Is Peer Review a Proxy for Scientific Validity?

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I. Introduction

Peer review, while generally believed to operate as a safeguard against unsupported scientific theories, can be a flawed process that may not detect major scientific shortcomings in published work. This panel will describe the peer review process, examples of its shortcomings, and what practitioners need to know to challenge and defend expert testimony.
II. Bringing Scientific Peer Review to Scientific Evidence

BY DAVID L. FAIGMAN

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The venerable process of scientific peer review can help judges evaluate a wide range of scientific subjects, says Professor David L. Faigman. This approach, though “unconventional,” is consistent with the lessons of Frye, which calls upon judges to admit scientific opinions based on generally accepted principles, and Daubert, which requires judges to examine the methods and principles underlying the proffered scientific opinion, the author says. Faigman discusses the structural challenges to bringing “good science” to courts, and concludes scientific peer review will provide a “systematic process by which scientists from the relevant field can help inform courts regarding the bases of proffered science.”

BY DAVID L. FAIGMAN

It has been more than 20 years since the United States Supreme Court decided the case of Daubert v. Merrell Dow Pharmaceuticals, Inc.¹ Yet the import of that decision remains deeply controversial.

Daubert arguably revolutionized the law of expert evidence by making the judge a gatekeeper, charged with screening scientific evidence for its empirical soundness.² Under the vintage general acceptance test, first announced in Frye v. United States,³ courts ask only whether the scientific technique or findings are “generally accepted” in the expert’s respective field. Daubert requires trial court judges to assess the scientific validity underlying the proffered expertise.

But Daubert remains an enigma, with courts and commentators continuing to disagree over what it means for a trial court to guard the gate.⁴ This is so de-

spite two additional Supreme Court decisions on the subject—General Electric Co. v. Joiner and Kumho Tire Co. v. Carmichael—and an amended Federal Rule 702 that was intended to codify the Daubert trilogy. Although there remains much in dispute regarding the extent of the trial court’s gatekeeping duties, there is little disagreement that Daubert changed the focus of the inquiry.

The move from Frye to Daubert embodied a fundamental change in perspective, from one of deferring to the respective field from which the expertise came to evaluating the methods, principles, and data that supported that expertise. Whereas Frye called upon judges to survey scientists about the soundness of the science, Daubert calls upon judges to assess the science. But perhaps it is now time to bring the two tests together and to use the insight of Frye to answer the questions set forth in Daubert.

What is needed is a systematic process by which scientists from the relevant field can help inform courts regarding the bases of proffered science. It turns out that scientists themselves have been using such a process for millennia. The process is called scientific peer review and courts could benefit greatly from its use.

Daubert’s revolutionary shift was reflected in Chief Justice Rehnquist’s famous complaint in his separate opinion in Daubert that he did not think that Rule 702 imposed on judges “either the obligation or the authority to become amateur scientists.” But, as Chief Justice Rehnquist’s own opinion for the Court in Joiner illustrates, if judges are to effectively screen proffered scientific evidence, they must have some understanding of the methods of science. And this means that the lawyers that appear before them should have this ability too.

But this is easier said than done. As most lawyers and judges will readily admit, math and science do not come easily to them. Indeed, they may have gone to law school because of it. Lawyers on average share Huckleberry Finn’s lament about mathematics:

“I had been to school most all the time, and could spell, and read, and write just a little, and could say the multiplication table up to six times seven is thirty-five, and I don’t reckon I could ever get any further than that if I was to live forever. I don’t take no stock in mathematics, anyway.”

The question presented, then, is if modern rules of evidence, both federal and most states, require more than a modicum of scientific sensibility, how is this to be accomplished? In short, is it possible to ensure that the scientific evidence that reaches the courtroom is based on good grounds? I think that it is. However, the answer—or at least part of the answer—is to return to the sensibilities of the Frye test in order to accomplish the objectives of Daubert. Lawyers and judges should embrace the insight of Frye of asking scientists about the expertise offered in court so that Daubert’s validity assessment can be carried out. This can be accomplished through the venerable institution of scientific peer review.

