

DNA EVIDENCE IN SOUTH AFRICA: FALLACIES AND THE FUTURE

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SUMMARY

DNA profiling evidence has become an important part of criminal proceedings in South Africa over the last decade. However, it is important to realize that DNA profiling evidence is not infallible. South African legislation and case law on DNA profiling evidence are limited. In this article, South African case law, as well as applicable legislation relating to the issue, is reviewed, followed by a discussion of relevant legislation and case law in other jurisdictions such as England, Canada and Australia. This will hopefully provide a framework for the South African legislative and the courts in dealing with DNA profiling evidence.

1 INTRODUCTION

One of the major changes that has occurred in both the South African courts as well as other jurisdictions is the increase in the use of DNA profiling evidence in criminal cases. This phenomenon is set to continue through the first decade of the 21st century. Since 1986 when Sir Alex Jeffreys first published a successful method of DNA profiling and such evidence was first used in court, in a civil case, a number of different profiling methods have been used.¹ The first indirect use of DNA profiling in England in a criminal case was in *R v Pitchfork*,² while the first conviction as a direct result of DNA profiling was in *R v Melias*.³ It is not the intention here to describe the methods of DNA profiling as outlines of the various methods can be found elsewhere.⁴ What is common to the various methods of DNA profiling is the following:

¹ Jeffreys, Wilson and Thein "Individual Specific 'Fingerprints' of Human DNA" 1985 316 *Nature* 76-79; Gill, Jeffreys and Werrett "Forensic Application of DNA Fingerprints" 1985 318 *Nature* 577-579.

² (1990) CLR 479.

³ *The Times* 14 November 1987.

⁴ Inman and Rudin *An Introduction to Forensic DNA Analysis* 2ed (2002); and Easta, McLeod and Reed *DNA Profiling. Principles, Pitfalls and Potential* (1991).

- (1) They can effectively exclude a suspect.
- (2) They cannot prove conclusively that the sample is from the suspect.
- (3) They provide a probability of the profile occurring within a given population.⁵

DNA profiling of samples in criminal cases increased the degree of statistical certainty over older techniques.⁶ Modern DNA profiling⁷ can produce match frequencies of 1 in 100 million. As the population of South Africa is fewer than 50 million, in such a situation there is statistically a probability of less than one that such a profile exists in the South African population. This affects the evidential weight of the profile in court. How the court treats the various aspects of DNA profiling evidence becomes important in four major ways:

- (1) The evidential chain becomes very important as DNA can be identified using the Polymerase Chain Reaction technique from as little as a single cell. This is best emphasized by the ability to identify the profile of someone who has picked up an object.⁸
- (2) The evidence is a mixture of real evidence (the samples and profiles) and expert evidence (the interpretation of the profiles). Thus, how the court treats the two forms of evidence can have an influence, especially if the court is not experienced in DNA profiling.
- (3) Statistics may be presented to the court in a variety of different ways. Many criminal cases in South Africa are defended by lawyers appointed by Legal Aid. This limits the ability of the defence to question the way the DNA profiling evidence is presented because of a lack of resources and time. This is because statistics, inherently because of their mathematical nature, lend themselves to interpretations by non-statisticians that may not be warranted scientifically.⁹

⁵ This means that within a group of individuals, a profile occurs at a particular frequency that can be calculated mathematically.

⁶ DNA profiling can be defined as the use of the sequence information in DNA from a particular person to define the individuality of that person. As each person's DNA is unique, even for identical twins, in theory, if used to sufficient depth, every individual human could be defined as an individual by DNA profiling. The development of the different DNA profiling systems used over nearly 20 years has rested in simplifying the system and increasing the discrimination. The two requirements do not necessarily go hand-in-hand.

⁷ Currently the most modern and the most universal method is the Short Tandem Repeat or STR system.

⁸ Van Oorschot and Jones "DNA Fingerprints from Fingerprints" 1997 387 *Nature* 767; and Findlay, Tayler, Quirke, Frazier and Urquhart "DNA Fingerprinting from Single Cells" 1997 389 *Nature* 555-556.

⁹ Courts are reluctant to get involved in statistics (*cf R v Adams* (1997) EWCA Crim 2474 (16 Oct 1997)). Unfortunately, as will be shown at various instances below, this is unavoidable with DNA evidence.

- (4) DNA profiles, especially the latest STR-type profiles, lend themselves to easy storage in computer-based databases. The searching of such databases for a match is extremely easy.

Since the introduction of fingerprints at the beginning of the 20th century no similar rudimental change has occurred in the type of evidence presented in South Africa. The parallel is quite interesting since fingerprints were first introduced in 1902 by Colonel Clarke, Natal Mounted Police, for the identification of absconding indentured labourers, not for criminal cases.¹⁰ Judicial precedent created the methodology by which fingerprints are now accepted in South African courts. Perhaps because of this origin, it is interesting to note that the criteria for acceptance of identity between fingerprints are lower in South Africa than in the UK. The UK uses the so-called “16-point standard”,¹¹ while South Africa uses a “7-point standard”.¹² Like fingerprints in the past and still today, DNA profiling poses a number of problems for civil liberties that may require the intervention of the courts.

In this article, it is intended to look at two of the above aspects of DNA profiling in terms of the treatment afforded by South African law and to compare these aspects with other jurisdictions. The first aspect is to analyse how the courts look at the statistical aspects of the scientific evidence and how they approach using this evidence. The second is to consider how DNA profile databases are used.

2 INTERPRETATION OF A DNA PROFILE MATCH/NON-MATCH

DNA profiling is best used to exclude a party as participant to a crime. Such exclusion is absolute provided that the DNA is not a mixture (a mixture is when DNA from two or more individuals makes up the sample, *eg*, in a multiple rape). Such exclusion cases are not problematic.¹³ Problems arise when DNA evidence is used to try to prove that evidential samples from the crime site and the accused are the same and thus to show the accused's presence at the crime scene. The evidence consists of producing a profile made up of a series of visualized DNA molecules from the two or more samples, an analysis by an expert as to whether any of these samples match and an estimation of the likelihood of such a match occurring in the general population. The result is an average frequency for each profile in the population. It is important to note that human populations vary both over

¹⁰ Clarke *The Diary of Colonel Clarke, Natal Mounted Police, Natal Police, South African Mounted Rifles* (1933) Unpublished.

