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Comparative Bullet Lead Analysis: A Retrospective

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For over thirty years, FBI experts testified about comparative bullet lead analysis (CBLA), a technique that was first used in the investigation into President Kennedy's assassination.[1] CBLA compares trace chemicals found in bullets at crime scenes with ammunition found in the possession of a suspect.[2] This technique was used by the FBI when firearms ("ballistics") identification could not be employed—for example, if the weapon was not recovered or the bullet was too mutilated for comparison purposes.

Although the FBI eventually ceased using CBLA, the Bureau's conduct in first employing the technique and then defending it after it was challenged provides an insight into how forensic science sometimes works.

A. The Technique

FBI experts used various analytical techniques (first, neutron activation analysis (NAA), and then inductively coupled plasma-atomic emission spectrometry (ICP-AES)) to determine the concentrations of seven elements—arsenic, antimony, tin, copper, bismuth, silver, and cadmium—in the bullet lead alloy of both the crime-scene and suspect's bullets. Statistical tests were then used to compare the elements in each bullet and determine whether the fragments and suspect's bullets were "analytically indistinguishable" for each of the elemental concentration means. Exactly what the phrase "analytically indistinguishable" meant was the critical issue—i.e., did such a finding mean that the bullet fragments came from a small or large universe? The probative value of the test results would, of course, differ if only a hundred bullets had the same chemical composition as opposed to several million bullets.

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[1]See generally Erik Randich & Patrick M. Grant, Proper Assessment of the JFK Assassination Bullet Lead Evidence from Metallurgical and Statistical Perspectives, 51 J. Forensic Sci. 717 (2006) (discussing the original analysis of the bullet fragments).

[2]The overwhelming majority of cases were homicide prosecutions, some of which were capital cases. Because there are few federal homicide statutes, CBLA evidence was most commonly used in state prosecutions.

B. The Challenge

The technique was not seriously challenged until a retired FBI examiner, William Tobin, began questioning the procedure in scientific and legal journals[3] and in court testimony as well.[4] These challenges apparently lead one FBI expert, Kathleen Lundy, to testify falsely. In *Commonwealth v. Ragland*,[5] a Kentucky murder case, she stated at a pretrial admissibility hearing that the elemental composition of a .243 caliber bullet fragment removed from the victim's body was analytically indistinguishable from bullets found at the home of the defendant's parents.[6] Lundy further testified that the Winchester Company purchased its bullet lead in *block* form prior to 1996 and then remelted it at its manufacturing plant. However, during cross-examination at trial, Lundy admitted that she knew prior to the pretrial hearing that Winchester had purchased its lead in *billet* form in 1994.[7] This was not a minor point. Millions more bullets could have the same "source" if they were last melted by a secondary smelter instead of by Winchester.[8] Lundy subsequently admitted to her superiors that she had lied,[9] and on June 17, 2003, she pleaded guilty to testifying falsely

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[3]See Edward J. Imwinkelried & William A. Tobin, Comparative Bullet Lead Analysis (CBLA) Evidence: Valid Inference or Ipse Dixit?, 28 Okla. City U. L. Rev. 43 (2003); Erik Randich et al., A Metallurgical Review of the Interpretation of Bullet Lead Compositional Analysis, 127 Forensic Sci. Int'l 174 (2002) (Tobin was a coauthor); William A. Tobin & Wayne Duerfeldt, How Probative is Comparative Bullet Lead Analysis?, 17 Crim. Just. 26 (Fall 2002).

[4]E.g., *Ragland v. Com.*, 191 S.W.3d 569, 577 (Ky. 2006); *Clemons v. State*, 392 Md. 339, 896 A.2d 1059, 1070 (2006); *State v. Behn*, 375 N.J. Super. 409, 868 A.2d 329, 339–40 (App. Div. 2005) (Tobin's affidavit submitted). Although a metallurgist, Tobin worked in a different section of the lab.

[5]*Ragland v. Com.*, 191 S.W.3d 569, 580 (Ky. 2006).

[6]See Dan Eggen, FBI Lab Moves to New Home, Wash. Post, Apr. 25, 2003, at A21; New Allegations Target DNA, Bullet Analysis at FBI Lab, Associated Press, Apr. 23, 2003 ("Weeks after testifying at a court hearing in a Kentucky murder, FBI scientist Kathleen Lundy told her superiors a secret. She knowingly gave false testimony about her specialty of lead bullet analysis."); Joseph Gerth, Ragland Prosecutor Can Stay on Case, Courier-Journal, Oct. 19, 2002, at 1B.

