

631 N.W.2d 862 (2001)

262 Neb. 215

John SCHAFERSMAN and Eileen Schafersman, husband and wife, Appellees,**v.****AGLAND COOP, a Nebraska cooperative corporation, Appellant.**No. S-98-623.**Supreme Court of Nebraska.**

July 20, 2001.

867 *867 Dan H. Ketcham, Omaha, and Jason R. Yungtum, of Engles, Ketcham, Olson & Keith, P.C., for appellant.

David A. Domina, Omaha, and Pamela J. Dahlquist, of Domina Law, P.C., for appellees.

HENDRY, C.J., and WRIGHT, CONNOLLY, GERRARD, STEPHAN, McCORMACK, and MILLER-LERMAN, JJ.

GERRARD, Justice.

INTRODUCTION

John **Schafersman** and Eileen **Schafersman** sued **Agland Coop (Agland)**, a Nebraska cooperative corporation, and won a \$120,000 jury verdict, based upon the jury's finding that contaminated hog feed, negligently delivered to the Schafersmans, caused illnesses and deaths among the Schafersmans' herd of dairy cows. **Agland** seeks further review of a decision of the Nebraska Court of Appeals affirming the district court's judgment. The primary question presented in this appeal is whether sufficient foundation was presented for the opinion of the Schafersmans' expert witness, Dr. Wallace Wass.

For the reasons that follow, we conclude that the district court abused its discretion in permitting Wass to testify regarding his theory that "multiple mineral toxicity" caused the injuries to the Schafersmans' cows and, therefore, reverse the judgment of the district court and remand the cause for a new trial. Furthermore, we conclude that the framework for evaluating expert opinion testimony in Nebraska should no longer be guided by *Frye v. United States*, 293 F. 1013 (D.C.Cir.1923), but should instead reflect the criteria set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), and its progeny.

FACTUAL AND PROCEDURAL BACKGROUND

The Schafersmans operate a commercial dairy farming operation in Washington County, Nebraska. **Agland** sells grain and feed for various agricultural endeavors. On the date of the incident that forms the basis of the Schafersmans' claims, they allege that there were 54 lactating cows in their dairy herd and 21 additional cows that were not lactating located in a "dry lot."

The Schafersmans allege that in June 1994, they ordered 40 bushels of unadulterated commercial grade oats from **Agland**. On June 22, **Agland** delivered 3,260 pounds of product to the Schafersmans' grinder-mixer, to be mixed with other ingredients for the Schafersmans' dairy mix, and from which the mix was augered into a gravity bin to be fed directly to the cows.

Agland does not dispute that the oats were contaminated with "Envirolean 2.5L Swine Concentrate" (Envirolean), a hog premix concentrate that included high-protein minerals, vitamins, and other micronutrients. The Schafersmans allege that

868 they noticed the contaminant just after the oats were delivered, but that they were *868 verbally reassured by **Agland** that the substance was harmless.

The Schafersmans further allege that after the mixture was fed to the dairy herd, the cows went off their feed and milk production dropped. The Schafersmans allege that the cows dried up, became lame, and developed poor body condition; that some died or were liquidated; and that none of the 54 cows that consumed the mix ever returned to proper milk production. The Schafersmans allege that of the 54 lactating cows that consumed the contaminated feed, 23 dried up in July, 31 dried up later, some developed jaundice, and many developed diarrhea.

The Schafersmans claimed damages for lost milk production, cows lost to natural death or slaughter, increased labor costs, and veterinary costs, for a total of \$117,743.29 in special damages. The Schafersmans' operative petition claimed theories of recovery in negligence, implied warranty, express warranty, and misrepresentation, although the latter theories were voluntarily dismissed by the Schafersmans at trial. **Agland's** answer asserted that the Schafersmans were contributorily negligent in failing to allow **Agland** to remedy the contamination, in continuing to feed the contaminated feed to the cows after problems developed, and in failing to immediately notify **Agland** or consult a veterinarian.

At trial, the Schafersmans presented the expert opinion testimony of Wass, who opined that the alleged damage to the Schafersmans' cows was caused by "multiple mineral toxicity," a condition that Wass said was the result of the aggregation of above-normal quantities of minerals potentially toxic to dairy cows. **Agland** filed a motion in limine seeking to prevent Wass' testimony and objected at trial on foundational grounds, but both the motion in limine and the foundation objection were overruled. The substance of Wass' testimony is set forth in more detail in the analysis portion of this opinion. **Agland's** expert witness testified that the Envirolean contained no minerals above tolerable levels and that the contaminated feed was nontoxic and did not harm the cows.

