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The Crime Lab in the Age of the Genetic Panopticon

Brandon L. Garrett
University of Virginia School of Law

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THE CRIME LAB IN THE AGE OF THE GENETIC PANOPTICON

*Brandon L. Garrett**

UNFAIR: THE NEW SCIENCE OF CRIMINAL INJUSTICE. By *Adam Benforado*. New York: Crown Publishers. 2015. Pp. xx, 286. $26.

INSIDE THE CELL: THE DARK SIDE OF FORENSIC DNA. By *Erin E. Murphy*. New York: Nation Books. 2015. Pp. xii, 312. $27.99.

COPS IN LAB COATS: CURBING WRONGFUL CONVICTIONS THROUGH INDEPENDENT FORENSIC LABORATORIES. By *Sandra Guerra Thompson*. Durham, North Carolina: Carolina Academic Press. 2015. Pp. xvii, 236. $37.

INTRODUCTION

"Scientific evidence really nails this man to the wall," the Harris County, Texas prosecutor told the jurors in closing statements.[1] In February 1987, two men abducted and raped a fourteen-year-old girl in Houston, Texas (Thompson, p. 3). The victim initially identified two brothers and a man named Isidro Yanez, but after several suggestive lineup procedures were used, she instead identified George Rodriguez (Thompson, pp. 5–7). At trial, George Rodriguez claimed he was innocent and that he had been working a factory the day of the crime. The prosecutor emphasized, however, that the blood type of swabs taken from the victim showed that Rodriguez did commit the crime, that a hair from the crime scene matched him, and that the person the defense sought to inculpate, Yanez, "beyond a doubt . . . could not have committed the offense."[2] Rodriguez was convicted of aggravated kidnapping and aggravated sexual assault and sentenced to sixty years in prison (Thompson, p. 14).

But seventeen years later, the same hair was tested again, this time using DNA analysis instead of visual matching (Thompson, p. 17). The technology had changed, but so had the Houston police crime laboratory, which was in the midst of a crisis that would ultimately lead to the entire crime lab being shut down and recreated (Thompson, p. 222). The downfall and subsequent

* Justice Thurgood Marshall Distinguished Professor of Law, University of Virginia School of Law. I thank Allison Thornton for invaluable research assistance. I also thank the Center for Statistics and Applications in Forensic Evidence (CSAFE) and the National Institute for Standards and Technology (NIST) for its research support.

1. Adam Liptak & Ralph Blumenthal, *New Doubt Cast on Testing in Houston Police Crime Lab*, N.Y. TIMES, Aug. 5, 2004, at A19.

2. *Id.*

resurrection of the Houston crime lab mirrors the larger story of the ups and downs of the American crime lab, an institutional newcomer to the law enforcement scene.

Because millions of viewers watch media depictions of crime labs in shows like *CSI: Crime Scene Investigation* and *Crime Scene* and *Bones*, judges have considered instructing jurors on the so-called CSI-effect.[3] But the impact of the modern crime lab on criminal justice is far more complex than what is shown on television. The crime lab has permitted a stunning growth in the use of forensic evidence in criminal cases, but it has also brought with it new challenges, scandals, and concerns (Thompson, pp. 150–61). These range from poor quality control (Thompson, p. 44), backlogs in processing material (Thompson, pp. 46–49), privacy breaches, to outright fraud and misuses of the science (Thompson, pp. 39–43). Today, the scientific community is increasingly involved in rethinking the standards crime labs use,[4] while judges and the bar have had to improvise as they intervene to untangle the mass scandals that result when crime lab work goes terribly wrong in thousands or even tens of thousands of cases.[5] Scholars have studied the institution of the prosecutor, the public defender, and the operation of criminal courts; now the crime lab is deservedly receiving academic attention.

Three wonderful recent books examine different aspects of the changing relationship between science and criminal law. In this Review, I hope to do justice to all three, and I hope that what I write can encourage you carefully read each of these remarkable books. The case of George Rodriguez illustrates why the crime lab has entered a time of crisis. I will discuss that case and the larger story of the Houston lab, to introduce the first of three books: Sandra Guerra Thompson's *Cops in Lab Coats: Curbing Wrongful Convictions Through Independent Forensic Laboratories*.[6] Second, I will turn to Erin Murphy's[7] book, *Inside the Cell: The Dark Side of Forensic DNA*, to explore why DNA testing is no panacea for these growing problems and may instead actually magnify some of them. These failings raise the larger question whether improved research to support forensic disciplines, national regulation regarding the quality and standards for labs, and constitutional criminal procedure to remedy the poor litigation of forensics in the courtroom can

3. *See* Donald E. Shelton et al., *A Study of Juror Expectations and Demands Concerning Scientific Evidence: Does the "*CSI *Effect" Exist?*, 9 VAND. J. ENT. & TECH. L. 331, 332 (2006) (discussing the "CSI-effect"); *see also* *'CSI' Earth's No. 1 Show*, N.Y. POST (June 17, 2008), http://nypost.com/2008/06/17/csi-earths-no-1-show/ [https://perma.cc/NSD4-LFBZ] ("According to a new study, nearly 84 million viewers around the globe watched the CBS crime drama in 2007."); Tim K. Franklin, *Bones, CSI, and the Art of Forensic Science*, EZINEARTICLES (July 20, 2009), http://ezinearticles.com/?%20Bones,-CSI,-and-the-Art-of-Forensic-Science&id=2638177 [https://perma.cc/E97W-UN2X].

4. *See, e.g.*, Thompson, pp. 92–94.

5. *See, e.g.*, Thompson, p. 35.

6. Sandra Guerra Thompson is the Alumnae College Professor of Law and Director of the Criminal Justice Institute, University of Houston Law Center.

7. Professor of Law, New York University School of Law.

help to address the failings of our crime labs. I suggest that efforts to improve research, regulation, and criminal procedure are beginning to show promise, but that much remains to be done. Third, I will discuss Adam Benforado's[8] book, *Unfair: The New Science of Criminal Injustice*, which looks broadly at the role of social science and criminal law. Here, though, I will focus on his exploration of cognitive research and expert evidence. Finally, I will discuss how advances in scientific research and technology will reshape the crime lab of the future, creating new challenges and opportunities for criminal justice.

I. The Legal Regulation of Crime Labs

Although the victim had identified George Rodriguez based on "the way he stood," this eyewitness identification was fairly weak. She had not identified him initially, and police later used a suggestive, one-on-one "show up" procedure to secure the identification.[9] Moreover, Rodriguez's boss at the factory where he worked testified that he was at work during the entire day of the assault (Thompson, p. 8). With an otherwise weak case, the prosecution relied on the forensic evidence at trial. The crime lab analyst testified that Rodriguez's hairs and blood type both matched the evidence taken from the victim (Thompson, pp. 11–12). In 1987, DNA testing technology was still in its infancy. Lacking the ability to conduct a DNA test, the crime lab analyst found the single hair located on the victim's panties to have been "consistent with" those from Rodriguez, based on a simple examination of the hairs under a microscope (Thompson, p. 12). In recent years, the scientific community has called into question whether such microscopic hair comparisons can ever be used to reliably link evidence to individuals.[10] The community has also asked whether it was appropriate to call hairs a match absent any data on how many others could similarly have such "matching" hairs.[11] The second type of test that the analyst conducted, though, was a valid one: familiar A, B, and O blood-typing of swabs from the rape kit (Thompson, p. 12). Of course, large percentages of the population share

8. Professor of Law, Drexel University.

9. Thompson, p. 7 (citing Steve McVicker, *DNA Test Review Casts Shadow of Doubt on 1987 Rape Convictions*, Hous. Chron. (Aug. 22, 2004), http://www.chron.com/news/article/DNA-test-review-casts-shadow-of-doubt-on-1987-1983999.php [https://perma.cc/8BLQ-J5WA]).

