POLICY FORUM

Science and the Toxic Tort

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The U.S. Supreme Court recently decided a case with important implications for the role of science in court. The issue before the court in *Daubert* v. *Merrell Dow Pharmaceuticals* (*1*) was the standard that should govern the admissibility of scientific evidence at trial. This is the key issue in much toxic tort (*2*) and other litigation.

In a hazardous exposure suit, the plaintiff usually has to prove that the exposure in question more likely than not caused his or her injuries. Two (not necessarily distinct) problems frequently arise: how to assess the relevant scientific evidence and how to assess the proffered testimony of individual expert witnesses.

The first problem arises from the vexing difficulty of risk research, which naturally spills over into the courtroom. The scientific evidence generally includes statistical (epidemiologic) and high-dose animal studies. The difficulties in inferring causation from epidemiologic studies are well known to scientists (*3*) (if not to many laymen), and the relevance of high-dose animal studies to evaluating risks of low exposures to humans is unclear at best.

Two aspects of the first problem regularly surface in court: the proper application of statistics and the underlying validity of the studies themselves. For example, the epidemiologic evidence regarding miscarriage and use of video display terminals or birth defects and the morning sickness drug Bendectin includes a sprinkling of positive results in a body of overwhelmingly negative findings. The number of apparent positive findings would increase still further if, as some tort lawyers demand, statistical tests were based on less restrictive criteria than the usually accepted $p < 0.05$. But the measurement of reproductive risk is notoriously prone to many errors that are not reflected in statistical confidence intervals (*4*). For barely detectable risks, the scientific evidence will always be murky and inconsistent. This calls for comprehensive risk assessments, critical appraisals of data, and attempts to seek reasonable middle grounds—and creates daunting problems for judges faced with the need to assess the reliability of the scientific evidence.

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The second problem arises most starkly with witnesses with questionable testimony (*5*)—what one of us has called junk science (*6*). Clinical ecology, for example, is a fringe medical specialty, whose methods are regarded skeptically by the American College of Physicians (*7*). Some clinical ecologists have repeatedly appeared as expert witnesses in personal injury suits, offering alarming (and grossly inappropriate) diagnoses such as "chemically induced AIDS" in support of claimants' cases. Indeed, were it not for their availability as witnesses, many suits would not have been filed at all.

The importance of the *Daubert* ruling must be understood in the context of evolving federal standards for admitting scientific evidence. Previously, most courts followed the *Frye* rule, named after a 1923 federal court decision (*8*) holding that expert testimony is admissible only when it had received "general acceptance" in the "particular field in which it belongs."

The *Frye* rule came under attack in the 1960s and 1970s. Some critics viewed it as elitist and unhelpful, particularly in cases involving environmental or medical hazards, and argued that it was an unfair burden on plaintiffs to prove rigorously the cause of their injuries. Other critics argued that "general acceptance" had become a rubric that substituted for real analysis of the scientific merit of proffered testimony.

In 1975 the federal government adopted the Federal Rules of Evidence, which were soon adopted by most states as well. Three rules have direct bearing on scientific evidence in court: Rule 403 permits the exclusion of otherwise relevant evidence if its probative value is substantially outweighed by dangers of prejudice, confusion, misleading the jury, or wasting time. Rule 702 states that any qualified scientific expert may testify at a trial who possesses "scientific, technical, or other specialized knowledge [which] will assist the trier of fact [the jury] to understand the evidence or to determine a fact in issue." Rule 703 provides that experts may base their opinion on data that might not be admissible as evidence, if they are "reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject." This rule allows an expert to base his or her testimony on hearsay evidence, which would otherwise be excluded.

These rules, and the commentary accompanying them, liberalized the standards for admitting scientific evidence. Some judges interpreted them as allowing almost any scientific testimony, however implausible, to be presented to a jury. Following a series of embarrassing federal decisions (*9*), some courts moved toward stricter scrutiny of scientific evidence (*10*). The issue in *Daubert* was the survival of the *Frye* rule in light of the Federal Rules of Evidence.

The Supreme Court held that *Frye* had been superseded by the Rules of Evidence. But it affirmed the role of judges as gatekeepers to screen scientific testimony before allowing it to be presented to a jury. The Court made it clear that evidentiary reliability depends on the scientific validity of the proffered testimony and that there must be a logically relevant connection between the expert's reasoning and the facts at issue in a case. The Court offered general factors as examples of what judges might consider under Rule 702: the testability of the theory or technique in question, peer review, the known or potential errors in the technique, and general acceptance.

