of the accused were collected from.

²³ For a description of the process see: *R v Karger* (2001) 83 SASR 1 at [45] ff

²⁴ For a description of the nature of the procedures see: *R v Karger* (2001) 83 SASR 1 at [46] ff

²⁵ The consequences of a failure in this regard are starkly illustrated in relation to two "expert witnesses" relied on by the defence during a pre-trial argument challenging the admissibility of the DNA and accompanying statistical evidence in *R v Karger* (2001) 83 SASR 1 at [254] – [372], [373] – [448]. See similarly in *R v Butler* (supra) at [126] ff in relation to a witness called by the petitioner in a matter which had been referred to the Court of Appeal (there had been an earlier appeal).

²⁶ *Fox v Percy* (2003) 214 CLR 118

²⁷ For example, it was argued that DNA of the accused on a balaclava which was said to be used in the commission of an offence did not relate the accused to the crime: *R v Wells* [2008] QCA 173. Or DNA on a door handle at the scene was argued to have been transferred there: *R v Richardson* [2010] QCA 216. And see: *R v Amjad* [2010] SASCF 68

Whatever the argument at trial, if DNA testing forms part of the evidence it must be presented appropriately. Often its accuracy is not in issue, nonetheless it must be lead or agreed accurately and in sufficient detail to enable the trial judge to properly direct on the relevant issues and to enable the jury to appropriately evaluate it. It is insufficient to simply read or tender DNA reports. The use of charts, diagrams or other form of pictorial depiction of the evidence is an effective method to adopt in leading the evidence.

DNA issues considered by appellate courts

As the techniques for DNA testing are now well accepted, in recent years there have been relatively few occasions when appellate courts were required to consider such evidence and when it has, generally the focus has been on the statistical presentation as to the weight of the evidence²⁸ and whether it was improperly prejudicial;²⁹ directions of the trial judge about this evidence;³⁰ and the sufficiency of the evidence to sustain a conviction.³¹

Statistics

There are two stages to DNA evidence: determining the DNA profile of the relevant sample and whether it “matches” a known/reference profile and, if so, determining the significance of the match. The first step is undertaken by scientific testing of the relevant samples and the interpretation of the results, the second by the application of statistical calculations to the profile obtained. Generally it is that second aspect which continues to be the subject of argument.

DNA is presented, if there is a match, as “*X could not be excluded as the source of the DNA*”. The significance of that match, or the weight to be attached to it, is calculated using statistical formulae accepted by the scientific community as being accurate and reliable for this purpose. Without that assistance the jury would not be able to assess what, if any, significance the evidence has.³²

As the Victorian Court of Appeal in *R v Noll*³³ observed:

²⁸ *R v Berry* (supra)

²⁹ *Aytugrul v R* [2010] NSWCCA 272

³⁰ For example: *R v Marticanaj* [2010] SASCFC 82; *R v Berry* (supra) at [48]-[60]; *R v JCG* (2001) 127 A Crim R 493

³¹ *R v Forbes* (2009) ACTCA 10; *R v Butler* (supra); *R v Gibson* (2001) 120 A Crim R 543; *R v Gum* (2007) 108 SASR 77

³² *R v JCG* (supra) at [45]

³³ “*It is the statistical step in the reasoning that gives DNA evidence its probative value*” *R v Noll* (1999) 3 VR 704 at 708

“Unless evidence can be given in a numerical form, a jury is unlikely to appreciate the probative force of the DNA tests...

Where, as here, there is well established and widely recognised scientific basis for conducting the relevant computations, it is appropriate that the jury be assisted in this manner.”

