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Scientific Testing and Proof of Paternity: Some Controversy and Key Issues for Family Law Counsel

Christopher L. Blakesley*

I. INTRODUCTION

Blood and tissue testing, especially DNA matching, have become important elements of both criminal and paternity or maternity litigation. Such scientific testing has become so important that it has taken on aspects that may cause it to benefit or to do harm to the judicial process or to any given case. This article focuses on the value and the dangers surrounding this interesting subject.

A. Blood and Tissue Testing

The 1995 Louisiana Supreme Court decision in *Pace v. State* reemphasized the importance of DNA testing generally and the significance of blood and tissue genetic testing used to exclude paternity.¹ The advances in and importance of genetic testing have been recognized and supported by courts across the nation. For example, Ohio courts have taken judicial notice of the accuracy of DNA testing.² The court noted that an illegitimate child may prove paternity by genetic testing and allowed the alleged father to be disinterred to conduct the test. The court stated that "the accuracy and infallibility of the DNA test are nothing short of remarkable," and proclaimed that the proof problems which had plagued paternity cases should no longer deprive an illegitimate child of the opportunity to prove paternity.³

In 1991, the Louisiana Supreme Court, in *In re J.M.*,⁴ also noted that "... the modern status [of blood grouping tests in paternity cases] has been described by one commentator as follows: 'As far as accuracy, reliability, dependability—even infallibility—of the test are concerned, there is no longer any controversy. The result of the test is universally accepted by distinguished scientific and medical authority.... [T]here is now ... practically universal and unanimous judicial

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1. *Pace v. State*, 648 So. 2d 1302 (La. 1995).

2. *Alexander v. Alexander*, 537 N.E.2d 1310 (P. Ct. Franklin County 1988).

3. *Alexander*, 537 N.E.2d at 1314 (emphasis added). See also *Batchelder v. Boyd*, 423 S.E.2d 810 (N.C. Ct. App. 1992); *In re Estate of Greenwood*, 587 A.2d 749 (Pa. 1991). The tendency of experts to claim testing infallibility is one of the serious problems facing the judiciary. First, it is not true. Second, it is claimed often. See, e.g., *Jones v. State*, 569 So. 2d 1234 (Fla. 1990) ("[I]t is technically impossible to make a false/positive identification." (transcript at 677)); *Kelly v. State*, 792 S.W.2d 579 (Tex. App. 1990) ("There is no way to get a false positive with this technology." (transcript at 919)). See cases cited and quoted by Jonathan J. Koehler, *Error and Exaggeration in the Presentation of DNA Evidence at Trial*, 34 *Jurimetrics J.* 21, 23 and nn.4-7 (1993).

4. *In re J.M.*, 590 So. 2d 565, 567 (La. 1991).

willingness to give decisive and controlling evidentiary weight to a blood test *exclusion of paternity*."⁵

This statement may be true to the limited extent that the testing procedure in that case was completed correctly; blood or tissue testing always depends on the quality of the testers and of the testing procedures. Also, the court's comment *relates only to exclusion of paternity*. When the testing is used to "prove paternity," it relies on statistical probability. This, clearly, is more problematical. The accuracy of the "scientific" claim obviously depends not only on the quality of the evidence and the quality of its collection and treatment during storage and testing, but also on the quality of the statistical evidence and the capacity of the presenter of that evidence to allow the trier of fact to understand its actual validity and appropriate impact.

B. New Federal Law

The federal government amended, on August 22, 1996, 42 U.S.C. § 666(a)(5) to require states to provide for and to insist upon genetic testing in contested paternity cases.⁶ The child and all other parties, unless specifically excepted out (or otherwise barred by state law), are required to submit to genetic testing upon the request of any party.⁷ The requesting party must support her request with "a sworn statement alleging paternity, and setting forth facts establishing a reasonable possibility of the requisite sexual contact between the parties; or . . . denying paternity, and setting forth facts establishing a reasonable possibility of the nonexistence of sexual contact between the parties."⁸ The statute also calls for admissibility of genetic testing results if the test is "of a type generally acknowledged as reliable by accreditation bodies designated by the Secretary; and . . . performed by a laboratory approved by such an accreditation body. . . ."⁹ An objection to the admissibility of genetic test results must be made in writing no later than a specified number of days before any hearing at which the results may be introduced into evidence, or, at the option of the state, no later than a specified number of days after receipt of the results.¹⁰ The genetic test results are "admissi-

5. *Id.* (quoting *Little v. Streater*, 452 U.S. 1, 7, 101 S. Ct. 2202, 2206 (1980) (quoting Sidney B. Schatkin, *Disputed Paternity Proceedings* § 9.13 (1975))) (emphasis added). See also *State Dep't of Social Servs. v. Jones*, 638 So. 2d 699 (La. App. 3d Cir. 1994) (DNA indication of "99.49%" insufficient without other evidence supporting paternity); compare *County of El Dorado*, 38 Cal. Rptr. 2d 908 (Cal. Ct. App. 1995) (where paternity index is high enough, alleged father admitted having sexual intercourse with the mother at the relevant time, and produced no countervailing evidence, the presumption of paternity is not rebutted). The opposite result obtains in California without corroborating evidence. *Steven W. v. Matthew S.*, 39 Cal. Rptr. 2d 535 (Cal. Ct. App. 1995).

6. *Personal Responsibility and Work Opportunity Reconciliation Act of 1996*, 110 Stat. 2105, 104th Cong., 2d Session, August 22, 1996, amending 42 U.S.C. § 666(a)(5).

7. *Id.* at 42 U.S.C. § 666 (a)(5)(B)(i).

8. *Id.* The law also calls for specific voluntary acknowledgment mechanisms and services. 42 U.S.C. § 666(a)(5)(C).

9. 42 U.S.C. § 666(a)(5)(F).

10. *Id.*

ble as evidence of paternity without the need for foundation testimony or other proof of authenticity or accuracy, unless objection is made."¹¹

The new federal statute also "allows" a state to establish a rebuttable or even a conclusive presumption of paternity upon genetic testing results which indicate a "threshold probability that the alleged father is the father of the child."¹² This provision is not only a misstatement of the nature of the testing results available, but it may be unconstitutional when considered along with other parts of the law. These difficulties are a major focus of this article. Other provisions have problems as well. The appropriate paternity decision may be rendered by a judicial or even by an *administrative* body if it is shown "by clear and convincing evidence of paternity (on the basis of genetic tests or other evidence)."¹³ Like in other Louisiana family law matters, a problem is not created if a party has no right to a jury trial.¹⁴

The new federal law and the laws in many states, including Louisiana, are misleading as to the values they pretend to represent and risk doing as much harm as good. The tendency to be overwhelmed, or overenamored, with scientific testing, because it may be a boon to establishing paternity, and therefore to protecting children and parental interests as well, risks causing harm. Harm can result when overzealousness in a good cause overcomes caution and legal common sense. Science may become a talisman and a false-god, wreaking havoc and harm, if judges are not vigilant in ensuring that the application of the test and the admission of the testing results are done in a manner to assure accuracy and understanding rather than mere incantation. This article, while recognizing the value and interest in utilizing valuable new tools, suggests caution and the need to address the above-noted tendencies.

C. Some Tests Not Sufficient—Low Sperm Count

Scientists or doctors who conduct tests to determine a low sperm count are not "experts" in dispute per Louisiana Revised Statutes 9:397. Louisiana Revised Statutes 9:397 only contemplates qualified examiners of blood samples, not those who claim impotence or testify as to low sperm count.¹⁵

D. The Purpose of Blood and Tissue Analysis

A major use of blood or tissue analysis is either to exclude the possibility of paternity of an alleged father or, if he is not excluded by the evidence, "to calculate the odds that the defendant would have passed the disclosed genetic markers to a particular child."¹⁶ Louisiana jurisprudence has consistently approved of and

11. *Id.*

12. *Id.* at (G).

13. *Id.* at (J).

14. *Id.* at (I).

15. *State v. Bolden*, 519 So. 2d 362, 365 (La. App. 2d Cir. 1988).

16. *Litton v. Litton*, 624 So. 2d 472, 475 (La. App. 2d Cir. 1993); *State v. Givens*, 616 So. 2d

supported scientific testing to *exclude* individuals from being considered the father of a child, holding it to be reliable and accurate.¹⁷ As noted in the legislative history of the Federal Child Support Enforcement Amendments, increasingly sophisticated tests for genetic markers permit the exclusion of over 99% of those who may be accused of paternity.¹⁸ Such precision may be available even after the putative father is deceased because DNA testing uses molecules that often remain stable and testable long after death.¹⁹ The advent of DNA and related testing portends higher accuracy in actually *proving paternity*. In fact, since its first reported results in 1985, DNA matching has progressed to "general acceptance in less than a decade."²⁰ This article considers both traditional blood testing and DNA matching for purposes of proving paternity.

DNA testing also allows proof of paternity either posthumously or while the father is alive.²¹ The Louisiana Supreme Court articulated the rationale for allowing posthumous proof of paternity in *Sudwischer v. Estate of Hoffpauir*,²² where plaintiff brought a filiation action in order to establish her relationship to the decedent during the course of a succession proceeding. Relying on existing civil discovery rules, the Louisiana Supreme Court held that collateral parties could be ordered to submit to a blood test for DNA comparison purposes.²³ This, of course, raises privacy and other constitutional issues.

E. The Constitutionality of Blood and Tissue Testing. The Impact of Substantive Due Process—Privacy, Search and Seizure

Blood and tissue testing must meet substantive and procedural due process standards. As a general rule, the law ought to protect the interests of individuals in having their genetic information kept private. The new testing technologies pose serious risks to freedom and privacy. They risk increasing the power that a very few people will hold over many.²⁴

259, 261 (La. App. 2d Cir. 1993); *State v. Stringer*, 567 So. 2d 758, 762-63 (La. App. 2d Cir. 1990).

17. *Pace v. State*, 648 So. 2d 1302 (La. 1995); *In re J.M.*, 590 So. 2d 565 (La. 1991) (citing *Winston v. Lee*, 470 U.S. 753, 105 S. Ct. 1611 (1985), and other authority).

18. *Clark v. Jeter*, 486 U.S. 456, 465, 108 S. Ct. 1910, 1916 (1988).

19. Charles N. LeRay, *Implications of DNA Technology on Posthumous Paternity Determination: Deciding the Facts When Daddy Can't Give His Opinion*, 35 B.C. L. Rev. 747 (1994). See *Pace*, 648 So. 2d at 1302 (citing e.g., *Tipps v. Metropolitan Life Ins. Co.*, 768 F. Supp. 577 (S.D. Tex. 1991) and *In re Estate of Rogers*, 583 A.2d 782 (N.J. Super. Ct. App. Div. 1990)).

20. Jay P. Kesan, Note, *An Autopsy of Scientific Evidence in A Post-Daubert World*, 84 Geo. L.J. 1985, 2009 (1996). DNA profiling is commonly used to prove paternity. E.g., *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996); *Johnson v. Meehan*, 461 S.E.2d 369, 370 (N.C. Ct. App. 1995); cf. *State Dep't of Social Serv. v. Bradley*, 673 So. 2d 1247 (La. App. 5th Cir. 1996).

21. See *Pace*, 648 So. 2d at 1302 (citing e.g., *Tipps v. Metropolitan Life Ins. Co.*, 768 F. Supp. 577 (S.D. Tex. 1991) and *In re Estate of Rogers*, 583 A.2d 782 (N.J. Super. Ct. App. Div. 1990)); *In re J.M.*, 590 So. 2d 565, 567 (La. 1991).

22. *Sudwischer v. Estate of Hoffpauir*, 589 So. 2d 474 (La. 1991).

23. *Pace*, 648 So. 2d at 1302.

24. John A. Robertson, *Genetic Selection of Offspring Characteristics*, 76 B.U. L. Rev. 421,

In 1991, the Louisiana Supreme Court in *In re J.M.*,²⁵ recognized the need for constitutional protection when it upheld the constitutionality of Louisiana Revised Statutes 9:396. Louisiana Revised Statutes 9:396 authorizes court-ordered blood testing of a child, the child's mother and the alleged father to prove paternity. The court held that "although, [an] alleged father has a right to privacy and to be free from unreasonable searches and seizures, those rights are not absolute and may be reasonably regulated when the state has a sufficiently weighty interest."²⁶ It also held that blood and tissue testing is a search and seizure. The significant state interest in the welfare of children and the conservation of public assistance funds, however, justifies the intrusion. The *compelling* interest stems from the pervasive concern for the welfare of children.²⁷

The court applied the balancing test articulated in the United States Supreme Court decision of *Matthews v. Eldridge*²⁸ to determine what procedures are constitutionally required to protect the alleged father's rights. The defendant's privacy interests were balanced against the state's compelling interest in protecting its children. The court also factored in the risk of arriving at an erroneous determination under the circumstances because such a determination could seriously impact upon the a father's significant interests.²⁹ In balancing the alleged father's privacy and liberty interests, the Louisiana Supreme Court stated, "[a] blood test is minimally intrusive, relatively painless, and medically safe. In facilitating a determination of paternity, blood tests are highly reliable and unequalled in evidentiary value. . . ."³⁰

1. Procedural Due Process

In addition, the *In re J.M.* court held that although the statute does not explicitly require it, procedural due process requires that the party alleging paternity make a preliminary showing that there is a reasonable possibility of paternity. It is clear "that an individual's constitutional right to due process is implicated when compulsory blood testing is ordered by a court."³¹ Sufficient procedural safeguards to afford due process must, therefore, be provided.

2. Various State Statutory Protections

In addition to the constitutional protections, a number of states since 1995 have passed laws limiting the accessibility and use of genetic information

422 (1996) (considering the benefits and dangers of the "genome project").

25. 590 So. 2d 565 (La. 1991).

26. *Id.* at 568 (citing *Winston v. Lee*, 470 U.S. 753, 105 S. Ct. 1611 (1985)).

27. 590 So. 2d at 568; La. R.S. 46:236.1 (1982 and Supp. 1996); see *Kay v. White*, 286 F. Supp. 684, 687 (E.D. La. 1968).

28. 424 U.S. 319, 96 S. Ct. 893 (1976).

29. *In re J.M.*, 590 So. 2d 565 (La. 1991).

30. *Id.* at 567.

31. *Id.* at 569 (citing *Breithaupt v. Abram*, 352 U.S. 432, 77 S. Ct. 408 (1957)).

because of the serious potential for abuse and the significant risks to privacy and liberty interests.³² These new laws generally prohibit obtaining genetic information from an individual and taking an individual's tissue sample for DNA testing purposes without first obtaining informed consent.³³ These protections have exceptions, however.

Exceptions to this general rule of privacy include: identification of a deceased person, where governmental entities are so authorized by specific law (e.g., for criminal investigations); screening newborns; anonymous research; and, key to the purposes of this article, *establishment of paternity*.³⁴ In such cases, consent may not be necessary.

F. Scientific Testing Is Constitutional and Impressive, but No Panacea

DNA identification evidence is and should be a powerful tool in identifying parents and children.³⁵ The laboratory reported match may be highly suggestive of a true match, but it is not the same as a true match.³⁶ Although DNA testing is used to help establish that individuals have been wrongly convicted, Barry Scheck and Peter Neufeld showed in the O.J. Simpson trial, as they and others have done elsewhere, that it is a two-edged sword. They established how vulnerable such testing may be and ought to be, if not carried out correctly. Questions and challenges to the testing are appropriate because there is little peer scrutiny due to the small forensic scientific community.³⁷ We will consider the areas of vulnerability and related problems with the testing process.

G. Some Miscellaneous, Related Information

If a child is illegitimate under Civil Code article 180 and the natural father is known by the mother, she shall complete and sign a "*paternity information form*," issued by the Vital Records Registry. *This form shall include:* the child's

32. E.g., Or. Rev. Stat. §§ 659.700-720 (Supp. 1996) (effective July 19, 1995). See generally Michael M. J. Lin, *Conferring a Federal Property Right in Genetic Material: Stepping into the Future with the Genetic Privacy Act*, 22 Am. J. L. & Med. 109 (1996); cf. *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996).

33. E.g., Or. Rev. Stat. § 659.710(1) (Supp. 1996).

34. Or. Rev. Stat. § 659.710(1)(a)-(e) (Supp. 1996). See *Sudwischer v. Hoffpauir*, 589 So. 2d 474 (La. 1991) (child has right to prove paternity of deceased father—using DNA testing of legitimate daughter); J.E. Cullens, Jr., Note, *Should the Legitimate Child be Forced to Pay for the Sins of Her Father?*: *Sudwischer v. Estate of Hoffpauir*, 53 La. L. Rev. 1675 (1993); John Devlin, *Review of Recent Developments: 1992-93, Louisiana Constitutional Law*, 54 La. L. Rev. 683 (1994); Katherine S. Spaht & Kenneth Rigby, *Louisiana's New Divorce Legislation: Background and Commentary*, 54 La. L. Rev. 19 (1993). See also Matthew Goldstein, *Posthumous Use of Blood Tests Allowed*, 215 N.Y. L.J. 1 (col. 3) (Apr. 12, 1996).

35. Cf. Koehler, *supra* note 3.

36. *Id.*

37. Kesan, *supra* note 20.

name; date of birth; alleged father's full name; his mailing address; his street address or the location where he may be found; his date of birth; and the name of his parent or guardian if he is a minor. It also includes his city and state of birth, his social security number, and his place of employment. Within fifteen days after the date of admission (of the mother or the birth?) the hospital "birthing facility" shall forward the form to support enforcement services, office of family support, Department of Social Services. If the birth occurred in a place other than a licensed hospital or birthing facility, the form shall be completed at the time the home birth is recorded in the Vital Records Registry and will be submitted to support enforcement services fifteen days thereafter. If the father has not acknowledged the child, the mother shall sign as informant. If she is incapable, her representative shall sign for her.

Louisiana Revised Statutes 40:34(E) requires the Department of Social Services to serve the alleged father (or his tutor/guardian if he is a minor) with notice that he has been named as father on the form. Notice shall include the name of the child and the name of the mother. It shall advise the alleged father of the allegation and how it may be contested. It shall also advise him that he can request that blood tests be conducted. It also is to indicate that he can sign an acknowledgment. Upon receipt of notice, the father has ninety days to contest the allegation. This is done by advising the Department in writing that he is not the father.

Louisiana Revised Statutes 40:34(E)(3), (6), (7) provides that if the alleged father fails to contest the allegation in writing within ninety days, he shall be presumed to be the father of the child, "*for support purposes only.*" The agency seeking support or custodial parent can use this presumption to obtain a support order. If the alleged father contests paternity, a hearing is to be held and blood tests may be ordered. If the "results of the blood tests indicate by a probability of 99.9% or higher that the alleged father is in fact the father of the child, or if the alleged parent fails to appear for the court-ordered blood tests, the court shall rule that he is the father of the child, for purposes of support only, and shall issue an order for support." The father must pay all costs if he is found to be the father; otherwise, the party making the allegations must pay.

These laws pose some potential constitutional and scientific/legal problems: Blood tests (or even DNA tests) do not really *establish* that there is a certain percentage chance that the tested individual is the father. As noted *infra*, there are problems with the theory behind the genetic population groupings and, even more significantly, in the testing procedures. There are so many places where the testers, those who ship, store, and report the testing results, may contaminate or otherwise cause a false positive, that it is misleading (indeed incorrect) to state in the statute that blood tests may "indicate by a probability of 99.9% or higher that he is in fact the father."³⁸

38. See Christopher L. Blakesley, Louisiana Family Law Ch. 6 (Michie 1992 and 1996 update).

H. Standard of Proof in Establishing Paternity

Louisiana Civil Code article 209 (A) has long provided that proof of paternity by a preponderance of the evidence is required when the alleged parent is alive.³⁹ In Louisiana, proof by a preponderance of the evidence means that, taking the evidence as a whole, the proof adduced shows that the fact or cause sought to be established is more probable than not.⁴⁰ In 1987, the United States Supreme Court, in *Rivira v. Minnich*,⁴¹ affirmed the constitutionality of applying the preponderance standard to establish paternity. Louisiana Civil Code article 209 (B) calls for proof by clear and convincing evidence when the alleged father is deceased.⁴²

I. New Medical Evidence on the Time of Conception

A new scientific development impacts and emphasizes the need for corroboration. Recent scientific studies establish that 65% of all pregnancies are conceived on either the day of ovulation or on the preceding day and that an additional 11% are conceived two days before ovulation. Relatively few children are conceived from intercourse more than six days before ovulation or at any time after ovulation.⁴³

II. THE NATURE AND PROCESS OF BLOOD AND TISSUE TESTING

A. The Paternity Index

With the combination of tests, the expert may often state confidently, in an appropriate case, that the probabilities are between 97% to 99.95% that a given man is the father of the child in question.⁴⁴ For example, where "the scientific evidence showed a paternity index of 1359 to 1, and a 99.93 percent probability of paternity . . .," courts often find this to be "very strong evidence" that the named defendant is actually the father."⁴⁵

39. La. Civ. Code art. 209(A); *McKenzie v. Thomas*, 678 So. 2d 42 (La. App. 1st Cir. 1996); *State v. Guichard*, 655 So. 2d 1371, 1379 (La. App. 1st Cir.), writ denied, 660 So. 2d 454 (1995); *Litton v. Litton*, 624 So. 2d 472, 474 (La. App. 2d Cir. 1993).

