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Applying *Daubert* Inconsistently?

PROOF OF INDIVIDUAL CAUSATION IN TOXIC TORT AND FORENSIC CASES

Joseph Sanders[†]

I. INTRODUCTION

Daubert v. Merrell Dow Pharmaceuticals, Inc.[1] ushered in a new era in the assessment of expert testimony. *Daubert* and its two companion cases in the "*Daubert* trilogy," *General Electric v. Joiner*[2] and *Kumho Tire v. Carmichael*,[3] drastically altered the law governing the admissibility of expert evidence.[4] In the federal courts and in a substantial majority of state courts, the old *Frye* rule was swept aside for a new, multifaceted test.[5] All three of these cases involved a causal

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[†] Thanks to Edward Cheng for helpful comments on an earlier draft. I am particularly honored to be part of a festschrift for Margaret Berger. One anecdote tells all. Not long after the Supreme Court's decision in *Daubert v. Merrell Dow Pharmaceutical*, Margaret and I each published an article in the Minnesota Law Review. Our articles were grouped together as a "special issue" on *Daubert*. One of my colleagues later jokingly commented that I must be special to be one half of an entire special issue. I replied, no, Margaret's article was the special issue and I tagged along. By the way, her article, *Procedural Paradigms for Applying the* Daubert *Test*, 78 MINN. L. REV. 1345(1994) was an early beacon for judges grappling with this new admissibility rule.

[1] 509 U.S. 579 (1993).

[2] 522 U.S. 136 (1997).

[3] 526 U.S. 137 (1999).

[4] The Federal Rules of Evidence have been changed to reflect these cases. Most importantly, Rule 702 now reads:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, *if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.*

FED. R. EVID. 702 (changes in italics).

[5] Frye v. United States, 293 F. 1013 (D.C. Cir. 1923). According to the *Frye* test, scientific evidence should be admitted only when the scientific principle upon which the expert's testimony is based is "sufficiently established to have gained general acceptance in the particular field in which it belongs." *Id.* at 1014.

question and challenges to causal assertions have remained at the very center of admissibility law. The costs and benefits of this filter on expert causal assertions has been the source of considerable controversy.[6] One aspect of the controversy is a concern that the standard is not applied in a consistent manner.

Inconsistency appears in many guises. There is inter-jurisdictional inconsistency between the federal and state courts that have adopted *Daubert* and the state courts that continue to apply the *Frye* test.[7] Even among jurisdictions employing the same test, there is substantial variation.[8]

More worrisome, perhaps, are inconsistencies within jurisdictions. In this regard, the most frequently discussed inconsistency is between civil and criminal cases. A number of people note that courts are more likely to permit causation experts, especially the state's experts, to testify in criminal cases than in civil cases. For example, Professor Berger notes that,

> In civil cases, courts engage in rigorous gatekeeping and often exclude plaintiffs' experts because the theory underlying their testimony has not been adequately validated. But I see no sign of a parallel approach in criminal cases even [where] there are problems with the assumptions on which the prosecution's expert testimony rests.[9]

Others have made similar observations[10] and this conclusion is supported by several empirical studies.[11] On the other hand,

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[6] *See generally* Symposium, *A Cross-Disciplinary Look at Scientific Truth: What's the Law to Do?*, 73 BROOK. L. REV. 847 (2008).

[7] Frye v. United States, 293 F. 1013 (App. D.C. 1923). *See* David E. Bernstein & Jeffrey D. Jackson, *The* Daubert *Trilogy in the States*, 44 JURIMETRICS J. 351 (2004); John M. Conley &, Scott W. Gaylord, *Scientific Evidence in the State Courts:* Daubert *and the Problem of Outcomes*, 44 NO. 4 JUDGES' J. 6, 6 (2005).

[8] For example, within both *Frye* and *Daubert* jurisdictions differences exist as to whether the admissibility decision should be restricted to novel scientific evidence; whether courts should distinguish between scientific evidence and other types of expert testimony, and, if so, what test should be employed for experience testimony. *See generally* David L. Faigman, *Admissibility Regimes: The "Opinion Rule" and Other Oddities and Exceptions to Scientific Evidence, the Scientific Revolution, and Common Sense*, 36 SW. U. L. REV. 699 (2008); Joseph Sanders, Daubert, Frye, *And the States: Thoughts on the Choice of a Standard*, *in* POUND CIVIL JUSTICE INSTITUTE, THE WHOLE TRUTH? EXPERTS, EVIDENCE, AND THE BLINDFOLDING OF THE JURY 5 (2007), *available at* http://poundinstitute org/images/2006ForumReport.pdf.

[9] Margaret A. Berger, *Expert Testimony in Criminal Proceedings: Questions* Daubert *Does Not Answer*, 33 SETON HALL L. REV. 1125, 1125 (2003).

[10] *See* Paul C. Giannelli, *The Supreme Court's "Criminal"* Daubert *Cases*, 33 SETON HALL L. REV. 1071, 1072-73 (2003) (discussing difference between civil and criminal applications of Daubert standard); Christopher Slobogin, *The Structure of Expertise in Criminal Cases*, 34 SETON HALL L. REV. 105, 109-10 (2003).

[11] *See* Jennifer L. Groscup et al., *The Effects of Daubert on the Admissibility of Expert Testimony in State and Federal Criminal Cases*, 8 PSYCHOL. PUB. POL'Y & L. 339, 364 (2002) ("[T]he Daubert decision did not impact on the admission rates of

many have argued that the admissibility bar is set too high on the civil side.[12]

In this article, I argue that we misunderstand the nature and cause of the inconsistency when we lump together all toxic tort cases and compare them to all forensic cases. If we disaggregate the toxic tort admissibility opinions that deal with general questions (e.g., whether asbestos causes lung cancer), and those that deal with causal questions that relate to the individual plaintiff, we see that experts testifying on the latter causal question are judged by admissibility standards that are nearly as liberal as the standards applied in forensic cases. On the other hand, with respect to one type of forensic proof, DNA testimony, the courts impose an admissibility standard at least as high as that used for general causation cases in toxic torts.

It is the thesis of this article that the liberal standards applied with respect to specific causation and forensic experts have a similar source. They are the result of a gulf between the needs of the law and the products of science and they reflect a judiciary grappling with—or, in the forensic context, sometimes refusing to grapple with—the difficulties this presents for expert witness admissibility standards.[13]

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expert testimony at either the trial or appellate court levels."); D. Michael Risinger, *Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?*, 64 ALB. L. REV. 99, 103-12 (2000) (providing empirical evidence that judges are more likely to admit prosecution expert testimony than other types of expert testimony). For a review of the empirical findings, see Faigman, *supra* note 8, at 717-18.

[12] Among the critical articles are: Michel F. Baumeister & Dorothea M. Capone, *Admissibility Standards as Politics—The Imperial Gate Closers Arrive!!!*, 33 SETON HALL L. REV. 1025 (2003); Margaret A. Berger, *Upsetting the Balance Between Adverse Interests: The Impact of the Supreme Court's Trilogy on Expert Testimony in Toxic Tort Litigation*, 64 LAW & CONTEMP. PROBS. 289, 324 (2001); Margaret A. Berger & Aaron D. Twerski, *Uncertainty and Informed Choice: Unmasking* Daubert, 104 MICH. L. REV. 257 (2005); Carl F. Cranor & David A. Eastmond, *Scientific Ignorance and Reliable Patterns of Evidence in Toxic Tort Causation: Is There a Need for Liability Reform?*, 64 LAW & CONTEMP. PROBS. 5, 15 (2001); Lucinda M. Finley, *Guarding the Gate to the Courthouse: How Trial Judges Are Using Their Evidentiary Screening Role to Remake Tort Causation Rules*, 49 DEPAUL L. REV. 335, 337 (1999); Allan Kanner & M. Ryan Casey, Daubert *and the Disappearing Jury Trial*, 69 U. PITT. L. REV. 281 (2007); Bobak Razavi, *Admissible Expert Testimony and Summary Judgment*, 29 J. LEGAL MED. 307 (2008).

[13] After I had completed this article, David Faigman shared with me his contribution to this festschrift. His article, *Evidentiary Incommensurability: A Preliminary Exploration of the Problem of Reasoning from General Scientific Data to Individualized Legal Decision Making*, 75 BROOK. L. REV. 1115 (2010), makes many of the points I make in this article concerning the gulf between the causal generalizations of most scientific inquiry and the specific causal analyses required in individual trials. *See also* DAVID L. FAIGMAN, LEGAL ALCHEMY: THE USE AND MISUSE OF SCIENCE IN THE LAW 69 (1999).

In Part II, I describe the gulf between the search for generalities in science and the need for particulars in law. In Parts III and IV, I discuss the effect of this gulf, first with respect to toxic tort "specific causation" experts and, second, with respect to forensic experts. In both areas, the relative weakness of the available empirical evidence leads courts to adopt liberal admissibility standards. Part V briefly summarizes the discussion in the previous two sections. Part VI argues that the liberal admissibility standards applied in these two areas are but two instantiations of law's general contextual approach to knowledge.[14] By and large, this contextual approach serves the legal system well, but in some situations it produces less than optimal levels of expertise. This occurs because the courts fail to adopt a contextual approach that attends to the future as well as to the case being decided. I outline the circumstances in which a longer view may serve us well and argue that those circumstances exist in the forensic arena. Part VII discusses alternatives open to the courts if they wish to adopt this longer view. The article ends with a brief summary of the argument.

II. THE SCIENCE-LAW DISCONNECT

There is a disconnect between science and law, and this disconnect helps to explain how law approaches certain types of causal questions. The disconnect is simply this: the law's search for causal information about a particular case often finds little or no help from science. In order to understand this problem, I need to say a bit about the scientific enterprise. Those who study the doing of science would generally agree that there is no special "scientific method" that is different from and better than other ways of understanding the world.[15] However, science is chock full of specific theories and methodological prescriptions concerning how to test these

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[14] A contextual approach varies the justification needed to hold a belief depending upon the quantity and quality of the available evidence.

[15] As Susan Haack notes:

> What is distinctive about natural-scientific inquiry isn't that it uses a particular mode or modes of inference, but the vast range of helps to inquiry scientists have developed, many of them – specific instruments, specific kinds of precaution against experimental error, specific models and metaphors – local to this or that field or sub-discipline.

SUSAN HAACK, DEFENDING SCIENCE WITHIN REASON: BETWEEN SCIENTISM AND CYNICISM 167 (2003).

theories. A substantial part of having what passes for scientific expertise in a field is an ability to understand and use the tools of the trade.

Susan Haack divides these aids to understanding into several categories, including helps to the senses and helps to reasoning.[16] Instruments that expand our senses are at the very heart of progress in physics, astronomy, chemistry, and biology as well as practical disciplines such as medicine and engineering. Aids to reasoning are also critical. These include mathematics in its many different forms as well as experimental and quasi-experimental designs and other investigatory devices designed to assist in making causal assertions.[17]

For purposes of this article, I focus on the second set of aids: aids to reasoning. Most of the common mathematical and logical aids to reasoning employed by science are designed to facilitate not simply inquiry, but inquiry of a certain type: inquiry into general laws or principles. This does not mean that scientists are uninterested in the particular case; many scientists and individuals in fields that rely on science, such as engineering, devote most of their energy to specific situations. But the heroes of science are those who are able to put forth explanations in terms of general laws that explain a myriad of particular observations.

This interest in the general and the generalizable leads to a second component of scientific conventions, the lack of a timetable. An inquiry takes as long as it takes and with respect to many questions the answer experts are most comfortable with is, "we don't know." "We don't know" does not necessarily mean that we don't have a guess. Often it means we do not

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[16] *Id.* at 98.

[17] *See* WILLIAM R. SHADISH, THOMAS D. COOK & DONALD T. CAMPBELL, EXPERIMENTAL AND QUASI-EXPERIMENTAL DESIGNS FOR GENERALIZED CAUSAL INFERENCE (2002). Even the social sciences play an important role in this process when they uncover and document the many systematic reasoning errors that result from judgment by heuristics and then suggest affirmative steps we might take to minimize such errors. *See* Cass R. Sunstein, *Cognition and Cost-Benefit Analysis*, 29 J. LEGAL STUD. 1059 (2000).

