

**100 Years of the National Research Council: A  
Critical Examination of Judicial References to  
Forensic Science NAS Reports**

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## Abstract

The National Academy of Sciences (NAS) is the leading advisor to the United States federal government on matters of science and technology. Since its creation in 1863, it has developed a diverse portfolio of scientific research. One area that the NAS – and its research body, the National Research Council (NRC) – has undertaken considerable research on is forensic science. Between 1992 and 2009, six seminal reports were published: *DNA Technology in Forensic Science (1992)*; *The Evaluation of Forensic DNA Evidence (1996)*; *The Polygraph and Lie Detection (2003)*; *Forensic Analysis: Weighing Bullet Lead Evidence (2004)*; *Ballistic Imaging (2008)*; and *Strengthening Forensic Science in the United States: A Path Forward (2008)*. Each has critically engaged with forensic science techniques, highlighted scientific progress, and received considerable engagement from the criminal justice system.

Despite extensive study, there remains a gap discussing how these reports have interplayed with the criminal justice system and the wider legal process norms that govern its actors, admissibility decisions, and consideration of constitutional issues. This thesis seeks to investigate judicial reference to these NAS reports through a comprehensive study of judicial decision-making. It aims to fill gaps left by existing literature through answering the following questions:

- How many times have each of the six NAS reports been referenced in criminal appellate decisions across the United States?
- In what types of legal claims are the NAS reports referenced?
- What is the purpose of the reference to the NAS report(s) within the judgment?
- How does judicial decision-making referencing the forensic science NAS reports reflect legal process values?

This thesis finds 644 decisions referencing these reports. These decisions reflect fidelity to the legal process vision through four principles: the dominance of precedent; deference to institutional settlement; pursuit of finality; and fidelity to the rationality assumption. Findings also raise questions

about the relationship between law and science. The author concludes that legal cultural norms and scientific progress can be reconciled through developing legal actors' forensic science knowledge, facilitated by the NAS.

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## Introduction

This thesis explores a juncture in the intersection of law and science in the United States through examining judicial decision-making in federal and state criminal appellate courts when forensic science has been challenged. More specifically, the thesis explores judicial responses to questions of forensic science, in instances where (at least) one of six reports of the National Academy of Sciences examining the reliability and validity of forensic science techniques have been referenced. These reports provide an authoritative scientific voice on forensic science matters, as the National Academy of Sciences occupies a unique position in US scientific history. Under its federal charter, the National Academy of Sciences is “charged with providing independent, objective advice to the nation on matters related to science and technology.”<sup>1</sup> Its current authority is shaped by its long-standing history, and its influence on both science and politics.

### **History of the NAS**

The National Academies of Sciences, Engineering, and Medicine are a network of private, non-profit institutions in the United States of America,<sup>2</sup> comprised of distinguished scholars from a wide range of scientific disciplines.<sup>3</sup> Under its establishing Congressional Charter, signed by President Lincoln in 1863, the Academies must “report upon any subject of science or art... whenever called upon by any department of the Government.”<sup>4</sup> This mandate has been formally expanded twice, on the creation of the National Academy of Engineering and the National Academy of Medicine in 1964<sup>5</sup> and 1970<sup>6</sup> respectively.

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<sup>1</sup> The National Academy of Sciences, Mission, <http://www.nasonline.org/about-nas/mission/> (last visited Nov. 4, 2019).

<sup>2</sup> The National Academies of Sciences Engineering Medicine, Who We Are, <http://www.nationalacademies.org/about/whoweare/index.html> (last visited Nov. 4, 2019).

<sup>3</sup> National Academy of Sciences, *supra* note 1.

<sup>4</sup> An Act to Incorporate the National Academy of Sciences, 36 U.S.C §251 *et seq.* (1863) [hereinafter *Act of Incorporation*].

<sup>5</sup> National Academy of Engineering, About the National Academy of Engineering (NAE), <https://www.nae.edu/About.aspx> (last visited Nov. 4, 2019).

<sup>6</sup> National Academy of Medicine, About the National Academy of Medicine, <https://nam.edu/about-the-nam/> (last visited Nov. 4, 2019).

The National Academy of Sciences (hereafter, NAS) is considered to be the United States' premier scientific research center, with a mandate to "...report upon any subject of science..."<sup>7</sup> when called upon by the federal government. Under its mission statement, the NAS is "committed to furthering science in America,"<sup>8</sup> but its members are also "active contributors to the international scientific community."<sup>9</sup> As such, the National Academies occupy a unique and prestigious place in the scientific workings of the United States as a nation.

Over the last 150 years, the NAS has developed a diverse portfolio of scientific research. Its publications and research fields are categorized into seven broad subject divisions.<sup>10</sup> Within this, the Division of Behavioral and Social Sciences and Education has recently reported on: realizing opportunity for youth,<sup>11</sup> reducing child poverty,<sup>12</sup> and STEM in education.<sup>13</sup> The Division on Earth and Life Studies has recently published reports discussing: the status of coral reefs,<sup>14</sup> urban flooding in the United States,<sup>15</sup> and forest health and biotechnology.<sup>16</sup> The NAS primarily carries out research for the federal government, but it has also carried out research on behalf of private organizations, further contributing towards its vast catalogue of reports and areas of expertise.

Despite its current diverse portfolio, the NAS' 150-year history has not been without challenge, particularly during its formative years. During the first century of the NAS' history, it struggled to maintain a consistent relationship with the federal government. These difficulties were often caused by issues stemming from a lack of regular funding, which led to several periods of tension between

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<sup>7</sup> National Academy of Sciences, *supra* note 1.

<sup>8</sup> *Id.*

<sup>9</sup> *Id.*

<sup>10</sup> The seven subject divisions are: Behavioral and Social Sciences and Education; Earth and Life Studies; Engineering and Physical Sciences; Health and Medicine; Policy and Global Affairs; Transportation Research Board; and the Gulf Research Program.

<sup>11</sup> RICHARD J. BONNIE & EMILY P. BACKES, *THE PROMISE OF ADOLESCENCE: REALIZING OPPORTUNITY FOR ALL YOUTH* (National Academies Press 2019).

<sup>12</sup> GREG DUNCAN & SUZANNE LE MENESTREL, *A ROADMAP TO REDUCING CHILD POVERTY* (National Academies Press 2019).

<sup>13</sup> *See, e.g.*, MARK B. ROSENBERG, MARGARET L. HILTON, & KENNE A. DIBNER, *INDICATORS FOR MONITORING UNDERGRADUATE STEM EDUCATION* (National Academies Press 2018).

<sup>14</sup> STEPHEN R. PALUMBI, *A DECISION FRAMEWORK FOR INTERVENTIONS TO INCREASE THE PERSISTENCE AND RESILIENCE OF CORAL REEFS* (National Academies Press 2019).

<sup>15</sup> DAVID R. MAIDMENT, *FRAMING THE CHALLENGE OF URBAN FLOODING IN THE UNITED STATES* (National Academies Press 2019).

<sup>16</sup> SUSAN E. OFFUTT, *FOREST HEALTH AND BIOTECHNOLOGY: POSSIBILITIES AND CONSIDERATIONS* (National Academies Press 2019).

the NAS and federal government. This, over the course of the NAS' first hundred years, left the NAS' work lacking direction in periods when government requests for research were absent.<sup>17</sup>

In 1863, as directed by its Act of Incorporation, the NAS received no stipendiary funding from the federal government.<sup>18</sup> This left the newly-created NAS without resources to undertake and support any independent scientific research.<sup>19</sup> Although in its initial decade, the NAS did carry out several research projects for the federal government,<sup>20</sup> after the American Civil War, internal tensions between members and a lack of government-commissioned research led to uncertainty surrounding its future.<sup>21</sup> Despite such initial struggles, by the end of the nineteenth century, the NAS took a lead role in creating the national forest system,<sup>22</sup> which helped to rebuild its relationship with the federal government as a scientific advisor.

The relationship between the federal government and the NAS was strengthened through the creation of the National Research Council (NRC) in 1916. The NRC was established under the NAS by President Wilson as a wartime agency<sup>23</sup> designed to "bring into cooperation existing governmental, educational, industrial and other research organizations"<sup>24</sup> to advance scientific research, national security, and welfare.<sup>25</sup> The NRC centralized NAS research, and provided a guarantee to the federal government that research would be carried out using the best available resources and expertise.<sup>26</sup>

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<sup>17</sup> REXMOND C. COCHRANE, *THE NATIONAL ACADEMY OF SCIENCES: THE FIRST HUNDRED YEARS 1863-1963* 101 (National Academies Press 1978).

<sup>18</sup> *Act of Incorporation*, *supra* note 4, at §3.

<sup>19</sup> COCHRANE, *supra* note 17, at 101.

<sup>20</sup> *Id.*, from 80.

<sup>21</sup> *Id.*, at 105-110, 150.

<sup>22</sup> Gerald W. Williams & Char Miller, *At the Creation: The National Forest Commission of 1896-97*, *FOREST HISTORY TODAY*, SPRING/FALL 2005 32 (2005).

<sup>23</sup> National Academies of Sciences, Engineering, Medicine, [Organization of the National Research Council](http://www.nationalacademies.org/about/history/index.html), <http://www.nationalacademies.org/about/history/index.html> (last visited Nov. 4, 2019).

<sup>24</sup> George E. Hale, Edwin G. Conklin, Simon Flexner, Robert A. Millikan & Arthur A. Noyes, *The National Research Council*, *SCIENCE*, Aug. 25, 1916, at 264.

<sup>25</sup> *Id.*

<sup>26</sup> *Id.*

During World War I, the NAS – through the NRC – carried out government-commissioned research on a variety of public interest matters.<sup>27</sup> It conducted research into public health and nutrition,<sup>28</sup> but avoided direct engagement in warfare technology. This legacy of the NRC in researching matters that have a public interest element has continued to this day,<sup>29</sup> made possible by President Wilson’s action in 1919 to make the NRC permanent through Executive Order.<sup>30</sup>

Throughout the inter-war period, the NAS returned to its pre-war financial independence,<sup>31</sup> but maintained its research focus towards applied science.<sup>32</sup> The NAS building was completed in 1924 along the National Mall in Washington D.C.,<sup>33</sup> maintaining its close physical proximity to the headquarters of the three branches of government: the Supreme Court, Congress and the White House.<sup>34</sup> To fund the building, the NAS sought a private sponsor, and received funding from the Carnegie Corporation.<sup>35</sup> During this time, the NAS published considerably fewer government-commissioned reports, leaving the NRC to explore a more nuanced agenda, including research into the potential benefits in calendar reform and weather forecasting.<sup>36</sup>

Upon President Roosevelt’s inauguration, NAS and NRC resources were commissioned by the President to inform New Deal policies through the federal government-created Science Advisory Board, which was part of the NAS.<sup>37</sup> However, the Science Advisory Board undertook a research agenda similar to the work of the NRC. This left the position of the NRC unclear and created workload

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<sup>27</sup> ALBERT L. BARROWS, *The Relationship of the National Research Council to Industrial Research*, in RESEARCH – A NATIONAL RESOURCE: II – INDUSTRIAL RESEARCH 365 (United States Government Printing Office 1940).

<sup>28</sup> *Id.*

<sup>29</sup> National Academies of Sciences, Engineering Medicine, Our Reputation, <http://www.nationalacademies.org/about/reputation/index.html> (last visited Nov. 4, 2019).

<sup>30</sup> Exec. Order No. 2859 of May 11, 1918, *reinstated by* Exec. Order No. 10668, 21 FR 3155, 3 C.F.R. (1954-1958).

<sup>31</sup> Vernon Kellogg, *The National Research Council*, 7 INT’L CONCILIATION 423, 424 (1920-21).

<sup>32</sup> Before World War I, the Academy occupied its time in the pursuit of discovery, covering six independent areas: mathematics and astronomy, physics and engineering, chemistry, geology and palaeontology, biology and anthropology. See, COCHRANE, *supra* note 17, at 186.

<sup>33</sup> THE NATIONAL ACADEMY OF SCIENCES, *THE NATIONAL ACADEMY OF SCIENCES BUILDING: A HOME FOR SCIENCE IN AMERICA*, Chapter 1 (National Academies Press 2013).

<sup>34</sup> National Academy of Sciences, Visitor’s Guide <http://www.cpnas.org/collections/visitor-guide.pdf> (last visited Nov. 4, 2019).

<sup>35</sup> THE NATIONAL ACADEMY OF SCIENCES, *supra* note 33.

<sup>36</sup> COCHRANE, *supra* note 17, at 248.

<sup>37</sup> William A. Blanpied, *Science Policy in the Early New Deal and its Impact in the 1940s*, 1 FED. HIST. 9, 17-18 (2009).

tensions between the NAS and federal government. Although tensions in the relationship between the NAS and the federal government<sup>38</sup> remained unresolved,<sup>39</sup> upon the breakout of World War II, the NAS and NRC once again re-engaged in government-focused research by responding to the federal government's wartime priorities under the authority of the National Defense Research Committee.

During WWII, the NAS and NRC operated within the federal government's National Defense Research Committee.<sup>40</sup> The NAS, having developed a strong research foundation through undertaking projects alongside the federal government throughout WWI and the New Deal era, and investigating the application of science in industry and medicine,<sup>41</sup> became involved in researching warfare technology for the first time.<sup>42</sup> The NAS' cross-sector contribution to science under the National Defense Research Committee persuaded President Roosevelt to re-affirm the perpetuity of the NRC by Executive Order.<sup>43</sup> This allowed the NRC to continue its research into further matters of government interest following the war. This post-war research became a natural extension of its wartime agenda: the NRC reported on atomic energy and carried out longitudinal studies into the health of atomic bomb victims in Japan.<sup>44</sup>

As the aftermath of WWII evolved into the Cold War, the NAS continued to research scientific developments and projects conceived during WWII, in collaboration with the federal government. The President of the NAS, Dr Frank Jewett, prioritized this collaboration,<sup>45</sup> as a means to continue the success of wartime projects. This gave the federal government scope to shape and influence the NAS' growing research agenda. This government-led agenda created NAS reports on oceanography<sup>46</sup> and

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<sup>38</sup> COCHRANE, *supra* note 17, at 365-378.

<sup>39</sup> Fred D. Fagg, Jr, Charles T. McCormick & John H. Wigmore, *The Science Advisory Board*, 18 J. PAT. OFF. SOC'Y 82, 82 (1936).

<sup>40</sup> COCHRANE, *supra* note 17, at 392.

<sup>41</sup> *Id.*, at 401

<sup>42</sup> *Id.*, at 396-397.

<sup>43</sup> Exec. Order No. 10668, 21 FR 3255, 3 C.F.R. (1954-1958)

<sup>44</sup> *See, e.g.* The work of the Atomic Bomb Casualty Commission and reports such as JAMES V. NEEL & W. J. SCHULL, EFFECT OF EXPOSURE TO THE ATOMIC BOMBS ON PREGNANCY TERMINATION IN HIROSHIMA AND NAGASAKI (National Academies Press 1956).

<sup>45</sup> COCHRANE, *supra* note 17, at 466-469.

<sup>46</sup> ARTHUR R. M. NOWELL, 50 YEARS OF OCEAN DISCOVERY: NATIONAL SCIENCES FOUNDATION 1950-2000 (National Academies Press 2000).

the study of pacific islands.<sup>47</sup> The federal government also used NAS resources to explore scientific matters of public interest, including mapping the effects of atomic warfare,<sup>48</sup> in response to public concerns raised by the media.<sup>49</sup>

Throughout the cold war era, the NAS was also used as a diplomatic tool by the federal government to assist in improving international scientific dialogue and cooperation, protecting national security interests.<sup>50</sup> The federal government used the NAS to establish scientific exchanges with the USSR and China to promote scientific leadership.<sup>51</sup> This relationship proved valuable in maintaining international dialogue when political relations had broken down.<sup>52</sup> This new pseudo-political role was not without controversy for the NAS, who struggled to adapt to political sensitivities. However, it allowed the NAS to develop a more transparent approach to working, especially when carrying out high-profile and politically motivated work in collaboration with the federal government.<sup>53</sup>

During this period, the NAS also benefited from the federal government's renewed interest in science. The NAS' wartime and post-war experience put it in a strong position to initiate further research into areas that had captured the heart of the nation. This became a turning point for the NAS, beginning a period of permanent government collaboration, which expanded rapidly during the decades that followed.

The rapid expansion and rise in popular interest in science and technology throughout the 1960s<sup>54</sup> diversified the NAS' research portfolio. This decade saw many American scientific firsts, including

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<sup>47</sup> MARIE-HELENE SACHET, F. RAYMOND FOSBERG, *ISLAND BIBLIOGRAPHIES: MICRONESIAN BOTANY, LAND ENVIRONMENT AND ECOLOGY OF CORAL ATOLLS, VEGETATION OF TROPICAL PACIFIC ISLANDS* (National Academies Press 1955).

<sup>48</sup> *See*, NEEL & SCHULL, *supra* note 44.

<sup>49</sup> *See, e.g.*, John Hersey, *Hiroshima*, *THE NEW YORKER*, August 31, 1946.

<sup>50</sup> Peter Westwick, *Reconciling National Security with Scientific Internationalism*, *PNAS*, June 24, 2014, 9331, 9332-9333.

<sup>51</sup> *Id.*, at 9332.

<sup>52</sup> *Id.*

<sup>53</sup> Issues of NAS members' lack of security clearance while working on atomic energy committees and other government-classified projects, even in non-classified roles, led to questions being asked about the NAS' loyalty to the US federal government. Such concerns were only set aside in 1955-56 when the NAS re-affirmed loyalty to the federal government in a statement found in its annual report. *See*, COCHRANE, *supra* note 17, at 531.

<sup>54</sup> JEROME B. WIESNER, *WHERE SCIENCE AND POLITICS MEET*, 41 (McGraw-Hill Book Company 1965).

space exploration<sup>55</sup> and naval developments,<sup>56</sup> which contributed towards technological advances becoming more politically sensitive. President Kennedy's agenda also focused political momentum towards scientific advancements. To sustain scientific momentum, he created and allocated research grants to train new scientists.<sup>57</sup> His work strengthened the presidential relationship with the NAS through creating science advisory positions<sup>58</sup> and engaging directly in NAS functions.<sup>59</sup> Collaboratively, they created the NAS Committee on Government Relations,<sup>60</sup> which has since become the Committee on Science, Engineering, Medicine, and Public Policy. In the years that have followed its creation, this committee has published on areas pertinent to government policy. Such publications include: *Scientific Communication and National Security* (1982);<sup>61</sup> *Technology and Employment: Innovation and Growth in the U.S. Economy* (1987);<sup>62</sup> and *Reshaping the Graduate Education of Scientists and Engineers* (1995).<sup>63</sup> This committee still provides technology-related research to the President, federal government, and Congress.<sup>64</sup>

As government research requests have diversified, more committees and NAS bodies have undertaken research addressing issues at the behest of the federal government. One such example is forensic science. Within this area, NAS committees have crossed areas of scientific interest, with forensic science-related reports being produced in conjunction with the Division of Earth and Life Studies,<sup>65</sup> Division of Behavioral and Social Sciences and Education,<sup>66</sup> and Division on Engineering and Physical

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<sup>55</sup> The Economist, *America and the Space Race*, THE ECONOMIST, Aug. 2, 2014.

<sup>56</sup> EDWARD P. STAFFORD & PAUL STILLWELL, *THE BIG E: THE STORY OF THE USS ENTERPRISE* (Naval Institute Press 2016).

<sup>57</sup> WEISNER, *supra* note 54, at 6.

<sup>58</sup> COCHRANE, *supra* note 17, at 574.

<sup>59</sup> WEISNER, *supra* note 54, at 7.

<sup>60</sup> The National Academies of Sciences, Engineering, Medicine, Committee on Science, Engineering, Medicine, and Public Policy – Policy and Global Affairs: History, [http://sites.nationalacademies.org/PGA/COSEPUP/PGA\\_044177](http://sites.nationalacademies.org/PGA/COSEPUP/PGA_044177) (last visited Nov. 4, 2019).

<sup>61</sup> DALE R. CORSON ET AL., *SCIENTIFIC COMMUNICATION AND NATIONAL SECURITY* (National Academies Press 1982).

<sup>62</sup> RICHARD M. CYERT, DAVID C. MOWERY, *TECHNOLOGY AND EMPLOYMENT: INNOVATION AND GROWTH IN THE U.S. ECONOMY* (National Academies Press 1987).

<sup>63</sup> PHILLIP A. GRIFFITHS ET AL., *RESHAPING THE GRADUATE EDUCATION OF SCIENTISTS AND ENGINEERS* (National Academies Press 1995).

<sup>64</sup> The National Academies of Sciences, Engineering, Medicine, Committee on Science, Engineering, Medicine, and Public Policy – Policy and Global Affairs <http://sites.nationalacademies.org/PGA/COSEPUP/index.htm> (last visited Nov. 4, 2019).

<sup>65</sup> VICTOR A. MCKUSICK, *DNA TECHNOLOGY IN FORENSIC SCIENCE* (National Academies Press 1992); JAMES F. CROW, *THE EVALUATION OF FORENSIC DNA EVIDENCE* (National Academies Press 1996); KENNETH O. MACFADDEN, *FORENSIC ANALYSIS: WEIGHING LEAD BULLET EVIDENCE* (National Academies Press 2004).

<sup>66</sup> STEPHEN E. FEINBERG, *THE POLYGRAPH AND LIE DETECTION* (National Academies Press 2003); DANIEL L. CORK, *BALLISTIC IMAGING*, (National Academies Press 2008).

Sciences.<sup>67</sup> Although forensic science-focused reports have been published by a number of committees, they each examine the reliability and validity of forensic science techniques, which is the subject of this thesis. More specifically, the author has identified six reports, published between 1992 and 2009, which examine a large number of forensic science disciplines.

This study, in undertaking an assessment of the intersection of law and science, focuses on exploring the judicial reference to these reports through examining criminal case law published between 1992 and 2017.

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Forensic science evidence has long been used to assist legal actors in the search for legal proof. One of the most prominent examples of this is the courtroom use of DNA evidence, beginning in the late 1980s. Research into genetic material has been carried out throughout the twentieth century, with the discovery of DNA's double helix in 1953<sup>68</sup> sparking a flurry of genetics-based research. During the 1960s and 1970s, DNA technology furthered research in many areas, including virus prevention,<sup>69</sup> human history,<sup>70</sup> and molecular cloning.<sup>71</sup> In the 1980s, the beginnings of the Human Genome Project were established,<sup>72</sup> and DNA was first used as a means of identification as evidence in a courtroom, both in terms of determining parental lineage,<sup>73</sup> and as evidence in criminal proceedings. DNA evidence quickly proved useful in securing convictions<sup>74</sup> and exonerations<sup>75</sup> in the United States and United Kingdom.

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<sup>67</sup> HARRY T. EDWARDS & CONSTANTINE GATSONIS, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 1* (National Academies Press 2009).

<sup>68</sup> JAMES WATSON & ANDREW BERRY, *DNA: THE SECRET OF LIFE* 52 (2004).

<sup>69</sup> *Id.*, at 55.

<sup>70</sup> *Id.*, at 232.

<sup>71</sup> *Id.*, at 82-107.

<sup>72</sup> National Human Genome Research Institute, [A Brief History of the Human Genome Project](https://www.genome.gov/12011239/a-brief-history-of-the-human-genome-project/) <https://www.genome.gov/12011239/a-brief-history-of-the-human-genome-project/> (last visited Nov. 4, 2019).

<sup>73</sup> WATSON & BERRY, *supra* note 68, at 271-272.

<sup>74</sup> *R v. Pitchfork* [2009] EWCA (crim.) 963, [11] (Eng.); *Andrews v. State* 533 So.2d 841 (Fla. Dist. Ct. App. 1988).

<sup>75</sup> Innocence Project [Gary Doston](http://www.innocenceproject.org/cases/gary-dotson/), <http://www.innocenceproject.org/cases/gary-dotson/> (last visited Nov. 4, 2019).

Upon its introduction into the criminal justice system – particularly in England and the United States – DNA evidence revolutionized forensic science evidence.<sup>76</sup> After its early acceptance as evidence in the United States in the late 1980s, judges struggled to interpret the probative value of DNA evidence<sup>77</sup> due to its complexities and constant technological developments.<sup>78</sup> Consequently, DNA evidence was admitted and used inconsistently, with parties wishing to introduce DNA evidence holding lengthy admissibility hearings discussing DNA’s general acceptance<sup>79</sup> and admissibility.<sup>80</sup> This period has been frequently referred to as the “DNA admissibility war.”<sup>81</sup> Most notably, the decision in *People v. Castro* (1989)<sup>82</sup> questioned DNA’s admissibility under *Frye*’s general acceptance test, resulting in its first exclusion from evidence.<sup>83</sup>

As the DNA admissibility war continued, DNA exonerations exposed limitations in many forensic science techniques,<sup>84</sup> which threatened to undermine the stability of law, built around decades of precedent.<sup>85</sup> To resolve the confusion and uncertainty surrounding DNA’s admissibility, the NAS initiated research to generate a report on the forensic application of DNA evidence.<sup>86</sup> The resulting report, *DNA Technology in Forensic Science* (1992), was followed by *The Evaluation of Forensic DNA Evidence* (1996) which are outlined in sections (1) and (2). These reports, and four subsequent reports examining the reliability and validity of further forensic science evidence techniques – *The Polygraph and Lie Detection* (2003); *Forensic Analysis: Weighing Bullet Lead Evidence* (2004); *Ballistic Imaging*

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<sup>76</sup> Eric S. Lander, *DNA Fingerprints on Trial*, 339 *Nature* 501 (1989).

<sup>77</sup> Paul C. Giannelli, *Regulating Crime Laboratories: The Impact of DNA Evidence*, 15 *J.L. & Pol’y* 59, 79-80 (2007).

<sup>78</sup> *Id.*

<sup>79</sup> The prevailing admissibility standard was the “general acceptance” standard first devised in *Frye v. United States* 293 F. 1013 (D.C. Cir. 1923).

<sup>80</sup> Lander, *supra* note 76.

<sup>81</sup> Giannelli, *supra* note 77, at 77.

<sup>82</sup> *People v. Castro* 144 Misc.2d 956 (N.Y. 1989).

<sup>83</sup> Lawrence B. Ebert, *Frye after Daubert: The Role of Scientists in Admissibility Issues As Seen Through Analysis of the DNA Profiling Cases*, 1993 *U. CHI. L. SCH. ROUNDTABLE* 219, from 224 (1993).

<sup>84</sup> See, Innocence Project, [Featured Cases Exonerated by DNA](https://www.innocenceproject.org/all-cases/), <https://www.innocenceproject.org/all-cases/> (last visited Nov. 4, 2019).

<sup>85</sup> William C. Thompson, *Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the DNA 'War,'* 84 *J. CRIM. L. & CRIMINOLOGY* 22 (1993).

<sup>86</sup> McKUSICK, *supra* note 65, at 149.

(2008); and *Strengthening Forensic Science in the United States: A Path Forward* (2009) – are the focus of the thesis.

### 1. *DNA Technology in Forensic Science* (1992)

Following “calls for an examination of the issues”<sup>87</sup> brought to light through questions surrounding whether DNA evidence had achieved “general acceptance,”<sup>88</sup> the NAS undertook a study to examine the reliability, validity and management of forensic DNA evidence.<sup>89</sup> This was supported by funding grants from several federal bodies.<sup>90</sup> The resulting report, *DNA Technology in Forensic Science* (hereafter **DNA 1**), supported the admissibility of correctly prepared DNA evidence in legal proceedings,<sup>91</sup> whilst also showing an awareness of ongoing research in the area.<sup>92</sup> The committee discussed the rationale behind DNA typing and its underlying scientific research<sup>93</sup> and considered the technical limitations of DNA evidence when taking into account analysis methods.<sup>94</sup> Its consideration of human error in the PCR (polymerase chain reaction)<sup>95</sup> and RFLP (restriction fragment length polymorphisms)<sup>96</sup> analysis methods<sup>97</sup> led the report to recommend that analysts follow the RFLP analysis method, designed to minimize the risk of error.<sup>98</sup>

To assist judges and jurors in their understanding of DNA evidence, the NAS committee recommended experts also use statistical representations to determine the significance of a match.<sup>99</sup> The committee showed concern about the small size of the DNA population database, highlighting the increased risk

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<sup>87</sup> *Id.*, at vii.

<sup>88</sup> This was the federal admissibility standard during the 1980s and early 1990s, stemming from *Frye* 293 F. 1013.

<sup>89</sup> MCKUSICK, *supra* note 65, at 1.

<sup>90</sup> *Id.*, viii.

<sup>91</sup> *Id.*, at 145-146.

<sup>92</sup> *Id.*

<sup>93</sup> *Id.*, at 32-44.

<sup>94</sup> *Id.*, at Chapter 2.

<sup>95</sup> PCR involves creating millions of copies of short regions of DNA evidence. This amplified region can then be compared for a match, which can allow for the analysis of very small samples of DNA evidence.

<sup>96</sup> The RFLP analysis method involves “snipping” DNA evidence into fragments using an enzyme. Once arranged, these are called restriction fragment length polymorphisms, which can then be used as a comparison for determining a DNA match.

<sup>97</sup> MCKUSICK, *supra* note 65, at Chapter 2.

<sup>98</sup> *Id.*, at 72.

<sup>99</sup> *Id.*, at 74.

of familial matches.<sup>100</sup> It also warned of the potential existence of population sub-groups.<sup>101</sup> In light of this, the committee recommended that the significance of a match be calculated using a deliberately conservative method – the ceiling principle.<sup>102</sup>

After establishing the reliability of the RFLP technique and method used to calculate the significance of a DNA match, the report discussed the forensic application of DNA technology. It explored the admissibility of DNA under *Frye*<sup>103</sup> and the Federal Rules of Evidence.<sup>104</sup> Ultimately, the committee recommended that courts should take judicial notice of the principles underpinning DNA typing,<sup>105</sup> but should analyze admissibility on a case-by-case basis, evaluating the procedures and methods used during the expert's analysis to ensure adherence to high standards.<sup>106</sup>

The committee also considered the privacy implications of maintaining DNA databanks. It approved of the creation of a nationwide database,<sup>107</sup> but recommended that privacy protection be prioritized.<sup>108</sup> Furthermore, it urged governments to show transparency about how DNA databanks are used,<sup>109</sup> encouraging them to be mindful of the impact of sample storage and retention on those whose DNA is stored within databases.<sup>110</sup>

This report has widely been considered as a contributory factor in resolving the DNA admissibility war.<sup>111</sup> However, although cautiously supported by some,<sup>112</sup> its recommendation of using the ceiling principle approach to calculate the statistical significance of DNA was controversial amongst many

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<sup>100</sup> *Id.*, at 79-80.

<sup>101</sup> *Id.*

<sup>102</sup> *Id.*, at 82-85.

<sup>103</sup> *Id.*, at 82-85.

<sup>104</sup> *Id.*, from 137.

<sup>105</sup> *Id.*, at 149.

<sup>106</sup> *Id.*

<sup>107</sup> *Id.*, at 128.

<sup>108</sup> *Id.*, at 113.

<sup>109</sup> *Id.*, at 116.

<sup>110</sup> *Id.*, at 118-123.

<sup>111</sup> Jennifer Callahan, *The Admissibility of DNA Evidence in the United States and England*, 19 SUFFOLK TRANSNATIONAL LAW REVIEW 537, 545-548 (1995-1996).

<sup>112</sup> Elizabeth A. Allen, *The Admissibility of DNA Evidence in Washington after State v. Cauthron*, 69 WASH. L. REV. 383 (1994).

members of the scientific community, due to its conservative calculation of a match.<sup>113</sup> Ultimately this controversy, alongside developments in DNA technology, prompted the NAS to re-evaluate the status of DNA evidence in a second report.<sup>114</sup>

## **2. *The Evaluation of Forensic DNA Evidence (1996)***

The Director of the FBI commissioned a follow-up study to **DNA 1** in 1993 to “resolve the controversy [caused by the ceiling principle] and to answer any other questions that empirical work permitted such a study to address.”<sup>115</sup>

*The Evaluation of Forensic DNA Evidence* (hereafter **DNA 2**), was narrower in scope than **DNA 1**. It provided an update to the issue of population frequencies discussed in **DNA 1**. The report found the ceiling principle no longer necessary in calculating population frequencies and instead advocated a second method – the product rule.<sup>116</sup> It also recommended including ethnicity-specific calculations if the ethnic group of the perpetrator is known.<sup>117</sup>

The report acknowledged weaknesses in population data, especially where relatives are included in the suspect pool, and recommended special procedures be applied to account for this.<sup>118</sup> It also examined the need for courtroom actors to take into account limitations in DNA statistical calculations,<sup>119</sup> and focused on increasing the utility of the DNA database.<sup>120</sup> It recommended undertaking further research to strengthen statistical models<sup>121</sup> and changed the NAS’ position on

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<sup>113</sup> See, e.g., David H. Kaye, *DNA, NAS, NRC, DAB, RFLP, PCR and More: An Introduction to the Symposium on the 1996 NRC Report on Forensic DNA Evidence*, 37 JURIMETRICS 395; (1996-1997); L. Damon Whitmore, *The Admissibility of DNA Evidence in Criminal Proceedings*, 39 WAYNE L. REV. 1411, 1412 (1992-1993).

<sup>114</sup> CROW, *supra* note 65, at v-vi.

<sup>115</sup> *Id.*

<sup>116</sup> *Id.*, at 156.

<sup>117</sup> *Id.*, at 122.

<sup>118</sup> *Id.*, at 113.

<sup>119</sup> *Id.*, at Chapter 5.

<sup>120</sup> *Id.*, at 125.

<sup>121</sup> *Id.*, at 162.

error rates, recommending that errors should be addressed on a case-by-case basis and retesting should be used if there are concerns about a match.<sup>122</sup>

The high reliability of DNA evidence led to questions being raised about the reliability and validity of other, long-standing forensic science techniques. Ultimately, the NAS published four additional reports examining the scientific underpinning of further techniques. These four reports, *The Polygraph and Lie Detection* (2003); *Forensic Analysis: Weighing Bullet Lead Evidence* (2004); *Ballistic Imaging* (2008); and *Strengthening Forensic Science in the United States: A Path Forward* (2009) are outlined in sections (3)-(6).

### 3. *The Polygraph and Lie Detection* (2003)

Among the forensic science techniques questioned by the high reliability of DNA evidence,<sup>123</sup> polygraph testing soon became subject to considerable scrutiny.<sup>124</sup> Uncertainty about lie detection evidence was also spurred by states adopting the *Daubert* reliability-based admissibility framework and the rise of online publications challenging the reliability of polygraph testing.<sup>125</sup>

The Department of Energy commissioned the NAS to conduct a scientific inquiry into existing research underpinning polygraph testing<sup>126</sup> to determine its suitability for employment and pre-employment screening, conducted by the Department of Energy.<sup>127</sup> The report, *The Polygraph and Lie Detection* (hereafter *Polygraph*), reviewed the validity of polygraph evidence and concluded that there was little basis for claims of high accuracy.<sup>128</sup> *Polygraph* found that improvements in testing techniques would

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<sup>122</sup> *Id.*, at 86-87. Commentators have disagreed as to whether the NAS should have taken a more direct approach, with concerns that the recommended approach towards error rates had led to confusion and a higher risk of error post-1996, as error rates have rarely been discussed in the courtroom since *DNA 2*. Another major body of literature post-publication has responded to uncertainty surrounding the statistical significance of DNA. Many authors have shown concern that lawyers and juries misunderstand statistics, which has prevented their effective use. These authors have encouraged lawyers to gain a greater knowledge of statistics, and develop confidence in Bayesian analysis methods, to make best use of the significance of a DNA match and avoid incorrect assumptions.

<sup>123</sup> See generally, David L. Faigman, *Judges as Amateur Scientists*, 86 B.U.L. REV. 1207 (2006).

<sup>124</sup> FEINBERG, *supra* note 66, at xiii.

<sup>125</sup> *Id.*, at xiii.

<sup>126</sup> *Id.* This was carried out for the purposes of understanding the value of polygraphs during personnel security screening, as well as having potential applications for terrorism investigations if found sufficiently reliable.

<sup>127</sup> *Id.*

<sup>128</sup> *Id.*, at 212.

only produce modest improvements, as results are easily manipulated by countermeasures.<sup>129</sup> It did note, however, that emerging neuroscience-based techniques had potential to provide more accurate lie detection measurements, although research was in its infancy.<sup>130</sup>

#### **4. Forensic Analysis: Weighing Bullet Lead Evidence (2004)**

A 2002 publication written by several forensic science experts, including a former FBI metallurgist highlighted concerns about the reliability of Comparative Bullet Lead Analysis (CBLA).<sup>131</sup> CBLA was developed by the FBI in the mid-twentieth century as a tool to determine the source of bullet fragments found during criminal investigations.<sup>132</sup> To analyze CBLA, examiners compare the ratio between seven chemical elements, and conclude a match if the chemical make-up of two samples are sufficiently similar.<sup>133</sup>

First used following the assassination of President Kennedy,<sup>134</sup> the FBI was the sole laboratory that performed CBLA.<sup>135</sup> In response to the 2002 study, the FBI commissioned the NAS to examine the underlying principles of CBLA<sup>136</sup> to determine the optimal manner for conducting examinations.<sup>137</sup> The resulting report, *Forensic Analysis: Weighing Bullet Lead Evidence* (hereafter **Bullet Lead**), validated the FBI's methods of determining a CBLA match<sup>138</sup> and showed support for the admissibility of CBLA under *Daubert*,<sup>139</sup> provided that improvements in analysis techniques were implemented.<sup>140</sup> The report, however, did caution the FBI that the significance of a match lacked clarity.<sup>141</sup>

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<sup>129</sup> *Id.*, at 213.

<sup>130</sup> For a wider discussion of the potential admissibility of neuroscience-based lie detection, *See, e.g.*, Eric K. Gerard, *Waiting in the Wings - The Admissibility of Neuroimaging for Lie Detection*, 27 DEV. MENTAL HEALTH L. 1 (2008).

<sup>131</sup> Erik Randich, Wayne Duerfeldt, Wade McLendon & William Tobin, *A Metallurgical View of the Interpretation of Bullet Lead Compositional Analysis*, FORENSIC SCIENCE INTERNATIONAL 127 (2002).

<sup>132</sup> MACFADDEN, *supra* note 65, at 1.

<sup>133</sup> *Id.*, at 8.

<sup>134</sup> Paul C. Giannelli, *Daubert and Forensic Science: The Pitfalls of Law Enforcement Control of Scientific Research*, 2011 U. ILL. L. REV. 53, 81 (2011).

<sup>135</sup> William C. Thompson, *Analyzing the Relevance and Admissibility of Bullet-Lead Evidence: Did the NRC Report Miss the Target*, 46 JURIMETRICS 65, 66 (2005-2006).

<sup>136</sup> MACFADDEN, *supra* note 65, at 2.

<sup>137</sup> *Id.*

<sup>138</sup> *Id.*, at 107.

<sup>139</sup> *Id.*, at 100-101.

<sup>140</sup> *Id.*, at 107-108.

<sup>141</sup> *Id.*, at 109.

As a consequence, the FBI conducted its own internal review of CBLA, and in 2005, “after extensive study and consideration,”<sup>142</sup> it declared that it would “no longer conduct the examination of bullet lead”<sup>143</sup> due to costs associated with making the requisite improvements.<sup>144</sup>

### **5. *Ballistic Imaging (2008)***

The National Institute of Justice commissioned the NAS to assess the potential benefits of creating a computerized national ballistics database for aiding criminal investigations.<sup>145</sup> *Ballistic Imaging* (hereafter ***Ballistic Imaging***) examined ballistic imaging technology and existing databases<sup>146</sup> to assess potential future directions of the technology.<sup>147</sup> It concluded that a national database was not feasible,<sup>148</sup> as current technology could not distinguish individualization of bullet marks.<sup>149</sup> Instead, the report recommended the further exploration of alternative methods of firearms tracing.<sup>150</sup>

### **6. *Strengthening Forensic Science in the United States: A Path Forward (2009)***

In 2005,<sup>151</sup> Congress commissioned the NAS to report on the past, present and future of the forensic science community in the United States.<sup>152</sup> The report was designed to “chart an agenda for progress in the forensic science community and its scientific disciplines.”<sup>153</sup>

*Strengthening Forensic Science in the United States: A Path Forward* (hereafter ***Strengthening***) evaluated the status of the forensic science community and found the sector to be fragmented and under resourced,<sup>154</sup> limiting forensic science’s potential to serve stakeholders.<sup>155</sup> To remedy this, the

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<sup>142</sup> FBI National Press Office, [FBI Laboratory Announces Discontinuation of Bullet Lead Examinations](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations) (Sept. 1, 2005), <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations> (last visited Nov. 4, 2018).

<sup>143</sup> *Id.*

<sup>144</sup> *Id.*

<sup>145</sup> CORK, *supra* note 66, at 1-2.

<sup>146</sup> *Id.*, at 91.

<sup>147</sup> *Id.*, at 255.

<sup>148</sup> *Id.*, at 4-5.

<sup>149</sup> *Id.*, at 239.

<sup>150</sup> *Id.*, at 255.

<sup>151</sup> EDWARDS & GATSONIS, *supra* note 67, at 1.

<sup>152</sup> *Id.*, at xix.

<sup>153</sup> *Id.*, at xix.

<sup>154</sup> *Id.*, at 77-78.

<sup>155</sup> *Id.*

report recommended Congress create an independent oversight body to implement the report's recommendations.<sup>156</sup> Wider initiatives were also discussed and recommended, designed to improve standards and provide education across the sector.<sup>157</sup>

The report summarized various forensic science techniques' adherence to fundamental scientific principles.<sup>158</sup> This included: biological evidence;<sup>159</sup> drug and controlled substance analysis;<sup>160</sup> friction ridge analysis (fingerprints);<sup>161</sup> other pattern and impression evidence;<sup>162</sup> tool mark and firearms identification evidence;<sup>163</sup> microscopic hair evidence;<sup>164</sup> fiber evidence;<sup>165</sup> document examination ;<sup>166</sup> paint and coatings evidence;<sup>167</sup> explosives evidence and fire debris;<sup>168</sup> forensic odontology (bite impressions);<sup>169</sup> bloodstain pattern analysis;<sup>170</sup> and digital and multimedia analysis.<sup>171</sup> The NAS concluded that "with 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

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<sup>156</sup> *Id.*, at 80.

<sup>157</sup> *Id.*

<sup>158</sup> *Id.*, from 112.

<sup>159</sup> The report examined blood stain analysis, and other biological fluid evidence, concluding that nuclear DNA analysis is the most reliable way of attributing fluids to individuals, but other DNA analysis methods may also assist. As DNA developed through scientific methods, DNA analysis is highly reliable. *Id.*, at 128-133.

<sup>160</sup> The report demonstrated concerns that appropriate standards and recommendations are not followed, as these standards cover a range of drugs – it is the analyst's responsibility to decide the appropriate testing method. This is problematic as drug analysis reports are often inadequate. *Id.*, at 133-136.

<sup>161</sup> In acknowledging the utility of fingerprint analysis, the report refuted claims of a zero error rate. It found limited research supporting reliability of analysis techniques and individualization of prints, recommending further research. *Id.*, at 136-145.

<sup>162</sup> The report found experts find it difficult to avoid bias, and that the experience-reliant nature of impression matching rendered the imposition of universal standards difficult. Further research to understand the rarity of characteristics was recommended. *Id.*, at 145-150.

<sup>163</sup> In concluding, the report determined that not enough is known about tool mark variability, meaning that it is impossible to set a confidence level. It also showed concern about a lack of defined analysis process and difficulties with experts' qualitative reasoning. *Id.*, at 150-155.

<sup>164</sup> The report did not find any scientifically accepted statistics about frequency distribution of hair characteristics, and analysts' conclusions are often inaccurate, calling testimony "highly unreliable." *Id.*, at 155-161.

<sup>165</sup> No studies were found supporting methods of matching hair fibers, leaving a determination of a match ambiguous as to its probative value. *Id.*, at 161-163.

<sup>166</sup> The report concluded that the scientific basis of document examination needs strengthening, as limited research has been carried out. *Id.*, at 163-167.

<sup>167</sup> While based on solid foundation of chemistry, the report showed concerns about the lack of standard practices for determining a match of two samples. *Id.*, at 167-170.

<sup>168</sup> The report supported the chemistry-based foundations of explosives evidence, but found very little research into burn patterns, leaving expert opinions unsupported. *Id.*, at 170-173.

<sup>169</sup> The reliability of bite mark evidence was refuted, with the report rejecting the methods used by analysts to identify individuals based on dental impressions. In addition, no studies have been carried out supporting the use of this technique. *Id.*, at 173-176.

<sup>170</sup> Some aspects of bloodstain pattern analysis are supported by studies, but the technique is resource intensive, especially if analysts wish to provide causal links. *Id.*, at 177-179.

<sup>171</sup> The report acknowledges the emerging nature of this field, acknowledging its potential to collect vast amounts of information. The report recommended training amongst police officers. *Id.*, at 179-182.

connection between evidence and a specific individual or source.”<sup>172</sup> The NAS found that techniques vary in their reliability and underpinning research,<sup>173</sup> and that several techniques “do not contribute as much to criminal justice as they could.”<sup>174</sup>

Being careful not to comment on the admissibility of any forensic science techniques, the report discussed the criminal justice system’s reliance on forensic science.<sup>175</sup> It identified inadequacies in admissibility standards,<sup>176</sup> and discussed pertinent judicial dispositions of questions relating to several forensic science disciplines.<sup>177</sup> For example, the NAS discussed and criticized the judicially-assumed irrefutability of fingerprint evidence.<sup>178</sup> Additionally, it was particularly critical of the judiciary when carrying out a *Daubert* analysis, stating that “the present situation... is seriously wanting”<sup>179</sup> and that “*Daubert* has done little to improve the use of forensic science evidence in criminal cases.”<sup>180</sup>

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These six reports form a vehicle for this thesis. All have garnered responses from forensic science stakeholders, especially when findings have challenged existing forensic science practices. Responses have come from commissioning bodies, as well as wider stakeholders with an interest in the criminal justice system. These responses have been varied, and have also commented on subsequent measures

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<sup>172</sup> *Id.*, at 7.

<sup>173</sup> *Id.*, at 182.

<sup>174</sup> *Id.*, at 183.

<sup>175</sup> *Id.*, at 85.

<sup>176</sup> *Id.*, at 86-95.

<sup>177</sup> *Id.*, at 99-109.

<sup>178</sup> *Id.*, at 102-104.

<sup>179</sup> *Id.*, at 110.

<sup>180</sup> *Id.*, at 106.

taken by the FBI,<sup>181</sup> Department of Justice,<sup>182</sup> Congress,<sup>183</sup> and the President's Office.<sup>184</sup> Most notably, however, all six reports have received a response from legal actors. Within the legal system, lawyers and judges have made use of each of these six reports to varying degrees. The reference to these reports and impact on judicial decision-making is the focus of this study.

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Taking into account the unique background of the NAS, this thesis explores the ways in which appellate courts have referenced these six reports and used them as a tool to aid decision-making. These reports represent scientific progress, either through their exploration of novel and emerging techniques, or through a review and re-ordering of existing scientific research. The study posits that by examining the ways in which these reports are referenced in the criminal justice system – specifically through judicial decision-making – challenges within this intersection between law and science will become apparent. It argues that these difficulties arise due to the law's reliance on the legal process vision. Using the legal process vision as an analytical framework to carry out a review of all criminal appellate decisions published between 1992 and 2017 where one or more of these reports have been

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<sup>181</sup> Following **Bullet Lead**, the FBI discontinued its CBLA practices in September 2005 (FBI National Press Office, *supra* note 127), followed by a review of past cases that have relied on CBLA evidence (FBI National Press Office, [FBI Laboratory to Increase Outreach in Bullet Lead Cases](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases) (Nov. 17, 2007) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases> (last visited Nov. 4, 2019)). The FBI, in response to **Strengthening** and pressure from the Washington Post, undertook a review of cases where microscopic hair analysis has been used (FBI National Press Office, [FBI Testimony on Microscopic Hair Analysis Contained Errors in at least 90 Percent of Cases in Ongoing Review](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) (April 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> (last visited Nov. 4, 2019)).

<sup>182</sup> In 2013, the Department of Justice established the National Commission on Forensic Science. This was designed to research and implement reform within the forensic sciences (NATIONAL COMMISSION ON FORENSIC SCIENCE, [REFLECTING BACK – LOOKING TOWARD THE FUTURE](https://www.justice.gov/archives/ncfs), 3 (National Institute of Standards and Technology, U.S. Department of Commerce, 2017)). The Commission's charter expired in 2017 (The United States Department of Justice Archives, [National Commission on Forensic Science](https://www.justice.gov/archives/ncfs) <https://www.justice.gov/archives/ncfs> (last visited Nov. 4, 2019)).

<sup>183</sup> The National Academies have attributed the enactment of several pieces of legislation to the findings and recommendations of **Strengthening** (THE NATIONAL ACADEMY OF SCIENCES, ENGINEERING, MEDICINE, [Strengthening Forensic Science in the United States: A Path Forward](https://www.nap.edu/resource/12589/interactive/?utm_source=NASEM+News+and+Publications&utm_campaign=51e87760e5-Forensic_Science_Timeline_2019_04_24&utm_medium=email&utm_term=0_96101de015-51e87760e5-104918549&goal=0_96101de015-51e87760e5-104918549&mc_cid=51e87760e5&mc_eid=1d95e6da32) 2009-2019 [https://www.nap.edu/resource/12589/interactive/?utm\\_source=NASEM+News+and+Publications&utm\\_campaign=51e87760e5-Forensic\\_Science\\_Timeline\\_2019\\_04\\_24&utm\\_medium=email&utm\\_term=0\\_96101de015-51e87760e5-104918549&goal=0\\_96101de015-51e87760e5-104918549&mc\\_cid=51e87760e5&mc\\_eid=1d95e6da32](https://www.nap.edu/resource/12589/interactive/?utm_source=NASEM+News+and+Publications&utm_campaign=51e87760e5-Forensic_Science_Timeline_2019_04_24&utm_medium=email&utm_term=0_96101de015-51e87760e5-104918549&goal=0_96101de015-51e87760e5-104918549&mc_cid=51e87760e5&mc_eid=1d95e6da32). (last visited Nov. 4, 2019). In addition to this, legislation following other reports, including the DNA Identification Act 1994 (DNA Identification Act of 1994 42 U.S.C. §14132), was passed, following the findings of **DNA 1**.

<sup>184</sup> The President's Council of Advisors on Science and Technology published a report in 2016 reviewing action taken to reform the forensic science community since the publication of **Strengthening**. The report offered recommendations that judges limit the admissibility of the forensic science disciplines that the NAS found not to be based on scientific principles (EXECUTIVE OFFICE OF THE PRESIDENT, [PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY, FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE COMPARISON METHODS](https://www.eopd.gov/reports/forensic-science-in-criminal-courts) (Executive Office of the President Of The United States 2016)).

referenced, this thesis examines the extent of legal actors' – particularly judges – engagement with the six NAS reports and what they represent: progress within the forensic science community.

Part I presents the literature review to this thesis, highlighting gaps in current knowledge, and justifying the use of the legal process framework. In summary, the extant literature relevant to the thesis demonstrates widespread engagement with the six NAS reports, but there have been no studies exploring how these reports have been used in judicial decision-making over an extended period of time. This thesis seeks to fill the gap. To investigate this gap in the literature, the chapter provides an explanation of the analytical framework created by the author, used to find the data set and explore judicial fidelity to the legal process vision in decisions involving the interpretation of one of the six forensic science NAS reports.

Part II argues that the data set demonstrates judicial fidelity to the legal process vision, reaffirming several existing studies.<sup>185</sup> This is presented through four broad themes: (1) judicial reliance on the dominant role of precedent; (2) deference to institutional settlement (3) the pursuit of finality interests; and (4) fidelity to the rationality assumption. Within each, the author provides case law examples to demonstrate judicial fidelity to these legal process principles, including anomalies within the case law.

Part III discusses the findings and conclusions of this study. It discusses potential avenues for future research, designed to bridge the gap between law and science, and increase scientific literacy through the use of NAS report findings, alleviating tensions caused by scientific uncertainty. It offers suggestions for future research, designed to investigate the challenges faced by criminal justice actors, and recommends that the NAS should harness its unique position to direct future research into forensic science evidence and increase forensic science literacy.

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<sup>185</sup> See, Simon A. Cole, Gary Edmond, *Science without Precedent: The Impact of the National Research Council on the Admissibility and use of Forensic Science Evidence in the United States*, 4 BRIT. J. AM. LEGAL STUD. 585 (2015); Sarah Lucy Cooper, *Judicial Responses to Shifting Scientific Opinion in Forensic Identification Evidence and Newly Discovered Evidence Claims in the United States: The Influence of Finality and Legal Process Theory*, 4 BRIT. J. AM. LEGAL STUD. 649 (2015).

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The next chapter sets out the existing literature surrounding the six forensic science reports, identifying the gaps in the literature. Within this, it details the methods by which the literature was amassed and provides an explanation of the framework devised by the author to categorize and analyze the existing literature. It identifies the gap that this study seeks to fill, and then sets out the method used to generate the data set and explains the approach the author used to carry out analysis of this data.

## Part I

### Chapter 1: Review of Existing Literature Engaging with the Forensic Science NAS Reports

This section provides an overview of the extant literature relating to the six forensic science NAS reports. Section 1 sets out the method used to collate the corpus. Section 2 explains what themes emerged from the author's review of the corpus. Section 3 unpacks these themes in more detail, revealing the research gaps that remain, including those explored in this thesis. Section 4 sets out the author's research questions for addressing the specific gaps explored in this study.

#### **1. Devising a Research Method**

The author devised a research method to create a corpus of literature centered on the six reports. As this thesis sits within legal academic scholarship, the author sought to find legal scholarship commenting on these reports. This method was designed to be wide-reaching, to allow for the discovery of as many relevant articles as possible. The reports served as a starting point from which key search terms were drawn. These key terms were input into legal databases for retrieval. In addition to the six report titles, the author identified between twelve and fifteen additional search terms from each of the reports. Key terms were identified as either chapter headings or important issues identified by the NAS in the reports. A full list of search terms can be found in Appendix A. Each term was input alongside the title of the relevant report (and spelling variants) into several standard and comprehensive legal scholarship databases, namely, HeinOnline, LexisLibrary and Westlaw International.<sup>1</sup>

Although this method was designed to be wide in scope, it was restricted to articles published between 1992 and 2017. This covers the first twenty-five years following the publication of the first report, *DNA 1*, which includes the publication of all six reports, and the several years following their

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<sup>1</sup> The author observed that legal academic literature commenting on *Bullet Lead* often referred to national news media. In response to this, a search was carried out using Nexis on the report's title. This generated over 50 news print sources discussing *Bullet Lead* and CBLA evidence.

publication. This time frame also reflects the data set, which reviews decisions made between 1992 and 2017.

## 2. Findings from the Extant Literature

This research method generated approximately 1,100 articles. The majority of these articles cited either *DNA 1*, *DNA 2*, or *Strengthening*, although the other three reports still appear in a significant number of citations. A detailed breakdown of the number of citations are as follows:

<b>Number of Articles Relating to Each of the Six Forensic Science NAS Reports</b>	
<i>DNA Technology in Forensic Science (1992)</i>	278
<i>The Evaluation of Forensic DNA Evidence (1996)</i>	206
<i>The Polygraph and Lie Detection (2003)</i>	82
<i>Forensic Analysis: Weighing Bullet Lead Evidence (2004)</i>	111, comprising 68 academic articles and 43 news articles
<i>Ballistic Imaging (2008)</i>	34
<i>Strengthening Forensic Science in the United States: A Path Forward (2009)</i>	391

Amongst these articles, very few offer a direct analysis of a report.<sup>2</sup> The literature is more reflective of the use of the reports where they have been used to inform other areas of discussion around forensic science. Examples where the NAS reports have informed areas of discussion include: the lack of judicial understanding of scientific evidence,<sup>3</sup> and concerns about the post-*Melendez-Diaz*

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<sup>2</sup> For an example of an article providing a direct criticism of a NAS report, see, Kenneth R. Kreiling, *DNA Technology in Forensic Science, Review Commentary*, 33 JURIMETRICS J. 449 (1992-1993). This article critiques the findings and recommendations of *DNA 1*.

<sup>3</sup> See, e.g., David L. Faigman, *Judges as Amateur Scientists*, 86 B. U. L. REV. 1207 (2006).

interpretation of the Sixth Amendment Confrontation Clause.<sup>4</sup> Aside from articles citing **DNA 1** and **DNA 2** together,<sup>5</sup> relatively few engage with more than one report.

The subjects reviewed in existing literature are wide ranging, and the reports are used in a variety of different ways. One recurring theme across the literature is the role of the judge in interpreting forensic science evidence. Within this, several authors have discussed the limitations of legal actors' understanding of forensic science evidence,<sup>6</sup> but relatively few authors have investigated why such limitations exist. Two examples of studies that have sought to explore the reasoning behind the limitations in judicial decision-making have done so in response to **Strengthening**. The first is Cole and Edmond's *Science Without Precedent: The Impact of the National Research Council on the Admissibility and use of Forensic Science Evidence in the United States*, which highlights the importance of legal framing when interpreting NAS report findings,<sup>7</sup> arguing that it acts as a barrier to law's interpretation of science.<sup>8</sup> A second example, Cooper's *Judicial Responses to Shifting Scientific Opinion in Forensic Identification Evidence and Newly Discovered Evidence Claims in the United States: The Influence of Finality and Legal Process Theory*, is more explicit in finding that fidelity to the legal process vision has side-lined claims of newly discovered evidence when **Strengthening** has been referenced.<sup>9</sup>

In addition to discussions surrounding the relationship between forensic science evidence and the judiciary, the literature also discusses challenges faced by government departments in implementing change. Within this, the FBI and Department of Justice's challenges in ensuring high laboratory standards and preventing wrongful convictions are discussed,<sup>10</sup> which can be contrasted against other

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<sup>4</sup> See, e.g., Paul C. Giannelli, *Confrontation, Experts, and Rule 703*, 20 J. L. & POL'Y 443 (2011-2012).

<sup>5</sup> See, e.g., Jonathan J. Koehler, *Proficiency Tests to Estimate Error Rates in the Forensic Sciences*, 12 LAW PROB. & RISK 89 (2013).

<sup>6</sup> See, e.g., Erica Beecher-Monas, *Blinded by Science: How Judges Avoid the Science in Scientific Evidence*, 71 TEMP. L. REV. 55 (1998); Jane Campbell Moriarty, *Will History be Servitude: the NAS Report of Forensic Science and the Role of the Judiciary* 2010 UTAH L. REV. 299 (2010).

<sup>7</sup> Simon A. Cole & Gary Edmond, *Science Without Precedent: The Impact of the National Research Council on the Admissibility and use of Forensic Science Evidence in the United States* 4 BRIT. J. AM. LEGAL STUD. 585, 616-617 (2015).

<sup>8</sup> *Id.*, at 617.

<sup>9</sup> Sarah Lucy Cooper, *Judicial Responses to Shifting Scientific Opinion in Forensic Identification Evidence and Newly Discovered Evidence Claims in the United States: The Influence of Finality and Legal Process Theory*, 4 BRIT. J. AM. LEGAL STUD. 649, 688 (2015).

<sup>10</sup> Edward J. Ungvarsky, *Remarks on the Use and Misuse of Forensic Science to Lead to False Convictions*, 41 NEW ENG. L. REV. 609 (2006-2007).

discussions, including the constitutional limits on gun control.<sup>11</sup> As the literature reflects such a wide spectrum of interest, the author made the decision to create a thematic framework through which the literature could be analyzed.

### **3. Creating a Lens through which to View the Existing Literature**

As the scope of the existing literature is particularly wide, the author devised a thematic approach to analyzing and organizing it. After reviewing each item, the author created four overarching themes reflecting the make-up of the literature, within which each article was placed. Each was further divided into a number of sub-themes, reflecting the diversity of topics explored. The themes and sub-themes show areas where NAS reports have informed legal conversations. As the themes mirror the content of the literature, it has become apparent that three reports, *DNA 1*, *DNA 2*, and *Strengthening* are featured far more heavily in the literature than *Polygraph*, *Bullet Lead*, and *Ballistic Imaging*.

The themes are set out as follows:

#### **1. Tensions between Science and the Law**

- a. The Law's Perception of Science
- b. Methodological Limitations of Forensic Science Techniques
- c. Reforming the Law's Approach to Forensic Science

#### **2. Admissibility and Judicial Gatekeeping**

- a. Admissibility
- b. Judicial Gatekeeping

#### **3. The Role of Courtroom Actors and Criminal Justice Stakeholders**

- a. Courtroom Actors
  - i. The Judiciary
  - ii. Lawyers

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<sup>11</sup> See, Lauren Hirsh, *Brothers in Arms Control: Introducing Australian-Style Gun Control in the United States*, 12 MACQUARIE L. J. 81 (2013).

- iii. Testifying Experts
- iv. Juries
- b. Criminal Justice Stakeholders
  - i. The FBI
  - ii. Forensic Science Laboratories
  - iii. Educational Institutions
  - iv. Presidential Action
  - v. Legislative Provisions
  - vi. Media

#### 4. Constitutional Issues

- a. Tracing Firearms and the Second Amendment
- b. DNA Evidence, Privacy, and the Fourth Amendment
- c. Forensic Science, the Protection Against Self Incrimination, and the Fifth Amendment
- d. **Strengthening** and the Confrontation Clause

These themes have been chosen to reflect the breadth of the literature. They also highlight several gaps in knowledge. The existing literature, in general, does not provide a direct criticism of the NAS reports themselves and their influence on government bodies and criminal justice stakeholders. A major theme in the literature, in particular, explores the arguments surrounding judicial decision-making in terms of the admissibility of forensic science evidence, but such discussions do not always discuss this in relation to case law, and do not assess the judicial reference to NAS report findings and recommendations. The themes also discuss the limitations of actors' abilities to respond to the NAS reports, but seldom offer justifications for this. In addition, there lacks a holistic study assessing the influence of multiple NAS reports on judicial decision-making.

The next section unpacks these themes to reveal research gaps.

## 1. Tensions Between Science and the Law

This theme discusses the challenges faced by legal actors when interpreting science in a legal setting. When discussed in existing literature, the six NAS reports are used by authors to demonstrate scientific research and progress. Authors have examined how legal actors have interpreted these NAS reports, particularly concentrating efforts on areas where the reports have questioned long-held assumptions about the reliability of forensic science techniques<sup>12</sup> and refuted current practices.<sup>13</sup> Sub-theme (a) discusses the law's perception of science and the impact of the innocence movement on non-DNA evidence,<sup>14</sup> showing concern that the lack of research underpinning certain forensic science techniques has had little impact on the admissibility of this evidence.<sup>15</sup> Following this, concerns about the methodological limitations of forensic science techniques are examined under sub-theme (b), especially in relation to DNA evidence and techniques analyzed in **Strengthening**. Sub-theme (c) explores how the probative value of forensic science can be increased, examining commentary that discusses the feasibility of a federal oversight mechanism, as recommended in **Strengthening** and implemented by the Department of Justice.

### a. The Law's Perception of Science

The literature, on the whole, demonstrates concern for the law's tendency to be blindly guided by the presence of scientific evidence. For example, Judge Edwards, co-chair of the committee that prepared and published **Strengthening**, admitted that prior to the NAS inquiry, he had "no skepticism regarding the forensic science community" and "assumed... that the forensic science disciplines are well grounded in scientific methodology."<sup>16</sup>

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<sup>12</sup> See, HARRY T. EDWARDS & CONSTANTINE GATSONIS, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 7* (National Academies Press 2009).

<sup>13</sup> STEPHEN E. FEINBERG, *THE POLYGRAPH AND LIE DETECTION 212* (National Academies Press 2003).

<sup>14</sup> See, e.g., Bruce A. Macfarlane, *Wrongful Convictions: Is it Proper for the Crown to Root Around, Looking for Miscarriages of Justice*, 36 *MAN. L. J.* 1 (2012-2013).

<sup>15</sup> See, e.g., Keith A. Findley, *Innocence Protection in the Appellate Process*, 93 *MARQ. L. REV.* 591, 605 (2009-2010).

<sup>16</sup> Harry T. Edwards, *The National Academy of Sciences Report on Forensic Science: What it Means for the Bench and Bar*, 51 *JURIMETRICS* 1, 3 (2010-2011).

This assumption, and the perception that forensic science is highly reliable, has been commented on frequently in the literature.<sup>17</sup> It has made use of the NAS reports (particularly *Strengthening*) to dispel this assumption and demonstrate limitations of forensic science techniques, particularly fingerprint technology.<sup>18</sup> Scholars have indicated and encouraged legal actors to engage with the content of the NAS reports as a tool to educate themselves on the limitations of forensic science techniques.<sup>19</sup>

The literature has consistently identified the strong scientific foundations of DNA evidence and its high reliability as the primary driver for discovering limitations within other forensic science techniques. This is commonly demonstrated through literature discussing the effect of the American Innocence Movement and DNA evidence's undermining of traditional forensic science techniques.<sup>20</sup> Scholars have argued that DNA evidence's high reliability has, in turn, undermined longstanding assumptions and the perception that traditional forensic science techniques – particularly fingerprint evidence – are infallible.<sup>21</sup> The literature also sets the perception of forensic science and its limitations within the wider context of additional factors contributing to miscarriages of justice, with several authors tempering the conversation, arguing that misinterpretations and misleading perceptions of forensic science are only one of several contributory factors to miscarriages of justice.<sup>22</sup> These authors have recommended that improved practices and education in forensic science will to help resolve the current dissonance between forensic science and legal actors' understanding of its probative value.<sup>23</sup>

The wrongful conviction literature that demonstrates the increased reliability of DNA evidence over traditional forensic science techniques often presents DNA evidence as a catalyst for a culture-shift in

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<sup>17</sup> See, e.g., Richard H. Underwood, *Evaluating Scientific and Forensic Evidence*, 24 AM. J. TRIAL ADVOC. 149 (2000-2001).

<sup>18</sup> See, e.g., Jacqueline McMurtrie, *Swirls and Whorls: Litigating Post-Conviction Claims of Fingerprint Misidentification after the NAS Report*, 2010 UTAH L. REV. 267 (2010).

<sup>19</sup> Jacqueline A. Goodwin & Lirieka Meintjes-Van Der Walt, *The Use of DNA Evidence in South Africa: Powerful Tool or Prone to Pitfalls*, 114 S. AFRICAN L. J. 151, 172 (1997).

<sup>20</sup> See, e.g., Macfarlane, *supra* note 14.

<sup>21</sup> See, e.g., Craig M. Cooley & Gabriel S. Overfield, *Increasing Forensic Evidence's Reliability and Minimizing Wrongful Convictions: Applying Daubert Isn't the Only Problem*, 43 TULSA L. REV. 285 (2007-2008).

<sup>22</sup> Jon B. Gould and Richard A. Leo have identified seven major causes of wrongful convictions: 1) mistaken eyewitness identification, 2) false confessions, 3) tunnel vision, 4) informant testimony, 5) imperfect forensic science, 6) prosecutorial misconduct, and 7) inadequate defense representation. See, Jon B. Gould & Richard A. Leo, *One Hundred Years Later: Wrongful Convictions after a Century of Research*, 100 J. CRIM. L. & CRIMINOLOGY 825, 841 (2010).

<sup>23</sup> *Id.*

scientific knowledge, which has undermined traditional forensic science practices. A case study approach has often been used, with scholars frequently citing three examples of wrongful convictions: the case of Todd Willingham, which demonstrates the progress of thought in relation to arson indicators and “fire science;”<sup>24</sup> the Brandon Mayfield affair, which raised questions about fingerprint evidence;<sup>25</sup> and the exoneration of Ray Krone, which shows the fundamental limitations of forensic odontology.<sup>26</sup> These examples have raised considerable awareness of the limitations of forensic science, undermining traditional perceptions. However, the literature indicates that few changes have been made to reduce the impact of these unsupported forensic science techniques,<sup>27</sup> with authors merely noting progress in reducing wrongful convictions attributed to other factors,<sup>28</sup> namely false confession evidence and mistaken eyewitness identification.<sup>29</sup>

As misguided perceptions exist, particularly amongst lawyers and judges, of the infallibility/high reliability of forensic science, a section of the literature is devoted to addressing this through education measures. Lawyers and judges have been encouraged to make use of available tools to thoroughly investigate the reliability of forensic science techniques when conducting admissibility hearings under *Daubert* and Federal Rule 702.<sup>30</sup> The literature also discusses the judicial reluctance to undertake thorough *Daubert* reviews, by relying on assumptions that evidence is sufficiently reliable.<sup>31</sup> Authors have focused on channeling the findings of the NAS reports as a means to challenge the admissibility of forensic science disciplines. They have largely focused on one forensic science technique,<sup>32</sup> demonstrating that current judicial approaches to forensic science remain entrenched in

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<sup>24</sup> See, e.g., Paul C. Giannelli, *Junk Science and the Execution of an Innocent Man*, 7 N. Y. U. J. L. & LIBERTY 221 (2013).

<sup>25</sup> David Chandler, *The Reliability and Admissibility of Fingerprint and Bitemark Analyses*, 32 BUFF. PUB. INT. L. J. 41 (2013-2014).

<sup>26</sup> *Id.*

<sup>27</sup> See, e.g., Findley, *supra* note 15, at 605.

<sup>28</sup> See, e.g., Millar W. Shealy Jr., *The Hunting of Man: Lies, Damn Lies, and Police Interrogations*, 4 U. MIAMI RACE & SOC. JUST. L. REV. 21 (2014).

<sup>29</sup> Brandon L. Garrett, *Introduction: New England Law Review Symposium on Convicting the Innocent*, 46 NEW ENG. L. REV. 671, 671 (2011-2012).

<sup>30</sup> See, e.g., Cooley & Overfield, *supra* note 21.

<sup>31</sup> Edward Imwinkelried, *Coming to Grips with Scientific Research in Daubert's Brave New World: The Courts' Need to Appreciate the Evidentiary Differences between Validity and Proficiency Studies*, 61 BROOK L. REV. 1247 (1995).

<sup>32</sup> See, e.g., J. R. H. Law, *Cherry-Picking Memories: Why Neuroimaging-Based Lie Detection Requires a New Framework for the Admissibility of Scientific Evidence under FRE 702 and Daubert*, 14 YALE L. J. & TECH. 1 (2011).

the misguided perception that forensic science evidence is highly reliable and does not need rigorous scrutiny when making admissibility decisions.<sup>33</sup>

#### **b. Methodological Limitations of Forensic Science Techniques**

A second part of the literature discussing the disconnect between science and the law focuses on encouraging legal actors to gain an appreciation for the methodological limitations of forensic science techniques. This is most notably seen through comments surrounding the fast-paced technical advances in DNA analysis throughout the 1990s. The technological developments in DNA analysis were so substantial that four years after *DNA 1* was published, the NAS issued a follow up report – *DNA 2*. This led the academic community to comment on the changing analysis methods used by DNA analysts, their benefits, and limitations.<sup>34</sup> In particular, complexities of DNA statistical calculations have been recognized in the literature, with several authors encouraging juror education to assist their understanding of complexities in statistical calculations and the limitations of DNA methodologies.<sup>35</sup> Furthermore, several prominent authors including Kaye<sup>36</sup> and Koehler,<sup>37</sup> have each published multiple articles calling for greater transparency as to the methodological limitations of both DNA evidence and traditional, non-DNA forensic science, through recommending that methodological limitations be calculated by using a statistical analysis framework akin to DNA calculations. Kaye, in particular, has been critical of approaches taken by forensic science analysts, and has encouraged analysts to show greater clarity in their work.<sup>38</sup> His work has also criticized the NAS' suggested approach in *Bullet Lead* that CBLA evidence be accompanied by a statistical calculation, arguing that it would not provide

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<sup>33</sup> *Id.*

<sup>34</sup> See, the debate surrounding the admissibility of the product rule versus the ceiling principle. *E.g.*, Jennifer Callahan, *The Admissibility of DNA Evidence in the United States and England*, 19 SUFFOLK TRANSNATIONAL LAW REVIEW 537 (1995-1996).

<sup>35</sup> Matthew Goode, *Some Observations on Evidence of DNA Frequency*, 23 ADEL. L. REV. 45, 45 (2002).

<sup>36</sup> See, *e.g.*, David H. Kaye, *DNA Evidence: Probability, Population Genetics and the Courts*, 7 HARV. L. J. & TECH. 101 (1993-1994); David H. Kaye, *Rounding up the Usual Suspects: A Legal and Logical Analysis of DNA Trawling Cases*, 87 N. C. L. REV. 425 (2008-2009).

<sup>37</sup> See, *e.g.*, Koehler, *supra* note 5; Jonathan J. Koehler, *Why DNA Likelihood Ratios Should Account for Error (Even When A National Research Council Report Says They Should Not)*, 37 JURIMETRICS 425 (1996-1997).

<sup>38</sup> David H. Kaye, *The NRC Bullet-Lead Report: Should Science Committees Make Legal Findings?*, 46 JURIMETRICS 91, 105 (2005-2006).

sufficient information about the probative value of CBLA evidence.<sup>39</sup> More generally, following **Strengthening**, legal academics have urged forensic science experts to make the limitations of forensic science techniques clear, through abandoning individualization claims<sup>40</sup> and providing more information regarding the methodological and scientific limitations of the relevant forensic science technique.<sup>41</sup> While this subsection of the literature concentrates on ensuring transparency around the limitations of forensic science analysis methods, it also highlights difficulties in translating scientific principles, such as error rates and “scientific certainty” to a legal audience.<sup>42</sup> In exploring potential ways to present this evidence, the literature has sought to improve legal actors’ understanding of the limitations of forensic science evidence, arguing that by doing so, its probative value is increased.<sup>43</sup>

### c. Reforming the Law’s Approach to Forensic Science

In an attempt to raise awareness of the limitations of forensic science evidence, several commentators have discussed areas where the law has modified its approach to certain forensic science techniques – either directly or indirectly – in response to the publication of a NAS report. This is particularly seen in relation to microscopic hair analysis, as well as additional changes made following **Strengthening’s** recommendations.

**Strengthening** presented a blunt criticism of many traditional forensic science techniques, including microscopic hair analysis. Following its criticism that the technique was “highly unreliable,”<sup>44</sup> the FBI embarked on a collaborative review of cases.<sup>45</sup> Following this, several authors have commented on

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<sup>39</sup> *Id.*, at 97.

<sup>40</sup> David H. Kaye, *Probability, Individualisation, and Uniqueness in Forensic Science Evidence - Listening to the Academies*, 75 BROOK. L. REV. 1163, 1173 (2010).

<sup>41</sup> *Id.*

<sup>42</sup> Vern L. Walker, *Theories of Uncertainty: Explaining the Possible Sources of Error in Inferences*, 22 CARDOZO L. REV. 1523 (2000-2001).

<sup>43</sup> Jonathan J. Koehler, *On Conveying the Probative Value of DNA Evidence: Frequencies, Likelihood Ratios and Error Rates*, 67 U. COLO. L. REV. 859 (1996).

<sup>44</sup> Edwards & Gatsonis, *supra* note 12, at 161.

<sup>45</sup> FBI National Press Office, *FBI Testimony on Microscopic Hair Analysis Contained Errors in at least 90 Percent of Cases in Ongoing Review* (April 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> (last visited Nov. 4, 2019).

the progress of this review.<sup>46</sup> Using this review as an example, numerous authors have encouraged stakeholders to review their use of forensic science, encouraging the introduction of monitoring and oversight mechanisms to minimize human error and direct funding towards affected areas.<sup>47</sup> Recommendations for oversight mechanisms have been designed to improve reliability and increase the probative value of forensic science evidence.

Authors have praised the NAS' recommendation in *Strengthening* that a federal oversight body would assist in raising standards in the forensic science community and provide greater consistency in expert testimony.<sup>48</sup> Regret has also been expressed for the lack of requisite funding to maximize effective oversight mechanisms,<sup>49</sup> with critics recognizing that state level mechanisms have instead provided effective oversight.<sup>50</sup> While there lacks consensus in how forensic science oversight should be delivered, the literature is in agreement that a mechanism is necessary to ensure high standards<sup>51</sup> and a national approach to research.<sup>52</sup> The Department of Justice's efforts in creating a federal oversight body, the (now disbanded) National Commission on Forensic Science, received a mixed response by commentators,<sup>53</sup> while the National Institute of Standards and Technology's Forensic Science Center of Excellence has been praised.<sup>54</sup>

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<sup>46</sup> See, e.g., Valena Elizabeth Beety, *Cops in Lab Coats and Forensics in the Courtroom*, 13 OHIO ST. J. CRIM. L. 543, 551 (2015-2016).

<sup>47</sup> See, e.g., Juan Hinojosa & Lynn Garcia, *Improving Forensic Science through State Oversight: The Texas Model*, 91 TEX. L. REV. SEE ALSO 19 (2012).

<sup>48</sup> See, e.g., Jessica D. Gabel & Ashley D. Champion, *Regulating the Science of Forensic Evidence: A Broken System Requires a New Federal Agency*, 90 TEX. L. REV. SEE ALSO 19 (2011-2012); Simon A. Cole, *Acculturating Forensic Science: What is Scientific Culture, and How Can Forensic Science Adopt It*, 38 FORDHAM URB. L. J. 435, 436 (2010-2011).

<sup>49</sup> Eric Moloney, *Two More Problems and Too Little Money: Can Congress Truly Reform Forensic Science*, 14 MINN. J. L. SCI. & TECH. 923, 942 (2013).

<sup>50</sup> See, Hinojosa & Garcia, *supra* note 47.

<sup>51</sup> Jennifer E. Laurin, *Criminal Law's Science Lag: How Criminal Justice Meets Changed Scientific Understanding*, 93 TEX. L. REV. 1751, 1767 (2014-2015).

<sup>52</sup> Sandra Guerra Thompson & Nicole Bremner Casarez, *Building the Infrastructure for Justice Through Science: The Texas Model*, 119 W. VA. L. REV. 711, 720 (2016-2017).

<sup>53</sup> See, Jonathan J. Koehler & John B. Meixner, Jr., *An Empirical Research Agenda for the Forensic Sciences*, 106 J. CRIM. L. & CRIMINOLOGY 1 (2016); *c.f.*, Jules Epstein, *The National Commission on Forensic Science: Impactful or Ineffectual?*, 48 SETON HALL L. REV. 743 (2018).

<sup>54</sup> Valena Elizabeth Beety, *Identifying the Culprit in Wrongful Convictions*, 82 TENN. L. REV. 975, 984 (2014-2015).

Further measures following *Strengthening's* recommendations have generally been considered inadequate by scholars in facilitating the reforms recommended in the report.<sup>55</sup> For example, although funding has been created to make improvements to non-DNA forensic science techniques,<sup>56</sup> the literature promotes the provision of additional funding, especially for research.<sup>57</sup> Commentators have shown support for the 2016 follow-up investigation carried out by the President's Council of Advisors on Science and Technology (PCAST),<sup>58</sup> which recommended further research and restrictions to the admissibility of certain forensic science evidence techniques.<sup>59</sup> Despite the PCAST report enjoying a positive reception from critics,<sup>60</sup> there exists much disappointment in the lack of government funding available to improve the probative value of forensic science in line with the findings of the PCAST report.<sup>61</sup>

## 2. Admissibility and Judicial Gatekeeping

A section of the literature discusses the admissibility of forensic science evidence in criminal legal proceedings and the ability of trial judges to effectively carry out their role when making admissibility decisions. *DNA 1* and *DNA 2* are often used as examples to discuss the benefits and disadvantages of the *Frye* and *Daubert* admissibility frameworks, particularly the judicial gatekeeping role under *Daubert* and judges' alleged inability to adequately assess the admissibility of forensic science under Federal Rule of Evidence 702. This literature also raises concerns about the admissibility of many forensic science techniques, including those examined in *Strengthening*, *Bullet Lead*, and *Polygraph*.

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<sup>55</sup> Erin Murphy, *What Strengthening Forensic Science Today Means for Tomorrow: DNA Exceptionalism and the 2009 NAS Report*, 9 LAW, PROB. & RISK 7, 15 (2010).

<sup>56</sup> Paul Coverdell National Forensic Sciences Improvement Act 42 U. S. C. § 3045 *et seq.* (2000); Justice for All Act H.R.5107 (2004).

<sup>57</sup> Craig M. Cooley, *Nurturing Forensic Science: How Appropriate Funding and Government Oversight Can Further Strengthen the Forensic Science Community*, 17 TEX. WESLEYAN L. REV. 441, 448 (2010-2011).

<sup>58</sup> Brandon L. Garrett, *The Crime Lab in the Age of the Genetic Panopticon*, 115 MICH. L. REV. 979, 993-994 (2016-2017).

<sup>59</sup> EXECUTIVE OFFICE OF THE PRESIDENT, PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY, FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE COMPARISON METHODS (Executive Office of the President Of The United States 2016).

<sup>60</sup> See, e.g., Eric S. Lander, *THE PHILIP D. REED LECTURE SERIES ADVISORY COMMITTEE ON EVIDENCE RULES: 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 (2018).

<sup>61</sup> Garrett, *supra* note 58, at 993-994.

### a. Admissibility

The admissibility of all forensic science techniques examined across the six NAS reports has been discussed at length in existing literature. In particular, a body of literature has focused on the ways that these reports have informed judicial decision-making practices, especially in relation to the admissibility of DNA evidence.

The first report, **DNA 1**, was published to answer questions raised by judges relating to the admissibility of DNA evidence.<sup>62</sup> The report supported the admissibility of DNA evidence prepared using certain methods, and has largely been supported by academic commentary.<sup>63</sup> The surrounding literature teases out issues emerging following the report's publication, including the admissibility of the PCR analysis technique,<sup>64</sup> the product rule method of statistical analysis,<sup>65</sup> and concerns about the overly conservative nature of the ceiling principle, recommended by **DNA 1**.<sup>66</sup>

Several of the issues raised in commentary following **DNA 1** were subsequently addressed by the NAS in **DNA 2**. This report has been generally supported by critics for its role in clarifying the admissibility of the product rule and PCR analysis.<sup>67</sup> However, there exists a subsection within this body of literature which has criticized **DNA 2** for not addressing further issues that may affect the admissibility of DNA evidence,<sup>68</sup> especially in relation to how error rates should be interpreted.<sup>69</sup>

Similarly, a body of literature has also responded to the findings in **Strengthening** that several forensic science techniques lack validity. More specifically, critics have questioned the longstanding

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<sup>62</sup> VICTOR A. MCKUSICK, *DNA TECHNOLOGY IN FORENSIC SCIENCE* vii (National Academies Press 1992).

<sup>63</sup> See, William C. Thompson, *Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the "DNA War"*, 84 J. CRIM. L. & CRIMINOLOGY 22, 42-51 (1993-1994).

<sup>64</sup> See, e.g., Karla K. Hotis, *The Admissibility of PCR-Based DNA Evidence: State v. Lyons*, 37 JURIMETRICS 495 (1996-1997).

<sup>65</sup> See, e.g., Richard A. Nakashima, *DNA Evidence in Criminal Trials: A Defense Attorney's Primer*, 74 NEB. L. REV. 444 (1995).

<sup>66</sup> See, e.g., Richard Lempert, *DNA, Science and The Law: Two Cheers for the Ceiling Principle*, 36 JURIMETRICS J. 193 (1993-1994); cf. David H. Kaye, *DNA, NAS, NRC, DAB, RFLP, PCR and More: An Introduction to the Symposium on the 1996 NRC Report on Forensic DNA Evidence*, 37 JURIMETRICS 395 (1996-1997).

<sup>67</sup> See, George Bundy Smith & Janet A. Gordon, *The Admission of DNA Evidence in State and Federal Courts*, 65 FORDHAM L. REV. 2465 (1996-1997).

<sup>68</sup> James M. Curran, *An Introduction to Bayesian Credible Intervals for Sampling Error in DNA Profiles*, 4 LAW PROB. & RISK 115 (2005).

<sup>69</sup> *Id.*

admissibility of several forensic science techniques, including: bite marks,<sup>70</sup> fingerprints,<sup>71</sup> and fire and arson indicators.<sup>72</sup> Following the criticisms laid out in *Strengthening*, several authors have supported the exclusion of these techniques, arguing that they lack demonstrable reliability (as required by *Daubert*).<sup>73</sup> They have also expressed disappointment about the lack of impact that *Strengthening's* findings have had on the admissibility of the forensic science techniques.<sup>74</sup>

A forensic science discipline where a NAS report and subsequent action taken by government bodies has had a marked impact on admissibility is CBLA evidence. Critics have commentated on and followed these admissibility changes. For example, Thompson expressed disappointment that *Bullet Lead* did not recommend that CBLA be inadmissible under *Daubert*,<sup>75</sup> viewing the report as a missed opportunity.<sup>76</sup> However, the subsequent actions of the FBI in discontinuing CBLA have been supported.<sup>77</sup> Thompson argued that the publication of *Bullet Lead* removed the general acceptance of CBLA evidence, rendering it inadmissible.<sup>78</sup> Commentators have highlighted several court decisions which have used *Bullet Lead* to find CBLA evidence inadmissible, which they have argued represents a turning point in rejecting the admissibility of CBLA evidence.<sup>79</sup>

The 2003 report, *Polygraph*, has also led to considerable discussions challenging the admissibility of lie detection evidence. Polygraph evidence has generally been inadmissible since *Frye*,<sup>80</sup> so scholarship has focused on the emerging techniques recognized in *Polygraph* to discuss ways in which this lie

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<sup>70</sup>See, Adam Deitch, *An Inconvenient Tooth: Forensic Odontology is an Inadmissible Junk Science When it is Used to Match Teeth Marks to Bitemarks in Skin*, 2009 WIS. L. REV. 1205 (2009).

<sup>71</sup> See, Gary Edmond, *What Lawyers Should Know about the Forensic Sciences*, 36 ADEL. L. REV. 33 (2015).

<sup>72</sup> Caitlin M. Plummer & Imran J. Syed, *Shifted Science and Post-Conviction Relief*, 8 STAN. J. C. R. & C. L. 259 (2012).

<sup>73</sup> Gary Edmond, Simon Cole, Emma Cunliffe & Andrew Roberts, *Admissibility Compared: The Reception of Incriminating Expert Evidence (I.E Forensic Science) in Four Adversarial Jurisdictions*, 3 U. DENV. CRIM. L. REV. 31, 109 (2013).

<sup>74</sup> David E. Bernstein & Eric G. Lasker, *Defending Daubert: It's Time to Amend Federal Rule of Evidence 702*, 57 WM. & MARY L. REV. 1, 48 (2015-2016).

<sup>75</sup> William C. Thompson, *Analyzing the Relevance and Admissibility of Bullet-Lead Evidence: Did the NRC Report Miss the Target*, 46 JURIMETRICS 65, 83 (2005-2006).

<sup>76</sup> *Id.*

<sup>77</sup> *Id.*, at 85.

<sup>78</sup> *Id.*

<sup>79</sup> See *e.g.*, *More v. State*, 880 N.W.2d 487 (Iowa 2016); *State v. Behn*, 375 N.J.Super. 409 (N.J. Super. 2005).

<sup>80</sup> *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

detection technology can satisfy admissibility criteria.<sup>81</sup> Further literature has also identified other potential admissibility challenges for lie detection technology, including discussions surrounding its compatibility with the Federal Rules of Evidence.<sup>82</sup>

### **b. Judicial Gatekeeping**

One year after the publication of *DNA 1*, the United States Supreme Court adopted the *Daubert* admissibility standard.<sup>83</sup> The *Daubert* framework requires trial judges to make admissibility decisions based on an evaluation of the proffered evidence, examining: error rates, professional standards, general acceptance, testability, and peer review.<sup>84</sup> This changed the responsibility for determining admissibility away from “the relevant scientific community,”<sup>85</sup> and onto trial judges, making them gatekeepers of scientific evidence.

Forensic science evidence, particularly DNA evidence in the early 1990s, has been used by commentators as an example to discuss the application of the *Daubert* framework.<sup>86</sup> More generally, concerns have been raised in relation to the judicial failure to exclude unreliable evidence.<sup>87</sup> These failures have been noted particularly in the criminal application of *Daubert*, with Giannelli voicing concerns about the civil-criminal divide, having found a greater level of scrutiny in civil cases.<sup>88</sup>

A large body of literature has analyzed the general judicial hesitancy to embrace the *Daubert* admissibility criteria. Initial commentary resisted *Daubert*, defending *Frye*’s general acceptance test,<sup>89</sup>

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<sup>81</sup> See, Zachary E. Shapiro, *Truth, Deceit and Neuroimaging: Can Functional Magnetic Resonance Imaging Serve as a Technology-Based Method of Lie Detection*, 29 HARVARD J. L. & TECH. 527, 528-529 (2015-2016).

<sup>82</sup> Mark Pettit Jr., *fMRI and BF Meet FRE: Brain Imaging and the Federal Rules of Evidence*, 33 AM. J. L. & MED. 319, 333 (2007).

<sup>83</sup> *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

<sup>84</sup> *Id.*

<sup>85</sup> *Frye*, 293 F.

<sup>86</sup> See, e.g., Margaret A. Berger, *Procedural Paradigms for Applying the Daubert Test*, 78 MINN. L. REV. 1345 (1993-1994).

<sup>87</sup> William C. Thompson, *The National Research Council’s Plan to Strengthen Forensic Science: Does the Path Forward Run Through The Courts*, 50 JURIMETRICS 35, 39-40 (2009-2010).

<sup>88</sup> See, Paul C. Giannelli, *The Supreme Court’s Criminal Daubert Cases*, 33 SETON HALL L. REV. 1071 (2002-2003).

<sup>89</sup> See, e.g., Paul B. Tyler, *Evidence*, 22 PEPP. L. REV. 1274 (1994-1995).

but states' adoption of *Daubert*<sup>90</sup> resulted in increased academic support throughout the 1990s.<sup>91</sup> Following ***Strengthening***, scholars have encouraged judges to use *Daubert* to challenge and exclude longstanding evidence that lacks demonstrable reliability.<sup>92</sup> Internationally, commentators have discussed and supported reform towards a *Daubert*-style admissibility framework in several common law jurisdictions, including Australia,<sup>93</sup> Canada,<sup>94</sup> and the United Kingdom.<sup>95</sup>

Although *Daubert* has now widely been adopted by states, the surrounding literature has also acknowledged difficulties inherent within the flexible nature of the *Daubert* framework.<sup>96</sup> As part of this, commentators have encouraged programs to develop judicial literacy in scientific matters, particularly highlighting the need for judicial awareness of ***Strengthening***'s finding that many forensic science techniques lack reliability.<sup>97</sup>

Wider studies examining *Daubert* post-***Strengthening*** have directly criticized judicial interpretations of forensic science evidence,<sup>98</sup> finding that *Daubert* and ***Strengthening*** have had little impact on admissibility practices.<sup>99</sup> They have shown concern that "institutional concerns and legal framing tend to pre-dominate use and interpretations"<sup>100</sup> of forensic science evidence, acknowledging the disconnect between scientific evidence and legal actors' engagement with forensic science, especially in relation to judicial gatekeeping.<sup>101</sup>

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<sup>90</sup> Heather G. Hamilton, *The Movement from Frye to Daubert: Where do the States Stand?*, 38 JURIMETRICS 201, 209 (1997-1998).

<sup>91</sup> Paul C. Giannelli, *Forensic Symposium: The Use and Misuse of Forensic Evidence* 28 OKLA. CITY U. L. REV. 1, 7-13 (2003). In this article, Giannelli offers an explanation as to why the *Frye* admissibility standard has been superseded by the *Daubert* admissibility framework.

<sup>92</sup> Paul C. Giannelli, *Daubert and Forensic Science: The Pitfalls of Law Enforcement Control of Scientific Research*, 2011 U. ILL. L. REV. 53, 61-63 (2011).

<sup>93</sup> Gary Edmond, *The Science of Miscarriages of Justice*, 37 U. N. S. W. L. J. 376, 391 (2014).

<sup>94</sup> See, Emma Cunliffe & Gary Edmond, *Gatekeeping in Canada: Mis-Steps in Assessing the Reliability of Expert Testimony*, 92 CAN. B. REV. 327 (2013), which provides an overview of the role of reliability in Canadian evidence law.

<sup>95</sup> THE LAW COMMISSION, CONSULTATION PAPER NO 190: THE ADMISSIBILITY OF EXPERT EVIDENCE IN CRIMINAL PROCEEDINGS IN ENGLAND AND WALES: A NEW APPROACH TO THE DETERMINATION OF EVIDENTIARY RELIABILITY (The Law Commission 2009).

<sup>96</sup> Edmond, *supra* note 93, at 391.

<sup>97</sup> Cooper, *supra* note 9, at 664-673.

<sup>98</sup> See, e.g., Cole & Edmond, *supra* note 7; Cooper, *supra* note 9, Jules Epstein, *Looking Backwards at Old Cases: When Science Moves Forward*, 106 J. CRIM. L. & CRIMINOLOGY 49 (2016).

<sup>99</sup> Gary Edmond & Kent Roach, *A Contextual Approach to the Admissibility of the State's Forensic Science and Medical Evidence*, 61 U. TORONTO L. J. 343, 357-358 (2011).

<sup>100</sup> Cole & Edmond, *supra* note 7, at 616.

<sup>101</sup> *Id.*, at 617.

### 3. The Role of Courtroom Actors and Stakeholders

The third theme within the literature discusses the responses of courtroom actors and wider stakeholders to the NAS reports and the challenges that these actors face. Sub-theme (a) examines the challenges that courtroom actors face in interpreting forensic science evidence. Sub-theme (b) explores wider stakeholders' responses to the reports, particularly **Bullet Lead** and **Strengthening**.

#### a. Courtroom Actors

**Strengthening** itself raised the issue of the legal system's restricted ability to address the limitations of forensic science evidence, stating that "the legal system is ill-equipped to correct the problems of the forensic science community."<sup>102</sup> A body of legal scholarship has explored this in further detail, discussing the challenges faced by courtroom actors when assessing scientific evidence.<sup>103</sup> In the literature's exploration of the disconnect between the NAS reports as a scientific authority and courtroom actors' understanding of forensic science evidence – namely judges, lawyers, experts, and juries – it further demonstrates the disconnect between law and science.

#### i. The Judiciary

In connection with concerns across the literature regarding the judicial ability to carry out their gatekeeping function under *Daubert*,<sup>104</sup> the literature has questioned the judicial practice of merely paying lip service to *Daubert*. In particular, following **Strengthening**, a number of authors have criticized the judicial practice of admitting forensic science techniques that lack a solid scientific underpinning.<sup>105</sup> Within this, the literature has highlighted the role of the judiciary and discussed the difficulties they face when engaging with forensic science evidence.

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<sup>102</sup> EDWARDS & GATSONIS, *supra* note 12, at 53.

<sup>103</sup> Anthony J. Casey & Julia Simon-Kerr, *A Simple Theory of Complex Valuation*, 113 MICH. L. REV. 1175, 1177 (2015).

<sup>104</sup> See, e.g., Beth A. Riffe, *The Aftermath of Melendez: Highlighting the Need for Accreditation-Based Rules of Admissibility for Forensic Evidence*, 27 T. M. COOLEY L. REV. 165, 176 (2010).

<sup>105</sup> Cooper, *supra* note 9, at 664-673.

More specifically, concerns have been raised that judges lack the requisite scientific expertise to carry out their gatekeeping role. There is, however, disagreement as to the reasons for this. Several critics have blamed the judiciary for failing to engage in scientific research (most notably **Strengthening**),<sup>106</sup> but others have identified complexities within the decision-making process that make reliability and admissibility decisions difficult.<sup>107</sup> Regardless, this body of work encourages judges to engage in the scientific evidence underpinning forensic science and pursue a formal scientific education.<sup>108</sup> Authors have encouraged judges to make use of all available resources, including employing the seldom-used independent expert mechanism, found under Federal Rule of Evidence 706.<sup>109</sup>

Further, **Strengthening** raised concerns about bias within the judiciary.<sup>110</sup> Following this, literature has particularly focused on judges' bias in favor of admissibility under *Daubert*. Authors have explored the effects of both conscious and subconscious bias on decision-making, finding that bias helps judges to create a coherent narrative.<sup>111</sup> Studies have shown that judges use different facts as anchors when making sentencing decisions, creating inconsistencies in the reasoning behind decision-making.<sup>112</sup> These studies have also discussed the prevalence of subconscious bias amongst judges, warning that bias can damage a thorough evaluation of forensic science evidence.<sup>113</sup> They have also highlighted the presence of confirmation bias in appellate decision-making, preventing the discovery of error.<sup>114</sup>

Judges themselves have provided reflections about their decision-making role and the judicial interpretation of forensic science. Judge Edwards, co-chair of the **Strengthening** committee, has discussed how **Strengthening** dispelled his own prior beliefs about the forensic sciences.<sup>115</sup> His

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<sup>106</sup> *Id.*

<sup>107</sup> Joseph Sanders, *Utterly Ineffective: Do Courts have a Role in Improving the Quality of Forensic Expert Testimony*, 38 *FORDHAM URB. L. J.* 547, 547 (2010-2011).

<sup>108</sup> Edward K. Cheng, *Independent Judicial Research in the Daubert Age*, 56 *DUKE L. J.* 1263, 1273-1274 (2006-2007).

<sup>109</sup> *FED. R. EVID.* 706.

<sup>110</sup> EDWARDS & GATSONIS, *supra* note 12, at 184-185.

<sup>111</sup> Emma Cunliffe, *Judging, Fast and Slow: Using Decision-Making Theory to Explore Judicial Fact Determination*, 18 *INT'L J. EVIDENCE & PROOF* 139, 145 (2014).

<sup>112</sup> Sherry Nakhaeizadeh, Itiel E. Dror & Ruth M. Morgan, *The Emergence of Cognitive Bias in Forensic Science and Criminal Investigations*, 4 *BRIT. J. AM. LEGAL STUD* 527, 536 (2015).

<sup>113</sup> David E. Bernstein, *The Misbegotten Judicial Resistance to the Daubert Revolution*, 89 *NOTRE DAME L. REV.* 27, 31 (2013-2014).

<sup>114</sup> Findley, *supra* note 15, at 605.

<sup>115</sup> Edwards, *supra* note 16, at 8.

reflections, accompanied by those of retired Federal District Judge, Judge Gertner, express optimism about the increased scientific evidence made available to the judiciary.<sup>116</sup> They have argued that embracing scientific research will create stronger judicial decisions,<sup>117</sup> and have encouraged judges to make use of scientific research.<sup>118</sup> In particular, Judge Gertner has encouraged judges to use NAS report findings when making admissibility decisions under *Daubert*, even during post-conviction decisions.<sup>119</sup> Judge Shelton has also commented on the role of the judiciary, and has discussed the general failures of the criminal justice system and the challenges and opportunities that forensic science brings to the judiciary.<sup>120</sup> His work has provided an insight into the difficulties of making admissibility decisions in relation to several forensic science techniques,<sup>121</sup> and has explained the changing relationship between judge and jury at trial.<sup>122</sup>

These judges have taken a proactive approach to analyzing forensic science, but these accounts contrast against case law-based studies which have examined decision-making following ***Strengthening***. Studies focusing on the admissibility of fingerprint evidence post-***Strengthening*** have recommended that judges take greater notice of challenges faced by other courtroom actors, providing assistance to jurors where necessary.<sup>123</sup> A study by Cole and Edmond has concluded that the judicial reluctance to engage with ***Strengthening's*** findings has limited the impact of the report.<sup>124</sup>

In contrast, other authors have claimed that the impact of DNA exonerations and the American Innocence Movement has undermined finality in post-conviction proceedings.<sup>125</sup> These studies use examples of DNA exonerations to raise further questions about judicial certainty and the reliability of

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<sup>116</sup> Nancy Gertner, *National Academy of Sciences Report: A Challenge to the Courts*, 27 CRIM. JUST. 8 (2012-2013).

