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American Society of Crime Laboratory Directors
International Association for Identification
International Association of Coroners and Medical Examiners
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Forensic Investigative Genetic Genealogy

The Consortium of Forensic Science Organizations (CFSO) represents over 20,000 forensic science and forensic medicine practitioners. CFSO advocates to the federal government and the United States Congress on behalf of these practitioners and seven of the largest forensic science member organizations in the world.

Background:

Forensic Investigative Genetic Genealogy (FIGG) is a hybrid of being able to use molecular biology techniques to either sequence most or all of the human genome, known as whole genome sequencing (WGS), or being able to evaluate many areas in the genome where single base pairs of the DNA sequence change, known as single nucleotide polymorphisms (SNPs). Changes in the human DNA genome that can be monitored by WGS or SNP analysis are linked to family lines. Basically, the closer the familial relationship, the closer the DNA sequences will match. Many years ago, large genealogical companies started to use these DNA technologies to help people find family members. As people submit their DNA for WGS or SNP testing, they may also consent (or not) to allow law enforcement to search their DNA to obtain information about crimes. Simply, law enforcement pays a private DNA company to develop a WGS or SNP array profile for the crime scene or alleged perpetrator sample and then professional genealogists search that profile in the database to see if they can identify family relationships that might exist to the crime scene DNA. There are two distinct processes, the DNA sequencing and the genealogy searching.

Purpose:

Law enforcement (often supported by forensic science providers) use this technology and technique to work on cold cases where DNA exists and other DNA techniques have not been successful in generating helpful suspect leads or identification of human remains. Specifically, this technique is recommended if DNA has been uploaded to the national DNA database called the National DNA Index System (NDIS) of the Combined DNA Index System (CODIS) and no matches have been generated. While the number of samples in CODIS is increasing as states pass laws to add arrestee and convicted offender DNA, CODIS does not contain samples from people that have never been arrested or convicted of a crime. However, the genealogy databases contain DNA information from the general population that are interested first in finding relatives (but sign a consent that they are willing to allow their DNA to be searched by law enforcement), thus the genealogy databases provide a different way to generate investigative leads on cases. FIGG provides investigative leads to investigators so that they are able to interview potential suspects leading to potentially solving unsolved crimes. These cases do not need to be old, this technology can be used on current homicide, assault, sexual assault, and unidentified remains cases. The biggest limitation of this technology is that the success of the genealogical searching depends on having robust DNA genealogical databases. There are certain cultures and communities that are more comfortable with entering their DNA into these databases, and this technology is not as good in communities of people that are mistrusting of DNA databasing or have other privacy concerns.

Private Entities:

Labs: Due to the extreme cost of instrumentation and implementation, WGS and robust SNP array analysis is currently only performed in educational, research, or venture capital funded private laboratories. Many of these laboratories are in the United States, but this is also performed outside of the United States. The start-up instrument cost for the analysis is between \$400,000 and \$1M per instrument. The instruments also have extreme data storage and computing needs. Furthermore, data analysts are also needed because of the sheer amount of data generated by these instruments. These labs have offered services to mostly law enforcement entities working on cold cases. Now that many of these entities are now getting subpoenas and other legal documents from ongoing forensic science litigation, some are no longer providing this service to law enforcement. There is one forensic science vendor corporation that provides a limited SNP array for public

forensic science labs, but it is not currently robust enough to solve some cases. Several private labs and public labs have validated this abbreviated SNP array. Public labs have only recently started to evaluate implementing the more robust WGS or more robust SNP array analysis, and implementation is likely years away due to needed validation studies.

Genealogy: Due to their familiarity with this technique, genealogy searching was first used by commercial or hobbyist genealogists. Many of the commercial laboratories have hired professional genealogists to work on their staff. However, the lab work does not necessarily have to be coupled with the genealogy work. Therefore, many professional and hobby genealogists have formed businesses or even crowd-source ventures to complete this genealogy work. These genealogists use tools originally developed to find family members and relations in the commercial DNA databases, but tools have been specifically provided for law enforcement to use these commercial DNA databases. A few programs have been set up by educational entities to teach public law enforcement and public forensic science practitioners to build family trees and perform this searching. The first effort to formally train state law enforcement and forensic science staff has just started. The goal is to train law enforcement and forensic science laboratory staff to perform this searching to address the privacy concerns using hobbyist genealogists to do this work. Further, recent crowd sourcing for this work has raised concerns about bias, privacy, and other concerns on law enforcement cases.

Policy:

The Department of Justice has established an “Interim Policy On Forensic Genetic Genealogical DNA Analysis and Searching” to ensure DOJ agencies, and all those using DOJ grants or funding, follow rules for responsible use of the technology. Entities using this technology with their own funding are not required to follow this policy. States are currently working to implement state laws and policies regarding the responsible use of this technology. The federal government does not have laws or permanent policy related to the use of this technology. Any law would need to ensure that this technology remains available to law enforcement for solving criminal cases and identifying human remains.