10. Nat'l Research Council, Strengthening Forensic Science in the United States: A Path Forward 161 (2009) [hereinafter 2009 NAS Report] (stating that the committee "found no scientific support for the use of hair comparisons for individualization in the absence of nuclear DNA"). The FBI and a number of states, including Texas, are now conducting audits of old cases involving such hair comparisons. Press Release, Fed. Bureau of Investigation, FBI Clarifies Reporting on Microscopic Hair Comparisons Conducted by the Laboratory (July 13, 2012), http://www.fbi.gov/news/pressrel/press-releases/fbi-clarifies-reporting-on-microscopic-hair-comparisons-conducted-by-the-laboratory [https://perma.cc/GQV8-847P]; *see also Texas Hair Microscopy Case Review*, Tex. Forensic Sci. Comm'n, http://www.fsc.texas.gov/texas-hair-microscopy-case-review [https://perma.cc/PL5P-NGJR].

11. *See* 2009 NAS Report, *supra* note 10, at 160–61.

each of those blood types.[12] At trial, the analyst testified that Rodriguez could have left the stains and also helped to refute the defense theory in the case. The analyst testified that Yanez was definitively excluded since "one would predict his genetics would show up as a donor in a sexual assault" and blood of his type was not observed on the victim's panties.[13] This was flat-out wrong. In reality, neither Rodriguez nor Yanez could be excluded, nor could most males in the entire population.[14] Thus, the serology results were not probative in any way (Thompson, pp. 12–13). At trial, however, Rodriguez's defense lawyer did not question the crime lab analyst about those flaws in the analysis and presumably did not even realize that the findings were erroneous (Thompson, p. 13).[15]

After losing all of his appeals, Rodriguez languished in prison for eighteen years. And he might have remained there for far longer, since the biological evidence in his case was mostly destroyed by the crime lab, had it not been for a single hair that had miraculously been saved (Thompson, pp. 13–14, 16). By 2003, scientists could conduct mitochondrial DNA testing on even a single hair (Thompson, pp. 16–17). The New York–based Innocence Project stepped in, secured the DNA tests, and the very hair found "consistent" at trial now exonerated Rodriguez. His conviction was vacated by the Texas Court of Criminal Appeals in 2005 (Thompson, pp. 16–17).

Sandra Guerra Thompson tells this saga in her new book, *Cops in Lab Coats*, using the case and its fallout as an entry point to explore what is wrong with our crime labs. Thompson suggests that the problem was that this was a police-run crime lab, where analysts worked hand-in-hand with the police investigating the case (Thompson, pp. 16–17).

Yet the idea that anyone other than the police would test evidence from crime scenes is itself a novel one. Using scientific evidence to solve crimes was a thrilling innovation when Sir Arthur Conan Doyle created his legendary character Sherlock Holmes, but the reality of forensic practice lagged far behind fiction. In the United States, J. Edgar Hoover established the first American crime lab at the FBI, setting up shop in 1932 in a single room.[16] The FBI Technical Crime Laboratory began to train agents to examine latent

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12. *See* Brandon L. Garrett, Convicting the Innocent: Where Criminal Prosecutions Go Wrong 218 (2011).

13. Brandon L. Garrett & Peter J. Neufeld, *Invalid Forensic Science Testimony and Wrongful Convictions*, 95 Va. L. Rev. 1 app. (2009), http://www.law.virginia.edu/pdf/faculty/garrett/falseconfess/appendix_.pdf [https://perma.cc/N7JS-WCAL].

14. Thompson, pp. 16–17. For a detailed account, see Michael R. Bromwich, Final Report of the Independent Investigator for the Houston Police Department Crime Laboratory and Property Room 199–200 (2007), http://www.hpdlabinvestigation.org/reports/070613report.pdf [https://perma.cc/KE4V-YDWE].

15. This was completely typical, and I have found that in half of the DNA exoneration cases involving invalid forensic testimony, "the defense lawyers failed to ask any questions at all about the areas in which the analyst testified erroneously." Garrett, *supra* note 12, at 113.

16. John F. Fox, Jr., *The Birth of the FBI's Technical Laboratory—1924 to 1935*, FBI https://www.fbi.gov/about-us/history/highlights-of-history/articles/laboratory [https://perma.cc/4X6U-KSEV].

fingerprints, handwriting, and ballistic evidence. That crime lab garnered early fame when its analysts performed high-profile work in the Charles Lindbergh kidnapping case. In time, the FBI lab became the largest crime lab in the country and the center of innovation and training on forensics in the United States.[17] The advent of DNA testing could have challenged the FBI's claim to the title, but the FBI reasserted its forensic primacy in the modern world of DNA testing as well.

Today, crime labs are run largely by local law enforcement and serve state and local jurisdictions. There are over four hundred public crime labs in the United States, as well as several private crime labs, particularly in the for-profit DNA testing area.[18] The federal Bureau of Justice Statistics has irregularly conducted surveys of crime laboratories, and has documented a steady increase in their size and funding. In 2002, there were 11,000 full-time personnel at crime labs; by 2009, there were about 13,000.[19] This personnel expansion was, unsurprisingly, also accompanied by larger crime lab budgets.[20] Crime labs vastly expanded their footprint due to the drug war, with its demands for high-volume drug testing, and the advent of DNA testing, which required expensive testing equipment. Modern crime labs perform testing of potential controlled substances—drug testing constitutes the largest portion of what crime labs do.[21] Roughly the other half of the work of crime labs, according to these Bureau of Justice Statistics surveys, relates to identifying culprits and assessing how crimes occurred. That work includes DNA testing, but despite its prominence, relatively few cases permit a DNA test. Crime labs still handle far more requests relating to traditional forensic methods—such as comparing ballistics, latent fingerprints, fibers, and toolmarks.[22] As the high-profile dispute between the federal government and Apple over unlocking a smartphone indicates, digital forensics is an increasingly prominent type of analysis.[23]

Crime labs are typically regulated at the local level.[24] By way of comparison, medical and scientific facilities may be run locally, but they are subject to federal regulation.[25] A hospital or scientific laboratory is subject to federal

17. *Id.*

18. Matthew R. Durose et al., Bureau of Justice Statistics, NCJ 238252, Census of Publicly Funded Forensic Crime Laboratories, 2009, at 1 (2012), http://www.bjs.gov/content/pub/pdf/cpffcl09.pdf [https://perma.cc/398Y-BU8J].

19. *Id.*

20. *Id.* at 9–10.

21. *Id.* at 13.

22. *Id.*

23. *See e.g.*, *Breaking Down Apple's iPhone Fight with the U.S. Government*, N.Y. Times (Mar. 21, 2016), http://www.nytimes.com/interactive/2016/03/03/technology/apple-iphone-fbi-fight-explained.html [https://perma.cc/G6H2-4H8J].

24. *See* Mark Hansen, *Crime Labs Under the Microscope After a String of Shoddy, Suspect and Fraudulent Results*, ABA Journal (Sept. 1, 2013, 10:20 AM), http://www.abajournal.com/magazine/article/crime_labs_under_the_microscope_after_a_string_of_shoddy_suspect_and_fraudu/ [https://perma.cc/5CB9-4P8H].

25. *See e.g.*, 42 U.S.C. § 263a (2012).

laws regarding Medicare and Medicaid, insurance regulations, and restrictions accompanying federal research grants, among others.[26] Any medical facility risks malpractice litigation if it does not carefully adopt systems for quality control and error response. If an error like the one in the Rodriguez case came to light, it would result in routine investigations of what went wrong.

