Detangling *Daubert* and *Frye:* The Misuse of Scientific Evidence in Shaken Baby Cases

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ABSTRACT:

Decisions regarding admissibility of scientific evidence continue to diverge throughout the country. From a societal perspective, nothing could be more disturbing – and dangerous – than evidentiary lapses rejecting Shaken Baby Syndrome (SBS), a rare traumatic brain injury diagnosed in newborns.[1] Also called abusive head trauma (AHT), SBS affects over 1,000 U.S. babies yearly. Approximately 25% of afflicted babies die; many are permanently brain damaged. The latest legal debacle illustrates the dangers

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[1] Tina Joyce, William Gossman & Martin R Huecker, *Pediatric Abusive Head Trauma* (Treasure Island, FL: StatPearls Publishing, 2023), online: <www.ncbi.nlm.nih.gov/books/NBK499836/> [perma.cc/4WR2-L9NN].

of courts misunderstanding the predicates for scientific admissibility and the manner in which medicine is practiced, and serves as a warning for future cases on this and other scientifically-related subjects.

According to the vast consensus of the medical community, brain damage in SBS is caused by a nonpenetrating injury to the brain after rapid forward and/or backward/rotational movement (shaking) repeatedly bangs the soft brain against the bony skull housing it. While the diagnosis is made by a medical doctor, some in the biomechanics community, along with individual doctors and defense lawyers, have recently advocated that shaking alone cannot cause the condition. Cases have been reversed where such evidence was not presented.

Such evidence predicated a recent NJ decision rejecting the State's SBS case in its entirety, eviscerating the diagnosis under the guise of erroneous scientific evidence rulings, misunderstanding *Frye*, and bastardizing *Daubert*. Additionally, the NJ court erroneously ruled that a transdisciplinary consensus (from the biomechanics community) was needed before medical testimony could be introduced. Instead, the court accepted an unvetted defense position that biomechanics does not establish shaking as a cause of the injuries claimed. Indeed, for ethical reasons, the proof the court seeks is not possible. Instead, deductions from established principles of medicine are legally acceptable proof.

The consequences of this ruling are dire. In NJ, suspected SBS perpetrators would no longer be subject to prosecution. The matter is currently at issue elsewhere, even allowing doctors who have not examined the child to testify. The misapprehensions of scientific evidence which predicated this travesty are examined in this Article as a case study of judicial misapprehension affecting scientific rulings.

INTRODUCTION:

At three weeks old, Brice was admitted to the hospital with profound bleeding in his brain and multiple fractures.[2] He is now permanently and significantly brain damaged. There was also Austin, Grayson, and Kyra, all suffering profound brain bleeds, called subdural hematomas, all significantly brain damaged by the time they were toddlers.[3] Austin's case

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2 SBSK, "A Child with Shaken Baby Syndrome (Assaulted as an Infant)" (14 September 2023), online (video): <www.youtube.com/watch?v=R-HluTm-Uc0> [perma.cc/XB6X-RCZM].

3 See "Shaken Baby Syndrome" (30 April 2024), online:

is particularly severe: his right brain was crushed, he is paralyzed, and has no use of his left side.[4] All these cases appeared suddenly in otherwise healthy children. All of the children were diagnosed as victims of violent shaking, the official name: Shaken Baby Syndrome (SBS),[5] a type of traumatic brain injury.[6] According to the vast consensus of the medical community across the globe, the damage is caused by a nonpenetrating injury to the brain after rapid forward/backward and/or rotational movement,[7] banging the baby's soft brain against the bony skull housing it, bruising and shearing vulnerable brain tissue and blood vessels in the process.[8] Some months ago, the medical diagnosis of SBS was legally eviscerated by a New Jersey court, and suspected SBS perpetrators are no longer subject to prosecution. The matter is currently at issue elsewhere.

SBS, also called abusive head trauma (AHT), affects over 1,000 American babies yearly.[9] Approximately 25% of afflicted babies die; most

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<www.aans.org/patients/conditions-treatments/shaken-baby-syndrome/> [perma.cc/76RM-LENP], ("a collection of blood between the surface of the brain and the dura (the tough, fibrous outer membrane surrounding the brain. This occurs when the veins that bridge from the brain to the dura are stretched beyond their elasticity, causing tears and bleeding").

4 Brian Replogle, "Meet Austin" (last visited 17 June 2025), online: <www.dontshake.org/family-stories/itemlist/category/15-stories-from-victims-of-sbs> [perma.cc/WP98-SL6T].

5 See Joyce, Gossman & Huecker, *supra* note 1. Similar findings have been noted in Canada. W James King et al, "Shaken baby syndrome in Canada: clinical characteristics and outcomes in hospital cases" (2003) 168:2 CMAJ 155, noting a "history and/or clinical evidence of previous maltreatment was noted in 220 children (60%), and 80 families (22%) had had previous involvement with child welfare authorities. As a direct result of the shaking, 69 children died (19%) and, of those who survived, 162 (55%) had ongoing neurological injury and 192 (65%) had visual impairment."

6 "Shaken Baby Syndrome" (last modified 24 January 2023), online: <medlineplus.gov/ency/article/007578.htm> [perma.cc/HG84-PLYL] [Medline].

7 Mary Case et al, "Positional Paper on Fatal Abusive Head Injuries in Infants and Young Children" (2001) 22:2 American J Forensic Medicine & Pathology 112 at 113.

8 "Traumatic Brain Injury" (last visited 17 June 2025), online: <www.hopkinsmedicine.org/health/conditions-and-diseases/traumatic-brain-injury> [perma.cc/LH36-SP7L].

9 See "How is Shaken Baby Syndrome Defined by California Law" (last visited 17 June 2025), online: <www.simmrinlawgroup.com/faqs/shaken-baby-syndrome-defined-by-ca-law/> [perma.cc/6YMV-6J6T]; See also AANS, *supra* note 3, (the National Center on Shaken Baby Syndrome estimates there are between 600 and 1400 cases in the U.S. a year); See also "Shaken Baby Syndrome: Facts and Figures" (last modified October 2010), online:

are permanently brain damaged.[10] The diagnosis is made when the child presents with multiple signs, often identified as the "triad": brain bleed (subdural hematoma), fractured skull, and retinal detachment or hemorrhage, often leading to blindness,[11] objectively found on MRI, X-rays,

<www.health.ny.gov/prevention/injury_prevention/shaken_baby_syndrome/sbs_fact_sheet.htm> [perma.cc/K82D-ZVGK] [New York State Department of Health], (New York reports 1000-3000 cases yearly in the US, with 80% suffering permanent brain damage); In Canada, the number is significantly lower, with approximately 40 cases annually, see Theresa Boyle, "Baby death review 'daunting'", *Toronto Star* (7 October 2008), online: <canadiancrc.com/Newspaper_Articles/Toronto_Star_220_Shaken_Baby_Syndrome_Deaths_under_review_07OCCT08.aspx> [perma.cc/UFR9-ZSYU]; See also W James King, Morag MacKay & Angela Sirnick, "Shaken baby syndrome in Canada: clinical characteristics and outcomes of hospital cases" (2003) 168:2 Can Medical Assoc J 155 (which evaluated close to 400 cases over a ten year period and noted: "A history and/or clinical evidence of previous maltreatment was noted in 220 children (60%), and 80 families (22%) had had previous involvement with child welfare authorities").

10 "Be On The Safe Side: Prevention of Shaken Baby Syndrome" (last visited 17 June 2025), online: <ncchildcare.ncdhhs.gov/Whats-New/be-on-the-safe-side-prevention-of-shaken-baby-syndrome#:~:text=North%20Carolina%20Child%20Care%20Rules,syndrome%20and%20abusive%20head%20trauma> [perma.cc/46M3-5VVH]; See also "Learn More" (last visited 17 June 2025), online: <www.dontshake.org/learn-more> [perma.cc/4U8C-RF5P].

11 Some define the triad as composed of "brain swelling, bleeding on the surface of the brain and bleeding behind the eye"; See Clyde Haberman, "Shaken Baby Syndrome: A Diagnosis That Divides the Medical World", *New York Times* (13 September 2015), online: <www.nytimes.com/2015/09/14/us/shaken-baby-syndrome-a-diagnosis-that-divides-the-medical-world.html> [perma.cc/Z2JM-WNCF]; See also Göran Elinder et. al, "Traumatic Shaking: The Role of the Triad in Medical Investigations of Suspected Traumatic Shaking" (2018) 107 Acta Paediatrica 3, online: <doi.org/10.1111/apa.14473open_in_new> [perma.cc/E9F4-C5XD]; Geoffrey David Debelle et al, "Abusive Head Trauma & the Triad: A Critique on Behalf of RCPCH of 'Traumatic Shaking: The Role of the Triad in Medical Investigations of Suspected Traumatic Shaking'" (2018) 103:6 Archives Disease in Childhood_606, online: <doi.org/10.1136/archdischild-2017-313855> [perma.cc/U29R-YP9C]. See also Kourosh Shahraki & Donny W Suh, "An Update to Biomechanical and Biochemical Principles of Retinal Injury in Child Abuse" (2024) 11:5 Children 586, online: <doi.org/10.3390/children11050586> [perma.cc/Y5ZR-658Q], supporting a biomechanical causal mechanism for retinal injury occasioned by shaking, and noting: "Impressively, the likelihood of RH [retinal hemorrhage being attributed to AHT surged significantly, …indicating a remarkable 91% probability of abuse," and highlighting a unique manner of "retinal injury in AHT distinct from other conditions."

and ophthalmological examinations.[12] The diagnosis is made in the absence of other explanations, i.e., when all other possible causal conditions are ruled out. This technique, known as "differential diagnosis", is essential to the practice of medicine and recognized in law, although attacked by defenders of alleged SBS perpetrators.

In most jurisdictions, the diagnosis heralds a child abuse investigation with consequent indictments. Forty-eight states criminalize child abuse, and most have mandatory reporting requirements for suspicion. Several states, New York and California[13] among them, have laws specifically criminalizing Shaken Baby Syndrome.[14] The propriety of the diagnosis has been examined by dozens of courts in multiple states – and until recently, virtually all affirmed the diagnostic validity, if not its application, in the particular set of facts before the court.

Enter *State of New Jersey v. Darryl Nieves, and Michael Cafelli*.[15] There, the New Jersey appellate court rejected the State's medical witness and nixed the SBS diagnosis entirely.[16] Based on a flawed interpretation of the legal caveats of scientific evidence, the court disregarded generally accepted medical practices and instead relied on irrelevant and unreliable scientific studies proffered by the defense, as well as advocacy-oriented law review articles contributed by law professors and defense attorneys. Supported by some non-mainstream doctors and 13 biomechanics,[17] the court invaded

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12 "Abusive Head Trauma (Shaken Baby Syndrome)" (last modified August 2024), online: <kidshealth.org/en/parents/shaken.html> [perma.cc/X5M2-AWPF].

13 See Simmrin Law Group, *supra* note 9; See also *Cal Health and Safety Code*, 20 § 24520-24522 (1995).

14 Barbara Pfeffer Billauer, "Is the Law Dismembering Child Abuse Prosecution" (12 October 2023) [Billauer, "Child Abuse Prosecution"], online: <www.acsh.org/news/2023/10/12/law-dismembering-child-abuse-prosecution-17399> [https://perma.cc/5CFD-5L2L].

15 *New Jersey v Nieves*, A-2069-21 (Supp Ct App Div 2023) [*Nieves*], online (pdf): <www.njcourts.gov/system/files/court-opinions/2023/a2069-21a2936-21.pdf> [perma.cc/UK9C-KJPT]. The case was affirmed on appeal. See *State v. Nieves,* 345 A (3d) 1127 (NJ 2025). For a fuller discussion, see Barbara Pfeffer Billauer, "Silent Victims, Flawed Science: How Erroneous Accusations and Court Rejections of SBS Fail Abused Infants While Devastating the Innocent" (29 January 2026), online: https://www.acsh.org/news/2026/01/29/silent-victims-flawed-science-how-erroneous-accusations-and-court-rejections-sbs [perma.cc/K6VF-CLN7]. While the NJ Supreme Court affirmed the Appellate Division's holding, they did leave open a crack to review the matter.

16 *Ibid.* See also *People v Lemons,* 514 Mich 485 (Sup Ct 2024) [*Lemons*].

17 Such as "The Association of American Physicians and Surgeons (AAPS) which

the province of the medical profession and invalidated the diagnosis per se. In doing so, they ignored consensus statements of no less than 15 domestic and international medical bodies and legislation of most states validating the diagnosis,[18] all the while commingling evidentiary and scientific standards of reliability and validity, entangling *Daubert* and *Frye* standards. Without a "reliable" diagnosis, ruled the *Nieves* court, there was no predicate to send the case to the jury, and without that, the indictments were dismissed.

The New Jersey case is a harbinger of things to come,[19] portending that suspected perpetrators can no longer be indicted without corroborating evidence, such as confessions[20] or eyewitness accounts. In other words, this is not a case-specific ruling: prosecution of future shaken baby cases will be impaired, if not obviated entirely, as the court blithely mangles standards of legal evaluation, transmuting Daubert standards into a Frye analysis and "conveniently" forgetting that both decisions were meant to apply to novel science. Moreover, the cases bandy the term "junk science",[21] diluting and minimizing its existence in other venues.

Wikipedia identifies as a politically conservative non-profit association that promotes conspiracy theories and medical misinformation, such as HIV/AIDS denialism, ….and vaccine and autism connections…." See "Association of American Physicians and Surgeons" (last modified 29 May 2025), online: <en.wikipedia.org/wiki/Association_of_American_Physicians_and_Surgeons> [perma.cc/L6FS-82S8].

18 *Nieves, supra* note 15; Sandeep Narang, "A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome" (2011) 11:3 Hous J Health L & Policy 505 at 574, online (pdf): <www.law.uh.edu/hjhlp/volumes/Vol_11_3/Narang.pdf> [perma.cc/GJ9X-SQEP].

19 Per Roderick Kennedy, "The Excited Utterance Listserv of Evidence Professors" (9 March 2024) (unpublished, on file with author), lamenting the state of forensic science in criminal courts, states: "Shaken Baby is a sinking syndrome."

20 Studies correlating SBS with confessions abound, although it is difficult to verify them. See Jan E Leestma, "'Shaken Baby Syndrome': Do Confessions by Alleged Perpetrators Validate the Concept?" (2006) 11:1 J American Physicians & Surgeons 14, online (pdf): <www.jpands.org/vol11no1/leestma.pdf> [perma.cc/H562-CZK7]. Confessions are rare, but do exist. See Jason Evans & Padma Murughappun, "Dad shook baby so hard he caused terrible brain injuries then blamed the dog" *Express* (28 July 2025), online: <www.express.co.uk/news/uk/2087840/dad-shook-baby-so-hard-he-caused-terrible-brain> [perma.cc/8PSZ-4MWQ].

21 Elizabeth Weill-Greenberg, "New Jersey 'Shaken Baby Syndrome' Ruling Puts 'Junk Science' Diagnosis Under Fire", *The Appeal* (4 October 2023), online: <theappeal.org/shaken-baby-syndrome-new-jersey-darryl-nieves/> [perma.cc/9DUW-3A5J].

Additionally, the court furthers the dangerous practice of judges practicing medicine, as it reduces to precedent its own understanding of medical diagnostic techniques.[22] Going further, the court conglomerates medical diagnosis as a transdisciplinary exercise needing the imprimatur of the biomechanical community[23] – an unheard-of approach to medical practice.[24] Finally, the case demonstrates how judges (and lawyers) without backgrounds in the practice of medicine, the field of biomechanics, or even legal expertise in assessing scientific evidence, can corrupt the legal system.

The motives of defense lawyers were surely noble.[25] Cases abound where convictions for SBS were clearly improper.[26] Racial inequities have

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22 *See* Barbara Pfeffer Billauer, "Ivermectin & The Practice of Mob-Medicine" (15 September 2021), online: <www.acsh.org/news/2021/09/15/ivermectin-practice-mob-medicine-15806> [perma.cc/W6UN-RYSC].

23 Barbara Pfeffer Billauer, "Should Judges Tell Doctors How to Practice Medicine" (07 December 2021), online: <www.acsh.org/news/2021/12/07/should-judges-tell-doctors-how-practice-medicine-15979> [perma.cc/QUV4-UHWB]. [Billauer, "Practice Medicine"].

24 Biomechanics may testify on the quantum and types of force required to produce an injury as part of a general causation inquiry in personal injury cases. See *Maines v Fox*, 190 So (3d) 1135 (Fla St App 2016); See also John Lloyd, "Admissibility of Biomechanics Testimony on Causation of Injury", online: <drbiomechanics.com/biomechanics/biomechanics-testimony/> [perma.cc/KP77-EMLU].

25 See Weill-Greenbert, *supra* note 21, (quoting Nieves as saying: "I was thinking that the government fails everyone, especially Black African Americans, so I felt it was going to fail me," and noting the judge declared the controversial theory 'akin to junk science').

26 See Eza Bella Zakirova, "Shaken Baby Syndrome as a Controversy in Wrongful Conviction Cases" (2018) 81:3 Alb L Review 1027, (Reporting bias colours the debate. One article reported that between 2001 and 2018, some 10% of the "charges were dropped or dismissed, or the convictions were overturned...."); See also Debbie Cenziper, "Prosecutors build murder cases on disputed Shaken Baby Syndrome diagnosis", *The Washington Post* (20 March 2015) online: <www.washingtonpost.com/graphics/investigations/shaken-baby-syndrome/> [perma.cc/62B9-SURL], (in actuality, only 16 cases were reversed on relevant legal grounds); *Cf* Hunter Moyler, "Convicted Murder's Sentence Reversed after Lawyer Argues Shaken Baby Syndrome Isn't Real", *Newsweek* (30 October 2019), online: <www.newsweek.com/shaken-baby-syndrome-conviction-overturned-1468749> [perma.cc/ZJ77-3CYT], (reporting that the diagnosis has been discredited and the defendant was granted a new trial. On appeal, that decision was reversed, and the original conviction and prison term reinstated); See Ansley Perkins, "Itawamba Co. man convicted of killing his child will not get a new trial", *WCBI* (04 February 2021), online: <www.wcbi.com/itawamba-co-man-convicted-of-killing-his-child-will-not-get-a-new-trial/> [perma.cc/N6XR-4S54]; see *Clark v Mississippi*, 314 So (3d) 987 at para 23 (Miss Sup Ct 2021), (rejecting the lower court ruling under a *Daubert* analysis, holding

been raised as fostering overreporting of Black and Brown suspects,[27] discussed in Part II. Zealous physicians make accusations without tempered assessments.[28] And there is some dissent in the medical community,[29] not unlike controversies regarding ketamine therapy, gastric bypass surgery,[30] puberty blockers,[31] or even COVID vaccines.[32] These medical controversies

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"That one party's expert witness contradicts the testimony of the other party's expert witness should come as no surprise. We even have a name for it. We call it a "battle of the experts." .... The fact the Court... may itself deem the expert testimony from the defense as better than that of Dr. Lakin's testimony is irrelevant...."); *Cf* the Canadian view, discussed in James Farley, "To Be or Not to Be... a (Truly Qualified) Expert Witness" (02 August 2021), online: <www.lexology.com/library/detail.aspx?g=c5ba18c5-a453-47fb-b8b8-355c397c6939> [perma.cc/L9G9-352G].

27 Cynthia J Najdowski et al, "Do Racial Stereotypes Contribute to Medical Misdiagnosis of Child Abuse? Investigating Tunnel Vision in the Emergency Room" (2020) 1:2 Wrongful Conviction L Rev 153; See also Onji Okeke, "Child Protective Services Is Being Weaponized Against Our Black Patients" *MedPage Today* (13 February 2024), online: <www.medpagetoday.com/opinion/second-opinions/108723?xid=nl_secondopinion_2024-02-18&eun=g1506471d0r> [perma.cc/9J6J-LLJK]; But see S L Brenner et al, "Race and the shaken baby syndrome: experience at one hospital" (1989) 81:2 J Natl Med Assoc 183, where white children were over reported, and Sinal SH et al, "Is race or ethnicity a predictive factor in Shaken Baby Syndrome?" (2000) 24:9 Child Abuse Neglect 1241, online: <doi.org/10.1016/S0145-2134(00)00177-0> [perma.cc/JT7W-GZZ7], where race was not related to diagnosis; See generally Barbara Pfeffer Billauer, "When the Law of Scientific Evidence Collides with Medical Practice" (13 December 2023), online: <petrieflom.law.harvard.edu/2023/12/13/when-the-law-of-scientific-evidence-collides-with-medical-practice/> [perma.cc/P9CP-9EBU] [Billauer, "Collides with Medical Practice"].

