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The Disappointing History of Science in the Courtroom: Frye, Daubert, and the Ongoing Crisis of "Junk Science" in Criminal Trials

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Abstract
Twenty-five years ago, the Supreme Court decided one of the most important cases concerning the use of science in courtrooms. In Daubert v. Merrell Dow Pharmaceuticals , the Court addressed widespread concerns that courts were admitting unreliable scientific evidence. In addition, lower courts lacked clarity on the status of the previous landmark case for courtroom science, Frye v. United States. In the years leading up to the Daubert decision, policy-makers and legal observers sounded the alarm about the rise in the use of "junk science" by so-called expert witnesses. Some critics went so far as to suggest that American businesses and the viability of the court system itself were at stake.

Despite the likely exaggeration of such claims, the law of the admissibility of expert testimony certainly needed reform by the time of Daubert. As the Court itself acknowledged, there was a circuit split on the appropriate standard for courts to apply. Lower courts had been applying inconsistent criteria and, for the most part, had ignored the nearly twenty year-old codified rule of evidence on the subject. In addition, after a century of the growth of science in the courtroom, expert witnesses had become a prominent feature of the legal system, requiring courts to respond to more and more questions concerning the admissibility of their testimony.

Part I of this Article will address the history of expert witness admission in the modem legal era and the important role of Frye. Part II of this Article will explore what led to Daubert and the Court's decision. Part III of this Article will distill the meaning of Daubert and subsequent Supreme Court cases and examine the many studies that have attempted to measure Daubert's impact on the court system. Part IV will discuss Daubert's limited impact on the criminal justice system, highlighting a few profoundly disturbing examples of unreliable forensic science that currently plague criminal courts. Part V will discuss potential options for improving how courts admit expert witness testimony.

Keywords
Daubert, Frye, Evidence, Expert witnesses, Junk science, Scientific evidence

Disciplines
Evidence

THE DISAPPOINTING HISTORY OF SCIENCE IN THE COURTROOM: *FRYE*, *DAUBERT*, AND THE ONGOING CRISIS OF "JUNK SCIENCE" IN CRIMINAL TRIALS

JIM HILBERT*

Introduction

Twenty-five years ago, the Supreme Court decided one of the most important cases concerning the use of science in courtrooms.[1] In *Daubert v. Merrell Dow Pharmaceuticals*,[2] the Court addressed widespread concerns that courts were admitting unreliable scientific evidence.[3] In addition, lower courts lacked clarity on the status of the previous landmark

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1. *See* David E. Bernstein, *The Unfinished* Daubert *Revolution*, ENGAGE: J. FEDERALIST SOC'Y PRAC. GROUPS, Feb. 2009, at 35, 35 (declaring *Daubert* as "probably the most radical, sudden, and consequential change in the modern history of the law of evidence"); Barbara P. Billauer, *Admissibility of Scientific Evidence Under* Daubert*: The Fatal Flaws of 'Falsifiability' and 'Falsification,'* 22 B.U. J. SCI. & TECH. L. 21, 23 (2016) [hereinafter Billauer, *Admissibility*] (claiming the *Daubert* decision "would profoundly change the face of scientific evidence in American courts"); David L. Faigman, *The* Daubert *Revolution and the Birth of Modernity: Managing Scientific Evidence in the Age of Science*, 46 U.C. DAVIS L. REV. 893, 895 (2013) (describing the changes ushered in by *Daubert* as "revolutionary"); Erin Murphy, *Neuroscience and the Civil/Criminal Daubert Divide*, 85 FORDHAM L. REV. 619, 621 (2016) ("When announced by the U.S. Supreme Court in 1993, *Daubert* was heralded as a watershed moment in the treatment of scientific evidence.").

2. Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993).

3. According to a popular, yet polemical, book at the time, the courts were overrun with pseudo-science and fake expertise in the late 1980s. *See* PETER W. HUBER, GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM 2 (1991) ("Maverick scientists shunned by their reputable colleagues have been embraced by lawyers. Eccentric theories that no respectable government agency would ever fund are rewarded munificently by the courts. . . . Courts resound with elaborate, systematized, jargon-filled, serious-sounding deceptions that fully deserve the contemptuous label used by trial lawyers themselves: *junk science*."). For a more thorough discussion, and critique, of Huber's book, *see infra* notes 108-114 and accompanying text.

case for courtroom science, *Frye v. United States*.[4] In the years leading up to the *Daubert* decision, policy-makers and legal observers sounded the alarm about the rise in the use of "junk science" by so-called expert witnesses.[5] Some critics went so far as to suggest that American businesses and the viability of the court system itself were at stake.[6]

Despite the likely exaggeration of such claims, the law of the admissibility of expert testimony certainly needed reform by the time of *Daubert*.[7] As the Court itself acknowledged, there was a circuit split on the appropriate standard for courts to apply.[8] Lower courts had been applying inconsistent criteria and, for the most part, had ignored the nearly twenty-year-old codified rule of evidence on the subject.[9] In addition, after a century of the growth of science in the courtroom,[10] expert witnesses had

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4. Frye v. United States, 293 F. 1013, 1014 (D.C. Cir. 1923), *overruled by Daubert*, 509 U.S. 579. In *Daubert*, the Court held that *Frye* was superseded by Federal Rule of Evidence 702, which governs expert testimony in federal courts. *Daubert*, 509 U.S. at 588.

5. In the early 1990s, "[t]he President's Council on Competitiveness, chaired by former Vice President Dan Quayle, established a Civil Justice Reform Task Force" to examine the perceived proliferation of unreliable expert testimony. Paul C. Giannelli, *'Junk Science': The Criminal Cases*, 84 J. CRIM. L. & CRIMINOLOGY 105, 109 (1993). Vice President Quayle became an outspoken advocate for reforming the tort system, claiming that "uncontrolled use of expert witnesses . . . has also allowed 'junk science' to tarnish the legal process." Dan Quayle, *Civil Justice Reform,* 41 AM. U. L. REV. 559, 565 (1992).

6. One leading book spared no hyperbole. *See* WALTER K. OLSON, THE LITIGATION EXPLOSION: WHAT HAPPENED WHEN AMERICA UNLEASHED THE LAWSUIT 2 (1991) ("The unleashing of litigation in its full fury has done cruel, grave harm and little lasting good. It has helped sunder some of the most sensitive and profound relationships of human life . . . .").

7. Indeed, the standards of how expert witness testimony would be assessed had been inconsistent for the previous 100 years or more. The variety of ways courts assessed the admissibility of expert witnesses "became the crucible in which *Frye* was reexamined, sometimes questioned, often implicitly modified, and occasionally rejected." Mark McCormick, *Scientific Evidence: Defining a New Approach to Admissibility,* 67 IOWA L. REV. 879, 885 (1982).

8. *Daubert*, 509 U.S. at 585 ("We granted certiorari in light of sharp divisions among the courts regarding the proper standard for the admission of expert testimony.") (citation omitted).

9. *See, e.g.*, Jean Macchiaroli Eggen, *Toxic Torts, Causation, and Scientific Evidence After* Daubert, 55 U. PITT. L. REV. 889, 910 (1994) (evaluating cases and writing at the time of the *Daubert* decision that "courts have been uncertain regarding the precise scope of the Federal Rules").

10. Jennifer L. Mnookin, *Expert Evidence, Partisanship, and Epistemic Competence*, 73 BROOK. L. REV. 1009, 1009 (2008) ("In various ways, skilled witnesses have been used in courtroom processes since just about the dawn of the jury trial. The expert witness in its modern form—a witness whose presence in court results not from being a percipient witness

become a prominent feature of the legal system, requiring courts to respond to more and more questions concerning the admissibility of their testimony.[11]

More specifically, however, *Daubert* was arguably supposed to address the sort of junk science that had surfaced in the criminal case, *Barefoot v. Estelle*, ten years earlier.[12] In *Barefoot*, the Court allowed the testimony of a psychiatrist regarding the future dangerousness of the defendant in order to impose the death penalty.[13] The Court did so despite clear evidence "that psychiatrists simply have no expertise in predicting long-term future dangerousness" and that "*two out of three* predictions of long-term future

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to material facts, but instead because of education, training, experience, or other specialized knowledge relevant to the case, and who is called by one party to testify, and is typically compensated by that party as well—can be traced back to at least the middle of the nineteenth century."). According to Judge Posner, there is "a widespread, and increasingly troublesome, discomfort among lawyers and judges confronted by a scientific or other technological issue." Jackson v. Pollion, 733 F.3d 786, 787 (7th Cir. 2013) (Posner, J.). As he explained, "[I]t's increasingly concerning, because of the extraordinary rate of scientific and other technological advances that figure increasingly in litigation." *Id.* at 788.

11. According to numerous studies, expert witnesses now appear in the vast majority of trials. Remarkably, three major studies have each concluded that expert witnesses appear in 86% of cases. *See* Andrew W. Jurs, *Expert Prevalence, Persuasion, and Price: What Trial Participants Really Think About Experts*, 91 IND. L.J. 353, 355 (2016) (finding that "the data reveals that expert witnesses appear in 86% of the cases in the study, which is an identical percentage as in two prior research studies"); Shari Seidman Diamond, *How Jurors Deal with Expert Testimony and How Judges Can Help*, 16 J.L. & POL'Y 47, 56 (2007) (finding that forty-three of the fifty civil trials examined in Arizona involved expert testimony (86%)); Samuel R. Gross, *Expert Evidence*, 1991 WIS. L. REV. 1113, 1119 (finding that 86% of 529 reported cases from 1985 and 1986 from *Jury Verdicts Weekly* involved expert testimony); *see also* Anthony Champagne, Daniel Shuman & Elizabeth Whitaker, *An Empirical Examination of the Use of Expert Witnesses in American Courts*, 31 JURIMETRICS J. 375 (1991) (finding that expert witnesses featured in 63% of cases in the study); Daniel W. Shuman, Elizabeth Whitaker & Anthony Champagne, *An Empirical Examination of the Use of Expert Witnesses in the Courts-Part II: A Three City Study*, 34 JURIMETRICS J. 193 (1994) (72%).

12. Barefoot v. Estelle, 463 U.S. 880, 916 (1983). As the co-founder of the Innocence Project put it, "Many thought *Daubert* would be the meaningful standard that was lacking in criminal cases and that it would serve to protect innocent defendants." Peter J. Neufeld, *The (Near) Irrelevance of* Daubert *to Criminal Justice and Some Suggestions for Reform*, 95 AM. J. PUB. HEALTH S107, S109 (2009).

13. *Barefoot*, 463 U.S. at 924 ("Death is a permissible punishment in Texas only if the jury finds beyond a reasonable doubt that there is a probability the defendant will commit future acts of criminal violence.").

violence made by psychiatrists are wrong."[14] Justice Blackmun, who would go on to write the *Daubert* decision, expressed serious concerns in his blistering dissent in *Barefoot* as to "how juries are to separate valid from invalid expert opinions when the 'experts' themselves are so obviously unable to do so."[15]

The *Daubert* decision did not, however, address *Barefoot* or discuss any forensic science, for that matter.[16] Since *Daubert*, courts have not used the decision to reign in the junk science of criminal prosecutions.[17] Instead, with each new study unveiled in the twenty-five years since *Daubert*, the legal community has had to repeatedly confront the reality that nearly every method of forensic science is either of questionable validity or entirely unreliable.[18]

More than just a failure of science, the inability of *Daubert* to address the problem of junk science in criminal cases has undoubtedly resulted in

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14. *Id.* at 920-21 (Blackmun, J., dissenting). As Justice Blackmun explained: "Despite its recognition that the testimony at issue was probably wrong and certainly prejudicial, the Court holds this testimony admissible because the Court is 'unconvinced . . . that the adversary process cannot be trusted to sort out the reliable from the unreliable evidence and opinion about future dangerousness.'" *Id.* at 929.

15. *Id.* at 929. Justice Blackmun was also particularly bothered by such lax oversight from the Court given that it was literally a question of life or death for the defendant. *See id.* at 916 ("[W]hen a person's life is at stake—no matter how heinous his offense—a requirement of greater reliability should prevail. In a capital case, the specious testimony of a psychiatrist, colored in the eyes of an impressionable jury by the inevitable untouchability of a medical specialist's words, equates with death itself."). Particularly troublesome was that the psychiatrist testified that there was a "one hundred percent and absolute" chance that the defendant would commit future acts of criminal violence despite having never examined the defendant. *Id.* at 919 (quoting the transcript). Justice Blackmun, who had seriously considered going to medical school and spent nine years as resident counsel for the Mayo Clinic, was likely not terribly impressed with the methodology of the testifying psychiatrist. *See generally* Stephen L. Wasby, *Justice Harry A. Blackmun in the Burger Court*, 11 HAMLINE L. REV. 183, 185 (1988) (detailing Justice Blackmun's interest in medicine).

16. *See infra* notes 136-65 and accompanying text (discussing the *Daubert* decision).

17. *See infra* notes 166-79 and accompanying text (reviewing the post-*Daubert* case law).

18. *See* Jane Campbell Moriarty, *Will History Be Servitude?: The NAS Report on Forensic Science and the Role of the Judiciary*, 2010 UTAH L. REV. 299, 300 ("By not requiring minimal standards for the reliability of individualization evidence, courts have allowed the forensic science system to operate without any checks and balances and to convict innocent people in numbers we can only estimate."); *see also infra* notes 209-308 and accompanying text (reviewing studies on the continuing use of faulty science in criminal courts).

wrongful convictions, including some death penalty cases, like *Barefoot*.[19] Of the hundreds of such individuals who have been exonerated since *Daubert*, approximately half were imprisoned due to the use of faulty science in their trial.[20] Science in the courtroom has cut both ways for criminal defendants. DNA evidence has freed hundreds, but roughly half of those were wrongfully convicted because of defective forensic science in the first place.[21]

Part I of this Article will address the history of expert witness admission in the modern legal era and the important role of *Frye*. Part II of this Article will explore what led to *Daubert* and the Court's decision. Part III of this Article will distill the meaning of *Daubert* and subsequent Supreme Court cases and examine the many studies that have attempted to measure *Daubert's* impact on the court system. Part IV will discuss *Daubert*'s limited impact on the criminal justice system, highlighting a few profoundly disturbing examples of unreliable forensic science that currently plague criminal courts. Part V will discuss potential options for improving how courts admit expert witness testimony.

I. History of Expert Witness Testimony in American Courts

A. The World Before Frye

The use of experts in the courtroom is not a recent development. As early as the mid-1800s, parties relied on expert testimony to make or defend

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19. *See* Eric S. Lander, *Fixing Rule 702: The PCAST Report and Steps to Ensure the Reliability of Forensic Feature-Comparison Methods in the Criminal Courts*, 86 FORDHAM L. REV. 1661, 1662 (2018) (explaining that many defendants who were later exonerated were inmates on death row or had spent decades in prison, and that some of the defective science that courts allowed to convict them was "egregiously faulty").

20. *See* Cynthia E. Jones, *Here Comes the Judge: A Model for Judicial Oversight and Regulations of the Brady Disclosure Duty*, 46 HOFSTRA L. REV. 87, 118 (2017) ("Nearly 50% of the first 300 DNA-based exonerations of the Innocence Project involved inaccurate forensic science testimony." (citing Paul C. Giannelli, *Wrongful Convictions and Forensic Science: The Need to Regulate Crime Labs*, 86 N.C. L. REV. 163, 172-96 (2007))); *see also* INNOCENCE PROJECT, WRONGFUL CONVICTIONS INVOLVING UNVALIDATED OR IMPROPER FORENSIC SCIENCE THAT WERE LATER OVERTURNED THROUGH DNA TESTING 1 (2016), https://www.innocenceproject.org/wp-content/uploads/2016/02/DNA_Exonerations_Forensic_Science.pdf (reporting that "more than 50% [of exoneration cases] involved unvalidated or improper forensic science" as a contributing factor in wrongfully convicting the defendant).

21. Of course, the actual number of people wrongfully convicted by faulty science "must be considerably larger since evidence that could prove innocence is only rarely available and preserved." Lander, *supra* note 19, at 1663.

their case.[22] Science was becoming an indispensable feature in many legal disputes.[23] While *Frye v. United States* is often considered the first modern case on the admissibility of expert witness testimony,[24] judges had been evaluating expert testimony under at least two standards for the previous several decades.[25]

One common test courts employed was whether the expert testimony would assist the jury in understanding the facts of the case. Using a basic relevancy test that in many ways modeled the current rule,[26] courts simply evaluated the helpfulness of the evidence to a lay jury and admitted the evidence if it was relevant.[27] Courts placed few limits on expert testimony, so long as it was relevant to the facts of the case and the expert was qualified.[28] The basic question was whether the subject matter of a particular issue was beyond the range of knowledge of the average juror, and if so, whether a qualified expert's opinion "would be helpful, if not essential, to the jury's determination of the facts at issue."[29] As one commentator stated in 1880:

> The practice of the courts is to admit the testimony of a class of witnesses who are not supposed to have personal knowledge of any facts or circumstances bearing upon a pending case, but on the assumption that they are able from their special training and experience to apply scientific tests and present to the court and

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22. *See* Mnookin, *supra* note 10, at 1009.

23. *See* TAL GOLAN, LAWS OF MEN AND LAWS OF NATURE 52 (2004) ("By the end of the eighteenth century, it was clear to the legal profession that in a growing number of cases, the 'Best Evidence that the nature of the thing was capable of' could be produced by science and science alone.").

24. *See id.* at 263 ("Although formulated in the radical context of the lie detector, it embodied a general judicial state of mind, the fruit of two centuries of growing legal dependence on, and frustration with, science.").

25. *See id.* at 250 (explaining that at the time of *Frye*, "scientific evidence was mainly evaluated according to the two traditional evidentiary criteria: the logical relevancy and helpfulness of the evidence and the qualifications of the witness").

26. David L. Faigman et al., *Check Your Crystal Ball at the Courthouse Door, Please: Exploring the Past, Understanding the Present, and Worrying About the Future of Scientific Evidence*, 15 CARDOZO L. REV. 1799, 1803 n.11 (1994) ("The 'helpfulness' element of admissibility is still present today in the Federal Rules of Evidence." (citing *FED. R. EVID. 702* (expert can testify if it "will assist the trier of fact"))).

27. *Id.* at 1803 (explaining that the relevant inquiry was whether the testimony was from an area beyond the knowledge of the average juror).

28. James R. Dillon, *Expertise on Trial*, 19 COLUM. SCI. & TECH. L. REV. 247, 258 (2018).

29. Faigman et al., *supra* note 26, at 1803.

> jury the import and value of such evidence as may appear, which laymen could not be expected to comprehend and properly estimate.[30]

Back then, another common test for courts was assessing "the commercial success (outside of litigation) of the proffered witness in his or her field."[31] Known as the "the commercial marketplace test," courts presumed that an expert was qualified if that expert could "make a living selling his knowledge in the marketplace."[32] Courts admitted expert testimony based on whether the expert had demonstrated professional success in the expertise at issue.[33] Courts generally did not articulate the commercial place test, but rather implied it in their reasoning.[34] An expert's qualification "was implied from the expert's success in an occupation or profession which embraced that knowledge."[35]

To the extent courts applied these standards, they were applied rather loosely. If the court deemed the expert's testimony relevant and the expert qualified, parties had wide latitude to introduce the expert testimony as they saw fit.[36] This relaxed approach to expert testimony was part of a larger

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30. *Id.* at 1803 (quoting John B. Chapin, *Experts and Expert Testimony*, 22 ALB. L.J. 365, 365 (1880)).

31. Michael J. Saks, *Judging Admissibility*, 35 J. CORP. L. 135, 136 (2009).

32. Faigman et al., *supra* note 26, at 1804.

33. *Id.* at 1804 (noting that judges would evaluate the qualifications and expertise of the expert through "the expert's success in an occupation or profession which embraced" the subject matter in question); *see also* Saks, *supra* note 31, at 136 (explaining that judges often inferred expertise from the expert's commercial success). This practice goes back at least as far as the Civil War. *Id.*

34. *See, e.g.*, New England Glass Co. v. Lovell, 61 Mass. (7 Cush.) 319, 321 (1851) ("[I]t is because a man's professional pursuits, his peculiar skill and knowledge in some department of science, not common to men in general, enable him to draw an inference, where men of common experience, after all the facts proved, would be left in doubt."); Buffum v. Harris, 5 R.I. 243, 251 (1858) ("[K]nowledge of any kind, gained for and in the course of one's business as pertaining thereto, is precisely that which entitles one to be considered an expert, so as to render his opinion, founded on such knowledge, admissible in evidence."); *see also* Faigman et al., *supra* note 26, at 1804 ("This is not a point that courts made explicitly, but it seems to be implicit in the courts' determinations of who was 'qualified.'"); Saks, *supra* note 31, at 136 ("The implicit measure of expertise seems to have been how the expert witness fared in the commercial market for the witness's learning.").

35. Faigman et al., *supra* note 26, at 1804.

36. *See* Dillon, *supra* note 28, at 258 ("As long as the proposed expert's testimony was relevant and the expert was qualified, parties generally were free to introduce the testimony of experts as they saw fit.").

judicial philosophy of the "sporting theory"[37] where quality control was exercised not by judges in excluding testimony, but by the parties through cross-examination and the adversarial process.[38] As Professor Jennifer Mnookin puts it, "so long as parties had an equal opportunity to bring forward opposing experts, under the same rules and with the same judge as umpire, then whatever the jury made of the competing experts' stories was acceptable."[39]

By the turn of the century, however, every corner of the legal community began voicing concerns about the open policy for admitting expert testimony.[40] Even a Supreme Court justice had earlier called expert opinions "reveries," arguing that they were as "effective in producing obscurity and error, as in the elucidation of truth."[41] State supreme courts also expressed serious concerns with experts' partisan opinions and the impact on trials.[42] Public sentiment about the use of experts "produced a

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37. Mnookin applies Roscoe Pound's account of the "sporting theory of justice" to the nineteenth century evidentiary regime. *See* Mnookin, *supra* note 10, at 1015 (citing Roscoe Pound, *The Causes of Popular Dissatisfaction with the Administration of Justice*, 14 AM. L. 445, 447-48 (1906)).

38. *See* Dillon, *supra* note 28, at 258 ("[P]utative expert testimony was freely admissible and cross-examination served as the principal check against spurious claims of epistemic authority."). This was Justice White's rationale for admitting the testimony of Dr. Grigson in *Barefoot v. Estelle*. *See* 463 U.S. 880, 898 (1983) (explaining that jurors "have the benefit of cross-examination and contrary evidence by the opposing party").

39. Mnookin, *supra* note 10, at 1015.

40. *See, e.g.*, GOLAN, *supra* note 23, at 255 ("[A]t [the 1897 New Hampshire Medical Society] annual meeting, Judge William Foster opened his address with a joke popular within legal circles: 'There are three kinds of liars: the common liar, the damned liar, and the scientific expert.'").

