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Genetic Genealogy in the Legal System



The use of genetic-genealogy test results by law enforcement agencies and other investigators to attempt to identify criminal suspects is regarded by many people as positive, but scientific limitations and privacy-related legal and ethical concerns abound.



Genetic genealogy uses SNP (single nucleotide polymorphism) or WGS (whole genome sequencing) DNA analysis and traditional family trees to trace a person's ancestry. People can use genetic genealogy to link family members with shared segments of DNA, create ethnicity profiles, and identify potential health risks.

The science is based on inherited DNA through generations – half from each biological parent. Because of recombination, however, each individual inherits different combinations of parental DNA, with random segments potentially being shared. If there are around 500 or more common SNPs, it is considered an identical-by-descent (IBD) segment. IBD segments are measured in cM – the higher the cM, the longer that IBD segment is. The farther apart two individuals are in a family line, the more recombination happens, and additional DNA contributors come in, so those relatives would be expected to have fewer and shorter IBD segments than direct siblings, for example.

Genetic Genealogy: From Hobbyists to Criminal Investigators

Commercial use of genetic genealogy has been around since the start of FamilyTreeDNA in 2000. Now, five companies offering public genealogy services dominate the industry: 23andMe, AncestryDNA, MyHeritage, Family Tree DNA, and Living DNA. Each company has software that compares databases of millions of DNA profiles to the submitted customer sample to identify the ethnic and ancestral profile and identify potential relatives who have also submitted samples to their company.

GEDMatch, now owned by Verogen, provides genetic genealogy services but does not conduct any DNA testing. Only GEDMatch, FamilyTreeDNA, and MyHeritage allow uploading profiles tested by other providers. Of these three, only GEDMatch and FamilyTreeDNA allow use by law enforcement agencies. The use of these databases for criminal cases is referred to as forensic genetic genealogy (FGG). Using commercial websites allows investigators to search millions of individuals not in the official DNA databases that contain DNA of people who have been arrested and convicted felons. The use of

FGG effectively expands a DNA search from the approximately 16 million individuals¹ in official databases to potentially the entire population of the United States. For example, “for Americans of European-descent, 60 percent of long-range searches will come up with a match with someone who was a third cousin or closer. For 15 percent, the searches will find a second cousin or closer.”² For each identified related person in the commercial database, all relatives are effectively part of the FGG search.

When using proper parameters and algorithms, genetic genealogy can reliably help individuals find family members, fill in unknown heritage, and help investigators solve cases, including cold cases that otherwise might have remained unsolved. It is estimated that as of 2019, 436 cases had been solved with the help of forensic genetic genealogy.³

FGG might have helped solve several cases associated with the infamous Golden State Killer. Investigators initially uploaded DNA preserved in a sexual assault kit to several genetic genealogy sites, including MyHeritage, which eventually came up with a close relative match to the submitted profile. Through family trees and information they had about the killer's description (for example, age and gender), investigators were able to trace the DNA back to Joseph James DeAngelo Jr.

However, forensic genetic genealogy also has limitations that should be considered.

Genetic genealogy has been widely accepted as it has moved into forensic usage, but the forensic application often involves degraded and contaminated samples that are not always appropriate for testing. Results will also be affected by the reference samples used and other algorithm parameters. Laboratories can manipulate the data and get different results depending on how they apply their bioinformatics system. Lastly, even if the software and algorithms are accurate and reliable when used properly, there are ethics concerns related to privacy and using the genealogy sites for forensic purposes without consent. The remainder of this article focuses on these limitations and FGG's implications for the legal system.

Forensic Genetic Genealogy Limitations

Foundational research is crucial to establishing the validity and reliability of any science

– experimentally testing the accuracy of the science (does genetic genealogy accurately produce genetic profiles) and whether the results are repeatable (does the same DNA sample yield the same genetic profile when tested multiple times). Several studies have produced low false-positive rates – the probability of incorrectly matching two DNA profiles as coming from people who are relatives when the two people are unrelated.⁴ 23andMe was accurate over 99% of the time, which was similar to AncestryDNA.⁵ However, this can differ depending on the available DNA and algorithms used, which in forensic cases are less than ideal and can be manipulated for desired results.

Generally, the recommended amount of DNA for testing is 200 ng,⁶ although some systems have produced results with less.⁷ Genetic genealogy companies have individuals send in samples controlled for contamination and quantity to get this ideal sample for accurate results. Forensic samples, on the other hand, are usually degraded and in lower quantities, often less than 1 ng of DNA and even down to the range of 0.1 ng. Sibling matches might be able to withstand the smaller samples, but accuracy

drops for second and third cousins once going below 1 ng.⁸ For third cousins, even with ideal 200 ng samples, results were only accurate on average 74.6% of the time.

Another factor is the threshold for shared cM – the recommendation is around 7 cM. False positives are more likely to occur when the cM is set too low, as someone can be more likely to, by chance, share a smaller section of DNA. Durand found that when setting the threshold for declaring a match or relative at 2-4cM, over 67% of 2-4cM segments were false positive matches.⁹ Unfortunately, labs and investigators are not always transparent about the exact algorithms and parameters they used to obtain their results, so it can be difficult to assess whether the results are reliable or are a product of manipulating bioinformatics.

Legal Issues

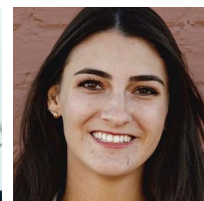
As with all DNA technology, FGG has rushed into the criminal justice system relatively unchecked and without scrutiny. As with many other types of forensic evidence, numerous potential legal issues remain largely undecided and unimagined.

