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The Uneasy Relationship Between Science and Law: An Essay and Introduction

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A Cross-Disciplinary Look at Scientific Truth: What's the Law to Do?

THE UNEASY RELATIONSHIP BETWEEN SCIENCE AND LAW: AN ESSAY AND INTRODUCTION

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It would seem to be a match made in heaven. Trials attempt to seek the truth about contested events. Science attempts to seek the truth about observable phenomena. When the events that are the subject of legal disputes can be determined, at least in part, by virtue of scientific discovery, we might expect the law to embrace science as a means for ensuring that legal procedures get it right. Richard Katskee, an attorney who, on behalf of Americans United for Separation of Church and State, successfully challenged the inclusion of intelligent design in the biology curriculum of a Pennsylvania school district,[1] puts it this way:

> Scientific evidence has special value in legal proceedings because science confers intersubjective validity that other categories of truth-claims often lack. It offers factfinders and concerned observers a common yardstick against which to measure the validity and explanatory power of proffered evidence. So opinions grounded in science carry their own tests for reliability and usefulness, thus inspiring special confidence in judgments based on them. And by fostering greater public trust in legal rulings, judgments premised on scientific evidence reinforce the legal system's ability to resolve

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[1] *See* Kitzmiller v. Dover Area Sch. Dist., 400 F. Supp. 2d 707, 708, 765-66 (M.D. Pa. 2005).

> disputes that might otherwise threaten a peaceful, well-ordered society.[2]

He later elaborates:

> A conclusion based on evidence derived from research properly employing the scientific method inspires confidence because everyone can evaluate it using common and relatively easily applied criteria (namely, those that a scientific discipline sets for itself to test and potentially falsify hypotheses). And hence, there is never any need to take it on faith that an opinion or assertion is reliable.[3]

Yet science and law do not enjoy such a comfortable relationship, and the tension is nothing new. The replacement in the eighteenth century of court-appointed scientific experts by experts called to testify by parties within the adversarial system, combined with changes in the nature of scientific inquiry and the proliferation of legal cases that raise questions of science and technology, have led to shifting roles for scientists in the courtroom. In his insightful essay, "Revisiting the History of Scientific Expert Testimony," historian Tal Golan introduces many of these developments, and the legal system's reactions to them.[4] If anything, things are better now than they have been. Golan concludes:

> Far from being a late twentieth-century pathology, the putative problem of scientific expert testimony has been chronic for over two centuries. Moreover, during the twentieth century, the courts were able to take advantage of the professionalization of science and the standardization of the market of expertise and actually improved their ability to control the performance of science in the courtroom.[5]

In recent years, as the Supreme Court has formulated a new test for the admissibility of expert testimony to be administered by the trial judge as the "gatekeeper,"[6] the legal system has been experiencing difficulty in determining just how it

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[2] Richard B. Katskee, *Science, Intersubjective Validity, and Judicial Legitimacy*, 73 BROOK. L. REV. 857, 858 (2008) (this volume).

[3] *Id.* at 869.

[4] Tal Golan, *Revisiting the History of Scientific Expert Testimony*, 73 BROOK. L. REV. 879 (2008) (this volume).

[5] *Id.* at 881.

[6] The cases doing so are often referred to as the *"Daubert* trilogy." *See* Daubert v. Merrill Dow Pharm., 509 U.S. 579 (1993); Gen. Elec. v. Joiner, 522 U.S. 136 (1997); and Kumho Tire Co. Ltd. v. Carmichael, 526 U.S. 137 (1999). For discussion, see Margaret A. Berger, *The Supreme Court's Trilogy on the Admissibility of Expert Testimony*, *in* FEDERAL JUDICIAL CENTER, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 9-38 (2d ed. 2000).

should properly control this performance. It is in that context that we explore the question of truth in science and law.

