TO CATCH A KILLER COUSIN: INVESTIGATIVE GENETIC GENEALOGY AS A CRITICAL EXTENSION OF FAMILIAL SEARCHING IN SERIOUS CRIME CONVICTIONS IN AUSTRALIA

CALLUM VITTALI-SMITH*

The ways in which DNA can be used to identify unknown offenders in criminal investigations is constantly evolving. This article takes a developmental approach, exploring the use of DNA profiling, familial searching, and investigative genetic genealogy ('IGG'), and considers whether Australia could, and should, expand its application of DNA analysis to identify offenders. Part II examines DNA profiling and familial searching which is now the status quo in Australia. However, it is then argued that familial searching is flawed, presenting unique issues of privacy and consent, and producing substantial biases. Part III then posits IGG as an emerging solution to the limitations of familial searching. Its development in the United States is explored, before explaining how the limitations of familial searching can be directly redressed by IGG. The article concludes by calling for IGG to be implemented in Australia, and offering some initial recommendations on how this might best be achieved.

'DNA neither cares nor knows. DNA just is. And we dance to its music.'[1]

I INTRODUCTION

On the evening of 2 February 1978, young newlyweds Brian and Katie Maggiore took their poodle Thumper on their daily walk around the quiet, tree-lined streets of Rancho Cordova in Northern California.[2] Without warning, a gunman wearing a ski mask approached them, and chased the couple as they desperately fled, running through gardens in an attempt to escape.[3] The assailant was fast and fit, and within

* BA/LLB (Hons) (USyd). Practising solicitor, guest lecturer and continuing professional development speaker on DNA use in criminal prosecutions. I extend my thanks to Dr Carolyn McKay, Dr Jason Chin, and Prof David Hamer for their support, guidance and encouragement.

1 Richard Dawkins, *River out of Eden: A Darwinian View of Life* (Weidenfeld & Nicolson, 1995) 133.

2 Michelle McNamara, 'In the Footsteps of a Killer: The Writer's Cut', *Los Angeles Magazine* (online, 27 February 2013) <https://www.lamag.com/thejump/in-the-footsteps-of-a-killer-the-writers-cut/6/>.

3 Federal Bureau of Investigation, 'Retired Sacramento County Sheriff's Detective Ray Biondi' (YouTube, 16 June 2016) <https://www.youtube.com/watch?v=Vp4f0VSfYqk>.

minutes Brian and Katie were gunned down execution-style next to a pool in a leafy backyard.[4] The killer fled into the night. Over time, it became clear to police that the Maggiores were victims of the Golden State Killer, who terrorised California with a spree of rapes and murders in the 1970s and 1980s.[5]

Despite the best efforts of investigators, the killer remained unidentified for decades. Then, a third cousin he had never met purchased a consumer DNA test to explore his family history.[6] This enabled investigators to apply the cutting-edge process of investigative genetic genealogy ('IGG'), which led to the 2018 arrest,[7] and eventual guilty plea,[8] of retired police officer Joseph DeAngelo. But this exciting new technology is not being used in Australia. Should it be? Could it be? What are we using now? To answer these questions, this article takes a developmental approach, exploring the evolution of DNA-based offender identification, applying a mix of international case analysis, Australian legislative analysis, and social science literature.

Part II examines the discovery and development of familial searching. It then demonstrates that not only is familial searching clearly permissible under the Australian statutory framework, but that it has now been applied in several cases. However, it will be made clear that familial searching has substantial limitations, including privacy and consent issues and the exacerbation of biases in the criminal justice system. If familial searching is so flawed, then what should Australia use instead?

Part III offers a novel and cutting-edge solution, positing IGG as a means of directly redressing the key limitations of familial searching. It explores the development and application of IGG in the United States, and explains how it responds to key privacy and consent issues of familial searching, and how it could go some way to redress the biases inherent in familial searching. This article concludes by arguing that, on the basis of existing legislation and police practices, IGG could be applied in Australia with ease, and should be the next step forward.

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4 Liz Kreutz, 'Golden State Killer: 15-Year-Old Witness Describes Hearing the Maggiore Murders', *ABC 10* (online, 27 April 2018) <https://www.abc10.com/article/news/local/sacramento/golden-state-killer-15-year-old-witness-describes-hearing-the-maggiore-murders/103-546420576>.

5 Avi Selk, 'The Most Disturbing Parts of the 171-Page Warrant for the Golden State Killer Suspect', *The Washington Post* (online, 2 June 2018) <https://www.washingtonpost.com/news/post-nation/wp/2018/06/02/the-most-disturbing-parts-of-the-171-page-warrants-for-the-golden-state-killer-suspect/>.

6 Ewen Callaway, 'Privacy Concerns over DNA Used for Crime Investigation' (2018) 562(7727) *Nature* 315, 316 <https://doi.org/10.1038/d41586-018-06997-8>.

7 Emily Shapiro, Whit Johnson and Jenna Harrison, 'Suspected "Golden State Killer" Seemed Shocked by Arrest, Told Police He Had a Roast in the Oven: Official', *ABC News* (online, 27 April 2018) <https://abcnews.go.com/US/suspected-golden-state-killer-shocked-arrest-told-police/story?id=54746113d>.

8 Heather Murphy and Tim Arango, 'Joseph DeAngelo Pleads Guilty in Golden State Killer Cases', *The New York Times* (online, 29 June 2020) <https://www.nytimes.com/2020/06/29/us/golden-state-killer-joseph-deangelo.html>; Dani Anguiano, 'Golden State Killer: Former Police Officer Pleads Guilty to String of Murders', *The Guardian* (online, 30 June 2020) <https://www.theguardian.com/us-news/2020/jun/29/golden-state-killer-joseph-deangelo-guilty-plea>.

II FAMILIAL SEARCHING

A The Science and How It Works

1 DNA Profiling

The power of DNA as an identification tool lies in the hypervariable minisatellite regions[9] of each individual's DNA. In 1985, geneticist Sir Alec Jeffreys discovered that performing a short tandem repeat ('STR') analysis of the core sequence of minisatellites can provide what he termed 'an individual-specific DNA "fingerprint" of general use in human genetic analysis'.[10] In other words, each individual has a unique pattern of minisatellites in their DNA, and an STR analysis – which is a fairly straightforward method of genetic comparison – can therefore identify whether two DNA samples belong to the same person.[11]

The immediate appeal of Sir Alec's discovery to law enforcement is easily understood: where investigators possess a crime scene DNA sample (for example, semen left on the clothing of a sexual assault victim,[12] or hair found under a homicide victim's fingernail),[13] they are able to use STR analysis to determine whether a suspect's DNA matches the crime scene sample. This technique, which became known as DNA profiling, was first implemented by law enforcement investigating the rape and murder of two teenage girls in neighbouring Leicestershire villages in the mid-1980s.[14] An intellectually disabled 17-year-old had confessed to one of the offences,[15] however when Sir Alec and his team conducted an STR analysis, the young man's minisatellites did not match the crime scene sample: despite his confession, he was not the killer.[16]

Capitalising on the new technology available, the investigators then arranged for a dragnet DNA search – calling for all local men to voluntarily provide DNA samples for STR analysis.[17] Although initially resulting in no matches, in an unusual twist, a male whose DNA did not match the crime scene sample confessed to having produced an identity document belonging to a friend, Colin Pitchfork,

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9 The most highly variable sequence of human DNA, distinct between all except identical twins: see Britannica, *Encyclopaedia Britannica* (online at 18 November 2022) Medicine, 'DNA Fingerprinting'.

10 Alec J Jeffreys, Victoria Wilson and Swee Lay Thein, 'Hypervariable "Minisatellite" Regions in Human DNA' (1985) 314(6006) *Nature* 67, 67 <https://doi.org/10.1038/314067a0>.

11 Kelly M Elkins, *Forensic DNA Biology: A Laboratory Manual* (Academic Press, 2013) xvi <https://doi.org/10.1016/C2011-0-06748-0>.

12 See, eg, *DPP v Challenger* [2019] VCC 894.

13 See, eg, *Aytugrul v The Queen* (2012) 247 CLR 170.

14 *R v Pitchfork* [2009] EWCA Crim 963 ('*Pitchfork*'); Robin M White and Jeremy JD Greenwood, 'DNA Fingerprinting and the Law' (1988) 51(2) *Modern Law Review* 145, 149 <https://doi.org/10.1111/j.1468-2230.1988.tb01748.x>.

15 Colin Dale, 'The Impact of DNA on Criminal Investigation' (2016) 7(3) *Journal of Intellectual Disabilities and Offending Behaviour* 105, 106 <https://doi.org/10.1108/JIDOB-07-2016-0010>.

16 Michael Naughton and Gabe Tan, 'The Right to Access DNA Testing by Alleged Innocent Victims of Wrongful Convictions in the United Kingdom?' (2010) 14(4) *International Journal of Evidence and Proof* 326, 332 <https://doi.org/10.1350/ijep.2010.14.4.362>.

17 Lutz Roewer, 'DNA Fingerprinting in Forensics: Past, Present, Future' (2013) 4(1) *Investigative Genetics* 22, 22 <http://dx.doi.org/10.1186/2041-2223-4-22>.

when providing his blood sample.[18] This had appeared to exonerate Pitchfork. However, following his friend's confession, Pitchfork was arrested under suspicion of the offences, and an STR analysis showed his DNA was a direct match with the crime scene sample.[19] Pitchfork was convicted of two counts of murder and, after being released from prison in 2021, was recalled after approaching young women, and remains incarcerated.[20] Despite Pitchfork's attempt to circumvent the investigation, DNA profiling not only led to his conviction, but also prevented the grave injustice that could have resulted had the intellectually disabled 17-year-old's confession been taken at face value.

Following its highly successful implementation in *R v Pitchfork* ('*Pitchfork*'),[21] DNA profiling has become one of the most fundamental and widely used forms of DNA evidence in criminal investigations. To facilitate its use, almost all developed law enforcement systems have established substantial DNA databases, which variably contain DNA samples of offenders, arrestees, and volunteers.[22] As of October 2021, the United States' ('US') National DNA Index System ('NDIS') contained 19,350,445 offender and arrestee profiles representing approximately 4% of the population.[23] The United Kingdom's ('UK') National DNA Database ('NDNAD') has collected DNA samples from all offenders convicted of felonies, as well as many arrestees (who did not necessarily go on to be convicted) since 1995.[24] As of September 2022, the NDNAD contains over 5,853,817 samples: 80% belonging to males.[25] As a result, it can be estimated that approximately 8% of British males are contained within the law enforcement DNA database.[26]

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18 Robin Napper, 'A National DNA Database: The United Kingdom Experience' (2000) 32(2) *Australian Journal of Forensic Sciences* 65, 65 <https://doi.org/10.1080/00450610009410799>.

19 Ibid.

20 Ciaran Fagan, 'Child Killer Colin Pitchfork "Will Make New Bid for Freedom" Later This Year, MP Confirms', *Leicester Mercury* (online, 4 August 2020) <https://www.leicestermercury.co.uk/news/leicester-news/child-killer-colin-pitchfork-will-4395249>; Sonia Kataria, 'Colin Pitchfork Parole Hearing Should Be Public, Says MP', *BBC News* (online, 4 October 2022) <https://www.bbc.com/news/uk-england-leicestershire-63122141>.

21 *Pitchfork* (n 14).

22 Ian Cobain, 'Killer Breakthrough: The Day DNA Evidence First Nailed a Murderer', *The Guardian* (online, 8 June 2016) <https://www.theguardian.com/uk-news/2016/jun/07/killer-dna-evidence-genetic-profiling-criminal-investigation>.

23 Federal Bureau of Investigation (US), 'CODIS-NDIS Statistics', *Law Enforcement Resources* (Web Page) <https://le.fbi.gov/science-and-lab-resources/biometrics-and-fingerprints/codis/codis-ndis-statistics>. Note that several participating laboratories have been unable to submit comprehensive updates due to ongoing COVID-19 restrictions, so this is likely to be an underestimate of the total number of profiles.

24 Henry T Greely et al, 'Family Ties: The Use of DNA Offender Databases to Catch Offenders' Kin' (2006) 34(2) *Journal of Law, Medicine and Ethics* 248, 250 <https://doi.org/10.1111/j.1748-720x.2006.00031.x>.

25 Home Office (UK), 'National DNA Database Statistics as of 30th September 2022' (Spreadsheet, October 2022) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1109589/FINDS_DNA_Website_Figures-30-09-2022_-_Final.ods >.

