

THE EVER CHANGING LANDSCAPE: ADMITTING NOVEL SCIENTIFIC EVIDENCE IN PROVING LIABILITY FOR PESTICIDE APPLICATION

Bryon Gleisner

I.	Pesticide Exposure and Illness: Complex World, Complex Answers	197
II.	Threshold Issues	199
III.	“General Acceptance”	200
IV.	The Tests Scientists Use	202
V.	Federal Rules of Evidence	203
VI.	Creation of a New Standard: <i>Daubert v. Merrell Dow Pharmaceuticals, Inc.</i>	204
	A. Understanding <i>Daubert</i>	206
	B. Criticisms of <i>Daubert</i>	207
	C. The Supreme Court’s Quest to Clarify <i>Daubert</i> : the <i>Joiner</i> & <i>Kumho Tire</i> Cases	208
VIII.	Amended Federal Rule of Evidence 702	211
IX.	Liability in Pesticide Application	212
	A. Florida Sticks with <i>Frye</i>	213
	B. “ <i>Frye</i> Plus Reliability:” Illinois’s Hybrid Solution	217
X.	Conclusion	221

I. PESTICIDE EXPOSURE AND ILLNESS: COMPLEX WORLD, COMPLEX ANSWERS

In the United States, it is estimated that farmers apply 661 million pounds of pesticides every year to control the detrimental effects of over 10,000 species of insects, 1500 plant diseases, and 1800 different weeds.¹ There are approximately forty thousand registered pesticides containing over six hundred active ingredients.² In 1998, at least eighty-three different ingredients in pesticides were found to be cancer-causing agents in either animals or humans.³ Between 1964 and 1993,

1. See Mary Cabrera, *Legal Remedies for Victims of Pesticide Exposure*, 1 KAN. J.L. & PUB. POL’Y 113, 113 (1991). See also Frederick R. Anderson, et al., *Regulation of Pesticide Use: The Federal Insecticide, Fungicide, and Rodenticide Act* (last modified June 9, 2000) <<http://lawstudy.law.ukans.edu/glicks/envprot/7-FIFRA.htm>> (defining pesticides as “a generic name for three different classes of chemical compounds: fungicides, insecticides, and rodenticides”). The website is a section of a textbook authored by Frederick R. Anderson and colleagues entitled ENVIRONMENTAL PROTECTION: LAW AND POLICY (3d ed. 1999). This section of the textbook can only be found on the website.

2. See Anderson, *supra* note 1.

3. See Diana L. Mitts, *Epidemiological Evidence as a Basis for Causation: Implications for Suspected Pesticide-Induced Cancer*, 8 SAN JOAQUIN AGRIC. L. REV. 187, 193 (1998).

pesticide use in the United States has increased by two hundred fifty percent.⁴ From this level of pesticide use on American farms, it is estimated that pesticides poison three hundred thousand farm workers per year.⁵ Additionally, farm workers and non-farm workers claim that through direct or indirect exposure⁶ to these pesticides, they have developed cancer, birth defects, or other diseases.⁷ Some studies have linked certain chemicals to an increased risk of developing leukemia, lung and testicular cancer, birth defects, reproductive disorders, chronic allergic dermatitis, non-Hodgkin's lymphoma, damage to the lungs, liver, and kidneys, a weakened immune system,⁸ and possibly even Parkinson's disease.⁹ However, many forms of cancer, birth defects, and other diseases are caused by incalculable environmental factors and other personal factors, such as "genetics, age, ethnicity, gender, immune system, pre-existing disease, and level of nutrition."¹⁰ Additional situational factors can also increase or decrease the toxicity¹¹ of pesticides.¹² Some of these factors include: soil composition, temperature, moisture in the air, wind velocity, amount of protective clothing worn, manner of contact (e.g. oral, dermal, or inhalation), level of exposure, and duration and frequency of exposure.¹³ Even pesticides that are inert upon application may increase in toxicity as they interact with the atmosphere and soil.¹⁴ Additionally, one or more pesticides may be combined creating a synergistic effect in the environment.¹⁵ The interplay between these innumerable factors makes it

4. See Anderson, *supra* note 1.

5. See Cabrera, *supra* note 1, at 113.

6. See *Toxicity of Pesticides* (module 4) (last modified May 23, 1999) <<http://pmep.cce.cornell.edu/facts-slides-self/core-tutorial/module04>>. "Pesticide exposure is defined as coming in contact with a pesticide," and can be either acute or chronic. *Id.* Acute exposure is pesticide exposure for twenty-four hours or less. See *id.* Chronic exposure is long-term and repeated exposure to pesticides. See *id.*

7. See generally *Ferebee v. Chevron Chem. Co.*, 736 F.2d 1529 (D.C. Cir. 1984) (analyzing the admissibility of novel scientific evidence in which an agricultural worker claimed he developed pulmonary fibrosis as a result of long term exposure to paraquat, a popular herbicide); *E.I. Du Pont De Nemours & Co. v. Castillo*, 748 So. 2d 1108 (Fla. Dist. Ct. App. 2000) (analyzing the admissibility of novel scientific evidence in which a non-farm worker claimed birth defects from exposure to Benlate, an agricultural fungicide).

8. See Cabrera, *supra* note 1, at 113-14.

9. See Lisa Peck Lindelef, *California Farmworkers: Legal Remedies for Pesticide Exposure*, 7 STAN. ENVTL. L.J. 72, 81 (1988).

10. Mitts, *supra* note 3, at 192.

11. See *Toxicity of Pesticides*, *supra* note 6 (defining toxicity as the capacity of a substance to cause injury to a living system (i.e. the kind and extent of damage the substance can cause to living tissue)). Toxicity can also be either acute or chronic. See *id.* Acute toxicity refers to the short-term effect of exposure to chemical substances on living tissue; generally within twenty-four hours. See *id.* Chronic toxicity is the long-term consequences of exposure, which is "measured in experimental conditions after three months of either continuous or occasional exposure." *Id.*

12. See Lindelef, *supra* note 9, at 80-81.

13. See *id.* at 80.

14. See *id.*

15. See *Toxicity of Pesticides*, *supra* note 6. "A synergistic effect occurs when the combined toxic effect of two pesticides is much greater, or worse, than the sum of the effects of each by itself. Synergism is similar to adding 2 + 2 and getting 5 as the result." *Id.*

difficult, if not impossible, to prove that the chemical in question caused the specific ailment from which the individual suffers.¹⁶

II. THRESHOLD ISSUES

In order for a plaintiff who suffers from an ailment allegedly caused by exposure to an agricultural chemical to prevail over a farmer who applies it or the manufacturer who made it, the plaintiff must resolve two threshold questions: (1) whether the product applied by the farmer and manufactured by the producer “can be demonstrated to have caused the harm complained of by the plaintiff;” and (2) whether exposure to the defendant’s product actually caused the plaintiff’s harm.¹⁷

In light of the limited scientific knowledge of the conditions that actually cause cancer,¹⁸ the question then becomes what evidence should the plaintiff be allowed to use in proving the link between the suspected chemical and the plaintiff’s harm? Admitting too much uncertain and unproven scientific evidence to show this link may unfairly punish the defendants for producing and applying a pesticide that is not harmful to humans.¹⁹ Admitting too little of this type of evidence leaves the plaintiff without a remedy simply because our scientific knowledge is too primitive to absolutely prove a link between the chemical and the harm.²⁰

Scientific evidence is only as good as the techniques utilized to generate it.²¹ The reliability of scientific evidence depends on: “(1) the validity of the underlying principle; (2) the validity of the technique applying that principle; and (3) the proper application of the technique on a particular occasion.”²² “Validity” refers to a test’s accuracy—whether the test measures what it is supposed to measure.²³ “Reliability” refers to consistency—whether different scientists can obtain the same results each time the test is performed.²⁴ Both validity and reliability are important in determining if scientific evidence is admissible because evidence must be reliable to contribute to the truth determining function at trial, and evidence cannot be reliable unless a valid principle and technique are applied.²⁵

16. See Cabrera, *supra* note 1, at 114; Lindelef, *supra* note 9, at 82.

17. Gregg L. Spyridon, *Scientific Evidence vs. “Junk Science”—Proof of Medical Causation in Toxic Tort Litigation: The Fifth Circuit “Fryes” a New Test* (Christophersen v. Allied-Signal Corp.), 61 Miss. L.J. 287, 292 (1991).

