FAMILIAL DNA TESTING AND PHENOTYPE DNA TESTING

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So you've just committed a crime but you're quietly confident because, even if investigators find a DNA sample, you're not on their database. They have no way of tracing you. Well bad news: don't relax! If a close relative is on the database authorities can track you down.

And in the not-too-distant future investigators might even be able to use your DNA sample to construct an identikit image of your face.

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Transcript

Damien Carrick: The science of fighting crime is certainly leaping forward all the time. But, is the law keeping up? Today we talk to a scientist who is working on the Holy Grail of crime investigators, turning a drop of a suspect's blood into a wanted poster.

Manfred Kayser: Yeah, I mean that's of course the kind of dream of a policeman, where you take a blood sample, you put it in the machine and on the computer screen you get a facial image, like the one that is drawn from eye-witnesses.

Damien Carrick: But the dream may be closer than you think. That's renowned forensic geneticist Manfred Kayser, who we'll hear from a little later.

In 2011, DNA testing is an extremely important tool for crime investigators. In simple terms, police seek to match the DNA taken from a crime scene against samples which are on a DNA database. Around the world those databases normally contain samples taken from convicted offenders. But as well as seeking a perfect match, it's also possible to look for a partial match. If the actual offender is not on the DNA database, perhaps a close relative is.

Liz Porter is a legal journalist, and author of the book Cold Case Files. She explains how the technique of familial DNA testing was first used in Wales.

Liz Porter: Well, it was where familial DNA was actually invented. And it was the murder of three young girls, which had taken place in Wales in 1973, and then, in the way of these things, the crime scene samples were reanalysed back in the late '90s with new DNA techniques, which enabled scientists to get a good profile from a tiny amount of quite old material. And then they decided to reinvestigate the murders, and they had to go back to all the original huge amounts of suspect lists, statements, etc. etc. And they drew up a list of 500 suspects to be re-examined. So, found, interviewed, DNA tested. And they were working their way down, about, you know, 200 of them, and they were getting really fed up, because every time they'd get DNA there would be no match.

And some of the people had died...

And along the way, Dr Jonathan Whitaker, who Australians might know as the guy who came out here to give evidence and to work on the Bradley John Murdoch case, the murder of Peter Falconio. He basically had one of those scientific eureka moments. You know, we all know that we get our DNA from our parents, half from our mother and half from our father, and he suddenly thought, 'Well, let's use this in trying to find this unknown perpetrator. Let's assume that, possibly, this perpetrator is no longer offending, or might even have died, let's go looking for half his DNA, on the DNA database.' And there's a couple of assumptions there; crime does run in families, not genetically, but sociologically. The best predictor of a child's criminality will be the fact that his or her father is in prison. Depressing little note there. Anyway, so they decided to go looking for half the DNA profile.

Damien Carrick: So, they had, sort of, some samples from 1973.

Liz Porter: Yes, they had the profile, they had a profile of an unknown perpetrator, the same profile which was on the underwear of the two murdered girls. The third one came in later. So, they, basically, were trying to find the owner of that.

Damien Carrick: So what they did was, with that sample, they cross-checked that with all the people on the DNA database in the UK.

Liz Porter: Well, they couldn't actually do that at that point, no. No, that's what you do when you have a full profile, and they had a program to do that. They didn't have a program to go looking for half a DNA profile. They had to go to do it manually, or by eye, which was just a ridiculous task. So they had to make some more assumptions here. They decided to assume that the killer had stayed in the area, which is not too bad an assumption; you know, it's the upwardly mobile that go criss-crossing the country to go to university and move to better jobs and things. Often crims do hang around near home. So that was the big assumption, so they had about 20,000 DNA profiles from the local area, and they literally, a DNA profile is a set of numbers, and they literally had columns and figures, and they had to look down them. They focused on one unusual set of alleles, as they're called, in the profile. But basically they came down to a list of about 90 profiles, and then one of them had a name that jumped out at the detectives, because it was a name on the original 500 suspects from back in the 70s, and it was the son of one of those people.

Damien Carrick: And that was a Mr Kappen, yes?

