B179 Assessment of Fingerprints for Forensic Short Tandem Repeat (STR) Analysis

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After attending this presentation, attendees will understand the challenges of working with fingerprints. The presentation will focus on the evaluation of cellular and DNA content of a single fingerprint and the ability to produce Combined DNA Index System (CODIS)-eligible STR profiles.

This presentation will impact the forensic science community by providing information on investigative values of fingerprints as forensic DNA samples.

Touched or grabbed items, such as handles of weapons, tools, or other objects with no apparent biological staining, can be used as evidence in investigations in a wide variety of criminal cases, including homicides, sexual assault, and property crimes; however, there are some fundamental difficulties when working with samples collected from touched objects, including variability in quantity and quality of extracted DNA. Fingerprints can result in little-to-no DNA but also in DNA profiles that are suitable for upload to forensic STR databases. Importantly, sometimes fingerprints are the only available source for forensic DNA testing. Obtaining high-quality DNA profiles that can be used for CODIS from the aforementioned types of evidences has a tremendous potential in the investigation of a wide variety of criminal offenses.

In a longitudinal study, the New York City Office of Chief Medical Examiner Department of Forensic Biology collected more than 700 fingerprints. Unrelated volunteers provided several series of fingerprints on separate days. Sample collection was performed under similar conditions to minimize variations. Following deposition, the fingerprints were assigned a quality score of one to five (sparse to dense shedding), aided by the use of an Olympus® SZX-16® stereomicroscope. Individuals differed in their shedding scores; however, most fingerprints scored three or four. A Chi-square test on the data confirmed that it is not possible to classify people as good or bad shedders. Nevertheless, some individual's scores tended to be slightly lower, enabling these persons to be described as "bad shedders" relative to individuals who's scores tended to be a little higher. A Chi-square test also revealed no differences between left and right hand regarding the shedding score, indicating that shedding is independent of hand dominance or how frequently one hand is used over the other.

The laboratory further investigated whether there is a correlation between shedding score and the amount of DNA recovered. Linear regression showed that one unit in shedding score is associated with a 2.24pg/µl increase in the amount of DNA recovered; however, this is not significant ($p=0.20$) indicating shedding score is not helpful in predicting DNA amount. The laboratory also investigated the correlation between shedding score and completeness of the DNA profile obtained. Linear regression showed that each unit of shedding score was associated with a 4.2% increase in the percent profile obtained and this was significant ($p=4.8x10^{-4}$); however, because of the great variability in profile quality, shedding score alone was not a reliable predictor of profile quality. A possible explanation for this could be that many deposited cells in a fingerprint may not be nucleated, plus cell flakes may or may not be carriers for extracellular DNA which is not visible microscopically.

Most of the STR profiles obtained from the fingerprints were partial. Profiles that were at least 70% complete were considered as valuable, since such profiles could be used to search databases. The probability to obtain such profiles from a single fingerprint varied, but was approximately 50%. In conclusion, a fingerprint can be considered as a potential source of DNA for forensic identification.

Fingerprints, STR Profiles, Touched Items