18. See Cabrera, *supra* note 1, at 114.

19. See Spyridon, *supra* note 17, at 293.

20. See *id.* at 311.

21. See John D. Borders, Jr., *Fit To Be Fryed: Frye v. United States and the Admissibility of Novel Scientific Evidence*, 77 KY. L.J. 849, 857-58 (1989); Paul C. Giannelli, *The Admissibility of Novel Scientific Evidence: Frye v. United States, a Half Century Later*, 80 COLUM. L. REV. 1197, 1200-01 (1980) (discussing the reliability of evidence).

22. Borders, *supra* note 21, at 857. See also Giannelli, *supra* note 21, at 1200-01.

23. See Borders, *supra* note 21, at 857-58 & n.64. See also Giannelli, *supra* note 21, at 1200-01 & n.20.

24. See Borders, *supra* note 21, at 857-58 & n.64. See also Giannelli, *supra* note 21, at 1200-01 & n.20.

25. See Giannelli, *supra* note 21, at 1200-01.

III. “GENERAL ACCEPTANCE”

In the 1900s, both federal and state courts in the United States struggled with issues of what and how much novel scientific evidence to admit.²⁶ In 1923 with *Frye v. United States*,²⁷ the Court of Appeals of the District of Columbia established the “general acceptance” test in determining whether or not to admit novel scientific evidence.²⁸ The court held:

The rule is that the opinions of experts or skilled witnesses are admissible in evidence in those cases in which the matter of inquiry is such that inexperienced persons are unlikely to prove capable of forming a correct judgment upon it, for the reason that the subject-matter so far partakes of a science, art, or trade as to require a previous habit or experience or study in it, in order to acquire a knowledge of it. When the question involved does not lie within the range of common experience or common knowledge, but requires special experience or special knowledge, then the opinions of witnesses skilled in that particular science, art, or trade to which the question relates are admissible in evidence.²⁹

....

Just when a specific principle of discovery crosses the line between the experimental and demonstrable stage is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained *general acceptance* in the particular field in which it belongs.³⁰

So what exactly did the court mean by this statement? At first glance, it would seem that determining whether or not a scientific principle or technique is “sufficiently established to have gained *general acceptance* in the particular field in which it belongs” would be a simple task.³¹ However, on closer review and in actual practice, this seemingly simple standard becomes quite complex in its various avenues of analysis.³²

26. See generally *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923) (discussing the admissibility of expert testimony); *Commonwealth v. Lykus*, 327 N.E.2d 671 (Mass. 1975) (holding that greater weight be given to experts who have had direct and empirical experience).

27. *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

28. See *id.* at 1014. See generally Borders, *supra* note 21 (referring to the test devised in *Frye v. United States* as the “general acceptance” test).

29. *Frye*, 293 F. at 1014.

30. *Id.* at 1013 (emphasis added).

31. *Id.* at 1014. (emphasis added).

32. See Giannelli, *supra* note 21, at 1204-05.

Viewed broadly, a technique must pass through two stages for it to be admissible as novel scientific evidence.³³ First, the scientific community analyzes and scrutinizes the technique used to generate the evidence (the “experimental” stage).³⁴ Second, the judiciary recognizes the technique as reliable enough to admit it into court (the “demonstrable” stage).³⁵ The court will not allow a technique to pass onto the “demonstrable” stage until the technique is “generally accepted by the relevant scientific community.”³⁶

“[G]eneral acceptance in the relevant scientific community” is easily established if previously published appellate decisions have upheld the admissibility of the technique.³⁷ However, the difficulty arises when new techniques are an issue of first impression.³⁸ Judges must decide what the relevant scientific community is.³⁹ Is it chemistry, biology, genetics, kinetics, computer technology, pharmacy, or some other field? Next, the court must determine if the technique is generally accepted.⁴⁰ Must it be universally accepted, accepted by more than fifty-percent, less than fifty-percent, or by some other measure? Should general acceptance be determined by expert testimony, scientific and legal literature, judicial opinions, or some other method?⁴¹ Third, the court must determine exactly what must be accepted.⁴² Is it enough that the technique itself is accepted, or must the underlying theory behind the technique also be accepted?⁴³ These numerous questions muddy the seemingly clear waters of the “general acceptance” standard.⁴⁴

The “general acceptance” test was the dominant test on admissibility of novel scientific evidence well into the 1970s.⁴⁵ However, the “general acceptance” test began receiving criticism for the reasons listed above, as well as for being too

33. *See id.* at 1205.

34. *See id.*

35. *See id.*

36. *Id.*

37. Brett Watson, *California Supreme Court Survey, The Kelly/Frye Foundational Test for the Admissibility of Evidence Based Upon New Scientific Technique is Composed of Three Prongs. The First Prong, Which Requires That Reliability Be Established By Showing That the Technique Has Gained General Scientific Acceptance, Can Be Established if a Previously Published Appellate Decision Has Already Upheld the Admissibility of That Technique. However, the Third Prong, Which Requires That the Procedures Used In the Instant Case Complied With Those of the Generally Accepted Standard, Is Case Specific and Cannot Rely On Previously Published Decisions*, 26 PEPP. L. REV. 683, 746 (1999).

38. *See Giannelli, supra* note 21, at 1208-21.

39. *See id.* at 1208.

40. *See id.* at 1210.

41. *See id.* at 1215-19.

42. *See id.* at 1211.

43. *See id.*

44. *See generally id.* (discussing application of the “general acceptance” test).

45. *See* Edward J. Imwinkelried, *The Standard for Admitting Scientific Evidence: A Critique From the Perspective of Juror Psychology*, 28 VILL. L. REV. 554, 557 (1983). “Indeed, at one point in the mid-1970s, Frye seemed to be the controlling test in at least forty-five states.” *Id.*

ambiguous, inconsistent, restrictive in admitting technical evidence, and for lagging too far behind the scientific field.⁴⁶

The emergence of science in the mid-1900s made the limitations of the “general acceptance” test unacceptable because the rapid pace of science quickly outpaced the lethargic courts—leading to the exclusion of relevant and imperative scientific evidence.⁴⁷ To prove a link between pesticides and cancer, science began to use and depend on epidemiology, animal studies, immunotoxicity/clinical ecology, structural analysis and anecdotal data/clinical studies.⁴⁸

IV. THE TESTS SCIENTISTS USE

Epidemiologists are scientists who compare the incidence of disease in those exposed to a certain chemical to those not exposed.⁴⁹ They take samples from the general population and from this, use statistics to draw an inference between the chemical and the disease.⁵⁰ In animal studies, these scientists expose animals to chemicals and analyze their responses.⁵¹ Epidemiologists then assume that humans would react similarly when exposed to the same chemical.⁵² However, the major problem is that there is no proof that animals and humans will react in the same way to chemical exposure.⁵³ Immunotoxicity/Clinical Ecology is on the cutting edge of science and not widely accepted by the medical community.⁵⁴ This area employs the theory that exposure to various chemicals suppresses the immune system leaving the body susceptible to disease.⁵⁵ Structural analysis involves looking at the molecular structure of like chemicals and analogizing the effects of one to the other similar chemicals.⁵⁶ Finally, anecdotal data or clinical studies look at individual case studies of people who have developed certain diseases after exposure to a chemical.⁵⁷ The reasoning is that because the individual was healthy before the exposure, the chemical must have caused the disease.⁵⁸

46. See Borders, *supra* note 21, at 860-61. See also Robert D. Leinbach, *Novel Scientific Evidence After Reese v. Stroh: The Washington Supreme Court's Love Affair With Frye*, 71 WASH. L. REV. 1127, 1130 (1996); Paige Queen, *Evidence: Taylor v. State—Oklahoma Abandons the Frye Test and its State Court Judges to Enter the Twilight Zone*, 49 OKLA. L. REV. 385, 387 (1996).

47. See Jack B. Weinstein, *Expert Testimony and Novel Scientific Evidence in Toxic Tort Litigation*, in ALI/ABA COURSE OF STUDY: ENVIRONMENTAL LAW 895, 903 (1988) (on file with author).

48. See Spyridon, *supra* note 17, at 294-99.

49. See *id.* at 294.

50. See *id.* at 294-99.

51. See *id.*

52. See Erin K.L. Mahaney, *Assessing the Fitness of Novel Scientific Evidence In the Post-Daubert Era: Pesticide Exposure Cases as a Paradigm for Determining Admissibility*, 26 ENVTL. L. 1161, 1182-85 (1996). See also Spyridon, *supra* note 17, at 294-99.

