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Images of Expertise: Converging Discourses on the Use and Abuse of Science in Massachusetts v. EPA

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IMAGES OF EXPERTISE: CONVERGING DISCOURSES ON THE USE AND ABUSE OF SCIENCE IN *MASSACHUSETTS v. EPA*

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> While climate change is an interesting issue, it's not a legal issue . . . . The Supreme Court only takes a few limited cases every year, and this is just a vanilla exercise in statutory interpretation . . . .[1]
>
> The reality is, a case is not going to be about – shouldn't be about – science. If I was working for one side or the other in [*Massachusetts v. EPA*], I'd be concerned about presenting certain legal questions properly a lot more than I'd be worried about what science is before the Court.[2]

In October 1999, several organizations petitioned the Environmental Protection Agency (EPA) to regulate, under the Clean Air Act (CAA), carbon dioxide and other greenhouse gases from new motor vehicles.[3] In May 2001, as the public comment period on the rulemaking petition closed, President George W. Bush requested a National Research Council (NRC) review of the state of global warming science.[4] In June 2003, as the EPA continued to delay ruling on the 1999 petition, three state attorneys general sued

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1. *See* Craig Welch, *Seattle's Big Role in Fight on Global Warming*, SEATTLE TIMES, May 16, 2006, *available at* http://seattletimes.nwsource.com/html/localnews/2002996980_globalwarm16m.html (quoting Allison Wood) (suggesting U.S. Supreme Court would decline hearing *Massachusetts v. EPA*).

2. *See* Laura Fitzpatrick, *The Jury on Global Warming*, SEED, Aug. 3, 2006, *available at* http://www.seedmagazine.com/news/2006/08/the_jury_on_global_warming.php?page=all (quoting Jonathan Adler, Case Western University law professor) (expressing lack of concern regarding Court's potential engagement with science of global warming).

3. *See* Bradford C. Mank, *Standing and Global Warming: Is Injury to All Injury to None?*, 35 ENVTL. L. 1, 65 (2005) (claiming these emissions are significantly contributing to global climate change and EPA has duty to regulate them under CAA section 202(a)).

4. *See* Massachusetts v. EPA, 415 F.3d 50, 56 (D.C. Cir. 2005) (receiving nearly 50,000 comment submissions).

the EPA for failing in its duty to regulate carbon dioxide emissions.[5] Relying on the uncertainty (with respect to the causes of global warming) in the NRC report and concluding that carbon dioxide is not an "air pollutant" under the CAA, the EPA denied the 1999 petition on the basis that the EPA lacked authority to regulate vehicle emissions in September 2003.[6] In October 2003, Massachusetts, eleven other states, five governmental entities and fourteen environmental organizations filed separate petitions, now consolidated in *Massachusetts v. EPA*,[7] challenging the EPA's denial.[8] The U.S. Court of Appeals for the D.C. Circuit, having jurisdiction over challenges to final agency actions, ruled against the petitioners in April 2005,[9] and after a rehearing *en banc* was denied, the U.S. Supreme Court granted the petitioners review.[10]

Massachusetts v. EPA is significant for many reasons beyond the scope of this Article — the national debate over global warming and its divisiveness (eleven states supported the EPA's right not to regulate)[11] will heat up, the question of standing to sue will be addressed (and may preclude a decision on the merits),[12] and the dispute over whether the EPA should identify carbon dioxide as a pollutant under the CAA will be spotlighted in the popular press and in scholarly journals.[13] My own focus is on *Massachusetts v. EPA* as a point of convergence for numerous contemporary discourses concerning the intersection of law and science. Following a brief

5. *See* Massachusetts v. Whitman, No. 3:303CV984, (D. Conn. June 4, 2003); *see also* The Office of Massachusetts Attorney General, *Supreme Court To Hear Global Warming Case November 29; Massachusetts and Coalition of 11 Other States Led by AG Reilly Requested Court Review of Case Involving Regulation of Greenhouse Gas Pollutants, available at* http://www.ago.state.ma.us/sp.cfm?pageid=1234.

6. *See Control of Emissions from New Highway Vehicles and Engines*, 68 Fed. Reg. 52,922 (Sept. 8, 2003) (providing notice of denial of petition for rulemaking); *see also Massachusetts v. EPA*, 415 F.3d at 56-57; Mank, *supra* note 3, at 68-69 (attempting to resolve standing before proceeding to merits of case).

7. 415 F.3d 50 (D.C. Cir. 2005), *rehearing en banc, denied* (2005), *cert. granted* (2006) (writing for majority, Judge Randolph).

8. *See* Mank, *supra* note 3, at 8 (describing parties in suit).

9. *See generally* 415 F.3d. at 53 (finding section 307(b)(1) of Clean Air Act gives court exclusive jurisdiction over "nationally applicable regulations promulgated, or final action taken, by the Administrator").

10. *See generally* 126 S. Ct. 2960 (granting petition for writ of certiorari).

11. *See* Welch, *supra* note 1, at 3 (identifying mostly western and midwestern states).

12. *See Massachusetts v. EPA*, 415 F.3d 50, 54-55 (discussing issues of causation and redressability in standing); *see generally* Mank, *supra* note 3 (finding no link between harm to people directly from carbon dioxide emitted from cars).

13. *See generally* Janine Maney, *Carbon Dioxide Emissions, Climate Change, and the Clean Air Act: An Analysis of Whether Carbon Dioxide Should Be Listed as a Criteria Pollutant*, 13 N.Y.U. ENVTL. L.J. 298 (2005).

summary of the uncertainty with respect to the role of automobile emissions in global warming, as reflected in the 2001 NRC report, I identify and distinguish nine discourses or narratives that are relevant to and implicated in *Massachusetts v. EPA*. The discourses I identify overlap and run together to such a degree that they are often not distinguished or even noticed in the blur of popular and scholarly commentary on the place of science in law. All of them, nevertheless, will likely feed into that lawsuit and feed off of whatever happens to the suit in the U.S. Supreme Court.

I. UNCERTAINTY IN SCIENCE

> [P]olicy makers . . . frequently have to weigh tradeoffs and make decisions on important issues, despite the inevitable uncertainties in our scientific understanding concerning particular aspects [of global warming]. Science never has all the answers.[14]

The disagreement between Circuit Judges Randolph and Tatel in *Massachusetts v. EPA*[15] over the uncertainty surrounding the "causal linkage" between greenhouse gas emissions and global warming[16] confirms the interpretive instability of scientific reports. In deciding that the EPA Administrator properly exercised his discretion in declining to regulate greenhouse gas emissions from new motor vehicles,[17] Judge Randolph noted that in

> denying the rulemaking petition, EPA . . . decided to rely on the [National Research] Council's "objective and independent assessment of the relevant science."
>
> The National Research Council concluded that "a causal linkage" between greenhouse gas emissions and global warming "cannot be unequivocally established" . . . . "[T]here is considerable uncertainty in current understanding of how the climate system varies naturally and re-

14. *See* NATIONAL ACADEMY OF SCIENCES, CLIMATE CHANGE SCIENCE: AN ANALYSIS OF SOME KEY QUESTIONS (2001), at vii, *available at* http://books.nap.edu/openbook.php?record_id=101398page=R7.html (providing succinct and balanced overview of what science can currently say about potential for future climate change, while outlining uncertainties that remain in our scientific knowledge).

