Cold Hit Complacency: The Dangers of DNA Databases Re-examined

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Introduction

The use of DNA profiles stored on a computer database to investigate and solve crime is one the most significant, and apparently successful, innovations in the criminal justice system. DNA database evidence is likely to be a cornerstone of police investigative practices in the near future with the genuine possibility of significant expansion. This article will challenge some of the most fundamental assumptions underlying the political enthusiasm for the use of DNA database evidence. The first is the common assertion that the innocent have nothing to fear from DNA databases. The second is that DNA database evidence is reliable and compelling evidence of guilt that, of itself, can be sufficient to safely found a conviction.

The article will outline the numerous potential weaknesses of DNA database evidence. These weaknesses include the danger that the statistical significance of a DNA match can be over stated; the existence of many different innocent explanations for the presence of DNA at a crime scene; the multitude of possible errors that can arise during laboratory analysis and data entry; and the great potential for corruption and fabrication. While some of the risks attaching to DNA evidence have long been acknowledged, others are only now becoming truly apparent. Their cumulative effect leaves the innocent with much to fear and suggests the very real possibility that an innocent person could already have been the victim of a DNA 'cold hit'.[1]

Despite the inherent dangers of database evidence, the article does not argue that database evidence is irredeemably flawed. Instead it suggests that the safety and legitimacy of the DNA database system rests heavily on the existence of careful and competent scrutiny of the evidence by criminal defence lawyers. The importance of defence scrutiny goes beyond the need to detect and prevent individual cases of wrongful conviction; it also acts as an important deterrent to the temptation towards sloppy practice, corruption and misuse. There are reasons to believe that this essential scrutiny is not always occurring. The

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1 A 'cold hit' occurs when a person who was not previously suspected of a crime is linked to an offence because of a connection between their DNA profile and a crime scene profile stored on a computer database. A cold hit can be contrasted with a 'warm hit' which occurs when the DNA profile of an existing suspect is compared and matched to a crime scene profile.

article briefly outlines a number of pressures facing those who are charged with 'cold hit' offences, and their legal representatives, to quickly enter a plea of guilty even where the suspect may not be sure of his or her own guilt and the evidence has not been thoroughly examined.

Part I of the article provides a brief background to the political context of DNA database evidence and then examines three of the major risks common to all DNA evidence: the chance of error due to coincidence, kinship and contamination. These risks are relatively well known, and were raised prior to the introduction of the database system, but recent cases and events illustrate the continuing prospect of wrongful conviction inherent in heavy reliance on DNA evidence. Part II introduces the new and to date under-realised dangers posed by the widespread use of database evidence. These include the effect of the practice of selective sample testing and the implications of the increasing use of 'trace DNA' in DNA databases. The section also identifies a multitude of possible sites of data entry error in the current system. Part III outlines the continuing potential for misuse of DNA evidence by both corrupt law enforcers and perpetrators. Each of the first three parts notes how many risks can be reduced, albeit not eliminated, by careful scrutiny and informed strategy by defence lawyers. Part IV questions the safety of the assumption that this scrutiny always takes place. This part contextualises the manner in which lawyers have to approach database cases within the criminal justice system and notes the systemic pressures and temptations faced by lawyers to bypass comprehensive examination and plead guilty as soon as possible.

In discussion the situation in NSW will be given particular focus but the implications will generally be equally applicable to all Australian states.

Part I - Background

> DNA profiling is the single most important advance in police investigation techniques since the development of fingerprint classification systems in the late nineteenth century (<www.crimtac.gov.au>).

DNA Databases and Mass Offender Sampling

DNA databases are a very recent development in the Australian criminal justice system. While every Australian state has a DNA database, most were not regulated by legislation until after 2000.[2] The majority of DNA profiles on all state databases belong to convicted offenders. In most Australian states incarcerated offenders convicted of certain prescribed offences have their DNA compulsorily sampled by authorities.[3] The NSW program of mass compulsory sampling of incarcerated offenders began in January 2001 after the introduction of the *Crimes (Forensic Procedures) Act* 2001. The Act gave NSW police the power to obtain DNA samples, both voluntarily and coercively, from incarcerated inmates who were 'serious indictable offenders'. The definition of a serious indictable offender was deceptively broad,[4] covering approximately 75% of incarcerated offenders. It was unclear

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2 Victoria, Queensland and South Australia had statutes concerning some forensic procedures before this date but the Commonwealth, New South Wales, Western Australia and Tasmania did not introduce legislation until 2000 or later.

3 See for example Part 7 of the *Crimes (Forensic Procedures) Act* 2000 (NSW).

4 'Serious indictable offenders' were defined as those convicted of offences punishable by a maximum of five years imprisonment. The offender did not need to be serving a sentence of five years to be caught by the Act, only to be sentenced to one which carried that term as a maximum penalty. The definition also encompassed those convicted of indictable offences dealt with summarily in Local Courts where offenders could only receive a maximum of two years imprisonment.

during the passage of the Act in NSW Parliament if the legislation was intended to authorise a large scale mass sampling of the prison population but, once the Act was passed, NSW police moved quickly to implement a cooperative system with the Department of Corrective Services to obtain as many inmate samples as possible. Within two years over ten thousand samples had been collected from inmates after a large scale operation (Ombudsman 2004:3). The DNA samples were, and continue to be, sent to the NSW Division of Analytical Laboratories (DAL) to be analysed and stored on the NSW convicted offenders' database.[5] Profiles obtained from these offenders are continuously run against profiles obtained from crime scenes[6] using computer database cross-referencing. If a match occurs between an offender profile and a crime scene profile then police will be notified. The link is known as a 'cold hit' or 'cold link'.

The bare statistical picture suggests that the program has been a great success. The linkage rate between sampled convicted offenders and crime scenes was extraordinarily high, reported at 86% in 2003 (Findlay 2003:44). Cold hits appeared to be particularly successful at achieving one of the main purposes of the Act: improving the 'clear-up' rate of high volume offences like break and enter offences which police traditionally struggle to solve. The apparent success of the program mirrored the experience of influential overseas jurisdictions, particularly the UK and the USA, which had provided an early justification for the introduction of the database matching system.

The International Experience

The United Kingdom has been the world front runner in the use of DNA technology in the criminal justice system and it is the most influential international jurisdiction. The English database is the largest in the world with well over 3 million stored profiles. Projections from the Home Office suggest that by 2008 database profiles will number 4.2 million (*egov* Monitor 2006).

The UK experience clearly impressed and influenced NSW members of Parliament and the success of the UK database was a driving force behind the introduction of the Crimes (Forensic Procedures) Bill. During parliamentary debate the leader of the Opposition in the Legislative Council commented in 21 June 2000:

> [T]he figures from the United Kingdom speak for themselves: DNA testing has assisted to solve more than 212 murders, 868 sexual assaults, 479 serious robberies and 34 murders that were previously recorded as unsolved. The paper presented to the Sydney Forensic Society states that police now have 740,000 suspected [sic] samples with a hit rate of 92 per cent. In fact, some 400 crimes are solved each week using DNA testing (Ombudsman 2004:37).

Like almost all jurisdictions that have introduced DNA databases, the English experience has been characterised by what critics of DNA databases have dubbed 'function creep'. When the database was introduced in 1995 English police routinely obtained DNA samples only from those convicted of extremely serious offences, like sexual assault and murder, but

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5 A standard complete DNA profile in Australia looks like a list of 18 numbers. These numbers represent the measured length of repeating DNA sequences at nine different regions of DNA that are tested. The nine regions are called loci (the singular is locus). Each locus has two numbers attached to it (the two numbers might be the same i.e. 15, 15 or different i.e. 15, 17). The numbers are known as 'alleles'. Thus, a complete DNA profile has 18 alleles, 2 at each of the nine loci. One allele at each locus is inherited from the mother and the other from the father of a person. A DNA profile will also indicate whether the donor is male or female.

6 When DNA is recovered from a crime scene the DNA profile is put on a computer database called 'the crime scene index'.

they rapidly moved to sample those convicted of most other offences (ALRC DP 66:34.38). Once the database was introduced all serving inmates were retrospectively sampled (Napper 2000:67).

In 2001 police in England and Wales expanded the scope of the DNA database to include profiles obtained from those who had been arrested, even in cases where charges were not filed or withdrawn. That collection practice now even extends to juvenile suspects: the database encompasses 24,000 profiles belonging to juveniles who were arrested but subsequently neither cautioned nor charged.[7] The Scottish government has indicated it will soon follow suit and obtain profiles from arrested suspects (McLeod *The Scotsman* 2006). Calls are periodically made, including by the inventor of DNA profiling Sir Alec Jeffries, for a universal DNA database of UK citizens derived from material taken from all newborn babies (Gibbs *The Times* 2005). This call has not been officially heeded, and a similar proposal was rejected in Australia prior to the introduction of the database system (ALRC 96:19.80–19.88), but the UK Conservative Party recently issued a press release accusing the British government of attempting to create a universal DNA database by stealth (Alexander *Evening Post* 2006).

The United States has witnessed a similar expansion in DNA database collection and investigation. A large number of US states, including California, have mimicked the UK by allowing police to collect DNA samples for database comparison from 'arrestees'(Bewley *Philadelphia Inquirer* 2006). At the beginning of 2006 US federal legislation was enacted to similarly expand the scope of the national DNA database. The provisions allow state and federal law enforcement authorities to upload the DNA profiles of all arrestees into the federal Combined DNA Index System ('CODIS') database. The legislation also authorises DNA testing of federal arrestees and immigrants attempting to enter the US illegally. A large private DNA testing laboratory, Orchid Cellmark, issued a press release promoting the legislation, stating: 'there's no real downside. The check swab samples are less invasive than taking fingerprints ... If the person's not committed any crime, then he's not subjecting himself to any risk' (*PR Newswire* 2006).

Australian Expansion?

The actual effectiveness of the DNA databases as a crime fighting tool has been questioned in Australia. Commentators note that linkage statistics are often inflated by the inclusion of crime scene to crime scene links and by multiple crimes linked to the one offender (Findlay 2003:45–47). In the US critics have noted that high linkage rates are not supported by evidence of high conviction rates (Bieber 2006:227). Even conviction rates can be misleading. DNA evidence can be 'credited' with a conviction whenever there is a database link, irrespective of the weight played by the evidence in securing the conviction. Convictions will be linked to DNA even when the offender was caught red handed; when the offender makes full admissions without even knowing of the link; and when DNA evidence played no part in the eventual case against the offender, for example when presence at the crime scene is not contested by the suspect or when sexual intercourse is conceded in a rape case but consent is in dispute.

