BLOOD TEST EVIDENCE IN DISPUTED PATERNITY CASES: UNJUSTIFIED ADHERENCE TO THE EXCLUSIONARY RULE

The number of illegitimate[1] births in the United States rose at an alarming rate during the last decade. Expanded legal rights of abortion[2] and the use of contraceptives[3] did not, as some had expected,[4] curtail the proliferation of illegitimacy. By 1977 the annual number of illegitimate births exceeded half a million.[5] Several factors, including

1. The marital status of a child's parents generally determines legitimacy, although a child may sometimes attain legitimacy even though his parents have not been married. Most statutes expressly or impliedly refer to the time of conception in order to legitimatize a child conceived before his parents marry. Generally, neither the parents' divorce nor the husband's death before birth of the child affects legitimacy if the child is born within a specified time, usually ten months or 300 days, after the marriage ends. Moreover, most states have abandoned the strict common-law requirement that the marriage be valid, providing instead for legitimacy whenever the child is born of a relationship that resembles a formal marriage. Thus, a child may be legitimate even though his parents' marriage was not legal because of a failure to comply with substantive requirements (e.g., health checks or parental consent) or because of a legal disability to marry (e.g., incest, nonage, insanity, or the existence of a prior valid marriage). Krause, *Paternity Testing: Legal Considerations*, in PATERNITY TESTING 137-38 (1978).

2. *See, e.g.,* Planned Parenthood v. Danforth, 428 U.S. 52 (1976); Roe v. Wade, 410 U.S. 113 (1973).

3. *See, e.g.,* Eisenstadt v. Baird, 405 U.S. 438 (1972); Griswold v. Connecticut, 381 U.S. 479 (1965).

4. *See Joint AMA-ABA Guidelines: Present Status of Serologic Testing in Problems of Disputed Parentage*, 10 FAM. L.Q. 247, 249 (1976) [hereinafter cited as *AMA-ABA Guidelines*].

5. There were 515,700 illegitimate births in the United States in 1977, the first year in which the total exceeded half a million. The number was an increase of 47,600 over the 1976 total and represented a continuation of the steady increase in the yearly number of illegitimate births. The following yearly totals illustrate the trend:

1977	515,700
1976	468,100
1975	447,900
1974	418,100
1973	407,300
1972	403,200
1970	398,700
1965	291,200
1960	224,300
1955	183,300
1950	141,600

The 1977 figure was an increase of 29.3% over the 1970 total. More startling, however, were the marked increases over the 1960 and 1950 totals—increases of almost 130% and more than 264%, respectively. BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 66 (1979).

Although the 29.3% increase during the years between 1970 and 1977 was considerably smaller

the "new morality" and increased social acceptance of illegitimacy,[6] have combined to produce record proportions of illegitimate births each year.[7] The national average in 1977 was 15.5%,[8] but in many urban areas the illegitimacy rate is 40%, and in some it exceeds 50%.[9] The overall birth rate has declined, but illegitimacy "remains at the level of a national crisis."[10]

The proliferation of illegitimate births has resulted in a concomitant increase in the number of actions[11] to determine paternity.[12] Because he now can receive many of the legal benefits that inure to his parents,

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than the percentage increase of the 1960s (77.8%) or the 1950s (58.4%), it does not actually reflect a slowing in the growth of illegitimacy. During the 1970s the number of births per 1,000 unmarried women was actually higher than it was during either of the two previous decades. The average number of births per 1,000 unmarried women was 19.3 in 1955, 21.6 in 1960, and 23.5 in 1965. During the 1970s, however, the rate ranged from a low of 24.1 in 1974 to highs of 26.0 in 1977 and 26.4 in 1970. *Id.* Furthermore, the percentage of live births that were illegitimate continued to climb steadily during the 1970s. *See* note 7 *infra*.

Younger women bear by far the greatest number of illegitimate children. In 1977, a year that is representative of other years, 15 to 19 year-old women bore 234,700 illegitimate children, or 45.5% of all illegitimate children born that year. Women 20-24 years old bore 168,600 illegitimate children, or 32.7%. Together the two groups accounted for 78.2% of all illegitimate births in 1977. BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 66 (1979).

6. *AMA-ABA Guidelines, supra* note 4, at 249.

7. Illegitimate births constitute an increasing percentage of live births in the United States each year. In 1950 illegitimate births accounted for only 4.0% of all live births, and in 1960 they constituted only 5.3%. By 1970, 10.7% of all live births were illegitimate, and since then the percentage has increased gradually each year:

1972	12.4%
1973	13.0%
1974	13.2%
1975	14.2%
1976	14.8%
1977	15.5%

BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 66 (1979).

8. *Id.*

9. *AMA-ABA Guidelines, supra* note 4, at 249.

10. *Id.*

11. Usually the mother, the state, or the person acting on behalf of the child may bring the paternity action. *See, e.g.,* ALA. CODE § 26-12-1 (1975) (mother, custodian of child, or state if child may become a public charge); ARK. STAT. ANN. § 34-702 (1962) (mother); CONN. GEN. STAT. §§ 46b-160, -162 (1979) (mother, state, or town). Some statutes also allow the father to bring the action. *E.g.,* ARIZ. REV. STAT. ANN. § 12-843 (Supp. 1980).

12. The marked increase in paternity testings in American laboratories, *see* Lee, *Numerical Expression of Paternity Test Results Using Predetermined Indexes*, 73 AM. J. CLIN. PATH. 522, 522 (1980), reflects the increase in the number of paternity actions. The influx of paternity cases has come during the last five years. In 1975, for example, the Minneapolis War Memorial Blood Bank

an illegitimate child has a direct interest in achieving legitimacy[13] by establishing the identity of his father. At common law illegitimacy was often a basis for discrimination,[14] but recent United States Supreme Court decisions have established the equality of legitimate and illegitimate children[15] with respect to inheritance status,[16] rights to financial

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conducted blood tests in 230 cases; by 1978, the number had increased to 850. Polesky, *Parentage Testing 1979*, 10 LAB. MED. 601 (1979).

The 1975 amendments to the Social Security Act account in part for the increase in the number of paternity actions. Congress provided funds for the states to establish child support enforcement agencies that are charged with determining paternity in order to shift the support burden from the state to the child's father. In most situations the mother must cooperate with the agency by naming the father in order to receive the full amount of benefits provided under the Aid to Families with Dependent Children (AFDC) program. 42 U.S.C. § 602(a)(26)(B) (1976).

13. Camden County Bd. of Social Servs. v. Kellner, No. DR-466-76 (N.J. Juv. & Dom. Rel. Ct. Camden County Jan. 28, 1980).

14. "For centuries the concept of 'bastardy' was a convenient means of assuring inheritance of title and property only by offspring conceived within the confines of a marital bond." Polesky, *supra* note 12, at 601. At common law, an illegitimate child had few, if any, rights. "[O]ur law . . . traditionally has all but denied the existence" of an illegitimate child's father. *AMA-ABA Guidelines, supra* note 4, at 250. Notwithstanding a series of recent Supreme Court decisions finding expanded rights for illegitimate children, *see* notes 16-20 *infra* and accompanying text, "most states have continued to discriminate heavily in the substantive relationship between father and illegitimate child" as to "rights of support, inheritance, custody, name, and claims under father-related welfare statutes, such as workmen's compensation, wrongful death, and various federal acts." *AMA-ABA Guidelines, supra* note 4, at 250. Furthermore, the Court's decisions are at best confusing and often contradictory. *See* notes 16, 20 *infra* and accompanying text.

15. For an excellent discussion of the Court's treatment of the illegitimacy problem, see Clark, *Constitutional Protection of the Illegitimate Child?*, 12 U. CAL. D.L. REV. 383 (1979). *See also* Krause, *Equal Protection for the Illegitimate*, 65 MICH. L. REV. 477 (1967); Note, *Illegitimates and Equal Protection*, 10 U. MICH. J.L. REF. 543 (1977).

16. Trimble v. Gordon, 430 U.S. 762 (1977). The Court held unconstitutional an Illinois statute allowing illegitimate children to inherit only from their mothers. Under Illinois law, legitimate children could inherit from both parents. *But see* Labine v. Vincent, 401 U.S. 532 (1971), upholding a Louisiana statute allowing an acknowledged illegitimate child to inherit from his father only if the father died leaving no legitimate descendants, no parents or grandparents, and no collateral relatives, and Lalli v. Lalli, 439 U.S. 259 (1978), upholding a New York statute providing that an illegitimate child can inherit from his father only if a court had, during the father's lifetime, adjudged paternity during the mother's pregnancy or within two years after the child's birth. Given the Court's inconsistent treatment of the question of inheritance rights for illegitimate children, any predictions of future rulings "based on opinions as ambiguous as those in *Labine, Trimble* and *Lalli* are necessarily unreliable." Clark, *supra* note 15, at 390.

At least one state court has declared unconstitutional a statute of limitations for paternity actions similar to the one involved in *Lalli*. In County of Lenoir *ex rel.* Cogdell v. Johnson, 46 N.C. App. 182, 264 S.E.2d 816 (1980), the court said that recent advances in blood test technology vitiate the state's need for a statute of limitations in paternity actions. Under state law, preventing an illegitimate child from asserting paternity prevented him from receiving the support of his natural father. Thus, the court said, the statute was not "substantially related" to a "permissible State interest," and it therefore denied illegitimate children equal protection of the law. *Id.* at 189,

support,[17] recovery under wrongful death[18] and workmen's compensation[19] statutes, and claims under the Social Security Act.[20] An illegitimate child therefore has a substantial economic interest in documenting paternity. One commentator has suggested, however, that the child's primary interest is in ascertaining his personal identity—with the chance that a lasting father-child relationship eventually may develop.[21]

The mother and the state have interests that are principally economic. Without assistance from the father, the mother must support

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264 S.E.2d at 821. *But see* Thompson v. Thompson, 40 Md. App. 256, 265, 390 A.2d 1139, 1144 (1978), *aff'd,* 285 Md. 488, 404 A.2d 269 (1979), *appeal dismissed,* 444 U.S. 1062 (1980), refusing to strike down a similar statute of limitations:

> We . . . agree that medical technology is, indeed, making progress in the science of blood testing. Perhaps our technology will eventually devise a virtually perfect test for determining one's paternity. We are not convinced, however, that day is at hand. . . . Until it arrives, we do not feel that we are constitutionally required, under the less restrictive means theory, to strike down the statute of limitations . . . .

17. Gomez v. Perez, 409 U.S. 535 (1973), held unconstitutional on equal protection grounds Texas' refusal to permit illegitimate children to recover support from their fathers when legitimate children had the right to do so. The Court said that "once a state posits a judicially enforceable right on behalf of children to needed support from their natural fathers there is no constitutionally sufficient justification for denying such an essential right to a child simply because its natural father has not married its mother." *Id.* at 538. The same year, the Court in New Jersey Welfare Rights Organization v. Cahill, 411 U.S. 619 (1973), struck down a New Jersey statute limiting welfare benefits to families composed of only married persons and their children.

18. Levy v. Louisiana, 391 U.S. 68 (1968). The Court in *Levy* struck down as invidiously discriminatory a wrongful death statute that refused to allow an illegitimate child to recover for his mother's death.

19. In Weber v. Aetna Cas. & Sur. Co., 406 U.S. 164 (1972), the Court declared unconstitutional a statutory payment scheme denying workmen's compensation payments to an unacknowledged illegitimate child upon the death of his father unless there were too few other dependent survivors, including legitimate and acknowledged illegitimate children, to collect all maximum allowable benefits.

20. In Davis v. Richardson, 409 U.S. 1069, *aff'g mem.* 342 F. Supp. 588 (D. Conn. 1972), and Griffin v. Richardson, 409 U.S. 1069, *aff'g mem.* 346 F. Supp. 1226 (D. Md. 1972), the Supreme Court's summary affirmations held unconstitutional a provision of the Social Security Act discriminating between legitimate and illegitimate children in the payment of benefits to the children of a deceased wage earner. In Jimenez v. Weinberger, 417 U.S. 628 (1974), the Court declared unconstitutional that portion of the Social Security Act that denied benefit payments to illegitimate children born after the occurrence of the father's disability. *But see* Mathews v. Lucas, 427 U.S. 495 (1976), which upheld a provision of the Social Security Act prohibiting illegitimate children from claiming insurance benefits upon the wage earner's death.

21. One commentator has argued that

> [p]erhaps the greatest, and least understood, urgency to establish parentage is strictly emotional. A sense of personal identity is derived, in part, from an awareness of lineage. That half of a child's heritage which is denied at birth may be partially restored when the parental relationship is legally established. While not assured, there is even the chance that a genuine relationship may eventually develop between father and child.

Keith, *Resolution of Paternity Disputes—Genetic Testing*, 1980 CHILD SUPPORT REP., 4, 5 (April).

the child herself. To do so she often must leave the child in another's care. The alternative is to turn to some form of outside, usually governmental, assistance. The state has an interest in protecting children from the stigma of illegitimacy[22] and in preserving the family,[23] but its primary interest is also largely economic. One-third of all children who receive assistance under Aid to Families with Dependent Children are illegitimate.[24] With paternity established, the state can ensure that the responsible individuals, rather than the taxpayers, bear this financial burden.[25] The taxpayers therefore have a "right to know who is the father of the child or if a particular person is not the father."[26]

Blood testing has changed the nature of paternity proceedings and today provides the best method for fulfilling the interests involved. Paternity proceedings once were little more than swearing contests in which the credibility of the mother or the alleged father often was dispositive. The use of scientific blood test evidence, however, reduces the subjectivity upon which the determination of paternity traditionally has been made by providing a more objective basis for the decision.[27] Although it is impossible to prove paternity conclusively, blood test evidence, when considered in view of other evidence of the relationship between the mother and the putative father, lends objectivity that aids the courts in the discovery of truth and the administration of justice[28]—which should be the goal of all paternity proceedings.[29]

Blood tests also provide an added measure of protection for men who are accused falsely by either mistake or design. An alleged father

22. Cramer v. Morrison, 88 Cal. App. 3d 873, 885, 153 Cal. Rptr. 865, 872 (1979).

23. *Id.* at 885, 153 Cal. Rptr. at 872.

24. OFFICE OF CHILD SUPPORT ENFORCEMENT, U.S. DEP'T OF HEALTH, EDUCATION & WELFARE, TEMPO No. FOUR 1 (1980) [hereinafter cited as TEMPO No. FOUR].

25. Cramer v. Morrison, 88 Cal. App. 3d 873, 885, 153 Cal. Rptr. 865, 872 (1979).

26. Lascaris v. Lardeo, 100 Misc. 2d 220, 224, 417 N.Y.S.2d 665, 668 (Fam. Ct. 1979) (citing Schleimer *ex rel.* McCoy v. Swann, 93 Misc. 2d 520, 402 N.Y.S.2d 897 (Fam. Ct. 1978)).

27. Keith, *supra* note 21, at 4. *See* note 45 *infra*.

28. Malvasi v. Malvasi, 167 N.J. Super. 513, 515, 401 A.2d 279, 280 (1979).

One court has suggested that the state has a duty to use blood tests in order to ensure the accuracy of the paternity determination. "It is in the child's interest not only to have it adjudicated that *some* man is his or her father and thus liable for support, but to have some assurance that the correct person has been so identified." Therefore, the court argued, "the state owes it to the child to insure that an accurate determination of parentage will be made." Salas v. Cortez, 24 Cal. 3d 22, 34, 593 P.2d 226, 234, 154 Cal. Rptr. 529, 537, *cert. denied,* 444 U.S. 900 (1979).

29. One writer has argued that "[c]onsidering the interests at stake and the costs of an erroneous decision—to the parties, to society, to the integrity of the legal system—the question of paternity should be dealt with empirically, as a question of genetics." 16 J. FAM. L. 537, 537 (1978).

has an interest in remaining free from wrongly imposed financial obligations, imprisonment, and injury to his reputation.[30] Consequently, the interest in avoiding erroneous imposition of the parent-child relationship is as strong as any interest that favors parental identification.[31] A mother, however, often will accuse a man because of convenience[32] or the size of his income.[33] Blood testing helps determine the veracity of her claim[34] and thus protects both a falsely accused male and the community from fraud.[35] It also saves considerable administrative, judicial, and legal expenses[36] as well as the enormous cost of support imposed upon an accused if he is falsely adjudged to be the father.[37]

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30. Hepfel v. Bashaw, 279 N.W.2d 342, 345 (Minn. 1979).