53. See Mahaney, *supra* note 52, at 1183.

54. See Spyridon, *supra* note 17, at 296.

55. See *id.* at 294-99.

56. See *id.* at 296-97.

57. See *id.* at 297-99.

58. See *id.* at 297.

Each of these techniques has their own strengths and weaknesses when compiling scientific evidence.⁵⁹ It is probably fair to say that some of these tests are so uncertain that they should not be allowed into court under any circumstances. However, it is equally fair to say that many of these studies should be allowed because they provide invaluable insight into causation. It is the exclusion of these invaluable studies that had courts and commentators clamoring for a new standard.⁶⁰

V. FEDERAL RULES OF EVIDENCE

The Federal Rules of Evidence, codified in 1975,⁶¹ created a much more liberal standard than the “general acceptance” standard for admitting novel scientific evidence into court.⁶² Many thought a more liberal approach was necessary to give the jury access to reliable scientific evidence, thereby giving them the ability to make better and more informed decisions.⁶³

Three rules are central to the question of admissibility of novel scientific evidence: 702, 401, and 402.⁶⁴ At the time of its codification, Federal Rule of Evidence 702 stated, “if scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.”⁶⁵ It required the judge to determine two preliminary questions.⁶⁶ The first is whether the “scientific or technical knowledge will assist . . . [the jury in understanding] the evidence or to determine a fact in issue”⁶⁷ This liberal standard allows into court evidence that is merely “helpful” to the jury’s understanding of the case.⁶⁸ “An expert on the stand may give a dissertation or exposition of scientific or other principles relevant to the case, leaving the trier of fact to apply them to the facts.”⁶⁹ Second, the judge must determine whether the witness is qualified as an expert.⁷⁰ The trial judge has much discretion in this area, but generally will look to see if the person proclaiming to be

59. *See id.* at 294-99.

60. *See id.* at 300-13.

61. *See* Kaushal B. Majmudar, *Daubert v. Merrell Dow: A Flexible Approach to the Admissibility of Novel Scientific Evidence*, 7 HARV. J.L. & TECH. 187, 198 (1993). *See also* Weinstein, *supra* note 47, at 903.

62. *See* Weinstein, *supra* note 47, at 908.

63. *See id.*

64. *See generally* FED. R. EVID. 702, 401, 402 (discussing the admissibility of evidence).

65. FED. R. EVID. 702. On December 1, 2000, Federal Rule of Evidence 702 was amended in response to *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993) (discussed *infra* Part VI) and other cases applying the *Daubert* standard. *See* FED. R. EVID. 702 (Supp. 2000). For a brief discussion of the amended Federal Rule of Evidence 702 see *infra* Part VIII.

66. *See* FED. R. EVID. 702.

67. *Id.*

68. *See* STEVEN L. EMANUEL, EVIDENCE 516 (3d ed. 2000).

69. FED. R. EVID. 702 advisory committee’s note.

70. *See* FED. R. EVID. 702.

an expert has “knowledge and/or skill in a particular area that distinguish her from an ordinary person.”⁷¹ Federal Rule of Evidence 702 is a balancing test which

requires that a district court “conduct a preliminary inquiry focusing on (1) the soundness and reliability of the process of technique used in generating the evidence; (2) the possibility that admitting the evidence would overwhelm, confuse, or mislead the jury, and (3) the proffered connection between the scientific research or test result to be presented, and particular disputed factual issues in the case.”⁷²

Next, Federal Rule of Evidence 402 requires the judge to determine if the technique is relevant.⁷³ “All relevant evidence is admissible . . . Evidence which is not relevant is not admissible.”⁷⁴ If the evidence is relevant, Rule 403 requires the judge to perform a balancing test.⁷⁵ “Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.”⁷⁶ Rule 703 allows experts to base their opinions on inadmissible testimony.⁷⁷

After the creation of the Federal Rules of Evidence, questions began to arise.⁷⁸ Was *Frye* still good law? Should some other test apply? If so, what should the test be? Exactly how should the Federal Rules of Evidence be interpreted?

VI. CREATION OF A NEW STANDARD: *DAUBERT V. MERRELL DOW PHARMACEUTICALS, INC.*

In 1993 with *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,⁷⁹ the United States Supreme Court decided to answer the questions of *Frye*'s interpretation and validity since the inception of the Federal Rules of Evidence.⁸⁰ In an opinion by

71. EMANUEL, *supra* note 68, at 514-15.

72. Weinstein, *supra* note 47, at 904 (quoting *United States v. Downing*, 753 F.2d 1224, 1237 (3d Cir. 1985).

73. See FED. R. EVID. 402. See also Borders, *supra* note 21, at 874-75.

74. FED. R. EVID. 402.

75. See FED. R. EVID. 403. See also Borders, *supra* note 21, at 875.

76. FED. R. EVID. 403.

77. See FED. R. EVID. 703. This remains true under the December 1, 2000 amendment to Rule 703. See FED. R. EVID. 703 (Supp. 2000). In relevant part the amendment reads, “[i]f of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence in order for the opinion or inference to be admitted.” *Id.* The underlying information, however, generally remains inadmissible. See *id.* at advisory committee’s notes.

78. See generally Imwinkelried, *supra* note 45 (discussing the debate and confusion among the courts on which standard of admissibility to apply and how to interpret it).

79. *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993).

80. See generally *id.* at 579 (overruling *Frye v. United States* and creating a new standard for the admissibility of scientific evidence); Clayton C. Skaggs, *Evidence: Say Good-bye to the Frye*

Justice Blackmun, the Court had the following to say about the relationship between the Federal Rules of Evidence and *Frye*'s "general acceptance" test:

The drafting history makes no mention of *Frye*, and a rigid "general acceptance" requirement would be at odds with the "liberal thrust" of the Federal Rules and their "general approach of relaxing the traditional barriers to 'opinion' testimony."⁸¹

. . . .

To summarize: "General acceptance" is *not* a necessary precondition to the admissibility of scientific evidence under the Federal Rules of Evidence, but the Rules of Evidence—especially Rule 702—do assign to the trial judge the task of ensuring that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand. Pertinent evidence based on scientifically valid principles will satisfy those demands.⁸²

When a trial judge determines whether the scientific evidence to be received is based on "scientifically valid principles" there is no definitive checklist he or she can turn to.⁸³ Instead, the judge must consider various general observations.⁸⁴ First, scientific evidence does not need to be known to a certainty because, as the Court points out, "there are no certainties in science."⁸⁵ However, the evidence must be based on "good grounds" on what is known (i.e., it must pertain to "scientific knowledge").⁸⁶

Second, as stated earlier, the Federal Rules of Evidence require that the scientific evidence "assist the trier of fact to understand or determine a fact in issue."⁸⁷ The key inquiry to answer this question is whether the theory or technique can be tested.⁸⁸ Under this rule, the Court rightly recognized that science consists of "generating hypotheses and testing them to see if they can be falsified."⁸⁹

A third "consideration is whether the theory or technique has been subjected to peer review and publication."⁹⁰ Publication is "merely one element of peer review [and] not a *sine qua non* of admissibility."⁹¹ Publication in a peer-reviewed journal is

"General Acceptance" Test [*Daubert v. Merrell Dow Pharmaceutical*, 113 S. Ct. 2786 (1993)], 33 WASHBURN L.J. 450, 463 (1994) (stating "[t]he Court's holding in *Daubert* is in direct response to the dispute among the circuits over the proper standard for the admission of expert testimony").

81. *Daubert*, 509 U.S. at 588 (quoting *Beech Aircraft Corp. v. Rainey*, 488 U.S. 153, 169 (1988)).

82. *Id.* at 597 (emphasis added).

83. *See id.* at 593.

84. *See id.*; Skaggs, *supra* note 80, at 458.

85. *Daubert*, 509 U.S. at 590.

86. *See id.*

87. *Id.* at 592.

88. *See id.* at 593.

