

Science, Technology, and the Limits of Judicial Competence

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Resolution of scientific and technological controversies occupies an increasingly important position in the agenda of the federal courts. Government efforts to regulate problems related to technological advances have given rise to a new brand of litigation that focuses directly on issues debated among scientific experts. Legislation to control environmental and health risks, such as the National Environmental Policy Act, the Clean Air Act, and the Toxic Substances Control Act, require decisions based on the "best scientific information" as well as relevant social and economic considerations. Science itself has become a focus of litigation as advances in biomedical science lead to controversial research and clinical practices that are challenged in the courts. Thus, scientists are frequently called on to provide technical evidence in order to prove the rationality of administrative decisions or to establish the legitimacy of innovative research practices.

The resulting surge of science-related disputes into the judicial arena has produced a set of difficult and highly visible problems for the courts, and it is widely believed that the traditional processes of adjudication are no longer capable of handling many of these disputes. Introducing a panel on science and the law at the 1978 annual meeting of the American Bar Association, a legal scholar remarked (1):

Traditional legal techniques, education and institutions, may soon be the same kind of anachronism in an age of science-based technology that canon law institutions became with the decline of temporal religious authority. . . . What may be required is a reform of existing structures which is no less comprehensive than the reforms that freed Anglo-American law from the technicalities of writs and those that freed science from the grip of Aristotle.

Some scholars have argued that scientific and technical disputes fall outside the limits of judicial competence and that courts should therefore be content with a greatly reduced role in such controversies, limiting themselves to reviewing the

adequacy of procedures for collecting and analyzing scientific evidence. Judge Bazelon, for example, has suggested that courts reviewing actions of administrative agencies can do no more than verify that major technical issues are addressed in agency decision-making, that decisions are based on a consideration of all the relevant factors, and that the data and reasoning supporting administrative decisions are entered into the public record (2). Others seek a more substantive role for the courts, pointing out that it is virtually impossible in practice to avoid scientific and technical issues, because courts have to acquire some understanding of the basis of agency decisions simply to evaluate the adequacy of the un-

Summary. Resolution of technological controversies occupies an increasingly important position in the judicial arena. It is widely believed that traditional processes of adjudication are no longer capable of handling many of the disputes engendered by a complex technological society. This article examines recent litigation based on disputes over science and technology, the burdens on the adjudicatory process, and some proposed reforms. It is argued that such proposals frequently misconceive the problems faced by the courts because they concentrate on the question of technical uncertainty rather than the conceptual and policy issues at stake.

derlying administrative procedures (3). Lawyers and scientists subscribing to this view have put forward a variety of proposals designed to increase the scientific competence of judicial decision-makers and provide better technical input into the judicial process.

In this article we consider some recent litigation in an effort to understand why controversies with a large scientific or technical component seem to place an unusual burden on the adjudicatory process. These controversies fall into two major classes: (i) those in which ethical issues have been raised by scientific advances, particularly in the biological sciences, and (ii) those involving societal risks and perceived deficiencies in the government's effort to mitigate these risks through regulatory action. In part, the problems encountered by the courts stem from the scale and complexity of

the issues involved. A "good" decision is hard to reach without evaluating trade-offs whose ultimate consequences the courts are ill-equipped to consider in the framework of a conventional adjudicatory proceeding. The high level of uncertainty involved in the regulation of scientific and technological developments compounds the difficulty. Disagreements exist about the magnitude of risk, the appropriateness of measuring techniques, and the reliability of data. Because of its great visibility, the problem of technical uncertainty has become the main focus of proposals intended to mitigate the difficulty of adjudicating scientific and technical disputes. We have examined some of these proposed reforms and conclude that they frequently concentrate on the question of technical uncertainty to the exclusion of the conceptual and policy issues at stake.

Scientific Disputes That Strain the Adjudicatory Process

Theoretical and technical advances, especially in the biological sciences, have made possible clinical applications and research procedures that are controversial on religious or moral grounds.

Activities such as fetal research, in vitro fertilization, resuscitation of terminally ill patients, and the creation of living microorganisms through recombinant DNA techniques are perceived by some as having the potential to change the "normal" state of nature, alter the genetic structure of man, threaten cherished values, or even violate natural law. Opposition frequently crystallizes around particular applications of such research as attempts are made case-by-case to define limits through administra-

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tive appeals and, increasingly, through litigation. Opponents of particular applications seek judicial support for their moral or religious positions by invoking the traditional power of the courts to prevent or compensate for injurious activity.