After the case was submitted, the jury returned a verdict finding for the Schafersmans on the negligence theory of recovery. The jury found the Schafersmans' total damages to be \$147,190, found that the Schafersmans failed to mitigate their damages in the amount of \$27,190, and returned a verdict for the Schafersmans in the amount of \$120,000. The district court entered judgment accordingly.

Agland appealed to the Court of Appeals, which affirmed the judgment of the district court. See *Schafersman v. Agland Coop*, No. A-98-623, 2000 WL 704984 (Neb.App. May 30, 2000) (not designated for permanent publication). We granted **Agland's** petition for further review.

ASSIGNMENTS OF ERROR

Agland assigns, consolidated and restated, that the Court of Appeals erred in determining that (1) Wass' expert testimony was properly admitted, (2) contributory negligence should not have been submitted to the jury, and (3) the jury was properly instructed regarding damages and that the damages were supported by the evidence.

STANDARD OF REVIEW

869 A trial court's ruling in receiving or excluding an expert's testimony which is otherwise relevant will be reversed only when there has been an abuse of discretion. *Nebraska Nutrients v. Shepherd*, 261 Neb. 723, 626 N.W.2d 472 (2001). A judicial abuse of discretion exists when a judge, within the effective limits of authorized judicial power, elects to act or refrain *869 from acting, but the selected option results in a decision which is untenable and unfairly deprives a litigant of a substantial right or a just result in matters submitted for disposition through a judicial system. *Noonan v. Noonan*, 261 Neb. 552, 624 N.W.2d 314 (2001).

ANALYSIS

The first argument to be addressed is **Agland's** claim that Wass' opinion lacked appropriate foundation. In connection with

this claim, **Agland** argues on further review that this court should again consider adopting the standards for evaluating expert opinion testimony set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993). See, generally, *Phillips v. Industrial Machine*, 257 Neb. 256, 597 N.W.2d 377 (1999) (Gerrard, J., concurring, joined by Hendry, C.J., and Miller-Lerman, J.).

WASS' TESTIMONY

Wass is a professor at Iowa State University in the department of diagnostic and production animal medicine and was head of that department when it was known as the department of clinical sciences. Wass is board certified in veterinary internal medicine, and he specializes in diseases of metabolism, nutrition, and toxicology. Wass obtained both a bachelor of science degree in agriculture and a doctor of veterinary medicine degree from the University of Minnesota, and later obtained a doctorate degree in veterinary medicine with a minor in pathology from the same university.

Wass testified that in preparing his opinion, he physically went to the **Schafersman** farm, but only examined the Schafersmans' records relating to the cows. Wass admitted that he did not perform a clinical examination of any of the cows and did not treat the cows. Wass did not perform any tests on the cows to rule out other causes of the jaundice that had been observed in the cows by the Schafersmans' veterinarian, nor did he test for copper toxicity, which Wass opined was a contributing factor to the illness afflicting the cows. Wass performed no tests to rule out other potential causes for the alleged drop in milk production. Wass acknowledged that he should have tested for copper toxicity and performed other tests on the cows. Wass further testified that while he tested a sample of the mixture delivered to the Schafersmans by **Agland**, he did not test the composition of the total ration actually fed to the cows after it was combined by the Schafersmans with corn and other nutrients.

Nonetheless, Wass testified that it was his opinion that the problems with the cows were caused by the Envirolean because the cows that had eaten the Envirolean-contaminated mix became sick. The basis for Wass' opinion was his theory that the cows were afflicted with "multiple mineral toxicity," which Wass claimed could result when a number of potentially toxic minerals were simultaneously fed to cows in otherwise-tolerable quantities. Wass admitted that no minerals were present in the feed that were, singly, above scientifically accepted toxic or even tolerable levels.

870 With respect to the theory of multiple mineral toxicity, Wass testified that he had neither studied multiple mineral toxicity nor authored any publications concerning multiple mineral toxicity. Wass testified that he was aware of no controlled studies that related to multiple mineral toxicity, although he claimed that people in the field have observed it. Wass conceded that the theory he proposed set forth no standard for determining what levels of any given minerals could result in a toxic effect. In his deposition, which was admitted *870 at the hearing on **Agland's** motion in limine, Wass stated that he had seen a similar prior case, but he did not testify regarding the mineral levels present in that instance, nor did he discuss any testing that might have been performed in that instance. Wass conceded, in his deposition, that he had not conducted any tests that were intended to bear out his theory of multiple mineral toxicity.