26 See Office for National Statistics (UK), 'Male and Female Populations', *Ethnicity Facts and Figures* (Web Page, 14 May 2019) <https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/male-and-female-populations/latest>; 'United Kingdom Population Mid-Year Estimate, *Office for National Statistics (UK)*, (Web Page, 24 June 2020). <https://web.archive.org/web/20221206104907/https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/timeseries/ukpop/pop>.

This means that if any of these men committed an offence, and left their genetic information at the crime scene, routine DNA profiling would result in a direct match and an immediate identification.

That about 1 in 12 British males are under effectively constant genetic surveillance is a sobering reality – and Australia is not far behind. As of 2019, Australia's national law enforcement DNA database, the National Criminal Investigation DNA Database ('NCIDD'), holds over 1,324,575 DNA profiles.[27] Between 2010 and 2016, the growth rate of samples was a remarkable 66.9%.[28] The NCIDD was established in 2001,[29] and is now administered by the Australian Criminal Intelligence Commission.[30] It is now used by law enforcement agencies in all states and territories both to upload DNA samples and to conduct DNA profiling searches. In the 2019–20 financial year, 111,393 searches attempting to match crime scene samples to existing offender or arrestee samples were performed.[31]

It should also be noted that in the field of genetic comparison, a non-match between two DNA samples, known as an 'exclusion', is generally considered to be conclusive evidence that they do not belong to the same person; whilst a full match between samples, known as an 'inclusion', is considered to provide highly suggestive, though not conclusive, evidence that the samples belong to the same person.[32] This is due to the recognition that although rare, false matches can occur; for example, due to an adventitious match, or sample contamination at the crime scene or in the laboratory.[33]

Importantly, DNA profiling only requires access to the regions of DNA believed to be non-coding,[34] which provide sufficient information to lead to identification, whilst not revealing additional personal information about the sample provider.[35] This is in stark contrast to alternative forms of DNA analysis, such as DNA phenotyping, which uses the coding regions of the sample provider's genome and can therefore reveal personal details including their ethnicity, aspects

27 Australian Criminal Intelligence Commission, *Australian Criminal Intelligence Commission Annual Report 2019–20* (Report, 16 September 2020) 60 ('*Annual Report 2019–20*').

28 Felix Ralph, 'Convictions through Kith and Kin: Legal, Policy and Ethical Issues in DNA Familial Matching and Genetic Metadata' (2018) 29(3) *Current Issues in Criminal Justice* 243, 245 <https://doi.org/10.1080/10345329.2018.12036100>.

29 Rachel Bradshaw, 'The Use and Misuse of DNA Profiles in Australia' (2013) 37(1) *Australian Bar Review* 17, 18.

30 Australian Criminal Intelligence Commission, 'National Criminal Investigation DNA Database', *Biometric and Forensic Services* (Web Page, 2021) <https://www.acic.gov.au/our-services/biometric-and-forensic-services>.

31 *Annual Report 2019–20* (n 27) 46.

32 Jeremy Gans and Gregor Urbas, 'DNA Identification in the Criminal Justice System' (Research Paper No 226, Australian Institute of Criminology, May 2002) 3.

33 Marcus Smith and Monique Mann, 'Recent Developments in DNA Evidence' (Research Paper No 506, Australian Institute of Criminology, November 2015) 2. See, eg, *R v Jama* (Victorian Court of Appeal, Warren CJ, Redlich and Bongiorno JJA, 7 December 2009).

34 DNA that does not encode protein sequences, and generally does not impact gene function. See Academic Press, *Encyclopedia of Evolutionary Biology* (online at 6 April 2023) 'Noncoding DNA Evolution: Junk DNA Revisited' 124; Academic Press, *Brenner's Encyclopedia of Genetics* (online at 6 April 2023) 'Non-coding'.

35 Smith and Mann (n 33) 2.

of their appearance such as hair and eye colour, and certain health issues, including psychological disorders.[36] DNA profiling is therefore significantly less intrusive than alternative forms of investigative DNA analysis: it provides investigators with either an inclusion or exclusion as to the suspect's identity, but does not and cannot reveal anything else.

2 Familial Searching

Despite its efficacy, the use of DNA profiling to identify unknown offenders has one inherent limitation: the unknown offender must *already* be included in the law enforcement DNA database. If the unknown offender is a first-time offender, or committed their last offence prior to the development of the law enforcement database, or has simply evaded apprehension for previous offences (or has, for some reason, been removed from the DNA database), DNA profiling will come back negative, as there will be no direct match to the crime scene sample.

However, when a DNA profiling search produces no direct matches, the search stringency can be amended, thus producing a list of any partial matches to the crime scene sample.[37] These partial matches do not precisely match the crime scene sample – and therefore cannot be the unidentified offender – however, they do share substantial amounts of DNA with the crime scene sample, and therefore are likely to be related to the unidentified offender.[38] Partial matches can be discovered inadvertently, such as when a traditional database search does not produce a direct match, but instead produces a very close match indicative of a familial relationship.[39]

Given the power of partial matches to significantly broaden the scope of law enforcement DNA databases, investigators began deliberately searching for partial matches – a technique which became known as familial searching.[40] When analysing the crime scene sample, investigators are able to perform lower stringency searches of the database, thus producing a list of partial matches. It is claimed that a 'reasonably tailored search' is generally likely to produce between 1 and 25 partial matches.[41] Many of these partial matches will not actually be related to the unidentified offender, as completely unrelated individuals may still have allele cells at specific loci in common. It is estimated that the DNA of two random, unrelated British individuals would match on average 6 or 7 of the 20 alleles[42] used in NDNAD searches.[43]

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36 Ibid 3.

37 Erin Murphy, 'Relative Doubt: Familial Searches of DNA Databases' (2010) 109(3) *Michigan Law Review* 291, 297–9.

38 Ibid.

39 Sophie Rushton, *Familial Searching and Predictive DNA Testing for Forensic Purposes: A Review of Laws and Practices* (Report, July 2010) 6.

40 Ibid.

41 Murphy (n 37) 298. See also Thomas M Reid et al, 'Use of Sibling Pairs to Determine the Familial Searching Efficiency of Forensic Databases' (2008) 2(4) *Forensic Science International: Genetics* 340, 341 <https://doi.org/10.1016/j.fsigen.2008.04.008>.

42 The version of each gene that occurs at a given site (locus) of DNA: see Britannica, *Encyclopaedia Britannica* (online at 18 November 2022) Genetics & Evolution, 'Allele'.

43 Greely et al (n 24) 251.

However, particularly close matches – those who share a minimum of approximately 13 alleles with the crime scene sample – are almost certainly related to the unidentified offender.[44] In fact, they are almost certainly an immediate relative: familial searching can identify a potential parent or child of the offender, or a potential sibling of the offender (who shares on average approximately 16.7 alleles).[45] Indeed, it is approximated that where a database sample matches at 13 or more alleles with the crime scene sample, there is only a 3% chance that the database sample is not related to the unidentified offender.[46] Where the database sample shares 13 or more alleles with the crime scene sample, and there is at least one match at each of those sites of shared DNA, then the chance the two samples are unrelated to each other is reduced to just 1 in 2000.[47] It is estimated that if a relative of the unidentified offender is indeed already in the database, and a familial search is conducted with appropriate stringency, there is an 80% chance that the relative will appear as a partial match.[48] It is clear that when combined with traditional policing and investigative work – which may very efficiently rule out certain relatives on the basis of age, gender, location, and opportunity[49] – familial searching may prove particularly useful in identifying unknown offenders.

B Pioneering Use in the United Kingdom and New Zealand

Much like DNA profiling, the UK pioneered the use of familial searching. It was first applied in 2002, in a cold case investigation into a series of rapes and murders committed in Port Talbot, Wales in the 1970s. Previous traditional law enforcement investigations had resulted in a shortlist of 500 potential suspects.[50] Almost 30 years later, a familial search was conducted, comparing the crime scene sample to the NDNAD. The results showed a very close partial match with a man named Paul Kappen, whose DNA was in the NDNAD due to previous convictions for motor vehicle theft.[51] The shared alleles between Kappen and the crime scene sample suggested the killer was an immediate relative.[52] Investigators soon realised that Kappen's deceased father, Joseph Kappen, was one of the 500 shortlisted suspects.[53] The strong familial match provided probable cause to exhume Joseph Kappen's remains and perform a further DNA test, which resulted

44 Murphy (n 37) 295.
45 Greely et al (n 24) 253.
46 Ibid 252.
47 Ibid.
48 Frederick R Bieber, Charles H Brenner and David Lazer, 'Finding Criminals through DNA of Their Relatives' (2006) 312(5778) *Science* 1315, 1316 <https://doi.org/10.1126/science.1122655>.
49 Ellen M Greytak, CeCe Moore and Steven L Armentrout, 'Genetic Genealogy for Cold Case and Active Investigations' (2019) 299(1) *Forensic Science International* 103, 108 <https://doi.org/10.1016/j.forsciint.2019.03.039>.
50 Robin Williams and Paul Johnson, 'Inclusiveness, Effectiveness and Intrusiveness: Issues in the Developing Uses of DNA Profiling in Support of Criminal Investigations' (2006) 33(3) *Journal of Law, Medicine and Ethics* 545, 554 <https://doi.org/10.1111/j.1748-720X.2005.tb00517.x>.
51 Kevin Toolis, 'The Hunt for the Saturday Night Strangler', *The Guardian* (online, 18 January 2003) <https://www.theguardian.com/lifeandstyle/2003/jan/18/weekend.kevintoolis>.
52 Ibid.
53 Williams and Johnson (n 50) 554.

in a direct match and confirmed Joseph Kappen was the Port Talbot rapist.[54] The Kappen case demonstrates the effective combination of traditional investigative methods – developing the suspect shortlist at the time of the offences – with modern technology, and illustrates the power of familial searching to resolve even decades-old cold cases.

It was in 2004 that familial searching secured its first conviction in an active criminal investigation, thus cementing its use by law enforcement in the UK and paving the way for a similar application in other jurisdictions. A driver in Surrey was killed when a brick was thrown from an overpass and crashed through his windscreen, striking his chest.[55] The brick contained not only the driver's blood, but also blood presumably from the unidentified offender, who had broken the window of a nearby vehicle shortly before the attack[56] – thus providing a perfect crime scene sample. This sample was then uploaded to the NDNAD, but no direct match was found.[57] A familial search, however, produced a series of partial matches: the closest shared 16 alleles with the crime scene sample.[58] As noted above, siblings share 16.7 alleles on average. When investigators discovered that the partial match had a brother, 20-year-old local Craig Harman was arrested and further DNA testing revealed he was a direct match to the crime scene sample.[59] Harman was convicted of manslaughter and sentenced to six years imprisonment.[60]

Following the success of the Kappen and Harman cases, familial searching became a fundamental mode of identification in serious crime investigations in the UK. Within its first decade of use, familial searching had been applied in around 210 cases and successfully led to the identification of 41 previously unknown offenders.[61] However, despite its prominent use, there is no legislation governing familial searching: it remains governed by confidential internal department policies.[62] Prior to undertaking a familial search of the NDNAD, investigators must receive approval from the Forensic Information National DNA Strategy Board.[63] Approval is only given in investigations into 'the most serious of crimes'.[64] However, interestingly, this threshold does not appear to be grounded in a determination of principle to limit the use of such an intrusive process to

54 Ibid.

55 Marc Smith and Gregor Frank Urbas, 'Regulating New Forms of Forensic DNA Profiling under Australian Legislation: Familial Matching and DNA Phenotyping' (2012) 44(1) *Australian Journal of Forensic Sciences* 63, 67 <https://doi.org/10.1080/00450618.2011.581250>.

56 Smith and Mann (n 33) 6.

57 Ibid.

58 Greely et al (n 24) 251.

59 Ibid.

60 Paul Cheston and Rebecca Mowling, 'Six Years for Lorry Driver's Killing', *Evening Standard* (online, 18 April 2004) <https://www.standard.co.uk/news/six-years-for-lorry-drivers-killing-6939990.html>.

61 CN Maguire et al, 'Familial Searching: A Specialist Forensic DNA Profiling Service Utilising the National DNA Database to Identify Unknown Offenders via Their Relatives' (2014) 8(1) *Forensic Science International: Genetics* 1, 5 <https://doi.org/10.1016/j.fsigen.2013.07.004>.

62 New Zealand Law Commission, *The Use of DNA in Criminal Investigations* (Issues Paper No 43, December 2018) 290 ('*DNA in Criminal Investigations*').

63 Home Office (UK), *National DNA Database Strategy Board Annual Report 2017/18* (Report, February 2019) 52.

64 Ibid 9.

assisting in the investigation of only the worst offences. Instead, the Board claims that this threshold is for practical reasons only, due to limited resources and the cost and staffing required to undertake familial searches.[65] If and when familial searching becomes more automated and requires the use of less resources, a more considered determination of this threshold may be required by the Board.