The Houston lab exemplifies what can go wrong in a crime lab left to its own devices, without independent oversight or regulation. Problems came to light in 2002, before Rodriguez sought DNA testing, when journalists uncovered errors in the DNA unit's work. Initially, just the DNA unit was shut down to allow for an audit and retesting of hundreds of cases (Thompson, p. 205). As so often happens, however, the errors were not isolated mistakes made by a few "bad apple" analysts, but rather symptoms of a deeper problem. DNA tests in the case of a man named Josiah Sutton were found to have been erroneously conducted; new DNA tests cleared him (Thompson, p. 205). Later, Rodriguez was similarly cleared (Thompson, pp. 16–17). But not all of the mistakes could be so swiftly corrected. In the intervening years, the analyst who presented the blood and hair testimony in Rodriguez's case had been promoted to head the entire lab's serology and DNA units (Thompson, p. 12). Since that analyst supervised so much of what the crime lab had done for years, tens of thousands of forensic cases were suddenly called into question.

Now, in many other cases—including those of DNA exonerees—the response to revelations of system failure has often been to sweep the problems under the rug. To their credit, the City of Houston ordered a comprehensive audit of the crime lab. It hired an extremely prominent auditor, Michael Bromwich, who has since headed a range of high-profile audits and investigations, including those conducted in the wake of the BP Gulf Oil Spill.[27] Bromwich's team investigated and produced detailed reports over several years (Thompson, p. 208). They learned of other types of problems at the lab, including "drylabbing," that is, fabricating conclusions when no forensic analysis was in fact conducted, and false assertions that there was no DNA to test.[28] The audit team looked at hundreds of old cases and recommended that hundreds of them be reopened: they recommended sweeping changes to the procedures, policies, and supervision of the crime lab (Thompson, pp. 208–09). The city even shut down the crime lab entirely. In 2014, when the lab reopened, it had undergone a metamorphosis into a different legal institution. The new crime lab was independent of law enforcement (Thompson, pp. 214–16, 222). No longer were lab analysts "cops in lab coats," but rather the new regulations defining lab chain of command and budgets put the scientists squarely in charge.

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26. Robert I. Field, *Why is Health Care Regulation So Complex?*, 33 PHARMACY & THERAPEUTICS 607 (2008).

27. Thompson, p. 208; *Michael R. Bromwich*, BROMWICH GROUP, http://www.bromwichgroup.com/about-us/michael-r-bromwich/ [https://perma.cc/DQN5-JKMU].

28. BROMWICH, *supra* note 14, at 5.

Ever since DNA testing became available in the mid-1980s, there have been private, for-profit labs in the United States with plenty of paying customers—including people with paternity cases, who want DNA to be tested. But law enforcement controls the vast majority of crime labs in the United States (Thompson, p. 198). Most labs will only test evidence if law enforcement requests it, and many will only report results to law enforcement, at least absent a subpoena. For a city to set up an independent, scientist-run lab was a real change. In 2012, the Houston lab was renamed and separately incorporated. No longer a police crime lab, it was reincorporated as the Houston Forensic Science Center (HFSC), with an independent oversight board, a concept currently being considered by other jurisdictions.[29] The Houston lab has adopted important new quality controls, including strict procedures to ensure that evidence is collected properly and a blind quality control program, where fake test cases are included in analysts' workloads to assess their performance.[30] According to Thompson—as well as the auditor, Michael Bromwich—he newly reconstituted lab has been transformed. With new quality controls, standards, staff, and procedures, the lab is now "a very different place" (Thompson, p. 221).

While local laws and procedure regulate police departments,[31] crime labs have in the past largely been treated as outside the scope of criminal procedure. Crime labs might exist simply as a room in a police department basement. The lab staff members were treated like scientists, even if they were employed as police, and that ambiguity permitted a relative lack of regulation. In some jurisdictions, such labs are functionally a part of law enforcement, while in other states and cities they are separately constituted by enabling legislation that sets out their oversight and functions as a separate municipal entity.[32] Those statutes and regulations have not been a subject of

29. Thompson, pp. 214–15, 217, 222, 225; Houston Forensic Science LGC, Inc., *Certificate of Formation*, Hous. Forensic Sci. Ctr. (Jun. 26, 2012), http://houstonforensicscience.org/significant/150430_HFSC_Current_CF.pdf [https://perma.cc/4U6D-RLN8].

30. Robert Arnold, *Working to Move Beyond Troubled Past at Houston's Crime Lab*, Click2Houston/KPRC2 (Jan. 21, 2016, 10:15 PM), http://www.click2houston.com/news/investigates/working-to-move-beyond-troubled-past-at-houstons-crime-lab [https://perma.cc/PQW6-LTDX].

31. Note that there is a recognized body of the "law of the police," even if it has been—outside of constitutional criminal procedure—a neglected subject of academic study. *See* Rachel Harmon, *Reconsidering Criminal Procedure: Teaching the Law of the Police*, 60 St. Louis U. L.J. 391 (2016) (describing why criminal procedure courses present an inadequate view of the police and describing a course and casebook designed to teach the law of the police).

32. For example, the organization chart of the St. Louis Metropolitan Police Department shows the crime laboratory as the responsibility of the Bureau of Operations, under the Deputy Commander, and as part of the "Evidence Management and Auxiliary Services" group, which also includes "property custody" and "prisoner processing." *Organizational Chart*, St. Louis Metropolitan Police Dep't (Mar. 9, 2016), http://www.slmpd.org/images/org_chart.pdf [https://perma.cc/KDY4-5S47]. In contrast, the Department of Forensic Science in Washington, D.C. has an independent organizational structure, and a "Science Advisory Board" and "Stakeholder Council" to advise it. *DFS Organizational Chart* (Jan. 16, 2014), http://dfs.dc.gov/sites/default/files/dc/sites/dfs/publication/attachments/DFS%20Organizational%20Chart%20%282%29.pdf [https://perma.cc/KBH3-QKTL]. That independent crime lab was created

study before, but in places like Houston, all of a sudden they have become an important subject for lawmaking—as policymakers have become concerned that crime labs need to have audit functions, quality control, and scientific oversight. Such modern, thoughtful, and detailed regulation (the new statutes for the Metropolitan Police Department's crime lab in Washington, D.C. are another model) is a far cry from a crime lab existing as simply a room in a police station or an old FBI warehouse.

Most crime labs today are constituted fairly informally. As part of law enforcement, their accreditation demands very little of them.[33] They remain chiefly subject to a voluntary system of accreditation from the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB), which requires mostly periodic review of lab procedures, but not of casework.[34] In response, a few states have created forensic science commissions designed to provide more oversight.[35] In Texas, such a commission has ordered sweeping audits of the use of hair evidence, DNA evidence, and bite-mark evidence in hundreds of old cases across the state.[36] Yet even labs subject to accreditation, and even labs in states with forensic science commissions, have endured scandals and audits.[37] Still more troubling, though, are the states and labs that have not conducted audits in response to forensic errors, or have done so haltingly, narrowly, or only after many years passed.[38] Thompson includes a very disturbing appendix that proceeds state by state, listing examples of crime labs that have had errors and audits in recent years, ranging from drug theft and use, falsifying results, and planting

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through legislation. Department of Forensic Sciences Act of 2011, D.C. CODE §§ 5-1501.01–.16 (2011). Similarly, the Virginia Department of Forensic Science was created by statute as a separate agency within the state Department of Criminal Justice Services, VA. CODE § 9.1-1100 (2011), and with an advisory Forensic Science Board, *id.* §§ 9.1-1109- to -13.