I. Structural Challenges to Bringing Good Science to Court

In a real sense, both Frye and Daubert share the judgment that expert testimony offered in court should rest upon the foundation of scientific knowledge that already exists in the field. Law should lag science, not lead it. The courtroom is not the place for scientific speculation. Moreover, fact finders should not be deciding scientific disputes that scientists themselves cannot resolve. And the expertise offered in the courtroom should reflect mainstream opinion, and not the polarized views of a small group of outliers. It is enough to hope that actors in the legal system will understand the basic premises of scientific opinion. Expecting judges to settle scientific disputes or take the full measure of a field is too much. The goal in regard to scientific evidence, therefore, should be the intelligent use of conventional mainstream science to enable courts to decide legal disputes in which such proof is relevant. This is the most, and the least, that Frye and Daubert require.

Yet, structurally, the law is unsuited to identifying the median of scientific opinion or reconciling scientific disputes among scientific experts. This is so for a couple of reasons that, together, create the perfect storm of scientific ineptitude. The first is the general lack of training in science among the bench and bar. But even if such training occurred, the broad expanse of methods and culture of science. Despite the contemporar y challenges in the legal job market, the best advice for a straight A English major might still be law school. Law schools have traditionally required little background in math and science for their applicants, and this attitude is largely maintained through graduation. Law schools remain largely mired in the subjects and pedagogy of the late 19th century, a time when science, technology and statistics were not pervasive throughout society and, thus, did not permeate every subject of legal practice. Although the profession shows some glimpses of change, it appears still to be true that large

A. Innumeracy

A substantial and abiding obstacle to the competent integration of scientific research into legal decision making is lawyers’ and judges’ limited facility with the methods and culture of science. Despite the contemporar y challenges in the legal job market, the best advice for a straight A English major might still be law school. Law schools have traditionally required little background in math and science for their applicants, and this attitude is largely maintained through graduation. Law schools remain largely mired in the subjects and pedagogy of the late 19th century, a time when science, technology and statistics were not pervasive throughout society and, thus, did not permeate every subject of legal practice. Although the profession shows some glimpses of change, it appears still to be true that large

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7 FED. R. EVID. 702, Advisory Comment (2000 Amendment).
8 Daubert, 509 U.S. at 601 (Rehnquist, C.J., concurring in part and dissenting in part).
10 There are, of course, many exceptions. Indeed, the patent bar is certainly one. Also, many litigators have developed an expertise in the area of science, such as medical causation, in which they practice. But many have not.
12 Rider v. Sandoz Pharmaceuticals Corp., 295 F.3d 1194 (11th Cir. 2002). (“Given time, information, and resources, courts may only admit the state of science as it is. Courts are cautioned not to admit speculation, conjecture, or inference that cannot be supported by sound scientific principles. The courtroom is not the place for scientific guesswork, even of the inspired sort. Law lags science; it does not lead it.”) (quoting Rosen v. Ciba-Geigy Corp., 78 F.3d 316, 319 (7th Cir. 1996)).
numbers of lawyers and judges are not well trained, if
to attend all, in the rigors of scientific research.13

Yet, however much value might come from having a
numerate and scientifically sophisticated bench and
bar, it is also true that this ability would not entirely
be transferable to lawyers or, particularly, judges, to handle the
broad expanse of subjects that land in court. Courts de-
cide disputes in areas of expertise ranging from acous-
tics to zoology.

Even a well-trained scientist would have difficulty
with the number and variety of subjects that courts
must address. Scientists, of course, are not, themselves,
experts in all areas of science. We should hardly expect
lawyers and judges to be. In science, as much as in any
profession, scientists specialize in their respective area
of expertise. Scientists, in practice, rely on a mixture of
factors to determine their confidence in the accuracy of
one or another claimed finding. These include many
factors, some directly pertinent to the research, such as
the design used to test the hypotheses, or whether the
findings are consistent with other research in the area,
and some more indirect, such as the prestige of the in-
stitution of the principal investigators, or the impact-
score of the journal in which the findings were pub-
lished. But one of the key factors is whether the re-
search has been published in a peer-reviewed journal
and, moreover, how such work is viewed more gener-
ally among scientists in the field.

B. The Adversarial Process

Complicating matters beyond the bench and bar’s in-
numeracy are the systemic barriers the law places on
the reception of mainstream scientific opinion. The
American adversarial system seems especially well de-
signed to frustrate the reception of the middle ground
of scientific opinion. On most subjects of applied sci-
ence that appear in court, scientific opinion varies, but
likely takes the shape of the well-known bell-shaped
curve. Most scientists will group in the middle, and
there will inevitably be some that feel strongly in favor
of, and some who feel strongly against, the scientific
proposition of interest. These scientists occupy the two
tails of the distribution of scientific opinion.

