

**ON “FALSIFICATION”
AND “FALSIFIABILITY”:
THE FIRST *DAUBERT* FACTOR
AND THE PHILOSOPHY OF SCIENCE***

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ABSTRACT: In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 593 (1993), the Supreme Court suggested that in evaluating the admissibility of scientific evidence, federal courts should consider "whether a theory or technique . . . can be (and has been) tested." Several commentators have thought that this suggestion represents an adoption of the philosophy of science of Karl Popper, and several courts have treated the abstract possibility of falsification as sufficient to satisfy this aspect of the screening of scientific evidence called for in *Daubert*. This essay challenges these views. It first explains the distinct meanings of "falsification" and "falsifiability." It then argues that while the Court did not embrace the views of any specific philosopher of science, inquiring into the existence of meaningful attempts at falsification is an appropriate and crucial consideration in admissibility determinations. Consequently, it concludes that courts that are substituting mere "falsifiability" for actual empirical testing are misconstruing and misapplying *Daubert*.

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Everyone who knows anything about scientific evidence knows that *Daubert v. Merrell Dow Pharmaceuticals, Inc.*¹ has radically altered the law on the admissibility of such evidence, suddenly turning federal judges into “gatekeepers” and erecting a brand-new structure to fence out “junk science.” Of course, it is not this simple. Trial judges have long been gatekeepers of all kinds of evidence, scientific and nonscientific alike.² Furthermore, *Daubert* itself was less a radical break with the past than a continuation of a pre-existing line of cases espousing a “relevancy-plus standard” for scientific evidence.³ Furthermore, the competing standards, properly applied, are not as different as the copious quantities of ink spilled on this subject might suggest.⁴

Nevertheless, the details of *Daubert* are novel, and one detail that has attracted attention is the use of the term “falsifiability” at the outset of the Court’s description of several characteristics or indicators of scientific validity. Because parts of the passage are often misunderstood or seen as problematic, it is worth quoting in full:

Ordinarily, a key question to be answered in determining whether a theory or technique is scientific knowledge that will assist the trier of fact will be whether it can be (and has been) tested. “Scientific methodology today is based on generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry.” Green 645. See also C. Hempel, *Philosophy of Natural Science* 49 (1966) (“[T]he statements constituting a scientific explanation must be capable of empirical test”); K. Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge* 37 (5th ed. 1989) (“[T]he criterion of the scientific status of a theory is its falsifiability, or refutability, or testability”) (emphasis deleted).⁵

The Chief Justice and Justice Stevens found this concept mysterious. In a separate opinion, they responded that:

Following [the first] sentence are three quotations from treatises, which not only speak of empirical testing, but one of which states that the ““criterion of the scientific status of a theory is its falsifiability, or refutability, or testability,”

....

I defer to no one in my confidence in federal judges; but I am at a loss to know what is meant when it is said that the scientific status of a theory depends on its “falsifiability,” and I suspect some of them will be, too.⁶

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

2. KAYE ET AL., *supra* note *, § 6.4.1, at 223; Margaret A. Berger, *Expert Testimony: The Supreme Court’s Rules*, ISSUES IN SCI. & TECH., Summer 2000, at 57, 58.

3. KAYE ET AL., *supra* note *, § 6.3.2, at 202.

4. *Id.* § 6.4.2(a), at 228.

5. *Daubert*, 509 U.S. at 593. The first citation is to a law review article, Michael D. Green, *Expert Witnesses and Sufficiency of Evidence in Toxic Substances Litigation: The Legacy of Agent Orange and Bendectin Litigation*, 86 Nw. U. L. REV. 643, 645 (1992).

6. 509 U.S. at 600.

Scholars more familiar with basic readings in the philosophy of science objected to these passages as philosophically naive,⁷ unhelpful,⁸ or out of date.⁹ As one noted epistemologist quipped, the Court was guilty of “mixing up its Hoppers and its Pempels.”¹⁰

This essay argues that these criticisms do not indicate any fundamental flaw in *Daubert*. Rather, they point to a familiar rhetorical characteristic of Supreme Court opinions—leaning on the literature of another discipline much as a drunk leans on a lamppost, for support rather than for illumination. I hope to show that the Court’s opinion can be understood and applied sensibly without resolving too many contested questions in the philosophy of science.¹¹

Let me begin with the Chief Justice’s professed befuddlement as to the meaning of “falsifiability.” The idea is clear enough. A theory that cannot be contradicted by any conceivable observation is not part of science.¹² It might be

7. SUSAN HAACK, DEFENDING SCIENCE—WITHIN REASON: BETWEEN SCIENTISM AND CYNICISM 251 (2003) (deriding the citations in *Daubert* as a manifestation of “having read someone who read someone who read Popper”); Susan Haack, *Trials and Tribulations: Science in the Courts*, DAEDALUS, Fall 2003, at 54, 59 (suggesting that because the Court realized that “Popper’s philosophy of science is particularly ill suited as a guide to reliability,” it “ran Popper together with Hempel” even though “Popper’s and Hempel’s philosophy of science are not compatible.”).

