DNA Typing of Forensic Skeletal Remains

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In the context of questions that arise in regard to the identification of skeletons, DNA investigations are gaining increasing importance, the majority of which are concerned with the skull or parts thereof. Problematic in connection with forensic bone remains are the extremely variable conditions involved in conservation of the bodies, which can lead to difficulties in determining the time of death and in DNA investigations.

The success in amplifying DNA using the polymerase chain reaction (PCR) depends in the first place on the extraction of a sufficient amount of DNA. In this connection, we compared the efficiency of several non-automated extraction methods mentioned in the literature, first using rather fresh material (less than half-a-year old: n-24 individuals, each consisting of rib, calotte, clavicula, petrosum): second, using forensically relevant material (less than 50 years old: n-12, calottes): and third, using bone remains found in archeological sites (up to 1500 years, n-5). The possibility of amplification was examined by using the TH01 STR system, the X and Y chromosomal loci of the alpha satellite DNA family, and PCR amplification of mtDNA.

In the case of the more recent skeletal material, DNA could be extracted in all cases according to the relatively simple protocols of Lee *et al*. (1991) and Fisher *et al*. (1993) for use in PCR amplification but the amount of DNA extracted was greater when Lee's method was applied. These methods could not be applied in the case of skeletal material that dated back further; instead, the method described by Hochmeister *et al*. (1991) was successfully used. Human DNA could be extracted in 50% of all cases; the amplification of nuclear and mitochondrial DNA proved successful in 17% of all cases studied. Among the archeological bone remains, only one rib section (male, approximately 100-years-old) could be typed successfully.

The anatomical origin of the bones had a decisive influence on the DNA yield: it decreased according to the spongy matter from rib>calotte>clavicula>petrosum. In general, the individual results varied considerably.

In six cases, skulls that still contained brain matter, found in moist environments in an advanced skeletal condition (ranging from less than 1-year-old up to 45 years old), were included in the investigations. DNA typing was unsuccessful for the bones but the remains of the brains could nevertheless be classified: in one case by using nuclear DNA and in three cases when mtDNA was used. Because it is located in a moist environment and is relatively resistant to decay, the brain seems, in contrast to bones, to have a certain protective influence on the DNA.