These accepted methods include expressing the conclusion as a *likelihood ratio*, as a *match probability*³⁴ or as an *exclusionary figure*.³⁵

The likelihood ratio is based on two competing scenarios/hypotheses – the prosecution viewpoint that the accused left the stain at the crime scene and the defence viewpoint that some other unrelated person has left the stain. The form of the evidence is – *“the crime scene stain is X times more likely to match the profile of the accused if he left it rather than if an unknown unrelated person left it”* – or *“it is X times more likely if the accused left the sample than if a random person left the sample.”*³⁶ It is not evidence of the probability that the accused was the source of the DNA.³⁷

The match probability is the chance of a second person having the same profile as the accused – that is X. An exclusionary figure is simply turning that around – X per cent of the population can be excluded as having a profile of that type.

Recently the NSWCCA in *Aytugal v R*³⁸ dealt with an argument that the form in which the statistical evidence was expressed ought to have been excluded pursuant to s 137 of the *Evidence Act (NSW) 1995*.

That argument is not new: it has been an avenue of challenge since the outset.

Intertwined with this have been arguments that the statistical evidence should be accompanied by a warning to the jury as to its use, which is primarily based on the proposition that the statistical evidence without a warning the jury might be misused; the jury

³⁴ *R v Karger* (2001) 83 SASR 1 at [663]; *Gibson v The Queen* [2001] TASSC 59 at [49]; *R v GK* (2001) 53 NSWLR 317 at [43]; *Latch v The Queen* (1998) 127 NTR 1; *R v Milat* (1996) 87 A Crim R 441 at [451]; *R v Humphries* (1999) 72 SASR 558

³⁵ *Aytugrul v R* (supra)

³⁶ *R v Karger* (2002) 83 SASR 135 at [14]

³⁷ *R v Carroll* [2010] SASC 156 at [28]

³⁸ [2010] NSWCCA 272

may give undue weight to any match,³⁹ the jury are likely to be “*overwhelmed*” by the statistics.

These arguments were addressed by South Australian Court of Criminal Appeal in *R v Karger*.⁴⁰

In that case the accused had been charged with murder. Evidence was led of DNA matches between samples taken for two stains on the back of the deceased’s blouse (which she was wearing when her body was found) and the reference sample of the accused. One stain KO22C was tested using both the Quadruplex and Profiler Plus systems which led to obtaining a result for 10 loci. The profile matched the reference sample of the accused at those 10 loci. The evidence, expressed as a *likelihood ratio*, was that the stain was greater than 90 billion times more likely to match the profile of Karger, if he left it, rather than if an unknown person unrelated to the accused left it. Expressed as a *match probability* the evidence was that the chance of a second person having the same profile was one in 90 billion. There was other evidence, apart from the DNA, implicating the accused.

It was argued on appeal that a warning as to the use of the statistical evidence was required as a matter of law. That argument was dismissed,⁴¹ but in doing so Doyle CJ provided some guidance as to the admissibility and use of this evidence.⁴²

He held the evidence was admissible; it was a well established scientific method of explaining the significance of a DNA match.⁴³ As to the use to be made of the evidence he stated:

“...that the evidence was to be treated like any other expert evidence in a criminal trial. It was for the jury to consider the evidence and to decide what significance and weight should be attached to the evidence. The jury were not obliged to act on the evidence, nor should the jury allow any expert opinion put before them to be used as a substitute for their own satisfaction, to the appropriate degree of proof, of a matter required to be proved as part of the prosecution case ... the proper approach to the issue of whether the incriminating DNA came from the appellant, and to the

³⁹ *R v Karger* (2002) 83 SASR 135 at [7]

⁴⁰ *R v Karger* (2002) 83 SASR 135, special leave refused: [2004] HCA Trans 128

⁴¹ This was also rejected in *R v Berry* (supra)

⁴² Guidance was also provided by the NTCCA in *R v Latcha* (1998) 127 NTR 1

⁴³ *R v Karger* (2002) 83 SASR 135 at [25]

issue of guilt of the crime charged, was to treat the statistical evidence as evidence to be considered along with other circumstantial evidence, not allowing it to displace or to overwhelm the consideration of all material evidence, but at the same time giving it such weight as the jury thought proper.”⁴⁴