A third set of aids discussed by Haack are helps to evidence sharing and intellectual honesty. This includes things such as peer review, publication, replication of findings and other formal and informal devices that involve scientists looking over each other's shoulders. Often this peek over the shoulder focuses on the correct use of the first two types of aids; instruments, mathematics and experimental design. All of these aids are fallible and none guarantees that we will arrive at correct outcomes. From the supposed benefits of bleeding to the more recent realization that many ulcers have a bacteriological, not a psychological source, it is easy to point to occasions where we have been lead astray for lengthy periods of time. Collectively, however, these conventions are thought to facilitate inquiry over the long term.

have enough evidence of the kind we find persuasive to support a conclusion about a phenomenon.[18]

If science tends to focus on systematic and general knowledge, most trials must deal with specific events. To be sure, law often is concerned with general questions, e.g., does drug X cause injury Y? However, it is also nearly always concerned with what happened to a specific person at a particular point in time. Did drug X cause the plaintiff's injury? Were these fingerprints left at the crime scene those of the defendant?

This inquiry into individual causation is accompanied by a mindset that is contrary to the "wait and see" attitude of science. Legal conventions ask experts to make a decision now based on the evidence at hand.[19] Fred Prichard quotes the following passage from an expert confronting for the first time the law's push for a decision now.

> Bill (the expert's attorney) asked me a question about whether the belt was on or not, the lap belt. And I said, "Well, could have been. But then, it may not have been." Woo, rockets went off. "What do you mean? You're my expert in this case, and you say it 'could be' or 'couldn't be?' Look, I'm going to tell you. The other side doesn't waffle. They pick one view. And they will push that view. And they will make their case in front of a jury. And there will be no misunderstanding. There will be no gray area. They will take a position one way or the other and make it stick. Now, they don't have any other course of action. That's their life. They make their living going in front of juries and making statements, whether they have facts to back them up or not. Now you, you can go back to designing cars. You have another career. They don't. You better start thinking like they do."[20]

This anecdotal evidence is supported by survey research. Champagne et al. report that 56% of the experts they

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[18] When a community of investigators say this they are referring to evidence which is derived from the application of the aids to reasoning (and the instruments) to which a field of inquiry is committed. There may not be a "scientific method" writ large, but there are methods and aids to inquiry to which communities of scholars are committed and evidence derived from these techniques enjoy greater warrant in the community than other types of evidence. Over time, these methods may change as new ways to collect and observe are created. Methods are, ultimately, simply tools and a new problem may call for new tools. In this sense, methodology is a pragmatic search for what works. However, at any given point in time the ability of an investigator to persuade her peers about some hypothesis without the use of these devices and methods is limited.

[19] Herbert Kritzer, *The Arts of Persuasion in Science and Law: Conflicting Norms in the Courtroom*, 72 L. & CONTEMP. PROBS. 41, 48 (2009).

[20] FRED PRICHARD, EXPERTS IN CIVIL CASES: AN INSIDE VIEW 30-31 (2005).

interviewed say their lawyers ask them to be less tentative.[21] They found a similar percentage (57%) in a second, follow-up study.[22] Perhaps more alarmingly, 12% of the experts in the first study and 22% in the second study agreed with the statement that lawyers try to get their experts to testify to issues for which there is no scientific basis.[23]

How then should we summarize the conventions of science and law? Three scientific conventions are particularly relevant to this discussion: a) searching for the general and theoretical, b) doing so by employing the methods and techniques accepted by one's field, and c) an attitude of agnosticism that encourages waiting for persuasive evidence before making up one's mind.[24] On the other hand, legal conventions: a) often focus on the specific event and b) push witnesses toward arriving at a conclusion.[25]

For the moment, I wish to set aside the second difference, science's wait-and-see attitude versus the law's desire to arrive at a conclusion, and focus on the first difference. The fact that much of science focuses on understanding the general, while law is usually interested in the specific, does not always present difficulties. In some areas, the translation from the general to the specific is so well understood that one can reach nearly unanimous consensus about the cause of a specific event through the application of general principles. Engineering is often a case in point. For example, there were multiple hypotheses as to why the I-35 bridge across the Mississippi River at Minneapolis suffered a catastrophic collapse on August 1, 2007.[26] They included metal

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[21] Anthony Champagne, Daniel Shuman & Elizabeth Whitaker, *An Empirical Examination of the Use of Expert Witnesses in American Courts*, 31 JURIMETRICS J. 375, 385 (1991).

[22] Daniel W. Shuman, Elizabeth Whitaker & Anthony Champagne, *An Empirical Examination of the Use of Expert Witnesses in the Courts—Part II: A Three City Study*, 34 JURIMETRICS J. 193, 201 (1994).

[23] *Id.*; Champagne et al., *supra* note 21, at 385.

[24] A fourth scientific convention is "a commitment to sharing data, intellectual honesty, and disinterestedness." Joseph Sanders, *Science, Law, And The Expert Witness*, 72 L. & CONTEMP. PROBS. 63, 66 (2009). I discuss this convention and how it differs from the legal view of expert knowledge as a partisan resource. I do not explore this difference in the present article.

[25] Note that the second element in scientific conventions, a commitment to the methods and techniques of inquiry accepted by one's field, has no direct parallel in legal conventions. I return to this point later in the article. *See infra* Part VI.

[26] *See* Press Release, National Transportation Safety Board, NTSB Determines Inadequate Load Capacity Due to Design Errors of Gusset Plates Caused I-35 Bridge to Collapse (Nov. 14, 2008), *available at* http://www.ntsb.gov/pressrel/2008/081114.html [hereinafter NTSB Press Release]; *see also* Stephen Flynn, *Minn. Bridge*

fatigue among other options.[27] However, in November 2008, the National Transportation Safety Board concluded that the primary source of the failure was a design flaw.[28] The bridge gusset plates were approximately half as thick as they should have been.[29] This failure, combined with substantial increases in the weight of the bridge from earlier modifications and the storage of tons of construction material on the bridge at the time of collapse, caused the failure.[30] Engineers were able to work from the general, e.g., the load bearing capacity of various materials and designs, to the specific flaw in this particular bridge.

Unfortunately, this easy ability to understand the general case and then to translate from the general to the specific case is precisely what is absent in many civil and criminal cases.[31] Whatever the evidence concerning the general principle, e.g., that Vioxx causes heart problems or that individual fingerprints are unique, translating this to the particular case is fraught with difficulty. In the next two sections, I discuss this problem first in the civil context and then in the criminal context.

III. ADMISSIBILITY STANDARDS IN TOXIC TORT CASES

In no area has the *Daubert* revolution had a greater effect than in toxic torts. The number of cases in which expert causation testimony has been excluded must by now run into the thousands. Many commentators have reacted negatively to this trend, arguing that the bar has been set too high.[32]

Collapse Reveals Brittle America: Expert Op-Ed, POPULAR MECHANICS, Aug. 2, 2007, available at http://www.popularmechanics.com/technology/transportation/421998.html; *Minnesota: Cause of Bridge Collapse is Questioned*, N.Y. TIMES, Mar. 26, 2009, at A20.

[27] *Id.*

[28] *See* NTSB Press Release, *supra* note 26; *see also* Matthew L. Wald, *Bridge Collapse is Laid to Design Flaw*, N.Y. TIMES, Nov. 14, 2008, at A19.

[29] *See* NTSB Press Release, *supra* note 26.

[30] *Id.*

[31] This ability is not absent in all cases. DNA testing is an area where the transition from the general to the individual case is well understood. This is also true with respect to toxic torts that produce signature diseases.

[32] *See supra* note 12 and accompanying text. This is especially troublesome to critics when the exclusion of the expert testimony results in a summary judgment for the defendant because the plaintiff no longer has any admissible evidence on causation.

Clearly, the bar is higher than it once was. Before *Daubert*, very few cases were concluded as a result of an expert witness admissibility determination. The Bendectin litigation, of which *Daubert* is a part, is a good example. Almost all the twenty-five or so Bendectin cases that were heard on the merits were tried to either a judge or a jury. Although the plaintiffs never prevailed in any of these cases, this was

I do not engage in this debate. Rather, I argue that the height of the bar depends on the causal question being addressed. The causal question in toxic tort cases is usually divided into two parts: general causation and specific causation. The general causation question is whether a substance or drug has been shown to harm any individuals. The specific causation question is whether the harm suffered by the plaintiff was caused by the substance or the drug in question.[33] When evidence is excluded, is it usually because of a failure to present reliable evidence on general causation or a failure to present reliable evidence on specific causation?

Unfortunately, the question is easier to pose than it is to answer. Within the toxic tort arena, most specific causation testimony is presented as "differential diagnosis" testimony.[34] But one cannot judge the frequency with which specific causation testimony is excluded simply by looking at the frequently with which "differential diagnosis" testimony is excluded. This is because most *Daubert* opinions rule on general causation before reaching the question of specific causation. They require plaintiffs to "rule in" the alleged causal agent, i.e., they must show that the agent causes the injury to some individuals, before "ruling out" other possible causes.[35]

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the result of defense verdicts or judicial reversal of plaintiff verdicts. *See generally* JOSEPH SANDERS, BENDECTIN ON TRIAL (1998).

[33] For a discussion of these terms, see RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARMS § 28 cmt. c (2005).

[34] For discussions of differential diagnosis testimony, see Edward J. Imwinkelried, *The Admissibility and Legal Sufficiency of Testimony About Differential Diagnosis (Etiology): Of Under—and Over—Estimations*, 56 BAYLOR L. REV. 391 (2004); Joseph Sanders & Julie Machal-Fulks, *The Admissibility of Differential Diagnosis Testimony to Prove Causation in Toxic Tort Cases: The Interplay of Adjective and Substantive Law*, 64 AUT LAW & CONTEMP. PROBS. 107 (2001); Ian S. Spechler, *Physicians at the Gates of* Daubert*: A Look at the Admissibility of Differential Diagnosis Testimony to Show External Causation in Toxic Tort Litigation*, 26 REV. LITIG. 739 (2007). The term is itself problematical. When physicians use this term in their medical practice they are referring to the process of determining which disease produced a set of symptoms. However, in the legal arena the term is used to describe a process by which one searches for the cause of the underlying disease. The latter exercise might better be called "differential etiology." *Id.*

[35] In *Cavallo v. Star Enterprise*, the trial judge made the following comment:

> The process of differential diagnosis is undoubtedly important to the question of "specific causation." If other possible causes of an injury cannot be ruled out, or at least the probability of their contribution to causation minimized, then the "more likely than not" threshold for proving causation may not be met. But, it is also important to recognize that a fundamental assumption underlying this method is that the final, suspected "cause" remaining after this process of elimination must actually be *capable* of causing the injury. That is, the expert must "rule in" the suspected cause as well as "rule out"

Specific causation witnesses are frequently excluded because neither they nor some other expert has provided sufficient evidence to "rule in" the suspect substance.[36]

Once we set those cases aside, that is, once we look only to the cases where there is evidence of general causation, what evidence must the expert present in order to survive an admissibility challenge to the specific causation testimony? The answer is, not very much.

In some *Frye* jurisdictions, experts conducting a differential diagnosis are considered to be "experience experts"[37] and are allowed to testify without any reliability filter.[38] The

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other possible causes. And, of course, expert opinion on this issue of "general causation" must be derived from a scientifically valid methodology.

892 F. Supp. 756, 771 (E.D. Va. 1995), *aff'd in part*, *rev'd in part*, 100 F.3d 1150 (4th Cir. 1996).

The great majority of all federal cases on point come to the same conclusion. *See* 3 FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE § 21:6 (2009).

[36] Sometimes, the "ruling in" analysis focuses on the question of dosage. To how much of a substance was the plaintiff exposed? This, too, is best thought of as a question of general causation. *See id.*

[37] Such experts are variously called "experience" experts, "opinion" experts, or "clinical" experts. David E. Bernstein, *Expert Witnesses, Adversarial Bias, and The (Partial) Failures of the Daubert Revolution*, 93 IOWA L. REV. 451 (2008) (connoisseur evidence); Faigman, *supra* note 8 (opinion evidence); Joseph Sanders, Kumho *and How We Know*, 64 LAW & CONTEMP. PROBS. 373 (2001) (experience evidence).

