A61 Examining the Persistence of Human DNA in Soil During Cadaver Decomposition

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After attending this presentation, attendees will gain a more thorough understanding of the persistence of human DNA in the soil during human cadaveric decomposition.

This presentation will impact the forensic science community by complementing existing information concerning taphonomic changes in the soil environment during human decomposition. The results of this project will progress the understanding of the persistence of human DNA in soil, thereby expanding upon the current understanding of the interplay between chemical, physical, and biological processes occurring in the soil in concert with human decomposition.

The majority of experimental work involving human decomposition has focused on aboveground processes, ignoring the potential impact imposed on the underlying soil. Though recent decades have seen a marked increase in research of this type, including the fate of certain cadaveric biological correlates once they enter the soil, the fate of another important biological correlate in grave soil — human DNA — has been relatively understudied.[1-10] This study sought to redress this gap in existing knowledge by assessing the persistence (i.e., presence or absence) of human nuclear and mitochondrial DNA (mtDNA) and evaluating the quantity of recovered DNA from soil over the course of decomposition of four human cadavers placed at the University of Tennessee's Anthropological Research Facility.

To test hypotheses that both human nuclear and mtDNA would be recoverable from the soil environment and that the quantity of DNA would be greatest during active and advanced decay stages of decomposition, samples were assessed using end-point and real-time quantitative PCR (qPCR). Cadaver DNA from soil samples was verified by comparing sequences from the human mtDNA control region (HVI and HVII) between cadaver blood samples and a subset of soil samples taken from below each cadaver following the initiation of decomposition.

Human nuclear DNA was largely unrecoverable from the soil throughout decomposition, while cadaver mitochondrial DNA was detectable throughout all decomposition stages. MtDNA copy number increased as decomposition progressed, peaked during active decay (Max. Value=$1.9X10^6$ copies gdw^{-1}), and declined throughout the remainder of decomposition, reaching a minimum value of $1.4X10^4$ copies gdw^{-1}. When tested against additional variables including time (measured in Cumulative Degree Hours (CDH)) and soil chemistry, mtDNA copy number showed a positive correlation with CDH (rs=0.420, p=0.041), Total Organic Carbon (TOC) (rs=0.418, p=0.042), and Total extractable Nitrogen (TN) (rs=0.569, p=0.004).

In conclusion, human mtDNA can be recovered from soil and is of a high enough quality to be used for exclusionary purposes during identification efforts.

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Soil Taphonomy, Human DNA, Identification