Are You My Mother? The Scientific and Legal Validity of Conventional Blood Testing and DNA Fingerprinting to Establish Proof of Parentage in Immigration Cases

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I. INTRODUCTION

Disputes regarding a child's parentage date back to biblical days,¹ but scientifically valid and legally acceptable tests which can help resolve these disputes have only recently been developed. These tests involve analyzing specific genetic traits that are present in a child and in her putative parents. Blood is extremely rich in such genetic markers: red cell groups, white cell (leukocyte) groups, serum groups, hemoglobin variants and deoxyribonucleic acid (DNA). These markers provide information about the biological relationship between a child and a putative parent.

In 8 U.S.C. § 1151, Congress established numerical limitations on the number of immigrant visas that will be granted each year by the United States. The statute also provides exemptions from those quotas for certain classes of immigrants, including immediate family members of United States citizens.² The exemption is only available to the “children, spouses, and parents of a citizen of the United States,”³ so the visa applicant has to prove that she meets the definition in order to qualify. Blood tests are one way a visa applicant can prove the parent-child relationship.

This Comment discusses the accuracy and reliability of the parentage tests and determines that these tests are reliable indicators of biological parentage. Results of these tests should be used by immigration officials to determine whether putative

¹. King Solomon resolved a dispute between two putative mothers by offering to cut the baby in half so that each claimant could share the child equally. One of the women relinquished her claim in order to spare her child's life, providing sufficient evidence to Solomon that she was the child's true mother. 1 Kings 3:16-27.
². 8 U.S.C. § 1151(b) (Supp. II 1990) provides that “[a]llien[s] described in this subsection, who are not subject to the worldwide levels or numerical limitations . . . of this section, are as follows: . . . (2)(A)(i) Immediate relatives.”
³. Id. § 1151(b)(2)(A)(i).
relatives of a naturalized United States citizen qualify for the immediate family exemption.

Part II of this Comment sets forth a case study where DNA testing was effectively used to determine the parentage of a naturalized United States citizen in order to qualify his Chinese parents for permanent residency. Part III discusses conventional blood testing methods—red blood cell grouping and human leukocyte antigen testing—and concludes that these tests, which are well accepted in the scientific community, are reliable and legally valid indicators of parentage. Part IV focuses on the newer and more powerful technique of DNA "fingerprinting," a process presently well accepted by molecular and cellular scientists. Part IV further demonstrates that DNA evidence provides clear evidence of a person's parentage which should be used in determining a visa applicant's eligibility for the immediate family exception.

II. THE SAGA OF JOHNNY A-LO HOANG—A CASE STUDY FOR DNA TESTING IN THE IMMIGRATION CONTEXT

In 1980, Johnny A-Lo Hoang and his family were forced out of Vietnam because they were Chinese. Johnny, then eleven years old, managed to escape with his younger brother and uncle to a refugee camp in Hong Kong. At the camp, the uncle was told that unless he claimed the two nephews as his sons, they would be split up and sent to different countries. The uncle did as he was instructed, claiming the boys as his sons in order to remain with them and take care of them. Later, Johnny, his brother, and his uncle were able to immigrate to the United States. Johnny became a United States citizen and, pursuant to 8 U.S.C. § 1151, petitioned for immediate family visas for his parents so that they, too, could come to America. However, when the consular officer in China, where his parents then lived, reviewed the refugee camp records reflecting Johnny's uncle's statement that he was his nephew's father, the consulate refused to approve the visas.

Johnny provided extensive documentary evidence to prove the relationship between Johnny A-Lo and his parents and to explain why his uncle claimed he was the boys' father. In addi-

4. I worked on Johnny's case while clerking at the law firm of Steptoe & Johnson in Washington, D.C. I gratefully acknowledge the firm's willingness to allow me to use the case as an example for this Comment.
tion to birth and marriage certificates from Vietnam and China, the petition included four types of documents. First, American school and church records showed that throughout Johnny A-Lo's stay in the United States he always publicly stated that his father (who was still living in China) was Jia Sheng Hoang and that the man he lived with (Hung Gia Hoang) was his uncle. Second, the uncle's rental records listed Johnny A-Lo and his brother as nephews. Third, in correspondence between Johnny A-Lo and his family and friends in China, he consistently referred to his parents (in China) and his uncle (in the United States). Finally, Johnny A-Lo and his uncle provided personal statements explaining the circumstances behind the uncle's claim in the Hong Kong camp that the children were his. Together, these documents offered resounding proof of the required family relationship between Johnny A-Lo Hoang and his parents in China. State Department officials, however, still refused to grant the immediate family visas. Only after Johnny A-Lo and his mother submitted the results of blood grouping and DNA tests did the State Department grant Johnny A-Lo's petition and approve his parents' visas.