41. McCormick v. Talcott, 61 U.S. 402, 409 (1857) (Daniel, J., dissenting). One year later, the Court complained that "opposite opinions of persons professing to be experts may be obtained to any amount" and that experts are often "perplexing, instead of elucidating, the questions involved in the issue." Winans v. N.Y. & Erie R.R. Co., 62 U.S. 88, 101 (1858).

42. *See, e.g.*, Ferguson v. Hubbel, 97 N.Y. 507, 514 (1884) (stating that the expert witnesses' "opinions cannot fail generally to be warped by a desire to promote the cause in which they are enlisted"). An 1899 Wisconsin Supreme Court opinion fumed:

> [S]killed witnesses come with such a bias on their minds that hardly any weight should be given to their evidence. It seems that if a person is called as a witness to support one side of a controversy by opinion evidence, he is quite likely to espouse such side with all the zeal of blind partisanship, to view the situation from the point of interest and necessity of that one side of the controversy with such a degree of mental concentration as to shut out of view everything not within that narrow focus, inducing a mental condition of entire incapability of giving an independent, impartial opinion, and capability only of acting in the

crisis of confidence in the courts."[43] They were "denounced in legal journals and by the popular press . . . and lambasted for being partisan 'hired guns . . . .'"[44] The marketplace test was no longer a sufficient means to qualify an expert.[45]

B. Frye v. United States*–A New Test to Judge Expert Testimony*

When viewed from this historical perspective, *Frye v. United States*[46] seems like an inevitable move by the courts to place limits on the

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> line which the interest of the one side suggests, with as much certainty as the hypnotized follows the mental suggestion of the hypnotizer.

Baxter v. Chicago & N.W. Ry., 80 N.W. 644, 653 (Wis. 1899); *see also* DAVID H. KAYE, DAVID E. BERNSTEIN & JENNIFER L. MNOOKIN, THE NEW WIGMORE: A TREATISE ON EVIDENCE: EXPERT EVIDENCE, § 1.3, Westlaw (2d ed. 2018) ("It is amazing the number of hard things which the courts of last resort have said about expert testimony; a volume quite as large as the Illinois Statutes could be compiled of condemnatory phrases and language." (quoting Arthur J. Eddy, *What Reforms in the Nature of Expert Testimony Are Advisable?*, 58 ALB. L.J. 251, 251 (1898))); *see also* E. E. S. Wood, *Medical Testimony*, 7 AM. LAW. 92, 94 (1899) (noting that "cases condemning the value of expert witnesses and cautioning the jury against paying much attention to their opinion, are so numerous that they form an entire literature").

43. Dillon, *supra* note 28, at 258. Indeed, perceived abuses by experts in the courtroom and "experts' status as partisan witnesses placed them in adversarial positions that undermined the public's confidence in scientific objectivity." *Id.* As one lawyer wrote in 1899, the testimony of experts "is the subject of everybody's sneer and the object of everybody's derision. It has become a newspaper jest. The public has no confidence in expert testimony." KAYE, BERNSTEIN & MNOOKIN, *supra* note 42 (quoting Henry Wollman, "*Physicians-Expert Witnesses.*" *"Some Reforms."*, 17 MEDICO-LEGAL J. 20, 20 (1899)).

44. Jennifer L. Mnookin, *Idealizing Science and Demonizing Experts: An Intellectual History of Expert Evidence*, 52 VILL. L. REV. 763, 771 (2007). In an 1897 address to the New Hampshire Medical Society, Judge William Foster reported that expert witness partisanship "or inclination in favor of the party by whom the witness is employed, is probably the most frequent complaint of all against the expert witness." William L. Foster, *Expert Testimony – Prevalent Complaints and Proposed Remedies*, 11 HARV. L. REV. 169, 171 (1897).

45. *See* Saks, *supra* note 31, at 137 ("One problem is that the market can tell us only what people select; it cannot tell us whether what they select is any good. Thus, for example, the marketplace test is incapable of distinguishing astronomy from astrology. The market values both. Commercial value is not a measure of scientific or any other kind of validity. Another problem is that some fields have little or no life in any commercial marketplace. That is true of cutting-edge knowledge which has yet to develop a market for itself, and of fields that have little or no function outside of their possible courtroom utility (sometimes signaled by the adjective 'forensic,' as in 'forensic science').").

46. 293 F. 1013 (D.C. Cir. 1923), *superseded by statute*, FED. R. EVID. 702, *as recognized in* Daubert v. Merrill Dow Pharm., Inc., 509 U.S. 579, 587 (1993).

admissibility of expert witness testimony.[47] By the time of the *Frye* decision in 1923, the problems with relying on merely the relevance of the testimony or the reputation of the expert "led the D.C. Circuit to reconsider the standard for admissibility of expert evidence."[48] In imposing a new standard for courts to use when assessing expert witness testimony, the D.C. Circuit started a slow but monumental shift in how experts were handled in the courtroom.[49] As Professor Jill Lepore explains, *Frye* "held sway for seven decades, remains the standard in several states, and continues to influence federal law."[50]

Frye's critical role in shaping the law on expert witness testimony, however, should not obscure the compelling facts and history of the case and the parties involved.[51] The *Frye* case is named for James Alphonzo Frye, whose appeal of his second-degree murder conviction was denied in the famous decision that now bears his name.[52] Frye had confessed to the

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47. *See* Dillon, *supra* note 28, at 259 ("The D.C. Circuit's 1923 decision in *Frye v. United States* was an early effort to constrain the free-for-all sporting theory . . . .").

48. Andrew Jurs & Scott DeVito, *The Stricter Standard: An Empirical Assessment of* Daubert's *Effect on Civil Defendants*, 62 CATH. U. L. REV. 675, 682 (2013); *see also* Michael J. Saks, *Merlin and Solomon: Lessons from the Law's Formative Encounters with Forensic Identification Science*, 49 HASTINGS L.J. 1069, 1074 (1998) (explaining that the flaws of the commercial marketplace test necessitated the *Frye* standard).

49. *See* Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 585 (1993) ("In the 70 years since its formulation in the *Frye* case, the 'general acceptance' test has been the dominant standard for determining the admissibility of novel scientific evidence at trial.") (citations omitted); *see also* GOLAN, *supra* note 23, at 253 (explaining *Frye* "was accepted for most of the twentieth century as the standard of the admissibility of new scientific evidence in practically all of America's courts" and its "exclusionary rationale [has] been able to dominate American legal thought ever since").

50. Jill Lepore, *On Evidence: Proving* Frye *as a Matter of Law, Science, and History*, 124 YALE L.J. 1092, 1096 (2015).

51. *See id.* at 1149 ("[T]he facts behind *Frye* reveal just how great has been the tension, and how wide the gap, between ideas about evidence in history, science, and the law."). Yet as Professor Lepore laments, "Only a handful of scholars—historians of science—have ever investigated the case." *Id.* at 1141. Some have taken notice since, however. Professor Lepore's thorough history of the *Frye* case has been recognized as a must-read for anyone interested in expert witness jurisprudence. *See e.g.*, Dillon, *supra* note 28, at 259 n.31 (encouraging readers to review her "engaging history" of the particular facts of *Frye*).

52. *Frye v. United States*, 293 F. at 1013, 1014 (D.C. Cir. 1923), *superseded by statute*, FED. R. EVID. 702, *as recognized in Daubert*, 509 U.S. at 587; *see also* Lepore, *supra* note 50, at 1149 (recounting the efforts of *Frye* to clear his name of the conviction even years after his parole, all of which were unsuccessful).

police but later tried to retract his admission.[53] The trial judge refused to allow an expert witness to testify about Frye's truthfulness in recanting his admission.[54] The defense was planning to call the expert to testify about the results of Frye's use of a "systolic blood pressure deception test" (an earlier version of a lie detector test), which apparently verified the truth of Frye's story.[55] The use of the deception test was the last viable defense Frye's counsel had available.[56] Frye was found guilty.

On appeal, the D.C. Circuit Court focused entirely on the exclusion of the expert witness and his deception test.[57] In discussing admissibility, the court recognized that "when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define."[58] Nonetheless, the court went on:

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53. Lepore, *supra* note 50, at 1120. The trial judge had refused to accept the lie detector test as sufficiently established: "When it is developed to the perfection of the telephone and the telegraph and wireless and a few other things we will consider it. I shall be dead by that time, probably, and it will bother some other judge, not me." *Id.* at 1132 (quoting the trial transcript).

54. *Frye*, 293 F. at 1014. In one of the more interesting features of the *Frye* case backstory, the defense's expert, William Marston, would later go on to write the Wonder Woman comic strip. JILL LEPORE, THE SECRET HISTORY OF WONDER WOMAN 73 (2014) (noting this detail is "[a]mong the many facts about the *Frye* case that have never been discovered by anyone who has ever cited or studied it").

55. *Frye*, 293 F. at 1013-14. Frye's counsel had initially encouraged Frye to plead guilty and had engaged the expert and his deception test to show Frye that his attempt to lie would be detected. Instead, Frye passed the deception test with flying colors, as the machine confirmed (in its way) that Frye was telling the truth. GOLAN, *supra* note 23, at 246.

56. Frye's counsel was apparently desperate for any kind of defense. GOLAN, *supra* note 23, at 246 ("Unable to find a single witness to support Frye's alleged alibi, or a way to discredit Frye's detailed confession, not to mention the testimony of at least one eye witness, [defense counsel Richard] Mattingly made a desperate though imaginative move and contacted William Marston.").

57. *See Frye*, 293 F. at 1013-14; *see also* Lepore, *supra* note 50, at 1124 ("[Defense counsel] Mattingly and [Lester] Wood based their defense on establishing that Frye's confession was a lie, and that, in disavowing it, Frye was telling the truth."). The deception test supposedly worked by measuring the subject's blood pressure. *See id.* at 1113. "It is asserted," wrote the court, "that blood pressure is influenced by change in the emotions of the witness, and that the systolic blood pressure rises are brought about by nervous impulses sent to the sympathetic branch of the autonomic nervous system." *Frye*, 293 F. at 1013. The court characterized the deception test evidence as a "theory," finding that "truth is spontaneous, and comes without conscious effort, while the utterance of a falsehood requires a conscious effort, which is reflected in the blood pressure." *Id.* at 1014.

58. *Id.*

> Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.[59]

The court ultimately ruled that use of the deception test "ha[s] not yet gained such standing and scientific recognition among physiological and psychological authorities" to justify its admission as evidence.[60] Based on this reasoning, the court upheld the exclusion of the evidence and Frye's conviction.[61]

C. The Lasting Impact of Frye

The appellate court's "cryptic" decision used only a total of 669 words and did not make "a single reference to case law or precedent, nor any references to scientific literature."[62] Despite these unusual features, *Frye* became the default standard as state and federal courts around the country began to follow *Frye's* "general acceptance" test.[63] Indeed, the court established a standard that still stands in numerous state courts.[64] The *Frye*

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59. *Id.*

60. *Id.*

61. *Id.*

62. Lepore, *supra* note 50, at 1140.

63. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 585 (1993); Bert Black et al., *Science and the Law in the Wake of* Daubert *: A New Search for Scientific Knowledge*, 72 TEX. L. REV. 715, 726 (1994) ("This notion of a special rule for scientific evidence originated [with *Frye*].") (citing 1 CHARLES T. MCCORMICK, MCCORMICK ON EVIDENCE § 203 (4th ed. 1992)).

64. *See* Barbara Pfeffer Billauer, Daubert *Debunked: A History of Legal Retrogression and the Need to Reassess "Scientific Admissibility*," 21 SUFFOLK J. TRIAL & APP. ADVOC. 1, 11 (2015-2016) [hereinafter Billauer, Daubert *Debunked*] (describing how the "the ghost of *Frye* still hangs heavy on the courts" as it is "still good law in eight jurisdictions at last count (although the number is constantly changing) along with the District of Columbia"); *see also* David E. Bernstein, Frye, Frye, *Again: The Past, Present, and Future of the General Acceptance Test*, 41 JURIMETRICS 385, 386–87, nn.7–23 (2001) (referencing the decisions of seventeen states as supporting the assertion that "[m]any jurisdictions continue to adhere to *Frye*" (citing S. Energy Homes, Inc. v. Washington, 774 So. 2d 505, 517 n.5 (Ala. 2000); Logerquist v. McVey, 1 P.3d 113 (Ariz. 2000); State v. Johnson, 922 P.2d 294 (Ariz. 1996); State v. Bible, 858 P.2d 1152 (Ariz. 1993); People v. Leahy, 882 P.2d 321 (Cal. 1994); Lindsey v. People, 892 P.2d 281 (Colo. 1995); Nixon v. United States, 728 A.2d 582, 588 (D.C. 1999); Flanagan v. State, 625 So. 2d 827 (Fla. 1993); People v. Miller, 670 N.E.2d

decision became "the controlling test for the admissibility of scientific and technical evidence for much of the twentieth century."[65] By the late 1970s, at least one state supreme court recognized that "[t]he *Frye* test ha[d] been accepted as the standard in practically all of the courts of this country which have considered the question of the admissibility of new scientific evidence."[66]

Yet a closer look at the legal history of *Frye* tells a slightly different, and more complicated, story. While held out today as one of the most important cases in all of evidence, much less expert witness admissibility,[67] the reality is that the *Frye* test "went unnoticed for decades."[68] Even Judge Van Orsdel, the judge who wrote the *Frye* opinion, ignored his own ruling in another important scientific evidence case he handed down on the very same day.[69] The *Frye* opinion did not receive a citation in any circuit court

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721, 731 (Ill. 1996); State v. Heath, 957 P.2d 449 (Kan. 1998); Hutton v. State, 663 A.2d 1289 (Md. 1995); DePyper v. Navarro, 1995 WL 788828, at *34 (Mich. Cir. Ct. Nov. 27, 1995); Goeb v. Tharaldson, 615 N.W.2d 800 (Minn. 2000); Gleeton v. State, 716 So. 2d 1083 (Miss. 1998); State v. Carter, 524 N.W.2d 763 (Neb. 1994); Phillips v. Indus. Machine, 597 N.W.2d 377, 389 (Neb. 1999) (Gerrard, J., concurring); State v. Harvey, 699 A.2d 596 (N.J. 1997); People v. Wesley, 633 N.E.2d 451, 454 n.2 (N.Y. 1994); Commonwealth v. Blasioli, 713 A.2d 1117 (Pa. 1998); State v. Copeland, 922 P.2d 1304, 1310 (Wash. 1996))).

65. Dillon, *supra* note 28, at 259; *see also* Lepore, *supra* note 50, at 1140 (citation omitted) ("*Frye's* 'general acceptance' test wasn't meaningfully challenged until *Daubert v. Merrell Dow Pharmaceuticals* in 1993 . . . .").

66. *Id.* at 1140 (quoting State v. Miller, 732 P.2d 756, 759 (1987)).

67. *See, e.g.*, *id.* at 1096 (describing *Frye* as "one of the most influential rules of evidence in the history of American law").

68. Saks, *supra* note 31, at 139. No federal or state court cited *Frye* for at least ten years. *Id.* at 139. In fact, the only uses of *Frye* in the first three decades after the decision were in criminal cases to exclude from trial "various lie detection and truth serum schemes." GOLAN, *supra* note 23, at 259. During its first twenty-five years, "*Frye* was cited in only eight federal cases and five state cases. During its second quarter-century, it was cited 54 times in federal cases and 29 times in state cases." Saks, *supra* note 31, at 139. *But see* Bernstein, *supra* note 64, at 388-89 ("[T]he dearth of citations to *Frye* does not mean that courts ignored it. First, some courts adopted the general acceptance test without citing *Frye*. Second, *Frye* applied only to novel scientific techniques. There were few major advances in forensic criminal evidence during this period that courts did not quickly accept."); Black et al., *supra* note 63, at 722 n.30 ("The ever-increasing use of scientific evidence is reflected in ever-increasing citations to *Frye*. After World War II, the case was only cited 6 times before 1950, 20 times during the 1950s, 21 times during the 1960s, 100 times during the 1970s, 470 time[s] during the 1980s, and 350 times in the early 1990s.").

69. Saks, *supra* note 31, at 139 (citing Laney v. United States, 294 F. 412 (D.C. Cir. 1923) (ruling on the admissibility of firearms identification)). The court in *Laney* "not only made no use of the *Frye* test, it made no mention of it, and did not explain why it was not applied or applicable to the novel question of firearms identification." *Id.* at 139 n.23.

case until 1984.[70] Courts did not start using the *Frye* test regularly until the mid-1970s, about the time of the codification of the Federal Rules of Evidence.[71] Heavier use of the *Frye* test, somewhat paradoxically,[72] took place after the Federal Rules were adopted.[73] By the 1980s, "*Frye* was being cited as much [on a yearly basis] as it had been in its first 50 years added together."[74]

At this same time, however, prominent evidence scholars reported that "the (*Frye*) general acceptance test has been rejected by an increasing number of courts, and attacked by commentators, who have labeled the test

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Moreover, a leading state supreme court had that same year denied admissibility to firearms identification. People v. Berkman, 139 N.E. 91 (Ill. 1923). As Professor Saks surmises, "Perhaps Judge Van Orsdel foreshadowed later judges by using the *Frye* test merely as a legal tool to be used or not used depending on the outcome desired." Saks, *supra* note 31, at 139 n.23.

70. *See* Michael H. Gottesman, *From* Barefoot *to* Daubert *to* Joiner*: Triple Play or Double Error?*, 40 ARIZ. L. REV. 753, 755 n.11 (1998) (noting that "the first such appellate decision appear[ed] to be *Barrel of Fun, Inc. v. State Farm Fire & Casualty Co.*, 739 F.2d 1028, 1031 (5th Cir. 1984)").

71. Act of Jan. 2, 1975, Pub. L. No. 93-595 (1975) (codified at FED. R. EVID. 702 (1975)). Rule 702, as originally adopted, stated that "[i]f scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise." FED. R. EVID. 702 (1975) (amended 2011).

72. *See Barrel of Fun*, 739 F.2d at 1031 n.9 ("Although this Court has noted that it is an unresolved question whether the Federal Rules of Evidence silently abolished or adopted the *Frye* test, we have continued to utilize *Frye's* 'general scientific acceptability' criteria." (citations omitted)); *see also* David M. Flores et al., *Examining the Effects of the* Daubert *Trilogy on Expert Evidence Practices in Federal Civil Court: An Empirical Analysis*, 34 S. ILL. U. L.J. 533, 534-35 (2010) ("While the adoption of [Federal Rule of Evidence 702] did not specifically preclude the use of the general acceptance rule in the evaluation of expert testimony, questions arose about the continued applicability of *Frye*.").

73. Saks, *supra* note 31, at 139. *But see* Billauer, *Admissibility*, *supra* note 1, at 29 n.44 (citing LLOYD DIXON & BRIAN GILL, RAND INST. FOR CIVIL JUSTICE, CHANGES IN THE STANDARDS FOR ADMITTING EXPERT EVIDENCE IN FEDERAL CIVIL CASES SINCE THE DAUBERT DECISION (2001), https://www.rand.org/content/dam/rand/pubs/monograph_reports/2005/MR1439.pdf) (referencing an empirical study that found that the "general acceptance" test was used by courts only rarely (5% of the sample cases) between 1980 and 1993 and became much more prominent *after* the Supreme Court's decision in *Daubert*).

74. Saks, *supra* note 31, at 139; *see also* Lepore, *supra* note 50, at 1096 ("On the matter of expert testimony, few cases are more cited than *Frye*."); *id.* at 1096 n.26 (citing Robert Schriek, *Most-Cited U.S. Courts of Appeals Cases from 1932 Until the Late 1980s*, 83 LAW. LIB. J. 317, 330 (1991)) (noting that *Frye* "is only one of two pre-1932 cases to rank in his study").

'infamous,' 'a sport,' 'archaic,' and 'antiquated on the day of its pronouncement.'"[75] The concerns about *Frye* rested on its seeming reliance on the old "sporting theory" and the trust that the adversarial system was robust enough on its own to protect the courts from unqualified science.[76] There was also confusion among judges on these issues, which led to contradictory *Frye* rulings in different jurisdictions concerning the same types of evidence.[77] Things were about to get more serious.

II. The Road to Daubert

A. The Rise of "Junk Science"

While contradictions were piling up in lower courts over how to address the standards for admitting expert testimony, there was also a growing perception that large cases involving complex science were overwhelming federal courts.[78] Vice President Dan Quayle wrote in 1992 that federal civil

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75. Gottesman, *supra* note 70, at 755 n.11 (citing PAUL C. GIANNELLI & EDWARD J. IMWINKELRIED, SCIENTIFIC EVIDENCE 13-14 (1986)).

76. Mnookin, *supra* note 10, at 1016; *see also* Bernstein, *supra* note 64, at 390 ("Commentators began to attack *Frye* on a variety of grounds. Some argued that *Frye* was too conservative in restricting evidence that had not yet received 'general acceptance.' Others were unhappy with *Frye's* vagueness. The opinion does not define 'general acceptance' or the 'particular field's' boundaries, nor does it suggest whether the judge should defer to the scientific community or use another standard to resolve these uncertainties. Confusion among judges on these issues led to contradictory *Frye* rulings in different jurisdictions concerning the same types of evidence."). Indeed, some recent scholarship argues that courts maintained a laissez-faire attitude toward gatekeeping until the early 1990s. *See* JACK FISHER, SILICONE ON TRIAL: BREAST IMPLANTS AND THE POLITICS OF RISK 222 (2015).

77. Bernstein, *supra* note 64, at 390.

78. These claims were certainly overblown. *See, e.g.*, Marc Galanter, *Reading the Landscape of Disputes: What We Know and Don't Know (and Think We Know) About Our Allegedly Contentious and Litigious Society*, 31 UCLA L. REV. 4, 71 (1983) (analyzing data and arguing in 1983 that claims that America is experiencing a "litigation explosion" rely on scholarship and analysis that are "thin and spotty"); Richard L. Marcus, *The Revival of Fact Pleading Under the Federal Rules of Civil Procedure*, 86 COLUM. L. REV. 433, 442 n.54 (1986) (noting that "dramatic increases in litigation are hardly unprecedented" and "empirical investigation suggests that the current preoccupation with the litigation 'boom' may be an overreaction"); Jack B. Weinstein, *After Fifty Years of the Federal Rules of Civil Procedure: Are the Barriers to Justice Being Raised?*, 137 U. PA. L. REV. 1901, 1909 (1989) (doubting the existence of a litigation explosion and noting in 1989 that federal judges had approximately the same number of cases then as they had in 1960). But it is true that the high point in the number of civil trials in federal court was in the mid-1980s, the period of time when these claims were becoming pronounced. Marc Galanter, *The Hundred-Year Decline of Trials and the Thirty Years War*, 57 STAN. L. REV. 1255, 1264 (2005). Part of the

litigation had almost quadrupled between 1960 and 1990, and that, in 1989 alone, eighteen million new lawsuits were filed, amounting to one lawsuit for every ten American adults.[79] One prominent study reported that a "dramatic growth" in toxic torts and environmental litigation put unique strain on the court system, which had to both adjudicate difficult legal issues and resolve questions of new and complex science.[80]

The prime concern was the rising "epidemic of toxic tort cases."[81] The emergence of mass toxic tort litigation in the 1980s allegedly resulted in

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perception of a "litigation explosion" may have been fueled by the very real growth in the number of lawyers. As the then-dean of Harvard Law School humorously opined:

> In 1960, there was one lawyer for every 627 people in the United States. In 1988, there was one lawyer for every 339 people. During the last half of this twenty-eight year period, the number of lawyers in the United States increased at a rate that was more than five times faster than the rate of growth for the general population. . . . I calculate that if we keep going in this way, by the year 2023 there will be more lawyers than people.