Experience evidence is not restricted to civil cases. As several scholars have noted, much of the testimony of forensic experts may be viewed as experience evidence. *See* Simon A. Cole, *Toward Evidence-Based Evidence: Supporting Forensic Knowledge Claims in the Post-Daubert Era*, 43 TULSA L. REV. 263, 276 (2007); Lyn Haber & Ralph Norman Haber, *Experiential or Scientific Expertise*, 7 LAW, PROBABILITY & RISK 143 (2008). That is, the experts justify their opinion on the basis of their experience with respect to the task at hand.

[38] For example, in *Kuhn v. Sandoz Pharmaceuticals*, the plaintiff offered expert testimony that his wife's death was "direct[ly] and proximately cause[d]" by her ingestion of Parlodel, a drug taken to suppress lactation in women who chose not to nurse their newborn children. 14 P.3d 1170, 1173-75 (Kan. 2000). The defendant challenged the admissibility of this testimony. *Id.* at 1180. The Kansas Supreme court held that the *Frye* test is not applicable to cases where the expert offers "pure opinion" testimony. *Id.* at 1178. "The validity of pure opinion is tested by cross-examination of the witness." *Id.* at 1179. The plaintiff's three experts offered to testify that Parlodel caused or contributed to Bishop's death. *Id.* at 1175. They arrived at this result through a process of "differential diagnosis" by which they considered and ruled out other causes. *Id*. at 1177. Apparently, *Kuhn* removes most if not all medical doctor differential diagnosis testimony from any judicial reliability assessment.

Florida also has adopted this position. In *Marsh v. Valyou*, echoing *Kuhn*, the court concluded that "[i]t is well-established that *Frye* is inapplicable to 'pure opinion' testimony. . . . [b]ecause testimony causally linking trauma to fibromyalgia is based on the experts' experience and training, it is 'pure opinion' admissible without having to satisfy *Frye*." 977 So. 2d 543, 548-49 (Fla. 2007).

The Arizona Supreme Court adopted a similar approach to expert testimony on repressed memory in *Logerquist v. McVey*, 1 P.3d 113, 123 (2000). The *Logerquist* court said:

federal and state courts that have adopted *Daubert*, refuse to adopt this approach.[39] However, as the following discussion indicates, they do not apply a strenuous admissibility standard for specific causation testimony.

What are the admissibility standards? First the expert must offer more than simple temporal order, i.e., the injury followed the exposure and, therefore, the exposure caused the injury.[40] Nevertheless, experts continue to offer this as proof of causation. The very fact that temporal order is so frequently the basis of exclusion is itself an indication of the relatively low threshold set for the admissibility of differential diagnosis testimony for in the context of many long latency period toxic torts temporal order is nearly no evidence at all.[41] Plaintiff experts may also be excluded if they fail to address and rule out

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> Although compliance with *Frye* is necessary when the scientist reaches a conclusion by applying a scientific theory or process based on the work or discovery of others, under [Arizona Rules of Evidence 702 and 703] experts may testify concerning their own experimentation and observation and opinions based on their own work without first showing general acceptance.

Id. at 123 (quoting State v. Hummert, 933 P.2d 1187, 1195). The *Logerquist* opinion was the subject of an issue of the Arizona State Law Journal. *See* Margaret A. Berger, *When is Clinical Psychology Like Astrology?*, 33 ARIZ. ST. L. J. 75 (2001); David L. Faigman, *Embracing the Darkness:* Logerquist v. McVey *and the Doctrine of Ignorance of Science Is an Excuse*, 33 ARIZ. ST. L.J. 87, 91 (2001); Paul C. Giannelli, *Scientific Evidence in Civil and Criminal Cases*, 33 ARIZ. ST. L.J. 103 (2001); Edward J. Imwinkelried, Logerquist v. McVey*: The Majority's Flawed Procedural Assumptions*, 33 ARIZ. ST. L.J. 121 (2001).

[39] A few *Daubert* opinions have come close. For example, in *Emig. v. Electrolux Home Products, Inc.*, the court said:

> "It is not appropriate to invoke the *Daubert* test in cases where expert testimony is based solely on experience or training, as opposed to a methodology or technique." Indeed, where the expert's opinion is based on "years of accumulated learning and insight," the reliability of such opinion "should be assessed without resort to the *Daubert* factors."

No. 06-CV-4791, 2008 WL 4200988, at *7 (S.D.N.Y., Sept. 11, 2008) (internal citations omitted) (quoting Liriano v. Hobart Corp., 949 F. Supp. 171, 177-78 (S.D.N.Y.1996)).

[40] *See* 3 FAIGMAN, ET AL., *supra* note 35, at § 21:7. *See, e.g.*, Whiting v. Boston Edison, Co., 891 F. Supp. 12, 23 (D. Mass. 1995) ("[Plaintiff's experts] propound the argument that . . . because Gary Whiting was exposed to radiation before he contracted [acute lymphocytic leukemia], his ALL must have been caused by radiation exposure. This is a classic illustration of the logical fallacy post hoc ergo propter hoc."); Schmaltz v. Norfolk & Western Ry. Co., 878 F. Supp. 1119, 1122 (N.D. Ill. 1995) ("It is well settled that a causation opinion based solely on a temporal relationship is not derived from the scientific method and is therefore insufficient to satisfy the requirements of Fed. R. Evid. 702.").

There are a handful of cases that balk at even this limitation. *See* Kannankeril v. Terminis International, Inc., 128 F.3d 802 (3d Cir. 1997).

[41] Even some of the temporal order cases are, at bottom, about general causation. *See* Ervin v. Johnson & Johnson, Inc., 492 F.3d 901 (7th Cir. 2007).

other possible causes. Experts who fail to consider alternatives are often excluded.[42]

If, however, experts do avoid these two obvious inadequacies, their testimony is rarely excluded. When doctors employ standard diagnostic techniques many courts are likely to admit their differential diagnosis testimony. The classic statement of this position comes from the *In re Paoli* opinion: "to the extent that a doctor utilizes standard diagnostic techniques in gathering . . . this information, the more likely we are to find that the doctor's methodology is reliable."[43] Moreover, most courts would agree with *Paoli* that a failure to account for all possible causes does not render expert opinion based on differential diagnosis inadmissible.[44]

John's Heating Service v. Lamb,[45] is a state court opinion supporting this position:

> Of course, "[a] differential diagnosis that fails to take serious account of other potential causes may be so lacking that it cannot provide a reliable basis for an opinion on causation." But here that is not the case. Here, doctors experienced with carbon monoxide exposure performed the differential diagnosis, which included making physical examinations, taking medical history, and reviewing clinical tests. In addition, the diagnosis was bolstered by a temporal relationship between the symptoms and the possible carbon monoxide exposure and the discrepancy between Cynthia's performance and verbal IQs corresponding almost uniquely to carbon monoxide poisoning. An expert's causation conclusion should not be excluded because she has not ruled out every possible alternative; rather, existing possible alternatives should affect the weight that the jury gives the experts' testimony.[46]

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[42] *See* Terry v. Ottawa Cty. Bd. of Mental Retardation & Developmental Delay, 658, 847 N.E.2d 1246 (Oh. Ct. App. 2006) ("We agree with the trial court: Dr. Bernstein did not conduct a scientifically valid differential diagnosis, because his method relied primarily upon temporal relationships and because he did not rule out other possible causes. He was properly barred from testifying to specific causation."); *see also* Roche v. Lincoln Property Co., 278 F.Supp.2d 744 (E.D. Va. 2003) (Plaintiff's expert's testimony that mold caused the plaintiffs' allergy-like symptoms excluded in part because he failed "to rule out the Roches' significant allergies to cats, dust mites, grasses, weeds, and trees as potential causes for the Roches' symptoms." Mrs. Roche had been to the emergency room on several occasions with similar symptoms prior to moving to the defendant's apartment.).

[43] *In re* Paoli R.R. Yard PCB Litigation, 35 F.3d 717, 758 (3d Cir. 1994).

[44] *See* Westberry v. Gislaved Gummi AB, 178 F.3d 257, 265-66 (4th Cir. 1999); Heller v. Shaw Industries, Inc., 167 F.3d 146, 156 (3d Cir. 1999).

[45] John's Heating Service v. Lamb, 46 P.3d 1024 (Alaska 2002).

[46] John's Heating Service v. Lamb, 46 P.3d 1024, 1036 (Alaska 2002) (internal citation omitted); *see also* Asad v. Continental Airlines, Inc., 314 F. Supp. 2d 726 (N.D. Ohio 2004); Perkins v. Origin Medsystems, Inc., 299 F. Supp. 2d 45 (D. Conn. 2004); Yarchak v. Trek Bicycle Corp., 208 F. Supp. 2d 470, 498 (D.N.J. 2002); Keener v.

The process of ruling out other causes is relatively easy when there is a unique connection between an exposure and a disease (a so-called signature disease)[47] or, as in *John's Heating*, when there is a unique connection between an exposure and a particular set of symptoms. The task becomes more difficult when various causes do not produce demonstrable differences in the disease.

The task becomes even more difficult when the causes of the type of injury under investigation are not well understood. When the etiology of an illness is not well understood, there will be many idiopathic injuries. This raises an important general point. Should courts permit experts to present differential diagnosis testimony when the clear weight of scientific evidence points to the fact that the substantial majority of certain types of injuries are from unknown causes? Logically, when this situation arises the best differential diagnosis would be legally insufficient. For example, if, with respect to some injury, we know that 5% of the cases are caused by an exposure to a drug, 5% are caused by another known cause, and 90% have no known cause, then even if a differential diagnosis clearly excludes the other known cause it remains the case that it is much more likely than not that the cause in any individual case is not the drug.

Doe v. Ortho-Clinical Diagnostics, Inc.,[48] apparently adopted this line of argument. *Doe* is one of a number of cases involving the question of whether exposure to the mercury in thimerosal, a preservative once used in vaccines and other biologic products, is capable of causing autism in children.[49] After excluding the plaintiff's causal expert on general causation grounds, the court made the following observation:

> More troubling, however, is that Dr. Geier's differential diagnosis failed to acknowledge the one conclusion that is generally accepted in the medical community with respect to the causation of autism, which is, that its cause is genetic, but that the exact genetic sequence of autism is unknown. . . . Although Dr. Geier apparently

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Mid-Continent Cas., 817 So. 2d 347 (La. Ct. App. 5th Cir. 2002), *writ denied*, 825 So. 2d 1175 (La. 2002).

As the John's Heating quote indicates, many factors may enter into a differential diagnosis, including individual and family history, genetic predispositions, exposure to other known causes, and the results of various tests.

[47] This is the situation with respect to asbestos exposure and mesothelioma.

[48] Doe v. Ortho-Clinical Diagnostics, Inc., 440 F. Supp. 2d 465, 477-78 (M.D. N.C. 2006).

[49] *See* Snyder ex rel. Snyder v. Sec'y of Health and Human Servs., 88 Fed. Cl. 706, 711 (2009); Cedillo v. Sec'y of Health and Human Servs., 89 Fed. Cl. 158, 163 (2009).

> has considered a number of specific genetic disorders in performing his differential diagnosis, the Court finds that his failure to take into account the existence of such a strong likelihood of a currently unknown genetic cause of autism serves to negate Dr. Geier's use of the differential diagnosis technique as being proper in this instance.[50]

What is interesting about *Doe* is that its position is quite rare. Courts do not generally rule against the admissibility of a differential diagnosis on these grounds and note that even in *Doe* the passage was a bit of an afterthought, perhaps even dicta. Recall, the court had already concluded that the plaintiff could not prevail on general causation.