In this kind of litigation the conflicting values that underlie a dispute are often masked by scientific issues, and the dynamics of adversary litigation seldom permit a separation or clear identification of the values at stake. This is what happened, for example, in the Del Zio case, in which a plaintiff sued Columbia University, Presbyterian Hospital, and the chairman of Columbia's department of obstetrics for refusing her permission to undergo a voluntary in vitro fertilization procedure. During the trial, the qualifications and scientific credentials of doctors who had agreed to perform the procedure became the subject of debate. Attention was focused not only on their past performance as researchers but also on particular technical decisions, such as the use of temperature charts to determine the time of ovulation and of test tubes rather than petri dishes for fertilization. Relatively little attention was paid to what some have seen as the basic issue in the case: the conflict between Mrs. Del Zio's desire to have a baby, even with the aid of controversial scientific techniques, and Columbia University's prior agreement with the federal government not to permit human experimentation without adequate review (4). The litigation reduced the ethical issues involved in in vitro fertilization to a debate about what constitutes competent clinical work. This is ironic in view of the fact that adjudication is probably far better suited to weighing competing values and interests than to settling disputes among scientific experts.

A similar blurring of scientific, social, and moral concerns is evident in many of the "right to die" cases that are making their way into the courts. That courts have a legitimate role to play in this area is apparent from a careful reading of the Massachusetts Supreme Judicial Court's decision in the case of the *Superintendent of Belchertown State School v. Saikewicz* (5). Here, the plaintiff was a 67-year-old, severely retarded man suffering from a fatal form of leukemia. The issue before the court was whether life-prolonging treatment should be administered to Saikewicz. Chemotherapy, the treatment routinely available to and accepted by most competent persons with the same disease, could have led to a remission lasting up to 13 months. The judges decided, after balancing the factors for and against treatment, that the

plaintiff, acting through his guardian ad litem, could properly refuse such procedures. The central question in the case concerned the extent of an incompetent person's right to refuse life-prolonging treatment, taking into consideration the state's countervailing interest in preserving human life by any available means. Whatever one thinks of the particular balance struck by the court, it must be recognized that the weighing of competing interests carried out in this case constituted an appropriate functioning of the adjudicatory process.

Most "right to die" cases that reach the courts present considerably less clear-cut issues for adjudication. Typically, these cases arise when physicians refuse to discontinue treatment of terminally ill patients until they are assured by a court of law that the decision may be taken without fear of prosecution. Judicial approval is sought even though both the doctors and the patients' representatives agree from the outset that further treatment would be futile. One result is that the courts are converted into forums where litigants seek to establish the meaning of death in scientific terms. Moreover, it has been argued that resort to the courts in these cases is socially destructive, because court-ordered immunity from prosecution in effect permits the medical profession to escape the responsibility it should assume in making life or death decisions (6).

No doubt the existence of legally valid definitions of life and death would make such decisions considerably less painful for doctors and for the families of patients, but it is questionable whether litigation is an appropriate avenue for establishing such definitions. For one thing, it would be unreasonable to expect sporadic litigation to aid the development of generally recognized biological criteria for defining concepts such as brain death. A scientific consensus could only be reached if the medical community worked actively toward establishing such criteria and ratified them through consistent professional practice. There is every indication that the courts would respect the results of such an effort and would not compel treatment beyond a point where responsible medical opinion would declare the use of life-prolonging techniques to be useless (6). However, until a consensus exists, it is perhaps inevitable that a certain number of life-termination decisions will be challenged in the courts. In the meantime, by seeking protection against the threat of lawsuits, doctors may actually delay the attainment of a scientific consensus.

With respect to the ethical issues, although moral, social, or religious scrup-

les may underlie the positions adopted by parties to a lawsuit, the technical rules of litigation virtually ensure that these will not themselves become the subject of courtroom debate. Most "right to die" cases essentially ignore the social or religious aspects of dying and focus instead on the technical definitions of death. In the Del Zio case, the social and ethical questions related to in vitro fertilization did not surface during litigation. Similarly, in the recent controversy over the patentability of living microorganisms, legal arguments have necessarily focused on the intended coverage of the patent laws and the distinction between an invention and a living organism, not on the morality of extending the concept of proprietary rights to the creation and commercial use of new life forms (7).

Technological developments in areas outside the biological sciences do not directly interfere with the processes of life and death, but frequently pose risks to human health, safety, and welfare that generate controversies. Environmental groups and individuals have increasingly turned to litigation to prevent or minimize such risks, but for a variety of reasons this type of litigation strains the adjudicatory process almost to the breaking point.