Discovery. The discovery process is an essential early step in preparation of any defense case. Defense counsel has an obligation to investigate any facts or legal theories that might apply in a particular case. In any case involving DNA evidence, best practice requires that counsel obtain not only reports but also the underlying bench notes, data, and ancillary materials that explain the testing conducted.¹⁰ Nothing about the use of forensic investigative genetic genealogy methods alters these legal and ethical obligations. It is also incumbent on the prosecution to provide to the defense evidence that is material or exculpatory.¹¹

In many jurisdictions, prosecutors have argued that FGG materials are not relevant because the prosecution will not offer them at trial and that the



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provision of FGG materials will violate the privacy interests of individuals in the genetic databases searched. In one motion opposing discovery of FGG materials, prosecutors argued that allowing defense access would upset the public, who might respond by “not using genealogical databases if they believe that they will become involved in a criminal investigation [and] if individuals in society stop wanting to enter DNA in consumer genealogical databases for fear that their privacy is not being protected, then law enforcement loses a powerful technique.” Further, the argument goes that “revealing specific sites used could result in a backlash against that site resulting in a tightening of restrictions on the site or use of the site.”¹²

In a recent detailed ruling, an Idaho trial court judge found that FGG materials were material to the defense. The prosecution conceded that the defense was entitled to the results of the SNP/WGS testing.¹³ The court, relying on the standard of materiality, recognized the testing and FGG search material could be used by the defense for purposes including 1) investigation of possible suspects, 2) statistical impact of the search method on the standard STR testing, and 3) the admissibility of the evidence.¹⁴

Privacy Rights, the Fourth Amendment, and Prosecutorial Overreach. Recent reporting has revealed that law enforcement agencies

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have skirted or directly violated the privacy policies of certain genetic genealogy databases and that few policies on law enforcement access to information in genetic genealogy databases have been promulgated. The U.S. Department of Justice issued an “interim policy” on the use of FGG by federal agencies in 2018.¹⁵ The policy states that “[i]nvestigative

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Advancements in technology and testing have revolutionized the resources available to investigators, prosecutors, and defense counsel. However, the misuse and misconceptions surrounding these advances can have dire consequences within the criminal justice system. In addition, recent scrutiny of long-standing courtroom sciences has raised critical questions that demand attention.

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agencies shall identify themselves as law enforcement to GG services and enter and search FGG profiles only in those GG services that provide explicit notice to their service users.” Despite the stated policy to respect the privacy policies of commercial databases, law enforcement agencies have repeatedly violated the terms of service of these sites.

Some practitioners have described

in the GEDMatch website, which allowed researchers to show them the profiles of individuals who had specifically opted out of the use of their data in law enforcement searches. The DNA Doe Project, a nonprofit established to identify homicide victims, released a statement acknowledging that its workers were aware of the loophole in GEDMatch and neither “encouraged nor discouraged” its use.

In June 2023, an online post revealed that the Riverside County Regional Cold Case Homicide Team, possibly in cooperation with the FBI, had uploaded a victim's DNA to MyHeritage in direct violation of the company's terms of service, which forbid all law enforcement use.¹⁸

Perhaps most disturbing, in 2022 it was revealed that law enforcement officers had obtained blood samples of an infant from the New Jersey Newborn Screening Laboratory to investigate the child's father.¹⁹ The samples were

the FGG field as the “wild, wild west,”¹⁶ and in a recent webinar, one practitioner described FGG as akin to “building the plane while flying it.”¹⁷ Notwithstanding the lip service paid to privacy, it appears that in numerous instances the privacy policies of commercial websites have been violated. The Intercept documented the exploitation of a privacy loophole



obtained via subpoena, not warrant. These blood draws are routinely done to screen for common genetic disorders, and the collection process sometimes is done without the parents' consent.

Given the newness of the technology, a limited amount of legal analysis has

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been applied to the privacy rights of defendants charged in these cases or the individuals in the databases whose DNA is searched, often without their knowledge or consent. Several Fourth Amendment challenges have been brought using two legal theories: that the "abandonment doctrine" does not apply to SNP/WGS DNA testing under *Carpenter v. United States*²⁰ and *Skinner v. Railway Labor Executives' Ass'n*²¹ and that the search of the FGG for common stretches of DNA from relatives

implicates a defendant's privacy rights.

Foundational to both arguments is that society is now prepared to recognize that there is a reasonable expectation of privacy in humans' genetic material. SNP/WGS testing as described above can reveal the most intimate

personal biological information about a person. To allow law enforcement access to this information simply because a person abandons a common object such as a cigarette butt or beverage straw in a public place would vitiate all privacy rights to our genetic material. This "abandonment" is not knowing and as we learn more about DNA and its ability to move from object to object and person to person, there is no way a person can avoid revealing all their genetic secrets to anyone who has the ability to

collect a piece of garbage and subject it to DNA testing.

Conclusion

The courts face a new challenge in applying traditional legal standards to this latest use of DNA technology. The courts should not be left alone to create a patchwork of law. Policy makers need to step up to create guidance for the courts in these cases so that the "wild, wild west" of FGG does not inculcate innocent individuals and violate the privacy rights of millions of individuals seeking to investigate their genetic heritage. The cavalier use of FGG methods as illustrated by the Doe Project's own statements needs to be regulated, whether by the courts or legislatures. **WL**

ENDNOTES

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