Robert C. Clark, *Why So Many Lawyers? Are They Good or Bad?*, 61 FORDHAM L. REV. 275, 276 (1992).

79. Quayle, *supra* note 5, at 560. As with much of the data used at the time to support the notion that the courts were overrun, the Vice President's statistics were immediately criticized as inaccurate and misleading. *See, e.g.*, Deborah R. Hensler, *Taking Aim at the American Legal System: The Council on Competitiveness' Agenda for Legal Reform*, 75 JUDICATURE 244, 245 (1992) (reviewing the data and concluding that "its empirical underpinning is shaky" and "at best incomplete and at worst misleading"). Despite his reliance on shaky data, the Vice President made expert testimony a particular target of reform. *See infra* notes 95–99 and accompanying text (outlining the history of the administration's reform efforts).

80. According to the study by the Carnegie Foundation, this "dramatic growth in toxic torts and environmental litigation has put new pressure on the legal system, which is simultaneously being asked to adjudicate issues on the cutting edge of science and to develop theories of substantive law." CARNEGIE COMM'N ON SCI., TECH. & GOV'T, SCIENCE AND TECHNOLOGY IN JUDICIAL DECISION MAKING 10 (Mar. 1993) [hereinafter CARNEGIE COMM'N]. The pressure is particularly "intense because of the large numbers of people that are involved and the profound social, economic, and public policy concerns that these new legal claims raise." *Id.*; *see also* Bernstein, *supra* note 64, at 390 ("As debate grew over the merits of *Frye*, the relevancy approach, and the reliability approach with regard to forensic criminal evidence, courts faced a new evidentiary challenge—toxic tort litigation.").

81. Billauer, Daubert *Debunked*, *supra* note 64, at 24 (observing that Asbestos and Dalkon Shield were "the most notorious"); *see* FISHER, *supra* note 76, at 205 (detailing the complex history of silicone breast implant litigation). Some of the increased litigation stemmed from legitimate anger by the public toward large companies' insensitivities to the dangers of their products. Billauer, Daubert *Debunked*, *supra* note 64, at 24. For example, "what inflamed the asbestos litigation were reckless statements by company managers and reckless conduct of the early manufacturers." *Id.* (citing Mealey's Litig. Rep.: Asbestos, July 27, 1984, at 982). In the 1960s, an executive for a company that used asbestos in its

enormous payouts and unsurprisingly inspired "loud complaints from industry and insurance groups."[82] Cases involving chemical manufacturers, pharmaceutical companies, and health care workers received the most attention, and everyone from industry heads to elected officials "argued that the profitability and viability of production and manufacturing in the United States were under serious attack."[83]

The main complaint was that questionable science was leading to erroneous jury verdicts. One paradigm issue was the silicone implant. While no legitimate medical science ever substantiated any causal connection between implants and serious health conditions,[84] by the early 1990s six thousand plaintiffs signed up in state courts and four thousand more in federal courts against the major corporations of the silicone implant industry.[85] Despite the lack of scientific evidence, the silicone litigation became "an industry in itself."[86] By 1993 (the year of *Daubert*), "the four

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products wrote a letter that was widely circulated and became the spark for many punitive damages awards. *Id.* at 24 n.111. In the letter, the executive wrote, "My answer to the problem is: If you have enjoyed a good life working with asbestos products, why not die from it? There has to be some cause [of death]." *Id.* As Professor Billauer notes, "The public had been sensitized to cavalier pronouncements by the 'them that has' and were primed for revenge, and the plaintiff's bar took advantage of this societal state of mind." *Id.* at 24.

82. Gary Edmond & David Mercer, *Trashing "Junk Science,"* 1998 STAN. TECH. L. REV. 3, 6.

83. *Id.* Vice President Quale argued that "[t]he use of litigation as a preferred means in our society for resolving disputes and achieving social reforms has burdened the courts and has resulted in significant economic detriment." Quayle, *supra* note 5, at 568. Industry executives apparently felt the same way. *See id.* at 561 ("[A] survey of over 250 American companies revealed that more than three-quarters of the executives believe that the United States will be increasingly disadvantaged in world markets unless modifications are made in the liability system.").

84. In 1996, a judicially appointed National Science Panel found "that there is no meaningful or consistent association between silicone gel-filled implants and any of the conditions studied." Norris v. Baxter Healthcare Corp., 397 F. 3d 878, 882 (10th Cir. 2005); *see also* Daniel Q. Posin, *Silicone Breast Implant Litigation and My Father-in-Law: A Neo-Coasen Analysis,* 70 TUL. L. REV. 2565, 2571-72 (1996) ("Certainly, at the time the silicone breast litigation explosion commenced (in 1990) there was no evidence that silicone breast implants did any more than cause localized inflammation and tissue hardening.").

85. Billauer, Daubert *Debunked*, *supra* note 64, at 24-25.

86. Posin, *supra* note 84, at 2571; *see also In re* Silica Prod. Liab. Litig., 398 F. Supp. 2d 563, 634 (S.D. Tex. 2005) ("[A]ssembly line diagnosing . . . is an ingenious method of grossly inflating the number of positive diagnoses."); Erica Beecher-Monas, *Lost in Translation: Statistical Inference in Court*, 46 ARIZ. ST. L.J. 1057, 1077 (2014) (discussing the admission of "highly suspect mass medical screenings by a few doctors for litigation rather than treatment purposes" as specific causation testimony, often without challenge).

major implant manufacturers jointly announced that they had collectively set aside 4.75 *billion* dollars to settle claims filed over the next thirty years."[87] And many companies would decide to get out of the implant business altogether.[88]

The silicone implant litigation was only the tip of the iceberg, according to the many critics[89] who had by then embraced a new, powerful phrase meant to get at the heart of the issue: "junk science."[90] That single two-word dysphemism became a rallying cry, made prominent in the best-selling book by Peter Huber, *Galileo's Revenge*.[91] Despite many

87. Billauer, Daubert *Debunked*, *supra* note 64, at 24-25.

88. Until protected by later federal legislation, some suppliers stopped producing the material used in medical devices in order to avoid being sued. Phil Goldberg, Christopher E. Appel & Victor E. Schwartz, *The Liability Engine That Could Not: Why the Decades-Long Litigation Pursuit of Natural Resource Suppliers Should Grind to a Halt*, 12 J.L. ECON. & POL'Y 47, 59 (2016); *see also* Posin, *supra* note 84, at 2572 ("Many of the large suppliers of silicone and other related compounds, including Dow Chemical, Du Pont, and Dow Corning, have decided to stop making plastics for medical implants because of the breast implant litigation."). The ripple effects of these decisions were potentially enormous. *See* Jack W. Snyder, *Silicone Breast Implants: Can Emerging Medical, Legal, and Scientific Concepts Be Reconciled?*, 18 J. LEGAL MED. 133, 136 (1997) (stating that "over 500 medical products contain measurable amounts of silicone").

89. Perhaps ironically, some of the earliest calls for a crackdown on questionable expert testimony in toxic torts cases came from editorials in traditionally liberal publications, such as the *New England Journal of Medicine* and the *New York Times*. David E. Bernstein & Eric G. Lasker, *Defending* Daubert*: It's Time to Amend Federal Rule of Evidence 702*, 57 WM. & MARY L. REV. 1, 10 (2015) (citing James L. Mills & Duane Alexander, *Occasional Notes: Teratogens and "Litogens,"* 315 NEW ENG. J. MED. 1234, 1234-35 (1986); Opinion, *Federal Judges vs. Science*, N.Y. TIMES (Dec. 27, 1986), https://www.nytimes.com/1986/12/27/opinion/federal-judges-vs-science.html). These editorials expressed particular concern about "how bogus lawsuits were jeopardizing access to contraception, in particular after a notorious case in which the Eleventh Circuit affirmed a $5 million award to a plaintiff who alleged that his mother's use of a common spermicide had caused his birth defects." *Id.* at 10 (citing Wells v. Ortho Pharm. Corp., 788 F.2d 741, 742-43, 747-48 (11th Cir. 1986)).

90. Most agree that the term "junk science" seems to have emerged in the late 1980s and early 1990s. *See* Edmond & Mercer, *supra* note 82, at 4 ("It received its initial impetus and articulation in the polemical works of Peter Huber of the Manhattan Institute, a conservative think-tank supported by various industry and insurance groups."). Former Attorney General Dick Thornburgh, Attorney General under President George H. W. Bush, offered his own definition. *See* Dick Thornburgh, *Junk Science-The Lawyer's Ethical Responsibilities*, 25 FORDHAM URB. L.J. 449, 449 (1998) ("I hold that 'junk science' in the courtroom emanates from testimony by expert witnesses hired not for their scientific expertise, but for their willingness, for a price, to say whatever is needed to make the client's case.").

91. *See* HUBER, *supra* note 3, at 2-3; *see also* Kenneth J. Chesebro, *Galileo's Retort: Peter Huber's Junk Scholarship*, 42 AM. U. L. REV. 1637, 1642 (1993) ("*Galileo's Revenge*

questionable declarations and dubious science,[92] Huber's book was embraced by policy-makers, lawyers, and the media.[93] The rising problem of "junk science" became a topic of mainstream public debate, as the book attracted a great deal of attention.[94]

Huber's influence extended to the administration at the time.[95] The President's Council on Competitiveness, which was chaired by Vice President Dan Quayle, instituted the Civil Justice Reform Task Force to target expert testimony.[96] Vice President Quayle became an outspoken advocate for reforming the way in which courts evaluate expert witness testimony, claiming that "uncontrolled use of expert witnesses . . . has also allowed 'junk science' to tarnish the legal process."[97] The Vice President specifically, and inaccurately, used anecdotes from Huber's book. For example, the Vice President cites one of the most sensational examples of "junk science" involving a "soothsayer" who, "with the backing of expert testimony from a doctor and several police department officials," won a million-dollar jury award due to the loss of "her psychic powers following a CAT scan," without acknowledging that the verdict in that case was thrown

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and its author have received heavy publicity and have been treated by lawyers as well as laypeople as if they *were* part of legitimate scholarship on these issues.").

92. *See infra* notes 112-16 and accompanying text (cataloging the many concerns about the data and assertions in the book by numerous commentators).

93. *See* Chesebro, *supra* note 91, at 1642 ("*Galileo's Revenge* and Huber's other writings have been widely cited by lawyers, lobbyists, and even former Vice President Dan Quayle, and have been glowingly reviewed by lay writers."). The mainstream media was particularly fond of Huber and his book. *See id.* at 1647 ("The lay press, for the most part, has seen Huber as an unalloyed precious metal.").

94. *See* Bernstein, *supra* note 64, at 391 ("A consistent theme of the book was that to avoid the risk of being bamboozled by fringe scientists, courts should defer to mainstream scientific opinion when reviewing scientific evidence.").

95. *See* Jeff L. Lewin, *Calabresi's Revenge? Junk Science in the Work of Peter Huber*, 21 HOFSTRA L. REV. 183, 185 (1992) ("The administration at the time certainly took notice of Huber's work and relied on it for their own attacks on the growing use of courts for toxic tort plaintiffs.").

96. Giannelli, *supra* note 5, at 109. The Solicitor General at the time, Kenneth Starr, chaired the Task Force. *Id.* at 109 n.24. To review this report, see PRESIDENT'S COUNCIL ON COMPETITIVENESS, AGENDA FOR CIVIL JUSTICE REFORM IN AMERICA (Aug. 1991), *reprinted in* 60 U. CIN. L. REV. 979 (1992).

97. Quayle, *supra* note 5, at 565. According to the Vice President, "'Expert' witnesses regularly offer their 'scientific' opinions on the connections between automobile accidents and breast cancer or environmental pollutants and 'chemically induced AIDS.'" *Id.* at 566 (citing HUBER, *supra* note 3, at 4).

out by the trial judge.[98] Building on the Vice President's efforts, "[t]he 1992 Republican platform included a promise to 'throw out "junk science"' from American courtrooms."[99]

Courts, too, were getting in on the act advising against the use of "junk science."[100] Indeed, the Ninth Circuit, in the decision later reversed by the Supreme Court in *Daubert,* specifically cited Huber's book in rejecting the testimony of plaintiffs' experts.[101] But the larger issues for the courts at the time were the perceived "attitude of judicial *laissez-faire*" when it came to admitting "expert testimony from "just about anyone the plaintiffs chose to designate . . . even persons without relevant training, credential or experience."[102] Throughout the mid-1980s, courts "typically applied a very lenient standard to the admissibility of expert testimony."[103] Equally problematic, courts were applying different standards to toxic torts cases. Some courts applied a loose "reliability test" to such evidence.[104] Other

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98. *Id. But see* Giannelli, *supra* note 5, at 108 n.16 ("Vice President Quayle cites this example without including the next sentence. Huber's next sentence is: 'The trial judge threw out *that* verdict.'" (citing HUBER, *supra* note 3, at 4)). Instead, the Vice President writes that such stories "are becoming almost commonplace." Quayle, *supra* note 5, at 566.

99. Lewin, *supra* note 95, at 185.

100. *See, e.g.,* Carroll v. Otis Elevator Co., 896 F.2d 210, 215 (7th Cir. 1990) (Easterbrook, J., concurring) ("[T]he district judge did not abuse his discretion in admitting the testimony. Perceptual psychology (a part of experimental psychology) is not 'junk science,' and Professor Walker is no quack.").

101. Daubert v. Merrell Dow Pharm., Inc., 951 F.2d 1128, 1131 (9th Cir. 1991) ("The best test of certainty we have is good science—the science of publication, replication, and verification, the science of consensus and peer review." (quoting HUBER, *supra* note 3, at 228)); *see also* Thomas M. Crowley, *Help Me Mr. Wizard! Can We Really Have "Neutral" Rule 706 Experts?*, 1998 DET. C.L. REV. 927, 935 n.34 ("Given the circuit's opinion, and the 22 amicus briefs filed in the [later Supreme Court] case, representing a range of parties from the Carnegie Commission on Science, Technology and Government to the American Tort Reform Association (referring explicitly to junk science), the *Daubert* court was undoubtedly aware of the larger societal issues at stake.").

102. Billauer, Daubert *Debunked*, *supra* note 64, at 26; *see also* FISHER, *supra* note 76, at 222.

103. Bernstein & Lasker, *supra* note 89, at 4. Even when courts "purported to apply a seemingly strict reliability test," they usually allowed the testimony of the expert to be admitted. *See* Bernstein, *supra* note 64, at 390 (citing, as but two examples, *In re* Paoli R.R. Yard PCB Litig., 916 F.2d 829 (3d Cir. 1990); DeLuca v. Merrell Dow Pharm., 911 F.2d 941 (3d Cir. 1990)).

104. *See, e.g., In re* "Agent Orange" Prod. Liab. Litig., 611 F. Supp. 1223, 1246 (E.D.N.Y. 1985), *aff'd on other grounds*, 818 F.2d 187 (2d Cir. 1987) ("[C]ourts look to evidence from experts in the field about the reliability of the materials in question . . . .").

courts applied versions of a relevancy test.[105] Until 1988, no toxic tort case applied the *Frye* test, which until then was nearly exclusively used in criminal cases.[106] By 1993, the year of *Daubert*, "the Supreme Court got the message: [s]omething needed to be done."[107]

Before moving on to *Daubert*, it is interesting to ask, were "the courts really overrun with 'junk science'?" "Not only are there no studies that support" the allegation,[108] but a Carnegie Commission report on Science, Technology, and Government released at the time "concluded that, as for the 'allegations that "junk science" is flooding the courtroom, . . . many of the concerns are greatly exaggerated' and 'it does not appear that the federal courts are being inundated with fringe science.'"[109] Huber's infamous book itself was heavily criticized as "junk science"[110] and overly reliant on anecdotal evidence.[111] Huber and others' use of junk science to

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105. *See, e.g.*, Ferebee v. Chevron Chem. Co., 736 F.2d 1529, 1536 (D.C. Cir. 1984) ("[T]he test for allowing a plaintiff to recover in a tort suit of this type is not scientific certainty but legal sufficiency; if reasonable jurors *could* conclude from the expert testimony that paraquat more likely than not caused Ferebee's injury, the fact that . . . science would require more evidence before conclusively considering the causation question resolved is irrelevant.").

106. *See* Bernstein, *supra* note 64, at 390 ("Until 1988, no court applied *Frye*—which was mainly limited to forensic evidence in criminal trials—in a toxic tort case.").

107. Billauer, Daubert *Debunked*, *supra* note 64, at 27 (referencing personal meeting with Chief Justice Rehnquist).

108. Chesebro, *supra* note 91, at 1653 (quoting CARNEGIE COMM'N, *supra* note 80, at 13).

109. *Id.* (quoting CARNEGIE COMM'N, *supra* note 80, at 13).

110. *See, e.g.*, Chesebro, *supra* note 91, at 1726 (using Huber's own terms in asserting that "the errors in Huber's factual description and legal analysis are so frequent and profound that Galileo would go further to repudiate Huber's book—on Huber's own terms—as 'a catalog of every conceivable kind of error: data dredging, wishful thinking, truculent dogmatism, and, now and again, outright fraud'"); Edmond & Mercer, *supra* note 82, at 10 (criticizing the "limitations of the junk science model, focusing particular attention on the simplistic, idealized, and frequently erroneous images of science employed by the model's proponents"); Lewin, *supra* note 95, at 203-04 ("Huber harnesses the power of junk litigation science to stir up fear of the tort system, purveying the pernicious myth that junk science is rampant in our courts and that liability frequently is imposed without a well-founded scientific basis."); Book Note, *Rebel Without a Cause,* 105 HARV. L. REV. 935, 940 (1992) (reviewing Huber's book) ("[I]t is imperative to disentangle Huber's two criticisms: one evidentiary, against junk science; the other policy-oriented, against modern substantive tort law.").

111. Lewin, *supra* note 95, at 189. As Professor Lewin explains,

> At the core of the work are over 100 pages of horror stories about the legal system's mishandling of scientifically untenable claims that various persons or entities were the cause of the victims' damages. Compounding the anecdotal character of his evidence is the fact that, despite Huber's overblown rhetoric,

promote reform "plays a strategic, rhetorical role in the agendas of many who attempt to address the pervasive perception of an ongoing legal crisis."[112] The use of the "junk science" rhetorical attack was heavily subsidized by conservative forces.[113] This may help explain why the focus in the early 1990s of "junk science" avoided criminal defendants and criminal cases generally.[114]

B. The Bendectin Litigation

In many respects, *Daubert v. Merrell Dow Pharmaceuticals*[115] was an ideal case for resetting the standards for admitting expert testimony. The defendant, Merrell Dow, manufactured a morning-sickness drug, Bendectin, that by the mid-1970s, was taken by 30% of pregnant women throughout the country.[116] This high participation rate gave rise to plenty of potential plaintiffs alleging that this morning-sickness drug caused birth

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> these stories do not reveal a pattern of systematic judicial acceptance of junk science, nor do they uniformly support his thesis that we face a serious threat from junk science in the courtroom.

Id.

112. Edmond & Mercer, *supra* note 82, at 5-6 ("Junk science is a convenient scapegoat for deeper law-science conflicts because it plays on public fears of science and technology being out of control, while providing a rallying point for legal reform.").

113. *See* Thomas O. McGarity, *Our Science Is Sound Science and Their Science Is Junk Science: Science-Based Strategies for Avoiding Accountability and Responsibility for Risk-Producing Products and Activities*, 52 U. KAN. L. REV. 897, 905 (2004) ("[T]he Manhattan Institute went to great lengths to publicize Huber's catchy 'junk science' claim in the popular press."); *id.* at 905 n.25 (noting that Huber's book "'reached the public through a massive publicity blitz' financed by the Manhattan Institute" (citing SHELDON RAMPTON & JOHN STAUBER, TRUST US, WE'RE EXPERTS! 223-24 (2001))); Edmond & Mercer, *supra* note 82, at 4-6 (describing the Manhattan Institute as "a conservative think-tank supported by various industry and insurance groups," and conservative policy-makers).

114. Simon A. Cole, *Grandfathering Evidence: Fingerprint Admissibility Rulings from* Jennings *to* Llera Plaza *and Back Again*, 41 AM. CRIM. L. REV. 1189, 1194 & n.10 (2004) ("It is no secret that Huber's book was aimed at the supposed abuse of science by civil plaintiffs. Huber did not symmetrically apply the same standards to evidence offered by the government in criminal cases."). Importantly, "[t]his period also marked the beginning of an era of the federalization of criminal law, when the federal government began to prosecute crimes that had once been solely the responsibility of the states." Bernstein, *supra* note 64, at 390; *see, e.g.*, Kathleen F. Brickey, *Criminal Mischief: The Federalization of American Criminal Law*, 46 HASTINGS L.J. 1135, 1148 (1995) ("The federal government's 'war on drugs' is the single most significant contributor to this self-perpetuating cycle. The drug war has skewed the federal criminal (and civil) justice system at every possible level.").

115. Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579 (1993).

116. Richard Marcus, *Reexamining the Bendectin Litigation Story*, 83 IOWA L. REV. 231, 236 (1997).

defects in the children they carried.[117] The first reported trial concerning Bendectin was in 1980 and lasted two months.[118] After multiple deadlocks, the jury awarded a small "compromise" verdict of $20,000.[119]

Despite the limited success of the first trial, potential plaintiffs claimed victory, and the number of those willing to join suit "increased dramatically, resulting in the filing of numerous suits and the consolidation of [smaller] cases into joint trials."[120] As it prepared to defend an escalating number of cases, Merrell Dow removed Bendectin from the market in 1983.[121] Contributing to the momentum for plaintiffs, the National Enquirer ran a feature story that blamed Bendectin for babies born without brains, some without eyeballs, and "several thousand tragically deformed infants in the U.S. alone."[122] Quoted in the story was Dr. William McBride, who had been widely credited as one of the physicians who first recognized in the 1960s that a different drug, Thalidomide, had caused serious birth defects.[123]

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117. Susan Haack, *Mind the Analytical Gap! Tracing a Fault Line in* Daubert, 61 WAYNE L. REV. 653, 659 (2016).