33. *See* 2009 NAS REPORT, *supra* note 10, at 14 ("Too often [forensic science facilities] have inadequate educational programs, and they typically lack mandatory and enforceable standards, founded on rigorous research and testing, certification requirements, and accreditation programs."). Some states require accreditation by statute. *See, e.g.*, MO. REV. STAT. § 650.060 (2014) ("On or after December 31, 2012, any crime laboratory providing reports or testimony to a state court pertaining to a result of the forensic analysis of evidence shall be accredited or provisionally accredited by a laboratory accrediting organization approved by the department of public safety.")

34. 2009 NAS REPORT, *supra* note 10, at 195–200.

35. North Carolina, for example, created a Forensic Science Advisory Board and also changed its accreditation statute to require an accrediting body that follows "International Laboratory Accreditation Cooperation (ILAC)" standards. N.C. GEN. STAT. § 8-58.20(b) (2015); N.C. GEN. STAT. § 114-61 (2015); *see also* TEX. CODE CRIM. PROC. ANN. art. 38.01 (West 2015). *See generally* Paul C. Giannelli, *The North Carolina Crime Lab Scandal*, CRIM. JUST., Spring 2012, at 43.

36. *See* TEX. FORENSIC SCI. COMM'N, FOURTH ANNUAL REPORT 15–22 (2015), http://www.fsc.texas.gov/sites/default/files/documents/files/2015%20FSC%20Annual%20Report%20PostPo%20Smaller%20Size.pdf [https://perma.cc/Q4QB-EC52].

37. *See, e.g.*, Thompson, pp. 56–57, 192–95 (documenting the occurrence of forensic scandals in New York, one of the two states with an established Forensic Science Commission).

38. *Id.* at 44–45 (discussing the failure of law enforcement officials in Washington State to meaningfully respond to revelations in forensic incompetence).

evidence, to the practice of drylabbing (Thompson, pp. 52–61). The one federal law that requires auditing as a condition of federal grants to DNA labs has been largely unenforced (a good illustration of the weakness of Congress's conditional spending power).[39] Is the solution to this problem to be found not just at the local level, as with the Houston story, but at the state or even the federal level?

II. National Regulation of Crime Labs

The law of the crime lab is becoming increasingly national and less fragmented. This has costs and benefits. Erin Murphy's book explores the negative aspects of federal involvement, including how the federal government puts pressure on localities—through federal funding and powerful and broadly drafted databank-enabling statutes—to create ever-larger DNA databanks. The advent of DNA testing, the new "gold standard" in forensics, has not solved all of our problems by permitting computerized CSI-type tools to replace outdated techniques.[40] Murphy's accessible book, *Inside the Cell*, is a wonderful read and surprising at every turn. The core message is Murphy's caution that even DNA testing, the gold standard, the most reliable and validated forensic technology that we have, can take on a sinister edge when deployed in a fragmented and flawed criminal justice system (Murphy, pp. ix–xii). Indeed, it is in the area of DNA testing that crime labs are mostly tightly linked together, through federal grants and federally-run databases.[41] The FBI cemented its longstanding role as a leader in forensic science in this country by becoming the standard setter and nerve center for DNA data (Murphy, pp. 14–16). The FBI runs the Combined DNA Index System (CODIS), the set of DNA databanks, according to protocols elaborated by the FBI, as permitted by federal enabling statutes and through substantial largesse from Congress. Congress has funded the expansion of state DNA labs so that they can process the millions of swabs that have made this unprecedented DNA collection from felons, and increasingly arrestees, possible.[42] Is this the dark side of federal involvement in forensics? Instead of sound federal scientific standards, do we get supersized imposition on citizens' privacy?

The FBI's culture of secrecy, which extends back to Hoover's era of "Do Not File" memos and secret files with paperwork on public figures, now surrounds the far more high-tech genetic databanks. While criminal investigations demand some degree of secrecy, scientific endeavors demand some

39. For a discussion of this problem, see Kerry Abrams & Brandon L. Garrett, *DNA and Distrust*, 91 Notre Dame L. Rev. 757, 783–85, 784 n.138 (2016).

40. William C. Thompson, *Tarnish on the "Gold Standard": Understanding Recent Problems in Forensic DNA Testing*, Champion, Jan./Feb. 2006, at 10, 15.

41. *See* Abrams & Garrett, *supra* note 39, at 778–85.

42. H.R. Rep. No. 106-900, pt. 1, at 8–9 (2000), *as reprinted in* 2000 U.S.C.C.A.N. 2323, 2324–25 (discussing the legislation enabling creation of the CODIS); 2009 NAS Report, *supra* note 10, at 71–72 (describing one billion dollars in federal funding for 2003 DNA testing initiative).

degree of transparency in data collection and analysis, including through peer review and replication of research. For that reason, the enabling legislation for the DNA databanks provides for access by the scientific community. Yet despite those statutes, the FBI has not permitted such access, and as a result the statistics used to calculate a "match" in the CODIS remain opaque (Murphy, p. 111). With the increase in the size of these databanks, and as partial samples are increasingly run in them, there is an increasing (but undisclosed) chance of "adventitious" or coincidental matches.[43] While concerns had been registered for years, only recently did the FBI admit that it made basic mathematical errors in the tables used by DNA analysts—not just at the FBI but at crime labs generally—to calculate statistics for CODIS matches.[44] For example, in one Galveston County case, the lab originally calculated that the odds that a person in the population would be expected to randomly match the DNA found on a piece of evidence was 1 in 290 million.[45] After the DNA probabilities were recalculated in response to the May 2015 FBI announcement, the lab revised its result. The lab determined that the odds were actually 1 in 38, and the lab also detected an additional problem having to do with incorrect methods for calculation of statistics in mixed DNA samples.[46] Texas is now auditing thousands of old cases; although the problem is national one, so far only the state of Texas is conducting such a systematic review.[47] DNA labs are not required to disclose their error rates, creating "the myth that DNA testing is infallible" (Murphy, pp. 123–24). But DNA testing is not infallible. Murphy describes the Houston case of Josiah Sutton, convicted based on a faulty interpretation of a DNA test result (Murphy, pp. 65–66).

The national system of interconnected DNA databanks is one-sided, since the defense lacks the right to obtain DNA database searches (Murphy, pp. 147–50). Murphy describes how in West Virginia, prosecutors refused Joseph Buffey access to DNA testing for years. Buffey finally obtained DNA tests and a database search, which resulted in a "cold hit" with someone else (Murphy, p. 296). Not only do federal regulations and statutes create a system designed to facilitate central federal data repositories for law enforcement but not for defendants, but as cases like Buffey's suggest, the U.S. Constitution offers little protection for criminal suspects and defendants

43. Murphy, pp. 114–15 (citing Eur. Network of Forensic Science Insts. DNA Working Grp., DNA-Database Management: Review and Recommendations (2014), http://www.dnaresource.com/documents/ENFSIDatabaseRecommendations.pdf [https://perma.cc/G5HZ-RJZV]).

44. Gabrielle Banks, *Texas Reviewing Thousands of DNA Cases that Used Outdated Method for Calculating Odds*, Dall. News (Feb. 1, 2016 10:18 PM), http://www.dallasnews.com/news/crime/headlines/20160131-texas-reviewing-thousands-of-dna-cases-that-used-outdated-method-for-calculating-odds.ece [https://perma.cc/85VF-RTD4].

45. *Id.* (quoting Sandra Guerra Thompson noting that "Texas is really the only state that's taking it seriously").

