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Fortuity and Forensic Familial Identification

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ARTICLES

FORTUITY AND FORENSIC FAMILIAL IDENTIFICATION

Natalie Ram*

On July 7, 2010, Los Angeles police announced the arrest of a suspect in the Grim Sleeper murders, so called because of a decade-long hiatus in killings. The break in the case came when California searched its state DNA database for a genetic profile similar, but not identical, to the killer's. DNA is inherited in specific and predictable ways, so a partial match might indicate that a close genetic relative of the matching offender was the Grim Sleeper. California's apparent success in the Grim Sleeper case has intensified interest in policymaking for partial matching. To date, however, little information about existing state policies—and the wisdom of those policies—has been available. This Article fills two significant gaps in the literature about partial matching. First, it reports the results of a survey of state policies governing partial matching—the most complete survey of its kind. Second, it dismantles a distinction drawn by more than a dozen states between partial matches that arise fortuitously during the course of routine data-

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As this Article was going to press, three states underwent significant changes in policy. Virginia completed its draft policy and validated software for deliberate partial matching. That state now conducts deliberate searches for partial matches. See Press Release, Office of the Governor, Governor McDonnell Announces Virginia Department of Forensic Science to Begin Using Familial DNA Searches in Virginia (Mar. 21, 2011), available at <http://www.governor.virginia.gov/news/viewRelease.cfm?id=648>. In Minnesota and Pennsylvania, draft legislation was introduced that would permit deliberate partial matching. See H.F. 981, 2011 Leg., 87th Sess. (Minn. 2011); S.B. 775, 2011 Gen. Assemb., Reg. Sess. (Pa. 2011). These new data are not reflected in the analysis below. They do not change its reasoning or conclusion.

base searches and partial matches that are deliberately sought, exposing this distinction as harmful and illogical. In examining this feature of state policies, this Article is more immediately relevant to determining how states ought to address the ever-expanding scope of uses to which DNA databases may be put.

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INTRODUCTION

On July 7, 2010, Los Angeles police announced that they had cracked a series of murders spanning decades,¹ arresting a suspect in the Grim Sleeper murders—so called because of an apparent hiatus in killings lasting a dozen years.² Although the serial killer had left DNA behind at several crime scenes, that DNA was not identical to any of several million DNA profiles of past offenders in the National DNA Index System.³ The break in the case came when California searched its state DNA database for a genetic profile similar—but not identical—to the killer’s.⁴ Because DNA is inherited in specific and predictable ways, a partial match might indicate that a close genetic relative of the matching offender was the Grim Sleeper.

Partial matches may be uncovered in two ways: fortuitously or deliberately. Fortuitous partial matches are those discovered during routine database searches intended to identify exact matches. Deliberate partial matches are those uncovered through an intentional search of a DNA database for such matches. The intentional search for matches indicating possible familial involvement is frequently termed “familial searching.” This Article adopts the terminology of “deliberate partial matching,” however, to emphasize that the information uncovered by both fortuitous and deliberate means is functionally similar. Both draw investigative attention to offenders’ kin who would not, absent their relation to a databased offender, be subject to genetic identification.

California first embraced partial matching in April 2008, when its Attorney General issued a well-publicized memorandum permitting the state lab not only to inform law enforcement investigators about partial matches fortuitously uncovered during routine database searches, but also to search deliberately for such matches.⁵ The state developed special software for better identifying true

1. Mitchell Landsberg, *DNA Leads to Arrest in Serial Case*, L.A. TIMES, at A1.

2. See Natasha Singer, *In Fighting Crime, How Wide Should a Genetic Net Reach?*, N.Y. TIMES, July 25, 2010, at BU3.

3. See Jack Leonard, *DNA Check Missed in Sleeper Case*, L.A. TIMES, July 15, 2010, at A1.

4. See Maura Dolan, *A New Tack in DNA Search*, L.A. TIMES, July 10, 2010, at A1.

5. See Memorandum from Edmund G. Brown Jr., Att’y Gen., to All Cal. Law Enforcement Agencies and Dist. Att’y’s Offices, DNA Partial Match (Crime Scene DNA Profile to Offender) Policy (2008) [hereinafter California Partial Match Policy], available at http://ag.ca.gov/cms_attachments/press/pdfs/n1548_08-bfs-01.pdf. This Article uses the word “investigator” to describe the law enforcement personnel who follow up on (investigate) DNA leads provided by lab analysts, without regard to whether such leads result from fortuitous or deliberate partial matches. Laboratory personnel responsible for preparing DNA profiles for inclusion in the Combined DNA Index System (CODIS) and reviewing CODIS results are described, where relevant, as “analysts.”

familial relationships,⁶ and set its sights on the Grim Sleeper as its first major target.⁷ But initial efforts to identify a possible relative were unsuccessful.⁸

In April 2010, a new round of database searches produced several hundred partial matches—potential relatives, but likely more false leads.⁹ To weed out these false starts, the state lab analyzed the Y chromosome of two hundred of the partial match results, comparing that data with the Y chromosome profile of the Grim Sleeper.¹⁰ Because sons inherit their Y chromosomes from their fathers in full, fathers, sons, and patrilineal brothers all share the same profile. Of the two hundred potential relatives, one matched perfectly.¹¹ The police tailed the databased offender's father, Lonnie David Franklin, Jr. When Franklin threw out a slice of pizza, investigators nabbed it for testing.¹² Human DNA left on the pizza matched the Grim Sleeper DNA left at crime scenes.¹³ To great fanfare, L.A. police arrested Franklin as the Grim Sleeper.¹⁴

The Grim Sleeper case highlights multiple controversies about the collection and use of DNA to crack cases.¹⁵ First, California used a partial DNA match in its database to target a non-databased relative for investigation. Second, the state police obtained Franklin's DNA surreptitiously by collecting it from a discarded slice of pizza—no warrant required. Both of these issues pose thorny questions about what sort of privacy interest, if any, individuals can expect to have in their genetic information. Courts have routinely found

6. See Jill Spriggs, *Familial Search Procedure*, in CAL-DNA DATA BANK TECHNICAL PROCEDURES MANUAL 27, 29 (2008) [hereinafter *California Familial Search Procedure*], available at http://www.aclunc.org/news/press_releases/asset_upload_file504_8577.pdf (describing the “Ratiometer,” which generates “kinship indices,” and the “Ratiometer Output Analyzer,” which ranks offender profiles identified by the Ratiometer); Eva Steinberger & Gary Sims, *Finding Criminals Through the DNA of Their Relatives—Familial Searching of the California Offender DNA Database*, 31 PROSECUTOR'S BRIEF 28, 31 (2008) (describing “The Ratiometer,” which examines allele frequency in the general population and the frequency of a given Y chromosome haplotype).

7. See Jeffrey Rosen, *Genetic Surveillance for All*, SLATE (Mar. 17, 2009), <http://www.slate.com/id/2213958>.

8. See *id.*

9. See Dolan, *supra* note 4.

10. *Id.*

11. *Id.*

12. Maura Dolan et al., *Pizza Slice Helped Link Suspects to Grim Sleeper Serial Killings*, *Sources Say*, L.A. NOW (July 7, 2010), <http://latimesblogs.latimes.com/lanow/2010/07/pizza-slice-helped-link-suspect-to-grim-sleeper-serial-killings.html>.

13. *Id.*

14. See *id.*

15. Elizabeth Joh identifies “three different uses of DNA evidence in the Grim Sleeper investigation that we should be concerned about.” Elizabeth Joh, *A ‘Familial’ Net: We Mustn’t Ignore the Perils of Genetic Data Mining*, L.A. TIMES, July 10, 2010, at A27. In addition to the two discussed below, Joh identifies a third source of controversy: “Two years ago, LAPD vice officers arrested a number of suspected johns not as part of a crackdown on prostitution but rather for the purpose of collecting their DNA. (Many of the Grim Sleeper’s victims were prostitutes.) Such a technique is known as a DNA dragnet.” *Id.*

that people have an expectation of privacy in their DNA.¹⁶ But we shed DNA constantly, and as the Grim Sleeper case demonstrates, our relatives' DNA can be used to identify us.

This Article advances the conversation about partial matching—and about the use of DNA in criminal investigations more broadly—both by identifying the range and scope of state policies governing partial matches and by exposing the distinction that several states have drawn between fortuitous and deliberate partial matching as empty and dangerous. News reports about the Grim Sleeper explained that only California and Colorado have embraced deliberate searches for partial matches.¹⁷ To be sure, in October 2009, Colorado announced that it would permit disclosure to investigators of both fortuitously and deliberately uncovered partial matches, and that it was employing specialized software to enable better familial identification.¹⁸ But such reports do not come close to providing an accurate account of how states make use of partial matches in forensic investigation. In addition to California and Colorado, at least two other states presently permit both fortuitous and deliberate partial matching.¹⁹ Only two jurisdictions, Maryland and the District of Columbia, have enacted statutes prohibiting deliberate partial match searches.²⁰ At least fourteen states, meanwhile, have permitted the investigative use of a fortuitously discovered partial DNA match, while simultaneously precluding, often explicitly, the deliberate search for such matches.²¹

This Article analyzes the distinction that these states have drawn between fortuitously and deliberately discovered partial matches, arguing that it imposes significant structural and transparency costs and yet is supported by neither log-

16. See, e.g., *Friedman v. Boucher*, 568 F.3d 1119, 1130 (9th Cir. 2009) (“The warrantless, suspicionless, forcible extraction of a DNA sample from a private citizen violates the Fourth Amendment.”); see also *infra* notes 191-92 and accompanying text.

17. See, e.g., Jessica Cerretani, *Whodunit? Family Members' DNA May Lead Investigators to the Answers, but Using It as a Forensic Technique Brings Up Some Troubling Questions*, BOS. GLOBE, Oct. 31, 2010, (Magazine), at 20; Singer, *supra* note 2 (contrasting “[e]arly-adopter states like California and Colorado” with “wait-and-see states”).

18. See Colo. Bureau of Investigation, DNA Familial Search Policy (Oct. 22, 2009) [hereinafter Colorado Familial Search Policy], available at http://www.denverda.org/DNA_Documents/Familial_DNA/CBI%20DNA%20Familial%20Search%20Policy%20Oct%202009%20-%20Signed.pdf.

19. See *infra* Part II.B.1.b.

20. See D.C. CODE § 22-4151(b) (2010) (“DNA collected by an agency of the District of Columbia shall not be searched for the purpose of identifying a family member related to the individual from whom the DNA sample was acquired.”); MD. CODE ANN., PUB. SAFETY § 2-506(d) (LexisNexis 2010) (prohibiting “search[es] of the statewide DNA data base for the purpose of identification of an offender in connection with a crime for which the offender may be a biological relative of the individual from whom the DNA sample was acquired”). Maryland’s statute is set to expire in 2013 unless the state legislature acts to maintain it. See Act of May 13, 2008, ch. 337, 2008 Md. Laws 3221.

21. See *infra* Part II.B.1.a.

ic nor principle. States should either permit both forms of partial match investigation, as California and Colorado have done, or permit neither.

This Article makes two distinct contributions to the growing literature on partial matching in forensic investigation. First, after Part I provides a primer on the science and history of forensic genetic identification, Part II sets forth a survey of state policies regarding partial matches. Reliable data about the range and scope of state policies governing partial matching have been hard to come by. This survey is the most complete dataset available on this issue.

Second, in Part III, this Article dismantles the distinction between fortuitous and deliberate partial matches and contends that states and the federal government cannot justifiably distinguish between them. The existing literature has thus far examined almost exclusively the more general question of whether the use of partial matches ought to be permissible at all.²² None of this literature, however, has focused on actual state policies or on the wisdom of the distinction that so many states have drawn between fortuitous and deliberate matches. This Article does both, and so it is more immediately relevant to determining how states ought to address the ever-expanding scope of uses to which DNA databases may be put.

22. See Frederick R. Bieber, *Turning Base Hits into Earned Runs: Improving the Effectiveness of Forensic DNA Data Bank Programs*, 34 J.L. MED. & ETHICS 222, 225-26 (2006); Jules Epstein, "Genetic Surveillance"—*The Bogeyman Response to Familial DNA Investigation*, 2009 J.L. TECH. & POL'Y 141; Jessica D. Gabel, *Probable Cause from Probable Bonds: A Genetic Tattle Tale Based on Familial DNA*, 21 HASTINGS WOMEN'S L.J. 3 (2010); Henry T. Greely et al., *Family Ties: The Use of DNA Offender Databases to Catch Offenders' Kin*, 34 J.L. MED. & ETHICS 248 (2006); Erica Haimes, *Social and Ethical Issues in the Use of Familial Searching in Forensic Investigations: Insights from Family and Kinship Studies*, 34 J.L. MED. & ETHICS 263 (2006); Erin Murphy, *Relative Doubt: Familial Searches of DNA Databases*, 109 MICH. L. REV. 291 (2010); Stephen S. Owen & Tod W. Burke, *DNA Databases and Familial Searching*, 43 CRIM. L. BULL. 617 (2007); Robin Williams & Paul Johnson, *Inclusiveness, Effectiveness and Intrusiveness: Issues in the Developing Uses of DNA Profiling in Support of Criminal Investigations*, 34 J.L. MED. & ETHICS 234 (2006); Duncan Carling, Note, *Less Privacy Please, We're British: Investigating Crime with DNA in the U.K. and the U.S.*, 31 HASTINGS INT'L & COMP. L. REV. 487 (2008); Daniel J. Grimm, Note, *The Demographics of Genetic Surveillance: Familial DNA Testing and the Hispanic Community*, 107 COLUM. L. REV. 1164 (2007); Lina Alexandra Hogan, Note, *Fourth Amendment—Guilt by Relation: If Your Brother Is Convicted of a Crime, You Too May Do Time*, 30 W. NEW ENG. L. REV. 543 (2008); Kimberly A. Wah, Note, *A New Investigative Lead: Familial Searching as an Effective Crime-Fighting Tool*, 29 WHITTIER L. REV. 909 (2008). Of these, only a few have even noted the disjunction between fortuitous and deliberate partial matches in American state policies. See, e.g., Bieber, *supra*, at 226 (noting that proactive familial searches have not been widely embraced in the United States); Murphy, *supra*, at 341 (positing that "the distinction between intentional and inadvertent partial match searches should be considered largely artificial").

I. A PRIMER ON DNA FORENSICS

A basic understanding of the science and history of DNA matching is necessary for an informed exploration and critique of state policies governing partial matching. Subpart A describes the science of genetic identification. Subpart B then provides a brief overview of its history in the United States. Finally, Subpart C describes two methods by which partial matches may be uncovered during a database search—fortuitously or deliberately. Readers already familiar with these topics may wish to proceed directly to Part II.

A. *Some Scientific Background*

The average adult human body has between fifty trillion and one hundred trillion cells.²³ Nearly all of these cells have a nucleus that contains DNA, the genetic material that tells the cells how to reproduce, differentiate into different cell types, and grow. Each DNA sequence is comprised of a series of just four different bases: adenine (A), cytosine (C), guanine (G), or thymine (T).²⁴ In the ladder-like structure of DNA's double helix, each "rung" is a pair of bases matched in set patterns: As with Ts; Gs with Cs.²⁵ The sequence of these bases differs between individuals, encoding the information that makes each person, except identical twins, genetically different.

In humans, DNA is organized into twenty-three pairs of chromosomes. In each generation, different portions of the DNA sequence in the chromosomes from each parent are passed on to each child.²⁶ As a result, each child is unique, though she shares some parts of her sequence with her parents and also with her siblings, who likewise inherited parental DNA—but in a different mix. The total DNA sequence is what we mean when we refer to an individual's "genome." A human genome contains roughly 3.2 billion base pairs of DNA.²⁷

Current research indicates that, although the genetic makeup of even unrelated individuals differs only by hundredths of a percent,²⁸ this still represents a very large number of base differences between each person. In fact, stretches of DNA, called "microsatellites," contain a large amount of this variability and

23. Greely et al., *supra* note 22, at 249.

24. *Id.*

25. *Id.*

26. WILLIAM GOODWIN, ADRIAN LINACRE & SIBTE HADI, AN INTRODUCTION TO FORENSIC GENETICS 7 (2007). Twenty-two of these sets are inherited identically by both sexes. In the last, the sex chromosomes, males inherit XY chromosomes, while females inherit XX. Murphy, *supra* note 22, at 294 n.13. Thus, the Y chromosome appears only in males.

27. Greely et al., *supra* note 22, at 249.

28. See Genomic Science Program, *SNP Fact Sheet*, GENOMICS.ENERGY.GOV, http://www.ornl.gov/sci/techresources/Human_Genome/faq/snps.shtml (last visited Dec. 20, 2009) ("[M]ore than 99% of human DNA sequences are the same . . .").

can be used to distinguish one individual from another.²⁹ At microsatellites, the genetic sequence often contains variable numbers of repeats of short sequences of base pairs.³⁰ Variations in the lengths of these short tandem repeats (STRs) are what analysts currently use to examine an individual's genetic profile at a given genomic location (or "locus"; plural "loci").³¹

In the United States, the most common form of forensic DNA typing examines thirteen STR loci in the genome.³² These loci are spread across the twenty-two nonsex chromosomes inherited equally in males and females.³³ Each locus reveals two variants of repeat lengths, or alleles, one inherited from each genetic parent. These thirteen loci thus yield a total of twenty-six data points.³⁴ In addition, analysts may also look at STRs on the Y chromosome (Y-STRs). The Y chromosome appears only in males, however, and is inherited from father to son in full. As a result, a Y-STR profile is not specific to an individual, although it may identify a particular family or male line.

An individual inherits fifty percent of her genetic material from each parent and is expected to have roughly fifty percent of her genes in common with any full sibling.³⁵ As a result, there is a significant probability that such close genetic relatives will also share a significant number of STR alleles. Children will share, at minimum, thirteen alleles with each parent.³⁶ According to one estimate, siblings on average share 16.7 alleles.³⁷ By contrast, two unrelated, ran-

29. JOHN M. BUTLER, *FORENSIC DNA TYPING: BIOLOGY, TECHNOLOGY, AND GENETICS OF STR MARKERS* 85-86 (2d ed. 2005).

30. Greely et al., *supra* note 22, at 249.

31. *Id.* at 249-50. For a more complete discussion of DNA typing, see generally Erin Murphy, *The Art in the Science of DNA: A Layperson's Guide to the Subjectivity Inherent in Forensic DNA Typing*, 58 EMORY L.J. 489 (2008).

32. Murphy, *supra* note 22, at 295.

33. *Id.*

34. *Id.*

35. BRUCE R. KORF, *HUMAN GENETICS AND GENOMICS* 36 (3d ed. 2007) (defining Mendelian patterns of genetic inheritance). Identical twins, of course, are expected to have identical or nearly identical genetic sequences. See DANIEL L. HARTL & ELIZABETH W. JONES, *ESSENTIAL GENETICS: A GENOMICS PERSPECTIVE* 544 (4th ed. 2006) (noting that identical twins are genetically identical because they arise from the splitting of a single fertilized egg).

36. Murphy, *supra* note 22, at 295; see also Michael R. Seringhaus, *The Problem Child: Forensic DNA Databases, Familial Search, and a Call for Reform* 14 n.35 (May 2010) (unpublished manuscript), available at http://digitalcommons.law.yale.edu/ylsspps_papers/50 ("Barring mutation, normal parent-child pairs must share at least 13/26 alleles, in a distinctive pattern (at least one shared allele per locus); on average, they will share 15.7 alleles.").