To begin with, such cases give rise to problems that have little to do with their scientific or technical dimensions. Courts are confronted with voluminous records and lengthy procedural wranglings, just as they are in large antitrust cases or other litigation involving major corporate entities and multiple parties. The special flavor of recent technology-related litigation, however, derives from its unique policy context. Government regulation of major technologies has to take into account a conflicting array of scientific, social, and economic considerations and of public and private interests. The trade-offs considered in the course of regulation are so complex that industry, private citizens, and special interest groups all find ample opportunity to raise questions about the scientific or technical validity and procedural fairness of individual decisions, as well as the underlying social values they seem to represent. Litigation growing out of this context takes many forms. Exposure limits for particular toxic substances, siting decisions and the environmental impact statements they are based on, methodologies such as cost-benefit analysis used to evaluate trade-offs, are all subject to challenge in the courts. And when technological failures occur, as at Love Canal or Three Mile Island, numerous and varied claims are filed against

public and private entities by persons seeking compensation.

In the American legal system, basic rules of adjudication, such as those for determining standing or for assigning liability, have largely evolved out of a framework of two-party litigation. These procedures tend to break down in modern technology-related litigation, where the complexity of the issues makes it difficult to determine precisely who those affected are, how they have been injured, and by what agency. Liability is hard to apportion because of the confusion of public and private responsibility in the management of large technological enterprises. In the welter of facts, assumptions, and values represented in such litigation, it is almost impossible for judges to perform the painstaking analysis and balancing of conflicting values appropriate to the adjudicatory process.

The conceptual difficulties created for the courts by scientific and technical controversies are mirrored in the novel legal theories developed by the plaintiffs. For example, demonstrators at nuclear power plant sites have attempted to defend themselves against trespass charges by resurrecting the old "lesser of two evils" doctrine. In the course of judicial proceedings they have argued, with occasional success, that the crime of trespassing is less evil than the dangers of nuclear power and that trespassing is therefore justified as a means of dramatizing the greater evil. By invoking such a defense, litigants seek to ensure that some discussion of values will be injected into an otherwise routine proceeding for dealing with a minor infraction of the law. In another example, opposition to the use of nuclear energy resulted in nothing less than a "lawsuit to end atomic power." In *Honicker v. Hendrie*, the plaintiff's lawyers prepared a brief arguing that the harmful effects of ionizing radiation justify closing down all nuclear fuel cycle operations immediately (8). Legal support for this position was derived from an array of national and international sources of law: principles adopted during the Nuremberg trials, covenants of the United Nations, provisions of the U.S. Constitution. As a social manifesto, and even as an indictment of nuclear power, the resulting document makes fascinating reading, but one does not have to engage in sophisticated legal reasoning to see why it could not carry the day in court. In its audacious reliance on litigation to effect large-scale social change, the *Honicker* case drastically, and perhaps intentionally, overstepped the dividing line between adjudication and policy-making. Not unexpectedly, the Supreme Court rejected *Honicker's*

petition against the Nuclear Regulatory Commission without comment, reaffirming its earlier, constitutionally based judgment that a policy decision concerning nuclear power must ultimately be left to Congress and the states.

Evidentiary Problems

The strains created by litigants wishing to compel policy formulation through the adjudicatory process are compounded by the uncertainty that pervades scientific and technological controversies. Efforts by the government to prevent or reduce harm from scientific and technological activities require decisions to be made at the frontiers of scientific knowledge, often on the basis of incomplete evidence. Challenges to these decisions bring into the courts disputes concerning the quality and interpretation of data that cannot be resolved definitively on the basis of current scientific knowledge. Examples of such questions abound: What is a "safe" standard for human exposure to low-level radiation? How can data from animal toxicity tests be extrapolated to human beings? How does noise affect human health and well-being?

Although issues like these are frequently raised in litigation, it is important to recognize that courts reviewing administrative decisions dealing with such questions are not themselves in the business of coming up with the "right" answer. It is not the correctness of the decision that is at issue, but the substantive and procedural adequacy of the record that supports it. The major function of the court is thus to ensure that the decision-making body, usually a federal regulatory agency, has not engaged in "arbitrary and capricious" action (9) and that due process has been afforded to all parties.