> An adjudication of paternity may profoundly affect a person's life. It may disrupt an established family and damage reputations. Further, a court's determination of paternity exposes a defendant to deprivation of property and, potentially, liberty. It entails the obligation to support and educate a child . . ., an obligation that does not end at the child's age of majority. . . . Moreover, a child support order is more freely enforceable by garnishment than an ordinary civil judgment . . . and is not dischargeable in bankruptcy . . . . Also, the failure to pay child support may be enforced through the civil contempt power . . . as well as the Uniform Civil Liability Act . . . and interstate assistance statutes . . . . A judgment of paternity, even if taken by default, is res judicata in any subsequent civil enforcement proceeding.
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> Failure to support a child may also be prosecuted criminally.

Salas v. Cortez, 24 Cal. 3d 22, 28, 593 P.2d 226, 230, 154 Cal. Rptr. 529, 533, *cert. denied,* 444 U.S. 900 (1979).

31. Salas v. Cortez, 24 Cal. 3d 22, 28, 593 P.2d 226, 230, 154 Cal. Rptr. 529, 533, *cert. denied,* 444 U.S. 900 (1979).

32. As a condition of receiving full assistance under the Aid to Families with Dependent Children (AFDC) program, federal law requires mothers of illegitimate children to cooperate with state authorities, usually by naming an alleged father, in an effort to ascertain paternity. *See* note 12 *supra*. Requiring the mother to name an alleged father so that AFDC payments will not be decreased or stopped increases the risk that a man will be accused falsely. Blood testing can help expose fraudulent or incorrect accusations. Lascaris v. Lardeo, 100 Misc. 2d 220, 226-27, 417 N.Y.S.2d 665, 669 (Fam. Ct. 1979).

33. Polesky, *supra* note 12, at 602.

34. Fraudulent accusations are not uncommon. One study found that approximately 10% of women who make accusations of paternity fail to appear for blood tests ordered by the court, "a situation which must be considered suspect." L. SUSSMAN, PATERNITY TESTING BY BLOOD GROUPING 139 (2d ed. 1976). Another study showed that 48% of the mothers surveyed had lied when they denied having sexual relations with another man during the critical conception period. Ellman & Kaye, *Probabilities and Proof: Can HLA and Blood Group Testing Prove Paternity?*, 54 N.Y.U. L. REV. 1131, 1134 (1979).

35. Lascaris v. Lardeo, 100 Misc. 2d 220, 227, 417 N.Y.S.2d 665, 669 (Fam. Ct. 1979).

36. TEMPO No. FOUR, *supra* note 24, at 2.

37. Blood test evidence is "conclusive, widely available, and relatively inexpensive." The alternative, "supporting someone else's child for eighteen years," makes the cost of several hundred dollars for the tests "almost inconsequential." The comparatively low cost of blood testing thus makes "[o]bjective scientific evidence . . . available where economic and other considerations might dictate an otherwise one-sided proceeding." Keith, *supra* note 21, at 4. *See also* Se-

Blood tests have been used increasingly in disputed paternity cases. Innovations in medical technology have made it possible to exclude a falsely accused man from paternity in more than ninety-nine percent of all cases.[38] Given the high possibility that a falsely accused man will be excluded, it is reasonable to infer that he is the true father if blood tests fail to exclude him. It is also possible to calculate reliably the likelihood that he is the actual father.[39]

In many jurisdictions, however, blood test results are inadmissible as evidence unless they conclusively exclude the putative father.[40] Recent technological advances have destroyed the underlying rationale for excluding such evidence. This Note first describes two recent advances in blood testing technology that make possible extreme accuracy in determining paternity. Second, this Note discusses the potential barrier to the admission of those blood test results posed by stringent requirements for the validation of novel scientific evidence. Finally, this Note examines the exclusionary rule, weighs the probative value of nonexclusionary blood test evidence and the countervailing probative dangers of admitting it, and evaluates the continued need for the rule.

I. Recent Advances in Blood Testing Technology

Karl Landsteiner discovered identifiable characteristics in blood when he isolated the ABO blood group in 1901.[41] In 1910 van Dungern and Hirszfeld laid the foundation for modern paternity testing by proving that children inherit the ABO blood group according to the rules of Mendelian genetics.[42] Researchers have since identified several other red blood cell antigen[43] groups.[44]

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bring, Polesky & Schanfield, *Gm and Km Allotypes in Disputed Parentage*, 71 Am. J. Clin. Path. 281, 281 (1979).

38. *See* note 61 *infra* and accompanying text.

39. *See* notes 210-23 *infra* and accompanying text.

40. *See* notes 175-87 *infra* and accompanying text.

41. 1 S. Schatkin, Disputed Paternity Proceedings § 5.01, at 5-1 (4th ed. 1980).

42. Silver, *An Introduction to Paternity Testing*, in Paternity Testing vii (1978).

43. Antigens are substances on the surface of the blood cells that stimulate production of antibodies when they are introduced into another individual. Genes produce them under genetic control. Terasaki, *Resolution By HLA Testing of 1000 Paternity Cases Not Excluded by ABO Testing*, 16 J. Fam. L. 543, 545 (1978).

44. For a good overview of the red cell antigen blood groups, see L. Sussman, *supra* note 34; *AMA-ABA Guidelines, supra* note 4. *See generally* A. Erskine & W. Socha, The Principles and Practice of Blood Grouping (2d ed. 1978); O. Prokop & G. Uhlenbruck, Human Blood and Serum Groups (1969); R. Race & R. Sanger, Blood Groups in Man (6th ed.

The scientific basis for blood testing in disputed paternity cases rests on the principles of Mendelian genetics. Blood contains a large number of distinguishable genetic markers[45] that have specific inheritance patterns. Children inherit genetic markers in pairs, one from each parent. A child cannot possess a given marker unless at least one of his parents also possesses it. If a child has a marker not present in either his mother or the alleged father, the accused is excluded. Similarly, a child must possess at least one of the markers that his father possesses. If at least one of the alleged father's markers is not present in the child, the accused again is excluded.[46]

Most laboratories utilize six principal red cell antigen groups for paternity testing. Each of the ABO, Rh, MNSs, Kell, Duffy, and Kidd groups produces a relatively high level of exclusion[47] in relation to the

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1975). The history of the discovery of red cell antigen groups is recounted generally in C. McCORMICK, HANDBOOK OF THE LAW OF EVIDENCE § 211 (2d ed. E. Cleary 1972).

45. Genetic markers are "personal characteristics inherited from the parents and controlled by genes on a pair of chromosomes. Personal characteristics can be physical, such as the color of hair, eyes and skin, or detectable properties of the blood components." Lee, *Current Status of Paternity Testing*, 9 FAM. L.Q. 615, 616 (1975).

Genetic markers in the blood are readily identifiable and follow the principles of Mendelian genetics. Tippett, *Blood Group Genetics and Paternity Tests*, in PATERNITY TESTING 1-18 (1978). *See generally* R. RACE & R. SANGER, *supra* note 44. The chances of a mutation that would cause the normal inheritance pattern to deviate are only one in every 40,000 persons, and thus they effectively may be disregarded. *AMA-ABA Guidelines, supra* note 4, at 260. Because a child necessarily must inherit genetic characteristics of the blood from his father as well as from his mother, blood tests may be used to exclude conclusively a putative father from paternity. *See generally id.*; Larson, *Blood Test Exclusion Procedures in Paternity Litigation: The Uniform Acts and Beyond*, 13 J. FAM. L. 713 (1973-74). *See also* note 46 *infra* and accompanying text. Even when an alleged father is not conclusively excluded, it is possible to calculate the probability that he is in fact the father of the child. *See* notes 210-21 *infra* and accompanying text. Therefore,

> [t]he testing of genetic markers provides the only source of scientific evidence in legal cases that otherwise often are decided by hearsay and perjury. It is not uncommon that the man accused of being the father is selected because of the size of his income, or that the defense is based on trying to show that the mother is promiscuous. Carefully performed and correctly interpreted blood tests can provide proof of nonpaternity, eliminating the necessity to depend on witnesses to events that may or may not have occurred.

Polesky, *supra* note 12, at 602.

46. Tippett, *supra* note 45, at 1-2.

47. The usefulness for paternity testing of a given system of genetic markers depends upon the probability of exclusion that the system produces. The probability of exclusion measures the chance that testing with a given system will exclude a falsely accused man. The frequency with which given markers occur among the population determines the probability, which usually is expressed as a percentage. Thus, a system that has a probability of exclusion of 65% will exclude 65 falsely accused men out of 100. It does *not* mean, however, that there is a 65% chance that a nonexcluded man is actually the father. *See* note 216 *infra* and accompanying text.

cost of analysis.[48] In addition, the antisera[49] required for testing are reliable and readily available.[50] The six systems produce a cumulative probability of exclusion of sixty-three to seventy-two percent, depending upon race.[51]

Red cell antigen tests have low evidentiary utility, however, if they fail to exclude the alleged father from paternity. Proof that testing has not excluded the accused is logically relevant to the question of whether he is the true father.[52] Yet because the probability of exclusion by red cell antigen testing is not high enough to allow an accurate inference of paternity from nonexclusion,[53] the probative danger of admitting nonexclusionary test results into evidence outweighs the probative

48. *AMA-ABA Guidelines, supra* note 4, at 257. The cost of red cell antigen tests ranges from $75 to $450 for three persons (mother, child, and putative father). *See* OFFICE OF CHILD SUPPORT ENFORCEMENT, U.S. DEP'T OF HEALTH & HUMAN SERVICES, TEMPO NO. NINE 5-21 (1980) [hereinafter cited as TEMPO NO. NINE].

The probability of exclusion for each red cell antigen group varies according to race. While the probabilities vary for each individual system, the cumulative probability of exclusion is considerably higher for white males than for blacks or Japanese. Red cell antigen testing will exclude a falsely accused man between 63% and 72% of the time.

PROBABILITY OF EXCLUSION OF NONFATHERS (%)

	BLACK		WHITE		JAPANESE	
System	Mean	Cum.	Mean	Cum.	Mean	Cum.
ABO	17.74	17.74	13.42	13.42	19.17	19.16
Rh	18.59	33.03	27.46	37.19	20.50	35.74
MNSs	32.06	54.50	30.95	56.63	25.31	52.0
Kell	.49	54.72	3.54	58.17	0.0	52.0
Duffy	4.20	56.63	18.44	65.88	11.59	57.56
Kidd	15.45	63.37	18.69	72.26	15.73	64.24

AMA-ABA Guidelines, supra note 4, at 257-58. *See also* L. SUSSMAN, *supra* note 34, at 9.

49. Antisera are used to identify blood groups. Each antiserum contains an antibody that combines with a particular antigen and causes agglutination of blood cells that contain that antigen. Blood antigen types are identified by whether they agglutinate whenever their particular antiserum is applied. *See* AMERICAN ASSOCIATION OF BLOOD BANKS, TECHNICAL METHODS & PROCEDURES 34-35 (5th ed. 1970).

50. *AMA-ABA Guidelines, supra* note 4, at 257.

51. *See* note 48 *supra*.

52. *See* C. MCCORMICK, *supra* note 44, § 185, at 437: "[T]he most acceptable test of relevancy is the question, does the evidence offered render the desired inference *more probable than it would be without the evidence?*"

53. Analysts usually consider nonexclusion by red cell antigen tests to be inconclusive. *See* notes 178-81 *infra* and accompanying text. Red cell antigen tests produce a probability of exclusion of between 63% and 72%. *See* note 48 *supra*. There is, therefore, a substantial 28% to 37% chance that a falsely accused man may nevertheless not be excluded by red cell antigen tests alone. *See* note 47 *supra*.

value.[54] Thus, although they recommend the use of ABO, Rh, MNSs, Kell, Duffy, and Kidd systems,[55] the American Medical Association and the American Bar Association recommend further testing if red cell antigen testing fails to produce an exclusion.[56] Red cell antigen testing alone "is no longer an acceptable extent of testing if there is a failure to exclude."[57]

Research in recent years has produced two blood testing techniques that greatly increase the accuracy of paternity determinations. The first, human leukocyte antigen (HLA) testing, provides a probability of exclusion greater than that of the six red cell antigen groups combined.[58] The other, the testing of red cell enzymes and blood serum proteins by a method known as electrophoresis, generally is slightly less accurate than HLA but nevertheless provides a high probability of exclusion.[59] Either HLA or enzyme-protein testing, when combined with accepted red cell antigen testing, will produce a probability of exclusion of nearly ninety-seven percent.[60] The three systems combined will exclude a falsely accused man in more than ninety-nine percent of all cases.[61]

A. *The Human Leukocyte Antigen System*

Testing for human leukocyte antigens seeks to identify inheritable[62] antigens on the surface of white, rather than red, blood cells.[63] Re-

54. Courts and legislatures generally have refused to allow admission of nonexclusionary red cell antigen test results because they fear that the jury will infer paternity improperly. *See* notes 176-83 *infra* and accompanying text.

55. *AMA-ABA Guidelines, supra* note 4, at 257. The report recommends initial testing by ABO, Rh, and MNSs. If there is no exclusion, the report recommends additional testing using the Kell, Duffy, and Kidd antigen systems. *Id.* at 256.

56. *Id.*

57. Walker, *Probability in the Analysis of Paternity Test Results*, in PATERNITY TESTING 95-96 (1978).

58. *Compare* note 80 *infra* and accompanying text *with* note 48 *supra* and accompanying text.

59. *See* notes 108-15 *infra* and accompanying text.

60. *See* note 114 *infra. See also* TEMPO NO. FOUR, *supra* note 24, at 7.

61. *See* TEMPO NO. FOUR, *supra* note 24, at 7.

62. Like that of red cell antigens, the inheritance of human leukocyte antigens follows the laws of Mendelian genetics. Miller, *HLA Serotyping in Cases of Disputed Paternity*, in PATERNITY TESTING 55 (1978). *See* notes 45-46 *supra* and accompanying text.

63. HLA technically is a tissue typing test, because the antigens it tests can be found in almost all bodily tissues, including the liver and the kidneys. J.B. v. A.F., 92 Wis. 2d 696, 701, 285 N.W.2d 880, 882 (Ct. App. 1979). Courts differ on whether HLA testing is a "blood test" within the meaning of statutes prescribing the scope of admissibility of blood test results. *Compare id.* at 699-705, 285 N.W.2d at 881-84 (HLA is a "blood test," and proof of nonexclusion of putative

searchers have identified a large number of white cell antigens. The number of possible combinations of white cell antigens is so high that only one person in a thousand has an HLA type similar to that of a given individual.[64] The "high degree of discrimination"[65] of the HLA system thus makes HLA the most accurate method available for ascertaining paternity.[66] Its extreme accuracy, especially in combination with accepted red cell antigen tests, has caused a "revolution" in paternity testing.[67]

Human body cells contain twenty-three pairs of chromosomes. A child inherits one chromosome in each pair from his father and the other from his mother. Present on the chromosome are genes, which determine the traits an individual will possess. A *locus* is the spot a gene occupies on a chromosome.[68]

The HLA region is the area of the chromosome in which white cell antigens are found. In the HLA region there are four loci, two of which, HLA-A and HLA-B, are most commonly used in paternity testing. At each locus are two genetic expressions for antigens, called *alleles*, that represent alternative gene forms occupying the same locus on paired chromosomes.[69]

Considering only the HLA-A and HLA-B loci, a maximum of four antigens can be expressed on the cell.[70] The summary of the four identifiable antigens[71] is the *phenotype*.[72] Children inherit the antigens in pairs called *haplotypes*, which are combinations of one A locus allele

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father therefore was inadmissible under statute proscribing admission of nonexclusionary blood test results) *with* Phillips *ex rel.* Utah State Dep't of Social Servs. v. Jackson, 615 P.2d 1228, 1233 (Utah 1980) (HLA not necessarily characterized as a "blood test" and therefore did not fall within "blood test" language of statute).

64. Terasaki, *supra* note 43, at 544.

65. *Id.* at 543.