37. Greely et al., *supra* note 22, at 253; Seringhaus, *supra* note 36, at 14 n.35 ("Siblings can theoretically share anywhere from 0-26 alleles, but on average will share 16.7. 13 of these come from a 50% chance of each sib inheriting the same allele from a parent; additional alleles come from 1) parents possibly having 2 copies of an allele (i.e. being homozygous at that locus), or 2) parents sharing an allele. For an average pair of Caucasian siblings at 13

domly selected individuals will have substantially fewer alleles in common—on average, 8.59.³⁸

The usefulness of shared alleles in determining relatedness is a function of more than simply the number of shared alleles. Rather, close genetic relatives have similar genetic “motifs,”³⁹ and so patterns of similarity among the alleles are significant. The commonness of the particular allele in the population at large is also instructive. Where two DNA samples share alleles that appear infrequently, it is a stronger indication of relatedness than allele sharing alone.⁴⁰

Importantly, the STRs that American forensics labs typically examine are located in noncoding portions of the genome—DNA that does not encode for proteins and has no as-yet-discernable function.⁴¹ Some states explicitly prohibit analysis that could predict genetic disease or predisposition to illness,⁴² and so the distinction between coding and noncoding regions of the genome would appear significant. Yet, new research suggests that noncoding DNA is not merely “junk.” Consider, for instance, a study examining just one percent of the human genome.⁴³ Although only two percent of a genome consists of protein-coding DNA, eighty percent of the bases studied “showed signs of being expressed.”⁴⁴ And while biologists have often assumed that genes are compact, the new research indicates that “genes can be sprawling, with far-flung protein-coding and regulatory regions that overlap with other genes.”⁴⁵ These findings “suggest that a multidimensional network regulates gene expression.”⁴⁶ They also suggest that the distinction between genes and noncoding DNA is more complex than previously believed. Policymakers may need to exercise more

STR loci, there is 1 locus with no shared alleles, 7 loci with one shared allele, and 5 loci with both alleles shared.”)

38. See David R. Paoletti et al., *Empirical Analysis of the STR Profiles Resulting from Conceptual Mixtures*, 50 J. FORENSIC SCI. 1, 3 (2005) (reporting hypothetical shared allele counts among the 13 CODIS loci as 8.59 between random individuals, 10.95 between cousins, and 16.94 between siblings).

39. Thomas M. Reid et al., *Use of Sibling Pairs to Determine the Familial Searching Efficiency of Forensic Databases*, 2 FORENSIC SCI. INT’L: GENETICS 340, 340 (2008).

40. See Greely et al., *supra* note 22, at 253.

41. See BUTLER, *supra* note 29, at 22.

42. See, e.g., R.I. GEN. LAWS § 12-1.5-10(5) (2010) (forbidding use of DNA samples for purposes of obtaining information about “physical characteristics, traits or dispositions for disease”); UTAH CODE ANN. § 53-10-406(1) (LexisNexis 2010) (requiring bureau to “ensure that the DNA identification system does not provide information allowing prediction of genetic disease or predisposition to illness”).

43. See Elizabeth Pennisi, *DNA Study Forces Rethink of What It Means to Be a Gene*, 316 SCIENCE 1556, 1556 (2007). Note that although we frequently refer to “the human genome,” no such singular thing exists because individual humans, apart from identical twins, differ at the genetic level at least in part.

44. *Id.* Bases are “expressed” when they are, in effect, active for purposes of transcription to RNA and translation into proteins.

45. *Id.*

46. *Id.* at 1557.

caution in claiming that the DNA examined for forensic investigation has no other meaning.

Finally, in addition to nuclear DNA, cells also contain small amounts of genetic material in organelles outside the nucleus called mitochondria.⁴⁷ In humans, mitochondria are exclusively inherited from the mother. Therefore, individuals descended from the same mother will share the same mitochondrial DNA sequence.⁴⁸ Mitochondrial DNA (mtDNA) is identifying to families, not to specific individuals. It is nonetheless useful because many copies of it exist in any given cell. While “nuclear DNA contains much more information, there are only two copies of it in each cell (one maternal and one paternal),” and each of these copies is independently significant for identification purposes.⁴⁹ Mitochondrial DNA, by contrast, contains only a bit of useful information, but that information appears in hundreds of copies per cell. Although mtDNA can therefore often be recovered for analysis even when nuclear DNA has degraded,⁵⁰ its analysis produces less specific results, and so mtDNA testing is not routine.⁵¹

B. *Brief History*

In 1989, Virginia established the first forensic DNA database in the United States.⁵² In 1994, Congress followed suit. The DNA Identification Act authorized the Federal Bureau of Investigation (FBI) to establish and maintain a national DNA database and instructed the Bureau to develop software to allow for rapid comparison of DNA profiles and sharing of information within and between jurisdictions.⁵³ Pursuant to that legislation, the FBI pioneered the Combined DNA Index System (CODIS)—a central database into which participating states and agencies can “load” the genetic profiles they lawfully acquire and search among the profiles made available by other jurisdictions.⁵⁴ Today, all

47. See BUTLER, *supra* note 29, at 241.

48. See *id.* at 248-49. A new study indicates that mtDNA may actually be far less homogeneous than previously believed, and that the frequency of some genetic variants differs considerably between different tissue in the same individual. See Yiping He et al., *Heteroplasmic Mitochondrial DNA Mutations in Normal and Tumour Cells*, 464 NATURE 610 (2010).

49. BUTLER, *supra* note 29, at 241.

50. See *id.*

51. See Murphy, *supra* note 31, at 494.

52. Courtney Lerch, Tod W. Burke & Stephen S. Owen, *Familial DNA: It's All in the Family*, POLICE & SECURITY NEWS, Sept.-Oct. 2008, at 56, 57.

53. See DNA Identification Act of 1994, Pub. L. No. 103-322, § 210304, 108 Stat. 2065, 2069 (codified as amended at 42 U.S.C. § 14132 (2006)).

54. See Murphy, *supra* note 22, at 296. Technically, CODIS is the name for the software that the FBI maintains and participating agencies use to search the available databases, but the name has come to refer more broadly to the national database itself.

fifty states, the District of Columbia, and the federal government collect, store, and share genetic information through CODIS.⁵⁵

The national database organizes genetic profiles in a number of indices.⁵⁶ For present purposes, the most relevant indices are the database storing profiles of forensic samples collected at crime scenes (so-called forensic profiles) and the database containing profiles of known persons (so-called offender profiles). The profiles uploaded to CODIS report only the numbers describing the alleles present in an individual DNA sample and sufficient identifying information to trace the sample back to the uploading agency. Personal information, such as the name and address of the individual from whom the DNA sample was taken, is retained by the uploading agency and may only be disclosed to particular persons for approved reasons.⁵⁷

CODIS also operates within three jurisdictional tiers: local (LDIS), state (SDIS), and national (NDIS). Federal statutes and regulations set minimum standards for the information that may be uploaded to NDIS and establish minimum quality control requirements that participating laboratories must meet.⁵⁸ The tiered approach, meanwhile, permits state and local agencies to operate their respective DNA databases under less stringent standards, according to applicable state law and local policy. Under recent amendments, states may now upload to NDIS any profile collected in a manner consistent with their own laws.⁵⁹

Nonetheless, until 2006, the FBI did not permit states to share offenders' identifying information unless a match indicated a specific offender as the "putative perpetrator."⁶⁰ States could only obtain identifying information for partial matches located in their own state or local databases.⁶¹ Pursuant to an

55. *See id.* at 295-96.

56. *See* 42 U.S.C. § 14132(a) (authorizing the Director of the FBI to "establish an index of . . . DNA identification records of . . . persons convicted of crimes," as well as indices of "analyses of DNA samples recovered from crime scenes," "recovered from unidentified human remains," and "voluntarily contributed from relatives of missing persons").

57. *See* Murphy, *supra* note 22, at 296-97 ("If a search conducted in the national database reveals a match, then the FBI facilitates the disclosure of information between the jurisdictions according to FBI policy. In contrast, a search within a jurisdiction or locality that turns up a match can be dealt with according to that jurisdiction's own rules.").

58. For example, NDIS rules set forth the thirteen "core loci" that constitute the CODIS standard profile. *See* FBI LAB., NATIONAL DNA INDEX SYSTEM (NDIS) DNA DATA ACCEPTANCE STANDARDS: OPERATIONAL PROCEDURES 3 (rev. 2005).

59. *See* 42 U.S.C. § 14132(a)(1) (amending the scope of genetic profiles that may be indexed by the FBI to include profiles of "persons who have been charged in an indictment or information with a crime" and "other persons whose DNA samples are collected under applicable legal authorities").

60. Murphy, *supra* note 22, at 292.

61. *See id.*

interim policy issued in July 2006, states may now also share partial match information under certain circumstances.⁶²

In the years since its inception, CODIS has grown rapidly. Initially, many states limited the collection and retention of DNA to sex offenders.⁶³ Today, however, nearly all states, as well as the federal government, mandate DNA sampling from all convicted felons.⁶⁴ Many have gone further still. To date, at least sixteen states require the collection and retention of genetic information from some misdemeanants,⁶⁵ and at least twenty-one states, as well as the federal government, compel samples from arrestees who have yet to be convicted.⁶⁶ The FBI reports that, as of December 2010, “[t]he National DNA Index (NDIS) contains over 9,233,554 offender profiles and 351,951 forensic profiles.”⁶⁷

In addition to these well-documented trends in database expansion, local jurisdictions also often maintain DNA databases not limited to “offender” samples. Some of these “rogue” databases include DNA profiles of victims, excluded suspects, or lab workers.⁶⁸ These profiles are generally not includable in the state or national DNA database, but it is unclear how this information may be used by local law enforcement. In at least one instance, investigators working with lab analysts used a victim’s genetic profile to identify her brother as the perpetrator of a string of other crimes.⁶⁹

Law enforcement personnel use CODIS to uncover a variety of informative genetic links. DNA collected at crime scenes can be compared with the DNA profiles of known individuals stored in the “offender database.” When a search returns a match, this may be probative evidence that the matching offender committed the crime. As new offender profiles enter the database, a hit may re-

62. See Maura Dolan & Jason Felch, *Tracing a Suspect Through a Relative*, L.A. TIMES, Nov. 25, 2008, at A1. See generally COMBINED DNA INDEX SYS., BULLETIN NO. BT072006, INTERIM PLAN FOR THE RELEASE OF INFORMATION IN THE EVENT OF A “PARTIAL MATCH” AT NDIS (2006).

63. See Tania Simoncelli, *Dangerous Excursions: The Case Against Expanding Forensic DNA Databases to Innocent Persons*, 34 J.L. MED. & ETHICS 390, 390 (2006).

64. See *State Laws on DNA Data Banks*, NAT’L CONF. ST. LEGISLATURES (Feb. 25, 2010), <http://www.ncsl.org/default.aspx?tabid=12737> (identifying forty-seven states requiring that all convicted felons provide a DNA sample for database retention).

65. See *id.* (Arkansas, Delaware, Illinois, Iowa, Maine, Maryland, Minnesota, Nevada, New Jersey, New York, Ohio, South Carolina, Texas, Utah, Vermont, and Wisconsin).

66. See *id.* (Alabama, Alaska, Arizona, Arkansas, California, Colorado, Florida, Kansas, Louisiana, Maryland, Michigan, Minnesota, Missouri, New Mexico, North Dakota, South Carolina, South Dakota, Tennessee, Texas, Vermont, and Virginia); see also 28 C.F.R. § 28.12(b) (2010) (requiring DNA sampling from federal arrestees and “non-United States persons who are detained under the authority of the United States”).

67. CODIS—NDIS Statistics, FED. BUREAU INVESTIGATION, <http://www.fbi.gov/about-us/lab/codis/ndis-statistics> (last visited Jan. 24, 2011).

68. See Ellen Nakashima, *From DNA of Family, a Tool to Make Arrests*, WASH. POST, Apr. 21, 2008, at A1.

69. See *id.*

sult for an old, as yet unsolved case (a “cold hit”). Alternatively, DNA from a recent crime scene may indicate that a previously convicted (or arrested) individual has committed a new infraction. Separately, DNA from multiple crime scenes can be compared to uncover strings of crimes presumably committed by the same person. According to the FBI, CODIS hits have “added value” to more than 100,000 investigations to date.⁷⁰

In searching CODIS, an investigator must determine not only what database(s) to search, but also how strictly to constrain the match parameters. The CODIS software enables searches at three levels of specificity: high, moderate, and low stringency.⁷¹

A high-stringency search requires identity both in number and kind of all twenty-six of the alleles in the two samples. A moderate-stringency search returns matches in which the profile has all twenty-six alleles of the submission, but the submission contains additional material as well. Such a search could be useful in the case of mixtures, when investigators wish to pull up all profiles that contain all of the submitted sample’s alleles, while also allowing the submission to have extra alleles likely belonging to another person. A low-stringency search returns matches in which at least one allele is present, even though the profile has additional alleles that the sample does not, or vice versa.⁷²

Investigators typically employ high- or moderate-stringency searches, with the goal of identifying an exact match indicating the probable perpetrator of a crime. But as stringency is relaxed from high to moderate to low, a search may return close but imperfect—partial—matches.

C. *Methods of Partial Matching*

In some respects, partial matches resemble the exact matches that have become a mainstay in American forensic investigation. Both partial and exact matches seek to identify connections between crime scene DNA evidence and known offender profiles. Both compare the same kinds of DNA and CODIS databases—no additional DNA need be collected for investigators to identify potential familial involvement in a crime.

However, these two kinds of matches are also distinct. When an exact match is uncovered, this may be probative evidence that the matching offender was involved in the crime under investigation. The offender whose profile provided the match is thus the target of investigation. The target of a partial match is different. A “partial” match in this context refers to two genetic profiles—one derived from a crime scene sample and the other from CODIS—that share some, but not all, of the thirteen core DNA loci that comprise a CODIS profile. This kind of match generally excludes the offender whose CODIS profile pro-

70. See *CODIS—NDIS Statistics*, *supra* note 67.

71. Steinberger & Sims, *supra* note 6, at 30.

72. Murphy, *supra* note 22, at 297 (footnotes omitted).

vides the match, because that individual's DNA is demonstrably different from the crime scene sample. A partial match may instead inculpate the offender's close genetic relatives as possible perpetrators of a crime because they, like the crime scene sample, share some but not all of the examined loci with the individual whose CODIS profile provided the partial match. The information derived from a partial match where two nonmatching profiles share rare genetic markers will be particularly suggestive of a relative's involvement in a crime.⁷³ The target of a partial match is thus fundamentally different from that of an exact match: the partial match targets an offender's close genetic relatives, while an exact match targets the offender himself.

Partial matches may be uncovered either fortuitously or deliberately. While fortuitous partial matches appear in routine database searches, deliberate partial matches are the product of an intentional database search for such matches. Fortuitous partial matches may turn up as the result of lower-stringency search parameters.

To conduct deliberate searches for partial matches, California and Colorado have each pioneered new software utilities for better analyzing the likelihood of relatedness between partially matching DNA profiles.⁷⁴ These new software programs mark a leap forward in familial identification procedures, as the current iteration of CODIS software is poorly designed for identifying true leads where partial matches are uncovered.⁷⁵ The CODIS software was not designed to identify familial relationships; it was designed to identify exact matches indicating a particular offender profile as belonging to the probable perpetrator of a crime. As a result, the software "fails to take into account the wide variation in the popularity of certain allelic combinations as opposed to others."⁷⁶ California's and Colorado's new software programs, by contrast, are designed to take this kind of information into account.⁷⁷

Partial matching methods presently have a significant rate of false positives—supposed relatives who, upon analysis, turn out not to be related. At least one scientific study has concluded that partial matching, fortuitous or de-

73. See Marjan Sjerps & Ate D. Kloosterman, *On the Consequences of DNA Profile Mismatches for Close Relatives of an Excluded Suspect*, 112 INT'L J. LEGAL MED. 176, 176 (1999).

74. See *California Familial Search Procedure*, *supra* note 6, at 29; Colorado Familial Search Policy, *supra* note 18. Texas has also adopted specialized software for conducting deliberate searches for partial matches, but relevant policy statements reveal little about how this software operates. See Tex. Dep't of Pub. Safety, Standard Operating Procedures: Partial Matches and Familial Searches 1 (May 25, 2010) (on file with author) [hereinafter Texas Partial Match Policy]; Tex. Dep't of Pub. Safety, Standard Operating Procedures: Searches 3 (May 25, 2010) (on file with author) [hereinafter Texas Search Policy].

75. See Murphy, *supra* note 22, at 300 & n.42 (explaining that most experts agree that current CODIS software "does a poor job of identifying true leads in familial searches").

76. *Id.* at 300.

77. See *California Familial Search Procedure*, *supra* note 6, at 29; Colorado Familial Search Policy, *supra* note 18.

liberate, yields too many false positives to be recommended at this time.⁷⁸ This study considered two methods for searching for known sibling pairs in mock offender databases—degree of allele sharing and kinship matching.⁷⁹ Like the software now being used in California and Colorado, kinship matching examines not only the number of alleles shared, but also the frequency of those alleles in the population at large.⁸⁰ Using a mock database containing roughly 13,000 profiles, researchers found that, when a person's sibling was in the database, that sibling was the "top match" in only 42% of cases.⁸¹ In the remaining cases, someone other than the sibling was identified as the top match. Moreover, some of the control profiles with no siblings in the mock databases turned up strong partial matches.⁸² The researchers concluded that "for sibling relationships the data shown here is not compelling enough to recommend that it be done in every case."⁸³

As discussed in more detail below, more than a dozen states authorize the reporting of fortuitous partial matches while explicitly precluding the deliberate search for such matches.

II. EXISTING STATE POLICIES FOR REPORTING PARTIAL MATCHES

In the years since the FBI released its interim policy regarding partial matches, states have taken a number of approaches to these matches. Apart from a few well-publicized and publicly available policy statements, however, much of the policymaking surrounding partial matches has been obscured from public view. Reliable data about the range and scope of state policies under the

78. See Reid et al., *supra* note 39, at 342.

79. See *id.* at 340.

80. See *id.*

81. *Id.* at 341 (employing both allele sharing and kinship matching methods of analysis). Other studies have reached similar conclusions, finding that a true familial relationship is the top match only about half of the time, and that a close genetic relative in the database will generally appear in the top one hundred matches. See, e.g., Frederick R. Bieber, Charles H. Brenner & David Lazer, *Finding Criminals Through DNA of Their Relatives*, 312 SCIENCE 1315, 1315 (2006) (finding that, in a 50,000 profile database, a relative is the top match about half of the time and "has a 99% chance of appearing among the 100 largest" likelihood ratios); James M. Curran & John S. Buckleton, *Effectiveness of Familial Searches*, 84 SCI. & JUST. 164, 166 (2008) (using allele counting and likelihood ratio analysis methods, and finding a 72-78% probability that a true sibling will be among the top 100 matches).

82. See Reid et al., *supra* note 39, at 342.

83. *Id.* The study found that "in cases where a high likelihood ratio exists between two individuals familial searching may indeed be an effective investigative tool. However, since *there is no way to know a priori* the strength of a match between a profile in CODIS and a possible suspect relative there is no assurance that a familial search will be of use, particularly when it comes to siblings." *Id.* (emphasis added).

FBI's interim plan has been hard to come by, and much of the information cited in the existing literature is anecdotal.⁸⁴

This Part reports the results of a survey initially conducted in the summer of 2009 and updated to reflect additional policies adopted through fall 2010. These data reveal the most complete picture yet on this issue. Subpart A briefly describes the methodologies employed in conducting this survey. Subpart B reports the survey results.

A. *Survey Methodology*

This survey was conducted in two parts. I first analyzed relevant statutes, regulations, and attorney general memos available on the LexisNexis and Westlaw legal databases. In addition, I canvassed any pending legislation to amend DNA database statutes. These sources revealed largely general statements governing database purpose and use, but not clear rules governing partial matching.⁸⁵ Accordingly, in a second phase of the survey, I contacted state forensic crime laboratories by phone or e-mail. In most instances, I communicated with CODIS administrators or DNA technical leaders who provided relevant information.⁸⁶

Initially, my inquiries were limited to ascertaining whether a state conducted "familial or partial matching." In speaking with state laboratory personnel, however, it quickly became apparent that many states distinguish between these two terms, reserving "partial matching" for fortuitous partial matches and defining the deliberate search for partial matches as "familial searching."⁸⁷ Consequently, for most states, I asked state lab personnel about "familial searching" (deliberate partial matching) as distinct from "partial match reporting" (fortuitous partial matching). In addition, I attempted to recontact states I had interviewed prior to distinguishing between fortuitous and deliberate partial matching in my questions.