¹¹ Evett, Foreman, Jackson and Lambert “DNA Profiling: A Discussion of Issues Related to the Reporting of Very Small Match Probabilities” 2000 *Criminal Law Reports* 341-355.

¹² *S v Kimimbi* 1963 3 SA 543 (A); and *S v Nala* 1965 4 SA 360 (A).

¹³ *R v Button* (2001) QCA 133 (10 Apr 2001); and *S v Fourie* 2001 2 SACR 118 (SCA).

long and short distances and thus within larger¹⁴ as well as within small countries.¹⁵ Thus, what one defines as a population and what one uses as a population for one's statistical evidence are important. A general definition of a population is:

“A subgroup of individuals from a species that, either because of geographic or other barriers, is not undergoing random mating with the species as a whole or other populations of the species.”¹⁶

The effect of subdivision into populations is that a variety of genetic phenomena come into play, and these result in variations between populations of the frequency of a given profile. This is because genetic changes occur within populations when they are no longer randomly mating with one another. Thus, lack of interaction results in the populations drifting apart genetically. Icelanders, for example, have a very different frequency for a given genetic profile compared to Australian Aborigines. The degree of divergence varies but can be extreme if multiple factors have come into play. Obviously, this has implications in human DNA profiling where travel has resulted in people from different geographic regions living in the same place. It also has implications when a population is made up of various racial groups, such as in South Africa, where historically and geographically imposed limitations on gene flow have occurred.

2.1 The Prosecution's Fallacy

Another problem that occurs with the interpretation of a DNA profile match is what is termed the Prosecution's Fallacy.¹⁶ This revolves around the presentation of statistical evidence to the court. As the scientific methods have become more discriminating, the probability that a given genotype may occur in a population is very low and can be as low as 1 in 1,000,000. This can be presented to a court as:

“The defendant is 1,000,000 times more likely than not to have left the DNA.”

Presented as such, this does not correctly reflect the statistical evidence and presents the match as seemingly beyond reasonable doubt, and in the best light.¹⁷ The reverse of this, the Defence Fallacy is presented to the court as this:

“The defendant is one of 40 or more persons in South Africa and one of many thousands in the world with this profile.”

¹⁴ Lowe, Urquhart, Foreman and Evett “Inferring Ethnic Origin by Means of an STR Profile” 2001 119 *Forensic Science International* 17-22.

¹⁵ Rangel-Villalobos, Rivas, Sandoval, Ibarra, Garcia-Carvajal, Cantu and Figuera “Genetic Variation Among Four Mexican Populations (Huichol, Purepecha, Tarahumara and Mestizo) Revealed by Two VNTRs and Four STRs” 2000 72 *Human Biology* 983-995.

¹⁶ Redmayne “Doubts and Burdens: DNA Evidence, Probability and the Courts” 1995 *Criminal Law Review* 464-482; and *R v Doheny and Adams* (1996) EWCA Crim 728 (31 July 1996).

¹⁷ *R v Doheny and Adams supra*.

The problem of such fallacies is made worse when the profile is imperfect or when no account has been taken by the expert presenting the evidence to the court of population subdivision, of close relatives and how the probability ratio was calculated. Unqualified statistical evidence, even if the court is presented with how the calculations were made, can be misleading especially if unchallenged by a defence expert witness.

2.2 Assumption of membership of a population

Membership of a particular racial group creates a continuing scientific problem with DNA profiling. Different racial groups have different allele frequencies and thus produce a different probability of a match. This means that the frequency of a DNA profile for one racial group is in no way predictive of the frequency in any other racial group. The frequency of a particular profile can be higher, lower or even zero. One common practice has been the use of the accused's racial group, such as Caucasian, Chinese, Australian Aborigine, *etcetera*, as the source of the samples from which the statistics of the database are calculated.¹⁸ This is an unwarranted assumption because, although a person of that racial group is on trial, there is usually no evidence presented as to which racial group perpetrated the crime. In the absence of a full series of racial databases and therefore all appropriate frequencies, expert witnesses have then presented the frequency from the "best", that is "best for the accused", known racial group. This is a still a poor substitute and really has no meaning,¹⁹ although the overall problem has been dubbed "one of the most persistent fallacies" in DNA profiling.²⁰ Whether this statement is true or not, the availability of all racial databases is an excellent policy to make justice be seen to be done.

Additionally, the possible involvement of another close family member dramatically changes the match probability. The chance that two brothers would have the same profile is about 1 in 500 compared to 1 in 10,000,000 for unrelated individuals for a 6-locus STR system.²¹ It is possible to expand this example to include a family of 5 brothers, 20 uncles and nephews, and 100 first cousins, which is not an uncommon family size in South Africa. The chance of a match occurring between two members of this family is 2 in 100 for the 6-locus STR system.²² Any close relationship between the grandparents or parents, for example that they are first cousins, would result in a further dramatic increase in the possibility that a relative has the same profile. The "my brother did it" scenario, when confronted with a crime scene match, is thus very real.

¹⁸ *R v Pantoja* (1996) 88 A Crim R 554 31.

¹⁹ *R v Pantoja supra* 35-36.

²⁰ Redmayne 1995 *Criminal Law Review* 477.

²¹ Evett "Evaluating DNA Profiles in a Case Where the Defense is 'It was my Brother'" 1992 32 *Journal of the Forensic Science Society* 5-14.

²² Evett *et al* 2000 *Criminal Law Review* 341-355.

