H37 Correlation of Forensic Anthropologic Findings With DNA Profiles Obtained From Cold Cases

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After attending this presentation, attendees will understand the methods of extraction of DNA from environmentally challenged samples (bones) that can be used for cold cases.

This presentation will impact the forensic community and/or humanity by providing the physical anthropologist alternate methods to detect DNA from samples commonly seen in cold cases providing rapid resolution of cases.

The identification of missing and unidentified persons in cold cases poses a number of challenges. Current Deoxyribonucleic acid (DNA) extraction methods, apart from being extremely time consuming and labor-intensive, carry additional risks of degradation and contamination. The recovery of DNA from bones presents specific difficulties in DNA purification and the amplification using polymerase chain reaction in the presence of inhibitors. Moreover, samples of DNA extracted from bones may be highly degraded and difficult to extract in sufficient quality and quantity. Associating anthropologic findings from macroscopic analyses with DNA results provide (1) for an effective method for rapid resolution of cases, and (2) a direct test of the accuracy of traditional anthropological analyses.

In the present study cold case samples (N=45) from Florida Medical Examiner Districts 4 and 20 were initially analyzed using forensic anthropologic methods: nonmetric and metric analysis of bones and teeth in order to determine the unknown decedent's biological profile, e.g., age, ancestry, sex, and stature. Age estimation was determined through macroscopic analysis of the sternal end of the right fourth rib and pubic symphyseal surfaces. Ancestry, sex, and stature were primarily determined through metric assessment (in mm.) with FORDISC 3.9. Subsequently, fibular bone was excised from each decedent using a Stryker oscillating bone saw. A new saw blade was used for each sample in order to prevent contamination. The fibular sections consisted of one (1) 2-inch by 4-inch window that was be divided in half and placed into sterile test ampoules (e.g., one COVARIS and one mortar/pestle sample) following Armed Forces DNA Identification laboratory (AFDIL) protocol. When the right fibula was absent the right fibula was substituted.

For DNA extraction, a novel ultrasonic technology, the Covaris™ E200, was utilized to rapidly and effectively extract even trace amounts of DNA from human long bones. Notably, this technology not only extracts DNA but also preserves its integrity since there is minimal heating or foaming during the automated extraction process. The goal for the extraction procedure involved minimal handling of DNA after extraction to prevent contamination of the DNA obtained from other sources e.g., technician, anthropologist, and other cases. Human bones were processed using the Covaris™ Cryo prep unit, followed by ultrasonic treatment with the Covaris™ E200. DNA was obtained by salt extraction followed by purification with silica beads. Subsequently, the DNA was amplified using primers designed for the amelogenin locus. Both agarose and capillary electrophoresis analysis revealed DNA of high quality and quantity from control bone samples. The authors will also present data from some cold cases correlating the sex and origin based on anthropological findings vs. STR analysis. The protocol is being optimized to decrease inhibition and degradation for use with environmentally compromised samples including those human skeletal remains that have been burned, both during the post and perimortem intervals, and/or exposed to the elements years (e.g., water, sun, wind, and soil) for months to years.

Anthropologic Findings, Bones, DNA Extraction

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