In addition, **Agland's** expert witness, Dr. David Reed, a veterinarian who specializes in dairy cows and nutritional consulting for dairy producers, reviewed Wass' deposition testimony and the attached exhibits. Reed testified that the scientific literature did not contain a theory of multiple mineral toxicity and that in his opinion, that theory did not apply to the instant case.

FRYE ANALYSIS

When a court is faced with an offer of a novel form of expertise which has not yet received judicial sanction, it must conduct an initial inquiry to determine whether the new technique or principle is sufficiently reliable to aid the jury in reaching accurate results. *State v. Baue*, 258 Neb. 968, 607 N.W.2d 191 (2000). In this state, where the rules of evidence apply, the admissibility of an expert's testimony, including an opinion, which is based on a scientific principle or on a technique or process which utilizes or applies a scientific principle, depends on general acceptance of the principle, technique, or process in the relevant scientific community. *State v. Buckman*, 259 Neb. 924, 613 N.W.2d 463 (2000);

Sheridan v. Catering Mgmt., Inc., 252 Neb. 825, 566 N.W.2d 110 (1997). Stated otherwise, Nebraska has adhered to the *Frye* test, under which the proponent of the evidence must prove general acceptance by surveying scientific publications, judicial decisions, or practical applications, or by presenting testimony from scientists as to the attitudes of their fellow scientists. Buckman, supra; Sheridan, supra.

Under the standard of helpfulness required by Neb. Evid. R. 702, a court may exclude an expert's opinion which is nothing more than an expression of how the trier of fact should decide a case or what result should be reached on any issue to be resolved by the trier of fact. State v. Reynolds, 235 Neb. 662, 457 N.W.2d 405 (1990), *disapproved on other grounds*, State v. Messersmith, 238 Neb. 924, 473 N.W.2d 83 (1991). When an expert's opinion on a disputed issue is a conclusion which may be deduced equally as well by the trier of fact with sufficient evidence on the issue, the expert's opinion is superfluous and does not assist the trier in understanding the evidence or determining a factual issue. *Id.*

The Schafersmans argue, and the Court of Appeals agreed, that Wass' diagnosis of multiple mineral toxicity was not novel and, thus, that the *Frye* test does not apply. We disagree. The testimony of Wass and Reed clearly establishes the novelty of the theory underlying Wass' conclusions regarding the cause of the illnesses afflicting the Schafersmans' cows. In originally promulgating the *Frye* test, the Court of Appeals of the District of Columbia stated that "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." Frye v. United States, 293 F. 1013, 1014 (D.C.Cir.1923).

871 The deduction at issue in this case, Wass' opinion on the cause of the illnesses afflicting the Schafersmans' cows, is not derived from a principle or procedure that has gained general acceptance in the particular *871 field in which it belongs. Wass' opinion is dependent upon the underlying theory of multiple mineral toxicity, and the evidence at trial established that this theory is not generally accepted in any scientific field.

Nor does the record reveal any other basis to support Wass' conclusions regarding the causal connection between the Envirolean and the illnesses. For instance, Wass admittedly did not conduct a differential diagnosis to rule out other potential causes of any illnesses. Differential diagnosis, or differential etiology, is a standard scientific technique of identifying the cause of a medical problem by eliminating the likely causes until the most probable one is isolated. See, e.g., Glastetter v. Novartis Pharmaceuticals Corp., Nos. 00-3087, 00-3467, 2001 WL 630651 (8th Cir. June 8, 2001); Hardyman v. Norfolk & Western Ry. Co., 243 F.3d 255 (6th Cir.2001); Westberry v. Gislaved Gummi AB, 178 F.3d 257 (4th Cir.1999); Jennings v. Baxter Healthcare Corp., 331 Or. 285, 14 P.3d 596 (2000). See, also, In re Diet Drugs, No. MDL 1203, 2001 WL 454586 (E.D.Pa. Feb.1, 2001); Kelley v. American Hever-Schulte Corp., 957 F.Supp. 873 (W.D.Tex. 1997) (noting that observed association between exposure and condition may reflect true cause-effect relationship or spurious finding, and to distinguish between these alternatives, it is necessary first to consider confounding factors). A reliable differential diagnosis can provide suitable foundation for an expert opinion, see Kelley, supra; however, Wass admitted that he did not perform tests in this instance to rule out other potential causes of the illnesses among the Schafersmans' cows.