15. *See generally* 415 F.3d 50.

16. *See id.* at 57-58 (asking if proof of direct link is required).

17. *See id.* at 56 (finding even though EPA concluded it did not have statutory authority under CAA section 202(a)(1), court in *Massachusetts v. EPA* assumed *arguendo* that it did and addressed whether EPA properly declined to exercise authority).

> acts to emissions of greenhouse gases." This uncertainty is compounded by the possibility for error inherent in the assumptions necessary to predict future climate change.[18]

Although the petitioners claimed that the "EPA Administrator's refusal to regulate rested entirely on [an invocation of] scientific uncertainty," the court disagreed — "the Administrator relied on many 'policy' considerations that . . . warranted regulatory forbearance at this time," including risk assessment.[19]

Judge Tatel, in his dissent, read the NRC report differently. For Judge Tatel, Judge Randolph "seize[d] on" the uncertainty implied by the phrase "a causal linkage . . . cannot be unequivocally established" without attending to the context of that phrase:

> [T]his uncertainty . . . appears little more than an application of the principle that, as the NRC Report later puts it, "[c]onfidence limits and probabilistic information, with their basis, should always be considered as an integral part of the information that climate scientists provide to policy and decision makers." Indeed, the NRC Report goes on to state that the "fact that the magnitude of the observed warming is large compared to natural variability . . . is suggestive of such a linkage" . . . though not "proof" of it.[20]

While the scope of future global warming may be uncertain, Judge Tatel also doubted that the "EPA could credibly conclude that it needs more research to determine whether [greenhouse gas]-caused global warming 'may reasonably be anticipated to endanger' welfare."[21] In any event, reasonable anticipation of danger is the CAA standard to EPA determinations, not unequivocal proof.[22]

The Randolph-Tatel debate reveals two images of scientific expertise, each of which is characterized by representations of what

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18. *See id.* at 57 (quoting CLIMATE CHANGE SCIENCE, *supra* note 14, at 17) (stating EPA relied on NRC's assessment that there was no link between greenhouse gas emissions and global warming).

19. *See id.* at 58 (noting that EPA Administrator relied on these "policy" considerations in addition to scientific uncertainty about causal effects of greenhouse gases on future climate of earth).

20. *See Massachusetts v. EPA*, 415 F.3d at 63-64 (Tatel, J., dissenting) (noting that Judge Randolph erroneously depicts uncertainty as applying to global warming, in general, rather than to more recent warming trends) (citations omitted).

21. *See id.* at 77 (Tatel, J., dissenting) (noting that EPA's silence on this point is telling and looking at NRC Report as whole).

22. *See id.* (Tatel, J., dissenting) (stating that EPA may withhold endangerment finding only if it needs more information to determine whether statutory standard has been met).

scientists do and what the law can reasonably expect from science. The debate also echoes the charges: that the regulatory arena has been "*Daubert*-ized;" that science can be used and abused for political and economic reasons; that uncertainty can be manufactured to delay regulation; that the Bush administration strategically demands "sound science;" that science is misunderstood in law; and that scientific advice must be disinterested in order to (1) stop regulatory abuse of business or (2) stop businesses from delaying regulation. All of these charges, and the narratives that have supported and repeated them over the last ten years, converge in *Massachusetts v. EPA* and accompany the debate over regulation of greenhouse gases to slow global warming.

II. NINE CONVERGING DISCOURSES

A. Two Images of Scientific Expertise

Judicial review of agency action, as in *Massachusetts v. EPA*, occupies a point of connection between the images of science that prevail among judges and litigators, with respect to expert testimony, and the images of science that prevail in the regulatory arena among administrators and stakeholders, with respect to science advisors. Following *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (*Daubert*),[23] when commentators attempted to describe accurately the new regime for admissibility decisions, they were faced with some ambiguities — was *Daubert* more restrictive, i.e., was the standard represented by the "four factors" higher than in the past?[24] The text of *Daubert* included both an assurance that the new standard was generous toward admissibility *and* an emphasis on judicial gatekeeping to ensure credible expertise.[25] It was not until *Daubert* was applied in the years following the opinion, that the meaning of *Daubert* would become clearer. As it turns out, the meaning of *Daubert* varies in accordance with individual judges — some are generous, and some are restrictive — such that we can talk of the *meanings* of *Daubert*.

In an effort to understand the *Daubert* regime, Professor L.H. LaRue and I did a study of cases involving admissibility of experts in

23. 509 U.S. 579 (1993).

24. *See Massachusetts*, 415 F.3d. at 59-94 (holding so-called four factors for scientific validity include testability, low error rate, peer-reviewed publications and general acceptance).

25. *See* Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 587 (confirming liberal thrust of Federal Rules of Evidence); *see also id.* at 593 (confirming need for judicial assessment of scientific validity).

federal courts, focusing on appellate opinions in which a trial judge's admissibility decision (to adopt or reject an expert) was reversed on appeal. We summarized the results of that study in *No Magic Wand: The Idealization of Science in Law* (2006), wherein we identified two images of the scientific enterprise that were influential in assessing reliability of expertise: (1) some judges viewed science as a modest, pragmatic endeavor that is characterized by probabilistic conclusions, uncertainties, scientific disputes and a history of refutations, reversals and revisions and (2) other judges had a more romantic image of science as a producer of stable knowledge, characterized by rigorous methodology, consensus and certainty.

We went on to argue that the latter, idealized conception of science, leads judges into two different types of errors. First, judges who idealize science often become overly generous in admitting highly-credentialed experts on that ground alone, even if their testimony is otherwise flawed. Second, judges who idealize science, conversely, become overly restrictive and reject the testimony of (otherwise credible) experts who concede the uncertainties that are inevitable in science. We concluded that judges with modest, non-romantic images of science seem to make better admissibility decisions — they do not expect too much from science, and they understand that the inevitable, pragmatic features of all science do not take anything away from scientific utility and progress.