The legality of familial searching was considered in the New Zealand case *R v Reekers* ('*Reekers*').[66] A young woman was raped and murdered in Auckland in 2001. A semen stain provided a viable crime scene DNA sample, which was then uploaded to the National DNA Databank ('NDD').[67] Although there was no direct match, a later familial search revealed a partial match which shared DNA with the crime scene sample at a rate expected of siblings.[68] The partial match belonged to Anneke Bishop, who had been convicted of a minor driving offence in 2002 and had at the time of her arrest agreed to provide a DNA sample, which was then added to the NDD.[69] Bishop had a brother, Joseph Reekers; and whilst Reekers had previously been convicted of sexual assault,[70] his offences predated the establishment of the NDD. It was therefore familial searching which led to Reekers' arrest, and when his DNA was compared to the crime scene sample, it was a direct match.[71]

At this stage, Reekers opposed an application by police to obtain a further DNA profile for use at trial, claiming that the police were not permitted to undertake familial searching.[72] Reekers argued that the *Criminal Investigations (Bodily Samples) Act 1995* (NZ) ('*CI(BS) Act*') permitted the use of a DNA profile to determine whether or not two samples belonged to the same person, but not to identify any partial matches that may be related to one of the samples.[73] Woodhouse J rejected this argument, instead giving the *CI(BS) Act* a more liberal interpretation. In particular, Woodhouse J referred to section 27(1)(a) of the *CI(BS) Act*, which states that police may have access to, and may disclose, any genetic information stored on the NDD 'for the purpose of forensic comparison'.[74] Forensic comparison itself is separately defined as being a comparison performed for 'the purpose of confirming or disproving the involvement of any person in the commission of an offence'.[75]

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65 Ibid.

66 (High Court of New Zealand, Woodhouse J, 8 October 2008) ('*Reekers*').

67 Australia New Zealand Policing Advisory Agency, 'Familial DNA Searching' (Fact Sheet, January 2018) 1 <https://www.anzpaa.org.au/ArticleDocuments/220/Familial%20DNA%20Searching%20Fact%20Sheet.pdf.aspx>.

68 Ibid.

69 Tony Wall, 'My Brother, The Killer', *Stuff* (online, 3 January 2010) <https://www.stuff.co.nz/sunday-star-times/3203418/My-brother-the-killer>.

70 Tony Wall and Jonathan Marshall, '"He's My Friend. Would You Go to the Cops and Tell On Your Friend?"', *Stuff* (online, 21 February 2010) <https://www.stuff.co.nz/sunday-star-times/latest-edition/3354351/Hes-my-friend-Would-you-go-to-the-cops-and-tell-on-your-friend>.

71 Australia New Zealand Policing Advisory Agency (n 67).

72 *DNA in Criminal Investigations* (n 62) 280.

73 Ibid.

74 *Reekers* (n 66) [19].

75 *Criminal Investigations (Bodily Samples) Act 1995* (NZ) s 2(1).

Woodhouse J concluded that due to this wide language, the *CI(BS) Act* facilitates the use of genetic information stored on the NDD not only in relation to the crime scene sample and any direct matches as Reekers argued, but in relation to 'any person'.[76] There is no statutory restriction that DNA stored on the NDD can only be used to determine whether it is a direct match to a crime scene sample: the use of the sister's DNA fell within the definition of lawful 'forensic comparison'.[77] Therefore, whilst the *CI(BS) Act* makes no express mention of familial searching, and was indeed drafted long before familial searching became a recognised technique, it does accommodate familial searching.[78] The decision in *Reekers* exemplifies the preparation of common law courts to recognise the legality of familial searching even without express statutory provision. Indeed, it may be seen as having laid a foundation for Australian courts to take a similar approach.

C Legality of Familial Searching in Australia

Australia lagged about 15 years behind the UK and at least 10 years behind New Zealand and some US jurisdictions in its adoption and use of familial searching. As with the UK and New Zealand, Australia has no legislation which permits or prohibits – or even expressly references – familial searching. In 2012, five years before familial searching first led to an Australian criminal conviction, Marc Smith and Gregor Frank Urbas analysed the Australian statutory framework to determine whether familial searching was likely to be permitted.[79] Most prescient is section 23YDAF of the *Crimes Act 1914* (Cth), which governs the permissible matching of DNA profiles using the NCIDD. This section provides a table, listing the different types of possible DNA samples (crime scene, suspects, volunteers, serious offenders, missing persons, and unknown deceased persons), and determines which category of samples each are permitted to be genetically compared to.[80]

Following the *Crimes Legislation Enhancement Act 2003* (Cth)[81] and the *Crimes Act Amendment (Forensic Procedures) Act (No 1) 2006* (Cth),[82] the table in section 23YDAF does not expressly prohibit any sample combination for DNA matching purposes. In fact, DNA comparison between all categories of samples is expressly permitted, with the exception of DNA samples provided by 'limited purpose' volunteers, in which DNA matching is permitted only if it falls within those limited purposes. It is clear that an application of the permissible matching table expressly permits familial searching: this would generally involve a 'crime scene' sample (row 1) being compared to a 'serious offenders' sample (column 6) which is expressly permitted.

76 *Reekers* (n 66) [19].
77 *DNA in Criminal Investigations* (n 62) 280, 286.
78 Ibid 280.
79 Smith and Urbas (n 55) 63.
80 *Crimes Act 1914* (Cth) s 23YDAF(1) ('*Crimes Act*').
81 *Crimes Legislation Enhancement Act 2003* (Cth) sch 1 pt 3A item 7A.
82 *Crimes Act Amendment (Forensic Procedures) Act (No 1) 2006* (Cth) sch 1 items 27–31.

Profile to Be Matched	Is Matching Permitted?						
Column 1	**Column 2: Crime Scene**	**Column 3: Suspects**	**Column 4: Volunteers (limited purposes)**	**Column 5: Volunteers (unlimited purposes)**	**Column 6: Serious offenders**	**Column 7: Missing persons**	**Column 8: Unknown deceased persons**
1. Crime Scene	Yes	Yes	Only if within purpose	Yes	Yes	Yes	Yes
2. Suspects	Yes	Yes	Only if within purpose	Yes	Yes	Yes	Yes
3. Volunteers (limited purposes)	Only if within purpose	Only if within purpose	Only if within purpose	Only if within purpose	Only if within purpose	Only if within purpose	Only if within purpose
4. Volunteers (unlimited purposes)	Yes	Yes	Only if within purpose	Yes	Yes	Yes	Yes
5. Serious offenders	Yes	Yes	Only if within purpose	Yes	Yes	Yes	Yes
6. Missing persons	Yes	Yes	Only if within purpose	Yes	Yes	Yes	Yes
7. Unknown deceased persons	Yes	Yes	Only if within purpose	Yes	Yes	Yes	Yes

Figure 1: Permissible Matching Table in Section 23YDAF of the *Crimes Act 1914* (Cth)

Complications could arise if the NCIDD sample – the partial match – belonged to an individual who had not committed a 'serious offence', which is defined in section 3C as being one that is punishable by imprisonment for two years or more.[83] However in those cases, it is possible that a combination of a 'crime scene' sample (row 1) and either 'volunteer (limited purposes)' (column 4) or 'volunteer (unlimited purposes)' (column 5) could apply. A forensic 'volunteer' is defined very broadly in section 23XWQ as a person 'who volunteers to a constable to

83 *Crimes Act* (n 80) s 3C(1) (definition of 'serious offence').

undergo a forensic procedure'.[84] This generous definition is likely to capture many arrestees and offenders who agree or consent to provide a DNA sample to the arresting officer (such as Anneke Bishop in *Reekers*) and are thus 'volunteers'. These 'volunteers' would then need to be categorised as having provided their DNA sample either for unlimited purposes, or only for a limited purpose. If the former, familial searching is permitted. If the latter, a familial search will not be permitted unless the limited purpose for which the 'volunteer' provided their sample was, or included, familial searching.

Ultimately, the section 23YDAF table does not expressly prohibit any form of DNA matching, and it is likely that in the vast majority of cases familial searching is permitted.[85] It should also be noted that equivalent permissible matching tables appear in state legislation in New South Wales ('NSW'),[86] Victoria,[87] Tasmania,[88] Western Australia,[89] and the Australian Capital Territory.[90] Whilst these tables are generally more restrictive than the Commonwealth table, all allow matching between crime scene samples and serious offender samples, thus providing a foundation for familial searching. Whilst the Australian Law Reform Commission ('ALRC') has noted the inconsistent statutory treatment of permissive DNA matching between jurisdictions,[91] it is sufficient for the purposes of this article to note that familial searching is not prohibited in any Australian jurisdiction.

With the respective statutory frameworks implicitly permitting familial searching in both countries, the Australia New Zealand Policing Advisory Agency ('ANZPAA') has developed a clear policy guideline for its use.[92] The ability to conduct familial searches pursuant to the policy guideline is consistently described as being 'subject to legislation'.[93] It is therefore likely that this guideline will continue to apply until familial searching is expressly considered in the relevant statutory framework. The distinction is drawn between intra-jurisdictional and inter-jurisdictional searches. Intra-jurisdictional searches involve comparing the crime scene sample to the samples held on the law enforcement DNA database of a single state or territory.[94] Intra-jurisdictional searches require approval from the relevant state or territory DNA testing body, and approval is generally only granted to assist investigations into 'serious unsolved crimes'.[95] Inter-jurisdictional searches involve comparing the crime scene sample with all other samples in the NCIDD.[96] There is a National Policy governing inter-jurisdictional familial searches, but like

84 Ibid s 23XWQ(1)(a).
85 Smith and Urbas (n 55) 79.
86 *Crimes (Forensic Procedures) Act 2000* (NSW) s 93(1).
87 *Crimes Amendment (DNA Database) Act 2007* (Vic) s 8(1).
88 *Forensic Procedures Act 2000* (Tas) s 54(1).
89 *Criminal Investigation (Identifying People) Act 2002* (WA) s 78.
90 *Crimes (Forensic Procedures) Act 2000* (ACT) s 97.
91 Australian Law Reform Commission, *Essentially Yours: The Protection of Human Genetic Information in Australia* (Report No 96, 30 May 2003) vol 2, 989 [40.2] ('*Essentially Yours*').
92 Australia New Zealand Policing Advisory Agency (n 67).
93 Ibid.
94 Ibid.
95 Ibid.
96 Ibid.

the UK[97] and New Zealand,[98] this policy is not publicly available.[99] What is known is that searches are subject to strict case criteria and strict approval criteria.[100] Known limitations include the offence being amongst 'the most serious crimes', and that 'all lines of other investigative work have been exhausted'.[101] These restrictions also mirror what is known about the UK and New Zealand policies.

The publicly available ANZPAA policy guideline also clearly outlines the steps to be involved in any familial search conducted in Australia and New Zealand. Once approval is granted by the relevant body, the search is performed, and a list of DNA samples belonging to potential biological relatives of the crime scene sample is developed.[102] There are then two potential approaches for ranking this list. The first is a statistical threshold approach, under which 'appropriate experts' recommend a certain amount of shared DNA to be used as a threshold, and only partial matches with at least that amount will appear on the list.[103] The second is a top candidates approach, under which 'appropriate experts' suggest a certain number of samples to be included on the list – for example, 20 – and therefore the list will include only the 20 highest partial matches.[104] The final candidate list is then provided to investigators.

This alone does *not* provide the investigators with the identity of the hitherto unknown offenders. It simply provides a list of *potential* biological relatives and, if the partial match is high enough, the likely biological relationship to the offender. It is then up to the police to investigate the partial matches and their families, in order to identify the unknown offender. If this leads to a tentative identification of the offender, their DNA profile must then be compared to the crime scene sample to see if it is a direct match.[105] Returning to the section 23YDAF permissible matching table (Figure 1), this search is permitted, as it compares a 'suspects' sample (row 2) to a 'crime scene' sample (column 2). Overall, the ANZPAA guidelines indicate that although familial searching is not legislated for in Australia, it is comprehensively regulated.

D Use of Familial Searching in Australia

Familial searching has now led to at least two convictions in Australia. Although neither were published and one remains suppressed, it appears both have complied with the ANZPAA policy guidelines, and that both generally reflect the above analysis of the existing statutory framework.