Liz Porter: That's right. The son had been a convicted car thief, that's why he got onto the DNA database, because, as people may not know, you have to commit a crime to get onto the DNA database. So then, the police went to the family, they discovered that Kappen Senior, Joe Kappen, who had been a nightclub bouncer, had actually died. So they had in fact already been, the detectives...
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had already been to his home, and so he'd gone down to the bottom of the list as someone who was dead. They were still going to
do all the DNA testing, but they thought they'd leave it till later. So they came back, they tested his by now ex-wife, a couple of the
kids, so they could work out what would be, what they call, an inferred profile of the man, of Joe Kappen. And it seemed to be a
pretty good match. But to be absolutely sure, they actually exhumed him.

**Damien Carrick:** So, they dug up his body from the cemetery.

**Liz Porter:** Yes.

**Damien Carrick:** They did some tests.

**Liz Porter:** And it was a match.

**Damien Carrick:** And it was a match. And that was the first familial DNA test to solve a cold case.

**Liz Porter:** Exactly. This is a 30 year-old case, this involved an exhumation at midnight in a dark and lonely graveyard on a hillside
in Wales. This is an extraordinary case, and it was the case for which the technique was invented.

**Damien Carrick:** Author Liz Porter. One of the people behind an upcoming conference, organised by the Australian Institute of
Judicial Administration, which is being held next week in Sydney. One of the conference speakers will be Gregor Urbas, a senior
lecturer at the Australian National University's law school. In the latest addition of the Australian Journal of Forensic Sciences,
Gregor, together with co-author Mark Smith, addresses the challenges of regulating new forms of DNA testing. He says that while
the first crime solved using familial DNA was in Wales, the first conviction was obtained across the border, in England.

**Gregor Urbas:** There's a case that arose in the United Kingdom, in 2003. The offender's name here is Harman, and I believe the
victim's name was Little. And the victim was a truck driver, who was driving along, and a brick was thrown from a footbridge towards
his vehicle. It went through the window, hit him in the chest, he suffered a cardiac arrest and subsequently died. So, there was a
homicide investigation. Now, there was some DNA material on the brick that had been thrown, which gave police a profile that they
could then use to try to locate a suspect.

They ran that profile against their national database, which is actually very large, and didn't obtain any complete matches, but they
obtained one or more interesting partial matches. They were then able to narrow the focus of the investigation to approximately 20
individuals, who resided in counties close to where the crime was committed, and when the individual with the partial match most
similar to the crime scene sample was interviewed, it was discovered that he had a 20-year-old brother who was in the vicinity of the
crime when it was committed. When police interviewed that individual, he denied involvement in the crime, but he agreed to provide
a DNA sample to police, and the profile that they generated was found to match the one obtained from the brick. When he was
presented with that information then he confessed to the crime. He was convicted of manslaughter, and I believe he was sentenced
to six years.

**Damien Carrick:** The ANU law school's Gregor Urbas. Here in Australia it's unlikely that familial DNA testing is taking place.
CrimTrac is the organisation that runs the National Criminal Investigation Database on behalf of Australia's various police forces.
CrimTrac says that the National Database does not currently accommodate familial testing. At a state and territory level, the picture
is less clear, but certainly no one I've spoken to here in Australia is aware of any use of databases for familial DNA testing. Across
the Tasman, the picture is much clearer. Jill Vintener is the head of Forensic Services with ESR, which is the New Zealand
equivalent of CrimTrac. She says, since 2007, there have been two convictions. The first involved a series of sexual offences. The
second a murder.

**Jill Vintiner:** Back in 2001, Marie Jamieson was murdered, and DNA profiling results were obtained; a male DNA profile, and again
a very extensive police investigation, but it remained unsolved for many years, until nine years later, when familial testing was
carried out, this case was put forward by the New Zealand police, and it led, as a result of that testing, to a person that police
investigated further, and there was a case put forward to the court, and that individual pled guilty.

