B28 Touch DNA in Forensic Science

Ashley Hall, PhD, University of Illinois at Chicago, 833 S Wood Street, 456A PHARM (MC 865), Chicago, IL 60612*

The goal of this presentation is to inform attendees about the use of touch DNA.

This presentation will impact the forensic science community by advancing the proposal that touch DNA should be accepted as routine evidence.

The relationship between fingerprint component topography and touch DNA retrieval will have an impact on the forensic science community by increasing the efficiency of touch DNA retrieval from fingerprints. Optimized touch DNA collection methods based on this knowledge will be presented in order to expand their application across the forensic science community.

Touch DNA is a trace amount of DNA left on a surface by a donor who touches said surface and can be found on everyday objects as well as on evidence left at a crime scene. Fingerprints may lead to the identification of a donor through their uniqueness in ridge detail, but they may also be used to identify the donor as touch DNA evidence. Skin cells, eccrine sweat, and sebum comprise fingerprint residue. Though a touched surface may retain cells from the donor individual, cell-free DNA can also contribute to the retrieval of human touch DNA. Microorganisms on the skin also transfer to surfaces. DNA analysts, with improvements in technology and techniques, have the potential to extract a full or partial DNA profile from a single fingerprint from a touched surface; however, several confounding factors can inhibit this potential, such as shedder status of the donor and degradation of the DNA present due to environmental factors.

A thorough survey of the location in which cell-free DNA, whole human cells, and microorganisms reside within a fingerprint was conducted to fully assess the impact of these topographical differences on touch DNA retrieval. To meet this goal, three research objectives were developed and executed: (1) develop a technique for fluorescent and bright field visualization of palmar keratinocytes, cell-free DNA, nuclear DNA, and microorganisms in true fingerprints; (2) assess fingerprint topography before and after DNA collection methods to determine where any lack of collection may be occurring; and, (3) optimize DNA collection techniques on various surfaces and with various collection media based on these results to minimize sample loss.

Due to the complex composition and unique donation of DNA from fingerprint to fingerprint, mock fingerprints containing a known quantity of DNA were developed from buccal epithelial cells to generate standard curves for quantification purposes. Standardizing these mock fingerprints as a positive control for collection alongside true fingerprints allowed for further examination into loss of DNA during collection and extraction. By determining the quantity of DNA retrieved from these mock fingerprints, estimations of extraction efficiencies as well as initial DNA deposited in a true fingerprint can be made.

Both true and mock fingerprints were visualized through staining of various biological components: whole cells, cell-free DNA, nuclear DNA, and microorganisms. The distribution of these components in true and mock fingerprints was gauged before and after collection of touch DNA from glass slides using a variety of collection methods and devices. Once the optimal collection method from glass was determined from these results, mock and true fingerprints were deposited onto/collected from various surfaces, such as wood and paper, and various objects one might receive as evidence, such as a steering wheel or piece of tile. The most successful retrieval methods and collection devices for each respective surface will be presented in order to encourage their use by other forensic analysts and, ultimately, lead to enhanced performance and efficiency in forensic DNA collection.

Touch DNA, Fingerprint, Low Template