DAUBERT'S DEBUT: THE SUPREME COURT, THE ECONOMICS OF SCIENTIFIC EVIDENCE, AND THE ADVERSARIAL SYSTEM

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Daubert's Debut: The Supreme Court, the Economics of Scientific Evidence, and the Adversarial System

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In Daubert v Merrell Dow Pharmaceuticals, Inc., *the Supreme Court replaced the prevailing rule of evidentiary admissibility for scientific testimony with a new standard. Under the older* Frye *rule, admissibility was determined by whether the expert's views enjoyed "general acceptance." Under* Daubert, *the trial judge will simply determine whether the expert's testimony is sufficiently "scientific" to be admitted. This article argues that the* Daubert *approach is economically superior because it reduces the incentives for external interest groups to influence the content of admitted testimony. The article also considers more general proposals to displace adversary party control of evidentiary presentation with more active judicial supervision or with other external constraints. The article concludes that such external constraints are unnecessary and would probably be socially undesirable.*

I. INTRODUCTION

In *Daubert v Merrell Dow Pharmaceuticals, Inc.*,[1] the Supreme Court resolved some two decades of debate over the standard for the admissibility of scientific evidence in federal trials under the 1975 Federal Rules of Evidence.[2] Rejecting the pre-existing

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[1] 113 S Ct 2786 (1993).

[2] As enacted by Pub L No 93-595, 88 Stat 1926 (1975). Although various rules have been added or amended over the years, the expert testimony standards of Rules

Frye standard of "general acceptance" in the scientific community,[3] the Court established a new standard of admissibility that places less emphasis on acceptance of the testifying scientist's views outside the courtroom. The *Daubert* rule simply requires that proposed scientific expert testimony be "scientific."[4] It remains to be seen whether *Daubert* will still the larger debate over the use of scientific evidence in American trials, a debate that has taken its popular form as a controversy over "junk science" in the courtroom.[5] Even if it does not settle that debate, however, *Daubert* may help turn the discussion in a useful direction.

This article argues that *Daubert* should recast the "junk science" debate by shifting the discussion away from a misguided critique of the law of evidence. Rules of evidentiary admissibility cannot realistically be expected to address all possible misuses of scientific evidence, which stem from more profound causes.[6] *Daubert* sensibly recognizes that fact, and takes a more modest approach to the role of admissibility standards. For that reason, *Daubert* may be as good a decision as we can expect, and it certainly is better than either *Frye* or the other alternatives that have been suggested, such as the creation of a "science court," or the use of court-appointed experts or official expert panels.[7] My thesis is that the Supreme Court got one right in *Daubert,* or as nearly "right" as the decisions of law courts can be in the very messy world of real litigation.

I develop this thesis by applying both transaction-cost and public-choice economics. Transaction-cost economics shows that efficiency is unlikely to be enhanced by legal rules that create diffuse

702 and 703, at issue in *Daubert,* have not been substantively amended since their original enactment.

[3] So named after *Frye v United States,* 293 F 1013 (DC Cir 1923), which ruled that results of a systolic blood pressure test (a precursor to the polygraph test) were inadmissible, on the ground that, in order for "deductions" embodied in expert testimony to be admissible, "the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs." Id at 1014. *Daubert* held that "*Frye* has been superseded" by the Federal Rules of Evidence, and therefore "should not be applied in federal trials." *Daubert,* 113 S Ct at 2794 & n 6.

[4] See id at 2794-98. The new standard, drawn directly from the text of Federal Evidence Rule 702, is "whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact." Id at 2796. Whether *Daubert's* new standard provides a less or more demanding threshold to admissibility is already a matter of vigorous debate among courts and commentators. See Part V below.

[5] See, for example, Peter W. Huber, *Galileo's Revenge: Junk Science in the Courtroom* (Basic Books, 1991) ("Huber, *Galileo's Revenge*").

[6] See Part IV.D below.

[7] See Part IV.A below.

external effects. Public-choice analysis indicates that granting outsiders a stake in the outcome of a governmental decision will induce them to influence that decision in their own private self-interest, and not in the public interest. Both of these effects were produced by the *Frye* rule. Outside parties—specifically interest groups of expert witnesses—were given a stake in the outcome of private litigation decisions through the "general acceptance" standard. The outsiders' interests, which lay primarily in maximizing their income across a series of cases presenting scientific issues, were unlikely to coincide either with the immediate litigants' interests or with society's interest in resolving the litigants' factual disputes in a neutral fashion. In particular, the outsiders' interests—and especially the need under the *Frye* rule for outsiders to organize themselves into "general acceptance" groups in order to earn income as testifying expert witnesses—likely had a biasing effect on the content of scientific evidence supplied to litigation.

The error of the *Frye* rule was in ignoring its own effect on the supply of scientific information to litigation. I characterize this error as a "free lunch" fallacy because it embodies the assumption that the supply of scientific information to litigation is "free" in the sense that its supply (and its content) are entirely independent of the demand created by litigation and the methods used to determine its admissibility, which in effect set its "price" to the litigants.[8] The assumption of a "free lunch" is unlikely to be valid because the supply of scientific evidence to litigation, like the supply of all other commodities, is likely to be responsive to the opportunity cost of its production and to the nature of the demand for the commodity. If scientific evidence is not "free" in this sense, then *Frye* produced both a suppression of some supply (of "unaccepted" opinions) and a bias in supplied opinions toward what is "accepted."

Unless there is some reason to believe in a high correlation between "general acceptance" and some objectively verifiable standard of accuracy or "truth," then the *Frye* rule did not promote the efficiency or neutrality of fact-finding in litigation. The correlation must be high, not just positive, because admissibility determinations under *Frye* influenced future cases as well as the cases in

[8] According to Robert Hessen's article in *The New Palgrave*, variants of the "free lunch" expression date back to the nineteenth century, but "[a]ll efforts to identify the true originator proved unavailing." Robert Hessen, "Free Lunch," in John Eatwell, Murray Milgate, and Peter Newman, eds, 2 *The New Palgrave: A Dictionary of Economics* 420 (Macmillan, 1987) ("Eatwell, Milgate & Newman, *The New Palgrave*"). As used here, the expression is intended to draw attention to the fact that scientific information, like all other products of human action, is costly. See Part IV below.

which they were made. The correlation between "general acceptance" and "truth," however, does not appear to be very close. In addition, the incentives that *Frye* created for the production of "general acceptance" also appear to be unrelated to "truth" or even to neutrality. Instead, those incentives encouraged adherence to a consistent opinion within relatively small "general acceptance" interest groups of testifying experts, whose income from testifying would have increased if they followed such a strategy.

Seen in this light, *Daubert* is a good decision because it at least partially recognizes that general acceptance cannot provide a "free lunch." Rather than allowing relatively small "general acceptance" groups to dictate admissibility, *Daubert* requires only that proffered expert testimony be "science" in some generic and vaguely defined sense. This is an improvement over *Frye* in two ways.[9] First, if "truth" in fact is more positively correlated with diversity than with commonality of opinion, then *Daubert* may improve results simply by expanding the range of potentially admissible opinion (whether it raises or lowers the average cost of adducing expert opinion). Second, to the extent that *Daubert* dilutes the effect of "general acceptance" on admissibility, it also reduces the incentives for rent-seeking behavior by external interest groups, and thereby reduces the amount of systematic bias on production incentives that is introduced by the evidentiary rules themselves.[10]

With the more internalized threshold standard of admissibility supplied by *Daubert*, incentives to invest in scientific evidence are more closely aligned with the stakes that the parties to litigation have in the particular lawsuit at issue. These stakes, in turn, are driven primarily by the rules of substantive law or, if by the procedural system, by features other than the law of evidence. One might still decry the use of "junk science" in litigation. But that is not a problem that rules of evidentiary admissibility are likely to address effectively.

[9] Arguably, however, *Daubert* does not go far enough because it still adheres to an external standard of "scientific method," and for this reason may be assuming a "free snack."

[10] Part of the analysis here is similar to, and draws upon, recent work by Bruce Kobayashi and Luke Froeb. See Luke M. Froeb and Bruce H. Kobayashi, *Competition in the Production of Costly Information: An Economic Analysis of Adversarial versus Court-Appointed Presentation of Expert Testimony* (GMU School of Law Working Paper, 1994) ("Froeb and Kobayashi, *Competition*"). Their paper shows that adversarial presentation of expert testimony to a "naïve" decisionmaker is not dominated by the alternative of "perfect" court-appointed experts, and that *Frye*, even if modeled favorably as simply narrowing the range of permissible testimony, is at best neutral. This article suggests that, once public-choice considerations are brought in, both *Frye* and court-appointed experts appear to be worse than unrestricted adversarial presentation. See Part IV.B below.

Daubert is a step in the right direction because it is more consistent with the structure of adversarial litigation than any attempt to "regulate" the content of scientific evidence through centralized control, which is fraught with the potential for manipulation by interest groups. The alternatives to the *Daubert* standard all suffer from one or another form of the "free lunch" fallacy. The *Frye* standard of "general acceptance" and its variants embody the fallacy in their assumption of an immutable external standard, whereas in fact any such standard is vulnerable to interest group manipulation. Similarly, replacing the litigants' incentives with governmental organs—as through court-appointed experts or publicly chosen "scientific panels"—creates the same problems in a more familiar form and to a more severe degree. None of these variations of admissibility doctrine seems likely to produce better results, in terms either of disciplining the content of scientific evidence or of minimizing the costs of litigation, than an internalized standard such as *Daubert*'s, applied by presumably uninformed trial court judges in a systematically unbiased manner. The problems that remain are not soluble by evidence law doctrine because they are problems of deviations from the standard case of adversarial litigation with symmetrical stakes that are internalized by the immediate parties.

Daubert will produce a pattern of disparate outcomes on similar facts, which may not make a pretty picture for those who equate adjudication with a search for factual consistency. But the adversarial system of adjudication has never produced a neat and tidy picture, and no system of adjudication can pretend to find immutable "truth." As the *Daubert* decision itself notes, even the scientists do not make that claim for their own disciplines,[11] and adjudication operates under a far more severe set of constraints. Let the philosophers seek for "truth." And let the law courts get about the practical business of resolving litigated disputes between the immediate parties to those disputes, on the narrowest possible grounds and with a minimum of external effects.

This argument is developed through the remaining five parts of this article. Part II sets the context by locating the admissibility of scientific evidence within evidence law doctrine and reviewing the competing tests of admissibility involved in the pre-*Daubert* debate. Part III describes the Supreme Court's decision in *Daubert*. Part IV develops the economic analysis of scientific evidence as a form of costly information, showing why the *Daubert* standard is preferable to alternative tests of admissibility.

Part V briefly examines commentators' responses to *Daubert*, and the post-*Daubert* experience in the federal and state courts,

[11] See *Daubert*, 113 S Ct at 2795.

including the federal court of appeals' decision in the *Daubert* case itself on remand from the Supreme Court. Although preliminary indications are ambiguous, there already appears to be some disagreement on the meaning and application of *Daubert*, which may produce inconsistencies in future admissibility outcomes. If that pattern develops, it will be a positive sign for the efficacy of the *Daubert* standard, as it will suggest that the standard is having precisely the unbiased effect that is desirable. Part VI concludes with a discussion of this effect, and of its broader implications for the adversarial system of adjudication.

The Supreme Court's future challenge will be to resist the temptation to tamper with a sensible decision for an imperfect world. As *Daubert* makes its way through the lower federal courts, there is likely to be a dispersion of outcomes on the admissibility of given types of scientific testimony in different cases. So long as the disparities in outcome appear to be relatively random and unbiased, there is no need to intervene. This conclusion will not be intuitively obvious to all observers, many of whom will undoubtedly see the dispersion of outcomes as a sure sign of some underlying pathology. Forgetting, or not realizing, that society has little interest in the factual findings in particular cases, critics may denounce the system's "inconsistency" and call for further "reform." But for the Supreme Court—and for the judiciary's rulemaking committees and the Congress—the better part of wisdom will be to leave well enough alone.

II. EVIDENTIARY DOCTRINE AND THE PRE-*DAUBERT* DEBATE

In evidence law, the special problems of scientific evidence stem from the law's traditional approach to testimonial qualification or, as it is called by some sources, the "competency"[12] or "founda-

[12] Terminology on this topic can be confusing. Modern evidence law doctrine, as exemplified in the Federal Rules of Evidence, tends to use the term "competency" in reference to a witness's mental capacity or legal or institutional qualification to testify at all, see Fed R Evid 601, 605-606, while some sources distinguish between that sense of the competency of witnesses and the "competency" of their testimony in the sense of meeting the threshold requirements to admissibility. See Christopher B. Mueller and Laird C. Kirkpatrick, *Evidence* § 6.1 at 498-99 (Little Brown, 1995). To further compound the confusion, the leading doctrinal authorities insist on drawing a distinction, within the threshold factual requirements to admissibility, between "competency" questions to be decided by the judge and "conditional relevancy" questions that are left to the jury. See John William Strong, ed, 1 *McCormick on Evidence* § 69 (West, 4th ed 1992) ("*McCormick on Evidence*"); 9 *Wigmore on Evidence* § 2550 (Little Brown, Chadbourn rev. 1981); Fed R Evid 104(a) & (b).

tional"[13] requirement of testimonial evidence.[14] As a general rule, testimony is not admissible unless based upon the "first-hand knowledge" gleaned from the witness's personal sense perceptions of relevant events. As "expert" scientific witnesses rarely have such a perception, and because they typically provide their information in the form of inferential "opinion" rather than first-hand "knowledge," their testimony is treated as an exception to this general rule. Much of the debate over the admissibility standards for scientific evidence is fundamentally a debate over an acceptable substitute for the first-hand knowledge requirement. Therefore, it is appropriate first to review the nature and evolution of that requirement, and then to consider its implications for the admissibility of scientific evidence.

A. First-Hand Knowledge as a Principle of Institutional Specialization

The rule of first-hand knowledge determines who will be permitted to testify and what they will be permitted to say. In this respect, the historical background of the rule is instructive. Putting the problem most starkly, two polar opposites logically suggest themselves as starting points: anyone may testify or no one may testify. Strange as it may seem to the modern reader, the early English common law approximated the second pole as its starting point, and has been slowly evolving toward the first over the past millennium.

At early common law, no one could testify—neither parties nor "witnesses" in the modern sense. Instead, common law procedure evolved an elaborate system of responsive pleadings that was designed to reduce a case to issues of law only, or, failing that, to a single, narrowly-defined issue of fact.[15] The institution of the jury

[13] Practicing lawyers and many courts tend to use the term "foundation" in reference to any prerequisite to admissibility, including the requirement of first-hand knowledge under consideration here.

[14] I refer here primarily to "testimonial" evidence as given orally by witnesses in open court because that is the central model of Anglo-American evidence doctrine and the usual context for the presentation of scientific evidence. However, documents or "writings" (as they are traditionally called in evidence doctrine) are no different in principle, as they are conceptualized simply as statements by their authors, and therefore are subject to qualification in the same manner as testimony. In addition, because most writings are prepared outside the courtroom, they are almost invariably subject to several further admissibility hurdles, including the rule against hearsay (which, together with its many exceptions, makes up a large proportion of evidence law doctrine), authentication requirements, and the "best evidence" rule's preference for the "original" writing.

[15] See Fleming James, Jr., Geoffrey C. Hazard, Jr., and John Leubsdorf, *Civil Procedure* § 3.2 (Little Brown, 4th ed 1992) ("James, Hazard & Leubsdorf, *Civil Procedure*").

originally developed as a device for tapping the personal knowledge of the jurors in order to resolve any residual issues.[16] Jurors were selected from the community in which the litigated dispute arose, and for their personal knowledge about the underlying facts and community customs.[17] As the jurors were expected to give their verdict from personal knowledge and their independent investigation of tangible proofs,[18] such as lands and the relatively scarce written records, testimonial evidence was deemed unnecessary and

[16] In the earliest period, issues of fact and law were not nearly so sharply divided as they are today; all of the contested issues would be submitted to the jury. See Frederick Pollock and Frederic William Maitland, 2 *The History of English Law* 629-30 (2d ed 1911) ("Pollock & Maitland, *History of English Law*").

