G28 Osseous DNA Sampling Procedures and Success Rates at the Pima County Office of the Medical Examiner

Angela Soler, MA, Michigan State University, Department of Anthropology, 354 Baker Hall, East Lansing, MI 48824; Angela L. Williamson, PhD*, Bode Technology, 10430 Furnace Road, Suite 107, Lorton, VA 22079; Bruce E. Anderson, PhD, Forensic Science Center, Office of the Medical Examiner, 2825 East District Street, Tucson, AZ 85714; and Lindsay H. Trammell, MA, University of Tennessee, Department of Anthropology, 250 South Stadium Hall, Knoxville, TN 37996-0720*

After attending this presentation, attendees will learn the results of a study examining the success rates of an osseous DNA sampling procedure.

This presentation will impact the forensic science community by providing procedural guidelines for a successful, scientifically rigorous, and economical sampling procedure for obtaining DNA profiles from osseous elements recovered from an arid desert environment. Furthermore, it presents the results of a study on the success of these sampling procedures in providing DNA profiles from skeletal elements in varying stages of decomposition.

Over the years, DNA analysis has become elemental in the positive identification of individuals in mass fatality situations and for decedents without appropriate antemortem records for comparison. Increasingly, forensic anthropologists are responsible for obtaining osseous tissue samples from decomposed, burned, mummified, and skeletonized remains. There are over one hundred cases each year of unidentified decedents without sufficient antemortem records. Due to the extreme climate and desert environment, many of these individuals are in varying stages of decomposition and require an osseous sample for DNA testing. With the large number of cases and the high cost of sampling and testing samples, efforts have been made to apply a procedure that is scientifically rigorous, while simultaneously prompt and economical.

The first step in laboratory preparation at PCOME is the adornment of basic personal protective equipment, such as gloves and a mask. All osseous DNA samples are taken at the analytical table using a non-disposable Stryker saw blade that has been soaked in bleach and cleaned with a brush. Osseous elements with the thickest portion of cortical area are typically selected for sampling, such as the posterior femur, anterior tibia, and parietal. When these are unavailable, samples are taken from other osseous elements, including the humerus, occipital, and mandible. Some skeletal elements may have been processed in simmering water with Alconox and Sodium Carbonate prior to sampling; however research demonstrates that this technique has no affect on DNA extraction rates (Rennick *et al.* 2005; Lee *et al.* 2010). A rectangle of bone weighing approximately 15-25 grams is resected, wrapped in filter paper, placed into a manila envelope, and sealed into a plastic heat-and-seal bag. All samples are then cooled for varying periods of time to await shipment in chilled transport containers. After shipment to Bode, the osseous samples are decontaminated by using a dremel tool to sand the top layers and then put through bleach and ethanol washes. The osseous samples are then re-sampled and powdered using a blender cup or by drilling a hole, depending on the size and quality of the bone. The bone powder (input amount ranging from 0.2g - 2.0g) then undergoes a decalcification step prior to DNA being extracted using a proprietary extraction method, which has been optimized and validated for use on skeletal samples.

For this study data was collected on osseous samples submitted from the past several years (n = 420). Information regarding the estimated postmortem interval (PMI), freshness of the bone sample, quality of the cortical surface of the bone, and skeletal element sampled was collected for analysis. These variables were then compared with the number of STR loci reported and the mtDNA region developed for each sample.

Results demonstrate a high success rate for both STR and mtDNA extraction. In total, 73.5% of all samples developed at least 8 STR loci, the minimum necessary for entry into the Missing Person's DNA Database, and 58.3% of the total sample developed a full STR profile. Of those tested for mtDNA, 93.7% developed an adequate profile. Predictably, there is a statistical relationship between the success rates for developing a full STR profile and the freshness of the bone, the estimated postmortem interval, and the quality of cortical surface of the osseous sample. Regardless, 59% of skeletal remains with a PMI estimate of one to two years, and 37% of remains with a PMI estimate of more than two years developed an STR profile of at least 8 loci. Furthermore, 41% of the samples with sunbleached and weathered cortical surfaces developed at least 8 STR loci indicating the success in obtaining STR profiles from even highly degraded osseous samples.

Forensic Anthropology, Osseous Sampling, DNA

 ** Presenting Author*