Basic authority to develop a scientific record and to make the necessary factual determinations in such cases is lodged in the administrative agency, which has at its disposal powerful procedures for generating evidence. As Judge Bazelon commented in reviewing the Atomic Energy Commission's rule-making process on nuclear waste disposal (10):

Many procedural devices for creating a genuine dialogue on these issues were available to the agency—including informal conferences between intervenors and staff, document discovery, interrogatories, technical advisory committees comprised of outside experts with differing perspectives, limited cross-examination, funding independent research by intervenors, detailed annotation of technical reports, surveys of existing literature, memoranda explaining methodology.

The role of the court is not to dictate the choice of particular procedures, but to make sure that the agency uses all the means at its disposal to generate a full record of relevant facts in support of its regulatory decision. Although it may often be difficult for the courts to determine what facts are most relevant and whether a "genuine dialogue" has been created by the agency, it seems clear that the reviewing court does not need independent access to the same fact-finding mechanisms that are available to the agency.

Too great an emphasis on the uncertainty of technological impacts can lead both scientists and regulators to recommend inaction, pending the development of better evidence of risk and causation. But decisions to protect human health and welfare need not invariably depend on scientific proof of harm. It is possible to obtain relief at common law from odors, noise, and other nuisances even when their effects on health or well-being are not scientifically well understood. The California Supreme Court recognized this last year in upholding an award of damages for distress caused by airport noise. Compensation was approved for "a sense or feeling of annoyance, strain, worry, anger, frustration, nervousness, fear, and irritability" produced in neighbors of the airport (11). By refusing to insist on medical evidence that exposure to noise causes ill health, the court confirmed that, at least in cases involving demonstrable harm from technological enterprises, a scientific rationale does not have to be provided to justify relief. In this case, judicial power was exercised to prevent an adjudicable conflict over values from being converted into a scientific dilemma.

However, the element of technical and scientific uncertainty often seems to encourage litigants to translate questions of social value into a technical discourse. It is assumed that the resolution of uncertainty will automatically clarify social choices and resolve value conflicts related to scientific and technological advances. Thus recommendations for improving the adjudication of scientific or technical disputes focus more and more on the technical competence of the courts.

Some Proposed Reforms

The courts face a diversity of problems as they are drawn into the resolution of problems related to scientific and technological advances. Technical uncertainty, a diversity of regulatory policies, and a complex array of social,

moral, and religious questions complicate the judicial resolution of such disputes. Yet almost all recent proposals for judicial reform are narrowly directed toward improving the scientific literacy of lawyers and judges and clarifying technical information used as a basis for judicial decisions.

Proposals to enhance the technical competence of the courts range from those suggesting basic changes in the adjudicatory process to those calling for the introduction of scientific advisory and training programs. It has been argued that the structure of litigation should be changed to recognize the crucial role of expertise; that because technical knowledge is necessary to evaluate risks and technical causation, interaction between lawyers and experts should take place at every stage in the process of litigation. The authors of one proposal for reform, in the area of product liability, seek a "seriated" trial format in which the question of technical causation would be debated before any claim for damages is considered. This would allow the theory of liability to develop consistently with an "expert" evaluation of the technical data; the intention is to make the litigation process "more responsive to technological realities" (12).

In another call for structural change, Judge Leventhal proposed setting up a cadre of scientific experts who would act as aides to appellate judges, helping them to understand problems of scientific methodology and to assess substantive data (13). More extreme reformers would establish a system of special courts equipped to deal with technical matters and run by expert judges able to deal with questions of statistical reliability and the performance of complex technologies (14).

Other suggestions for improving the ability of the courts to deal with technical information include the appointment of science advisers and special masters or changes in the training of lawyers, judges, and their clerks. Special masters or science advisers would be set up in ad hoc positions, depending on the need for special expertise. One proposal would extend a system now used in the Court of Customs and Patent Appeals to all the federal courts, buttressing them with a staff of technical advisers trained in both science and the law (15). In effect, all these recommendations would equip the courts with sufficient expertise to consider scientific and technical claims more intelligently.

Such attempts to improve the competence of the courts, however, do not confront a common problem, namely,

that the technical evidence presented for consideration is often inadequate, confused, and controversial. Accordingly, proposals have also been developed for clarifying technical issues and scientific arguments before they enter the courts. Their object is to create a scientifically sound basis for decisions, to develop criteria by which to assess the adequacy and competence of information, and to arrive at a consensus on controversial technical questions that represents the best judgment of the scientific community.