Doyle CJ rejected the need for a warning as a matter of law:⁴⁵

“... it is the function of the jury to determine issues of fact. In my view courts can be confident that, given proper guidance, juries can evaluate properly evidence such as given in this case: R v Lissoff...; R v GK... It is stating the obvious to say that the guidance that a jury requires, to ensure a trial is fair and there is no risk of a miscarriage of justice, will depend on the nature of the evidence, its significance, the manner in which the evidence is presented and on the manner in which the trial is conducted.”
(citations omitted)

Doyle CJ adopted in this regard a number of the observations of Mason P in *R v GK*.⁴⁶ In that case Mason P addressing an argument that the statistical figure should have been excluded concluded:

“If ten unconnected eyewitnesses identify X as the person whom they saw stab a victim, and if X were immediately apprehended by them thereby removing any identification issue, the evidence of guilt would amount to virtual certainty. Some of the witnesses might well give evidence expressing themselves as “100 percent certain” of what they saw. Yet no one would dream of seeking to have this evidence excluded pursuant to s 137, for the simple reason that no unfair prejudice flows from the testimony.

It is not the judicial function to give the accused a fighting chance of gaining an acquittal, as if the trial were a horse race and the judge were a handicapper deciding how much weight to place in the Crown’s

⁴⁴ *R v Karger* (2002) 83 SASR 135 at [20][21] and see [16][17][18] and see *R v Carroll* (supra): *R v Henness* [2009] SASC 243

⁴⁵ *R v Karger* (2002) 83 SASR 135 at [3][31][36]

⁴⁶ (2001) 53 NSWLR 317 at [36] – [39]

saddlebags. The admissibility of the evidence is not in an inverse ratio to its probative value.

Experience teaches us that witnesses can be “100 percent certain”, yet wrong. And, so long as juries determine issues of guilt, jurors will be entitled to reject the confident testimony of lay and scientific witnesses, especially if it does not fit with other evidence that they do accept.

Accordingly, if relevant statistical evidence is tendered through a witness of due expertise then its probative weight cannot itself be a ground for withholding it from the jury. Indeed its very significant probative weight is a factor in favour of admission notwithstanding the capacity of extremely high odds to carry a prejudicial overlay ... evidence is admitted on the basis that the jury will be properly instructed as to its use. It is wrong to exclude evidence merely because it is capable of being misunderstood or misused.”

In *Aytugrul v R*⁴⁷ an argument was that the form in which the statistical evidence was presented was too prejudicial and ought to have been excluded was dismissed by majority. There, the evidence was that 1 in 1600 people would be expected to share the profile found at the crime scene. That was also expressed as an exclusion percentage: that 99.9 percent of the population are excluded for having that type of DNA. It was accepted that both forms of expression were accurate and there was no challenge to the admissibility of the evidence; rather it was argued that the evidence in the latter form of expression ought to have been excluded pursuant to s 135 or s 137 of the *Evidence Act* (NSW) 1995. Exclusion on that basis requires a conclusion that the evidence might be misleading, confusing or cause a waste of time (s 135) or its probative value being outweighed by unfair prejudice to the accused. Simpson J (Fullerton J agreeing) rejected that argument.

Whether cases like *Aytugrul* give rise to further such arguments remains to be seen. As more places on the DNA strand (loci)⁴⁸ are targeted, the results of the testing process will become more discriminating; and the consequent matches may be of greater probative value.

⁴⁷ [2010] NSWCCA 272

⁴⁸ See *R v Karger* (2001) 83 SASR 1 at [42] – [43]

Evidence of DNA testing may be highly probative, but that is not a basis for concluding it is unfairly so.⁴⁹ Any prejudicial effect can provide no basis to exclude the evidence if it is due to its probative value.

What is clear from past experience is that the statistical side of the DNA evidence has the potential to provide fertile grounds for argument.