40. La. Civ. Code art. 209(A); *Guichard*, 655 So. 2d at 1379.

41. 483 U.S. 574, 107 S. Ct. 3001 (1987).

42. See also, e.g., *Bilbrey v. Smithers*, 1996 WL 494990 (Tenn. Sept. 3, 1996) (Tennessee requires clear and convincing evidence after alleged father's death—and paternity must be established before property of the deceased father vests in persons other than the claimant).

43. Joe Leigh Simpson, *Pregnancy and the Timing of Intercourse*, 333 New Eng. J. Med. 1563 (1995); Allan J. Wilcox et al., *Timing of Sexual Intercourse in Relation to Ovulation; Effects on the Probability of Conception, Survival of the Pregnancy, and the Sex of the Baby*, 333 New Eng. J. Med. 1517 (1995); see also Ira M. Ellman et al., *Family Law: Cases, Text, Problems* 37 (update to 2d ed., 1996).

44. See Blakesley, *supra* note 38, and authority cited therein.

45. *Litton v. Litton*, 624 So. 2d 472, 475 (La. App. 2d Cir. 1993) (but the scientific evidence was corroborated by the trial judge's "recogniz[ing] a strong physical resemblance between defendant and the child . . ." and significant relationship and corroborative factors were present).

B. The Bayes Theorem

The "paternity index" is determined by applying the *Bayes Theorem*, a theorem developed by an Eighteenth Century Presbyterian minister in England. It is designed to help calculate the impact of evidence "respecting the occurrence of a questioned event upon the prior probability that the event occurred."⁴⁶ The Theorem may be expressed in several forms. The simplest may be:

$$\text{Odds (X/E)} = \frac{P(E/X)}{P(E/\text{not-X})} \times \text{Odds (X)}$$

In narrative form, this means that "the odds of an unknown fact, here paternity, given that we have new evidence, (E), is equal to the ratio between the probability that the new evidence is true and the probability that it is not true, multiplied by the prior assessment of the probability of that unknown fact."⁴⁷ Testimony regarding the *Bayes Theorem* may be misleading if the expert does not make it clear that: (1) he or she has made an assumption about the prior probability; and (2) the jury is free to second guess the estimate of the prior probability. If the witness does not make that clear, the witness may effectively usurp the jury's authority.⁴⁸

C. What Exactly Is the "Paternity Index?"

The paternity index has been described as "the probability that a cross between the defendant and the mother would produce an offspring with the child's phenotypes and the corresponding probability for a random selection of genes from the male population."⁴⁹ In other words, as explained by Professors Clark and Glowinsky:

For paternity testing purposes the apparent complications of this theorem may be simplified. The first step in the process is to determine the prior odds that the defendant is the child's father. The prevailing convention among the experts, testers and others, is to assume that the prior odds are 1:1, sometimes justified on the ground that this reflects an attempt to be impartial by assuming that either the plaintiff or the defendant is or is not telling the truth. The second step is to multiply the odds of 1:1 by a fraction, the numerator of which is the probability

46. Homer H. Clark, Jr. & Carol Glowinsky, *Domestic Relations: Cases & Materials* 328 (5th ed. 1995).

47. *Id.* (citing Christopher B. Mueller & Laird C. Kirkpatrick, *Evidence Under the Rules* 734-40 (2d ed. 1993)).

48. See generally Edward J. Imwinkelried, *Evidence Law Visits Jurassic Park: The Far-Reaching Implication of the Daubert Court's Recognition of the Uncertainty of the Scientific Enterprise*, 80 Iowa L. Rev. 55 (1995).

49. D. H. Kaye, *Plemel as a Primer on Proving Paternity*, 24 Willamette L. Rev. 867, 877 (1988); see also Clark & Glowinsky, *supra* note 46, at 328-29.

that the defendant is the child's father and the denominator is the probability that a man chosen at random from the population is the father. In other words the numerator is the probability, in terms of a percentage figure that a man having the defendant's genotypes would transmit the necessary genes to the child, given the mother's genotypes. The denominator is the probability, expressed as a percentage figure, that a mythical randomly chosen man could transmit those genes to the child, taking into account the mother's genes. In fact the denominator of the fraction turns out to be the percentage of men of the same race in the population who possess the haplotypes possessed by the child and not received from the mother. When that fraction so computed is converted into a whole number, that number, expressed usually as a percentage, is the Paternity Index. The Paternity Index multiplied by the conventional prior odds of 1:1 does not change in value.⁵⁰

Non-statistical or blood testing evidence must be adduced to avoid significant error. Commentators warn that although courts and experts often label the paternity index as the probability of paternity, this use of the PI is improper.⁵¹ The paternity index is really nothing more than "a comparison between the probability that the defendant transmitted the necessary genes to the child with the statistical incidence of those genes in the general population."⁵² In a case in which it was stated by an expert that the alleged father's "chance of paternity" was 99.4%, this really meant that the odds of his being father were 178 to 1.⁵³

D. DNA Testing

Forensic scientists long have dreamed of a process that can place a suspect at a crime scene [or prove paternity] with absolute certainty using a minute amount of physical evidence.⁵⁴ DNA comparison appeared to be close to that ideal. Since its development ten or so years ago, the popular press has sensationalized the use of DNA fingerprinting.⁵⁵ Its proponents claim that it is possible to determine that unique code by testing bodily fluid and other tissue. If sufficiently perfected to establish paternity affirmatively and with certainty, all the other complex and elaborate blood and tissue testing would be rendered

50. Clark & Glowinsky, *supra* note 46, at 328-29.

51. *Id.* at 329 (emphasis added).

52. *Id.* at 329.

53. *Plemel v. Walter*, 735 P.2d 1209 (Or. 1987), discussed in Clark & Glowinsky, *supra* note 46, at 314-28.

54. Jon Thames, *It's Not Bad Law—It's Bad Science: Problems With Expert Testimony in Trial Proceedings*, 18 Am. J. Trial Adv. 545 (1995).

55. E.g., *Scientists Create First Genetic Map Designed to Track Causes of Illnesses*, Houston Chron. at 9 (Oct. 8, 1987), noted in Michael Mouri, *The Myth of the DNA Fingerprint—Is It For Real?*, 37 Med. Trial Tech. Q. 337, 338 (1991).

obsolete.⁵⁶ DNA identification evidence is and should be a powerful tool in identifying parents and children.⁵⁷ DNA testing, however, is no panacea. Problems exist relating to the population bases and to the processes of gathering, storing, and testing evidence. We will focus on these below.

Over the last several years, molecular biology has advanced to the degree that it has revolutionized and simplified the problem of identification. Deoxyribonucleic acid (DNA) testing has been applied in criminal cases, such as the *Buckland Case*, in England. This case involved the first forensic use of DNA testing to convict an individual.⁵⁸

Genetic codes have been found in every cell of all tissue that has a nucleus. Except for identical twins or triplets, etc., everyone's genetic code is unique; chromosomes within human cells have a pattern that apparently is unique and distinct.⁵⁹ It is an identifier like a fingerprint.⁶⁰ The F.B.I. and the uniformed military services, along with the Department of Defense are, as of 1991, conducting studies on the application of DNA fingerprinting for identification. The methods used by the major laboratories include the following standard biomedical techniques: DNA cleavage with restriction endonuclease, Southern blotting after gel electrophoresis, recombinant DNA cloning of the probes, hybridization and gene amplification.⁶¹ The Washington Supreme Court explained:

Human genes, the fundamental units of heredity, are made up of deoxyribonucleic acid (DNA). The DNA molecule consists of a long string of repeating units, nucleotides, in two strands resembling a spiral staircase (a double helix). The nucleotides, which are of just four types, are paired across the two strands in complementary sequence (they will only pair in certain combinations). Except for identical twins, the complete sequence of base pairs in the DNA is unique for every person. Most of human DNA is the same from person to person, but a very

56. Clark & Glowinsky, *supra* note 46, at 347 (citing Michael Henry and Victoria Schwartz, U.S. Dep't of Health and Human Services, Office of Child Support, *A Guide for Judges in Child Support Enforcement* 84 (2d ed. 1987) (describing the DNA testing procedure); David B. Jackson, *DNA Fingerprinting and Proof of Paternity*, 15 Fam. L. Rptr. 3007 (1989) (with more detail); see also *Cobey v. State*, 559 A.2d 391 (Md. Ct. Spec. App. 1989) (which approved the admission of DNA test results in a criminal case); *In re Baby Girl S.*, 532 N.Y.S.2d 634 (N.Y. Surr. Ct. 1988) (DNA test evidence admitted in paternity case).

57. Cf. Koehler, *supra* note 3, at 21.

58. Anthony Schmitz, *Murder on Black Pad*, *Hippocrates* 49-58 (Jan./Feb. 1988).

59. Julie G. Shoop, *Is DNA Typing Ready for Trial?*, 26 Trial 11 (Sept. 1990); K. F. Kelly et al., *Methods and Application of DNA Fingerprinting: A Guide for the Non-Scientist*, 1987 Crim. L. Rev. 105, 105-06 (1987); Alec J. Jeffreys et al., *Individual-Specific "Fingerprints" of Human DNA*, 316 Nature 76, 77 (1985); Lee Thaggard, Note, *DNA Fingerprinting: Overview of the Impact of the Genetic Witness on the American System of Criminal Justice*, 61 Miss. L.J. 423, 424 (1991).

60. See Mouri, *supra* note 55, at 344. See also *supra* notes 38-59, *infra* notes 79-231, 247-272.

61. These techniques and the history of their development are discussed in Mouri, *supra* note 55.

small percentage differs from person to person. The differences are polymorphisms, and are the key to DNA typing. One type of polymorphism consists of variations in the length of DNA at specific locations (loci) consisting of short repeating DNA sequences called VNTRs (variable number of tandem repeats). The physical length of the DNA molecule at these loci depends upon the number of short repeating sequences. In the human population there are many versions of the DNA at a specific locus—these are called alleles. VNTRs are examined (typed) by the RFLP technique (restriction fragment length polymorphism analysis). If a suspect's blood sample is found to "match" that of a forensic sample, then mathematical and statistical methods are used to estimate the frequency of the genetic profile in major population groups.⁶²

On the other hand, particular parts of the DNA molecule examined specifically in a given test may be identical to a particular part of another person's DNA molecule. This requires testing laboratories to calculate how likely it is that a given match occurred by chance matching of two portions from two different persons.⁶³

DNA testing requires a six-step process to determine, in a paternity action, whether the molecular structure of the alleged father matches that of his alleged child in such a manner that a scientist could say that the man was the father.⁶⁴ If the prints do not match, the man is not the father.⁶⁵ The scientist will compare the alleged father's DNA to that represented in a laboratory database which contains samples from at least one hundred men of the same or similar race, calculating the frequency with which the subject's fingerprint or other bodily material is found in such a population.⁶⁶ From this calculation the

62. *State v. Copeland*, 922 P.2d 1304, 1315-16 (Wash. 1996) (citing Committee on DNA Technology in Forensic Science, *DNA Technology in Forensic Science* (1992)); Howard Coleman & Eric Swenson, *DNA in the Courtroom: A Trial Watcher's Guide* 29-42 (1994); and *State v. Cauthron*, 846 P.2d 502 (Wash. 1993).

63. Shoop, *supra* note 59, at 11; Thaggard, *supra* note 59, at 427-28.

64. For a helpful survey of the whole process, which provides analysis and tips for choosing a laboratory and trial preparation, see Angela Arkin Byne, *Using DNA Evidence to Prove Paternity: What the Attorney Needs to Know*, 19 Fam. L. Rptr. 3001 (1992); see also J. Michael Conneally, *Review-Essay, Reference Manual on DNA Evidence*, 36 *Jurimetrics J.* 193 (1996).

65. *Massachusetts v. Breadmore*, 596 N.E.2d 311 (Mass. 1992); David B. Jackson, *DNA Fingerprinting and Proof of Paternity*, 15 Fam. L. Rptr. 3007 (1989).

66. Byne, *supra* note 64, at 3001; Jonathan J. Koehler, *DNA Matches and Statistics: Important Questions, Surprising Answers*, 76 *Judicature* 222 and n.1 (1993); *United States v. Jakobetz*, 747 F. Supp. 250, 253 (D.C. Vt. 1990), *aff'd*, 955 F.2d 786 (2d Cir. 1992) (every FBI database contains at least 200 individuals), *superseded* to adopt the *Daubert* standard, but proposition in text stands, with even more force. See, e.g., *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S. Ct. 2786 (1993); cf. *United States v. Garcia*, 42 F.3d 573 (10th Cir. 1994) (relating to sentencing guidelines).

likelihood of fatherhood will supposedly be determined.⁶⁷ We will see below that the various population genetic theories utilized for this calculation are currently in hot debate.

Louisiana Revised Statutes 15:441.1 codifies the use of DNA, blood and saliva testing as relevant proof in identifying and convicting individuals for crimes committed in conformity with the Louisiana Code of Evidence. No civil counterpart to Louisiana Revised Statutes 15:441.1 has been enacted in Louisiana, except insofar as it is listed in Civil Code article 187 for disavowal purposes, and is recognized as a means of proving paternity via Civil Code articles 208 and 209. DNA matching is available and valuable for many important purposes, including those relating to family law, such as establishing who both parents of a child are when the child has been adopted or has been abandoned.⁶⁸

E. More General Louisiana Blood Testing Legislation

Louisiana adopted, in its entirety, the Uniform Act on Blood Tests to Determine Paternity in 1972 [Louisiana Revised Statutes 9:396, et seq.]. Apparently, "the legislature intended to provide a carefully regulated evidentiary procedure having precedence over laws of general applicability."⁶⁹ Whether all of this legislation is "careful" is open to question. "The thrust of the statute is to make available scientific evidence, adduced through medical experts appointed by the court and called to testify by the court."⁷⁰ It has been held to be constitutional in Louisiana.⁷¹

Louisiana Revised Statutes 9:396 provides the authority for a trial court to order blood samples to be drawn in any civil action in which paternity is a relevant fact so that inherited characteristics in the samples may be determined by appropriate testing procedures.

Louisiana Revised Statutes 9:397 provides for selection of experts to conduct the tests.

Louisiana Revised Statutes 9:397.2 provides for proof of the chain of custody of the blood samples to meet the requirements of the admissibility of the blood test results.⁷²

Louisiana Revised Statutes 9:397.3 focuses on the admissibility and effect of blood test results. It provides that, "[i]f the court finds that the conclusions

67. Byne, *supra* note 64; *Jakobetz*, 747 F. Supp. at 253.

68. See Wing K. Fung et al., *Determination of Both Parents Using DNA Profiling*, 36 *Jurimetrics J.* 337 (1996).

69. *Jones v. Thibodeaux*, 445 So. 2d 44, 47 (La. App. 4th Cir.), *writ denied*, 448 So. 2d 112 (1984).

70. *Id.*

71. *E.g.*, *Didier v. Fasola*, 597 So. 2d 450, 451-52 (La. App. 1st Cir. 1991).

72. *Handler v. Stanford*, 590 So. 2d 748, 750 (La. App. 3d Cir. 1991). See discussion of chain of custody and other related matters *infra* text accompanying notes 230-236.

of all the experts as disclosed by the reports, based upon the tests, are that the alleged father is not the father of the child, the question of paternity shall be resolved accordingly. If the experts disagree in their findings or conclusions, the question shall be submitted upon all the evidence."

F. Entranced by Science. Burden Proof in Louisiana Since 1995—Louisiana Revised Statutes 9:397.3(B)(1)(b), As Amended in 1995

In 1995, Louisiana Revised Statutes 9:397.3(B)(1)(b) was amended to create a rebuttable presumption of paternity when a validly certified blood report indicates a 99.9% or greater "probability that [he] is [the father]."⁷³ This presumption is questionable; it is misleading as to the real value of the statistical evidence. It inaccurately describes what the testing does and what the statistics mean. It may mislead the trier of fact as to the actual valid impact or meaning of the testing. If the population base is such that the percentage could actually include some 50,000 potential fathers, why should not the claimant be required to establish that some timely sexual access occurred? Now that the presumption has changed the traditional rule on corroboration, it is fully up to counsel for the alleged father to dislodge it. The danger lies in the tendency to be overwhelmed by scientific, mathematical, or statistical evidence or in using it as a talisman. This is not what Louisiana legislation or jurisprudence has required in the past and there is serious question about the validity or propriety of doing so now.

Whether a plaintiff has met the burden of proof and presented sufficient evidence of paternity is a determination for the trier of fact.⁷⁴ We have already seen, and will develop this further below, that scientific testing is open to criticism and should not be the sole factor in determining paternity.⁷⁵ Alone, scientific testing is insufficient to meet the standard (preponderance of the evidence required) to prove paternity.⁷⁶ Nevertheless, some states are providing that when a person attempts to "challenge a support order on the basis of non paternity without externally obtained clear medical proof," the challenge should be rejected.⁷⁷

We will focus on the reliability of the claim that scientific testing establishes such a presumption. Suffice it to say at this point that to suggest that testing can produce a 99.9% or higher "probability of fatherhood" is misleading in many circumstances. What does the statistical percentage really mean? What is the

73. La. R.S. 9:397.3(B)(2)(b) (Supp. 1996); *see also* La. Civ. Code art. 209(A) and (B); *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996); *Litton v. Litton*, 624 So. 2d 472, 474 (La. App. 2d Cir. 1993).

74. *See Didier*, 597 So. 2d at 456; *Litton*, 624 So. 2d at 475; *State v. Smith*, 605 So. 2d 222, 224 (La. App. 2d Cir. 1992).

75. *E.g.*, *State Dep't of Social Serv. v. Dorsey*, 665 So. 2d 95, 96 (La. App. 1st Cir. 1995).

76. *McKenzie v. Thomas*, No. 95-CA-2226, 1996 WL 375017 (La. App. 1st Cir. June 28, 1996); *State v. Guichard*, 655 So. 2d 1371, 1379-80 (La. App. 1st Cir.), *writ denied*, 660 So. 2d 454 (1995); *Litton*, 624 So. 2d at 476.

77. *E.g.*, *Leiter v. Scott*, 654 N.E.2d 742 (Ind. 1995).

population base and what is its impact on the potentiality of fatherhood? One must ask whether the trier of fact and counsel are capable of understanding the complexities of the mathematical information. If not, can they apply any appropriate value to the probabilistic evidence? We will consider, below, the complexities and vagaries of the scientific and statistical quagmire that courts find themselves in and will indicate why corroboration should still be required.

G. Problems in Testing Procedure—"Procedural Errors"—1995 Amendment and Re-enactment of Louisiana Revised Statutes 9:397.3(B)

In 1995, the Legislature attempted to provide protection against errors in taking blood or tissue samples, their labeling, storage, shipping, testing, or in other parts of the chain of custody. The legislation provided:

B. (1) If the court finds there has been a procedural error in the administration of the tests, the court shall order an additional test made by the same laboratory or expert.

(2)(a) If there is no timely challenge to the testing procedure or if the court finds there has been no *procedural error* in the testing procedure, the certified report shall be admitted in evidence at trial as *prima facie* proof of its contents, provided that the party against whom the report is sought to be used may summon and examine those making the original of the report as witnesses under cross-examination.

(b) A certified report of blood or tissue sampling which indicates by a ninety-nine and nine-tenths percentage [99.9%] point threshold probability that the alleged father is the father of the child creates a rebuttable presumption of paternity. (emphasis added).

The term "*procedural error*" in Louisiana Revised Statutes 9:397.3(B)(2)(a) includes errors in the taking of the samples, their storage, shipping, testing and breach of or failure to verify chain of custody in the proper, sworn affidavit.⁷⁸

It has been held to be untimely to wait some eight months after notice of the filing of the blood test report to challenge the results of blood and tissue tests.⁷⁹ The legislation provides no indication of what will rebut the presumption. The statute should call for corroborating evidence because the so-called percentage determined does not have much meaning if no evidence of access or the like is also presented. As noted above, the jurisprudence requires such corroboration.⁸⁰

78. State Dep't of Social Serv. v. White, 651 So. 2d 366, 369 (La. App. 2d Cir. 1995).

79. *Id.* at 368; Rigaud v. Derruise, 539 So. 2d 979 (La. App. 4th Cir. 1989), *appeal after remand*, 613 So. 2d 761 (La. App. 4th Cir. 1993).

80. *E.g.*, Litton, 624 So. 2d at 475. *See also generally* State v. Dorsey, 665 So. 2d 95, 96 (La. App. 1st Cir. 1995); State v. Simien, 677 So. 2d 1138, 1144 (La. App. 3d Cir. 1996); Didier v.

