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THE UNANSWERED QUESTIONS OF CHRISTOPHERSEN V. ALLIED-SIGNAL CORP.

Richard O. Faulk†

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In Christophersen v. Allied-Signal Corp., the Fifth Circuit sitting en banc announced a controversial new test for evaluating the admissibility of scientific evidence. An earlier panel decision reversed a summary judgment for the defendant chemical manufacturers, holding that the testimony of the plaintiffs’ expert regarding cancer causation was not so fundamentally unreliable that it should be excluded from jury consideration. On rehearing en banc, a divided court disagreed with the panel decision and affirmed the district court’s summary judgment rendered on behalf of the chemical manufacturers. In its en banc opinion, the Fifth Circuit announced a new test for analyzing the admissibility of expert testimony.
of scientific proof under the Federal Rules of Evidence.\textsuperscript{4}

In general, the court required experts to base their opinions upon facts which are reasonably relied upon by experts in their field.\textsuperscript{5} The court also required the opinions to be derived through generally accepted scientific methods.\textsuperscript{6} Despite a concerted attempt to resolve general scientific evidence issues, the Christophersen court left many important questions unanswered. Most importantly, the court did not provide district courts with any guidance for cases where the experts disagree concerning the necessity for certain facts or the appropriateness of particular methodologies.

I. Background of the Dispute

Christophersen concerned the admissibility of the plaintiffs’ expert’s testimony regarding the causal connection between exposure to cadmium and colon cancer.\textsuperscript{7} Since the plaintiffs had only one expert who testified about this connection, their causation case depended entirely upon the admissibility of his opinions.\textsuperscript{8} In deciding that the opinion of the plaintiffs’ expert should be excluded because it was unreliable, the district court emphasized the insufficiency of exposure evidence.\textsuperscript{9} The plaintiffs’ expert

4. \textit{Id.} at 1110.
5. \textit{Id.} at 1111.
6. \textit{Id.} “As long as the expert’s methodology is well founded, the nature of the expert’s conclusion is generally irrelevant.” \textit{Id.}
7. \textit{Id.} at 1108. In 1986, Christophersen died as a result of a rare, small-cell form of cancer that originated in his colon and metastasized to his liver. \textit{Id.} During the 14 years preceding his death, Christophersen worked for Marathon, a plant that produces nickel/cadmium batteries. \textit{Id.} Although Christophersen was not directly involved in the production of the batteries, his job duties did require him to visit the plant area where the batteries were manufactured. \textit{Id.} Christophersen was allegedly exposed to nickel and cadmium fumes on these visits. \textit{Id.} Christophersen’s surviving spouse and child, the plaintiffs, contended that these fumes contained particles of nickel and cadmium, and that the exposure caused the cancer that resulted in his death. \textit{Id.}
8. Christophersen, 902 F.2d at 364. The district court weighed “Dr. Miller’s affidavit as the only evidence supporting plaintiffs’ claim of causation. . . Therefore, if the district court properly determined that Dr. Miller’s conclusion should be excluded, the grant of summary judgment was appropriate.” \textit{Id.}
9. \textit{Id.} at 365. The district court analyzed Dr. Miller’s opinion under Federal Rule of Evidence 703. Rule 703 reads:

The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to the expert at or before the hearing. If 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.
conceded that the level and duration of exposure were "important considerations when evaluating the effect of exposure to a toxic substance." 10 The court, however, found that the expert had relied almost entirely on incomplete or inaccurate exposure data from an affidavit by one of the defendant's former employees.11 For example, the affidavit did not describe the chemical composition or concentrations of the fumes to which the decedent was exposed.12 The expert had no information regarding the size of the workplace or its ventilation characteristics.13

The expert also made significant factual errors by overstating the decedent's duration of exposure.14 Apparently, the expert merely assumed the decedent was exposed to sufficient levels of cadmium without any objective evidence of dosage and inaccurate evidence of duration. Additionally, although the expert acknowledged the importance of animal, in vitro, and epidemiologic studies in determining causation, he did not rely upon any of those methods in reaching his opinions.15 Rather, his conclusions were based upon general references to unspecified medical literature, the plaintiffs' medical records, and the expert's personal experience and training.16

Based upon these inconsistencies, the district court held that the expert's opinion was unreliable as a matter of law.17 According to the district court, the expert's testimony failed to satisfy the mandate of Rule 703 of the Federal Rules of Evidence, which requires the facts and data supporting an expert's opinions to be "of a type reasonably relied upon by experts" in his particular