Lawyers, however, have no incentive to identify the
trend of scientific opinion on any relevant subject. All applied science is probabilistic and infused
with uncertainty. This uncertainty creates doubt, not
something that litigants want to publicize. Indeed, the
litigation process begins, and ends, with processes and
practices that are likely to lead to expert polarization. In
particular, two such processes promote this outcome.
First, litigators search for testifying experts that agree
with their litigating position. And second, once the tes-
tifying expert is on-board, well, he or she is on-board.

That litigators seek experts who already agree, or are
likely to agree, with their litigating position is hardly
surprising. The adversarial system essentially requires
it. The actual distribution of views in the field might, in
fact, be quite narrow, largely clumping around a central
consensus. Nonetheless, the incentives of the system
demand that lawyers seek out spokespersons that will
situate their claims or defenses in the best empirical
light possible. These experts are likely to be selected
from the opposite poles of the distribution of scientific
opinion.

The natural polarizing effect of the adversarial pro-
cess means that courts often see experts that agree on
little about the science. This disagreement might, in
fact, reflect genuine disagreement in the field or it
might be an artifact of the selection bias that went into
identifying the experts in the first place. The well-worn
cliche of the battle of the experts has much truth behind
it. Judges are thus often confronted with polarized
views of the field and no knowledge of, and little ability
to find out, what is the middle ground view of the pro-
ession.

Another circumstance that likely contributes to the
polarizing effects of the adversarial process is that the
expert joins the team that is fighting to win the litiga-
tion. Experts experience strong pressures to become
team players. This might manifest in several ways, all
contributing to this polarizing effect. First, it might lead
experts to state their opinion more forcefully than they
otherwise believe on a controverted issue. Second, ex-
erts might be persuaded to state their conclusions cat-
egorically, rather than probabilistically. Third, the team
atmosphere might buttress experts’ confidence in their
opinions and allay any reasonable doubts about their
position. Finally, party experts are more likely to use le-
gal verbiage to describe their opinions, thus translating
the science for courtroom consumption and leaving cer-
tain key assumptions unstated.

Despite the cultural and institutional barriers to the
identification of mainstream scientific opinion, rules of
admissibility, as reflected in the Frye and Daubert tests,
are designed to assess the broad (or narrow) middle
ground of scientific thought. These rules impose upon
d courts the responsibility to admit good science and ex-
clude “junk” science.14 However, as the next section
explores, Frye and Daubert have not succeeded well in
their assigned task.

II. Conventional Solutions

From the judge’s perspective, dueling experts are the
rule, not the exception. The parties are, after all, in litiga-
tion. The judge has little opportunity to assess the
median scientific opinion in a field, much less deter-
mine whether one or the other party’s expert represents
that mainstream view. To be sure, a party’s expert will
do his or her best to educate the judge regarding the de-
fects in the opponent’s expert’s position. And vice
versa. But without a depth of knowledge in the field, the
judge’s task is a challenging one. Of course, courts have
the option of hiring court-appointed experts under most
evidence codes, or even technical advisers or special
masters, to assist them. However, the option of bringing
in appointed help is rarely exercised.15

Conventional rules of evidence are intended to guide a
judge’s threshold admissibility determination. The

13 See, e.g., Jackson v. Pollion, 733 F.3d 786, 788 (7th Cir.
2013) (“As a general matter, lawyers and science don’t mix.”)
(“Quoting Peter Lee, Patent Law and the Two Cultures, 120 YALE
L.J. 2, 4 (2010)).

14 Kumho Tire, 526 U.S. at 159 (Scalia, J., concurring)
(Courts have “discretion to choose among reasonable means
of excluding expertise that is fausse and science that is
junky.”) (emphasis in original).

15 See Joseph Cecil & Thomas Willging, Accepting
Daubert’s Invitation: Defining a Role for Court-Appointed
Experts in Assessing Scientific Validity, 43 EMORY L.J. 995, 1004
(1994).
two principal rules in operation today come from the cases of Frye and Daubert. This section briefly considers these tests, which do much to identify the right questions to ask, but little to assist judges regarding what answers should be forthcoming.

A. Frye v. United States

The defendant in Frye proffered an early form of polygraph testing, the "systolic blood pressure deception test," the results of which purportedly supported James Alphonso Frye’s plea of innocence to a charge of murder. This was a novel form of evidence that the courts had not previously evaluated for its validity. Judge Van Orsdel observed that this required the court to determine ""[j]ust when a scientific principle or discovery crosses the line between the experimental and demonstrable stages."