Although the tests conducted on Johnny and his mother have not, as yet, been widely used to resolve similar cases, the remainder of this Comment discusses the tests and demonstrates their usefulness for immigration lawyers.

III. DETERMINING PARENTAGE THROUGH CONVENTIONAL BLOOD TESTING

As used in this Comment, "conventional blood testing" refers to two well-known and long-established blood testing methods: red blood cell grouping and human leukocyte antigen testing. These tests indicate parentage by identifying genetic markers which, under the laws of heredity, will be similar in parent and child.

A. Red Blood Cell Grouping Is Well Accepted by the Scientific Community

One of the best-known methods of testing a child's parentage involves comparing the blood groups of the putative mother or father with that of the child. The term "blood groups" denotes the factors that differentiate red blood cells.5 Blood-

5. See generally Patricia Tippett, Blood Group Genetics and Paternity Test-
grouping tests identify a physically discernible genetic characteristic, known as a genetic marker, present in the blood. The most common blood group test is the ABO red blood cell antigen test.

The ABO test classifies blood into one of four categories: A, B, AB, and O. A child inherits from each parent one of three genes, A, B or O, with the A and B genes being co-dominant and the O gene being recessive. Blood group testing compares a child’s blood type with those of the putative parents. For example, if both parents are type A, their child may be either A or O; if the child is type B, he cannot be that couple’s offspring. Similarly, a father with blood type AB cannot have a type O child because the A and B genes are co-dominant. By this process, scientists can reliably exclude a putative parent from consideration as the child’s biological parent.

B. Determining Parentage Through HLA Testing

The human leukocyte antigen (HLA) test is a tissue-typing test developed to determine whether, in a human organ transplant, the recipient’s system will accept or reject the transplanted tissue. The chromosomes in a person’s cells contain an “HLA region,” which plays a major role in the survival or rejection of transplanted or grafted tissue. The chromosomes located in the HLA region control production of specific antigens; those antigens in turn stimulate the production of antibodies when cells containing the antigens are introduced into another person’s body. The antigens can be detected by combining a small amount of a person’s tissue (usually white blood cells from a blood sample) with certain reagents that indicate the presence of specific antigens.

The HLA test, as applied to parentage determinations, identifies and types antigen markers found in white blood cells and other bodily tissues. Because HLA antigens are inherited, it is possible, by identifying a child’s antigens, to determine
with a high degree of certainty those that were inherited from the child's parents. "This high degree of discrimination in either excluding or including . . . [a putative parent] is a result of the extreme diversity of HLA types in the population. Most people are 'rare' types because only about one out of a thousand people will have a similar HLA type."9

HLA testing is well accepted by the scientific community as a reliable indicator of parentage, and the substantial weight of medical authority attests to the accuracy of the HLA test.10

C. Conventional Blood Testing in Immigration and Paternity Cases Is Legally Valid and Provides Probative Evidence of Parentage

1. Conventional blood testing provides conclusive proof of exclusion

Conventional blood testing has been used in immigration proceedings and in paternity disputes for many years, and is widely regarded as conclusive proof of exclusion (that is, that a putative parent could not be a child's biological parent).11

In immigration matters, blood test results have long been accepted to refute claims of derivative citizenship by proving that a putative parent could not be the biological parent of a particular child.12 Because conventional blood testing is such a