28 Dyan Neary, "What Happened to Maya", *The Cut* (09 November 2023), online: <www.thecut.com/article/child-abuse-munchausen-syndrome-by-proxy.html> [perma.cc/LX2Z-RQ5E], (see Maya Kowalski case).

29 Haberman, *supra* note 11.

30 "5 Controversial Medical Treatments Used in Modern Medicine" (27 November 2023), online: <www.stephenslaw.com/blog/5-controversial-medical-treatments-used-in-modern-medicine/> [perma.cc/227Z-YUJ8].

31 See e.g., Kate Quiñones, "Puberty Blockers May Cause Irreversible Harm to Young Boys, Mayo Clinic Study Finds" (11 April 2024), online: <www.ncregister.com/cna/puberty-blockers-may-cause-irreversible-harm-to-young-boys-mayo-clinic-study-finds> [perma.cc/Y245-2GWA].

32 See Elizabeth Payne, "'Shaken baby syndrome' a medical term of the past", *Ottawa Citizen* (20 July 2015), online: <ottawacitizen.com/news/local-news/shaken-baby-syndrome-a-medical-term-of-the-past> [perma.cc/8M2E-L5J2], (in some hospitals in Canada, the term Shaken Baby Syndrome is no longer used, instead using the terms traumatic brain injury or abusive head injury).

typically engender discussion and debate, not an outright diagnostic ban by a court.[33] Such social trip-points are real and must be remedied. But dismembering the legal methodology for analysis of scientific evidence is not the way.

This Article will not focus on validating the SBS diagnosis,[34] which has been admirably detailed by a legal scholar with medical credentials.[35] Nor does this Article discuss the diagnosis in individual cases (i.e., specific causation).[36] Indeed, in diagnosing that a child has suffered SBS, the examining physician cannot tell who caused the harm, precisely when the harm was caused,[37] or the mens rea of the accused.

The Article does, however, seek to detangle the mangled evidentiary approach used by the court to arrive at their precedential ruling, focusing on judicial misapprehension of the standards of scientific admissibility, a practice surfacing in other cases.[38] In so doing, I address the parameters for evaluating scientific evidence, showcasing the legal errors in assessing scientific evidence and the confusion resulting from misusing and confusing the scientific terms "reliability" and "validity," discussed in Part III. Additionally, I address the purpose of *Fyre* and *Daubert* (superseded/amended by the Federal Rules of Evidence). In Part IV, I expose judicial misunderstanding of the practice of medicine, notably differential diagnosis, leading to revocation of the generally accepted SBS

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33 Where society wishes to ban a medical practice legislation has been used, (e.g., Excited Delerium).

34 See Narang, *supra* note 18 at 578, reviewing "at least 700 peer-reviewed, clinical medical articles, comprising thousands of pages of medical literature, published by over 1000 different medical authors, from … twenty-eight different countries. AHT has been peer-reviewed and published in the following disciplines: biomechanical engineering, general pediatrics, neonatology, neurology, neurosurgery, nursing, obstetrics, ophthalmology, orthopedics, pathology (forensic pathology), radiology, and rehabilitative medicine. ….In fact, … AHT is the most peer-reviewed and well-published topic in child abuse pediatrics".

35 *Ibid.*

36 *In re Acetaminophen ASD-ADHD Products Liability Litigation*, 707 F Supp (3d) 309 at 46 (2nd Cir 2023), citing *Daniels Feasel v Forest Pharmaceuticals Inc*, 2021 Lexis 168292 at 5 (SD NY)., affirmed in 2023 Lexis 19448 (2nd Cir).

37 MRI's can grossly determine whether a brain bleed is "new" or "old."

38 See e.g. *Re Zantac (Ranitidine) Litigation,* 2024 Del Super Lexis 440 [*Zantac* 2024], (case decided by Judge Medinalla under *Daubert* currently on appeal); see Barbara Pfeffer Billauer, "Delaware's Travesty Junk Science Taints Science-Phobic Judges" (1 July 2024), online: <www.acsh.org/news/2024/07/01/delawares-travesty-junk-science-taints-science-phobic-judges-48839> [perma.cc/5BXB-GXNK].

diagnosis, along with the flawed requirement of trans-disciplinary consensus in evaluating medical diagnoses. Finally, in Part V, I offer some solutions.

Opponents of the validity of the SBS diagnosis have been roundly criticized by mainstream medicine; they are called child-abuse deniers, among other names. I will refer to this group, be they defense lawyers, academics, expert witnesses for the defense, non-mainstream practitioners, and ad hoc biomechanics, among others, as "the objectants."

I. BACKGROUND

Resolution of scientific evidentiary disputes continues to diverge throughout the country.[39] However, the significance of judicial misadventure in the SBS cases is monumental, as other defendants are looking to *Nieves* for support and prosecutors may be disinclined to pursue prosecution without clear guidance.[40]

"Shaken baby syndrome is a type of brain injury that happens when a baby or young child is shaken violently. When this happens, the brain can bang back and forth against the skull (the *contrecoup* lesion, discussed in Part IV)[41] causing bleeding, bruising, and swelling."[42] As defined by NY law, where the shaken baby survives, the majority suffer lifelong disabilities. Apart from the objective signs, "immediate symptoms of SBS include tiredness, not eating, smiling, talking, or laughing, difficulty swallowing or breathing, vomiting, difficulty staying awake, or the baby is very stiff like a rag doll."[43]

The diagnosis is codified by several states, including the California Health and Safety Code, as "a medically serious, sometimes fatal, matter

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39 *Cf* Judge Medinalla's decision, *ibid*, with that of Judge Robin Rosenberg where all ten plaintiffs' experts were rejected, also under *Daubert*, resulting in the dismissal of some 50,000 claims. Under a *Frye* analysis, a California judge reached the opposite conclusion; See *Re Zantac (Ranitidine) Prods Liab Litig,* 510 F Supp (3d) 1234 (SD Fla 2020); See also Susanna Moldoveana, "Delaware Zantac Court Fails to Keep the Gate" (13 June 2024), online (blog): <www.druganddevicelawblog.com/2024/06/delaware-zantac-court-fails-to-keep-the-gate.html> [perma.cc/DJW8-29NR]; See also Barbara Pfeffer Billauer, "Zantac and Cancer, Round 2: Admissibility of Scientific Evidence Gets Bungled" (02 June 2023), online: <www.acsh.org/news/2023/06/02/zantac-and-cancer-round-2-admissibility-scientific-evidence-gets-bungled-17105> [perma.cc/H5M2-JUA4].

40 *Lemons, supra* note 16, awaiting new trial.

41 See Part IV, below, for more on this topic.

42 Medline, *supra* note 6.

43 New York State Department of Health, *supra* note 9.

affecting newborns and very young children,"[44] and is generally prosecuted as a form of child abuse. Most states legislatively validate the diagnosis,[45] corroborated by medical consensus statements of at least 15 medical organizations around the world.[46] Of late, however, controversy has arisen in the scientific community. This situation largely arose by virtue of over-prosecution of defendants and suspected perpetrators,[47] generating outrage and an opening for defense attorneys and advocacy associations. Their voice, apparent by their books and law reviews, is loud and compelling. By comparison, no organized voice advocates on behalf of the battered child. It is here that the law has abandoned its mission.

First recognized over a century ago, the SBS diagnosis was linked to violent shaking 20 years later,[48] gaining general acceptance in 1962 (65 years ago), with the publication of an article in the *Journal of the American Medical Association*.[49] In 1914, a prominent British neurosurgeon validated that trauma caused the condition, [50] a conclusion reiterated in 1946 by Dr. John Caffrey, regarded as the father of pediatric radiology.[51] However, by 2001, a slice of the legal community, whose mission was to protect unjustly accused defendants, emerged in opposition, producing three major law

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44 Cal Health & Safety Code, 20 HSC § 24520 (2024).

45 US, Bill HR 4642, *The Shaken Baby Syndrome Prevention Act*, 111th Cong, 2010. Sponsored by U.S. Rep. Nita Lowey (D-NY 18) and U.S. Christopher Dodd (D-CT).

46 *Nieves, supra* note 15 at 41.

47 See "United States Supreme Court Decisions: 2023-2024 Term" (last visited 19 June 2025), online: <deathpenaltyinfo.org/stories/united-states-supreme-court-decisions-2023-2024-term> [perma.cc/RM5R-3DBJ].

48 The objectants claim the diagnosis was first documented by Dr. Norman Guthkelch in 1971. See e.g., Zakirova, *supra* note 26; Earlier references identify the work of John Caffey, "Multiple fractures in the long bones of infants suffering from chronic subdural hematoma" (1946) 56:2 Am J Roentgenology Radium Therapy & Nuclear Medicine 163; The seminal article was published in 1962 by C Henry Kempe et. al., "The Battered Child Syndrome" (1962) 181:1 JAMA 17; When, even per the objectants (e.g., Leetsma, *supra* note 20), the diagnosis gained general acceptance, "A French forensic physician, Auguste Ambroise Tardieu) ... penned the first detailed medical description of child abuse in his 1860 publication *Etude Medico-Legale sur les Sevices et Mauvais Traitements Exerces sur des Enfants*." Narang, *supra* note 18 at 523-524, citing Adelon et al, *Annales d'hygiène publique* (Paris: Jean-Baptiste Baillière, 1860).

49 Kempe, *supra* note 48. *Narang*, *supra* note 18 at 523-524.

50 Narang, *supra* note 18 at 525.

51 *Ibid* at 526.

review articles beginning in 2006.[52] Some doctors and a handful of biomechanics, many of whom are expert defense witnesses,[53] joined the fray.[54]

The mainstream scientific community supports the diagnosis, noting: "Abusive head trauma, including shaken baby syndrome, is a severe form of child abuse that results in a brain injury."[55] It is the leading cause of death in children under five and is often precipitated by incessant crying. In 2016, the American Bar Association (ABA) echoed this position.[56] That year, an ABA publication reported that SBS and AHT were "[a]ccepted as [v]alid [d]iagnoses by [m]ost [p]hysicians',[57] reiterating the medical consensus. In 2020, a bill was introduced to support the prevention of SBS,[58] and approximately 20 states have enacted laws advocating for SBS education.[59]

Rather than campaigning for better adherence to the diagnostic criteria, the legal champions of defendants continued their efforts at dismembering the diagnosis, based on biomechanical studies they claim demonstrate the negative – i.e., that the experiments do not "reliably" prove that shaking causes morbid harm.[60] Indeed, ethically speaking, the diagnosis can and will

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52 Deborah Tuerkheimer, "The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts" (2009) 87:1 Wash U L Rev 1.

53 See e.g. Leetsma, *supra* note 20.

54 See Findley et al, "Shaken Baby Syndrome, Abusive Head Trauma, and Actual Innocence: Getting it Right" (2012) 12:2

55 CDC, "About Abusive Head Trauma" (16 May 2024), online: <www.cdc.gov/child-abuse-neglect/about/about-abusive-head-trauma.html> [perma.cc/H6NF-7JKX].

56 "Shaken Baby Syndrome and Abusive Head Trauma Accepted as Valid Diagnoses by Most Physicians" (01 August 2016), online: <www.americanbar.org/groups/public_interest/child_law/resources/child_law_practiceonline/child_law_practice/vol-35/august-2016/shaken-baby-syndrome-and-abusive-head-trauma-accepted-as-valid-d/> [perma.cc/3NNQ-H876].

57 *Ibid.*

58 Lowey & Dodd, *supra* note 45.

59 Kelly Crane, "Why Prevention Matters" (October 2020), online (pdf): <preventchildabuse.org/wp-content/uploads/2020/10/crane_wht_ppr-1.pdf> [perma.cc/6CCM-LDAT]; North Carolina Child Care Rules 10A NCAC 09 .0608 and 1726 require that all facilities serving children up to five years of age must develop policies to prevent shaken baby syndrome and abusive head trauma - see NC Childcare, supra note 10.

60 See Jeffrey A Singer, "Shaken Baby Syndrome: A Hypothesis That Keeps Sending Innocent People to Prison" (30 December 2024), online (blog): <www.cato.org/blog/shaken-baby-syndrome-hypothesis-keeps-sending-innocent-people-

never be validated by the level of proof sought by the *Nieves* court; experiments on human babies are verboten.

Instead, as detailed below,[61] objectants proffer evidence derived from dolls or dummies (two studies used lambs) to ostensibly prove their negative hypothesis (i.e., that shaking does not rise to the level of force needed to cause damage). However, these surrogates have never been validated as human models, i.e., no methodology has been validated enabling data derived therefrom to be applied to human infants.[62] Hence, legally, the data cannot be reliably extrapolated. Further, even though multiple courts rely on these studies, the dummy studies (at least those used in *Nieves*) do not even measure the cumulative force from *repeated* shakings, but rather that of a single thrust.

Multiple extrapolations and deductions from known adult human responses to trauma, then, are required to achieve this "non-causal" link approximating the underpinnings of grievous traumatic injuries in babies too young to testify on their own behalf.[63]

A. The Undoing of Child Protection

Recognition of over-aggressive prosecution came to light in 1997, when an 18-year-old British au pair was accused of shaking an 8-month-old boy to death.[64] Since then, proponents of the diagnosis have accepted that the diagnosis may be employed too readily and careful attention to excluding other possible causes has not always been employed.[65] Of late, perhaps

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prison> [perma.cc/Y88F-XUEP]; But see CZ Cory & Beng MD Jones, "Can shaking alone cause fatal brain injury? A biomechanical assessment of the Duhaime shaken baby syndrome model" (2003) 43:4 Med Sci L 317 at 326, noting that the conclusion ruling out shaking as a cause of SBS is not reliable. "There must now be sufficient doubt in the reliability of the Duhaime et al. (1987) biomechanical study to warrant the exclusion of such testimony in cases of shaken baby syndrome. Moreover, per Popper, the foundation of *Daubert*, it is impossible to say "that there can never be shaking force sufficient to cause SBS"; See Barbara Pfeffer Billauer, "Admissibility of Scientific Evidence Under Daubert: The Fatal Flaws of 'Falsifiability' and 'Falsification'" (2016) 22 BUJ Sci & Tech L 21 [Billauer, "Admissibility"].

61 See Part IV, *below*, for more on this topic.

62 As would be required under the *Joiner* case. See *General Electric Co v Joiner*, 522 US 136 (1997) [*Joiner*].

63 See *Daubert v Merrell Dow Pharmaceuticals Inc*, 43 F (3d) 1311 (9th Cir 1995) [*Daubert*].

64 Haberman, *supra* note 11.

65 This Article is not meant to suggest that in all conviction or diagnoses were proper. My purpose is to spotlight the flawed methodology this court used to eviscerate the diagnosis as medically unprovable in *all cases*.

spurred by the successes of the Innocence Project,[66] law professors[67] and others[68] have contested the existence of the SBS diagnosis.[69]

On September 11, 2023, they got their wish. In *State of New Jersey v Nieves,*[70] the New Jersey Appellate Court ruled that the State had not met its burden of proving the admissibility of its scientific evidence.[71] The evidence in question: the diagnosis of SBS. The argument was not that the expert physician misapplied the diagnosis in particular cases; indeed, the horrific and battered condition of two previously healthy infants was not controverted. Instead, the defense contended that the diagnosis itself, which implied a means of causation (shakings), was invalid since shakings per se had not been "reliably" (i.e., experimentally) shown to cause the condition. Because shaking had not been (and cannot be) used to fracture skulls and shear blood vessels in living human babies' brains, the defense argued that

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66 Emily Bazelon, "Shaken-Baby Syndrome Faces New Questions in Court" *The New York Times* (2 February 2011), online: <www.nytimes.com/2011/02/06/magazine/06baby-t.html> [perma.cc/T5PG-8ULX], (Keith Findley, a lawyer for the Wisconsin Innocence Project,) was the lead author on one of a key law review article on the subject).

67 Tuerkheimer , *supra* note 52, ("[l]ast September, the fight among the doctors broke out in public on the Web after Tuerkheimer, a former prosecutor and a law professor at DePaul, wrote a New York Times Op-Ed warning of wrongful convictions and calling on the National Academy of Sciences to referee the shaken-baby-syndrome dispute. On the Web site CommonHealth, about 20 doctors commented, mostly to express outrage. One of them was Block. He wrote that Tuerkheimer had "been beguiled by a group of physicians who are using the courtroom to distort science, facts and reality." He denounced her for "furthering the cause of the so-called innocence project"); See also amicus of Prof. Patrick Barnes, emeritus of Stanford University, in Robertson v. Texas US no.22-7546 9/26/23; See Findley et al, "Feigned Consensus: Usurping the Law in Shaken Baby Syndrome/Abusive Head Trauma Prosecutions" (2020) 4 Wis L Rev 1211.

68 Haberman, *supra* note 11; Julie Mack, "Shaken Baby Syndrome: Examining the Evidence in the Shadow of an Execution" (2 October 2024), online (video): <www.cato.org/multimedia/events/shaken-baby-syndrome-examining-evidence-shadow-execution>.

69 See Narang, *supra* note 18 at 534; As demonstrated in Joelle Anne Moreno & Brian Holmgren, "The Supreme Court Screws Up the Science: There is No Abusive Head Trauma/Shaken /Baby Syndrome "Scientific" Controversy" (2013) 2013:5 Utah L Rev 1367, noting SBS cases is litigation driven science and relies on manufactures false "scientific controversies" without any real basis in scientific evidence, thereby vitiating any opposition to the accepted diagnosis of SBS.

70 Nieves, *supra* note 15.

71 The Supreme Court allowed a conviction based on the diagnosis to stand. See *Roberson v Texas,* 145 US 3 (2024). See also *Cavazos v Smith*, 565 US 1 (2011).

the defendants could not be liable for the horrific injuries presented in their hitherto, healthy charges.

B. Noble Motives Make Bad Law:

Perhaps it should come as no surprise that the Innocence Project, which has successfully (and commendably) used science to extricate improperly charged defendants, is heavily invested in commandeering science to clear SBS suspects.[72] One study investigating 1800 child abuse cases reported 1600 convictions.[73] The study, touted by those opposing the SBS diagnosis, is of dubious significance. While 200 "charges were dropped or dismissed, defendants acquitted, or their convictions overturned,"[74] we don't know for what reason – was it medical malfeasance or legal?

In Britain, after one mother's shaken-baby conviction was overturned, the attorney general reviewed 88 more cases. In 2006, he announced doubts regarding three convictions because these cases were based on limited medical proof.[75] In the other cases, the attorney general found that there was additional evidence pointing to the defendant's guilt.[76]

Canadian courts have also wrestled with the problems presented by expert testimony in pediatric forensic cases,[77] documenting the high prevalence of morbidity and mortality resulting from SBS.[78] In 2008, at the

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72 The objection to the diagnosis and to prosecution has taken on a life of its own in the legal arena. See generally Joëlle Anne Moreno & Brian Holmgren, "The Supreme Court Screws up the Science: There Is No Abusive Head Trauma/Shaken Baby Syndrome "Scientific" Controversy" (2013) 5 Utah L Rev 1357 at 1364-66, with the prosecutors given the aura of "bad guys"; See Jessica Lussenhop, "A doctor challenged the opinion of a powerful child abuse specialist. Then he lost his job" *MPR News* (30 June 2025), online: <www.mprnews.org/story/2025/06/27/a-doctor-challenged-the-opinion-of-a-powerful-child-abuse-specialist-then-he-lost-his-job> [perma.cc/L9PJ-JT75].

73 Haberman, *supra* note 11.

74 *Ibid.*

75 Clare Dyer, "Quashed convictions unlikely after shaken baby review" *The* Guardian (14 February 2006), online: <www.theguardian.com/society/2006/feb/15/childrensservices.uknews> [perma.cc/M5Y8-HJLL]; See also Jonathan Gornell, "Standing up for justice" (2007) 334:7604 BMJ, (noting the problem was not inherent to specific cases).