8. HAACK, DEFENDING SCIENCE, *supra* note 7, at 251 (criticizing the “court’s preoccupation with specifying what the method of inquiry is that distinguishes the scientific and reliable from the non-scientific and unreliable” because “[t]here is no such method”); Haack, *Trials and Tribulations*, *supra* note 7, at 59 (insisting that “[n]o philosophy of science could . . . supply the hoped-for crisp criterion to discriminate the scientific, and hence reliable, from the unscientific, and hence unreliable.”); Susan Haack, *An Epistemologist in the Bramble-Bush: At the Supreme Court with Mr. Joiner*, 26 J. HEALTH POLITICS, POL’Y & L. 217, 232 (2001) (contending that neither Hempel’s nor Popper’s philosophy of science can “help a judge decide either whether evidence proffered is really scientific, or how reliable it is”); cf. Michael A. Mason, Comment, *The Scientific Evidence Problem: A Philosophical Approach*, 33 ARIZ. ST. L.J. 887, 902 (2001) (arguing that “Popperian uncertainty is not necessarily the appropriate view for courts to take in determining the admissibility of scientific evidence.”).

9. Ronald J. Allen, *Expertise and the Daubert Decision*, 84 J. CRIM. L. & CRIMINOLOGY 1157, 1168–69 (1994) (“the Court simply replaced a judicial anachronism with a philosophical one.”); cf. Joseph Sanders et al., *Legal Perceptions of Science and Expert Knowledge*, 8 PSYCHOL., PUB. POL’Y & L. 139, 148 (2002) (“The court’s admissibility rulings do seem to have proceeded in happy obliviousness to the ‘science wars’ that arguably began with Fleck, flourished with Kuhn and Feyerabend, and have raged for much of the last half century between the defenders of a more traditional, realist view of science and those critics who emphasize its historical, political, social, and rhetorical aspects.”) (citations omitted). *But see* Sean O’Connor, *The Supreme Court’s Philosophy of Science: Will the Real Karl Popper Please Stand Up?*, 35 JURIMETRICS J. 263, 264 (1995) (noting that “‘Popperianism’ has not been a dominant trend in philosophy of science for some time,” but “it deserves a more accurate portrayal than it has received”) in the early legal commentary on *Daubert*).

10. HAACK, DEFENDING SCIENCE, *supra* note 7, at 251, and Haack, *An Epistemologist in the Bramble-Bush*, *supra* note 8, at 232 (expressing “minor scholarly irritation” at “the *Daubert* Court’s mixing up its Hoppers and its Pempels”).

11. Major issues and contemporary thinking about them are summarized nicely in Brian Leiter, *The Epistemology of Admissibility: Why Even Good Philosophy of Science Would Not Make for Good Philosophy of Evidence*, 1997 BYU L. REV. 803.

12. See, e.g., Francisco J. Ayala & Bert Black, *Science and the Courts*, 81 AM. SCIENTIST 230, 234 (1993). Popper explains “falsifiability” as follows:

mathematics, metaphysics, religion, pseudoscience, or something else, but it is not empirical, scientific knowledge. For example, the theory that all organisms have the detailed anatomical structures that they do because a higher power designed them that way could be true. But unless there is some independent test for the existence and proclivities of this higher power, the theory is not falsifiable. No observation of any peculiar anatomical structure would count as evidence against this version of the intelligent-design theory. The basic idea of falsifiability as a criterion for separating science from metaphysics surely is accessible to judges.¹³ The problem, as we shall see, is that this notion is not terribly useful in evaluating most scientific evidence.

The philosophical critics of the paragraph in Justice Blackmun's opinion have more of a point—but only a minor one. Certainly, the Court did not attend to the divide between Popper and Hempel. Both Hempel and Popper emphasized the importance of empirical testing of hypotheses. In Hempel's words, "while

[A] statement (a theory, a conjecture) has the status of belonging to the empirical sciences if and only if it is falsifiable.