66. Jeannet, Hässig & Bernheim, *Use of the HL-A Antigen System in Disputed Paternity Cases*, 23 VOX SANGUINIS 197, 200 (1972).

67. Miller, *supra* note 62, at 55. One commentator has said that the accuracy of HLA testing may make HLA "the means for making the paternity action respectable." 16 J. FAM. L. 537, 541 (1978).

68. Terasaki, *supra* note 43, at 545.

69. *Id.*

70. If four different antigens (two at each locus) appear, there can be no others, and there is no possibility of missing one because of technical error. If fewer than four antigens are present, either the available reagents cannot detect the missing antigen or the individual has identical alleles on a given locus. *Id.* at 545-46.

71. White cell antigens are identified by their locus, A or B, and a number—*e.g.*, A8 or B14.

72. For example, a person may possess a phenotype of A2-A6-B3-B11.

and one B locus allele on the same chromosome. Each person possesses two haplotypes, one inherited from each of his parents.[73]

The polymorphic[74] character of HLA makes it extremely useful in paternity testing. By 1976 researchers had identified thirty-nine different antigens for the HLA-A and HLA-B loci.[75] Using only the HLA-A antigens and fifteen HLA-B antigens, there are 6,600 possible phenotypes.[76] The number of possible combinations of antigens among the four alleles therefore renders highly unlikely the possibility that a nonrelated child and putative father share a common haplotype.[77] The relative rarity of HLA antigens,[78] and thus haplotypes,[79] in the population further contributes to the efficacy of HLA testing in the determination of paternity.

HLA testing has two major strengths. First, it can conclusively exclude a falsely accused man in more than ninety percent of all cases.[80]

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73. Terasaki, *supra* note 43, at 545. To illustrate, assume that a child possesses a phenotype of A2-A6-B3-B11, the mother a phenotype of A2-A8-B7-B11, and the father a phenotype of A6-A13-B3-B9. The A2-B11 haplotype must have come from the mother, and the A6-B3 haplotype must have come from the father.

74. Polymorphic is defined as "[h]aving different molecular forms but the same biochemical function." Grunbaum, *Potential and Limitations of Forensic Blood Analysis*, in HANDBOOK FOR FORENSIC INDIVIDUALIZATION OF HUMAN BLOOD AND BLOODSTAINS 3 n. (B. Grunbaum ed. 1980). It is important that genetic markers used in paternity testing be reasonably polymorphic. The greater the number of variants within a particular group of genetic markers, the less likely that two nonrelated individuals will possess the same variant.

75. *AMA-ABA Guidelines, supra* note 4, at 272. For data on the identified number of HLA specificities and the gene frequencies of HLA antigens, see *id.* at 273-75. Calculation of the probability of paternity, *see* notes 216-21 *infra* and accompanying text, requires the use of haplotype frequencies instead of independent gene frequencies. Presently, however, there is relatively little information on haplotype frequencies for blacks, orientals, and American Indians, and the information available for whites is based on comparatively small studies. Miller, *supra* note 62, at 64.

76. Lee, Lebeck & Wong, *Estimating Paternity Index from HLA-typing Results*, 74 AM. J. CLIN. PATH. 218, 218 (1980). The 6,600 figure reflects a 65% increase since 1975. In 1975, identified HLA antigens made possible only 4,000 phenotypes. H. POLESKY, PATERNITY TESTING 61 (1975).

77. Most persons possess "rare" HLA types. Only one person in 1,000 has an HLA type similar to that of a given individual. *See* note 64 *supra* and accompanying text. The chance that a nonrelated child and putative father share a common haplotype becomes even smaller when one considers the usually small number of possible fathers.

78. Most HLA antigens occur in fewer than 15% of the population, and all occur in fewer than 50%. Miller, *supra* note 62, at 55.

79. Terasaki, Gjertson, Bernoco, Perdue, Mickey & Bond, *Twins With Two Different Fathers Identified by HLA*, 299 NEW ENG. J. MED. 590, 590 (1978).

80. Miller, *supra* note 62, at 55.

HLA testing has become increasingly more accurate in recent years. In 1972 the chances of

If the child possesses neither of the alleged father's haplotypes, the accused obviously is not the actual father.[81] HLA testing has produced exclusions even when death had rendered the mother[82] or the putative father[83] unavailable for testing.[84] Second, HLA allows for a reasonably accurate computation of the probability that an alleged father is the actual father[85] if the tests fail to exclude him.[86] If a child possesses the same rare HLA type as the putative father, the infrequency of similar HLA types in nonrelated individuals makes it highly probable that the

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excluding a falsely accused man by HLA testing alone was 76%. Jeannet, Hässig & Bernheim, *supra* note 66, at 197. By 1976 the probability of exclusion reached 78% to 80%. *AMA-ABA Guidelines, supra* note 4, at 258. Today, conservative estimates place the probability of exclusion of HLA at between 85% and 91%. TEMPO No. FOUR, *supra* note 24, at 7. Others place the figure as high as 95%. Letter from Dr. Leon N. Sussman, Lindsley F. Kimball Research Institute of the New York Blood Center, to author (Dec. 9, 1980) (on file with the *Washington University Law Quarterly*).

The accuracy of HLA testing varies according to race. It depends upon the racial and geographic origin of the subjects, because the frequencies of the haplotypes vary between ethnic groups and subpopulations in various areas. *AMA-ABA Guidelines, supra* note 4, at 276.

81. Miller, *supra* note 62, at 60; Terasaki, *supra* note 43, at 544. *See* notes 45-46 *supra* and accompanying text.

82. Terasaki, *supra* note 43, at 550. Exclusion of the alleged father is possible even though the mother is unavailable for testing if the accused man possesses none of the haplotypes that the actual father must have. *See* notes 46, 81 *supra* and accompanying text.

83. Speiser, *Exclusion of Paternity in the HL-A System Without Testing the Deceased Accused Man*, 27 VOX SANGUINIS 379, 379-81 (1974). It is possible to exclude the deceased putative father by testing his relatives. If the putative father's parents, for example, possess none of the haplotypes that the actual father must have, the deceased putative father could not have possessed them and therefore could not have been the father of the illegitimate child. *See* notes 45-46 *supra* and accompanying text.

84. In a more startling case, HLA testing showed that fraternal twins had different fathers. *See* Terasaki, Gjertson, Bernoco, Perdue, Mickey & Bond, *supra* note 79, at 590. Proof that two different men fathered one twin each is "striking testimony to the power of HLA typing to determine paternity." *Id.* A third man could have fathered both twins, but the probability that a third man was involved was only one in 140,000. *Id.* at 591.

85. *See* notes 216-21 *infra* and accompanying text.

86. The probability is generally high. It is possible in most cases to show a probability of paternity of more than 90%, and virtually all nonexcluded men have a probability of paternity greater than 85%. Miller, *supra* note 62, at 55. It would be virtually impossible to achieve such probabilities with conventional red cell antigen testing, Terasaki, *supra* note 43, at 552, because the small number of variables involved in red cell antigen testing makes possible a probability of paternity of only 50% to 60%, Cramer v. Morrison, 88 Cal. App. 3d 873, 878, 153 Cal. Rptr. 865, 867 (1979). In Professor Terasaki's survey of 1,000 cases, 25% of the 1,000 putative fathers were excluded conclusively. Testing showed with a probability of 90% or more that 64% were the actual fathers; of those, the probability of paternity for 16% was 99-100%, and the probability for another 15% was 98-99%. Only 10% of the cases were inconclusive. Terasaki, *supra* note 43, at 552.

accused man is actually the father.[87]

Although its low error rate makes the HLA system a reliable paternity testing method[88] that several laboratories now perform,[89] HLA has a number of disadvantages. White blood cells are less stable than are red cells. Because fresh white cells are necessary for HLA testing,[90] the analyst must perform the tests within twenty-four hours after sampling.[91] The instability of white cells, especially at extreme tempera-

87. Terasaki, *supra* note 43, at 544. Given the rarity of HLA antigens and haplotypes, *see* notes 75-79 *supra* and accompanying text, the presence of a haplotype in both the child and the putative father provides presumptive evidence of paternity. Miller, *supra* note 62, at 60. At least it implies, and usually produces, a high probability of paternity. *See* note 86 *supra*.

For example, suppose that the mother has a phenotype of A1-A3-B7-B8; the child a phenotype of A1-A11-B8-B12; putative father A a phenotype of A1-A3-B14-B17; and putative father B a phenotype of A11-A26-B7-B12. The A1-B8 haplotype must have come from the mother, and thus the paternal haplotype must be A11-B12. Putative father A can be excluded because he does not have the required paternal haplotype. Putative father B possesses A11 and B12, and he therefore cannot be excluded. In this situation, with the antigens given, the probability that putative B is the true father is 98.3%. Terasaki, *supra* note 43, at 546.

88. Miller, *supra* note 62, at 55.

89. Several laboratories in the United States perform HLA testing in cases of disputed paternity. The following is a representative sample that is included only for the convenience of the reader, who should infer no endorsement: Dr. J.F. Shaw, 615 Clinical Service Building, University of Alabama Medical Center, 619 S. 19th Street, Birmingham, Ala. 35233; Dr. Paul Terasaki, Department of Surgery, University of California-Los Angeles, 1000 Veteran Avenue, Los Angeles, Cal. 90024; Dr. Harvey Bernhardt, American Medical Laboratories, Inc., 4173 Roosevelt Blvd., Jacksonville, Fla. 32210; Dr. C.L. Lee, Charles Hymen Blood Center of Mt. Sinai Hospital Medical Center, 2746 W. 15th Street, Chicago, Ill. 60608; Dr. Wilma Bias, Immunogenetics Laboratory, Johns Hopkins Hospital, 720 Rutland Avenue, Baltimore, Md. 21205; Dr. E.M. Berkman, New England Medical Center Hospital Blood Bank, 171 Harrison Avenue, Boston, Mass. 02111; Dr. Herbert F. Polesky, Minneapolis War Memorial Blood Bank, 2304 Park Avenue, Minneapolis, Minn. 55404; Dr. William V. Miller, Missouri-Illinois Red Cross Blood Center, 4050 Lindell Blvd., St. Louis, Mo. 63108; Dr. Fred H. Allen, Jr. and Dr. Leon N. Sussman, New York Blood Center, Laboratory for Genetic Services, 310 E. 67th Street, New York City, N.Y. 10021; Dr. M.B. Stroud, Medical Center Clinical Laboratory, Suite 178, 4499 Medical Drive, San Antonio, Tex. 78229; Dr. A.A. Hossaini, Medical College of Virginia, 1200 E. Broad Street, Richmond, Va. 23298. For a more complete state-by-state listing, see AMERICAN ASSOCIATION OF BLOOD BANKS, SPECIAL SERVICES DIRECTORY 29-45 (1980). *See also* TEMPO NO. NINE, *supra* note 48, at 5-21.

Persons who need the services of a laboratory for the performance of blood testing should consider six factors before making a choice: (1) whether the laboratory performs sufficiently detailed series of tests to exclude most wrongfully accused men; (2) whether it can handle the required volume; (3) whether it has effective quality control techniques; (4) whether it provides clear reports providing the probability of paternity if tests fail to exclude the alleged father; (5) whether it has an expert who is prepared to testify at trial if he is needed; and (6) whether the cost of the laboratory's services is reasonable. *Id.* at 1.

90. H. POLESKY, *supra* note 76, at 61; Miller, *supra* note 62, at 61.

91. TEMPO NO. FOUR, *supra* note 24, at 6.

tures, makes the transfer of blood samples by ordinary mail difficult.[92] Some laboratories therefore refuse mail-in blood specimens.[93] Furthermore, the cost of HLA testing is, for a number of reasons, much greater than that of other blood tests.[94] The reagents necessary for HLA testing are expensive and difficult to obtain.[95] Extraction of white cells for testing requires extra effort, and HLA testing takes two and one-half times longer to complete than does red cell antigen testing.[96]

The accuracy of HLA obviously outweighs its disadvantages. Because the presence or absence of such highly probative evidence often is outcome determinative, HLA's cost and difficulty of procurement are justified. Yet the second recent breakthrough in blood testing technology, the testing of red cell enzymes and blood serum proteins, provides comparable accuracy and lacks many of HLA's disadvantages.

B. *The Red Cell Enzyme and Blood Serum Protein Systems*

The accuracy of the paternity determination depends largely upon the number of genetic markers the analyst tests. The probability that tests will exclude a falsely accused man increases as each additional marker is tested.[97] The interests of justice, for all parties involved, therefore make it worthwhile to test additional polymorphic genetic markers.[98] Yet testing all of the immunologic and biochemical systems

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92. *Id.*

93. *See* Miller, *supra* note 62, at 61.

94. The cost of HLA testing varies widely among laboratories. Laboratories listing services with the United States Department of Health and Human Services charge $150 to $900 for HLA testing of three persons (mother, child, and putative father). Most charge between $300 and $500. *See* TEMPO No. NINE, *supra* note 48, at 5-21. The cost of HLA testing, therefore, is generally much higher than that of red cell antigen testing, *see* note 48 *supra*, or red cell enzyme and serum protein testing, *see* note 121 *infra*.

95. The antisera required for HLA testing are "rare, expensive, and generally not available. . . . There are relatively few licensed reagents available, certainly not enough for complete phenotyping." Miller, *supra* note 62, at 61, 63. The general unavailability of well-defined antisera for HLA typing "is a major limitation of HL-A typing in paternity studies." H. POLESKY, *supra* note 76, at 61.

96. Lascaris v. Lardeo, 100 Misc. 2d 220, 223, 417 N.Y.S.2d 665, 667 (Fam. Ct. 1979).

97. Lee, *supra* note 45, at 615.

98. *See* Sebring, Polesky & Schanfield, *supra* note 37, at 281. Additional testing clearly is in the putative father's interest if it will exonerate him. If it will not, the child, the mother, and the state benefit from the higher probability thus established that the accused actually is the father—assuming that nonexclusionary evidence is admissible. *See* notes 175-87 *infra* and accompanying text.

that are of potential use[99] is neither feasible nor practical.[100]

Several red cell enzymes and blood serum proteins, however, have proven useful in paternity testing.[101] Testing enzymes and proteins by a process known as electrophoresis[102] both provides first-hand exclusion[103] and corroborates exclusions obtained by tests using other systems.[104] Because enzymes and proteins possess well-established

99. At least 62 immunologic and biochemical systems are potentially useful in paternity testing. *AMA-ABA Guidelines, supra* note 4, at 252. For data on the probability of exclusion for individual genetic markers in black, white, and Japanese nonfathers, see *id.* at 253-56.

100. It is not feasible routinely to test all genetic markers because the antisera required for testing some of them generally are not available. Similarly, testing all markers would be impractical. Some markers are present in a large proportion of the population, and thus they provide a low probability of exclusion. Therefore, the slight increase in the probability of exclusion would not justify the extreme cost of testing all possible systems. *Id.* at 252, 254-56.

101. Several studies in both the United States and in Europe have demonstrated the viability of red cell enzymes and serum proteins as determinants in cases of disputed parentage. *See* Dykes & Polesky, *Application of Tests for Serum Proteins and Red Cell Enzymes in Determination of Parentage*, in PATERNITY TESTING 42 (1978), and authorities cited therein. *See also, e.g.*, Dykes & Polesky, *Properdin Factor B (Bf) as an Exclusion Determinate in Parentage Testing*, 30 HUMAN HERED. 286 (1980); Dykes & Polesky, *The Usefulness of Serum Protein and Erythrocyte Enzyme Polymorphisms in Paternity Testing*, 65 AM. J. CLIN. PATH. 982 (1976); Grunbaum, Selvin, Myhre & Pace, *Distribution of Gene Frequencies and Discrimination Probabilities of 22 Human Blood Genetic Systems in Four Racial Groups*, 25 J. FOR. SCI. 428 (1980); Grunbaum, Selvin, Pace & Black, *Frequency Distribution and Discrimination Probability of Twelve Protein Genetic Variants in Human Blood as Functions of Race, Sex, and Age*, 23 J. FOR. SCI. 577 (1978); Sebring, Polesky & Schanfield, *supra* note 37.