97 *DNA in Criminal Investigations* (n 62) 290.
98 Ibid 281.
99 Ibid 291.
100 Grace Tobin and Chris Gillett, 'The Controversial Forensic Test Catching Killers and Rapists through Relatives' DNA', *ABC News* (online, 14 June 2020) <https://www.abc.net.au/news/2020-06-15/forensic-test-catching-killers-and-rapists-through-familys-dna/12349898>.
101 Ibid.
102 Australia New Zealand Policing Advisory Agency (n 67).
103 Ibid.
104 Ibid.
105 *DNA in Criminal Investigations* (n 62) 282.

The second and to date only non-suppressed Australian conviction on the basis of familial searching occurred in *R v Matthew Ross White* ('*White*'),[106] heard in the Supreme Court of Queensland. The body of a 42-year-old woman was found in a river in Far North Queensland in 2017.[107] She had been murdered. A viable crime scene DNA sample was located on twine discarded alongside her body.[108] A search of the law enforcement DNA database did not produce any direct matches.[109] The circumstances of this case allowed police to invoke the unusual method of a dragnet DNA search: just as this technique proved useful in the small Leicestershire villages in *Pitchfork*, it was appropriate here in the remote Queensland community of Cooktown. One obvious benefit of a dragnet DNA search is that it circumvents the approval process for familial searching as described in the ANZPAA. Investigators appealed for locals to volunteer their DNA for the purposes of familial searching. Two hundred locals volunteered and provided their DNA.[110]

Returning to the section 23YDAF permissible matching table (Figure 1), this dragnet search is clearly permissible, comparing a 'crime scene' sample (row 1) with a 'volunteers (limited purpose)' sample (column 4), as the volunteers expressly provided their DNA sample to police for the limited purpose of performing a familial search. Therefore, the familial search is clearly permitted as it is 'within purpose'. Amanda White, one of the locals who volunteered her DNA, proved to be a very strong partial match with the crime scene sample: that of parent and child.[111] Her son, 27-year-old Matthew White, confessed to the murder[112] and was sentenced to life imprisonment.[113] Like in instances of sexual assault, DNA evidence can have substantial effects on the criminal justice process in homicide trials: cases invoking DNA evidence are over 14 times more likely to reach court,[114] and juries are over 23 times more likely to convict a defendant where the prosecution elicits DNA evidence.[115] In cases such as *White*, where small remote communities are engulfed by shock and fear following a local homicide which would otherwise likely be unsolvable, familial searching can provide safety and closure.

106 (Supreme Court of Queensland, Henry J, 22 August 2019) ('*White*').

107 Kristy Sexton-McGrath, 'Cooktown Woman Donna Steele Murdered during Extortion Bid Gone Wrong, Cairns Court Told', *ABC News* (online, 21 August 2019) <https://www.abc.net.au/news/2019-08-20/donna-steele-murder-cooktown-court-trial-cairns/11427972>.

108 Tobin and Gillett (n 100).

109 Ibid.

110 Ibid.

111 Ibid.

112 Kristy Sexton-McGrath, 'Accused Murderer Matthew White Changes Plea to Guilty over Death of Donna Steele', *ABC News* (online, 22 August 2019) <https://www.abc.net.au/news/2019-08-21/cooktown-murder-donna-steele-matthew-ross-white-drug-strangle/11434520>.

113 Kirsty Sexton-McGrath and Jesse Thompson, 'Matthew Ross White Sentenced to Life Behind Bars for Killing Cooktown Woman in Botched Extortion Bid', *ABC News* (online, 23 August 2019) <https://www.abc.net.au/news/2019-08-22/cooktown-murder-matthew-ross-white-gets-life-in-prison/11437146>.

114 Michael Briody, 'The Effects of DNA Evidence on Homicide Cases in Court' (2004) 37(2) *Australian and New Zealand Journal of Criminology* 231, 245 <https://doi.org/10.1375/acri.37.2.231>.

115 Ibid 242.

E Limitations of Familial Searching

Despite the putative success stories of *White* and the further suppressed Australian case, the recent embrace of familial searching in Australia should not be celebrated. The use of familial searching as the exclusive tool of DNA analysis for identification in criminal investigations is productive of serious injustices. These injustices can be broadly categorised into privacy and consent issues; the criminalisation of families; and the exacerbation of existing issues of overrepresentation in the criminal justice system, which in Australia is highly racialised.

1 Privacy and Consent Issues

Any application of DNA comparison to determine offender identity raises some degree of concern about privacy.[116] Even DNA profiling relies on the development and maintenance of law enforcement DNA databases, meaning law enforcement departments hold the personal genomic data of arrestees and convicted offenders. Some immediate privacy concerns – such as the potential use of DNA to determine health outcomes and be misused by government departments or the private sector (for example, insurance companies using DNA profiles to determine genetic predisposition to diseases and restricting coverage on that basis)[117] – are arguably placated by the storage and use by law enforcement of only non-coding regions of DNA. As explained above, these regions can assist in identification but do not reveal personal attributes or physical characteristics.

However, a particular privacy concern raised by familial searching is that it makes partial matches – those arrestees or offenders already on the NCIDD who then partially match a crime scene sample – into what Sonia M Suter has termed 'genetic informant[s]'.[118] The unknown offender could not be identified but for the presence of the partial matches on the NCIDD. These partial matches may therefore be subject to significant emotional and psychological distress, feelings of guilt, and substantially damaged relationships with the newly identified offender.[119] Whilst concerns about the creation of genetic informants have been raised in the literature,[120] often overlooked are their actual lived experiences. One example is Anneke Bishop in *Reekers* – she has described her brother as blaming her for giving her DNA sample to police upon her arrest for dangerous driving many years ago, and believing his identification and conviction for murder was '[her] fault'.[121]

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116 Rushton (n 39) 12.

117 Jane Tiller et al, 'Genetic Discrimination by Australian Insurance Companies: A Survey of Consumer Experiences' (2020) 28(1) *European Journal of Human Genetics* 108 <https://doi.org/10.1038/s41431-019-0426-1>; Laura Spinney, 'Your DNA is a Valuable Asset, so Why Give It to Ancestry Websites for Free?', *The Guardian* (online, 16 February 2020) <https://www.theguardian.com/commentisfree/2020/feb/16/dna-hugely-valuable-health-tech-privacy>.

118 Sonia M Suter, 'All in the Family: Privacy and DNA Familial Searching' (2010) 23(2) *Harvard Journal of Law and Technology* 309, 328.

119 Murphy (n 37) 319–20.

120 See, eg, Mary McCarthy, 'Am I My Brother's Keeper? Familial DNA Searches in the Twenty-First Century' (2011) 86(1) *Notre Dame Law Review* 381, 400; Ralph (n 28) 248.

121 Wall (n 69).

Ms Bishop suffered a panic attack and significant mental distress following her realisation that it was her DNA sample that led to her brother's arrest.[122] Ms Bishop's experience is likely to be replicated in many instances of familial searching, the emotional distress compounded by the fact that it is effective only in cases of immediate biological relatives: parents, children and siblings.

Indeed, this biological limitation of familial searching produces issues of its own: although the concept of 'family' is generally considered to be a social construct,[123] familial searching is entirely restricted to base biological constructs of 'family'. As it relies on partial matches suggestive of immediate biological relationships, there is no space within familial searching for even common non-biological relationships, such as adoption, step-parenting, and non-paternity events (where someone believed to be a child's father is not the biological father).[124] Familial searching can therefore reveal genetic information previously unknown to those involved: it may, for example, produce a partial match indicative of 'parent-child' to a putatively childless man, and thus reveal the existence of a hitherto unknown biological child.[125] These discoveries can have significant psychological effects on the individuals involved, and it is clear that a familial search led by criminal investigators is a particularly unfavourable context in which to make such a discovery.

Given these significant concerns, it might be expected that there are stringent requirements of informed consent before familial searching can be conducted. The matters which a suspect must be informed of before giving consent to undergo a forensic procedure (such as providing a DNA sample) are covered by section 23WJ of the *Crimes Act 1914* (Cth). These include the purpose for which the forensic procedure is required,[126] and how it will be carried out.[127] However, as familial searching is not expressly referenced in the legislation, there is no particular requirement that an arrestee or offender be told that a DNA sample provided by them may later become relevant as a partial match in a familial search. Indeed, as the NCIDD was established in 2001 and familial searching was not used in Australia until 2017, the vast majority of the 1,324,575 individuals whose DNA is stored on the database simply could not have been informed about the potential application of familial searching to their DNA sample when providing their sample. Illustrating this again with the New Zealand example of *Reekers*, at

122 Ibid.

123 See, eg, Lisa Young et al, *Family Law in Australia* (LexisNexis Butterworths, 9th ed, 2016); *Royal Commission on Human Relationships* (Final Report, 21 November 1977) vol 4, 1; 'Family Characteristics and Transitions', *Australian Bureau of Statistics* (Web Page, 26 February 2015) <https://www.abs.gov.au/statistics/people/people-and-communities/family-characteristics-and-transitions/latest-release>.

124 Erica Haimes, 'Social and Ethical Issues in the Use of Familial Searching in Forensic Investigations: Insights from Family and Kinship Studies' (2006) 34(2) *Journal of Law, Medicine and Ethics* 263, 265 <https://doi.org/10.1111/j.1748-720X.2006.00032.x>.

125 See, eg, BA Scelza et al, 'High Rate of Extrapair Paternity in a Human Population Demonstrates Diversity in Human Reproductive Strategies' (2020) 6(8) *Science Advances* 6195 <https://doi.org/10.1126/sciadv.aay6195>. Cf Michael Gilding, 'The Fatherhood Myth', *Inside Story* (online, 26 July 2011) <https://insidestory.org.au/the-fatherhood-myth/>.

126 *Crimes Act* (n 80) s 23WJ(1)(b).

127 Ibid s 23WJ(1)(d).

the time Ms Bishop agreed to provide her DNA sample to police upon her arrest in 2002, familial searching had not publicly been used anywhere in the world. She may have consented to her DNA sample being added to the law enforcement database, but she could not have foreseen the use of familial searching to connect her brother with a homicide on the basis of her DNA.

2 Criminalisation of Families

Henry T Greely et al categorised an individual as 'findable' using familial searching if they had a first degree relative whose DNA was stored on the relevant law enforcement DNA database.[128] Applying this in the Australian context in 2018, Felix Ralph calculated that up to five million Australians are 'findable' using familial searching.[129] That represents approximately 20% of the total Australian population,[130] who are therefore subject to lifelong genetic surveillance. If these individuals commit an offence and leave a crime scene sample, they will be almost immediately identifiable using familial searching; whilst the remaining 80% of the Australian population will not be identifiable in the same circumstances. This distinction essentially creates two classes: a criminal class who are under constant, and intergenerational, genetic surveillance; and a non-criminal class who are not subject to the same level of genetic surveillance.

These separate classes are entirely biologically determined as identifiability through familial searching relies on the presence of an immediate relative's DNA on a law enforcement database. In the US, concerns have been raised that through familial searching, individuals become the target of investigations, and indeed become suspects, on the basis entirely of the past criminal behaviour of their family members.[131] Erica Haimes has raised the concern that this appears to reinforce 'stereotypes about the "heritability" of criminality'.[132] Indeed, placing individuals under genetic surveillance on the basis of the criminal acts of their genetic relatives is certainly suggestive of archaic criminological theories of biological determinism.[133] The creation of a 'criminal' and a 'non-criminal' class is a highly concerning effect of familial searching, and one which appears almost impossible to resolve.

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128 Greely et al (n 24) 259.

129 Ralph (n 28) 245.

130 'Population Clock', *Australian Bureau of Statistics* (Web Page, 18 November 2022) <https://www.abs.gov.au/ausstats/abs%40.nsf/94713ad445ff1425ca25682000192af2/1647509ef7e25faaca2568a900154b63?OpenDocument>.

131 McCarthy (n 120) 401.

132 Haimes (n 124) 271.

133 See, eg, Elisabetta Sirgiovanni, 'Criminal Heredity: The Influence of Cesare Lombroso's Concept of the "Born Criminal" on Contemporary Neurogenetics and Its Forensic Applications' (2017) 29(1) *Journal of History of Medicine* 165; Nicolas Carrier and Kevin Walby, 'Ptolemizing Lombroso: The Pseudo-revolution of Biosocial Criminology' (2014) 6(1) *Journal of Theoretical and Philosophical Criminology* 1 <https://doi.org/10.1002/9781118517390.wbetc024>.