But when is a statement falsifiable? [F]alsifiability in the sense of my demarcation criterion is a purely logical affair. It has to do only with the logical structure of statements and of classes of statements. And it has *nothing* to do with the question whether or not certain possible experimental results would be accepted as falsifications.

A statement or theory is, according to my criterion, falsifiable if and only if there exists at least one potential falsifier—at least one possible basic statement that conflicts with it logically. It is important not to demand that the basic statement in question be *true*. The class of basic statements is designed so that a basic statement describes a logically possible event of which it is logically possible that it might be observed.

To make these matters less abstract, I shall give four examples here: two of falsifiable statements, and two of unfalsifiable statements.

(1) 'All swans are white'. This theory is falsifiable since, for example, it contradicts the basic statement (which is, incidentally, false): 'On the 16th of May, 1934, a black swan stood between 10 and 11 o'clock in the morning in front of the statue of Empress Elizabeth in the Volksgarten in Vienna.'

(2) Einstein's principle of proportionality of inert and (passively) heavy mass. This equivalence principle conflicts with many potential falsifiers: events whose observation is logically possible. Yet despite all attempts . . . to realize such a falsification experimentally, the experiments have so far corroborated the principle of equivalence.

(3) 'All human actions are egotistic, motivated by self-interest.' This theory is widely held: it has variants in behaviourism, psycho-analysis, individual psychology, utilitarianism, vulgar-Marxism, religion, and sociology of knowledge. Clearly this theory, with all its variants, is not falsifiable: no example of an altruistic action can refute the view that there was an egotistic motive hidden behind it.

(4) Purely existential statements are not falsifiable—as in Rudolf Carnap's famous example: 'There is a colour ('Trumpet-red') which incites terror in those who look at it.' Another example is: 'There is a ceremony whose exact performance forces the devil to appear.' Such statements are not falsifiable. (They are, in principle, verifiable: it is logically possible to find a ceremony whose performance leads to the appearance of a human-like form with horns and hooves. And if a repetition of the ceremony fails to achieve the same result, that would be no falsification, for perhaps an unnoticed yet essential aspect of the correct ceremony was omitted.)

KARL R. POPPER, REALISM AND THE AIM OF SCIENCE xix–xxi (W.W. Bartley III ed., 1983).

13. There are indications that judges to date are less than clear on the meaning of falsifiability. In telephone interviews with written follow-up, only 5% of 400 state trial court judges gave answers that were said to indicate a clear understanding of falsifiability. Sophia Gatowski et al., *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post-Daubert World*, 25 LAW & HUM. BEHAV. 433, 433 (2001). However, inasmuch as the judges were drawn from all 50 states and the District of Columbia, many would have had no experience applying this aspect of *Daubert*.

hypotheses and theories may be freely invented and *proposed* in science, they can be *accepted* into the body of scientific knowledge only if they pass critical scrutiny, which includes in particular the checking of suitable test implications by careful observation or experiment."¹⁴ Hempel and the logical positivists saw each new observation that was consistent with the hypothesis as producing an "increase in confirmation,"¹⁵ and they sought to express the degree of confirmation as an "*inductive probability of the hypothesis relative to the given information.*"¹⁶ Popper also sought to define the degree to which a scientific fact or theory had been corroborated, but he insisted that the degree of corroboration could not be captured by an inductive probability that counted the number of confirming instances or the like. Rejecting "verificationism," he maintained that corroboration must be understood in terms of a process akin to natural selection, in which theories that survive the most severe tests, emerge as highly "corroborated."¹⁷ This general view is congenial to many working scientists, but most philosophers of science do not accept Popper's specific views on the appropriate measure of confirmation or corroboration.¹⁸ In addition to eliding this difference between Hempel and Popper,¹⁹ the Court did not consider the subtleties in articulating a philosophically satisfying conception of falsifiability or a more satisfactory substitute for it.²⁰

14. CARL G. HEMPEL, *PHILOSOPHY OF NATURAL SCIENCE* 16 (1966) (emphasis in original). In the same vein, "Popper has always been primarily concerned with . . . the testing of theories and the growth of knowledge . . ." BRIAN MAGEE, *PHILOSOPHY AND THE REAL WORLD: AN INTRODUCTION TO KARL POPPER* 39 (1985).

15. HEMPEL, *supra* note 14, at 33.

16. *Id.* at 46 (referring to Carnap's work).