118. JOSEPH SANDERS, BENDECTIN ON TRIAL: A STUDY OF MASS TORT LITIGATION 11 (1998).

119. In the first trial, *Meckdeci v. Merrell National Laboratories*, the jury returned a small award to the parents for only the out-of-pocket costs for care of their injured son (which had been stipulated to be $20,000). *Id.* at 12. The jury did not award any other damages for the son's injuries. *Id.*

120. Gary Edmond, *Whigs in Court: Historical Problems with Expert Evidence*, 14 YALE J.L. & HUMAN 123, 160 (2002).

121. *See* W. Kip Viscusi, *Corporate Risk Analysis: A Reckless Act?*, 52 STAN. L. REV. 547, 584 (2000) ("[T]he wave of Bendectin litigation ultimately cost manufacturers so much that they stopped marketing the product.").

122. HUBER, *supra* note 3, at 111. The headline read "New Thalidomide Scandal – Experts Reveal." SANDERS, *supra* note 118, at 10. *See infra* note 123 for background on the history of Thalidomide.

123. SANDERS, *supra* note 118, at 5; *see also* McBride v. Merrell Dow & Pharm., Inc., 800 F.2d 1208, 1211 (D.C. Cir. 1986) ("The alleged link between Bendectin and birth defects had begotten a widespread and heated public controversy over the drug's safety. McBride voluntarily entered this controversy, intending to influence its outcome. As a world-renowned expert on birth defects—he was prominent in discovering the dangers of Thalidomide and has been dubbed the 'Father of Teratology'— McBride occupied a central place in the Bendectin debate." (internal citations omitted)). Thalidomide was introduced as a sedative in Europe in the late 1950s. Gail H. Javitt & Kathy Hudson, *Regulating (for the Benefit of) Future Persons: A Different Perspective on the FDA's Jurisdiction to Regulate Human Reproductive Cloning,* 2003 UTAH L. REV. 1201, 1220. When given to women early in pregnancy, however, it caused severe birth defects. *Id.* The FDA, having seen foreign studies of the side effects, never approved Thalidomide for use in the United States. *See*

Plaintiffs had other incentives to sue Merrell Dow. After Bendectin had been on the market for two decades, "a few epidemiological studies produced in the late 1970s raised, somewhat inconclusively, concerns about its safety."[124] Merrell Dow had also been an early manufacturer and distributor of Thalidomide in the 1960s, using questionably lax standards in sharing the medication with numerous pregnant mothers despite the FDA's lack of approval.[125] Around that same time, Merrell Dow had conducted shoddy research concerning Bendectin, leading plaintiffs to conclude that the company might have something to hide.[126]

Within a few short years, however, suits about the potential harms of Bendectin began to seem much less meritorious. After the initial lawsuits, the FDA and other researchers immediately began studying the drug, providing a particularly well-developed suite of studies.[127] Two years after

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Marc A. Rodwin, *Patient Accountability and Quality of Care: Lessons from Medical Consumerism and the Patients' Rights, Women's Health and Disability Rights Movements*, 20 AM. J. L. & MED. 147, 158 (1994).

124. Edmond, *supra* note 120, at 159; *see also* Michael D. Green, *Expert Witnesses and Sufficiency of Evidence in Toxic Substances Litigation: The Legacy of Agent Orange and Bendectin Litigation*, 86 NW. U. L. REV. 643, 679 (1992) (noting that plaintiffs were encouraged by "the publicity generated about the allegations of Bendectin's teratogenicity [and] the horror of the Thalidomide experience of the 1960s looming in the background").

125. While awaiting FDA approval, Merrell Dow "engaged in what might charitably be called extremely lax behavior" in distributing 2.5 million Thalidomide pills to 20,000 patients, including 624 pregnant women, injuring at least ten babies with significant birth defects. Joseph Sanders, *The Bendectin Litigation: A Case Study in the Life Cycle of Mass Torts*, 43 HASTINGS L.J. 301, 314 (1992). Interestingly, "[i]n recent years Thalidomide has made a comeback of sorts as evidence increases that it may be effective in treating a variety of serious diseases such as AIDS, cancer, and leprosy." Javitt & Hudson, *supra* note 123, at 1221 n.146.

126. *See* Green, *supra* note 126, at 677 n.155 ("The first epidemiologic study performed in 1963 by a Merrell employee and relied on by Merrell for fifteen years was so shoddy in method and interpretation that even Merrell has conceded its lack of validity; it has provided an inviting target for plaintiffs' attorneys' attacks and claims for punitive damages."). In addition, Merrell Dow employees were caught reclassifying various animal studies. *Id.* As Professor Green concludes, "[G]iven the early scientific record, it was largely fortuitous that Bendectin turned out not to [cause birth defects]." *Id.* at 678 n.155.

127. *See* Green, *supra* note 126, at 677 ("[T]he scientific record on Bendectin's teratogenicity by the mid-to-late 1980s had become unusually rich."). Indeed, "Bendectin might safely be generalized to the relatively few agents for which an established and mature body of epidemiologic evidence exists. Tobacco and asbestos are other such agents that come to mind, albeit ones where the epidemiologic record demonstrates causation." *Id.* at 679 n.116; *see also id.* at 679-80 ("In 1980, after the compromise jury verdict[], the FDA convened a review panel of experts to examine the scientific record and render a judgment on Bendectin's safety. The panel essentially exonerated Bendectin. The panel concluded

being removed from the market, there were over thirty studies on the effects of Bendectin.[128] Because birth defects appear so soon after exposure, "the development of a significant epidemiologic record [was] much more feasible [for Bendectin] than for other toxic substances."[129]

Looking back, the claims against Bendectin seem particularly futile. Indeed, judges and scholars routinely cite the Bendectin litigation to support the need for reform.[130] Some have gone so far as to hold out the Bendectin litigation as the epitome of plaintiffs using bad science to attack perfectly safe products.[131] Moreover, by the late 1980s it was becoming increasingly obvious that Dr. McBride, who by then had served as a plaintiffs' expert in multiple cases, had deliberately falsified his research on Bendectin.[132] Ultimately, *Merrell Dow* was vindicated, as not a single

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that 'available data do not demonstrate an association between birth defects and Bendectin.'" (quoting Press Release, Department of Health and Human Services News, No. P80-45 (Oct. 7, 1980))).

128. *Id.* at 678 ("By 1985, there were twenty-one epidemiologic studies that focused on Bendectin and fourteen other studies that included Bendectin (or one of its components) among the agents studied.").

129. *Id.* at 679. Bendectin's toxicity was more investigated than many other suspected toxic substances. *Id.* at 678. This is because the sort of injury alleged was apparent at birth, which means it was detectable in less than nine months. *Id.* By contrast, many carcinogens take decades to show their impact, "which greatly delay (and make more expensive) epidemiologic study of carcinogens." *Id.* This made Bendectin unique among the group of suspected substances. The situation concerning Bendectin was also unique given its proven record of safety because of the FDA and other investigations. *See id.* at 679 ("The additional confidence provided the courts by the Food and Drug Administration's regulatory authority over Bendectin is yet another reason why the Bendectin decisions are not generalizable.").

130. *See* Edmond, *supra* note 120, at 160 ("The cases provide an extensive public record of trial and appellate judgments and have generated considerable legal commentary.").

131. *See* MICHAEL GREEN, BENDECTIN AND BIRTH DEFECTS: THE CHALLENGES OF MASS TOXIC SUBSTANCES LITIGATION 328 (1996) ("Bendectin is the Taj Mahal of horror stories about the tort system: the single most criticized piece of large-scale litigation of all time."); *see also* Edmond, *supra* note 120, at 160 ("[T]he concerns of commentators are focused on the inability of juries, and to a lesser degree judges, to *properly* value the great weight of scientific evidence that demonstrated no legally or scientifically meaningful correlation between the incidence of birth defects and the consumption of Bendectin.").

132. James M. Sabovich, *Petition Without Prejudice: Against the Fraud Exception to Noerr-Pennington Immunity from the Toxic Tort Perspective*, 17 PENN ST. ENVTL. L. REV. 1, 30-31 (2008) (citing Norman Swan, *The Man Who Stopped Thalidomide Accused of Fraud*, SYDNEY MORNING HERALD (Dec. 14, 1987)). Indeed, Dr. McBride was discharged from the practice of medicine for having falsified Bendectin research the same year as *Daubert*. *Id.* at 31 n.200 (citing Margaret Scheikowski, *Thalidomide Doctor Back After Fraud*, DAILY TELEGRAPH (Sydney, Austl.) Nov. 10, 1998, at 3).

Bendectin verdict withstood appeal,[133] but not before "the withdrawal of [a major drug] from the market" and significant public health ramifications.[134] Without the morning-sickness medication, many pregnant women developed serious medical conditions requiring hospitalizations.[135]

C. Daubert *to the Rescue?*

By the time the Supreme Court was ready to hear *Daubert*,[136] lower "courts ha[d] taken a variety of inconsistent approaches in assessing the admissibility of expert testimony on the causal link" between Bendectin and plaintiffs' birth defects.[137] The particular case in *Daubert* was very much like all of the other Bendectin cases.[138] In *Daubert*, "two boys [had been] born with tragic birth defects that reduced the size of their limbs."[139] Their parents sued Merrell Dow, as the manufacturer of "Bendectin, alleging that the mothers' use of the drug during pregnancy caused the deformities."[140] At trial, the defendant's experts had a stack of epidemiological studies all concluding that Bendectin was perfectly safe.[141] The plaintiffs' experts had mere "reanalyses of the data used in one or two of those epidemiological

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133. Viscusi, *supra* note 123, at 584.

134. GREEN, *supra* note 133, at 336.

135. The absence of Bendectin led to "an increase in hospitalizations for hyperemesis gravidarum, a severe form of morning sickness that requires medical intervention, often by intravenous rehydration." *Id.* Many American women drove to Canada to obtain Bendectin and "[i]n desperation, a few doctors say they t[old] women essentially to make their own Bendectin." Sabovich, *supra* note 134, at 32 (quoting Gina Kolata, *Controversial Drug Makes a Comeback*, N.Y. TIMES, Sept. 26, 2000, at F.).

136. Daubert v. Merrell Dow Pharm., Inc., 727 F. Supp. 570 (S.D. Cal. 1989), *aff'd*, 951 F.2d 1128 (9th Cir. 1991), *vacated*, 509 U.S. 579 (1993), *and aff'd*, 43 F.3d 1311 (9th Cir. 1995).

137. Lewin, *supra* note 95, at 184–85; *see also id.* at 185 n.7 (collecting cases).

138. *See* Haack, *supra* note 117, at 659 ("*Daubert v. Merrell Dow Pharmaceuticals* was in most respects a routine Bendectin case, indistinguishable from the many other cases alleging that this morning-sickness drug caused birth defects in the children born to women who took it.").

139. Bernstein, *supra* note 64, at 392; *see also Daubert*, 509 U.S. at 583.

140. Bernstein, *supra* note 64, at 392; *see also Daubert*, 509 U.S. at 583.

141. *See* Bernstein, *supra* note 64, at 392 ("The problem facing the plaintiffs was that the defendant presented the trial court with a large body of epidemiological studies showing that babies exposed to Bendectin *in utero* do not have a higher rate of limb reductions than those not exposed.").

studies."[142] The trial court held that plaintiffs' evidence was insufficient to show causation and granted summary judgment.[143]

The Ninth Circuit affirmed,[144] and remarkably, relied on *Frye* in upholding the lower court's dismissal.[145] The court noted that the plaintiffs' experts had not submitted their reanalysis to peer review or published them in a scientific journal.[146] Citing Huber, the court held that because the work was not "subjected to verification and scrutiny by others in the field," it would not be accepted in the scientific community.[147] As many commentators have reported, "[t]he Ninth Circuit's *Daubert* opinion quickly gained notoriety for its strong reliance on *Frye* to exclude evidence in a toxic tort case."[148] The Ninth Circuit's unusual ruling, in combination with a range of other rationales other circuits employed in the Bendectin

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142. *Id.*

143. Daubert v. Merrell Dow Pharm., Inc., 727 F. Supp. 570, 575-76 (S.D. Cal. 1989). The court also rejected the plaintiffs' experts' use of animal studies. *See id.* at 575 ("[E]xpert testimony concluding that Bendectin causes limb reduction defects which is generally based upon *in vitro* studies, chemical structure analyses and animal studies is insufficient to take the issue to the jury.").

144. Daubert v. Merrell Dow Pharm., Inc., 951 F.2d 1128, 1129 (9th Cir. 1991).

145. *See id.* at 1129–30; *see also* Bernstein, *supra* note 65, at 392 ("[T]he court simply ignored the fact that [*Frye's*] general acceptance test had never previously been applied in a civil case in the Ninth Circuit, and had only been applied twice before in the toxic tort context in other jurisdictions."); Haack, *supra* note 117, at 660 & n.50 ("[I]n affirming this exclusion, the court of appeals had specifically cited *Frye*—which, however, had up till then been used in criminal trials rather than in [two] civil cases." (citing Barrel of Fun v. State Farm Fire & Cas. Co., 739 F.2d at 1028 (5th Cir.1984); Christopherson v. Allied Signal Corp., 902 F.2d 362 (5th Cir.1990), *superseded by* 939 F.2d 1106 (5th Cir. 1990))).

146. *Daubert*, 951 F.2d at 1130.

147. *Id.* at 1131. As the Ninth Circuit reasoned on remand:

> Bendectin litigation has been pending in the courts for over a decade, yet the only review the plaintiffs' experts' work has received has been by judges and juries, and the only place their theories and studies have been published is in the pages of federal and state reporters. None of the plaintiffs' experts has published his work on Bendectin in a scientific journal or solicited formal review by his colleagues. Despite the many years the controversy has been brewing, no one in the scientific community—except defendant's experts—has deemed these studies worthy of verification, refutation or even comment. It's as if there were a tacit understanding within the scientific community that what's going on here is not science at all, but litigation.

Daubert v. Merrell Dow Pharm., Inc., 43 F.3d 1311, 1318 (9th Cir. 1995).

148. Bernstein, *supra* note 64, at 393.

litigation, offered the Supreme Court the perfect case to square the standard once and for all.[149]

While the Court certainly addressed the basic issue before it—namely, the continued viability of *Frye* in the federal courts[150]—the Court went further to establish a new standard for the admissibility of expert evidence.[151] In explaining this evidentiary standard, the *Daubert* Court pointed to several factors that a trial judge might consider: (1) "whether a theory or technique . . . can be (and has been) tested"; (2) "whether the theory or technique has been subjected to peer review and publication"; (3) "[i]n the case of a particular scientific technique . . . the known or potential rate of error"; and (4) a scientific technique's "degree of acceptance within [a relevant scientific] community."[152] The Court emphasized that the review is "a flexible one."[153] The Court expressed confidence in the adversarial system, explaining that "[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence."[154] As a procedural matter, the Court advised that judges should perform a "preliminary assessment of whether that reasoning or methodology underlying the testimony is scientifically valid" in advance of trial.[155]

Many have criticized the *Daubert* decision as unclear and contradictory, leaving future courts confused as to whether they should interpret *Daubert* as establishing a strict or lenient standard of admissibility.[156] As Professor David Bernstein and co-author Eric Lasker explain, the Court clearly

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149. As the Court explained, "We granted certiorari in light of sharp divisions among the courts regarding the proper standard for the admission of expert testimony." Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 585 (1993) (citation omitted).

150. *Id.* at 589 (holding that "the *Frye* test was displaced by the Rules of Evidence").

151. *See* Flores et al., *supra* note 72, at 535 (detailing how "the '*Daubert* trilogy' would fundamentally alter the dynamic of expert evidence admissibility").

152. *Daubert*, 509 U.S. at 593–94. The Court further explained that "[m]any factors will bear on the inquiry, and we do not presume to set out a definitive checklist or test." *Id.* at 593.

153. *Id.* at 594.

154. *Id.* at 596 (citing Rock v. Arkansas, 483 U.S. 44, 61 (1987)).

155. *Id.* at 592-93; *see also* Flores et al., *supra* note 72, at 536 ("*Daubert* effectively placed judges in a 'gatekeeper' position, necessitating a more active role than under *Frye* and charging them with the responsibility for evaluating the scientific validity of the basis for expert testimony.").

156. *See, e.g.*, Bernstein & Lasker, *supra* note 89, at 5 ("The Court larded *Daubert* with conflicting rhetoric that left ambiguous whether the case should be interpreted as establishing a strict or lenient standard of admissibility.").

suggested a lenient standard when it "noted 'the "liberal thrust" of the Federal Rules [of Evidence] and their "general approach of relaxing the traditional barriers to 'opinion' testimony,"'[157] and "emphasized the 'flexible' nature of the inquiry in which trial courts must engage."[158] As they point out, "[t]he Court [even] expressed optimism about the capabilities of the adversarial process and of the jury, and [it] spoke of 'shaky but admissible evidence.'"[159] But the Court in *Daubert* also suggests applying a strict standard. As Bernstein and Lasker explain, "the Court insisted that trial court judges adopt 'a gatekeeping role' to 'ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable;'"[160] "[t]he Court emphasized that Rule 702 'requires a valid scientific connection to the pertinent inquiry as a precondition to admissibility;'"[161] "[a]nd the Court explained that under the Federal Rules, a trial judge 'exercises more control over experts than over lay witnesses.'"[162]

The two most immediate changes to the courts from the *Daubert* decision started with "the new role it thrust upon the district judge."[163] First, the examination of expert testimony shifted from after the verdict to pretrial motions *in limine*.[164] Interestingly, studies showed that the increase

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157. *Id.* (quoting *Daubert*, 509 U.S. at 588).

158. *Id.* (quoting *Daubert*, 509 U.S. at 594).

159. *Id.* (quoting *Daubert*, 509 U.S. at 596); *see also* David E. Bernstein, *The Misbegotten Judicial Resistance to the* Daubert *Revolution*, 89 NOTRE DAME L. REV. 27, 43 (2013) [hereinafter Bernstein, *Misbegotten*] ("The Court's more forgiving remarks seemed aimed primarily at a mythical version of *Frye*, understood as an 'austere' rule that made it extremely difficult to present expert testimony."). The Court's view of the application of *Frye* "is not, in fact, how *Frye* had traditionally been applied." Bernstein & Lasker, *supra* note 90, at 5 n.14. Courts were far more permissive in their application of *Frye* than what the Court suggested. *See* Bernstein & Lasker, *supra* note 90, at 6.

160. Bernstein & Lasker, *supra* note 90, at 5 (quoting *Daubert*, 509 U.S. at 587, 597); *see also* Lander, *supra* note 19, at 1662 ("The U.S. Supreme Court held that Rule 702 requires courts to serve as 'gatekeepers' who must assess the underlying 'reliability' of proffered expert testimony."). "[T]here was nothing particularly novel about a trial judge having the *power* to exclude inappropriate expert testimony," given Federal Rule of Evidence 104(a). Margaret A. Berger, *Upsetting the Balance Between Adverse Interests: The Impact of the Supreme Court's Trilogy on Expert Testimony in Toxic Tort Litigation*, 64 LAW & CONTEMP. PROBS. 289, 293 (2001) (citing FED. R. EVID. 104(a)). But "*Daubert* stressed the trial court's *obligation* to exercise this power." *Id.*

161. Bernstein & Lasker, *supra* note 90, at 5 (quoting *Daubert*, 509 U.S. at 592).

162. *Id.* (quoting *Daubert*, 509 U.S. at 595).

163. *See* Berger, *supra* note 160, at 293.

164. As Professor Berger points out,

in motions was largely driven by civil defendants challenging plaintiffs' experts.[165]

Second, "judges were put on notice that—like it or not—they were going to have to deal with science."[166] Judges could no longer simply rely on the credentials of an expert witness.[167] *Daubert* now required judges to assess the validity of the expert's testimony and "whether their testimony was based on 'scientific knowledge.'"[168]

III. Daubert*'s Impact on the Law and the Courts*

A. The Daubert *Trilogy*

The Court continued to refine the *Daubert* standard in two subsequent decisions, which together with *Daubert* comprise the "*Daubert* Trilogy." *General Electric Co. v. Joiner*,[169] the second case in the trilogy, put greater control in the hands of the trial court. The Court in *Joiner* addressed "the standard of appellate review for evidentiary rulings" under *Daubert*.[170] The district court had excluded Joiner's experts and granted summary

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> Although some expert proof was excluded before trial on admissibility grounds prior to *Daubert*, the Bendectin litigation demonstrates that this was not the customary procedure in the federal courts. Plaintiffs were uniformly unsuccessful in these cases in federal court, not because judges refused to admit their proffered expert proof, but because trial and appellate courts found it insufficient even when plaintiffs received a jury verdict at trial.

Id. at 293 n.29 (citing Sanders, *supra* note 125, at 374-79). "Defendants were quick to see the implications." *Id.* at 293. Judges' new responsibility to filter out bad science before trial "encouraged defendants to seek pretrial rulings on the admissibility of expert testimony and to follow a favorable result with a motion for summary judgment if the experts excluded were essential to the plaintiff's prima facie case." *Id.*

165. *See* Flores et al., *supra* note 72, at 539; *see also id.* at 561-64 (discussing the results of their study and summarizing data from other studies).

166. Berger, *supra* note 160, at 293.

167. *Id.*

168. *Id.*; *see also* Daubert v. Merrell Dow Pharm., Inc., 43 F.3d 1311, 1316 (9th Cir. 1995) (applying, on remand, the standard created by the Supreme Court with the statement, "Mindful of our position in the hierarchy of the federal judiciary, we take a deep breath and proceed with this heady task").

169. 522 U.S. 136 (1997) (considering plaintiff's claim that his lung cancer is from exposure to polychlorinated biphenyls ("PCBs")).

170. *Id.* at 140; *see id.* at 138-39 ("We granted certiorari in this case to determine what standard an appellate court should apply in reviewing a trial court's decision to admit or exclude expert testimony under *Daubert*. We hold that abuse of discretion is the appropriate standard." (citations omitted)).

judgement, dismissing his case.[171] The court of appeals reversed, arguing that because there is a preference for admissibility, appellate courts should apply a "particularly stringent standard of review."[172]

The Court disagreed and held that *Daubert* had not changed the standard of review of evidentiary exclusions, which remained the same as in other evidentiary rulings: abuse of discretion.[173] Because the exclusion of plaintiff's expert proof on causation led to a grant of summary judgment, the standard presumably applies even when the ruling was "outcome determinative."[174] The Court went on to clarify that the trial court had *not* abused its discretion in excluding Joiner's experts.[175]

Kumho Tire Co. v. Carmichael,[176] the final case in the trilogy, expanded the reach of *Daubert* to non-scientist expert witnesses.[177] Specifically, the

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171. The trial court found persuasive the absence of studies demonstrating the promotion of cancer in any species other than mice. Joiner v. Gen. Elec. Co., 864 F. Supp. 1310, 1324 (N.D. Ga. 1994), *rev'd*, 78 F.3d 524 (11th Cir. 1996), *rev'd*, 522 U.S. 136 (1997).