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11. See, e.g., Jackson v. Jackson, 430 P.2d 289, 291 (Cal. 1967) (stating that blood-grouping tests are admissible to rebut presumption of paternity); Dodd v. Henkel, 148 Cal. Rptr. 780, 781 (Ct. App. 1978) (holding that blood grouping is a reliable method of establishing nonpaternity and is widely accepted in the scientific and legal communities); Beck v. Beck, 304 N.E.2d 541, 544 (Ind. Ct. App. 1973) (holding that exclusionary blood-grouping tests are admissible in divorce proceedings); Commonwealth v. Stapp, 143 N.E.2d 221, 223 (Mass. 1957) (pointing out that substantial authority supports the reliability of blood-grouping tests to prove the impossibility of paternity); State v. Summers, 489 S.W.2d 225, 228 (Mo. Ct. App. 1972) (stating that the reliability of blood tests to prove nonparentage is unquestioned). For citations of additional rulings on the admissibility of blood tests for exclusion, see infra Appendix.
12. See, e.g., Lew Moon Cheung v. Rogers, 272 F.2d 354, 362 (9th Cir. 1959) (evidence of parentage rebutted by negative blood test results); Et Min Ng v.
reliable indicator of nonparentage, test results that do not exclude the visa applicant as the United States citizen's biological parent are highly probative of parentage.

2. Conventional blood tests provide strong proof of inclusion

In order to understand the importance of conventional blood test results, it is necessary to determine the legal validity of inclusive results. As technology has become more sophisticated, courts have begun to accept conventional blood test results as proof of inclusion. For example, in situations where the testimonial and documentary evidence strongly indicates the existence of a parent-child relationship between the United States citizen and his foreign parents, blood test results have been admitted and have been relied upon by decision makers in determining whether to grant a visa under the immediate family exemption.13

In immigration cases where an applicant seeks a visa under the immediate family exemption, the key question is whether the naturalized citizen is truly the parent or child of the applicant. From a legal and scientific point of view, this is identical to the question raised in paternity disputes, where the identity of a child's biological father is at issue. Thus, judicial decisions ruling on the admissibility of blood test evidence in paternity disputes are directly applicable to the immigration context. Several state courts have admitted test results into evidence, relying on statutes authorizing the use of blood tests for determining a child's parentage.14

Brownell, 258 F.2d 304, 309 (9th Cir. 1958) (admitting blood test evidence refuting claimed parentage).

13. See, e.g., Wong Chong Oy v. Dulles, 132 F. Supp. 483, 485 (D. Minn. 1955) (stating that blood test results established that the plaintiff was the son of an American citizen, despite testimonial inconsistencies); In re Ng, 12 I. & N. Dec. 27 (Bd. Imm. App. 1966) (blood test results which strongly suggested parent-child relationship were held not only to be admissible but sufficient to reopen proceedings which previously resulted in a finding of nonparenthood).

14. See, e.g., Scott v. State, 500 So. 2d 469, 470 (Ala. Civ. App. 1986) (blood test results may be admitted into evidence by state if statistical probability of alleged father's paternity is available); Dade v. State, 725 P.2d 706, 708 (Alaska 1986) (blood test resulting in 95% probability of paternity raises a presumption of paternity that can only be rebutted by clear and convincing evidence); County of Sonoma v. Grant W., 232 Cal. Rptr. 471, 474 (Ct. App. 1986) ("The use of the HLA blood test to prove paternity is by now well-established in California courts."); LeBlanc v. LeBlanc, 497 So. 2d 1361, 1363 (La. 1986) (expert testimony that blood tests showed a 98% probability of paternity was persuasive and objective testimony that could help establish proof by preponderance of evidence); Abwilda V. v. Thom-
Other courts have recognized that blood test results are generally admissible to help resolve paternity disputes by providing proof of a child's parentage, even if no state statute specifically authorizes such evidence.\footnote{Davis v. State, 476 N.E.2d 127, 139-40 (Ind. Ct. App. 1985) (evidence based on blood tests was sufficient to establish parentage of an abandoned infant); Patterson v. Johnson, 509 So. 2d 35, 36, 38-39 (La. Ct. App. 1987) (blood test showing a 98.62% probability of paternity, together with testimonial evidence, was sufficient to establish paternity); Worley v. Thirdkill, 506 So. 2d 1288, 1289, 1291 (La. Ct. App. 1987) (admitting blood test showing 97.3% probability of paternity); Department of Human Servs. v. Hulit, 524 A.2d 19, 20 (Minn. Ct. App. 1986) (finding of paternity was sufficiently supported by blood test results); State v. Guy, 750 S.W.2d 618, 620 (Mo. Ct. App. 1988) (results of blood tests are generally admissible to establish paternity).}

