



# Beware; gloves and equipment used during the examination of exhibits are potential vectors for transfer of DNA-containing material

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**Abstract.** DNA-containing material can accumulate on tools and surfaces relevant to the examination of exhibits. Some of this can be of exhibit origin that has the potential to contaminate subsequently examined exhibits. © 2005 Elsevier B.V. All rights reserved.

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## 1. Introduction

Gloves are worn during the examination of exhibits in forensic biology laboratories to protect the wearer from harmful agents and to protect the exhibit from contamination by DNA-containing material derived from the surface of the hand of the examiner. Gloved hands may however be capable of picking-up DNA-containing material from exhibits being examined and transferring this to other areas of the exhibit and/or tools being utilised whilst examining. If so and if these tools are not adequately cleaned after examination of a particular exhibit they may become a potential vector for future pick-up and transfer of DNA derived from an exhibit examined earlier to a subsequently examined exhibit. Items that come into direct contact with exhibits, and thus pose a high risk, such as scissor blades and forcep tongues, are routinely cleaned between exhibit examinations, however, their handles, containers, tissue boxes, pipettes, examination lamps etc, that are touched by gloved hands during examination, may not.

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The risk of contamination is in part dependent on the frequency of contacts with tools/surfaces, the amount of DNA-containing material that accumulates on them, the proportion of this that may be picked up and then transferred to another surface, and how many transfer steps would be required for DNA-containing material to be picked up from a primary source and ultimately deposited on to an item being investigated.

Whilst this type of transfer is only of relevance if the DNA-containing material is transferred to an area that is subsequently sampled for DNA profiling, and if it is of a detectable amount which is of a significant proportion of the total DNA retrieved from a sampled area, there is a risk of inadvertent contamination. Information on the extent and origin of DNA-containing material on items on and around an examination bench will assist in evaluating the level of risk and could possibly precipitate change in procedures.

## **2. Materials and methods**

75 sites/vectors (23 in the high risk, 46 of medium risk and 6 of low relative risk) were swabbed or tape lifted (depending on the surface) for DNA analysis as per routine casework. (Areas of  $\sim 30 \times 20$  cm were swabbed of those items where the whole of the item could not practically be sampled e.g. benches, floor.)

DNA was extracted using a 5% chelex solution, concentrated to 80  $\mu$ l using Centricon-100 columns, quantified using Quantiblot<sup>®</sup> (Perkin-Elmer) (10  $\mu$ l) and amplified using AmpF/STR Profiler Plus<sup>™</sup> (Applied Biosystems) (50  $\mu$ l reactions, 28 cycles). Those samples that gave a negative quantitation were amplified using the maximum volume of 20  $\mu$ l (25% of extract). Samples were run on an ABI Prism<sup>™</sup> 310 Genetic Analyser (5 second injections). Initially 1  $\mu$ l of amplified DNA was added to 12.2  $\mu$ l of reaction mix. Those samples that gave a negative profile (but indicated possible alleles below 100 RFU) were re-run using 2  $\mu$ l amplified DNA. The profiles were typed using Genotyper<sup>®</sup> version 2.5 (Perkin-Elmer).

## **3. Results**

Of the 23 items that were considered to pose a high risk as they may come into direct contact with an exhibit (including: cutting edge of scissors, forceps, rulers, laboratory coat cuffs, benches), none returned a positive DNA profile except for one sample taken from a 30 cm ruler which provided a partial profile (7 alleles). The owner/user of the ruler could not be excluded as the source of the profile.

Of the 46 items that were considered to pose a medium risk as only two transfer steps (via gloved hands) would be required for contamination from this source to occur (including: tape dispensers, magnifying lamps, examination floodlights, glove boxes, pens, haemastix bottle, chairs, hairdryer, tag guns, hydrochlorite glass bottles, ethanol glass bottles, fridge floors, exhibit bags), 36 did not provide a profile, 7 gave partial profiles (1 to 5 alleles), 2 swabs taken from fridge floors gave complex profiles of unknown origin, and 1 from a magnifying lamp gave a profile exhibiting 18 alleles.

The profile obtained from the magnification lamp was entered onto a database of laboratory generated DNA profiles and found to match a number of samples, all related to one case, including two evidentiary samples that were examined on the bench associated with the magnifying lamp in question. These two samples, one bloodstain and one trace, were taken from the same item, described as a 'bulky jacket', 3 months prior to the swabbing of the magnifying lamp. The

magnifying light would have been used during this examination (personal communication with the analyst). As it is unlikely that the exhibit came into direct contact with the top side of the lamp we suggest that the likely cause of this DNA appearing on the lamp is due to DNA-containing material transferring from the jacket on to a glove and then from the glove on to the lamp whilst examining the jacket. No matches to other case items on the database were observed, suggesting that contamination to other casework caused by the presence of DNA on the magnifying lamp is unlikely. It is, however, possible that contamination from quaternary transfer (i.e. jacket to glove to magnification light to other glove to other exhibit) may have occurred subsequently, but that the amounts are beyond current instrumentation sensitivity and/or that the amount has been swamped by the amount of target DNA.

Of the six items that were considered to pose a low risk as multiple transfer steps would be required for contamination from this source to occur (including: floors, taps), only one did not provide a DNA profile. Two returned a partial profile (5 to 20 alleles) and three exhibited more than 20 alleles. The origin of these profiles remains unknown.

To further help evaluate the above finding swabs were taken from gloves worn whilst examining a heavily soiled dress during routine casework examination. A significant amount of DNA was retrieved which exhibited a genetic profile that matched that of samples taken from the exhibit.

#### **4. Discussion**

We have changed some of our laboratory practices as a result of these findings. It is recommended that examiners of exhibits, from which samples may be taken for DNA analysis, regularly change their gloves whilst examining exhibits; avoid contact with areas of the exhibit that are likely to be sampled for DNA analysis; and regularly clean tools and objects that they may come into contact with whilst examining exhibits. This is especially so for cases involving trace quantities of DNA.

There have been limited studies on trace background DNA (in laboratories or in casework) and its transfer [1–4]. More are required to enhance our knowledge of potential contamination risk and to assist in criminal investigations.

#### **References**

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