172. *Joiner*, 78 F.3d at 529.

173. *Joiner*, 522 U.S. at 142.

174. *Id.* at 141-43. By imposing an abuse of discretion standard, however, the Court "effectively insulates the trial judge's decision from serious appellate review." Gottesman, *supra* note 70, at 760 n.33. This is potentially worrisome because "only one trial judge sits on a case, in contrast to multiple jurors, and thus a greater risk exists that an aberrant notion will go uncorrected and determine the outcome." *Id.*

175. *Joiner*, 522 U.S. at 146-47. The Court provided a detailed review of why the trial court did not abuse its discretion in excluding plaintiff's expert:

> The studies involved infant mice that had developed cancer after being exposed to PCB's. The infant mice in the studies had had massive doses of PCB's injected directly into their peritoneums or stomachs. Joiner was an adult human being whose alleged exposure to PCB's was far less than the exposure in the animal studies. The PCB's were injected into the mice in a highly concentrated form. The fluid with which Joiner had come into contact generally had a much smaller PCB concentration of between 0-to-500 parts per million. The cancer that these mice developed was alveologenic adenomas; Joiner had developed small-cell carcinomas. No study demonstrated that adult mice developed cancer after being exposed to PCB's. One of the experts admitted that no study had demonstrated that PCB's lead to cancer in any other species.

Id. at 144. Because the Court employed such a detailed review of the evidence in question, its opinion "provides insights into applying the *Daubert* test in a toxic tort context." Berger, *supra* note 158, at 294.

176. 526 U.S. 137 (1999).

177. *Id.* at 138 ("The *Daubert* 'gatekeeping' obligation applies not only to 'scientific' testimony, but to all expert testimony."); *see id.* at 147 ("The initial question before us is whether this basic gatekeeping obligation applies only to 'scientific' testimony or to all expert testimony. We . . . believe that it applies to all expert testimony."); *see id.* at 151 ("We do not believe that Rule 702 creates a schematism that segregates expertise by type

Court held that the *Daubert* test applied to plaintiff's engineering expert.[178] Importantly, the Court held that the exclusion of plaintiff's expert was proper, using a "flexible" application of *Daubert*.[179] The Court emphasized repeatedly that the *Daubert* test was to be viewed as "flexible" and not a rigid checklist of factors to apply in every case.[180] Without explaining exactly how a trial court would determine whether a particular *Daubert* factor is pertinent, the Court stressed that a trial court has "considerable leeway" in developing its procedure for determining whether a particular expert's testimony is reliable. As the Court left it, a judge "should consider the specific factors identified in *Daubert* where they are reasonable measures of the reliability of expert testimony."[181]

B. Daubert*: The Results*

After twenty-five years, there is still considerable dispute over whether *Daubert* has resulted in greater exclusion of expert testimony.[182] The first

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while mapping certain kinds of questions to certain kinds of experts. Life and the legal cases that it generates are too complex to warrant so definitive a match.").

178. *See* Berger, *supra* note 158, at 295 n.43 ("The court below, as well as some other circuits, had held that a less stringent test applies in the case of non-scientific expert testimony."). Indeed, that was the appellate court's decision here. *See* Carmichael v. Samyang Tire, 131 F.3d 1433 (11th Cir. 1998), *rev'd*, Kumho Tire Co. v. Carmichael, 526 U.S. 137 (1999) (holding that non-scientific testimony was not held to the *Daubert* test). The case originated from a rear tire blowout on a minivan occupied by eight members of the Carmichael family. *Kumho Tire*, 526 U.S. at 142. One member of the Carmichael family died in the resulting accident, and the others were severely injured. *Id.* The engineering expert intended to testify that the blowout was due to a manufacturing or design defect. *Id.*

179. *Kumho Tire*, 526 U.S. at 139 ("[T]here is no indication in the record that other experts in the industry use Carlson's *particular* approach or that tire experts normally make the very fine distinctions necessary to support his conclusions, nor are there references to articles or papers that validate his approach.").

180. According to the Court, the *Daubert* factors do not constitute a "definitive checklist or test." *Id.* at 150. The Court clarified:

> [W]e can neither rule out, nor rule in, for all cases and for all time the applicability of the factors mentioned in *Daubert,* nor can we now do so for subsets of cases categorized by category of expert or by kind of evidence. Too much depends upon the particular circumstances of the particular case at issue.

Id. This flexibility was dependent on the facts of each individual case. *Id.*

181. *Id.* at 152 ("[W]e conclude that the trial judge must have considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable.").

182. *See* Brandon L. Garrett & M. Chris Fabricant, *The Myth of the Reliability Test*, 86 FORDHAM L. REV. 1559, 1568 (2018) ("Some scholars, focusing on both civil and criminal cases, have observed that *Daubert* did not change the practice in federal or state courts, while others have found a qualitative difference and a measurably stricter analysis in civil

sign that this might be a complicated question is that both sides of the debate—plaintiff's and defense counsel—claimed victory after the decision.[183] Many researchers have concluded that *Daubert* resulted in a significant increase in the exclusion of expert testimony, particularly in the area of toxic torts, and the case has drawn criticism that the standard set the bar too high.[184] Other interpretations of the data suggest that the exclusion of expert testimony did not increase significantly after *Daubert*.[185] The

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cases in state and federal courts."). Indeed, five years ago Professors Jurs & Devito noted that "[t]he question of whether *Daubert* . . . adopted a more lenient or more stringent standard for testing the reliability of expert evidence has dogged academics, practitioners, and researchers for twenty years." Jurs & Devito, *supra* note 48, at 677; *see also* Erica Beecher-Monas, *Blinded by Science: How Judges Avoid the Science in Scientific Evidence*, 71 TEMP. L. REV. 55, 74-76 (1998) (observing that already in the early days after *Daubert*, the issue of whether *Daubert* imposes a stricter standard for the admissibility of scientific evidence is a recurring topic of debate). Of course, conducting valid studies with precise measures of the impact of *Daubert* runs into many logistical barriers, including selection bias given how few cases proceed to trial and the difficulty in identifying information in cases that utilize expert evidence, but in which no challenge or *Daubert* issue is raised, among other problems in researching the issue. Flores et al., *supra* note 72, at 541.

183. Faigman et al., *supra* note 26, at 1819.

184. *See, e.g.*, Jurs & Devito, *supra* note 48, at 677 n.4 ("Our analysis of district court opinions suggests that after *Daubert*, judges scrutinized reliability more carefully and applied stricter standards in deciding whether to admit expert evidence." (quoting LLOYD DIXON & BRIAN GILL, RAND INST. FOR CIVIL JUSTICE, CHANGES IN THE STANDARD FOR ADMITTING EXPERT EVIDENCE IN FEDERAL CIVIL CASES SINCE THE *DAUBERT* DECISION xv (2001))); Carol Krafka et al., *Judge and Attorney Experiences, Practices, and Concerns Regarding Expert Testimony in Federal Civil Trials*, 8 PSYCHOL. PUB. POL'Y & L. 309, 330 (2002) ("The number of trials in which all of the proffered expert testimony was allowed has been reduced relative to the pre-*Daubert* era. The difference in rates is modest but robust."); Joseph Sanders, *Applying* Daubert *Inconsistently? Proof of Individual Causation in Toxic Tort and Forensic Cases*, 75 BROOK. L. REV. 1367, 1374 (2010) ("In no area has the *Daubert* revolution had a greater effect than in toxic torts. The number of cases in which expert causation testimony has been excluded must by now run into the thousands. Many commentators have reacted negatively to this trend, arguing that the bar has been set too high.").

185. *See* Billauer, Daubert *Debunked*, *supra* note 64, at 22 ("While more evidence was evaluated for admissibility after *Daubert*, by 1997 roughly the same percentage of evidence was deemed admissible."); Edward K. Cheng & Albert H. Yoon, *Does* Frye *or* Daubert *Matter? A Study of Scientific Admissibility Standards*, 91 VA. L. REV. 471, 498 (2005) (finding that the influence of *Daubert* on removal rates was "vanishingly small" in magnitude and "statistically insignificant"); Jennifer L. Groscup et al., *The Effects of* Daubert *on the Admissibility of Expert Testimony in State and Federal Criminal Cases*, 8 PSYCHOL. PUB. POL'Y & L. 339, 345-46 (2002) (study of 693 state and federal criminal appeals cases between 1987 and 1998 found no statistically significant change in overall admissibility rates).

reality is that "[r]esearch since 1993, using a variety of methodologies, has been largely inconsistent."[186]

The picture gets a little clearer when looking at the years immediately before and after *Daubert*. According to a recent analysis, in the three years prior to *Daubert*, there was a relatively sharp increase in the admissibility of scientific evidence, particularly in toxic tort cases.[187] This was followed by a significant decrease in the three years following the decision, as the rate of exclusion increased after the Court's decision in *Daubert*.[188] As the author of the analysis concluded, "This suggests that the decision in *Daubert* was a response to concerns about the increase in 'junk science' being used as evidence in court proceedings, and that the decrease following *Daubert* was simply righting the ship."[189]

Whatever impact *Daubert* had on the actual exclusion rates by courts, one influence is fairly well-documented: the impact on perceptions and

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186. Jurs & DeVito, *supra* note 48, at 677; *see also id.* at 731 ("Some survey data indicated that judges saw *Daubert* as a stricter standard, while some did not. Some case review analysis found that *Daubert* was a stricter standard, while some did not."). *But see id.* at 679-81 (finding evidence, based on changes in removal rates in four million cases from state to federal court depending on state court adoption of *Daubert* standards, that "civil defendants believe the *Daubert* standard is more restrictive to expert testimony and act accordingly").

187. Billauer, Daubert *Debunked*, *supra* note 64, at 18.

188. *Id.* Interestingly, "[w]hile more evidence was evaluated for admissibility after *Daubert*, by 1997 "roughly the same percentage of evidence was deemed admissible." *Id.* at 22; *see id.* at 23 ("In effect, then, *Daubert* merely effectuated a short-term course correction to address an anomalous situation—before matters returned to the old status quo."); *id.* at 23 n.103 ("noting sharp rise in excluded evidence immediately after *Daubert* and returning to base-line equilibrium after 1997, assuming the years 1980-89 reflect baseline"); *see also* Krafka et al., *supra* note 184, at 322 (reporting that federal judges surveyed prior to *Daubert* reported excluding or limiting challenged expert evidence in 25% of the cases and excluding or limiting challenged expert evidence in 41% in a survey conducted approximately a half decade following the decision).

189. Billauer, Daubert *Debunked*, *supra* note 64, at 23; Alexandra Kennedy-Breit, *Admissibility of Expert Evidence to Prove Causation in Toxic Torts*, 53 TORT TRIAL & INS. PRAC. L.J. 139, 146 (2017). Another interesting recent discovery is that the percentage of experts that are plaintiff's experts has dropped significantly since *Daubert*. Flores et al., *supra* note 72, at 549. Of course, other changes besides *Daubert* have no doubt had an impact on expert testimony admissibility. *Id.* at 564 (noting that in a survey of judges, one common response was that "*Daubert* . . . was one change (albeit a major one) among many used by the federal court system to deal with heavy caseloads and the growing use of expert evidence."); *id.* ("Thus, concluding that *Daubert* led to all the changes delineated in our report could arguably be a spurious claim.").

norms.[190] Indeed, some have argued "that *Daubert*'s most important contribution . . . has more to do with *Daubert*'s educative function than with its doctrinal text."[191] *Daubert* created a "cultural shift" that altered the behavior of both judges and lawyers.[192] As one study noted, "attorneys reported more closely scrutinizing the credentials of their own experts and filing more motions to exclude opposing expert evidence."[193] The shift from post-trial to pre-trial evaluation of expert witness testimony by courts resulted in greater use of motions *in limine*.[194] Lawyers also reported being more active "in the preparation of their experts' testimony."[195] Daubert's

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190. *See* Jurs & DeVito, *supra* note 48, at 731 ("[B]ased on actual behavior in millions of real cases, civil defendants believe the *Daubert* standard to be a stricter one. Not only does the removal rate increase in the years after *Daubert*, as one would expect if the standard for admissibility is tighter, but we can also show that if the state adopts *Daubert*, and in so doing returns the state and federal court to the same admissibility standard, the removal rate then drops in response. Both of these effects support the conclusion that defendants perceive *Daubert* as an advantageous, stricter standard.").

191. A. Leah Vickers, Daubert, *Critique and Interpretation: What Empirical Studies Tell Us About the Application of* Daubert, 40 U.S.F. L. REV. 109, 147 (2005); *see also id.* at 110 ("*Daubert* has had a profound effect on the admissibility of evidence but not via the means that most critics would guess. In fact, *Daubert*'s impacts appear to be the result not of the doctrinal test set forth in the decision, but rather of a cultural phenomenon either sparked by the decision, or to which the decision has contributed.").

192. *Id.* at 147 (observing that the impact of *Daubert* appears to be a cultural shift toward a better appreciation of scientific evidence); *see also* Billauer, Daubert *Debunked*, *supra* note 64, at 22-23 ("I (and others) argue that the spike in evidentiary rejection in the years preceding 1997 occurred because *Daubert* sounded a clarion cry that evidence was being too hastily and inappropriately admitted in the period immediately prior—rather than any implementation of the *Daubert* tests."); *id.* at 23 n.106 ("[A]fter a short period of judicial crackdown (1993-1997) plaintiffs' attorneys stopped introducing patently improper evidence—a practice that in the years leading up to *Daubert*, was judicially sanctioned, causing more bad science to be proffered, and more to be admitted.").

193. Krafka et al., *supra* note 184, at 330. The study hypothesized that the change was "[p]erhaps in response to the increasingly active role of the judges in excluding or limiting testimony." *Id.*; *see also* Flores et al., *supra* note 72, at 563 ("*Daubert* has had a considerable impact with regard to challenges to proffered expert evidence. *In limine* challenges have grown in frequency, and the bases of these challenges are now based heavily on substantive grounds, including the *Daubert* standards.").

194. Krafka et al., *supra* note 184, at 330 ("Motions *in limine* are in much greater use than they were prior to *Daubert*, so it is not surprising to find that judges are holding more pretrial *Daubert*-like hearings than previously.").

195. *Id.* The changes in behavior have affected both lawyers and judges. *See id.* ("The results of these surveys suggest that recent Supreme Court decisions have influenced the practices of federal judges and attorneys with respect to expert testimony in civil cases. Clarification of admissibility standards appears to have encouraged both groups to take a

major impact was not through imposing a more rigid legal test, "but rather in its ability to create greater awareness of the problems of junk science."[196]

C. Problems with Judges and the Application of the Daubert *Standard*

In the wake of *Daubert*, courts applied inconsistent criteria to the admissibility of expert witness testimony. Lower courts relied on "cherry-picked, permissive-sounding language from *Daubert*" to justify their rulings, which sparked efforts to amend the Federal Rules of Evidence to better reflect and clarify the rule on expert admissibility.[197] Rule 702 was amended in 2000 "for the express purpose of resolving conflicts in the courts about the meaning of *Daubert*."[198] The new rule, however, did not fix the problem.[199] As a recent analysis found, "federal courts often ignore the language of amended Rule 702 when determining whether to uphold a district court decision excluding expert testimony. Other courts pay lip service to the Rule by quoting its language but then proceed to ignore its text for the remainder of the opinion."[200] The researchers conclude that "it is now apparent that the 2000 amendments to Rule 702 have not succeeded in entrenching these requirements."[201]

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more active role in scrutinizing proffered testimony. Judges have become more discerning with respect to the evidence they permit experts to introduce at trial.").

196. Cheng & Yoon, *supra* note 185, at 503; *see* Vickers, *supra* note 191, at 140 ("To the extent the decision had a real effect on admissibility, it did so primarily by informing judges that they should function as gatekeepers to ensure that bad science does not make its way into the courtroom.").

197. Bernstein & Lasker, *supra* note 90, at 6.

198. *Id.* at 6; *see also id.* at 7 n.31 ("This Rule, along with other Federal Rules of Evidence, was restyled in 2011 'to make [it] more easily understood and to make style and terminology consistent throughout the rules.'" (quoting FED. R. EVID. 702 advisory committee's note to 2011 amendment)).

199. *Id.* at 43 ("Notwithstanding the rulemaking efforts of the Judicial Conference, the courts remain as divided over *Daubert*'s meaning today as they were in the 1990s.").

200. *Id.* at 19 (citing cases as examples).

201. *Id.* at 8 ("Although the language of the 2000 amendments appeared sufficient at the time to rein in recalcitrant judges who had tried to evade the *Daubert* trilogy's exacting admissibility standards, with the benefit of hindsight, it is now clear that the Judicial Conference failed to account for the tenacity of those who prefer the pre-*Daubert* approach to expert testimony."); *see also* Krafka et al., *supra* note 184, at 330 ("The bases for limiting or excluding testimony do not appear to have been greatly affected by *Daubert*, at least not with respect to the cases we sampled. Judges who excluded testimony in the recent survey did so most often because it was not relevant, the witness was not qualified, or the testimony would not have assisted the trier of fact. These reasons are similar to reasons most frequently cited by judges in 1991, and they do not reflect the factors cited in *Daubert*.").

Part of the reason for judges' lack of consistency in applying *Daubert* could be a widespread lack of scientific competency.[202] As Professor Jules Epstein explains, "[s]tudies have shown an appalling lack of understanding of *Daubert* . . . terms,"[203] and "[j]udges, when surveyed, have acknowledged 'that their [scientific] education had left them inadequately prepared to serve as gatekeepers under *Daubert*.'"[204] In a survey of 400 state court judges, for example, 96% "reported that they had *not* received instruction about general scientific methods and principles."[205] Confirming Chief Justice Rehnquist's worries in his *Daubert* dissent that the Court's decision might result in turning judges into "amateur scientists,"[206] one study found that a relatively small percentage of judges have any job

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202. *See* Andrew Jurs, *Judicial Analysis of Complex & Cutting-Edge Science in the* Daubert *Era: Epidemiologic Risk Assessment as a Test Case for Reform Strategies*, 42 CONN. L. REV. 49, 52, 71 (2009) ("[E]mpirical research demonstrates that the judiciary is poorly prepared to handle the difficult scientific issues presented in courtrooms."); *see also* Valerie P. Hans, *Judges, Juries, and Scientific Evidence*, 16 J.L. & POL'Y 19, 30 (2007) ("Some scholars have speculated that many judges have little attraction to or aptitude for math and science."). Of course, lawyers are not much better. *See* Jules Epstein, *The National Commission on Forensic Science: Impactful or Ineffectual*, 48 SETON HALL L. REV. 743, 756 n.73 (2018) ("[L]awyers as a group evidence an appalling degree of scientific illiteracy, which ill equips them to educate and guide the bench in its decisions on admissibility of evidence proffered through expert witnesses.").

203. Epstein, *supra* note 202, at 757. *See generally* Sophia I. Gatowski et al., *Asking the Gatekeepers: A National Survey of Judges on Judging Scientific Evidence in a Post-Daubert World*, 25 LAW & HUM. BEHAV. 433, 444-45 (2001) (asking 400 state court judges to define error rate and falsifiability and finding that only 4% and 6%, respectively, could give a sound definition of these two key guidelines from *Daubert*).

204. Epstein, *supra* note 202, at 757 (quoting Edward J. Imwinkelried, *Expert Testimony Trends in State Practice and the Uniform Rules of Evidence*, *in* OPINION AND EXPERT TESTIMONY IN FEDERAL AND STATE COURTS 417 (ALI-CLE Course of Study 2008)).

205. Gatowski et al., *supra* note 203, at 442.

206. *See* Daubert v. Merrill Dow Pharms., Inc., 509 U.S. 579, 600-01 (1993) (Rehnquist, C.J., concurring in part and dissenting in part) ("I do not doubt that Rule 702 confides to the judge some gatekeeping responsibility. . . . But I do not think it imposes on them either the obligation or the authority to become amateur scientists."). On remand, the Ninth Circuit echoed similar concerns. *See* Daubert v. Merrell Dow Pharm., Inc., 43 F.3d 1311, 1316 (9th Cir. 1995) ("As we read the Supreme Court's teaching in *Daubert*, therefore, though we are largely untrained in science and certainly no match for any of the witnesses whose testimony we are reviewing, it is our responsibility to determine whether those experts' proposed testimony amounts to 'scientific knowledge,' constitutes 'good science,' and was 'derived by the scientific method.'"). Justice Breyer made a similar observation in *Joiner*. *See* General Elec. Co. v. Joiner, 522 U.S. 136, 148 (1997) (Breyer, J. concurring) ("[J]udges are not scientists and do not have the scientific training that can facilitate the making of such decisions.").

experience with math or science.[207] Given the complexity of cases involving science, judges may also have an irresistible incentive to bypass the time-consuming analysis required in cases with hard science expert testimony.[208]

IV. Daubert*'s Unfinished Work: Criminal Cases and Junk Forensic Science*

While the data on the exact impact of *Daubert* may still be unsettled, one distressing conclusion is clear: there are profound disparities in how *Daubert* has been applied, both between civil and criminal contexts, and between parties in each context. Multiple studies examining the disparities reach the same result.[209] *Daubert* has had little or no influence on the admissibility of science—good or bad—in criminal cases.[210] Initial studies "showed that the bulk of federal cases citing to *Daubert* were in civil, not

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207. Hans, *supra* note 202, at 30 (stating that, of the sixty-five judges surveyed, only "five [7.7%] reported having some job experience [with] math or science").

208. *See* Billauer, Daubert *Debunked*, *supra* note 64, at 4 ("It is no surprise, then, some studies indicate that gatekeepers have simply substituted their own methods for evaluating evidence, rather than relying on standards set forth in *Daubert*, which to them are incomprehensible."); Gottesman, *supra* note 70, at 760 n.33 ("[T]rial judges have an incentive, however much they try to prevent its subconscious effect on their decisions, to clear their crowded dockets of cases that are likely to be time-consuming and, given the technicality of the evidence, tedious. A virtually unreviewable opportunity to shed cases that the judge thinks of doubtful merit must be a powerful temptation.").

209. *See infra* notes 212-51 and accompanying text (collecting studies).

