



## B3 The “Secondary Burial” in Southern Italy: How Traditional Funerary Practices Affect DNA Preservation in Forensic Human Identification

Ciro Di Nunzio, PhD\*, Magna Graecia University, Catanzaro 88100, ITALY; Michele Di Nunzio\*, Universidad de Barcelona, Barcelona 08036, SPAIN; Aldo Di Nunzio\*, University of Naples Federico II, Naples 80100, ITALY; Pietrantonio Ricci, PhD, University of Catanzaro, Catanzaro, ITALY; Matteo Borrini, PhD\*, Liverpool John Moores University, Liverpool, AE L3 3AF, UNITED KINGDOM

**Learning Overview:** After attending this presentation, attendees will be able to describe how burial practices affect DNA preservation for forensic purposes.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by demonstrating that the handling of human remains in South Italian cemeteries may promote the preservation of human bones and, hence, improve the analysis of degraded DNA.

Death represents the definitive transition from life to afterlife, from one social status to another. These transitions are part of different cultures, and it is possible to notice them every time a member belonging to a society dies. Burial rituals are among the few tangible forms of mortuary customs that reflect the belief in the afterlife. These procedures are the result of a complex mix of factors: cultural, philosophical, and practical (e.g., body handling, grave location, and cemetery organization).<sup>1</sup>

In Southern Italian tradition, the deceased person is perceived to be in a transition stage, between life and death, until the burial ceremony takes place. To verify that the transition to the afterlife was successful, from the 18<sup>th</sup> century on, a so-called “secondary burial” has been carried out. During the first stage (as soon as the person dies), cemetery attendants bury the corpse in a sealed wooden coffin. Then, after five to ten years, the morticians exhume the corpse for the definitive allocation. At this stage, the deceased’s relatives take care of the remains. They wash, disinfect, and wrap the human remains in a linen sheet and finally bury the deceased in a stone niche. The whole procedure is performed in compliance with Italian Presidential Decree no. 285, September 19, 1990.

If parentage or any other forensic tests are required, the Judicial Authority allows experts (e.g., forensic geneticists, pathologists, anthropologists) to perform the sampling and analysis. According to the time since death, the remains are recovered from the burial site in different stages of decomposition.

For the present study, four decomposition stages have been recognized: Fresh, Bloated, Advance Decay, and Skeletonized/Mummified.

Although DNA extraction can be conducted in any area of the body, the femoral compact bone represents the best suitable tissue, especially when DNA is degraded due to postmortem phenomena.<sup>2,3</sup>

A review of 150 analyses performed from 2001 to 2018 is presented here to evaluate how the different decomposition stages can affect both the quality and concentration of the DNA extracted from human remains that underwent a “secondary burial.”

As expected, the quality and quantity of extracted DNA decreased with the decomposition process; however, all the Short Tandem Repeat (STR) genetic profiles were adequate for forensic purposes.<sup>4-7</sup> These results demonstrate how the traditional “secondary burial” allows for better preservation of the genetic evidence compared with more modern mortuary customs.

The goal of this study is to evaluate how the handling of human remains in Southern Italian cemeteries positively affects the preservation of human bones and, hence, improves DNA analysis. These results are particularly relevant for the experts involved in exhumations related to parentage tests and identifications of an individual for both recent and cold cases.

### Reference(s):

1. Rebay-Salisbury K. Inhumation and Cremation: How burial practices are linked to beliefs. In MLS Sørensen, Rebay-Salisbury K, editors, *Embodied Knowledge: Historical Perspectives on Technology and Belief*. Oxford: Oxbow Books 2012: 15-26.
2. Edson S.M., Ross J.P., Coble M.D., Parson T.J., Barritt S.M. Naming the Dead—Confronting the realities of rapid Identification of Degraded skeletal remains. *Forensic Sci Rev* 2004; 16(1): 63-90.
3. Anderson G.S., VanLaerhoven S.L. Initial studies on insect succession on carrion in South Western British Columbia. *J Forensic Sci.* 1996; 41(4): 617-25.
4. Loreille O.M., Diegoli T.M., Irwin J.A., Coble M.D., Parson T.J. High efficiency DNA extraction from bone by total demineralization. *Forensic Sci Int Genet.* 2007; 1:191-95.
5. Milos A., Selmanović A., Smajlović L., Huel R.L., Katzmarzyk C., Rizvić A., Parsons T.J. Success rates of nuclear short tandem repeat typing from different skeletal elements. *Croat Med J.* 2007; 48(4): 486-93.
6. Lee E.J., Luedtke J.G., Allison J.L., Arber C.E., Merriwether D.A., Steadman D.W. The effects of different maceration techniques on nuclear DNA amplification using human bone. *J Forensic Sci.* 2010; 55(4): 1032-8.
7. Kitayama T., Ogawa Y., Fujii K., Nakahara H., Mizuno N., Sekiguchi K., Kasai K., Yurino N., Yokoi T., Fukuma Y., Yamamoto K., Oki T., Asamura H., Fukushima H. Evaluation of a new experimental kit for the extraction of DNA from bones and teeth using a non-powder method. *Leg Med.* 2010; 12: 84-9.

### Forensic Science, DNA Analysis, STRs Identification