



Can “contamination” occur in body bags?—The example of background fibres in body bags used in Australia



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ABSTRACT

Impurities that are transferred to a crime scene or a body can have a significant negative impact on the investigation if the existence of the contamination is not known, and the source of the contamination is not identified. Forensic consumables, such as DNA swabs, have been known to have caused contaminations, wrongfully linking crimes throughout Europe. In that context, this study focused on body bags, widely used to transfer a corpse from the crime scene to the morgue. Our preliminary survey showed that several countries and Australian Jurisdictions are conducting the sampling of trace evidence at the morgue after the transportation of the body. Potential impurities present in body bags could thus interfere with pertinent traces.

The aim of this work was to qualify and quantify the background contamination of trace evidence in body bags used within Australia. Fifteen body bags from four Australian Jurisdictions or laboratories were searched for micro traces. Impurities such as fibres and unidentified particles were detected in each examined body bag, with an estimated average of 3603 coloured fibres and 1429 unidentified particles. This number of fibres is similar to the amount found on a vinyl cinema seat in other studies. Various other contaminants such as pieces of fabric, hairs, parts of insects or feathers were also observed. It is hypothesised that these impurities are introduced during the manufacturing process.

This high number of impurities can lead to incorrect conclusions and misleading investigative leads. This paper presents an overview of the problems these impurities can cause and proposes several strategies to prevent future issues.

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1. Introduction

Introduction of irrelevant material (i.e. not related to the crime) can occur at several stages in a police investigation, for example at the crime scene or in the laboratory while the exhibits are examined. It is a known problem that crime scene examiners and forensic scientists in general have to be aware of and manage appropriately. However, if not recognised as such, the presence of this material can become a critical issue and could lead to a waste of resources during the investigative stage and, possibly in the most serious cases, to a miscarriage of justice.

In order to have a consistent terminology throughout this paper, the terms “contamination”, “pollution”, “impurities”, “background”, “sample” and “specimen” are defined (Table 1), largely based on Margot [1]. “Contamination” relates to the natural background noise (non-pertinent traces) present on investigation scenes before any intervention. Since it cannot be avoided, collecting and analysing elimination or control specimens can help in identifying these traces as being contaminations. The weathering of the crime scene (e.g. weather conditions, geological events, insects or scavenging animals) [2,3] can also contribute to the creation of contamination, but will more often lead to the loss and destruction of traces. The term “pollution” was first proposed by Margot [1] and has been subject of numerous publications [3–8]. It refers to the introduction of traces that are not related to the crime, by the people working on the case. Pollution can occur at any time during the intervention of the first responders (paramedics, police and firemen), the processing of the crime scene (police, crime scene investigators), the transport and storage

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Table 1
Common terminology used throughout the study. These definitions are based on the glossary for the Basic General Forensic Knowledge Examination, ENFSI Monopoly Project M2-2010.

	Definition
Contamination	Contamination is the non-pertinent traces on investigation scenes before any intervention (of emergency services, crime scene service, etc). It is normal forensic science conditions and cannot be avoided. We need to understand potential effects on interpretation and conclusions.
Pollution	Pollution is what has been added to the investigation scene or to the forensic material due to careless handling. It should be avoided by adopting protective measures or can be documented in certain circumstances (e.g. medical help).
Sample	In science, the notion of 'sample' refers to a representative selection of items from a population of items (or, more generally speaking, the extraction of a representative part of a whole). The choice of item is conducted in a way that should allow reasoning about the properties of the source population. This is typically the case with seizures of items thought to contain something illegal. The notion of sample is appropriate when referring to the collection of statistically representative material from a source.
Specimen	Like a sample, a specimen is also part of a whole, yet it is fundamentally different from a sample. In a great majority of forensic contexts, a specimen represents a single (possibly degraded or even contaminated) item, such as a stain, a fingermark, a shoemark, etc. found on a crime scene. A characteristic feature of a specimen of this kind is that it does not offer the same qualities as a sample because there is a fundamental uncertainty arising from its nature as trace material. For example, it may not be representative and/or replicable.
Impurities	Material on forensic equipment originating from the equipment itself (e.g. particles from the zipper, fibres from the sewing yarn, material from the fabric of the bag).
Background	Material present on forensic equipment that does not originate from the equipment itself but from an extraneous source (e.g. fibres, glass, sand . . .).