FED. R. EVID. 703 (emphasis added).
10. Christophersen, 939 F.2d at 1113.
11. Id. The district court found that virtually all of plaintiffs' expert's data came from the affidavit of a Marathon employee named Edgar Manoliu. Id.
12. Id. The affidavit was lacking of any "information about the type of fumes to which Christophersen was exposed or the type of fumes generated by the battery manufacturing process." Id.
13. Id. Plaintiffs' expert, Dr. Miller, was not informed "as to the physical facilities at the Marathon plant, including the size of the plant or the impregnation and soak area, or the ventilation available in these areas or in Christophersen's office." Id.
14. Christophersen, 939 F.2d at 1113. Dr. Miller's opinion assumed that Christophersen had worked in the plant for 20 years when in fact he had only worked there for the 14 years preceding his death. Id.
15. Id. at 1115.
16. Id. Plaintiffs' expert merely had a "scientific hunch . . . [which is] inadequate to support a judgment in favor of Christophersen." Id.
17. Id. at 1116. For a discussion of the district court's analysis, see supra notes 7-9 and accompanying text.
field.\textsuperscript{18} Since the expert agreed that dosage was an important consideration in determining causation, his inability to quantify accurately the nature or timing of exposure demonstrated that his opinion was not based on facts "reasonably relied upon" by experts in his field.\textsuperscript{19}

Initially, a panel of three judges of the United States Court of Appeals for the Fifth Circuit reversed the district court's judgment.\textsuperscript{20} According to the panel, the district court failed to give proper deference to the role of the jury in evaluating the credibility of expert witnesses. The panel emphasized that "questions relating to the bases and sources of an expert's opinion affect the weight to be assigned that opinion rather than its admissibility and should be left for the jury's consideration."\textsuperscript{21} According to the panel, the opinion should be disregarded only if it is fundamentally unsupported and "would not actually assist the jury in arriving at an intelligent and sound verdict."\textsuperscript{22} In view of the apparent conflicts between the panel's decision and previous Fifth Circuit precedents, the manufacturers moved for a rehearing en banc.\textsuperscript{23}

\section{II. A Background of Conflicting Precedents}

The Fifth Circuit's en banc reconsideration of the panel's decision was not unexpected. For some time, a number of the Fifth Circuit's judges have been concerned with the difficulties posed by the role of experts and scientific proof.\textsuperscript{24} For this reason, the rehearing attracted a number of amicus curiae briefs from organizations such as the Chemical Manufacturers Association, Products Liability Advisory Council, and the Trial Lawyers for Public Justice.\textsuperscript{25} Consistent with Judge Higginbotham's concerns in \textit{Brock v. Merrell Dow Pharmaceuticals, Inc.},\textsuperscript{26} the briefs submitted on behalf of the manufacturers expressed concern over "the role of experts

\textsuperscript{18} Christopherersen, 939 F.2d at 1113.
\textsuperscript{19} Id.
\textsuperscript{20} Id. at 1109. This panel held that plaintiffs' expert's "opinion was not so fundamentally unreliable that the jury should not consider it." \textit{Id}.
\textsuperscript{21} Christopherersen, 902 F.2d at 364.
\textsuperscript{22} Id.
\textsuperscript{23} Christopherersen, 939 F.2d at 1109.
\textsuperscript{25} Christopherersen, 939 F.2d at 1108.
\textsuperscript{26} 884 F.2d 167 (5th Cir. 1989), \textit{cert. denied}, 494 U.S. 1046 (1990).
in the federal courts, including whether we should accept opinions of experts not based upon a generally accepted scientific principle." 27 Additionally, they echoed Judge Higginbotham's "more broadly stated concern that substantive principles such as tort law are not handling science issues in a rational manner." 28

Unfortunately, the Fifth Circuit could not approach this issue afresh. In a number of earlier cases, the court rendered some difficult, case-specific decisions. 29 Prior cases had required an expert to do more than state his credentials and a subjective opinion. 30 Beyond this general requirement, however, the Circuit's opinions are blurred. Each case seemed to turn upon its respective panel's view of the scientific data. Some endorsed a battle of the experts, while others viewed such conflicts with distaste. 31 Although the Christophersen panel reached their result by

27. Id. at 168. On October 13, 1992, the Supreme Court granted certiorari to hear Daubert v. Merrell Dow Pharmaceuticals, Inc., 951 F.2d 1138 (9th Cir. 1991), cert. granted, 61 U.S.L.W. 3061. This case contains the same fact situation (birth defects caused by ingestion of a prescribed drug during pregnancy) and legal issue (how must expert opinion and methodology be substantiated in order to be admissible) as Brock. In Daubert, the parents of two children born with limb defects sued the manufacturer of the anti-nausea drug, Bendectin, for causing the birth defects. Daubert, 951 F.2d at 1129. Plaintiffs' causation evidence consisted primarily of an expert opinion based on "in vitro and in vivo animal tests, chemical structure analyses and the reanalysis of epidemiological studies." Id. (emphasis added). Merrell Dow Pharmaceuticals presented expert opinions that of the more than 30 published studies involving over 130,000 patients, no statistically significant association between Bendectin and birth defects had been demonstrated. Id. The district court granted summary judgment, deciding that the plaintiffs had not met their burden of proving that Bendectin caused the children's birth defects. Id. On appeal, the Ninth Circuit reviewed the plaintiffs' expert's methodology using the Frye test. Id. "For expert opinion based on a given scientific methodology to be admissible, the methodology cannot diverge significantly from the procedures accepted by recognized authorities in the field." Id. The court found that "reanalysis of epidemiological studies" is only a "generally accepted scientific technique" when it is subjected to verification and scrutiny by others in the field. Id. at 1130-31. Since the expert's opinion had not been subjected to such scrutiny, the court affirmed the district court's grant of summary judgment. Id.