102. Dykes & Polesky, *Application of Tests for Serum Proteins and Red Cell Enzymes in Determination of Parentage, supra* note 101, at 35. Electrophoresis is a process in which enzymes and proteins separate under an electric current. Proteins take positive, negative, or neutral charges, depending upon the solution in which they are placed. After placing the blood on an appropriate medium, such as agar, the analyst subjects it to an electric field, and the charged protein molecules migrate across the medium toward the pole of the opposite charge. Because blood proteins have different sizes, shapes, densities, and charges, they vary in mobility. Electrophoresis separates them into clear bands on the supporting medium. The analyst then applies indicator dyes that unite with only one protein. In most cases, the pattern of separated proteins and the intensity of the dyes identify the proteins present in the blood. Enzymes separate during electrophoresis in much the same way and are identified by a chemical reaction that forms a colored compound induced by the enzyme. *See* A. MOENSSENS & F. INBAU, SCIENTIFIC EVIDENCE IN CRIMINAL CASES 301 (2d ed. 1978); Grunbaum, *supra* note 74, at 3.

103. Dykes & Polesky, *Application of Tests for Serum Proteins and Red Cell Enzymes in Determination of Parentage, supra* note 101, at 44. Dykes and Polesky found that "in actual practice increasing the number of systems tested provides a larger than expected increase in the number of individuals proven to be falsely accused." Dykes & Polesky, *The Usefulness of Serum Protein and Erythrocyte Enzyme Polymorphisms in Paternity Testing, supra* note 101, at 986.

104. Dykes & Polesky, *Application of Tests for Serum Proteins and Red Cell Enzymes in Determination of Parentage, supra* note 101, at 35; Dykes & Polesky, *The Usefulness of Serum Protein and Erythrocyte Enzyme Polymorphisms in Paternity Testing, supra* note 101, at 986.

Mendelian inheritance patterns[105] and are reasonably polymorphic,[106] they render with certainty a comparatively high probability of exclusion. Furthermore, the following characteristics also make enzymes and proteins extremely useful in paternity testing: they are identifiable in newborn children, are not sex related, are stable in storage, and remain relatively unaffected by external factors.[107]

Red cell enzyme and serum protein testing can equal or exceed HLA in accuracy.[108] Researchers have identified enough enzymes and proteins to exclude a falsely accused man in more than ninety-five percent of all cases.[109] It is neither practical[110] nor necessary, however, to test them all. Testing only a few will yield a sufficiently high probability of exclusion.[111] Eleven enzymes and proteins[112] produce an eighty-five percent probability of exclusion.[113] Enzyme-protein and red cell anti-

105. Dykes & Polesky, *Application of Tests for Serum Proteins and Red Cell Enzymes in Determination of Parentage, supra* note 101, at 35.

106. *See* note 74 *supra*.

107. Dykes & Polesky, *Application of Tests for Serum Proteins and Red Cell Enzymes in Determination of Parentage, supra* note 101, at 35.

Experts are not, however, in universal agreement about the usefulness of protein testing in newborn children. One expert argues that protein electrophoresis is not useful in newborns because many maternal proteins can pass from the mother to the child and remain present in the child for several months. Letter from Dr. William V. Miller, Director, Missouri-Illinois Red Cross Blood Center, to author (May 27, 1981) (on file with the *Washington University Law Quarterly*).

108. Letter from Dr. Benjamin W. Grunbaum, Research Biochemist, University of California-Berkeley, to author (Dec. 3, 1980) (on file with the *Washington University Law Quarterly*). *Compare* notes 80, 86 *supra* and accompanying text *with* notes 112-15 *infra* and accompanying text.

109. Letter from Dr. Leon N. Sussman, *supra* note 80.

110. *See* notes 99-100 *supra* and accompanying text.

111. Four serum proteins and seven red cell enzymes are particularly useful in paternity testing: haptoglobin (Hp), transferrin (Tf), group-specific component (Gc), properdin factor B (Bf), acid phosphatase (AcP), 6-Phosphogluconate dehydrogenase (6-PGD), phosphoglucomutase-1 (PGM_1), adenylate kinase (AK), glutamic pyruvic transaminase (GPT), esterase-D (EsD), and adenosine deaminase (ADA). TEMPO No. FOUR, *supra* note 24, at 7. Others that are useful include Gm, Km, ceruloplasmin (Cp), and glyoxalase (GLO). *See* Dykes & Polesky, *The Usefulness of Serum Protein and Erythrocyte Enzyme Polymorphisms in Paternity Testing, supra* note 101, at 985; Lee & Ying, *Phenotyping of Eight Erythrocytic Enzymes in One Acrylamide Gel*, 71 AM. J. CLIN. PATH. 672, 672 (1979); Sebring, Polesky & Schanfield, *supra* note 37, at 284-85.

112. *See* note 111 *supra*.

113. TEMPO No. FOUR, *supra* note 24, at 7. Sussman's list of probabilities places the cumulative probability of exclusion at 85.3%. Letter from Dr. Leon N. Sussman, *supra* note 80.

The cumulative probability of exclusion that red cell enzymes and serum proteins provide depends upon which, and how many, enzymes and proteins are tested. Lee and Ying tested eight enzymes and proteins (PGM_1, AK, 6-PGD, ADA, GLO, EsD, AcP, and GPT) and obtained probabilities of exclusion of 55.6% for blacks and 66.3% for whites. Lee & Ying, *supra* note 111, at 672. The study that Dykes and Polesky conducted with nine enzymes and proteins (Hp, Gc, Cp, Tf, AcP, PGM_1, ADA, AK, and 6-PGD) produced a probability of exclusion of 60.38%. Dykes & Polesky, *The Usefulness of Serum Protein and Erythrocyte Enzyme Polymorphisms in Paternity Testing, supra* note 101, at 985. The use of 18 enzymes and proteins (Hp, Gm, Tf, Gc, Km, Ag, ORO,

gen testing combined[114] yield a probability of exclusion as high as ninety-seven percent.[115]

The advantages of red cell enzyme and serum protein testing make it "inevitable that the protein-enzyme systems will be used very extensively as time goes on."[116] Unlike HLA and red cell antigen testing, enzyme-protein testing can identify both common and rare variants.[117] The overall error rate of the blood enzyme system is approximately one-half of one percent, while the error rate in testing cellular antigens, including HLA, is about two percent.[118] Unlike HLA,[119] enzyme-protein tests need not be conducted within the twenty-four hour period after sampling.[120] Red blood cells are hardier and more stable than white blood cells, and thus they may be mailed to a laboratory for testing. Finally, enzyme-protein tests cost less than HLA.[121]

Enzyme-protein testing does, however, have two major disadvantages. Because the process is relatively new, few laboratories presently perform it.[122] Moreover, none of the three appellate courts that have

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C3, Bf, AcP, 6-PGD, PGM_1, AK, ADA, GPT, GLO, EsD, and PGP) will exclude a falsely accused man 95.7% of the time. Letter from Dr. Leon N. Sussman, *supra* note 80.

114. Both HLA and red cell enzymes and serum proteins usually are tested in conjunction with red cell antigens, and they yield comparable results. The probability of exclusion of HLA and red cell antigens is 98.79%. Letter from Dr. Leon N. Sussman, *supra* note 80. Use of 11 enzymes and proteins, *see* note 111 *supra*, in conjunction with red cell antigen tests produces a somewhat lower probability of exclusion of 96.43%, and the testing of 18 enzymes and proteins, *see* note 111 *supra*, along with red cell antigens results in a slightly higher 98.6% probability of exclusion. Letter from Dr. Leon N. Sussman, *supra* note 80.

115. TEMPO No. FOUR, *supra* note 24, at 7. *Cf.* Letter from Dr. Leon N. Sussman, *supra* note 80 (96.43%).

116. Letter from Dr. Benjamin W. Grunbaum, *supra* note 108.

117. *Id.*

> [W]e can identify in a given system not only the common variants but also the rare variants, using either specific chemicals or antisera. This is not true in the histocompatability testing for HLA or the red blood cell antigens where the detection is based on the use of a specific antiserum for a specific antigen only.

Id.

118. *Id.*

119. *See* note 91 *supra* and accompanying text.

120. TEMPO No. FOUR, *supra* note 24, at 6. *See* text accompanying notes 90-93 *supra*.

121. Laboratories listing services with the United States Department of Health and Human Services charge $135 to $300 for enzyme-protein testing of three persons (mother, child, and putative father). Most laboratories conduct enzyme-protein tests only in conjunction with red cell antigen tests and charge $210 to $750 for the combination. TEMPO No. NINE, *supra* note 48, at 5-12. The cost of enzyme protein tests is comparable to, and at times less than, that of red cell antigen tests, *see* note 48 *supra*, and it is considerably less than that of HLA tests, *see* note 94 *supra*.

122. The following is a representative sample of laboratories that perform red cell enzyme and

considered the admissibility of enzyme-protein test results as evidence did so in the context of a paternity proceeding.[123]

II. VALIDATION OF NOVEL BLOOD TEST EVIDENCE

Courts have been very cautious about admitting scientific evidence. Because judges generally have neither the qualifications nor the experience to determine the reliability of a particular scientific method, they often are skeptical of claims that scientific proof is virtually infallible.[124] They also fear that scientific evidence will overwhelm the jury, causing uncritical lay jurors to accord it too much weight relative to the other evidence.[125] As a result, most courts require stringent proof of reliability in an effort to screen out unreliable novel scientific evidence.[126] Although it would seem sufficient to prove the validity of the underlying theory and the reliability of the instrument used to perform the tests,[127] most jurisdictions impose a higher standard by requiring a demonstration that both the theory and the instrument have gained

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serum protein tests. It is included only for the convenience of the reader, who should infer no endorsement: Dr. J.W. Morris, Memorial Hospital Medical Center, 2801 Atlantic Avenue, Long Beach, Cal. 90801; Dr. R.E. Gaensslen and Dr. H.C. Lee, University of New Haven Forensic Science Laboratory, West Haven, Conn. 06516; Dr. C.L. Lee, Charles Hymen Blood Center of Mt. Sinai Hospital Medical Center, 2746 W. 15th Street, Chicago, Ill. 60608; Dr. Wilma Bias, Immunogenetics Laboratory, Johns Hopkins Hospital, 720 Rutland Avenue, Baltimore, Md. 21205; Dr. Herbert F. Polesky, Minneapolis War Memorial Blood Bank, 2304 Park Avenue, Minneapolis, Minn. 55404; Dr. Fred H. Allen, Jr. and Dr. Leon N. Sussman, New York Blood Center, Laboratory for Genetic Services, 310 E. 67th Street, New York City, N.Y. 10021; Dr. E.W. Lovrien, University of Oregon Health Science Center, Genetics Department, P.O. Box 574, Portland, Or. 97207; Dr. M.B. Stroud, Medical Center Clinical Laboratory, Suite 178, 4499 Medical Drive, San Antonio, Tex. 78229; Dr. A.A. Hossaini, Medical College of Virginia, 1200 E. Broad Street, Richmond, Va. 23298. For a more complete state-by-state listing, see AMERICAN ASSOCIATION OF BLOOD BANKS, *supra* note 89, at 29-45. *See also* TEMPO NO. NINE, *supra* note 48, at 5-12.

123. *See* note 173 *infra* and accompanying text. The Minnesota Supreme Court in Hennepin County Welfare Bd. v. Ayers, 304 N.W.2d 879 (Minn. 1981) (en banc), recently held that the nonexclusionary results of enzyme-protein tests are admissible in a paternity action, but the court addressed only the question of the admissibility of nonexclusionary test results and did not discuss the validity of enzyme-protein testing. *See* note 172 *infra* and accompanying text.

124. E. IMWINKELRIED, EVIDENTIARY FOUNDATIONS 92 (1980).

125. *Id.*

126. An in-depth discussion of the standards for admissibility of scientific evidence is beyond the scope of this Note. For a comprehensive treatment of the standards and their inherent strengths and weaknesses, see Giannelli, *The Admissibility of Scientific Evidence:* Frye v. United States, *a Half-Century Later*, 80 COLUM. L. REV. 1197 (1980); Comment, *Changing the Standard for the Admissibility of Novel Scientific Evidence:* State v. Williams, 40 OHIO ST. L.J. 730 (1979).

127. E. IMWINKELRIED, *supra* note 124, at 91.

general acceptance within the relevant scientific circle.[128]

The District of Columbia Circuit Court of Appeals first espoused the general acceptance doctrine in *Frye v. United States*.[129] In *Frye*, the court considered the admissibility of results of the systolic blood pressure deception test, a forerunner of the polygraph. Refusing to apply the normal foundational requirements for the introduction of expert testimony to the admission of scientific evidence, the court noted the difficulty in determining the validity of an underlying principle that is not well-recognized.[130] The court concluded that the systolic blood pressure deception test was not sufficiently accepted among authorities in the fields of physiology and psychology to allow admission of the test results into evidence.[131]

Three difficulties with the *Frye* formulation are readily apparent. First, authorities disagree on what constitutes "the thing from which the deduction is made."[132] Some courts have said it is the underlying scientific principle, others have said that it is the instrument itself,[133] and Dean McCormick argues that it might be the qualifications of the expert witness to interpret the data derived from the test.[134] Second, although the general acceptance standard requires neither unanimity[135] nor infallibility,[136] at least one court has held the testimony of a single

128. The rule is one of competence based upon the supposed unreliability of the evidence. Therefore, the questions of the validity of the underlying scientific theory, the reliability of the instrument, and the general acceptance of both in the relevant scientific circles are ones of preliminary fact to be decided by the trial judge.

129. 293 F. 1013 (D.C. Cir. 1923).

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

Id. at 1014.

131. *Id.*

132. *Id.*

133. Comment, *supra* note 126, at 761.

134. C. MCCORMICK, *supra* note 44, § 203, at 489.

135. Comment, *supra* note 126, at 761.

136. Courts have acknowledged that

[t]here is a probability factor in even the most carefully structured scientific inquiry; seldom is it possible to exclude all possible chance for error in human endeavor. But there is no requirement in our law that the admissibility of scientific-test evidence must be predicated on a 100 percent degree of accuracy.

Phillips *ex rel.* Utah State Dep't of Social Servs. v. Jackson, 615 P.2d 1228, 1234 (Utah 1980) (quoting People v. Slone, 76 Cal. App. 3d 611, 625, 143 Cal. Rptr. 61, 70 (1978)). Thus, "neither

expert insufficient to establish general acceptance,[137] and another has said that experts who vouch for a novel scientific theory must be "disinterested" so that their "livelihood [is] not intimately connected with" the technique.[138] Finally, adopting a broad definition of the relevant scientific circle often will result in the exclusion of valid scientific evidence, but adopting a narrow one may make it difficult for the opponent of the evidence to find qualified experts who oppose use of the method.[139]

Frye, therefore, is at best susceptible to a number of different and inconsistent interpretations, leading courts to apply it selectively.[140] There nevertheless remains widespread support for the *Frye* doctrine.[141]

Some courts and commentators dissatisfied with the *Frye* standard

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newness nor lack of absolute certainty in a test suffices to render it inadmissible in court. Every useful new development must have its first day in court." United States v. Stifel, 433 F.2d 431, 438 (6th Cir. 1970), *cert. denied,* 401 U.S. 994 (1971). *See also* United States v. Alexander, 526 F.2d 161, 163 n.3 (8th Cir. 1975); United States v. Franks, 511 F.2d 25, 33 (6th Cir.), *cert. denied,* 422 U.S. 1042, 1048 (1975).

137. Commonwealth v. Topa, 471 Pa. 223, 369 A.2d 1277 (1977).

138. People v. Barbara, 400 Mich. 352, 376, 255 N.W.2d 171, 180 (1977).

139. Although the *Frye* standard helps prevent the admission of unreliable evidence, it may be characterized fairly as a popularity contest more than an effective tool for the proper administration of justice. "A determination of reliability cannot rest solely on a process of 'counting (scientific) noses.' . . . Selection of the 'relevant scientific community,' appears to influence the result." United States v. Williams, 583 F.2d 1194, 1198 (2d Cir. 1975), *cert. denied,* 439 U.S. 1117 (1979). *Frye* ensures widespread acceptance of scientific techniques and thus gives opponents greater accessibility to contradictory evidence. Yet it often frustrates justice by excluding proper, reliable evidence, forcing the judicial system to lag perhaps several years behind current technology. *See* Coppolino v. State, 223 So. 2d 68, 75 (Fla. Dist. Ct. App. 1968) (Mann, J., concurring) ("[s]ociety need not tolerate homicide until there develops a body of medical literature about some particular lethal agent"), *appeal dismissed,* 234 So. 2d 120 (Fla. 1969), *cert. denied,* 399 U.S. 927 (1970).