[17] For an overview of the historical development of the jury, see generally Theodore F.T. Plucknett, *A Concise History of the Common Law,* book one, part II, ch 4 (Little Brown, 5th ed 1956). At the time of the Norman conquest, the prevailing modes of Anglo-Saxon trial were by ordeal, by combat, or by "compurgation," also known as "wager of law," whereby the litigants produced a specified number of individuals to swear to the justice of their cause. See F.W. Maitland, *The Forms of Action at Common Law* 14 (A.H. Chaytor & W.J. Whittaker eds., Cambridge U, 1936) ("Maitland, *Forms of Action*"). According to Pollack and Maitland, the jury was introduced to England originally by the Normans, as the royal prerogative of "inquest" in Frankish tradition, and it gradually expanded with the jurisdiction of the royal courts. Pollock & Maitland, 1 *History of English Law* at 138-50; 2 id at 616-59 (cited in note 16).

[18] The qualifications and procedures are stated clearly by Glanvill, a contemporary twelfth-century commentary on English procedure, in describing a realty case in the "Grand Assize," the progenitor of the petit jury:

> When the twelve knights have been elected, they must be summoned to come to court ready to declare on oath which of the parties, that is whether the demandant or tenant, has the greater right in his claim. . . . And meanwhile the twelve shall view the land (or tenement from which services are demanded). . . .
>
> . . . .
>
> When the assize reaches the stage where the recognition is made, then either the true legal position is well known to all the jurors, or else some know and some do not, or else none of them knows. If none of them knows the truth of the matter, and they have stated this on their oath in court, recourse shall be had to others until such as do know the truth of it are found. If, however, some know the truth of the matter and some do not, those who do not shall be rejected and others summoned to court until at least twelve can be found to agree on it. . . . The knowledge required from the jurors is that they shall know about the matter from what they have personally seen and heard, or from statements which their fathers made to them in such circumstances that they are bound to believe them as if they had seen and heard for themselves.

C.D.G. Hall, ed, *The Treatise on the Laws and Customs of the Realm of England Commonly Called Glanvill* 33-35 (English Translation) (Clarendon, 1993).

mostly unwelcome.[19] At this early stage, the jurors *were* the witnesses.[20]

Whatever else might be said of the early common law's adjudicatory methods, they certainly were sensitive to the severe limitations of the fact-finding technology of their era,[21] and they reflected a subtle appreciation for the vicissitudes of human nature.[22] Testimony by litigants was disqualified by their obvious self-interest, and that same rationale was extended to their relatives and other confidants. Originally, even unrelated and apparently disinterested witnesses were placed in that same category: because witnesses were not regularly compelled to give testimony (except by pre-litigation contract) until the sixteenth century,[23] the common law generally reasoned that they must have an interest in the outcome of the litigation, for otherwise they would not come forward.[24] Even when this attitude was relaxed, ascertainably "interested" witnesses were still disqualified from testifying.

[19] See Pollock & Maitland, 2 *History of English Law* at 601 (cited in note 16) ("Besides the oaths of the litigants and their oath-helpers, the law also knew the oaths of witnesses; but apparently in the oldest period it did not have recourse to this mode of proof . . . .").

[20] See Maitland, *Forms of Action* at 15 (cited in note 17) ("[T]rial by jury is far from being what it became in later times; jurors are not 'judges of fact,' they are witnesses . . . .").

[21] Among other things, the relatively high costs of transportation, communication, and information generally made it difficult to verify witnesses' testimony. In these circumstances, it should not be surprising to find a de-emphasis on testimony in the fact-finding process.

[22] See generally Edward J. Imwinkelried, *The Worst Evidence Principle: The Best Hypothesis as to the Logical Structure of Evidence Law,* 46 U Miami L Rev 1069, 1071 (1992) (arguing that "[a] worst evidence principle—a concern about witness perjury—is the best explanatory hypothesis for the logical structure of Evidence law" as developed in the English common law).

[23] The history is traced in detail by Wigmore, see 8 *Wigmore on Evidence* § 2190 (McNaughton rev., Little Brown, 1961) ("*Wigmore on Evidence*"). The earliest stage is summarized by Pollock & Maitland:

> [I]t seems to have been a general rule that no one could be compelled, or even suffered, to testify to a fact, unless when that fact happened he was solemnly "taken to witness." Secondly, when the witness was adduced, he came merely in order that he might swear to a set formula. His was no promissory oath to tell the truth in answer to questions, but an assertory oath.

Pollock & Maitland, 2 *History of English Law* at 601 (cited in note 16).

[24] As Wigmore explains:

> The ordinary witness (such as we now know him) was not only not compelled; he *was not welcomed.* There was a radical and strict discouragement of "maintenance," and the man who comes to labor privately with his neighbors on the jury by generally urging his influence in favor of one of the parties was

As Anglo-American procedure evolved toward its modern form, the old "disqualifications" and "incompetencies" to testimony were transformed into grounds for attack on the credibility of testimony through cross-examination and impeachment by the adverse party,[25] or, in some cases, into evidentiary privileges.[26] In those forms, they remain a part of the law of evidence today. To a very large extent, this transformation reflects not only or even primarily a more permissive attitude toward the reception of evidence, but a growing confidence in the robustness of adversarial testing as an effective check on factual fabrication.[27]

Anglo-American procedure, however, has not traveled all the way to the opposite pole. Although nearly anyone can now testify, not all testimony is "qualified" or "competent." The current qualification standard is analogous to the ancient selection criterion for jurors: to be admissible, a witness's testimony must be based on the witness's own personal knowledge, as distinguished from either second-hand sources or what is called "opinion." In effect, witnesses now have replaced jurors as providers of factual inputs to litigation. The jury now is ideally both an unbiased and an uninformed fact-finding body, whose members are chosen primarily for their ignorance of any facts relating to the particular case, or at least are put on their oath to set aside any such knowledge and give their verdict solely on the basis of the evidence presented at trial.

The resulting evidence law doctrine of testimonial qualification generally is known as the "personal knowledge" or "first-hand

> not carefully distinguished from the man who comes merely to tell them what he knows of the facts. He is in either case (they thought) trying to make them decide for one of the parties rather than the other; he is a meddler; that was the law's attitude toward him.

8 *Wigmore on Evidence* § 2190, at 63-64 (cited in note 23).

[25] See 1 *McCormick on Evidence* § 61 (cited in note 12).

[26] For example, the previous disqualification of testimony by the spouse of a litigant generally has now evolved into a "privilege" against testimony exercisable by the litigant or witness spouse, or either of them, and a separate privilege for confidential marital communications. Some jurisdictions have both privileges. See, for example, Cal Evid Code §§ 970-73 (privilege against testimony); §§ 980-87 (confidential marital communications) (West 1966).

[27] By the twentieth century, this development had ripened into Wigmore's famous paean to adversarial testing by cross-examination as

> beyond any doubt the greatest legal engine ever invented for the discovery of truth. . . . If we omit political considerations of broader range, then cross-examination, not trial by jury, is the great and permanent contribution of the Anglo-American system of law to improved methods of trial procedure.

5 *Wigmore on Evidence* § 1367, at 32 (Chadbourn rev, Little Brown, 1974).

knowledge" rule. In essence, the rule requires that a witness's testimony consist of information obtained by the witness from her or his personal sense perception—the familiar instruction that witnesses confine their testimony to "what you saw and heard" (or tasted, smelled, or touched).[28] As the *Daubert* Court pointed out, this rule represents "a 'most pervasive manifestation' of the common law insistence upon 'the most reliable sources of information.' "[29]

The negative correlative to the first-hand knowledge rule is the so-called opinion rule—more accurately characterized as the no-opinion rule—which generally prohibits witnesses from testifying to "opinion" or "conclusion" as distinguished from first-hand "knowledge."[30] As has been pointed out, if this distinction between knowledge and opinion were taken to its epistemological extreme, there would be no such thing as admissible testimony, as virtually any description of sense perceptions is an opinion.[31] Of course, the opinion rule has not been so applied. Instead, both the first-hand knowledge rule and the opinion rule have been applied essentially on the basis of the relative institutional functions of witnesses as compared with jurors (or judges, when acting as fact-finders).

Under modern institutional arrangements, the fact-finder is assigned only part of its original role—what might be called the "inferential" function.[32] The fact-finders, with the assistance of the

[28] The current federal codification of this standard is Rule 602 of the Federal Rules of Evidence, which provides that "[a] witness may not testify to a matter unless evidence is introduced sufficient to support a finding that the witness has personal knowledge of the matter." Fed R Evid 602.

[29] 113 S Ct at 2796, quoting from Advisory Committee's Note on Fed R Evid 602, 56 FRD 183, 263 (1973) quoting from *McCormick on Evidence* § 10, at 19 (West, 1954).

[30] Compare Fed R Evid 602 with id 701 and 702.

[31]
> In a way, all human assertions are opinions. . . . Our whole conscious life is a process of forming working beliefs or opinions from the evidence of our senses, few of them exactly accurate, most of them near enough correct for practical use, some of them seriously erroneous. Every assertion involves the expression of one or more of these opinions. A rule of evidence which called for the exclusion of opinion in this broad sense would therefore make trials quite impossible.

John MacArthur Maguire, *Evidence: Common Sense and Common Law* 24 (Foundation Press, 1947) ("Maguire, *Evidence*").

[32] Despite pioneering work by Wigmore early in this century, culminating in the appearance of the third edition of his work on "proof" as distinguished from admissibility in 1937, the inferential function was largely ignored by legal scholars until relatively recently. See John Henry Wigmore, *The Science of Judicial Proof* (Little Brown, 3d ed 1937). The study of the processes of inference and proof in trials now

adversarial presentations and arguments by the parties, are to take the raw materials provided by the witnesses and draw their own conclusions. From this point of view, the first-hand knowledge and opinion rules—and indeed the majority of evidence law, most of which is concerned with "reliability" standards[33]—operate primarily to protect the institutional function of the fact-finder. They do this by requiring that evidence be "broken down" into a form that exposes the parties' patterns of inferential reasoning to independent evaluation by the fact-finder.[34]

The basic logic here is analogous to the economics of specialization, as applied within the institutional context of litigation.[35] The fact-finders specialize in the inferential function, while the "fact" witnesses specialize in providing observational inputs. This

is undergoing a renaissance, based largely on Wigmore's earlier work. See, for example, Terence Anderson and William Twining, *Analysis of Evidence* (Little Brown, 1991); David A. Schum, *The Evidential Foundations of Probabilistic Reasoning* (John Wiley, 1994).

[33] In terms of admissibility as distinguished from trial procedure or proof, there are only two basic doctrines of evidence law concerned with intrinsic fact-finding: (1) "relevancy," which is a minimal requirement of probative value; and (2) "reliability," which takes in the rules of competency, authentication, hearsay, "best evidence," and the like, designed to provide some assurance that proffered evidence represents a genuine factual input. See *Daubert*, 113 S Ct at 2795-96. The third general topic of admissibility doctrine concerns rules of evidentiary privilege and other rules (such as the rules against evidence of subsequent remedial measures, Fed R Evid 407, or settlement negotiations, Fed R Evid 408) that exclude evidence on the basis of what typically are referred to as "extrinsic" policy considerations.

[34] As articulated by Maguire in his "common sense" terms:

> It is . . . plain good sense to refuse to let a non-expert purport to give evidence about matters he does not understand. He is more likely to mislead than to afford sound guidance. The trier of fact is equally capable of forming its own conclusions. By expanding this last statement we shall get a phrasing of the practice under which courts have tended to exclude testimony consciously cast in terms of opinion and referring to commonplace matters, whenever they believe this testimony can be broken down into its rudiments—that is, normally, into statements of perception from which the relevant opinion or conclusion is to be derived. It is fundamental to our method of litigating factual issues that the trier of fact, whether judge of juror, shall so far as his capacities and the nature of the issues permit draw for himself all the conclusions which build themselves into his determination. Witnesses are to state their perceptions of fact, the triers to appraise credibility, make findings of fundamental fact, and draw the inferences necessary to decision.

Maguire, *Evidence* at 25 (cited in note 31).

[35] In economics, the benefits of specialization have been developed primarily in connection with the gains from trade or exchange in an explicit market. See generally Armen A. Alchian and William R. Allen, *Exchange & Production: Competition, Coordination and Control* ch 7 (Wadsworth, 3d ed 1983). Still, the logic of the spe-

logic is relatively explicit in the legal doctrine, especially in Federal Rule 701's codification of the opinion rule and its exceptions as applied to "lay" (non-expert) witnesses: opinions or inferences by such witnesses are prohibited unless the opinions or inferences are both "rationally based" on the witnesses' sense perception and determined to be "helpful to a clear understanding of the witness' testimony or the determination of a fact in issue."[36] Note that the exceptions follow the same logic as the general rule, in that even "helpful" inferences by fact witnesses still must be based in their observational advantage over fact-finders in terms of personal sense impression.

The same logic applies to expert testimony, which is admissible under the Federal Rule 702 only when there has been a determination that expert testimony (1) actually is "expert" information, in the same sense that it is "specialized" information not possessed by the fact-finders (or too costly for fact-finders to acquire), and (2) "will assist the trier of fact to understand the evidence or to deter-

cialization is analogous in this context, when viewed in the institutional perspective. Identifying the gains from explicit trade simply is one way of recognizing a difference in marginal opportunity costs of production versus trade: in the classical example, the English make cloth and buy wine, because the opportunity cost of the English foregoing cloth production to make wine is higher than the market price of Portuguese wine. Similarly here, the current institutional arrangements imply that the fact-finders make inferences and "buy" observational inputs from the witnesses, which suggests that the opportunity costs of combining both functions in the fact-finders are high. This could be true, for example, if direct observation will actually impair the reliability of the inferences that one later draws within the litigation context.

Something like this logic may account for the historical evolution of specialized roles for jurors and witnesses. Because factual testimony originally could not be compelled, and therefore had to be "bought" in an explicit market, parties may have found it less costly to purchase the testimony from witnesses than to incur the costs of leaving jurors to inform themselves about the underlying facts. Similarly, jurors may have wanted to avoid the opportunity costs of investigating the facts—as they presumably had more productive uses for that increment of their time—and "traded" that right in exchange for specialization in the inferential function. Under this interpretation, both litigants and jurors had positive incentives to acquiesce in the transition to witness testimony. Judges do not appear to have had any strong incentive to resist that transition, especially if it also increased the reliability and therefore acceptability of fact-finding in litigation.

[36] Rule 701 provides:

> If the witness is not testifying as an expert, the witness' testimony in the form of opinions or inferences is limited to those opinions or inferences which are (a) rationally based on the perception of the witness and (b) helpful to a clear understanding of the witness' testimony or the determination of a fact in issue.

Fed R Evid 701.

mine a fact in issue."[37] Thus, the principle justifying the admission of expert testimony appears to be both equivalent to the general doctrine and relatively noncontroversial in concept. The difficulties have arisen not with the principle, but rather with formulating a practical test for admissibility that can be applied by the nonexpert trial judge charged with implementing that principle.

B. The Pre-*Daubert* Debate

The special problems of expert testimony arise from a seeming deficiency in the competence of the trial judge to determine whether proposed expert opinion testimony offers the fact-finder any advantage in drawing conclusions. The trial judge might reasonably be expected to determine whether a lay opinion would be "helpful" to the fact-finder, because the judge, as another "lay" person, presumably is in a position to appreciate the inferential process involved in forming that opinion. But how can the judge make the similar determination that expert opinion will "assist" the fact-finder, when the expert opinion rests on an inferential process that, by definition, is beyond the understanding of lay persons, including the judge? This is the question that has haunted the debates over the admissibility of scientific evidence, from *Frye* through *Daubert*, and the one that has tempted some courts and commentators to the vain hope that there is a free lunch.

The logic of the situation suggests two different points of view, which in fact did emerge as opposing schools of thought in the pre-*Daubert* debate. One point of view is "internal" to the litigation process, while the other is "external." The "internal" point of view manifests a confidence in the ability of the trial judge, with the assistance of adversarial presentation, to distinguish between useful and misleading (or pointless) expert testimony. In contrast, the "external" point of view reflects the belief that the adversarial process is easily fooled, confused, or misled by proffered scientific evidence, making it necessary to judge the admissibility of such evidence by a standard that is external to the litigation process.

The "internal" perspective is associated with what came to be called the "relevancy" or, after its principal exponent, the "McCor-

[37] Rule 702 provides:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or 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.

