



## **B36 The Expansion of Genealogy Into Forensics: The Challenges of Converting a Commercial Industry Into a Forensic Industry**

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**Learning Overview:** This presentation will highlight the challenges that are being faced when forensic samples are used for Forensic Genetic Genealogy (FGG).

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by being of interest to agencies looking to outsource their cases for genetic genealogy research.

There is an abundance of forensic cases that have had no current leads with autosomal Short Tandem Repeat (STR) and Y-chromosomal Short Tandem Repeat (Y-STR) testing. Whether the case is seeking to identify an unidentified victim or a foreign profile that is believed to be the suspect, there are only so many possibilities for database searching STR profiles. A profile can be uploaded to the Combined DNA Index System (CODIS) database or the unknown profile can be compared against references standards that are submitted in the case. When those two avenues do not provide any possible connections, many agencies are now turning toward genealogy analysis. In many instances, homicide units are submitting cold cases for such analysis to private laboratories, as local and state government laboratories do not have the means for Single Nucleotide Polymorphism (SNP) testing, or on staff genealogists. Commercial laboratories and genealogists have faced new challenges by working with lower quantities of DNA, samples with degradation, and data with varying call-rates.

Private laboratories that perform SNP testing have only recently started analyzing samples for forensic applications. Typically, these laboratories perform commercial assays to assist with clinical diagnostics, genetic research, and relationship testing. Samples that are frequently analyzed include whole blood, buccal swabs, and frozen tissue. Unfortunately, forensic samples do not always result in such robust quantities of DNA. Many unidentified victim cases involve bone samples, which can either be degraded, have poor sample quality, or yield insufficient DNA. Lower quantities of human DNA and degradation issues are probably the biggest challenge facing forensic laboratories interested in genealogy. As the quantity and quality of the DNA coincide with the call-rate, the eligibility of a sample for upload into a database is affected.

When a forensic sample yields sufficient DNA for genetic genealogy, it is often still a degraded sample, which can cause issues for the genetic genealogy research. In genetic genealogy, the relationship between two genetic matches is estimated based on the shared DNA, which is measured using centimorgans (cM). When dealing with a degraded forensic sample, there is less DNA to match against others in the database, and this may cause certain matches to seem more distant due to less total shared cM and smaller segments of shared cM. This issue can also be exacerbated if the forensic sample came from someone who descends from an endogamous population. Techniques using chromosome mapping (a.k.a. DNA painting) are being developed to help mitigate these problems, but if successful, they still would not be able to completely resolve the issues resulting from degradation.

Another challenge with FGG, also referred to as Investigative Genetic Genealogy (IGG), is contacting genetic matches or other genealogists about the case. Due to the sensitive nature of FGG, labs do not directly contact any genetic matches or associated genealogists but instead pass along the information to law enforcement so they can make the contact through the appropriate channels. In traditional genetic genealogy, it is common to not only directly contact genetic matches or the associated genealogists but to also seek help through various public genealogy forums.

There are several steps between the time a sample is submitted for genetic genealogy analysis and the time the genetic genealogy research occurs. Some of these steps include a review of the questioned sample, outsourcing to a laboratory to perform the SNP testing, and uploading the results to one or more databases. Moving this entire process in-house may alleviate some of the challenges that are currently being tackled. This will also aid in streamlining the process by having analysts in-house review the submissions, sequence the data, and work continuously with a forensic genealogist. As this previously commercial industry further progresses into the forensic world, innovation will streamline the process further making FGG indispensable to cold case detectives.

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### **Forensic Genetic Genealogy (FGG), Single Nucleotide Polymorphism, Cold Case**