140. *See* C. MCCORMICK, *supra* note 44, § 203, at 490; Giannelli, *supra* note 126, at 1228.

141. *E.g., Ex parte* Dolvin, 391 So. 2d 677 (Ala. 1980); Pulakis v. State, 476 P.2d 474 (Alaska 1970); Scales v. City Court, 122 Ariz. 231, 594 P.2d 97 (1979); People v. Kelly, 17 Cal. 3d 24, 549 P.2d 1240, 130 Cal. Rptr. 144 (1976); Brooke v. People, 139 Colo. 388, 339 P.2d 993 (1959); Salisbury v. State, 221 Ga. 718, 146 S.E.2d 776 (1966); State v. Linn, 93 Idaho 430, 462 P.2d 729 (1969); Reid v. State, 267 Ind. 555, 372 N.E.2d 1149 (1978); State v. Washington, 229 Kan. 47, 622 P.2d 986 (1981); Reed v. State, 283 Md. 374, 391 A.2d 364 (1978); People v. Morse, 325 Mich. 270, 38 N.W.2d 322 (1949); State v. Stout, 478 S.W.2d 368 (Mo. 1972); Boeche v. State, 151 Neb. 368, 37 N.W.2d 593 (1949); Malvasi v. Malvasi, 167 N.J. Super. 513, 401 A.2d 279 (1979); People v. Alston, 79 Misc. 2d 1077, 362 N.Y.S.2d 356 (1974); State v. Steele, 27 N.C. App. 496, 219 S.E.2d 540 (1975); State v. Swanson, 225 N.W.2d 283 (N.D. 1974); State v. Smith, 50 Ohio App. 2d 183, 362 N.E.2d 1239 (1976); Henderson v. State, 94 Okla. Crim. 45, 230 P.2d 495, *cert. denied,* 342 U.S. 898 (1951); State v. Green, 271 Or. 153, 531 P.2d 245 (1975); Romero v. State, 493 S.W.2d 206 (Tex. Crim. App. 1973); State v. Woo, 84 Wash. 2d 472, 527 P.2d 271 (1974); State v. Clawson, 270 S.E.2d 659 (W. Va. 1980).

reject it in favor of a policy of general admissibility in which the question of reliability relates to the credibility, rather than the competence, of the evidence. The leading case is *Coppolino v. State*,[142] which upheld admission of the results of a scientific test formulated especially to determine the cause of death in *that* murder prosecution.[143] Obviously the medical profession had not generally accepted the test. Nevertheless the court held that the trial judge had not abused his "wide discretion" in admitting the evidence.[144] The court paid lip service to *Frye* but stated that the "general rule" governing the admissibility of scientific evidence is either the general acceptance test or "that the demonstration shall have passed from the stage of experimentation and uncertainty to that of reasonable demonstrability."[145] Under *Coppolino*, therefore, the judge decides the validity of the underlying theory, but the issue of reliability becomes a question for the jury.[146] Other state and federal courts[147] and Dean McCormick[148] have en-

142. 223 So. 2d 68 (Fla. Dist. Ct. App. 1968), *appeal dismissed,* 234 So. 2d 120 (Fla. 1969), *cert. denied,* 399 U.S. 927 (1970).

143. Prosecution experts had designed the test to detect succinylcholine chloride. The state attempted to prove that the defendant had murdered his wife by administering a lethal dose of the chemical. Prior to the trial no test existed for detecting succinylcholine chloride in human tissues. *Id.* at 70, 75.

144. *Id.* at 70.

145. *Id.*

146. Judge Mann, concurring specially, explained that "[t]he expert witnesses were examined and cross-examined at great length and the jury could either believe or doubt the prosecution's testimony as it chose." *Id.* at 75.

147. *E.g.,* United States v. Williams, 583 F.2d 1194 (2d Cir. 1978), *cert. denied,* 439 U.S. 1117 (1979); United States v. Baller, 519 F.2d 463 (4th Cir.), *cert. denied,* 423 U.S. 1019 (1975); State v. Williams, 388 A.2d 500 (Me. 1978); State v. Dorsey, 88 N.M. 184, 539 P.2d 204 (1975). The court in *Baller* held that

> [u]nless an exaggerated popular opinion of the accuracy of a particular technique makes its use prejudicial or likely to mislead the jury, it is better to admit relevant scientific evidence, in the same manner as other expert testimony and allow its weight to be attacked by cross-examination and refutation.

519 F.2d at 466.

148. Dean McCormick argues that the approach taken in Coppolino v. State, 223 So. 2d 68 (Fla. Dist. Ct. App. 1968), *appeal dismissed,* 234 So. 2d 120 (Fla. 1969), *cert. denied,* 399 U.S. 927 (1970),

> should be followed in respect to expert testimony and scientific evidence generally. "General scientific acceptance" is a proper condition for taking judicial notice of scientific facts, but not a criterion for the admissibility of scientific evidence. Any relevant conclusions which are supported by a qualified expert witness should be received unless there are other reasons for exclusion. Particularly, probative value may be overborne by the familiar dangers of prejudicing or misleading the jury, and undue consumption of time. If the courts used this approach, instead of repeating a supposed requirement of

dorsed this view.[149]

Authority is split over whether the Federal Rules of Evidence, which twenty states have adopted in various forms,[150] embody the *Coppolino* approach by eliminating judicial ability to create common-law competence rules. The language of the rules suggests such an adoption. Rule 402 provides that "[a]ll relevant evidence is admissible,"[151] with "relevant evidence" defined in Rule 401 as "evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence."[152] The standard for admissibility of scientific evidence, therefore, would be the same as that for admissibility of expert opinion testimony under Rules 702 and 703.[153] Yet most courts

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"general acceptance" not elsewhere imposed, they would arrive at a practical way of utilizing the results of scientific advances.

C. MCCORMICK, *supra* note 44, § 204, at 491 (footnotes omitted).

149. Various other commentators also have proposed standards other than the "general acceptance" rule. *See, e.g.*, Boyce, *Judicial Recognition of Scientific Evidence in Criminal Cases*, 8 UTAH L. REV. 313 (1963-64); Giannelli, *supra* note 126; Strong, *Questions Affecting the Admissibility of Scientific Evidence*, 1970 U. ILL. L.F. 1.

150. To date, 20 states have adopted various forms of the Federal Rules: Alaska, Arizona, Arkansas, Colorado, Delaware, Florida, Maine, Michigan, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oklahoma, South Dakota, Washington, Wisconsin, and Wyoming. *See* Giannelli, *supra* note 126, at 1228.

151. FED. R. EVID. 402 provides:

Rule 402. Relevant Evidence Generally Admissible; Irrelevant Evidence Inadmissible.

All relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by Act of Congress, by these rules, or by other rules prescribed by the Supreme Court pursuant to statutory authority. Evidence which is not relevant is not admissible.

152. FED. R. EVID. 401.

153. United States v. Williams, 583 F.2d 1194, 1200 n.11 (2d Cir. 1978), *cert. denied,* 439 U.S. 1117 (1979). The rules for admissibility of expert opinion testimony provide:

Rule 702. Testimony by Experts.

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.

Rule 703. Bases of Opinion Testimony by Experts.

The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to him at or before the hearing. If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence.

FED. R. EVID. 702, 703. The trial judge still maintains the residual discretion under FED. R. EVID. 403 to exclude the evidence on legal relevance grounds. The rule provides:

Rule 403. Exclusion of Relevant Evidence on Grounds of Prejudice, Confusion, or Waste of Time.

Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the

continue to apply *Frye*. It is arguable that the Federal Rules leave *Frye* intact because, notwithstanding the language of the Rules, neither the advisory committee's notes nor the legislative history repudiates it.[154] Thus, although a few federal and state courts have said that the Rules abrogate *Frye*,[155] the majority adheres to the general acceptance doctrine.[156] As a result, courts have been slow to admit novel blood test evidence.[157]

Recent decisions have eroded the barrier that *Frye* erects to the admission of HLA test results in disputed paternity cases. Courts applying the *Frye* test still may reach contrary conclusions,[158] but the trend today is toward recognizing that HLA satisfies the general acceptance requirement.[159] In 1979 the California court in *Cramer v. Morri-*

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jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.

154. *See* Giannelli, *supra* note 126, at 1229.

155. At least two federal appellate courts have abandoned the general acceptance rule. United States v. Williams, 583 F.2d 1194 (2d Cir. 1978), *cert. denied,* 439 U.S. 1117 (1979); United States v. Baller, 519 F.2d 463 (4th Cir.), *cert. denied,* 423 U.S. 1019 (1975). Similarly, two state courts have held that state rules of evidence modeled after the Federal Rules have abrogated the general acceptance requirement. State v. Williams, 388 A.2d 500 (Me. 1980); State v. Dorsey, 88 N.M. 184, 539 P.2d 204 (1975).

156. Four United States Courts of Appeals have reaffirmed the general acceptance doctrine since the adoption of the Federal Rules of Evidence in 1975. United States v. Brady, 595 F.2d 359, 363 (6th Cir.), *cert. denied,* 444 U.S. 862 (1979); United States v. Kilgus, 571 F.2d 508, 510 (9th Cir. 1978); United States v. Brown, 557 F.2d 541, 556 (6th Cir. 1977); United States v. McDaniel, 538 F.2d 408, 412 (D.C. Cir. 1976); United States v. Bowers, 534 F.2d 186, 193 (9th Cir.), *cert. denied,* 429 U.S. 942 (1976); United States v. Alexander, 526 F.2d 161, 163 & n.3 (8th Cir. 1975). Most states, including some that have adopted forms of the Federal Rules, adhere to the general acceptance rule. *See* notes 141, 150 *supra* and accompanying text.

157. Although red blood cell antigen test results are well established as admissible evidence in disputed paternity cases, *see generally* Annot., 46 A.L.R.2d 1000, 1019-22 (1956), courts have begun only recently to accept HLA and enzyme-protein testing as reliable. For example, although HLA was used in paternity testing as early as 1972, Jeannet, Hässig & Bernheim, *supra* note 66, courts did not approve admission of HLA test results as evidence until 1979, *see* Cramer v. Morrison, 88 Cal. App. 3d 873, 153 Cal. Rptr. 865 (1979); notes 160-62 *infra* and accompanying text.

158. *See* Comment, *supra* note 126, at 762. The author cites conflicting decisions on the admissibility of spectographic voice identification results. The court in Hodo v. Superior Court, 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973), found that sound spectography was generally accepted within the scientific community, but the Michigan Supreme Court in People v. Tobey, 401 Mich. 141, 257 N.W.2d 537 (1977), held that it was not.

159. Six of the nine states that have considered HLA test results have held them admissible: *California: e.g.,* County of Fresno v. Superior Court, 92 Cal. App. 3d 133, 154 Cal. Rptr. 660 (1979); Cramer v. Morrison, 88 Cal. App. 3d 873, 153 Cal. Rptr. 865 (1979); *Florida:* Carlyon v. Weeks, 387 So. 2d 465 (Fla. Dist. Ct. App. 1980); *Illinois:* Miller v. Smith, No. 79-M1-185098 (Ill. Cir. Ct. Cook County May 27, 1980); *New Jersey:* Camden County Bd. of Social Servs. v. Kellner, No. DR-466-76 (N.J. Juv. & Dom. Rel. Ct. Camden County Jan. 28, 1980); Malvasi v. Malvasi,

son[160] sanctioned the use of HLA test results if the proponent could demonstrate that HLA had gained general acceptance within the scientific community,[161] but it refused to decide the general acceptance question pending a full hearing of the issue upon remand.[162]

Subsequent cases have found that HLA is generally accepted within scientific circles. In *Goodrich v. Norman*[163] a New York court held that an alleged father has the right to have the court order HLA testing if red cell antigen tests do not exclude him. The judge found that HLA "is widely accepted in scientific communities because in cases involving organ transplants it is used to match the donor and the recipient. Accuracy is essential when dealing with the lives of patients."[164] In *Malvasi v. Malvasi*[165] a New Jersey court found that the scientific community had recognized the reliability and accuracy of HLA, and it therefore granted the putative father's motion to compel the mother to undergo

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167 N.J. Super. 513, 401 A.2d 279 (1979); *New York: e.g.,* Lascaris v. Lardeo, 100 Misc. 2d 220, 417 N.Y.S.2d 665 (Fam. Ct. 1979); Goodrich v. Norman, 100 Misc. 2d 33, 421 N.Y.S.2d 285 (Fam. Ct. 1979); *Washington:* State v. Meacham, 93 Wash. 2d 738, 612 P.2d 795 (1980). The three states that have refused to admit HLA test results have recognized the efficacy of HLA. They held against admission on grounds other than reliability. *Massachusetts:* Commonwealth v. Blazo, __ Mass. App. Ct. __, 406 N.E.2d 1323 (1980) (trial judge had discretion to exclude evidence); *Utah:* Phillips *ex rel.* Utah State Dep't of Social Servs. v. Jackson, 615 P.2d 1228 (Utah 1980) (proponents of evidence had not laid proper foundation for admission of evidence); *Wisconsin:* J.B. v. A.F., 92 Wis. 2d 696, 285 N.W.2d 880 (Ct. App. 1979) (nonexclusionary evidence inadmissible under statute).

160. 88 Cal. App. 3d 873, 153 Cal. Rptr. 865 (1979).

161. In Cramer v. Morrison, 88 Cal. App. 3d 873, 153 Cal. Rptr. 865 (1979), the trial judge had granted the putative father's motion *in limine* to prevent introduction of HLA test results that had not excluded him from paternity. The judge based his ruling on two grounds. He ruled that nonexclusionary blood test results were inadmissible because California's version of the Uniform Act on Blood Tests to Determine Paternity, *see* note 188 *infra*, had eliminated the language allowing the trial judge discretion to admit nonexclusionary test results depending upon the rarity of the blood type involved. Second, he said that there was a possibility that statistical evidence indicating a high probability that defendant was the father would have a prejudicial effect that would outweigh its probative value. 88 Cal. App. 3d at 878, 153 Cal. Rptr. at 867-68. The court of appeals reversed, holding that HLA test results "are clearly probative and therefore relevant in an action to establish paternity." *Id.* at 880, 153 Cal. Rptr. at 868.

162. The court assumed that HLA had gained general acceptance. Cramer v. Morrison, 88 Cal. App. 3d 873, 880, 153 Cal. Rptr. 865, 868 (1979). It expressly reserved judgment on the question pending a full hearing on remand, however, because an uninformed appellate decision finding admissibility would have "far-reaching implications" that would "establish a precedent that would 'control subsequent trials, at least until new evidence is presented reflecting a change in the attitude of the scientific community.' " *Id.* at 888, 153 Cal. Rptr. at 874.

163. 100 Misc. 2d 33, 421 N.Y.S.2d 285 (Fam. Ct. 1979).

164. *Id.* at 37, 421 N.Y.S.2d at 287.

165. 167 N.J. Super. 513, 401 A.2d 279 (1979).

HLA testing.[166] Finally, the Massachusetts court in *Commonwealth v. Blazo*[167] upheld the trial judge's refusal to order the parties in a paternity action to undergo HLA testing, but it recognized "the high level of accuracy now attained from the HLA test and its recognition and general acceptance by the scientific and medical community" since the date of the trial.[168] Several other decisions have recognized the efficacy of HLA.[169]

State legislatures also have circumvented the *Frye* obstacle by recognizing the value of HLA as an aid in the determination of paternity.

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166. The court said that HLA has "important probative value where paternity is in issue." *Id.* at 516, 401 A.2d at 280. *See also* Camden County Bd. of Social Servs. v. Kellner, No. DR-466-76, slip op. at 12-13 (N.J. Juv. & Dom. Rel. Ct. Camden County Jan. 28, 1980), in which the court said:

> It is incumbent upon trial courts, in order to further their search for the truth, to employ scientific developments which will aid their discovery and which have achieved acceptance in the scientific community. . . .
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> . . . .
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> . . . H.L.A. testing has been accepted in the scientific community . . . [and] has a high degree of scientific reliability.