The court famously devised the "general acceptance" test to resolve this difficulty, stating that "while the courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the passage of time and the advance of science may not always keep the line between the scientific and the non-scientific clear.

Frye has been the target of considerable commentary, much of it critical.

B. Daubert v. Merrell Dow Pharmaceuticals

The admissibility test crafted in Daubert is based on the reference to "scientific . . . knowledge" in the text of Federal Rule 702. The Court first noted that the statutory reference to "knowledge" "connotes more than subjective belief or unsupported speculation." The opinion explained that "[t]he adjective 'scientific' implies a grounding in the methods and procedures of science." The Court explained:

In order to qualify as 'scientific knowledge,' an inference or assertion must be derived by the scientific method. Proposed testimony must be supported by appropriate validation.... In short, the requirement that an expert’s testimony pertain to 'scientific knowledge' establishes a standard of evidentiary reliability.

The basic holding of Daubert is straightforward and courts duly repeat it case after case. First, the expert evidence must be relevant; that is, it must relate to an issue in the case. The Court referred to this element as one of "fit," in that the empirical basis for the evidence must help answer a fact in dispute. Second, the expert must be qualified to testify on the subject at-hand. This element is fairly permissive and can be met "by knowledge, skill, experience, training, or education." It must be met, however, in light of the nature of the testimony being offered. Third, the "[p]roposed testimony must be supported by appropriate validation," what the Daubert Court referred to as "good grounds."

Although the first two criteria for admissibility of expert evidence—relevance and qualifications of the expert—are essential, the third prong of reliability represents the revolutionary turn in this area. In order to assess the evidentiary reliability of proffered expert testimony, trial courts have the responsibility to examine the methodologies and principles underlying proffered expert testimony to determine whether those principles and methods are sufficiently valid to admit. The Daubert test, in contrast to Frye, thus focuses courts’ attention on the scientific bases supporting proffered expert opinion. Whether that opinion is based on good

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17 Frye, 293 F. at 1014.
18 Id.
20 See Constantin J. Maletskos & Stephen J. Spielman, Introduction of New Scientific Methods in Court, in Law Enforcement, Science & Technology, 957, 958 (S.A. Yefsky ed. 1967) (“A literal reading of [Frye] would require that the court always await the passing of a ‘cultural lag’ during which period the new method will have had enough time to diffuse through the scientific discipline and create the requisite body of scientific opinion needed for scientific acceptability.”).
21 See, e.g., Com. v. Patterson, 840 N.E.2d 12, 32-33 (Mass. 2005) (admitting fingerprint identification as reliable under Daubert because it was generally accepted among fingerprint examiners).
22 Daubert, 509 U.S. at 589-90.
23 FED. R. EVID. 702. See McCoy v. Whirlpool Corp., 214 F.R.D. 646 (D. Kan. 2003) (“Rule 702 does not require that expert witnesses enjoy national accreditation. As we know from the scarecrow in 'The Wizard of Oz,' a witness who is otherwise qualified is not disqualified for lack of credentials.”).
24 See, e.g., Lujano v. Town of Cicero, 2011 BL 306708, No. 07 C 4822 (N.D. Ill. 2011) (“Ultimately, ‘whether a witness is qualified as an expert can only be determined by comparing the area in which the witness has superior knowledge. . . with the subject matter of the witnesses’ testimony’) (quoting Carroll v. Otis Elevator Co., 896 F.2d 210, 212 (7th Cir. 1990)).
25 Daubert, 509 U.S. at 590.
grounds, therefore, is a preliminary inquiry for the trial judge to determine.26

The Daubert inquiry, therefore, calls upon courts to have considerable sophistication regarding scientific processes. But twenty-plus years of experience under the test has not given observers of the evidentiary scene much confidence that judges have risen to the challenge.27 Indeed, there remains considerable disagreement even about the specific scope of a trial court’s responsibilities under Rule 702 and Daubert.28 Indeed, in some areas of application, such as forensic identification expertise, the courts have largely abdicated their gatekeeping responsibilities,29 or, worse, embarrassed themselves by the way they ostensibly carried out those responsibilities.30 The experience with Daubert and Rule 702, much as was the case with Frye, is that their stated purpose of ensuring that courts receive good science is not being achieved in practice. Something more is needed.