In sum, the high exclusion rate in toxic torts disguises the fact that these cases address two separate issues, general and specific causation. With respect to general causation, the courts rely heavily on the available science to exclude expert testimony. However, with respect to specific causation, courts are, on balance, much more lenient. If an expert follows normal procedures, i.e., collects a medical history of the patient and the patient's family, conducts appropriate laboratory and diagnostic tests, and gives consideration to other causes, and if there is no a glaring alternative cause that seems far more likely to have caused the illness,[51] courts are likely to admit differential diagnosis testimony even though there simply are no tests one can perform that will produce a quantified estimate as to whether an injury is the result of one cause or another.[52]

IV. ADMISSIBILITY STANDARDS IN FORENSIC CASES

Prior to *Daubert*, the *Frye* "general acceptance" test was used primarily in criminal cases.[53] Courts excluded proffered

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[50] *Ortho-Clinical*, 440 F. Supp. 2d at 477 (internal citations omitted).

[51] *See* Newton v. Roche Laboratories, Inc., 243 F. Supp. 2d 672 (W.D. Tex. 2002).

[52] Susan R. Poulter, *Science and Toxic Torts: Is There a Rational Solution to the Problem of Causation?*, 7 HIGH TECH. L.J. 189, 209-10 (1992) ("Scientists know very little about how, in a mechanistic sense, toxic substances cause disease such as cancer or birth defects.").

[53] Indeed, nearly all *Frye* admissibility rulings that excluded expert testimony were in the criminal area. Federal civil cases in which the *Frye* test was employed to exclude testimony are extraordinarily rare. Kenneth Chesebro, *Galileo's Retort*, 42 AM. U. L. REV. 1637, 1695 (1993) reports there were only two federal appellate court opinions excluding civil evidence on *Frye* grounds prior to the lower court *Daubert* decision. Christophersen v. Allied-Signal Corp., 939 F.2d 1106, 1115-16 (5th Cir. 1991) (employing Frye to determine that district court was within its discretion to exclude medical expert's testimony in civil case where that testimony was not generally accepted within relevant scientific community), cert. denied, 112 S. Ct. 1280 (1991) (using Frye to exclude epidemiological re-analysis studies in civil suit); Barrel of Fun, Inc. v. State Farm Fire & Casualty Co., 739 F.2d 1028, 1031 (5th Cir.

expert testimony in a few areas. The inadmissibility of lie detector results is the most well known example.[54] With respect to most areas of forensic evidence, however, the courts concluded that expert testimony met the general acceptance standard.[55] As pointed out by Paul Giannelli, the courts arrived at this result by defining the relevant field of expertise as the very group of individuals, e.g., handwriting analysts, whose expertise was being judged.[56] Unsurprisingly, this group vouched for its own endeavor.[57] Admissibility rulings did not concern themselves with the quality of the evidence.

Daubert offered an opportunity to revisit these admissibility decisions but by and large the pattern of liberal admissibility decisions has not changed. Although federal courts and state courts in jurisdictions that have adopted *Daubert* often pay lip-service to that test, it is rarely used to exclude forensic evidence experts.[58]

There are, undoubtedly, many reasons why courts apply liberal standards when considering forensic evidence.[59] However, I believe an important factor is the same one that leads to liberal admissibility rulings in toxic tort, specific causation determinations. There is very little hard scientific evidence upon which to base opinions. As a consequence, similar to the specific causation situation, the courts rely on

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1984) (employing Frye to overturn district court's admission of type of "voice stress analysis" in civil diversity case involving insurance claim, but failing to consider propriety of imposing Frye in civil case).

[54] *See* 4 FAIGMAN ET AL., *supra* note 35, at § 35.

[55] *See* 1 FAIGMAN ET AL., *supra* note 35, at § 1:35.

[56] Paul Giannelli, *The Admissibility of Novel Scientific Evidence:* Frye v. United States *a Half-Century Later*, 80 COLUM. L. REV. 1197 (1980).

[57] *Id.* at 1203.

[58] For examples of this reluctance to apply Daubert factors, see 4 FAIGMAN ET AL., *supra* note 35, at § 32 (fingerprint identification), § 33 (handwriting identification), § 36 (bitemark identification).

[59] They include: a) bias in favor of the state in criminal prosecutions, b) the quality of criminal defense attorney and their limited resources, c) the negative effects on judges if they refuse to permit the state to present its experts (a consideration that may be particularly relevant to elected judges, d) the long history of admissibility of forensic evidence which creates its own inertia to keep things the way they have always been, and e) judicial belief of the claims of forensic experts. For a very useful discussion of why lower courts may actually believe forensic experts despite the limited empirical evidence supporting some of their claims, see Michael J. Saks, *Explaining the Tension Between the Supreme Court's Embrace of Validity as the Touchstone of Admissibility of Expert Testimony and Lower Courts' (Seeming) Rejection of Same*, 3 EPISTEME 329 (2008).

expert testimony that is not much more than a clinical judgment from an experience based expert.[60]

Before I expand on this point, I should be clear on another. I do not mean to suggest that the causal issue in the forensic context is exactly the same as the issue in toxic torts. Within the context of forensic experts, the distinction between general and specific causation is rarely, if ever made. We simply do not think about forensic evidence in that way. Indeed, the terms "general causation" and "specific causation" seem to be terms of art that are restricted to the toxic tort context.

Nevertheless, one can think of forensic evidence in these terms. From one point of view, the connection between general causation and specific causation is easier in forensic cases. The problem in toxic torts is to determine which of several things caused the plaintiff's disease. This problem does not exist in forensics. Latent fingerprints are "caused" by fingers, not some other source. In the jargon of toxic torts, latent prints are a "signature disease" cause by human fingers. This is true of even the most suspect forms of forensic evidence, e.g., bite marks. It is, in fact, the existence of this relationship that gives much forensic evidence testimony its initial plausibility.

Another, perhaps more useful way to compare the causal question in toxic tort and forensic cases is to think of each individual as a source of many latent prints. That person is, in the jargon of toxic torts, an entity that is a "general cause" of some prints. The individual problem is determining whether this person, rather than all the other plausible sources of the print, is the "cause" of a particular print.[61] From this

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[60] *See* Simon A. Cole, *Toward Evidence-Based Evidence: Supporting Forensic Knowledge Claims in the Post-*Daubert *Era*, 43 TULSA L. REV. 263, 276 (2007); Lyn Haber & Ralph Norman Haber, *Experiential or Scientific Expertise*, 7 LAW, PROBABILITY & RISK 143 (2008).

[61] From this point of view, the forensic evidence problem is similar to the problem that arises in tort when we have an indeterminate defendant. This issue was brought into starkest relief in the DES cases. *See* Sindell v. Abbott Laboratories, 26 Cal.3d 588, 601 (1980). In those cases, through no fault of their own, the plaintiffs could not identify which drug company manufactured the drug sold to their mothers many years earlier. In the *Sindell* case the court solved the plaintiff's proof problem by forcing defendants to prove that they did not sell the prescription or be liable for a share of the plaintiff's injury based on each defendant's market share of sales of DES in the relevant market. This solution has rarely escaped the narrow confines of the DES cases, and generally a plaintiff simply cannot prevail in this circumstance. *Id.*

A related problem arises when many defendants contributed some part of the total dose of a harmful substance that caused the plaintiff's injury. This issue arises in asbestos cases. One solution is to ask the jury to assign liability to each defendant based on the percentage of the total risk of injury generated by that defendant's product. Thus, if a defendant made 10 percent of the total asbestos to

perspective, the individual causation questions are parallel. Can we detect which agent caused a disease by looking at a patient's illness? Can we detect which finger left a print by looking at the latent print?

In both areas, the accuracy with which we can make this judgment turns on the quality and quantity of our general understanding of a phenomenon and our ability to translate this knowledge to a judgment about the individual case. In the forensics arena, as in the toxic tort arena, the courts must try to answer a question without the benefit of much underlying general scientific knowledge. The problem in toxic torts is that the base rate information supplied by epidemiological research and, to a lesser extent, animal studies, is not easily translated into information about causation in the particular case. The problem in most forensics situations is in one sense more fundamental: with the exception of DNA testing, there is very little base rate information at all. In the next few paragraphs, I illustrate the problem using the example of fingerprint identification.[62]

A. Fingerprint Identification

The primary method used to examine fingerprints in the United States is called ACE-V, an acronym which stands for the stages of the examination: Analysis-Comparison-Evaluation-Verification.[63] As described by Haber and Haber,[64] the ACE-V examination proceeds as follows.

At the Analysis Stage, "the fingerprint examiner looks at a latent fingerprint and decides whether it contains sufficient quantity and quality of detail so that it exceeds the

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which the plaintiff was exposed, it would ideally be assigned 10 percent of the liability. *See* Rutherford v. Owens-Illinois, Inc., 16 Cal. 4th 953, 957 (1997).

It is important to note that in both the *Sindell* and the *Rutherford* situations the courts are prepared to adopt this solution only in the cases where every one of the defendants has breached a duty to the plaintiff. Obviously, this is never the situation in criminal cases. One potential defendant "breached a duty" to the plaintiff, but all the other potential defendants are innocent.

On rare occasions, one might have a specific causation issue in forensics which is similar to that in toxic torts. For example, a case might arise where the question was whether a bite mark was caused by human or animal teeth.

[62] I chose fingerprint identification because it is an area of forensics with high face validity. If a problem exists here, a fortiori, it exists in other areas such as handwriting analysis.

[63] Lyn Haber & Ralph Norman Haber, *Scientific Validation of Fingerprint Evidence Under* Daubert, 7 LAW, PROBABILITY & RISK 87, 87 (2008).

[64] *Id.*

standard for value."[65] If it does not, no further steps are possible and the prints are rejected.[66]

If a latent print does meet the value standard, the examiner collects as much evidence as possible on "the nature of the surface on which [the print] was deposited, the amount and direction of pressure used in touch[ing the surface, and the way] . . . in which the ridge details of the [print] were transferred onto the surface," e.g., sweat.[67] All of this is employed in the next step to account for inevitable distortions between the latent print and the print against which it is being compared.[68]

For prints that do meet the value standard, the examiner chooses a feature-rich area of the latent print.[69] "Within this area, he selects the particular features along the various ridge paths in the latent print, in their spatial locations relative to one another . . . ."[70]

In the Comparison Stage, the examiner attempts to ascertain whether one of the suspects' fingers made the latent print by comparing the same area that he chose for the latent print.[71] Failure to find a correspondence that cannot be accounted for by factors such as distortion lead to an exclusion of that finger.[72] This, of course, is the most likely result. If there are sufficient points of similarity and no excluding differences, the examiner will return to the latent print, examine another area of the latent print, and then again compare this area to the exemplar print.[73] This process will be repeated until "all the features of the latent print have been compared."[74] If there are sufficient points of comparison and no excluding differences, the examiner proceeds to the Evaluation Stage.[75]

"In [the Evaluation Stage], the examiner applies a sufficiency standard to the amount of corresponding agreement between the latent and the exemplar [print]."[76] "If the amount of corresponding agreement exceeds the sufficiency standard,

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[65] *Id.* at 90 (emphasis omitted).
[66] *Id.*
[67] *Id.*
[68] *Id.*
[69] Haber & Haber, *supra* note 63, at 90.
[70] *Id.*
[71] *Id.*
[72] *Id.* at 90-91.
[73] *Id.* at 91.
[74] *Id.*
[75] Haber & Haber, *supra* note 63, at 91.
[76] *Id.*

then the examiner concludes that the crime scene latent print [was made by the suspect finger]."[77] (In the language of latent print examiners, "the crime scene latent print can be *individuated* to the suspect.")[78] "If the amount of agreement does not reach th[is] standard," the examiner may say the comparison is inconclusive.[79] This sufficiency standard can be numeric, i.e., there are X number of points of similarity between the latent print and the exemplar.[80] Or, the standard can be experiential, "based on the individual examiner's training and experience."[81] Fingerprint examiners in the United States rarely use a numeric standard.[82]

In the Verification Stage, which is done in larger laboratories, after an examiner has concluded that the latent print did come from a suspect finger, a second examiner confirms or disconfirms the conclusion.[83] The verification is not a complete re-analysis, but rather is a review of the evidence and the conclusions of the examiner.[84]

As cautious and thorough as this sounds, apparently there is no peer-reviewed study testing the validity of the ACE-V method.[85] Indeed, such a study would be difficult to conduct because the details of how an examiner is to proceed are left quite open ended.[86] As a consequence, here is what a recent National Academy of Science (the "National Academy") report on the state of forensic evidence has to say about ACE-V.