Courts are particularly willing to permit affirmative use of blood test evidence if the red blood antigen test results are offered in conjunction with results of the more accurate and sophisticated HLA test. For example, in Balfour v. Balfour,\footnote{413 So. 2d 1167 (Ala. Civ. App. 1982).} the court held that red cell test results together with HLA tests results would be admissible to aid the trial court in determining whether a woman's husband was the father of her child. Another court stated that "it would be unreasonable not to utilize all available and scientifically accepted technology" and that the HLA test combined with the red cell grouping test was precise enough to be probative of inclusion.\footnote{Pratt v. Victor B., 448 N.Y.S.2d 351, 352 (Fam. Ct. 1982).} Similarly, in Barber v. Davis,\footnote{502 N.Y.S.2d 19, 20 (App. Div. 1986).} the court determined that the HLA test combined with the red blood cell test resulted in a 99.999% probability of paternity and amounted to clear and convincing evidence that the alleged father was the child's true father.\footnote{See also County of El Dorado v. Schneider, 237 Cal. Rptr. 51, 53, 58-59 (Ct. App. 1987) (stating that HLA and other blood tests may be used affirmatively to establish paternity); E.M.F. v. N.N., 717 P.2d 961, 963 (Colo. Ct. App. 1985) ("HLA tests are now generally accepted in the scientific community as reliable evidence on the issue of paternity."); State v. Thompson, 503 A.2d 689, 690 (Me. 1986) (blood tests conducted by Roche Biomedical Laboratories showing a 99.46% probability of paternity were admissible against the defendant in a prosecution for...}
IV. DNA TESTING IS A VALID MEANS OF DETERMINING PARENTAGE

A. Introduction—The Theoretical and Technological Basis of Establishing Parentage Through DNA Fingerprinting

The fundamental theory underlying DNA parentage testing is that all genetic information passed from parents to children is contained in the complex DNA molecule. This theory is based on several key principles regarding the structure and characteristics of DNA. First, each individual's DNA is unique (except in identical twins), and the DNA structure remains unchanged throughout a person's life. Within each person, the structure of DNA is constant from cell to cell and can be extracted from cells and analyzed.


21. Id. at 61-62. DNA resides in the nucleus of a person's cells. Thus, cells that do not have a nucleus (red blood cells, for example) do not contain DNA and cannot be used for DNA analysis.
the others. The DNA molecule is extremely long and may have millions of pairs of bases.

Third, the ordered arrangement of the bases constitutes a "genetic code" that contains the information necessary to form the human body. Since human beings are more similar than different, the basic structure of the DNA molecule does not vary much from one person to another, but certain sections of the DNA code are unique to each person. These variable sections are called "polymorphisms" and are the sections that are important for DNA fingerprinting.

Fourth, the DNA structure can be taken apart and analyzed. The twisted double helix can be "unzipped" into two single strands whose components can be analyzed, and it can be cut into fragments at the site of the polymorphic sections to analyze their length. Because the location of the polymorphisms for each person is unique, the length of the fragments will also be unique. These unique components and fragment lengths identify the person, and the strength of similarities between a parent's and a child's DNA indicates the likelihood of parentage.

B. The Theory Underlying DNA Identification Is Broadly Accepted in the Scientific Community

In the past few years, advances in genetic research have allowed scientists to more fully understand DNA and its potential for providing information about human beings. DNA analysis allows scientists to determine the identity of criminals or to resolve paternity disputes. The theory behind DNA testing is not controversial—the scientific community has long recognized that DNA can be identified and studied.