Fed R Evid 702.

mick" test of admissibility.[38] Under this view, there is no special prerequisite to the admissibility of scientific evidence, which therefore is subject only to ordinary admissibility requirements, primarily relevance. According to McCormick, this was the "traditional" approach to scientific evidence, followed prior to the twentieth century, and the "notion of a special rule for scientific evidence originated in 1923 in *Frye*."[39]

The "external" perspective is represented by the *Frye* (or, more descriptively, the "general acceptance") test for the admissibility of scientific evidence. Under this test, scientific evidence is inadmissible unless it is shown to be based on reasoning that is "sufficiently established to have gained general acceptance in the particular field in which it belongs."[40] In essence, the rationale for this test is that neither courts nor juries—nor any litigation processes—are capable of distinguishing between "good" science and "bad" science by themselves, so that the scientific community must be given the "determinative voice."[41]

The emergence of the *Frye* test opened up a division of authority in the case law, and a spirited debate in the secondary literature, all of which was intensified by the 1975 enactment of the Federal Rules of Evidence.[42] Because the Federal Rules did not mention *Frye*, it was uncertain whether the Rules displaced or incorporated the *Frye* test or its variants. That question created a conflict among the federal courts of appeals, which finally prompted the Supreme Court to grant certiorari in *Daubert*.[43]

III. THE *DAUBERT* DECISION

In June 1993, the Supreme Court resolved the conflict among the federal circuits by ruling in *Daubert* that "the *Frye* test was displaced by the [Federal] Rules of Evidence."[44] Taken alone, this unanimous holding might be viewed merely as a somewhat formalistic exercise in statutory interpretation of the legislatively-en-

[38] See *McCormick on Evidence* § 170, at 362-64 (West, 1st ed 1954).

[39] 1 *McCormick on Evidence* § 203, at 869 (cited in note 13).

[40] *Frye v United States*, 293 F 1013, 1014 (DC Cir 1923).

[41] Paul C. Giannelli and Edward J. Imwinkelried, 1 *Scientific Evidence* § 1-5(A) at 13 & n 76 (Michie, 2d ed 1993) (quoting from *United States v Addison*, 498 F 2d 741, 743-44 (DC Cir 1974)) ("Giannelli and Imwinkelried, *Scientific Evidence*").

[42] The legal literature is vast. For a general survey through 1992, see id at ch. 1. The recent leading sources were cited by the Supreme Court in *Daubert*, 113 S Ct at 2793 nn 4-5.

[43] See *Daubert*, 113 S Ct at 2792.

[44] *Daubert*, 113 S Ct at 2794. Justice Blackmun wrote for the Court, which was unanimous on this point.

acted Federal Rules of Evidence.[45] The Court, however, went on to provide a detailed explanation of its decision, in a portion of the opinion from which two Justices dissented.[46] This explanation displays both an interesting analysis of the evidentiary doctrine surrounding the problems of scientific evidence and at least some appreciation of the policy questions involved.

Daubert itself involved two of the many personal injury cases that had been brought in recent years against Merrell Dow Pharmaceuticals on the allegation that its drug Bendectin, an anti-nausea medication prescribed during pregnancy, caused birth defects in the gestating children. After removal of the two cases from state to federal court in California, Merrell Dow moved for summary judgment. Merrell Dow's most important contention was that the plaintiffs would be unable to present admissible scientific evidence of causation because all of the published epidemiological (human statistical) studies had failed to find a link between Bendectin and birth defects. The plaintiffs conceded the state of the published literature, but joined issue on the admissibility question by proffering expert testimony based upon animal and chemical structure studies, plus unpublished "reanalyses" of the published epidemiological data, all purporting to show evidence of the causative link.

The federal trial court ruled that the experts opinions proffered by the plaintiffs were inadmissible under *Frye*, and therefore gave summary judgment for Merrell Dow.[47] The United States Court of Appeals for the Ninth Circuit affirmed.[48] The animal and chemical structure studies were ruled inadmissible in light of the published epidemiological studies' findings; where substantial human studies are extant, the court concluded, non-human studies are not "generally accepted" as reliable. The "reanalyses" were excluded on the ground that such studies are "generally accepted" only when published and subject to peer review.

The Supreme Court reversed and remanded on the ground that the *Frye* standard did not survive the Federal Rules of Evidence. The Court's basic ruling was predicated on a formal and almost

[45] See id at 2792-94 (Part II-A of the Court's opinion, in which all justices joined).

[46] See id at 2794-99 (Parts II-B, II-C, III, and IV of the Court's opinion, in which seven of the nine justices joined). Chief Justice Rehnquist, joined by Justice Stevens, filed an opinion that dissented from all but Parts I (the factual statement) and II-A (the basic ruling that *Frye* had been displaced by the Federal Rules of Evidence) of the Court's opinion. The dissenters argued that "the Court would be far better advised in this case . . . to leave the further development of this important area of the law to future cases." Id at 2800 (Rehnquist concurring in part and dissenting in part).

[47] *Daubert v Merrell Dow Pharmaceuticals, Inc.*, 727 F Supp 570 (SD Cal 1989).

[48] *Daubert v Merrell Dow Pharmaceuticals, Inc.*, 951 F 2d 1128 (9th Cir 1991).

mechanical legal analysis: finessing the policy implications, the Court simply ruled that the *Frye* standard was not within the purview of the Congress enacting the Federal Rules of Evidence in 1975. The Court read Federal Evidence Rule 402 as a "liberal" standard authorizing the admissibility of any relevant evidence unless there is explicit authority for exclusion.[49] According to the Court's analysis, expert testimony is governed specifically by Rule 702,[50] which did not embody the *Frye* standard and therefore failed to authorize the "general acceptance" standard as a threshold to admissibility.

Up until this point, the Court's *Daubert* opinion could be viewed as an endorsement of the "relevance" test in its most rudimentary form: by simply ruling that the *Frye* test was superseded by the Federal Rules, the Court could have relegated scientific evidence to the same category of presumptive admissibility, subject to the trial court's discretionary authority to exclude for confusion, prejudice, or waste of time, as all other "relevant" evidence. That apparently was the option favored by the two dissenters, as they joined only in this aspect of the ruling. The majority of the Court, however, went on to provide a framework for lower courts to use in addressing the admissibility of scientific evidence.

In place of the *Frye* standard, the *Daubert* majority articulated a concept of "reliability" that is analogous to the "competency" or "foundational" standards associated with non-expert testimony: "[U]nder the [Federal] Rules the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable."[51] According to the Court, the "primary locus of this obligation is Rule 702,"[52] which was directly analogized by the Court to the foundational requirement of first-hand knowledge. Like that requirement, according to the Court, Rule 702 is designed to assure that "the expert's opinion will have a reliable basis in the knowledge and experience of his discipline."[53]

The Court's opinion resolves the Rule 702 standard into two distinct aspects: (1) whether the proffered evidence is "scientific

[49] Rule 402 provides:

> All relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by Act of Congress, by these rules, or by other rules prescribed by the Supreme Court pursuant to statutory authority. Evidence which is not relevant is not admissible.

Fed R Evid 402.

[50] Rule 702 is set out in note 37 above.

[51] 113 S Ct at 2795.

[52] Id.

[53] Id at 2796.

knowledge," which means, in essence, that it was arrived at through the scientific method; and (2) whether the evidence "will assist the trier of fact to understand or determine a fact in issue," which means that there is an adequate "fit" or "valid scientific connection" to the factual issues in the litigation.[54] In addition to the Rule 702 standards, the trial court may also apply the balancing test of Rule 403 to exclude scientific evidence when "its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence."[55]

There is little doubt that the content of the admissibility standards enunciated by *Daubert* will be the subject of much case law and commentary, as they already have been in the relatively short time since *Daubert* was decided.[56] For purposes of this article, however, the exact contents of the new *Daubert* standards are less important than their general tendencies. First, as noted above, *Daubert* represents an explicit recognition that the threshold standards for the admissibility of scientific evidence are intended to serve the same relatively minimal "reliability" function that is served by the rule of first-hand knowledge for nonexpert evidence. Second, *Daubert* primarily takes the "internal" point of view on scientific evidence, which relies upon the adversarial system itself to police abuses.

This second feature of the *Daubert* ruling was made more explicit in the Court's concluding discussion, where the Court responded briefly to the concerns of both sides in the pre-*Daubert* debate. On the one hand, the Court believed that the "junk science" critique was

> overly pessimistic about the capabilities of the jury, and of the adversary system generally. Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the

[54] Id.

[55] Rule 403 reads in full:

> Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.

Fed R Evid 403.

[56] There have been many individual articles on *Daubert*, and symposia have appeared in 15 *Cardozo Law Review* (nos. 6-7 (combined), April 1994) and 43 *Emory Law Journal* (no. 3, Summer 1994).

> burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.[57]

On the other hand, the Court believed that fears of overly parsimonious "gatekeeping" by the trial court judges—leading to "a stifling and repressive scientific orthodoxy" also were overdrawn, given the different roles of scientific and judicial fact-finding:

> It is true that open debate is an essential part of both legal and scientific analyses. Yet there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory. Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly. The scientific project is advanced by broad and wide-ranging consideration of a multitude of hypotheses, for those that are incorrect will eventually be shown to be so, and that in itself is an advance. Conjectures that are probably wrong are of little use, however, in the project of reaching a quick, final, and binding legal judgment—often of great consequence—about a particular set of events in the past. We recognize that in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes.[58]

With these observations, the Court's *Daubert* opinion displays a refreshing appreciation for both the strengths of the adversary system and the severe limitations of any adjudicative process in discovering immutable "truth." For these reasons, *Daubert* appears generally to be a sound decision. As I will show in the next section, it is an improvement over *Frye*, simply because *Daubert*—unlike *Frye*—at least begins to recognize that the production of scientific information has costs.

IV. THE ECONOMICS OF SCIENTIFIC EVIDENCE

There is no free lunch. Most economists and non-economists alike profess adherence to that axiom. There nonetheless appears to be widespread vulnerability to the fallacy that maybe there is a free

[57] 113 S Ct at 2798.
[58] Id at 2798-99.

lunch—or at least a very cheap lunch—out there somewhere, which we can find if only we are very clever about searching for it, and as long as we do not call it a "lunch." But that quest contradicts the axiom. Perhaps the metaphor in the expression stands as an obstacle to broad understanding and application of its principle. In that case, let us remove the metaphor. Nothing is free. All human action (or inaction) consumes resources, if only in the diversion of human imagination and effort from one opportunity to another.[59] Because all human action consumes resources, all products of human action are costly.

These principles apply to information, just as they do to all other products of human activity.[60] As the economists say, information is costly. And yet, it is precisely in the context of information production—and most especially scientific information—that the "free lunch" fallacy seems to be most seductive.[61] Perhaps that is because there is such a powerful urge to believe that all the secrets of the Universe simply lie waiting to be uncovered, and, once understood,

[59] "Costs are equal to the value attached to the satisfaction which one must forego to attain the end aimed at." Ludwig von Mises, *Human Action: A Treatise on Economics* 97 (Henry Regnery, 3d rev ed 1966). See also James M. Buchanan, *Cost and Choice: An Inquiry in Economic Theory* (U Chicago, 1978). It is especially the failure to consider opportunity costs that can feed the "free lunch" fallacy. See, for example, Steven M. Crafton and Margaret F. Brinig, *Quantitative Methods for Lawyers* 24 (Carolina, 1994).

[60] The economics literature is surveyed in Jack Hirshleifer and John G. Riley, *The Analytics of Uncertainty and Information,* part II, chs 5-7 (Cambridge U, 1992) ("Hirshleifer and Riley, *Analytics*"). In the law-and-economics literature, the fullest generalizations are given by Frank H. Easterbrook, *Insider Trading, Secret Agents, Evidentiary Privileges, and the Production of Information,* 1981 Sup Ct Rev 309 ("Easterbrook, *Insider Trading*"), and in three papers that appeared in a special issue of *The Journal of Legal Studies* in 1980: George J. Stigler, *An Introduction to Privacy in Economics and Politics,* 9 J Legal Stud 623 (1980) ("Stigler, *Introduction to Privacy*"); Edmund W. Kitch, *The Law and Economics of Rights in Valuable Information,* 9 J Legal Stud 683 (1980); and John P. Gould, *Privacy and the Economics of Information,* 9 J Legal Stud 827 (1980).

[61] Stigler summarizes the key problem:

> Economists have come to view the production of knowledge as an expensive, resource-consuming activity, but the dissemination of this knowledge as virtually free. . . . [But] are the production and dissemination of information separable? . . .
>
> The distinction between producing and using information is a hypothesis. It has not been shown to possess a large capacity to generate interesting hypotheses about the working of markets for information. In this undeveloped state it is a poor basis for deducing welfare conclusions.

Stigler, *Introduction to Privacy* at 640-41 (cited in note 60). See also Easterbrook, *Insider Trading* at 313-14, 364-65 (cited in note 60).

will form themselves into a perfect and disciplined whole.[62] Whatever the merits of this belief in immutable "truth," which can be neither created by human understanding nor destroyed by human ignorance, the processes of human understanding and human behavior themselves are quite mutable. Those processes, moreover, do not magically lose their all-too-human qualities simply because they are turned toward a search for immutable truth.

Accordingly, it is a fair question whether any form of information can ever be treated as a "given" for any purpose of law or economics.[63] That general question is beyond the scope of this article, which is concerned with the supply of scientific evidence to litigated matters. As to that species of information, there can be no doubt that production incentives are at work, as the underlying activity is costly.[64] We need only observe that the process of scientific investigation—as opposed to the immutable "truths" for which it seeks—is itself a costly activity that consumes considerable resources and occupies a number of people throughout their lives. Furthermore, when litigation enters the picture, we observe that individuals can earn positive incomes for their scientific "expert" testimony on the matters at issue. Those simple facts are sufficient to frame the economic analysis of scientific evidence, and to show that the *Frye* rule of admissibility—and any variant that purports to regulate the content of scientific evidence by reference to an external standard of "acceptance"—is based on the fallacy that scientific knowledge is somehow just lying around waiting for the courts to make use of it in resolving disputes. This is a fallacy because the quantity and quality of the scientific knowledge that is produced will be affected by the uses to which such knowledge is put by the courts.

Because the provision of scientific expert testimony to litigation is a costly activity, and because the standard of admissibility will affect the incomes of people who provide such testimony, the behavior of individuals engaged in that activity will differ depending on the content of the admissibility standard. In the case of *Frye*, its admissibility standard created incentives for interest groups to form

[62] The basic arguments are traced in Hirschleifer & Riley, *Analytics* § 7.1 (cited in note 60).

[63] The most powerful statement of this general critique is Friedrich A. Hayek, *The Use of Knowledge in Society*, 35 Am Econ Rev 519 (1945).

[64] See Jack Hirshleifer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 Am Econ Rev 561 (1971). Although his principal concern is with the question of private over- or under-investment in inventive activity, Hirschleifer's paper shows that, even in a world of perfect and costless exchange, the redistribution of information will affect production incentives.

around the concept of "general acceptance." Those organizational incentives in turn both raised the costs and influenced the content of scientific evidence produced for use in litigation, at least on the margin.

Frye's error was to assume that its admissibility standard would have no effect on scientific "acceptance." At the margin, however, the "general acceptance" standard must affect what scientific research is conducted, what papers are published, and how scientific fields are defined.[65] Those marginal effects, moreover, are likely to be heavily represented in litigated disputes over the admissibility of scientific evidence.[66] It is difficult to say empirically whether *Frye*'s effect on science overall has been large or small, but that does not change the analysis. So long as the effect of *Frye* has not been zero, then it had some effect on the nature of the scientific evidence supplied. But *Frye* could have zero effect only if immutable truths of science both exist (which is widely doubted among scientists) and can be costlessly apprehended. If those conditions were satisfied, however, there would be no need for scientific testimony at all, and the entire question of admissibility standards for scientific evidence would disappear.

From this perspective, *Daubert* is an improvement over *Frye*, though hardly a panacea. *Daubert* may still assume a "free snack" because it recurs to a purportedly external standard of what constitutes "science" for its threshold to admissibil-

[65] The most obvious of many possible examples are suggested by the terms "forensic science" and "forensic medicine." Without the demand created by litigation, these fields of activity would not even exist. Because of that demand, however, these fields, like others, have their professional associations and societies. See Part V below. As the costs of organizing such groups are not zero, their existence—and their necessity under the *Frye* standard—affect the production cost structure.

[66] Virtually by definition, scientific expert testimony is at the "margin" of scientific activity, on both the supply and demand sides. The selection bias in cases that proceed to trial suggests that the closer and more sharply contested cases will provide most of the demand for expert testimony. See George L. Priest and Benjamin Klein, *The Selection of Disputes for Litigation*, 13 J Legal Stud 1 (1984). That condition, in turn, is likely to call forth controversial scientific expert testimony, which will also be the most sharply contested in terms of admissibility.