<sup>117</sup> Edwards, *supra* note 16, at 8.

<sup>118</sup> *Id.*

<sup>119</sup> See generally, Gertner, *supra* note 116.

<sup>120</sup> Donald E. Shelton, *Twenty-First Century Forensic Science Challenges for Trial Judges in Criminal Cases: Where the Polybutadiene Meets the Bitumen*, 18 WIDENER L. J. 309 (2008-2009).

<sup>121</sup> *Id.*

<sup>122</sup> *Id.*, at 312-370.

<sup>123</sup> See generally, Sarah Lucy Cooper, *Challenges to Fingerprint Identification Evidence: Why the Courts need a New Approach to Finality*, 42 MITCHELL HAMLINE L. REV. 756 (2016).

<sup>124</sup> Cole & Edmond, *supra* note 7, at 616-617.

<sup>125</sup> Brandon L. Garrett, *Claiming Innocence*, 92 MINN. L. REV. 1629, 1630-1631 (2007-2008).

forensic science, especially in areas where science has shifted. This is most notable in studies examining the changing research surrounding arson indicators<sup>126</sup> and shaken baby evidence.<sup>127</sup>

## ii. Lawyers

Alongside scrutiny of the judiciary, the literature has also examined the role of lawyers, and the importance of their understanding of scientific evidence, as their presentation of evidence is important in assisting decision-makers' analysis and understanding of evidence. The literature echoes the criticism of judges' scientific understanding,<sup>128</sup> and has suggested that lawyers lack a coherent understanding of forensic science and associated limitations,<sup>129</sup> leading to evidence being inaccurately presented to decision-makers at trial.<sup>130</sup> As such, the literature has encouraged lawyers to use the NAS reports' findings to inform their practices.<sup>131</sup>

While it is generally agreed amongst scholars that lawyers' lack of scientific knowledge has also impeded other actors' understanding of forensic science evidence, the potential causes examined in the literature are diverse. It has been argued that the adversarial system does not provide sufficient support to lawyers,<sup>132</sup> and that lawyers' lack of scientific knowledge is particularly problematic due to the way that the adversarial system requires evidence to be presented,<sup>133</sup> although several authors have encouraged lawyers to educate themselves in scientific principles and processes, so that they can better present forensic science evidence to decision-makers.<sup>134</sup>

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<sup>126</sup> See, e.g., Thomas R. May, *Fire Pattern Analysis, Junk Science, Old Wives Tales, and Ipse Dixit: Emerging Forensic 3D Imaging Technologies to the Rescue*, 16 RICH. J. L. & TECH. 1 (2009-2010).

<sup>127</sup> Plummer & Syed, *supra* note 72, at 267, 271.

<sup>128</sup> See, Erica Beecher-Monas, *The Heuristics of Intellectual Due Process: A Primer for Triers of Science*, 75 N. Y. U. L. REV. 1563 (2000). This article examines the challenges for judges and lawyers when understanding scientific issues.

<sup>129</sup> Michael J. Saks, *Merlin and Solomon: Lessons from the Law's Formative Encounters with Forensic Identification Science*, 49 HASTINGS L. J. 1069, 1136 (1997-1998).

<sup>130</sup> Literature has demonstrated many cases whereby lawyers have made decisions on the forensic sciences without showing an understanding of the relevant technology, See, e.g., Caitlin M. Plummer & Imran J. Syed, *Criminal Procedure v Scientific Progress: The Challenging Path to Post-Conviction Relief in Cases that Arise During Periods of Shifts in Science*, 41 VT. L. REV. 279 (2016-2017).

<sup>131</sup> Barry C. Scheck, *DNA and Daubert*, 15 CARDOZO L. REV. 1959, 1962 (1993-1994).

<sup>132</sup> See generally, Epstein, *supra* note 98.

<sup>133</sup> *Id.*

<sup>134</sup> See, Kate Cashman & Terese Henning, *Lawyers and DNA: Issues in Understanding and Challenging the Evidence*, 24 CURRENT ISSUES CRIM. JUST. 6 (2012-2013).

The literature suggests that the public defender system and the pressures placed on defense lawyers have also contributed to lawyers' lack of understanding of forensic science evidence. Concerns have been raised about defense lawyers' lack of funding and limited resources, and as a consequence, successful defense-led claims are rare.<sup>135</sup> The literature has identified underfunding of defense lawyers as a major barrier to effective case management and truth discovery.<sup>136</sup> This has led critics to blame the success and widespread use of the public defender system for these funding shortages.<sup>137</sup> However, this opinion is not shared by all, with others dismissing this argument as simplistic, believing that wider failings have prevented the public defender system from adequately providing for indigent defendants and appellants.<sup>138</sup> Many authors have found the inequality between parties a barrier to the discovery of truth within forensic science. They have suggested that the adversarial system has reversed the burden of proof, leaving defense counsel to prove "reasonable doubt" by introducing counter-evidence.<sup>139</sup> It has been argued that prosecutors have abused their expertise by controlling case content,<sup>140</sup> and by instructing experts to be vague about the limitations of their evidence discipline.<sup>141</sup> Prosecutors have also been accused of working too closely with investigators.<sup>142</sup> All this has led to calls for greater prosecutorial regulation.<sup>143</sup>

### iii. Testifying Experts

The literature also discusses the role of scientific experts in the trial process. It is particularly focused around two main areas of concern: errors in testimony, and expert bias. Since the 1992 publication of

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<sup>135</sup> Jules Epstein, *Preferring the Wise Man to Science: The Failure of Courts and Non-Litigation Mechanisms to Demand Validity in Forensic Matching Testimony*, 20 WIDENER L. REV. 81, 96 (2014).

<sup>136</sup> Keith A. Findley, *Adversarial Inquisitions: Rethinking the Search for the Truth*, 56 N. Y. L. SCH. REV. 911, 914 (2011-2012).

<sup>137</sup> Laurence A. Benner, *The California Public Defender: Its Origins, Evolution and Decline*, 5 CAL. LEGAL HIST. 173, 207-208 (2016).

<sup>138</sup> Laurel Gilbert, *Sharpening the Tools of an Adequate Defense: Providing For Appointment of Experts for Indigent Defendants in Child Death Cases under Ake v. Oklahoma*, 50 SAN DIAGO L. REV. 469, 488 (2013).

<sup>139</sup> Edward J. Ungvarsky, *supra* note 10, at 613.

<sup>140</sup> See generally, Laurie L. Levenson, *The Problem with Cynical Prosecutor's Syndrome: Rethinking A Prosecutor's Role in Post-Conviction Cases*, 20 BERKELEY J. CRIM. L. 335 (2015).

<sup>141</sup> Jonathan J. Koehler, *If the Shoe Fits They Might Acquit: The Value of Forensic Science Testimony*, 8 J. EMPIRICAL LEGAL STUD. 21, 42 (2011).

<sup>142</sup> See generally, Keith A. Findley, *Judicial Gatekeeping of Suspect Evidence: Due Process and Evidentiary Rules in the Age of Innocence*, 47 GA. L. REV. 723 (2012-2013).

<sup>143</sup> *Id.*

**DNA 1**, experts have come under scrutiny by the NAS, with **DNA 1** recommending an independent advisory committee to oversee developments in DNA technology and ensure high standards amongst experts.<sup>144</sup> **Strengthening** also raised concerns about experts, showing concern about exaggerated testimony<sup>145</sup> and encouraging experts to focus on the scientific principles underpinning their area of expertise.<sup>146</sup> Following this criticism, authors have recommended that experts do not testify to 100% certainty in areas that lack adequate scientific underpinning, particularly firearm and fingerprint evidence,<sup>147</sup> but include more information on the methodological limitations of these techniques.<sup>148</sup>

Following **Strengthening**, commentators have also drawn attention to the subconscious biases of experts,<sup>149</sup> particularly government-employed analysts.<sup>150</sup> Studies have shown concern for motivational bias, which can lead to inaccuracies in analysis results.<sup>151</sup> To act as a balance against this, commentators have encouraged judges to make greater use of court-appointed experts,<sup>152</sup> to ensure that evidence is of a high standard and lacks party bias.<sup>153</sup>

When discussing party bias, commentators have explored the effect that expert biases may have on the decisions made by judges and juries.<sup>154</sup> Commentators have supported the adoption of inquisitorial-inspired principles,<sup>155</sup> in the belief that decision-makers would better understand the probative value of forensic science evidence.<sup>156</sup> By addressing concerns about reliability and expert

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<sup>144</sup> McKUSICK, *supra* note 62, at 72.

<sup>145</sup> EDWARDS & GATSONIS, *supra* note 12, at 4.

<sup>146</sup> *Id.*, at 10.

<sup>147</sup> Paul C. Giannelli, *The NRC Report and its Implications for Criminal Litigation*, 50 JURIMETRICS 53, 57-58 (2009-2010).

<sup>148</sup> See, e.g., Simon A. Cole, *Forensics Without Uniqueness, Conclusions Without Individualization: The New Epistemology of Forensic Identification*, 8 LAW, PROB. & RISK 233 (2009).

<sup>149</sup> Parisa Dehghani-Tafti & Paul Bieber, *Folklore and Forensics: The Challenges of Arson Investigation and Innocence Claims*, 119 W. VA. L. REV. 549, 581-584 (2016).

<sup>150</sup> David E. Bernstein, *Expert Witnesses, Adversarial Bias, and the (Partial) Failure of the Daubert Revolution*, 93 IOWA L. REV. 451, 456 (2007-2008).

<sup>151</sup> Jennifer E. Laurin, *Quasi-Inquisitorialism: Accounting for Deference in Pretrial Criminal Procedure*, 90 NOTRE DAME L. REV. 786, 796-797 (2014).

<sup>152</sup> Justin Sevier, *Redesigning the Science Court*, 73 MD. L. REV. 770, 816 (2013-2014).

<sup>153</sup> Christopher Slobogin, *Lessons from Inquisitorialism*, 87 S. CAL. L. REV. 699, 706 (2014).

<sup>154</sup> See, David E. Bernstein, *supra* note 113, at 31.

<sup>155</sup> See generally, Laurin, *supra* note 151.

<sup>156</sup> Keith A. Findley, *To Walk in Their Shoes: The Problem of Missing, Misunderstood, and Misrepresented Context in Judging Criminal Confessions*, 56 N. Y. L. SCH. REV. 911, 913 (2011-2012).

bias, this commentary has aligned with the principles behind *Strengthening's* recommendation that federal oversight is necessary to ensure and increase reliability amongst experts.<sup>157</sup>

#### iv. Jurors

Alongside other courtroom actors, several studies have concentrated on jurors' interpretation of forensic science evidence and the role of the NAS reports in assisting jurors' understanding. Mock juror studies have routinely been used to explore typical juror engagement with forensic science evidence and testifying experts.

Several articles have explored jurors' understanding of forensic science, finding that jurors are easily influenced by testifying experts.<sup>158</sup> Studies have focused on their understanding of DNA evidence and have recommended that the NAS reports, namely *DNA 1* and *DNA 2*, should be used to explain the research status of relevant disciplines.<sup>159</sup> They have encouraged data to be presented in accessible formats, so that jurors can better understand its significance.<sup>160</sup> Other studies have found that jurors use statistics merely as an indicative measure,<sup>161</sup> questioning the utility of a thorough explanation of statistical calculations. These studies have also examined jurors' perceptions of scientific experts, finding that jurors assume expert witness neutrality.<sup>162</sup> This has sparked concern for jurors' unconscious bias when making decisions.<sup>163</sup> These combined findings have led others to suggest that jurors do not sufficiently understand the complexities within forensic science evidence, particularly DNA, and have offered alternatives to traditional jury trials when scientific evidence is complex, with authors exploring the potential value of science-qualified juries.<sup>164</sup>

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<sup>157</sup> Paul C. Giannelli, *Independent Crime Laboratories: The Problem of Motivational and Cognitive Bias*, 2010 UTAH L. REV. 247, 251 (2010).

<sup>158</sup> Chandler, *supra* note 25, at 37, 43, 56 (2013-2014).

<sup>159</sup> Mike Redmayne, *Presenting Probabilities in Court: The DNA Experience*, 1 INT'L J. EVIDENCE & PROOF 187, 189 (1996-1997).

<sup>160</sup> See, e.g., Samuel Lindsey et al., *Communicating Statistical DNA Evidence*, 43 JURIMETRICS 147, 148 (2002-2003).

<sup>161</sup> Jonathan Kahn, *Race, Genes and Justice - A Call to Reform the Presentation of Forensic DNA Evidence in Criminal Trials*, 74 BROOK. L. REV. 325, 341 (2008-2009).

<sup>162</sup> See, Bernstein, *supra* note 150, at 455.

<sup>163</sup> *Id.*

<sup>164</sup> Note, *Confronting the New Challenges of Scientific Evidence*, 108 HARV. L. REV. 1481, 1583-1605 (1995).

Concerns about jurors' understanding of forensic science is not confined to DNA evidence. Following *Polygraph*, concerns about jurors' capacity to understand lie detector evidence has been discussed by opponents of lie detection techniques. Authors have argued that polygraph results (and other lie detection methods) would likely have an undue influence on jurors,<sup>165</sup> and have advocated using Federal Rule of Evidence 403 – which allows evidence to be excluded if its probative value may be outweighed by prejudice, confusion, waste of time, or other reasons<sup>166</sup> – should the evidence meet reliability-based admissibility standards.<sup>167</sup>

Another approach that studies have taken when examining jury decision-making has been to examine the influence of television programs. This has been fueled by the rise in popularity of criminal dramas throughout the 2000s that portrayed forensic science evidence as infallible and opened the debate as to a possible “CSI effect,” which posits that jurors are influenced by the media’s portrayal of forensic science.<sup>168</sup> Mock juror studies<sup>169</sup> have largely been inconclusive about any potential undue media influence,<sup>170</sup> with skeptics attributing changing expectations amongst jurors to increased technology in the public’s lives, dubbed the “tech effect.”<sup>171</sup>

#### **b. Criminal Justice Stakeholders**

Wider actors with an interest in the forensic sciences and criminal justice have equally been observed and studied by commentators. The major stakeholders discussed in the literature have been identified by the author as: the FBI, laboratories, educational institutions, the Obama presidential administration, Congress and state legislatures, and the media.

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<sup>165</sup> Pettit, *supra* note 82, at 331-332.

<sup>166</sup> FED. R. EVID. 403.

<sup>167</sup> Pettit, *supra* note 82, at 331-332.

<sup>168</sup> See, Craig M. Cooley, *The CSI Effect: Its Impact, and Potential Concerns*, 41 NEW ENG. L. REV. 471 (2006-2007).

<sup>169</sup> See, e.g., Shelton, *supra* note 120.

<sup>170</sup> Edward J. Imwinkleried, *Dealing with Supposed Jury Preconceptions about the Significance of the Lack of Evidence: The Difference between the Perspective of the Policymaker and that of the Advocate*, 27 T. M. COOLEY L. REV. 37, 45 (2010).

<sup>171</sup> See, e.g., Kathleen Keough Griebel, *Fred Zain, the CSI Effect, and a Philosophical Idea of Justice: Using West Virginia as a Model for Change*, 114 W. VA. L. REV. 1155 (2012).

## i. The FBI

The FBI has been scrutinized in the literature due to its close connection with several of the NAS reports, having commissioned *DNA 2*,<sup>172</sup> *Bullet Lead*,<sup>173</sup> and provided funding for *DNA 1*.<sup>174</sup> Therefore, in the reports, several findings and recommendations were specifically directed towards the FBI,<sup>175</sup> as well as further general recommendations also being relevant to its practices. In general, the literature has followed the FBI's actions in discontinuing CBLA following *Bullet Lead*, but has also commented on the FBI's resistance to change and criticism following the publication of NAS reports.

In response to the publication of *Bullet Lead*, the FBI's practices of carrying out CBLA were particularly scrutinized, especially in the media. Initially following the report, the media heavily criticized the FBI for not immediately discontinuing CBLA.<sup>176</sup> Further media criticism following the FBI's 2005 decision to discontinue CBLA was designed to expose the FBI's failure to re-investigate closed cases.<sup>177</sup>

The media has also informed academic literature, and widespread coverage of laboratory scandals and misconduct<sup>178</sup> has resulted in calls for the FBI to be subjected to external scrutiny.<sup>179</sup> Commentators have regularly criticized the FBI's culture of secrecy,<sup>180</sup> as it directly conflicts with the principles of openness and collaboration at the heart of the scientific method.<sup>181</sup>

Further criticism of FBI practices has taken a broader approach. In response to *Strengthening*, many critics have demonstrated concern for FBI scientific practices, finding that its policies do not follow best practice. The literature has identified the FBI's failure to both ensure high standards across its

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<sup>172</sup> JAMES F. CROW, *THE EVALUATION OF FORENSIC DNA EVIDENCE*, iv-v (National Academies Press 1995).

<sup>173</sup> KENNETH O. MACFADDEN, *FORENSIC ANALYSIS: WEIGHING BULLET LEAD EVIDENCE*, ix (National Academies Press 2004).

<sup>174</sup> MCKUSICK, *supra* note 62, at vii-viii.

<sup>175</sup> This was especially the case after the publication of *Bullet Lead*, as CBLA evidence was exclusively used by the FBI.

<sup>176</sup> INEWS Network CNN, *Global Broadcast Database*, Jan. 13, 2005.

<sup>177</sup> CBS, *Evidence of Injustice*, YOUTUBE (Sep. 14, 2008) <https://www.youtube.com/watch?v=H4g62cpRz7M> (last visited, Nov. 4, 2019).

<sup>178</sup> William C. Thompson, *Accepting Lower Standards: The National Research Council's Second Report on Forensic DNA Evidence*, 37 *JURIMETRICS* 405, 408 (1996-1997).

<sup>179</sup> *Id.*, at 409.

<sup>180</sup> Paul C. Giannelli, *Wrongful Convictions and Forensic Science: The Need to Regulate Crime Labs*, 86 *N. C. L. Rev.* 163 (2007-2008).

<sup>181</sup> Garrett, *supra* note 58, at 987.

laboratories<sup>182</sup> and identify mistakes.<sup>183</sup> Following **Strengthening**, the FBI has been criticized for failing to review its forensic science practices. It has been accused of “undercutting efforts”<sup>184</sup> to establish empirical support for fingerprint evidence,<sup>185</sup> and in 2010, Koehler wrote of his disappointment in the FBI’s lack of engagement with the content of the report.<sup>186</sup> However, it has been noted that the FBI has made some concessions in the years following the publication of **Strengthening**, especially in undertaking a review of microscopic hair analysis.<sup>187</sup>

## ii. Forensic Science Laboratories

Several NAS reports have dedicated specific chapters/recommendations to ensuring high standards in laboratories. For example, **Strengthening** showed concern for laboratories’ inability to detect fraud<sup>188</sup> (demonstrated through several high-profile scandals<sup>189</sup>), and **DNA 1** discussed high standards in DNA analysis.<sup>190</sup> These concerns are echoed in the literature,<sup>191</sup> with authors believing that standards can only be improved once laboratories are removed from the pressures of law enforcement.<sup>192</sup>

The literature has long called for laboratory independence,<sup>193</sup> but **Strengthening** emboldened this voice<sup>194</sup> tabling further benefits of laboratory independence. Academic research has suggested that independence will reduce analysts’ confirmation bias<sup>195</sup> and susceptibility to investigator bias.<sup>196</sup>

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<sup>182</sup> Ungvarsky, *supra* note 10.

<sup>183</sup> *Id.*, at 615.

<sup>184</sup> Giannelli, *supra* note 180, at 208.

<sup>185</sup> *Id.*

<sup>186</sup> Jonathan J. Koehler, *Forensic Science Reform in the 21st Century: A Major Conference, a Blockbuster Report and Reasons to be Pessimistic*, 9 LAW, PROB. & RISK 1, 3-4 (2010).

<sup>187</sup> Beety, *supra* note 54, at 988.

<sup>188</sup> EDWARDS & GATSONIS, *supra* note 12, at 183-184.

<sup>189</sup> *Id.*

<sup>190</sup> McKusick, *supra* note 62, at 44-48.

<sup>191</sup> For a summary of the Fred Zain affair, *see, e.g.*, Kathleen Keough Griebel, *supra* note 171, from 1182.

<sup>192</sup> *See*, Paul C. Giannelli, *The Abuse of Scientific Evidence in Criminal Cases: The Need for Independent Crime Laboratories*, 4 VA. J. SOC. POL’Y & L. 439 (1996-1997).

<sup>193</sup> *Id.*

<sup>194</sup> EDWARDS & GATSONIS, *supra* note 12, at 183-184.

<sup>195</sup> Giannelli, *supra* note 157.

<sup>196</sup> Dehghani-Tafti & Bieber, *supra* note 149, at 575-576.

Authors have also recommended supplementing laboratory independence with mandatory high standards, achieved through laboratory accreditation<sup>197</sup> and blind testing procedures.<sup>198</sup>

Several authors have also discussed the funding status of laboratories. It has been identified that crime laboratories suffer from chronic underfunding,<sup>199</sup> and suggestions have advocated federal legislation to make increased funding available to support all forensic science disciplines.<sup>200</sup> This would provide for equal support and funding for both DNA and non-DNA initiatives.<sup>201</sup> In addition, greater funding would provide for increased stability within laboratories,<sup>202</sup> and would contribute to reducing staff turnover, improving salaries, and improved access to state-of-the-art equipment.<sup>203</sup>

### iii. Educational Institutions

Following *Strengthening*, a general conversation about the quality of forensic science education has opened the whole of forensic science education to scrutiny. As such, colleges and universities have been identified as having an important role in ensuring high standards, as university programs provide the foundations for training forensic scientists.<sup>204</sup> While undergraduate programs in forensic science are currently popular,<sup>205</sup> they have been criticized for inconsistencies in teaching standards and inadequacies in training.<sup>206</sup> To improve standards, the literature suggests that universities provide more research opportunities for forensic science students,<sup>207</sup> particularly at postgraduate level.<sup>208</sup> Mnookin et al. have commended existing postgraduate programs,<sup>209</sup> and have promoted the

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<sup>197</sup> Keough Griebel, *supra* note 171, at 1190.

<sup>198</sup> Cooley, *supra* note 57, at 478.

<sup>199</sup> Giannelli, *supra* note 157, at 260.

<sup>200</sup> Paul C. Giannelli, *Forensic Science*, 34 J. L. MED. & ETHICS 310, 312 (2006).

<sup>201</sup> See, e.g., DNA Analysis Backlog Elimination Act, 42 U. S. C. § 14135 *et seq.* (2000).

<sup>202</sup> Cooley, *supra* note 57.

<sup>203</sup> Cooley, *supra* note 168, at 474.

<sup>204</sup> Cooley, *supra* note 57.

<sup>205</sup> Claude Roux, Frank Crispino & Olivier Ribaux, *From Forensics to Forensic Science*, 24 CURRENT ISSUES CRIM. JUST. 7, 9 (2012-2013).

<sup>206</sup> *Id.*

<sup>207</sup> Jennifer L. Mnookin, Simon A. Cole, Itiel E. Dror & Barry A. J. Fisher, *The Need for a Research Culture in the Forensic Sciences*, 58 UCLA L. REV. 725, 764 (2010-2011).

<sup>208</sup> Cooley, *supra* note 57, at 455.

<sup>209</sup> Mnookin, Cole, Dror & Fisher, *supra* note 207, at 765.

expansion of practice-based learning, recommending the use of teaching laboratories to reduce the training gap experienced by graduates.<sup>210</sup>

The literature has also highlighted the advantageous position of universities and colleges in encouraging and spearheading reform and innovation.<sup>211</sup> **DNA 1** promoted the idea of continuous education for laboratory technicians.<sup>212</sup> Following this, universities have been encouraged to pursue both goals collaboratively by forging partnerships with crime laboratories<sup>213</sup> and other stakeholders.<sup>214</sup> As part of this, commentators have encouraged universities to embrace the interdisciplinarity within the forensic sciences.<sup>215</sup>

In addition to having a responsibility for training future forensic analysts, law schools also provide training and education for future lawyers and judges. Within this, Innocence Projects housed within law schools have been praised for their positive impact on law students, especially in exposing them to the limitations of forensic science evidence.<sup>216</sup> Although these projects are narrow in scope,<sup>217</sup> they have been celebrated for teaching critical thinking and providing students with exposure to clinical work, preparing students to tackle real-world challenges.<sup>218</sup> Several universities have also been praised for providing educational resources to legal practitioners, allowing them to remain up-to-date with forensic science progress.<sup>219</sup>

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<sup>210</sup> *Id.*, at 765.

<sup>211</sup> Jessica D. Gabel, *Realizing Reliability in Forensic Science: Science from the Ground Up*, 104 J. CRIM. JUST. & CRIMINOLOGY 283, 324 (2014).

<sup>212</sup> McKUSICK, *supra* note 62, at 98.

<sup>213</sup> *Id.*, at 328.

<sup>214</sup> Sayo O. Fakayode, James P. Mayes, Margaret I. Kanipes, David Johnson & Ernest L. Cuthbertson, *Promoting Student Learning in Criminal Justice, STEM, and Forensic Science: Aggie Sleuth Initiative (AggieSI)-Guided Inquiry Learning Experience*, 28 J. CRIM. JUST. EDUC. 192, 194 (2017).

<sup>215</sup> Karen Clark, Stephanie Gerstenblith, Diane Alonson, Robert Wright & Niyati Pandya, *Inter-Institutional Partnerships: The Development of Multidisciplinary/Interprofessional Course in Forensics*, 24 J. CRIM. JUST. EDUC. 357 (2013).

<sup>216</sup> Tifanei Ressler-Moyer, *The Intersection of Forensic Science and Technology with Criminal Justice in Massachusetts: Interview with David Siegel*, 42 NEW ENG. J. ON CRIM. & CONFINEMENT 51, 55-56 (2016).

<sup>217</sup> See, Jessica S. Henry, *Promoting the Study of Wrongful Convictions in Criminal Justice Curricula*, 25 J. CRIM. JUST. EDUC. 236 (2014).

<sup>218</sup> See generally, Emily West, Vanessa Meterko, *Innocence Project: DNA Exonerations 1989-2014: Review of Data and Findings from the First 25 Years*, 79 ALB. L. REV. 717 (2015).

<sup>219</sup> Carol Henderson & Diana Botluk, *Sleuthing Scientific Evidence Information on the Internet*, 106 J. CRIM. L. & CRIMINOLOGY 59, 60 (2016).

#### iv. Presidential Action

Following *Strengthening*, President Obama undertook several initiatives to enhance and encourage forensic science research,<sup>220</sup> most notably publishing a report in 2016 by the President's Council of Advisors on Science and Technology (PCAST).<sup>221</sup> This report, and its engagement with *Strengthening* has been discussed extensively in existing literature.<sup>222</sup> His administration also encouraged additional forensic science initiatives, including the creation of the National Commission on Forensic Science (NCFS), which was established within the Department of Justice.<sup>223</sup> The NCFS was designed to table recommendations for improving forensic science practices,<sup>224</sup> and although it has now been disbanded, several of its recommendations have been implemented,<sup>225</sup> including the National Institute for Standards and Technology undertaking research into pattern identification and digital evidence.<sup>226</sup>

The 2016 PCAST report examined progress within forensic science following the publication of *Strengthening*. In particular, the report explored the validity of comparative forensic science techniques.<sup>227</sup> It recommended limitations be placed on the admissibility of several techniques.<sup>228</sup> Despite the report gaining academic support,<sup>229</sup> it has been dismissed and rejected by several

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<sup>220</sup> Barack Obama, *The President's Role in Advancing Criminal Justice Reform*, 130 HARV. L. REV. 811, 860 (2017).

<sup>221</sup> EXECUTIVE OFFICE OF THE PRESIDENT, *supra* note 59.

<sup>222</sup> See, e.g., Adam B. Shniderman, *Prosecutors Respond to Calls for Forensic Science Reform: More Sharks in Dirty Water*, 126 YALE L. J. F. 348 (2016-2017); Stephanie Domitrovich, *Fulfilling Daubert's Gatekeeping Mandate through Court-Appointed Experts*, 106 CRIM. L. & CRIMINOLOGY 35 (2016).

<sup>223</sup> NATIONAL COMMISSION ON FORENSIC SCIENCE, REFLECTING BACK – LOOKING TOWARD THE FUTURE I (National Institute of Standards and Technology, U.S. Department of Commerce, 2017).

<sup>224</sup> *Id.*

<sup>225</sup> Obama, *supra* note 220, at 861.

<sup>226</sup> Michael E. Newman, *New NIST Center of Excellence to Improve Statistical Analysis of Forensic Evidence* (May 26, 2015) <https://www.nist.gov/news-events/news/2015/05/new-nist-center-excellence-improve-statistical-analysis-forensic-evidence> (last visited Nov. 4, 2019).

<sup>227</sup> EXECUTIVE OFFICE OF THE PRESIDENT, *supra* note 59.

<sup>228</sup> *Id.*, at 142-145.

<sup>229</sup> See, Geoffrey Stewart Morrison & William C. Thompson, *Assessing the Admissibility of a New Generation of Forensic Voice Comparison Testimony*, 18 COLUM. SCI. & TECH. L. REV. 326 (2016-2017).

stakeholders, including the FBI,<sup>230</sup> Department of Justice,<sup>231</sup> and the Association of Firearms and Tool Mark Examiners.<sup>232</sup>

#### v. Legislative Provisions

A further section of the literature calls for, and comments on, legislative action to assist in improving the status of the forensic science community. The literature has documented the effect of **DNA 1** and **DNA 2** on legislation, finding that these reports have acted as catalysts for the legislative provision of funding for research into forensic DNA analysis.<sup>233</sup> In addition, Congress's lack of response to **Strengthening's** recommendations has also been discussed. State initiatives to improve forensic science have also been evaluated throughout the literature,<sup>234</sup> with particular emphasis on creative and successful initiatives.<sup>235</sup>

Federal legislative initiatives created following **DNA 1** and **DNA 2** have received mixed responses by commentators. For example, federal initiatives designed to grant individuals access to post-conviction DNA testing, such as the Innocence Protection Act,<sup>236</sup> have been criticized for imposing overly restrictive appeal conditions and time restrictions on individuals.<sup>237</sup> These concerns have also extended to post-conviction legislation at state level.<sup>238</sup> The DNA Identification Act<sup>239</sup> has received considerable attention since its enactment in 1994. This Act is a formative piece of legislation

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<sup>230</sup> FBI, *Comments on: President's Council of Advisors on Science and Technology REPORT TO THE PRESIDENT Forensic Science in the Criminal Courts: Ensuring Scientific Validity of Pattern Comparison Methods*, (Sept. 20, 2016) <https://pceinc.org/wp-content/uploads/2016/10/20160920-Response-to-PCAST-Report-FBI-.pdf> (last visited Nov. 4, 2019).

<sup>231</sup> Gary Fields, *White House Advisory Council Report is Critical of Forensics Used in Criminal Trials*, WALL STREET JOURNAL, Sept. 20, 2016.

<sup>232</sup> Association of Firearm and Tool Mark Examiners, *Response to PCAST Report on Forensic Science*, (Oct. 31, 2016) [https://afte.org/uploads/documents/AFTE\\_PCAST\\_Response.pdf](https://afte.org/uploads/documents/AFTE_PCAST_Response.pdf) (last visited, Nov. 4, 2019).

<sup>233</sup> See, e.g., DNA Analysis Backlog Elimination Act, 42 U. S. C. § 14135 *et seq.* (2000), *supra* note 201; Paul Coverdell National Forensic Sciences Improvement Act 42 U. S. C. § 3045 *et seq.* (2000), *supra* note 56.

<sup>234</sup> See, e.g., Tania Simoncelli & Barry Steinhardt, *California's Proposition 69: A Dangerous Precedent for Criminal DNA Databases*, 34 J. L. MED. & ETHICS 199 (2006).

<sup>235</sup> See, e.g., Guerra Thompson & Bremner Casarez, *supra* note 52.

<sup>236</sup> Justice for All Act H.R.5107 (2004) Title IV.

<sup>237</sup> Janet Moore, *Democracy Enhancement in Criminal Law and Procedure*, 2014 UTAH L. REV. 543, 589 (2014).

<sup>238</sup> See, e.g., Kaitlyn Potter, *Innocent Suffering: The Unavailability of Post-Conviction Relief in Virginia Courts*, 51 U. RICH. L. REV. 299 (2016). This article criticizes the shortcomings and restrictions of Virginian post-conviction relief legislation, but similarly restrictive legislative measures can be found throughout the United States.

<sup>239</sup> DNA Identification Act of 1994 42 U.S.C. §14132.

regarding DNA regulation, and created the CODIS databank system.<sup>240</sup> The CODIS databank system is the FBI's current DNA databank system, used to identify individuals for a number of purposes, including finding suspects and missing persons.<sup>241</sup> This legislation has attracted continuous attention from commentators,<sup>242</sup> who have raised concerns about the scope and use of CODIS, often criticizing its provisions for overlooking genetic privacy concerns.<sup>243</sup>

State measures creating innovative solutions in addressing the shortfalls of forensic science technology have, however, had a more positive reception, especially when state-based provision has been made for a forensic science oversight body. Texan post-conviction legislation granting offenders access to forensic evidence from their case has been viewed as a successful example of good practice,<sup>244</sup> and the North Carolina Innocence Inquiry Commission has also been praised.<sup>245</sup> Although these two measures were enacted in response to localized issues (and not the oversight body recommended in *Strengthening*),<sup>246</sup> commentators have used these examples of successful oversight to encourage further oversight measures, as recommended in *Strengthening*.<sup>247</sup>

#### vi. Media

Several authors have commented on the influence of the media. Two major issues have been raised and discussed: (1) the impact of media campaigning on the FBI following the publication of *Bullet Lead*; and (2) the media's shaping of jurors' understanding of forensic science technology through television programming.

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<sup>240</sup> Anna M. Franceschelli, *Motions for Postconviction DNA Testing: Determining the Standard of Proof Necessary in Granting Requests*, 31 CAP. U. L. REV. 243, 270-274 (2003).

<sup>241</sup> FBI, *Combined DNA Index System*, <https://www.fbi.gov/services/laboratory/biometric-analysis/codis> (last visited Nov. 4, 2019).

<sup>242</sup> See, Dan L. Burk, *Genetic Privacy: Constitutional Considerations in Forensic DNA Testing*, 5 GEO. MASON U. C.R. L.J. 1 (1994-1995); Khaleda Parven, *Forensic Use of DNA Information v Human Rights and Privacy Challenges*, 17 U. W. SYDNEY L. REV. 14 (2013).

<sup>243</sup> For an overview of the issues raised as to the use of the CODIS databank system, see Shelton, *supra* note 120, from 356.

<sup>244</sup> See, e.g., Guerra Thompson & Bremner Casarez, *supra* note 52.

<sup>245</sup> James R. Acker, Catherine L. Bonventre, *Protecting the Innocent in New York: Moving Beyond Changing Only their Names*, 73 ALB. L. REV. 1245, 1336-1340 (2009-2010).

<sup>246</sup> Ryan M. Goldstein, *Improving Forensic Science through State Oversight*, 90 TEX. L. REV. 225 (2011-2012).

<sup>247</sup> Moore, *supra* note 237, at 589.

As exemplified by the Washington Post's efforts post-**Bullet Lead**,<sup>248</sup> the literature has acknowledged that the media has exerted a substantial role in disseminating the findings of NAS reports. It was the media that broke the news nationally of the 2002 article<sup>249</sup> questioning the scientific underpinnings of CBLA evidence.<sup>250</sup> It followed that news media reported on **Bullet Lead**,<sup>251</sup> and subsequent developments.<sup>252</sup> It was the pressure of the national media that urged the FBI to review past cases using CBLA evidence.<sup>253</sup> This campaign was successful, and the FBI's review started in 2007.<sup>254</sup>

Several commentators have discussed the influence of television programming on the public's perception of forensic science. Several have argued that its portrayal in television programs such as CSI have changed the perception of forensic science evidence.<sup>255</sup> While this has been interpreted in different ways, from jurors demanding forensic science evidence (particularly DNA<sup>256</sup>) in every case,<sup>257</sup> to jurors assuming reliability in all forensic science evidence,<sup>258</sup> they have argued that these changes are attributable to television crime drama.<sup>259</sup> They have further argued that **Strengthening** should serve as a wake-up call that forensic science evidence is more limited than its portrayal in the media.<sup>260</sup>

#### 4. Constitutional Issues

The exploration of constitutional issues is rather more distinct than the other three themes. Each sub-theme addresses a separate constitutional issue raised or discussed through the findings and

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<sup>248</sup> John Solomon, *FBI's Forensic Test Full of Holes*, WASHINGTON POST, Nov. 18, 2007.

<sup>249</sup> Erik Randich, Wayne Duerfeldt, Wade McLendon & William Tobin, *A Metallurgical View of the Interpretation of Bullet Lead Compositional Analysis* FORENSIC SCIENCE INTERNATIONAL 127, 174-191 (2002).

<sup>250</sup> See, e.g., NRP All Things Considered, *Debate over the Use of Bullet Lead Analysis as Crime Evidence*, May 12, 2005.

<sup>251</sup> The Associated Press, *Court Overturns Murder Conviction After Challenge of FBI Bullet Analysis*, March 8, 2005.

<sup>252</sup> See, Eric Lichtblau, *F.B.I. Abandons Disputed Test for Bullets from Crime Scenes*, N.Y. TIMES, September 2, 2005.

<sup>253</sup> Solomon, *supra* note 248.

<sup>254</sup> FBI National Press Office, [FBI Laboratory to Increase Outreach in Bullet Lead Cases](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases) (Nov. 17, 2007) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases> (last visited Nov. 4, 2019).

<sup>255</sup> Robert H. Aronson & Jaqueline McMurtrie, *The Use and Misuse of High Tech Evidence By Prosecutors: Ethical and Evidentiary Issues*, 76 FORDHAM L. REV. 1453, 1473 (2007).

<sup>256</sup> Osagie K. Obasogie, *The Return of Biological Race: Regulating Innovations in Race and Genetics through Administrative Agency Race Impact Assessments*, 22 S. CAL. INTERDISC. L. J. 1, 39 (2012-2013).

<sup>257</sup> *Id.*

<sup>258</sup> Chandler, *supra* note 25, at 41-42.

<sup>259</sup> *Id.*

<sup>260</sup> See, Joelle Anne Moreno, *CSI Bulls#!t: The National Academy of Sciences, Melendez-Diaz v. Massachusetts, and Future Challenges to Forensic Science and Forensic Experts*, 2010 UTAH L. REV. 327 (2010).

recommendations of a NAS report. The literature discusses the constitutional limits of several issues, framed within the context of forensic science, focusing particularly on how *Ballistic Imaging*, *DNA 1*, *DNA 2*, and *Strengthening* have informed constitutional discussions.

#### a. Tracing Firearms and the Second Amendment

*Ballistic Imaging* was commissioned to explore the feasibility of a national firearms database. Its publication opened a discussion about whether a national database would infringe “the right of the people to keep and bear arms”<sup>261</sup> under the Second Amendment. Potential constitutional implications were recognized in the report, which acknowledged the debate between those who believe any restriction would violate the Second Amendment,<sup>262</sup> and those who have embraced reform.<sup>263</sup>

In general, authors discussing *Ballistic Imaging* and gun control have supported gun control measures, including restrictive measures such as a national database.<sup>264</sup> The literature has supported the view that even originalist interpretations of the Constitution would allow some restrictions to the Second Amendment.<sup>265</sup> Certain authors have advocated stringent restrictions on gun control, using public protection reasons to encourage the United States to adopt an Australian-style regulation system.<sup>266</sup> However, they have recognized the limitations of justifying constitutional restrictions in this manner.<sup>267</sup>

#### b. DNA Evidence, Privacy, and the Fourth Amendment

*DNA 1* acknowledged concerns about potential difficulties in reconciling the Fourth Amendment with the storage and retention of DNA samples.<sup>268</sup> As the law surrounding DNA sample retention has developed, several concerns have been explored across the literature.

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<sup>261</sup> U.S. CONST. amend. II.

<sup>262</sup> DANIEL CORK, *BALLISTIC IMAGING*, 13 (National Academies Press 2008).

<sup>263</sup> *Id.*

<sup>264</sup> David Muradyan, *Firearm Microstamping: A Bullet with a Name on It*, 39 McGEORGE L. REV. 616 (2008).

<sup>265</sup> Lawrence Rosenthal, *The Limits of Second Amendment Originalism and the Constitutional Case for Gun Control*, 92 WASH. U. L. REV. 1187, 1209-1201 (2014-2015).

<sup>266</sup> *See*, Hirsh, *supra* note 11.

<sup>267</sup> *Id.*

<sup>268</sup> McKusick, *supra* note 62, at 131.

Several authors have argued that seizure of DNA without consent constitutes a violation<sup>269</sup> of the Fourth Amendment's protection against unreasonable search and seizure.<sup>270</sup> In response to a US Supreme Court decision that held that taking a cheek swab during police booking procedures was reasonable,<sup>271</sup> commentators have raised further questions about the general constitutionality and privacy protection safeguards in CODIS.<sup>272</sup> Privacy concerns about the impact of the CODIS system were identified in *DNA 1*, and were discussed at length following its publication.<sup>273</sup> Following *DNA 2*, these discussions continued.<sup>274</sup> While the debate surrounding the constitutionality of DNA storage and retention has slowed,<sup>275</sup> the post-2000s literature has refocused, and become increasingly critical of the disproportionate impact that familial searching has had on minority ethnic groups.<sup>276</sup>

Amongst the literature questioning the constitutionality of sample storage and retention under CODIS, several critics have called for a different approach to current practices. For example, Ruby has urged for the anonymized publication of CODIS,<sup>277</sup> arguing that making the database available to researchers would be a valuable genetic resource, and provide an administrative check on the government.<sup>278</sup>

### **c. Forensic Science, the Protection against Self-Incrimination, and the Fifth Amendment**

The Fifth Amendment contains a provision which protects individuals against self-incrimination.<sup>279</sup>

Within the literature, several authors have discussed whether forensic science evidence, particularly

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<sup>269</sup> See, Sheryl H. Love, *Allowing New Technology to Erode Constitutional Protections: A Fourth Amendment Challenge to Non-Consensual DNA Testing of Prisoners*, 38 VILL. L. REV. 1617 (1993).

<sup>270</sup> U.S. CONST. amend. IV.

<sup>271</sup> *Maryland v. King*, 2013 569 U.S. \_\_ (2013).

<sup>272</sup> See, Ken Strutin, *DNA Without Warrant: Decoding Privacy, Probable Cause and Personhood*, 18 RICH. J. L. & PUB. INT. 319 (2014-2015).

<sup>273</sup> Burk, *supra* note 242.

<sup>274</sup> See, e.g., Veronica Valdivieso, *DNA Warrants: A Panacea for Old, Cold Rape Cases*, 90 GEO. L. J. 1009 (2002).

<sup>275</sup> Much of the literature that debates the potential flaws and complications of DNA databanks and their operation were published in the early 2000s. Typical concerns can be found in John P. Cronan, *The Next Frontier of Law Enforcement: A Proposal for Complete DNA Banks*, 28 AM. J. CRIM. L. 119, 134-137 (2000).

<sup>276</sup> See, Brett Mares, *A Chip off the Old Block: Familial DNA Searches and the African American Community*, 29 LAW & INEQ. 395 (2011); Rachel Cox, *Unethical Intrusion: The Disproportionate Impact of Law Enforcement DNA Sampling on Minority Populations*, 52 AM. CRIM. L. REV. 155 (2015).

<sup>277</sup> Sarah M. Ruby, *Checking the Math: Government Secrecy and DNA Databases*, 6 ISJLP 257 (2010-2011).

<sup>278</sup> *Id.*

<sup>279</sup> U.S. CONST. amend. VI.

DNA and polygraph reports, violates this provision.<sup>280</sup> In addition, studies exploring miscarriages of justice have also discussed confession evidence within the context of *Miranda* rights.<sup>281</sup>

The arrival of DNA evidence into the criminal justice system, and the publication of **DNA 1** and **DNA 2**, have raised issues about whether DNA evidence is testimonial,<sup>282</sup> and therefore prohibited by the Fifth Amendment.<sup>283</sup> Courts have consistently held that DNA evidence is non-testimonial.<sup>284</sup> Commentators have challenged the restrictive nature of the courts' interpretation of this provision,<sup>285</sup> but have also recognized the legal difficulties if DNA evidence were to be found testimonial.<sup>286</sup>

Similarly, polygraph results have sparked a debate about the limits of what can be considered testimonial under the Fifth Amendment.<sup>287</sup> Unlike DNA evidence, polygraph evidence has largely been inadmissible in criminal proceedings, which has precluded court judgment on the matter. Despite this, critics have sought to argue that polygraph results and neuroimaging fall outside the Fifth Amendment, although the legal status of this is unclear.<sup>288</sup>

The literature discussing the dangers of potential miscarriages of justice has also linked the forensic science techniques discussed in **Strengthening** to false/coerced confession evidence. Within this, critics have highlighted the importance<sup>289</sup> of ensuring *Miranda* rights<sup>290</sup> to protect vulnerable suspects.<sup>291</sup> They have warned that the factually innocent are particularly vulnerable to waiving their

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<sup>280</sup> See, Rockne P. Harmon & Edward J. Imwinkelried, *The Admissibility of Evidence of the Accused's Opportunity to Retest Physical Evidence in Criminal Cases*, 37 NEW ENG. J. ON CRIM. & CIV. CONFINEMENT 3 (2011); Mark A. Rothstein & Sandra Carnahan, *Legal and Policy Issues in Expanding the Scope of Law Enforcement DNA Data Banks*, 67 BROOK L. REV. 127 (2001-2002).

<sup>281</sup> See, e.g., Saul M. Kassin, *Confession Evidence: Commonsense Myths and Misconceptions*, 35 CRIM. JUST. & BEHAVIOR 1309 (2008); Richard A. Rosen, *Reflections on Innocence*, 2006 WIS. L. REV. 237 (2006).

<sup>282</sup> See, Cynthia Bryant, *When One Man's DNA is Another Man's Exonerating Evidence: Compelling Consensual Sexual Partners of Rape Victims to Provide DNA Samples to Postconviction Petitioners*, 33 COLUM. J. L. & SOC. PROBS. 113, 139-140 (1999-2000).

<sup>283</sup> U.S. CONST. amend. V ("No person... shall be compelled in any criminal case to be a witness against himself").

<sup>284</sup> See, e.g., *Hoffman v. United States*, 341 U.S. 479 (1951).

<sup>285</sup> Mark A. Rothstein & Sandra Carnahan, *Legal and Policy Issues in Expanding the Scope of Law Enforcement DNA Data Banks*, 67 BROOK L. REV. 127, 149 (2001-2002).

<sup>286</sup> Sang Jee Park, *On the Constitutionality of Mandatory Pretrial DNA Tests on Those Arrested or Indicted for a Felony*, 48 CT. REV. 138, 141 (2012).

<sup>287</sup> Jennifer S. Bard, *Ah Yes, I Remember It Well: Why the Inherent Unreliability of Human Memory Makes Brain Imaging Technology a Poor Measure of Truth-Telling in the Courtroom*, 94 OR. L. REV. 295, 328 (2015-2016).

<sup>288</sup> Aaron J. Hurd, *Reaching Past Fingertips with Forensic Neuroimaging – Non-Testimonial Evidence Exceeding the Fifth Amendment's Grasp*, 58 LOY. L. REV. 213, 227-228 (2012).

<sup>289</sup> Robert J. Norris, Catherine L. Bonventre, Allison D. Redlich & James R. Acker, *Than That One Innocent Suffer: Evaluating State Safeguards against Wrongful Convictions*, 74 ALB. L. REV. 1301, 1334 (2010-2011).

<sup>290</sup> *Miranda v. Arizona*, 384 U.S. 436 (1966).

<sup>291</sup> Norris, Bonventre, Redlich & Acker, *supra* note 289, at 1334.

*Miranda* rights, as they hold a belief that they have nothing to hide, and therefore require additional protection.<sup>292</sup>

#### d. **Strengthening** and the Confrontation Clause

A trilogy of Supreme Court cases decided between 2009 and 2012 reinterpreted the Sixth Amendment's Confrontation Clause.<sup>293</sup> In *Melendez-Diaz v. Massachusetts* (2009), Justice Scalia recognized that **Strengthening** found that "the forensic science system... has serious problems."<sup>294</sup> In this case, the court interpreted the Confrontation Clause to require in-court testimony to be delivered by the analyst who performed the testing.<sup>295</sup> *Melendez-Diaz*, and the two subsequent cases, *Bullcoming v. New Mexico* (2011),<sup>296</sup> and *Williams v. Illinois* (2012),<sup>297</sup> have been extensively discussed in the literature. Within this, **Strengthening** has been consistently used to demonstrate the challenges in interpreting forensic science testimony.<sup>298</sup>

In exploring post-*Melendez-Diaz* issues about what is considered testimonial, the literature highlights the fragility of these decisions.<sup>299</sup> Within this, several authors have criticized the majority/plurality understanding of fundamental issues.<sup>300</sup> Authors have suggested that post-2009 appointments to the Supreme Court may disrupt the stability of this interpretation of the Confrontation Clause, especially following *Bullcoming*.<sup>301</sup> In particular, *Bullcoming* has generated discussions that Justice Sotomayor's concurring opinion<sup>302</sup> opened a loophole through its acknowledgement of instances where testimony

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<sup>292</sup> Boaz Sangero & Mordechai Halpert, *Proposal to Reverse the View of a Confession: From Key Evidence Requiring Corroboration to Corroboration for Key Evidence*, 44 U. MICH. J. L. REFORM 511, 517 (2010-2011).

<sup>293</sup> U.S. CONST. amend. VI - The Confrontation Clause allows "the accused... to be confronted with the witnesses against him."

<sup>294</sup> *Melendez-Diaz v. Massachusetts*, 556 U.S. 305, at 319, quoting EDWARDS & GATSONIS, *supra* note 12, at xx.

<sup>295</sup> *Id.*

<sup>296</sup> *Bullcoming v. New Mexico*, 564 U.S. 647 (2011).

<sup>297</sup> *Williams v. Illinois*, 567 U.S. 50 (2012).

<sup>298</sup> *See, e.g.*, Moreno, *supra* note 260, at 329.

<sup>299</sup> *See, e.g.*, Paul F. Rothstein, *Unwrapping the Box the Supreme Court Justices Have Gotten Themselves Into: Internal Confrontations over Confronting the Confrontation Clause*, 58 HOWARD L. J. 479, 489-493 (2015).

<sup>300</sup> *See, e.g.*, Justice Kennedy's discussion of the purpose of the Confrontation Clause in his dissent in *Melendez-Diaz v. Massachusetts*, where he argues that the majority have misinterpreted it to include testimony, without providing any clarity on the meaning of "testimonial."

<sup>301</sup> Tara R. Price, *Bull Coming From the States: Why the Supreme Court Should use Williams v. Illinois to Close One of Bullcoming's Confrontation Clause Loopholes*, 39 FLA. ST. U. L. REV. 533, 550-555 (2012).

<sup>302</sup> *Bullcoming*, 564 U.S. from 668.

may be delivered by a secondary analyst.<sup>303</sup> Aside from concerns about the stability of the *Melendez-Diaz* interpretation of the Confrontation Clause, the literature has warned about the potential exclusion of reliable evidence,<sup>304</sup> increased costs,<sup>305</sup> and conflicting status of non-testimonial autopsy reports.<sup>306</sup>

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## 5. Exploring the Limitations of the Literature

Unpacking these themes leaves several areas in the legal scholarship that require further investigation. The four themes identified in existing literature, although diverse, reflect areas where the six NAS reports have informed legal scholarship. These themes contain significant areas of overlap, particularly in relation to the role of actors within the criminal justice system and their ability to address uncertainty surrounding forensic science evidence.

Authors' work discussing the role of legal actors cover a wide range of topics and perspectives, but several areas remain unexplored. Several authors have explored the role of legal actors – particularly judicial gatekeeping – through case law studies.<sup>307</sup> However, these studies have been small-scale, often focusing on one decision,<sup>308</sup> or a small number of cases, and have examined the influence of one of the six NAS reports.<sup>309</sup> Within the existing literature, there is no large evidence-based study examining the judicial reference to the NAS over a long period of time, covering multiple reports. This thesis builds on existing studies, through a large-scale and in-depth analysis of judicial decision-

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<sup>303</sup> Justice Sotomayor, B-II, *Bullcoming*, 564 U.S.

<sup>304</sup> Ryan Sullivan, *The Aftermath of Melendez-Diaz v. Massachusetts*, 129 S. Ct. 2527 - *Identifying the Analyst who can Satisfy Confrontation*, 89 NEB. L. REV. 561, 564 (2010-2011).

<sup>305</sup> For an evaluation of costs in Virginia, see, Joseph King, Chris Leibig & Kristen D. Clardy, *Melendez-Diaz and Briscoe: Return of Constitutional Guarantees Worth the Cost to the System*, 36 NEW ENG. J. ON CRIM. & CIV. CONFINEMENT 289 (2010).

<sup>306</sup> See, Dana Amato, *What Happens if Autopsy Reports are Found Testimonial: The Next Step to Ensure the Admissibility of these Critical Documents in Criminal Trials*, 107 J. CRIM L. & CRIMINOLOGY 293 (2017).

<sup>307</sup> See, e.g., Cole & Edmond, *supra* note 7.

<sup>308</sup> See, e.g., Sherry J. Whitney, *State v. Bible: The Admissibility of Forensic DNA Profiling and Statistical Probability Evidence in Arizona Criminal Proceedings*, 26 ARIZ. ST. L. J. 593 (1994); David H. Kaye, *Case Comment: People v. Nelson - A Tale of Two Statistics*, 7 LAW PROB. & RISK 249 (2008); Denise A. Filicoma, *Unravelling the DNA Controversy: People v. Wesley, A Step in the Right Direction*, 3 J. L. & POL'Y 937 (1994-1995).

<sup>309</sup> See, Cole & Edmond, *supra* note 7; Cooper, *supra* note 9.

making, undertaking an examination of all cases explicitly referencing at least one of the six NAS reports.

In exploring the reasons why judicial decision-making follows certain patterns, this study examines all criminal appellate decisions mentioning at least one of the six reports. In taking a cross-report approach and a much larger data set than existing studies – spanning a twenty-five-year period and all six forensic science NAS reports – this study expands on existing literature. By undertaking an extensive analysis and not confining the data set to specific claims/reports, this study can explore the judicial reference to the NAS reports themselves, an area under-researched within the literature.

A further area where current knowledge is limited is in commentators' ability to explain why there is a disconnect between legal actors' – particularly judges' – understanding of scientific evidence and the findings of the NAS reports, products of scientific progress. Some small-scale studies have explored the reasons why judges have limited ability to engage with the findings and recommendations of these reports using the legal process vision as an explanation as to why legal actors have struggled to incorporate NAS reports. This thesis, in using the legal process vision as a lens, has been designed to determine whether findings from existing studies<sup>310</sup> can be replicated on a wider scale.

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In order to explore the potential value of the legal process vision as an explanation as to why legal actors may be limited in their capacity to embrace scientific change, an introduction to the legal process is outlined below.

### **Introduction to the Legal Process Vision**

The legal process vision views the law as a series of rational processes. It operates within a wider societal framework and encompasses all government activity. First conceived by Henry M. Hart and

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<sup>310</sup> *Id.*

Albert M. Sacks in the late 1950s, it views the law as a progressive and dynamic organ within society.<sup>311</sup> Within this, law-making follows a series of rational processes.<sup>312</sup> The legal process is grounded in the need to recognize continuous progression within society, founded in the relationship between communities and social utility,<sup>313</sup> and is underpinned by legal rules and ethical principles. It dictates that any decision made without being “reached by some rational process” is meaningless.<sup>314</sup>

Under the legal process vision, judges are given the competence to create and adjudicate law. This attribution of competence is named “institutional settlement.”<sup>315</sup> To assist in adjudication and support their reasoning, judges are encouraged to make use of tools, whilst refraining from encroaching upon the competence of other actors. Within the text, *The Legal Process*, following customs and statutory interpretation are explored as examples of decision-making tools.<sup>316</sup>

In relation to this study, the six NAS reports are examples of progress within society. Under the legal process model, the law evolves in response to progress of thought,<sup>317</sup> including scientific progress. The literature addresses legal actors’ decision-making when attempting to reconcile scientific progress with existing legal principles. It has highlighted the challenges within this, as judges are bound to follow precedent, the principle that “all legal rules... must be consistent with each other.”<sup>318</sup> Judges are also required to operate within their area of competency and cannot encroach upon the role of the legislature.<sup>319</sup> The literature reflects this struggle. It has also discussed lawmakers’ struggles to adopt and implement NAS recommendations in areas, making the judicial task of reconciling scientific progress and existing provisions particularly difficult.

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<sup>311</sup> HENRY M. HART, JR., ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW*, ED. WILLIAM N. ESKRIDGE JR., PHILIP P. FRICKEY CXXXVII (Foundation Press 1993).

<sup>312</sup> *Id.*, at 1xxxiii, xcii.

<sup>313</sup> *Id.*, at 3.

<sup>314</sup> HENRY M. HART, JR., ALBERT M. SACKS, *supra* note 311, at 397.

<sup>315</sup> *Id.*, at 4-5.

<sup>316</sup> *Id.*, at 397.

<sup>317</sup> *Id.*, at 3.

<sup>318</sup> *Id.*, at 434.

<sup>319</sup> *Id.*, at 1378.

The influence of the legal process model provides an explanation to judicial decision-making that has not yet been fully explored in current literature. This study seeks to do this by conducting research into the judicial reference to the NAS reports on a large scale. In doing so, the legal process lens may provide an insight into why legal actors have struggled to embrace the NAS report findings. This study uses the legal process lens to explore judicial fidelity to legal process drivers, which include stare decisis,<sup>320</sup> institutional settlement, and finality interests.<sup>321</sup> It uses the forensic science NAS reports as an example of scientific progress, which according to the legal process vision, should be taken into consideration during the decision-making process.

## **6. Gaps in the Research and Questions Stemming from the Extant Literature**

In building on and expanding existing efforts and methodologies by those authors who have sought to explain legal actors' actions through the legal process framework, this thesis undertakes a comprehensive study of all cases referencing at least one of the six forensic science NAS reports over the period 1992-2017, using a legal process vision as an analysis lens. In order to explore areas not covered by existing research and further develop this study, the author devised a list of research questions, to be explored by the current study. These are:

1. How many times have each of the six NAS reports been referenced in criminal appellate decisions across the United States?
2. In what types of legal claims are the NAS reports referenced?
3. What is the purpose of the reference to the NAS report(s) within the judgment?
4. How does judicial decision-making referencing the forensic science NAS reports reflect legal process values?

The next section sets out a method for exploring these research questions.

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<sup>320</sup> James Hardisty, *Reflections on Stare Decisis*, 55 IND. L.J. 41, 48 (1979-1980).

<sup>321</sup> See, Paul M. Bator, *Finality in Criminal Law and Federal Habeas Corpus for State Prisoners*, 76 HARV. L. REV. 441 (1963).

## Chapter 2: Methods

This section sets out the methods used to explore the research questions pertinent to this study. The research questions are:

1. How many times have each of the six NAS reports been referenced in criminal appellate decisions across the United States?
2. In what types of legal claims are the NAS reports referenced?
3. What is the purpose of the reference to the NAS report(s) within the judgment?
4. How does judicial decision-making referencing the forensic science NAS reports reflect legal process values?

To explore these research questions, the author developed a method for case retrieval and analysis. This framework was designed to identify all cases that reference at least one of the six forensic science NAS reports. The six reports that are at the center of this study are: *DNA Technology in Forensic Science* (1992); *The Evaluation of Forensic DNA Evidence* (1996); *The Polygraph and Lie Detection* (2003); *Forensic Analysis: Weighing Bullet Lead Evidence* (2004); *Ballistic Imaging* (2008); and *Strengthening Forensic Science in the United States: A Path Forward* (2009).

### **1. Creating an Analytical Framework to Explore the Research Questions**

Prior to generating the data set, the author created an analytical framework, designed to capture identical information from each case. The analytical framework underwent several evolutions as test cases were used to review and revise the data captured. Criteria were designed to answer the research questions identified by gaps in existing literature. These criteria can also be divided into several overarching categories, which are: referencing information, information about facts, judicial engagement, report-specific engagement, and legal process drivers, and are outlined in the table below.

**Table 1: Analytical Framework Criteria Created by Author to Explore Data Set**

List of key words used, broken down into five categories to collect and arrange data points for analysis.

<u>Referencing Information</u>	<u>Information about Facts of Case</u>	<u>Judicial Engagement</u>	<u>Report-Specific Engagement</u>	<u>Legal Process Drivers</u>
Citation	Relevant Offence	Judicial Decision	Report Referenced	Treatment of the NAS report
Jurisdiction (State)	Legal Claim	Judicial Agreement	Who used NAS report? What for?	Reason for Treatment
Court	Petitioner's Argument	Authorities Cited	Type of Evidence Challenged	Overriding Interest
Year Decided	Petitioner's Position on Admissibility	Use of Additional Authorities	Report put to Jury?	
Party Names	Relevant Admissibility Standard	Evidence Correctly Admitted?	Does Report Influence Judicial Decision?	
Pre/Post-Conviction	Further Inculpatory Evidence	Reasons for the Decision – Detail	How does the Judge Engage with Report?	
Procedural Posture	Was there an Evidentiary Hearing?	Reasons for the Decision – Brief	(if appropriate) Report Quote	
	Is the Forensic Science Technique Explained?	Any Dissents? Reasoning		
	Further Arguments Raised			
	Any Extra Information			

Research question (1) was designed to retrieve the cases that form the data set and find the total cohort of cases. Following the retrieval of this information, the author noted the “referencing information” of each case, which was designed to make it easy to identify and reference each case. This information also provided the author with a starting point for answering further research questions.

To answer question (2), the author captured information to identify the different types of claims where the reports have been used. Criteria identifying this information within the analytical framework include: the procedural posture; whether the hearing has taken place pre or post-conviction; the type of legal claim; the petitioner’s argument and any links that this may have to admissibility; the relevant admissibility standard; the report referenced; and the type(s) of evidence challenged. It also includes whether information from the relevant report had been put to a jury at trial, although this is more peripheral.

Research question (3) was designed as an informational extension to question (2), examining specifically the judicial reference to the six forensic science NAS reports. Within the analytical framework, this includes criteria such as: which report has been referenced by the judge(s); which party sought to rely on the NAS report; and how the NAS report has been used to support the trial court’s decision; the outcome of the judicial decision; and how the judge engages with the report.

Question (4) was designed to determine whether judicial decision-making is governed by legal process indicators. Several criteria in the analytical framework were created to capture this information, including: the procedural posture; how has the judge engaged with the relevant report(s)?; whether the judge had found that the evidence had been correctly admitted; any other authorities cited and their influence on the decision-making process; any further inculpatory evidence; whether there is there an explanation of the questioned forensic science technique; the judicial outcome and whether the report influenced the decision made; any relevant quotes; and any further information that may be relevant.

The culmination of these criteria as applied through the analytical framework provides sufficient information to answer these questions.

## **2. Applying the Analytical Framework to Review Case Law**

To obtain the data set and apply the data set to the analytical framework, the author conducted case law searches, using standard legal interrogation techniques and a comprehensive legal database (Westlaw International). The author intended to capture all cases referencing at least one of the six NAS reports. The author conducted searches on all United States jurisdictions, limiting searches to criminal cases published between 1992 and 2017. By assessing cases decided across all United States jurisdictions, the study was designed to examine judicial reference to these NAS reports at national level. This would allow for differences in judicial approaches and admissibility/analytical frameworks used across different jurisdictions to be compared against one another for their reference to the NAS reports' findings and recommendations. The design of the study therefore provided for a more representative view of the use of the NAS reports in different jurisdictions, over a long period of time.

The search for the data set was restricted to criminal cases, excluding cases decided in the civil courts. There are a number of reasons for this. For example, the chosen NAS reports are most frequently cited in criminal litigation, as they examine forensic science techniques that are routinely used in criminal investigations. In addition, as other NAS reports are more relevant to civil cases, there is little benefit in comparing civil and criminal approaches, as there exists a lack of direct comparison. It would also widen the scope of the study considerably. Moreover, despite *Daubert* providing one set of rules governing the admissibility of all scientific evidence, in practice, the admissibility of scientific evidence is treated differently in civil and criminal contexts.

The six reports also define the timeframe for the data set. As ***DNA 1*** was published in 1992, the timeframe of the data set reflects this, with the earliest cases being decided in 1992. Post-2017 results have been excluded for the purposes of this study, as the data set was collated in early 2018. Taking twenty-five years' worth of cases has provided the study with sufficient data, with the most recent

report, **Strengthening**, being published almost a decade before 2017, having been referenced in well over 200 judicial decisions.

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To create the data set, the author took a report-by-report approach to data capture and analysis, initially using the six report titles as search terms. This was designed to capture as many cases mentioning each report as possible, even if the reference was made merely in passing or in a footnote. Each jurisdiction was examined separately, in alphabetical order, with the exception of federal cases, which were reviewed first.

After identifying and applying the analytical framework to several cases, it became clear that the reports were not consistently being referenced by their titles. Reports of judgments showed that abbreviations were often used and confusion as to the reports' titles was not uncommon. For example, the Supreme Court of Arizona erroneously referred to **DNA 1** as "The Evaluation of Forensic DNA Evidence" (the title of **DNA 2**) in *State v. Boles*.<sup>1</sup> Through such errors, and by using additional common references including those taken from the case law and literature (**DNA 1** and **DNA 2** are frequently cited as NRC I and NRC II), the author conducted a secondary set of searches to capture further cases referring to the NAS reports. This second stage of searches produced an additional 194 cases, which were pooled together with the initial 450 cases identified using the reports' titles. These additional search terms are listed in the table below:

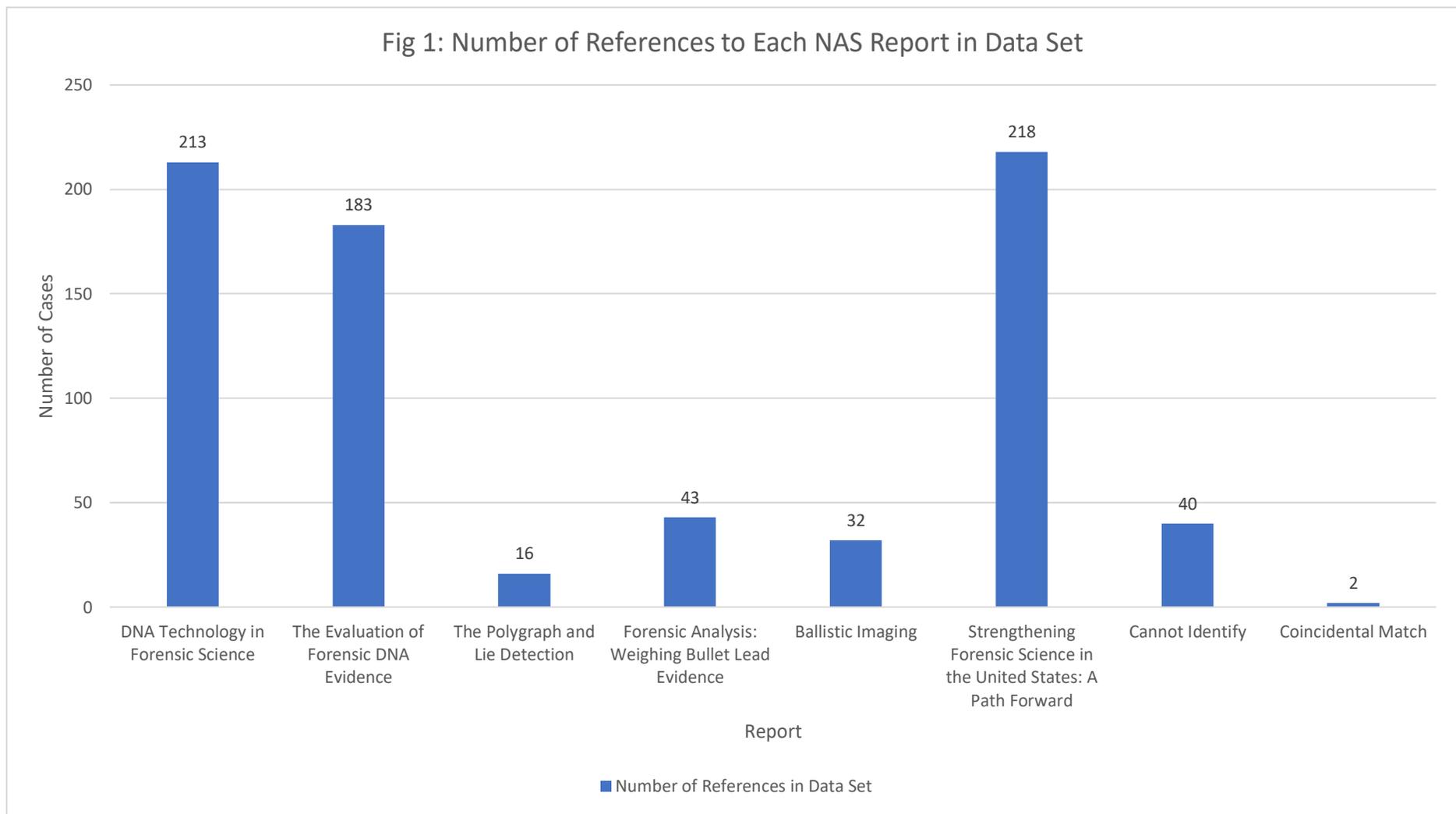
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<sup>1</sup> *State v. Boles*, 188 Ariz. 129 (Ariz. 1997).

<b>Table 2: Key Words Used to Search Databases for Data Set</b>		
<b><u>Report Title</u></b>	<b><u>Alternative Search Term</u></b>	<b><u>Additional non-Report Specific Search Terms</u></b>
DNA Technology in Forensic Science	DNA Technology and Forensic Science	NRC Report
	NRC AND DNA	National Research Council
	NRC 1/ NRC I	National Academy of Science(s)
The Evaluation of Forensic DNA Evidence	NRC 2/ NRC II	National Academies
The Polygraph and Lie Detection		
Forensic Analysis: Weighing Bullet Lead Evidence	Weighing Lead Bullet Evidence	
	Weighing Lead Bullet	
Ballistic Imaging	Ballistics Imaging	
Strengthening Forensic Science in the United States: A Path Forward	Strengthening AND NAS	
	Strengthening AND NRC	
	Strengthening Forensic Science in the United States	

Undertaking searches using the titles of each of the reports and the above additional search terms produced 644 cases. These cases, forming the data set, span each of the six reports, with some referencing more than one, covering the entirety of the period 1992-2017. After applying the analytical framework, the cases break down per report as follows:

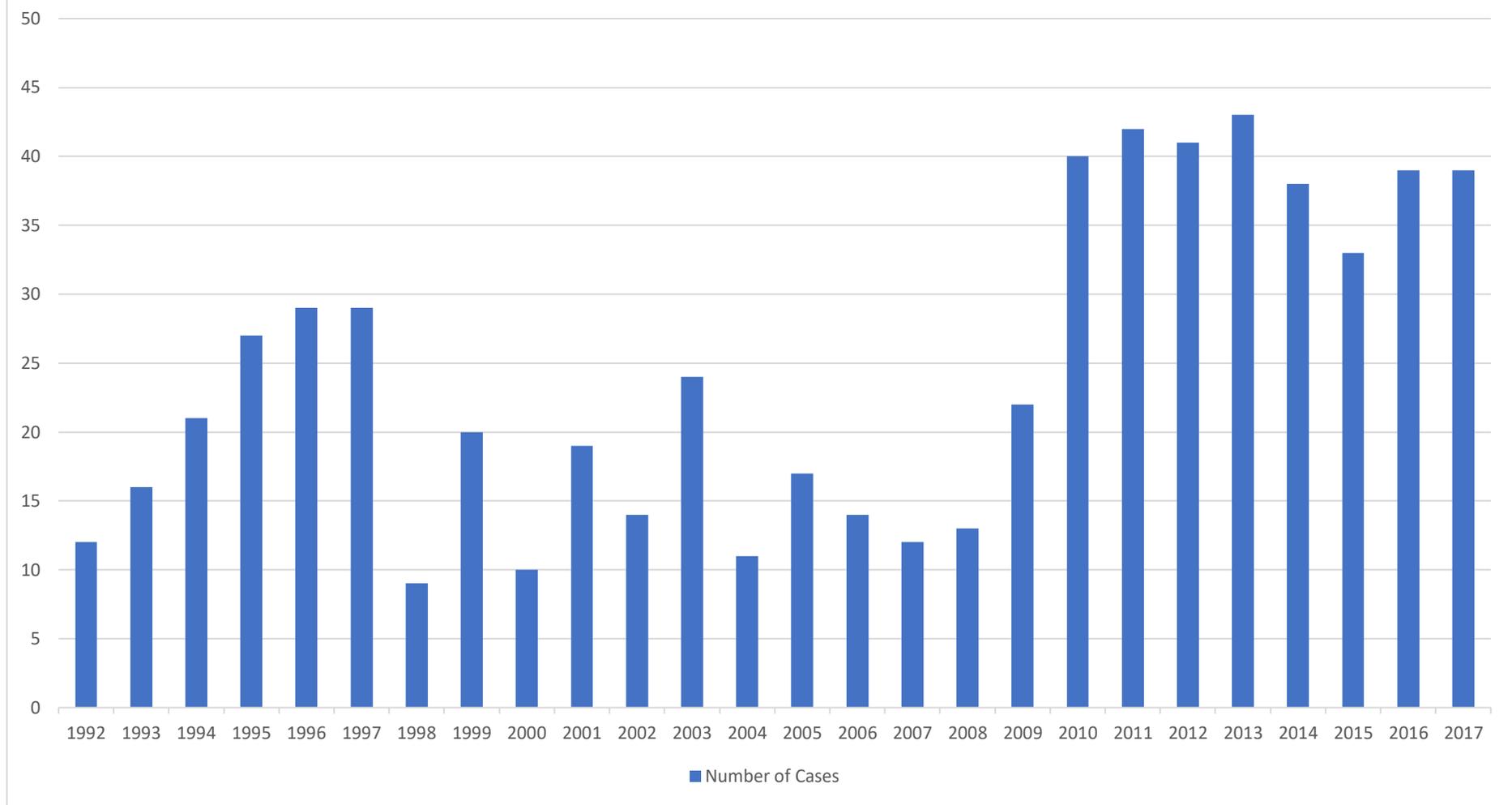
Fig 1: Number of References to Each NAS Report in Data Set



While the vast majority of NAS references made from the second wave of searches can be attributed to individual reports, there are forty cases that the author has not been able to definitively identify which NAS report has been referenced. These forty cases often involve a broad discussion mentioning a NAS/NRC report in relation to either DNA evidence or ballistics/firearm evidence. As these neither reference a report title, specific findings, or a publication date, the author could not attribute a specific report to the decision, as both forms of forensic evidence are discussed in multiple reports. The implications of this lack of clarity are discussed later in Chapter 6.

In terms of the number of reports cited over the twenty-five-year period spanning the data set, the number of cases referenced per year are displayed in the graph below. When examining the frequency of cases per year, it is important to remember that in addition to the publication years of each of the reports having an effect on the number of citations in case law (1992, 1996, 2003, 2004, 2008, 2009), external factors have also had an impact on the number of cases in litigation (e.g. FBI review of cases involving CBLA commencing in 2007 and its review of microscopic hair evidence from 2013):

Fig 2: Number of Cases in Data Set Citing NAS Reports Annually



### 3. The Importance of Doctrinal Research

Despite there being some value in recognizing such quantitative information, this study takes a largely qualitative approach to its analysis of judicial decision-making. By focusing on qualitative analysis, this thesis follows the doctrinal method of legal analysis. Tiller and Cross have discussed at length the benefits of doctrinal research over relying purely on quantitative methods, supporting its detailed approach to legal analysis when compared with the reductionist quantitative methods traditionally used to analyze law.<sup>1</sup> They have supported doctrinal research for its ability to create strong links between reasoning and judicial decision-making.<sup>2</sup> In addition, they have advocated using the doctrinal method to undertake research as it also helps to understand influential factors in decision-making, separating ideological positions from the practical application of the law.<sup>3</sup>

Legal doctrine also allows the researcher to explore beyond the judiciary as an institution and gain an insight into the reasons behind individual decisions, from the point of view of individual judges making value judgments,<sup>4</sup> although this remains contextualized within the institutional framework.<sup>5</sup> This is particularly poignant when applied to this study, as it seeks to assess the extent of judges' engagement with the six forensic science NAS reports whilst operating within their competence as dictated by the legal process vision.

Furthermore, the operation of the United States' common law system presents challenges, especially when uncertainty arises in relation to the application of the law. Uncertainty often occurs when the law lacks clarity and requires additional interpretation. It has been well established in common law practices that judges do more than merely interpret existing provisions, especially where uncertainty

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<sup>1</sup> Emerson H. Tiller & Frank B. Cross, *What is Legal Doctrine?*, 100 NW. U. L. REV. 517, 522-523 (2006).

<sup>2</sup> *Id.*, at 524.

<sup>3</sup> *Id.*, at 526.

<sup>4</sup> Edward Rubin & Malcolm Feeley, *Creating Legal Doctrine*, 69 S. CAL. L. REV. 1989, 1992 (1996).

<sup>5</sup> *Id.*, at 1994.

or gaps within the law exist.<sup>6</sup> The qualitative nature of doctrinal research allows for examination of judicial decision-making through the in-depth analysis of judicial opinions.<sup>7</sup>

The use of a doctrinal approach is appropriate for this study as it provides a qualitative framework allowing for an in-depth analysis of judicial decisions. The analytical framework devised for this study, which has been designed using a legal process vision lens, has given the author the opportunity to review judicial decisions within the wider context of society and government. This is particularly important to this study as it examines the reference to the six forensic science NAS reports (examples of non-legal sources, representative of progress within society) during judicial decision-making (a legal process). Taking a doctrinal approach also requires a thorough and systematic methodology which produces a system where all possible relevant documents are identified, making it easy to replicate findings<sup>8</sup> and provide validity to this study.

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The next section sets out the broad qualitative findings from the data analysis, including the general responses of judges where each report has been raised in case law, providing an overview of judicial reference to each of the six NAS reports. It also briefly sets out the ways in which the author has presented the findings of this study and how the data set reflects fidelity to the legal process vision.

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<sup>6</sup> *Id.*, at 1990.

<sup>7</sup> Tiller & Cross *supra* note 1, at 518.

<sup>8</sup> Ian Dobinson and Francis Johns, *Qualitative Legal Research*, in MIKE MCCONVILLE, WING HONG CHUI, RESEARCH METHODS FOR LAW 32 (2007).

## General Courtroom Responses to the Forensic Science NAS Reports

Each of the six forensic science NAS reports has highlighted limitations in the reliability and validity of forensic science evidence, which has led actors to question the criminal justice system's current understanding of forensic science evidence, relied upon by multiple criminal justice stakeholders. Broadly speaking, these reports have been well received by critics and stakeholders. In particular, ***Strengthening*** has been praised in the decade since its publication, with the co-chairs of the committee that delivered the report – Judge Harry Edwards and Constantine Gatsonis – having been awarded the Innocence Network's 2018 Champion of Justice Award, in recognition of the report and its impact.<sup>1</sup> Upon receipt of the award, ***Strengthening*** was recognized as having “truly transformed the state of forensic science and the involvement of the research community in service of criminal justice reform.”<sup>2</sup>

The six reports have appealed to a wide variety of criminal justice stakeholders, with many taking action following the publication of a report, particularly when directly responding to findings and recommendations.<sup>3</sup> However, the most activity surrounding the interpretation and integration of the reports' findings and recommendations come from judicial decisions. In general, the six forensic science NAS reports have entered the criminal courts in one of two ways: First, reports have been brought forward as evidence by petitioners to support challenge to the reliability of forensic science evidence; and second, NAS reports have been cited by judges to provide reference information about the forensic science techniques and their methodologies. Each of the six reports has gained a unique reception, which is summarized below.

***DNA Technology in Forensic Science (1992)***: As this report was published only a few years after DNA evidence was first presented during a criminal trial, and the admissibility status of DNA evidence was

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<sup>1</sup> National Academies of Sciences Engineering Medicine, *Co-Chairs of Forensic Science Report Honored by Innocence Network*, News, (Apr. 12, 2019), <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=4122019>.

<sup>2</sup> *Id.*

<sup>3</sup> See, Amelia Shooter & Sarah L. Cooper, *A Template for Enhancing the Impact of the National Academy of Sciences; Reporting on Forensic Science*, 9 BJALS (2019).

still subject to lengthy admissibility hearings,<sup>4</sup> its publication appeared to resolve the pertinent admissibility questions: the report recommended that DNA evidence was sufficiently reliable – and accepted in the scientific community – to be admitted into evidence when prepared in accordance with recommended procedures.<sup>5</sup> As a consequence, the majority of decisions citing this report have used its findings and recommendations to support the admissibility of DNA evidence<sup>6</sup> and provide referencing information about extraction and analysis methods.<sup>7</sup>

Individual petitioners have frequently relied on the report’s recommendations to argue that DNA evidence had been admitted erroneously in their trial. The report has been cited by petitioners in support of many different claims. These have largely centered around petitioners using the NAS report to argue that the methods used to extract and analyze DNA evidence (usually the PCR method of analysis) had not received general acceptance;<sup>8</sup> as well as arguing that the product rule method to calculate the statistical significance of a match should not have been admitted at trial.<sup>9</sup>

Both the PCR analysis method and the product rule method of statistical analysis were still in development when **DNA 1** was published, but these practices were soon adopted by the FBI.<sup>10</sup> The admissibility of the FBI’s use of these methods have frequently been challenged by petitioners on appeal, using **DNA 1** to support claims, even after the revisions made by **DNA 2**, which found these techniques to be sufficiently reliable.

**The Evaluation of Forensic DNA Evidence (1996):** In general, courts have treated this report as an extension of **DNA 1**, as the report itself was designed as a “follow-up,”<sup>11</sup> reflecting advances in DNA

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<sup>4</sup> See, e.g., R. Stephen Kramer, *Admissibility of DNA Statistical Data: A Proliferation of Misconception*, 30 CAL. W. L. REV. 145 (1993-1994); Daryl E. Harris, *By Any Means Necessary: Evaluating the Effectiveness of Texas’ DNA Testing Law in the Adjudication of Free-Standing Claims of Actual Innocence*, 6 SCHOLAR 121 (2003-2004).

<sup>5</sup> VICTOR A. MCKUSICK, *DNA TECHNOLOGY IN FORENSIC SCIENCE* 23 (National Academies Press 1992).

<sup>6</sup> See, e.g., *Harmon v. State*, 908 P.2d 434 (Alaska Ct. App. 1995).

<sup>7</sup> See, e.g., *Woods v. Sinclair*, 655 F.3d 886 (9th Cir. 2014).

<sup>8</sup> See, e.g., *People v. Pope*, 284 Ill.App.3d 695 (Ill. App. Ct. 1996).

<sup>9</sup> See, e.g., *People v. Heaton*, 266 Ill.App.3d 469 (Ill. App. Ct. 1994).

<sup>10</sup> See, e.g., *State v. Anderson*, 118 N.M. 284 (N.M. 1994), where the petitioner challenged the FBI’s presentation of the statistical significance of DNA evidence using the product rule, arguing that this procedure was not admissible as it had not been recommended by **DNA 1**.

<sup>11</sup> JAMES F. CROW, *THE EVALUATION OF FORENSIC DNA EVIDENCE*, v-vi (National Academies Press 1996).

technology throughout the first half of the 1990s.<sup>12</sup> In addition to using the report as a reference tool to define terms and provide an overview of DNA analysis techniques,<sup>13</sup> judges have cited this report as an authority to support the admissibility of DNA evidence, particularly PCR analysis<sup>14</sup> and the product rule method of statistical analysis.<sup>15</sup>

Individual petitioners have also relied on the findings and recommendations of the report to challenge the admissibility of more recent and emerging forms of DNA technology. These challenges have been wide-ranging, but have included challenging the admissibility of: low copy number DNA evidence (LCN);<sup>16</sup> the product rule method of statistical analysis in cold hit cases;<sup>17</sup> the presentation and significance of error rates;<sup>18</sup> and mixed samples of DNA evidence.<sup>19</sup> In general, the judiciary have dismissed these challenges by confirming the decisions made by the trial court, supported by findings from **DNA 2**, and have often decided that issues relating to the limitations of DNA evidence are matters of weight, to be decided by the jury.

**The Polygraph and Lie Detection (2003)**: Generally, polygraph evidence is inadmissible, and has been since **Frye v. United States (1923)**.<sup>20</sup> However, in instances where the inadmissibility of polygraph evidence has been challenged, **Polygraph** has been referred to as an authoritative text on polygraph science, both in instances where polygraph evidence has been found admissible<sup>21</sup> and inadmissible.<sup>22</sup> The report has been used to make decisions during appeals and during *in limine* hearings.

The majority of decisions discussing the findings and recommendations in **Polygraph** have been presented by parties, frequently to argue that polygraph test results lacked reliability and validity, and

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<sup>12</sup> *Id.*

<sup>13</sup> *See, e.g.,* Brodine v. State, 936 P.2d 545 (Alaska Ct. App. 1997); United States v. Davis, 602 F.Supp.2d 658 (D. Md. 2009).

<sup>14</sup> *See, e.g.,* State v. Lyons, 324 Or. 256 (Or. Ct. App. 1993).

<sup>15</sup> *See, e.g.,* Commonwealth v. Blasioli, 552 Pa.149 (Pa. 1998).

<sup>16</sup> *See, e.g.,* United States v. McCluskey, 954 F.Supp.2d 1224 (D. N.M. 2013); State v. Bigger, 227 Ariz. 196 (Ariz. Ct. App. 2011).

<sup>17</sup> *See, e.g.,* Crews v. Johnson, 702 F.Supp.2d 618 (W.D. Va. 2010).

<sup>18</sup> *See, e.g.,* People v. Nelson, 48 Cal.Rptr.3d 399 (Cal. Ct. App. 2006).

<sup>19</sup> *See, e.g.,* People v. McCraw, 2003 WL 21061481 (Cal. Ct. App. 2003).

<sup>20</sup> Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).

<sup>21</sup> Lee v. Martinez, 136 N.M. 166 (N.M. 2004).

<sup>22</sup> *See, e.g.,* United States v. Rouse, 329 F.Supp.2d 1077 (D.S.D. 2004); United States v. Loaiza-Clavijo, 2012 WL 529981 (N.D. Ga. 2012).

were therefore inadmissible. This has led courts to exclude polygraph evidence on the basis that the evidence does not satisfy admissibility standards.<sup>23</sup> However, notably the Supreme Court of New Mexico in *Lee v. Martinez (2004)* referred to *Polygraph* to find that polygraph evidence in New Mexico should not be generally inadmissible.<sup>24</sup>

**Forensic Analysis: Weighing Bullet Lead Evidence (2004):** As the FBI discontinued CBLA practices shortly after the publication of the report,<sup>25</sup> the majority of decisions citing *Bullet Lead* have challenged the reliability of CBLA evidence based on the NAS report's findings and the FBI's discontinuation. This report has not only been used in direct appeal challenges to the admissibility of CBLA,<sup>26</sup> but also in newly discovered evidence claims.<sup>27</sup> In addition, several challenges have been further accompanied by a letter from the FBI,<sup>28</sup> issued as part of a review of closed cases using CBLA evidence.<sup>29</sup>

When presented as evidence to support an admissibility challenge, *Bullet Lead* has been referenced by appellate judges in several different ways. Judges have widely accepted the authority of the NAS reports, although have generally only been willing to overturn convictions based on CBLA evidence when CBLA evidence is the primary form of evidence supporting the conviction.<sup>30</sup> When additional inculpatory evidence has supported the conviction, admissibility challenges have often been dismissed as harmless error, as discounting the unreliable CBLA evidence would not have altered the outcome of the trial.<sup>31</sup>

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<sup>23</sup> See, e.g., *United States v. Moultrie*, 552 F.Supp.2d 598 (N.D. Miss. 2008); *State v. A.O.*, 198 N.J. 69 (N.J. 2009).

<sup>24</sup> *Lee v. Martinez*, 136 N.M. 166 (N.M. 2004).

<sup>25</sup> FBI National Press Office, [FBI Laboratory Announces Discontinuation of Bullet Lead Examinations](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations) (Sept. 1, 2005) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations> (last visited Nov. 4, 2019).

<sup>26</sup> See, *United States v. Chalan*, 2011 WL 13196038 (D. N.M. 2011); *Zamarippa v. State*, 100 So.3d 746 (Fla. Dist. Ct. App. 2012).

<sup>27</sup> See, *Berry v. United States*, 2007 WL 4225068 (E.D. Wash. 2007); *Higgs v. United States*, 711 F.Supp.2d 479 (D. Md. 2010).

<sup>28</sup> *Wyatt v. State*, 71 So.3d 86 (Fla. 2011).

<sup>29</sup> See, FBI National Press Office, [FBI Laboratory to Increase Outreach in Bullet Lead Cases](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases) (Nov. 17, 2007) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases> (last visited Nov. 4, 2019)).

<sup>30</sup> See, e.g., *Ragland v. Commonwealth*, 191 S.W.3d 569 (Ky. 2006); *Clemons v. State*, 392 Md. 339 (Md. 2006).

<sup>31</sup> See, e.g., *Commonwealth v. Kretchmar*, 971 A.2d 1249 (Pa. 2009); *Gassler v. State*, 787 N.W.2d 575 (Minn. 2010).

However, this general rule is not universally applicable to all decisions assessing the admissibility of CBLA evidence using **Bullet Lead**. Several further decisions have found that the report was not sufficiently strong to constitute newly discovered evidence. These decisions have argued that the NAS report and FBI discontinuation merely established a loss of general acceptance of CBLA evidence.<sup>32</sup> Alternatively, these decisions have found that as the inherent limitations of CBLA evidence had been discussed during the petitioner’s trial, reliability challenges could not be revisited on appeal.<sup>33</sup>

**Ballistic Imaging (2008)**: Reference to this report to support admissibility challenges to firearms evidence and in judicial decision-making is often found in conjunction with **Strengthening**. Individuals citing **Ballistic Imaging** – either alongside **Strengthening** or alone – have used the report to challenge the admissibility of ballistics and tool mark evidence. The report has been cited in both *in limine* hearings and during post-conviction proceedings. Hearings held *in limine* has on occasion led to experts limiting the extent to which they can testify to individualization or certainty.<sup>34</sup> However, when petitioners have challenged the admissibility of ballistics evidence on appeal by referring to **Ballistic Imaging**, appeals have largely been dismissed on the basis that ballistic evidence had properly been evaluated during the trial.<sup>35</sup>

**Strengthening Forensic Science in the United States: A Path Forward (2009)**: This report has been cited in 218 judicial decisions, having received so many citations due to its reference to numerous forensic science evidence techniques. The report has largely been referenced by petitioners seeking to challenge the reliability and validity of forensic science evidence presented during their trial, arguing that **Strengthening** undermined the reliability of the evidence, and subsequently their conviction. Appellate challenges have spanned a wide variety of forensic science techniques, but most

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<sup>32</sup> See, e.g., *More v. State*, 880 N.W.2d 487 (Iowa Ct. App. 2015).

<sup>33</sup> See, e.g., *St Clair v. Commonwealth*, 451 S.W.3d 597 (Ky. 2014).

<sup>34</sup> See, e.g., *United States v. Glynn*, 578 F.Supp.2d 567 (S.D.N.Y. 2008).

<sup>35</sup> See, e.g., *United States v. Guillen-Cruz*, 853 F.3 768 (5th Cir. 2017).

commonly, **Strengthening** has been cited to challenge the reliability of fingerprint and other pattern analysis evidence techniques, and ballistics evidence.

In response to these challenges, appellate judges have largely dismissed claims, using a variety of legal process mechanisms. Many decisions have been dismissed because the trial judge had correctly disposed of the evidence,<sup>36</sup> and/or the jury had determined the correct weight of the evidence.<sup>37</sup> However, there have been some types of claims where petitioners' challenges have been more successful. This can be seen in cases where the admissibility of drug analysis evidence has been challenged under the Confrontation Clause, following **Melendez-Diaz v. Massachusetts (2009)**,<sup>38</sup> and in challenges to microscopic hair analysis evidence,<sup>39</sup> a forensic science technique that has undergone a case law review by the FBI following **Strengthening**.<sup>40</sup> In these decisions, **Strengthening** has been cited to demonstrate limitations in forensic science evidence, supported by further justification tools.

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The author undertook an analysis of the data set using the legal process vision as a lens through which to review judicial decision-making. As outlined in the literature review, the legal process vision views the law as a series of processes, followed by actors within society.<sup>41</sup> The legal process emphasizes the rationality within decision-making, finding that decisions not "reached by some rational process" are meaningless.<sup>42</sup>

The judicial fidelity to the legal process vision can be seen throughout the decisions within the data set. The author argues that the data shows the legal system carries out its mandate by following the principles of the legal process vision. While legal process indicators are wide-ranging, the data set

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<sup>36</sup> See, e.g., *Commonwealth v. French*, 88 Mass.App.Ct. 477 (Mass. App. Ct. 2015).

<sup>37</sup> See, e.g., *Rodriguez v. State*, 30 A.3d 764 (Del. 2011).

<sup>38</sup> *Melendez-Diaz v. Massachusetts*, 557 U.S. 305 (2009).

<sup>39</sup> See, e.g., *Commonwealth v. Chmiel*, 173 A.3d 617 (Pa. 2017).

<sup>40</sup> FBI, [FBI Testimony on Microscopic Hair Analysis Contained Errors in at Least 90 Percent of Cases in Ongoing Review](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), <<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>> (last visited Nov. 4, 2019).

<sup>41</sup> HENRY M. HART, JR., ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW*, ED. WILLIAM N. ESKRIDGE JR., PHILIP P. FRICKEY 1xxxiii, xcii. (Foundation Press 1993).

<sup>42</sup> *Id.*, at 397.

shows fidelity to these principles through four hallmarks of the legal process vision, which are followed consistently. Where one of the six forensic science NAS reports are brought into the legal system – the author argues – judicial fidelity to the legal process will define the report’s treatment. If a report presents evidence to support the legitimate outcome under the legal process, courts will reference the report to support its reasoning; however, if a report is used to challenge a process that holds legitimacy under the legal process vision, or presents an obstacle to the legal process, legal process mechanisms will be used to work around the challenge. However, what is clear from the data set is that the legal system is not compromising on its values and aims.

Within the data set, there is a clear fidelity to legal process values. While they naturally overlap, four major indicators of the legal process vision are apparent within judicial decision-making. These are:

1. The dominance of precedent
2. Deference to institutional settlement
3. Fidelity to finality interests
4. Reliance on the rationality assumption

Each of these four indicators are explored in considerable detail in Part II of the thesis. Each of the following four chapters explores at length how the NAS reports are referenced within the context of these hallmarks of the legal process vision. To support the argument that the content of the NAS reports are manipulated by legal procedures to ensure the regularity of the legal process, the author has used examples from the data set which have been specifically chosen to explore these issues, to demonstrate how these indicators establish fidelity to the legal process vision.

## Part II

### Chapter 3: The Dominance of Precedent

As a set of common law jurisdictions, the United States functions out of a body of law that is derived from judicial decisions. Within this, each state and the federal system operates its own court structure and hierarchy, typically consisting of trial courts, appellate courts, and a supreme court.<sup>1</sup> The position of the court determines the effect of its treatment by subsequent decision makers, due to the principles of precedent and *stare decisis*.<sup>2</sup> The principle of *stare decisis* requires courts to abide by precedents and not disturb settled points of law.<sup>3</sup> Precedent is binding on a court if it is decided by that court or a higher court within the jurisdiction, requiring all subsequent judges to follow the rules and decisions laid down in the previous case.<sup>4</sup> Decisions of equivalent or higher courts from other jurisdictions still hold persuasive authority, but judges are not bound to follow these decisions.<sup>5</sup> The only exception to this is the federal interpretation of constitutional provisions and other federal law, which is binding on all courts in all US jurisdictions.<sup>6</sup>

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The legal process vision acknowledges the principle of *stare decisis* to bring legitimacy to the decision-making process. Under the legal process vision, “learned judges recognize the fact that all legal rules under whatever head of the law they belong must be consistent with each other.”<sup>7</sup> Legal process scholars have argued that precedent is self-imposed by the courts,<sup>8</sup> but have found a lack of clarity in the outer limits of courts’ behavior in instances where lower courts are required to make decisions when the matter has not yet been addressed by a higher court.<sup>9</sup> Although affirming adherence to the

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<sup>1</sup> HELENE S. SHAPO, MARILYN R. WALTER & ELIZABETH FANJANS, *WRITING AND ANALYSIS IN THE LAW* 3-5 (6th ed., Foundation Press 2013).

<sup>2</sup> *Id.*, at 11.

<sup>3</sup> WILLIAM F. CLARKE, *SOUL OF THE LAW*, 185 (1942).

<sup>4</sup> SHAPO, WALTER, & FANJANS, *supra* note 1, at 12.

<sup>5</sup> *Id.*, at 11-12.

<sup>6</sup> *Id.*, at 13.

<sup>7</sup> HENRY M. HART, JR. & ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW*, ED. WILLIAM N. ESKRIDGE JR. & PHILIP P. FRICKEY 434 (Foundation Press 1993).

<sup>8</sup> James Hardisty, *Reflections on Stare Decisis*, 55 *IND. L.J.* 41, 48 (1979-1980).

<sup>9</sup> HART & SACKS, *supra* note 7, at 597-599.

doctrine of *stare decisis*, Hart and Sacks demonstrate caution in following decisions where there is a dearth of precedent, particularly in the absence of a Supreme Court decision explicitly determining the competence of lower courts.<sup>10</sup>

This framework of *stare decisis*, as interpreted by Hart and Sacks, also acknowledges the need for the judiciary to demonstrate flexibility in decision-making, which allows them to recognize progress within communities.<sup>11</sup> Their model advocates using statutory interpretation as a method of incorporating such progress, so that judges can give effect to changes and progress without stepping outside of their decision-making competence.<sup>12</sup> Statutory interpretation is described in *The Legal Process* as the judicial search to find validity within the law and to make new applications upon old enactments,<sup>13</sup> without having to set aside existing legislation.<sup>14</sup> By interpreting the law within existing frameworks – including existing judicial decisions – judges remain within their own competence, and do not disturb the competence of the legislator and/or higher courts.<sup>15</sup> In taking this approach, the law is allowed to progress and develop, whilst maintaining a degree of consistency in decision-making.<sup>16</sup>

Scholars have long argued about where the balance must be struck between creating a predictable system of rules and being responsive to change. While some have argued that there is a tremendous social cost in relentlessly following previous decisions, especially in areas where technology and human thinking have advanced,<sup>17</sup> others have considered the increased predictability in following precedent to lead to greater efficiencies in resolving disputes, especially in relation to the high costs associated with litigation.<sup>18</sup> Those who consider the legal system to be overly dependent on precedent have argued that changes should be introduced slowly to create an evolution in precedent, especially

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<sup>10</sup> *Id.*, at 597-599.