22. This concept is known as the "base-pair" rule. A and T will bond exclusively with each other, as will C and G. Id. at 62.
23. Id.
24. COMMITTEE ON DNA TECHNOLOGY IN FORENSIC SCIENCE, NATIONAL RESEARCH COUNCIL, DNA TECHNOLOGY IN FORENSIC SCIENCE 32-33 (1992); Paivi Helminen et al., Application of DNA "Fingerprints" to Paternity Determinations, 1 LANCET 574, 575 (1988).
26. See, e.g., M. Baird et al., The Application of DNA-Print for the Estimation of Paternity, in 2 ADVANCES IN FORENSIC HAMOGENETICS 354 (W.R. Mayr ed., 1988); M. Baird et al., The Application of DNA-Print for Identification from Foren-
C. DNA Testing Procedures Are Well Accepted in the Scientific Community as a Means of Resolving Questions of Parentage

To conduct the DNA parentage test, scientists use a procedure known as "restriction fragment length polymorphism" (RFLP) analysis. This procedure can be broken into six distinct steps which are performed sequentially. This section describes each of these steps and demonstrates that each step of the process is well accepted in the scientific community.

1. Extraction of DNA for parentage testing is a well-accepted scientific procedure

The first step in the RFLP analysis involves obtaining a volume of sample material,\(^{27}\) isolating the DNA in the nuclei of the cells and extracting it with chemicals and centrifugal force. The procedures for DNA extraction are broadly accepted by molecular and cell biologists and have been described in several papers and textbooks.\(^{28}\)

Much of the criticism of DNA fingerprinting has focused on this phase of the process, primarily because of the difficulties associated with forensic applications of DNA testing. Critics have challenged the validity of DNA testing because of the problems that can arise in forensic analysis when extracting DNA from sample material that is contaminated or of insufficient quantity.\(^{29}\) However, the problems pointed out by the critics of forensic DNA testing simply do not exist in the context of parentage testing, where the test is conducted under controlled laboratory conditions with fresh, uncontaminated

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\(^{27}\) In parentage testing, the sample material is usually blood drawn from the test subjects. In the forensic context it can be blood, semen, hair, skin, etc. recovered from the victim, or the crime scene, or both.

\(^{28}\) See, e.g., T. MANIATIS ET AL., MOLECULAR CLONING: A LABORATORY MANUAL 280 (1982); Bernhard G. Herrmann & Anna-Maria Frischau, Isolation of Genomic DNA, 152 METHODS IN ENZYMOLoGY 180 (1987).

\(^{29}\) See, e.g., Thompson & Ford, supra note 20, at 65-67.
samples. Thus, the extraction and analysis of DNA for parentage determinations is a well-accepted and noncontroversial scientific process that raises none of the issues regarding technological reliability encountered in the forensic context.

2. Restriction digestion is well accepted in the scientific community

Once the DNA is extracted, it "can be seen by the naked eye, and resembles a tangled skein of cotton fiber that would stretch out to about three feet if unraveled." Because the long molecule is difficult to work with, it is necessary to break it into more workable pieces and analyze those pieces. To break the DNA into fragments, scientists use a process known as "restriction digestion." In this process, the DNA is cut into short pieces by a restriction enzyme which locates specific sites along the DNA strand and breaks the chain at those points. The length of each fragment is determined by the sequence of bases. Thus, wherever there is a variation in the sequence (e.g., the "polymorphisms"), the fragments will be different lengths.

Restriction digestion is well accepted and widely used by genetic scientists. In fact, a textbook on genetic engineering declares that "[p]resent-day DNA technology is totally dependent upon our ability to cut DNA molecules at specific sites with restriction endonucleases."31

3. Gel electrophoresis is a well-accepted scientific method for sorting DNA fragments according to their size

The next step in the RFLP process is to separate the fragments according to size using a technique known as agarose gel electrophoresis.32 The use of electrophoresis for sorting DNA fragments is broadly accepted in the scientific community. "Indeed, there are few important experiments in the field of

31. COMMITTEE ON DNA TECHNOLOGY IN FORENSIC SCIENCE, supra note 24, at 36-37.
molecular biology that have not relied, at least in part, on DNA electrophoresis.  

Electrophoresis involves placing the DNA fragments in a sheet of agarose gel and passing an electric current through the gel. The negatively charged DNA fragments move toward the positively charged end of the sheet; the smaller fragments move further than the larger fragments, so they line up in parallel rows according to their length.  

