



Forensic response vehicle: Rapid analysis of evidence at the scene of a crime

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Abstract. The first hours of a criminal investigation can be the most important. A suspect arrested soon after a crime has less time to remove evidence from their person, possibly allowing stronger forensic ties between the individual and the crime scene. We have developed a mobile laboratory with designated work areas for the searching of small items and pre and post PCR work. An SGM+ profile can be produced and compared to the National DNA Database in approximately 8.5 h, potentially providing the police with valuable intelligence early in the investigation of a crime. © 2006 Published by Elsevier B.V.

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1. Introduction

The first hours of a criminal investigation can be the most informative. Real-time delivery of forensic intelligence which aids in the identification of a suspect soon after a crime can allow more effective collection of evidence. An individual arrested a few hours after a crime has occurred has less time to remove evidence from their person, possibly allowing stronger forensic ties between the individual and the crime scene. Furthermore, a rapid turn round has the potential to significantly reduce the time and cost of a police investigation.

The forensic response vehicle (FRV™), a mobile laboratory with designated work areas for the searching of small items and pre and post PCR work has been developed by the FSS and piloted with a UK police force with considerable success.

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FRV™ DNA process utilises a combination of off the shelf and bespoke equipment and consumables to perform extraction, amplification and analysis of the sample. Indeed, FRV™ has the capability to produce an SGM+ profile and compare it to the National DNA Database in under 8.5 h. The service provided by FRV™ has the potential of providing the police with valuable intelligence early in the investigation of a crime.

The vehicle also carries the capability for the interrogation of electronic items such as mobile phones. Satellite communication systems allow direct connection with the FSS network allowing images of fingermarks and footwear marks to be searched against the appropriate databases.

2. Forensic response vehicle

The FRV™ has been built upon the chassis of a 7.5 ton lorry. Accommodation includes a PCR clean laboratory and a Post PCR lab, both with independent access from their own lobby. Samples are passed between the 2 laboratories via an airtight hatch. Communication between the vehicle and the other FSS laboratories is via satellite link.

3. Mode of operation

FRV™ is called to a scene of crime by the customer, on the advice of a forensic scientist attending the scene. The FRV™ can be mobilised within an hour and driven to the scene. Samples are submitted either by an FSS scientist or directly by the customer with the appropriate paperwork. Items are logged into the FRV™ system using an electronic laboratory information management system (LIMS) upon submission and subsequently are searched according to the scientist's instructions. The PCR clean lab has sufficient space for searching of small items, from swabs to small articles of clothing. Standard presumptive testing allows identification of body fluid stains which can be recovered for DNA extraction.

4. DNA processing

All sample movements are routinely monitored and checked by scanning sample tube barcodes at each stage of the process to provide continuity of evidence.

4.1. Pre-PCR DNA process

Four samples were batched with appropriate controls prior to extraction by Qiagen methodology. Following quantification by PicoGreen™ [1], two PCR reactions were set up for each sample using 1 and 0.5 ng of template DNA, essentially in accordance with the methods described in Cotton et al. [2].

4.2. Post PCR process

Samples passed through the airtight hatch to the Post PCR laboratory were placed on a Tetrad DNA engine and cycled through 28 cycles of amplification. The process has been re-optimised to allow amplification of SGMPlus™ in 1 h 40 min whilst maintaining the profile quality.

Amplified samples are then separated and detected by laser induced fluorescence, along with allelic ladder on a novel instrument which has been designed specifically to be robust

to the mobile environment. Data from the instrument is imported to bespoke software for analysis followed by FSS-i³® for interpretation of the DNA profiles. Profiles are transferred electronically to the UK National DNA Database and searched against the 3 million plus profiles held thereon.

Any matches are reported to the customer on receipt.

5. Operation gazelle

FRV™ was piloted with Lincolnshire Police Force in a volume crime initiative with the aim of reducing the turn round time of volume crime DNA samples.

Up to 8 samples were submitted daily to the FRV™ in batches of up to 4 samples.

A total of 20 samples were submitted by the customer over a 5-day period. Of these samples, 12 produced profiles suitable for searching on the national DNA database.

Eight samples provided match information, giving a match rate of 40% in a turn round time averaging 8.5 h. The rapid provision of this intelligence data allowed the customer to react quickly to volume crime in their force area. In one case the suspect was arrested 40 min after the match report was provided to the police.

References

- [1] A. Hopwood, et al., Rapid quantification of DNAsamples extracted from buccal scrapes prior to DNA profiling, *Biotechniques* 23 (1997) 18–20.
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