84. See Murphy, *supra* note 22, at 302 (observing that "[t]he picture of familial searching in the United States is considerably murkier, both formally and informally").

85. See, e.g., MINN. STAT. ANN. §§ 299C.155, 609.117 (West 2010) (neither prohibiting nor providing for partial matching).

86. In several instances, sources within state laboratories requested anonymity in reporting. Accordingly, source names are not disclosed for any state. This information is on file with the author.

87. As set forth in Part I, this Article employs the language of fortuitous and deliberate partial matching throughout, as these terms better account for the similarities between these two types of partial matches. Most accounts of partial matching, however, employ the term "partial matching" only to refer to fortuitous partial matching, while describing deliberate partial matching as "familial searching." In my survey, I employed the more popular, though less precise, terminology in order to limit confusion.

B. Survey Results—Policies Vary Widely

In all, data was gathered for forty-seven jurisdictions, including the District of Columbia.⁸⁸ Three states—Hawaii, Idaho, and Kansas—declined to participate. New Jersey simply did not respond.

Forty-one jurisdictions have articulated policies or practices for partial match reporting. Four others—Illinois, North Dakota, Virginia, and West Virginia—reported that policies are currently being formulated or codified.⁸⁹ Representatives of Arkansas and Pennsylvania could not say for sure whether partial match reporting of any kind was permitted. DNA policy in this arena varies widely between jurisdictions. Nonetheless, some significant trends can be discerned, three of which are discussed here. First, among those states that embrace the investigative use of partial matches, many distinguish between fortuitous and deliberate partial matches, permitting the former while precluding the latter. Second, many state policies, whether permitting or prohibiting partial matching, are unwritten or accessible only with difficulty. Finally, states permitting partial matching often impose additional technical and procedural requirements prior to disclosing such a match.

1. Distinguishing fortuitous and deliberate partial matches

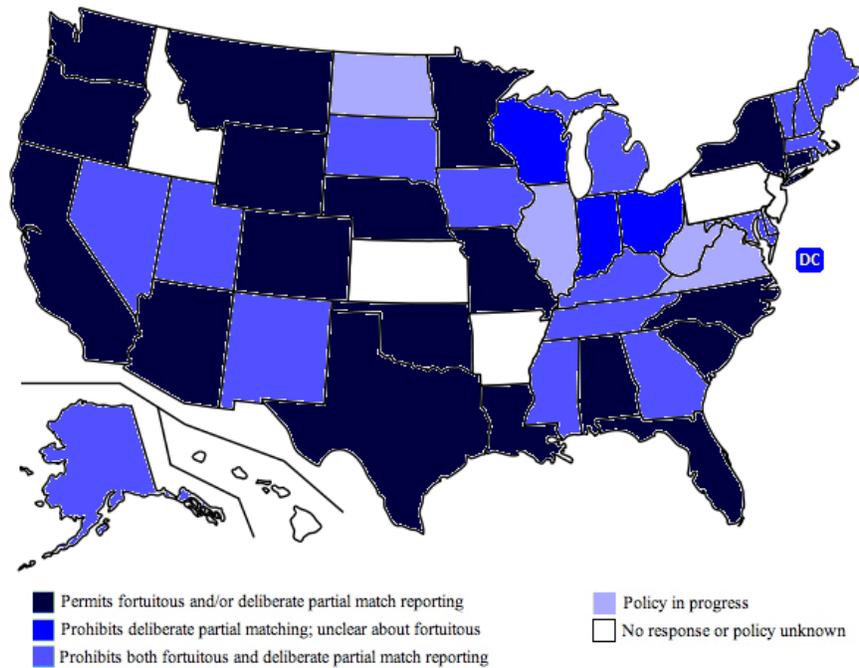
Of the forty-one jurisdictions with some policy or practice already in place, at least nineteen permit or have permitted the reporting of a partial DNA match to criminal investigators for purposes of familial investigation (Figure 1).⁹⁰

88. The sources of each state's information are compiled in Appendix A.

89. Illinois and Virginia indicated that, while their policies are in development, they do not report any partial matches. North Dakota stated that while its policy remains pending, it will consider both fortuitous and deliberate matching on a case-by-case basis. It reported that neither had been reported or undertaken to date. These interim approaches are not included in the data presented below.

90. Alabama, Arizona, California, Colorado, Connecticut, Florida, Louisiana, Minnesota, Missouri, Montana, Nebraska, New York, North Carolina, Oklahoma, Oregon, South Carolina, Texas, Washington, and Wyoming. The figures and data presented in this Part build on work first published in *Science Progress*. See Natalie Ram, *Interactive Map: State Policies for DNA Crime Databases Vary Widely*, SCI. PROGRESS (Nov. 2, 2009), <http://www.scienceprogress.org/2009/11/map-state-dna-policies>.

FIGURE 1
How Many States Permit Partial Matching of Any Kind?⁹¹



<i>Policy type</i>	<i>Number of relevant jurisdictions</i>
Permits some partial matching	19
Prohibits deliberate partial matching; unclear about fortuitous matching	4
No partial matching permitted	18
Policy in progress	4
No response or policy unknown	6

a. *States permitting fortuitous but not deliberate partial matches*

Nearly all of these states draw a sharp distinction between reporting fortuitous and deliberate partial matches. All nineteen states have approved or actually reported fortuitous partial matches at least once. Conversely, as Figure 2

91. See Appendix A for a complete table setting forth policy types and noting whether relevant policies are written.

shows, at least fourteen of these states will not carry out a deliberate familial search.⁹²

At least ten states have policies that expressly preclude the deliberate search for partial matches, while permitting reporting of fortuitously discovered partial matches. Washington, for example, addresses partial matches uncovered during routine “moderate stringency” searches, but states that it does not conduct deliberate partial match searches.⁹³ In North Carolina, while DNA reports note only exact matches—hence a partial match would be designated a non-match—analysts may nonetheless informally discuss partial matches with investigators. Because partial matches are never formally reported, deliberate searches for such matches are not undertaken. And Wyoming’s written policy could not be more clear in distinguishing fortuitous and deliberate partial matches: it utilizes separate vocabulary for each. That policy states that “standard search procedure may occasionally result in a partial match,” which may be disclosed; the policy emphasizes, however, that “[f]amilial searches are *not* currently being performed at the WSCL and are not addressed in this document.”⁹⁴

New York’s newly codified policy permitting fortuitous partial matching also precludes deliberate searching for partial matches. The amended regulations define an “indirect association” as one that results from “the CODIS candidate match confirmation process”—the routine CODIS matching procedure.⁹⁵ Public statements by commissioners have made clear that only fortuitous partial matches are permitted under the new policy. For instance, Denise E. O’Donnell, New York’s Deputy Secretary for Public Safety and Chairwoman of the Commission on Forensic Science, has stated that a partial match may be reported only if its discovery was “inadvertent”—if it was discovered in the course of conducting a search for an exact match.⁹⁶

92. Alabama, Arizona, Florida, Louisiana, Minnesota, Missouri, Montana, New York, North Carolina, Oklahoma, Oregon, South Carolina, Washington, and Wyoming. As discussed below in this Subpart, Connecticut’s policy is vague with respect to deliberate partial matches, while it clearly permits reporting fortuitous partial matches.

93. See E-mail from Forensic Lab. Servs., Wash. State Police, to author (Aug. 13, 2009) (on file with author) [hereinafter Washington Partial Match Policy] (providing an extract from Washington’s *Convicted Offender/CODIS Standard Operating Procedures*).

94. WYO. STATE CRIME LAB., CODIS TECHNICAL MANUAL §§ 11.1-2 (2d ed. 2009) (on file with author) (some emphasis omitted) (setting forth “WSCL Partial Match Policy”). The lab manual defines a “partial match” as a “DNA match made during a standard SDIS search, which does not identify an individual, but may be an indication of a familial relationship between the DNA donors.” A “familial search” is a “CODIS search performed with the sole purpose of identifying possible genetic relationships between DNA sample donors.” *Id.*

95. N.Y. COMP. CODES R. & REGS. tit. 9, § 6192.1(s) (2010) (emphasis omitted).

96. Jeremy W. Peters, *New Rule Allows Use of Partial DNA Matches*, N.Y. TIMES, Jan. 25, 2010, at A12; see also Press Release, N.Y. State Div. of Criminal Justice Servs., Forensic Science Commission Approves Regulations Governing “Partial-Match” DNA (Dec. 13, 2009), available at http://www.criminaljustice.state.ny.us/pio/press_releases/2009-12-13_pressrelease.html.

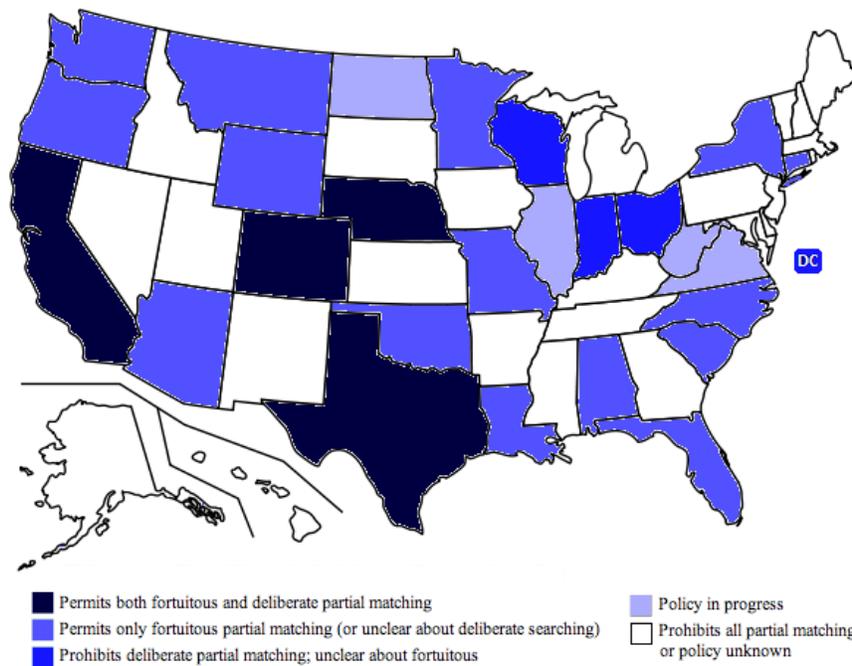
In addition to those states drawing explicit lines between fortuitous and deliberate partial matches, Arizona, Florida, Missouri, and Oregon have adopted the same line by less overt terms, excluding deliberate searches by implication. Florida's policy, set forth in the state laboratory manual, is limited to "moderate stringency" matches resulting from a "CODIS Autosearch."⁹⁷ Although this policy does not explicitly mention deliberate partial matching, that practice appears to be implicitly prohibited by the reference to the routine autosearch. Oregon likewise restricts its policy to partial matches appearing during "routine" CODIS searches.⁹⁸ Similarly, Arizona and Missouri laboratory manual procedures permit disclosure of partial match information uncovered during routine searches and exclude deliberate searches only by implication.

In Connecticut, meanwhile, a minimalist policy suggests that similarity between two profiles must raise the hair on the back of the analyst's neck to be worth pursuing. Little is said about how those profiles are identified. It is therefore difficult to determine whether these partial matches may be uncovered deliberately as well as fortuitously.

97. E-mail from Fla. Dep't of Law Enforcement to author (July 15, 2009) (on file with author) [hereinafter Florida Partial Match Policy] (quoting *Florida CODIS Match Procedures*).

98. E-mail from Portland Forensic Lab. to author (Aug. 14, 2009) (on file with author) (disclosing Oregon's partial match policy).

FIGURE 2
What Kinds of Partial Matching Are Permitted?



<i>Policy type</i>	<i>Number of relevant jurisdictions</i>
Permits both fortuitous and deliberate partial matching	4
Permits only fortuitous partial matching (or unclear about deliberate searching)	15
Prohibits deliberate partial matching; unclear about fortuitous	4
Policy in progress	4
Prohibits all partial matching or policy unknown	24

b. *States permitting both fortuitous and deliberate partial matches—but often imposing different restrictions for each*

Only four states—California, Colorado, Nebraska, and Texas—have acknowledged the deliberate search for partial matches as a permissible compo-

ment of state policy.⁹⁹ California's policy, set forth in a memorandum from the Attorney General, describes distinct, though overlapping, sets of conditions for pursuing fortuitously and deliberately discovered partial matches.¹⁰⁰ Colorado's policy, set forth in a policy statement from the Colorado Bureau of Investigation, states:

A familial search of the state offender DNA database, using specialized non-CODIS software designed for the application, at the discretion of the Director of the Colorado Bureau of Investigation, may be conducted . . .

a. [where a] potential match is obtained from a CODIS search and the case is under investigation and is unsolved, or

b. [where a] special request for a familial search of a CODIS profile has been made by the chief law enforcement officer of the investigating law enforcement agency, or by the district attorney of the jurisdiction[.] . . . or

c. [where a] routine familial search [is] performed by the CBI.¹⁰¹

Texas's policy, contained only in the state's laboratory manual, sets forth similar, though distinctly enumerated, procedures for reporting to investigators fortuitously and deliberately discovered partial matches.¹⁰²

Nebraska's policy, which like Texas's forms a part of the state's DNA Databank Procedures Manual, describes a single policy for the "Release of Information to Law Enforcement Agencies in the Event of a 'Partial Benchwork Match.'"¹⁰³ This policy is less clear about deliberate partial matching than the other policies discussed in this Subpart. Nebraska's policy statement describes "partial benchwork matches" as "discovered," which may imply fortuitous discovery rather than deliberate search. In discussing this policy, however, lab personnel indicated that "targeted analysis" may be conducted on a case-by-case basis and upon specific request. Nonetheless, in most cases, a partial match will result from fortuitous rather than deliberate discovery.

In some circumstances, even these states have drawn distinctions regarding when one practice, but not the other, may be used. California requires that where deliberate partial matching is sought, the unsolved crime must present

99. Virginia recently acquired Colorado's software for deliberate partial matching, and the state is now in the process of examining and validating that software for use in Virginia. See Frank Green, *New Va. DNA Searches Possible*, RICH. TIMES-DISPATCH, Jan. 6, 2011, at A1; E-mail from Va. Dep't of Forensic Sci. to author (Jan. 7, 2011) (on file with author). West Virginia is presently considering draft legislation that would authorize both fortuitous and deliberate partial matching. See *infra* note 167. Other policy revisions are underway or in contemplation in Illinois and North Dakota.

100. See California Partial Match Policy, *supra* note 5.

101. Colorado Familial Search Policy, *supra* note 18, at 1.

102. See Texas Partial Match Policy, *supra* note 74; Texas Search Policy, *supra* note 74. Texas adopted these policies effective May 25, 2010.

103. See NSP CRIME LAB., *Release of Information to Law Enforcement Agencies in the Event of a "Partial Benchwork Match,"* in DNA DATABANK PROCEDURES MANUAL (2008) (on file with author) [hereinafter *Nebraska Partial Match Policy*].

“critical public safety implications.”¹⁰⁴ In Colorado, deliberate partial matching may be undertaken at the request of law enforcement only where an unsolved crime has “significant public safety concerns.”¹⁰⁵ And Nebraska’s invocation of a case-by-case basis for deliberate partial matching implies that such matches are subject to closer scrutiny than partial matches that arise fortuitously.

But not every state permitting both fortuitous and deliberate partial matching draws such distinctions. Texas imposes a “significant public safety” requirement for both types of partial matches.¹⁰⁶ Neither form of partial matching is permitted for property crimes.¹⁰⁷

c. *States prohibiting deliberate partial matches, but not identifying a policy for fortuitous partial matches*

Four additional jurisdictions have explicitly disclaimed conducting deliberate searches for partial matches, while not specifying a policy with respect to fortuitous matches.¹⁰⁸ The District of Columbia’s policy, for instance, states that “DNA collected by an agency of the District of Columbia shall not be searched for the purpose of identifying a family member related to the individual from whom the DNA sample was acquired.”¹⁰⁹ This language definitively bars deliberate searches—searches with “the purpose” of familial identification. It is less clear with respect to fortuitous partial matches, and D.C. personnel could not be reached for clarification. Maryland’s experience with a similar prohibition, which that state has construed as banning all types of partial matching, may indicate that a total ban is also intended here.¹¹⁰ At present, however, the scope of D.C.’s policy has not been determined.

The policies in other states are even more opaque. The policy in Indiana is unwritten.¹¹¹ Ohio and Wisconsin did not indicate whether their policies were written or unwritten, further muddling analysis. Indiana and Ohio were among the first states contacted, prior to revising the survey to distinguish fortuitous from deliberate partial matching. Efforts to recontact these states for further in-

104. California Partial Match Policy, *supra* note 5, at 2. Nebraska does not differentiate conditions for fortuitous and deliberate partial matching, requiring that any partial match reported to investigators must be in connection with a “crime of violence” with “no other available investigative information.” *Nebraska Partial Match Policy*, *supra* note 103, at 1.

105. Colorado Familial Search Policy, *supra* note 18, at 2. Colorado’s seriousness condition may not actually act as much of a constraint. *See infra* notes 149-50 and accompanying text.

106. Texas Partial Match Policy, *supra* note 74, at 2, 4.

107. *See id.*

108. The District of Columbia, Indiana, Ohio, and Wisconsin.

109. D.C. CODE § 22-4151(b) (2010).

110. *See infra* note 117 and accompanying text (discussing Maryland statute).

111. For information regarding whether states’ policies are written or unwritten, see Appendix A.

formation were unsuccessful. Wisconsin provided limited information, stating only that the state does not engage in deliberate searches for partial matches. Information regarding the handling of fortuitous partial matches in Wisconsin is therefore unavailable.

d. *States prohibiting both fortuitous and deliberate partial matches*

Finally, eighteen states responded that they do not report any partial matches uncovered during database searches.¹¹² Like California, Colorado, Nebraska, and Texas, these states have thus adopted a uniform policy with respect to both fortuitous and deliberate partial matches. In some states, this uniformity in policy appears to be the product of luck—the state has never encountered a sufficiently close match during a routine database search and thus has never faced the issue of whether to report such a match to investigators.¹¹³

Other states, however, have purposefully adopted a uniform policy. Some of these policies appear intended to be long-lasting responses to the questions raised by partial matching. In Alaska, the state laboratory concluded after considerable discussion that partial matching of any kind was inappropriate. Rhode Island reported that its policy not to release anything less definitive than an exact match will remain in place until the Attorney General or legislature instructs otherwise. Arizona similarly stated that any change in policy would have to be preceded by discussions with the Attorney General's office. Nevada indicated that it would not alter its current nonreporting policy unless meetings with the public to gauge and address concerns regarding genetic privacy were undertaken first. New Mexico affirmed that its policy not to reveal familial information knowingly would remain in place unless state law is changed by legislative or judicial action. Similarly, Vermont explained that it would not provide partial match information without additional input from the legal channels in the state.

For other states, prohibitions on partial matching may only be temporary. Georgia, for instance, has not engaged in familial identification because its lab

112. Alaska, Delaware, Georgia, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Mississippi, Nevada, New Hampshire, New Mexico, Rhode Island, South Dakota, Tennessee, Utah, and Vermont. A caveat is needed: Although Maine will not release partial match information obtained during a database search, it will alert investigators about a partial match between a crime scene sample and a specific reference sample obtained from a particular suspect. In these instances, Maine requires that the samples match one allele at each locus. As such information is not the result of database searching, which is the focus of this Article, I have classified Maine as reporting neither fortuitous nor deliberate partial matches. (Virginia presently permits similar kinds of reporting, although it did not specify thresholds for such a match. As discussed elsewhere, Virginia is in the process of implementing a deliberate partial matching regime. *See supra* note 99.)