76 UK, HL Deb (14 February 2006), vol 678, col 106, (Lord Evans of Temple Guiting); See also Bazelon, *supra* note 66.

77 See *Inquiry into Pediatric Forensic Pathology in Ontario*, vol 2 (Toronto: Publications Ontario, 2008).

78 W James King, Morag MacKay, & Angela Sirnick, "Shaken baby syndrome in Canada: clinical characteristics and outcomes of hospital cases" (2003) 168:2 CMAJ 155.

urging of the province's chief forensic pathologist, the Ontario government reviewed 142 shaken-baby cases because, as characterized by one reporter, of the alleged "scientific uncertainty that has come to characterize that diagnosis."[79] The report concluded that the vast majority of the cases resulting in conviction[80] did not involve any indications of flawed pediatric forensic pathology. Sadly, all problematic cases arose from the testimony of one unqualified and overzealous expert.[81]

Some assert that defendants may have been unfairly targeted due to race.[82] Recent evidence substantiates the disproportionate focus on Black suspects.[83] While other studies disagree,[84] and still others reports sustain the claim.[85] In one study of 800,000 abused children, "Black patients were over-represented among suspected child abuse victims, comprising 33% of suspected child abuse victims and 18% of the general population of injured children. White children comprised 51% of suspected child abuse victims and 66% of the general population of injured children,"86 even controlling for poverty, another significant risk factor. Another study found that "Black

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79 See Bazelon, *supra* note 66.

80 See Brad D Booth, Joel Watts & Mathieu Dufour, "*Lessons from Canadian Courts for All Expert Witnesses*" (2019) 53:2 J Am Academy Psychiatry & L.

81 The inquiry was triggered by the scores of abuses committed by one pediatric pathologist, named Dr. Charles Smith. See Attorney General, Ontario Completes Review Of "Shaken Baby" Cases (14 March 2011) online: <news.ontario.ca/en/backgrounder/17270/ontario-completes-review-of-shaken-baby-cases> [perma.cc/NK9P-YR7R], (noting that four cases out of 129 actual cases presented raised questions for further investigation).

82 See generally Najdowski et al, *supra* note 27; Okeke, *supra* note 27; But see Brenner et al, *supra* note 27.

83 Okeke, *supra* note 27.

84 Sinal et al, *supra* note 27 at 1245, (concluding "Race was not a significant factor in predicting shaken baby syndrome in the referral area studied....". Final statistics of injury may be influenced by after-care, which is notably less impressive in heavily Black neighborhoods"); See also Brenner et al, *supra* note 27, where white children were overreported. See also Judy George, "Brain Injury More Severe From Falls at U.S.-Mexico Border Wall" *MedPage Today* (10 April 2024), online: <www.medpagetoday.com/neurology/headtrauma/109606> [perma.cc/PX36-WK72].

85 Erin Digitale, "Child abuse reports by medical staff linked to children's race, Stanford Medicine study finds" *Stanford Medicine* (6 February 2023), online: <med.stanford.edu/news/all-news/2023/02/child-abuse-report-race.html?utm_source=Stanford+ALL&utm_campaign=5fe1ef2d62-int_COPY_01&utm_medium=email&utm_term=0_c042b4aad7-5fe1ef2d62-55004962> [perma.cc/FLZ2-UH3A].

86 *Ibid.*

children are reported at about twice the rate of white children and their cases are more likely to be investigated, confirmed, and brought to court."[87]

In Canada, too, racial disparities have been identified in child welfare investigations, including the overrepresentation of Indigenous and Black children in child welfare cases.[88] While there is limited Canadian jurisprudence linking these disparities directly to SBS prosecutions, the pattern suggests the need for racially sensitive safeguards in both child protection and criminal justice proceedings involving medical diagnoses of abuse.

The dangers and harms of over-targeting and false convictions are real – not only to the falsely accused, but also to the child, who may be deprived of parental care from an innocent parent wrongfully incarcerated.[89] On the other hand, so are the dangers of under-investigation: Said one expert:

> If you over-identify cases of suspected child abuse, you're separating children unnecessarily from their families and creating stress that lasts a lifetime. But child abuse is extremely deadly, and if you miss one event — maybe a well-to-do Caucasian child where you think 'No way' — you may send that child back

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87 Billauer, "Child Abuse Prosecution", *supra* note 14, (quoting Anne Zimmerman, Editor-in-Chief at Voices in Bioethics); See also Kadee D Atkinson, Spencer T Fix & Rebecca Fix, "Racial Disparities in Child Physical and Sexual Abuse Substantiations: Association with Childs' and Accused Individuals' Race" (2022) 32 J Child & Family Studies 44; See also Billauer, "Collides with Medical Practice", *supra* note 27.

88 See Department of Justice Canada, "Black People in Criminal Courts in Canada: An Exploration Using the Relative Rate Index" (2023), noting "Research shows a strong relationship between the overrepresentation of Black people in the CJS and the discrimination and marginalization they face in other socio-economic areas such as child welfare, education and employment. Black children are overrepresented in child welfare cases ....Because much of the literature on parenting is grounded in Eurocentric parenting practices, Canadian professionals may misrecognize certain parenting styles as requiring intervention ..... This can result in children being removed unnecessarily from Black families instead of parents being provided with the appropriate supports needed".

89 Okeke, *supra* note 27; See also Mark Freeman, "What to Expect Criminal Charges" <www.shakenbabydefense.com/what-to-expect/criminal-charges#:~:text=Normally%20a%20defendant%20will%20face,penalty%20for%20first%20degree%20murder.> [perma.cc/3KW7-8MC7], "([n]ormally a defendant will face a mandatory five-year minimum jail sentence for these charges. If the baby dies, the charge is murder or manslaughter, and jail sentences can be much longer: 20 to 40 years for third degree murder is not unusual. Life imprisonment and even the death penalty for first degree murder").

> unprotected to a very dangerous environment. The consequences are really sad and devastating on both sides.[90]

This medical conflict introduces controversy into an already emotionally taxing and vexing conundrum and demands further research into racial bias and structured solutions. It also invites consideration of a counter-factual: Perhaps it is not Black caretakers who are being over-targeted, but rather white ones, especially wealthy or civically prominent citizens, who are under-targeted.[91] Regardless, this battle should not be fought on the altar of admissibility of scientific evidence, and judges should not revert to *Frye* (or *Daubert*) as a cover for judicial-activist remediation of an admittedly serious problem. Further, lawyers and legal academics without education in the sciences or medicine, who are understandably eager to "get a client" off,[92] should likewise refrain from the misleading use of scientific evidentiary principles or reliance on simplistic experiments without due scientific rigor or reliability.[93]

II. Law and the Science: How the *Nieves* Court Got Tangled – Let me Count the Ways.

A. Violating the Frye Consensus Standard

The guiding legal principle determining admissibility in Nieves was the Frye standard. This requires existence of a general consensus in the relevant scientific community before evidence can be admitted. Justice Wecht, concurring in Walsh v BASF Corp., was even more explicit, noting:

> [T]he Frye test, which is premised on a rule of "general acceptance" is more likely to yield uniform, objective, and predictable results among the courts, than is the application of the Daubert standard . . . . Moreover, the decision, ctyns of individual judges, whose backgrounds in science may vary widely, will be similarly

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90 Digitale, *supra* note 85. Jenny et al, "Analysis of Missed Cases of Abusive Head Trauma" (1999) 281:7 JAMA 621; See also Sinal et al, *supra* note 27 and Brenner et al, *supra* note 27.

91 If anything, the diagnosis may be underreported. See Jenny et al, *supra* note 90 at 623, (which found 31.2% of 173 children with abusive head trauma were not diagnosed on presentation. The diagnosis was more likely to be missed in young children from white, "intact" families); See also Vincent J Palusci & Ann S Botash, "Race and Bias in Child Maltreatment Diagnosis and. Reporting" (2021) 148:1 Am Academy Pediatrics at 2; See also Jenny et al, *supra* note 90 at 623, noting "Abusive head trauma was missed significantly more often in white children than children of minority races."

92 See e.g. *Lemons*, *supra* note 16.

93 See e.g. Findley et al, *supra* note 67.

> guided by the consensus that exists in the scientific community on such matters."94

Indeed, the controversy over shaken baby syndrome exemplifies the need for consensus. As synopsized by Professor David Caudill, the controversy which he calls "manufactured", began some two decades ago:

> [C]ommentators identified an alleged shift in medical opinion, based solely on outlier sources, that was used by criminal defense attorneys to cast doubt on a "clinically valid and evidence-based [diagnosis, recognized] by an overwhelming majority of pediatric medical specialists..., substantiated by the bulk of the medical research in a range of scientific discipline ... recognized and defined by the Centers for Disease Control and Prevention, and widely accepted by courts in the U.S. and numerous foreign countries.
> ... A judge could therefore find the proponents of the new research unreliable as informants and thus instruct the jury to follow the consensus definition and diagnosis[95]

However, by 2008, the Wisconsin Court of Appeals wrote that there is "fierce disagreement" among doctors about the shaken-baby diagnosis,[96] signaling "a shift in mainstream medical opinion."[97] Yet, consensus and applicable standard have been more than amply met regarding the existence of the SBS diagnosis according to the vast majority of medical organizations, signaling a significant gap between legal and medical assessment of the diagnosis, and leading courts to pursue idiosyncratic approaches to assessment of the relevant medical evidence.

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94 David Caudill, Harry Collins & Robert Evans, "Judges Should Be Discerning Consensus, Not Evaluating Scientific Expertise" (2024) 92:4 U Cin L Rev 1032 at 1065

95 *Ibid* at 1076. See also Joëlle Anne Moreno & Brian Holmgren, "The Supreme Court Screws up the Science: There Is No Abusive Head Trauma/Shaken Baby Syndrome "Scientific" Controversy" (2013) 5 Utah L Rev 1357 at 1367, noting "These sources [were] selected without explanation from among the over seven hundred published research papers on" shaken baby syndrome."; *Cf Cavazos v Smith*, 565 US 1 (2011), where "the dissenting Justices' sweeping scientific-sounding conclusions are not based on any sort of legitimate attempt at a meta-analysis of the relevant data, but rely solely on a handful of single-sentence quotes excerpted from seven cherry-picked articles, all but one of which reflect the extreme outlier child abuse defense argument that [shaken baby syndrome] is diagnostically invalid.

96 *State v Edmunds,* 2008 WI App 33.

97 The "fierce" seems to refer to loudness or intensity of iconoclasts, rather than numbers or official objections.

B. Bypassing the General Causation Inquiry:

As a general rule, before the precise scientific evidence for admissibility analysis can be evaluated, the structure of the case and the purpose for which the evidence is to be admitted must be determined. When multiple causes (or actors) are suspected, the causal question involves bifurcation into two separate inquiries: general causation, i.e., can a putative agent or stressor cause the condition in the general population? and specific causation, i.e., did the agent or stressor cause the harm in this particular case?[98]

Overturned SBS convictions thus far have turned on "what/who was the *specific* cause?" Since the existence or severity of the child's condition is generally not disputed, concerns centre on medical (diagnostic) deficiencies in a particular case, i.e., the failure to exhaustively exclude other causes (differential diagnosis),[99] or facts unassociated with the medical diagnosis, such as mens rea, or the time interval between act and injury. These pertain to what would be "specific causation" issues in civil cases.

The law of causal analysis (and scientific evidence) in the civil arena is, admittedly, more refined than in the criminal sphere. In civil products liability cases, all "fifty states require some evidence of general causation in … cases involving complex products liability or medical issues."[100] Because the specific circumstances in criminal cases generally pertain to individuals, the general causation question isn't usually addressed. However, when a court makes sweeping generalizations as to the propriety and scientific validity of a diagnosis that affects an entire population, that inquiry must be resurrected.

The *Nieves* court, in blunderbuss fashion, fails to recognize the distinction. Issues pertaining to whether the diagnosis was properly applied to the two children involved (specific causation) were hardly addressed. With its legal bludgeon, the court decapitates the SBS diagnosis *ab initio*, rejecting the general causation between shaking and mortal injury based on misreading of scientific studies, the writings of partisan and scientifically-

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98 See Barbara Pfeffer Billauer, "The Causal Conundrum: Examining Medical-Legal Disconnects from a Cultural Perspective - or How the Law Swallowed the Epidemiologist and Grew Long Legs and a Tail" (2018) 51 Creighton L Rev at 5 [Billauer, "Causal Conundrum"]; See also *Milward v Rust-Oleum Corp*, 820 F (3d) 469 (1st Cir 2016), (re differential dx and differential etiology) [*Milward*].

99 Discussed below in Part III.

100 See re Mirena IUS Levonorgestrel-Related Products Liability Litigation, 982 F (3d) 113 (2nd Cir 2020) [*Mirena*], cited in In *re Acetaminophen*, *supra* note 36 at 8; See also *Daniels*, *supra* note 36 at 5.

untutored lawyers, a small ad hoc group of biomechanics, a minority of the medical community, testimony of the defendant's experts, and briefs of their amici.

Rushing headlong into a general causation inquiry, the court fails to note that SBS is a long-existing and accepted diagnosis in the medical community, enjoying broad consensus. This state of affairs should have short-circuited general causation questions under the *Frye* doctrine, the governing law at the time of the *Nieves* decision. [101]

To recapitulate: testimony relying on controversial scientific evidence must be assessed by the applicable legal standard, which varies depending on the state and the court. Federal courts rely on the *Daubert* standard[102] (as expounded in the *Daubert* trilogy), enumerated in 1993 and codified under Federal Rules of Evidence, recently amended.[103] The decision overruled the earlier *Frye* standard, decided in 1923. State courts generally apply *Daubert*, but six states still use the *Frye* approach. At the time of the *Nieves* case, New Jersey was an anomaly, using a hybrid approach – *Daubert* for civil cases, *Frye* for criminal ones.[104]

Dispute runs rampant regarding which approach favours which side.[105] In the criminal context, the *Daubert* standard, held to be less rigorous, is believed to be more favourable to the defendant.[106] But the *Nieves* court admits to being bound by *Frye,* or so it claims at the outset. Whether it remained true to that assertion is the topic of this section.

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101 *State v Harvey,* 151 NJ 117 (1997) at para 13 [*Harvey*], ("[i]n criminal cases we continue to apply the general acceptance or Frye test for determining the scientific reliability of expert testimony"); See also Dana Difilippo, "Expert testimony in criminal cases to face more rigorous standard after court ruling", *New Jersey Monitor* (17 February 2023), online: <newjerseymonitor.com/2023/02/17/expert-testimony-in-criminal-cases-to-face-more-rigorous-standard-after-court-ruling/> [perma.cc/DH7Q-YMQ8].

102 *Ibid.*

103 US, *Federal Rules of Evidence* FRE 701 and 703 also assign the proponent bears the burden of proof; See Assad H Rajani & Anna K Thompson, "Amended Federal Rule of Evidence 702: What You Need to Know About the Admissibility of Expert Testimony" (1 December 2023), online: <www.arnoldporter.com/en/perspectives/advisories/2023/12/amended-federal-rule-of-evidence-702> [perma.cc/WK94-P2ZY].

104 *Harvey*, *supra* note 101.

105 Barbara Pfeffer Billauer, "Daubert Debunked: A History of Legal Retrogression and the Need to Reassess "Scientific Evidence and Admissibility" (2016) 21 Suffolk J Trial Advoc at 8 [Billauer, "Daubert Debunked"].

106 Difilippo, *supra* note 101; While many say Daubert is more malleable, toxic tort cases, e.g. the Roundup cases, are preferentially filed in states like Pennsylvania and California state courts, which both utilize *Frye*.

C. Ignoring the Novelty Requirement

Both *Frye* and *Daubert* were provoked by (and applicable only to) determining the admissibility of novel or new scientific discoveries.[107] Established scientific precepts did not invoke admissibility controversy.[108] The focus of both standards was to assess when novel theories crossed the line of conjecture or theory and became established as scientific principles, as determined by the scientific community (*Frye*), or acceptable under the principles of the scientific method (*Daubert*) with its focus on proving reliability and error rates of data, later expanded to assessing methodology and nexus of opinion (Joiner).[109] This critical factor the Nieves court notes in passing, but glosses over when analyzing the proffers.[110]

> For many years in the twentieth century, expert testimony on *novel* scientific evidence was admissible only if the opinion offered was based on a "well-recognized, scientific principle or discovery . . . [that was] sufficiently established to have gained general acceptance in the particular field in which it belongs. That

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107 Some states still explicitly abide by this requirement: "the Montana Supreme Court has expressly rejected *Daubert* as the sole test for "non-novel" expert testimony while endorsing it for "novel" expert methodology." Cynthia Ford, "When Daubert is the Way: The Road Less Traveled By" (2018) 11 Faculty J Articles & Other Writings at 14; *State v Cline*, 909 P (2d) 1171 (Mont Sup Ct 1996) at 55, noting the Daubert test should only be used to determine the admissibility of **novel scientific evidence**. (Emphasis added): "We later clarified, however, that Daubert does not apply to all expert testimony; instead, it applies only to "novel scientific evidence."; See also J Ken Thompson, "A Review of the Admissibility of Novel Scientific Evidence" (1994) 17:3 AM J Trial Advoc 741.

108 Nor had novel scientific constructs prior to Frye. See Tal Golan, "The Authority of Shadows: The Legal Embrace of the X-Ray" (1998) 24:3 Historical Reflections 437 at 438-454, discussing *Smith v Grant* (1896); See also Anjelica Cappellino, "The Frye Standard in Expert Testimony" (last modified 10 July 2024), online: <www.expertinstitute.com/resources/insights/admitting-expert-testimony-under-the-frye-standard-the-ultimate-guide/> [perma.cc/CS86-PWJS], noting "The standard set forth in Frye is applied to new or novel scientific techniques to determine whether the principles are accepted in the relevant scientific community. But what is general acceptance? It has been defined in vastly different ways, from "widespread; prevalent; extensive, though not universal" to a finding that applies a "substantial section of the scientific community."

109 Examining the scientific validity of the conclusion fell to the *Joiner* case; See *Joiner, supra* note 62.

110 *Nieves, supra* note 15 at 51, "[i]n Doriguzzi, 334 N.J. Super at 540, we expressed caution on relying solely on judicial opinions, in part due to the different standards and considerations other jurisdictions employ, but also the need to have "reliable scientific data" when determining a *novel* issue."

> standard, enunciated in *Frye v. United States*, was also known as the "general acceptance" test.[111]

Frye, decided in 1923, arose in the context of determining the admissibility of testimony generated by a newfangled contraption, a lie-detector prototype. The case augured discussion on when *new* inventions or discoveries have been validated and accepted as mainstream science.[112] Based on its novelty, the *Frye* court rejected the testimony because the science behind the device[113] was not generally accepted by the scientific community.[114] This remained the national standard until 1993.[115]

Seventy years later in the wake of the "junk science crisis",[116] *Daubert* again addressed novel epidemiological evidence.[117] Saddling the judge with the role of "gatekeeper" to exclude from the courtroom evidence that did not pass muster in terms of its reliability and relevance, *Daubert* held that scientific consensus was only one of five non-exclusive rubrics by which judges can evaluate testimony, including – but not requiring - general acceptance.[118] The case has come under intense scrutiny for various reasons, including comingling legal terms (e.g., reliability) with scientific terms (e.g., validity and statistical reliability).[119] But *Daubert*, too, pertains to inquiry into the admissibility only of novel science or scientific techniques.[120] (As

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111 Narang, *supra* note 18 at 508.

112 See Billauer, "Daubert Debunked", *supra* note 105 at 43.

113 *Frye v United States*, 293 F 1013 (DC Cir 1923) [*Frye*].

114 The question emerges why formal legal inquiry wasn't required earlier. Could it be that hard scientific questions never presented themselves beforehand? Hardly. As early as the turn of the 19th century, judges were evaluating complex scientific cases without issue. One conjecture is that judges at the time were more comfortable understanding science, having been school in natural philosophy. See *Muller v Oregon* (1908) and the Brandeis Brief, Ruth Bader Ginsburg discussed in Billauer, "Daubert Debunked", *supra* note 105 at 52.

115 NCSC, "The Changing Role of Judges in the Admissibility of Expert Evidence" (2006), online (pdf): <ncsc.contentdm.oclc.org> [perma.cc/GL4X-MG4E], noting early "judges evaluated the admissibility of expert witnesses using the "commercial marketplace test." Expertise was assessed by whether there was a commercial market for the proffered knowledge. In other words, if an expert was able to make a living through espousing the said knowledge, the witness was deemed an expert."

116 Jack Fisher, *Silicone on Trial: Breast Implants and the Politics of Risk* (Charleston, SC: The Sager Group LLC, 2015).