The successful employment of science in the courtroom is most likely to happen when natural phenomena upon which the scientific community has reached consensus just happen to be in dispute in a legal case. For example, scientists might be able to assist the legal system in determining whether a particular toxin was emitted by a factory by scraping the factory's smokestacks and analyzing the residue using well-accepted methods for the detection of chemical substances. When the scientific evidence relevant to a legal dispute is a matter of observable phenomena that have been studied and recorded scientifically, it is easy enough for the legal system to absorb this knowledge into its factfinding mission.

But both sides are likely to disappoint each other. The problems are most salient when scientists are called upon to offer opinions on causation. Although the title of this symposium contains the word "truth" and does not contain the word "causation," it should be no surprise that many of the articles herein deal directly with the question of causation. Using as an example the well-accepted hypothesis that a particular virus causes a certain cancer, epidemiologist Douglas Weed explains why causation is such a problem for the legal system:

> [T]he causal claim itself—that this type of virus caused that sort of cancer—does not have this same sort of connection back to some unique event that can be documented, verified, and directly observed. The causal claim is a scientific hypothesis and we cannot ever know if it is true in the same sense as the existence of the virus, the cancer, and its author. The hypothesis can be well supported or not by the available evidence. It can be more or less certain, more or less proven, but it cannot ever be true. The reason is remarkably straightforward. Causation cannot be seen. Causation cannot be proven. And the evidence for causation always underdetermines our capacity to choose between the causal hypothesis of interest and its various alternatives.[7]

The problem that underlies the indeterminacy of causation, philosopher Richard Scheines explains,[8] is that determining causation necessarily requires that we think counterfactually, and drawing inferences from what has never occurred can be a tricky business. If we want to know whether

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[7] Douglas L. Weed, *Truth, Epidemiology, and General Causation*, 73 BROOK. L. REV. 943, 949 (2008) (this volume).

[8] Richard Scheines, *Causation, Truth, and the Law*, 73 BROOK. L. REV. 959 (2008) (this volume).

the emission of a chemical by a factory has led to the increase in endocrine disease in the immediate area, solid proof of causation can come only from comparing the actual world in which a population has experienced an increase in the disease with an imaginary world in which the very same population has had precisely the same experiences except for exposure to the chemical. If the occurrence of disease does not increase in this possible world, then we can conclude that the chemical has caused the disease, since exposure to the chemical is the only difference between the real world and the possible world.[9]

Of course, such experimentation is impossible, both for ethical and practical reasons. As a result, we must compare the population with the increase in disease with itself before exposure to the chemical, or with other populations assumed to be similar in all relevant respects. At this stage, doubts arise: Doesn't this generation eat more fast food than earlier generations? Isn't the base rate of pollution different than it was in the past? Are there other respects in which either an earlier generation or a neighboring population are not really the same?

So scientists do the best they can to tell what they consider the most reasonable story given what they know. The business of science is to investigate the range of possible variables and to select those most likely to produce a correct diagnosis. Scientists seem to be comfortable with this degree of uncertainty and with their quest for more certainty. They have chosen to make their livings that way. Susan Haack, in her essay, "Of Truth, in Science and Law," puts it this way:

> Whether or not they articulate it explicitly, most serious scientists have a firm-enough grasp of the complexities of evidence; this is why, wary of claiming to have found the truth, they prefer to say, "this seems like a promising idea," "this model seems to fit what we know so far," "probably the value of c is approximately n," "perhaps the explanation might be this," "possibly, it's this way," and such.[10]

But these scientists are not as certain as the lawyers would like them to be. Although there are many scientific truths accepted in both the scientific and lay communities, much of contemporary science involves researchers hypothesizing about

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[9] Philosophers use the expression "possible worlds" to describe this process. *See* DAVID LEWIS, COUNTERFACTUALS 84-90 (1973). Professor Scheines' essay incorporates this terminology.

[10] Susan Haack, *Of Truth, in Science and in Law*, 73 BROOK. L. REV. 985, 996 (2008) (this volume).

natural phenomena and offering tentative explanations that become the subject of further research, which results in both refinements and broad challenges. Moreover, there is often legitimate disagreement among scientists about the mechanisms that cause disease.