113. For example, New Hampshire and Utah. Despite efforts to formally approve some form of partial matching, both North Dakota and West Virginia reported that they, too, had yet to face a situation involving a fortuitous partial match.

cannot yet process confirmatory testing like Y-STR or mtDNA analysis. If such analysis can be validated, the lab will reconsider its policy. Michigan, meanwhile, is waiting to see what the FBI will do in terms of both national policy and software tools available for analysis.

Massachusetts has a somewhat more confused approach. Existing regulations appear to authorize reporting of both fortuitously and deliberately discovered partial matches:

For purposes of searches of the DNA Database, a minimum of four loci shall be provided by a laboratory or other authorized agency requesting a casework (forensic) search against the DNA Database. Notwithstanding this requirement, the laboratory or other authorized agency may, at its discretion, request that a search be performed using fewer loci if there are scientific reasons which support using fewer than four loci in a particular case, *including but not limited to . . . the possible involvement of relatives.*¹¹⁴

At present, however, the state does neither. Indeed, in 2007, the administrator of the Massachusetts state DNA database resigned in part because he had reported four partial matches to investigators.¹¹⁵ State officials claimed that such reporting was prohibited.¹¹⁶

Finally, Maryland laboratory personnel have given that state's potentially ambiguous statutory provision a broad interpretation. Maryland prohibits "search[es] of the statewide DNA data base for the purpose of identification of an offender in connection with a crime for which the offender may be a biological relative of the individual from whom the DNA sample was acquired."¹¹⁷ Like D.C.'s statute, Maryland's statute expressly bars searches with "the purpose" of familial identification—deliberate searches. On its face, this language is less clear with respect to fortuitous partial matches. Maryland personnel indicated, however, that fortuitous matches are not treated differently from deliberately sought-after ones. In other words, the statutory prohibition is treated as a ban on both types of partial matching. There are sound reasons for this interpretation. Moderate- or low-stringency searches might be construed as having a dual purpose of uncovering both exact and partial matches, such that no partial

114. 515 MASS. CODE REGS. 2.14(2) (LexisNexis 2010) (emphasis added). New York's regulations employ similar language. See N.Y. COMP. CODES R. & REGS. tit. 9, § 6192.3(c) (2010) ("For purposes of searches of the DNA databank, a minimum of four loci shall be provided by a laboratory requesting a forensic DNA profile search against the DNA databank. Generally, all available loci associated with a forensic DNA profile shall be searched in the DNA databank. Notwithstanding this requirement, the laboratory may, at its discretion, request that a search be performed using fewer loci if there is an investigative need and sufficient scientific reasons which support using fewer than four loci in a particular case."). New York, like Massachusetts, declined to interpret this language as authorizing partial matching of any kind. Instead, as discussed above, New York established new regulations specific to partial matching. See *supra* notes 95-96 and accompanying text.

115. See Jonathan Saltzman, *Director of Crime Lab Quits Post*, BOS. GLOBE, Mar. 10, 2007, at A1.

116. See *id.*

117. MD. CODE ANN., PUB. SAFETY § 2-506(d) (LexisNexis 2010).

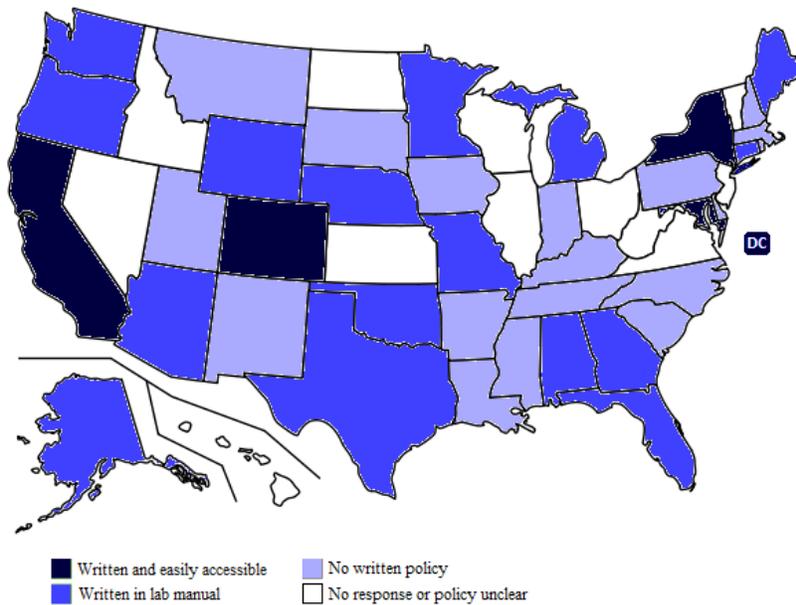
match is truly “fortuitous.” Moreover, as discussed in Part III, states concerned about deliberate partial matching ought to be similarly concerned about fortuitous partial matches, such that legislative purpose might counsel a broad statutory construction. That Maryland appears to have adopted this broad interpretation of its statute is nonetheless noteworthy.

2. Unwritten policies

Most jurisdictions have refrained from prescribing rules governing partial matching in easily accessible formats. California, Colorado, the District of Columbia, Maryland, and New York are marked outliers, having codified their policies in a public memorandum, a public policy statement, a statute, a statute, and regulations, respectively.

Figure 3 maps which states have written and unwritten policies, and also indicates which written state policies are easily accessible by the public.

FIGURE 3
Are Partial Match Policies Written? Where?



<i>Policy type</i>	<i>Number of relevant jurisdictions</i>
Written and easily accessible	5
Written in a lab manual	16
No written policy	18
No response or policy unclear	12

The survey data reveal a startling lack of transparency in rulemaking. Of the forty-one responding jurisdictions that have some policy or practice regarding partial matches, at least eighteen have left these policies unwritten.¹¹⁸ Most of these states have left unwritten a practice not to search deliberately for partial matches¹¹⁹ or not to turn over partial match information more broadly.¹²⁰ In one sense, we might be unsurprised that such nonpractices would remain unwritten. Trying to dream up all of the things we might do with DNA and then prohibiting most of these might well be an unending exercise.

Nevertheless, some states have been proactive in their regulation of DNA databases to specify not only types of analysis that may be completed, but also types of analysis that may not. The District of Columbia and Maryland have codified by statute a prohibition on (at least) deliberate searches for partial matches.¹²¹ Rhode Island and Utah also include explicit statutory prohibitions on analysis that could predict genetic disease or predisposition to illness.¹²² The failure to address in writing deliberate decisions regarding partial match reporting constitutes a failure of transparency, making it extremely difficult for outside observers—and perhaps even laboratory personnel—to know exactly what the state’s policy is.

Nor is inattention to the issue of partial matching always the reason that policies are unwritten. In New Mexico, for instance, an unwritten policy not to knowingly report a partial match was voted on and accepted by the state’s DNA Identification System Oversight Committee. This committee is not merely advisory; it wields rulemaking authority. Its partial match reporting policy, though unwritten, contains specific, approved language—prohibiting the *knowing* reporting of partial match information for familial identification purposes. Furthermore, as noted above, the committee chair stated that this policy will remain in place unless and until there is a change in state law either by legislative enactment or court decision clearly authorizing disclosure of familial-identifying information. Yet it seems that the policy is deliberately unwritten.

118. Arkansas, Delaware, Indiana, Iowa, Kentucky, Louisiana, Massachusetts, Mississippi, Montana, New Hampshire, New Mexico, North Carolina, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, and Utah. Massachusetts presents a confusing case; as previously described, existing state regulations appear to permit all manner of partial matching, but the state—by unwritten policy—does not engage in any. As the most salient portion of Massachusetts’s policy is unwritten, I have classified the state among those operating under unwritten policies.

119. For example, Indiana.

120. Delaware, Iowa, Kentucky, Massachusetts, Mississippi, New Hampshire, New Mexico, Rhode Island, South Dakota, Tennessee, and Utah.

121. *See* D.C. CODE § 22-4151(b) (2010); MD. CODE ANN., PUB. SAFETY § 2-506(d) (LexisNexis 2010).

122. *See* R.I. GEN. LAWS § 12-1.5-10(5) (2010) (forbidding the use of DNA samples “for the purpose of obtaining information about physical characteristics, traits or predispositions for disease”); UTAH CODE ANN. § 53-10-406(1) (LexisNexis 2010) (directing that bureau must “ensure that the DNA identification system does not provide information allowing prediction of genetic disease or predisposition to illness”).

On the other hand, most states that permit reporting of at least fortuitous partial matches have set forth their policies on this practice in writing. Of the nineteen states permitting some kind of partial matching, fifteen have written policies in place.¹²³ The other four states—Louisiana, Montana, North Carolina, and South Carolina—have reported a partial match at least once in the absence of any written policy.

Even written policies, however, may not be easy to find or document. Nearly all written state policies are available only in internal lab manuals. Twelve states permitting some partial matching¹²⁴ and four states prohibiting all partial matching¹²⁵ appear only in this format. Such policy documents are often nearly as inaccessible to the general public as unwritten policies. Some states declined to provide copies of their partial matching policies upon request.¹²⁶ Other state labs were unwilling to share copies of the relevant written policies absent a formal request or a request under the state's freedom of information act.¹²⁷ One state, Georgia, which was otherwise forthcoming and informative, declined to release a copy of the relevant policy on grounds that the lab documents are subject to outside copyright. In contrast, several states, including Florida, Nebraska, New York, Oregon, Texas, Washington, and Wyoming, helpfully excerpted the relevant written state policies in their lab manuals.

Finally, only three states have adopted policies through formal channels permitting public participation—the District of Columbia, Maryland, and New York.¹²⁸ The District of Columbia and Maryland enacted prohibitions. Thus, only one state permitting partial matching has engaged in policymaking open to public input.

3. *Additional requirements*

States impose a range of additional procedural requirements that must be met before a partial match is released to investigators. At least fourteen states recommend or require that reporting be contingent on additional genetic or statistical analysis that indicates a possible familial relationship between the two DNA samples being compared.¹²⁹ A somewhat different set of eleven states re-

123. Alabama, Arizona, California, Colorado, Connecticut, Florida, Minnesota, Missouri, Nebraska, New York, Oklahoma, Oregon, Texas, Washington, and Wyoming.

124. Alabama, Arizona, Connecticut, Florida, Minnesota, Missouri, Nebraska, Oklahoma, Oregon, Texas, Washington, and Wyoming.

125. Alaska, Georgia, Maine, and Michigan.

126. For example, Alabama, Alaska, Arizona, and Oklahoma.

127. For example, Connecticut and Wyoming.

128. *See* D.C. CODE § 22-4151(b) (2010); MD. CODE ANN., PUB. SAFETY § 2-506(d) (LexisNexis 2010); N.Y. COMP. CODES R. & REGS. tit. 9, § 6192.3(e)-(f) (2010).

129. Alabama, Arizona, California, Colorado, Connecticut, Florida, Minnesota, Missouri, Nebraska, New York, Oklahoma, Texas, Washington, and Wyoming. Of these, lab

quires that the DNA samples in question have some minimum number of alleles in common—generally, at least half.¹³⁰

These conditions on release of partial match information reflect some of the recommendations of the Scientific Working Group on DNA Analysis Methods (SWGDM). SWGDM is a group of forensic scientists under the guidance of the FBI that, among other things, serves as a general liaison between the FBI and the forensic DNA community. This body has issued recommendations identifying circumstances under which it deems fortuitous or deliberate partial matching ethically acceptable.¹³¹ SWGDM recommended that familial identification information be disclosed only where, *inter alia*: identification involved single-source samples; analysts searched local databases before larger, more general ones; a match was obtained for a substantial number of core loci (as many as possible); additional genetic testing (Y-STR, mtDNA) was performed and confirmed a possible familial link; and (statistical) tests for expected match ratio and expected kinship ratio were performed and confirmed a possible familial link.¹³²

Perhaps unsurprisingly, the most detailed policies in this arena have emerged from states that have approved release of not only fortuitously discovered partial matches, but also deliberately uncovered matches. California's policy establishes minimum standards for the quality of the match between offender and forensic samples, including requirements that the crime scene sample must be from a single source,¹³³ the offender and forensic sample must match on at least fifteen alleles, and Y-STR analysis must be consistent with a familial relationship.¹³⁴ Critically, however, this policy also specifies minimum requirements for the kinds of cases for which partial match information will be

personnel in two states—Nebraska and Washington—indicated during phone interviews that their laboratories do not conduct additional genetic analysis like Y-STR testing on-site, and that they would merely recommend to investigators that such analysis be obtained once partial match information is turned over. For both, however, written policies on file make clear mention of Y-STR testing, and Washington's policy explicitly states, while Nebraska's implies, that such testing will precede the release of partial match information to investigators. I therefore group these states with others recommending or requiring pre-release Y-STR analysis.

130. Arizona, California, Colorado, Connecticut, Florida, Nebraska, North Carolina, Oklahoma, Oregon, Texas, and Washington. Arizona reports that although its written policy does not specify that the two profiles at issue share a minimum number of alleles, such a requirement is imposed by implication and practice. See Appendix B for a complete table setting forth various restrictions imposed by state partial matching policies, and which states have adopted which restrictions.

131. See Ted Staples, Chair, Scientific Working Grp. on DNA Analysis Methods, Address at the Genetic Information Work Group 32-33 (June 24, 2008) (transcript available at <http://www.ipad.state.mn.us/docs/geninfo17.pdf>) (setting forth SWGDM's recommendations regarding familial identification practices).

132. See *id.* at 33.

133. "Single source" means a DNA profile determined to be from a single individual.

134. See California Partial Match Policy, *supra* note 5, at 1.

released: the case must be unsolved, all other investigative leads must have been exhausted, and the investigating agency and prosecutor must commit to follow up on any name released following partial match analysis.¹³⁵ Colorado, Nebraska, and Texas—which, together with California, are the only states to permit both fortuitous and deliberate partial matching—are the only other states known to require exhaustion of all other investigative leads prior to pursuit of partial match information.¹³⁶ Both Colorado and Texas also require that investigators commit to pursue a partial match lead.¹³⁷

Colorado's policy, however, is generally much broader than those in California, Nebraska, and Texas. The Colorado policy permits "routine familial search[es]" by state authorities, in addition to the more common approaches of following up on routine partial matches and responding to special requests from law enforcement.¹³⁸ Making use of new software intended to improve identification of true familial relationships, Colorado appears poised to undertake deliberate searches for partial matches whenever a single-source (or deduced-from-mixture) forensic sample is available.¹³⁹ Moreover, while Y-STR analysis is required, the number of common alleles in the standard CODIS profile prior to reporting must simply be "sufficient."¹⁴⁰

Nevertheless, Colorado's policy is not without its demands. Unlike any other policy identified in this survey, Colorado's specifies a number of steps that law enforcement officers must undertake in investigating partial match information.¹⁴¹ The reason for such specificity regarding investigative follow up is, nominally, to "insure consideration of potential family issues before contacting family members."¹⁴²

135. *See id.*

136. *See* Colorado Familial Search Policy, *supra* note 18, at 2; *Nebraska Partial Match Policy*, *supra* note 103, at 1; Texas Partial Match Policy, *supra* note 74, at 2-4.

137. *See* Colorado Familial Search Policy, *supra* note 18, at 2; Texas Partial Match Policy, *supra* note 74, at 3-4.

138. Colorado Familial Search Policy, *supra* note 18, at 1.

139. Colorado's new software takes allele frequency into account in an attempt to make better use of the CODIS loci in correctly identifying familial relationships. It is far from clear, however, that even this new software is sufficiently effective at this task. Indeed, one study has suggested that familial identification methods including kinship matching (the method of analysis on which the Colorado software appears to rely) will correctly identify a sibling pair as the first hit among partial match results less than half of the time. *See* Reid et al., *supra* note 39, at 341. The high rate of false positives for this methodology led the researchers to conclude that "for sibling relationships the data shown here is not compelling enough to recommend that it be done in every case." *Id.* at 342.

140. Colorado Familial Search Policy, *supra* note 18, at 2.

141. *See id.* at 3 (identifying information sources from which law enforcement can conduct "a full background check of the identified individual and family members" and investigative records that should be used to exclude a partially matching offender's relatives as possible suspects).

142. *Id.* at 4 (noting "[p]otential issues constituting reasons for delaying contact with family members," including the "unknown child" issue (the "possibility that a father is not aware of the existence of an offspring"), the "misbelieved paternity" issue (the "possibility

Unlike California's and Colorado's policies, those in Nebraska and Texas have not been the subject of public scrutiny. This is likely because these policies appear only in state laboratory manuals, rather than in more publicly accessible sources. Nonetheless, Texas's policy is particularly detailed and rigorous. Going beyond California, Colorado, and Nebraska, Texas only permits partial matching where the evidentiary profile is not only single source, but also complete.¹⁴³ All partial matches must also stem from forensic samples unambiguously connected to the crime in question, share one allele at each CODIS locus, and yield Y-STR and statistical analysis consistent with kinship.¹⁴⁴

These four states also require that the unsolved case be serious. California requires that an unsolved crime present "critical public safety implications" in order to request deliberate partial matching.¹⁴⁵ Colorado's policy for undertaking a deliberate search for partial matches is that an unsolved crime must have "significant public safety concerns."¹⁴⁶ In Nebraska, partial matches can be reported to investigators only in connection with an unsolved "crime of violence."¹⁴⁷ And Texas demands that the crime involved be "an unsolved homicide, sexual assault, or other crime that has significant public safety concerns."¹⁴⁸ None of the other states surveyed conditioned release of partial match information on the nature of the unsolved crime.

Despite the concern for "significant public safety," as indicated above, Colorado's policy nevertheless permits "routine familial search[es]."¹⁴⁹ It is therefore unclear whether the Colorado requirements constrain the use of deliberate partial match searches. Indeed, Colorado's most prominent partial matching success story belies the seriousness constraint. That case involved a car break-in where the burglar "left a drop of blood on a passenger seat when he broke a car window and stole \$1.40 in change."¹⁵⁰ Texas's policy, by contrast, expressly precludes partial matching for such property crimes.¹⁵¹

that a family might have assumed a child's father is someone else"), and "other possible family privacy concerns").

143. See Texas Partial Match Policy, *supra* note 74, at 2, 4.

144. See *id.* at 2, 4.

145. California Partial Match Policy, *supra* note 5, at 2.

146. Colorado Familial Search Policy, *supra* note 18, at 2.

147. Nebraska Partial Match Policy, *supra* note 103, at 1.

148. Texas Partial Match Policy, *supra* note 74, at 2, 4.

149. Colorado Familial Search Policy, *supra* note 18, at 1.

150. P. Solomon Banda, *Police Debate Use of Family DNA to ID Suspects*, MSNBC.COM (Feb. 9, 2010), http://www.msnbc.msn.com/id/35317812/ns/technology_and_science-science. He was targeted for investigation based on his brother's presence in the state offender database. See Jim Spellman, *Using Relative's DNA Cracks Crime, but Privacy Questions Raised*, CNN.COM (Nov. 18, 2009), <http://www.cnn.com/2009/CRIME/11/17/colorado.family.dna>. Interestingly, only a few years ago, Mitch Morrissey, Denver's District Attorney and a prominent advocate of partial matching, explained that partial matching should be used for serious crime, stating: "This isn't [about] car break-ins . . ." Dolan & Felch, *supra* note 62.