3 Racial Bias: Overrepresentation of Indigenous Australians

The creation of a biologically determined 'criminal class' is itself demonstrative of unwelcome bias, but even further bias is revealed when considering *who* falls within this class. Because law enforcement DNA databases, such as the NCIDD, are primarily comprised of the DNA profiles of arrestees and convicted offenders, any overrepresentations in the criminal justice and law enforcement systems will be directly reflected on the databases. In turn, because familial searching relies entirely on these databases, it not only further reflects, but in fact exacerbates these overrepresentations and existing injustices. Even proponents of familial searching, such as Frederick R Bieber, Charles H Brenner and David Lazer, admit that it undeniably 'amplifies these existing disparities' within the criminal justice system.[134]

The racial biases produced by familial searching were first considered in the US context. Because of the differential arrest rates and chronic overrepresentation of African Americans in the criminal justice system, US law enforcement DNA databases are expected to include approximately five times more African Americans than white Americans.[135] Greely et al have calculated that approximately 6.6 million African Americans will either be on a law enforcement DNA database, or a first-degree relative of someone on the database (and thus identifiable through familial searching).[136] This represents 17% of the total African American population[137] – considerably higher than the estimated 4% of the white population who are similarly 'findable'.[138] Where law enforcement DNA databases include those who have been arrested but not necessarily convicted, this effect is amplified even further. If a database included only arrestees, DH Kaye and Michael E Smith found that in some areas of the US, up to 90% of African American males would be included on the database.[139] Such a database would, they argue, 'have the look and feel of a universal DNA database for black males'.[140] This may not be the case with most state or national law enforcement DNA databases, but the fact that African Americans are indeed overrepresented on these databases by approximately five times – and are thus five times more likely to be identifiable using familial searching – is deeply problematic and a cogent argument against the use of familial searching.

The racialised effects of familial searching have also been analysed in the New Zealand context. The Law Commission of New Zealand has recognised that due to their overrepresentation in the criminal justice system, 'Maori adults are much more likely to have a close relative on the known person databank' and will therefore be impacted by familial searching at a greatly disproportionate rate compared to non-Maori adults.[141] The Commission noted calculations that approximately 15% of the Maori population had a DNA profile on the law enforcement database, compared

134 Bieber, Brenner and Lazer (n 48) 1316.
135 Rushton (n 39) 15.
136 Greely et al (n 24) 259.
137 Ibid.
138 Ibid.
139 DH Kaye and Michael E Smith, 'DNA Identification Databases: Legality, Legitimacy, and the Case for Population-Wide Coverage' [2003] (3) *Wisconsin Law Review* 413, 455.
140 Ibid 456.
141 *DNA in Criminal Investigations* (n 62) 283.

with only 3.4% of the non-Maori population.[142] This ratio is comparable to the racial disparity revealed in the US calculations, suggesting this is an issue likely to be replicated in all societies with racialised criminal justice systems. Interestingly, in New Zealand, the argument has been put forward that increased use of familial searching may in fact breach section 19 of the *New Zealand Bill of Rights Act 1990* (NZ), which protects the right to freedom from discrimination on the grounds of, inter alia, race.[143] While this argument has not gained traction, and familial searching continues to be applied in New Zealand, it does illustrate the increasing recognition that familial searching is a deeply flawed identification technique not only reflective, but actively productive of substantial racial injustice.

Because familial searching has only led to two convictions in Australia thus far, there is very limited analysis of its racial outcomes here. However, drawing upon the comprehensive assessments in the US and New Zealand, confident conclusions can be drawn. Aboriginal and Torres Strait Islanders are overrepresented in Australia's criminal justice system: although they make up approximately 2–3% of the Australian population, they constitute 27% of the national prison population.[144] In fact, the Aboriginal and Torres Strait Islander imprisonment rate – 2,440 per 100,000,[145] is higher than the African American imprisonment rate in the US, at 2,207 per 100,000.[146] These figures will be directly reflected on the NCIDD, and therefore directly lead to the identifiability of Aboriginal and Torres Strait Islanders using familial searching.

Particularly alarming is the fact that 30% of all Aboriginal and Torres Strait Islander males have come before Corrective Services at some point in their lives.[147] Even if just over half of those males came from different nuclear families, and assuming that each have an average of five immediate blood relatives – then almost every Aboriginal and Torres Strait Islander living in Australia will be identifiable using familial searching and thus subject to lifelong, and intergenerational, genetic surveillance. Kaye and Smith's notion of a 'universal DNA database for black males' in certain US jurisdictions could therefore be a reality in Australia in 2023.[148] This issue is further exacerbated by the fact that even if the racialised issues of overrepresentation in the criminal justice system improve going forward, the DNA samples of arrestees and offenders have been added to the NCIDD since 2001. The racial biases that existed at that time, and have persisted over the intervening 20 years,[149] will always be reflected in the NCIDD and will therefore always be

142 Ibid.
143 Ibid 53.
144 Hannah Kingston, 'What is the Indigenous Incarceration Rate in Australia?', *Crikey* (online, 15 June 2020) <https://www.crikey.com.au/2020/06/15/what-is-the-indigenous-incarceration-rate-in-australia/>.
145 Jens Korff, 'Aboriginal Prison Rates', *Creative Spirits* (Web Page, 24 October 2022) <https://www.creativespirits.info/aboriginalculture/law/aboriginal-prison-rates>.
146 Ibid.
147 Ibid.
148 Kaye and Smith (n 139) 456.
149 See, eg, Lorena Allam, Calla Wahlquist and Nick Evershed, 'Aboriginal Deaths in Custody: 434 Have Died Since 1991, New Data Shows', *The Guardian* (online, 6 June 2020) <https://www.theguardian.com/australia-news/2020/jun/06/aboriginal-deaths-in-custody-434-have-died-since-1991-new-data-shows>.

reflected in familial searching outcomes. Ultimately, Ralph's suggestion that the 'question of racialised justice' could be the 'strongest argument against' familial searching is not only clearly cogent,[150] but is perhaps a conservative estimation of its fatality to any serious pro-familial searching argument.

E Familial Searching as the Worst-Case Scenario in DNA-based Offender Identification

As the preceding section has demonstrated, familial searching is a deeply problematic investigative technique which raises serious concerns about privacy and consent, creates a biologically determined criminal class subject to intergenerational genetic surveillance, and not only reflects, but actively exacerbates existing racial injustices concomitant to the criminal justice system. Some commentators, such as Erin Murphy, have called for familial searching to be banned outright, arguing that it represents much of what modern 'constitutional and evidentiary rules have long endeavored to counteract'.[151] However, whilst it may be tempting to suggest that simply preventing the use of familial searching would avoid the injustices it produces, it is abundantly clear that familial searching is an emerging and expanding technique, and its use is likely to increase.

Familial searching has now been used in hundreds of cases in the UK,[152] and over 100 familial searches have been conducted in New Zealand.[153] It has also been used in several US jurisdictions,[154] including for increasingly minor offences, such as car break-ins,[155] although this is not without controversy as policies generally indicate its use should be reserved only for serious offences.[156] The fact that familial searching has been consistently applied over the course of almost 20 years, led to numerous convictions, and been unsuccessfully challenged in other common law jurisdictions,[157] suggests that it is very unlikely that Australia will ban or cease the use of familial searching. This is especially the case now that familial searching has led to two convictions in separate Australian jurisdictions – for rape in South Australia and homicide in Queensland – with the judge in the former praising the DNA evidence presented. Furthermore, the NCIDD is consistently expanding – by 66.9% between 2010 and 2016, for example[158] – and in 2018 it was announced that a new program was being integrated into the NCIDD with the express purpose

150 Ralph (n 28) 253.
151 Murphy (n 37) 304.
152 Maguire et al (n 61) 5.
153 *DNA in Criminal Investigations* (n 62) 281.
154 Ibid 290.
155 Michael B Field et al, 'Study of Familial DNA Searching Policies and Practices: Case Study Brief Series' (Research Report No 251081, National Criminal Justice Reference Service, August 2017) 5.
156 See, eg, Anne Marie Schubert, 'Memorandum of Understanding: Investigative Genetic Genealogy Searching' (Draft Memorandum of Understanding, Sacramento County District Attorney's Office) <https://chia187.wildapricot.org/resources/Documents/Sacramento%20County%20District%20Attorney's%20Office%20-%20IGG%20MOU%20Example.pdf> ('Draft Memorandum of Understanding').
157 See, eg, *Reekers* (n 66).
158 Ralph (n 28) 245.

of allowing familial searching in Australia to become 'more coordinated and standardized'.[159]

These developments are all indicative of an intended expansion of familial searching in Australia. In 2019, Damien Abarno et al explicitly called for familial searching to be used earlier in the criminal investigation process, in order to minimise the resource-intensive police work generally conducted prior to a DNA database search being conducted.[160] Of course, the benefits of familial searching do need to be recognised: not only could it save considerable time and resources,[161] but by identifying offenders who would otherwise not be linked to the crime and almost certainly never be identified, familial searching can achieve justice for victims and keep the community safe.

However, the substantial limitations of familial searching make its ongoing use clearly problematic. Most of the issues that have been discussed, from informed consent, to the creation of a criminal class, to the exacerbation of racial biases, arise out of the fact that familial searching is inherently limited to law enforcement DNA databases, and therefore targets the relatives of criminals. If the same process was to be applied, for example, to a universal database, then many of these concerns would immediately subside.

Indeed, several legal commentators and academics have suggested that the creation of a universal DNA database is a necessary step. Murphy argues that if the benefits of DNA identification are considered to outweigh the negatives, then a national, universal DNA database is the 'equitable and optimal route'.[162] Kaye and Smith have strongly advocated for a universal DNA database, arguing that it would advance 'both public safety and racial evenhandedness in the criminal justice system'.[163] Indeed, Greely et al have suggested that a universal DNA database is the *only* way to avoid racialised justice.[164] There is substantial merit in these arguments: for as long as the criminal justice system is affected by racial injustice, so too will familial searching be affected. However, as these commentators recognise, a universal DNA database is extremely unlikely to be established, primarily on social and political grounds.[165]

If a universal database is not the answer, what is? There is an emerging solution which has not yet been comprehensively considered in the literature, and which this article explores in Part III: the complementary application of investigative genetic genealogy.

159 Damien Abarno et al, 'The First Australian Conviction Resulting from a Familial Search' (2019) 51(1) *Australian Journal of Forensic Sciences* 56, 59.
160 Ibid.
161 Ibid.
162 Murphy (n 37) 308.
163 Kaye and Smith (n 139) 440.
164 Greely et al (n 24), discussed in Ralph (n 28) 253.
165 Kaye and Smith (n 139) 441.

III INVESTIGATIVE GENETIC GENEALOGY

A The Science and How It Works

IGG aims to discover the identity of a crime scene sample by applying genetic genealogy, which combines DNA data with traditional genealogical research (based primarily on civil records such as birth, marriage and death certificates) to form likely conclusions about familial relationships. Unlike DNA profiling and familial searching, which utilise short tandem repeats, genetic genealogy examines the hundreds of thousands of single nucleotide polymorphisms ('SNPs')[166] of the autosome.[167] Two individuals are likely to be genetically related if they share a certain number of SNPs. Further precision is provided by an analysis of the length of the shared DNA segments between two individuals. Closer relatives share longer stretches of DNA, and these strands of DNA go through a process of recombination and get broken up in each new generation.[168] The length of the DNA segments shared between two individuals can suggest how many generations between each individual and their most recent common ancestor, and therefore how closely they are likely to be related.[169]

In an impressive citizen science project, Blaine T Bettinger's 'Shared cM Project' has collected over 60,000 submissions from amateur genetic genealogists setting out the amount of shared centimorgans[170] between individuals whose biological relationship to each other is known with certainty.[171] These submissions have been aggregated and the resulting data can be used to estimate the degree of relativity between two genetically connected individuals. For example, first cousins share on average 866 centimorgans with each other; second cousins share an average of 229 centimorgans; and third cousins share an average of 73 centimorgans.[172] The number of shared centimorgans decreases as the degree of relativity becomes more distant.

166 Variation in a genetic sequence, used to identify the location of genes on chromosomes: see Britannica, *Encyclopaedia Britannica* (online at 18 November 2022) Genetics & Evolution, 'Single Nucleotide Polymorphism' <https://www.britannica.com/science/single-nucleotide-polymorphism>.

167 The 22 non-sex chromosomes in each human's DNA: see Britannica, *Encyclopedia Britannica* (online at 18 November 2022) Cells, Organs & Tissues, 'Autosome' <https://www.britannica.com/science/autosome>; Greytak, Moore and Armentrout (n 49) 103.

168 Greytak, Moore and Armentrout (n 49) 105.

169 Ibid.

170 A unit of genetic measurement showing how much DNA is shared between relatives: see Annelie Hansen, 'Untangling the Centimorgans on Your DNA Test', *FamilySearch Blog* (Blog Post, 6 April 2020) <https://www.familysearch.org/blog/en/centimorgan-chart-understanding-dna/>.