> [T]he assessment of latent prints from crime scenes is based largely on human interpretation. Note that the ACE-V method does not specify particular measurements or a standard test protocol, and examiners must make subjective assessments throughout. In the United States, the threshold for making a source identification is deliberately kept subjective, so that the examiner can take into account both the quantity and quality of comparable details. As a

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[77] *Id.*

[78] *Id.* at 91.

[79] *Id.*

[80] *Id.*

[81] Haber & Haber, *supra* note 63, at 91.

[82] *Id.* at 102.

[83] *Id.* at 91.

[84] *Id.*

[85] *Id.* at 95.

[86] NAT'L RESEARCH COUNCIL, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 139 (2009).

> result, the outcome of a friction ridge analysis is not necessarily repeatable from examiner to examiner . . . .[87]
>
> This subjectivity is intrinsic to friction ridge analysis, as can be seen when comparing it with DNA analysis. For the latter, 13 specific segments of DNA (generally) are compared for each of two DNA samples. Each of these segments consists of ordered sequences of the base pairs, called A, G, C, and T. Studies have been conducted to determine the range of variation in the sequence of base pairs at each of the 13 loci and also to determine how much variation exists in different populations. From these data, scientists can calculate the probability that two DNA samples from different people will have the same permutations at each of the 13 loci.
>
> By contrast, before examining two fingerprints, one cannot say a priori which features should be compared. Features are selected during the comparison phase of ACE-V, when a fingerprint examiner identifies which features are common the two impressions and are clear enough to be evaluated. Because a feature that was helpful during a previous comparison might not exist on these prints or might not have been captured in the latent impression, the process does not allow one to stipulate specific measurements in advance, as is done for a DNA analysis. Moreover, a small stretching of distance between two fingerprint features, or a twisting of angles, can result from either a difference between the fingers that left the prints or from distortions from the impression process. For these reasons, population statistics for fingerprints have not been developed and friction ridge analysis relies on subjective judgments by the examiner. Little research has been directed toward developing population statistics, although more would be feasible.[88]

As the National Academy report notes, population statistics are a perquisite to fully quantifying the diagnosticity of an observed set of fingerprint characteristics. If the characteristics are rare, then a reported match is more diagnostic of the claim that two prints came from a common source.[89] For example, in DNA testing, the random match probability, i.e., the frequency with which a genetic profile exists in the population, captures the diagnosticity of a match.

Developing population statistics for fingerprints will not be an easy task. We do not have a "map" of fingerprints in the same sense that we have a map of the human genome. Thus,

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[87] *Id.* at 139-40. The report cites recent research that suggests even "experienced examiners do not necessarily agree with even their own past conclusions when the task is presented in a different context" at a later time. *See id.* (citing Itiel E. Dror & David Charlton, *Why Experts Make Errors*, 56 J. FORENSIC IDENTIFICATION 600 (2006)).

[88] *Id.*

[89] *See* Jonathan J. Koehler, *Fingerprint Error Rates and Proficiency Tests: What They Are and Why They Matter*, 59 HASTINGS L.J. 1077, 1078 (2008).

we do not know the frequency of different patterns in the way that we know the variations in the sequencing of base pairs in specific loci. Nor do we have strong evidence of the independence of patterns.[90]

Even if we were to have such base rate information, we would find it to be of less practical use than it is in DNA testing. In most cases, DNA matches are made with sufficient DNA that we can make comparisons at multiple locations.[91] The DNA samples contain complete or nearly complete information about the sequences of base pairs at multiple loci. Metaphorically, the samples are nearly "perfect prints." The problem in the real world of fingerprint identification arises when the latent print is far, far from perfect. The impression left by a given finger will differ every time because of variations in pressure and the impression medium.

Given this reality, the National Academy report proposes some other steps that could be taken to move the area toward a sounder scientific footing.[92] For example, the field could conduct research on the variables that effect latent print differences.[93] Note that these steps are designed to improve our general understanding of fingerprint marks, a general causation-like issue. Even more helpful in the short run would

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[90] Independence means that the sequence of base pairs at one location is independent of the sequence at another location. When independence exists, one can use the product rule to determine the overall probability of a match. Thus if a particular sequence at location one occurs in 5% of the population and a particular sequence at location two occurs in 10% of the population, the probability of observing the same sequence at both loci is 5% times 10% or 0.5%. In the early years of DNA testing it was not clear that the independence assumption was valid, causing some to propose a more conservative rule when combining probabilities. *See* Richard Lempert, *DNA, Science and the Law: Two Cheers for the Ceiling Principle*, 34 JURIMETRICS J. 41, 42-43 (1993).

[91] The widespread adoption of Polymerase Chain Reaction (PCR) test protocols has greatly reduced the occasion where the sample quantity of DNA is insufficient for a proper analysis. *See* 4 FAIGMAN ET AL., *supra* note 35, at § 30:44.

[92] Some efforts have been made to examine the ability of automated fingerprint identification systems (AFIS) to identify the source of simulated latent prints. *See* Simon Cole et al., *Beyond the Individuality of Fingerprints: A Measure of Simulated Computer Latent Print Source Attribution Accuracy*, 7 LAW, PROBABILITY & RISK 165, 170 (2008). Insofar as it reduces the role of subjective judgment, there is much to be said for this approach. *See* Itiel E. Dror & Jennifer L. Mnookin, *The Use of Technology in Human Expert Domains: Challenges and Risks Arising from the Use of Automated Fingerprint Identification Systems in Forensics*, LAW, PROBABILITY & RISK (forthcoming 2009) (manuscript at 4, *available at* http://lpr.oxfordjournals.org/cgi/reprint/mgp031v1.pdf); David L. Faigman, *Anecdotal Forensics, Phrenology and Other Abject Lessons from the History of Science*, 59 HASTINGS L.J. 979, 980 (2008).

[93] NAT'L RESEARCH COUNCIL, *supra* note 86, at 105-06.

be research on reliability.[94] The most frequently suggested way to achieve better reliability estimates is to engage in serious proficiency testing. Such testing would provide a better estimate of the error rate (the frequency of false positives and false negatives) associated with reported matches.[95]

Some fingerprint identification proficiency tests have occurred, but they have not used rigorous double blind methodology and most observers agree that the tests have not involved challenging partial prints.[96] Nearly everyone agrees that reliability is very high when the examination involves good-quality impressions of all ten fingers.[97] The critical question is how far we can move from this best-case situation before identification accuracy begins to deteriorate. Proficiency tests employing challenging partials address this question. Without some studies along these lines we are unable to assess the reliability of expert assertions in different identification settings.[98]

Most courts have not been sensitive to the importance of distinguishing among different identification situations. With very, very few exceptions, they have admitted fingerprint identifications.[99] Courts have refused to conduct *Daubert* hearings,[100] have implicitly reversed the burden of persuasion to require the defendant to demonstrate that a fingerprint

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[94] The reliability of a reported match addresses the issue of whether two reportedly matching prints actually do share a set of common characteristics. Is the match a true match, or has the examiner made an error? *See* Koehler, *supra* note 89, at 1078 (citing Suzanne O. Kaasa et al., *Statistical Inference and Forensic Evidence: Evaluating a Bullet Lead Match*, 31 LAW & HUM. BEHAV. 433, 434 (2007)).

[95] Under such a scheme, examiners would be sent prints to be analyzed. The examiner would not know that the prints were part of a proficiency test and the examiner would not be provided other evidence of a suspect's guilt or innocence. Such double blind testing is standard practice in other areas such as clinical trials for new drugs.

[96] *See* Jennifer L. Mnookin, *The Validity of Latent Fingerprint Identification: Confessions of a Fingerprinting Moderate*, 7 LAW, PROBABILITY & RISK 127, 135 (2008) (quoting a Scotland Yard fingerprint expert testifying in *Llera Plaza II*, 188 F. Supp. 2d 549, 558 (E.D. Pa. 2002)).

[97] *See* Mark P. Denbeaux & D. Michael Risinger, Kumho Tire *and Expert Reliability: How the Question You Ask Gives the Answer You Get*, 34 SETON HALL L. REV. 15, 68-69 (2004).

[98] *See* Cole, *supra* note 37, at 273.

[99] For a thorough discussion of the post-*Daubert* case law on the admissibility of fingerprint evidence, see 4 FAIGMAN ET AL., *supra* note 35, at §§ 33:3-:19. The following paragraph borrows heavily from this discussion. Although the following discussion focuses on federal court opinions, the states generally replicate this pattern. *See id.* at § 33:19.

[100] *See, e.g.*, United States v. Joseph, No. CR. A. 99-238, 2001 WL 515213, at *1 (E.D. La. May 14, 2001); United States v. Ambriz-Vasquez, 34 Fed. Appx. 356, 359 (9th Cir. 2002).

identification is not reliable,[101] have refused to focus on the "task at hand" as required by *Kumho Tire*,[102] have refused to conduct an assessment of the evidence on fingerprint reliability,[103] have admitted expert testimony by relying on the fact that other courts have admitted the testimony,[104] have relegated any concerns about validity to weight, not admissibility,[105] and in general have lowered the bar to the level necessary to admit fingerprint identification.[106]

The story is the same with respect to many other types of forensic evidence. Courts often seem to simply mouth the *Daubert* criteria without actually assessing whether the proffered evidence meets these criteria.[107] In sum, the critique of judicial leniency toward forensic experts is well founded. But is it any more lenient than proof of specific causation in toxic tort cases? The next section compares the two areas.

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[101] United States v. Rogers, 26 Fed. Appx. 171, 173 (4th Cir. 2001).

[102] 4 FAIGMAN ET AL., *supra* note 35, at § 33:6.

[103] United States v. Havvard, 117 F.Supp.2d 848, 855 (S.D. Ind. 2000), *aff'd*, 260 F.3d 597 (7th Cir. 2001).

[104] *Havvard*, 260 F.3d at 600; United States v. Frias, No. 01 Cr. 307, 2003 WL 352502, at *1 (S.D.N.Y. Feb. 13, 2003).

[105] United States v. Cline, 188 F. Supp. 2d 1287, 1294 (D. Kan. 2002), *aff'd*, 349 F.3d 1276 (10th Cir. 2003).

[106] *Id.* A rare exception to this landslide of opinions admitting fingerprint evidence was *United States v. Llera Plaza*, 179 F. Supp. 2d 492 (E.D. Pa. 2002). However, Judge Pollak later withdrew his initial opinion excluding fingerprint evidence and admitted the evidence. United States v. Llera Plaza, 188 F. Supp. 2d 549 (E.D. Pa. 2002); *see also* United States v. Crisp, 324 F.3d 261, 272 (4th Cir. 2003) (Michael, J., dissenting).

[107] Faigman, *supra* note 8, at 718; *see also* Johnson v. Commonwealth, 12 S.W.3d 258, 260-64 (Ky. 1999). For a discussion of *Johnson*, see Michael J. Saks, *Protecting Factfinders From Being Overly Misled, While Still Admitting Weakly Supported Forensic Science into Evidence*, 43 TULSA L. REV. 609 (2007):

> In a challenge to the admissibility of microscopic hair identification evidence, the Kentucky Supreme Court purported to be conducting an analysis under that state's version of *Daubert*. The record was devoid of research studies on the validity of asserted microscopic hair identification expertise, so the Court relied entirely on the "general acceptance" criterion of *Daubert*. But there was no evidence of that in the record either. So the Court turned to its own earlier (pre-*Daubert*) Kentucky decisions in search of general acceptance of microscopic hair comparison. But not one of the earlier cases admitting testimony on hair identification said a word about general acceptance of the technique. So the Court stated that it would assume that those earlier decisions must have: addressed the question, conducted an appropriate inquiry, and found general acceptance. How else could they have admitted the testimony?