[7]*Ragland*, 191 S.W.3d at 580 ("During cross-examination at trial, Lundy admitted that her testimony at the *Daubert* hearing was false and that she knew prior to the *Daubert* hearing that Winchester purchased its bullet lead in billets in 1994. Her only explanation for her false testimony was that she had misunderstood the question. When defense counsel read the questions and answers to her from a transcript, she asserted that she could not remember if that was, in fact, her testimony.").

[8]*Ragland*, 191 S.W.3d at 576–77.

[9]See Charles Pillar & Robin Mejia, Science Casts Doubt on FBI's Bullet Evidence, L.A. Times, Feb. 3, 2003 ("In a sworn affidavit, she admitted that her trial testimony was untruthful and that the manufacturing batch was many times larger than she had

and was sentenced to a suspended ninety-day jail sentence and a $250 fine.[10]

As a result of Tobin's testimony, the FBI asked the National Academy of Sciences (NAS) to review the technique. NAS appointed a committee of scientists, statisticians, and attorneys to conduct the review.[11]

C. The NAS Report

One of the first things the NAS Committee discovered was the disparate (often inconsistent) interpretive conclusions provided by FBI experts in the reported cases. In some, experts testified only that two exhibits were "analytically indistinguishable."[12] In other cases, examiners concluded that samples *could have* come from the same "source" or "batch."[13] In still others, they stated that the samples *came* from the same source.[14] The testimony in numerous cases went much further and referred to a "box" of ammunition. For example, two specimens:

- Could have come from the same box,[15]
- Could have come from the same box or a box manufactured on the same day,[16]
- Were consistent with their having come from the same box of ammunition,[17]

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suggested. . . . Lundy blamed her conduct partly on a sense of crisis in her work, fed by 'new and repeated challenges to the validity of the science associated with bullet lead comparison analysis.' ").

[10]Mark Pitsch, Ex-FBI Scientist Pleads Guilty, Courier-Journal, June 18, 2003, at 1B. See also Steve Bailey, Defense Attorneys Want Prosecutors Disqualified, Associated Press, Sept. 6, 2002 ("Attorneys for both sides were in court for a hearing in which FBI ballistics expert Kathleen Lundy was scheduled to testify about lying during a preliminary hearing in Shane Ragland's murder case."); Maurice Possley, Study Shoots Holes in Bullet Analysis by FBI, Chi. Trib., Feb. 11, 2004, at C14.

[11]National Research Council, National Academy of Sciences, Forensic Analysis: Weighing Bullet Lead Evidence 6 (2004). The author served on the NAS Committee.

[12]See *Wilkerson v. State*, 139 Md. App. 557, 776 A.2d 685, 689 (2001).

[13]See *State v. Krummacher*, 269 Or. 125, 523 P.2d 1009, 1012–13 (1974).

[14]See *U.S. v. Davis*, 103 F.3d 660, 673–74, 46 Fed. R. Evid. Serv. 189 (8th Cir. 1996); *People v. Lane*, 256 Ill. App. 3d 38, 195 Ill. Dec. 218, 628 N.E.2d 682, 689–90 (1st Dist. 1993).

[15]See *State v. Strain*, 885 P.2d 810, 817 (Utah Ct. App. 1994); *Jones v. State*, 425 N.E.2d 128, 131 (Ind. 1981).

[16]See *State v. Grube*, 126 Idaho 377, 883 P.2d 1069, 1078 (1994); *People v. Johnson*, 114 Ill. 2d 170, 102 Ill. Dec. 342, 499 N.E.2d 1355, 1366 (1986).

[17]See *State v. Reynolds*, 307 N.C. 184, 297 S.E.2d 532, 534, 31 A.L.R.4th 473 (1982).

- Probably came from the same box,[18] and
- Must have come from the same box or from another box that would have been made by the same company on the same day.[19]

Testimony that two specimens came from the same box of ammunition (usually 50 loaded cartridges, sometimes 20) is powerful evidence.

Several other (and different) statements appear in the published opinions. An early case reported that the specimens "had come from the same batch of ammunition: they had been made by the same manufacturer on the same day and at the *same hour.*"[20] One case reports the expert's conclusion with a statistic.[21] In another case, the expert used the expressions "rare finding"[22] and "a very rare finding."[23] In still another case, the expert "opined that the same company produced the bullets at the same time, using the same lead source. Based upon Department of Justice records, she opined that an overseas company called PMC produced the bullets around 1982."[24] These inconsistencies suggest that the FBI laboratory was not monitoring the trial testimony of its experts.