3 DNA DATABASES

The creation of DNA profile databases for criminals, in particular criminals guilty of serious and violent crimes, is not particularly controversial. Disputes over whether an offence is one that requires a DNA profile to be entered into the database have come before the courts in a number of countries and this is a result of DNA databases having a legal framework.²³ General databases of all criminals, which may also involve suspects, volunteers with no criminal record,²⁴ *etcetera* are more controversial and are prone to problems although some authorities minimize this.²⁵ The problems of a countrywide general database including all individuals have recently been aired extensively.²⁶

DNA databases are made up of two types. The first is a physical database made up of DNA samples extracted from volunteers, victims, suspects, criminals and crime scene samples. Particularly in the case of murder victims and crime scene samples, these databases are similar to normal forensic samples. Little controversy is associated with these latter samples and they have been used to identify perpetrators of murder and rape many years after the initial crime as techniques have advanced.²⁷ The continued storage of volunteers' samples and suspects' samples is problematic. The storage of physical samples has become less important as electronic databases of DNA profiles have developed. The profiles produced by the STR system are analysed electronically, albeit with verification by a scientist, and are automatically storable in an electronic database with sample details attached. This can be searched rapidly as any new profile becomes available. Thus, a DNA profile from one crime scene can be linked to that from another crime scene or any volunteer, suspect or criminal sample available. This has immense implications for civil liberty if such profiling became compulsory in the same way fingerprinting is compulsory for ID documents in South Africa. This has been discussed by Mooki²⁸ where a case is made for legislative control of DNA databases. The author supports an interpretation of section 37(5) of the Criminal Procedure Act 51 of 1977 that would allow the retention of blood samples if a prosecution succeeds or if the person is not brought to court. It should be noted that DNA profiles stored as numbers on a database probably do not fall under the destruction of samples as specified by this Act when a person is found not guilty, as they

²³ *R v Cooper* (2001) ABQB 250; and *Stefanopoulos v Police* (2000) SASC 51.

²⁴ *Eg*, as occurred in the police enquiry leading to *R v Pitchfork supra* 479.

²⁵ Redmayne "The DNA Database: Civil Liberty and Evidentiary Issues" 1998 *Criminal Law Review* 437-454.

²⁶ Williamson and Duncan "DNA Testing for All" 2002 418 *Nature* 585-586; and Kirby "Pitfalls of DNA Profiling Complete National Populations for Forensic Purposes" 2002 419 *Nature* 247.

²⁷ *R v Arnold* (2001) BCCA 374; *R v Dhillon* (2001) BCCA 555; *R v Hassett* (1998) EWCA Crim 368 (21 May 1999); and *R v Martin* (1996) EWCA Crim 730 (31 July 1996).

²⁸ "DNA Typing as a Forensic Tool: Application and Implications for Civil Liberties" 1997 *SAJHR* 565-580.

are not real evidence like a fingerprint card or a blood sample. This has serious implications for civil liberties, which were not discussed by Mooki.

3 1 Hot hits, warm hits and cold hits

Large-scale DNA profile databases allow for the identification of a suspect solely on the basis of DNA left at the crime scene. Such evidence is purely forensic in nature and can be divided into three types: hot hits, warm hits and cold hits.

Hot hits are the most common and occur where there is a link between a suspect and the crime, and DNA forensic evidence is found at the crime scene. In order to identify the source of the crime scene DNA, the DNA profile of the suspect is obtained using, for example, section 37(5) of the Criminal Procedure Act 51 of 1977 in South Africa. Hot hits do not require a comparative database but still require a statistical database to provide probabilities based on the evidence.²⁹ The DNA samples and probably the profiles are real evidence in the same way that grooves on a bullet or fingerprints are real evidence and can be physically produced in court.³⁰ However, direct interpretation of the real evidence by the court is almost impossible. Thus the evidence needs to be interpreted to the court through expert testimony.

Warm hits occur when the searchable database is made up of the DNA profiles of convicted criminals. A crime scene DNA profile is screened against either the appropriate sub-class of criminal or the whole criminal database. The logic to the latter is that the database is made up of convicted criminals, who are likely to re-offend, whatever the crime, particularly in a country like South Africa with a high rate of recidivism. This evidence, although still real evidence, is also similar to fact evidence and its admissibility will be affected by this.³¹ Sub-classified database use resembles police interviewing of likely known offenders. For full criminal databases, this concept breaks down. Is a person convicted of fraud in Grahamstown likely to be the perpetrator of a rape in Kimberly? Full criminal database screening approaches closely that of the third category, cold hits.

Cold hits occur when an unlimited DNA database is available and any crime scene DNA sample profile is screened against the full database and any hit is taken as the initial evidence that this person is likely to be the perpetrator of the crime. They are cold because there is no reason to link that person with the crime other than the database. A person may be on the database for many reasons other than the commission of a crime. Thus there is no similar fact link and because DNA profiles are not unique, the evidence

²⁹ Inman and Rudin 87 and 133.

³⁰ STR profiles are purely electronic in nature and this may pose a problem in the future.

³¹ Schwikkard *Principles of Evidence* (1997) 63-75.

depends entirely on the frequency of that profile in the population at large and the possibility of error. The full database warm hit resembles this because the only link is being found guilty of a crime, perhaps even just a traffic offence, if there is no limit on the processing and storage of profiles into the database.³²

3 2 Error rates

Generally, courts are reluctant to get involved in statistics.³³ Unfortunately, this is unavoidable with DNA expert scientific evidence. One unknown factor in all DNA profiling is the rate at which errors occur in the laboratories carrying out DNA profiling and database creation.³⁴ It is probably not very high because laboratories go to great pains to minimize them and to be accredited.³⁵ However, errors do occur and these can consist of:

- (1) Incorrect labelling of DNA samples.
- (2) Analysis of the wrong sample and linkage of the resulting profile to the wrong name or sample.
- (3) Incorrect interpretation of DNA profiles to create an incorrect profile for a given sample.
- (4) Incorrect transfer of a profile to the database creating an incorrect profile for the person.
- (5) Incorrect transfer of a profile to the database creating a profile, which is of one person but is labelled as another person.
- (6) (4) and (5) for a crime sample.

Some errors are identifiable by retesting, but not all, and the effect of an error can be substantial. The problem arises because the match probability for the general population has reached levels >1 in 10,000,000 and can easily be understood in general terms. For a match probability of 1 in 10,000,000 and the error rate of 1 in 1,000,000, for a cold general database match, the result is ten times more likely to be an error than a real match. This also affects full criminal-based databases because fraud or traffic offences do not provide a direct link to rape or murder. It is possible to test the error rate in a laboratory, but with annual runs of less than 10,000 samples, the results are not statistically relevant.