**Damien Carrick:** I understand the sample which helped solve the crime belonged to a lady called Anneke Bishop, and I understand
that, back in about 2002, she was reported to be driving erratically, and police came to her house and she was taken to the police
station and asked for a blood sample, I think, or a bodily fluid sample, and this turned out to be a partial DNA match for semen found
at the crime scene back in 2001, in the murder of Marie Jamieson. Then authorities were able to make the connection to her
brother.

**Jill Vintiner:** Yes, I mean, familial testing it looks for a person on the DNA databank who could be a close relative of the offender.
And in this instance the sister, as you've indicated, had provided a sample to the DNA databank, and it was sufficiently similar
equal to the offender's profile that it came up as a result of a familial search.

**Damien Carrick:** And so Joseph Martin Reekers, the brother of Anneke Bishop, he ended up pleading guilty.

**Jill Vintiner:** He did.

**Damien Carrick:** Tell me, how often is this technique used in New Zealand?

**Jill Vintiner:** It's not used very often at all. It's only used for a handful of cases, I would say less than 20. It's for cases which are
serious offences, usually homicide, and where, despite, you know, police investigations, there just hasn't been any leads which
police have, you know, been able to use, and so familial testing is considered.

**Damien Carrick:** So it's not used in say, standard burglary cases.

**Jill Vintiner:** Absolutely not.
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Damien Carrick: The Reekers case went all the way to the New Zealand High Court, which determined that the existing New Zealand legislation allows for the use of familial DNA testing. Incidentally, according to New Zealand newspaper the Sunday Star Times, his sister, Anneke Bishop, is devastated by the thought that she is to blame for her brother's arrest. Judge Arthur Tompkins of the New Zealand District Court is one of the speakers at the upcoming AIJA conference in Sydney. He acknowledges that there are civil liberties issues surrounding familial DNA testing.

Arthur Tompkins: A number of academic commentators in both the United Kingdom and the United States are really concerned about the expansion of the scope of DNA databanks without explicit legislative authority, beyond those persons who are included in the databank as a result of the country's legislation, whether a convicted person or an arrested person. The expansion of the databank, not only to those persons, but also to relatives of persons who are included in the databank. What the commentators are saying is that it essentially turns people who are included in the databank into genetic informants of their relations, whether parents, or children or brothers or sisters.

Damien Carrick: And people are saying that there are civil liberties implications to that move.

Arthur Tompkins: Yes, it's really, trying to balance liberty and freedom from suspicion on one hand, and freedom from police surveillance on one hand, with the community's undoubted interest in the solving of serious crimes. And that tension is, that manifests itself in lots of different ways and always has done, in terms of ordinary search warrants, and interception warrants, and phone-tapping and the like. It's exactly the same issue.

Damien Carrick: Can I ask, Judge Tompkins, if authorities suspect a person of involvement in a crime, and, for whatever reason they can't locate them to ask them for or insist that they provide a sample, but a close relative is on hand, and they're definitely not a suspect but simply a relative of a suspect, if that relative says, 'No, I don't want to provide you with a sample,' can authorities compel them to provide a sample?

Arthur Tompkins: They could do, but it would have to be on the basis of a court order under the local legislation. There was a very high profile case in the United States; a serial rapist was located when police obtained access to his daughter's Pap smear, and they got that on the basis of a search warrant, although, as I understand it, the daughter was not opposed to that. My understanding is that the medical authorities required the court order, but once that was obtained they provided that, and that allowed the familial search to be obtained.

There was another case where the name escapes me for the moment, when a son who committed another offence provided the profile, and that allowed the breakthrough. But laws around the world differ, but there would have to be, in the event that the suspected relative didn't provide a sample or was not consenting to it, almost certainly there would have to be a court order, and that would depend on the court being satisfied as to the other evidence that the police might have identifying the potential offender.

Damien Carrick: Judge Arthur Tompkins of the New Zealand District Court. I'm Damien Carrick, and you're listening to the Law Report, broadcast each week on ABC Radio National, Radio Australia and ABC News Radio. The program's also available for download at iTunes, or at our website, abc.net.au/m/lawreport. At that site you can also read transcripts or leave us a comment.