Despite these critiques there is good reason to believe that the UK and US database expansion will be emulated in Australia. The notion that 'the innocent person has nothing to fear' is a common feature of the discourse concerning DNA evidence in Australia[8] and,

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7 This figure is out of the 127,000 profiles collected from suspects when they were aged between 10 and 17 (Reuters 2006; Doward *The Observer* 2006).

8 The NSW Police Minister was quoted as stating exactly that in 2001 (Haesler 2001:62).

at face value, there has been 'no real downside' to the program. The statistical critiques are certainly unlikely to dampen political enthusiasm for the use of DNA databases. Campaigning political parties now place financing and expanding DNA database operations at the forefront of their law and order platforms (see e.g. <http://www.wa.alp.org.au/policy/election/index.html>). DNA database evidence is seen as reliable and 'objective' with the potential to quickly reduce politically embarrassing clear-up rates and promote a perception of improved public safety. The consequences of the risks of DNA database evidence are concentrated on the existing offender population, a group with little or no political leverage. As a tool of investigation, mass sampling of convicted offenders is both efficient and cost-effective.

Finally, and perhaps most significantly, the credibility of DNA database evidence has not been dented by significant challenge within the legal system. There have been few of the type of high profile acquittals required to shake public confidence in DNA evidence or, for that matter, police confidence in and reliance on DNA technology. In fact, many of the first rush of charges resulting from the mass offender sampling program were apparently resolved by charged offenders entering a guilty plea (see Part IV). Guilty pleas enhance the legitimacy of the database system, but only if the pleas reflect a true recognition of guilt by the offender or an acknowledgement of the futility of contesting very compelling evidence after careful scrutiny by defence representatives. What if the guilty pleas are instead being entered because the dangers of wrongful conviction, and the great potential for defence argument, are not properly understood by defendants and their lawyers? Now that there is no doubt that the DNA database system is here to stay, and possibly grow in use and significance, the answer to this question is critical. Has DNA evidence effortlessly assumed a central role in the justice system because of dangerous ignorance and complacency about its weaknesses or is it simply too good to attack successfully?

The Known Risks of DNA

Understanding the Statistical Significance of a DNA Match

There is a common misapprehension in the general community that because the composition of our DNA is unique therefore DNA profiles, including those stored on databases, are unique. This fallacy is recognised to be incorrect in legal circles and it is accepted that a DNA link can not conclusively prove identity; a profile match can only ever 'fail to exclude' a defendant. The accepted method of expressing the strength of DNA evidence is through a statistical calculation of the chance that a randomly selected member of the community will share the same DNA profile.[9] The figures commonly used in DNA database cases involve millions, billions, even trillions, and they almost always indicate that the chances of a 'random match' exceed the population of Australia, even the whole world.[10] The numerical estimates are so overwhelming that they in effect leave lawyers in the same position as the community: apparently safe in the assumption that an innocent person is not going to be linked to a crime via a database cold hit because they coincidentally share the DNA profile of the perpetrator of the crime.

9 The calculation is known as the 'random match probability assessment' or the 'likelihood ratio'.

10 In the trial of Sydney man Wayne Butler for the murder of Natasha Douty *The Age* newspaper reported: '[T]he principal forensic scientist at Queensland Health, Associate Professor Leo Freney, told the jurors that the chances of someone else having a matching DNA profile were 43 trillion to one -- that's more people than all the people who have lived, are presently alive or who might live thousands of years from now.' (Fannin *The Age* 2002). Mr Butler's case is now before the Queensland Court of Appeal after expert evidence cast doubt on the procedures of the DNA testing laboratory (the John Tonge Centre) and the DNA results that linked him to the murder.

In fact, coincidental matches can and do occur. They are considerably more likely to occur when the crime stain involves a mixed or partial profile, or when the people with matching profiles come from certain ethnic communities or are related. Large databases will also produce chance matches from time to time.[11] However, if a defendant is Caucasian, with no close relatives of a crime-committing age, the likelihood of a coincidental cold hit in any particular case is extremely low. That said, there are cases which provide concrete illustrations of these rare occasions and the most dramatic answer to the question 'what do innocent people have to fear from a DNA database?'

In the UK a man with advanced Parkinson's disease was arrested and charged with a break and enter offence which occurred in a second floor unit over 200 miles from his home. The man could not drive or even dress himself without assistance but his DNA profile coincidentally matched the crime stain at six loci. He was detained for seven hours and eventually cleared when another testing kit determined he was excluded at further loci. The chance of a random match was described as 1 in 37 million (McKenna 2003:139–142). A bartender in London was arrested and charged with a murder in Italy after his six loci DNA profile matched a DNA profile from the crime scene placed on an Interpol database. The bartender had a strong alibi and had never been to Italy or even left the UK. He was forced to spend one night in custody but was cleared of the murder when additional loci were tested (Johnson *Daily Post* 2003). In the US and in Germany inmates have been matched to crime scene stains when it has been established that they were serving jail sentences at time the crime occurred. The matches were believed to be to seven and ten loci respectively (Edwards 2005:76). It is unknown if a relative was responsible for the stain.

The coincidental match cases are important because they puncture the myth of infallibility that DNA carries in the general community and they put a very human face on the risks that can be disguised by the enormity of the statistical calculations.[12] But the significance of the cases should equally not be overstated. It is important to identify the key features underlying the cases that increase the chance of wrongful conviction and determine to what extent these risks are alive in the Australia database system.

The chances of a coincidental match increase when:

- databases are large;
- the number of loci (regions of DNA) compared are small; and
- there is any possibility of the involvement of relatives.

Databases

The databases currently in use in Australian states are still relatively small and only nine loci are tested.[13] In the US, profiles must have 13 loci to be lawfully entered onto the

11 Buckleton et al (Ch 5 2005) give the example of a database of 50,000 profiles where the average match probability is given at 1 in a billion. The expected number of matching profiles is 12.5 matches, i.e. it would be expected to find at least 12 matching profiles on such a database.

12 Jurors are warned that coincidental matches are possible, but unlikely. Some might argue that judges can downplay the possibility slightly too much. This extract from a trial judge's summing up is notable for the frequent use of the word 'remote': 'Nevertheless, it is possible that by chance, no matter how remote that chance may be, that two people could have the same profile, and because of that chance, albeit extremely remote, the DNA scientists cannot and do not say that the DNA found on the object found, for example, at a crime scene, is that of a particular person, because of that remote chance that by coincidence two people have the same DNA profile.' *R v Yates, Parry, Hyland, Powick* at [143].

13 All Australian laboratories used by law enforcement agencies use a commercially available testing kit called 'Profiler Plus'. Different testing kits will test different number of loci, for example the 'Identifiler' kit commonly used in the US targets 15 loci and a gender marker, the 'SGM Plus' system used in the UK tests 10 loci plus gender (Interpol).

national database. Sir Alec Jeffries, the acknowledged inventor of DNA profiling, believes that the 10 loci tested as part of the enormous UK database are insufficient to prevent coincidental (sometimes called 'adventitious') matches and has recommended that at least five further loci be added to the database (Jha *The Guardian* 2004). The size of Australian databases are increasing rapidly but there has been no suggestion that the number of loci tested in Australia will increase.[14]

One way to determine if the number of tested loci sufficiently guards against coincidental matching is to examine the number of similar and identical profiles on the existing database. Proper analysis of matches requires two stages of investigation. First, the matching profiles must be identified and then the matches need to be 'resolved'. Resolving matches is required because there are three potential explanations for any given pair of matching profiles on a database: the profiles might belong to identical twins, the profile might be a 'duplicate' (i.e. the same person was profiled by two different agencies) or the pair might be a genuine coincidental match.[15] It is inevitable that any combination of databases will throw up some duplicates; however, ascertaining those duplicates requires care. A matching pair of profiles attributed to two very similar names might be explicable by dual sampling or by a mere spelling error. However, the similarity in names might also occur because the profiles belong to two different people from ethnic communities where relatives can have very similar names. Resolution of inter-state matching profiles is conducted by police investigation but the methodology used by the police has never been publicly disclosed. Complex legislative provisions are believed to prevent any investigation of intra-state profiles.

A cloud of uncertainty therefore lies over the existence of matching profiles on Australian databases. A published comparative study of Australian state databases in 2002, when database sizes were considerably smaller, found 28 nine loci matches across the databases but the report stated that unspecified 'subsequent investigation' revealed that the matches were either identical twins or were duplicates. A review of the NZ database of almost 11,000 six loci profiles in 2000 found 10 matching pairs: eight were brothers or twins, two were not related (National Institute of Justice 2000).

A 2005 study commissioned by the National Institute of Forensic Science (NIFS) examined 33,858 profiles drawn from numerous Australian databases and found 206 unresolved pairs of profiles matching at least nine loci.[16] The number of matches was higher than mathematically predicted which could suggest a large number of duplicates but could also suggest current mathematical assumptions underestimate the presence of matching profiles. Approximately 100 matches were said to be resolved by police investigation but legislative barriers prevented further examination. A recent study from New Zealand found there were 61 unresolved matching profiles out of a database of approximately 50,000 full nine loci profiles.

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14 A recent newspaper report on the Queensland database stated that there were 70,000 convicted offenders on the database (Burke *The Sunday Mail* 2006). As footnote 11 explains, it is likely that some of those profiles match exactly.

15 It is sometimes said there is a fourth explanation for a coincidental match: close relatives. While the practice is to remove the matching profiles of close relatives from DNA databases, the existence of these matches is of scientific significance and they should not be considered to be in the same category as duplicates (essentially errors) and identical twins.

16 Personal notes, NIFS Seminar Series 'Australian Population Genetics' 19 May 2006. The analysis of the matches was only an incidental examination after a detailed study of Aboriginal datasets.

The difficulty of resolving exact matches can be circumvented in part by analysing the presence of profiles which are similar but not exact matches. These profiles can be assumed to derive from different sources but can indicate the potential for coincidental matches on the database. Curiously, the Australian databases have not been carefully studied to detect the presence of extremely similar profiles.[17] The 2002 study, discussed above, found two profiles that matched at least eight loci (a father and son) and 13 profiles which matched at least seven loci (Weir et al 2004:1–3).[18] The 2005 NIFS study adopted an Excel formula which only detected exact matches at an identical number of loci. This formula not only would underestimate exact matches but fail to detect non-identical but extremely similar profiles.