For example, the concepts of the “*prosecutor’s fallacy*” and “*defence counsel’s fallacy*”⁵⁰ which can be committed by counsel (or a trial judge) are well recognised and have led to convictions being overturned.⁵¹ It is the former fallacy that has received most attention. The prosecutor’s fallacy transposes the conditional. For example, a statement that “*the chance of observing this DNA type if the blood came from someone other than the accused is 1 in 1 million*” is erroneously interpreted as “*the chance the blood came from someone else is 1 in 1 million*.”⁵² The two are different concepts; the second does not follow from the first.⁵³ These errors occur directly as a result of a lack of understanding of the significance of the evidence.

This aspect of the DNA evidence must be understood to enable the parties to properly assess the significance of any DNA match and to ensure that it is explained accurately to a jury. A failure to do so may result in the significance being misunderstood, or the fallacy just referred to occurring. Any directions to the jury must ensure that the evidence and relevant issues accompanying are clearly explained; it must be tailored to meet the circumstances of the given case.⁵⁴

⁴⁹ *R v GK* (supra) at [39] “if relevant DNA evidence is tendered through a witness of due expertise then its probative weight cannot itself be a ground for withholding it from the jury. Indeed its significant probative value is a factor in favour of admission notwithstanding the capacity of extremely high odds to carry a prejudicial overlay” Mason P

⁵⁰ These terms were coined by Thompson and Schumann “*Interpretation of Statistical Evidence in Criminal Trials: The Prosecutor’s Fallacy and the Defence Attorney’s Fallacy*” (1987) *Law and Human Behaviour* 167, and see Balding and Donnelly “*The Prosecutor’s Fallacy and DNA Evidence*” (1994) *Crim L R* 717; Evatt and Weir “*Interpreting DNA Evidence : Statistical Genetics for Forensic Scientists*” published 1998 at pp. 30 – 32.

⁵¹ *R v JCG* (supra) at [80] – [97]; *R v Dohney and Adams* (1997) 1 Cr App R 369 at 372 – 373; *R v Keir* (supra)

⁵² Another example: described in *R v Dohney and Adams* (supra) is “*It is easy, if one eschews rigorous analysis, to draw the following conclusion: only one person in a million will have the DNA profile which matches that of the crime scene. The defendant has a DNA profile which matches the crime scene. Ergo there is a million to one probability that the defendant left the crime scene stain and is guilty of the crime*” at 372 - 372

⁵³ “*Interpreting DNA Evidence*” Evatt and Weir, 1998 at 30 - 31

⁵⁴ See for example *R v Marticanaj* (supra) where a complaint was made on appeal about the directions to the jury in relation to the DNA evidence. When considering the adequacy of the direction given, the Court placed reliance on how the issue of the DNA had been dealt with at first instance. While the evidence was not detailed as it might have been the appellant had been represented by senior counsel. There was no suggestion there was a basis to attack the forensic opinion, there was no challenge to the analysis (at [34] – [41]).

The DNA evidence or its statistical aspect does not require a warning about its use; there is nothing intrinsically unreliable about it. The obligation is, as in all trials, to direct the jury to ensure that the issues are appropriately ventilated to prevent a miscarriage of justice.⁵⁵

However, reliance on potentially complex expert evidence in proving a case is not new, nor is it confined to DNA evidence.

Unsafe and Unsatisfactory

Not surprisingly *Jama* has enlivened the vexed question of whether evidence of DNA testing alone is sufficient to sustain a conviction.

The issue has also become more prominent with the use of DNA databases leading to “cold hit” matches resulting in charges being laid.⁵⁶ However, it does not follow that simply because a match is obtained in that way that there is no other evidence implicating an accused or, with further investigation as a result of the match, that such evidence could not be found. Indeed such investigations must be conducted.

