

## The Science and Law Underlying Post-Conviction Challenges to Shaken Baby Syndrome Convictions: A Response to Professor Imwinkelried

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### I. INTRODUCTION

As the criminal justice system increasingly relies upon expert evidence, including scientific or pseudo-scientific evidence, the contingent and evolutionary nature of scientific knowledge poses growing challenges to the fair administration of justice. Professor Edward Imwinkelried’s thoughtful contribution to this symposium in part grapples with those challenges.<sup>1</sup> We fear, however, that, in addressing some of those problems, Professor Imwinkelried has painted too broadly, and has failed to acknowledge or address nuances that are very real and indeed common in so-called “shifted science” cases,<sup>2</sup> and that require a different calculus than he applies.

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<sup>1</sup> Edward J. Imwinkelried, *Debunked, Discredited, but Still Defended Revising State Post-Conviction Relief Statutes to Cover Convictions Resting on Subsequently Invalidated Expert Testimony*, 48 SETON HALL L. REV. 1095 (2018).

<sup>2</sup> “Shifted science” refers to situations in which new scientific studies undermine the consensus that once existed in regard to particular knowledge claims, which claims are sometimes (but not always) based on science-derived evidence to begin with. See Caitlin M. Plummer & Imran J. Syed, “*Shifted Science*” and *Post-Conviction Relief*, 8 STAN. J. CIV. RTS. & CIV. LIB. 259 (2012); Caitlin M. Plummer & Imran J. Syed, “*Shifted Science*” Revisited: *Percolation Delays and the Persistence of Wrongful Convictions Based on Outdated Science*, 64 CLEV. ST. L. REV. 483 (2016); Caitlin M. Plummer & Imran J. Syed, *Criminal Procedure*

In order to set up our criticisms in context, we must summarize Professor Imwinkelried's position more broadly. As he explains in detail at the outset, the article concentrates on a single variable in a multi-variable analysis that is required under the law to determine if new scientific knowledge warrants giving post-conviction relief to a person whose original trial included the now-challenged expert results. That single issue is whether the results of new research sufficiently undermine the testimony given at trial to justify relief if the other variables in the applicable legal test are satisfied. He begins this part of the analysis by two extreme examples to anchor the two ends of a continuum. The first assumes that new research exists, but that it actually supports or does not contradict the main thrust of the testimony at issue, and this obviously would not qualify as undermining the trial testimony even though there were relevant post-trial research results.<sup>3</sup> The second hypothesizes post-trial research that "thoroughly discredits the validity of the earlier testimony."<sup>4</sup> This circumstance would justify giving post-conviction relief, again assuming the other parts of the applicable test were met. Finally, in discussing situations where the research arguably creates a basis to doubt the trial testimony falling short of his notion of "thoroughly discrediting" the trial testimony, Professor Imwinkelried begins his analysis as follows: "Suppose that after a criminal trial at which the prosecution relied on expert testimony, later scientific research raises a question about the validity of the testimony. Standing alone, that should not lead to a new trial."<sup>5</sup>

In its most elemental sense, Professor Imwinkelried's point might often be correct, at least when limited in the sense that he himself limits it. He expands on his point in this way: "Assume that after a criminal trial at which the prosecution relied on expert testimony, later scientific research raises a question about the validity of the testimony. Standing alone, that should not lead to a new trial."<sup>6</sup> He later contrasts such situations from situations where

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*vs. 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).

<sup>3</sup> Imwinkelried, *supra* note 1, at 1107. He illustrates this with a DNA example—that the development of the STR technique for analyzing DNA did not call into question the accuracy of the results of previously testified to single locus probe RFLP DNA results.

<sup>4</sup> Imwinkelried, *supra* note 1, at 1108. He illustrates this with another DNA example—that results from the single locus probe RFLP process that contradicted previously testified to results of the earlier multi-locus probe technique were simply more accurate than the previous results. NOTE—it is not the results of the single locus probe that directly contradict the previous testimony exactly, but the realization that the multi-locus probe technique potentially had much greater potential dependency between alleles and made the product rule of questionable application. The single locus probe results merely confirmed that overvaluation in the individual case when it generated a random match probability greater than that testified to in the previous case that used the product rule on multi-locus probe results.

<sup>5</sup> Imwinkelried, *supra* note 1, text at 1109 n.60.

<sup>6</sup> Imwinkelried, *supra* note 1, at 1109.

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the later research “seriously undermines” the trial testimony. So, his main division of intermediate cases where new research does not “thoroughly discredit” the trial testimony is between those where new research merely “raises a question” about the trial testimony, and those which “seriously undermine” the trial testimony.<sup>7</sup>

Putting aside any reservations about whether this binary classification can appropriately handle the myriad types of expertise involved in trial testimony and the myriad ways that new research can bear on it, our main objection is to the use of the controversy over Shaken Baby Syndrome as an example of subsequent research which “merely raises a question” about the propriety of trial testimony.

Professor Imwinkelried elaborates:

Suppose that after the trial, a single new scientific study reaches an outcome at odds with the validity of the expert technique relied on at trial. The subsequent research may render the prior testimony debatable but, at this point, the testimony has hardly been debunked. The outcome in the new research could easily be an artifact.<sup>8</sup>

However, we believe that Professor Imwinkelried goes astray when he uses the current debates raging about the Shaken Baby Syndrome (SBS) (now more frequently and expansively called “Abusive Head Trauma” (AHT)), to illustrate this point.

We believe that Professor Imwinkelried overlooks the true nature of the medical-scientific debates in SBS/AHT cases; the import of the expert evidence in such cases; the various legal issues that can arise related to the expert testimony in such cases; and ultimately, therefore, the significance of newly recognized controversies in the medico-legal hypotheses underlying expert testimony in such cases. We examine each of these concerns in turn.

## II. THE MEDICAL AND SCIENTIFIC DEBATES ABOUT SBS/AHT

Given the case that Professor Imwinkelried initially posits—one in which ample scientific research supports the expert testimony of prosecution witnesses at trial, and, after conviction, the defense comes up with “a single new scientific study” that contradicts it (or even several such studies)—such a case ordinarily would not lead one to conclude safely that the state’s hypothesis has been debunked, or perhaps even undermined sufficiently to warrant a new trial. But that does not describe the nature of either the

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<sup>7</sup> Imwinkelried, *supra* note 1, at 1106, 1109.

<sup>8</sup> Imwinkelried, *supra* note 1, at 1109.

underlying science or the new research in the SBS/AHT debates (or, for that matter, the standards for obtaining a new trial).

To begin, the convictions in such cases, when they rest on the SBS/AHT hypothesis, rest upon a thin reed indeed and not a well-researched and validated scientific principle. The SBS hypothesis was first developed in the 1970s as a way to try to understand what was happening when babies presented with serious brain injuries but no external signs of trauma.<sup>9</sup> But because it is ethically impossible to conduct randomized controlled studies involving shaking and other abuse of children, it has been exceedingly difficult to conduct high-quality scientific studies to validate or invalidate the hypothesis. As a consequence, the hypothesis remains largely unvalidated, devoid of a solid evidence base to establish either that shaking alone can cause such injuries, or that shaking alone or combined with an impact can be “diagnosed” reliably on the basis of the medical findings often used to form the expert opinions in these cases.<sup>10</sup> Indeed, as Dr. Norman Guthkelch, one of the “fathers” of the SBS hypothesis, wrote, some 40+ years after he first proposed the hypothesis, he initially floated the idea as a hypothesis, and only a hypothesis, and it remains just that—an unproven hypothesis still in search of scientific support.<sup>11</sup> The fundamental premise underlying Professor Imwinkelried’s hypothetical therefore does not describe the real world of SBS/AHT cases.