46. *Id.*

47. *Id.*

who seek to question or obtain forensics.[48] Fortunately, since Murphy wrote her book, the West Virginia Supreme Court in *Buffey v. Ballard* surveyed authority and concluded in a landmark ruling that prosecutors are obligated to provide exculpatory forensic evidence to the defense during plea negotiations.[49] While the DNA tests excluded Buffey as one of the contributors in a case involving rape, the State maintained Buffey would have pleaded guilty regardless, the results were not material, and the results did not rule out his involvement. The West Virginia Supreme Court held that the *Brady v. Maryland* due process right entitles a defendant, even during plea negotiations, to access to such potentially exculpatory evidence, and that none of those arguments "detract from the exculpatory nature of the evidence of DNA testing or its materiality."[50] The court reversed Buffey's conviction.[51] Whether other courts will follow that interpretation of *Brady v. Maryland* remains to be seen.

One reaction to the new institution of the crime lab is that it seems immune to the usual protections of criminal procedure that regulate police and, to a lesser extent, prosecutors. Crime lab analysts, as scientists, often document their work in a far more detailed way than police officers.[52] Yet in most jurisdictions they are not required to disclose to the defense their underlying notes (called bench notes) explaining the work that they did to reach their forensic conclusions.[53] Police and prosecutors must, under *Brady v. Maryland,* disclose all material exculpatory evidence, and some states' criminal discovery rules require more.[54] Yet many courts have concluded that the only material information coming out of the crime lab is the exculpatory or inculpatory "result" in the form of a certification stating the forensic conclusions, rather than the underlying notes detailing the analysis.[55] That state of affairs is changing. The Supreme Court's Sixth Amendment rulings have required that the defense be offered the right to confront "testimonial" witnesses, including the crime lab analysts who performed the analysis in the lab.[56] Now, crime labs typically assign technicians and analysts

48. *See* Murphy, p. 297.

49. Buffey v. Ballard, 782 S.E.2d 204, 216 (W. Va. 2015) ("Having scrutinized the reasoning of other jurisdictions, this Court finds that the better-reasoned authority supports the conclusion that a defendant is constitutionally entitled to exculpatory evidence during the plea negotiation stage.").

50. *Id.* at 220; *see also* Brady v. Maryland, 373 U.S. 83, 86–89 (1963) (holding that the government withholding exculpatory evidence is a violation of due process).

51. *Buffey*, 782 S.E.2d at 221.

52. *See* Paul C. Giannelli, *Scientific Evidence: Bench Notes & Lab Reports*, CRIM. JUST., Summer 2007, at 50–51.

53. *See id.*

54. *Brady*, 373 U.S. at 86–89; *see* Bennett L. Gershman, *Reflections on* Brady v. Maryland, 47 S. TEX. L. REV. 685, 725–28 (2006).

55. *See* Giannelli, *supra* note 52, at 50–51 (collecting cases).

56. *See* Williams v. Illinois, 132 S. Ct. 2221, 2239–41 (2012); Bullcoming v. New Mexico, 564 U.S. 647, 661–65 (2011); Melendez-Diaz v. Massachusetts, 557 U.S. 305, 311 (2009).

different tasks in a given case.[57] The Court's rulings have created more of an incentive to designate a chief forensic analyst, experienced at testifying in court, to take the lead in lab work; to fully document that analyst's role, however, more information may need to be conveyed to the court and to the defense about what that analyst did. More cases involving errors in labs, including where mistakes were apparent from the bench notes, may create pressure for judges to order discovery on such underlying documents and for lab supervisors to insist on them. More modern lab procedures set out far more clearly what must be documented when an analyst does work on a case; no longer should a forensic conclusion be a subjective decision to be informally recorded, without clear parameters and supervisory review.[58] Also importantly, Sixth Amendment right-to-counsel rulings may increasingly cement the obligation of the defense to seek discovery on forensics and to retain experts who can independently examine the analysis conducted and opine on its reliability.[59] Each of those areas of constitutional criminal procedure may increasingly affect the modern crime lab.

The Supreme Court's Fourth Amendment ruling on DNA collection from arrestees may facilitate the inexorable expansion of forensic databanks, which now include DNA and fingerprints and increasingly include additional biometric information.[60] Perhaps they will also include surveillance data and still more data scooped up from new sources on the internet. Murphy trenchantly critiques the Supreme Court's ruling in *Maryland v. King*,[61] which holds that taking DNA from an arrestee in order to run it in the CODIS DNA databank to check whether the person is wanted for other crimes is a form of identity verification during "booking" that imposes only a minimal invasion of privacy.[62] Now officers will ask for: "License, [r]egistration, and [c]heek [s]wab, [p]lease" (Murphy, p. 153). Already, states are taking the hint from the *King* ruling and expanding DNA collection programs beyond just the "serious" crimes that the opinion supposedly limited its endorsement to, extending collection to minor and even juvenile crimes (Murphy, p. 161). Justice Antonin Scalia memorably dissented in the

57. *See, e.g.*, *Williams*, 132 S. Ct. at 2244, 2247 (dictum) (discussing the various divisions of labor in modern crime labs between multiple technicians and analysts).

58. Some laboratories make those detailed procedures available to the public; the Virginia Department of Forensic Science does so. *See Procedure Manuals*, VA. DEPT' OF FORENSIC SCI., http://www.dfs.virginia.gov/laboratory-forensic-services/biology/manuals/ [https://perma.cc/33NG-2ES6].

59. *See* Brandon L. Garrett, *The Constitutional Regulation of Forensic Evidence,* 73 WASH. & LEE L. REV. 1147 (2016).

60. For example, the Department of Homeland Security maintains the Automatic Biometric Identification System (IDENT), which includes "digital fingerprints, photographs, iris scans, and facial images," linked with "biographic information." KENNETH GANTT, U.S. DEP'T OF HOMELAND SEC., PRIVACY IMPACT ASSESSMENT FOR THE AUTOMATED BIOMETRIC IDENTIFICATION SYSTEM (IDENT) 2 (2012), https://www.dhs.gov/sites/default/files/publications/privacy-pia-nppd-ident-06252013_0.pdf [https://perma.cc/QN37-V5RH].

61. Murphy, pp. 157–63; 133 S. Ct. 1958 (2013).

62. *King*, 133 S. Ct. at 1980.

King case and deplored the "genetic panopticon" that the Court now endorses.[63]

Mass surveillance has already reshaped privacy and policing in ways that the public, the courts, and law enforcement are just beginning to grapple with. A dystopian future of genetic surveillance is not so far off, as Murphy explores. Our current forensic databanks turn booking into the source for raw material for yet another remarkable new mass-surveillance tool: genetic information that can be archived and searched indefinitely, whether or not an arrestee is ever convicted of a crime (Murphy, pp. 162–63). As these databases expand, the results will be racially disparate, Murphy explains, given the manner in which police disparately target and arrest minorities (Murphy, pp. 256–60).

Nor will these databanks solve as many more crimes as their champions would suggest. Murphy explains why expanding databanks does not solve more crimes if we do not test evidence from crime scenes (Murphy, p. 261). Many police departments and crime labs have enormous backlogs of untested material because it costs far more to carefully collect evidence, hire CSI units, and test complex sets of evidence from the crime scene than to process arrestee swabs en masse (Murphy, p. 268–71). Bigger is not necessarily better where forensic databases are concerned.[64] Indeed, bigger databases may be more error prone: as duplicate entries result, chances of coincidental matches increase, and labs try to do more risky DNA tests, such as testing "low copy" samples or engaging in "familial" DNA searches in which labs try to locate suspects by seeking partial matches with potential family members.[65] The uses of DNA tests will only increase as research identifies more information that can be learned from testing DNA. Perhaps in the future, DNA searches and tests will be used to identify physical features of suspects, or to test for medical predispositions, or even to test for predispositions for aggression or violence.[66] So far the Supreme Court has decided to remain at the sidelines;[67] few state courts have intervened.[68] Unless the regulations change, there are few rules for what can be done with the genetic information of millions of individuals.

