It is easy—but important—to imagine how government could run amok with technology at the expense of civil liberties. State-sanctioned use of genetic information has provided particularly fertile ground for hypothesizing a parade of horribles; one need look no further than popular films such as *Gattaca* (note the title composed of DNA chemical “letters” A, T, C, G) and *Minority Report*, or federal appellate case law citing these films. (See United States v. Kincade, 379 F.3d 813, 851 (9th Cir. 2004) (Reinhardt, J. dissenting) (warning that finding law enforcement DNA databases to comply with the Fourth Amendment under a totality of circumstances analysis is “reason to fear that the nightmarish worlds depicted in films such as *Minority Report* and *Gattaca* will become realities”).) The same dissent went on to prophesize that DNA databases “could be used to repress dissent or, quite literally, to eliminate political opposition,” and expressed alarm at the government’s potential use of DNA samples to “predict the likelihood that a given individual will engage in certain types of criminal, or non-criminal but perhaps socially disfavored, behavior.” (Id. at 847, 850.) Dire sentiments indeed.

But, this being the present and not the future, all one can hope to do is to allay such fears by explaining the scientific techniques that law enforcement is using, to what end(s) it is using them, and under what legal conditions. I hope that the following description of familial DNA searching will provide sufficient explanation to allow ongoing discussion about this particular law enforcement tool from a common knowledge base, and without resort to grim but unfounded Orwellian predictions.

**Familial DNA Searching in a Nutshell**

Familial searching involves use of a DNA database to generate a lead for detectives investigating an unsolved crime. In this general sense, it is no different than any other use of a CODIS (Combined DNA Index System) DNA database. The distinction, however, lies in the nature of the investigative lead. Historically and typically, a DNA profile generated from biological evidence left by the perpetrator at a crime scene is searched against a DNA database of profiles generated from known samples submitted by convicted—and in many states arrested—persons. When a crime scene profile matches a person’s database profile, the known offender’s name may be disclosed to case investigators as the source of the crime scene evidence, e.g., the burglar who bled on the windowsill. In a familial search scenario, however, there is no direct match between the perpetrator’s DNA profile and someone in the database. The bad guy’s not in there.

Instead, the agency operating the database conducts a second search using different software and different search parameters. This new search looks for known people who do not match completely, but nonetheless share a significant portion of the perpetrator’s DNA profile. The theory is that such commonalities, depending upon how many there are and how rarely or frequently they occur at random in human populations, are more likely to be observed in relatives than in unrelated people. Using criteria established by the agency conducting the familial search (which may differ from agency to agency;
California’s method will be explained in detail below), the database offender’s name may be disclosed to the police agency as an investigative lead if the available data and other information indicate a kinship relationship between the unknown perpetrator and the known offender. To paraphrase: “This is not the criminal, but he’s probably a close relative of the person you’re looking for.” This information is much, much better than nothing. And, as will be discussed, familial searching works.

Theoretical Bases for Familial Searching: Biology and Sociology

The first premise of familial searching is the basic law of inheritance that relatives share more genetic characteristics than unrelated people because of their common ancestry. This is why, for example, close family members tend to appear similar in various respects. In 2006, three prominent researchers suggested that “kinship analysis would be valuable now for detecting potential suspects who are the parents, children, or siblings of those whose profiles are in forensic databases.” (Frederick R. Bieber, Charles H. Brenner & David Lazer, Finding Criminals Through DNA of Their Relatives, 312 Sci. 1315, 1315 (2006).) But of course neither a person’s appearance, nor any other biological trait other than gender, plays a role in the function of forensic identification databases, and such considerations are equally irrelevant to searching for relatives in a DNA database of forensic profiles.

