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Forensic DNA Evidence: Recent Cases; Recurring Issues

by

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FORENSIC DNA EVIDENCE: RECENT CASES; RECURRING ISSUES

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1. INTRODUCTION

On 12/4/01 'The Australian' published an article about the freeing of Frank Alan Button. The lead paragraphs read:

> *The case of a man wrongfully imprisoned in Queensland for rape and set free by DNA tests highlighted the gross unfairness of forensic testing nationwide, lawyers and civil libertarians claimed yesterday.*
>
> *Frank Alan Button, 30, enjoyed his first full day of freedom in 10 months after the Queensland Court of Appeal quashed his conviction on Tuesday for raping a 13-year old girl.*
>
> *It was only after Mr.Button was found guilty by a jury and jailed that forensic testing of bed linen, which police could have carried out earlier, was ordered for his appeal.*

A report on the same case in the previous day's 'Daily Telegraph' concluded with the following paragraph:

> *The Court of Appeal heard the sheets were not originally tested because Investigators believed, as it was Button's house, his DNA would be on the sheets as a matter of course. Justice Williams noted police seemed to have dismissed a "rumour that another man had intercourse with the girl".*

The point of drawing attention to these reports is to highlight the fact that in each jurisdiction in Australia forensic DNA testing occurs almost exclusively within the context of a police investigation. The forensic scientists responsible for carrying out the testing are part of the investigation team designated to carry out the work of identifying a primary suspect in respect of a particular crime, and then - once a decision has been made to prosecute - to assist in building a case against that person.

In the 'Northern Territory News' of 9/6/01, there was a report about a purported rationale given by the current NSW Police Minister for introducing DNA laws requiring the DNA testing of prison inmates, namely, to uncover past wrongful convictions which had resulted from unethical police behaviour. The article reported that:

> *The State Government last year introduced DNA laws to test all inmates with a view to weeding out innocent men and women and linking others to unsolved crimes.*

Broadly targeted DNA testing will not however result in the overturning of wrongful convictions in circumstances such as those faced by Frank Button. It is often not a matter of testing suspects but rather one of testing the right crime scene or other samples, and the available resources and choices in that regard tend to rest with the Police and prosecutors.

When a criminal investigation/prosecution is running its course for the first time there will from time to time be DNA evidence that is arguably equivocal, or which may be regarded as consistent with two competing theories of guilt and innocence in that particular case. A resort to a state or nationwide database of convicted criminals to may simply help to nail shut the metaphorical coffin of an accused person, when the real issue in the case may be whether a match should be "called" at all.

It would appear from the recent decision of Mullighan J. in *R v Karger* (unreported voire dire decision in S.A. Supreme Court proceeding [2001] SASC 64, reasons for decision given on 29/3/01) that the direction we are heading in legally is that calling a match is becoming the professional prerogative of that select group of forensic experts employed in the various Police DNA laboratories. The qualifications of would-be defence experts who, regardless of their long term experience in the forensic DNA field, do not work on a daily basis with the commercially acquired system called "Profiler Plus" and its associated computer software (now uniformly adopted for use by the Police DNA labs in each jurisdiction) will not be regarded as adequate to permit them to proffer a contrary interpretation. The power and responsibility that this monopoly on the interpretation of DNA testing results places in the hands of the Police forensic scientists is awesome.

I will attempt in this paper to provide a brief travelogue through recent forensic DNA cases and issues, but to the extent that there is any loosely framed theme that I would seek to harp on it is that forensic DNA testing is a development of such critical significance in the criminal justice system that it is unfair and inappropriate for such testing to be a tool honed and adapted for exclusive use by law enforcement agencies rather than an independent resource available to both parties in a criminal proceeding.

I will not spend any time or space in the text which follows trying to explain or outline any of the technical aspects of forensic DNA testing, There is another paper being presented at this conference that will, I understand, cover such matters, and fairly detailed explanations/outlines are available in a number of the judicial rulings I will mention, including in *R v Karger* itself.

2. *PRE-KARGER CASES OUTSIDE AUSTRALIA*

The most widely cited early attempt at judicially defining criteria for the admission into evidence of forensic DNA test results was that of Justice Sheindlin in the 1989 case of *The People v Castro*, 545 N.Y.S. 2d 985. The defendant stood accused of two counts of murder in the second degree, it being alleged that on 5/2/87 he stabbed to death 20-year old Vilma Ponce, who was seven months pregnant at the time, and her 2 year old daughter. A wrist watch worn by the defendant was seized. What appeared to be bloodstains on the watch were noted by detectives. The defendant stated that the blood was his own. The prosecution sought to lead DNA evidence to establish that the origin of the bloodstains on the watch was the blood of the adult victim.

Judge Sheindlin applied the test set out in *Frye v United States*, 293 F. 1013 at 1014 (D.C. Cir. 1923) and formulated a "three prong" approach as follows (at p.988):

> ***Prong I***
> *Is there a theory, which is generally accepted in the scientific community, which supports the conclusion that DNA forensic testing can produce reliable results ?*
>
> ***Prong II***
> *Are there techniques or experiments that currently exist that are capable of producing reliable results in DNA identification and which are generally accepted in the scientific community ?*
>
> ***Prong III***
> *Did the testing laboratory perform the accepted scientific techniques in analyzing the forensic samples in this particular case ?*

Judge Sheindlin had no problem in finding that Prongs I and II were satisfied and that the DNA testing was sufficiently reliable to enable evidence to be led at trial to the effect that the blood on the watch was not that of the defendant. However, when it came to evidence of a DNA profile match between the blood on the watch and the profile of the adult victim, it was held that the defence had mounted a persuasive challenge to the reliability of the testing carried out by the testing laboratory (run by the commercial operator "Lifecodes") both in relation to confusion in the test results as to whether or not there was in fact a match and in relation to the statistical probabilities put forward as to a random match.

While the various aspects of forensic DNA testing have evolved significantly since *Castro*, most jurisdictions in the United States (those that don't apply the *Daubert* "assistance to the trier of fact" test prescribed for Federal courts) have continued to adopt the same approach when assessing the admissibility of DNA evidence, an approach which was also adopted by Justice Mullighan in *R v Karger*.