These guidelines probably come closer than the *Frye* rule to an approach that scientists themselves might choose. But they will not resolve the troubled relationship between science and the courts, for at least two reasons. First, a judge who is intimidated by science might find the role of gatekeeper to be daunting and adopt a "let it all in" approach, permitting the kinds of abuses of science that have long been present in the American tort system. Second, the guidelines do not address the deficiencies that regularly surface in toxic tort litigation. These problems can only be addressed by better scientific advice to judges. We offer several recommendations.

1) Judges and lawyers should become aware of the scientific issues in risk research. Much of the scientific evidence that has been presented in toxic tort suits has questionable relevance to human health. For example, many immune system tests yield variable results in normal populations and are of little use for diagnosing human disease (*11*) yet often are admitted as testimony. Much of the legal controversy about health effects of electromagnetic fields concerns the interpretation of bioeffects studies that have no direct relevance to health [and the studies frequently cannot be independently confirmed or have obvious technical flaws (*12*)]. High-dose animal studies have questionable relevance to risks to humans from low-dose exposures. Such evidence, presented outside the context of a comprehensive risk assessment, is a gross misuse of scientific data that should be excluded from the courtroom. Continuing-education

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courses might be effective in introducing judges and lawyers to elementary concepts of risk assessment.

As a positive contribution, Cornfeld (a lawyer) and Schlossman (a scientist) have proposed evidentiary standards for the admission of the results of immunologic laboratory tests and expert testimony based thereon (*13*). Other guidelines are needed. They should preferably be developed by consensus panels of scientists and lawyers under the auspices of scientific or legal societies.

2) Courts should examine closely the scope of expertise of expert witnesses. A treating physician, for example, is an appropriate expert to testify about injury or ill health of a patient and his or her treatment. But clinicians are not necessarily experts on the causes of injury, etiology of disease, or risk assessment, and the theories they present in court need to be examined carefully. For many years in traumatic cancer cases, judges and juries gave too much weight to the opinions of treating physicians and too little to the experts in oncology.

3) Courts should insist on peer review and independent evaluation of scientific evidence, in particular that which is based on new or not generally accepted theories or methodologies.

4) Judges should be encouraged to use their own expert witnesses. European judges routinely summon their own experts. American judges have similar powers, but few choose to exercise them (*14*). The *Daubert* opinion explicitly reminded judges of their power to hire their own experts, and may encourage them to do so. These experts can be particularly helpful in assisting the judge in pretrial hearings to screen scientific testimony. The greater use of such hearings was the chief recommendation in a recent Carnegie Commission report (*15*).

Many trial lawyers vehemently oppose the use of court-appointed experts, perceiving (correctly, no doubt) that consensus cannot be good for a conflict-centered livelihood. But questions such as the probative value of meta-analyses of epidemiologic data and statistical treatment of data (key issues in *Daubert*) are complex and involve both legal and scientific considerations.

5) Professional organizations should set standards for their members. Providing expert testimony is a rapidly growing, largely unregulated industry with no standard methodology and few clearly formulated standards.

Societies such as the National Academy of Forensic Engineers and the American Academy of Forensic Sciences have recently proposed or are now developing codes of behavior that, if followed, will help to improve the reliability of expert testimony. Some of these codes address directly or indirectly the problems of eccentric or unreliable testimony. For example, the Recommended Practices of the National Academy of Forensic Engineers (adopted in 1988) include: (i) "*Recommendation 3.* The expert should consider other practitioners' opinions relative to the principles associated with the matter at issue." The accompanying commentary states that "experts who disagree with the opinion of other professionals should be prepared to explain to the trier of fact the differences which exist and why a particular opinion should prevail." A witness who cannot or will not describe for the benefit of the court the scientific consensus on an issue should not be considered an expert at all. (ii) "*Recommendation 5.* The expert should evaluate reasonable explanations of causes and effects." The commentary states that ". . . experts should study and evaluate different explanations of causes and effects. Experts should not limit their inquiry for the purpose of proving the contentions advanced by those who have retained them." Courts should be most skeptical of conclusions when an expert either obscures an explanation or refuses to provide one.

These and other professional standards are voluntary; mandatory standards might expose a society to threat of antitrust suits. But they are useful guidance for potential experts and can help courts develop standards for screening out testimony that an expert's scientific peers would reject.