Relatives and Relatedness

DNA is inherited from each parent — every child inherits one allele that matches their father at each loci and one allele that matches their mother. This means that brothers and sisters will have very similar profiles and may match exactly at a number of loci. Identical twins will have the same DNA profile.[19]

The similarity of sibling profiles has been exploited more to date by law enforcement agencies than defence lawyers. It is increasingly common for police to investigate the family members of offenders on the database whose profiles are a close but not exact match to crime scene profiles. This investigation practice, known as 'familial matching' or 'kinship analysis', is particularly common in the UK and has been credited with solving a number of serious crimes (Robinson *Yorkshire Post Today* 2006). NSW police have acknowledged they too use familial matching techniques (Ombudsman 2004:211). The investigation practice means that, by definition, innocent people have something to fear from DNA databases: they can be subject to surveillance and investigation simply because a family member on the database has a similar DNA profile to one found at a crime scene.[20]

The risk of wrongful conviction is very high when cold hit links are to offenders with close relatives who could be the real perpetrator. In Sicily, Italy a man was charged with three murders on the basis of a DNA match. Later, charges against him were dropped and his brother was charged with the offence. The brother's DNA profiles matched at eight loci (Edwards 2005:n153). There has been a reported case of an Aboriginal brother and sister matching at nine loci in a remote community in the Northern Territory[21] (*Riley v Western Australia*). These cases demonstrate not only that siblings can have extraordinarily similar

17 A notable exception is the 2005 NIFS study into Aboriginal sub-populations (Walsh & Buckleton 2005).

18 These matches were consistent with statistical projections of how many matches would be expected between unrelated individuals on the database. This means that while the people who matched at seven loci might be related there is a good chance that they are not.

19 In the US there have been a number of reported cases where DNA has linked identical twins to a crime. In one case culpability was ironically determined because only one twin had a tattoo with 'twinz' written on his arm. The tattoo was noted by the complainant in her police statement (De Marzo & Vise *Miami Herald* 2003). A reliable statistic on the number of identical twins in Australia is extremely hard to come by. Twins, both fraternal and identical, accounted for 1.65% of births in 2003 (AIHW 2003). Anecdotal estimates suggest that as many as 1 in every 250 people is an identical twin.

20 The civil liberties implications of this practice, particularly given the predominance of ethnic minorities on criminal databanks, has attracted a lot of recent discussion in the UK and the US but a detailed analysis is beyond the scope of this paper.

21 This case is sometimes discussed as if it is the only known example of a nine loci sibling match. It should be remembered that, as discussed above, a large number of matching nine loci profiles have been discovered on criminal databases in Australia and New Zealand. It is possible, in the absence of thorough investigation, that some or even many of these profiles belong to siblings or close relatives.

DNA profiles but that similarities are more common in certain ethnic communities. These similarities can be disguised by the method of calculation employed in DNA cases.

The statistical chances of a coincidental match are calculated assuming a population that mates randomly. This assumption is convenient mathematically but has no realistic foundation. The more insular a community is, the more likely it is that breeding occurs within the community and outside influences are not often added to the gene pool. This can lead to certain allelic combinations being common in certain communities. Because the database is comprised almost entirely with the DNA profiles of convicted offenders it is to be expected that there will be concentrations of profiles from certain ethnicities; certain locations; and from socio-economic groups that may share a low level of relatedness.[22] The extent to which these factors impact upon the 'representativeness' of the database, and how match odds should be adjusted to accommodate these issues, is a matter of active debate within the scientific community. It is also a matter of active debate how statistical calculations should be adjusted when a link is drawn from a selected database of profiles rather than from the population at large.[23]

Lawyers can't be expected to have an exhaustive understanding of these debates and experts can be used to ventilate these issues as they have in some very recent WA cases. The danger exists that the chance of a coincidental match between relatives or ethnic kin will be underestimated by lawyers, and no thought given to even retaining an expert, because the numerical estimates make the chance of a match seem unlikely, even preposterous. Not all lawyers understand that DNA statistics are not confined to the national, or even the world population.[24] The possibility of a random match to *any* full DNA profile would be expressed in the hundreds of millions, or billions, but if two unrelated matching profiles were found to already exist on the overall NSW database it would be unlikely to generate enormous scientific interest, or even surprise.[25]

One example. using much smaller numbers, illustrates the ease with which statistical estimates can be misunderstood. In *R v Bropho* an Indigenous man was charged with the rape of a woman and it was alleged that the rape had led to the conception of a child. A DNA test of the child could not exclude the defendant as a potential father. The case revolved around the competing statistical estimates of the chances of paternity provided by different expert witnesses. The inclusion estimates for unrelated matches ranged from 'one in a thousand' to 'one in eleven thousand' based on different methods of calculation. When a search was conducted on a mixed race database of just over 200 profiles it was revealed that

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22 It is for this reason that Sir Alec Jeffries opposes a 'suspects database' and prefers a universal DNA database, he is quoted as commenting on a proposal for a suspects database '[T]his is likely to be discriminatory; it won't affect people at random but be skewed in favour of certain socioeconomic and ethnic groups' (Gibbs *The Times* 2005). 'The DNA profiles of nearly four in 10 black men in the UK are on the National Database — compared with fewer than one in 10 white men, according to figures compiled by *The Guardian*' (Randerson *The Guardian* 2005).

23 This is sometimes referred to as the 'NRC2 debate'. This debate, and a number of other statistical issues, are discussed in *Riley v Western Australia*.

24 In the Northern Territory DNA statistical estimates are capped so that the random match probability will always be expressed in words to the effect of 'the profile is at least 200 million times more likely to come from the nominated person than from another unrelated individual'. Apparently this formula is used, even when estimates go into quadrillions, because it is 'a number that people tend to have some sort of feel for, being 10 times the population of Australia'. (Testimony of Carmen Eckhoff *The Queen v Bradley Murdoch*)

25 The chance of a crime scene sample being a coincidental match to a given profile on the database is very different to the chance of any two profiles on a database being the same. The latter is much more likely. But unless lawyers clearly understand why. they should be reluctant to substitute their own assessment of success based on statistical probabilities with that of an expert opinion.

there were three potential paternity matches[26] (as well as the defendant) on the database. Because the database was roughly half male and female the result meant there were four potential paternity matches out of a database of approximately 100 male profiles (trial transcript *R v Bropho*). The matches did not necessarily mean that the statistical calculations were wrong, in fact at least one expert argued the database matches were to be expected; it merely illustrates how counter-intuitive and misleading statistical estimates can be for the lay person. Many lawyers, and probably many jurors, would struggle with the notion that an expressed chance of a match of 'one in a thousand' could still lead to four matches out of a database of 100, no matter how clearly it was explained.[27] Some lawyers struggle with the much simpler statistical proposition that if the chance of a random match in Australia is 'one in two million' there will be a 90% chance the match is to the wrong person.[28]

On the other hand, well-informed lawyers can see the probative value of DNA evidence transformed by directing attention towards how statistical estimates can be adjusted when cases involve relatives or defendants of certain ethnicity. The PathWest laboratory in Perth is reported to have withdrawn a number of statistical calculation reports after defence scrutiny (Banks *The Australian* 2006). The DNA evidence in *R v Bropho* was excluded because of difference in expert opinion about how calculations should be adjusted to take into account the relatedness of the relevant Aboriginal subpopulation. It was also noted by the trial judge that the defendant's close relatives had not been eliminated as potential suspects. In *R v Watters* a UK appellate court reviewed the conviction of a man of four counts of burglary involving a DNA match and 'other evidence of guilt'. The DNA match was to a profile extracted from cigarette butts left at the scene of five sophisticated safe breaking robberies. The defendant was one of three brothers, one of whom had been an early suspect. The forensic expert for the Crown testified at trial that the chance of obtaining a 'false match' with an unrelated person in the circumstances was one in 86 million. However in cross-examination the expert conceded that if the defendant had two brothers then the probability would increase to 1 in 267. In light of that adjustment, the appellate court found the DNA evidence should never have been placed before the jury, particularly when the 'other evidence' was revealed to be:

> firstly, that the applicant was a smoker or, more accurately, that he had admitted in interview that he had been on his way to purchase a packet of cigarettes; secondly, the Crown said it was relevant that the applicant lived in the general locality of the burglaries; and thirdly, that the appellant was a man and most safe crackers were male (at [10]).

The court quashed the conviction and made no order for retrial.

Contamination

The risk of wrongful conviction arising from errors in handling and processing DNA evidence was mooted by a number of commentators prior to the introduction of the database system. At the time, cases of contamination were known but rare, the standards of Australian labs were highly regarded and it was thought that strict adherence to protocols,

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26 A 'paternity match' is not an exact match, it means that the profile is consistent with paternity of the offspring in question i.e., one allele at every loci is the same as the offspring and the other allele is consistent with the mother.

27 The explanation might be that departures from predicted probabilities can occur when looking at distinct databases, especially small databases, just as the toss of just 10 coins could unexpectedly result in 9 heads rather than the predicted 5. Another explanation could be a flawed statistical formula.

28 The proposition is based on the population of Australia. If there are 20 million people in Australia, 1 in 2 million would be equivalent to 10 potential matches. The chance of a correct match is therefore 1 in 10. The chance of an incorrect match is therefore 9 in 10, i.e. 90% (Hocking et al 1997:17).

internal scrutiny and observation of the stringent National Accreditation standards could reduce, even eliminate, the chances of error (Gans & Urbas 2002:4). Confidence in standards and protocols, however, has been shaken in recent years as reports have emerged of an avalanche of crime laboratory scandals in the USA. The scandals were nationwide and involved allegations including corruption, incompetence, misrepresentation, prosecution bias and numerous instances of contamination (Edwards 2005:79–81). Australian DNA laboratories have now endured their own embarrassments but nothing of the magnitude of the US situation has been revealed.[29] However, the US scandals proved that even the world's best testing laboratories were not immune from committing significant error.[30] Many of the impugned laboratories, including the FBI crime laboratory, observed protocols at least as strict as those required for accreditation in Australia.

The potential for error arising from contamination has increased with the heightened sensitivity of DNA testing techniques. It is extremely easy to contaminate biological samples; this can occur by failing to change gloves or clean instruments properly, failing to wipe down benches properly between testing, or by sneezing or even talking over a sample (Buckleton et al 2005:277). Contamination can occur even when strict protocols designed to prevent contamination are in place and when laboratory staff insist that the protocols have not been deviated from. The most recent high profile example of laboratory contamination was revealed during the trial of Bradley Murdoch for the murder of Peter Falconio (*Guardian Unlimited* 2005). The court heard evidence that the DNA profile of the Director of the Northern Territory testing laboratory, Dr Peter Thatcher, was detected on a significant exhibit in the case. There was no explanation provided by the laboratory for the contamination. Forensic biologist Carmen Eckhoff was reported as telling the court: 'You will have to ask him … [i]t could be that he's handled it without gloves … There are a number of [possible] reasons' (Murdoch *Sydney Morning Herald* 2005).