In *The People v Barney* 10 Cal.Rptr.2d 731 (Cal.App. 1 Dist. 1992) a California appeals court considered the controversy amongst scientists in the DNA field at the time regarding the extent to which populations genetics considerations rendered statistical calculations of random match probabilities unreliable. The debate was outlined as follows (at p.740):

> *There is currently a fundamental disagreement among population geneticists concerning the determination of the statistical significance of a match of DNA patterns. The dispute was recently featured in a leading scientific Journal, Science, in which Richard C.Lewontin of Harvard University and Daniel L.Hartl of Washington University attack the reliability of DNA statistical analysis, while Ranajit Chakraborty of the University of Texas and Kenneth K.Kidd of Yale University defend it. (Lewontin & Hartl, Population Genetics in Forensic DNA Typing, Dec.20, 1991, Science, at p.1745 [hereafter Lewontin & Hartl]; Chakraborty & Kidd, The Utility Of DNA Typing in Forensic Work, Dec.20, 1991, Science, at p.1734 [hereafter Chakraborty & Kidd]).*
>
> *Lewontin & Hartl question the reliability of the current method of multiplying together the frequencies with which each band representative of a DNA fragment appears in a broad database. The problem, they say, is that this method is based on incorrect assumptions that (1) members of the racial groups represented by the broad databases – Caucasians, Blacks, and Hispanics – mate within their groups at random, i.e. without regard to religion, ethnicity, and geography, and (2) the DNA fragments identified by DNA processing behave independently and thus are "independent in a statistical sense" – i.e., in the language of population genetics, they are in "linkage equilibrium" (Lewontin & Hartl, supra, at p.1746).*
>
> *Lewontin and Hartl claim that, contrary to the assumption of random mating, ethnic subgroups within each database tend to mate endogamously (i.e. within a specific subgroup) with persons of like religion or ethnicity or who live within close geographical distance. Such endogamous mating tends to maintain genetic differences between subgroups – or substructuring – which existed when ancestral populations emigrated to the United States and has not yet had time to dissipate. As a result, the subgroups may have substantial differences in the frequency of a given DNA fragment – or VNTR allele – identified in the processing step of DNA analysis. A given VNTR allele may be relatively common in some subgroups but not in the broader database. (Lewontin & Hartl, supra, at pp.1747-1749).*
>
> *There are purportedly two consequences of genetic substructuring and subgroup differences in allele frequencies: (1) it is inappropriate to use broad databases to which all Caucasians, Blacks, and Hispanics may be referred for estimating frequencies together, for want of linkage equilibrium. The current multiplication method, using the Hardy-Weinburg equation (which requires statistical*

independence within a locus, or Hardy-Weinburg equilbrium) and the product rule (which requires statistical independence across loci, or linkage equilibrium) will be reliable only if there is extensive study of VNTR allele frequencies in a wide variety of ethnic subgroups. (Lewontin & Hartl, supra, at pp.1748-1749).

The Court in *Barney* had regard to a 1992 report on DNA analysis by the National Research Council of a respected U.S. body called the National Academy of Sciences. I will refer to this 1992 report as "NRC 1". NRC 1 adverted to the existence of a scientific controversy regarding the statistical interpretation of DNA profile matches, and proposed a solution, outlined in *Barney* as follows:

The NRC report on DNA analysis appears to point the way to such common ground. The report proposes a method of statistical calculation which accounts for the possibility of population substructuring, eliminates ethnicity as a factor in the calculation process, and permits the use of the product rule while ensuring that probability estimates are appropriately conservative. The report proposes a "ceiling frequency" approach, in which DNA samples from 15 to 20 homogenous populations will be analyzed for allele frequencies. In subsequent analysis of the DNA of a suspect or crime scene sample, each allele will be assigned the highest frequency that appears in the tested populations, or 5 percent, whichever is greater. These frequencies will then be multiplied together using the product rule. (NRC rep., supra, at pp. 12-12, 82-83, 95, 134).

Until the ceiling approach is in place, the report proposes that the following interim methods should be used to report frequencies. (1) Using a "counting principle" approach, the frequency of a DNA pattern (e.g., zero) in an existing database should be reported. (2) Using a modified ceiling approach, each allele should be assigned a frequency of either 95 percent "upper confidence limit" for its frequency in existing databases (wherein the true frequency has only a 5 percent chance of variance), or a 10 percent, whichever is larger, and a statistical calculation should then be made using the product rule. (NRC rep., supra, at pp.14-15, 91-92, 95; see also p.76).

The "ceiling" and "modified ceiling" approaches were endorsed in *Barney* as providing a basis for the admission of statistical evidence about DNA matches in future cases. To cut a long story short, what happened next was:

1. The FBI, unhappy with the rejection of statistical evidence proferred by its experts according to pre-NRC 1 calculations, sponsored a symposium on forensic DNA typing at its Quantico headquarters.

"Some of the judges who had authored opinions rejecting the admissibility of the FBI's statistical methods were among the invited guests. The guests heard condemnation heaped upon the NRC report and on the judicial opinions extolling its virtues. This was not, however, an open forum or public gathering of scientists. Instead the FBI restricted attendance at the meeting and limited the range of opinions that were expressed there. The only lawyers and scientists in attendance were sympathetic to the FBI's position. The Bureau made it abundantly clear to me and other lawyers interested in the subject, as well as to scientists critical of the Bureau's methods, that we would not be allowed to attend, much less address this gathering.

This spring, the FBI asked the National Academy of Sciences to convene another committee comprising different scientists to re-examine the statistical issues that the Academy had just spent two years studying. The Bureau's request went through the normal Academy channels and was initially rejected. Undaunted by this rejection, Director Sessions reiterated his request, this time formally to the president of the Academy, with an offer to underwrite the project. The normal procedures were dispensed with, and in May, 1993, the president gave Sessions the green light for an entirely new committee. So much for the integrity of the Bureau and the independence of science."
("Have You No Sense Of Decency?", Peter J.Neufeld, The Journal Of Criminal Law & Criminology, Spring 1993)

2. Population studies were carried out within various racial and ethnic groups in relation to the particular DNA markers then in use by the FBI and other law enforcement agencies. These studies indicated that as regards the main population group categories (e.g. Caucasian) the extent of "sub-structuring" was negligible. The situation as regards smaller and more isolated population groups (e.g. certain Native American tribes) was less clear.

