'Familial searching,' its promise and perils

DNA crime-fighting tools can help crack cases, but authorities must put proper procedures in place.

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It was an unfinished slice of pizza that led to the identification of Lonnie David Franklin Jr. as the prime suspect in the Grim Sleeper murder investigation. But the pizza was just the final clue leading to his arrest.

The key break in the investigation, intermittently conducted over 25 years, came when investigators found a close — but not perfect — match between the DNA recovered at multiple crime scenes and a man being held in a California prison. Such a near-match strongly indicated that the person wanted by police was a close relative of the man in prison, and police soon focused on the man's father, Lonnie Franklin. They put him under surveillance, obtained his discarded pizza and found that his DNA matched that recovered at a Grim Sleeper crime scene.

Four years ago, in the journal Science, we described how a data-mining technique known as "familial searching" could be used for efficient identification of possible crime suspects when traditional investigative efforts fail. The paper (which we wrote along with UC Berkeley mathematician Charles Brenner) explained how crime laboratories might benefit from searching not just for perfect matches, but also for close ones, when trying to connect DNA from unsolved crimes to the DNA of known offenders whose genetic profiles are held in local, state and national databases. Because relatives share common DNA profiles, close matches can implicate family members as possible crime suspects.

The importance of this technique was clearly demonstrated this week in Los Angeles. Yet currently in the U.S., familial searching is allowed only in California and parts of Colorado. As experience with familial searching increases, other states will probably embrace the technique. And as they do, it is imperative that policies be carefully crafted to ensure both efficiency and accuracy in case selection, statistical thresholds and follow-up testing and investigation.

Familial searching extends the size and reach of the nation's DNA databases to effectively include the parents, children and siblings of the 8 million offenders and arrestees whose DNA profiles are already stored in databases. Additional technologies, including Y-chromosome genotyping and examination of mitochondrial DNA, can provide analyses even further out on the family tree. Extending the reach of databases to possibly tens of millions of additional individuals brings great opportunities for solving crimes. But it also raises concerns.

By utilizing these techniques, officials have the ability to reach far beyond the pool of those mandated to provide DNA samples. This sparks legitimate privacy considerations. It also magnifies concerns that African Americans and Latinos are disproportionately represented in offender databases, although this also can mean that the benefits of

familial searching will accrue to these overrepresented groups. This case demonstrates that point, as Franklin and all of the Grim Sleeper's known victims are African American.

Because of the chance that someone unconnected to a crime might appear to be related to the perpetrator, extra laboratory testing steps are always needed to narrow the list of potential suspects to avoid intrusions and conserve investigative time and resources.

But California has demonstrated how these concerns can be addressed in a way that limits the potential for intruding in the privacy of uninvolved parties, yet allows investigators to utilize an important crime-solving technique. The state limits familial searching to high-priority cases when other investigative methods have failed, requires additional Y-chromosome typing and makes use, if available, of non-forensic information in order to identify additional evidence bearing on relatedness.

The Grim Sleeper case will undoubtedly become the poster child case for proponents of familial searching around the country, and indeed, those who oppose any use of familial searching must justify not using these methods when there is lingering ongoing danger to the public. Still, states should put safeguards in place as California has done before embracing the technique.

The collection of DNA by law enforcement officials has expanded over the last decade. Initially, databases included only the DNA of those convicted of a narrow array of violent crimes. Then it was expanded to all convicted felons, and then, in California and many other states, to those arrested — but not necessarily convicted — of qualifying crimes.

Familial searching is a quantum leap because it expands the potential for DNA scrutiny to millions who have not even been suspected of a crime. And it demands a question: If it is just the capricious hand of fate that separates those of us under surveillance from those who are not, what is the justification for not creating a universal database as the only equitable solution?

Although there are many inside and outside the United States who have made cogent arguments supporting creation of a universal database, we would not support such an extension of state authority.

These are issues our system will grapple with over time. But in the interim, it is essential that states tread deliberately and carefully as they expand DNA analysis to include familial searches. Only in doing so can our public institutions both protect our individual rights while at the same time bring to justice dangerous criminals.