Id. at 619-20. In point of fact, the *Frye* test had not been adopted or even mentioned in Kentucky cases until after those cases were decided. As Saks notes, "this Court had to create out of thin air the basis for admission under the weakest of the *Daubert* prongs." *Id.* at 620.

V. COMPARING TOXIC TORT AND FORENSIC ADMISSIBILITY STANDARDS

I do not wish to argue that there are no differences in admissibility standards in toxic tort cases and in admissibility standards in forensic cases. There are. Many tort plaintiffs lose their lawsuit at the summary judgment stage after the court has excluded their causation experts. Only very rarely does the same fate befall the state in criminal prosecutions.[108] However, the differences disguise an underlying similarity that is revealed once we control for the quantity and quality of the scientific evidence available to address various causal questions. Plaintiff experts are excluded in toxic tort cases largely because of an inability to show general causation, something about which there is often a body of empirical evidence. However, when there is relatively little evidence, which occurs most frequently with respect to proof of specific causation, the courts set a threshold that is not much higher than that required in the forensic area to prove a particular defendant left some piece of trace evidence at a crime scene.

This does not mean that experts who testify about individual causation always have little or no support for the position they espouse. Quite frequently, they do. The point is well made by Professor Mnookin with respect to fingerprint evidence.

> [T]he reality is that there are plenty of cases where the totality of the evidence—including but not limited to a fingerprint identification—leaves little practical doubt about ground truth. Fingerprint identification's 100 years of use in a variety of contexts does not come close to answering all the questions about precisely how accurate it is, or how commonly identification errors are made, but it does provide some degree of prima facie evidence of its general validity.[109]

The same may be said for many differential diagnoses. Often the probabilistic evidence that a particular substance caused a particular illness may be very high and we can state with substantial certainty that one caused the other even in the absence of a mechanistic understanding of how this occurs.[110]

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[108] Michael H. Graham, *The Expert Witness Predicament: Determining "Reliable" Under the Gatekeeping Test of* Daubert*,* Kumho*, and Proposed Amended Rule 702 of the Federal Rules of Evidence*, 54 U. MIAMI L. REV. 317, 322 (2000).

[109] *See* Mnookin, *supra* note 96, at 134.

[110] I certainly do not mean to suggest that such probabilistic evidence is never a sufficient substitute for a mechanistic understanding. This argument is similar to the cigarette industry's long standing argument that the causal link between tobacco usage

The point is not that all such testimony is unreliable (although in certain areas such as bite marks, a large percentage of the testimony may be of very low validity). Rather, the point is that the threshold for admissibility is low and, in part, this is a judicial response to the fact that there is little useful quantified empirical evidence courts may employ to establish a higher admissibility baseline.[111]

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and lung cancer was not established because we did not understand the exact way in which tobacco smoke caused cancer. In the case of cigarettes, where the relative risk of lung cancer among serious smokers is approximately five-fold that of non smokers, neither common sense nor law requires mechanistic causation to assert that more likely than not any particular lung cancer of a long-time smoker was caused by their habit.

[111] In the absence of direct empirical evidence, following a set routine and expressing conclusions in a formulistic way takes on increased importance. In the toxic tort arena, the best differential diagnoses involve factors such as: a patient examination and patient history, diagnostic tests, laboratory tests, tissue samples and biopsies, and genetic testing. *See* 3 FAIGMAN, ET AL., *supra* note 35, § 21:31-:39. Failure to structure one's testimony along these lines or a failure verbally to give full consideration to all of the data may lead to the exclusion of the expert's testimony. *See, e.g.*, Cooper v. Smith & Nephew, Inc., 259 F.3d 194, 203 (4th Cir. 2001); Viterbo v. Dow Chem. Co. 826 F.2d 420, 424 (5th Cir. 1987).

Likewise, fingerprint expertise may be rejected if the state makes no effort to explain and justify an examiner's conclusion. *See* Jacobs v. Gov't of the Virgin Islands, 53 Fed. Appx. 651 (3d Cir. 2002). The recent emergence of the ACE-V terminology for fingerprint analysis may be understood from this perspective. Professor Cole notes that the terminology was first adopted after the Daubert opinion. "Given the fortuitous timing, one might suspect that the term was adopted in the wake of Daubert to lend forensic fingerprint identification a scientific patina." Simon A. Cole, *Grandfathering Evidence: Fingerprint Admissibility Rulings From Jennings to Llera-Plaza and Back Again*, 41 AM. CRIM. L. REV. 1189, 1236 n.201 (2004).

Wrapping testimony in the rhetoric of a methodology does not, of course, make it more reliable. As Professor Cole notes with respect to ACE-V, "[I]t indicates little more than looking at two objects and determining, subjectively, whether they originate from a common source, and then repeating this process." *Id.*

Professor Mnookin argues that courts should not settle for explanations of method standing alone.

> Indeed, the history of the identification sciences in court shows a repeated and dangerous pattern: when judges are provided with an intuitively appealing description of a science of 'matching,' they frequently let poorly specified explanations of method substitute for a more searching assessment of validity and reliability . . . .
>
> Judges, therefore, would be well advised to focus on the degree of testing associated with the claims made by experts rather than emphasizing whether the expert has offered a seemingly plausible explanation of her technique and her conclusion.

Jennifer Mnookin, *Of Black Boxes, Instruments, and Experts: Testing the Validity of Forensic Science*, 5 EPISTEME 343, 349-51 (2008).

VI. CONTEXTUALISM AND THE LAW'S APPROACH TO INDIVIDUAL CAUSATION

Many critics of the lax admissibility standards in forensic cases call upon the courts to tighten things up. At the same time, some call upon courts to ease admissibility standards in civil cases. A first reaction to these two requests might be that the courts should search for one appropriate standard that applies to all admissibility questions. A single standard might be epistemologically more satisfying, but given the social objectives of the law, in my opinion, it would be ill advised. A brief discussion of the standard epistemological approach to knowledge will help us to see why this is the case.

The standard approach to the question of "when . . . it is proper to say someone knows something . . . involves the interplay of three primary variables: belief, truth, and justification."[112] Belief is a person's subjective position concerning the truth of a proposition. Truth is the reality of the proposition independent of belief. Justification involves the quality of the reasons for a belief. To count as knowledge, something must be believed to be true, it must be true, and a person's belief that it is true must be justified. In the absence of belief, we have ignorance. In the absence of truth, we have error. In the absence of appropriate justification, we have mere opinion.[113] What is most noteworthy about this standard approach is that its main concern is not knowledge per se but justification. Even correct beliefs without justification are not knowledge.

For courts, the relevant question is what level of justification should be required before experts are permitted to testify? Clearly, the level must be sufficient to qualify the person as an expert, i.e., in the jargon of evidence law, a person must be in possession of knowledge (and justification for that knowledge) that is beyond the ken of the lay person. But beyond that, how much? Presumably, a single admissibility standard would require the same level of justification from all experts. But from where would such a standard come?

Earlier in the article, I compared legal and scientific conventions. I noted that three relevant scientific conventions

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[112] D. Michael Risinger & Michael J. Saks, *Rationality, Research and Leviathan: Law Enforcement-Sponsored Research and the Criminal Process*, 2003 MICH. ST. L. REV. 1023, 1024.

[113] MICHAEL WILLIAMS, PROBLEMS OF KNOWLEDGE: A CRITICAL INTRODUCTION TO EPISTEMOLOGY 16-19 (2001).

are: a) a search for general and theoretical propositions, b) doing so by employing the methods and techniques accepted by one's field, and c) an attitude of agnosticism that encourages a wait-and-see attitude. I compared these to the relevant legal conventions which: a) often focus on the specific event, and b) push witnesses toward arriving at a conclusion.

The point I wish to make here is that the second element in scientific conventions, a commitment to the methods and techniques of inquiry accepted by one's field, has no direct parallel in legal conventions. Of course, the law has conventional techniques it uses to arrive at causal conclusions. Substantial parts of the law of evidence could be understood in this way. But ultimately when it comes to methods and techniques of acquiring knowledge in the first instance, the law has no methodology of its own. It simply borrows the relevant scientific methodology. Presumably, the law could be indifferent to the methods and techniques used by an investigator or even ask the investigator to forego these techniques when appearing in court. However, most post-*Daubert* courts are respectful of these methods. Many successful *Daubert* challenges turn on the argument that the expert failed to use the methods deemed to be appropriate by those in his field when arriving at a causal conclusion.[114]

Even if the courts were inclined to establish a single level of justification for causal assertions, what should it be? In some situations, raising the bar may systematically guarantee victory for one side, a result many courts find to be undesirable as a general principle.[115] If raising the bar has problems, how about lowering the bar? This does not lead inevitably to a victory for one side, but it has its own problems. If experts are not to use their normal methods for determining causation, what are they to use? Because the question has no obvious

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[114] One need look no further than *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137 (1999). Referring to the plaintiff's expert, the court said, "Indeed, no one has argued that Carlson himself, were he still working for Michelin, would have concluded in a report to his employer that a similar tire was similarly defective on grounds identical to those upon which he rested his conclusion here." *Id*. at 157.

[115] In the toxic tort area, opinions that require the plaintiff to have epidemiological evidence in order to prove causation note that this is not always necessary. *See* Merrell Dow Pharms., Inc. v. Havner, 953 S.W.2d 706, 718 (1997). One suspects that a similar concern underlies many lenient forensic opinions. The court may fear that raising the bar too high would make it impossible for the state to prove its case in many criminal trials.

answer, courts are also reluctant to adopt this position.[116] Where does this leave us?

The epistemological approaches most congenial to the standard legal position on what constitutes adequate justification are contextual approaches to knowledge.[117] The central idea behind contextualism is that the standards for making knowledge attributions vary depending on the context within which they are made.[118] The rules of evidence are applied in a way that is consistent with the contextualist's fundamental observation that the level of justification we require for something to count as knowledge and coincidently for someone to be epistemically responsible in asserting a

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[116] I attended a Court of Federal Claims conference in November of 2008. One of the panels was on compensation under the National Vaccine Act. The central topic of the panel was proof of causation under the Act. A number of attorneys from the petitioners' bar argued for a relaxed standard of causation that would be different from "scientific" causation. Those in favor of this position argued that a medical theory combined with temporal order should be sufficient to prove causation. If one suffered an injury shortly after being vaccinated and some theory supported a causal connection then one should recover under the Act. In support of this position, the petitioners cited *Althen v. Sec'y of Health & Human Servs.*, which set forth three criteria for recovery under the Act: (1) medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a proximate temporal relationship between vaccination and injury.

In response to this argument, a special master in a thimerosal case before the court responded:

> Althen requires more than merely a medical theory. Petitioners must offer a *biologically plausible* medical theory. . . .
>
> What is missing from petitioners' formulation of the medical theory prong of *Althen* is the requirement that such a theory be reliable.
>
> Under the Vaccine Act, a special master may determine the reliability of a medical theory by considering the framework established by *Daubert*. *See Terran v. Sec'y, HHS*, 195 F.3d 1302, 1316 (Fed. Cir. 1999) (framework established by *Daubert* for evaluating the reliability of evidence appropriate for use by special masters). *Daubert* requires that an opinion be supported by something more than subjective belief; it must be grounded "in the methods and procedures of science."

Snyder v. Sec'y of Health & Human Servs., No. 01-162V (Fed. Cl. Feb. 12, 2009) (internal citations omitted), *available at* http://www.autism-watch.org/omnibus/snyder.pdf.

[117] David Lewis, *Elusive Knowledge*, *in* EPISTEMOLOGY: AN ANTHOLOGY 503 (Ernest Sosa & Jaegwon Kim eds., 2000); Keith DeRose, *Solving the Skeptical Problem*, *in* EPISTEMOLOGY: AN ANTHOLOGY 482 (Ernest Sosa & Jaegwon Kim eds., 2000); Michael Williams, *Epistemological Realism*, *in* EPISTEMOLOGY: AN ANTHOLOGY 536 (Ernest Sosa and Jaegwon Kim eds., 2000). Cranor advocates a similar position in the area of regulation. *See* CARL F. CRANOR, REGULATING TOXIC SUBSTANCES: A PHILOSOPHY OF SCIENCE AND LAW ch. 5 (1993).