Many proponents of the hypothesis adamantly insist, especially when responding to defense challenges to the expert testimony, that the hypothesis is well supported by volumes of research.<sup>12</sup> And indeed there are volumes of papers devoted to trying to understand such brain injuries in infants and young children, and in particular attempting to support both the SBS hypothesis and the diagnostic criteria for SBS/AHT. But none of that research achieves high quality-of-evidence ratings under evidence-based

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<sup>9</sup> See Arthur N. Guthkelch, *Infantile Subdural Haematoma and its Relationship to Whiplash Injuries*, 2 BRIT. MED. J. 430 (1971); John Caffee, *The Whiplash Shaken Infant Syndrome: Manual Shaking by the Extremities with Whiplash-Induced Intraocular Bleedings, Linked with Residual Permanent Brain Damage and Mental Retardation*, 54 PEDIATRICS 396 (1974).

<sup>10</sup> See Keith A. Findley, Patrick D. Barnes, David A. Moran & Waney Squier, *Shaken Baby Syndrome, Abusive Head Trauma, and Actual Innocence: Getting It Right*, 12 HOUS. J. HEALTH L. & POL’Y 209, 263–67 (2012).

<sup>11</sup> Arthur N. Guthkelch, *Problems of Infant-Retino-Dural Hemorrhage with Minimal External Injury*, 12 HOUS. J. HEALTH L. & POL’Y 201, 207 (2012) (“SBS and AHT are hypotheses that have been advanced to explain findings that are not yet fully understood. There is nothing wrong in advancing such hypotheses; this is how medicine and science progress. It is wrong, however, to fail to advise parents and courts when these are simply hypotheses, not proven medical or scientific facts, or to attack those who point out problems with these hypotheses or who advance alternatives.”).

<sup>12</sup> See, e.g., Sandeep K. Narang, *A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome*, 11 HOUS. J. HEALTH L. & POL’Y 505 (2011), and literature cited therein.

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medicine standards, for the reasons outlined above. Most of the research is of necessity retrospective in nature; it involves examining cases in which children have suffered severe brain injury or death, dividing them into “abuse” or “non-abuse” categories, and then looking to see what conclusions can be drawn from, and what diagnostic features are presented in, each category. But because there is no gold standard for distinguishing abuse from non-abuse, the research tends to rely for sorting on the very diagnostic features being studied (typically subdural hematoma, retinal hemorrhages, cerebral edema, or a smattering of other findings)—thereby building in a circularity confound. Virtually all of the research in the field—including that purporting to support the SBS/AHT hypothesis—recognizes this inherent circularity challenge.<sup>13</sup>

Where attempts have been made to evaluate the evidence base under evidence-based-medicine standards, the evidence base has invariably come up wanting.<sup>14</sup> Most recently, the Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU) undertook an exhaustive review of the literature in the field and concluded that “[t]here is limited scientific evidence” to support the claim that the traditional diagnostic “triad” or “its components can be associated with traumatic shaking (very low quality evidence)” and that “[t]here is insufficient scientific evidence on which to assess the diagnostic accuracy of the triad in identifying traumatic shaking (very low quality evidence).”<sup>15</sup> The SBU

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<sup>13</sup> See, e.g., S. A. Maguire et al., *Estimating the Probability of Abusive Head Trauma: A Pooled Analysis*, 128 PEDIATRICS 550, 558 (2011) (“Diagnostic studies in this field are open to criticism of circularity because of their dependence on a constellation of clinical features, as opposed to a single gold-standard diagnostic test, which does not exist.”); Shalea J. Piteau et al., *Clinical and Radiographic Characteristics Associated with Abusive and Nonabusive Head Trauma: A Systematic Review*, 130 PEDIATRICS 315, 321 (2012) (“As there are no standardized criteria for the definition of abuse, most authors developed their own criteria and many of these are fraught with circular reasoning.”); Narang, *supra* note 12, at 560–62 (while defending the research on SBS/AHT, acknowledging that “some circularity is inevitable, because we are unwilling to experimentally shake infants, and even reliably confessed accounts have some doubts”).

<sup>14</sup> See, e.g., Mark Donohoe, *Evidence-Based Medicine and Shaken Baby Syndrome*, 24 AM. J. FORENSIC MED. & PATHOLOGY 239, 239 (2003). Dr. Donohoe’s paper has been criticized by SBS-hypothesis proponents, who claim that the search terms he used for his literature review were not expansive enough. See, e.g., Joelle Anne Moreno & Brian Holmgren, *The Supreme Court Screws Up the Science: There is No Abusive Head Trauma/Shaken Baby Syndrome Scientific Controversy*, 2013 UTAH L. REV. 1357, 1390–96 (2013); Narang, *supra* note 12, at 535. But those critics have never identified any papers that Dr. Donohoe’s search omitted *that would have changed his assessment*—that the evidence base is very weak—in any way. Nor have they identified any errors in his application of evidence-based-medicine standards to the research, other than to assert that, because SBS/AHT research can never employ randomized controlled studies, that inherent weakness should not be held against the research base. Narang, *supra* note 12, at 535.

<sup>15</sup> Niels Lynøe, Göran Elinder, Boubou Hallberg, Måns Rosén, Pia Maly Sundgren & Anders Eriksson, *Insufficient Evidence for “Shaken Baby Syndrome”—A Systematic Review*,

elaborated:

Although relatively many studies met the criteria for inclusion [in this literature review], the literature search identified only two studies of moderate quality. This is disconcerting, because traumatic shaking is very serious and has dramatic consequences for both the child and its family. The research field is complex, but this does not excuse, for example, circular reasoning and inadequate presentation of data collection. It is important that reviews of the field include consideration of the methodological flaws which characterise this field of research.<sup>16</sup>

In this country, while no comparable governmental inquiry has yet been conducted into the scientific status of the SBS hypothesis, the President's Council of Advisors on Science and Technology (PCAST), in its 2016 groundbreaking report on other forensic sciences, observed "that there are issues related to the scientific validity of other types of forensic evidence that are beyond the scope of this report but *require urgent attention*—including notably . . . abusive head trauma commonly referred to as 'Shaken Baby Syndrome.'"<sup>17</sup>

Indeed, even many of the SBS-hypothesis's strongest advocates, in their more candid moments, have acknowledged that the mechanism of injury in these cases is poorly understood, and that the scientific foundation is not solid.<sup>18</sup> In 2009, for example, the American Academy of Pediatrics—which as an organization consistently and vehemently defends the SBS/AHT hypothesis—revised its official position paper, backing off of some of the certainty about the "diagnosis" that it had expressed in earlier iterations,<sup>19</sup> observing that "[f]ew pediatric diagnoses engender as much debate as AHT," and that "many clinicians and researchers acknowledge that precise

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106 ACTA PAEDIATRICA 1021 (2017).