H. Elaboration of Issues Surrounding "Procedural Error"

DNA evidence, when admitted, often holds an aura of virtual certainty.⁸¹ Nevertheless, the testing procedure is rife with potential error. Any form of scientific analysis is subject to error. Indeed, although a laboratory may have reported a match may be highly suggestive of a true match, it is not the same as a true match.⁸² The opportunity for error occurs at each stage of the procedure and the concerns of misrepresentation or misinterpretation increase as the stages of the process cumulate. Each phase is part of a chain of inferences which is cumulative.⁸³ Thus, even as the inferences drawn from each phase are cumulative, so are the opportunities for error, creating the potential for erroneous results.⁸⁴ Failure to follow proper procedure at any stage makes error more likely at that stage and the potential cumulates over the chain of stages and the inferences drawn therefrom.⁸⁵ Professor Jonathan Koehler explains that many experts, judges, and attorneys "not only fail to see the cumulative nature of the problems that can occur when moving along the inferential chain, but they frequently confuse the probabilistic estimates that are reached at one state with estimates of the others. . . . [T]he resulting misrepresentation and misinterpretation of these estimates lead to exaggerated expressions about the strength and implications of the DNA evidence."⁸⁶

A National Institute of Justice study sent samples of blood, among other items of physical evidence to more than 200 police laboratories in the United States and Canada for scientific analysis. The results were that 71% of the blood samples were *misidentified*.⁸⁷ Efforts in proficiency testing, perhaps, have increased the quality.⁸⁸

Fasola, 597 So. 2d 450, 454 (La. App. 1st Cir. 1991); *State ex rel. Gray v. Hogan*, 613 So. 2d 681, 683 (La. App. 5th Cir. 1993); *State v. Montgomery*, 574 So. 2d 1297, 1301 (La. App. 3d Cir.), *writ denied*, 577 So. 2d 38 (1991).

81. Some courts so hold. See, e.g., *Colorado v. Fishback*, 829 P.2d 489 (Colo. Ct. App. 1991), *aff'd*, 851 P.2d 884, 892 (1993) (claiming that DNA testing is "failsafe"); *Missouri v. Davis*, 814 S.W.2d 593 (Mo. 1991) (claiming an accuracy rate is 100%); *Andrews v. State*, 533 So. 2d 841, 890 (Fla. App. 1988), *aff'd*, 542 So. 2d 1332 (1989). Cf. *Pace v. State*, 648 So. 2d 1302 (La. 1995); *Interest of J.M.*, 590 So. 2d 454 (La. 1991).

82. See *supra* note 81. See also Steven Terry, *Development: Evidence*, 22 Wm. Mitchell L. Rev. 237, 238-39 (1996).

83. Koehler, *supra* note 3, at 22.

84. *Id.*; Leslie Roberts, *DNA Fingerprinting: Academy Reports*, 256 Science 300 (April 17, 1992).

85. Koehler, *supra* note 3, at 22; *State Dep't of Social Serv. v. White*, 651 So. 2d 366, 368 (La. App. 2d Cir. 1995); *Rigaud v. Deruise*, 539 So. 2d 979 (La. App. 4th Cir. 1989), *appeal after remand*, 613 So. 2d 761 (La. App. 4th Cir. 1993).

86. Koehler, *supra* note 3, at 22.

87. Jon P. Thames, *It's Not Bad Law—It's Bad Science: Problems With Expert Testimony in Trial Proceedings*, 18 Am. J. Trial Adv. 545, 547 (1995) (citing Michael J. Saks, *Accuracy v. Advocacy: Expert Testimony Before the Bench*, 90 Tech. Rev. 42, 47 (Aug.-Sept. 1987)).

88. See *Assuring the Quality of Laboratory Tests*, 267 J.A.M.A. 1722 (Apr. 1, 1992) (for health care labs, but not for forensic labs).

Laboratory experts have not only been known to make errors, they have been known to cheat. For example, one was found to have committed "acts of misconduct," including: "(1) overstating the strength of results; (2) overstating the frequency of genetic matches on individual pieces of evidence; (3) misreporting the frequency of genetic matches on multiple pieces of evidence; (4) reporting that multiple items had been tested, when only a single item had been tested; (5) reporting inconclusive results as conclusive; (6) repeatedly altering laboratory records; (7) grouping results to create the erroneous impression that genetic markers had been obtained from all samples tested; (8) failing to report conflicting results; (9) failing to conduct or to report conducting additional testing to resolve conflicting results; (10) implying a match with a suspect when testing supported only a match with the victim; and (11) reporting scientifically impossible or improbable results."⁸⁹

Any reasonably effective defense can mount a substantial attack on such evidence, but this requires a defense team with sufficient expertise.⁹⁰ The following thoughts about what should be in interrogatories may be helpful in cases where scientific testing results are at issue. It would be worthwhile for counsel to work with scientists to develop interrogatories designed to expose error.⁹¹

"Accuracy of test results requires a competent staff and a properly designed set of laboratory procedures."⁹² Poor lab work or poor gathering or storing techniques can cause controversy and error masked with the aura of science.⁹³ Laboratory error includes all human and technical errors, including: mislabelings, misrecordings, misrepresentations, case mix-ups, contaminations, and all sorts of interpretive errors.⁹⁴ The DNA replication process that makes possible the testing of minute samples or the repeated testing of small samples lends itself to the possibility of problems of contamination, which will confuse and cause error; since

89. Matter of Investigation of West Virginia State Police Crime Laboratory Serology Div., 438 S.E.2d 501 (W. Va. 1993), noted and discussed in *West's Legal News, Criminal Justice: Witness Credibility—DNA Expert Who Helped Convict Innocent May Elude [Perjury] Charges*, 11/13/96 *West's Legal News* 12118, 1996 WL 655016. See also *Ex Parte Jean Matthews*, No. 176-95, 1996 WL 604183 (Tex. Cr. App. Oct. 23, 1996).

90. Thames, *supra* note 54, at 557.

91. For sample interrogatories to consider and other questions to ask, see discussion in Blakesley, *supra* note 38, Ch. 6, § 6.13.

92. Sylvia Iannucci, Note, *Establishing Paternity Through HLA Testing: Utah Standards for Admissibility*, 1988 Utah L. Rev. 717, app. at 738; see Janet C. Hoeffel, Note, *The Dark Side of DNA Profiling: Unreliable Scientific Evidence Meets the Criminal Defendant*, 42 Stan. L. Rev. 465, 493-95 (1990), Thames, *supra* note 54, at 547-48. There are certain problems inherent in any, even excellent, laboratory environment.

93. See Thames, *supra* note 54, at 557 (citing Hoeffel, *supra* note 92, at 480); see also Christopher G. Shank, Note, *DNA Evidence in Criminal Trials: Modifying the Law's Approach to Protect the Accused from Prejudicial Genetic Evidence*, 34 Ariz. L. Rev. 829 (1992); cf. Thomas M. Fleming, Annotation, *Admissibility of DNA Identification Evidence*, 84 A.L.R. 4th 313 (1991 and Supp. 1996).

94. Jonathan J. Koehler et al., *The Random Match Probability in DNA Evidence: Irrelevant and Prejudicial?*, 35 *Jurimetrics J.* 201, 203, n.7 (1995).

most samples come from sources that may be contaminated with bacteria, there is the possibility that the DNA replicated is that of the contaminant.⁹⁵ There is a constant danger of samples being switched, of cross-contamination, and of contamination of the sample-taking. Errors are not uncommon in relation to the storing of tools or devices involved in the taking, storing, and sending of the samples to the testing laboratory. Moisture and bacteria can cause DNA degradation.⁹⁶

Bacteria, foreign blood, or other material may contaminate the materials or tools utilized in the testing. Contaminated tools contaminate the sample. Misleading results thus occur. Dr. Michael Baird, Director of Forensic and Paternity Testing at Lifecodes, testified in the famous *Castro* case that his company knowingly continued to use contaminated containers and tools used in the testing process. Indeed, "it was not his practice to even bother to record in a laboratory notebook the fact that a probe was found to be contaminated."⁹⁷ This practice "virtually invites the occurrence of false positives and false negatives."⁹⁸ It is reported that many laboratory technicians are hardworking, dedicated, and capable. Some are simply incompetent.⁹⁹

Notwithstanding this potentiality for error, recent Louisiana decisions have held that where a paternity expert testifies that an accurate protocol was followed in processing the evidence, the trial court should admit the expert's report.¹⁰⁰ This is fine, as long as there is a meaningful opportunity to cross-examine someone who has the pertinent knowledge of the actual testing. Prior Louisiana jurisprudence always required corroboration of the scientific evidence. Other jurisdictions do the same and some require precise indication of the true value of the scientific testing and the exact process utilized in the particular case. For example, British Courts of Appeal have recently laid down guidelines for the introduction of DNA evidence. The decisions required that "the methodology of DNA analysis and statistical calculation be as transparent as possible to the defence and . . . required fair and accurate explanation of the evidence" and its true value. They held that it was improper for scientific experts to "overstep the line into the province of [the trier of fact]: they should state, on the basis of the statistical data, the 'random

95. See P. Michael Conneally, *Review Essay: Reference Manual on Scientific Evidence*, 36 *Juremetrics* J. 193, 195-96 (1996); Michael R. Flaherty, Annotation, *Admissibility, In Prosecution for Sex-Related Offense, of Results of Tests on Semen or Seminal Fluids*, 75 A.L.R. 4th 897, at §§ 8, 11, 15(f) (1990); Fleming, *supra* note 93.

96. Thaggard, *supra* note 59, at 442; Debra Cassens Moss, *DNA—The New Fingerprints*, 74 A.B.A. J., May 1, 1989, at 67.

97. Dr. Eric S. Lander, *Expert's Report* at 23, in *People v. Castro*, No. 1508/87 (N.Y. Sup. Ct. 1989) (on file with Stanford Law Review); see also Eric S. Lander, *DNA Fingerprinting on Trial*, 339 *Nature* 501, 503 (1989).

98. Lander, *Castro Expert's Report*, *supra* note 97, at 6.

99. Ronald J. Bretz, *Scientific Evidence and the Frye Rule: The Case for a Cautious Approach*, 4 *Cooley L. Rev.* 506, 518 (1987); Thames, *supra* note 54, at 547-48; Hoeffel, *supra* note 92, at 493-95.

100. *Litton v. Litton*, 624 So. 2d 472, 475 (La. App. 2d Cir. 1993); cf. *State In re Braden v. Nash*, 550 So. 2d 866 (La. App. 2d Cir. 1989).

occurrence ration' [sic] (the frequency with which matching DNA characteristics would be found in the population at large), but should not express an opinion as to the likelihood that the DNA found and tested was the defendant's." Moreover, the defense should be told the "basis used in calculating the random occurrence ratio. . . ." ¹⁰¹

Louisiana Revised Statutes 9:397.3(B) provides that if a court finds a "procedural error in the administration of the tests, the court *shall* order an additional test made by the same laboratory or expert." A procedural error may be raised by the court upon its own motion. ¹⁰² This is really a substantive rule, designed to protect against errors which may cause false positives or false negatives.

It is a false claim that "false positives" may not be caused by human error. Most false positives are caused by human error. It is frequently stated, incorrectly, that false positives are impossible in DNA (RFLP) analysis. ¹⁰³ Whether a "false positive" can be generated by DNA tests depends on how one defines "false positive." If the definition asks whether there can be a "false positive" if the actual testing system fails, then there is little likelihood that there can be a "false positive." If the definition asks if human error or design can cause a "false positive," the answer, as in any science, is obviously yes. ¹⁰⁴ The major problem with the "presumption" in the Uniform Blood Testing Act ¹⁰⁵ is that it nearly ignores the truth that false positives arise from human error and nearly prevents establishment of actual, specific errors committed by technicians or scientists. Although there are few published studies of actual error rate in forensic DNA testing, those which have been done seem to suggest an error rate of about one percent (one false positive in every 100 samples). ¹⁰⁶

I. Problems, Difficulties and Controversies

Professor Jon Thames recently noted many of the problems and controversies relating to DNA testing. ¹⁰⁷ In the early days of DNA testing, fairly large trace samples were required, and the process was limited to analyzing blood and

101. *R. v. Doherty and R. v. Adams*, The Times (London) Aug. 8, 1996, at 33, and in 17-18 Bull. Legal Developments 203-04 (U.K., Sept. 16, 1996).

102. *State Dep't of Social Serv. v. White*, 651 So. 2d 366, 369-70 (La. App. 2d Cir. 1995).

103. See *United States v. Yee*, 134 F.R.D. 161, 175 (N.D. Ohio 1991), *aff'd*, 12 F.3d 540 (6th Cir. 1993); Koehler, *supra* note 3, at 23 nn.4-9; Richard A. Nakashima, *DNA Evidence In Criminal Trials: A Defense Attorney's Primer*, 74 Neb. L. Rev. 444, 464 (1995).

104. Gerald Sheindlin, *DNA: Is the Presentation of Statistical Evidence Necessary?*, 214 N.Y. L.J. 1 (col. 1) (Aug. 4, 1995).

105. La. R.S. 9:396 (Supp. 1996).

106. Nakashima, *supra* note 103, at 464; cf. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S. Ct. 2786, 2787 (1993) (noting the known or potential error rate as one of factors). *Daubert* is analyzed *infra* text accompanying notes 279-301.

107. Thames, *supra* note 54.

semen.¹⁰⁸ Recent developments in DNA replication, however, have made testing minute samples of blood, semen, hair follicles, saliva, or skin tissue possible.¹⁰⁹

Courts in both the civil and criminal arenas have rushed to embrace this new technology.¹¹⁰ Its value is great and its use is quite appropriate, although the embrace is somewhat overdone. One court thrilled to the vision that DNA testing "constitute(s) the single greatest advance in the 'search for truth,' and the goal of convicting the guilty and acquitting the innocent, since the advent of cross-examination."¹¹¹ Experts sometimes claim that DNA testing is infallable. This, indeed, is a serious problem facing the judiciary. First, it is not true. Second, it is claimed quite often. For example, actual testimony of experts in courts has included statements like the following. "[I]t is technically impossible to make a false/positive identification."¹¹² "There is no way to get a false positive with this technology."¹¹³ DNA analysis is "failsafe."¹¹⁴ The accuracy rate is 100%.¹¹⁵ Professor Koehler quotes from the transcript of a Texas case:

Q: Now, you're telling us that you can only get a result or no result; is that correct?

A: That's correct.

Q: And you couldn't get a false positive?

A: There's nothing like a false positive in this, no.

Q: How about if you use the wrong sample?

A: If you use the wrong sample?

Q: (Nods head).

A: You either get a result, or you don't get a result. There's no false positives.¹¹⁶

"These claims are extremely misleading and may be reversible error."¹¹⁷ The trier of fact really needs to determine how likely it is that the reported match is or is not a true match.¹¹⁸ The cumulation of procedural errors makes the possibility

108. *Id.* at 554.

109. *Id.* at 554-57 (citing Lorne T. Kirby, *DNA Fingerprinting: An Introduction* (1990)).

110. *Thames*, *supra* note 54, at 554-57.

111. *Id.* (citing *New York v. Wesley*, 533 N.Y.S.2d 643, 644 (Albany Cty. Ct. 1988)).

112. *Jones v. State*, 569 So. 2d 1234 (Fla. 1990) (transcript at 677), *cited and quoted in* Koehler, *supra* note 3, at 23 n.4.

113. *Kelly v. State*, 792 S.W.2d 579 (Tex. Ct. App. 1990), *cited and quoted in* Koehler, *supra* note 3, at 23 n.5.

114. *People v. Fishback*, 829 P.2d 489 (Colo. App. 1991), *aff'd*, 851 P.2d 884 (1993), *cited and quoted in* Koehler, *supra* note 3, at 23 n.7.

115. *State v. Davis*, 814 S.W.2d 593 (Mo. 1991) (transcript at 82), *cited in* Koehler, *supra* note 3, at 23 n.8. *See also* additional authority in Professor Koehler's article, especially in notes 8 and 9.

116. Koehler, *supra* note 3, at n.9 (quoting from transcript of *State v. Bethune*, 821 S.W.2d 222 (Tex. App. 1991) (transcript at 2228)).

117. Koehler, *supra* note 3, at 24.

118. *Id.*

of error increase. Errors occur! Their occurrence has been documented in both laboratory proficiency tests and in actual casework.¹¹⁹ It is clear that technical failures occur. For this reason alone, the infallibility claims ought to be forbidden.¹²⁰ When one adds the astounding claims of probability that are presented, the danger of error is obvious. Some of these have included: "the probability of selecting an unrelated individual of the population from the same race . . . who had a genetic profile matching [defendant] was one in ten billion."¹²¹ As discussed before, laboratory experts not only make errors, they have been known to cheat.¹²²

It is not clear that these claims of infallibility are true. We will consider, below, the vigorous debate over these statistics and the population studies that back them up. The six-step methodology is described above.¹²³ In summary, it works as follows.¹²⁴ The legal factfinder is told by an expert that the blood or tissue of the relevant parties "matches." This match is generally represented by what is called a "random match probability" (RMP).¹²⁵ The RMP signals the "probability that the DNA profile of a randomly selected person from some reference population (e.g., a racial group) will match the profile of the [evidence]."¹²⁶

There is still a dearth of relevant population studies necessary to attach any real degree of significance to a given match.¹²⁷ Indeed, some argument remains regarding the scientific validity of DNA testing itself.¹²⁸ Notwithstanding all of the controversy, Professor Thames admits that one may characterize the process as "a breakthrough." He argues, however, that although it is here to stay, DNA testing presents a difficult situation for the courts because it is a process that the legal profession "may not know how to properly use."¹²⁹

Although the contributors to legal literature are at odds over the efficacy and even the validity of the process,¹³⁰ apparently the only successful challenges of

119. *Id.* (citing California Ass'n of Crime Laboratory Directors, DNA Committee Rpt. No. 6 (Oct. 1, 1988)); Simon Ford & William C. Thompson, *A Question of Identity: Some Reasonable Doubts About DNA "Fingerprints,"* 30 *Sciences* 37 (Jan.-Feb. 1990); Lander, *supra* note 97; William C. Thompson & Simon Ford, *The Meaning of a Match: Sources of Ambiguity in the Interpretation of DNA Prints,* in *Forensic DNA Technology* 93 (Mark A. Farley & James J. Harrington, eds., 1991).

120. Koehler, *supra* note 3, at 24.

121. *Knight v. State*, 435 S.E.2d 276, 278 (Ga. App. 1993) (criminal case), *quoted in* Koehler et al., *supra* note 94, at 202 n.3; *see also* additional authority in that footnote.

122. *See supra* note 89 and accompanying text.

123. *See supra* notes 63-67 and accompanying text.

124. As explained this time by Koehler et al., *supra* note 94, at 202.

125. *Id.*

126. *Id.*

127. Dan L. Burk, *DNA Fingerprinting: Possibilities and Pitfalls of a New Technique*, 28 *Jurimetrics J.* 455, 465-66 (1988).

128. *See supra* notes 107-127, *infra* notes 129-224 and accompanying text.

129. *Id.*

130. Thames, *supra* note 54. Also, compare Hoeffel, *supra* note 92 (contending that the process fails the *Frye* standard, the test of relevance under the Federal Rules of Evidence, the Fourth Amendment prohibition against unreasonable searches, and the defendant's right to privacy) with

DNA evidence in court have been those that accept the process but attack its implementation.¹³¹

J. The Problem with "Matching"

An important area of controversy relates to matching. Professor Thames explains that the bands produced by the DNA testing process do not fall on a single point but appear across a spectrum of points. "A value is given by determining where the darkest point occurs. This can be done by 'eyeball' or relegated to a computer."¹³² The FBI uses a computer, but the analyst may override the computer's placement of the marker,¹³³ and no record is kept of the override.¹³⁴ There is no standard for declaring matches."¹³⁵ If this can be done and no record is kept, there is opportunity for error and there may be no opportunity to prove the error, unless one is able to cross-examine the actual principals.

K. Controversy—the Use of DNA Statistical Evidence and Human Error

DNA testing is not a panacea. DNA evidence has been touted as being nearly infallible.¹³⁶ Prosecutors (and parties alleging paternity) have felt [traditionally] that it is their courtroom ally.¹³⁷ The most realistic opportunity for attacking DNA testing today probably rests in the establishment of errors in and attacks on the test as conducted from the time the evidence is gathered, while it is shipped and stored, to the time it is tested and its results reported.¹³⁸

Suzanne H. Stenson, Comment, *Admit It! DNA Finger Printing Is Reliable*, 26 Hous. L. Rev. 677 (1989) (supporting the use of DNA testing).

131. Thames, *supra* note 54 (citing, e.g., *New York v. Castro*, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989)).

132. Thames, *supra* note 54, at 556 (citing Kirby, *supra* note 109, at 117-18).

133. Thames, *supra* note 54, at 556.

134. *Id.*

135. Hoeftel, *supra* note 92, at 486-92.

136. The tendency of experts to claim testing infallibility is one of the serious problems facing the judiciary. See, e.g., *Jones v. State*, 569 So. 2d 1234 (Fla. 1990) ("[I]t is technically impossible to make a false/positive identification." (transcript at 677)); *Kelly v. State*, 792 S.W.2d 579 (Tex. App. 1990) ("There is no way to get a false positive with this technology." (transcript at 919)). Cases cited and quoted by Koehler, *supra* note 3, at 23 and n.4.