[118] On the different forms of contextualism, compare Steward Cohen, *Contextualist Solutions to Epistemological Problems: Scepticism, Gettier, and the Lottery*, *in* EPISTEMOLOGY: AN ANTHOLOGY 517 (Ernest Sosa & Jaegwon Kim eds., 2000) with David Lewis, *Elusive Knowledge*, *in* EPISTEMOLOGY: AN ANTHOLOGY, *supra*, at 503.

belief, varies according to the context within which the belief is held and expressed. Within the confines of the present discussion, the most important context is the quantity and quality of the available evidence.[119]

The contextual nature of legal epistemology is both a strength and a weakness. It is a strength because it balances two important legal goals. Earlier in the article, when listing differences between scientific and legal conventions, I noted that the law needs to arrive at a conclusion. A wait-and-see attitude that advises us to bide our time until we arrive at a greater level of justification for a belief may suffice in science, but not in the courtroom. Competing against the goal of resolving cases is the goal of arriving at the factually correct outcome. As Federal Rule of Evidence 102 states, evidentiary rules shall be construed toward the end of ascertaining the truth.[120] Acquiescing to a low level of justification when in fact experts can do better is to insure more incorrect outcomes than are necessary. A contextual approach balances these objectives. If, as Aquinas teaches us, prudence is the first virtue, contextualism is indeed a virtue.[121] And as a practical matter this approach permits the law to sidestep difficult philosophical questions concerning knowledge and get on with the business of deciding cases.[122]

However, if the contextual approach's flexibility is its strength, it is also its potential weakness. Without more, it offers no independent standard by which courts may measure the twin problems of epistemological adequacy: when is the

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[119] In this article, I do not propose to provide a complete review of the many ways in which courts adopt a contextual approach. One example, however, might be in order. In the rather well known handwriting analysis, United States v. Starzecpyzel, 880 F. Supp. 1027 (S.D.N.Y. 1995), Judge McKenna was met with a defense challenge that the state's expert should be excluded because there was little or no scientific support for the reliability of his alleged expertise. The judge concluded that if the *Daubert* standard were applied, the state's expert should be excluded. Rather than take this step, the judge concluded that *Daubert* did not apply to "skilled" experts. Here, the key point is that the court invents a special category of expert with a special admissibility standard precisely because it recognizes that the standard to which experts were held to in *Daubert* would lead to the exclusion of the state's document examiner.

[120] FED. R. EVID. 102.

[121] ST. THOMAS AQUINAS, THE CARDINAL VIRTUES: PRUDENCE, JUSTICE, FORTITUDE, AND TEMPERANCE (Richard J Regan, trans., 2005).

[122] One is reminded of Sir Frederick Pollock's famous aphorism that "The lawyer cannot afford to adventure himself with philosophers in the logical and metaphysical controversies that beset the idea of cause." SIR FREDERICK POLLOCK, THE LAW OF TORTS 36 (11th ed. 1920).

admissibility bar set too high and, my primary concern in this article, when is the bar set too low?[123]

The best answer to date, and an answer consistent with a contextual approach, has been advanced by Professor Nance[124] and Professor Mnookin.[125] Courts should require a level of justification that is as good as practicably possible. Assuming such a standard is as good as we can do, what does it practically mean with respect to individual causation evidence in toxic tort cases and many types of forensic evidence? Importantly, does it condemn us to perpetually accepting a low threshold when there is little available science? I believe that if we properly understand the nature of the contextual approach, the answer is no. Allow me to elaborate.

If the contextual approach tells courts to require a level of justification that is as good as practicably possible, how should courts understand the context within which to apply this standard? Should the relevant context only be the case at hand and the evidence available at that moment in time, or should we take a longer view? If we focus solely on the case at hand, that is, if we set the level of necessary justification to reflect the state of knowledge at the moment a particular case is being tried, we may find ourselves permanently settling for relatively little by way of justification.[126] If, on the other hand,

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[123] With respect to the former question, at least in those areas where experts employ their expertise outside the courtroom, I believe the best answer is to require experts to use the same intellectual rigor they employ in their day-to-day work. *See* Joseph Sanders, *Expert Witness Ethics*, 76 FORDHAM L. REV. 1539 (2007). This means that even in the same general area of litigation, e.g. toxic torts, the courts may require more justification when there is substantially more evidence available. This, apparently, is what courts in fact generally do. *See* David L. Faigman et al., *How Good is Good Enough? Expert Evidence under* Daubert *and* Kumho, 50 CASE W. RES. L. REV. 645 (2000).

[124] "The best that is reasonably available should be admitted, at least so far as the reliability requirement of Rule 702 is concerned." Dale Nance, *Reliability and the Admissibility of Experts*, 34 SETON HALL. L. REV. 191, 241 (2003).

[125] "One appropriate focal point for the judge, it seems to me, ought to be whether the expert evidence on offer is as reliable as it can reasonably be, considering the particular context and circumstances." Mnookin, *supra* note 96, at 133.

[126] This does not mean courts will settle for anything. For example, under some fact patterns even the relatively lenient standard prevalent in specific causation cases may be insurmountable. Consider, for example, *Newton v. Roche Labs., Inc.*, 243 F. Supp. 2d 672 (W.D. Tex. 2002). In this case, the plaintiffs claimed that exposure to Accutane induced their child's schizophrenia. Excluding the differential diagnosis testimony of the plaintiffs' expert, the court noted:

> Dr. Rossiter's conclusion that Accutane induced Candis's schizophrenia relies solely on the temporal proximity of her illness and her taking of the drug. However, he does not adequately consider that Candis's uncle and sister were schizophrenic and her mother outwardly exhibited symptoms consistent with

we take a longer view, we concern ourselves with the impact of present admissibility decisions on the body of foreseeable future science and foreseeable future cases. I believe that the better course of action is for courts to adopt this longer view.

The longer view is superior because it allows us to recognize situations where the courts may be able to push lawyers and, to the extent possible, science toward better evidence. Moving the system toward better evidence can be accomplished in two ways: by improving the mix of cases and by and improving the underlying science. I discuss each in turn.

Improving the mix of cases. At any point in time, an admissibility ruling produces a shadow effect on future cases. A decision that admits expert testimony puts pressure on the other side to mount a more complete case, by including stronger opposing expertise. An exclusionary decision has the opposite effect: it encourages proponents of such cases to produce better evidence in the future.[127]

It may be that the nature of the science available on a legal question and the quality of the expert opinions available to report on that science are a constant. In this situation, a higher standard can affect the mix of cases that are litigated, but it cannot influence the quality of future cases. On the other hand, if lawyers have not presented the best possible evidence or have employed less well qualified experts, then a heightened admissibility standard may improve the quality of evidence in the same type of cases.[128]

Improving the science. In most situations, scientific investigations are, at best, marginally influenced by what is going on in court. When an area of litigation becomes a hot topic, this may spur some research. For example, there is evidence that the litigation surrounding the drug Bendectin generated some research that would not otherwise have been

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> schizophrenia; Candis was severely malnourished in her early childhood; and Candis's natural father was sixty years old at the time of her birth—all of which Dr. Rossiter agrees are considered risk factors for the natural onset of schizophrenia. Dr. Rossiter's reaction to this evidence was only that Accutane could also be a possible contributing cause.

Id. at 683.

[127] Because this article focuses on two areas where admissibility decisions are lax, I focus my attention on the effect of tightening admissibility standards.

[128] There is some evidence that this may have happened in some civil cases. Lloyd Dixon & Brian Gill, *Changes in the Standards for Admitting Expert Evidence in Federal Civil Cases Since* Daubert, 8 PSYCHOL. PUB. POL'Y & L. 251, 298-99 (2002).

published.[129] Note, however, that it was the litigation itself, not admissibility rulings per se that led to a better scientific understanding of the issue at hand. The influence of legal opinions on the production of science may be much stronger in situations where the legal system itself is the primary market for the information.[130]

All of this suggests that from the perspective of a longer view, the specific causation in toxic tort cases and in forensic cases is not the same. The impact of admissibility decisions is likely to be greater in forensic cases.

In both areas, admissibility rulings may influence the mix of cases. And marginally, they may influence the quality of expertise presented in a particular trial.[131] However, adverse admissibility rulings are likely to have a larger effect on case mix in the forensic setting. This is due to the social organization of criminal prosecutions when compared to the social organization of tort litigations. The latter is much less well organized. Many tort claims are brought by small time entrepreneurial tort lawyers. And even when the plaintiff's bar is more organized, as it often is with respect to mass torts, there is a much more limited hierarchical structure. Individual lawyers may bring relatively weak cases, unimpeded by concerns for the larger body of claims. This is somewhat less likely, at least within any given prosecutor's office, where an adverse ruling in a given case may impact other similar cases brought in the future.

However, the most substantial difference between the toxic and the forensic situation is in the ability of admissibility rulings to influence the science itself. On the civil side, lawyers might wish that scientists would do more research of direct relevance to their cases and on rare occasions may even fund

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[129] "Jean Goldberg, author of a[n]. . . article on Bendectin and oral clefts, noted, 'if nothing had been happening over the drug . . . I doubt even whether I would have written it up.'" JOSEPH SANDERS, BENDECTIN ON TRIAL: A STUDY OF MASS TORT LITIGATION 63 (1998) (quoting MICHAEL D. GREEN, BENDECTIN AND BIRTH DEFECTS: THE CHALLENGE OF MASS TOXIC SUBSTANCES LITIGATION 332 (1996)). Some research may be mandated by the government. The largest animal study on Bendectin was conducted at the specific request of the Food and Drug Administration. JOSEPH SANDERS, BENDECTIN ON TRIAL 63 (1998).

[130] Susan Haack, *Irreconcilable Differences: The Troubled Marriage Between Science and the Law*, 72 LAW & CONTEMP. PROBS. 16 (2009).

[131] Because the parties in some civil cases may have more resources than the parties in a criminal trial, they may be in a better position to respond to an adverse admissibility ruling by seeking out better experts and better existing data in subsequent cases. However, they may not be in a superior position when it comes to generating new data.

research, but by and large the scientists have their own agenda over which the legal system has very little influence. This is not the case with respect to many forensic areas. The legal regime is the primary market for most types of forensic science. Indeed, a substantial percentage of the people who work in this area are the employees of legal entities. This community's failure to respond to legal signals will have a significant impact on its livelihood. Moreover, the hierarchical structure of the criminal justice system makes it relatively easy for the legal system to organize a research strategy.[132]

Of course, if there are no scientific improvements to be made, legal influence will come to naught.[133] But as I noted in the discussion of fingerprint identification,[134] there are both short run and long run ways to improve the quality of at least some types of forensic evidence.

VII. ADMISSIBILITY STRATEGIES FOCUSED ON THE LONGER VIEW

Assuming that I am correct that admissibility decisions can have a greater impact in forensic cases and that using these decisions to push litigators in the direction of better

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[132] I do not want to leave the impression that admissibility decisions have no potential influence on the quality of science in the toxic tort specific causation situation. The path to improving the evidence in these cases is less well defined, but it is not non-existent. Most significantly, the field of toxicogenomics offers the long run possibility that we will be able to ascertain causation at the level of the individual case, radically changing all specific causation testimony. *See generally*, Gary E. Marchant, *Genetics and Toxic Torts*, 31 SETON HALL L. REV. 949 (2001); Gary E. Marchant, *Genetic Data in Toxic Tort Litigation*, 14 J.L. & POL'Y 7 (2006); Jamie A. Grodsky, *Genomics and Toxic Torts: Dismantling the Risk-Injury Divide*, 59 STAN. L. REV. 1671 (2007).

In the shorter run, genetic information may assist traditional specific causation testimony by allowing experts to make better estimates that the various possible causes of a disease played a role in the plaintiff's case. *See* Gary E. Marchant, *Genetic Data in Toxic Tort Litigation*, 14 J.L. & POL'Y 7 (2006).

In addition, one could envision some level of proficiency testing for specific causation clinical judgments, but the reality is that this approach would be of very limited value because in most cases of interest we simply do not know what caused the plaintiff's injury and, therefore, we would have no way of knowing if the expert's judgment was or was not correct.

