B130 A Modified Hair Extraction Technique for Mitochondrial DNA Analysis

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After attending this presentation, attendees will learn about a modified technique for the processing of evidentiary hairs for use in mitochondrial DNA testing, including, but not limited to, the documentation, handling, washing, and extraction technique employed by the mitochondrial DNA laboratory at the Office of Chief Medical Examiner in New York City.

This presentation will impact the forensic community and/or humanity by demonstrating the evidentiary value of hair, whether collected from a crime scene, taken from a body at autopsy, or lifted from evidence in the laboratory, cannot be underestimated. An improved way to process hair evidence for mitochondrial DNA testing will be useful in forensic casework.

In the course of implementing a mitochondrial DNA laboratory for the Office of Chief Medical Examiner in New York City, a validation study on hair extraction was performed to ensure the proper handling and processing of evidentiary hairs in forensic casework. One of the goals was to improve the enzymatic digestion technique and to eliminate the high cost and timeconsuming process of manually grinding hairs, which is also a possible source of contamination. To ensure the cleanliness of the hair, a technique of cleaning the hair was developed in which the evidentiary hairs were immobilized on a moist membrane following sonication in a detergent. The membrane, being liquid permeable, allowed the hair to be washed with a variety of reagents and dried in open air without risking the loss of the sample. An enzymatic digestion technique was modified and optimized using regular laboratory-grade reagents, resulting in the complete digestion of a standard 2 cm cutting of a hair shaft in under a half-hour, in nearly all of the samples tested. A variety of studies were carried out on the quality of obtaining viable sequence data from previously mounted hairs, as well as a sensitivity study on the necessary length of the hair prior to enzymatic digestions. Several studies on chemically treated/dyed hair were carried out as well. The enzymatic digestion technique was successful in obtaining mitochondrial DNA from all types of hair, regardless of the mountant or fixative, regardless of chemical alteration or dyes, and from as little as 2 mm of hair shaft. A high success rate was observed in obtaining highquality mitochondrial sequence data from all of the hair extracts (regardless of complete digestion of the hair shaft), initially using Linear Array strips from Roche Applied Science, and confirmed by DNA sequencing and 3100 analysis.

The forensic documentation of the hairs, prior to the processing for extraction, was done on a stereomicroscope from Mideo Systems Inc., allowing for the rapid identification, measurement, and photography of the hair, including the region of interest that would be submitted for the extraction of mitochondrial DNA. Furthermore, the use of dead-air hoods from Labconco and the strict adherence to a conservative decontamination policy in a dedicated pre-amplified room served to reduce the overall effects of contamination and sample loss that are common when dealing with mitochondrial DNA analysis and evidentiary hairs.

Mitochondrial DNA, Hair, Extraction

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