<sup>11</sup> *Id.*, at 3.

<sup>12</sup> *Id.*, at 4-5.

<sup>13</sup> *Id.*, at 1149, 1172.

<sup>14</sup> For more information on methods of statutory interpretation, see HART & SACKS, *supra* note 7, at Chapter 7.

<sup>15</sup> *Id.*, at 4-5.

<sup>16</sup> *Id.*, at 4-5.

<sup>17</sup> Lawrence E. Blume & Daniel L. Rubinfeld, *The Dynamics of the Legal Process*, 11 J. LEGAL STUD. 405, 410 (1982).

<sup>18</sup> Isaac Ehrlich & Richard A. Posner, *An Economic Analysis of Legal Rulemaking*, 3 J. LEGAL STUD. 257 (1974).

in instances where changes depart considerably from existing law.<sup>19</sup> These scholars have recognized areas where departure from longstanding precedent has become a force for social change, reflecting evolving standards within society.<sup>20</sup> Theorists have linked the judicial adoption of societal changes to many factors, including legislative inaction and statutory interpretation,<sup>21</sup> as viewed through the legal process vision, as a means to minimize uncertainty within the legal system as a whole.<sup>22</sup>

Despite having considerable discretion to interpret and evolve legal provisions, the data set provides evidence that judges consistently seek out precedent to strengthen their decision-making. Across the 644 cases in the data set, judicial decision-making is dominated by reliance on precedent, albeit to varying degrees. This is particularly seen in decisions where the admissibility of a forensic science technique is questioned, where one or more NAS reports are referenced to either support the admissibility of a forensic science technique, or to demonstrate the limitations of the forensic science technique in question. Precedent has played a decisive role in determining the judicial treatment of both the questioned forensic science technique and the use of the relevant NAS report.

The author argues that judicial fidelity to precedent dominates decision-making as a means to create certainty and strengthen judicial decisions. This is explained through cases in the data set which have been specifically chosen to demonstrate the strength of precedent's influence on judicial decisions. The six NAS reports serve as examples of scientific progress, which the legal process vision recognizes as an important factor in the continual progression of law within society. This should be recognized by judges, under Hart and Sacks' vision of the legal process.<sup>23</sup> The judicial decisions relying on precedent often contain hallmarks of additional drivers within the legal process vision, as these concepts are

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<sup>19</sup> Blume & Rubinfeld, *supra* note 17, at 418.

<sup>20</sup> See, e.g., *Whether to Overrule Statutory Based Civil Rights Precedent: Whose Needs Should Prevail*, 41 FLA. L. REV. 369 (1989).

<sup>21</sup> See generally, Randy J. Kozel, *Statutory Interpretation, Judicial Deference, and the Law of Stare Decisis*, 97 TEX. L. REV. 1125 (2018-19).

<sup>22</sup> Jonathan R. Macey, *The Internal and External Costs and Benefits of Stare Decisis*, 65 CHI.-KENT L. REV. 93, 107 (1989).

<sup>23</sup> HART & SACKS, *supra* note 7, at 3.

inherently interlinked. However, during this chapter, the author's findings and analysis are focused solely on the influence of precedent.

The data set shows the dominance of precedent in judicial decision-making, as evidenced through five different patterns of behavior in judicial decision-making. Subsection (1) shows that where precedent does not exist or is sporadic, judges take inspiration from any/all indicators available to them. Subsection (2) explores the dominance of precedent in a growing area of law, through the emerging consensus and acceptance of DNA evidence in the 1990s. Subsection (3) discusses the lack of friction experienced by **DNA 2** in updating scientific knowledge and providing clarity to judges in an already-established area. Subsection (4) provides an insight into the difficulties in challenging a body of existing precedent, specifically through the findings and recommendations of **Strengthening**. Finally, subsection (5) discusses the influence of precedent when it forms part of collective reasoning. Within these subsections, the case law examples demonstrate the dominance of precedent in supporting judicial reasoning. As these themes discuss specific circumstances surrounding the development of, and challenges to consensus, this section largely follows a report-based approach to analysis.

### **1. Judicial Reluctance to Engage in NAS Report Findings in the Absence of Precedent**

The publication of **DNA 1** was specifically designed to be used as a reference tool by the judiciary to enhance their understanding of DNA technology and support the admissibility of (properly prepared) DNA evidence.<sup>24</sup> Before the report's publication, the admissibility status of DNA evidence in United States was uncertain. DNA evidence was admitted indiscriminately from its first use as a forensic tool<sup>25</sup> until *People v. Castro* (1989), where DNA evidence was found to be inadmissible for the first time in its short history.<sup>26</sup> In *Castro*, the exclusion of DNA evidence was due to a disagreement between parties about the odds of a random DNA match, which played out during an extensive pre-trial

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<sup>24</sup> VICTOR A. MCKUSICK., DNA TECHNOLOGY IN FORENSIC SCIENCE 145-146 (National Academies Press 1992).

<sup>25</sup> Leonard J. Deftos, *Daubert & (and) Frye: Compounding the Controversy over the Forensic Use of DNA Testing*, 15 WHITTIER L. REV. 955, 955 (1994)

<sup>26</sup> *People v. Castro*, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989).

hearing.<sup>27</sup> Following this decision, further courts began to find DNA evidence inadmissible, attributable to the detailed examination of DNA evidence in *Castro*.<sup>28</sup> This period became known as the “DNA Admissibility War,”<sup>29</sup> typified by long hearings to determine whether DNA evidence was generally accepted under the *Frye* admissibility standard.<sup>30</sup>

Designed to resolve the issues plaguing DNA evidence, ***DNA 1*** found nuclear DNA evidence to be reliable, recommending that it should be found admissible by courts when prepared according to recommended procedures, provided that evidence be accompanied by a statistical representation of a random match to determine the significance of a match.<sup>31</sup> The report recommended that the deliberately conservative ceiling principle should be used to calculate the statistical frequency of a random match.<sup>32</sup> This superseded the product rule method, which uses multiplications of genetic characteristics in the general population to calculate a random match.<sup>33</sup>

The data shows that in the months following the publication of ***DNA 1***, judges referencing its findings found the report to be significant, but in the absence of precedent, struggled to ascertain the report’s probative value. This is shown through the inconsistencies in judicial interpretations of the report’s findings and recommendations, especially in cases where the relevant state supreme court had not yet given a judgment. The cases in the data set from this period are typified by individuals seeking to challenge the admissibility of DNA evidence under the *Frye* admissibility standard, often claiming that the DNA extraction and analysis methods used by the DNA analyst lacked general acceptance. Alternatively, individuals have sought to appeal decisions where DNA evidence has been excluded. The inconsistencies in reference to and application of ***DNA 1*** in the absence of a clear body of precedent and subsequent judicial caution is displayed through the following cases.

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<sup>27</sup> *Id.*

<sup>28</sup> *See, Deftos, supra* note 25, at 957.

<sup>29</sup> Paul C. Giannelli, *Regulating Crime Laboratories: The Impact of DNA Evidence*, 15 J.L & POL’Y 59, 77 (2007).

<sup>30</sup> *See, Eric S. Lander, DNA Fingerprints on Trial*, 339 NATURE 501 (1989).

<sup>31</sup> MCKUSICK, *supra* note 24, at 74.

<sup>32</sup> *Id.*, at 82-85.

<sup>33</sup> *Id.*

Early cases from 1992 and 1993 show courts' acknowledgment of the findings and recommendations of **DNA 1**, but decisions often being justified on procedural grounds, avoiding the reliance on **DNA 1**, in the absence of precedent. For example, the court in **People v. Wardell (1992)**, when presented with a challenge to the trial court's decision to exclude DNA evidence, found that the trial court was correct to exclude DNA evidence, as at the time of trial "DNA fingerprinting had neither reached the degree of acceptability recognized now in 1992 nor had any Illinois court ruled on this issue."<sup>34</sup> While the lack of precedent allowed the court to avoid an application of **DNA 1**'s findings, the court handpicked an excerpt from **DNA 1**, which cautioned that DNA evidence is not infallible.<sup>35</sup> This is contrary to the general findings of **DNA 1** which found DNA evidence reliable. In using this excerpt, it allowed the court to dismiss the report's significance, additionally supported by a justification on the procedural ground that advances in scientific knowledge cannot be applied retrospectively.<sup>36</sup>

Further, the court in **People v. Wesley (1992)** acknowledged **DNA 1** but relied on the content of the DNA evidence presented at trial to avoid engaging with the report's findings.<sup>37</sup> In this case, the petitioner challenged the admissibility of the government's proffered DNA evidence. His challenge questioned the circumstances under which DNA evidence is admissible.<sup>38</sup> In response, the New York Supreme Court used the evidence presented at trial to determine that the methodology and statistics presented at trial were sufficiently accepted to be admitted into evidence, avoiding engagement with the findings and recommendations of the **DNA 1**, which was published after the petitioner's trial.<sup>39</sup> Instead, the court merely acknowledged the report as an example of the controversial literature surrounding the admissibility of DNA evidence.<sup>40</sup>

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<sup>34</sup> *People v. Wardell*, 595 N.E.2d 1148, 1153 (Ill. App. Ct. 1992).

<sup>35</sup> *Id.*, at 1154.

<sup>36</sup> *Id.*

<sup>37</sup> *People v. Wesley*, 183 A.D.2d 75 (N.Y. 1992).

<sup>38</sup> *Id.*

<sup>39</sup> *Id.*

<sup>40</sup> *Id.*, at 78.

The first notable federal decision referencing **DNA 1** was **United States v. Bonds (1993)**.<sup>41</sup> The court was charged with determining whether DNA evidence as used in this case was admissible. The court had to determine the admissibility of the novel DNA evidence within the context of the newly adopted **Daubert** admissibility framework.<sup>42</sup> The court reviewed **DNA 1**'s recommendations at length, providing significant insight into the court's hesitancy to embrace its findings and recommendations. The court noted that "there is considerable dispute over the significance of its contents."<sup>43</sup> As such, the court determined the issue on procedural grounds.<sup>44</sup> The court's avoidance of the science in the report has not gone unnoticed, with Deftos arguing that the court "seemed to take refuge"<sup>45</sup> in focusing on procedural, rather than substantive issues.<sup>46</sup> This is also clear from **Wardell** and **Wesley**: courts have focused on procedural issues as a mechanism to reduce uncertainty in the absence of precedent.

Other courts, despite the lack of clear precedent during this time, have demonstrated a tentative willingness to follow in the findings and recommendations of **DNA 1**. For example, in **United States v. Porter (1992)** the court cautiously engaged with the NAS report's findings. This *in limine* hearing examined the admissibility of DNA evidence under *Frye*, after the prosecution sought to introduce DNA evidence into a rape trial. Alongside the findings of **DNA 1**, the court examined the wider literature discussing the most appropriate methods to calculate the significance of a DNA match.<sup>47</sup> The court cited **DNA 1** a tool to demonstrate that the ceiling principle was generally accepted by the relevant scientific community, finding that "the NRC REPORT... suggests that the DNA evidence should be admitted on the basis of a probability calculation for which the required consensus now exists."<sup>48</sup> Despite ultimately following **DNA 1**'s findings, this decision shows caution in its approach, through acknowledging difficulties associated with the lack of scientific resolution of population sub-structures

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<sup>41</sup> United States v. Bonds, 12 F.3d 540 (6th Cir. 1993).

<sup>42</sup> *Id.*

<sup>43</sup> *Id.*, at 553.

<sup>44</sup> *Id.*

<sup>45</sup> Deftos, *supra* note 24, at 976.

<sup>46</sup> *Id.*

<sup>47</sup> United States v. Porter, 618 A.2d 629, 636 (D.C. 1992).

<sup>48</sup> *Id.*, at 631.

when calculating DNA match statistics, especially in relation to the conservative nature of the NAS-recommended ceiling principle, used to calculate the frequency of a random match.<sup>49</sup>

The Court of Appeal of California in *People v. Barney* (1992) also held that DNA evidence should be accompanied by statistical evidence showing the significance of a random match calculated using the ceiling principle, following *DNA 1*.<sup>50</sup> The court followed the findings and recommendations of *DNA 1* closely in deliberating on the admissibility of the challenged DNA evidence, which used the product rule method to determine the significance of a match.<sup>51</sup> The court acknowledged that the ceiling principle was offered by the NAS as a compromise, designed to resolve scientific uncertainty.<sup>52</sup> It ultimately followed the NAS report's recommendations, finding that the DNA evidence was improperly admitted.<sup>53</sup> This decision was justified on the basis that the product rule lacked general scientific acceptance (evidenced by the ongoing debate regarding the possibility of population substructures) and that there was a lack of inquiry into the specific procedures used in this case.<sup>54</sup>

## 2. Borrowing Precedent and Persuasive Nature of Non-Binding Decisions to Find Consensus in Support of Judicial Reasoning

Building on the tentative foundations laid out in *Bonds* and *Barney*, a small number of decisions began to receive momentum as authorities to show how *DNA 1* should be referenced. These decisions were quickly cited by subsequent courts, to demonstrate the beginnings of consensus in favor of the admissibility of DNA evidence when accompanied by a statistical calculation regarding the likelihood of a random match. These two decisions, alongside several state Supreme Court judgments,<sup>55</sup> which include: *Commonwealth v. Lanigan* (1993);<sup>56</sup> *State v. Vandebogart* (1992);<sup>57</sup> and *State v. Cauthron*

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<sup>49</sup> *Id.*, at 640-641.

<sup>50</sup> *People v. Barney*, 8 Cal.App.4th 798, 814 (Cal. Ct. App. 1992).

<sup>51</sup> *Id.*, at 809-810.

<sup>52</sup> *Id.*, at 819.

<sup>53</sup> *Id.*, at 824-825.

<sup>54</sup> *Id.*

<sup>55</sup> *See e.g.*, *State v. Bible*, 175 Ariz. 549 (Ariz. 1993); *Nelson v. State*, 628 A.2d 69 (Del. 1993); *Commonwealth v. Lanigan*, 413 Mass. 154 (Mass. 1993); *State v. Vandebogart*, 136 N.H. 365 (N.H. 1992); *State v. Cauthron*, 120 Wash.2d 879 (Wash. 1993).

<sup>56</sup> *Lanigan*, 413 Mass.

<sup>57</sup> *Vandebogart*, 136 N.H.

(1993)<sup>58</sup> provided a core body of precedent used by courts to support their decisions that DNA evidence (as interpreted by **DNA 1**) is admissible. These judgments have been cited in courts across the United States, not just in the states where these decisions are binding. This pattern of behavior, seen across the data set, suggests that where some evidence of precedent exists in other jurisdictions, but the matter has not been adjudicated by the state in question, judges are inclined to follow existing precedent. These seminal cases, and decisions following these precedents, shall now be explored.

In **Barney**, as discussed above, the court undertook a thorough review of **DNA 1**'s findings and recommendations. In particular, it engaged in the debate surrounding the potential for population substructures to affect the significance of a DNA match.<sup>59</sup> It reviewed the inconsistencies in the approaches taken by previous courts,<sup>60</sup> and followed the findings and recommendations of **DNA 1** in acknowledging the ceiling principle as finding "common ground"<sup>61</sup> in the debate. It explicitly included a direction for future courts, suggesting that future judges find the ceiling principle admissible as it had attained general acceptance.<sup>62</sup> Subsequent courts following this decision helped to build consensus around the admissibility of DNA evidence in California<sup>63</sup> and in other US jurisdictions.

Further courts have been equally explicit in encouraging future courts to follow the findings and recommendations of **DNA 1**. This can be seen in **Nelson v. State (1993)**, where the Supreme Court of Delaware determined that the statistical significance of a DNA match needs to accompany a DNA match under Delaware law.<sup>64</sup> In stating that "in any subsequent DNA case a trial court should consider the *DNA Committee Report* and any other peer literature related to this rapidly advancing scientific

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<sup>58</sup> *Cauthron*, 120 Wash.2d.

<sup>59</sup> *Barney*, 8 Cal.App.4th at 815-6.

<sup>60</sup> *Id.*, at 820.

<sup>61</sup> *Id.*, at 821.

<sup>62</sup> *Id.*, at 823.

<sup>63</sup> *See, e.g.*, *People v. Wallace*, 14 Cal.App.4th 651 (Cal. Ct. App. 1993); *People v. Venegas*, 40 Cal.App.4th 128 (Cal. Ct. App. 1995); *People v. Wilds*, 31 Cal.App.4th 636 (Cal. Ct. App. 1995).

<sup>64</sup> *Nelson*, 628 A.2d at 76.

field.”<sup>65</sup> This judgment provided subsequent lower courts with an explicit instruction to follow the findings and recommendations of **DNA 1**.

The court in **State v. Cauthron (1993)** determined, in line with **DNA 1**, that DNA evidence is generally accepted, and therefore admissible under *Frye*, provided that DNA evidence be accompanied by statistical calculations determining the probability of a random match.<sup>66</sup> The court found that the ceiling principle, as recommended by **DNA 1**, was the appropriate method to determine these calculations.<sup>67</sup> **Commonwealth v. Lanigan (1992)** also provided a clear precedent for future courts to determine the admissibility of DNA evidence using **DNA 1**. The **Lanigan** court used **DNA 1** to determine that the product rule, as used by Cellmark and FBI laboratories, had not gained general acceptance.<sup>68</sup> It referred to **DNA 1** throughout the judgment, establishing the NAS report as an authority that judges can use to determine the admissibility of DNA evidence and the significance of a match.<sup>69</sup>

Similarly, the New Hampshire Supreme Court held in **State v. Vandebogart (1992)** that the product rule method of determining the random match probability was inadmissible for lack of general acceptance under *Frye*.<sup>70</sup> The court remanded this case back to trial, providing specific instructions to the trial court. The decision instructed the trial court to conduct an admissibility hearing to determine whether the ceiling principle, as recommended by **DNA 1**, was generally accepted.<sup>71</sup>

The instructions given by these decisions provided a clear direction for subsequent courts to incorporate **DNA 1**'s findings and recommendations into their admissibility decisions. These decisions have also encouraged subsequent courts' engagement with other, supplementary sources in the field. The explicit call to future courts removed the early uncertainty and lack of direction, providing courts with a clear signpost that **DNA 1** should be cited as a scientific authority to determine the admissibility

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<sup>65</sup> *Id.*, at 76-77.

<sup>66</sup> *Cauthron*, 120 Wash.2d. at 906.

<sup>67</sup> *Id.*, at 908-909.

<sup>68</sup> *Lanigan*, 413 Mass. at 163.

<sup>69</sup> *Id.*

<sup>70</sup> *Vandebogart*, 136 N.H. at 381.

<sup>71</sup> *Id.*, at 383.

of DNA evidence. These directions are consistent with the legal process principle of building stability through reliance on precedent. The persuasive precedent of these decisions has also had an influence on many subsequent cases in other jurisdictions.

A further state supreme court judgment which is cited across the data set in relation to the interpretation of DNA evidence is ***State v. Bible (1993)***.<sup>72</sup> The judgment in ***Bible***, however, closely followed ***People v. Barney's*** interpretation of the admissibility of DNA evidence and ***DNA 1*** throughout the judicial decision. Following ***Barney***, the ***Bible*** court used ***DNA 1*** to analyze the admissibility of the DNA evidence and its statistical significance as it had been presented at trial.<sup>73</sup> While it determined that the introduction of DNA statistics using the product rule was harmless error,<sup>74</sup> it transformed the way that Arizonan courts analyzed DNA evidence. The Arizona Supreme Court explicitly addressed future courts, determining that future courts were no longer bound to conduct *Frye* admissibility hearings to determine the general acceptance of the principles and theories underlying DNA evidence.<sup>75</sup> This followed the recommendation in ***DNA 1*** that when prepared properly, courts can take judicial notice of the science underpinning DNA evidence.<sup>76</sup> In both following ***Barney*** and providing a direction to future courts, ***Bible*** established the authority of ***Barney***, as subsequent Arizonan courts were bound to follow this decision, demonstrating the beginnings of consensus within the interpretation of DNA evidence using the authority of persuasive precedent.

Furthermore, these state supreme court decisions have been used both separately and collectively to establish the NAS report's authority in a number of additional jurisdictions, including Arizona, Alaska, Connecticut and the federal jurisdiction. For example, in the federal case of ***United States v. Chischilly (1994)***, the Ninth Circuit used ***Barney*** to find that "the NRC report... is at least the functional equivalent of a publication subject to peer-review under *Daubert*".<sup>77</sup> Similarly, ***Vandebogart*** has been cited in the

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<sup>72</sup> *Bible*, 175 Ariz.

<sup>73</sup> *Id.*

<sup>74</sup> *Id.*, at 590.

<sup>75</sup> *Id.*

<sup>76</sup> McKUSICK, *supra* note 24, at 149.

<sup>77</sup> *United States v. Chischilly*, 30 F.3d 1144 (9th Cir. 1994).

federal case of *Government of Virgin Islands v. Byers (1996)*, which used this judgment to consider that “there is still the possibility that the sample at the crime scene came from a different person whose patterns at the targeted loci are indistinguishable from the defendant’s.”<sup>78</sup>

State courts have also used these judgments to provide an example of precedent and guide their decision-making. For example, in *Harmon v. State (1995)*, the Court of Appeals of Alaska cited *Cauthron* to provide an overview of DNA evidence.<sup>79</sup> It cited *Vandebogart* to support the general acceptance of DNA evidence under *Frye*.<sup>80</sup> Similarly, several examples of precedent were cited in *State v. Hummert (1994)*.<sup>81</sup> The court found that “*Cauthron* directly supports our conclusion in this case”<sup>82</sup> that testimony of a match without any statistical estimates was inadmissible.<sup>83</sup> It also cited the decisions made in *Barney, Nelson, Lanigan, and Vandebogart* to support the conclusion that the DNA evidence was improperly admitted at trial.<sup>84</sup> Similarly, further courts have relied on precedent from other jurisdiction to support judicial reasoning, which is seen across the data set.<sup>85</sup>

While the majority of decisions in the data set citing these judgments were decided in the early-mid 1990s, courts as late as 2005 have used these core cases as precedent to support their decision that DNA evidence requires evidence of the significance of a match to be admissible. This is despite elements of *DNA 1* being superseded by the publication of *DNA 2*. For example, the judgments of *Cauthron* and *Curnin*<sup>86</sup> were cited by the Court of Appeals of Michigan in *People v. Coy (2000)* to support the court’s decision to follow the *DNA 1* finding that “to say that two patterns match, without

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<sup>78</sup> *Government of Virgin Islands v. Byers*, 941 F.Supp. 513 (D.V.I. 1996).

<sup>79</sup> *Harmon v. State*, 908 P.2d 434, 440 (Alaska Ct. App. 1995).

<sup>80</sup> *Id.*, at 446.

<sup>81</sup> *State v. Hummert*, 183 Ariz. 484 (Ariz. Ct. App. 1994).

<sup>82</sup> *Id.*, at 491.

<sup>83</sup> *Id.*

<sup>84</sup> *Id.*, at 490.

<sup>85</sup> *See, e.g.*, *State v. Sivri*, 231 Conn. 115 (Conn. 1994); *State v. Anderson*, 118 N.M. 284 (N.M. 1994); *Clark v. State*, 679 So.2d 321 (Fla. Dist. Ct. App. 1996); *State v. Begley*, 956 S.W.2d 471 (Tenn. 1997).

<sup>86</sup> The case of *Commonwealth v. Curnin*, 409 Mass. 218 (Mass. 1991) does not appear in the data set, as it was decided prior to the publication of *DNA 1*. However, it has been cited numerous times in decisions across the data set, as the court found that the admission of a DNA match was inadmissible, as the statistical frequencies used to determine the match significance in this case were not found to be generally accepted. This was because the match statistics were calculated using only 200 blood samples (at 224, 227).

providing any scientifically valid estimate... is meaningless.”<sup>87</sup> This reasoning is also replicated by the Court of Appeals of Maryland in *Young v. State (2005)*, which relied on precedent, including *Vandebogart, Cauthron* and *Nelson*, to provide an explanation of the underlying science behind DNA evidence<sup>88</sup> and assert the need for a statistical analysis to determine the significance of a DNA match.<sup>89</sup> Reference to these decisions however, did not preclude the court from also citing *DNA 2* as a tool to determine the most appropriate method to calculate the statistical significance of DNA evidence.<sup>90</sup>

While it is clear that courts’ borrowing of precedent from other states has had a significant impact on creating a consensus surrounding the admissibility of DNA evidence as seen throughout the data set, these seminal judgments have also had a decisive impact in the states within which these decisions were made, where the precedent is binding. Most notably, in California, the data set shows that *Barney* has been particularly influential. It has been used as a starting point for many subsequent decisions assessing the admissibility of DNA evidence, seen through a number of cases.

The Supreme Court of California in *People v. Venegas (1998)* later revisited the admissibility of the product rule following the publication of *DNA 2*. The court used *Barney* as a starting point, expanding the *Barney* decision to incorporate the updated findings of *DNA 2* – which supported the admissibility of the product rule of statistical analysis<sup>91</sup> – to find that *DNA 2* demonstrated that “the United States population is sufficiently random to justify using them [racial ethnic categories] in conjunction with the product rule to calculate the frequency of a DNA profile.”<sup>92</sup> This decision re-opened the potential for courts to reconsider the admissibility of the product rule, in light of the findings and recommendations of *DNA 2*. This evolution was continued in *People v. Reeves (2001)*, where the Court

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<sup>87</sup> *People v. Coy*, 243 Mich.App. 283, 299-300 (Mich. Ct. App. 2000).

<sup>88</sup> *Young v. State*, 388 Md. 99, 107 (Md. 2005).

<sup>89</sup> *Id.*, at 111-2.

<sup>90</sup> *Young*, 388 Md.

<sup>91</sup> JAMES F. CROW, *THE EVALUATION OF FORENSIC DNA EVIDENCE* 158 (National Academies Press 1996).

<sup>92</sup> *People v. Venegas*, 18 Cal.4th 47, 67 (Cal. 1998).

of Appeal applied the principles found in *Barney* and *Venegas*, and ultimately found that the trial court's decision to admit DNA evidence accompanied by the product rule was not made in error.<sup>93</sup>

Subsequently, *People v. Pizarro (2002)* also evaluated the admissibility of the statistical significance of a DNA match in reference to *Barney* and *Venegas*, calling both decisions "significant" in the development of DNA case law.<sup>94</sup> *Pizarro* used these decisions to determine the admissibility of DNA evidence, considering the effect of *DNA 2*'s recommendation that a  $\pm 5\%$  statistical window should be used to determine whether or not two alleles match. The court followed both *Venegas* and *Reeves* to determine that the smaller statistical window used by the FBI to determine the significance of a DNA match in this case was improper, and inadmissible under *Kelly* admissibility framework, applying the decision in *Venegas* which determined that a  $\pm 5\%$  match window should have been used.<sup>95</sup>

These decisions demonstrate the constantly expanding number of cases building a consensus relating to the admissibility of DNA evidence, based upon a select handful of cases in the data set from the early 1990s. However, several decisions have expressly departed from this body of precedent. For example, in *Commonwealth v. Thad T. (2003)*, the Massachusetts Court of Appeal discussed *Lanigan*, but dismissed the requirement set out in *Lanigan* that a statistical calculation of the significance of a DNA match should accompany the declaration of a match.<sup>96</sup> The court interpreted *Lanigan* to mean that "a DNA match be accompanied by information *indicating* the probability that a match in question might have occurred by chance,"<sup>97</sup> which did not have to be based on statistics [emphasis added]. This decision, however, remains an outlier, with the vast majority of court decisions still requiring random match statistics to accompany a DNA match, in line with the recommendations found in *DNA 1*.

Further decisions have also declined to follow the principles of these seminal cases, using cases decided before *DNA 1* to support their reasoning. This approach is seen several times in cases decided

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<sup>93</sup> *People v. Reeves*, 91 Cal.App.4th 14 (Cal. Ct. App. 2001).

<sup>94</sup> *People v. Pizarro*, 123 Cal.Rptr.2d 782 (Cal. Ct. App. 2002).

<sup>95</sup> *Id.*, at 918.

<sup>96</sup> *Commonwealth v. Thad T.*, 59 Mass.App.Ct. 497, 506 (Mass. App. Ct. 2003).

<sup>97</sup> *Id.*, at 506.

before the 1996 publication of *DNA 2*, where conflicting scientific opinions questioned the need for the ceiling principle, with courts relying on older precedent to avoid potential areas of conflict. The Michigan Court of Appeal's decision in *People v. Chandler (1995)* provides an example of this.<sup>98</sup> The court's decision relied upon a 1994 publication from two DNA scientists (Eric S. Lander and Bruce Budowle's *DNA Fingerprinting Dispute Laid to Rest*<sup>99</sup>), which "indicate[d] that the product rule method of DNA statistical evidence is now generally accepted in the relevant scientific community."<sup>100</sup> In doing this, the court expressly declined to follow both *Barney* and *Lanigan*.<sup>101</sup> Instead, it followed *People v. Adams (1992)*, a case decided by the Michigan Court of Appeal prior to the publication of *DNA 1*.<sup>102</sup>

This is not the only decision in the data set that found the product rule admissible prior to the publication of *DNA 2*.<sup>103</sup> The Court of Appeal of Maryland in *Keirse v. State (1995)* interpreted *DNA 1* to find that "the multiplication rule, ceiling principle and the database [used in this case]... are all admissible."<sup>104</sup> The court justified this by finding that all types of calculations were admissible on the basis that this decision did not conflict with the reasoning in *Vandebogart*.<sup>105</sup> However, this decision stands alone in interpreting *Vandebogart* so widely.

Similarly, the Supreme Court of Colorado also ruled in favor of the admissibility of the product rule in *Lindsey v. People (1995)*. The court relied on a 1991 Californian judgment, which undertook a *Frye* admissibility analysis of the product rule, and found the product rule was generally accepted and admissible.<sup>106</sup> The court in *Lindsey* did, however, acknowledge the debate surrounding the possibility of population substructures and the ceiling principle, but used the 1994 article by Eric S. Lander and Bruce Budowle<sup>107</sup> to justify returning to following pre-1992 cases, as the product rule had once again

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<sup>98</sup> *People v. Chandler*, 211 Mich.App. 604 (Mich. Ct. App. 1995).

<sup>99</sup> Eric S. Lander & Bruce Budowle, *DNA Fingerprinting Dispute Laid to Rest*, 371 NATURE 735 (1994).

<sup>100</sup> *Chandler*, 211 Mich.App. at 610-611.

<sup>101</sup> *Id.*

<sup>102</sup> *People v. Adams*, 195 Mich.App. 267 (Mich. Ct. App. 1992).

<sup>103</sup> See, e.g., *Lindsey v. People*, 892 P.2d 281 (Colo. 1995); *State v. Pierce*, 64 Ohio St.3d 490 (Ohio 1992); *Taylor v. State*, 889 P.2d 319 (Ohio Ct. App. 1995).

<sup>104</sup> *Keirse v. State*, 106 Md.App. 551 (Md. Ct. Spec. App. 1995).

<sup>105</sup> *Id.*, at 575-576.

<sup>106</sup> *Lindsey*, 892 P.2d at 293.

<sup>107</sup> Lander & Budowle, *supra* note 99.

attained general acceptance. It found that the article was evidence of “the calming of DNA waters... in the scientific community.”<sup>108</sup> This judgment also alluded to the decision in *Fishback v. People (1993)*,<sup>109</sup> where the Supreme Court of Colorado cited several pre-*DNA 1* cases to justify its decision not to overturn the trial court’s decision to admit DNA evidence accompanied by the product rule.<sup>110</sup>

Despite there being a lack of unanimous consensus surrounding the interpretation of *DNA 1* and the most appropriate means of presenting DNA evidence, as evidenced by the above cases, the frequent citation of a few cases across a wide number of decisions in the data set, spanning different states, demonstrates the importance of the consideration of precedent. This is especially so when an area of law is in development, and persuasive precedent becomes particularly important. The data set indicates that the seminal cases of *Barney, Lanigan, Vandebogart* and others have provided a core consensus surrounding the understanding and interpretation of *DNA 1* and the admissibility of DNA across many US jurisdictions. The data set also suggests that although elements of these decisions have become outdated (particularly following the publication of *DNA 2*), they remain strong authorities in support of the admissibility of DNA evidence in general.

### **3. Reducing Uncertainty in an Established Area of Law: The Acceptance of *The Evaluation of Forensic DNA Evidence* (1996)**

The data set shows that by 1996, a large number of state courts had found DNA evidence admissible. However, during this time, uncertainty was growing surrounding the general acceptance of the ceiling principle<sup>111</sup> and the PCR method of DNA analysis was increasingly used by analysts over the traditional RFLP method. Technological advancements had been recognized by courts, who acknowledged that “DNA typing will continue to evolve and the techniques will be refined,”<sup>112</sup> causing courts to question some of the findings of *DNA 1*, which had not endorsed these techniques.

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<sup>108</sup> *Lindsey*, 892 P.2d at 293.

<sup>109</sup> *Fishback v. People*, 851 P.2d 884 (Colo. 1993).

<sup>110</sup> *Id.*, at 888.

<sup>111</sup> *See, e.g., Keirsay*, 106 Md.App; *Lindsey*, 892 P.2d.

<sup>112</sup> *Lindsey*, 892 P.2d at 294.

In response to “recent empirical work”<sup>113</sup> and uncertainty surrounding whether the ceiling principle or product rule was the most appropriate means to calculate the frequency of a random DNA match, the Director of the FBI – Judge William Sessions – commissioned **DNA 2**.<sup>114</sup> This report was billed as a follow-up to **DNA 1**<sup>115</sup> and recommended that technology had advanced sufficiently that PCR analysis should be considered admissible<sup>116</sup> and that the product rule method of determining the significance of a match had superseded the ceiling principle,<sup>117</sup> addressing the questions raised by courts. The data set shows that **DNA 2** was immediately treated as an authoritative interpretation of current DNA technology by courts. This is apparent particularly when both **DNA 1** and **DNA 2** are cited alongside each other. The data set also shows that not unlike the interpretation of **DNA 1**, a small number of decisions have been frequently cited which provide precedent for the interpretation of **DNA 2**.

The data set suggests that **DNA 2** was treated as an extension of **DNA 1** by judges, as decisions immediately recognized and implemented its findings and recommendations, both regarding the admissibility of PCR analysis<sup>118</sup> and the product rule.<sup>119</sup> These decisions relied upon the existing authority of **DNA 1** to introduce **DNA 2** as an authoritative tool to assist in the decision-making process.

One case decided shortly after the publication of **DNA 2**, *State v. Hummert (1997)*, framed the authority of **DNA 2**'s findings as a natural extension of **DNA 1**. The Supreme Court of Arizona expanded *Bible* to incorporate the findings of **DNA 2**. This report was referenced by the court to provide additional clarification, finding that **DNA 2** resolved scientific uncertainty regarding the status of the significance of a DNA match.<sup>120</sup> Through using precedent to support the authority of **DNA 1**, and by extension **DNA 2**, the court treated the findings and recommendations of **DNA 2** as an extension of

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<sup>113</sup> Crow, *supra* note 91, at v.

<sup>114</sup> *Id.*, at v-vi.

<sup>115</sup> *Id.*, at vi.

<sup>116</sup> *Id.*, at Chapter 4.

<sup>117</sup> *Id.*, at 156.

<sup>118</sup> *See, e.g.*, United States v. Gaines, 979 F.Supp. 1429 (S.D. Fla. 1997); State v. Harvey, 151 N.J. 117 (N.J. 1997); State v. Lyons, 324 Or. 256 (Or. 1993).

<sup>119</sup> *See, e.g.*, Brim v. State, 695 So.2d 268 (Fla. Dist. Ct. App. 2000); Commonwealth v. Fowler, 425 Mass. 819 (Mass. 1997); State v. Kinder, 942 S.W.2d 313 (Mo. 1996).

<sup>120</sup> State v. Hummert, 188 Ariz. 119, 123-124 (Ariz. 1997).

**DNA 1** and justified its reliance on **DNA 2** as an authority, resolving some of the uncertainty surrounding the treatment of emerging DNA analysis techniques since the publication of **DNA 1**.

The data set shows that **DNA 2** has been used to justify the admissibility of the PCR method of statistical analysis, provided that proper analysis methods have been followed.<sup>121</sup> For example, in the absence of a binding decision deliberating on the admissibility of PCR-STR testing,<sup>122</sup> the Californian Court of Appeal in **People v. Allen (1999)** followed two supreme court decisions from other states to justify its finding that PCR-STR testing was admissible.<sup>123</sup> The Court of Appeal relied upon **Commonwealth v. Rosier (Massachusetts, 1997)** and **State v. Jackson (Nebraska, 1998)**, which referenced **DNA 2** (and other sources) to determine that PCR-STR is scientifically reliable, and therefore admissible.<sup>124</sup> Subsequent decisions in California have since relied on **Allen**, expanding the court's justification and finding PCR analysis admissible. For example, alongside **Allen, People v. Kennedy (2003)** cited further cases which also found PCR evidence admissible, relying particularly on **People v. Morganti (1996)**, which was decided before **DNA 2** and **People v. Reeves (2001)** to support the decision that PCR-based DNA analysis is admissible under *Kelly-Frye*.<sup>125</sup> The court further relied on **DNA 2** as an authority to explain PCR DNA in more detail.<sup>126</sup>

The data set also shows the judicial reference to **DNA 2's** recommendation that the product rule is sufficiently reliable to be admitted, through reliance on precedent, restored certainty in decision-making. A series of decisions made in Illinois demonstrates the importance of precedent in the acceptance of the product rule. In **People v. Hickey (1997)**, the state Supreme Court found in favor of the admissibility of the product rule. As part of its decision-making, the court cited **DNA 2** to provide an authority in support of admissibility when the RFLP method of DNA extraction and analysis had

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<sup>121</sup> Crow, *supra* note 91, at 21-23.

<sup>122</sup> PCR-STR testing involves testing DNA evidence using the PCR method. PCR involves analysts amplifying a short sample of DNA to replicate how it appears in the cell. Short tandem repeats of a few nucleotide units are chosen to amplify using PCR-STR. For more information, see, Crow, *supra* note 91, at 69-70.

<sup>123</sup> *People v. Allen*, 72 Cal.App.4th 1093, 1100 (Cal. Ct. App. 1999).

<sup>124</sup> *Id.*

<sup>125</sup> *People v. Kennedy*, 2003 WL 21205925, 15 (Cal. Ct. App. 2003).

<sup>126</sup> *Id.*

been used, following several decisions from equivalent courts in other states.<sup>127</sup> The court further justified its reliance on the authority of **DNA 2** as it provided a specific update to **DNA 1**.<sup>128</sup> In taking this approach, the Illinois Supreme Court laid down a precedent for future courts to follow.

The Appellate Court of Illinois later followed this decision in **People v. Oliver (1999)**, where it relied on **Hickey** to determine that through **DNA 2**, the NAS had endorsed the reliability (and admissibility) of the product rule.<sup>129</sup> It held that **DNA 2** was sufficient evidence that the product rule had become generally accepted, finding that the trial court had correctly admitted this evidence.<sup>130</sup> The court in **People v. Watson (2003)** also followed the judicial reasoning in **Hickey**, but took the decision further to determine that **DNA 2** demonstrated that the product rule was admissible as evidence, and that the ceiling principle as recommended by **DNA 1** was no longer necessary.<sup>131</sup> In its decision to reject a second *Frye* hearing, the court re-affirmed the authority of **Hickey**.<sup>132</sup>

The updated position of the NAS regarding the admissibility of the product rule and ceiling principle following **DNA 2** is also shown through further decisions within data set. In recognition of **DNA 2**'s findings, courts have relied on precedent to affirm the admissibility of the product rule. Precedent has been used to reinforce the strength of courts' decision-making. For example, in **State v. Bailey (2004)**, the Supreme Court of Minnesota relied on two of its previous judgments, **State v. Miller (2003)** and **State v. Roman-Nose (2002)**, to support the authority of **DNA 2**.<sup>133</sup> In relying on the authority of these judgments, the court decided to follow its previous decision in **State v. Bloom (1994)**,<sup>134</sup> where it had previously found that the ceiling principle was not the only generally accepted method of statistical analysis, expressly departing from **DNA 1**'s interpretation of the ceiling principle.<sup>135</sup> Although the

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<sup>127</sup> The Supreme Court of Illinois cited *State v. Copeland*, 130 Wash.2d 244 (Wash. 1996); *State v. Johnson*, 183 Ariz. 623 (Ariz. Ct. App. 1995); *Brim v. State*, 695 So.2d 268 (Fla. 1997). See, *People v. Hickey*, 178 Ill.2d 256, 279 (Ill. 1997).

<sup>128</sup> *Id.*, at 278-279.

<sup>129</sup> *People v. Oliver*, 306 Ill.App.3d 59 (Ill. App. Ct. 1999).

<sup>130</sup> *Id.*

<sup>131</sup> *People v. Watson*, 338 Ill.App.3d 765 (Ill. App. Ct. 2003).

<sup>132</sup> *Id.*

<sup>133</sup> *State v. Bailey*, 677 N.W.2d 380 (Minn. 2004).

<sup>134</sup> *Id.*

<sup>135</sup> *Id.*

**Bailey** court cited both **Miller** and **Roman-Nose** to support its reliance on the authority of **DNA 2**, these judgments are not wholly consistent with each other. The court in **Miller** avoided providing a justification as to why the product rule had superseded the ceiling principle,<sup>136</sup> whereas **Roman-Nose** engaged in a more thorough discussion of the principles underpinning the product rule, leading the court to recognize its general acceptance under *Frye*.<sup>137</sup> Despite engaging in the science behind the evidence, **Roman-Nose** paid deference to the decision of the trial court when assessing the admissibility of the product rule.<sup>138</sup> In consolidating these opinions, the Supreme Court of Minnesota in **Bailey** provided clarity in its confirmation of the admissibility of the product rule, using **DNA 2**.

#### 4. Judicial Reluctance to Depart from a Body of Precedent when Consensus is Challenged

Both **DNA 1** and **DNA 2** were published to address emerging issues related to the use of DNA technology in the criminal justice system, a forensic science technique that in 1992 had not yet widely been accepted as admissible. With the exception of **Polygraph**, the four additional forensic science NAS reports have analyzed forensic science techniques that have a long-standing admissibility history. Serious deficiencies in longstanding and frequently used forensic science techniques were found in **Ballistic Imaging** and **Strengthening**, which has led petitioners to refer to the reports to raise admissibility challenges. The data set shows that individuals who have cited these reports (either together or separately) to challenge the admissibility of the evidence presented by the prosecution at trial have been met with considerable resistance by judges, due to the large body of precedent supporting the admissibility of the forensic science techniques evaluated in these reports. As seen through judicial decision-making across the data set, it is the strength of this body of precedent that has often led to the dismissal of these admissibility challenges.

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<sup>136</sup> The Supreme Court of Minnesota in *State v. Miller*, 666 N.W.2d 703 (Minn. 2003) determined that the admissibility of the product rule, recognized as the appropriate method of DNA statistical analysis in **DNA 2**, was properly decided by the district court. As it was not misleading or prejudicial, the decision was made properly, and left to stand (at 711).

<sup>137</sup> *State v. Roman-Nose*, 667 N.W.2d 386, 397 (Minn. 2003).

<sup>138</sup> *Id.*

### a. Wholesale Admissibility Challenges

Although *Strengthening* found methodological limitations in many forensic science techniques, it has notably been cited in challenges to fingerprint evidence. In particular, individual petitioners in both state and federal courts have referenced *Strengthening* to undermine the evidence presented at trial, although petitioners have cited the report in different ways. In response, several courts have undertaken an evaluation of the admissibility of fingerprint evidence using *Strengthening* as a tool to provide information about fingerprint evidence. In deciding that the trial court properly took judicial notice of the general acceptance of the ACE-V method of fingerprint analysis under *Frye*, the court in *People v. Luna (2013)* reviewed previous challenges to ACE-V, citing *Strengthening* to provide an overview of fingerprint evidence.<sup>139</sup> The petitioner relied upon *Strengthening* to support his argument that ACE-V was no longer generally accepted.<sup>140</sup> The court dismissed the claim, finding that there was no novelty in the ACE-V method used by the examiner (as required under *Frye*) and relied on precedent to find that “wholesale objections to the ACE-V methodology have been uniformly rejected by state appellate courts... and by federal appellate courts.”<sup>141</sup>

The petitioner in *Commonwealth v. Joyner (2014)* took a different approach when challenging the fingerprint evidence presented at his trial.<sup>142</sup> He challenged the sufficiency of the evidence against him, arguing that the primary inculpatory evidence – fingerprint evidence – was insufficient to uphold his conviction. He argued that the lack of statistical representation of the significance of the match was not sufficient to support his conviction.<sup>143</sup> The court acknowledged the petitioner’s concerns, likening his challenge to *Commonwealth v. Gambora (2010)*, which acknowledged that *Strengthening* highlighted a tendency for examiners to overstate the accuracy of fingerprint comparisons.<sup>144</sup> Despite acknowledging *Strengthening*’s findings and the issues associated with fingerprint examiners’

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<sup>139</sup> *People v. Luna*, 989 N.E.2d 655, 669 (Ill. App. Ct. 2013).

<sup>140</sup> *Id.*, at 666.

<sup>141</sup> *Id.*, at 671.

<sup>142</sup> *Commonwealth v. Joyner*, 467 Mass. 176 (Mass. 2014).

<sup>143</sup> *Id.*

<sup>144</sup> *Id.*, at 181.

accuracy statements, the *Joyner* court dismissed the petitioner’s challenge by following precedent from the earlier case of *Commonwealth v. Patterson (2000)*. It used *Patterson* to determine that “the underlying theory and process of latent print identification, and the ACE-V method in particular, are sufficiently reliable to admit expert opinion testimony regarding the matching of a latent impression with a full fingerprint.”<sup>145</sup> In citing the combination of pre and post-*Strengthening* decisions, it acknowledged *Strengthening*, but side-lined its significance by deciding that its findings did not undermine the admissibility of fingerprint evidence.

Similarly, petitioners seeking to claim that *Strengthening* undermines firearms and tool mark evidence have largely been unsuccessful, on the basis that firearms and tool mark evidence has been held consistently admissible.<sup>146</sup> For example, in response to an admissibility challenge, the Court of Special Appeals of Maryland in *Fleming v. State (2010)* “found the traditional method [of tool mark identification] to be generally accepted within the scientific community,”<sup>147</sup> justified on the basis that tool mark admissibility is “consistent with recent federal precedent in courts around the country.”<sup>148</sup>

The court in *State v. Adams (2011)* was more specific in identifying precedent as a justification to dismiss the petitioner’s admissibility challenge, relying on decisions which pre-dated *Ballistic Imaging* and *Strengthening*.<sup>149</sup> It held that “precedent, in conjunction with the trial court’s factual findings, demonstrate the trial court did not abuse its discretion” in allowing the ballistics expert to testify.<sup>150</sup>

Some courts have dismissed challenges to the admissibility of ballistics evidence not only by following precedent, but by distinguishing the decision at hand from previous cases which have limited forensic examiner testimony. For example, in *People v. Blacknell (2015)*, the petitioner sought to argue that tool mark evidence was inadmissible under *Kelly*, as the technique had been subject to scientific

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<sup>145</sup> *Id.*, at 182, quoting *Commonwealth v. Patterson*, 445 Mass. 626, 628 (Mass. 2005).

<sup>146</sup> For more information, see, Paul C. Giannelli, *Forensic Science: Why No Research?*, 38 *FORDHAM URB. L.J.* 503, 504-505 (2010-11).

<sup>147</sup> *Fleming v. State*, 194 Md.App. 76, 107 (Md. Ct. Spec. App. 2010).

<sup>148</sup> *Id.*

<sup>149</sup> *State v. Adams*, 212 N.C.App. 235 (N.C. Ct. App. 2011).

<sup>150</sup> *Id.*, at 7.

criticism (through **Ballistic Imaging** and **Strengthening**), and that it “should be considered a “new” technique that is not generally accepted.”<sup>151</sup> In its response, the court turned to precedent to reject this argument. It followed the California Supreme Court case of **People v. Cowan (2010)**, which acknowledged the limitations of firearm evidence, but determined that the principles behind tool mark analysis were “obvious to the senses of lay jurors,”<sup>152</sup> making it easy for a jury to fully understand and evaluate the limitations of the evidence themselves.<sup>153</sup> It continued by expressly distinguishing federal cases that had placed express limits of examiners’ degree of certainty regarding a match.<sup>154</sup> This included **United States v. Glynn (2008)**,<sup>155</sup> **United States v. Green (2005)**,<sup>156</sup> and **United States v. Otero (2012)**,<sup>157</sup> finding that these cases “involv[ed] examiners who have not followed best practices,”<sup>158</sup> which was not the case in **Blacknell**.

Similarly, the Appellate Court of Illinois has dismissed the significance of the approach taken in **Glynn** in **People v. Robinson (2013)**. The court found that “although the scholarly materials cited by defendant and defendants in other cases may raise substantial criticisms of the methodology at issue in this case, no court has found these critiques sufficient to conclude the methodology is no longer generally accepted.”<sup>159</sup> The materials in question included both **Ballistic Imaging** and **Strengthening**, as well as further evidence challenging the reliability of firearm and tool mark evidence.<sup>160</sup> These cases, although acknowledging the findings and recommendations of **Ballistic Imaging** and **Strengthening**, demonstrate courts’ reluctance to restrict/exclude firearms and tool mark evidence under the *Frye* and *Kelly* admissibility frameworks because little precedent exists to support this position. Note, *Glynn, Green, etc.* were hearings conducted *in limine*.

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<sup>151</sup> *People v. Blacknell*, 2015 WL 6157479, 9 (Cal. Ct. App. 2015).

<sup>152</sup> *Id.*, citing *People v. Cowan*, 50 Cal.4th 468 (Cal. 2010).

<sup>153</sup> *Id.*

<sup>154</sup> *Id.*, at 11.

<sup>155</sup> *United States v. Glynn*, 578 F.Supp.2d 567 (S.D.N.Y. 2008).

<sup>156</sup> *United States v. Green*, 405 F.Supp.2d 104 (D. Mass. 2005).

<sup>157</sup> *United States v. Otero*, 849 F.Supp.2d 425 (D.N.J. 2012).

<sup>158</sup> *Blacknell*, 2015 WL at 11.

<sup>159</sup> *People v. Robinson*, 2 N.E.3d 383, 402 (Ill. 2013).

<sup>160</sup> Richard Grzybowski et al., *Firearm/Toolmark Identification: Passing the Reliability Test Under Federal and State Evidentiary Standards*, 35 AFTE J. 209 (2013).

The judicial reliance on precedent to dismiss individuals' admissibility challenges based on the findings of *Ballistic Imaging* and *Strengthening* is not generally found outside these forensic science disciplines. This is unsurprising, given that across the data set, there exists a much higher number of cases challenging the admissibility of firearms/tool mark evidence and fingerprints than other techniques reviewed in *Strengthening*. While judicial decisions dismissing challenges to other disciplines evaluated within *Strengthening* exist, these judgments are far less reliant on precedent, with judges being more inclined to use other means of justification to dismiss these claims.<sup>161</sup>

**b. Exceptions: Departing from Precedent through the Judicial Reliance on *Polygraph***

Contrary to judicial decision-making using precedent to justify forensic science admissibility decisions, the data set shows that often the admissibility of polygraph testing has been assessed on a case-by-case basis. Two landmark federal cases, *United States v. Frye (1923)* and *United States v. Scheffer (1998)*, provide precedent excluding polygraph evidence,<sup>162</sup> which has often been relied upon by courts to justify its inadmissibility.<sup>163</sup> The NAS report, *Polygraph*, has provided additional support to these arguments, as it found that there is a lack of reliability in polygraph testing techniques<sup>164</sup> and subsequent decisions in the data set have acknowledged this.<sup>165</sup>

The Supreme Court in *United States v. Scheffer (1998)* reviewed the reliability of polygraph evidence under a *Daubert* admissibility framework, determining that the exclusion of polygraph evidence does not unconstitutionally restrict the right to present a defense. Within this, the court recognized that "there is simply no consensus that polygraph evidence is reliable."<sup>166</sup> This has remained good law, having been cited several times following the publication of *Polygraph*. For example, *in limine* proceedings in *United States v. Matusiewicz (2015)* followed *Scheffer* to justify the inadmissibility of

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<sup>161</sup> These additional legal process values used in judicial decision-making are explored in detail in chapters 4-6.

<sup>162</sup> See, *Frye v. United States*, 293 F. 1013 (D.C. Cir 1923); *United States v. Scheffer*, 523 U.S. 303 (1998).

<sup>163</sup> See, e.g., *United States v. Rouse*, 329 F.Supp.2d 1077 (D.S.D. 2004); *In Re Jordan R.*, 205 Cal.App.4th 111 (Cal. Ct. App. 2012); *State v. Perry*, 139 Idaho 520 (Idaho 2003).

<sup>164</sup> STEPHEN E. FEINBERG, *THE POLYGRAPH AND LIE DETECTION* 213 (National Academies Press 2003).

<sup>165</sup> See, e.g., *Rouse*, 329 F.Supp.2d; *In Re Jordan R.* 205 Cal.App.4th; *Perry* 139 Idaho.

<sup>166</sup> *United States v. Scheffer*, 523 U.S. 303, 309 (1998).

polygraph test results. The court underlined that the federal position had not been altered by *Polygraph*.<sup>167</sup> This is unsurprising, as *Polygraph* does not contradict the findings in *Frye* and *Scheffer*.

Despite federal and state courts within the data set routinely excluding polygraph evidence, the New Mexico Supreme Court in *Lee v. Martinez (2004)* undertook a review of polygraph admissibility decisions from across the United States to determine whether polygraph test results are admissible as evidence. It found that supporters of polygraph evidence had “little success before courts that have maintained a pre-*Daubert* standard or courts that have adopted *Daubert*,”<sup>168</sup> recognizing jurisprudence dating back to *Frye v. United States*.<sup>169</sup> The court cited *Polygraph* to provide an overview of polygraph testing, concluding that *Polygraph* fulfilled the requirement under *Daubert* that “the polygraph has been subjected to peer review and publication.”<sup>170</sup> Despite *Polygraph* also highlighting serious concerns about the reliability of polygraph testing,<sup>171</sup> the court continued to undertake an evaluation of the relevant polygraph test results using the state admissibility framework, concluding that despite widespread inadmissibility, polygraph tests are routinely used “for a variety of law enforcement purposes.”<sup>172</sup> The court ultimately determined that subsequent courts were free to establish the reliability of the testimony of polygraph examiners on a case-by-case basis.<sup>173</sup>

While this decision provided for the admission for polygraph evidence on a case-by-case basis, the *in limine* decision in *State v. Sharma (2007)* found that “the unique circumstances of this case and the great advancements in the technology of polygraph examinations and greater consensus by the scientific community as to its accuracy,”<sup>174</sup> which allowed the polygraph evidence presented to be admitted.<sup>175</sup> However, this case presents a particular dilemma, as the testifying expert in this case “indicated that in 2003 the National Academy of Sciences... indicated an average accuracy rate of 86

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<sup>167</sup> *United States v. Matusiewicz*, 155 F.Supp.3d 482 (D. Del. 2015).

<sup>168</sup> *Lee v. Martinez*, 136 N.M. 166, 185 (N.M. 2004).

<sup>169</sup> *Id.*

<sup>170</sup> *Id.*, at 176.

<sup>171</sup> FEINBERG, *supra* note 164, at 139-145.

<sup>172</sup> *Id.*, at 181.

<sup>173</sup> *Id.*, at 182.

<sup>174</sup> *State v. Sharma*, 875 N.E.2d 1002 (Ohio Ct. Com. Pl. 2007).

<sup>175</sup> *Id.*, at 1011.

percent for laboratory research and an average accuracy rate of 89 percent for field research.”<sup>176</sup>

There are no such indications present in *Polygraph*.

## 5. The Role of Precedent in Collective Reasoning

This subsection explores the role of precedent when it is not the primary reason for a decision. It examines decisions within the data set that have been primarily determined by other factors. The data set shows that even under these circumstances, precedent has an influence in decision-making. This has already been explored to a certain extent in subsections (1)-(3), through the courts’ engagement with the findings and recommendations of *DNA 1* and *DNA 2* alongside precedent. In this context, the courts made use of the authority of the two NAS reports to provide information about DNA evidence, supplementing existing precedent. While these decisions, as seen above, were driven by precedent and courts’ previous interpretations of NAS reports’ findings and recommendations, other decisions within the data set show that precedent is not always the primary justification for decisions, although it always remains a consideration. This is unsurprising, given the binding nature of in-state precedent. Even when precedent is merely one of several decision-making factors, its importance is particularly visible in cases challenging the probative value of CBLA evidence following *Bullet Lead*.<sup>177</sup> The majority of CBLA cases within the data set were decided after the FBI’s decision to discontinue CBLA in 2005,<sup>178</sup> with several further cases decided following the FBI’s case review, which also used subsequent letters issued to individuals, informing the court of CBLA’s lack of reliability.<sup>179</sup> Typically, individual petitioners have sought to rely on *Bullet Lead* and the subsequent discontinuation of CBLA, either with or without an FBI review letter, to argue that the unreliability of CBLA evidence undermined the petitioner’s conviction.

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<sup>176</sup> *Id.*, at 1008.

<sup>177</sup> KENNETH O. MACFADDEN, *FORENSIC ANALYSIS: WEIGHING LEAD BULLET EVIDENCE* (National Academies Press 2004).

<sup>178</sup> FBI National Press Office, [FBI Laboratory Announces Discontinuation of Bullet Lead Examinations](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations) (Sept. 1, 2005) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations> (last visited Nov. 4, 2019).

<sup>179</sup> *See*, FBI National Press Office, [FBI Laboratory to Increase Outreach in Bullet Lead Cases](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases) (Nov. 17, 2007) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases> (last visited Nov. 4, 2019)).

This can be seen in ***Bowling v. Parker (2012)***, wherein the federal district court responded to the petitioner’s habeas corpus petition – which argued that the admission of the CBLA evidence rendered the trial fundamentally unfair – by primarily relying on an analysis of the CBLA expert’s testimony, but additionally relied upon the general principles of CBLA and its discreditation as interpreted through precedent.<sup>180</sup> The court introduced its analysis of CBLA evidence by acknowledging the demise of CBLA evidence as a general fact, by stating “as it later turned out, however, CBLA was not all it was cracked up to be,”<sup>181</sup> before outlining the limitations CBLA evidence found in ***Bullet Lead***.<sup>182</sup> Further, the court noted that previous decisions – namely ***United States v. Berry (2010)***<sup>183</sup> and ***United States v. Higgs (2011)***<sup>184</sup> – had found that the presence of CBLA evidence did not warrant reversal. This precedent demonstrated that the presence of CBLA alone did not violate the petitioner’s due process rights, and did not prejudice a petitioner in instances where it merely corroborated additional evidence of guilt.<sup>185</sup> This allowed the court to conclude that although CBLA evidence is no longer admissible, it still retained some probative value.<sup>186</sup> It was at this point where the court’s reliance on precedent ended.

Turning to the facts of ***Bowling’s*** case and evaluating the merits of his claims, the court used a threefold justification to determine that the CBLA evidence did not render Bowling’s trial fundamentally unfair. Interpreting the decisions in ***Berry*** and ***Higgs***, the court found that as the CBLA expert did not definitively state that all of the bullets came from the same box; the evidence corroborated additional evidence linking the petitioner to the crime; and the CBLA expert did not make any direct claims, avoiding many of the pitfalls of CBLA evidence and making few overstatements (previous cases were used to provide examples of such overstatements), the CBLA evidence did not deprive the petitioner of due process.<sup>187</sup>

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<sup>180</sup> *Bowling v. Parker*, 2012 WL 2415167 (E.D. Ky. 2012).

<sup>181</sup> *Id.*, at 55.

<sup>182</sup> *Id.*

<sup>183</sup> *United States v. Berry*, 624 F.3d 1031 (9th Cir.2010).

<sup>184</sup> *United States v. Higgs*, 663 F.3d 726 (4th Cir.2011).

<sup>185</sup> *Bowling v. Parker*, 2012 WL at 56.

<sup>186</sup> *Id.*, at 57.

<sup>187</sup> *Id.*, at 57-58.

Further decisions have also relied on a combination of precedent and other factors to resolve challenges to CBLA evidence. In **Gonzalez v. Thaler (2012)**,<sup>188</sup> the court interpreted **Bowling v. Parker** and other cases to determine that a balance must be struck between recognizing the limitations of CBLA evidence as published in **Bullet Lead** and attaining the high threshold required for a violation of due process.<sup>189</sup> In analyzing the petitioner’s claim, the court ultimately found that the petitioner had failed to show that the admission of CBLA evidence was fundamentally unfair, holding that the trial court had already decided on the admissibility of the evidence following a gatekeeping hearing.<sup>190</sup> It stated if CBLA evidence were admitted erroneously, its admission “was harmless because it did not have a substantial and injurious influence on the jury’s verdict.”<sup>191</sup> By not only looking to precedent, but also recognizing the considerations and decision of the trial court, the decision demonstrates how precedent can interact with other considerations in the decision-making process. Within the interpretation of issues surrounding CBLA evidence, precedent has served to provide a starting point for an analysis of CBLA evidence.

The data set shows that the interpretation of precedent has also played a part, but not dominated decision-making in cases involving petitioners’ claims that their Sixth Amendment Confrontation Clause rights have been violated. For example, in **Commonwealth v. Vasquez (2010)**, the Supreme Judicial Court of Massachusetts discussed whether written drug certificates were incorrectly admitted, contravening the Sixth Amendment Confrontation Clause, as interpreted in **Melendez-Diaz v. Massachusetts (2009)**.<sup>192</sup> As part of its analysis, it reviewed the decisions in many previous cases to establish the standard required to overturn a trial court decision.<sup>193</sup>

In justifying its dismissal of the petitioner’s challenge, the court reviewed a large number of previous cases, distinguishing them from the circumstances of the evidence in this case regarding the admission

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<sup>188</sup> Gonzalez v. Thaler, 2012 WL 5462682 (S.D. Tex. 2012).

<sup>189</sup> *Id.*, at 8.

<sup>190</sup> *Id.*

<sup>191</sup> *Id.*, at 7.

<sup>192</sup> Commonwealth v. Vasquez, 456 Mass. 350 (Mass. 2010).

<sup>193</sup> *Id.*, at 362-363.

of drugs testimony.<sup>194</sup> The volume of cases reviewed by the court indicates its search to find a suitable precedent to follow, but in the absence of this, relied on the circumstances of the case to carve out its own approach. In this instance, it held that as the constitutional issue was preserved on appeal, it placed “little weight on defense counsel’s decision not to challenge the admission of the drug certificates,”<sup>195</sup> finding that the inability of defense counsel to cross-examine the expert violated the Confrontation Clause as interpreted by *Melendez-Diaz v. Massachusetts*.<sup>196</sup>

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<sup>194</sup> *Id.*, at 356-367.

<sup>195</sup> *Id.*, at 368.

<sup>196</sup> *Id.*

## Positioning these Findings Within Existing Knowledge

In general, the data set shows that judicial decision-making is dominated by precedent. Each of the subsections explored above demonstrates that precedent is the biggest driving force behind decision-making. This is particularly shown where precedent is absent, as judges have actively sought out precedent from other jurisdictions and re-interpreted old precedents in light of new evidence to give legitimacy to decisions made. This confirms concerns raised in academic comment discussing the arrival of DNA evidence and the impact of **DNA 1** in existing literature.

The majority of comment surrounding the difficulties in establishing the authority of **DNA 1** has expressed concern about the lack of consensus in the interpretation of **DNA 1**. Authors have highlighted the fragility of the admissibility of DNA evidence at this time. For example, in *Legal Criticisms of DNA Typing: Where's the Beef?*, concern was raised about the lack of consensus in judicial decision-making regarding the admissibility of DNA evidence.<sup>197</sup> Harmon expressed concern that courts' DNA analyses merely viewed a snapshot of technological advancements in DNA evidence, which resulted in inconsistencies in admissibility decisions.<sup>198</sup> Other commentators have attributed the lack of consensus in early DNA cases to scientific uncertainty surrounding the potential presence of population sub-structures.<sup>199</sup> In identifying and explaining these issues, the existing literature fleshes out the reasons behind courts' struggles to reach consensus on the application of DNA evidence and accompanying statistical significance.<sup>200</sup> This is particularly explored by Kaye, who has followed the influence of **State v. Bible** in Arizona and the difficulties that subsequent courts experienced in applying its principles.<sup>201</sup> Case law from other states has also been documented.<sup>202</sup>

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<sup>197</sup> Rockne P. Harmon, *Legal Criticisms of DNA Typing: Where's the Beef?*, 84 J. CRIM. L. & CRIMINOLOGY 175, 182 (1993-1994).

<sup>198</sup> *Id.*

<sup>199</sup> Yale H. Lee, *Criminal DNA Data Banks: Revolution for Law Enforcement or Threat to Individual Privacy*, 22 AM. J. CRIM. L. 461 (1994-1995).

<sup>200</sup> See, Richard A. Nakashima, *DNA Evidence in Criminal Trials: A Defense Attorney's Primer*, 75 NEB. L. REV. 444 (1995).

<sup>201</sup> David H. Kaye, *Bible Reading: DNA Evidence in Arizona*, 28 ARIZ. ST. L. J. 1035 (1996).

<sup>202</sup> See, e.g., James P. O'Brien, *DNA Fingerprinting: The Virginia Approach*, 35 WM. & MARY L. REV. 767 (1994).

Further scholarship written during this time reflects concerns about the courts' application of *Daubert*, and whether states should be encouraged to depart from *Frye* admissibility.<sup>203</sup>

Existing literature documenting growing consensus surrounding the admissibility of DNA evidence has tended to focus on the impact of *Bible* as the beginning of judicial consensus surrounding the admissibility of DNA evidence.<sup>204</sup> However, this data set shows other seminal cases to have had an equal or greater influence on subsequent judicial decisions. While it is clear that *Bible* has had a decisive impact, other cases, such as *Barney*, *Venegas*, *Vandebogart* and *Cauthron* have each had an effect on the inter-state admissibility of DNA evidence. Instead of examining the admissibility of DNA evidence itself and the growing consensus surrounding DNA evidence through these seminal cases and the influence of both *DNA 1* and *DNA 2*, scholars have criticized the judicial application of both the *Frye* and *Daubert* admissibility frameworks<sup>205</sup> and have commented on the wider concerns surrounding the ceiling principle.<sup>206</sup>

Additionally, the data set, in allowing for a comparison of such a large number of cases where the admissibility of DNA evidence has been examined, has found that the uncertainty in the admissibility of DNA evidence and the application of *DNA 1* as voiced by scholars in the early 1990s was merely a short-term issue. It demonstrates that as consensus surrounding the interpretation of DNA evidence developed, coupled with the publication of *DNA 2*, the uncertainties and concerns raised in the literature did not continue long-term. The data set shows that the publication of *DNA 2* resolved much controversy surrounding population sub-structures, alleviating concerns raised by commentators.

The data set, as explored through the cases above, shows a relatively quick acceptance of *DNA 2*, especially when compared against the judicial caution when interpreting *DNA 1*. The data shows that

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<sup>203</sup> See, e.g., Michael A. Riley, *How Should North Dakota Approach the Admissibility of DNA: A Comprehensive Analysis of How Other Courts Approach the Admissibility of DNA*, 72 N. D. L. REV. 607 (1996).

<sup>204</sup> See, e.g., Sherry J. Whitney, *State v. Bible: The Admissibility of Forensic DNA Profiling and Statistical Probability Evidence in Arizona Criminal Proceedings*, 26 ARIZ. ST. L. J. 593 (1994).

<sup>205</sup> See, e.g., Edward J. Imwinkelried, *The Case Against Evidentiary Admissibility Standards that Attempt to "Freeze" the State of a Scientific Technique*, 67 U. COLO. L. REV. 887 (1996).

<sup>206</sup> See, e.g., D. H. Kaye, *The Forensic Debut of the National Research Council's DNA Report: Population Structure, Ceiling Frequencies and the Need for Numbers*, 34 JURIMETRICS J. 369 (1993-1994).

the reliance on precedent interpreting **DNA 2** provided a clear resolution to the underlying uncertainty of two main elements of DNA technology: population sub-structures and the admissibility of the product rule method of DNA statistical analysis. By comparing the judicial approaches to both **DNA 1** and **DNA 2**, this study demonstrates the importance of existing precedent in the acceptance of evolving scientific research, within the context of DNA evidence.

Some existing scholarship following the publication of **DNA 2** has also discussed the growing acceptance of the admissibility of DNA evidence, which this study has confirmed on a larger scale.<sup>207</sup> However, in the literature, concerns about the content of **DNA 2** have also been raised. For example, Koehler has been critical of the reductionist approach taken by the NAS in **DNA 2**, arguing that the report provided an over-simplistic account of error rates.<sup>208</sup> This contrasts the clarity that the report provided to courts in resolving the uncertainty relating to the forensic application of the PCR method of DNA analysis and the product rule calculation method.

The clarity in decision-making that **DNA 2** provided to decision-makers, as found across this data set, has also been recognized by Kaye, who has found that one of the key features of **DNA 2** was to provide clarity for courtroom actors. He has acknowledged that although **DNA 2** was designed to resolve certain areas of conflict, it was not indicative of complete consensus within the scientific community, which is reflected across academic commentary.<sup>209</sup> This study reflects the acceptance of **DNA 2** – the report clearly had an immediate impact on the admissibility status of the product rule and PCR analysis. The data set shows that the driving force behind the reference to **DNA 2** was a growing body of supporting precedent already established by discussions relating to **DNA 1**.

The data set also shows that when a large body of precedent is challenged, judicial decision-makers are reluctant to depart from established practices. This is particularly true when **Strengthening** has

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<sup>207</sup> Julian Adams, *Nuclear and Mitochondrial DNA in the Courtroom*, 13 J. L. POL'Y 69 (2005).

<sup>208</sup> See, Jonathan J. Koehler, *Why DNA Likelihood Ratios Should Account for Error (Even When A National Research Council Report Says They Should Not)*, 37 JURIMETRICS 425 (1996-1997); Jonathan J. Koehler, *Proficiency Tests to Estimate Error Rates in the Forensic Sciences*, 12 LAW PROB. & RISK 89 (2013).

<sup>209</sup> David H. Kaye, *DNA, NAS, NRC, DAB, RFLP, PCR and More: An introduction to the Symposium on the 1996 NRC Report on Forensic DNA Evidence*, 37 JURIMETRICS 395 (1996-1997).

been used to support reliability and admissibility challenges. The majority of literature discussing admissibility issues surrounding admissibility and **Strengthening** speaks generally of courts' lack of understanding about the limitations of (especially) fingerprint evidence,<sup>210</sup> showing concern for courts' dismissal of these findings. Scholars commenting on the lack of successful challenges have recognized that one of the highest hurdles for fingerprint challenges is its longstanding admissibility.<sup>211</sup> Other authors have acknowledged the importance of cases that have limited the extent of expert testimony – such as **United States v. Glynn** – although have done so in varying contexts. For example, Roth has suggested that cases limiting admission of expert testimony “provide the “stick” to... encourage law enforcement agencies to improve,”<sup>212</sup> although others have discussed the approach taken in these cases as providing a valuable tool in addressing issues surrounding the methodological limitations of these forensic science techniques.<sup>213</sup> Despite some enthusiasm for embracing the decisions that have limited expert testimony in these cases, scholars have highlighted the limited scope and utility of these decisions,<sup>214</sup> mirroring the limited acceptance of these decisions authorities as precedent, as found across the data set.

Further, this data set confirms appellate courts' limited engagement with precedent that has limited the extent of forensic science testimony, and has found that these decisions and the findings in **Strengthening** and **Ballistic Imaging** are not strong enough to undermine decades of precedent. However, in relation to polygraph evidence, precedent has been cited alongside **Polygraph** to confirm and support reliance on existing precedent. While cases such as **Lee v. Martinez** were decided on the basis of multiple factors and suggested that existing precedent finding polygraph evidence inadmissible does not automatically preclude later courts from introducing it into evidence,

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<sup>210</sup> See, e.g., Jacqueline McMurtrie, *Swirls and Whorls: Litigating Post-Conviction Claims of Fingerprint Misidentification after the NAS Report*, 2010 UTAH L. REV. 267 (2010).

<sup>211</sup> Jennifer L. Mnookin, Simon A. Cole, Itiel E. Dror & Barry A. J. Fisher, *The Need for a Research Culture in the Forensic Sciences*, 58 UCLA L. REV. 725, 747-748 (2010-2011).

<sup>212</sup> Jessica A. Roth, *Informant Witnesses and the Risk of Wrongful Convictions*, 53 AM. CRIM. L. REV. 737 (2016).

<sup>213</sup> Keith A. Findley, *Judicial Gatekeeping of Suspect Evidence: Due Process and Evidentiary Rules in the Age of Innocence*, 47 GA. L. REV. 723 (2012-2013).

<sup>214</sup> Sarah Lucy Cooper, *The Collision of Law and Science: American Court Responds to Developments in Forensic Science*, 33 PACE L. REV. 234, 287-288 (2013).

particularly when this decision is made by a state supreme court, this is not typical of all polygraph cases. In line with the findings of the data set, scholars have identified the importance of the pre-**Polygraph** case of *United States v. Scheffer (1998)*<sup>215</sup> and have speculated on the potential impact of New Mexico's polygraph admissibility.<sup>216</sup> However, there have been few cases citing **Polygraph** since the decision was made. This study has highlighted the lack of consensus surrounding **Scheffer** and **Frye**, through the judgment in *Lee v. Martinez*, although there are few decisions that have followed this precedent.

The judicial treatment of precedent in polygraph cases, although worth noting, is an outlier across the data set, where decision-making is generally dominated by consideration of precedent. While precedent is not always the only driving force behind a decision, it is clear that precedent is always a consideration. Existing literature discussing the role of precedent in relation to a case study analysis is often directed towards the impact of *Melendez-Diaz* on the interpretation of the Confrontation Clause.<sup>217</sup> Scholars have commented on the evolving interpretation of the Confrontation Clause and its implications for decision-makers,<sup>218</sup> experts,<sup>219</sup> and parties,<sup>220</sup> although commentary has largely concentrated on the lack of consensus between Supreme Court justices,<sup>221</sup> and not the decision's impact on lower courts.

Outside of the Confrontation Clause, there is little case law-based discussion on the impact of precedent on judicial decision-making. When case law has been examined, scholars have also found

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<sup>215</sup> See, Michael O. Finkelstein & Bruce Levin, *On the Probative Value of Evidence from a Screening Search*, 43 JURIMETRICS 265 (2002-2003).

<sup>216</sup> See, e.g., John C. Bush, *Warping the Rules: How Some Courts Misapply Generic Evidentiary Rules to Exclude Polygraph Evidence*, 59 VAND. L. REV. 539 (2006); Jodi Mayers, *Lee V. Martinez: Does Polygraph Evidence Really Satisfy Daubert?*, 36 JURIMETRICS 391 (2005-2006).

<sup>217</sup> See, e.g., Justin Chou, *Melendez-Diaz v. Massachusetts: Raising the Confrontation Requirements for Forensic Evidence in California*, 14 BERKLEY J. CRIM. L. 439 (2009-2010); Mohammad A. Yasin, *Williams Plurality Relies on Inherently Unreliable Forensic Evidence: Confrontation Clauses Analyses across the Nation in Disarray*, 49 SUFFOLK U. L. REV. 395 (2016).

<sup>218</sup> See, e.g., Elizabeth Stevens, *Crawford's Last Stand - What Melendez-Diaz v. Massachusetts means for the Confrontation Clause and for Criminal Trials*, 2 AKRON J. CONST L. & POL'Y 81 (2010-2011).

<sup>219</sup> Daniel J. Capra & Joseph Tartakovsky, *Autopsy Reports and the Confrontation Clause: A Presumption of Admissibility*, 2 VA. J. CRIM. L. 62 (2014).

<sup>220</sup> Jules Epstein, *Cross-Examination: Seemingly Ubiquitous, Purportedly Omnipotent, and At Risk*, 14 WIDENER L. REV. 427 (2008-2009).

<sup>221</sup> See, e.g., Megan Weisgerber, *Confronting Forensics: Bullcoming v. New Mexico and the Sixth Amendment*, 45 LOY. L. A. L. REV. 613 (2011-2012).

that the impact of **Strengthening** has been tempered by judicial reliance on precedent.<sup>222</sup> For example, Cole and Edmond have suggested that in addition to precedent, several factors have contributed towards the judicial dismissal of admissibility challenges.<sup>223</sup> This study confirms these findings on a larger scale, examining judicial responses to challenges to more forensic science techniques and further NAS reports. This further demonstrates that while judges frequently make use of precedent as a tool to dismiss admissibility challenges, it is not always the only mechanism employed by judges, and is often considered in conjunction with additional legal process drivers.

More generally, judicial reliance on precedent demonstrates fidelity to the principle of *stare decisis*, a hallmark of the legal process vision.<sup>224</sup> By placing a judicial decision within the framework of a decision that has come before it, judges are ensuring that their decision-making is built on accepted and legally sound frameworks. This has the effect of minimizing legal uncertainty, even if this disregards uncertainty or recent changes in scientific consensus. By taking this approach, it becomes more difficult for decisions to be challenged where no irregularity in legal procedures exist.

Reliance on precedent has been an important factor in suppressing uncertainty brought about by the challenges to the reliability of forensic science disciplines found within the NAS reports. There are many articles across existing literature that highlight this tension. When general comments about the primary place of precedent has been discussed, especially in admissibility of traditional forensic science techniques analyzed in **Strengthening**, authors have, in general, advocated for greater reliance on the findings and recommendations of **Strengthening**, but cautioned that judges need to act within the parameters of their competence, often referencing the judgment of **United States v. Llera-Plaza (2002)**<sup>225</sup> as a cautionary tale against departing from precedent.<sup>226</sup> Although standing outside the data

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<sup>222</sup> Simon A. Cole & Gary Edmond, *Science without Precedent: The Impact of the National Research Council on the Admissibility and use of Forensic Science Evidence in the United States*, 4 BRIT. J. AM. LEGAL STUD. 585, 605 (2015).

<sup>223</sup> *Id.*, from 601.

<sup>224</sup> HART & SACKS, *supra* note 7, at 597-599.

<sup>225</sup> *United States v. Llera-Plaza*, 179 F.Supp.2d 492 (E.D. Pa. 2002), *vacated by* 188 F.Supp.2d 549 (E.D. Pa. 2002). For comment on this case, *see*, David H. Kaye, *The Nonscience of Fingerprinting: United States v. Llera-Plaza*, 21 QUINNIPIAC L. REV. 1073 (2003).

<sup>226</sup> *See, e.g.*, Jennifer L. Mnookin, *The Courts, the NAS, and the Future of Forensic Science*, 75 BROOK. L. REV. 1209 (2010).

set, the *Llera-Plaza* court reversed its decision to exclude fingerprint evidence upon re-hearing. Commentary surrounding these decisions have become part of the discourse discussing challenges to forensic science evidence.<sup>227</sup> Authors considering the findings of *Strengthening* in the context of this case have highlighted the uncertainty caused by the departure from an established body of precedent, with Kaye describing the *Llera-Plaza* decision to restrict fingerprint evidence as having “sent shock waves through the community of fingerprint analysts.”<sup>228</sup>

More generally, Giannelli’s work has highlighted the importance of *Strengthening*’s goal to create a bridge between the criminal justice system and the scientific community,<sup>229</sup> which would allow for the progress of forensic science evidence and its acceptance by courtroom decision-makers, as progress in DNA evidence had been accepted before it. Furthermore, Epstein has suggested that only “a reinvigoration”<sup>230</sup> of admissibility standards would allow courts to depart from their obligation to follow precedent, after finding that under both *Frye* and *Daubert* admissibility frameworks, precedent has impacted lower courts’ ability to act in cases where scientific evidence is debated, and oversight agencies have limited authority in impacting courtroom decisions.<sup>231</sup>

The data set shows that there is consistency across appellate court decisions when citing the findings and recommendations of the six NAS reports (perhaps with the exception of *Polygraph* which has a much smaller number of cases) when faced with admissibility and constitutional challenges. This can be attributed to judicial fidelity to precedent, whether it be within the context of *DNA 1* and *DNA 2* providing clarity to courts on emerging scientific issues,<sup>232</sup> or challenges to longstanding precedent using *Ballistic Imaging* and *Strengthening*.<sup>233</sup> What is clear from the data set, especially through decisions such as *Bonds*, is that judges avoid analyzing new evidence if no precedent exists, preferring

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<sup>227</sup> See, e.g., Paul C. Giannelli, *Scientific Evidence in Criminal Prosecutions: A Retrospective*, 75 BROOK. L. REV. 1137 (2009-2010).

<sup>228</sup> D. H. Kaye, *supra* note 225, at 1073 (2003).

<sup>229</sup> Paul C. Giannelli, *Daubert and Forensic Science: The Pitfalls of Law Enforcement Control of Scientific Research*, 2011 U. ILL. L. REV. 53 (2011).

<sup>230</sup> Jules Epstein, *Preferring the Wise Man to Science: The Failure of Courts and Non-Litigation Mechanisms to Demand Validity in Forensic Matching Testimony*, 20 WIDENER L. REV. 81, 117 (2014).

<sup>231</sup> *Id.*, at 109-110.

<sup>232</sup> See *supra*, subsections (1)-(3).

<sup>233</sup> See *supra*, subsections (4)-(5).

to decide matters on other grounds, demonstrating the difficulties in decision-making where there is a lack of precedent. Scientific avoidance is also seen where established precedent is challenged by petitioners citing NAS report findings. This is not a new phenomenon. Faigman has long appreciated that legal “insecurity with science... creates an assortment of doctrinal problems for the law, as justices and judges do somersaults to avoid substantive scientific analysis.”<sup>234</sup> He attributes this to the fundamental differences in approaches between legal and scientific methods, particularly the need for the law to provide immediate and certain remedies.<sup>235</sup> The data set shows that this is perpetuated through the law’s constant reliance on precedent. In creating certainty within the law through reliance on precedent, decision-makers have ignored emerging issues within science, especially those that conflict with established legal rules.

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<sup>234</sup> DAVID L. FAIGMAN, *LEGAL ALCHEMY: THE USE AND MISUSE OF SCIENCE IN THE LAW* 26 (1999).

<sup>235</sup> *Id.*, at 66.

#### Chapter 4: Deference to Institutional Settlement

This chapter demonstrates that legal actors within the criminal justice system are beholden to the legal process vision by paying deference to institutional settlement. Within the data set, deference to institutional settlement is seen when NAS reports are referenced, regardless of whether its findings are followed or dismissed, with judges prioritizing institutional competence over concerns raised by the NAS reports.

One of the core principles of the legal process vision is institutional settlement, also known as institutional competence. The principle of institutional settlement provides that each government actor – legislative, executive, and judiciary – (and by extension, actors within the criminal justice system) has bestowed upon them a specific competence,<sup>1</sup> within their own areas of expertise which gives them authority for decision-making.<sup>2</sup> Therefore, when a decision is “arrived at [as a] result of duly established procedures”,<sup>3</sup> it “ought to be accepted as binding upon the whole society unless and until they [the procedures] are duly changed.”<sup>4</sup> Institutional settlement emphasizes the importance of procedure. It is centered in the notion that consistency and regularity in decision-making – when carried out by an institution that has the competence to make such decisions – provides legitimacy to decisions that are made.<sup>5</sup> While this pursues a number of policy goals, this reliance on legitimacy of process is primarily “an effective way to obtain good decisions,”<sup>6</sup> because it creates consistency, stability and rationality.<sup>7</sup>

The legal process vision provides that within the justice system, judges are required to make decisions regarding the adjudication of the law.<sup>8</sup> In general, judges are given the competence to apply legislative

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<sup>1</sup> HENRY M. HART, JR. & ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW*, ED. WILLIAM N. ESKRIDGE JR. & PHILIP P. FRICKEY 4-5 (Foundation Press 1993).

<sup>2</sup> *Id.*

<sup>3</sup> *Id.*, at 2045.

<sup>4</sup> *Id.*

<sup>5</sup> See, William N. Eskridge Jr. & Gary Peller, *The New Public Law Movement: Moderation as a Postmodern Cultural Form*, 89 MICH. L. REV. 707, 722 (1991).

<sup>6</sup> *Id.*, at 721.

<sup>7</sup> Sarah Lucy Cooper, *Forensic Science Developments and Judicial Decision-Making in the Era of Innocence: The Influence of Legal Process Theory and its Implications*, 19 RICH. J. L. & PUB. INT. 211, 214 (2016).

<sup>8</sup> HART & SACKS, *supra* note 1, at 4-5.

measures made in good faith.<sup>9</sup> Their role is to consider all evidence before them,<sup>10</sup> adjudicating and meting out punishment, provided that this does not fall outside their competence.<sup>11</sup> Judicial competence can be further divided by court level: trial judges are charged with adjudicating over the trial process, and appellate judges generally review trial court decisions for an abuse of process. Typically, appellate courts do not examine issues *de novo* (where the decision is reviewed as if it has not previously been decided), as it encroaches the competence of the trial judge. Therefore, appellate judges pay deference to the decisions made by trial courts, provided that these decisions have followed established procedural requirements.<sup>12</sup>

Within the data set, appellate judges have paid considerable deference to institutional settlement where trial court admissibility decisions have been challenged. Within this, the judicial consideration of the forensic science NAS reports largely takes three forms. First, where findings and recommendations of a NAS report align with a decision made at trial, appellate judges have used the reports as a tool for reaffirming institutional competence by referring to these findings and recommendations to confirm the decision made by the trial court, engaging in the content of the reports. Second, appellate judges defer to the high thresholds of review to dismiss petitioners' claims. Third, where petitioners' have challenged trial court decisions using NAS report findings and recommendations, appellate judges have deferred to the decisions made by trial court actors, most notably the trial judge and jury.

Across the three responses, appellate judges have used multiple legal mechanisms to justify their deference to trial court decisions. This is explored in detail below, using examples from within the data set. This chapter is divided into three sections: Section 1 examines the judicial engagement with NAS report findings in support of institutional settlement; Section 2 discusses cases where appellate judges

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<sup>9</sup> *Id.*, at 1378.

<sup>10</sup> This is evidenced in the analysis of "The Significance of an Institutional System: The Case of the Spoiled Cantaloupes," HART, JR. & SACKS, *supra* note 1, at 10-68.

<sup>11</sup> *Id.*, at 483.

<sup>12</sup> *See, e.g.*, State v. Davidson, 2015 WL 1087126 (Tenn. Ct. App. 2015); Coronado v. State, 384 S.W.3d 919 (Tex. Crim. App. 2012); United States v. Ewell, 252 F.Supp.2d 104 (D. N.J. 2003).

have used the high review thresholds to defer to trial court decisions; and Section 3 discusses decisions where appellate courts have rejected the significance of NAS report findings, in favor of retaining the decisions made by trial court actors. They collectively demonstrate that regardless of whether the relevant NAS report supports the trial court's decision, in the absence of a procedural irregularity, deference is paid to institutional settlement.

### **1. Using the Findings and Recommendations of NAS Reports to Reaffirm the Institutional Competence of the Trial Judge**

This part, in discussing how appellate judges have used the findings and recommendations of NAS reports to justify deferring to the decisions made by trial courts, largely examines case law where DNA evidence has been challenged. The data set shows that where the admissibility of DNA evidence has been challenged, judges have often referenced **DNA 1**, **DNA 2**, or a combination of both reports to justify that the trial court had correctly examined the evidence. This shows judicial deference to institutional settlement and the competence of the trial judge, with judges citing the NAS reports' findings as a tool to affirm this. Such decisions are particularly prevalent where a trial court admitted DNA evidence during the 1990s, when DNA technology was in a period of rapid development.

While largely seen in relation to DNA evidence, the judicial reference to NAS report findings and recommendations to dismiss evidentiary challenges is not confined to decisions referencing **DNA 1** and **DNA 2**. Although much less prevalent within the data set, judges have also cited the findings and recommendations of **Polygraph** to support trial court admissibility decisions.<sup>13</sup> The fidelity to institutional settlement is also seen in instances where appellate judges have overturned trial court decisions, referring to NAS report findings to recognize an irregularity in trial court decision-making.

The admissibility of scientific evidence is largely governed by one of two frameworks: *Frye* or *Daubert*. The governing framework is dependent upon the jurisdiction wherein the decision has been made.

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<sup>13</sup> See, e.g., *United States v. Rouse*, 329 F.Supp.2d 1077 (D.S.D. 2004); *State v. Shaneyfelt*, 695 N.W.2d 506 (Iowa Ct. App. 2005).

Under *Frye*, the trial judge can only admit scientific evidence if it has “general acceptance in the particular field in which it belongs.”<sup>14</sup> Within the *Daubert* framework, judges are given a “gatekeeping role.”<sup>15</sup> This framework, now adopted by a majority of states,<sup>16</sup> gives trial judges the competence to determine admissibility of scientific evidence. In their gatekeeping capacity, trial judges are required to consider error rates, professional standards, general acceptance, testability and peer review to determine the admissibility of scientific evidence.<sup>17</sup>

The appellate judicial response to petitioners’ admissibility challenges have varied. Typically, appellate claims are reviewed for procedural error, although at times a review *de novo*<sup>18</sup> has been carried out.<sup>19</sup> Where **DNA 1** and/or **DNA 2** have been used to support admissibility arguments, judges have engaged in the findings and recommendations of these reports as a referencing tool to support institutional settlement and further underpin the trial court’s decision.<sup>20</sup>

From the data set, the author has identified four indicators by which appellate judges show fidelity to institutional settlement when deferring to trial court decisions. They have done so by: (a) using one or more NAS reports as a referencing tool to support the trial court’s decision to admit DNA evidence; (b) citing NAS report findings (namely **Polygraph**) to support the trial court’s decision that the questioned forensic science evidence is inadmissible; (c) referring to one or more NAS reports as part of collective reasoning to support a trial court’s admissibility decision, and; (d) relying on one or more NAS reports to determine that there had been an irregularity in process, overturning a decision made by a trial court. Each will now be explored in reference to specific cases within the data set.

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<sup>14</sup> *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir 1923).

<sup>15</sup> *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 597 (1993).

<sup>16</sup> Michael Morgenstern, *Daubert v. Frye – A State-by-State Comparison*, THE EXPERT INSTITUTE (Apr. 3, 2017) <https://www.theexpertinstitute.com/daubert-v-frye-a-state-by-state-comparison/>.

<sup>17</sup> *See, Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. at 587.

<sup>18</sup> A *de novo* review examines the relevant issue as if it had not been previously heard or decided.

<sup>19</sup> *See, e.g.*, *People v. Pizarro*, 123 Cal.Rptr.2d 782 (Cal. Ct. App. 2002); *Brim v. State*, 779 So.2d 427 (Fla. Dist. Ct. App. 2000).

<sup>20</sup> *See, e.g.*, *Williams v. State*, 342 Md. 724 (Md. 1996); *Commonwealth v. Rosier*, 425 Mass. 807 (Mass. 1997).

**a. Judicial Reliance on the Findings and Recommendations of *DNA 1* and *DNA 2* to Provide a Referencing Tool to Support Trial Court Reasoning and the Competence of the Trial Judge**

The data set shows that judges have referenced both *DNA 1* and *DNA 2* to support admissibility decisions made by trial courts, affirming their competence. To this end, these reports are cited as a referencing tool, either independently or collectively. The findings of these reports are relied upon to varying degrees, although findings have been referenced by appellate judges to provide a foundation for their analysis of the trial court's admissibility decision. Judges have either: (i) referred to a NAS report to provide a definition or background information about DNA typing, or; (ii) used the findings and recommendations from the relevant NAS report to guide their reasoning in a more detailed way.

**i. Using *DNA 1* and/or *DNA 2* as a Referencing Tool to Introduce Principles of DNA Evidence**

The data set shows that appellate judges have cited *DNA 1* and *DNA 2* to establish information about the process of DNA typing. While this approach is not exclusive to DNA evidence, and is seen elsewhere in the data set to provide an explanation of tool mark identification techniques,<sup>21</sup> the ACE-V method of fingerprint comparison,<sup>22</sup> and the roles of the medical and autopsy examiner,<sup>23</sup> it is most prevalent in cases assessing the admissibility of DNA evidence.

For example, in *People v. Soto (1999)*, the Supreme Court of California cited *DNA 1* and *DNA 2* to provide factual information about the process of DNA typing.<sup>24</sup> In response to a post-conviction admissibility challenge to the method used to calculate the significance of a DNA match,<sup>25</sup> the judge cited both *DNA 1* and *DNA 2* to establish and define the standard methods used to extract and analyze DNA evidence and identify the most appropriate method for calculating the chances of a random DNA match.<sup>26</sup> With this established, the court reviewed its existing interpretation of DNA evidence, which

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<sup>21</sup> See, e.g., *United States v. Otero*, 849 F.Supp.2d 425 (D. N.J. 2012).

<sup>22</sup> See, e.g., *United States v. Herrera*, 704 F.3d 480 (7th Cir. 2013); *People v. Luna*, 989 N.E.2d 655 (Ill. App. Ct. 2013).

<sup>23</sup> See, e.g., *State v. Jaramillo*, 272 P.3d 682 (N.M. Ct. App. 2011); *Rosario v. State*, 175 So.3d. 843 (Fla. Dist. Ct. App. 2015).

<sup>24</sup> *People v. Soto*, 21 Cal.4th 512 (Cal. 1999).

<sup>25</sup> *Id.*

<sup>26</sup> *Id.*, at 519-524.

had relied on findings and recommendations from **DNA 1** as interpreted by precedent.<sup>27</sup> However, as existing precedent had been decided before the publication of **DNA 2**, the court referenced **DNA 2**'s recommendations, leading it to find that "it is clear from... the published scientific commentary... that use of the unmodified product rule in DNA forensic analysis has gained general acceptance in the relevant scientific community."<sup>28</sup> In establishing the general acceptance of the product rule by referencing **DNA 2**, the court ultimately concluded that the unmodified product rule had met the *Kelly* admissibility standard, affirming the decision of the trial court.<sup>29</sup>

The findings and recommendations of **DNA 1** and **DNA 2** have been used collectively by appellate courts from several further states as a referencing tool to confirm trial court reasoning, using the reports' findings to provide further clarity to the trial court's decision. For example, in **Thomas v. State (1999)**, the Court of Criminal Appeals of Alabama cited an extract from **DNA 2** to provide methodological information about the product rule when reviewing the petitioner's claim.<sup>30</sup> The petitioner had argued that the prosecution had failed to establish that DNA evidence was reliable<sup>31</sup> and that it should not have been admitted under the state's *Frye-Plus* admissibility framework.<sup>32</sup> In support of the trial court's decision that DNA evidence was sufficiently reliable,<sup>33</sup> the appellate court cited findings and recommendations from **DNA 2**, as the DNA expert at trial had testified to following the procedures that had been recommended by **DNA 2**.<sup>34</sup> It used **DNA 2** to justify the trial court's determination that the evidence presented was sufficiently reliable to be admitted,<sup>35</sup> supporting the trial court's reasoning and paying deference to institutional settlement.<sup>36</sup>

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<sup>27</sup> *Id.*, at 515.

<sup>28</sup> *Id.*, at 516.

<sup>29</sup> *Id.*, at 542.

<sup>30</sup> *Thomas v. State*, 824 So.2d 1 (Ala. Crim. App. 1999).

<sup>31</sup> *Id.*, at 51.

<sup>32</sup> The *Frye-Plus* admissibility standard in this case consisted of a three-pronged approach, which requires: reliability, general acceptance in the relevant scientific community, and is error free. *See, Ex Parte Perry*, 586 So.2d 242, 250 (Ala. 1991).

<sup>33</sup> *Thomas*, 824 So.2d at 51.

<sup>34</sup> *Id.*, at 52.

<sup>35</sup> *Id.*, at 52-54.

<sup>36</sup> *Id.*, at 52.

The judicial reference to both **DNA 1** and **DNA 2** to provide a scientific authority and referencing tool is also seen in the Supreme Court of New Jersey's decision of **State v. Harvey (1997)**.<sup>37</sup> On appeal, the court addressed the petitioner's challenge that the PCR method of DNA analysis should not have been admitted, as the petitioner had been identified from a mixed DNA sample.<sup>38</sup> In determining that the trial court was right to find PCR sufficiently reliable, the court cited several passages from **DNA 2** to provide information about DNA evidence and PCR typing methods.<sup>39</sup> It referenced the report to explain elements of dot intensity analysis in PCR<sup>40</sup> and a summary of the debate surrounding the presence of population sub-groups.<sup>41</sup> This was then applied to the trial court's decision, confirming its decision<sup>42</sup> that the DNA typing procedures used had gained general acceptance.<sup>43</sup> As it found that the trial court had correctly determined the admissibility of the evidence, the appeal was dismissed.

Appeals decided before **DNA 2** also reflect fidelity to institutional settlement by referring solely to **DNA 1**. For example, cases such as **Armstead v. State (1996)** have extensively cited the findings and recommendations of **DNA 1** to provide information about elements of DNA typing and analysis methods.<sup>44</sup> In **Armstead**, the petitioner challenged the admissibility of the product rule method of DNA statistical analysis. The court's discussion was guided by **DNA 1**. It cited the report to provide an explanation of each element of DNA extraction and analysis.<sup>45</sup> The reliance on the content of **DNA 1** is considerable and detailed, providing referencing information at each stage of analysis.<sup>46</sup> In reviewing the trial court's decision to admit the relevant DNA evidence with a match calculated using the product rule, the court paid considerable deference to the trial court's admissibility decision – as the technique

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<sup>37</sup> State v. Harvey, 151 N.J. 117 (N.J. 1997).

<sup>38</sup> *Id.*

<sup>39</sup> *Id.*, from 158.

<sup>40</sup> *Id.*, at 183.

<sup>41</sup> *Id.*, at 198.

<sup>42</sup> *Id.*, at 236.

<sup>43</sup> Harvey, 151 N.J. at 236.

<sup>44</sup> Armstead v. State, 342 Md. 38 (Md. 1996).

<sup>45</sup> *Id.*, from 50.