167. __ Mass. App. Ct. __, 406 N.E.2d 1323 (1980).

168. *Id.* at __, 406 N.E.2d at 1326. The court held that the trial judge did not abuse his discretion in refusing to grant the defendant putative father's motion that the court compel the parties to undergo HLA testing. The motion was made and denied in 1975, before much of the scientific proof of the reliability of HLA was available. Thus, the court said, "[t]he judge could have determined on the record before him at the time . . . that the reliability of and general acceptance of the HLA test had not been established." *Id.* at __, 406 N.E.2d at 1325. Recognizing the present general acceptance of HLA, however, the court said that whenever a putative father requests HLA testing today, "the judge should carefully consider in the exercise of his or her sound discretion ordering the administration of the HLA test to the defendant, the mother, and the child." *Id.* at __, 406 N.E.2d at 1326.

169. In Lascaris v. Lardeo, 100 Misc. 2d 220, 227, 417 N.Y.S.2d 665, 669 (Fam. Ct. 1979), the New York court said that HLA "provides the best available scientific information to the court." Miller v. Smith, No. 79-M1-185098, slip op. at 6 (Ill. Cir. Ct. Cook County May 27, 1980), and State v. Meacham, 93 Wash. 2d 738, __, 612 P.2d 795, 797 (1980) (en banc), similarly acknowledge its high reliability. The Wisconsin court in J.B. v. A.F., 92 Wis. 2d 696, 705, 285 N.W.2d 880, 884 (Ct. App. 1979), reluctantly refused to admit HLA test results because of a restrictive state statute providing for admission of blood test evidence only when it excludes the putative father. In Phillips *ex rel.* Utah State Dep't of Social Servs. v. Jackson, 615 P.2d 1228, 1233 (Utah 1980), the Utah Supreme Court said that given the greater reliability of HLA than that of red cell antigen tests, HLA, "if otherwise admissible, should also be admissible." It held, however, that the proponent had not established a sufficient foundation for admission of the evidence. The court laid down six elements needed for a proper foundation: (1) the correctness of HLA's underlying genetic theory; (2) the accuracy and reliability of the methods used to apply the theory; (3) the effect on the accuracy of the test of nationality or ethnic origin of the subject; (4) other factors that might influence probability of accuracy or invalidate the test altogether; (5) proof of proper procedure in conducting the test, including the proper materials and equipment; and (6) proper qualifications of the vouching expert witness. *Id.* at 1235.

Two states, Georgia and Indiana, recently enacted statutes that expressly permit the use of HLA testing in paternity proceedings.[170] When statutes specifically provide otherwise, the *Frye* general acceptance standard cannot bar admission of HLA evidence.

Frye should also impose no obstacle to the admission of red cell enzyme and serum protein test results in disputed paternity cases. Experts indicate that enzyme-protein testing is generally accepted within relevant scientific circles.[171] One court has implicitly accepted the process in a paternity proceeding,[172] and others have accepted it explicitly in criminal prosecutions as a means of establishing that the defendant

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170. GA. CODE ANN. § 74-306 (1981) provides:

> *74-306 Pretrial proceedings*
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> As soon as practicable after an action has been brought the court upon motion of the plaintiff, the defendant, or any other interested party, may order the mother, the alleged father, and the child to submit to any blood tests, *including human leukocyte antigen (HLA) testing if available*, which have been developed or established for purposes of disproving or proving parentage and which are reasonably accessible. If the court orders such blood tests and if the action is brought prior to the birth of the child, the court shall order the blood tests made as soon as medically feasible after the birth. The tests shall be performed by a duly qualified licensed practicing physician, duly qualified immunologist, or other qualified person. The court may, upon motion by a party, order that independent tests be performed by other experts qualified as examiners of blood types. In all cases, however, the court shall determine the number and qualifications of the experts. An order issued under this subsection is enforceable by contempt; except that if the petitioner refuses to submit to an order for a blood test, the court upon motion of the defendant may dismiss the suit.

(Emphasis added). IND. CODE ANN. § 31-6-6.1-8 (Burns 1980) provides:

> 31-6-6.1-8. *Order for medical tests.*—Upon the motion of any party, the court shall order all of the parties to the action to undergo either a blood grouping test *or a Human Leukocyte Antigen (HLA) tissue test*. The tests shall be performed by a qualified expert approved by the court, and the results of the tests may be received in evidence.

(Emphasis added).

171. Letter from Dr. Herbert F. Polesky, Director, Minneapolis War Memorial Blood Bank, Minneapolis, Minnesota, to author (Feb. 26, 1981) (on file with the *Washington University Law Quarterly*); telephone interview with Dr. Benjamin W. Grunbaum, Research Biochemist, University of California-Berkeley (Feb. 25, 1981).

172. Hennepin County Welfare Bd. v. Ayers, 304 N.W.2d 879 (Minn. 1981) (en banc). In *Ayers*, red cell antigen and enzyme-protein tests showed that there was a probability of 99.9% that the appellee was the father of appellant's child. Brief of Appellant, Hennepin County Welfare Bd. v. Ayers, 304 N.W.2d 879 (Minn. 1981), at app. 4. The trial court excluded the evidence, which appellant proposed to use in order to prove that appellee was the father. The Minnesota Supreme Court reversed and remanded, holding that whenever a proper foundation is laid for the evidence, results of blood tests that do not exclude the putative father are admissible to show paternity. 304 N.W.2d at 882. Because the trial court had sustained appellee's objection to appellant's pre-trial motion to admit the evidence, the supreme court did not have to reach the question of the validity of enzyme-protein testing.

committed the crime.[173] For purposes of blood analysis, there is no distinction between criminal prosecutions and paternity proceedings, because the issue—identity—is the same in both. The fact that the use of enzyme-protein tests is of relatively recent vintage and therefore not widespread should not preclude the admission of enzyme-protein test results.[174]

III. THE EXCLUSIONARY RULE

A. *The Rule and Alternatives*

Many courts and state legislatures view the *Frye* requirement of general scientific acceptance[175] as an inadequate safeguard in paternity proceedings. *Frye* established a competence rule that helps to protect the putative father in paternity cases from an adverse decision grounded on erroneously admitted unreliable scientific evidence. The rule, however, does not consider the possible prejudicial effect of admitting scientific evidence that satisfies the test for reliability. Both courts and legislatures, therefore, have attempted to safeguard the putative father further by refusing to admit evidence of blood test results that do not exclude the accused conclusively.[176]

This exclusionary rule resulted from the fear that evidence of nonexclusion might so color the paternity proceeding that the jury might de-

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173. State v. Washington, 229 Kan. 47, 622 P.2d 986 (1981); State v. Rolls, 389 A.2d 824 (Me. 1978); Robinson v. State, 47 Md. App. 558, 425 A.2d 211 (Ct. Spec. App. 1981).

174. [I]n an age when one scientific advancement tumbles in rapid succession upon another and may be known only among a limited circle of scientists, we are not inclined to adopt a standard that would deprive the judicial process of relevant scientific evidence simply because it is of recent vintage or because knowledge of the principles . . . is limited to a small but highly specialized group of experts. Tests that have passed from the experimental stage may be admissible if their reliability is reasonably demonstrable.

. . . We do not intend, however, that a courtroom should be a forum of scientific experimentation. Adjudication means fact-finding, and while speculation is not legitimate in that process, a trier of fact should not be deprived of scientific data because some controversy attaches to it. Management of doubt is a major aspect of our rules of procedure and evidence, and that which reasonably leads to resolution of doubt and ascertainment of truth should be adducible.

Phillips *ex rel.* Utah State Dep't of Social Servs. v. Jackson, 615 P.2d 1228, 1234-35 (Utah 1980). *See also* People v. Williams, 164 Cal. App. 2d 858, 862, 331 P.2d 251, 254 (1958), in which the court said that the nalline test to detect narcotics "has been generally accepted by those who would be expected to be familiar with its use. In this age of specialization more should not be required."

175. *See* notes 128-31 *supra* and accompanying text.

176. *See* note 187 *infra* and accompanying text.

cide the case on an improper basis.[177] The fear was once a rational one. Most jurisdictions adopted the exclusionary rule when red cell antigen tests were the only ones available for paternity testing. Because red cell antigen tests provide a relatively low probability of exclusion,[178] the jury cannot accurately infer that a nonexcluded accused man is actually the biological father.[179] Nonexclusion by red cell antigen tests is at best inconclusive,[180] and thus the "practical value" of red cell antigen tests "is a negative one."[181] States adopted the exclusionary rule because they feared that the admission of such inconclusive evidence, coupled with the deference that lay jurors often give scientific evidence,[182] would unfairly prejudice the alleged father.[183]

Although the fear of prejudice was reasonable, one may question the wisdom of the exclusionary rule as applied to even nonexclusionary red cell antigen test results. It seems more sound to admit the evidence and allow the jury to consider it. The issue in a paternity proceeding is the identity of the biological father, and evidence that blood testing failed

177. Frye v. United States, 293 F. 1013 (D.C. Cir. 1923), established an evidentiary competence doctrine based on the supposed unreliability of scientific techniques that have not gained general acceptance within the relevant scientific circle. In contrast, the traditional rule that nonexclusionary blood test evidence is inadmissible is based upon considerations of legal relevance. The argument is thus incorrect that "[t]he traditional approach falsely assumes that only evidence which proves a disputed fact with certainty is admissible to prove that fact." Comment, *The Use of Blood Tests to Prove Paternity in California*, 3 U.S.F.L. REV. 297, 302 (1969). Evidence that blood tests have failed to exclude a putative father obviously is logically relevant to the determination of the question whether the accused is the biological father of the illegitimate child. *See* note 52 *supra* and accompanying text. It is excluded as *legally irrelevant*, however, because of the fear that its admission as affirmative evidence of paternity will unfairly prejudice the accused father. *See* notes 178-83 *infra* and accompanying text. FED. R. EVID. 403 codifies the legal relevance doctrine. *See* note 153 *supra*.

178. *See* note 51 *supra* and accompanying text.

179. An accused man not excluded by ABO testing, for example, nevertheless has only a low probability of being the actual father. "Thus, for purposes of blood test evidence, any random male could have been the father almost as easily as the nonexcluded putative father." Terasaki, *supra* note 43, at 543.

180. *See id.*

181. Malvasi v. Malvasi, 167 N.J. Super. 513, 514, 401 A.2d 279, 279 (1979).

182. Jury deference to scientific evidence is a tenuous justification for the exclusionary rule. Empirical studies suggest that it is false to assume that jurors unqualifiedly acquiesce in scientific findings. *See* Carlson, Pasano & Jannuzzo, *The Effect of Lie Detector Evidence on Jury Deliberations: An Empirical Study*, 5 J. POLICE SCI. & AD. 148 (1977); Markwart & Lynch, *The Effect of Polygraph Evidence on Mock Jury Decision-Making*, 7 J. POLICE SCI. & AD. 324 (1979). *See also* Tarlow, *Admissibility of Polygraph Evidence in 1975: An Aid in Determining Credibility in a Perjury-Plagued System*, 26 HASTINGS L.J. 917, 928 (1975).

183. *See* Goodrich v. Norman, 100 Misc. 2d 33, 38, 421 N.Y.S.2d 285, 288 (Fam. Ct. 1979).

to exclude the putative father is clearly relevant to that inquiry.[184] Moreover, evidence with a basis in reliable scientific fact lends objectivity to a proceeding that is otherwise highly subjective and often emotional.[185] Any scientific evidence thus seems better than none. A cautionary instruction to the jury regarding the weight of the evidence would in most cases counter the danger of prejudice.[186] Nevertheless, the exclusionary rule remains effective in at least twenty states.[187]

184. Dean McCormick argues that "[t]he question is one of identity. Every identifying mark of the father, however common the trait, (so long as not universal) such as height, weight, color of hair, is relevant, and it is from the accumulation of identifying traits that circumstantial proof of identity gains its persuasive power." C. MCCORMICK, *supra* note 44, § 211, at 522.

185. *See* notes 27-29 *supra* and accompanying text; note 203 *infra* and accompanying text.

186. The jury must be made acutely aware that the mere fact that blood tests have not excluded the accused is not dispositive. It should be informed of the percentage of the population that possesses the same blood type as do the putative father and the child. Furthermore, the jury must be told that it cannot disregard the other evidence in the case. If the evidence is nevertheless too prejudicial, the trial judge always may exclude it in his discretion. *See* note 153 *supra*.

187. The majority of states has adopted the exclusionary rule by statute. ALA. CODE § 26-12-5 (1975); ARK. STAT. ANN. § 34-705.1 (1962); CAL. EVID. CODE § 895 (Deering 1966); CONN. GEN. STAT. § 46b-168 (1979); IDAHO CODE § 7-1115 (1979) (as construed by Isaacson v. Obendorf, 99 Idaho 304, 581 P.2d 350 (1978)); ILL. ANN. STAT. ch. 40, § 1401 (Smith-Hurd 1980); MD. ANN. CODE art. 16, § 66G (1981); MASS. ANN. LAWS ch. 273, § 12A (Michie/Law Co-op 1980); MICH. STAT. ANN. § 25.496(d) (1974); MISS. CODE ANN. § 93-9-27 (1972); N.J. STAT. ANN. § 2A:83-2, -3 (West 1976); N.Y. JUD.-CT. ACTS LAW § 532 (McKinney Supp. 1980); OHIO REV. CODE ANN. § 3111.16 (Page 1980); OKLA. STAT. ANN. tit. 10, § 504 (West Supp. 1980); 42 PA. CONS. STAT. ANN. § 6136 (Purdon Supp. 1981); TENN. CODE ANN. § 36-228 (1977); W. VA. CODE § 48-7-8 (1980). The exclusionary rule in five of those states—California, Illinois, Mississippi, Oklahoma, and Pennsylvania—is not found in the statutory language but, rather, is implied by the deletion or change of the language contained in the uniform acts that would allow the judge discretion to admit nonexclusionary blood test results. *See* note 191 *infra* and accompanying text. Three states embrace the exclusionary rule by judicial decision. Simons v. Jorg, 375 So. 2d 288 (Fla. Dist. Ct. App. 1979); T.A.L.S. v. R.D.B., 539 S.W.2d 737 (Mo. Ct. App. 1976); State *ex rel.* Wollock v. Brigham, 72 S.D. 278, 33 N.W.2d 285 (1948).

Courts disagree about the evidentiary weight to be accorded blood tests that conclusively exclude the putative father. Three views exist. The majority of courts holds, with Dean McCormick's approval, *see* C. MCCORMICK, *supra* note 44, § 211, at 522, that blood tests that exclude the putative father are conclusive on the issue of paternity. *E.g.,* Kusior v. Silver, 54 Cal. 2d 603, 620, 354 P.2d 657, 668-69, 7 Cal. Rptr. 129, 140-41 (1960); V.L.P. v. J.S.S., 407 A.2d 244, 248-49 (Del. Fam. Ct. 1978); Durfrene v. Durfrene, 366 So. 2d 1016, 1017 (La. App. 1978); Ross v. Marx, 21 N.J. Super. 95, 99, 90 A.2d 545, 546, *aff'd,* 24 N.J. Super. 25, 93 A.2d 597 (1952); Anonymous v. Anonymous, 1 A.D.2d 312, 316, 150 N.Y.S.2d 344, 348 (1956); State *ex rel.* Lyons v. De Valk, 47 Wis. 2d 200, 204, 177 N.W.2d 106, 108 (1970). In *Ross*, the court said that "[f]or a court to declare that these tests are not conclusive would be as unrealistic as it would be for a court to declare that the world is flat." 21 N.J. Super. at 99, 90 A.2d at 546. The second view is that exclusionary blood test results are not conclusive but should be given great weight in the determination of paternity. *E.g.,* Beck v. Beck, 153 Colo. 90, 92-93, 384 P.2d 731, 732 (1963). The third view, the distinct minority, is that exclusionary test results are merely ordinary evidence that the jury should consider with other evidence in the case. *E.g.,* People *ex rel.* De Vos v. Laurin, 73 Ill. App. 3d 219,

Two uniform acts provide a compromise between the strict exclusionary rule and unqualified admissibility of nonexclusionary blood test results. The Uniform Act on Paternity and the Uniform Act on Blood Tests to Determine Paternity allow the trial judge discretion to admit nonexclusionary blood test results as affirmative evidence of paternity, depending upon the rarity of the child's and the putative father's blood type.[188] The judge probably would exclude evidence that a nonexcluded accused father must have belonged to groups A, B, or O, which comprise ninety-seven percent of the population, but he likely would admit evidence that the accused must have belonged to groups B or AB, which comprise only thirteen percent.[189] Nonexclusionary HLA and enzyme-protein test results would be admissible in most cases because of the infrequency with which the genetic markers for those systems occur in the population. The Acts thus provide a more flexible standard and yet maintain adequate safeguards for the accused. Today, seven of the twelve states that have enacted one or both of them have adopted the language that allows judicial discretion in admitting nonexclusionary blood test evidence.[190] The other five states, however,

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223, 391 N.E.2d 164, 167 (1979); State v. Camp, 286 N.C. 148, 152-53, 209 S.E.2d 754, 756-57 (1974). The most noted case is Berry v. Chaplin, 74 Cal. App. 2d 652, 169 P.2d 442 (1946), in which blood tests showed that Charles Chaplin, the defendant, could *not* have been the father of plaintiff's child. The court held, however, that the question was for the jury because the blood test evidence conflicted with the plaintiff's testimony that she had sexual intercourse with Chaplin at the critical conception time. *Id.* at 664-65, 169 P.2d at 451. The states, including California, that have adopted various forms of the uniform acts, *see* notes 188-94 *infra* and accompanying text, have abolished the *Chaplin* rule by providing that blood tests are conclusive whenever they show that the accused could not be the biological father.

