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DNA: transfer and persistence

- A review of current literature

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Åsa Jufvas och Ricky Ansell

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Öppen

1 Introduction

The understanding of transfer and persistence of biological traces and DNA is becoming increasingly important in the field of forensics. The development of more sensitive and robust methods for DNA amplification and analysis allows for detection of minute amounts of DNA, but at the same time renders challenges regarding interpretation.

In many cases today, the matching of a crime scene DNA finding to an individual is not the key issue in concluding guilt, regardless of the strength of the match itself. Instead, it is rather the explanations on how the DNA came into place that will be important for the case outcome.

The number of publications on topics like transfer and persistence of DNA, background DNA and ultimately the activity level of DNA findings, are rapidly increasing. This report is a compilation of published papers and reports regarding these and closely related topics. Each paper is followed by a short summary of its content, allowing the reader to get an overview of a selected topic as well as suggestions of papers to dig deeper into.

This report is organized in different sections by selected topics. The publications in each section are in alphabetical order by author. Topics used in this report are:

Activity level	Adhesive tapes	Ammunition & spent cartridges
Background DNA	Case studies	Clothes
Contamination	Court decisions	Explosives
Fingerprints	Finger samples	LCN/LT
Penile swabs	Persistence	Review articles
Touch DNA	Transfer	Washed stains/clothes
Weapons & arms		

Naturally, topics and references overlap, which should be taken into account when using the report. Many papers appear more than once depending on the topics covered. The authors claim neither full coverage of the separation of all the papers into the different topics, nor that the compiled publications are exhaustive – additional papers do exist and new ones will be published!

To increase the usability of the report all references are presented with an accurate weblink, often to full texts, but at times only the abstracts are accessible.

2 Materials and methods

References in the report have been retrieved through the internal NFC library and by online searches using scientific portals such as Pubmed, Scopus and ScienceDirect, as well as other more general search sites like Google Scholar.

Could secondary DNA transfer falsely place someone at the scene of a crime?

Cale CM, Earll ME, Latham KE, Bush GL. J Forensic Sci 2015; 61(1): 196-203.

<http://onlinelibrary.wiley.com/doi/10.1111/1556-4029.12894/abstract>

Setup: Hand to hand contact for two minutes, then handling a knife (smooth or rough handled knives). Knives were immediately swabbed for DNA.

Secondary transfer was detected in 85 % of the samples. In some cases the secondary contributor was the major or the only identified DNA profile.

There was no significant difference in concentration of DNA between smooth and rough handled knives.

For one smooth-handled knife the major contributor was neither one of the test-subjects nor one of the personnel.

Forensic DNA evidence is not infallible.

Cale CM. Nature 2015; 526: 611.

<http://www.nature.com/news/forensic-dna-evidence-is-not-infallible-1.18654>

This is a one page "personal take" on the subject of secondary transfer of DNA. For more detailed reading see "Could secondary DNA transfer falsely place someone at the scene of a crime?" by Cale *et al.* J Forensic Sci 2015.

DNA transfer: informed judgement or mere guesswork?

Champod C. Front Genet 2013; 4: 300.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3872334/>

Opinion article

"... the quantity of DNA or the quality of the profile cannot be used "to reliably infer the mode of transfer by which the DNA came to be on the surface of interest." (Meakin and Jamieson 2013).

The prevalence of mixed DNA profiles in fingernail samples taken from individuals in the general population

Cook O, Dixon L. Forensic Sci Int Genet 2007; 1: 62-68.

<http://www.ncbi.nlm.nih.gov/pubmed/19083729>

Aim: "...examination of the incidence of mixed DNA profiles derived from fingernail samples from members of the general population..."

Setup: Fingernail swabs from 100 volunteers.

Results: Foreign DNA was detected in 13 % of the samples, only 6 % of these gave reportable mixed DNA profiles.

"This study demonstrated a low level of foreign DNA under the fingernails of the general population, suggesting that when a strong mixed DNA profile is obtained from a fingernail swab it is unlikely that it exists only due to previous contact between the suspect and victim."

Mostly male donors had significant amounts of foreign DNA in their nail swabbings.

The transfer of touch DNA from hands to glass, fabric and wood

Daly DJ, C. Murphy C, McDermott SD. Forensic Sci Int Genet 2012; 6: 41-46.

<http://www.ncbi.nlm.nih.gov/pubmed/21330229>

Setup: Glass fabric/wood, 100 volunteers per type of material, 60 s contact, objects were mini taped.

Results: Wood gave the best yield of DNA (36 % gave handler profile) followed by fabric (23 %) and then glass (9 %).

10 % of the total number of samples gave mixed profiles indicating secondary transfer.

An investigation of the presence of DNA on unused laboratory gloves

Daniel R. van Oorschot RAH. Forensic Sci Int Genet Suppl Ser 2011; 3: e45-46.

<http://www.sciencedirect.com/science/article/pii/S1875176811000230>

DNA was found (up to 20 alleles) on gloves from unopened boxes (vinyl gloves, specific brand).

DNA was found (up to 14 alleles) on gloves from opened boxes from different brands and of different materials.