<sup>46</sup> *Id.*, at 83.

had not been recommended by **DNA 1**. It ultimately found that the trial court had not abused its discretion in admitting the DNA evidence.<sup>47</sup>

The judicial reference to **DNA 1** to further support the trial court's reasoning and affirm its institutional competence is also found in **State v. Schweitzer (1995)**.<sup>48</sup> The petitioner had argued that the trial court had erred in admitting DNA evidence accompanied by statistical calculations that followed a framework devised by the testifying expert, not recommended by **DNA 1**.<sup>49</sup> The court outlined the underlying principles of DNA evidence by referencing **DNA 1**,<sup>50</sup> before determining that the trial court had correctly assessed the admissibility of the expert evidence.<sup>51</sup> To further its justification, the court determined that the presentation of DNA evidence required a statistical analysis of a random match, which the trial expert had provided.<sup>52</sup>

This reasoning is also used in **State v. Chapman (1997)**.<sup>53</sup> The petitioner argued that the DNA evidence was incorrectly admitted during his trial, as the court had failed to properly consider the evidence under the state's admissibility framework.<sup>54</sup> On appeal, the court referenced **DNA 1** to provide information about the significance of DNA statistical analysis,<sup>55</sup> although ultimately concluded that the DNA evidence was "based on accepted scientific practice."<sup>56</sup> In finding this, it confirmed the trial court's decision, concluding that it had acted within its discretion when admitting the DNA evidence.<sup>57</sup>

These cases have frequently cited the findings and recommendations of **DNA 1** and/or **DNA 2** to agree with the decisions made by the trial court, providing further justification to support the appellate court's reasoning. A number of further cases have also relied upon these reports as a referencing tool for DNA evidence, but to a lesser extent, and have referenced both **DNA 1** and **DNA 2** to provide a

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<sup>47</sup> *Id.*, at 83.

<sup>48</sup> *State v. Schweitzer*, 533 N.W.2d 156 (S.D. 1995).

<sup>49</sup> *Id.*, at 158.

<sup>50</sup> *Id.*

<sup>51</sup> *Id.*, at 159-160.

<sup>52</sup> *Id.*, at 160.

<sup>53</sup> *State v. Chapman* 1997 WL 602944 (Tenn. Ct. App. 1997).

<sup>54</sup> *Id.*, at 9.

<sup>55</sup> *Id.*, at 11.

<sup>56</sup> *Id.*, at 13.

<sup>57</sup> *Id.*

general and contextual introduction to DNA evidence, which has been used as a supplementary justification mechanism to support decisions confirming trial court reasoning. Several cases, including **Williams v. State (1996)**<sup>58</sup> and **State v. Gross (2000)**,<sup>59</sup> have cited **DNA 1** to provide a contextual overview of the processes involved in DNA extraction and analysis before undertaking a review of the particular issues raised. **DNA 2** is also used in the same way, as found in cases such as **Young v. State (2005)**,<sup>60</sup> where the court cited the report to provide a summary of the PCR method of DNA analysis.<sup>61</sup> In using both **DNA 1** and **DNA 2** to justify the trial court decision without completely relying on the reports to explore legal questions, the **Young** court provided a scientific foundation for determining that the trial court had been correct in admitting DNA evidence analyzed using the PCR method.<sup>62</sup>

In addition, **DNA 1** and **DNA 2** have also been referenced by appellate courts to retrospectively justify a trial court's departure from precedent, relying on the reports' findings to demonstrate that DNA science is in a state of constant evolution. This can be seen in **People v. Reeves (2001)**, where the California Court of Appeal cited both **DNA 1** and **DNA 2** to provide an overview of DNA evidence, its extraction methods, and its analysis.<sup>63</sup> The court referenced **DNA 2's** findings to argue that DNA technology had progressed significantly since the publication of **DNA 1**, to the point where the conservative ceiling principle method of DNA analysis – previously found to be the only admissible method of analysis<sup>64</sup> – was no longer necessary and had been superseded by the product rule.<sup>65</sup> After examining these findings, the court determined that the trial court was correct in finding the DNA evidence admissible, especially in holding that the procedures used by the Department of Justice in calculating the probability of a random DNA match were admissible.<sup>66</sup>

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<sup>58</sup> *Williams*, 342 Md.

<sup>59</sup> *State v. Gross*, 134 Md.App. 528 (Md. Ct. Spec. App. 2000).

<sup>60</sup> *Young v. State*, 388 Md. 99 (Md. 2005).

<sup>61</sup> *Id.*, at 108-110, 117.

<sup>62</sup> *Id.*

<sup>63</sup> *People v. Reeves*, 91 Cal.App.4th 14, 25-28 (Cal. Ct. App. 2001).

<sup>64</sup> *See, People v. Barney*, 8 Cal.App.4th 798 (Cal. Ct. App. 1992).

<sup>65</sup> *Reeves*, 91 Cal.App.4th, at 32, 36.

<sup>66</sup> *Id.*, at 49.

ii. **Using *DNA 1* and/or *DNA 2* to Inform Appellate Judges' Decisions that the Trial Court had Acted within its Competence**

The data set shows that appellate courts have also referenced the findings and recommendations of *DNA 1* and/or *DNA 2* not only to provide contextual information as a foundation for their decision-making, but as the primary tool to inform the decision-making process and confirm trial court decisions. This demonstrates judicial deference to institutional settlement, as these reports are referenced as a means to confirm trial court decisions. Both *DNA 1* and *DNA 2* have been used in this way, separately and together, in a variety of contexts, to affirm trial court admissibility decisions.

The California Court of Appeal decision in *People v. Nelson (2006)* provides a clear example of an appellate court's use of both *DNA 1* and *DNA 2* as the primary tool to guide decision-making.<sup>67</sup> The petitioner had argued that there was no generally accepted scientific method for determining the significance of a DNA match when the suspect had been identified through a cold match (found as the result of a trawl through DNA databases), and the DNA evidence was therefore inadmissible.<sup>68</sup> In its review of the trial court's decision to admit the DNA evidence, the Court of Appeal used findings from both *DNA 1* and *DNA 2* to review the reliability of the methods used to calculate the significance of a DNA match.<sup>69</sup> It primarily cited *DNA 1* and *DNA 2* to review the general acceptance of various calculation methods. This included the ceiling principle, finding that "the NRC-I approach [the ceiling principle] has been generally rejected"<sup>70</sup> following the publication of *DNA 2*. Following this, it undertook a review of the product rule method (used in this case), and referenced *DNA 2* to provide significant information about the product rule.<sup>71</sup> This led it to find that the product rule had gained general acceptance, and concluded that the trial court was correct in finding it admissible.<sup>72</sup> This was supported by findings from *DNA 2*, which advocated for the admissibility of the product rule.<sup>73</sup> This

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<sup>67</sup> *People v. Nelson*, 48 Cal.Rptr.3d 399 (Cal. Ct. App. 2006).

<sup>68</sup> *Id.*, at 411.

<sup>69</sup> *Id.*, from 414.

<sup>70</sup> *Id.*, at 416.

<sup>71</sup> *Id.*, at 420.

<sup>72</sup> *Id.*

<sup>73</sup> *Nelson*, 48 Cal.Rptr.3d at 420.

decision was later confirmed by the Supreme Court of California, which found that the trial court had properly considered the evidence.<sup>74</sup> This decision made explicit reference to the competence of the trial judge, finding that “a hallmark responsibility of the trial judge”<sup>75</sup> is the determination of the relevancy and admissibility of forensic science evidence.<sup>76</sup>

The judicial reference to **DNA 1** and **DNA 2** to affirm trial court reasoning has occurred in a number of other decisions in the data set, where **DNA 1** and **DNA 2** have guided appellate decision-making. For example, the Supreme Court of Florida used the processes laid out in **DNA 1** to guide its decision-making process in *Brim v. State (1997)*.<sup>77</sup> The court determined that the presentation of DNA evidence needed to be accompanied by a statistical calculation confirming the likelihood of a random match.<sup>78</sup> In reviewing the trial and appeal courts’ judgments, it acknowledged that **DNA 1** had influenced the trial and appeal court reasoning significantly, as **DNA 1** supported the general acceptance of DNA evidence, as required under *Frye*.<sup>79</sup> In supporting the lower courts’ reliance on the findings and recommendations of **DNA 1** that the underpinning science behind DNA evidence was generally accepted, the court found that the statistical calculation of a random match may still require a *Frye* hearing, in acknowledgement of the concerns raised in **DNA 1** that this technology was still evolving.<sup>80</sup> In conducting a *Frye* analysis, the court did not reach a conclusion about whether the procedures used to determine the significance of a DNA match were generally accepted.<sup>81</sup> It decided, however, that the findings and recommendations of **DNA 2** may have subsequently influenced the general acceptance of the procedures used at trial, leading it to order a new hearing to re-determine the admissibility of the random match calculations.<sup>82</sup> This approach is slightly different from other decisions within the data set, as the court was largely influenced by the findings and recommendations

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<sup>74</sup> *People v. Nelson*, 43 Cal.4th 1242 (Cal. 2008).

<sup>75</sup> *Id.*, at 1265.

<sup>76</sup> *Id.*, at 1265-1267.

<sup>77</sup> *Brim v. State*, 695 So.2d 268 (Fla. 1997).

<sup>78</sup> *Id.*, at 269-270.

<sup>79</sup> *Id.*, at 272-273.

<sup>80</sup> *Id.*, at 271.

<sup>81</sup> *Id.*, at 275.

<sup>82</sup> *Id.*

of **DNA 2**, but did not go so far as to invalidate or directly undermine the conflicting decision made by the trial court. In referring the decision back to the trial court, the appellate judges re-enforced the role of trial judges and their institutional competence.

While the court in *Brim* recognized that the scientific developments recommended in **DNA 2** needed to be considered when making DNA admissibility decisions, other courts have struggled to reconcile the differences between **DNA 1** and **DNA 2** – particularly in relation to the admissibility of the product rule – when the differences between the reports’ recommendations have challenged established procedures. To remedy this, appellate courts have deferred to trial court reasoning, finding that trial courts have the competence to determine the weight to be attributed to these reports. This has given appellate courts the scope to reference and acknowledge **DNA 2**’s findings and recommendations.

This can be seen, for example, in *Commonwealth v. Fowler (1997)*.<sup>83</sup> On appeal, the petitioner sought to challenge the trial court’s decision to admit the product rule method of statistical analysis under *Frye*.<sup>84</sup> He cited the findings of **DNA 1** to argue that the product rule was inadmissible.<sup>85</sup> In response, the court acknowledged the controversy surrounding the admissibility of the previously-considered ceiling principle, using both **DNA 1** and **DNA 2** to establish this.<sup>86</sup> The court justified its reliance on **DNA 2** by noting that “the judge did not, of course, have the benefit of the 1996 NRC Report,”<sup>87</sup> allowing it to recognize the relevance of **DNA 2**’s to the decision.<sup>88</sup> In doing so, it added **DNA 2** to further support the trial court reasoning that the product rule had received general acceptance.<sup>89</sup>

The court in *State v. Freeman (1996)* was also tasked with attempting to reconcile the findings and recommendations of **DNA 1** with those of **DNA 2**.<sup>90</sup> In this case, the petitioner challenged the general

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<sup>83</sup> *Commonwealth v. Fowler*, 425 Mass. 819 (Mass. 1997).

<sup>84</sup> *Id.*

<sup>85</sup> *Id.*, at 823.

<sup>86</sup> *Id.*, at 826.

<sup>87</sup> *Id.*

<sup>88</sup> *Id.*, at 829.

<sup>89</sup> *Fowler*, 425 Mass. at 829.

<sup>90</sup> *State v. Freeman*, 253 Neb. 385 (Neb. 1997).

acceptance of the product rule under *Frye*.<sup>91</sup> The court examined its previous decision of *State v. Carter (1994)*,<sup>92</sup> which had referenced *DNA 1* to find that the product rule had not yet gained general acceptance.<sup>93</sup> The *Freeman* court summarized the *Carter* reasoning as part of an overview of the general acceptance of different DNA statistical calculation methods.<sup>94</sup> However, the court recognized that the recent publication of *DNA 2* should be taken into account when making admissibility decisions, which led it to find that the product rule had gained general acceptance, and that the trial court had been correct to admit it.<sup>95</sup> While this decision was influenced by precedent, the court reconciled this with *DNA 2* to find that the trial court had followed correct procedures to find general acceptance in the product rule.<sup>96</sup> The court also made an express reference to institutional settlement, by stating that it would only overturn a decision if it found plain error, and that the decision made by the trial court would be treated in a favorable light.<sup>97</sup> It justified its decision to overrule *Carter* as it was “based on an outdated level of acceptance by the relevant scientific community.”<sup>98</sup>

Further courts have deferred to institutional settlement, using *DNA 1* and *DNA 2* to confirm trial court decisions that have admitted DNA evidence prepared using the PCR analysis method. Appellate courts have also deferred to institutional settlement to find PCR admissible prior to *DNA 2*. The influence of the growing general acceptance of PCR can be seen in *People v. Pope (1996)*, wherein the petitioner challenged the admissibility of PCR analysis under *Frye*,<sup>99</sup> using *DNA 1* to show that PCR was not sufficiently developed.<sup>100</sup> The court, in response, also referred to *DNA 1* to guide its decision-making, but ultimately deferred to the trial court’s decision which had found PCR admissible.<sup>101</sup> It did, however, require additional safeguards to be in place when using PCR analysis, cautioning that PCR was still a

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<sup>91</sup> *Id.*, at 405.

<sup>92</sup> *State v. Carter*, 246 Neb. 953 (Neb. 1994).

<sup>93</sup> *Freeman*, 253 Neb. at 408.

<sup>94</sup> *Id.*, from 406.

<sup>95</sup> *Id.*, at 412.

<sup>96</sup> *Id.*

<sup>97</sup> *Id.*, at 413.

<sup>98</sup> *Id.*

<sup>99</sup> *People v. Pope*, 672 N.E.2d 1321 (Ill. App. Ct. 1996).

<sup>100</sup> *Id.*, at 1326.

<sup>101</sup> *Id.*, at 1327.

developing analysis method.<sup>102</sup> In establishing the need for additional safeguards, the court reviewed the testimony of the DNA expert at the *Frye* hearing,<sup>103</sup> who testified that quality control measures had been used to ensure high reliability.<sup>104</sup> It found that these safeguards were adequate, leading it to find that the trial court did not abuse its discretion in admitting PCR DNA evidence.<sup>105</sup> It further supported its decision by citing precedent.<sup>106</sup> While the analysis of the DNA evidence in this case was far less detailed than decisions such as *Brim v. State (1997)*, the findings and recommendations from *DNA 1* still formed the basis of the court's approach to reviewing the trial court decision and ultimate conclusion that the trial court had correctly determined PCR admissible.

The data set shows that *DNA 1* and *DNA 2* have had a significant influence in appellate courts' acceptance of trial courts' decisions to admit DNA evidence, including providing an authoritative overview of analysis methods developed throughout the early-mid 1990s, particularly in relation to questions surrounding the methods used to calculate the statistical significance of a DNA match. The data set also shows that appellate courts have regularly deferred to trial court reasoning, using an analysis of *DNA 1* and *DNA 2* as tools to further justify the decisions made by trial judges when admitting DNA evidence.

**b. The Judicial Use of *Polygraph* to Confirm Trial Court Decisions which have Excluded Lie Detector Evidence**

The data set shows that appellate judges have referenced findings from *Polygraph*, used as a tool to confirm decisions made by trial courts, deferring to their competence in decision-making, which demonstrates fidelity to the legal process vision. Although the number of decisions citing *Polygraph* is considerably smaller than those referring to *DNA 1* and *DNA 2*, there is a significant number of decisions where the trial court decision to exclude polygraph evidence has been confirmed at appeal

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<sup>102</sup> *Id.*, at 703.

<sup>103</sup> *Id.*

<sup>104</sup> *Id.*

<sup>105</sup> *Pope*, 672 N.E.2d at 704.

<sup>106</sup> *Id.*, at 704.

through reliance on *Polygraph*. In addition, several hearings conducted *in limine* have also demonstrated the impact that *Polygraph* has had on judicial decision-making.

**i. Appellate Decisions Using *Polygraph* to Confirm Trial Court Reasoning**

Following a conviction for child sexual abuse, the petitioner in *United States v. Rouse (2004)* sought to request a new trial, arguing that he wished to introduce into evidence results of a polygraph test from one of the victims who had recanted their allegations.<sup>107</sup> He had wanted to introduce polygraph results during his appeal to corroborate the victim’s recantation, but both were found inadmissible by under *Daubert*.<sup>108</sup> Upon review of the admissibility decision, the court reviewed the testimony given by the polygraph experts during the *Daubert* hearing. Further evidence given included findings from *Polygraph*, which was reviewed at appeal and led the court to confirm the decision made by the trial court, concluding that the “polygraph evidence in this case is not reliable enough to determine the truthfulness of D.R.’s [the victim’s] testimony.”<sup>109</sup>

Similarly, the petitioner in *State v. Shaneyfelt (2005)* challenged the admissibility of polygraph evidence, arguing that it did not fulfil the reliability requirement be admitted at trial, nor during his sentencing hearing.<sup>110</sup> In response, the court cited several studies – including *Polygraph* – to conduct a reliability review of polygraph evidence, which supported the state’s long-held rule that “polygraph evidence is not admissible at trial.”<sup>111</sup> It found “the NRC’s assessment persuasive”<sup>112</sup> that “[the test] performance is far below perfection and highly variable across situations.”<sup>113</sup>

In addition, the court was influenced by the Supreme Court’s decision in *United States v. Scheffer (1998)*,<sup>114</sup> which raised several further issues relating to the admissibility of polygraph evidence.<sup>115</sup> The

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<sup>107</sup> *Rouse*, 329 F.Supp.2d.

<sup>108</sup> *Id.*, at 1082-1083.

<sup>109</sup> *Id.*, at 1086.

<sup>110</sup> *Shaneyfelt*, 695 N.W.2d at 4.

<sup>111</sup> *Id.*

<sup>112</sup> *Id.*, at footnote 2.

<sup>113</sup> *Id.*, quoting STEPHEN E. FEINBERG, THE POLYGRAPH AND LIE DETECTION 149 (National Academies Press 2003).

<sup>114</sup> *United States v. Scheffer*, 523 U.S. 303 (1998).

<sup>115</sup> *Shaneyfelt*, 695 N.W.2d at 4.

combination of these sources led the court to determine that the use of the unstipulated polygraph examination could not be used as a factor to increase the petitioner’s sentence,<sup>116</sup> although the court expressed that the scope of the judgment was narrow,<sup>117</sup> allowing it to re-consider polygraph evidence in the future if it is favorable to the petitioner as a mitigating factor. This decision demonstrates that judicial reference to **Polygraph** can be used to overturn trial court decisions where an irregularity has been found (i.e. use of polygraph evidence for sentencing), although the narrow scope of this judgment protects the generally wide competence of the trial court.

**Polygraph** has also been cited to a lesser extent as a factual referencing tool to establish concerns about the admissibility of polygraph evidence. For example, in **State v. A.O. (2009)**, the New Jersey Supreme Court referred to **Polygraph** when undertaking a review of the trial court’s decision to admit polygraph results into evidence.<sup>118</sup> Following conviction, the petitioner challenged the admissibility of the polygraph evidence introduced at trial.<sup>119</sup> The polygraph evidence, though generally inadmissible, was admitted into evidence on the basis that the petitioner consented to the polygraph testing.<sup>120</sup> In reviewing this decision, the court discussed the reliability concerns raised in **Polygraph**, paying particular attention to polygraph evidence’s overwhelming influence over juries, and susceptibility to counter-measures.<sup>121</sup> Relying on this (and other factors<sup>122</sup>), it found that admitting this evidence amounted to reversible error,<sup>123</sup> suggesting that deference to institutional settlement is limited to instances where courts have found regularity in the trial procedure.

## ii. ***In Limine* Hearings Using **Polygraph** to Exclude Polygraph Evidence**

Trial courts during *in limine* decisions have relied on **Polygraph** to exclude polygraph evidence, showing the considerable discretion in the tools available to the trial court. For example, **Polygraph**

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<sup>116</sup> *Id.*, at 5.

<sup>117</sup> *Id.*

<sup>118</sup> *State v. A.O.*, 198 N.J. 69 (N.J. 2009).

<sup>119</sup> *Id.*, at 73-74.

<sup>120</sup> *Id.*

<sup>121</sup> *Id.*, at 83.

<sup>122</sup> *Id.*, at 90.

<sup>123</sup> *Id.*

was cited in ***United States v. Moultrie (2008)***, where the court found polygraph evidence inadmissible under *Daubert*.<sup>124</sup> The petitioner had sought to admit the results of two polygraph tests.<sup>125</sup> The decision was primarily influenced by the testimony of a polygraph expert who discussed the findings of ***Polygraph***.<sup>126</sup> After hearing that ***Polygraph*** had found lie detector evidence to have a “rate of significant error,”<sup>127</sup> the court denied the motion to admit the results of the polygraph examination.<sup>128</sup>

***Polygraph*** was also cited – alongside other tools – to justify the exclusion of polygraph evidence in ***United States v. Loaiza-Clavijo (2012)***.<sup>129</sup> In this decision, the court found that ***Polygraph*** raised issues regarding the testability and known error rate of polygraph evidence, two of the requirements under *Daubert*.<sup>130</sup> In recognition of this, it determined that polygraph evidence was inadmissible for lack of testability and known error rate.<sup>131</sup> This is also seen in ***United States v. Matusiewicz (2015)***.<sup>132</sup>

**c. Acknowledging NAS Report Findings Alongside Other Tools to Defer to Trial Court Decisions and Affirm Regularity in the Trial Process**

The data set shows that, in addition to relying primarily on the findings and recommendations of the forensic science NAS reports to confirm a decision made by a trial court, the reports are also referenced as supplementary evidence to support elements of judicial reasoning relied on by appellate courts to demonstrate fidelity to the legal process vision, in finding regularity in decisions made at trial. In these decisions, the findings and recommendations of the relevant NAS report are referenced alongside other decision-making tools, primarily precedent, standard practices, and expert testimony. This can be seen in a variety of cases, but in relation to this data set, appear particularly where the admissibility of DNA evidence has been challenged and subsequently dismissed at appeal.

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<sup>124</sup> *United States v. Moultrie*, 552 F.Supp.2d 598 (N.D. Miss. 2008).

<sup>125</sup> *Id.*

<sup>126</sup> *Id.*, at 602.

<sup>127</sup> *Id.*

<sup>128</sup> *Id.*

<sup>129</sup> *United States v. Loaiza-Clavijo*, 2012 WL 529981 (N.D. Ga. 2012).

<sup>130</sup> *Id.*, at 3-4.

<sup>131</sup> *Id.*, at 4.

<sup>132</sup> *United States v. Matusiewicz*, 155 F.Supp.3d 482 (D. Del. 2015).

The reference to NAS reports alongside other decision-making tools can be seen through a number of cases within the data set. For example, in *Lindsey v. People (1995)*,<sup>133</sup> the Supreme Court of Colorado referenced **DNA 1** to provide an overview of the science underpinning DNA evidence.<sup>134</sup> The petitioner had sought to challenge the admissibility of DNA evidence, arguing that the product rule method used to calculate the statistical significance of a match was not admissible.<sup>135</sup> In dismissing the petitioner's objections to the admissibility of DNA evidence, the court analyzed the debate surrounding the potential presence of genetic sub-populations, as outlined by **DNA 1**.<sup>136</sup> Although the court did not follow the recommendations of **DNA 1** – which recommended that the ceiling principle was the most appropriate means of determining the significance of a DNA match – it stated that it was “mindful that DNA typing will continue to evolve and the techniques will be refined”<sup>137</sup> but that “the refinement... does not require us to rule that prior scientific analyses are invalid.”<sup>138</sup>

Despite the court's acknowledgment of the uncertainties in the early 1990s regarding the most appropriate means to determine the significance of a DNA match through the ceiling principle as recommended by **DNA 1**,<sup>139</sup> the court set aside this information to support its decision. In holding that the trial court had correctly evaluated the admissibility of the DNA evidence, it placed considerable weight on the trial court's admissibility considerations.<sup>140</sup> This was further supported by its additional consideration that the FBI had continued to improve its practices by following the product rule of statistical analysis,<sup>141</sup> which allowed the appellate court to side-line the concerns raised by **DNA 1**.

The findings and recommendations of **DNA 1** have also been considered in conjunction with other tools employed by courts. In *People v. Chandler (1995)*, the petitioner challenged the trial court's decision to admit DNA evidence accompanied by random match statistics calculated using the product

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<sup>133</sup> *Lindsey v. People*, 892 P.2d 281 (Colo. 1995).

<sup>134</sup> *Id.*

<sup>135</sup> *Id.*, at 288.

<sup>136</sup> *Id.*, at 291.

<sup>137</sup> *Id.*, at 294.

<sup>138</sup> *Id.*

<sup>139</sup> *Lindsey*, 892 P.2d at 294.

<sup>140</sup> *Id.*

<sup>141</sup> *Id.*

rule method.<sup>142</sup> He argued that, following **DNA 1**, the court should have only found the ceiling principle admissible.<sup>143</sup> In analyzing the merits of his claim, the court discussed **DNA 1** alongside precedent in examining the admissibility of the product rule.<sup>144</sup> Collectively, they provided a thorough overview of the methods used to calculate the product rule. Ultimately, the court followed precedent pre-dating **DNA 1**, holding that the trial court was correct in admitting the product rule under *Frye*.<sup>145</sup> In dismissing the appeal, the court further relied upon a 1994 article by Lander and Budowle – two genetics researchers active in the debate surrounding population substructures – which “resolved the controversy over DNA statistical evidence... [and] indicated that the product rule method of DNA statistical evidence is now generally accepted in the relevant scientific community.”<sup>146</sup> In the light of this, the court decided to reaffirm its pre-**DNA 1** position, whilst still acknowledging the “split of authority regarding this issue.”<sup>147</sup> In doing so, the court paid deference to the trial court’s analysis, using precedent, **DNA 1**, and additional scientific research articles to acknowledge the uncertainty and evolving nature of the science underpinning DNA evidence.

The influence of both **DNA 1** and **DNA 2** can also be seen in decisions where appellate courts have reviewed other admissibility challenges regarding DNA evidence. For example, the petitioner in **Magaletti v. State (2003)** challenged the admissibility of mitochondrial DNA (MtDNA).<sup>148</sup> In response, the court acknowledged scientific developments in MtDNA following its first analysis in **DNA 1**.<sup>149</sup> It found the findings and recommendations of **DNA 1** to be a key factor in courts finding nuclear DNA evidence admissible, as supported by its previous decision in **Brim v. State (1997)**.<sup>150</sup> This served as a starting point from which to analyze the admissibility of MtDNA evidence.<sup>151</sup> The court acknowledged the legitimacy in the outcome of the trial court’s *Frye* hearing, which found MtDNA evidence

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<sup>142</sup> *People v. Chandler*, 211 Mich.App. 604, 609-610 (Mich. Ct. App. 1995).

<sup>143</sup> *Id.*, at 610.

<sup>144</sup> *Id.*

<sup>145</sup> *Id.*, at 609.

<sup>146</sup> *Id.*, at 610-611, quoting Eric S. Lander & Bruce Budowle, *DNA Fingerprinting Dispute Laid to Rest*, 371 NATURE 735 (1994).

<sup>147</sup> *Id.*, at 611.

<sup>148</sup> *Magaletti v. State*, 847 So.2d 523 (Fla. Dist. Ct. App. 2003).

<sup>149</sup> *Id.*

<sup>150</sup> *Id.*, at 525-526.

<sup>151</sup> *Id.*

admissible.<sup>152</sup> In justifying its deference to the trial court decision, the appellate court acknowledged that the passage of time following **DNA 1** meant that although the report remained important, more recent research also needed to be considered.<sup>153</sup> This allowed the appeal court to determine that the trial court had acted correctly in admitting MtDNA under *Frye*.

Similar reasoning can be found in several other cases, including **People v. Smith (1996)**.<sup>154</sup> In *Smith*, the petitioner contended that the state's accepted admissibility status of DNA evidence (formulated by precedent<sup>155</sup>) had become outdated, and that it needed to be updated to account for the possibility of population substructures as evidenced by articles in *Science* and *Nature*,<sup>156</sup> He argued that these developments had not been considered when reviewing the admissibility of DNA evidence.<sup>157</sup> In dismissing the appeal, the court justified the trial court's decision by finding that these indications of population substructures had not received general acceptance in the scientific community, but may be relevant to admissibility considerations if such developments continue.<sup>158</sup> Additionally, it found the testifying expert's explanation of **DNA 1** further served to justify the trial court's decision.<sup>159</sup>

Other courts have also used both **DNA 1** and **DNA 2** alongside other tools to demonstrate regularity in trial court decision-making when assessing the admissibility of new DNA technology, allowing it to adopt a flexible approach to DNA analysis. For example, the court in **Keirsey v. State (1995)** acknowledged the importance of statistical analysis to determine the weight of DNA evidence, but ultimately used additional tools to take a more flexible approach to that outlined in **DNA 1**,<sup>160</sup> deferring to the trial court's decision to admit the DNA evidence. The petitioner had sought to argue that DNA evidence should have been subject to a *Frye-Reed* admissibility hearing,<sup>161</sup> challenging the

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<sup>152</sup> *Id.*, at 528.

<sup>153</sup> *Id.*

<sup>154</sup> *People v. Smith*, 49 Cal.Rptr.2d 608 (Cal. Ct. App. 1996).

<sup>155</sup> The court's admissibility framework for DNA evidence was devised in *People v. Axell*, 235 Cal.App.3d 836 (Cal. Ct. App. 1991).

<sup>156</sup> *Smith*, 49 Cal.Rptr.2d at 613.

<sup>157</sup> *Id.*

<sup>158</sup> *Id.*, at 615.

<sup>159</sup> *Id.*, at 611.

<sup>160</sup> *Keirsey v. State*, 106 Md.App. 551 (Md. Ct. Spec. App. 1995).

<sup>161</sup> *Id.*, at 556-7.

admissibility of the product rule.<sup>162</sup> He argued that the ceiling principle, as recommended in **DNA 1**, should have been used.<sup>163</sup> In response, the court acknowledged the benefits of a statistical calculation of a DNA match, but found that the product rule “is nothing more than a theory that produces an estimate [and] the ceiling frequency principle is nothing more than a policy that produces an estimate.”<sup>164</sup> Though the court found that the method of calculation was not a matter of admissibility, it still recognized the important role of statistical calculations, although found the significance of the differences between approaches to be minimal.<sup>165</sup> In the court’s recognition of certain elements of **DNA 1** but refusal to strictly follow its findings, it acknowledged wider considerations raised by other sources, particularly in relation to the ongoing research and technological developments surrounding DNA evidence.<sup>166</sup> This allowed it to “affirm the trial judge’s refusal”<sup>167</sup> of an admissibility hearing.

**DNA 2** has also been used by appellate courts alongside other tools to confirm trial court reasoning where a regular legal procedure has been followed, particularly when **DNA 2** has been used to find that **DNA 1** recommendations have become outdated. This can be seen in decisions such as **State v. Boles (1997)**, where the petitioner challenged the admissibility of DNA evidence when presented without statistical qualification.<sup>168</sup> The court was tasked with reconciling its previous decisions of **State v. Hummert (1994)**, **State v. Johnson (1995)** and **State v. Bible (1993)** which required calculations to be made using the ceiling principle, with **DNA 2**’s recommendations and the decision made by the trial court to admit DNA without statistics. It interpreted the findings of **DNA 2** widely, finding that **DNA 2** “makes no specific requirements for the form of testimony expressing the significance of a match.”<sup>169</sup> This interpretation allowed for experts to testify using their experiences of the likelihood of a random match without providing further statistics.<sup>170</sup> This decision acknowledged the authority of both **DNA 1**

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<sup>162</sup> *Id.*

<sup>163</sup> *Id.*, at 574-5.

<sup>164</sup> *Id.*, at 575.

<sup>165</sup> *Id.*

<sup>166</sup> *Keirse*, 106 Md.App. at 575.

<sup>167</sup> *Id.*, at 558.

<sup>168</sup> *State v. Boles*, 188 Ariz. 129, 131 (Ariz. 1997).

<sup>169</sup> *Id.*, at 132.

<sup>170</sup> *Id.*

and **DNA 2**, but interpreted them widely, reconciling their findings both with each other and precedent, which allowed the court to affirm the decision made by the trial court.

**State v. Marshall (1999)** further clarified the authority of **DNA 1** following the publication of **DNA 2**.<sup>171</sup> The petitioner had challenged the admissibility of the product rule, arguing it had not yet received general acceptance at the time of trial, citing **DNA 1**.<sup>172</sup> The court acknowledged this argument, but found that **DNA 2** demonstrated “strong evidence of general acceptance within the relevant scientific community.”<sup>173</sup> It supported its decision by citing precedent from several US jurisdictions which had also found that **DNA 2** had superseded **DNA 1** in certain areas.<sup>174</sup> It then concluded that the trial court had acted correctly, as elements of the report had become outdated following **DNA 2**.

Several additional courts have found trial courts to have acted correctly in dismissing precedent and admitting DNA statistics calculated using the product rule following the publication of **DNA 2**. This can be seen in **Clark v. State (1996)**, where the appeal court reconciled the differences between **DNA 1** and **DNA 2**’s recommendations in response to a DNA admissibility challenge.<sup>175</sup> It found that “DNA match probability calculations under the product rule are admissible... and evidence based upon the ceiling principle is not.”<sup>176</sup> In further support of this decision, the court made reference to a large number of cases from across different states which demonstrated the continuing evolution of DNA evidence and its evolving fulfilment of admissibility criteria.<sup>177</sup> This decision confirmed the trial court reasoning, using both **DNA 1** and **DNA 2** to further support this.

Further, in **State v. Kinder (1996)**, the Supreme Court of Missouri addressed the petitioner’s challenge to the admissibility of the product rule under *Frye*.<sup>178</sup> The petitioner had argued that **DNA 1** did not

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<sup>171</sup> State v. Marshall, 193 Ariz. 547 (Ariz. Ct. App. 1999).

<sup>172</sup> *Id.*, at 550.

<sup>173</sup> *Id.*, at 551.

<sup>174</sup> *Id.*

<sup>175</sup> Clark v. State, 679 So.2d 321 (Fla. Dist. Ct. App. 1996).

<sup>176</sup> *Id.*, at 322.

<sup>177</sup> *Id.*

<sup>178</sup> State v. Kinder, 942 S.W.2d 313 (Mo. 1996).

establish the reliability of the product rule.<sup>179</sup> In its response, the court acknowledged the criticisms of the product rule, but directed its analysis towards the findings and recommendations of **DNA 2** (which had recently been published) and found that the report supported the reliability of the product rule sufficiently.<sup>180</sup> In a further justification, the court cited precedent from other states which had found the product rule admissible, ultimately finding “that the product rule is generally accepted in the scientific community, and that... any criticism of the reliability of the product rule or of the particular methods used to apply the product rule pertains only to the weight to be given the DNA evidence by the jury.”<sup>181</sup> By acknowledging the evolving status of DNA research and accepting the admissibility of the product rule, the court referenced **DNA 1** and **DNA 2** whilst confirming the regularity of process in the trial court decision, demonstrating fidelity to institutional competence.

**d. Decisions Where Appellate Courts Have Overturned Trial Court Decisions due to a Procedural Irregularity, Demonstrating Fidelity to the Legal Process Vision**

In general, the data set shows that **DNA 1**, **DNA 2** and – to a lesser extent – **Polygraph** have been cited as tools by appellate courts to confirm trial court reasoning and provide additional justification to supplement a trial court decision. However, at times, appellate courts have employed these reports to support their finding that the trial court had acted outside its competence, using the reports as tools to support their decision to reverse the trial decision. This demonstrates fidelity to the legal process vision, as in reversing a decision containing irregularities, appellate courts have responded to, and rectified, an irregularity in process.

Despite these cases only forming a minority of decisions within the data set, they demonstrate that the NAS reports can be used to identify irregularities in the trial process, justifying reversal of a trial court decision. However, aside from some exceptions, including where both parties admitted error,<sup>182</sup>

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<sup>179</sup> *Id.*, at 327.

<sup>180</sup> *Id.*

<sup>181</sup> *Id.*, at 328.

<sup>182</sup> *See, e.g.*, *Smith v. Curry*, 580 F.3d 1071 (9th Cir. 2009); *Leonard v. Michigan*, 256 F.Supp.2d 723 (W.D Mich. 2003).

there is often little material difference in decisions where irregularity has been found when compared to those that have been dismissed due to regularity of procedure. The decisions examined in this subsection are reviewed within the context of NAS report(s) being cited as evidence to support an irregularity in the decision-making process.

**i. The Judicial Reference to *DNA 1* and *DNA 2* when used as a Tool to Reverse a Trial Decision where the NAS Report Demonstrated a Procedural Irregularity**

In the data set, 350 decisions have cited *DNA 1* and *DNA 2*, separately and together, with petitioners in many cases using these reports to challenge trial court admissibility decisions. These have taken various forms. As part of this, petitioners have argued that: DNA evidence does not pass admissibility standards; that the scientific evidence relied upon by the trial court was outdated; or that trial court decision-makers misunderstood/misinterpreted relevant scientific considerations. Courts have adjudicated on these issues, and when finding in favor of the petitioner, have relied on the findings and recommendations from *DNA 1* and *DNA 2* to support their reasoning.

The appellate court's acknowledgement of a trial court's misinterpretation of scientific considerations is seen in *People v. Pizarro (2002)*.<sup>183</sup> In this case, the court referenced both *DNA 1* and *DNA 2* to support its reasoning that the trial court had misinterpreted the DNA evidence, overturning the decision. The petitioner had claimed that the trial court had erroneously admitted DNA evidence, supporting his claim using several arguments.<sup>184</sup> In response, the court evaluated *de novo* whether the evidence presented at trial was admissible under the *Kelly* framework.<sup>185</sup> In conducting its *Kelly* admissibility analysis, the court followed *DNA 1* to determine whether the RFLP DNA analysis admitted at trial had been conducted according to industry standards.<sup>186</sup> The court was further guided by the findings and recommendations of both *DNA 1* and *DNA 2*, and referred to both NAS reports on a

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<sup>183</sup> *Pizarro*, 123 Cal.Rptr.2d.

<sup>184</sup> *Id.*, at 797.

<sup>185</sup> *Id.*, at 798.

<sup>186</sup> *Id.*, at 857-860.

number of occasions.<sup>187</sup> In particular, it cited the reports to provide information about particular aspects of DNA analysis.<sup>188</sup> For example, it discussed whether the trial court had correctly admitted evidence of the significance of a match based on calculations that the defendant was Hispanic (rather than their interpretation that the racial profile of the suspect was relevant).<sup>189</sup> This led the court to discuss issues relating to race. It found that where racial ambiguities exist, the general DNA population should be used as a baseline to calculate the significance of a DNA match,<sup>190</sup> following **DNA 2**. In this instance, it found that the trial court had been correct in using these calculations.<sup>191</sup>

However, the petitioner also claimed the DNA evidence was insufficient to uphold the conviction, as the DNA evidence was part of a mixed sample. In response, the court examined the testimony of the DNA experts at trial alongside the findings from **DNA 1** and **DNA 2**,<sup>192</sup> as well as previous courts' approaches to reviewing the admissibility of DNA evidence, including **People v. Barney** and **People v. Venegas**.<sup>193</sup> The court ultimately concluded that the DNA evidence had not sufficiently been proven to belong to the petitioner, as mixed DNA required supplementary evidence to support the match, which was not present.<sup>194</sup> This irregularity led to the court ordering a retrial.

The irregularity in the trial court decision may have only become apparent due to the court's decision to conduct a *de novo* review, as a *de novo* review a far more detailed analysis than if the evidence had been reviewed for plain error, which is found across many of the judgments in the data set.<sup>195</sup> However, after the re-trial the petitioner once again challenged the admissibility of the evidence, arguing again that correct procedures had not been followed and the DNA evidence was inadmissible under *Kelly*.<sup>196</sup> The court again referenced information from both **DNA 1** and **DNA 2** to inform its

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<sup>187</sup> *Id.*

<sup>188</sup> *Id.*

<sup>189</sup> *Pizarro*, 123 Cal.Rptr.2d at 857-860.

<sup>190</sup> *Id.*, at 860.

<sup>191</sup> *Id.*

<sup>192</sup> *Id.*, from 847.

<sup>193</sup> *Id.*, at 882.

<sup>194</sup> *Id.*, at 893.

<sup>195</sup> *See, e.g.*, *Roberts v. United States*, 916 A.2d 922 (D.C. 2007); *State v. Cavazos*, 2001 WL 170167 (Minn. Ct. App. 2001); *State v. Harvey*, 151 N.J. 117 (N.J. 1997); *State v. Spinks*, 244 N.C.App 345 (N.C. Ct. App 2015).

<sup>196</sup> *People v. Pizarro*, 110 Cal.App.4th 530 (Cal. Ct. App. 2003).

review, determining that the proper procedures had not been followed and that it was “difficult to imagine how the jury could have reached other than a guilty verdict”<sup>197</sup> when presented with the evidence in that form during the trial.<sup>198</sup>

Other courts have also referenced the findings and recommendations of **DNA 1** and **DNA 2** to find procedural irregularity in the trial process and overturn a conviction, often in relation to the admission of DNA statistics. For example, in **People v. Coy (2000)**,<sup>199</sup> the court addressed whether DNA evidence was admissible where an expert declared a mixed sample to match, without being supported by match statistics.<sup>200</sup> It undertook an admissibility assessment using Rule 702 standards, citing the findings and recommendations of **DNA 1** to determine that to be admissible, DNA evidence needs to be accompanied by a statistical calculation of the probability of a random match.<sup>201</sup> In finding that an indication of the probative value was required, the court further cited a passage from **DNA 2**, which stated that “a judge or juror’s untutored impression of how unusual a DNA profile is could be very wrong.”<sup>202</sup> This ultimately led the court to conclude that the evidence presented by the DNA expert was insufficient to sustain a conviction, as no statistical representation was given.<sup>203</sup> Based on the findings and recommendations of **DNA 2**, the court was able to determine that the evidence produced at trial amounted to plain error, an irregularity which led it to overturn the conviction.

Appellate courts have also found that the use of the product rule prior to **DNA 2** amounted to an irregularity in the trial process. This can be seen in **State v. Sivri (1994)**, where the Supreme Court of Connecticut reviewed several issues relating to the admissibility of DNA evidence.<sup>204</sup> The petitioner claimed that the product rule, used to determine the statistical significance of the DNA match, was inadmissible under *Frye*.<sup>205</sup> The court referenced the findings of **DNA 1** (alongside other sources) to

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<sup>197</sup> *Id.*, at 634.

<sup>198</sup> *Id.*

<sup>199</sup> *People v. Coy*, 243 Mich.App. 283 (Mich. Ct. App. 2000).

<sup>200</sup> *Id.*, at 294.

<sup>201</sup> *Id.*, at 300.

<sup>202</sup> *Id.*, at 301, quoting JAMES F. CROW, *THE EVALUATION OF FORENSIC DNA EVIDENCE* 193 (National Academies Press 1996).

<sup>203</sup> *Id.*

<sup>204</sup> *State v. Sivri*, 231 Conn. 115 (Conn. 1994).

<sup>205</sup> *Id.*, at 151-157.

support its decision.<sup>206</sup> It alluded to precedent to establish the generally accepted procedures used to calculate the statistical significance of a DNA match, citing decisions such as *State v. Vandebogart* and *State v. Bible* as examples of cases that had found the ceiling principle to be the only method admissible under *Frye*.<sup>207</sup> In reviewing these cases, the court found *DNA 1* to be instrumental in highlighting the concerns about the product rule and potential presence of genetic sub-populations.<sup>208</sup> Through its interpretation of precedent and *DNA 1*, the court further justified its decision to overturn the trial court's decision. These authoritative tools had demonstrated to the court that the admission of the product rule had amounted to an irregularity in the trial process. Ultimately, the court returned the admissibility issue to the trial court to determine whether the statistical calculations of a DNA match were admissible, explicitly instructing the court to take into consideration the conclusions and recommendations of *DNA 1*, as well as "any other relevant evidence."<sup>209</sup>

The Supreme Court of Florida in *Hayes v. State (1995)* took a more direct approach in overturning the trial court's admission of DNA evidence, finding that "it did not meet accepted scientific principles."<sup>210</sup> It justified its decision on the basis that the DNA examiner had used a process called "band shifting"<sup>211</sup> to find a DNA match.<sup>212</sup> The court undertook a detailed analysis of DNA evidence in general, and the DNA evidence brought in this specific case.<sup>213</sup> It specifically relied on the findings and recommendations of *DNA 1* to support its conclusion that DNA evidence is generally reliable and underpinned by scientific research.<sup>214</sup> When assessing the issue of band shifting, it followed the recommendations of *DNA 1*, which stated that when band shifting occurs, any DNA results should be

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<sup>206</sup> *Id.*

<sup>207</sup> *Id.*, at 156.

<sup>208</sup> *Id.*, at 159.

<sup>209</sup> *Id.*, at 161.

<sup>210</sup> *Hayes v. State*, 660 So.2d 257, 265 (Fla. 1995).

<sup>211</sup> See, VICTOR A. MCKUSICK, DNA TECHNOLOGY IN FORENSIC SCIENCE 57-61 (National Academies Press 1992).

<sup>212</sup> *Hayes*, 660 So.2d at 264.

<sup>213</sup> *Id.*, at 262.

<sup>214</sup> *Id.*

published and declared inconclusive.<sup>215</sup> This led it to find that the DNA evidence was incorrectly admitted,<sup>216</sup> and ordered a retrial.<sup>217</sup>

These cases are just some examples of courts using **DNA 1** and/or **DNA 2** as tools to support a decision that there had been an irregularity of process in admitting DNA evidence.<sup>218</sup> There are at least 20 examples of this in the data set. While this is small in relation to the number of decisions discussing DNA evidence – implicit or explicit reference to **DNA 1** and/or **DNA 2** is found in 350 cases – it demonstrates that appellate courts are beholden to the legal process, and are willing to reverse decisions when an irregularity in the process is found and/or a trial court has acted outside its competence.

ii. **The Judicial Reference to *Bullet Lead* when used as a Tool to Reverse a Trial Decision where the NAS Report has Demonstrated a Procedural Irregularity**

Following the publication of ***Bullet Lead***, consensus within the criminal justice system began to build, discrediting CBLA evidence. This is demonstrated by CBLA's discontinuation by the FBI, and its subsequent review of decisions made using CBLA evidence,<sup>219</sup> which were informed by the findings of ***Bullet Lead***. The data set shows that courts have often engaged in ***Bullet Lead*** and surrounding materials to guide their decision-making, and have, on occasion, found them sufficiently compelling to overturn trial court decisions where it has been found that the introduction of CBLA evidence amounted to a procedural irregularity, particularly if CBLA was the primary evidence presented during trial. The reversal of decisions upon finding an irregularity demonstrates fidelity to the legal process

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<sup>215</sup> *Id.*, at 264, quoting VICTOR A. MCKUSICK, *DNA TECHNOLOGY IN FORENSIC SCIENCE* 61 (National Academies Press 1992).

<sup>216</sup> *Id.*

<sup>217</sup> *Id.*

<sup>218</sup> See, e.g., *Dubose v. State*, 662 So.2d 1156 (Ala. Crim. App. 1993); *State v. Hummert*, 183 Ariz. 484 (Ariz. Ct. App. 1994); *Vargas v. State*, 640 So.2d 1139 (Fla. Dist. Ct. App. 1994); *Murray v. State*, 692 So.2d 157 (Fla. 1997).

<sup>219</sup> See, FBI National Press Office, [FBI Laboratory Announces Discontinuation of Bullet Lead Examinations](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations) (Sept. 1, 2005) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations> (last visited Nov. 4, 2019); FBI National Press Office, [FBI Laboratory to Increase Outreach in Bullet Lead Cases](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases) (Nov. 17, 2007) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-to-increase-outreach-in-bullet-lead-cases> (last visited Nov. 4, 2019).

vision, as appellate judges have only been willing to reverse trial court decisions where trial judges have acted outside their competence, or an irregularity has been found in the trial process itself.

The Supreme Court of Kentucky in *Ragland v. Commonwealth (2006)* found CBLA evidence to be unreliable under *Daubert* and therefore insufficient in upholding the petitioner's conviction.<sup>220</sup> The petitioner argued that the trial court had committed reversible error by admitting CBLA evidence. Analyzing the reliability of the evidence presented before the trial court, the appellate court noted that the expert's testimony contained several inconsistencies,<sup>221</sup> finding that when viewed against the findings of *Bullet Lead* and applied to a *Daubert* framework, the CBLA evidence did not satisfy any of the *Daubert* reliability criteria.<sup>222</sup> Referencing the findings and recommendations of *Bullet Lead*, the court found that that "the NRC also made findings that seriously challenge the relevancy of CBLA evidence,"<sup>223</sup> using excerpts from *Bullet Lead* to justify its reasoning.<sup>224</sup> Ultimately, the court found that "the erroneous admission of this evidence was not harmless error"<sup>225</sup> because the court was "not able to conclude that there is no substantial possibility that the result would have been different but for the admission of the CBLA evidence."<sup>226</sup> This led the court to reverse the trial court decision, as it found that the admission of CBLA evidence presented an irregularity in the trial process.

Other courts have also cited *Bullet Lead* as a tool to demonstrate an irregularity in the trial procedure and reverse a trial court decision, particularly where CBLA evidence was the primary form of evidence supporting a conviction. In these instances, courts have used *Bullet Lead* and the subsequent actions of the FBI to support their argument that either the trial court erred in finding CBLA evidence admissible or find that *Bullet Lead* provided sufficient grounds for a successful newly discovered

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<sup>220</sup> *Ragland v. Commonwealth*, 191 S.W.3d 569 (Ky. 2006).

<sup>221</sup> *Id.*, at 580.

<sup>222</sup> *Id.*, at 578.

<sup>223</sup> *Id.*, at 579.

<sup>224</sup> *Id.*

<sup>225</sup> *Ragland*, 191 S.W.3d at 582.

<sup>226</sup> *Id.*

evidence claim. The decisions of *Murphy v. State* (2009)<sup>227</sup> and *Ward v. State* (2015)<sup>228</sup> provide examples of appellate courts finding **Bullet Lead** to constitute newly discovered evidence.

In *Murphy*, the court held, in response to the petitioner’s claim that **Bullet Lead** constituted newly discovered evidence,<sup>229</sup> that the findings of the report were significant in undermining the CBLA evidence introduced at trial.<sup>230</sup> It relied on **Bullet Lead** and a previous decision, *Clemons v. State* (2006),<sup>231</sup> to find that CBLA evidence does not satisfy the state’s admissibility criteria, which was unknown at the time of trial.<sup>232</sup>

Similarly, the court in *Ward* also took inspiration from **Bullet Lead** and *Clemons* to find that the CBLA evidence presented during trial was inadmissible under a *Frye* admissibility framework.<sup>233</sup> Critical to this decision was the wording of the expert testimony, which stated that the two samples derived from “the same source. They came from the same box... that’s a fact.”<sup>234</sup> It was decided by the court that the findings within **Bullet Lead** (and other sources undermining the reliability of CBLA) “directly contradicted... the state’s substantive evidence.”<sup>235</sup> This led the court to find that the error in admitting the expert’s testimony was sufficient to vacate the judgment and remand the case for further consideration by the circuit court.<sup>236</sup> These decisions demonstrate appellate courts’ fidelity to legal process values, as **Bullet Lead** undermined the legitimacy of the trial process, leading appellate courts to find an irregularity in the trial process and reverse trial court decisions.

iii. **The Judicial Reference to *Strengthening* when used as a Tool to Reverse a Trial Decision where the Report has Demonstrated a Procedural Irregularity**

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<sup>227</sup> *Murphy v. State*, 24 So.3d 1220 (Fla. Dist. Ct. App. 2009).

<sup>228</sup> *Ward v. State*, 221 Md.App. 146 (Md. Ct. Spec. App. 2015).

<sup>229</sup> *Murphy*, 24 So.3d at 1221.

<sup>230</sup> *Id.*, at 1222.

<sup>231</sup> *Clemons v. State*, 392 Md. 339 (Md. 2006).

<sup>232</sup> *Id.*

<sup>233</sup> *Ward*, 221 Md.App.

<sup>234</sup> *Id.*, at 151.

<sup>235</sup> *Id.*, at 168.

<sup>236</sup> *Id.*, at 169-170.

The data set contains over thirty decisions where individuals have sought to rely on **Strengthening** to argue that its findings constituted newly discovered evidence which undermined the reliability of the forensic science technique(s) presented at trial. Moreover, petitioners in over seventy-five cases argued that that **Strengthening** demonstrated that the trial court committed error in admissibility decisions.<sup>237</sup> Despite these cases being numerous, the data set shows the influence of institutional settlement on appellate decision-making, as appellate judges have only overturned decisions on the (rare) instance that an irregularity in the trial process itself was identified, demonstrating that trial judges have considerable discretion when analyzing forensic science evidence. However, within this, there exists one forensic science discipline where more procedural irregularities have been identified than other **Strengthening** disciplines – microscopic hair analysis – due to the subsequent review of the technique carried out by the FBI in addition to **Strengthening**.<sup>238</sup> In general, aside from this, **Strengthening** alone has not been sufficient to demonstrate such an irregularity.

Where the admissibility of microscopic hair analysis has been challenged using **Strengthening**, often in claims that **Strengthening** and the FBI review collectively constitute newly discovered evidence undermining a conviction, courts have found this evidence to undermine the regularity and legitimacy of the trial process. This can be seen in **Commonwealth v. Perrot (2016)**, where the court undertook a review of microscopic hair analysis using findings from **Strengthening** and the subsequent FBI review.<sup>239</sup> The court found that **Strengthening** and the FBI review demonstrated that microscopic hair analysis was unreliable and not built upon sufficient scientific foundations.<sup>240</sup> This led the court to find that this constituted newly discovered evidence, which caused it to reverse the petitioner's conviction,<sup>241</sup> as the newly discovered evidence undermined the legitimacy of the trial decision.

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<sup>237</sup> See, e.g., *Commonwealth v. Abdul-Salaam*, 615 Pa. 297 (Pa. 2012); *Commonwealth v. Roney*, 622 Pa. 1 (Pa. 2013); *Ex Parte Pruett*, 458 S.W.3d 537 (Tex. Crim. App. 2015).

<sup>238</sup> See, e.g., *Commonwealth v. Edmiston*, 619 Pa. 549 (Pa. 2013).

<sup>239</sup> *Commonwealth v. Perrot*, 2016 WL 380123 (Mass. App. Ct. 2016).

<sup>240</sup> *Id.*

<sup>241</sup> *Id.*

The legitimacy of the trial court decision to admit microscopic hair analysis was also reviewed in *Commonwealth v. Edmiston (2013)*, which took into consideration *Strengthening*'s findings.<sup>242</sup> The petitioner argued that *Strengthening* constituted newly discovered evidence which undermined the reliability of microscopic hair analysis.<sup>243</sup> Although the court ultimately found that the claim was invalid on procedural grounds,<sup>244</sup> a court in the later case of *Commonwealth v. Chmiel (2017)* used the reasoning in *Edmiston* to find that *Strengthening* was the "tipping point"<sup>245</sup> in the rejection of microscopic hair analysis and that the NAS report constituted newly discovered evidence. This was considered alongside further evidence discrediting microscopic hair analysis, including the FBI's rejection of microscopic hair analysis, which found hair analysis to be "scientifically flawed testimony."<sup>246</sup> This led the court to reverse the judgment and remand the case for further proceedings.<sup>247</sup> However, this trend is not universal, with the court in *United States v. Ausby (2017)* finding that *Strengthening* was insufficient to overturn microscopic hair analysis.<sup>248</sup>

The finding that *Strengthening* constituted newly discovered evidence undermined the legitimacy of the trial court decision created an irregularity in the trial process which led the *Chmiel* and *Perrot* courts to overturn trial court decisions. The data shows that further claims have also attempted to rely on *Strengthening* in this way to challenge other forensic science techniques, although courts have been far less willing to concede that the NAS report alone casts doubt on the legitimacy of the trial court decision. Where challenges have been successful, appellate courts have focused on the presentation of the questioned evidence. For example, in *State v. Sheehan (2012)*, the petitioner challenged the trial court's decision which precluded *Strengthening* from being used as a cross-examination tool by defense counsel.<sup>249</sup> The petitioner argued that this significantly limited his

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<sup>242</sup> *Edmiston*, 619 Pa.

<sup>243</sup> *Id.*, at 567.

<sup>244</sup> *Id.*, at 571.

<sup>245</sup> *Commonwealth v. Chmiel*, 173 A.3d 617, 627 (Pa. 2017).

<sup>246</sup> *Id.*, at 625.

<sup>247</sup> *Id.*, at 620.

<sup>248</sup> *United States v. Ausby*, 275 F.Supp.3d 7 (D.D.C. 2017).

<sup>249</sup> *State v. Sheehan*, 273 P.3d 417 (Utah Ct. App. 2012).

opportunity to cross-examine the state's fingerprint expert.<sup>250</sup> He further argued that **Strengthening** contained evidence that was important to his claim, as it refuted the expert's claim that fingerprint evidence had a zero-error rate.<sup>251</sup> Upon consideration, the court did not discuss whether **Strengthening's** findings would have had an effect on the trial outcome, but found that the trial court had acted erroneously in excluding the evidence.<sup>252</sup> It found that the trial court had misinterpreted the concept of admissibility.<sup>253</sup> This irregularity led the court to overturn the trial verdict, but did not make any further comment upon the weight to be given to **Strengthening** when making admissibility considerations.<sup>254</sup>

**Strengthening** has also been used as a tool by appellate courts to demonstrate an irregularity in the trial court process where the Sixth Amendment Confrontation Clause has been violated, following **Melendez-Diaz v. Massachusetts (2009)**.<sup>255</sup> In these cases, petitioners have relied on **Strengthening** to provide contextual support for the requirement that scientific experts testify in person (to allow for cross-examination). This can be seen in **State v. Ward (2010)**, where the court not only recognized the gravity of the **Melendez-Diaz** decision, but also the weight that this decision attached to **Strengthening**,<sup>256</sup> finding **Strengthening** instrumental in the decision-making process as it demonstrated the need for cross-examination on the limitations of forensic science evidence.<sup>257</sup> This led it to find that the drug analysis report without accompanying testimony constituted an irregularity, and that the trial court had abused its discretion when it admitted expert evidence based solely on a visual inspection of controlled substances.<sup>258</sup>

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<sup>250</sup> *Id.*, at 423.

<sup>251</sup> *Id.*, at 421.

<sup>252</sup> *Id.*, at 430.

<sup>253</sup> *Id.*, at 426.

<sup>254</sup> *Id.*, at 427.

<sup>255</sup> *Melendez-Diaz v. Massachusetts*, 557 U.S. 305 (2009).

<sup>256</sup> *State v. Ward*, 364 N.C. 133, 141 (N.C. 2010).

<sup>257</sup> *Id.*, at 148.

<sup>258</sup> *Id.*

## **2. The Judicial Fidelity to the Institutional Competence of the Trial Court as seen through Appellate Courts Placing Regularity of Process over Evidentiary Concerns Raised by NAS Report Findings**

In addition to paying deference to decisions made by the trial judge, appellate courts have also deferred to the trial process itself. When confronted with evidentiary challenges where petitioners have referenced NAS report findings to support their argument, the data set shows that appellate courts have placed importance on the legitimacy of the process itself over reliability challenges, demonstrating fidelity to the legal process vision. Courts have relied on certain legal mechanisms to justify deferring to trial procedures. Judicial deference to institutional settlement under these circumstances can be seen across challenges to all forensic science disciplines in the data set, and appeals are largely treated similarly, irrespective of forensic science technique or relevant NAS report.

The high thresholds required of petitioners demonstrates the deference given to the trial process. In general, petitioners' challenges are reviewed using a plain error standard. When challenged, the high thresholds protect the decisions made during trial, decisions of both the trial judge and jury. The author argues that the appellate courts' use of these high thresholds demonstrates that deference to institutional settlement outweighs the considerations of the NAS reports.

### **High Thresholds allowing Appellate Courts to Defer to the Decisions of the Trial Court**

In the data set, appellate judges have generally deferred to the admissibility decisions made by trial judges. As the role of the appellate court is to review trial court decisions, and not carry out a *de novo* judgment, the plain error threshold generally applies, which imposes a high threshold. Additionally, trial judges are afforded considerable discretion when making decisions, and the data set demonstrates that appellate courts will only overturn a decision when a judge has "overstepped his discretionary authority"<sup>259</sup> presenting a high threshold for petitioners to attain to demonstrate

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<sup>259</sup> Mark G. Kalpakis, *Abuse of Discretion by a Trial Judge*, 7 N. KY. L. REV. 311, 311 (1980).

irregularity. Subsection (a) explores the extent of judicial reliance on the plain error standard to ensure judicial deference is paid to trial court decisions when assessing petitioners' challenges, and subsection (b) reviews the appellate courts' application of the abuse of discretion standard.

#### **a. Plain Error Standard**

The doctrine of plain error allows for an issue not litigated or preserved during the trial to be reviewed in post-conviction proceedings under certain circumstances. Generally, a post-conviction review of these issues is not permissible, as specific objections need to be lodged during the trial to be litigated during an appeal.<sup>260</sup> However, Rule 52 of the Federal Rules of Criminal Procedure provides that “a plain error that affects substantial rights may be considered even though it was not brought to the court’s attention.”<sup>261</sup>

The doctrine of plain error employs a high threshold for petitioners, namely that “any error... that does not affect substantial rights must be disregarded” as harmless error.<sup>262</sup> The Supreme Court has consistently interpreted the plain error doctrine to require the violation of regular process during the trial process, and has interpreted the plain error doctrine to require the violation to be “clear, or... obvious,”<sup>263</sup> affecting the outcome of the trial proceedings.<sup>264</sup> The requirement of a significant procedural irregularity affecting the legitimacy of the outcome is inherently legal process vision-centric as it demonstrates fidelity to the of regularity of procedure and institutional settlement.

The data set shows that admissibility challenges raised by petitioners are often reviewed for plain error, particularly when the relevant NAS report has been published following the conclusion of the petitioner’s trial, i.e. it could not be raised on the record at trial. Within the data set, the plain error standard has been applied largely in relation to challenges to DNA evidence and pattern analysis

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<sup>260</sup> Patricia A. Ham, *Making the Appellate Record: A Trial Defense Attorney’s Guide to Preserving Objections – The Why and How*, 2003 ARMY LAW. 10, 10 (2003).

<sup>261</sup> FED. R. CRIM. P. 52(b).

<sup>262</sup> FED. R. CRIM. P. 52(a).

<sup>263</sup> *United States v. Olano*, 507 U.S. 725, 732-734 (1993).

<sup>264</sup> *Id.*

evidence, using **DNA 1** and/or **DNA 2** and **Strengthening** – this subsection is presented in this way, and takes a report-specific approach to reviewing case law.

**i. DNA Evidence: Application of Plain Error to Dismiss Evidentiary Challenges**

As technological advancements in DNA typing and analysis developed over the 1990s, within the data set, petitioners have raised claims of plain error arguing that DNA evidence had been improperly admitted, supported by the findings and recommendations of **DNA 1** and/or **DNA 2**. While many petitioners have sought to rely on these reports to challenge the admissibility of the DNA evidence presented during their trials, the data set shows that the high threshold required to demonstrate plain error has been difficult to attain when challenging DNA evidence, as appellate judges pay considerable deference to trial court decisions, demonstrating the judicial fidelity to legal process values.

The high threshold of plain error review has often resulted in the findings and recommendations of **DNA 1** and/or **DNA 2** not being sufficient to displace the decisions made at trial. This can be seen in cases across the data set, including **Nelson v. State (1993)**.<sup>265</sup> The petitioner argued that the trial court’s admission of DNA evidence without supporting statistical evidence to determine the significance of the match amounted to plain error.<sup>266</sup> The court responded by undertaking a review of DNA evidence, finding that since the publication of **DNA 1**, evidence of a DNA match needed to be accompanied by a statistical calculation demonstrating its significance.<sup>267</sup> This led it to determine that the trial court’s decision to admit DNA evidence without a statistical calculation was erroneous.<sup>268</sup> However, it concluded that the omission of DNA statistics was harmless, as additional evidence existed to support the petitioner’s conviction.<sup>269</sup> It found that “the evidence of defendant’s guilt is not only substantial, untainted and direct, but conclusive.”<sup>270</sup> This judgment demonstrates that the imposition

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<sup>265</sup> Nelson v. State, 628 A.2d 69 (Del. 1993).

<sup>266</sup> *Id.*

<sup>267</sup> *Id.*, at 76.

<sup>268</sup> *Id.*

<sup>269</sup> *Id.*, at 77.

<sup>270</sup> *Id.*, at 77.

of high threshold affords considerable deference to the regularity of process over evidentiary issues, as the court determined that the petitioner had not been prejudiced by the error.

The high threshold required of the plain error standard allows appellate judges to pay considerable deference to trial court decision. Even when error has been identified, a trial court decision will only be overturned if the error was so significant that it prejudiced the petitioner. This high threshold and deference to the decisions of the trial court are indicators of fidelity to the legal process vision. The lack of prejudice, indicating the judicial fidelity to legal process values is seen in ***State v. Williams (1998)***.<sup>271</sup> The petitioner challenged the admissibility of DNA evidence as it had been admitted without a statistical calculation of the significance of the match.<sup>272</sup> In response, the court cited findings from ***DNA 1*** to find that although the trial court had erred in admitting DNA evidence without accompanying statistics,<sup>273</sup> “Williams has not suffered any miscarriage of justice,”<sup>274</sup> and found “the error to be harmless,”<sup>275</sup> as the expert merely “stated that based on the evidence that he could not exclude Williams as a possible donor”<sup>276</sup> and “did not say Williams was the donor.”<sup>277</sup>

Similarly, in ***People v. Koua Xiong (2013)***, the petitioner argued that the statistics used to calculate a DNA match were inadmissible (and insufficient to support his conviction) as the DNA match was found as a result of a cold-hit database trawl.<sup>278</sup> The court found that the statistics used to calculate the significance of the match were not so significant that jurors would have found the evidence less compelling,<sup>279</sup> but recognized that if an error occurred, it would have been harmless, as the trial

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<sup>271</sup> *State v. Williams*, 574 N.W.2d 293 (Iowa 1998).

<sup>272</sup> *Id.*, at 297.

<sup>273</sup> *Id.*, at 298.

<sup>274</sup> *Id.*

<sup>275</sup> *Id.*

<sup>276</sup> *Id.*

<sup>277</sup> *Williams*, 574 N.W.2d at 298.

<sup>278</sup> *People v. Koua Xiong*, 215 Cal.App.4th 1259, 1270-1 (Cal. Ct. App. 2013).

<sup>279</sup> *Id.*, at 1277.

outcome would not have changed.<sup>280</sup> This was later confirmed by a subsequent court,<sup>281</sup> and several further decisions have also disposed of petitioners' challenges in this way.<sup>282</sup>

Within these decisions, appellate courts have focused on the lack of prejudice to the petitioner, showing that the general presence of error does not necessarily disturb institutional settlement. This is dependent upon the error being admitted in good faith, as demonstrated in *State v. Quatrevingt (1996)*.<sup>283</sup> The petitioner appealed his conviction on the basis that the trial court had erroneously admitted DNA evidence.<sup>284</sup> He used **DNA 1** to demonstrate that the trial court had violated Louisiana Code of Evidence Article 702 by admitting DNA evidence which was prepared using non-standard methods.<sup>285</sup> While the court found that the trial court acted in error,<sup>286</sup> it found that the error was harmless.<sup>287</sup> This was because additional inculpatory evidence was presented at trial, which led it to determine that there was "no reasonable conclusion but that the defendant is guilty of the commission of this crime."<sup>288</sup> The court considered the fact that **DNA 1** had not been published until two years after the petitioner's trial,<sup>289</sup> although it did still take into account the findings and recommendations of **DNA 1**. In focusing on the petitioner's lack of prejudice, the appellate court's deference to the trial outcome demonstrates the dominance of institutional settlement.

Further issues surrounding DNA evidence addressed by plain error claims have also occurred beyond the straightforward admissibility of DNA evidence and its presentation at trial. The data set shows that appellate courts have often found other errors in trial court considerations of DNA evidence harmless, with some courts expressly relying on institutional settlement to support their reasoning. For example, the court in *State v. Smith (2000)* stated that appellate courts "generally uphold the evidentiary rulings

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<sup>280</sup> *Id.*

<sup>281</sup> *People v. Jones*, 57 Cal.4th 899 (Cal. 2013).

<sup>282</sup> *See, e.g., Commonwealth v. Daggett*, 416 Mass. 347 (Mass. 1993); *State v. Jackson*, 1999 WL 688674 (Minn. Ct. App. 1999).

<sup>283</sup> *State v. Quatrevingt*, 670 So.2d 197 (La. 1996).

<sup>284</sup> *Id.*, at 204.

<sup>285</sup> *Id.*

<sup>286</sup> *Id.*, at 206.

<sup>287</sup> *Id.*

<sup>288</sup> *Id.*, at 207.

<sup>289</sup> *Quatrevingt*, 670 So.2d at 207.

by the trial court.”<sup>290</sup> Therefore, in response to the MtDNA admissibility challenge,<sup>291</sup> the court did not conduct a thorough review. The court justified this as “the mtDNA evidence was used only to show that [the victim’s] mtDNA was consistent with the mtDNA in the blood samples”<sup>292</sup> and “merely duplicated the nuclear DNA evidence.”<sup>293</sup> It therefore avoided scrutinizing the trial court’s admissibility decision, finding that if any error occurred, it was harmless, as the nuclear DNA evidence had been correctly evaluated.<sup>294</sup>

Another example of appellate courts’ explicit deference to trial court rulings is found in ***State v. Leuluai*** (2003),<sup>295</sup> where the petitioner argued that the admission of canine DNA evidence amounted to plain error, as no standardized testing procedures existed, and was inadmissible under *Frye*.<sup>296</sup> The court’s review found a procedural error, in that a *Frye* analysis was required to determine the admissibility of this evidence.<sup>297</sup> However, upon examination of the trial court proceedings as a whole, the appellate court found that “the error in admitting the canine DNA evidence was harmless... the error did not affect the outcome of the trial within reasonable probabilities.”<sup>298</sup> The court also found that additional inculpatory evidence rendered the error harmless.<sup>299</sup> The lack of prejudice provided the courts with justification to dismiss the petitioner’s claim, showing general deference to the legitimacy of the trial court outcome.

Further, the appellate court in ***People v. Marks*** (2015) also paid deference to the decisions of the trial court, finding that the trial court’s error in admitting inconclusive DNA test results was harmless, as the statistics cited were so wide that the jury would have appreciated the fact that the DNA was not incriminating.<sup>300</sup> Unlike the majority of challenges questioning the admissibility of DNA evidence, the

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<sup>290</sup> *State v. Smith*, 100 Wash.App 1064, 1 (Wash. Ct. App. 2000).

<sup>291</sup> *Id.*

<sup>292</sup> *Id.*, at 4.

<sup>293</sup> *Id.*

<sup>294</sup> *Id.*

<sup>295</sup> *State v. Leuluai*, 118 Wash.App. 780 (Wash. Ct. App. 2003).

<sup>296</sup> *Id.*, at 786.

<sup>297</sup> *Id.*, at 790.

<sup>298</sup> *Id.*, at 796.

<sup>299</sup> *Id.*

<sup>300</sup> *People v. Marks*, 374 P.3d 518 (Colo. App. 2015).

claim raised did not question the reliability of DNA evidence under Rule 702, but whether the evidence was inadmissible as the inconclusive result was misleading under Colorado Rule of Evidence 403.<sup>301</sup>

The court found the DNA test results relevant, but found that its probative value was “substantially outweighed by the risk of unfair prejudice and misleading the jury,”<sup>302</sup> in violation of Rule 403. However, the error was considered harmless under the circumstances, as the admission of the inconclusive DNA results did not affect the trial verdict.<sup>303</sup> It determined that as the evidence had played a minor role in the parties’ submissions and other forms of evidence had taken a more prominent role amongst party submissions, this was presumably so for the jury’s verdict.<sup>304</sup> So that this error did not undermine the decision made by the jury, the court left the decision to stand. The presence of additional inculpatory evidence has allowed appellate courts to defer to the trial court decisions and find legitimacy in the trial court outcome.

#### ii. DNA Evidence: Where Appellate Courts Have Found Plain Error

Within the data set, there only exists one judgment where an appellate court has found that the admission of DNA evidence had amounted to plain error, sufficient to reverse the trial verdict. ***State v. Carter (1994)***, determined by the Supreme Court of Nebraska, found that the admission of DNA evidence – alongside additional evidence of prior bad acts – amounted to plain error.<sup>305</sup> The additional prior bad acts were found to have been admitted within the trial court’s discretion.<sup>306</sup> However, in addressing the claim that PCR evidence had not gained general acceptance under *Frye*,<sup>307</sup> the court found that the evidence was not generally accepted and had been admitted erroneously.<sup>308</sup> The court also found that the statistical calculations used by the DNA expert to calculate the significance of a

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<sup>301</sup> *Id.*, at 525.

<sup>302</sup> *Id.*, at 526.

<sup>303</sup> *Id.*, at 527.

<sup>304</sup> *Id.*

<sup>305</sup> *Carter*, 246 Neb.

<sup>306</sup> *Id.*, at 967.

<sup>307</sup> *Id.*

<sup>308</sup> *Id.*, at 986.

match had not attained general acceptance, due to “substantial disagreement within the scientific community,”<sup>309</sup> finding this to also be an important factor in the admissibility of DNA evidence.<sup>310</sup>

Following this, the court found that the error in admitting the DNA evidence amounted to plain error, due to “the highly prejudicial nature of DNA evidence and the unusual circumstances of this case.”<sup>311</sup>

This led it to remand the case for a new trial.<sup>312</sup> The court, in its deliberation, confined the decision to the facts, citing the earlier case of ***State v. Houser (1992)***<sup>313</sup> to support its decision which found that “jurors could be unduly influenced by DNA evidence.”<sup>314</sup> This suggests that the Supreme Court of Nebraska’s decision to remand the case for a new trial did not just overturn the decision, but placed the decisions back in the competence of a (new) jury.

The lone status of this case suggests that courts are generally unwilling to find plain error and displace trial court decisions in this way. In recognition of this, courts will only overturn a decision – even if error has occurred – if the petitioner had suffered outcome changing prejudice. This shows that judges are beholden to the legal process vision in their decision-making, as appellate courts are only willing to disrupt the legal process when the legitimacy of outcome has been undermined or compromised.

### iii. **Pattern Analysis Evidence: Application of Plain Error to Dismiss Evidentiary Challenge**

Cases within the data set demonstrate the presence of judicial fidelity to values inherent to the legal process by finding trial court errors to be harmless and deferring to the decisions of the trial courts in challenges to pattern analysis evidence. The findings and recommendations of both ***Ballistic Imaging*** and ***Strengthening*** have questioned the legal interpretation of the techniques examined, leading petitioners to use these reports to argue that the evidence presented at trial had been improperly admitted, amounting to plain error. Appellate courts assessing whether error had occurred at trial

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<sup>309</sup> *Id.*, at 983.

<sup>310</sup> *Id.*, at 981.

<sup>311</sup> *Carter*, 246 Neb. at 990.

<sup>312</sup> *Id.*

<sup>313</sup> *State v. Houser*, 241 Neb. 525 (Neb. 1992).

<sup>314</sup> *Carter*, 246 Neb. at 989.

have seldom found plain error and, in comparison with challenges to DNA evidence, have been less likely to find error in the trial judge's decisions, showing deference to the trial court's considerations of the challenged evidence.

Within the data set, ten admissibility challenges raising findings from **Ballistic Imaging** and/or **Strengthening** have been found to amount to harmless error. These cases are typified by **Gardner v. United States (2016)**.<sup>315</sup> In this case, the petitioner challenged the admissibility of the ballistics evidence during his trial on the basis that the expert gave an unqualified opinion as to the provenance of the fatal bullet, meaning that he testified to absolute certainty.<sup>316</sup> In response, the government argued that although the unqualified testimony was erroneously admitted, the error did not have a substantial effect on the jury.<sup>317</sup> In its decision, the court relied on the findings of both **Ballistic Imaging** and **Strengthening**, which shaped its conversation surrounding the presentation of ballistic testimony.<sup>318</sup> The court ultimately found that the trial court had erred in admitting the unqualified evidence, but distinguished this decision from precedent,<sup>319</sup> as the issue in this case had been preserved during the trial.<sup>320</sup> This led the court to extend the ruling and recognize that unqualified opinions across the District of Columbia were inadmissible.<sup>321</sup> Despite this, the court found that the error was harmless in the circumstances, because the government presented additional "strong and compelling evidence"<sup>322</sup> that established the petitioner's guilt.<sup>323</sup>

The judicial reliance on additional inculpatory evidence is a typical mechanism used to dismiss admissibility challenges where error has been found. For example, in **State v. Harper (2012)**, the petitioner challenged the trial court's refusal to admit findings from **Ballistic Imaging** into evidence,<sup>324</sup>

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<sup>315</sup> Gardner v. United States, 140 A.3d 1172 (D.C. Cir 2016).

<sup>316</sup> *Id.*

<sup>317</sup> *Id.*, at 1182-1183.

<sup>318</sup> *Id.*

<sup>319</sup> *Id.*

<sup>320</sup> *Id.*, at 1184.

<sup>321</sup> Gardner, 140 A.3d at 1184.

<sup>322</sup> *Id.*, at 1185.

<sup>323</sup> *Id.*

<sup>324</sup> State v. Harper, 344 Wis.2d 297 (Wis. Ct. App. 2012).

claiming that it amounted to plain error.<sup>325</sup> The court found that *Ballistic Imaging* had been erroneously excluded, with the court clarifying that the report was “a report of public agency, setting forth factual findings... [and] an exception to the hearsay rule.”<sup>326</sup> Although it found that trial court erred in excluding the evidence, it found the exclusion to be harmless error, as “the trial evidence against Harper was overwhelming.”<sup>327</sup>

This approach taken by the courts is not unique to challenges relating to ballistics evidence. *State v. Martinez (2013)* is a further example of an appeal court dismissing an evidentiary challenge by finding harmless error<sup>328</sup> in the context of narcotics testing,<sup>329</sup> specifically the testimony of the narcotics expert. During her testimony, the expert affirmed that she could not explain the underlying chemical reactions in the narcotics testing process and conceded that standard tests produced false positives.<sup>330</sup> The appeal court, in reviewing the evidence produced at trial and the expert’s testimony, also reviewed the findings of several scientific reports.<sup>331</sup> This led it to conclude that the expert’s testimony “provided an insufficient basis for the court’s conclusion that the reliability of field tests was sufficiently established.”<sup>332</sup> Despite this, the court found that the admission of the narcotics tests did not affect the outcome of the petitioner’s trial, concluding that the error was harmless.<sup>333</sup>

Harmless error can be found across the data set in relation to additional forensic science techniques. Challenges across the data set include: incorrectly admitted bloodstain evidence when additional evidence against the petitioner was overwhelming;<sup>334</sup> an incorrectly admitted autopsy report without being accompanied by in-court expert testimony;<sup>335</sup> fingerprint testimony incorrectly attributed to an

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<sup>325</sup> *Id.*

<sup>326</sup> *Id.*, at 2.

<sup>327</sup> *Id.*, at 3.

<sup>328</sup> *State v. Martinez*, 143 Conn.App. 541 (Conn. App. Ct. 2013).

<sup>329</sup> *Id.*

<sup>330</sup> *Id.*, at 562.

<sup>331</sup> *Id.*, at 563.

<sup>332</sup> *Id.*

<sup>333</sup> *Id.*, at 570.

<sup>334</sup> *People v. Morris*, 997 N.E.2d 847 (Ill. App. Ct. 2013).

<sup>335</sup> *Rosario*, 175 So.3d.

individual source following an admission from the petitioner,<sup>336</sup> and the trial court's decision to exclude cross-examination based on *Ballistic Imaging*, where the findings from the report would not have changed the trial outcome.<sup>337</sup>

Courts have also found harmless error in relation to constitutional claims relating to forensic science evidence. In *Rosario v. State (2015)*, the court was charged with determining whether the admission of an autopsy report was testimonial under the Confrontation Clause.<sup>338</sup> Following *Melendez-Diaz v. Massachusetts (2009)*,<sup>339</sup> the court found that the autopsy report prepared following the murder – but 12 years before the petitioner's trial – was testimonial,<sup>340</sup> and was required to be accompanied by in-court expert testimony.<sup>341</sup> In determining the absence of live testimony erroneous, it found the error harmless, as the trial result would not have been different had the evidence not been admitted.<sup>342</sup> These decisions demonstrate the judicial fidelity to the legal process vision, as appellate courts are only willing to disrupt the legal process when the legitimacy of outcome has been undermined by error.

#### iv. Pattern Analysis Evidence: Where Appellate Courts Have Found Plain Error

The data set shows that the judicial fidelity to the legal process extends beyond general deference to trial court decisions, as in instances where appellate courts have found that an identified error would have changed the outcome of the trial, trial decisions have been reversed, as the error undermined the rationality in the trial court's reasoning. While these examples are few, *State v. Romero (2016)* provides an example of this. In *Romero*, the cumulative exclusion of both the defense's ballistics expert and findings from *Strengthening* which raised reliability issues<sup>343</sup> was found to amount to more

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<sup>336</sup> Commonwealth v. Gambora, 457 Mass. 715 (Mass. 2010).

<sup>337</sup> *Harper*, 344 Wis.2d.

<sup>338</sup> *Rosario*, 175 So.3d.

<sup>339</sup> See, *Melendez-Diaz*, 557 U.S.

<sup>340</sup> *Rosario*, 175 So.3d. at 856.

<sup>341</sup> *Id.*

<sup>342</sup> *Id.*, at 858-859.

<sup>343</sup> *Id.*, at 509.

than harmless error.<sup>344</sup> The court determined that while the defense ballistics expert was not designed to be the primary defense evidence,<sup>345</sup> the cumulative exclusion of both **Strengthening** and the defense's ballistic expert led the court to determine that the "state's emphasis on the defendant's lack of "witness stand" evidence supporting the NAS report exacerbated the error."<sup>346</sup> It found that the petitioner's lack of ability to defend his position was prejudicial, as had these tools been available, the jury would have placed weight on the limitations of the evidence.<sup>347</sup> This led the court to further determine that the compounded error amounted to plain error,<sup>348</sup> despite the dissenting judge arguing that the jury decision could not be attributed to the admission of the ballistics evidence.<sup>349</sup>

Within the data set, plain error has most frequently been found in cases where petitioners have challenged the admissibility of CBLA evidence, following the publication of **Bullet Lead**. For example, in **Ragland v. Commonwealth (2006)**,<sup>350</sup> the Supreme Court of Kentucky found plain error following the petitioner's claim that the state's expert should not have testified that the CBLA test results showed that the bullet fragment found in the victim's body was "chemically indistinguishable" from bullets found to have a connection with the petitioner.<sup>351</sup> The court ultimately determined that the trial court had committed reversible error.<sup>352</sup> It relied on **Bullet Lead** to find that the *Daubert* requirement of a known error rate within CBLA was "only partially satisfied."<sup>353</sup> The court continued to reference the findings and recommendations of **Bullet Lead** and subsequent discontinuation of CBLA by the FBI to determine that CBLA evidence was insufficiently reliable to be admitted.<sup>354</sup> In finding plain error, the court based its reasoning on the pivotal nature of the CBLA evidence during trial, as it was the only evidence "linking the defendant to the murder bullet."<sup>355</sup> As all additional

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<sup>344</sup> State v. Romero, 240 Ariz. 503 (Ariz. Ct. App. 2016).

<sup>345</sup> *Id.*

<sup>346</sup> *Id.*, at 511.

<sup>347</sup> *Id.*

<sup>348</sup> *Id.*

<sup>349</sup> *Id.*

<sup>350</sup> *Ragland*, 191 S.W.3d.

<sup>351</sup> *Id.*

<sup>352</sup> *Id.*, at 578.

<sup>353</sup> *Id.*, at 579.

<sup>354</sup> *Id.*, at 580.

<sup>355</sup> *Id.*, at 582.

evidence was circumstantial, the court held that it was “unable to conclude that there is no substantial possibility that the result would have been different but for the admission of the CBLA evidence.”<sup>356</sup> Its conclusion that the error was not harmless demonstrates judicial fidelity to the legal process vision, as the admission of the unreliable CBLA evidence (which was central to the case) undermined the legitimacy of the trial outcome, demonstrating a procedural irregularity. By overturning this decision, the court recognized the importance of legitimacy of process, as valued by the legal process vision.

#### **b. The Judicial Abuse of Discretion Standard**

The data set shows that appellate courts also rely on the “abuse of discretion” standard to provide flexibility in their review of trial court decisions, and ultimately pay considerable deference to the decisions made within the trial itself. The abuse of discretion standard requires a petitioner to demonstrate that the judge had “overstepped his discretionary authority.”<sup>357</sup> Although this is also a high burden for petitioners to attain, the abuse of discretion standard is distinct from plain error as it focuses on the trial judge acting outside their institutional competence. At appellate level, considerable discretion is given to trial judges’ decision-making, but this is not absolute. The data set demonstrates that the breadth of this discretion shows appellate courts’ deference to the institutional competence of trial judges – a principle of the legal process vision – but on the occasion that a trial judge has acted outside their competence, an abuse of discretion is found. This demonstrates that the fidelity to the legitimacy of the legal process is prioritized over absolute deference to trial proceedings. Petitioners claiming an abuse of discretion have largely been met with a high burden of proof. Appellate courts finding that the trial court have not abused its discretion is most prevalent when a trial court’s interpretation of DNA evidence has been challenged. Examples of these claims will be examined in subsection (i), followed by challenges to pattern analysis evidence in subsection (ii).

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<sup>356</sup> *Ragland*, 191 S.W.3d. at 582.

<sup>357</sup> *Kalpakis*, *supra* note 258, at 311.

Decisions in the data set where appellate courts have found an abuse of judicial discretion are contained in subsection (iii).

#### i. DNA Evidence: Appellate Courts' Deference to Trial Court Decisions

The data set shows that appellate courts' use of the abuse of discretion standard allows trial court judges considerable deference when reviewing DNA admissibility decisions.<sup>358</sup> In addition to demonstrating the importance placed on the legal process value of institutional settlement, this approach also reconciles inconsistencies in trial courts' approaches to the admissibility of DNA evidence, taking into account technological developments in DNA evidence across the twenty-five-year period spanning the data set. The abuse of discretion standard also allows for appellate courts to acknowledge scientific progress and debates without displacing trial court reasoning and decisions.

For example, in *United States v. Chischilly (1994)*, the Federal Court of Appeals applied an abuse of discretion standard to examine whether – amongst other things – the district court had been incorrect in admitting DNA evidence amid “raging controversy” in the scientific community.<sup>359</sup> It also considered the admissibility of DNA evidence in light of the then-recent departure from the *Frye* general acceptance test and whether DNA evidence was admissible under *Daubert's* reliability framework.<sup>360</sup>

In *Chischilly*, the petitioner relied on several recent pieces of academic commentary to argue that DNA evidence was inadmissible in his trial. He argued that he had been prejudiced because his Navajo ancestry was underrepresented in the DNA database, invalidating the significance of the match.<sup>361</sup> In response, the court found that the trial court had acted within its discretion in admitting the DNA evidence.<sup>362</sup> It supported its decision by referencing findings from *DNA 1*. While it acknowledged that the debate surrounding the product rule method of calculating the significance of a DNA match and

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<sup>358</sup> See, e.g., *State v. Burdick*, 395 S.W.3d 120 (Tenn. 2012); *Commonwealth v. Gaynor*, 443 Mass. 245 (Mass. 2005).

<sup>359</sup> *United States v. Chischilly*, 30 F.3d 1144, 1152 (9th Cir. 1994).

<sup>360</sup> *Id.*

<sup>361</sup> *Id.*, at 1153.

<sup>362</sup> *Id.*

that this method was not recommended by the NAS,<sup>363</sup> it ultimately found that the DNA evidence was more probative than prejudicial.<sup>364</sup> This allowed it to conclude that the trial court did not abuse its discretion in admitting the evidence.<sup>365</sup> The court further justified its decision by referring to the circumstances of the case, finding that a jury would logically come to the conclusion that the petitioner was the source of the DNA, given the wider evidence presented at trial, finding that the DNA evidence was admissible under both *Daubert*/Federal Rule of Evidence 702 and Federal Rule of Evidence 403.<sup>366</sup> Similarly, the abuse of discretion standard was applied in ***People v. Heaton (1994)***.<sup>367</sup> The petitioner challenged the admissibility of DNA evidence and lack of a *Frye* hearing, arguing that the product rule method was inadmissible, as it lacked general acceptance under *Frye*.<sup>368</sup> He supported his decision with findings from ***DNA 1***.<sup>369</sup> The appellate court found that that as a motion for a *Frye* hearing had taken place prior to the publication of ***DNA 1*** and Illinois courts had already found the product rule admissible under *Frye*, the trial court did not abuse its discretion in admitting the DNA evidence.<sup>370</sup> Moreover, the challenge was dismissed because the petitioner had not renewed his request for a *Frye* hearing, and had not challenged the admissibility of the DNA evidence following the publication of ***DNA 1***.<sup>371</sup> Ultimately, the court determined that because the trial court had not been provided with any evidence that suggested any debate surrounding the admissibility of the product rule method, it did not abuse its discretion, grounding the decision in “the state of record as it existed in the trial court at the time the trial court made its DNA admissibility decision.”<sup>372</sup>

The appeal courts in both ***Chischilly*** and ***Heaton*** found that the trial court did not abuse its discretion by admitting the statistics calculated using the product rule, despite ***DNA 1*** recommending an

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<sup>363</sup> *Id.*, at 1156.

<sup>364</sup> *Id.*

<sup>365</sup> *Chischilly*, 30 F.3d. at 1156.

<sup>366</sup> *Id.*, at 1158.

<sup>367</sup> *People v. Heaton*, 266 Ill.App.3d 469, 475 (Ill. App. Ct. 1994).

<sup>368</sup> *Id.*, at 475.

<sup>369</sup> *Id.*

<sup>370</sup> *Id.*, at 478.

<sup>371</sup> *Id.*

<sup>372</sup> *Id.*

alternative calculation method. However, the juxtaposition of NAS report recommendations and trial court acceptance of the product rule is only present in cases decided before 1996, as **DNA 2** found that the product rule had become the appropriate method to calculate DNA match statistics.<sup>373</sup>

The publication of **DNA 2** and its recommendation advocating the product rule afforded appellate courts considerably more latitude to find that trial courts had not abused their discretion when the admission of the product rule had been challenged, even when the trial had taken place prior to 1996. The retrospective application of **DNA 2** by appellate judges as a tool to justify the appellate court's reasoning is seen in **State v. Kinder (1996)**, one of the first decisions reviewing the admissibility of the product rule following the publication of **DNA 2**.<sup>374</sup> The petitioner argued that the product rule was not generally accepted, using findings from **DNA 1** to support his claim.<sup>375</sup> The appellate court used **DNA 2** – published following the petitioner's trial – to find that the product rule had gained sufficient reliability to be admitted as evidence.<sup>376</sup> Citing **DNA 2** and precedent which also supported the admissibility of the product rule, the court found that the trial court had not abused its discretion, and instead found that any criticisms regarding its reliability should properly be directed towards the weight of the evidence.<sup>377</sup>

Appellate decisions have also discussed whether trial courts have abused their discretion in finding DNA evidence inadmissible. For example, in **People v. Wardell (1992)**, the petitioner argued that the consideration of DNA evidence could have excluded him as the perpetrator.<sup>378</sup> The appellate court determined that the outcome of the trial court's decision to exclude the evidence, and not the trial court's reasoning, was subject to review.<sup>379</sup> It also reviewed the trial court's decision within the temporal context of the trial, which was conducted in 1988. The appellate court determined that at

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<sup>373</sup> JAMES F. CROW, *THE EVALUATION OF FORENSIC DNA EVIDENCE* 156 (National Academies Press 1996).

<sup>374</sup> *Kinder*, 942 S.W.2d.

<sup>375</sup> *Id.*, at 327.

<sup>376</sup> *Id.*

<sup>377</sup> *Id.*

<sup>378</sup> *Id.*, at 1099.

<sup>379</sup> *Id.*, at 1100.

this time, there was “prior hesitancy in accepting DNA testing.”<sup>380</sup> It used various subsequent studies, including *DNA 1*, to determine that the trial court did not abuse its discretion in excluding DNA evidence, finding that DNA testing had not achieved general acceptance by 1988.<sup>381</sup> By situating its analysis within the context of the information available to the trial court, the appellate court reinforced the importance of decision-making procedures being correctly followed at the time of trial. The subsequent acceptance of DNA evidence had little bearing on this decision.

This decision suggests that the review of judicial decisions is driven by context-specific details. This has allowed courts to determine that despite subsequent technological developments, the trial court had properly considered the contested evidence, and had therefore correctly followed procedural requirements. This context-specific approach was used in *People v. Reeves (2001)* in relation to the admissibility of the product rule.<sup>382</sup> The petitioner had argued that the trial court’s decision to admit DNA evidence with statistics calculated using the product rule was an abuse of discretion because, under the *Kelly* admissibility framework, the product rule had not yet gained general acceptance.<sup>383</sup> In its review, the appeal court first sought to establish the general acceptance of the product rule. It referred to both precedent and *DNA 2* to find that the defense expert’s “lone dissent [that the product rule is not generally accepted] is not sufficient to generate a controversy where the remainder of the scientific community has reached consensus.”<sup>384</sup> The court stated that the abuse of discretion standard requires appellate courts to pay deference to the determinations of the trial court, and found that the trial court’s decision did not amount to an abuse of discretion.<sup>385</sup>

As part of its decision-making, the *Reeves* court recognized the existence of conflicting testimony and lack of complete consensus, but did not find that the trial court had abused its discretion in finding that the Department of Justice (the prosecution expert) had used correct procedures in calculating

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<sup>380</sup> *Kinder*, 942 S.W.2d. at 1100.

<sup>381</sup> *Id.*, at 1101.

<sup>382</sup> *Reeves*, 91 Cal.App.4th.

<sup>383</sup> *Id.*, at 37.

<sup>384</sup> *Id.*, at 41.

<sup>385</sup> *Id.*, at 47.

random match frequencies.<sup>386</sup> This was further supported by the court's decision to dismiss the petitioner's challenge to the significance of the match, finding that although the defense expert disagreed with the prosecution on the generally accepted error rate, it was not satisfied that the petitioner had produced evidence to suggest that error rates had not been considered.<sup>387</sup>

Temporal consideration and the high threshold required to demonstrate an abuse of discretion, as demonstrated by these cases, shows that appellate judges afford trial courts considerable discretion when making admissibility decisions about DNA evidence, demonstrating fidelity to the legal process principle of institutional settlement. This has been used to afford discretion to trial court decisions when DNA evidence has been questioned post-conviction, as scientific developments in DNA typing following trial had the potential to disturb/undermine the outcome of the trial. While the reliance on the abuse of discretion standard has led to inconsistencies between judicial decisions, the justification given by appellate judges demonstrate fidelity to the legal process values of institutional competence and regularity of process. Further, several decisions within the data set have directed challenges to the weight of the evidence, not its admissibility.<sup>388</sup>

## ii. **Pattern Analysis Evidence: Appellate Courts' Deference to Trial Court Decisions**

The data shows that appellate judges generally apply an abuse of discretion standard to admissibility challenges to pattern analysis evidence. The discretion given to trial courts and the resulting high threshold for petitioners demonstrates fidelity to the legal process vision's principle of institutional competence, provided that the decision has been made as a result of a regular process. Typically, petitioners have challenged the admissibility of pattern evidence by referencing findings from **Strengthening** to support their reliability challenge, but appellate courts have found that the report alone is insufficient to demonstrate a procedural irregularity.

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<sup>386</sup> *Id.*, at 49.

<sup>387</sup> *Id.*

<sup>388</sup> *See, e.g., Kinder*, 942 S.W.2d.

The wide discretion afforded to trial court decisions is seen frequently in cases within the data set, with over twenty decisions dismissing petitioners' claims for lack of abuse of discretion. For example, in ***State v. Adams (2011)***, the Court of Appeals of North Carolina addressed the petitioner's challenge that the ballistic expert's testimony presented during trial should not have been admitted, as the analysis methods used by the expert were not sufficiently reliable.<sup>389</sup> The expert testified at trial that she had been trained in accordance with guidelines published by the AFTE (Association of Firearms and Tool Mark Examiners) and had followed standard AFTE analysis methods in analyzing the ballistics evidence.<sup>390</sup> The defense had presented counter-evidence, referencing findings from both ***Ballistic Imaging*** and ***Strengthening*** to argue that the approach was subjective, and questioned the underlying assumptions of the AFTE method.<sup>391</sup> Ultimately, the court found that the trial court had determined that the expert had conducted her analysis using standard procedures, and similar techniques had previously been found sufficiently reliable by precedent – demonstrating regularity in procedure – leading it to find that the trial court did not abuse its discretion in allowing the expert's testimony.<sup>392</sup>

The appellate court in ***Adams*** did not go into detail in its reasoning, and merely listed and followed previous cases that had decided that AFTE ballistics methods were admissible. Other courts – particularly when specific claims against the admissibility of expert testimony has been challenged – have provided a more detailed justification of their dismissal of challenges to ballistics evidence. In ***State v. McGraw (2015)***, the petitioner claimed that the trial court had abused its discretion in allowing a ballistics expert to testify to a degree of absolute certainty during trial.<sup>393</sup> The petitioner argued that in testifying to absolute certainty, the expert exceeded what was generally accepted under the state's admissibility framework.<sup>394</sup> The court dismissed the challenge, justified on the basis that precedent that had limited the certainty of expert testimony was within the discretion of the trial

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<sup>389</sup> *State v. Adams*, 212 N.C.App. 235 (N.C. Ct. App. 2001).

<sup>390</sup> *Id.*, at 6.

<sup>391</sup> *Id.*

<sup>392</sup> *Id.*

<sup>393</sup> *State v. McGraw*, 243 N.C.App. 675 (N.C. Ct. App. 2015).

<sup>394</sup> *Id.*, at 5.

court, and not an admissibility requirement.<sup>395</sup> Consequentially, it found that the trial court had acted within its discretion in allowing the testimony.<sup>396</sup>

Appellate judges have also found trial courts to have acted within their discretion when petitioners have challenged fingerprint examiners' testimony of 100% match certainty. For example, in **United States v. Watkins (2011)**, the petitioner argued that the fingerprint expert's testimony should not have been admitted, as the expert testified that ACE-V fingerprint analysis had an error rate of zero.<sup>397</sup> Referring to **Strengthening** to support his challenge, he claimed that the trial court had abused its discretion.<sup>398</sup> The Court of Appeal rejected this argument using a twofold approach: first, it found that as **Strengthening** had not been put before the district court (as the trial took place prior to the report's publication), it could not consider its findings; and second, testifying to 100% certainty may have been an inaccurate statement, but did not mean that fingerprint evidence was unreliable or inadmissible.<sup>399</sup> It concluded that as the claim was limited to the certainty of the testimony and not the reliability of ACE-V and fingerprint analysis *per se*, it could not find an abuse of discretion.<sup>400</sup>

Another issue found to be within discretion of the trial court is found in **People v. Gonzalez (2012)**.<sup>401</sup> The petitioner appealed his conviction on the basis that the trial court had excluded the defense's fingerprint expert, who was to testify that there was not sufficient scientific data underpinning the reliability of fingerprint evidence.<sup>402</sup> The trial court had excluded the evidence on the basis that it did not assist the jury. When reviewed on appeal, the court found that the trial court did not abuse its discretion, supported by the further justification that the challenges raised using **Strengthening** were not sufficiently specific to the petitioner's case.<sup>403</sup>

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<sup>395</sup> *Id.*, at 8.

