B178 Improving Methods for the Recovery and Analysis of Touch DNA From Fingerprints at Crime Scenes

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After attending this presentation, attendees will better understand the most effective method of recovering DNA from touched or handled items at crime scenes for the purpose of human identification. The presentation will guide the audience through the optimum swabbing technique, the best swabbing media, and describe the process of direct Polymerase Chain Reaction (PCR) with the extraction step omitted.

This presentation will impact the forensic science community by highlighting the benefits of direct PCR in a forensic context and making the audience aware that an extraction step is not always beneficial for processing touch DNA swabs. This method reduces time and labor costs and minimizes the risk of contamination while increasing the likelihood of obtaining a meaningful profile for interpretation. The methodology described can easily be adapted into mainstream forensic practice.

The ability to generate a DNA profile from a fingerprint for the purpose of human identification will have significant implications for solving a broad spectrum of criminal investigations, ranging from theft to crimes of violence. DNA retrieved from fingermarks deposited by touch (referred to as "touch" DNA) is often degraded, limited in quantity, and may comprise elements that co-extract with the DNA and hinder subsequent amplification. There is a limit of sensitivity that still precludes many items touched at a scene from generating a useable DNA profile, despite their potential importance in a criminal investigation. Examples of these sample types include triggers, steering wheels, bullet cartridges, and handles of knives. In many criminal cases, the ability to retrieve the maximum amount of DNA from "touch" DNA samples is of paramount importance and crucial to resolving the case.

The first DNA profile generated from a fingerprint was reported over a decade ago and revolutionized forensic science. In spite of this, recent research demonstrates an extremely low success rate (5%-6%) using standard methodology in terms of generating a profile from "touch" DNA sources that is deemed suitable for identification purposes. This highlights the need for improved methodology. A novel method that routinely generates meaningful DNA profiles from latent fingermarks for the purpose of human identification is reported here. Depending on the type of short tandem repeat DNA profiling kit used, the success rate is 62% to 70% and is not dependent on an enhanced PCR cycle number. Its novelty that will be discussed involves an optimized swabbing technique and detergent media, omission of a DNA extraction process, and the addition of PCR facilitators to the reaction vessel. By using a direct PCR approach, full DNA profiles from fingerprints that have been deposited only 15 minutes after a person has washed his/her hands can routinely be generated.

A total of 34 people washed their hands to remove external DNA and after only 15 minutes deposited fingermarks from all digits of their dominant hand onto a plastic substrate. Nylon fibers pre-moistened with heated detergent were used to collect any DNA from the substrate and then placed directly into the amplification reaction tube. From the 170 fingermarks tested, only four DNA profiles (<1%) failed to yield DNA and 116 DNA profiles (68%) were recorded with sufficient data to be used in DNA databases. This finding demonstrates a 62-fold difference between standard methodology and the improved DNA-capture method.

The method has since been applied to casework to generate a DNA profile from a single fingermark deposited on a drug wrap, illustrating the potential for significant impact on forensic practice and criminal investigations. The process described is simple, elegant, and should readily gain general acceptance into legal systems. This will allow meaningful DNA profiles to be generated routinely from touched items where current forensic practice has little or no chance of generating a DNA profile.

DNA Profiling, Touch DNA, Direct PCR