Because the science that is offered by expert witnesses is the same science used in policy debates and decisions, these two competing images of science recur throughout the other discourses discussed below. Indeed, most of the critical discourses identified in this Article rely in part on one of the two images of science. Moreover, the debate over the uncertainty in the NRC Report between Judges Randolph and Tatel reflects the tensions between these two views of science — with Judge Randolph idealizing science, and Judge Tatel having more modest expectations in terms of scientific certitude. For Judge Tatel, the NRC Report is typical of science and betrays the usual uncertainties.

Finally, both images of science co-exist in *Daubert* jurisprudence, and each can ground an evaluation of expertise, though the resulting admissibility decision based on a modest, pragmatic image of science may be the opposite of a decision based on an idealized image of science. But when policy scholars speak about the "*Daubert*-ization" of the regulatory arena, either to welcome that framework or to criticize the importation of courtroom standards

into policy debates, the reference is almost always to the idealized view of science in *Daubert* jurisprudence.

B. The *Daubert*-ization of Agency Review

The impact of *Daubert* on the regulatory arena is not immediately clear. On the one hand, the distinction between administrative action and the courtroom was recognized in amici curiae briefs on both sides of the *Daubert* Supreme Court appeal.[26] On the other hand, some believe that "the apparent importance of this distinction . . . has since declined if not evaporated."[27] To the extent that *Daubert* in practice resulted in higher, more restrictive standards for admissibility of expert testimony in trials, a parallel movement toward higher standards for science in the regulatory arena is arguably detectable. Some trace the origins of the regulatory sound science movement, as well as data quality legislation for federal agencies (both of which are discussed below), to the *Daubert* regime generally.[28]

A more specific concern is the prospect of incorporating a *Daubert* form of judicial review into administrative law, which Professor Thomas McGarity identifies as "a profoundly bad idea:"[29] "[J]udicial adoption of a regulatory *Daubert* approach will likely result in unconstrained regulatory policymaking by unaccountable and scientifically illiterate judges and a much higher incidence of judicial remands of important regulations."[30] McGarity calls the *Daubert* mandate, as refined by the obligation in *Joiner* for trial courts "to evaluate the scientific validity of an expert's conclusions as well as its basis, a "corpuscular approach" to admissibility. "Under this approach, [a party] must establish the relevance and reliability . . . of each individual study on which [the party's] expert

26. *See* Roni A. Neff & Lynn R. Goldman, *Regulatory Parallels to Daubert: Stakeholder Influence, "Sound Science," and the Delayed Adoption of Health-Protective Standards*, 95 AM. J. PUB. HEALTH, Supp. 1, S81, at S85 (citing Brief for the American Society of Law, Medicine and Ethics et al., as Amici Curiae Supporting Petitioners, *Daubert*, 509 U.S. 579 (1993) (No. 92-102), and Brief for Product Liability Advisory Council, Inc., et al., as Amici Curiae Supporting Respondent, *Daubert*, 509 U.S. 579 (1993) (No. 92-102)) (recognizing distinction between administrative action and courtroom).

27. *See* Neff, *supra* note 26, at S85 (noting that distinction between administrative action and courtroom action is not necessarily critical).

28. *See id.* (explaining that *Daubert* ruling was impetus for movement).

29. *See* Thomas O. McGarity, Daubert *and the Proper Role for Courts in Health, Safety, and Environmental Regulation*, 95 AM. J. PUB. HEALTH, Supp. 1, S92 (2005) (admonishing against use of *Daubert* review in administrative law matters).

30. *See id.* at 94 (explaining that *Daubert* review would be unacceptable in regulatory matters).

relies as well as the relevance and reliability of the expert's overall conclusions."[31] In a toxic tort case, this "invites defendants to focus on flaws in the corpuscles of data" rather than on overall reliability and prevents an expert from using "the cumulative weight-of-the-evidence approach that regulatory agencies universally employ in assessing the risks" of toxic substances.[32]

Daubert-like judicial review of risk assessment, McGarity points out, was resisted in the 1970s and 1980s.[33] In *Public Citizen Health Research Group v. Tyson*,[34] for example, the D.C. Court reviewing a United States Department of Labor, Occupational Safety and Health Administration (OSHA) rule rejected an industry trade association's attack on

> each piece of evidence [to suggest] that no individual piece proves a relationship between [ethylene oxide] exposure and various adverse health effects. This approach disregards the marginal contribution that each piece of evidence makes to the total picture . . . . OSHA need not "prove" its assertions in [that] manner . . . . Our function . . . is only to search for substantial evidence, not proof positive.[35]

Likewise, in *Ethyl Corp. v. EPA*,[36] the *en banc* D.C. Circuit rejected the petitioner's "apparent suggestion" that in its review of a decision to phase tetraethyl lead out of gasoline, the court should

> seek a single dispositive study that fully supports the Administrator's determination. Science does not work that way; nor, for that matter, does adjudicatory factfinding . . . . By its nature, scientific evidence is cumulative: the

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31. *See* Thomas O. McGarity, *Our Science is Sound Science and Their Science is Junk Science: Science-Based Strategies for Avoiding Accountability and Responsibility for Risk-Producing Products and Activities*, 52 KAN. L. REV. 897, 922 (citing Erica Beecher-Monas, *Blinded by Science: How Judges Avoid the Science in Scientific Evidence*, 71 TEMP. L. REV. 55, 57, 69 (1998)) (explaining that *Daubert* approach when used in regulatory matters focuses court not on reliability of evidence but rather on potential flaws in data, keeping otherwise good scientific evidence out).

32. *See* McGarity, *supra* note 29, at S95 (describing approach to determining admissibility of expert testimony in toxic tort cases).

33. *See id.* at S96 (describing courts' responses to *Daubert*-like judicial review of risk assessment).

34. 796 F.2d 1479 (D.C. Cir. 1986).

35. *See id.* (quoting Pub. Citizen Health Research Group v. Tyson, 796 F.2d 1479, 1495 (D.C. Cir. 1986)).

36. 541 F.2d 1 (D.C. Cir. 1976).

> more supporting albeit inconclusive, evidence available, the more likely the accuracy of the conclusion.[37]

Such judicial restraint is, for McGarity, sensible and "altogether appropriate" because (1) agencies attempting to answer in advance "every question raised by outside commentators in scrupulous detail" will be unable "to fulfill their congressionally delegated responsibilities;" (2) agency scientists already tend to view evidence as inadmissible or admissible, "'rather than taking a scientific approach to see what could be inferred from all of the available evidence;'" (3) judges "do not always have a good sense for what is relevant in complex rulemakings;" (4) judges "intent on reducing the federal government's role in business activities" will be able to make agencies more timid; (5) *Daubert*-izing judicial review will encourage industry to manufacture uncertainty; and (6) no scientific "study is perfect [and risk] assessments are necessarily tentative . . . ."[38]

Such recurring attention to the way science and scientists actually work (receptiveness to "scientific nuance" in McGarity's terminology),[39] rather than idealizing science as offering certainty or "proof positive," echoes the notion of two judicial views concerning the scientific enterprise – romantic versus modest. It is the latter, pragmatic conception of science and its products that many view as the target of a newly defined conservative assault on science.