of the evidence (at short and long term), and during the laboratory analysis of the evidence. "Pollution" is generally due to careless handling and can thus be avoided by appropriate protective measures. Lastly, contaminants on forensic equipment and consumables can be sorted in two distinct categories; "impurities" can be used to define the material present on the forensic equipment resulting from the equipment itself. On the other hand, "background" defines extraneous material that does not originate from the forensic equipment. During the crime scene processing and the laboratory analysis, potential impurities and background can both cause pollution if they are transferred onto the crime scene or the material to be examined.

This particular study specifically focuses on background and impurities. If present on forensic material, they may become a problem if transferred into the crime scene or onto material to be examined. Several examples of issues caused by such impure forensic equipment have been previously reported. The most famous of these being the so-called "phantom of Heilbronn" case [9–11]. A mysterious female DNA profile linked approximately 40 different crimes between 1993 and 2009 throughout Germany, Austria, France and Eastern Europe. In March 2009, the DNA profile was found to be background present on the cotton swabs used for DNA probing. Since the swabs used for collecting biological material at crime scenes were produced for medical purpose rather than forensic purposes, they were thoroughly sterilised during the fabrication process, but were not exempt of DNA. This case subsequently prompted the forensic science community to develop standards for the manufacture of laboratory consumables used in forensic DNA analysis [12,13]. However, no standards have been elaborated so far for minimising (non-DNA) trace evidence pollution.

The "phantom of Heilbronn" case does not seem to be an isolated example; several other pollution issues from impure forensic consumables can be found in the literature. For example, Millen reports a case involving contaminated nylon bags for the preservation of accelerants [14]. Chisum and Turvey provide several case examples involving secondary transfer, pollution and other problems during an investigation [15]. An Austrian study provides also some interesting thoughts in relation to pollution during osseous human remains identification [16]. The question needs to be asked: could an analogous issue be raised with respect to the handling of bodies and the use of body bags?

A German study [17] showed that pollution of a body can occur throughout an autopsy. A risk evaluation of a secondary DNA transfer during the autopsy was conducted and the results showed that in four out of six investigated cases, a transfer of DNA from the autopsy table to the body was observed. A DNA profile of the bodies previously dissected could be detected even though the different instruments and the autopsy table were cleaned with disinfectant, which removes bacteria, spores and fungi. As shown by the results, the cleaning process did not remove DNA. Therefore, use of bleach was highly recommended for disinfection.

A body bag, used to transfer a corpse from a crime scene to the morgue, is another forensic consumable that can be contaminated. Impurities and background transferred from the body bag to the body or its clothes could potentially interfere with a micro traces examination. A study of background fibres in new, unused body bags has been conducted in the Northern Territory of Australia [18]. Throughout this study, a significant number of coloured, man-made fibres and miscellaneous debris (e.g. hairs, insect parts, metallic particles, coloured paper) were found inside the body bags. Such an amount of fibres and other foreign materials could potentially mislead an investigation. Therefore, to investigate this issue, body bags from different jurisdictions or laboratories across Australia were sourced and examined. The aim of this study was to qualify and quantify the background in the form of extraneous trace evidence present in the body bags used in Australia, and to develop a strategy to minimise the problems caused by a potential transfer of these traces.

2. Preliminary survey

It could be argued that pollution through impure body bags is not a major concern if sampling is conducted directly at the scene before the body is transferred to the morgue. A survey was thus implemented to examine the standard procedures of trace collection currently in use throughout Australia and worldwide. The main aim of the survey was to determine where bodies are generally examined for trace evidence. If the body is searched for trace evidence at the morgue, it might have been polluted by impurities and background present inside the body bag used during transportation. This issue does not occur if the body is searched for traces at the scene.

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