This is because DNA databases contain very little genetic information about the offenders represented in them. Forensic identification testing involves DNA analysis of a miniscule, but useful, fraction of the genome. For crime-solving purposes, a standard set of 13 or 15 genetic locations (or “loci”) spread among a person’s chromosomes is represented in a database by a pair of numbers for each location. Each number is a quantity of repeating short (e.g., four base pairs such as A-G-C-T) chemical sequences the person inherited from one parent; together the two numbers are analogous to the number of boxcars on two freight trains beside each other on parallel tracks. So, a person might be a “15, 16” at the site known as D8S1179, meaning 15 repeats from mother and 16 from father (or vice-versa). Notably, these repeating chemical sequences at the locations chosen for forensic use are highly variable between persons and in populations—like loops and swirls on a fingerprint—but do not code for known biological traits. From a privacy perspective, they are about as meaningful as, again, the pattern of loops and swirls on one’s fingertip. To put it bluntly, who cares if anyone knows that they’re a 15, 16 at D8S1179? By extension, arguments from genetic privacy advocates about the government having access to the genetic essence of one’s personhood, or ideas along those lines, are the stuff of science fiction.

The principles of inheritance, then, mean that the child of a parent who is a “15, 16” at a location must inherit either the 15-repeat or the 16-repeat characteristic from that parent, as well as one of two characteristics from the other parent. Further, and consequently, full siblings may have the same two characteristics at a location, or they may share one of the two, or they may share neither. But, when looking across all 13 or 15 sites assessed for forensic identification purposes, full siblings will likely share more characteristics than unrelated people.

A second premise of familial searching is that law enforcement databases actually contain DNA profiles of people who are closely related to perpetrators of unsolved crime. If this were not the case, the exercise would be pointless and any observed similarities between profiles would be coincidental. According to Bieber, Brenner, and Lazer, “[s]udies clearly indicate a strong probabilistic dependency between the chances of conviction of parents and their children, as well as among siblings. Consistent with these studies, in a U.S. Department of Justice survey, 46% of jail inmates indicated that they had at least one close relative who had been incarcerated.” (Id. at 1316.) It is reasonable to further infer that people who have been convicted of crime (i.e., those in the databases) are also more likely as a group to have relatives who have committed crime but have not been caught, and are thus subject to identification through familial searching. Of course, if this inference is wrong, familial searching using offender databases simply will not produce useful results. But if cases are solved using this method—and they have been—then any debate about the theoretical premises is academic.

Importantly, however, someone does not fall under suspicion just because he or she has a family member who has been convicted of a crime and is in a DNA database. Familial search programs can create rigorous filters to screen out consideration of any offender other than one probably related to the perpetrator of an unsolved crime.

Finally, questions of whether, to what degree, and why crime tends to run in families are difficult ones with often troubling sociological implications. When a crime has been committed, however, constructing kinship estimates by looking initially at other DNA profiles in a database is a process blind to who these people are, as well as race, geography, and other socioeconomic factors. Moreover, the composition of a DNA database is determined by law, which mandates DNA collection as an administrative consequence of conviction without any discretion on the part of law enforcement about whom to include. For better or for worse, DNA databases reflect the demographics of the criminal justice system. Claims that familial searching is a racially disparate investigative
Nuts and Bolts of California’s Familial Search Program

At present, only a few state DNA database programs, including those of California, Colorado, Florida, and Virginia, have constructed formal familial search protocols. Maryland and the District of Columbia prohibit familial searching by statute. Approaches to familial searching vary. For purposes of illustration I will discuss California’s program, administered by the California Department of Justice under the leadership of Attorney General Kamala D. Harris. It is a good example to use because California maintains the largest state DNA database in the country (more than 1,855,000 searchable profiles as of early November 2011), and the state’s familial search efforts, which began in October 2008, have produced the most significant results to date. Moreover, California follows a well-publicized familial search methodology, and its program has received the greatest degree of public scrutiny.

In California, a committee composed of California Department of Justice (CDOJ) scientists, investigators, and legal counsel administer the familial search program under carefully constructed protocols. Here’s how it works.

The process begins when a police agency in California writes a letter to the committee asking that a familial search be conducted in a particular case. Only serious cases, with an emphasis on those presenting significant public safety issues, will be considered by the committee. In practice this has meant homicides and sexual assaults exclusively. The familial search committee is selective when it comes to accepting cases; only 35 searches have been conducted in the 37 months since the operation began.