Because the risk of accidental contamination is so high, most laboratories keep staff DNA profiles on file to make sure that a technician has not contaminated a sample with their own DNA (VPLRC 2004:264). But laboratories may not always detect this form of contamination because many will not cross check every result, only those results which appear anomalous. There is also no requirement that laboratories routinely check to see if profiles from crime scene samples are detected in other crime samples tested that day, again detection relies on the observation of vigilant technicians. The level of vigilance might be expected to decline as laboratories struggle to deal with mounting backlogs. Police officers

29 The Australian cases include the incident involving the PathWest laboratory in Perth where it was admitted there might have been a 'contamination event or lab error' during DNA testing (Banks *The Australian* 2006); the failure of the Queensland state laboratory to meet NATA accreditation standards in 2001 and possible contamination in the laboratory leading to a dropped prosecution in the Arnott's biscuit case; and the Jaidyn Leskie case described below (Edwards 2005:72–74).

30 The FBI scandal involved an employed scientist failing to run control tests which act to detect and prevent contamination. The scientist had falsely claimed on documents that the tests had been conducted. A more recent scandal afflicted one of the most internationally prestigious DNA laboratories, the Commonwealth of Virginia Division of Forensic Science Central Laboratory, the inspiration for the fictional crime laboratory featured in the novels of Patricia Cornwall. An external audit by the US national accreditation body revealed that numerous errors were made by the laboratory, some of which were then missed in an internal audit, in a high profile case involving Earl Washington. The errors led to the wrongful conviction of Mr Washington who was sentenced to death before further DNA testing conducted by a private laboratory uncovered evidence that strongly suggested his innocence. The failure of the internal audit to uncover some of the errors resulted in Mr Washington being incarcerated for a further 12 months before his release. The Governor of Virginia ordered a widespread review of 161 DNA cases conducted by the laboratory after the scandal was revealed (Thompson 2006).

in some Australian states, including NSW, have 'strenuously resisted' having their DNA taken for elimination purposes (Findlay 2003:39). This means that unidentified profiles in crime stains may belong to investigating police officers or scene of crime officers. Contamination in mixed samples can lead to wrongful conviction because a contaminated sample might coincidentally contain the same combination of alleles as the suspect's DNA profile. The suspect loses his chance to be able to be eliminated properly from the mixture if the other contributors to the sample are unknown.

The practice of cold hit matching also leads to the danger of wrongful conviction occurring because of 'cross-contamination'. Cross-contamination occurs when DNA from one crime scene sample is detected in another, unrelated, crime scene sample at the same laboratory. In New Zealand, in 1999, an elderly assault victim was incorrectly linked by cold hit to two unsolved murders because of cross-contamination. The man's DNA sample had been undergoing analysis at the same time that the murder crime scene material was being tested in the NZ laboratory. There was no hint of contamination in the laboratory data and the forensic biologists insisted that all internal protocols designed to prevent contamination had been scrupulously adhered to. The man was extensively investigated by the police and eliminated as a suspect because he had an extremely strong alibi: time-stamped video footage showing him making a withdrawal from an ATM in Christchurch at the same time that one of the murders occurred in Wellington. The chance of a random match in the case was put at one in 930 million (Edwards 2005:77--78).

The New Zealand case was raised as a concern prior to the introduction of the NSW database system (Haesler 2001). Since then Australia has experienced its own cross-contamination incident. In Victoria, a DNA profile discovered on clothes belonging to murdered toddler Jaidyn Leskie was linked to a rape victim through a cold hit on the Victorian DNA database (Thompson 2003). Crime scene samples with the victim's DNA had been undergoing testing in the Victorian Police Forensic Science Centre (VPFSC) laboratory at the same time that crime scene material from the Leskie case was being tested. Like the NZ case, there was nothing in the laboratory data to suggest that contamination had occurred. The rape victim, who was 17 at the time of the rape and mildly intellectually disabled, was also thoroughly investigated by the police before being eliminated as a suspect (Gans 2005). The statistical probability of a coincidental match with an unrelated individual was put at one in 3.4 billion.

Cross-contamination is probably not the most common form of laboratory error and it is thought to be rare. But it is also one of the forms of DNA error that should cause 'the innocent' the most anxiety. Cross-contamination can't always be detected even with meticulous expert examination; this is a genuinely frightening prospect. Any innocent person linked to a crime scene via a contaminated cold hit would, at the least, experience sustained police suspicion and investigation. The rape victim in the Leskie example had no apparent reason to be involved in the crime, and had never been to the town where the toddler lived, but she was reported as complaining that police 'kept coming back and back thinking I was hiding something' (Gans 2005). It was actually in some ways fortunate that both the Victorian and New Zealand examples involved a cold hit to a crime victim and not to a convicted offender; the result at least seemed unusual.[31] An erroneous cold link from a crime scene to convicted offender without a convincing alibi would not only be extremely difficult to contest, it might go unnoticed.[32] A conviction in these circumstances may have

31 It may seem curious that the profile of the rape victim was even on the database. Dr Jeremy Gans has outlined how badly drafted legislative provisions expose rape victims to cold hits during database comparisons by allowing victim's profiles to be included on the 'crime scene index' (Gans 2005).

already occurred. The risk of wrongful conviction in these cases is exacerbated by the fact that many laboratories don't easily accept the possibility that error could have occurred. Forensic analysts at the VPFSC continue to deny the occurrence of cross-contamination in the Leskie case.[33] It is not unknown for DNA laboratories to strongly resist the suggestion of cross-contamination even where its occurrence seems incontrovertible (Edwards 2005:83–83).[34]

The potential for cross-contamination in a cold hit case exists whenever crime scene material overlaps with material containing the profile of the suspect in the testing laboratory. Usually the delay in processing offender samples means that analysis of the crime scene material, the compulsory convicted offender sample and the confirmatory reference sample will take place years apart. But material from the suspect might have been in the laboratory for another reason, for example if the suspect was involved in a bloody fight that attracted police involvement in the same week that the crime scene material was sent to the laboratory. Sometimes, after getting a cold hit, laboratories will retest crime scene material, or test additional samples, if the original analysis was performed years before. In these cases there can be an overlap with this testing and the testing of the suspect's reference sample.

Cross-contamination can also occur if there is any overlap between material connected to a suspect, and crime scene material being collected, stored and transported to laboratories. Contamination also can occur if people overlap. For example, there were reports that a man in the US had his conviction vacated after an investigator conceded that he did not have a specific memory of changing his latex gloves between assisting the defendant to get out of a car and handling a gun found at the crime scene (Hille *Winchester Star* 2003). This form of contamination is also known as 'transference' and is discussed in more detail in Part II.

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32 In the US a potential cross-contamination case was identified by scientists just before the case was to be featured on a television show. The scientists realised links to two crimes had been made to the same man when the samples were analysed on the same day. They tried to determine whether there was contamination of evidence, even submitted the samples to other outside experts, but no one could conclusively say whether the sample was pure. 'We tried to establish either that it wasn't contaminated or that it was,' the deputy superintendent said. 'Using every piece of technology that was available to us, we cannot do that either one way or the other.' At the time of the analysis there was no system in place in the laboratory that would detect such a coincidence (Spoto 2006).

33 The denials have occurred in trials involving DNA in Melbourne. For example, in *R v Nathan Daniel Berry* a scientist with the Victorian Police Forensic Science Centre stated in cross-examination that he maintained that it was 'highly unlikely' that contamination had occurred in the Leskie case and that ' "... the rape victim had a large number of close relatives, and Professor Weir examined the possibility that any one of those close relatives could have the same profile as the rape victim and this probability was quite a high probability, that because there are so many relatives and they are so close, there is quite a reasonable chance that a relative of the rape victim could have the same profile, and as far as I'm aware, none of those relatives has been eliminated from possible involvement in the Leskie case".' As an aside, this comment lends weight to the argument above concerning the subjectivity attached to statistical estimates. The described 'high probability' chance of a half-sibling sharing the same DNA profile as the rape victim was put by Professor Weir to be between 1 in 11 million and 1 in 73 million.

34 In the US a man contested forensic evidence linking him to a murder because the DNA of another man was also found on samples taken from the murder victim. The case was clearly one of cross-contamination because the second man was only four years old at the time of the offence, did not know the victim and lived in another state. The second man's profile was on material that was being tested by the same laboratory on the same day as the murder samples. The laboratory vigorously denied that cross-contamination could have occurred (Thompson 2006).

The difficulty of determining scientifically if cross-contamination has occurred places both lawyers and fact-finders in an unenviable quandary: how can the unknowable be proved or disproved? Focus must be directed back to the surrounding circumstances of the case. Courts and juries are more likely to accept the possibility of cross-contamination if the circumstances make the involvement of the suspect very unlikely, perhaps through the existence of a strong alibi, or if there is evidence of an overlap between suspect material and crime scene material in the laboratory. Diligent lawyers therefore need to carefully scrutinise the movement of exhibits and track the involvement of all relevant crime scene personnel. They also need to take careful instructions from their clients about the possibility of an alibi defence, the potential for their client's profile to be in a testing laboratory for any reason, and any interactions between the client and crime scene investigators.

In cold hit cases lawyers will be conducting these inquiries with one hand tied behind their back. There is no known way for defence lawyers to gain access to information about what DNA profiles were present in a testing laboratory on any given day to ascertain if their client's profile, or one similar, could have overlapped with crime scene material. Nor do they have access to the DNA profiles of laboratory staff or crime scene officers. Lawyers evaluating the possibility of an alibi defence may also be hampered by the delays between the offence and the date that the cold hit takes place. Establishing an alibi becomes increasingly difficult with the passage of time: the ATM footage used to clear the innocent man in the NZ cross-contamination case could have already been destroyed if the cold hit had been revealed years after the event. As Part II, and IV will elaborate, lawyers in cold hit cases are often faced with a combination of lengthy delays in cold hit notifications and clients with poor memories of events and circumstances. This combination should be of grave concern when alibi defences provide the only known safeguard against wrongful conviction due to undetectable contamination.

Part II - New Problems with Database Evidence

Cold hit cases tend to have a feature that differentiates them from many criminal cases: considerable delay between the time of the offence and the date of notification of the charge. Originally delays in NSW, and other states, were the result of the backlog of offender samples that needed to be tested and analysed before being placed for comparison on the database.[35] These delays might be expected to decline nationwide as increased resource expenditure, and some outsourced private testing, gradually reduces the backlog. But new samples from offenders entering prison are continually uploaded onto the database system and these samples always have the potential to match crime scene stains from incidents occurring many years ago. A recent article on the Queensland DNA database included discussion of a cold hit to the scene of a robbery committed eight years ago, another to a burglary committed 10 years ago and another to a rape committed 13 years ago (Burke *Sunday Mail* 2006).