171 Blaine T Bettinger, 'The Shared cM Project Version 4.0' (Research Report, March 2020) 1 <https://thegeneticgenealogist.com/wp-content/uploads/2020/03/Shared-cM-Project-Version-4.pdf>.

172 Ibid 52.

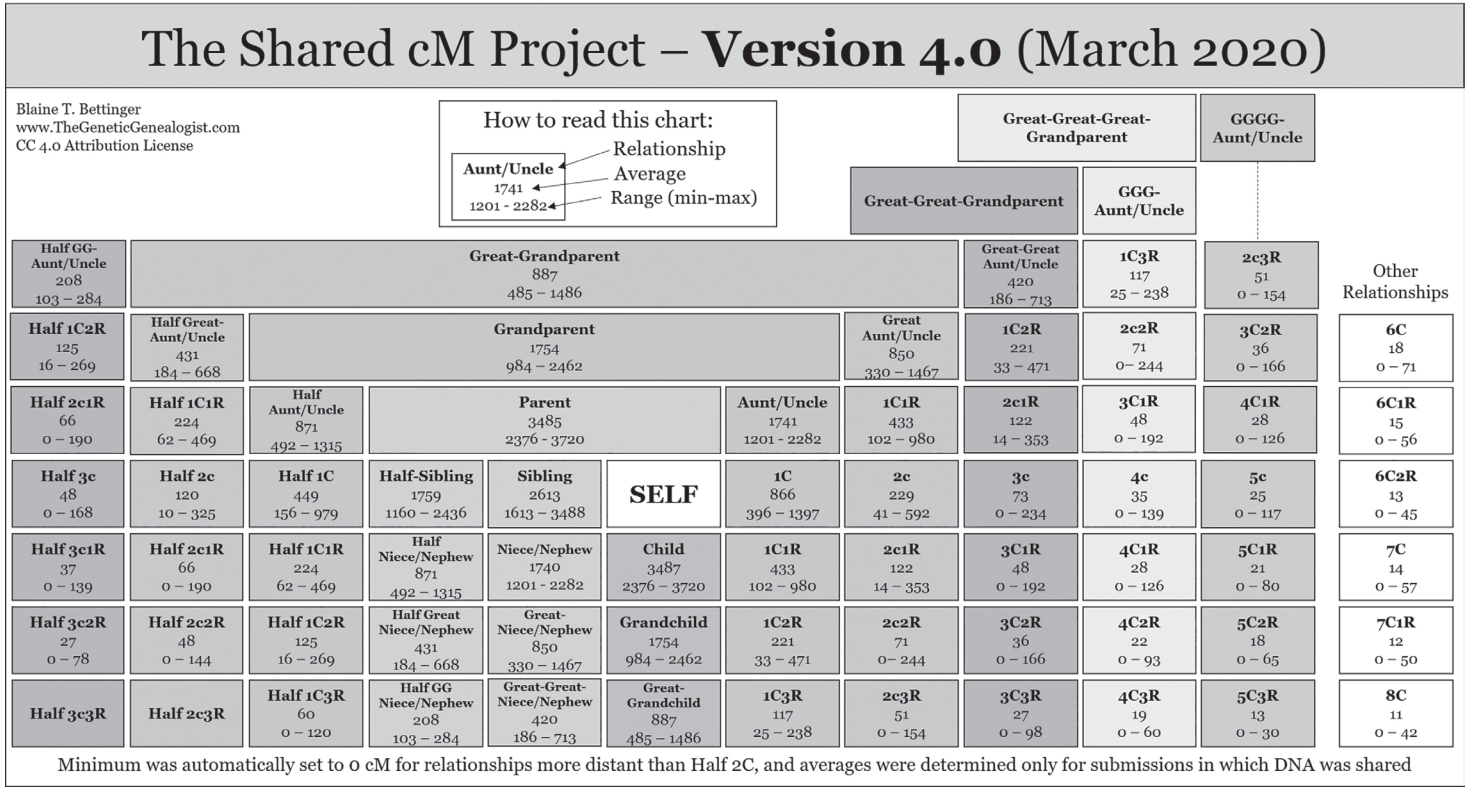

Figure 2: Bettinger's relationship chart demonstrating the expected amounts of shared centimorgans for different genetic relationships.[173]

173 Blaine Bettinger, 'Version 4.0! March 2020 Update to the Shared cM Project!', *The Genetic Genealogist* (Blog Post, 27 March 2020) <https://thegeneticgenealogist.com/2020/03/27/version-4-0-march-2020-update-to-the-shared-cm-project/> ('Version 4.0! March 2020 Update').

Because of the disparate rates of recombination in each generation – and indeed in each individual (siblings inherit different segments of DNA from their parents)[174] – the likely degree of relativity is best expressed in relationship ranges.[175] This enables researchers to estimate how different matches might be related to the crime scene sample. For example, if the target sample had a match who shared 800 centimorgans, it would be clear that this is a fairly close genetic relative. The range of relativity for such a match means they could be a first cousin, a first cousin once removed, a half first cousin, a great-aunt, or a half nephew. The precise relationship will then have to be determined through the use of traditional genealogical research.

The relative ease of genetic genealogy, especially at the more immediate levels of familial connection,[176] has no doubt contributed to its development into a substantial leisure market in recent years. By February 2019, it was estimated that over 26 million people worldwide had taken a direct-to-consumer genetic test, primarily for the purposes of genealogy and leisure.[177] Participant rates are growing rapidly.[178] Consumers provide a DNA sample to a genetic genealogy testing company, generally through spittle or swab, and within several months receive their results, which include a list of genetic matches and how many centimorgans they share. The leading testing companies are AncestryDNA (which has tested around 15 million people), 23andMe (over 10 million people), MyHeritage (2.5 million people), and FamilyTreeDNA ('FTDNA') (around 2 million people).[179]

However, out of these testing companies, only FTDNA allows law enforcement access to its database, and this access is qualified on the basis of police providing 'legal documentation' and FTDNA providing written permission.[180] A further database of importance to IGG is GEDmatch. GEDmatch is not a testing company, but instead a hosting service where amateur genealogists can upload their raw DNA data obtained from one of the testing companies. The purpose is to develop a common database allowing connections to be made between individuals who tested with different testing companies, and therefore would not otherwise be able to compare their DNA.[181] GEDmatch now has over 1.3 million DNA profiles, all

174 Greely et al (n 24) 253.

175 Debbie Kennett, 'Using Genetic Genealogy Databases in Missing Persons Cases and to Develop Suspect Leads in Violent Crimes' (2019) 301 (August) *Forensic Science International* 107, 108 <https://doi.org/10.1016/j.forsciint.2019.05.016>.

176 Ibid.

177 Antonio Regalado, 'More Than 26 Million People Have Taken an At-Home Ancestry Test', *MIT Technology Review* (online, 11 February 2019) <https://www.technologyreview.com/2019/02/11/103446/more-than-26-million-people-have-taken-an-at-home-ancestry-test/>.

178 Razib Khan and David Mittelman, 'Consumer Genomics Will Change Your Life, Whether You Get Tested or Not' (2018) 19(1) *Genome Biology* 120, 120 <https://doi.org/10.1186/s13059-018-1506-1>.

179 Kennett (n 175) 109.

180 'Terms of Service', *FamilyTreeDNA* (Web Page, 17 January 2022) cl 6(B)(xiv) <https://www.familytreedna.com/legal/terms-of-service>; Greytak, Moore and Armentrout (n 49) 106.

181 Chris Phillips, 'The Golden State Killer Investigation and the Nascent Field of Forensic Genealogy' (2018) 36 (September) *Forensic Science International: Genetics* 186, 187 <https://doi.org/10.1016/j.fsigen.2018.07.010>.

uploaded by its users.[182] This database is growing by several thousand profiles per day, with the expectation of reaching 3 million profiles within a couple of years.[183] In December 2019, it was reported that GEDmatch had been purchased by Verogen, a forensic genetics company, which announced its intention to develop a new version of GEDmatch which will not only connect family members, but will proactively have 'solving crimes' as its focus.[184] Verogen CEO Brett Williams described GEDmatch users as 'molecular eyewitnesses'.[185]

The power of GEDmatch for law enforcement is that it provides an entirely new database of DNA profiles for crime scene comparisons to be made. Instead of being restricted to the national law enforcement DNA database – confined to those who have been arrested or committed an offence and their immediate relatives – this provides a much broader genetic coverage of society. Because IGG is based on autosomal DNA analysis, it is not restricted to the identification of immediate relatives.[186] The crime scene sample which is uploaded to the database may only return matches indicative of third or fourth (or even more distant) cousin relationships. However, using genetic genealogy techniques such as triangulation (where several matches to the one profile are linked based on their own shared DNA, suggesting a common ancestor between them),[187] and traditional genealogy techniques, it may be possible to identify the unknown offender on the basis of these distant relationships.

The result is that an individual can be identified using IGG even if neither they nor any of their close family have ever submitted a DNA sample. This expansive coverage of IGG is one of its most significant assets to investigators. Yaniv Erlich et al analysed a dataset of 1.28 million individuals who had tested with MyHeritage, to determine the rate at which viable matches are returned.[188] Focusing on profiles belonging to those of European descent, the researchers found that nearly 60% of profiles return a match sharing 100 centimorgans or more.[189] Returning to Bettinger's chart (Figure 2), this is likely to be in the range of a second cousin once or twice removed, and will usually be a third cousin or closer.[190] This is a sufficiently close relationship for investigators to use traditional genealogical techniques to build a family tree and identify potential suspects. Furthermore, 15%

182 Jane Tiller, 'If You've Given Your DNA to a DNA Database, US Police May Now Have Access to It', *The Conversation* (online, 13 November 2019) <https://theconversation.com/if-youve-given-your-dna-to-a-dna-database-us-police-may-now-have-access-to-it-126680>.

183 Callaway (n 6) 316.

184 Adam Vaughan, 'DNA Site GEDmatch Sold to Firm Helping US Police Solve Crime', *New Scientist* (online, 10 December 2019) <https://www.newscientist.com/article/2226791-dna-site-gedmatch-sold-to-firm-helping-us-police-solve-crime/#:~:text=More%20than%201.2%20million%20people,attacks%20on%20users'%20genetic%20data.>.

185 Ibid.

186 Kennett (n 175) 108.

187 Greytak, Moore and Armentrout (n 49) 109.

188 Yaniv Erlich et al, 'Identity Inference of Genomic Data Using Long-Range Familial Searches' (2018) 362(6415) *Science* 690, 690 <https://doi.org/10.1126/science.aau4832>.

189 Ibid.

190 Bettinger, 'Version 4.0! March 2020 Update' (n 173) 7.

of the profiles had at least one match which shared over 300 centimorgans,[191] which is more likely to be a second cousin or even closer relative.[192]

It is when this data is aggregated that the true scope of IGG becomes clear. Erlich et al concluded that based on these match rates, a database that contained just 2% of American adults of European descent would allow for 99% of that population to match at least one third cousin, and 65% of that population to match at least one second cousin.[193] Ultimately, this level of matching, combined with genealogical investigation, would allow approximately 90% of European-descended adults to be identified through IGG.[194] The practical result is that if a crime scene sample of an unidentified offender belongs to an adult of European descent, then this sample can be added by investigators to a genetic genealogy database such as GEDmatch, and in 90% of cases, there will be sufficient matches for investigators to identify the assailant.

B Pioneering Use in the United States

With such promising statistics, it is not surprising that IGG is now being applied in criminal investigations across the US. The first conviction achieved through IGG following a not guilty plea was achieved in June 2019, when a jury in Snohomish County, Washington found William Earl Talbott II guilty of murdering a young Canadian couple travelling in Washington in 1987.[195] The case had long been considered cold, as although a viable crime scene sample was obtained, it did not produce any matches in the relevant law enforcement DNA databases.[196] Approximately 30 years after the murders, investigators uploaded the crime scene sample to GEDmatch. There were two matches of particular interest, Match A and Match B, and they shared an amount of centimorgans suggesting they were each second cousins of the unidentified offender.[197] As Bettinger's chart (Figure 2) indicates, second cousins share great-grandparents. As Match A and Match B did not match each other[198] (GEDmatch allows a comparison to determine if multiple matches share DNA with each other),[199] this suggested they were related to the unidentified offender on different branches of his family tree.

