USING DNA TECHNOLOGY TO ANALYZE HISTORIC SKELETAL REMAINS

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In early 1998, the University of Indianapolis Archeology and Forensics Laboratory performed an emergency excavation of the 19th century Cottrell Cemetery that was eroding from a cliff in Madison County, Indiana. Four individuals are believed to have been recovered, three in situ burials and one completely displaced individual without a burial contest. Osteological analyses were performed to produce a tentative biological profile for each set of remains. Significant commingling occurring prior to excavation made the osteological analysis more complex. Due to similarities in individual characteristics, some of the commingled elements could not be reallocated to a particular set of remains with any certainty.

The Cottrell remains present an excellent opportunity to augment standard osteological techniques with DNA analysis. To isolate DNA from the remains, long bone shaft samples were taken, were decalcified and solubilized, and were subjected to organic extraction. After removal of organic residues, the DNA was concentrated and amplified using polymerase chain reaction (PCR) for both nuclear and mitochondrial primers.

Both nuclear and mitochondrial DNA were still present in the bones, despite the fact that they had been buried for over 100 years. Large quantities of extraneous microbial and/or botanical DNA may have contaminated the remains, therefore human specific primer sequences were selected to exclusively amplify human DNA. Nuclear DNA fragments of the amelogenin region were amplified, targeting two chromosome-specific fragments (a 106 base pair fragment for the X-chromosome and a 112 base fragment for the Y-chromosome). The DNA evidence confirmed the presence of three males and one female in the sample. In addition, an element with no osteological assessment of sex was designated female through the genetic analysis. For this sample, well-preserved elements yielded the greatest quantities of DNA.

Additionally, issues of contamination were investigated by swabbing a human palm, a bone that had been externally treated with household bleach, and a laboratory table on which osteological analyses are constantly performed. The DNA from the swabs were also subjected to PCR using the same nuclear and mitochondrial primers. These data show that while even casual contact is enough to result in low-grade contamination, external treatment of bone samples with bleach is effective in removing some surface DNA contamination. However, DNA aerosols created by opening the PCR reaction tubes in the laboratory may contaminate subsequent PCR reactions.

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