89. *Id.*

90. *Id.*

91. *Id.*

relevant, but not dispositive in assessing the scientific validity of a technique of methodology.⁹² Peer review is considered because it is hoped that it will “increas[e] the likelihood that substantive flaws in methodology will be detected.”⁹³

Three other general considerations are: (1) “the known or potential rate of error;” (2) “existence and maintenance of standards controlling the technique’s operation;” and (3) “general acceptance.”⁹⁴ Once again, “general acceptance” is not required, but merely one general consideration.⁹⁵ The Court stressed that this new approach is designed to be flexible.⁹⁶ The trial judge is the “gatekeeper”—he or she must control the flow of scientific evidence into the courtroom.⁹⁷ Hence, the “relevancy” standard was born.⁹⁸

A. *Understanding Daubert*

In constructing the *Daubert* “relevancy” approach, the Supreme Court seemed acutely aware and motivated by the fact that under the “general acceptance” test many toxic tort plaintiffs could not survive summary judgment because their scientific evidence would be excluded.⁹⁹ This so-called concern over “[h]andcuffing is a pervasive problem for toxic tort plaintiffs, because they typically must rely on quite novel, often case-specific forms of statistical and epidemiological evidence to prove causation of diseases with long latency periods and multiple possible causes.”¹⁰⁰ A more flexible approach was necessary to allow toxic tort plaintiffs the opportunity to get their case in front of a jury.¹⁰¹

Daubert represents a major paradigm shift that recognized the need to balance greater judicial access to toxic tort plaintiffs against the potential for abuse through the manipulation of juries and the judicial system with unreliable evidence.¹⁰² The ultimate goal is to accept relevant and reliable novel scientific evidence without turning litigation into a “scientific free-for-all.”¹⁰³ Other observations about *Daubert* are also possible.¹⁰⁴ First, it is up to the traditional adversarial nature of the courts to reject unfounded scientific evidence.¹⁰⁵ “Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional

92. *See id.* at 594.

93. *Id.* at 593.

94. *Id.* at 594.

95. *See id.*

96. *See id.* at 597.

97. *See id.*; Mahaney, *supra* note 52, at 1165.

98. *See* J. Ken Thompson, Note, *A Review of the Admissibility of Novel Scientific Evidence*, 17 AM. J. TRIAL ADVOC. 741, 748 (1994).

99. *See* Harvard Law Review Association, *Confronting the New Challenges of Scientific Evidence*, 108 HARV. L. REV. 1481, 1508 (1995).

100. *Id.*

101. *See id.*

102. *See* Majmudar, *supra* note 61, at 203.

103. *See Daubert*, 509 U.S. at 595. *See also* Majmudar, *supra* note 61, at 203-04.

104. *See* Thompson, *supra* note 98, at 748-53 (discussing observations of *Daubert*).

105. *See id.* at 751.

and appropriate means of attacking shaky but admissible evidence.”¹⁰⁶ Second, the Supreme Court’s reliance on the adversarial nature of the courts places a great deal of faith in the judge and the jury in assessing scientific evidence.¹⁰⁷ The Court refused to presume that neither the judge nor the jury would be incapable of handling this burden.¹⁰⁸

B. *Criticisms of Daubert*

The Supreme Court did not pretend to create a perfect standard in *Daubert*.¹⁰⁹ The Court stated that the test, “no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations.”¹¹⁰ However, the criticisms of *Daubert* go well beyond this admission.

The Supreme Court’s quest for greater flexibility and consistency may be a failed one:

Daubert boxed the courts into working within a structure that has not functioned as anticipated by the Supreme Court and can fairly be said not to have functioned well at all. The Supreme Court sought to encourage liberal admissibility. It believed that it was abolishing a strict *Frye* test in favor of a more liberal factor[-]balancing analysis. In fact, liberality of admissibility has not occurred.¹¹¹

Additionally, the *Daubert* opinion is vague and rests primarily on dicta.¹¹² By remanding the case to the Court of Appeals instead of using the opportunity to apply the test, the Court failed to clarify the test, thereby depriving the lower courts a working model.¹¹³ Without a working model to follow, greater flexibility will lead to greater inconsistency.¹¹⁴ This outcome is quite ironic because one of the Supreme Court’s concerns was the lack of consistency in the application of the “general acceptance” test.¹¹⁵ This judicial inconsistency is exaggerated in the state courts because the *Daubert* “relevancy” test is based on the Federal Rules of Evidence, which are not binding on state courts.¹¹⁶ State courts may follow their own interpretation of either the *Frye* test or the *Daubert* test when admitting novel scientific evidence.¹¹⁷

106. *Daubert*, 509 U.S. at 596; see also Thompson, *supra* note 98, at 751.

107. See Thompson, *supra* note 98, at 751; Skaggs, *supra* note 80, at 458.

108. See Thompson, *supra* note 98, at 751; Skaggs, *supra* note 80, at 458.

109. See *Daubert*, 509 U.S. at 597.

110. *Id.*

111. *Harris v. Cropmate Co.*, 706 N.E.2d 55, 59 (Ill. App. Ct. 1999) (quoting 2 M. GRAHAM, HANDBOOK OF FEDERAL EVIDENCE § 702.5, at 34 (4th ed. Supp. 1999)).

112. See Harvard Law Review Association, *supra* note 99, at 1492.

113. See *Daubert*, 509 U.S. at 598.

114. See Majmudar, *supra* note 61, at 204.

115. See *id.*

116. See Harvard Law Review Association, *supra* note 99, at 1492.

117. See *id.*

Further, some argue that *Daubert* merely superficially changes how novel scientific evidence is admitted and therefore will not significantly affect the outcome of most admissibility disputes.¹¹⁸ Many states had already moved away from the “general acceptance” test even before *Daubert* was decided.¹¹⁹ In general, many of the same criticisms of the *Frye* test still apply under the supposedly “new-and-improved” *Daubert* standard.¹²⁰

C. *The Supreme Court’s Quest to Clarify Daubert:
The Joiner & Kumho Tire Cases*

The *Daubert* opinion itself did not address the proper standard of appellate review of a trial court’s decision on whether to admit novel scientific evidence.¹²¹ The Supreme Court addressed this issue in *General Electric Co. v. Joiner*.¹²² Writing for the majority, Chief Justice Rehnquist held that abuse of discretion is the proper standard of review.¹²³ An appellate court cannot reverse a trial court’s decision on the admissibility of scientific evidence “unless the ruling is manifestly erroneous.”¹²⁴

In the Court’s opinion, a more “searching standard of review” is inappropriate merely because inadmissibility of expert scientific evidence is “outcome determinative.”¹²⁵ “A court of appeals applying ‘abuse of discretion’ review to such rulings may not categorically distinguish between rulings allowing expert testimony and rulings disallowing it.”¹²⁶ Therefore, the Court of Appeals for the Eleventh Circuit erred when it applied an “overly ‘stringent’” review to reverse the trial court’s decision to exclude the expert scientific testimony and grant summary judgment.¹²⁷ The Supreme Court rejected the argument made by the Court of Appeals that a different standard was required because the Federal Rules of Evidence and *Daubert* displayed a preference for admissibility.¹²⁸ The Court went on to say that trial judges are the gatekeepers and it is among their duties to ensure that all evidence is relevant and reliable.¹²⁹ An “overly ‘stringent’” standard of review fails to give trial court judges their proper deference as gatekeepers.¹³⁰ The *Joiner* case clarified the appellate courts’ role in light of the *Daubert* relevancy standard, but did not clarify the trial courts’ boundaries in originally applying the *Daubert* test.¹³¹

118. See Majmudar, *supra* note 61, at 202-03.

119. See *id.* at 203.

120. See Thompson, *supra* note 98, at 751.

121. See *General Elec. Co. v. Joiner*, 522 U.S. 136, 142 (1997).

122. See *id.* at 141-43.

123. See *id.* at 143.

124. *Id.* at 142.

125. *Id.* at 142-43. “Outcome determinative” refers to the fact that inadmissibility of expert scientific testimony in some instances will result in summary judgment. See *id.*

126. *Id.* at 142.

127. See *id.* at 143.

128. See *id.* at 140, 142-43.

129. See *id.* at 142.

130. See *id.* at 143.

131. See *id.* at 141-43.

Some clarification would come in the Supreme Court's 1999 decision *Kumho Tire Co. v. Carmichael*.¹³² In that case, the Court reaffirmed the use of the abuse of discretion standard when reviewing a lower court's decision to admit or exclude expert scientific testimony.¹³³ The practical effect of this is that most often the battle regarding the admissibility of expert testimony will be won or lost at the trial level.¹³⁴ However, "a trial court does not have the discretion 'to abandon the gatekeeping function' or 'to perform [it] inadequately.'"¹³⁵ The Court also noted that the gatekeeping function, and thus the *Daubert* analysis, applies with equal force to "all 'scientific,' 'technical,' or 'other specialized' matters within its scope."¹³⁶

In its decision, the Supreme Court stressed that the four factors set out in *Daubert* are merely guidelines and are neither exhaustive nor required elements in determining the admissibility of novel scientific evidence.¹³⁷ In other words, a trial court may consider the *Daubert* factors, but is not required to do so.¹³⁸ The gatekeeping function of the trial judge requires that the inquiry of which elements to apply must be tied to the particular facts of the case.¹³⁹ All of the *Daubert* factors do not necessarily apply in every instance in which the reliability of scientific testimony is challenged.¹⁴⁰

[T]he factors identified in *Daubert* may or may not be pertinent in assessing reliability, depending on the nature of the issue, the expert's particular expertise, and the subject of his testimony.