Investigators researched each of these two matches' family trees back several generations, to first identify their great-grandparents, and then to research the descendants of these great-grandparents and try to establish a connection. They discovered that Match A's great-grandparents had a son who married Match B's

191 Erlich et al (n 188) 690.
192 Bettinger, 'Version 4.0! March 2020 Update' (n 173) 7.
193 Erlich et al (n 188) 690.
194 Ibid 691.
195 *State of Washington v Talbott* (Snohomish County Sup Ct, No 18-1-01670-31, 28 June 2019) ('*Talbott*'); Megan Molteni, 'Man Found Guilty in a Murder Mystery Cracked by Cousins' DNA', *Wired* (online, 28 June 2019) <https://www.wired.com/story/man-found-guilty-in-a-murder-mystery-cracked-by-cousins-dna/>.
196 Greytak, Moore and Armentrout (n 49) 110.
197 Ibid.
198 Ibid.
199 Tomohiro Takano, 'How to Use GEDmatch: Is it Safe?', *Genomelink Blog* (Blog Post, 8 November 2020) <https://blog.genomelink.io/posts/how-to-use-gedmatch>.

great-grandparents' granddaughter.[200] This would mean that if this couple had a child, they would be first cousins once removed with Match A, *and* second cousins with Match B. This child would therefore very likely be the unidentified offender who left the crime scene sample: this would explain why he matches both Match A *and* Match B, who are unrelated to each other. Researchers completed traditional descendancy genealogy, tracing all the descendants of the two sets of great-grandparents, to confirm that there were no other marriages or relationships connecting the otherwise unrelated families of Match A and Match B.[201] Having established that there were not, the couple's only son,[202] William Earl Talbott II, was confirmed to be the only known male who could be carrying the mixture of DNA held on the crime scene sample.[203]

Police investigated Talbott and obtained DNA from a cup he discarded.[204] As is the case in Australia, in the US, law enforcement use of 'abandoned' or 'discarded' genetic material is subject to minimal regulation.[205] In this instance, Talbott's DNA from his discarded cup proved to be a direct match to the crime scene sample.[206] Talbott's resulting conviction was celebrated as he had no known connection to the victims, no relevant criminal history, and had absolutely 'no reason to have been on the investigators' radar'.[207] The murder of the young Canadian couple would almost certainly never have been solved without IGG.

The most publicised application of IGG was in the investigation into the infamous Golden State Killer who committed 13 known murders, including that of Brian and Katie Maggiore, and almost 50 rapes across California between 1975 and 1986.[208] The offences were particularly violent, with the assailant screaming the name 'Bonnie' during many of the attacks.[209] Many members of California law enforcement were noted to have continued working on the case even long after retirement.[210] Although there were viable crime scene DNA samples, they did not produce any matches on the relevant law enforcement DNA databases.[211] In January 2018, investigators uploaded the crime scene sample to GEDmatch. There

200 Greytak, Moore and Armentrout (n 49) 110.
201 Ibid.
202 Tina Hesman Saey, 'Genetic Genealogy Could Solve Crimes' (2018) 193(11) *Science News* 11, 11.
203 Greytak, Moore and Armentrout (n 49) 111.
204 Saey (n 202) 11.
205 Benjamin E Berkman, Wynter K Miller and Christine Grady, 'Is it Ethical to Use Genealogy Data to Solve Crimes?' (2018) 169(5) *Annals of Internal Medicine* 333, 333 <https://doi.org/10.7326%2FM18-1348>; Kennett (n 175) 113.
206 Saey (n 202) 11.
207 Greytak, Moore and Armentrout (n 49) 111.
208 *People of California v DeAngelo* (Cal Sup Ct, No 18FE008017, 29 June 2020) ('*DeAngelo*').
209 Paige St John, 'Man in the Window', *Los Angeles Times* (online, 2020) <https://www.latimes.com/projects/man-in-the-window-joe-DeAngelo-golden-state-killer-serial/>.
210 'Hearing Transcript for Accused Golden State Killer Joseph James DeAngelo Jr', *Rev* (online, 29 June 2020) 25:06 <https://www.rev.com/blog/transcripts/hearing-transcript-for-accused-golden-state-killer-joseph-james-deangelo-jr> ('Rev Transcription').
211 Avi Selk, 'The Ingenious and "Dystopian" DNA Technique Police Used to Hunt the "Golden State Killer" Suspect', *The Washington Post* (online, 28 April 2018) <https://www.washingtonpost.com/news/true-crime/wp/2018/04/27/golden-state-killer-dna-website-gedmatch-was-used-to-identify-joseph-deangelo-as-suspect-police-say/>.

were several third cousin matches,[212] which it should be recalled can be expected in 99% of cases of American adults with European descent. This requires a greater level of traditional genealogical research, as the genetic link is likely derived from shared great-great-grandparents.

Having traced the relevant family trees, investigators originally suspected an elderly man living in an Oregon nursing home, and his daughter volunteered to provide a DNA sample.[213] Her sample did partially match the crime scene sample – proving the investigators were focusing on the right family – but did not match the crime scene sample at a parent-child level.[214] Therefore, the Oregon retiree could not be the Golden State Killer. Christi J Guerrini et al have criticised this series of events, noting the 'enormous emotional and reputational impacts on those thrust unfairly into the investigative spotlight'.[215] Ultimately, the Oregon retiree's daughter's DNA suggested that her father was in fact a second cousin of the Golden State Killer. This allowed investigators to identify Joseph James DeAngelo as a key suspect. The Sacramento Sheriff's Department posed as rubbish collectors using an empty truck, and collected DeAngelo's rubbish from the bin he placed on the street for collection[216] (an act considered to constitute 'discarding' the genetic material obtainable from the rubbish).[217] The DNA profile was a direct match to the Golden State Killer's crime scene sample. DeAngelo, who had been a police officer in California during the earlier offences,[218] and had once been engaged to a woman named Bonnie,[219] pleaded guilty to multiple counts of murder and rape on 29 June 2020.[220] In August 2020, he was sentenced to life imprisonment.[221] As with Talbott, there was nothing other than the IGG identification linking DeAngelo to the offences, and he would almost certainly have never been identified but for IGG.

State of Washington v Talbott ('*Talbott*')[222] and *People of California v DeAngelo* ('*DeAngelo*')[223] represent amongst the first criminal convictions derived from an application of IGG in the US and, as far as has been publicly revealed, internationally. As of late 2020, new arrests on the basis of IGG (and in particular

212 Rev Transcription (n 210) 26:47.

213 Christi J Guerrini et al, 'Should Police Have Access to Genetic Genealogy Databases? Capturing the Golden State Killer and Other Criminals Using a Controversial New Forensic Technique' (2018) 16(10) *PLOS Biology* e2006906:1–9, 6 <https://doi.org/10.1371/journal.pbio.2006906>.

214 Ibid.

215 Ibid.

216 Rev Transcription (n 210) 28:49.

217 Ibid.

218 Joseph Serna, Richard Winton and Sarah Parvini, 'As a Young Cop, Golden State Killer Suspect Was Aloof, Ambitious, "Always Serious"', *Los Angeles Times* (online, 1 May 2018) <https://www.latimes.com/local/lanow/la-me-golden-state-cops-20180501-story.html>.

219 Dean Balsamini, 'Golden State Killer Was Driven by Hatred of Ex-fiancée: Investigator', *New York Post* (online, 28 April 2018) <https://nypost.com/2018/04/28/golden-state-killer-was-driven-by-hatred-of-ex-fiancee-investigator/>.

220 Rev Transcription (n 210) 04:18.

221 Dani Anguiano, 'Golden State Killer: Joseph DeAngelo Sentenced to Life in Prison', *The Guardian* (online, 22 August 2020) <https://www.theguardian.com/us-news/2020/aug/21/golden-state-killer-joseph-deangelo-to-be-sentenced-to-life-in-prison>.

222 *Talbott* (n 195).

223 *DeAngelo* (n 208).

GEDmatch and FTDNA searches) in the US were being reported frequently, often at the rate of several arrests per week.[224] Many of these arrestees are now awaiting trial. Some have now been convicted. The use of IGG in the US will likely continue to grow, especially as database sizes consistently increase, and as the genealogical processes are streamlined. During an investigation into the 1988 rape and murder of an eight-year-old Indiana girl, genetic genealogist CeCe Moore applied IGG. Having uploaded the crime scene sample to GEDmatch, it took Moore just 16 hours of traditional genealogical work to identify two Indiana brothers, one of whom would almost certainly be the killer.[225] Police focused on one of the brothers, John Dale Miller, and obtained discarded DNA which proved to be a direct match to the crime scene sample.[226] Miller pleaded guilty in December 2018.[227] With IGG proving so efficient, it is not surprising that its use is now extending beyond the US. Sweden is one of the latest nations to adopt its use, with Daniel Nyqvist placed on trial for a 2004 double murder in September 2020, having been identified using IGG.[228] If the gradual international adoption of familial searching is taken as a precedent, then the use of IGG will no doubt expand throughout the 2020s.

C Ability to Overcome Limitations of Familial Searching

IGG has the ability to directly address the key injustices produced by the exclusive use of familial searching as explored in Part II. IGG could redress these limitations without the need to resort to the polar, and arguably unrealistic, proposals of either banning familial searching outright or the establishment of a universal DNA database. IGG addresses the limitations of familial searching in two key ways: first, through its operation, which minimises issues of privacy and consent; and secondly, through its coverage and demographic reach.

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224 See, eg, Anna Spoerre, 'Jury Convicts Iowa Man of First-Degree Murder in 1979 Slaying of Cedar Rapids Teen', *Des Moines Register* (online, 16 March 2020) <https://www.desmoinesregister.com/story/news/crime-and-courts/2020/02/24/jerry-lynn-burns-trial-michelle-martinko-murder-iowa-cold-case-verdict/4855807002/> (convicted); Seth Augenstein, 'True ID of "Chameleon" Killer Revealed: Terry Peder Rasmussen', *Forensic Magazine* (online, 18 August 2017) <https://www.forensicmag.com/news/2017/08/true-id-chameleon-killer-revealed-terry-peder-rasmussen> (identity of deceased suspect confirmed by authorities); Neal Augenstein, 'DNA Database Search Leads to Suspect, Guilty Plea in 2016 Virginia Rape', *WTOP News* (online, 17 October 2019) <https://wtop.com/alexandria/2019/10/dna-database-search-leads-to-suspect-guilty-plea-in-2016-virginia-rape/> (convicted); Alex Clark, 'Vannieuwenhoven Ruled Incompetent to Stand Trial', *Upper Michigan's Source* (online, 27 March 2020) <https://www.uppermichiganssource.com/content/news/Vannieuwenhoven-pleads-not-guilty-to-1976-double-homicide-512069581.html> (deemed incompetent to stand trial); Kelsey Rettke, 'Genetic DNA Tool Used to Catch Sycamore Double Murder Suspect Marks 100th Case for Lab', *Daily Chronicle* (online, 27 February 2020) <https://www.daily-chronicle.com/2020/02/25/genetic-dna-tool-used-to-catch-sycamore-double-murder-suspect-marks-100th-case-for-lab/ain4g0z/> (trial ongoing).

225 Megan Molteni, 'The Future of Crime-Fighting is Family Tree Forensics', *Wired* (online, 26 December 2018) <https://www.wired.com/story/the-future-of-crime-fighting-is-family-tree-forensics/>.

226 Ibid.

227 Vic Ryckaert, 'Who Killed April Tinsley? Longtime Suspect John D Miller Pleads Guilty to Girl's 1988 Murder', *IndyStar* (online, 7 December 2018) <https://www.indystar.com/story/news/crime/2018/12/07/april-tinsley-killer-john-d-miller-pleads-guilty-1988-indiana-murder/2239992002/>.

228 Agence France-Presse, 'Sweden: Man Goes on Trial for 2004 Murder after DNA Matched to Genealogy Site', *The Guardian* (online, 16 September 2020) <https://www.theguardian.com/world/2020/sep/15/man-on-trial-in-sweden-for-double-murder-after-15-year-dna-wait>.

1 Operation of Investigative Genetic Genealogy: Privacy and Consent

There are of course inherent privacy concerns with any use of DNA. These same inherent concerns apply equally to IGG as they do to familial searching. However, some of the issues particular to familial searching are resolved by IGG. In Part II, the issue of 'genetic informants' was raised, with the example of Anneke Bishop who unknowingly became a 'genetic informant' against her brother, who blamed her for his eventual conviction. This story is likely replicated in almost every case of familial searching, as it is restricted to identifying first-degree relatives: parents, children or siblings of the crime scene sample. In each successful case of familial searching, there is an immediate relative who has non-consensually acted as a 'genetic informant'.[229]

IGG is different: it does not require an immediate relative to match the crime scene sample. It can be applied effectively even where only very distant relatives have provided their DNA samples to the genetic genealogy database. This is illustrated by both *Talbott*, where the relevant matches were second cousins, and *DeAngelo*, where the relevant matches were third cousins. Whilst these individuals may still be termed 'genetic informants', they are unlikely to know the offender in question. IGG's reliance on second or third cousins as genetic informants therefore avoids the serious emotional and psychological impact that familial searching's reliance on immediate relatives as genetic informants produces.

