

**“The Interdependence of Science and Law”**

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Stephen G. Breyer\***

Thank you, Madam Chairman. I am honored indeed to have the opportunity to speak to the Association on the occasion of its one hundred fiftieth birthday. Let me begin by reading you something complimentary that Vaclav Havel recently wrote about our two professions – science and law. He said that

for the rest of the world, contemporary America is an almost symbolic concentration of all the best and worst of our civilization. On the one hand, there are its profound commitments to enhancing civil liberty and to maintaining the strength of its democratic institutions, and the fantastic developments in science and technology which have contributed so much to our well being; on the other hand . . . .

Let us not go on to consider Havel’s “other hand.” (He worries about American consumerism.) Rather, for present purposes, I recommend that we graciously accept Prime Minister Havel’s compliment – of American science and of American law – and ask whether those of us who work in science and in law might continue to produce human benefits that justify such praise — in part by learning to work better together.

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\* Associate Justice, Supreme Court of the United States

The fact of interdependence is evident. You find it obvious that the practice of science depends upon sound law – law that, at a minimum, provides support for science by offering the scientist breathing space. within which he or she may search freely for the truth upon which all knowledge depends. It is equally true that the law itself increasingly needs access to sound science. I should like to say a few words about that need and how it might be met.

The need arises because, as society becomes more dependent for its well being upon scientifically complex technology, we find that this technology increasingly underlies legal issues of importance to all of us. It is not surprising that the Federal Courts Study Commission reports that “economic, statistical, technological, and natural and social scientific data are becoming increasingly important in both routine and complex litigation.” We see this conclusion illustrated throughout the legal system.

Consider, for example, my own Court’s docket. One of the more significant cases the Court heard last year concerned the “right to die.” The specific legal question before us was whether the federal Constitution, which prohibits government from depriving “any person” of “liberty” without “due process of law,” requires a state to permit a doctor to assist in the suicide of a terminally ill patient. Is that “right to assisted suicide” part of the “liberty”

that the Constitution protects'? Underlying the legal question was a medical question: To what extent can medical technology reduce or eliminate the risk of dying in severe pain? The medical question did not determine the answer to the legal question, but, I believe, that to do our legal job properly we needed to develop an informed, though necessarily approximate, understanding of the state of that relevant scientific art.

Nor is the "right to die" case unique in this respect. A different case the same year involved the constitutionality of a state sexual psychopath statute. It involved a determination of when a person is both dangerous and mentally ill to the point that the public safety may justify indefinite non-criminal confinement – a question that implicates science and medicine, as well as law. One case on our docket this year concerns the sharing of responsibility, by juries, trial judges and appellate judges, for determining such scientific matters as the potential toxicity or carcinogenic quality of chemical substances, such as Benedectin or PCBs. A different criminal case involves the reliability of polygraph lie detector tests. A third case involves scientific advances in proving paternity, and the differences they may, or may not, make in respect to statutes that confer citizenship upon children born out of wedlock.

My own Court's docket is only illustrative. Scientific issues permeate the law. Criminal courts consider the scientific validity of, say, DNA sampling, or voice prints, or expert predictions of defendants' "future dangerousness" which can lead courts or juries to authorize or to withhold the punishment of death. Courts review the reasonableness of administrative agency conclusions about the safety of a drug, the risks attending nuclear waste disposal, the leakage potential of a toxic waste dump, or the risks to wildlife associated with the building of a dam. Patent law cases can turn almost entirely upon an understanding of the underlying technical or scientific subject matter. And, of course, tort law, assessing civil liability for injury or death, often involves difficult determinations about the degree of risk of death or injury associated with a chemical ingredient of say, a pesticide or of any other product.

The importance of scientific accuracy in the decision of such cases may reach well beyond the case itself. A decision wrongly denying compensation in a toxic substance case, for example, can deprive not only the plaintiff, say a worker, of warranted compensation, but can discourage other, similarly situated workers from even trying to obtain compensation and can encourage the continued use of a dangerous substance. On the other hand, a decision wrongly granting compensation, while of immediate

benefit to the plaintiff worker, can, through the strong financial disincentives that accompany a finding of tort liability, improperly force abandonment of the substance, which, if the decision is wrong, will improperly deprive the public of what can be far more important benefits — say those surrounding a drug that cures many while subjecting to less serious risk a few. The upshot is that we must search — but not for law that frees companies to cause serious harm, nor for law that forces them unnecessarily to abandon the thousands of artificial substances upon which modern life depends. Rather, here, as elsewhere, we must search for law that reflects an understanding of the relevant underlying scientific art.