The time frame that lawyers need to examine when evaluating cold hit cases is further extended by the longevity of DNA itself. DNA can sometimes survive for extended periods of time, particularly if protected from exposure to harsh environmental elements.[36] More importantly, it is not possible to determine with precision how long DNA has been present in a location, assumptions can be drawn from the level of degradation of the DNA but

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35 There are no statistics available on the average length of delay but a number of reported cases involving DNA cold hits involved delays of approximately 12–18 months between the date of incident and the date of formal charge: noted respectively: *R v Henry* (February 2001–July 2003), *R v Kay* (October 2001–March 2002), *R v Jones* (July 2001–November 2003), *R v Shorten* (May 2001–April 2003).

proper time estimates are rarely attempted. The improved sensitivity of extraction techniques increases the chance that small, and possibly old, deposits of DNA can be recovered from crime stains. The interaction of these elements is significant because timing plays a critical factor in evaluating the probative strength of a cold hit: the possibility of an innocent explanation for the presence of the material.

Innocent Explanations

DNA can never really conclusively prove guilt or innocence. At best, DNA provides biological evidence of a link between a defendant and a crime scene or person. The strength of the evidence against the defendant always depends on the existence of credible alternative explanations consistent with innocence. In some cases alternative explanations can be obvious, for example: in a break and enter offence where the DNA link has been derived from saliva on a cigarette butt found inside a property it is possible that the butt was left there by the perpetrator. However, it is also possible that the butt was innocently outside the house on the street and inadvertently transported into the property on the shoe of a different offender, or on the shoe of a crime scene investigator; that the butt blew into the house through an open door or window before or during crime scene investigation; that another perpetrator planted the butt; that a corrupt police officer planted the butt; or that the defendant left the butt at the house during an innocent visit long before the incident, perhaps when different tenants resided there.

Many break and enter offences, the bread and butter of cold hit cases, occur in high-crime areas like Housing Commission blocks with a high turnover of residency. A defence lawyer in a cold hit case needs to know if their client has *ever* had an innocent reason to be in the vicinity, like visiting the previous tenant of a unit or even previously living in the unit. Because DNA cannot be dated with certainty, the possibility for the innocent deposit could span several days or months, even years. Unfortunately, the delay in notifying defendants of cold hit links greatly impedes the assessment of this possibility. Imagine the case of a suspect in 2005 facing a cold hit to a burglary crime scene in their neighbourhood that occurred on 14 June 1996. The suspect might have legitimately visited the house on 11 June 1996 and smoked a cigarette, discarded a drink container, even slightly cut themselves, and the result could have been collected by crime scene examiners at the scene three days later. Even a suspect with an outstanding memory might struggle for an account of their movements in their own area in June 1996 and fail to recall their innocent visit to the house. A suspect with long-standing drug and alcohol problems, and a history of transient living arrangements and associations, will almost inevitably falter with the details.

Innocent deposits might seem unlikely when the source of DNA seems obviously connected to the offence, like a large pool of blood below a broken window, but it is not always possible to determine the source of a DNA profile. For example, a DNA extract from a hair soaked in blood might generate a profile from the hair, or from the blood, or show a mixture of the two profiles. This fact is very important as DNA testing becomes more sensitive. Profiles can be obtained from surfaces that have been touched by a person through minute, invisible to the human eye, particles that contain skin cells. DNA from touched surfaces is called 'trace DNA'. Trace DNA could be obtained from skin cells shed during sweat or even from dandruff. The cells could even fall onto a pool of blood and DNA could be extracted from the skin cells instead of from the blood.

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36 See for example *R v Butler* (at [25]): 'In the first place a period of 13¾ years is not, in DNA terms a long time. Good results have been obtained 20 or 30 years after the event and Dr Budowle even gave the example of DNA extracted from bones 60,000 years old. If the substance containing it is dry and out of sunlight it will not degrade for many years.'

Trace DNA and Secondary Transference

Trace DNA is now being submitted to laboratories for testing by high volume crime scene investigators and the profiles derived from trace DNA are going onto the crime scene database (Walsh 2002:8). A common form of trace DNA at high volume crimes is from food items or drink containers given the surprisingly common habit amongst perpetrators of breaking into a house, robbing it and then enjoying a snack. Trace DNA is so tiny that it can be moved from person to person without anyone knowing, even through a handshake (Buckleton et al 2005:277).[37] This movement of DNA is called 'secondary transference'.[38]

The possibility of alternative explanations for the presence of trace DNA is almost endless. This was demonstrated by a creative experiment conducted at the suggestion of a defence team in a US murder case. A DNA profile belonging to the defendant, the husband of the murdered woman, was found on a glove believed to have been discarded by her attacker. The defence wanted to argue that the profile could have been transferred when the gloved hand of the attacker touched the cheek of the woman and that the husband's DNA was on her cheek because they shared a bathroom towel. The experiment involved taking a towel that a man had used and having a woman wipe her face on the towel. A glove was then used on the woman's face in a way to simulate an attack. The experiment found that DNA from the man who used the towel was found on the glove[39] (Thompson et al 2003:Part 2:27).

The sensitivity of trace DNA to secondary transference can give rise to wrongful conviction when combined with the practice of selective laboratory testing (further discussed below). If the DNA that matches a suspect is from trace DNA, and a DNA profile from an untested larger sample matches a different potential offender, it is possible that the suspect's DNA at the scene is the result of secondary transference e.g. a handshake with the actual perpetrator. It has been reported by defence lawyers that some expert prosecution witnesses can be dismissive towards the possibility of this kind of transference (Haesler 2005). It is concerning if the risks of transference are being understated in court because

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37 Research suggests that in cases of secondary transference the DNA profile discovered will usually, but not always, be a mixture of the original and secondary donors. It also has found that the strongest portion of the mixture won't always belong to the person who touched the surface last. A 'good shedder' is more likely to leave epithelial cells than a 'poor shedder' and the good shedder may leave the dominant profile even if they are not the last person to touch the surface (Buckleton et al 2005:277). Intriguingly, it was suggested by a forensic biologist in the recent trial of Bradley Murdoch for the murder of Peter Falconio that some ethnic groups, specifically, 'Italians and Greeks', are better shedders than others. Testimony of Carmen Eckhoff *R v Bradley Murdoch.*

38 Further movement from that source would be called 'tertiary transference' and so on.

39 In Ireland events in a very recent trial suggest that a wrongful conviction may have been narrowly averted. The case neatly illustrates the risks of misleading statistical estimates, selective testing and secondary transference. A man confessed to killing a boy, his next door neighbour, after a violent encounter about the boy throwing rocks at his car. It was reported that the man was charged with murder rather than manslaughter because DNA evidence suggested the man had sexually assaulted the boy. A semen stain was found on the hand of the victim using a sophisticated and sensitive DNA technique called Low Copy Number ('LCN') testing. The DNA profile was linked to the defendant. It was reported that the chance that the DNA belonged to another man was 'one in 77 million'. On its own the evidence seemed to strongly suggest a sexual motive for the crime. Further DNA testing transformed the apparent value of the evidence. A semen stain was found on the bath mat on which the defendant said he had placed the boy's body after drying it in his bathroom. Testing on the mat revealed a semen stain. The DNA profile on the bathmat stain was very similar, but not identical, to the profile found on the boy. The possibility of 'cross transfer' was identified and the statistical estimate provided from the LCN testing was withdrawn. The results of the LCN testing were then disputed by the scientists who had conducted the tests on the bathmat stain. The man was convicted of manslaughter (McDonald & Leahy 2006).

recent reports demonstrate the potential for transference goes way beyond even immediate and recent contact. In December 2005 mystery profiles appearing in over 13 DNA samples from serious crimes were linked to plastic vials supplied to two separate crime laboratories in Florida (the contamination was not disclosed to defence attorneys) (Stutzman *Orlando Sentinel* 2005). It then became apparent that the same unknown, female DNA profile was appearing in crime scene samples hundreds of miles away in Arizona. The source of contamination could not be identified. One mooted explanation was a worker sneezing at the plant where the DNA equipment was being manufactured (Anglen *The Arizona Republic* 2005). The US case would not be the first time that contaminant DNA profiles were traced back to an equipment manufacturer: factory floor workers at a plant manufacturing DNA equipment in Germany were linked to 10 different mystery profiles appearing in a UK DNA laboratory's criminal casework. The UK laboratory now keeps an informal database of the DNA profiles of the employees of DNA equipment manufacturers for the purpose of elimination (Howitt 2003:2). These databases are not provided to UK defence lawyers.

Transference of trace DNA can also distort the probative value of the *location* of a DNA stain. Particles can easily be inadvertently picked up and moved from one location to another by crime scene investigators. For example, investigators might dust for fingerprints at the site of a break and enter offence. They might then take samples for DNA testing from areas which gave indications that fingerprints might be present. This is because fingerprints often contain DNA from skin cells (called 'epithelial cells') that are shed when hands sweat. Some research has suggested that it is possible for fingerprint brushes used by crime scene investigators to pick up DNA from one scene and deposit it at another site (Buckleton et al 2005:276). The original site of the DNA might have been far less damning than its eventual location.

Selective Testing

DNA laboratories will deliberately take a selective approach to testing material sent by police in criminal cases. A selective approach is necessary in part because of the backlogs that are faced by most DNA testing laboratories. The practice of selective testing means that it is very common for a laboratory to only test one biological sample when multiple samples from the same case are sent to the laboratory by investigating police officers. While the practice may be justifiable on resource grounds, a number of dangers arise from the practice.

There is one known case of wrongful conviction as a direct result of selective laboratory testing. Frank Button was charged with the rape of a young girl in Queensland in 1997. The victim named him as the perpetrator. Vaginal swabs taken from the victim had been tested by the Queensland laboratory, the John Tonge Centre, but no DNA result could be obtained. Mr Button was convicted (*R v Button*). It is not clear if Mr Button's trial lawyer was ever informed that bedding from the rape scene was transported to the laboratory but not tested for DNA material. When Mr Button's appeal lawyer asked for the bedding to be tested, a semen stain was detected and a DNA profile was obtained. The profile did not match Mr Button. Further testing on the vaginal swabs revealed a DNA profile which matched the stain on the bedding (Crimes and Misconduct Commission 2002:5). When the profile was run through the Queensland convicted offenders database it matched a convicted rapist who had been living in the area at the time of the rape. Frank Button was released after serving almost a year in jail. It was reported that he had been gang-raped whilst in custody and that doubts about his innocence persist within his community (*Four Corners* 2002:15).