29. See Viterbo v. Dow Chem. Co., 826 F.2d 420 (5th Cir. 1987) (expert opinion that is supported solely by credentials and subjective opinion is not admissible); United States v. Williams, 447 F.2d 1285, 1291 (5th Cir. 1971), cert. denied, 405 U.S. 954 (1972) (expert testimony can rely on facts or data not admitted into evidence if they are of type reasonably relied upon within expert's community).

30. See Viterbo, 826 F.2d at 424 (affirming summary judgment for manufacturer when opinion lacked foundation and reliability necessary to support expert testimony).

ineffectively distinguishing Brock,32 the en banc court attempted to reconcile the circuit’s ostensibly inconsistent precedents.33 The court did so by creating a four-part test for admissibility.

III. THE CHRISTOPHERSEN STANDARDS

According to the en banc court, a district court confronted with expert testimony must make the following determinations before admitting the testimony into evidence:34

(A) whether the witness is qualified to express an expert opinion;
(B) whether the facts upon which the expert relies are the same type as are relied upon by other experts in the field;
(C) whether in reaching his conclusion the expert used a well-founded methodology; and
(D) whether the testimony’s potential for unfair prejudice substantially outweighs its probative value.35

Although the court insisted that this test does not introduce any “new concepts into our jurisprudence,”36 the ultimate holding is indeed something completely different. In a real sense, this new test is a patchwork quilt which pieces the Federal Rules, Viterbo, Osburn, and Brock together with a surprising old thread - the “general acceptance” test of Frye v. United States.37

Frye was the seminal case regarding the admissibility of scien-

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32. Christophersen, 902 F.2d at 367.
33. Christophersen, 939 F.2d at 1111.
34. Id. at 1110. The court sets out this framework for trial judges struggling with expert testimony from Federal Rules of Evidence 702 and 703, and from Frye v. United States, 293 F. 1013 (D.C. Cir. 1923). Christophersen, 939 F.2d at 1110.
35. Christopherson, 939 F.2d at 1110.
36. Id. The court said that the four steps were “guideposts drawn from the Federal Rules of Evidence and [their] cases.” Id.
37. 293 F. 1013 (D.C. Cir. 1923). In Frye, the court stated that the time when a “scientific principle or discovery crosses the line between the experimental and demonstrable stages is . . . somewhere in . . . [the] twilight zone.” Id. at 1014. The court went on to state that although “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 . . . .” Id. The court held that the systolic blood pressure test was not established well enough by physiological and psychological authorities to be admitted. Id.
scientific evidence. It initiated the requirement that, as a prerequisite to admissibility, a scientific principle or discovery "must be sufficiently established to have gained general acceptance in the particular field in which it belongs."38 Until Christophersen, the continued viability of Frye after the promulgation of the Federal Rules of Evidence was an open question. Certainly, the Fifth Circuit had never applied Frye in a toxic tort context, citing it instead to disallow opinions based on novel scientific techniques, such as voice-stress analysis and hypnosis.39 Indeed, the court had categorically stated that, in a toxic tort case, "the absence of a scientific consensus on a given theory does not affect the admissibility of an expert's opinion."40 Despite this history, the Christophersen court cited and applied Frye to determine whether the expert's testimony was based upon a "well-founded methodology."41 As the dissent in Christophersen asserted, and as the majority intimated, an evaluation of methodology is in reality a review of the expert's "study and the reasons for his opinion."42 The evaluation is designed to ensure that experts reach their conclusions through rational thought processes, rather than speculations.

In applying this new test, the court did not seriously question the plaintiffs' expert's qualifications, except to note that the district court had the right to scrutinize the expert's "lack of specialized experience and knowledge."43 Moreover, the court did not emphasize the role of Federal Rule of Evidence 403, which generally permits courts to exclude otherwise admissible testimony because of the danger of "unfair prejudice."44 According to the court, Rule 403 merely serves a "general screening function."45 The court focused on the second and third inquiries, namely, the

38. Id. at 1014.
39. Christophersen, 939 F.2d at 1132 (Reavley, J., dissenting).
41. Christophersen, 939 F.2d at 1115. The court said that when analyzing the validity of an expert's methodology, the court should apply the "Frye test: whether the methodology or reasoning that the expert uses to connect the facts to his conclusion is generally accepted within the relevant scientific community." Id.
42. Id. at 1133.
43. Id. at 1112-13. Even though the district court scrutinized the expert's experience and knowledge, the expert's testimony was excluded under Federal Rule of Evidence 703 and the Frye methodology test. Id. at 1115-16.
44. Id. at 1116. Under Rule 403, a court can exclude relevant evidence if its probative value is substantially outweighed by the danger of unfair prejudice. Fed. R. Evid. 403.
45. Christophersen, 939 F.2d at 1112.
sufficiency of the facts upon which the opinions were based, and the reliability of the expert's methodology.

