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Beyond Blatchford v. Native Village of Noatak: Permitting the Indian Tribes to Sue the States Without Regard to the Eleventh Amendment Bar

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DNA PROFILING EVIDENCE: THE NEED FOR A UNIFORM AND WORKABLE EVIDENTIARY STANDARD OF ADMISSIBILITY

> If we are to save the law for a living future, if it is to remain manageable amidst the sprawling mass of rulings and statutes which stand increasingly to clog its simplicity, we must rescue these reasonings from forgetfulness.[1]

Science and law are two distinct professions that are increasingly becoming co-mingled as technology develops. Lawyers must attempt to comprehend the complexity of scientific analysis and terminology[2] if they are to fully understand testing procedures and results, and their impact in the legal arena. The legal system has dealt with novel scientific evidence on several occasions.[3] Yet, one recent development in the scientific arena has had a substantial and almost mesmerizing impact on the legal profession -- the development of deoxyribonucleic acid (DNA) profiling[4] in criminal cases.[5]

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1. 1 JOHN HENRY WIGMORE, EVIDENCE Introduction XIV (3rd ed. 1939).

2. Confusion may arise due to the exotic terminology associated with DNA typing and the tendency of scientists in different fields to use different terminology to describe essentially the same concepts and phenomena. *See* William C. Thompson & Simon Ford, *DNA Typing: Acceptance and Weight of the New Genetic Identification Tests*, 75 VA. L. REV. 45, 52 n.2 (1989) [hereinafter Thompson & Ford].

3. *Id.* at 52, n.43.

4. DNA is an organic substance found in the chromosomes in the nucleus of a cell. It provides the genetic code which determines an individual's characteristics. Caldwell v. State, 393 S.E.2d 436, 437 n.1 (Ga. 1990). This Note will use the less controversial term "DNA profiling" to describe the process used by laboratories which test DNA for identity purposes-either the exclusion or association of genetic characteristics. Other commentators have adopted the terms "genetic fingerprinting", "DNA fingerprinting", "DNA prints", or "DNA typing" to describe the process. However, the term "DNA fingerprinting" has been criticized as a partisan attempt to link the technique with traditional fingerprinting in the mind of jurors and the public. C. Thomas Blair, Spencer v. Commonwealth *and Recent Developments in the Admissibility of DNA Fingerprint Evidence*, 76 VA. L. REV. 853, n.1 (1990). *See also* United States v. Jakobetz, 747 F. Supp. 250 (D. Vt. 1990).

> It is misleading, however, to label DNA profiling or typing as DNA fingerprinting because such a characterization not only grossly oversimplifies the technical aspects of RFLP analysis, but it misrepresents the meaning of a genotype match. No two fingerprints are known to match unless they are from the same person. In contrast, a RFLP genotype across four or five loci can, in theory, be duplicated though the frequency of such occurrence is exceedingly low.

Id. at 258, n.17.

5. DNA analysis is also used in civil cases. *See generally* Leon N. Sussman, *Paternity Blood Tests*, 188 N.Y.L.J. 2 (1982); Ronald J. Richards, *DNA Fingerprinting and Paternity Testing*, 22 U.C. DAVIS L. REV. 609 (1989). However, within a criminal context, some of the charges in criminal cases where DNA analysis has been used include murder, attempted murder, rape, incest,

DNA profiling evidence, first introduced by prosecutors in the late 1980's, has the potential, without the presence of other evidence, to ensure a conviction by satisfying the heightened burden of proof[6] required for a criminal trial. A resulting conviction could be a matter of life or death for the defendant.[7] Although DNA testing for diagnostic purposes[8] has been used by the medical community for several years,[9] DNA testing for use in forensic science[10] is a relatively new phenomenon. In criminal, and more specifically, rape trials,[11]

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sexual assault, robbery, burglary, and kidnapping. *See generally* CELLMARK DIAGNOSTICS, INFORMATION PAMPHLET 1 (1989).

6. In criminal cases, as contrasted to civil cases, a higher burden of persuasion is required. *See In re* Winship, 397 U.S. 358 (1970). The Supreme Court in *Winship* expressed that the Due Process clause "protects the accused against conviction except upon proof beyond a reasonable doubt of every fact necessary to constitute the crime with which he is charged." *Id.* at 364.

7. *See* Caldwell v. State, 393 S.E.2d 436 (Ga. 1990) (prosecutor sought the death penalty against the defendant).