<sup>396</sup> *Id.*

<sup>397</sup> *United States v. Watkins*, 450 Fed.Appx. 511 (6th Cir. 2011).

<sup>398</sup> *Id.*, at 515.

<sup>399</sup> *Id.*

<sup>400</sup> *Id.*, at 516.

<sup>401</sup> *People v. Gonzalez*, 2012 WL 591383 (Cal. Ct. App. 2012).

<sup>402</sup> *Id.*, at 2.

<sup>403</sup> *Id.*, at 3.

These cases show the judicial reliance on the wide discretion afforded to trial courts, with courts justifying the dismissal of challenges based on the regularity of the trial process. Additional decisions within the data set have found that challenges raised by petitioners are not a consideration for the trial judge, but a matter of weight – determined by the jury – which had properly been considered at the time of the trial. This gives the jury the scope to determine the probative value of forensic science evidence – a particularly important decision given the limitations of forensic science (as demonstrated in *Strengthening*). The judicial dismissal of admissibility challenges by justifying that the issue was a matter of weight is seen in cases such as *Turner v. State (2011)*.<sup>404</sup> The petitioner challenged the trial court’s decision to admit several pieces of evidence – including firearms and tool mark identification testimony – claiming that the evidence did not meet the reliability threshold under Indiana Rule of Evidence 702.<sup>405</sup> He argued that the expert did not go into sufficient detail when testifying and could not recall details about studies supporting the reliability of his claims upon direct examination.<sup>406</sup>

The Supreme Court of Indiana explained that under Indiana law “it is not dispositive... whether [the expert’s] theory can be and has been tested, whether the theory has been subjected to peer review and publication, whether there is a known or potential error rate, and whether the theory has been generally accepted within the relevant field of study.”<sup>407</sup> Through this dismissal of the relevance of Rule 702 and the principles in *Daubert*, the court found the petitioner’s concerns to be a matter of weight, not admissibility, dismissing the challenge.<sup>408</sup> This decision was further supported by precedent that found firearms evidence generally admissible, despite limitations.<sup>409</sup> The court concluded that the trial court did not abuse its discretion in admitting the expert firearms testimony.<sup>410</sup>

This decision provided the trial court with considerable discretion, particularly as the appellate court interpreted the Rule 702 requirements flexibly. The approach taken by the court is far more

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<sup>404</sup> *Turner v. State*, 953 N.E.2d 1039 (Ind. 2011).

<sup>405</sup> *Id.*, at 1049.

<sup>406</sup> *Id.*, at 1051.

<sup>407</sup> *Id.*

<sup>408</sup> *Id.*

<sup>409</sup> *Id.*, at 1052-1053.

<sup>410</sup> *Turner*, 953 N.E.2d at 1052-1053.

reminiscent of *Frye's* general acceptance standard, although the debate is couched in terms of the *Daubert* framework. In general, decisions in the data set follow *Daubert* criteria far more closely where the admissibility of a forensic science technique is challenged. The *Daubert* approach has allowed, in general, for a more in-depth review of a trial court's decision, although in the data set, courts have rarely overturned the decision of a trial court to admit ballistics testimony. This approach pays deference to trial court decisions, with the **Turner** court affording considerable deference to the trial court. This deference demonstrates that appellate courts will only overturn a decision when there has been a clear violation of process, demonstrating the wide scope of institutional settlement, as well as appellate judges' reluctance to disrupt trial court decisions, demonstrating fidelity to the legal process.

Although appearing less frequently in the data set, appellate courts addressing challenges to other forensic science techniques have also deferred to trial court reasoning. For example, in **State v. Brodbeck (2017)**, the petitioner argued **Strengthening** (and additional documents) constituted newly discovered evidence that demonstrated that the blood spatter evidence introduced at trial was unreliable.<sup>411</sup> Included within the additional documents was a letter from a gunshot expert who opined that the gunshot wound was self-inflicted and not evidence of a murder.<sup>412</sup> The court found that the gunshot evidence was unrelated to the blood spatter evidence admitted at trial, and the letter did not specifically undermine the blood spatter conclusions.<sup>413</sup> The court found no reason why the contradictory evidence was not discoverable at trial, and held that the trial court did not abuse its discretion in admitting the blood spatter evidence.<sup>414</sup> This again demonstrates the judicial fidelity to institutional settlement principle of the legal process vision.

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<sup>411</sup> State v. Brodbeck, 2017 WL 3432624 (Ohio Ct. App. 2017).

<sup>412</sup> *Id.*, at 4.

<sup>413</sup> *Id.*, at 5.

<sup>414</sup> *Id.*

**iii. Appellate Decisions Reversing Trial Court Decisions Using a NAS Report to Demonstrate that a Trial Judge had Abused their Discretion and Caused an Irregularity in the Trial Process**

The data set shows that while appellate judges generally afford trial courts considerable discretion in their admissibility decisions, this is not without limitations. Where a trial judge has been found to abuse their discretion, appellate courts will overturn these decisions.<sup>415</sup> This demonstrates the importance of the need for trial courts to follow regular procedures, a key element of the legal process vision. Where an abuse of discretion has been found, appellate judges have supported their reasoning using passages from relevant NAS reports.

One example of an appellate court finding an abuse of discretion is *People v. Sutton (2004)*.<sup>416</sup> The petitioner appealed the trial court's decision to deny the defense counsel's request to have DNA evidence re-tested.<sup>417</sup> He argued that this breached several of his constitutional rights, including: the right to a fair trial; the right to confront witnesses; and the right to present a defense.<sup>418</sup> The trial court had initially decided that the original request for DNA re-testing was untimely.<sup>419</sup> On appeal, the court found in favor of the petitioner, as having DNA evidence re-tested would come at no burden to the state, there were no practical barriers to re-testing, and the initial discovery period was still ongoing at the time of the petitioner's original request.<sup>420</sup> In addition, the court cited several further publications to support its conclusion,<sup>421</sup> as well as refencing precedent which had found timeliness of claim irrelevant if it would deny the petitioner a fair and impartial trial.<sup>422</sup> It further supported its

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<sup>415</sup> See, e.g., *Husske v. Commonwealth*, 19 Va. App. 30 (Va. Ct. App. 1994); *United States v. Johnstead*, 30 F.Supp.3d 814 (W.D. Wis. 2013).

<sup>416</sup> *People v. Sutton*, 349 Ill.App.3d 608 (Ill. App. Ct. 2004).

<sup>417</sup> *Id.*

<sup>418</sup> *Id.*, at 618.

<sup>419</sup> *Id.*, at 619.

<sup>420</sup> *Id.*

<sup>421</sup> *Id.*, at 620.

<sup>422</sup> *Sutton*, 349 Ill.App.3d at 620.

decision by referencing findings and recommendations in **DNA 2**, which found DNA testing to be “one of the most effective means of identifying and correcting errors.”<sup>423</sup>

While **Sutton** is one of four decisions in the data set where an appeal court has found an abuse of discretion in a trial court’s handling of a DNA-related issue, there are only two decisions where an abuse of discretion has been found in relation to the admissibility or handling of other forensic science techniques, although these decisions have been confined to the specific facts. Within this, **People v. Jones (2015)** addressed the petitioner’s claim that the testimony given by the ballistic expert should have been excluded because the procedures that the expert had used to determine a match lacked adequate scientific foundation.<sup>424</sup> The petitioner relied on **Strengthening** to argue that all forensic science, ballistics evidence included, is subject to human error.<sup>425</sup> He also questioned the general acceptance of the expert’s ballistics testimony in his trial.<sup>426</sup> The court established its position for review by stating that that “all expert testimony... must have an adequate foundation,”<sup>427</sup> but found that the determination of this foundation is a matter for the trial court, and that such a decision “will not warrant a reversal of the judgment unless the record indicates the existence of substantial prejudice.”<sup>428</sup>

The court then reviewed relevant passages from **Strengthening**, and although it concluded that “the NRC report provides no basis for any change in Illinois law,”<sup>429</sup> it found that the petitioner’s assertion was valid because the state had “failed to carry its burden of showing beyond a reasonable doubt that the jury’s verdict would have been the same”<sup>430</sup> without the expert’s testimony. The court found that the ballistics testimony was of specific importance to the jury’s verdict, particularly as there was little other compelling evidence, and failed to see any evidence – with the exception of DNA – that would

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<sup>423</sup> *Id.*, at 621, quoting Crow, *supra* note 371, at 87.

<sup>424</sup> *People v. Jones*, 34 N.E.3d 1065 (Ill. App. Ct. 2015).

<sup>425</sup> *Id.*, at 1079.

<sup>426</sup> *Id.*

<sup>427</sup> *Id.*, at 1078.

<sup>428</sup> *Id.*

<sup>429</sup> *Id.*, at 1083.

<sup>430</sup> *Jones*, 34 N.E.3d at 1088.

have been more compelling and prejudicial than the evidence presented by the expert.<sup>431</sup> It ultimately held that the trial court had abused its discretion by admitting the evidence, and remanded the case for a new trial.<sup>432</sup> The second example of a challenge to non-DNA evidence, *People v. Johnson (2008)*, was decided on an issue that was not related to the forensic science challenge.<sup>433</sup>

As demonstrated by the small number of cases finding an abuse of discretion – one percent of the data set – appellate courts have rarely found a trial court to have abused its wide discretion. As seen in *Sutton*, the decision was justified by a number of additional factors, and in *Jones*, there was little other compelling evidence to support the conviction. These decisions are unusual in the data set, as typical cases dismissing abuse of discretion claims have found that challenged evidence had been admitted correctly by a judge with the competence to make that decision, as found in cases such as *Chischilly* and *Adams*, or harmless error. This general disposition provides trial judges with considerable decision-making competence. This further demonstrates appellate courts' fidelity to the legal process vision, as appellate courts provide trial judges and procedures with considerable discretion, and generally defer to their institutional competence. This demonstrates fidelity to the legal process vision as appellate courts will only overturn decisions where petitioners have convincingly demonstrated a procedural irregularity (overstepping of judicial discretion).

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<sup>431</sup> *Id.*, at 1089.

<sup>432</sup> *Id.*

<sup>433</sup> *People v. Johnson*, 2008 WL 2689657 (Cal. Ct. App. 2008).

### **3. Judicial Fidelity to the Institutional Competence of the Trial Court as seen through Appellate Courts' Deference to Jury Competence when NAS Reports are Raised to Question the Reliability of Forensic Science Evidence**

The data set shows that appellate judges dismiss petitioners' admissibility claims by relying on the institutional competence of the jury, deferring to their determinations of weight when the reliability of forensic science evidence has been challenged by petitioners. Often when this occurs, an appellate court will find that an admissibility challenge is not a matter of admissibility, but one of weight, which is part of the competence of the jury. By finding a challenge to be a matter of weight, appellate courts acknowledge the limitations of a forensic science discipline, whilst demonstrating fidelity to institutional settlement through deferring to the competence of the jury, a principle of the legal process. Appellate decisions within the data set that have found a challenge to be a matter of weight are particularly prevalent, although not exclusively, amongst cases where petitioners have cited **Strengthening** to challenge the reliability of pattern analysis evidence.

This section is presented in four subsections, each discussing one pattern of judicial behavior demonstrating fidelity to the legal process vision through deference to the competence of the jury. Subsection (a) explores the judicial determination that an admissibility challenge was a matter of weight, determined by the jury during trial; subsection (b) explores instances where *in limine*, judges have found limitations to be a matter for the jury to determine; subsection (c) examines judicial decision-making where significant scientific developments – in relation to CBLA evidence – have emerged following trial, questioning decisions made by the jury; and subsection (d) examines the limits of jury competence through the judicial exclusion of evidence under Federal Rule of Evidence 403, and state equivalent provisions, where judges have determined that the evidence would have an overwhelming effect on a jury.

**a. Deference to the Institutional Competence of the Jury by Finding that a Petitioner's Challenge was one of Weight, not Admissibility**

The data set shows that admissibility challenges to forensic science evidence are often dismissed, with appellate judges indicating that any limitations in the evidence are a matter of weight, determined by the jury. This highlights the defined nature of the jury, showing their broad competence and discretion to determine the weight of evidence within the trial process, even if evidence has significant limitations. This subsection is presented in relation to the three main forensic science techniques challenged in the data set: DNA evidence, firearms and tool mark evidence, and fingerprint evidence.

**i. DNA Evidence**

The 1990s was a time of rapid technological expansion for DNA technology and its forensic application. The data set reflects this, showing that appellate courts have responded to admissibility challenges by acknowledging the limitations of DNA evidence and analysis techniques. However, the data set shows that these challenges are often considered a determination of weight, not admissibility, demonstrating the jury's institutional competence to determine the probative value of DNA evidence.

For example, in *State v. Penton (1993)*, the petitioner objected to the trial court's decision to admit DNA evidence prepared using the PCR method.<sup>434</sup> He argued that **DNA 1** demonstrated that PCR evidence had not reached general acceptance in the relevant scientific community, and was therefore inadmissible under *Frye*.<sup>435</sup> The court, in response, held that the petitioner's challenge was not an issue of admissibility, and, moreover, found that the presence of contradicting expert testimony did not mean that the trial court had erred in admitting the evidence, but found that the challenge "goes to weight of the evidence not its admissibility. The jury was free to accept or reject the PCR/DNA results."<sup>436</sup>

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<sup>434</sup> State v. Penton, 1993 WL 102507 (Ohio Ct. App. 1993).

<sup>435</sup> *Id.*, at 4.

<sup>436</sup> *Id.*, at 5.

The court in ***State v. Honzu (1995)*** also rejected the petitioner’s challenge that the DNA analysis procedures used by the expert lacked reliability.<sup>437</sup> The petitioner argued that the expert’s laboratory had modified existing DNA procedures in their analysis, and therefore the techniques used had not been subjected to confirmatory testing.<sup>438</sup> The expert had testified extensively at trial about the DNA analysis procedures used, with the appellate court finding that the procedures followed by the expert were admissible, as the evidence would “assist the trier of fact in determining a fact in issue.”<sup>439</sup>

The court found that the petitioner’s challenge was a matter of weight. It highlighted the importance of defense counsel raising the limitations of the DNA evidence before the jury, finding that as the limitations of DNA evidence were raised before the jury during cross-examination, and the expert’s modification of standard procedures were merely minor changes,<sup>440</sup> the issue had been examined. It determined that the issue was a matter of weight, as it had “no effect or no bearing at all”<sup>441</sup> on the testing outcome.<sup>442</sup> Ultimately, this led the court to find that “the jury was entitled to accept, as they apparently did, the testimony of the state indicating that any minor variations in the testing procedures did not affect the reliability of the results.”<sup>443</sup>

Similarly, in ***State v. Register (1996)***, the Supreme Court of South Carolina court also paid deference to the institutional competence of the jury by finding the petitioner’s admissibility challenge to be a matter of weight.<sup>444</sup> The petitioner challenged the admissibility of DNA evidence under the state’s admissibility framework.<sup>445</sup> The court dismissed the petitioner’s claim, finding that the trial court had correctly admitted the DNA evidence.<sup>446</sup> However, it also found that the jury had a responsibility to

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<sup>437</sup> *State v. Honzu*, 1995 WL 326214 (Ohio Ct. App. 1995).

<sup>438</sup> *Id.*, at 6.

<sup>439</sup> *Id.*, at 7.

<sup>440</sup> *Id.*

<sup>441</sup> *Id.*

<sup>442</sup> *Id.*

<sup>443</sup> *Honzu*, 1995 WL at 8.

<sup>444</sup> *State v. Register*, 323 S.C. 471 (S.C. 1996).

<sup>445</sup> *Id.*

<sup>446</sup> *Id.*, at 481.

determine the weight of the DNA evidence, using the expert's method of calculating the statistical significance of the DNA evidence to assist their decision-making.<sup>447</sup>

Other decisions made by state supreme courts have also deferred to the institutional competence of the jury in determining the weight to be given to DNA evidence, particularly where novel and developing methods of DNA typing have been challenged. This can be seen in ***State v. Whittey (2003)***, where the petitioner sought to challenge the admissibility of PCR-STR DNA testing, which was analyzed using a commercial DNA testing kit.<sup>448</sup> The court agreed with the state's submissions that the petitioner's concerns were not relevant to the evidence's general acceptance under *Frye*, but were matters of weight, to be determined by the jury.<sup>449</sup> In finding this, it followed precedent which ruled that challenges to laboratory testing protocols are matters of weight.<sup>450</sup> In addition, the court reviewed the results of the trial court's *Frye* hearing and confirmed that the trial court was correct in finding the DNA evidence admissible, as standard procedures had been used, which are scientifically valid and reliable.<sup>451</sup> It found no specific issues which might have affected the gravity of the DNA evidence, and determined that the evidence presented during the *Frye* hearing had "overwhelming acceptance,"<sup>452</sup> suggesting that the trial outcome was correct and that the jury would have been correct in finding the DNA evidence to have a considerable bearing on their decision.

The Supreme Court of Washington has also found DNA admissibility challenges to be a matter of weight for the jury to determine.<sup>453</sup> In ***State v. Gregory (2006)***, the petitioner challenged the admission of DNA evidence without a *Frye* hearing.<sup>454</sup> The trial court had previously rejected the petitioner's request for a *Frye* hearing because the state had established that the methods used to analyze DNA were generally accepted.<sup>455</sup> The petitioner also challenged the use of flatbed scanning to examine the

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<sup>447</sup> *Id.*

<sup>448</sup> *State v. Whittey*, 149 N.H. 463 (N.H. 2003).

<sup>449</sup> *Id.*, at 472.

<sup>450</sup> *Id.*, at 474.

<sup>451</sup> *Id.*, at 473-4.

<sup>452</sup> *Id.*, at 475.

<sup>453</sup> *State v. Gregory*, 158 Wash.2d 759 (Wash. 2006).

<sup>454</sup> *Id.*, at 829.

<sup>455</sup> *Id.*, at 883.

intensity of dot analysis.<sup>456</sup> The court found that the trial court was correct in admitting the evidence, and as the laboratory analyst could be cross-examined on this point, they found that any issues would be a matter of weight, not admissibility.<sup>457</sup> These cases give considerable deference to the competence of the jury, demonstrating appellate courts' fidelity to the legal process vision.

Judicial deference to the jury's institutional competence is also found when appellate courts have addressed constitutional challenges claiming a violation of the Sixth Amendment Confrontation Clause. Appellate courts have found that such issues are a matter of weight, determined by the jury. For example, in ***Derr v. State (2013)***, the petitioner challenged the constitutionality of the admission of a statement claiming a DNA match, made by an expert out-of-court.<sup>458</sup> This challenge was raised in relation to the ***Melendez-Diaz*** trilogy of cases.<sup>459</sup> Applying a ***Melendez-Diaz*** interpretation of the Confrontation Clause, the court found that it needed to be satisfied that the relevant DNA evidence was a) testimonial, and b) offered for its truth.<sup>460</sup> Reviewing the DNA evidence report, the court found that it was not sufficiently formalized, and was therefore not testimonial, as there was no attestation to the accuracy of the results.<sup>461</sup> It followed the decisions in ***Bullcoming*** and ***Williams*** to find that these DNA results were not testimonial.<sup>462</sup> Despite the court finding no constitutional violation, it acknowledged that this evidence was important in corroborating the testimony provided by the FBI's DNA examiner.<sup>463</sup> The court ultimately determined that the expert's "lack of firsthand knowledge goes to the weight of the evidence, not its admissibility,"<sup>464</sup> deferring to the competence of the jury.

These cases are just a few of the twenty-seven decisions in the data set where appellate courts have determined that a petitioner's admissibility challenge is a matter of weight, not admissibility. The

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<sup>456</sup> *Id.*, at 831.

<sup>457</sup> *Id.*, at 831.

<sup>458</sup> *Derr v. State*, 434 Md. 88 (Md. 2013).

<sup>459</sup> See, *Melendez-Diaz*, 557 U.S.; *Bullcoming v. New Mexico*, 564 U.S. 647 (2011); *Williams v. Illinois*, 567 U.S. 50 (2012).

<sup>460</sup> *Derr*, 434 Md. at 118.

<sup>461</sup> *Id.*, at 120.

<sup>462</sup> *Id.*

<sup>463</sup> *Id.*

<sup>464</sup> *Id.*

judicial deference to institutional settlement and jury competence demonstrates fidelity to the legal process.

## ii. Firearms and Tool Mark Evidence

Judicial deference to the institutional competence of the jury is also seen in relation to firearms and tool mark evidence. Petitioners seeking to challenge the admissibility of this evidence by referencing **Ballistic Imaging** and/or **Strengthening** have found their challenges to be matters of weight, not admissibility, and thus part of the jury's decision-making competence. This deference to institutional competence shows appellate judges' fidelity to legal process vision. This response can be seen clearly in the following cases.

In **State v. Thomas (2016)**, the petitioner argued that the firearms expert should not have testified to absolute certainty of a ballistic match.<sup>465</sup> The petitioner supported this by citing both **Ballistic Imaging** and **Strengthening**, which questioned the individualization of ballistics matches.<sup>466</sup> In response, the court reviewed the admissibility of the expert's testimony using a Rule 702 framework, and rejected the substance of the findings of the two NAS reports, finding that "the purpose of the 2008 NAS report was not to pass judgment on the admissibility of ballistics evidence,"<sup>467</sup> and also applied this reasoning to **Strengthening**.<sup>468</sup> It cited precedent to find that the challenge did not amount to plain error. This led it to conclude that the "challenges utilizing the conclusions in the National Research Council report 'more appropriately will go to the weight of the evidence rather than its admissibility'."<sup>469</sup>

A similar approach appears in **State v. Romero (2014)**, decided by the Court of Appeals of Arizona.<sup>470</sup> The petitioner had claimed that the trial court was incorrect in excluding defense testimony challenging the prosecution's firearms evidence. He argued that the excluded testimony would have

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<sup>465</sup> State v. Thomas, 2016 WL 7799279 (Tenn. Ct. App. 2016).

<sup>466</sup> *Id.*, at 12-13.

<sup>467</sup> *Id.*, at 15.

<sup>468</sup> *Id.*, at 15-16.

<sup>469</sup> *Id.*, at 16, quoting State v. Davidson, 2015 WL 1087126, 32-33 (Tenn. Ct. App. 2015).

<sup>470</sup> State v. Romero, 236 Ariz. 451 (Ariz. Ct. App. 2014).

allowed the jury to determine the correct weight to be given to the evidence.<sup>471</sup> The court, however, dismissed this challenge as it found that the petitioner had developed the same critique of the evidence through cross-examination.<sup>472</sup> This decision, while paying deference to jury's decision, does not consider the significance of the presence of a counter-expert, and instead is assured by the legitimacy of the process and safeguards provided by cross-examination, showing the importance not only of the jury's decision-making, but also the role of defense counsel. However, the appellate courts' deference to the competence of jury in their decision-making capacity demonstrates the defined role of the jury and their discretion in determining the weight of evidence. This shows that appellate judges are beholden to the legal process vision through deference to the competence of juries.

### iii. Fingerprints and Pattern Analysis Evidence

Appellate courts have consistently found that **Strengthening's** findings are insufficient to overturn a trial court decision when findings are used to support general challenges to fingerprint evidence, but can be relevant to the weight of the evidence. For example, in **People v. Luna (2013)**, the petitioner challenged the general acceptance of the ACE-V method of fingerprint analysis.<sup>473</sup> He relied on the findings of **Strengthening** to support his claim, arguing that the trial court had erred in refusing to hold an *in limine* hearing to exclude the latent print expert's testimony.<sup>474</sup> In dismissing the claim, the court conducted a review of the trial court's application of the *Frye* admissibility standard, finding that general acceptance is not the same as universal acceptance.<sup>475</sup> With this established, the court undertook an analysis of the ACE-V method of fingerprint analysis.<sup>476</sup>

In concluding its analysis, the court rejected the petitioner's claim that **Strengthening** suggested that the ACE-V method is not admissible, as he could not further support his claim with examples of

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<sup>471</sup> *Id.*, at 462.

<sup>472</sup> *Id.*, at 463.

<sup>473</sup> *Luna*, 989 N.E.2d.

<sup>474</sup> *Id.*

<sup>475</sup> *Id.*, at 666.

<sup>476</sup> *Id.*

previous judicial decisions excluding ACE-V.<sup>477</sup> The court justified its decision by stating that “these criticisms – which have already been considered in detail by courts since the report’s release – do not undermine the uniform judicial conclusion that latent print identification is generally accepted in the scientific community.”<sup>478</sup> In finding that the admissibility challenge had no merit, it held that the methodological limitations in ACE-V analysis, particularly claims of zero error rate and absolute certainty, are generally matters of weight, determined by the jury.<sup>479</sup> It also explained that it interpreted the petitioner’s claim as a challenge to the application of ACE-V, and not the methodology itself, and that the trial court properly took judicial notice of the general acceptance of ACE-V.<sup>480</sup>

Similarly, in ***Commonwealth v. Joyner (2014)***, the Supreme Judicial Court of Massachusetts also found that the petitioner’s admissibility challenge to fingerprint evidence based on limitations of the ACE-V method were attributable to weight, not admissibility.<sup>481</sup> As in ***Luna***, the petitioner sought to challenge the scientific validity of the ACE-V method of fingerprint analysis, supporting his argument with findings from ***Strengthening***.<sup>482</sup> The court rejected the admissibility challenge and held that “the weight and credibility to be accorded the identification evidence provided by [the expert’s] testimony was for the jury to determine.”<sup>483</sup> This decision was further supported by reference to precedent throughout the decision.<sup>484</sup>

The memorandum and order decision of the Federal District Court in ***United States v. Gutierrez-Castro (2011)*** demonstrates the importance of the differences in the defined roles of the trial judge, jury, and trial lawyers within the context of a challenge to the admissibility of fingerprint evidence.<sup>485</sup> This decision considered whether the state’s fingerprint expert testimony was admissible, paying particular attention to the issue of whether the expert was sufficiently qualified to testify during the petitioner’s

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<sup>477</sup> *Id.*, at 672.

<sup>478</sup> *Id.*, at 673.

<sup>479</sup> *Luna*, 989 N.E.2d. at 673.

<sup>480</sup> *Id.*, at 679.

<sup>481</sup> *Commonwealth v. Joyner*, 467 Mass. 176 (Mass. 2014).

<sup>482</sup> *Id.*, at 180.

<sup>483</sup> *Id.*, at 184-185.

<sup>484</sup> *Id.*, from 180.

<sup>485</sup> *United States v. Gutierrez-Castro*, 805 F.Supp.2d 1218 (D.N.M. 2011).

trial.<sup>486</sup> The court used a *Daubert* analysis to find that the expert was sufficiently qualified to testify,<sup>487</sup> on the condition that he was not called an expert in the presence of the jury, because “an untested hypothesis does not provide a scientific basis to support an expert opinion.”<sup>488</sup> In addition, the court addressed the petitioner’s specific concerns about the limitations of fingerprint analysis, but found them to be a matter of weight, not admissibility, discoverable through cross-examination.<sup>489</sup>

To justify its decision that the evidence was admissible, the court referred to multiple factors, including the state’s assertion that fingerprints have been tested through decades of experience and its low error rate, even if this rate could not be defined.<sup>490</sup> The court also relied on precedent which had found fingerprint evidence admissible, despite recognizing its methodological limitations.<sup>491</sup> Under *Daubert*, precedent had determined that fingerprint evidence was “sufficiently reliable” to be admissible due to its “overwhelming acceptance” in the relevant scientific community.<sup>492</sup> Guided by this, the court’s *Daubert* analysis showed concern for fingerprint evidence’s lack of peer review and publication.<sup>493</sup> When examining *Strengthening*, the court recognized “a National Academy of Sciences Report calls into question ACE-V methodology... [which] finds that this factor does not weigh in favor of admissibility.”<sup>494</sup> Despite finding this, the court determined that other *Daubert* factors were sufficiently satisfied, allowing the evidence to be admitted, deciding that any limitations in ACE-V were attributable to the weight of the evidence.<sup>495</sup> It ultimately held that “any issues that the parties bring out in direct or cross examination will go to the weight and credibility of [the expert’s] testimony.”<sup>496</sup>

This decision provides an example of courts affording considerable discretion to the jury in its decision-making competence in determining the weight of fingerprint evidence, demonstrating fidelity to the

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<sup>486</sup> *Id.*, at 1224.

<sup>487</sup> *Id.*, at 1228.

<sup>488</sup> *Id.*, at 1227.

<sup>489</sup> *Id.*, at 1229.

<sup>490</sup> *Id.*, at 1230.

<sup>491</sup> *Gutierrez-Castro*, 805 F.Supp.2d from 1230.

<sup>492</sup> *Id.*, at 1232.

<sup>493</sup> *Id.*, at 1233.

<sup>494</sup> *Id.*, at 1233.

<sup>495</sup> *Id.*, at 1235.

<sup>496</sup> *Id.*, at 1235.

legal process value of institutional settlement. Within the data set, there are ten decisions where fingerprint admissibility challenges have been determined to be a matter of weight, not admissibility. Admissibility challenges to other pattern analysis evidence techniques have also been resolved in this way. For example, in **Rodriguez v. State (2011)**, the Supreme Court of Delaware examined whether the trial court had committed reversible error by allowing a latent fingerprint examiner to provide expert testimony in relation to boot and tire track evidence.<sup>497</sup> The petitioner had argued that boot and tire track analysis was a distinct field from fingerprint analysis, and that the expert was not qualified to testify.<sup>498</sup> The court reviewed the trial court's decision to admit the expert's testimony through a *Daubert* admissibility framework, and paid particularly attention to the expert's qualification to testify.<sup>499</sup> It also reviewed the defense's cross-examination of the expert, concluding that "by probing [the expert] on his particular experience in tire track and shoeprint analysis, defense counsel challenged his credibility before the jury and the weight to be given to the impression evidence." Consequentially, it became part of the jury's decision-making to determine the weight of the expert's testimony.<sup>500</sup>

**b. Deference to the Scope of Jury Decision-Making during *In Limine* Hearings**

*In limine* hearings – hearings conducted during the course of a trial, but outside the presence of the jury, so as not to influence their decision-making – are seen across the data set when admissibility questions are raised during the trial process. The judge presiding over the hearing has greater discretion than appellate courts and determines how the evidence is presented to a jury, if it is admitted into evidence. *In limine* decisions in the data set demonstrate judicial fidelity to institutional settlement, by affording juries considerable discretion in their decision-making. In general, *in limine* hearings decide to admit evidence, allowing the jury to weigh its probative value, with NAS reports

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<sup>497</sup> Rodriguez v. State, 30 A.3d 764 (Del. 2011).

<sup>498</sup> *Id.*, at 765.

<sup>499</sup> *Id.*, at 769-770.

<sup>500</sup> *Id.*, at 770.

highlighting the evidence’s limitations. However, this is not without exception, and examples from the data set show that judges have both excluded and limited the presentation of evidence.

The judicial fidelity to the competence of the jury in its decision-making is seen in ***United States v. Council (2012)***.<sup>501</sup> The petitioner challenged the admissibility of the government’s proposed palm print evidence, arguing that it lacked sufficient reliability, supported by findings from ***Strengthening***.<sup>502</sup> The court undertook a *Daubert* admissibility review of the ACE-V method of friction ridge analysis.<sup>503</sup> It found that as *Daubert* was designed to provide flexibility, evidence can be admitted despite a petitioner raising legitimate reliability concerns.<sup>504</sup> The court found the questioned palm print evidence was admissible, having given considerable weight to the general acceptance of ACE-V and friction ridge analysis. It found that the concerns raised by the petitioner would be best suited to assess to the weight of the evidence, and not its admissibility.<sup>505</sup>

Similarly, in ***United States v. Stone (2012)***, the petitioner challenged the admissibility of latent fingerprint evidence, relying on ***Strengthening*** to argue that fingerprint evidence lacked reliability, and was therefore inadmissible under *Daubert*.<sup>506</sup> The government responded by arguing that the reliability concerns would be best raised during cross-examination.<sup>507</sup> The court found the petitioner’s challenge flawed, as he had not raised any specific objections about the expert’s methodology or qualifications.<sup>508</sup> It supported its reasoning by referring to precedent, which had generally upheld the admissibility of the ACE-V method of fingerprint analysis,<sup>509</sup> leading it to dismiss the challenge.<sup>510</sup> The court further justified its reasoning by finding that *Daubert* was designed to admit “shaky” evidence, as long as the petitioner is given the opportunity to carry out “vigorous cross-examination [and]

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<sup>501</sup> *United States v. Council*, 777 F.Supp.2d 1006 (E.D. Va. 2011).

<sup>502</sup> *Id.*

<sup>503</sup> *Id.*, at 1010.

<sup>504</sup> *Id.*

<sup>505</sup> *Id.*, at 1013.

<sup>506</sup> *United States v. Stone*, 848 F.Supp.2d 714, 716-717 (E.D. Mich. 2012).

<sup>507</sup> *Id.*

<sup>508</sup> *Id.*, at 717.

<sup>509</sup> *Id.*, at 718.

<sup>510</sup> *Id.*

presentation of contrary evidence.”<sup>511</sup> It ultimately held that it was for the jury to determine the weight of the evidence, finding that judicial gatekeeping does not supplant the role of the jury.<sup>512</sup>

The *in limine* challenge in ***United States v. McCluskey (2013)*** was raised by the prosecution, who challenged the admissibility of the petitioner’s fingerprint counter-evidence,<sup>513</sup> which used ***Strengthening*** to highlight the limitations of fingerprint analysis.<sup>514</sup> In response, the court examined the admissibility of this evidence under the *Daubert* framework, and found that the expert had “sufficient expertise to assist the jury by advancing the jury’s understanding in this field,”<sup>515</sup> despite a lack of practical experience. As the defense expert evidence was also found to be relevant and reliable, the court denied the government’s motion to exclude the questioned evidence.<sup>516</sup>

This decision made by the court to admit the petitioner’s counter evidence suggests that the role of the trial judge is to ensure that jurors are provided with as much information as possible to determine the weight to be given to forensic science evidence, including limitations, unless it fails on several *Daubert* factors. This demonstrates judicial deference to the competence of the jury as a decision-maker, showing that appellate judges are beholden to this hallmark of the legal process vision. This is particularly strengthened by courts’ largely broad approach towards the admissibility of evidence, demonstrating the importance of jury competence in the legal process itself.

**c. Judicial Responses to Scientific Developments which have the Potential to Undermine the Soundness of the Jury’s Decision: Balancing Institutional Competence with Developments in CBLA Evidence**

Following the publication of ***Bullet Lead***, CBLA evidence has become largely discredited, with the FBI discontinuing CBLA testing in 2005<sup>517</sup> and carrying out a post-conviction review of CBLA cases from

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<sup>511</sup> *Id.*, at 719.

<sup>512</sup> *Stone*, 848 F.Supp.2d at 719.

<sup>513</sup> *United States v. McCluskey*, 2013 WL 12334168 (D.N.M. 2013).

<sup>514</sup> *Id.*

<sup>515</sup> *Id.*, at 8.

<sup>516</sup> *Id.*

<sup>517</sup> *See, e.g.*, FBI National Press Office, *supra* note 219.

2007.<sup>518</sup> As a consequence, these developments have undermined trial outcomes where CBLA evidence formed part of the trial decision. Under the legal process vision, this raises questions about the regularity of the trial process, which has played out in the data set. When challenged, the regularity of trial court actors' decision-making is has often taken temporal considerations into account, although developments in CBLA evidence have undermined the basis for the jury's reasoning. This has led appellate courts to address these inconsistencies. Typically, courts have responded by allowing a decision to stand if the verdict is supported by further evidence, but if CBLA is the primary or only form of inculpatory evidence, appellate courts have been more inclined to overturn trial court decisions, demonstrating their fidelity to the legal process vision by paying deference to the institutional competence of trial court actors.

The decision of *Clemons v. State* (2006) provides an example of an appeal court's consideration of the potential overwhelming effect of CBLA evidence on jury decision-making.<sup>519</sup> The court had previously recognized CBLA evidence as inadmissible under the state's *Frye-Reed* standard, following *Bullet Lead* to find that it was no longer generally accepted in the scientific community as valid and reliable evidence.<sup>520</sup> In response to the petitioner's challenge, the court's review showed particular concern for the effect that the discredited CBLA evidence had on the jury's decision,<sup>521</sup> finding that as "lay jurors tend to give considerable weight to 'scientific' evidence when presented with 'experts',"<sup>522</sup> it could not say for certain that the CBLA evidence did not significantly influence the verdict.<sup>523</sup> Ultimately, it reversed the judgment, as CBLA was the primary form of evidence against the petitioner. However, where additional inculpatory evidence exists, appellate judges have demonstrated a greater willingness to pay deference to the decisions made by the jury. For example, in *United States v. Berry* (2010), the petitioner appealed his conviction on two grounds: a) that CBLA evidence was not based

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<sup>518</sup> *Id.*

<sup>519</sup> *Clemons*, 329 Md.

<sup>520</sup> *Id.*, at 358.

<sup>521</sup> *Id.*, at 372.

<sup>522</sup> *Id.*

<sup>523</sup> *Id.*, at 372.

on scientific evidence, rendering his trial fundamentally unfair; and b) that the discontinuation of CBLA and perjury of expert undermined the jury's guilty verdict.<sup>524</sup> The court dismissed the petitioner's first claim, finding that the petitioner did not establish "that the evidence was so arbitrary that "the fact finder and the adversary system [were] not... competent to uncover, recognize, and take due account of its shortcomings.""<sup>525</sup> Instead, it found that the flaws in CBLA evidence are "precisely the kind of evidence that the adversary system is designed to test"<sup>526</sup> and that "vigorous cross examination would have exposed its flaws to the jury,"<sup>527</sup> demonstrating the considerable scope of deference placed upon the jury's decision-making competence and suggesting that the limitations raised in *Bullet Lead* could have been raised during cross-examination.<sup>528</sup> In dismissing the second claim, the court found that the challenge to the CBLA evidence was "no more than impeaching,"<sup>529</sup> due to there being sufficient additional evidence supporting the petitioner's conviction.<sup>530</sup>

The difference between these decisions demonstrates the considerable deference to the institutional competence of the jury, as appellate judges will only reverse a decision when there is no further evidence upon which the conviction is based, after discounting the CBLA evidence. This not only reflects the scientific developments following trial, but also demonstrates that when the justification behind a conviction is removed, appellate courts will recognize this, and reverse a trial decision on the basis that the scientific developments have created an irregularity in the decision-making process.

**d. The Limits of Jury Competence: Judicial Exclusion of Evidence when Admissibility has been Challenged using Rule 403**

In general, the data set shows that judges are beholden to the legal process vision's principle of institutional settlement by generally deferring to jurors' institutional competence when making

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<sup>524</sup> United States v. Berry, 624 F.3d 1031, 1039 (9th Cir. 2010).

<sup>525</sup> *Id.*, at 1040, quoting Barefoot v. Estelle, 463 U.S. 880, 899 (1983).

<sup>526</sup> *Id.*

<sup>527</sup> *Id.*

<sup>528</sup> *Id.*, at 1041.

<sup>529</sup> *Id.*, at 1043.

<sup>530</sup> *Berry*, 624 F.3d at 1043.

decisions about the weight to be attributed to forensic science evidence, even when evidence suffers from considerable limitations. However, this is not without limitations: Federal Rule of Evidence 403 (and state equivalents) gives courts discretion to “exclude relevant evidence if its probative value is substantially outweighed by a danger of... unfair prejudice, confusing the issues, misleading the jury...”<sup>531</sup> In the data set, several petitioners have sought to challenge evidence on the basis that it would mislead jury. This is most prevalent in challenges to polygraph evidence, often supported by **Polygraph**. Rule 403 challenges have also been raised in relation to the admissibility of DNA evidence.

#### i. Challenges to Polygraph Evidence

A number of federal decisions have raised issues relating to the admissibility of polygraph evidence. Petitioners have argued that polygraph test results are inadmissible under Federal Rule of Evidence 403, as the evidence presents a danger of misleading the jury. Judges reviewing on these challenges have drawn the line regarding the limits of the competence of the jury. Rule 403 challenges are found in both appeals and *in limine* motions, and are often accompanied by a further claim that polygraph evidence does not satisfy the reliability criteria laid out in Federal Rule of Evidence 702.

For example, in **United States v. Loaiza-Clavijo (2012)**, the petitioner sought to introduce exculpatory polygraph test results into evidence, arguing that they satisfied *Daubert* admissibility criteria.<sup>532</sup> The court conducted a *Daubert* review, finding that the evidence did not satisfy the reliability and relevance requirements under Rule 702.<sup>533</sup> It also justified the exclusion of the evidence under a Rule 403 standard. It found that under Rule 403, “the Court must weigh whether the probative value of the evidence is substantially outweighed by the danger of unfair prejudice, confusion of the issues, and the potential to mislead the jury.”<sup>534</sup> The court ultimately found that, if admitted, “the jury may accord undue weight to an expert opinion seeking to validate Defendant’s testimony on two critical and

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<sup>531</sup> FED. R. EVID. 403.

<sup>532</sup> United States v. Loiaiaza-Clavijo, 2012 WL 529981 (N.D. Ga. 2012).

<sup>533</sup> *Id.*, at 4.

<sup>534</sup> *Id.*, at 6.

ultimate issues in the case.”<sup>535</sup> It also showed concern about the validity of the polygraph test itself, as it was conducted via an interpreter, which meant that the probative value of the evidence was considerably outweighed by unfair prejudice and had considerable potential to mislead or confuse the jury.<sup>536</sup> As such, the polygraph evidence was excluded due to the undue risk of prejudice.

This approach can also be seen in ***United States v. Rouse (2004)***, where the appeal court found that the trial court had acted correctly in excluding polygraph examination results.<sup>537</sup> The court excluded this evidence after taking into account both Federal Rules of Evidence 403 and 702.<sup>538</sup> The petitioner had sought to argue that exculpatory polygraph test results were admissible and should have been presented to the jury. In rejecting this challenge, the court took into consideration the potential negative prejudice that may have outweighed the probative nature of the polygraph evidence.<sup>539</sup> It further relied on precedent to demonstrate that evidence can be excluded under Rule 403 if it is more prejudicial than probative.<sup>540</sup> Ultimately the court determined that the stipulated polygraph evidence was not sufficiently reliable, a decision made after considering the expert testimony at the *Daubert* hearing and findings from ***Polygraph***.<sup>541</sup>

The exclusion of polygraph evidence has also been considered in several state court decisions, through the application of the state equivalent of Rule 403. For example, the Supreme Court of New Jersey found in ***State v. A.O. (2009)*** that admitting lie detector test results amounted to plain error.<sup>542</sup> The petitioner challenged the admission of results from a failed polygraph test which was taken whilst in police custody, which had been admitted on the basis that the petitioner had consented to being tested.<sup>543</sup> The state argued that the petitioner’s consent had allowed the generally inadmissible results

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<sup>535</sup> *Id.*

<sup>536</sup> *Id.*

<sup>537</sup> *Rouse*, 329 F.Supp.2d.

<sup>538</sup> *Id.*, at 1083.

<sup>539</sup> *Id.*

<sup>540</sup> *Id.*

<sup>541</sup> *Id.*, at 1086.

<sup>542</sup> *A.O.*, 198 N.J. at 78-79.

<sup>543</sup> *Id.*, at 74.

to be admitted into evidence.<sup>544</sup> The lie detector test results formed the primary evidence against the petitioner during his rape trial, as neither physical nor medical evidence was introduced, although the petitioner did testify that he had committed a number of sexual acts, including rape.<sup>545</sup> In addition, the polygraph test had been conducted prior to the petitioner contacting a lawyer. On direct appeal, the Appellate Division reversed the petitioner's convictions on the procedural grounds that the admission of polygraph evidence violated the Sixth Amendment right to counsel, and that admitting the polygraph evidence amounted to plain error.<sup>546</sup>

On appeal to the state Supreme Court, the court undertook a further review of the admissibility of polygraph evidence. It looked to precedent from a number of states to support its conclusion that polygraph evidence is inadmissible, due to a lack of reliability.<sup>547</sup> The court found that the introduction of the polygraph evidence contravened New Jersey Rule of Evidence 403.<sup>548</sup> In addition, it discussed the insufficiency of cross-examination of polygraph evidence, stating that the "practice offends the core purpose of our evidentiary rules."<sup>549</sup> The court further justified its decision on additional grounds by finding that "defendants may waive their *Miranda* rights, but they do not stipulate to the admission of all statements that follow... a defendant can voluntarily agree to take [a polygraph] test, but its admissibility is a distinctly separate question."<sup>550</sup> Ultimately, it held that the "admission of the evidence was clearly capable of producing an unjust result,"<sup>551</sup> and was in violation of Rule 403.<sup>552</sup> This demonstrates fidelity to the legal process vision by highlighting the important role of the trial court in carving the outer limits of jury competence and when this is incorrectly drawn at trial, appellate courts have overturned the decision due to an irregularity of process.

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<sup>544</sup> *Id.*

<sup>545</sup> *Id.*, at 77.

<sup>546</sup> *Id.*, at 78-79.

<sup>547</sup> *Id.*, at 83-84.

<sup>548</sup> *A.O.*, 198 N.J. at 87.

<sup>549</sup> *Id.*, at 88.

<sup>550</sup> *Id.*, at 89.

<sup>551</sup> *Id.*, at 90.

<sup>552</sup> *Id.*

The exclusion of polygraph evidence under a Rule 403 standard, however, is not universally accepted by states. Most notably, the Supreme Court of New Mexico has developed a distinctly different approach to the admissibility of polygraph evidence.<sup>553</sup> The decision to admit polygraph test results was determined by the Supreme Court of New Mexico in **Lee v. Martinez (2004)**.<sup>554</sup> This judgment involved the collective challenge of several petitioners, each of whom sought to have polygraph test results admitted into evidence. The court examined the evidence thoroughly, and ultimately justified the admissibility of polygraph evidence on a number of grounds. In particular, it examined any potential conflict between polygraph evidence and New Mexico Rule of Evidence 11-403 – the state equivalent of Federal Rule 403.<sup>555</sup> The court rejected the exclusion of polygraph evidence as it “would be inappropriate... to categorically exclude any type of evidence under that rule.”<sup>556</sup> Ultimately, it held that a decision of a district court to exclude polygraph evidence on the basis that it is unreliable would be “an abuse of discretion of a district court.”<sup>557</sup>

In justifying its decision, the Supreme Court of New Mexico carried out an in-depth review of polygraph evidence.<sup>558</sup> It found that **Polygraph** did not categorically find polygraph results unreliable, although it did acknowledge **Polygraph**'s finding that polygraph test results are not conclusive.<sup>559</sup> It made the point of emphasizing that “the opponent of polygraph evidence has ample opportunity through cross-examination and argumentation to cast doubt upon the results of any particular polygraph examination that have been admitted into evidence.”<sup>560</sup> This decision, when compared to the position of courts in other jurisdictions in case such as **A.O., Rouse** and **Loaiza-Clavijo**, provides the jury with greater discretion to determine the trial outcome. While this decision shows greater deference to the competence of jury decision-making, the exclusion of polygraph evidence under Rule

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<sup>553</sup> See, John C. Bush, *Warping the Rules: How Some Courts Misapply Generic Evidentiary Rules to Exclude Polygraph Evidence*, 59 VAND. L. REV. 539, 552 (2006).

<sup>554</sup> *Lee v. Martinez*, 136 N.M. 166 (N.M. 2004).

<sup>555</sup> *Id.*, at 169.

<sup>556</sup> *Id.*

<sup>557</sup> *Id.*

<sup>558</sup> *Id.*, from 170.

<sup>559</sup> *Id.*, at 176-177.

<sup>560</sup> *Lee v. Martinez*, 136 N.M. at 177.

403 by other courts also exposes the risks associated with inherently misleading evidence. This consideration was particularly discussed in *A.O.*, where the court found that the admission of this evidence amounted to an irregularity in the trial process.

## ii. Challenges to DNA Evidence

The data set also demonstrates that the limits of the institutional competence of the jury have also been considered in relation to DNA evidence, through Rule 403 admissibility challenges. Petitioners have challenged the admissibility of DNA evidence under Rule 403, arguing that DNA has the potential to mislead jurors, and presents a substantial risk of confusing issues. In the data set, challenges are more prevalent where DNA evidence was challenged in the years immediately following *DNA 1*, when the forensic application of the technology was still relatively novel. For example, in *United States v. Bonds (1993)*, the Court of Appeal examined the potential conflict between DNA evidence and Federal Rule of Evidence 403 as part of an in-depth review of the admissibility of DNA evidence.<sup>561</sup> Although the primary discussion examined whether DNA evidence was admissible under Federal Rule of Evidence 702,<sup>562</sup> Rule 403 considerations were also discussed.<sup>563</sup>

In *Bonds*, the petitioners argued at trial that the prosecution's expert testimony did not meet Federal Rule of Evidence 403 standards, arguing that its probative value would be outweighed by the prejudicial effect of the evidence.<sup>564</sup> The appeal court reviewed the trial court's decision to admit DNA evidence using an abuse of discretion standard, finding that no unfair prejudice was caused by admitting DNA evidence, as the evidence had significant probative value.<sup>565</sup> Specifically, it found that any risk of the "damaging nature of the DNA evidence to defendants and the potential prejudice does not require exclusion."<sup>566</sup>

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<sup>561</sup> *United States v. Bonds*, 12 F.3d 540, from 567 (6th Cir. 1993).

<sup>562</sup> *Id.*, from 554.

<sup>563</sup> *Id.*, from 567.

<sup>564</sup> *Id.*

<sup>565</sup> *Id.*, at 567-568.

<sup>566</sup> *Id.*, at 568.

As the court had found that DNA evidence was sufficiently accepted, it determined that the petitioners had considerable opportunity to highlight any limitations of the evidence during cross-examination.<sup>567</sup> This judgment, while it provides precedent supporting the admissibility of DNA evidence under Rule 403 and 702,<sup>568</sup> demonstrates the judicial deference to the institutional competence of the jury. In deferring to judicial decision-making, courts have emphasized the importance of cross-examination, which encourages a jury to weigh the probative value of DNA evidence in light of limitations and other evidence presented during the trial.

Federal courts have since revisited the admissibility of DNA evidence under Federal Rule of Evidence 403, reviewed where DNA analysts have employed novel analysis methods. A joint Rule 702 and 403 claim was raised in *United States v. Davis (2009)*,<sup>569</sup> an *in limine* hearing assessing the admissibility of LCN (Low Copy Number) DNA.<sup>570</sup> After establishing and explaining the procedures used to conduct LCN analysis, the court focused on methods used to carry out LCN testing and the methods used to calculate the statistical significance of a LCN DNA match, paying particular attention to the match being found as a result of a cold hit search.<sup>571</sup> It found that the evidence was relevant, and reviewed a pre-**DNA 1** decision which cautioned against presenting evidence that would allow jurors to “simply jump to the bottom line... without giving any meaningful considerations to any dispute over the principles...”<sup>572</sup> It found that the expert was also presenting statistics explaining the significance of a match, and the defense counsel was able to cross-examine the evidence. Cross-examination, according to this decision, provided adequate protection which would allow the jury to weigh the probative value of this evidence, leading the court to dismiss the Rule 403 admissibility challenge.<sup>573</sup>

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<sup>567</sup> *Bonds*, 12 F.3d at 568.

<sup>568</sup> *See, e.g.*, *United States v. Jones*, 107 F.3d 1147 (6th Cir. 1997); *United States v. Shea*, 957 F.Supp. 331 (D.N.H. 1997); *United States v. Morrow*, 374 F.Supp.2d 51 (D.D.C. 2005).

<sup>569</sup> *United States v. Davis*, 602 F.Supp.2d. 658, 662 (D. Md. 2009).

<sup>570</sup> Low Copy Number DNA analysis is carried out on samples that contain below the minimum amount of DNA necessary to avoid having random processes dominate the DNA test results. This minimum amount is not clearly defined by industrial standards. *Id.*, at 668.

<sup>571</sup> *Id.*, at 667.

<sup>572</sup> *Id.*, at 685.

<sup>573</sup> *Id.*

State decisions in the data set have also found that DNA evidence satisfies Rule 403 admissibility requirements. For example, in *State v. Thomas (2002)*, the petitioner argued that the expert's testimony, which included a statistical representation of the chances of a random DNA match calculated using the product rule, was unduly prejudicial under Minnesota Rule of Evidence 403, as it would "persuade a jury to equate that number with a probability of guilt."<sup>574</sup> In exploring the issue, the court relied on *DNA 2* to find that the product rule was "an appropriate means of presenting the [DNA] results."<sup>575</sup> It concluded that as PCR-STR DNA evidence was widely accepted, and *DNA 2* required DNA evidence to be presented alongside statistics demonstrating the significance of a match and recommended the product rule to calculate this, the petitioner's challenge was without merit.<sup>576</sup>

A brief discussion about the potential overwhelming nature of DNA evidence and its possible prejudicial effect on jury decision-making under Rule 403 is discussed in *State v. Streich (1995)*.<sup>577</sup> The court reviewed the admissibility of DNA evidence under Vermont Rule of Evidence 403 as part of a wider admissibility review of DNA evidence in light of the publication of *DNA 1*. After using *DNA 1* to provide an explanation of DNA evidence, it sought to determine whether the DNA evidence had been correctly admitted.<sup>578</sup> While it found that the DNA evidence was admissible under Rule 702, it found that the product rule method of statistical calculations used at trial had not reached sufficient acceptance to merit admissibility, supported by precedent.<sup>579</sup> The court then turned to Rule 403 to further justify its decision that the DNA evidence was admissible. It found that presenting different statistical calculations as to the significance of a DNA match would merely result in a clash of experts, which would not assist the jury in understanding the significance of DNA evidence.<sup>580</sup> Instead, it found that the ceiling principle had attained general acceptance, supporting its use as a way to assist jurors

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<sup>574</sup> *State v. Thomas*, 2002 WL 1420724, 3 (Minn. Ct. App. 2002).

<sup>575</sup> *Id.*

<sup>576</sup> *Id.*

<sup>577</sup> *State v. Streich*, 163 Vt. 331 (Vt. 1995).

<sup>578</sup> *Id.*, at 342.

<sup>579</sup> *Id.*, at 345.

<sup>580</sup> *Id.*

in determining the probative value of DNA evidence.<sup>581</sup> The same court later confirmed this decision in *State v. Tester (2009)*, which also considered the findings and recommendations of *DNA 2*.<sup>582</sup> Its decision to admit DNA evidence and allow the jury to determine the weight of the evidence demonstrates the court's wide interpretation of the jury's institutional competence, albeit with directions designed to assist jury decision-making, showing judicial fidelity to the legal process vision's principle of institutional settlement, in recognition that the jury lack technical expertise.

### iii. Challenges to Firearms and Tool Mark Evidence

Judicial fidelity to the legal process vision's principle of institutional settlement can also be seen across the data set where judges have responded to admissibility challenges to firearms and tool mark evidence. For example, in *State v. Langlois (2013)* the petitioner challenged the admissibility of firearms evidence under Rule 403,<sup>583</sup> the only Rule 403 admissibility challenge to a forensic science technique evaluated in *Strengthening*. He sought to argue that its probative value was outweighed by substantial prejudice.<sup>584</sup> As the issue had not been preserved at trial, the court conducted a plain error review. It concluded that it was "not persuaded that the probative value of the other firearms evidence was *substantially* outweighed by the risk of *unfair* prejudice" to the petitioner [emphasis in original].<sup>585</sup> In contrast, it found that the firearms evidence would "appeal to [the jury's] collective intellect, inviting them to make inferences from explicit facts and to "connect the dots" in what was otherwise a circumstantial case... this evidence was useful to the jury in deciding whether to accept the state's contention not only that Langlois killed [the victim] but, inferentially, that certain facts about the mechanics of the murder *would have to be true* in order to reach that conclusion."<sup>586</sup> The petitioner's Rule 403 challenge was rejected on these grounds.

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<sup>581</sup> *Id.*, at 345-6.

<sup>582</sup> *State v. Tester*, 968 A.2d 895 (Vt. 2009).

<sup>583</sup> *State v. Langlois*, 2 N.E.3d 936 (Ohio Ct. App. 2013).

<sup>584</sup> *Id.*, at 952.

<sup>585</sup> *Id.*, at 960.

<sup>586</sup> *Id.*

In this decision, the court paid considerable deference to the role of the juror as fact-finder, demonstrating fidelity to their competence to “connect the dots,”<sup>587</sup> when weighing its probative value. This decision, although an outlier in the data set, suggests that when the admissibility of pattern analysis evidence is questioned under Rule 403, appellate courts will assess the admissibility of the evidence in terms of its probative value to the jury. This demonstrates the broad competence of the jury in their decision-making and the judicial deference to their institutional competence.

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<sup>587</sup> *Id.*

## **Positioning these Findings Within Existing Knowledge**

As seen through the above decisions, the data set shows that appellate judges pay considerable deference to institutional settlement, giving trial court actors considerable discretion in their decision-making competence. An appellate court will only overturn decisions when it has found an abuse of process, or discovered procedural irregularities affecting the outcome of the trial. This aligns with the legal process vision's interpretation of institutional settlement, whereby appeal judges generally accept as binding a decision that has been "duly arrived at"<sup>588</sup> by established procedures and confirms that judicial decision-making is beholden to the legal process vision. The data set also shows that, aside from admissibility challenges where *Polygraph* has been used to question lie detector evidence, appellate courts afford considerable deference to trial court actors, regardless of NAS report, or form of judicial challenge. These findings support existing literature, which discusses appellate judges' deference to the institutional competence of (a) trial judges; and (b) juries.

### **a. Confirming Existing Studies' Findings that Deference is Paid to the Competence of Trial Judges**

#### **i. Studies Exploring DNA Evidence**

The data set suggests that in relation to DNA evidence, the findings and recommendations of the NAS reports, despite several exceptions noted above, have generally had little bearing on the outcome of decisions made by appellate judges, although appellate judgments will often refer to these reports (particularly *DNA 1* and *DNA 2*) when affirming a decision made by the trial court, to further justify the reasons for their decision. In addition, appellate courts' reliance on the findings and recommendations of NAS reports, particularly *DNA 1* and *DNA 2*, provides a binding precedent to

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<sup>588</sup> HART & SACKS, *supra* note 1, at 2045.

future trial courts.<sup>589</sup> This is particularly so when a state supreme court's reasoning has been guided by a report's findings, as seen in cases such as *State v. Harvey (1997)*<sup>590</sup> and *Brim v. State (2000)*.<sup>591</sup>

These findings generally confirm existing literature, both in relation to the way that *DNA 1* and *DNA 2* have been cited by the judiciary and influenced the judicial understanding of DNA evidence,<sup>592</sup> and in relation to appellate courts' general deference to the decisions of trial court actors.<sup>593</sup> While existing studies do not always make explicit reference to the legal process and fidelity to institutional settlement, the behaviors analyzed by these studies implicitly invoke the principles of institutional settlement and the competence of trial court actors.<sup>594</sup>

There is much literature discussing the judicial use and application of both *DNA 1* and *DNA 2* in determining the admissibility of DNA evidence. The majority of scholars examining the influence of these reports have observed that, in general, *DNA 1* has been used by courts as a tool to support decisions that DNA evidence is sufficiently reliable and/or generally accepted to be admissible.<sup>595</sup> State-based case studies have been used by several authors to explore the growing consensus in the admissibility of DNA throughout the early 1990s, and have commented on the impact of *DNA 1* on the judicial acceptance of DNA evidence.<sup>596</sup> These studies have concluded that *DNA 1* had a positive impact on deciding the admissibility of DNA evidence, although the admissibility of DNA has somewhat been overshadowed by a debate determining whether the *Daubert* or *Frye* admissibility framework is

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<sup>589</sup> For more information about precedent, see *supra*, Chapter 3: The Dominance of Precedent.

<sup>590</sup> *Harvey*, 151 N.J.

<sup>591</sup> *Brim*, 695 S.2d.

<sup>592</sup> See, e.g., Paul C. Giannelli, *The Supreme Court's Criminal Daubert Cases*, 33 SETON HALL L. REV. 1071 (2002-2003); Richard Lempert, *DNA, Science and the Law: Two Cheers for the Ceiling Principle*, 34 JURIMETRICS J. 41 (1993-1994).

<sup>593</sup> See, e.g., Gary Edmond, *Forensic Science Evidence and the Conditions for Rational (Jury) Evaluation*, 39 MELB. U. L. REV. 77 (2015-2016); David H. Kaye, Valerie P. Hans, B. Michael Dann & Erin Farley, *Statistics in the Jury Box: How Jurors Respond to Mitochondrial DNA Match Probabilities*, 4 J. EMPIRICAL LEGAL STUD. 979 (2007).

<sup>594</sup> See, e.g., Holly Schaffter, *Postconviction DNA Evidence: A 500 Pound Gorilla in State Courts*, 50 DRAKE L. REV. 695 (2001-2002); Brandon L. Garrett, *Innocence, Harmless Error, and Federal Wrongful Conviction Law*, 2005 WIS. L. REV. 35 (2005).

<sup>595</sup> See, e.g., Denise A. Filicoma, *Unravelling the DNA Controversy: People v. Wesley, A Step in the Right Direction*, 3 J. L. & POL'Y 937 (1994-1995); Carlton Bailey, *The Admissibility of "Novel Scientific Evidence" in Arkansas: Does Frye Matter?*, 52 ARK. L. REV. 671 (1999); Elizabeth A. Allen, *The Admissibility of DNA Evidence in Washington after State v. Cauthron*, 69 WASH. L. REV. 383 (1994)

<sup>596</sup> *Id.*

preferable.<sup>597</sup> Despite decisions in the data set frequently referencing both **DNA 1** and **DNA 2**, this study suggests, to a certain extent, that the judicial reference to the findings and recommendations of these two reports may not necessarily have had a direct impact on the admissibility of DNA evidence, and contributed significantly to ending the admissibility war. Instead, it suggests that the deference paid to trial court decisions may have resolved the admissibility war without the NAS reports, as the legal process vision principle of institutional competence, coupled with precedent, would have assisted trial courts in their decision-making. Moreover, appellate judges have largely used the findings from **DNA 1** and **DNA 2** primarily as tools to confirm decisions already made by trial courts.

Despite a general recognition of the positive impact of **DNA 1** in improving the judicial understanding of DNA evidence, commentary between 1992 and 1996 showed some concern for the lack of clarity left by **DNA 1** in relation to the admissibility of the product rule, with authors discussing the judicial reluctance to acknowledge the potential presence of population substructures before the 1996 publication of **DNA 2**.<sup>598</sup> Other authors have portrayed the impact of **DNA 1** in a more negative light, finding the report to have increased the perception of tensions regarding population substructures,<sup>599</sup> and have found appellate courts' interpretations of **DNA 1** to be dependent upon the decision made by the lower court.<sup>600</sup> These findings are confirmed by this study, which demonstrates appellate courts' deference to institutional settlement and the confirmatory nature of the NAS reports. Building on existing literature, this study offers the judicial fidelity to the legal process vision as an explanation for appellate courts' behavior.

Some authors have undertaken a case analysis approach, exploring how **DNA 1** and/or **DNA 2** have influenced appellate decision-making, as seen in Kaye's commentary on the use of these reports in

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<sup>597</sup> See, e.g., Peter A. Talieri, *Evidence - Massachusetts Replaces Frye Test with Daubert Standard for Determining Admission of DNA Evidence in Criminal Trials*, 29 SUFFOLK U. L. REV. 357 (1995); Jason D. Altman, *Admissibility of Forensic DNA Profiling Evidence: A Movement away from Frye v. United States and a Step Toward the Federal Rules of Evidence: United States v. Jakobetz 955 F.2d 786 (2nd Cir. 1992), Cert. Denied, 113 S. Ct. 104 (1992)*, 44 WASH. U. J. URB. & CONTEMP. L. 211 (1993).

<sup>598</sup> See generally, R. Stephen Kramer, *Admissibility of DNA Statistical Data: A Proliferation of Misconception*, 30 CAL. W. L. REV. 145 (1993-1994).

<sup>599</sup> D. H. Kaye, *The Forensic Debut of the National Research Council's DNA Report: Population Structure, Ceiling Frequencies and the Need for Numbers*, 34 JURIMETRICS J. 369, 374 (1993-1994).

<sup>600</sup> *Id.*, at 375-376.

the decision of *People v. Nelson (2008)*, discussed above.<sup>601</sup> His analysis showed concern for the Supreme Court of California’s interpretation of both *DNA 1* and *DNA 2* in its reliance on the findings of these reports, but willful ignorance of wider literature criticizing the approach taken by the NAS committees.<sup>602</sup> In criticizing the approaches taken by both the Californian Court of Appeal and the Californian Supreme Court in *Nelson*, Kaye found the courts’ analysis and application of *DNA 2* to be “incomplete.”<sup>603</sup> While Kaye suggested alternative methods of analyzing cold hit matches,<sup>604</sup> his criticisms of the courts’ approaches concluded that the courts are mindful of institutional settlement when making confirmation decisions supported by NAS report findings, but still defer to the considerations of the lower courts, particularly in the Supreme Court’s agreement with the Court of Appeal judgment.<sup>605</sup>

When reviewed separately to *DNA 1*, authors have generally praised the courts’ use and interpretation of *DNA 2* in the decision-making process, particularly in relation to the courts’ quick acceptance of the report’s findings as a means to resolve the questions raised in *DNA 1*.<sup>606</sup> However, this opinion is not shared amongst all scholars, and while the impact of *DNA 2* in resolving tensions regarding the admissibility of PCR analysis and the product rule is not disputed,<sup>607</sup> others have warned that the judicial acceptance of *DNA 2* does not align with their understanding of continuing scientific progress, as the report provided “reassuring but poorly grounded conclusions about the quality of current DNA testing,”<sup>608</sup> undercutting some key elements of *DNA 1*.<sup>609</sup> This study has found that appellate courts may have interpreted the findings and recommendations of *DNA 2* in this way *because* trial courts had already made admissibility decisions in favor of PCR and the product rule (as this was within its

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<sup>601</sup> *Nelson*, 43 Cal.4th.

<sup>602</sup> David H. Kaye, *Case Comment – People v. Nelson: A Tale of Two Statistics*, 7 LAW PROB. & RISK 249, 251 (2008).

<sup>603</sup> *Id.*, at 252.

<sup>604</sup> *Id.*, at 255.

<sup>605</sup> *Id.*, at 253.

<sup>606</sup> Christopher L. Blakesley, *La Preuve Pénale et Tests Génétiques – United States Report*, 46 AM. J. COMP. L. SUPP. 605, 633-4 (1998).

<sup>607</sup> *Id.*

<sup>608</sup> William C. Thompson, *Accepting Lower Standards: The National Research Council’s Second Report on DNA Evidence*, 37 JURIMETRICS 405, 424 (1996-1997).

<sup>609</sup> *Id.*

competence), with appellate courts' responses merely using **DNA 2** as a tool to confirm trial court decisions in the interests of institutional settlement, as shown through the numerous decisions paying deference to trial decisions and the largely confirmatory outcome of admissibility challenges.

ii. **Studies Exploring the Use of *Polygraph, Bullet Lead, Ballistic Imaging* and *Strengthening***

Regardless of whether appellate judges have incorporated the findings of **DNA 1** and **DNA 2** to confirm trial court reasoning or demonstrate a thorough evaluation of the relevant scientific research and progress, the data shows that appellate courts have a tendency to defer to the decisions made by trial court actors when findings from ***Polygraph, Bullet Lead, Ballistic Imaging*** and ***Strengthening*** are used as tools by petitioners to challenge the admissibility of numerous forensic science disciplines, demonstrating that the findings from these reports alone are insufficient in demonstrating an irregularity of trial court process.

The lack of discussion of the findings of these NAS reports in affecting the outcome of judicial decisions, particularly viewed within the context of ***Strengthening***, has been well documented by commentators, with many implicitly suggesting that courts have self-imposed restrictions in their review of trial court decisions, in the interests of deferring to institutional settlement. For example, authors have expressed that the judicial reliance on the abuse of discretion standard has been detrimental to the appeal process.<sup>610</sup> There have been comments that the standard “ignores the tension between admissibility and weight,”<sup>611</sup> but that a *de novo* standard of review is not appropriate, as “appellate courts... are not necessarily in the best position”<sup>612</sup> to make admissibility assessments. This study confirms the lack of difference in outcome between different types of claims. Aside from challenges to polygraph evidence under Federal Rule of Evidence 403, there is little difference in outcome between judgments, with appellate courts finding admissibility challenges to be within the

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<sup>610</sup> *Confronting the New Challenges of Scientific Evidence*, 108 HARV. L. REV. 1481, 1528 (1995).

<sup>611</sup> *Id.*

<sup>612</sup> *Id.*, at 1529.

discretion of the trial judge, or considerations of weight for the jury. As existing studies suggest, this is not due to appellate courts' inability to review decisions *de novo*, but through the judicial decision to pay deference to trial court decisions.

Other authors have suggested otherwise, arguing that the judicial lack of understanding of scientific issues is the reason for the lack of engagement with scientific research and related materials. The data set shows that the justifications provided by judges to avoid engagement with scientific debate (through a meaningful discussion of the findings and recommendations of the NAS reports) is that trial court actors had appropriately addressed the limitations and issues at trial. However, the literature also raises issues regarding trial court actors' lack of understanding of scientific issues.<sup>613</sup>

Further, commentators have long-discussed concerns that judges and lawyers – as non-scientists – are not capable of understanding science in the way that the law requires, offering a potential explanation as to why appellate courts so frequently defer to the decisions made by trial actors and the principle of institutional settlement. This is seen through the work of several authors, who have raised concerns that trial judges are incapable of appreciating the *Daubert* framework, and frequently misapply its provisions.<sup>614</sup> In addition, studies have found that appellate judges have avoided addressing substantive scientific issues. For example, Beecher-Monas has stated that “judges are supposed to direct legal proceedings based on logical analysis and considered judgment,”<sup>615</sup> but instead avoid undertaking an analysis of scientific issues.<sup>616</sup> She has identified that in their reasoning, appellate judges often overlook issues for plain error,<sup>617</sup> which she recognized to be particularly

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<sup>613</sup> See, e.g., *Confronting the New Challenges of Scientific Evidence*, *supra* note 610; Dale A. Nance & Scott B. Morris, *Juror Understanding of DNA Evidence: An Empirical Assessment of Presentation Formats for Trace Evidence with a Relatively Small Random Match Probability*, 34 J. LEGAL STUD. 395 (2005); Erica Beecher-Monas, *Blinded by Science: How Judges Avoid the Science in Scientific Evidence*, 71 TEMP. L. REV. 55 (1998).

<sup>614</sup> See, e.g., Gary Edmond, Simon Cole, Emma Cunliffe & Andrew Roberts, *Admissibility Compared: The Reception of Incriminating Expert Evidence (I.E Forensic Science) in Four Adversarial Jurisdictions*, 3 U. DENV. CRIM. L. REV. 31 (2013); Joelle Anne Mareno, *CSI Bulls#!t: The National Academy of Sciences, Melendez-Diaz v. Massachusetts, and Future Challenges to Forensic Science and Forensic Experts*, 2010 UTAH L. REV. 327 (2010); Valena Elizabeth Beety, *Cops in Lab Coats and Forensics in the Courtroom*, 13 OHIO ST. J. CRIM. L. 543 (2015-2016).

<sup>615</sup> Beecher-Monas, *supra* note 613, at 55-56.

<sup>616</sup> *Id.*

<sup>617</sup> *Id.*, at 77.

problematic, since trial court judges equally “evade the scientific issues”<sup>618</sup> and ignore *Daubert*.<sup>619</sup> While she argued that *Daubert* presents a greater opportunity to assess the underlying theory behind proffered scientific evidence,<sup>620</sup> it also shows that in its application, there is a lack of tangible difference between *Daubert* and *Frye*, as judges have still avoided scientific issues.<sup>621</sup> The lack of tangible changes in judicial admissibility decisions since the introduction of *Daubert* has been widely recognized as problematic by critics,<sup>622</sup> particularly in their frequent decisions which allow the jury to determine the weight of scientific evidence in lieu of strictly applying the reliability test.<sup>623</sup>

As seen in the work of Beecher-Monas, and in further studies,<sup>624</sup> the discussion surrounding the judicial avoidance of scientific analysis is frequently tied to the notion of judicial gatekeeping under *Daubert*, although authors’ sentiments in these studies do implicitly reflect underlying reliance on institutional settlement. For example, commentators have linked the lack of judicial understanding of scientific evidence to the poor application of the *Daubert* framework,<sup>625</sup> but have equally encouraged judges to carry out greater analysis and seek guidance in understanding scientific evidence, as they “lack the background and training necessary to evaluate complex scientific issues”<sup>626</sup> themselves. Studies have recommended that judges should educate themselves in areas where they are lacking in expertise, relying on tools available to them.<sup>627</sup> Judicial education has also been promoted by Giannelli,<sup>628</sup> who has suggested that despite considerable challenges, the use of scientific evidence in the courtroom should be encouraged.<sup>629</sup> This study suggests that NAS reports – particularly **DNA 1** and **DNA 2** – are used as informational tools by judges, and while their influence is governed by legal

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<sup>618</sup> *Id.*, at 58.

<sup>619</sup> *Id.*

<sup>620</sup> *Id.*, at 101.

<sup>621</sup> *Id.*, at 102.

<sup>622</sup> See generally, David E. Bernstein, *The Misbegotten Judicial Resistance to the Daubert Revolution*, 89 NOTRE DAME L. REV. 27 (2013-2014).

<sup>623</sup> *Id.*, at 62-66.

<sup>624</sup> See, generally, Edmond, Cole, Cunliffe & Roberts, *supra* note 614; Mareno, *supra* note 614; Beety, *supra* note 614.

<sup>625</sup> *Confronting the New Challenges of Scientific Evidence*, *supra* note 613, at 1513.

<sup>626</sup> *Id.*

<sup>627</sup> *Id.*, at 1517.

<sup>628</sup> Paul C. Giannelli, *Scientific Evidence in Criminal Prosecutions - A Retrospective*, 75 BROOK L. REV. 1137, 1151-2 (2009-2010).

<sup>629</sup> See generally, Paul C. Giannelli, *Junk Science: The Criminal Cases*, 84 J. CRIM. L. & CRIMINOLOGY 105 (1993-1994).

process drivers, they are often cited to by appellate courts, to further justify the trial court's decision, confirming fidelity to institutional settlement.

**b. Confirming Existing Studies' Findings that Deference is Paid to the Jury's Decision-Making Competence**

The existing literature also explores the role of juries in the decision-making process. Criticism of the limitations of jury decision-making has largely mirrored those of judges, with authors showing concern for whether juries adequately understand and appreciate the probative value of forensic science evidence. This has resulted in discussions arguing juries are particularly susceptible to becoming overwhelmed by statistics when evidence is presented to them.<sup>630</sup> Studies have identified that juries' lack of ability to adequately understand scientific evidence is problematic,<sup>631</sup> which has cast doubt on their ability to appropriately weigh the probative value of scientific evidence.<sup>632</sup> In contrast, this study highlights the considerable deference paid to their decision-making and competence as trial court actors, with the data set suggesting that juries are generally perceived as competent to determine the probative value of forensic science evidence.

Mock juror studies have identified specific shortfalls in the decision-making of the jury. Studies have found that juries undervalue scientific evidence where it has been quantified.<sup>633</sup> Koehler has identified that jurors do not appreciate the differences in the way that subtle, but important, evidence is presented,<sup>634</sup> finding cross-examination (as it currently exists) "largely futile."<sup>635</sup> A study by Nance and Morris – focused on the presentation of DNA evidence – recommended that presenting evidence in terms of Bayesian statistics can assist juries in reaching more accurate verdicts,<sup>636</sup> providing additional

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<sup>630</sup> Jonathan J. Koehler, *The Psychology of Numbers in the Courtroom: How to Make DNA Match Statistics seem Impressive or Insufficient* 74 S. CAL. L. REV. 1275 (2000-2001).

<sup>631</sup> See, e.g., Jonathan J. Koehler, *If the Shoe Fits they Might Acquit: The Value of Forensic Science Testimony* 8 J. EMPIRICAL LEGAL STUD. 21 (2011); Dale A. Nance & Scott B. Morris, *An Empirical Assessment of Presentation formats for Trace Evidence with a Relatively Large and Quantifiable Random Match Probability*, 42 JURIMETRICS 403 (2001-2002).

<sup>632</sup> *Id.*

<sup>633</sup> Nance & Morris, *supra* note 631, at 404.

<sup>634</sup> Koehler, *supra* note 631, at 32.

<sup>635</sup> *Id.* 41.

<sup>636</sup> Nance & Morris, *supra* note 631, at 445.

support to their decision-making.<sup>637</sup> Further studies have also cast doubt on the way that juries make decisions.<sup>638</sup>

Other authors have argued that the jury understanding the probative value of scientific evidence is the responsibility of experts and lawyers. Plumtree has supported this position, arguing that experts are responsible for explaining the significance of scientific evidence so that juries can reach appropriate conclusions.<sup>639</sup> However, in disagreement with other criticism, he suggests that numerical evaluations of the significance of scientific evidence are not appropriate for all disciplines.<sup>640</sup> Instead, he has advocated the use of cross-examination to determine the true probative value of non-quantifiable evidence, citing John Wigmore that, “cross examination is “beyond any doubt the greatest legal engine invented for the discovery of truth”.”<sup>641</sup> It appears from this study that appellate judges mirror these sentiments, with appellate courts’ considerable deference to jury competence.

The mixed opinions about the effectiveness of cross-examination appear to stem from whether the procedural act of cross-examination or its substantive value of assisting the trial of fact is valued, an argument that fits with the legal process value of regularity in decision-making. This data set shows that, amongst appellate judges, adherence to procedural requirements bear considerably greater weight, with appellate judgments only overturning convictions – and the decisions of trial court actors – when a procedural irregularity has been found, as in *Clemons v. State (2006)* and *United States v. Rouse (2004)*. The importance of the procedure of cross-examination is demonstrated by courts’ general unwillingness to overturn jury decisions,<sup>642</sup> even when the scientific evidence presented has later become discredited.<sup>643</sup>

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<sup>637</sup> *Id.*

<sup>638</sup> See, e.g., N. J. Schweitzer & Michael J. Saks, *Jurors and Scientific Causation*; 4 J. EMPIRICAL LEGAL STUD. 797 (2007).

<sup>639</sup> Wayne G. Plumtree, *A Perspective on the Appropriate Weight to be given to the National Academy of Sciences' Report on Forensics in Evidentiary Hearings: The Significance of Continued Court Acceptance of Fingerprint Evidence*, 42 SW. L. REV. 605, 628-9 (2012-2013).

<sup>640</sup> *Id.*, at 635.

<sup>641</sup> *Id.*, Citing JOHN HENRY WIGMORE, A TREATISE ON THE ANGLO-AMERICAN SYSTEM OF EVIDENCE IN TRIALS AT COMMON LAW, 1367 (3d ed. 1940).

<sup>642</sup> See, e.g., *Rodriguez*, 30 A.3d.; *Council*, 777 F.Supp.2d.

<sup>643</sup> *Berry v. United States*, 2007 WL 4225068 (E.D. Wash. 2007).

The importance of the procedural act of cross-examination extends further than this, shown in both the literature and the data set. The literature has particularly emphasized the responsibility placed upon cross-examination under *Daubert*, where cross-examination is seen as the “appropriate means of attacking shaky but admissible evidence,”<sup>644</sup> and more recently *Melendez-Diaz v. Massachusetts (2009)*, which found that the purpose of cross-examination was “to weed out not only the fraudulent analyst, but the incompetent one too.”<sup>645</sup> However, despite the concern that commentators have shown for the poor judicial application of *Daubert*, and its subsequent creation of “bad law,”<sup>646</sup> *Melendez-Diaz* has placed greater emphasis on cross-examination as a fact-finding tool.

Although the existing literature provides a mixed response about whether cross-examination as it currently exists is adequate, particularly as it has been found to be “largely futile”<sup>647</sup> by Koehler, this study confirms that cross-examination is given significant weight by appellate judges. As, on appeal, the data set shows that appellate judges rarely find that trial judges have abused their discretion,<sup>648</sup> or that the issues surrounding the evidence’s admission amounted to harmless error,<sup>649</sup> much of the appellate courts’ evaluation of challenged forensic science evidence is subsequently based on the jury’s evaluation of the proffered scientific evidence. This is further shown through the data set’s finding that considerable deference is paid to jury decisions in determining the weight of the evidence, placing an even greater emphasis on the jury’s decision-making competence.<sup>650</sup> It also shows the importance of cross-examination and the following of correct procedures, as these mechanisms carry legitimacy within the legal process, ignoring critics’ concerns about these actors’ ability to undertake a thorough evaluation of the evidence.

A further point raised by various authors within the literature, related to jury decision-making competence, is the use of Rule 403 to exclude forensic science evidence. The exclusion of polygraph

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<sup>644</sup> *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. at 596.

<sup>645</sup> *Melendez-Diaz*, 557 U.S. at 319.

<sup>646</sup> Mareno, *supra* note 614, at 364.

<sup>647</sup> Koehler, *supra* note 631, at 41.

<sup>648</sup> See, e.g., *Chischilly*, 30 F.3d.; *Adams*, 212 N.C.App.

<sup>649</sup> See, e.g., *Nelson*, 628 A.2d; *Gardner*, 140 A.3d.

<sup>650</sup> See, e.g., *Rodriguez*, 30 A.3d; *Council*, 777 F.Supp.2d.

evidence under Rule 403 has been the subject of considerable discussion in existing literature, with critics arguing that the exclusion of polygraph evidence under Rule 403 is strategic.<sup>651</sup> This may provide an explanation of the unique treatment of polygraph evidence, being the only forensic science evidence technique in the data set excluded under Rule 403.<sup>652</sup> The exclusion of polygraph evidence under Rule 403 may help to explain the tighter judicial control surrounding the admissibility of polygraph evidence in the data set, over the general admissibility and deference to trial court actors' treatment of challenges relating to other forensic science techniques.

Despite a general lack of explicit engagement with legal process values, the relationship between institutional settlement and judicial decision-making has been explored explicitly to some extent in existing literature. This has been addressed largely in relation to the interpretation of **Strengthening**. For example, deference to institutional settlement has been identified as a tool that appellate judges use to avoid addressing issues that may have an effect on future cases,<sup>653</sup> preventing the development of the law.<sup>654</sup> This study confirms and strengthens these findings, as often deference to trial court actors has precluded appellate judges from examining new considerations and emerging scientific issues and following the findings and recommendations of the NAS reports, particularly **Bullet Lead** and **Strengthening**.

Other authors who have identified the links between judicial decision-making and deference to institutional settlement within the context of forensic science evidence and findings from NAS reports have found that courts show a general willingness to defer to institutional settlement.<sup>655</sup> Cooper has found that judges use institutional settlement to drive their reasoning, as it promotes efficacy within the criminal justice system.<sup>656</sup> She has also found that judges have been cautious not to undermine institutional settlement, even at the expense of embracing DNA technology.<sup>657</sup> She has found that

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<sup>651</sup> Mark Pettit Jr., *fMRI and BF Meet FRE: Brain Imaging and the Federal Rules of Evidence*, 33 AM. J. L. & MED. 319, 327 (2007).

<sup>652</sup> See, e.g., *A.O.*, 198 N.J.; *Rouse*, 329 F.Supp.2d.

<sup>653</sup> Jonathan S. Masur & Lisa Larrimore Ouellette, *Deference Mistakes*, 82 U. CHI. L. REV. 643, 656 (2015).

<sup>654</sup> *Id.*, at 731.

<sup>655</sup> Cooper, *supra* note 7, at 213.

<sup>656</sup> *Id.*, at 220-221

<sup>657</sup> *Id.*, at 221.

institutional settlement is frequently used to rationalize appellate decisions<sup>658</sup> and side-line substantive claims.<sup>659</sup> This can also be seen in the data set, as discussed above, which suggests that judges have only been willing to set aside trial court judgments once a substantial procedural irregularity has been recognized, with the NAS reports seemingly having little bearing on the outcome of an appeal, demonstrating judicial fidelity to the legal process vision through deference to institutional settlement. In addition to confirming findings from several existing studies, it offers the explanation for judicial behaviors not previously explored: fidelity to the legal process vision (through institutional settlement and regularity of process) takes priority over substantive issues raised by petitioners and considerations regarding the knowledge limitations of trial court actors.

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<sup>658</sup> *Id.*, at 222, 226.

<sup>659</sup> Sarah Lucy Cooper, *Judicial Responses to Shifting Scientific Opinion in Forensic Identification Evidence and Newly Discovered Evidence Claims in the United States: The Influence of Finality and Legal Process Theory*, 4 BRIT. J. AM. LEGAL STUD. 649, 688 (2015).

## Chapter 5: The Pursuit of Finality

Within the legal process, there is a strong emphasis on the adherence to procedure and rationality.<sup>1</sup>

Several authors have found the practical application of these legal process values to manifest themselves through finality interests,<sup>2</sup> as finality can help to restore certainty when faced with uncertainty. The concept of finality was developed through the work of Bator in the 1960s,<sup>3</sup> and provides a way of maintaining certainty in decision-making whilst recognizing the practical limitations of the legal system.

Bator's premise is founded upon the human frailty of the legal system.<sup>4</sup> As a system designed and operated by human agency, his work recognized that there is no way to determine facts about the past with 100% accuracy.<sup>5</sup> When applied to the judicial system, therefore, actors must "come to terms with the possibility of error,"<sup>6</sup> and allow for appeals to correct for these errors.<sup>7</sup> However, in recognizing inherent flaws in the system, appeals cannot be allowed indefinitely,<sup>8</sup> as "a procedural system which permits an endless repetition of inquiry into facts and law in a vain search for ultimate certitude implies a lack of confidence about the possibilities of justice that cannot but war with the effectiveness of the underlying substantive commands."<sup>9</sup>

Bator also argued that curtailing re-litigation also serves a number of important finality interests,<sup>10</sup> which have frequently been explored by scholars. As finality is not monolithic, but "actually shorthand

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<sup>1</sup> William N. Eskridge, Jr. & Gary Peller, *The New Public Law Movement: Moderation as a Postmodern Cultural Form*, 89 MICH. L. REV. 707, 721-2 (1991).

<sup>2</sup> See, e.g., Sigmund G. Popko, *Putting Finality in Perspective: Collateral Review of Criminal Judgments in the DNA Era*, 1 L. J. Soc. JUST. 75 (2011); Sarah Lucy Cooper, *Forensic Science Developments and Judicial Decision-Making in the Era of Innocence: The Influence of Legal Process Theory and its Implications*, 19 RICH. J. L. & PUB. INT. 211 (2015-2016); Andrew Chongseh Kim, *Beyond Finality: How Making Criminal Judgments Less Final Can Further the Interests of Finality*, 2013 UTAH L. REV. 561 (2013); Carrie Sperling, *When Finality and Innocence Collide*, in *CONTROVERSIES IN INNOCENCE CASES IN AMERICA* 139 (Sarah Lucy Cooper ed., 2014).

<sup>3</sup> Paul M. Bator, *Finality in Criminal Law and Federal Habeas Corpus for State Prisoners*, 76 HARV. L. REV. 441 (1963).

<sup>4</sup> *Id.*, at 448.

<sup>5</sup> *Id.*, at 447.

<sup>6</sup> *Id.*, at 448.

<sup>7</sup> *Id.*, at 451.

<sup>8</sup> *Id.*, at 446-451.

<sup>9</sup> *Id.*, at 452.

<sup>10</sup> *Id.*, at 446-447.

for a collection of interests scholars assume are furthered by any restriction on review,”<sup>11</sup> various interests have been identified to be served by finality. These include: allowing for greater confidence in the justice system and affording respect to jury verdicts,<sup>12</sup> conserving resources<sup>13</sup> and reducing costs,<sup>14</sup> preventing psychological exhaustion,<sup>15</sup> incentivizing defense counsel to get it right first time,<sup>16</sup> preventing a flood of frivolous claims,<sup>17</sup> and acting as a crime deterrent.<sup>18</sup> These interests largely serve greater societal collective interests, but it has also been suggested that certainty brought about by finality serves the interests of petitioners.<sup>19</sup>

Several authors, including Popko<sup>20</sup> and Levenson<sup>21</sup> have found that courts have embraced finality, particularly within the criminal justice system, as the United States Supreme Court has explicitly acknowledged the importance of finality interests on a number of occasions.<sup>22</sup> More generally, the criminal justice system operating within the United States, while designed to allow for appellate review,<sup>23</sup> does not provide a federal constitutional right to appeal,<sup>24</sup> although several mechanisms exist wherein individuals are able to petition courts for post-conviction review.<sup>25</sup> However, when reviewing individual claims, Levenson has noted that “the goal of finality is never far away.”<sup>26</sup>

Finality is inherently linked to values seen within the legal process vision in a number of ways. The link between the legal process vision and the criminal justice system has been explored by Sperling, who has found that policy and faith in the legitimacy of the criminal justice system has dictated its tendency

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<sup>11</sup> Kim, *supra* note 2, at 568.

<sup>12</sup> Sperling, *supra* note 2, at 141-2.

<sup>13</sup> Popko, *supra* note 2, at 77.

<sup>14</sup> Kim, *supra* note 2, at 568.

<sup>15</sup> Popko, *supra* note 2, at 77.

<sup>16</sup> Cooper, *supra* note 2, at 215.

<sup>17</sup> *Id.*

<sup>18</sup> Kim, *supra* note 2, at 569.

<sup>19</sup> Laurie L. Levenson, *Searching for Injustice: The Challenge of Postconviction Discovery, Investigation, and Litigation*, 87 S. CAL. L. REV. 545, 552-3 (2014).

<sup>20</sup> Popko, *supra* note 2, at 77.

<sup>21</sup> Levenson, *supra* note 19, at 551.

<sup>22</sup> Popko, *supra* note 2, at 77-79.

<sup>23</sup> James E. Lobsenz, *A Constitutional Right to an Appeal: Guarding Against Unacceptable Risks of Erroneous Conviction*, 8 U. PUGET SOUND L. REV. 375, 376-377 (1985).

<sup>24</sup> *See*, *McKane v. Durston*, 153 U.S. 684, 687 (1894); For more information, *see generally*, Marc M. Arkin, *Rethinking the Constitutional Right to a Criminal Appeal*, 39 UCLA L. REV. 503 (1992).

<sup>25</sup> *Id.*

<sup>26</sup> Levenson, *supra* note 19, at 551.

to pursue finality interests.<sup>27</sup> Her work shows that the criminal justice system operates on the faith that decision-making is grounded in accuracy,<sup>28</sup> and one mechanism that the courts use to pursue finality interests is the imposition of high thresholds on appellate review.<sup>29</sup> Cooper has argued that “the courts’ restriction of post-conviction review by narrowly interpreting the high thresholds for relief contained in newly discovered evidence rules, is symptomatic of an institution that favours finality over substantive accuracy.”<sup>30</sup> When viewed in this way, finality can be seen as a procedure that prioritizes the legitimacy of a process over substantive values. This is a clear hallmark of the legal process vision, which recognizes that when a decision is “arrived at [as a] result of duly established procedures,”<sup>31</sup> it “ought to be accepted as binding upon the whole society.”<sup>32</sup>

The data set suggests that finality is an important factor in the judicial decision-making process for all appellate claims, and presents itself in several forms of appeals, particularly direct appeals challenging the admissibility of forensic science evidence,<sup>33</sup> post-conviction claims of constitutional violations,<sup>34</sup> and newly discovered evidence claims.<sup>35</sup> While the data set does not present all finality interests, it is clear that judges in general have made use of a number of dismissal tools to prevent further litigation, in the pursuit of finality interests.

The data set shows that, in particular, appellate judges largely rely on four finality indicators to justify their treatment/dismissal of petitioners’ claims. These are: the imposition of high thresholds; deference to the institutional competence of trial court actors; incentivizing defense counsel to get it right at trial; and preventing future frivolous claims. In addition, these decisions clearly have also

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<sup>27</sup> Sperling, *supra* note 2, at 142.

<sup>28</sup> *Id.*

<sup>29</sup> *Id.*, from 145.

<sup>30</sup> Sarah Lucy Cooper, *Judicial Responses to Shifting Scientific Opinion in Forensic Identification Evidence and Newly Discovered Evidence Claims in the United States: The Influence of Finality and Legal Process Theory*, 4 BRIT. J. AM. LEGAL STUD. 649, 673 (2015).

<sup>31</sup> HENRY M. HART, JR. & ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW*, ED. WILLIAM N. ESKRIDGE JR. & PHILIP P. FRICKEY 2045 (Foundation Press 1993).

<sup>32</sup> *Id.*

<sup>33</sup> *See, e.g.*, *People v. Ortiz*, 2008 WL 2673365 (Cal. Ct. App. 2008); *Commonwealth v. Sabur*, 2014 WL 10919368 (Pa. Super. Ct. 2014).

<sup>34</sup> *See, e.g.*, *United States v. Anderson*, 169 F.Supp.3d 60 (D.D.C. 2016); *United States v. Higgs*, 663 F.3d 726 (4th Cir. 2011).

<sup>35</sup> *See, e.g.*, *Commonwealth v. Smallwood*, 155 A.3d 1054 (Pa. Super. Ct. 2017); *McAuley v. Ryan*, 2015 WL 4594521 (D. Ariz. 2015).

served to conserve resources. Each of these four initial indicators are shown through the mobilization of different legal mechanisms and when viewed as a whole, suggests that the introduction of findings and recommendations of the forensic science NAS reports alone are not sufficient to allow judges to review issues that lie beyond past their finality-focused lens. Each of the above four indicators will be discussed separately, examining examples from the data set where judges have relied on these mechanisms as a means to justify reliance on finality.

### **1. The Imposition of High Thresholds**

As a well-known hallmark of finality, the application of high thresholds aims to rationalize the dismissal of claims using a procedural framework, preventing the review of a claim's substantive merits.<sup>36</sup> Across the data set, appellate judges have assessed individual petitioners' claims by applying high thresholds to petitioners' forensic science admissibility challenges, as appellate courts are designated as a court of review. In decisions across the data set, judges have identified a number of procedural thresholds that petitioners must attain before presenting their substantive claims, including: examining issues for plain error; reviewing the trial procedure for an irregularity in process; applying a narrow scope to a petitioner's claim; and finding that, in general, a petitioner's claim lacks merit. Typically, these responses are found following either a forensic evidence admissibility challenge, or a constitutionality claim arguing a violation relating to the disposal of forensic science evidence. Each of these four mechanisms will be presented over the next four subsections, using examples from the data set to demonstrate the importance of finality considerations.

#### **a. Dismissal of Claims due to Procedures not being Properly Followed**

Post-conviction claims are inherently restrictive. The restrictive nature of the criteria required to present a claim is an example of the courts' imposition of high thresholds, but also prevents frivolous claims in the hope of a conviction being overturned, a further indicator of finality. The restrictive

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<sup>36</sup> See, Cooper, *supra* note 30, at 673.

nature of post-conviction review is particularly seen where procedural box-ticking requirements preclude a review of substantive issues. In the data set, this is seen most frequently where appellate courts have rejected claims for untimeliness. This can be found in several decisions, including ***Commonwealth v. Smallwood (2010)***, wherein the petitioner's newly discovered evidence claim was rejected for untimeliness.<sup>37</sup> More specifically, the court found not only that ***Strengthening*** itself did not undermine her conviction, but that the facts underpinning the newly discovered evidence claim were discoverable before the publication of ***Strengthening***.<sup>38</sup> This led the court to find that she had not acted with due diligence, and the claim was untimely.<sup>39</sup>

Similarly, the court in ***Rues v. Denney (2010)*** found that the petitioner's newly discovered evidence claim was untimely.<sup>40</sup> It dismissed the claim on the basis that ***Strengthening*** was not sufficient to constitute newly discovered evidence, and because the evidence was not new, his petition was untimely.<sup>41</sup> The court also rejected his secondary claim that if the petition was untimely, it would be eligible for equitable tolling.<sup>42</sup> In rejecting this, it used a strict framework to find that the miscalculation of dates did not result in the extraordinary circumstances required for equitable tolling.<sup>43</sup> These examples demonstrate just one way in which the merits of petitioners' claims have not been considered in favor of dismissal due to petitioners' non-conformity with procedural requirements, which themselves present a high hurdle for petitioners to overcome.

The data set shows that one procedural requirement that courts have interpreted strictly is timeliness of petition, particularly when petitioners have claimed that newly discovered evidence has emerged undermining their conviction. This judicial tendency has been identified in existing studies,<sup>44</sup> but is particularly apparent in the data set when judges have reviewed claims where petitioners have argued

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<sup>37</sup> *Smallwood*, 155 A.3d.

<sup>38</sup> *Id.*, at 1071.

<sup>39</sup> *Id.*

<sup>40</sup> *Rues v. Denney*, 2010 WL 1729181, 2 (W.D. Mo. 2010).

<sup>41</sup> *Id.*, at 3.

<sup>42</sup> *Id.*

<sup>43</sup> *Id.*

<sup>44</sup> See generally, Cooper, *supra* note 30.

that **Strengthening** undermines evidence presented during a petitioner’s trial. For example, in **McAuley v. Ryan (2015)**, the petitioner sought to argue that the publication of **Strengthening** re-opened the one-year limitations period, which would allow him once again to submit a timely petition challenging the reliability (and therefore admissibility) of the fiber, tire track, and shoe print evidence used at trial.<sup>45</sup> The court, in dismissing the petitioner’s claims, found that **Strengthening** did not qualify as a newly discovered fact for review and therefore did not re-open the limitations period.<sup>46</sup> The court downplayed the significance of **Strengthening** to the trial outcome, finding that “petitioner did not need the NAS report to refute the reliability of the forensic evidence... this is precisely the kind of evidence that the adversary system is designed to test.”<sup>47</sup>

#### b. Narrowing the Scope of the Review Lens

At appellate review, judges have frequently dismissed petitioners’ claims, finding that they do not satisfy the narrow procedural requirements, and do not constitute a valid claim. Decisions from within the data set show that when applied, the threshold for relief is not only a high burden for petitioners, but also that the appellate review of substantive issues are reserved for a smaller proportion of claims.

The narrow scope of appellate review has enabled courts to rely on finality in a number of claims across the data set. This is found in **Ex Parte Berkley (2010)**.<sup>48</sup> The Court of Criminal Appeals of Texas rejected the petitioner’s claim, finding that the CBLA admissibility challenge citing **Bullet Lead** and the FBI’s discontinuation of CBLA practices<sup>49</sup> were not relevant to an evidentiary claim, and would only be considered if a constitutional claim were raised in relation to CBLA evidence.<sup>50</sup>

The narrow scope of appellate review can also be seen in decisions where a NAS report relevant to a petitioner’s claim has been published following their trial. Courts in this instance have often held that,

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<sup>45</sup> *McAuley v. Ryan*, 2015 WL.

<sup>46</sup> *Id.*, at 2.

<sup>47</sup> *Id.*

<sup>48</sup> *Ex Parte Berkley*, 2010 WL 1610931 (Tex. Crim. App. 2010).