117 Billauer, "Admissibility", *supra* note 60 at 4.

118 Billauer, "Collides with Medical Practice", *supra* note 27.

119 Billauer, "Causal Conundrum", *supra* note 98 at 9.

120 Discussed in Part IV, *below*.

early as the turn of the last century, Judges had no problem assessing science which was well incorporated into our daily lives.[121])

By comparison, Canada has been regarded as employing an amalgam of *Frye* and *Daubert*, requiring satisfaction of a basic threshold of scientific soundness along with balancing considerations integral to the contextual purpose for which the evidence is admitted (such as prejudice or confusion).[122] The Canadian standard, as first enunciated in *R v Mohan*,[123] subjects the proffered (novel) evidence to four tests: (1) relevance; (2) necessity in assisting the trier of fact (which subsumes reliability); (3) the absence of any exclusionary rule; and (4) qualification of the expert. This basic rubric evolved over time[124] to include a separate assessment of reliability and incorporation of a gatekeeping function akin to *Daubert*.[125] According to *Mohan*, the relevance issue is a question of law.[126]

The New Jersey admissibility standards are reiterated in *State v Doriguzzi*, cited, but ignored by the *Nieves* court.[127] That case, like Canadian law,

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121 Billauer, "Daubert Debunked", *supra* note 105 at 45; See also Barbara Pfeffer Billauer, "Med Mal: Who Creates the Crisis, Lawyers or the Doctors" (25 April 2024), online: <www.acsh.org/news/2024/04/25/med-mal%25C2%25A0who-creates-crisis-lawyers-or-doctors-17793> [perma.cc/C4XU-URFN].

122 *R v Mohan*, [1994] 2 SCR 9 at para 28 [*Mohan*], 1994 CanLII 80, noting "[i]n summary, ... expert evidence which advances a novel scientific theory or technique is subjected to special scrutiny to determine whether it meets a basic threshold of reliability and whether it is essential in the sense that the trier of fact will be unable to come to a satisfactory conclusion without the assistance of the expert."; see also Farley, *supra* note 26.

123 *Mohan, supra* note 122 at para 18, discussing whether considered as an aspect of relevance or a general exclusionary rule, "[t]he reliability versus effect factor has special significance in assessing the admissibility of expert evidence".

124 The case of *R v J-LJ*, 2000 SCC 51 at para 33 [*JJ*] explicitly notes the contributions of Daubert, not necessarily as governing Canadian law, but providing additional parameters which could be helpful to the court in evaluating scientific evidence.

125 See *White Burgess Langille Inman v Abbott and Haliburton Co*, 2015 SCC 23 at para 7, although in quoting Nova Scotia Supreme Court in *Abbott and Haliburton Co Ltd v White Burgess Langille Inman*, 2012 NSSC 210, Pickup J, the court demonstrates the same confusion of reliability evidenced by some American courts to refer to dependability of the expert, rather than reproducibility of the data, as understood by the scientific community.

126 This formulation would allow exclusion of the biochemical evidence *ab initio*, as the extrapolated opinion testimony derived from doll and lamb studies would be considered irrelevant and overly prejudicial.

127 *State v Doriguzzi*, 334 NJ Super 530 (Sup Ct App Div 2000) at paras 2-7 [*Doriguzzi*].

reiterates that the inquiry only pertains to novel science[128] with established scientific precepts being conferred presumptive admittance:[129]

> A novel scientific test not previously approved by this court or our Supreme Court, in order to achieve admission into evidence, must meet the test articulated in Frye v. United States, [cites omitted]. Although Frye has been replaced in the federal court system in favor of the more lenient standards of Federal Rule of Evidence 702 as set forth in Daubert v. Merrell Dow Pharmaceuticals, Inc. [cites omitted] in New Jersey, ..., Frye remains the standard. [cites omitted] The Frye test asks whether the scientific test is generally accepted in the relevant scientific community.[130] [emphasis added]
>
> Just when a scientific principle or discovery crosses the line between the **experimental** and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized...[131] [emphasis added].

Lest there be any doubt, the *Doriguzzi* court continues: "A proponent of a newly-devised scientific technology can prove its general acceptance in three ways,"[132] [emphasis added] including legal opinions.[133] Thus, even assuming arguendo, the SBS diagnosis is subject to a *Frye* inquiry, that other courts have accepted the diagnosis (for decades) should be dispositive such that it no longer can be considered novel,[134] while, by comparison, the "objectants" view would be.

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128 *Harvey, supra* note 99 at para 9, (noting "[t]rial lawyers must make myriad choices in deciding how best to present or refute *novel* scientific evidence").

129 *Ibid.*

130 *Doriguzzi*, *supra* note 127 at 7.

131 *Ibid*, citing *Frye, supra* note 111.

132 *Doriguzzi*, *supra* note 127 at 7, by expert testimony as to the general acceptance among those in the profession, ... on which the proffered expert witness based his or her analysis; (2) by authoritative scientific and legal writings indicating that the scientific community accepts the premises underlying the proffered testimony; and (3) by judicial opinions that indicate the expert's premises have gained general acceptance."

133 *Harvey, supra* note 101 at para 9, **"**[i]n determining the general acceptance of novel scientific evidence in one case, the court generally will establish the acceptance of that evidence in other cases." See also *Flick v Warren,* 465 F Appx 461 (6th Cir 2012) [*Warren*].

134 *Jones v United States*, 548 A (2d) 35 at para 40 (DC 1988); See also Christine Funk, "Daubert vs Frye: A State-by-State Comparison" (10 July 2024), online: <www.expertinstitute.com/resources/insights/daubert-versus-frye-a-national-look-at-expert-evidentiary-standards/> [perma.cc/3VZK-WY98].

D. Failing to Subject the Defense Evidence to a Frye Inquiry

While the evidence proffered by the State is over half a century old and well-accepted, it is the "newly-devised" and novel evidence proffered by the "objectants" [135] that should trigger a *Frye* inquiry.[136] Instead, rejecting the prosecution experts outright, the court accepted the entire expert portfolio of the defense without even the most rudimentary evidentiary inquiry, relying on three defense experts holding a minority view and 13 amici touting relatively novel (and non-mainstream) theories,[137] who base their objections to the SBS diagnosis on (unreliable) experimental biomechanical tests using surrogates, including (unvalidated) inanimate dolls, and requiring a double extrapolation (discussed in greater detail below) to have any relevance to children and the case before the court, surely failing both *Frye* and *Daubert* analyses.[138]

And while the defense can demonstrate that other courts recognized that the matter is controversial, this is a far cry from demonstrating that their expert testimony has been embraced by the "consensus" of the scientific community, whether biomechanical or medical. In this regard, we do not see the prolonged, consistent, or validated experience necessary before novel science crosses over to mainstream acceptance, satisfying the prerequisite that "a novel scientific technique achieves general acceptance only when it passes from the experimental to the demonstrable stage."[139] [emphasis added].

That the objectants' critique of SBS falls into the novel science category can also be ascertained by the test put forth by history of science scholar

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135 As the court in *Lemons, supra* note 16 noted, the testimony from the defense experts suggests there was already a debate in the medical community regarding SBS in 2006, but much of the evidence offered in connection with defendant's motion encompassed advancements in the relevant research and literature that occurred after defendant's trial.

136 See *State v Blakney,* 389 NJ Super 302, 312, 316 (Sup Ct App Div 2006), rev'd on other grounds, 189 NJ 88 (2006) [*Blakney*].

137 *Warren, supra* note 133 at 11, "[w]hat controversy there is [about attacking the SBS diagnosis] apparently represented the minority view. In the end, even if trial counsel had attempted to mount a *Daubert* challenge to the prosecution's experts, he likely would have failed to unseat the prevailing scientific consensus."; See *Minner v American Mortg & Guar Co*, 791 A (2d) 826 at 843 (Del Sup Ct 2000) [*Minner*].

138 Thomas Lyons, "Frye Daubert And Where Do We Go From Here" (4 July 2019), online: www.sfandllaw.com/articles/frye-daubert-and-where-do-we-go-from-here/.

139 *Nieves, supra* note 15 at 53, citing *State v Cassidy, 235 NJ 482 at 492* [*Cassidy*], quoting *Harvey, supra* note 101.

Stephen Brush.[140] Brush advises that when the line is crossed between experimental work and accepted science is determined by what is contained in science/medical textbooks.[141] In that SBS (and the differential diagnosis technique) are standard medical diagnoses taught in medical school, that becomes the currently accepted medical consensus, not the contrary views of the defense.

1. Novelty and Reliability

In assessing the novelty of an issue, courts have also invoked the reliability doctrine. The relationship between novelty and reliability was acknowledged by *Nieves*, citing *Creanga v Jardel,*[142] which asserts that the New Jersey Rules of Evidence imposes three requirements for admissibility: the salient, here, being that the field testified to must be at a state of the art such that the expert's testimony could be sufficiently *reliable*, meaning that reliability is associated with familiarity and use within the scientific specialty involved, conducive to conferring a basis for general acceptance.

The *Nieves* court admits that:

> [t]o establish general acceptance of a scientific theory, 'the party proffering the evidence need not show infallibility of the technique nor unanimity of its acceptance in the scientific community,' [but] [r]ather . . . that the 'test and the interpretation of its results are non-experimental, demonstrable techniques that the relevant scientific community widely, but perhaps not unanimously, accepts as reliable.[143]

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140 Steven Brush, *Making 20th Century Science: How Theories Became Knowledge,* 1st ed (New York: Oxford University Press, 2015) at 73-74, 88-89. "Mere experimental evidence countering existing paradigms does not a new paradigm make, discussing Daubert and Frye."

141 *People v Martinez*, 74 P (3d) 316 at 323 (Colo Sup C 2003), ("we assume, as it is not in dispute, that the scientific principles of shaken-impact syndrome and subdural hematomas resulting from extreme accidents are reasonably reliable"); See_also Joyce et al, *supra* note 1, "[p]ediatric abusive head trauma (AHT) most often involves brain injury of infants and young children. Another term for this condition is shaken baby syndrome (SBS). Shaking, blunt impact or the combination can result in neurological injury. AHT is the most dangerous and deadly form of child abuse."

142 185 NJ 345 (2005) [*Creanga*]. Creanga is a civil case, subject to Daubert, and it is questionable whether the standards enumerated there are applicable in this Frye case. Nevertheless, the explication of the use of "the reliability" metric as indicative of general consensus may be relevant.

143 *Nieves, supra* note 15 at 2; See *State v Ghigliotty*, 463 NJ Super 355, 383 (App Div 2020), (quoting *Harvey*, *supra* note 101 at 171 and *Cassidy, supra* note 139 at 492; See also *People v Bailey*, 80 AD (3d) 999, at 723-27 (NY Sup Ct App Div 2014), aff'd, 41 AD (3d) 1562 (NY Sup Ct App Div 2016).

This test, the defense/objectants patently fail, not only in terms of burden, but also in substance.[144]

Surely the prosecutor has established this onus for the existence of SBS, although this is ignored by the court. By comparison, the open-house treatment of the defense testimony, which has no commensurate acceptance by any established body and relies on unverified experimental evidence, bears "stricter scrutiny". Under the *Frye* analysis required here, admittedly more stringent than *Daubert*, [145] the objectant/defense proffer does not pass muster, as will be seen below.[146] The best that can be said is that even if the matter is in equipoise, the case should be sent to the jury.

2. The Defense Bears the Burden of Proof for Its Experts

The *Nieves* court mistakenly assigns the burden of proof solely to the State, the proponent of the evidence in chief,[147] misreading its own precedent, *Doriguzzi*.[148] In truth, the burden falls on the party seeking to admit the critical evidence to prove it is generally accepted.[149] Here, the court blindly welcomes the defense experts' assertions, without subjecting their testimony and evidence to the most rudimentary admissibility analyses. Their smug assurances of their truth cannot, by mere *ipse dixit*, displace either established science, or the consensus required by *Frye*.[150] Nor

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144 See e.g. Findley et al, *supra* note 67.

145 National Institute of Justice, "The Frye Test" (last accessed 4 December 2025), online: <nij.ojp.gov/nij-hosted-online-training-courses/dna-prosecutors-practice-notebook-inventory/preparing-cases-involving-dna/admissibility/frye-test> [perma.cc/7R8B-5VTB], noting "[t]he Frye test is also known as the "general acceptance" test and only applies to novel scientific evidence".

146 Narang, *supra* note 18 at 509, noting "Daubert … mandated a "liberal" and "relaxed" approach to the admission of expert opinion testimony… [which] was within the province of the trial judge…. [but] … required trial judges to ensure "that any and all scientific testimony or evidence admitted is not only relevant, but reliable."

147 Under the newly amended FRE 702, the burden is clearly on the proponent of the evidence; see Rajani, *supra* note 101.

148 *Doriguzzi*, *supra* note 127 at para 8, noting "[t]he burden to "clearly establish" each of these methods is on the proponent." See also *State v Williams*, 252 NJ Super 369 at 376 (1991).

149 *Ibid.* See also *Harvey*, *supra* note 101 at 9.

150 Progress in science to achieve consensus is slow. As Nobel Laureate physicist Max Planck remarked, "Science progresses one funeral at a time". See Peter J McDonnell, "Moving forward: Does science progress one funeral at a time?" *Ophthalmology Times* (23

can the requisite standard be upended by an *ad hoc* group of proponents submitting amicus briefs, who, parenthetically, are vested with defending SBS suspects.

In sum, proving general acceptance that SBS as a diagnosis does not medically exist "entails the strict application of the scientific method, which requires an extraordinarily high level of proof based on prolonged,[151] controlled, consistent, and validated experience."[152] This does not exist here.

i. Comingling *Frye* and *Daubert* Standards: Reliability vs. Validity

Even as the *Nieves* court pays obeisance to *Frye*, noting "[o]ur assessment of the scientific reliability of the SBS/AHT theory is governed by the *Frye* standard,"[153] and quoting two other cases acknowledging the focus is on general acceptance,[154] *Daubert* criteria worm their way into the analysis. While the sinecure of *Frye* is general acceptance, the hallmark of *Daubert* is reliability.[155] Exemplifying its mixed-metaphor analysis, the *Nieves* court states: "The issue challenged in these appeals is the second query—whether SBS/AHT is a reliable scientific theory."

The court in *State v Cassidy*, the case which transformed New Jersey into a *Daubert* case for criminal cases,[156] again stresses the pivotal difference between *Daubert* and *Frye*. The distinction, says the *Cassidy* court, is that *Daubert* focuses on reliability, while *Frye* does not. As Chief Justice Stuart Rabner wrote in *Cassidy*:

> Reliability is critical to the admissibility of expert testimony, yet the Frye standard tasked judges with approaching the question of reliability indirectly by focusing on general acceptance . . . Instead of directing judges to examine actual measures of

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March 2021), online: <www.ophthalmologytimes.com/view/moving-forward-does-science-progress-one-funeral-at-a-time-> [perma.cc/D3SE-DBL9].

151 Thomas Kuhn noted that changing mainstream science is a slow, deliberate, and methodical process. Thomas S Kuhn, *The Structure of Scientific Revolutions*, 4th ed (Chicago: University of Chicago Press, 2012).

152 *Rubanick v Witco Chem Corp*, 125 NJ 421 at 30 (Sup C 1991).

153 *Nieves*, *supra* note 15 at 50.

154 Under that standard, "[s]cientific test results are admissible in a criminal trial only when the technique is shown to be generally accepted as reliable within the relevant scientific community." *Cassidy*, *supra* note 139 at 5. See *State v Pickett*, 466 NJ Super 270 at para 12 (App Div 2021) [*Pickett*].

155 Although four other non-exclusive and non-mandatory tests are furnished by the case. See Billauer, "Admissibility", *supra* note 60.

156 See also *State v Olenowski*, 253 NJ 133 (2023).

> reliability — like the soundness of the methodology used to validate a scientific theory or technique, the strength of the reasoning underlying it, and the accuracy of the theory or technique in practice — Frye only permits judges to consider the views of individuals in the relevant field."[157]

Nieves thus diminishes the primacy of general acceptance by elevating reliability as the pivot for admission, stating: "General acceptance is not an end in itself," it says, but a way to evaluate whether there is "a sufficient level of reliability" lying beneath the expert testimony to "allow consideration . . . by the factfinder."[158] It is true that reliability, which was not a rubric under *Frye*, meandered into later decision-making – but only for the purpose of assuring general acceptance,[159] and then only when assessing admissibility of novel issues.[160]

Even where reliability is a predicate for admissibility, either as a discreet pivot point (under *Daubert*), or as a modifier for *Frye's* general acceptance standard, the *Nieves* court misapprehends the meaning of the term, which has different meanings in law and science. In science, reliability means assurance that the result can be reproduced: "That is to say, the test must have a 'sufficient scientific basis to produce uniform and reasonably reliable results and will contribute materially to the ascertainment of the truth,'"[161] although it does not, without satisfying the validity requirement, establish the truth of the proposition for which it is offered. (By contrast, legal reliability focuses on the dependability of the expert). Further, reliable results can result in the same invalid, i.e., erroneous conclusions, repeatedly.[162]

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157 Difilippo, *supra* note 101.

158 *Nieves, supra* note 15 at 53, citing *Doriguzzi*, *supra* note 127 at 546.

159 "General acceptance is not an end in itself," but a way to evaluate whether there is "a sufficient level of reliability" lying beneath the expert testimony to "allow consideration . . . by the factfinder." *Doriguzzi*, *supra* note 127 at 546; "Where there is disagreement, or the evidence is in equipoise, the vehicle for resolution is through cross-examination:" *State v McClary*, 207 Conn 223 at para 102 (Sup C 1988), (explaining that any dispute about the theory can be adduced through cross-examination and the presentation of defense experts).

160 The need to have "reliable scientific data" [pertains to] ... determining a novel issue, *Doriguzzi*, *supra* note 127 at 540; *Ferlise v Eiler,* 202 NJ Super 330 at 335 (App Div 1985); *State v JLG*, 234 NJ 265 at 280 (2018), (quoting *State v Kelly*, 97 NJ 178 at 208 (1984). See *Blakney*, *supra* note 134 at 312-316.

161 *State v Pittman,* 419 NJ Super 584 at 592 (App Div 2011) (quoting *State v Chun*, 194 NJ 54 at 91 (2008)).

162 See *Lewis v City of Chicago,* 2005 US Dist Lexis 42544 (ND III 2005) [*Lewis*], "[t]he

For scientific soundness, the evidence must not only be reliable, but it must also be valid, i.e., it must prove the precept for which it is designed to establish and exclude other hypotheses.[163] Indeed, multiple hypotheses can account for the same result.[164] Validity pivots on scientific plausibility, and may be established by a nexus between hypothesis, methodology, and conclusion.[165] The word 'validity' hardly makes an appearance in *Daubert*,[166] and neither test surfaces in *Frye*.[167]

That the law elevates "reliability" to a sublime and singular focus bespeaks the courts' ignorance of how science is conducted.[168] In science, it is the combination of validity and reliability that determines general acceptance.[169] Scientific reliability, i.e., assurance of consistent results (often by statistical tests) is established differently in different disciplines (a feature

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reliability of a test refers to the extent to which scores are free from random error, *i.e.,* the extent to which retesting of a given applicant is expected to yield a consistent result." where invalid (but reliable) results were introduced and rejected.

163 See Brian McMahon et al, "Coffee and Cancer of the Pancreas" (1981) 304:11 N Engl J Med 630, where invalid data accrued when the methodology did not address the hypothesis.

164 Brush, *supra* note 140 at 89.

165 In *Lewis*, *supra* note 162, the tests used were reliable but not valid. It is possible that relevance, as used in *Daubert*, might be an adequate surrogate for validity, since an invalid (albeit reliable) test would be, by definition, irrelevant. However, care must be taken to understand that legal reliability has no counterpart in science, where it assures that the results were not due to chance, a measure typically reflected by statistical parameters, including P-values and confidence intervals.

166 "[T]he Court went on to state that "evidentiary *reliability* will be based upon scientific *validity*....The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate....Rule 702's 'helpfulness' standard requires **a** valid scientific connection to the pertinent inquiry as a precondition to admissibility." See Narang, *supra* note 18 at 509.

167 As noted in *Cassidy, supra* note 139.

168 *Nieves, supra* note 15 at 52, stating" Whether expert scientific evidence is sufficiently ***reliable*** under the Frye test to be admissible under N.J.R.E. 702 is a legal question that we review de novo. .... we consider the scientific ***reliability*** of expert testimony that shaking alone can cause the injuries associated with shaken baby syndrome." Notably neither validity nor consensus is considered by the court.