210. *See* Flores et al., *supra* note 72, at 538 n.37 ("This lack of significant difference with respect to changes in admissibility rates in the realm of criminal cases represents something of a departure from what was found in research utilizing civil case samples."); Groscup et al., *supra* note 185, at 364 (reviewing criminal appellate decisions and observing "the *Daubert* decision did not impact on the admission rates of expert testimony at either the trial or the appellate court levels"); Neufeld, *supra* note 12, at S107 (calling *Daubert* "almost irrelevant" to criminal justice). Perhaps this should not be a surprise, since *Daubert* itself did not mention criminal cases or forensic science. *See* Murphy, *supra* note 1, at 621 ("For instance, the opinion itself, which talked breathlessly about the scientific ideal of 'reliability' . . . conspicuously omitted any reference to the forensic sciences that routinely arose in criminal courts."). And the Ninth Circuit decision, on remand, went so far as to suggest that forensic science was not part of the *Daubert* mandate. *Daubert*, 43 F.3d at 1315, 1317 n.5. As Professor Murphy puts it, the court was "palpably bristling at the 'daunting' task of acting as an arbiter of scientific reliability, [and] took pains to exempt '[f]ingerprint analysis, voice recognition, DNA fingerprinting and a variety of other scientific endeavors closely tied to law enforcement' from *Daubert*'s strictures, setting up a *de facto* divide between civil and criminal *Daubert*." Murphy, *supra* note 1, at 622 (quoting *Daubert*, 43 F.3d at 1317 n.5).

criminal, cases."[211] Moreover, civil plaintiffs are more likely to lose on expert witness admissibility challenges than civil defendants, while criminal prosecutors are likely to win expert witness admissibility challenges far more frequently than criminal defendants, and more often than civil parties on either side.[212] As Professor Susan Rozelle summed up, "The game of scientific evidence looks fixed."[213] From all reaches of the legal community, "commentators, scholars, and courts themselves seem to acknowledge that there exists a *Daubert* double standard."[214]

A. Disparities in the Courts Part I: Between Criminal and Civil

While the application of *Daubert* arguably put a limit on the use of questionable science in civil cases, the opposite is true on the criminal side. A recent study "observed an entrenched judicial unwillingness to review expert evidence at all in criminal cases, much less to assess reliability and restrict expert testimony that is unreliable."[215] The impact on criminal defendants has been extreme, even leading to wrongful convictions, which "predictably result from this lax attitude toward judicial gatekeeping."[216] Hundreds of people have been exonerated in the past two decades; roughly half of these cases involved faulty forensic science that was not excluded by

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211. Garrett & Fabricant, *supra* note 182, at 1567-68. The data shows a "marked tilt toward civil litigation in the use of that expert gatekeeping standard." *Id.* at 1567.

212. Deirdre Dwyer, *(Why) Are Civil and Criminal Expert Evidence Different?*, 43 TULSA L. REV. 381, 383 (2007) ("[Although] [t]here are significant methodological difficulties with inferring general trial conduct from reported decisions, and particularly where those decisions are appellate[,] [t]he published reports do broadly support the anecdotal evidence of the unequal application of *Daubert*."). As Professor Murphy put it, "Civil defendants win their *Daubert* reliability challenges to plaintiffs' proffers most of the time, and . . . criminal defendants virtually always lose their reliability challenges to government proffers." Murphy, *supra* note 1, at 622-23 (quoting D. Michael Risinger, *Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?*, 64 ALB. L. REV. 99, 99 (2000)); *see also* Vickers, *supra* note 191, at 136 ("[C]ivil defendants prevail in their challenges to expert testimony most of the time, while criminal defendants 'virtually always lose their reliability challenges.'" (quoting Risinger, *supra*, at 99)).

213. Susan Rozelle, Daubert, *Schmaubert: Criminal Defendants and the Short End of the Science Stick*, 43 TULSA L. REV. 597, 598 (2007).

214. Murphy, *supra* note 1, at 624.

215. Garrett & Fabricant, *supra* note 182, at 1581; *see also* Margaret A. Berger, *What Has a Decade of* Daubert *Wrought?*, 95 AM. J. PUB. HEALTH S59, S64 (2005) (citing studies that show that "judges are much more likely since *Daubert* to scrutinize expert testimony before trial and then to limit or exclude expert testimony" in civil cases, although "courts are not applying *Daubert* stringently in the criminal context").

216. Garrett & Fabricant, *supra* note 182, at 1581.

the courts.[217] Unfortunately for these exonerees, and the many wrongfully convicted who will never have the chance to clear their names,[218] "the heightened standards of dependability imposed on expertise proffered in civil cases has continued to expand, but . . . expertise proffered by the prosecution in criminal cases has been largely insulated from any change in pre-*Daubert* standards or approach."[219]

Indeed, a recent report commissioned by the federal government confirmed the different standards in civil and criminal cases, remarking that "courts have not . . . imposed standards ensuring the application of scientifically valid reasoning and reliable methodology in criminal cases involving *Daubert* questions."[220] Furthermore, the report concludes that upon reviewing the reported decisions, "at least in criminal cases, forensic science evidence is not routinely scrutinized pursuant to the standard of reliability enunciated in *Daubert*."[221] In civil cases, on the other hand, "courts seem quite up to the task of evaluating microbiology, teratology, and toxicology evidence, discussing both science and statistics with plenty of acumen."[222] The general conclusion is that "judges do not appear to be as vigilant in criminal cases as they are in civil cases."[223]

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217. Lander, *supra* note 19, at 1662 (reporting that some of the exonerees were "inmates on death row or who had spent decades in prison" and that some of the defective science that courts admitted to convict them was "egregiously" faulty).

218. Sadly, the "true number of wrongful convictions must be considerably larger since evidence that could prove innocence is only rarely available and preserved." *Id.*

219. Risinger, *supra* note 212, at 149; *see also* Paul C. Giannelli, *The Supreme Court's "Criminal"* Daubert *Cases*, 33 SETON HALL L. REV. 1071, 1073 n.12 (2003) ("This issue is not new. The first Bush Administration, by executive order, imposed high standards for the admissibility of expert testimony in civil cases, while federal prosecutors were permitted to argue for lower standards in DNA cases."); *see also* Murphy, *supra* note 1, at 621 ("The conventional wisdom holds, and empirical studies support, that evidence proffered by plaintiffs in civil cases receives harsh scrutiny for reliability, whereas evidence proffered by prosecutors in criminal cases typically gets a free pass.").

220. NAT'L RESEARCH COUNCIL OF THE NAT'L ACADEMIES, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 96 (2009) [hereinafter NAS REPORT].

221. *Id.* at 106.

222. Moriarty, *supra* note 18, at 315; *see also* Saks, *supra* note 31, at 144-45 ("In civil cases and especially tort cases, judges can be seen to enforce *Daubert* aggressively and often insightfully, showing considerable acumen about research methodology. In other categories of cases, judges appear to be either incapable of applying *Daubert* to the expertise before them, or unwilling to do so, and find ways to evade the burden or to hedge the result that would have emerged if they had conscientiously undertaken the burden *Daubert* imposes on judges. These latter categories certainly include criminal cases, especially where the government proffers crime laboratory experts whose expertise purports to link evidence

Courts have admitted this disparity, too.[224] For example, one court, in evaluating proffered forensic handwriting expertise, concluded, "Were the court to apply *Daubert* to the proffered FDE [forensic document examiner] testimony, it would have to be excluded. This conclusion derives from a straightforward analysis of the suggested *Daubert* factors."[225] The court felt that it "might well have concluded that forensic document examination constitutes precisely the sort of junk science that *Daubert* addressed."[226] Nevertheless, the court admitted the expert testimony.[227] In another criminal case, the court held bite mark testimony admissible, while remarking that such evidence is "often speculative" and leaving it at that.[228]

In a recent study comparing treatment of handwriting analysis in civil and criminal cases, Professor Julie Seaman found that "the *Daubert* standard indeed may be disparately applied to even very similar evidence when offered in criminal versus civil cases."[229] According to the study, "In

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from the crime scene to the defendant. In these categories of cases, the principles of *Daubert* seem to vanish.").

223. Saks, *supra* note 31, at 145; *see also* Vickers, *supra* note 191, at 109-10 (reporting that in the civil context, "studies show that after *Daubert*, parties challenged the admissibility of evidence more frequently, and judges scrutinized evidence more carefully, excluding a greater proportion of it").

224. Julie A. Seaman, *A Tale of Two* Dauberts, 47 GA. L. REV. 889, 892 n.12 (2013) ("In the federal courts, where a uniform standard ostensibly applies, a more or less explicit acknowledgement occasionally peeks through." (citing United States v. Prime, 220 F. Supp. 2d 1203, 1210 (W.D. Wash. 2002), *aff'd*, 363 F.3d 1028 (9th Cir. 2004) (stating that "the court reasoned that certain time-tested forensic techniques used by law enforcement should not be excluded simply because of a lack of scientific data, methods, or statistical significance")); *see also* Murphy, *supra* note 1, at 624 ("Indeed, some criminal courts admitting forensic evidence despite defense challenges to reliability have expressly conceded that the proposed conclusions lack any scientific basis in data, methods, or statistical significance—and yet nonetheless embraced them citing nothing more than their longstanding pedigree.").

225. United States v. Starzecpyzel, 880 F. Supp. 1027, 1036 (S.D.N.Y. 1995).

226. *Id.* at 1028.

227. *Id.* at 1049.

228. State v. Cazes, 875 S.W.2d 253, 263 (Tenn. 1994); *see also* Erica Beecher-Monas, *Reality Bites: The Illusion of Science in Bite–Mark Evidence*, 30 CARDOZO L. REV. 1369, 1373 (2009) (examining the court decision in *Cazes*) ("This is a far cry from the exacting standards that the civil courts demand of expert evidence.").

229. Seaman, *supra* note 224, at 892. *But see id.* (cautioning that her study was "hardly a scientific sample"). Professor Seaman also examined fire science testimony and found that the rates were similar for both civil and criminal cases. Yet fire science testimony is often offered by defendants in civil cases, who enjoy a much higher success rate in civil cases than defendants in criminal cases do. *Id.* at 898; *see* Risinger, *supra* note 212, at 99 (summarizing that "when civil defendants' proffers are challenged by plaintiffs, those

the handwriting cases, prosecution evidence was admitted in nearly 90% of the criminal cases, whereas on the civil side it was admitted (or at least not excluded) in fewer than 40% of cases."[230]

The disparity between courts in civil and criminal dockets leaves many wondering why. As the court in *United States v. Hebshie* remarked, "it cannot be that science is different in criminal cases than in civil ones. Bad science is bad science; unreliable methodologies are unreliable methodologies, no matter the side of the docket."[231] The stakes are certainly high enough in criminal settings. In a criminal case, "the outcome of the decision to admit or exclude expert testimony could affect the defendant's freedom, liberty, and life."[232] Some even suggest that "[a]s a general proposition, judges disfavor civil plaintiffs and criminal defendants and are more likely to rule against them than against their opposites even when presenting equivalent evidence or arguments."[233] Immediately after the Court handed down its decision, Congress attempted to formally exempt criminal evidence from the heightened scrutiny of *Daubert* courts.[234]

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defendants usually win, but when criminal defendants' proffers are challenged by the prosecution, the criminal defendants usually lose"); *see also* Murphy, *supra* note 1, at 626 (reexamining the data and concluding that "they reaffirm and deepen the initial underlying premise: it depends as much on the offering party as it does on the type of case"); *id.* at 627 ("When faced with evidence offered by prosecutors or civil defendants, courts tend to take a generous approach, whereas even the same kind of evidence offered by civil plaintiffs is met with great skepticism.").

230. Seaman, *supra* note 224, at 908.

231. United States v. Hebshie, 754 F. Supp. 2d 89, 115 (D. Mass. 2010). "Paradoxically, and perhaps shamefully, this standard has not been consistently imposed in criminal cases." *Id.* (quoting Giannelli, *supra* note 219, at 1111).

232. Groscup et al., *supra* note 185, at 342.

233. Michael J. Saks & David L. Faigman, *Expert Evidence After* Daubert, 1 ANN. REV. L. & SOC. SCI. 105, 122 (2005); *see also* Murphy, *supra* note 1 at 622 ("Such findings have political and not just legal significance because in both civil and criminal cases, the methods and techniques most vulnerable to *Daubert* scrutiny, as judged by scientific standards, tend to be offered by only one side in the litigation."); D. Michael Risinger, *Goodbye to All That, or a Fool's Errand, by One of the Fools: How I Stopped Worrying About Court Responses to Handwriting Identification (and "Forensic Science" in General) and Learned to Love Misinterpretations of* Kumho Tire v. Carmichael, 43 TULSA L. REV. 447, 473 (2007) (concluding after examining how courts have overwhelmingly rejected defense challenges to fingerprint evidence, "there is some reason to believe that judges as a group are resistant to rejecting prosecution proffers of expert testimony").

234. Murphy, *supra* note 1, at 624 ("In the wake of *Daubert*, federal lawmakers circulated a bill to exempt criminal evidence from the proposed codification of the *Daubert* test, but their efforts failed." (citing H.R. 988, 104th Cong. (1995))). Georgia, however, still provides for absolute admission of expert testimony in criminal cases. GA. CODE ANN. § 24-

Criminal and civil cases have obvious and important differences, which may contribute to the disparity in treatment by the courts.[235] One primary difference is the resources available to criminal and civil defendants.[236] As Professor Paul Giannelli explains, "Instead of worrying about the 'hired gun' phenomenon as in civil litigation, the criminal defense lawyer often lacks money for any 'gun.'"[237] The science in criminal matters is usually produced in government labs rather than academic or private scientific research.[238] As a result, "expert evidence in criminal litigation is almost exclusively the preserve of the state."[239] Civil defendants enjoy stronger discovery mechanisms, such as depositions and interrogatories.[240] Perhaps most compelling, "there are strong policy grounds not to exclude a long adopted form of expert evidence, because to do so may not only adversely affect current and all future criminal prosecutions (though not

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7-707 (2016) ("In criminal proceedings, the opinions of experts on any question of science, skill, trade, or like questions shall always be admissible; and such opinions may be given on the facts as proved by other witnesses.").

235. *See* Giannelli, *supra* note 219, at 1072 ("The notion that expert testimony in criminal and civil cases should be treated differently does not seem, at least to me, to be a remarkable proposition.").

236. *See* Saks, *supra* note 31, at 145 n.60 ("The government has crime labs dedicated to serving police and prosecution needs. The defense has no institutional resources and typically no resources at all with which to hire ad hoc experts to scrutinize, re-analyze, or help think about the government's expert's report and testimony.").

237. Giannelli, *supra* note 219, at 1072 (citing Peter J. Neufeld & Neville Colman, *When Science Takes the Witness Stand*, SCI. AM., May 1990, at 46, 50 ("In DNA cases in Oklahoma and Alabama, . . . the defense did not retain any experts, because the presiding judge had refused to authorize funds.")).

238. *See* Dwyer, *supra* note 212, at 390-91 ("[M]uch of the expert evidence presented at a criminal trial is the product of disciplines that have been developed for the criminal process, while most expert evidence in civil trials is in use in society more widely, including in the area of academic scientific research.").

239. *Id.* at 391 (citing three reasons for this) ("First, almost all specialists in forensic science are employed by the state; secondly, most defendants are unable to afford to instruct their own experts, and public defense funds are limited in all jurisdictions; thirdly, the state controls crime scenes and physical evidence, and in turn access to materials for scientific testing.").

240. *See* Giannelli, *supra* note 219, at 1073 ("What is remarkable about the civil-criminal dichotomy is that civil litigants have far greater discovery rights than criminal practitioners even though it is well accepted that pretrial disclosure is critical. Not only are discovery depositions and interrogatories unavailable, but a defendant in a death penalty case involving DNA can be precluded from seeing an expert's lab notes before trial.").

investigations), but may also open the floodgates to appeals in all cases in which fingerprint identification evidence played a part."[241]

B. Disparities in the Courts Part II: Between Parties (in Both Criminal and Civil Courts)

In addition to applying different standards across dockets, courts apply *Daubert* differently depending on which side the party is on.[242] A major study[243] by Professor Michael Risinger found that courts excluded plaintiffs' proffered evidence at significantly higher rates than courts excluded defense evidence.[244] Evaluating appellate opinions, the study found that approximately 90% of the challenges to expert witness testimony were raised by civil defendants against plaintiffs' experts, and defendants' challenges were successful approximately two-thirds of the time.[245] On the flip side, in the comparatively small number of cases in which plaintiffs challenged defense experts, plaintiffs' challenges were successful roughly half the time.[246] Other studies have replicated Professor Risinger's findings through various means.[247] For example, a recent study from George Mason University confirmed a similar disparity.[248]

Professor Risinger also examined criminal courts. There, too, he found disturbing patterns. He identified 120 criminal appeal cases in which *Daubert* had been cited.[249] Of these, sixty-seven were cases in which the government challenged the exclusion of its experts.[250] In those sixty-seven

241. Dwyer, *supra* note 212, at 392.

242. *See, e.g.*, Vickers, *supra* note 191, at 136-37 ("[C]ivil defendants prevail in their challenges to expert testimony most of the time, while criminal defendants 'virtually always lose their reliability challenges.'").

243. Professor Murphy called the Risinger study "iconic." Murphy, *supra* note 1, at 623.

244. *See generally* Risinger, *supra* note 212, at 99 ("This article shows that, as to proffers of asserted expert testimony, civil defendants win their *Daubert* reliability challenges to plaintiffs' proffers most of the time.").

245. *Id.* at 108.

246. *Id.*

247. Murphy, *supra* note 1, at 623 (citing NAS REPORT, *supra* note 220, at 11; Paul C. Giannelli, *Daubert and Criminal Prosecutions*, 26 CRIM. JUST. 61 (2011)).

248. JAMES COOPER, TIMING AND DISPOSITION OF *DAUBERT* MOTIONS IN FEDERAL DISTRICT COURT: AN EMPIRICAL EXAMINATION ii (Geo. Mason Univ. Sch. of Law, Searle Civil Justice Inst. 2015) (reviewing ten years of data from ninety-one federal district courts and concluding that "[d]efendants are more likely than plaintiffs to have at least a portion of their *Daubert* motion granted").

249. Risinger, *supra* note 212, at 105.

250. *Id.*

cases, the prosecution prevailed in sixty-one of them.[251] On the other hand, of fifty-four challenges by criminal defendants that their expert was improperly excluded, the defendant lost forty-four cases.[252] Of the ten that the criminal defendants won, only one case was actually remanded for retrial.[253] As one commentator summarized, "It would seem that the expert evidence of civil plaintiffs, particularly in toxic tort cases, is subject to greater scrutiny than that of civil defendants, while the expert evidence of criminal prosecutors is subject to less scrutiny than that of criminal defendants, or than that of civil parties."[254]

C. Junk Forensic Science

Two landmark studies by the federal government have validated deeply troubling issues with the use of forensic science in American courts. In 2009, the National Academy of Sciences ("NAS") issued a "scathing indictment"[255] of the status of forensic science[256] and concluded that, "[w]ith the exception of nuclear DNA analysis, . . . no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source."[257] The report pulled no punches. According to the report, "The law's greatest dilemma in its heavy reliance on forensic evidence . . . concerns the question of whether—and to what extent—there is science in any given 'forensic science' discipline."[258]

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251. *Id.*

252. *Id.* at 106.

253. *Id.* at 106-07.

254. *See* Dwyer, *supra* note 212, at 383 ("[Although] [t]here are significant methodological difficulties with inferring general trial conduct from reported decisions, and particularly where those decisions are appellate[,] [t]he published reports do broadly support the anecdotal evidence of the unequal application of *Daubert*.").

255. Moriarty, *supra* note 18, at 300.

256. NAS REPORT, *supra* note 220, at 7. The report was initiated in 2005, "when Congress mandated that the National Research Council, the research arm of the U.S. National Academy of Sciences, undertake the first serious governmental study of forensic science." Lander, *supra* note 19, at 1663.

257. NAS REPORT, *supra* note 220, at 7-8. The NAS Report noted that "[n]ew doubts about the accuracy of some forensic science practices have intensified with the growing numbers of exonerations resulting from DNA analysis (and the concomitant realization that guilty parties sometimes walk free)." *Id.* at 37.

258. NAS REPORT, *supra* note 220, at 87; see also *id.* at 7-8 ("The simple reality is that the interpretation of forensic evidence is not always based on scientific studies to determine its validity.").

In 2016, the President's Council of Advisors on Science and Technology ("PCAST") issued a similarly damning report on forensic "feature-comparison" methods.[259] In its 150-page report, PCAST detailed how bite mark comparison evidence, shoeprint evidence, and firearms evidence are not foundationally valid.[260] PCAST determined that "there are two important gaps" in the state of forensic science: "(1) the need for clarity about the scientific standards for the validity and reliability of forensic methods[;] and (2) the need to evaluate specific forensic methods to determine whether they have been scientifically established as valid and reliable."[261]

In these two reports, the federal government acknowledged the crisis exposed by the "large numbers of cases later shown by post-conviction DNA tests to have been wrongful convictions of innocent defendants" based on faulty science.[262] Yet despite the government's study and the growing number of exonerated innocent defendants, "junk science" nevertheless continues to be freely admitted into courtrooms by judges, including some methods of identification so unreliable that they are not "foundationally valid."[263] And courts compound and continue the problem by relying on past cases without questioning even the most archaic justifications.[264]

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259. PRESIDENT'S COUNCIL OF ADVISORS ON SCI. & TECH., EXEC. OFFICE OF THE PRESIDENT, FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE-COMPARISON METHODS 1 (2016) [hereinafter PCAST]. According to former co-chair of PCAST, Professor Eric Lander, "PCAST is the leading scientific and technological advisory body to the executive branch, originally chartered by President Eisenhower in the weeks after the launch of Sputnik." Lander, *supra* note 19, at 1664. "Feature-comparison" methods are "methods that attempt to determine whether an evidentiary sample . . . is or is not associated with a potential 'source' sample . . . based on the presence of similar patterns, impressions, or other features in [each] sample." PCAST, *supra*, at 1.

260. PCAST, *supra* note 259, at 7-14.

261. *Id.* at 1.

262. Garrett & Fabricant, *supra* note 182, at 1561; Lander, *supra* note 19, at 1662-63 ("Roughly half of these cases involved forensic-science evidence that was faulty—sometimes egregiously so. The problem could not simply be blamed on a few 'bad apples' among forensic examiners. Rather, the failure was systemic in that some of the supposedly scientific methods had never been shown to be scientifically valid.").

263. PCAST, *supra* note 259, at 7-14.

264. Cole, *supra* note 114, at 1195-97. The inappropriateness of relying on past assessments of science was keenly pointed out by Professor Moriarty in what she described as the general "fallacy of historical reliance." *See* Moriarty, *supra* note 18, at 316 ("As late as 1920, the use of lancets and leeches for bloodletting was favored by some physicians to treat pneumonia.").