Although these factors are stated separately in the court's opinion, they are difficult to distinguish in its analysis. The critical part of the opinion deals with the expert's admission that accepted methodology requires a consideration of dosage and his subsequent expression of an opinion without such evidence. According to the court,

"if the dosage of the harmful substance and the duration of exposure to it are the types of information upon which experts reasonably rely when forming opinions on the subject, then the district court was justified in excluding Dr. Miller's opinion that is based upon critically incomplete or grossly inaccurate dosage or duration data."

Regarding this issue, the court apparently concluded that, although the expert acknowledged that certain facts should be considered before reaching a toxicologic conclusion, he lacked sufficient data to reach a reliable conclusion regarding the decedent. As a result, his specific causation opinion regarding the individual decedent was not based upon facts upon which "experts in the field" reasonably rely.

On the issue of general causation, namely, whether exposure to cadmium is capable of causing colon cancer, the court applied the third, or Frye, test. By this inquiry, the court asked whether the methodology or reasoning process used by the expert in reaching his opinions was "generally accepted" in the scientific community. Significantly, the existence of a standard methodology was not disputed. Although the expert testified that human epidemiological studies, live animal testing, and in vitro testing were the primary kinds of evidence "most often used to establish causation," his ultimate opinions did not rely on any of these methods. Rather, the expert relied, without citation of specific

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46. Id. at 1113. See supra text accompanying notes 14-16.
47. Christophersen, 999 F.2d at 1114.
48. Id. at 1114-15.
49. Id. at 1115.
50. Id. The court said that the way to analyze the validity of an expert's methodology "is by applying the Frye test . . . ." Id.
51. Id.
52. Christophersen, 999 F.2d at 1115.
53. Id. The district court found it inconsistent that the expert concluded that these were the primary kinds of evidence used to establish causation, but that the expert did not effectively rely upon any of them. Id.
medical authorities or literature, upon the medical records, research literature, and the expert's education and experience. The en banc court concluded that, as a matter of law, the expert's reasoning did not follow the "generally accepted" or "well-founded" methodology. As the court stated, "All Dr. Miller had was a scientific hunch, which as far as the record shows, no one else shares. This was enough to support further investigation but was inadequate to support a judgment in favor of Christophersen." Under this holding, causation opinions based upon hypotheses which cannot be rationally confirmed through generally accepted epidemiologic or toxicologic methods are inadmissible under the Frye test.

Thus, the majority opinion in Christophersen can be condensed into two basic holdings. First, in determining causation in a particular individual, experts must base their opinions on facts which are reasonably relied upon by other experts in their field. If certain facts are essential to the standard analysis, such as dose levels and duration, the expert must develop those facts accurately and must consider them in his analysis. If these facts are not properly developed and considered, the expert's opinion must be excluded. Secondly, the expert's causation opinions must be derived through generally accepted toxicologic or epidemiologic methods. If an expert acknowledges the significance of methods such as animal studies, in vitro studies or epidemiologic reviews, but fails to apply them in his analysis, his opinion is legally unreliable and must be excluded.

IV. Unanswered Questions

Unfortunately, these are not bright line tests, and Christophersen probably raises as many new questions as it answers. For example, what predicate must be laid down before a court concludes that the expert's facts are of a type reasonably relied upon by experts in the particular field? What showing must be made to prove that the expert's methodology is generally accepted? What happens when the experts themselves disagree regarding the need for certain facts, or whether a particular

54. Id. at 1124 (Reavley, J., dissenting). See supra note 16 and accompanying text.
55. Id. at 1115-16.
56. Id. at 1115.
57. For a relevant discussion, see supra notes 17-19 and accompanying text.
58. Id. For a relevant discussion, see supra notes 49-55 and accompanying text.
methodology has been generally accepted? In Christophersen, all of the experts apparently agreed regarding the necessity of certain exposure evidence and the relevance of certain specific methodologies.59 This simplified the analysis substantially. However, what about the next case, which will surely arise, where the expert testimony conflicts on these threshold points? Is an evidentiary or in limine hearing required to determine these controversies and, if so, what guideposts should the district court apply in weighing the expert’s credibility at such a hearing? These important questions are not answered by Christophersen. Therefore, one suspects that Christophersen is not the Fifth Circuit’s last word on scientific evidence.