137. Rorie Sherman, *DNA Unraveling*, 15 The Nat'l L.J. 1 (col. 1) (Feb. 1, 1993) (noting that there appears to have been a dramatic shift toward defense counsel in the vigorous tug-of-war with prosecutors regarding this evidence); Denise A. Filocomo, Comment, *Unravelling the DNA Controversy: Wesley, A Step in the Right Direction*, 3 J.L. & Pol'y 537, 542 (1995) (analyzing the New York Court of Appeals decision which found "DNA evidence was . . . generally accepted as reliable").

138. See also Blakesley, *supra* note 38; *supra* notes 92-99 and accompanying text; Edward J. Imwinkelried, *Criminal Law Symposium: The Debate in the DNA Cases Over the Foundation for the Admission of Scientific Evidence: The Importance of Human Error as a Cause of Focucis Misanalysis*, 69 Wash. U. L.Q. 19 (1991); Matthew Goldstein, *At Ease With Tough High-Profile*

This is in the arena of the "procedural error."¹³⁹ Again, Professor Jon Thames has noted:¹⁴⁰

... [c]ontroversy exists in the conversion of matching into probabilities. In *New York v. Castro*,¹⁴¹ an expert from Lifecodes Laboratories cited the probabilities of a random match as one in 100,000,000 while the defense expert, using Lifecodes' published procedures, calculated the odds as one in 78 and, using the FBI methodology, as one in 24.¹⁴² The National Research Council attempted to resolve this problem in its 1992 report¹⁴³ proposing a "modified ceiling" approach.¹⁴⁴ The major element of this method seems to involve assigning a minimum interim ceiling frequency of ten percent on any individual locus.¹⁴⁵ In *State v. Cauthron*, the Washington Supreme Court adopted this position stating, "Although we lack the scientific expertise to either assess or explain the methodology, its adoption by the (NRC) Committee indicates that sufficient acceptance within the scientific community has been achieved to satisfy Frye in appropriate circumstances."¹⁴⁶

Currently, state courts are "grappling" with the issues of DNA reliability and admissibility.¹⁴⁷ More than one judge has criticized the use of DNA statistical "expert" evidence. Justice Gerald Sheindlin, one of the more expert in the DNA arena,¹⁴⁸ has argued that:

Cases, 216 N.Y.L.J. 1 (col. 1) (Sept. 24, 1996). Professor Thames discusses five points of controversy and possible error.

139. See discussion of "procedural error," *supra* notes 78-108 and accompanying text.

140. Thames, *supra* note 54.

141. *People v. Castro*, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989).

142. Hoeffel, *supra* note 92, at 492 (citing the expert's report in the case).

143. National Research Council, *DNA Technology in Forensic Science* (1992) (cited in *Minnesota v. Alt*, 504 N.W.2d 38, 43 (Minn. Ct. App. 1993)).

144. *Alt*, 504 N.W.2d at 50.

145. *Id.*

146. Thames, *supra* note 54 (citing *State v. Cauthron*, 846 P.2d 502, 517 (Wash. 1993)).

147. See, e.g., James Morgan, *DNA Profiling in North Carolina*, 21 N.C. Cent. L.J. 300 (1995) (discussing "the reliability and the credence the North Carolina courts have given DNA analysis"); Scott D. Sherwood, *The Pennsylvania Supreme Court Defines the Standard of Admissibility for DNA Evidence at Trial—Commonwealth v. Crews*, 640 A.2d 395 (Pa. 1994), 68 Temple L. Rev. 953 (1995) (discussing the Pennsylvania Supreme Court's admission of testimony concerning DNA matching); Michael J. Short, *Forensic DNA Analysis: An Examination of Common Objections Raised to the Admission of DNA Fingerprinting as Illustrated by State v. Pierce*, 19 U. Dayton L. Rev. 133 (1993) (discussing the admissibility of DNA testing in criminal trials); Sarah E. Snyder, Note, *Experimental or Demonstrable: Has DNA Testing Truly Emerged from the Twilight Zone? An Assessment of Washington's Response to DNA Identification*, 31 Willamette L. Rev. 201 (1995) (discussing Washington state's handling of the introduction of DNA evidence in criminal trials).

148. Justice Gerald Sheindlin is a New York City criminal court judge, who also sits on the State Supreme Court. He is an expert on DNA evidence, has written two books on the subject, and has

While fully capable of understanding the scientific process used to generate the evidence, the trial lawyers and judge were confused and in awe of the analysis of complicated concepts such as Hardy-Weinberg equilibrium, linkage equilibrium, Wahlund principle, sub-populations, population drift, the Gaussian Curve and other mind boggling statistical complexities used to explain the significance of a match, and deferred to the population geneticist and statistician.¹⁴⁹

Judge Sheindlin explains the DNA testing process and the nature of the potentially harmful consequences of allowing "experts to invade the trial with their language rather than insist that the time honored use of our legal language, used with success and understanding from time immemorial, be the method by which expert opinion is presented."¹⁵⁰ Judge Sheindlin continues in a vein of criminal law but with pertinence to family law:

Assume that four DNA tests were conducted examining four different sections of chromosomes¹⁵¹ and a computerized match is observed between the DNA sample left at the crime scene and the defendant's DNA.¹⁵² Then the four separate DNA matches are compared to four separate databases consisting of a large number of randomly chosen people whose DNA was previously profiled.¹⁵³

Thereafter, for example, if two bands are observed, one at 10KB and another at 5KB (10,000 and 5,000 base pairs long), in both the defendant and the random persons tested in the database, and out of 500 people tested only one other person had the same length DNA at both areas of the chromosome, then the opinion is rendered that the odds of

been a lecturer on that topic for the FBI. He may be most well-known for his decision in the famous *People v. Castro* case discussed above. See Goldstein, *supra* note 138, at col. 3.

149. Gerald Sheindlin, *DNA: Is the Presentation of Statistical Evidence Necessary?*, 214 N.Y. L.J. 1 (col. 1) (Aug. 4, 1995).

150. *Id.*

151. There are currently 12 different probes developed to inspect nine different sections of chromosomes. Presently, six probes are the maximum actually utilized to examine portions of nine chromosomes using the RFLP technique. In PCR, there are approximately nine different probes that are utilized to examine the genes on about 10 different chromosomes or sections thereof.

Id. at n.2.

152. In these discussions, it is assumed that the DNA tests were performed correctly and with integrity. Whether a "false positive" can be generated by DNA tests, depends upon the definition assigned to "false positive." If the definition asks whether there can be a "false positive" if the actual testing system fails, then there is little likelihood that there can be a "false positive." If the definition asks if human error or design can cause a "false positive," the answer, as in any science, is obviously yes.

Id. at n.3.

153. "For example, the FBI database currently consists of Black, Hispanic, Southeastern Hispanic, Southwestern Hispanic, Caucasian, and Asian populations." *Id.* at n.4.

a random person having this band is 1 in 500. Then the match for the next chromosome is compared to a database for that chromosome.

Assuming there are 1,000 people in this database, and there are two matches at these different lengths of DNA, then again it can be said that the odds that anyone else having this band is 2 in 1,000 or 1 in 500. This process continues until the other two matches are compared and their odds are computed. These figures are then multiplied, one with the other (i.e. $500 \times 500 \times 350 \times 400$),¹⁵⁴ producing fantastic numbers which is the foundation for the opinion that sets forth the odds of randomly finding anyone else in the relevant population (i.e. Black, Caucasian, etc.) with the same unique DNA pattern over the four chromosomes tested.

In the example supplied, assuming a Caucasian defendant, the expert would render the opinion that the odds of finding a random person in the Caucasian population with the same genetic pattern is 1 in 35 billion. There are, however, only about 5-6 billion people on earth.¹⁵⁵

1. National Research Council (NRC) "Conservative" Approach

Several state appellate courts, and a United States territory, including California, Guam, New Mexico, Massachusetts, New Hampshire and Washington, D.C., however, have begun to follow the recommendations of the April 1992 report prepared by the prestigious National Research Council (NRC), and have refused to admit DNA evidence containing the dramatic statistics shown by the FBI and commercial laboratories.¹⁵⁶

Many courts have opted for the more conservative applications suggested by the NRC. The NRC compromise approach, generally considered to be "more conservative," is indicated by the NRC report and often called the "*ceiling principle*" or "*ceiling frequency*."¹⁵⁷ The NRC report recommended that random samples of 100 persons from each of 15-20 populations, which represent groups relatively homogeneous genetically, be taken. Researchers are then advised to take the "ceiling frequency," either the largest frequency in any of the referenced groups or populations or 5%, whichever is larger. "The use of the *ceiling principle* yields the same frequency of a given genotype, regardless of the

154. "This is the 'product rule.'" *Id.* at n.5.

155. Sheindlin, *supra* note 149.

156. Sherman, *supra* note 137.

157. *E.g.*, State v. Quatrevingt, 617 So. 2d 484, 501 (La. App. 4th Cir. 1992) (referring to the Report by the National Research Council, *DNA Technology in Forensic Science* (1992) [hereinafter NRC Report]), State v. Quatrevingt, 670 So. 2d 197 (La. 1996). See C.G.G. Aitken, *Evaluating DNA Evidence for Identification*, 4 S. Cal. Interdisciplinary L.J. 49, 61 (1995).

suspect's ethnic background, because the reported frequency represents a maximum for any possible ethnic heritage."¹⁵⁸

2. Raging Debates

But this "compromise" did not come easily and one wonders whether it is valid. "Raging" debates arose over population bases and the manner in which the statistics are computed.¹⁵⁹ Population geneticists and biostatisticians appear to be divided into three camps: (1) those who believe that the current DNA and statistical approaches are acceptable; (2) those who believe that, until significantly more research is completed, only estimates employing the *ceiling principle* should be admitted at trial; and (3) those who believe that even the NRC approach fails to provide a generally acceptable method.¹⁶⁰ "[T]hey also note that although Hispanics from Puerto Rico may have a different gene pool than Hispanics from Spain or South America, these groups are lumped together as 'Hispanics.' Accordingly, they argue that these numbers cannot be multiplied until the sub-populations are investigated."¹⁶¹

Another school of scientists argues that its research reveals that there is little distinction in the populations tested.¹⁶² They find such a small variation between sub-populations that if the databases were adjusted to account for these minor distinctions, the ultimate odds, even if lessened, would still be meaningful. Therefore, they conclude, the numbers generated can be multiplied validly, based on the current databases.¹⁶³

Judge Sheindlin suggests a simpler version of the debate: that the debate consists of one school of scientists which claims that there are sub-populations which are not reflected in the laboratory database.¹⁶⁴ They argue, for instance, that the gene pool for Italians in the Caucasian database may not be the same as the gene pool for Scandinavians.

158. *State v. Quatrevingt*, 617 So. 2d 484, 501-02 (La. App. 4th Cir. 1992), and *State v. Quatrevingt*, 670 So. 2d 197, 203-205 (La. 1996) (citing NRC Report, *supra* note 157, at S-12). The *ceiling principle* has been approved as valid in other states. *E.g.*, *State v. Johnson*, No. CR-95-0393-PR, 1996 WL 400077 (Ariz. July 16, 1996).

159. See discussion, *supra* text accompanying notes 140-158, *infra* notes 161-183; Richard C. Lewontin & Daniel L. Hartl, *Population Genetics in Forensic DNA Typing*, 254 *Science* 1745 (1991); Ranajit Chakraborty & Kenneth K. Kidd, *The Utility of DNA Typing in Forensic Work*, 254 *Science* 1735 (1991). With regard to the use of statistics, the Hardy-Weinberg principles and linkage equilibrium are the basis for the dispute. See Sheindlin, *supra* note 149.

160. Allan Sincox & Marijane Hemza-Placek, *Challenging the Admissibility of DNA Testing*, 83 Ill. B.J. 170, 174 (1995).

161. Hardy-Weinberg principles and linkage equilibrium, see *supra* text accompanying note 149.

162. Chakraborty & Kidd, *supra* note 159.

163. Leslie Roberts, *Fight Erupts Over DNA Fingerprinting*, 254 *Science* 1721 (1991) (reporting on the vitriolic debate); Lewontin & Hartl, *supra* note 159 (challenging the statistical validity of DNA testing); Chakraborty & Kidd, *supra* note 159 (defending the forensic use of these statistics).

164. Lewontin & Hartl, *supra* note 159.

The reason for the debate over population genetics sub-structuring is exemplified by the following example. If one builds a database by testing Hispanic people of Cuban ancestry in Miami, the frequencies determined might not obtain for Hispanic persons of Mexican ancestry in Los Angeles.¹⁶⁵

Dr. Richard Lewontin of Harvard University and Daniel Hartl of Washington University at St. Louis, "two of the leading lights of population genetics," assert that the claim made by proponents of "DNA fingerprinting . . . that the probability of two DNA samples matching by chance is minuscule . . . like 1:500,000 or 1:738,000,000,000,000, . . . are terribly misleading . . . [and] unjustifiable."¹⁶⁶ These scientists argue that there are simply no data on genetic variation among ethnic groups and subgroups to justify those claims.¹⁶⁷ They continue: "the claims are based on misinterpretations of population genetics theory. . . . More importantly, they ignore a considerable body of evidence indicating genetic substructure within what are called the 'Caucasian,' 'black,' and 'Hispanic' populations. [These] are actually each made up of multiple subpopulations that are genetically diverse. Consequently, with currently available data, the current method of estimating the probability of a match by multiplying together the frequencies with which each of the individual VNTR pattern occurs in a reference database is unjustified."¹⁶⁸

In other words, they argued that the DNA proponents base their claims on a number of unsupported and insupportable assumptions. The proponents assume that Blacks, Caucasians, and Hispanics are "homogenous populations undergoing random mating. . . ."¹⁶⁹ But this, they contend, ignores a considerable body of evidence which actually indicates that each of these groups is actually made of multiple sub-populations, each of which is genetically diverse.¹⁷⁰

Moreover, Lewontin and Hartl pointed out that the statistics are more suspect because demographic evidence indicates that "[t]he notion of an American 'melting pot' is true for some aspects of culture, but certainly not for marriage, which is strongly affected by religion and ethnicity Americans tend to marry the girl or boy next door. The net effect of propinquity, ethnic preferences, and religious custom is to produce a population that is highly biologically subdivided in regard to mating."¹⁷¹ They suggested, therefore, that the only way to come up with realistic probability estimates using the existing method is to look at the allele frequencies within each subgroup and then to multiply them. Yet data on genetic variation among ethnic subgroups simply do not exist and obtaining them could take up to fifteen years.¹⁷²

165. Professor Edward J. Imwinkelried provided the example.

166. Roberts, *supra* note 163, at 1721; Lewontin & Hartl, *supra* note 159, at 1745.

167. Lewontin & Hartl, *supra* note 159, at 1745-46; Roberts, *supra* note 163, at 1721.

168. Lewontin & Hartl, *supra* note 159, at 1746.

169. Roberts, *supra* note 163, at 1722.

170. *Id.*; Lewontin & Hartl, *supra* note 159, at 1746-1749.

171. Lewontin & Hartl, *supra* note 159, at 1748.

172. Roberts, *supra* note 163, at 1723.

On the other hand, the proponents of forensic use of DNA testing argue that detractors Lewontin and Hartl are counting angels on the head of a pin and "engaging in a fascinating if esoteric academic debate that has almost zero relevance to the use of DNA fingerprinting in court."¹⁷³ Thus, while the forensic "pragmatists" admit that population substructure may actually exist, they insist that current procedures are conservative enough to compensate for it.¹⁷⁴

3. *A Peace of Sorts*

The National Academy of Sciences (NAS) entered the fray. In its long-awaited report on DNA fingerprinting, which took approximately four years to produce, despite serious strife on the committee, a threatened minority opinion and countless leaks, the committee produced a unanimous conclusion from what appears to be a compromise between the above indicated warring camps.¹⁷⁵ A new and conservative method to calculate the ratios, which the committee thinks might end courtroom battles over the validity of the statistics, was produced. The committee report called for, among many other recommendations, vigorous quality assurance and mandatory accreditation and proficiency testing, overseen by scientists, not practitioners.¹⁷⁶

The report adopted the assumption that population subgroups exist, but "devised a practical and sound approach for accounting for it"¹⁷⁷ They combined the "multiplication rule" with what they denominate the "ceiling principle." They claim that this combination will be conservative enough to protect defendants in criminal cases.¹⁷⁸ The report also indicated that "this new technology burst on the scene so rapidly that there are essentially no standards and no regulation—a disturbing prospect since the largest potential source of error lies in poor laboratory practice."¹⁷⁹ The report urged Congress to promulgate legislation requiring accreditation of all DNA typing laboratories,

173. *Id.* at 1723; Chakraborty & Kidd, *supra* note 159, at 1735, 1737, 1739.

174. Chakraborty & Kidd, *supra* note 159, at 1735, 1737, 1739; Leslie Roberts, *DNA Fingerprinting: Academy Reports*, 256 *Science* 300 (1992).

175. Roberts, *supra* note 174, at 300.

176. *Id.*

177. *Id.* at 300-01.

178. *Id.* The ceiling principle has been adopted by courts of many states as being "conservative," if not "highly conservative," because it understates the rarity of a DNA profile; it provides profile frequencies that are more common than are deemed likely to be the case. *E.g.*, *Commonwealth v. Lanigan*, 641 N.E.2d 1342 (Mass. 1994); Conneally, *supra* note 95, at 197; Eric E. Wright, *DNA Evidence: Where We've Been, Where We Are, & Where We are Going*, 10 *Me. B.J.* 206, 208, 212 (July 1995). *Cf.* Sue Rosenthal, Note, *My Brother's Keeper: A Challenge to the Probative Value of DNA Fingerprinting*, 23 *Am. J. Crim. L.* 195, 204 (1995). *But see* articles which have criticized the N.R.C. Report, especially its "ceiling principle": *e.g.*, B. Devlin et al., *Comments on the Statistical Aspects of the NRC's Report on DNA Typing*, 39 *J. For. Sci.* 28 (1994); J. Cohen, *The Ceiling Principle Is Not Always Conservative in Assigning Genotype Frequencies for Forensic DNA Testing*, 51 *Am. J. Hum. Genetics* 1165 (1992).

179. Roberts, *supra* note 174, at 301.

recommended that the courts allow DNA evidence into evidence only if the laboratory has been accredited, and recommended that the Department of Health and Human Services, in consultation with the Department of Justice, be charged with the task of setting up the accreditation and regulatory program.¹⁸⁰ It also recommended that a National Committee Forensic DNA Typing be established and be housed in the National Institutes of Health or the National Institute of Standards and Technology to obviate expensive courtroom fights. This committee is to evaluate new approaches to DNA testing and matching, oversee the collection of blood samples for the population studies, and advise the courts on statistical questions.¹⁸¹

Judge Sheindlin reports that recently, two of the

opposing scientists to this quarrel reconciled their differences in a published paper and agreed that the dispute is over. They concluded that the argument was more academic than real and both sets of numbers (the conservative ceiling principle and the liberal product rule) should be admitted in evidence for a [trier of fact's] consideration.¹⁸²

Some states which originally refused to admit DNA testing results now allow it, but only if the so-called "compromise" *ceiling principle* is applied.¹⁸³

Does this "conservative method" of presenting statistics in a DNA case (*ceiling principle*) represent too much of a departure from reality? Judge Sheindlin queries:

Are conservative numbers as mischievous a legal approach as the presentation of ridiculous astronomical numbers generated by the product rule?¹⁸⁴ Does either approach have any meaningful relationship to the truth we are seeking in the trial of a criminal case? Does the presentation of these odds even come close to the truth that is being

180. *Id.*

181. *Id.*

182. Sheindlin, *supra* note 149. Lewontin and Hartl indeed seem to have backed away from their vigorous opposition and may have abandoned their "multiplication rule" in relation to genetic sub-groups. See Daniel L. Hartl & Richard C. Lewontin, *DNA Fingerprinting Report (Letter)*, 260 *Sci.* 473-74 (1993); Eric S. Lander & Bruce Budowle, *DNA Fingerprinting Dispute Laid to Rest*, 371 *Nature* 735 (1994).

183. *E.g.*, *Commonwealth v. Lanigan*, 596 N.E.2d 311 (Mass. 1992) (*Lanigan I*), *aff'd after remand*, 641 N.E.2d 1342 (Mass. 1994) (*Lanigan II*); *State v. Anderson*, 881 P.2d 29 (N.M. 1994).

184. In *California v. Soto*, 35 Cal. Rptr. 2d 846 (Cal. Ct. App. 1994), *review granted and opinion superseded*, 39 Cal. Rptr. 406 (Cal. 1995), the court in the original, now superseded, opinion noted the opinion of Dr. Kenneth Kidd, director of the Yale University DNA laboratory and an executive of the Human Genome Project, that the product rule is as accurate as any determination can possibly be: "Although the greater the database the greater the certainty of the estimate, any difference in estimates over one in a million becomes pragmatically meaningless." See Sheindlin, *supra* note 149. See discussion on the "resolution" of this controversy at *infra* notes 206-223 and accompanying text.

sought? Does evidence of negative odds tend to distract the jury? Do they tend to confuse the real issue?