4. Southern transfer is well accepted by the scientific community  

Next, the DNA is transferred to a nylon membrane through a process called "Southern transfer." This process is named for the scientist who developed it, and involves placing the nylon membrane in contact with the gel and blotting the gel with absorbent paper towels. The DNA fragments move out of the gel and bind themselves to the nylon membrane in precisely the same position they occupied in the gel. Southern transfer is a well-accepted procedure; in fact, "its reliability has never been questioned."  

5. Hybridization is a well-accepted process to create a visible image of the DNA fragments  

The fragments of DNA are not visible, so to create an image of the rows of fragments which can be analyzed, they must be marked with radioactive "probes," which are DNA fragments whose base pair sequence is known and which have been "labeled" with a radioactive isotope. In this step, known as "hybridization," the nylon membrane is immersed in a dish containing the probes, which attach themselves to the fragments at the polymorphic locations. In parentage tests, the probes are designed to seek out and attach themselves to the sections of the DNA that are inherited from the child's parents. The hybridization process has been carefully studied and is well accepted by genetic and molecular scientists as an accu-

34. Thompson & Ford, supra note 20, at 69.  
35. See Cellmark Diagnostics, DNA Fingerprinting and DNA Profiling 6 (n.d.) (available from Cellmark Diagnostics, 20271 Goldenrod Lane, Germantown, MD 20876); Jackson, supra note 30, at 3008.  
rate method for locating and marking the polymorphic locations on the DNA fragments.\(^{38}\)

6. \textit{Autoradiography is well accepted in the scientific community as a means of visualizing the DNA print}

Once the fragments have been marked by the probe, the positions of the polymorphic segments can be visualized by placing the nylon membrane on a sheet of X-ray film in a process called "autoradiography." The radioactive probes expose the film and produce a pattern of black bands called the "DNA fingerprint."\(^{39}\) This is a fairly simple procedure\(^{40}\) that has been widely used by DNA scientists for nearly twenty years.\(^{41}\) Autoradiography "clearly must be regarded as a well-accepted scientific practice."\(^{42}\)

7. \textit{There is little risk that laboratory errors will affect the test results in cases involving parentage determination}

One criticism of the laboratory procedures used in DNA parentage testing is that the techniques involved in the RFLP process are complicated and laboratory mistakes may result in inaccurate results.\(^{43}\) However, the American Association of Blood Banks (AABB) has promulgated a rigorous set of standards that must be followed by all of the AABB accredited laboratories. By carefully following these standards, risks of laboratory error can essentially be eliminated.\(^{44}\)

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40. MANIATIS ET AL., supra note 28, at 470-72.

41. Thompson & Ford, supra note 20, at 74.

42. Id.

43. See id. at 92-96.

44. COMMITTEE ON DNA TECHNOLOGY IN FORENSIC SCIENCE, supra note 24, at 102.
D. The RFLP Process Allows Scientists to Visually Compare the DNA Prints and Provides Conclusive Proof of Parentage

RFLP analysis allows scientists to compare the X-ray image of the child's DNA fragments with that of the putative father or mother. If the DNA prints do not match, it can be conclusively stated that the child is not related to the putative parent.45

The power of DNA fingerprinting, however, does not lie solely in its ability to conclusively exclude a putative parent, but in its capability to provide conclusive evidence of a child's parentage. Because the polymorphic sequences are passed from parent to child, the position of the fragments whose sequence was inherited from the child's parent will be the same for the child and parent.46 If the location of the child's DNA fragments matches the location of the parent's DNA, there is an extremely high—and mathematically calculable—probability that the test subjects are parent and child.47

E. Statistical Analysis of DNA Test Results Indicates the Matches Achieved in the Test Are Not Coincidental

If the DNA test does provide matching results, it is necessary to determine whether the match could be due to a rare coincidental match rather than the parent-child relationship between the test subjects. In order to quantify the possibility of a coincidental match, scientists employ several statistical formulas which express the probability that the test subjects are parent and child.48

The statistical analysis used by most DNA testing laboratories produces two figures. The first is a paternity (or parent-age) index.49 This number is a measure of the strength of the

