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SOLVING THE FIRST MURDER CASE IN ROMANIA USING FAMILIAL SEARCHING

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Abstract: The DNA of each of us is made from parts of our biological family: we share half of our autosomal DNA with our fathers, mothers, sons and daughters; we share a quarter of our autosomal DNA with our grandfathers, grandmothers, nephews and nieces; we share a variable proportion of autosomal DNA with our brothers and sisters; we share the same Y chromosome with our paternal lineage, if we are men, or we share the same mitochondrial DNA with our maternal lineage, if we are women. Those are our close kinship ties, but at some level all humans are related to each other. These biological rules allow today forensic specialists to find the author of an unidentified DNA profile based on its relatives DNA. This article presents, on short, the story of the first murder case solved in Romania using Familial searching and CODIS.

Keywords: forensic DNA databases, routine searching, familial searching, CODIS, National Judicial Genetic Data System.

INTRODUCTION

According to FBI, Familial searching (also known as Familial DNA searching) is "an intentional or deliberate search of the database conducted after a routine search for the purpose of potentially identifying close biological relatives of the unknown forensic sample associated with the crime scene profile" [1]. This type of search is different from routine DNA searches by means and purposes. The means will be detailed furthermore in this article, but regarding the purposes it should be highlighted from the start that, in Forensics, Familial searching has exclusively an investigative purpose. A Familial search cannot directly identify a person (like a murderer, or a kidnapper) but can offer investigative clues about that person, who must always be corroborated with other evidence of the case. If those evidence are strong, the results obtained by Familial searching are confirmed or infirmed by a direct comparison of the suspect's DNA profile with the initial unidentified DNA profile(s), recovered from the crime scene.

For solving serious crimes with the help of Familial searching, in Romania, four main steps were needed:

Step 1 – The development of a national DNA database

As we seen in the definition of Familial searching, the entire process of searching is dependent on the existence of a database. This database may be a forensic database (managed by national authorities) or a public one (usually managed by companies who offer DNA typing/sequencing services).

In Romania, the National Forensic Institute (NFI) is the custodian of the National Judicial Genetic Data System (NJGDS) according to Law no. 76/2008 regarding the organization and functioning of the National Judicial Genetic Data System. The Romanian Police forensic labs, - the main providers of forensic and persons DNA profiles for NJGDS, were built in 2003 (the forensic DNA lab) and 2012 (the national database DNA lab).

From an organizational perspective NJGDS is made from three subsystems or databases. The most important one for Familial searching or routine DNA searching is the Genetic Profiles Database.

The rules of how NJGDS works were transposed in "Government decision no. 25 of January 5,

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2011 for the approval of the Methodological Norms for the application of Law no. 76/2008 on the organization and functioning of the National Judicial Genetic Data System and on the creation of the internal legal framework necessary for the implementation of Council Decision 2008/615/JHA of 23 June 2008 on enhancing cross-border cooperation, in particular in the field of counter-terrorism and cross-border crime, regarding the automated transfer of genetic profiles".

Another main legislation act that affects the work of NJGDS is the "Law no. 118 of June 20, 2019 on the Automated National Register on persons who have committed sexual offenses, exploitation of persons or on minors, as well as for the completion of Law no. 76/2008 on the organization and functioning of the National Genetic Data System".

Step 2 – The CODIS installation

Without a serios hardware and software infrastructure a national forensic DNA database cannot function or be efficient. Nowadays the forensic DNA typing techniques are dependent on the development of software solutions starting with the biological sample processing step and ending with the step of making DNA data exchange with other countries.

In common forensic language, the term CODIS (Combined DNA Index System) have different meanings. CODIS may refer to the USA national DNA database, to the STR core loci of DNA profiles stocked in this database or to the software suite used for comparisons of offenders DNA profiles with crime scene DNA profiles, in order to identify the person(s) who committed a crime or to identify disappeared persons, disaster victim identification etc. On the FBI official website, "CODIS" is defined as "the generic term used to describe the FBI's program of support for criminal justice DNA databases as well as the software used to run these databases. The National DNA Index System or NDIS is considered one part of CODIS, the national level, containing the DNA profiles contributed by federal, state, and local participating forensic laboratories" [2]. In this paper the authors will use the CODIS term as the DNA database management system or simply "the software" used in the Genetic Profiles Database, which is part of the NJGDS.

