Identification of the Vietnam Tomb of the Unknown Soldier, The Many Roles of Mitochondrial DNA

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Mitochondrial DNA (mtDNA) can play a significant role in the identification of skeletal remains recovered from past military conflicts and in the identification of biological specimens collected from crime scenes. In general, mitochondrial DNA is used in forensic cases involving degraded or ancient DNA and can be useful when appropriate references for nuclear DNA analysis cannot be obtained. The role of mtDNA in a forensic investigation can vary depending on the circumstances in the case.

Mitochondrial DNA analysis was used to help identify the remains disinterred from the Tomb of the Unknown Soldier in Arlington National Cemetery. An mtDNA sequence was obtained for the submitted specimens and was compared to each of ten reference specimens comprising seven families. The results excluded six of the seven families and were consistent with one of the families, that of Air Force First Lieutenant Michael J. Blassie. This is an example of using mtDNA to include or exclude in a "closed population", meaning that these remains could be identified by a process of elimination. AFDIL has used mtDNA analysis in this role to help identify more than 100 service members from the Vietnam War where a presumptive identification is known before mtDNA analysis is initiated.

In a second role, AFDIL is going to use mtDNA analysis to help identify skeletal remains recovered from the Korean War, where a presumptive identification may not be known. Therefore, mtDNA analysis will be used to narrow the population, at which time, other non-DNA evidence can be used to confirm identification. A family reference database is being established in order to make comparisons between the sequences obtained from skeletal remains to sequences generated from the maternal references of the 8100 missing service members from the Korean War. To date, more than 1200 family references have been received by AFDIL.

A third scenario in which mtDNA analysis is used is in cases involving specimens collected from crime scenes. This involves the analysis of a biological specimen and a direct comparison to a reference. In this case, mtDNA analysis is used as an exclusionary tool in an "open population". While mtDNA is not as powerful as a nuclear DNA profile, it can be used with other circumstantial evidence to help elucidate the identity of a victim or suspect. In many cases, this additional non-DNA circumstantial evidence can help to close the population by a process of elimination, similar to the role mtDNA analysis played in the identification of Vietnam service members. Finally, if future convicted felon mtDNA sequence databases are generated, mtDNA could be used in the same member as the Korean family reference database by direct comparison of the questioned sequences generated to the database. However, as the size of the relevant population increases, the discriminatory power of mtDNA becomes diluted because the number of matches will increase. Therefore, non-DNA evidence would be more heavily relied upon to provide proper cause for arrest of a suspect.