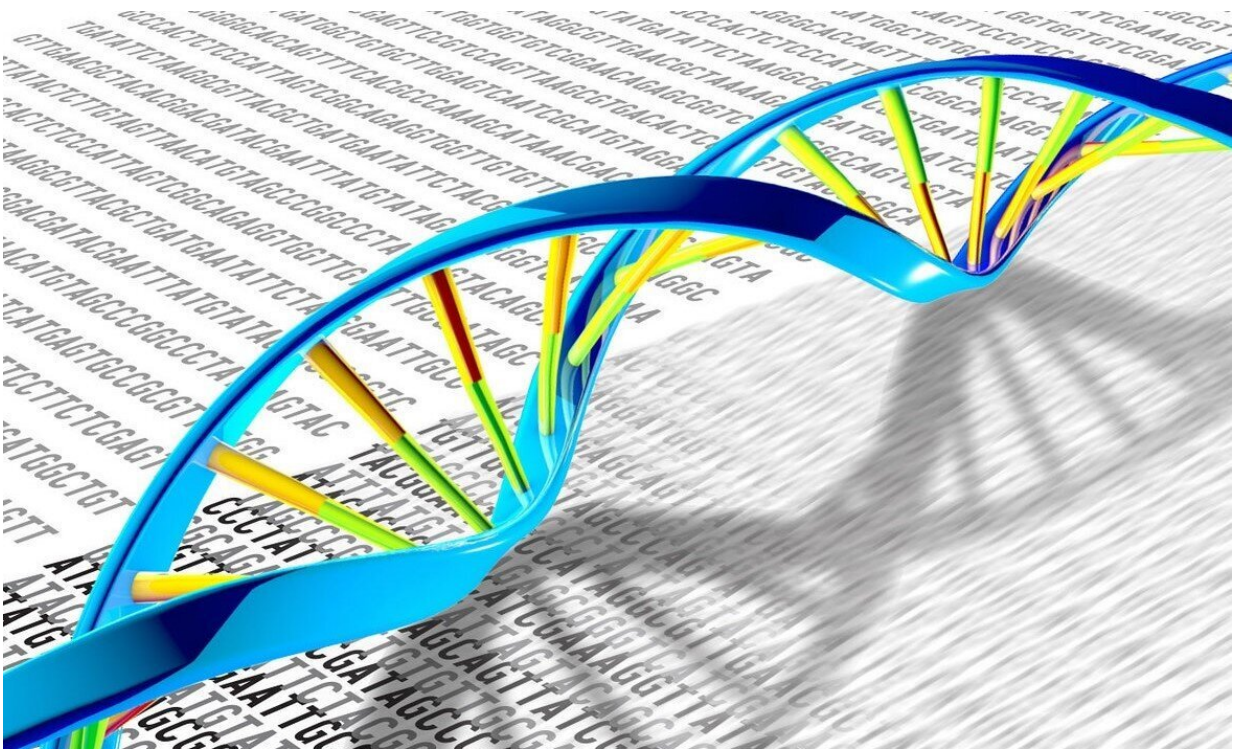


What is forensic genetic genealogy? Technique used in Rachel Morin case is scantly regulated

June 21 2024, by Dan Belson and Matt Hubbard, The Baltimore Sun



DNA, which has a double-helix structure, can have many genetic mutations and variations. Credit: NIH

Authorities touted the use of a growing, powerful, yet contentious forensic technique to bring the search for a suspect in last year's killing

of Rachel Morin to a long-awaited close.

Federal officials said at a news conference that agents crossed international borders to find leads in the case after developing a comprehensive DNA profile of the man who police believe killed the mother of five while she was walking on the Ma & Pa Heritage Trail last August. The killing of the 37-year-old caused shockwaves in Harford County and beyond, with national attention focusing on the months-long investigation that followed.

The FBI credited forensic genetic genealogy, an investigative technique brought to the public eye in 2018 when it was used to identify the "Golden State Killer," with helping them close in on Victor Martinez-Hernandez as the suspect in Morin's homicide. The up-and-coming, controversial technique involves authorities comparing a DNA profile against consumer genealogy databases in addition to their own law enforcement resources.

