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RICK BOWMER/AP/SHUTTERSTOCK



The long reach of law enforcement could now extend into our DNA.

CONSUMER GENETICS

Privacy concerns over DNA used for crime investigation

Almost all Americans of European descent could soon be traced using relatives' DNA.

BY EWEN CALLAWAY

Genetic sleuthing techniques that led to the arrest of a suspect in the infamous Golden State Killer case this year are set to become vastly more powerful, suggest two papers published last week^{1,2}.

They conclude that it could soon be possible to search crime-scene DNA for links to nearly all Americans of European descent, while vastly expanding the reach of an existing forensic database. The results raise urgent privacy issues. "It's important to have this discussion early on," says

Yaniv Erlich, chief scientific officer at consumer genetics firm MyHeritage in Yehuda, Israel, who led one of the studies¹.

From the mid 1970s to the late 1980s, a string of burglaries, sexual assaults and murders in California were attributed to an unknown person dubbed the Golden State Killer or the East Area Rapist. The case went cold, but in April 2018, police arrested Joseph James DeAngelo. He was identified as a suspect, in part, by matching crime-scene DNA to genetic profiles posted by his distant relatives on the genetic-genealogy website GEDmatch, which allows

people to upload data from consumer genetic companies and to search for relatives. Between April and August 2018, more than a dozen cases have been solved using this technique.

Erlich and his team set out to measure the reach of the method, known as long-range familial search. They analysed anonymized DNA profiles from 1.28 million MyHeritage customers. Like similar firms, the company allows customers to search for relatives who share DNA inherited from a common ancestor.

The researchers found that 60% of MyHeritage customers had a third cousin ▶

► or closer relative in its database. Searches of 30 randomly selected GEDmatch profiles found a similar rate of relative matching.

But such databases could identify many more people who aren't in them. DeAngelo was not on GEDmatch; detectives found him using profiles of his third cousins. Erlich's team estimates that a database containing genetic profiles of 3 million Americans of European descent could enable the identification of 90% of this demographic using public genealogy records. GEDmatch is growing by 1,000–2,000 profiles per day, says co-administrator Curtis Rogers, and should hit 3 million in the next few years.

To see whether they could track down people not in the database, the researchers attempted to identify an anonymous woman from Utah who had made her DNA public as part of the 1000 Genomes project. They uploaded her profile to GEDmatch and searched for distant cousins. Of the people who had enough DNA in common with her to suggest that they shared an ancestor in the past few generations, two also had enough public genealogical information to narrow the search. After a day spent ruling out hundreds of descendants, the team identified the Utah woman. (She is not named in the paper and the researchers made no attempt to contact her.)

SPOTTING INFORMATION

DeAngelo was identified only because crime-scene DNA had been preserved. This allowed forensic scientists to apply the approach now used in consumer genetics testing and many

biomedical studies: sequencing hundreds of thousands of DNA variants, or single-nucleotide polymorphisms (SNPs), across the genome.

For the past few decades, by contrast, most crime-scene DNA has been analysed using the sequences of more than a dozen 'short tandem repeats'. The FBI's Combined DNA Index System (CODIS) holds more than 13 million such profiles. These allow forensic scientists to determine an individual's genetic signature, but are poorly suited to matching relatives, says Noah Rosenberg, a population geneticist at Stanford

The team identified an anonymous woman who had made her DNA public.

University in California. To circumvent this, Rosenberg's team developed a computational method to cross-match CODIS profiles with a close relative's SNP profile. Simulations suggested that about one-third of people genotyped using short tandem repeats could be correctly matched to a first-degree relative genotyped with SNPs². This could allow investigators who are unable to generate SNP profiles from crime-scene material to look for matches to CODIS profiles in databases such as GEDmatch, and vice versa, Rosenberg says.

Forensic genealogical investigations similar to the Golden State Killer case are set to grow. The lack of regulation for such searches is striking, says Rori Rohlf, a statistical geneticist at San Francisco State University in California. However, some rules do exist: in California, for

example, law-enforcement forensic databases can be used to find relatives only in cases of serious crimes where there is a risk to public safety, and the genealogical investigative team must be distinct from local detectives on a case.

Erlich says that consumer genetics companies could include digital signatures with the data files people can download, allowing GEDmatch to differentiate them from crime-scene profiles uploaded by investigators, and shield consumers from searches. Rogers says that GEDmatch has no plans to limit law-enforcement access — after the Golden State Killer case emerged, the site updated its terms of service to explicitly warn users that investigators could use it — and he worries that regulating use will interfere with the site's purpose: helping people find relatives. "I don't think anyone's privacy is being violated," he says. "People should be able to control their own DNA and not the government."

Colleen Fitzpatrick, co-executive director of the DNA Doe Project in Sebastopol, California, which has used familial searching to help solve a number of missing-person cases, says the information gleaned from these searches isn't so different from other leads — and therefore shouldn't be treated differently. "Just about anything we do in life reveals information about others," she says. ■

1. Erlich, Y., Shor, T., Pe'er, I. & Carmi, S. *Science* <https://doi.org/10.1126/science.aau4832> (2018).
2. Kim, J., Edge, M. D., Algee-Hewitt, B. F. B., Li, J. Z. & Rosenberg, N. A. *Cell* <https://doi.org/10.1016/j.cell.2018.09.008> (2018).

FUNDING

Argentina's scientists struggle as peso slips

Inflation and currency devaluation have hobbled research.

BY MICHELE CATANZARO

Juan Pablo Paz's plans for a new cold-atom laboratory have slowly eroded over the past two years. Paz, a physicist at the University of Buenos Aires, won a US\$1.1-million grant in February 2017 to set up the facility. But the money, awarded by the Inter-American Development Bank, was transferred to Paz through an Argentinian government agency that paid him in pesos.

As Argentina's currency weakened, so did Paz's buying power. When the physicist won his grant, \$1 cost 16 pesos. "Now it costs 38," he says. "By the time I got the money, I was able to buy just a part of the equipment"

Paz, who is looking for money to cover the last 40% of his lab's start-up costs, is one

of many researchers who say that Argentina's worsening financial woes are hurting their research. The slipping peso makes it harder to purchase equipment from abroad, while rapidly increasing inflation has crushed scientists' budgets and salaries at home.

Researchers have also struggled under austerity measures adopted by the government in 2014 and intensified in June by a financing agreement that Argentina signed with the International Monetary Fund.

"The science and technology system of Argentina is collapsing," a group of high-profile scientists, including Paz, wrote in an open letter published late last month. More than 1,000 foreign scholars or Argentinian scientists working abroad — including several Nobel laureates — have endorsed the message.

Argentina's total science spending increased tenfold between 2003 and 2015, reaching the equivalent of \$3.96 billion. Along the way, in 2007, the country established a dedicated science ministry. Still, Argentina spends much less of its gross domestic product (GDP) on research than does South America's leader, Brazil. The slice of GDP that Argentina devotes to science peaked at 0.63% in 2012, when Brazil spent 1.13%.

And recent years have seen a reversal in fortune for research overall. The government's science outlay fell by almost 40% between 2015 and 2018 when measured in US dollars, and the share of Argentina's budget devoted to research has fallen from 1.69% in 2008 to 1.23% in 2017. The picture is set to grow grimmer next year: the budget proposed by Argentina's president, Mauricio Macri, includes further cuts to science.

PINCHED PURSE

The government's belt-tightening has drastically reduced the average value of awards made by ANPCyT, Argentina's main granting agency for science and technology. The country has also suspended its contributions to several international research projects.

The situation is also dire at CONICET, Argentina's national research council. The council, whose budget stood at \$681 million