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DNA Sweep Must Be Accompanied by Informed Consent

January 20, 2005
Frederick R. Bieber and David Lazer

Provincetown Banner

“An older man who hobbles painstakingly, seemed amused that anyone would think he could be a match [to the DNA found on the body of Christa Worthington]. "I can barely make it to the car," [he] said. NYT, Jan 10, 2005

Sampling DNA from an elderly hobbled man would hardly seem an effective way to solve the murder of Christa Worthington. But the trail is cold and this is just what happened last week in Truro, MA when the DNA dragnet began - with police asking all local males to “volunteer” a DNA sample for comparison to crime scene evidence.

While traditional DNA sweeps have had little success in directly identifying perpetrators, an important new twist on traditional methods, known as familial searching, could cast the net much wider by “shaking the family tree” to include the hobbled man’s relatives as well. Informed consent must be embedded in such practices. Public scrutiny is urgently needed.

Familial searching involves the comparison of crime scene DNA profiles to those of known suspects for close, but not perfect, matches. Familial searching has been successful in solving serious crimes even when no direct DNA match was found - by shaking the family tree for indirect identification of the perpetrator through a close relative whose DNA profile was already stored in a database of convicted offenders. Thus those Truro volunteers who are excluded themselves by DNA testing might be providing important genetic clues implicating their close family members.

Traditional DNA dragnets have had little success, as true perpetrators usually don’t rush forward to volunteer a blood or cheek swab sample for comparison to crime scene evidence. Thus, sampling from elderly hobbling men in Truro would, at first blush, seem to be a distinctly inefficient way to look for new leads – as traditional forensic DNA profiling compares genetic markers on the non-sex chromosomes and seeks to find a perfect match between evidence and known DNA samples.

In contrast to traditional methods, familial searching methods extend beyond the individual DNA profiles to identify individuals whose relatives could have left key crime scene evidence. There are several methods available, some focusing on male relatives. For example Y chromosome profiles are shared amongst all male relatives related to one another through the father’s bloodline. Therefore a volunteer’s DNA might not match the crime scene evidence, but it could be close enough to implicate a relative - like a son, a

brother or nephew.

Familial searching magnifies the power of law enforcement. A DNA dragnet of a few hundred Cape Cod males could effectively include, indirectly, several hundred more of their biological relatives. So even if no direct DNA matches are found to the volunteers, all is not lost. In fact, searching for close matches between crime scene evidence and common Y chromosome markers would be far more effective than hoping for a complete direct DNA match using traditional forensic profiling methods. Thus, paradoxically, with familial searching methods, certain indirect DNA matches could provide useful clues about possible relatives who would potentially be much more viable as suspects than the volunteers themselves.

With such investigative power comes great responsibility. Without individualized suspicion, and a bench warrant, contribution of DNA should be non-coercive, completely voluntary and well informed. What are the male volunteers in the Truro DNA dragnet being told about the use(s) of their DNA? What is planned for the disposition of the sample after DNA profiling is completed?

What happens to these samples and the DNA profiles remains a real concern. For example, blood spot cards have been obtained, since the early 1990s, from all military personnel upon entry into the service or prior to deployment. They were obtained initially as the modern day "dog tags", to be used only for humanitarian

DNA-based human remains identification. But legislative changes quickly moved us down the slippery slope - the Culberson (R-TX) amendment to the 2002 Defense Appropriation Act now permits these military blood spot cards to be used for DNA testing, under court order, for criminal investigations.

Such morphing of the methods and the original intent of DNA collections has led many to recommend universal DNA collection as the only fair way to avoid outright discrimination. Accordingly, we're curious - has any of the Truro investigative staff stepped up with the hobbled man to volunteer a sample?

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SECTION: Comment; Comment and Analysis; Pg. 20 **LENGTH:** 836 words
HEADLINE: Guilt by association; Should the law be able to use one person's DNA to carry out surveillance on their family? Not without a public debate say Frederick Bieber and David Lazer
BYLINE: Frederick R. Bieber; Frederick R. Bieber is associate professor of pathology at Brigham and Women's Hospital, Harvard Medical SchoolDavid **Lazer** is associate professor of public policy at Harvard University. He is editor of DNA and the Criminal Justice System: The technology of justice
BODY:
IN 1988, Lynette White was found stabbed to death in her flat in the Welsh capital, Cardiff. A DNA sample from the crime scene did not match any sample in the UK's national DNA database, and the murder confounded detectives. Then, in 2003, came a breakthrough. A new technique called familial searching, which retrieves a list of possible relatives of the owner of a particular DNA sample from the database, helped lead detectives to the murderer.