Essentially, the only basis for Wass' opinion, other than his theory of multiple mineral toxicity, was that since the cows consumed the feed and then became ill, the feed must have caused the illness. First, the assumption that correlation proves causation presents fallacious post hoc propter hoc reasoning that cannot be said to be helpful to the trier of fact under Neb. Evid. R. 702, even absent the application of a more stringent *Frye* or *Daubert* analysis. See, Black v. Food Lion, Inc., 171 F.3d 308 (5th Cir.1999); Nelson v. American Home Products Corp., 92 F.Supp.2d 954 (W.D.Mo.2000) (discussing fallacy of post hoc propter hoc reasoning). See, also, Glastetter v. Novartis Pharmaceuticals Corp., *supra* (stating that association is not scientifically valid proof of causation). Second, this reasoning can be deduced equally by the trier of fact; Wass' opinion on the matter is superfluous and again fails to assist the trier in determining a factual issue. See State v. Reynolds, 235 Neb. 662, 457 N.W.2d 405 (1990), *disapproved on other grounds*, State v. Messersmith, 238 Neb. 924, 473 N.W.2d 83 (1991).

In short, Wass' theory of multiple mineral toxicity did not meet the requirements of the *Frye* test, and Wass offered no other reasoning or scientific analysis that would support his opinion on causation. The district court abused its discretion in

permitting Wass to testify regarding multiple mineral toxicity and in allowing Wass to offer his opinion that any illnesses among the Schafersmans' cows were caused by the presence of Envirolean in the feed. As this error was clearly prejudicial to **Agland**, we conclude that the Court of Appeals erred in not reversing the judgment of the district court and remanding the cause for a new trial. That determination, however, does not end our analysis.

ADOPTION OF *DAUBERT* STANDARDS

872 **Agland** urges this court to again consider adopting the test set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 *872 L.Ed.2d 469 (1993), for the evaluation of expert opinion testimony. This issue is not necessary for our disposition of the present appeal. However, an appellate court may, at its discretion, discuss issues unnecessary to the disposition of an appeal where those issues are likely to recur during further proceedings. *Daniels v. Allstate Indemnity Co.*, 261 Neb. 671, 624 N.W.2d 636 (2001). We decline to discuss **Agland's** assignments of error with respect to contributory negligence and damages. We do, however, find it appropriate to discuss the standards that should be applied to the expert testimony proffered on retrial.

The most significant recent developments in the area of evaluating expert opinion testimony have resulted from the decision of the U.S. Supreme Court in *Daubert, supra*. In that case, the Supreme Court held that the "general acceptance" test for the admissibility of testimony about scientific evidence, as set out in *Frye v. United States*, 293 F. 1013 (D.C.Cir.1923), had been superseded by the adoption of the Federal Rules of Evidence. *Daubert, supra*. The Supreme Court rejected the *Frye* test and redefined the standard for the admission of expert testimony in the federal courts. *Id.* See, also, *General Electric Co. v. Joiner*, 522 U.S. 136, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997). Moreover, the Federal Rules of Evidence have recently been amended to incorporate and codify the *Daubert* standards. See Fed.R.Evid. 701 to 703.

Most states with evidentiary rules modeled after the Federal Rules of Evidence have adopted the *Daubert* standards. See, generally, *Phillips v. Industrial Machine*, 257 Neb. 256, 597 N.W.2d 377 (1999) (Gerrard, J., concurring) (citing cases and noting that 27 states had adopted *Daubert* standards). See, also, *People v. Shreck*, 22 P.3d 68 (Colo.2001) (abrogating *Frye* test in favor of *Daubert* reliability standards). This court, however, has previously rejected the adoption of *Daubert* and continued to rely on the *Frye* test. See, *State v. Carter*, 246 Neb. 953, 524 N.W.2d 763 (1994), overruled on other grounds, *State v. Freeman*, 253 Neb. 385, 571 N.W.2d 276 (1997); *State v. Dean*, 246 Neb. 869, 523 N.W.2d 681 (1994), overruled on other grounds, *State v. Burlison*, 255 Neb. 190, 583 N.W.2d 31 (1998).

The *Daubert* standards require proof of the scientific validity of principles and methodology utilized by an expert in arriving at an opinion in order to establish the evidentiary relevance and reliability of that opinion. Under *Daubert, supra*, when faced with a proffer of expert scientific testimony, a trial judge must determine at the outset whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails a preliminary assessment whether the reasoning or methodology underlying the testimony is scientifically valid and whether that reasoning or methodology properly can be applied to the facts in issue. *Daubert, supra*.