One primary source of the problem is that much of forensic testimony is generated in crime labs, which have come under fire for both institutional issues and recent scandals. Crime labs are connected to (and therefore closely aligned with) police departments, a link that undoubtedly creates strong incentives to provide prosecutors and police with what they want, rather than generate valid results.[265] As a result, forensic science testimony in criminal courts is "subject to significant unconscious bias" by experts "seeking to help their bosses, the prosecutors."[266] Moreover, crime labs are often underfunded, leading to significant quality control problems.[267] The lack of adequate resources has meant that "there is no division of labor between forensic analysis and interpretation."[268] Despite their pristine image on TV, the reality is that many crime labs suffer from poor training and a failure to follow protocols.[269]

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265. Bernstein, *supra* note 1, at 36. Publicly funded crime labs have, typically, an incentive to gain convictions independently of the guilt or innocence of the convicted person. *See* Roger Koppl & Meghan Sacks, *The Criminal Justice System Creates Incentives for False Convictions,* 32 CRIM. JUST. ETHICS 126, 128, 135, 139, 147 (2013) (stating that in several states, for example, state law establishes that public crime labs be funded in part per conviction); Paul C. Giannelli, *Regulating DNA Laboratories: The New Gold Standard?*, 69 N.Y.U. ANN. SURV. AM. L. 617, 619 (2014) (citing John I. Thornton, *Criminalistics—Past, Present, and Future*, 11 LEX ET SCIENTIA 1, 27 (1975) ("Because crime laboratories developed in police departments, they were imbued, unsurprisingly, with a law enforcement culture.")).

266. *See* Bernstein, *supra* note 1, at 36 ("Moreover, the structure of the forensic science system means that such bias, or even outright fraud, is likely to go undiscovered."); Craig M. Cooley, *Nurturing Forensic Science*, 17 TEX. WESLEYAN L. REV. 441, 442 (2011) ("[S]ignificant evidence has surfaced over the last decade indicating that public crime laboratories . . . are inadequately funded, staffed, and regulated.").

267. Crime labs generally lack the resources and the capability to conduct foundational research. Giannelli, *supra* note 265, at 620 n.14. As Professor Giannelli summarizes:

> First, the early crime labs, as is still true today, were operational, not research, laboratories. Second, basic research can be both time-consuming and expensive, and the underfunding of crime laboratories has been chronic. Third, even if research was perceived to be desirable, these laboratories were ill-equipped to conduct it. Police officers, whose skills were developed through on-the-job training, staffed these labs.

Id.

268. Roger Koppl, *How to Improve Forensic Science*, 20 EUR. J.L. & ECON. 255 (2005).

269. *See, e.g.*, Conor Friedersdorf, *CSI Is a Lie*, ATLANTIC, (Apr. 20, 2015), https://www.theatlantic.com/politics/archive/2015/04/csi-is-a-lie/390897/ (detailing crime lab issues in Massachusetts, St. Paul, Colorado, Detroit, Philadelphia, and North Carolina). *See generally* Mark Hansen, *Crime Labs Under the Microscope After a String of Shoddy, Suspect and Fraudulent Results*, ABA J. (Sept. 2013), http://www.abajournal.com/magazine/article/crime_labs_under_the_microscope_after_a_string_of_shoddy_suspect_and_fraudu/; Jordan

Two public scandals highlight the issue. The Houston, Texas crime lab was first exposed as "the paradigmatic example of a failed forensic agency" in 2002.[270] That year, a state audit revealed a "dysfunctional organization with serious contamination issues and an untrained staff using shoddy science."[271] As Professor Giannelli explained:

> As described by a subsequent investigation, the DNA Section was in shambles—plagued by a leaky roof, operating for years without a line supervisor, overseen by a technical leader who had no personal experience performing DNA analysis and who was lacking the qualifications required under the FBI standards, staffed by underpaid and undertrained analysts, and generating mistake-ridden and poorly documented casework.[272]

Several defendants were identified as wrongly convicted and have since been exonerated after the report.[273] According to Texas state senator

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Michael Smith, *Forget CSI: A Disaster Is Happening in America's Crime Labs*, BUS. INSIDER, (Apr. 30, 2015, 1:00 PM), https://www.businessinsider.com/forensic-csi-crime-labs-disaster-2014-4#ixzz3N4ORFkgq.

270. Giannelli, *supra* note 265, at 634.

271. *Id.* at 634 (quoting Quality Assurance Audit of Houston Police Department Crime Lab—DNA/Serology Section (Dec. 12-13, 2002)); *see also* Nick Madigan, *Houston's Troubled DNA Crime Lab Faces Growing Scrutiny*, N.Y. TIMES, Feb. 9, 2003, at L20 (reporting that operations were suspended after the audit found numerous problems, "including poor calibration and maintenance of equipment, improper record keeping and a lack of safeguards against contamination. . . . Among other problems, a leak in the roof was found to be a potential contaminant of samples on tables below.").

272. Giannelli, *supra* note 265, at 634 (quoting MICHAEL R. BROMWICH, THIRD REPORT OF THE INDEPENDENT INVESTIGATOR FOR THE HOUSTON POLICE DEPARTMENT CRIME LABORATORY AND PROPERTY ROOM 5 (2005)).

273. *See* Adam Liptak & Ralph Blumenthal, *New Doubt Cast on Testing in Houston Police Crime Lab*, N.Y. TIMES (Aug. 5, 2004), https://www.nytimes.com/2004/08/05/us/new-doubt-cast-on-testing-in-houston-police-crime-lab.html (summarizing a report that the Houston crime lab offered "'false and scientifically unsound' reports and testimony"). The issues with the crime lab are still prevalent. *See* Brian Rogers et al., *Crime-Scene Errors Put 65 Cases Under Review, Audit Finds*, HOUS. CHRON. (Apr. 12, 2017), https://www.chron.com/news/houston-texas/article/New-evidence-problems-raise-questions-in-65-11068118.php (describing "errors by a Houston crime-scene investigator [that] raised questions about key evidence in cases that include [twenty-six] homicides, [five] officer-involved shootings, and [six] child deaths since 2015"); Brian Rogers, *Ex-Crime Lab Analyst Told HPD Colleagues of Wrongdoing*, HOUS. CHRON. (June 25, 2014), https://www.houstonchronicle.com/news/houston-texas/houston/article/Former-HPD-crime-lab-analyst-told-colleagues-of-5580097.php (reporting "systemic, long-running complaints" regarding the Houston Crime Lab dating back to 2002 which resulted in retesting evidence in 185 cases, including fifty-one murders).

Rodney Ellis, "the validity of almost any case that has relied upon evidence produced by the lab is questionable."[274]

A recent scandal in St. Paul, Minnesota is another example. Two independent reviews of the St. Paul Police crime lab found "major errors in almost every area" of the crime lab's work, including the processing of fingerprint and crime scene evidence.[275] Employees claimed that some of the lab equipment was so poorly ventilated, that it spewed illegal substances into the air and contaminated subsequent tests.[276] The St. Paul Police Department and other elements in the city government had supposedly known of the problems for years.[277] An earlier report had made specific recommendations, but the city and the police department did not follow through on many of the major recommendations.[278]

D. Specific Examples

1. Hair Analysis

Of the forensic science errors associated with wrongful convictions, microscopic hair comparison is near the top of the list.[279] The FBI and DOJ

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274. Rodney Ellis, Editorial, *Want Tough on Crime? Start by Fixing Houston Police Department Lab*, HOUS. CHRON., Sept. 5, 2004, at D1.

275. The inventory of dysfunction at the crime lab is distressing in its breadth:

> The failures include sloppy documentation, dirty equipment, faulty techniques and ignorance of basic scientific procedures, according to reports released Thursday. Lab employees even used Wikipedia as a "technical reference" in at least one drug case. Consultants found lab employees mistakenly classified at least one-third of all fingerprints as unidentifiable and destroyed them. Case files "were largely unintelligible," consultants found. The lab lacked any clean area designated for the review and collection of DNA evidence. The lab stored crime scene photos on a computer that anyone could access without a password. Conditions at the lab violated federal safety and health requirements.

Madeleine Baran, *Troubled St. Paul Crime Lab Problems Even Worse Than First Thought, Probe Reveals*, MINN. PUB. RADIO NEWS (Feb. 14, 2013), https://www.mprnews.org/story/2013/02/14/news/saint-paul-crime-lab-major-errors-found.

276. Chao Xiong, *Crime Lab Reviews Cost $140K*, STAR TRIB., Sept. 7, 2012, at B1. Concerns were raised about tests being made unreliable from technicians' failures to change their gloves in between tests, as well as the reuse of the same tools on multiple samples. *Id.*

277. David Hanners, *St. Paul Crime Lab Woes First Recognized in 2006*, PIONEER PRESS, Sept. 1, 2012, at 1A. A prior report by one police official recommended new accreditation and millions for new equipment and employee costs. *Id.*

278. *Id.* The report further provided that the paucity of monies available to the lab had overburdened the staff and limited the laboratory's ability to "sustain [its] current rates of evidence examination and testing." *Id.*

279. *See* Brandon L. Garrett & Peter J. Neufeld, *Invalid Forensic Science Testimony and Wrongful Convictions*, 95 VA. L. REV. 1, 15 (2009) (reviewing multiple cases and reporting

recently announced that in cases where hair analysis testimony had been offered, "at least 90 percent of trial transcripts" contained "erroneous statements" concerning the forensic evidence.[280] According to the report, "Twenty-six of 28 FBI agent/analysts provided either testimony with erroneous statements or submitted laboratory reports with erroneous statements."[281] In the first stage of the analysis, the government had already determined that "[d]efendants in at least 35 of [those] cases received the death penalty" and that errors were present in nearly all of those cases (94%).[282] Tragically, "[n]ine of [the] defendants have already been executed[,] and five died of other causes while on death row."[283] As Peter Neufeld, Co-Director of the Innocence Project, summarized the report, "FBI microscopic hair analysts committed widespread, systematic error, grossly exaggerating the significance of their data under oath with the consequence of unfairly bolstering the prosecutions' case."[284]

As a result of its recent analysis, the FBI sent letters to the governor of every state in the country urging states to re-evaluate cases where microscopic hair comparison was used to conclude a match.[285] But the FBI has known for years that hair analysis is a faulty science in criminal courts. A 2002 paper by FBI scientists revealed that, "in contrast to earlier work claiming that hairs from different sources could be distinguished with an error rate of only 1 in 40,000 comparisons, DNA analysis of casework revealed that 11 percent of hairs (that is, 1 in 9) reported as microscopically

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that hair analysis may provide reliable evidence on some characteristics of the individual from which the specimen was taken, but it may not be able to reliably match the specimen with a specific individual).

280. *See* Press Release, Fed. Bureau of Investigation, FBI Testimony on Microscopic Hair Analysis Contained Errors in at Least 90 Percent of Cases in Ongoing Review (Apr. 20, 2015), https://www.fbi.gov/news/pressrel/press-releases/fbi-testimony-on-microscopic-hair-analysis-contained-errors-in-at-least-90-percent-of-cases-in-ongoing-review (finding that "erroneous statements were made in . . . (96 percent) of the cases" so far reviewed).

281. *Id.*

282. *Id.*

283. *Id.*

284. *Id.* The problem is much broader than just the FBI. The report also acknowledged that the same faulty hair analysis science has been spread throughout state and local enforcement agencies. *See id.* ("Over the course of 25 years, the FBI conducted multiple two-week training courses that reached several hundred state and local hair examiners throughout the country and that incorporated some of the same scientifically flawed language that the FBI's examiners had used in some lab reports and often in trial testimony.").

285. Letter from James B. Comey, Dir., Fed. Bureau Investigation, to State Governors (Feb. 26, 2016) (on file with author).

indistinguishable actually came from different sources."[286] In its review of hair analysis support materials provided by the DOJ, PCAST found that the "papers described in the DOJ supporting document do not provide a scientific basis for concluding that microscopic hair examination is a valid and reliable process."[287] To date, over seventy people have been exonerated after hair analysis was used to convict.[288] One particular case is emblematic. Santae Tribble, convicted of murder after an FBI analyst testified that hair from a stocking mask linked Tribble to the crime and "matched in all microscopic characteristics," spent twenty-eight years "in prison before DNA testing revealed that none of the 13 hairs belonged to Tribble and that one came from a dog."[289]

2. Fingerprints

The idea that fingerprint "matches" were not as absolute as previously understood came into full public view when American lawyer Brandon Mayfield was falsely accused of the Madrid train bombings in 2004.[290] An FBI examiner concluded with "100 percent" certainty that a fingerprint at the crime scene matched Mayfield.[291] Although there was no record of

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286. Lander, *supra* note 19, at 1672; *see also* PCAST, *supra* note 259, at 28 (explaining that the 2002 FBI analysis demonstrated that "the power of microscopic hair comparison to distinguish between samples from different sources was much lower than previously assumed"). One other issue is lax judicial review. In one stunning example, the Kentucky Supreme Court acknowledged that the record cited no studies, and therefore contained nothing that could support findings that the microscopic hair analysis had been satisfactorily tested, or that methodologically competent studies existed (whether published and peer reviewed or otherwise), and therefore no data existed regarding error rates. Johnson v. Commonwealth, 12 S.W.3d 258, 261 (Ky. 1999). Nevertheless, the Kentucky Supreme Court thought the evidence was admissible thanks to the general acceptance factor. *Id.* at 262.

287. PCAST, *supra* note 259, at 120.

288. *Hair Analysis Archives*, INNOCENCE PROJECT, https://www.innocenceproject.org/cases-categories/hair-analysis/#hair-analysis,exonerated-by-dna (last visited Nov. 28, 2018). For fourteen defendants who had either been executed or died of other causes while awaiting execution, the study came too late. *Id.*

289. PCAST *supra* note 259, at 44; Spencer S. Hsu, *Santae Tribble Cleared in 1978 Murder Based on DNA Hair Test*, WASH. POST, Dec. 14, 2012, at A30 (reporting that Tribble spent twenty-eight years in prison).

290. *See* Paul C. Giannelli, Daubert *Challenges to Fingerprints*, 42 CRIM. L. BULL. 624, 635 (2006) ("The terrorist train bombing in Madrid on March 11, 2004, which killed 191 and injured 2,000, exploded the myth of fingerprint infallibility more than any other event.").

291. OFFICE OF THE INSPECTOR GEN. OVERSIGHT & REVIEW DIV., A REVIEW OF THE FBI'S HANDLING OF THE BRANDON MAYFIELD CASE 64 (2006) [hereinafter OIG MAYFIELD REPORT

Mayfield having traveled to Spain, and he did not even have a valid passport,[292] the FBI detained Mayfield for fourteen days based on the fingerprint match, until Spanish authorities identified a different suspect as the source of the fingerprint.[293] In its 2011 report, the Office of Inspector General concluded that the examiners "made errors in their application of the latent fingerprint methodology that reflected systemic problems with the FBI Laboratory's operations."[294] In a previous report, the Office of Inspector General had also determined that the fact that Mayfield was a Muslim and had previously represented a convicted terrorist "also likely contributed to the examiners' failure" to catch the error.[295]

While courts have been admitting fingerprint evidence for over a hundred years,[296] the NAS Report in 2009 criticized the process for

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I]. The affidavit submitted for the material witness warrant stated that the FBI senior fingerprint examiner had a 100% certainty that the fingerprint at the crime scene matched Mayfield. *Id.* at 63-64. The assessment was verified by the supervisor, who had thirty years of experience in the FBI fingerprint lab. *Id.* at 64.

292. *See id.* at 58 ("Records reveal no travel by Mayfield or his wife as both have expired passports."). Undeterred, the FBI adapted the working hypothesis that Mayfield conducted the crime from the United States. *See id.* ("At this time, we are leaning toward the theory that Mayfield touched the bag in the U.S.").

293. *Id.* at 1.

294. OFFICE OF THE INSPECTOR GEN. OVERSIGHT & REVIEW DIV., A REVIEW OF THE FBI'S PROGRESS IN RESPONDING TO THE RECOMMENDATIONS IN THE OFFICE OF THE INSPECTOR GENERAL REPORT ON THE FINGERPRINT MISIDENTIFICATION IN THE BRANDON MAYFIELD CASE 2 (2011) [hereinafter OIG MAYFIELD REPORT II]. The OIG "made 18 recommendations to improve the FBI Laboratory's latent print operations and help prevent future misidentifications" as a result of its findings. *Id.*

295. OIG MAYFIELD REPORT I, *supra* note 291, at 179. However, "[t]he OIG [also] concluded that Mayfield's religion was not the sole or primary cause of the FBI's failure to question the original misidentification and catch its error." *Id.* at 12 ("The primary factors were the similarity of the prints and the laboratory's overconfidence in the superiority of its examiners.").

296. *See* OIG MAYFIELD REPORT II, *supra* note 294, at 19-20 (reviewing the case law and concluding that "courts have, almost without exception, upheld the admissibility of latent fingerprint evidence in response to *Daubert* challenges"); Mara L. Merlino et al., *Meeting the Challenges of the* Daubert *Trilogy: Refining and Redefining the Reliability of Forensic Evidence*, 43 TULSA L. REV. 417, 432 (2007) ("The use of fingerprints and latent print examination as proof of identity has been a mainstay of the criminal justice system and forensic science since it was first used in the 1910 trial of Thomas Jennings for the murder of Clarence Hiller."); Jennifer L. Mnookin, *The Validity of Latent Fingerprint Identification: Confessions of a Fingerprinting Moderate*, 7 LAW, PROBABILITY & RISK 127, 128 (2008), https://academic.oup.com/lpr/article/7/2/127/916583 (describing judicial opinions that laud fingerprint evidence as having "survived an entire century of testing within the crucible of

identifying suspects based entirely on their fingerprints because it lacked an industry-wide match standard.[297] Similarly, PCAST concluded that "estimated false positive rates are *much higher* than the general public . . . would likely believe based on longstanding claims about the accuracy of fingerprint analysis."[298] Few courts have carefully examined the reliability of latent fingerprint testimony, instead relying on past decisions as justification to allow the less-than-completely-accurate science.[299] Indeed, while there have been dozens of challenges to the admissibility of fingerprint evidence using *Daubert*, "not a single court has been able to cite any systematic empirical evidence supporting critical propositions underlying fingerprint identification claims."[300] It was not until the mistaken identification of an American lawyer in the Madrid railway bombing that the FBI began a thorough review of fingerprint evidence and initiated changes in protocols.[301]

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the courtroom"). "Every circuit that has [ruled on] the admissibility of latent fingerprint evidence has held that it is reliable." OIG MAYFIELD REPORT II, *supra* note 294, at 20 n.22.

297. NAS REPORT, *supra* note 220, at 140-41 (discussing the degree to which latent fingerprint analysis relies on the subjective interpretation of individual examiners).

298. PCAST, *supra* note 259, at 95.

299. Garrett & Fabricant, *supra* note 182, at 1570 (reviewing cases from every circuit and finding that courts "typically do not conduct any meaningful analysis of reliability of fingerprint evidence"). Instead, they rely on precedent. *Id.* (citing as examples United States v. Spotted Elk, 548 F.3d 641, 663 (8th Cir. 2008) (failing to discuss the requirements of court oversight but noting that fingerprint evidence has been recognized by other courts as "generally accepted" (quoting United States v. Collins, 340 F.3d 672, 682 (8th Cir. 2003))); United States v. Abreu, 406 F.3d 1304, 1307 (11th Cir. 2005) (declaring that "[w]e agree with the decisions of our sister circuits and hold that the fingerprint evidence admitted in this case satisfied *Daubert*" but failing to discuss or analyze any of the requirements)).

300. Saks, *supra* note 31, at 150; *see also* Mnookin, *supra* note 296, at 131 (noting "the near-universal judicial" acceptance of fingerprint analysis, and her own conclusion that most fingerprint evidence should be excluded under *Daubert*).

301. Donna Lee Elm, *Continued Challenges for Forensics*, CRIM. JUST., Summer 2017, at 4, 6 ("After the Madrid railway bombing led to the erroneous fingerprint 'match' with attorney Brandon Mayfield, the FBI initiated strict scientific studies to research 'confirmation bias' on fingerprint opinions, resulting in changes in protocols."); *see also* PCAST, *supra* note 259, at 90 ("[C]oncerns about the reliability of latent fingerprint analysis increased substantially following a prominent misidentification of a latent fingerprint recovered from the 2004 bombing of the Madrid commuter train system."). PCAST did report that there has been improvement in beginning "to move latent print analysis in the direction of an objective framework." *Id.* at 91. Nevertheless, PCAST concluded that fingerprint analysis has "a considerable way to go" before achieving objectivity. *Id.* at 88.

3. Bite Mark Analysis

As problematic as hair analysis and fingerprint identification are, bite mark analysis is discredited like no other science.[302] After reviewing numerous studies, PCAST concluded that "bite mark analysis does not meet the scientific standards for foundational validity and is far from meeting such standards."[303] The council went even further to suggest that bite mark methodology likely "may not be salvageable."[304] PCAST's findings were not new. In 2009, the NAS Report identified some of the basic problems inherent in bite mark analysis, including the lack of any studies to establish the uniqueness of bite marks and the tendency of bite marks on the skin to be distorted or change over time.[305]

One of the biggest concerns with bite mark evidence is that it is not reliable even to establish the marks "left on a victim's body as bite marks at all."[306] In 2016, the Texas Forensic Science Commission conducted a six-month investigation and "unanimously recommended a moratorium on the use of bite mark identifications in criminal trials, concluding that the validity of the technique has not been scientifically established."[307] As with other questionable forensic science though, courts avoid analysis and merely rely on past precedent to admit bite mark evidence.[308]

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302. M. Chris Fabricant & Tucker Carrington, *The Shifted Paradigm: Forensic Science's Overdue Evolution from Magic to Law*, 4 VA. J. CRIM. L. 1, 38 (2016) ("Perhaps no discredited forensic assay has benefited more from criminal courts' abdication of gatekeeper responsibilities than bite mark analysis.").

303. PCAST, *supra* note 259, at 87.

304. *Id.* at 14.

305. NAS REPORT, *supra* note 220, at 175-76.

306. *See* Beecher-Monas, *supra* note 228, at 1380 ("There is a great deal of controversy about the ability of forensic odontologists to identify marks left on a victim's body as bite marks at all."); *see also* PCAST, *supra* note 259, at 3 (reviewing studies and finding "that current procedures for comparing bite marks are unable to reliably exclude or include a suspect as a potential biter"); *id.* at 87 ("[A]vailable scientific evidence strongly suggests that examiners cannot consistently agree on whether an injury is a human bite mark and cannot identify the source of bite mark with reasonable accuracy.").

307. *Id.* at 29; *see also* Russell D. Covey, *Suspect Evidence and Coalmine Canaries*, 55 AM. CRIM. L. REV. 537, 570 (2018) ("The Texas Forensic Science Commission has recommended a moratorium on the use of bite mark evidence pending further scientific validation of the methodology.").