On June 16, 2011 a Letter of Agreement was signed between General Inspectorate of Romanian Police and FBI on which the NFI acquired for national and international use the latest available CODIS software version, at that time. From April 10, 2012 CODIS became the main official tool related to DNA database searching, being updated, and improved on a regularly base by the FBI (if in 2011 the CODIS version 7.0 was in use, now the CODIS version 9.0 was deployed in Europe. At the same time, SUA is preparing for deploying CODIS version 11.0).

Among different tools needed for routine searches the CODIS suite has two components (Pedigree manager and his searching capabilities and Rank manager) which allows searching of unidentified DNA profiles by building pedigree trees. These tools are useful in searching for familial DNA constellations, which are less or more complex, and depends on the pedigree tree size, the relatives rank (first or second degree) and the available number of relatives. This DNA Pedigree searching tools are valuable in searching of missing persons, unidentified human remains and for making familial searches.

Step 3 – The dissemination of data regarding Familial searching and first requests

Under the influence of various internal National Police training sessions, in which Florin Stanciu presented the notorious Elodie case, from France, solved with the help of Familial searching [3], or simply as a natural need of solving cold cases, like is done, for years, in SUA and other European countries [4], in August 2019 the Homicide Department of Bucharest General Police Directorate sent to NFI a series of six Familial searching requests. "Cold cases" are unsolved serious criminal investigations that are not being actively pursued because of a lack of evidence. These official requests accelerated the implementation of the needed procedures at the NJGDS workflows level, earlier than was initially planned.

Until now we received three more requests for Familial searching. Despite of the small number it is difficult for us to trace the results of our work because in Romania the judicial system is not built to offer feedback or to make more efficient the communication between involved entities. In the end only the judicial officer/prosecutor have the overview perspective and he can choose to share, or most times not to share, with us the value of our results in solving the criminal cases.

Familial searching rules

In the NJGDS the DNA Pedigree searching CODIS tool, is used for Familial searching. Usually, the pedigree tree is very simple, it has only one DNA profile, which is not from relatives or unidentified human remains DNA profile, as in routine pedigree tree searches. In Familial searching the searched DNA profile is a forensic unknown DNA profile and the query results, most often, consist in a list of possible candidates, which have in common half of their DNA

profile with the searched forensic unknown DNA profile. Also, the search is performed on almost all available indexes and is more complex than routine search, where the category of relatives is only searched against missing persons and unidentified persons categories and vice versa.

According to the Mendel's 2nd law, first degree relatives (father/mother and son/daughter) have in common half of their DNA on the ascending and descending of family line. Starting from this biological rule, each candidate has a probability (likelihood ratio) of being a first degree relative, which is dependent on the number of DNA markers and the allele frequencies of them, reported to a known human population (e.g., Caucasian, European, Romanian population etc.).

The validation of the relative's relationship nature - father/son or mother/daughter and also of other case related evidence (alibi, age, ethnic appearance, geography etc.) is exclusively a task for investigative officers. After this step a DNA profile is taken from the suspect and is compared by regular forensic means with the forensic unknown DNA (evidence DNA), which lead to the familial search, in first place.

Due to the intensive work and time consuming of the entire procedure we implemented some rules at NJGDS that will help us minimizing the false positive candidates and be more efficient in using the Familial searching results.

Rule 1 – Familial searching will be used only in serious crimes (murder, rape etc.) and only for identifying possible first degree relatives.

Rule 2 – Familial searching will be done only in those cases in which there is one or more unidentified DNA profile which have no other positive matching results after routine searches and the case does not have any other traces to be analyzed or clues to follow.

Rule 3 - Only results in which matching DNA profiles share alleles of a minimum of 15 autosomal markers, with one possible mismatch allowed, will be reported. In exceptional cases, where matching DNA profiles are of low quality, the candidates will be reported if they share alleles from no less than 7 autosomal markers, and no mismatch is allowed.

Rule 4 – In order to facilitate the investigative work, the candidates list will be arranged based on the number of shared markers and the value of the Combined Likelihood Ratio.

The first positive match - the Frimu murder case

On December 3, 2018, Florin Frimu, a 38-year-old man, was found dead, stabbed multiple times, in the apartment where he lived in rent, in a block of flats on Diham Alley [5].

This case involved watching hundreds of hours of recordings, over 150 people being interviewed, and different DNA tests. After viewing the video recordings of the victim's route, the main suspect was "a man about 18-25 years old, who appears in pictures in the company of the victim". The identity of that suspect could not be established based on these footages. The killer remained in Romania for a few months, then went to work in England, hoping to lose track [6].