151. See Texas Partial Match Policy, *supra* note 74, at 2, 4.

More generally, states that have written policies permitting partial matching have more detailed policies. At least twelve of these fifteen states require additional genetic testing—usually Y-STR analysis.¹⁵² At least ten refer to a minimum number of alleles that must be shared between partially matching profiles.¹⁵³ And at least nine specify that the forensic sample with which a partial match is made must either be single source or fully deduced from mixture, meaning that the putative perpetrator's DNA has been isolated from other DNA in the sample.¹⁵⁴

Conversely, the four states that have reported partial matches in the absence of a written policy appear to have placed fewer subsequent hurdles to disclosure once a partial match is identified. Two of these states, Louisiana and Montana, acknowledged that their labs had turned partial match information over to investigators at least once in the past, but both emphasized the rarity of this occurrence. In Montana, the decision to disclose partial match information was made by the state attorney general, after consultation with the lab analyst and DNA technical leader. Given the infrequency of reporting in these states, it is difficult to say anything concrete about their general policies in this respect.

The two remaining states, North and South Carolina, present a somewhat different picture. Although North Carolina forensic DNA reports note only exact matches and, hence, a partial match would be designated a nonmatch, analysts may nonetheless informally discuss partial matches with investigators. The only requirement for such information sharing appears to be similarity at a majority of available CODIS alleles (for example, thirteen or fourteen of sixteen available data points). Indeed, although the state laboratory handles Y-STR analysis, a partial match would not constitute a trigger for such analysis. Mere similarity at a majority of standard CODIS loci is sufficient. In South Carolina, a moderate-stringency candidate match that may indicate a familial relationship between a crime scene sample and an offender profile will trigger additional investigation, and possibly reporting.

In sum, several states appear to operate without written policies, some by seemingly deliberate decision. The policies of states with written rules appear to be not only easier to access in most cases, but also more specific in their instructions than their unwritten counterparts. For those states that have embraced partial matching, a written policy correlates with additional requirements go-

152. Alabama, Arizona, California, Colorado, Connecticut, Florida, Minnesota, Missouri, Nebraska, Oklahoma, Texas, and Washington. Notably, Missouri and Oklahoma were the only states to report that they presently conduct or plan to conduct routine Y-STR analysis for all male offenders, and only Oklahoma explicitly stated that it intends to store these profiles in a permanent database. Other states conducting Y-STR analysis, or commissioning such analysis from outside labs, reported doing so only on a case-by-case basis.

153. Arizona, California, Colorado, Connecticut, Florida, Nebraska, Oklahoma, Oregon, Texas, and Washington.

154. California, Colorado, Florida, Nebraska, New York, Oregon, Texas, Washington, and Wyoming.

verning the quality of the partial match as an indicator of familial involvement. Moreover, those states embracing both fortuitous and deliberate partial matching have gone further still, imposing conditions not only on the quality of the partial match, but also on the types of cases in which partial match information may be released. The transparency and detail of state policy thus appear to be correlated with whether that policy is written.

III. DISMANTLING THE DISTINCTION BETWEEN FORTUITOUS AND DELIBERATE PARTIAL MATCHING

At least fourteen of the nineteen states that permit or have previously permitted release of partial match information to investigators when such matches are fortuitously discovered have nonetheless prohibited the deliberate search for such matches.¹⁵⁵ This Part exposes the distinction between fortuitous and deliberate partial matching as one that imposes significant structural costs, and which is not supported by logic or principle. To create principled policy governing partial matches, states should treat both fortuitous and deliberate methods similarly.

Subpart A contends that the distinction between fortuitous and deliberate partial matches creates significant perverse incentives for state laboratories and policymakers. If the distinction is to be maintained, it must be supported by sound reasons. It is not: Subpart B argues that the reasons for accepting or rejecting partial matching apply equally to fortuitous and deliberate partial matches. Subpart C considers possible justifications for distinguishing between these two methods and rejects each as insufficient.

A. *The Fortuitous/Deliberate Distinction Imposes Structural Costs*

1. *Perverse incentives for laboratory personnel*

Distinguishing between fortuitous and deliberate partial matching encourages strategic behavior by laboratory personnel responsible for determining what constitutes a “routine” database search. The relationship between law enforcement and forensic DNA laboratories is a close one. Each of the laboratories contacted as part of the survey reported here was a state forensics lab, often housed in the state bureau of investigations, department of justice, or state police.¹⁵⁶ Most, if not all, of an analyst’s work is linked to law enforcement’s in-

155. Alabama, Arizona, Florida, Louisiana, Minnesota, Missouri, Montana, New York, North Carolina, Oklahoma, Oregon, South Carolina, Washington, and Wyoming. *See also* discussion *supra* Part II.B.1.a. Recall that Connecticut, which permits at least fortuitous partial matching, did not expressly rule out deliberate partial matching in discussing its policy with me.

156. *See, e.g., Scientific Crime Detection Laboratory*, ALASKA DEP’T PUB. SAFETY, <http://www.dps.state.ak.us/CrimeLab> (last visited May 19, 2010) (identifying Alaska’s

vestigatory and prosecutorial interests.¹⁵⁷ In this setting, the goal is to identify usable genetic matches. When states tie the usability of a partial match to its fortuity, they give lab personnel perverse incentives to set the stringency of their searches so that more partial matches “just happen” to come up. This slipperiness between fortuitous and deliberate partial matches undermines a state’s decision—for whatever reason—to eschew deliberate partial matching.

The line drawn by “routine” searching is movable. Several states have already bypassed high stringency in setting routine search procedures, adopting moderate stringency as routine.¹⁵⁸ Adopting low-stringency searches would broaden the scope of partial matches that “just happen” to arise in the course of routine procedures. Moderate-stringency searches report hits for offender profiles that match a crime scene sample in allele kind, if not in number.¹⁵⁹ Low-stringency searches, meanwhile, return matches where a crime scene sample and offender profile share at least one allele, although the offender profile or crime scene sample may contain additional alleles that the other does not have.¹⁶⁰ Low-stringency searches may sometimes be appropriate where, for instance, concerns about allelic dropout may combine with the difficulties of identifying a genetic match for a crime scene sample resulting from a mixture.¹⁶¹

Low-stringency searches may more often be useful, however, for the potential familial leads they generate. This is especially so for states that condition partial matching on single-source or fully deduced DNA samples.¹⁶² The draw of identifying a greater number of partial matches “fortuitously” through

DNA/CODIS service as part of the state scientific crime detection laboratory, a program under the state Department of Public Safety); *Forensic Biology (DNA)*, GA. BUREAU INVESTIGATION, http://dofs.gbi.georgia.gov/00/channel_title/0,2094,75166109_75728566,00.html (last visited May 19, 2010) (identifying Georgia’s DNA lab as a “section of the Georgia Bureau of Investigation”); *Forensic Science Division—State Crime Lab*, MONT. DEP’T JUST., <http://www.doj.mt.gov/enforcement/crimelab> (last visited May 19, 2010) (identifying Montana’s DNA analysis unit as under the aegis of the state Department of Justice).

157. Cf. Erin Murphy, *The New Forensics: Criminal Justice, False Certainty, and the Second Generation of Scientific Evidence*, 95 CALIF. L. REV. 721, 754 (2007) (observing that even independent testing of DNA evidence “is often [performed] by laboratories primarily beholden to government contracts and hostile to defense interests”).

158. See, e.g., Florida Partial Match Policy, *supra* note 97 (limiting partial matching to “moderate stringency” matches resulting from a “CODIS Autosearch”); Washington Partial Match Policy, *supra* note 93 (addressing partial matches uncovered during routine “moderate stringency” searches).

159. See Murphy, *supra* note 22, at 297.

160. See *id.*

161. Allelic dropout is failure to detect an allele within a sample resulting from the failure of an allele to amplify during the polymerase chain reaction. See BUTLER, *supra* note 29, at 133. Allelic dropout “commonly results from degraded or low quantity DNA samples,” and may also arise “as a result of genetic mutations that cause an allele not to amplify properly.” Murphy, *supra* note 31, at 506.

162. California, Colorado, Florida, Nebraska, New York, Oregon, Texas, Washington, and Wyoming.

low-stringency searching may drive states to employ this lower search standard more frequently or, indeed, routinely. Redefining routine search procedures would mask deliberate efforts to identify more partial matches as mere fortuity, making partial matching policies even more impenetrable to public oversight.

Moreover, new software or expanded genetic analysis designed to better identify exact matches may have as a secondary impetus the better identification of partial matches for familial investigation. For instance, software reporting not only the number of shared alleles, but also the rarity of these alleles, might serve both exact match and partial match efforts. Information about allele rarity would permit prosecutors to report with greater precision the odds that another individual shares a defendant's genetic profile. Yet, improved utility of the software for identifying familial leads would also clearly (and perhaps, primarily) be driving this software improvement. These twin aims undermine the claim that the partial matches such software uncovers are merely fortuitous.

The point here is not to suggest that laboratory personnel engage in behavior designed to convict the innocent. Rather, it recognizes that lab analysts often work under pressure to identify potential useful genetic matches. Both fortuitous and deliberate partial matches can fall into this category. Combining a fortuitous/deliberate distinction with this institutional inclination to identify more potential genetic leads, however, is likely to lead to expansion in routine search procedures for unacknowledged reasons. Masking deliberately sought partial matches as merely fortuitous also belies whatever reason a state might proffer for its decision to prohibit deliberate partial matching.

2. *Perverse incentives for policymakers*

The fortuitous/deliberate distinction also encourages strategic behavior on the part of policymakers interested in taking advantage of the crime-solving potential of partial matching without bearing the costs of public scrutiny. In explaining his hesitation to authorize deliberate partial matching, Thomas Callaghan, the former CODIS Unit Chief, has said: "The FBI would be more comfortable with congressional authorization to conduct familial searches. . . ."¹⁶³ The FBI has thus far refrained from conducting deliberate partial matching.¹⁶⁴ Under the FBI's interim policy, however, interstate information sharing is permitted for fortuitous partial matches, lack of legislation notwithstanding.¹⁶⁵

By inviting congressional approval for one, but not the other, form of partial matching, Callaghan implies that there is something significantly different between fortuitous and deliberate partial matching, something that makes the latter more invasive and more ethically or legally fraught than the former. Even

163. Nakashima, *supra* note 68.

164. *See id.*

165. *See* COMBINED DNA INDEX SYS., *supra* note 62.

if there is reason for the public to worry about deliberate partial matching, the theory goes, such concerns need not be visited upon its benign, fortuitous cousin. But it is not evident that fortuitous partial matching is so distinct from deliberate partial matching. Indeed, as the rest of this Part makes plain, there are no good reasons to distinguish between these two forms of partial matching. Adopting such a distinction thus serves largely rhetorical ends. Calling these practices by different names and treating them differently in policy is a savvy political move, as it obfuscates the similarities between them. To be sure, adopting a fortuitous/deliberate distinction prevents states from taking advantage of the full scope of crime-solving benefits that partial matching can yield, but avoiding significant public scrutiny by adopting a policy that is less “aggressive” than deliberate partial matching may well be worth it.¹⁶⁶ The fortuitous/deliberate distinction thus enables states to reap some of the potential crime-solving benefits of partial matching while short-circuiting public controversy over the appropriateness of such practices. This is a serious cost to transparency.

There is a second sense in which the fortuitous/deliberate distinction encourages transparency-debilitating behavior. The available data show a correlation between embracing both fortuitous and deliberate partial matching and adopting such policies through more publicly accessible means.¹⁶⁷ Only four states presently permit both forms of partial matching. Half of these states—California and Colorado—have announced their policies publicly and made policy documents widely available.¹⁶⁸ These policies have been subject to well-publicized discussion in major media sources.¹⁶⁹ Conversely, New York is the only one of the fourteen states that permit or have permitted only fortuitous partial matching that has made its policy similarly available. Four have not even committed a policy to writing,¹⁷⁰ while the remaining nine have placed their policies in lab manuals that are often difficult to access.¹⁷¹ None of these policies has been subject to public scrutiny.

166. Oregon reported that its lab does not engage in “aggressive” practices like deliberate partial matching, although it will relay information derived from fortuitous partial matches.

167. On the whole, states permitting partial matching have done so largely through policies defying significant public oversight. None of the nineteen states permitting partial matching have enacted legislation expressly authorizing the practice. West Virginia continues to pursue this path, but without success thus far. *See* S.B. 197, 79th Leg., 2d Sess. (W. Va. 2010); H.B. 3211, 79th Leg., Reg. Sess. (W. Va. 2009).

168. *See* California Partial Match Policy, *supra* note 5; Colorado Familial Search Policy, *supra* note 18.

169. *See, e.g.*, Maura Dolan & Jason Felch, *State Offers Police Extra DNA Tool; California Will Use Partial Matches from Relatives in Its Genetic Database to Try to Track Down Criminals*, L.A. TIMES, Apr. 26, 2008, at A1 (discussing California’s policy); Banda, *supra* note 150 (discussing California’s and Colorado’s policies).

170. Louisiana, Montana, North Carolina, and South Carolina.

171. Alabama, Arizona, Florida, Minnesota, Missouri, Oklahoma, Oregon, Washington, and Wyoming.

We should be cautious here not to confuse correlation with causation. The correlation between adopting a fortuitous/deliberate distinction and doing so by nontransparent means does not necessarily indicate that all states contemplating such a distinction will do so exclusively through lab manual policies and practices. Nor does this correlation indicate that states publicly undertaking policy-making in this arena are more likely to embrace broader policies permitting both fortuitous and deliberate partial matching. Indeed, the data do not uniformly support such hypotheses. Nebraska and Texas permit both fortuitous and deliberate partial matching by means of lab manual policies,¹⁷² while New York's newly codified regulatory amendments permitting only fortuitous partial matching¹⁷³ are publicly available and have been well publicized in major newspapers.¹⁷⁴ Nonetheless, there is limited convergence between adopting a fortuitous/deliberate distinction and proceeding through nonpublic means.

Even in the absence of a causal relationship, however, mere correlation may be troubling. So long as the correlation between the fortuitous/deliberate distinction and lack of public oversight persists, new states adopting that distinction can realize some of the rewards of partial matching while blending in with the several other states already making similar policy via quiet, lab-manual means. Here again, state legislatures and regulators seeking to take advantage of the potential crime-solving benefits of partial matching, while hoping to avoid public controversy about such practices, may be more likely to adopt a fortuitous/deliberate distinction. The strategic incentives once again point the way to greater secrecy and less public accountability.

B. *Arguments Favoring and Opposing Partial Matching Apply Broadly*

Were the distinction that several states have drawn between fortuitous and deliberate partial matching a harmless one, we should hardly care whether states adopt or eschew it. But as Subpart A has shown, this distinction is not without consequence. If this distinction is to persist, there must be sound and sufficient reasons in its favor. This Subpart and the next demonstrate, however, that no such reasons exist. Rather, the fortuitous/deliberate distinction is a distinction without substantive difference. Reasons for favoring or opposing partial matching generally have received thorough discussion elsewhere. This Subpart therefore reviews these arguments only briefly to show that none of these reasons can justify a fortuitous/deliberate distinction.

172. See *Nebraska Partial Match Policy*, *supra* note 103; *Texas Partial Match Policy*, *supra* note 74.

173. See N.Y. COMP. CODES R. & REGS. tit. 9, § 6192.3(e)-(f) (2010).

174. See, e.g., Peters, *supra* note 96.

1. *Arguments favoring partial matching*

The chief justification given for embracing partial match reporting is that it enables investigators to solve more crimes. All else being equal, increasing the scope of coverage in CODIS will enable more genetic identifications, which will likely solve more crimes.¹⁷⁵ California's apparent success in the Grim Sleeper case is a strong demonstration of the crime-solving potential of partial matching.¹⁷⁶ In the United Kingdom, where partial matching has been used for several years, partial matches have proved critical in at least eight cases.¹⁷⁷ If the state's goal in permitting fortuitous partial matching is to solve more crimes, however, that goal would also be advanced by the regulated use of deliberate partial matching.¹⁷⁸ Indeed, both California and the United Kingdom allow both fortuitous and deliberate partial matching, and so both support the usefulness of partial matching in enhancing genetic identification capabilities, regardless of method. Both methods of partial matching take advantage of genetic patterns of inheritance to incorporate otherwise nonincluded individuals into the scope of genetic identification.

Partial matches may also help exonerate the innocent. The lack of an exact DNA match between a suspect and decisive crime scene DNA ought usually to be sufficient to exculpate that suspect. Nonetheless, partial matching can point investigators in new and useful directions.¹⁷⁹ Here again, whatever the merits of partial matching for defense or exoneration purposes, they apply equally to both fortuitous and deliberate partial matching. Both provide investigators with

175. *But see* Carole McCartney, *The DNA Expansion Programme and Criminal Investigation*, 46 BRIT. J. CRIMINOLOGY 175, 188-89 (2006) (identifying possible areas for "mistake, mis-targeting and misinterpretation" in DNA analysis and identification, as well as "the potential for negative impacts upon police investigative practice" (citation omitted)); *cf. infra* Part III.C.3.

176. *See* Kim Zetter, *DNA Sample from Son Led to Arrest of Accused 'Grim Sleeper'*, WIRED (July 12, 2010), <http://www.wired.com/threatlevel/2010/07/dna-database>.

177. *See* Nakashima, *supra* note 68; *see also* Dolan & Felch, *supra* note 62 (reporting that British investigators have successfully employed partial matching in eighteen cases). The United Kingdom keeps its partial matching policy well hidden, refusing to make it available to reporters or the public.

178. *See* Rosen, *supra* note 7 (noting that Denver District Attorney Mitch Morrissey began advocating for deliberate partial matching because fortuitous partial matches only "occur unexpectedly and infrequently," and so are "unlikely to produce lots of investigative leads"). Of course, trying to generate "lots of investigative leads" may be a double-edged sword. As discussed below, the deliberate search for partial matches may generate "a list of hundreds of 'potential relatives', none of whom, on closer inspection, turn out to be genetically related to the perpetrator." Frederick R. Bieber & David Lazer, *Guilt by Association: Should the Law Be Able to Use One Person's DNA to Carry Out Surveillance on Their Family?*, NEW SCIENTIST, Oct. 23, 2004, at 20. Fortuitous partial matches are less likely to suffer from this overabundance of potential leads because they result haphazardly from routine database searches nominally designed to look for exact matches.

179. *See, e.g.*, Bieber, *supra* note 22, at 225-26 (discussing the case of Darryl Hunt as a favorable outcome of partial matching).

new potential leads in cases where an existing suspect or convicted offender claims innocence.

2. Arguments opposing partial matching

Just as the primary arguments favoring partial matching apply to both fortuitous and deliberate partial matches, so too do the core arguments against partial matching. In a recent comprehensive analysis, Erin Murphy identifies six grounds for opposing partial matching.¹⁸⁰ Five of these arguments are explored here, with the sixth discussed in Subpart C.

First, partial matching is, “by nature, arbitrary and discriminatory,” because it unjustly distinguishes between otherwise nonincludable persons related to databased offenders and otherwise nonincludable persons not related to databased offenders.¹⁸¹ Offenders’ relatives are not actually in CODIS—but they are “reachable” through the profiled relative. Their inclusion is a product of “biological happenstance.”¹⁸² Yet, just as one’s presence in a high crime neighborhood is insufficient, on its own, to constitute reasonable suspicion,¹⁸³ so too should be one’s mere relation to a criminal. There is “no empirically defensible reason to make suspects” of the otherwise nonincludable relatives of offenders, while ignoring the nonincludable relatives of unconvicted (or unarrested) persons.¹⁸⁴

Second, several scholars have noted that partial matching is worrisome because it aggravates racial disparities embedded in offender-based DNA databases.¹⁸⁵ Certain racial and ethnic populations are already overrepresented in CODIS.¹⁸⁶ Effectively, though implicitly, expanding database coverage to in-

180. See Murphy, *supra* note 22, at 303-27. These areas of concern do not consider the actual efficacy of partial matching procedures; for the sake of argument, Murphy assumes that, “in essence, familial searches work. That is, . . . near-miss searches, as a basic scientific and statistical matter, point directly enough toward potential perpetrators to be useful . . . [although] they also generate a limited number of false leads.” *Id.* at 304.

181. *Id.* at 305.