To be accepted for a familial search the case must include as evidence a full 15-locus single-source DNA profile attributable to the perpetrator, which has been uploaded into, and continually searched against, state and national DNA databases with negative results. There must also be enough untested DNA from the crime scene left over to permit additional specialized testing, for reasons I’ll discuss shortly. Finally, the police agency must attest that it has met with the local district attorney’s office, and all agree to pursue the case if and when evidence is developed sufficiently to move forward. This ensures that the CDOJ will not waste resources on a familial search when a prosecution would be barred by statute of limitations, or where the case is of little interest to local prosecutors.

Once the CDOJ committee accepts a case for searching, the perpetrator’s DNA profile—which, recall, is already in the state database—is searched against profiles in the state database using specially-constructed search software. A few points to note: First, California does not conduct familial searches using profiles generated from arrestee samples. Only convicted offender profiles are compared. Second, familial searches happen only at the state level. The national DNA database (NDIS), maintained by the FBI in Quantico, Virginia, is not involved. Third, the CODIS search software that all 50 states use is designed to detect direct matches between perpetrators and known offenders but is a poor tool for identifying relatives. If all California did is look for relatives using “partial matches” observed during its routine database searches, the CODIS computer program would likely identify fewer than (approximately) 1 in 1,000 pairs of siblings using the 13 core loci employed in CODIS searches, and the chance of finding parents and children of target profiles would be even worse.

Instead, CDOJ developed and validated software it calls “the ratiometer.” How the ratiometer was designed is an interesting story in itself. It involved, among other steps, creating and inserting into the state database fictitious DNA profiles for pretend “families,” and then testing whether the software program could pick them out in mock familial searches. After fine-tuning and validation, the ratiometer was ready. It operates by creating a “kinship index” of convicted offenders for a given perpetrator’s DNA profile, similar to a paternity index. The software ranks the convicted offenders in the state database by likelihood of close (i.e., parent-child or full sibling) kinship to the perpetrator as determined by the rarity of their shared forensic DNA characteristics.

Based on the lab’s research, a threshold cutoff was determined for the kinship index, with convicted offender profiles falling below it receiving no further attention. The cutoff is selective by design. Typically, out of the nearly 1.5 million convicted offender profiles considered, only 120 to 200 exceed it and thus merit further consideration. Such a stringent threshold means sometimes missing actual relatives of a perpetrator, but CDOJ has chosen a conservative route in order to (1) enhance the chance that any lead ultimately disclosed is a good one, and (2) minimize the pool of, and any privacy impacts upon, convicted offenders whose profiles are screened by the laboratory. In any event, at this point in the process even laboratory staff have no idea whose profiles these are. They are just sets of numbers with the equivalent of a bar code to tell them apart.

Once the “top tier” of candidate profiles has been determined, another round of DNA testing is performed to weed out those still-anonymous convicted offenders who do not share paternal ancestry with the unknown perpetrator. This is accomplished with “Y-STR” testing. It is the same kind of DNA testing used to generate the standard 13- or 15-marker profiles, but differs in that it only analyzes sites on the Y chromosome. The Y chromosome
is possessed exclusively by males, and is inherited intact from one's father (and paternal grandfather, etc.). Analysis of Y chromosome DNA is how, for example, researchers traced approximately 16 million living men back to common ancestor Genghis Khan. (Hillary Mayell, *Genghis Khan a Prolific Lover, DNA Data Implies*, Nat’l Geographic News, Feb. 14, 2003, available at http://tinyurl.com/637t.) Thus, if a convicted offender's Y-STR profile is different in any respect from the perpetrator's, they cannot share paternal ancestry and the offender is eliminated from consideration.

The observant reader may see two implications of the additional Y chromosome testing: First, as the process is presently configured, no female, even a full sibling sister of the perpetrator, will make it through the second round of testing because females do not have Y chromosomes. This is a calculated limitation, based on current analytical methods. Second, the program will not identify half brothers of the perpetrator with the same mother.