³² This is discussed as the “negative effect” in Redmayne 1998 *Criminal Law Review* 437-454; it is stated that DNA evidence, when used alone, weakens the weight of the evidence. This is because without any other evidence linking the accused to the crime, in theory all persons of the same sex in the whole world are potential perpetrators, perhaps 1000 individuals, and this needs to be weighed by the court.

³³ *R v Adams supra*.

³⁴ *Gibson v R* (2001) TASSC 59 (25 May 2001).

³⁵ Note that as of 2001, the SAPS Forensic Laboratory was still not accredited. *S v Maqhina* 2001 1 SACR 241 (T).

4 DNA PROFILING IN SOUTH AFRICA

All criminal DNA profiling is carried out by South African Police Services (SAPS), who also provide an expert prosecution witness.³⁶ No other South African laboratories are willing to carry out criminal profiling.³⁷ Thus retesting of DNA samples is only possible overseas. There are no specific laws controlling DNA profiling and databases in South Africa. The SAPS is highly professional with many safeguards in place but remain prosecution-orientated. Late presentation of DNA evidence to the defence would seem to occur regularly and this makes defence expert analysis difficult.

Together with the cases mentioned earlier from the Eastern Cape High Court, Mooki identified a number of other unreported cases where DNA profiling was used: In *S v Nondala* and *S v Conradie* the DNA evidence was accepted, while in *S v Smile* it was challenged.³⁸ There are not many reported cases on DNA profiling. Most cases in which this evidence is used seem to go unreported and this probably includes many cases in the Magistrate's Court. SAPS Forensics runs many more than 1000 DNA profiles per annum and this represents a minimum of 100 cases.³⁹ Only four of these cases seem to have been reported so far.

Two cases have been reported on the taking of samples in order that DNA profiles may be obtained. In *Sapat v The Director: Directorate for Organized Crime and Public Safety*,⁴⁰ a challenge to section 37 of the Criminal Procedure Act 51 of 1977 was heard by the Cape High Court. Blood, hair and saliva samples had been taken forcibly specifically for purposes unrelated to the charges for which that the applicants were arrested. Davis J found that it was unnecessary to decide on the issues as the matter was not ripe for adjudication by that court, and that it was up to the court hearing the actual case to decide whether the evidence should be accepted. This has implications for DNA profiling of any and all criminals in the same way that fingerprints are taken. Also included in the judgment are comments by Superintendent Phillip on the limited purposes for which the DNA is used, the limited access to DNA records and the identification of donors.⁴¹ The court suggests a very limited breach of privacy but makes no comment on what will happen to the DNA profiles in the future and all other profiles collected.

³⁶ This is similar to England and Wales where the analysis and database are run by the Forensic Science Service even though the Royal Commission on Criminal Justice *Report* CM 2263 (London, HMSO, 1993) recommended on p 16 that the national database should be overseen by an independent body.

³⁷ Personal communications with the Head of Blood Transfusion Service, KwaZulu Natal and the Head of Blood Transfusion Service, Western Cape. Both services and others carry out STR profiling for civil paternity cases.

³⁸ Mooki 1997 *SAJHR* 568.

³⁹ Personal Communication D Burger SAPS.

⁴⁰ 1999 2 *SACR* 435 (C).

⁴¹ *Sapat v The Director: Directorate for Organized Crime and Public Safety supra* 442j.

In *S v Segole*⁴² a comment is made on the fact that an accused appeared to plead guilty because there was DNA evidence against him in a rape case. This reflects the powerful nature of DNA profiling as scientific evidence presented as expert testimony. This is particularly true when statistics are presented to the accused in advance of the trial. Without guidelines on how such evidence ought to be presented, justice may not be easily achieved. This was probably the problem in *S v Motloutsi*⁴³ and here the prosecution elected not to tender DNA evidence because of the defence's assertion that the South African database was wholly inadequate. This reinforces the need for an adequate and openly scrutinised database for the statistical analysis of DNA profiles in South Africa. If it is not possible to analyse exactly how the South African DNA database has been created, its validity remains open to question every time it is used in court.

Submittedly, the most significant reported case on DNA profiling to date in South Africa is *S v Maqhina*.⁴⁴ The facts of the case were that the accused were charged jointly with murder and Accused 1 was also charged with assault with intent to do grievous bodily harm. Accused 1 admitted the stabbing but said it was in self-defence. Accused 2 alleged he was working nearby and had no knowledge of the allegations against him. The question before the court was whether the State had succeeded in proving Accused 2 guilty beyond reasonable doubt based exclusively on expert evidence on DNA profiling carried out on forensic samples.⁴⁵ The profiling results were such that neither of the accused could be eliminated as depositors of the genetic material on the knife (the murder weapon) and that the deceased could not be eliminated as the depositor of the material on the jeans worn by Accused 2.

The court found it self-evident that the State had to prove the reliability of the database on which the statistical calculations were based, as well as the method of calculation that was followed.⁴⁶ A fundamental requirement in the case of scientific analysis is that the prescribed procedures must be strictly followed in order to arrive at a reliable and accurate result.⁴⁷ Also, the analysis has to be executed and recorded with such care that it can be verified later by an objective scientist and also by the court.⁴⁸ In the present case, the defence identified a problem with the data in that five *loci* were identical between the two accused, thus the profiles were therefore not considered sufficiently discriminating. The problem was compounded by the lack of a duplicate strip, a photographic record of the strip and the fact that

⁴² 1999 2 SACR 115 (WLD) 119i.

⁴³ 1996 1 SACR 78 (C).

⁴⁴ *Supra*.

⁴⁵ *S v Maqhina supra* 245b.

⁴⁶ *S v Maqhina supra* 248-9.

⁴⁷ *S v Maqhina supra* 249e.

⁴⁸ *S v Maqhina supra* 251i. See also *S v Nthati* 1997 1 SACR 90 (O) 94.

the accreditation process for the laboratory was not complete.⁴⁹ Without a permanent record, the court could not verify the testing procedure and consequently the court felt that there was reasonable doubt whether the genetic material deposited on the trousers of the second accused came from the deceased.