<sup>16</sup> *Id.* at 1027.

<sup>17</sup> PRESIDENT'S COUNCIL OF ADVISORS ON SCI. & TECH., REPORT TO THE PRESIDENT: FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE-COMPARISON METHODS 23 n.15 (2016) (emphasis added).

<sup>18</sup> See, e.g., Mark Dias, *The Case for Shaking*, in CHILD ABUSE AND NEGLECT: DIAGNOSIS, TREATMENT, AND EVIDENCE 364 (2011) ("Unfortunately, nobody has yet marshalled a coherent and comprehensive argument in support of shaking as a causal mechanism for abusive head injury."); M. Vaughn Emerson et al., *Ocular Autopsy and Histopathologic Features of Child Abuse*, 114 AM. ACAD. OPHTHALMOLOGY 1384, 1394 (2007); Cindy W. Christian et al., *Abusive Head Trauma in Infants and Children*, 123 PEDIATRICS 1409, 1410 (2009), <http://pediatrics.aappublications.org/content/pediatrics/123/5/1409.full.pdf>. Critics of the SBS hypothesis also make the point. See, e.g., Wancy Squier, *The "Shaken Baby" Syndrome: Pathology and Mechanisms*, 122 ACTA NEUROPATHOLOGICA 519, 521 (2011).

<sup>19</sup> For a discussion of the changes in the position papers, see Findley et al., *supra* note 10, at 240–42.

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mechanisms for all abusive injuries remain incompletely understood.”<sup>20</sup> In a leading child abuse textbook, Dr. Mark Dias, another prominent proponent of the hypothesis, similarly acknowledged the thinness of the science in a chapter meant to provide the definitive argument in *support* of the hypothesis. In that chapter, entitled, “The Case for Shaking,” after acknowledging the lack of *scientific* evidence for the hypothesis, Dr. Dias concluded that “confessed shaking . . . is the evidentiary basis for shaking.”<sup>21</sup>

Given all this, and after hearing extensive testimony from experts on both sides of the debates in federal habeas corpus proceedings, federal District Court Judge Matthew Kennelly found Jennifer Del Prete to be innocent of the SBS crime for which she had been convicted.<sup>22</sup> In so ruling, Judge Kennelly found, in part, that the extensive scientific evidence presented to him “arguably suggests that a claim of shaken baby syndrome is more an article of faith than a proposition of science.”<sup>23</sup>

We fear that Professor Imwinkelried has glossed over the serious nature of the challenge to SBS/AHT expert opinions by framing the dispute as essentially one between pediatricians, armed with a solid body of medical research supporting the SBS/AHT hypothesis on the one hand, and a small group of biomechanical engineers armed with a few contradictory studies on the other.<sup>24</sup> Professor Imwinkelried notes, for example, that, “in recent years,

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<sup>20</sup> Christian et al., *supra* note 18, at 1409–10.

<sup>21</sup> Dias, *supra* note 18, at 364 (emphasis in original). To anyone familiar with either the literature on wrongful convictions or the social science literature on confessions and interrogations, such unquestioning reliance on alleged confessions to substitute for scientific research is, to say the least, startling. See Findley et al., *supra* note 10; DEBORAH TUEKHEIMER, *FLAWED CONVICTIONS: “SHAKEN BABY SYNDROME” AND THE INERTIA OF INJUSTICE* (2014).

<sup>22</sup> Del Prete v. Thompson, 10 F. Supp. 3d 907, 958 (N.D. Ill. 2014) (concluding that “no reasonable juror, hearing all of the evidence including that from Del Prete’s experts, could find her guilty beyond a reasonable doubt”).

<sup>23</sup> *Id.* at 957 n.10.

<sup>24</sup> In part, this may be because Professor Imwinkelried was misled by some of the writings he cites by authors such as Professor Joelle Anne Moreno and former SBS-prosecutor Brian Holmgren. See, e.g., Moreno & Holmgren, *supra* note 14. In those writings, Moreno and Holmgren take the U.S. Supreme Court (and the SBS-critics the justices relied upon) to task for recognizing the controversies in the SBS/AHT “diagnosis” in Cavazos v. Smith, 132 S. Ct. 2, 10 (2011) (Ginsburg, J., dissenting). In their critique, Moreno and Holmgren misleadingly take up one of the SBS proponents’ new strategic ploys—to deny that there is any controversy about SBS/AHT, or any weakness in the scientific foundations for the hypothesis—despite the widespread recognition of both the controversies and the weaknesses of the scientific foundation, discussed above, and elsewhere. See *supra* notes 9–21 and accompanying text; see also Carol E. Nicholson, *Preface to AMERICAN ACADEMY OF PEDIATRICS, INFLICTED CHILDHOOD NEUROTRAUMA*, at IX (Robert M. Reece & Carol E. Nicholson eds., 2003) (“The debate of ‘shaken baby syndrome’ continues to rage in our country. Because there is very little scientific experimental or descriptive work, the pathophysiology remains obscure, and the relationship to mechanics even cloudier. The situation has not been made better by the constant emotional and forensic advocacy, which

biomechanical experts have sharply criticized the hypothesis. They rely primarily on studies with primates and anthropomorphic models. Those studies suggest that without more, mere shaking cannot generate enough force to cause fatal injury to the infant brain.”<sup>25</sup>

Indeed the biomechanical research does pose an enormous challenge to the SBS hypothesis, because the biomechanical research—using well-accepted research tools and methodologies—consistently shows that violent shaking of an infant by a human adult cannot generate accelerations that come anywhere close to estimated thresholds for brain injury or death.<sup>26</sup> The research also consistently shows that, *if* shaking could generate sufficient accelerations, it would necessarily produce massive neck and spine injuries—which are not typical in SBS/AHT cases.<sup>27</sup> Finally, the biomechanical research consistently shows that short-distance falls (such as

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seems to escalate every week on every side of this subject area. . . . What we need is science—research and evidence that just isn’t there right now. The evidence that does exist has not been subjected to evidence-based scrutiny in a multidisciplinary scientific forum.”); Stephen Goudge, INQUIRY INTO PEDIATRIC FORENSIC PATHOLOGY IN ONTARIO—REPORT 527–28 (2008) (“[O]ne of the deepest controversies surrounding pediatric forensic pathology concerns shaken baby syndrome. . . . [The] evolution in forensic pathology in this area [has progressed such that] the predominant view is no longer that the triad on its own is diagnostic of SBS. Instead, the issue is fraught with controversy.”); Sandeep K. Narang et al., *Acceptance of Shaken Baby Syndrome and Abusive Head Trauma as Medical Diagnoses*, 177 J. PEDIATRICS 273, 277 (2016) (reporting that two surveys of pathologists found that thirty-five percent to nearly sixty percent of forensic pathologists in 2010 and 2015 respectively question the SBS “diagnosis”). In a new book, Randy Papetti meticulously and thoroughly debunks the specious claim that there is no legitimate debate about SBS/AHT. RANDY PAPETTI, *THE FORENSIC UNRELIABILITY OF THE SHAKEN BABY SYNDROME* ch. 4 (2017).