Analyzing the biological samples recovered from the crime scene, a blood sample provided a full forensic unknown DNA profile. This profile was searched in the NJGDS and in the national DNA databases of countries which made automated DNA data exchange with Romania at that time (24 European countries, UK being one of them), all with a negative result.

As we mentioned above the familial searching results are usually o list of possible candidates. In this case we obtained 21 candidates, but only one candidate complied with the reporting rules. The good news was that the single candidate was sharing alleles at all 17 analyzed autosomal loci with our forensic unknown DNA profile and the match had a 1.54908E+010 Combined Likelihood Ratio, the value being of great probative significance.

The matched profile belongs to a convicted offender, so the main suspect could had been the son or the father of this person. After the verification made by the Homicide Department the suspect was Gheorghe Marius, a 22 year old male, the son of 40 year old convicted offender with the name initials G.I. convicted for other murder and attempted murder felonies.

On June 15, 2020, a European investigation order was issued to the UK judicial authorities to determine the DNA profile of Gheorghe Marius [5]. Afterwards, his genetic profile was compared with the forensic unknown DNA profile recovered from the Florin Frimu apartment, resulting in a perfect match. According to our simulations, the forensic unknown DNA profile frequency in the Caucasian population is 1.9750E-30, which means that the chance of finding the DNA of Gheorghe Marius in the victim's house, by chance, is 1 in 506.300.000.000.000.000.000.000.00.

In conclusion, familial searching is a great investigative tool with important ethical, forensic, and operative implications, helping law enforcement develop leads in investigations that would otherwise go unsolved [7].

In this paper we described the most common

and simplest familial searching tool, but there are other tools or ways of making Familial searching – different DNA genotyping tools lead to different familial search methods (e.g., mtDNA, Y chromosome, SNP etc.) which involves specific databases, or there are tools that allows searching for relatives of other degrees (ranks).
Familial searching offers new opportunities in solving cold cases and raises new challenges when it comes the communication between the entities involved in solving serious crimes: experts, investigative officers, and prosecutors.

Conflict of interest

The authors declare that they have no conflict of interest.

Abbreviations

CODIS: Combined DNA Index System; FBI: Federal Bureau of Investigation NFI: National Forensic Institute; NJGDS: National Judicial Genetic Data System; mtDNA: mitochondrial DNA; SNP: single nucleotide polymorphism; STR: short tandem repeat.

Authors' contributions

Credit for CODIS operations and technical implementation of Familial searching in Romania belongs to Florin Stanciu. The credit for obtaining very good results from biological samples recovered in Frimu murder case belongs to Elena Dragomir and Tanța Bratu. Florin Stanciu wrote the manuscript. All authors read and approved the manuscript.

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References

1. Debus-Sherrill S, Field MB. Understanding Familial DNA Searching: Policies, Procedures, and Potential Impact. Summary Overview. Office of Justice Programs' National Criminal Justice Reference Service. U.S. Department of Justice. August 2017. Award Number: 2013-R2-CX-0013.
2. CODIS and NDIS Fact Sheet. FBI. https://www.fbi.gov/services/laboratory/biometric-analysis/codis/codis-and-ndis-fact-sheet. Published June 8, 2016. Accessed December 8, 2021.
3. France Elodie Kulik murder trial after 17-year fight for Justice. BBC News. https://www.bbc.com/news/world-europe-50502262. Published November 21, 2019. Accessed December 8, 2021.
4. Maguire C, McCallum L, Storey C, Whitaker J. Familial searching: A specialist forensic DNA profiling service utilising the national DNA database® to identify unknown offenders via their relatives—the UK experience. Forensic Science International: Genetics. 2014; 8(1), 1-9.
5. Crimă în București, polițiștii sunt în alertă. UN Tânăr a fost Găsit Mort, înjunghiat, Pe Aleea Diham. Observator. https://observatornews.ro/eveniment/crima-bucuresti-tanar-mort-injunghiat-aleea-diham-277277.html. Published December 3, 2018. Accessed December 14, 2021. Romanian.
6. Cupa V. Povestea crimei din Aleea Diham si cum a fost Gasit Ucigasul Dupa Doi Ani de investigatii. "au fost vizionate sute de ore de inregistrari video si audiate peste 150 de Persoane". Ziare.com. https://ziare.com/stiri/ancheta/crima-aleea-diham-bucuresti-bucatarul-florin-frimu-injunghiat-mortal-1670953. Published December 14, 2021. Accessed December 14, 2021. Romanian.
7. Kim J, Mammo D, Siegel MB, Katsanis SH. Policy implications for familial searching. Investig Genet. 2011;2:22. Published 2011 Nov 1.