Moving on: If the Y-STR testing of the top tier of convicted offender profiles reveals that none share a “concordant” (lab-speak for “matching”) haplotype (lab-speak for “Y-STR profile”), the process ends. Nothing is disclosed to law enforcement except a letter saying that the familial search was conducted with negative results. No convicted offender has ever been referenced by name, even within the laboratory. In California’s experience, approximately nine times out of 10 this is the result.

Assume, though, that out of 150 convicted offenders who meet the kinship index cutoff, one turns out to have a concordant Y chromosome profile with the perpetrator. (And never in California’s experience has more than one offender shared a Y chromosome profile with the perpetrator.) Then things get interesting. A matching Y-STR profile is very good, but not definitive, evidence that two people are paternal relatives. But when considered in combination with a high ranking on the ratiometer’s kinship index— which is based on testing completely different locations on the genome—the genetic data point compellingly toward kinship. In other words, laboratory staff get very excited when there’s a Y-profile match to a convicted offender.

California does not stop there, however. In the event of a Y chromosome match, CDOJ’s familial search committee reconvenes and reviews the information developed thus far. If the committee members agree that the DNA evidence indicates kinship, additional in-house research of a different sort takes place. For the first time, the name of the convicted offender under consideration is retrieved from a separate laboratory database. It is provided to a small team of CDOJ investigators who work for the state’s Bureau of Investigation and Intelligence (BII), and have been trained specifically for this assignment. Their task is to conduct records-based research to determine whether information exists that tends to disprove the hypothesis that this convicted offender is a close relative of the perpetrator. To accomplish this, BII investigators will look at things like department of motor vehicle records, county birth records, property ownership records, and law enforcement criminal history records. They do not interview civilians, conduct surveillance, or try to collect additional DNA samples. Nobody outside CDOJ, not even the police agency investigating the original crime, is aware that this research is taking place.

Here is an example of how the in-house investigation may be influential: Suppose that the crime was committed 20 years ago in San Diego, and witnesses back then described the perpetrator as an older Caucasian man. But also imagine that the BII team discovers that the convicted offender under consideration is an African-American man in his early twenties, with no older siblings. He lives in Sacramento but was raised on the east coast, where his African-American parents still live.

This would suggest that the DNA-based evidence was the result of coincidence, not kinship. In such event, the familial search committee may vote not to disclose the offender’s name as a lead, despite the DNA data.

But now change the facts and assume that BII investigators discover that the convicted offender is a Caucasian man who, 20 years ago, would have closely resembled the composite drawing of the perpetrator.

Now, nothing disproves the kinship hypothesis. To the contrary, the pieces fit together well. In this hypothetical, CDOJ’s familial search committee would reconvene, discuss the totality of the information available, and likely vote to release the offender’s name to investigators.

When an offender’s name is released, CDOJ carefully qualifies the information being provided. It emphasizes that the offender whose name is being provided is not the perpetrator, but a reasonable probability exists that he is a close relative of the perpetrator. Where possible, CDOJ will provide relevant information about what relatives of the offender can be ruled out as the perpetrator based on age, gender, or geographic considerations. CDOJ also reminds the police agency to be particularly sensitive to privacy expectations of the convicted offender and his relatives, most of whom are involved in the investigation only in a very collateral sense, if at all. At that point, the police agency investigating the crime takes over and follows up on the lead.

The best evidence confirming that a particular relative of the convicted offender is the perpetrator usually will be a known DNA sample from the suspect relative. As with any seizure of DNA by police, obtaining a known sample must comply with the Fourth Amendment. Police may try to collect DNA from property abandoned...
by the suspect, like a soda can or cigarette butt, or may seek a search warrant authorizing seizure of a reference DNA sample, or may attempt to obtain a sample with the suspect’s consent. Other options exist as well: perhaps the suspect relative is on parole in California and owes, but has not provided, a DNA sample mandated by state law for DNA database purposes. In any event, a direct DNA profile match between the relative of the convicted offender and the previously unknown perpetrator will confirm that the familial hit was valid. Thus, if and when a person is arrested after police follow up on a familial lead, the arrest will be based on far more than “guilt by association,” as critics like to argue.