In order to resolve the issue, we must be sensitive to the real questions being presented at the trial, to wit: (1) What is the relevance of the disputed evidence to the defendant on trial? (2) What is the relationship of DNA evidence to the ultimate question of whether the guilt of the defendant has been established beyond a reasonable doubt?¹⁸⁵

Some courts have held that "if an estimated rarity of a DNA profile was not arrived at in a scientifically generally accepted manner, and so was inadmissible, then so too was the fact of a match."¹⁸⁶ The *ceiling principle* is criticized severely.¹⁸⁷ It is charged that the ceiling principle is an unscientific guess at the best method of overcompensating for the problems of substructuring. On the other hand, for precisely that reason some courts, in *Frye* jurisdictions, are now holding that statistical testimony based on the modified ceiling principle is admissible even though testimony based on the traditional computation technique is inadmissible. The theory is that the ceiling principle generally understates the probability of a random match.¹⁸⁸

If the testing institutions do not agree on a standardized set of enzyme-probe combinations, they will lack the ability to make appropriate DNA fingerprint comparison.¹⁸⁹ All of the private laboratories and the F.B.I. utilize different DNA tests; there is no standardization or regulation of standards and each lab utilizes its own statistical basis to determine the "accuracy" of a DNA match.¹⁹⁰

That problem, the need for highly skilled laboratory technicians, other serious dangers relating to contamination, and errors resulting from faulty "links" in the chain of evidence, pose serious immediate problems impacting the validity of any given DNA test result and require vigilance on the part of counsel and the judiciary.¹⁹¹

185. Sheindlin, *supra* note 149.

186. This is the so-called "no stats, no match" rule. Wright, *supra* note 178, at 208. See also *People v. Wilds*, 37 Cal. Rptr. 2d 351, 354 (Cal. Ct. App.), *rev. granted*, 890 P.2d 1115 (1995); *People v. Wallace*, 17 Cal. Rptr. 2d 721, 726 n.3 (Cal. Ct. App. 1993).

187. E.g., Wright, *supra* note 178, at 208-13.

188. Letter from Edward J. Imwinkelried to Christopher L. Blakesley (Sept. 8, 1994) [hereinafter Imwinkelried Letter] (on file with author). See *Commonwealth v. Lanigan*, 596 N.E.2d 311 (Mass. 1992) (*Lanigan I*), *aff'd after remand*, 641 N.E.2d 1342 (Mass. 1994) (*Lanigan II*); *State v. Anderson*, 881 P.2d 29 (N.M. 1994).

189. Mouri, *supra* note 55, at 353.

190. Thaggard, *supra* note 59, at 442.

191. Mouri, *supra* note 55, at 353. Problems in DNA testing have been illustrated in several cases: e.g., *People v. Castro*, 545 N.Y.S.2d 985 (1989) (DNA test results unreliable due to manner in which they were performed)); *State v. Schwartz*, 447 N.W.2d 422 (Minn. 1989); see also *Crimes, Misdemeanors and Molecules*, M.D., March 1990, at 41; Gina Kolata, *Some Scientists Doubt the*

The United States Congress's Office of Technology Assessment (the O.T.A.) has reported that properly performed, DNA tests are reliable, but that there are problems of human error and improper monitoring of tests.¹⁹² This report also recommended that a DNA databank should be established and standardized, and that protections for individual privacy should be established.¹⁹³ California has proficiency studies which document a margin of error.

Judge Sheindlin submits a harsh critique, noting that the use of statistics in explaining DNA forensic evidence is mischievous and misses the point of a trial. A trial should be a search for the truth under the rules of evidence. Therefore, he explains, the most meaningful question presented to the expert should be whether the disputed genetic evidence is consistent with the defendant's genetic profile within a reasonable degree of scientific certainty.¹⁹⁴ He argues persuasively that this is the legal language which has always been the accepted method of presenting expert opinions.

The population geneticist answers the question of what the odds are that anyone else, other than the defendant, could have the genetic characteristic by citing the proportion of the population that possibly might have it.¹⁹⁵ He reports that the opinion usually takes the following hypothetical form: "The odds of randomly finding anyone else in the relevant population having that genetic profile is 1 in 35 billion." He then argues that in no other science is the question so awkwardly twisted to present matters that are not to be determined by the trier of fact. The use of negative odds can be extremely unrealistic and distracting. For example, in the same criminal trial, defense experts offered odds of 1 in 17, while prosecution experts stated the odds to be 1 in 60 million.¹⁹⁶

It seems evident, as Judge Sheindlin argues, that

Value of Genetic Fingerprint Evidence, N.Y. Times, January 29, 1990, at A1; *DNA Fingerprinting for Forensic Identification: Potential Effects on Data Interpretation of Subpopulation Heterogeneity and Band Number Variability*, 46 Am. J. Hum. Genet. 358 (1990).

192. U.S. Congress Office of Technology Assessment, [O.T.A.] Report, *Genetic Witness: Forensic Uses of DNA Tests* (July, 1990); Thaggard, *supra* note 59, at 443.

193. O.T.A. Report, *supra* note 192; Thaggard, *supra* note 59, at 443.

194. Sheindlin, *supra* note 149, noting that the evidentiary question of whether such negative odds result in an impermissible "inference on an inference" has not been argued or analyzed. The inference from negative odds seeks to exclude other people as depositors of the genetic material and then seeks the additional positive inference that it was therefore the defendant who deposited the genetic evidence.

195. *Id.*

196. *Id.* (citing *Harris v. Commonwealth*, 846 S.W.2d 678 (Ky. Sup. Ct. 1992) (upholding the use of the *Frye* standard, but applying case-by-case scrutiny for DNA testing decisions), where the FBI expert testified that the "likelihood of finding another unrelated individual from the black population, having a DNA profile like Mr. Harris, is approximately one in eight million." The conservative FBI binning method was used to calculate the odds. In 1995, *Harris* was overruled only in its use of the *Frye* standard, in favor of a *Daubert* approach, but the case-by-case determination of DNA's impact was retained with emphasis! *Mitchell v. Commonwealth*, 908 S.W.2d 100, 101 (Ky. 1995)). Judge Sheindlin cites other cases as well.

[i]n view of the fact that most laboratories, including the FBI, attempt to run at least four probes on at least four different chromosomes, it is inaccurate to state that we may find the same genetic profile in 1 person out of 17 or 1 person in millions. It is also inaccurate to state, in a four to five probe match, that two people in 34 have that genetic profile or two people in many millions have the same genetic profile.¹⁹⁷

It also seems correct that each estimate of odds, whether it be minuscule or phenomenal, misses the point and causes a serious distraction from the truth. "In no other forensic science are questions asked concerning the 'odds' that someone else may have deposited the forensic sample or have the genetic characteristic."¹⁹⁸

In criminal cases,

the FBI has not found a four probe match between a defendant and a random person in over 7.5 million DNA tests performed. The National Research Council of the National Academy of Sciences in its report of 1992 entitled "*DNA Technology in Forensic Science*" [notes] that it would be an extremely rare event to find two people with the same genetic profile over three or four chromosomes. Hence, is it appropriate to tell the jury the odds of a match when we know that information is not true? Do we do it in serology? fingerprinting? ballistics? paternity? Hair comparisons?¹⁹⁹

The negative odds offered in a DNA case are clearly distinguishable from the percentages offered in, for instance, paternity. When a percentage is offered in a paternity case, the opinion states that the person is the father and there is, for example, a 99.9% probability of that fact. The opinion is directly related to the issue to be determined. The opinion does not offer the odds of anyone else being the father, although this would be possible as the basis of the opinion is statistical probabilities derived from databases.

Judge Sheindlin's acerbic statement of doubt that

[i]n fingerprinting, the opinion might use the statistician's language and state that the chances of anyone else leaving that print other than the defendant is 1 in 200 million, as there are only approximately 200 million fingerprints on file. Does that mean two people out of 400 million have the same prints?²⁰⁰

is well taken!

197. Sheindlin, *supra* note 149.

198. *Id.*

199. *Id.*

200. *Id.*

Judge Sheindlin is correct in stating that the issue presented is the connection between the disputed genetic material and the defendant's genetic makeup. Is it powerfully similar or is it merely similar or does it exclude the accused defendant or the alleged father? He asks whether the answer of one in several million or billion or trillion really addresses the relevant question. "Does not this type of approach smack of the answer that I am less than one mile high or more than one inch high? Whether the odds are enormously high or unrealistically low, they are as irrelevant and distracting as the aforementioned estimates of height."²⁰¹

Judge Sheindlin raises important issues for paternity and other family law cases. He suggests, as I have, that the major problem facing our judicial system and the people it "processes" is related to the significant reality that when we allow scientists or statisticians to usurp the fact-finding role, we destroy the value, indeed the pertinence, of the judicial system. He finally states, "now that we [some of us] have become comfortable with our understanding of this fascinating science, should we not return to time honored legal method of presenting expert opinions. . .?"²⁰² He explains that "DNA profililing is [not] as clear as supermarket bar codes," and it is not true that "if the tests are not performed correctly absolutely no result will be obtained." Furthermore, he explains it is not true that "where tests are performed correctly a perfectly clear picture is obtained."²⁰³ Any such claim would be incorrect, yet courts continue to make decisions based on expert opinions making such faulty claims.²⁰⁴ Finally, he states, "[i]f DNA tests are not performed properly, you cannot distinguish one person from another, statistically or otherwise."²⁰⁵

4. *Washington Supreme Court and Others Hold That the Controversy Has Ended*

The Committee which prepared DNA Technology set out a method for estimating population frequencies called the ceiling principle. The Washington Supreme Court held that the methodology underlying RFLP typing is generally accepted by the scientific community and admissible under *Frye*.²⁰⁶ It also held that the statistical evidence of genetic profile frequency probabilities must be presented to the trier of fact. It approved the ceiling principle (modified, or

201. *Id.*

202. *Id.* at n.28.

203. *Id.*

204. *Id.* (citing *People v. Fishback*, 829 P.2d 489 (Colo. Ct. App. 1991), *aff'd*, 851 P.2d 884 (Colo. 1993) (claiming that DNA testing is "failsafe")); *State v. Davis*, 814 S.W.2d 593 (Mo. 1991), *cert. denied*, 502 U.S. 1047, 112 S. Ct. 911 (1992) (claiming an accuracy rate is 100%); *Andrews v. State*, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988), *rev. denied*, 542 So. 2d 1332 (1989).

205. Sheindlin, *supra* note 149, at n.28.

206. *State v. Copeland*, 922 P.2d 1304 (Wash. 1996) (en banc).

"interim," ceiling principle).²⁰⁷ In September, 1996, the Washington Supreme Court described the "product" or "multiplication" rule:

Briefly restated, the product rule (or "multiplication rule") as applied in RFLP typing means that the probability of a genetic profile occurring in the population is the product of the probabilities of each individual allele's occurrence in the population. Validity of the rule depends upon whether the individual alleles are actually statistically independent. *Cauthron*, 120 Wash.2d at 901, 846 P.2d 502 (citing *DNA Technology*, at 76). Two assumptions underlie use of the product rule when calculating genetic profile frequencies: linkage equilibrium, which means that the alleles at different loci are inherited independent of each other, and Hardy-Weinberg equilibrium, which means that one allele at a locus is not predictive of the other allele at that locus (one allele is inherited from the mother, the other from the father). Hardy-Weinberg equilibrium depends upon an assumption of a large population in which there is random mating. The Committee reported in 1992 that substantial controversy arose about the adequacy of population databases used to calculate frequency estimates and about the role of racial and ethnic origin in the frequency estimation. Potential problems could result from "genetic drift" resulting in small populations having distinct genetic differences, too small a database, lack of randomness of the samples, and most importantly, lack of a truly mixed population such that each locus is in Hardy-Weinberg equilibrium as well as linkage equilibrium.²⁰⁸

The "raging debate," noted earlier, has perhaps come to rest. The Supreme Court of Washington reports that it has. It notes that "some scientific literature supported the view that there were statistically significant deviations from Hardy-Weinberg equilibrium, indicating the presence of genetically distinct subgroups in Caucasian, black, and Hispanic groups."²⁰⁹ "However, other literature disputed early conclusions that the possibility of substructuring in major population groups was statistically significant."²¹⁰

As we have noted, a number of courts have concluded that in light of the scientific disagreement there was a lack of general acceptance of use of the

207. *Id.* For more on the "ceiling principle," see *supra* notes 156-158 and accompanying text, *State v. Jones*, 922 P.2d 806 (Wash. 1996) (en banc). However, while the *Copeland* court approved the ceiling principle, it has not foreclosed use of other statistical models provided they are accepted in the scientific community. *State v. Buckner*, 890 P.2d 460 (Wash. 1995) (en banc).

208. *Copeland*, 922 P.2d at 1317 (some citations omitted).

209. *Copeland*, 922 P.2d at 1317 (citing *State v. Cauthron*, 846 P.2d 502 (Wash. 1993) (citing, among others, *Lewontin & Hartl*, *supra* note 159, at 1747)).

210. *Copeland*, 922 P.2d at 1317 (citing, e.g., *Chakraborty & Kidd*, *supra* note 159).

product rule to estimate genetic profile frequencies and, accordingly, such calculations were not admissible.²¹¹

The Washington Supreme Court reversed its earlier decision that use of the product rule for this purpose was not generally accepted because of concerns that substructuring in human populations undercut certain assumptions underlying use of the rule. The Washington court noted that its decision was "heavily influenced by recognition of the Committee that there was a significant dispute among the scientists."²¹² It held that the evidence today, the literature, and the case law from other jurisdictions shows that use of the product rule now has sufficient general acceptance that it is admissible under *Frye*²¹³ for calculating statistical frequencies of genetic profiles from RFLP typing results.

State's experts at the *Frye* hearing in this case included Dr. Bruce Weir, a professor of mathematics, statistics and genetics, Dr. Ranajit Chakraborty, a preeminent expert in statistics and human genetics, with over twenty years of study involving human DNA and genetics, Dr. Richard Gelinas, a molecular biologist, and Dr. Ellen Wijsman, a population geneticist. State's experts did not dispute that substructuring exists, but concluded it is statistically insignificant because empirical studies have shown the databases were nonetheless sufficiently in Hardy-Weinberg equilibrium and linkage equilibrium so that substructuring did not improperly affect calculations using the product rule.

Defense experts, Dr. Laurence Mueller, a population geneticist, and Dr. Seymour Geisser, a statistician, disputed these conclusions. The Washington Supreme Court held that the trial court did not err when it found, that "this process of multiplication, known as the 'product rule,' is valid if each band (or bin) is independent of the others. That the frequencies of independent events may be multiplied to determine the frequency of their simultaneous occurrence is a universally accepted principle of statistics." It held that:

Although various experts have raised theoretical objections to the use of the product rule with RFLP data, those experts who have analyzed the data agree that there is no evidence of dependence between the alleles, defined as fixed bins, used by the FBI. Indeed, the testimony, published work, and analysis performed in this case by Ranajit Chakraborty, Bruce Weir, and Ellen Wijsman prove that independence between alleles defined as fixed bins is a valid assumption. The defense presented no evidence that the assumption of independence was invalid. (Dr. Mueller's testimony was neither persuasive nor credible.) Our review is de novo and we do not defer [sic] to the trial court's finding that the product rule is generally accepted. However, we have

211. *State v. Cauthron*, 846 P.2d 502 (Wash. 1993).

212. *Copeland*, 922 P.2d at 1317.

213. Washington continues to apply the *Frye* standard, discussed below. *Copeland*, 922 P.2d at 1317.

extensively reviewed the *Frye* hearing in this case, and we reach the same conclusion as the trial court did.

Although at one time a significant dispute existed among qualified scientists, from the present vantage point we are able to say that the significant dispute was short-lived. *Cauthron* was decided while the dispute raged; since that time additional empirical studies have been conducted, the FBI has collected data from around the world, and one of the most vociferous opponents of use of the product rule has joined with an FBI scientist in declaring that the DNA wars are over.²¹⁴

The Washington Supreme Court accepted this, based in part on the fact that the FBI had conducted a world-wide study of VNTR frequency data from around the world.²¹⁵ The study concluded:

1) that there are sufficient population data available to determine whether or not forensically significant differences might occur when using different population databases; 2) that subdivision, either by ethnic group or by U.S. geographic region, within a major population group does not substantially affect forensic estimates of the likelihood of occurrence of a DNA profile; 3) that estimates of the likelihood of occurrence of a DNA profile using major population group databases (e.g., Caucasian, Black, and Hispanic) provide a greater range of frequencies than would estimates from subgroups of a major population category; therefore, the estimate of the likelihood of occurrence of a DNA profile derived by the current practice of employing the multipli-

214. *Copeland*, 922 P.2d at 1318.

215. *Copeland*, 922 P.2d at 1318 (citing United States Department of Justice, Federal Bureau of Investigation, *1-A VNTR Population Data: A Worldwide Study* (Feb. 1993) (a 5 volume study) [hereinafter *Worldwide Study*]). The Hartl-Lowontin concerns rested on an assumption that intermarriage had a genetic effect on VNTR markers. VNTR is the abbreviation for "variable number of tandem repeats." This is a description of those sites selected for comparison because of the ease with which they are located; when the same pattern of two or three of the four possible bases is repeated a multitude of times forming a long chain, it is easily detected. Several courts have now held that the FBI's *Worldwide Study* appears to have established the opposite. See, e.g., *Copeland*, 922 P.2d at 1318; *People v. Dalcollo*, 669 N.E.2d 378, 388 (Ill. App. Ct. 1996); *People v. Pope*, No. 4-95-0021, 1996 WL 663358 (Ill. App. 1996); *People v. Smith*, 49 Cal. Rptr. 2d 608 (Cal. Ct. App. 1996); cf. *Armstead v. Maryland*, 673 A.2d 221 (Md. 1996); *Lindsey v. People*, 892 P.2d 281, 289 (Colo. 1995); *People v. Chandler*, 536 N.W.2d 799 (Mich. 1995). Specifically, the study found, inter alia, that (1) subdivisions in a major population group do not substantially affect forensic estimates of the likelihood of a DNA profile; and (2) estimates of the likelihood of occurrence of a DNA profile using major population group databases (e.g., Caucasian, Black, and Hispanic) provide a greater range of frequencies than would estimates for subgroups of a major population category. *Worldwide Study*, at 2. Based on these findings, the study concluded that the estimate of the likelihood of occurrence of a DNA profile derived by the current practice of employing the product rule and using general population databases is reliable, valid, and meaningful, without forensically significant consequences. *Worldwide Study*, at 2, cited in *Lindsey*, 892 P.2d at 294. Some courts have held that this study resolves the "bitter debate"—if ever there was one.

cation rule and using general population databases for allele frequencies is reliable, valid, and meaningful, without forensically significant consequences; and 4) that the data do not support the need for alternate procedures, such as the ceiling principle approach. . . .²¹⁶

In fact, a former opponent of use of the product rule has changed position. In 1994, Dr. Eric Lander co-authored an article with Bruce Budowle, declaring, "[t]he great DNA fingerprinting controversy over."²¹⁷ Lander and Budowle approved use of the Committee's ceiling principle, calling it "unabashedly conservative. . . ."²¹⁸ These scholars stated: "[s]ome of the statistical power was sacrificed to neutralize all possible worries about population substructure."²¹⁹

These scholars also wrote, however, that the Committee's report "failed to state clearly enough that the ceiling principle was intended as an ultra-conservative calculation, which did not bar experts from providing their own 'best estimates' based on the product rule."²²⁰ They noted that the FBI's population surveys "yielded a remarkable database for examining allele frequency variation among ethnic groups. Reassuringly, the observed variation is modest for the loci used in forensic analysis and random matches are quite rare, supporting the notion that the FBI's implementation of the product rule is a reasonable best estimate."²²¹

In addition to the Washington Supreme Court, other courts have begun to take notice of the FBI's worldwide study, the numerous empirical studies reported, and the Lander and Budowle article, and have recognized, as the *Copeland* court did, that the significant challenges to use of the product rule have

216. *Copeland*, 922 P.2d at 1318-19 (considering FBI's *Worldwide Study*). The Court also noted that other studies have similarly concluded that differences of allelic distribution is not forensically significant. E.g., Bruce Budowle et al., *The Assessment of Frequency Estimates of Hae III-Generated VNTR Profiles in Various Reference Databases*, 39 J. of Forensic Sciences 319 (Jan. 1994); Bruce Budowle et al., *Evaluation of Hinfl-Generated VNTR Profile Frequencies Determined Using Various Ethnic Databases*, 39 J. of Forensic Sciences 988 (July 1994); Shui Tse Chow et al., *The Development of DNA Profiling Database in an HAE III Based RFLP System for Chinese, Malays, and Indians in Singapore*, 38 J. of Forensic Sciences 874 (July 1993). Also, extensive literature in peer-reviewed journals indicates that substructuring does not have much impact on DNA population frequency estimates. See *People v. Marlow*, 41 Cal. Rptr. 2d 5, 33 (Cal. Ct. App. 1995) (citing a number of articles, including several submitted as exhibits in *Copeland's* Frye hearing), review granted, 899 P.2d 65 (Cal. 1995) (California rules provide that once review is granted, an opinion may not be cited as legal authority).