What should courts do when the proof of causation involves calculations demonstrating that the alleged offending substance could have caused an increase in illness, that the best account is that it *did* cause the increase in illness, but that the scientist, in all candor, can only make an educated guess? Permitting such proof may result in shifting the costs of illness to a defendant corporation that, the scientific community willingly admits, might not have caused the illness. Barring such proof, however, will almost certainly result in a grant of summary judgment in favor of the defendant for lack of proof of causation. As a result, there is no recovery for seriously ill or injured people whose plights, scientists believe, were caused by the defendant, but which they cannot prove to the judicial system's satisfaction.

Often enough, the legal system's answer to this question is that the evidence should be excluded,[11] In many of these cases, plaintiffs fail to establish general causation, never mind specific causation. *Daubert* was such a case,[12] although in that case, the weight of scientific opinion on the question at hand—whether Bendectin caused birth defects in children, and in particular, whether it had caused birth defects in Mrs. Daubert's child—did not weigh in favor of the plaintiffs. One of us (Berger) has written critically of this regime, suggesting that when proof of causation would seem to fail because adequate research into the dangers of an alleged toxin has not been conducted, the plaintiff's burden to prove causation should be relaxed, placing the onus of learning about the safety of chemicals on the companies that manufacture them.[13]

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[11] *See, e.g.*, Rider v. Sandoz Pharms. Corp., 295 F.3d 1194, 1197-203 (11th Cir. 2002); Glastetter v. Novartis Pharms. Corp., 252 F.3d 986, 988-92 (8th Cir. 2001); *In re* Meridia Prods. Liab. Litig., 328 F. Supp. 2d 791, 797-810 (N.D. Ohio 2004); Nelson v. Am. Home Prods. Corp., 92 F. Supp. 2d 954, 966-74 (W.D. Mo. 2000); Pick v. Am. Med. Sys., Inc., 958 F. Supp. 1151, 1164-78 (E.D. La. 1997); Kelley v. Am. Heyer-Schulte Corp., 957 F. Supp. 873, 877-84 (W.D. Tex. 1997); Grimes v. Hoffman-La Rouche, Inc., 907 F. Supp. 33, 37-39 (D. N.H. 1995); Wade-Greaux v. Whitehall Labs., Inc., 874 F. Supp. 1441, 1476-85 (D. V.I. 1994).

[12] Daubert v. Merrell Dow Pharm., Inc., 727 F. Supp. 570, 575-76 (S.D. Cal. 1989), *aff'd*, 43 F.3d 1311 (1995), *on remand from* 509 U.S. 579 (1993).

[13] Margaret A. Berger, *Eliminating General Causation: Notes Towards a New Theory of Justice and Toxic Torts*, 97 COLUM. L. REV. 2117 (1997).

Moreover, a closer look at the different goals of science and law can explain why judges appear to demand more of science than science demands of itself.[14] By convention, scientists assume that they have not proven a relationship (say, between ingestion of a drug and an increase in heart attack) if they cannot reject the hypothesis that there is no such relationship with ninety-five percent certainty. Even then, they recognize that confounding information might lead them to change their minds later. The legal system, in contrast, wants to know what happened. When a scientist testifies that she has not proven a particular relationship, a judge may not believe that he has any choice but to reject the scientist's opinion concerning the relationship. This has the effect of increasing the burden of proof in scientific cases from a preponderance of the evidence to near certainty.

The legal system's hostility to uncertainty brings with it some ironic results. Consider the following situation: rather than being in relative consensus, albeit without clear proof, the scientific community can often be in vigorous disagreement. Just as historians might argue about the relative importance of, say, the various events that led up to the American Civil War, scientists argue about the best explanations for natural phenomena. At any scientific conference, researchers will present papers that attempt to explain—better than the current literature—the phenomena that they have devoted their lives to investigating, which may include anything from crystal formation to the mechanisms that lead to various kinds of liver disease. The researchers will use methods that are, at least as a general matter, accepted as good science, but they will reach different conclusions. What is ironic is that the legal system is far more welcoming of dueling experts who reach opposite conclusions than it is of consensus without certainty.