However one measures the “success rate” of a familial search program, the metric used should reward protocols that err on the side of nondisclosure, are rigid and demanding in screening database offenders, minimize privacy-related implications for convicted offenders and their family members, and promote efficient expenditure of police agency resources by incentivizing the disclosure of useful leads only. Conversely, search protocols that cast a broad net and hope for the best should be discouraged.

Does It Work?
Yes, it does. California has provided familial leads to law enforcement, and it appears that all the leads to date have either identified actual relatives of the perpetrator, or are still being pursued based upon that probability. Because of the newness of the program, none of these cases have gone to trial yet and some investigations are ongoing. Two of California’s familial search leads have been discussed in public forums, however, and can be mentioned here.

The first is the infamous “Grim Sleeper” serial killer case in Los Angeles. Between 1985 and late-1988, someone killed seven women and a man in Los Angeles, while a ninth victim was raped but survived. No useful leads materialized. Thirteen years passed (hence the “Sleeper” moniker), then the killer struck again. He committed additional murders in 2002, 2003, and 2007. A common DNA profile for the killer was developed in six of the 12 cases, with the remaining cases linked through ballistics. Although the Los Angeles Police Department uploaded the DNA profile into state and national DNA databases, it did not match any known offender. The LAPD submitted a request for familial searching, and the case became the first familial search performed by CDOJ in October 2008, with negative results.

Eighteen months later, CDOJ ran the familial search again at LAPD’s request, this time against a database that had grown in size by several hundred thousand convicted offenders since the first attempt. This time, one offender who met the kinship index cutoff also had a Y chromosome profile that matched the perpetrator. His DNA profile had been added to the database in 2009, between the two searches. Given the age of the offender, and the fact that he shared one of the perpetrator’s genetic characteristics (alleles) at each of the 15 locations used for forensic testing, it appeared that he was the killer’s son. This theory was strengthened when CDOJ’s in-house investigation discovered that the offender’s father, a man named Lonnie David Franklin, Jr., had lived in Los Angeles very close to the scene of several of the killings during the relevant time periods.

LAPD detectives turned their attention to Lonnie David Franklin. Several days after receiving the investigative lead from CDOJ, undercover officers followed him into a pizza restaurant, and recovered napkins, a fork, and a partially eaten slice of pizza that Franklin had likely left DNA on. Two days later, after expedited testing of the items at the LAPD laboratory, it was confirmed that Lonnie Franklin’s DNA profile matched that of the Grim Sleeper. He was arrested that same day, and later charged with 10 counts of murder and one count of attempted murder, with special circumstances. As recently as late October 2011, the Los Angeles Times reported that investigators had linked six more killings to Franklin. He awaits trial.

The second case solved through a California familial lead that has been discussed in the press involved the sexual assault of a young woman as she was opening a Santa Cruz coffee shop for business early one morning in 2008. The perpetrator’s DNA profile did not match anyone in the DNA database directly, but did meet all familial search criteria with respect to an offender later identified as the perpetrator’s father. Santa Cruz investigators arrested that man’s son, local resident Elvis Lorenzo Garcia, several months later. Confirmation that Garcia was the rapist came after DNA testing of Garcia’s abandoned property matched the unknown crime scene profile. According to one newspaper account, “Santa Cruz police recovered a hairnet and a Gatorade bottle from Garcia’s trash at his home in the Seabright area. DNA retrieved from those items matched DNA in the 2008 assault.” (Stephen Baxter, Defendant in Santa Cruz Harbor Rape Case to Face Trial, Santa Cruz Sentinel, Aug. 23, 2011, available at http://www.santacruzsentinel.com/cgi_18737293.) Garcia now faces trial on charges of “sodomy, digital penetration, kidnapping, burglary, robbery, sexual battery and special allegations that include the use of a knife.” (Id.)