3. The reconvened and reconstituted DNA Committee of the National Research Council published a further report in 1996 ("NRC 2") which noted the results of the population studies that had been undertaken since NRC 1 and essentially endorsed the use of the product rule for the larger population group categories in respect of the DNA markers investigated by the population studies. The report proposed the use of statistical correction factors to remedy the effect of inbreeding or linkage disequilibrium in those smaller and more isolated populations where data from population studies was either unavailable or unclear.

4. The position set out in NRC 2 has gradually displaced the NRC 1 approach in cases dealing with the admissibility of statistical interpretations of DNA profile matches, both in the United States and elsewhere.

In the May 1998 judgement of *The People v Venegas* , 18 Cal.4th 47, the Supreme Court of California provides a useful overview of the legal and scientific developments since NRC 1 and notes the distinction between rigorous adherence to standardised mathematical accuracy (even at the expense of possibly not taking into account a potential error or anomaly favourable to an accused person) on the one hand, and "forensic reliability" (in the sense of eliminating potential prejudice to the accused person) on the other:

> *As the Court of Appeal observed below, although the prosecution's own expert witness in this case suggested the 1992 NRC Report's ceiling methodologies were not scientifically defensible, they reached that conclusion on the basis that such methodologies "produced unnecessarily conservative results that present a particular [DNA] profile as far, far more frequent in the population than the profile is in reality". We agree with the Court of Appeal's further conclusion that "the evidence [is] also clear that the scientific community regards the NRC statistical methodology as " forensically reliable" – i.e. as selecting figures that most favor the accused from the scientifically based range of probabilities.*

The mid-1990's controversy in relation to the statistical interpretation of DNA profile matches has to some extent gone onto the back burner as a result of the adoption of new sets of highly variable "short tandem repeat" ("STR") markers that can be easily utilised with new technology now available so as to as obtain simultaneous profile results in respect of multiple markers or loci. The sort of specifically designed population studies carried out after NRC 1 in relation to the old generation "VNTR" markers have not been conducted in relation to the new markers, but for the time being that fact does not seem to have generated legal challenges similar to the ones considered in *Barney* and *Venegas*. Instead the principal focus of recent legal challenges has been on a threshold issue relating to the validity of the commercially manufactured testing kits being used by law enforcement agency DNA laboratories to harness the greater discriminatory power of the STR markers.

Basically, the complaint has been that Perkin Elmer, the manufacturer of the testing system known as "Profiler Plus", refuses (purportedly for commercial confidentiality reasons) to publish developmental validation studies relating to the product, leading some to question whether the appropriate developmental validation work was in fact ever undertaken or successfully completed.

Profiler Plus simultaneously tests at 9 variable markers and at the gender locus, amelogenin. The system involves the use of four distinct kits, each labelled with dyes coloured red, blue, green, and yellow respectively. The blue, green, and yellow kits all relate to particular groups of markers.

In the May 1999 case of *People Of The State Of California v Bokin* the Superior Court of the State Of California In And For The City And County Of San Francisco (unreported ? SCN 1689461) rejected DNA evidence obtained with a Perkin Elmer product which was a precursor to Profiler Plus and using the markers in the "green" kit. The importance of the publication of developmental validation studies (as distinct from "internal validation studies") was explained in the following terms (pp.4 and 5):

> *The process of scientific validation has been stressed in DNA cases. In 1995, the "Guidelines for a Quality Assurance Program for DNA Analysis" were prepared By the Technical Working Group on DNA Analysis Methods (hereinafter TWGDAM), and a review of TWGDAM makes clear that validation, both developmental and internal proficiency, are central. In section 4 of TWGDAM, developmental validation is treated. Section 4.1.1 defines developmental validation as a process for the scientific community at large to properly assess whether a particular procedure can be obtained and determine the limitations of the procedure." Developmental validation by its nature requires the critical aspects of a procedure to be carefully monitored and controlled. TWGDAM at 4.1.1. Particular studies in this regard are specifically listed in section 4.1.5, with the requirement the results of developmental validation be "shared as soon as possible with the scientific community...[I]t is imperative that details of these studies be available for peer review through timely publications in scientific journals." TWGDAM at 4.1.5.12. What the laboratory learns through its developmental validation and how such is critically assessed by the membership of the community at large is fundamental for the forensic use of DNA identification.*
>
> *It is not enough that the particular laboratory which developed a procedure which is marketed engage in their own internal validation. The process of internal validation, detailed in section 4.5 of TWGDAM, is totally different from the notion of developmental validation.*

This passage goes on to note that "these TWGDAM guidelines are not forensically optional steps", and "the failure to either detail the developmental validation of a particular procedure or, alternatively, allow peer review of the same, is a serious defect in a particular procedure when seeking to substantiate prong one of Kelly" (*Kelly* being the Californian precedent directing adoption of the *Frye* test). After reviewing the evidence in the particular case before him the Superior Court judge found as follows (at p.9):

> *The sum of this record is that the government has not provided the Court with enough to conclude that STR's identified by using Green One with ABD Genetic Analyzer 310 satisfies TWGDAM requirements pertaining to developmental validation. There was no discovery of developmental validation conducted by Perkin-Elmer. The exhibits referenced by the prosecution in its post hearing brief deal with peer review of other methods involving STR identification.*

> *As to CODIS, the databank identification system, the fact that Green One is used by some agencies does not mean that Green One is forensically satisfactory. As was pointed out during argument, there are numerous scientific procedures used for various governmental and commercial endeavours, such as the polygraph, which fulfill important purposes. Yet, these procedures have not been accepted in court because, as Daubert and Kelly suggest, forensic "truth" is different from laboratory validity or employment utility.*

Subsequent to the decision in *Bokin* DNA results obtained through the use of the full Profiler Plus system have been rejected in a Colorado case (*People of Colorado v Schreck*, CR 2457, Division 4, 2000 case no.98, unreported) and a Vermont case (*State of Vermont v Pfennig*, 6/4/00, Vermont District Court Docket No. 57-5-96, unreported). Both these cases are discussed by Mullighan J. in *Karger* (at pp.64 and 65). Mullighan J. also referred to various other U.S. decisions in which Profiler Plus evidence had been admitted.

