ALTERNATIVE DNA PROFILING STRATEGIES FOR ROOTLESS HAIR SHAFTS

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Hairs are commonly found at crime scenes and can provide valuable genetic information about possible victims and suspects. Typically the usable genetic material is extracted from the root of the hair, located on the proximal side of the hair shaft, containing cells with intact nuclei and DNA. A potentially probative hair, lacking an intact root because it was shed naturally or sheared from the head, can fail traditional capillary electrophoresis based STR analysis. Without the intact cells located in the root, remaining nuclear DNA is both highly degraded from the keratinization process and low template. While mitochondrial based assays are highly successful with rootless hair shafts, viable alternatives are sought after to increase the power of discrimination from resulting genotypes.

In this research we collaborated with Innogenomics to utilize a novel extraction chemistry to recover DNA for two assays that can be used to supplement STR workflows in forensic laboratories. Collected hairs were examined microscopically with the roots being removed before DNA extraction. Samples were then amplified using Innogenomics' Innotyper 21 assay with analysis completed using an ABI 3500 capillary electrophoresis. This assay is based on retrotransposon insertion polymorphism markers that are 60-125 base pairs in length and is highly successful with degraded DNA. We also amplified samples using the Verogen ForenSeq DNA Signature Prep Kit for the MiSeq FGx. This assay has a lower limit of detection in comparison to traditional CE/STR based instrumentation. These assays were compared to traditional STR based analysis using ThermoFisher's Globalifer PCR Amplification Kit.

These methods can successfully supplement STR based assays that currently set the standard for human identification, increasing the range of viable sample types for forensic laboratories and increasing positive outcomes from genetic analysis.