Privacy Concerns and Responses
One need look no further than an ABA publication to find the alarming prediction that, “[f]amilial searching] would be subjecting hundreds of thousands of innocent people who happen to be relatives of individuals in the FBI database to lifelong ge-
netic surveillance.” (Molly McDonough, *Familial DNA Searches Are Creating Genetic Informants*, ABA J., Apr. 21, 2008, available at http://tinyurl.com/7la7dph.) The same article quotes a law professor’s opinion that “[t]he idea of holding people responsible for who they are rather than what they’ve done could challenge deep American principles of privacy and equality.” Even Professor Murphy in her counterpoint article asks, “[W]hy should the non-database eligible relatives of convicted offenders be accessible [to police as suspects based on genetic information], while everyone else retains the right to keep their genetic code private?” Fortunately, an understanding of how familial searching really works dispels the erroneous assumptions that are hidden in such rhetoric.

“Genetic surveillance” is a catchy phrase, but misleading. The family members of offenders in DNA databases are not “under genetic surveillance,” because they are not in any database. The government does not possess their “genetic code.” And as long as we’re being scrupulous with language, law enforcement does not even possess the “genetic code” of offenders whose profiles are in DNA databases by law; as noted above, only a tiny fraction of the genome is typed for identification purposes, is akin to loops and swirls on a fingerprint, and does not code for biological traits.

In fact, before a familial search is initiated in California, authorities have no idea whether a perpetrator has family members, whether any person in the database has family members, or whether any person in the database is related to the perpetrator. Nor would any other family member(s) of the database offender be added to a DNA database as a result of a familial search, with the entirely appropriate exception of the actual perpetrator if and when probable cause is developed to arrest and charge him with the crime(s). And arresting suspects upon probable cause is a far cry from holding them “responsible for who they are.” Moreover, if an offender’s name is released to law enforcement following a familial search in California, the primary qualification provided is that this person is innocent of the crime. It is difficult to imagine a convicted offender already and lawfully in a DNA database objecting to a police agency being told that he has been eliminated as a suspect in a serious investigation.

Following disclosure of a familial lead, police will have to determine whether the offender’s father, a son, or a brother is a suspect. This determination will likely be obvious based on passive computer research about the age, appearance, and whereabouts of the family members in question at the time of the crime; no actual surveillance necessary. It is certainly possible, however, that strong suspicion of a particular family member based on available records is misplaced because that person is not a true biological relative. Thus, there is no guarantee that law enforcement will not, for example, collect and test a DNA sample abandoned by a person who turns out not to be the perpetrator. Of course, considering but then eliminating a person as a suspect—through DNA testing or otherwise—is routine police work, and is inevitably welcome news to the former suspect.

Even if a follow-up investigation requires contact with family members in order to identify the suspect, the police are constrained by the Fourth Amendment as well as state constitutional privacy protections that, at least in California, are broader than their federal counterparts. (See Cal. Const., art. I, § 1; Am. Acad. of Pediatrics v. Lungren, 16 Cal. 4th 307, 326 (1997).) Investigators are well advised to use the least intrusive practical means of identifying the suspect, while bearing in mind that a family’s privacy interests do not exist in a vacuum. The interests of victims, their families, and society at large provide important context. It bears noting in addition that considering familial relationships by police is not uncommon in non-DNA investigations of, for example, domestic violence, child abuse, and child sexual assault cases. Yet generally one does not hear of witnesses in those cases complaining that they are under police “surveillance” because a family member is suspected of committing a crime.

**Conclusion**

Familial searching in California is certainly not a “solve a case at any cost” approach to law enforcement. Rather, it is a carefully calibrated method of using convicted offender DNA samples already lawfully present in the state database to generate, where possible, a strong investigative lead in selected serious but unsolved criminal investigations. Not only does it work, but even the ACLU, an institution often sharply critical of familial searching in theory, has endorsed California’s methodology: “From [the ACLU] perspective, if you are going to use familial DNA searching, [the Grim Sleeper] is the kind of case you should use it for, and the kind of precautions they took in this case are the kind that should be taken.” (Maura Dolan, *In Grim Sleeper Case, a New Tack in DNA Searching*, L.A. Times, July 10, 2010 (quoting Peter Bibring, staff attorney for the ACLU of Southern California.) High praise indeed, given its source.

Finally, and lest concerns persist, all should take heart in ongoing discussions of familial searching in forums such as this. The spotlight of public debate cannot help but to promote government transparency and accountability, which in the end benefits us all.