As Jennifer Mnookin points out in her essay, "Expert Evidence, Partisanship, and Epistemic Competence,"[15] there are two dangers in this situation. The first is that experts working within the adversarial system are prone to become partisan. The second, which is somewhat in tension with the first, is that legal decision-makers, whether judges or jurors,

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[14] For fuller discussion, see Margaret A. Berger, *Upsetting the Balance Between Adverse Interests: The Impact of the Supreme Court's Trilogy on Expert Testimony in Toxic Tort Litigation* 64 LAW & CONTEMP. PROBS. 289 (2001).

[15] Jennifer L. Mnookin, *Expert Evidence, Partisanship, and Epistemic Competence*, 73 BROOK. L. REV. 1009 (2008) (this volume).

are not likely to have the knowledge or expertise to evaluate the relative scientific merits of the competing positions, a point echoed by Frank Keil's essay, "Getting to the Truth: Grounding Incomplete Knowledge."[16] Returning to the use of court-appointed experts cannot provide a satisfactory answer, Mnookin explains, in part because these neutral experts might still testify based upon flawed reasoning, and jurors and judges are no better at understanding the scientific explanations of a neutral expert than a partisan one.

In combination, these concerns present serious problems for a legal system bent on discovering the truth through adversarial proceedings. Mnookin puts it this way:

> What this means is that those experts who succeed in the marketplace for experts within our adversarial processes will often not be those with the most knowledge or actual expertise in a particular area, but rather those whom parties believe will succeed in persuading the factfinder. The confluence of adversarialism with the need for expert information also has permitted the creation of a class of "professional" expert witnesses, those for whom expert witnessing is no longer a sideline, a once-in-a-while add-on to their primary work as a physician, economist, epidemiologist, statistician, or whatnot, but rather is a significant, or even primary, source of income.[17]

The result is that parties attempt to put on the witness stand individuals who are charismatic and whose past experience will impress jurors (or judges) regardless of the relative merits. The lawyer's job is to win cases, and it would violate the duty of representing their clients vigorously to do otherwise.

An additional, complementary problem enters the picture: the legal system must maintain a healthy skepticism about claims of scientific rigor in order to shield itself from being duped by those who practice "junk science" or "pseudo-science." As Frank Keil points out in his essay, reinforcing Mnookin's concerns, people are not very good at recognizing the limits of their own understanding of complex systems: "Most people are quite inept at estimating how well they understand various everyday phenomena, showing a strong tendency to assume they understand how the world works in far more detail than they really do."[18] Thus, Keil observes, people may be susceptible, for example, to giving special credence to techno-

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[16] Frank C. Keil, *Getting to the Truth: Grounding Incomplete Knowledge*, 73 BROOK. L. REV. 1035 (2008) (this volume).

[17] Mnookin, *supra* note 15, at 1011-12.

[18] Keil, *supra* note 16, at 1038.

logical explanations using, say, fMRI information, assuming that they understand the process well enough to make a valid judgment. Sometimes such evidence can be important. But it can also create the illusion of scientific certainty. Dennis Patterson's essay provides an argument for a case in point:[19] recent theorists have claimed that our brains contain universal and innate moral judgments characterized as a set of rules that we follow unselfconsciously and, more or less, automatically.[20] By challenging the conceptual foundations of a set of claims receiving considerable attention in the legal academic literature, Patterson points out that our ability to judge the legitimacy of scientific claims is surely subject to question.