The basic problem in *Maqhina* lay with the objective verification of the profiling, which the prosecution failed to provide. If DNA profiling is the only evidence against an accused, such a failure will lead to an acquittal. The court was not faced with how to use the statistical data, or how to approach the problem of database statistics for a diverse population like South Africa. Because of this, it would seem that the Prosecution's Fallacy was not raised. As there was no identification of the accused solely on the database, the problem of a cold or warm hit did not arise either.

Thus, although the South African courts have made a start to identifying how they should approach the scientific evidence itself based on previous cases on expert testimony, they have not expressed an opinion on how statistical evidence should be presented, on how the courts should approach the database problems of a genetically diverse population, nor finally, how to treat a cold or warm hit from a database of criminal DNA profiles. The South African courts are fortunate in that the absence of a jury makes the presentation of the statistical evidence less problematic than for other jurisdictions with juries. However, judicial officers may fall into the same traps in the absence of experience or adequate guidelines. For experience and guidelines, it is useful to consider the legal position in a few foreign legal systems.

5 THE LEGAL POSITION IN OTHER COUNTRIES

5.1 England

Although DNA fingerprinting was used before 1996, the use of this technique became much more common after this date due to new profiling methods. The legal basis of DNA profiling is found in section 57 of the Criminal Justice and Public Order Act of 1994 and this provides for legal control of DNA samples, DNA profiles and DNA databases. One early problem to arise from this Act was the use of the criminal samples in the DNA database to provide the statistics needed for profile probabilities and there was an attempt to exclude these from the database based on the wording of section 57, but this failed.⁵⁰ A similar approach has been used to build up the South African database and this potential problem should be

⁴⁹ The testing system used here was the physical strip system of DQ-alpha. This problem may be made worse by the electronic form of the STR system.

⁵⁰ *R v Willoughby* (1996) EWCA 1407 (12 Nov 1996).

borne in mind. In *R v Dall*,⁵¹ a murder and rape case, evidence was given in the original trial, by an expert witness, that the DNA profiles matched. No evidence on frequency in the population, racial grouping or something similar seems to have been presented, but it should be noted that this case was accessed for this study as an appeal. At almost the same time, in *R v Adams*,⁵² a rape case that rested entirely upon expert evidence on DNA profiling, a random match probability for the crime sample and the suspect was given as 1 in 200,000,000. Here it was pointed out that the suspect had a full brother and that the chance of a match between the two of them for the same nine bands tested was 1 in 220. This emphasises the problems associated with all statistics, particularly those associated with small populations. Because of the statistical nature of the evidence and the lack of other evidence linking the suspect to the crime, the court during the initial trial approached the statistics using the Bayes' Theorem and the jury was presented with the evidence in this way.⁵³ The end point of this approach is that all evidence is analysed statistically and results in a final probability of guilt. The Appeal Court ordered a retrial based on the failure of the judge to balance the statistical approach with a more common-sense approach. In effect, guidance was given to the English courts to avoid the use of mathematical approaches to identifying guilt but the court did reject the argument that DNA evidence alone was incapable of establishing guilt. These points were all strongly supported in a second appeal on the same case.⁵⁴ This is summed up in the quotation from the first judgment:

“To introduce the Bayes' Theorem, or any similar method, into a criminal trial plunges the jury into inappropriate and unnecessary realms of theory and complexity, deflecting them from their proper task.”

This does beg the question that if it is inappropriate for a jury, is it also such for a magistrate or judge carrying out a similar task in a South African court? It should be noted that there is still a great deal of interest in using a Bayesian approach to DNA profile analysis in the literature.⁵⁵

⁵¹ (1996) EWCA Crim 199 (25 Apr 1996).

⁵² (1996) EWCA Crim 222 (26 Apr 1996).

⁵³ Bayes' theorem or the Bayesian approach to a problem is a particular mathematical way of deciding the probability that an event has occurred. It involves breaking the steps required for the event down into a series of probabilities and treating these probabilities mathematically to come up with a final likelihood for the event. *Eg.* let us assume that the question in terms of the event is the murder of X. This can be posed as “Did the accused Y murder X?” or “Did the accused Y not murder X?”. A series of probabilities based on the available evidence is calculated for either question and two final probabilities are calculated. Obviously, in most cases, one will be higher than the other and this suggests how the event occurred. It should be clear that this approach has little connection with the legal concept of beyond reasonable doubt.

⁵⁴ *R v Adams* (1997) *supra*.

⁵⁵ Evett, Gill, Jackson, Whitaker and Champod “Interpreting Small Quantities of DNA: The Hierarchy of Propositions and the Use of Bayesian Networks” 2002 47 *J Forensic Sci* 520-530; Riancho and Zarrabeitia “The Prosecutor's and Defendant's Bayesian Nomograms” 2002 116 *Int J Legal Med* 312-313; Jowett “Lies, Damned Lies, and DNA Statistics: DNA Match Testing Bayes' Theorem, and the Criminal Courts” 2001 41 *Med*

In *R v Shreeve*⁵⁶ again DNA evidence was the only piece of forensic evidence linking the suspect with the double murder, although the suspect was known to the deceased. A DNA profile obtained from blood on a knife at the crime scene matched that of the suspect. The frequency of this profile was given as 1 in 4350 white persons. Two points come out of this case. The first is support in the appeal for the trial judge's approach to the statistical DNA evidence by balancing the 1 in 4350 with the statement that there would have been around 10 persons in Oxford at the time of the crime with the same profile. The second is the use of a racially based database when there was, as far as can be ascertained, no evidence to show that the perpetrator was white. The racial database problem was not raised at this trial, but was raised later in other cases. One such case was *R v Hoa Quoc Nguyen*.⁵⁷ In this case the use of an Afro-Caribbean database rather than a Vietnamese database was raised by the defence, whose expert witness suggested a ratio of 1 in 579 rather than 1 in 180,000,000. The absence of two bands in the crime scene sample, which may or may not have been due to allelic dropout, was noted. Both points were not analysed on appeal.