The usual case of expert testimony may usefully be contrasted with the little-used concept of "judicial notice," which assumes the existence of a "fact . . . not subject to reasonable dispute." Fed R Evid 201(b). In economic terms, this is the "inframarginal" case of scientific information used in courts. Perhaps more importantly for the analysis of this article, it does not utilize expert testimony at all, even if it relates to scientific phenomena. Prospective expert witnesses' incentives essentially are to minimize the application of this concept, which is consistent with its relatively rare appearance in contested matters.

ity.[67] Nonetheless, *Daubert* is a less strictly directive or regulatory standard, and it is vague. In this context, those features have the virtue of discouraging interest groups of litigants, lawyers, and expert witnesses from organizing themselves around the admissibility standard.[68] If the costs of organization and coordination are large enough, then *Daubert* may produce a relatively unbiased supply of scientific evidence to litigation.

The major difference between *Daubert* and *Frye* rests fundamentally in *Daubert*'s more "internal" perspective on fact-finding in litigation. *Frye* and its more recent variants reflect a long period of twentieth-century angst—which continues in several forms to the present—about the efficacy of the Anglo-American system of adversarial adjudication.[69] That angst produces a turn toward "external" guidance. *Daubert* is a reaffirmation of confidence in the adversarial system's internal ability to correct for misleading evidence.[70] The underlying question is whether recourse to some external standard, or a more directive role for public agents such as judges or court-appointed experts, can improve the fact-finding performance of the adversarial system. Certainly in the case of scientific evidence—if not more generally—both transaction-cost and public-choice economics suggest that the answer is "no."

The adversarial system operates essentially by conferring procedural rights on the parties to present whatever evidence they

[67] To the extent that *Daubert* looks to an external standard, it still assumes that this standard is in an important sense "free." This is fallacious because the external standard of what constitutes science, like the *Frye* standard, is potentially manipulable by external interest groups. *Daubert* differs from *Frye* mainly in creating weaker incentives for external interest groups to manipulate the standard because the costs of doing so effectively are higher. See Section B below.

[68] At least one commentator already has observed that "if *Daubert* is taken seriously, then much of forensic science is in serious trouble." Randolph N. Jonakait, *The Meaning of Daubert and What that Means for Forensic Science,* 15 Cardozo L Rev 2103, 2117 (1994). See also Randolph N. Jonakait, *Forensic Science: The Need for Regulation,* 4 Harv J L & Tech 109 (1991).

[69] This theme of "dissatisfaction" with the adversarial system can be traced back at least to the famous 1906 address by Roscoe Pound, then Dean of the Harvard Law School, to the American Bar Association on "The Causes of Popular Dissatisfaction with the Administration of Justice" (reprinted in 29 ABA Reports 395 (1917)). In more recent years, it is exemplified in the criticisms of Marvin E. Frankel, *Partisan Justice* (Hill and Wang, 1980), which expanded on his earlier article, *The Search for Truth: An Umpireal View,* 123 U Penn L Rev 1031 (1975). And see the sources cited at notes 82-87 below.

[70] For defenses of the adversarial system, see Stephan Landsman, *The Adversary System: A Description and Defense* (American Enterprise Institute, 1984); Lon L. Fuller, *The Forms and Limits of Adjudication,* 92 Harv L Rev 353 (1978).

wish, subject only to very loose regulation through the law of evidence and the trial court judge's rulings on procedural points at trial. The parties' incentives to invest in evidentiary presentation are provided by the substantive law of liability and damages. At trial, the basic norm is symmetry of opportunity for each side to present its case, subject to the conventions on burdens of proof. As noted above, fact-finders are chosen for disinterest, neutrality, and ex ante ignorance of the incident in litigation. At least formally, law determination is strictly separated from fact-finding, and fact-finding is subject to very limited appellate review. With some important modern exceptions,[71] the findings of fact are binding only upon the immediate parties. Fact-finding in this system is highly internalized to the immediate litigation and litigants: there is little or no external effect on society, except for the effects following from the determination of the immediate parties' legal rights in the narrow factual context of the litigation.

Within such an inwardly focused system, injecting an external standard of evidentiary qualification is unlikely to improve overall results, given the limited aims and consequences of fact finding in each individual case. On the contrary, recourse to an external standard—particularly one that is manipulable by private or public interest groups—is likely to degrade the performance of the system. Such a standard gives non-parties a stake in the outcome and thereby encourages their interference, which appears to be what occurred under the *Frye* test for scientific evidence.[72] Similarly, increasing the roles of public agents, such as judges or public experts, again would give those agents a stake in the litigation and therefore an incentive to influence the outcome. In neither case would society's interest in the fact-finding function of litigation be advanced materially.

In fact, society has very little interest in the factual—as opposed to the legal—outcome of any one trial, so long as the fact-finding process is tolerably accurate and systematically unbiased.[73] "Accuracy" itself is a difficult concept to define in any precise and prac-

[71] See Parts IV.A and IV.C below.

[72] The situation is therefore analogous to the economics of contract: if the parties fully internalize social costs and benefits, and if transaction costs are low, then bargaining leads to an efficient outcome. R.H. Coase, *The Problem of Social Cost,* 3 J L & Econ 1 (1960). Furthermore, all other things equal, granting non-litigants stakes in the outcome would tend to raise transaction costs and therefore impair efficiency. The number of affected individuals is much larger, and the stakes may no longer be symmetrical.

[73] See Richard A. Posner, *An Economic Approach to Legal Procedure and Judicial Administration,* 2 J Legal Stud 399 (1973). For an extensive recent analysis finding that even the systematic value of accuracy (conceived more broadly to include legal

tical way because the "accuracy" of litigated fact-findings cannot be evaluated on any independent basis. But no one operates under the illusion that perfect "accuracy"—however it might be defined—can or should be the aim of a practical fact-finding process in litigation. As the Court pointed out in its *Daubert* opinion, mistakes will sometimes be made, but that is the inevitable consequence of a fact-finding system "designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes."[74] The more practical policy question is how the incentives to invest in the fact-finding process should be structured. Given that the social value of the "accuracy"—however defined—of a single factual outcome is by definition small, economics suggests that external social intervention in the parties' investment decisions also should be small.

A. The Functions and Structure of Litigation

In our legal system, litigation has two principal functions: resolving an existing dispute between the immediate parties; and generating rules to govern future conduct.[75] There are important social interests in both functions, but in neither instance does the social interest place a great deal of importance on the precise outcome of the fact-finding process in any one particular case.

The function of generating rules (or declaring law) places little significance on the fact-finding process. Most law declaring in the American adjudicative system is done by appellate courts, in published opinions with factual recitations that often bear only a remote resemblance to the evidentiary facts of record.[76] Appellate review of fact-finding is extremely limited.[77] It is entirely consistent

outcomes) is an enormously complex question, see Louis Kaplow, *The Value of Accuracy in Adjudication: An Economic Analysis*, 23 J Legal Stud 307 (1994). The point here is the much more modest one that the social value of an "accurate" determination in a given marginal case approaches zero, essentially by definition.

[74] See note 58 and accompanying text above.

[75] See generally Richard A. Posner, *Economic Analysis of Law* chs 20-21 (Little Brown, 4th ed 1992).

[76] Perhaps the most famous example of this very common phenomenon is Judge Cardozo's opinion in *Palsgraf v Long Island R. Co.*, 248 NY 339 (1928), which is treated in detail by Richard A. Posner, *Cardozo: A Study in Reputation* ch 3 (U Chicago, 1990).

[77] With few exceptions, American appellate courts follow the federal pattern of highly deferential review of factual findings by the trial court. A trial court judge's findings of fact "shall not be set aside unless clearly erroneous, and due regard shall be given to the opportunity of the trial court to judge the credibility of witnesses," Fed R Civ P 52(a). "Clearly erroneous" is construed to mean that "the reviewing court on the entire evidence is left with the definite and firm conviction that a

with American doctrine that an appellate court would spend a great deal of effort in analyzing the law as applied to a set of facts that the appellate judges do not believe to be true, but are constrained to accept by the narrow scope of appellate review of fact-finding. Aside from the ultimate limitations imposed by doctrines of justiciability such as standing and mootness,[78] appellate courts could overtly make up hypothetical facts on which to declare law.[79] The law-declaring function is defined by the facts as recited by the appellate court, and is largely unaffected by whether those recited facts correspond with the evidence—much less with external reality.

The dispute-resolution function, from society's point of view, places only slightly more emphasis on the fact-finding process.[80] For the most part, factual findings in a particular case have no external effect whatsoever—they are binding only upon the litigants and only for purposes of the immediate litigation. Under this structure of adjudication, the social interest in the outcome of one particular case is negligible. Most members of society are not parties to the case, and will be unaffected by its findings of fact. Society's

mistake has been committed . . . hav[ing] in mind that their function is not to decide factual issues de novo," *Anderson v City of Bessemer City*, 470 US 564, 573 (1985). Appellate review of jury findings is even more constrained. Doctrinally, it does not exist. Functionally, it occurs when an appellate court reviews a trial court's decision whether to grant a directed verdict or a judgment notwithstanding the jury's verdict, under a standard requiring that, when viewing the evidence in the light most favorable to the winning party, no "reasonable" jury could have found the facts as it did. See Fed R Civ P 50(a)(1); *Galloway v United States*, 319 US 372 (1943).

[78] These doctrines are designed to limit judicial authority to concrete and particularized disputes between identifiable named parties and, in the case of standing, to concentrate the right to sue in one or a few parties. As such, they serve to reinforce the internalization effects of the adversarial system.

[79] In fact, appellate courts often do declare law on admittedly hypothetical facts by including dicta in their opinions, which are sometimes not distinguished from holdings by subsequent courts.

[80] The discussion in this section is directed primarily to private civil cases, which form the principal model of litigation in our system. It may be true that the social interest in fact-finding differs in criminal cases or in public civil cases, where a particular factual determination arguably has a broader significance. Our legal system's traditional response to this situation has been to provide for publicly financed enforcement, which focuses the social interest through the representative public party rather than by modifying the usual rules of evidentiary admissibility to take in the interests of non-parties, and therefore does not deviate from the basic pattern of internalization through the parties' incentives. In some instances of public enforcement, such as criminal prosecution, the rules of procedure and burdens of proof—the prime example being proof of guilt beyond a reasonable doubt—appear to have been modified to counteract agency-cost problems that arise in the system of publicly financed enforcement, which itself tends to disrupt the symmetry of stakes that is characteristic of the standard model. See Part IV.C below.

interest is limited to assuring that the fact-finding system is tolerably accurate and unbiased. If adjudicative fact-finding is wildly inaccurate or systematically biased, then litigants will no longer look to the courts for dispute resolution, and the entire rationale for publicly financed courts will be defeated.[81] However, once one crosses the threshold of tolerable accuracy and neutrality, fact-finding in litigation has a rapidly diminishing marginal product from society's point of view.

Of course, the immediate parties to the litigation take a very different view of things. From the parties' perspective—assuming

[81] The basic bargain made by private litigants with the public is to exchange their adversarially contested case of facts and law, as an input to the law-declaring function, for a peaceful and neutral resolution of their particular dispute. Thus, the public interest in particular cases is slight, but so is the public subsidy to private litigation.

Taking the federal courts as an example (and using figures from the 1990 Annual Report of the Director of the Administrative Office of the United States Courts ("*AO Report*")), the total budget for the entire federal judiciary, excluding the Supreme Court, was approximately $1.6 billion in 1990. *AO Report*, at 39 (Table 26). Total civil cases filed in the federal courts that year were approximately 218,000. Id at 8 (Table 6). In addition, there were about 50,000 criminal cases filed, id at 10 (Table 8), and another 725,000 bankruptcy petitions (of which 55,000 led to adversarial proceedings), id at 240, 242 (Tables F-2 and F-8), plus some 450,000 minor matters (mostly relating to petty offense prosecutions and other criminal proceedings) handled by U.S. Magistrate Judges. Id at 25 (Table 15). Even if we ignore the Magistrate Judges' work, exclude nonadversarial bankruptcy matters, and weight civil and criminal cases equally (notwithstanding that criminal cases typically consume a good deal more judicial resources), the average per-case public subsidy is only $5,000. At that level, in all but the very simplest of federal civil cases, the average total public expenditure would fall well short of a modest fee that could be charged by a lawyer for preparing the plaintiff's initial complaint, which is only the first of many tasks required of the lawyers for each litigant. Clearly, public expenditure is dwarfed by private litigation costs, and, in exchange for the modest public expenditures, the courts receive all of the raw material for the entire edifice of federal case law.

Using the average per-case figure of $5,000, and excluding all criminal cases, and the approximately 67,000 civil cases in which the United States Government was a party, see id at 8 (Table 6), but including all adversarial bankruptcy matters, the total federal expenditure on private civil litigation was approximately $1 billion, which represents something less than *one one-thousandth* of total federal outlays. By way of comparison, in 1990 the Congress spent about $2.2 billion on itself, $5.1 billion to run the Environmental Protection Agency, $9.76 billion on agricultural subsidies, $24 billion on food stamps, and $38.75 billion on education, not to mention some of the larger programs. See US Bureau of the Census, *Statistical Abstract of the United States 1993* at 332-33 (Table No. 514).

On a broader basis, all public expenditures by all levels of government federal, state, and local on all aspects of law enforcement, criminal and civil, public and private, and including all police, sheriffs, prosecutors, public defenders, prisons, and courts, accounted for only about 4% of public spending in this country. See US Dep't of Justice, *Sourcebook of Criminal Justice Statistics-1993* at 2 (Table 1.1); *1993 Economic Report of the President* 439 (Table B-77).

that they are not repeat litigants—the fact-finding process in a particular case may be the dominant feature of the adjudicative system. The American legal system's response to this divergence between social and private interest has been the tradition of party control and party presentation of evidence and argument, with the fact-finder playing essentially a passive role. In recent times, however, the tradition of adversary party control has come under increasing attack, through such mechanisms as "managerial" judging,[82] expanded disclosure requirements imposed upon litigants,[83] "public interest" duties imposed upon lawyers,[84] and unfavorable comparisons of the adversarial system with the "inquisitorial" system that prevails in civil law countries.[85] The *Frye* test and other mechanisms seeking to impose an "external" control on scientific

[82] See Judith A. Resnik, *Managerial Judges,* 96 Harv L Rev 374 (1982). In 1983, Rule 16 of the Federal Rules of Civil Procedure was amended extensively to promote such a "case management" role for the trial judge, which deviates substantially from the traditional pattern of judicial deference to party initiatives. See generally Arthur R. Miller, *The Adversary System: Dinosaur or Phoenix,* 69 Minn L Rev 1 (1984) (discussing the impact of reform proposals as modifying the traditionally passive role of the trial judge).

[83] In recent years, the adversarial character of the "discovery" process in federal civil cases has been subject to intense criticism. See, for example, Wayne Brazil, *The Adversary Character of Civil Discovery: A Critique and Proposals for Change,* 31 Vand L Rev 1295 (1978); William W. Schwarzer, *The Federal Rules, the Adversary Process, and Discovery Reform,* 50 U Pitt L Rev 703 (1989); William W. Schwarzer, *Slaying the Monsters of Cost and Delay: Would Disclosure Be More Effective Than Discovery?,* 74 Judicature 178 (1991). In 1993, Rule 26 of the Federal Rules of Civil Procedure was amended to add a new "disclosure" phase, in which litigants were required spontaneously to produce, inter alia, a copy or description of all documents "relevant to disputed facts alleged with particularity in the pleadings," and the names and addresses of all individuals "likely" to have information about such facts, in both instances without waiting for any request from the adversary. This amendment, however, was subject to a local "opt-out" power, and, within a year after its adoption, a majority of federal districts had "opted out" of the new rule. See Bruce H. Kobayashi, Jeffrey S. Parker, and Larry E. Ribstein, *The Process of Procedural Reform: Centralized Uniformity versus Local Experimentation* (GMU School of Law Working Paper, 1994).

[84] Rule 11 of the Federal Rules of Civil Procedure, which imposes sanctions—primarily on lawyers—for "frivolous" pleading, was amended in both 1983 and 1993, in both cases to expand the scope of its application, essentially on the rationale that lawyers have a duty to the courts and the public to screen their own clients' factual and legal contentions for objective "reasonableness." See Bruce H. Kobayashi and Jeffrey S. Parker, *No Armistice at 11: A Commentary on the Supreme Court's 1993 Amendment to Rule 11 of the Federal Rules of Civil Procedure,* 3 S Ct Econ Rev 93 (1994).