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63. *Id.* at 1989 (Scalia, J., dissenting).

64. Murphy, p. 193; *see also* Brandon L. Garrett & Erin Murphy, *Too Much Information*, SLATE (Feb. 12, 2013 8:22 AM), http://www.slate.com/articles/news_and_politics/jurisprudence/2013/02/dna_collection_at_the_supreme_court_maryland_v_king.html [https://perma.cc/FW4L-P559].

65. *See* Murphy, pp. 193–96.

66. *See* Murphy, p. 218; *see also* Erin Murphy, *Relative Doubt: Familial Searches of DNA Databases*, 109 MICH. L. REV. 291, 316 (2010).

67. Carrie Wells, *Court Ruling Allows DNA to be Used in Future Cases*, BALT. SUN (Aug. 12, 2015), http://www.baltimoresun.com/news/maryland/politics/bs-md-police-dna-20150812-story.html [https://perma.cc/L67R-S6RG].

68. *But see* State v. Medina, 102 A.3d 661, 683 (Vt. 2014) (holding that an amendment that required the collection of DNA from anyone arraigned for a felony violated the Vermont constitution); People v. Buza, 180 Cal. Rptr. 3d 753, 775–81 (Cal. Ct. App. 2014), *rev'd*, 342 P.3d 415 (Cal. 2015) (holding that DNA collection act was invalid under state constitution).

Nor is there any reason to think that this genetic evidence will remain solely in the government's custody. Any number of supposedly secure (and perhaps far more sensitive) federal databases have been breached by hackers in recent years.[69] Indeed, Murphy points out that one of the few good things about the decentralized structure of the CODIS—in which the system links separate state databases—is it is harder to hack.[70] The government cannot be counted on to assure our genetic privacy once it has collected its vast storehouse of our genetic information.

There are costs to the expanding federal role in forensics, and not just those from the funding of the expansion of a massive "genetic panopticon." But there are also very different benefits to the increasingly national and interconnected nature of modern crime lab work. Federal constitutional rules increasingly affect crime labs in ways that do protect criminal defendants, even if the Fourth Amendment currently offers very little in the way of protection. Until the Supreme Court found that forensic testimony was "testimonial" for Confrontation Clause purposes, constitutional rules did not regulate crime labs significantly. Now they do, and the unanticipated consequences of those Sixth Amendment rulings may result in more professionalized roles in crime labs.[71] As noted, ineffective-assistance-of-counsel rulings (including the *Hinton v. Alabama* per curiam ruling by the Supreme Court) may also influence how lawyers litigate forensics.[72]

National regulation of forensics can be traced back to the traditional role of the FBI in training state and local law enforcement and crime lab analysts on the state of the art.[73] In the 1990s, and to some degree before, the national scientific community had intervened to set national standards as well; in the mid-1990s, the National Academy of Sciences set an important precedent by issuing two landmark reports on the proper uses of DNA evidence in criminal cases.[74] In 2009, the National Academy of Sciences went further to call for a systemic overhaul in the way that forensics were used in criminal cases, beyond just DNA, and called for a national regulatory agency

69. Ellen Nakashima, *Hacks of OPM Databases Compromised 22.1 Million People, Federal Authorities Say*, Washington Post (July 9, 2015), https://www.washingtonpost.com/news/federal-eye/wp/2015/07/09/hack-of-security-clearance-system-affected-21-5-million-people-federal-authorities-say/ [https://perma.cc/36QY-Y2BC].

70. Murphy, p. 281. For additional discussion of these questions, see Abrams & Garrett, *supra* note 39.

71. For analysis of such rulings, see Garrett, *supra* note 59.

72. *See* Hinton v. Alabama, 134 S. Ct. 1081, 1088 (2014) (per curiam). For a discussion of other recent Supreme Court and lower court ineffective assistance of counsel cases involving forensics, see Garrett, *supra* note 59.

73. *Cf.* Seth Axelrad, *State Regulations on Quality Assurance for Forensic DNA Laboratories*, Am. Soc'y of L. Med. & Ethics 1, https://www.aslme.org/dna_04/reports/axelrad2.pdf [https://perma.cc/W4NY-H9SJ] (last updated June 29, 2004) (collecting state and local regulations, many of which use the quality standards set by the FBI).

74. Nat'l Research Council, DNA Technology in Forensic Science (1992); Nat'l Research Council, The Evaluation of Forensic DNA Evidence (1996).

to oversee scientific standards and quality in forensics.[75] No such National Institute of Forensic Science–type agency has been established by Congress.

But the Department of Justice (DOJ), likely taking cues from the recommendations in that Report, established in 2013 a National Commission on Forensic Science.[76] And the National Institute of Standards and Technology (NIST) has convened a group of Organization of Scientific Area Committees, which, like the DOJ Commission, include leading scientists from various disciplines, lawyers, and judges.[77] They are tasked with considering improved scientific standards, new research, and new procedures.[78] The DOJ Commission can additionally establish new ground rules for use in federal criminal cases. The DOJ Commission has already produced important guidance on topics like the accreditation of crime laboratories,[79] the need for meaningful pretrial discovery,[80] and the adoption of standards to minimize the use of vague language in forensic conclusions.[81] Most recently, the White House President's Council of Advisers on Science and Technology (PCAST) issued an important report underscoring the need for further scientific research, the need to cease use in criminal matters of disciplines currently unsupported by sufficient scientific research, and the need for proficiency testing and error-rate information concerning forensic disciplines, among a host of other detailed recommendations.[82] Troublingly, though, the DOJ

75. *See* 2009 NAS Report, *supra* note 10, at 56, 81–83.

76. *See* Press Release, U.S. Dep't of Justice, Department of Justice and National Institute of Standards and Technology Announce Launch of National Commission on Forensic Science (Feb. 15, 2013) https://www.justice.gov/opa/pr/department-justice-and-national-institute-standards-and-technology-announce-launch-national [https://perma.cc/7EW6-6SUC].

77. *Forensic Science Standards Effort Takes Shape as NIST Appoints Specific Area Committee Members*, Nat'l Inst. Standards & Tech. (Sept. 3, 2014), https://www.nist.gov/news-events/news/2014/09/forensic-science-standards-effort-takes-shape-nist-appoints-scientific-area [https://perma.cc/X3JQ-ZL7V] [hereinafter NIST OSAC Announcement].

78. *Id.*

79. Nat'l Comm'n on Forensic Sci., Universal Accreditation (2015), https://www.justice.gov/ncfs/file/477851/download [https://perma.cc/5C6V-EUZ5].

80. Nat'l Comm'n on Forensic Sci., Recommendations to the Attorney General: Pretrial Discovery (2016), https://www.justice.gov/ncfs/file/880241/download [https://perma.cc/8N4J-PKTX].

81. Nat'l Comm'n on Forensic Sci., Inconsistent Terminology (2015), https://www.justice.gov/ncfs/file/477841/download [https://perma.cc/2UJT-GFY7]. To be sure, these efforts have not been free of conflict. Murphy describes how Judge Rakoff resigned from the Commission in protest at the DOJ's failure to consider pretrial discovery of forensics as part of the Commission's agenda; the DOJ "quickly backtracked" in response. Murphy, pp. 288–89.