3. PRE-KARGER AUSTRALIAN CASES

Justice Mullighan's first reported foray into the field of forensic DNA profiling was in the case of *R v Jarrett* (1994) 73 A Crim R 160. In that case there was a defence challenge both to the reliability of the laboratory work conducted by the forensic scientists at the South Australian Forensic Science Centre, and as to the failure of the prosecution statistics expert to apply the NRC 1 modified ceiling approach. Mullighan J.'s ruling was to the effect that the issues joined by the respective prosecution and defence experts were a matter for the jury, not something that should be determined by him as threshold conditions for admissibility. In a separate but associated judgement dealing with an objection to the admission into evidence of data from the Forensic Science Centre's DNA database, Mullighan J. noted (at p.186):

> *There was a time when information as to DNA genotypes was stored in the database and was produced in the computer outputs as part of the data of the general population. The computer program was rewritten to exclude Aboriginal data and it is apparent from perusal of printouts of the database in 1992 and in 1994 that the alteration to the program has had the desired effect.*

In the main judgement at p.167 there is an observation that "Genotypes of Aboriginals have also been excluded in case there is a uniqueness by reason of race".

In the N.S.W. Court of Criminal Appeal case of *Pantoja v R* (1996) 88 A Crim R 554, the appellant, his wife, their two children, her sister, his brother Amancio, other relatives and a friend of the family all lived in the same premises in the Sydney suburb of St.Peters. They were all South American Indians, and members of a sub-group known as Quechua Indians. The appellant was charged with both the aggravated sexual assault of his wife's sister and the murder of his wife a week later.

The Crown led DNA profiling test results carried out on vaginal swabs from the wife's sister and semen stains taken from her nightdress with a view to establishing that the appellant had sexual intercourse with the wife's sister a week before the murder. Statistical evidence was led to the effect that only one person in 792,000 would have the same kind of DNA profile as the one shared by the Appellant and the semen stains on the nighdress. Results of a DNA profiling test on the same samples but using different DNA markers were relied on by the defence to show that the appellant was excluded. It was argued on appeal that the Crown DNA evidence should not have been admitted at trial, both because of the conflict between the experts as to the existence of a match and because of the inability of the Crown to satisfy concerns as to the capacity of the databases relied upon by the Crown for statistical calculation purposes to adequately address the arguably unusual population genetics circumstances of the case

The Appeal Judges in *Pantoja* made some general observations about forensic DNA evidence that have been adopted in subsequent cases in all Australian jurisdictions. Hunt CJ at Common Law noted (at p.564):

> *The significance of a match between the blood type of DNA of the offender and the suspect (or accused person) must be clearly explained to the jury: that (as I said earlier) it establishes no more than that the accused* ***could*** *be offender, whereas any blood test which positively excludes the accused as the offender – if* ***there is a reasonable possibility that the test is correct*** *– must necessarily exclude the accused completely notwithstanding that there is a match obtained by other blood tests which operate quite differently or independently, and however strong the other evidence in the case may be.*

As regards the issues in the case itself, it was held that the implications of the Crown's matching tests results on the one hand and the exclusion of the appellant on the defence test results on the other was a matter for the jury. As regards the statistical evidence Hunt CJ pointed out that the other members of the household had been tested and excluded and that there was no direct evidence in the case that pointed to the offender being a South American Indian. He was of the view that what was required was not a separate database of Quechua Indians but rather a judicial direction that when assessing the statistical calculations derived from the general database the jury should take the possibility of the offender having been a member of that sub-group into account (at p.563):

> *It is simply not practicable to devise a database which took all the circumstances peculiar to this case into account. But the possibility that – by reason of her association with persons of the South American Indian race – the person who had sexual intercourse with the appellant's sister-in-law may have been of that race (which was unlikely to have been represented in the databases used) required a direction to the jury that the chance or coincidence of a match thrown up by the use of such databases would have to be reduced in order to take that possibility into account*

Despite accepting that a general database could be used for the purposes of the case, Hunt CJ said that the statistical calculations should have been rejected because no expert evidence had been called by the Crown at trial to confirm that the databases relied upon were of a reliable size. Hidden J. adopted the reasons of Hunt CJ.

Abadee J. took a somewhat different approach, referring to cases in other jurisdictions where the suspect was a member of an indigenous sub-group, namely the Canadian cases of *R v Lafferty* ((1993) 80 C.C.C. (3d) 150) and *R v Batptiste* ((1994) 88 C.C.C. (3d) 211), and the U.S. Federal case of *United States v Two Bulls* (918 F.2d 56 (8th Cir.1990). He also referred to the U.K. case of *Gordon,* where the suspect was a person of Afro-Carribean descent ((1995) 1 Cr.App.R 290). He commented that (at p.582):

> *As I have said the final statistic is usually expressed in terms of the odds of this match occurring at random in the relevant population. Thus the method used to determine the probability statistic may be the subject of significant contest, since once the declaration of the match is admitted into evidence, it is the statistical probability of the random match which the jury must consider to determine if the sample found at the scene is indeed that of the accused.*
>
> *Hence the importance of the choice and selection of the relevant population when determining the probability of a coincidental match.*

Abadee J. noted (at p.583) with apparent approval in terms of its application to the case before him that "in *Gordon* it appears that where the suspect was a person from a particular racial group, a specific data base applicable to that group was used".

However, the primary basis given for exclusion of the statistical evidence was the lack of evidence at trial establishing the threshold statistical validity of the databases relied upon.

In *R v Milat* (1996) 87 A Crim R 446 Hunt CJ at CL had an opportunity to consider the sort of expert evidence about the reliability of forensic DNA databases that should have been adduced at the *Pantoja* trial, and made reference to the NRC 2 recommendation that an acceptable minimum number for any specific database was "several hundred persons".

Two more recent pre-*Karger* cases of interest, both at the intermediate level of their respective State court hierarchies, deal with objections to DNA evidence that were to resurface in *Karger.*

In *R v Prendergast* (unreported ruling of Justice Dee in the County Court of Victoria delivered 10/11/98) the Crown's DNA test results (using multiplexed STR markers but not the Profiler Plus system) were rejected due to the risk of "stochastic effect" error involved in testing the very small, unquantified, and uncharacterised (i.e. as to what particular form of human product) amount of DNA.