17. KARL R. POPPER, *THE LOGIC OF SCIENTIFIC DISCOVERY* §§ 81–84 (1959).

18. *E.g.*, Haack, *Trials and Tribulations*, *supra* note 7, at 59. There is little reason to imagine that the Supreme Court meant to weigh in on this debate. *Rosen v. Ciba-Geigy Corp.*, 78 F.3d 316, 318 (7th Cir. 1996) ("we do not have to become philosophers of science and set forth the necessary and sufficient conditions of 'real' science," or endeavor to discover "the essence of 'science,' if there is such an essence."); *Bitler v. A.O. Smith Corp.*, 391 F.3d 1114, 1121 n.1 (10th Cir. 2004) ("We may leave the philosophy of science to the philosophers."). *Contra* Allen, *supra* note 9, at 1168 ("The Court, in short, has adopted Karl Popper's conception of science."); Veronica B. Dahir et al., *Judicial Application of Daubert to Psychological Syndrome and Profile Evidence*, 11 *PSYCHOL. PUB. POL'Y & L.* 62, 77 (2005) ("Popper's notion of testability has become part of the law of the land via the *Daubert* trilogy").

19. Another difference between Popper and the logical positivists lies in the status they accord to theories that are not falsifiable:

Popper, in contrast to the Logical Positivists, never held that non-scientific activities were meaningless or even intellectually disreputable. What is disreputable is pseudo-science, which arises when holders of an empirical theory refuse to be deflected by observational disproof or where a supposedly scientific theory never makes any empirical predictions. Popper convicts Marxists of the first sin and psychoanalysis of the second, contrasting them with a true scientist like Einstein.

A. O'Hear, *Popper*, in *THE OXFORD COMPANION TO PHILOSOPHY* 702 (Ted Honderich ed. 1995).

20. *See, e.g.*, PHILIP KITCHER, *ABUSING SCIENCE: THE CASE AGAINST CREATIONISM* 42–49 (1982); Imre Lakatos, *Falsification and the Methodology of Scientific Research Programs*, in *CRITICISM AND THE GROWTH OF KNOWLEDGE* 91, 104–32 (Imre Lakatos & Alan Musgrave eds., 1970).

In short, as an essay on “What is science?”, the *Daubert* opinion is incomplete. However, it would be a mistake to take a few throw-away citations in a short paragraph too seriously. The more telling criticism of the paragraph is that it conflates the use of falsifiability, which was proposed only to demarcate the boundary between science and metaphysics, with the practical notion that a scientific theory that has withstood concerted and well designed attacks is well warranted.²¹ As Popper noted, “falsifiability . . . has *nothing* to do with the question whether or not certain possible experimental results would be accepted as falsifications.”²² In a few instances, theories advanced in court—such as those in silicone breast-implant litigation²³ and in defense of fingerprinting as a method of individualization²⁴—may not even be falsifiable. These theories can have little claim to the status of scientific knowledge.²⁵

Typically, however, it is falsification, and not falsifiability, that matters when it comes to admissibility. The essential question under *Daubert* is whether the expert’s purportedly scientific theory provides “good grounds” for the testimony.²⁶ In this regard, the *Daubert*’s parenthetical phrase, “*has been tested*,” normally is far more significant than the hypothetical, “*can be tested*,”²⁷ and the blurring of these matters in Justice Blackmun’s opinion for the Court in *Daubert* has permitted obvious misapplications of the demand for testing. In *Lee v.*

21. See HAACK, *supra* note 7, at 252.

22. Popper, *supra* note 12, at xx.

23. One epidemiological study after another failed to show that the implants were associated with any classical autoimmune diseases. To overcome these negative findings, plaintiffs proposed that the implants caused a previously unknown condition, denominated “atypical connective-tissue disease,” or ACTD. Exasperated researchers responded that ACTD is not merely untested, but that the vagueness of the description of the putative disease makes it impossible to gather data that would permit a meaningful epidemiological study. *E.g.*, Matthew H. Liang et al., *Letter to the Editor*, 333 NEW ENGL. J. MED. 1424, 1424 (1995) (“[t]he features of a unique connective-tissue syndrome have not been put into a coherent, valid, or reproducible case definition, which severely limits scientific study.”). Without a definition of ACTD, “[i]n the language of *Daubert*, the theory cannot be falsified.” Joseph Sanders & D.H. Kaye, *Expert Advice on Silicone Implants: Hall v. Baxter Healthcare Corp.*, 37 JURIMETRICS J. 113, 120 (1997).