....

The conclusion, in our view, is that we can neither rule out, nor rule in, for all cases and for all time the applicability of the factors mentioned in *Daubert*, nor can we now do so for subsets of cases categorized by category of expert or by kind of evidence. Too much depends upon the particular circumstances of the particular case at issue.¹⁴¹

132. See generally *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999) (discussing and applying the *Daubert* reliability standard).

133. See *id.* at 152.

134. See Kenneth S. Geller & Michael E. Lackey Jr., *Supreme Court's Kumho Decision a Boon to Public*, 15 *PRODUCT LIABILITY L. & STRATEGY* 1, 3 (Apr. 1999).

135. *Id.* (citing *Kumho Tire*, 526 U.S. at 158-59).

136. *Kumho Tire*, 526 U.S. at 147.

137. See *id.* at 150-51. The factors as set out and reiterated by the case are "[w]hether a 'theory or technique . . . can be (and has been) tested;' [w]hether it 'has been subjected to peer review and publication;' [w]hether, in respect to a particular technique, there is a high 'known or potential rate of error' and whether there are 'standards controlling the technique's operation;' and [w]hether the theory or technique enjoys 'general acceptance' within a 'relevant scientific community.'" *Id.* at 149-50.

138. See *id.* at 150-51.

139. See *id.* at 150.

140. See *id.* at 151.

141. *Id.* at 150.

The factors identified in *Daubert* provide a practical beginning for analyzing the reliability of expert scientific testimony but the analysis cannot end at this point.¹⁴² For example, merely because the “general acceptance” hurdle is overcome does not show that an expert’s testimony is reliable where the discipline itself lacks reliability.¹⁴³

On the other hand, the Supreme Court accepts the fact that “simply because an expert’s testimony cannot clear one or more of the *Daubert* hurdles does not mean that it must be excluded.”¹⁴⁴ However, in most instances, experts must be prepared to explain why their testimony cannot clear one or more of the *Daubert* factors if the testimony is to survive a challenge of inadmissibility.¹⁴⁵ Such an explanation will further the Supreme Court’s requirement that “an expert . . . employs in the court room the same level of intellectual rigor that characterizes the practice of an expert in the relevant field.”¹⁴⁶

“[W]hether *Daubert*’s specific factors are, or are not, reasonable measures of reliability in a particular case is a matter that the law grants the trial judge broad latitude to determine.”¹⁴⁷ The specific *Daubert* factors only need to be considered when they are “reasonable measures” of the reliability of expert testimony.¹⁴⁸ However, a concurring opinion by Justice Scalia, joined by Justices Thomas and O’Connor, warned that “in a particular case the failure to apply one or another of [the *Daubert* factors] may be unreasonable, and hence an abuse of discretion.”¹⁴⁹

Not only are *Daubert*’s factors flexible, but a trial judge also needs expansive latitude in deciding how to test an expert’s reliability.¹⁵⁰ A judge has the authority to decide whether special briefings or other proceedings are needed to investigate reliability.¹⁵¹ Through the trial judge’s discretion, the tenets of the Federal Rules of Evidence of avoiding “unjustifiable expense and delay” as part of their search for ‘truth’ and the ‘jus[t] determin[ation]’ of proceedings is furthered.¹⁵²

In light of the “same level of intellectual rigor” requirement, a showing that a testifying expert’s methodology is similar to that used by professionals in the relevant field is a factor in favor of admissibility.¹⁵³ By the same token, the testimony of an expert who is a professional witness and makes a living by testifying in court will be

142. See Geller & Lackey, *supra* note 134, at 3.

143. See *id.*; *Kumho Tire*, 526 U.S. at 151 (using the example that any theories or methodologies used in the fields of astrology or necromancy are unreliable because the fields themselves are unreliable).

144. Geller & Lackey, *supra* note 134, at 3.

145. See *id.*

146. *Kumho Tire*, 526 U.S. at 152.

147. *Id.* at 153.

148. See *id.* at 152.

149. *Id.* at 159.

150. See *id.* at 152.

151. See *id.*

152. *Id.* at 152-53.

153. See Geller & Lackey, *supra* note 134, at 3.

seen as less reliable—a factor in favor of inadmissibility.¹⁵⁴ This is true because such testimony is less likely to employ methodology similar to that used by professionals in the relevant field.¹⁵⁵

Under the *Kumho Tire* standard, another effective way to undermine an expert's testimony is to show that the facts relied on by the expert are inaccurate.¹⁵⁶ Such a showing, standing alone, may be enough to have the expert's testimony excluded.¹⁵⁷ An expert's progression from observation to conclusion must be explained, as well as how the expert knows he or she is correct.¹⁵⁸ "An expert who offers in response only his or her 'experience' and 'assurances' should be excluded, because such testimony amounts to nothing more than the 'ipse dixit' of the expert."¹⁵⁹

While it may be too soon to appreciate all the repercussions of *Joiner* and *Kumho*, a few observations jump to the forefront. First, there will be a greater focus on the expert's factual basis and methodology.¹⁶⁰ Second, the decisions are almost certain to cause more inconsistency among the courts.¹⁶¹ With no concrete set of factors to apply, a trial court may arbitrarily select from a never-ending plethora of factors.¹⁶² In similar situations, one trial judge may consider a factor while another does not.¹⁶³ Third, the appellate review abuse of discretion standard will make it extremely difficult for appellate courts to create a more stable list of factors and introduce greater consistency in determining whether novel scientific evidence should be admitted.¹⁶⁴ The confusion over the admissibility of novel scientific evidence has not lessened since *Frye* was replaced as the preferred method for admitting novel scientific evidence in 1993.¹⁶⁵ The confusion remains, and in some ways has become amplified by injecting more trial court discretion into the process.

VIII. AMENDED FEDERAL RULE OF EVIDENCE 702

In light of recent Supreme Court decisions, such as *Daubert* and *Kumho Tire*, as well as other appellate court decisions, Federal Rule of Evidence 702 has been amended to read:

154. *See id.*

155. *See id.*

156. *See id.* at 2. "An expert witness's testimony may be called into question because of its 'factual basis, data, principles, methods, or their application.'" *Id.*

157. *See id.* at 3.

158. *See id.* at 3.

159. *Id.* at 3 (citing *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997)). "Ipse dixit" is Latin for "such a thing is so because I say it is so." *Harris v. Cropmate Co.*, 706 N.E.2d 55, 65 (Ill. App. Ct. 1999); BLACK'S LAW DICTIONARY 828 (6th ed. 1990).

160. *See Geller & Lackey, supra* note 134, at 3.

161. *See supra* Part V.C and accompanying notes.

162. *See Geller & Lackey, supra* note 134, at 3.

163. *See id.*

164. *See id.*

165. *See generally Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999) (creating the standard of "relevancy" for admissibility of novel scientific evidence).

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if: (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.¹⁶⁶

The amendment reaffirms the trial court's role as a gatekeeper as established in *Daubert* and recognizes the six *Daubert* factors as set out by the Supreme Court.¹⁶⁷ However, these factors have not been codified into the Rule, but remain guidelines to assist the trial court in assessing the reliability of expert witnesses.¹⁶⁸ The amendment is intended to allow trial courts to consider "any or all of the specific *Daubert* factors where appropriate," and any additional factors the courts deems helpful in any given circumstance.¹⁶⁹

The amendment emphasizes that the techniques or principles utilized by the expert not only be valid, but that they also be properly applied to the given facts in a case.¹⁷⁰ The amendment recognizes the "considerable ingenuity and flexibility" of trial courts in assessing expert testimony under the approach promulgated in *Daubert* and anticipates that this will continue under the new rule.¹⁷¹ With this in mind, the likely trend anticipated under the amended version of Rule 702 is that the rejection of expert testimony will be the exception rather than the rule.¹⁷²

As noted in the previous sections, many commentators have criticized the rule in *Daubert* as not providing clarification for the admission of novel scientific evidence and expert testimony.¹⁷³ The advisory committee's notes following the amendment to Rule 702 fail to consider these criticisms or further clarify the issue.¹⁷⁴ The amendment does bring Rule 702 into alignment with the Supreme Court's decision in *Daubert* and *Kumho Tire*, but will likely have little effect in creating a more workable standard under which courts can analyze the admission of novel scientific evidence.