<sup>25</sup> Imwinkelried, *supra* note 1, at 1111 (footnote omitted).

<sup>26</sup> See, e.g., Christine Duhaime et al., *The Shaken Baby Syndrome: A Clinical, Pathological and Biomechanical Study*, 66 J. NEUROSURGERY 409, 414 (1987); Michael Thomas Prange et al., *Anthropomorphic Simulation of Falls, Shakes and Inflicted Impacts in Infants*, 99 J. NEUROSURGERY 143, 147, 149 (2003); John Lloyd et al., *Biomechanical Evaluation of Head Kinematics During Infant Shaking Versus Pediatric Activities of Daily Living*, J. FORENSIC BIOMECHANICS 6 (2011). As Professor Imwinkelried notes, SBS-hypothesis-proponents challenge the biomechanical research; indeed, they contend that the biomechanical research must all be wrong, in part because it relies on estimates of injury thresholds for infants that could be wrong. Estimating injury thresholds for infants is indeed a challenge, but that critique would only invalidate the findings of the biomechanical research if those estimates—based on extrapolation from known injury thresholds for adults, cadaver studies, animal studies, and computer modeling—were off by many orders of magnitude, which is highly unlikely. Moreover, that critique implicitly puts the burden of proof on the critics of the SBS hypothesis to prove that infant injury thresholds are not being estimated at least approximately correctly based on existing evidence, rather than on SBS-hypothesis-proponents to prove that the injury threshold is some order of magnitude different, a proposition for which there is *no* biomechanical evidence.

<sup>27</sup> See, e.g., Faris A. Bandak, *Shaken Baby Syndrome: A Biomechanics Analysis of Injury Mechanisms*, 151 FORENSIC SCI. INT’L 71, 71 (2005), [https://pdfs.semanticscholar.org/ee5c/5d9a5279da7237272ee50a76fa0344a9902e.pdf?\\_ga=2.255732685.434200710.1526570687-1838845519.1526570687](https://pdfs.semanticscholar.org/ee5c/5d9a5279da7237272ee50a76fa0344a9902e.pdf?_ga=2.255732685.434200710.1526570687-1838845519.1526570687); Prange et al., *supra* note 25, at 147; PAPETTI, *supra* note 24, at 96–104, and sources cited therein.



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falls off of furniture) produce many times more accelerations than the most vigorous shaking, and that they can produce accelerations that exceed estimated injury thresholds<sup>28</sup>—thereby debunking one of the cardinal principles of the SBS dogma, which has consistently maintained that the medical findings and injuries used to diagnose SBS/AHT cannot be caused by accidental short-distance falls.<sup>29</sup>

Moreover, unlike the (perhaps unintended) suggestion of Professor Imwinkelried’s analysis, the challenge to the SBS/AHT hypothesis does not rest solely on biomechanical engineering studies. Much of the challenge comes from a large and growing body of medical literature questioning the hypothesized mechanism and pathophysiology of injury in such cases.<sup>30</sup> Much also rests on a large and growing body of medical research identifying a range of natural and accidental causes that can and do generate the findings and injuries previously ascribed virtually exclusively to SBS/AHT—the so-called “mimics” of abuse, which can confound any attempt to “diagnose” abuse.<sup>31</sup> And much of it rests on a large and growing body of medical and

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<sup>28</sup> Patrick E. Lantz & Daniel E. Couture, *Fatal Acute Intracranial Injury, Subdural Hematoma and Retinal Hemorrhages Caused by Stairway Falls*, 56 J. FORENSIC SCI. 1648 (2011); Nicole G. Ibrahim & Susan S. Margulies, *Biomechanics of Toddler Head During Low-Height Falls: An Anthropomorphic Dummy Analysis*, 6 J. NEUROSURGERY PEDIATRICS 57 (2010); Chittaranjan Behera, Ravi Rautji & Tirath Das Dogra, *Fatal Accidental Fall from Height in Infants and Children: A Study from South Delhi*, 50 MED., SCI., & L. 224 (2010); Michael Thomas Prange, Ann-Christine Duhaime, Brittany Coats & Susan S. Margulies, *Anthropomorphic Simulation of Falls, Shakes and Inflicted Impacts in Infants*, 99 J. NEUROSURGERY 143 (2003); Paul Steinbok, Ashutosh Singhal, Ken Poskitt & D. Douglas Cochrane, *Early Hypodensity on Computed Tomographic Scan of the Brain in an Accidental Pediatric Head Injury*, 60 NEUROSURGERY 689 (2007); John Plunkett, *Fatal Pediatric Head Injuries Caused by Short Distance Falls*, 22 AM. J. FORENSIC MED. & PATHOLOGY 1 (2001), <https://pdfs.semanticscholar.org/c67e/29d482e7f9bea8f50ff3be3698b770dd4faa.pdf>.

<sup>29</sup> See Findley et al., *supra* note 10, at 245–49.

<sup>30</sup> See, e.g., Patrick D. Barnes, *Imaging of Nonaccidental Injury And The Mimics: Issues and Controversies in the Era of Evidence-Based Medicine*, 49 RADIOLOGIC CLINICS N. AM. 205 (2011); J.F. Geddes et al., *Dural Haemorrhage in Non-Traumatic Infant Deaths: Does It Explain the Bleeding in ‘Shaken Baby Syndrome’?*, 29 NEUROPATHOLOGY & APPLIED NEUROBIOLOGY 14, 14 (2003); J.F. Geddes et al., *Neuropathology of Inflicted Head Injury in Children, I. Patterns of Brain Damage*, 124 BRAIN 1290 (2001); J.F. Geddes et al., *Neuropathology of Inflicted Head Injury in Children, II. Microscopic Brain Injury in Infants*, 124 BRAIN 1299, 1299, 1304 (2001); Waney Squier, *The “Shaken Baby” Syndrome: Pathology and Mechanisms*, 122 ACTA NEUROPATHOLOGICA 519 (2011); Julie Mack, Waney Squier & James Eastman, *Anatomy and Development of the Meninges: Implications for Subdural Collections and CSF Circulation*, 39 PEDIATRIC RADIOLOGY 200, 200 (2009); Ronald H. Uscinski, *Shaken Baby Syndrome: An Odyssey*, 46 NEUROLOGIA MEDICO-CHIRURGICA (Tokyo) 57 (2006).

<sup>31</sup> See, e.g., Patrick D. Barnes & Michael Krasnokutsky, *Imaging of the Central Nervous System in Suspected or Alleged Nonaccidental Injury, Including the Mimics*, 18 TOPICS MAGNETIC RESONANCE IMAGING 53, 65–70 (2007); Andrew P. Sirotiak, *Medical Disorders that Mimic Abusive Head Trauma*, in *ABUSIVE HEAD TRAUMA IN INFANTS AND CHILDREN: A MEDICAL, LEGAL, AND FORENSIC REFERENCE* 191 (Lori Frasier et al., eds., 2006).

other scientific research indisputably debunking previously held beliefs about various aspects of the SBS/AHT hypothesis, such as old beliefs that the shaking had to have been intentional or at least reckless, because it would have required force equivalent to throwing a child out of a third-floor window or hitting a child with an automobile at 30 miles per hour;<sup>32</sup> or old beliefs that a child with the telltale brain injuries would have been rendered immediately comatose and unresponsive and could not have experienced a “lucid interval” between injury and collapse;<sup>33</sup> or old beliefs that findings like retinal hemorrhages could be caused by nothing except the violent rotational forces associated with shaking.<sup>34</sup> Finally, as discussed above, the challenge rests on the growing recognition that the SBS/AHT hypothesis simply lacks a scientific evidence base.