[85] See John H. Langbein, *The German Advantage in Civil Procedure,* 52 U Chi L Rev 823 (1985) ("Langbein, *German Advantage*"); Gordon Tullock, *Trials on Trial: The Pure Theory of Legal Procedure* (Columbia, 1980). And see the sources cited in note 69 above.

evidence—such as court-appointed experts[86] or official expert panels[87]—simply are variations on this same theme, which suggests that the adversary system needs protection from itself. Economics suggests that this entire critique is based upon a series of fallacies, all revolving around the central fallacy of the "free lunch."

Exploding the Fallacies. Scientific evidence provides a useful context for exploring whether the adversary system needs protection from itself, and if so, whether such protection is worth its costs.

Unlike the case of ordinary fact evidence, scientific "expert" evidence does not even arguably present a situation where an existing asset can be used by the adjudicative system for "free," without affecting its supply. For example, the paradigm of a fact witness is the disinterested bystander who accidentally observes the event in litigation. In that case, the witness is compelled to testify without remuneration on a "public duty" rationale.[88] The conventional wisdom wants to assume either that there has been no effect on behavior or on the production of information[89] or that an alternative

[86] See Tahirih V. Lee, *Court-Appointed Experts and Judicial Reluctance: A Proposal to Amend Rule 706 of the Federal Rules of Evidence,* 6 Yale L & Policy Rev 480 (1988). See also E. Donald Elliott, *Toward Incentive-Based Procedure: Three Approached for Regulating Scientific Evidence,* 69 BU L Rev 487 (1989); Langbein, *German Advantage* (cited in note 85).

[87] This type of proposal has been made for some years, in varying forms. One is a "science court"—essentially, a separate governmental agency to "screen" scientific developments for courtroom use. See Arthur Kantrowitz, *Controlling Technology Democratically,* 63 Am Sci 505 (1975); James A. Martin, *The Proposed "Science Court,"* 75 Mich L Rev 1058 (1977). More recently, essentially the same proposal has resurfaced in suggestions for the use of "expert consensus groups," to be staffed or assembled by governmental entities such as the National Academy of Sciences or the National Institutes of Health. See Kenneth R. Foster, David E. Bernstein, and Peter W. Huber, eds, *Phantom Risk: Scientific Inference and the Law* 438-40 (MIT, 1993) ("Foster, Bernstein & Huber, *Phantom Risk*").

[88] As noted above (see notes 23-24 and accompanying text), early common law imposed no compulsion to testify, even after the use of witnesses was permitted. However, beginning in the sixteenth century, the "rule of compulsion" appeared—primarily through legislation designed to close an important gap in powers between the competing systems of "law" and "equity" courts and the "public duty" rationale was developed as a justification for the change. See 8 *Wigmore on Evidence* §§ 2190, 2192 (cited in note 23).

[89] In economics, this form of the "free lunch" fallacy often operates under the terminology of "economic rent" and "quasi-rent." For the conventional economic definitions, see Armen A. Alchian, "Rent," in Eatwell, Milgate & Newman, 4 *The New Palgrave* at 141 (cited in note 8). The basic notion is that a rent or quasi-rent is earned when the supply of a resource is insensitive to the price paid. Thus, "fact" testimony is conceived as representing information that would have been acquired regardless of the needs of litigation, and therefore any payment for its use would be a "rent." The concept degenerates into the "free lunch" fallacy when it is used as a

system of compensation for fact witnesses would cause difficult hold-out problems or reduce the reliability of factual inputs to litigation. Although each of those points is debatable even in the fact-witness context, they are certainly not applicable to scientific expert evidence. By definition, an expert witness lacks first-hand knowledge of the facts in litigation, is qualified to testify only by specialized training or experience, and may not be compelled to testify without remuneration.[90]

Therefore, even if the expert's testimony is drawn entirely from her or his off-the-cuff reactions, without further analysis or investigation, it may not be confiscated and therefore will be sold for an explicit price. Given that the expert's information is a valuable asset—often accumulated through a lifetime of study and experience—then we should not be surprised to find that the content of the expert's opinions will be affected by their value in the litigation "market." This is really all that is meant by the popular critique of "junk science" in the courtroom.

To be sure, there are many other influences on the content of experts' opinions, including the inherent discipline of the expert's field, the effects of peer review and professional reputation, other opportunities for teaching and research income, and the like. As is discussed below, not all of these are entirely neutral for litigation purposes, but the immediate point is that, all other things equal, the marketability of the expert's opinions is influenced by the needs of litigation and by admissibility standards. To take a current example, consider whether there is any doubt whatsoever that the incomes of DNA identification experts would be lower if such tests were universally inadmissible into evidence.

Now consider the effect of an admissibility test like the *Frye* standard of "general acceptance." Under this rule the income potential of the expert's opinions in litigation becomes partially a function of their "acceptability" to the expert's peers. In that situation, the expert has two choices. The expert can adopt "acceptable" opinions. Or, that expert can join with other experts in a mutually self-supporting network of "acceptability," optimally of

justification for governmental confiscation of the resource, on the ground that any payment would be a "social loss" because the resource will exist ex ante regardless of the ex post confiscation. That is unlikely to be true in general, or as to factual testimony in particular. In the case of expert testimony, even the conventional view does not assume it to be a "rent" because obviously there would be fewer (or less expert) experts if the "expertise" were subject to confiscation by the courts.

[90] Thus, under current Rule 706 of the Federal Rules of Evidence, even court-appointed experts are entitled to compensation, and may not be appointed "unless the witness consents to act." Fed R Evid 706.

limited size in order to reduce organizational and coordination costs. This amounts to the same thing unless the expert happens to locate a support network that spontaneously comes to the same view costlessly. In either case, the content of the marketed opinions is likely to have been influenced by the admissibility standard.

Because the expert's options under *Frye* increase the cost of marketing expert opinion, the likely effect of *Frye* was to reduce both the volume and the diversity of the expert opinions reaching adjudicative fact-finders. Although some commentators appear to argue otherwise,[91] this result seems at best ambiguous from the perspective of social policy. Even if we assume that there is some "truth" out there to be discovered, both science and economics would suggest that, all other things being equal, the *Frye* standard would *reduce* the likelihood of that "truth" reaching the courtroom, by reducing the volume and diversity of opinions expressed in the market for expert testimony. Certainly, the history of scientific thought provides no indication that the type of group-think promoted by *Frye* optimizes the potential for discovering "truth."[92]

Instead, the *Frye* test seems to be predicated on the "free lunch" fallacy, combined with doubts about the ability of the adversary system to protect itself. The "free lunch" apparently was supposed to have been supplied by the scientific community at large, which was expected to police "unacceptable" opinion by rebutting the testifying experts' views. The problem with this mechanism is that the scientific community had no marginal incentive to do so. To the contrary, the incentives provided by *Frye* were for the scientific community to segment itself into testifying and non-testifying specialists, and, within testifying specialists, into ever-smaller "general acceptance" groups. For the non-testifying scientist, there was little or no payoff to debunking "unacceptable" opinions expressed in the courtroom, and the entire ethic of open scientific inquiry worked against that outcome. And once a scientist became a testifier, even in the "debunking" mode, he or she inevitably became subject to the *Frye* influences on marginal income. Ultimately, the *Frye* test relied for its discipline on altruism, in that it required the consistent performance of "public service" to the litigation system without private reward and possibly at considerable cost. Expecting this actually to happen is yet another manifestation of the "free lunch" fallacy.

[91] See Huber, *Galileo's Revenge* at 204 (cited in note 5).

[92] See generally, for example, Thomas S. Kuhn, *The Structure of Scientific Revolutions* (U Chicago, 2d ed 1970); F.A. Hayek, *The Counter-Revolution of Science: Studies on the Abuse of Reason* (Liberty Press, 2d ed 1979); Robert Scott Root-Bernstein, *Discovering* (Harvard, 1989).

Why was there ever any need for an "external" standard of any kind? The argument for an external standard was apparently based on the view that fact-finders are easily misled by expert opinion.[93] But what has never been clear in this critique is why the adversary system is inadequate to cope with that danger.

Property Rights in the Adversarial System. The fear that fact-finders are easily misled by expert opinion seems to overlook the role of the adverse party in the adjudicative system. The adversary may counter expert testimony through a variety of means—cross-examination and impeachment of the expert, argument, rebuttal evidence that undermines the factual basis for the expert's assumptions, and, most obviously, by hiring its own expert to give rebuttal expert testimony. Aside from *Frye*-like constraints on admissible opinion, the law of evidence generally places very few limitations on the rebuttal mechanisms available to the adversary. Here as elsewhere, the law of evidence is more enabling than prohibitive in nature: so long as the minimal standard of relevance is satisfied, and the evidence is cast in acceptable form, the adversary's options are very broad. Moreover, the basic norm observed in trials is to afford the adversary at least as much of the fact-finder's time and attention as the proponent of expert testimony is afforded.

In its traditional and still predominant form, the adversarial system also provides a symmetry of incentives to invest in presentation, through a symmetry in the stakes of the litigation, secured by a system of private "property rights" in litigation.[94] The paradigm of litigation is a private civil action for damages, in which the stake is simply a transfer payment from the defendant to the plaintiff, contingent upon the outcome of the litigation. Because the stakes are the same from each side's point of view, both sides—at least under the American rule that litigants bear their own costs—have equivalent private incentives to invest in their presentations of evidence and argument. If the plaintiff wins, then the plaintiff has a private property right to collect the judgment from the defendant, and only the defendant. If the defendant prevails, then the defendant has a private property right to protection from further litigation of the same claim by the same plaintiff, and only by the same

[93] See, for example, *United States v Baller*, 519 F 2d 463, 466 (4th Cir 1975) ("[N]ot every ostensibly scientific technique should be recognized as the basis for expert testimony. Because of its apparent objectivity, an opinion that claims a scientific basis is apt to carry undue weight with the trier of fact.").

[94] I use the term "property right" here in the conventional law-and-economics sense of an entitlement exercisable solely at the option of its owner, which has the characteristic of fully internalizing to its owner the consequences of its exercise.

plaintiff. In this way, the private costs and benefits of the litigation are fully internalized to the immediate parties. No one else can gain or lose by the factual outcome of the case.

In this basic model of litigation, there is no reason to doubt the efficacy of the adversarial system for dealing with any problems of "misleading" expert testimony. If one side chooses to retain an expert and bear that cost, then presumably it does so because it believes, on the basis of its private self-interest, that doing so will improve its chances of success on the merits. Similarly, if the adverse party chooses not to rebut even "misleading" expert testimony, presumably that decision reflects its decision that its private expenditures on litigation are better directed elsewhere.[95]

From a social point of view, we have no reason to second-guess the parties' decisions in this regard. Under the existing rules of procedure, parties are permitted, and generally are encouraged, to stipulate to a resolution—perhaps even a "misleading" one—of a factual issue that otherwise would be the subject of expert testimony. Indeed they could stipulate away the entire case by settlement, or stipulate to all of the facts and present the legal issues alone, because there is little social interest in the factual outcome of a particular case. To be sure, these decisions are likely to be affected by the applicable rules of substantive law and evidentiary standards. But within those constraints, the parties' decisions will reflect their private costs and benefits, including the costs and benefits of "misleading" expert testimony. In the absence of any other social interest in the particular outcome, the parties' decisions also would be efficient from a social point of view.

Given these conditions, it is difficult to understand quite what is meant by the criticism that expert testimony is sometimes "mis-

[95] Setting aside irrational behaviors or unusual risk preferences, this analysis is unaffected by the relative wealth of the parties. In the absence of external effects, even a "rich" party would be foolish indeed to invest beyond the stakes in the litigation. Any "rich" party that did so would find itself a regular target of litigation, which eventually would solve its "richness" problem. The "poor" party, if it is the plaintiff, simply faces the need to finance litigation costs in order to realize on its asset. The market has provided a ready mechanism to accomplish this function—and to minimize the effect of risk aversion—through the contingent fee, which regularly finances large volumes of litigation. If the "poor" litigant is the defendant, then that problem also is self-correcting: if the defendant is "poor" enough, then its insolvency ultimately will deter the action or defeat the result by preventing collection of the judgment, while if the defendant is not that "poor," then its incentives to invest are the same as if it were "rich." It is only in this last case of the marginally solvent defendant that risk aversion may have some effect, which is why people buy liability insurance that not only indemnifies them but also imposes a duty to defend upon the insurer.

leading" to fact finders. If it is "misleading" because fact-finders will place undue weight on expert testimony because of the expert's qualifications, then that advantage to the proponent is offset by the cost of purchasing the expert's testimony in the marketplace. And the marketplace will also provide the opponent with the opportunity to purchase rebuttal expert testimony. If expert testimony is somehow inherently "misleading," then we must ask whether that factor introduces systematic bias into the fact-finding system. If all expert testimony is "misleading," then the effect is simply to degrade the accuracy of the fact-finding system symmetrically, which will most affect the immediate parties. If not systematically biased, then both sides of the litigation will be spending more and getting less, which, with the internalization of costs and benefits, eventually will reduce the demand for expert testimony.

What is clear, however, is that a standard like *Frye* does not mitigate this type of problem, and instead is likely to make the problem worse, by disrupting the assignment of property rights to the parties in litigation and thereby introducing systematic bias. The idea of *Frye* was to limit expert testimony to "generally accepted" opinions. As noted above, the increased costs of arranging general acceptance raised the overall cost of expert testimony. However, that cost could be amortized over multiple litigations, and therefore the litigant relying on generally accepted opinion was likely to face an incremental cost advantage. But what about the litigant whose case turned on a point of expert opinion for which there was not yet a "general acceptance" group? That litigant faced a marginally higher cost of obtaining expert testimony, as it now had to organize (or join with other litigants to organize) its own "general acceptance" group. By interposing the external standard of "general acceptance," the *Frye* test externalized some of the costs and benefits of evidentiary presentation beyond the immediate parties to the litigation.

In law and economics, we often speak of legal rules as "internalizing externalities." *Frye* does exactly the opposite—it "externalized" what previously was an "internality." Furthermore, *Frye*'s externalization introduced a systematic bias against unconventional expert opinion testimony, by imposing higher costs on litigants who sought to rely upon such testimony. In some sense, this was the very purpose of the *Frye* test—to make unorthodox expert testimony more costly, if not altogether impossible.[96]

[96] Froeb and Kobayashi show that adversarial reporting of expert opinion does not dominate a neutral and "perfect" court-appointed expert, even when the fact-finder is "naïve" (modeled as "splitting the difference" between the adversarial experts) where the underlying distribution of opinion and the parties' costs of taking "draws" (selecting expert opinions) are symmetric. Froeb & Kobayashi, *Competition* (cited in

While the motivation—and possibly the effect—of *Frye* may have been to reduce litigants' aggregate expenditures on expert testimony, its principal consequence was to re-shape the incentives of both parties and experts toward the objective of organizing for "general acceptance." Instead of merely contracting with a single expert whose opinions supported a litigant's position in a particular case, parties now had to take account of a secondary market in "general acceptability" that ranged far beyond the needs of the particular litigation. With *Frye*, litigants (and expert witnesses) now had to solve a collective action problem in addition to the problems of their own case.

Simply in terms of transaction-cost economics, *Frye* would be inefficient even if it had no biasing effect. By replacing a straightforward system of internalized costs and benefits with a collective action problem, *Frye* raises the transaction costs of obtaining expert testimony without any apparent benefit, as the social interest in the factual outcome of the litigation is unchanged. Thus, *Frye* appears to be no better than a dissipated excise tax on expert testimony, and it could be worse. In terms of the relatively minimal social interest in factual accuracy on the margin, *Frye* is not beneficial unless orthodoxy has a strong positive correlation with accuracy *and* accuracy otherwise threatens to fall below an acceptable range from the social perspective. *Frye* is detrimental to the extent that useful expert opinion has been priced out of litigation by the costs of organizing to obtain "general acceptance" for useful opinions.[97]

But the more profound effects of *Frye* follow from its external biasing effect. From this perspective, *Frye* is more like a progressive tax on "unaccepted" expert testimony, and, worse yet, the tax is at least partially recoverable by the purveyors of "accepted" expert

note 10). They model *Frye* as truncating the tails of the sampling distribution symmetrically, and then show it has no advantage over unrestricted adversarial presentation. Id at 22-24. They refer only in passing to the public agency cost problem, and they suppress public choice considerations. Id at 22 n 34.