C. The Political Rights' War on Science

> The strategies Mooney details [in *The Republican War on Science* (2005)] are not new, but they have been perfected by savvy political advisors who claim the rhetorical high ground ("sound science" versus "junk science"), exploit marginal uncertainty and induce "analysis paralysis" through seemingly endless demands for further studies.[40]

Chris Mooney's critique of the conservative's politicization of science, which even a sympathetic reviewer found "tedious," "self-

37. *See id.* (quoting Ethyl Corp. v. EPA, 541 F.2d 1, 37-38 (D.C. Cir. 1976) (en banc)).

38. *See id.* at S96-97. (quoting Mark. R. Powell, *Science at the EPA: Information in the Regulatory Process*, WASHINGTON, D.C.: RESOURCES FOR THE FUTURE (1999)).

39. *See* McGarity, *supra* note 29, at S96 (commenting on effects of *Daubert*-izing judicial review of administrative actions).

40. *See* Stuart W. Leslie, *A Journalist Looks at the Assault on Science by the Political Right*, CHI. TRIB., Nov. 13, 2005, sec. 14, at 6 (providing review of CHRIS MOONEY, THE REPUBLICAN WAR ON SCIENCE (2005)).

righteous" and "surprisingly bland" in its curative recommendations,[41] presents the debate over the reduction of greenhouse gases as an example of how right-wing politicians raise doubtful objections to scientific consensus (e.g., regarding global climate change models).[42] As he was writing that book, Mooney published an article on the Klamath River Basin controversy that exemplifies his concerns.[43] Although reports from the NRC (1995), the Ecological Society of America (1996) and the General Accounting Office (2003) concluded that actions taken pursuant to the Endangered Species Act (ESA) (including species listings and critical habitat legislations) were generally scientifically sound, the Bureau of Reclamation's massive cut-off of irrigation water in 2001, to save three species of fish during a drought in the Klamath River Basin, ignited a controversy over the validity of ESA science.[44] A NRC interim report in 2002 stated

> that the decision to maintain higher water levels on Upper Klamath Lake and higher Klamath River flow levels lacked a "sound scientific basis." The committee couldn't find a clear link between lake water levels or river flow and the welfare of the two species of suckers or the coho salmon.[45]

Much was made of the negative effects of the inadequacy of the Bureau of Reclamation's science, including calls for ESA reform, but some members of the committee thought their preliminary analysis had been misinterpreted; the final report in 2003

> explicitly repudiates the spin put out by some critics of the . . . actions in the Klamath . . . . [One committee member explained that while] there was "not sufficient evidence to support what the agency did . . . we never said that what they did was a bad decision."
>
> The distinction is crucial: In the face of scientific uncertainty and insufficient evidence, the agencies exercised

41. *See id.* (criticizing Mooney's recommendation to depoliticize science).

42. *See id.* (summarizing Mooney's arguments).

43. *See* Chris Mooney, *Sucker Punch: How Conservatives are Trying to Use a Conflict Over Obscure Fish to Gut the Science Behind the Endangered Species Act*, LEGAL AFFAIRS, May/June 2004, at 23-25 (describing controversies over Endangered Species Act).

44. *See id.* at 23-24 (explaining background of conflict concerning Klamath River Basin).

45. *See id.* at 25 (stating results of study assessing validity of controversial actions).

> their professional judgment about how best to protect endangered species.[46]

Demanding better science, Mooney argues, will not help the problem of "making decisions in the face of uncertainty" — it is merely "an excuse for inaction and not a scientific endeavor at all."[47]

Such criticism has been around since early in the Bush administration. President Bush almost immediately "insisted that policy decisions . . . be made on the basis of 'sound science.' But many scientists assert that his stance, while laudable on its face, is a pretext for delaying or junking scientific findings that do not support his policy priorities."[48] Pulling out of an international global warming treaty, postponing new standards for arsenic in drinking water, opposing fuel efficiency standards — all are signals for critics that President Bush "selectively use[d] studies to fit [his] political agenda and to justify its challenge to dozens of [Clinton-era] environmental rules."[49] One group of scientists boycotted an OSHA research symposium (to "review new findings relevant to reducing the incident of 'musculoskeletal disorders' . . . in the workplace") because it would "only revisit settled science," but several "business groups contend that the link between the injuries and workplace conditions remain unproven."[50] Similarly, a 2004 report published by the Union of Concerned Scientists (signed by sixty highly credentialed researchers) suggested, among other criticisms, that

> the administration's calls for additional research to clarify uncertainties about climate change served mainly to excuse not issuing mandatory regulations to cut emissions of greenhouse gases . . . . [The report noted that the EPA] removed a section on global change from one of its reports after administration officials suggested changes to emphasize the scientific uncertainties . . . .[51]

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46. *See id.* (describing impact of final report on ESA and agency's role in policies) (citations omitted).

47. *See id.* (listing issues which would remain despite meeting requirements in ESA).

48. *See* Jeffrey Brainard, *How Sound is Bush's 'Sound Science'?*, CHRON. HIGH. ED., Mar. 5, 2004, at A18 (describing criticism of "sound science" requirement).

49. *See* Eric Pianin, *Science Used as Tool for Politics – Bush Camp Accused of Making Studies Fit Agenda*, WASH. POST, May 5, 2002, at A21 (indicating increasingly controversial use of science policy by Bush administration).

50. *See* Brainard, *supra* note 48, at 18 (discussing usefulness of regulations concerning workplace conditions).

51. *See id.* (providing relevant results of independent scientific review of climate-research program).

Finally, two scientists criticized the administration's approval of the Nevada Yucca Mountain nuclear waste repository "in the face of the scientific uncertainties about the site."[52]

The latter controversy seems to present a reverse phenomenon — scientific critics are claiming uncertainty and the need for more research, while the administration is claiming settled science! For the critics, however, Yucca Mountain exemplifies the political instability of the term "sound science," which is selectively invoked "to protect business and industry from the costs and changes suggested by scientific findings."[53] Nevertheless, the Yucca Mountain controversy is an anomaly in the discourse concerning "sound science" because it is perhaps the administration that is recognizing the inevitable uncertainties of science and expressing a modest view of science. The usual connotation of "sound science" concerns an idealized view of science and the invocation of unreasonably high standards.