V. CONCURRING AND DISSenting Views

Christophersen was not a unanimous opinion.60 The concurring and dissenting opinions were generally consistent in their disapproval of the majority’s reliance on Frye and their insistence that the new test could not be justified under Rules 702 and 703.61 In his concurrence, Chief Judge Clark asserted that the danger of unfair prejudice was alone sufficient to justify excluding the expert’s testimony under Rule 403.62 The dissenters severely criticized the majority’s decision as denying plaintiffs’ “right to trial by jury, and eliminating substantive rights in tort cases where federal courts have only diversity jurisdiction.”63 As the dissenters saw the controversy, “the jury represents neither the ideal arbitration of scientific conflict, nor its permanent resolution, but simply the essential voice of the community in solving one problem fairly brought before it.”64 They did not see the issue in terms of good or bad science, stating “Let the experts settle the

59. Christophersen, 999 F.2d at 1115. Both plaintiffs’ expert witness and defendant’s expert witness agreed as to the kinds of evidence used to establish causation. Id. However, plaintiffs’ witness did not rely upon these kinds of evidence. Id.

60. Seven judges contributed to the majority opinion; the Chief Judge filed a concurring opinion; four judges joined in a dissent. Id.

61. Christophersen, 999 F.2d at 1119-20, 1129-34 (Clark, C.J., concurring and Reavley, J., dissenting, respectively).

62. Id. at 1121-22. Chief Judge Clark stated that the expert’s testimony passed Rules 702 and 703. Id. at 1121. However, since there was no manifest error in the district court’s ruling that the expert’s testimony was substantially outweighed by the danger of unfair prejudice, Judge Clark did not reverse. Id. at 1122.

63. Id.

64. Id. at 1128. The dissenters noted that the resolution of the evidentiary conflict in this case requires but “attentive common sense.” Id. at 1129.
larger dispute in due time; we have cases to resolve." Of course, such remarks assume the question. There simply is no case to resolve in the absence of rational scientific evidence. The majority’s opinion holds that in the absence of a reasoned analysis based upon accurate facts and sound methods, there is no evidence for a jury to evaluate. Of course, cases can be resolved while the larger issue remains undecided, but without a rational scientific basis, the cases must be dismissed, rather than proceeding to trial.

VI. CONFLICTS WITH PAOLI

Christophersen conflicts with the Third Circuit’s opinion in In re Paoli Railroad Yard PCB Litigation. Although the Third and Fifth Circuits did not differ substantially regarding expert qualifications, factual reliability, or prejudice issues under Rule 403, the courts diverged when they addressed the issue of methodologic reliability. Although both courts focused upon the reliability of the methodologies underlying the expert’s opinions, they evaluated reliability in different ways. While Paoli asked whether an expert’s methodology was sufficiently accurate to be helpful to the jury, Christophersen required a showing that the methodology was “generally accepted” in the field. Unfortunately, neither court emphasized specific factors or considerations which a district court should consider in determining accuracy or general acceptance.

65. Id. at 1128-29.
66. Christophersen, 939 F.2d at 1136 (Reavley, J., dissenting).
67. 916 F.2d 829 (3d Cir. 1990), cert. denied, 111 S. Ct. 1584 (1991). In Paoli, the plaintiffs were 38 people who had worked or lived near the Paoli railyard. Id. at 835. Plaintiffs’ main claim was that they had contracted illnesses from exposure to polychlorinated biphenyls (PCBs). Id. The defendants were the Monsanto Corporation, a leading producer of PCBs; General Electric Company, manufacturer of transformers; Amtrak, owner of the railyard between 1976 and 1983; Southeastern Pennsylvania Transit Authority, owner of the railyard since 1983; and the City of Philadelphia, which owned some of the railroad cars at the railyard. Id. The district court granted summary judgment to defendants on all claims except for those for property damage and CERCLA response costs. In re Paoli R.R. Yard PCB Litig., 706 F. Supp. 358 (E.D. Pa. 1988). The Third Circuit Court of Appeals reversed, holding that when plaintiffs’ improperly excluded experts’ testimony is considered, general issues of material fact existed regarding whether plaintiffs had been exposed to PCBs, and whether PCBs had caused plaintiffs’ injuries. Paoli, 916 F.2d at 862.
68. Paoli, 916 F.2d at 857. The court held that the district court could not exclude an expert’s report on the ground that it had “not been peer-reviewed or accepted by anyone in particular . . . .” Id. at 857-58.
69. Christophersen, 939 F.2d at 1115. See supra discussion accompanying note 55.
In *Paoli*, the court applied the standards it enunciated in earlier decisions, most notably *United States v. Downing* and *DeLuca v. Merrell Dow Pharmaceuticals, Inc.* Under *Downing*, a court which is ruling on the admissibility of novel scientific evidence must conduct a preliminary inquiry to determine the "soundness and reliability of the process or technique used in generating the evidence." According to *DeLuca*, the court must give due deference to the "strong and undeniable preference" of the Federal Rules of Evidence for "admitting any evidence having some potential for assisting the trier of fact." Relying on these precedents, the *Paoli* court evaluated the proposed evidence under a standard of helpfulness. This "helpfulness" standard "turns on whether the expert's 'technique or principle [is] sufficiently reliable so that it will aid the jury in reaching accurate results.' The key element of this "helpfulness" standard is accuracy. Although the court noted that the "reliability inquiry must be flexible and may turn on a number of factors," it recognized that an opinion is excludable if its methodology is so fundamentally unreliable that it does not render accurate results. As the court stated: "[I]f there were evidence in this record that meta-analysis is inaccurate as a mode of analysis - that the concept of combining raw data from different independent studies and re-analyzing it in total does not render accurate results."