In addition to familial DNA testing, there is another form of DNA technology which is beginning to be used in some countries, but not yet here in Australia. This is what's known as phenotype testing. Traditional DNA testing looks at whether or not two samples come from the same person. Phenotype testing doesn't involve the comparison of two samples. Rather, it involves looking at a sample and then trying to determine what the person looks like; attributes like gender, geographic or ethnic origin, eye colour. This all sounds very sci-fi, but, in fact, some years ago, forward-looking Dutch legislators decided to introduce laws to deal with this fast evolving field of genetic science. Maurice Schellekens is a legal academic based at the University of Tilburg in the Netherlands. As he explains, the catalyst for the world-first legislation was a murder in the northern province of Friesland.

Maurice Schellekens: Yes, in 1999, there was a murder case in the northern part of the Netherlands, where a 16-year-old girl was murdered in the middle of the night, and this happened in a field in the neighbourhood of a asylum seeker centre, at the space in the Netherlands where people who have fled from their country, and seek refuge to the Netherlands are at first accepted. And the case wasn't resolved quickly, and this left to the local population believing that somebody from the asylum seeker centre, somebody from the Middle East, perhaps of the other countries, from where asylum seekers usually come, calculated murder, and this created quite a lot of anger. And then, because there was a DNA sample found on the victim, the sample that apparently was, that came from the perpetrator, that was then tested to see from what ethnic or geographic origin this person was. And it appears that the person was somebody from the Netherlands. At least, with a certain degree of probability.

Damien Carrick: So the test indicated that the ethnicity of the perpetrator was Dutch, or from the Netherlands, as opposed to somebody from the Middle East.

Maurice Schellekens: Yes, it was a Caucasian person, so somebody from Europe. At least, well, of course, that doesn't really say that with 100 per cent certainty, so there is always an element of uncertainty in that, but that was something the authorities, well, they couldn't deny it, but they seized it from the opportunity to say, 'Well, this is person from the Netherlands, so please, local people, don't worry about somebody from the asylum seeker centre.'

Damien Carrick: Very interesting. So, this case, where this test was used, and perhaps with a public policy agenda as much as a criminal investigation agenda, this led the Dutch parliament to pass laws, the first laws of their type, in the world, expressly allowing for phenotype DNA testing of certain attributes.
Maurice Schellekens: Yes, that's correct. And, well, of course, this first use of the technology was used to prove that somebody was not guilty, or that persons from a certain origin, not guilty, and perhaps that paved the way to make a law that allows this technology.

Damien Carrick: I wonder, Maurice Schellekens, what would have happened if the police investigators had found that, in fact, the perpetrator or the suspects or the DNA came from somebody of Middle East origin, for instance.

Maurice Schellekens: Well, you can only speculate about what would have happened, perhaps they would have kept the results secret, but that's pure speculation, I don't know.

Damien Carrick: Now, the laws as they now stand in the Netherlands, what forms of DNA phenotype testing do they allow for?

Maurice Schellekens: They allow only for traits that are externally acceptable [inaudible], externally visible, such as the gender and the geographic origin or ethnic origin and in future, also externally acceptable traits can be added, what cannot be done is things that are not visible, such as the medical conditions, which might be helpful for the police, if you know that somebody has diabetes, or some other disease you could perhaps engage the help of doctors to make the circle of suspects or the circle of the possible perpetrators smaller, but these non-visible traits cannot be used, cannot be researched, at least the legislator cannot create powers to do that. At least, that's what the law tries to establish.

Damien Carrick: Dutch legal academic, Maurice Schellekens, who has also researched the laws around phenotype testing in other countries. He says neighbouring Belgium has prohibited phenotype testing, as have several states in the USA. Germany allows testing, but for gender only, and the UK, well, it doesn't have any specific laws at all. Here in Australia, like the UK, our laws are silent about phenotype testing.

According to CrimTrac, this form of testing is not being used. Certainly not at a federal level. Gregor Urbas says there are other reports that phenotype testing has been used in parts of the USA.