III. An Unconventional Solution

The Federal Rules of Evidence and most state codes begin with the premise that courts should admit scientific insights that are based on good grounds in their respective fields. Frye sought to achieve this result by calling upon judges to only admit scientific opinion that was based on generally accepted principles. Daubert, in contrast, called upon judges to examine the methods and principles underlying the proffered scientific opinion. Under both tests, then, courts are gatekeepers, though the “magic words” each requires to be uttered in order to gain admission are different. But, in practice, courts largely do not have the wherewithal to employ either test effectively. They have no mechanism to adjust twenty-plus years in a field and most do not have the scientific acumen to evaluate the methods and statistics supporting proffered scientific expertise. As this section explores, however, it might be possible to use Frye’s suggested mode of analysis to answer the inquiry posed by Daubert.

A. Bringing Scientific Fields to Court

Judge Jack Weinstein, a leading thinker on evidence law and an influential voice on the subject of scientific expert testimony, is not generally known as a judge that regularly excludes expert testimony. But his scientific sensibilities are sound and he has sometimes had to do just that. In an Oregon Law Review article,31 he explained one such occasion as follows:

Several years ago, I tried a case involving whole-cell pertussis vaccine. The plaintiff was an infant of four or five months with a history of seizures, who was given a whole cell pertussis vaccination. Her brain, it was later discovered, was profoundly damaged. The cause of her neurological disorder was unclear. The questions posed at trial were whether it was improper to administer the vaccine in view of the seizures and whether the vaccine caused the seizures.

In opposition to the defendant’s fully credentialed experts, the plaintiff called a scientist I would consider borderline, under Daubert, in terms of expert credentials. He had the proper degrees and had done some research, but he had published nothing on the subject and had entered the field at the request of plaintiff’s attorney. He relied wholly upon secondary sources—a large number of published articles—to prepare himself for cross-examination.

The jury found, nevertheless, for the plaintiff. As a profoundly disabled child, her case was, obviously, very compelling. At that point, I set aside the verdict, taking into account all of the evidence, including the inadequacy, in my view, of the proof presented by the plaintiff’s expert. . . .32

Judge Weinstein speculated about what courts might do to ensure that experts bring a better quality of science to the courtroom. Among several possibilities, Judge Weinstein suggested bringing experts’ testimony in the courtroom to the greater attention of those experts’ respective professional communities. Such a course would bring a sort of professional peer review to expert testimony. He believed that “the publication of expert testimony, or synopses of such testimony, in professional journals” might bring a needed mainstream scientific perspective to bear in the courtroom.33 Judge Weinstein explained:

We have often touted the advantages of our system of public trials, in which witnesses appear in open court. As a practical matter, however, there are rarely more than a few spectators in the courtroom. Most scientists do not have time to become legal buffs, hanging out at the local courthouse waiting for trials involving scientific evidence to unfold. Publication would be a means of bringing expert testi-

26 Under Rule 104(a), a court must find this preliminary fact—that is, that the basis for the proffered evidence is sufficiently accepted in the scientific community to pass muster under Daubert—by a preponderance of the evidence. The Daubert Court explained Rule 104(a)’s operation when a court is “[f]aced with a proffer of expert scientific testimony,” as follows:

[T]he trial judge must determine at the outset, pursuant to Rule 104(a), whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue.

Daubert, 509 U.S. at 593, n.10.
27 Bernstein, supra note 5.
28 Compare In re Paoli R.R. Yard Litig., 33 F.3d 717, 745 (3d Cir. 1994) (Court held that “any step that renders the analysis unreliable . . . renders the expert’s testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology.”) with City of Pomona v. S.Q.N North America, 750 F.3d 1036, 1047-48 (9th Cir. 2014) (After citing the Paoli decision from the Third Circuit, the court stated that, “[i]n the Ninth Circuit, however, expert evidence is inadmissible where the analysis ‘is the result of a faulty methodology or theory as opposed to imperfect execution of laboratory techniques whose theoretical foundation is sufficiently accepted in the scientific community to pass muster under Daubert.’ ” (quoting United States v. Chischilly, 30 F.3d 1144, 1154 & n.11 (9th Cir. 1994) (citations omitted).
30 See, e.g., United States v. Havard, 117 F. Supp.2d 848, 854 (S.D. Iowa 2000) (Court found that Daubert’s testing requirement had been met by 100 years of having been “tested in adversarial proceedings.”).
32 Id. at 1011.
33 Id.
mony to the attention of those who are in a position to evaluate it.34