### III. THE IMPORTANCE OF THE EXPERT EVIDENCE IN SBS/AHT CASES

Professor Imwinkelried’s analysis also, we fear, fails to appreciate sufficiently the significance of the scientific or medical opinion evidence in SBS/AHT cases, and thereby fails to recognize the corresponding importance of new medical and scientific evidence when it emerges to challenge the trial expert testimony. More than almost any other type of case (with the possible exception of arson<sup>35</sup>), SBS/AHT prosecutions often rely almost entirely on expert testimony. The typical case is an unwitnessed event in which a child is found in seizure, or comatose and unresponsive. (Indeed, remarkably, no documented cases in the literature of which we are aware involve videotaped or even reliably witnessed incidents of shaking leading to serious brain injury or death; in every such videotaped incident involving violent shaking of which we are aware the child has been uninjured.)<sup>36</sup> Expert testimony is then used to establish every element of the crime.

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<sup>32</sup> See Keith A. Findley, *Examining Shaken Baby Syndrome Convictions in Light of New Medical Scientific Research*, 37 OKLA. CITY L. REV. 219, 223 (2012); Deborah Tuerkheimer, *The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts*, 87 WASH. U. L. REV. 1, 4 (2009).

<sup>33</sup> See, e.g., M.G.F. Gilliland, *Interval Duration Between Injury and Severe Symptoms in Nonaccidental Head Trauma in Infants and Young Children*, 43 J. FORENSIC SCI. 723, 724 (1998).

<sup>34</sup> See, e.g., E. Matshes, *Retinal and Optic Nerve Sheath Hemorrhages Are Not Pathognomonic of Abusive Head Injury*, 16 PROC. OF THE AM. ACAD. FORENS. SCI. 272 (2010); Findley et al., *supra* note 10, at 251–54.

<sup>35</sup> See, e.g., Keith A. Findley, *Flawed Science and the New Wave of Innocents*, in *WRONGFUL CONVICTIONS AND THE DNA REVOLUTION: TWENTY-FIVE YEARS OF FREEING THE INNOCENT 184* (Daniel S. Medwed ed., 2017).

<sup>36</sup> By contrast, there are now numerous reliably witnessed and videotaped incidents in which children have suffered short-distance falls (such as off of chairs or beds or low-height indoor play structures that resulted in brain injury and death).

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The experts opine as to the *actus reus*—violent shaking, or shaking with impact, had to have been employed to produce such injuries. The experts likewise opine as to *mens rea*—the shaking had to have been so violent that it could not have been accidental; it had to have been intentional, or at least reckless (the typical elements required for child abuse or homicide). And finally, the experts often opine—erroneously—that because the child would have become immediately comatose and unresponsive, the last person with the child had to be the perpetrator, thereby establishing identity.<sup>37</sup> These cases are thus what Professor Deborah Tuerkheimer has aptly called a “medical diagnosis of murder.”<sup>38</sup>

In this sense, though, even that terminology is not quite right, for these cases do not involve a medical diagnosis in the true sense. Rather, they involve a causation inquiry that goes beyond diagnosis, and ventures into etiology—a matter that exceeds the expertise of physicians, and makes the medical opinion evidence simultaneously much more important and less reliable than expert evidence in other kinds of cases.

As used in medicine, diagnosis refers to the process of determining the disease or dysfunctional condition from which a patient suffers in order to determine the best course of treatment to cure or relieve the disease or condition. The disease or condition is inferred from signs, symptoms, risk factors, and the results of diagnostic tests. Signs are objective conditions or manifestations observed by the physician either directly or with the aid of sense-enhancing instruments such as a stethoscope. Symptoms are subjective reports of pain, weakness, or other conditions associated with the complaint of the patient in regard to a dysfunctional condition or disease. Risk factors (beyond those represented directly by signs or symptoms) are such things as family history of disease, exposure to disease-causing agents, etc., which are usually derived from the patient’s history as recounted by the patient (or next of kin), or derived from the patient’s previous medical records. Finally, diagnostic tests, which are often the result of chemical analysis of bodily fluids or tissues, give results correlated by previous research with certain diseases or conditions. They are usually performed by someone other than the treating physician and are often now instrumented to a greater or lesser degree.

One thing to note at the outset is that diagnosis is not directly concerned with the *cause* of a disease or condition, although some diagnoses will entail causes established by previous research, and some diagnostic tests will reveal the presence of a causal agent associated with the condition by

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<sup>37</sup> DEBORAH TUERKHEIMER, *FLAWED CONVICTIONS: “SHAKEN BABY SYNDROME” AND THE INERTIA OF INJUSTICE* 5 (2014).

<sup>38</sup> Deborah Tuerkheimer, *The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts*, 87 WASH. U. L. REV. 1, 5 (2009).

previous research. The point is that diagnostic judgment itself does not address causation independent of previous research on the cause of a disease or constellation of sign and symptoms.

This is true also of the iterative process known as differential diagnosis. Differential diagnosis refers to the process whereby the physician ideally determines all the diseases or conditions that might account for a set of signs and symptoms, rank orders them by probability (or sometimes severity), and proceeds to attempt to rule out the members of the list by further tests. In practice, whether one actually rules out of every possibility except one will depend on the remoteness of initial probabilities and the availability and expense of diagnostic tests, and often the most life-threatening or the most probable disease after convenient diagnostic testing has been done will be treated first, and only when treatment fails will that disease be eliminated and either further more rigorous or costly testing, or treatment for the next most likely disease, be undertaken. Note that differential diagnosis involves a feedback loop where initial diagnostic hypotheses are modified in light of newly acquired information. And most importantly, skill in differential diagnosis (or diagnosis generally) does not provide one with special skill in determining causation in regard to the disease or condition finally settled on and treated successfully. The skill is in determining the disease or condition in the patient, and knowing how to treat it successfully, not in determining its cause.<sup>39</sup> Determining cause (the “etiology” of a disease) is a specialty of scientific medical research, not of practical diagnosis by practicing physicians. Of course, practicing physicians may be willing to opine on causation of conditions like various cancers, and they may invoke their diagnostic skills in the process, but this is misplaced. Determining the etiology of a disease that has not yet been established by formal research (even through a process that might resemble “differential diagnosis”

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<sup>39</sup> Here we must be clear on the sense in which we are using the term “cause.” It is not uncommon to say that when a particular disease has been identified as the source of a person’s signs and symptoms, the diagnosis has identified the “cause” of those signs and symptoms. In an extended sense this is not incorrect, but not in the sense covered by the concept of etiology, which deals with the question of what causes the disease itself. Malaria provides a helpful example. For centuries malaria was easily diagnosed in typical cases involving malarial paroxysm—shaking chills alternating with high fever and sweats over a two- or three-day cycle. However, the cause, in any useful sense, was unknown (the very name indicates the cause was assigned to “bad air.”) Identifying the cause of malaria in detail is a triumph of modern medical research, beginning in 1880 with Laveran’s observation of parasites in the blood of infected individuals, and continuing in the subsequent decades as the different species of Plasmodium responsible for the variations of the disease, and the role of mosquitos in spreading the infection was worked out in detail. See the history section of the Wikipedia article on malaria, *Malaria*, WIKIPEDIA (May 5, 2018), <https://en.wikipedia.org/wiki/Malaria>. So a physician in 1875 could diagnose the disease, and even treat some cases fairly well with quinine, but had no well-warranted idea of the cause of the disease itself—its etiology.

superficially) is beyond the scope of the practitioner's training an expertise, and represents no more than a conjectural hypothesis at best. There is no training, formal or otherwise, in "differential etiology" in medical school.