The argument here suggests that *Frye* is likely to be somewhat worse than the Froeb-Kobayashi results. In terms of the Froeb-Kobayashi model, my argument suggests that *Frye*'s external effect: (1) raises both sides' costs of taking "draws" from a base case without either the *Frye* or *Daubert* rules; and (2) introduces an asymmetry in the cost of taking draws, or, what amounts to the same thing, an asymmetrical truncation of the sampling distribution, that works against the litigant with a demand for the non-"consensus" opinion. In addition, the following Section B considers the public choice and public agency problems more explicitly.

[97] Thus, *Frye* operated somewhat like a legal rule that imposes a minimum firm size as a requirement for a "license" to engage in a particular line of business. While there will still be competition among the "licensed" firms, there is an efficiency loss to the extent that the minimum "legal" firm size excludes smaller firms who could participate at lower costs.

testimony. The incentives created by this structure lead to rent-seeking behaviors very similar to those observed in lobbying for legislation or other governmental action.

B. Public Choice and Public Agency Cost

By imposing an external standard of acceptability as the threshold to the admissibility of scientific evidence, *Frye* and similar concepts create a scenario familiar in public-choice economics, which is concerned with the influence of private interests on governmental action, classically legislation and more recently administrative actions such as licensing.[98] In essence, *Frye* created an opportunity for rent-seeking behavior by non-party interest groups in litigation that is analogous to the opportunities presented by legislation or licensing.[99] Moreover, several of the suggested alternatives to *Frye* and *Daubert*—such as court-appointed experts or a government-sponsored expert "science court"—would make that same problem worse, by adding the self-interest of government officials to the private interests involved. All of these devices share the common theme of granting external or public agents more control over the litigants' factual presentation, thereby diluting the system of private property rights in litigative fact-finding. Given the minimal social interest in the particular factual outcome of the litigants' case, this is likely to have a detrimental effect from a social perspective.

Traditionally, adjudication has been the most insulated of governmental actions from the influences of private interest groups. The mechanisms for insulating adjudication have included unelected judges, limits on adjudicative jurisdiction, and the system of private property rights in litigation discussed above.[100] Ideally, the

[98] For a general (and somewhat critical) introduction to public choice, see Daniel A. Farber and Philip P. Frickey, *Law and Public Choice* (U Chicago, 1991). A more technical survey of the public choice literature is Dennis C. Mueller, *Public Choice II* (Cambridge U, 1989) ("Mueller, *Public Choice II*").

[99] "Rent seeking" refers to activity that aims to secure a monopoly rent (a supracompetitive return) through favorable government action, such as a tariff against competing goods. See, for example, Gordon Tullock, *The Welfare Cost of Tariffs, Monopolies, and Theft*, 5 Western Econ J 224 (1967). Tullock's paper was the first general discussion of the activity in the modern era, although the term "rent seeking" was not used until Anne O. Krueger, *The Political Economy of the Rent-Seeking Society*, 64 Am Econ Rev 291 (June 1974). The literature through the late 1980s is summarized in Chapter 13 of Mueller, *Public Choice II* at 229-46 (cited in note 98).

[100] Of course, law declaring was a traditional exception to this structure, on the rationale that outside persons or groups—or society at large—may be affected by the legal rule declared in a particular case, and therefore legitimately could be heard as amici curiae or the like, subject to the limitations on ex parte contacts and the

full internalization of the costs and benefits of fact-finding in litigation to the immediate parties minimizes the influence of outside interest groups by eliminating any prospect of gain or loss to those groups from the outcome. By deviating from that model of full internalization, the *Frye* test inevitably creates incentives for non-parties to influence the factual presentation in their own self-interest, which is unlikely to be perfectly correlated with either the immediate parties' interests or society's interest in resolving the parties' dispute on a neutral and unbiased basis.

Let us explore the implications by taking a hypothetical example based in the surroundings of the *Daubert* decision. As litigated in the lower courts under the *Frye* rule, the case had focused on such things as whether animal studies or "reanalyses" of epidemiological data were "generally accepted" and therefore would be admissible. This was critical in the case because this disputed evidence was apparently the only evidence supporting the plaintiffs' claims that Merrell Dow's drug Bendectin caused birth defects in their children. Quite aside from the resources devoted by the immediate parties to these preliminary questions, notice how a number of non-parties may now have some stake in the outcome.

By definition, "general acceptance" involves some multiplicity of actors: some group of scientists or experts has to "accept" the concept involved, say "reanalysis."[101] Now we have the possibility of an "American Reanalysis Association" entering the picture. Its members may have a variety of motivations: they may wish to publish without doing original research, which requires more knowledge, creativity, and resources; they may be more focused on a particular subject, such as drug-induced birth defects, and they may believe that "reanalysis" is the key to holding the pharmaceutical companies to account; more simply, they may dislike pharmaceutical companies; or they may be interested in future work as a "reanalysis" expert, in litigation or otherwise, and obviously the "acceptability" of reanalysis affects their prospective income. Only some of these interests are in any way related to whether Bendectin caused the birth defects in the *Daubert* plaintiffs' children; some of them are entirely unrelated. And yet, they all give these various actors at least some interest in joining the

safeguard of searching appellate review on the law. Even so, the traditional doctrine of precedent limited the external effects of case law decisions, by permitting future litigants and courts to distinguish prior cases on their facts.

[101] "Reanalysis," also known as "meta-analysis," involves the re-grouping of data from multiple prior empirical studies. It has been the subject of much debate in the scientific and popular literature. See *Research News: Meta-Analysis in the Breach*, 249 Science 476 (1990).

"American Reanalysis Association," thereby giving "acceptability" to the opinions of the experts on which the *Daubert* plaintiffs sought to rely, and in that way externally assisting the plaintiffs' case.

More broadly, consider the plaintiffs' bar, which has some interest in reducing its costs of achieving plaintiffs' verdicts generally. If "reanalysis" helps to reduce that cost, the plaintiffs' bar as a group now has an incentive in invest in its promotion, perhaps by making charitable contributions to the non-profit "American Reanalysis Association" in order to subsidize its organizational costs.[102] That investment can be recovered over a wide range of future cases utilizing "reanalysis," whether or not those cases have anything to do with Bendectin or any drug-induced injury. As the plaintiffs' bar in the aggregate represents millions of potential plaintiffs, the effects could be quite profound.

All of the same incentives also exist on the defense side of the case. As a repeat litigant, a firm like Merrell Dow already has incentives that range beyond the *Daubert* case itself. To the extent that the acceptability of "reanalysis" increases its prospects of losing any type of case—not necessarily the *Daubert* case or any case involving Bendectin—then Merrell Dow has an incentive to invest in assuring that the technique is not "generally accepted."[103] That incentive is to some extent shared by other pharmaceutical firms, and perhaps more broadly by all manufacturers subject to product liability exposure, or by all business firms beset by the plaintiffs' bar. Consequently, the defense side may make generous contributions to a competing "American Original Research Association," populated by scientists who wish to preserve the brand name value of their product against the "reanalysts." They may value their product for its use in producing litigation or research income, or because they are scientific purists, or because they like drug companies, or for any number of other

[102] Lawyers' self-interest is the principal argument raised by Huber in *Galileo's Revenge* (cited in note 5), although Huber unaccountably fails to consider the interest-group potential of the *Frye* standard. In a post-*Daubert* article, Lester Brickman suggests that *Daubert* may not be adequate "to counter the inherent incentive structure underlying the expert witness industry," considering the interests of both lawyers and expert witnesses. Lester Brickman, *On the Relevance of the Admissibility of Scientific Evidence: Tort System Outcomes Are Principally Determined by Lawyers' Rates of Return*, 15 Cardozo L Rev 1755 (1994) ("Brickman, *On the Relevance*").

[103] This would be true even without an external preclusive effect. It is all the more true when considering the modern law of "offensive" collateral estoppel, under which Merrell Dow faces the very real prospect of being precluded, by one loss, from defending in many future cases. See Part IV.C below.

reasons.[104] Here again, very few of these motivations bear any relation to the particular matter at issue in *Daubert*. But they will influence the costs of presenting expert testimony in that case, whether intended to do so or not.

This example is not meant to suggest that there is anything sinister—or necessarily inefficient—in all of the interest group activity.[105] People have interests, and they have every right to join together voluntarily to promote those interests. Nor is there a fundamental economic objection to private organization of this type. To the contrary, private organization to advance common interests can be economically beneficial, so long as it is driven by market forces. Much of the same sort of interest group activity would exist with or without *Frye*, and we should not expect it to disappear with *Frye*'s demise.

What makes the marginal effect of *Frye* pernicious, as in the case of legislation or licensing, is the addition of governmental sanction to the private organization. In effect, *Frye* gives quasi-official status to the private interest groups, by allowing them—rather than the litigation process—to determine the admissibility of scientific evidence. Although the effect is not as powerful as the government-sanctioned monopoly conferred by licensing, it still requires the litigant to buy a "ticket" for the admissibility of its evidence, on pain of exclusion by governmental action for non-compliance. Furthermore, the ticket-purchasing process is less visible and less subject to public scrutiny and debate than overt governmental licensing, simply because it is private. As a result, and given the incentives of the interest groups that are likely to be in play, the price of admission may well be reflected in the content of the opinions expressed. Thus, the marginal consequences of the *Frye* standard are not merely to raise the cost and reduce the supply of expert testimony, but also to bias its content toward what is "popular" with the various interest groups that influence "general accep-

[104] Of course, the defense bar also has group interests, but they appear to be somewhat more complex than the plaintiffs' bar, as the defense bar is not simply interested in minimizing their clients' overall liability costs.

[105] Nor is there anything hypothetical about the effect, though my example uses hypothetical interest group names. When *Daubert* reached the Supreme Court, some two dozen amici briefs were filed. A partial listing of the amici includes: Association of Trial Lawyers of America; American Society of Law, Medicine and Ethics (an "organization of scientists, lawyers, and others with expertise on the use of scientific information in legal proceedings"); American College of Legal Medicine; Defense Research Institute; New England Journal of Medicine; American Medical Association (with 16 related groups); and the National Association of Manufacturers.

tance."[106] This will not necessarily bear any relation to anyone's idea of "truth,"[107] and will almost certainly be influenced by a far broader agenda than the particular issue in litigation.

Nor does substituting governmental licensors for private interest groups solve the problem. In some ways, it makes the situation worse. This is the more conventional public-choice problem: it eliminates the prospect of competition among private ticket-sellers, in exchange for presumably enhanced public scrutiny of the governmental monopoly licensing board. Particularly in the case of expert and scientific opinion—which by definition is not well-understood by the public at large—that tradeoff is unlikely to be favorable. The interest groups will still have the most influence, and now the governmental officials' personal interests also would come into play. The most likely form that such a proposal would take would be something like "expert panels" or a "science court" funded by the federal government, with members appointed for fixed terms, so as to avoid "political" influences. The individuals making up these panels are still people, with the same needs, hopes, and faults as the rest of us. They would need to earn a living, either during their service, or afterward, or both. Presumably, they would have to be established experts in their fields, which is very likely to mean that they already had an intellectual and perhaps a financial commitment to a certain point of view. "Political" influences

[106] This effect of the *Frye* standard did not go unnoticed by the courts and commentators. In *United States v Williams*, 583 F2d 1194, 1198 (2d Cir 1978), the court observed that "whatever the scientific 'voting' pattern may be, the courts cannot in any event surrender to scientists the responsibility for determining the reliability of that evidence." See also David L. Faigman, Elise Porter, and Michael J. Saks, *Check Your Crystal Ball at the Courthouse Door, Please: Exploring the Past, Understanding the Present, and Worrying about the Future of Scientific Evidence*, 15 Cardozo L Rev 1799, 1805-09 (1994).

[107] Some of the criticism of the *Frye* standard and its variants has been placed explicitly on the interest-group basis:

> [D]owsers, who use divining rods to locate water or minerals underground, have a professional organization, the American Society of Dowsers, which has 68 chapters and holds an annual conference that, in 1989, lasted five days. A credentialed dowser proffered as an expert witness could therefore probably produce peer support for his opinions from his professional "community."

Brian Stuart Koukoutchos, *Solomon Meets Galileo (and Isn't Quite Sure What to Do with Him)*, 15 Cardozo L Rev 2237, 2242 n 33 (1994). Much of the critique of "junk science" by Huber in *Galileo's Revenge* (cited in note 5) is predicated on the view of lawyers as a rent-seeking interest group. But both that work and Foster, Bernstein, & Huber's *Phantom Risk* (cited in note 87) inexplicably suggest a return to *Frye* and reliance on "professional standards" promulgated by (non-hypothetical) groups such as the National Academy of Forensic Engineers and the American Academy of Forensic Scientists. See id at 438.

would enter if they had aspirations for future appointments. And, of course, the government as an institution has its own interests that are not necessarily aligned with a broader concept of social welfare.

If all of this sounds familiar, that is because it is: this structure essentially is the model of the "expert" and "independent" administrative agency that has become a fixture of modern government over the past several decades. Our accumulated experience with that mechanism could hardly be characterized as positive in general,[108] and it seems particularly inappropriate to the governance of expert scientific testimony in courts. As applied in the federal courts, it would further undermine the independence of the judiciary, and create very difficult problems of cross-review between the courts and the "expert" panels, making it even less likely that the panels would be responsive to public control. In the end, we might even end up with the Congress—certainly no authority on science, and hardly a model of probity on any topic—voting on the "validity" of scientific opinions.[109] If also applied by the federal government to the states, it would have some of the same effects at the state level, and further erode the balance of federal and state power. And as applied in the many cases where the government is a party, such as criminal prosecutions, the absurd result is that the government decides on the admissibility of its own expert evidence. That problem is severe enough under our current system. It would bid fair to become intolerable with an "independent" expert-testimony agency.

Although governmental expert panels are likely to be somewhat worse than *Frye*, they share the same basic error of injecting external stakes into litigation that are out of proportion to the social interest, if any, in the fact-finding outcome of a particular case, while at the same time introducing the more serious problem of systematic bias in fact-finding. To return to the example based on *Daubert*, society at large has only a minimal interest in whether the facts in that particular case are found correctly, but it has a

[108] See, for example, Mueller, *Public Choice II* ch 14, at 247-73 (cited in note 98); Richard A. Posner, *The Behavior of Administrative Agencies*, 1 J Legal Stud 305 (1972).

[109] The closest analogy in the existing edifice of federal agencies may be the United States Sentencing Commission, which by law is "an independent commission in the judicial branch." 28 USC § 991(a) (1988). Although it is "in" the judicial branch, its actions—primarily the promulgation of sentencing guidelines governing the federal courts—are not subject to direct review by the courts. See 28 USC § 994(x) (1988) (applying the notice-and-comment procedures of the Administrative Procedure Act, but not the judicial review provisions). But the Commission's actions can be overruled by Act of Congress. See 28 USC §§ 994(p) (1988).

much more important interest in assuring that errors are unbiased. Suppose that "reanalysis" does in fact lead to more accurate determinations of medical causation on some objective basis. But then also suppose—as apparently was the case in the lower courts in *Daubert*—that the coordination costs imposed by the *Frye* standard were prohibitive of all plaintiffs' ability to meet the "general acceptance" criterion. Now the effect of *Frye* is to introduce systematic bias into the fact-finding process because no plaintiff can reach the jury with "reanalysis" evidence. This applies not only in *Daubert* itself but in all cases of ambiguous medical causation.

From the public-choice perspective, *Daubert* is an improvement over *Frye* because *Daubert* mutes the incentives for private organization around the admissibility standard by reducing the returns to successful organization. Although the *Daubert* majority substituted a test of something like "scientific method," that test is less subject to public-choice style manipulation simply because it reduces the admission "price" and increases competition among ticket-sellers, who now potentially include virtually any scientist in any field. Groups such as the hypothetical American Reanalysis Association and the American Original Research Association might still be organized to market their products, in litigation and otherwise, but the governmentally sanctioned rents that they can earn are now smaller. It still might be possible to organize an American Scientific Method Association—or adapt an existing association to that end—but the cost of doing so would be very high because, in order to earn substantial returns, it would be necessary to organize a much larger proportion of the scientific community into a single cartel.[110] From this point of view, the somewhat vague and diffuse nature of *Daubert*'s admissibility test—criticized on that basis by some legal commentators[111]—is a policy virtue, as it further raises the cost of successful cartelization.

Of course, *Daubert* does still leave the trial court judge in the somewhat vaguely defined "gatekeeping" role, and judges are people too. However, here the judge's lack of "expert" knowledge seems to be a virtue rather than a vice because it makes it less likely that enough judges will know enough about various scientific

[110] Of course, the cost may not be prohibitively high if the federal government steps in and appoints, say, the National Academy of Sciences, as the ultimate arbiter of "scientific method."