This is not to say that courts should hold science in low esteem, even the so-called "soft" sciences. David Faigman, in his essay, "Scientific Realism in Constitutional Law,"[21] points out that the Supreme Court routinely relies upon tacit theories of sociology and of folk psychology. Social scientists, in this context, may indeed have a role to play. Faigman illustrates his point with, among other examples, *Witherspoon v. Illinois*, in which the Court permitted prosecutors to exclude as jurors in the guilt phase of capital trials those who have moral scruples against capital punishment or who are opposed to the practice altogether.[22] The Court found that the data adduced by the defendant indicating a bias favoring guilt among a jury so selected was not worthy of consideration, but acknowledged that well-conducted studies might be relevant, at least in principle. However, once such studies were conducted by social scientists in response to the challenge in *Witherspoon*, the Court rejected the relevance of this sort of data altogether.[23] Faigman, whose work has been highly critical of the introduction of junk science into the courts,[24] nonetheless disagrees with

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[19] Dennis Patterson, *On the Conceptual and the Empirical: A Critique of John Mikhail's Cognitivism*, 73 BROOK. L. REV. 1053 (2008) (this volume).

[20] *See* John Mikhail, *Universal Moral Grammar: Theory, Evidence and the Future*, 11 TRENDS IN COGNITIVE SCI. 143 (2007).

[21] David L. Faigman, *Scientific Realism in Constitutional Law*, 73 BROOK. L. REV. 1067 (2008) (this volume).

[22] Witherspoon v. Illinois, 391 U.S. 510, 516-18 (1968).

[23] Lockhart v. McCree, 476 U.S. 162, 168-69, 171-72 (1986). The Court further endorsed a unitary jury deciding both the guilt and penalty phases of a capital trial, thus permitting prosecutors to reject potential jurors who are opposed to the death penalty to decide whether a defendant should be put to death. *Id.* at 182.

[24] *See, e.g.*, David L. Faigman et al., *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 (1994).

this position. While social science research may lack the crispness of the hard sciences, it can be conducted responsibly and should certainly not be ignored when its findings are relevant to the concerns of the legal system, even constitutional ones.

Sam Glucksberg's commentary begins, "Truth is hard to come by, even in optimal circumstances where the criteria are explicit and clear, and where it can be objectively established whether those criteria have been met (at least in principle)."[25] Courts are often confronted with circumstances that are not optimal. It is even more difficult to assess the reliability of a scientist's candid statement that there is a "best story" to tell, although it cannot yet be proven than it is to come by truth in Glucksberg's ideal situation. Nonetheless, the articles in this volume lead to an important conclusion: There is an important difference between junk science on the one hand and incomplete knowledge on the other. Junk science makes its way into the courtroom when experts offer opinions based merely on intuition, without evidence that their intuitions are any better than those of lay people. Michael Risinger, among others, has written about the historical admissibility of handwriting expertise as an example of this phenomenon, which similarly afflicts many other so-called forensic identification sciences.[26]

Junk science has no place in the legal system. But when a scientist says, "I'm not sure, but the data are suggestive," the scientist's words are not necessarily a tell-tale sign of junk science. On the contrary, it may be a sign that real science is occurring. The Supreme Court's *Daubert* trilogy appears to have allowed the continuation of junk science, while denying individuals their day in court when their proof includes real science at a state of incomplete knowledge.[27] The excellent essays in this volume tell us how this has come to happen. The solution, we believe, must lie in the legal system, judges and lawyers alike, recognizing what it means to be a gatekeeper with respect to scientific truth. And that, in turn, requires the legal system to come to understand just what it is that scientists do.

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[25] Sam Glucksberg, *The Discovery of Truth in Context: Comments on Faigman, Katskee, and Keil*, 73 BROOK. L. REV. 1103, 1103 (2008) (this volume).

[26] *See generally* D. Michael Risinger, *Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?*, 64 ALBANY L. REV. 99 (2000).

[27] *See id.* at 135-43 (discussing courts' willingness to accept expert identification testimony based on bite marks and handwriting without requiring proof that those fields are grounded in scientific research).