45. CELLMARK DIAGNOSTICS, supra note 35, at 7-8.
47. CELLMARK DIAGNOSTICS, supra note 35, at 8.
genetic evidence proving a parent-child relationship. "Essentially it is a ratio of the chance that the alleged father, if he was the father, would transmit the genetic markers observed in the child to the chance that a randomly selected man, if he was the father, would pass along these markers."50 The higher the number, the greater the strength of the genetic evidence. The second figure is a probability of parentage, which is based on a combination of genetic and nongenetic evidence of parentage.51 Applying statistical formulas to this evidence, scientists are able to determine the probability (based on a scale of 0 to 100%) that the putative parent is the citizen's actual parent.52

One of the primary criticisms of the statistical analysis focuses on the possibility that a population substructure or "subpopulation" may skew the statistical results. According to critics espousing this view, population genetic studies show some genetic variations within subpopulations. Thus, Caucasians, African-Americans, Hispanics, Asians, and Native Americans do not form a single homogeneous genetic population; rather, each group shows somewhat different polymorphic frequencies, and because people tend to mate within their own subgroup, the world's genetic makeup is not homogenized. Therefore, according to the subpopulation critics, statisticians must account for these differences when calculating the probability of a coincidental DNA match.53

Other scientists respond to these critics by pointing out that the minor differences between subpopulations do not lead to significant inaccuracies in the calculations of the coincidental match probabilities.54

50. Id. at 224.
51. Id.
52. For explanations of the legal significance of these statistical expressions, see Commonwealth v. Beausoleil, 490 N.E.2d 788 (Mass. 1986); Plemel v. Walter, 735 P.2d 1209 (Or. 1987); Kofford v. Flora, 744 P.2d 1343 (Utah 1987); State v. Hartman, 426 N.W.2d 320 (Wis. 1988); M.J.B. v. R.E.B., 425 N.W.2d 404 (Wis. 1988).
In response to the concerns surrounding the subpopulation problem, the National Research Council’s Committee on DNA Technology in Forensic Science recently published a report in which it suggests a methodology that should be followed in order to account for subpopulation variations and ensure the accuracy of DNA statistical analysis. This methodology requires statistical calculations to be based on a population substructure rather than on the general population of the world. Thus, the DNA prints of a Chinese test subject should be compared with the DNA fingerprints of thousands of other ethnic Chinese contained in a database.

F. DNA Testing Is a Legally Valid Means of Determining Parentage

Using traditional methods of blood testing, such as the ABO antigen test, scientists were only able to establish a negative; that is, they were able to exclude the test subject from possible parentage but were not able to positively include the person. DNA testing, on the other hand, has the advantage of permitting scientists to state confidently whether a particular person is a child’s parent.

The courts have become increasingly aware of the power of DNA identification and have admitted DNA test results under the rule developed in Frye v. United States. In Daubert v. Merrell Dow Pharmaceuticals, the Supreme Court stated that the Federal Rules of Evidence superseded the Frye rule. According to Daubert, scientific evidence should be admitted if it is relevant and reliable. The underlying assumption behind the Frye standard is reliability. “Once a procedure is sufficiently established to have gained general acceptance in the particular field in which it belongs, it presumably has gone through an extended period of use and testing within the scient-


55. COMMITTEE ON DNA TECHNOLOGY IN FORENSIC SCIENCE, supra note 24, at 80-85.

56. As discussed in Parts I.B-C, supra, the combination of HLA and ABO test results allows scientists to determine the probability of inclusion. However, DNA testing provides an even greater degree of accuracy and specificity.

57. 293 F. 1013 (D.C. Cir. 1923). Under Frye, admissibility of scientific evidence depended on whether the technology was “sufficiently established to have gained general acceptance in the particular field in which it belongs.” Id. at 1014.

58. 113 S. Ct. 2786 (1993).