*R v Doheny and Adams*⁵⁸ is probably one of the most important cases on DNA profiling and is quoted extensively in many later judgments. It builds on the approaches put forward in two earlier cases.⁵⁹ In the original trial, the judge gave an excellent outline of the Prosecution's Fallacy as well as the reverse interpretation of the statistics. The latter is where instead of a ratio such as 1 in 1,000,000, the data is presented as about 60 persons in the United Kingdom. The importance of a match is expounded, as is the probative value of DNA profile evidence. Even the possibility of laboratory error is covered. The following procedure was set out as an appropriate way of approaching DNA profiling evidence by an expert witness, and was approved by the Appeal Court:

- (1) The scientist should adduce the evidence of the DNA comparisons with his/her calculations of the random occurrence ratio.
- (2) Whenever such evidence is to be adduced, the Crown should serve upon the defence details as to how the calculations have been carried out which are sufficient for the defence to scrutinise the basis of the calculations.
- (3) The Forensic Science Service (the Crown DNA profiling service) should make available to a defence expert, if requested, the databases upon which the calculations have been based.

Sci Law 194-205; and Thompson, Taroni and Aitken "How the Probability of a False Positive Affects the Value of DNA Evidence" 2003 48 *J Forensic Sci* 47-54.

⁵⁶ (1996) EWCA Crim 1519 (22 Nov 1996).

⁵⁷ (1996) EWCA Crim 154 (23 Jan 1997).

⁵⁸ *Supra*.

⁵⁹ *R v Deen* Times Law Reports 10 January 1994 11; and *R v Dehaney* Times Law Reports 14 August 1996 504.

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- (4) That any issue of expert evidence should be identified and, if possible, resolved before the trial and this should be explored by the court in a pre-trial preview.
 - (5) The scientist should avoid overstepping the line in presenting his/her evidence. The nature of the match, the random occurrence ratio and how many persons match the profile in the population at large, or perhaps, if appropriate, a relevant subgroup, should be explained.
 - (6) The scientist should not be asked for an opinion on the likelihood that it was the defendant who left the DNA and should not express himself/herself during evidence in such a way.
 - (7) The use of Bayes' Theorem is inappropriate.

This approach has been upheld in a number of subsequent cases.⁶⁰ However, the procedure is not universally used in England and this has led to a number of appeals.⁶¹

*R v McClean and McCready*⁶² was unusual in that mitochondrial DNA profiling⁶³ was used but the database was not large enough "to provide conclusive proof". This suggests that the misunderstanding associated with other DNA methods is being perpetuated even in this less well-used method. No DNA profile can provide "conclusive proof".⁶⁴

Since 1995 there has been a national DNA database in England and Wales.⁶⁵ In at least two cases⁶⁶ DNA profiles that ought to have been removed from the database were used to identify suspects who had been DNA profiled for an unrelated crime. In both cases the defendant was acquitted based on the fact that the initial evidence was not admissible. However, though not overturning the verdicts, the House of Lords rejected

⁶⁰ *R v Dalby* (1996) EWCA Crim 1694 (12 Dec 1996); and *R v Hassett* (1998) EWCA Crim 368 (3 Feb 1998).

⁶¹ *R v Hopkins* (1997) EWCA Crim 3070 (27 Nov 1997); *R v Nuttall* (1998) EWCA Crim 347 (3 Feb 1998); and *R v Docherty* (1998) EWCA Crim 1916 (12 June 1998).

⁶² (2001) NIECA 25 (28 June 2001).

⁶³ This is a process by which the DNA sequence in a particular region of the circular DNA of a subcellular organelle, the mitochondrion, found in large numbers in all eukaryote cells, is DNA sequenced. The sequence variation is not as discriminating as STR profiling, but works even if the DNA is highly degraded, for example, in a skeleton.

⁶⁴ The idea that DNA provides "conclusive proof" of a link between a crime scene and an accused is highly suspect. All DNA profiles are based on samples of the DNA sequence of the individual. These samples are then compared with the known frequencies for such sequences in a database. Within the whole world population, identical profiles will occur regularly and even within a single country like South Africa or the UK, this is highly likely. This is the major argument against using DNA profiling as the sole evidence to convict an accused, the cold hit.

⁶⁵ Redmayne 1998 *Criminal Law Review* 437-454.

⁶⁶ *R v B* (2000) EWCA Crim 42 (26 May 2000); and *R v Weir* (2000) EWCA Crim 43 (26 May 2000).

this approach to section 64 (3B) of the Police and Criminal Evidence Act based on judicial discretion.⁶⁷ The section reads:

“Where samples are required to be destroyed under subsections (1), (2) or (3) above information derived from the sample of any person entitled to its destruction under subsection (1), (2) or (3) above shall not be used –

(a) in evidence against the person so entitled; or

(b) for the purposes of any investigation of an offense.”

The House of Lords analysed Part (b). The ruling did not revolve round the mandatory nature of the provision but that the provision did not make the evidence inadmissible. Effectively, the decision by the House of Lords is classically textual in approach rather than contextual in terms of statute interpretation. One would hope that in similar circumstances South African courts would apply the latter approach and reach a decision more in keeping with the intention of the Act. However, it does emphasise the need for legal certainty rather than the *ad hoc* approach used in South Africa up to the present.

5.2 Canada

The legal basis of DNA profiling and the DNA database in Canada, at present, is the DNA Identification Act of 1998 which has the purpose of:

“[E]stablishing a national DNA data bank to help law enforcement identify persons alleged to have committed designated offenses, including those committed before the coming into force of this Act.”

The Act identifies two indexes, a crime scene index and a convicted offenders index. It provides processes for obtaining the profiles, limits access to the information, identifies information to be kept indefinitely, and identifies information to be permanently removed. Regulations control the procedures used to maintain the database. How a match is made or the criteria to be used, are not defined. A number of cases have come before the court in order to decide what is a designated offence,⁶⁸ whether the application for such a sample can be made *ex parte*⁶⁹ and when a sample may be taken if there is an appeal.⁷⁰ In general the courts have supported the establishment of the database by allowing most applications with very few exceptions even though discretion is allowed within the legislation. A number of cases where permission was refused were overturned on appeal.⁷¹ An amendment allowing *ex parte* applications for a DNA sample has been found to conform to section 7 of the Canadian Charter of Rights as long as 14 days

⁶⁷ *Attorney General's Reference No 3 of 1999* (2000) UKHL 63; (2001) 2 WLR 56 (14 Dec 2000).