The argument that DNA alone is insufficient is based on the proposition that as all areas or places on a person’s DNA strand are not tested, a match could not be sufficient to establish proof beyond a reasonable doubt. It is argued that as this evidence is presented in the manner described above, “*that X could not be excluded as the donor of the relevant DNA sample*”, it could only be corroborative of other evidence.

This issue was the subject of an application for special leave in *R v Forbes*. Although the question of leave was referred to the Full Court, it was ultimately refused.

In *R v Forbes*⁵⁷ the appellant was convicted of rape. The complainant could not identify her attacker, rather the evidence of identity came from DNA tests conducted from samples taken from clothes she was wearing at the time of the attack. Evidence of testing of three samples taken from three different locations on the clothes was given;⁵⁸ the DNA of Mr Forbes “*matched*” each sample although one revealed a mixed partial profile. Mr Forbes denied the offence and his wife gave evidence supporting his alibi.

⁵⁵ *R v Karger* (2001) 83 SASR 135 at [27] – [39]; *R v Berry* (supra)

⁵⁶ See for example: Edwards “*Cold Hit Complacency: The Dangers of DNA Databases Re-examined*” (2006) 18 *Current Issues in Criminal Justice* 92

⁵⁷ [2009] ACTCA 10

⁵⁸ *R v Forbes* (supra) at [15] The samples were from the outer surface of the left and right bra cups, the inner surface of the left and right bra cups and staining on the upper right thigh area of the black trousers.

While the issue on appeal in the High Court was whether the verdict was unsafe and unsatisfactory, the Applicant sought to establish the principle that DNA was a particular class of evidence which, regardless of its particular content, should be held legally insufficient to support a conclusion that a disputed proposition of fact is established beyond a reasonable doubt”.⁵⁹ The submission had been rejected by the ACT Court of Appeal.⁶⁰

The nature of the argument in the High Court in *Forbes* naturally focussed attention on what weight could be attached to the DNA matches in that case. There was no issue in the case about the propriety of the testing, the results, contamination or transference.⁶¹ The only issue that was presented at trial was coincidence. By agreement between the parties the statistical evidence was given by verbal formulae; for two samples⁶² the result was described as “*extremely strong*” and the third sample was described as “*strong*”; as opposed to a specific number being presented to the jury. The terminology “*extremely strong*” was used to represent if the probability of profile was greater than 1 in 1 million; “*strong*” representing greater than 1 in 10,000. In fact, unbeknownst to the jury, in relation to one of the matches the true statistical calculation was 1 in 20 billion.⁶³

In refusing special leave French CJ stated that:

*“...it was open to the jury to conclude from the evidence that was led at trial that the applicant was guilty beyond a reasonable doubt. In light of the way the parties conducted the trial this is not, in our opinion, a suitable vehicle to consider the larger question that the applicant seeks to agitate.”*⁶⁴

There is no authority to support the proposition that DNA evidence, as a category of evidence, is insufficient to support a conviction. In *Forbes* the appellant relied on comments made by the NSW Court of Criminal Appeal and the NSW Supreme Court in the much earlier decisions of *R v Green*,⁶⁵ *R v Pantoja*⁶⁶ and *R v Milat*⁶⁷ (which were cited with approval by the Victorian Court of Appeal *R v Noll*).⁶⁸ In each of those decisions there were

⁵⁹ [2010] HCA Trans 120 at 60

⁶⁰ *R v Forbes* (supra) at [41][48]

⁶¹ *R v Forbes* (supra) at [34]

⁶² The inner bra cups and the trousers.

⁶³ This evidence was given on a voir dire: [2010] HCA Trans 120 at 27

⁶⁴ [2010] HCA Trans 120 at 62

⁶⁵ (1991) unreported NSWCCA 26/3/91

⁶⁶ (1996) 88 A Crim R 554

⁶⁷ (1996) 87 A Crim R 441

⁶⁸ (1999) 3 VR 704

comments by the Court that the significance of any match establishes no more than that the accused could be the offender. However, when considering those authorities it is important to recognise that they were amongst the first decisions where DNA evidence, and its significance, was in issue; now the science (and the associated statistical evidence) has significantly developed.⁶⁹ None of those cases were concerned with convictions based on DNA evidence alone.