IX. LIABILITY IN PESTICIDE APPLICATION

The remainder of this Note describes in detail two states attempts to apply the convoluted law of novel scientific evidence to cases specifically involving liability in pesticide application. The cases illustrated clearly show the state courts' frustration

166. FED. R. EVID. 702 (Supp. 2000). *See also id.* at advisory committee's notes.

167. *See* FED. R. EVID. 702 advisory committee's notes (Supp. 2000).

168. *See id.*

169. *Id.*

170. *See id.*

171. *Id.*

172. *See id.*

173. *See supra* Part VI.B and accompanying notes.

174. *See* FED. R. EVID. 702 advisory committee's notes (Supp. 2000).

and struggle with the admissibility of novel scientific evidence.¹⁷⁵ The test used and the type of novel scientific evidence allowed into court is of great importance to both the agricultural industry and to victims of pesticide exposure. If a victim's evidence is excluded it may result in summary judgment and prevent them from proving their case.¹⁷⁶ Additionally, it is clear that lax evidentiary standards will generally favor the plaintiff because they carry the burden in proving that exposure to pesticide caused their injury.¹⁷⁷ The cases discussed below demonstrate this point because in both instances it is the plaintiffs who are defending the trial courts' decisions to admit their novel scientific evidence.¹⁷⁸

A. *Florida Sticks with Frye*

The District Court of Appeal of Florida, Third District, wrestled with the issue of admitting novel scientific evidence in proving the liability of a farmer and pesticide manufacturer in *DuPont v. Castillo*.¹⁷⁹ The facts of the case are as follows. On November 1st or 2nd of 1989, Donna Castillo, seven weeks pregnant with her son John Castillo, walked past the "u-pick" farm (owned by Pine Island Farms) with her daughter, Adriana.¹⁸⁰ At that time she noticed a tractor "bucking and jerking," spraying mist into the air.¹⁸¹ As she walked, the mist completely drenched her, however, she did not shower that night when she returned home.¹⁸²

Donna Castillo claimed that the mist being sprayed into the air by the tractor was Benlate, an agricultural fungicide manufactured by DuPont.¹⁸³ She further asserted that through this exposure to Benlate, benomyl (the active ingredient in Benlate) entered her blood stream via absorption through the dermal layers.¹⁸⁴ She claimed this caused her son John to be born with microphthalmia, "a rare birth defect involving severely underdeveloped eyes."¹⁸⁵ The plaintiffs established that Pine Island sprayed Benlate on the date in question.¹⁸⁶

The Castillos sued both DuPont and Pine Island on theories of strict liability and negligence.¹⁸⁷ To support their claims the Castillos proffered the testimony of Dr. Charles Howard, a senior lecturer and associate professor at the University of

175. See generally *E.I. DuPont De Nemours & Co. v. Castillo*, 748 So. 2d 1108 (Fla. Dist. Ct. App. 2000); *Harris v. Cropmate Co.*, 706 N.E.2d 55 (Ill. App. Ct. 1999) (discussing Florida's and Illinois' analysis of novel scientific evidence in the context of liability for pesticide application).

176. See *General Elec. Co. v. Joiner*, 522 U.S. 136, 142-43 (1997).

177. See generally *E.I. DuPont*, 748 So. 2d at 1108; *Harris*, 706 N.E.2d at 55 (examples of burden of proof and admission of novel scientific evidence).

178. See *E.I. DuPont*, 748 So. 2d at 1110; *Harris*, 706 N.E.2d at 58

179. See *E.I. DuPont*, 748 So. 2d at 1108.

180. See *id.* at 1111.

181. See *id.*

182. See *id.*

183. See *id.* at 1110.

184. *Id.*

185. See *id.*

186. See *id.* at 1112.

187. See *id.* at 1110.

Liverpool in England.¹⁸⁸ Dr. Howard opined that fetal exposure to benomyl would cause microphthalmia in humans at levels of twenty parts per billion in the maternal blood stream.¹⁸⁹ His conclusions were based on two sources: (1) rat gavage studies and (2) lab experiments on human and rat cells.¹⁹⁰

Prior to trial, the defendants moved to exclude Dr. Howard's testimony "on the ground that his methodology for determining whether and at what level Benlate could cause birth defects in humans was not 'generally accepted' in the scientific community and thus inadmissible" because it did not satisfy the *Frye* test.¹⁹¹ The motion was denied.¹⁹²

The jury returned a verdict of \$4 million, holding DuPont liable on strict liability and both DuPont and Pine Island liable on negligence theories.¹⁹³ The verdict was allocated in the following: 99.5% against DuPont and 0.5% against Pine Island.¹⁹⁴ Both "DuPont and Pine Island moved to set aside the verdict and/or for a new trial."¹⁹⁵ The trial court denied this motion and the defendants appealed.¹⁹⁶

The admissibility of scientific evidence in Florida is governed by chapter 90.702 of the Florida statutes, which provides:

If scientific, technical, or other specialized knowledge will assist the trier of fact in understanding the evidence or in determining a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education may testify about it in the form of an opinion; however, the opinion is admissible only if it can be applied to evidence at trial.¹⁹⁷

The District Court of Appeals ruled that it continues "to adhere to the 'general acceptance' standard of *Frye*."¹⁹⁸ Florida continues to adhere to the *Frye* test despite the fact that *Daubert* explicitly replaced *Frye* as the "relevancy" test.¹⁹⁹ Of course, states remain free to do this.²⁰⁰ Further, the court held that "general acceptance" must be established by a preponderance of the evidence and it is up to the proponent to prove "general acceptance" of the underlying scientific principle and the testing procedures used to apply that principle.²⁰¹

188. *See id.*

189. *See id.*

190. *See id.*

191. *Id.*

192. *See id.*

193. *See id.* at 1111.

194. *See id.*

195. *Id.*

196. *See id.*

197. FLA. STAT. Ch. 90.702 (1995).

198. *E.I. DuPont*, 748 So. 2d at 1114.

199. *See Daubert*, 509 U.S. at 597.

200. *See Harvard Law Review Association*, *supra* note 99, at 1492.

201. *See E.I. DuPont*, 748 So. 2d at 1114.

The Florida courts utilize a four-step process for determining the admissibility of expert opinion testimony concerning a new or novel scientific principle:

First, the trial judge must determine whether such expert testimony will assist the jury in understanding the evidence or in determining a fact in issue Second, the trial judge must decide whether the expert's testimony is based on a scientific principle or discovery that is 'sufficiently established to have gained general acceptance in the particular field in which it belongs.'"

. . . .

The third step in the process is for the trial judge to determine whether a particular witness is qualified as an expert to present opinion testimony on the subject in issue Fourth, the judge may then allow the expert to render an opinion on the subject of his or her expertise, and it is then up to the jury to determine the credibility of the expert's opinion, which it may either accept or reject.²⁰²

Through statements by the trial court, the appellate court determined that the trial judge failed to determine whether the expert's scientific principles were generally accepted in the relevant field of study.²⁰³ The trial court's statements were as follows:

Well, I'm still a little confused since I'm the one who has to make the decision on this. This is not like the jury.

This is something like the hearing I had before you came in, which was a probable cause hearing. There is probable cause for me to let this in. In other words, if I believe that science is reliable and the jury—it would assist the trier of fact, in *Frye*, I'm going to let it in.

. . . .

The *Frye* hearing is not to decide the very seminal issue of this case, whether or not it's a teratogen. It's to decide whether the scientists who want to talk about it have reliability, and that is the sole purpose of *Frye*.

. . . .

I have to tell you I find it a human teratogen too, so you are really going to have a problem. I don't know what is in the levels, but I'm going to tell you that if it's a rat teratogen, most probably it's a human teratogen, and I'm going to make that quantum leap.²⁰⁴

202. *Id.* at 1114. (citing *Ramirez v. State*, 651 So.2d 1164, 1168 (Fla. 1995)).

203. *See id.* at 1115.

204. *Id.* at 1114-15 (emphasis omitted).