169 The sole nod to validity comes from *Daubert* that "evidentiary reliability will be based upon scientific validity." See Narang, *supra* note 18 at 509.

negating transdisciplinary involvement).[170] Validity also differs among disciplines, and turns on the method of proof.[171]

The *Nieves* court bolluxes up reliability and validity. Even assuming that reliability is countenanced as the standard for admissibility, the reliability involved would be the consistency in arriving at the diagnosis by the medical community. SBS is a very reliable diagnosis, attested to by the vast array of consensus statements by organized medical groups (who are empowered to make diagnoses), based on objective signs and performance of the differential diagnosis technique.[172] By contrast, the testimony proffered by the *ad hoc* amicus of biomechanics seeks to nullify the SBS diagnosis, a determination they are not qualified to make.

In sum, the objectants cannot argue that the diagnosis isn't reliable; it certainly is. When presented with the same or similar objective signs and history, physicians will reach the same diagnosis repeatedly. And since only physicians are empowered to make diagnoses, their expertise is the only relevant specialty. What the defense seems to argue is that the diagnosis isn't valid – because the precise causal mechanism cannot be proven. But as will be seen in Part III, that specificity is not a pre-requisite for establishing causation – and the court obliges.

Frye has no provision to separately assess validity other than general acceptance, i.e., if most medical people in the community accept a proposition's truth, it is assumed to be valid and reliable. Even under the *Daubert* framework, objectants would have to prove their experiments are relevant to shaken babies. They aren't, as discussed in part IV. But first, I disabuse the court's insistence on proof of transdisciplinary acceptance, followed by a discussion of medical differential diagnosis technique.

III. THE COURT'S MISUNDERSTANDING OF MEDICINE AND MIXING MEDICAL METAPHORS

A. Requiring Transdisciplinary Consensus Is Improper

As a basis to rejecting the SBS diagnosis entirely, the court reframes medical practice, claiming, without basis, that "where the underlying theory integrates multiple scientific disciplines [then] there might be more than

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170 As professor Caudill "argue[s] ... conventional descriptions of the differences between law and science often fail to focus on the types of expertise relied upon within each field." See Caudill, *supra* note 91 at 1032.

171 See Part IV, *below*, for more on this topic.

172 Differential diagnosis, discussed *below* in Part III.

one scientific community to consider," and the proponent must establish "cross-disciplinary validation to determine reliability."[173] The court relies on the *Pickett* case in support.

The *Pickett* case is distinguishable: a) it relates to novel science (involving probabilistic genotyping of DNA); and b) it does not involve the practice of medicine. Rather, it involves novel scientific (technological) tests. Or as Professor David Caudill notes, only where, "a lawsuit involve[s] a technical issue may . . . numerous fields of expertise with different views of whether consensus has been achieved [be considered]."[174] [emphasis added]

The Nieves court next supports its decision with a boot-strapped finding that: a) the SBS diagnosis is transdisciplinary, requiring consensus from both the medical and biomechanical communities; and b) some biomechanics and non-mainstream doctors have determined there is no experimental proof underpinning the diagnosis:

> SBS/AHT is a multidisciplinary diagnosis based on the theory that vigorously shaking an infant—with or without impact—creates such great rotational, acceleration and deceleration forces that result in a constellation of symptoms that may not manifest externally.[175] Whether SBS/AHT theory is generally accepted within the medical and scientific community requires evaluation of two considerations: (1) whether the theory is generally accepted by the biomechanical community and supported by biomechanical testing; and (2) whether the theory is generally accepted by the pediatric medical community and supported by the clinical data connecting the constellation of symptoms with SBS/AHT.[176]

However, as Professor Caudill and his colleagues note:

> [T]he knottiest problem posed by Frye is the definition of the relevant community: if the reliability inquiry is a matter of nose counting, whose noses are to be counted? This is a problem of great practical import because domains or sub disciplines often have disciplinary axioms and epistemic norms that lead them to view the reliability of a particular methodology quite differently. Closely related to the problem of identifying the relevant community is the problem of identifying its boundaries.[177]

Further, the *Nieves* court has a misinformed notion that SBS/AHT is a multidisciplinary diagnosis – meaning one involving medicine and an auxiliary science, here biomechanics. Diagnoses may involve multiple fields within medicine, but not medicine and another scientific discipline. We do not invite toxicologists to diagnose lead poisoning; nor do industrial

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173 *Nieves, supra* note 15 at 4; *Pickett, supra* note 153 at 302.

174 Caudill, *supra* note 94 at 1073.

175 *Nieves, supra* note 15 at 60.

176 *Ibid.*

177 Caudill, *supra* note 94 at 1072.

(occupational) hygienists diagnose mesothelioma; nor do pharmacologists determine opioid addiction or even treatment. Someone suffering from cancer caused by radiation does not consult a radiation physicist for diagnosis. Even biomechanics and ergonomicists do not diagnose carpal tunnel syndrome, a repetitive motion disorder involving force or vibrations,[178] and the orthopedist making the diagnosis does not consult the biomechanic beforehand. While a biomechanics "expert" can opine on the adequacy of the forces that caused the diagnosed condition, so can a physician – without aid from the biomechanic.[179] Moreover, even within the medical field, expert opinions diverge.[180] This discord does not invalidate the diagnosis of another well-credentialled physician.[181]

> Daubert itself involved, inter alia, testifying experts from the fields of epidemiology, biostatistics, chemistry, and medicine. Consensus in one of those fields that Bendectin could cause birth defects, however, would be enough under the Consensus Rule to instruct the jury to follow that consensus, unless that consensus could be challenged as reflecting bias or as a fringe view." [emphasis added].[182]

The *Nieves* court, however, holds, without credible support, that two consensuses are required because biomechanical theory is the foundation of the SBS/AHT hypothesis, and that:

> the very basis of the theory has never been proven - biomechanically. Without a biomechanical study supporting SBS/AHT, the court believes it remains a hypothesis without "uniform and reasonably reliable results" from which to ascertain the truth.[183]

The court's reasoning illustrates how little it understands. The study of physiology, neurologic trauma, concussion, and whiplash injury forms the

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178 Barbara Pfeffer Billauer, *Master's Thesis on Carpal Tunnel Syndrome*, (M.A. in Occupational Health and Safety, New York University, 1982) [unpublished], documenting the tortuous history of recognition of the disease by the law, later exemplified by enactment (and then revocation) of the OSHA ergonomics standard.

179 See *Creanga*, *supra* note 140. Biomechanics can testify on general causation, not specific causation in some jurisdictions. Note, however, the examining physician was permitted to testify to the quantum of force adequate to produce an injury.

180 See Joe Cecil, "Ten Years of Judicial Gatekeeping Under Daubert" (2005) 95:1 Am J Public Health 74.

181 Billauer, "Causal Conundrum", *supra* note 98 at 22.

182 Caudill, *supra* note 94 at 1073.

183 *Nieves, supra* note 15 at 58.

basis for the SBS diagnosis,[184] using acknowledged principles of medicine (including hematology, neurology, and immunology), and based on established principles of medical knowledge of how the body functions,[185] e.g., neurophysiology. This approach is well-recognized. Consider, for example, the diagnosis of chronic traumatic encephalopathy (CTE), a brain injury generated by repeated concussions suffered during football, hockey, or other head-banging activity.[186] There are no experimental studies demonstrating how much force is necessary to induce the concussive state or neurological damage. Nor can the diagnosis even be made conclusively while the patient is alive. Nevertheless, there is little medical dispute as to the existence or validity of the diagnosis (the only objectants being the NFL and its insurers, saddled with trying to avoid liability claims).[187]

Further,

> courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs. [188]

In requiring transdisciplinary consilience between biomechanical experimentation and clinical medical practice, the Nieves court again demonstrates that it doesn't understand how science works.[189] Different fields of sciences utilize different methodologies.[190] Thus, for example, one would not expect the method of proof to establish the existence of the Higgs

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184 "Not knowing the mechanism whereby a particular agent causes a particular effect is not always fatal to a plaintiffs' claim. Causation can be proved even if we do not know precisely how the damage occurred as long as there is sufficient proof that the damage occurred *somehow*." Daubert, *supra* note 63, citing the Reference Manual on Scientific Evidence, Fedl Judicial Center.

185 *Ibid.*

186 See Barbara Pfeffer Billauer, "Head Banging: The Dangers of Football and Fandom" (11 April 2024), online: <www.acsh.org/news/2024/04/11/head-banging-dangers-football-and-fandom-17768> [perma.cc/R3MZ-LTE2].

187 *Ibid*; see also Barbara Pfeffer Billauer, "Head Trauma in Teenage Sports: Accept the Risk or Ban the Ball" (14 September 2023), online: <www.acsh.org/news/2023/09/14/head-trauma-teen-sports-accept-risk-%25E2%2580%2593-or-ban-ball-17335> [perma.cc/X7A4-346X].

188 *Frye*, *supra* note 111 at 1014.

189 See Susan Haack, *Evidence Matters: Science, Proof, and Truth in the Law* (Cambridge University Press, 2014); See also Brush, *supra* note 140 at 88-89, both criticizing legal luminary David Faigman for exactly this infraction; See also Billauer, "Causal Conundrum" *supra* note 98.

190 Brush, *supra* note 140 at 89.

Boson[191] to be the same as establishing that SARS-CoV-2 causes COVID-19,[192] again negating the courts' insistence on transdisciplinary acceptance.

Indeed "[]btaining agreement of scientists [even] within the same field is difficult;[193] scientists have been famous for disagreements among themselves, giving rise to the image of the "battling experts."[194] As Nobel Laureate in Medicine, Barbara McClintock, wrote:

> "One of the characteristics of scientific development that most plagues historians is [that] ... consensus is never total ..., consensus always means the consensus of a particular community. Scientists make up many communities, and these communities vary by subject, by methodology, by place, and by degrees of influence. Science itself is a polyphonic chorus."[195] [emphasis added].

Because medicine and biomechanics use different methodologies to establish the soundness of their respective practices, the court's requirement of transdisciplinary approval is hallucinogenic.[196] As Dr. Brush states:

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191 Until *Cassidy*, *supra* note 139, "[a]dmissibility of scientific test results in a criminal trial is permitted only when those tests are shown to be generally accepted, within the relevant scientific community, to be reliable." See *Harvey*, *supra* note 101 at 252. That is to say, the test must have a "sufficient scientific basis to produce uniform and reasonably reliable results and will contribute materially to the ascertainment of the truth." See *State v Hurd*, 86 NJ 525 (1981) at 536.

192 See Brush, *supra* note 140 at 89; See also Lee Smolin, *The Trouble with Physics: The Rise of String Theory, The fall of a Science, and What Comes Next* (Boston: Houghton Mifflin, 2006) at xxiii, 8, 13, 24-25: noting "Different kinds of research are needed to solve different kinds of problems"; See also Evelyn Fox Keller, *A Feeling for the Organism: The Life and Work of Barbara McClintock* (New York: Freeman, 1983) at 174.

193 Matthew Cobb, *Life's Greatest Secret: The Race to Crack the Genetic Code* (New York: Basic Books, 2015) at 146; See Billauer, "Causal Conundrum", *supra* note 98 at 73: "Even simple, non-scientific words produce confusion in scientists of different persuasions, reflecting the cognitive (and cultural) milieu of each: Matthew Cobb recounts a story where Nobel Prize winner Joshua Lederberg (physiology) began a correspondence with physicist and Fermi Prize winner John von Neumann in 1955. "The two men soon realized that each of them did not understand what the other meant by [by the simple word] 'information', and that Lederberg eventually concluded that this was because they were thinking at very different level."

194 Tanya Albert Henry, "Jury needs to weigh evidence when there's battle of medical experts" (8 July 2021), online: <www.ama-assn.org/health-care-advocacy/judicial-advocacy/jury-needs-weigh-evidence-when-there-s-battle-medical> [perma.cc/TXP3-CUFY].

195 Keller, *supra* note 192 at 174, "The voices in that chorus are never equal, but what one hears as a dominant motif depends very much on where one stands. At times, some motifs appear dominant from any standpoint."

196 A view echoed by Judge Lee in *McNickle v Huntsman*, [2024] FCA 807 [*McNickle*] at 70:

> "The Frye rule wisely refrained from imposing a single methodology on all the sciences for all time. Why should we accept the fact that modern physics, chemistry, astronomy, geology, and biology have been successful by following the different methods that work best for them? If chemists solve chemical problems by using the scientific method, that's fine, but it doesn't mean physicists have to use the same method."[197]

B. Differential Diagnosis and Differential Etiology

The court next trashes the medical process of reaching the SBS diagnosis via the technique of differential diagnosis. An explanation of the method is first warranted. As Dr. Nahrang states:

> Once having received ... additional information, the clinician synthesizes that information with the known pathophysiologic processes of the human body, the evidence-based statistical information on the injuries, and the clinician's own experience in patient care.[198]

Indeed, the process of making a differential diagnosis, assessing causation based on history, and eliminating other causes is an integral part of diagnosing. A myriad of diseases, such as Asbestosis and Guillain-Barré Syndrome, cannot be diagnosed without this method. Yet, the *Nieves* court characterized the diagnostic process for SBS as somehow unique, claiming, "'[i]t [was] made by way of a process of elimination involving medical testing to assess and/or eliminate possible causes of the triad of injuries associated with [SBS][/]AHT,' with SBS/AHT as the 'final option' once all other possibilities were eliminated", and finding that "SBS/AHT was more conjecture than a diagnosis because it [was] an option embraced once a diagnostician runs out of diagnostic options."[199]

This is a lawyer's view of medicine. A differential diagnosis is indeed a process of exclusion required when pathognomonic, or precise, diagnostic tests are unavailable. Additionally, it is used if the patient doesn't respond to traditional therapy. Thus, even with a pathognomonic test, the physician suspecting a false positive laboratory result would review the original "pathognomonic diagnosis" using differential-diagnostic techniques. There is nothing novel or unusual about the method; indeed, it is approved by the

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> It is simplistic to say there is one "scientific method" because it depends upon the nature of the scientific task... these different objectives mean there are critical contextual differences between science and the law concerning methodologies and in the expression of conclusions of their differently focused enquires.

197 Brush, *supra* note 140 at 89.

198 Narang, *supra* note 18 at 573.

199 *Nieves, supra* note 15 at 45.

NJ judiciary.[200] It is also part of standard medical education,[201] as well as recognized by the courts.[202]

Thus, in an article entitled "Diagnostic Sleuthing" in the peer-reviewed and authoritative medical journal, The New England Journal of Medicine, the editors wrote that teaching differential diagnosis:

> continues to be an essential resource for today's learners, educators and seasoned clinicians, alike. While the science underpinning medical care has evolved, the essential required skills for the expert physician decision-making remain: to generate and hone an appropriate differential diagnosis, choose diagnostic tests wisely, and prescribe treatments judiciously.[203] [emphasis added].

In SBS, the diagnosis is made on the presentation of a previously healthy child who suddenly manifests a constellation of objective signs called a syndrome – e.g., skull fracture, hematoma, and hemorrhage. The differential diagnosis considers these presentations both individually and collectively: a moribund child – suddenly in a state mimicking pathology caused by trauma, internal and/or external. As SBS occurs when the

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200 See Narang, *supra* note 18 at 572-573; See also *In re Paoli RR Yard PCB Litig*, 35 F (3d) 717 at 759 (3rd Cir 1994); See also *Milward*, *supra* note 98 at 475-476; A causal reason "is a function of the anatomical, physiological and biochemical mechanisms that operate normally in the human body and the pathophysiologic behavior of these mechanisms in disease." Jerome P Kassirer & Richard I Kopelman, *Learning Clinical Reasoning* (Williams & Wilkins, 1991) at 28; Physicians "are accustomed to use any reliable data to assess causality, no matter what their source. . . . " see Jerome Kassirer & Joe Cecil, "Inconsistency in evidentiary standards for medical testimony: disorder in the courts" (2002) 22:11 JAMA 1382 at 1383; see also *Westberry v Gislaved Gummi AB,* 178 F (3d) 257 at 263 (4th Cir 1999), noting ("a *reliable* differential diagnosis provides a valid foundation for an expert opinion.") [emphasis added]; See also *Clausen v MV New Carissa*, 339 F (3d) 1049 at 1057 (9th Cir 2003), noting ("federal courts, generally speaking, have recognized that a *properly conducted* differential diagnosis is admissible under Daubert.") [emphasis added].

201 See NEJM, "Celebrating 100 Years of Diagnostic Sleuthing" (23 December 2023), online: <www.nejm.org/browse/nejm-article-type/case-records-of-the-massachusetts-general-hospital>.

202 In the RoundUp case of *McNickle v Huntsman*, [2024] FCA 807 [*McNickle*], Judge Lee uses etiology to mean causation, noting at para 104 "[t]he *first* step in assessing the epidemiological evidence and whether it indicates an etiologic relationship (that is, a causal relationship) between exposure to glyphosate and/or GBFs and development of NHL in humans is to identify the relevant peer-reviewed literature."

203 NEJM, *supra* note 201, noting: "While the science underpinning medical care has evolved [since 1923[, the essential, required skills for expert physician decision-making remain: to generate and hone an appropriate **differential diagnosis**, choose diagnostic tests wisely, and prescribe treatments judiciously." [emphasis added; See also Martin M Monti et al, "Willful Modulation of Brain Activity in Disorders of Consciousness" (2010) 362:7 New Eng J Med 579 at 588-589.

vulnerable baby-brain crashes against the bony skull via a rapid acceleration of multiple forces and stressors,[204] based on the pathophysiological response the body exhibits when subjected to *repetitive* stress injury and/or internal trauma or concussion,[205] after excluding other causes, the doctor can reliably conclude that before the incident someone subjected the child to sudden shaking/trauma.

After providing appropriate physical care, the physician can then intervene to prevent further injury by assisting in removing the child from that environment, rather than sending the child to the very locus where the incident arose in the first place, which, at least one study has verified, resulted in repeat injuries in almost 30% of cases studies, some of which could have been prevented.[206]

Even NJ courts law disagree with *Nieves*. In *Creanga v Jardal*,[207] New Jersey's highest court ruled that "an expert opinion derived from a differential diagnosis is admissible under the New Jersey Rules of Evidence,"[208] noting too, that "at the federal level the use of differential diagnosis has been broadly accepted. ... [and] is a technique that has widespread acceptance in the medical community, has been subject to peer review, and does not frequently lead to incorrect results."[209]

The situation in *Creanga* is analogous to SBS. There, the previously healthy patient suddenly went into premature labour. The expert employed the same differential diagnostic technique to determine the "causal link between defendant's allegedly negligent conduct and the plaintiff's injury."[210]

Indeed, the court in *Creanga* noted: "An expert need not conduct every possible test to rule out all possible causes of a patient's [injury] so long as he or she employed sufficient diagnostic techniques to have good grounds

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204 See Part V, *below*, for additional medical information.

205 External trauma, such as that producing chronic traumatic encephalopathy, produces a different constellation of signs and symptoms. See Mayo Clinic, "Traumatic brain injury" (last visited 30 June 2025), online: <www.mayoclinic.org/diseases-conditions/traumatic-brain-injury/symptoms-causes/syc-20378557> [perma.cc/GBR3-8JN].

206 See Jenny et al, *supra* note 90 at 624, illustrating the importance of severing the child from the conditions causing the condition, noting "27.8% [of children] were reinjured after the missed diagnosis, and 4 of 5 deaths might have been prevented."

207 *Creanga*, *supra* note 142 at 349.

208 *Ibid*.

209 *Ibid* at 357.

210 *Ibid* at 354.

for his or her conclusion."[211] While the *Nieves* court pays obeisance to *Creanga*, it rejects its applicability because the defendant's experts suggest another possible cause, BESS (which is criticized by mainstream doctors).[212] That an alternative diagnosis exists does not negate the testimony of the State's expert, who also happened to be the examining physician.

> The purpose of differential diagnosis is that it allows experts to make conclusions on medical causation in circumstances where they do not have all the necessary facts to prove a single hypothesis. A differential diagnosis does not prove one hypothesis, but rather it allows the expert to use the facts at hand to disprove all other hypotheses.[213]

Further, the temporal proximity between incident and injury supports a causally related diagnosis, echoed by *Creanga*. Thus, when an initially healthy child suddenly presents with a constellation of objective signs, "consideration of temporality is proper in this manner."[214] Interestingly, the *Creanga* court allowed the medical expert to testify regarding whether forces involved in an auto accident were sufficient to cause the injuries. No biomechanical proof was adduced, nor was any sought to prove the causal nexus between forces from trauma and injury. The physician's diagnosis was accepted without experimental evidence of the precise quantum of force needed to ratify the causal connection between the condition and the auto accident.

C. Lawyers Sound In

Perhaps the most damning attempt at undermining differential diagnosis comes from a (non-peer reviewed) law review [hereinafter Findley et al.],[215] written by lawyers active in defending the accused in SBS cases, joined by two physicians who have been defense experts in these cases.[216]

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211 *Ibid* at 356.