Gregor Urbas: There is a case recorded where police in the US used genetic variation amongst ethnic groups to predict an offender's race, and thereby narrow their investigation. So, in Louisiana they analysed biological material found at the scene of a number of homicides, that they believed had been committed by the same offender. And, using phenotypic analysis of the samples they concluded that the individual who had committed the crimes was unlikely to be Caucasian, and so that narrowed their focus on alternatives including African American suspects, and that ultimately led to the apprehension of the offender.

Damien Carrick: Gregor Urbas, senior lecturer at the ANU law school. At the moment gender and geographic or ethnic origin as distinct from racial appearance, can be determined through phenotype testing. But the science is fast evolving. World renowned German forensic geneticist, Manfred Keiser, is head of the forensic molecular biology department at the Erasmus University medical centre in Rotterdam, in the Netherlands. He's been working on tests for a number of attributes, including eye colour. He expects his eye colour test will, within weeks, gain approval for use by Dutch investigators.

Manfred Kayser: So, at this moment you can do eye colour. There is the knowledge, there is the DNA test we developed, we even forensically validated the DNA test which usually forensic practitioners would like to see for quality control, it's used before they run the tests, so this is all done for eye colour, and it gives you quite some good prediction accuracies, at least for blue and brown eye colour.

Damien Carrick: So, also hair colour is another area?

Manfred Kayser: Hair colour is not yet that far, in terms of having a test available and the forensic validation, but we are working on this, so it's coming. The knowledge is there, and it allows quite some good accuracy, and that's actually it for this moment. There are people working on skin colour, it's not that easy, we are working on age, it's not that easy, but there is something possible, so there are some developments on other traits, like hair morphology, perhaps even facial features, but that's more something for the future.

Damien Carrick: So, let's talk about some of those separately. I understand that last year your department made headlines around the world when you published research showing that a DNA sample extracted from a blood sample could determine the age of the person from whom the sample had come from. I think within about an eight or nine year leeway either side.

Manfred Kayser: Yes, that's true, and the nice thing is that this really is a DNA test where usually people will assume that DNA would not be informative for age testing, because usually your DNA does not change with age, but what actually does change, and that's what we took advantage of with this test is the amount of DNA in one particular cell type, and that's the T-cells, so it's the cells that are in the thymus and that's because the number of these thymus cells goes down quite regularly with age. As you said, so there is some uncertainty coming with the test, and the plus minus nine years, I mean, it's not so useful to actually predict a point age, as to whether a person is 20 or 21, so we are far not yet there, with any molecular testing, but what the test can already do is give you a kind of group age estimate, and that quite accurately leads to the say, the person is rather 20, or rather 40 or rather 60 or rather 80, and of course, in terms of appearance this is very informative, because usually a person, by looking at someone else, just about the physical features, can differentiate between this type of age groups, and if then the DNA test can do, this at least for the appearance trait work is quite informative.

Damien Carrick: I understand that your lab is part of a consortium of labs which are currently putting resources into the creation of a computer-generated DNA-based facial sketch. How far along is that project?

Manfred Kayser: Yes, I mean, that's of course the kind of dream of a policeman, where you take a blood sample, you put it in a...
Emeritus Professor John Furedy:
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This morning’s Law Report on familial and phenotype DNA testing raised problems of civil rights.

I would like to elaborate on these problems by referring to the issues of voluntariness both in providing samples by family members, and with regards to a confession of guilt by the accused.

These issues arose some 25 years ago in connection with the lie detector or polygraph so-called “test”. As we detailed in Canadian legal journal in 1986 (http://www.psych.utoronto.ca/users/furedy/Papers/id/Confess.doc), the polygraph can become a “psychological rubber hose” in the hands of the police both to persuade people to engage in the “test”, and to provide confessions that are not voluntary in the legal sense of the term. The psychological pressures upon an accused involved in the polygraph may not be consciously exerted by the police. There seem to be direct parallels with the use of familial DNA.

If a family member refuses to supply a sample for DNA testing, this may carry an implication that the person fears the suspect is guilty. As in the case of the polygraph, the police may suggest that the family member can be cleared of suspicion if only the extra DNA sample is given.
Indeed, the civil libertarians are right to raise questions about familial DNA testing. It must be carried out so as not to be used as a ‘psychological rubber hose.’