



### **B82 The Armed Forces DNA Identification Laboratory mtDNA Testing Program for Missing Military Personnel: An Update**

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After attending this presentation, attendees will learn of new advances in forensic sciences that focus on the generation of mtDNA sequence information from degraded human skeletal remains. Attendees will be able to return to their laboratories with this information on new protocols and bioinformatics and perhaps implement some of them into their own protocols and practices, thereby increasing their efficiency in identifying missing persons.

This presentation will impact the forensic community and/or humanity by providing the forensic community with information on the integration of bioinformatics and laboratory processes in a laboratory specializing in DNA analysis of degraded skeletal remains. The increase in efficiency at AFDIL due to this integration will provide other laboratories within the forensic community with a model for handling these types of remains.

Since 1991, the Armed Forces DNA Identification Laboratory (AFDIL) has been aiding the Joint POW/MIA Command's Central Identification Laboratory (JPAC-CIL) to identify remains from soldiers missing from previous military conflicts such as World War II, the Korean War, and the Southeast Asia conflict through mitochondrial DNA (mtDNA) testing. Significant technological advances have been made since the creation of AFDIL, resulting in an increase in the efficiency, quality, and overall success rate of the testing. Due to the aging population of the family members of the missing and the desire for fullest possible accounting, the demands on mtDNA testing has risen from processing 200 skeletal elements per year to 800 specimens per year. Most of these specimens have been exposed to the elements for over 30 years. In addition, many of the cases involve a high velocity aircraft impact in which the remains were subjected to fragmentation upon impact and subsequent high temperatures due to burning fuel. A typical case may consist of one small fragment of long bone fractured, degraded with only 3g of shaft remaining. In this scenario, an anthropological analysis is not possible, and DNA becomes the primary source of scientific information, combining with circumstantial evidence to support identification.

This presentation will include the preparation for the successful escalation to process 800 osseous specimens in a single year, as well as the processing and maintaining a reference database of mtDNA sequences consisting of over 8,000 family members. Typically, these reference materials consist of blood or saliva; however, if the service casualty officer is unable to locate a suitable living maternal reference, an alternate reference such as baby hair or tooth, envelopes, biopsy specimen, razor, watch or other personal effects from either the decedent or a maternal relative may be submitted for testing. Several of these cases have proven to be successful and have resulted in an identification of a missing service member. The impact mtDNA analysis has on the mission will continue to increase as more degraded specimens are tested and the presence of anthropological data is limited.

This vast undertaking would not be possible without the implementation of a tracking system for both evidence and laboratory processes. Numerous laboratories have explored or are utilizing some form of laboratory information management system (LIMS). Future Technologies, Inc. (FTI), has created for AFDIL their own LIMS system which includes numerous unique features such as automated laboratory notes during processing; automated tracking of high-throughput specimens; a specialized mtDNA searching tool to aid in population database searching, evidence to evidence comparisons, evidence to reference comparisons, staff profile searches, and contamination tracking; web access for clients; and standard operating procedure management. This system has been paramount to the

success of bringing home the heroes of this nation and providing closure to families long awaiting answers. Continuing advances in both bioinformatics and laboratory processes that will increase the efficiency and efficacy of using DNA analysis to identify missing soldiers will be discussed.

The views expressed herein are those of the authors and are not the Armed Forces Institute of Pathology, The US Army Surgeon General, or the US Department of Defense.

**mtDNA, Degraded Skeletal Remains, Bioinformatics**