⁶⁸ *R v Hoogenboom* (2000) ABPC 154; *R v Briggs* OCA Docket C34813 (8 May 2001); *R v PRF*; *R v Rown and Hendry*; *R v McIver*; *R v Whitebear* heard together as OCA Docket C34770 (31 Oct 2001).

⁶⁹ *R v Thompson* (2000) ABPC 107.

⁷⁰ *R v Cooper supra*.

⁷¹ *R v PRF*; *R v Rown and Hendry*; *R v McIver*; *R v Whitebear supra*.

were allowed for an application for judicial review. It is not clear why there is a need for *ex parte* applications except to inhibit the person providing the sample from contesting the application. In contrast, the courts have generally allowed a stay in the execution of the DNA sampling if the person is appealing his/her conviction on the basis of the person's civil rights.⁷²

In *R v Arp*⁷³ the court found that DNA samples, taken with consent during one case, stored and then used in a second case, were admissible. This was notwithstanding the lack of consent for a second use of the sample:

“In the absence of any limitation placed by the police or the consenting party on the use to be made of the hair sample, there is nothing inherently unfair or illegal about the police retaining evidence obtained in connection with one investigation and using it in connection with a later investigation which was not anticipated by the police at the time.”

An extension of this approach would allow any sample collected with perfunctory consent to be used later for any purpose. In *R v Xie*⁷⁴ Burrows J found, with very high frequency estimates of 1 in 17 trillion for a match between a sample from a gun and Xie, that “I am prepared to accept the evidence as proving that DNA found on the handle of the pistol was that of Xie ...” Thus, strong DNA profile evidence is given high probative value. It is also interesting to note that this is the only case as yet, as far as it has been possible to ascertain, in which touching of an object only and not bodily fluids, left enough DNA for a conviction.⁷⁵

Finally, in *R v Dhillon* the Court of Appeal for British Columbia supported the view of the trial judge in a lower court.⁷⁶ This was a complex case brought in 1998 for a rape/murder in 1977. There was evidence for a mixed profile, conflicting expert testimony and a racial database problem (Dhillon was ethnically from the Indian subcontinent). The judge remarked:

“Do not be overwhelmed by the aura of scientific infallibility associated with scientific evidence. DNA evidence is never, even on the Crown's best day, more than an item of circumstantial evidence.”

5 3 Australian Federal Law

The legal basis of DNA profiling and the DNA database in Australia, at present, is the Crimes (Forensic Procedures) Act of 2000. It provides:

⁷² *R v Hoogenboom supra*.

⁷³ (1998) 3 SCR.

⁷⁴ (2000) ABQB 478.

⁷⁵ Van Oorschot and Jones 1997 387 *Nature* 767; Findlay *et al* 1997 389 *Nature* 555-556; and Schulz and Reichert “Archived or Directly Swabbed Latent Fingerprints as a DNA Source for STR Typing 2002 *Forensic Sci Int* 127, 128-130.

⁷⁶ *R v Dhillon supra*.

- (1) When forensic procedures including DNA profiling can take place with and without consent and what matters are to be considered in the case of the latter.
- (2) How the forensic procedures should be carried out both before and after conviction.
- (3) The admissibility of the DNA evidence.
- (4) When evidence can be destroyed, including the removal of information from the database.
- (5) The database structure and the procedures to be used when the database is accessed.
- (6) What parts of the database may be used as evidence in court.

Thus, the Act is very comprehensive but does not include anything on how the database evidence should be presented in court, on matches/exclusions or how statistical evidence should be presented. Thus, the Australian courts have had to rule on reliability, the presentation of DNA profiling evidence and databases, both before and after the introduction of the Act in 2000. Reliability was addressed in a number of cases with respect to various aspects including the possibility of the introduction of a warning by the judge to the jury when there is contradictory expert testimony,⁷⁷ the reliability of databases,⁷⁸ the amount of DNA and the reliability of a new test,⁷⁹ and the possibility of fraud.⁸⁰ The general conclusion drawn was that it was up to the jury to measure the weight to be placed on the scientific evidence, that reliability should be tested in court and that expert evidence should not be excluded because there was a disagreement between experts. Specifically, the question of race was extensively analysed in a case involving a South American Indian. The need for an acceptable racial database for statistical purposes was made clear as well as the problems of using a general database when a racial database is not available.⁸¹ The result was a retrial that returned to the New South Wales Supreme Court where the use of a general database was upheld.⁸²

The Australian courts have followed the *R v Doheny and Adams* approach to the Prosecution's Fallacy⁸³ and the *R v Adams* approach to the introduction of Bayes' Theorem. The validity of statistical evidence was upheld in *R v Noll*,⁸⁴ while in *The Queen v Mitchell*⁸⁵ Higgins J clearly states

⁷⁷ *Dunn v The Queen* A53/1997 (13 Aug 1998).

⁷⁸ *R v Humphrey* (1999) SASC 67 (25 Feb 1999).

⁷⁹ *R v Rees* NSWSC (2000) 544 (16 June 2000); and *R v McIntyre* (2001) NSWSC 311 (11 April 2001).

⁸⁰ *R v Fitzherbert* (2000) QCA 255 (30 June 2000).

⁸¹ *R v Pantoja supra*.

⁸² *R v Pantoja* (1998) NSWSC 565 (5 Nov 1998).

⁸³ *R v GK* (2001) NSWCCA 413 (16 Oct 2001).

⁸⁴ (1999) VSCA 164 (7 Oct 1999).