217. Lander & Budowle, *supra* note 182. Dr. Lander's opinions were extensively relied upon by the *Cauthron* court.

218. Lander & Budowle, *supra* note 182, at 736.

219. *Copeland*, 922 P.2d at 1319 (citing Lander & Budowle, *supra* note 182, at 735).

220. *Copeland*, 922 P.2d at 1319 (quoting Lander & Budowle, *supra* note 182, at 737. Dr. Lander was a member of the Committee and Dr. Budowle is the F.B.I.'s Program Manager for DNA research. They were both primary architects in the development of forensic DNA use.).

221. *Copeland*, 922 P.2d at 1319 (citing Lander & Budowle, *supra* note 182, at 738).

been sufficiently resolved.²²² Unanimity, of course, does not exist on this point and controversy has not been eliminated. The Washington Supreme Court held that it does not require unanimity among scientists before finding general acceptance in the relevant scientific community. The Washington Supreme Court thus held that "use of the product rule in establishing statistical probabilities of a genetic profile frequency in the human population is generally accepted within the relevant scientific community and that a significant dispute no longer exists on this matter."²²³ It did this, however, in the context of reaffirming the *Frye* standard, which is no longer the rule in Louisiana.²²⁴

L. Evidence—the Need for Corroboration: May or Should Scientific Testing Be the Sole Factor in Determining Paternity?

The discussion so far suggests that although scientific testing, especially DNA and related tests, are more reliable than earlier blood tests, it is nevertheless challengeable and ought to be well-corroborated. Professor James Starrs was quoted by the Washington Post: "I don't know of any other instance in forensics where the jury [or other trier of fact] is just overwhelmed with a visual and pictorial presentation."²²⁵ Louisiana law traditionally has mandated that DNA or other scientific testing may not be the sole factor in determining paternity. The tests have been considered to be but one factor to be weighed by the trier of fact against the totality of the circumstances, including sexual access and the credibility of witnesses.²²⁶

M. Traditionally, Louisiana Jurisprudence Has Required Corroboration

Is it constitutional, proper, or wise to establish paternity by presumption based on scientific testing, as in Louisiana Revised Statutes 9:397.3(B)(1)(b) or the federal rule in 42 U.S.C. 666(a)(5)? Although scientific testing clearly ought to be utilized and admitted in court, serious doubt exists as to whether "any expert—no matter how skilled in biochemistry or biostatistics—can correctly testify

222. *Copeland*, 922 P.2d at 1319 (citing, e.g., *Lindsey v. People*, 892 P.2d 281 (Colo. 1995); *Armstead v. State*, 673 A.2d 221 (Md. 1996); *People v. Chandler*, 536 N.W.2d 799 (Mich. Ct. App. 1995)).

223. *Copeland*, 922 P.2d at 1319.

224. Louisiana applies the *Daubert* test, which is analyzed below.

225. James E. Starrs, quoted in Naftali Bendavid, *DNA: What the Code Won't Unlock: In the Search for Evidence, Our Faith in Science Can Lead Us Astray*, Wash. Post, Aug. 14, 1994, at C3, and in Jennifer Sue Deck, Note, *Prelude to a Miss: A Cautionary Note Against Expanding DNA Databanks in the Face of Scientific Uncertainty*, 20 Vt. L. Rev. 1057, 1090 (1996).

226. *State Dep't of Social Servs. v. Dorsey*, 665 So. 2d 95, 96 (La. App. 1st Cir. 1995); *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996); *Didier v. Fasola*, 597 So. 2d 450, 454 (La. App. 1st Cir. 1991), writ denied, 600 So. 2d 661 (1992); *State ex rel. Gray v. Hogan*, 613 So. 2d 681, 683 (La. App. 5th Cir. 1993); *State v. Montgomery*, 574 So. 2d 1297, 1301 (La. App. 3d Cir.), writ denied, 577 So. 2d 38 (1991).

to any quantified probability that the defendant in a given case is in fact the father."²²⁷ So, notwithstanding the high degree of confidence placed in the tests by the scientific community and many courts, applying complicated statistical evidence in a paternity case poses a serious danger of misleading the court.

Because of the dangers related to scientific testing, although the testing is persuasive and often effective, testing or statistical evidence by itself has been insufficient to prove paternity in Louisiana.²²⁸ Statistical evidence has always had to be and still should be corroborated. Otherwise, the scientific and probability evidence may be misleading and may not provide a true picture for the trier of fact. This is why, in a case in which the evidence as a whole is unfavorable to the plaintiff's case, the fact that the blood or tissue tests show a high probability that the defendant is the biological father has not been allowed, without other credible evidence (such as sexual access during the critical period), to establish paternity by a preponderance of the evidence.²²⁹

The need for corroboration stems from several factors, including difficulties with the gathering, storing, and testing process itself and the extreme difficulty in presenting the scientific and statistical evidence to the court in a manner that allows it to be clearly and correctly understood. Its actual value, even its meaning, must be understood, but often is difficult to understand. Thus, most jurisdictions traditionally have required corroboration and have allowed the trier of fact to consider the expert testimony for what they feel it is worth; they may even discard it entirely.²³⁰

Therefore, the traditional and prudent approach provided that, while Louisiana Revised Statutes 9:397.3 (both before and after its 1988 amendment) directed the trial court to dismiss a paternity action if blood tests show that the defendant is not the father (exclusion may be definitive), the statute provided no positive direction for cases in which the blood tests "*strongly indicate*" that he is the father.²³¹ Thus, the Third Circuit Court of Appeal held in 1989, that

227. *Litton v. Litton*, 624 So. 2d 472, 474 (La. App. 2d Cir. 1993); Ira. M. Ellman & David Kaye, *Probabilities and Proof: Can HLA and Blood Grouping Testing Prove Paternity?*, 54 N.Y.U. L. Rev. 1131, 1133 (1979).

228. *LeBlanc v. LeBlanc*, 497 So. 2d 1361 (La. 1986); *State v. Jackson*, 583 So. 2d 1240, 1242 (La. App. 5th Cir. 1991); *Perkins v. Vega*, 554 So. 2d 787 (La. App. 5th Cir. 1989), *writ denied*, 559 So. 2d 139 (1990).

229. *Suire v. Robison*, 511 So. 2d 35 (La. App. 3d Cir. 1987).

230. *South Carolina Dep't of Social Servs. v. Bacot*, 313 S.E.2d 45 (S.C. Ct. App. 1984); *Plemel v. Walter*, 735 P.2d 1209 (Or. 1987); *see generally*, Annotation, *Admissibility, Weight and Sufficiency of Human Leukocyte Antigen (HLA) Tissue Typing Tests in Paternity Cases*, 37 A.L.R. 4th 167 (1985); *Jackson v. Jackson*, 322 S.E.2d 725 (Ga. 1984); *Minnesota v. Hagen*, 382 N.W.2d 556 (Minn. Ct. App. 1986).

231. *Perkins v. Vega*, 554 So. 2d 787 (La. App. 5th Cir. 1989), *writ denied*, 559 So. 2d 139 (1990). Even in criminal cases, loose language is not uncommon. For example, *see State v. Every*, 678 So. 2d 952 (La. App. 5th Cir. 1996) ("an expert in . . . molecular biology and DNA analysis, testified that a towel seized from the defendant's residence contained blood which 'was consistent

although an expert testified that the blood tests could not prove paternity beyond any doubt, but did indicate "a 99.2% chance" that the defendant was the father, the mother did not meet her burden of persuasion. This is because she did not produce any other evidence placing the alleged father with her at the time of conception.

N. Corroborated Scientific Evidence Has Been Sufficient

In 1993, the Second Circuit Court of Appeal affirmed that paternity was proved when scientific testing was *corroborated* and "not . . . an alleged one night encounter between virtual strangers. . . ."²³² Nor were the test results unexplained by expert testimony, as respectively portrayed in *Perkins v. Vega*,²³³ and *State v. Montgomery*.²³⁴ The man whose tissue testing provided a high indicator that he may be the father also had cohabited with mother during the crucial time for conception.

O. Louisiana Evidentiary Law and Procedure—Chain of Evidence

The chain of evidence method of identification is a widely recognized approach in both civil and criminal cases. Louisiana, apparently enamored by the model act and influenced by the Department of Social Services and the interest in protecting children and the State coffers, adopted the entirety of the Uniform Act on Blood Tests. It provides in Louisiana Revised Statutes 9:397.2, that "[t]he chain of custody of blood or tissue samples . . . may be established by affidavit if verified documentation of the chain of custody is submitted with the expert's report and if such documentation was made at or near the time of the chain of custody and was made in the course of regularly conducted business activity." This has been held to authorize the introduction of blood test results without the necessity of any personal appearance or live testimony by an expert.²³⁵ *This breaks tradition and the import of the chain of custody.* Traditionally and generally in the arena of the chain of custody of evidence,

with the victim . . . and most probably came from her." *Id.* (emphasis added).

232. *Litton v. Litton*, 624 So. 2d 472, 475 (La. App. 2d Cir. 1993), *writ denied*, 624 So. 2d 472 (1994).

233. *Perkins v. Vega*, 554 So. 2d 787 (La. App. 5th Cir. 1989), *writ denied*, 559 So. 2d 139 (1990).

234. *State v. Montgomery*, 574 So. 2d 1297 (La. App. 3d Cir.), *writ denied*, 577 So. 2d 38 (1991). See *Litton*, 624 So. 2d at 474. See also, generally, *State v. Dorsey*, 665 So. 2d 95, 96 (La. App. 1st Cir. 1995); *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996); *Didier v. Fasola*, 597 So. 2d 450, 454 (La. App. 1st Cir. 1991); *State ex rel. Gray v. Hogan*, 613 So. 2d 681, 683 (La. App. 5th Cir. 1993); *State v. Montgomery*, 574 So. 2d 1297, 1301 (La. App. 3d Cir.), *writ denied*, 577 So. 2d 38 (1991).

235. *Simien*, 677 So. 2d at 1140-41; *State ex rel. Garret v. Ashy*, 653 So. 2d 20, 24-25 (La. App. 1st Cir. 1995). But cf. *State ex rel. Johnson v. White*, 651 So. 2d 366, 367-69 (La. App. 2d Cir. 1995).

courts do not allow the identity and authenticity of an exhibit to be established by a single witness.²³⁶ This is because several people have usually handled the specimen before, during, and after its analysis.²³⁷ Blood and tissue samples or specimens, of course, should be handled with utmost care. All persons who had access to the specimen should be ready and able to identify it and to testify to its custody and unchanged condition when in their custody. Gaps or gaffs in the chain provide opportunity for attacking the validity of the test results. Many states, however, hold that the decision as to the chain of custody is a matter within the discretion of the trial judge and will not be overturned unless there is clear error or an abuse of discretion.²³⁸ Courts, however, now often accept simply a "reasonable assurance of the identity of the sample."²³⁹ Here follows an example of trial testimony regarding chain of custody:

... [T]he blood was drawn by a phlebotomist and not by the witness testifying. The witness, Dr. Hubbard, testified as follows:

Q. Do your records reflect the dates upon which those tests (DNA) were conducted, and in whose presence they may have been conducted, and under what types of conditions and policy?

A. Which would you like for me to answer first? I can explain to you the normal operating procedure. The blood is drawn in the hospital laboratory, not by me, it's drawn by a phlebotomist, who are people who are specifically trained to draw blood. After the blood is drawn, there are various documents that have to be signed to maintain chain of possession of the blood. An authorization to do the testing is given by individuals involved in the case. Their phlebotomy or the blood being drawn is witnessed, and the witnesses sign as to who they are. Individuals participating in the case are photographed, identified using a picture ID usually, or mutual identification. They are fingerprinted and they are photographed. Once the blood is drawn, the participants, if they are able, initial the blood tubes, if they are able. I mean if it's a minor, then one of the guardians initial the blood tubes. Then they are sealed in a sample—in a tamper evident sample package, it's not tamper proof. And once the blood samples are sealed in that tamper evident bag, along with the documentation, then participants in the test initial the seal, and then they are taken to my laboratory, and then I, or

236. See, e.g., *Shell v. Law*, C.A. No. 03A01-9509-CV-00323, 1996 WL 275006 (Tenn. Ct. App. May 24, 1996).

237. See Blakesley, *supra* note 38.

238. E.g., *State v. Brown*, 238 A.2d 482 (N.J. Super. Ct.), *cert. denied*, 242 A.2d 16 (1968); *Patterson v. State*, 160 S.E.2d 815 (Ga. 1968); *Shell v. Law*, C.A. No. 03A01-9509-CV-00323, 1996 WL 275006 (Tenn. Ct. App. May 24, 1996).

239. See *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996); *Patterson v. State*, 160 S.E.2d 815 (Ga. 1968); *Shell v. Law*, C.A. No. 03A01-9509-CV-00323, 1996 WL 275006 (Tenn. Ct. App. May 24, 1996).

one of my technologists, opens the bag and the tests will proceed from there.²⁴⁰

P. Preparation and Use of Experts

Successful litigation often depends on counsel's ability to guide his or her expert through the difficulties of being an effective witness. Proof of paternity cases, where testimony about scientific testing is required provides a prime example.²⁴¹ The expert might be a nobel laureate and still not do well; the key often is not that the expert be the most qualified or knowledgeable on the subject, but whether counsel has done the necessary preparation to make him an effective witness.²⁴² Counsel must prepare the witness to answer (on direct and cross) in a direct, candid and courteous manner.²⁴³ The expert must know the difference between legal, as opposed to pure scientific, terms: *e.g.*, the difference between possible and probable or "reasonable scientific certainty."²⁴⁴ Good cross-examination will exploit use of the wrong term. By the same token, counsel must be familiar with the scientific terminology.²⁴⁵

Q. More Difficulties and Dangers Relating to Scientific Testing and Its Use in Court

We have seen that a vigorous debate is currently raging over the probity/policy distinction and the value of statistical evidence in trials.²⁴⁶ Proponents of broad

240. *Shell*, 1996 WL 275006, at *7.

241. *Guide Your Expert Through the Thicket*, 19 Fam. Advoc. 29 (1996).

242. *Id.*

243. *Id.*

244. *Id.*

245. *Id.* Even the letter counsel sends to engage the expert may be discovered, so it must be written appropriately. It should advise the expert what will be required and provide the judge with insight into what counsel is requesting. *Id.*

246. See, *e.g.*, Michael O. Finkelstein & Bruce Levin, *Review-Essays: Reference Manual on Science Evidence, Reference Guide on Statistics: Non-Lasciare Esperanza*, 36 *Jurimetrics J.* 201 (1996); Joe S. Cecil, *Response: Limitations and Potential of the Reference Manual on Scientific Evidence*, 36 *Jurimetrics J.* 225 (1996); David E. Bernstein, *Abstract: Junk Science in the United States and the Commonwealth*, 21 *Yale J. Int'l L.* 123 (1996); *Book Note: Legal Fact, Science Fiction? [review of] Science at the Bar*, 109 *Harv. L. Rev.* 1821 (1996); Peter J. Cohen, *How Shall They Be Known? Daubert v. Merrell Dow Pharmaceuticals and Eyewitness Identification*, 16 *Pace L. Rev.* 237 (1996); Imwinkelried, *supra* note 48; Aitken, *supra* note 157, at 61; Edward J. Imwinkelried, *The Daubert Decision on the Admissibility of Scientific Evidence: The Supreme Court Chooses the Right Piece for All the Evidentiary Puzzles*, 9 *St. Johns J. Legal Comment* 5 (1993) [hereinafter *Daubert Decision*]; Edward J. Imwinkelried, *A Brief Defense of the Supreme Court's Approach to the Interpretation of the Federal Rules of Evidence*, 27 *Ind. L. Rev.* 267 (1993) [hereinafter *Brief Defense*]; Paul C. Giannelli & Edward J. Imwinkelried, *Scientific Evidence* (2d ed. 1993 and Supp. 1996); John M. Conley & David W. Peterson, *The Science of Gatekeeping: The Federal Judicial Center's New Reference Manual on Scientific Evidence*, 74 *N.C. L. Rev.* 1183 (1996); G. Michael Fenner, *The Daubert Handbook: The Case, Its Essential Dilemma, and Its*

use of statistical evidence admit that "[s]ome evidence—including some types of statistical or probabilistic evidence—is and should be withheld from juries for policy reasons unrelated to accurate fact finding."²⁴⁷

Even if understood by counsel, statistical evidence ought to be used, but it must be presented in a manner that allows the decision-maker to understand its actual probative value. Otherwise it will actually be misleading. Decision-makers may not be able to translate all the relevant evidence into meaningful numerical terms:

Computational complexity is only one aspect of what may often be the prohibitive difficulty of applying rules of mathematical logic in the courtroom. A more fundamental problem is that fact-finders are likely to experience difficulty in translating all relevant evidence into numerical terms. Since few people are accustomed to statistical ways of thinking and reasoning, there is a danger that one's opinions and judgments may be altered when they are restated numerically.

A related problem is that some of the probabilities needed to perform particular mathematical operations may be unavailable or difficult to specify.²⁴⁸

Louisiana appears to be enamored with the elimination of the right to effective cross-examination of principals. Notwithstanding the significant problems and dangers surrounding scientific testing and its use in court, Louisiana decisions have recently held that Louisiana Revised Statutes 9:396, *et seq.* authorize the introduction of blood test results without the necessity of the personal and live testimony of an expert.²⁴⁹ The Louisiana First Circuit Court of Appeal held, for example, that the *laboratory report* of paternity established

Progeny, 29 Creighton L. Rev. 939 (1996); Kesam, *supra* note 20; Daniel N. Shaviro, *Statistical-Probability Evidence and the Appearance of Justice*, 103 Harv. L. Rev. 530 (1989); Ronald J. Allen, *On the Significance of Batting Averages and Strikeout Totals: A Clarification of the "Naked Statistical Evidence" Debate, the Meaning of "Evidence," and the Requirement of Proof Beyond a Reasonable Doubt*, 65 Tul. L. Rev. 1093 (1991); Craig R. Callen, *Cognitive Science and the "Sufficiency of the Evidence" Tests*, 65 Tul. L. Rev. 1113 (1991); Craig R. Callen, *Adjudication and the Appearance of Statistical Evidence*, 65 Tul. L. Rev. 457 (1991); Daniel Shaviro, *A Response to Professor Callen*, 65 Tul. L. Rev. 499 (1991); Jonathan J. Koehler, *The Probity/Policy Distinction in the Statistical Evidence Debate*, 66 Tul. L. Rev. 141 (1991); Jonathan J. Koehler & Daniel N. Shaviro, *Veridical Verdicts: Increasing Verdict Accuracy Through the Use of Overtly Probabilistic Evidence and Methods*, 75 Cornell L. Rev. 247 (1990); Charles N. LeRay, Note, *Implications of DNA Technology on Posthumous Paternity Determination: Deciding the Facts When Daddy Can't Give His Opinion*, 35 B.C. L. Rev. 747 (1994).

247. Koehler, *supra* note 246.

248. Koehler & Shaviro, *supra* note 246, at 275-76.

249. La. R.S. 9:397.3 (1991 and Supp. 1996); for more detail, see *supra* notes 69-77 and accompanying text; *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996); *State ex rel. Braden v. Nash*, 550 So. 2d 866 (La. App. 2d Cir. 1989); *State ex rel. Bankston v. Davis*, 521 So. 2d 575 (La. App. 1st Cir. 1988).

by blood testing was sufficient to establish paternity, without live appearance by the gatherers or testers of the evidence.²⁵⁰ The Court provided, however, that Louisiana law grants access to the report to allow defendant an indication of whom to subpoena or depose.²⁵¹ Apparently, counsel notified the trial court that he would object to the testing procedure and, during the trial, did enter his objection, but proffered no testimony or evidence as to any possible errors. Counsel certainly should request appearance of the principals for cross examination and this should be allowed.

In the first circuit decision, the test results at issue simply contained a "certification by the phlebotomist who drew and packaged the blood samples and the witness who observed the withdrawal of blood."²⁵² The results also contained the "certification by the individual who received the blood samples for [the testing laboratory] . . . [and] the test results include[d] an affidavit by the . . . laboratory director, . . . certifying the samples were under his care, custody, and control, that the testing was in accordance with medically accepted procedures, that the results [were] correct as reported, and that the documentation of the chain of custody was made at or near the time of the chain of custody, in the course of regular business activities."²⁵³

The court may have allowed defendant to call any of these individuals to be cross-examined, if he were able to establish a valid reason to do so. That need would seem always to be self-evident. It is shocking that possibly self-serving affidavits from the testing facility are allowed to stand as sufficient, without cross-examination of the principals.²⁵⁴ The person who has verified the quality control methods of the laboratory should appear personally, but that alone is not sufficient. It would seem difficult to establish errors in the process without the opportunity to cross-examine those who performed the various parts of the process.