[111] See, for example, Bert Black, Francisco J. Ayala and Carol Saffran-Brinks, *Science and the Law in the Wake of Daubert: A New Search for Scientific Knowledge*, 72 Tex L Rev 715, 801 (1994); Margaret G. Farrell, *Daubert v. Merrell Dow Pharmaceuticals, Inc.: Epistemology and Legal Process*, 15 Cardozo L Rev 2183 (1994).

fields to be biased in a systematic way.[112] Moreover, outside of criminal prosecutions, it seems unlikely that the judiciary as a whole will be systematically biased for or against any particular scientific theories or opinions. Normal human curiosity, as well as trial judges' aversion to reversal, may suggest a bias toward admissibility in all cases, but if there is to be any bias, that one probably is the least objectionable. In any case, the admissibility decisions of the trial court judges—unlike the interest groups and probably unlike the "expert panels"—are subject to appellate review, and do not present fundamentally different concerns from the myriad other rulings made at trial.

C. Stakes, Symmetry, and External Effects

So far, the analysis has focused on the basic model of private litigation involving symmetrical stakes and no external effects of the fact-finding outcome. What about variations from that model?

The important variations are two: (1) litigation to which the government is a party; and (2) external preclusive effects through nonmutual collateral estoppel. Both cases involve asymmetrical stakes. In the government case, this is caused by the detachment of governmental agents' incentives from the stakes of a particular case. In the preclusion case, it is caused by the "capitalization" effect of the abandonment in many jurisdictions of the traditional rule of "mutuality" of collateral estoppel, which was one of the legal mechanisms assuring the internalization of litigation fact-finding results.[113]

[112] Interest groups will remain active, however, and judges should be vigilant against more subtle forms of interest group influence. The appearance of the Federal Judicial Center's *Reference Manual on Scientific Evidence* in late 1994 is a somewhat troubling signal. This document includes "Reference Guides" on each of several scientific fields, written with private support to the authors and reviewers. Id at vii. The lists of authors and reviewers includes a number of individuals who are not disinterested observers, and the *Manual* provocatively discloses that "[t]he names of several reviewers have been omitted from the list at their request." Id at 623. The danger is that this *Manual* will become a sort of "official" orthodoxy about scientific matters—far more rigid and monolithic than anything *Frye* could have produced—and that its contents could be influenced by private interests. In any event, it gives us a taste of what a federal "science court" might involve.

[113] Under the traditional rule of mutuality, a prior judgment could not be utilized for factually preclusive effects unless the party seeking to use the judgment in its favor would have been bound by an adverse determination in the prior action. This usually meant that the party seeking to use the judgment was a party or in "privity" with a party (a transactional successor to that party's property right) to the litigation leading to the prior judgment. See *Bigelow v Old Dominion Copper Mining & Smelting Co.*, 225 US 111 (1912). This doctrine therefore was a very explicit manifestation

In these and other cases of asymmetry in stakes, one side has the incentive to "outspend" the other, on expert evidence as well as other litigation expenditures, because one side has (or acts as if it has) more to gain or lose than the other. To the extent that litigation expenditures influence the factual outcome, asymmetry can bias fact-finding. The shift from *Frye* to *Daubert* as a standard for the admissibility of scientific evidence does not redress these asymmetries. However, here again *Daubert* is something of an improvement over *Frye,* because the *Frye* test has a tendency to exacerbate the biasing effect of asymmetrical stakes.

The non-mutual estoppel case illustrates the effect most clearly. Returning to the example of the *Daubert* facts, Merrell Dow is in the position of the repeat litigant with more to lose (from non-mutual collateral estoppel) than the plaintiffs have to gain. Under the rules of collateral estoppel now prevailing in most jurisdictions, Merrell Dow faces the prospect of being precluded from offering a defense on at least some issues in future cases brought by similarly-situated plaintiffs by a loss in the first case. In contrast, future plaintiffs' cases would be unaffected by a Merrell Dow victory in the first case—they would be free to relitigate all issues.[114] For a repeat litigant like Merrell Dow, the simple summary of the law is "if you win one, you win one; while if you lose one, you lose them all" (at least as to certain issues that are likely to be the same among the cases, such as basic negligence or product liability determinations). Thus, the modern rules of non-mutual collateral estoppel create an asymmetry of stakes through external preclusive effects on one side only.

Given these incentives, Merrell Dow is likely to invest more in defending each case than any one plaintiff invests in prosecuting it,

of the policy of internalizing the costs *and* benefits of adjudicative fact-finding to the immediate parties. Given that the vastly predominant form of stake was a cash transfer payment, which was embedded in remedial law's reluctance to grant relief other than in the form of monetary damages, the mutuality rule also promoted symmetry of stakes. Under the mutuality rule, the only "capitalization" effect of present fact-finding on future litigation was also between the immediate parties, and generally also symmetrical.

[114] For a general summary of current collateral estoppel rules, see James, Hazard, & Leubsdorf, *Civil Procedure* ch 11 (cited in note 15). Non-mutual estoppel can create asymmetric stakes for repeat litigants who are either plaintiffs, which is referred to as "defensive" use, or defendants, which is referred to as "offensive" use. See *Blonder-Tongue Laboratories v University of Illinois Foundation,* 402 US 313 (1971) ("defensive" use against a patent holder-plaintiff who had lost a prior case on patent validity); *Parklane Hosiery Co. v Shore,* 439 US 322 (1979) ("offensive" use against a defendant who had lost a prior securities fraud case against the government, applied in favor of a private plaintiff).

at least in the early cases.[115] Of course, potential plaintiffs as a group could counter that effect by joining together to pool resources, but, in order to do so, plaintiffs would have to solve a collective action problem. Not only do the potential plaintiffs face positive costs of locating each other and organizing themselves, but also each plaintiff has the incentive to wait for another plaintiff to sue and then "free ride" on a judgment against Merrell Dow. Furthermore, and similarly to the interest-group situation generally, not all plaintiffs will have exactly identical interests.

Now add the *Frye* standard to this scenario. As discussed above, *Frye* itself creates a collective-action problem. But it is a somewhat different problem, involving a wider range of interests and actors, than would be presented by considering only the common interests of potential plaintiffs against Merrell Dow in Bendectin cases. Thus, on the plaintiffs' side of multiple litigation with collateral estoppel potential, *Frye* makes an existing collective-action problem even more complex. It also will be more costly unless there are positive economies of combination, which does not seem probable, though perhaps it is possible. On the defense side, *Frye* increases the return to investing on the basis of external effects, as it creates another line of defense for Merrell Dow against all potential plaintiffs. But the marginal costs of defense investment in organizing around the *Frye* standard may be relatively smaller than for the plaintiffs, especially if Merrell Dow by itself faces enough litigation to justify unilateral action to organize its own "general acceptance" group.

On both sides of multiple litigation with collateral estoppel potential—as in the general case—*Frye* has the effect of raising the external "stake" in the litigation, and thus moving the litigation even farther away from the model of fully internalized costs and benefits. Although *Frye* also creates an additional issue of common interest among successive parties with the relatively lower stake (plaintiffs in the example), it does not seem likely that this effect will redress the asymmetry, and it may well increase the distortion of the fact-finding process by introducing the interests of non-litigants, such as the expert witnesses themselves. To the extent that *Daubert* mutes the incentives for "general acceptance" organization extrinsic to the litigation, it will reduce this distorting effect. Furthermore, to the extent that *Daubert* shifts the admissibility of scientific evidence from a "general" issue to one that is decided on

[115] Fully characterizing defense expenditures in this sequential-defense scenario is somewhat complex. However, as a first approximation, it is likely that a party in Merrell Dow's position would view its expenditures on previous cases as "sunk" costs, and therefore re-evaluate defense expenditures at each successive phase on the basis of its remaining capitalized exposure under non-mutual collateral estoppel.

the basis of the facts of each particular case, it actually may reduce the effects of asymmetry, by eliminating an issue that is considered common to a series of otherwise similar cases.

The effects in a case involving the government are similar, though the mechanism differs somewhat. To some extent, the government tends to "capitalize" all of its cases simply because it is the government (an entity that does not strongly internalize any of the costs and benefits of its litigation activity). As government agents are almost never called to account for their litigation expenditures in the same manner as private agents, the government tends to spend out of proportion to the stakes, and to be influenced in its expenditures by all sorts of extrinsic factors—publicity, pride, symbolism, the "public interest," the career ambitions of the government lawyers or executives handling the case, and the like.[116] The only constraint on any of this is the political process, which is far too diffuse to place any sort of meaningful control on expenditures in a particular case.

As in the case of non-mutual estoppel, adding *Frye* to the government case exacerbates the tendency to invest out of proportion to individual case stakes. On issues of scientific evidence that the government litigates frequently, the biasing effect can be profound. For example, consider the "science" of fingerprint identification, which is virtually a governmental monopoly. In that field, the only "generally accepted" principles are those accepted by at least some of the government's fingerprint identification experts. In this instance, we have an overt case of "scientific" principles in a particular field being dictated by a governmental bureaucracy.[117] Although the advent of *Daubert* is hardly likely to break the government's hold on fingerprinting expertise or other aspects of "forensic science" used predominantly in criminal prosecutions, at least it would theoretically permit a private expert to offer some evidence that is not based on principles already accepted by the government. In contexts where the government's dominance is less

[116] The clearest example is criminal prosecutions. Only in rare cases is it even known publicly how much taxpayers' money is spent on a particular prosecution. While prosecutors' offices generally have budgets and finite resources, those limitations primarily affect the selection of cases to pursue. As a practical matter, there is no budget for a particular criminal prosecution, and any proposal to create such limits on prosecution expenditures would be met with objections to putting a "price tag" on such non-pecuniary interests as public safety or victims' suffering.

[117] Giannelli & Imwinkelried further report that the FBI Laboratory's services, which extend to a variety of "criminal forensics," are made available without charge to state and local governments, and "include both the examination of evidence and the court appearance of the expert." Giannelli & Imwinkelried, 1 *Scientific Evidence* at 110 (cited in note 41).

complete, the shift from *Frye* to *Daubert* is likely to be more meaningful, and, like the case of non-mutual estoppel, may tend slightly to mitigate the effects of asymmetry.

In neither of these variations are the effects of asymmetry of stakes vitiated by something like the *Frye* test. Indeed, they may be aggravated. Although the shift to *Daubert* may be ameliorative to some extent, it does not operate on the underlying asymmetries of incentive to invest in litigation, which are driven by external effects. This exposes the more general point that problems such as asymmetrical stakes and external effects are not fundamentally problems of evidence or fact-finding at all, and they are not problems that evidence law is likely to be able to address effectively.

D. The Domain of Admissibility Doctrine

Asymmetries of stakes created by external effects are not the only cause of "junk science" in the courtroom, nor the most important one. Far more important are the magnitudes and variance in the stakes of litigation, which are functions of the substantive law of liability and damages. The ever expanding scope of legal liability, together with the ever increasing likelihood of large damage awards, punitive and otherwise, are the principal reasons for the growth in the use and importance of expert testimony in litigation. In simple economic terms, there is a strong demand for expert testimony (along with all other forms of litigation expenditure) derived from the increasing returns to litigation as a means of wealth transfer. As the explicit pricing of "fact" evidence is suppressed by the formal system of unremunerative compulsion, the explicitly priced supply of expert and scientific evidence makes it an easy target of criticism.

The returns to litigation activity are raised still higher by certain features of the modern procedural system, such as liberal pleading rules and broad discovery and, most recently, "disclosure" obligations. The emergence of "mass tort" and other forms of multiple litigation, together with non-mutual collateral estoppel, raises the stakes in litigation further, and provides incentives for interest groups to organize for coordination across multiple cases. With or without facilitative legal rules, interest groups have formed to litigate "public interest" cases that seek to establish broad principles or policies rather than overtly to secure a transfer payment from a particular defendant to a particular plaintiff. And, of course, with the growth of statute and regulatory law, government at all levels has increasingly become involved in litigating broad issues of social policy.

As against all of these powerful forces tending toward increased investment in litigation expenditure, the evidentiary standard for the admissibility of scientific evidence can have only a limited marginal effect.[118] The problem with the *Frye* standard and its suggested variants is that its marginal effect is in the wrong direction—toward reinforcing rather than dampening all of the other influences that tend both to raise and to externalize the stakes of litigation. But no standard of evidentiary admissibility could stem that tide.

More fundamentally, no test of evidentiary admissibility that looks to an "external" guidepost seems likely to improve the performance of litigation fact-finding because all such standards will partake to some extent in the "free lunch" fallacy. It is a tempting fantasy to believe that somewhere out there is the polestar that can guide the imperfect course of adjudication at law. Tempting as it is, it is a fantasy nonetheless. Questing for the Polaris of "true" scientific evidence—assuming that it exists at all—cannot be done with the naked eye. It requires a telescope. Someone, who wants to get paid, has to make the telescope. Not all telescopes are equal, and the "consensus" telescope may very well be distorted. In terms of the fact-finding needs of a particular case, it is likely to be distorted by the broader interests of the consensus-makers.

Daubert does not entirely eliminate this problem. On one level, it seems to replace the "consensus" telescope with a scenario of looking through competing telescopes, or perhaps alternative navigational aids, so long as they all qualify under some generic standard as "scientific" methods. At a more profound level, *Daubert* also could be read as questioning whether Polaris exists at all or, even if it does, whether its location is important or even useful to the adjudicatory enterprise.

Ultimately, *Daubert*'s rhetoric in this respect may be more important than whatever "test" eventually emerges in the lower courts. The majority's opinion in *Daubert* is a welcome recognition that fact-finding in litigation is not a search for "cosmic understand-

[118] This is the essential thesis of Brickman in *On the Relevance* (cited in note 102), although his analysis focuses narrowly (too narrowly, in my view) on lawyers' incentives. If lawyering is a competitive business, lawyers' rates of return are unlikely to be much different from anyone else's. The effect is more fundamentally in *litigants'* rates of return, which are determined by the stakes in litigation as set by the substantive law of liability and damages. Whether contingent legal fees consume a large or small proportion of recoveries is beside the point: the typical contingent-fee plaintiff's return is astronomical by any measure because these plaintiffs essentially risk nothing and invest only a small amount of their own time and energy in the litigation. In effect, they have bought a lottery ticket by purchasing an option in litigation at a very low premium. See Bradford Cornell, *The Incentive to Sue: An Option-Pricing Approach*, 19 J Legal Stud 173 (1990).

ing." Many of the influences that are operating to increase the stakes (and expenditures) in litigation appear to be based on the opposite view that the factual findings in a single litigation are a matter of broad social import. To the extent that *Daubert* helps provide an antidote to that thinking, it will make a positive contribution to the law and economics of litigation.

In operational terms, *Daubert* reorients admissibility doctrine more closely to what one might reasonably expect of evidence law. As was discussed in Part II above, the entire problem of admissibility of scientific evidence is simply a matter of finding an acceptable analog in expert testimony to the foundational requirement of "first-hand knowledge" in ordinary testimony. *Daubert* makes that analogy explicit, and therefore provides a basis for extending the underlying logic of foundational requirements to scientific evidence. For ordinary testimony, the requirement of first-hand knowledge is a minimal standard designed to ensure that the witness has an observational advantage over the fact-finders. It does not require or imply that the witness is the definitive source, or that the witness is correct in his or her perceptions.

There does not appear to be any reason why a similar approach should not guide the application of the *Daubert* standard. As with opinion testimony by ordinary witnesses, if the expert's testimony is "rationally based" (not in personal sense impression but rather in the specialized "scientific" knowledge of the expert's field) and, as the Court stated in *Daubert*, "pertinent" to the factual issues of the case, then the testimony presumptively is admissible, subject to the ordinary counterweights.

Asking more of the standard of admissibility is asking too much of evidence law. If problems remain with "junk science" in the courtroom, they are far more powerfully related to the incentives of substantive law and other features of the procedural system, and they can be addressed far more effectively by attending to those causative factors rather than overstressing or distorting the law of evidence. As illustrated by *Frye*, seeking to address those problems through inappropriate admissibility doctrine can make them worse.

V. POST-*DAUBERT* EXPERIENCE

In a paper concerning scientific evidence, one would hope to formulate a falsifiable hypothesis. The analysis presented above does lead to testable predictions regarding the expected consequences of *Daubert*. Unfortunately, however, *Daubert* is still too new—even at this writing, some eighteen months after the decision was announced—to have generated systematically observable effects. Even

when, and if, it does, the methodological problems of isolating *Daubert*'s effects will be formidable. The observable experience to date, which is only suggestive and mostly episodic, does provide some support for the argument of this article. However, the preliminary signals are mixed.