188. Both the Uniform Act on Paternity and the Uniform Act on Blood Tests to Determine Paternity provide:

> If the court finds that the conclusions of all the experts, as disclosed by the evidence 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. If the experts conclude that the blood tests show the possibility of the alleged father's paternity, admission of this evidence is within the discretion of the court, depending upon the infrequency of the blood type.

UNIFORM ACT ON PATERNITY § 10; UNIFORM ACT ON BLOOD TESTS TO DETERMINE PATERNITY § 4.

189. *See* C. MCCORMICK, *supra* note 44, § 211, at 522-23.

190. COLO. REV. STAT. § 13-25-126(c)(III) (Supp. 1980); KY. REV. STAT. ANN. § 406.111 (Baldwin 1979); ME. REV. STAT. ANN. tit. 19, § 280 (1981); N.H. REV. STAT. ANN. § 522:4 (1974); OR. REV. STAT. § 109.258 (1979); R.I. GEN. LAWS § 15-8-14 (Supp. 1980); UTAH CODE ANN. §§ 78-25-21, -45(a)-10 (1977).

Seventeen other states allow admission of nonexclusionary blood test results as affirmative evidence of paternity. Eight of them allow the jury to consider the fact of nonexclusion. Davis v.

have retained the exclusionary rule by deleting or changing the language.[191]

The Uniform Parentage Act rejects the exclusionary rule entirely by opting for unrestricted admission of nonexclusionary blood test results. Section 12 provides in part that "[e]vidence relating to paternity may include . . . blood test results, weighted in accordance with evidence, if available, of the statistical probability of the alleged father's paternity."[192] The Act allows the jury not only to infer paternity from nonexclusion but also to hear the expert's appraisal of the "probability of paternity."[193] Presently, seven states have adopted section 12 of the Uniform Parentage Act, and nine allow admission of probability statistics.[194]

Holloway, 265 S.E.2d 264 (S.C. 1980); ARIZ. REV. STAT. ANN. § 12-847C (Supp. 1980); GA. CODE ANN. §§ 74-306, -307(a) (1981); IND. CODE ANN. § 31-6-6.1-8 (Burns 1980); KAN. STAT. ANN. § 23-131 (1974); TEX. FAM. CODE ANN. § 13.06 (Vernon Supp. 1980); VA. CODE § 20-61.2 (Supp. 1980); WIS. STAT. ANN. § 885.23 (West Supp. 1980) (effective July 1, 1981). The remaining nine states, the most liberal, allow the jury to consider the probability statistics that indicate the relative chances of the alleged father's paternity. *See* note 194 *infra*.

191. CAL. EVID. CODE § 895 (Deering 1966) (omits language giving judge discretion); ILL. ANN. STAT. ch. 40, § 1401 (Smith-Hurd 1980) (changes language to allow only exclusionary test results); MISS. CODE ANN. § 93-9-27 (1972) (omits language giving judge discretion); OKLA. STAT. ANN. tit. 10, § 504 (West Supp. 1980) (changes language to "[e]vidence of the 'possibility' of paternity shall be inadmissible"); 42 PA. CONS. STAT. ANN. § 6136 (Purdon Supp. 1981) (omits language giving judge discretion).

192. UNIFORM PARENTAGE ACT § 12(3). Section 12 provides five categories of admissible evidence:

> Evidence relating to paternity may include:
>
> (1) evidence of sexual intercourse between the mother and alleged father at any possible time of conception;
>
> (2) an expert's opinion concerning the statistical probability of the alleged father's paternity based upon the duration of the mother's pregnancy;
>
> (3) blood test results, weighted in accordance with evidence, if available, of the statistical probability of the alleged father's paternity;
>
> (4) medical or anthropological evidence relating to the alleged father's paternity of the child based on tests performed by experts. If a man has been identified as a possible father of the child, the court may, and upon request of a party shall, require the child, the mother, and the man to submit to appropriate tests; and
>
> (5) all other evidence relevant to the issue of paternity of the child.

193. *See* note 192 *supra*. Introduction of the alleged father's probability of paternity involves legal relevance problems not present in merely admitting evidence that blood tests failed to exclude the accused. *See* notes 221, 224-31 *infra* and accompanying text.

194. Seven states have adopted § 12 of the Uniform Parentage Act. COLO. REV. STAT. § 19-6-113(c) (1978); HAWAII REV. STAT. § 584-12(3) (1976); MINN. STAT. ANN. § 257.63(1)(c) (West Supp. 1981); MONT. REV. CODES ANN. § 40-6-113(3) (1979); N.D. CENT. CODE § 14-17-11(3) (Supp. 1977); WASH. REV. CODE ANN. § 26.26.110(3) (Supp. 1980); WYO. STAT. § 14-2-110(iii) (1978). Two other states allow admission of a calculated probability of paternity. NEV. REV. STAT. § 56.020 (1979); N.C. GEN. STAT. § 49-7 (Supp. 1975), § 8-50.1(a),-(b) (Cum. Supp. 1979).

The exclusionary rule clearly provides the greatest obstacle to the use of blood test evidence, including HLA and enzyme-protein test results, in disputed paternity cases. At least twenty states obstinately adhere to it.[195] Advances in technology, however, have vitiated any need for retaining the rule.

B. *Unjustified Adherence to the Rule*

The extreme accuracy of modern blood tests has made the exclusionary rule obsolete. No longer is the failure of blood tests to exclude an accused man inconclusive as to whether he is in fact the biological father. When tests with a cumulative probability of exclusion of ninety-seven to ninety-nine percent[196] do not exclude the accused, the jury properly may infer that there is a high probability that he is the true father.[197] In such cases, fear that the jury might wrongfully infer paternity from evidence of nonexclusion[198] no longer justifies the exclusionary rule.[199]

Disenchantment with the rule has led several courts to use its underlying rationale as a means to circumvent the language of exclusionary statutes. The rule was adopted to prevent the admission of inconclu-

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195. *See* note 187 *supra* and accompanying text. The standard in six states—Alaska, Delaware, Iowa, Nebraska, New Mexico, and Vermont—is unclear.

196. *See* notes 58-59 *supra* and accompanying text.

197. *AMA-ABA Guidelines, supra* note 4, at 260-61. "[I]t must be appreciated that the likelihood of paternity is very high if [tests with a cumulative probability of exclusion of 90% or greater fail] to obtain an exclusion. This fact coupled with the allegation of the mother makes the probability of paternity . . . very high indeed." Walker, *supra* note 57, at 84. Tests with a cumulative probability of exclusion of 97%, for example, will exclude 97 falsely accused men out of 100. Thus, out of the 100, only two others besides the nonexcluded putative father are capable of being the true father. When both the child and the putative father possess "an extremely rare inherited biochemical variant" but the mother does not, the "single locus is sufficient to strongly incriminate the putative father. . . . [T]he same degree of improbability . . . can also grow out of a collection of polymorphic genetic systems." Chakraborty, Shaw & Schull, *Exclusion of Paternity: The Current State of the Art*, 26 AM. J. HUMAN GENETICS 477, 485 (1974). The Uniform Act on Paternity and the Uniform Act on Blood Tests to Determine Paternity recognize the value of evidence that blood tests have not excluded a putative father who possesses a relatively rare blood type. *See* note 188 *supra* and accompanying text.

198. *See* notes 177-83 *supra* and accompanying text.

199. Abandonment of the exclusionary rule clearly depends upon the type of tests involved. It is arguable that even nonexclusionary red cell antigen test results should be admitted if there are proper procedural safeguards. *See* notes 184-86 *supra* and accompanying text. Obviously the rule should not apply to highly accurate—and therefore highly probative—HLA and red cell enzyme and serum protein test results.

sive red cell antigen test results.[200] Therefore, the courts reason, the rule should not apply to the results of highly probative tests, such as HLA, that were nonexistent when the legislatures enacted it.[201]

Today the exclusionary rule provides too much protection for a putative father. Because of the usually small number of men whom a mother can accuse in any one case, it is highly likely that a nonexcluded putative father is the biological parent. It is anomalous to deny

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200. *See* notes 177-83 *supra* and accompanying text.

201. Cramer v. Morrison, 88 Cal. App. 3d 873, 153 Cal. Rptr. 865 (1979); Carlyon v. Weeks, 387 So. 2d 465 (Fla. Dist. Ct. App. 1980); Miller v. Smith, No. 79-M1-185098 (Ill. Cir. Ct. Cook County May 27, 1980); Camden County Bd. of Social Servs. v. Kellner, No. DR-466-76 (N.J. Juv. & Dom. Rel. Ct. Camden County Jan. 28, 1980). *See also* Phillips *ex rel.* Utah State Dep't of Social Servs. v. Jackson, 615 P.2d 1228 (Utah 1980).

However proper the result, a decision to ignore the plain language of a statute creates a conflict between judges and legislators. Whether judicial legislation is proper in the context of circumventing exclusionary statutes is a question that need not be resolved here. It suffices to say that there are strong arguments supporting both sides. On the one hand, it is arguable that "[a] statute must be read and given effect as it is written by the Legislature, not as the court may think it should or would have been written if the Legislature had envisaged all of the problems and complications which might arise in the course of its administration." N.Y. STATUTES § 73 (McKinney 1971). The amount of protection to be afforded an accused father is more a question of public policy than a rule of evidence, and courts might be wise to leave the decision to abandon the exclusionary rule to the legislatures. Indeed, at least two courts have refused to ignore the clear legislative mandate that nonexclusionary blood test results should not be admitted in paternity proceedings. Goodrich v. Norman, 100 Misc. 2d 33, 421 N.Y.S.2d 285 (Fam. Ct. 1979); J.B. v. A.F., 92 Wis. 2d 696, 285 N.W.2d 880 (Ct. App. 1979). Although one court has suggested that a legislative rule proscribing the admission of nonexclusionary test results unconstitutionally violates the doctrine of separation of powers by encroaching upon the prerogative of the courts, Miller v. Smith, No. 79-M1-185098, slip op. at 6 (Ill. Cir. Ct. Cook County May 27, 1980), circumvention of exclusionary statutes under the guise of "interpretation" is little more than judicial usurpation of the legislative function.

On the other hand, it is arguable that courts must be able to assess the interpretative intent of the legislature in order to give flexibility to the law. Because the legislature might not, or could not, have foreseen subsequent developments, literal interpretation of statutes often produces an inflexible standard that is unworkable in changing times. Moreover, the process of ascertaining interpretative intent is hardly foreign to the courts. It occurs frequently in a variety of contexts. In commercial settings, for example, judges must determine the intent of the parties in order to decide whether they actually intended to create a contract and, if so, to determine its terms. *See* U.C.C. § 2-204(3). In constitutional adjudication, courts cannot rely upon the intent of the framers in deciding issues such as the constitutionality of electronic surveillance techniques, *see* Irvine v. California, 347 U.S. 128 (1954), or television cameras in the courtroom, *see* Chandler v. Florida, 101 S. Ct. 802 (1981); Estes v. Texas, 381 U.S. 532 (1965), because it is clear that the framers never could have anticipated them. Thus, courts should be allowed to carry out the process of interpretation for which they are uniquely suited.

Given the potential for controversy and the difficulties inherent in attempting to ascertain interpretative legislative intent, the legislatures should reconsider the question and declare present policy in order to resolve the dispute.

admission of highly probative nonexclusionary blood test results in paternity proceedings but allow it in criminal cases in which the stakes may be considerably higher.[202] The nongenetic evidence in a paternity case often consists of little or nothing more than the biased testimony of the mother and the putative father.[203] Exclusion of blood test evidence may therefore create a subjective credibility contest that obfuscates the truth and results in a miscarriage of justice. It would be far better to admit the evidence, provided there are adequate procedural safeguards.[204]

The question is one of establishing a priority for the interests involved. The mother, the putative father, and the state certainly have interests in the outcome of the paternity proceeding.[205] The child, though, is the primary beneficiary of the determination of parentage. Recent Supreme Court decisions have struck down distinctions between legitimate and illegitimate children.[206] Refusing to allow blood test evidence to prove paternity, while admitting it for disproval, seems to offend the policy of granting equality to illegitimates.[207] One court has suggested that refusing to admit nonexclusionary blood test results

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202. *See* Shanks v. State, 185 Md. 437, 45 A.2d 85 (Ct. App. 1945). In *Shanks*, there was evidence that type O blood found on defendant's coat was the same type as the victim's blood. The court noted that approximately 45% of the population possesses type O blood, *id.* at 445, 45 A.2d at 88, but it rejected defendant's contention that the blood test evidence and the other evidence was too remote to be admissible:

> [Neither the blood test evidence nor the other corroborative evidence], standing alone, would prove conclusively that appellant was the guilty man, but taken together they constitute a chain of circumstantial evidence tending to . . . support the inference that the accused was the person who committed the crime.
>
> The objection of remoteness goes to the weight of the evidence rather than to its admissibility. To exclude evidence merely because it tends to establish a possibility, rather than a probability, would produce curious results not heretofore thought of. . . . Similar evidence [to that placing defendant near the scene of the crime] has never been questioned as being too remote. That is a question of weight to be determined by the court or the jury.

Id. at 446-47, 45 A.2d at 89.

The prosecution must prove criminal charges beyond a reasonable doubt, but the proponent in a civil paternity proceeding needs only a preponderance of the evidence in order to prevail. *E.g.*, G.L. v. S.D., 403 A.2d 1121 (Del. 1979); State *ex rel.* Brown v. Middleton, 259 Iowa 1140, 147 N.W.2d 40 (1966). The difference in the burden of proof, however, is irrelevant in deciding whether to admit nonexclusionary blood test evidence. The issue—the question of identity—is the same in both contexts.

203. *See, e.g.*, B.S.H. v. J.J.H., 613 S.W.2d 453, 457 (Mo. Ct. App. 1981).

204. *See* note 186 *supra* and accompanying text.

205. *See* notes 22-26, 30-37 *supra* and accompanying text.

206. *See* notes 15-20 *supra* and accompanying text.

207. *See* Comment, *supra* note 177, at 310.

"might be in violation of due process of law."[208]

The decision to admit nonexclusionary blood test results necessarily involves a determination of the scope of admissibility. Two alternatives exist. The first is to allow the jury to consider the fact of nonexclusion in the context of the probability that the given test systems would have excluded the putative father if he were falsely accused. The second, more dangerous and controversial, is to admit the expert's determination of the probability that the accused is the true father.

Abandonment of the exclusionary rule requires, at base, that the jury be allowed to draw inferences from the fact that blood testing did not exclude the putative father. The likelihood that the accused is the true father increases proportionately with increases in the cumulative probability of exclusion of the test systems employed.[209] The chance that the accused is the actual father is therefore greater if the probability of exclusion is ninety-five percent than if it is eighty-five percent. Under this approach, the jury itself must assess the raw data.