It was explained in Part II that those whose DNA samples are stored on law enforcement DNA databases such as the NCIDD could not have provided informed consent for familial searching at the time of providing their sample – in most cases, because the technique simply had not been developed at the time they provided their sample. IGG responds to this by explicitly requiring all volunteers who provide their DNA sample to the genetic genealogy database to provide their fully informed consent for its use by law enforcement for familial searching purposes. This has not always been the case: users of GEDmatch were not aware that law enforcement had access to the database until the widely publicised *DeAngelo* case.[230]

However, in April 2018 GEDmatch posted an announcement to all users clearly explaining the ability of law enforcement to access the database.[231] Shortly afterwards, GEDmatch took proactive steps to email all users alerting them of this use.[232] GEDmatch also introduced a consent module, whereby users uploading their DNA sample to the database could either 'opt in' or 'opt out' of law enforcement access to their profile.[233] Those who 'opt out' ensure that their DNA profile will not come up as a match to a crime scene sample uploaded to the database by law enforcement agencies. Therefore, at least since May 2018, those who provide their DNA samples to the genetic genealogy databases utilised by IGG have expressly

229 Murphy (n 37) 319–20.
230 Kennett (n 175) 111.
231 Matthew Feeney, '"Genetic Informants" and the Hunt for the Golden State Killer', *Cato Institute* (Blog Post, 30 April 2018) <https://www.cato.org/blog/genetic-informants-hunt-golden-state-killer>.
232 Kennett (n 175) 112.
233 'Terms of Service and Privacy Policy', *GEDmatch* (Web Page, 30 December 2021) <https://www.gedmatch.com/tos.htm>.

provided their informed consent and proactively chosen to opt in rather than opt out; in direct contrast to the arrestees and offenders whose DNA profiles are used for familial searching without any informed consent whatsoever.

2 Coverage of Investigative Genetic Genealogy: Criminalisation of Families and Racial Justice

In Part II, it was made clear that familial searching is productive of substantial injustice as its reliance on law enforcement DNA databases means it only covers those who have immediate relatives in the database: this criminalises particular families and exacerbates any existing racial biases and issues of overrepresentation in the criminal justice system. IGG directly addresses these concerns, because the demographic coverage of genetic genealogy databases is essentially the polar opposite of the demographic coverage of law enforcement DNA databases.

The typical consumer of genetic genealogy testing services is white and high income.[234] Users generally require a certain amount of cultural capital and discretionary financial capital for leisure expenses (direct-to-consumer genetic testing generally costs around $100). These demographics directly counteract the overrepresentation of lower socioeconomic and Aboriginal and Torres Strait Islander Australians in the NCIDD. Genetic genealogy databases such as GEDmatch are very strongly overrepresented by those of Northern European descent: indeed, Erlich et al found that approximately 75% of the 1.28 million direct-to-consumer DNA profiles held by MyHeritage were of primarily Northern European descent.[235] Furthermore, those of Northern European background are 30 times more likely to have a match sharing above 100 centimorgans than those of an African genetic background.[236]

In practice, this means that IGG can lead to the identification of unknown offenders who could never be discovered using familial searching, because they do not have any criminality in their immediate families. Whilst familial searching is statistically more likely to lead to the identification of Aboriginal and Torres Strait Islander Australians, and thus exacerbates existing racial biases, IGG is statistically more likely to lead to the identification of white Australians of Northern European descent. These two differences allow IGG to respond to, and directly counteract, the concerns that familial searching criminalises certain families and perpetuates racial discrimination.

D Can Investigative Genetic Genealogy Be Implemented in Australia?

IGG offers a novel and comprehensive solution to the serious biases produced by familial searching in Australia, as well as redressing key privacy and consent issues raised by familial searching. There is no legislation expressly prohibiting or regulating the use of IGG. No Australian court has publicly considered its legality, nor has there been substantial commentary on its likely permissibility. However, it has recently been reported that the Australian Federal Police, as well as the state

234 Guerrini et al (n 213) 5.
235 Erlich et al (n 188) 690.
236 Ibid.

agencies in NSW and Victoria, have begun receiving assistance from staff of the US's Federal Bureau of Investigation to use IGG in investigating cold cases, as seen in the recent identification of the 'Bondi Beast' rapist of the 1980s to early 2000s.[237] As federal and state agencies begin attempting to implement IGG, it has become a matter of urgency to determine whether IGG can indeed be implemented in Australia, and how this might best be achieved.

Considering existing police powers and practices, there is clear scope for the application of IGG in Australia. As highlighted above, once investigators have identified a suspect on the basis of IGG, they need to obtain a DNA sample from that suspect to test for a direct match. This has typically been achieved covertly. For example, William Talbott's DNA was obtained from a cup he discarded in public, and Joseph DeAngelo's DNA was obtained from his household rubbish. Like in the US, law enforcement agencies in Australia have substantial discretion in their acquisition of DNA samples. Covert acquisition of DNA samples is not prohibited and is essentially unregulated.[238] Taking NSW as an example, it has been clear since *R v Kane* ('*Kane*')[239] that the *Crimes (Forensic Procedures) Act 2000* (NSW) does not substantially impede on broad police discretion.[240] In *Kane* it was established that a DNA sample obtained covertly from a cigarette butt discarded by the suspect, without any interference with the suspect, and which is of significant probative value, does not constitute a 'forensic procedure' for the purposes of the statutory regime and is therefore not prohibited.[241] *Kane* draws clear parallels with the covert sample acquisition in *Talbott* and *DeAngelo*: IGG could be implemented with minimal change to existing police practices.

However, the ALRC has noted that covert DNA sample acquisition has essentially arisen as a 'parallel system' falling outside the Commonwealth regulatory framework[242] (which is nearly identical to the NSW framework),[243] and has suggested that Parliament may not have intended for it to be permissible at all.[244] Similarly, the NSW Ombudsman has formally recommended, with NSW Police support, that the State Parliament consider regulating the collection of covert samples.[245] These same issues are likely to arise if IGG is implemented in Australia in the absence of statutory regulation. To avoid protracted debate and eventual parliamentary review, it would be preferable for clear legislative provisions to

237 Mark Morri, 'The Beast of Bondi: How Police Used DNA to Catch a Serial Rapist', *The Daily Telegraph* (online, 21 November 2022) <https://www.dailytelegraph.com.au/truecrimeaustralia/police-courts-nsw/the-beast-of-bondi-how-police-used-dna-to-catch-a-serial-rapist/news-story/9aea397cd64c89678ac391639bf2334d>.

238 New South Wales Ombudsman, *DNA Sampling and Other Forensic Procedures Conducted on Suspects and Volunteers under the Crimes (Forensic Procedures) Act 2000* (Report, October 2006) 171 ('*DNA Sampling*').

239 (2004) 144 A Crim R 496 ('*Kane*').

240 See, eg, *R v White* [2005] NSWSC 60. See also *R v Daley* [2001] NSWSC 1211; *R v Nicola* [2002] NSWCCA 63.

241 *Kane* (n 239) 501 [13] (Sully J).

242 *Essentially Yours* (n 91) 1049 [41.197].

243 Ibid 977 [39.17]. See *Crimes Act* (n 80) pt 1D.

244 *Essentially Yours* (n 91) 1049 [41.197].

245 *DNA Sampling* (n 238) 174.

be proactively introduced to govern IGG. The legislative process will ensure the implementation of IGG is subject to parliamentary scrutiny, and that public interest and opinion is taken into account.

Surveys in the US[246] and UK[247] have consistently demonstrated strong public support for the use of IGG, although this support is restricted to its application for solving serious violent offences.[248] A similar level of support for the application of IGG to serious offences was observed by Alexandra R Quinton, Sally F Kelty and Nathan Scudder, who conducted one of the only surveys to date examining public support for IGG in Australia.[249] Approximately 85% of the 438 respondents to the survey agreed with the application of IGG to cases of sexual assault and homicide.[250] Approximately 60% of respondents agreed with the use of IGG to solve cases of robbery, showing that like in the US and UK, levels of public support for the implementation of IGG in Australia differs depending on the perceived seriousness of the crime being solved.[251] Whilst Quinton, Kelty and Scudder's survey has provided a strong foundational analysis of public support for IGG in Australia, the sample size was quite small and further research is required in this field.

Further, legislating the use of IGG would provide an opportunity to address remaining concerns relating to privacy and consent. For example, the legislation could require that law enforcement be restricted to conducting IGG using only genetic databases that demand informed consent of its users (such as GEDmatch) and must only access DNA match lists of users who have indeed provided their informed consent. Existing police policies governing familial searching, as explored in Part II, could be used as a general blueprint: the use of IGG could be restricted to 'the most serious' offences, and only where all other reasonable investigative leads have been exhausted. Borrowing from the regulations governing IGG in Sacramento County, where the Golden State Killer was identified, a further restriction may be that there are 'critical public safety implications' demanding the offender be identified.[252] This would align well with existing evidentiary considerations in the Australian statutory framework, such as the desirability of admitting the evidence, its probative value, and the nature of the offence.[253] Ultimately, there is no existing prohibition on the use of IGG in Australia, and it could likely be implemented with minimal change to existing police practices and policies.

In late 2022, police investigating the 1982 cold case murder of Eddie Crabbe in Queensland revealed that they were attempting to employ IGG to identify the

246 Guerrini et al (n 213) 3.
247 G Samuel and D Kennett, 'The Impact of Investigative Genetic Genealogy: Perceptions of UK Professional and Public Stakeholders' (2020) 48 *Forensic Science International: Genetics* 102366:1–9, 3.
248 Ibid 6.
249 Alexandra R Quinton, Sally F Kelty and Nathan Scudder, 'Attitudes towards Police Use of Consumer/Private DNA Databases in Investigations' (2022) 62(3) *Science and Justice* 263.
250 Ibid.
251 Ibid.
252 Schubert (n 156) 1.
253 *Crimes (Forensic Procedures) Act 2000* (NSW) s 82; *Evidence Act 1995* (Cth) s 138.

killer.[254] As of November 2022, police had identified 15,000 individuals who may be genetic relatives of the unknown killer, and investigations were ongoing.[255] Although Queensland law enforcement have not had the same immediate success as seen in other jurisdictions, it is promising that they have demonstrated their willingness to employ IGG. This recent adoption of IGG also reveals the urgency behind the above calls for considered legislative and regulatory action.

IV CONCLUSION

In late August 2020, a feeble Joseph DeAngelo was wheeled out of Sacramento Superior Court to begin his life sentence. After 42 years, justice was finally achieved for Brian and Katie Maggiore, and DeAngelo's many other victims. Yet this powerful, cutting-edge technique has not yet been implemented in Australia. As this article has demonstrated, this is not merely a case of Australia being slow in the uptake of new investigative tools: this is a case of Australia falling rapidly behind best practice and maintaining the worst-case scenario as the status quo.

In Part II, it was shown that familial searching extended upon DNA profiling and has been a lynchpin of criminal investigations in the UK and New Zealand for over 15 years. Whilst not expressly legislated for, familial searching is permissible in Australia and has now led to criminal convictions. Although its application has led to the identification and conviction of dangerous offenders, the use of familial searching in Australia should not be celebrated. The creation of genetic informants within suspects' immediate families, the lack of informed consent, the creation of a biologically determined criminal class subject to intergenerational surveillance, the exacerbation and production of racial biases – these limitations make the ongoing application of familial searching in Australia an affront to our basic concepts of justice and equity.

What is the solution? Suggestions already promulgated include banning familial searching or introducing a universal DNA database. Both appear idealistic and implausible. There is a much more practical solution. This is IGG – a technique which is not only efficacious, but which directly redresses the key limitations of familial searching. There is no prohibition on the use of IGG in Australia, and its practical application can be achieved in line with existing and well-established police practices. The first international conviction on the basis of IGG was in June 2019. This is Australia's chance to be, for once, on the cutting edge of DNA identification in criminal investigations. Whether IGG is introduced through quiet adaptation of existing policing practices – which appears to have begun in late 2022, or through more formal legislative processes – as this article recommends – one thing is clear: Australia simply cannot afford to be 15 years behind yet again.

254 Lillian Rangiah, 'Queensland Police Hopeful New DNA Tool Could Help Solve Cold Case Murder of Eddie Crabbe 40 Years Ago', *ABC News* (online, 9 November 2022) <https://amp.abc.net.au/article/101633810>.

255 Ibid.