

Plenary Block: Managing the Implementation of New Technology

Title: Investigative Genetic Genealogy: Current Status and Future Potential

Abstract: Investigative Genetic Genealogy is a recent technique that generates new leads on previously unsolved cases where DNA from the suspect is present at the crime scene. When there are no CODIS (Combined DNA Index System) hits on a suspect crime scene STR (Short Tandem Repeat) DNA profile and a case remains unsolved, further DNA analysis can now be conducted to develop a new profile using different DNA markers known as single nucleotide polymorphisms (SNPs) [1]. Approximately 800,000 SNPs are in the profile conducted by direct-to-consumer ancestry companies. This SNP profile can be compared against a publicly available database (e.g. GEDMatch, Family Tree DNA) where individuals have voluntarily placed their genetic information, permitting it to be searched to find potential relatives of the perpetrator. These relatives may include those suspected of committing the unsolved crimes, therefore generating leads for comparison to crime scene data.

Recidivism occurs when a suspect commits new and frequently escalating crimes on new victims, creating a cycle of crime. When a suspect profile is found at a crime scene, a CODIS hit results approximately 40% of the time. While this hit rate solves many cases without a suspect, it also leaves many potential cases unsolved using current methods. Investigative Genetic Genealogy can solve these cases by providing new suspects for direct comparison to crime scene DNA. To date, 56 cases are documented as having used Investigative Genetic Genealogy to assist their investigations in developing a suspect. Crimes against the person are particularly costly, therefore interrupting the cycle of crime offers considerable savings, which will be discussed in a business case model. In this model, the cost of conducting Investigative Genetic Genealogy will be contrasted against the costs of crime to demonstrate the potential cost benefit.

While the investigation of any type of case could potentially benefit from the use of Investigative Genetic Genealogy, given the high level of resource requirements, costs, and ethical considerations, it is proposed that only major crimes against the person be processed. In a survey of over 1,500 individuals conducted by bioethicists, 80% were in favor of the use of forensic genealogy, 79% supported its use on homicide and sexual assault cases, while only 39% supported its use on property crimes [2].

Recognizing the concept of proportionality [1] and business case potential benefits demonstrated by Investigative Genetic Genealogy balanced against legal and ethical concerns, the following features are proposed as minimum criteria for consideration for Forensic Genealogy:

1. Sexual Assault or Homicide Case with sufficient DNA evidence available for SNP DNA
2. Crime scene sample is believed to be from the potential perpetrator

3. Searched in CODIS with no hit
4. Reasonable traditional investigative efforts have not developed successful leads
5. Remaining crime scene DNA sample is of sufficient quality and quantity for SNP analysis
6. Signed MOU or formal policies with police agency and prosecuting office to investigate and pursue prosecution where warranted
7. Training for all crime lab and investigators prior to release of investigative leads
8. Training for all local prosecutors and judges

Forensic laboratories are stewards of the field of forensic science. When performed responsibly, and as demonstrated by the business case presented, Investigative Genetic Genealogy has the potential to be one of the greatest crime solving and preventing technologies to emerge since DNA analysis was applied to crimes. Therefore, there is a major role for forensic lab guided ethical use of Investigative Genetic Genealogy in solving and preventing crimes.

Key words: Investigative genetic genealogy, genealogy, recidivism, business case

#### References:

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- [2] Guerrini, C.J, Robinson, J.O., Peterson, D. and A.L. McGuire. 2018. Should police have access to genetic databases? Capturing the Golden State Killer and other criminals using a controversial new forensic technique. *PLoS Biol.* October 2. 16 (10). <https://journals.plos.org/plosbiology/article/file?id=10.1371/journal.pbio.2006906&type=printable>