The value of the HLA and enzyme-protein systems, however, lies in their ability to enable the analyst to calculate a relatively certain mathematical probability that the accused is the actual father.[210] The *probability of paternity* is extrapolated from evidence of nonexclusion. Dangers inhere in the use of the probability of paternity, but it is, when properly calculated,[211] the most effective method for "assess[ing] the likelihood associated with the failure of genetic evidence to give a conclusive answer."[212] When stated as a percentage, the probability of paternity provides the jury with an effective tool for resolution of parentage questions.

The Uniform Parentage Act recognizes the value of statistical evidence indicating probability of paternity. It codifies the practice that European courts have used for several years[213] by allowing admission

208. Goodrich v. Norman, 100 Misc. 2d 33, 39, 421 N.Y.S.2d 285, 289 (Fam. Ct. 1979).

209. The probability of exclusion of a given blood test system is the percentage chance that testing with that system would have excluded a falsely accused man. *See* note 47 *supra* and accompanying text.

210. *See* Lee, *supra* note 12; Lee, Lebeck & Wong, *supra* note 76; Walker, *supra* note 57.

211. No one method exists for calculating the probability of paternity. At least one cannot be used because it would unfairly prejudice the putative father. *See* note 221 *infra* and accompanying text. The American Association of Blood Banks is planning an international workshop for 1982 in an effort to standardize the approach to the problem. Letter from Dr. William V. Miller, *supra* note 107.

212. Grunbaum, Selvin, Myhre & Pace, *supra* note 101, at 428.

213. *See* Krause, *The Uniform Parentage Act*, 8 FAM. L.Q. 1 (1974); Lee, *supra* note 12, at 523.

of "blood tests results, weighted in accordance with evidence, if available, of the statistical probability of the alleged father's paternity."[214] The American Medical Association and the American Bar Association also recommend that a blood test report that includes an estimation of the probability of paternity "be received in evidence by stipulation of the parties or by order of the court."[215]

The probability of paternity expresses as a percentage the chance that the nonexcluded accused is the true father compared to the chance that either the accused or a random man is the true father.[216] Using known frequencies of genetic markers in the population,[217] the analyst calculates the chance that the mating of either the mother and the alleged father or the mother and a random man would produce a child with the genetic markers in question.[218] Using these data, the probability of paternity can be determined simply[219] by applying the Essen-Möller version of Bayes' Theorem.[220] Unlike Bayes' Theroem, which has been criticized, the Essen-Möller formula properly leaves the

214. UNIFORM PARENTAGE ACT § 12(3). *See* note 192 *supra* for the full text of § 12. To date, seven states have adopted § 12 of the Uniform Parentage Act. *See* note 194 *supra*.

215. *AMA-ABA Guidelines, supra* note 4, at 283.

216. Terasaki, *supra* note 43, at 549. The probability of paternity is not necessarily equivalent to the probability of exclusion. Because the two are calculated differently, cases in which they might be equal arise merely by coincidence. The probability of exclusion merely expresses the chance that a given system of genetic markers will exclude a falsely accused man. *See* note 47 *supra*. The probability of paternity expresses the chance that a nonexcluded putative father can pass the given genetic markers in relation to the chance that either the putative father or a random man could pass them. *See* notes 217-21 *infra* and accompanying text.

217. For figures on gene, phenotype, and haplotype frequencies for HLA testing, see Miller, *supra* note 62, at 57-58; *AMA-ABA Guidelines, supra* note 4, at 273-75. For data on phenotype and gene frequencies for enzyme-protein testing, see Grunbaum, Selvin, Myhre & Pace, *supra* note 101, at 437-38; Grunbaum, Selvin, Pace & Black, *supra* note 101, at 582-83.

Gene frequencies vary significantly among various races. It is therefore necessary to know the racial background of the parties involved in order to obtain an accurate determination of the probability of paternity. The analyst should also consider the "possibilities of genetic variances, phenotypes missing from a survey of a small population, and mixed racial heritage." Lee, *supra* note 12, at 533.

218. Six assumptions are inherent in the probability determination: (1) that the mother is the biologic mother; (2) that no mutations have affected the blood group genes; (3) that each party (mother, child, and putative father) was positively identified; (4) that no clerical errors have occurred in labeling the specimen tubes, aliquoting the specimens, and recording the results; (5) that the reagents used in the tests were potent and specific; and (6) that all tests were performed properly with attention to detail and correct procedures. Walker, *supra* note 57, at 69.

219. The calculation "can be easily accomplished with the help of a calculator for routine purposes or with a computer for a large workload." Lee, Lebeck & Wong, *supra* note 76, at 222.

220. *See* text accompanying note 216 *supra*. The Essen-Möller formulation of Bayes' Theorem is relatively simple:

task of weighing the genetic and nongenetic evidence to the jury, because it focuses solely on the genetic probabilities without considering nongenetic evidence.[221]

$$W = \frac{X}{X+Y} = \frac{1}{1+\frac{Y}{X}}$$

where W is the probability of paternity, X is the chance that the accused could pass the genetic markers involved, and Y is the chance that a random man could pass the genetic markers involved. *See* Walker, *supra* note 57, at 84-87. *See also AMA-ABA Guidelines, supra* note 4, at 260-62. For example, assume that X=0.25 and Y=0.0543. The formula yields the following result:

$$W = \frac{0.25}{0.25 + 0.0543}$$

$$= \frac{1}{1 + \frac{0.0543}{0.25}}$$

$$= \frac{1}{1.2172}$$

$$= .8216 \text{ or } 82.16\%$$

The probability of paternity is thus 82.16%, and the probability of nonpaternity is 100%-82.16%, or 17.84%. *See* Lee, Lebeck & Wong, *supra* note 76, at 222.

The theorem has both its opponents and proponents. In Langaney & Pison, *Probability of Paternity: Useless*, 27 AM. J. HUMAN GENETICS 558 (1975), the authors argue that "classical statistical testing using paternity probabilities does not allow safe decisions in cases of disputed paternity." *Id.* at 560. They contend that "[t]he only potential interest of the Bayesian probability method concerns the nonexcluded putative fathers. . . . [T]he method is powerless and should not be used because the risks of error are unacceptably high." *Id. But see* Valentin, *Statistical Evidence in Paternity Cases: Imperative*, 28 AM. J. HUMAN GENETICS 620, 621 (1976) ("a statement in a paternity case that a particular man is highly likely (or unlikely) to be the true father, based on Bayesian calculations, will seldom be erroneous").

221. The Essen-Möller version of Bayes' Theorem therefore is not amenable to the criticism leveled at Bayes' Theorem itself in Ellman & Kaye, *supra* note 34. In order to use Bayes' Theorem, one first must derive a probability from the nongenetic evidence. Bayes' Theorem is then used in order to demonstrate the impact of the genetic evidence on that prior probability. The article criticizes the use of Bayes' Theorem because the final determination of the probability of paternity is predicated upon the analyst's assessment of the probability resulting from the nongenetic evidence. The authors conclude that giving the jury a single numerical expression of the probability of paternity will unfairly prejudice the putative father. *Id.* at 1149-52.

The criticism of Bayes' Theorem is valid, because "[t]he question of prior probability . . . does not apply to paternity testing." Letter from Dr. C.L. Lee, Director, Charles Hymen Blood Center of Mt. Sinai Hospital Medical Center, Chicago, Illinois, to author (Jan. 29, 1981) (on file with the *Washington University Law Quarterly*). One analyst indicates that he begins with a prior 50-50 probability—assuming that the accused "is as likely as not, on the basis of other evidence, to be

Calculation of the probability of paternity offers a number of advantages. The most obvious is the fact that it is extremely probative on the question of the identity of the biological father, the central issue in a paternity proceeding.[222] Second, all of the parties involved can easily understand the meaning of the term "probability of paternity." Knowledge of genetics is not essential, because only simple genetic rules are involved and the probabilities for individual genetic markers have been published. Finally, the calculation considers the genetic composition of both the mother and the child, factors that greatly influence the determination of paternity.[223]

Submitting statistics to the jury always poses the danger that the evidence may overwhelm or mislead the jurors and unfairly prejudice the putative father. Testimony that there is a high probability that the accused is the biological father can be irreparably damaging. Because the evidence is "scientific," lay jurors may be tempted to accord it exaggerated weight. Furthermore, the distinction between the probability of exclusion and the probability of paternity may confuse the jury.

Arguably, testimony concerning the probability of paternity would

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the biological father"—and "leave[s] it to the jury and the attorneys to factor in their assessment of the strength of the other evidence and to arrive at an overall assessment." Letter from Dr. Ray Mickey, UCLA School of Medicine, Los Angeles, California, to author (Feb. 18, 1981) (on file with the *Washington University Law Quarterly*). The argument fails for three reasons. First, the putative father can never win. The only real controversy exists when the accused is not excluded. If one begins with a 50-50 prior probability, the fact of nonexclusion—the only reason for the case to be contested—automatically moves the probability above the 50% mark and thus satisfies the plaintiff's burden of proof. Second, there appears to be no basis for the 50-50 assumption. Ellman & Kaye, *supra* note 34, at 1150. Allowing the expert to base his conclusion upon a probability for which there is no foundation may prejudicially mislead the jury. *See* People v. Collins, 68 Cal. 2d 319, 438 P.2d 33, 66 Cal. Rptr. 497 (1968) (reversing the trial court's admission of evidence, based upon unfounded prior probabilities, that chances were 1/12,000,000 that another interracial couple could have possessed all the characteristics of the defendants). Third, although it is conceded that the probability based upon the 50-50 assumption is only *a* probability of paternity and not *the* probability of paternity, letter from Dr. Ray Mickey, *supra*, the jury may not fully understand the distinction, and the putative father may thus be unduly prejudiced.

222. Professor Hummel's interpretation of the numerical probabilities is helpful in clarifying the meaning of the raw data. He suggests the following characterization of the evidence:

PROBABILITY	LIKELIHOOD OF PATERNITY
99.80%-99.90%	Practically proved
99.10%-99.75%	Extremely likely
95.00%-99.00%	Very likely
90.00%-95.00%	Likely
80.00%-90.00%	Undecided
Less than 80.00%	Not useful

AMA-ABA Guidelines, supra note 4, at 262.

223. Lee, *supra* note 12, at 523.

prejudice the accused no more than would other types of scientific evidence[224] and, in any event, presents a better alternative to the present system.[225] Allowing the jury to draw its own inferences from statistics, however, creates problems of jury control not present with other categories of scientific proof such as breathalyzer or fingerprint evidence. Courts therefore should admit statistics only if there are adequate procedural and substantive safeguards to ensure that the evidence is reliable and that the jury is able to assess it objectively.

Procedurally, the trial judge should require a strong foundation before admitting statistical evidence. Forcing the proponent to show that the analyst was fully qualified to perform the tests minimizes the chance that an overzealous analyst might submit inaccurate data.[226] Concomitantly, there must be a showing that the analyst conducted the tests properly, using antisera with a high degree of potency and specificity.[227] The blood test report should be highly detailed as to both the

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224. One court has argued that "[i]t certainly cannot be said that the admission of a positive finding of paternity would . . . create substantial danger of undue prejudice any more than any probative relevant scientific evidence such as breathalyzer, VASCAR, fingerprints, etc. . . . [T]he probative value of the probability of paternity outweigh[s] its possible prejudicial effect." Camden County Bd. of Social Servs. v. Kellner, No. DR-466-76, slip op. at 16 (N.J. Juv. & Dom. Rel. Ct. Camden County Jan. 28, 1980).

225. Evidence of physical resemblance of the child to the putative father is sometimes admitted, and it is anomalous to argue that blood test results, which "can also be used to show 'physical resemblance' between the child and the alleged father," would more confuse the jury and therefore should be excluded. Comment, *supra* note 177, at 306.

> There can be no logical distinction made between the evidence of physical resemblance which is corporeal and visible to the jury and resemblance which is chemical and must be shown by the use of tests. . . . [T]he only distinction that could be made is that the tests showing chemical resemblance are more objective, as they are not influenced by any subjective attitudes held by the jurors. . . . [I]n the case of corporeal physical resemblance, the inheritance of many of the traits which make up a person's general appearance is not well known, and it is not known how frequently the traits appear in the population. . . . The admission of such corporeal resemblance is therefore, more likely to mislead the jury than is the chemical resemblance shown by the tests. The inheritance of chemical traits is well known, and for most of them it is known how frequently they appear in the population. For these reasons, the evidence of the tests should not be excluded as tending to confuse or mislead the jury.

Id. at 306-07.

226. L. SUSSMAN, *supra* note 34, at 129-30. According to Sussman,

> [t]he number of errors which occur can be kept at a minimum only if every expert consulted by the courts limits his report to those tests for which that expert is fully qualified by study and experience. Unfortunately, there are experts who seem unable to resist the temptation to carry out tests . . . which they are not fully qualified to do, in order to make their report as "complete" as possible.

Id.

227. *Id.* at 129.

expert's findings and the bases for his opinion so that few questions, if any, are left unanswered.[228] Finally, unless the parties stipulate otherwise, the written report must be introduced by live sponsoring testimony so that the jury can hear the expert's explanation and evaluate his credibility and so that the opponent has an opportunity for cross-examination.[229]

Substantively, the expert should explain clearly the difference between the probability of exclusion and the probability of paternity[230] in order to minimize the possibility that the jury will misinterpret the statistical data. In addition, the judge should emphasize that the jury must consider all the evidence in the case. Such an instruction would help prevent the jury from giving undue weight to the probability of paternity in making the final determination. As a final check, the judge could allow admission of blood test results only to corroborate independent evidence, such as testimony that the putative father had sexual relations with the mother at the critical time.[231] The use of these safeguards largely negates the probative danger of admitting evidence of the probability of paternity.

IV. CONCLUSION

Blood testing today is a highly accurate science that can greatly assist courts in the resolution of disputed parentage questions. Both HLA

228. *AMA-ABA Guidelines, supra* note 4, at 282.

229. Courts should not always require that the expert who testifies be a licensed physician. Schedule exigencies dictate that physicians not spend a significant amount of time in court. Were they required to do so,

> the medical profession would not be of much help and we would have to bow out of the field. None of us [has] the time or inclination to spend all of our time in court. [If], on the other hand, testimony of technicians and technologists could be permitted, the situation would be more manageable.

Letter from Dr. William V. Miller, *supra* note 107. Laboratory technicians routinely perform paternity testing, and their testimony would suffice if they could demonstrate that they were qualified not only to perform the tests but also to explain the underlying theory and interpret the test results.

Courts should also be more willing to admit the evidence without live sponsoring testimony if the trial is to the court rather than before a jury. In such instances there is less danger of prejudice to the putative father, because judges are less likely than lay jurors to misunderstand the nature and limitations of the evidence.

230. *See* note 216 *supra* and accompanying text.

231. Comment, *supra* note 177, at 308. Restricting the use of blood test results to corroboration of independent evidence "would prevent the mother from using any previous knowledge of the genetic make-up of the defendant . . . and would prevent a 'trial by mathematics' without any other evidence." *Id. See also* 16 J. FAM. L. 537, 540-41 (1978).

and red cell enzyme and blood serum protein testing have proved reliable to an extraordinary degree. Courts have recognized that HLA is generally accepted within the medical profession as a viable method for paternity testing, and HLA results therefore should be admitted routinely in disputed paternity proceedings. Likewise, courts have recognized the general acceptance of enzyme-protein testing in other contexts, and they should adopt a policy of admission in paternity proceedings as well.

Given the extreme accuracy of HLA and enzyme-protein testing, rules rendering nonexclusionary blood test evidence inadmissible are obsolete. Today a falsely accused putative father can be excluded from paternity in excess of ninety-nine percent of all cases. When extensive testing fails to exclude an accused man, there usually exists a high probability that he is indeed the biological father. Evidence of nonexclusion, therefore, is highly probative on the question of the true father's identity, and it should not be withheld from the jury. Exclusionary statutes should be either repealed or narrowly construed, and cases adopting the exclusionary rule should be over-ruled.

Finally, courts should allow the jury to consider the probability of paternity. The calculation provides the most easily understood explanation for the failure of blood tests to exclude the accused. When attended by appropriate safeguards, the probative value of the probability of paternity outweighs any possible probative danger.

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