In the NSW District Court at Moree on 28/2/01 Profiler Plus evidence was rejected after a voire dire hearing in which the Crown forensic expert was unable to establish that the system had been appropriately validated (unreported decision of Nader J. in the case of *R v Christopher William Argue*, 98/31/0391).

4. FOCUS ON THE N.T.

The only reported DNA case from the N.T. is the Court of Criminal Appeal's judgement in *Latcha v R* (1998) 8 NTLR 122, which sets out general guidelines as to the manner in which the Crown should adduce DNA evidence. The guidelines are influenced by those set out in the U.K. case of *Doheny and Adams v R* [1997] 1 Cr App R 369 (inaccurately cited in the report as "*Doherty*"). The Court also made the following observations regarding population statistics (at p.129):

> *We note that in other Australian jurisdictions the relevant population figure is based on the whole of the State but that in the United Kingdom the relevant population is that of the whole country (see for example, Doherty* (sic)*(supra) at 378) although, if it is known that the defendant was in the place where the assault occurred at the relevant time, evidence (if available) may be led to show how many Caucasians (or Afro-Caribbean, or as the case may be) sexually active males with matching characteristics are likely to be found in that area: ibid, at 374. The reason why a figure based on the whole population, or in a rape case, based on the sexually active male population of the relevant group, is chosen, is not only because the database in the United Kingdom is based on the total population, but presumably on the fact that the United Kingdom is a relatively small country and it is not difficult for a criminal to be in some other more distant part of the country in a short period of time.*
>
> *It is a notorious fact that the Northern Territory's population is extremely mobile. There are a large number of tourists and other visitors. It is equally not difficult for a criminal to escape a crime scene can be anywhere else in Australia within twenty-four hours.*
>
> *In those circumstances, we consider that fairness may require, depending on the circumstances, that evidence be given of a likelihood ratio based on the whole of the relevant population of Australia. We appreciate that, as there is yet no national database, this would give rise to the difficulty that, unless the expert has access to every database in the country, any figure given assumes that the whole Australian population is in Hardy-Weinburg equilibrium and that it is valid to use a Northern Territory database to draw conclusions about the whole Australian population. Those are matters which the expert could comment upon and which the trial judge could instruct the jury to take into account, in line with the reasoning of Hunt CJ at CL in* ***R v Pantoja*** *(1996) 88 A Crim R 554 at 563.*

> *It would also have been open to the Crown to lead evidence of an appropriate figure based on the relevant Northern Territory and Darwin populations.*

It is submitted that the above observations in *Latcha v R* do not reduce the obligation on the Crown to fairly address circumstances representing the 'flip side of the coin' which will frequently crop up in the Territory, namely circumstances where an offence occurs in a very remote location and where the pool of suspects is completely or predominantly Aboriginal. In such a scenario a general mixed-race database (whether based on the Darwin population, the Northern Territory population, or the Australian population) would usually be of assistance only to the prosecution in that it would tend to make the (combined) profile of the accused seem rarer than if an N.T. Aboriginal database was used.

Although the various trials (and one unreported voire dire) preceding *Latcha* have not generated judgements that can be referred to for the purpose of tracing a development of judicially outlined DNA issues, the DNA evidence disputes in the cases are nevertheless of interest in terms of the way forensic DNA testing and the interpretation of such test results has evolved in a particular Australian jurisdiction.

In committal proceedings in November 1992, in the case of *Robert Melville* the sole forensic biologist then working for the Northern Territory Police gave evidence that she had started doing DNA work in the N.T. Police forensic biology laboratory in February of that year. Only one marker was used to start off with (HLA DQ alpha). As at that point there was no separation of the database as between Aboriginal and non-Aboriginal people, an issue which was focussed on by the defence.

By the time that the trial in *R v Morley* commenced in November 1995, the N.T. laboratory was carrying out testing in relation to two additional markers and there had been modifications to the configuration of the database, as outlined in the following passage of trial evidence from the forensic biologist (T62):

> *Well, in order to do the statistical analyses of our results, statistics experts have required that our figures have to be in what they call Hardy Weinburg Equilibrium. This means that the population that you're dealing with has to be undergoing random mating so that there's no actual ethnic group, as it were, that skews your data. Right ? A Hardy Weinburg analysis of my data showed that it was not in equilibrium, which meant that I couldn't work out the statistics as to the frequency of the occurrence. The main reason for this non-equilibrium situation was the fact that I had a large number of traditional Aboriginal people on my database and they have, in certain systems, a different weighting or different occurrence of alleles. So consequently, in order to do the statistics properly, I have to report my figures in terms of Aboriginal and non-Aboriginal so that my data is split according to Aboriginality and I must emphasise here that*

the Aboriginal database is only traditional Aboriginals. That is as close as I am able to determine whether a person is a traditional or full-blood Aboriginal.

A similar sort of system has been used in Queensland and my data has been analysed by a statistician who's also analysed the Queensland data and she asked me why mine was so different and it turns out that the Queensland laboratory, their Aboriginal database is on declaration, not – traditional or full-blood categorisation, and I try as – as much as I can to only include traditional or full-blood people in my Aboriginal database and that's why there is a difference between the Queensland and the Northern Territory statistics.

What group then forms the non-Aboriginal ? --- The non-Aboriginal is everybody else. So it's the whole population of the Northern Territory that I deal with, who can be caucasian, can be Asian, can be part-Aboriginal or can be everything else that's not a full-blood Aboriginal.

In the August 1996 trial of *R v Siganto* the Crown adduced evidence of the DNA profile (at 8 markers) of blood found on the accused's motor vehicle, which matched the DNA profile of the Aboriginal rape victim. The rape occurred in Darwin and the car was found in Darwin. The forensic biologist called by the Crown gave evidence to the effect that the relevant population when it came to considering the possibility of the blood coming from someone other than the victim was the Darwin population. The forensic biologist conceded that there were very few Asians in the non-Aboriginal database she had referred to for the purpose of attributing a statistical frequency to the profile, and that it was difficult to isolate them within the database. The thrust of one of the challenges made by the defence to the statistical evidence was that Darwin had a significant Asian population and the database used therefore failed to properly reflect the relevant population. This criticism was taken on board, and it emerged in evidence in a later case that a specific Asian field had been incorporated into the database, and that greater numbers of Asian people had been included in it.