D. Demands for "Sound Science"

> There is broad agreement that regulatory decisions about the environment, safety, and health should be based on evidence. But pressures for ever-increasing documentation, review, and "sound science" have been used to create unreasonable standards of evidence, interfering with the government's task of protecting the public.[54]

Examples of "sound science" initiatives include not only increased demands for data quality and integrity (discussed below), but also preferences for empirical, field tested and peer-reviewed data in, for example, endangered species protection.

> This may seem innocuous, but scientists read the language as a stealthy attempt to ban one of the most reliable techniques they have for understanding the vulnerability of species: population modeling, which projects current data into the future and is thus neither exclusively empirical nor field-tested (though the initial data has to come from the field). "When they start [preferring field-testing and

52. *See* Pianin, *supra* note 49, at A21 (quoting Rodney Ewing and Alison MacFarlane, *Nuclear Waste: Yucca Mountain*, SCI. (April 2002)) (addressing debate about Yucca Mountain nuclear waste repository).

53. *See* Brainard, *supra* note 48, at 18 (articulating adversary opinion regarding president's motivation for insistence on additional research).

54. *See* Neff & Goldman, *supra* note 26, at S81 (noting delay in health-protective regulations due to demands for sound science).

> peer review,] that is a total misrepresentation of how science goes," said [biologist] Gordon Orians . . . "If you're going to say, 'we can't use models,' you might as well shut down the scientific enterprise. . . ."[55]

In another formulation, "sound science" is "shorthand for a narrow definition of what counts as scientific evidence," which definition might "rely on epidemiology . . . and . . . dismiss animal studies . . . ."[56] "[T]his narrow definition . . . leaves out vast areas of scientific knowledge and inquiry and many legitimate tools of investigation. Scientists themselves rely on animal studies, models, systematic field observation, and even causal observations . . . ."[57] The concern in the regulatory arena is that legitimate science can be excluded by stakeholders for whom it is inconvenient.

Demands for sound science appear in various regulatory contexts. In a proposed amendment to Tennessee's version of Medicaid (TennCare), which provides reimbursement for "medically necessary" services, medical procedures that are "experimental or investigational" would not qualify as necessary:[58]

> A medical item or service is experimental or investigational if there is inadequate empirically-based objective clinical scientific evidence of its safety and effectiveness for the particular use in question. This standard is not satisfied by a provider's subjective clinical judgment . . . or by a reasonable medical or clinical hypothesis based on an extrapolation from use in another setting or from use in diagnosing or treating another condition.[59]

The sound science requirement functions here as a strategy to avoid reimbursement for a vast array of conventional medical procedures.

Finally, the No Child Left Behind Act of 2001 is famous for its requirement that funding for educational research will be limited to "scientifically-based research," which is defined narrowly as re-

55. *See* Mooney, *supra* note 43, at 24 (quoting Gordon Orians, a biologist at the University of Washington in Seattle and chairman of National Academics of Sciences Board on Environmental Studies and Toxicology).

56. *See* Carolyn Raffensperger & Nancy Meyers, Science and Environmental Health Network, *Detox for Torts: How to Bring Justice Back to the Tort System – Part I*, THE NETWORKER, June 2003 (explaining meaning of "sound science").

57. *See id.* (highlighting misleading nature of "sound science" phrase).

58. *See* H.B. 3513, 104th Gen. Assem., 2nd Reg. Sess. (Tenn. 2005) (providing proposed amendment to Tenncare Demonstration Project).

59. *See id.* (clarifying TennCare will not provide payment for medical services that are experimental or investigational).

search that employs a quantitative methodological approach.[60] While many welcome the demand for "rigorous education science" to replace education research based on "fad, fancy, and personal bias,"[61] critics "see the conceptions of scientific educational research that have emerged as retrograde, aimed at reinstating experimental-quantitative methods, especially the randomized or "true" experiment, as the "gold standard" of educational science and, in the process, rendering qualitative methods auxiliary and epistemologically second-rate."[62] Margaret Eisenhart, for example, who finds the reinstatement of this "gold standard" exemplified in the No Child Left Behind Act, argues that "experimental methods are a powerful tool for addressing precisely defined causal questions but exist alongside other, equally legitimate research questions and methods of addressing them."[63] Thomas Schwandt likewise suggests that "experimental as well as fieldwork methods, qualitative as well as quantitative data, and narrative as well as statistical forms of analysis and reporting are important in understanding social reality."[64] Schwandt sees the hierarchical move toward quantitative preferences as an example of "the Bush administration's insertion of itself into various venues in order to spin, suppress, and manipulate the findings of scientific investigations on a variety of topics – all in the name of scientific integrity."[65]

E. Manufacturing Uncertainty

There is some dissonance between the discourse of *magnifying* uncertainty and the discourse of *manufacturing* uncertainty. After all, if uncertainty is a conventional aspect of normal science, then the abuse on the part of those who make unreasonable demands of science is in highlighting uncertainty as if it signals bad science. In that case, "we need a new conception of science, one based on coping with uncertainty rather than pretending to be achieving perfect certainty."[66] But David Michaels, in a move that parallels the cri-

60. *See* No Child Left Behind Act of 2001, 20 U.S.C. § 6301 (2006).

61. *See* Kenneth R. Howe, *The Education Science Question: A Symposium*, 55 EDUC. THEORY 235, 240 (2005) (discussing Thomas Schwandt's representation of position in support of "scientific" educational research of federal government's Institute of Education Sciences and What Works Clearinghouse).

62. *See id.* at 235 (discussing federal government's forceful insertion of itself into largely autonomous arena of research methodology).

63. *See id.* at 236 (discussing Eisenhart's views).

64. *See id.* at 240 (quoting Thomas Schwandt).

65. *See id.* at 241 (discussing Schwandt's views).

66. *See* JEROME RAVETZ, THE NO-NONSENSE GUIDE TO SCIENCE, 82 (2005) (suggesting new way of thinking about science).

tique of demands for sound science, has popularized the term "manufacturing uncertainty" to claim that "industry . . . has mastered the art of manufacturing uncertainty, of demanding often impossible proof over common-sense precaution in the realm of public health."[67] Michaels seems to use the term "manufacturing uncertainty" with reference to regulatory fields in which there is little uncertainty; therefore the uncertainty must be created.[68] His examples include (1) the tobacco industry, which in the face of "inexorable" science "conjured their own studies with questionable data and forgone conclusions" and (2) the campaign to start a debate over the OSHA standard for beryllium exposure, even though for "many years it has been clear that workers exposed to beryllium levels below the federal . . . standard can develop chronic beryllium disease."[69]

Other examples that fit the notion of creating uncertainty in the face of compelling evidence include the aspirin industry's demands for more proof before acknowledging the risk of Reye's syndrome[70] and employment of similar strategies by the lead, chemical and asbestos industries.[71] Indeed, according to David Michaels, it is now "rare for proposed regulations *not* to be challenged with claims that the scientific evidence is flawed or otherwise imperfect."[72] Moreover, manufactured uncertainty "has achieved a new level of official respectability in the Data Quality Act, which . . . allows parties subject to regulation to challenge every piece of evidence considered by regulators."[73]

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67. *See* David Michaels, *The Art of 'Manufacturing Uncertainty,'* L.A. TIMES, June 24, 2005, at B11 (explaining how uncertainty is easily manipulated).