The publication of the NAS Report in 2004 undercut much of this testimony. According to the report, "The available data do not support any statement that a crime bullet came from a particular box of ammunition. In particular, references to 'boxes' of ammunition in any

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[18]See *Bryan v. State*, 935 P.2d 338, 360, 1997 OK CR 15 (Okla. Crim. App. 1997).

[19]See *U.S. v. Davis*, 103 F.3d 660, 666–67, 46 Fed. R. Evid. Serv. 189 (8th Cir. 1996) ("An expert testified that such a finding is rare and that the bullets must have come from the same box or from another box that would have been made by the same company on the same day."); *Com. v. Daye*, 411 Mass. 719, 587 N.E.2d 194, 207 (1992); *State v. King*, 353 N.C. 457, 546 S.E.2d 575, 584 (2001) (Kathleen Lundy "opined that, based on her lead analysis, the bullets she examined either came from the same box of cartridges or came from different boxes of the same caliber, manufactured at the same time.").

[20]*Brown v. State*, 601 P.2d 221, 224 (Alaska 1979) (emphasis added).

[21]*Earhart v. State*, 823 S.W.2d 607, 614 (Tex. Crim. App. 1991).

[22]*U.S. v. Davis*, 103 F.3d 660, 666, 46 Fed. R. Evid. Serv. 189 (8th Cir. 1996).

[23]*Davis*, 103 F.3d at 667.

[24]*People v. Villarta*, 2002 WL 66887 (Cal. App. 6th Dist. 2002) (murder). In recent years, the testimony became more limited. A 2002 FBI publication states the conclusion as follows: "Therefore, they *likely* originated from the same manufacturer's source (melt) of lead." Charles A. Peters, The Basis for Compositional Bullet Lead Comparisons, 4 Forensic Sci. Comm. No. 3, at 5 (July 2002) (emphasis added). Testimony to the same effect has also been proffered. Testimony of Charles Peters, *Commonwealth v. Wilcox*, Kentucky, Feb. 28, 2002, Transcript (trial testimony): "Well, bullets that are analytically indistinguishable likely come from the same molten lead sources of lead, uh, as opposed to bullets that have different composition come from different, uh, melts of lead."

form should be avoided as misleading under Federal Rule of Evidence 403."[25] The most disturbing case is *State v. Earhart*,[26] a capital murder case in which the CBLA evidence apparently played a significant role.[27] The transcript contains the following expert testimony: "We can—from my 21 years experience of doing bullet lead analysis and doing research on boxes of ammunition down though the years I can determine if bullets came from the same box of ammunition . . ."[28] However, according to the NAS Committee the amount of bullets that can be produced from a melt "can range from the equivalent of as few as 12,000 to as many as 35 million 40 grain, .22 caliber longrifle bullets."[29] Earhart was executed before the NAS Report was published.[30]

In 2003, a federal district court excluded CBLA evidence under the *Daubert* standard.[31] This was apparently the first case to rule such evidence inadmissible.

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[25]National Research Council, supra note 11, at 7.

[26]*Earhart v. State*, 823 S.W.2d 607, 614 (Tex. Crim. App. 1991) ("He concluded that the likelihood that two .22 caliber bullets came from the same batch, based on *all* the .22 bullets made in one year, is approximately .000025 percent, 'give or take a zero.' He subsequently acknowledged, however, that the numbers which he used to reach the .000025 percent statistic failed to take into account that there are different types of .22 caliber bullets made each year — .22, .22 long, and .22 long rifle. Agent Riley ultimately testified that there could be several hundred thousand bullets per batch, but with some variation in the elemental composition within the batch.") (emphasis added).

[27]See *Earhart v. Johnson*, 132 F.3d 1062, 1068 (5th Cir. 1998) (denying habeas relief, the court referred to "the significant role the bullet evidence played in the prosecution's case").