The science court, a well-publicized proposal for dealing with technical disputes, was intended as an adversary forum in which scientists with different views on controversial issues would argue in structured debates before unbiased scientific judges. Debate would be limited to questions of fact: judges would give opinions only on factual matters, leaving social value questions for the political or traditional legal arena. It was assumed, however, that the opinions of these judges would be authoritative enough to provide a basis for adjudicatory decisions. Indeed, proponents of the science court claimed that this procedure would make it possible "to find truth among the conflicting claims made by sophisticated advocates when there is serious controversy within the technological community" (16). Similar beliefs have generated calls for a "technological magistrature" and for a new profession of "certified public scientists" who would make independent technical evaluations of scientific disputes (17).

Alternatively, legal scholars have proposed a systematic use of scientific bodies, such as the National Academy of Sciences, to resolve controversial technical questions. Their scientific findings and risk assessments would serve as a basis for judicial decisions.

A somewhat different approach, but one also intended to improve the technical information available to the courts, seeks to accommodate technical uncertainty rather than resolve it. Advocates of this approach stress that uncertainty requires open ventilation of the differences in expert opinion. For example, the decision in *Calvert Cliffs' Coordinating Committee, Inc. v. United States Atomic Energy Commission* pointed out that poorly financed intervenors may lack the wherewithal to marshal technical evidence and thus be at a disadvantage in administrative proceedings and in the courts (18). The problem could be ameliorated by distributing resources so as to allow all sides to air their concerns and to present expert data in support of

their positions. Measures for promoting this include the funding of technical intervenors and the distribution of scientific resources to citizen groups.

Analysis

Are such reforms likely to resolve the problem of judicial competence? Will they enhance the ability of the courts to deal with the characteristics of science and technology that have strained the adjudicatory process? Although the proposals described above would certainly improve the technical competence of the courts, we believe that they hold little promise of solving the more basic problems involved in scientific and technological litigation.

We have suggested that advances in science and technology, especially in the biological sciences, have created new conceptual problems that cannot be resolved by analogy to existing legal precedents. Proposals to enhance technical competence do not confront these new problems. Furthermore, proposals that seek to develop factual justification for ethical decisions often represent an extension of scientific rationality to inappropriate areas. In an effort to provide legitimacy for judicial decisions, scientific data are used to resolve questions that have little to do with science at all. Questions of aesthetics, of human dignity, and of religious belief underlie many allegedly scientific disputes. Practices such as involuntary sterilization or fetal research threaten what Tribe (19) has called "fragile values"—values that are nonquantifiable, intangible, resistant to categorization. The empirical or logical deductive methods of science have little to do with such issues and may even "squeeze out" important values by subjecting them to precise definition. In such cases, using science to resolve disputes will not satisfy the parties involved.

Some proposals also seem to ignore the fact that the technical uncertainty underlying many disputes is genuine; in many cases the evidentiary basis for definitive resolution simply does not exist. In these cases, scientists operate less as neutral parties than as advocates, providing evidence on both sides of technical disputes. Proposals that enhance the role of scientists in adjudicatory procedures may bring areas of technical disagreement into sharper focus, but will not necessarily lead to resolution.

The use of expert forums in settling legal disputes can be questioned from still another perspective. The belief that

scientific expertise is inherently removed from value considerations and that scientists are therefore political celibates is an anachronistic and even dangerous one. Expert forums may limit the role of dissent by giving a dominant place to establishment views on controversial topics. Such consensus-building procedures may also perpetuate misconceptions about the relation between facts and values in controversial areas where questions of value are difficult to distinguish from questions of fact. Furthermore, the need for urgent action in controversial areas may lead to undue reliance on expert opinion. When policymakers and the courts need quick answers, tentative scientific judgments may be treated as definitive conclusions and the qualifications intended by scientists may be lost (20).

In the end, proposals to bolster judicial competence in technical areas fall short, for the problems faced by the courts in dealing with controversies in these areas cannot be attributed simply to lack of judicial expertise. They also reflect the failure of the policy process to recognize fully the public and multifaceted character of modern scientific and technological development. In the ab-

sence of controlling policy principles, broad questions that follow from scientific and technological activities will continue to reach the courts in the artificial guise of two-party adversarial litigation. Equipping the courts with scientific and technical support may facilitate the adjudication of these issues; however, it may also divert attention from the public responsibility for major policy decisions and encourage the conversion of moral and political questions into technical debates among experts. As our strongest institution for defending fragile values, the courts should guard against such overextension of scientific expertise. However, the fundamental choices involved are not simply matters to be resolved by adjudication; they call for setting priorities and evaluating the public will, clearly a political, not a judicial, role.

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