68. *See id.* (discussing manufactured uncertainty).

69. *See id.* (naming fields where manufacturing uncertainty is created).

70. *See* David Michaels & Celeste Monforten, *Manufacturing Uncertainty: Contested Science and the Protection of the Public's Health and Environment*, 95 AM. J. PUB. HEALTH, Supp. 1, S39 (2005) (discussing proof before acknowledging risk of Reye's syndrome). "Although . . . four studies were enough for the [Centers for Disease Control] to issue warnings, the industry raised 17 specific 'flaws' in the studies and insisted that more reliable studies were needed to establish a causal association between aspirin and Reye's syndrome." *Id.*

71. *See id.* at S41 (listing instances where manufacturing uncertainty is created).

72. *See* David Michaels, *Scientific Evidence and Public Policy*, 95 AM. J. PUB. HEALTH, Supp. 1, S5, S6 (2005) (emphasizing prevalence of uncertainty).

73. *See id.* (showing prevalence of manufactured uncertainty requiring scrutiny).

F. Information Quality and Scientific Peer Review

> The title and language of the [2001 Data Quality Act] suggest that the law is designed to improve the quality of data used by the government to make decisions . . . . [I]t is hard to oppose "data quality[,]" [but] critics of the law assert that the law is . . . designed . . . to transform the government's policies by changing the information upon which the government can rely to make decisions.[74]

Critics of the Data Quality Act (the Act) point out that this new "tool in the arsenal" of those who oppose or want to delay health regulations was "slipped into" an appropriation bill and "sandwiched between" unrelated provisions without hearings or debate.[75] The Act requires the Office of Management and Budget (OMB) to issue guidelines providing "policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility and integrity of information . . . disseminated by federal agencies."[76] The OMB Guidelines issued in 2002 require relevant agencies to establish procedures to allow persons to seek corrections of information that is disseminated but does not meet the data quality standards.[77] Since the Act was passed, "businesses have frequently challenged precautionary decisions by government agencies by arguing that the data on which the agencies are relying to support their decisions does not meet the quality standards of the law."[78] In 2004, the OMB issued its "Final Information Quality Bulletin for Peer Review," setting standards for peer review of "scientific information the agency reasonably can determine will have or

74. *See* Stephen M. Johnson, *Junking the "Junk Science" Law: Reforming the Information Quality Act*, 58 ADMIN. L. REV. 37, 41 (2006) (discussing law ensuring accurate data used by government). The Data Quality Act (or Information Quality Act) was enacted as section 515 of the Treasury and Government Appropriations Act of 2001 (PL 106-54, H.R. 5658). The Office of Management and Budget (OMB), as directed by the Act, published final guidelines to implement section 515 in 66 Fed. Reg. 49718 (Sept. 28, 2001).

75. *See* Michaels & Monforton, *supra* note 70, at S44 (showing existence of skepticism).

76. *See* Information Quality Act of 2001, 114 Stat. 2763A-15-154 (Dec. 21, 2000), § 515(a) (providing guidelines ensuring accurate data).

77. *See* 67 Fed. Reg. 8452, 8459 (Feb. 22, 2002) (providing more stringent requirements).

78. *See* Johnson, *supra* note 74, at 42 (offering example of challenge, by Competitive Enterprise Institute, to National Assessment on Climate Change, report issued by National Oceanic and Atmospheric Administration (NOAA)). The NOAA report concluded that "global warming is likely to lead to temperature increases, increased flooding and drought, plant and animal migrations, and coastal erosion." *Id.*

does have a clear and substantial impact on important public policies or private sector decisions."[79] According to critics, this "formal peer review process is designed to delay rules and regulations that might affect business. It is designed to require science to prove harm beyond a shadow of a doubt before anything can be done by government to prevent it."[80] Because the OMB Guidelines "limit the information agencies use to justify environmental controls and . . . make it more difficult . . . to impose those controls on regulated industries," the Data Quality Act arguably should be repealed.[81]

On the other side of this debate, supporters claim that "all the Data Quality Act does . . . is allow the public to question the reliability of scientific data used to establish public policy."[82] As to peer review requirements:

> Critics cite potential regulatory delays and a new level of intrusion of . . . OMB into agency decision-making . . . . But [peer review] may help ensure that basic scientific and technical conclusions are formulated more objectively, with an early and complete record of what a broader range of independent scientists think about the science behind new federal initiatives.[83]

Supporters say we should welcome an information "due process" movement that promises transparency and unbiased, unconflicted selection of peer reviewers.[84] After all, "public review of data and methodology is crucial for both good science and good public policy. Scientific data collected by federal agencies have often been subjected to independent review and found to be in error . . . . [I]ndependent review will help society avoid costly public policy mistakes."[85] Examples of such public policy mistakes arguably in-

79. *See* 70 Fed. Reg. 2664, 2667 (Jan. 14, 2005) (providing OMB's final bulletin on improving quality, objectivity, utility and integrity of information disseminated by federal government to public).

80. *See* Carolyn Raffensperger, *Why Industry Wants Rules Peer Reviewed*, THE ENV. FORUM, Mar./Apr. 2004, at 12 (providing opposing policy views).

81. *See* Johnson, *supra* note 74, at 79-80 (noting that OMB Guidelines pressure agencies to ignore data they would otherwise consider).

82. *See* Mark Hansen, *Science Experiment: Industries Are Using a Landmark Case and a 2001 Law to Block Regulation, Critics Say*, A.B.A. J., Nov. 2005, at 12 (explaining opinions of proponents of Data Quality Act). Steven Milloy states, "We view [the Act] as a way of checking up on the people who want to use junk science to regulate the way we live." *Id.*

83. Frederick R. Anderson, *Peer Review of Data*, NAT'L L.J., Sept. 29, 2003, at 1 (referring to Sept. 15, 2003, OMB bulletin, 66 Fed. Reg. 54023).

84. *See id.* (encouraging independent and external peer review).