[28]Testimony of John Riley, State v. Earhart, No. 4064, Dist. Ct. Lee County, 21st Judicial Dist., Texas, Transcript at 5248–49. See also id. at 5258 ("Well, bullets that are — that have analytically indistinguishable compositions or compositions that are generally similar typically are found within the same box of ammunition and that is the case that we have here. Now, bullets that are the same composition can also be found in other boxes of ammunition, but it's most likely those boxes would have been manufactured at the same place on or about the same date."). But see testimony of Charles Peters, FBI examiner, Commonwealth v. Wilcox, Kentucky, Feb. 28, 2002 (*Daubert* hearing: "We have never testified, to my knowledge, that that bullet came from that box. We'd never say that. All we are testifying is that that bullet, or that victim fragment or something, the bullet, either came from that box or the *many* boxes that were produced at the same time." Transcript at 1–2.) (emphasis added).

[29]National Research Council, supra note 11, at 6.

[30]See Death Penalty Information Center, Searchable Database of Executions, http://www.deathpenaltyinfo.org/executions (search for "Earhart" under "Find Person" search box) (last visited Dec. 28, 2010).

[31]*U.S. v. Mikos*, 2003 WL 22922197 (N.D. Ill. 2003).

D. Withholding Data

Much of the FBI testimony rested on a database that the Bureau had built up over the course of many years. Although the NAS Committee frequently asked for this data during its year-long investigation, the FBI did not turn over the data until it was too late to include an analysis of the information in its report.[32] Karen Kafadar and Cliff H. Spiegelman, the two statisticians who served on the NAS Committee, would later write that their subsequent inspection of the data "identified several peculiarities."[33] First, the database was incomplete. The FBI claimed to have a "complete data file" of some 71,000+ measurements but only 64,869 were turned over. Moreover, only measurements made by ICP-AES were included; a different analytical method, NAA, had been used before 1997. Both techniques measured the same elements, and therefore the results from either technique would have been suitable for comparison. Further, the numbering system for the bullets was "highly inconsistent and rather unexpected," suggesting that some bullet measurements had been deleted.[34] Additionally, "a rough investigation of the measurement error indicated many measurement errors that exceeded the FBI's claimed analytical precision of 2–5%."[35] Finally, "only 15% of the 1,079 cases listed in these two files had measurements from [National Institute of Standards and Technology] . . . [,] making it impossible to determine the frequency of

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[32]See Cliff H. Spiegelman & Karen Kafadar, Data Integrity and the Scientific Method: The Case for Bullet Lead Data as Forensic Evidence, 19:2 Chance 16, 22 (2006) ("During the open sessions of the committee meetings, the FBI claimed to have a 'complete data file' of some 71,000+ measurements. Following repeated requests from the Committee, the FBI submitted at its last meeting a CD-ROM that contained two data files with a combined total of 64,869 bullet (not 71,000+) measurement records. . . . This data set could not be analyzed in time for the release of the report . . .").

[33]Spiegelman & Kafadar, supra note 32.

[34]Spiegelman & Kafadar, supra note 32 ("[T]he numbering system of the bullets was highly inconsistent and rather unexpected, e.g., the bullets from a suspect in a particular case might be numbered Q13A, Q13B, Q13C, Q14A, Q14B, Q14C, . . ., leading one to wonder what happened to bullets Q01, Q02, . . ., Q12."). Other illustrations of incomplete data were noted: "[W]hile most of the bullets indicated 3 measurements, about 30 bullets had six or more measurements." Id. "[O]nly about 50% of the bullets in this data set were identified as having come from one of the four major bullet manufacturers in the United States (Cascade Cartridge, Inc.; Federal; Remington; Winchester); the 'complete data file' of 71,000 bullets may yield a higher proportion of bullets from these four manufacturers." Id.

[35]Spiegelman & Kafadar, supra note 32.

'matches' " in some cases.[36] Accordingly, the "missing data and the inconsistent precisions" undermined the Bureau's public claims.[37]

As researchers steeped in the traditions of science, Kafadar and Spiegelman were puzzled by the FBI's failure to disclose this data. They wrote: "The scientific method is important for science generally; forensic science is no exception. . . . [T]he evidence in this paper suggest that, at least for [CBLA], forensic science failed in the requirement to share the material, methods and data to reach conclusions with the scientific community."[38]

In short, the NAS Committee, appointed at the behest of and funded by the FBI, was not provided with critical data that would have assisted it in evaluating the technique. This data formed the basis of the Bureau's testimony in about 500 prosecutions, including death penalty cases.[39]

E. "Spinning" the Science

The FBI's response to the NAS Report was also disconcerting. The Bureau quickly put out a press release, obscuring the report's findings. The release highlighted the NAS Committee's conclusion that the FBI was using appropriate instrumentation and the correct elements for comparison. Yet these aspects of CBLA were not the ones in question. Rather, the interpretation of the data was the disputed issue. Only one sentence in the press release addressed this important issue: "Recommendations by the [NAS] include suggestions to improve the statistical analysis, quality control procedures, as well as expert testimony."[40] The news media read the report quite differently — e.g., "Study Shoots Holes in Bullet Analysis By FBI,"[41] "Report Finds Flaws,"[42] "Panel

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[36]Spiegelman & Kafadar, supra note 32.