While a powerful investigative tool, it remains largely unregulated, drawing genetic privacy concerns.

The technique involves investigators using DNA sequences to create a family tree of a suspect's potential relatives to glean leads, but that has raised alarm from privacy advocates who warn that the practice compares evidence against uninvolved people's sensitive genetic data. In 2021, Maryland became one of the first states to place limits on forensic genetic genealogy, but the practice remains largely unregulated throughout the country.

The process involves using [forensic evidence](#) to develop a detailed DNA profile, which is then compared against the data stored in the consumer databases. Authorities then can try to deduce relatives of their subject, either distant or close, who have uploaded genetic data saved from

popular consumer tests like AncestryDNA and 23andMe.

New and ever-expanding, the practice transcends traditional expectations of genetic privacy and "has the potential to make all of us findable" using millions of DNA profiles, said Natalie Ram, a [law professor](#) at the University of Maryland School of Law in Baltimore who focuses on bioethics.

The genetic profiles used are far more detailed than what is processed through the Combined DNA Index System, a law enforcement program abbreviated as CODIS that operates state, local and nationwide databases of DNA profiles with a limited scope—the genetic material stored comes from evidence from unsolved crimes, missing persons cases and people convicted of crimes.

Some of the sequencing performed in Morin's case uses thousands of data points found in DNA called "markers," that can be compared to detailed, consumer-focused databases, while CODIS only uses 20 markers and is only able to identify and match DNA samples to existing samples in the law enforcement databases.

Putting the pieces together

Some crime scene evidence used to ultimately identify Martinez-Hernandez, 23, as the suspect was sent to private labs for DNA evaluation and analysis, according to the Harford County Sheriff's Office. Some forensic evidence was processed by a [private company](#) in Texas.

The company, Othram, was founded in 2018 with the aim of using forensic genetic genealogy to solve cold cases and identify homicide victims. The biotech company also runs its own genetic database, DNASolves, which asks the public to crowdfund lab testing for cold

cases and volunteer their DNA for a database used by law enforcement.

The company's lab uses a "forensic grade" genome sequencing process to build comprehensive DNA profiles out of damaged DNA samples typically found at crime scenes. For active investigations, like Morin's case, law enforcement agencies pay the costs for the lab to develop genetic profiles from forensic evidence.

The profiles developed through Othram's genome sequencing allow investigators to traverse generations of a biological family tree to identify the DNA makeup and family members of potential suspects in a matter of days.

"We built something that can work with the most untraceable DNA evidence and still build a profile that is so comprehensive that you can identify all relatives of a person," said Dr. Kristen Mittleman, Othram's chief business development officer.

In Morin's case, CODIS was used to match DNA found at the scene of the Bel Air homicide to DNA found at a scene in Los Angeles, where a 9-year-old girl and her mother were assaulted during a home invasion. But the identity of the suspect was not available in American law enforcement databases, so investigators consulted Othram.

"Our technology comes into play when someone is not in the database and you need to confirm their identity," Mittleman said.

Once a profile is built, Othram uploads it to law enforcement consenting databases much larger than what CODIS offers.

In Morin's case, Mittleman said, the FBI took point on dialing in a suspect with the Othram profile. Although investigators have not said how they tracked Morin's killer using the profile, Mittleman said the

typical process for obtaining a person's identity using genome sequencing dives into "distant relationships" found through database matches.

"Once we find distant relatives, we are able to get a feel for how far in relation the unidentified person is from the many matches we obtain to figure out exactly where they belong on a family tree," Mittleman said. "It doesn't identify a specific person that leads us to answers; it leads us to be able to fill the missing puzzle piece into the generation on a family tree."

What authorities have said so far

Martinez-Hernandez is still in Oklahoma as he awaits extradition to face murder and rape charges in Harford County. An abridged version of the precise steps investigators took to place Martinez-Hernandez at the scene of Morin's killing likely will be explained over the course of several hours in court, should the case make it to trial.