873 The Court in *Daubert* also set out a list of considerations that a trial court may use to evaluate the validity of scientific testimony. These include: (1) whether the theory or technique can be, and has been, tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) the known or potential rate of error, and the existence and maintenance of standards controlling the technique's operation; and (4) the "general acceptance" of the theory or technique. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993). Thus, the Court did not sweep away the *Frye* test, but simply determined that it was to be one of a *873 myriad of possible considerations in determining the validity of evidence. See *Phillips, supra*.

In *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999), the Supreme Court determined that *Daubert's* general holding, setting forth the trial judge's general "gatekeeping" obligation, applies not only to testimony based on "scientific" knowledge, but also to testimony based on "technical" and "other specialized" knowledge. 526 U.S. at 141, 119 S.Ct. 1167. The Court in *Kumho* made it clear that the *Daubert* standards were to apply, not only to "scientific" knowledge, but to all types of expert testimony that are admitted pursuant to Fed.R.Evid. 702.

In Carter, supra, this court discussed two reasons for continued adherence to the *Frye* test: (1) that the *Daubert* standards were relatively undeveloped and uncertain and (2) that *Daubert* might fail to exclude unreliable "junk science." These concerns were, at the time, entirely reasonable. The experience of the intervening years, however, has put those concerns to rest. See Phillips v. Industrial Machine, 257 Neb. 256, 597 N.W.2d 377 (1999) (Gerrard, J., concurring). In that time, *Daubert* has become the majority rule and *Frye v. United States, 293 F. 1013 (D.C.Cir.1923)* has become an ever-shrinking minority view. Given the number of jurisdictions that have adopted the *Daubert* standards and the extensive development of the *Daubert* standards in the state and federal courts, it can no longer be said that the nature and implications of *Daubert* are unknown. See Phillips, supra. In fact, to the extent that this consideration is still relevant, it militates in favor of adopting the *Daubert* standards, as Nebraska courts risk losing the benefit of helpful and persuasive authority from other jurisdictions on newly presented evidentiary issues by their continued reliance on a test that is being increasingly removed from the jurisprudential mainstream. See Phillips, supra.

Furthermore,

[t]he concern about "junk science" expressed in Carter, supra, now also weighs in favor of adopting the *Daubert/Kumho Tire* standards. The "gatekeeper" function exercised by trial courts under the *Daubert/Kumho Tire* analysis is, in fact, a more effective means of excluding unreliable expert testimony than is the *Frye* test. The experience in jurisdictions which have adopted the *Daubert* standards suggests that the admission of so-called "junk science" evidence is a minimal risk.

Phillips, 257 Neb. at 273, 597 N.W.2d at 388-89 (Gerrard, J., concurring), citing State v. Coon, 974 P.2d 386 (Alaska 1999).

As one writer has noted:

To say that *Daubert* is less restrictive of expert evidence, to say that it opens the door for the introduction of expert evidence that would not have been admissible under the *Frye* test, is not to say that *Daubert's* test is an easier test. It may be more lenient in that it allows more—and more novel—science into evidence, but it can be much more difficult in that the *Daubert* test can require a more exacting, expensive, and time consuming foundation.

....

On the one hand, more science comes in. Science does not have to be generally accepted by other scientists to be admissible in court; the universe of admissible science is expanded by doing away with the general acceptance requirement. On the other hand, less science comes in. The trial judge is to act as gatekeeper and is to scrutinize carefully the proffered scientific evidence and to keep out what is not good science.

874 *874 The universe of science actually admitted may be contracted by the close scrutiny judges are supposed to give this evidence. While it may be that most science generally accepted in the relevant scientific community will be good science, it is not necessarily so.

G. Michael Fenner, *The Daubert Handbook: The Case, Its Essential Dilemma, and Its Progeny*, 29 Creighton L.Rev. 939, 953 (1996).

Placing the focus on reliability, rather than general acceptance, may have unexpected but not undesirable results. For instance, a court may find that application of the *Daubert* standards results in the admissibility of new theories or techniques, where the court is satisfied that the expert testifying has presented foundation sufficient to demonstrate the reliability of the scientific analysis supporting his or her opinion. On the other hand, a court may find that evidence that had previously been admitted with little discussion is no longer satisfactory, where the reliability of that evidence has been appropriately challenged.