The early comments about DNA must be considered in context. For example in *R v CJG*⁷⁰ Spigelman CJ (Sully and Adams JJ agreeing) observed that “*the Courts have approached DNA evidence with caution. However, that caution is naturally abating as experience with the use of such evidence has grown. A similar process occurred less than a century ago when fingerprint evidence was comparatively new.*”⁷¹ After referring to the 1912 fingerprint case of *R v Parker*⁷² he concluded that “*The use of DNA evidence appears to have reached a similar stage to fingerprint evidence in about 1912. Like fingerprint evidence, it is of particular power, both to establish innocence and guilt.*”⁷³ Interestingly, essentially the same argument was advanced in relation to fingerprints as is now being relied on in DNA: when the only evidence of identity is of fingerprints, it is insufficient to support a conviction. Special leave to advance that argument was refused.⁷⁴

The occasions when there is only DNA evidence are rare.⁷⁵ There is usually some other evidence, albeit it might be slight.

For example in *R v Rowe*⁷⁶ in dismissing an argument that the verdict was unsafe on the basis that DNA was the only evidence of identification, the Bleby J (Doyle CJ and Gray J agreeing) concluded:

“The evidence was the subject of expert opinion. It was subjected to close scrutiny by the trial judge who directed the jury that they must be satisfied beyond reasonable doubt as to the reliability and accuracy of the DNA analysis. It probably founded a safer basis for a conviction than the frailty

⁶⁹ *R v Karger* (2001) 83 SASR 1 at [42]

⁷⁰ (2001) 127 A Crim R 453; [2001] NSWCCA 504.

⁷¹ *R v JCG* (supra) at [98][99]

⁷² (1912) VLR 152, (1912) 14 CLR 681

⁷³ *R v JCG* (supra) at [106]

⁷⁴ (1912) 14 CLR 681

⁷⁵ See also: *R v Gibson* (supra), [2001] TASSC 59; *R v Butler* (supra), [2009] QCA 111; *R v Garrett* (supra)

⁷⁶ [2004] SASC 427 at [40]

often attending the evidence of a single eye-witness who gives evidence of identification of the offender”

In that case the evidence was of a DNA profile obtained from a sample of blood. The blood had been deposited on the shirt of a police officer who had physically come into contact with an offender whom he had unsuccessfully attempted to apprehend while fleeing the scene of a crime. After the offender was eventually arrested two samples, taken at different times, were obtained from him. Each was tested, again at different times, and the profile obtained matched the blood on the police officers shirt. There was no evidence of eyewitness identification, simply a general description of the offender.

Similarly in *R v Gum*⁷⁷ Vanstone J (with whom Duggan and Kelly JJ agreed) observed:

“Plainly the evidence that DNA matching the appellant’s was found at each ‘scene’ was extremely potent. The jury would have been entitled to view this evidence standing alone, as sufficient proof of either count.”

The Appellant had been convicted of two counts of rape against different women. In addition to the DNA there was evidence of a general description of the offender which broadly fitted the accused.⁷⁸

There is no authority in support of the proposition that a conviction cannot be based on DNA alone, or that any such conviction is necessarily unsafe. Attempts to establish that principle here and elsewhere⁷⁹ have not succeeded.

There is no doubt that after *Forbes*, the argument will be run again in a case which is considered an appropriate vehicle.

The question of whether evidence of DNA testing alone is sufficient is too broad a question. It ignores the fact that even if there is only DNA evidence, it does not carry the same weight in each case. It ignores that ultimately every case must depend on and be determined by its own facts. It presupposes that regardless of the evidence it could never be enough. Is the argument that it will never be sufficient evidence by itself unless every area on the DNA

⁷⁷ (2007) 108 SASR 77 at [32]

⁷⁸ And see *R v Carroll* (supra). This was a trial by judge alone where the complainant had died before trial. The charge was rape. Primary reliance was placed on DNA sample from vaginal swabs. Sulan J concluded that the samples were of high quality, that the DNA evidence was strong circumstantial evidence implicating the accused, and that there was other evidence to support that conclusion; he lived in and was familiar with the area.