24. A leading FBI fingerprint expert testified that:

If the scientific method is followed, adhered to in your process, [then] the error in the analysis and comparative process will be zero. It only becomes the subjective opinion of the examiner involved at the evaluation phase. And that would become the error rate of the practitioner.

United States v. Llera Plaza, Cr. No. 98-362-10, 11, 12, 2002 U.S. Dist. LEXIS 344, at *48 (E.D. Pa. Jan. 7, 2002), *vacated*, 188 F. Supp. 2d 549 (2002). Inasmuch as “methodological error” is not measurable, the claim that the abstract process (divorced somehow from the examiners who apply it) never errs is well insulated from empirical testing.

25. Whether and how much of an elevated status scientific knowledge has over other types of knowledge is well beyond the scope of these remarks. For one view of this matter, see SUSAN HAACK, *DEFENDING SCIENCE*, *supra* note 7.

26. 509 U.S. at 509.

27. See Haack, *An Epistemologist in the Bramble-Bush*, *supra* note 8, at 231–32; Clifton T. Hutchinson & Danny S. Ashby, *Daubert v. Merrell Dow Pharmaceuticals, Inc.: Redefining the Bases for Admissibility of Expert Scientific Testimony*, 15 CARDOZO L. REV. 1875, 1887–95 (1994).

Martinez,²⁸ for instance, the Supreme Court of New Mexico deemed the “testability” prong of *Daubert* satisfied merely because “the control question polygraph examination *can* be tested.”²⁹ Similarly, in *United States v. Mitchell*,³⁰ Judge Becker wrote for the Third Circuit Court of Appeals that:

testability—which assures the opponent of proffered evidence the possibility of meaningful cross-examination (should he or someone else undertake the testing)—is one of the factors announced by the *Daubert* Court as an indicium of reliability. In sum, the hypotheses that undergird the discipline of fingerprint identification are testable, if only to a lesser extent actually tested by experience, and so we find this factor to weigh in favor of admitting the evidence.³¹

These cases overemphasize the abstract possibility of falsifiability and substitute a mere theoretical possibility for actual empirical research. Relying on falsifiability rather than actual corroboration misses the point of the *Daubert* Court’s insistence on empirical testing. In *Mitchell*, Judge Becker maintained that “testability” is valuable—even without actual testing—because it “assures . . . meaningful cross-examination,” but this view is extremely optimistic. *Mitchell* itself reveals how difficult it is for “the opponent of the proffered evidence” to “undertake the testing.” The public defender’s office is hardly in a position to perform or commission the type of studies that were the subject of a National Institute of Justice solicitation for grant proposals to conduct “basic research to determine the scientific validity of individuality in friction ridge examination.”³² The definitional claim that science concerns propositions that “can be . . . tested” cannot substitute for the systematic empirical testing that science requires. If, for more than a century, the government and the forensic-science community have neglected to validate their procedures for fingerprint identification, then the fact that validation could have been done is a strange reason to think that the empirical-testing prong of *Daubert* favors admission.

As to the crucial issue of actually testing a scientific theory, the *Daubert* Court did not adopt the details of either Hempel’s or Popper’s approach to defining the extent to which an empirical theory is corroborated or verified. Neither did it adopt some strange amalgam of the two.³³ It merely made the point that hypotheses that have not been validated by experiments or other tests capable of refuting them are less secure than those that have been tested. Surviving serious empirical testing is not all there is to a credible scientific theory, but it is a good

28. 96 P.3d 291 (N.M. 2004).

29. *Id.* at 299 (emphasis added).

30. 365 F.3d 215 (3d Cir. 2004).

31. *Id.* at 238.

32. NATIONAL INSTITUTE OF JUSTICE, FORENSIC FRICTION RIDGE (FINGERPRINT) EXAMINATION VALIDATION STUDIES 4 (Mar. 2000), available at <http://www.ncjrs.org/pdffiles/nij/s/000386.pdp>.

33. *Contra* Susan Haack, *Trial and Error: The Supreme Court’s Philosophy of Science*, AM. J. PUBLIC HEALTH (forthcoming), available at <http://ssrn.com/abstract=695341> (“the *Daubert* Court settled on an unstable amalgam of Popper’s and Hempel’s very different approaches—neither of which, however, is suitable to the task at hand”).

start.³⁴ For this reason, *Daubert's* concern with “testing” is a sensible and important part of the judicial inquiry into scientific validity.