In this regard, the flexibility of the *Daubert* standards has a clear advantage over the *Frye* test, as the rigid application of *Frye* results in evidence which has once met with judicial approval no longer being "novel," and thus no longer subject to

foundational inquiry under *Frye v. United States*, 293 F. 1013 (D.C.Cir.1923), *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), on the other hand, does not require that courts reinvent the wheel each time that evidence is adduced, but it does permit the re-examination of certain types of evidence where recent developments raise doubts about the validity of previously relied-upon theories or techniques. In other words, once an issue is determined under *Frye*, it is closed to further *Frye* analysis because it is no longer "novel." *Daubert*, on the other hand, permits re-examination of the issue if the validity of the prior determination can be appropriately questioned.

Moreover, the flexibility of *Daubert* does not require that the validity of a theory or technique be determined solely by the general acceptance of a particular field that may prove to be too accepting. As one writer has stated:

Despite some dicta in *Daubert* stating that the test embodied by Rule 702 is a more liberal one than *Frye*, when compared to the general acceptance test, the *Daubert* test requires more from some fields and less from others depending on the state of the knowledge being offered. *Frye* asks whether something is generally accepted. *Daubert* asks whether it is dependable. These are different questions. Often they will produce the same answer. That happens when the basis of knowledge is weak and a field recognizes it is weak, or when the basis of knowledge is sound and a field recognizes it is sound. But *Daubert* is more liberal when the expert evidence is solid, but on the cutting edge, and therefore not yet generally accepted.... On the other hand, *Frye* is more liberal when what is offered is unsound expert evidence that nevertheless has become "generally accepted" in its field. This is the category that judges have encountered in numerous cases in the wake of *Daubert*, and found themselves puzzled about why a supposedly more liberal standard was leading them toward exclusion of evidence that long had been admitted without question.

875 The *Frye* test required faith to be placed in various fields and their practitioners, and inevitably made the courts more accepting of speculative, pseudo and sloppy science, but it had the appearance *875 of being easier for judges to administer. *Daubert* requires that fields justify their claims, and this places a heavy cognitive burden on judges. The essential requirement of *Daubert* and its progeny is that to avoid exclusion, experts must offer the courts more than unsupported assertions; they must offer evidence about the basis of their asserted expertise sufficient to enable a judge to conclude that their expert testimony will provide dependable information to the factfinder.

David L. Faigman et al., *How Good is Good Enough?: Expert Evidence Under Daubert and Kumho*, 50 Case W. Res. L.Rev. 645, 656-57 (2000).

Frye-like tests allow judges to piggyback their decisions onto someone else's judgment of whether the proffered evidence was sufficiently valid to be admitted. See Michael J. Saks, *The Aftermath of Daubert: An Evolving Jurisprudence of Expert Evidence*, 40 *Jurimetrics J.* 229 (2000). "The *Frye* test permit[s] judges to ask whether an asserted expertise [i]s believed valid by enough asserted experts. If enough of them [think] so—that is, if the asserted expertise enjoys 'general acceptance'—then a court [i]s justified in concluding that the proffered testimony [i]s valid." Saks, *supra* at 230. In addition to its better known and more obvious defects, the *Frye* test suffers from a special paradox: because less rigorous fields will reach a state of "general acceptance" more readily than more rigorous fields, courts employing *Frye* may more readily admit the offerings of less dependable fields and less readily admit the offerings of more dependable fields. See *id.*

While these distinctions between *Frye v. United States*, 293 F. 1013 (D.C.Cir.1923), and *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), are significant, they should not be taken to mean that *Daubert* has worked a sea change in evidence law. A review of the case law after *Daubert* shows that rejection of expert testimony is the exception rather than the rule. See Fed.R.Evid. 702 advisory committee's note. In most instances, obviously, that which is reliable will be generally accepted, and vice versa. Only by permitting the trial court to conduct the gatekeeper function for the reliability of expert testimony, however, can we ensure that reliable evidence is presented not just in most, but in *all* instances.

Moreover, as the U.S. Supreme Court noted in *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999), this gatekeeper function for the trial court retains its utility and imperative regardless of whether the testimony at issue is "scientific" or otherwise. The evidentiary rationale that underlies the *Daubert* gatekeeping responsibility is not

limited to scientific knowledge. As the Court stated,

it would prove difficult, if not impossible, for judges to administer evidentiary rules under which a gatekeeping obligation depended upon a distinction between "scientific" knowledge and "technical" or "other specialized" knowledge. There is no clear line that divides the one from the others....

