B3 A Novel Collection Method That Improves Direct DNA Amplification From Various Bloodstained Porous Materials

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Learning Overview: The goal of this presentation is to demonstrate the effectiveness of a novel collection method, which utilizes FTA™ Elute cards to significantly improve direct genotyping from a variety of bloodstained materials.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing practitioners with a simple and effective collection method that improves the quantity and quality of short tandem repeat (STR) loci directly amplified, while also reducing the time and cost of DNA analysis.

The demand for DNA testing to solve crimes and assist in the identification of victims from mass disasters and terror attacks continues to grow and has contributed to an ever-increasing backlog of samples that require analysis.

Direct Polymerase Chain Reaction (PCR) amplification has focused on genotyping samples from the source, avoiding the time-consuming extraction process attributed to traditional methods. In addition to reducing the cost and time it takes to generate a DNA profile, direct PCR analysis also reduces the amount of DNA lost from sample transfer during the multi-step purification process and minimizes handling, decreasing the risk of contamination.

Directly profiling DNA from its source may not always be possible. Biological evidence can be found on any inanimate object, many of which cannot be sectioned to fit into a PCR tube or may require specialized and expensive equipment that is not readily available to the laboratory. Recovering DNA from trace amounts of blood deposited on porous materials can be problematic. Biological samples can be become embedded within the material's porous matrix, potentially reducing the amount of DNA recovered. In addition, samples collected may contain known inhibitors that could impede the PCR process. Hemoglobin from whole blood, indigo dye found in jeans, and humic compounds found in soil have all been shown to inhibit the PCR.

FTA™ Elute cards are traditionally used to store and preserve blood and saliva samples that are typically provided by a donor. Their ability to allow direct amplification of DNA that has become embedded within its matrix has become an invaluable tool to the medical and forensic communities. FTA™ Elute cards contain a chaotropic salt that can lyse cells and keep proteins tightly bound to its matrix while DNA is eluted and made available for amplification. This project investigated a novel application of FTA™ Elute cards in their ability to directly profile minute amounts of blood that have been deposited on different porous structures.

FTA™ Elute cards significantly improves the quantity and quality of STR loci directly amplified. Using FTA™ Elute cards 90 % (93 % concrete, 95 % jean, 88 % wood and 85 % soil) of PowerPlex® Fusion (5C) alleles were successfully amplified. In comparison, the traditional swab successfully amplified 52 % (36 % concrete, 85% jean, 76 % wood and 14 % soil) Fusion alleles. Moreover, directly genotyping samples using FTA™ Elute cards significantly increased the RFU peak heights and peak height ratios of STR profiles when compared to samples genotyped using the swab.

Developing a collection method that could reduce the effect of inhibitory factors and provide a reliable measure of DNA collected would reduce the number of repeat samples minimizing the amount of time and money saved. The study demonstrates the potential of using FTA™ Elute cards as a collection tool, showing a significant improvement in results when compared to the swab.

Direct DNA Amplification, Porous Materials, FTA Elute Cards