182. Seringhaus, *supra* note 36, at 70.

183. See *Illinois v. Wardlow*, 528 U.S. 119, 124 (2000) (“An individual’s presence in an area of expected criminal activity, standing alone, is not enough to support a reasonable, particularized suspicion that the person is committing a crime.”).

184. Murphy, *supra* note 22, at 308.

185. See Greely et al., *supra* note 22, at 258-59; D.H. Kaye & Michael E. Smith, *DNA Identification Databases: Legality, Legitimacy, and the Case for Population-Wide Coverage*, 2003 WIS. L. REV. 413, 452-59; Murphy, *supra* note 22, at 321-25; Seringhaus, *supra* note 36, at 70-72.

186. CODIS now aggregates profiles for nearly all convicted (and many arrested) persons throughout the United States, and so disparities in the offender population are replicated in CODIS. African American males are therefore overrepresented in the CODIS population. See THOMAS P. BONCZAR, BUREAU OF JUSTICE STATISTICS, U.S. DEP’T OF JUSTICE, PREVALENCE OF IMPRISONMENT IN THE U.S. POPULATION, 1974-2001, at 1 (2003), available at <http://bjs.ojp.usdoj.gov/content/pub/pdf/piusp01.pdf> (explaining that the rate of incarceration

clude offenders' relatives through partial matching grossly amplifies this existing bias. Combining the ethnic makeup of CODIS with simple assumptions about family structure, Greely and colleagues have estimated that "more than four times as much of the African American population as [of] the U.S. Caucasian population would be 'under surveillance' as a result of family forensic DNA."¹⁸⁷ The impact of partial matching may be even greater for Hispanics because they tend to have larger family structures.¹⁸⁸ Such disparities are politically, if not also legally, suspect.¹⁸⁹ Moreover, as DNA databases expand in both actual and virtual scope, partial matching may yield near-universal coverage for some groups and not others.¹⁹⁰

Third, partial matching imposes costs on individual privacy. In upholding statutes compelling database inclusion for convicted offenders against Fourth Amendment claims, courts have relied on two rationales: prisoners' diminished expectations of privacy, and states' interests in having accurate tools of identification and preventing recidivism.¹⁹¹ In addition, courts have frequently em-

for adult black males is more than six times greater than for adult white males). The rate of incarceration for Hispanic males is also disproportionate—almost three times that of white males. *Id.*

187. Greely et al., *supra* note 22, at 259.

188. See Grimm, *supra* note 22, at 1175-85.

189. Legal arguments based on equal protection are unlikely to gain traction in the absence of evidence of discriminatory intent. See *Washington v. Davis*, 426 U.S. 229, 239-42 (1976); see also Greely et al., *supra* note 22, at 259 (discounting equal protection claims founded on disparate impact alone, but acknowledging that this disparity, "like racial profiling, . . . does seem fundamentally unfair").

190. See Kaye & Smith, *supra* note 185, at 455-56 (observing that, if all arrestees are included in the database, the result may be functionally indistinguishable from a universal DNA database for African Americans, but not other ethnic or racial groups).

191. See, e.g., *United States v. Kincade*, 379 F.3d 813, 833-35 (9th Cir. 2004) (en banc). Courts analyzing the Fourth Amendment implications of DNA database statutes have split as to the appropriate test to apply. See *United States v. Weikert*, 504 F.3d 1, 8-9 (1st Cir. 2007) (collecting cases). The majority of the circuits have employed a "totality of the circumstances" test, balancing the government's legitimate interests against the diminished privacy interests of convicted persons to determine whether the search and seizure of DNA is reasonable. See, e.g., *Weikert*, 504 F.3d at 11; *United States v. Kraklio*, 451 F.3d 922, 924 (8th Cir. 2006); *Johnson v. Quander*, 440 F.3d 489, 496 (D.C. Cir. 2006); *United States v. Sczubelek*, 402 F.3d 175, 184-86 (3d Cir. 2005); *Padgett v. Donald*, 401 F.3d 1273, 1280 (11th Cir. 2005); *Kincade*, 379 F.3d at 832 (five judges endorsing the reasonableness standard; one, the special needs exception; and five dissenting); *Groceman v. U.S. Dep't of Justice*, 354 F.3d 411, 413 (5th Cir. 2004) (per curiam); *Jones v. Murray*, 962 F.2d 302, 307 (4th Cir. 1992). The Second, Seventh, and Tenth Circuits have applied the "special needs" test, examining whether the compulsory DNA analysis and profiling constitutes a "special need[], beyond the normal need for law enforcement, [which] make[s] the warrant and probable-cause requirement impracticable." *Griffin v. Wisconsin*, 483 U.S. 868, 873 (1987) (quoting *New Jersey v. T.L.O.*, 469 U.S. 325, 351 (1985) (Blackmun, J., concurring in the judgment)); see *United States v. Amerson*, 483 F.3d 73, 79 & n.6 (2d Cir. 2007); *United States v. Hook*, 471 F.3d 766, 773 (7th Cir. 2006); *United States v. Kimler*, 335 F.3d 1132, 1146 (10th Cir. 2003). The Sixth Circuit declined to adopt a test, finding the 2000 DNA Act constitutional under either standard. See *United States v. Conley*, 453 F.3d 674, 679-81 (6th

phasized that the information collected through DNA profiling is “junk,” revealing nothing more than the offender’s identity.¹⁹² Partial matching upsets each of these justifications when it makes otherwise nonincluded relatives targets of investigation.¹⁹³ Ordinary citizens possess the full, undiminished panoply of privacy rights.¹⁹⁴ Nor can relatives’ genetic information be necessary for deterring recidivism because, for partial matching to be useful, it must capture individuals who have not previously been convicted of a qualifying offense (or at least not previously been subject to compulsory DNA collection).¹⁹⁵ While partial matching generates broad possibilities for investigation, it also inherently identifies many spurious connections to offenders, exacerbating the invasion of privacy.

Proponents of partial matching contend that nothing has been seized from the relatives, and that these relatives have not been searched.¹⁹⁶ These relatives’ genetic profiles are not actually in CODIS—they are merely virtual “suspects by association.” The constitutional lines here are murky at best.¹⁹⁷ At least one court has held, and many others have implied, that it is unconstitutional to compel DNA collection from an individual not subject to state over-

Cir. 2006). Regardless of approach, all of these courts reached the same result—that such statutes are constitutional with respect to individuals who have been convicted. *See Weikert*, 504 F.3d at 2-3.

192. *See, e.g., Weikert*, 504 F.3d at 3-4 (“Profiling is performed using only so-called ‘junk DNA’—DNA that differs from one individual to the next and thus can be used for purposes of identification but which was ‘purposely selected because [it is] not associated with any known physical or medical characteristics’ and ‘do[es] not control or influence the expression of any trait.’” (alterations in original) (quoting H.R. REP. NO. 106-900(I), at 27 (2000))); *Nicholas v. Goord*, 430 F.3d 652, 670 (2d Cir. 2005) (“The junk DNA that is extracted has, at present, no known function, except to accurately and uniquely establish identity.”). In *Kincade*, the Ninth Circuit observed that it would be possible to locate a relative using the DNA of their kin, *see* 379 F.3d at 818 n.7, but also made clear that the DNA profiles were only to be used for identification, rejecting the fear that retention of samples meant they “could be mined for more private information or otherwise misused in the future,” *id.* at 837-38.

193. Murphy also discusses how partial matching can upset the rationales for database inclusion with respect to the databased person and the actual source of a crime scene sample. *See* Murphy, *supra* note 22, at 314-19.

194. *See, e.g., Friedman v. Boucher*, 568 F.3d 1119, 1130 (9th Cir. 2009) (“The warrantless, suspicionless, forcible extraction of a DNA sample from a private citizen violates the Fourth Amendment.”).

195. *See* Seringhaus, *supra* note 36, at 67-68.

196. *See* Greely et al., *supra* note 22, at 257.

197. *See* *United States v. Pool*, 621 F.3d 1213, 1221 (9th Cir. 2010) (“[I]t is not clear that familial comparisons raise a constitutional privacy issue or, if they do, whose interests are violated.”); *Boroian v. Mueller*, 616 F.3d 60, 69-70 (1st Cir. 2010) (acknowledging that, “[a]rguably, the government’s use of CODIS to discover partial matches could raise privacy concerns not raised by a traditional fingerprint database,” but declining to consider this issue); Murphy, *supra* note 22, at 330-39.

sight—an individual with no diminished expectation of privacy.¹⁹⁸ But even if this is so, it is by no means clear that such an individual has any privacy interest in the genetic information of another, even if that other's DNA can identify them both. For one, courts have generally found that DNA sampling constitutes a Fourth Amendment search because it involves a bodily intrusion, by either blood sample or cheek swab.¹⁹⁹ For another, the so-called third-party doctrine holds that an individual has no expectation of privacy in information or property held by or shared with another.²⁰⁰

But these rules do not apply neatly to partial matching so as to definitively foreclose a Fourth Amendment claim in this context. Bodily intrusion may be a well-recognized trigger for Fourth Amendment scrutiny, but such intrusion is not always required. *Skinner v. Railway Labor Executives' Ass'n*, the case on which most lower courts rely in finding that DNA sampling constitutes a Fourth Amendment search, actually held that collecting and testing urine samples—for which no intrusion was required—fell within the ambit of Fourth Amendment scrutiny.²⁰¹ Specifically, *Skinner* found that urinalysis implicated Fourth Amendment interests because “chemical analysis of urine, like that of blood, can reveal a host of private medical facts about an employee, including whether he or she is epileptic, pregnant, or diabetic.”²⁰² Thus, it is not always necessary for physical intrusion to accompany a Fourth Amendment claim. Analysis of bodily substances that may reveal private information can be trigger enough. DNA can reveal such information not only about the person from whom it was taken, but also about her close genetic relatives. Their privacy may similarly be implicated by genetic analysis, especially when that analysis makes those relatives its target.

The third-party doctrine is a trickier puzzle. The leading cases expositing the third-party doctrine emphasize that individuals have no expectation of privacy in information they voluntarily share with others.²⁰³ The key word here is

198. See *Friedman*, 568 F.3d at 1130; see also *supra* notes 191-92 and accompanying text.

199. See, e.g., *United States v. Sczubelek*, 402 F.3d 175, 182 (3d Cir. 2005) (finding that a blood draw is a Fourth Amendment search); *Padgett v. Donald*, 401 F.3d 1273, 1277 (11th Cir. 2005) (presuming, with citation to *Skinner v. Railway Labor Executives' Ass'n*, 489 U.S. 602 (1989), that taking a saliva sample is a Fourth Amendment search).

200. See, e.g., *United States v. Miller*, 425 U.S. 435, 443 (1976) (“This Court has held repeatedly that the Fourth Amendment does not prohibit the obtaining of information revealed to a third party and conveyed by him to Government authorities, even if the information is revealed on the assumption that it will be used only for a limited purpose and the confidence placed in the third party will not be betrayed.”); see also *Georgia v. Randolph*, 547 U.S. 103, 133 (2006) (Roberts, C.J., dissenting) (“Even in our most private relationships, our observable actions and possessions are private at the discretion of those around us.”).

201. 489 U.S. at 617.

202. *Id.*

203. See *Smith v. Maryland*, 442 U.S. 735, 744 (1979) (holding that installing a pen register without a warrant does not violate the Fourth Amendment because, “[w]hen he used his phone, petitioner voluntarily conveyed numerical information to the telephone company

voluntarily. The third-party doctrine can thus be viewed as a functional consent test.²⁰⁴ An individual does not, however, *voluntarily* share identifying genetic information in common with her close genetic relatives. Similarity in this genetic information is a product of biology, not consent. At best, parents might be said to consent to expose themselves to genetic identification by way of their children by choosing to procreate. Nothing similar may be said of children, who do not choose their parents, or of siblings, who have no (or very little) control over whether their parents have additional children. The third-party doctrine is thus a poor fit for partial matching. This doctrine does, however, expose fault lines in the notion of genetic privacy entirely. If an individual can be identified through the DNA of her sister, parents, or children, then can that information really be said to be private in a constitutionally meaningful sense? Perhaps the unsuitability of the third-party doctrine indicates that no one has an expectation of privacy in genetic information, rather than that we have such expectations in the DNA of others as well as our own.²⁰⁵

Fourth, partial matching may impose unique burdens on family integrity. Searches in CODIS often yield multiple partial matches, each belonging to an offender with a number of relatives, now considered possible crime suspects. While many such leads will prove false, their investigation alone may “deepen painful rifts within strained familial relationships.”²⁰⁶ In particular, the nature of partial matching effectively makes offenders into “involuntary ‘genetic informants’” of their kin, which is likely to burden the relationship between a

and ‘exposed’ that information to its equipment in the ordinary course of business.” (emphasis added); *Miller*, 425 U.S. at 442 (“All of the documents obtained, including financial statements and deposit slips, contain only information *voluntarily* conveyed to the banks and exposed to their employees in the ordinary course of business.” (emphasis added)); see also *Smith*, 442 U.S. at 743-44 (collecting cases supporting the proposition that “a person has no legitimate expectation of privacy in information he *voluntarily* turns over to third parties” (emphasis added)). Other cases in the Fourth Amendment canon also focus on voluntary sharing of space or information. See, e.g., *Randolph*, 547 U.S. at 134-35 (Roberts, C.J., dissenting) (“The common thread in our decisions upholding searches conducted pursuant to third-party consent is an understanding that a person ‘assume[s] the risk’ that those who have access to and control over his shared property might consent to a search. . . . To the extent a person wants to ensure that his possessions will be subject to a consent search only due to his *own* consent, he is free to place these items in an area over which others do *not* share access and control, be it a private room or a locked suitcase under a bed.” (alteration in original) (quoting *United States v. Matlock*, 415 U.S. 164, 171 n.7 (1974))).

204. See Orin S. Kerr, *The Case for the Third-Party Doctrine*, 107 MICH. L. REV. 561, 588-90 (2009); cf. *Randolph*, 547 U.S. at 134 (Roberts, C.J., dissenting) (describing the doctrine of third-party consent as one of assumption of risk).

205. This brief discussion merely samples the range and complexity of issues in adjudicating the constitutionality of partial matching. Additional questions arise about who might raise a constitutional challenge to partial matching (the partially matching offender or the investigated relative?) and of what type (is a litigant’s claim that investigation directed at her is the fruit of the poisonous partial match tree, or is it an alternative freestanding claim?). Suffice it to say that the constitutionality of partial matching—and the administrability of such claims—is not clear.

206. Murphy, *supra* note 22, at 319.

past offender and his otherwise nonincluded relatives.²⁰⁷ Although Colorado has acknowledged that “potential family issues” may arise through partial matching,²⁰⁸ its concern has been over issues of unknown children or misattributed paternity, rather than on intact family units.²⁰⁹ As Murphy points out, however, family strain “can occur even absent an actual match: the mere awareness by Good Sibling that Bad Sibling’s conviction now leaves her susceptible to this kind of intrusion may itself generate tension.”²¹⁰

Finally, partial matching subverts democratic accountability. As Part II revealed, partial match policies have largely been effectuated through inaccessible lab policies, and rarely through means in which the public may actively participate. This means that partial matching widens the genetic net without statutory amendment or, in most instances, public knowledge. Partial matching widens “the *size* of databases by effectively including relatives within them.”²¹¹ It widens “the *types of testing* conducted on DNA samples by undertaking additional forms of genetic typing,” such as Y-STR or mtDNA analysis.²¹² And it widens “the *scope of information* exposed by the ‘junk’ DNA the government collects” by, for example, subjecting the standard CODIS STRs to kinship analysis designed to draw out more than simple identifying information pertaining to the offender in question.²¹³ The relative lack of public knowledge about these policies and the near-total lack of public oversight in their promulgation sets the adoption of partial matching apart from previous database expansions in ways that many find troubling.

Each of the foregoing arguments opposing partial matching shares, at its core, a common thread: a fundamental objection to the implicit inclusion in law enforcement databases of otherwise nonincludable individuals through exploitation of mere “biological happenstance.”²¹⁴ One need not find these claims persuasive in order to be persuaded that these claims apply equally to fortuitous and deliberate partial matching. In both instances, every database search raises the possibility of discovering a partial match, and so every database search accomplishes implicit inclusion regardless of whether, how often, or how deliberately such matches are found. States therefore cannot rely on these arguments for treating fortuitous partial matching differently from partial matches obtained through deliberate familial searches.

207. *Id.* at 320 (quoting Haimen, *supra* note 22, at 269).

208. Colorado Familial Search Policy, *supra* note 18, at 4.

209. *See id.*

210. Murphy, *supra* note 22, at 320.

211. *Id.* at 326.

212. *Id.* at 326-27.

213. *Id.*

214. Seringhaus, *supra* note 36, at 70.

C. *Arguments Favoring a Fortuitous/Deliberate Distinction Are Insufficient*

In addition to arguments favoring or opposing partial matching generally, there are a number of possible arguments focused more narrowly on permitting fortuitous while precluding deliberate partial matching. States surveyed did not often articulate justifications for the fortuitous/deliberate distinction where adopted. Nonetheless, some possible justifications can be identified from the extant literature. This Subpart examines several contenders: intent, limited resources, the institutional role of laboratory analysts, and the near-perfect match. It ultimately finds each insufficient to justify such a distinction.

1. *“The key is intent”*²¹⁵

The FBI’s 2006 interim policy approved interstate information sharing in response to fortuitous partial matches, but did not address deliberate searches for such matches. In defending this policy, Thomas Callaghan, former CODIS Unit Chief, reported that the key was *intent*—with respect to fortuitous partial matches, the Bureau would not be “deliberately trolling the database looking for relatives.”²¹⁶

In invoking intent, Callaghan appears to imply that incorporating offenders’ relatives into the database is ethically (and perhaps legally) fraught. Indeed, Callaghan’s language in describing deliberate partial matching—“trolling the database”—is negative. Having implied that deliberate partial matching is problematic, there are at least two senses of “intent” to which Callaghan may be appealing. Upon inspection, neither is capable of supporting the fortuitous/deliberate distinction.

The first suggests that, even were we to view the implicit incorporation of offenders’ relatives into the database as wrong, we might nonetheless permit investigators to make use of partial matches when they occur as a by-product of acceptable routine database-search procedures.²¹⁷ In other words, the “merely foreseen side effect” of implicit database incorporation may be permissible, even where the intentional bringing about of such incorporation would not be.²¹⁸

215. Nakashima, *supra* note 68.

216. *Id.* (quoting Callaghan).

217. This reasoning echoes the doctrine of double effect. See Alison McIntyre, *Doctrine of Double Effect*, STAN. ENCYCLOPEDIA PHIL. (June 29, 2009), <http://plato.stanford.edu/entries/double-effect> (defining the doctrine as holding that “it is permissible to cause . . . a harm as a side effect (or ‘double effect’) of bringing about a good result even though it would not be permissible to cause such a harm as a means to bringing about the same good end”).

218. *Id.*

Yet, invoking this line of reasoning to distinguish fortuitous from deliberate partial matches is problematic. As an initial matter, differentiating between an intended result and an unintended one when both are foreseen is difficult.²¹⁹ If an individual knows that a particular effect will result from a course of conduct, and yet nonetheless undertakes that course of conduct, it is hard to say that that individual did not in some sense intend the result to come about. Nor are all unintended but foreseen effects equal. Even if, for example, a physician may give a terminally ill patient who is in pain medicines that relieve pain while also hastening death, a physician would surely not act ethically (or legally) in providing the same pain-relieving medicine to a patient suffering from kidney stones or another non-life-threatening condition. Proportionality plays a role in justifying an unintended but foreseen result of an action.²²⁰ Insofar as this is so, the quality and nature of the otherwise impermissible result matters in assessing its permissibility when that result is merely foreseen and not intended.