This suggestion anticipates Justice Breyer’s often-quoted statement in *Kumho Tire*, decided one year later, in which he explained that a primary purpose of the “Daubert gatekeeping requirement . . . is to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field.”35 Judge Weinstein’s publication idea provides a concrete way to achieve Justice Breyer’s injunction. Although in 1998 such an effort would have been unrealistic as a practical matter, contemporary technology makes such an insight, or a variation of it, feasible.36

B. Scientific Peer Review

Frye and *Daubert* both contemplate that the law should employ scientific knowledge that has achieved some foundation in the field from which it comes. Neither, however, details how this should be accomplished as a practical matter. Frye calls upon courts to assess the level of acceptance of the basis for proffered scientific testimony, but courts have no ready mechanism to survey applicable fields. *Daubert* calls upon judges to adjudge the validity of the basis for proffered scientific testimony by considering the scientific merits themselves or proxies such as peer review and general acceptance, though courts have little demonstrated ability to carry out this function. The question then is, given evidence rules’ demand that courts bring scientific sensibilities to the issue of admissibility, how can courts best obtain and utilize those sensibilities. Judge Weinstein’s suggestion of peer review appears to be the most promising alternative.

Although the contemporary process of systematic double-blind peer review is of relatively recent vintage, the concept of subjecting scientific claims to the evaluation of peers is ancient. Indeed, an early documented example comes from the book “Ethics of the Physician,” by Ishap bin Ali Al Rahwi, who lived around 900 AD.37 This book advised that it was the duty of the physician to take detailed notes of his treatment and have those notes reviewed by a local council of physicians. Based on these notes and the corresponding reviews, a physician could be held liable for malpractice.38

More formal and systematic efforts of peer review had to await Guttenberg’s invention of the printing press. The event identified as the inception of the modern approach to peer review occurred around 1752, when the Royal Society of London assumed control of the journal *Philosophical Transactions*. They adopted an approach used by the Royal Society of Edinburgh, dating to 1731, which relied on a select group of members knowledgeable in the respective field to evaluate submissions. These reviews were relied on by the editors in making publication decisions.39

The process of peer review deepened and expanded over time and in the 20th century, particularly with the advent of the Xerox photocopier, became the standard approach for selecting manuscripts for publication. Although the internet has expanded the ways peer review might occur, including crowd-sourcing, blogs, and other innovations, the basic model of subjecting scientific claims to the review of those most knowledgeable in the respective field is deeply entrenched in contemporary scientific practice.

The *Daubert* Court itself identified peer review and publication as an important consideration in the assessment of the validity of scientific opinion. Indeed, the Court recognized that peer review was “a component of ‘good science.’”40 In fact, the value of such review only starts with publication; once findings are published, the greater scientific community then has the opportunity to weigh-in on the merits of the scientific claims.

Donald Kennedy, the former editor of the prestigious journal *Science*, alluded to the limits of journal peer review while touting the power of such review subsequent to initial publication. In defending the journal’s decision to publish a controversial study, he wrote:

I have been asked, Why are you going forward with a paper attached to so much controversy? Well, that’s what we do; our mission is to put interesting, potentially important science into public view after ensuring its quality as best as we possibly can. After that, efforts at repetition and reinterpretation can take place out in the open. That’s where it belongs, not in an alternative universe in which anonymity prevails, rumor leaks out, and facts stay inside. It goes without saying that we cannot publish papers with a guarantee that every result is right. We’re not that smart. That is why we are prepared for occasional disappointment when our internal judgments and our processes of external review turn out to be wrong, and a provocative result is not fully confirmed. What we ARE very sure of is that publication is the right option, even—and perhaps especially—when there is some controversy.41

Peer review, as many have pointed out, suffers limitations. It is inherently conservative, tends to reinforce dominant views in the field, and may be unavailable or unduly restrictive regarding certain fields of study. But from the law’s perspective, these limitations are also virtues. The law is, at bottom, a fairly conservative enterprise. In the domain of scientific evidence, courts are ill-suited to identify emerging trends or to distinguish between those promising hypotheses that will eventually gain acceptance and those destined for the junk heap.