85. *See* Michael Gough & Steven Milloy, *The Case for Public Access to Federally Funded Research Data*, Executive Summary No. 366, Cato Institute, Feb. 2, 2000, at 1

clude EPA regulation of airborne asbestos, the panic over endocrine disruptors and the controversy over the herbicide 2, 4-D.[86] Finally, "because regulatory agencies are rarely penalized for erroneous science, they are less motivated to ensure that the science they use is valid."[87] Hence the need for public review to correct regulatory abuse.

G. Right-Wing Stories of Regulatory Abuse

> Today, we are not only dealing with out-of-control regulatory agencies, but we are also dealing with bureaucrats who disagree with each other and solve their disputes by implementing duplicative regulation . . . . We have had fifty-plus years of regulatory growth and, as President Reagan said, "the hardest thing to kill is a government program once it has been created."[88]

According to Steven Milloy, a 1999 EPA proposal to reduce tailpipe emissions from sport utility vehicles was based on a single study that was (1) financed by the EPA; (2) published in a journal that receives EPA subsidies and lobbies for stricter air pollution regulations; and (3) not "science at all – it's simply a statistical analysis of questionable data . . . ."[89] According to Bonner Cohen, the EPA in 1998 ignored independent, peer-reviewed science when it insisted on a zero (instead of 300 parts per billion) standard for chloroform in drinking water, which meant that "water system operators [would] devote their limited resources to combating the fictitious risks posed by disinfectant by-products . . . ."[90] According to Dennis Avery, a May 30, 2000 executive order to save the Gulf of Mexico fisheries from fertilizer run-off ignored the fact that it would likely starve the fishery and reduce the efficiency of Midwestern corn fields, even though current nutrient flows appeared to cause "no

(expressing support for Shelby Amendment which gives public greater access to data in published reports and federal regulations).

86. *See id.* at 3-10 (discussing examples in further detail).

87. *See id.* at 3 (explaining why public must check science).

88. *See* Senator Jim Inhofe, INTRODUCTION TO BIG GOVERNMENT AND BAD SCIENCE: TEN CASES IN REGULATORY ABUSE (Bonner R. Cohen & Thomas A. Giovanetti eds., 1999) (joint publication of Institute for Policy Innovation and the Lexington Institute) (criticizing current state of regulatory agencies).

89. *See* Steven J. Milloy, *SUVs: Another Case of Missing EPA Data*, in BIG GOVERNMENT, *supra* note 88, at 3 (discussing problems with "Pope" study).

90. *See* Bonner R. Cohen, *Safe Drinking Water: Politics Trumps Science*, in BIG GOVERNMENT, *supra* note 88, at 8 (noting zero standard is unattainable and irrational).

economic or ecological damage."[91] Likewise, Bonner Cohen argues that EPA plans to rid the Hudson River of PCBs, by declaring parts of the river to be Superfund clean-up sites, would only "stir [the PCBs] up, thereby defeating the purpose of the whole exercise."[92]

These and other similar stories[93] are promulgated by the Institute for Policy Innovation, which focuses on harnessing the strengths of "individual choice" and "free markets," and by the Lexington Institute, which "believes in limiting the role of the federal government" and "opposes the unnecessary intrusion of the federal government into the commerce and culture of the nation . . . .,"[94] to suggest that politics (particularly in the past Clinton administration) often trumps science. Such approaches feed into a narrative (concerning regulatory abuse) that will join the renewed debate over global warming in the wake of *Massachusetts v. EPA*.

H. Getting Politics Out of Science

> [A]ffected parties who are not burdened with scientific scruples can make sound science appear controversial by challenging individual methodological decisions, even when scientists themselves would find the choices necessary and appropriate. Affected parties can also conduct ends-oriented research, replete with undisclosed methodological and design decisions selected precisely because they produce a desired, predetermined result.[95]

Interest, it seems, is in the eye of the beholder. Those concerned with regulatory abuse, discussed in the previous section, refer to those who have been the recipients of generous grants from the EPA[96] and "private researchers" [who conduct studies] courtesy

91. *See* Dennis Avery, *Hypoxia: The Dead Zone Lives*, in BIG GOVERNMENT, *supra* note 88, at 9 (stating that bureaucrats, scientists, and special interest groups ignored pertinent information).

92. *See* Bonner R. Cohen, *PCBs: EPA Occupies the Hudson Valley*, in BIG GOVERNMENT, *supra* note 88, at 16 (noting that if left alone, problem would fix itself).

93. *See generally* BIG GOVERNMENT, *supra* note 88 (suggesting that government regulation has become excessive).

94. *See id.* at 24 (stating Institute's mission).

95. *See* Wendy Wagner, *The Perils of Relying on Interested Parties to Evaluate Scientific Quality*, 95 AM. J. PUB. HEALTH, Supp. 1, S99 (2005) (noting ability of affected parties to discredit and manipulate research for their own benefit).

96. *See* Cohen, *Safe Drinking Water*, *supra* note 90, at 8 (referring to Washington-based environmental groups).

of a grant from the EPA,[97] as biased or interested scientists, as opposed to "independent" scientists "outside the agency."[98] From the opposite perspective, it is the use of interest groups to review the quality of the science within agencies that presents the greater challenge:

> Until the late 1990s, science advisory boards and agency peer-review processes provided the primary source of advice on scientific quality for agencies engaged in science-based regulation. This "expert" model helped to vet and anchor the relevant science through a balanced committee or group of scientists before subjecting it to the adversarial, ends-oriented attacks of stakeholders.[99]

In this view, "disinterested" scientists were used to confirm the quality and validity of technical research, and thereafter the agency would solicit "input from interest groups and [the] affected public on how the science should be used for policy."[100] Nowadays, however, there is a

> shift towards using interest groups for both functions – the evaluation of scientific quality, as well as how that science should be used in public policy – without soliciting the advice or input of the scientific community . . . . [I]n many cases these new processes that solicit interest group review of scientific quality effectively eliminate the need to consult with experts . . . . [I]nterest groups are portrayed as legitimate and constructive sources of scientific quality.[101]

This picture presents an interesting, and somewhat idealistic, vision of science in the regulatory process. "Interest" exists among stakeholders, outside the agency, who await the scientific judgments of disinterested "experts" working for the agency; interest groups here are the opposite of experts, as if interest groups do not rely on legitimate science, and "adversarial challenges" become the opposite of

97. *See* Milloy, *supra* note 85, at 3 (discussing auto emissions study produced by private researchers funded by EPA).

98. *See* Cohen, *Safe Drinking Water*, *supra* note 90, at 7 (discussing EPA's rejection of mutual conclusion between both EPA and unaffiliated scientists).

99. *See* Wagner, *supra* note 95, at S100 (explaining role of interest group in setting standard for scientific quality).