<sup>49</sup> See, FBI National Press Office, [FBI Laboratory Announces Discontinuation of Bullet Lead Examinations](https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations) (Sept. 1, 2005) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations> (last visited Nov. 4, 2019).

<sup>50</sup> *Ex Parte Berkley*, 2010 WL at 3.

where a NAS report's findings have subsequently contradicted information provided at trial, NAS report findings cannot be introduced retrospectively. This is found in several direct appeals, particularly in relation to DNA evidence, as in *United States v. Bonds (1993)*.<sup>51</sup> In *Bonds*, the relevant NAS report – **DNA 1** – had been published after the conclusion of the petitioner's trial. Although the court referenced the findings of **DNA 1** as part of a lengthy discussion about the admissibility of DNA evidence,<sup>52</sup> it ultimately rejected the petitioner's claim without reviewing its merits,<sup>53</sup> on the basis that **DNA 1** was published more than a year following the petitioner's conviction and did not form part of the trial record.<sup>54</sup> The court explicitly dismissed the petitioner's claim on procedural grounds to avoid making a decision on one of the controversial elements of the report – whether judicial notice of the ceiling principle should be taken,<sup>55</sup> demonstrating the judicial tendency to narrow the scope of review and dismiss claims using procedural requirements to avoid a review of substantive scientific issues.

The application of a narrow review lens can also be seen in *United States v. Bolden (2016)*, where the judicial decision reflects a reluctance to retrospectively apply *Strengthening's* findings to support the petitioner's Sixth Amendment claim.<sup>56</sup> The petitioner sought to rely on findings from *Strengthening* to argue that the government's firearms evidence presented at trial was unreliable and scientifically flawed, although did not link the report's findings to the methodology employed by the expert.<sup>57</sup> The petitioner also argued that in failing to object to this evidence, his defense counsel was deficient.<sup>58</sup> The court, however, dismissed this claim for two reasons: first, the defense counsel employed a ballistics expert to challenge the weight of the ballistic evidence;<sup>59</sup> and second, the relevance of *Strengthening* was also dismissed, as the NAS report was not published until after the conclusion of trial.<sup>60</sup> The court found that his defense counsel could not have been inefficient, as the report's

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<sup>51</sup> *United States v. Bonds*, 12 F.3d 540 (6th Cir. 1993).

<sup>52</sup> *Id.*

<sup>53</sup> *Id.*

<sup>54</sup> *Id.*, at 552.

<sup>55</sup> *Id.*

<sup>56</sup> *Bolden v. United States*, 171 F.Supp.3d 891 (E.D. Miss. 2016).

<sup>57</sup> *Id.*, at 918.

<sup>58</sup> *Id.*

<sup>59</sup> *Id.*

<sup>60</sup> *Id.*

findings were not discoverable at the time of trial.<sup>61</sup> More specifically, this shows that the presentation of petitioners' claims have been used by courts to narrow the scope of review.

**i. The Petitioner has not Brought Sufficient Evidence**

The data set shows that judges tend to reject claims when they are framed in a way that contains ambiguities, or where challenges are lacking in detail. Such rejections have largely been confined to claims where a convicted individual has argued on appeal that the findings of **Strengthening** have undermined the decision made by the trial court, and the relevant forensic science evidence should not have been admitted.

This can be seen clearly in decisions such as **State v. McAuley (2017)**, where the appellate court rejected the petitioner's appeal due to the lack of evidence supporting his claim.<sup>62</sup> It "den[ied] relief because McAuley failed to present a colorable claim for relief."<sup>63</sup> In his initial claim, the petitioner argued that a NAS report undermined his conviction. However, he did not identify a specific NAS report relevant to his claim, nor explain why or how the report's findings and recommendations were relevant.<sup>64</sup> Upon further appeal, the petitioner identified **Strengthening** as the report relevant to his claim, but again failed to identify its relevance and neglected to highlight any particular issues relating to error.<sup>65</sup> Further courts have also found **Strengthening** to be insufficient evidence when presented by petitioners without additional evidence supporting an admissibility challenge. This is seen in **State v. Leonard (2013)**, where the court found that findings from one single study, **Strengthening**, were insufficient in supporting a claim challenging the admissibility of fingerprint evidence, particularly as the questioned evidence was supported by "decades of precedent."<sup>66</sup>

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<sup>61</sup> *Id.*

<sup>62</sup> *State v. McAuley*, 2017 WL 772410 (Ariz. Ct. App. 2017).

<sup>63</sup> *Id.*, at 1.

<sup>64</sup> *Id.*

<sup>65</sup> *Id.*

<sup>66</sup> *State v. Leonard*, 225 N.C.App. 266, 3 (N.C. Ct. App. 2013).

## ii. The Petitioner's Claim Lacks Specific Relevance

A petitioner's claim not fitting the narrow scope of review is only one example from within the data set where judges have relied upon high threshold to pursue finality interests. Claims have often been dismissed due to lack of specific detail, as courts have required petitioners to present claims in a specific form, and without this, its merits will not be considered. For example, the Supreme Judicial Court of Massachusetts in ***Commonwealth v. Johnson (2012)***<sup>67</sup> rejected the petitioner's admissibility challenge to gunshot residue evidence, finding that it was not compelling in nature and insufficient to undermine the probative value of the evidence presented at trial.<sup>68</sup> In addition, the court emphasized that ***Strengthening***, relied on by the petitioner to undermine the reliability of the evidence, did not fit the petitioner's claim, as gunshot residue was not assessed directly by ***Strengthening***.<sup>69</sup>

The judicial requirement that petitioners' claims need to be clear and specific, or will be dismissed prior to any adjudication on the merits is also seen in several other decisions, including ***Ross v. Epps (2015)***.<sup>70</sup> The court dismissed the petitioner's claim that the false testimony of the ballistics expert violated his due process rights,<sup>71</sup> on the basis that the petitioner's claim was not specific in demonstrating a constitutional violation.<sup>72</sup> It found that "there is no suggestion that [the expert] testified at Ross's trial to anything that even contradicted this quoted language."<sup>73</sup> The court expanded its reasoning for dismissing the probative value of ***Strengthening*** by finding that the report did not contain any new information, holding that ***Strengthening*** "merely informs the reader there are various subspecialties in the study of ballistics and... cannot credibly be argued by Ross not to have been available... in advance of his trial."<sup>74</sup>

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<sup>67</sup> *Commonwealth v. Johnson*, 463 Mass. 95 (Mass. 2012).

<sup>68</sup> *Id.*, at 108.

<sup>69</sup> *Id.*, at 107.

<sup>70</sup> *Ross v. Epps*, 2015 WL 5772196, (N.D. Miss. 2015).

<sup>71</sup> *Id.*, at 6.

<sup>72</sup> *Id.*, at 6.

<sup>73</sup> *Id.*, at 33.

<sup>74</sup> *Id.*

### iii. The Claim had not been Exhausted

Appellate courts have also dismissed claims that have not previously been addressed by a lower court, as they are incorrectly raised before the appeal court. This can be seen in several cases within the data set, including in ***Hooper v. Warden (2010)***, where a habeas corpus petition was dismissed as the claim had not been exhausted.<sup>75</sup> The petitioner claimed that new evidence had become available following his trial that undermined the fingerprint expert's opinions concerning the fingerprint and body print evidence brought by the government at trial.<sup>76</sup> He based his claim on ***Strengthening***'s evaluation of the status of fingerprint evidence and the ACE-V method of analysis. However, the court did not consider the merits of the claim because "it had not been exhausted and provides no basis for habeas relief."<sup>77</sup> The federal court determined that such a claim needed to be argued by the relevant state court before it could be addressed by a federal court.<sup>78</sup>

Further, claims that have not been properly exhausted, even within state courts, have been dismissed by appellate courts, precluding the review of substantive issues. State examples have included ***Commonwealth v. Sabur (2014)***, where the court found that the issue raised by the petitioner – the admissibility of a ballistic evidence report – was not eligible for review, as it did not form part of the original trial record.<sup>79</sup> In rejecting the claim, the court expressed that it was "constrained to affirm" the decision at trial,<sup>80</sup> demonstrating the importance of fulfilling procedural requirements before substantive claims are addressed.

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As seen by a number of decisions from within the data set, petitioners are required to overcome high thresholds before the merits of their appeals are considered. These thresholds are set deliberately

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<sup>75</sup> *Hooper v. Warden*, 2010 WL 1233968, 7 (D.N.H. 2010).

<sup>76</sup> *Id.*, at 6

<sup>77</sup> *Id.*, at 7.

<sup>78</sup> *Id.*

<sup>79</sup> *Sabur*, 2014 WL.

<sup>80</sup> *Id.*, at 8.

high so as to ensure finality and certainty in convictions. In existing literature, the use of timeliness to advance finality has been particularly explored. The judicial reliance on timeliness in pursuit of finality is explored in relation to shifting scientific opinion, with changes and developments in scientific opinion being flagged as particularly problematic where these changes have taken considerable time to develop.<sup>81</sup> Scholars who have discussed these issues have studied the impact of untimeliness to pursue finality interests relating to claims of shaken baby syndrome and arson indicators, two areas where scientific understanding has significantly developed over the last twenty years.<sup>82</sup>

Existing studies have also recognized that **Strengthening** alone has not been able to overcome the judicial emphasis on finality, with judges frequently finding timeliness to be a barrier to substantive review, particularly in claims of newly discovered evidence.<sup>83</sup> Authors have argued that the judicial dismissal of appeals on the basis of untimeliness demonstrates fidelity to finality interests, even when **Strengthening**'s findings represent a shift in scientific opinion.<sup>84</sup> The findings from this study replicate this, with cases demonstrating that not only **Strengthening** – but **Bullet Lead**, **DNA 1** and **DNA 2** – are often also insufficient to overcome the high thresholds required of petitioners. More generally, the difficulties for petitioners wishing to challenge the basis for their convictions have been well established: Cole and Edmond have recognized that the abuse of discretion “is an onerous standard,”<sup>85</sup> but this study recognizes the breadth of forensic science disciplines affected by the narrow scope and high thresholds required to present a claim for relief is wider than suggested by Cole and Edmond, as it takes into account six NAS reports. The greater weight placed on procedural regularity over potential substantive claims demonstrates the favoring of finality over substantive accuracy.

This study has also found that a number of high thresholds are used to preclude substantive review. These include lack of specificity in substantive claims<sup>86</sup> and the importance of fulfilling other

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<sup>81</sup> Cooper, *supra* note 30, at 655.

<sup>82</sup> Caitlin M. Plummer & Imran J. Syed, *Shifted Science and Post-Conviction Relief*, 8 STAN. J. C. R. & C. L. 259 (2012).

<sup>83</sup> See generally, Cooper, *supra* note 30.

<sup>84</sup> *Id.* at 671-2.

<sup>85</sup> Simon A. Cole & Gary Edmond, *Science without Precedent: The Impact of the National Research Council on the Admissibility and use of Forensic Science Evidence in the United States*, 4 BRIT. J. AM. LEGAL STUD. 585, 595 (2015).

<sup>86</sup> See, e.g., McAuley, 2017 WL.

procedural requirements,<sup>87</sup> in addition to timeliness.<sup>88</sup> This also suggests, that when procedural barriers and high thresholds exist to limit substantive review, their weight is considerably stronger than the concerns raised using findings from NAS reports.

This study's findings, in demonstrating the importance that judges allocate to procedural regularity, align with findings from existing studies.<sup>89</sup> Further, existing studies and additional commentary show a deep concern for the judicial preference of asserting certainty through procedural regularity as a means of dismissing substantive issues which potentially hold merit.<sup>90</sup> However, much of the commentary surrounding the judicial tendency to ignore NAS report findings – particularly **Strengthening** – does not seek to examine why and how regularity of procedure is given priority over substantive claims. This study recognizes that, alongside literature discussing the role of finality<sup>91</sup> and the work of Bator<sup>92</sup> within the context of judicial decision-making, judges use high thresholds and a narrow review lens to minimize the number of appellate claims and pursue finality.

## 2. Deference to the Institutional Competence of Trial Court Actors

Appellate courts have limited the scope of their review not only as a means to ensure high thresholds, but also to pay deference to the decisions made by trial court actors. This is particularly seen where courts have found that admissibility challenges had already been properly considered earlier in the process, often by trial court actors. Pursuing finality by preventing further litigation on issues that have already been addressed can be seen across the data set, with appellate courts dismissing issues that have already been addressed by either the trial judge, or jury. For example, the appellate court in **People v. Ortiz (2008)** dismissed the petitioner's claim that the techniques used to analyze the DNA evidence presented at trial were inadmissible, as the expert did not use the procedures recommended

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<sup>87</sup> See, e.g. *Hooper v. Warden*, 2010 WL; *Sabur*, 2014 WL.

<sup>88</sup> See, e.g., *Smallwood*, 155 A.3d.

<sup>89</sup> Cole & Edmond, *supra* note 85, at 595.

<sup>90</sup> See, e.g., Brandon L. Garrett, *Judging Innocence*, 108 COLUM. L. REV. 55 (2008).

<sup>91</sup> Popko, *supra* note 2.

<sup>92</sup> Bator, *supra* note 3.

by **DNA 1**.<sup>93</sup> The appeal was dismissed on the basis that the *Kelly* hearing had properly been conducted and the DNA evidence was properly admitted in accordance with *Kelly* admissibility standards.<sup>94</sup> In addition, as the findings of **DNA 1** had not been introduced during the trial, the court found that it could not examine the **DNA 1** claim, demonstrating the narrow scope of review.<sup>95</sup>

#### a. The Trial Court Properly Considered the Evidence

In the data set, one means by which an appellate court has prevented further litigation is through deferring to the decisions already made by the trial judge, finding that the trial judge had correctly determined the admissibility of challenged evidence. This can be found in a number of decisions across the data set, including in *St Clair v. Commonwealth (2014)*.<sup>96</sup> In this decision, the appellate court took a temporally contextual approach to its review of the petitioner's CBLA challenge, and found that although the acceptance of CBLA evidence had changed significantly following the petitioner's trial – which included the publication of *Bullet Lead* – the trial court had correctly admitted the CBLA evidence and that the petitioner had received a fair trial.<sup>97</sup>

Several further cases within the data set replicate this decision across a number of forensic science disciplines. For example, in *State v. Hummert (1997)*, the Supreme Court of Arizona dismissed the petitioner's argument that the introduction of DNA evidence without accompanying statistics as to the significance of a match was inadmissible.<sup>98</sup> It found that it was “unclear that the NRC intended to say that only numerical expressions are acceptable in court”<sup>99</sup> and interpreted **DNA 2** to have “no single or specific method of expressing the significance of a match.”<sup>100</sup> Further, the court examined the trial court's decision, taking into consideration the information available to them at the time.<sup>101</sup> It

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<sup>93</sup> *Ortiz*, 2008 WL.

<sup>94</sup> *Id.*, at 17.

<sup>95</sup> *Id.*, at 16.

<sup>96</sup> *St Clair v. Commonwealth*, 451 S.W.3d 597 (Ky. 2014).

<sup>97</sup> *Id.*

<sup>98</sup> *State v. Hummert*, 188 Ariz. 119 (Ariz. 1997).

<sup>99</sup> *Id.*, at 124.

<sup>100</sup> *Id.*

<sup>101</sup> *Id.*, at 127.

acknowledged that “the passage of time has left us in a better position to evaluate the admissibility of DNA evidence,”<sup>102</sup> but determined that as the trial court properly considered the DNA evidence at the time, the petitioner’s challenge had no merit.<sup>103</sup>

There are several further examples in the data set where a DNA admissibility challenge has been dismissed on appeal. They have found that the trial court had acted correctly in admitting new and evolving DNA technology into evidence. For example, in **People v. Stevey (2012)**, the petitioner sought to challenge the admissibility of Y-STR PCR DNA testing,<sup>104</sup> arguing that **DNA 2** required each new method of PCR to be subjected to an admissibility hearing by the court.<sup>105</sup> On appeal, the court reviewed the admissibility of Y-STR and found that Y-STR evidence was generally accepted, and therefore admissible.<sup>106</sup> Further, it held that the petitioner had not sufficiently demonstrated that Y-STR is distinct from other types of PCR testing<sup>107</sup> and that “the trial court did not abuse its discretion by relying on [the expert’s] testimony that she followed correct scientific procedures.”<sup>108</sup>

One area that has often been challenged in the data set is the admissibility of different methods to calculate the statistical significance of a DNA match through calculating the probability of a random match. For example, in **State v. Marshall (1999)**, the Court of Appeal found that the trial court had not erred in finding statistical evidence admissible, despite the petitioner arguing that the match window used by the FBI to determine a DNA match in his case was too wide, and not generally accepted.<sup>109</sup> He also argued that at the time of his trial in the early 1990s,<sup>110</sup> calculations using the product rule should not have been admitted, as it was not recommended by **DNA 1**.<sup>111</sup> The court, in

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<sup>102</sup> *Id.*

<sup>103</sup> *Id.*

<sup>104</sup> Y-STR testing is a method of DNA analysis used to isolate the male Y chromosome. While this is less discriminative than traditional PCR testing, it is often used to isolate male DNA in a mixed sample and is frequently used as a means to identify perpetrators of sexual offences where victims are female.

<sup>105</sup> *People v. Stevey*, 209 Cal.App.4th 1400, 1414 (Cal. Ct. App. 2012).

<sup>106</sup> *Id.*

<sup>107</sup> *Id.*

<sup>108</sup> *Id.*, at 1415.

<sup>109</sup> *State v. Marshall*, 193 Ariz. 547, 550 (Ariz. Ct. App. 1999).

<sup>110</sup> The offence had been committed in 1990. It was not until 1996 when the NAS recommended in **DNA 2** that the product rule was sufficiently reliable to be admissible.

<sup>111</sup> *Marshall*, 193 Ariz. at 551.

rejecting the petitioner’s argument, cited **DNA 2** to determine that the product rule had become generally accepted, referencing the NAS report as an endorsement of its acceptance.<sup>112</sup> While this decision did not take into account the temporal context of information available to the trial court, it provides an example of courts’ leaving trial court decisions to stand and affording a wide discretion to trial court admissibility decisions, particularly in relation to developing DNA analysis methods.

Appellate judges have also given trial courts considerable discretion when making admissibility decisions about other forensic science evidence techniques, which has allowed them to leave decisions standing, despite inconsistencies in interpretation. This indicates the judicial pursuit of finality interests, as by deferring to trial court decisions and reasoning, appellate courts prevent future litigation on issues surrounding the admissibility of that forensic science technique and preclude future courts from examining the issues upon further appeal. This can be seen through the judicial dismissal of admissibility challenges relating to firearms evidence. For example, in **Fleming v. State (2010)**, the petitioner challenged the admissibility of ballistics evidence introduced during his trial, supported by findings from **Ballistic Imaging**.<sup>113</sup> He claimed that the admission amounted to plain error because the unreliable firearm identification testimony was central to the prosecution’s submissions.<sup>114</sup> The appellate court determined that the trial court did not err in admitting the evidence,<sup>115</sup> using **Strengthening** to determine that “firearms testimony has remained widely admissible in the face of recent challenges.”<sup>116</sup> After considering the admissibility of the firearms evidence, the court dismissed the petitioner’s challenge, finding that “the trial court did not err in admitting the expert testimony using the traditional comparative microscopy method.”<sup>117</sup>

Similarly, the Court of Appeals of North Carolina in **State v. Adams (2011)** concluded that “precedent, in conjunction with the trial court’s findings, demonstrate the trial court did not abuse its discretion”<sup>118</sup>

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<sup>112</sup> *Id.*

<sup>113</sup> *Fleming v. State*, 194 Md.App. 76 (Md. Ct. Spec. App. 2010).

<sup>114</sup> *Id.*, at 98.

<sup>115</sup> *Id.*, at 99.

<sup>116</sup> *Id.*, at 104.

<sup>117</sup> *Id.*, at 109.

<sup>118</sup> *State v. Adams*, 212 N.C.App. 235 (N.C. Ct. App. 2011).

in allowing the ballistic expert to testify, despite the defense expert at trial questioning the underlying methodologies used by the expert, by citing *Ballistic Imaging* and *Strengthening*.<sup>119</sup> As the expert in both cases had used traditional and standard methodology and the appellate court's decision was supported by precedent, the dismissal of the challenges provided finality in deferring to the trial court decision, preventing further litigation on the issue, and providing a clear direction to future courts.

The inbuilt flexibility afforded to trial court actors by appellate courts is present in many appeals across the data set, including in *People v. Perrien (2015)*, which demonstrates the difficulties faced by petitioners who raise challenges relating to the reliability of ballistics and tool mark evidence.<sup>120</sup> The petitioner had referenced both precedent and *Strengthening* to argue that the tool mark evidence presented during his trial was unreliable and should not have been admitted into evidence.<sup>121</sup> The court, in dismissing the significance of the precedent and *Strengthening* separately, found the precedent to be non-binding,<sup>122</sup> and held that findings from *Strengthening* were not sufficient to demonstrate plain error.<sup>123</sup> The court decided that the evidence had been properly considered by the trial court, which allowed the appellate court to further reject cumulative error based on all the petitioner's claims, as no further errors were found in the trial court proceedings.<sup>124</sup>

#### **b. Dismissal as Harmless Error**

The data set shows that another tool used by appellate courts to dismiss claims in the interests of finality is finding harmless error. The doctrine of plain error presents a high threshold for petitioners, as "any error... that does not affect substantial rights must be disregarded" as harmless error.<sup>125</sup> Within the data set, numerous courts have conceded that evidence presented at trial was admitted erroneously, often because it did not meet the admissibility framework or required constitutional

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<sup>119</sup> *Id.*

<sup>120</sup> *People v. Perrien*, 2015 WL 7283216 (Mich. Ct. App. 2015).

<sup>121</sup> *Id.*, at 12.

<sup>122</sup> *Id.*

<sup>123</sup> *Id.*, at 13.

<sup>124</sup> *Id.*

<sup>125</sup> FED. R. CRIM. P. 52(a).

standard. Despite this, appellate courts have frequently found such errors to be harmless where they would not have affected the trial outcome. Reliance on the doctrine of harmless error reflects the substantial value that courts and society place on the finality of criminal judgments.<sup>126</sup> This is seen in many decisions, particularly those challenging the admissibility of forensic science techniques using **DNA 1**, **DNA 2**, **Bullet Lead**, and **Strengthening**. Where harmless error has been found, the error has not amounted to plain error, which has been described as “the erroneous admission of scientific analysis evidence requires reversal only if it is reasonably probable the verdict would have been more favorable to the defendant in the absence of the error.”<sup>127</sup>

#### i. Harmless Error when DNA Evidence is Challenged

One of the seminal cases concerning the admissibility the ceiling principle, referencing **DNA 1** is **People v. Barney (1992)**.<sup>128</sup> While this decision has been cited many times across the data set as an authority to support the admissibility of the ceiling principle under the *Kelly/Frye* admissibility framework,<sup>129</sup> the judgment concluded that the error in admitting the statistical significance of DNA evidence using the product rule was harmless, finding that “it is not reasonably probable a different result would have been reached absent the admission of the DNA evidence.”<sup>130</sup> In reaching this conclusion, the court undertook a detailed review of DNA practices and existing scholarship. Although the court agreed that **DNA 1**’s ceiling principle was the only generally accepted method of presenting DNA statistics in California,<sup>131</sup> the court found that as the outcome would not have been different when discounting the DNA evidence, it dismissed the petitioner’s challenge as harmless error.

This approach is also found in **State v. Bible (1993)**.<sup>132</sup> The Supreme Court of Arizona considered, amongst other things, whether the trial court had erred in admitting DNA statistics calculated using

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<sup>126</sup> See, Popko, *supra* note 2, at 80.

<sup>127</sup> *People v. Jones*, 2013 WL 5397389, 4 (Cal. Ct. App. 2013).

<sup>128</sup> *People v. Barney*, 8 Cal.App.4th 798, (Cal. Ct. App. 1992).

<sup>129</sup> See, e.g., *People v. Soto*, 30 Cal.App.4th 340 (Cal. Ct. App. 1994); *People v. Venegas*, 40 Cal.App.4th 128 (Cal. Ct. App. 1995).

<sup>130</sup> *Barney*, 8 Cal.App.4th at 825.

<sup>131</sup> *Id.*

<sup>132</sup> *State v. Bible*, 175 Ariz. 549 (Ariz. 1993).

the product rule.<sup>133</sup> While it found that **DNA 1** had recommended calculations to be made using the ceiling principle,<sup>134</sup> which was the only generally accepted method to calculate the probability of a random DNA match,<sup>135</sup> it determined that the error in admitting product rule calculations was harmless, finding that discounting this evidence would not have changed the outcome of the jury verdict, due to overwhelming other inculpatory evidence.<sup>136</sup>

Though the publication of **DNA 2** found that the product rule had become sufficiently reliable in the period between **DNA 1** and **DNA 2**,<sup>137</sup> several questions raised by the 1996 report have been found by appellate courts to have been erroneously interpreted by trial judges. For example, in **State v. Smith (2000)**, the petitioner challenged the trial court's decision to admit MtDNA into evidence, arguing that it was not generally accepted and inadmissible under *Frye*.<sup>138</sup> In dismissing the claim, the court did not directly confirm whether the admission of MtDNA was erroneous, finding that as the MtDNA merely duplicated the nuclear DNA evidence, if any error had occurred, it would have been harmless.<sup>139</sup>

Another issue that an appellate court found to be harmless error was determined in **State v. Leuluai (2003)**, where the petitioner argued that the admission of canine DNA evidence was erroneous, as it was not generally accepted under *Frye*, and the absence of a *Frye* hearing amounted to constitutional error.<sup>140</sup> Finding error, the Court of Appeals determined that the canine DNA "involved novel scientific theory... [and] a *Frye* hearing was absolutely necessary."<sup>141</sup> Despite concluding that it was "not convinced that forensic canine DNA identification is a theory that has received general acceptance in the scientific community,"<sup>142</sup> the court ultimately held "it was not an

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<sup>133</sup> *Id.*

<sup>134</sup> VICTOR A. MCKUSICK, DNA TECHNOLOGY IN FORENSIC SCIENCE 13 (National Academies Press 1992).

<sup>135</sup> *Bible*, 175 Ariz., at 585.

<sup>136</sup> *Id.*, at 589.

<sup>137</sup> JAMES F. CROW, THE EVALUATION OF FORENSIC DNA EVIDENCE (National Academies Press 1996).

<sup>138</sup> *State v. Smith*, 100 Wash.App 1064 (Wash. Ct. App. 2000).

<sup>139</sup> *Id.*

<sup>140</sup> *State v. Leuluai*, 118 Wash.App 780, 789 (Wash. Ct. App. 2003).

<sup>141</sup> *Id.*

<sup>142</sup> *Id.*, at 790.

error of constitutional magnitude”<sup>143</sup> and was not “convinced that the error did not affect the outcome of the trial within reasonable probabilities.”<sup>144</sup>

## ii. Harmless Error when CBLA Evidence is Challenged

Often when petitioners have challenged the admissibility of CBLA evidence on appeal, their reliance on references to *Bullet Lead* has not been sufficient to overturn trial court decisions. For example, in *More v. State (2015)*, the Court of Appeals of Iowa rejected More’s newly discovered evidence claim that CBLA evidence was unreliable, undermining the trial outcome.<sup>145</sup> In doing so, it determined that “the soundness of More’s conviction is not significantly weakened by [the CBLA expert’s] testimony and the discredited CBLA evidence.”<sup>146</sup> Although it acknowledged inconsistencies in precedent,<sup>147</sup> it found that the exclusion of the evidence would not have changed the results of the trial.<sup>148</sup>

The appellate court’s fidelity to trial court decisions is also seen in *Commonwealth v. Daye (2005)*, where the court justified its decision to dismiss the petitioner’s claim that *Bullet Lead* undermined the basis of the petitioner’s conviction, as additional evidence discounted the significance of the CBLA evidence.<sup>149</sup> In justifying its decision, it determined that although the evidence would no longer be considered admissible, the presence of additional evidence diminished its significance.<sup>150</sup> The court in *Gassler v. State (2010)* also justified its rejection of the petitioner’s CBLA claim on this basis.<sup>151</sup> After extensive consideration of the evidence challenging CBLA evidence, including *Bullet Lead*, it held that “the elimination of that evidence does not clearly and convincingly establish that Gassler is innocent.”<sup>152</sup> This review was detailed, but in finding harmless error, the court demonstrated the importance of finality interests, particularly as the court foreclosed any future litigation on the matter.

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<sup>143</sup> *Id.*, at 796.

<sup>144</sup> *Id.*

<sup>145</sup> *More v. State*, 871 N.W.2d 705 (Iowa Ct. App. 2015).

<sup>146</sup> *Id.*, at 13.

<sup>147</sup> *Id.*

<sup>148</sup> *Id.*, at 16.

<sup>149</sup> *Commonwealth v. Daye*, 19 Mass.L.Rptr 674 (2005).

<sup>150</sup> *Id.*

<sup>151</sup> *Gassler v. State*, 787 N.W.2d 575 (Minn. 2010).

<sup>152</sup> *Id.*, at 583.

The insufficiency of **Bullet Lead** is also seen in constitutional claims related to CBLA evidence. For example, in **United States v. Berry (2012)**, the petitioner argued that the government breached its obligation to disclose information about the FBI’s knowledge of CBLA’s lack of validity,<sup>153</sup> claiming a Brady violation.<sup>154</sup> Demonstrating the steadfastness and weight given to the trial court’s decision, the appellate court determined that either: 1) the issue had been litigated and dismissed; or 2) that the claim was untimely.<sup>155</sup> The court found that the issue had been previously litigated, but nevertheless continued to find that if the issue were addressed on the merits, the petitioner would not be entitled to relief.<sup>156</sup> The court reasoned that this was because the claim failed to meet the threshold required for a new trial, namely that the new evidence would probably produce an acquittal.<sup>157</sup> The court justified this on the basis that the CBLA evidence was “certainly not the “crux” of the evidence”<sup>158</sup> and that his conviction was supported by a significant amount of additional evidence.<sup>159</sup>

### iii. Harmless Error when Evidence Reviewed in *Strengthening* is Challenged

Within the data set, there are a number of decisions where harmless error has been found in relation to admissibility challenges related to forensic science disciplines discussed in **Strengthening**, suggesting that the reference to the limitations of evidence raised in **Strengthening** is insufficient to undermine the weight attributed to trial court decisions. This is found in relation to a number of forensic science techniques, including: ballistics and tool mark evidence; fingerprints; autopsy reports; results of narcotics testing; and other forms of pattern and impression evidence.

For example, in **United States v. Gardner (2016)**, the petitioner’s challenge to the admissibility of ballistics evidence was rejected,<sup>160</sup> despite the court acknowledging that the expert testimony without

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<sup>153</sup> *Berry v. United States*, 2012 WL 1442787 (E.D. Wash. 2012).

<sup>154</sup> *Id.*

<sup>155</sup> *Id.*, at 6.

<sup>156</sup> *Id.*, at 7.

<sup>157</sup> *Id.*

<sup>158</sup> *Id.*

<sup>159</sup> *Id.*

<sup>160</sup> *Gardner v. United States*, 140 A.3d 1172 (D.C. 2016).

qualification as to the significance of a match had a substantial effect on the jury.<sup>161</sup> Upon evaluation, the court did acknowledge the impact that the findings of both *Ballistic Imaging* and *Strengthening* have had on courts' decision-making, with some having used the reports to limit the scope of ballistic testimony.<sup>162</sup> This led it to conclude that the trial court's decision to admit the unqualified opinion was erroneous,<sup>163</sup> but ultimately found the error to be harmless, as the government had supported its submissions with further evidence.<sup>164</sup> To further justify this, it listed additional inculpatory evidence, finding this sufficient to support the petitioner's conviction, absent the ballistics testimony.<sup>165</sup>

Harmless error has also been found when admissibility challenges to narcotics evidence have been raised. In *State v. Martinez (2013)*, the petitioner argued that the trial court had erred in admitting narcotics evidence without an admissibility hearing, arguing it was unreliable.<sup>166</sup> The appellate court reviewed the trial court's decision not to hold an admissibility hearing, finding that the decision was erroneous<sup>167</sup> as narcotics testing had not been sufficiently established as reliable.<sup>168</sup> However, it determined that excluding this evidence would not have altered the outcome of the trial, and was harmless error.<sup>169</sup> The court further found that the conviction was supported by additional inculpatory evidence, leading the court to find that absent the results of the narcotics testing, the trial result would have been the same.<sup>170</sup>

A similar approach is also found in *Commonwealth v. Rice (2013)*.<sup>171</sup> Alongside additional claims challenging his conviction,<sup>172</sup> the petitioner used *Strengthening* to argue that the firearms and tool mark evidence used by the Commonwealth's expert witness was incorrectly admitted, as it lacked

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<sup>161</sup> *Id.*, at 1183.

<sup>162</sup> *Id.*

<sup>163</sup> *Id.*, at 1184.

<sup>164</sup> *Id.*

<sup>165</sup> *Id.*, at 1185.

<sup>166</sup> *State v. Martinez*, 143 Conn.App. 541 (Conn. App. Ct. 2013).

<sup>167</sup> *Id.*, at 555-556.

<sup>168</sup> *Id.*, at 562.

<sup>169</sup> *Id.*

<sup>170</sup> *Id.*, at 570.

<sup>171</sup> *Commonwealth v. Rice*, 2013 WL 11256379 (Pa. Super. Ct. 2013).

<sup>172</sup> *Id.*

reliability.<sup>173</sup> The court, however, did not address the merits of the petitioner’s claims, finding instead that “whether or not the NAS report actually casts doubt on the ballistic evidence is irrelevant considering the rest of the evidence presented by the Commonwealth against Rice.”<sup>174</sup> This decision demonstrates the central importance and gravity of trial court decisions. It suggests that even if a petitioner raises a substantial issue, high thresholds may preclude a review of the issues.

Harmless error in fingerprint evidence has also been found in *Commonwealth v. Gambora (2010)*.<sup>175</sup> The petitioner challenged the general acceptance of fingerprint evidence, arguing that *Strengthening* undermined assumptions about fingerprint evidence, which meant that its admission constituted prejudicial error and warranted reversal.<sup>176</sup> Although the appellate court acknowledged the petitioner’s concerns, it cited *Strengthening*’s conclusion that fingerprint evidence is not so unreliable that it should be excluded, dismissing the claim.<sup>177</sup> To support its decision that the error was harmless, the court acknowledged that one of the major concerns of *Strengthening* was that examiners were testifying to absolute certainty or that the ACE-V method of analysis was “error free.”<sup>178</sup> However, in this case, the expert did not make any such claims, and the issue of error had been addressed in cross-examination.<sup>179</sup> This led it to conclude that even if the fingerprint evidence was admitted in error, the assumed error was harmless due to additional evidence supporting his conviction, which included an admission from the petitioner that he had put his hand on the surface that was tested for prints.<sup>180</sup>

A challenge against the admissibility of palm print evidence has also been dismissed as harmless error in *People v. Morris (2013)*, where the petitioner cited *Strengthening* to argue that there was a lack of studies supporting the reliability (and admissibility) of the technique.<sup>181</sup> This was heard alongside

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<sup>173</sup> *Id.*, at 12.

<sup>174</sup> *Id.*, at 13.

<sup>175</sup> *Commonwealth v. Gambora*, 457 Mass. 715 (Mass. 2010).

<sup>176</sup> *Id.*, at 724.

<sup>177</sup> *Id.*, at 725.

<sup>178</sup> HARRY T. EDWARDS & CONSTANTINE GATSONIS, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* 143 (National Academies Press 2009).

<sup>179</sup> *Gambora*, 457 Mass. at 727-8.

<sup>180</sup> *Id.*, at 728.

<sup>181</sup> *People v. Morris*, 997 N.E.2d. 847 (Ill. App. Ct. 2013).

several additional challenges,<sup>182</sup> but the petitioner argued that in handling the latent print evidence, defense counsel provided ineffective assistance by not requesting a *Frye* hearing to determine the admissibility of palm print evidence.<sup>183</sup> Morris used ***Strengthening*** to support his argument that there was longstanding debate surrounding the validity of latent print identification.<sup>184</sup> However, the court stopped short of analyzing the merits of the claim, as it found that overwhelming inculpatory evidence precluded any potential prejudice that may have been suffered.<sup>185</sup>

Harmless error has also been used by courts when the admissibility of new and evolving forensic science techniques have been challenged by petitioners, such as in ***Commonwealth v. Treiber (2015)***.<sup>186</sup> The court in this instance examined whether the petitioner's challenge to canine DNA evidence was sufficiently reliable and whether the petitioner's defense counsel was ineffective in failing to object to this evidence.<sup>187</sup> However, demonstrating the weight that appellate courts give to decisions made by trial courts, the appeal court quickly dismissed the claim by stating that neither claim was relevant because "he failed to demonstrate the outcome of the guilt phase would have been different had the canine DNA evidence been excluded from his trial."<sup>188</sup> Despite the majority's dismissal of the challenge, the dissenting judge acknowledged "that there are grave concerns being raised concerning the government's use of novel scientific techniques,"<sup>189</sup> finding that ***Strengthening*** further supported this premise, with many forensic science techniques not being sufficiently reliable to be admitted.<sup>190</sup>

Harmless error has also been found where ***Strengthening*** has been used to support claims of constitutional violations. This is particularly prevalent in cases where a petitioner has claimed that their Sixth Amendment right to confront witnesses against them has been violated, as interpreted by

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<sup>182</sup> *Id.*, at 863.

<sup>183</sup> *Id.*, at 870.

<sup>184</sup> *Id.*, at 871.

<sup>185</sup> *Id.*, at 872.

<sup>186</sup> *Commonwealth v. Treiber*, 632 Pa. 449 (Pa. 2015).

<sup>187</sup> *Id.*

<sup>188</sup> *Id.*, at 451.

<sup>189</sup> *Id.*, at 477.

<sup>190</sup> *Id.*, at 478.

*Melendez-Diaz v. Massachusetts*.<sup>191</sup> In ***Rosario v. State (2015)***,<sup>192</sup> the petitioner argued that the admission of an autopsy report without live testimony from the medical examiner who carried out the autopsy amounted to a violation of the Confrontation Clause.<sup>193</sup> Referencing findings from ***Strengthening***, the court found that autopsy reports are partly designed to “serve the criminal justice system,”<sup>194</sup> which, alongside other means of justification, led it to determine that it was testimonial, as it was designed to create evidence for the trial, meaning that live testimony was required to allow for the cross-examination of the expert.<sup>195</sup> However, as the error was not prejudicial to the outcome of the petitioner’s trial, the court found the constitutional error to be harmless.<sup>196</sup>

### c. Weight not Admissibility

The data set also shows that where limitations in forensic science evidence have already been addressed by the jury, there is no need to re-address decisions that have already been made. A number of judgments across the data set dispose of forensic science challenges in this way, including in ***State v. Langlois (2013)***, where the appellate court determined that where evidence had been correctly admitted, any limitations of forensic science evidence would be properly attributed to the weight of the evidence.<sup>197</sup> Where an appeal court has no reason to believe that there has been in irregularity in the jury’s decision-making, the court will let the decision stand.

On direct appeal, the petitioner in ***People v. Sandifer (2016)*** argued that the jury had succumbed to the prosecutor’s fallacy (where the jury assumes that the random match probability is the same as the probability that the petitioner was not the source of the DNA found at the crime scene<sup>198</sup>) and that his counsel was ineffective in failing to object to the testimony.<sup>199</sup> The court referred to ***DNA 2*** to provide

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<sup>191</sup> See, *Melendez-Diaz v. Massachusetts*, 557 U.S. 305 (2009).

<sup>192</sup> *Rosario v. State*, 175 So.3d 843 (Fla. Dist. Ct. App. 2015).

<sup>193</sup> *Id.*, at 844.

<sup>194</sup> *Id.*, at 855.

<sup>195</sup> *Id.*

<sup>196</sup> *Id.*, at 858.

<sup>197</sup> *State v. Langlois*, 2 N.E.3d 936, 950-951 (Ohio Ct. App. 2013).

<sup>198</sup> *People v. Sandifer*, 65 N.E.3d 969, 981 (Ill. App. Ct. 2016).

<sup>199</sup> *Id.*

an understanding of the prosecutor's fallacy. However, it rejected the argument that the jury had succumbed to the prosecutor's fallacy, as "no argument was advanced that conflated the statistics and gave a skewed calculation..."<sup>200</sup> demonstrating the high threshold required to displace the weight of evidence as examined by the jury.

The courts' downplayed significance of **Strengthening** is also found in relation to constitutional claims, suggesting that reliance solely on **Strengthening**'s findings are not sufficient to overturn a jury verdict. The decision in **Rice v. Gavin (2016)** provides an example of the insufficiencies of **Strengthening** to overturn a due process claim.<sup>201</sup> The court dismissed the petitioner's claim that his due process rights were violated on the basis that false ballistics evidence had been presented during his trial,<sup>202</sup> which he argued to be false based on findings in **Strengthening**.<sup>203</sup> The court held that as the defense counsel had cross-examined the evidence at length during trial, and the petitioner's claim was meritless.<sup>204</sup>

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Within existing literature, there is an absence of commentary discussing reasons for judicial decision-making and reliance on trial court decisions when challenges are raised using the NAS reports, although many authors have used **Strengthening** to caution criminal justice actors against the blind acceptance of forensic science evidence.<sup>205</sup> Although few studies exist, where appellate judges have paid deference to decisions made by trial courts and found practices to be within the discretion of the trial judge, particularly within the context of admissibility challenges supported by **Strengthening**, commentators have found that courts have consistently rejected claims that trial courts have abused their discretion in admitting evidence, even "in extreme cases."<sup>206</sup> Examples of extreme cases identified in the literature have included experts testifying that their methodology is error free, or

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<sup>200</sup> *Id.*

<sup>201</sup> *Rice v. Gavin*, 2016 WL 3009392 (E.D. Pa. 2016).

<sup>202</sup> *Id.*, at 9.

<sup>203</sup> *Id.*

<sup>204</sup> *Id.*

<sup>205</sup> See generally, Jennifer L. Mnookin, Simon A. Cole, Itiel E. Dror & Barry A. J. Fisher, *The Need for a Research Culture in the Forensic Sciences*, 58 UCLA L. REV. 725 (2010-2011)

<sup>206</sup> Cole & Edmond, *supra* note 85, at 603.

testifying to 100% certainty or infallibility.<sup>207</sup> This data set also shows that the judicial reluctance to displace trial court decisions is often at odds with the scientific knowledge found within the NAS reports, and that appellate judges will review trial court decisions by giving considerable discretion to trial court actors' decision-making. Authors have suggested that this action demonstrates the heavy value that society places on the finality of criminal judgments,<sup>208</sup> as even when error has been found, trial decisions have been left to stand.<sup>209</sup>

Although there are numerous authors who have discussed appellate courts' deference to trial court decisions, authors have rarely linked this behavior to finality interests. While fidelity to institutional settlement is discussed in more detail in the previous chapter, scholars have largely linked deference to trial court actors' decisions to the application of the *Daubert* admissibility framework. Scholars have found that the *Daubert* framework "indicates that the trial judge gatekeeper has the discretion to totally reject and disallow an expert's opinion, even if based on accepted methodology."<sup>210</sup> This suggests that it is the *Daubert* framework itself that prevents appellate judges from finding error when reviewing trial court judicial decision-making, as considerable discretion and flexibility is built into the framework itself. The combination of the judicial pursuit of finality put in place by trial courts using the *Daubert* framework and the wide discretion given to trial court actors explains the reasons why judges so often find an absence of error upon a review of trial court decisions.

Judicial deference to trial court decisions has been explored at length by Moriarty, who has linked finality to the importance of trial court actors, within the application of *Daubert*.<sup>211</sup> She has focused on the process of gatekeeping, arguing that there is a lack of thorough evaluation of legal principles.<sup>212</sup> However, she has identified that even during trial court proceedings, judges are "merely giving lip

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<sup>207</sup> *Id.*, at 604.

<sup>208</sup> *See*, Popko, *supra* note 2, at 80.

<sup>209</sup> *See*, e.g., *Rosario*, 175 So.3d; *Gambora*, 457 Mass.

<sup>210</sup> Donald E. Shelton, *Twenty-First Century Forensic Science Challenges for Trial Judges in Criminal Cases: Where the Polybutadiene Meets the Bitumen*, 18 WIDENER L. J. 309, 315 (2008-2009).

<sup>211</sup> Jane Campbell Moriarty, *Will History be Servitude: the NAS Report of Forensic Science and the Role of the Judiciary*, 2010 UTAH L. REV. 299, 305-307 (2010).

<sup>212</sup> *Id.*

service”<sup>213</sup> to scientific considerations.<sup>214</sup> This puts into doubt whether appellate courts are correct in their deference to trial court actors’ evaluation of forensic science evidence, as issues are not thoroughly assessed at trial. She has suggested that the appellate review of admissibility challenges referencing *Ballistic Imaging* and *Strengthening* to challenge these techniques are insignificant, especially where issues were correctly disposed of at trial (procedurally)<sup>215</sup> and that the processes, incidentally, were designed to be pro-prosecution.<sup>216</sup>

The importance of finality and certainty in the law is further explained by the use of the doctrine of harmless error, which is often relied on in the data set by appellate judges reviewing trial court decisions.<sup>217</sup> This practice of finding an error to be harmless has been described by Popko as a mechanism designed to “save the verdict.”<sup>218</sup> The emphasis on the stipulated error’s inability to change the outcome of the trial court decision is clearly pivotal to this, although as demonstrated by decisions within the data set, including *Commonwealth v. Rice (2013)*, the finding of plain error presents a high threshold for petitioners to demonstrate, as courts have disregarded potential errors as harmless without examining the merits of petitioners’ claims.<sup>219</sup>

Within existing literature, cases where harmless error has been found have been discussed by scholars, but largely in other contexts. In particular, the seminal DNA cases of *Barney* and *Bible* have been cited frequently as providing an example of courts’ recognition of progress in DNA technology, further built upon by subsequent judgments, despite the courts in these cases finding that the error made by the trial court was harmless.<sup>220</sup> Existing literature surrounding these cases fails to recognize that these decisions did not provide relief for those affected, due to the finding of harmless error.

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<sup>213</sup> *Id.*, at 307.

<sup>214</sup> *Id.*

<sup>215</sup> *Id.*, at 314.

<sup>216</sup> *Id.*

<sup>217</sup> *See, e.g., Gardner*, 140 A.3d; *Martinez*, 143 Conn.App.

<sup>218</sup> Popko, *supra* note 2, at 80.

<sup>219</sup> *See, Rice*, 2013 WL.

<sup>220</sup> *See, e.g., Jonathan Kahn, Race, Genes and Justice - A Call to Reform the Presentation of Forensic DNA Evidence in Criminal Trials*, 74 BROOK. L. REV. 325 (2008-2009).

The data set shows that the assignment of harmless error when scientific evidence (particularly DNA evidence) is novel is a way that appellate judges can both impose finality into judicial decisions and account for inconsistencies in applications between courts. This is seen in decisions such as *Smith* and *Leuluaialii*, where the appellate court acknowledged that non-human/non-nuclear DNA evidence had been admitted erroneously.<sup>221</sup> Such instances of harmless error in “non-standard” DNA evidence have received little attention by scholars. While Giannelli has discussed the admissibility of MtDNA evidence in general terms,<sup>222</sup> his comments have been within the context of raising awareness of potential areas where this evidence may lack the same individualization characteristics of nuclear DNA.<sup>223</sup> Despite recognizing issues within these emerging techniques, discussions have not gone as far as the examination of judicial approaches to emerging forms of evidence. This study demonstrates that the judicial treatment of emerging techniques is similar to those observed in early cases where DNA evidence was challenged,<sup>224</sup> with courts reconciling discrepancies and ensuring finality by finding any error harmless in the circumstances.

One area where commentators have debated whether harmless error is an appropriate means to dispose of cases is when CBLA evidence is challenged using the findings from *Bullet Lead*. Some authors have indicated that as CBLA evidence is no longer in use, any potential errors have been resolved.<sup>225</sup> However, this opinion has sat uncomfortably with others.<sup>226</sup> Those showing concern about courts’ rejection of CBLA challenges on the basis of harmless error argued that courts have avoided evaluating substantive issues, placing a greater emphasis on decisions made by trial court actors.<sup>227</sup>

This study has found that while the presence of additional inculpatory evidence has allowed appellate

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<sup>221</sup> See, e.g., *Smith*, 100 Wash.App; *Leuluaialii*, 118 Wash.App.

<sup>222</sup> See, e.g., Paul C. Giannelli, *Mitochondrial DNA*, 19 CRIM. JUST. 54 (2004-2005).

<sup>223</sup> *Id.*, at 54.

<sup>224</sup> See, e.g., *Barney*, 8 Cal.App.4th; *Bible*, 175 Ariz.

<sup>225</sup> See, e.g., Jane Campbell Moriarty, *Forensic Science: Grand Goals, Tragic Flaws, and Judicial Gatekeeping*, 44 JUDGES J. 16, 23 (2005). This article depicts the FBI’s CBLA practices as a “cautionary lesson” and does not discuss any potential remainder issues following the discontinuation of CBLA evidence.

<sup>226</sup> See, e.g., David H. Kaye, *The Current State of Bullet-Lead Evidence*, 47 JURIMETRICS 99, 102 (2006-2007).

<sup>227</sup> Sarah Lucy Cooper, *Judicial Responses to Challenges to Firearms-Identification Evidence: A Need for New Judicial Perspectives on Finality*, 31 T. M. COOLEY L. REV. 457, 475 (2014).

judges to dismiss challenges relating to the admissibility of CBLA evidence in the interests of finality,<sup>228</sup> judges have been more open to reviewing challenges to CBLA evidence, possibly because CBLA has now permanently been discontinued, meaning that future challenges to CBLA evidence are finite.

In general, the principle of harmless error itself (outside of a forensic science context) has been heavily contested in existing literature, particularly in the acknowledgment of the juxtaposition created by the concept.<sup>229</sup> While the data set demonstrates a significant crossover between the interpretation of procedural error and constitutional error where harmless error is found, scholars have discussed these separately. Within this, Marks has highlighted the fundamental difficulties in labelling constitutional errors harmless,<sup>230</sup> while Garrett has gone into detail about the dangers of harmless error.<sup>231</sup> When evaluating the determination of error in judicial decision-making, Cole and Edmond have claimed that review for plain error as being “formalistic and remarkably insensitive to what might be thought of as substantial limitations within the relevant forensic science techniques.”<sup>232</sup>

The judicial formalism and insensitivity to the substantive considerations raised by petitioners within the data set demonstrates fidelity to the legal process vision. This is shown through the reliance on harmless error prior to addressing any potential merits of a claim, as seen in cases such as *Treiber* and *Morris*, where courts have refused to address the merits of petitioners’ claims on the basis that their challenges would not have altered the outcome of the trial.<sup>233</sup> It is also seen in cases where judges have dismissed claims on the basis that the petitioner has not satisfied the high thresholds required for review,<sup>234</sup> demonstrating the relationship between the imposition of high thresholds and

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<sup>228</sup> See, e.g., *More*, 871 N.W.2d; *Gassler*, 787 N.W.2d; *Berry*, 2012 WL.

<sup>229</sup> See generally, Kimberly Cogdell Boies, *Misuse of DNA is not Always a Harmless Error: DNA Evidence, Prosecutorial Misconduct, and Wrongful Conviction*, 17 TEX. WESLEYAN L. REV. 403 (2010-2011)

<sup>230</sup> Jason S. Marks, *Harmless Constitutional Error: Fundamental Fairness and Constitutional Integrity*, 8 CRIM. JUST. 2 (1993-1994).

<sup>231</sup> Brandon L. Garrett, *Innocence, Harmless Error, and Federal Wrongful Conviction Law*, 2005 WIS. L. REV. 35, from 56 (2005).

<sup>232</sup> Cole & Edmond, *supra* note 85, at 606.

<sup>233</sup> See, e.g., *Treiber*, 632 Pa.; *Morris*, 997 N.E.2d.

<sup>234</sup> See, e.g., *Ross v. Epps*, 2015 WL; *Hooper v. Warden*, 2010 WL.

deference to institutional settlement in the pursuit of finality. This is clearly motivated by finality interests, particularly certainty and deference to trial court decisions.

### 3. Incentivizing Defense Counsel

A further goal pursued by finality is designed to encourage defense counsel to get it right first time. Within the data set, judicial decisions have demonstrated that evidentiary issues are matters of consideration for the trial court. This has been shown in a variety of decisions, but is particularly prevalent in the appeal courts' dismissal of constitutional claims of ineffective assistance of counsel, under the Sixth Amendment.<sup>235</sup> In these cases, it is clear that the high thresholds required of petitioners to successfully claim ineffective assistance – and the additional high thresholds to petition a successful appeal – provides defense counsel with an incentive to get it right first time (at trial). However, cases from within the data set demonstrating this often place unrealistic expectations on defense counsel, particularly when scientific opinion is challenged *after* trial.

These unrealistic expectations can be seen in cases where counsel has been challenged for ignoring the discreditation of CBLA evidence. Although the FBI discontinued CBLA evidence shortly after the publication of ***Bullet Lead***, courts have dismissed claims where ***Bullet Lead*** has been used to challenge defense counsel practices, on the basis that ***Bullet Lead*** was not primarily designed to be used by legal counsel. For example, in ***United States v. Higgs (2011)***,<sup>236</sup> the court dismissed the significance of ***Bullet Lead*** by stating that it “did little more than advise the FBI that further study was warranted.”<sup>237</sup> It also found that counsel’s failure to initiate post-trial proceedings following the publication of ***Bullet Lead*** did not render his legal assistance “constitutionally ineffective,”<sup>238</sup> a high threshold in itself.<sup>239</sup>

Several further claims that trial counsel had been ineffective in failing to address concerns raised in other NAS reports have been dismissed by appellate courts. In ***People v. Hernandez (2013)***, the

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<sup>235</sup> U.S. Const. Amend. VI.

<sup>236</sup> *United States v. Higgs*, 663 F.3d 726 (4th Cir. 2011).

<sup>237</sup> *Id.*, at 738.

<sup>238</sup> *Id.*, at 743.

<sup>239</sup> *See, Strickland v. Washington*, 466 U.S. 668 (1984).

petitioner argued that his defense counsel at trial was ineffective in their failure to question the state's expert ballistics examiner, as they failed to cite *Ballistic Imaging*.<sup>240</sup> The court found that the trial strategy used by counsel was not deficient.<sup>241</sup> This is further seen in *Smith v. Uribe (2016)*, where the petitioner argued that his counsel should have requested a *Kelly* hearing based on the findings of *Ballistic Imaging*, and submitted evidence that his counsel was deficient as they were unaware of the report.<sup>242</sup> The court dismissed the claim by stating that "the [state] Court of Appeal held petitioner's trial counsel did not provide ineffective assistance... the court agrees."<sup>243</sup> In agreeing with the Court of Appeal, the Federal District Court found that *Ballistic Imaging* did not reach the conclusion that firearms and tool mark evidence was unreliable, and therefore did not qualify as grounds for a *Kelly* hearing.<sup>244</sup> Additional Sixth Amendment challenges were also dismissed. These decisions clearly show the importance of defense counsel utilizing all information available to them during the trial, as the threshold of ineffective assistance is particularly difficult for a petitioner to reach.

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The high thresholds required to address constitutional claims are well-documented in existing literature, in particular the threshold required to demonstrate a violation under *Strickland's* interpretation of the Sixth Amendment, and have been recognized as presenting significant challenges for petitioners.<sup>245</sup> Concerns about the threshold required to find ineffective assistance of counsel where science has developed has been particularly criticized by Plummer and Syed, who have argued that finality is not an appropriate means to deal with lawyers' lack of knowledge of emerging scientific issues.<sup>246</sup>

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<sup>240</sup> *People v. Hernandez*, 2013 WL 144970, 6 (Cal. Ct. App. 2013).

<sup>241</sup> *Id.*

<sup>242</sup> *Smith v. Uribe*, 2016 WL 1165822, 10 (C.D. Cal. 2016).

<sup>243</sup> *Id.*

<sup>244</sup> *Id.*

<sup>245</sup> *See generally*, John H. Blume & Sheryl Lynn Johnson, *Gideon Exceptionalism*, 122 *YALE L. J.* 2126 (2013).

<sup>246</sup> Plummer & Syed, *supra* note 82, at 283-284.

Cooper has identified the importance of finality as a means to incentivize defense counsel to present claims in the best way first time.<sup>247</sup> Although it is clear from the data set that appellate judges make use of finality to incentivize defense counsel, the issues raised by Plummer and Syed present further concerns about the practical value of reliance on finality.<sup>248</sup> Moreover, further studies have explored trial court actors' lack of understanding of scientific issues<sup>249</sup> and the under-appreciation of the pressures placed on defense attorneys within the public defender system,<sup>250</sup> suggesting that the reliance on trial court actors' decision-making may provide certainty, but overlooks wider problems within the criminal justice system.

#### 4. Preventing Frivolous Claims in the Future

The data set also shows that appellate challenges have been rejected on the basis that claims simply do not constitute what is required for a successful appeal. Existing literature suggests that this is often linked to the prevention of frivolous claims in the future, a mechanism fulfilled by finality.<sup>251</sup> This can be seen in a number of decisions across the data set, including in *State v. Langlois (2013)*, where the petitioner referenced both *Ballistic Imaging* and *Strengthening* to argue that the state's ballistics expert should not have been allowed to testify, due to the lack of scientific evidence underpinning ballistic analysis.<sup>252</sup> The court, in reviewing the NAS reports, determined that "it was not [the reports'] purpose to opine on the long-standing admissibility of tool mark and firearms testimony in criminal prosecutions."<sup>253</sup> It reasoned that neither *Ballistic Imaging* nor *Strengthening* discussed forensic science in any legal context<sup>254</sup> and the reports were insufficient to support an appellate claim.<sup>255</sup>

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<sup>247</sup> Sarah Lucy Cooper, *Challenges to Fingerprint Identification Evidence: Why the Courts need a New Approach to Finality*, 42 MITCHELL HAMLINE L. REV. 756, 775 (2016).

<sup>248</sup> Plummer & Syed, *supra* note 82.

<sup>249</sup> See, e.g., Paul C. Giannelli, *The NRC Report and its Implications for Criminal Litigation*, 50 JURIMETRICS 53 (2009-2010); David S. Caudill, *Lawyers Judging Experts: Oversimplifying Science and Undervaluing Advocacy to Construct an Ethical Duty*, 38 PEPP. L. REV. 675 (2010-2011).

<sup>250</sup> James R. Acker & Catherine L. Bonventre, *Protecting the Innocent in New York: Moving Beyond Changing Only their Names*, 73 ALB. L. REV. 1245, 1325-7 (2009-2010).

<sup>251</sup> See, Cooper, *supra* note 2, at 229.

<sup>252</sup> *Langlois*, 2 N.E.3d.

<sup>253</sup> *Id.*, at 945.

<sup>254</sup> *Id.*, at 946.

<sup>255</sup> *Id.*

This is also seen in *State v. Thomas (2016)*, where the petitioner referred to findings from *Ballistic Imaging* and *Strengthening* to challenge the admissibility of the ballistics testing used in his trial.<sup>256</sup> His newly discovered evidence claim argued “that the legal and scientific landscape has changed since his May 2008 trial,”<sup>257</sup> which led to the discreditation of ballistic evidence. Although the court examined the context surrounding the evidence at trial and the trial court’s rejection of a request for a new trial, it ultimately determined that the petitioner had failed to provide any evidential proof that a new trial was necessary, calling his claims “speculation.”<sup>258</sup> This allowed the court to dismiss the claim, as the reports alone were insufficient.<sup>259</sup> This decision demonstrates that findings from these two NAS reports are insufficient in Tennessee to overturn any convictions where an issue is raised relating to the general reliability of forensic science techniques, and the decision has the consequence of preventing future forensic science admissibility challenges on this basis.

The clear and conscious decisions made by appellate judges to dismiss general challenges to the admissibility of forensic science evidence based on the limitations discussed in *Strengthening* have prevented further general challenges supported solely by NAS report findings. This is seen in *United States v. Campbell (2012)*, where the petitioner’s claim that fingerprint evidence was inadmissible as the methodology was not supported by scientific research<sup>260</sup> was rejected by the court.<sup>261</sup> It found that the petitioner’s claims did not support relief, rejecting the general claim that fingerprint evidence is inadmissible, minimizing the strength of the choice of challenge presented by the petitioner by stating that he should have challenged the expert’s credentials and/or methodology.<sup>262</sup> This makes it clear that in the federal system, general challenges to the admissibility of fingerprint evidence will not reach the threshold for relief, encouraging defense lawyers and experts to be specific in their challenges to forensic science evidence, during both the trial and post-conviction proceedings.

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<sup>256</sup> *State v. Thomas*, 2016 WL 7799279 (Tenn. Ct. App. 2016).

<sup>257</sup> *Id.*, at 13.

<sup>258</sup> *Id.*, at 18.

<sup>259</sup> *Id.*

<sup>260</sup> *United States v. Campbell*, 2012 WL 2374528, 3 (N.D. Ga. 2012).

<sup>261</sup> *Id.*, at 6.

<sup>262</sup> *Id.*

This is also seen in *Honken v. United States (2012)*, where general challenges to multiple forensic science evidence techniques were dismissed, with the court finding that the petitioner’s unreliability claims were unfounded.<sup>263</sup> The court dismissed the reliability challenge,<sup>264</sup> finding that “generalizations do not demonstrate that the jury improperly considered any forensic evidence,”<sup>265</sup> demonstrating reliance on finality as a mechanism to prevent future claims and defer to decisions made at trial. Similarly, the Court of Appeals of Iowa dismissed the petitioner’s claim that *Strengthening* constituted newly discovered evidence undermining fingerprint evidence presented by the prosecution in *Enderle v. State (2014)*.<sup>266</sup> The court found that the evidence was “not newly discovered evidence entitling him to a new trial,”<sup>267</sup> and denied the appeal as the claim lacked merit.<sup>268</sup>

*Strengthening*’s findings have also been insufficient to undermine a conviction based on microscopic hair analysis, a forensic science technique widely discredited since the publication of *Strengthening*.<sup>269</sup> In *United States v. Butler (2017)*, the petitioner cited *Strengthening* and the subsequent FBI case review to argue that the microscopic hair analysis presented at trial violated the due process requirement of fairness as the now-discredited science was a critical element of the government’s submission.<sup>270</sup> He stipulated that *Strengthening* demonstrated that the prosecution ought to have known about the lack of science underpinning the evidence.<sup>271</sup> The court determined that the knowledge of false or incorrect testimony is not enough to grant a new trial automatically.<sup>272</sup> It further relied upon precedent to support its reasoning. It acknowledged that the claim had some merit, as microscopic hair analysis “can be both powerful and quite misleading,”<sup>273</sup> but ultimately dismissed the

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<sup>263</sup> *Honken v. United States*, 42 F.Supp.3d 937, 1191 (N.D. Iowa 2013).

<sup>264</sup> *Id.*, at 1156.

<sup>265</sup> *Id.*, at 1191.

<sup>266</sup> *Enderle v. State*, 847 N.W.2d 235 (Iowa Ct. App. 2014).

<sup>267</sup> *Id.*, at 9.

<sup>268</sup> *Id.*

<sup>269</sup> FBI National Press Office, [FBI Testimony on Microscopic Hair Analysis Contained Errors in at least 90 Percent of Cases in Ongoing Review](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) (April 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> (last visited Nov. 4, 2019).

<sup>270</sup> *United States v. Butler*, 278 F.Supp.3d 461 (D.D.C. 2017).

<sup>271</sup> *Id.*, at 477-478.

<sup>272</sup> *Id.*, at 478.

<sup>273</sup> *Id.*, at 481.

claims as the “hair evidence... was not as demonstrably important... as the defendant would suggest.”<sup>274</sup> The government stated that the petitioner’s argument lacked merit as during the trial, the expert testified to the limitations of hair analysis. The court concluded that merits aside, discounting the hair analysis led to “no reasonable likelihood that presentation of the false hair matching evidence could have altered the outcome of the case.”<sup>275</sup> It found that both the petitioner’s claim was not sufficient to overturn the conviction, and that any error would have been harmless.<sup>276</sup>

While acting as an outlier in the data set, due to the decision being made between the publication of **Bullet Lead** and the FBI’s permanent discontinuation of CBLA, the court in **Commonwealth v. Fisher (2005)** also rejected the idea that a NAS report alone can overturn a conviction.<sup>277</sup> The Supreme Court of Pennsylvania rejected the petitioner’s claim that **Bullet Lead** constituted newly discovered evidence, citing **Bullet Lead** to argue that “the FBI technique is the best currently available technology for analyzing bullet fragments”<sup>278</sup> and is “reasonably accurate.”<sup>279</sup> It determined that “the language hardly supports the Appellant’s claim,”<sup>280</sup> dismissing the relevance of the report for the purposes of post-conviction claims. Again, the court’s dismissal of the claim that **Bullet Lead** constituted newly discovered evidence undermining CBLA evidence serves to prevent future claims seeking relief based on the report, although the FBI’s permanent discontinuation of CBLA from September 2005 allowed for further petitioners to incorporate subsequent developments to strengthen their claims.<sup>281</sup>

The data set shows that another issue where courts have sought to prevent future claims is in relation to “John Doe” warrants when DNA has been found at a crime scene. **Commonwealth v. Dixon (2010)** shows the judicial dismissal of such a Fifth Amendment due process claim.<sup>282</sup> The court dismissed the petitioner’s claim that he was not on notice until his name had been added to the John Doe DNA

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<sup>274</sup> *Id.*

<sup>275</sup> *Id.*, at 485.

<sup>276</sup> *Butler*, 278 F.Supp.3d, at 485.

<sup>277</sup> *Commonwealth v. Fisher*, 582 Pa. 276 (Pa. 2005).

<sup>278</sup> *Id.*, at 287.

<sup>279</sup> *Id.*

<sup>280</sup> *Id.*

<sup>281</sup> *See, e.g.*, *In Re Personal Restraint of Trapp*, 165 Wash.App. 1003 (2011); *Wyatt v. State* 71 So.3d 86 (Fla. 2011).

<sup>282</sup> *Commonwealth v. Dixon*, 458 Mass. 446 (Mass. 2010).

warrant, after the statute of limitations period had expired.<sup>283</sup> The court referenced **DNA 2** to support its decision that a DNA profile was a unique identifier,<sup>284</sup> dismissing the appeal. In addition, the court was mindful of the limits of its own competence, and stated that “it is in the first instance for the Legislature to determine whether these safeguards... are inadequate to protect putative defendants.”<sup>285</sup> This decision therefore demonstrates an awareness of the limits of judicial competence in the criminal justice system in addition to pursuing finality to prevent future constitutional challenges to John Doe DNA warrants. This policy decision is unsurprising, given that police commonly use “John Doe” arrest warrants to meet the statute of limitations.<sup>286</sup>

Additional constitutional challenges to standard DNA practices have also been met with considerable judicial resistance, as allowing such claims would open the proverbial floodgates and undermine certainty in many decisions made. This can be seen in **United States v. Anderson (2016)**, where the petitioner argued that DNA evidence had been improperly handled, arguing that the DNA samples should have been split prior to testing, to allow the defense to analyze the evidence.<sup>287</sup> He argued that splitting the DNA evidence was necessary to preserve his due process rights.<sup>288</sup> The court found that the government’s practices were consistent with wider international standards and practices, and as the government’s actions did not prevent the petitioner from presenting a defense, dismissed the claim.<sup>289</sup> This decision frequently alludes to the widespread nature of the practice that was challenged,<sup>290</sup> suggesting that if the court were to allow the petitioner’s challenge to succeed, there would be a large number of claims that would follow.

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<sup>283</sup> *Id.*, at 451.

<sup>284</sup> *Id.*, at 453.

<sup>285</sup> *Id.*, at 459.

<sup>286</sup> See, e.g., Meredith A. Bieber, *Meeting the Statute or Beating it: Using John Doe Indictments Based on DNA to Meet the Statute of Limitations*, 150 U. PA. L. REV. 1079 (2001-2002).

<sup>287</sup> *Anderson*, 169 F.Supp.3d.

<sup>288</sup> *Id.*, at 64.

<sup>289</sup> *Id.*, at 68-69.

<sup>290</sup> *Id.*

These decisions, when viewed collectively, demonstrate the importance that courts place on the selective nature of post-conviction claims. These decisions show that appellate courts make a conscious effort to narrow the number of future claims by expressly preventing future courts from analyzing the merits of certain claims.<sup>291</sup> While this is seen in decisions such as *Bonds*, where specific instructions to future courts have been given,<sup>292</sup> it also narrows the interpretation of constitutional claims, as seen in decisions such as *Anderson* and *Dixon*.

The data set shows that judges are conscious of finality considerations and during decision-making, allude to concerns that if an appeal were allowed, it would create a flood of future claims. Finality has been identified in existing literature as a mechanism designed to prevent such claims, which allows courts to narrow and focus on credible appeals.<sup>293</sup> Studies have acknowledged the importance of finality in the criminal justice system as a way to guard public resources,<sup>294</sup> and have found that senior judges have been particularly mindful not to waste resources on frivolous claims.<sup>295</sup> While these studies have largely focused on claims of actual innocence and habeas corpus review,<sup>296</sup> this study demonstrates that finality has a wider application, used during all post-conviction proceedings as a means to prevent frivolous claims.

This goal of finality is found throughout judicial decisions across the data set, with appellate courts rejecting petitioners' claims – either expressly or implicitly – to demonstrate that petitioners' challenges are not suited for appellate review. Each of the above cases demonstrate that for both evidentiary and constitutional challenges, appellate judges have shown resistance towards allowing forensic science admissibility challenges founded on the NAS reports. By holding, in particular, that claims based on the general limitations of these forensic science techniques do not warrant appellate

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<sup>291</sup> See, e.g., *Dixon*, 458 Mass.; *Anderson*, 169 F.Supp.3d.

<sup>292</sup> *Bonds*, 12 F.3d.

<sup>293</sup> Cooper, *supra* note 2, at 229.

<sup>294</sup> Robert J. Smith, *Recalibrating Constitutional Innocence Protection*, 87 WASH. L. REV. 139, 198 (2012).

<sup>295</sup> *Id.*

<sup>296</sup> See, e.g., Peter A. Chickris & Mykal J. Fox, *Present Danger: Preventing Wrongful Convictions by Resolving Critical Issues within Texas's Criminal Justice System*, 52 S. TEX. L. REV. 365 (2010-2011).

review,<sup>297</sup> appellate courts are expressly declaring that future claims based on general findings will not amount to successful challenges, preventing future claims. The data set suggests that unless an individual can demonstrate a clear link between the relevant NAS report findings and a specific error in their case, a petition will not be successful. This is addressed specifically in several decisions in the data set, including ***Commonwealth v. Fisher (2005)***.<sup>298</sup>

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<sup>297</sup> See, e.g., *Enderle*, 847 N.W.2d; *Butler*, 278 F.Supp.3d.

<sup>298</sup> *Fisher*, 582 Pa.

## Positioning these Findings Within Existing Knowledge

The data set shows that judges make use of several mechanisms to pursue finality and various policy objectives. As finality does not pursue one single interest, the examples given across the data set merely reflect some of the considerations linked with finality, although by reviewing these considerations collectively, it is clear that finality itself presents a barrier to the judicial consideration of NAS report findings. The data set suggests that where petitioners have referenced NAS report findings to challenge trial court decisions, the NAS reports alone are not substantial enough to overturn the finality in these decisions.

Although finality does not serve one sole interest, the purposes of finality can often be interlinked. This can be seen throughout the decisions outlined above. The connection between finality interests is explored in detail in the literature, particularly within the context of high thresholds and the prevention of frivolous claims. These finality interests are frequently cited as barriers to the fulfilment of justice, particularly when taking into consideration instances of wrongful convictions.<sup>299</sup> While some scholars have found finality considerations to be unduly restrictive, particularly given the number of wrongful convictions discovered through the innocence movement,<sup>300</sup> others have found legal certainty and finality to be an important consideration.<sup>301</sup>

The data set demonstrates the strong relationship between the imposition of high thresholds on appeal and deference to institutional settlement, with courts often using both as a means to justify the dismissal of a petitioner's claim, in the interest of finality. This is most clearly seen through the high threshold of plain error being used as the legal threshold by judges to justify their deference to

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<sup>299</sup> See, e.g., Jonathan W. Diehl, *Drafting a Fair DNA Exception to the Statute of Limitations in Sexual Assault Cases*, 39 JURIMETRICS J. 431 (1998-1999); Plummer & Syed, *supra* note 82.

<sup>300</sup> See, e.g., Anna M. Franceschelli, *Motions for Postconviction DNA Testing: Determining the Standard of Proof Necessary in Granting Requests*, 31 CAP. U. L. REV. 243 (2003); Brandon L. Garrett, *Claiming Innocence*, 92 MINN. L. REV. 1629 (2007-2008).

<sup>301</sup> Normal C. Bay, *Constitution and Truth Seeking: A New Theory on Expert Services for Indigent Defendants*, 86 WASH. U. L. REV. 241 (2008-2009).

trial court decisions – using the legitimacy and certainty within the jury’s decision-making as a means to dismiss petitioners’ challenges, showing fidelity to the legal process through finality.

Although the vast majority of commentary discussing the judicial reasoning and the pursuit of finality as seen in the data set has concentrated on the court’s reliance on the doctrine of harmless error,<sup>302</sup> often within the context of newly discovered evidence claims, this study has identified several additional finality interests that appellate judges have taken into consideration to pursue finality. Each of these interests: high thresholds, deference to institutional settlement, incentivizing defense counsel, and preventing the opening of “floodgates” of frivolous claims, have raised concerns in existing literature, with authors suggesting that the reliance on these interests undermines and impedes the true pursuit of justice, particularly within the context of the innocence movement.<sup>303</sup> Although not explicitly linking finality to the work of Bator and the legal process vision, authors such as Levenson have discussed prosecutors’ focus on finality, even if there exists a chance that there has been a miscarriage of justice.<sup>304</sup> She has also noted that the federal and state criminal justice systems are designed to make post-conviction challenges difficult for petitioners, especially due to the restrictive nature of timeliness and specificity of claim in habeas corpus proceedings.<sup>305</sup> While this study does not focus exclusively on habeas corpus petitions, the findings outlined above provide further instances where individuals have struggled to raise successful post-conviction claims, either due to the high thresholds required to demonstrate prejudice under the law, the lack of procedural error, or the error’s lack of significance to the trial’s outcome.

One of the largest bodies of existing literature discussing the concept of finality discusses the diminishing importance of finality in the era of innocence. Several authors have used examples of DNA exonerations to demonstrate changing attitudes away from finality, especially in areas where scientific

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<sup>302</sup> See, e.g., Keith A. Findley, *Innocence Protection in the Appellate Process*, 93 MARQ. L. REV. 591 (2009-2010); Marks, *supra* note 230; Brandon L. Garrett, *Innocence, Harmless Error, and Federal Wrongful Conviction Law*, 2005 WIS. L. REV. 35 (2005).

<sup>303</sup> See, e.g., Margaret A. Berger, *The Impact of DNA Exonerations on the Criminal Justice System*, 34 J. L. MED. & ETHICS 320 (2006); Marvin Zalman, *An Integrated Justice Model of Wrongful Convictions*, 74 ALB. L. REV. 1465 (2010-2011).

<sup>304</sup> Laurie L. Levenson, *The Problem with Cynical Prosecutor’s Syndrome: Rethinking A Prosecutor’s Role in Post-Conviction Cases*, 20 BERKELEY J. CRIM. L. 335, 376 (2015).

<sup>305</sup> *Id.*

research has undermined the certainty of law.<sup>306</sup> Although this data set discusses similar issues, its findings directly contrast studies focusing on the success of innocence project work in the innocence movement. For example, these findings largely contradict several studies which have specifically analyzed cases where the Innocence Project's DNA exonerations<sup>307</sup> have been studied.<sup>308</sup> By only examining cases where individuals have been successful in challenging evidence, authors have been able to pinpoint hallmarks of a successful challenge,<sup>309</sup> although Garrett has voiced concern that even these challenges have frequently been considered harmless error in previous hearings.<sup>310</sup> Despite this, these studies inform the reader of judicial progress in rejecting finality and embracing scientific findings, providing a one-sided approach to analysis.

The data set in this study examines the underside of this. It reviews the cases where post-conviction appeals have not been able to reach as far as obtaining DNA samples for analysis, or no evidence was present for analysis. It represents the wider struggles of petitioners' challenges to forensic science evidence and the response of the criminal justice system. This data set therefore highlights the wider limitations of judicial decision-making where forensic science is lacking in certainty and there is no clear answer guided by science. In the absence of this, the data set confirms that appellate courts rely on finality indicators to provide certainty in decision-making, dependent upon the type of claim raised. Reliance on finality in this way not only creates certainty for decisions that have already been made, but also prevents future litigation in areas where the underpinning science is lacking in certainty.

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<sup>306</sup> See, e.g., Plummer & Syed, *supra* note 82.

<sup>307</sup> All Cases, Innocence Project, <https://www.innocenceproject.org/all-cases/#> (last visited, Nov. 4, 2019).

<sup>308</sup> See, e.g., Emily West, Vanessa Meterko, *Innocence Project: DNA Exonerations 1989-2014: Review of Data and Findings from the First 25 Years*, 79 ALB. L. REV. 717 (2015).

<sup>309</sup> *Id.*

<sup>310</sup> Garrett, *supra* note 302.

## Chapter 6: Judicial Adherence to the Rationality Assumption

At the heart of the legal process vision is the idea that legitimacy is achieved through a series of processes being followed correctly.<sup>1</sup> Provided that the person/body charged with undertaking a process has the competence to do so (through institutional settlement), the legal process vision recognizes that decisions arrived at are legitimate.<sup>2</sup> Consequently, in the context of the criminal justice system, the responsibility for ensuring that decisions are legitimate is shared between trial court actors. This includes experts and lawyers, as well as judges and juries.

Legal process scholars have situated the purpose of law as being grounded in rationality. Hart and Sacks, in explaining the legal process, believed that “law is a doing of something, a purposive activity, a continuous striving to solve the basic problems of social living.”<sup>3</sup> This has, in turn, placed “severe constraints on the judicial imagination,”<sup>4</sup> particularly where statutes exist.<sup>5</sup> These constraints have helped to create consistency in legal decision-making, which Hart and Sacks believed complement the responsibility of the legislature, as they argued that “every statute must be conclusively presumed to be a purposive act.”<sup>6</sup> This has been dubbed the “rationality assumption,” which Eskridge and Frickey have found critically important to all decision-making within the legal process vision, because it “reaffirmed the objectivity, indeed the legitimacy, of legal rules.”<sup>7</sup>

Legal process scholars have found that legislative bodies have considerable discretion to legislate on a wide variety of matters. The interaction between government branches and the limits of the competence of these actors helps ground the law in rationality,<sup>8</sup> provided that legislative bodies follow “informed, deliberative and efficient procedures,”<sup>9</sup> which are requirements of the legislature’s

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<sup>1</sup> HENRY M. HART, JR. & ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW*, ED. WILLIAM N. ESKRIDGE JR. & PHILIP P. FRICKEY 2045 (Foundation Press 1993)

<sup>2</sup> *Id.*

<sup>3</sup> *Id.*, at 148.

<sup>4</sup> Robert Weisberg, *The Calabresian Judicial Artist: Statutes and the New Legal Process*, 35 *STAN. L. REV.* 213, 217 (1982-83).

<sup>5</sup> *Id.*

<sup>6</sup> HART & SACKS, *supra* note 1, at 1124.

<sup>7</sup> William N. Eskridge & Philip P. Frickey, *Legislation Scholarship and Pedagogy in the Post-Legal Process Era*, 48 *U. PITT. L. REV.* 691, 695 (1987).

<sup>8</sup> HART & SACKS, *supra* note 1, at 148-149.

<sup>9</sup> Eskridge & Frickey, *supra* note 7, at 698.

institutional competence.<sup>10</sup> In existing literature, this has been expanded to include judicial decision-making, with authors arguing that the assumption of rationality is inherently linked to legitimacy in judicial decision-making.<sup>11</sup>

This chapter explores the judicial adherence to the rationality assumption, as seen through appellate judges' reliance on legitimacy, justified through a number of mechanisms. The data set shows that in finding legitimacy in the decision-making process, appellate judges have demonstrated their belief in the rationality of trial court decisions. However, this rationalization has led to irrational results at times, as courts' treatment and interpretation of NAS reports has avoided scientific issues, and is not always grounded in a true representation of the reports. This has often created a paradoxical outcome, which raises questions about the judicial focus on the legitimacy of decision-making through adherence to procedural requirements.

Within the data set, there are four patterns of behavior through which appellate judges demonstrate fidelity to the assumption of rationality, despite leading to irrationalities in the outcome of decisions. These are: 1) the judicial assumption of expert reliability and lawyer competence, despite issues; 2) the judicial assumption of rationality despite a misrepresentation of the findings and recommendations of the NAS reports; 3) the judicial assumption of rationality despite ambiguities in referencing the NAS reports; and 4) the judicial assumption of rationality, despite overlooking substantive issues. Each will now be explored in turn, using examples from the data set to support these arguments.

### **1. The Judicial Assumption of Expert Reliability and Lawyer Competence, Despite Issues**

The data set shows that appellate courts have largely paid deference to the competence of trial court actors. While fidelity to institutional settlement has been discussed in a previous chapter,<sup>12</sup> this section

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<sup>10</sup> HART & SACKS, *supra* note 1, at 164.

<sup>11</sup> See generally, Sarah Lucy Cooper, *Forensic Science Developments and Judicial Decision-Making in the Era of Innocence: The Influence of Legal Process Theory and its Implications*, 19 RICH. J. L. & PUB. INT. 2011 (2015-2016).

<sup>12</sup> See *supra*, Chapter 4: Deference to Institutional Settlement.

discusses decisions where appellate courts have relied on the competence of lawyers and testimony given by scientific expert witnesses to find that trial court verdicts were correctly decided. This is particularly seen where NAS reports have been referenced by petitioners to raise concerns about the methodological limitations in forensic science evidence, contradicting experts' testimony, particularly pattern analysis and additional forms of non-DNA evidence. In addition, where trial court decisions are challenged, emphasis has been placed on the role of the lawyer in cross-examining experts. However, this reliance on the competence of experts<sup>13</sup> and lawyers<sup>14</sup> to affirm trial court decisions, based on the assumption of rationality, has led to irrationalities in the outcome of the appellate court's decision in instances where expert testimony has misled trial court decision-makers.

In the data set, expert testimony is generally afforded considerable deference. This is even seen in instances where experts have provided information that has misled trial court actors. One example where an expert's misleading testimony was given considerable weight and relied upon by decision-makers is *State v. Sharma (2007)*.<sup>15</sup> In this case, polygraph evidence was admitted following a pre-trial hearing, wherein a polygraph expert gave live testimony in support of its admission. The expert testified that polygraph evidence was sufficiently reliable to be admitted, stating that "in 2003 the National Academy of Sciences... indicated an average accuracy rate of 86 percent for laboratory research and an average accuracy rate of 89 percent for field research"<sup>16</sup> of polygraph results. He also alluded to several additional polygraph studies, indicating that they found similar levels of accuracy in polygraph testing,<sup>17</sup> although the reported judgment contains no further details about these studies.

Although the expert primarily relied upon findings from *Polygraph* to support the admissibility of polygraph evidence, *Polygraph* contains no mention of accuracy rates beyond its finding that "the polygraph has an accuracy greater than chance,"<sup>18</sup> and explanation that "variability of accuracy... is

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<sup>13</sup> See, e.g., *State v. Hummert*, 188 Ariz. 119 (Ariz. 1997); *United States v. Allison*, 63 M.J. 365 (M.J. 2006).

<sup>14</sup> See, e.g., *United States v. Gutierrez-Castro*, 805 F.Supp.2d 1218 (D.N.M. 2011); *People v. Gilley*, 2016 WL 383404 (Cal. Ct. App. 2016); *Commonwealth v. Burns*, 90 Mass.App.Ct. 1120 (Mass. App. Ct. 2016).

<sup>15</sup> *State v. Sharma*, 143 Ohio.Misc.2d 27 (Ohio Ct. Com. Pl. 2007).

<sup>16</sup> *Id.*, at 35.

<sup>17</sup> *Id.*

<sup>18</sup> STEPHEN E. FEINBERG, *THE POLYGRAPH AND LIE DETECTION* 123 (National Academies Press 2003).

high.”<sup>19</sup> Despite the inaccuracies in the testimony, the court found the expert to be “eminently qualified,”<sup>20</sup> thanks to his extensive teaching experience in psychology, publications on polygraphs, and professional memberships,<sup>21</sup> leaving the accuracy of polygraph evidence unquestioned. This allowed the court to admit the evidence, finding that “significant advancements have occurred concerning the reliability and relevancy of polygraph tests.”<sup>22</sup> This departed from the federal position outlined in **United States v. Scheffer (1998)**, which found polygraph test results generally inadmissible under *Daubert*.<sup>23</sup> In finding the polygraph evidence admissible,<sup>24</sup> the court’s decision demonstrates an irrationality in making assumptions that expert testimony is factually accurate and reliable, particularly when expert testimony departs from existing understandings of evidence.

The judicial adherence to the rationality assumption through reliance on expert competence despite a resulting irrationality is also seen in **State v. Thomas (2016)**. In *Thomas*, the petitioner argued that the testimony of the ballistics expert should have been limited “to account for scientific and statistical impossibilities in the field.”<sup>25</sup> The petitioner referred to **Ballistic Imaging** and **Strengthening** to support this argument, claiming that the NAS reports “have discredited the reliability of ballistic prints as a form of affirmative proof.”<sup>26</sup> The court dismissed his claim following a review of the ballistics testimony, finding that the expert’s experience gave her the competence to testify “to a scientific certainty.”<sup>27</sup> The court determined that the trial court did not have the opportunity to thoroughly engage with the petitioner’s challenge, which made use of both **Ballistic Imaging** and **Strengthening**, because the petitioner had merely made “fleeting references to the reports.”<sup>28</sup> This furthered the court’s justification that no legal error had been made.<sup>29</sup> The appellate court’s decision was grounded

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<sup>19</sup> *Id.*, at 124.

<sup>20</sup> *Sharma*, 143 Ohio.Misc.2d, at 34.

<sup>21</sup> *Id.*

<sup>22</sup> *Id.*, at 36.

<sup>23</sup> *See*, *United States v. Scheffer*, 523 U.S. 303 (1998).

<sup>24</sup> *Sharma*, 143 Ohio.Misc.2d at 37.

<sup>25</sup> *State v. Thomas*, 2016 WL 7799279, 12 (Tenn. Ct. App. 2016).

<sup>26</sup> *Id.*, at 13.

<sup>27</sup> *Id.*, at 14.

<sup>28</sup> *Id.*, at 16.

<sup>29</sup> *Id.*

in the rationality assumption, as they found that the trial court was correct in determining the weight of the ballistics evidence, as the expert had used “widely accepted”<sup>30</sup> techniques to determine a match. It concluded that it was improper to conduct a plain error review of the admission of the evidence.<sup>31</sup> This decision was grounded in the rationality that the expert had sufficient competence to testify, using her experience to avoid discussing the reliability issues raised by the two NAS reports.

Courts have also relied on the competence of testifying experts, even when their experience and qualifications have been questioned or undermined. For example, in ***Smith v. Uribe (2016)***, the petitioner claimed that his trial counsel was ineffective in failing to object to the state’s firearms testimony, as ***Ballistic Imaging*** discredited the testimony, and defense counsel did not make use of the report to challenge the testimony.<sup>32</sup> The court downplayed the significance of defense counsel’s lack of awareness of the report, on the basis that counsel was not expected to know, as ***Ballistic Imaging*** was published “just a few months before petitioner’s trial.”<sup>33</sup> This affirmed the legitimacy in the trial outcome and rationalized the defense counsel’s behavior, which allowed the court to find that counsel had not acted outside of their competence. However, the court still addressed questions relating to the expert’s credentials, concluding that the expert also acted within their competence, as they were “an expert with substantial training and experience.”<sup>34</sup> It ultimately found that both the expert and defense counsel had acted within their competence and the jury had come to a rational decision, dismissing the petitioner’s objections as he could not “show his testimony rendered the trial fundamentally unfair.”<sup>35</sup>

Following ***Melendez-Diaz v. Massachusetts (2009)***, courts have placed a greater emphasis on the procedural requirement of cross-examination, designed to require experts to testify in person<sup>36</sup> and allow lawyers the opportunity for cross-examination, as required under the Confrontation Clause. By

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<sup>30</sup> *Id.*

<sup>31</sup> *Thomas*, 2016 WL.

<sup>32</sup> *Smith v. Uribe*, 2016 WL 1165822, 10 (C.D. Cal. 2016).

<sup>33</sup> *Id.*

<sup>34</sup> *Id.*, at 11.

<sup>35</sup> *Id.*

<sup>36</sup> *See, Melendez-Diaz v. Massachusetts*, 557 U.S. 305 (2009).

requiring experts to testify in person and be available for cross-examination,<sup>37</sup> the role of the expert has changed, as they are subject to a greater level of scrutiny through the mandatory opportunity to cross-examine by opposing counsel.<sup>38</sup> This opportunity for cross-examination has been interpreted by courts to equate to fairness in the trial process, and consequently rationality in the outcome.

Despite the increased responsibility of experts under *Melendez-Diaz*, courts still need to take a flexible approach towards the admissibility of expert testimony in the courtroom, due to the diversity of forensic science disciplines. This places a functional benefit on assuming the rationality in expert testimony, as an independent verification of expert competence would place a heavy burden on the criminal justice system. Given the diversity of forensic science disciplines and methodologies,<sup>39</sup> decisions within the data set have generally found it reasonable to assume that the responsibility for demonstrating the reliability of their technique is on the testifying expert, including limitations.<sup>40</sup> However, in early examples from the data set where DNA evidence has been questioned, judges have been more willing to explore the findings and recommendations of *DNA 1* and *DNA 2*.<sup>41</sup> Later decisions have reverted to a greater reliance on experts' competence.<sup>42</sup>

One example of the judicial reliance on the competence of experts in their testimony as a means to assume rationality in the trial court's decision is found in *State v. Hummert (1997)*. The court dismissed the petitioner's DNA admissibility challenge, which questioned the DNA expert's decision to provide a qualitative determination of the significance of a DNA match, and interpreted *DNA 2* to mean that "there is no single or specific ways of explaining the significance [of a DNA match] in a forensic setting... the expert may testify and express his or her opinions in several ways that effectively communicate his or her findings."<sup>43</sup> This interpretation emphasizes the assumption that experts are

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<sup>37</sup> *Id.*

<sup>38</sup> *Id.*

<sup>39</sup> See generally, Gary Edmond, *What Lawyers Should Know about the Forensic Sciences*, 36 ADEL. L. REV. 33 (2015).

<sup>40</sup> See, e.g., *United States v. Boyd*, 686 F.Supp.2d 382 (S.D.N.Y. 2010); *Turner v. State*, 953 N.E.2d 1039 (Ind. 2011).

<sup>41</sup> See, e.g., *United States v. Bonds*, 12 F.3d 540 (6th Cir. 1993); *People v. Barney*, 8 Cal.App.4th 798 (Cal. Ct. App. 1992).

<sup>42</sup> See, e.g., *Hudson v. State*, 844 So.2d 762 (Fla. Dist. Ct. App. 2003); *Brown v. State*, 163 S.W.3d 818 (Tex. App. 2005); *State v. Belken*, 633 N.W.2d 786 (Iowa 2001).

<sup>43</sup> *Hummert*, 188 Ariz. at 124.

sufficiently versed in their craft to decide how to present evidence, and that despite **DNA 2** contradicting this, courts are not willing to question experts' competence, assuming rationality in experts' analysis and testimony. As an additional safeguard, the court encouraged defense counsel to carry out effective cross-examination of the witness, to determine the expert's qualifications and reliability of their findings and conclusions.<sup>44</sup>

In ensuring that experts demonstrate the reliability of their scientific evidence before the trial judge and jury – particularly through cross-examination – appellate courts have assumed rationality in trial court decisions. This can be found even in instances where expert testimony has contradicted NAS report findings, seen in several cases prior to **DNA 2** which found that the significance of a DNA match using the product rule was admissible, contrary to **DNA 1**'s recommendations. For example, in **People v. Heaton (1994)**, the court dismissed the petitioner's challenge to the admissibility of the product rule, finding that "the trial court was not faced with evidence that [the DNA expert's] product rule method was the subject of debate within the scientific community."<sup>45</sup> It rationalized its decision to dismiss the appeal as the "defendant presented no such evidence [of debate], and no such evidence is properly before the court on review."<sup>46</sup> The court placed responsibility on trial counsel to highlight any potential irregularities/irrationality in the expert testimony. In doing so, it acknowledged the rationality in the competence of both the expert and trial court, particularly as the trial court was not made aware of the limitations of the proffered DNA evidence.

Similarly, in **People v. Soto (1994)**, the court also dismissed the petitioner's admissibility challenge to the product rule, supported by **DNA 1**.<sup>47</sup> By calling the admissibility of the product rule a "narrow issue"<sup>48</sup> and finding that it satisfied the *Kelly* admissibility framework,<sup>49</sup> the court limited the significance of the petitioner's challenge and avoided an analysis of the scientific issues. By resolving

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<sup>44</sup> *Id.*, at 126.

<sup>45</sup> *People v. Heaton*, 640 N.E.2d 630, 636 (Ill. App. Ct. 1994).

<sup>46</sup> *Id.*

<sup>47</sup> *People v. Soto*, 35 Cal.Rptr.2d 846, 853 (Cal. Ct. App. 1994).

<sup>48</sup> *Id.*, at 854.

<sup>49</sup> *Id.*, at 855.

the issue through a legal mechanism, the court demonstrates the assumption of rationality in the trial court's decision-making, finding that the correct legal analysis procedures had been followed.

The judicial avoidance of scientific issues and deference to trial court procedures on the assumption of rationality in trial court decisions has led to irrationality in appellate decisions in several further cases. For example, in *Keirsay v. State (1995)*, the court found the product rule to be “nothing more than a theory that produces an estimate,”<sup>50</sup> when its admissibility was challenged. It concluded that the expert had satisfied the trial court that the product rule was admissible under the state's *Frye-Reed* standard,<sup>51</sup> as it was an equivalent alternative to the *DNA 1*-recommended ceiling principle,<sup>52</sup> despite the technique being highlighted by *DNA 1* as requiring more development. By couching its justification in terms of the expert's competence, the court was able to rationalize its departure from the findings and recommendations of *DNA 1* and precedent, allowing the trial court decision to stand.

This approach – accepting the admissibility of an emerging DNA analysis technique prior to its recommendation by the NAS – is seen in *Harmon v. State (1995)*, where the court found that the trial court had been correct in admitting DNA evidence prepared using PCR analysis.<sup>53</sup> It justified its decision in the belief that the expert had sufficiently demonstrated the general acceptance of PCR DNA typing.<sup>54</sup> The court, in using the expert's testimony as a justification for their acceptance of the PCR analysis method, ignored the recommendations of *DNA 1*, which found the technique had not yet gained sufficient reliability, creating a paradox in their assumption of the rationality in the trial court's decision.

By relying on the competence of experts, and the competence of defense counsel to carry out cross-examination, appellate courts have allowed their decisions to be grounded in the rationality assumption. The rationality assumption, in assuming that juries have made legitimate decisions based

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<sup>50</sup> *Keirsay v. State*, 106 Md. App. 551, 575 (Md. Ct. Spec. App. 1995).

<sup>51</sup> *Id.*

<sup>52</sup> *Id.*

<sup>53</sup> *Harmon v. State*, 908 P.2d 434 (Alaska Ct. App. 1995).

<sup>54</sup> *Id.*, at 442.

on the information provided to them by competent experts, allows for appellate judges to find legitimacy – and therefore rationality – in trial court decisions, despite the findings and recommendations of the NAS reports often providing contradictory information.

## **2. The Judicial Assumption of Rationality Despite a Misrepresentation of the Findings and Recommendations of the NAS Reports**

Across the data set, petitioners have challenged the admissibility of forensic science evidence, relying on findings and recommendations of the NAS reports which have found limitations in forensic science methodologies. As a consequence, courts have routinely evaluated the relevant findings and recommendations to explore admissibility issues raised by petitioners, using the rationality assumption (and other legal process indicators) to determine that forensic science limitations have properly been considered. However, several decisions in the data set show that decision-makers have relied upon misinterpretations or misrepresentations of these reports' findings in their analysis, meaning that the rationality behind the decision is built on inaccurate foundations, demonstrating that the rationality of these decisions is flawed.

One of the most common instances in the data set where appellate judges have dismissed claims based on flawed rationality is when courts have accepted scientific impossibilities as fact, particularly in relation to claims of zero error rates, an issue that has been consistently highlighted by NAS reports. For example, in *State v. McGraw (2015)*, the appellate court rejected the petitioner's motion that the State's firearms expert exceeded the scope of their testimony when they testified "that the spent shell was fired from the Mossberg to the exclusion of all other firearms."<sup>55</sup> The petitioner had referred to *Ballistic Imaging* to support his argument that absolute certainty is impossible.<sup>56</sup> The court dismissed the claim, finding that *Ballistic Imaging*, and additional sources relied upon by the petitioner, "at most... show no complete uniformity of thought presently exists regarding the reliability of firearm

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<sup>55</sup> *State v. McGraw*, 243 N.C.App. 675, 4 (N.C. Ct. App. 2015).

<sup>56</sup> *Id.*

identification,”<sup>57</sup> and that where a conflict exists, “the proper weight to be accorded the evidence is within the province of the jury,”<sup>58</sup> concluding that cross-examination eliminated any possibilities of a different conclusion.<sup>59</sup>

In reviewing this decision, it appears that the court’s interpretation overlooked *Ballistic Imaging’s* findings, despite recognizing the conflict between the expert’s certainty and the report’s findings. The decision suggests that the court did not thoroughly examine the NAS report, as its reasoning appears to be based on generalizations, overlooking the specific concerns raised by the petitioner and ignoring the findings and recommendations of *Ballistic Imaging*.

Similar issues have arisen in further decisions where petitioners have challenged expert testimony stating that a ballistics match is 100% accurate, that an expert is absolutely certain about a match, or that the method used has an error rate of zero. For example, the petitioner in *State v. Langlois (2013)* referenced the scrutiny placed upon ballistic evidence in both *Ballistic Imaging* and *Strengthening* to challenge the reliability of the ballistics evidence introduced at trial and the expert’s claim of absolute certainty.<sup>60</sup> After acknowledging the contributions of the NAS reports to current scientific opinion about ballistic and tool mark evidence, the court limited the significance of these reports by stating that “it is not its [the reports’] purpose to opine on the long-established admissibility of tool mark and firearms testimony in criminal prosecutions,”<sup>61</sup> whilst acknowledging that the court had the competence to review the admissibility of evidence presented.<sup>62</sup> After reviewing the firearms testimony, it determined that the evidence had satisfied the reliability threshold under the State’s Evidence Rule 702.<sup>63</sup> The court further justified its decision on the basis that the ballistics experts

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<sup>57</sup> *Id.*, at 7.

<sup>58</sup> *Id.*

<sup>59</sup> *Id.*, at 10.

<sup>60</sup> *State v. Langlois*, 2 N.E.3d 936, 944-945 (Ohio Ct. App. 2013).