212 See Narang, *supra* note 18 at 574.

213 *Creanga*, *supra* note 142 at 361, disproving hypotheses is analogous to Popper's definition of falsifiability, which some equate as the *sine qua non* underlying *Daubert*.

214 *Ibid* at 359.

215 Findley et al, *supra* note 67.

216 One is a radiologist whose expertise is breast cancer imaging: Julie Mack, MD, Cancer Institute, Breast Cancer Team. See "Researcher Profile" (last visited 2 July 2025), online: <cancer.psu.edu/researchers/individual/-/researcher/5B6500F63DE638DBE0540010E056499A/julie-mack-md> [perma.cc/J3PG-B2WX].

As with the *Papetti* article (relied on as evidence in chief by the *Nieves* court and discussed in Part IV),[217] the Findley law review begins with an apologetic explanation as to why it is not published in a peer-reviewed medical journal,[218] while admitting the "methodological challenges" presented in biomechanical research.[219] The article provides a host of purportedly negative studies – which does not prove anything, and hence are legally worthless.[220] Findley argues that the mechanism for establishing the diagnosis has not yet been proven; however, this is not a legal infirmity for introducing testimony as to the validity of the diagnosis:[221]

> [N]ot knowing the mechanism whereby a particular agent causes a particular effect is not always fatal to a plaintiff's claim. Causation can be proved even where we do not know precisely how the damage occurred if there is sufficiently compelling proof that the agent must have caused the damage somehow.[222]

1. Unsound evidence: Etiology as Expertise

Findley et al. try to distinguish the breadth of testimony allowed in SBS from other cases. First, they claim that physicians are incapable or not tutored in determining causation, which they call etiology, and which they assert, without support, is outside the physician's ken,[223] falsely claiming:

> [T]he use of the term "diagnosis" is wrong, for these cases do not involve a medical diagnosis in the true sense.[224] Rather, they involve a causation inquiry that goes

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217 Randy Papetti, Paige Kaneb & Lindsay Herf, "Outside the Echo Chamber: A Response to the 'Consensus Statement on Abusive Head Trauma in Infants and Young Children" (2019) 59:2 Santa Clara L Rev 299.

218 Whether this conflict of interest would preclude publishing in a medical journal is not known; however, the requirement of disclosure, including financial interests, would be required and might pre-empt publication.

219 Findley et al, *supra* note 67 at 1220-21.

220 The basis for the Popper argument relied on in the Daubert case is based on logical positivistic reasoning, the foundation for Daubert, which claims you cannot prove a negative- ever. See Billauer, "Causal Conundrum", *supra* note 98 at 83; see also Haack, *supra* note 189.

221 Daubert, *supra* note 63 at para 13.

222 *Ibid* at para 3; See also *In re Asbestos Litig*, 911 A (2d) 1176 at 1201; See also *Minner, supra* note 135 at 842; See also *Zantac* 2024, *supra* note 38 at 11.

223 The Federal Judicial Manual on Scientific Evidence tries to reserve "causation" to the legal profession and limit the medical profession etiology. "Contrary to the legal consensus, however, [epidemiologist] Armenian tells us that doctors do use the word causation - and do so "to refer to the reason a specific patient succumbed to a particular illness." Billauer, "Causal Conundrum", *supra* note 98 at 78.

224 Findley et al, *supra* note 67 at 1238.

> beyond diagnosis, and ventures into etiology—a matter that in most contexts, including these, exceeds the training and expertise of clinical physicians." [225]

This is patently incorrect. As the court in *Milward v Rustoleum* noted:

> "an opinion, by the way, does not have to conclusively prove causation to be admissible. "[M]edical knowledge," we can all agree, "is often uncertain. The human body is complex, etiology is often uncertain, and ethical concerns often prevent double-blind studies calculated to establish statistical proof." But that "does not preclude the introduction of medical expert opinion testimony when medical knowledge permits the assertion of a reasonable opinion."[226]

Further, physicians often determine the "etiology" (or cause) of a patient's condition as part of their workup. For example, regarding the causes of Multiple Sclerosis (MS), one physician noted: the prevailing view has been that MS is "an autoimmune disease of unknown etiology."[227] Now we know MS is a complication of a viral infection. Indeed, the term has been employed in medical practice for a century and a half, as demonstrated by a report on the clinical history of cholera written in in 1873: where "the second chapter is on the etiology of cholera ... consider[ing] the nature of the cause and the mode of its diffusion, and illustrate[d] ... by experiments and opinions."[228] [emphasis added].

Apparently, Findley misapprehends the terms "cause" and "etiology" as used in medicine. In clinical practice, the physician might use "cause" to refer to the proximate cause or biological disease process, as in "cause of death" and the underlying cause or origin of the disease or condition as "etiology," e.g., cause of death: "aortic aneurysm, etiology, hypertension." Thus, in response to a patient complaining of wheezing and hives, the medical chart might read: "allergic reaction; etiology unknown," because the etiology (the triggering or underlying cause) of allergic reactions (the proximate cause or biological mechanism) is notoriously hard to pin down. This does not disavow the significance of the diagnosis or the physiological underpinnings of the disease. In other cases, etiology can be determined presumptively. The cause of a patient's difficulty in breathing, for example, may be fibrosis (scarring) of the lung; the etiology, however, may not be

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225 *Ibid.*

226 *Milward*, *supra* note 98 at 480.

227 Kjetil Bjornevik, "Longitudinal analysis reveals high prevalence of Epstein-Barr virus associated with multiple sclerosis" (2022) 375:6578 Science 296, online: <10.1126/science.abj822> [perma.cc/MS2D-F4NE].

228 Ely McClellan, *Cholera in the US in 1873* (Washington: GPO, 1875) at 20, online (pdf): <www.ncbi.nlm.nih.gov/pmc/articles/PMC5144804/pdf/brforeignmcrev73234-0020.pdf> [perma.cc/35CF-UP7A].

discernable while the patient is alive. Nevertheless, the occupational health physician will diagnose asbestosis as the "etiology" or "cause" – based on nothing but history. Perhaps the objectants get bolluxed up by confusing differential diagnosis, a medical technique, with "differential etiology," a made-up legalism with no meaning in medicine.[229]

Findley next falsely claims that "determining cause (the 'etiology' of a disease) is a specialty of scientific medical research, not of practical diagnosis by practicing physicians," citing themselves and Wikipedia.[230] Baselessly asserting that "the diagnosis is not directly concerned with the cause of a disease or condition,"[231] they provide a flawed example:

> "Pneumonia provides another useful example… Regardless of cause, the treatment would be [the same] for the illness— typically a broad-spectrum antibiotic…But the particular etiology of that pneumonia need not be identified to treat the patient (and few physicians would claim to be able to "diagnose" how a particular pneumonia developed in any one patient)."[232]

This is patently erroneous. Determining the cause of the condition is crucial to determine the appropriate treatment, i.e., identifying the etiology as viral, or bacterial, or aspiration. Treatment by a broad-spectrum antibiotic would be malpractice if the pneumonia is viral. Certain antibiotics work for gram-positive organisms, others for gram-negative ones. Giving the wrong (or any) antibiotic without testing for the etiology (or cause, if you will) of the pneumonia or flu could well cause harm.[233]

Further, physicians do incorporate assessment of external causes in their practice of medicine. The type of testimony sought here is no different from that sought of a physician in a rape or domestic abuse case, or an

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229 Billauer, "Causal Conundrum", *supra* note 98 at 78.

230 Findley et al, *supra* note 67 at 1241.

231 *Ibid* at 1239.

232 *Ibid* at 1240.

233 See Caitlyn Stulpin, "Incorrect' initial antibiotic treatment for K. pneumonia increases patient mortality" (13 September 2023), online: <www.healio.com/news/infectious-disease/20230913/incorrect-initial-antibiotic-treatment-for-k-pneumonia-increases-patient-mortality#:~:text='Incorrect'%20initial%20antibiotic%20treatment%20for,pneumonia%20increases%20patient%20mortality;See%20also%20Antibiotic%20Use%20When%20Sick%20With%20the%20Flu%20Can%20Increase%20Risk%20of%20Developing%20Bacterial%20Pneumonia> [perma.cc/PA8L-LP8L]; See also "Study: Antibiotics Can Cause Harm to Flu Patients" (12 November 2024), online: <www.cedars-sinai.org/newsroom/study-antibiotics-can-cause-harm-to-flu-patients/#:~:text=Antibiotic%20Use%20When%20Sick%20With,out%20pathogens%20from%20the%20lungs.> [perma.cc/4BGC-R7RP].

occupational health physician making a diagnosis of say asbestosis, also a disease without a pathognomonic test, purely from history and presenting signs. Finally, expert witnesses, especially examining physicians, may give opinions as to causation under either FRCP 702/*Daubert* or *Frye*, and certainly may testify beyond direct knowledge.[234]

Errors in the Findley article proliferate. Thus, these authors claim: "To be appropriately considered in diagnosis, risk factors must have been established as being such by previous empirical research."[235] Hardly. There are a myriad diseases without known risk factors. Autism, for one; idiopathic epilepsy is another. [236] Indeed, "idiopathic" diseases are, by definition, diseases without known causes.[237]

2. Querulous Arguments and Abuse of Abuse

Findley also proclaims without supporting evidence or citations, that "under Frye, because all knowledgeable physicians recognize that 'diagnosing' [child] abuse involves clinical judgment, and is not testable by any definitive test, any claim to definitiveness of the 'diagnosis' cannot be said to achieve 'general acceptance' in the medical community."[238] [emphasis added].

This, too, is patently incorrect. The general consensus is that the diagnosis involves clinical judgment, and that is what physicians do. While medicine relies to a greater extent on judgment, other sciences, even the hard sciences such as physics, "the science with the reputation for seeking 'ultimate truth,'"[239] also rely on judgment. In the words of Lisë Meitner, the physicist who discovered nuclear fission: "The controversy [regarding the

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234 See *Milward*, *supra* note 98 at 472.

235 Findley et al, *supra* note 67 at 1239.

236 Steven C Schachter, "Nutritional Deficiencies as a Seizure Trigger" (last visited 2 July 2025), online: <www.epilepsy.com/what-is-epilepsy/seizure-triggers/nutritional-deficiencies#:~:text=The%20only%20vitamin%20deficiency%20known,IV%20while%20recording%20the%20EEG> [perma.cc/U8HE-CJBQ].

237 Seema A Tirlapur et al, "How do we define the term idiopathic" (2013) 25:6 Current Opinion Obstetrics Gynecology 468, online: <pubmed.ncbi.nlm.nih.gov/24121599/> [perma.cc/3CPW-79N5].

238 Findley et al, *supra* note 67 at 1258.

239 Ruth Lewin Sime, *Lise Meitner: A Life in Physics,* 1st ed (University of California Press, 1997) at 17.

movement of atoms] made plain to students [is] that scientific endeavor is not coldly objective but relies on human judgment."[240]

3. Hoist By their Own Legal Petard

To demonstrate their claim that scientific evidence does not support SBS, Findley cites cases where the conviction was overturned or a new trial ordered. While indeed many such cases do exist, they pointedly refer to *People v Bailey*, an SBS case against caregiver Renee Bailey:[241]

> In Rochester, New York, ... a court held a postconviction hearing ... at which it heard, the four experts who had testified at trial ... [and] an additional thirteen experts—eight for the defense and five for the prosecution. At the conclusion.... the court granted a new trial [because testimony of the state's experts] were either demonstrably wrong or are now subject to new debate. The trial court's decision was affirmed on appeal. Full disclosure: One of us (Findley) was co-counsel for the defendant, Rene Bailey, in that case, and two of us (Barnes and Mack) were expert witnesses for the defense in the postconviction proceedings.[242]

Here's what really happened on the eve of the new trial (June 2017) – stunningly not included in the Findley article:[243]

> In a stunning turnaround, René Bailey, whose 2001 shaken-baby murder conviction was overturned in a landmark legal decision, accepted legal responsibility Monday for the death of the toddler for whom she had been caring.[244]

Indeed, the appellate court rejected the opinion of the "Medical experts [who] testified at the first trial that the 23-pound toddler suffered injuries equal to being shaken violently ten to 20 times. They said the injuries could

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240 *Ibid.* See also Caudill, *supra* note 94 at 1033, "[d]iscerning what is true in a scientific field or domain involves making scientific judgments within that domain, and there are many such domains, each with their own specialist techniques, methods and language."

241 Findley et al, *supra* note 67 at 1235, discussing the case of *People v Bailey*, 144 AD (3d) 1562 (NY App Div 2016).

242 *Ibid.*

243 The matter was apparently not reported in Lexis/Nexis, and hence not discoverable by a routine legal search. However, a protracted search revealed it was covered in the regular media which would not ordinarily surface, although the outcome was known by Findley and not revealed.

244 Steve Orr, "Shaken-baby defendant, freed but facing retrial, pleads guilty to assault", *Democrat & Chronicle* (26 June 2017), online: <www.democratandchronicle.com/story/news/2017/06/26/shaken-baby-defendant-freed-but-facing-retrial-pleads-guilty-assault/428043001/> [perma.cc/DJ9T-NBQD].

only have been caused by Bailey."[245] However, right before the new trial was to begin, Bailey pleaded guilty to first degree assault. "In so doing, she agreed that the government would be able to prove that she had caused the injuries that led to the 2001 death of 2½-year-old Brittany Sheets."[246] She was sentenced to 12 and a half years in jail.

Similarly, Findley and colleagues rely on *Clark v Mississippi*,[247] asserting that "[j]ust as this article was going to print, the en banc Court of Appeals of the State of Mississippi [held that] ... it was error to admit the opinion of a pediatrician purporting to 'diagnose' SBS. In the course of its ruling, the Court observed that the record included 'evidence that showed the reliability of SBS as a diagnosis is being increasingly challenged and questioned."

That decision was reversed by the Mississippi Supreme Court.[248]

4. Shaking Causes Death in Humans:

One anatomically proven example of the effects of shaking has been reported in torture investigations, where injuries similar to those seen in shaken baby syndrome have been documented. "Shaking is when "[t]he interrogator grabs the interogee, ... and shakes him violently, so that and his head is thrown backward and forward."[249] At least one victim died "as result of brain damage caused by violent shaking during interrogation."[250]

> Autopsy and police investigation reports confirm that [the interrogee]... died as a result of a brain hemorrhage caused by being violently shaken in detention. There were no injuries to the neck, face or scalp and there was no fracture of the skull nor of the facial bones." The reports and autopsy findings depict the hypothesized

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245 "Rene Bailey sentenced for child's 2001 death", *WHAM* (31 August 2017), online: <13wham.com/news/local/rene-bailey-sentenced-to-12-and-a-half-years-in-prison> [perma.cc/4XQG-S3G3].

246 Orr, *supra* note 244.

247 Findley et al, *supra* note 67 at 1236, discussing *Clark v State*, 263 So (3d) 880 (Miss App 2019).

248 See *Clark v State,* 315 So (3d) 987 (Miss 2021).

249 *Public Committee Against Torture v Israel*, HCJ 5100/94 at 6-8.

250 Amnesty International Report 1995, "Israel and the Occupied Territories: Death by shaking: the case of 'Abd al-Samad Harizat" (30 September 1995), online: <www.amnesty.org/en/documents/mde15/023/1995/en/> [perma.cc/8ATA-RR2Q]; See also Melissa L Clark, "Israel's High Court of Justice Ruling on the General Security Service Use of 'Moderate Physical Pressure': An End to the Sanctioned Use of Torture?" (2000) 11:1 Ind Intl & Comp L Rev 145 at 154.

> mechanism raised in SBS and justify a conclusion that if shaking can produce brain damage and death in an adult, it can surely have that affect in babies.[251]

D. When Consensus is Challenged, Daubert has answers

While it should be apparent that the State's expert testimony must be admitted under *Frye*, the issue now turns to whether the defense testimony may be admitted to impeach the credibility of the State's witnesses. Several courts in recent years have allowed this, believing this "new" or "novel" science upends previous medical consensus.[252]

Under *Frye,* the defense expert's testimony must fail admissibility – there being no consensus holding that SBS is not a reliable (and valid) diagnosis upon a thorough differential diagnostic analysis. Nevertheless, even under the more lenient *Daubert* standard, the evidence proffered by the defense falls short of demonstrating that the requisite level of reasoning or methodology contesting SBS's existence is scientifically valid and properly can be applied to the facts in issue.

The Advisory Committee to the 2000 amendment of F.R.E. 702 noted that "many factors will bear on the inquiry, and we do not presume to set out a definitive checklist or test."[253] Other factors, they note which courts have found "relevant in determining whether expert testimony is sufficiently reliable to be considered by the trier of fact," include whether the expert:

> (1) is "proposing to testify about matters growing naturally and directly out of research they have conducted independent of the litigation, or whether they have developed their opinions expressly for purposes of testifying."
> (2) has unjustifiably extrapolated from an accepted premise to an unfounded conclusion.
> (3) has adequately accounted for obvious alternative explanations.
> (4) "is being as careful as he would be in his regular professional work outside his paid litigation consulting."
> (5) Whether "the field of expertise claimed by the expert is known to reach reliable results for the type of opinion the expert would give."[254]

Before analyzing infirmities in the defense testimony according to these factors, a more detailed understanding of the field of biomechanics and SBS pathophysiology is in order and provided in Sections A and B of the following part. We will return to above caveats after taking a deeper dive

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251 Amnesty International Report 1995, *supra* note 250.

252 As concluded in *Warren, supra* note 133.

253 Caudill, *supra* note 94 at 1070.

254 *Ibid.*

into the defense evidence and testimony adduced to dismantle the SBS diagnosis in Section C.

IV. BIOMECHANICS AND MEDICAL ERRORS

A. Biomechanics is the Novel Field Requiring a Frye Analysis

Biomechanics is a comparatively new field, formally founded in 1934.[255] The American Society of Biomechanics was founded in 1977,[256] and formalized research on forces involved in impact injuries didn't begin until the 1970s.[257] The field is still in its infancy: as of 2023, there is still no generally acceptable theory even as to whether running injuries are caused by impact.[258]

A biomechanics expert[259] is characterized as "a scientist who is half-anatomist and half-engineer, and who seeks to improve the fit between man and machine."[260] The description is important in understanding the limitations of experts testifying on SBS. They do so from a mechanical perspective, augmented by an understanding of human anatomy. As will be discussed, concussion injuries involve much more than anatomy, requiring knowledge of hematology, physiology, neurology, and immunology – in short, subjects that medical doctors study in school and receive advanced training in during internship and residency, including the assessment of dynamic and changing injuries and disease processes.

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255 Marvin A Fishman, "Child neurology: past, present, future" (1996) 11:4 J Child Neurology 331 at 332.

256 American Society of Biomechanics, "History" (last visited 2 July 2025), online: <asbweb.org/history/> [perma.cc/5EBX-Q47N]. Their teaching repository signals nothing involving Shaken Baby Syndrome, "Sortable and Searchable Teaching Repository" (last visited 2 July 2025), online: <docs.google.com/spreadsheets/d/1Hs-t_Yk3M8ABvu4ZF_BhmxW-3a3DPlYM7kDCbKAL2PQ/edit?gid=0#gid=0> [perma.cc/2R53-865T].

257 Allison H Gruber, "The 'impacts cause injury' hypothesis: Running in circles or making new strides?" (2023) 156 J Biomechanics at 1.

258 *Ibid.*

259 Like Erwin Tichauer, a pioneering professor and practitioner, my master's thesis advisor.

260 "Environment: Building a Better Mouse Trap" *Time* (2 May 1969), online: <content.time.com/time/subscriber/article/0,33009,900817-1,00.html> [perma.cc/DS4V-F39].

The use of experts in biomechanics has been recognized both in the US and in Canada, although some Canadian courts have noted frisson between the fields, being skeptical that consensus between biomechanics and medicine would be possible.[261]

Within biomechanics, head injury has been studied beginning in the 1990s in a sub-field called "traumatic brain injury" or TBI- biomechanics.[262] "TBI is the consequence of the spatiotemporal pressure variations occurring inside the brain during head traumas."[263] According to the Centers for Disease Control and Prevention, the medical condition "[t]raumatic brain injury (TBI) [including SBS] is a disruption of normal brain function caused by a collision, shock, concussion, or penetrating head injury." [264] This field explores the mechanical phenomena that cause the initial cranio-cerebral lesions and thus represents the starting point for the overall understanding of TBI pathophysiology. By definition, TBI-biomechanics does not study pathophysiology of the brain trauma process.