⁷⁹ This argument has been rejected in the UK.

strand of a person is tested or until every person is tested? There is a degree of objectivity to this form of expert evidence by comparison to others in the forensic field. Australian courts have not identified any category of expert evidence, or other evidence, as insufficient on its own to prove a case. A person can be convicted on the identification evidence of one eye witness (or the evidence of an accomplice) even in light of the recognised dangers and fallibility of such evidence.

Our criminal justice system is based on the jury being the arbiter of the facts. It is for them alone to determine what weight they will attach to any evidence. Courts have repeatedly expressed their confidence in the ability of a jury, properly instructed, to appropriately evaluate evidence, even complex or conflicting evidence.⁸⁰ If there is no basis to exclude the evidence of the DNA testing, how then could a jury be prevented from relying on it if it is satisfied beyond reasonable doubt?

Regardless of the merits of the debate, what is abundantly clear is that if a prosecution is to rely solely on DNA evidence it must be thoroughly and critically investigated.

Ultimately the issue for the appellate court is whether, in a particular case, the verdict is unsafe.

Future challenges

In 2009 the US National Academy of Sciences published a report on forensic science⁸¹ in which DNA testing was regarded as the gold standard of forensic science. It concluded that *“amongst existing forensic methods, only nuclear DNA analysis, has been rigorously shown to have the capacity to consistently and with a high degree of certainty demonstrate a connection between the evidentiary sample and a specific individual or source.”* DNA testing processes have been rigorously validated. Since its inception it has been the subject of courtroom challenges which, no doubt, focussed attention by the scientific community on the necessity to impose exacting standards to the validation and implementation of the testing processes to ensure the evidence is accurate and reliable.

It does not follow that the evidence is immune to challenge or it is too difficult to challenge. As *Jama* demonstrates there may be problems in a particular case.

⁸⁰ *R v Duke* (supra); *R v Karger* (2001) 83 SASR 135; *R v Berry* (supra)

⁸¹ *Strengthening Forensic Science in the United States: A Path Forward* United States, Research Council of the National Academies, Report on the Committee on Identifying the Needs of the Forensic Science Community, 2009

The extremely sensitive nature of the amplification (PCR) process already allows for minute amounts of DNA to be typed – how minute is a question that will no doubt continue to be investigated. However with that, the potential problems with contamination may intensify and certain issues of interpretation become more acute. The sensitive nature of the techniques already adopted enables DNA profiles to be obtained from a sample although there is no identifiable bodily fluid. Similarly, the opportunity for secondary transference as an explanation for the DNA may increase.

Interpretation issues⁸² which may arise when testing particularly low levels of DNA (Low Copy Number DNA “LCN DNA”) have already been the subject of argument here⁸³ and in England.⁸⁴ While recognising that these issues were real and that there is a need to fully appreciate them, the evidence has been held to be admissible.

Of course any such development and its use are in a context where crime scene samples, by their very nature are often of low quantity or are degraded; where the typing results may give rise to partial or mixed profiles.

As observed earlier, as more locations on the DNA strand are targeted during the testing process, the results will become more discriminating. Currently, the system of DNA analysis utilised by Australian laboratories (Profiler Plus) targets ten locations. Already on the market⁸⁵ is what is described as the Next Generation Multiplex, a system which targets sixteen loci. One assumes that it is only a question of time before this will be implemented.