Indeed, in civil cases, courts have recognized the important distinction between differential etiology and differential diagnosis, and that the former is a much more dubious proposition. As one civil court put it bluntly, "The differential diagnosis method has an inherent reliability; the differential etiology method does not."<sup>40</sup> Part of this is because doctors receive training in diagnosis, but not etiology. But part of it is also because etiological questions offer no opportunity for learning from experience. As there is no treatment for shaking (or other abuse), there simply is no mechanism for learning about or informing a physician about whether a diagnosis" of abuse was correct or incorrect;<sup>41</sup> without such feedback, there is no opportunity to learn.<sup>42</sup>

Moreover, as one of us has observed previously:

As problematic as the causation determination can be in tort cases, that determination, employing a differential etiology methodology, is even more challenging in SBS/AHT cases. The reason is simple. In the typical tort case the question posed to the expert is whether a known historical fact connects causally to a known injury or outcome. But in SBS/AHT cases, the historical fact at issue—whether the accused violently shook or shook and slammed the child—is itself unproven and unknown. In the SBS/AHT context, the expert is asked not just to relate cause to effect

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<sup>40</sup> *Bowers v. Norfolk S. Corp.*, 537 F. Supp. 2d 1343, 1361 (M.D. Ga. 2007), *aff'd*, 300 F. App'x 700 (11th Cir. 2008). *See also* TUEKHEIMER, *supra* note 20, at 76; Findley, *supra* note 35.

<sup>41</sup> One of us has explained this previously in this way: "Experience can be a valuable part of any expert's expertise, if it is the sort of experience from which the expert can learn. The true differential diagnosis—diagnosing a patient's medical illness or condition for purposes of prescribing treatment—at least has the potential for enabling the doctor to learn from experience, and hence for improving reliability. If the doctor misdiagnoses an illness or condition, the treatment will likely fail, and the doctor will adjust the diagnosis and the treatment accordingly. But because there is no treatment for abuse, judgments about causation (etiology) do not offer similar opportunities for feedback and learning, and hence for ensuring experience-based reliability. Asking doctors to draw legal conclusions, like causation, imposes demands on science that it is ill-suited to meet." *Findley, supra* note 35, at 191–92.

<sup>42</sup> *See, e.g.*, Gordon D. Schiff, *Minimizing Diagnostic Error: The Importance of Follow-up and Feedback*, 121 AM. J. MED. S38, S38 (2008) ("An open-loop system (also called a 'nonfeedback controlled' system) is one that makes decisions based solely on preprogrammed criteria and the preexisting model of the system. This approach does not use feedback to calibrate its output or determine if the desired goal is achieved. . . . [Such a system] cannot engage in learning."); Eta S. Berner & Mark L. Graber, *Overconfidence as a Cause of Diagnostic Error in Medicine*, 121 AM. J. MED. S2, S10 (2008) (discussing the problems with absent or delayed feedback in medical diagnosis).

when both the alleged cause and effect have been observed, but to relate cause to effect when *only* the effect has been observed; it asks the expert to divine not only the relationship between the precipitating event and the outcome, but to divine even the existence of the alleged precipitating event itself, which has not been observed or otherwise proven.<sup>43</sup>

Given all this, it is important to keep in mind that expert testimony in SBS/AHT cases is not just routine expert evidence. It is often the whole case, or the primary evidence of guilt. And yet it is highly tenuous. Thus, we believe shifts in the scientific and medical understandings underlying the SBS/AHT hypothesis necessarily take on greater significance than Professor Imwinkelried recognizes.

#### IV. THE VARIED LEGAL ISSUES THAT CAN ARISE RELATED TO THE EXPERT TESTIMONY IN SBS AND LIKE CASES

Professor Imwinkelried illustrates his point by referring to the Ninth Circuit's decision in *Gimenez v. Ochoa*,<sup>44</sup> and in particular by contrasting it to the Wisconsin Court of Appeals' decision in *State v. Edmunds*.<sup>45</sup> Again, we fear, Professor Imwinkelried's analysis paints too broadly, and masks important distinctions between the cases, and the very limited nature of the holding in *Gimenez*. Before explaining why, however, it is worth noting that the shifting science related to SBS/AHT—as with any developing scientific matter—can pose a variety of legal issues in the post-conviction context, which require varied analyses. One issue inevitably relates to admissibility of expert opinions, whether the jurisdiction follows *Daubert*<sup>46</sup> or *Frye*,<sup>47</sup> or some other admissibility standard. We take it that Professor Imwinkelried's analysis in this symposium is not addressed to admissibility of either the prosecution or defense experts in such cases—a matter that Professor Imwinkelried has addressed in detail in prior writing.<sup>48</sup> Other claims arising

<sup>43</sup> Findley, *supra* note 35, at 192 (footnote omitted).

<sup>44</sup> *Gimenez v. Ochoa*, 821 F.3d 1136 (9th Cir.), *cert. denied*, 137 S. Ct. 503 (2016).

<sup>45</sup> *State v. Edmunds*, 746 N.W.2d 590 (Wis. Ct. App. 2008).

<sup>46</sup> *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993).

<sup>47</sup> *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

<sup>48</sup> Edward J. Imwinkelried, *Shaken Baby Syndrome: A Genuine Battle of the Scientific (and Non-Scientific) Experts*, 46 CRIM. L. BULL. 1, 3 (2010) (arguing that “given the current state of the empirical data, there is a genuine battle of the experts . . . [and that, therefore,] both sides should be permitted to present their theories to the trier of fact”). Even on that issue, however, it is worth noting that, while in global terms, Professor Imwinkelried is correct that expert testimony on both sides is likely admissible, in particular aspects or applications, some claims that have been made by experts in the past are clearly now scientifically wrong, and hence can no longer be admissible. These include claims that physicians at one time regularly made for example, that nothing can cause the triad of findings except violent shaking; or that

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from evolving science relate to the standards for granting a new trial based on shifted science. But even within that category, the issues can be varied and nuanced. In some cases, for example, the question might be whether the science has shifted sufficiently to reveal that the prosecution relied upon false evidence at trial. In others, it might be whether shifts or emerging debates are adequate to satisfy a jurisdiction's standards for granting a new trial based on newly discovered evidence. In others, the question will be whether new scientific evidence is sufficient to establish innocence to a degree sufficient to permit a federal court in habeas review to permit a procedurally defaulted claim to proceed under *Schlup v. Delo*,<sup>49</sup> or to permit a federal habeas court consider a successive petition. In still others, the question will be whether the shifted science is enough to meet whatever freestanding claim of actual innocence there might be under the Due Process Clause after *Herrera v. Collins*.<sup>50</sup> It is in this regard that we fear Professor Imwinkelried's analysis obscures these distinctions, and thus fails to recognize the many instances in which the kinds of evidence presented in *Gimenez* might indeed warrant granting post-conviction relief.

