G5 The Effect of Environmental Degradation on DNA With Respect to Time and Conditions

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The goals of this presentation are to show the effects of environmental degradation of DNA due to environmental conditions and exposure over time and to show the development of degradation curves and a degradation timeline based on type of burial.

This presentation will impact the forensic community by providing an estimation of decomposition of rates of nuclear DNA and provide information concerning the best method for recovery of information from degraded samples.

The goal of this presentation is to show the effects of environmental degradation on DNA with respect to time and environmental conditions in order to develop a better understanding of these effects on the analysis of tissue and bone samples. Ultimately these studies will assist an analyst in determining the relative age of an individual sample, whether a lack of PCR activity is due to degradation or PCR inhibition, and what quantity of DNA must be recovered from the sample in order to generate an optimal genetic profile.

This study will examine the rate of decomposition of human remains under a variety of conditions, focusing on the quality and quantity of DNA that can be recovered over time. Control blood samples will be utilized to provide a clear estimate of initial quality of the DNA. The effect of different types of burial environments on DNA will then be investigated. Three types of samples will be obtained: above ground, in water, and underground burials. The focus of this study will be to determine the rate of degradation of DNA between samples based on the type of burial and the environmental conditions. Both real time PCR and STR amplification will be used to estimate these effects. Due to the advances in rtPCR techniques and the development of mini STR kits, current capabilities for the analysis of such samples have greatly improved. However, laboratories need guidance on when to use specialized analytical systems for degraded samples and when more traditional large multiplex kits can be used. Ultimately it is expected that these experiments will provide guidelines on how such samples should be prepared and analyzed.

Tissue, blood, bone, and nail samples have been obtained from the University of Tennessee Anthropological Center and extracted using QIAGEN Blood and Tissue kits and amplified using an Alu based Real-Time PCR method. The 25mg Lfor samples tissue samples typically yielded concentrations of well over 1ng/µL less than 4 weeks old. For samples 4 to 6 weeks old, a yield of between 1.0ng/µL and 0.1ng/µL was observed. More highly degraded samples obtained after 8 weeks yielded even lower concentrations of DNA. A variety of amplicon sizes were used with real time PCR to next examine the relative levels of DNA degradation and these results were compared with profiles of the extracted samples generated from an ABI Prism® 310 Genetic Analyzer. Comparisons made between bone, blood and tissue samples and corresponding non-degraded blood samples were used to estimate relative rates of degradation. Studies on the effects of inhibitors on these samples will also be discussed.

The results of this study indicate that there is a timeline that degradation follows as samples that were 8 weeks or older have, when compared to more recent remains, a substantial reduction in the amount of extractable DNA. This study also indicates relative rates of decompositions based on sample conditions and helps provide a comparison of different extraction and amplification procedures using real samples with known history.

DNA, Degradation, Environmental

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