70. 753 F.2d 1224 (3d Cir.). The Third Circuit ruled that the district court had erred in refusing to admit testimony of a defense psychologist, an expert in the field of human perception and memory. *Id.* at 1226. *Downing* stands for the rule that admissible scientific techniques must: (1) be reliable, (2) not mislead jurors, and (3) have a sufficient connection to the specific factual issues in the case. *Id.*

71. 911 F.2d 941 (3d Cir. 1990). Parents of an infant born with severe defects sought damages for those defects, allegedly caused by the use of a morning sickness drug. *Id.* at 943. The Third Circuit reversed the district court's ruling, holding that epidemiological studies showing that the drug caused the defects were the type of data a reasonable expert would rely upon, and were therefore admissible. *Id.*

72. *Downing*, 753 F.2d at 1237.

73. *DeLuca*, 911 F.2d at 956. The court stated that Federal Rules of Evidence 401 and 402 (relating to relevance), 403 (relating to undue prejudice), and Rules 701-703 (relating to expert testimony) provide that evidence with any marginal utility should be admitted, absent a substantial countervailing concern. *Id.*

74. *Paoli*, 916 F.2d at 857.

75. *Id.* (citing *DeLuca*, 911 F.2d at 1235, quoting 3 J. WEINSTEIN et al., WEINSTEIN'S EVIDENCE ¶ 702[03], at 702-35).

76. *Id.* at 857 (citing *Downing*, 753 F.2d at 1238). The court, however, declined to set the exact level at which a district court may determine that a technique is sufficiently unreliable. *Id.*
results - then there might be grounds for excluding meta-analysis.”  

In view of the absence of evidence challenging the accuracy of meta-analysis as a general principle, the Paoli court viewed the meta-analysis controversy as a dispute over the probative value of a specific study, not an argument over the overall reliability of meta-analysis as a scientific technique.

Although the Paoli court recognized that general challenges to the reliability of disputed methodologies must be resolved by the judge before the evidence is admitted, the court emphasized that challenges to opinions generated from accepted methodologies must be resolved as fact issues by the jury. As the record did not demonstrate that meta-analysis was an unreliable scientific technique, the case resolved into a battle of the experts over the value of a particular piece of evidence. Traditionally, the outcomes of such battles are determined by the trier of fact.

Unfortunately, despite the Paoli court’s concern for accuracy, it provides very little guidance for determining just how much accuracy is required. Although the court seems content to leave the question open to an unspecified number of factors relevant to the facts of each particular case, a careful reading of Paoli’s precedents provides more information. In Downing, the principal Third Circuit decision regarding scientific evidence before Paoli, the court set forth some specific factors to be considered in the reliability analysis. These include:

(A) the “novelty” of the new technique and its relationship to more established modes of scientific analysis;

(B) the existence of specialized literature which deals with the new technique;

77. Id. at 858. “What we have, therefore is a record that shows significant disagreement about whether this particular meta-analysis is reliable.” Id.

78. Id. at 916 F.2d at 857. The court noted that the “reliability requirement” of Rule 702 must not be used by the courts as a tool to exclude all questionable evidence. Id. The Federal Rules of Evidence “embody a strong and undeniable pretense for admitting any evidence having some potential for assisting the trier of fact . . . .” Id. (quoting DeLuca, 911 F.2d at 956).

80. Id. at 858. The court said that if a reliable methodology were substantially altered, the Downing standard would apply. However, “if the challenged procedure is more accurately described as an application of an accepted methodology, it is not the proper subject of a Rule 702-based exclusion, but is rather the subject of cross-examination of the expert and resolution by the jury.” Id.

81. Downing, 753 F.2d at 1237.
(C) whether the new technique has been exposed to critical scientific scrutiny;
(D) the qualifications and professional stature of the expert witnesses advancing the technique;
(E) the non-judicial uses of the technique;
(F) the frequency with which the new technique leads to erroneous results, considering both the frequency and types of errors generated.82

As this analysis reveals, the Third Circuit does not exclude peer review as a factor for determining the reliability of methodologies, as opposed to ultimate opinions.83 Cumulatively considering the factors set forth in Downing, it seems clear that Paoli's emphasis on accuracy suggests, at the very least, predictability. If, for example, counsel demonstrates that animal studies do not accurately predict carcinogenicity in specific human tissues, a court may determine that animal studies are not sufficiently accurate to meet Paoli's reliability threshold.