Neither is there a convincing need to make such distinctions. Experts of all kinds tie observations to conclusions through the use of what Judge Learned Hand called "general truths derived from ... specialized experience." [Learned] Hand, Historical and Practical Considerations Regarding Expert Testimony, 15 Harv. L.Rev. 40, 54 (1901). And whether the specific expert testimony focuses upon specialized observations, the specialized translation of those observations into theory, a specialized *876 theory itself, or the application of such a theory in a particular case, the expert's testimony often will rest "upon an experience confessedly foreign in kind to [the jury's] own." *Ibid*. The trial judge's effort to assure that the specialized testimony is reliable and relevant can help the jury evaluate that foreign experience, whether the testimony reflects scientific, technical, or other specialized knowledge.

Kumho Tire Co., 526 U.S. at 148-49, 119 S.Ct. 1167.

Despite the evident wisdom of applying the trial court's gatekeeper function to all varieties of specialized expert testimony, Nebraska's reliance on the *Frye* test and the limitation of that test to scientific evidence precludes the trial court from acting as gatekeeper where technical or other specialized knowledge is concerned. *Phillips v. Industrial Machine*, 257 Neb. 256, 597 N.W.2d 377 (1999) (Gerrard, J., concurring). Adoption of the *Daubert* standards, on the other hand, both encourages the trial court to act as gatekeeper and places that function in the context of a sensible and uniform scheme for the evaluation of all types of expert opinion testimony. *Id*.

One commentator cogently noted:

[B]efore the *Daubert/Joiner/Kumho* trilogy, courts and lawyers strove mightily to force the analysis of scientific evidence into the legalistic rather than the scientific framework. The *Frye* rule, which *Daubert* displaced, focused on "general acceptance" as a surrogate for determining scientific validity, a test steeped in the tradition of precedent, authority, and opinion as evidence.

ALI-ABA, Course of Study on Products Liability (2000), Bert Black, *Lewis Carroll Meets the Law, or How to Use the Daubert Trilogy to Slay the Jabberwock of Jargon*, 277 at 284.

We are convinced that by shifting the focus to the kind of reasoning required in science—empirically supported rational explanation—the *Daubert/Joiner/Kumho Tire Co.* trilogy of cases greatly improves the reliability of the information upon which verdicts and other legal decisions are based. Because courts and juries cannot do justice in a factual vacuum, the better information the fact finders have, the more likely that verdicts will be just. See *id*. Indeed, though the "scientific method" may not be an appropriate "standard" for all experts, the fundamental commonsense requirements of rational explanation and empirical support should apply to all experts. *Id*.

We are persuaded that Nebraska should join the majority of jurisdictions that have already concluded that the *Daubert* standards provide a more effective and just means of evaluating the admissibility of expert opinion testimony. Use of these standards may initially place more demands on trial and appellate courts, but will also permit those courts to ensure that juries in Nebraska are presented with expert testimony that is theoretically and methodologically reliable. We therefore hold prospectively, for trials commencing on or after October 1, 2001, that in trial proceedings, the admissibility of expert opinion testimony under the Nebraska rules of evidence should be determined based upon the standards first set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993).

Specifically, we hold that in those limited situations in which a court is faced with a decision regarding the admissibility of expert opinion evidence, the trial judge must determine at the outset, pursuant to Neb. Evid. R. 702, whether the expert is proposing to testify to (1) scientific, *877 technical, or other specialized knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails a preliminary assessment whether the reasoning or methodology underlying the testimony is valid and whether that reasoning or methodology properly can be applied to the facts in issue.

We stress, however, that in making this preliminary assessment, the trial judge has the discretion both to avoid unnecessary Neb.Rev.Stat. § 27-104 (Reissue 1995) hearings, where the reliability of an expert's methods is stipulated to or properly taken for granted, and to require appropriate proceedings in the less usual or more complex cases, where cause for questioning the expert's reliability arises. See *Kumho Tire v. Carmichael*, 526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999).

In so holding, we also note that once the validity of the expert's reasoning or methodology has been satisfactorily established, any remaining questions regarding the manner in which that methodology was *applied* in a particular case will generally go to the weight of such evidence. See *State v. Porter*, 241 Conn. 57, 698 A.2d 739 (1997). Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof remain the traditional and appropriate means of attacking evidence that is admissible, but subject to debate. See *Daubert, supra*.

APPLICATION OF DAUBERT STANDARDS IN NEW TRIAL

We note that although Wass' testimony did not meet the requirements of the *Frye* test at the first trial, this does not necessarily preclude the Schafersmans from offering such testimony at a second trial. As stated above, novel scientific theories can be reliable and thus admissible under *Daubert* even if not generally accepted in the scientific field, so long as foundation is presented to satisfy the court of the validity of the theory or methodology underlying the proffered opinion.