B. Pathophysiology- The Blind Spot of Biomechanics

It must be recalled that SBS involves repeated shaking of a living human baby. The damage occurs when the soft brain bangs against the hard skull, causing an initial *coup* lesion (the trauma of the brain against the skull as it is catapulted forward). Further damage occurs when the brain ricochets backward in its hard casing, banging against the back of the skull at the opposite region of the first strike, called a *contrecoup* lesion.[265] This type of concussive trauma also occurs (usually once) in whiplash injuries.[266] A

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261 *More v Bauer Nike Hockey Inc,* 2010 BCSC 1395 at 103, noting "Biomechanics is concerned with determining the nature and direction of the forces that cause particular injuries. It is apparent that biomechanical experts must work closely with medical experts who diagnose specific injuries. The two fields of expertise, medical and biomechanics, bring different but important perspectives to bear .... I would not expect an expert in either field to entirely defer to one or the other...."

262 C Obreja, "Biomechanics of Brain Injury" (last visited 2 July 2025), online: <www.neuroskills.com/brain-injury-overview/#:~:text=TBI%20biomechanics%20explores%20the%20mechanical,the%20brain%20during%20head%20traumas> [perma.cc/FJ49-MKPJ].

263 *Ibid.*

264 Yana Naumenko et al, "Mild traumatic brain injury as a pathological process" (2023) 9:7 Heliyon at 1.

265 *Ibid.* See also William N Payne, Orlando De Jesus & Andrew N Payne, *Contrecoup Brain Injury* (Treasure Island, FL: StatsPearls Publishing, 2025),

266 *Ibid,* noting: "Contrecoup lesions arise from forces within the intracranial cavity, which

contrecoup lesion called "Second impact syndrome"[267] can produce lethal injury. This occurs when the "second head impact is sustained during a 'vulnerable period' before the complete symptomatic resolution of the initial impact, leading to profound engorgement, massive edema, and increased intracranial pressure within minutes of the impact, resulting in brain herniation, followed by coma and death."[268] "Second impact syndrome has a morbidity rate of 100% and a mortality rate of 50%."[269]

In SBS, these impacts occur repeatedly, damaging the brain and surrounding blood vessels and nerves. The impacts occur from multi-directional forces inflicted by shaking: forward and backward (linear),[270] both acceleration and deceleration, rotational,[271] and stereotactic. This reflects the motion of the head as it is thrust forward or moves sideways.[272]. The extent of the movement[273] is dependent on the size of the brain vis-à-vis the skull.[274] "[T]he stereotactical phenomena explain why the cerebral contrecoup lesions (CCL) are often more important than the direct lesions (DL)."[275] The damage presents as intracerebral hemorrhage or contusions noted on computed tomographic (CT) scan or magnetic resonance imaging (MRI). The internal trauma occasioned by shaking does not stop when the

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are not directly related to the site of the focal blow, but instead related to stress on the brain and its structure caused by the force of the blow on an already moving head. After the head receives an impact, the floating brain rebounds in the opposite direction."

267 Paul McCrory, Gavin Davis & Michael Makdissi, "Second impact syndrome or cerebral swelling after sporting head injury" (2012) 11:1 Current Sports Med Rep at 21.

268 Robert A Laskowski, Jennifer A Creed & Ramesh Raghupathi, *Brain Neurotrauma: Molecular, Neuropsychological, and Rehabilitation Aspects* (Boca Raton, FL: CRC Press) at s 4(1).

269 *Ibid.*

270 Obreja, *supra* note 262, noting "[t]he linear acceleration theory was first evoked about one century ago. Relative movements and secondary impacts occur between the skull and the brain during a head impact. The pressure increases in the superficial cerebral structures below the impact zone, proportionally to the head linear acceleration (4). This theory explains the superficial cerebral lesions' occurrence."

271 Prange et al, "Anthropomorphic Simulations of Falls, Shakes & Inflicted Impacts on Infants" (2003) 99:1 J Neurosurgery 143 at 146.

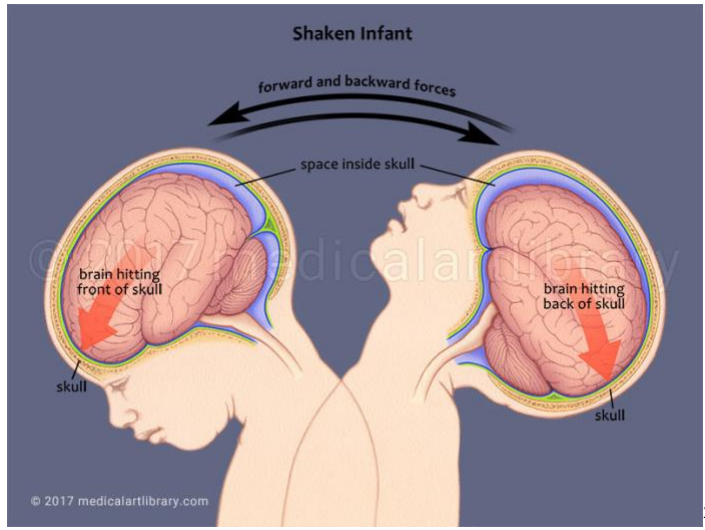
272 *Ibid.*

273 David F Meaney, Barclay Morrison & Cameron Dale Bass, "The Mechanics of Traumatic Brain Injury: A Review of What We Know and What We Need to Know for Reducing Its Societal Burden" (2014) 136:2 J Biomech Eng at 4.

274 *Ibid.*

275 *Ibid.*

shaking is over. The vibrational impact occasioned by the forces continues.[276]



[277]

The result is vigorous movements of the various intracranial compartments relative to one another, e.g., vibrations between the skull and dura on the one hand and the cerebral surface on the other. The overwhelming majority of investigators agree that the resulting shear forces

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[276] *Ibid*, noting "[t]he physical properties of the brain tissue within the cranial vault are critical. Well-developed MRI technology [can] demonstrate… the striking distances the brain can move under a simple, repeated rotation in the horizontal plane." See also Sebastian Glowinski & Alina Glowinska, "Unveiling the abusive head trauma and Shaken Baby Syndrome: A comprehensive wavelet analysis" (2025) 107 Biomedical Signal Processing & Control, online: <doi.org/10.1016/j.bspc.2025.107862> [perma.cc/XTG4-RYBF], noting that "during vigorous shaking the instantaneous center of rotation of the head shifts, influencing the associated dynamic parameters," and resulting in dynamic energy transfer between anatomical parts, thus rendering current biomechanical surrogate models suspect. Further, the authors note the limitations of the dummy model as incapable of modeling physiological parameters, emphasizing the natural frequency of the brain as a determinant of harm.

[277] See Medical Art Library, "Human Body Diagrams Index" (2017), online: <medicalartlibrary.com/shaken-baby/> [perma.cc/5W8S-Y9GP], noting "[d]uring shaking, rapid acceleration-deceleration forces can cause the brain to strike the inner surface of the skull, resulting in bruising, swelling and diffuse axonal (nerve cell) damage. Blood vessels can tear forming a subdural hematoma. A classic finding of SBS is retinal bleeding in the back of the eye, seen during examination."

are responsible for subdural hemorrhages and diffuse brain damage. Simple shaking without impact suffices to produce the full picture of SBS with or without fatal outcome.[278]

While we still face challenges in merging the mechanical response with human pathophysiological response, this gap does not preclude diagnosing SBS.[279] Knowledge derived from related concussive conditions, including those for which no clear measure of force required to cause injury have been identified, such as chronic traumatic encephalopathy (CTE),[280] produced by repetitive concussions in contact sports, provides additional insights.

C. The (Defense) Biomechanics Experts Do Not Pass Evidentiary Muster

The studies relied on by the defense experts assess single force insults – either linear or rotational.[281] The doll/dummy studies do not assess internal (i.e., brain) injuries at all! And here is where biomechanics fails. In *Nieves*, the defense brought 13 amicus experts, primarily with expertise in biomechanics – relying on unreliable (meaning inconsistent, even among themselves) research and invalid experimental studies using dolls or lambs to assess the initial loading force (the motion of the head being thrust forward) on a single occasion. However, it is not head damage or forces to which the head is subjected per se that results in SBS – it is sequelae or consequence of damage to the brain and surrounding structures that occurs

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278 Sebastian Glowinski et al, "Trauma in a shaken infant? A case study" (2021) 56 Aggression & Violent Behaviour at 1, 5; Jakob Matschke et al, "Shaken Baby Syndrome: A Common Variant of Non-Accidental Head Injury in Infants" 106:13 Deutsches Arzteblatt Intl 211 at 213, online: <pmc.ncbi.nlm.nih.gov/articles/PMC2680569/> [perma.cc/BRW3-88JU]; See also Obreja, *supra* note 262; See also Meaney et al, *supra* note 273, noting: "knowing the accurate size and shape of the brain, the brain deformation, and the brain movement relative to the skull during an exposure is a critical factor in developing an ability to … predict when injuries will occur."

279 Obreja, *supra* note 262.

280 Adina Wise, "Contact sports cause CTE. So why are Americans watching more football than ever?" *StatNews* (9 February 2024), online: <www.statnews.com/2024/02/09/cte-super-bowl-chiefs-49ers-chronic-traumatic-encephalopathy/?_hsmi=293523073> [perma.cc/B22S-Z4W4].

281 The Ad Hoc Committee on Shaken Baby Syndrome of the National Association of Medical Examiners explained that the brain swelling and encephalopathy (brain dysfunction) seen in many serious SBS/AHT cases reflects "shearing injury or traumatic diffuse axonal injury [DAI]." M E Case, "Position paper on fatal abusive head injuries in infants and young children" (2001) 22:2 Am J Forensic Med Pathol 112, online: <journals.lww.com/amjforensicmedicine/fulltext/2001/06000/position_paper_on_fatal_abusive_head_injuries_in.2.aspx>.

as the brain repeatedly bangs against the skull. Those are injuries biomechanics cannot study and hence should be precluded from testifying about.

In *Nieves*, several articles are relied on by the defense to support the negation of proof that shaking can cause SBS.[282] Given that no scientific consensus supports the defense claim, the defense argument fails under Frye outright and should not be considered by the court or even admitted for cross-examination purposes, I will turn to the more lenient Daubert to assess whether the defense evidence passes muster even under that standard.

The defense in *Nieves* presented three experts: two medical doctors and a biomechanics expert, Dr. Chris Alan Van Ee.[283] In support of his testimony, Van Ee cited various studies, often misrepresenting their findings. His version is summarily accepted by the Court without further inquiry (or review), which I will review here for the most egregious findings.

The first study belongs to Prange et al.,[284] which examined the impact of a single unidirectional force using a rudimentary "doll" or dummy, representing the average one-and-half-month-old baby. Later studies (referenced in the opinion) found this mock-up was inaccurate (and hence unreliable). Using an average "baby" (aka doll) gives no data about the impact on small, pre-mature, or weak human children, and hence are not generalizable to those children most often brought to the ER with injuries consistent with SBS.

The model was designed to measure the impact of a single external force on the skull, not damage to the brain, using a doll's plastic head as a surrogate. There were no brain, spinal cord, vasculature, nerves or eyes in the mock-up. Even the author had reservations about the study's reliability or relevance,[285] noting, for starters, that "the differential in neck conformity

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282 The studies adduced by the defense, however, routinely measure the force generated by only linear or rotational acceleration.

283 Who also testified in the Lemon case.

284 Prange, *supra* note 271.

285 *Ibid* at 143-144, noting "the mechanical responses experienced by the head and injury tolerances associated with shaking... have not been established... [and] tissue thresholds specific to the infant would be required to predict injury on the basis of local intracranial stresses or strains produced by the rapid rotations. Such thresholds are currently unavailable for the pediatric population....In lieu of this information we used a more qualitative approach to determine injuries likely to occur during simulated events. Specifically... we compared accelerations and changes in velocity with injuries documented from cadaver and animals... "

might affect the results.[286] The limitations rendered by the authors ("the results of the dummy tests cannot be used to predict whether such rotations are sufficient to cause injury")[287] per se invalidate testimony relying on it, either under *Frye* or *Daubert*,[288] as the study does not examine the internal impact of repeated shaking in a live baby but rather the external force of a single thrust in a plastic doll.

While conceding "that does not mean that shaking is a good thing. It is horrible. It is abuse,"[289] defense expert Van Ee opines via ipse dixit a *Daubert* and *Joiner* rejectable Popperian negative: that data establishes that violent shaking produces forces below the threshold where medical experts would expect a 6-month[290] to 1-year-old baby to suffer a head injury.[291]

The opinion of defense expert Van Ee requires a double extrapolation: first, data is extrapolated to correlate doll/dummy to human data, and second, to correlate external forces to internal ones using animal or unvalidated human cadaver studies. Even Van Ee concedes that "biomechanical tests did not actually measure injury [but] ... instead measured ... acceleration [forces], which could then be compared to 'injury reference values' to make 'meaningful inferences.'"[292]

Notwithstanding, Van Ee cites Carole A. Jenny et al.[293] in support of his position. The court notes that per Van Ee, "Jenny's later study suggested that "the biomechanical data did not support the clinical thinking about SBS/AHT." Nothing could be farther from the truth. Jenny takes great pains to illustrate how brain injury could occur in infants from shaking,

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286 *Ibid* at 271, where Prange admits "the biofidelity of the surrogate has not been established".

287 *Ibid*.

288 See *McNickle*, *supra* note 202.

289 Cain Madden, "Testimony about shaken baby syndrome in Havard hearing continues" *Natchez The Democrat* (16 August 2017), online: <www.natchezdemocrat.com/2017/08/16/testimony-about-shaken-baby-syndrome-in-havard-hearing-continues/> [perma.cc/DK24-3YBV].

290 *Ibid.* In the companion case to *Nieves*, *State of New Jersey v Cifelli*, A-2936-21, which reached the same untoward end as Nieves, the infant involved was ten weeks old.

291 *Nieves, supra* note 15 at 29-30. His *ipse dixit* is a violation of *Joiner*: "[a]s explained by Van Ee, Prange concluded "we still don't have any data that says shaking can give rise to the injuries associated with it" and that "the term shaking should not be used in legal settings" because "there's not a scientific basis from *biomechanics* to support this idea." [emphasis added.]

292 *Ibid* at 33.

293 See Carole A Jenny et al, "Biomechanical Response of the Infant Head to Shaking: An Experimental Investigation" (2017) 34:8 J Neurotrauma 1579.

admitting that any biomechanical study would be unreliable (and hence inadmissible), and producing several biological mechanisms to explain how injuries found in SBS could be produced from shaking.[294] Further, she disavows the doll studies used to disprove SBS: noting the inability of any currently available ATD [anthropomorphic test device] to represent the biomechanical characteristics of an infant with complete accuracy."[295] Finally, she concludes, the influence of shaking on the infant brain and the pathophysiology of infant brain injury is more complicated than can be represented in existing surrogate models used in biomechanical shaking experiments.[296]

Nevertheless, "Van Ee testified that Jenny's outcomes show shaking did not reach the injury thresholds."[297] First, this is a patent misrepresentation. In fact, noting differences in baby brains and increased susceptibility compared to adults, Jenny summarizes: "Taking these factors into account, predictions of risk based on comparison with published brain injury thresholds are not likely to be reliable given the limitations inherent in these thresholds."[298] [emphasis added].

> Such studies can only (imprecisely) measure external forces of impact on the static and external skull (of an inanimate object), without considering the dynamic and internal responses generated by ensuing and cascading physiological mechanisms, such as a hematological, neurological, metabolic, or immunological cascades, where "mechanically induced brain injury initiates ionic, metabolic, inflammatory, and neurovascular changes in the CNS [Central Nervous System, and] ... can lead to acute, subacute, and chronic neurological consequences.[299] (See appendix depicting the cascade effect of vascular injury).

Further, we must recognize no-threshold diseases, where a minute amount of exposure can cause grievous harm. For example, there is no threshold

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294 D R Wolfson et al, "Rigid-body modelling of shaken baby syndrome" (2005) 219:1 J Engineering in Medicine 63 at 63, 65.

295 *Ibid.*

296 J W Finnie et al, "Neuropathological changes in a lamb model of non-accidental head injury (the shaken baby syndrome" (2012) 19 J Clinical Neuroscience 1159 at 1159 [Finnie et al, "Neuropathological changes"], where Finnie, too, acknowledges that " [t]here is currently no satisfactory biomechanical model in which to investigate the pathogenesis of [SBS]".

297 *Nieves, supra* note 15.

298 *Ibid.*

299 Naumenko et al, *supra* note 26 at 1; See also Mark S Dias, "The Case for Shaking", in *Child Abuse and Neglect, Diagnosis, Treatment and Evidence* at 368; Neil Stoodley, "Non-Accidental Head Injury in Children: Gathering the Evidence" (2022) 360 The Lancet 271 at 271-2.

exposure for anaphylaxis due to allergy, epilepsy, or pin-prick hematoma (see appendix), either. That does not invalidate the diagnosis for tiny exposures which are not usually noxious to a "normal" individual. Indeed, in SBS, we may well have the "eggshell" plaintiff come to life.[300]

As doll-dummy studies are demonstrably invalid, the defense turns to animal studies, relying on John W. Finnie,[301] a veterinarian.[302] Finnie studied lambs, claiming they sufficiently resemble human babies[303] (although they are not the validated surrogate of choice).[304] Nevertheless, out of nine lambs studied, after multiple shakings – three died!!

> "Although it is debated whether shaking alone can generate impact loading sufficient to cause brain damage consistent with NAHI [non-accidental head injury] or whether an additional head impact is required, our finding that shaking alone resulted in death in a subset of younger lambs is evidence that a head impact is not always needed."[305] [emphasis added].

This result – ignored by the court – corroborates the premise that shaking alone can cause fatal consequences. Not surprisingly, and mimicking SBS findings in children born with low body weights, the three lambs which died were those with the lowest body weights. Most notably, Finnie postulates

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300 *Vosburg v Putney*, 80 Wis 523 (1891).

301 Finnie et al, "Neuropathological changes", *supra* note 296.

302 See "Researcher Profiles: Associate Professor John Finnie" (last visited 3 July 2025), online: <researchers.adelaide.edu.au/profile/john.finnie> [perma.cc/3BL7-S32S].

303 Finnie et al, "Neuropathological changes", *supra* note 296 at 1164; also at 1163 noting "the lamb nevertheless resembles a human infant in important respects in the present context, namely having a relatively large gyrencephalic brain and weak neck muscles supporting the head" and at 1159, noting "[e}ach lamb was shaken … 10 times of 30 seconds duration over a 30 minute period… No head impact occurred".

304 Animal models of Traumatic Brain Injury (TBI) have been developed in the ferret, cat, pig, and monkey, but the most common and developed model is the rodent. See Meaney, *supra* note 273 at 7, although animal models have not been found to be representative of all aspects of AHT: "No animal model has been able to reliably reproduce the full range of neuropathologic AHT changes… [However], one animal model demonstrated that shaking of a freely mobile head, without an additional head impact, could be lethal, and produce significant brain pathology." John W Finnie & Peter C Blumbergs, "Animal models of pediatric abusive head trauma" (2022) 38:12 Childs Nerv Syst 2317 at 2317, online: <link.springer.com/article/10.1007/s00381-022-05577-6> [perma.cc/LV4Q-XAEN]; Using an invalidated model compromises the validity of the defense/objectant studies, see Finnie et al, "Neuropathological changes", *supra* note 296.

305 Finnie et al, "Neuropathological changes", *supra* note 296 at 1164.

the effect of a contrecoup lesion[306] or reverse banging of the brain against the bony skull causing a double injury, one at the site of first impact and the other on the opposite side of the brain as it ricochets backwards. This event can damage blood vessels, leading to widespread edema (swelling) and precipitating a cascade of further injury.[307] Indeed, Finnie's necropsy demonstrates relevant physiological mechanisms such as damage to nerves and blood vessels which lead to brain swelling (edema) due to anoxia (lack of oxygen) which, in turn, could produce the signs and symptoms prevalent in SBS, signifying that the syndrome was due to cascaded or indirect effects, rather than direct trauma.

A second study by Finnie involving seven lambs[308] was astoundingly misrepresented by the court as only "showing small subdural hemorrhage" in two lambs and "minimal" retinal hemorrhage in two.[309] In actuality, that statement refers to the macroscopic damage. Contrary to the court's representation, Finnie reports that "this lamb model of the SBS showed widespread neuronal … immunoreactivity, consistent with an acute stress response."[310]

In sum, Van Ee testified that falls are a more likely cause of injury than shaking. This does not mean, of course, that shaking does not cause injury, although that is how the court interpreted it.