That search is not a search for scientific precision. One could not hope to replicate the subtleties and uncertainties that characterize good scientific work. A judge is not a scientist and a courtroom is not a scientific laboratory. Rather, to explain the nature of the search through metaphor, I shall remind you of a remark made by the physicist Wolfgang Pauli. After a colleague asked whether a certain scientific paper was wrong, Pauli replied, “Oh, no. Certainly not. That paper is not good enough to be wrong.” That is our objective. It is to avoid legal decisions that reflect that paper’s so-called science. It is to avoid the kind of serious scientific mistake that once led one court, for example, to hold that dropping a can of orange juice

caused cancer. Rather, the law must seek decisions that fall within the outer boundaries that mark the scientifically sound-decisions that, roughly speaking, approximately reflect the scientific "state of the art."

This objective, while uncontroversial in theory, is nonetheless sometimes difficult to achieve in practice. I shall mention a few of the reasons that is so. The most obvious reason is one I have already mentioned. Judges are not trained scientists. They inevitably lack the scientific training that might facilitate the evaluation of scientific claims or the evaluation of expert witnesses who make such claims. They typically are generalists, dealing with cases that may vary widely in respect to substantive subject matter. Their primary objective is usually process-related: that of seeing that a decision is reached fairly and in a timely way. And the decision in a court of law typically (though not always) focuses upon a particular event and specific, individualized evidence.

Now compare the scientist, who often (but not always) looks for more general truths, and who, in doing so, is trained to look very closely at a few matters, holding all others constant. Truth, rather than justice, is the primary goal; considerations of accuracy ordinarily must override contrary concerns related to time, cost, or the need for a definite answer. And, of course,

scientists have much of importance to do other than spend their time in courtrooms or on governmental committees.

Further, science itself may be highly uncertain and controversial in respect to many of the matters that come before the courts. To return to my carcinogenic chemical example — an important example in light of the fact that cancers kill nearly a quarter of all Americans — scientists often express considerable uncertainty about the danger that attaches to a particular substance. And their views may differ in respect to many related questions that courts may have to answer. What, for example, is the relevance to human cancer of studies showing that a substance causes some cancers, perhaps only a few, in test groups of mice or rats? What is the significance of extrapolations from toxicity studies involving high doses of a substance to cases where the doses are much, much smaller. After all, extrapolations have limits; as others have pointed out, piglets grow to become pigs, not elephants. Some substances, perhaps cyanide, dangerous in large doses, are proportionately less dangerous in smaller doses. Others, like sugar, are dangerous when too much is eaten, but perfectly safe in small amounts. Still others, say iodine, are deadly in large doses, but where abstinence is total: dead again. Can lawyers or judges or anyone else expect scientists always to be certain, or always to have uniform views, about whether a particular

potentially carcinogenic substance is more like cyanide or sugar or iodine in respect to an extrapolation from a large to a small dose, when the causes of, and mechanisms related to, cancer are generally not well known? Many difficult legal cases fall within the very heartland of this kind of scientific uncertainty.

Finally, a court proceeding, such as a trial, is not simply a search for dispassionate truth. It must serve other important values as well. The law must be fair. And, in our country, it must always seek to protect basic human liberties. One important procedural safeguard, guaranteed by our Constitution's Seventh Amendment, is the right to a trial by jury. **Any** effort to bring better science into the courtroom must respect the jury's constitutionally specified role – even if doing so means, from time to time, what is, from a scientific perspective, an incorrect result. **As** Justice Frankfurter wrote many years ago, “it will not do to say it must all be left to the skill of experts.” The ultimate legal decisions must remain with judge and jury.

Despite the difficulties, I believe there is an increasingly important need for law to reflect sound science, and I remain optimistic about the likelihood that it will do so. It is common to find cooperation between governmental institutions and the scientific community where the need for



that cooperation is apparent. Today, as a matter of course, the President works with a science advisor, Congress solicits advice, say on the current dangers of saccharine, from the National Academy of Sciences, and the scientific regulatory agencies will often work with outside scientists, as well as their own, in their efforts to develop a work product that reflects good science.

The judiciary, too, has begun to look for ways to improve the quality of the science upon which scientifically-related judicial determinations will rest. In our Court, as a matter of course, we hear, not only from the parties to a case, but also from outside groups, which file briefs — thirty page *amicus curiae* briefs — which help us to become more informed, for example, about the relevant scientific “state of the art.” In the “right to die” case we received about sixty such documents, from organizations of doctors, psychologists, nurses, hospice workers, and handicapped persons, among others. Many discussed pain control technology, thereby helping us to identify areas of technical consensus and disagreement. In my own view, such briefs play an important role in educating the judges on potentially relevant technical matters, helping to make us, not experts, but moderately educated lay persons, and that education helps to improve the quality of our decisions.