<sup>61</sup> *Id.*, at 945.

<sup>62</sup> *Id.*

<sup>63</sup> *Id.*, at 950.

testified that they had employed standard methods for analyzing the examined objects, and that “neither expert opined in absolute terms.”<sup>64</sup>

The court’s recognition of the importance of findings from *Ballistic Imaging* and *Strengthening* but subsequent efforts to side-line findings and recommendations in favor of following established legal procedures puts into question the rationality behind the court’s reasoning, particularly in the misinterpretation that absolute certainty and reliability are interchangeable. In *Strengthening*, the NAS warned about the dangers of experts misleading decision-makers when testifying to absolute certainty,<sup>65</sup> but stopped short of discussing the admissibility of these techniques.<sup>66</sup> The court in *Langlois* mistakenly took this to advocate the acceptance of unqualified expert testimony.

This is also seen in relation to other forensic science techniques evaluated in *Strengthening*. For example, in *United States v. Watkins (2011)*, the petitioner challenged the testimony of the state’s fingerprint expert, arguing that their submission that “where the ACE-V method for identifying fingerprints “is used properly by a competent examiner,” the error rate for identification is zero,”<sup>67</sup> was a false assertion.<sup>68</sup> The court, in dismissing the challenge, stated that *Strengthening*’s findings did not mean that “the district court erred in determining that the ACE-V method was scientifically valid,”<sup>69</sup> finding rationality in the trial court’s decision. The court downplayed the petitioner’s concerns, finding the expert’s error rate to be “allegedly mistaken.”<sup>70</sup> However, in doing so, this decision created inconsistencies in the appellate decision as it had previously acknowledged the merits of *Strengthening*, undermining the rationality in the court’s reasoning.

The misunderstanding of the significance of *Strengthening* is also seen in *United States v. Stone (2012)*. In *Stone*, the court addressed the petitioner’s *in limine* challenge to exclude latent print

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<sup>64</sup> *Id.*, at 951.

<sup>65</sup> *See, e.g.*, HARRY T. EDWARDS & CONSTANTINE GATSONIS, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* 103-104 (National Academies Press 2009).

<sup>66</sup> *Id.*, at 154.

<sup>67</sup> *United States v. Watkins*, 450 Fed.Appx. 511, 515 (6th Cir. 2011).

<sup>68</sup> *Id.*

<sup>69</sup> *Id.*, at 516.

<sup>70</sup> *Id.*

testimony on the basis that **Strengthening** undermined the reliability of fingerprint analysis.<sup>71</sup> It found that “such an unspecified challenge to a well-established area of expertise does not warrant a *Daubert* hearing,”<sup>72</sup> justifying its decision to side-line the findings of **Strengthening** because the report was not designed to have a direct and specific application to the questioned testimony.<sup>73</sup>

It has been argued that courts’ side-lining of NAS report findings provided legal grounds to justify dismissal of the petitioner’s claim, which are instead justified through a reliance on scientific assumptions,<sup>74</sup> ignoring scientific knowledge accumulation, research and culture.<sup>75</sup> The author agrees with this position, finding that the rationalization of decisions through legal mechanisms can lead to absurdities as a result of ignoring scientific considerations.

This absurdity in justifying decisions through procedural legitimacy, despite the NAS reports questioning the substance upon which the decisions were made is also found in **Commonwealth v. Wadlington (2017)**. In **Wadlington**, the court used the testifying expert’s interpretation of error rates (and defense counsel’s lack of specific objection to the testimony) to dismiss the significance of **Strengthening**.<sup>76</sup>

These decisions are merely a few from the data set that dismiss the significance of the findings and recommendations of **Strengthening** and/or **Ballistic Imaging**, either by misrepresenting the findings and recommendations of the reports, or limiting their significance to the point that it creates double standards, undermining the rationality assumption.<sup>77</sup> The misinterpretation of NAS reports – or at least uncertainty surrounding the use of these reports in the criminal justice system – can also be seen in relation to the application of **DNA 1** and **DNA 2**. This has led to a misapplication of these reports’

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<sup>71</sup> United States v. Stone, 848 F.Supp.2d 714, 716-717 (E.D. Mich. 2012).

<sup>72</sup> *Id.*, at 717.

<sup>73</sup> *Id.*

<sup>74</sup> See generally, Erica Beecher-Monas, *The Heuristics of Intellectual Due Process: A Primer for Triers of Science*, 75 N. Y. U. L. REV. 1563, 1583 (2000).

<sup>75</sup> *Id.*, at 1578-1584.

<sup>76</sup> Commonwealth v. Wadlington, 467 Mass. 192, 205 (Mass. 2014).

<sup>77</sup> See also, United States v. Barnes, 2008 WL 9359653 (S.D.N.Y. 2008); People v. Givens, 30 Misc.3d 475 (N.Y. 2010); In Re Pruett, 609 Fed.Appx. 819 (5th Cir. 2015).

findings in several decisions, although unlike instances where **Strengthening** has been subject to misrepresentation/misinterpretation, the extent of this is more limited.

Questions about the interpretation of a NAS report and the resulting conflicting interpretations of findings have led to inconsistencies in decisions across the data set. This also demonstrates appellate courts' willingness to interpret the findings and recommendations of NAS reports in a way that allows an appellate court to find rationality in trial court decisions. The uncertainty and resulting conflict in interpretation of a specific excerpt from **DNA 2** is found in **People v. Pizarro (2002)**<sup>78</sup> and subsequent cases. The court closely followed the findings and recommendations of **DNA 1** and **DNA 2** to analyze whether the DNA evidence had been correctly admitted.<sup>79</sup> In its analysis, it settled an area of uncertainty and interpreted a recommendation from **DNA 2** regarding the calculation of the product rule to require the race of the *perpetrator* to be considered when calculating the frequency of a random match, if this information is known, as opposed to using the race of the *suspect*.<sup>80</sup> In reaching this conclusion, the court reviewed general commentary surrounding this recommendation,<sup>81</sup> which stated that "if the race of the person who left the evidence-sample is known, the database for the person's race should be used."<sup>82</sup>

In the subsequent case of **People v. Wilson (2004)**, the same court rejected the petitioner's claim, which argued that the **Pizarro** interpretation of **DNA 2** should have been followed, particularly as it provided clarity on an area that had been the subject of academic debate.<sup>83</sup> Specifically, the petitioner argued that "a preliminary showing of the perpetrator's race is needed to establish the relevant population database for calculating a DNA profile frequency."<sup>84</sup> However, after acknowledging the relevance of **Pizarro**, the court rejected its reasoning, finding that "the relevant group for determining random-match probabilities is the *population of possible suspects*, not the perpetrator's population"

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<sup>78</sup> *People v. Pizarro*, 123 Cal.Rptr.2d 782 (Cal. Ct. App. 2002).

<sup>79</sup> *Id.*

<sup>80</sup> *Id.*, at 857.

<sup>81</sup> *Id.*, at 858.

<sup>82</sup> JAMES F. CROW, *THE EVALUATION OF FORENSIC DNA EVIDENCE*, 122 (National Academies Press 1995).

<sup>83</sup> *Pizarro*, 123 Cal.Rptr.2d at 858.

<sup>84</sup> *People v. Wilson* 21 Cal.Rptr.3d 102, 103 (Cal. Ct. App. 2004).

[emphasis in original].<sup>85</sup> The court supported its conclusion by referencing an extract from **DNA 2**,<sup>86</sup> which required the “most relevant”<sup>87</sup> racial population to calculate the frequency of a random match.

In light of the ambiguity in the interpretation of **DNA 2**, the court was able to determine that by creating population frequencies based on the *suspect’s* ethnicity, it assesses “the rarity of the matched profile in the population from which the evidence sample *may* have come” [emphasis in original].<sup>88</sup>

The court further relied on precedent, specifically **People v. Soto (1999)**, which also discussed the interpretation of population groups and probability statistics.<sup>89</sup> However, **Soto** does not directly address the relevance of different population groups when calculating the significance of a DNA match, as the DNA expert in **Soto** had prepared probability statistics for all major population groups,<sup>90</sup> and the issue that was before the court was whether the unmodified product rule had gained general acceptance to satisfy the *Kelly* admissibility framework.<sup>91</sup>

The **Wilson** court’s rationalization of its decision to depart from **Pizarro** through relying on precedent is flawed. In addition, its isolated approach to interpreting **DNA 2** also appears to be based upon a limited understanding of the NAS report. This has been problematic, as the **Wilson** interpretation of **DNA 2** has since been followed in subsequent cases. For example, in **People v. Cua (2011)**, the court determined that the expert’s use of “major population groups within the United States”<sup>92</sup> was a satisfactory way of fulfilling the requirements of the recommendation in **DNA 2**.<sup>93</sup>

A further, and more common misinterpretation of the findings and recommendations of **DNA 1** and **DNA 2** has involved courts’ acceptance of DNA evidence presented without any accompanying evidence of the statistical significance of the DNA match. When compared with the number of cases

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<sup>85</sup> *Id.*, at 104.

<sup>86</sup> *Id.*

<sup>87</sup> CROW, *supra* note 82, at 127.

<sup>88</sup> *Wilson*, 21 Cal.Rptr.3d at 104.

<sup>89</sup> *Soto*, 35 Cal.Rptr.2d.

<sup>90</sup> *Id.*, at 532.

<sup>91</sup> *Id.*, at 541.

<sup>92</sup> *People v. Cua*, 191 Cal.App.4th 582, 603 (Cal. Ct. App. 2011).

<sup>93</sup> *Id.*

discussing **DNA 1** and **DNA 2** across the data set, they are comparatively small in number, with only twelve decisions upholding the admissibility of DNA evidence without statistics. However, their existence demonstrates courts' willingness to interpret the NAS reports in a way that supports a trial court's decision to omit statistics, even though this misrepresents the NAS reports' findings, particularly, **DNA 1**, which recommended that a DNA match "requires a valid scientific method or estimating the probability that a random person might by chance have matched the forensic sample at the sites of DNA variation examined."<sup>94</sup>

The acknowledgement of the NAS report's recommendation but subsequent dismissal of petitioners' claims questions the rationality of the decision made in several cases, including *State v. Bloom (1994)*.<sup>95</sup> In *Bloom*, the court acknowledged **DNA 1**'s recommendation that the ceiling principle should be used to calculate the significance of a DNA match.<sup>96</sup> However, it found that "it may be pointless to expect ever to reach a conclusion on how to estimate, with any degree of precision, the probability of a random match."<sup>97</sup> This led the court to conclude that – believed to be in accordance with **DNA 1** – the expert should not be allowed to testify to uniqueness,<sup>98</sup> but held that a "verbal, qualitative, non-statistical presentation of underlying statistical evidence"<sup>99</sup> was admissible, despite **DNA 1** only recommending the ceiling principle.

The same rationalization mechanisms have been used in decisions analyzing **DNA 2**, which has also led to irrationality in decisions made. In **DNA 2**, the NAS changed its position regarding the most appropriate means to calculate the significance of a DNA match, finding that "sufficient data have been gathered to establish that neither ceiling principle is needed,"<sup>100</sup> and instead recommended the product rule calculation method.<sup>101</sup> Some courts struggled to adapt to this change, as the reasoning

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<sup>94</sup> VICTOR A. MCKUSICK, *DNA TECHNOLOGY IN FORENSIC SCIENCE* 74 (National Academies Press 1992).

<sup>95</sup> *State v. Bloom*, 516 N.W.2d 159 (Minn. 1994).

<sup>96</sup> *Id.*, at 172-173.

<sup>97</sup> *Id.*, at 166.

<sup>98</sup> *Id.*, at 168.

<sup>99</sup> *Id.*

<sup>100</sup> CROW, *supra* note 82, at 35.

<sup>101</sup> *Id.*, at Chapter 5.

that they previously relied upon to rationalize decisions changed. This has led to some decisions misinterpreting *DNA 2*. For example, in *Young v. State (2005)*, the Maryland Court of Appeal relied on an excerpt from *DNA 2* to find that if the significance of a random match is so small that it becomes “unreasonable to suppose that a second person in the population might have the same profile,”<sup>102</sup> an assumption of uniqueness may be given.<sup>103</sup> This decision, while quoting *DNA 2*, disregarded the report’s recommendations – which found that the use of statistics to determine the probative value of a match was rational – which raises questions about the rationality of the decision. This is problematic, considering that this was subsequently followed in *Commonwealth v. Thad. T. (2003)*, where a qualitative opinion as to a DNA match was found admissible,<sup>104</sup> despite recognition that qualitative evaluations were against general practice.<sup>105</sup>

Similarly, the court in *People v. Coy (2000)* discussed the relevance of the statistical significance of a non-exclusionary DNA match in a mixed sample. The petitioner had challenged the state’s assertion that statistical calculations of the DNA match were simply a matter of weight, and the DNA evidence was admissible without statistical calculations.<sup>106</sup> The court agreed, following an excerpt from *DNA 1* which stated that “to say that two patterns match, without providing any scientifically valid estimate... of the frequency with which such matches might occur by chance, is meaningless.”<sup>107</sup> In its decision, the court also referred to precedent, even though the cited precedent found the need for the statistical significance of a match to accompany DNA evidence to be an admissibility matter, including *United States v. Porter (1992)*,<sup>108</sup> *People v. Barney (1992)*,<sup>109</sup> and *Commonwealth v. Lanigan (1992)*.<sup>110</sup> Although it ultimately reversed the trial court decision and remanded the case for a new trial,<sup>111</sup> the court demonstrated hesitancy in interpreting the specific requirements of *DNA 2*, and

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<sup>102</sup> *Young v. State*, 388 Md. 99, 115 (Md. 2005), quoting *Crow*, *supra* note 82, at 136.

<sup>103</sup> *Id.*

<sup>104</sup> *Commonwealth v. Thad T.*, 59 Mass.App.Ct. 497, 505-506 (Mass. App. Ct. 2003).

<sup>105</sup> *Id.*

<sup>106</sup> *People v. Coy*, 243 Mich.App. 283 (Mich. Ct. App. 2000).

<sup>107</sup> *Id.*, at 298, quoting *McKusick*, *supra* note 94, at 74.

<sup>108</sup> *United States v. Porter*, 618 A.2d 629 (D.C. 1992).

<sup>109</sup> *Barney*, 8 Cal.App.4th.

<sup>110</sup> *Commonwealth v. Lanigan*, 413 Mass. 154 (Mass. 1993).

<sup>111</sup> *Coy*, 243 Mich.App. at 317.

instead recommended that experts provide the trier of fact with “some expert guidance about its probative value.”<sup>112</sup> This resulted in a broad interpretation of the case law and NAS reports, with the court finding that “some qualitative or quantitative interpretation must accompany evidence of the potential match.”<sup>113</sup>

A court’s hesitancy in creating a definitive interpretation of NAS report findings to avoid disagreement with a trial court decision is also seen in *People v. Pike (2016)*, where the petitioner questioned the relevance of DNA statistics in relation to a degraded DNA sample which did not positively identify the petitioner.<sup>114</sup> In this case, the DNA recovered from the crime scene could not be positively identified, but tested positive for a Y chromosome, excluding the biologically female population. These findings were subsequently brought into evidence, even though they only excluded 50% of the population. The court, in response to the challenge to the relevancy of this evidence, sought to determine whether this evidence had any probative value.<sup>115</sup> It found that admitting a 50% inclusion probability statistic was erroneous, as the statistic was irrelevant,<sup>116</sup> but held that the error was harmless as the victims also positively identified the petitioner, which further supported the conviction.<sup>117</sup> This suggests that the court acknowledged the irrationality in the admission of the DNA evidence as the evidence itself lacked specific relevance. However, as further evidence supported the petitioner’s conviction, it was able to rationalize its decision to dismiss the claim and limit the significance of the DNA evidence.

These cases demonstrate that courts have relied on misinterpretations of NAS report findings to find rationality in trial court decisions. These decisions are often supported by precedent to further strengthen their justification. However, this decision-making has led to some inconsistencies and irrationality, due to decisions being justified through misinterpretations of NAS report findings. Moreover, the data set suggests that precedent allows these misrepresentations to be perpetuated,

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<sup>112</sup> *Coy*, 243 Mich.App. at 301, quoting *Crow*, *supra* note 82, at 193.

<sup>113</sup> *Id.*, at 302.

<sup>114</sup> *People v. Pike*, 53 N.E.3d 147 (Ill. App. Ct. 2016).

<sup>115</sup> *Id.*, at 168-170.

<sup>116</sup> *Id.*, at 170.

<sup>117</sup> *Id.*

as such interpretations have been relied upon by subsequent courts, showing the vulnerability of decision-making. This form of irrationality can appear in several ways, but is most commonly seen where NAS report findings – particularly **DNA 1** and **DNA 2** – are interpreted without the wider context of the report.<sup>118</sup>

These findings suggest that while courts are aware of the NAS reports and show willingness to reference their findings to support decision-making (often dictated by precedent, as found in **People v. Coy**<sup>119</sup>), where contradicting precedent exists, judges are hesitant to directly follow the content of the NAS reports. This suggests that the rationality assumption is primarily concerned about internal legal and procedural issues, which dictate how non-legal (in this case, scientific) issues are perceived and interpreted. The data set shows that this can lead to absurdity when these issues do not align, as appellate courts have overlooked petitioners' concerns<sup>120</sup> and misinterpreted NAS report findings and recommendations when raised by petitioners.<sup>121</sup>

### **3. The Judicial Assumption of Rationality in Decision-Making Despite Ambiguities in Judges' Reliance on the NAS Reports**

Within the data set, a significant number of decisions have not provided any clarity as to which NAS report is used to support either the petitioner's claim or the court's reasoning. Across the data set, nearly 200 decisions have not referred to a NAS report explicitly by name, including forty cases that have referenced a forensic science NAS report without providing any indicators as to which report has been referenced.<sup>122</sup> The majority of these decisions include indicators of specific NAS reports,

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<sup>118</sup> See, e.g., *Bloom*, 516 N.W.2d; *Young*, 388 Md.; *Thad T.*, 59 Mass.App.Ct.

<sup>119</sup> *Coy*, 243 Mich.App.

<sup>120</sup> See, e.g., *McGraw*, 243 N.C.App.; *Langlois*, 2 N.E.3d.

<sup>121</sup> See, e.g., *Pike*, 53 N.E.3d.

<sup>122</sup> See *supra*, Chapter 2: Methods, at 75.

including dates,<sup>123</sup> citations,<sup>124</sup> forensic science discipline evaluated,<sup>125</sup> report-specific discussions,<sup>126</sup> report-specific abbreviations,<sup>127</sup> and simple mistakes.<sup>128</sup> The residual forty cases could not positively identify a single NAS report.<sup>129</sup>

In addition to decisions leaving ambiguity as to which NAS report is relevant to the claim, there are several examples where NAS reports are referred to inaccurately, which raises questions about the appellate court's basis for their decision, as inaccurate references can undermine the assumption of rationality in the decision-making process. It also questions the thoroughness of the court's analysis of the substantive issues. For example, the Supreme Court of Kansas quoted **DNA 1** in *State v. Colbert (1995)*, but erroneously referred to the report committee as "the Committee on DNA Technology and Forensic Science."<sup>130</sup> This inaccuracy is minor, although potentially problematic – the committee was named the Committee on DNA Technology *in* Forensic Science. This opinion was subsequently cited by the same court in *State v. Isley (1997)* without being corrected. In *Isley*, the court directly quoted the passage from *Colbert*,<sup>131</sup> with any potential subsequent cases citing either decision potentially perpetuating the inaccurate reference, particularly if courtroom actors do not return to the original source. This potentially gives rise to inaccurate interpretations. Inaccurate references to the NAS

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<sup>123</sup> For example, the author determined that **DNA 1** was referenced in cases such as *United States v. Bonds*, 18 F.3d 1327 (6th Cir. 1994) and *People v. Chandler*, 211 Mich.App. 604 (Mich. Ct. App. 1995), because these cases were decided in 1994 and 1995 respectively. As these decisions discuss a NAS report as referenced in relation to DNA evidence, the author's determination relied upon the reference being made before the publication of **DNA 2**.

<sup>124</sup> For example, in *State v. Negrone*, 2002 WL 575577 (Iowa. Ct. App. 2002), the court cited **DNA 1** by referring to it as "the NRC report" (at 2). As the court directly cited a passage from the NAS report, it was clear that the court was discussing **DNA 1**.

<sup>125</sup> The relevant NAS report was clearly identifiable in *Murphy v. State*, 24 So.3d 1220 (Fla. Dist. Ct. App. 2009). The court referred to **Bullet Lead** as "a 2004 report by the National Research Council on comparative bullet-lead analysis" (at 1222). Similar determinations have been made to attribute NAS report references to further cases, including in *Webster v. State*, 252 P.3d 259 (Okla. Crim. App. 2011), where the court quoted **Strengthening** by referring to the report as "a recent report from the National Academy of Science" within the context of fingerprint analysis (at 277).

<sup>126</sup> In *Kulbicki v. State*, 207 Md.App. 412 (Md. Ct. Spec. App. 2012), the court discussed **Bullet Lead**'s explanation of CBLA evidence at length, without mentioning the report by name.

<sup>127</sup> Often, the two DNA reports **DNA 1** and **DNA 2** are simply referenced as NRC 1/I and NRC 2/II. These were allocated accordingly as either citing **DNA 1**, **DNA 2** or both.

<sup>128</sup> The Supreme Court of Kansas in *State v. Colbert*, 257 Kan. 896 (Kan. 1995) referred to **DNA 1** as "the publications of the Committee on DNA Technology and Forensic Science," when the committee producing the report was entitled the Committee on DNA Technology *in* Forensic Science [emphasis added].

<sup>129</sup> See, e.g., *Leonard v. Michigan*, 256 F.Supp.2d 723 (W.D. Mich. 2003); *People v. Allred*, 2003 WL 21101793 (Cal. Ct. App. 2003); *Belken*, 633 N.W.2d.

<sup>130</sup> *Colbert*, 257 Kan., at 908.

<sup>131</sup> *State v. Isley*, 262 Kan. 281, 287 (Kan. 1997).

reports are not uncommon among the data set, with several further examples of reference to fundamental information about a NAS report is found in *United States v. Glynn (2008)*, where *Ballistic Imaging* was referenced as “Ballistics Imaging.”<sup>132</sup> Further, the court in *State v. Hummert (1997)* erroneously referred to *DNA 1* as “The Evaluation of Forensic DNA Evidence,” the title of *DNA 2*.<sup>133</sup>

In addition to these decisions inaccurately citing the forensic science NAS reports, there are forty decisions in the data set where the author was not able to positively identify a report, leaving ambiguities about the rationality of the appellate court’s decision. This is because it is difficult to understand the rationale behind a court’s decision-making process if the decision is dependent upon the findings and recommendations of an unidentified NAS report.

This lack of clarity in referring to NAS reports has led to ambiguity in a number of decisions which have referenced a NAS report as part of the decision-making process. This ambiguity raises questions about the legitimacy – and therefore rationality – of the court’s decision, due to the lack of transparency, and resulting confusion of issues. For example, in *United States v. Allison (2006)*, the court found that the DNA expert in this case had “used a method provided by the National Research Council (NRC) giving guidance on “how frequency [*sic*] of occurred values should be calculated.””<sup>134</sup> This is particularly ambiguous as *DNA 1* and *DNA 2* provided different recommendations about how the frequency of a DNA match should be calculated, with *DNA 2* determining that the ceiling principle recommended in *DNA 1* was no longer necessary, as technology had developed sufficiently for the ceiling principle to be superseded by the product rule calculation method.<sup>135</sup> It is therefore difficult to determine which method was used, as there is no specific mention of either calculation technique.

This lack of clarity, therefore, leaves uncertainty in a pivotal element of the admissibility decision. This is particularly problematic as this was pivotal to the challenge, as the petitioner sought to challenge

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<sup>132</sup> *United States v. Glynn*, 578 F.Supp.2d 567, 572 (S.D.N.Y. 2008).

<sup>133</sup> *Hummert*, 188 Ariz. at 123.

<sup>134</sup> *Allison*, 63 M.J. at 367.

<sup>135</sup> *Crow*, *supra* note 82, at 35.

the DNA evidence on the basis that the DNA analyst was not sufficiently qualified to testify about the statistical analysis of DNA evidence.<sup>136</sup> Although the court did ultimately find that the expert was sufficiently qualified,<sup>137</sup> the judgment does not provide clarity regarding which calculations were used by the expert, and from which NAS report the calculation framework was taken, casting doubt over the assumption of rationality in the court's decision.

A lack of clarity in relation to which NAS report is relevant to the decision has also led to confusion in ***State v. Cruz (2005)***.<sup>138</sup> In this decision, the court discussed a NAS report as part of its review of the trial court record, in relation to rebuttal evidence given by the state's DNA expert. As part of its identification of the correct method for DNA analysis, the court's discussion surrounded the "terms of the NRC guidelines."<sup>139</sup> However, there is no further indication as to which NAS report is being referenced, which is problematic because ***DNA 1*** and ***DNA 2*** recommended different frameworks for best practice. The court limited the significance of the relevant method for DNA analysis, instead focusing on the petitioner's "fail[ure] to demonstrate a manifest abuse of discretion."<sup>140</sup> By resolving the claim using the legal mechanism of the petitioner's insufficient evidence, the significance of the NAS report was not a major factor in the decision-making process, although the ambiguity in reference to the relevant NAS report raises questions about the rationality behind the court's decision.

***Hudson v. State (2003)*** also contains ambiguity in relation to which NAS report has been cited by the court.<sup>141</sup> The petitioner raised a challenge to the admissibility of the DNA expert's testimony, arguing that he was not sufficiently qualified to testify about DNA statistical calculations.<sup>142</sup> In justifying the trial court's decision that the expert was sufficiently qualified, the court identified that the expert "noted that the number of samples collected and the manner in which they were collected met NRC

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<sup>136</sup> *Allison*, 63 M.J. at 367.

<sup>137</sup> *Id.*, at 370.

<sup>138</sup> *State v. Cruz*, 127 Wash.App. 1034 (Wash. Ct. App. 2005).

<sup>139</sup> *Id.*, at 10.

<sup>140</sup> *Id.*

<sup>141</sup> *Hudson*, 844 So.2d.

<sup>142</sup> *Id.*

requirements”<sup>143</sup> and that the expert was “familiar with the NRC guidelines.”<sup>144</sup> As the court did not support its decision with any further information or clarification as to which NAS report guidelines and requirements were being referenced, the resulting ambiguities question the court’s understanding of the NAS reports’ recommendations and their significance, raising questions about its assumption of the rationality of the expert’s testimony.

The ambiguity in the judicial decision-making process caused by a lack of clarity in a court’s reference to a NAS report has also been problematic when ballistics evidence is challenged. Three of the six forensic science NAS reports – ***Bullet Lead***, ***Ballistic Imaging***, and ***Strengthening*** – address and/or discuss the reliability of some form of ballistics evidence. Where CBLA evidence is challenged, it is often easy to identify that the NAS report examined is ***Bullet Lead***. For example, in ***Murphy v. State (2009)***, the court implicitly referenced ***Bullet Lead*** as “a 2004 report by the National Research Council on comparative bullet-lead analysis.”<sup>145</sup> More generally, as CBLA evidence is distinct from other types of ballistics/firearms evidence, it is usually clear from the context that ***Bullet Lead*** is being cited.<sup>146</sup> In addition, as CBLA evidence was discontinued permanently in 2005,<sup>147</sup> challenges against CBLA evidence often form part of newly discovered evidence claims, making it easier to identify the relevant NAS report. Despite this, the lack of positive identification still raises questions about the court’s understanding of the report, and the rationality behind the decision-making process.

Within the data set, there are several examples of ambiguity as to whether ***Ballistic Imaging*** or ***Strengthening*** is referenced by the court, as both reports provide an overview and criticism of ballistics and firearms evidence. This has resulted in confusion in several decisions, questioning the rationality behind several courts’ decisions, which can be seen clearly in ***United States v. Johnson***

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<sup>143</sup> *Id.*, at 764.

<sup>144</sup> *Id.*

<sup>145</sup> *Murphy v. State*, 24 So.3d 1220, 1222 (Fla. Dist. Ct. App. 2009).

<sup>146</sup> *See, e.g., Smith v. State*, 23 So.3d 1277 (Fla. Dist. Ct. App. 2010); *Commonwealth v. Lopez*, 616 Pa. 570 (Pa. 2012).

<sup>147</sup> *See*, FBI National Press Office, ***FBI Laboratory Announces Discontinuation of Bullet Lead Examinations*** (Sept. 1, 2005) <https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-laboratory-announces-discontinuation-of-bullet-lead-examinations> (last visited Nov. 4, 2019).

(2017).<sup>148</sup> The petitioner had argued that the firearms expert misapplied the standard ballistics methodology recommended by the AFTE by identifying a bullet match “to a reasonable degree of scientific certainty.”<sup>149</sup> He argued that “the National Academy of Sciences has sharply criticized the AFTE methodology for failing to incorporate standardized protocols.”<sup>150</sup> To further support his claim, the petitioner cited precedent, including *United States v. Cerna (2010)*<sup>151</sup> and *United States v. Glynn (2008)*.<sup>152</sup> However, the reference to precedent does not provide any further clarity about which NAS report was referenced, as *Cerna* discussed *Strengthening*, and *Glynn* discussed the findings and recommendations in *Ballistic Imaging*. Although the reference to the NAS report in *Johnson* itself remains ambiguous, it would not be unreasonable to assume that the petitioner sought to rely on NAS’ general position, given the references made to both of these cases. However, the court’s lack of clarity means that this remains an assumption. The reliance on assumptions also raises issues about transparency in decision-making.

While the ambiguity in *Johnson* appeared to originate from the petitioner’s submission, it was court’s position in *Caston v. United States (2016)* that created uncertainty as to which NAS report was relevant. In addressing the petitioner’s challenge, which challenged whether the weight placed upon the ballistics evidence produced at trial was proportionate, the court referred to a previous case “citing a National Research Council report stating that “[t]he validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated.””<sup>153</sup> The court cited precedent to further justify its decision, although the precedent that it cited did not provide any further clarity as to which NAS report was used, as the decisions cited both *Ballistic Imaging* and *Strengthening*.<sup>154</sup> In particular, it relied upon *Gardner v. United States (2016)*, which quoted an extract from *Ballistic Imaging*, which was directly cited by *Strengthening*.

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<sup>148</sup> *United States v. Johnson*, 875 F.3d 1265 (9th Cir. 2017).

<sup>149</sup> *Id.*, at 1280.

<sup>150</sup> *Id.*

<sup>151</sup> *United States v. Cerna*, 2010 WL 3448528 (N.D. Cal. 2010).

<sup>152</sup> *Glynn*, 578 F.Supp.2d.

<sup>153</sup> *Caston v. United States*, 146 A.3d 1082, 1100 (D.C. 2016).

<sup>154</sup> *Id.*, citing *Gardner v. United States*, 140 A.3d 1172, 1183 (D.C. 2016).

Although this demonstrates the proximity of subject matter between the two NAS reports, the way that the NAS is referenced does not provide clarity in the decision. The lack of direct connection between the NAS reports and the decision raises questions about the legitimacy, and therefore rationality, of the decision-making process, as the relevant NAS report could not be identified.

Although in cases relating to **Ballistic Imaging** and/or **Strengthening**, the ambiguity in reference has not always had a decisive outcome on the judgment, there are several instances where vague and general references to a NAS report have arisen as part of wholesale challenges to the admissibility of ballistics evidence. Under these circumstances, the lack of clarity casts doubt over the rationale behind the court's decision, particularly when the rest of the decision is lacking detail and is solely reliant on legal mechanisms to dismiss a claim. For example, in **State v. Rodriguez (2011)**, the petitioner "contend[ed] a report issued by the National Academy of Sciences "years after his trial" constituted newly discovered evidence"<sup>155</sup> challenging the state's ballistic expert. The court failed to address the issues raised, simply deferring to legal procedure by finding that "the court denied relief in a thorough and detailed minute order that... correctly ruled,"<sup>156</sup> and that the petitioner had not established that the trial court had abused its discretion, precluding it from discussing the merits of the claim.

Further decisions in the data set also demonstrate the importance of parties providing clarity when citing NAS reports, as courts can be left with a lack of understanding of the reports. This lack of understanding, though driven by parties, has led to courts avoiding substantive scientific issues and deferring to legal mechanisms to dispose of petitioners' challenges. This is seen in **Blackwell v. Frauenheim (2014)**,<sup>157</sup> where the petitioner filed a *pro se* writ of habeas corpus, seeking to rely on "a report prepared by the National Research Council, in which it indicated that there were significant problems in the methodology of toolmark comparison."<sup>158</sup> There are no further details that identify whether **Ballistic Imaging** or **Strengthening** is the relevant report. The court's disposal of the

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<sup>155</sup> State v. Rodriguez, 2011 WL 6916543 (Ariz. Ct. App. 2011).

<sup>156</sup> *Id.*, at 2.

<sup>157</sup> Blackwell v. Frauenheim, 2014 WL 3572152 (C.D. Cal. 2014).

<sup>158</sup> *Id.*, at 9.

petitioner's argument rendered the identification irrelevant, as the court stated that the petitioner had "not referred the Court to any authority indicating that the forensic testing used in *this* case was unreliable or otherwise suspect"<sup>159</sup> [emphasis in original], demonstrating the court's deferral to legal mechanisms to avoid addressing the ambiguity. This avoidance of scientific issues, whilst grounded in legal rationality, leaves scientific issues with potential merit unresolved, which in itself questions the rationality of the decision.

In certain circumstances, deference to legal mechanisms to avoid scientific issues raised through NAS reports is used to downplay issues raised by petitioners, as courts have found it easier to justify rationality by deferring to legal reasoning. However, this can be problematic, as it prevents scientific issues from being discussed. For example, in ***State v. Celaya (2012)***, the petitioner argued that "a National Academy of Sciences report related to ballistic evidence"<sup>160</sup> constituted newly discovered evidence undermining his conviction.<sup>161</sup> The decision did not specify a particular NAS report, but by finding that "the trial court clearly identified these claims [the issues raised by the petitioner] and correctly resolved them,"<sup>162</sup> the court minimized the significance of the NAS report and decided to dismiss the appeal on legal grounds, finding that there was "no need to rehash that ruling."<sup>163</sup>

In using legal mechanisms to avoid addressing scientific issues, particularly when ambiguities arise as to which report is relevant, the assumption of rationality in the decision ignores any potential merit in petitioners' claims. While ambiguities in citing the NAS reports have not always been a direct part of the court's decision, as they have merely been cited through precedent,<sup>164</sup> other courts have directly limited the significance of a NAS report and associated issues. These decisions have instead relied upon a legal justification to rationalize their decision to dismiss petitioners' claims.<sup>165</sup> However, where issues raised through reference to the NAS reports have been overlooked due to ambiguity or

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<sup>159</sup> *Id.*

<sup>160</sup> *State v. Celaya*, 2012 WL 724049, 2 (Ariz. Ct. App. 2012).

<sup>161</sup> *Id.*

<sup>162</sup> *Id.*

<sup>163</sup> *Id.*

<sup>164</sup> *See, Johnson*, 875 F.3d.; *Caston*, 146 A.3d.

<sup>165</sup> *See, Blackwell v. Frauenheim*, 2014 WL; *Celaya*, 2012 WL.

inaccuracy in citing the reports, courts have not been able to analyze the merits of petitioners' claims. Without an assessment of these claims, the rationality of a court's decision may be flawed, as often the NAS reports' findings and recommendations conflict with a court's decision.

#### 4. The Judicial Assumption of Rationality, Despite Overlooking Substantive Issues

Across the data set, judicial decisions have often relied upon a reductionist understanding of arguments to dispose of complex challenges, particularly when assessing the admissibility of forensic science evidence. This approach has been used by appellate courts to find that the trial court had acted within its discretion in finding forensic science evidence admissible. It allows for courts to find rationality in decision-making, although these decisions are limited by the reductionist approach taken. The principle of reductionism is a valuable tool, used to provide a contextual understanding of complex issues without the need to engage in in-depth, technical and specialist material.<sup>166</sup> However, at the same time, it can also act as a mechanism to give way to a procedural review of issues without getting to the heart of substantive matter.<sup>167</sup>

In general, decisions relying on an overly-reductionist approach to scientific issues have engaged positively with the findings and recommendations of **DNA 1** and/or **DNA 2**,<sup>168</sup> but have avoided addressing some of the more controversial or technical elements of DNA typing examined in the reports.<sup>169</sup> In addition, where **Bullet Lead**, **Ballistic Imaging** and **Strengthening** have been used to challenge forensic science evidence, appellate judges have often responded by taking a reductionist approach to analyzing the issues, responding in one of two ways. Judges have either: (a) reduced the petitioner's claim to a procedural or legal issue, ignoring the significance of the scientific challenge or

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<sup>166</sup> MARY MIDGLEY, *THE MYTHS WE LIVE BY* 1-2 (2004).

<sup>167</sup> Mary Midgley, *Madness in the Method*, 3 *PERSPECTIVES* 1 (1998).

<sup>168</sup> See, e.g., *Barney*, 8 Cal.App.4th; *Bonds*, 12 F.3d; *United States v. Shea*, 957 F.Supp. 331 (D. N.H. 1997); *Vandebogart*, 136 N.H.

<sup>169</sup> See, e.g., *United States v. Mason*, 2003 58 M.J. 521 (M.J. 2003); *Hammonds v. State*, 777 So.2d 750 (Ala. Crim. App. 1999); *People v. Nelson*, 43 Cal.4th 1242 (Cal. 2008).

(b), reduced the complexities of the findings of a NAS report to a single issue. These are discussed in subsections (a) and (b).

**a. Reducing the Scientific Issues Raised by Petitioners to a Procedural or Legal Issue**

An overly-reductionist approach to petitioners' claims is often seen where courts have reduced a scientific issue raised to a legal or procedural issue, allowing a court to dispose of a claim without a consideration of the scientific issues. This occurs because courts review issues in terms of procedural regularity, according to the legal process. This is most clearly seen in the data set when **Strengthening** has been used to raise challenges about the limitations of forensic science evidence.

When **Strengthening** has been referenced by petitioners to challenge trial courts' decisions to admit forensic science evidence, several appellate courts have relied on a statement by Judge Harry Edwards, co-chair of the **Strengthening** committee, as a means to dismiss a petitioner's claims. In the statement, Judge Edwards explained that "the question whether forensic evidence in a particular case is admissible under applicable law is not coterminous with the question whether there are studies confirming the scientific validity and reliability of a forensic science discipline."<sup>170</sup> For example, in **United States v. Rose (2009)**, the petitioner argued that **Strengthening** and other documents undermined the reliability of the fingerprint evidence presented at his trial.<sup>171</sup> In rejecting his claim, the court relied upon Judge Edwards' statement that "nothing in the Report was intended to answer the "question whether forensic evidence in a particular case is admissible under applicable law.""<sup>172</sup> Although it recognized that the report "provoked debate,"<sup>173</sup> it found that the report did "not discredit the ACE-V methodology."<sup>174</sup> The court also found that the ACE-V method of fingerprint analysis was

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<sup>170</sup> *Strengthening Forensic Science in the United States: A Path Forward: Before the S. Comm. on the Judiciary*, 111th Cong. (Mar. 18, 2009) (statement of the Honorable Harry T. Edwards, Co-Chair, Committee on Identifying the Needs of the Forensic Science Community, The Research Council of the National Academies), at 10, available at <https://www.judiciary.senate.gov/imo/media/doc/09-03-18EdwardsTestimony.pdf>.

<sup>171</sup> *United States v. Rose*, 672 F.Supp.2d 723 (D. Md. 2009).

<sup>172</sup> *Id.*, at 725.

<sup>173</sup> *Id.*, at 726.

<sup>174</sup> *Id.*

generally accepted and sufficiently reliable to be admissible under Federal Rule of Evidence 702.<sup>175</sup> In taking this approach, the court avoided examining the issues discussed within *Strengthening*, reducing the issues raised by the petitioner to a matter of admissibility, allowing it to dismiss the petitioner's claim as the fingerprint evidence in question had a longstanding history of admissibility. When used consistently, this framework prevents any changes in scientific opinion from being reviewed by appeal courts, which is problematic given the evolutionary nature of scientific knowledge and ignores criticisms raised in NAS reports, particularly *Strengthening*.

Similarly, in *United States v. Cerna (2010)*<sup>176</sup> and *State v. McGuire (2011)*,<sup>177</sup> both courts rejected the relevance of *Strengthening*'s findings by minimizing the significance of the NAS report. In both judgments, the courts were able to rely on precedent to avoid a substantial examination of the report's content. The court in *McGuire* was charged with establishing whether tool mark evidence had correctly been admitted at trial.<sup>178</sup> The petitioner had referred to *Strengthening* to support his claim that the evidence was unreliable, and used two previous decisions where expert testimony had been ruled inadmissible on the basis of NAS report findings – *Ragland v. Commonwealth (2006)*, which relied on *Bullet Lead*, and *Commonwealth v. Lanigan (1993)*, which cited *DNA 1*<sup>179</sup> – to support his argument that *Strengthening* was sufficient evidence to support his claim. The court consciously departed from these two decisions by using a further example from precedent, taken from a decision made in-state, *State v. Harvey (1997)*,<sup>180</sup> which “concluded that the National Research Council criticism may have affected the weight and credibility of the scientific evidence, not its admissibility.”<sup>181</sup> In addition, it distinguished *Lanigan*, finding that *DNA 1* “did not constitute the sole basis”<sup>182</sup> for the decision. This gave the court scope to reject the authority of *Strengthening*, side-

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<sup>175</sup> *Id.*

<sup>176</sup> *See, Cerna*, 2010 WL.

<sup>177</sup> *United States v. McGuire*, 419 N.J.Super. 88 (N.J. Super. Ct. App. Div. 2011).

<sup>178</sup> *Id.*

<sup>179</sup> *Ragland v. Commonwealth*, 191 S.W.3d 569 (Ky. 2006); *Lanigan*, 413 Mass.

<sup>180</sup> *State v. Harvey* 151 N.J. 117 (N.J. 1997).

<sup>181</sup> *McGuire*, 419 N.J.Super. at 133.

<sup>182</sup> *Id.*, at 132-133.

lining the relevance of the report. Within this, the court found that “the purpose of the NAS report is to highlight deficiencies in a forensic field and to propose improvements to existing protocols, not to recommend against admission of evidence.”<sup>183</sup> Again, by reducing the petitioner’s claim to a legal issue, the court neglected the change to address any potential merit in the petitioner’s claim. As **Strengthening** highlighted considerable limitations within tool mark evidence, the court’s decision to avoid examining the issues reduces the issues to the point of absurdity.

Courts have dismissed the significance of **Ballistic Imaging** in a similar way. In **United States v. Casey (2013)**, the federal district court interpreted a passage from **United States v. Glynn (2008)** – which limited the extent to which a ballistics expert could testify to certainty<sup>184</sup> – to support its reasoning that “the purpose of the 2008 report was not to pass judgment on the admissibility of ballistics evidence in legal proceedings.”<sup>185</sup> This led the court to minimize the relevance of **Ballistic Imaging**, and reduced the decision to an evaluation of legal principles, avoiding assessing the potential merit in the scientific-based claim raised by the petitioner.

**State v. Thomas (2016)** followed the reasoning laid out in **Casey** to dismiss the petitioner’s claim.<sup>186</sup> The petitioner had sought to challenge his conviction by citing of both **Ballistic Imaging** and **Strengthening** to support his claim that the trial court had erred in admitting expert ballistics testimony.<sup>187</sup> In response, the court found that the two NAS reports and accompanying precedent submitted by the petitioner had “no binding effect.”<sup>188</sup> The court did, however, recognize that the two reports could be considered and used to help determine the “weight of the evidence rather than its admissibility.”<sup>189</sup> Despite it recognizing the relevance of the reports, it found them irrelevant to the petitioner’s claim, as the reports had not formed part of the trial record.<sup>190</sup> While this decision

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<sup>183</sup> *Id.*, at 132.

<sup>184</sup> *Glynn*, 578 F.Supp.2d.

<sup>185</sup> *United States v. Casey*, 928 F.Supp.2d 397, 399 (D.P.R. 2013), citing *Glynn*, 578 F.Supp.2d.

<sup>186</sup> *Thomas*, 2016 WL.

<sup>187</sup> *Id.*

<sup>188</sup> *Id.*, at 15.

<sup>189</sup> *Id.*, at 16, citing *State v. Davidson*, 2015 WL 1087126 (Tenn. Crim. App. 2015).

<sup>190</sup> *Id.*

provided a more in-depth review of the NAS reports, it still reduced the petitioner's claim to a challenge of admissibility/weight, and in deferring to the decisions made by the jury, ignored the details of the issues raised by the petitioner. This is problematic, as by assuming rationality in the jury's decision, scientific issues were ignored.

Courts have justified their decision to dismiss challenges using legal mechanisms by finding that **Ballistic Imaging** and **Strengthening** are non-binding authorities, specifically designed not to have an effect the admissibility of any forensic science techniques. This has given courts the opportunity to use other, legal mechanisms to address challenges raised by petitioners. Despite this, these decisions have provided directions to future courts to make reference to the NAS reports as a tool to assist trial court decision-makers. However, by taking the approach that the reports – particularly **Strengthening** – cannot be used as a mechanism to challenge admissibility decisions, courts have ignored the issues raised by the NAS reports, reducing them to the point where the substance of the claim has fundamentally changed. In doing so, the rationality behind courts' decisions are inherently flawed, as they address a fundamentally different question to the claim raised by the petitioner.

#### **b. Reducing the Complex Scientific Issues Raised by Petitioners to a Single Issue**

The data set demonstrates that courts have also disposed of petitioners' claims by reducing complex scientific issues raised to single issues. This has the appearance of engaging with the findings and recommendations of the NAS reports, although, in general, courts' analysis of these issues has been inadequate. This raises questions about the rationality behind courts' decision-making, as by reducing claims to a single issue, the issues raised by petitioners are not adequately addressed, which presents questions about the rationality behind the court's decision-making.

The reduction of a petitioner's claim to a single issue is found in several decisions in the data set, including **United States v. Glynn (2008)**, where the court ruled *in limine* to limit the testimony of a

firearms expert.<sup>191</sup> It relied upon the findings of *Ballistic Imaging* to provide information on the assumption that tool mark individualization provides the basis for positive identifications, and found that the assumptions of positive identification were subject to significant challenge, given that the “assertion has not been put to the rigorous testing that science demands.”<sup>192</sup> The court discussed the findings of *Ballistic Imaging* at length, but as the challenge questioned the extent to which an expert could testify to certainty, the breadth of the court’s discussion was limited. While it held that the expert was limited “to testify only that a firearms match was “more likely than not,””<sup>193</sup> it did not address many of the issues raised in *Ballistic Imaging* and failed to engage with the scientific reasoning underpinning the report’s findings. This has become particularly problematic, given the number of subsequent petitioners that have cited the outcome of this case as a means to challenge the admissibility of ballistics testimony given at trial.<sup>194</sup>

Further decisions in the data set also show courts’ failure to grasp the complexities of the content of the NAS reports. A further federal decision, *United States v. Willock (2010)*, explicitly recognized the importance of taking a reductionist approach when discussing the petitioner’s challenge to the admissibility of ballistics evidence.<sup>195</sup> He had sought to limit the extent to which the government could testify to the certainty of a ballistics match.<sup>196</sup> The court’s decision discussed on the potential negative consequences of limiting/excluding ballistics testimony, focusing on the need to interpret the *Daubert* admissibility criteria with a degree of flexibility.<sup>197</sup> In doing so, the court acknowledged that it was taking a reductionist approach to the admissibility of ballistics evidence in having “reduced [the argument] to its essentials,”<sup>198</sup> and ultimately rejected the petitioner’s challenge.

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<sup>191</sup> *Glynn*, 578 F.Supp.2d.

<sup>192</sup> *Id.*, at 573.

<sup>193</sup> *Id.*, at 575.

<sup>194</sup> *See, e.g., Casey*, 928 F.Supp.2d; *Fleming v. State*, 194 Md.App. 76 (Md. Ct. Spec. App. 2010); *United States v. Taylor*, 663 F.Supp.2d 1170 (D. N.M 2009).

<sup>195</sup> *United States v. Willock*, 696 F.Supp.2d 536 (D. Md. 2010).

<sup>196</sup> *Id.*

<sup>197</sup> *Id.*, at 569.

<sup>198</sup> *Id.*, at 572.

This approach was also taken by the court in *Commonwealth v. Pytou Heang (2011)*.<sup>199</sup> The petitioner referenced both *Ballistic Imaging* and *Strengthening* as part of his challenge against the admissibility of ballistics evidence, which he had further supported by precedent.<sup>200</sup> The court responded by referencing the broad issues regarding the limitations of ballistics evidence in general, as discussed in both *Ballistic Imaging* and *Strengthening*.<sup>201</sup> It analyzed the admissibility framework in more detail than in *Glynn*, and discussed at length the difficulties associated with testifying a match using individualization.<sup>202</sup> While the court recognized the limitations raised by the NAS reports, it did not take these criticisms into consideration in its decision, finding that “there was no abuse of discretion in the judge’s admission of the expert opinion.”<sup>203</sup> As part of its reasoning, the court acknowledged that the trial court’s decision to restrict the opinion to a “reasonable degree of scientific certainty,”<sup>204</sup> aligned with standard practice, and conceded that this decision forged a “middle ground”<sup>205</sup> given the “current understanding of the scientific rigor underpinning forensic ballistics.”<sup>206</sup> This simplification of the issues, while a practical approach, did not address any of the further limitations explored in the NAS reports, raising questions about the rationality behind the court’s reasoning, particularly given its acknowledgement of the issues.

Similarly, in the Californian Court of Appeal’s decision in *People v. Nelson (2006)*,<sup>207</sup> the petitioner sought to challenge the admissibility of the DNA evidence used at trial, arguing that the method used to calculate the significance of the match was inadmissible, as the suspect had been identified through a database trawl.<sup>208</sup> The court found that the use of the DNA databank was sufficient to identify the petitioner, as it was based on a test that had received general acceptance.<sup>209</sup> The Court of Appeal

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<sup>199</sup> *Commonwealth v. Pytou Heang*, 458 Mass. 827 (Mass. 2011).

<sup>200</sup> *Id.*, at 837.

<sup>201</sup> *Id.*, at 838-843.

<sup>202</sup> *Id.*

<sup>203</sup> *Id.*, at 943.

<sup>204</sup> *Pytou Heang*, 458 Mass. at 946.

<sup>205</sup> *Id.*

<sup>206</sup> *Id.*

<sup>207</sup> *People v. Nelson*, 48 Cal.Rptr.3d 399 (Cal. Ct. App. 2006).

<sup>208</sup> *Id.*

<sup>209</sup> *Id.*, at 402.

affirmed the conviction as the random match calculations used had been “judicially determined to be generally accepted in the scientific community,”<sup>210</sup> finding that the evidence had properly been admitted.<sup>211</sup>

Upon appeal to the Supreme Court of California in *People v. Nelson (2008)*,<sup>212</sup> the Court of Appeal’s decision was affirmed, with the court finding that the method used to calculate the significance of the match was sufficiently reliable.<sup>213</sup> The court acknowledged the findings of *DNA 2*,<sup>214</sup> but ultimately answered the more general question of whether the product rule method (used in this case) was generally accepted.<sup>215</sup> This overlooked the more complex issues raised by the petitioner, particularly whether the fact that the DNA match was found as a result of a database trawl necessitated a different method of statistical analysis.

This has raised questions about the court’s overly-simplistic view of the issues raised by the petitioner. In particular, Kaye has argued that both the Court of Appeal and Supreme Court of California in *Nelson* failed to appreciate the complexities of the petitioner’s claim,<sup>216</sup> particularly in relation to the findings and recommendations of *DNA 2*.<sup>217</sup> He has argued that this approach demonstrates that courts are unable to analyze complex issues, so they rely on simplistic interpretations and legal mechanisms to resolve scientific challenges.<sup>218</sup>

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<sup>210</sup> *Id.*, at 419.

<sup>211</sup> *Id.*, at 420.

<sup>212</sup> *Nelson*, 43 Cal.4th.

<sup>213</sup> *Id.*, at 1266.

<sup>214</sup> *Id.*, at 1262.

<sup>215</sup> *Id.*, at 1263-4.

<sup>216</sup> David H. Kaye, *Case Comment: People v. Nelson - A Tale of Two Statistics*, 7 LAW PROB. & RISK 249, 254 (2008).

<sup>217</sup> *Id.*, at 253.

<sup>218</sup> *Id.*

### Positioning these Findings Within Existing Knowledge

The data set shows that when scientific evidence is challenged and cannot be reconciled with the legal process (which brings legitimacy to decision-making), judges defer to the rationality assumption within the legal process to justify their decision-making and make use of legal reasoning to avoid engagement with the findings and recommendations of the NAS reports. This approach relies on legal mechanisms to limit the significance of the NAS reports, allowing courts to rationalize their decision-making in terms of procedural legitimacy. However, the data set demonstrates that this approach can lead to irrationalities, as the findings and recommendations of the NAS reports often contradict courts' decisions. This is symptomatic of the wider disconnect between law and science.

This paradox that has been created by courts acts as a barrier to substantive justice, as although appellate decisions comply with the procedural requirements of law, courts' avoidance or reduction of scientific issues leaves many issues unaddressed. This has received relatively little attention in existing literature, although several commentators have provided numerous reasons as to why the judicial avoidance of scientific issues is problematic. For example, Beecher-Monas has identified that judges "are avoiding the scientific component, particularly in criminal cases."<sup>219</sup> Her work shows that in criminal courts, many of the forensic science techniques presented during trials do not meet *Daubert* admissibility standards.<sup>220</sup> Her research has found that "courts are using circumventing gambits to avoid analysis that would reveal the systemic inadequacies of criminal laboratories."<sup>221</sup> She has also argued that such avoidance is a mechanism used by judges to avoid accountability.<sup>222</sup>

The data set confirms these findings. It has demonstrated that courts have avoided engaging in scientific issues when a claim can be resolved through procedural means. The author argues that this is due to the legal process vision's need to recognize legitimacy and rationality within the law. Under the legal process vision, legitimacy is primarily achieved by correctly following procedures, affirming

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<sup>219</sup> Erica Beecher-Monas, *Blinded by Science: How Judges Avoid the Science in Scientific Evidence*, 71 TEMP. L. REV. 55, 56 (1998).

<sup>220</sup> *Id.*, at 67.

<sup>221</sup> *Id.*

<sup>222</sup> *Id.*, at 74.

the assumption of rationality. However, the data set shows through the above cases that this has led to irrationality where procedures have been correctly followed, but scientific issues have been overlooked. This raises further question about the wider relationship between law and science, specifically in law's consumption of science.

As the criminal justice system is reliant on scientific evidence, experts are best placed to bridge the gap between law and science. As seen in cases such as *State v. Thomas (2016)* and *Smith v. Uribe (2016)*, this practice can be problematic, as experts do not always show an appreciation for the way that the law consumes scientific evidence. In more extreme cases, such as *State v. Sharma (2007)*,<sup>223</sup> experts' false representation of reliability has the potential to undermine rationality in decisions, particularly when legal mechanisms are ineffective at detecting these irregularities. This highlights the importance of experts' knowledge of the role of forensic science in the criminal justice system. This is potentially problematic as in existing literature authors have, in general, questioned the true expertise of testifying experts, particularly in the years following *Melendez-Diaz v. Massachusetts (2009)* and the changing role of experts in relation to the post-2009 interpretation of the Confrontation Clause.<sup>224</sup>

A considerable debate surrounds the place of experts in assessing *Daubert* admissibility criteria and the scrutiny placed on experts during admissibility proceedings. Some authors have seen the introduction of *Daubert* admissibility standards as raising the bar for experts,<sup>225</sup> while others have found *Daubert* ineffective in improving standards.<sup>226</sup> Regardless of what commentators have written about current admissibility frameworks, authors have argued that judges rely heavily on experts –

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<sup>223</sup> See, e.g., *Sharma*, 143 Ohio.Misc.2d.

<sup>224</sup> See generally, *Melendez-Diaz v. Massachusetts* 557 U.S. 305 (2009); *Bullcoming v. New Mexico*, 564 U.S. 647 (2011); *Williams v. Illinois* 567 U.S. 50 (2012).

<sup>225</sup> Edward Imwinkelried, *Flawed Expert Testimony: Striking the Right Balance in Admissibility Standards*, 18 CRIM. JUST. 28 (2003-2004).

<sup>226</sup> See, e.g., Caitlin M. Plummer & Imran J. Syed, *Criminal Procedure v Scientific Progress: The Challenging Path to Post-Conviction Relief in Cases that Arise During Periods of Shifts in Science*, 41 VT. L. REV. 279 (2016-2017).

even if their forensic science discipline is not scientifically supported – because reliance on experts provides legitimacy to trial court decisions.<sup>227</sup>

The judicial reliance on experts has also been discussed by the NAS itself in **Strengthening**.<sup>228</sup> It found that “courts continue to rely on forensic evidence without fully understanding and addressing the limitations of different forensic science disciplines.”<sup>229</sup> The NAS attributed this reliance to the “uneasy alliance”<sup>230</sup> between law and science. However, outside of the recognition of courts’ reliance on experts, there is little information documenting either the causes or consequences of this. The data set demonstrates that when forensic science admissibility is challenged, appellate courts are bound to review the legitimacy of the processes followed by lower courts, relying primarily on legal mechanisms before attempting to address scientific authorities, if deemed necessary, and the findings and recommendations of the forensic science NAS reports can be used for this, although they do not always hold significant weight.

Despite a lack of discussion on the specific issues identified in this chapter, several authors have discussed the disconnect between law and science when forensic science evidence is considered/challenged. They have recognized that science and the law are functionally co-dependent, but this relationship has been described as a “marriage of opposites.”<sup>231</sup> The data set demonstrates that one way that the criminal justice system tries to consume scientific evidence is through reductionism. Redmayne identified that courts use a reductionist approach to analyze scientific issues,<sup>232</sup> finding that this can lead to a misinterpretation of both law and science.<sup>233</sup> He argued that there is no “magical solution”<sup>234</sup> to resolving the challenges between the law and science, but suggested that appreciating common ground between the two disciplines may help to alleviate

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<sup>227</sup> See, e.g., Joelle Anne Mareno, *CSI Bulls#!t: The National Academy of Sciences, Melendez-Diaz v. Massachusetts, and Future Challenges to Forensic Science and Forensic Experts*, 2010 UTAH L. REV. 327 (2010).

<sup>228</sup> EDWARDS & GATSONIS, *supra* note 65, at 85.

<sup>229</sup> *Id.*

<sup>230</sup> *Id.*, at 86.

<sup>231</sup> Mike Redmayne, *Expert Evidence and Scientific Disagreement*, 30 U. C. DAVIS L. REV. 1027, 1035 (1996-1997).

<sup>232</sup> *Id.*, at 1037.

<sup>233</sup> *Id.*, at 1038.

<sup>234</sup> *Id.*, at 1079.

tensions.<sup>235</sup> The need for common ground has been identified by further authors,<sup>236</sup> who have also argued that “the lawyer must first have a fundamental grasp of the science and its application to the crime scene evidence,”<sup>237</sup> which may also allow for the judicial appreciation of scientific issues in a different way. This may reduce the need to rely on reductionism to the point where it creates irrationality.

This remains the extent of authors’ commentary on the irrationality created by the judicial reliance on the rationality assumption and disposal of issues using a solely legal lens. However, the reliance on the rationality assumption, particularly when viewed in relation to concerns raised in existing literature, raises more general issues about the relationship between law and science. Faigman has attributed the wider conflict between law and science to their differences in approaches to knowledge accumulation,<sup>238</sup> observing that the law seeks proof, whereas science seeks truth.<sup>239</sup> This has the consequence that in the courtroom, scientific considerations are secondary to legal mechanisms and are difficult to reconcile. The data set demonstrates this, finding that the judicial reliance and focus on the rationality assumption and legitimacy of legal processes can side-line scientific considerations, which has, on occasion, had the effect of creating irrationality in the outcome of decisions made.

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<sup>235</sup> *Id.*, at 1079-1080.

<sup>236</sup> See, e.g., Jane Maienschein, James P. Collins & Daniel S. Strouse, *Biology and Law: Challenges of Adjudicating Competing Claims in a Democracy*, 38 JURIMETRICS J. 151 (1997-1998); Keith A. Findley, *Innocents at Risk: Adversary Imbalance, Forensic Science and the Search for Truth*, 38 SETON HALL L. REV. 893 (2008); Edward Imwinkelreid, *The Importance of Forensic Metrology in Preventing Miscarriages of Justice: Intellectual Honesty about the Uncertainty of Measures in Scientific Analysis*, 7 J. MARSHALL L. J. 333 (2013-2014).

<sup>237</sup> Peter J. Neufeld, *Have You No Sense of Decency? Comments*, 84 J. CRIM. L. CRIMINOLOGY 189, 190 (1993).

<sup>238</sup> DAVID L. FAIGMAN, *LEGAL ALCHEMY: THE USE AND MISUSE OF SCIENCE IN THE LAW* 56-57 (1999).

<sup>239</sup> Sarah Lucy Cooper, *The Collision of Law and Science: American Court Responds to Developments in Forensic Science*, 33 PACE L. REV. 234, 238 (2013).

### Part III

#### Chapter 7: Conclusions

This thesis was designed to explore judicial reference to the forensic science NAS reports and reflect on the role of these six reports within the US criminal justice system. This part reflects on this investigation, outlining the limitations of study, the study's unique contribution to knowledge, and discusses suggestions for future research directions, based on the findings from this study.

#### **Limitations**

The unique contribution to knowledge made in this study should be understood within the context of the study's limitations. The limitations of this study relate to both the broad research parameters and specific limitations relating to its research methods, spanning at least five points. First, this study is confined to the jurisdictions of the United States (inclusive of federal and state). Second, within the United States, this study is confined to criminal appellate decisions (including direct appeals, *in limine* hearings, and habeas corpus petitions). Third, this study was designed to only review decisions in these forums where reference is made to the six forensic science NAS reports. Fourth, within this, it was confined to a specific time period, covering the period between January 1, 1992 (the year that the first report, *DNA 1*, was published) and the end of 2017, capturing the 25-year period following the publication of the first NAS report.

The limitations of this study extend to the methods used. This study is confined to the methodological interrogation techniques of the author (i.e. the way that the data set was generated, as explained in Chapter 2). As a consequence, it is possible that some decisions have been missed. This is plausible, particularly because the author has recognized that judicial decisions contain errors in their reference to the six NAS reports and judges have often referenced the reports implicitly. The author revised the research method to accommodate this to the greatest extent possible, and managed to include over 200 decisions in the data set that do not reference the reports explicitly.

Finally, the author is aware that any interpretation of the data set is subjective.

### **Unique Contribution to Knowledge**

This thesis provides a unique contribution to knowledge. There are novel aspects to its design, method, and findings.

#### **1. Design**

By design, this study was created to explore judicial reference to the six forensic science NAS reports over an extended time period (25 years) – no studies in the existing literature have previously reviewed such a large time scale. In addition, the author’s choice to collectively include six NAS reports sets it aside from existing research, which has been more limited in scope, both in relation to time frames and number of NAS reports. This study was also designed to broaden findings from existing literature which have indicated that judicial treatment of forensic science evidence is governed by the legal process vision,<sup>1</sup> which became the basis for the analytical framework created for this study.

#### **2. Method**

To explore the judicial fidelity to the legal process vision, the author created a bespoke method to analyze the data set, which was designed to answer questions left unanswered in existing literature. Further novel elements to this study include: the method used to collate existing literature (which was based upon key points taken from the six forensic science NAS reports); the method used to generate the data set (based upon the titles of the six reports and common reference terms, as well as more general terms relating to the NAS); and the analytical framework applied to the data set (which allowed the data to be analyzed through a legal process vision lens). The use of these methods means that the study is unrivalled in size, generating a data set of 644 decisions.

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<sup>1</sup> See, e.g., Andrew W. Jurs, *Balancing Legal Process with Scientific Expertise: Expert Witness Methodology in Five Nations and Suggestions for Reform of Post-Daubert U.S. Reliability Determinations*, 95 MARQ. L. REV. 1329 (2012); Sarah Lucy Cooper, *Judicial Responses to Shifting Scientific Opinion in Forensic Identification Evidence and Newly Discovered Evidence Claims in the United States: The Influence of Finality and Legal Process Theory*, 4 BRIT. J. AM. LEGAL STUD. 649 (2015).

### 3. Findings

The thesis sought to answer several specific research questions that had been left unanswered by existing literature. The design and methodological approach of the study has allowed the author to generate answers to these questions. Part II uses the data set to build an evidence base, allowing the author to answer these research questions. The research questions posed at the beginning of this study will now be answered. In summary, the answer to these questions are:

**How many times have each of the six NAS reports been referenced in criminal appellate decisions across the United States?** Between 1992 and 2017, the six NAS reports have been cited in 644 separate decisions. The author was able to identify that *DNA 1* was cited 213 times; *DNA 2*, 183 times; *Polygraph*, 16 times; *Bullet Lead* has been referenced 43 times; *Ballistic Imaging* has been cited 32 times; and *Strengthening* has been cited 218 times. In addition, a further 40 cases have referred to a forensic science NAS report, although the author was not able to positively identify the relevant report.

**In what types of legal claims are the NAS reports referenced?** The six NAS reports are most frequently raised in post-conviction cases challenging the admissibility of forensic science evidence. These challenges span both federal and state jurisdictions. Within the data set, 398 decisions are direct appeals, although 64 decisions have discussed the NAS reports during *in limine* hearings.<sup>2</sup> In addition, 61 cases have discussed the reports as part of habeas corpus petitions. The reports have also been cited as a tool to discuss forensic science evidence during several further types of claims, although the numbers of additional claims (e.g. motions to vacate sentences, motions for post-conviction forensic testing, etc.) are small.

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<sup>2</sup> See, e.g., *Henyard v. State*, 689 So.2d 239 (Fla. 1996); *State v. Stills*, 124 N.M. 66 (N.M. 1998); *State v. Cox*, 2000 WL 1562920 (Tenn. Ct. App. 2000); *People v. Kennedy*, 2003 WL 21205925 (Cal. Ct. App. 2013); *United States v. Berry*, 624 F.3d 1031 (9th Cir. 2010); *Gonzalez v. Thaler*, 2012 WL 5462682 (S.D. Tex. 2012); *United States v. Nascimento*, 2009 WL 3297273 (D. Mass. 2009); *United States v. Casey*, 928 F.Supp.2d 397 (D.P.R. 2013); *United States v. Montalvo-Rangel*, 2010 WL 1484708 (W.D. Tex. 2010); *Dennis v. State*, 109 So.3d 680 (Fla. 2012); *Commonwealth v. Wadlington*, 476 Mass. 192 (Mass. 2014).

**What is the purpose of the reference to the NAS report(s) within the judgment?** Each of the six NAS reports have been referenced in different ways. In general, they have all been referenced by appellate judges to assist in their decision-making and have been cited by petitioners to challenge the admissibility of forensic science evidence.

Generally, **DNA 1** and **DNA 2** have been referenced by petitioners to argue that DNA procedures and/or expert testimony did not conform to the standards recommended by the NAS reports. In particular, petitioners have challenged the methods used to calculate the statistical significance of a DNA match, citing either **DNA 1** or **DNA 2** to provide guidance when making admissibility decisions. Judges have also relied upon these two reports as an authoritative source on the reliability of DNA evidence. They have referred to these reports to provide definitions and other reference materials, used to evaluate the admissibility of DNA evidence.

**Polygraph** has largely been cited by judges as a tool to interpret the admissibility of polygraph evidence. In general, the judiciary have referenced the findings of this report to determine that polygraph evidence is inadmissible, although exceptions exist.

**Bullet Lead, Ballistic Imaging** and **Strengthening** have largely been cited by petitioners to challenge the admissibility of relevant forensic science disciplines. These reports have highlighted limitations inherent in these forensic science techniques. Judges have generally acknowledged the findings of **Bullet Lead**, and have referenced the report as an authority to support reversing a trial verdict, often seen where there was no further inculpatory evidence supporting the verdict.

Petitioners raising admissibility challenges using **Ballistic Imaging** and/or **Strengthening** have used the reports to highlight considerable limitations in relevant forensic science evidence, most often ballistics/firearm evidence and fingerprint evidence. While some judges have made reference to these reports and used them as a tool to assist their understanding of the relevant forensic science evidence, judges have often dismissed the merits of claims based on the NAS reports.

**How does judicial decision-making referencing the forensic science NAS reports reflect legal process values?** The data set demonstrates that decision-making can be mapped to the principles of the legal process vision. The data set indicates that four principles of the legal process vision drive judicial decision-making. The author has categorized these to fullest extent possible, but acknowledges that they naturally overlap. These are: 1) the dominance of precedent, which sees decisions driven by the following of previous cases, which has the consequence of the law struggling to update in response to scientific progress; 2) judicial deference to institutional settlement, where appellate judges rely on the regularity of decisions already made by trial court actors to dispose of claims, which can preclude a review of substantive scientific claims, which have been supported by the NAS reports; 3) the pursuit of finality, which sees judges rely on standard legal tactics, such as the application of high thresholds and institutional settlement, to avoid a substantive examination of claims raised using the NAS reports; and 4) fidelity to the rationality assumption, which allows appellate judges to assume rationality in trial court proceedings, despite the NAS reports suggesting irrationality.

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This study has also generated findings beyond these research questions. A broader issue has also emerged as a result. In addition to finding that judicial decision-making is beholden to the legal process, from the data set has emerged a reiteration of the broader tensions between law and science. The legal process vision dictates the considerations that judges need to take into account when making decisions, but the data set demonstrates that criminal justice actors struggle to reconcile these legal cultural norms with progress in scientific thought, as seen through judges' often-limited response to the six NAS reports. Within this study, these reports represent the publication of new scientific findings and/or a review and re-ordering of scientific knowledge.

The legal process recognizes the need for legal actors to acknowledge progress in communities,<sup>3</sup> although the data set demonstrates that actors have struggled to reconcile scientific progress (as demonstrated by NAS reports' findings and recommendations) with other principles of the legal process vision. This, in the author's view, provides a direction for future research.

### **Directions for Future Research**

The data set shows that the criminal justice system, as an institution, is subject to cultural and normative restraints, dictated by the principles of the legal process vision. This has restricted the extent of the law's ability to consume science, as legal process mechanisms overlook scientific issues. The author is mindful that legal institutions in the United States – and many other jurisdictions – are subject to institutional limitations and that the justice system cannot feasibly undertake wholesale changes. While there is an ever-increasing body of research discussing the intersection of law and science in many areas, a direction for future research could collate these findings and draw on areas where legal institutions have successfully responded to scientific developments to determine why they have been successful and how successes could translate across to other legal institutions.

More specifically, to address the issues raised in relation to the criminal justice system's lack of interaction with scientific knowledge, as highlighted in the data set, further research should encourage legal actors to support the institution of law to evolve alongside scientific progress, which would extend beyond knowledge of the NAS reports. Therefore, in the view of the author, future research should be vested in supporting the increased scientific literacy of legal actors. As agents of the institution, criminal justice actors should be equipped with scientific knowledge, so that it is easier for institutions to evolve in response to scientific developments. This potentially has a wider application in relation to the justice system as a whole.

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<sup>3</sup> HENRY M. HART, JR. & ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW*, ED. WILLIAM N. ESKRIDGE JR. & PHILIP P. FRICKEY 3 (Foundation Press 1993).

There is a body of existing literature discussing legal actors' scientific literacy, including many articles encouraging legal actors to more thoroughly engage in scientific educational tools.<sup>4</sup> In fact, in more general terms, the NAS itself has published on scientific literacy.<sup>5</sup> In its 2016 report, *Science Literacy: Concepts, Contexts, and Consequences*, it identified the importance of science and health literacy,<sup>6</sup> explored different measures of scientific literacy,<sup>7</sup> and discussed factors affecting individuals' perception and understanding of science.<sup>8</sup>

In collating many existing studies, the NAS found that although science literacy is subject to many interpretations<sup>9</sup> and is difficult to measure,<sup>10</sup> it serves numerous important functions.<sup>11</sup> It recognized that individuals' understanding of scientific and health information is affected by their community groups and society,<sup>12</sup> and that both individuals and communities need to be responsive to changing scientific attitudes.<sup>13</sup> Additionally, the report specifically identified the importance of scientific literacy in the justice system, as such "critical social systems"<sup>14</sup> are frequently required to analyze scientific principles and methodologies in numerous scientific fields.<sup>15</sup>

Although measures of scientific literacy are complex, the data set suggests that criminal justice actors' engagement with forensic science evidence could be enhanced through increased science literacy. By supporting literacy among criminal justice actors – namely judges, lawyers and jurors – the criminal justice system, as an institution, will be able to respond better to scientific progress. Future research in this area should focus on how criminal justice actors perceive legal process values and reconcile

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<sup>4</sup> See, e.g., Christine Funk & Evan Berman, *Rising to the Challenge of the NAS Report Strengthening Forensic Science in the United States: A Path Forward: A Call for Demonstrated Competence Amongst Legal Practitioners*, 37 WM. MITCHELL L. REV. 683 (2010-2011); Kate Cashman & Terese Henning, *Lawyers and DNA: Issues in Understanding and Challenging the Evidence*, 24 CURRENT ISSUES CRIM. JUST. 6 (2012-2013); Jessica D. Gabel, *Forensiphilia: Is Public Fascination with Forensic Science a Love Affair or Fatal Attraction*, 36 NEW ENG. J. ON CRIM. & CIV. CONFINEMENT 233 (2010).

<sup>5</sup> CATHERINE SNOW, *SCIENCE LITERACY: CONCEPTS, CONTEXTS, AND CONSEQUENCES* (National Academies Press 2016).

<sup>6</sup> *Id.*, at 22-26.

<sup>7</sup> *Id.*, from 36.

<sup>8</sup> *Id.*, at 85.

<sup>9</sup> *Id.*, at 2.

<sup>10</sup> *Id.*, at 39-42.

<sup>11</sup> *Id.*, at 26.

<sup>12</sup> *Id.*, at 15.

<sup>13</sup> *Id.*, at 94.

<sup>14</sup> *Id.*, at 110.

<sup>15</sup> *Id.*, at 110-111.

these norms with scientific progress. In doing so, it should explore the current perception of scientific evidence and progress amongst criminal justice actors through qualitative and empirical research methods. It should use the results of these future studies to inform ways in which actors can be encouraged to engage with scientific products in a more meaningful way.

Future research directed towards forensic science actors – particularly judges and lawyers – should be designed to increase scientific literacy, and could focus on:

- Scientific education during training, continuing through professional development.
- Cross-cultural competencies (including the presentation of scientific evidence during direct and cross-examination).
- The use of opportunities and mechanisms available to actors (e.g. Federal Rule of Evidence 706 and materials available through the National Clearinghouse for Science, Technology and the Law<sup>16</sup>).

The author suggests that research should go beyond the doctrinal research used in this study, and should concentrate efforts on empirical research, examining lawyers' and judges' understanding and appreciation of scientific evidence and education in relation to the legal cultural norms dictated by the legal process.

The NAS itself, as a body that has reported extensively on science within the criminal justice system and scientific literacy, should have a role in maintaining and encouraging a relationship between law and science actors. It has the capacity to influence actors within the justice system, as demonstrated by its longstanding influence in the United States and frequent reference to its work by criminal justice actors. This places the NAS in a strong and unique position to facilitate cross-disciplinary dialogue between scientists and lawyers, and its diverse history and research portfolio should be harnessed to

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<sup>16</sup> The National Clearinghouse for Science, Technology and the Law, <http://www.ncstl.org/> (last visited Nov. 4, 2019).

increase scientific literacy amongst criminal justice actors and reduce the knowledge gap between legal actors and scientific knowledge.

The data set shows that the NAS is an existing authority in the criminal justice system, but to increase the utility of its reporting mechanisms, when addressing the criminal justice system, the NAS needs to be mindful of wider legal process constraints and cultural norms relating to the law. For example, Chapter 6 highlighted the law's tendency to find rationality in legal processes, making it difficult to adjudicate on scientific considerations, particularly where there is no explicit link between legal mechanisms and scientific knowledge, seen particularly through the dismissal of the significance of **Strengthening's** findings when reviewing admissibility decisions.<sup>17</sup> However, even when a direct conflict exists, certain courts have still side-lined reports' findings at times.<sup>18</sup> Therefore, future NAS reporting should be explicit in discussing how scientific knowledge and progress affects legal considerations, as it did in recommending the admissibility of DNA evidence.<sup>19</sup> Moreover, in future reporting, the NAS should also be mindful of the legal process frameworks which govern legal actors' analysis of issues. Although the NAS should be mindful of these considerations when addressing legally-focused issues, its broad portfolio in scientific matters spanning numerous different audiences places it in a strong position to take notice of such concerns and should not deter future NAS research crossing the intersection between law and science.

As this study specifically recommends that the NAS continue to focus efforts on identifying barriers to science literacy amongst legal actors and overcoming these barriers, the author recommends that the NAS, as a scientific organization, pursues these goals by collaborating with legal bodies and actors. This would position the NAS in an even stronger position to continue its work in packaging scientific knowledge to assist actors within the criminal justice system – and wider legal system. There are

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<sup>17</sup> See *supra*, Chapter 6: Judicial Adherence to the Rationality Assumption, section 4.

<sup>18</sup> See *supra*, Chapter 6: Judicial Adherence to the Rationality Assumption, section 2.

<sup>19</sup> VICTOR A. MCKUSICK, DNA TECHNOLOGY IN FORENSIC SCIENCE 149 (National Academies Press 1992).

various directions that future projects could follow, and should evolve as barriers to science literacy amongst legal actors are broken. Potential directions for future research in this area could include:

- Facilitating and creating educational material for undergraduate and postgraduate legal education in scientific principles and methods, particularly within the context of scientific disciplines common to the legal system.
- Expanding the NAS' forensic science educational modules.<sup>20</sup>
- Establishing collaborative projects with legal professional bodies, such as the American Bar Association. Such projects could work with legal actors to discover barriers to science literacy and subsequently deliver development and training to legal professionals.
- Developing legal actors' knowledge and understanding of further forensic science techniques not addressed in the six reports studied in this thesis but pertinent to the criminal justice system.
- Developing legal actors' knowledge and understanding of scientific evidence commonly found in the civil legal system.

By taking cultural considerations into account, and by continuing its work to bring together a wide range of stakeholders, the NAS, as a scientific organization, is in a strong position to undertake further research to explore barriers to science literacy within the legal community and take steps to improving legal actors' science literacy, helping to alleviate tensions between these two communities. The NAS, as the premier science advisor to the US government, has the expertise to undertake and deliver such cross-disciplinary research. Moreover, its own mandate compels it to provide "independent, objective advice,"<sup>21</sup> which would help to improve the relationship between science and the law.

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<sup>20</sup> The National Academies of Sciences Engineering Medicine, Science Policy Decision-Making: The Modules [http://sites.nationalacademies.org/pga/scipol\\_ed\\_modules/pga\\_171924?utm\\_source=NASEM+News+and+Publications&utm\\_campaign=f1947dbc9f-Educational\\_Modules\\_Forensic\\_2017\\_08\\_23&utm\\_medium=email&utm\\_term=0\\_96101de015-f1947dbc9f-104585381&goal=0\\_96101de015-f1947dbc9f-104585381&mc\\_cid=f1947dbc9f&mc\\_eid=cf7b5994ef](http://sites.nationalacademies.org/pga/scipol_ed_modules/pga_171924?utm_source=NASEM+News+and+Publications&utm_campaign=f1947dbc9f-Educational_Modules_Forensic_2017_08_23&utm_medium=email&utm_term=0_96101de015-f1947dbc9f-104585381&goal=0_96101de015-f1947dbc9f-104585381&mc_cid=f1947dbc9f&mc_eid=cf7b5994ef) (last visited Nov. 4, 2019).

<sup>21</sup> The National Academy of Sciences, Mission, <http://www.nasonline.org/about-nas/mission/> (last visited Nov. 4, 2019).

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**Appendix A: Literature Review Search Terms**

<b>Search Terms For Each of the Six NAS Reports</b>	
<b>Report</b>	<b>Key Terms</b>
<b><i>DNA Technology in Forensic Science (1992)</i></b>	Admissibility
	Ceiling Principle
	Databank
	DNA Typing
	Laboratory Protocol
	PCR (Polymerase Chain Reaction)
	Population Frequency Estimation
	Privacy
	Product Rule
	Quality Assurance
	RFLP (Restriction Fragment Length Polymorphisms)
	VNTR (Variable Number Tandem Repeats)
	Weighing Evidence
<b><i>The Evaluation of Forensic DNA Evidence (1996)</i></b>	1992 NRC Report
	Ceiling Principle/Interim Ceiling Principle
	DNA Profiling
	DNA Typing
	Error Rates
	General Acceptance

	Laboratory Performance
	Likelihood Ratio
	Matching and Binning
	Mitochondrial DNA
	PCR (Polymerase Chain Reaction) Analysis
	Population Genetics
	Random-Match Probabilities
	STR (Short Tandem Repeats)
	Subpopulations
	VNTR (Variable Number Tandem Repeats)
<b><i>The Polygraph and Lie Detection (2003)</i></b>	Accuracy
	Alternative Techniques
	Countermeasures
	Cultural Bias
	Deception
	Decision Thresholds
	Error
	Physiological Responses
	Polygraph Questioning
	Psychological Theories
	Quality Control
	Reliability
	Validity

<b><i>Forensic Analysis: Weighing Bullet Lead Evidence (2004)</i></b>	Admissibility Standards
	Alternative Testing
	Analytical Method
	CABL (Composition Analysis of Bullet Lead)
	Chaining
	CIVL (Compositionally Indistinguishable Volume of Lead)
	False Match Probability
	Interpretation Issues
	Reliability
	Significance of Bullet Manufacturing
Statistics for Comparison	
<b><i>Ballistic Imaging (2008)</i></b>	Alternative Technologies
	Analysis of Tool marks
	Best Practice
	Current Technology
	Future Developments
	Manufacturing Firearms
	Microstamping
	National Ballistics Database
	NIBIN (National Integrated Ballistic Information Network)
	RBID (Reference Ballistic Image Database)

	Sources of Variability
	Tool marks as Evidence
	Tool marks on Bullets
	Uniqueness of Markings
<b><i>Strengthening Forensic Science in the United States: A Path Forward (2009)</i></b>	Admissibility
	Education and Training
	Forensic Science Practices
	Forensic Science Techniques
	Impact of DNA
	Improving Forensic Science
	Interpretation
	Laboratory Practices
	NIFS (National Institute of Forensic Science)
	Pressures on Forensic Science
	Quality Control
	Research and Development
	Scientific Principles
	Standardization and Best Practise

**Appendix B: Index of Literature Review**

<b>Literature Collated Pertaining to <i>DNA Technology in Forensic Science</i> (1992)</b>		
<b>Author(s)</b>	<b>Title</b>	<b>Citation</b>
Kenneth R. Kreiling	DNA Technology in Forensic Science, Review Commentary	33 JURIMETRICS J. 449 (1992-1993)
Paul C. Giannelli	Forensic Symposium: The Use and Misuse of Forensic Evidence	28 OKLA. CITY U. L. REV. 1 (2003)
Margann Bennett	Admissibility Issues of Forensic DNA Evidence	44 U. KAN. L. REV. 141 (1995-1996)
L. Damon Whitmore	The Admissibility of DNA Evidence in Criminal Proceedings	39 WAYNE L. REV. 1411 (1992-1993)
R. Stephen Kramer	Admissibility of DNA Statistical Data: A Proliferation of Misconception	30 CAL. W. L. REV. 145 (1993-1994)
Michael A. Riley	How Should North Dakota Approach the Admissibility of DNA: A Comprehensive Analysis of How Other Courts Approach the Admissibility of DNA	72 N. D. L. REV. 607 (1996)
Edward Imwinkelried	Flawed Expert Testimony: Striking the Right Balance in Admissibility Standards	18 CRIM. JUST. 28 (2003-2004)
Elizabeth A. Allen	The Admissibility of DNA Evidence in Washington after State v Cauthron	69 WASH. L. REV. 383 (1994)
Karla K. Hotis	The Admissibility of PCR-Based DNA Evidence: State v Lyons	37 JURIMETRICS 495 (1996-1997)
Gordon Russell	A Pathfinder on the Admissibility of Forensic DNA Evidence in Criminal Cases	13 LEGAL REFERENCE SERVICES Q. 19 (1993-1994)
Rockne P. Harmon & Edward J. Imwinkelried	The Admissibility of Evidence of the Accused's Opportunity to Retest Physical Evidence in Criminal Cases	37 NEW ENG. J. ON CRIM. & CIV. CONFINEMENT 3 (2011)
Jennifer Callahan	The Admissibility of DNA Evidence in the United States and England	19 SUFFOLK TRANSNATIONAL LAW REVIEW 537 (1995-1996)
Kathleen W. Berdan	The Admissibility of DNA Evidence: Minnesota No Longer Stands Alone	20 WM. MITCHELL L. REV. 1063 (1994)
Scott D. Sherwood	The Pennsylvania Supreme Court Denies the Standard of Admissibility for DNA Evidence at Trial	68 TEMPLE L. REV. 953 (1995)
William C. Thompson	Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the "DNA War"	84 J. CRIM. L. & CRIMINOLOGY 22 (1993-1994)
Adina Schwartz	A Systematic Challenge to the Reliability and Admissibility of Firearms and Toolmark Identification	6 COLUM. SCI. & TECH. L. REV. 1 (2004-2005)
Carlton Bailey	The Admissibility of "Novel Scientific Evidence" in Arkansas: Does Frye Matter?	52 ARK. L. REV. 671 (1999)
Lawrence B. Ebert	Frye after Daubert: The Role of Scientists in Admissibility Issues As Seen Through Analysis of the DNA Profiling Cases	1993 U. CHI. L. SCH. ROUNDTABLE 219 (1993)
Sherry J. Whitney	State v Bible: The Admissibility of Forensic DNA Profiling and Statistical Probability Evidence in Arizona Criminal Proceedings	26 ARIZ. ST. L. J. 593 (1994)

Edward Imwinkelried	The Case Against Evidentiary Admissibility Standards that Attempt to Freeze the State of a Scientific Technique	67 U. COLO. L. REV. 887 (1996)
Irene M. Flannery	Frye or Frye Not: Should the Reliability of DNA Evidence be a Question of Weight or Admissibility	30 AM. CRIM. L. REV. 161 (1992-1993)
Justin Amirian	Weighing the Admissibility of fMRI Technology under FRE 403: For the Law, FRE Changes Everything - And Nothing	41 FORDHAM URB. L.J. 715 (2013-14)
Simon A. Cole	Science without Precedent: The Impact of the National Research Council on the Admissibility and use of Forensic Science Evidence in the United States	4 BRIT. J. AM. LEGAL STUD. 585 (2015)
Jason D. Altman	Admissibility of Forensic DNA Profiling Evidence: A Movement away from Frye v United States and a Step Toward the Federal Rules of Evidence: United States v Jakobetz 955 F.2d 786 (2nd Cir. 1992), Cert. Denied, 113 S. Ct. 104 (1992)	44 WASH. U. J. URB. & CONTEMP. L. 211 (1993)
Judicature	Letters	77 JUDICATURE 5 (1993-1994)
Gilles Renaud	Book Reviews	66 POLICE J. 430 (1993)
D. H. Kaye	DNA, NAS, NRC, DAB, RFLP, PCR and More: An introduction to the Symposium on the 1996 NRC Report on Forensic DNA Evidence	37 JURIMETRICS 395 (1996-1997)
Jasmin Samrad	Book Reviews	10 HIGH TECH. L. J. 433 (1995)
Dan. L. Burk.	Genetic Privacy: Constitutional Considerations in Forensic DNA Testing	5 GEO. MASON U. C.R. L.J. 1 (1994-1995)
Alan R. Davies	Are you my mother? The scientific and Legal Validity of Conventional Blood Testing and DNA Fingerprints to Establish Proof of Parentage in Immigration Cases	1994 BYU L. REV. 129 (1994)
Leonard J. Deftos	Daubert & (and) Frye: Compounding the Controversy over the Forensic Use of DNA Testing	15 WHITTIER L. REV. 955 (1994)
D. H. Kaye	The Forensic Debut of the National Research Council's DNA Report: Population Structure, Ceiling Frequencies and the Need for Numbers	34 JURIMETRICS J. 369 (1993-1994)
Peter A. Talieri	Evidence - Massachusetts Replaces Frye Test with Daubert Standard for Determining Admission of DNA Evidence in Criminal Trials	29 SUFFOLK U. L. REV. 357 (1995)
Anada I. Gunn-Sanders	From Crime Scene to Court Room: The Emergence of Mitochondrial DNA as Evidence	14 ADELPHIA L. J. 19 (2001-2003)
James Morgan	DNA Profiling in North Carolina	21 N. C. CENT. L.J. 300 (1995)
Sue Rosenthal	My Brother's Keeper: A Challenge to the Probative Value of DNA Fingerprinting	23 AM. J. CRIM. L. 195 (1995-1996)
Peter J. Neufeld	Have you No Sense of Decency? Comments	84 J. CRIM. L. CRIMINOLOGY 189 (1993)
Arthur V. N. Wint	There is Power in the Blood (Comments)	9 J. CRIM. JUST. EDUC. 169 (1998)
Khaleda Parven	Forensic Use of DNA Information v Human rights and Privacy Challenges	17 U. W. SYDNEY L. REV. 14 (2013)
Edward Imwinkelried	Professor Margaret Berger, the Epitome of the Fully Engaged Scholar and Friend of the Court	75 BROOK L. REV. 1153 (2009-2010)
Leo Adler	DNA and Me and You	20 LEGAL MED. Q. 1 (1996)

Jonathan J. Koehler	Why DNA Likelihood Ratios Should Account for Error (Even When A National Research Council Report Says they should not)	37 JURIMETRICS 425 (1996-1997)
David H. Kaye	Case Comment: People v Nelson - A Tale of Two statistics	7 LAW PROB. & RISK 249 (2008)
Denise A. Filicoma	Unravelling the DNA Controversy: People v Wesley, a step in the right direction	3 J. L. & POL'Y 937 (1994-1995)
Jonathan J. Koehler	Proficiency Tests to Estimate Error Rates in the Forensic Sciences	12 LAW PROB. & RISK 89 (2013)
Steven M. Johnson	DNA Evidence in Virginia	8 CAP. DEF. DIG. 43 1995-(1996)
Yale H. Yee	Criminal DNA Data Banks: Revolution for Law Enforcement or Threat to Individual Privacy	22 AM. J. CRIM. L. 461 (1994-1995)
Sarah E. Snyder	Experimental or Demonstrable: Has DNA Testing truly Emerged from the Twilight Zone - An Assessment of Washington's Response to DNA Identification	31 WILLAMETTE L. REV. 201 (1995)
Soren Frederiksen	The National Academy of Sciences, Canadian DNA Jurisprudence and Changing Forensic Practice	35 MAN. L. J. 111 2011-(2012)
D. H. Kaye	The NRC Bullet Lead Report: Should Science Committees Make Legal Findings	46 JURIMETRICS 91 (2005-2006)
Catherine M. Polizzi	A New View into the Truth: Impact of a Reliable Deception Detection Technology on the Legal System	21 RUTGERS COMPUTER & TECH. L.J. 395 (1995)
Gerald D. Robin	DNA Evidence in Court: The Odds aren't Even	9 CRIM. JUST. 8 (1994-1995)
Michael Lynch	Expertise in Action - Presenting and Attacking Expert Evidence in DNA Fingerprint Cases	52 VILL. L. REV. 925 (2007)
John McCabe	DNA Fingerprinting: The Failings of Frye	16 N. ILL. U. L. REV. 455 (1995-1996)
Edward Imwinkelried	The Next Step in Conceptualising the Presentation of Expert Evidence as Education: The Case for Didactic Trial Procedures	1 INT'L J. EVIDENCE & PROOF 128 (1996-1997)
Edward Imwinkelried	The Next Step after Daubert: Developing a Similarly Epistemological Approach to Ensuring the Reliability of Nonscientific Expert Testimony	15 CARDOZO L. REV. 2271 (1993-1994)
Ricardo G. Federico	The Genetic Witness: A Higher Judicial Solicitude	49 CRIM. L. Q. 187 (2004-2005)
Rockne P. Harmon	Legal Criticisms of DNA Typing: Where's the Beef?	84 J. CRIM. L. & CRIMINOLOGY 175 (1993-1994)
David H. Kaye	The Science of DNA Identification From the Laboratory to the Court Room	8 MINN. J. L. SCI. & TECH. 409 (2007)
Margaret A. Berger	Expert Testimony in Criminal Proceedings: Questions Daubert does not Answer	33 SETON HALL L. REV. 1125 (2002-2003)
Dara L. McKinney	Criminal Procedure - New Mexico Accepts Forensic DNA Evidence under Rule of Evidence 11-702 State v Anderson	25 N. M. L. REV. 283 (1995)
Julian Adams	Nuclear and Mitochondrial DNA in the Courtroom	13 J. L. POL'Y 69 (2005)
	Index of Discussed Books, Articles and Essays	15 CARDOZO L. REV. 2387 (1993-1994)
Randi. B. Weiss et al.	The Use of Genetic Testing in the Courtroom	34 WAKE FOREST L. REV. 889 (1999)

George Sensabaugh, D. H. Kaye	Non Human DNA Evidence	39 JURIMETRICS 1 (1998-1999)
William C. Thompson	A Sociological Perspective on the Science of Forensic DNA Testing	30 U. C. DAVIS L. REV. 1113 (1996-1997)
Margaret A. Berger	The Impact of DNA Exonerations on the Criminal Justice System	34 J. L. MED. & ETHICS 320 (2006)
Jonathan J. Koehler	The Random Match Probability in DNA Evidence: Irrelevant and Prejudicial	35 JURIMETRICS J. 201 (1994-1995)
Monjur Kader et al.	The use of DNA Forensic Evidence in Criminal Justice	29 SING. L. REV. 35 (2011)
American Bar Association	American Bar Association Criminal Justice Section Report to the House of Delegates	22 FORDHAM URB. L. J. 343 (1994-1995)
Christopher L. Blakesley	La Preuve Penale et Tests Genetiques United States Report	46 AM. J. COMP. L. SUP. 605 (1998)
Mary Gaston	State v Gentry: The Washington Supreme Court Opens the Door For Unreliable Scientific Evidence	31 GONZ. L. REV. 475 1995-(1996)
Judith E. Lewter	The Use of Forensic DNA in Criminal Cases in Kentucky as Compared with Selected Other States	86 KY. L. J. 223 (1997-1998)
Major Douglas A. Dribben	DNA Statistical Evidence and the "Ceiling Principle": Science or Science Fiction?	146 MIL. L. REV. 94 (1994)
Kamarin T. MacKnight	The Polymerase Chain Reaction (PCR): the Second Generation of DNA Analysis Methods Takes the Stand	205 SANTA CLARA COMPUTER AND HIGH TECH L. J. 95 (2003-2004)
Christopher L. Blakesley	Scientific Testing and Proof of Paternity: Some Controversy and Key Issues for Family Law Counsel	57 LA. L. REV. 279 (1996-1997)
Jurimetrics	Book Reviews	52 JURIMETRICS 107 (2011-2012)
Kamarin T. MacKnight	Polymerase Chain Reaction (PCR): The Second Generation of DNA Analysis Methods Takes the Stand	9 SANTA CLARA COMPUTER & HIGH TECH L. J. 287 (1993)
Jon P. Thames	It's Not Bad Law - It's Bad Science: Problems with Expert Testimony in Trial Proceedings	18 AM. J. TRIAL ADVOC. 545 (1994-1995)
Jennifer Sue Deck	Prelude to a Miss: A Cautionary Note Against Expanding DNA Databases in the face of Scientific Uncertainty	20 VT. L. REV. 1057 (1995-1996)
Paul C. Giannelli	Forensic Science: Under the Microscope	34 OHIO N. U. L. REV. 315 (2008)
Edward Imwinkelried	Coming to Grips with Scientific Research in Daubert's Brave New World: The Courts' Need to Appreciate the Evidentiary Differences between Validity and Proficiency Studies	61 BROOK L. REV. 1247 (1995)
Margaret A. Berger	Laboratory Error Seen Through the Lens of Science and Policy	30 U. C. DAVIS L. REV. 1081 (1996-1997)
Mike Redmayne	Expert Evidence and Scientific Disagreement	30 U. C. DAVIS L. REV. 1027 (1996-1997)
Ryan McDonald	Juries and Crime Labs: Connecting the Weak Links in the DNA Chain	24 AM. J. L. & MED. 345 (1998)
Paul C. Giannelli, Susan Friedman	The National Academy of Sciences Report: A Challenge to Forensic Science	24 CRIM. JUST. 4 (2009-2010)
William C. Thompson	The National Research Council's Plan to Strengthen Forensic Science: Does the Path Forward Run Through The Courts	50 JURIMETRICS 35 (2009-2010)
Richard H. Underwood	Evaluating Scientific and Forensic Evidence	24 AM. J. TRIAL ADVOC. 149 (2000-2001)

David H. Kaye	Identification, Individualisation and Uniqueness: What's the Difference	8 LAW, PROB. & RISK 85 (2009)
Jonathan Kahn	Race, Genes and Justice - A Call to Reform the Presentation of Forensic DNA Evidence in Criminal Trials	74 BROOK. L. REV. 325 (2008-2009)
Paul C. Giannelli	Forensic Science and the ABA Innocence Report	37 SW. U. L. REV. 993 (2008)
Manning A. Connors III	DNA Databases: The Case for the Combined DNA Index System	29 WAKE FOREST L. REV. 889 (1994)
Trevor R. McDonald	Genetic Justice: DNA Evidence and the Criminal Law in Canada	26 MAN. L. J. 1 (1998-1999)
Jacqueline A. Goodwin, Lirieka Meintjes-Van Der Walt	The Use of DNA Evidence in South Africa: Powerful Tool or Prone to Pitfalls	114 S. AFRICAN L. J. 151 (1997)
James R. Ehleringer, Scott M. Matheson Jr.	Stable Isotopes and Courts	2010 UTAH L. REV. 385 (2010)
J. Clay Smith Jr.	The Precarious Implications of DNA Profiling	55 U. PITT. L. REV. 865 (1993-1994)
Michael J. Saks	Merlin and Solomon: Lessons from the Law's Formative Encounters with Forensic Identification Science	49 HASTINGS L. J. 1069 (1997-1998)
Gary Edmond	(Ad)Ministering Justice: Expert Evidence and the Professional Responsibilities of Prosecutors	36 U. N. S. W. L. J. 921 (2013)
Sheila Jasanoff	Research Subpoenas and the Sociology of Knowledge	59 LAW & CONTEMP. PROBS. 95 (1996)
Stephen E. Feinberg et al.	Understanding and Evaluating Statistical Evidence in Litigation	36 JURIMETRICS J. 1 (1995-1996)
John B. Arango	Defense Services for the Poor	9 CRIM. JUST. 51 (1994-1995)
Paul C. Giannelli	Scientific Evidence in Criminal Prosecutions - A Retrospective	75 BROOK L. REV. 1137 (2009-2010)
Wayne g. Plumtree	A Perspective on the Appropriate Weight to be given to the National Academy of Sciences' Report on Forensics in Evidentiary Hearings: The Significance of Continued Court Acceptance of Fingerprint Evidence	42 SW. L. REV. 605 (2012-2013)
Sheryl H. Love	Allowing New Technology to Erode Constitutional Protections: A Fourth Amendment Challenge to Non-Consensual DNA Testing of Prisoners	38 VILL. L. REV. 1617 (1993)
Edward K. Cheng	Mitochondrial DNA: Emerging Legal Issues	13 J. L. POL'Y 99 (2005)
Paul C. Giannelli	The NRC Report and its Implications for Criminal Litigation	50 JURIMETRICS 53 (2009-2010)
Michael J. Short	Forensic Data Analysis: An Examination of Common Objects Raised to the Admission of DNA Fingerprinting as Illustrated by State v Pierce	19 U. DAYTON L. REV. 133 (1993-1994)
Barry C. Scheck	DNA and Daubert	15 CARDOZO L. REV. 1959 (1993-1994)
Aviam Soifer, Miriam Wugmeister	Mapping and Matching DNA: Several Legal Complications of Accurate Classifications	22 HASTINGS CONST. L. Q. 1 (1994-1995)