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306 Payne et al, *supra* note 268; See also Girish M Fatterpekar, Thomas P Naidich & Peter M Som, *The Teaching Files: Brain and Spine* (New York: Saunders, 2013) at 110; See also Dolman Law Group, "What is a coup-contrecoup brain injury" (21 June 2023), online (blog): <www.dolmanlaw.com/blog/coup-contrecoup-brain-injuries/> [perma.cc/Q3KU-X3J9].

307 Finnie et al, "Neuropathological changes", *supra* note 296 at 1164. "The observed retinal damage in shaken lambs may also have been caused by mechanical deformation from rotational/translational and acceleration/deceleration forces."

308 John W Finnie et al, "Diffuse Neuronal Perikaryal Amyloid Precursor Protein Immunoreactivity in an Ovine Model of Non-Accidental Head Injury (the Shaken Baby Syndrome)" (2010) 17:2 J Clinical Neuroscience 237 [Finnie et al, "Diffuse"].

309 *Ibid* at 239, noting "[a] small subdural haemorrhage was found in two shaken lambs, due to tearing of fragile bridging veins between the cortical surface and dural sinuses during shaking," While the extent of the injury may be small, the mechanism causing/contributing to the injury, i.e., shearing of bridging veins has been indicted as causing significant damage, to which Finnie notes the infant is predisposed due to the differential between large head, weak cervical muscles and large subarachnoid space (facilitating intracranial movement and capable of augmenting shearing and vibratory force.) "The thin, pliable infant skull also transmits impact forces more readily to deeper brain structures."

310 *Ibid.*

1. Admissibility of Defense Expert Van Ee's Study Defies Rules of Scientific Evidence

Testimony regarding Van Ee's own [non-peer-reviewed] study was also relied on by the court.[311] This apparently never-published research was admitted without any known consensus accepting it. Even under the looser Daubert doctrine, the study fails: no inquiry is made as to its methodology, which is never detailed, its reliability (error rate), which is unknown, nor the data, which is not reported.[312] Nevertheless, the court embraces an unreliable, unreported study performed by a paid expert witness.

2. Dolls are Different

In summary, the errors and unreliability of the defense studies and testimony can be summarized thusly:

1. The experimental volunteers doing the shaking are acting on command, rather than in the heat of intense emotion in response to a crying baby. [313]
2. The force examined by the negative defense studies in the doll studies is generated by a single impact, rather than cumulative forces of multiple shakings.[314]

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311 Van Ee's appearance as a defense expert is not new. As of 2013, he had already been characterized as a biomechanical "expert" frequently called by the defense. See Moreno & Holmgren, *supra* note 69 at 1409.

312 A court must "carefully scrutinize, pause, and take a hard look at the expert's methodology." See *Mirena, supra* note 98 at HN3; also at HN28, so long as an expert's analysis is reliable "at every step," ... [with] the indicia of reliability identified in Rule 702, a trial court may consider the criteria enumerated in Daubert. But "any step that renders the analysis unreliable ... renders the expert's testimony inadmissible."; See also *re Zoloft (Sertraline Hydrochloride) Products Liability Litigation*, 858 F (3d) 787 at 797 (3rd Cir 2017).

313 Nor have they considered all forces involved in producing SBS. Prange's experiment simulated five shakes by six volunteers (told to use their maximum strength, although we have no data as to the relative strength of the volunteers), evaluating the *single* "worst" force (or most severe shake) of each series. It did not evaluate cumulative trauma. It did not account for duration between shakes, nor for differences in the response of the polyurethane plastic skull versus that of a human child's. See Prange, *supra* note 274 at 145.

314 Finnie's lamb study, which did test the impact of multiple and cumulative shakings, resulted in death in one-third of the test animals. Finnie's second study resulted in brain hemorrhage or retinal damage in 4 of the 7 lambs studied. See Finnie et al, "Neuropathological changes", *supra* note 300 and Finnie et al, "Diffuse", *supra* note 311; see also Prange, *supra* note 271 at 143-144, noting "the mechanical responses experienced by the head and injury tolerances associated with shaking... have not been

3. The studies do not evaluate the effects of the frequency of shaking.
4. The studies do not evaluate the effects of shaking *duration.*[315]
5. The studies evaluate unidimensional forces, either rotational or linear, rather than combined acceleration/deceleration forces, as would ensue in the typical situation. Nor do they examine stereotactic forces relating to brain to skull cavity size, or ensuing vibrational patterns.
6. Most studies use unvalidated, inanimate doll/dummy surrogates whose innards are not examined. [316]
7. The doll studies measure force of an "average" head – not damage to the brain in a low birth weight baby, the relevant situation. [317]
8. The sole study relied on by the defense that involved repetitive shaking - was done in live lambs – and resulted in death in one-third of the lambs.[318]
9. The force evaluated is static as opposed to dynamic (from external application), hence unable to evaluate cascading

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established... [and] tissue thresholds specific to the infant would be required to predict injury on the basis of local intracranial stresses or strains produced by the rapid rotations. Such thresholds are currently unavailable for the pediatric population. In lieu of this information we used a more qualitative approach to determine injuries likely to occur during simulated events. Specifically... we compared accelerations and changes in velocity with injuries documented from cadaver and animals..."

315 "The duration of exposure to acceleration is also an important factor when attempting to predict the risk and type of brain injury... [Research shows that] accelerations and associated pulse durations ... lead... to subdural hematomas, substantial shorter pulse duration than experienced by our... shaking," suggesting that longer acceleration pulse durations permit brain tissue strains resulting from accelerations to propagate deeper into the brain leading to functional damage found in cerebral concussion or structural damage found in axonal injury." Jenny, *supra* note 293 at 9.

316 Prange, *supra* note 271.

317 *Ibid.* Not only the composite of the surrogate affects results, but the sophistication of limb movement. Jenny's surrogate neck was free to move in all three planes. Prange's "*doll hinge allows only anteroposterion flexion and extension, while the cervical spring allows for rotation of the neck in different directions.*"

318 "[F]actors, such as brain properties and geometry, must also be considered when attempting to assess brain injury risk. Further, published TBI pediatric thresholds fail to account for repetitive exposure to acceleration or deceleration that occurs in shaking, but instead only consider exposure to a single event. Repetitive TBIs in animal's models have been shown to cause greater injury at lower peak rotational velocities than do single impulse loads." Jenny, *supra* note 293 at 8.

internal effects occurring in humans.[319] (See appendix pictures of the sequential dynamic nature of vascular damages).

10. Data is extrapolated to human babies. The extrapolation is twofold:
    a. From average doll (or lamb) to average baby (not representative of the neonate born prematurely or with low birth weight) to human.
    b. Secondarily, from adult or cadaver data to infants.

In sum, the defense studies and testimony relying on them are both facially irrelevant and unreliable. The only arguably informative study (i.e. Finnie's lamb study) demonstrates that 33% of the lambs studied died soon after shaking, or that they suffered significant internal (tissue and cellular) brain and eye injury.

Turning back to the caveats divined from the didactic Daubert analysis, listed earlier, we see that even under the most lenient assessment, the defense testimony must be excluded.

D. Scientific Controversies Shaped by Legal Advocacy

1. The Papetti Review

The examining physician, pediatric abuse expert Dr. Gladibel Medina, relied on a 2018 peer-reviewed "Consensus Statement" by 15 pediatric and radiological organizations supporting the SBS/AHT diagnosis, published in a peer-reviewed medical journal.[320] To rebut this medical consensus, in addition to the medical studies discussed above, the court also relies on a non-peer-reviewed article[321] written by three lawyers with vested interests in the outcome, lead authored by lawyer Randy Papetti[322] and published in a

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319 See Prange, *supra* note 271 at 144.

320 Specifically, 15 medical doctors, specializing in radiology, pediatric radiology, and child abuse reported in Aribinda Kumar Choudary et al, "Consensus Statement on Abusive Head Trauma in Infants & Young Children" (2018) 48:8 Pediatrics Radiology 1048 at 1048. The contributing authors are radiologists and pediatric radiologists associated with major hospitals around the world, including the US, UK, Greece, Italy and Crete.

321 See Daubert, *supra* note 63 at 593-4, noting that publication in a peer-reviewed source is relevant to determination of reliability).

322 Rather relying on eminent and experienced physicians – or even biomechanics- Papetti, himself, with a vested conflict of interest as a defense lawyer representing suspected perpetrators, writes with two law professors associated with the Northern California Innocence Project, and the Arizona Justice Project. See Papetti et al, *supra* note 219.

non-peer-reviewed law review.[323] Papetti, too, goes to great lengths to explain why a legal venue was chosen for publication.[324]

The court gives as much weight to lawyer Papetti as to the medical and biomechanical experts, noting without reservation that "Papetti [the lawyer without biomechanics or medical training, or expertise in scientific evidence] concluded that shaking creates low acceleration-deceleration forces which do not reach the injury threshold." Arguably, the uncredentialed Papetti would never have been permitted to testify as a live expert, as unqualified.[325]

Illustrating their unfamiliarity with the medical diagnostic process, Papetti et al. dissect each presenting sign of the child brought to the ER individually to divine alternative explanations for each – i.e., they perform an individual differential diagnosis for each sign and symptom, ignoring the import of a constellation of signs and symptoms presenting simultaneously, medically called a syndrome.[326] Instead, Papetti finds a different explanation for each sign/symptom presented – where the SBS diagnosis accounts for all, satisfying the "elegance theory."[327] In other words, to account for all the findings presented in the Emergency Room, per Papetti, the child would have to be suffering from at least three different diseases simultaneously.

Papetti speculates on additional alternative causes, which would not be relevant in the *Nieves* situation, nor most other SBS cases: "such as, by way of example, those that can be present during child-birth, during a prolonged period of cardiac arrest or low oxygen, or, perhaps, while an infant is sustained on life support."[328] Considering that most of these children (including those in *Nieves*) had been examined shortly before the presenting cavalcade of signs and found healthy, one is hard-pressed to attribute the hemorrhage, fractures, and hematomas to injuries sustained at birth months before the child is taken to the ER.

2. Elegance Theory

As philosopher Milton Steinberg wrote in dissecting differences between science and religion, when testing the value of ideas, this must be done not in abstract or conceptual terms but in terms of consequences. He

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323 Papetti et al, *supra* note 217 at 303.

324 *Ibid* at 366.

325 Papetti et al, *supra* note 217; See also Farley, *supra* note 26, for a Canadian perspective.

326 Papetti et al, *supra* note 217 at 306-307.

327 *Ibid.*

328 *Ibid* at 323.

raises three analytic rubrics: practicality, plausibility, and elegance, noting that, "if one is choosing between two ideas, one must always choose the idea which covers the facts more efficiently and comprehensively," remarking that the preferable theory depends upon the fewest assumptions.[329] [emphasis added].

> The test of plausibility is characteristic of the scientific enterprises. When the scientist wishes to choose between two alternative hypotheses, he asks, which accounts for the facts better? He asks second, which works out better; but the scientist also makes a third test. The scientist uses the test of economy, of simplicity – in essence, an aesthetic test [sometimes called elegance of thought], but a test that has pertinence to the problems of truth: [330]

From the outset, lawyer Papetti, like lawyer Findley, miscasts the problem. First is the reframing of the diagnostic milieu, as "a medical diagnosis in the sense that physicians make it based on certain physical findings. But its dominant function is forensic."[331] He argues, without citation or support, that "[i]t is not a diagnosis made for treatment, but rather to identify abuse—specifically, that the child has been violently shaken or subjected to other severe "acceleration-deceleration" head trauma."[332] In fact, the differential diagnosis of SBS/AHT is made for the purposes of excluding other possible causes amenable to treatment.[333] Once those are ruled out, the only treatment left to the physicians is symptomatic, preventive – remove the child from its environment, and societal: turn the matter over to law enforcement and family services to prevent future abuse. Again, this is no different from a physician making a rape diagnosis or battery due to domestic violence. Here, however, the child cannot testify and the physician must piece the puzzle together from available medical evidence – including the child's healthy status shortly prior to the presenting event – to prevent future harm.[334]

Again, without substantiation, Papetti proclaims: "The SBS/AHT diagnosis is premised on certain biomechanical and pathophysiological

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329 Milton Steinberg, *Anatomy of Faith*, 1st ed (New York: Harcourt, 1960) at 250, the concept is called "elegance" by mathematicians. For the simplest explanation in science, see Smolin, *supra* note 193 at 27, 36.

330 Steinberg, *supra* note 329 at 250.

331 Papetti et al, *supra* note 217 at 301.

332 *Ibid*; The SBS Diagnosis is indeed made for treatment purposes. See Dias, *supra* note 303; see also Joyce et al, *supra* note 1.

333 Matschke et al, *supra* note 278 at 211, noting "failure to recognize abuse may have severe consequences."

334 Jenny et al, *supra* note 293.

assumptions and beliefs, nearly all of which have been shown to be unreliable."[335] Rather, as shown above, it is the experimental "evidence" on which Papetti relies that is unreliable. Trying vainly to bolster his conclusions, Papetti cites the Duhaime study, noting that "no matter how hard the volunteers shook the [inanimate dummy] models, the shaking did not generate acceleration measurements anywhere near those estimated as necessary to tear cortical bridging veins and cause subdural hemorrhage or other intracranial injury."[336] [emphasis added]. Notably, these are single thrust experiments which do not consider the impact of multiple forces involved in producing SBS. More significantly, he concedes the levels needed to cause physiological damage, are estimated.

Further, these models – which have never been validated – do not measure disease or the disease process in the brain of a human baby, nor do they assess the sequential and cascading effects of brain swelling on vasculature, lymph vessels, blood supply, and neurons. To opine on that requires a double extrapolation: relating surrogate studies to the human experience,[337] and extrapolating adult exposures to children. A third level, the impact of single impact to repeated shakings is not even considered.

Papetti then diminishes medical doctors as lacking in biomechanical expertise by focusing only on the traumatic force of external thrust, and ignoring internal physiological results of that force, augmented by multiple impacts of repeated contrecoup lesions and consequent vibratory forces triggering a dynamic series of sequential lesions, including vascular rupture, leakage, lack of oxygen, brain swelling, cascading much like Fisher-Price toys, where one wheel spins another ad infinitum.[338]

Papetti's final argument is that SBS, even if triggered by blood vessel damage or vascular trauma, often results from an accident or injury that "can happen to anyone."[339] Indeed, someone can develop lung cancer from smoking. That cancer may also occur from natural causes does not exclude causation by cigarettes, nor does it exculpate cigarette manufacturers in the smoking patient. Nor, in a patient with a ten-pack-a-day habit for ten years,

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335 Papetti et al, *supra* note 219 at 303.

336 *Ibid* at 312.

337 *Ibid.* Jenny states that the configuration of the dolls changes the results, hence doll models are per se unreliable because they get different results, even if they could be validated.

338 *Ibid.*

339 *Ibid* at 346: "There is no reason to infer from thrombosed cortical veins that the child sustained significant head trauma when the thrombosis can and usually does occur naturally to the head."

are cigarettes excluded as a cause merely because we may not know precisely whether the cause is genetic or from some other pulmonary toxin. Moreover, as noted above, even if we don't know the etiology of a diagnosis, this does not eviscerate the diagnostic construct itself.[340]

Papetti concedes that "shaking can never tear cortical veins or inflict brain injury... other than perhaps in rare or extreme circumstances."[341] [emphasis added]. Indeed, Papetti neglects to consider the rarity of the SBS diagnosis which presents in the rare circumstances of neonates and premature, low birth weight babies. (Given an estimated yearly incidence of 1000 babies diagnosed with SBS, and the 3.6 million US babies born, SBS would have an incidence rate of .03%, of which about 310,000 are low birth weight). Arguably, SBS would account for about .3% of these – qualifying as a rare or extreme circumstance.

In short, lawyer Papetti makes unsubstantiated claims via a series of unsubstantiated *ipse dixits,* inadmissible as a medical opinion, yet relied on by the court. Further, Papetti denigrates the medical consensus statement as low quality. The preponderance of physicians disagree. Who is the court to believe? The scientific and medical experts or lawyers without medical or biomechanics training, whose mission it is to acquit suspected perpetrators?[342]

V. Conclusions and Solutions:

Recently, law professors and defense attorneys with no training in medicine, biomechanics, or the law of scientific evidence, along with a handful of individual non-mainstream physicians and biomechanics, have authored analyses which provide the toe-hold for judges to invade the practice of medicine,[343] dangerously seeding the turf for future judicial incursions into medical practice.

In actuality, the causal basis for the SBS diagnosis depends on known and generally accepted inferences and deductions from trauma physiology – especially brain trauma. In the legal context where it is impossible (and

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340 "That [Hypoxic Ischemioc Injury] HII II has a destructive impact on the brain is undisputed, but what consequences it triggers throughout the central nervous system in infants and young children is incompletely understood." *Ibid* at 350.

341 *Ibid* at 313.

342 "Science" produced for litigation is frowned on by the Courts. This premise should bar admission of Papetti's "study."

343 See Billauer, "Practice Medicine", *supra* note 23; the crisis of legislatures dismantling gender-affirming care or providing abortion services is well known.

unethical) to perform experimental studies, this knowledge (of medicine, including physiology) provides legally acceptable answers. While biomechanics can provide information regarding the impact of external forces, not all forces involved were examined simultaneously in the studies presented, and the effects of multiple forces acting in conjunction with each other (i.e., repetition, frequency, duration, and cumulative) are ignored, along with the impact of repetitive shaking. Further, the double extrapolation needed to arrive at the positions that counter the validity of an SBS diagnosis should, in itself, indicate the extreme unreliability of opinions based thereon.

Surely, unjust convictions and overzealous prosecution have troubled the field, damaging not only innocent defendants but also improperly removing that person from contact with the child. The comprehensive analysis provided by the Canadian Goudge report echoes these dangers. Nevertheless, it highlights the Canadian problem as generated by one uncredentialed expert, a pediatric pathologist, non-schooled in forensics or child abuse, which infected scores of cases. The report does not suggest the presence of systemic difficulties with the diagnosis itself. Undoubtedly, there is room for improvement and the four-volume report outlines hundreds of recommendations, including insisting on properly qualified experts to avoid untoward consequences, educating the judiciary, and introducing law students to the principles of the scientific method and the pitfalls associated with the misuse of scientific evidence. If there is any overall moral from the report, it is the need to establish standards for expert testimony in these cases, monitored by a consensus-based examining body of forensic pathologists.

While the Canadian Gouge report provides a litany of recommendations, I will take this opportunity to add another:

Since the defendant is given his/her own advocate to voice a defense, it is suggested, that a *guardian ad litem* be appointed to give voice to the child's interests. It is further suggested that law schools implement scientific evidence programs to enable assisted didactic analysis of proffered defense studies. Finally, it is suggested that in lieu of a single doctor making the SBS determination (or any finding of abuse), the diagnosis should be approved by an ethics committee – if only to avoid potential abuse by a biased individual physician.[344]

In sum, the noble objective of defending falsely accused suspects has furthered a misuse of scientific evidentiary rules, whose precedential value

[344] See e.g. Neary, *supra* note 28, (discussing the Mary Kowalski case).

portends ominously. Since the SBS diagnosis can only be deduced from known and accepted principles of medicine and physiology and cannot be experimentally tested, as unethical, the *Nieves* court and a group of interested lawyers are assuring that abused children get to stay with their abusers.

Canada's experience, particularly through the evolution of *Mohan*, the Goudge Inquiry, and child welfare jurisprudence, provides a useful comparative lens. It underscores the need for a principled, consistent, and nuanced approach to evaluating scientific evidence—one that respects appropriately qualified and properly bounded scientific experts and refrains from judicial overreach into complex scientific domains. While some believe Canadian law avoids the rigidities of *Daubert* and *Frye,* it still embraces the gatekeeping function while highlighting both evidentiary (data) reliability along with reliability of experts. This balance may serve as a guide for reform in jurisdictions experiencing the evidentiary confusion *Nieves* now illustrates.

Doll Used in the Jenny study.

Diffuse Non Local Hypoxic and Vascular Damage from a Needle Prick (Blood Draw) in an Adult Manifesting Over Five Days:

Day 1 **Day 2** **Day 4** **Day 5**

(note the extreme swelling of the entire lower arm (causing temporary nerve damage) and the bruising on the upper arm all resulted from a blood draw at the antecubital fossa (the bend inside the elbow).