Of course, this does not mean that “testing” or the other factors enumerated in *Daubert* are easily applied.³⁵ Courts continue to struggle with the task of excluding purportedly scientific testimony that is not sufficiently helpful to the trier of fact. The law of evidence requires judges to ascertain whether a particular scientific theory or method is worth betting on, and they would do well to place their bets on theories that are not only testable but that also are tested. This, and only this, is the meaning of *Daubert's* first indicator of scientific validity.

One can complain that it leaves a great deal unsaid, but so does any opinion that points to a general standard rather than a mechanical rule. Law professors and philosophers may debate the teachings of “logical empiricism,” “revised empiricism,”³⁶ “social epistemology,”³⁷ and “science studies.”³⁸ Judges may

34. Of course, deciding whether a claim has been tested adequately is not always a simple inquiry. Indeed, some working scientists see the process as “the very essence of scientific inquiry.” Roger A. Nicoll & Robert C. Malenka, *A Tale of Two Transmitters*, 281 *SCIENCE* 360 (1998):

Scientists are crazy people. How else would you describe an individual who works late into the night in order to destroy or falsify another scientist's hypothesis, or even more bizarre, to destroy his or her own hypothesis? Yet, as clearly enunciated by the philosopher Karl Popper, this is the very essence of scientific inquiry. On the basis of a few bits of data, we form a hypothesis that goes far beyond the data. The hypothesis provides a framework upon which experiments are designed to verify—or refute—the hypothesis. The longer the hypothesis can withstand these potshots, the more likely it is to be “true.” More often than not, hypotheses do not withstand the onslaught of experiments and have either to be abandoned altogether or to undergo major overhauls. As cumbersome as it may seem, this is the way science advances.

See also T. H. Huxley, *The Method of Scientific Investigation*, in *SCIENCE: METHOD AND MEANING* 2, 5 (Samuel Rapport & Helen Wright eds., 1963) (“In scientific inquiry it becomes a matter of duty to expose a supposed law to every possible kind of verification, and to take care, moreover, that this is done intentionally, and not left to a mere accident.”); Ayala & Black, *supra* note 12, at 234–38 (giving examples); Arnold S. Relman & Marcia Angell, *How Good Is Peer Review?*, 321 *NEW ENG. J. MED.* 827, 828 (1989) (“In a sense, science advances by the continual discovery and correction of error.”).

35. It has been said that by focusing on the extent to which empirical theories have been tested, “legal practice has effectively converted the social authority conferred by Blackmun's reference to Popper (and Hempel and others) into a legally tractable exclusionary rule. Rather than engage in the history and philosophy of science federal judges can now simply inquire whether a knowledge claim has been ‘tested’.” Gary Edmond & David Mercer, *Experts and Expertise in Legal and Regulatory Settings*, in *EXPERTISE IN REGULATION AND LAW* 1, 23 (Gary Edmond ed., 2004). But *Daubert* never required judges “to engage in the history and philosophy of science,” and determining whether a theory or practice has been adequately tested for forensic purposes is hardly a simple inquiry. Cf. Leiter, *supra* note 11 (arguing that a sound epistemology of science does not, *ipso facto*, supply a sound rule of evidence).

36. The phrase appears in Heidi Li Feldman, *Science and Uncertainty in Mass Exposure Litigation*, 74 *TEX. L. REV.* 1, 10 (1995) (defining “revised empiricism” as “a philosophical revision of logical empiricism” that regards “a version of testability as one distinctive feature of science” but stresses “the definitive role of scientists' collective judgment in making testability work”).

37. See ALVIN I. GOLDMAN, *EPISTEMOLOGY AND COGNITION* 5 (1986) (explaining that “[s]ocial epistemology is concerned with the truth-getting impact of different patterns and arrangements of social intercourse . . . such as classrooms, courtrooms, and assemblies.”).

38. See, e.g., Sheila Jasanoff, *Breaking the Waves in Science Studies: Comment on H.M. Collins and Robert Evan*, “The Third Wave of Science Studies,” 33 *SOCIAL STUD. SCI.* 389 (2003).

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benefit from understanding what the debate is all about. But the *Daubert* Court's failure to articulate precisely how scientific theories are tested was unavoidable — after all, courts write opinions, not treatises. And the Court's willingness to cite a few philosophers who agreed on the importance of the process but not on its particulars does not make the inquiry any less feasible and important.