In Christophersen, the court hinged "reliability" upon whether the expert's opinion was derived from a methodology which was "sufficiently established to have gained general acceptance in the particular field to which it belongs."84 This reasoning is derived from Frye, a case which rejected the use of evidence resulting from a systolic blood pressure test.85 Frye was the seminal case regarding the standards for evaluating expert opinions derived from novel scientific techniques.86 As in Paoli, this test applies only to methods, not ultimate opinions. As long as the methodology is generally accepted, "the nature of the expert's conclusion is irrelevant, even if it is controversial or unique."87

Unfortunately, the Christophersen court failed to set forth the factors which a trial court may appropriately consider in determining whether a methodology is generally accepted. This was

82. Id. at 1238-39. The court proposed a flexible reliability inquiry, based on these considerations. Id. See also 3 J. Weinstein et al., Weinstein's Evidence ¶ 702(03), at 702-18 (providing exhaustive list of factors to be considered in reliability evaluation).
83. See Paoli, 916 F.2d at 857-58 (noting that expert's opinions need not be subjected to peer review in published journals).
84. Christophersen, 939 F.2d at 1111 (quoting Frye, 293 F. at 1014). The court expanded, saying that "as long as the expert's methodology is well founded, the nature of the expert's conclusion is generally irrelevant ...." Id.
86. For a brief discussion of Frye, see supra notes 37-39 and accompanying text.
87. Christophersen, 939 F.2d at 1111.
because the existence and appropriate use of certain generally accepted methodologies was undisputed. In Christophersen, the experts for both sides agreed that epidemiology studies, animal studies, and in vitro tests were the primary techniques used to establish causation.\textsuperscript{88} Despite this consensus, the plaintiffs' expert witness did not derive his opinions from any of these methods.\textsuperscript{89} Rather, he generally relied upon the decedent's medical records, research literature, and his education and experience.\textsuperscript{90} The court concluded that, as a matter of law, the expert's opinion was inadmissible because his reasoning did not follow the generally accepted methodologies.\textsuperscript{91}

Thus, neither Paoli nor Christophersen confronted a situation where there was conflicting evidence regarding the reliability of the appropriate methods used to reach a causation opinion. In Paoli, there was no evidence that, as a general principle, meta-analysis was an unreliable scientific technique.\textsuperscript{92} In Christophersen, there was no dispute that, in reaching a causation opinion, experts should rely upon epidemiology, animal studies, or in vitro testing.\textsuperscript{93} Thus, neither court was forced to analyze a record where the experts disagreed on the reliability of a particular methodology. Nevertheless, unlike Paoli's "accuracy" test, Christophersen's "general acceptance" standard has a long history of precedents.\textsuperscript{94} These precedents allow one to forecast the manner in which the Fifth Circuit may determine whether a particular technique is "generally accepted."

Since Frye was decided in 1923, the principal source for evaluating the "general acceptance" of a particular technique has been the evolving scientific literature. Courts which have followed the Frye rule have regularly required plaintiffs to justify novel methodologies by showing a consensus in published articles. As the California Supreme Court stated in People v. Shirley:\textsuperscript{95}

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88. Id. at 1115. Both plaintiffs' expert witness and defendant's expert witness agreed as to the kinds of evidence used to establish causation. Id.
89. Id.
90. Id. For a relevant discussion, see supra text accompanying notes 46-55.
91. Id. at 1116.
92. Paoli, 916 F.2d at 857.
93. Christophersen, 939 F.2d at 1115.
95. People v. Shirley, 641 P.2d 775 (Cal. 1982). In Shirley, the court concluded that the testimony of a witness given after she had undergone hypnosis for the purpose of restoring her memory should not be admitted into evidence. Id. at 776.
\end{flushleft}
The burden is on the proponent of the new technique to show a scientific consensus supporting its use; if a fair overview of the literature discloses that scientists significant either in number or expertise publicly oppose [the reliability of a particular methodology], the court may safely conclude that there is no such consensus at the present time.96

Under this fair overview approach, peer review is an indispensable element of the “general acceptance” standard adopted in Christophersen. Expert opinions based upon methodologies which have not been critiqued and accepted by a consensus of the scientific community in the published literature are unreliable and inadmissible. Indeed, the Christophersen court foreshadowed this rule by stressing that “[a]ll Dr. Miller had was a scientific hunch, which as far as the record shows, no one else shares.”97 This is a critical distinction from Paoli, where peer review is, at best, only one of many factors in the trial court’s “accuracy” analysis.98

Although the Fifth Circuit may be considerably slower to admit evidence based on novel techniques after Christophersen, this cautious approach is based on a realistic evaluation of the effect of expert testimony on jurors. Other Frye jurisdictions have stressed the benefits of this approach:

“There has always existed a considerable lag between advances and discoveries in scientific fields and their acceptance as evidence in a court proceeding.” Several reasons founded in logic and common sense support a posture of judicial caution in this area. Lay jurors tend to give considerable weight to “scientific” evidence when presented by “experts” with impressive credentials. We have acknowledged the existence of a “… misleading aura of certainty which often envelops a new scientific process, obscuring its currently experimental nature.”99

Given the Fifth Circuit’s traditional skepticism and concerns that

96. Id. at 797.
97. Christophersen, 939 F.2d at 1115 (emphasis added).
98. Paoli, 916 F.2d at 857.
scientific evidence be evaluated in a rational manner, its cautious insistence on the Frye test is understandable.