Some of the developments will focus on the practical issues. For example the use of automation in the laboratory processes may offer an added aspect of quality control as it removes, at some stages, the human element. It may also have the capacity to increase the

⁸² For example; the stochastic effect or peak height imbalance etc. For a general description of these concepts see: *R v Karger* (2001) 83 SASR 1 at [47][131]- [132] (stochastic effect), [118] – [123] (peak height imbalance)

⁸³ *R v Murdoch* [2005] NTSC 76. This was a first instance ruling of Martin CJ who admitted the evidence; it does not appear to have been a ground in the appeal.

⁸⁴ Originally and issue was raised about the reliability of this evidence when an accused was found not guilty of a number of counts of murder: *R v Hoey* (the “Omagh Bombing”) [2007] NICC 49. A Review of this type of evidence was then conducted by Professor Caddy who concluded that the processes were valid although reporting of the results should contain certain caveats; that the nature of the starting material is unknown, the time it was transferred could not be inferred and the opportunity for secondary transference is increased by comparison to standard DNA profiling. Subsequent challenges to the admissibility of the evidence of LCN DNA have been dismissed: *R v Reed and Reed* [2009] EWCA Crim 2698; *R v Broughton* [2010] EWCA Crim 2578; *R v C* [201] EWCA 2578

⁸⁵ Promega and Bio Systems have marketed such a product.

through-put of samples which is a live issue given the delays in criminal proceedings which often occur waiting for test result.⁸⁶

Other developments will be as to the use of the technology. For example, “familial searching” of databases has been the subject of discussion. This is based on the premise that close relatives will share features of their DNA profiles (alleles) more than unrelated individuals. While there may be no DNA match between a crime scene profile and one on a database, a “near genetic” match may be made which is of a close relative of the source of the DNA sample. It has been recognised that familial searching may provide useful intelligence in crime solving;⁸⁷ there is evidence that it will assist in identifying offenders.⁸⁸

Whatever the developments, the ongoing challenge for lawyers and judges is to have sufficient knowledge to recognise when an issue does arise and to address it appropriately.

Conclusion

Integrity at each stage of the process is critical to ensuring the high standards demanded by the criminal justice of expert evidence. *Jama* provides a salutary reminder of the responsibility of the legal profession in dealing with such evidence.

Appropriate training and knowledge of the area of expertise relied upon is fundamental. Only then can the strengths and limitations of the evidence be properly assessed, and if required, presented to a jury in an accurate and comprehensible manner with its true significance being exposed.

Preparation is vital. If an issue as to a DNA result does arise, careful examination is necessary to determine whether there is a basis for concern and, if so, for that concerned to be addressed.

⁸⁶ For a consideration of the type of future developments in this field: Budowle and Van Daal “*Extracting Evidence From Forensic DNA Analyses: Future Molecular Biology Directions*”, *Beyond Darwin: the Future of Molecular Biology* (2009) at 339

⁸⁷ The Forensic Use of Bioinformation; Ethical Issues, Nuffield Council Of Bioethics, Executive Summary at [30][31]

⁸⁸ The recent Ford Review into Pt 1D of the *Crimes Act 1914* addresses its benefits and acknowledges that the ability to use it may fall within Pt 1D (and the equivalent State and Territory provisions) but that the National Database (NCIDD) would require attention as, in its current form, it would be inadequate for those purposes. It acknowledged that DNA technology is developing and that that ought to be accommodated but that any significant development, including familial searching, ought only be adopted after appropriate exposure: “*DNA Forensic Procedures: Further Independent Review of Pt 1D of the Crimes Act 1914*” delivered 30 June 2010. At 21; and see Budowle “*Familial Searching: Extending the Investigative Lead Potential of DNA Typing*” Profiles in DNA 13(2) [Internet] 2010 available from www.promega.com/profiles/1302/1302_07.html .

The power of the technology creates a demand for its use. This will only increase with time. Appropriate resourcing to those working in the field is necessary to meet the demands in timely fashion for the criminal justice system, while assisting to ensure that the high standards rightly demanded of this important expert evidence are maintained.