R v Staats was a voire dire hearing in March 1997 in which the defence sought the exclusion of forensic DNA testing carried out on a vibrator. The Crown case was that the accused, a doctor, had sedated his teenage female patient and then inserted the vibrator. The DNA test results gave mixed profiles in relation to particular parts of the vibrator, but the Crown case was that the victim's profile could be identified within the mixture. The defence challenge was mounted on a number of fronts but a particular focus was a criticism that the two forensic biologists working at the N.T. Police Forensic Biology laboratory were failing to follow the protocols of the manufacturer (Perkin Elmer) in relation to the calling of results from certain (pre-Profiler Plus) DNA testing kits.

The thrust of the cross-examination was that results would be called or not called according to the extent to which a particular result would fit in with the Crown case. This contention was unsurprisingly rejected by the two forensic biologists concerned, and the

trial judge (Justice Mildren) ruled that the assessment of the claimed shortcomings in the DNA testing was a matter for the jury at trial. No written reasons for the ruling were ever delivered because after the voire dire ruling (which covered challenges to the admission of other evidence as well as the DNA evidence) the accused pleaded guilty to the charges against him.

Prior to or during the course of the *Staats* voire dire, the defence were provided with allele frequency summaries for the Northern Territory non-Aboriginal database. The summary for the marker HBGG showed that as at 9/5/96 there was one person recorded with the rare genotype "BC". However, as at 30/1/97 there was no-one in the database with that genotype, despite the fact that the summary showed that 56 people had been added to that part of the database in the intervening period.

R v Harrison was a January 1998 trial in which the accused was charged with the rape of a schoolteacher at the community of Barunga. After the exclusion of a confession made by the accused the only real evidence against the accused was a clear DNA match with the crime scene samples. The defence case was that the apparently damning statistical frequency figure placed on the match by the Crown experts should not be accepted because of the unreliability of the Aboriginal database used to calculate the frequency (both due to its manner of compilation and due to the potential for skewed results arising from variation in profile frequencies as between different N.T. Aboriginal communities), and because of the possibility that the crime scene stains had been left by a close relative of the accused living at or near Barunga. Evidence was given that there was a higher likelihood of a close relative having the same profile as the accused and the crime scene stains than the likelihood of a randomly selected unrelated Aboriginal person having that profile. The defence had not had the resources to carry out any empirical population testing of its own, and sought to criticise the Crown for failing to validate its testing in that way, in particular as regards the non-testing of close relatives for exclusion purposes. The accused was found guilty.

During the course of cross-examination of the forensic biologist called by the Crown, she was asked for an explanation for the discrepancies between the allele frequency summaries provided to the defence in the earlier *Staats* case and was unable to do so.

R v Watt and Parella was an aggravated assault trial in June 1998 where the Crown case against one of the two accused relied substantially on DNA profiles obtained from blood and other biological material found on the inside of a pair of discarded rubber gloves. The Crown case was that the mixed profile identifed comprised the profile of the accused together with the profile of the victim, and (at at least one place tested) the profile of a further unknown person. The great difficulties involved in credibly and reliably interpreting such mixtures were effectively exploited by the defence and both accused were acquitted, including the individual alleged to have been the source of the profile in the rubber glove.

The difficulties emphasised by the defence related both to the actual identification of particular profiles in the mixture, and to the process of calculating a statistical frequency figure.

5. R v KARGER

There is little point in reviewing Mullighan J.'s judgement in *R v Karger* in any great detail. It is a lengthy and carefully prepared comprehensive demolition of almost any argument that might floated as to why Profiler Plus test results should not be relied upon and a ringing endorsement of the work carried out by the S.A. Forensic Science Centre (and by implication of the work carried out by the Police forensic laboratories in other jurisdictions).The very length of the judgement (168 pages) and amount of information it contains creates a momentum that lends authority and an impression of conclusiveness to the findings.

Because it is the first of such decisions at the Supreme Court level, and because of the care taken by Mullighan J. in reviewing the evidence before him and explaining his reasons for ruling that the Profiler Plus results were admissible, *Karger* is likely to become the main reference point in any future admissibility challenges. Defence lawyers who are considering a challenge to any aspect of Profiler Plus testing will have to read the judgement carefully and assess whether there is any point in running a challenge before a judge (who is likely to rely on *Karger*) rather than before a jury.

The Crown case was that the victim had been strangled to death with an article of her clothing, a camisole, while she was lying face down on her bed. It appeared that the back of the victim's blouse had been cut with scissors, and near the line of the cut in the inside of the blouse were two stains. DNA was extracted from the stains and the results of analyses (using Profiler Plus and an earlier but similar automated system called Quadruplex) showed the same profiles as those of the accused. The name of the person who carried out the tests was Mr.Pearman.

Particulars of the defence case on the voire dire were formally provided in the following terms (at pp.11-13):

1. *Profiler Plus is not recognised or accepted by the scientific community as reliable.*

    1.1 *The scientific community cannot recognise or accept a genetic profiling process without being able to test it.*

    1.2 *The Perkin Elmer Profiler Plus system is a commercial kit which has not been able to evaluated by the scientific community because validation or other studies performed by, or relied on, by Perkin Elmer have not been released, and evaluation of its proprietary systems and software have not been permitted.*

1A *Further and alternatively, the Perkin Elmer Quadruplex system and the Perkin Elmer Profiler Plus system:*

(a) *have not been shown to comply with TWGDAM and NATA requirements, including but not limited to:*

- *Minimum samples*
- *Peak heights on the Gene-scan and/or Genotyper*
- *As to amplification without valid positive control samples*
- *As to extraction and processing without a reagent blank*
- *Contamination*
- *Internal validation studies*

(b) *have not been shown to have valid application outside the analysis parameters and protocols vouched for by Perkin Elmer; in particular, but not limited to:*

- *Minimum samples*
- *Peak heights on the Gene-Scan and/or Genotyper*
- *As to Amplification without valid positive control samples*
- *As to extraction and processing without a reagent blank*
- *Contamination*
- *Internal validation studies*
- *Substrate controls*
- *Off ladder alleles*
- *Establishing and applying the sizing standard*
- *Saturation*
- *Matrix*
- *Editing of the Genotyper function*

2. *Mr.Pearman does not have sufficient expertise to use such systems or to interpret the results, because his conduct and supervision of the systems:*

- *Reveal a lack of understanding of the process and of essential steps in the process*
- *Ignore the absence of validated laboratory protocols*
- *Reveal a disregard of scientific method*
- *Reveal a lack of scientific objectivity*

4. *The validity of the database or databases*

4.1 *The SA Caucasian database (PP99) cannot be used to express opinions based on "probabilities", because the total of useable samples is too small for statistical purposes.*

4.2 The samples used for the Quad 98 and Quad 99 databases must be shown to be ueseable

All the above criticicisms were rejected by Mullighan J., who characterised Profiler Plus as merely an extension of technology that had been in use for some time for the simultaneous automated testing of STR loci.