[37]Spiegelman & Kafadar, supra note 32.

[38]Spiegelman & Kafadar, supra note 32, at 22–23.

[39]See Paul C. Giannelli, Wrongful Convictions and Forensic Science: The Need to Regulate Crime Labs, 86 N.C. L. Rev. 163, 198–203 (2007) (discussing CBLA).

[40]Department of Justice, FBI News Release, Feb. 10, 2004.

[41]Maurice Possley, Study Shoots Holes in Bullet Analysis By FBI, Chi. Trib., Feb. 11, 2004, at 14.

[42]Charles Pillar, Report Finds Flaws in FBI Bullet Analysis; Changes are Proposed for the Technique Often Cited in Expert Testimony in Criminal Trials, L.A. Times, Feb. 11, 2004, at 12.

Questions FBI Bullet Analysis,"[43] and "Report Questions the Reliability of an F.B.I. Ballistics Test."[44]

The Bureau also included the following passage in the press release: "The basis of bullet lead compositional analysis is supported by approximately 50 peer-reviewed articles found in scientific publications beginning in the early 1970's. Published research and validation studies have continued to demonstrate the usefulness of the measurements of trace elements within bullet lead."[45] In contrast, the NAS Report pointed out that there were "very few peer-reviewed articles on homogeneity and the rate of false positive matches" and "outside reviews have only recently been published."[46] In effect, the FBI cherry-picked favorable statements from the report and downplayed the unfavorable crucial findings.

Over a year after the release of the NAS study, the FBI discontinued CBLA testing,[47] issuing another slanted press release. Once again, the release minimized the problems, citing the following reason for its decision: "While the FBI Laboratory still firmly supports the scientific foundation of bullet lead analysis, given the costs of maintaining the equipment, the resources necessary to do the examination, and its relative probative value, the FBI Laboratory has decided that it will no longer conduct this exam."[48] Nevertheless, a month earlier, Dwight Adams, the laboratory director, had written a memorandum to the FBI Director specifying different reasons for abandoning the technique, including the following comments: (1) "We cannot afford to be misleading to a jury" and (2) "We plan to discourage prosecutors from using our previous results in future cases."[49] Neither concern was reflected in the press release.

In the wake of the National Academy's report, several state courts excluded CBLA evidence.[50] Surprisingly, the FBI supplied affidavits in several cases supporting prosecutors' efforts to sustain convictions

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[43]Randolph E. Schmid, Panel Questions FBI Bullet Analysis, Associated Press, Feb. 10, 2004.

[44]Eric Lichtblau, Report Questions the Reliability of an F.B.I. Ballistics Test, N.Y. Times, Feb. 11, 2004, at 22.

[45]FBI News Release, supra note 40.

[46]National Research Council, supra note 11, at 100.

[47]Eric Lichtblau, F.B.I. Abandons Disputed Test for Bullets From Crime Scene, N.Y. Times, Sept. 2, 2005, at A12.

[48]Department of Justice, FBI News Release, Sept. 1, 2005.

[49]John Solomon, FBI's Forensic Test Full of Holes, Wash. Post, Nov. 18, 2007, at A1.

[50]See *Ragland v. Com.*, 191 S.W.3d 569, 580 (Ky. 2006) (noting that "[i]f the FBI Laboratory that produced the CBLA evidence now considers such evidence to be of

based on the technique. In one affidavit, the FBI cited the Academy's report but failed to mention that the report had faulted the Bureau's statistical methods. The chair of the NAS Committee criticized the affidavit because it did "not discuss the statistical bullet-matching technique, which is key and probably the most significant scientific flaw found by the committee."[51] The affidavit was also misleading because it estimated that the maximum number of .22-caliber bullets in a batch of lead was 1.3 million, when the NAS Committee found that the number could be as high as 35 million.[52]