100. *See id.* at S99 (identifying two-tier structure where interest groups comment on political implementation of experts' scientific conclusions).

101. *See id.* at S100 (noting trend toward permitting interest groups to both establish scientific quality and opine on policy implementation).

"expert consensus," as if scientists are never adversarial.[102] "Relying on affected parties and adversarial processes for the review of scientific quality violates one of the fundamental tenets of science, namely that scientific research, as well as peer review of that research, should be unbiased, objective, and disinterested."[103] Contrast this aphorism with the accusation that scientists receiving EPA grants are biased and interested,[104] and you have a contested discourse in which both sides appeal to the same idealistic view of science — the only difference is who you characterize as a biased stakeholder (the EPA or big business), which scientists are biased (those funded by the EPA or by "private" sources) and what constitutes "independence" (freedom from agency or industry group politics).

Donald Elliott, former EPA General Counsel from 1989-91, tries to help matters by appealing to science as the opposite of politics: "[V]ery few knowledgeable persons would contend that our environmental decisions today are too much dominated by neutral scientific expertise and do not reflect politics . . . . My belief is that there is currently too much politics and not enough science . . . ."[105] Elliott recognizes that his appeal to the "common sense" category of "science" is problematic, but he dismisses (as "fine philosophical questions that [others] discuss at length") concerns "with the nature of science, whether all scientists must agree, whether science is 'objective', [or] for that matter, whether science actually exists."[106] He then proposes, in a "thoroughly conventional" fashion, the creation of a "high level advocate for science" (a "chief science officer" to ensure scientific integrity) and a "Science Watch" Non-Governmental Organization (NGO) to represent disinterested scientists who have no financial stakes in the administration process: "Perhaps it is time for science qua science to get into the game by organizing . . . independent environmental scientists whose only common interest is speaking up for the integrity of science in the process."[107] Such idealism, albeit guarded (e.g., "objec-

102. *See id.* (discussing relationship between interest groups, experts and scientific conclusions).

103. *See id.* at S101 (stating research and review must be unbiased, objective and disinterested).

104. For a discussion of research conducted by interested scientists, see *supra* and *infra* notes 95-107 and accompanying text.

105. *See* E. Donald Elliott, *Strengthening Science's Voice at EPA*, 66 L. & CONTEMP. PROB. 45, 49 (2003) (discussing tension between politics and experts in science).

106. *See id.* at 47 (regarding arguments not discussed).

107. *See id.* at 52-53, 59, 60 (proposing creation of committee focused solely on supporting and advocating integrity of science).

tions . . . are obvious," "[W]ho can be so audacious as to purport to speak for science?" "science is not totally objective, nor does it provide definitive answers to all definitive questions"), serves to introduce my final discourse relevant to *Massachusetts v. EPA*, namely the discourse of science studies.

I. Science Studies and Law

The discipline of "science studies," referred to as the "sociology of scientific knowledge" or "science and technology studies" or the "history, philosophy, and sociology of science," is associated with the study of scientific progress and practices in their social, historical, and institutional contexts.[108] Because scholars in science studies typically attend to the rhetorical and social aspects of a scientific field, such as advocacy and consensus-building techniques on the part of scientists, rather than focusing on the more conventional aspects of science, such as observation of natural phenomenon, science studies has been criticized for viewing scientific facts as "social constructions" rather than as stable, cumulative bits of knowledge about nature.[109]

> Recent work in science studies [, however,] has confirmed that the polarization between utter faith and confidence in science, on the one hand, and criticism of science as a social construction, on the other, is unnecessary. Science is the product of *both* (i) observation and experiment with respect to natural reality, *and* (ii) norms, conventions, and expectations within the scientific community.[110]

The picture of science that emerges from such a conception is pragmatic rather than idealistic. Without denying scientific progress and utility on many fronts, science can be viewed (1) as a social practice reflecting the scientific community's goals and standards; (2) as a dynamic practice evolving on the basis of reasonable beliefs

108. *See generally* David S. Caudill, *Law, Science, and Science Studies: Contrasting the Deposition of a Scientific Expert with Ethnographic Studies of Scientific Practice*, 12 S.CAL. INTERDISC. L.J. 85, 88-92 (2002); David S. Caudill, *Law and Science: An Essay on Links and Socio-Natural Hybrids*, 51 SYRACUSE L. REV. 841, 853-61 (2001); David S. Caudill & Richard E. Redding, *Junk Philosophy of Science?: The Paradox of Expertise and Interdisciplinarity in Federal Courts*, 57 WASH. & LEE L. REV. 685, 726-36 (2000) (discussing socio-natural hybrids for science and law).

109. *See generally* DAVID S. CAUDILL & L.H. LARUE, NO MAGIC WAND: THE IDEALIZATION OF SCIENCE IN LAW, xv-xvi (Rowman & Littlefield Publishers, Inc., 2006) (comparing multiple views of science studies).

110. *See id.* (arguing multidimensional aspect of science studies including both social and experimental elements).

and resolution of internal debates; and (3) as a professional practice reflecting authority structures and institutions, as well as economic and political interests and limitations.[111]

This discourse concerning the pragmatic features and limitations of science is interwoven with the others discussed in this section, insofar as it conflicts with idealized views of science, including unrealistically high standards for certainty in the regulatory arena, as well as unrealistically high standards for "disinterested" science. The literature of science studies could potentially have an impact in regulatory debates by demonstrating that all science is interested in some respect (and therefore that "interested" science is not unreliable for that reason). There is some concern, however, that

> [c]redible studies, traditional research methods, and respected researchers . . . may all be deconstructed if those judging or scrutinizing the science do not respect the vulnerable, socially constructed features of traditional research methods . . . . [E]stablished scientific communities informally agree on "accepted methods," some of which are necessarily based on consensual, but technically invalidated, assumptions. If a court or agency is unaware or unconcerned about the necessity of these constructed features of science, attacks against the accepted conventions are likely to succeed.[112]

In other words, until judges understand the tentative aspects of science, arguments based on idealized views of science remain compelling.

III. CONCLUSION

The purpose of this Article is to suggest, in opposition to those who dismissively identify *Massachusetts v. EPA* as an ordinary, vanilla case of regulatory review without any striking features, that the controversy represents much more than that. The debate in the D.C. Court of Appeals over uncertainty — is uncertainty a normal feature of useful science, or a signal to wait for, and demand more, certainty in science? — is a point of convergence for numerous debates about the uses and abuses of science in law. The debate over the causes of global warming, at least in its legal version, has everything to do with the contested images of science in our culture.

111. *See id.* at 24 (discussing varying conceptualizations of scientific study).

112. *See* Wagner, *supra* note 95, at S102 (considering result of disregarding "accepted methods" of scientific research for defined validation of results).