The basic prediction of the analysis presented here is that decisions on the admissibility of scientific evidence under *Daubert* will be subject to less influence from the external interest groups necessary to achieve "general acceptance" than were comparable decisions under *Frye.* Even under the best of circumstances, isolating this effect will be difficult. Aside from the general condition that social and particularly legal observations often can defy experimental design, the effect may be subtle. *Daubert* preserves "general acceptance" as one of several factors that trial judges may consider in applying its broader standard.[119] Furthermore, even in the pre-*Daubert* era, the *Frye* test was neither universally accepted nor uniformly applied where it was accepted.

Two general approaches suggest themselves. First, one could examine the "internal" effect of *Daubert* on admissibility decisions in the reported case law, ideally by comparing otherwise similar decisions between courts applying *Frye* and *Daubert,* either longitudinally or cross-sectionally. The prediction is that, if all else is held constant, admissibility decisions under *Daubert* will exhibit less consistency—more dispersion in admissibility outcomes for a given type of expert testimony—than decisions under *Frye.* This would be a direct indication that interest groups have less to gain under *Daubert.* Second, one could look to the "external" effect on the funding, size, and distribution of the "general acceptance" interest groups. From this perspective, the prediction would be that—all else equal—at least the more narrowly-based interest groups will tend to decline in size and funding. Broader interest groups, which might have some plausible claim to representing the "scientific method" more generally, may gain members. But overall, to the extent that these groups are predicated on litigation rent-seeking, their total membership, total financing, or both, should decline, if *Daubert* has reduced realizable rents.

However, it appears that *Daubert* is still too new to have generated unambiguous effects from either perspective. Reported case law (and commentary), and available summary data on organizations' membership, show mixed results.

An examination of the post-*Daubert* case law in the federal and state courts has not identified instances where applications of

[119] See *Daubert,* 113 S Ct at 2797.

Daubert show detectably greater dispersion in admissibility outcomes than applications of *Frye*.[120] However, to the extent that differing doctrinal interpretations may presage ultimate differences in outcomes, there already are at least two distinct interpretations of the *Daubert* standard. One group of courts focuses on the "liberal admissibility" aspect of *Daubert* to view the new standard as establishing a lower threshold to admissibility.[121] Another group of courts takes *Daubert*'s emphasis on scientific validity and the "gatekeeping" role of the trial court judge as tight-

[120] Research for this article encompassed all reported federal and state cases citing *Daubert* through August 1994, and more selective research in prior and subsequent cases.

As prior law presaged *Daubert* in some instances, such as the Third Circuit's decision in *United States v Downing*, 753 F 2d 1224, 1232-37 (3d Cir 1985) (Judge Becker) (rejecting *Frye* and adopting a test of "reliability" and "fit" similar to *Daubert*, see 113 S Ct at 2795-96), it may be possible to perform cross-sectional analysis in the prior law, although I have not undertaken to do so for this article. However, some of the possibilities are suggested by the experience with the type of expert testimony involved in *Downing*, which was opinion on the reliability (or lack thereof) of eyewitness "fact" testimony. Courts following the *Frye* test consistently excluded this type of scientific evidence. See, as the leading authorities, *United States v Rincon*, 984 F 2d 1003 (9th Cir 1992); *United States v Larkin*, 978 F 2d 964 (7th Cir 1992); *United States v Serna*, 799 F 2d 842 (2d Cir 1986); *United States v Fosher*, 590 F 2d 381 (1st Cir 1979); *United States v Amaral*, 488 F 2d 1148 (9th Cir 1973).

In *Downing* itself, the Third Circuit reversed and remanded the exclusion of such testimony for reconsideration in light of its rejection of *Frye*. On remand, the district court adhered to the original outcome of exclusion, and the Third Circuit affirmed. *United States v Downing*, 609 F Supp 784 (ED Pa 1985), aff'd without opinion, 780 F 2d 1017 (3d Cir 1985). Much the same result ensued from the Ninth Circuit's decision in *Rincon* (cited earlier in this footnote), excluding that same type of testimony under *Frye*, which was vacated and remanded by the Supreme Court, 114 S Ct 41 (1993), for further consideration in light of *Daubert*. On remand, the Ninth Circuit adhered to the original outcome under the *Daubert* test, and the Supreme Court denied certiorari. *United States v Rincon*, 28 F3d 921 (9th Cir 1994), *cert denied*, 115 S Ct 605 (1994).

In the meantime, however, another Third Circuit opinion by Judge Becker (the author of *Downing*) had reversed a district court decision excluding expert testimony on eyewitness reliability—the same outcome ultimately affirmed in *Downing*—in *United States v Stevens*, 935 F 2d 1380, 1397-1402 (3d Cir 1991). See also *United States v Garcia*, 40 M J 533 (USAF Ct Mil Rev 1994) (post-*Daubert* decision reaching the *Stevens* result).

While this evidence is purely anecdotal, it does suggest that the *Daubert* standard is less directive of particular outcomes than *Frye*. Under the analysis of this article, that is the predicted effect.

[121] Among the federal circuits, see *United States v Chischilly*, 30 F3d 1144, 1152 (9th Cir 1994) (*Frye* described as "more arduous" than *Daubert*); *United States v Bonds*, 12 F3d 540, 566 n 21 (6th Cir 1993) (*Daubert* "more liberal" towards admissibility); *United States v Bynum*, 3 F3d 769, 773 (4th Cir 1993), *cert denied*, 114 S Ct 1105 (1994). The Eight Circuit seems to be on the fence: in *Sorensen v Shaklee*

ening the standard for admissibility.[122] Both strands of case law, as well as most of the commentary on *Daubert*, seem to acknowledge that *Daubert* did shift admissibility doctrine away from deference to external acceptance of the content of proffered scientific evidence and toward an evaluation of the method for arriving at the scientific opinion that is more internalized to the judicial process.[123]

Perhaps the best current indicator of this shift in doctrinal emphasis, and its likely effect of decreasing the predictability of admissibility outcomes, is the Ninth Circuit's treatment of the *Daubert* case itself on remand from the Supreme Court. In June 1993, the Supreme Court vacated the Ninth Circuit's original decision excluding the plaintiffs' proffered expert testimony, and remanded the case for reconsideration in light of the newly announced *Daubert* standard. In January 1995, the Ninth Circuit issued its opinion on remand, which adhered to the original result of exclusion upon application of the new standard.[124] Judge Kozinski's opinion for the Ninth Circuit describes the analysis required by *Daubert* as "a far more complex and daunting task" than Frye demanded,[125] and one that "puts federal judges in an uncomfortable position":

> [T]hough we are largely untrained in science and certainly no match for any of the witnesses whose testimony we are re-

Corp., 31 F3d 638 (8th Cir 1994), the court described *Frye* as "more restrictive" than the new *Daubert* standard, id at 646 n 13, but seemed to apply the opposite view in substance. See also *United States v Martinez*, 3 F3d 1191 (8th Cir 1993), *cert denied*, 114 S Ct 734 (1994). On the state level, see *State v Alberico*, 116 NM 156, 861 P2d 192 (1993); *Hart-Albin Co v McLees Corp.*, 264 Mont 1, 870 P2d 51 (1994); *State v Cephas*, 637 A2d 20 (Del 1994).

[122] Federal cases suggesting a more demanding interpretation of *Daubert* include, in addition to the *Daubert* case itself on remand (discussed below), *In re Paoli RR Yard PCB Litigation*, 35 F3d 717, 741-50 (3d Cir 1994) (extensive discussion of *Daubert* and *Downing* by Judge Becker, the author of *Downing*), *Robinson v Missouri Pacific R Co.*, 16 F3d 1083, 1088-89 (10th Cir 1994) (emphasizing the trial judge's "gatekeeping" role), and *Porter v Whitehall Laboratories, Inc.*, 9 F3d 607 (7th Cir 1993). At the state level, see *State v Foret*, 628 S2d 1116 (La 1993).

[122] An example of a shift away from external interest group influence is *Bradley v Brown*, 852 F Supp 690 (ND Ind 1994), which involved proffered testimony by "clinical ecologists" on "Multiple Chemical Sensitivities" syndrome. The clinical ecologists were well-organized, with peer-reviewed literature and, within their self-defined field, "general acceptance" of their views. Nonetheless, the evidence was excluded by the district court under *Daubert* on the rationale that the field involved insufficient scientific testing. See id at 698-700.

[124] *Daubert v Merrell Dow Pharmaceuticals, Inc.*, 43 F3d 1311 (9th Cir 1995).

[125] Id at 1315.

> viewing, it is our responsibility to determine whether those experts' proposed testimony amounts to "scientific knowledge," constitutes "good science," and was "derived by the scientific method."
>
> The task before us is more daunting still when the dispute concerns matters at the very cutting edge of scientific research, where fact meets theory and certainty dissolves into probability. As the record in this case illustrates, scientists often have vigorous and sincere disagreements . . . . Our responsibility, then, unless we badly misread the Supreme Court's opinion, is to resolve disputes among respected, well-credentialed scientists about matters squarely within their expertise, in areas where there is no scientific consensus as to what is and what is not "good science," and occasionally to reject such expert testimony because it was not "derived by the scientific method." Mindful of our position in the hierarchy of the federal judiciary, we take a deep breath and proceed with this heady task.[126]

Notwithstanding Judge Kozinski's reticence, the Ninth Circuit in fact did proceed to reject qualified experts' testimony, and Merrell Dow ultimately won its case.

Of course, any new legal standard announced by the Supreme Court is bound to create uncertainties and disagreements in its initial applications. But Judge Kozinski's remarks on remand in *Daubert* appear to represent something more durable: in essence, they are a restatement of the perennial question in scientific evidence—whether judges are competent to evaluate scientific opinion testimony.[127] The Supreme Court's opinion in *Daubert* gives an answer: rely on the adversarial system, in full recognition that such a system sometimes errs. If Judge Kozinski's concerns are well-founded, then "unqualified" judges are likely to make differing and sometimes inconsistent decisions on similar types of scientific testimony. A deferential standard of appellate review of such decisions—if applied under *Daubert*—all but ensures that such inconsistencies will enter the reported case law. If so, the resulting body of decisions may have an untidy appearance to some observers, but it will be positive for social welfare if the disparities in outcome are relatively random and unbiased: that will indicate that *Daubert* has decreased the influence of external interest groups.

[126] Id at 1316.
[127] See Part II above.

If that development proceeds, then we should expect to see such interest groups undergo a relative decline in size and funding.[128] However, it appears to be too soon to conduct a controlled empirical study, at least with generally available data. A preliminary review of the available summary statistics from the *Encyclopedia of Associations* as of mid-1994 indicates that self-identified "forensic" associations[129] are growing at a slightly smaller average rate than a random sample[130] of all associations.[131] However, there is no indication that this difference is significant,[132] or that it suggests any general trend at all. Furthermore, these samples are very small, the data appear very rough, and this comparison does not control for other factors—such as the total volume or value of litigation—that may affect litigation-related organizations differentially.

[128] Of course, there are many possible influences on associations' membership and funding, but the prediction is that, holding all else constant, "scientific evidence" associations should decline in relative importance.

[129] Based upon the 1991 and 1995 editions of the *Encyclopedia of Associations* and *International Encyclopedia of Associations* (Gale, 1990 & 1994), there were 21 U.S.-based nationwide or international associations classified in the "forensic sciences" and "forensic medicine" categories and reporting membership in both 1990 and 1994. Of those, only one reported a drop in membership: the International Society of Stress Analysts, which dropped from 250 to 50 members. Eleven others reported the same membership: American Academy of Forensic Psychology (120 members); American Association of Police Polygraphists (700 members); American Polygraph Association (2500 members); Evidence Photographers International council (500 members); Independent Association of Questioned Document Examiners (175 members); American Board of Forensic Anthropology (39 members); International Reference Organization in Forensic Medicine and Sciences (1200 members); Milton Helpern Institute of Forensic Medicine (405 members); National Bureau of Document Examiners (50 members); National Forensic Center (5000 members); World Association of Document Examiners (500 members). The remaining nine reported increases: American Academy of Forensic Sciences (from 3300 to 3750 members); American Society of Crime Laboratory Directors (from 250 to 300 members); American Society of Questioned Document Examiners (from 50 to 110 members); Association of Forensic Document Examiners (from 25 to 30 members); National Association of Forensic Economists (from 325 to 520 members); American Board of Forensic Psychiatry (from 220 to 227 members); International Association for Identification (from 2500 to 3600 members); National Association of Document Examiners (from 65 to 130 members); and Society of Forensic Toxicologists (from 300 to 425 members).

[130] Random selection on the basis of association number as used in the directory produced 25 observations, of which 2 were excluded as not reporting membership for both 1990 and 1994.

[131] The average percentage growth of the "forensic" group was +17.7% (with a standard deviation of 54.1%), while the random group's average percentage growth was +19.7% (with a standard deviation of 38.8%).

[132] Given the large standard deviations (see the preceding note), there is no confidence that there is any statistical difference between these two rates.

In time, it may be possible to construct a controlled empirical study using a similar data source that would show whether a subset of organizations or associations identified as having an interest in expert testimony had experienced a relative decline that could be attributable to *Daubert*.[133]

VI. CONCLUSION

Assessing the ultimate effect of *Daubert* on the admission of scientific evidence is likely to require several more years of judicial experience followed by rigorous empirical study. Certainly, the amount of attention lavished on *Daubert* to date by the commentators, and the emerging disagreements among the federal and state courts on its meaning, suggest that its doctrine will matter. But at this point, there is little agreement on how it will matter. Respectable opinion predicts both less and more stringent attitudes towards the admissibility of scientific evidence, and some predict little or no effect on outcomes at all.

This article has argued that the disagreements over *Daubert*'s meaning may themselves be indicators of yet another effect of *Daubert* that ultimately may be more profound. Whether *Daubert* increases or decreases the cost of presenting scientific evidence generally, it is likely to reduce the influence of external interest groups on the content and costs of scientific evidence proffered under its standard. If that prediction is correct, the results certainly will do no harm to science, and will be favorable for the adjudicatory system, as it will remove or at least reduce one source of external bias on the supply of scientific evidence to litigation.

In a broader view, *Daubert* focuses our attention on the virtues and vices of the adversarial system as it operates on fact-finding at trial. Whatever its vices, adversarial presentation of evidence has the signal virtue of internalizing the costs and benefits of fact-finding to the immediate parties, much as substantive property rights do in the contracting process. While litigation, given its coercive aspect, is not entirely analogous to contracting, it comes closest in the context of fact-finding in a particular case, where the social interest in the particular outcome approaches zero. Much of the criticism of the adversarial system in recent years seems to ignore this point. The Supreme Court's decision in *Daubert* reminds us

[133] If the absence of measurable effects at present is mainly the result of the fact that *Daubert* is a new decision, that problem should cure itself. There are, of course, other possibilities. The interest groups, for example, may (now or later) shift their activities to other interests of the members, which will create measurement problems of a different kind.

that fact-finding in particular cases is not an "exhaustive search for cosmic understanding." Accordingly, *Daubert* instructs trial judges to apply the ordinary tools of the adversarial system to determine when to receive scientific evidence, even when that task casts judges in what the Ninth Circuit on remand believed was the "uncomfortable position" of resolving disputes among respected, well-credentialed scientists.

Unfortunately, there is no better alternative to the judges' discomfort. The judicial system cannot have a free lunch any more than others can. Judges will make mistakes. Under *Daubert,* those mistakes can and should be confined in their effect to the particular legal dispute in which they are made. Under *Frye,* judicial error could be induced and then multiplied to other cases under the influence of external interest groups with a stake in "general acceptance." To assume that judicial determinations can be improved or assisted by reference to a manipulable external standard is to assume that there is a free lunch. Thus, the answer to the perennial question of how we can expect "inexpert" judges to evaluate expert testimony is simply that their doing the best they can is better than the next best alternative.

To avoid the free lunch fallacy, courts and law reformers need only attend to the proper limitations on the social consequences of fact-finding in particular litigated matters. Litigation will never be a neat and tidy business, and perhaps it should not be. Some degree of uncertainty in litigated outcomes probably is desirable, as it provides incentives for parties to avoid litigation ex ante. When trials cannot be avoided, the imperfections of the fact-finding process should be confined to the immediate parties, and not exported into other cases. Whatever the imperfections of the adversarial process in fact-finding, they are highly unlikely to be cured by creating diffuse external effects.