In the meantime, court filings and legal arguments could shed light on how Martinez-Hernandez, of El Salvador, was identified as a suspect. But investigators have released a few details since his arrest at a Tulsa sports bar.

Matt McMahon, the father of Morin's eldest daughter, said Harford investigators told him sometime last fall that genetic genealogy analysis determined the suspect was from El Salvador.

William DelBagno, who heads the FBI's Baltimore field office, said that agents traveled to El Salvador as part of the efforts to identify Martinez-Hernandez after the field office's investigative genetic genealogy team traced his potential relatives.

Harford County Sheriff's Office spokesperson Cristie Hopkins said that the Bel Air and Los Angeles cases were linked with "additional evidence recovered from interviews with family members," some in El Salvador, after forensic evidence from "multiple sources" was evaluated and analyzed.

Finally, a lead on May 20, Morin's birthday, seemed to be the final big break, Harford Sheriff Jeff Gahler said after the arrest. Gahler has not said what information was received that day.

Maryland's guardrails for a powerful tool

The rise of forensic genetic genealogy has notably broadened authorities' ability to identify and locate suspects who can't be found through traditional law enforcement databases. Othram is backing legislation in Congress that would set aside federal funds for state labs to handle forensic genealogy and collect data to measure its success.

"With our profiles, we can get a perpetrator off the streets, and there are victims who will get home who would have been the next victim of an unidentified perpetrator that will never even know and will live a perfectly normal life," Mittleman said. "To me, that means the world."

But the technique's remarkable investigative power comes from law enforcement using an unprecedented amount of sensitive genetic information from people who are not suspects but have volunteered their DNA to consumer databases, which market themselves on their ability to find ancestors and identify customers' health risks.

Ram, the Maryland law professor, noted the practice enters uncharted territory in terms of consent. She said cases like Morin's, which she called "truly heinous," are often used to justify expanding use of those databases.

Rules of engagement have been set for law enforcement DNA collection programs like CODIS, which stores very little genetic information compared to what's kept in consumer databases, and is significantly limited as to whose DNA profiles are stored.

But forensic genetic genealogy hinges on DNA volunteered by a suspect's distant relatives—sometimes a second, third or even ninth cousin—who use consumer services for unrelated reasons and might not be aware of law enforcement access, Ram said.

And although courts have permitted genetic information to be taken and stored in CODIS databases in many circumstances, they also have noted that those DNA profiles are less invasive—they contain little information about a person and are akin to a fingerprint. The type of information stored in consumer databases is much more extensive, Ram said.

Some private services, like Othram's DNASolves, solely market their genetic [database](#) to law enforcement. The most popular consumer platforms, Ancestry and 23andMe, resist law enforcement requests without a court order, subpoena or warrant.

GEDMatch and FamilyTreeDNA, sites through which users can upload their data to cross between separate consumer services, have become popular platforms for forensic genetic genealogy, though they now require authorities to pay for a limited account and only show data from users who opt into sharing information with law enforcement.

But because investigative genetic genealogy is sparsely regulated, investigators simply can ignore the terms of service and use the platforms under the guise of a normal user, Ram said.

Most states have no laws setting boundaries for how authorities conduct

forensic genetic genealogy. The U.S. Department of Justice has developed interim regulations for federal law enforcement.

Maryland is "leading the charge to regulate and formalize" the practice, said Ram, who pushed for the bipartisan legislation that passed in 2021.

Maryland's law requires the technique to only be performed with the approval of a judge. It mandates that authorities attest under oath that the technique is being used to investigate certain high crimes—murder, rape and other ongoing threats to public safety—and use databases that require users to acknowledge their information could be used by law enforcement.

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Citation: What is forensic genetic genealogy? Technique used in Rachel Morin case is scantily regulated (2024, June 21) retrieved 26 June 2024 from <https://phys.org/news/2024-06-forensic-genetic-genealogy-technique-rachel.html>

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