The case showed what a powerful tool familial searching can be. But its broader implications have been given little attention. For example, it brings with it the indirect lifelong surveillance of citizens simply because they are related to someone whose DNA profile is on record.

There are real fears that this could erode the privacy of a large number of people and could create new social divisions -- between families whose members have been subjected to DNA fingerprinting and the rest of society.

DNA databases worldwide are growing fast and a very large number of innocent people could be affected. This year the UK became the first country to permit the DNA profile of anyone arrested to be kept indefinitely, regardless of whether they are subsequently convicted. The UK database already contains DNA profiles of over 2 million people. On 2 November, Californians will vote on Proposition 69, which mandates the collection of the DNA profile of anyone who is arrested for a serious crime, whether subsequently convicted or not.

Familial searching will stretch the reach of these databases far beyond the individuals profiled in them. For every person in the database, their close relatives may be only a short calculation away. This means that within a few years a large proportion of the UK's population will be included, by association, in the database, even though they have never even been suspected of a crime, let alone convicted.

In the White case, the UK's DNA database happened to include the profile of the murderer's 14-year-old nephew -- who had not even been born when White was killed -- because he'd had dealings with the police. When DNA taken from the crime scene was tested against DNA profiles in the database the nephew was flagged up because he shared an

uncommon genetic marker with the person who had left their DNA at the crime scene. Detectives then tracked down his uncle, Jeffrey Gafoor, who admitted the murder. This case, together with a handful of others in the UK, New Zealand and North America, has led law enforcers to trumpet familial searching as an important new tool for investigating

crimes.
Familial searching is based on the way we inherit our genes. Close relatives (especially parents, children and siblings) will share certain alleles -- versions of a particular gene -- which can act as genetic markers. Crime investigators can exploit this to compare crime scene DNA profiles with the profile of known individuals in the hope of finding a relationship between the two.
Three methods are available. Rare allele searching begins by looking for rare alleles in crime-scene evidence and then cross-referencing these alleles with profiles in a DNA database. Allele counting compares the overall number of alleles the crime-scene sample shares with database profiles across all regions of the genome. Kinship analysis combines these two approaches to rank in order of likelihood the people in the database who could be related to the owner of the crime-scene DNA.
The UK's Forensic Science Service now promotes familial searching to police forces in England and Wales as a way of tracking down perpetrators of serious crimes through their relatives. In North America, such searches occur informally at the local level.
There are still technical problems with familial searching. Indirect searches of national DNA databases can produce a list of hundreds of "potential relatives", none of whom, on closer inspection, turn out to be genetically related to the perpetrator. However, the scope and power of familial searching will increase as the cost of extracting genetic information drops, making it possible to retest DNA samples from convicts and arrestees to expand the repertoire of markers in DNA databases.
Soon it may be possible to routinely reach beyond close relatives, especially if the databases are extended to include Y chromosome markers, which are only transmitted through the generations from fathers to sons, and mitochondrial DNA sequences, which are transmitted by mothers to both sons and daughters.
In the UK,the inventor of DNA fingerprinting, Alec Jeffreys, recently argued that blanket profiling of the entire population would be the only fair way to avoid splitting society between those under permanent surveillance and those who are not. But is a blanket database a good idea? And should familial searching be allowed to develop? That debate should be open to the public now, otherwise familial searching will effectively produce a blanket database whether we like it or not.