[133] For example, we might wish to have some type of proficiency testing in toxic tort cases to ascertain the error rate of physicians making differential diagnoses. Unfortunately, because there is no way to know the ground truth in toxic cases, i.e. what *did* cause the plaintiff's illness, proficiency testing is not a viable avenue of investigation.

[134] *See supra* Part IV.A.

science is a good thing,[135] how should courts go about this task? There are several alternatives.

Immediately excluding whole areas of testimony. The most radical approach to improving the quality of evidence would be to declare a body of expertise inadmissible until the proponent is able to produce better evidence. The temptation to espouse this solution in the forensics area is fortified by the lackadaisical, even obstructionist attitude of some practitioners in the field. For example, the fingerprint examiner community clings to a set of conceptual perspectives and professional norms that discourage testing.[136] Experts claim that their technique has an error rate of zero. That is, they assert certainty that when they declare a match they have matched the latent print under investigation to the one and only person in the entire world whose finger could have produced the print.[137] This position is the product of what Professors Saks and Koehler label the "Individualization Fallacy," which they define as "placing an object in a unit category that consists of a single unit. Individualization implies uniqueness."[138] The

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[135] I am far from the first person to argue for this approach. Professor Mnookin makes the same point in the following passage.

> Practically speaking, what should *Daubert* mean? How high a standard of reliability ought trial judges to impose before permitting expert evidence before a jury? One appropriate focal point for the judge, it seems to me, ought to be whether the expert evidence on offer *is as reliable as it can reasonably be, considering the particular context and circumstances*. Validity under *Daubert* is not an on/off switch or an all or nothing proposition. It is, at least to some degree, appropriately contextual and gradational: reliability ought to be determined in relation to what information is available or what information could or should have been available with reasonable effort.

Mnookin, *supra* note 96, at 133; *see also* Michael J. Risinger, *Goodbye To All That, Or a Fool's Errand, By One of the Fools: How I Stopped Worrying About Court Responses to Handwriting Identification (and "Forensic Science" in General) and Learned to Love Misinterpretations of* Kumho Tire v. Carmichael, 43 TULSA L. REV. 447 (2007) (decrying the willingness of some courts to admit every handwriting expert, regardless of the justification for the expert's position).

[136] *See* Simon A. Cole, *Comment on 'Scientific Validation of Fingerprint Evidence Under* Daubert', 7 LAW, PROBABILITY & RISK 119 (2008).

[137] *See* Simon A. Cole, *Out of the* Daubert *Fire and Into the* Frye*ing Pan? Self Validation, Meta-Expertise and the Admissibility of Latent Print Evidence in* Frye *Jurisdictions*, 9 MINN. J. L. SCI. & TECH. 453, 470 (2008); Mnookin, *supra* note 96, at 139. As Mnookin notes, an examiner might face a disciplinary sanction if she were to testify that a match between the latent print and the comparison print was only "likely" or "probable." *Id*.

[138] Michael J. Saks & Jonathan J. Koehler, *The Individualization Fallacy in Forensic Science Evidence*, 61 VAND. L. REV. 199, 205 (2008). The fallacy leads to statements such as a firearms examiner's testimony that he is able to identify an unknown weapon "to the exclusion of every other firearm in the world." United States v. Green, 405 F. Supp. 2d 104, 107 (D. Mass. 2005); *see also* Paul C. Giannelli, *Forensic*

position is indefensible.[139] It engenders a response that says, "if they think that, then they should not be allowed to testify at all."

Nevertheless, if the history of admissibility decisions in the forensics area teaches us anything, it is that this approach is not going to win favor with the courts. Elected judges might well be committing re-election suicide by excluding key evidence in a criminal case, but even the life-tenured federal judiciary seems unwilling to take such a step.

Prohibiting testimony about individual causation. Another option is to limit what experts can say with respect to the particular case. There is some precedent for this solution. When expert evidence on eyewitness identification is permitted, it is generally restricted to general testimony about the factors that affect eyewitness accuracy.[140] Testimony about whether or not a particular witness is correct is almost always prohibited.[141] A few courts have placed similar restrictions on

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Science: Under the Microscope, 34 OHIO N.U. L. REV. 315, 323-24 (2008). Similarly, we have a forensic dentist's testimony that the defendant "was the only person in the world who could have inflicted the bite marks on [the murder victim's] body." Otero v. Warnick, 614 N.W.2d 177, 178 (Mich. App. 2000). Fortunately for the plaintiff in *Otero*, "the Detroit Police Crime Laboratory [later] released a supplemental report that concluded that [he] was excluded as a possible source of DNA obtained from vaginal and rectal swabs taken from [the victim's] body." *Id*. at 178. *Otero* is a civil suit by the alleged offender against the dentist for gross negligence in his investigation and testimony. *Id*. The court found that the dentist owed no duty to the plaintiff. *Id.* at 182. For a discussion of the limits of civil suits as a method of holding expert witnesses accountable, see Sanders, *supra* note 123, at 1562-72.

[139] "Given the general lack of validity testing for fingerprinting, the relative dearth of difficult proficiency tests, the lack of a statistically valid model of fingerprinting and the lack of validated standards for declaring a match, such claims of absolute, certain confidence in identification are unjustified." Mnookin, *supra* note 96, at 139.

[140] *See* 2 FAIGMAN ET AL., *supra* note 35, at § 16.

[141] Ordinarily, experts on eyewitness identifications—or the courts in which they testify—limit their testimony to the general principles derived from sound empirical research. One exception appears to have been the testimony of Dr. Gerald Loftus in *United States v. Mathis*, 264 F.3d 321 (3d Cir. 2001). Applying the general finding of eyewitness research to the case at hand, according to the court:

> Dr. Loftus stated that "it's two to three times as likely that the identification in the photo montage was made based on seeing the photograph four weeks earlier than it was based on seeing the individual" who fled on October 14, 1998.

Id. at 334.

At least one treatise written by a well known investigator in the field made the following comments concerning this type of testimony:

> Without the transcript of the trial, it is impossible to say what literature Dr. Loftus relied upon in making these conclusions regarding the likely accuracy of a particular witness' specific identification. To our knowledge, there is no research support in the scientific literature for the validity of such clinical opinions. In psychology, work on eyewitness identifications has, on the whole,

handwriting experts. For example, the expert is permitted to testify about general features that distinguish individual handwriting, but not whether a particular signature is a forgery.[142]

As attractive as this alternative may be in some criminal law contexts, were it ever to be used on the civil side it would run directly into the plaintiff's burden to prove specific causation by a preponderance of the evidence. And simply because there is no expert opinion on the individual causation question does not mean that the jury can avoid the issue. It must decide if this signature is a forgery or if the plaintiff's disease was caused by the defendant. We do not know enough about jury decision making to know whether the quality of the jury's judgment would benefit from restricting expert testimony in this way.

Exclude the worst testimony. This alternative assumes that even in areas where there is little science we may still distinguish levels of reliability, and that some testimony is so unreliable that it fails a minimal threshold of reliability. One way to think about such a situation is to conclude that the expert is not an expert at all because the area of so-called expertise does not exist. The "expert" witness is a lay witness in disguise.

This approach has the advantage of incrementalism. One does not need to make global pronouncements concerning a particular type of expert testimony. For example, courts might decide to admit handwriting expert testimony when the task is to determine whether a signature is a forgery based on many exemplars of known authentic signatures while excluding testimony asserting the authorship of an attempted forgery.[143]

> been of a kind that the field should be most proud. Indeed, no other topic has garnered the same degree of attention among psychologists. It has been unfortunate that courts have been slow to recognize the valuable insights this research has to offer the law. But psychologists should be cautioned not to overreach and offer opinions beyond what the data can support. Opinions regarding the accuracy of individual identification appear to exemplify just such overreaching.

2 FAIGMAN, ET AL., *supra* note 35, at § 16:2.

The fact that the expert witness research community opposes particularistic testimony says a good deal about the gulf between clinicians and non-clinicians. The community of eyewitness identification experts is comprised largely of experimental psychologists holding university professorships. Their expert culture causes them to resist clinical judgments about a specific identification.

[142] Paul Giannelli, *supra* note 138, at 319 n.30 notes that this was the position of the courts in *United States v. Rutherford*, 104 F. Supp. 2d 1190, 1194 (D. Neb. 2000) and *United States v. Hines*, 55 F. Supp. 2d 62, 67 (D. Mass. 1999).

[143] *See generally* Risinger, *supra* note 135.

The approach requires the courts to draw difficult lines and thus it threatens to produce inconsistent outcomes in close cases. Nevertheless, this may be the best that we can do in areas where admissibility decisions will not have a foreseeable impact on future cases or future science and the only goal courts can hope to achieve is to change the mix of cases by eliminating the weakest among them.

Excluding evidence at some point in the future. There is an additional alternative that directly focuses on the longer view. A court could declare that at some future time the proponent of a type of evidence must present a better justification for its reliability or risk the exclusion. A precise timetable is not required. The court does not need to establish a date certain when evidence will no longer be admitted without better science. A vaguer nod to the future may well suffice. For example, the court could tell the United States that it should ask the F.B.I. to engage in significant, serious proficiency testing.[144] For all cases coming before district courts two or three years hence, experts testifying about a fingerprint identification should be prepared to present the results of such tests or indicate why this is not yet possible. The details of such an opinion are less important than the general requirement that the proponent work toward better justification for its position.

I know of no cases that have adopted this position. In most situations, because of the very limited impact legal opinions have on advancements in our causal understanding, it would be unnecessary, inappropriate, or both. But in the forensic area we find ourselves in a unique chicken-and-egg situation. Because courts are committed to a contextual approach to justification, they permit forensic expert testimony with very little warrant. But this liberal approach unnecessarily helps to perpetuate the status quo. Absent the very unlikely prospect of a congressional mandate, the courts are in the best position to move us toward a time when forensic evidence stands on a more solid scientific foundation.

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[144] Because of the F.B.I.'s central role in the production of forensic evidence, the greatest impact would come from a federal circuit court opinion sets a timetable for improved evidence. One must be wary, of course, of the quality of research generated by the very organization being asked to provide evidence. On this point, the F.B.I.'s track record is anything but reassuring. For an insightful article on the less than evenhanded nature of past law-enforcement sponsored research efforts, see D. Risinger & Saks, *supra* note 112, at 1023. Given this record, a court might wish to stipulate in advance that the research is undertaken by an independent entity.

VIII. SUMMARY

Following the United States Supreme Court's opinion in *Daubert v. Merrell Dow Pharmaceuticals*, trial courts are increasingly asked to assess the reliability of expert testimony. Testimony that is deemed to be insufficiently reliable is excluded. Many scholars argue that the courts apply the reliability requirement inconsistently. One frequently mentioned example is the use of liberal admissibility standards in criminal law forensic evidence cases and the use of stringent admissibility standards in tort law toxic tort cases. I argue that this apparent inconsistency misses a key point.

Admissibility decisions in toxic tort cases appear to be stringent because they address two separate causal questions: evidence of general causation and evidence of specific causation. When we focus on admissibility decisions dealing exclusively with specific causation we see that courts adopt a liberal standard. I compare this standard with liberal admissibility standards in forensic cases, using fingerprint evidence as an example.

In both situations, courts must decide a causal question with respect to a particular individual and often the only expertise available to address the issue is the judgment of a clinician, be that clinician a medical doctor or a fingerprint analyst. In neither situation does the expert have much by way of quantified, empirical evidence to support her conclusion. It is the relative lack of scientific information that causes the courts to lower their admissibility standard in both these situations.

This liberal admissibility standard is consistent with law's contextual approach to knowledge. A contextual approach varies the amount of justification necessary for an expert to express an opinion depending on the quantity and quality of evidence on the point. Admissibility standards with respect to questions of individual causation are relatively liberal because we have relatively little systematic scientific evidence on point.

Unfortunately, the contextual approach does not create any incentive for the parties to improve the quality of evidence even in situations where this might be possible. I argue that some branches of forensics are such situations. When this occurs, courts should view the relevant context from a longitudinal perspective and adjust their admissibility rulings accordingly.