82. President's Council of Advisors on Sci. and Tech., Exec. Office of the President, Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods 57, 102, 124–45 (2016), https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf [https://perma.cc/WL2Y-T23S] [hereinafter PCAST Report].

immediately stated that it would reject outright the PCAST recommendation concerning nonuse in criminal matters of forensic disciplines not currently supported by sufficient scientific research.[83]

These changes at the national level are affecting local crime labs, and more labs have adopted or are considering new procedures and quality controls. This is not heavy-handed federal regulation, but federal scientific and legal leadership will nevertheless have a real, positive impact. Moreover, since crime labs receive such extensive federal funding, it may become increasingly difficult for labs to deviate from federal standards. Murphy describes how these new bodies have "dramatically improved the quality of conversations around best practices in the field," and NIST scientists have performed "critical research" and provided "invaluable training" to the forensics community (Murphy, p. 287). We can only hope that those marked improvements in research and practice continue in the years ahead.

III. Science, Technology, and the Future of the Crime Lab

More of an optimist about the role of science in criminal justice, Adam Benforado, in his book *Unfair*, hopes that we can harness psychological research on the types of cognitive biases that can affect all professionals, including criminal justice actors like forensic analysts, police officers, lawyers, and judges.[84] Benforado suggests that not just crime labs themselves, but rather all expert witnesses, serve as impartial evaluators, paid by the court and not the prosecution or the defense (Benforado, pp. 264–65). His focus extends to criminal justice broadly and not just forensics. For example, he suggests ways to focus on prevention rather than criminalization (Benforado, pp. 283–84). More on the topic of this review, Benforado suggests that to avoid biasing jurors, trials could be conducted virtually using avatars (Benforado pp. 266–68). Prior to any plea or trial, smartphone apps could provide checklists to ensure that police (or presumably forensic analysts) do their work according to impartial procedures.[85]

Scientific research is rapidly advancing and may address at least some of the underlying failings in many forms of forensics. First, statisticians and scientists have been in recent years making real progress toward modeling statistical methods for expressing conclusions about traditional forensics like fingerprints. Substantial federal funding directed towards forensics research is one reason for this progress.[86] When and if more accurate models are

83. Kira Lerner, *Attorney General to Ignore New Report Finding That Commonly-Used Forensics Are Bogus*, ThinkProgress (Sept. 21, 2016), https://thinkprogress.org/attorney-general-to-ignore-new-report-finding-that-commonly-used-forensics-are-bogus-633a3b313a6a#.y2e4smk7f [https://perma.cc/TMJ7-REKX].

84. *See* Benforado, pp. 20–21, 36, chapter 12.

85. *See* Benforado, p. 265.

86. *See* Ctr. for Statistics and Applications in Forensic Evidence, http://forensic.stat.iastate.edu [https://perma.cc/8RDP-NQ5M]; *New NIST Center of Excellence to Improve Statistical Analysis of Forensic Evidence*, Nat'l Inst. of Standards & Tech., (May 26, 2015),

available, we will not need to rely on an analyst's bare conclusion that evidence is a "match."

Internal procedures in crime labs may make work "blind" to minimize cognitive bias—a central concern of Adam Benforado's is the role that cognitive bias can play. For example, Benforado describes the confirmation bias that can result when, for example, investigators obtain a confession (Benforado, p. 36). Subsequently, "everyone—investigators, lawyers, jurors, and judges" will view the "whole case through the lens of guilt" (Benforado, p. 36). They may even find the other nonforensic evidence to have been more compelling when looked at through a guilt-presumptive lens than they would have absent the bias. Benforado discusses the incredibly troubling case of Juan Rivera, in which he was tried and convicted three separate times on the strength of a troubling confession statement, despite DNA tests that excluded him by the time of his final trial in 2009.[87] Benforado describes how the impulse to do right may cause people to "cut corners" and bend rules because they care deeply about protecting victims and future victims, and not because they actually want to see the wrong person convicted (Benforado, p. 84).

Forensic analysts, in particular, may feel pressure, unconsciously but perhaps also consciously, to conform their results to evidence of guilt, like a confession. These concerns have been explored in the research of scholars like Itiel Dror, whose cognitive bias work is having an enormous influence on lawyers, judges, and most importantly, crime labs.[88] That research suggests, like Benforado discusses, that knowledge of other evidence of guilt can cross-contaminate how other forensic evidence is weighed.[89] Even DNA testing may be affected by everyday cognitive bias (Benforado, pp. 20–21); a study by Dror and Greg Hampikian examined the effect of cognitive bias on DNA mixture interpretation.[90] Researchers have proposed selective blinding

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https://www.nist.gov/news-events/news/2015/05/new-nist-center-excellence-improve-statistical-analysis-forensic-evidence [https://perma.cc/J47U-EQ5J]. I should note that the author is a principal investigator for a portion of a consortium funded by NIST as part of these efforts. *See People*, Ctr. for Statistics and Applications in Forensic Evidence, http://forensic.stat.iastate.edu/people [https://perma.cc/H24A-U4DB].

87. Benforado, pp. 36–37; *see also* Rob Warden, ,*Juan Rivera*, Bluhm Legal Clinic: Ctr. on Wrongful Convictions, http://www.law.northwestern.edu/legalclinic/wrongfulconvictions/exonerations/il/juan-rivera.html [https://perma.cc/2QJF-ZCDL]. For data on cases in which individuals who had falsely confessed were convicted despite DNA exclusions, see Brandon L. Garrett, *Confession Contamination Revisited*, 101 Va. L. Rev. 395 (2015).

88. *E.g.*, Itiel E. Dror et al., *Contextual Information Renders Experts Vulnerable to Making Erroneous Identifications*, 156 Forensic Sci. Int'l 74 (2006). For work examining cognitive bias in the area of competency evaluations, see Daniel C. Murrie et al., *Are Forensic Experts Biased by the Side That Retained Them?*, 24 Psychol. Sci. 1889 (2013).

89. Benforado, pp. 20–21 (discussing confirmation bias in DNA testing); *see also* Saul M. Kassin et al., *The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions*, 2 J. Applied Res. Memory & Cognition 42, 46–47 (2013).

90. Itiel E. Dror & Greg Hampikian, *Subjectivity and Bias in Forensic DNA Mixture Interpretation*, 51 Sci. and Just. 204 (2011).

so that analysts do not receive case information not relevant to their analysis, and some laboratories have started to consider such procedures, as well as blind verification, or a review by supervisors of an analyst's work where the supervisor does not know what conclusion the analyst reached.[91] The type of blind quality control that the Houston lab is doing, using phony samples to test the performance of analysts, should be routine at any crime lab.[92]

A second type of research looks to actors in the court system: What do jurors and practicing lawyers think of forensics? This psychological research also relates to central concerns in Benforado's book, including his broad skepticism of criminal trials.[93] When we survey nonlawyers (lawyers are more skeptical) about forensic evidence, we find that they have extremely strong faith in the accuracy and uniqueness of evidence like fingerprints and DNA.[94] People believe that forensics can unfailingly identify guilty criminals. Although forensic analysts had in the past told jurors that their work was error-proof,[95] such infallibility is simply impossible. Human error is inevitable, but it can be minimized.