David H. Kaye	The Relevance of "Matching" DNA: Is the Window Half Open or Half Shut?	85 J. CRIM. L. & CRIMINOLOGY 676 (1994-1995)
Margaret A. Berger	Procedural Paradigms for Applying the Daubert Test	78 MINN. L. REV. 1345 (1993-1994)
William C. Thompson	Accepting Lower Standards: The National Research Council's Second Report on Forensic DNA Evidence	37 JURIMETRICS 405 (1996-1997)
Paul C. Giannelli	Forensic Science	34 J. L. MED. & ETHICS 310 (2006)
David H. Kaye	Bioethics, Bench and Bar: Selected Arguments in Landry v Attorney General	40 JURIMETRICS 193 (1999-2000)
Richard A. Nakashima	DNA Evidence in Criminal Trials: A Defense Attorney's Primer	75 NEB. L. REV. 444 (1995)
Paul C. Giannelli	Forensic Science	33 J. L. MED. & ETHICS 535 (2005)
Edward Imwinkelried	Impoverishing the Trier of Fact: Excluding the Proponent Expert Testimony due to the Opponent's Inability to Afford Rebuttal Evidence	40 CONN. L. REV. 317 (2007-2008)
Paul C. Giannelli	Book Reviews	88 J. CRIM. L. & CRIMINOLOGY 380 (1997-1998)
Warren R. Webster Jr.	DNA Database Statutes and Privacy in the Information Age	10 HEALTH MATRIX 119 (2000)
	Confronting the New Challenges of Scientific Evidence	108 HARV. L. REV. 1481 (1995)
Edward K. Cheng	Scientific Evidence as Foreign Law	75 BROOK. L. REV. 1095 (2010)
Christian B. Sundquist	Science Fictions and Racial Fables: Navigating the Final Frontier of Genetic Interpretation	25 HARV. BLACKLETTER L. J. 57 (2009)
Jonathan J. Koehler	When Do Courts Think Base Rate Statistics are Relevant	42 JURIMETRICS 373 2001- (2002)
Carol Might	DNA Analysis and the Freedom of information Act: Information or Invasion	24 OKLA. CITY. U. L. REV. 773 (2001)
David H. Kaye	The Role of Race in DNA Statistics: What Experts Say, What California Courts Allow	37 SW. U. L. REV. 303 (2008)
Joseph Sanders	Utterly Ineffective: Do Courts have a Role in Improving the Quality of Forensic Expert Testimony	38 FORDHAM URB. L. J. 547 (2010-2011)
Omphemetse Mooki	DNA Typing as a Forensic Tool: Applications and Implications for Civil Liberties	13 S. AFR. J. ON HUM. RTS. 565 (1997)
John P Cronan	The Next Frontier of Law Enforcement: A Proposal for Complete DNA Banks	28 AM. J. CRIM. L. 119 (2000)
Dale A. Nance, Scott B. Morris	An Empirical Assessment of Presentation formats for Trace Evidence with a Relatively Large and Quantifiable Random Match Probability	42 JURIMETRICS 403 2001- (2002)
Michael R. Sweeney	DNA Typing: Defending a Process under Vigorous Attack	21 CAP. U. L. REV. 611 (1992)
Richard Lempert	After the DNA Wars: A Mopping Up Operation	31 ISR. L. REV. 536 (1997)
Richard Lempert	After the DNA Wars: Skirmishing with NRCII	37 JURIMETRICS 439 (1996-1997)
Lirieka Meintjes-van der Walt	An Overview of the Use of DNA Evidence in South African Criminal Courts	21 S. AFR. J. CRIM. JUST. 22 (2008)

Dale A. Nance, Scott B. Morris	Juror Understanding of DNA Evidence: An Empirical Assessment of Presentation Formats for Trace Evidence with a Relatively Small Random Match Probability	34 J. LEGAL STUD. 395 205
Simon A. Cole	Who Speaks for Science? A Response to the National Academy of Sciences Report on Forensic Science	9 LAW PROB. & RISK 25 2010
Veronica Valdivieso	DNA Warrants: A Panacea for Old, Cold Rape Cases	90 GEO. L. J. 1009 2002
Paul C. Giannelli	Junk Science: The Criminal Cases	84 J. CRIM. L. & CRIMINOLOGY 105 (1993- 1994)
Edward Imwinkelried, David H. Kaye	DNA Typing: Emerging or Neglected Issue	76 WASH. L. REV. 413 (2001)
Paul C. Giannelli	Regulating Crime Laboratories: The Impact of DNA Evidence	15 J. L. & POL'Y 59 (2007)
Edward J. Kionka, James R. Williams	Survey of Illinois Law: Evidence	17 S. ILL. U. L. J. 873 (1992- 1993)
Jay P. Kesan	A Critical Examination of the Post-Daubert Scientific Evidence Landscape	52 FOOD & DRUG L. J. 225 (1997)
Matthew Goode	Some Observations on Evidence of DNA Frequency	23 ADEL. L. REV. 45 (2002)
Paul B. Tyler	Evidence	22 PEPP. L. REV. 1274 (1994-1995)
Paul C. Giannelli	The Supreme Court's Criminal Daubert Cases	33 SETON HALL L. REV. 1071 (2002-2003)
Paul C. Giannelli	Expert Testimony and the Confrontation Clause	22 CAP. U. L. REV. 45 (1993)
Anna M. Franceschelli	Motions for Postconviction DNA Testing: Determining the Standard of Proof Necessary in Granting Requests	31 CAP. U. L. REV. 243 (2003)
Mark B. Watson	Criminal Law/Procedure	2 ROGER WILLIAMS U. L. REV. 436 (1996-1997)
John Devlin	Genetics and Justice: An Indigent Defendant's Right to DNA Expert Assistance	1998 U. CHI. LEGAL F. 395 (1998)
Peter Donnelly, Richard D. Friedman	DNA Database Searches and the Legal Consumption of Scientific Evidence	97 MICH. L. REV. 931 1998- (1999)
Kenneth E. Melson	Embracing the Path Forward: the Journey to Justice Continues	36 NEW ENG. J. ON CRIM. & CIV. CONFINEMENT 197 (2010)
George Bundy Smith, Janet A. Gordon	The Admission of DNA Evidence in State and Federal Courts	65 FORDHAM L. REV. 2465 (1996-1997)
Jennifer N. Mellon	Manufacturing Convictions: Why Defendants are Entitled to the Data Underlying Forensic DNA Kits	51 DUKE L. J. 1097 (2001- 2002)
William C. Thompson	DNA Evidence in the O.J. Simpson Trial	67 U. COLO. L. REV. 827 (1996)
John J. Walsh	The Population Genetics of Forensic DNA Typing: Could it Have Been Someone Else	34 CRIM. L. Q. 469 (1991- 1992)
David H. Kaye	Bible Reading: DNA Evidence in Arizona	28 ARIZ. ST. L. J. 1035 (1996)
Aaron P. Stevens	Arresting Crime: Expanding the Scope of DNA Databases in America.	79 TEX. L. REV. 921 (2000- 2001)
Dale Alan Bruschi	Evidence: 1996 Survey of Florida Law	21 NOVA. L. REV. 149 (1996-1997)

Daryl E. Harris	By Any Means Necessary: Evaluating the Effectiveness of Texas' DNA Testing Law in the Adjudication of Free-Standing Claims of Actual Innocence	6 SCHOLAR 121 (2003-2004)
David H. Kaye	Probability, Individualisation, and Uniqueness in Forensic Science Evidence - Listening to the Academies	75 BROOK. L. REV. 1163 (2010)
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Simon A. Cole, Gary Edmond	Science without Precedent: The Impact of the National Research Council on the Admissibility and use of Forensic Science Evidence in the United States	4 BRIT. J. AM. LEGAL STUD. 585 (2015)
Paul C. Giannelli	Analysis of Bullet Lead: A Cautionary Tale	21 CRIM. JUST. 52 (2006-2007)
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Harry T. Edwards	The National Academy of Sciences Report on Forensic Science: What it Means for the Bench and Bar	51 JURIMETRICS 1 (2010-2011)
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Jules Epstein	Cross-Examination: Seemingly Ubiquitous, Purportedly Omnipotent, and At Risk	14 WIDENER L. REV. 427 (2008-2009)
Rachel Dioso-Villa	Scientific and Legal Developments in Fire and Arson Investigation Expertise in Texas v Willingham	14 MINN. J. L. SCI. & TECH. 817 (2013)
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Rachel E. Barkow	Prosecutorial Administration: Prosecutor Bias and The Department of Justice	99 VA. L. REV. 271 (2013)
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Kathryn E. Carso	Amending the Illinois Postconviction Statute to Include Ballistics Testing	56 DEPAUL L. REV. 695 (2006-2007)
William A. Tobin, Peter J. Blau	Hypothesis Testing of the Critical Underlying Premise of Discernible Uniqueness in Firearms-Toolmarks Forensic Practice	53 JURIMETRICS 121 (2012- 2013)
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Eugene Volokh	Crime-Facilitating Speech	57 STAN. L. REV. 1095 (2005)
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Paul C. Giannelli	The NRC Report and its Implications for Criminal Litigation	50 JURIMETRICS 53 (2009- 2010)
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Sarah L. Cooper	Judicial Responses to Challenges to Firearms-Identification Evidence: A Need for New Judicial Perspectives on Finality	31 T. M. COOLEY L. REV. 457 (2014)
Herbert B. Dixon, Jr	Forensic Science Under the Spotlight	48 JUDGES J. 36 (2009)
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David Hamer	Tendency Evidence in Hughes v The Queen: Similarity, Probative Value and Admissibility	38 SYDNEY L. REV. 491 (2016)
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Thomas Craig	By a Scintilla of Evidence: The Issues Involved in the Admissibility of Low Copy	23 B. U. J. SCI. & TECH. L. 180 (2017)

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Beth A. Riffe	The Aftermath of Melendez: Highlighting the Need for Accreditation-Based Rules of Admissibility for Forensic Evidence	27 T. M. COOLEY L. REV. 165 (2010)
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Edward J. Imwinkleried	Evidence of a Third Party's Guilt of the Crime that the Accused is Charged With: The Constitutionalization of the SODDI (Some Other Dude Did It) Defense 2.0	47 LOY. U. CHI. L. J. 91 (2015-2016)
Paul S. Milich	Georgia's New Evidence Code - An Overview	28 GA. ST. U. L. REV. 379 (2011-2012)
Nanning Zhang, Douglas Walton	Recent Trends in Evidence Law in China and the New Evidence Scholarship	9 LAW, PROB. & RISK 103 (2010)
Joshua D. Jones	Fingerprint Problems: Laden with Historical Misconceptions	18 W. MICH. COOLEY J. PRAC. & CLINICAL L. 199 (2016)
Dan Simon	Criminal Law at the Crossroads: Turn to Accuracy	87 S. CAL. L. REV. 421 (2013-2014)
Valerie J. Silverman	Testing the Testimonial Doctrine: The Impact of Melendez-Diaz v Massachusetts on State-Level Criminal Prosecutions and Procedure	91 B. U. L. REV. 789 (2011)
Jesse J. Norris	Who Can Testify about Lab Results after Melendez-Diaz and Bullcoming: Surrogate Testimony and the Confrontation Clause	38 AM. J. CRIM. L. 375 (2010-2011)
Parisa Dehghani-Tafti, Paul Bieber	Folklore and Forensics: The Challenges of Arson Investigation and Innocence Claims	119 W. VA. L. REV. 549 (2016)
Jessica D. Gabel	Realizing Reliability in Forensic Science: Science from the Ground Up	104 J. CRIM. JUST. & CRIMINOLOGY 283 (2014)
Brandon L. Garrett	Constitutional Regulation of Forensic Evidence	73 WASH. & LEE L. REV. 1147 (2016)
Henry T. Greely	Neuroscience, Mindreading, and the Courts: The Example of Pain	18 J. HEALTH CARE L. & POL'Y 171 (2015)
Seth Stoughton	Evidentiary Rulings as Police Reform	69 U. MIAMI L. REV. 429 (2014-2015)
Laurel Gilbert	Sharpening the Tools of an Adequate Defense: Providing For Appointment of Experts for Indigent Defendants in Child Death Cases under Ake v Oklahoma	50 SAN DIAGO L. REV. 469 (2013)
David L. Faigman, John Monahan, Christopher Slobogin	Group to Individual (G2i) Inference in Scientific Expert Testimony	81 U. CHI. L. REV. 417 (2014)
Trevor Rosson	A New Remedy for Junk Science: Article 11.073 and Texas's Response to the Changing Landscape in the Forensic Sciences	48 ST MARY'S L. J. 465 (2016-2017)
Donald P. Judges, Stephen J. Cribari	Speaking of Silence: A Reply to Making Defendants Speak	94 MINN. L. REV. 800 (2009-2010)
Emma Cunliffe	Judging, Fast and Slow: Using Decision-Making Theory to Explore Judicial Fact Determination	18 INT'L J. EVIDENCE & PROOF 139 (2014)

Gary Edmond, Kristy Martire, Mehera San Roque	Expert Reports and the Forensic Sciences	40 U. N. S. W. L. J. 590 (2017)
Nicholas Klaiber	Confronting Reality: Surrogate Forensic Science Witnesses under the Confrontation Clause	97 VA. L. REV. 199 (2011)
Peter A. Chickris, Mykal J. Fix	Present Danger: Preventing Wrongful Convictions by Resolving Critical Issues within Texas's Criminal Justice System	52 S. TEX. L. REV. 365 (2010-2011)
Ben K. Grunwald	Suboptimal Social Science and Judicial Precedent	161 U. PA. L. REV. 1409 (2013)
Deborah L. Meyer	Melendez-Diaz v Massachusetts: What Expanded Confrontation Clause Ruling Means for Computer Forensics and Electronic Discovery	28 TEMP. J. SCI. TECH. & ENVTL. L. 243 (2009)
Gary Edmond	Forensic Science Evidence and the Conditions for Rational (Jury)Evaluation	39 MELB. U. L. REV. 77 (2015-2016)
Erica Beecher-Monas	Lost of Translation: Statistical Inference in Court	46 ARIZ. ST. L. J. 1057 (2014)
Gary Edmond, Emma Cunliffe	Cinderella Story: The Social Production of a Forensic Science	106 J. CRIM. L. & CRIMINOLOGY 219 (2016)
Kimberley Cogdell Boies	Misuse of DNA is not Always a Harmless Error: DNA Evidence, Prosecutorial Misconduct, and Wrongful Conviction	17 TEX. WESLEYAN L. REV. 403 (2010-2011)
Ethan Thomas	The Confrontation Clause and New Mexico's Short-Lived Acceptance of Surrogate Forensic Witnesses	42 N. M. L. REV. 263 (2012)
John H. Blume, Rebecca K. Helm	The Unexonerated: Factually Innocent Defendants Who Plead Guilty	100 CORNELL L. REV. 157 (2014-2015)
Jennifer E. Laurin	Criminal Law's Science Lag: How Criminal Justice Meets Changed Scientific Understanding	93 TEX. L. REV. 1751 (2014-2015)
Erin Murphy	The Mismatch Between Twenty-First Century Forensic Evidence and Our Antiquated Criminal Justice System	64 RI BAR JNL. 4 (2014)
Lauren Quint	Bridging the Gap: An Application of Social Frameworks Evidence to Shaken Baby Syndrome	62 HASTINGS L. J. 1839 (2010-2011)
Sean K. Driscoll	I Messed Up Bad: Lessons on the Confrontation Clause from the Annie Doohkan Scandal	56 ARIZ. L. REV. 707 (2014)
Esther K. Hong	Friend or Foe: The Sixth Amendment Confrontation Clause in Post-Conviction Formal Revocation Proceedings	66 S. M. U. L. REV. 227 (2013)
Jennifer B. Sokoler	Between Substance and Procedure: A Role for States' Interests in the Scope of the Confrontation Clause	110 COLUM. L. REV. 161 (2010)
Millar W. Shealy Jr.	The Hunting of Man: Lies, Damn Lies, and Police Interrogations	4 U. MIAMI RACE & SOC. JUST. L. REV. 21 (2014)
Robert J. Norris, Catherine L. Bonventre, Allison D. Redlich, James R. Acker	Than That One Innocent Suffer: Evaluating State Safeguards against Wrongful Convictions	74 ALB. L. REV. 1301 (2010-2011)
Keith A. Findley	Innocence Protection in the Appellate Process	93 MARQ. L. REV. 591 (2009-2010)
Oren Perez	Judicial Strategies For Reviewing Conflicting Expert Evidence: Biases, Heuristics, and Higher-Order Evidence	64 AM. J. COMP. L. 75 (2016)
Margery Malkin Koosed	Reforming Eyewitness Identification Law and Practice to Protect the Innocent	42 CREIGHTON L. REV. 595 (2008-2009)

Andrew W. Jurs	Science Court: Past Proposals, Current Considerations, and a Suggested Structure	15 VA. J. L. & TECH. 1 (2010)
Marvin Zalman	An Integrated Justice Model of Wrongful Convictions	74 ALB. L. REV. 1465 (2010-2011)
Sandra Guerra Thompson	Daubert Gatekeeping for Eyewitness Identifications	65 S. M. U. L. REV. 593 (2012)
John Leubsdorf	Evidence Law as a System of Incentives	95 IOWA L. REV. 1621 (2009-2010)
Jennifer Mnookin, David Kaye	Confronting Science: Expert Evidence and the Confrontation Clause	2012 SUP. CT. REV. 99 (2012)
Donald E. Shelton	Twenty-First Century Forensic Science Challenges for Trial Judges in Criminal Cases: Where the Polybutadiene Meets the Bitumen	18 WIDENER L. J. 309 2008-(2009)
Anne Bowen Poulin	Experience-Based Opinion Testimony: Strengthening the Lay Opinion Rule	39 PEPP. L. REV. 551 (2012)
Joseph Ezzo	The Leonard Peltier Case: An Argument in Support of Executive Clemency Based on Norms of International Human Rights	38 AM. INDIAN L. REV. 35 (2013-2014)
Andrew W. Jurs	Balancing Legal Process with Scientific Expertise: Expert Witness Methodology in Five Nations and Suggestions for Reform of Post-Daubert U.S. Reliability Determinations	95 MARQ. L. REV. 1329 (2012)
Dan Simon	More Problems with Criminal Trials: The Limited Effectiveness of Legal Mechanisms	75 LAW & CONTEMP. PROBS. 167 (2012)
Wayne A. Logan	Policing Identity	92 B. U. L. REV. 1561 (2012)
Sandra Guerra Thompson	Judicial Gatekeeping of Police - Generated Witness Testimony	102 J. CRIM. L. & CRIMINOLOGY 329 (2012)
Charles F. Sabel, William H. Simon	Contextualizing Regimes: Institutionalization as a Response to the Limits of Interpretation and Policy Engineering	110 MICH. L. REV. 1265 (2011-2012)
Leonard Sosnov	Brady Reconstructed: An Overdue Expansion of Rights and Remedies	45 N. M. L. REV. 171 (2014-2015)
Achraf Farraj	Refugees and the Biometric Future: The Impact of Biometrics on Refugees and Asylum Seekers	42 COLUM. HUM. RTS. L. REV. 891 (2010-2011)
Milli Kanani Hansen	Testing Justice: Prospects for Constitutional Claims by Victims Whose Rape Kits Remain Untested	42 COLUM. HUM. RTS. L. REV. 943 (2010-2011)
Lissa Griffin	Correcting Injustice: Studying How the United Kingdom and the United States Review Claims of Innocence	41 U. TOL. L. REV. 107 (2009-2010)
Stephen William Smith	Policing Hoover's Ghost: The Privilege for Law Enforcement Techniques	54 AM. CRIM. L. REV. 233 (2017)
Amy A. Liberty	Defending the Black Sheep of the Forensic DNA Family: The Case for Implementing Familial DNA Searching in Minnesota	38 HAMLIN L. REV. 467 (2015)
Boaz Sangero, Mordechai Halpert	Scientific Evidence v Junk Science	11 ALEI MISHPAT 425 (2014)
Thomas D. Holland	Since I Must Please Those Below: Human Skeletal Remains Research and the Law	41 AM. J. L. & MED. 617 (2015)
Caitlin M. Plummer, Imran J. Syed	Criminal Procedure v Scientific Progress: The Challenging Path to Post-Conviction Relief in Cases that Arise During Periods of Shifts in Science	41 VT. L. REV. 279 (2016-2017)

Jennifer S. Bard	Ah Yes, I Remember it Well: Why the Inherent Unreliability of Human Memory Makes Brain Imaging Technology a Poor Measure of Truth-Telling in the Courtroom	94 OR. L. REV. 295 (2015-2016)
Aaron J. Lyttle	Return of the Repressed: Coping with Post-Conviction Innocence Claims in Wyoming	14 WYO. L. REV. 555 (2014)
Deborah Tuerkheimer	The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts	87 WASH. U. L. REV. 1 (2009-2010)
David Alan Sklansky	Hearsay's Last Hurrah	2009 SUP. CT. REV. 1 (2009)
Deborah Tuerkheimer	Science-Dependent Prosecution and the Problem of Epistemic Contingency: A Study of Shaken Baby Syndrome	62 ALA. L. REV. 513 (2010-2011)
Jon Yorke	Comity, Finality, and Oklahoma's Lethal Injection Protocol	69 OKLA. L. REV. 545 (2016-2017)
David L. Noll	Constitutional Evasion and the Confrontation Puzzle	56 B. C. L. REV. 1899 (2015)
Keith A. Findley	Implementing the Lessons from Wrongful Convictions: An Empirical Analysis of Eyewitness Identification Reform Strategies	81 MO. L. REV. 377 (2016)
Elizabeth Stevens	Crawford's Last Stand - What Melendez-Diaz v Massachusetts means for the Confrontation Clause and for Criminal Trials	2 AKRON J. CONST. L. & POL'Y 81 (2010-2011)
	Forty-Third Selected Bibliography on Computers, Technology and the Law	38 RUTGERS COMPUTER & TECH L. J. 277 (2012)
	Book Reviews	90 TEX. L. REV. 1473 (2011-2012)
Andrea Roth	Trial By Machine	104 GEO. L. J. 1245 (2015-2016)
Cynthia E. Jones	The Right Remedy for the Wrongly Convicted: Judicial Sanctions for Destruction of DNA Evidence	77 FORDHAM L. REV. 2893 (2008-2009)
Brendon L. Garrett	Invalid Forensic Science Testimony and Wrongful Convictions	95 VA. L. REV. 1 (2009)
Jonathan S. Masur, Lisa Larrimore Ouellette	Deference Mistakes	82 U. CHI. L. REV. 643 (2015)
Tucker Carrington, M. Chris Fabricant	The Shifted Paradigm: Forensic Science's Overdue Evolution from Magic to Law	4 VA. J. CRIM. L. 1 (2016)
Jennifer E. Laurin	Quasi-Inquisitorialism: Accounting for Deference in Pretrial Criminal Procedure	90 NOTRE DAME L. REV. 783 (2014-2015)
Jessica A. Roth	Informant Witnesses and the Risk of Wrongful Convictions	53 AM. CRIM. L. REV. 737 (2016)
Marvin Zalman, Ralph Grunewald	Reinventing the Trial: The Innocence Revolution and Proposals to Modify the American Criminal Trial	3 TEX. A & M L. REV. 189 (2015-2016)
Kerry Abrams	DNA and Distrust	91 NOTRE DAME L. REV. 757 (2015-2016)
Samuel R. Wiseman	Waiving Innocence	96 MINN. L. REV. 952 (2011-2012)
Robert J. Smith	Recalibrating Constitutional Innocence Protection	87 WASH. L. REV. 139 (2012)
Wayne McCormack	US Judicial Independence: Victim in the War on Terror	71 WASH. & LEE L. REV. 305 (2014)
Janet Moore	Democracy Enhancement in Criminal Law and Procedure	2014 UTAH L. REV. 543 (2014)

Melanie D. Wilson	An Exclusionary Rule for Police Lies	37 AM. CRIM. L. REV. 1 (2010)
Andrea Roth	Safety in Numbers - Deciding when DNA Alone is Enough to Convict	85 N. Y. U. L. REV. 1130 (2010)
James R Acker, Catherine L. Bonventre	Protecting the Innocent in New York: Moving Beyond Changing Only their Names	73 ALB. L. REV. 1245 (2009-2010)
James S. Liebman, Shawn Blackburn, David Mattern, Jonathan Waisnor	The Evidence of Things Not Seen: Non-Matches as Evidence of Innocence	98 IOWA L. REV. 577 (2012-2013)
James L. Robertson	Variations on a Theme by Posner: Facing the Factual Component of the Reliability Imperative in the Process of Adjudication	84 MISS. L. J. 471 (2014-2015)
Sandeep K. Narang, John D. Melville, Christopher S. Greeley, James D. Anderst	A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome - Part II: An Examination of the Differential Diagnosis	13 HOUS. J. HEALTH L. & POL'Y 203 (2012-2013)
	Transcript	46 U. C. D. L. REV. 759 (2012-2013)
Joshua A. T. Fairfield, Erik Luna	Digital Innocence	99 CORNELL L. REV. 981 (2013-2014)
Anthony G. Hertz, Randy Amsterdam	Table of Cases and Other Authorities	TRIAL MANUAL 6 FOR THE DEFENSE OF CRIMINAL CASES (2017)
Robert Snoddy, Kyo Suh	Rewards Programs in Remainder of Bar Year	25 CRIM. JUST. 52 (2010)
Cynthia E. Jones	I Am Ronald Cotton: Teaching Wrongful Convictions in a Criminal Law Class	10 OHIO ST. CRIM. L. 609 (2013)
	Book Reviews	62 J. LEGAL EDUC. 367 (2012-2013)
Sayo O. Fakayode, James P. Mayes, Margaret I. Kanipes, David Johnson, Ernest L. Cuthbertson	Promoting Student Learning in Criminal Justice, STEM, and Forensic Science: Aggie Sleuth Initiative (AggieSI)-Guided Inquiry Learning Experience	28 J. CRIM. JUST. EDUC. 192 (2017)
Karen Clark, Stephanie Gerstenblith, Diane Alonson, Robert Wright, Niyati Pandya	Inter-Institutional Partnerships: The Development of Multidisciplinary/Interprofessional Course in Forensics	24 J. CRIM. JUST. EDUC. 357 (2013)
James Robertson	Should Forensic Science Services be Independent of Policing - A Critical Reflection	24 CURRENT ISSUES CRIM. JUST. 131 (2012)
Alastair Ross	Forensic Science in Australia: Where Does Australia Sit in relation to Trends and Issues in the International Context	24 CURRENT ISSUES CRIM. JUST. 121 (2012)
Tamara R. Piety	Postscript	45 TULSA L. REV. 157 (2009)

Jessica D. Gabel, Ashley D. Champion	Regulating the Science of Forensic Evidence: A Broken System Requires a New Federal Agency	90 TEX. L. REV. SEE ALSO 19 (2011-2012)
Stephen Saloom	Adversaries as Allies: Joining Together to Prevent Criminal Injustice	73 ALB. L. REV. 1235 (2010)
Claude Roux, Frank Crispino, Olivier Ribaux	From Forensics to Forensic Science	24 CURRENT ISSUES CRIM. JUST. 7 (2012-2013)
Craig M. Cooley	Nurturing Forensic Science: How Appropriate Funding and Government Oversight can Further Strengthen the Forensic Science Community	17 TEX. WESLEYAN L. REV. 441 (2010-2011)
Emily West, Vanessa Meterko	Innocence Project: DNA Exonerations 1989-2014: Review of Data and Findings from the First 25 Years	79 ALB. L. REV. 717 (2015)
Erin Murphy	Physician Heal Thyself: Whither the Police and Prosecutor in the Tale of Forensic Science Gone Wrong	91 TEX. L. REV. SEE ALSO 102 (2012)
Boaz Sangero, Mordechai Halpert	A Safety Doctrine for the Criminal Justice System	2011 MICH. ST. L. REV. 1293 (2011)
Juan Hinojosa, Lynn Garcia	Improving Forensic Science through State Oversight: The Texas Model	91 TEX. L. REV. SEE ALSO 19 (2012)
Donald F. Tibbs	Of Law and Black Lives, 50 Years Later: Race and Policing in the Aftermath of the Moynihan Report	8 GEO. J. L. & MOD. CRITICAL RACE PERSP. 85 (2016)
Edward J. Imwinkleried	Dealing with Supposed Jury Preconceptions about the Significance of the Lack of Evidence: The Difference between the Perspective of the Policymaker and that of the Advocate	27 T. M. COOLEY L. REV. 37 (2010)
Danley	Duties and Difficulties of Investigating and Prosecuting Biocrimes	3 J. BIOSECURITY BIOSAFETY & BIODEFENSE L. 1 (2012)
Alec Karakatsanis	Policing, Mass Imprisonment, and the Failure of American Lawyers	128 HARV. L. REV. F. 253 (2014-2015)
Elizabeth L. Coyne	A Crumbling Keystone: Rebuilding Pennsylvania's Twenty-Year-Old Anatomical Gift Legislation	88 TEMP. L. REV. 551 (2016)
Kavita Marfatia Berger	The Role of Science in Preparedness and Response	6 U. ST. THOMAS L. J. 622 (2009)
Meghan J. Ryan	Finality and Rehabilitation	4 WAKE FOREST J. L. & POL'Y 121 (2014)
Daniel G. Orenstein	Shaken to The Core: Emerging Scientific Opinion and Post-Conviction Relief in Cases of Shaken Baby Syndrome	42 ARIZ. ST. L. J. 1305 (2010)
Tara R. Price	Bull Coming from the States: Why the Supreme Court should use Williams v Illinois to Close one of Bullcoming's Confrontation Clause Loopholes	39 FLA. ST. U. L. REV. 553 (2012)
Deborah Baskin, Ira Sommers	The Influence of Forensic Evidence on the Case Outcomes of Assault and Robbery Incidents	23 CRIM. JUST. POL'Y REV. 186 (2012)
Christopher Slobogin	Lessons From Inquisitorialism	87 S. CAL. L. REV. 699 (2014)
Kaitlyn Potter	Innocent Suffering: The Unavailability of Post-Conviction Relief in Virginia Courts	51 U. RICH. L. REV. 299 (2016)
Aaron Roussel	The Forensic Identification of Marijuana: Suspicion, Moral Danger, and the Creation of Non-Psychoactive THC	22 ALB. L. J. SCI. & TECH. 103 (2011-2012)
Christian B. Sundquist	The Dialects of Racial Genetics	76 ALB. L. REV. 1751 (2012)
Barack Obama	The President's Role in Advancing Criminal Justice Reform	130 HARV. L. REV. 811 (2017)

Laurence A. Benner	The California Public Defender: Its Origins, Evolution and Decline	5 CAL. LEGAL HIST. 173 (2016)
Anthony J. Casey, Julia Simon-Kerr	A Simple Theory of Complex Valuation	113 MICH. L. REV. 1175 (2015)
Marvin Zalman, Julia Carrano	Sustainability of Innocence Reform	77 ALB. L. REV. 955 (2013)
Jon B. Gould, Julia Carrano, Richard A. Leo	Predicting Erroneous Convictions	99 IOWA L. REV. 471 (2014)
Rachel Pecker	Quasi-Judicial Prosecutors and Post-Conviction Claims of Innocence: Granting Recusals to Make Impartiality a Reality	34 CARDOZO L. REV. 1609 (2013)
Keith A. Findley	Defining Innocence	74 ALB. L. REV. 1157 (2010)
Erin Murphy	Relative Doubt: Familial Searches of DNA Databases	109 MICH. L. REV. 291 (2010)
Gregory C. Sisk	The Legal Ethics of Real Evidence: Of Child Porn on the Choirmaster's Computer and Bloody Knives under the Stairs	89 WASH. L. REV. 819 (2014)
Marvin Zalman, Matthew Larson	Elephants in the Station House: Serial Crimes, Wrongful Convictions, and Expanding Wrongful Conviction Analysis to Include Police Investigation	79 ALB. L. REV. 941 (2015)
	Setting Forensic Science on a New Path	92 JUDICATURE 188 (2009)
Leila Barraza, Daniel G. Orenstein, Doug Campos-Outcalt	Denialism and its Adverse Effect on Public Health	53 JURIMETRICS 307 (2012-2013)
Stephen Cordner	Expert Opinions and Evidence: A Perspective from Forensic Pathology	17 FLINDERS L. J. 263 (2015)
Katherine Judson	Bias, Subjectivity, and Wrongful Conviction	50 U. MICH. J. L. REFORM 779 (2017)
John H. Blume, Sheryl Lynn Johnson	Gideon Exceptionalism	122 YALE L. J. 2126 (2013)
Stephen D. Mastrofski, James J. Willis	Police Organization Continuity and Change: Into the Twenty First Century	39 CRIME & JUST. 55 (2010)
Jennifer E. Laurin	Melendez-Diaz v Massachusetts, Rodriguez v City of Houston, and Remedial Rationing	109 COLUM. L. REV. SIDEBAR 82 (2009)
Julie Jonas	True Independence for Medical Examiners Equals Due Process for Criminal Defendants and More Efficiencies in the Criminal Justice System	37 WM. MITCHELL L. REV. 698 (2010-2011)
Jennifer Mnookin	Excerpt from Transcript of Proceedings: Experts and Forensic Evidence	39 SW. U. L. REV. 1009 (2009)
Lucian E. Dervan, Richard A. Leo, Meghan J. Ryan, Valena E. Beety, Gregory M. Gilchrist, William W. Berry III	Voices on Innocence	68 FLA. L. REV. 1569 (2016)
Kathleen Wayland, Sean D. O'Brien	Deconstructing Antisocial Personality Disorder and Psychopathy: A Guidelines-Based Approach to Prejudicial Psychiatric Labels	42 HOFSTRA L. REV. 519 (2013-2014)

Deborah Baskin, Ira Sommers	Solving Residential Burglaries in the United States: The Impact of Forensic Evidence on Case Outcomes	13 INT'L J. POLICE SC. & MGMT. 70 (2011)
Lila Kazemian, Ken Pease, David P. Farrington	DNA Retention Policies: The Potential Contribution of Criminal Career Research	8 EUR. J. CRIMINOLOGY 48 (2011)
Rachel E. Barkow	Prosecutorial Administration: Prosecutor Bias and The Department of Justice	99 VA. L. REV. 271 (2013)
Sarah M. Ruby	Checking the Math: Government Secrecy and DNA Databases	6 ISJLP 257 (2010-2011)
Myrna S. Raeder	Introduction to Wrongful Convictions Symposium	37 SW. U. L. REV. 763 (2008)
Paul C. Giannelli	Independent Crime Laboratories: The Problem of Motivational and Cognitive Bias	2010 UTAH L. REV. 247 (2010)
Paul C. Giannelli	Regulating DNA Laboratories: The New Gold Standard	69 N. Y. U. ANN. SURV. AM. L. 617 (2013-2014)
Jon B. Gould, Richard A. Leo	One Hundred Years Later: Wrongful Convictions after a Century of Research	100 J. CRIM. L. & CRIMINOLOGY 825 (2010)
Michael D. Risinger	The NAS/NRC Report on Forensic Science: A Glass Nine-Tenths Full (This is about the Other Tenth)	50 JURIMETRICS 21 (2009-2010)
Brandon L. Garrett	Big Data and Due Process	99-100 CORNELL L. REV. ONLINE 207 (2013-2015)
Brandon L. Garrett	The Crime Lab in the Age of the Genetic Panopticon	115 MICH. L. REV. 979 (2016-2017)
Daniel Richman	Framing the Prosecution	87 S. CAL. L. REV. 673 (2013-2014)
James M. Doyle	Learning from Error in American Criminal Justice	100 J. CRIM. L. & CRIMINOLOGY 109 (2010)
John Maddux	Arresting Development: A Call for North Carolina to Expand its Forensic Database by Collecting DNA from Felony Arrestees	32 CAMPBELL L. REV. 103 (2009-2010)
Craig M. Kabatchnick, P. Michelle Fitzsimmons, Jonathan B. Kelly	Radioactive Veterans: A New Look at the Nuclear History of America	14 MARQ. ELDER'S ADVISER 141 (2012-2013)
Boaz Sangero, Mordechai Halpert	Proposal to Reverse the View of a Confession: From Key Evidence Requiring Corroboration to Corroboration for Key Evidence	44 U. MICH. J. L. REFORM 511 (2010-2011)
David H. Kaye	Hypothesis Testing in Law and Forensic Science: a Memorandum	130 HARV. L. REV. F. 127 (2016-2017)

**Appendix C: List of Cases Comprising Data Set**

<b>Citation</b>	<b>Party Names</b>	<b>Relevant NAS Report(s)</b>
12 F.3d 540 6th Cir. 1993)	United States v. Bonds	DNA 1
30 F.3d 1144 (9th Cir 1994)	United States v. Chischilly	DNA 1
895 F.Supp. 460 (E.D. N.Y. 1995)	United States v. Shonubi	DNA 1
944 F.Supp. 1222 (E.D. Va. 1997)	Satcher v. J.D. Netherland	DNA 1
941 F.Supp. 513 (D.V.I. 1996)	Government of the Virgin Islands v. Byers	DNA 1
954 F.Supp. 401 (D. Mass. 1997)	United States v. Lowe	DNA 1
957 F.Supp. 331 (D. N.H. 1997)	United States v. Shea	DNA 1
979 F.Supp. 1429 (S.D. Fl. 1997)	United States v. Gaines	DNA 1
37 F.Supp.2d 279 (S.D. N.Y. 1999)	United States v. Cuff	DNA 1
58 M.J. 521 (M.J. 2003)	United States v. Mason	DNA 1
2005 WL 3159575 (D. D.C. 2005)	United States v.	DNA 1
374 F.Supp.2d 51 (D. D.C. 2005)	United States v. Morrow	DNA 1
2007 WL 1294602 (N.D. Fl. 2007)	Esty v. McDonough	DNA 1
602 F.Supp.2d 658 (D. Md. 2009)	United States v. Davis	DNA 1
655 F.3d 886 (9th Cir. 2011)	Woods v. Sinclair	DNA 1
764 F.3d 1109 (9th Cir. 2014)	Woods v. Sinclair	DNA 1
662 So.2d 1156 (Ala. Crim. App. 1993)	Dubose v. State	DNA 1
662 So.2d 1189 (Ala. 1995)	Ex Parte State of Alabama	DNA 1
704 So.2d 487 (Ala. Crim. App. 1997)	Barnes v. State	DNA 1
777 So.2d 750 (Ala. Crim. App. 1999)	Hammonds v. State	DNA 1
824 So.2d 1 (Ala. Crim. App. 1999)	Thomas v. State	DNA 1
908 P.2d 434 (Alaska Ct. App. 1995)	Harmon v. State	DNA 1
936 P.2d 545 (Alaska Ct. App. 1997)	Brodine v. State	DNA 1
175 Ariz. 549 (Ariz. 1993)	State v. Bible	DNA 1
183 Ariz. 484 (Ariz. Ct. App. 1994)	State v. Hummert	DNA 1
183 Ariz. 506 (Ariz. Ct. App. 1995)	State v. Bogan	DNA 1
183 Ariz. 623 (Ariz. Ct. App. 1995)	State v. Johnson	DNA 1
186 Ariz. 329 (Ariz. 1996)	State v. Johnson	DNA 1
8 Cal.App.4th 798 (Cal. Ct. App. 1992)	People v. Barney	DNA 1
10 Cal.App.4th 57 (Cal. Ct. App. 1993)	People v. Pizarro	DNA 1
14 Cal.App.4th 651 (Cal. Ct. App. 1993)	People v. Wallace	DNA 1
40 Cal.App.4th 128 (Cal. Ct. App. 1995)	People v. Venegas	DNA 1
31 Cal.App.4th 636 (Cal. Ct. App. 1995)	People v. Wilds	DNA 1
34 Cal.App.4th 1151 (Cal. Ct. App. 1995)	People v. Amundson	DNA 1
51 Cal.App.4th 180 (Cal. Ct. App. 1995)	People v. Burks	DNA 1
43 Cal.App.4th 643 (Cal. Ct. App. 1996)	People v. Morganti	DNA 1
18 Cal.4th 47 (Cal. 1998)	People v. Venegas	DNA 1
19 Cal.4th 481 (Cal. 1998)	People v. Roybal	DNA 1
21 Cal.4th 512 (Cal. 1999)	People v. Soto	DNA 1
91 Cal.App.4th 14 (Cal. Ct. App. 2001)	People v. Reeves	DNA 1
91 Cal.App.4th 623 (Cal. Ct. App. 2001)	People v. Brown	DNA 1
123 Cal.Rptr.2d 782 (Cal. Ct. App. 2002)	People v. Pizarro	DNA 1
29 Cal.4th 1229 (Cal. 2003)	People v. Jones	DNA 1
110 Cal.App.4th 530 (Cal. Ct. App. 2003)	People v. Pizarro	DNA 1
48 Cal.Rptr.3d 399 (Cal. Ct. App. 2006)	People v. Nelson	DNA 1

43 Cal.4th 1242 (Cal. 2008)	People v. Nelson	DNA 1
2008 WL 2673365 (Cal. Ct. App. 2008)	People v. Ortiz	DNA 1
191 Cal.App.4th 582 (Cal. Ct. App. 2011)	People v. Cua	DNA 1
215 Cal.App.4th 1259 (Cal. Ct. App. 2013)	People v. Koua Xiong	DNA 1
158 Cal.Rptr.3d 55 (Cal. Ct. App. 2013)	People v. Pizarro	DNA 1
57 Cal.4th 899 (Cal. 2013)	People v. Jones	DNA 1
851 P.2d 884 (Colo. 1993)	Fishback v. People	DNA 1
892 P.2d 281 (Colo. 1995)	Lindsey v. People	DNA 1
231 Conn. 115 (Conn. 1994)	State v. Sivri	DNA 1
256 Conn. 854 (Conn. 2001)	State v. Pappas	DNA 1
628 A.2d 69 (Del. 1993)	Nelson v. State	DNA 1
1996 WL 190045 (unreported)	State v. Howard	DNA 1
2002 WL 484645 (unreported)	State v. Hammons	DNA 1
618 A.2d 629 (D.C. 1992)	United States v. Porter	DNA 1
1994 WL 742297 (D.C. 1994)	United States v. Porter	DNA 1
916 A.2d 922 (D.C. 2007)	Roberts v. United States	DNA 1
640 So.2d 1139 (Fla. Dist. Ct. App. 1994)	Vargas v. State	DNA 1
660 So.2d 257 (Fla. 1995)	Hayes v. State	DNA 1
689 So.2d 239 (Fla. 1996)	Henyard v. State	DNA 1
695 So.2d 268 (Fla. 1997)	Brim v. State	DNA 1
692 So.2d 157 (Fla. 1997)	Murray v. State	DNA 1
838 So.2d 1073 (Fla. 2002)	Murray v. State	DNA 1
842 So.2d 817 (Fla. 2003)	Butler v. State	DNA 1
230 Ill.App.3d 1093 (Ill. App. Ct. 1992)	People v. Wardell	DNA 1
257 Ill.App.3d 915 (Ill. App. Ct. 1994)	People v. Watson	DNA 1
266 Ill.App.3d 469 (Ill. App. Ct. 1994)	People v. Heaton	DNA 1
282 Ill.App.3d 944 (Ill. App. Ct. 1996)	People v. Dalcollo	DNA 1
284 Ill.App.3d 695 (Ill. App. Ct. 1996)	People v. Pope	DNA 1
2016 IL App (1st) 122626 (Ill. App. Ct. 2016)	People v. Pike	DNA 1
742 N.E.2d 4 (Ind. Ct. App. 2000)	Patterson v. State	DNA 1
574 N.W.2d 293 (Iowa 1998)	State v. Williams	DNA 1
797 N.W.2d 565 (Iowa 1998)	King v. State	DNA 1
313 S.W.3d 577 (Ky. 2010)	Brown v. Commonwealth	DNA 1
322 S.W.3d 81 (Ky. 2010)	Duncan v. Commonwealth	DNA 1
617 So.2d 484 (La. Ct. App. 1992)	State v. Quatrevingt	DNA 1
670 So.2d 197 (La. 1996)	State v. Quatrevingt	DNA 1
698 A.2d 503 (Ma. 1997)	State v. Fleming	DNA 1
342 Md. 38 (Md. 1996)	Armstead v. State	DNA 1
342 Md. 724 (Md. 1996)	Williams v. State	DNA 1
134 Md.App. 528 (Md. Ct. Spec. App. 2000)	State v. Gross	DNA 1
388 Md. 99 (Md. 2005)	Young v. State	DNA 1
393 Md. 569 (Md. 2006)	Rivers v. State	DNA 1
413 Mass. 154 (Mass. 1993)	Commonwealth v. Lanigan	DNA 1
416 Mass. 347 (Mass. 1993)	Commonwealth v. Daggett	DNA 1
2 Mass.L.Rptr. 168 (unreported)	Commonwealth v. Fowler	DNA 1
419 Mass. 15 (Mass. 1994)	Commonwealth v. Lanigan	DNA 1
40 Mass.App.Ct. 236 (Mass. App. Ct. 1994)	Commonwealth v. Teixeira	DNA 1
425 Mass. 819 (Mass. 1997)	Commonwealth v. Fowler	DNA 1
59 Mass.App.Ct. 497 (Mass. App. Ct. 2003)	Commonwealth v. Thad T., a Juvenile	DNA 1
212 Mich.App. 228 (Mass. App. Ct. 1995)	People v. Lee	DNA 1

243 Mich.App. 283 (Mass. App. Ct. 2000)	People v. Coy	DNA 1
486 N.W.2d 407 (Minn. 1992)	State v. Jobe	DNA 1
504 N.W.2d 38 (Minn. Ct. App. 1993)	State v. Alt	DNA 1
516 N.W.2d 159 (Minn. 1994)	State v. Bloom	DNA 1
1996 WL 33092 (Minn. Ct. App. 1996)	State v. Bloom	DNA 1
2001 WL 170167 (Minn. Ct. App. 2001)	State v. Cavazos	DNA 1
687 So.2d 708 (Miss. 1996)	Hull v. State	DNA 1
942 SW.2d 313 (Mo. 1996)	State v. Kinder	DNA 1
268 Mont. 20 (Mont. 1994)	State v. Moore	DNA 1
246 Neb. 953 (Neb. 1994)	State v. Carter	DNA 1
1996 WL 608328 (Neb. Ct. App. 1996)	State v. Freeman	DNA 1
253 Neb. 385 (Neb. 1997)	State v. Freeman	DNA 1
136 N.H. 365 (N.H. 1992)	State v. Vandebogart	DNA 1
139 N.H. 145 (N.H. 1994)	State v. Vandebogart	DNA 1
294 N.J.Super. 267 (N. J. Super. Ct. App. Div. 1996)	State v. Marcus	DNA 1
297 N.J.Super. 254 (N. J. Super. Ct. App. Div. 1997)	State v. Dishon	DNA 1
151 N.J. 117 (N.J. 1997)	State v. Harvey	DNA 1
115 N.M. 433 (N.M. Ct. App. 1993)	State v. Anderson	DNA 1
118 N.M. 303 (N.M. 1994)	State v. Duran	DNA 1
118 N.M. 284 (N.M. 1994)	State v. Anderson	DNA 1
123 N.M. 667 (N.M. Ct. App. 1997)	State v. Peters	DNA 1
124 N.M. 66 (N.M. 1998)	State v. Stills	DNA 1
183 A.D.2d 75 (N.Y. App. Div. 1992)	People v. Wesley	DNA 1
156 Misc.2d 108 (N.Y. App. Div. 1992)	People v. Keene	DNA 1
83 N.Y.2d 417 (N.Y. 1994)	People v. Wesley	DNA 1
166 Misc.2d 631 (N.Y. App. Div. 1995)	People v. Ladson	DNA 1
64 Ohio St.3d 490 (Ohio 1992)	State v. Pierce	DNA 1
144 Ohio.App.3d 648 (Ohio Ct. App. 2001)	State v. Lockett	DNA 1
889 P.2d 319 (Okla. Crim. App. 1995)	Taylor v. State	DNA 1
123 Or.App. 176 (Or. Ct. App. 1993)	State v. Futch	DNA 1
124 Or.App. 598 (Or. Ct. App. 1993)	State v. Lyons	DNA 1
324 Or. 256 (Or. 1996)	State v. Lyons	DNA 1
552 Pa.149 (Pa. 1998)	Commonwealth v. Blasioli	DNA 1
733 A.2d 1 (unreported)	Dial v. Vaughn	DNA 1
170 A.3d 1065 (Pa. 2017)	Commonwealth v. Jacoby	DNA 1
676 A.2d 1347 (R.I. 1996)	State v. Morel	DNA 1
533 N.W.2d 156 (S.D. 1995)	State v. Schweitzer	DNA 1
548 N.W.2d 465 (S.D. 1996)	State v. Moeller	DNA 1
1992 WL 297626 (Tenn. Ct. App. 1992)	State v. Myers	DNA 1
1997 WL 602944 (Tenn. Ct. App. 1997)	State v. Chapman	DNA 1
2000 WL 1562920 (Tenn. Ct. App. 2000)	State v. Cox	DNA 1
1996 WL 668977 (Tex. Crim. App. 1996)	Rodarte v. State	DNA 1
185 Vt. 241 (Vt. 2009)	State v. Tester	DNA 1
244 Va. 220 (Va. 1992)	Satcher v. Commonwealth	DNA 1
19 Va.App. 30 (Va. Ct. App. 1994)	Husske v. Commonwealth	DNA 1
1995 WL 378611 (Va. Ct. App. 1995)	Brown v. Commonwealth	DNA 1
2000 WL 1693977 (Va. Ct. App. 2000)	Lansberry v. Chief Commonwealth of Virginia	DNA 1

860 P.2d 435 (Wyo. 1993)	Springfield v. State	DNA 1
156 F.Supp.2d 145 (D.P.R. 2001)	United States v. Santiago Santiago	DNA 2
162 F.Supp.2d 336 (D. Del. 2001)	United States v. Trala	DNA 2
374 F.Supp.2d 42 (D.D.C. 2005)	United States v. Morrow	DNA 2
414 F.Supp.2d 744 (E.D. Mich. 2006)	Coy v. Renico	DNA 2
2007 WL 313576 (E.D. Mich. 2007)	Huff v. Davis	DNA 2
576 F.Supp.2d 1130 (W.D. Wash. 2008)	Gentry v. Sinclair	DNA 2
2009 WL 3052290 (D. Colo. 2009)	Compton v. Hartley	DNA 2
2009 WL 3244713 (E.D. Cal. 2009)	Wilson v. Evans	DNA 2
130 S.Ct 665 (2010)	McDaniel v. Brown	DNA 2
702 F.Supp.2d 618 (W.D. Va. 2010)	Crews v. Johnson	DNA 2
2010 WL 3385275 (S.D. Fla. 2010)	Williams v. McNeil	DNA 2
954 F.Supp.2d 1224 (D.N.M. 2013)	United States v. McCluskey	DNA 1, DNA 2, Strengthening
2013 WL 4518215 (D. Haw. 2013)	United States v. Williams	DNA 2
993 F.Supp.2d 1203 (C.D. Cal. 2014)	United States v. Pritchard	DNA 2
2015 WL 5569276 (N.D. Cal. 2015)	United States v. Cervantes	DNA 2
2015 WL 7734281 (N.D. Cal. 2015)	United States v. Cervantes	DNA 2
169 F.Supp.3d 60 (D.D.C. 2016)	United States v. Anderson	DNA 2
2016 WL 3194997 (N.D. Cal. 2016)	Dyleski v. Grounds	DNA 2
876 F.3d 395 (2nd Cir. 2017)	Washington v. Griffin	DNA 2
18 P.3d 1224 (Alaska Ct. App. 2001)	Peters v. State	DNA 2
188 Ariz. 119 (Ariz. 1997)	State v. Hummert	DNA 1, DNA 2
188 Ariz. 129 (Ariz. 1997)	State v. Boles	DNA 1, DNA 2
191 Ariz. 359 (Ariz. 1998)	State v. Tankersley	DNA 1, DNA 2
193 Ariz. 547 (Ariz. Ct. App. 1999)	State v. Marshall	DNA 1, DNA 2
197 Ariz. 79 (Ariz. Ct. App. 1999)	State v. Garcia	DNA 2
61 Cal.Rptr.2d 816 (Cal. Ct. App. 1997)	People v. Givens	DNA 1, DNA 2
72 Cal.App.4th 1093 (Cal. Ct. App. 1999)	People v. Allen	DNA 2
2002 WL 228865 (Cal. Ct. App. 2002)	People v. King	DNA 2
107 Cal.App.4th 646 (Cal. Ct. App. 2003)	People v. Smith	DNA 2
2003 WL 21061326 (Cal. Ct. App. 2003)	People v. Townes	DNA 2
2003 WL 21061481 (Cal. Ct. App. 2003)	People v. McCraw	DNA 2
2003 WL 21205925 (Cal. Ct. App. 2003)	People v. Kennedy	DNA 1, DNA 2
2003 WL 22451982 (Cal. Ct. App. 2003)	People v. Smith	DNA 2
21 Cal.Rptr.3d 102 (Cal. Ct. App. 2004)	People v. Wilson	DNA 2
2004 WL 2944016 (Cal. Ct. App. 2004)	People v. Nawi	DNA 2
2005 WL 2338792 (Cal. Ct. App. 2005)	People v. Cheung	DNA 2
2006 WL 1756066 (Cal. Ct. App. 2006)	People v. Silva	DNA 2
38 Cal.4th 1237 (Cal. 2006)	People v. Wilson	DNA 2
2009 WL 1114077 (Cal. Ct. App. 2009)	People v. Dyleski	DNA 2
2010 WL 1387754 (Cal. Ct. App. 2010)	People v. Hernandez	DNA 2
2011 WL 1834422 (Cal. Ct. App. 2011)	People v. Bennett	DNA 2
209 Cal.App.4th 1400 (Cal. Ct. App. 2012)	People v. Stevey	DNA 2
2017 WL 393263 (Cal. Ct. App. 2017)	People v. Easton	DNA 2
374 P.3d 518 (Colo. App. 2015)	People v. Marks	DNA 2
887 A.2d 1013 (D.C. 2005)	United States v. Jenkins	DNA 2
27 A.3d 1130 (D.C. 2011)	Jones v. United States	DNA 2, Ballistic Imaging, Strengthening

679 So.2d 321 (Fla. Dist. Ct. App. 1996)	Clark v. State	DNA 1, DNA 2
779 So.2d 427 (Fla. Dist. Ct. App. 2000)	Brim v. State	DNA 2
791 So.2d 1258 (Fla. Dist. Ct. App. 2001)	Wynn v. State	DNA 2
802 So.2d 402 (Fla. Dist. Ct. App. 2001)	Lemour v. State	DNA 2
178 Ill.2d 256 (Ill. 1997)	People v. Hickey	DNA 1, DNA 2
306 Ill.App.3d 59 (Ill. App. Ct. 1999)	People v. Oliver	DNA 2
338 Ill.App.3d 765 (Ill. App. Ct. 2003)	People v. Watson	DNA 2
349 Ill.App.3d 608 (Ill. App. Ct. 2004)	People v. Sutton	DNA 2
385 Ill.App.3d 894 (Ill. App. Ct. 2008)	In Re Jessica (A Minor)	DNA 2
399 Ill.App.3d 730 (Ill. App. Ct. 2010)	In Re Jessica (A Minor)	DNA 2
2016 IL App (1st) 133397 Ill. App. Ct. 2016)	People v. Sandifer	DNA 2
702 N.E.2d 668 (Ind. 1998)	Smith v. State	DNA 2
395 Md. 240 (Md. 2006)	Thompson v. State	DNA 2
425 Mass. 787 (Mass. 1997)	Commonwealth v. Sok	DNA 2
425 Mass. 807 (Mass. 1997)	Commonwealth v. Rosier	DNA 2
429 Mass. 336 (Mass. 1999)	Landry v. Attorney General	DNA 2
434 Mass. 839 (Mass. 2001)	Commonwealth v. McNickles	DNA 2
443 Mass. 245 (Mass. 2005)	Commonwealth v. Gaynor	DNA 2
457 Mass. 773 (Mass. 2010)	Commonwealth v. Barbosa	DNA 2, Strengthening
458 Mass. 446 (Mass. 2010)	Commonwealth v. Dixon	DNA 2
667 N.W.2d 386 (Minn. 2003)	State v. Roman Nose	DNA 2
612 So.2d 381 (Miss. 1992)	Polk v. State	
733 So.2d 214 (Miss. 1999)	Watts v. State	DNA 1, DNA 2
360 Mont. 246 (Mont. 2011)	State v. Wright	DNA 2
354 N.J.Super. 76 (N.J. Super. Ct. App. Div. 2002)	State v. Deloatch	DNA 2
134 N.C.App. 533 (N.C. Ct. App. 1999)	State v. Underwood	DNA 2
244 N.C.App 345 (N.C. Ct. App. 2015)	State v. Spinks	DNA 2
454 Pa.Super 207 (Pa. Super. Ct. 1996)	Commonwealth v. Blasioli	DNA 1, DNA 2
348 S.C. 322 (S.C. Ct. App. 2001)	State v. Proctor	DNA 1, DNA 2
347 S.C. 587 (S.C. Ct. App. 2001)	State v. Proctor	DNA 1, DNA 2
956 S.W.2d 471 (Tenn. 1997)	State v. Begley	DNA 1, DNA 2
395 S.W.3d 120 (Tenn. 2012)	State v. Burdick	DNA 2
16 S.W.3d 156 (Tex. Crim. App. 2000)	Robertson v. State	DNA 2
27 P.3d 1133 (Utah 2001)	State v. Butterfield	DNA 2
1999 WL 1129713 (Va. Ct. App. 1999)	Beverly v. Commonwealth	DNA 2
60 Va.App. 486 (Va. Ct. App. 2012)	Pope v. Commonwealth	DNA 2
130 Wash.2d 244 (Wash. 1996)	State v. Copeland	DNA 1, DNA 2
130 Wash.2d 302 (Wash. 1996)	State v. Jones	DNA 1, DNA 2
133 Wash.2d 63 (Wash. 1997)	State v. Buckner	DNA 2
100 Wash.App 1064 (Wash. Ct. App. 2000)	State v. Smith	DNA 2
143 Wash.2d 288 (Wash. 2001)	State v. Gore	DNA 2
118 Wash.App 780 (Wash. Ct. App. 2003)	State v. Leuluaialii	DNA 2
150 Wash.App 690 (Wash. Ct. App. 2009)	State v. Bander	DNA 1, DNA 2
178 Wash.2d 34 (Wash. 2013)	State v. Saintcalle	DNA 2
120 Wash.2d 879 (Wash. 1993)	State v. Cauthron	DNA 1
125 Wash.2d 24 (Wash. 1994)	State v. Russell	DNA 1
125 Wash.2d 570 (Wash. 1995)	State v. Gentry	DNA 1
125 Wash.2d 915 (Wash. 1995)	State v. Buckner	DNA 1

175 Wash.App. 630 (Wash. Ct. App. 2013)	State v. King County District Court West Division	DNA 1
329 F.Supp.2d 1077 (D.S.D. 2004)	United States v. Rouse	Polygraph
552 F.Supp.2d 598 (N.D. Miss. 2008)	United States v. Moultrie	Polygraph
2012 WL 529981 (N.D. Ga. 2012)	United States v. Loaiza-Clavijo	Polygraph
2012 WL 529975 (N.D. Ga. 2012)	United States v. Loaiza-Clavijo	Polygraph
155 F.Supp.3d 482 (D. Del. 2015)	United States v. Matusiewicz	Polygraph
243 F.Supp.3d 383 (S.D. N.Y. 2017)	American Civil Liberties Union Foundation v. Department of Homeland Security	Polygraph
205 Cal.App.4th 111 (Cal. Ct. App. 2012)	In Re Jordan R.	Polygraph
2013 Ill App (1st) 110237 (Ill. App. Ct. 2012)	People v. Hughes	Polygraph
695 N.W.2d 506 (Iowa. Ct. App. 2005)	State v. Shaneyfelt	Polygraph
1 A.3d 408 (Me. 2010)	State v. Lavoie	Polygraph
198 N.J 69 (N.J. 2009)	State v. A.O.	Polygraph
136 N.M. 166 (N.M. 2004)	Lee v. Martinez	Polygraph
2007 WL 4225068 (E.D. Wash. 2007)	Berry v. United States	Bullet Lead
711 F.Supp.2d 479 (D. Md. 2010)	Higgs v. United States	Bullet Lead
624 F.3d 1031 (9th Cir. 2010)	United States v. Berry	Bullet Lead
2011 WL 13196038 (D.N.M. 2011)	United States v. Chalan	Bullet Lead
663 F.3d 726 (4th Cir. 2011)	United States v. Higgs	Bullet Lead
2012 WL 2415167 (E.D. Ky. 2012)	Bowling v. Parker	Bullet Lead
2012 WL 4498647 (E.D. Ky. 2012)	Bowling v. Haeberlin	Bullet Lead
2012 WL 5462682 (S.D. Tex. 2012)	Gonzalez v. Thaler	Bullet Lead
185 F.Supp.3d 401 (S.D. N.Y. 2016)	Almeciga v. Center For Investigative Reporting, Inc.	Bullet Lead, Strengthening
2004 WL 2058779 (Cal. Ct. App. 2004)	People v. Ortgies	Bullet Lead
100 So.3d 746 (Fla. Dist. Ct. App. 2012)	Zamrippa v. State	Bullet Lead
871 N.W.2d 705 (Iowa Ct. App. 2015)	More v. State	Bullet Lead
880 N.W.2d 487 (Iowa 2016)	More v. State	Bullet Lead
191 S.W.3d 569 (Ky. 2006)	Ragland v. Commonwealth	Bullet Lead
451 S.W.3d 597 (Ky. 2014)	St Clair v. Commonwealth	Bullet Lead
329 Md. 339 (Md. 2006)	Clemons v. State	Bullet Lead
440 Md. 33 (Md. 2014)	Kulbicki v. State	Bullet Lead
221 Md.App. 146 (Md. Ct. Spec. App. 2015)	Ward v. State	Bullet Lead
19 Mass.L.Rptr 674 (unreported)	Commonwealth v. Daye	Bullet Lead
20 Mass.L.Rptr 598 (unreported)	Commonwealth v. Lykus	Voice Spectroscopy, Bullet Lead
451 Mass. 310 (Mass. 2008)	Commonwealth v. Lykus	Voice Spectroscopy, Bullet Lead
787 N.W.2d 575 (Minn. 2010)	Gassler v. State	Bullet Lead
788 N.W.2d 497 (Minn. 2010)	Scott v. State	Bullet Lead
375 N.J.Super. 409 (N.J. Super. Ct. App. Div. 2005)	State v. Behn	Bullet Lead
582 Pa. 276 (Pa. 2005)	Commonwealth v. Fisher	Bullet Lead
971 A.2d 1249 (Pa. Super. Ct. 2009)	Commonwealth v. Kretchmar	Bullet Lead
619 Pa. 549 (Pa. 2013)	Commonwealth v. Edmiston	Bullet Lead, Strengthening
2010 WL 711783 (Tex. Crim. App. 2010)	Gonzalez v. State	Bullet Lead
2010 WL 1610931 (Tex. Crim. App. 2010)	Ex Parte Berkley	Bullet Lead

165 Wash.App. 1003 (Wash. Ct. App. 2011)	In Re Personal Restraint of Trapp	Bullet Lead, Strengthening
2008 WL 9359653 (S.D. N.Y. 2008)	United States v. Barnes	Ballistic Imaging
578 F.Supp.2d 567 (S.D. N.Y. 2008)	United States v. Glynn	Ballistic Imaging
2009 WL 1543806 (D. Mass. 2009)	United States v. Nascimento	Ballistic Imaging
2009 WL 3297273 (D. Mass. 2009)	United States v. Nascimento	Ballistic Imaging
663 F.Supp.2d 1170 (D.N.M. 2009)	United States v. Taylor	Ballistic Imaging, Strengthening
696 F.Supp.2d 536 (D. Md. 2010)	United States v. Willock	Ballistic Imaging, Strengthening
849 F.Supp.2d 425 (D. N.J. 2012)	United States v. Otero	Ballistic Imaging, Strengthening
2013 WL 12335325 (D.N.M. 2013)	United States v. McCluskey	Ballistic Imaging, Strengthening
2013 WL 12190516 (D.P.R. 2013)	United States v. Casey	Ballistic Imaging, Strengthening
928 F.Supp.2d 397 (D.P.R. 2013)	United States v. Casey	Ballistic Imaging, Strengthening
2016 WL 1165822 (C.D. Cal. 2016)	Smith v. Uribe	Ballistic Imaging
853 F.3 768 (5th Cir. 2017)	United States v. Guillen-Cruz	Ballistic Imaging
2015 WL 6157479 (Cal. Ct. App. 2015)	People v. Blacknell	Ballistic Imaging, Strengthening
27 A.3d 1130 (D.C. 2011)	Jones v. United States	Ballistic Imaging, Strengthening
130 A.3d 343 (D.C. 2016)	Williams v. United States	Ballistic Imaging, Strengthening
140 A.3d 1172 (D.C. 2016)	Gardner v. United States	Ballistic Imaging, Strengthening
407 Ill.App.3d 526 (Ill. App. Ct. 2011)	People v. Pursley	-
2012 Ill App (2d) 100308 (Ill. App. Ct. 2012)	People v. Rozo	-
2013 Ill App (1st) 102476 (Ill. App. Ct. 2013)	People v. Robinson	Ballistic Imaging, Strengthening
194 Md.App. 76 (Md. Ct. Spec. App. 2010)	Fleming v. State	Ballistic Imaging, Strengthening
458 Mass. 827 (Mass. 2011)	Commonwealth v. Pytou Heang	Ballistic Imaging, Strengthening
212 N.C.App. 235 (N.C. Ct. App. 2011)	State v. Adams	Ballistic Imaging, Strengthening
243 N.C.App. 675 (N.C. Ct. App. 2015)	State v. McGraw	Ballistic Imaging
2 N.E.3d 936 (Ohio Ct. App. 2013)	State v. Langlois	Ballistic Imaging, Strengthening
2016 WL 7799279 (Tenn. Ct. App. 2016)	State v. Thomas	Ballistic Imaging, Strengthening
344 Wis.2d 297 (Wis. Ct. App. 2012)	State v. Harper	Ballistic Imaging
614 F.Supp.2d 1257 (N.D. Ala. 2009)	Thomas v. Allen	Strengthening
129 S.Ct. 2527 (2009)	Melendez-Diaz v. Massachusetts	Strengthening
2009 WL 2634446 (D. Neb. 2009)	United States v. Prokupek	Strengthening
672 F.Supp.2d 723 (D. Md. 2009)	United States v. Rose	Strengthening
686 F.Supp.2d 382 (S.D. N.Y. 2010)	United States v. Boyd	Strengthening
2010 WL 1233968 (D.N.H. 2010)	Hooper v. Warden	Strengthening

2010 WL 1484708 (W.D. Tex. 2010)	United States v. Montalvo-Rangel	Strengthening
741 F.Supp.2d 821 (E.D. Mich. 2010)	United States v. Mood	Strengthening
2010 WL 3448528 (N.D. Cal. 2010)	United States v. Cernan	Strengthening
749 F.Supp.2d 1299 (D. Utah 2010)	United States v. Zajac	Strengthening
2010 WL 4168823 (W.D. Ky. 2010)	United States v. Smallwood	Strengthening
748 F.Supp.2d 531 (E.D. Va. 2010)	United States v. Aman	Strengthening
754 F.Supp.2d 89 (D. Mass. 2010)	United States v. Hebshie	Strengthening
777 F.Supp.2d 1006 (E.D. Va. 2011)	United States v. Council	Strengthening
2011 WL 2173644 (S.D. Cal. 2011)	United States v. Love	Strengthening
2011 WL 13210238 (D.N.M. 2011)	United States v. Lujan	Strengthening
450 Fed.Appx. 511 (6th Cir. 2011)	United States v. Watkins	Strengthening
456 Fed.Appx. 563 (6th Cir. 2012)	United States v. Smallwood	Strengthening
848 F.Supp.2d 714 (E.D. Mich. 2012)	United States v. Stone	Strengthening
2012 WL 2374528 (N.D. Ga. 2012)	United States v. Campbell	Strengthening
2012 WL 5989813 (E.D. N.Y. 2012)	United States v. Sebborn	Strengthening
704 F.3d 480 (7th Cir. 2012)	United States v. Herrera	Strengthening
2013 WL 12334168 (D.N.M. 2013)	United States v. McCluskey	Strengthening
2013 WL 12329921 (D.N.M. 2013)	United States v. McCluskey	Strengthening
42 F.Supp.3d 937 (N.D. Iowa 2013)	Honken v. United States	Strengthening
30 F.Supp.3d 814 (W.D. Wis. 2013)	United States v. Johnstead	Strengthening
2014 WL 31359 (N.D. Cal. 2014)	Melcher v. Holland	Strengthening
134 S.Ct. 1081 (2014)	Hinton v. Alabama	Strengthening
16 F.Supp.3d 420 (M.D. Pa. 2014)	Abdul-Salaam v. Beard	Strengthening
756 F.3d 1179 (10th Cir. 2014)	United States v. Smith	Strengthening
2014 WL 3715036 (D.V.A. 2014)	United States v. Wrensford	Strengthening
2014 WL 4344618 (N.D. Ill. 2014)	United States ex rel. Thival v. Harrington	Strengthening
88 F.Supp.3d 239 (E.D. N.Y. 2015)	United States v. Ashburn	Strengthening
2015 WL 1516401 (W.D. Okla. 2015)	Holden v. Addison	Strengthening
123 F.Supp.3d 1036 (N.D. Ill 2015)	Starks v. City of Waukegan	Strengthening
626 Fed. Appx. 610 (6th Cir. 2015)	United States v. Reynolds	Strengthening
2015 WL 5772196 (N.D. Miss. 2015)	Ross v. Epps	Strengthening
2016 WL 3009392 (E.D. Pa. 2016)	Rice v. Gavin	Strengthening
2016 WL 1275603 (D. Idaho 2016)	Smith v. Wasden	Strengthening
2016 WL 10257478 (D.N.M 2016)	United States v. Stockton	Strengthening
821 F.3d 1136 (9th Cir. 2016)	Gimenez v. Ochoa	Strengthening
831 F.3d 931 (7th Cir. 2016)	United States v. Rivas	Strengthening
2016 WL 6699681 (D. Ariz. 2016)	Spears v. Ryan	Strengthening
2017 WL 358597 (D.R.I. 2017)	United States v. Wallace	Strengthening
2017 WL 1807907 (S.D. Cal. 2017)	Lucas v. Davis	Strengthening
2017 WL 2807452 (S.D. Ohio 2017)	Widmer v. Warden, Correctional Reception Center	Strengthening
275 F.Supp.3d 7 (D.D.C. 2017)	United States v. Ausby	Strengthening
278 F.Supp.3d 461 (D.D.C. 2017)	United States v. Butler	Strengthening
2017 WL 4127772 (D. Nev. 2017)	Vincent v. McDaniel	Strengthening
2017 WL 4511061 (N.D. Ill. 2017)	United States v. Bonds	Strengthening
2017 WL 5158673 (D.N.M. 2017)	United States v. Sedillo	Strengthening
236 Ariz. 451 (Ariz. Ct. App. 2014)	State v. Romero	Strengthening
240 Ariz. 503 (Ariz. Ct. App. 2016)	State v. Romero	Strengthening
2017 WL 772410 (Ariz. Ct. App. 2017)	State v. McAuley	Strengthening
2011 WL 1350762 (Cal. Ct. App. 2011)	People v. Smith	Strengthening

2011 WL 2043957 (Cal. Ct. App. 2011)	People v. Price	Strengthening
2011 WL 4432935 (Cal. Ct. App. 2011)	People v. Melcher	Strengthening
2012 WL 591383 (Cal. Ct. App. 2012)	People v. Gonzalez	Strengthening
2013 WL 5397389 (Cal. Ct. App. 2013)	People v. Jones	Strengthening
2015 WL 342179 (Cal. Ct. App. 2015)	People v. Cain	Strengthening
2016 WL 5462089 (Cal. Ct. App. 2016)	People v. Ware	Strengthening
143 Conn.App. 541 (Conn. App. Ct. 2013)	State v. Martinez	Strengthening
30 A.3d 764 (Del. 2011)	Rodriguez v. State	Strengthening
37 A.3d 213 (D.C. 2012)	Pettus v. United States	Strengthening
54 A.3d 1249 (D.C. 2012)	Gee v. United States	Strengthening
147 A.3d 751 (D.C. 2016)	Motorola Inc. v. Murray	Strengthening
27 So.3d 11 (Fla. 2010)	Johnston v. State	Strengthening
109 So.3d 680 (Fla. 2012)	Dennis v. State	Strengthening
132 So.3d 40 (Fla. 2013)	Foster v. State	Strengthening
125 So.3d 745 (Fla. 2013)	Henry v. State	Strengthening
175 So.3d 843 (Fla. Dist. Ct. App. 2015)	Rosario v. State	Strengthening
212 So.3d 982 (Fla. 2017)	Hojan v. State	Strengthening
220 So.2d 1133 (Fla. 2017)	Anderson v. State	Strengthening
2011 IL App (1st) 083143 (Ill. App. Ct. 2011)	People v. Mitchell	Strengthening
2013 IL App (1st) 072253 (Ill. App. Ct. 2013)	People v. Luna	Strengthening
2013 IL App (1st) 111251 (Ill. App. Ct. 2013)	People v. Morris	Strengthening
2015 IL App (1st) 121016 (Ill. App. Ct. 2015)	People v. Jones	Strengthening
2017 IL App (1st) 141379 (Ill. App. Ct. 2017)	People v. Rodriguez	Strengthening
953 N.E.2d 1039 (Ind. 2011)	Turner v. State	Strengthening
847 N.W.2d 235 (Iowa. 2014)	Enderle v. State	Strengthening
256 P.3d 896 (Kan. Ct. App. 2010)	State v. Lopez-Martinez	Strengthening
2014 WL 3973113 (Ky. Ct. App 2014)	Napier v. Commonwealth	Strengthening
534 S.W.3d 217 (Ky. 2017)	Garrett v. Commonwealth	Strengthening
217 So.3d 1266 (La. Ct. App. 2017)	State v. Lee	Strengthening
2017 WL 4974768 (La. Ct. App. 2017)	State v. Allen	Strengthening
229 Md.App. 630 (Md. Ct. Spec. App. 2016)	Patterson v. State	Strengthening
456 Mass. 350 (Mass. 2010)	Commonwealth v. Vasquez	Strengthening
457 Mass. 715 (Mass. 2010)	Commonwealth v. Gambora	Strengthening
458 Mass. 137 (Mass. 2010)	Commonwealth v. Fernandez	Strengthening
461 Mass. 126 (Mass. 2011)	Commonwealth v. Munoz	Strengthening
461 Mass. 354 (Mass. 2012)	Commonwealth v. King	Strengthening
462 Mass. 827 (Mass. 2012)	Commonwealth v. Vasquez	Strengthening
463 Mass. 95 (Mass. 2012)	Commonwealth v. Johnson	Strengthening
464 Mass. 580 (Mass. 2013)	Commonwealth v. Greineder	Strengthening
476 Mass. 192 (Mass. 2014)	Commonwealth v. Wadlington	Strengthening
467 Mass. 176 (Mass. 2014)	Commonwealth v. Joyner	Strengthening
468 Mass. 391 (Mass. 2014)	Commonwealth v. Tassone	Strengthening
88 Mass.App.Ct. 477 (Mass. App. Ct. 2015)	Commonwealth v. French	Strengthening
2016 WL 380123 (Mass. App. Ct. 2016)	Commonwealth v. Perrot	Strengthening
90 Mass.App.Ct. 1120 (Mass. App. Ct. 2016)	Commonwealth v. Burns	Strengthening
477 Mass. 20 (Mass. 2017)	Commonwealth v. Fulgiam	Strengthening
2015 WL 7283216 (Mich. Ct. App. 2015)	People v. Perrien	Strengthening
788 N.W.2d 91 (Minn. 2010)	State v. Hull	Strengthening
813 N.W.2d 814 (Minn. 2012)	State v. Becroft	Strengthening

822 N.W.2d 664 (Minn. Ct. App. 2012)	State v. Dixon	Strengthening
831 N.W.2d 546 (Minn. 2013)	State v. Hayes	Strengthening
890 N.W.2d 413 (Minn. Ct. App. 2017)	State v. Thomas	Strengthening
419 N.J.Super. 88 (N.J. Super. Ct. App. Div. 2011)	State v. McGuire	Strengthening
2017 WL 1955254 (N.J. Super. Ct. App. Div. 2017)	State v. Fields	Strengthening
272 P.3d 682 (N.M. Ct. App. 2011)	State v. Jaramillo	Strengthening
294 P.3d 435 (N.M. 2013)	State v. Navarette	Strengthening
382 P.3d 948 (N.M. 2016)	State v. Montoya	Strengthening
27 Misc.3d 293 (unreported)	People v. Carreira	Strengthening
364 N.C. 133 (N.C. 2010)	State v. Ward	Strengthening
225 N.C.App 266 (N.C. Ct. App. 2013)	State v. Leonard	Strengthening
2017 WL 3432624 (Ohio Ct. App. 2017)	State v. Brodbeck	Strengthening
2013 WL 11256379 (Pa. Super. Ct. 2013)	Commonwealth v. Rice	Strengthening
2013 WL 11250763 (Pa. Super. Ct. 2013)	Commonwealth v. Mapp	Strengthening
632 Pa. 449 (Pa. 2015)	Commonwealth v. Treiber	Strengthening
155 A.3d 1054 (Pa. Super. Ct. 2017)	Commonwealth v. Smallwood	Strengthening
2017 WL 2992978 (Pa. Super. Ct. 2017)	Commonwealth v. Walker	Strengthening
173 A.3d 617 (Pa. 2017)	Commonwealth v. Chmiel	Strengthening
172 A.3d 1203 (R.I. 2017)	Motyka v. State	Strengthening
2011 WL 1344287 (Tenn. Ct. App. 2011)	Molina v. State	Strengthening
454 S.W.3d 450 (Tenn. 2015)	Kendrick III v. State	Strengthening
2015 WL 1087126 (Tenn. Ct. App. 2015)	State v. Davidson	Strengthening
509 S.W.3d 156 (Tenn. 2016)	State v. Davidson	Strengthening
360 S.W.3d 446 (Tex. Crim. App. 2011)	Ex Parte Robbins	Strengthening
384 S.W.3d 919 (Tex. Crim. App. 2012)	Coronado v. State	Strengthening
478 S.W.3d 678 (Tex. Crim. App. 2014)	Ex Parte Robbins	Strengthening
2015 WL 3637930 (Tex. Crim. App. 2015)	Ross v. State	Strengthening
2017 WL 2333213 (Tex. Crim. App. 2017)	Aekins v. State	Strengthening
172 Wash.App. 408 (Wash. Ct. App. 2012)	State v. Crumpton	Strengthening
181 Wash.App. 247 (Wash. Ct. App. 2014)	State v. Pigott	Strengthening
180 Wash.App. 1014 (Wash. Ct. App. 2014)	State v. Pigott	Strengthening
182 Wash.App. 1028 (Wash. Ct. App. 2014)	State v. Hill	Strengthening
189 Wash.App. 1003 (Wash. Ct. App. 2015)	State v. Franks	Strengthening
194 Wash.App. 1020 (Wash. Ct. App. 2016)	State v. Washington	Strengthening
257 Kan. 896 (Kan. 1995)	State v. Colbert	DNA 1
262 Kan. 281 (Kan. 1997)	State v. Isley	DNA 1
18 F.3d 1327 (6th Cir. 1994)	United States v. Bonds	DNA 1
285 F.3d 298 (4th Cir. 2002)	Harvey v. Horan	DNA 1
252 F.Supp.2d 104 (D. N.J. 2003)	United States v. Ewell	DNA 1, DNA 2
256 F.Supp.2d 723 (W.D. Mich. 2003)	Leonard v. Michigan	-
59 M.J. 416 (M.J. 2004)	United States v. Mason	-
63 M.J. 365 (M.J. 2006)	United States v. Allison	-
2007 WL 1994020 (E.D. Cal. 2007)	Manley v. Campbell	DNA 2
572 F.Supp.2d 144 (D.D.C. 2008)	United States v. Orleans-Lindsay	DNA 2
2011 WL 333236 (N.D. Okla. 2011)	United States v. Hair	DNA 2
2011 WL 3055323 (E.D. Cal. 2011)	Nelson v. Swarthout	DNA 2
2012 WL 1339905 (N.D. Ala. 2012)	Williams v. Alabama	DNA 1, DNA 2
2012 WL 1965679 (S.D. Tex. 2012)	Napper v. Thaler	-

30 Cal.App.4th 340 (Cal. Ct. App. 1994)	People v. Soto	DNA 1
163 Vt. 331 (Vt. 1995)	State v. Streich	DNA 1
40 Cal.Rptr.2d 132 (Cal. Ct. App. 1995)	People v. Taylor	DNA 1
43 Cal.App.4th 1503 (Cal. Ct. App. 1995)	People v. Amundson	DNA 1
667 So.2d 175 (Fla. 1995)	State v. Vargas	DNA 1
46 Cal.App.4th 1412 (Cal. Ct. App. 1996)	People v. Smith	DNA 1
1999 WL 688674 (Minn. Ct. App. 1996)	State v. Jackson	DNA 1
735 So.2d 238 (Miss. 1999)	Hughes v. State	DNA 2
62 Cal.App.4th 1529 (Cal. Ct. App. 1998)	People v. Daniels	DNA 1, DNA 2
2002 WL 575577 (Iowa Ct. App. 2002)	State v. Negroni	DNA 1
808 So.2d 145 (Fla. 2002)	Darling v. State	DNA 1, DNA 2
769 A.2d 143 (D.C. 2001)	Porter v. United States	DNA 1
795 So.2d 753 (Ala. Crim. App. 1999)	Williams v. State	DNA 1, DNA 2
127 Wash.App. 1034 (Wash. Ct. App. 2005)	State v. Cruz	-
677 N.W.2d 380 (Minn. 2004)	State v. Bailey	DNA 1, DNA 2
666 N.W.2d 703 (Minn. 2003)	State v. Miller	DNA 1, DNA 2
2003 WL 21101793 (Cal. Ct. App. 2003)	People v. Allred	-
844 So.2d 762 (Fla. Dist. Ct. App. 2003)	Hudson v. State	-
2003 WL 1914116 (6th Cir 2003)	People v. Wilson	DNA 2
2002 WL 1420724 (Minn. Ct. App. 2002)	State v. Thoms	DNA 2
163 S.W.3d 818 (Tex. Crim. App. 2005)	Brown v. State	DNA 2
43 Cal.Rptr.3d 587 (Cal. Ct. App. 2006)	People v. Johnson	DNA 2
2008 WL 2404210 (Cal. Ct. App. 2008)	People v. Deo	DNA 2
755 N.W.2d 8 (Minn. 2008)	State v. Bartylla	DNA 1, DNA 2
2009 WL 3633652 (Cal. Ct. App. 2009)	People v. Hua Vang	DNA 1, DNA 2
322 S.W.3d 202 (Tex. Crim. App. 2010)	Ex Parte Napper	DNA 2
227 Ariz. 196 (Ariz. Ct. App. 2011)	State v. Bigger	DNA 2
2011 WL 4840979 (Cal. Ct. App. 2011)	People v. Reyes	DNA 1, DNA 2
2012 IL App (2d) 091328 (Ill. Pp. Ct. 2012)	People v. Watson	-
207 Md.App. 412 (Md. Ct. Spec. App. 2012)	Kulbicki v. State	Bullet Lead
63 A.3d 1033 (D.C. 2013)	Young v. United States	DNA 2
58 Cal.4th 1013 (Cal. 2014)	People v. Suff	-
2014 WL 3896752 (Cal. Ct. App. 2014)	People v. Armstrong	DNA 2
2014 WL 4724896 (Cal. Ct. App. 2014)	People v. Johnson	DNA 2
70 N.E.3d 353 (Ind. Ct. App. 2016)	Alcantar v. State	DNA 2
66 N.E.3d 1009 (Ind. Ct. App. 2016)	Alcantar v. State	DNA 2
107 F.3d 1147 (6th Cir. 1997)	United States v. Jones	DNA 1
2007 WL 841747 (E.D. Cal. 2007)	Smith v. Curry	-
580 F.3d 1071 (9th Cir. 2009)	Smith v. Curry	-
2010 WL 1729181 (W.D. Mo. 2010)	Rues v. Denney	Strengthening
643 F.3d 618 (8th Cir. 2011)	Rues v. Denney	Strengthening
805 F.Supp.2d 1218 (D.N.M. 2011)	United States v. Gutierrez-Castro	Strengthening
720 F.3d 1137 (9th Cir. 2013)	United States v. Kriesel	DNA 1
2013 WL 4106640 (E.D. Pa. 2013)	Ortiz v. Folino	-
2014 WL 117345 (C.D. Cal. 2014)	Blackwell v. Montgomery	-
2015 WL 4594521 (D. Ariz. 2015)	McAuley v. Ryan	Strengthening
2015 WL 5734458 (S.D. Ohio 2015)	Bobby v. Davis	Strengthening
2016 WL 424967 (D. Minn. 2016)	United States v. Adams	Strengthening
2016 WL 1188438 (W.D. N.Y. 2016)	Nicholas Morgan v. Mark Bradt	Ballistic Imaging

2016 WL 5173326 (N.D. Ohio. 2016)	Langlois v. Coleman	Ballistic Imaging, Strengthening
2017 WL 581352 (C.D. Cal. 2017)	Eleby v. Price	Strengthening
2017 WL 3172637 (N.D. Tex. 2017)	Dominguez v. Davis	Strengthening
875 F.3d 1265 (9th Cir. 2017)	United States v. Johnson	-
514 N.W.2d 740 (Iowa Ct. App. 1994)	State v. Ripperger	DNA 1
106 Md.App. 551 (Md. Ct. Spec. App. 1995)	Keirsev v. State	DNA 1
633 N.W.2d 786 (Iowa 2001)	State v. Belken	-
139 Idaho 520 (Idaho. 2003)	State v. Perry	Polygraph
390 Md. 343 (Md. 2005)	Moore v. State	DNA 1
143 Ohio.Misc.2d 27 (Ohio Ct. Com. Pl. 2007)	State v. Sharma	Polygraph
2008 WL 4291670 (Ky. 2008)	Bowling v. Commonwealth	Bullet Lead
24 So.3d 1220 (Fla. Dist. Ct. App. 2009)	Murphy v. State	Bullet Lead
23 So.3d 1277 (Fla. Dist. Ct. App. 2009)	Smith v. State	Bullet Lead
207 N.C.App. 525 (N.C. Ct. App. 2010)	State v. Edwards	Strengthening
30 Misc.3d 475 (N.Y. 2010)	People v. Givens	Strengthening
252 P.3d 259 (Okla. Crim. App. 2011)	Webster v. State	Strengthening
2011 WL 2418911 (Tenn. Ct. App. 2011)	State v. Taylor	Strengthening
2011 WL 4844737 (Cal. Ct. App. 2011)	People v. Nichols	Strengthening
2011 WL 5509077 (Ohio Ct. App. 2011)	State v. Martemus	Strengthening
2011 WL 6916543 (Ariz. Ct. App. 2011)	State v. Rodriguez	-
2012 WL 724049 (Ariz. Ct. App. 2012)	State v. Celaya	-
615 Pa. 297 (Pa. 2012)	Commonwealth v. Abdul-Salaam	Strengthening
94 So.3d 482 (Fla. 2012)	Tanzi v. State	Strengthening
2012 WL 1548192 (Cal Ct. App. 2012)	People v. Eleby	Strengthening
616 Pa. 570 (Pa. 2012)	Commonwealth v. Lopez	Bullet Lead
55 Cal.4th 569 (Cal. 2012)	People v. Lopez	Strengthening
224 N.C.App. 115 (N.C. Ct. App. 2012)	State v. Hoff	Strengthening
2013 WL 144970 (Cal. Ct. App. 2013)	People v. Hernandez	Ballistic Imaging
2013 Ill App (2d) 120687-U (Ill. App. Ct. 2013)	People v. Chest	Strengthening
309 P.3d 943 (Colo. 2013)	Marshall v. People	Strengthening
434 Md. 88 (Md. 2013)	Derr v. State	-
2013 WL 11251627 (Pa. Super. Ct. 2013)	Commonwealth v. Pittman	Strengthening
622 Pa. 1 (Pa. 2013)	Commonwealth v. Roney	Strengthening
221 Cal. App.4th 1001 (Cal. Ct. App. 2014)	In Re O.D.	Strengthening
232 N.C.App. 522 (N.C. Ct. App 2014)	State v. Alexander	Strengthening
2014 WL 10919368 (Pa. Super. Ct. 2014)	Commonwealth v. Sabur	Ballistic Imaging
330 P.3d 1283 (Utah Ct. App. 2014)	State v. Woodard	Strengthening
2014 WL 3973378 (Mich. Ct. App. 2014)	People v. Jackson	-
627 Pa. 151 (Pa. 2014)	Commonwealth v. Reid	Strengthening
2014 WL 4244049 (Ariz. Ct. App. 2014)	State v. Celaya	Strengthening
2014 WL 5491315 (Tenn. Ct. App. 2014)	Robertson v. State	Bullet Lead
2015 WL 424998 (unreported)	Mourning v. National Commissioner of Correction	Ballistic Imaging
458 S.W.3d 537 (Tex. Crim. App. 2015)	Ex Parte Pruet	Strengthening
238 Cal.App.4th 967 (Cal. Ct. App. 2015)	People v. Rivas	Strengthening
191 Wash.App. 530 (Wash. Ct. App. 2015)	State v. Lizarraga	Strengthening
200 So.3d 685 (Fla. 2015)	Boyd v. State	Strengthening

89 Mass.App.Ct. 1125 (Mass. App. Ct. 2016)	Commonwealth v. Harriot	Strengthening
2016 WL 4275640 (Tex. Crim. App. 2016)	Ex Parte Pruett	Strengthening
2016 WL 383404 (Cal. Ct. App. 2016)	People v. Gilley	Strengthening
511 S.W.3d 454 (Mo. Ct. App. 2017)	State v. Hightower	Strengthening
899 N.W.2d 740 (Iowa Ct. App. 2017)	Keyes v. State	Strengthening
2017 WL 1245431 (Tex. Crim. App. 2017)	Pruett v. State	Strengthening
2017 WL 4334199 (Pa. Super. Ct. 2017)	Commonwealth v. Cruz	Strengthening
2017 WL 4386915 (Tex. Crim. App. 2017)	Ex Parte Pruett	Strengthening
2017 WL 6568212 (Pa. 2017)	Commonwealth v. Riddick	Strengthening
95 F.3d 1214 (4th Cir. 1996)	O'Dell v. Netherland	-
2002 WL 31663513 (W.D. N.Y. 2002)	Greco v. Duncan	DNA 1
2004 WL 2677267 (Navy-Marine Crim. App. 2017)	United States v. Allison	DNA 2
2006 WL 6181129 (D. Nev. 2006)	Brown v. Farwell	DNA 2
2009 WL 6529703 (C.D. Cal. 2009)	Richie v. Runnels	DNA 2
2012 WL 1442787 (E.D. Wash. 2012)	Berry v. United States	Bullet Lead
32 F.Supp.3d 49 (D.D.C. 2014)	Kretchmar v. Federal Bureau of Investigation, et al.	Bullet Lead
2014 WL 3572152 (C.D. Cal. 2014)	Blackwell v. Frauenheim	-
20 F.Supp.3d 1196 (C.D. Cal. 2014)	United States v. Harry	Polygraph
2015 WL 5012949 (N.D. Cal. 2015)	United States v. Johnson	Strengthening
2016 WL 898881 (E.D. Mo. 2016)	Komhardt v. United States	Strengthening
171 F.Supp.3d 891 (E.D. Mo. 2016)	Bolden v. United States	Strengthening
1993 WL 102507 (Ohio Ct. App. 1993)	State v. Penton	DNA 1
654 So.2d 184 (Fla. Dist. Ct. App. 1995)	Brim v. State	DNA 1
1995 WL 326214 (Ohio Ct. App. 1995)	State v. Honzu	DNA 1
211 Mich.App. 604 (Mich. Ct. App. 1995)	People v. Chandler	DNA 1
927 S.W.2d 411 (Mo. Ct. App. 1996)	State v. Huchting	DNA 1
323 S.C. 471 (S.C. 1996)	State v. Register	DNA 1
130 Wash.2d 313 (Wash. 1996)	State v. Cannon	DNA 1
1997 WL 33832396 (Alaska Ct. App. 1997)	Charles v. State	DNA 1
695 So.2d 184 (Ala. 1997)	Ex Parte Brooks	-
24 Va.App. 795 (Va. Ct. App. 1997)	Keen v. Commonwealth	-
1997 WL 732475 (Tex. Crim. App. 1997)	Barron v. State	-
716 So.2d 1028 (Miss. 1998)	Crawford v. State	DNA 1
735 So.2d 186 (Miss. 1999)	Genry v. State	DNA 1, DNA 2
738 So.2d 387 (Fla. Dist. Ct. App. 1999)	Timot v. State	-
797 So.2d 1134 (Ala. Crim. App. 1999)	Simmons v. State	-
720 N.E.2d 707 (Ind. 1999)	Allen v. State	-
784 So.2d 328 (Ala. Crim. App. 2000)	Tyson v. State	DNA 1, DNA 2
22 A.L.R.5th 765 (Colo. 2001)	People v. Shreck	DNA 1
2001 WL 1464138 (Cal. Ct. App. 2001)	People v. Garcia	-
114 Wash.App. 1080 (Wash. Ct. App. 2002)	State v. Davis	DNA 2
825 So.2d 769 (Ala. 2002)	Ex Parte Taylor	DNA 1, DNA 2
2002 WL 313198 (Cal. Ct. App. 2002)	People v. Funston	DNA 2
2002 WL 1360001 (Cal. Ct. App. 2002)	People v. Brown	DNA 2
649 N.W.2d 815 (Minn. 2002)	State v. Roman Nose	DNA 2
827 So.2d 523 (Fla. Dist. Ct. App. 2003)	Magaletti v. State	DNA 1
149 N.H. 463 (N.H. 2003)	State v. Whittey	DNA 2

127 S.W.3d 799 (Tex. Crim. App. 2003)	De La O v. State	-
887 So.2d 804 (Miss. Ct. App. 2004)	Morris v. State	-
893 So.2d 1278 (Fla. 2004)	Everett v. State	DNA 2
2005 WL 1340382 (Cal. Ct. App 2005)	People v. Richie	DNA 2
915 So.2d 199 (Fla. Dist. Ct. App 2005)	Gibson v. State	DNA 2
2006 WL 142149 (Mich. 2006)	People v. Phea	DNA 1
893 A.2d 267 (R.I. 2006)	State v. Motyka	-
158 Wash.2d 759 (Wash. 2006)	State v. Gregory	DNA 2
2007 WL 102500 (Cal. Ct. App. 2007)	People v. Wimberly	DNA 1
448 Mass. 473 (Mass. 2007)	Commonwealth v. Bly	DNA 2
2007 WL 765967 (Tex. Crim. App. 2007)	Stewart v. State	-
11 So.3d 866 (Ala. Crim. App. 2007)	Brown v. State	DNA 2
2007 WL 2391258 (Cal. Ct. App. 2007)	People v. Rathbun	DNA 1
2008 WL 2689657 (Cal. Ct. App. 2008)	People v. Johnson	-
2009 WL 1509110 (Cal. Ct. App. 2009)	People v. Smith	DNA 1
2009 WL 4877478 (Ariz. Ct. App. 2009)	State v. Goudeau	-
2010 WL 1657048 (Minn. Ct. App. 2010)	State v. Smith	DNA 1, DNA 2
71 So.3d 86 (Fla. 2011)	Wyatt v. State	Bullet Lead
2011 WL 2869403 (Cal. Ct. App. 2011)	People v. Gomez	DNA 1, DNA 2
78 So.3d 512 (Fla. 2011)	Wyatt v. State	Bullet Lead
273 P.3d 417 (Utah Ct. App. 2012)	State v. Sheehan	Strengthening
435 S.W.3d 526 (Ky. 2013)	Meskimen v. Commonwealth	Strengthening
132 So.3d 678 (Fla. 2013)	Gosciminski v. State	Polygraph
2013 WL 6084198 (Mich. Ct. App. 2013)	People v. Farley	DNA 2
148 So.3d 1163 (Fla. 2014)	Duckett v. State	Bullet Lead
2014 IL App (1st) 120074-U (Ill. App. Ct. 2014)	People v. Mosley	DNA 2
416 S.C. 584 (S.C. 2016)	Simmons v. State	-
146 A.3d 1082 (D.C. 2016)	Caston v. United States	-
2016 WL 7285042 (Ohio Ct. App. 2016)	State v. Quiller	-
2010 So.3d 1 (Fla. 2016)	Asay v. State	Bullet Lead, Ballistic Imaging, Strengthening
902 N.W.2d 590 (Iowa Ct. App. 2017)	Schmidt v. State	Strengthening
2014 WL 693315 (Mont. 2014)	Rosling v. Kirkegard	Strengthening
609 Fed.Appx. 819 (5th Cir. 2015)	In Re Pruett	Strengthening
315 Mont. 395 (Mont. 2003)	State v. Ayers	-

**Appendix D: Data Analysis – A Brief Overview of Quantitative Findings**

<b>Frequency of Different Claims in the Data Set</b>	
<b>Type of Claim</b>	<b>Number of Claims</b>
*Direct Appeal	398
* <i>In Limine</i> Hearing	64
Claim of Constitutional Violation	146 (21 successful)
Petition of Habeas Corpus	61 (10 successful)
Claim of Actual Innocence	5 (1 successful)
*Challenge to Admissibility (All)	358 (47 successful)
Trial Court Error in Admissibility Decision	78 (10 successful)
Trial Court Abuse of Discretion in Admissibility Decision	22 (7 successful)
Newly Discovered Evidence	41 (8 successful)
<p>*These decisions have been disposed of in several different ways, making it difficult to categorically provide the number of successful claims.</p>	