At the heart of the challenge based on the non-publication of Perkin Elmer developmental validation studies was the significance attributed by the defence to the failure by Perkin Elmer to reveal the relevant primer sequences:

> *The primers introduced in the amplification kit are obviously specific to the particular loci inspected by the Profiler Plus system. It is these primers which formed a major plank in the challenge to the admissibility of the impugned evidence. The Profiler Plus is, in a sense, strictly speaking the kit used at the amplification stage which contains the various reagents from that process, the primers, the fluorescent tags as well as the internal sizing standard and the allelic ladders for each locus.*
> (pp. 32-33)

Mullighan J. summarised the evidence as regards the non-publication of the primer sequences as follows (at p.121):

> *Scientific articles and publications admitted into evidence establish that over the years since STR fluorescence technology was introduced, the chromosomal locations and primer sequences for each locus as they came to be used in the various systems have been published. I have mentioned some of them. They incude those inspected by Profiler Plus and consequently have been available to the forensic science community. The manual provided by Perkin Elmer with the Profiler Plus when it was released to the market also published this information in the form of reference to scientific articles and publications. In 1999 the forensic science laboratory of the Royal Canadian Mounted Police published this information*
>
> *The forensic community has had the opportunity to use the various systems with the knowledge of the particular primer sequences but I accept the evidence of Mr. Pearman that when Profiler Plus was developed, the original primer sequences, or some of them, were used as a starting point and were modified and those modifications have not been published. It is Mr.Pearman's understanding that Perkin Elmer selected the loci as had been published and modified the primers so that they worked better together and also to ensure that the loci were spaced apart.*

> *I am satisfied that Perkin Elmer has been requested on occasions to disclose the modified primer sequences but has refused to do so because it asserts that they are trade secrets.*

He also noted that:

> *Although the evidence is not clear, it is possible that the modification of the original primer sequences, or some of them, has necessarily resulted in some alteration in the chromosomal locations of all or some of the loci. Mr.Pearman was inclined to accept that possibility and I proceed on that basis.*
> (p.122)

However, Justice Mullighan was ultimately not concerned by the non-publication of the primer sequences:

> *According to Mr.Pearman, knowledge of the primer sequences is not necessary because the reliability and the robustness of the system can be demonstrated through validation studies. I accept that evidence. It accords with common sense and logic. If the system is validated in an appropriate way as accurate and reliable and robust, it is difficult to see why the precise sequences of the primers must be known. As has been seen, that is the view taken in America in* ***Bertsch & Hronis***, ***Dishmon***, *and* ***Gaynor***. *I have mentioned the decisions to the contrary in* ***Schreck*** *and* ***Pfennig***. *However, I decline to follow those decisions as upon the application of the general acceptance test, the evidence clearly establishes that Profiler Plus has been widely accepted as accurate and reliable. Without question, forensic scientists in many placed around the world have used Profiler Plus for forensic purposes and have accepted it as accurate and reliable even though the modified primer sequences have not been made available. It is reasonable to draw the inference that, like Mr.Pearman, they do not consider the knowledge of the primer sequences to be necessary.*
>
> *If I am wrong in my consideration about the publication of the chromosomal locations of the loci inspected by Profiler Plus, much the same observation may be made. If the system is validated by men and women of science, found to be accurate and reliable and is accepted by them for use in the forensic context, the non-disclosure of chromosomal locations is of no significance.*

Justice Mullighan was also unconcerned about the non-publication of Perkin Elmer developmental validation studies generally (i.e. including the relevant accumulated experimental data), concluding that it was sufficient that the results of such studies be set out in the Profiler Plus manual (p.128).

The main expert witness called by the defence in the voire dire was Dr.Bentley Atchison, who has given evidence in many past DNA cases (including the N.T. cases of *Siganto* and *Watt & Parella*, and the Victorian County Court case of *Prendergast*, in which he was described by the judge as "an experienced leader in this field both in terms of academic qualifications and experience").

Dr.Atchison has been carrying out forensic DNA analysis since 1986, when he developed procedures and systems for the process originally adopted in Victoria. He started using STR loci for his own casework (which has included casework for the prosecution in other States) in 1993 or 1994, and developed his own primers:

> *Dr. Atchison designed and developed his own primers. He explained what must be known for the purpose is the region outside the tandem repeat which is suitable to act as a primer and the temperatures at which the PCR will be undertaken. He said it is necessary to search a database to make sure the selected primers will not amplify other regions of DNA. He optimised thePCR for the specific loci he targeted. He said that he selected loci following the TWGDAM guidelines which require that the sequences and locations of loci be published. That approach was adopted by SAG in 1991. It was necessary to select loci which were genetically independent, this is achieved by choosing loci on different chromosomes or, if on the same chromosome, which were not in proximity.*
>
> *Dr.Atchison developed a multiplex system which analyses two groups of four of the eight loci which have been mentioned, amelogenin and APOB and D1S80. The four loci in each group are analysed simultaneously. He designed the PCR reactions and used the same primers. According to him, for use in a multiplex system the primers must be balanced. If not, they will interact with each other. The concentration of each of the primers must be adjusted accordingly so that each locus is producing the same intensity of result. If a locus produces a weak result, it may drop out. Dr.Atchison also said the if the primers are not designed and optimised appropriately, they would bind to themselves producing either false bands or drop out of a locus. Having designed the primers, he arranged for them to be manufactured by a private company.*

Dr.Atchison gave evidence that he chose not to adopt automated multiplex technology for his laboratory because of a concern that it produced artefacts and that it was not possible to tell the difference between an artefact and a true allele.