Louisiana courts have also held that even if the overseeing expert actually testifies, he need not be the actual person who drew the blood or took the tissue sample, stored it, shipped it, performed the tests, or compiled the statistics for comparison.²⁵⁵ The witness may rely on the data compiled by other technicians. Where the record contains affidavits indicating an *unbroken chain of custody of the . . . specimens* from the moment they were drawn and sealed to the moment they were opened for testing . . . [which are] signed, dated, and clocked. . ." it is sufficient.²⁵⁶ "All that is required is that the technicians do

250. *McKenzie v. Thomas*, 678 So. 2d 42 (La. App. 1st Cir. 1996).

251. *Id.* at 45 (citing *State ex rel. Triche v. Stewart*, 570 So. 2d 182, 184 (La. App. 5th Cir. 1990)).

252. *McKenzie*, 678 So. 2d at 45 (emphasis added).

253. *Id.* (emphasis added).

254. It is not clear that counsel requested to have the principles appear to be questioned.

255. See La. Code Evid. art. 703; *State ex rel. Braden v. Nash*, 550 So. 2d 866 (La. App. 2d Cir. 1989); *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996).

256. *Simien*, 677 So. 2d at 1142 (emphasis added).

the work under the supervision of the certifying expert, provided that it is demonstrated at trial that the blood samples have not been adulterated or tampered with."²⁵⁷

Yet in most litigation, courts are careful to ensure the right to cross examine: "[t]he importance to any litigant of cross-examination of a crucial expert witness cannot be overstated."²⁵⁸

It should be an absolute requirement that counsel challenging the results be allowed to determine whether there had been contamination or other problem in the testing process. *How can this be done without the opportunity to cross-examine a live person who actually participated in or actually oversaw the process?* In the *Simien* case, the expert who testified (and the court held that one need not even testify) had merely reviewed the data which was developed from the testing. *This is not consistent with Louisiana Revised Statutes 9:397.3(A).* To be fair and accurate, an expert must be required to appear. Moreover, this expert must be one who was actually involved in or supervised the process of testing, etc., not merely one who supervised the writing of the report.²⁵⁹

R. The Revered Position of Science—Curse or Blessing?

1. What Does the Statistical Evidence Really Mean?

Science is given such a revered position on our society that its theories and even its exponent opinions are often viewed by society as truth. This reverence creates the risk of according expert scientific opinion more weight than it deserves in the overall legal equation to be drawn. Often a court will believe that the 97% or 99.5% figure given by the expert indicates the actual probability of paternity of this man in this case. It may be that this is a probability of paternity. On the other hand, the percentage may not be that the person before the bench, not excluded by the test, is the father. Rather, it is merely a probability of exclusion or the probability that a man selected at random from the relevant population would be excluded by the test.²⁶⁰ This is far from being the probability that this man is actually the father, although the court, unless caused not to do so, may take it as such.²⁶¹

It is up to the counsel to be sure that the court is not misled by the evidence. Professors Ellman and Kaye and many others suggest that it is possible to utilize a modified chart method to present to the trier of fact the statistical and mathemati-

257. *Simien*, 677 So. 2d at 1142 (emphasis added). See also *Mills v. Mills*, 626 So. 2d 1230 (La. App. 3d Cir. 1993); *State ex rel. Crawford v. Gibson*, 611 So. 2d 769 (La. App. 4th Cir. 1992).

258. *Rowe v. State Farm Mutual Automobile Ins. Co.*, 670 So. 2d 718, 724 (La. App. 3d Cir. 1996) (citing Linda S. Simard & William G. Young, *Daubert's Gatekeeper: The Role of the District Judge in Admitting Expert Testimony*, 68 Tul. L. Rev. 1457 (1994)).

259. *Simien*, 677 So. 2d at 1144 (dissent).

260. Ellman & Kaye, *supra* note 227, at 1141-43.

261. Clark & Glowinsky, *supra* note 46, at 343.

cal evidence in a manner that will help them not to be confused about the probability that the man before the court is the father.²⁶²

The court will have to rely upon the skill of counsel to clarify the appropriate impact of the evidence. The currently utilized method for doing this is properly called the *paternity index*.²⁶³ The paternity index is generally utilized in the application of the so-called Bayes' Theorem, which allows calculation of how "blood and tissue typing tests will change a prior probability of paternity based upon evidence other than blood tests."²⁶⁴ In a Louisiana case, an expert testified that on the basis of HLA testing the "probability of paternity was 99.91%."²⁶⁵ This, despite the fact that there was corroborated evidence that the defendant had had a vasectomy, that his sperm count was negative, and that he could not have had intercourse with the plaintiff on at least one of the occasions on which she alleged that they were together.²⁶⁶

Professor Koehler makes the point:

Consider a paternity suit that includes the following evidence: (1) A forensic scientist testifies that blood tests indicate that the defendant is among the 1% of the population [what population] who could have fathered a particular child [i.e., who have the blood-based characteristics that would have gone to the child]; (2) A physician testifies that the defendant had a vasectomy prior to conception and therefore could not be the father. Although both testimonies are probative (but in opposite directions), neither is definitive. The blood test's failure to exclude the defendant may have arisen by chance [and the population could have been enormous], and the physician may have been mistaken about the date (or success) of the vasectomy. Indeed, wherever a chance of error, mistake, or deceit exists, no item of evidence is probatively definitive. . . . A determination of relative probity hinges on one's subjective judgements about issues such as the credibility of the witnesses and the reliability of the procedures described.²⁶⁷

Although there has been strident criticism of the Bayes Theorem, its application in paternity testing, when applied with caution, is often accepted.²⁶⁸

262. Ellman & Kaye, *supra* note 227, at 1152-58.

263. Clark & Glowinsky, *supra* note 46, at 343-44; Christopher B. Mueller & Laird C. Kirkpatrick, *Evidence Under the Rules 760-68* (1988).

264. Clark & Glowinsky, *supra* note 46, at 343-44.

265. *O'Bannon v. Azar*, 435 So. 2d 1144 (La. App. 4th Cir.), *writ denied*, 441 So. 2d 749 (1983).

266. *O'Bannon*, 435 So. 2d at 1146-47 (court viewing blood test evidence in conjunction with all other evidence and holding paternity was not established); Clark & Glowinsky, *supra* note 46, at 345.

267. Koehler, *supra* note 246, at 1436.

268. Clark & Glowinsky, *supra* note 46, at 344; Lea Brilmayer and Lewis Kornhauser, *Review: Quantitative Methods and Legal Decisions*, 46 U. Chi. L. Rev. 116, 135 (1978); *see also* Lawrence H. Tribe, *Trial By Mathematics: Precision and Ritual in the Legal Process*, 84 Harv. L. Rev. 1329, 1358 (1971) (focusing on use in criminal cases).

It remains to be seen whether many trial counsel will be comfortable enough with the advancing technology to succeed in understanding it themselves, much less in communicating an accurate understanding to the trier of fact.

With these improvements and care taken to present the statistical evidence along with other evidence, and critical scrutiny of the testing procedures, the use of scientific testing holds significant potential for identification purposes and ought not to be rejected, but must be placed in the context of other evidence and presented in a manner that will allow the trier of fact to understand its relevance and probative value in the given case.

2. *Some Approaches in Other States*

Many jurisdictions have considered the problems relating to the evaluation and impact of mathematical and statistical evidence relating to paternity. The general rule appears to be that HLA test results, properly authenticated and supported by other evidence, are admissible as evidence of paternity, but are not conclusive.

The majority of these jurisdictions seems to allow the trier of fact to consider the expert testimony for what they feel it is worth, and they may discard it entirely.²⁶⁹ In *Minnesota v. Hagen*, for example, the putative father admitted having sex with the mother, but asserted it was not during the critical time of conception. The court held the probability evidence was insufficient. The HLA tests showed a "likelihood" of 99.62% that the man was the father.

A Minnesota Court of Appeal found that "[a] blood test is only one factor to be considered and weighed by a jury in determining paternity. . . . The jury, here, obviously believed that Hagen did not have access [to the mother] during the time of conception. This is a credibility determination. Credibility determinations are for the finder of fact and should not be disturbed on appeal."²⁷⁰

The Pennsylvania Supreme Court held that statistical evidence could be ignored when the evidence was adduced that the mother had engaged in sex with other men during the conception period.²⁷¹ It thus reversed and reinstated the original verdict, finding that the appellate decisions had invaded the province of the jury in discounting the credibility of the testimony. It also found that the court had placed too much emphasis on the HLA test results in light of the jury's finding that the defendant's witnesses were credible.

3. *Protection Against Abusive Claims*

The Iowa Supreme Court held that a trial court abused its discretion in sanctioning the state welfare agency for failing to investigate sufficiently prior

269. *Minnesota v. Hagen*, 382 N.W.2d 556 (Minn. App. 1986); *Jackson v. Jackson*, 322 S.E.2d 725 (Ga. 1984).

270. *Hagen*, 382 N.W.2d at 559 (citations omitted).

271. *Smith v. Shaffer*, 515 A.2d 527 (Pa. 1986).

to a paternity action. When blood tests proved that the alleged father could not possibly have been the father of the child, the trial court ordered the agency to pay part of the man's attorney's fees pursuant to Iowa Rule of Civil Procedure 80(a) (similar to Federal Rule of Civil Procedure 11), which allows sanctions against a party or attorney who did not conduct a reasonable inquiry into the facts of the case before filing a complaint. The Iowa Supreme Court held that the agency may accept the woman's word that she had had sexual intercourse with the defendant several times and only once with another man, and could bring the paternity action. Iowa law does not require corroboration of the mother's testimony.²⁷²

III. DAUBERT AND ITS PROGENY

A. Admissibility of DNA Evidence in Paternity Actions

If the alleged father's DNA matches that of the child, the scientist calculates the likelihood that DNA from a randomly chosen person of the same race might also match.²⁷³

Where the paternity expert testifies that an accurate protocol was followed in processing the evidence, the trial court should admit the expert's report.²⁷⁴

1. The Frye Standard

Prior to *Daubert*, and still in some states, courts would admit DNA or other "novel" scientific evidence, if the scientific technique has gained general acceptance in the pertinent scientific community. This is the so-called *Frye* standard, posited by the D.C. Circuit in 1923, in *United States v. Frye*.²⁷⁵

272. Iowa ex rel. Carrigan v. Duckert, 465 N.W.2d 871 (Iowa 1991).

273. See *United States v. Porter*, Crim. No. F06277-89, 1991 WL 319015 (D.C. Super. Ct. Sept. 20, 1991); *District of Columbia ex rel. J.A.B. v. W.R.*, Civ. A. No. DR-2792'89P, 1991 WL 214204 (D.C. Super. Ct. Aug. 2, 1991); *Minnesota v. Schwartz*, 447 N.W.2d 422 (Minn. 1989); Byne, *supra* note 64.

274. *Litton v. Litton*, 624 So. 2d 472, 475 (La. App. 2d Cir. 1993), writ denied, 624 So. 2d 472 (1994); cf. *State v. Simien*, 677 So. 2d 1138 (La. App. 3d Cir. 1996); *State ex rel. Braden v. Nash*, 550 So. 2d 866 (La. App. 2d Cir. 1989). But see discussion *supra* notes 235-259, *Simien*, 677 So. 2d at 1144 (dissent).

275. *United States v. Frye*, 293 F. 1013, 1014 (D.C. Cir. 1923) (finding polygraph testing inadmissible). For thorough analysis of the *Frye* standard, see Paul C. Giannelli, *The Admissibility of Novel Scientific Evidence: Frye v. U.S., A Half-Century Later*, 80 Colum. L. Rev. 1197 (1980). See also *United States v. Jacobetz*, 955 F.2d 786 (2d Cir. 1992), cert. denied, 506 U.S. 834, 113 S. Ct. 104 (1992) (adopting a relevancy test), superceded by *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S. Ct. 2786 (1993). See *United States v. Garcia*, 42 F.3d 573 (10th Cir. 1994) (noting that *Jacobetz* is overturned in relation to the sentencing guidelines, but not in relation to the impact of DNA testing). The *Frye* and relevancy standards are considered at *infra* notes 294-298 and accompanying text. See also, e.g., other cases using the *Frye* standard, *State v. Freeman*, No. A-95-1027, 1996 WL 608328 at *16 (Neb. App. 1996).

The above discussion illustrates the *Frye* standard. Some courts have found that the process of DNA analysis is not only generally admissible but when properly performed and analyzed, it also appears to be universally admissible, by both federal and state courts alike applying either the *Frye* standard, the *Frye*-plus standard, or what some call the relevancy approach.²⁷⁶ Others find to the contrary.²⁷⁷

Some jurisdictions apply what is called the *Frye*-plus test which requires every aspect of the testing process to be accepted: (1) the theory; (2) the testing processes and procedures utilized; and (3) that the testing was properly performed in the instant situation.²⁷⁸

2. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*

Federal Rule of Evidence 702 reads: "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. . . ." Louisiana Evidence Code article 702 is virtually identical.

The United States Supreme Court, in the 1993 decision of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,²⁷⁹ thrust trial courts into the rigorous position of gatekeeper for proffers of scientific evidence. Courts are the screeners of the validity of scientific evidence under Federal Rule of Evidence 702.²⁸⁰ The Louisiana Supreme Court embraced *Daubert* in 1994, in *State v. Foret*.²⁸¹

276. See, e.g., *United States v. Jacobetz*, 955 F.2d 786 (2d Cir. 1992), *cert. denied*, 506 U.S. 834, 113 S. Ct. 104 (1992); *State v. Lyons*, 924 P.2d 802, 811 (Or. 1996); *State v. Anderson*, 881 P.2d 29, 45 (N.M. 1994) (almost universally accepted); *State v. Cauthron*, 846 P.2d 502, 503 (Wash. 1993); cf. *Commonwealth v. Crews*, 640 A.2d 395, 400 (Pa. 1994) (scientists almost certain to agree on whether DNA samples match or do not match—do not agree on proper impact of this). But see *State v. Freeman*, No. A-95-1027, 1996 WL 608328, at *17 (Neb. App. 1996) (no general acceptance given the substantial disagreement in the scientific community).

277. E.g., *State v. Freeman*, No. A-95-1027, 1996 WL 608328 (Neb. App. 1996).

278. E.g., *New York v. Castro*, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989); *Ex Parte Perry*, 586 So. 2d 242 (Ala. 1991); *United States v. Two Bulls*, 918 F.2d 56 (8th Cir. 1990), *discussed in* Byne, *supra* note 64, at 3001.

279. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S. Ct. 2786 (1993). Some recent articles on the subject include: Laurens Walker & John Monahan, *Daubert and the Reference Manual: An Essay on the Future of Science in Law*, 82 Va. L. Rev. 837, 838 (1996) (suggesting that the significance of *Daubert* goes beyond evidentiary questions, but signals "a new receptivity to science as a functional component of American jurisprudence"); Aitken, *supra* note 157, at 61; Imwinkelried, *Daubert Decision*, *supra* note 246; Imwinkelried, *Brief Defense*, *supra* note 246; Giannelli & Imwinkelried, *supra* note 246; Conley & Peterson, *supra* note 246; Fenner, *supra* note 246; Kesan, *supra* note 20.

280. *Daubert*, 509 U.S. at 579, 113 S. Ct. at 2786.

281. *State v. Foret*, 628 So. 2d 1116, 1123 (La. 1993) (holding also that it applied retroactively). See also *Young v. Logue*, 660 So. 2d 32 (La. App. 4th Cir. 1995) (admission of "experts' scientific testimony").

The *Daubert* decision recognizes the fundamental truth that science is at its base a methodology, not a mass of knowledge.²⁸² Courts must now focus on the scientific methodology utilized to provide the foundation for and verifying the integrity of the proffer of evidence, rather than simply look at the muster of scientists who support the evidence; they must scrutinize every stage of the evidence gathering, storage, and testing process to ensure its integrity. This was the old rule adopted in the *Frye* standard which was posited in *United States v. Frye*.²⁸³

The United States Supreme Court's rule in *Daubert* was concerned with determining the admissibility of testimony relating to "novel scientific knowledge and techniques" and whether an expert's testimony will be helpful to the fact finder. Many argue that the *Daubert* criteria should include peer review of the expert's work, publication, rate of error, and testability.²⁸⁴

It is also argued that the criteria should include the acceptance of the expert, his theory and methodology by the scientific community.

The Louisiana Evidence Code has gone the way of the federal system and many other states in adopting the *Daubert* so-called "helpfulness" test. The Louisiana Supreme Court adopted the *Daubert* test as controlling under Federal Evidence Code article 702. *Daubert* applies to any blood and tissue testing, not only to DNA testing.²⁸⁵

In *Daubert*, the United States Supreme Court rejected the *Frye* standard as being inconsistent with the Federal Rules of Evidence, but it also held that scientific evidence must satisfy a *reliability test*.²⁸⁶ Moreover, the Court noted that *unamended* Rule 702 of the Federal Rules of Civil Procedure uses the term "scientific" and "knowledge" which require, to qualify as such, that "an inference or assertion . . . be derived by the scientific method. Proposed testimony must be supported by appropriate validation—i.e., 'good grounds,' based on what is known. In short, the requirement that an expert's testimony pertain to 'scientific knowledge' establishes a standard of evidentiary reliability."²⁸⁷

Apparently a trial court must apply Federal Rule of Evidence 104(a) for admissibility of scientific evidence. This requires the court to assess the validity

282. *Daubert*, 509 U.S. at 589-90, 113 S. Ct. at 2795.

283. *United States v. Frye*, 293 F. 1013, 1014 (D.C. Cir. 1923) ("general acceptance," relating to the admissibility of polygraph test results and holding that the polygraph had, "not yet gained [general] standing and scientific recognition among physiological and psychological authorities"). See generally Giannelli, *supra* note 275; see also Sarah Brashears-Macafee, Note, *A Test Both Lawyers and Scientists Can Live With: The Rigorous Five-Prong Test for the Admission of DNA Profiling Evidence Adopted in United States v. Matthew Sylvester Two Bulls*, 71 Neb. L. Rev. 920, 923-24 (1992).

284. E.g., Effie S. Chan, Note, *The "Brave New World" of Daubert: True Peer Review, Editorial Peer Review, and Scientific Validity*, 70 N.Y.U. L. Rev. 100 (1995).

285. *Foret*, 628 So. 2d at 1123; see also *Young v. Logue*, 660 So. 2d 32 (La. App. 4th Cir. 1995) (relating to admission of "experts' scientific testimony").

286. *Daubert*, 509 U.S. at 579, 113 S. Ct. at 2786; Paul C. Giannelli, *Forensic Science, Frye, Daubert, and the Federal Rules*, 29 Crim. L. Bull. 428, 433 (1993).

287. *Daubert*, 509 U.S. at 579, 113 S. Ct. at 2786; Giannelli, *supra* note 286, at 433.

of the methodology underlying scientific expert testimony. The Supreme Court listed several factors to assist the court in this determination, including: (1) empirical testing; (2) whether a theory or technique has been subjected to peer review and publication (relevant, but not dispositive); (3) the technique's "known or potential rate of error"; (4) the "existence and maintenance of standards controlling the technique's operation" as an indicia of trustworthiness; and (5) "general acceptance" as an important criterion, although not dispositive.²⁸⁸

The *Daubert* Court quoted *Weinstein's Evidence*, which lists several factors:

(1) the potential error rate in using the technique, (2) the existence and maintenance of standards governing its use, (3) presence of safeguards in the characteristics of the technique, (4) analogy to other scientific techniques whose results are admissible, (5) the extent to which the technique has been accepted by scientists in the field involved, (6) the nature and breadth of the inference adduced, (7) the clarity and simplicity with which the technique can be described and its results explained, (8) the extent to which the basic data are verifiable by the court and the jury, (9) the availability of other experts to test and evaluate the technique, (10) the probative significance of the evidence in the circumstances of the case, and (11) the care with which the technique was employed.²⁸⁹

The impact of *Daubert* is still unclear. It applies only to federal cases, so states may, and many will, continue to apply the *Frye* standard.²⁹⁰ One news account noted that the new *Daubert* test "invites judges to be aggressive in screening out ill-founded or speculative scientific theories."²⁹¹

On the other hand, it seems clear that the decision will at least allow evidence, such as DNA testing evidence, in more readily and allow the attacks upon it to be based on its value or weight.

3. Some Outstanding Issues

One thing is clear: The Supreme Court answered two significant questions that it did not expressly address or acknowledge. First, are there cases that defy the ability of fact finders to understand them?²⁹² Second, even if fact finders could finally learn enough to deal with a complex mathematical problem, would the time that it would take for them to do so be more costly than would make

288. *Daubert*, 509 U.S. at 2797, 113 S. Ct. at 594; Giannelli, *supra* note 286, at 434.

289. 3 J. Weinstein and M. Berger, *Weinstein's Evidence* ¶ 702[3] (1992), *cited in Daubert*, 509 U.S. at 587, 113 S. Ct. at 2793.