Unfortunately, neither of these cases attracted the attention of the United States Supreme Court. In view of this difficult situation, the trial courts of this nation are justifiably confused about the standards for admitting scientific evidence. Moreover, the state courts of many jurisdictions will continue to march to their own drummer, often surpassing Paoli in their zeal for compensating plaintiffs.\(^\text{100}\) Paraphrasing Christophersen's dissent, the trial bench should not be forced to decide these difficult cases while the larger issues remain in conflict because of Supreme Court indifference.\(^\text{101}\) It is time for the high court to resolve this confusing situation once and for all.

VII. Practical Applications

The Supreme Court has denied certiorari in Christophersen.\(^\text{102}\)

All in all, this decision is not surprising. Because of its limited record, Christophersen was not the ideal case for further review. Given the Supreme Court's ruling, it is vitally important for counsel to appreciate the differences between Paoli and Christophersen and understand the practical problems presented by their holdings. Since the Supreme Court has elected to allow this confusing situation to continue, practitioners who apply these cases must have a fundamental appreciation of their respective requirements.

As a practical matter, the differences between the Third and Fifth Circuits' decisions in Paoli and Christophersen can be traced to fundamental disagreements regarding the need to safeguard jury from questionable expert opinions. These disagreements do not, however, preclude defense counsel from making appropriate challenges to unreliable scientific proof. Rather, they simply illustrate the need for counsel to design their challenges in accordance with each circuit's perspective.

In both circuits, for example, counsel may challenge expert opinions because they are based on inaccurate or incomplete facts. In a toxicology context, opinions may be unreliable if they inaccurately or incompletely consider: the levels and durations of exposure, the presence and potential antagonistic effects of other

\(^{100}\) See, e.g., Rubanick v. Witco Chem. Corp., 593 A.2d 733 (N.J. 1991) (permitting expert testimony based on methodology that is sufficiently factual and has scientific underpinnings to expert's theory of causation).

\(^{101}\) Christophersen, 939 F.2d at 1137-38.

\(^{102}\) 112 S. Ct. 1280 (1992).
toxic substances in the environment, the relative toxicities of those substances, and other critical toxicologic information. In an epidemiology context, opinions may be unreliable if they fail to consider and account for confounding factors, such as the existence of conditions or diseases capable of producing similar conditions, prescription drug history, residential histories, age, sex, race, and prior occupational histories. For example, a study designed to explore the relationship between asbestos exposure and lung cancer may be factually unreliable if it fails to consider the effect of smoking on the study groups. Since smoking profoundly influences the rate of lung cancer, no reliable conclusions can be made if the participants’ smoking history is unknown.

Although both circuits also permit challenges to opinions based upon unreliable methodologies, the Third Circuit requires a substantially stronger showing. Although a methodology is not inadmissible merely because it is not “generally accepted” by a consensus of the scientific community, the lack of “general acceptance” is still an important factor in the Paoli analysis. More importantly, however, defense counsel must objectively demonstrate that the methods used by the experts do not predictably produce accurate results.

Such challenges must focus on an opinion’s lack of objectivity. Experts who base their opinions on subjective assumptions, such as the assumption that there is no safe level of exposure to a carcinogen, may face serious obstacles in the Third Circuit. Typically, the “no safe level” theory asserts that since science has not determined safe levels of exposure, it must be presumed that there are no such levels. Under this theory, brief low-level exposures to carcinogens are deemed sufficient to cause disease. Such a presumption fails to meet the Paoli criteria because it impermissibly shifts the burden of proof. Under Paoli, as well as in all other civil courts, the burden remains on the plaintiff to show that his disease was actually caused by low-level exposure.103 If the expert’s opinion is based upon a “no safe level” assumption, rather than an objective analysis, his methodology is fatally flawed and the opinion is probably unreliable.

Alternatively, defense counsel may challenge opinions by asserting that “a reliable methodology was so altered as to skew the methodology itself.”104 For example, an expert opinion is not admissible simply because it relies upon an accepted methodol-

103. Paoli, 916 F.2d at 860-62.
104. Id. at 858.
ogy, such as epidemiology. If the expert refuses to accept the requirement that epidemiological opinions must be based upon statistically significant associations, he has altered the methodology and produced unreliable results. Similarly, if an expert offers a toxicological opinion, but refuses to accept the importance of dosage and duration of exposure in that discipline, the methodology has been skewed and the opinion is unreliable. Since many outrageous causation opinions depart substantially from standard toxicologic and epidemiologic principles, even Paoli would preclude expert opinions which do not apply standard principles.

These examples illustrate that Paoli has not raised insurmountable obstacles to scientific evidence challenges. Rather, together with Christophersen, the Paoli court focuses upon the expert's reasoning process, rather than the subjective outrageousness of the ultimate opinions. Although the Third Circuit requires a more detailed showing than the Fifth Circuit, defense counsel may still attack unreliable scientific proof by creatively tailoring their objections and examinations to reveal fatal inaccuracies or subjectivities.