Peer review provides an invaluable check on scientific claims. In fact, it is the centerpiece of the scientific community, one that, while competing to uncover new truths, cooperates in the general enterprise of advancing knowledge. If done well, which usually involves some level of anonymous—i.e., “blind”—evaluation, the law could be provided with objective and detached evaluations of the methods and principles that underlie

34 Id. at 1011-12.
35 *Kumho Tire*, 526 U.S. at 152.
36 Partly on the basis of Judge Weinstein’s suggestion here, I recently co-founded a company dedicated to the idea of bringing professional peer review to expert testimony. See www.jurilytics.com.
38 Id.
39 Id.
40 *Daubert*, 509 U.S. at 593. The Court also recognized the limits of peer review and noted that having the underlying research published in a peer reviewed journal does not guarant
41 Donald Kennedy, *To Publish or Not to Publish*, 295 SCIENCE 1793 (2002).
scientific opinion testimony. This would produce a host of salutary benefits.

First, it would give courts a window into the mainstream views of the respective scientific field, ala Frye. Frye provided no mechanism for assessing general acceptance in a field, other than querying the self-interested party expert on the subject. Independent peer review provides such a mechanism.

Second, the reports of peer reviewers would provide a detailed written explanation and evaluation of the bases for the expert opinion. Although the parties' expert reports do this as well—at least in civil litigation—indeed, peer reviewers are likely to give a more detached, discipline-level, view of the issues.

Finally, over time, if peer review becomes an accepted—or, even, expected—aspect of threshold admissibility decisions, the party experts themselves will likely better tailor their own opinions to those of the mainstream. This will mean that disagreements to be resolved in court reflect real debates in the field, rather than being the products of the litigants' choosing outlier experts.

A possible objection to the idea of bringing scientific peer review to scientific evidence is one considered above, the American commitment to the adversarial process. After all, if judges are reluctant to hire court-appointed experts, largely out of fidelity to the adversarial process, wouldn't they be reluctant to send out expert reports for peer review for the same reason? They might, but there are good reasons to think not. Foremost, peer review could actually be arranged by one of the parties to the litigation, and used to demonstrate that their own expert is in the mainstream or that the opponent's expert is not. But even when used by the judge, peer review is substantially less threatening to the adversarial process, wouldn't they be reluctant to send out expert reports for peer review for the same reason? They might, but there are good reasons to think not.

Foremost, peer review could actually be arranged by one of the parties to the litigation, and used to demonstrate that their own expert is in the mainstream or that the opponent's expert is not. But even when used by the judge, peer review is substantially less threatening to the adversarial process than court-appointed experts or technical advisers. Peer reviewers would not testify (unless separately invited to do so). They would merely provide written reviews of one or more party experts, to which all of the interested parties would have a full opportunity to respond. They would also be much less expensive than court-appointed experts.

In all civil litigation, and potentially in criminal prosecutions as well, testifying experts provide detailed reports to support their proposed testimony. These reports are often the subject of intense discovery, depositions, and provide the fodder for many preliminary hearings. Within this process there is adequate time, opportunity, and need for scientific peer review. Scientists and other scholars have employed this method for millennia and it is today the standard practice for virtually all mainstream scholarly journals. In focusing courts' attention on the methodologies of science, Daubert should be understood as inviting courts to consider employing all of the instruments of modern science.

Peer review is one of these. It is now time for this venerable instrument to find a place in the courtroom.

IV. Conclusion

The revolution that Daubert brought to the courtroom is, quite fundamentally, the scientific revolution itself. Whereas Frye required little scientific understanding among judges, Daubert called upon them to be gatekeepers that evaluate the methods and principles scientists use to gather knowledge.

But it is both unrealistic and highly unlikely that judges will ever have the expertise to be able to evaluate the wide range of scientific subjects that come to court. Nor need they have such expertise.

Scientists themselves claim no such breadth of talent. Scientific journals long ago solved the problem of the limits of human capacity by relying on the neutral and unbiased assessment of scientific research findings by asking those who have the expertise but who otherwise largely have no horse in the race. This is the venerable and highly respected process of scientific peer review. Peer review asks scientists "in the particular field in which the [science] belongs" whether the methods and principles underlying proffered scientific evidence are reliable and valid. It’s Frye’s solution to Daubert’s question.

42 A notable exception, of course, are law reviews. However, the sword-notes of most law review articles indicate that legal scholars invariably receive substantial feedback on their ideas from colleagues who read drafts or attend workshops.
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