Selective testing creates particular risks in cold hit cases because of the possibility the 'hit' will be described in a misleading fashion on facts sheets. When suspects in NSW are first charged with an offence, lawyers are initially given a one to two page 'facts sheet' written by the investigating officer which details the offence and the evidence against the defendant. In cases involving high volume offences with a DNA 'hit', or several hits, the factual description of the crime scene and evidence may only be a paragraph long. Lawyers involved in high volume crime cases may assess the merits of entering a plea armed only with this information and without ever requesting a full police brief or DNA file (this is further discussed in Part IV). Facts sheets are notoriously unreliable; they are rarely deliberately inaccurate but are known to be written in a hurry by investigating officers and can be imprecise to an extent that they are misleading. A common error on facts sheets is incorrect nomination of the date of the offence. This simple error can destroy the possibility of an alibi defence, requiring defence lawyers to either double-check dates or dramatically expand the scope of their alibi inquiries. Reliance on facts sheets can further mislead lawyers about:

- the type of biological substance found at the crime scene;
- the location of the stain; and
- what material was at the scene but not tested.

In all DNA cases the probative value of a match greatly depends on what kind of biological material is the source of the DNA. In 'break and enter' offences often the most incriminatory piece of evidence is a blood stain found on or near a pane of glass near the presumed entry point. The presence of actual blood on the glass is the foundation for the suggestion that the defendant left the DNA after cutting himself when entering the property. A phrase commonly used in facts sheets is 'a red/brownish stain consistent with blood'. There is a temptation for lawyers to substitute this elaborate wording with 'blood'. In fact, descriptions of substances can be based on quick 'on the spot' subjective assessments and may be incorrect. Scepticism is justified even if the facts sheet states that 'scientific testing' has found the substance to be blood. The standard preliminary test for blood — 'otol' (orthotolodine) — can also test positive for substances containing iron like paint and rust and for other substances including cordial and bleach. Another commonly used presumptive test for blood, TMB (tetramethylbenzidine) can give 'false positive' results to unstained cotton and commonly used vegetables like tomatoes, celery, avocado, mushroom and lettuce (Cox 1991:1503–1511). Preliminary tests for semen can test positive for a range of other substances including hair gel, contraceptive foam and vaginal secretions (*R v Joyce*). Presumptive tests for saliva can also be incorrect. A false positive for blood, semen or saliva can disguise the real value of the evidence: DNA extracted from other sources is more likely to be 'trace DNA' which, as detailed above, can result from innocent secondary transference or from contamination.

The practice of selective testing means that the sample that is tested for a DNA profile may not be the one that was in the most incriminating position. A lawyer working at Legal Aid in NSW represented a defendant in a 'break and enter' case where three bloodstains were found inside commercial premises. Two stains were large pools of blood found inside the property, one near the broken window 'entry point'. The third stain was on a pane of glass on the outside face. Close examination of the full police brief revealed that only the sample from the glass pane had undergone DNA testing. Furthermore, the pane had only been tested for biological material after it had been sent away for repairs and then returned. There were clearly many more explanations consistent with innocence for this particular stain than the other two. If the lawyer had read the facts sheet too quickly she might have noted two large bloodstains were found inside the property and that a DNA match to her client had occurred — facts strongly suggesting a guilty plea should be recommended. Because the facts sheet did not specify which stain had actually been tested she investigated further; her discovery led to charges not proceeding against her client.

Facts sheets may omit reference to untested crime scene material. As the Button case illustrates, further DNA testing can make an apparently open and shut case seem considerably more ambiguous. In a NSW case a lawyer examining a DNA file from DAL discovered that only one of two blood stains found at the scene of 'break and enter' at a hardware store had been tested by the laboratory. The profile from the tested sample matched his client, an offender on the database with many break and enter convictions. Further testing requested by the lawyer revealed another profile on the second stain — it matched another convicted offender with a similarly long history of like offences. The further testing in this case was performed with the co-operation of the DPP. It is unclear if defence lawyers can demand the further testing of forensic samples as of right. The case also illustrates how dangerous and misleading facts sheet omissions can be. A person on the convicted offenders' database could leave his DNA on an innocent visit to a business or residence that is later the subject of a burglary. Once a link is made between a DNA profile found at a crime scene and a profile on the convicted offender database there is a good chance that the suspect will be charged and no further police investigation or forensic testing will take place. If the presence of other untested stains is not mentioned on the facts sheet the lawyer will have no reason to suspect the involvement of an alternative perpetrator. Convincing evidence of the innocence of her or his client could easily remain untested in the laboratory.

Mistakes

Data Entry

In the UK a convicted rapist eluded detection for eight years after committing a sexual offence, despite leaving his DNA at the scene, because his DNA profile was typed incorrectly by a laboratory technician onto the national database (Tapsfield *The Scotsman* 2005). When consideration is given to the scale of mass sampling operations this simple error is hardly surprising. Ironically, the risks of data entry error in large scale DNA operations are comfortably acknowledged in contexts outside the criminal justice system. In a press release detailing the efforts of forensic teams to provide DNA identifications from the remains of victims after the New York World Trade Centre attacks it is noted: 'Collecting and recording large numbers of samples perfectly is difficult. Errors and omissions occur' (Penn State 2006).

A cold hit system necessitates several layers of data entry — a wrongful conviction can result if there is an error in just one. In Chicago, USA a woman was nominated by a DNA database link to a break and enter offence (*Chicago Sun Times* 2004a). Prison and court records conclusively established that she was in custody at the time of the burglary. An eye-opening number of different possibilities were mooted to explain the curious match including:

- that prison officials had written the wrong name on the inmate's sample when it was taken for entry into the database as part of the compulsory convicted offender swabbing program;
- that the profile was not entered correctly onto the database by laboratory technicians;
- that a label on the crime scene bloodstain was incorrect (due to either laboratory or police error) and the stain was in fact not connected to that particular burglary; or
- that the police data entry about the date of the offence was incorrect.

None of these possibilities are far fetched in the Australian context. Serious questions were raised about the quality of DNA record keeping in NSW when a NSW Ombudsman report noted numerous errors when cross-referencing DNA database information and the police database (Computerised Operating Policing System, 'COPS') entry information (Ombudsman 2004:206). It is unlikely that any of the reported errors could have led to a wrongful conviction but the Ombudsman's report showed how commonly data entry errors occur.[40] The Ombudsman also investigated, and in some cases verified, complaints about the misspelling of inmates' names, confusion resulting from poor handwriting when recording inmate information and inmates samples not being recorded leading to requests for duplicate samples (Ombudsman 2004:202–204). Recommendations by the Ombudsman for audits have not been translated into legislative amendments and it is likely that there continues to be 'an imperfect flow of information between police, the ODPP and the laboratory' in NSW (Findlay 2003:118). Victoria seems to have a similarly 'messy' data system: in a US media profile of DNA expert Professor Bill Thompson a casual reference was made to his discovery of 'trends toward double entry of profiles and erroneous data entries' on the Victorian DNA database.[41]

Laboratory Notifications

In *R v Kennelly* a bail applicant claimed that he had been incorrectly linked by DNA database link to a crime he did not commit and that his conviction was later annulled. While the claim can not be officially confirmed, anecdotal reports from both police and defence lawyers confirm many aspects of the man's account.[42] According to these reports the man had been correctly linked via DNA database links to five break and enter offences but police had misread a notification from the NSW laboratory and also charged the man with a sixth break and enter offence. All six offences appeared on the same facts sheet, the paragraph relating to the sixth offence stating incorrectly that a DNA sample obtained from the scene had been matched to the defendant. The defendant was apparently unrepresented, had a poor memory of the time, and plead guilty to all the offences (other reports suggest he may have been convicted in his absence after failing to attend court). It is agreed that the police discovered their own error and lodged an application to annul the conviction.[43]

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40 Incorrect COPS details should only slow an investigation if proper procedure is followed because it would be expected that police would confirm any database match with another DNA reference sample from the suspect. A COPS error could lead to a person suffering from the distress and inconvenience of an unnecessary police investigation before being cleared by a reference sample. The suspicion and inconvenience could last some time if there were delays in testing the reference sample.

41 Apparently Professor Thompson was provided with the database as part of his work as an expert witness in the Jaidyn Leskie inquest. The quote reads '[H]e and some colleagues have the DNA database from Victoria, Australia, on their computers. It allowed Thompson and his colleagues to discover trends toward double entry of profiles and erroneous data entries' (Murray 2004).

42 Some limited documentary support does exist: for example, I am in possession of an apparently authentic copy of the annulment application.

43 The application was made utilising the statutory predecessor of the *Crimes (Local Courts Appeal and Review) Act* 2001 s4.

If true, the honesty and courage of the police in this case was impressive, but the capacity for such an error is also thought provoking, even frightening. What would happen if police did not detect their own error in reading a database notification or failed to take steps to correct a discovered error?

Switching Names

There is at least one reported case where DNA data entry has led to wrongful imprisonment. In Las Vegas, USA the names attached to the DNA profiles of two men sharing a prison cell were switched around before both profiles were run against a crime scene database. The wrong man was then charged with two rapes that matched 'his' (in fact the other man's) profile. The man spent over a year in custody, and was even positively identified by one of the victims, before the error was discovered by a lawyer cross-referencing data in the case (Puit *Las Vegas Review Journal* 2002). There are also at least two known cases in the US where laboratory technicians have accidentally switched the victim's and the perpetrator's names when recording DNA profiles. This meant that a man was incorrectly suspected of raping a woman because 'his' DNA (it was actually hers) was detected on a vaginal swab (Thompson 2006).

Partial Matches

The culprit in the Chicago case above turned out to be a different form of data entry error than any of those contemplated in newspaper reports. It was discovered that the DNA profile recovered from the crime scene was only a partial one — seven loci. The match was reported to the police in the same way as if it were a complete match. It was concluded that the woman had coincidentally the same seven loci profile as the offender i.e. they both shared the same 14 alleles (*Chicago Sun Times* 2004b). In the US a profile must have 13 loci (regions of DNA) before it can be entered onto the national database. In Australia only nine loci and a gender marker are tested. Police in Australia are notified by their state laboratory if a suspect's profile matches a crime scene profile at 16 out of 18 alleles. There are sound reasons for this practice (including the potential for data entry error) but it is vitally important that police are informed of the different significance of the 'match' *and* that a subsequent confirmatory suspect sample reveals a complete match. It remains legally possible for a suspect to be charged only on the basis of a partial cold hit match with the partial nature of the profile reflected only in the statistical odds provided with the certificate of analysis. The only real way to properly guard against data entry error is for defence lawyers to subpoena the full DNA file to cross-check all the underlying data.

The danger of many data entry errors can be eliminated by what police in NSW state is their standard practice in DNA cold hit cases: obtaining a second reference DNA sample from a suspect and ensuring that it too matches the crime scene profile (Ombudsman:202). While the police insistence on this practice is reassuring; more comfort could be drawn if this practice was enshrined within forensic procedure legislation and if prosecutors, defence lawyers and judicial officers routinely sought confirmation that the standard procedure did in fact occur. It is much more difficult to ensure that the link is not based on an incorrect typing of the *crime stain profile*: often crime scene material is consumed by original testing or is unable to be located to be retested. In these cases an error could pass undetected.