On November 18, 2007, *60 Minutes* aired a segment on CBLA. In an interview for *60 Minutes*, the FBI lab director, now retired, acknowledged that testimony about boxes was "misleading and inappropriate."[53] That broadcast, along with a *Washington Post* investigation, called into question the FBI's response to the NAS Report. The main problem was that only the FBI had records of all the cases in which its experts had testified, and the Bureau had declined to disclose the names of those cases.[54] Instead, the Bureau relied on the NAS Report, its own press releases, and pro forma letters sent to prosecution and defense organizations to notify defendants that the prosecution experts had relied upon faulty science. Yet the letters neither highlighted the problem, nor its significance, and therefore were grossly inadequate means of communication, especially for

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insufficient reliability to justify continuing to produce it, a finding by the trial court that the evidence is both scientifically reliable and relevant would be clearly erroneous"); *Clemons v. State*, 392 Md. 339, 896 A.2d 1059, 1070, 1078 (2006) ("CBLA is not admissible under the *Frye-Reed* standard because it is not generally accepted within the scientific community as valid and reliable."; "Based on the criticism of the processes and assumptions underlying CBLA, we determine that the trial court erred in admitting expert testimony based on CBLA because of the lack of general acceptance of the process in the scientific community."); *State v. Behn*, 375 N.J. Super. 409, 868 A.2d 329, 331 (App. Div. 2005) (finding the technique was "based on erroneous scientific foundations").

But see *Com. v. Fisher*, 582 Pa. 276, 870 A.2d 864, 871 (2005) ("The CBAL evidence, at best, established a possible connection between Appellant and the bullets recovered from the victim's body."). See also *U.S. v. Davis*, 406 F.3d 505, 509 (8th Cir. 2005) ("Davis's trial counsel cannot be said to be ineffective for failing to challenge the FBI's methodology on a basis that was not advanced by the scientific community at the time of trial.").

[51]Solomon, supra note 49 (quoting Ken MacFadden).

[52]See supra text accompanying note 29.

[53]60 Minutes: Evidence of Injustice (CBS television broadcast Nov. 18, 2007).

[54]Solomon, supra note 49, at A1 ("Hundreds of defendants sitting in prisons nationwide have been convicted with the help of an FBI forensic tool that was discarded more than two years ago. But the FBI lab has yet to take steps to alert the affected defendants or courts, even as the window for appealing convictions is closing . . .").

prisoners without attorneys.[55] A few days after the *60 Minutes* expose, Senator Patrick Leahy, the Chairman of the Senate Judiciary Committee, sent a letter to the FBI Director, noting that the Bureau's letters gave "the false impression that these discredited tests had continuing reliability."[56]

Conclusion

Several lessons can be gleaned from the CBLA experience. First, the failure to publish the empirical data that supports scientific conclusions is unacceptable. Scientists "are generally expected to exchange research data as well as unique research materials that are essential to the replication or extension of reported findings."[57] Second, defense attorneys were unable to successfully challenge the evidence until Tobin, the retired FBI expert, became a defense witness. This is not surprising because no defendant, no matter how rich, can conduct extensive empirical studies. A defense expert in a particular case can critique the bases of a prosecution expert's opinion but can rarely replicate the research upon which that opinion rests.[58]

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[55]The Innocence Network and the National Association of Criminal Defense Lawyers have formed a task force and are working with the FBI to contact defense attorneys and convicts. See Vesna Jaksic, Faulty Bullet-test Cases Finding Way to Court, Nat'l L.J., Feb. 25, 2008 ("The task force is lining up pro bono commitments from several law firms to handle the cases.").

[56]John Solomon, Leahy Pursues Forensic-Test Answers; Attorney General Is Told to Prepare For Senate Inquiry, Wash. Post, Nov. 22, 2007, at A2. Leahy also wrote: "The new revelations about bullet-lead analysis are just the latest examples of the Department's inadequate efforts to ensure that sound forensic testing is utilized to the maximum extent to find the guilty rather than merely obtain a conviction. Punishing the innocent is wrong and allows the guilty party to remain free." Id.

[57]National Research Council, National Academies of Sciences, Responsible Science 11 (1992). See also National Research Council, National Academies of Sciences, Sharing Publication-Related Data and Materials: Responsibilities of Authorship in the Life Sciences 4 (2003) (advocating a "uniform principle for sharing integral data and materials expeditiously" or UPSIDE).

[58]See generally Paul C. Giannelli, *Ake v. Oklahoma*: The Right to Expert Assistance in a Post-*Daubert*, Post-DNA World, 89 Cornell L. Rev. 1305, 1329-30 (2004).