Moreover, our Court recently made clear that the law imposes upon trial judges the duty, in respect to scientific evidence, to become evidentiary “gatekeepers.” The judge, without interfering with the jury’s role as trier of fact, must determine whether purported scientific evidence is “reliable” and will “assist the trier of fact,” thereby keeping from juries testimony that, in Pauli’s sense, isn’t even good enough to be wrong. Trial judges, looking for ways better to perform this function, increasingly have used pretrial conferences to narrow the scientific issues in dispute, pretrial hearings where potential experts are subject to examination by the court, and the appointment of specially trained “law clerks” or scientific “special masters.”

Judge Weinstein of New York, for example, suggests that courts sometimes “go beyond the experts proffered by the parties” and “appoint independent experts” as the federal Rules of Evidence allow. Judge Reavely of Texas points out that two hundred years ago Lord Mansfield would sit with two experts next to him on the bench to explain technical commercial terms and practices. Judge Rosen of Michigan recently appointed a University of Michigan Medical School professor to testify as an expert witness for the court, helping to determine the relevant fact in a case challenging a Michigan law prohibiting partial birth abortions. Judge Steams of Massachusetts, acting with the consent of the parties, in a recent

highly technical genetic-engineering patent case appointed a Harvard Medical School professor, as the “court’s technical advisor.” In a written agreement with the court, the “advisor” promised to serve “as a sounding board for the court to think through the scientific significance of the evidence” and to “assist the court in determining the validity of any scientific evidence, hypothesis or theory on which the experts base their testimony.”

These techniques are neutral, in principle favoring neither plaintiffs nor defendants. When used, they have typically proved successful. Judge Stearns found that working with a well-qualified technical expert serving as an advisor was a helpful way to understand, and thereby better to deal with, the technical claims of the parties in a highly technical case. I am told that many of those, perhaps all of those, involved in the Michigan case concluded that the judge’s use of an independent expert enhanced both the credibility and the objectivity of the legal process.

Nonetheless, judges have not often invoked their Rules-provided authority to appoint their own experts. They may hesitate simply because the process is unfamiliar, or because the use of this kind of technique inevitably raises questions. Will use of an independent expert, in effect, substitute that expert’s judgment for that of the court? Will it

inappropriately deprive the parties of control over the presentation of the case? Will it improperly intrude upon the proper function of the jury? Where is one to find a truly neutral expert? After all, different experts, in total honesty, often can interpret the same data differently. Will the search for the expert create inordinate delay or significantly increase costs? Who will pay the expert? Judge Acker of Alabama writes:

Unless and until there is a national register of experts on various subjects and a method by which they can be fairly compensated, the federal amateurs wearing black robes will have to overlook their new gatekeeping function lest they assume the intolerable burden of becoming experts themselves in every discipline known to the physical and social sciences, and some as yet unknown but sure to blossom.

It is fortunate that this Association, working with the American Bar Association and Federal Judicial Center, has begun to explore these matters with an eye toward finding practical ways to provide scientific help. The AAAS has helped develop a pilot project, just recently getting underway, to test the feasibility of increased use of court appointed experts in cases that present technical issues. The project, aimed at both civil and criminal litigation,

will provide a slate of candidates to serve as court-appointed experts in cases in which the court has determined that the traditional means of clarifying issues under the adversarial system are unlikely to yield the information that is necessary for a reasoned and principled resolution of the disputed issues.

The project might also examine in some detail instances in which courts have successfully used their own outside experts. How were those experts identified? How might this better be done? How did the court, while protecting the interests of the lawyers and the parties they represent, also protect the experts from unreasonable demands, say on their time? How did the court prepare the expert to encounter what may be an unfamiliar and sometimes hostile legal environment?

The project might also ask whether criteria emerge that help to determine when a court-appointed expert will prove useful and whether that expert might better serve in an advisor-type or in a witness-like capacity. It would undoubtedly also be helpful to recommend methods for educating efficiently (i.e., in a few hours) willing scientists in the ways of the courts, just as it is helpful to develop those kinds of training that might better equip judges to understand the ways of science and the ethical, as well as the practical and the legal aspects of the matter, could be usefully explored.

To answer some of these or related questions will help determine the practicality of what seem promising methods to help bring science and law closer together. There may be others. As FDR said many years ago, “it is common sense to take a method and try it. If it fails, admit it frankly and try another. But, above all, try. . .”

I conclude where I began. I believe that in this age of science we must build legal foundations that are sound in science, as well as in law. You have offered your help. We in the legal community should accept that offer, and we are in the process of doing so. The result, in my view, will further not only the interests of truth, but also those of justice. The law will work better to resolve many of the most important human problems of our time.