Part III - Misuse of DNA Evidence

DNA evidence is ideally suited to planting: it is highly probative; easy to obtain surreptitiously and can be concealed, transported and deposited without difficulty or detection. Some lawyers and academics have suggested that planted DNA evidence could become 'the new verbal'; replacing fabricated confessions and admissions as the most common mechanism for framing suspects (Findlay 2003:37). There is a long history of evidence planting in the NSW police force. In 2002 the NSW Police Integrity Commission (PIC)'Operation Florida' report revealed that there had been a cabinet at the Chatswood Headquarters of the Major Crime Squad North Squad containing a cache of guns, balaclavas and ammunition for the purpose of planting evidence on suspects (PIC 2002:87). The cache was eventually dumped in the Hawkesbury river by detectives nervous that ongoing corruption investigations would uncover it. Will a drawer of cigarette butts be the replacement? It would certainly be naive to assume that the practice of evidence planting was eliminated by PIC or by any other police probe. In the 2003 Independent Review police acknowledged that DNA evidence was easy to plant and hard to detect; they also conceded 'that there may be inducements to fabricate evidence through planting or corrupting forensic samples, particularly at crime scenes' (Findlay 2003:35). It might be thought that the risks are overstated since some forms of DNA evidence are of course much easier to plant than others. Large pools of blood for example, or semen, are less likely to be planted than a cigarette butt or a hair. In fact, suggestions that both blood and semen are being planted are increasing and are discussed below.[44]

The use of DNA derived from cigarette butts and drink containers is of particular concern because anecdotal reports from police in NSW suggest that it is common for investigators to save materials like cigarette butts, styrofoam coffee cups and drink cans surreptitiously obtained from suspects and 'people of interest' to obtain DNA profiles for 'intelligence purposes'. The practice has also attracted attention in Victoria with recent newspapers reports suggesting that the state government is planning to 'crack down' on the covert collection of DNA by police (Giles *Herald Sun* 2005). The practice of covert collection greatly increases the chances of planted DNA material: it leaves easily transportable material with profiles belonging to those who have attracted negative police attention in police possession with no system of accountability for their storage and use. The popular choices for the source of covertly obtained profile DNA profiles - butts, drink containers and discarded tissues - are also the kinds of items commonly found at high volume crime scenes.

Despite this risk, there is little reason to think that the practice of covert collection of samples for DNA analysis will change, at least in NSW, in the near future. The *Crimes (Forensic Procedures) Act* was intended to provide a regulatory framework for forensic procedure practices by police but in operation the Act's framework has been revealed to contain some significant chasms. The NSW Supreme Court recently held that a covertly collected abandoned cigarette butt from a 'person of interest' in a murder inquiry did not fall within the ambit of the Act, possibly allowing police to side-step the Act by classifying the target of investigations as a 'person of interest' rather than a 'suspect'(*R v White*). The judgment also adopted the reasoning of a previous Court of Criminal Appeal decision that determined that covertly collecting an abandoned cigarette butt from a crime suspect under surveillance fell outside the ambit of the Act because that form of collection was not 'a forensic procedure' under the Act's provisions.[45] In another NSW case, *R v Daley*, police conducted a bogus random breath test operation in order to obtain a DNA sample from a

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44 It is possible to manufacture DNA and spray it directly onto large blood stains in a way that may not be detected (Catalyst 2004). One can only hope that perpetrators and corrupt police are yet to reach that level of determination and scientific sophistication.

45 *R v Kane*: 'A careful examination of the s3 definitions earlier herein quoted shows, in my opinion, that what is actually contemplated by the notion of a forensic procedure, whether intimate or non-intimate, is that it is a procedure actually carried out on the person of some specific individual' (at [13]).

serial rape suspect without his knowledge. The sample was held not to be 'improperly obtained' and furthermore, even it had been improperly obtained the judge indicated that she would have admitted the evidence after consideration of section 138 of the *Evidence Act* 1995 (NSW).[46] The decisions all concerned 'warm hits' and each turned on issues of statutory interpretation and policy outside the scope of this article. However, their combined effect might be perceived by police in NSW as a judicial imprimatur on the practice of covert collection of biological evidence. Unlike Victoria, there is no apparent political outcry over the practice in NSW and it is unlikely that legislative amendment will address the practice in the near future.

The risks of planting don't just arise from police malpractice; there have been suggestions that offenders, some inspired by television shows like *CSI*, have begun to plant evidence including blood and semen. A newspaper reported that an offender in France admitted to stealing used condoms from the garbage bin at the apartment complex where he worked and storing the contents in his freezer. The man would then leave semen smears from the stolen condoms at the scene of rapes that he committed; he is said to have gained the idea from a television show (*Adelaide Advertiser* 2003). It was widely reported, although denied by Thai authorities, that suspects in a murder of a British backpacker in 2003 in Thailand confessed to planting semen and blood on the body of the victim to mislead police (Press Association 2002). Police in the UK have also been noting an increase in random cigarette butts appearing at crime scenes and theorise that offenders are deliberately creating a false DNA trail (Lettice *The Register* 2006).

There are both scientific and straight-forward investigative ways to detect the possibility of some planting. In the OJ Simpson case it was argued that a crime scene blood stain consistent with OJ's DNA profile had been planted from a reference blood sample from OJ because the blood was found to contain EDTA, a preservative used in test tubes. This suggested that the blood had been spilt (or poured) from a test-tube and was not freshly spilled during a struggle (Buckleton et al 2005:50). In *R v Lisoff* a defence team successfully applied to exclude DNA evidence when they argued that blood found on a suspect's pants which matched the victim of an assault was planted. It was suggested that a corrupt police officer could have used a syringe filled with the victim's blood using a reference sample that was obtained *after* the victim had undergone a post-assault blood transfusion. The sabotage argument was possible because there were no notes that blood was detected on the pants in initial checks; the reference blood samples and pants had been stored in the same police exhibit room; and a defence DNA expert testified that there were indications that the blood could be *post-transfusion* blood.[47]

Most allegations of planting can be tested without recourse to an expert but it requires time-consuming examination. A careful check of contemporaneous notes of the times, dates and locations of discovered evidence and cross-referencing the times and dates on labels of samples that were sent to, and acknowledged by laboratories, increases the chance that discrepancies can be detected. Anecdotal reports suggest that it is common for clients to claim that their compulsorily acquired DNA sample was used to frame them. This claim can easily be tested by checking the date on the original crime scene analysis data. If a DNA

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46 Very similar reasoning occurred in *R v Nicola* where the DNA of a rape suspect was obtained from a styrofoam coffee cup that had been used by the suspect during his attendance at a police station and covertly collected when he discarded it. The trial judge held the DNA profile of the suspect was not improperly obtained, and even if it had been, would be admissible under s138 of the *Evidence Act* (NSW). The decision was upheld on appeal.

47 The decision of the trial judge to exclude the evidence was overturned on appeal in *R v Lisoff*. The defendant was acquitted on retrial (Haesler 2005 4).

profile was derived before sampling took place then it is unlikely that planting occurred. The chance of planting by police is also diminished if a crime scene profile languished for years on the crime scene index before a database cold hit: if police wanted to frame a pre-determined suspect they could easily do so by covertly obtaining abandoned DNA from their target and ensuring a rapid warm hit. Alert lawyers could also pay special attention to sources of DNA that could be easily planted including cigarette butts, tissues, hairs and food and drink containers. Lawyers can ask clients if their DNA could have been covertly collected, for example by being offered a cigarette or food and drink during contact with police. In any case involving large and easily identifiable sources of DNA evidence, for example cigarette butts, drink cans and pools of blood, crime scene examiners should be able to produce photographs of the scene and be available for cross-examination about other extrinsic records that exist to corroborate the discovery of the evidence.

Careful scrutiny by defence lawyers will not detect all forms of planting but there are some anecdotal reports of successful defences based on apparent discrepancies concerning DNA evidence discovered at crime scenes. At least one trial in NSW has been abandoned because 'irregularities' in the use of DNA by police were uncovered (Findlay 2003:37). Widespread and, importantly, widely known scrutiny of extrinsic documents by defence lawyers will undoubtedly have a chilling effect on at least the more obvious forms of evidence planting. From a systemic point of view, the role of the defence lawyer in this area is to increase the 'transaction costs' of framing suspects so that the 'inducements' acknowledged by police become considerably less tempting. On the other hand, continued failure by defence lawyers to properly scrutinise DNA cases for signs of planting is likely to guarantee an increase in improper behaviour.

Part IV - Obstacles to Scrutiny and Pressures to Plead

While the dearth of reliable statistical data on the operation and outcomes of the DNA database is a lamentable feature of the field (Findlay 2003:15), there is probably enough empirical data to support the common anecdotal claim that most cold hit cases are resolved by way of guilty plea. The 2003 Independent Review found that the 'vast majority' of database cold links were to break and enter offences. In turn, statistically, the vast majority of break and enter offences are resolved by guilty plea (Bureau of Crime Statistics).

No doubt a number of those charged with cold hit offences readily remember and admit their own guilt. The extent to which guilty pleas always represent this acknowledgment can be called into question by an examination of the context in which plea decisions take place in the criminal justice system. Cold hit cases are confined to the convicted offender population. Incarceration tends to have a devastating impact on the financial circumstances of offenders so it would be expected that a great number would be represented by legal aid duty lawyers. These lawyers have high volume practices, particularly in local courts where many break and enter cases are disposed of, and will generally see many prisoners in one day.[48] The first point of assessment in these cases will be the facts sheet, the dangers of which are discussed in Part III. The level of scrutiny beyond the facts sheet generally depends on the attitude of the suspect to the charge. Would an innocent suspect necessarily vehemently protest their innocence? A history of serious drug and alcohol abuse is common amongst incarcerated offenders, particularly those serving sentences for high volume offences like break and enter crimes that are often used to fund drug habits. A history of

48 There is no reason to think that legal aid lawyers pressure clients to plead guilty, the 'rubber hosing' legal aid solicitor is probably an urban myth. There is no doubt, however, that duty lawyers are pushed for time and that they have no financial incentive for extending the disposition of a case.

mental illness is also extremely common amongst convicted offenders. While the average person would know full well if they had ever committed a break and enter offence, an incarcerated offender could genuinely have no idea if he is guilty of the alleged crime or not.