290. Giannelli, *supra* note 286, at 435.

291. Linda Greenhouse, *Justices Put Judges in Charge of Deciding Reliability of Scientific Testimony*, N.Y. Times, June 29, 1993, at A10.

292. Ronald J. Allen, *Expertise and the Daubert Decision*, 84 J. Crim. L. & Crim. 1157, 1158-59 (1994).

it worth our paying for them to come to grips with it?²⁹³ The answer to the first question is no. The answer to the second is more problematic and depends on the circumstances, although there must be some, if not many, cases where it would not be worth it.²⁹⁴

Allied questions arise: Could resources be better used elsewhere? Who should decide whether they could better be used elsewhere? Where should they be used? Who decides that? How can fact finders decide which of two "experts" is correct, without actually understanding what each of the experts understands? So in each case, the fact finder must become the expert. Under Section 702 of the Federal Rule of Evidence, the issue is whether the given "scientific knowledge" is helpful to the fact finder. That, of course, does not say what "scientific knowledge" is! Does this make the decision simply go back to the *Frye* standard that the Court pretended to abrogate? So, *Frye* lives, although now in the form of *guidelines*, rather than *rule*.²⁹⁵

Professor Ronald Allen has written:

In my opinion, the most regrettable aspect of *Daubert* is that the Court seemed quite unaware of the implications of admitting data without a basis for believing that the data can be understood. By doing so, it seems to be putting its stamp of approval on undeliberative and nonrational legal decision making, which I think to be the antithesis of the law's aspirations. Jurors or judges who cannot understand the reasoning of a witness can only accept or reject the witness' conclusions, but neither acceptance nor rejection will occur rationally. The choice will not be made because a fact finder understands the reasoning and sees either its cogency or its flaws; it will be made for some other reason. And the set of "some other reasons" is, from the point of view of the law's aspirations, filled with unsavory characters.²⁹⁶

The proper term to describe the *Daubert* test would be as a validation or reliability standard.²⁹⁷ The so-called "relevancy" test [*validation or reliability standard*] focuses on the relevancy of the scientific evidence to the ultimate question [paternity], the qualifications of the scientist testifying, whether the evidence presented will be more helpful than confusing to the trier of fact, and whether the possible prejudicial effects of the evidence will be outweighed by its probative value.²⁹⁸

293. *Id.*

294. *Id.*

295. *Id.* at 1158-59, 1169.

296. *Id.* at 1174-75.

297. Imwinkelried Letter, *supra* note 188.

298. *E.g.*, *Andrews v. Florida*, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988); *Spencer v. Virginia*, 384 S.E.2d 775 (Va. 1989); *Kelley v. Texas*, 792 S.W.2d 579 (Tex. Ct. App. 1990); *United States v. Jakobetz*, 747 F. Supp. 250 (D. Vt. 1990), *aff'd*, 955 F.2d 786 (2d Cir. 1992), *discussed in* Byne, *supra* note 64.

Many jurisdictions are moving to the *Daubert* test, but some continue to apply one of the earlier tests. Courts today applying any of the tests do not seem to reject DNA testing as such in a paternity case, although they sometimes do hold given evidence or given tests to be inadmissible.²⁹⁹ In California, it has been held that the evidence is inadmissible under the *Frye* standard.³⁰⁰ In Massachusetts, the court found that the testing laboratory had violated its own laboratory protocol in rendering their decision based on only one DNA probe, even though the parties involved were first degree relatives.³⁰¹

4. The Latest Louisiana Supreme Court Decision—*State v. Quatrevingt*

In 1996, the Louisiana Supreme Court reiterated its and the Legislature's acceptance of *Daubert*.³⁰² The Louisiana Court reiterated its adoption (in *Foret*) of the *Daubert* standard for admission of scientific evidence. In *Daubert*, the United States Supreme Court held that Federal Rule of Evidence 702, rather than the "general acceptance" standard established by *United States v. Frye*,³⁰³ controls the admissibility of expert scientific evidence in federal court. Under this new standard, the trial court is required to act as a "gatekeeper" to "ensure that any and all scientific testimony or evidence admitted is not only relevant but reliable."³⁰⁴

The reliability of scientific evidence is to be ensured by a requirement that there be a "valid scientific connection to the pertinent inquiry as a precondition to admissibility."³⁰⁵ This connection is to be examined in light of a "preliminary assessment" by the trial court "of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether the reasoning or methodology properly can be applied to the facts at issue."³⁰⁶ The Louisiana Supreme Court held:

In considering whether scientific evidence is reliable, the trial court should consider the following factors suggested in *Daubert*:

- (1) The "testability" of the expert's theory or technique;
- (2) Whether the theory or technique has been subjected to peer review and publication;
- (3) The known or potential rate of error; and

299. Byne, *supra* note 64, at 3002 (citing *In re Baby Girl S.*, 532 N.Y.S.2d 634 (Surr. Ct. NY Cty. 1988); *J.L.K. v. J.J.*, 445 N.W.2d 673 (Wis. Ct. App. 1989) (DNA tests admissible per blood test statutes)).

300. *People v. Wilds*, 37 Cal. Rptr. 2d 351, 354 (Cal. Ct. App.), *rev. granted*, 39 Cal. Rptr. 2d 406 (1995); *People v. Wallace*, 17 Cal. Rptr. 2d 721 (Cal. Ct. App. 1993).

301. *Massachusetts v. Lanigan*, 596 N.E.2d 311 (Mass. 1992).

302. *State v. Quatrevingt*, 670 So. 2d 197, 203-05 (La. 1996).

303. 293 F. 1013 (D.C. Cir. 1923).

304. *Quatrevingt*, 670 So. 2d at 204.

305. *Id.*

306. *State v. Foret*, 628 So. 2d 1116, 1122 (La. 1993).

(4) Whether the methodology is generally accepted in the scientific community.³⁰⁷

The Court had noted in *Foret* that its past decisions had already espoused similar sentiments regarding the admission of scientific evidence. In *State v. Cantanese*,³⁰⁸ this Court rejected *Frye*'s "general acceptance" test in the scientific community as the only test for the admissibility of polygraph results in criminal trials.

The Louisiana Supreme Court noted that scientific evidence should be admitted in those proceedings whenever the trial court, after balancing the probative value of the evidence against its prejudicial effect, determines that "the evidence is reliable and will aid in a decision."³⁰⁹ The admission of the evidence was subject to the "discretion of the trial judge."³¹⁰ The Louisiana Supreme Court reiterated:

As we noted in *Foret*, *Daubert* goes further than *Cantanese* in that it sets forth clearer guidelines for determining the reliability of scientific evidence in its consideration of the probative value aspect of the balancing test set forth in *Cantanese*. The similarity between La.Code Evid. art. 702 and its federal counterpart, along with the fact that *Cantanese* had already provided similar guidelines for the admission of scientific evidence, persuaded this Court to adopt *Daubert*'s requirement that, in order to be admissible under La.Code Evid. art. 702, scientific evidence must rise to a threshold level of reliability.³¹¹

As to application of the *Daubert* standard, the Louisiana Supreme Court noted that, with regard to the relevance of DNA testing, Louisiana Revised Statutes 15:441.1 provides: "Evidence of deoxyribonucleic acid profiles, genetic markers of the blood, and secretor status of the saliva offered to establish the identity of the offender of any crime is relevant as proof in conformity with the Louisiana Code of Evidence."³¹² It is clear from this provision, stated the court, "that the Louisiana legislature intended DNA evidence to be admissible absent a showing that the evidence is unreliable. Thus, the first part of the *Daubert/Foret* analysis, the question of relevancy, is satisfied."³¹³

Louisiana courts have recognized that DNA typing is sufficiently scientifically reliable to cross the admissibility threshold.³¹⁴ In addition, both federal and

307. *Id.*

308. 368 So. 2d 975 (La. 1979).

309. *Quatrevingt*, 670 So. 2d at 201, 204.

310. *Id.* (citing *Foret*, 628 So. 2d at 1123 (citing *Cantanese*, 368 So. 2d at 978-79, 983)).

311. 670 So. 2d at 204 (citing *Foret*, 628 So. 2d at 1123).

312. 670 So. 2d at 204.

313. *Id.*

314. See *State v. Stelly*, 645 So. 2d 804 (La. App. 3d Cir. 1994), writ denied, 653 So. 2d 589 (1995); *State v. Brossette*, 634 So. 2d 1309 (La. App. 3d Cir.), writ denied, 640 So. 2d 1344 (1994).

other state courts have found that, in general, DNA profiling is a reliable technique and is admissible.³¹⁵

The Louisiana Supreme Court agreed with these courts that the principles of DNA profiling and RFLP analysis are both relevant and reliable and, therefore, are admissible.³¹⁶

B. Daubert and "Band Shifting Correction"

The Louisiana Supreme Court in *Quatrevingt* focused on the troublesome problem of *band shifting*. Professor Jon Thames explains that *band shifting* is not well understood. "*Band shifting* results from the movement between lanes of the gel used for electrophoresis,³¹⁷ which leads to altered band lengths. A monomorphic probe should be used to test for band shift.³¹⁸ Even if no such probe is used, however, courts are prone to hold that this relates only to the weight and not the admissibility of the evidence."³¹⁹

Band shifting can sometimes be caused by differences in the amount of DNA loaded, particularly when ethidium bromide is used in the gel.³²⁰ Before the restriction endonuclease digestion, the technician would normally measure the concentration of DNA in each sample, and then digest equal amounts to be run in each lane.³²¹ Inaccuracy in the measurement can result in one lane being overloaded with DNA. This lane will run differently than adjacent lanes loaded with a "normal" amount of DNA.

The Louisiana Supreme Court noted in *Quatrevingt* that the defendant had acknowledged that DNA profiling in general and RFLP analysis were admissible, but argued that the specific method employed by the testing laboratory to

315. E.g., *United States v. Jakobetz*, 955 F.2d 786 (2d Cir. 1992); *Hayes v. State*, 660 So. 2d 257 (Fla. 1995); *Commonwealth v. Rodgers*, 605 A.2d 1228 (Pa. Super. Ct. 1992); *Trimboli v. State*, 817 S.W.2d 785 (Tex. App. 1991), *aff'd*, 826 S.W.2d 953 (Tex. Crim. App. 1992); *Caldwell v. State*, 393 S.E.2d 436 (Ga. 1990).

316. *Quatrevingt*, 670 So. 2d at 201, 204-05.

317. Office of Technology Assessment, *Genetic Witness: Forensic Uses of DNA Test* 63 (1990).

318. *State v. Jobe*, 486 N.W.2d 407, 420 n.3 (Minn. 1992).

319. Thames, *supra* note 54 (citing *Minnesota v. Alt*, 504 N.W.2d 38, 47 (1993)).

320. Nakashima, *supra* note 103 (citing *United States v. Yee*, 134 F.R.D. 161, 179 (N.D. Ohio 1991), *aff'd*, 12 F.3d 540 (6th Cir. 1993); *People v. Mehlberg*, 618 N.E.2d 1168, 1179, 1183 (Ill. App. Ct.), *cert. denied*, 624 N.E.2d 813 (1993)).

321. Nakashima, *supra* note 103, at 466 n.99.

DNA concentration can be measured by determining the amount of UV light of 280 nanometer wavelength that is absorbed by a sample. The more UV light is absorbed by the sample, the greater the concentration of DNA in the sample. This measurement is inherently inaccurate because UV light absorption can be caused by other contaminants like proteins, ribonucleic acids and free nucleotides. A more accurate technique is to add a fluorescent dye that binds to DNA and to measure the amount of sample fluorescence. Results obtained with the fluorescence technique can still be skewed by sample contamination.

Id.

"correct" for band shifting was unreliable because there is no scientifically accepted protocol of how to adjust the bands. The Louisiana Supreme Court noted in a footnote that the issue of the laboratory's correction for band shifting appears to have played little or no role in the majority and concurring opinions of the Court of Appeal.³²²

The expert had testified at the admissibility hearing and at trial that band shifting is a common phenomenon in DNA analysis. He explained that Lifecodes uses monomorphic probes, a method of correction which allows the technician to resituate the bands where they would have appeared had they not shifted. He maintained that this method still allows the laboratory to declare a match where band shifting has occurred.

Following the trial court's ruling allowing the state to present the expert scientific testimony, this expert and a forensic scientist expert testified that the laboratory "had declared a match between the defendant's DNA imprint and the seminal fluid found on the towel near the victim's leg even though the autorad showed evidence of band shifting."³²³

The first expert testified that the laboratory is the only lab which attempts to correct for band shifting and still declare a match. He maintained that the correction procedure was valid, reliable, and has been reviewed by the scientific community. By the date of the trial, the laboratory had submitted one paper for publication in *The Journal of Forensic Science* on the use of monomorphic probes to correct for band shifting, but the paper had not yet been published and was undergoing peer review.³²⁴

The defendant's experts disputed the lab's claims. The first defense expert testified that there was no way to correct for band shifting and that scientists generally disregarded such results. He remarked that he was extremely disturbed that the laboratory independently created a correction factor that was "their own personal fudge factor that no one else accepts," and noted it had not even been documented.³²⁵ He observed that without the correction some of the bands in this case would be outside of laboratory's "match" criterion of 2% deviation.

The other defense expert further informed the jury that no valid methods existed to correct the bands and that the laboratory expert's claim that the laboratory's method had been peer reviewed was unfounded.

The defendant cited jurisprudence from other jurisdictions applying the "general acceptance" or *Frye* standard as a basis to hold inadmissible DNA results which have employed correction for band shifting.³²⁶

322. *State v. Quatrevingt*, 670 So. 2d 197, 205 n.8 (La. 1996).

323. *Id.* at 205.

324. Nakashima, *supra* note 103, at 466 n.99.

325. *Quatrevingt*, 670 So. 2d at 197.

326. *Id.* (citing *People v. Keene*, 591 N.Y.S.2d 733 (N.Y. Sup. Ct. 1992); *Hayes v. State*, 660 So. 2d 257 (Fla. 1995), in which the Florida Supreme Court rejected Lifecodes' correction method for band shifting under the *Frye* standard, relying in part on the NRC report).

In addition, defendant pointed to the findings presented by the National Research Council in its report on *DNA Technology in Forensic Science*,³²⁷ the NRC report referred to above which provides an in-depth analysis of the forensic use of DNA evidence and associated areas, including band shifting.

The Louisiana Supreme Court noted that it did not need to rely upon the conclusions of the report in deciding the assignment of error in the instant case. Nevertheless, the Report is illustrative of the issue. The NRC directly addresses the problem of band shifting as follows:

Testing for band shifting is easy, correcting for it is harder. The best approach is to clean the samples . . . and repeat the experiment in the hope of avoiding band shifting. When that is impossible because too little sample is available or it fails . . . , it is possible in principle to determine the molecular weights of polymorphic fragments in a sample by comparing them with monomorphic human bands in the same lane—so called internal molecular weight standards. These monomorphic fragments are expected to have undergone the same band shift, so they should provide an accurate internal ruler for measurement. . . .³²⁸

The court indicated that the use of internal standards presents serious difficulties in actual practice, however. It notes:

Accurate size determination requires a number of internal standards. If band shifting caused all fragments to change their mobility by the same percentage, one would need only a single monomorphic fragment to determine the extent of shift. But band shifting appears to be more complex than that. Different regions of the gel shift by different amounts.

Little has been published on the nature of band shifting, on the number of monomorphic internal control bands needed for reliable correction, and on the accuracy and reproducibility of measurements made with such correction. For the present, several laboratories have decided against attempting quantitative corrections; samples that lie outside the match criterion because of apparent band shifting are declared to be "inconclusive." The committee urges further study of the problems associated with band shifting. Until testing laboratories have published adequate studies on the accuracy and reliability of such corrections, we recommend that they adopt the policy of declaring samples that show apparent band shifting to be "inconclusive."³²⁹

Finally, the court noted that under the *Daubert/Foret* test, and even under the more rigid *Cantanese* test, the expert testimony elicited at the trial showed

327. See NRC Report, *supra* note 157.

328. *Quatrevingt*, 570 So. 2d at 197 (citing NRC Report, *supra* note 157).

329. 570 So. 2d at 206.

that the practice of using monomorphic probes to correct for band shifting had not been proven reliable.

The proponent of the evidence, the state, had failed to demonstrate at the admissibility hearing: (1) the "testability" of the technique; (2) that the technique has been subjected to peer review and publication; (3) the known or potential rate of error; and (4) that the methodology is generally accepted in the scientific community.³³⁰

Thus, the Louisiana Supreme Court held that "[w]hile the results of DNA and RFLP analysis are generally admissible in Louisiana so long as the trial court's 'gatekeeping' function has been performed in accordance with *Daubert/Foret*, Lifecodes' use of monomorphic probes to correct for band shifting was not shown to be reliable in the trial court, and the trial court erred in admitting the DNA evidence. . . ."³³¹

C. Admissibility of Evidence Versus Proffered Expert's Qualifications

There is a distinction between admissibility and the proffered expert's expertise. Nevertheless, Evidence Code article 702 addresses both.³³² This is virtually identical to the Federal Rules of Evidence article 702 and to the rule in many other states. DNA evidence has generally been held admissible in paternity cases. Apparently, no appellate court, to date, has rejected DNA outright in a paternity case, although some have found given evidence inadmissible.³³³

Evidence is to be excluded when a laboratory violates its own protocol.³³⁴

The Minnesota Supreme Court, although acknowledging the validity of DNA printing, refused to admit evidence when the testing laboratory had not published its population genetics studies.³³⁵

Louisiana Revised Statutes 9:396(A) provides that:

Notwithstanding any other provision of law to the contrary, in any civil action in which paternity is a relevant fact, or in an action desaveu, the court, upon its own initiative or upon request made by or on behalf of any person whose blood is involved, may or, upon motion of any party to the action made at a time so as to not delay the proceedings unduly, shall order the mother, child, and alleged father to submit to the drawing of blood samples, *including, but not limited to blood and tissue type*, be determined by appropriate testing procedures. If any person

330. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 593, 113 S. Ct. 2786, 2796-97 (1993).

331. *Quatrevingt*, 670 So. 2d at 206.

332. *Cf. State v. Lewis*, 654 So. 2d 761, 763 (La. App. 4th Cir. 1995).

333. *Byne*, *supra* note 64, at 3002 (citing *In re Baby Girl S.*, 532 N.Y.S.2d 634 (Surr. Ct. NY Cty. 1988); *J.L.J. v. J.J.*, 445 N.W.2d 673 (Wis. Ct. App. 1989) (DNA tests admissible per blood test statutes)).

334. *E.g., Commonwealth v. Breadmore*, 596 N.E.2d 311 (Mass. 1992); *Byne*, *supra* note 64.

335. *State v. Schwartz*, 447 N.W.2d 422 (Minn. 1989).

refuses to submit to such tests, the court may resolve the question of paternity against such party or enforce its order if the rights of others and the interests of justice so require.³³⁶

Thus, Louisiana, like most, if not all, states, accepts blood testing and DNA matching to prove or disprove paternity. In fact, the United States District Court for the Southern District of Texas held that since Texas law allows Texas courts to accept DNA fingerprinting to establish family relationships, that procedure is also appropriate for establishing or disestablishing the fatherhood of a deceased insurance policy holder when an alleged child sought to recover as a beneficiary.³³⁷

It went on to hold that the tests were done properly and their results, along with other evidence adduced at trial, provided clear and convincing evidence that the decedent was not the biological father of the child born to his ex-wife shortly after their divorce. In Texas, like in Louisiana, the child was presumed to be the child of the ex-husband of the mother when the child was born within 300 days of the termination of the marriage. Under Texas law, the burden is on the party denying paternity to rebut the presumption of paternity. The presumption may be rebutted only by clear and convincing evidence. The DNA fingerprinting, along with the additional evidence adduced at trial, was held to have satisfied this burden.³³⁸

Thus, while scientific testing is important and can provide much valuable evidence relating to important family law issues, it is no panacea. Worse, it lends itself to becoming a talisman that allows courts to avoid their duty to apply the law to the facts and to make legal decisions. Although some scientists would love to do so, and believe that it is appropriate, they should not be allowed to usurp the role of the judicial system.

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336. Emphasis added.

337. See *Glover v. Texas*, 787 S.W.2d 544 (Tex. Ct. App. 1990) ("DNA fingerprinting—its underlying principles, procedure and technology—is a scientific test that is reliable and has gained acceptance in the scientific community in the particular field in which it belongs."). *Id.* See also *Tipps v. Metropolitan Life Ins. Co.*, 768 F. Supp. 577 (S.D. Tex. 1991), in which DNA "fingerprinting" paternity test results accepted as persuasive to determine whether a deceased federal employee had fathered a child, who was born to his ex-wife shortly after their divorce, and now seeks to share in the group life insurance benefits. The Court held that the properly administered tests results and the other evidence in the case presented clear and convincing evidence that the decedent was not the father of the child.

338. *Tipps v. Metropolitan Life Ins. Co.*, 768 F. Supp. 577 (S.D. Tex. 1991).

