H40 Early Diagenesis of Bone and DNA Preservation

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After attending this presentation participants will understand the impact of microbial degradation on the preservation of bone and DNA. Factors that influence early postmortem degradation of bone will be characterized.

This presentation will impact the forensic community by providing a straight forward method to estimate and anticipate DNA preservation in bone.

Skeletal remains are an important resource for forensic identification, not only for osteological characteristics, but also as a source of DNA. Unfor- tunately degradation processes affecting bone can be detrimental to DNA survival. A major pathway of degradation in human bone is destruction of the bone structure by micro-organisms such as fungi and bacteria. This, presumably, has a significant effect on DNA preservation as bone porosity is increased and biomolecular material is removed. In a study on the preser- vation of archaeological bone it was found that intact human burials show more bacterial alteration than fragmented and processed bones. Based on this and other work it was hypothesised that bacterial alteration starts early post- mortem during putrefaction of the body and is mainly caused by commensal bacteria that initially arrive in the bone via the vascular system. This type of degradation will, in that case, not occur in situations where putrefactive bacterial growth has been inhibited (e.g., extreme temperatures, bactericidal chemicals), or where putrefactive bacteria have had no opportunity to access the bone (e.g. fragmentation or butchering).

In the framework of an European Union Marie Curie Fellowship (FP6; project number 22210), human bone material sampled for DNA at the Central Identification Laboratory (CIL) has been analysed for degradation using histology and backscattered electron scanning electron microscopy (BSE- SEM). Histology is a useful technique to determine both extent and type of microbial degradation in bone. The aim of the project is to characterise early degradation of bone, as well as investigate the relationship between bone preservation and DNA results. More than 70 samples from long bones were analysed at the CIL, from different sites in Europe, Asia and Oceania. The extent of preservation of the samples, as well as the pathway of degradation (microbial, physico-chemical) was assessed.

From the preliminary results it becomes clear that significant microbial alteration takes place within the first 40-50 years postmortem in the majority of cases. Microbial alteration seems generally less extreme in the middle of the transversal bone section, indicating this as a preferred area for DNA sampling. The type of incident – e.g., plane crash or ground loss - influences whether bacterial alteration takes place, perhaps explaining unexpected DNA success in some fragmentary remains. Histology results will be compared to DNA yield to assess the influence of different types of degradation.

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DNA, Bone Preservation, Histology

 ** Presenting Author*