The final decision as to plea always lies with the individual who is charged with the offence but defendants place great store in the advice provided to them by defence lawyers. The reliance on lawyers is particularly strong when defendants do not have a personal recollection of the crime; the decision to plead in these cases rests heavily on the defence lawyer's assessment and advice about the prospects of success. Anecdotal reports suggest that defence lawyers approach DNA cases with some pessimism. Defence lawyers certainly have good reason to feel on the back foot when presented with DNA evidence in any case. Lawyers are well aware that jurors find DNA evidence both extremely reliable and extremely compelling, a fact confirmed by NSW juror surveys and presumably increasing with the ongoing popularity of forensic shows like *CSI* (Briody 2002; Findlay & Grix 2002). Defence lawyers are also at a genuine disadvantage if they try to contest the results of DNA analysis. The science underlying DNA analysis is considered beyond challenge by courts. Lawyers complain that contesting individual results is hampered by the existence of a very small pool of available independent experts. While prosecution lawyers can use the expertise of government DNA laboratories whenever they require it, defence lawyers have to make hard choices about the resource expenditure they are able to make, particularly when contemplating the use of international experts.

When DNA evidence is put in issue by the defence it remains difficult to gain a forensic advantage. Defence experts risk being labelled 'hired guns' and may lack the practical experience, and thus the credibility, of the apparently objective government experts who perform DNA analysis everyday.[49] The issues surrounding DNA evidence can be hard for the average lawyer to master and many are daunted by maths and science. Defence lawyers will joke that if they had any aptitude for science they would have become doctors and made a lot more money, or that they gave up on statistics the minute they could master a form guide (Haesler 2005:1). Even those defence lawyers who go to the trouble of properly understanding DNA can witness an apparently successful cross-examination of a prosecution expert fall flat; juror research indicates jurors will 'turn off when the lawyer and the expert are debating the intricacies of DNA analysis' (Findlay & Grix 2002:133).

Cold hit cases present further obstacles to defence lawyers. The foremost obstacle is the client him or herself. Whether or not the client has a memory of the offence, he or she is unlikely to have a good memory of the surrounding circumstances of the period. This could be because of drug and alcohol problems, mental illness, a generally poor memory or a long delay between the offence and notification of the charge. As discussed above, detailed recollection of movements can be crucial for a lawyer evaluating the possibility of mounting an alibi defence or the existence of an innocent explanation for the presence of DNA at the crime scene. The difficulties in presenting an affirmative defence are exacerbated by the risks that tendency evidence will be used against the defendant. A long criminal history involving break and enter offences should not of itself be admissible as evidence of tendency, cold hit cases by definition draw from a pre-selected pool where that

49 See for example the voir dire decision of Martin CJ in *R v Murdoch*: 'Dr Whitaker gave evidence before the jury and the accused called Dr Both, a scientist of extensive experience in the area of forensic DNA. Dr Both does not accept the scientific validity of LCN and identified a number of areas which are of concern to her. It is unnecessary to canvass the evidence of Dr Both in detail except to observe that her evidence did not shake my confidence in the evidence of Dr Whitaker. Dr Both has had very little practical experience with the LCN methodology and her knowledge of LCN is derived primarily from reading publications. In certain respects Dr Both displayed an unfortunate intransigence' (at [46]).

history is very common. Defence lawyers might be justifiably concerned, however, that judicial officers and fact-finders might pay insufficient attention to this factor when assessing the admissibility, or evaluating the probative value, of the evidence. 'Stock in trade' similarities, features common to many break and enter offences, might seem more distinctive when viewed in isolation. Defence lawyers don't have access to the criminal histories of other potential suspects, including those with similar DNA profiles, when trying to argue against the probative value of the evidence.

Clients with long histories of similar offences may also be very prepared to accept their own guilt, especially if they have no recollection of the time: 'it sounds like me, if they have my DNA it must be me'.[50] Offenders are not likely to be aware of the many limitations of DNA discussed in this article; like other community members they can be influenced by the 'truth-telling' mystique of DNA promoted by shows like *CSI* and ignorant of the possibilities of suggesting alternative explanations.

The willingness of some clients to plead guilty is accompanied by some significant systemic incentives. Justice activists and defence lawyers have noted it is not uncommon for incarcerated defendants to be presented with charges as they are nearing their release date. This can be an ideal time to be sentenced for cold hit offences. The client can present a persuasive picture of their prospects of rehabilitation: they might have evidence of rehabilitative efforts like drug and alcohol programs undertaken in custody, they can demonstrate accommodation and job prospects on release and they can highlight the expectation of dependant family members that they will be released. If the client is already serving a sentence of imprisonment for a 'spree' of high volume offences to fund a drug addiction, it is arguable that few purposes of sentencing are served by the addition of a significant extra custodial term for offences committed during the same period that have only just been detected. Compassionate sentencing judges and magistrates may feel reluctant to demoralise offenders by adding significant extra custodial periods.[51]

Defendants who plead guilty will also receive greater discounts on sentence the sooner the plea is entered after charge. A defendant who enters a plea on the first mention date may even receive a backdated concurrent sentence, with little or even no actual extra time to serve. In these circumstances the focus of the client in discussions with their legal representative may well be more concentrated on 'what am I going to get?' than 'are they sure it's really me?'

Even defence lawyers who are determined to focus carefully on the quality of the DNA evidence will still need to pragmatically balance possible sentence outcomes against the delays that effectively work to penalise defendants who contest DNA evidence. A police brief of evidence takes three to four weeks to arrive. if a lawyer also decides to order a full

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50 One of the few reported appeal cases involving cold hit evidence, *R v Newman*, illustrates the scenario exactly: 'When interviewed [by police] in relation to these matters the applicant claimed to have had no memory of them. At various points he indicated that if DNA found at the scene matched his DNA, then he was not disputing that fact, although he indicated additionally (e.g. Q & A 46–49) that, 'I can't, I'm not saying nothing till I know.' After being asked some questions about the last of the offences, he made it clear that he did not intend to answer any further questions indicating (A63) 'it's over and done with'; (A64) 'youse just charge me' and (A65) 'why would I pled [sic] not guilty.'

51 Cases which have examined the sentencing principles applicable in cases of delayed cold hits are listed at footnote 36. These cases demonstrate that appeals based on the impact of delayed notification on sentence have met with little success but delay is taken into account by sentencing judges as a factor going to 'totality' in sentence and can be of benefit to defendants. Local court decisions, where anecdotally defendants receive the most benefit on sentence from cold hit delay, are hard to examine for trends because reported cases are so rare.

brief of DNA material the delay in getting reports and results back from the laboratory could take up to six months or more. The *Sydney Morning Herald* reported in 2004 that the average time from request for DNA reports to delivery was 180 days (Jacobsen 2004). If a client is refused bail, or fails to obtain parole, he or she may be in custody waiting for DNA results longer than if he or she just pleaded guilty originally. The possibility of the refusal of bail or parole is a realistic one, despite the obvious unfairness to the defendant, because the criminal history of the defendant can be used to demonstrate a danger to the community and the strong likelihood of a further custodial sentence. Defendants with a drug and alcohol background can also have poor records of attendance at court which reduces the prospect of obtaining bail.

In serious cold hit cases, like charges of murder or sexual assault where conviction will inevitably result in a lengthy sentence, it is likely that a full police brief and a full DNA file would be ordered on the advice of a competent solicitor even if their client is inclined towards entering a guilty plea. When a lawyer represents a client charged with cold hit break and enter charges, particularly in the local court, the decision as to whether to scrutinise all the available evidence is far less obvious. When the client is facing five or six charges, has a long criminal history of like offences, the lawyer is pushed for time, and the client does not recall the offence and is focussed on obtaining the best possible sentence outcome, there must be an almost unbearable temptation to heed client instructions to plead without comment. In these situations quickly entering a guilty plea could seem natural and sensible, even inevitable. But this is why the risk of wrongful convictions in cold hit cases is so high.

Conclusion

At first blush, the risks of wrongful conviction posed to drug addicted convicted offenders, with memories and habits so poor they are not even sure of their guilt, might not be at the forefront of community concern and thus, seem unlikely to puncture the bubble of complacency that has surrounded the use of DNA database evidence. This would be a short-sighted approach. This article demonstrates that the dangers of DNA evidence have already impacted on an elderly church deacon, a mentally vulnerable 17-year-old rape victim, a wheel-chair bound Parkinson's sufferer and an unjustly imprisoned Indigenous man. But focus on individual cases of wrongful suspicion or conviction, whatever the merits of the 'innocent' involved, should always serve the primary purpose of casting a spotlight on the justice system itself. When a DNA cold hit is made to a person the burden of proof effectively shifts, not in a formal legal sense but practically and forensically, to the 'linkee' to provide an innocent explanation for the presence of the DNA. While potential innocent explanations are in fact numerous in most DNA cases, they are not well known and this article has demonstrated that there are a number of practical impediments to recognising flaws in the evidence and discharging the onus to 'explain away' the DNA link. This should be of particular concern when DNA can be used as the sole evidentiary foundation for a criminal conviction.[52] DNA database evidence has the potential to live up to its reputation as reliable and powerful evidence but only if its inherent dangers are properly understood

52 The issue of whether DNA evidence 'alone' is sufficient to found a conviction is a looming legal debate, yet to be determined conclusively by any Court of Criminal Appeal in Australia (but see *R v Pantoja*). In NSW charges are still routinely presented in District, and especially Local, Court matters where DNA cold hit evidence is the main or sole evidence of guilt. Anecdotal evidence suggests some 'no bill' applications to the DPP have been successful but many guilty pleas are also known to have been entered in such cases.

by all players in the criminal justice system; more attention is paid to evaluating the probative weight of DNA evidence in context with other evidence; and it is properly acknowledged that DNA database evidence, like any other form of evidence, is fallible and will always pose fears for the innocent.

The risk to innocent citizens exists whether or not the scope of the database is expanded and it goes beyond those identified to convicted offenders, crime victims and the family members of perpetrators and convicted offenders. It even exists if it is assumed that all those nominated by cold hits are in fact guilty. It has long been acknowledged as dangerous in a civilised society to allow law enforcement bodies to effortlessly secure criminal convictions. The job of a defence lawyer is not just to protect the innocent but to ensure the integrity of a system. If defence lawyers don't scrutinise and challenge strong prosecution cases complacency can develop amongst police officers, crime scene investigators and forensic scientists. This aura of complacency allows dangerous practices to flourish, and that is when all innocent people become in danger. Recently in the US reports surfaced of a practice called 'dry-labbing' where laboratory technicians would write reports that supported prosecution theories without ever testing the actual evidence (*Houston Chronicle* 2005). This practice could only emerge in an environment where technicians were confident that defence lawyers would never subpoena laboratory data which would usually include technician's bench notes. Competent scrutiny of DNA database evidence by defence lawyers may lead to only a few acquittals but, perhaps more importantly, it has the potential to keep all the players in the system honest.

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