“General acceptance” is a critical issue and a determinative factor in the Florida test.²⁰⁵ This represents a second divergence from the *Daubert* standard, which considers “general acceptance” to be merely a factor to consider.²⁰⁶

Florida appellate courts review a *Frye* issue as a matter of law, de novo, rather than using the abuse of discretion standard.²⁰⁷ “The de novo review of the *Frye* issue includes an examination of three methods of proof: (1) expert testimony, (2) scientific and legal writings, and (3) judicial opinions.”²⁰⁸ Further, “general acceptance” is considered at the time of appeal rather than the time of trial.²⁰⁹ The standard of review in Florida is a third major deviation from the federal standard of reviewing trial court decisions, which requires use of the “abuse of discretion” standard.²¹⁰

Dr. Howard’s expert scientific evidence was based on teratology, the specialized study of the causation of birth defects.²¹¹ Three primary types of evidence are used in teratology to establish causation: (1) epidemiology; (2) in vivo testing; and (3) in vitro testing.²¹² While no epidemiological studies conclude that Benlate is a teratogen, some in vivo and in vitro tests do establish a link.²¹³

The defendants agreed that in vivo and in vitro tests are generally accepted methods for analyzing the toxicology of chemicals such as Benlate.²¹⁴ However, they argued that direct extrapolation of data from in vivo and in vitro tests to conclude Benlate is a teratogen in humans, such as the method used by Dr. Howard, is not “generally accepted.”²¹⁵ The defendants further claimed no scientific authority can be pointed to that accepts in vivo and in vitro toxicology studies as proof of human developmental factors.²¹⁶ The plaintiffs, in turn, argue that because Dr. Howard’s opinion is based on “generally accepted” scientific principles and methodology, it was not required that his opinion be “generally accepted” as well.²¹⁷ In the alternative, they argued that even if such an extrapolation could not be made, a jury should have been able to decide, from data not subject to extrapolation, whether Benlate caused the birth defect.²¹⁸

The district court in finding for defendants said,

We do not conclude that epidemiological studies are a mandatory prerequisite to establish a toxic substance’s teratogenicity in human beings.

205. *See id.* at 1114.

206. *See Daubert*, 509 U.S. at 597.

207. *See E.I. DuPont*, 748 So. 2d at 1115.

208. *Id.*

209. *See id.*

210. *See General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997).

211. *See E.I. DuPont*, 748 So. 2d at 1115-16.

212. *See id.* at 1116.

213. *See id.* at 1118.

214. *See id.*

215. *See id.*

216. *See id.* at 1119.

217. *See id.* at 1118.

218. *See id.* at 1119.

We do, however, conclude that where, as here, plaintiffs wish to establish a substance's teratogenicity in human beings based on animal and in vitro studies, the methodology used in the studies, *including the method of extrapolating from the achieved results*, must be generally accepted in the relevant scientific community.²¹⁹

Additionally, the plaintiffs' expert admitted at trial that no scientific, governmental, or academic publication relied on direct extrapolation from in vitro test results to determine toxicity in humans.²²⁰

The district court reversed and remanded the trial court's decision to admit the plaintiffs' scientific evidence because "the methodology used to obtain them is not generally accepted in the relevant scientific community."²²¹ Therefore, no proof of causation was presented and "DuPont and Pine Island's motions for directed verdict should have been granted."²²² In support of its conclusion, the Florida District Court quoted the Supreme Court of Texas:

[H]istory tells us that the scientific community has been slow at times to accept valid research and its results. While these observations are true, history also tells us that valid and reliable research and theories are generally accepted quickly within the scientific community when sufficient explanation is provided and empirical data are adequate Our legal system requires that claimants prove their cases by a preponderance of the evidence. In keeping with this sound proposition at the heart of our jurisprudence, the law should not be hasty to impose liability when scientifically reliable evidence is unavailable. As Judge Posner said, "[l]aw lags science; it does not lead it."²²³

B. "Frye Plus Reliability:" Illinois' Hybrid Solution

In the case of *Harris v. Cropmate Co.*,²²⁴ the Illinois Court of Appeals for the Fourth District applied the "Frye plus reliability" standard for the admission of novel scientific evidence.²²⁵ The case involved claims by a farmer that Cropmate Company negligently sprayed herbicide, specifically 2,4-D, on adjacent farmland causing damage to the farmer's cantaloupe, pumpkin, and watermelon crops.²²⁶ At trial the plaintiff was awarded \$280,756 in damages, and Cropmate appealed on the basis that

219. *Id.* at 1120 (emphasis added).

220. *See id.*

221. *Id.* at 1121.

222. *Id.*

223. *Id.* (quoting *Merrell Dow Pharm., Inc. v. Havner*, 953 S.W.2d 706, 727-28 (Tex. 1997)).

224. *Harris v. Cropmate Co.*, 706 N.E.2d 55 (Ill. App. Ct. 1999).

225. *See id.* at 60.

226. *See id.* at 58, 60. Although the facts in this case involve claims of property damage from pesticide application rather than illness, the test proffered would apply equally to the latter.

the *Daubert* standard should have been applied to exclude the testimony of the plaintiff's experts.²²⁷

The Illinois court initially seemed to struggle with their own evidentiary standard and stated, "it *appears* that Illinois utilizes a 'Frye plus reliability' standard for admission of 'novel scientific evidence.'"²²⁸ However, the court was absolutely clear that Illinois never adopted the *Daubert* standard.²²⁹ After determining the proper test to be utilized, the court detailed the following six-prong test:²³⁰

- (1) "Precisely, what evidence is being proffered?"²³¹
Once it is determined exactly what evidence is being offered to the court, go to step 2 to apply the remainder of the test.²³²
- (2) "Will the proffered testimony assist the trier of fact to understand the evidence or determine facts in issue . . . ?"²³³
If no, the testimony should be rejected.²³⁴ This is essentially a function of Federal Rule of Evidence 702 and its similar state counterpart, because under the Rules, evidence should be admitted if it "will assist the trier of fact to understand the evidence or to determine a fact in issue"²³⁵
If yes, go to step three.²³⁶
- (3) "Does the proffered testimony constitute 'scientific' evidence?"²³⁷
If no, the *Frye* standard does not apply, and an evidentiary hearing on the reliability of the proffered testimony may still be conducted.²³⁸
If yes, go to step 4.²³⁹
- (4) "Is that scientific evidence 'novel' . . . ?"²⁴⁰
If no, "the scientific method or technique has been generally accepted in the relevant scientific community," and the *Frye* standard is satisfied.²⁴¹ Once again, the court is allowed at its discretion to hold a hearing into the reliability of the testimony.²⁴²

227. See *id.* at 59; Joseph G. Feehan, *Life After Daubert and Kumho Tire: An Update On Admissibility of Expert Testimony*, 88 ILL. B.J. 134, 138 (2000).

228. *Harris*, 706 N.E.2d at 60 (emphasis added).

229. See *id.* at 58. The court then went on to voice its concerns about *Daubert*, stating "we are not at all sure *Daubert* should be adopted in this State—at least not at the present." *Id.* at 59.

230. See *id.* at 60. For greater understanding, the test has been configured into flowchart form.

231. *Id.*

232. See *id.*

233. *Id.*

234. See *id.*

235. FED. R. EVID. 702.

236. See *Harris*, 706 N.E.2d at 60.

237. *Id.*

238. See *id.*

239. See *id.* at 62.

240. *Id.* In making the determination under this prong, it is important for courts to look for any controlling precedent on point. See *id.*

241. *Id.*

242. See *id.* at 62-63.

If yes, go to step 5.²⁴³

(5) “[D]oes the evidence meet the *Frye* admissibility standard?”²⁴⁴ The fifth prong requires the trial court to make two further determinations: (1) what is the relevant scientific community to which the opinion witness belongs?; and (2) in that identified scientific community, is the technique or method generally accepted?²⁴⁵

If the technique is not generally accepted, it fails the *Frye* standard and should not be admitted at trial.²⁴⁶

If the technique is generally accepted, go to step 6.²⁴⁷

(6) “[I]s this evidence reliable?”²⁴⁸ In making this determination, the Illinois Appellate Court took a *Daubert*-like approach to reliability.²⁴⁹ As in *Daubert*, the following factors do not create a rigid test, but merely guideposts for the courts to follow.²⁵⁰

(1) Can the scientific technique or method employed be empirically tested, and if so, has it been? (2) Has the technique or method been subjected to peer review and publication? (3) What is the technique or method’s known or potential error rate? (4) Are its underlying data reliable? (5) Is the witness proposing to testify about matters growing naturally and directly out of research she has conducted independently of the litigation, or has the witness developed her opinion solely for the purpose of testifying? and (6) Did the witness form her opinion and then look for reasons to support, rather than doing research that led her to her conclusion?²⁵¹

In determining reliability, trial courts are not bound by the rules of evidence and, therefore, may consider hearsay, such as: scientific journals, law reviews, prior decisions, and testimony regarding the acceptance of the technique or method and the attitudes of fellow scientists.²⁵²

When the court applied the test to the specific facts of this case it quickly ruled that the *Frye* standard of admissibility was not satisfied.²⁵³ Under the first prong, the court examined exactly what evidence was being proffered, which was the testimony of Kregel, a seed salesman with experience applying 2,4-D, Hager, a

243. See *id.* at 62, 64.

244. *Id.* at 64.