Because Dr.Atchison did not use Profiler Plus and its associated equipment, Mullighan J. ruled that he was not qualified to express opinions about the interpretation of Profiler Plus analysis results.

5. *POST-KARGER AND PENDING CASES*

There have been at least two recent voire dire challenges to Profiler Plus evidence in NSW that have raised the same, or similar issues to those raised in *Karger*.

The District Court case of *R v Simana Kami* (00/11/0608) and *R v David Kami* (00/11/0610) involved charges against two accused persons of Tongan descent. The DNA evidence involved mixed profiles. The voire dire started on 30/4/01 and finished on 14/5/01. The Profiler Plus evidence was admitted. The attacks on the DNA evidence were replayed before the jury at trial and the accused were acquitted on 1/6/01.

R v Gallagher (70080-99) was a Supreme Court proceeding before Justice Byers in which a voire dire challenge was also unsuccessful but in which the accused was also acquitted at a subsequent trial (acquittal date the same as in *Kami*, 1/6/01). Written reasons for the voire dire ruling have only recently become available and a summary will be provided in an addendum to follow this paper.

In Queensland, a recent voire dire challenge to Profiler Plus evidence in the retrial of *R v Hytch* was unsuccessful but the same issues will be inevitably be raised at a trial scheduled for later this year.

6. *SUMMARY*

The Profiler Plus loci have not been the subject of broad population studies of the kind that were carried out after NRC 1 in relation to the VNTR loci in use at that time. In particular there is uncertainty as to the extent of frequency variation between the N.T. Aboriginal population (or sub-groups within that population) and other larger population groups. For the time being such uncertainty will at the very least call for the use of a significant correction factor.

Dr.Atchison isn't the only scientist working in the forensic DNA field to have concerns about Profiler Plus and the failure by Perkin Elmer to reveal its primer sequences. There is concern in particular about the potential for confusion as between homozygous and heterozygous profiles arising from the null allele rate in respect of at least one locus.

The main problem facing defence lawyers as a result of the *Karger* decision is that if a scientist with the decades of experience and achievement behind him of a Bentley Atchison can be rejected as an expert for the purpose of providing an alternative opinion on the interpretation of Profiler Plus-derived DNA profiles, then there is probably only one other "independent" expert (i.e. "independent" in the sense of not being employed by or beholden to a law enforcement agency) available to the defence in the whole of Australia.

As forensic DNA technology develops, the costs of running a laboratory with the latest equipment and protocols are enormous, especially to the level where the laboratory can qualify for accreditation. The N.T. laboratory is still not accredited even now. It will become increasingly less viable for independent scientists to accumulate the sort of working knowledge that *Karger* suggests is a precondition to expressing an opinion on the satisfaction of what are supposed to be standardised match criteria.

This will essentially leave the various law enforcement agency forensic laboratory scientists occupying the field, with only hit-or-miss defence lawyer cross-examination standing in the way of automatic acceptance of any interpretation opinion provided.

If that is the forecast for the future, then it is vital that the forensic DNA laboratory in each jurisdiction be formally "divorced" from the Police Force in each jurisdiction. Legislation should be passed establishing the laboratories as statutory entities in their own right and strictly circumscribing the extent of collaboration between staff and Police Officers, and setting out procedures to be followed as regards the recording and processing of requests made to the laboratory for tests to be carried out. Alternative testing (such as was eventually undertaken in *Button's* case) should be available to the defence without charge.

... ...

David Dalrymple 13/6/01

To be inserted after p. 310 of Conference Papers as part of paper by David Dalrymple.

SUPPLEMENTARY MATTERS: CORRECTIONS; CLARIFICATIONS; FURTHER INFORMATION AND COMMENT

Corrections

- **Second last sentence in last paragraph of page 7**
  Profiler Plus is in fact a single kit with four parts to it

- **First sentence in third paragraph of page 21**
  The trial judge in *R v Gallagher* was Justice Barr not Justice Byers.

Clarifications

- **Various references to "Police DNA laboratories" or "Police forensic laboratories"**
  In pages 143 to 145 of his *Karger* reasons for judgement, Mullighan J. identifies the forensic laboratory in each Australian jurisdiction that undertakes the DNA testing work for the prosecution in each jurisdiction. Some of the laboratories are in fact established as operating entities which are at least notionally independent of the Police Force which provides the bulk of their work. However, it is submitted that the reality of the existing situation is that all the forensic laboratories essentially function as arms of or adjuncts to the Police Force in each jurisdiction.

- ***Karger* and the applicable test for admissibility**
  The defence submission in the *Karger* voire dire was that the applicable test for admissibility should include a requirement that the evidence be shown to be reliable. Mullighan J. rejected reliability as a criterion of admissibility. Arguably reliability is one of the component requirements in the *Frye* test, and to that extent it may not be the case that Mullighan J. fully applied that test (as suggested earlier in this paper). An appeal has been lodged by Karger, one of the grounds of which is that Mullighan J. misidentified the proper test in this regard.

Further Information

- ***Gallagher* voire dire decision**

  Justice Barr's written reasons for judgement in relation to his decision to admit the DNA evidence in *R v Gallagher* were handed down on 4/5/01. The gist of the reasons is very similar to that of the *Karger* judgement – not only is it concluded that the issues raised in the voire dire were issues for the jury but Barr J. also rejects the various attacks that were made on Profiler Plus and the use made of it by the NSW Department of Analytical Laboratories Forensic Science Biology Laboratory.

Hytch voire dire decision and trial result

Justice Cullinane was the trial judge in *Hytch*. His voire dire reasons for decision were given in Court on 28/5/01. After reviewing the evidence before him and making reference to *Karger*, he stated:

> *The absence of knowledge about the primer sequence with the resultant lack of verifiability, which Dr.McDonald has spoken of in evidence, raises, I accept, a serious matter and I recognise the force of Dr.McDonald's opinion as a scientist.*
>
> *However, I am not persuaded that the reservations raised by him requires the exclusion of the evidence. I think the evidence meets the test of admissibility that I have referred to and propose to admit it.*

Appeal result in the case of _Schreck_

The original judgement in *Schreck* referred to in this paper was overturned on appeal. The basis for the changed result was that the applicable test was not the *Frye* test but the less stringent *Daubert* test.