In evaluating expert opinion testimony under *Daubert*, where such testimony's factual basis, data, principles, methods, or their application are called sufficiently into question, the trial judge must determine whether the testimony has a reliable basis in the knowledge and experience of the relevant discipline. See *Kumho Tire Co., supra*. In determining the admissibility of an expert's testimony, a trial judge may consider several more specific factors that *Daubert* said might "bear on" a judge's gatekeeping determination. See *id.* These factors include whether a theory or technique can be (and has been) tested; whether it has been subjected to peer review and publication; whether, in respect to a particular technique, there is a high known or potential rate of error; whether there are standards controlling the technique's operation; and whether the theory or technique enjoys general acceptance within a relevant scientific community. See *id.* These factors are, however, neither exclusive nor binding; different factors may prove more significant in different cases, and additional factors may prove relevant under particular circumstances. See, e.g., *Oddi v. Ford Motor Co.*, 234 F.3d 136 (3d Cir.2000), cert. denied, _____ U.S. _____, 121 S.Ct. 1357, 149 L.Ed.2d 287 (2001) (setting forth additional factors to be considered).

878 In the instant case, the questions presented arise in the discipline of veterinary epidemiology. When epidemiology is used in legal disputes, the methodological soundness of a study and its implications for resolution of the question of causation require the assessment of whether the study reveals an association between an agent and disease, whether *878 sources of error in the study may have contributed to an inaccurate result, and whether any relationship between the agent and the disease is causal. See, generally, Michael D. Green et al., *Reference Guide on Epidemiology*, in Reference Manual on Scientific Evidence 333 (Federal Judicial Center 2d ed.2000), at <http://air.fjc.gov/public/fjcweb.nsf/pages/16>. A trial court must also consider whether an expert has accounted for other possible causes of disease; differential diagnosis—the process of eliminating other possible causes—can be an essential component in establishing specific causation. See Sarah Brew, *Where the Rubber Hits the Road: Steering the Trial Court Through a Post-Kumho Tire Evaluation of Expert Testimony*, 27 Wm. Mitchell L.Rev. 467 (2000).

Evidence of an association may be sufficient for formulation of a hypothesis that can later be tested and confirmed, but it is not proof of causation in the courtroom or the scientific community. *Nelson v. American Home Products Corp.*, 92 F.Supp.2d 954 (W.D.Mo.2000). A gatekeeping court must evaluate the reliability of the bridge the expert takes to the opinion, not the opinion itself. *Owens v. Amtrol, Inc.*, 94 F.Supp.2d 952 (N.D.Ind.2000).

Thus, in applying the *Daubert* standards, Nebraska courts should remember that the focus must be on the principles and methodology utilized by expert witnesses, and not on the conclusions that they generate. See *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993). Reasonable differences in scientific evaluation are not a basis for exclusion of an expert witness' opinion. See *Falise v. American Tobacco Co.*, 107 F.Supp.2d

200 (E.D.N.Y.2000). As Judge Jack Weinstein observed:

Too nitpicking an approach to find reasons to exclude expert testimony from distinguished scientists will tend to drive the best of them out of the courtroom. The greatest danger to the courts is not the incompetent who will testify for pay, but our failure to encourage sound scientists to assist the law.

Id. at 205.

Exercise of the *Daubert* gatekeeping responsibility requires a balance between rigorous examination of the reliability of the principles and methodology of expert witnesses, and acceptance of reasonable disagreement regarding such principles and methods and the conclusions that they generate. We are confident that the trial courts of Nebraska, like the majority of courts throughout the United States, will be able to strike this balance.

CONCLUSION

We conclude that given the foundation presented, the district court abused its discretion in permitting Wass to testify regarding the theory of multiple mineral toxicity and his ultimate opinion as to causation in the instant case. Consequently, we determine that the Court of Appeals erred in affirming the judgment of the district court. We further determine that for trials commencing on or after October 1, 2001, trial courts shall evaluate the admissibility of expert opinion testimony under the analytical framework first established in *Daubert, supra*, as adopted in the holding of this case.

The judgment of the Court of Appeals is, therefore, reversed, and the cause is remanded to the Court of Appeals with directions to reverse the judgment of the district court and remand the cause for a new trial, including proceedings consistent with this opinion.

REVERSED AND REMANDED FOR A NEW TRIAL.

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