308. *See* Beecher–Monas, *supra* note 228, at 1372 ("Courts frequently admit bite mark testimony simply because other courts have done so.") (citing two cases as examples, Verdict v. State, 868 S.W.2d 443, 447 (Ark. 1993) (finding no error in admitting bite mark testimony of Dr. West because "evidence on human bite marks is widely accepted by the courts"); State v. Timmendequas, 737 A.2d 55, 114 (N.J. 1999) (finding bite mark testimony

V. What Options Exist for the Big Changes Needed

In the twenty-five years since the *Daubert* decision, criminal defendants have seen little, if any, benefit from the landmark decision. And there has been insufficient progress toward limiting the unreliable scientific testimony used to convict them.[309] The same lax oversight that the Court employed in *Barefoot* is still the dominant practice in criminal courtrooms today.[310] There will be no easy fixes. As the Committee co-chairs acknowledged in the NAS Report, "The forensic science system, encompassing both research and practice, has serious problems that can only be addressed by a national commitment to overhaul the current structure that supports the forensic science community in this country."[311]

The Court's decision in *Barefoot*, the case discussed in the introduction, still stands as a cautionary tale. In the penultimate decision of whether to impose death,[312] the Court had no problem relying on expert testimony—by

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in a capital case to be reliable because "thirty states considering such evidence have found it admissible")).

309. *See, e.g.*, Garrett & Neufeld, *supra* note 279, at 14 (reviewing the cases of exonerated defendants where forensic science was used) ("[I]nvalid forensic science testimony was not just common but prevalent. This study found that 82 cases—60% of the 137 in the study set—involved invalid forensic science testimony."). As the authors point out, "Though the technology has changed over time, the sources of human error, misinterpretation, and misconduct have not." *Id.* at 97; *see also* Jessica Gabel & Karyn Heavenrich, *Reigning in the Wild West: The Necessary Outcomes and Inevitable Pitfalls of Reforming Forensic Science*, 24 ALB. L. J. SCI. & TECH 81, 102 (2014) ("The number of individuals convicted based on false evidence is staggering."). A Ninth Circuit judge noted that "[m]any defendants have been convicted and spent countless years in prison based on evidence by arson experts who were later shown to be little better than witch doctors." Alex Kozinski, *Preface: Criminal Law 2.0*, 44 GEO. L.J. ANN. REV. CRIM. PROC. iii, v (2015).

310. *See* NAS REPORT, *supra* note 220, at 11 ("[T]he vast majority of the *reported* opinions in criminal cases indicate that trial judges rarely exclude or restrict expert testimony offered by prosecutors; most *reported* opinions also indicate that appellate courts routinely deny appeals contesting trial court decisions admitting forensic evidence against criminal defendants.").

311. *Id.* at xx.

312. The Court has long recognized the fundamental difference in character between death and all other penalties. As the Court has explained, "In capital proceedings generally, this Court has demanded that factfinding procedures aspire to a heightened standard of reliability. This especial concern is a natural consequence of the knowledge that execution is the most irremediable and unfathomable of penalties; that death is different." Ford v. Wainwright, 477 U.S. 399, 411 (1986) (citing Woodson v. North Carolina, 428 U.S. 280, 305 (1976)).

a psychiatrist known as "Dr. Death"[313]—that it understood as being wrong more often than it was right.[314] Justice Blackmun, ten years before he would author *Daubert*, implored the Court to apply basic common sense.[315]

But all is not lost. Science has played a major role in one of the most positive developments in criminal law over the last few decades. DNA evidence has forever changed expectations for increased scientific validity and, more importantly, freed hundreds of wrongly convicted. The decades of progress to bring DNA into the mainstream bring hope for future reforms.[316] Efforts similar to those undertaken to establish DNA evidence could provide the structural reforms necessary now.[317] As Professor Adam Shniderman explained, "Certainly, if the criminal justice system can survive the challenge and exclusion of what is likely to be the most conclusive forensic feature comparison discipline, it can survive the exclusion of less certain and reliable forensic science disciplines."[318]

Many who have carefully followed the history of forensic science and the courts suggest that modifications to the Rules of Evidence and clarifications in the instructions to courts would help address the current problem.[319] As the general argument goes, courts need more guidance on

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313. The psychiatrist in question, James Grigson, nicknamed "Dr. Death," came to some prominence in the documentary film, *The Thin Blue Line,* which tells the story surrounding the capital trial of Randall Adams. RON ROSENBAUM, TRAVELS WITH DR. DEATH 219 (1991). Filmmaker Errol Morris originally planned to do the film on Dr. Grigson but changed his mind after investigating Hall's case. *Id.* Morris' efforts not only identified the actual murderer in the case, but also led to the eventual exoneration of Hall. *Id.* Grigson was later reprimanded by the American Psychological Association for his opinion on predictions of future dangerousness. *Id.* at 218.

314. The Court was sufficiently comfortable that "the jury will [] be able to separate the wheat from the chaff." Barefoot v. Estrelle, 463 U.S. 880, 899 n.7 (1983). Writing for the Court, Justice White noted that "[n]either petitioner nor [amicus American Psychological Association] suggests that psychiatrists are always wrong with respect to future dangerousness, only most of the time." *Id.* at 901. At another point the Court wrote, "We are not persuaded that such testimony is almost entirely unreliable . . . ." *Id.* at 899.

315. *See id.* at 916 (Blackmun, J., dissenting) ("The Court holds that psychiatric testimony about a defendant's future dangerousness is admissible, despite the fact that such testimony is wrong two times out of three.").

316. *See* Adam B. Shniderman, *Prosecutors Respond to Calls for Forensic Science Reform: More Sharks in Dirty Water*, 126 YALE L.J. F. 348, 357-60 (2017) (detailing how DNA evidence became a trusted mainstay in criminal courts).

317. *See id.* at 357 ("DNA profiling is an excellent starting point for discussing how best to reform scientific evidence.").

318. *Id.* at 360.

319. *See, e.g.*, Bernstein & Lasker, *supra* note 89, at 44 ("[Y]ears of experience under amended Rule 702 teaches that revisions to the Rule are needed. These revisions need not

what the proper criteria are for assessing expert testimony in criminal cases.[320] As part of its recommendations for reform, PCAST stated that one of the most effective solutions would be for the Judicial Conference of the United States to clarify the meaning of "reliable methods" for forensic feature-comparison methods.[321]

While such reforms would be welcome, it is hard to see how additional changes to the rules would have any more impact than previous changes did, particularly considering how poorly courts have interpreted the current rules. The rules were changed in 2000 (and again stylistically updated in 2007) to address lower court confusion over how to apply *Daubert*. It is clear that those reforms did not have the impact sought. What would make this time different?

Media reports have had significant impact on forensic evidence, particularly when measured against the scope of public awareness. The very public—and highly publicized[322]—case of Brandon Mayfield clearly

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involve wholesale changes."); *see also* Karen Kafadar, *The Critical Role of Statistics in Demonstrating the Reliability of Expert Evidence*, 86 FORDHAM L. REV. 1617, 1635 (2018) (reporting that Brendan Max, chief of the forensic science division at the Chicago Public Defender's Office "recommends the following changes to Rule 702: (1) 'Require pre-trial qualification evidentiary hearings upon written motion of a litigant,' (2) '[r]equire any expert who is the subject of a pre-trial qualification hearing to submit to a compulsory deposition, and' (3) '[r]equire that experts disclose all the facts and data that support their proffered opinions (such as all features in a fingerprint case that support an association between a latent print and a suspect)'"); Garrett & Fabricant, *supra* note 182, at 1564 ("The language of Rule 702 is not the sole problem—after all, that language squarely addresses reliability, both of methods and their application to the facts. That reliability language, however, has largely been ignored by state and federal judges. More forceful language might make the importance of assessing reliability more salient to judges, perhaps with more detailed accompanying guidance in Advisory Committee notes.").

320. Bernstein & Lasker, *supra* note 89, at 43 ("The Supreme Court is ill-positioned to solve this problem. The Court can decide only issues in the context of specific cases, and even if a case cleanly presents one of the many conflicts that have arisen over *Daubert*, the other conflicts would remain."); *see also* Lander, *supra* note 19, at 1676 ("First, many judges simply do not know how to apply the concepts of reliability and scientific validity to any given scientific discipline. In the absence of a clear definition, they are often willing to accept the trappings of reliability (examiners' experience and professional practices) rather than insist on actual reliability. Second, many judges are also reluctant to challenge longstanding precedents concerning the admissibility of forensic methods, even when they were established long before current problems became apparent.").

321. PCAST, *supra* note 259, at 20.

322. *See, e.g.*, Sharon Begley, *Fingerprint Matches Come Under More Fire as Potentially Fallible*, WALL ST. J. (Oct. 7, 2005, 12:01 AM ET), https://www.wsj.com/articles/SB112864132376462238; Sarah Kershaw & Eric Lichtblau, *Bomb Case Against*

pushed the FBI to look more carefully at fingerprint evidence.[323] The agency's open confession about past misdeeds is certainly a good start, but significantly more progress is required. The media coverage of crime lab abuses is another example of increasing public awareness, and in some cases it is spearheading reform.[324] Also, continued media exposure of the problems with forensic science would keep up its role in making changes. Further exonerations and the promotion of those stories, such as those of Santae Tribble and even Dr. Death—the subject of the documentary that saved the life of Randall Hall[325]—might encourage such changes.

Both the NAS Report and PCAST Study were heralded as important developments in improving how forensic science would be used in criminal courts.[326] The NAS issued the report after Congress, in 2005, ordered it to "assess the present and future resource needs of the forensic science community," recognizing that "there exists little to no analysis of the remaining needs of the community outside of the area of DNA."[327] The members of the NAS committee included research scientists, academics,

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Lawyer Is Rejected, N.Y. TIMES (May 25, 2004), https://www.nytimes.com/2004/05/25/us/bomb-case-against-lawyer-is-rejected.html.

323. *See* Epstein, *supra* note 202, at 747 ("The highly publicized error was a significant event in the lead-up to the National Academy of Science review of the state of forensic discipline practice and testimony.").

324. *See, e.g.*, Giannelli, *supra* note 20, at 187 (detailing the history of the problems in the Houston crime lab) ("The story began with a television station's investigation, which led in turn to a state audit of the lab in December 2002."). Another example is the FBI's abandonment of tracing bullets to a specific manufacturer's batch after *60 Minutes* and the *Washington Post* reported problems with reliability. *See* Spencer S. Hsu, *Justice Dept., FBI to Review Use of Forensic Evidence in Thousands of Cases*, WASH. POST (July 10, 2012), https://www.washingtonpost.com/local/crime/justice-dept-fbi-to-review-use-of-forensic-evidence-in-thousands-of-cases/2012/07/10/gJQAT6DlbW_story.html?noredirect=on&utm_term=.4a3c6514428e; Steve Kroft, *Evidence of Injustice: FBI's Bullet Lead Analysis Used Flawed Science to Convict Hundreds of Defendants*, 60 MINUTES (Nov. 16, 2007), http://www.cbsnews.com/news/evidence-of-injustice (noting that the CBLA paradigm "went unchallenged for 40 years—until [William] Tobin [who was the chief metallurgist for the FBI] retired in 1998 and decided to do his own study, discovering that the basic premise had never actually been scientifically tested").

325. *See infra* note 313 and accompanying text.

326. *See* Lander, *supra* note 19, at 1676 (sharing his assessment as co-chair of PCAST from 2009-17) ("They have unanimously agreed that methods have historically lacked meaningful scientific validation, that their accuracy has been seriously overstated, and that their misuse has led to wrongful convictions. Moreover, they agree that requiring empirical testing is feasible and would increase the quality of forensic science—with benefits for prosecutors, defendants, and the public.").

327. NAS REPORT, *supra* note 220, at 1-2.

forensic scientists, pathologists, judges, a defense attorney, and a former prosecutor.[328] In 2015, President Obama requested that PCAST determine "whether there were additional steps on the scientific side, beyond those already taken by the Administration in the aftermath of the highly critical [NAS] report."[329] In response, PCAST established a panel of senior advisors that included ten current or former judges, a former U.S. Solicitor General, two law-school deans, and two statisticians.[330]

Despite the work of both of these organizations, neither report made much of a dent in criminal courtrooms. The NAS Report, which is now nearly ten years old, is still relatively unknown in most mainstream legal circles.[331] The reality is that "the Report has had minimal impact on the admissibility or scope of forensic discipline testimony or the conclusions an expert is permitted to present."[332] While it was mentioned in a number of court decisions, "[m]any of those involve passing references or discussions of whether the Report, when relied upon in a post-conviction proceeding, constitutes newly-discovered evidence."[333] In 2017, the National Commission on Forensic Science, a product of the NAS Report, "was forced to disband as a result of Attorney General Jeff Sessions' decision not to renew the Commission's charter."[334]

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328. *Id.* at v, 287-302; *see also* Harry T. Edwards, *The National Academy of Sciences Report in Forensic Sciences: What It Means for the Bench and Bar*, 51 JURIMETRICS J. 1 (2010) ("The Committee was composed of a diverse and accomplished group of professionals. Seven of the 17 Committee members are prominent professionals in the forensic science community, with extensive experience in forensic analysis and practice; 11 members of the committee are trained scientists (with expertise in physics, chemistry, biology, engineering, biostatistics, statistics, and medicine); 10 members of the Committee have Ph.D.'s., 2 have M.D.'s, 5 have J.D.'s, and one has an M.S. in chemistry.").

329. PCAST, *supra* note 259, at x.

330. *Id.* at vii-ix; *see also* Lander, *supra* note 19, at 1664 ("The unanimous report was the result of a year-long study, during which PCAST reviewed 2,100 scientific papers, as well as hundreds of pages of input invited from the forensic-science community.").

331. *See* Epstein, *supra* note 202, at 757 ("[J]udges and practitioners are often unaware of the NAS Report . . . .").

332. *Id.* at 755 ("Courts have either let the experts continue their testimony in the same form as before the Report was issued or 'toned it down' in form but not in substance, as when an expert would have to testify only that it was his or her 'opinion' that the fingerprint came from the defendant and no other source or use the term 'reasonable ballistic certainty' rather than 'reasonable *scientific* certainty.'").

333. *Id.* at 755; *see also* Garrett & Fabricant, *supra* note 182, at 1580 ("Very few rulings cited to the 2009 [NAS] Report.").

334. Epstein, *supra* note 202, at 743. The Commission originated with the recommendations of the NAS Report. *See* NAS REPORT, *supra* note 220, at 18 ("The committee believes that what is needed to support and oversee the forensic science

Similarly, PCAST has already been rejected by prosecutors and courts.[335] This is maybe no surprise given that President Obama's own Attorney General did not adopt the report.[336] Prosecutors immediately rejected its findings.[337] Defense counsel relying on PCAST and its warnings about the lack of scientific validity have already been left wanting in the courtroom, as courts are rejecting objections to expert testimony based on PCAST's findings.[338]

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community is a new, strong, and independent entity that could take on the tasks that would be assigned to it in a manner that is as objective and free of bias as possible—one with no ties to the past and with the authority and resources to implement a fresh agenda designed to address the problems found by the committee and discussed in this report."); *see also* Epstein, *supra* note 202, at 747-48 (detailing the steps from the NAS Report recommendation to the actual establishment of the NCFS). Unfortunately, however, "the Commission's work and indeed its existence can be seen as having had no relevance to the judiciary." *Id.* at 754 ("As of June 4, 2017, only one reported decision even mentions the Commission's existence, and even then, only noting that an expert witness mentioned the Commission while describing his credentials, stating he was invited to serve on one of its subcommittees.").

335. *See* Garrett & Fabricant, *supra* note 182, at 1580 ("New research findings, reports from scientific bodies, and changes in the law have had little impact on this analysis.").

336. *See* Rachel E. Barkow & Mark Osler, *Designed to Fail: The President's Deference to the Department of Justice in Advancing Criminal Justice Reform*, 59 WM. & MARY L. REV. 387, 452-53 (2017) ("Despite the fact that the PCAST report was authored by nineteen preeminent scientists, that its logic and grounding in scientific methods is irrefutable, that it was commissioned by the President, and that its results were touted in a press release by the White House, the Department [of Justice] simply refused to accept it."). The DOJ response was noteworthy for both its refusal and for its concision. "Attorney General Loretta Lynch curtly and quickly responded to PCAST's release that, although the Department 'appreciate[s] their contribution to the field of scientific inquiry, the [D]epartment will not be adopting the recommendations related to the admissibility of forensic science evidence.'" *Id.* at 453 (alteration in original) (quoting Gary Fields, *White House Advisory Council Report Is Critical of Forensics Used in Criminal Trials*, WALL ST. J., (Sept. 20, 2016, 4:25 PM ET), https://www.wsj.com/articles/white-house-advisory-council-releases-report-critical-of-forensics-used-in-criminal-trials-1474394743).

337. *See infra* note 340 and accompanying text; *see also* Radley Balko, Opinion, *Incredibly, Prosecutors Are Still Defending Bite Mark Analysis*, WASH. POST (Jan. 30, 2017), https://www.washingtonpost.com/news/the-watch/wp/2017/01/30/incredibly-prosecutors-are-still-defending-bite-mark-evidence/?utm_term=.b8e2012c4c1b (detailing the filings of prosecutors since PCAST and observing that they are "arguing that the *only* opinions that should matter in these cases are those of prior courts, prosecutors, law enforcement and the small community of forensic analysts in the very field being challenged").

338. *See, e.g.*, State v. Patel, No. LLICR130143598S, 2016 WL 8135385, at *8 (Conn. Super. Ct. Dec. 28, 2016) (rejecting an objection based on the PCAST report) ("The defendant's reference to the PCAST report is insufficient to bring about a different result.

That may leave it to the prosecutors, who have yet to embrace forensic science reform at the group level. Indeed, the reaction to PCAST from the National District Attorneys Association (NDAA) "leave[s] little hope" that the necessary reforms will come from prosecutors.[339] The NDAA released a press statement shortly after PCAST's report was published criticizing the report and arguing that "the opinions expressed by PCAST in their report clearly and obviously disregard large bodies of scientific evidence to the contrary and rely, at times, on unreliable and discredited research."[340] NDAA decried the report as "scientifically irresponsible" and cautioned that adopting "any" of its recommendations would have a "devastating effect" on law enforcement.[341]

But the real changes in *Daubert* in the civil side were as much about culture and norms as they were about rules and law.[342] Changes in attitude and processes ushered in whatever "revolution" *Daubert* brought to toxic tort litigation. Perhaps a similar miracle is possible in criminal courtrooms and prosecutors?

This is not a new idea, of course.[343] Prosecutors are in the best position to make the necessary changes, since they are the ones who offer the scientific evidence in question.[344] Indeed, prosecutors have been on notice

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There is no basis on which this court can conclude, as the defendant would have it, that the PCAST report constitutes 'the scientific community.'").

339. *See* Shniderman, *supra* note 316, at 349 ("Initial reactions to the PCAST report from the law enforcement community leave little hope that it will inspire any more reform than the NAS Report has.").

340. Press Release, Nat'l Dist. Attorneys Ass'n, National District Attorneys Association Slams President's Council of Advisors on Science and Technology Report (Sept. 2, 2016), http://www.ndaa.org/pdf/NDAA%20Press%C20Release%C20on%C20PCAST%20Report.pdf.

341. *Id.* Six weeks later, the NDAA submitted a letter to President Obama detailing its concerns about the report. Letter from Michael A. Ramos, President, Nat'l Dist. Attorneys Ass'n, to President Obama (Nov. 16, 2016), http://tinyurl.com/hczkt3k. The NDAA argued that not all of the feature comparison disciplines will necessarily be subject to strict admissibility requirements of "science," because some disciplines incorporate certain aspects of science but also constitute "technical" and "specialized knowledge" as described by Federal Rule of Evidence 702. *Id.*

342. *See supra* notes 187-93 and accompanying text.

343. Ten years ago, it was reported that "the legal system and commentators have paid little attention to prosecutorial discretion in the use of unreliable expert testimony—despite mounting evidence that misconvictions have been based upon unreliable expert testimony." Jane Campbell Moriarty, *"Misconvictions," Science, and the Ministers of Justice*, 86 NEB L. REV. 1, 23 (2007).

344. *See* Garrett & Neufeld, *supra* note 279, at 85 (detailing concerns about how prosecutors distort and exaggerate "the testimony of the forensic analyst in closings, making

long enough that some of the forensic science on which they rely is likely unreliable.[345] Their own ethical obligations should provide some limits.[346] They could enact these changes earlier in the process, where the scientific evidence is used to consider indictment and proceeding to trial.[347]

VI. Conclusion

The revolution that *Daubert* was to bring regarding how courts managed science is still unfinished.[348] Its impact on toxic tort cases arguably provided a necessary framework to improve how lawyers use science through expert witnesses. Its neglect in the criminal courts is a stain on our system of justice. Unreliable forensic science plagues our criminal trials and defendants are wrongly convicted as a result. After two major government studies and several decades of calls for reform from researchers, academics, and criminal lawyers, there is no longer any doubt that a wide range of scientific methods for identifying defendants, in

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claims that the forensic scientist clearly did not make"); Bennett L. Gershman, *Misuse of Scientific Evidence by Prosecutors*, 28 OKLA. CITY U. L. REV. 17, 18-19 (2003) ("Many, if not most, . . . wrongful convictions are attributable to scientific evidence presented by prosecutors as trustworthy, and relied on as such by juries, when in fact the evidence was erroneous or fraudulent.").

345. *See* Covey, *supra* note 307, at 538 ("Even prior to the recent revelations regarding these forensic practices, it is virtually inconceivable that prosecutors were not aware of the risks involved. Nonetheless, prosecutors have not only used such evidence to obtain scores of criminal convictions, but they continue to do so.").

346. *See* Bruce A. Green, *Access to Criminal Justice: Where Are the Prosecutors*, 3 TEX. A&M L. REV. 515, 527-28 (2016) ("[T]o protect against wrongful convictions, good prosecutors should not introduce unreliable evidence, even if, for disciplinary purposes, they *may* do so. It is unfair for prosecutors to leave it to lay juries to determine the credibility of dubious evidence. A prosecutor has a gate-keeping function to assure the credibility of evidence: If prosecutors themselves do not reasonably believe testimony, they should not present it to the jury. And particularly in the case of forensic evidence that a jury lacks the scientific and technical capability to evaluate, prosecutors should ensure the reliability of the testimony.").

347. Moriarty, *supra* note 343, at 27 ("If it is too much to ask prosecutors to second-guess their scientific and expert evidence in the heat of trial or after a conviction, perhaps prosecutors should think about their discretionary actions in the pre-indictment and pre-trial stages of the case, where much of the forensic science is developed as the bedrock of the prosecution."); *see also* Covey, *supra* note 307, at 583 (providing evidence that the prosecutorial use of certain types of known unreliable forensic evidence is correlated with increased indicators of official misconduct).

348. *See* Bernstein, *supra* note 1, at 37-38 ("*Daubert* has not done much to alleviate the problem of forensic science quackspertise . . . . These problems demand resolution before one can conclude that the *Daubert* revolution is complete.").

particular, are simply invalid. Hair analysis, fingerprint identification, and bite mark analysis are only the tips of the iceberg. Until courts and prosecutors commit themselves to their respective obligations as gatekeepers to preserve the integrity of the science used to convict, our criminal justice system will continue to be overrun with "junk science."

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