



THE FORENSIC SCIENCE SERVICE®

Fact sheet (6)

DNA Low Copy Number

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Since its implementation in the early 1980s, DNA profiling has developed rapidly to become more discriminating and more sensitive. Since 1999 The Forensic Science Service® (FSS®) has offered a specialist service that has had a major impact on police investigations for not only the most serious current crimes, but also those that happened decades ago.

DNA Low Copy Number (DNA LCN) is an extension of the routine SGM Plus® profiling technique and enables scientists to produce DNA profiles from samples expected to contain very few cells, even if they are too small to be visible to the naked eye. Initially used for the most serious crime cases, the technique is now also used to help police investigating crimes such as burglaries and thefts. More recently the FSS has been called in to carry out DNA LCN testing in international cases, where standard DNA testing has failed to get a result.

The main application of this technique is to target areas on items where it is believed that an offender may have transferred DNA through touch, like the residue believed to have come from cells such as skin or sweat, left in a fingerprint. DNA LCN profiles have also been successfully generated from items such as discarded tools, matchsticks, weapon handles and grabbed clothing.

Given its increased sensitivity, DNA LCN can be a particularly useful tool for investigating serious crimes where other profiling techniques have been exhausted or when options for forensic evidence appear to be limited. For example, when there is a very small amount of material present.

DNA LCN takes longer than routine DNA profiling techniques – usually a couple of weeks for serious crimes, where specialist interpretation is critical, - but can provide extremely valuable intelligence for the police. As with all forensic evidence, the context and interpretation need to be considered carefully. This is even more important with DNA LCN, due to its sensitivity and the possibility that the DNA detected is unconnected with the offence under investigation.

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One of DNA LCN's most effective uses is in 'cold case reviews' – reviews of crimes from the past which have remained unsolved, possibly for decades. The technique allows the FSS to re-test historic samples that have either previously failed to yield a DNA profile through less sensitive profiling techniques or where DNA profiling had not been thought possible previously because of the evidence type and /or substrate available.

Science behind the technique

- DNA LCN is an extension of the routine SGM Plus® profiling technique. Profiles obtained using the technique are compatible with The National DNA Database® (NDNAD) and are produced by copying ten informative DNA sites. DNA LCN is more sensitive than SGM Plus® because a greater number of copies are generated from a smaller amount of starting material.
- DNA LCN has the same discriminating power as the routine technique – about one in a billion. This means that if the DNA found at a crime scene matched a suspect, then the chance of obtaining the profile if it had originated from someone other than and unrelated to that suspect, is approximately one in a billion.

Case studies

General

- Antoni Imiela – DNA LCN was one of the techniques used to find the smallest traces of DNA from items of clothing and medical samples in the investigation into a series of rapes. Work by the FSS showed a DNA link between the first rape in Kent in November 2001 and a second offence in Surrey several months later. This intelligence was a major breakthrough in the police investigation. In March 2004 Antoni Imiela was convicted of seven rapes, and the kidnap, indecent assault and attempted rape of a 10-year-old girl and given seven life sentences at Maidstone Crown Court.

Cold cases

- DNA LCN was used to obtain a DNA profile from a microscope slide retained from an unsolved rape case from 1995. The unsolved case was selected for review in 2004 as part of Operation Advance – a project involving the FSS, Home Office, and Association of Chief Police Officers. The profile was loaded to the NDNAD, and matched against the profile of Mark Henson, who was convicted and sentenced to life in prison in 2005 – nearly 10 years after the crime was committed.

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- DNA LCN was used to obtain a profile of the killer of Marion Crofts who was raped and killed in 1981. Microscope slides were deliberately left untouched for 20 years until techniques would be sensitive enough to obtain a profile. In 1999 using DNA LCN a profile was obtained from Tony Jasinskyj which matched samples taken from Marion's clothing. He was convicted and jailed for life in 2002.

International cases

- Anna Lindh murder - Swedish authorities requested the help of the FSS to carry out DNA LCN profiling on a knife used in the murder of Swedish Foreign Minister, Anna Lindh, in 2003. The testing on the knife handle was successful and a mixed DNA profile was obtained. Part of the profile matched Anna Lindh herself (as she had bled) and the remaining part matched that of suspect Mijailo Mijailovic. This result provided extremely strong evidence of association between Mijailovic and the weapon. Mijailovic was later convicted of stabbing Ms Lindh to death and jailed for life. This case demonstrates the efficacy of using LCN to detect the DNA of an individual who may have held an implement such as a weapon.
- Helen Nilsson and Jannika Ekblad murders - a semen sample retained on a microscope slide for nearly 15 years was sent to the FSS in 2003 from Sweden. The sample came from the body of a 10 year-old girl, Helen Nilsson, killed in 1989. The FSS used DNA LCN to obtain a full DNA profile, and police then asked possible suspects to give DNA samples. There was a match against Ulf Olsson. The following year the FSS carried out further DNA LCN analysis, this time on semen from Jannika Ekblad, killed in August 1989, and again a profile was obtained that matched Olsson. Olsson was convicted of the murders in April 2005. These cases also incorporated the use of the specialist sperm recovery technique called LMD (Laser Microdissection).
- Palmerston North New Zealand - rape. New Zealand authorities called in the FSS after DNA tests failed to get a sufficient result from samples from a victim in a rape case. The FSS carried out LCN testing on extracts from two swabs with a low sperm score, which produced a full DNA profile and a partial one respectively. These both matched the suspect in the case. Joseph Lepper was found guilty of rape and sentenced to 10 years imprisonment. This was the first time LCN evidence had been heard in the NZ judicial system and the technique went through a full voire dire. An appeal in October 2005 was dismissed.
- Peter Falconio – [Click here](#) to read the press release

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