6) Courts should pay closer attention to reports of scientific consensus groups. Consensus reports, developed outside of the context of litigation, can provide useful guidance to judges on the scientific consensus about issues. Several consensus reports have appeared on health effects of electromagnetic fields. Their viewpoints vary (none makes any strong claims for cancer from magnetic fields; they all recommend more research) but are all responsible discussions of the issue—much more so than some discussions of the issue presented in court or by the lay media.

A valuable contribution would be for scientific societies to form panels, composed of individuals from diverse subdisciplines, to study and report on key scientific issues (particularly methodological issues) facing courts. Serving on consensus panels is time-consuming and professionally unrewarding for many scientists. However, such panels are an effective mechanism for outlining areas of broad agreement among scientists.

Astonishingly, all parties expressed satisfaction with the *Daubert* decision—the lawyers for the plaintiff and defense, and scientists who wrote *amicus* briefs. The final outcome of the case remains to be seen. The Ninth Circuit (whose decision was appealed to the Supreme Court and to which the case will be remanded) might simply provide a better explanation of why it affirmed a lower (trial) court in excluding the testimony of a key witness for the plaintiff. The case may never be sent back to the trial court.

But the ruling, by focusing the judge's attention on the process of science and reliability of scientific evidence, will have wide impact in science-related cases of all sorts. The opinion not only should encourage the trend towards strict scrutiny of scientific evidence by judges, but should spur lawyers and scientists to greater collaboration in improving the quality of scientific evidence.

REFERENCES AND NOTES

1. *Daubert* v. *Merrell Dow Pharmaceuticals, Inc.* 61 U.S.L.W. 4805 (1993). This was one of more than a thousand suits, most of them unsuccessful, seeking recovery for birth defects allegedly caused by the morning sickness drug Benedectin.
2. Toxic tort cases are personal injury cases involving exposure to hazardous substances, usually from environmental exposure.
3. A. B. Hill, *Proc. R. Soc. Med.* **58**, 295 (1965); K. J. Rothman, Ed., *Causal Inference* (Epidemiology Resources, Chestnut Hill, MA, 1988); M. Susser, *Am. J. Epidem.* **133**, 635 (1991).
4. J. L. Mills, in *Phantom Risk, Scientific Inference and the Law*, K. R. Foster, D. E. Bernstein, P. W. Huber, Eds. (MIT Press, Cambridge, MA, 1993), pp. 87–100; L. Lasagna and S. R. Shulman in *ibid.*, pp. 101–122.
5. M. A. Berger, Procedural and Evidentiary Mechanisms for Dealing with Experts in Toxic Tort Litigation: A Critique and Proposal (Carnegie Commission, October 1991).
6. P. W. Huber, *Galileo's Revenge: Junk Science in the Courtroom* (Basic, New York, 1991).
7. American College of Physicians, *Ann. Int. Med.* **111**, 168 (1989) (position paper).
8. *Frye* v. *United States*, 293 F. 1013 (D.C. Cir., 1923).
9. One notorious case was *Wells* v. *Ortho Pharmaceutical Corp.*, 615 F. Supp. 262 (N.D. Ga. 1985), *affirmed in part, modified in part*, 788 F. 2d 741, *reh'g denied en banc*, 795 F. 2d 89 (11th Cir.), *cert. denied*, 479 U.S. 950 (1986), which resulted in a $4.7-million award for birth defects allegedly resulting from the mother's use of spermicide [K. R. Foster *et al.* in (*4*), pp. 137–138; see also (*6*)].
10. For example, *Christopherson* v. *Allied Signal Corp.*, 939 F. 2d 1106 (5th Cir., 1991) (en banc). The case involved allegations of cancer produced in a worker in a battery plant by fumes containing nickel and cadmium. The appellate court upheld the dismissal of the case by a trial court.
11. M. I. Luster, G. J. Rosenthal, and D. R. Germolec, in (*4*), pp. 379–400.
12. K. R. Foster, *Health Phys.* **62**, 429 (1992).
13. R. Cornfeld and S. Schlossman, *Toxics L. Rep.* 381 (6 September 1989); in (*4*), pp. 401–424. Schlossman is a Harvard immunologist whose laboratory developed immunologic tests that are often used in support of claims of immune-system damage from hazardous exposures.
14. T. Lee, *Yale Law Policy Rev.* **6**, 480 (1988).
15. Carnegie Commission, Science and Technology in Judicial Decision Making (Carnegie Commission, New York, March 1993).
16. D. E. Bernstein, *Rev. Litig.* **10**, 117 (1990).

17. We thank an anonymous referee for valuable suggestions and criticisms of an earlier version of this manuscript and the Manhattan Institute for support.