245. See *id.* Merely because a scientific technique is new does not bar its admissibility. See *id.* If the technique is or would be generally accepted by the scientific community then it may be admitted. See *id.*

246. See *id.*

247. See *id.*

248. *Id.*

249. See *id.* See also Robert Pisani, *Illinois Fourth Appellate Court Adopts Daubert-like Analysis for Admission of Expert Testimony*, 1 TOXIC TORT & ENVIRON. L. NEWS 1 (June 1999) available at <<http://www.mckenna-law.com/Toxic%20Torts/6-99.htm>>.

250. See *Harris*, 706 N.E.2d at 65. See also *Daubert*, 509 U.S. at 592-93.

251. *Harris*, 706 N.E.2d at 65.

252. See *id.*

253. See *id.* at 62.

doctoral student in weed science, and Scott, a research biologist.²⁵⁴ Each testified that the herbicide 2,4-D caused the damage to Harris's crops based upon their visual examinations of the crops.²⁵⁵ Under the second prong, the court noted that Cropmate did not contend that that the proffered testimony would not assist the jury, and the court proceeded to prong three.²⁵⁶ Under prong three, the court must determine if the proffered testimony constitutes scientific evidence.²⁵⁷ The court concluded that the testimony proffered, a recount of the visual inspection of the damaged crops, did not meet the definition of scientific evidence, and the *Frye* standard of admissibility did not apply.²⁵⁸ The technique utilized by the plaintiff's witnesses is called "comparative symptomology."²⁵⁹ This technique simply compares plants known to be exposed to a certain chemical with plants suspected of being exposed to the same chemical.²⁶⁰ None of the experts relied on any particular scientific principle or methodology in determining that the crops were exposed to the herbicide 2,4-D, but relied upon: "(1) their generalized knowledge of agriculture, including crops and weeds; (2) their first hand experience with and observations of the effects of exposure to 2,4-D upon cucurbits; and (3) the type of deductive reasoning common to everyone."²⁶¹

Having ruled that the testimony was not scientific and therefore, that the *Frye* standard of admissibility did not apply, the appellate court affirmed the judgment of the trial court.²⁶² Because the Illinois Appellate Court ended its analysis with the third prong, it never applied the *Daubert* reliability factors of the sixth prong.²⁶³ However, in *Kumho Tire* the Supreme Court of the United States clearly stated that

254. *See id.* at 60.

255. *See id.*

256. *See id.*

257. *See id.*

258. *See id.* at 62. As stated earlier, a hearing into the reliability of the testimony may still be conducted. *See id.* at 60. A scientific expert is defined as, "an expert who relies on the application of scientific principles, rather than on skill—or experience—based observation, for the basis of his opinion." *Carmichael v. Samyang Tire Inc.*, 131 F.3d 1433, 1435 (11th Cir. 1997).

259. *See Feehan, supra* note 227, at 138.

260. *See id.* *See also Harris*, 706 N.E.2d at 62.

261. *Harris*, 706 N.E.2d at 62. To draw the distinction between scientific and non-scientific expert testimony, the court used the illustration of the testimony of an aeronautical engineer and a beekeeper to prove how bees fly. *See id.* at 61. The aeronautical engineer, using principles of flight, could explain how a bee flies without ever having even seen a bee and such testimony would be considered to be scientific evidence. *See id.* A beekeeper, on the other hand, could testify that bees always take off into the wind, but his or her testimony would not be considered scientific evidence because the beekeeper reached this opinion through his or her knowledge of bees, observations of bees, and common reasoning. *See id.*

262. *See id.* at 62. Once a court decides that testimony is not scientific evidence, the analysis usually ends. *See id.* However, the court raised the hypothesis that assuming it was scientific evidence that under the fourth prong it would not be novel. *See id.* at 62-63. The court rested this conclusion on the fact that it is standard practice to visually examine plants in order to make a diagnosis, and that documentation on the visual examination of plants exposed to 2,4-D had been published in the 1980s. *See id.* at 63.

263. *See id.* at 62.

the analysis of expert testimony is the same for both scientific and non-scientific expert testimony.²⁶⁴ While state courts are allowed to create their own tests for the admissibility of novel scientific evidence,²⁶⁵ it remains unclear if they may treat the admissibility of scientific and non-scientific evidence differently in light of the *Kumho* decision.²⁶⁶

X. CONCLUSION

The evolution of the admissibility of novel scientific evidence, partially motivated by the handcuffing that toxic tort litigants experienced under *Frye*, has been an attempt by the federal courts for greater consistency among their decisions, while simultaneously striving for greater flexibility.²⁶⁷ Predominantly, the Supreme Court has achieved the latter objective, but has fallen short on the former. Greater discretion and flexibility among the trial court levels furthers the trial judge's role as gatekeeper but increased flexibility proliferates inconsistency.

E.I. DuPont and *Harris* illustrate the stark contrast between the rules applied among the states, and between the state and federal levels. State courts are not required to follow the Supreme Court's lead on this issue and many opt not to, preferring their own rules.²⁶⁸ While the result in *E.I. DuPont* may very well be the same as at the federal level, the test presented in *E.I. DuPont* is obviously less flexible.²⁶⁹ Novel scientific evidence that fails to meet the "general acceptance" test is automatically excluded, although the Florida court also recognized several other factors to consider, similar to that of the federal standard.²⁷⁰ It is clear that some novel scientific evidence that would pass under the *Daubert* standard would likely fail under the Florida test. What the Florida test does offer is a greater sense of consistency. Illinois appears to appreciate the flexibility of the *Daubert* standard, but seems infatuated with the consistency of the *Frye* standard. Illinois obviously attempted to combine the best of aspects of both tests into their new "*Frye* plus reliability" standard. Only time will tell if this new standard will create the desired result.

A toxic tort plaintiff wishing to recover from a farmer who has spread chemicals on his field, thereby causing illness, is in quite a quandary. At the federal level, the plaintiff faces a trial court judge having a great deal of discretion to admit or exclude the plaintiff's novel scientific evidence.²⁷¹ If the court excludes the evidence, the plaintiff has little redress due to the "abuse of discretion" standard at

264. See *Kumho Tire*, 526 U.S. at 148.

265. See Harvard Law Review Association, *supra* note 99, at 1492.

266. See Feehan, *supra* note 227, at 141.

267. See Harvard Law Review Association, *supra* note 99, at 1508. See also *Daubert*, 509 U.S. at 597.

268. See Harvard Law Review Association, *supra* note 99, at 1492.

269. Compare *Daubert*, 509 U.S. at 597, and *Kumho Tire*, 526 U.S. at 137, with *E.I. Du Pont*, 748 So. 2d at 1120.

270. See *E.I. Du Pont*, 748 So. 2d at 1120.

271. See, e.g., *General Elec. Co. v. Joiner*, 522 U.S. 512, 517-19 (1997).

the appellate level.²⁷² If the state courts are utilized, the plaintiff will be required to determine exactly what standard their state uses.²⁷³ Depending on the state, the rules may be more or less consistent in their outcomes and proportionately more or less flexible. For example, Florida's stringent rules of admissibility do not allow the trial court to be very flexible in admitting scientific evidence but should allow the plaintiff to determine beforehand whether the proposed novel scientific evidence is likely to be admitted.²⁷⁴

In today's vast maze of federal and state courts, the world of novel scientific evidence does not boast many clear answers. Many plaintiffs are left to wonder whether their causes of action will survive. In this world of shifting and changing landscapes, plaintiffs must learn how to navigate the terrain or be left by the wayside of toxic tort litigation.

272. See, e.g., *id.* at 517.

273. See, e.g., *E.I. DuPont*, 748 So. 2d at 1115 (stating Florida uses a de novo standard of review).

274. See *id.* at 1114-15.