More importantly, however, fortuitous partial matching requires intentional acts that render this sort of reasoning about unintended effects inapplicable. Nearly all states permitting partial matching impose some conditions that must be met before a partial match is released to investigators. At least twelve states recommend or require additional genetic analysis (usually Y-STR testing) concordant with a familial relationship.²²¹ Five states require additional statistical analysis consistent with a familial relationship.²²² Indeed, the FBI's own subcommittee charged with making recommendations regarding partial matching similarly recommended additional genetic and statistical analysis prior to informing investigators of a partial match.²²³ Yet, only one state reported that it planned to automatically analyze and record Y-STR profiles for all male offenders.²²⁴

In the absence of a Y-STR database, or profiles ready-made with statistical calculations of allele frequency, additional laboratory analysis must be actively—intentionally—undertaken before partial match information can or should be released to investigators. Moreover, laboratories, or the government bodies that oversee them, must actively adopt a policy that such matches ought to be reported to investigators at all. Partial matches may arise on occasion in the

219. *See id.* § 3 (identifying criticisms of the doctrine of double effect).

220. *See id.*

221. Alabama, Arizona, California, Colorado, Connecticut, Florida, Minnesota, Missouri, Nebraska, Oklahoma, Texas, and Washington.

222. Colorado, Nebraska, New York, Texas, and Wyoming.

223. *See Staples, supra* note 131, at 33 (setting forth SWGDAM's recommendations regarding familial identification practices).

224. Oklahoma. One other state, Missouri, reported that it presently conducts routine Y-STR analysis for all male offenders, but did not say whether these profiles are then stored in a permanent database. Other states conducting Y-STR analysis, or commissioning such analysis from outside labs, reported doing so only on a case-by-case basis.

course of routine database searching, but these results are not automatically relayed to investigators. Some intervening actor—lab personnel, state CODIS administrators, state attorneys general, or others—must authorize the turning over of partial match information. The need for additional analysis and active reporting thus belies the claim that fortuitous partial matching occurs merely by happenstance. Only the first step in the process of partial matching occurs fortuitously. Accordingly, a rule premised on the permissibility of unintended but foreseen effects cannot sustain the fortuitous/deliberate distinction.

The second lens through which we may interpret Callaghan's invocation of "intent" is no more successful. On this interpretation, there are cases in which following up—intentionally—on fortuitously acquired information is morally justifiable, even though intentionally acquiring that information would not be morally justifiable. In our criminal justice system, it is generally unjustifiable, in the absence of reasonable suspicion of wrongdoing, to violate a person's privacy (and risk harming her) in order to make sure she is not engaged in wrongdoing.²²⁵ But where there is sufficient reason to suspect someone of wrongdoing, then it is justifiable to violate her privacy (and risk harming her) in order to determine whether she is, in fact, engaged in wrongdoing. On this account, deliberate partial matching is problematic because it involves intentional action seeking out offenders' kin in the absence of evidence indicating that any particular individual was involved in a crime. Fortuitous partial matching, by contrast, merely follows up on fortuitously obtained evidence indicating criminal behavior by an individual closely linked to a particular databased offender.

This reasoning fails too, however, largely for scientific reasons. A partial match arising fortuitously from a routine database search is, unfortunately, very weak evidence that any particular individual—or any individual closely linked to a particular databased offender—has engaged in wrongdoing.²²⁶ As has been emphasized, CODIS is poorly designed for identifying true familial relationships.²²⁷ Studies showing that a true sibling relationship, where present, will be at the top of partial match results about half of the time are inapposite because those studies take allelic frequency into account, while CODIS does not.²²⁸ CODIS thus cannot hope to meet even these less-than-stellar performance expectations. Except in rare instances of very high allelic overlap, partial matches

225. See *Terry v. Ohio*, 392 U.S. 1, 21-23 (1968) (requiring reasonable suspicion prior to stopping an individual briefly for questioning). Note, however, that several courts have relied on the special needs doctrine in upholding the constitutionality of DNA databases. See discussion *supra* note 191.

226. Cf. Texas Partial Match Policy, *supra* note 74, at 1 ("Despite the possibility of success, it should be understood that the processes in this policy have had very little success in practice.").

227. See *Murphy*, *supra* note 22, at 300 & n.42 (explaining that most experts agree that current CODIS software "does a poor job of identifying true leads in familial searches"); Seiringhaus, *supra* note 36, at 68-69; see also *supra* text accompanying notes 75-76.

228. See Bieber, Brenner & Lazer, *supra* note 81, at 1315; Curran & Buckleton, *supra* note 81, at 166; Reid et al., *supra* note 39, at 340-41.

uncovered through routine CODIS searches will not yield probative evidence of a familial relationship until *after* follow-up testing, such as Y-STR analysis, is completed. And it is the need for follow-up analysis that exposes this intent-based argument as false. Fortuitously discovered information does not, in fact, provide sufficient reason to suspect someone of wrongdoing. Thus, any wrong inflicted by the intentional actions of deliberate partial matching accompanies fortuitous partial matching as well.

Whatever Callaghan's desired meaning, his invocation of intent will not do the work he needs. Intent will not support the fortuitous/deliberate distinction.

2. *Partial match quality*

A cluster of possible arguments about partial matching draws attention to the limited resources of laboratories and law enforcement units. These claims examine the quality, direct costs, and opportunity costs of pursuing fortuitous as opposed to deliberate partial matches. Importantly, these claims do not require the conclusion that deliberate partial matching is any more inherently problematic than fortuitous partial matching. Instead, they build from an assertion that fortuitous matches are functionally "better" than deliberately identified ones for reasons of quality or cost.

Turning first to match quality, the argument proceeds as follows: Fortuitous partial matches are likely to be of higher average quality than deliberately discovered partial matches because fortuitous matches arise in the course of moderate- rather than low-stringency searching, and so display more common alleles and fewer allele mismatches. Given that confirming and investigating partial matches is expensive,²²⁹ focusing attention on higher quality information sources saves time and money.

At least one state appeared to adopt this view. Oregon reported that, although it will relay information derived from fortuitous partial matches, the lab does not engage in "aggressive" practices like deliberate partial matching and is not inclined to adopt such a practice. The reason, at least in part, is that the lab takes pride in its ability to report high quality investigative information. The implication here is that fortuitous partial matches can meet that high quality standard, while deliberate partial match practices would disturb it.

This approach might merit some weight if there were convincing evidence that fortuitous partial matches are, in fact, more likely to indicate true familial relationships than partial matches obtained through deliberate database searches. But such evidence does not appear to be forthcoming. Available research does indicate that deliberate partial matching will correctly identify a true sibling relationship as the first partial match hit only about half of the time,

229. See Greely et al., *supra* note 22, at 253 (observing that the cost of following up on leads generated by partial matching "may be extensive, involving interviewing many offenders and then finding and interviewing any of their relatives who could be possible suspects").

though such a match has a much greater chance of appearing among the top one hundred partial matches.²³⁰ Again, however, these data do not reveal the likelihood that a fortuitously obtained partial match will accurately identify a familial relationship between a known offender and an unknown perpetrator. And again, CODIS is not well designed to identify true familial relationships.²³¹ Accordingly, it is by no means clear that any method of partial matching that initially makes use of standard CODIS software will yield high quality candidates for investigation.

The implementation of software specially designed to seek out partial matches in California, Colorado, and Texas, conversely, suggests that deliberate partial matching may in fact yield higher quality data than fortuitous partial matching. California's and Colorado's software for deliberately identifying partial matches improve upon the standard CODIS software by accounting for allelic frequency within and among populations.²³² This is not to say that only deliberate partial matches should trigger further analysis; rather, it suggests that fortuitous partial matches should perhaps be subjected to additional deliberate searching using software specialized for this purpose. These new software programs indicate that partial match information is unlikely to be of significantly higher quality when it results from routine CODIS searching than when it results from deliberate partial matching; indeed, the opposite is likely true.

3. *The direct costs of deliberate partial matching*

Another resource-focused basis for distinguishing fortuitous from deliberate partial matching looks to the direct costs of searching for and following up on partial matches. Greely and colleagues have noted:

The cost of following-up the leads generated by family forensic DNA may be extensive, involving interviewing many offenders and then finding and interviewing any of their relatives who could be possible suspects. Sometimes, the computerized search will reveal hundreds of matches at that level. Sometimes, it might reveal only fifty such matches. Sometimes it might reveal a handful—or only one. Certainly, police are less likely to use these leads if the genotype is common and there are hundreds of partial matches, and more likely to use them if the genotype is rare and there are only a few leads.²³³

230. See Bieber, Brenner & Lazer, *supra* note 81, at 1315; Curran & Buckleton, *supra* note 81, at 166; Reid et al., *supra* note 39, at 341. Again, because these reports involved searches accounting for allelic frequency (kinship indices), which standard CODIS software does not take into account, they are not good indicators of the likely true-positive rate for partial matches uncovered through a low-stringency search using standard CODIS software.

231. See *supra* text accompanying notes 75-76.

232. See *California Familial Search Procedure*, *supra* note 6, at 28; Colorado Familial Search Policy, *supra* note 18, at 1. Texas has also implemented special software for deliberate partial matching. See Texas Partial Match Policy, *supra* note 74, at 1. Texas's partial match policy, however, does not include information about how this software operates.

233. Greely et al., *supra* note 22, at 253 (emphasis omitted).

While Greely and colleagues were making the case for deliberate partial matching, their observations can be interposed as an argument favoring a policy of permitting fortuitous but not deliberate partial matching. Fortuitous partial matching, the argument would go, yields fewer partial match hits, and so the costs of following up on these matches are smaller overall.

In assessing the relative costs of fortuitous and deliberate partial matching, however, it is important to separate various intervals in the process of identifying and investigating a partial match candidate. Often, the costs for both fortuitous and deliberate partial matching will be roughly equivalent. The cost of initially identifying partial matches, for instance, will not differ dramatically. Although deliberate partial matching requires an additional database search, “[t]he cost of looking to see how many partial matches exist for a given crime scene sample should be quite small—a tiny amount of computer processor time and a moment’s glance at a computer screen.”²³⁴ Both offender and crime scene samples must be genotyped and uploaded to the relevant database for exact match searching; thus the costs of genotyping and uploading are the same for any method of partial matching that examines the CODIS loci.

Moreover, contrary to the reasoning of Greely and colleagues above, the costs to investigators of following up on partial matches are unlikely to be substantially greater for deliberate, as opposed to fortuitous, partial matching. This is because the number of partial matches reported to investigators is likely to be quite small, given the conditions that most states have placed on reporting such matches. As explained above, seventeen of the nineteen states engaged in partial matching have imposed some constraint on the reporting of such matches to investigators.²³⁵ SWGDAM has recognized additional genetic and statistical analysis as critical steps to evaluating partial matches prior to informing investigators about such matches.²³⁶ With these pre-reporting conditions in place, handfuls (or more) of reportable partial matches will rarely occur for a single case.²³⁷ Undertaking partial matching in a responsible fashion thus limits the number of partial matches that will require expensive police follow up, regard-

234. *Id.* The cost of specialized software for deliberate partial matching may be considerable, but Colorado has already made its expertise available to other states. See Michael Roberts, *Denver DA Mitch Morrissey Wants to Make DNA Investigations Family Affairs*, DENV. WESTWORD BLOGS (Nov. 17, 2009), http://blogs.westword.com/latestword/2009/11/denver_da_mitch_morrissey_want.php (discussing Mitch Morrissey’s plans to travel to other states to assist in partial matching efforts).

235. Alabama, Arizona, California, Colorado, Connecticut, Florida, Minnesota, Missouri, Montana, Nebraska, New York, North Carolina, Oklahoma, Oregon, Texas, Washington, and Wyoming. Louisiana and South Carolina are the odd states out.

236. See Staples, *supra* note 131, at 33.

237. See Dolan, *supra* note 4 (describing California’s partial matching process in the Grim Sleeper case, which only resulted in one reportable partial match); Dolan & Felch, *supra* note 62 (noting that the three partial matches that first prompted Mitch Morrissey’s campaign for partial matching did not pan out).

less of whether partial matches are initially identified fortuitously or deliberately.

Costs might well differ, nonetheless, where pre-reporting analysis is considered. Fortuitous partial matches only “occur unexpectedly and infrequently,” and so are “unlikely to produce lots of investigative leads.”²³⁸ Deliberate partial matching, conversely, may generate “a list of hundreds of ‘potential relatives’, none of whom, on closer inspection, turn out to be genetically related to the perpetrator.”²³⁹ Trying to generate “lots of investigative leads” may thus be a double-edged sword. Y-STR analysis, for instance, must be completed for both crime scene samples and partially matching offender profiles in order to confirm whether both samples arise from the same male line. The cost of conducting Y-STR typing for hundreds of potential familial leads would be extensive. Unlike CODIS genotyping, most states have not made Y-STR analysis standard, meaning that more partial matches identified requires more laboratory money (and often time) expended to conduct follow-up analysis.²⁴⁰

These costs are not insignificant. Nearly all state and federal labs have been laboring under immense backlogs since their inception, and these backlogs show no sign of dissipating as jurisdictions expand the scope of individuals from whom DNA sampling is authorized.²⁴¹ At least twenty-one states and the federal government, for example, now authorize arrestee sampling.²⁴² News reports indicate that, due to backlogs, DNA analysis can take months, or even years, to complete.²⁴³ The addition of further genetic analysis to verify partial matches thus threatens to exacerbate an already serious and growing crisis of limited resources, especially where deliberate partial match searches yield hundreds of possible familial leads.

Although these pre-reporting follow-up costs are potentially significant, California, Colorado, and Texas indicate that these costs are not uncontrollable. Here again, the specialized software that these states have implemented proves critical. The new software enables more precise initial identification of poten-

238. Rosen, *supra* note 7.

239. Bieber & Lazer, *supra* note 178, at 20.

240. Only Missouri and Oklahoma reported that they presently conduct or plan to conduct routine Y-STR analysis for all male offenders. Only Oklahoma explicitly stated that it intends to store these profiles in a permanent database. Other states reported obtaining Y-STR data only on a case-by-case basis.

241. See generally NAT'L INST. OF JUSTICE, MAKING SENSE OF DNA BACKLOGS—MYTHS VS. REALITY (2010), available at <http://www.ncjrs.gov/pdffiles1/nij/230183.pdf> (detailing the extent of backlogs, their causes, and the federal government's efforts at backlog reduction).

242. See 28 C.F.R. § 28.12(b) (2010) (requiring DNA sampling from federal arrestees and “non-United States persons who are detained under the authority of the United States”); *State Laws on DNA Data Banks*, *supra* note 64.

243. See, e.g., Solomon Moore, *Progress Is Minimal in Clearing DNA Cases*, N.Y. TIMES, Oct. 25, 2008, at A9.

tial familial relationships.²⁴⁴ As the initial search mechanism improves, fewer false positives should result, and thus fewer partial matches should trigger additional confirmatory analysis. California's partial match policy further specifies that where deliberate partial matching is undertaken, "[t]he modified CODIS search conducted by DOJ must result in a manageable number of candidates."²⁴⁵ Texas's policy "prohibits the laboratory from testing all candidates," noting that some deliberate or fortuitous partial-match searches bring up "several thousand" names.²⁴⁶ These constraints aim to minimize the number of partial matches triggering additional analysis. A "list of hundreds of potential relatives" may thus be avoided, or at least minimized, through targeting the initial search software and the threshold values (in both number and quality) of partial matches. Accordingly, concern about costs should not cause states to favor fortuitous partial matching while categorically precluding deliberate partial matching.

4. *The opportunity costs of partial matching*

The last resource-based possibility for distinguishing fortuitous from deliberate partial matching focuses attention on the "accuracy" of partial matches, examining the opportunity costs of pursuing these matches. This is the last of Murphy's objections to partial matching generally, discussed here because this concern threatens to scale differently for fortuitous as opposed to deliberate partial matching. "Accuracy" in this context describes the risk that partial matching may "cause investigators to rely on genetic leads at the expense of more traditional lines of investigation—essentially a fear of overreliance."²⁴⁷ Existing experience with partial matching already indicates familial leads will often be unsuccessful.²⁴⁸ Even assuming that partial matches, "as a basic scientific and statistical matter, point directly enough toward potential perpetrators to be useful," they will also "generate a limited number of false leads."²⁴⁹ Yet the allure of partial matching may entice investigative efforts while other critical investigative information is lost in the interim.

Genetic dependence may also skew investigations where a genetic source is found because "the genetic evidence may so dominate and shape the course

244. See *California Familial Search Procedure*, *supra* note 6, at 29; Colorado Familial Search Policy, *supra* note 18, at 1; Texas Partial Match Policy, *supra* note 74, at 1.

245. California Partial Match Policy, *supra* note 5, at 2.

246. Texas Partial Match Policy, *supra* note 74, at 2.

247. Murphy, *supra* note 22, at 309.

248. See, e.g., Dolan & Felch, *supra* note 62 (noting that the three partial matches that first prompted Mitch Morrissey's campaign for partial matching did not pan out). *But see* Dolan, *supra* note 4 (describing California's successful use of partial matching in the Grim Sleeper case).

249. Murphy, *supra* note 22, at 304.

of any subsequent investigation that it inevitably taints the results.”²⁵⁰ Even where a genetic lead is available, other investigative methods are necessary for corroborating or disproving the guilt of the genetic source. Yet, as one officer has remarked, “[t]here tends to be a reliance on forensic evidence in terms of once you have it, other avenues aren’t followed up.”²⁵¹

These dangers are present in all cases involving possible DNA evidence, but partial matching—particularly deliberate partial matching—exacerbates them. Fortuitous partial matching may occasionally yield familial leads. Deliberate partial matching, by contrast, radically expands the range of cases in which genetic evidence may provide investigative leads—Bieber and colleagues estimate a forty percent increase in the cold-hit rate²⁵²—and thus expands the range of cases in which genetic evidence may skew investigations. Moreover, partial matching provides less precise and informative leads than exact database matches. Murphy likens partial matching to “an occasionally reliable informant who spits out several names and says one of them has a brother who maybe did it.”²⁵³ The benefit of following up on partial match leads is potentially smaller, and, at the expense of other investigative methods, the costs are likely greater. And once again, these costs will be greater for deliberate partial matching than for fortuitous, because law enforcement officers will obtain partial match leads from forensics personnel more frequently. More investigations making use of partial match information, the thinking goes, means more investigations skewed.

However, relying on claims about accuracy and opportunity cost to distinguish fortuitous from deliberate partial matches is unsuccessful. If those making policy governing partial matching truly believe that partial match information skews investigations in negative ways, they ought to reject partial matching whether it is fortuitous or deliberate. Distinguishing between methods of discovering partial matches in order to address accuracy concerns is illogical. It at once appears to recognize that partial matches harm investigatory and truth-finding processes while also permitting that harm to come about in some instances. Yet, there is nothing inherent in fortuitous partial matches that make them less likely to engender genetic dependence. Partial match information will or will not skew investigative efforts in an individual case, regardless of whether it results from fortuitous or deliberate means. As described above, there is no sound basis for believing that fortuitous partial matches are likely to be of higher quality than deliberate ones.²⁵⁴ A fortuitous/deliberate distinction in this context is arbitrary: it permits fortuitous partial matches only because they are easier to come by, a feature that reflects nothing about accuracy.

250. *Id.* at 309.

251. McCartney, *supra* note 175, at 185.

252. Bieber, Brenner & Lazer, *supra* note 81, at 1316.

253. Murphy, *supra* note 22, at 313.

254. *See supra* Part III.C.2.

Moreover, if partial matching is to be pursued, there are more principled lines to be drawn in response to concerns about accuracy than the one between fortuitous and deliberate partial matches. Rule makers should focus on identifying those cases that “reap the greatest social benefit in terms of need and likely effectiveness.”²⁵⁵ For instance, in response to concerns about skewed investigations, states might restrict partial matching to those cases in which other investigative leads have been exhausted. To date, this kind of rule has not been widely adopted. Only California, Nebraska, and Texas have implemented such a rule.²⁵⁶ Colorado purports to employ a similar restriction in instances where deliberate partial matching is undertaken at the request of law enforcement, but its implementation of “routine familial search[es]” suggests that such requests will be largely unnecessary.²⁵⁷ Other state policies make no mention of exhaustion of other leads prior to turning to partial matches. Yet, making partial matching a matter of last resort would minimize the risks of ignoring other investigative opportunities in favor of genetic leads.