The Boston Globe
April 12, 2003, Saturday ,THIRD EDITION
SECTION: OP-ED; Pg. A13 **LENGTH:** 858 words
HEADLINE: FREDERICK R. BIEBER AND DAVID LAZER Frederick R. Bieber, an associate professor at Harvard Medical School, reviewed the evidence in the Maher case for District Attorney Martha Coakley. David Lazer is a professor at Harvard's John F. Kennedy School of Government.; LESSONS LEARNED FROM A MISCARRIAGE OF JUSTICE
BYLINE: BY FREDERICK R. BIEBER AND DAVID **LAZER**
BODY:
IN 1984 DENNIS MAHER WAS SENTENCED TO LIFE IN PRISON FOR TWO SEXUAL ASSAULTS AND AN ATTEMPTED ASSAULT. AFTER SERVING 19 YEARS IN PRISON, HE WAS RELEASED LAST WEEK BECAUSE DNA testing of old evidence excluded him as the source of the biological evidence in the two assaults. While no one can restore 19 years of Maher's life, a just society is obligated to glean lessons from his case and others like it to prevent future injustices.
Maher joins the ranks of 126 others whose original convictions were overturned based on retrospective DNA analysis of biological evidence. These cases have moved through the system largely through the efforts of the Innocence Project, founded in 1992 by law professors and law students from around the nation. They scour old court records for convictions based in large part on circumstantial or eyewitness testimony and in which biological evidence was available but was not previously tested using modern DNA technologies.
While some seem assured that the majority of worthy cases have been processed, in fact, the next wave of post- conviction cases will come soon, as contemporary DNA-based studies reveal that a large proportion of purported microscopic human hair matches are incorrect. Before it confronts this second generation of post-conviction cases, the criminal justice system needs to learn several lessons from the first.
First, the system needs to provide access to post-conviction review. Middlesex DA Martha Oakley deserves credit for her openness to DNA testing in Maher's case, and for her unconditional support of his prompt release. But it is wrong that the system relies so heavily on the sound judgment of individual DAs and provides no funding to perform the tasks so ably done on a shoestring budget by the Innocence Project.
Reanalysis of old evidence using new methods should be imbedded within the existing system and not dependent on pleas from the outside and good will from the inside. Legislatively mandated funding and external oversight would assure that other cases receive fair and equitable scientific and legal review. Thirty other states have moved toward such legislation, and Massachusetts should as well.
Second, the system needs to do a better job at managing eyewitness memories. Research over the last three decades has shed light on how we constantly construct and reconstruct our memories. Of the 127 convictions now reversed after DNA testing, 80 percent involved mistaken eyewitness identifications, a rate that improved witness identification
methods can greatly reduce. For example, studies suggest that sequential presentation of lineups to witnesses may reduce erroneous identifications by roughly 50 percent. New Jersey and

select other jurisdictions have adopted this procedure, and Massachusetts should, too. Third, physical evidence needs to be better safeguarded. In the Maher case, access to such evidence was delayed almost a decade because it had been misplaced. A law student investigating the case eventually found it in the basement of a courthouse. This is appalling, and, unfortunately, not an aberration. The Innocence Project estimates that key physical evidence is missing in 75 percent of the cases it reviews nationwide. The criminal justice system needs additional funding to properly implement a massive, but clearly necessary, improvement in the storage and inventory of crime-scene evidence. Fourth, the system needs to adapt to the technology of DNA so that the same DNA analysis that exonerates the innocent also convicts the guilty. The DNA profile(s) of the actual perpetrator(s) of the crimes for which Maher was convicted will be sent to the national DNA database, where it may match that of a known offender. But while Maher was unjustly incarcerated, the statutes of limitation on the assaults expired, and the real perpetrator(s), if found, cannot be prosecuted. This final injustice to the victims and to society is unnecessary. Massachusetts should join the dozen states that have lengthened or abolished the statutes of limitation in cases where DNA evidence is newly available. Finally, the wrongfully convicted should be compensated. Maher, like most who have been exonerated, was incarcerated during his most productive years. As he put it, he should be married with children, collecting a pension from the Army, and starting a second career. While no amount of money can compensate for these losses, financial restitution for the exonerated would enable them to more successfully begin their free lives? A goal that is both just, and in society's interest. Unlike in some states, under current Massachusetts law, Maher will receive neither compensation nor social services. The success of DNA testing reminds those of us involved in forensics and the criminal justice system of what we know all too well? The system is not perfect. Even with our collective care and diligence, justice does not always prevail. Not for the victims of crime, and not for those falsely accused or convicted of them. A fair justice system must remain continually open to review so that justice is truly served.