⁸⁵ (1997) ACTSC 93 (18 Nov 1997).

that if statistical evidence is presented to a jury, the jury should be warned not to use it to calculate in a strictly mathematical way. The Bayes' Theorem approach, which is one method of approaching the probability of guilt in a strictly mathematical way, was unequivocally rejected in *Gibson v R*, *R v GK* and *R v Karger*.⁸⁶ Finally, in *R v Karger* there was a detailed consideration of the STR system and its possible problems.⁸⁷

6 GAINING LEGAL CERTAINTY IN SOUTH AFRICA ABOUT THE PRESENTATION OF DNA PROFILING EVIDENCE

*S v Maqhina*⁸⁸ emphasises the South African courts' approach to scientific evidence with respect to when the proof of an accused's guilt depends only on the scientific analysis, such as DNA profiles. This is that the science has to be executed and recorded with such care that the evidence can later be verified by any objective scientist and also by the court. This confirms previous decisions on scientific evidence and provides a good framework for all future DNA profiling evidence presented in the South African courts. Unfortunately, because the evidence was flawed, an opportunity to decide on an approach to the presentation of DNA profiling evidence was missed. It can be argued that this is not needed in the South African system because of the lack of juries, unlike the other jurisdictions discussed above. However, most persons deciding cases in South Africa lack a mathematical or scientific background and this is also true for both the prosecution and defence. The approach put forward in *R v Doheny and Adams*⁸⁹ is a good one to follow. This idea is supported because England, Canada and Australia all seem to use a similar basis for the presentation of evidence, although the Canadian approach seems a little out of step.

A problem still remains with the Bayesian approach to the statistical evidence. This has been rejected by the courts in all three countries discussed above, but has not been tested here. The major reason put forward for this rejection is that it presumes on the normal jury function of measuring the weight of evidence by prescribing a particular approach. This problem theoretically would be less important in South Africa because of the absence of juries. Until a Bayesian approach has been put to a South African court, what the reaction would be remains moot, but if there is a well-expounded explanation of all the aspects of the DNA evidence, a Bayesian approach is probably not necessary.

⁸⁶ *Gibson v R supra*; *R v GK supra*; and *R v Karger* (2001) SAS 64.

⁸⁷ *R v Karger supra*.

⁸⁸ *Supra*.

⁸⁹ *Supra*.

6.1 Possible approaches to the South African DNA database

The South African DNA database has several significant problems. It is not regulated by either law or regulations. The basis of the database has not really been tested in detail in the courts but its reliability was questioned in *S v Motloutsi*⁹⁰ and *S v Maqhina*.⁹¹ With the racial diversity present in South Africa, a well-documented and extensive database is a requirement for the use of DNA profiling on any other than exclusion. The database therefore needs to be tested in court. The lack of regulation of the database leaves open the question of warm and cold hits from persons with no other link to the crime in question other than a DNA profile match. In the UK, for example, in theory any DNA profile from an accused is removed from the database if that person is found not guilty and this is governed by statute. This is not the case in South Africa. It is likely that warm hits will occur especially if the crime is similar to that for which the data were placed on the database. However, as shown by *Sapat v The Director: Directorate for Organized Crime and Public Safety*,⁹² the courts are not averse to the use of the Criminal Procedure Act to add profiles to the database even when there is no forensic evidence to support the need for profiling of the accused. The removal of suspects' profiles when enquiries have been finished and accuseds' profiles when they are acquitted are not regulated in law, although the samples themselves are. Cold hits are very likely to occur in the future and if the approach of the House of Lords is followed, then re-profiling will be allowed. This leaves open the question of error rates as a problem in such cases. Mooki approached the problem of databases from a civil liberties standpoint and suggested a legislative framework to address these problems.⁹³ My argument is that, notwithstanding the civil liberties implications, there are evidential problems that need to be addressed too, together with the structure by which DNA profiling is carried out in South Africa.

7 CONCLUSION: THE WAY FORWARD

The legislative approach to the regulation of DNA profile databases has many advantages. It would allow, at its most basic level, the courts to have available a legal structure covering the collection of samples, profiling of samples, storage of samples, storage of data, destruction of samples, removal of profiles from the database and when DNA profile information from the database can be used in court. The South African Criminal Procedure Act 51 of 1977, while clearly allowing DNA profiling and the introduction of such evidence into court, provides no real safeguards on the use of such evidence.

⁹⁰ *Supra*.

⁹¹ *Supra*.

⁹² *Supra*.

⁹³ Mooki 1997 SAJHR 565-580.

Judicial discretion under section 210 gives wide powers to allow the entry of evidence of probative value even though it is stated in a negative form. This is supported by the statement that “[t]he law of evidence is foundationally based on the principle that evidence is admissible if it is relevant to an issue in the case.”⁹⁴ A law similar to the Australian Crimes (Forensic Procedures) Act of 2000, rather than the Canadian DNA Identification Act of 1998, would go a long way to addressing the current problems. Because of the genetic diversity in South Africa, an addition to this Act could be a minimum size and countrywide diversity for the statistical database with a procedure for how it should be created. The retention and elimination of DNA profiles from the database based on the source, the outcome of the case, *etcetera*, also need to be controlled by legislation.

It would be difficult for a law to provide a structure for how matches should be made because the science is likely to change in the future. Similarly, it is probably not appropriate for Parliament to decide on how such evidence and statistics should be presented. The legal precedents for the presentation of expert evidence are well developed in South African law. In *Gentiruco AG v Firestone SA (Pty) Ltd*⁹⁵ the need for expert evidence was stated as: “the true and practical test of the admissibility of a skilled witness is whether or not the court can receive ‘appreciable help’ from that witness on the particular issue”. This is clearly true of DNA profiling evidence because without expert testimony, there would be no evidence at all. However, the party presenting the expert evidence needs to lay a foundation and the expert witness needs to give reasons for his/her opinion in order to define the probative value of the opinion.⁹⁶ However, when the opportunity presents itself in a High Court or the Supreme Court of Appeal, a precedent on this area based on *R v Doheny and Adams*⁹⁷ would create a structure for the presentation of DNA profiling evidence for all courts.

The use of statistics in the form of Bayes’ Theorem is controversial, having been rejected widely by many foreign courts. The absence of a jury in South Africa removes the major objection to this approach and the approach does present a useful way of looking at the statistics created by DNA profiling. The magistrates and judges of South Africa are unlikely to be prejudiced by this type of evidence in the same way as a jury and perhaps it might allow a more balanced approach as to how much weight should be placed on DNA profiling statistics.

⁹⁴ *R v Trupelo* 1920 AD 58 62; and *R v Gokool* 1965 3 SA 461 (N) 475G.

⁹⁵ 1972 1 SA 589 (A) 616H.

⁹⁶ *R v Nksatlala* 1960 3 SA 543 (A) 546D; and *S v Mkhize* 1999 1 SACR 256 (WLD).

⁹⁷ *Supra*.