B127 The Influence of Skeletal Weathering and Bone Type on MtDNA Analysis

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After attending this presentation, attendees will learn in what way bone type and its level of weathering, as well as age and sex of the deceased, can be used to help predict the success of mtDNA typing of skeletal material.

By using these types of objective comparisons of bone condition and type presented, and individual age and sex, the forensic biologist should be able to better predict the likelihood of successfully amplifying mtDNA from weathered bone, and devise strategies for targeting amplicon length. This presentation will impact the forensic community and/or humanity by increasing the productivity and efficiency of DNA analysis of skeletal material.

Forensic investigation of human skeletal remains may require DNA analysis for identification. In many instances such remains are in poor physical condition owing to weathering. This leaves the forensic biologist with the difficulty of predicting how to commence with the analysis, or whether DNA analysis might be successful at all. The goal of this study was to determine if the degradative state of skeletal remains can be used in a predictive manner with regard to mitochondrial DNA (mtDNA) analysis. Further, bone type was examined to establish what role it plays in DNA recovery from weathered bone. Information regarding the sex and estimated age of each individual was also compared to amplification success. Analysis of Variance (ANOVA) was used to test for differences in amplification success among the samples, considering each of these variables. The likelihood of successfully amplifying DNA based on the outer appearance of a bone, as well as the type of bone in question, and what size DNA fragment should be targeted would allow the forensic biologist to begin analysis on skeletal material with the greatest chance of producing results, reducing both the time and resources spent on analysis of aged skeletal remains.

In this study, mtDNA was isolated and amplified from a series of skeletons found in an abandoned cemetery in Pittsburgh, Pennsylvania. The cemetery was utilized by Swiss-German immigrants from 1833 to 1861, after which it was eventually built over and subsequently uncovered during an Interstate expansion project in 1987. Over 700 graves were found, and all remains were analyzed anthropologically. The level of weathering was assessed for whole skeletons, and later for individual bones, to determine if either or both would be beneficial for predicting PCR success and mtDNA quality. Skeletons were graded on a 0 to 5 scale, with 5 being the most weathered, representing bone that crumbled easily. Multiple bone types from skeletons at five out of six stages (1 – 5) were tested genetically. These same sets of bones were regraded on a 1 to 4 scale based on individual bone weathering. Maximum mtDNA amplification size was assessed using primers that produced amplicons of 107 bp, 220 bp 329 bp, and 402 bp.

The analysis of this material allowed researchers to determine statistically what influence skeletal and/or bone weathering conditions have on successful mtDNA analysis, as well as what role the type of bone plays. Variables such as the sex and age of the deceased were also included. By using these types of objective comparisons of bone condition and type, and individual age and sex, the forensic biologist should be able to better predict the likelihood of successfully amplifying mtDNA from weathered bone, and devise strategies for targeting amplicon length. This then, would increase the productivity and efficiency of DNA analysis of skeletal material.

MtDNA, Bone Degradation, Skeletal Remains

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