B126 Tracking DNA Loss in Forensic Touch Samples

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Learning Overview: After attending this presentation, attendees will understand at which stages of the collection and extraction processes the highest loss of DNA from touch samples is observed, and the effects that different substrates can have on DNA yields.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by identifying whether the initial collection of a touch sample by swabbing or an organic based extraction may benefit from changes to maximize the amount of touch DNA obtained. Additionally, knowing how touch DNA yields are affected by certain substrate types can guide future investigations into how to better deal with these surfaces.

The Locard exchange principle states that, with contact between two items, there will be an exchange of material—a concept central to the science of fingerprints. The hands are vectors for the transmission of forensic evidence; sweat and oil are transferred as the ridge detail that is the conventional information-bearing component of the exchange. However, for the last two decades forensic scientists have recognized the added capability of extracting "DNA fingerprints from fingerprints," that is, the sweat and oil exchange contains a second information-bearing component in the DNA-containing cells that support genetic profiling: this is the science of touch DNA.

Touch samples contain a low quantity of DNA, and the manipulations of collection and analysis can further reduce this amount. In fact, studies have tracked up to a 90% loss of DNA during the performance of standard protocols. However, it has been not clear at which point(s) during collection and/or analysis the DNA is primarily lost. To better identify and define these points, three "mock fingerprint" controls were developed, each containing a specific, known quantity of DNA. To evaluate loss during collection and extraction, 20 µl mock fingerprints were pipetted: (1) on to a surface—to measure the quantity of DNA left after swabbing, (2) on to a swab—to quantify DNA retained on the swab, and 3) directly into the lysis buffer—to evaluate loss due to the manipulations of extraction. Samples were collected and analyzed using a baseline protocol—mock fingerprint deposition, collection with a cotton-tipped swab wetted with 2% SDS, organic extraction, and real-time PCR quantification.

Each of the three types of mock fingerprint controls were used to construct five-point standard curves (0-1500 cells, 0.00 – 9.00 ng DNA) by plotting DNA added vs DNA recovered after extraction. With the mock fingerprint controls, true fingerprints were deposited on three different surfaces—a brass door handle, a steering wheel, a glassine (drug) baggie—and then analyzed. The quantities of DNA extracted were plotted on the standard curve and values for the human DNA that had been present in the true fingerprints at deposition were interpolated. The values ranged from 3.38 – 5.39 ng, with recoveries of only 1.54% (0.0520 – 0.0830 ng) of the amount of human DNA originally deposited, with most of the DNA loss attributed to retention on the collection swab. Strategies to increase recovery based upon the data collected will be discussed.

Touch DNA, Mock Fingerprint, Quantification