*Gimenez* addressed just two (or three) of the issues outlined above—and they were ones under which the petitioner was required to meet the most onerous of all of the various legal standards that govern these various claims, made even more onerous because the claim was raised in a federal habeas challenge to a state court conviction under the very tight restrictions imposed by Congress in that context. The first claim was that Due Process was violated because the prosecution's expert witnesses presented false testimony at trial.<sup>51</sup> It was only in that context that the court ruled that shifting medical opinions and emerging controversies are not enough, because disagreements, even profound ones, do not prove prior testimony to be false. The court explained: "To the extent that this new testimony contradicts the prosecution's expert testimony, it's simply a difference in opinions—not false testimony."<sup>52</sup>

The second, and related, third claim similarly alleged that the trial testimony was false, but somewhat differently claimed that the new evidence

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short falls cannot kill; or that a child cannot suffer a lucid interval after suffering a fatal brain injury. For a discussion of these limitations, see Findley et al., *supra* note 10, at 245–51, 302–06. Further, it is worth noting that, when criminal responsibility is at stake, simply throwing such disputes to juries to resolve, most likely inconsistently from case to case, is not necessarily a good practice comporting with substantial justice, but that problem is probably better handled through principles of sufficiency of evidence rather than by reference to admissibility.

<sup>49</sup> 513 U.S. 298 (1995).

<sup>50</sup> 506 U.S. 390 (1993).

<sup>51</sup> *Gimenez v. Ochoa*, 821 F.3d 1136, 1142 (9th Cir. 2016).

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

proved Gimenez's actual innocence such that he was entitled both to seek relief in a "successive" habeas petition and substantively entitled to relief. But again, the standard was too onerous to meet in the face of disagreement among experts. As the court put it, "Gimenez can't prove by 'clear and convincing evidence' that 'no reasonable factfinder' would have found him guilty but for the introduction of purportedly flawed SBS testimony."<sup>53</sup>

As this brief analysis of the issues demonstrates, *Gimenez* does not at all address admissibility of any of the expert evidence, or more importantly, whether a new trial should be granted based on newly discovered evidence (based on new SBS/AHT research) or ineffective assistance of counsel (based on counsel's failure to present existing research)—these latter claims being the ones that most frequently arise in post-conviction SBS litigation. It was precisely such a claim that the Wisconsin court addressed in *State v. Edmunds*.<sup>54</sup> There, the court concluded that, where the case depended entirely on expert opinions; and where the jury at trial had been told that *nothing* could have caused the triad of findings but shaking or shaking with impact, that the child could not have experienced a "lucid interval," and that the medical science on these points was settled and indisputable; *then* under those circumstances the emergence of contrary science after trial was indeed enough to constitute newly discovered evidence and require a new trial, at which the jury could consider the competing expert opinions. The *Edmunds* Court explained: "[T]here has been a shift in mainstream medical opinion since the time of Edmunds's trial as to the cause of the types of injuries Natalie suffered. . . . However, it is the emergence of a legitimate and significant dispute within the medical community as to the cause of those injuries that constitutes newly discovered evidence."<sup>55</sup> Unlike in *Gimenez*, the defendant's burden was not to prove that the testimony from trial was indisputably false, but rather to show that new science constituted new evidence that created at least a reasonable probability that a jury would find reasonable doubt and acquit.<sup>56</sup>

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<sup>53</sup> *Id.* at 1145.

<sup>54</sup> In the interest of full disclosure, we note that one of us, Findley, was counsel for Audrey Edmunds in that litigation.

<sup>55</sup> *State v. Edmunds*, 746 N.W.2d 590, ¶ 23 (Wis. Ct. App. 2008).

<sup>56</sup> This is the substantive standard of harmfulness to be applied to evidence not before the jury as the result of ineffective assistance of counsel, applicable to all jurisdictions under *Strickland v. Washington*, 466 U.S. 668 (1984). If the new evidence comes from advances in science since the trial, however, there is no currently no clear constitutionally necessary uniformity in the standard to be applied from state to state, since the original trial was free of constitutional error when it took place. Nevertheless, many states do apply a test analogous to the *Strickland* test of harm to determine the propriety of granting a new trial based on newly discovered evidence. See the cases collected in footnote 57 below. In addition, we believe that this standard is the morally correct standard for evaluating the propriety of giving a new trial in all cases of "fresh evidence," as the British call it, wherever it falls into the artificial



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Unfortunately, that is a scenario that Professor Imwinkelried does not address at all, despite his reference to *Edmunds*. Yet that is the context in which courts are now most frequently granting post-conviction relief in SBS/AHT cases.<sup>57</sup> Worse, by juxtaposing *Gimenez* against *Edmunds*,

dichotomy between evidence that was not before the jury because of ineffective assistance of counsel or because it is considered “newly discovered.” Professor Imwinkelried’s “general standard” asks different questions concerning the evaluation of new science-based knowledge. In order to obtain relief, he says “(1) the accused presents testimony about a new analytic technique developed in subsequent scientific research; (2) that technique yields a different outcome than the expert technique used at the prior trial; and (3) the validation of the new technique is so extensive that it *either* discredits the prior expert testimony *or* seriously undermines confidence in its correctness.” Imwinkelried, *supra* note 1, text at 19 n.83. First, on a purely technical level, it should not matter if the “analytic technique” deployed is new, as long as the results are new and could not have been obtained by a reasonably diligent defense attorney for trial. The undermining of comparative bullet lead analysis did not result from new techniques, but from known research techniques newly deployed. Second, the general standard does not directly ask a question about the probable effect of the new information on a jury. While Professor Imwinkelried’s general standard might be interpreted in this way, it might not, and we believe that the effect on a jury of the new information in the context of the whole case is the pole star for determining the propriety of a new trial grant in every case.

