B110 DNA Profile From a Fingerprint Developed With a Columnar Thin Film

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After attending this presentation, attendees will understand that an emerging fingerprint-development technique preserves DNA from body fluids on a fingerprint and that good quality DNA profiles can be obtained from the fingerprint. It is hypothesized that the developed body-fluid fingerprints will be of better quality than those that have not been developed and that the fingerprints will give the same quality DNA profiles.

This presentation will impact the forensic science community by promoting knowledge of the options available to forensic scientists in developing body-fluid fingerprints. Moreover, this presentation describes how to obtain DNA from fingerprints and subjectively and objectively grade the quality of those fingerprints. The Columnar Thin Film (CTF) method is also analyzed in regard to fingerprint quality and the potential for DNA preservation.

DNA and fingerprint analyses are the two major methods of identification used in forensic science. If these two methods can be implemented on the same sample, identification of a suspect or a victim can be greatly improved. In this research, blood was collected by pricking the finger and smearing it on the fingertip. Saliva was collected by dipping fingers into saliva. Sixty fingerprints produced with blood and 40 fingerprints made with saliva (100 total fingerprints) were placed on brass. Fingerprints were allowed to dry at room temperature and CTF deposition occurred the following day. Half the fingerprints were developed with CTF technique and the other 50 remained undeveloped.

The CTF technique involves the resistive heating of a material, which sublimes and condenses conformally as a tight stack of upright nanoscale columns atop a fingerprint. The CTF entombs the entirety of the residue, serving as a barrier between the residue and the environment, and potentially preserving DNA in the residue.

After the fingerprints were developed, the substrate was swabbed to collect the residue comprising the fingerprint emulsion, the body fluid, if necessary, and the CTF. All samples underwent DNA analysis. In the case of the fingerprints with body fluids, the DNA was extracted from the collected residue and quantitated using Real-Time Polymerase Chain Reaction (PCR) technology. Concentration of DNA ranged from 0.226ng/µL to 7.05ng/µL. Approximately 1.0ng of DNA was amplified with the Identifiler® Plus amplification kit for all fingerprint samples. DNA from the amplified product was detected by capillary electrophoresis injection on the Applied Biosystems® 3130xl Genetic Analyzer. The generated data was analyzed using GeneMarker® HID Software from SoftGenetics®.

Latent fingerprints without body fluids were also harvested and placed on glass. With these latent fingerprints, the extraction procedure involved low-template DNA-analysis methods previously used in this study's laboratory. DNA was quantified using the Trio kit from Applied Biosystems® and the InnoQuant™ kit from InnoGenomics. The yield of DNA from fingerprints, which had been aged for defined periods of time, allowed the researchers to compare the degree of degradation which took place between the enhancement techniques.

This research indicates that fingerprints wetted with body fluids and developed with the CTF technique are better quality than latent fingerprints. It was possible to generate complete DNA profiles from 100% of the fingerprints wetted with body fluids and developed by the CTF technique. The profiles were concordant with the reference samples of the donors. Of the fingerprints wetted with body fluids and not developed by the CTF technique, complete profiles were obtained from 83.33% of the samples, partial profiles were generated from 8.33% of the samples, and no profile was obtained from 8.33% of the samples. Since a measurable amount of DNA and complete DNA profiles were obtained from these fingerprints after CTF exposure, it was determined that the CTF had no negative effect on the methods of DNA analysis, and therefore it is believed that the DNA profiles obtained from CTF-developed fingerprints are of the same quality as non-developed fingerprints. This research also indicates that there is a sufficient quantity of DNA in multiple latent fingerprints to analyze DNA amplicon length ratios. Thus, it is possible to determine the amount of degradation in the sample. Overall, the combination of the CTF-development technique and DNA analysis could prove useful for identification purposes in a crime laboratory.

Fingerprints, DNA, Columnar Thin Film