59. Id. at 2795.
Since the Federal Rules, as explained by Daubert, are more relaxed than Frye’s general acceptance test, the cases admitting DNA evidence under the Frye standard are persuasive precedent that DNA evidence, as long as it is relevant, should be admitted under Daubert.61

The recognition that DNA identification has broad scientific acceptance allows courts to rely heavily on the tests in paternity dispute resolutions. For example, in Mastromatteo v. Harkins,62 the court determined that DNA evidence was not duplicative of the HLA test that indicated a probability of paternity of 99.4% because the DNA test “excluded the world’s population, other than [the alleged father], from the probability of paternity.”63 Similarly, in Batcheldor v. Boyd,64 the court held that DNA sampling is “dependable evidence” of a child’s parentage. In In re Baby Girl S.,65 the court concluded that DNA fingerprinting, together with other proof, provided “totally clear, convincing, satisfactory” evidence that the putative father was the biological father of the child in that case.66

G. DNA Evidence Is Dispositive in the Resolution of Immigration Cases Where Parentage Is at Issue

Although the majority of these DNA fingerprinting cases relate to paternity disputes arising in the family law context, DNA identification tests can also be very beneficial to the resolution of immigration cases where the parentage of a U.S. citi-


61. See, e.g., United States v. Jakobetz, 955 F.2d 786, 796-800 (2d Cir.) (finding DNA evidence reliable and holding that courts could subsequently take judicial notice of the reliability of DNA testing), cert. denied, 113 S. Ct. 104 (1992); Andrews v. State, 533 So. 2d 841, 850 (Fla. Dist. Ct. App. 1988) (“Evidence derived from DNA print identification appears based on proven scientific principles.”), review denied, 542 So. 2d 1332 (Fla. 1989); S.L.B. v. K.A., 579 N.Y.S.2d 964, 966-68 (Fam. Ct.) (putative father ordered to undergo a DNA test in order to more accurately establish paternity), aff’d, 588 N.Y.S.2d 710 (Fam. Ct. 1992); People v. Castro, 545 N.Y.S.2d 965, 999 (Sup. Ct. 1989) (DNA evidence is admissible when the tests are performed under carefully controlled conditions); In re Baby Girl S., 532 N.Y.S.2d 634, 636-37 (Surrogate’s Ct. 1988) (admitting DNA test results in paternity determination).


63. Id. at 393.


65. 532 N.Y.S.2d at 634.

66. Id. at 638.
zen is in question. An English immigration case offers a good example of how DNA testing can be used effectively in the immigration context. In that case, a Ghanaian boy was denied permission to remain in the United Kingdom because officials doubted he was really the son of a woman claiming to be his mother. DNA fingerprinting tests revealed that the boy was in fact the woman's son. In light of this information, the immigration officials dropped the case against him and allowed him to remain with his family. Commentators have also recommended that DNA be used to resolve immigration cases where familial relationship is contested.

V. CONCLUSION

The allure of the "American Dream" has for decades prompted millions of people to leave their native countries and immigrate to the United States. In many cases, these people leave family and loved ones behind when they emigrate. Once a person becomes a naturalized United States citizen, however, that person's immediate family members qualify for automatic visas to come to this country as permanent residents. Therefore, the question of whether a visa applicant is actually a member of a United States citizen's immediate family is an important one.

In cases where there is some doubt whether a person qualifies for the immediate family exemption, DNA testing, a powerful and relatively new identification procedure, may provide clear and unequivocal answers. The process is accurate, reliable and scientifically and legally valid; therefore, the State Department should encourage and facilitate the use of DNA fingerprinting to determine the parentage of naturalized United States citizens who are seeking visas for their families.

Alan R. Davis


APPENDIX

CITATIONS OF ADDITIONAL RULINGS ON THE ADMISSIBILITY OF BLOOD TESTS TO EXCLUDE A PUTATIVE PARENT FROM THE GROUP OF POTENTIAL PARENTS


Arkansas: Richardson v. Richardson, 478 S.W.2d 423 (Ark. 1972).


Kentucky: Simmons v. Simmons, 479 S.W.2d 585 (Ky. 1972).
Maine: Jordan v. Davis, 57 A.2d 209 (Me. 1948).
Maryland: Shanks v. State, 45 A.2d 85 (Md. 1945).


Wisconsin: State ex rel. Lyons v. De Valk, 177 N.W.2d 106 (Wis. 1970); Limberg v. Limberg, 92 N.W.2d 767 (Wis. 1958); Prochnow v. Prochnow, 80 N.W.2d 278 (Wis. 1957); Euclide v. State, 286 N.W. 3 (Wis. 1939).