<sup>57</sup> For examples of other cases in which courts have ordered new trials in SBS/AHT cases based on the shifting science, either because the science is newly discovered, or because counsel was ineffective for failing to use it at trial, or because the defense was otherwise denied resources needed to challenge the medical evidence, see *People v. Roberts*, 892 N.W.2d 353 (Mich. 2017) (ineffective assistance of counsel); *Commonwealth v. Millien*, 50 N.E.3d 808 (Mass. 2016) (ineffective assistance of counsel); *Commonwealth v. Epps*, 53 N.E.3d 1247 (Mass. 2016) (ineffective assistance of counsel and newly discovered evidence); *Isham v. State*, 161 So.3d 1076 (Miss. 2015) (ineffective assistance of counsel); *People v. Ackley*, 870 N.W.2d 858 (Mich. 2015) (ineffective assistance of counsel); *Brown v. State*, 152 So.3d 1146 (Miss. 2014) (new trial granted because trial court erroneously denied funds for defense to hire experts to challenge State’s expert medical evidence); *People v. Baumer*, 781 N.W.2d 309 (Mich. 2010) (ineffective assistance of counsel); *State v. Schoonmaker*, 176 P.3d 1105 (N.M. 2008) (ineffective assistance of counsel); *State v. Hales*, 152 P.3d 321 (Utah 2007) (ineffective assistance of counsel); *State v. Weaver*, 554 N.W.2d 240 (Iowa 1996) (ineffective assistance of counsel); *People v. DiMambro*, 897 N.W.2d 233 (Mich. Ct. App. 2016) (ineffective assistance of counsel); *In re Pers. Restraint of Fero*, 367 P.3d 588 (Wash. Ct. App. 2016) (newly discovered evidence); *Ex Parte Henderson*, 384 S.W.3d 833 (Tex. Crim. App. 2012) (newly discovered evidence); *State v. Hansen*, 805 N.W.2d 915 (Minn. Ct. App. 2011) (newly discovered evidence); *State v. Ware*, 679 S.E.2d 797 (Ga. Ct. App. 2009) (ineffective assistance of counsel); *People v. Bartok*, 953 N.E.2d 91 (Ill. App. Ct. 2007); *Ex Parte Briggs*, 187 S.W.3d 458 (Tex. Crim. App. 2005) (ineffective assistance of counsel); *People v. Bailey*, 999 N.Y.S.2d 713, 728 (Cty. Ct., Monroe Cty. 2014) (newly discovered evidence); *State v. Hyatt*, No. 06M7-0CR00016-02 (Cir. Ct. Shelby Cty., Mo., Nov. 2007) (newly discovered evidence); *Illinois v. Rieken*, No. 05C-CFJ75 (Cir. Ct. Iroquois Cty., Ill., Mar. 2009) (newly discovered evidence); *State v. Witt*, No. 2-CA-CR2011-0320, 2012 WL 5991566 (Ariz. Ct. App. Nov. 30, 2012) (newly discovered evidence); Alexandra Gross, *John Peel*, NAT’L REGISTRY OF EXONERATIONS (2012), <https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3813> (newly discovered evidence); Maurice Possley, *Joel Lehmer*, NAT’L REGISTRY OF EXONERATIONS (July 29, 2012), <https://www.law.umich.edu/special/exoneration/Pages/casedetail.aspx?caseid=3953> (newly discovered evidence); Joseph Shapiro, *Free, But Not Cleared: Ernie Lopez Comes Home*, NAT’L PUB. RADIO (Mar. 5, 2012), <https://www.npr.org/2012/03/05/147969316/free-but-not>

Professor Imwinkelried creates the impression that they two cases reach contradictory results, and that *Gimenez* is the more principled. But the reality is, they are not inconsistent; they just address different legal claims that require different analyses (and in some cases, different outcomes). *Edmunds* and the growing body of like cases are analytically and factually sound, regardless of the limitations of federal habeas law in addressing narrow claims like those addressed in *Gimenez*.

V. THE ULTIMATE SIGNIFICANCE OF NEWLY RECOGNIZED  
CONTROVERSIES IN THE MEDICO-LEGAL HYPOTHESES  
UNDERLYING EXPERT TESTIMONY IN SUCH CASES

What's missing from Professor Imwinkelried's analysis is recognition that the case he posits—expert trial testimony based on a solid foundation at trial that is then challenged post-conviction by a single new study that contradicts the trial experts, raised in a narrow context (like federal habeas) where the convicted person's burden is to prove that the trial testimony was demonstrably false, or the individual is demonstrably innocent—is so narrow and extreme as to be almost meaningless. In the real-world context of SBS/AHT litigation, the much more frequent scenario is one in which expert testimony constituted almost the entirety of the proof at trial, the scientific foundation for that testimony was never (and still is not) there, the research undermining the SBS/AHT testimony either did not yet exist or was erroneously overlooked, and so the jury never had the opportunity to consider the real legal and scientific issues in the case. In those circumstances, neither law nor logic requires what *Gimenez* requires—proof that the science at trial has been indisputably shown to be false. Rather, *Edmunds* and the growing number of like cases that have followed<sup>58</sup> strike that balance, establishing that new challenges to the medical opinions at trial often are enough to warrant a new trial when the science is this central to the case, and the challenge is so serious that a jury ought in fairness to hear it because there is a reasonable probability of an acquittal given the new evidence.

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cleared-ernie-lopez-comes-home (ineffective assistance of counsel); Barry Siegel, *Judging Parents as Murderers on 4 Specks of Blood*, L.A. TIMES (July 11, 1999), <http://articles.latimes.com/1999/jul/11/news/mn-54984> (newly discovered evidence); *Kenneth Marsh*, CAL. INNOCENCE PROJECT (2018), <https://californiainnocenceproject.org/read-their-stories/kenneth-marsh/> (newly discovered evidence); *Armando Castillo Vacated After 13 Years*, ARIZ. JUST. PROJECT (May 21, 2015), <https://www.azjusticeproject.org/manifest-injustice-profiles/armando-castillo> (ineffective assistance of counsel and newly discovered evidence). Still other courts have also granted relief under the more difficult standards requiring a petitioner to establish actual innocence. *See, e.g.*, *Del Prete v. Thompson*, 10 F. Supp. 3d 907 (N.D. Ill. 2014); *Robins v. State*, No. 65063, 2016 WL 5801204 (Nev. Sept. 22, 2016).

<sup>58</sup> *See id.*

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And this is no longer just a judicial response to this problem. In jurisdictions where state law provided no avenue for relief in such cases, legislatures are beginning to respond by creating statutes designed to permit, even require, new trials when new evidence emerges to challenge the science relied upon at trial. Texas was the first of these states,<sup>59</sup> followed thereafter by California.<sup>60</sup> In both states, the statutes now provide a remedy when scientific evidence presented at trial has been undermined by subsequent research. It is a response that only makes sense. While the tensions between law and science have been widely recognized in many contexts, it is in cases like this—where weak science constitutes the entirety of the case—that the law must most readily accommodate shifts and challenges to that science.

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<sup>59</sup> Texas State Bill 344 authorizes courts to grant relief in state habeas corpus petitions where the petitioner shows that relevant scientific evidence that is currently available but was not available at the time of trial if the court finds by a preponderance of the evidence that the person would not have been convicted had the new evidence been presented at trial. *See* S.B. 344, 85th Leg., (Tex. 2017), <https://openstates.org/tx/bills/85/SB344>.

<sup>60</sup> California Penal Code section 1473, subdivisions (b)(1) and (b)(3), provide a right to a new trial under either of two circumstances: (1) if the expert repudiates his or her own opinion given at trial; or (2) if the opinion given at trial is undermined by subsequent “scientific research or technological advances.” CAL. PENAL CODE §1473(b)(1), (b)(3) (West 2017).