Funding:

Currently, many law enforcement agencies are funding the investigation of these cases. Typically the private laboratory testing is \$1,000-\$3,000 and the genealogy work is \$2,000-\$3,000 per case. Typically, local, county, state, or federal law enforcement agencies pay these fees out of agency funds or secure federal government grants to pay for the lab testing and genealogy work. Several states have now performed a procurement process to obtain a state contract with a private laboratory or individual proprietor. Sometimes these contracts are managed by law enforcement entities and other times they are managed by public forensic science laboratories in the jurisdiction. The Office of Justice Programs (OJP) manages many grant programs where the solicitation allows for law enforcement and forensic science providers to apply for funding to outsource Forensic Genetic Genealogy testing.

Among these OJP grant programs are:

- Sexual Assault Kit Initiative (SAKI)
- Edward Byrne Memorial Justice Assistance Grant (JAG)
- Emmett Till Cold Case Investigations and Training and Technical Assistance Program
- Prosecuting Cold Cases Using DNA
- Postconviction Testing of DNA Evidence
- Matthew Shepard and James Byrd Hate Crimes
- Project Safe Neighborhoods (PSN)
- Upholding the Rule of Law and Preventing Wrongful Convictions Site Based and Training and Technical Assistance Program

Federal Government Involvement:

The FBI has established an investigative team that uses private laboratories for the WGS and SNP testing. Furthermore, the FBI has trained federal investigators to build family trees and perform genealogy searching. The FBI laboratory is monitoring the progress of state and local laboratories to implement the WGS and SNP testing, but have chosen not to pursue implementing this technology at the FBI laboratory at this time. They are also waiting to make a decision on any CODIS use of this technology. Efforts of state and local forensic science service providers to implement this technology are strictly focused on the use for investigative purposes and **not** for CODIS.

Plan for Public Forensic Science Laboratories and Law Enforcement:

The National Technology Validation and Implementation Collaborative (NTVIC) was established in 2022 with 11 state forensic science laboratory directors agreeing to participate with a vision to collaborate nationally on validation and method development. The states participating is now 17, with that number growing quickly. This group of laboratory directors shares a common vision to share existing resources to work together on difficult projects to lessen the burden on individual forensic science and forensic medicine providers to perform the work.

The first committee of the NTVIC is focused on the implementation of Forensic Investigative Genetic Genealogy (FIGG) in public forensic science laboratories. Directors from state or major regional labs in eleven (11) states convened this committee to look at transitioning the lab work and also genealogical searching from the private laboratory space into the public forensic science laboratory space. While some public labs have purchased instrumentation and are navigating to implement a single nucleotide polymorphism (SNP) based technology, the focus of this group will be a robust SNP or whole genome sequencing (WGS) approach combined with the public entity performing the genealogical searching and building the family trees to develop investigative and identification leads.

The committee has engaged with several major research institutions, private companies already working in the space, federal agencies and laboratories, and top-tier researchers. The short-term goals of the committee are to:

- 1) Train public forensic science practitioners and investigators to perform genealogical searching;
- 2) Develop a national network of trained public forensic practitioners that can work as a team to solve difficult cases and teach other public forensic science professionals to use the technology;
- 3) Develop robust policy and procedures for states to implement immediately for the responsible use of this technique and technology;
- 4) Decide on terminology that will be used in this forensic science discipline;
- 5) Evaluate the appropriate instrumentation and methods that will be fit for purpose, affordable, and possible for public laboratories to implement in-house for WGS or SNP array testing;

The longer-term goals of the committee are to:

- 1) Purchase and validate the instrumentation and methods and implement WGS and robust SNP array analysis in public forensic science labs for investigative purposes;
- 2) Develop a package of resources such as procurement documentation, analytical methods, performance verification plans, publication templates to implement this technology in other public forensic science labs for investigative purposes;
- 3) Secure funding for this technology to be implemented in public forensic science labs;
- 4) Evaluate the potential viability for this technology to be implemented as part of the national CODIS program.

While this group functions independently of any forensic science organization or government entity, this group has integrated with these other organizations to share information and ensure project goals are achieved. Four subcommittees have been formed to address the training, policy, and technical issues of FIGG. The work of this group, and updates of the progress, will be presented at forensic science and other scientific meetings.

Concerns:

One concern from law enforcement is that some of these cases are being crowd sourced for funding or “public good samaritan” investigation. Meaning, funded by organizations or individuals interested in solving crime or bloggers, investigative journalists, or the public interested in being “investigators.” This may compromise the actual criminal investigation.

Successes:

Identification of human remains and cold cases are being solved every day in the United States using this technology and technique. This is a very useful technology to solve unidentified remains cases, assuming that the decedent is from a well-represented population in the DNA database. FIGG is also being used to solve homicide, assault, and sexual assault cases on a regular basis. These stories are hitting media outlets on a regular basis from all levels of government and private individuals.