Other policy choices would boost the “likely effectiveness” of those partial matches that are released to investigators. States have already adopted some of these quite broadly, including conditions requiring or recommending additional genetic analysis,²⁵⁸ or requiring that the crime scene sample be single source or fully deduced from mixture.²⁵⁹ The use of specialized partial matching software in California, Colorado, and Texas is a further advance designed to minimize, though not eliminate, the range of false positives.

5. *Institutional role*

Another attempt to justify the fortuitous/deliberate distinction draws attention to the lab analysts responsible for the initial handling of search results. When a partial match results fortuitously, the lab analyst in charge of that crime scene sample will be aware of it, regardless of whether she reports that match to an investigator or others in the lab. Regardless of a state’s approach to deliberate partial matching, requiring lab personnel to keep fortuitous partial match information secret may interfere with the conscientious reporting of results that such personnel provide.²⁶⁰ In other words, we should not require lab personnel to sit on potentially probative information, regardless of whether we go the extra step to seek out that information in the first instance.

255. Murphy, *supra* note 22, at 342.

256. See California Partial Match Policy, *supra* note 5, at 1-2; *Nebraska Partial Match Policy*, *supra* note 103, at 1; Texas Partial Match Policy, *supra* note 74, at 3-4.

257. Colorado Familial Search Policy, *supra* note 18, at 1.

258. Adopted in at least twelve states: Alabama, Arizona, California, Colorado, Connecticut, Florida, Minnesota, Missouri, Nebraska, Oklahoma, Texas, and Washington.

259. Adopted in nine states: California, Colorado, Florida, Nebraska, New York, Oregon, Texas, Washington, and Wyoming.

260. See Ram, *supra* note 90.

This reasoning fails for two reasons. First, our sympathies for the awkward institutional role of laboratory analysts are insufficient, standing alone, to justify a distinction between fortuitous and deliberate partial matching. As discussed above, most forensic genetic analysis is conducted in government-run labs or private labs “primarily beholden to government contracts and hostile to defense interests.”²⁶¹ This close link between labs conducting forensic analysis and law enforcement can negatively influence the rigor of forensic findings, even for a sophisticated forensic science like DNA typing. Interpreting the results of genetic analysis routinely requires the exercise of professional judgment.²⁶² “When faced with an ambiguous situation, where the call could go either way, crime lab analysts frequently slant their interpretations in ways that support prosecution theories.”²⁶³ At least part of the reason for an interpretative slant likely lies in the fact that the analyst frequently works under the aegis of the state’s law enforcement arm.

The foregoing suggests that it may well be inappropriate for lab personnel to be so closely tied to investigators and prosecutors. Yet, permitting analysts to report fortuitous partial matches merely because forbidding it would induce analyst awkwardness would reinforce this troublesome institutional arrangement. Embracing fortuitous partial matching on this basis would communicate to lab analysts that generating matches is paramount, even where the basis for identification is imprecise at best. States should reject such a problematic approach.

Second, this argument about institutional role treats fortuitous partial matches not only as data points that “just happen” during routine database searches, but also as information that can simply be reported to investigators. As discussed earlier, additional genetic or other analysis is very often required,²⁶⁴ and it is recommended by the FBI’s advisory committee.²⁶⁵ Verifying a possible familial lead generally requires steps not necessary where an exact match candidate is identified. Extra steps are taken wherever partial matches are in play, whether fortuitous or deliberate. This argument thus collapses back into an argument about the relevance of intent with regard to identifying partial matches.²⁶⁶

261. Murphy, *supra* note 157, at 754.

262. See Murphy, *supra* note 31, at 501-08.

263. Paul C. Giannelli, *Ake v. Oklahoma: The Right to Expert Assistance in a Post-Daubert, Post-DNA World*, 89 CORNELL L. REV. 1305, 1396 (2004).

264. See *supra* note 129 and accompanying text (identifying twelve states requiring additional genetic analysis).

265. See Staples, *supra* note 131, at 33.

266. See *supra* Part III.C.1.

6. *The near-perfect match*

Even if we accept that many partial matches are not highly probative of a relative's involvement, there are some circumstances we can imagine in which it would be extremely difficult not to act on a partial match. For example, suppose a database search reveals an offender profile matching a crime scene sample on twenty-four or twenty-five of the twenty-six possible CODIS alleles. Such a match would be so close that it would be highly unlikely to come from someone other than a very near genetic relative of the partially matching offender. In this instance, concerns about the number of false positives, which are scientifically valid with respect to thirteen-allele matches, would appear misplaced. Were such a match to turn up, would it be realistic, much less good policy, to demand that a lab analyst do nothing in response?

This near-perfect match scenario is compelling on the surface, but its imagined benefits are almost certainly outweighed by its certain costs. Consider first that such matches are extremely unlikely to occur. Parents and children share on average about sixteen alleles;²⁶⁷ siblings on average share about seventeen alleles.²⁶⁸ The frequency of parent-child or sibling pairs sharing twenty-four or twenty-five alleles will be exceedingly small. Indeed, at least one state emphasized that a single allele mismatch would not necessarily disqualify the databased offender as the source of the near-match forensic sample.²⁶⁹ It is more likely that such a near-perfect match results from an exact match obfuscated by an error in processing the relevant samples.

Weighed against this vanishingly small number of possible cases are the various costs and burdens set forth in the preceding Parts. If arguments about privacy, discrimination, or family integrity are at all persuasive, they remain persuasive as a general matter and ought not be breached for the sake of a policy that will virtually never yield its intended benefits. And if these arguments are not persuasive, then there is no sense in only responding to near-perfect matches when they arise fortuitously. There is nothing in the nature of a near-perfect match that requires it to arise fortuitously.

Moreover, this form of narrow partial matching policy still imposes perverse incentives. For lab analysts, the pressure to define a near-perfect match more broadly will be intense. If a match at twenty-four or twenty-five alleles is worth pursuing, why not a match at twenty-three? Such a match might also be sufficiently rare so as to be probative. And if a match at twenty-three, why not also a match at twenty-two? For lawmakers, the benefits of partial matching are still possible while the costs of confronting difficult questions about the ethics of partial matching generally can still be avoided. Indeed, this narrower policy opens the door to future expansions so quietly that it is likely to go utterly

267. See Seringhaus, *supra* note 36, at 14 n.35.

268. See Paoletti et al., *supra* note 38, at 3.

269. Utah.

without notice. Should there be doubt about whether such a policy would be expanded, one need only look at the history of forensic DNA databasing to know that when a little of something seems like a good idea, a whole lot more seems sure to follow.²⁷⁰ Thus, even a fortuitous partial matching policy so limited is not free of considerable burdens—burdens that are very likely to outweigh the benefits of pursuing those few instances in which we can know with certainty and without any further testing that a partial match is probative.

Finally, a point about reality: even if we conclude that following up on partial matches only makes sense when they are truly near-perfect, most state policies demand something considerably less than this. Although at least eleven states require some minimum number of shared alleles in their partial matching policies,²⁷¹ that minimum number is often half of the twenty-six possible alleles and rarely more than seventeen.²⁷² Yet, most of these states justify their policies, at least in part, on the fortuitous/deliberate distinction. In view of the actual content of these policies, an argument based on near-perfect matches, even if viable, will not suffice to justify the current policy landscape.

CONCLUSION

Very little is publicly known about state practices regarding partial matching, whether fortuitously or deliberately discovered. Policymaking in this arena has largely taken place behind closed laboratory doors, with little or no public knowledge. But public interest and concern about partial matching is growing rapidly, thanks in part to California's apparent success in identifying the Grim Sleeper killer.

This Article has sought to shine some sunlight in these shadows. In the most complete survey of its kind, this Article reports that at least nineteen states have already released partial match information to investigators or have a policy in place for doing so. Four of these not only make use of partial matches that "just happen" to arise in the course of routine database searches, but also deliberately search for such matches. Nearly all of the remaining fifteen draw a clear line between fortuitous and deliberate partial matches.

But this line creates a distinction without a difference. All of the reasons for favoring or opposing one form of partial matching apply equally to the other. Arguments attempting to justify the fortuitous/deliberate distinction are si-

270. See *supra* notes 63-69 and accompanying text.

271. Arizona, California, Colorado, Connecticut, Florida, Nebraska, North Carolina, Oklahoma, Oregon, Texas, and Washington.

272. See, e.g., Florida Partial Match Policy, *supra* note 97 (requiring seventeen common alleles where the forensic profile is complete, and as few as fourteen shared alleles where the forensic profile is incomplete); *Nebraska Partial Match Policy*, *supra* note 103, at 1 (requiring "at least one allele in common at a majority of the CODIS core loci"); Texas Partial Match Policy, *supra* note 74, at 1-2 (requiring at least thirteen alleles in common—one allele in common at each locus).

milarly unavailing. Perhaps most damaging, the fortuitous/deliberate distinction itself yields perverse incentives for both lab analysts and policymakers. Where this distinction is in play, laboratory personnel are likely to define what constitutes a “routine” database search ever more broadly in an attempt to uncover more potentially useful partial matches. Policymakers, meanwhile, are likely to employ this distinction in order to make policy quietly, avoiding public controversy while reaping some of the potential rewards of partial matching.

Policymakers should reject this false distinction, politically useful though it may be. States ought to treat the two forms of partial matching similarly—either embracing or rejecting both. The reason is simple: public oversight matters. The distinction between fortuitous and deliberate partial matching obscures what partial matching does—it provides genetically based investigative leads about possible perpetrators, but at the same time makes numerous innocent individuals potential investigatory targets simply by virtue of their genetic relationship with a past offender or arrestee. This is not the ordinary course of genetic identification or the traditional use of DNA databases. If we are to accept such a change, we ought to do so forthrightly and transparently. Hiding this fact behind the fortuitous/deliberate distinction disserves the public.

APPENDIX A

Fifty States, Many Policies: Which States Permit Partial Matching? And Which Policies Are Written?

<i>State</i>	<i>Allows/Prohibits</i>	<i>Written Policy?</i>	<i>Source</i>
Alabama	Allows fortuitous	Yes	Telephone Interview with Ala. Dep't of Forensic Sci. (Aug. 13, 2009)
Alaska	Allows none	Yes	Telephone Interview with Alaska Dep't of Pub. Safety (Aug. 5, 2009)
Arizona	Allows fortuitous	Yes	Telephone Interview with Ariz. Dep't of Pub. Safety (Sept. 20, 2010)
Arkansas	Unknown	No	Telephone Interview with Ark. State Crime Lab. (July 8, 2009)
California	Allows both fortuitous and deliberate	Yes	Memorandum from Edmund G. Brown Jr., Att'y Gen., to All Cal. Law Enforcement Agencies and Dist. Att'ys Offices, DNA Partial Match (Crime Scene DNA Profile to Offender) Policy (2008), available at http://ag.ca.gov/cms_attachments/press/pdfs/n1548_08-bfs-01.pdf
Colorado	Allows both fortuitous and deliberate	Yes	Colo. Bureau of Investigation, DNA Familial Search Policy (Oct. 22, 2009), available at http://www.denverda.org/DNA_Documents/Familial_DNA/CBI%20DNA%20Familial%20Search%20Policy%20Oct%202009%20-%20Signed.pdf
Connecticut	Allows fortuitous	Yes	Telephone Interview with Div. of Sci. Servs., Conn. Dep't of Pub. Safety (Aug. 5, 2010)
Delaware	Allows none	No	Telephone Interview with Office of the Chief Med. Exam'r, Del. Health & Soc. Servs. (Sept. 20, 2010)
District of Columbia	Prohibits deliberate	Yes	D.C. CODE § 22-4151 (LexisNexis 2010)
Florida	Allows fortuitous	Yes	E-mail from Fla. Dep't of Law Enforcement to author (July 15, 2009) (on file with author)
Georgia	Allows none	Yes	Telephone Interview with Div. of Forensic Scis., Ga. Bureau of Investigation (Aug. 10, 2009)
Hawaii	Declined to participate		Telephone interview with Haw. State Crime Lab. (Sept. 20, 2010)
Idaho	Declined to participate		Telephone Interview with Bureau of Forensic Servs., Idaho State Police (Aug. 5, 2009)
Illinois	Policy in progress	Policy in progress	Telephone Interview with Forensic Scis. Command, Ill. State Police (Oct. 8, 2010); E-mail from Forensic Scis. Command, Ill. State Police, to author (July 23, 2009) (on file with author)
Indiana	Prohibits deliberate	No	Telephone Interview with Lab. Div., Ind. State Police (July 20, 2009)
Iowa	Allows none	No	Telephone Interview with Criminalistics Lab., Iowa Dep't of Pub. Safety (July 2, 2010)
Kansas	Declined to participate		Telephone Interview with Forensic Lab. Servs., Kan. Bureau of Investigation (July 20, 2009)
Kentucky	Allows none	No	Telephone Interview with Ky. State Police Forensic Lab. (July 2, 2009)
Louisiana	Allows fortuitous	No	Telephone Interview with La. State Police Crime Lab. (Aug. 17, 2009)
Maine	Allows none	Yes	Telephone Interview with Forensic Biology Section, Me. State Police (Aug. 13, 2009)

Maryland	Allows none	Yes	MD. CODE ANN., PUB. SAFETY § 2-506(d) (LexisNexis 2010); Telephone Interview with Forensic Scis. Div., Md. State Police (Nov. 1, 2010)
Massachusetts	Allows none	No	E-mail from Mass. State Police Forensic & Tech. Ctr. to author (July 17, 2009) (on file with author)
Michigan	Allows none	Yes	Telephone Interview with Forensic Sci. Div., Mich. State Police (Aug. 6, 2009)
Minnesota	Allows fortuitous	Yes	Telephone Interview with Forensic Sci. Serv., Minn. Dep't of Pub. Safety (Aug. 4, 2009)
Mississippi	Allows none	No	E-mails from Miss. Crime Lab. to author (Oct. 11, 2010) (on file with author)
Missouri	Allows fortuitous	Yes	Telephone Interview with Mo. State Highway Patrol Crime Lab. (Aug. 4, 2009)
Montana	Allows fortuitous	No	E-mails from Forensic Sci. Div. Lab., Mont. Dep't of Justice, to author (Aug. 6, 2009) (on file with author)
Nebraska	Allows both fortuitous and deliberate	Yes	NSP CRIME LAB., <i>Release of Information to Law Enforcement Agencies in the Event of a "Partial Benchwork Match,"</i> in DNA DATABANK PROCEDURES MANUAL (2008) (on file with author); Telephone Interview with Neb. State Police Crime Lab. (Aug. 10, 2009)
Nevada	Allows none	Unknown	Telephone Interview with Nev. Dep't of Pub. Safety (Aug. 5, 2009)
New Hampshire	Allows none	No	Telephone Interview with State Police Forensic Lab., N.H. Dep't of Safety (July 2, 2010)
New Jersey	No response		
New Mexico	Allows none	No	Telephone Interview with DNA Identification Sys. Oversight Comm. (Aug. 13, 2009)
New York	Allows fortuitous	Yes	N.Y. COMP. CODES R. & REGS. tit. 9, §§ 6192.1, .3 (2010)
North Carolina	Allows fortuitous	No	Telephone Interview with DNA Unit, N.C. State Bureau of Investigation (Aug. 4, 2009)
North Dakota	Policy in progress	Policy in progress	Telephone Interview with N.D. Bureau of Criminal Investigation (Oct. 14, 2010)
Ohio	Prohibits deliberate	Unknown	Telephone Interview with Ohio Bureau of Criminal Identification and Investigation (Aug. 4, 2009)
Oklahoma	Allows fortuitous	Yes	Telephone Interview with Okla. State Bureau of Investigation (Aug. 14, 2009)
Oregon	Allows fortuitous	Yes	E-mail from Portland Forensic Lab. to author (Aug. 14, 2009) (on file with author)
Pennsylvania	Unknown	No	Telephone Interview with Bureau of Forensic Servs., Pa. State Police (Aug. 17, 2009)
Rhode Island	Allows none	No	Telephone Interview with Forensic Scis. Lab., R.I. Dep't of Health (Aug. 5, 2009)
South Carolina	Allows fortuitous	No	E-mails from Database Unit, S.C. Law Enforcement Div., to author (Aug. 6, 2009) (on file with author)
South Dakota	Allows none	No	Telephone Interview with S.D. Forensic Lab., Div. of Criminal Investigation (Oct. 8, 2010)
Tennessee	Allows none	No	Telephone Interview with Forensic Servs. Div., Tenn. Bureau of Investigation (Aug. 4, 2009)
Texas	Allows both fortuitous and deliberate	Yes	Tex. Dep't of Pub. Safety, Standard Operating Procedures: Partial Matches and Familial Searches (May 25, 2010) (on file with author); Tex. Dep't of Pub. Safety, Standard Operating Procedures: Searches (May 25, 2010) (on file with author)

Utah	Allows none	No	Telephone Interview with Forensic Biology Div., Utah Bureau of Forensic Servs. (Aug. 4, 2009)
Vermont	Allows none	Unknown	E-mail from Forensics Lab., Vt. Dep't of Pub. Safety, to author (Oct. 27, 2009) (on file with author); Telephone Interview with Forensics Lab., Vt. Dep't of Pub. Safety (Aug. 4, 2009)
Virginia	Policy in progress	Policy in progress	E-mail from Va. Dep't of Forensic Sci. to author (Jan. 7, 2011) (on file with author); E-mail from Va. Dep't of Forensic Sci. to author (Oct. 21, 2010) (on file with author)
Washington	Allows fortuitous	Yes	E-mail from Forensic Lab. Servs., Wash. State Police, to author (Aug. 13, 2009) (on file with author)
West Virginia	Policy in progress	Policy in progress	Telephone Interview with W.V. State Police (Aug. 4, 2009)
Wisconsin	Prohibits deliberate	Unknown	Telephone Interview with Wis. Dep't of Justice (Aug. 17, 2009)
Wyoming	Allows fortuitous	Yes	WYO. STATE CRIME LAB., CODIS TECHNICAL MANUAL §§ 11.1-.2 (2d ed. 2009) (on file with author)

APPENDIX B

Policies Permitting Partial Matching: Are They Written? What Do They Permit? And What Do They Require?

State	Conditions for Sample and Match Quality				Conditions for Investigation							
	Written	Permits Deliberate Partial Matching	Single-Source Profiles	Complete Forensic Profile	Minimum Number of Shared Alleles	Additional Genetic Testing (Y-STR, mtDNA)	Additional Statistical Analysis	Exhaustion of Other Leads	Commitment to Pursue Lead	Open Case Is Serious Crime (e.g., Crime of Violence)	Legal or Political Approval for Release	Additional Scientific Approval for Release
California	Yes	Yes	X		X	X		X	X	X*	X	
Colorado	Yes	Yes	X**		X	X		X*	X	X*		X
Nebraska	Yes	Yes	X		X	X		X	X	X		X
Texas	Yes	Yes	X**	X	X	X		X	X	X		X
Alabama	Yes	No			X							
Arizona	Yes	No			X							X
Connecticut	Yes	No			X							
Florida	Yes	No	X		X			X				
Minnesota	Yes	No			X							
Missouri	Yes	No			X							
New York	Yes	No	X					X	X			
Oklahoma	Yes	No				X			X			
Oregon	Yes	No	X**	X	X							X
Washington	Yes	No	X		X						X	
Wyoming	Yes	No	X**									X
Louisiana	No	No					X					
Montana	No	No									X	
N. Carolina	No	No			X							
S. Carolina	No	No										

Note: *Condition for deliberate searches only. **Single-source profile or profile fully deduced from mixture.