A second wave of law and psychology research may help to ensure that what forensic analysts say in the courtroom does not mislead lawyers and jurors. Then again, lawyers may be primed to accept evidence that confirms their prior beliefs. If prosecutors and defense lawyers are accustomed to litigating cases with very limited information about the forensics, and they are accustomed to seeing forensics that readily confirm guilt, they may tend to ask no more questions than did George Rodriguez's defense lawyer. (Thompson, p. 13). It is "tempting" to fail to investigate the forensics, Benforado describes, for a host of institutional reasons, including "tight deadlines" and tough caseloads (Benforado, p. 86). Even if forensic reports are written in a more informative way, lawyers may not pay careful attention unless forensic analysts really make clear that their role is to provide accurate science, and that they expect the lawyers on both sides to use that science to obtain accurate and fair results. Lasting change may require the kind of "cultural shift" that has occurred in Houston (Benforado, p. 88).

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91. *See, e.g.*, Dan E. Krane et al., Letter to the Editor, *Sequential Unmasking: A Means of Minimizing Observer Effects in Forensic DNA Interpretation*, 53 J. Forensic Sci. 1006 (2008). The FBI, for example, now uses blind verification in certain fingerprint cases. Peter E. Peterson et al., *Latent Prints: A Perspective on the State of Science*, FBI: Forensic Sci. Commc'ns (Oct. 2009), https://www.fbi.gov/about-us/lab/forensic-science-communications/fsc/oct2009/review [https://perma.cc/W6JF-MPYM].

92. Arnold, *supra* note 30.

93. *See, e.g.*, Benforado, chapter 7 (discussing the unreliability of expert witnesses).

94. Brandon L. Garrett & Gregory Mitchell, *Forensics and Fallibility: Comparing the Views of Lawyers and Jurors*, 119 W. Va. L. Rev. (forthcoming 2017) [hereinafter Garrett & Mitchell, *Forensics and Fallibility*]; Brandon Garrett & Gregory Mitchell, *How Jurors Evaluate Fingerprint Evidence: The Relative Importance of Match Language, Method Information, and Error Acknowledgement*, 10 J. Empirical Legal Stud. 484 (2013) [hereinafter Garrett & Mitchell, *Fingerprint Evidence*].

95. *See* Garrett & Mitchell, *Fingerprint Evidence*, *supra* note 94, at 488–89.

Third, new hard science may provide tools to better detect and collect crime scene evidence and could improve the relationship between police and crime lab analysts. Those advances may be most important of all, since so often evidence goes untested because it was collected poorly or not at all. Benforado suggests that more "real time" analysis of forensics may help to "quickly close cases" (Benforado, p. 261) (although he acknowledges that, for example, there may be biological samples to DNA test in only five to ten percent of criminal cases) (Benforado, p. 284). Consider the advent of field DNA testing kits—mini-sized DNA labs which may soon be capable of widespread use, which may soon be connected to the CODIS, if federal enacting legislation permits.[96] Wherever police arrest and book individuals, DNA could be tested rapidly in the field and then directly fed into the databank system. Will quality control suffer? Will sound regulation of crime labs matter less when any police officer can use a small device to test people, checking the cheek swab as quickly as the license and registration? Will near-instant DNA testing make biometric screening a fact of everyday life for much of the population—or perhaps just targeted populations of immigrations, minorities, and youth? Will DNA phenotyping, the use of DNA profiles to try to generate visual "mugshots" of suspects, be used? The technology, as Murphy describes, still "has a ways to go," and may even lead to false eyewitness identifications of people who look like inaccurate "DNA mugshots" but not like the actual culprits.[97] Scientific standards, quality controls at the federal and the local levels, and careful consideration of ethical and privacy issues will become more important than ever.

This is an incredibly exciting time for forensics, but also a time of terrible privacy concerns and troubling growing pains as the crime lab emerges from a time of almost complete nonregulation—when forensic analysts neither were cops nor wore lab coats and were not governed by established police procedures or by sound science. The advances of the past two decades, including the advent of nuclear DNA testing and databanks, are just the beginning of the transformation of the crime lab as a scientific and legal institution. Now the crime lab is finally coming into its own as a criminal justice actor—and with that will come legal regulation, constitutional criminal procedure, and improved scientific standards and oversight. Whether judges, lawyers, scholars, and law enforcement will adequately reckon with the ethical, privacy, and scientific implications of new technology remains to be seen.[98]

96. Ava Kofman, *The Troubling Rise of Rapid DNA Testing*, New Republic (Feb. 24, 2016), https://newrepublic.com/article/130443/troubling-rise-rapid-dna-testing [https://perma.cc/WKQ4-EMY8].

97. *See* Murphy, p. 224.

98. For a cautionary discussion, see Murphy, pp. 288–92.

Conclusion

The crime lab evolved as a law enforcement institution, with scientific trappings that long permitted it to avoid practical, legal, and constitutional scrutiny. That model is now changing as crime labs have become important state and national players in criminal justice. As a result, crime labs are slowly becoming more closely regulated legally and subject to more scientific oversight. As crime labs' budgets have swelled and their profiles have risen in criminal cases, and as the costs of systemic errors and fraud have become abundantly clear, the law and the science have had to catch up. We spend, as Benforado reminds us, upwards of $60 billion a year on our correctional system and far more to run our mass incarceration system (Benforado, p. 231). Yet somehow, comforted by the notion that our trial procedures will catch errors, for decades we have failed to spend a fraction of that amount to make sure that crime labs get the evidence right.[99]

Perhaps we need to turn from constitutional privacy rights under the Fourth Amendment to protections geared toward remedying defects in the adversary and the plea bargaining process. I have suggested that recent Supreme Court rulings finding ineffective assistance of counsel regarding litigation of forensics have real promise.[100] So do rulings, like the one in the *Buffey* case, that emphasize obligations of prosecutors and crime labs to disclose evidence, particularly since so many cases are resolved through pleas. Lawyers may increasingly litigate forensics issues and demand greater discovery or experts of their own to assess whether the forensics were done properly.[101] State law is also catching up. New statutes and regulations define the structure and procedures for crime labs in new ways. States are adopting new statutes geared towards reopening criminal cases, not because of entirely new forensic tests like DNA tests, but because the underlying scientific understanding has changed over time.[102]

And crime labs can change: the Houston story shows how it can happen and how it must happen at the local and the national level (Thompson, pp. 208–09). Many scholars and forensic scientists have called for a broader change in creating a "research culture" for crime labs,[103] particularly following the recommendations of the National Academy of Sciences in a prominent 2009 report.[104] Those efforts are slowly starting to bear fruit, as I have described, with work being done to establish new quality controls at the more progressive crime labs; efforts by the Department of Justice and the

99. *See* Durose et al., *supra* note 18, at 10.

100. *See* Garrett & Mitchell, *Forensics and Fallibility*, *supra* note 94.

101. For a study that begins to examine this question using surveys, see *id.*

102. *See* Cal. Penal Code § 1473 (West Supp. 2016); Tex. Code Crim. Proc. Ann. art. 11.073(b) (West Supp. 2015).

103. Jennifer L. Mnookin et al., *The Need for a Research Culture in the Forensic Sciences*, 58 UCLA L. Rev. 725, 744–60 (2011).

104. 2009 NAS Report, supra note 10.

National Institute for Standards and Technology to develop legal and scientific standards for forensics; and funding of a new wave of basic research.[105]

It is quite sobering to be reminded by these authors that the crime lab, from quite humble beginnings, has been for so long permitted to place evidence into our courtrooms with minimal oversight, constitutional protections, or, still worse, scientific standards. As science and law catch up with the modern crime lab, one hopes that the result will better safeguard the broader interests of the public. If the crime lab can make that transition to a full-fledged scientific and legal institution, our entire criminal system will be far more accurate and just.

105. *See* NIST OSAC Announcement, *supra* note 77; Dep't of Justice, *supra* note 76.