8. Eric S. Lander, *DNA Fingerprinting on Trial*, 339 NAT. 501 (1989). DNA diagnostics is a process which requires identifying whether each parent has passed to a child the Restriction Fragment Length Polymorphism (RFLP) pattern inherited from his or her mother or father. Because the four discrete patterns are known in advance, these investigations have built-in consistency checks which guard against errors. *Id.*

9. U.S. Congress, Office of Technology Assessment, *Genetic Witness: Forensic Uses of DNA Tests*, OTA-BA-438, 41 (Washington, DC: U.S. Government Printing Office, July 1990) [hereinafter Congress].

10. *See id.* at 3. Forensic science involves the application of several scientific expertise (e.g., biology, chemistry, toxicology, medicine) to situations concerned with courts of justice or public debate. This Note uses the term "forensic purposes" to refer to the uses of various DNA technologies to identify individuals.

11. DNA testing is generally used in rape cases to compare an accused's genetic code to that of the residue of body fluids found at the crime scene or on a piece of the victim's clothing. However, other uses for DNA testing are currently being explored. Prosecutors in Texas are using DNA test results obtained from tissue samples from an aborted fetus of a thirteen-year-old to prosecute the girl's uncle, who is charged with raping her. The samples from the fetus and the girl will be compared with that of the girl's uncle. Although James Werner, president of Cellmark Diagnostics stated that his staff had performed several DNA tests on fetal tissue, officials with the F.B.I.'s genetics testing lab in Washington stated that they could not remember any cases involving rape and the use of genetic testing on aborted fetal tissue. The testing of fetal tissue in rape cases may pose sensitive ethical questions, however, Barry Scheck, a professor at Cardozo Law School in New York City (a critic of forensic DNA testing) states, "in scientific and legal terms it's nothing new." *Tissue of Aborted Fetus Tested for DNA "Fingerprint"*, N.Y. TIMES, Oct. 31, 1990, at 1.

Additionally, two other cases further illustrate the variety of potential uses of DNA analysis. In Britain, one case involves a rape victim who discovered that she was pregnant and the victim wants to know the identity of the father. If the woman knows that her husband is the child's father, she will carry the baby to term. However, if the victim became pregnant as a result of rape she may decide to terminate the pregnancy. According to Jeffreys, the person who developed the method of the DNA fingerprint, the test can be done on a small amount of what will become placental matter as early as eight to ten weeks after conception. If no match exists between the fingerprint on the developing fetus and the victim's husband, it can be concluded that the rapist is not the father of the child. 1 BNA CRIM. PRAC. MANUAL No. 19 (Sept. 23, 1987).

The second case to which the DNA testing method has been used is in the paternity testing of

the use of DNA test results is revolutionizing evidentiary advances.[12] In cases where a victim may not, due either to a physical or mental impairment, be able to identify the assailant, a chance still exists that the assailant will be identified. DNA profiling evidence has the ability to provide the needed identification. The process used in this type of genetic analysis offers the criminal justice system a more precise and powerful means of identification, as compared to testimonial or eyewitness accounts, from a trace amount of biological material.[13] More specifically, not only can the test results identify a person as the perpetrator of a crime,[14] but DNA test results can, and is sometimes admitted as evidence to exculpate a criminal defendant.[15] Indeed, the use of DNA evidence for identification purposes can be used both offensively and defensively.[16]

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a dog. Since all living organisms contain DNA, there is no differentiation in type of DNA between genders, or even species. Thus the same type of DNA fingerprint that can be obtained from humans can be obtained from dogs, cats, cattle, and even plants. In the area of animal breeding, the test can be used to settle disputes about the bloodlines of a particular pedigreed animal. *Id.*

12. *See, e.g.*, United States v. Two Bulls, 918 F.2d 56 (8th Cir. 1990); United States v. Yee, No. 89-CR0720, 1990 U.S. Dist. LEXIS 15908 (N.D. Ohio 1990); United States v. Jakobetz, 747 F. Supp 250 (D. Vt. 1990); Andrews v. State, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988); State v. Dotson, 424 N.E.2d 1319 (Ill. App. Ct. 1981).

A woman is forcibly raped every six minutes in the United States. DNA typing of semen stains will benefit associational identification because the useful protein genetic markers in semen are limited. *See generally* J.L. PETERSON, IMPACT OF BIOLOGICAL EVIDENCE ON THE ADJUDICATION OF CRIMINAL CASES: POTENTIAL FOR DNA TECHNOLOGY (1989).

13. *See* Congress, *supra* note 9, at 109. DNA testing for forensic purposes can be performed on several different sources of biological matter. These sources include blood, semen, tissue, bone (marrow), hair root, saliva, urine and teeth (pulp). *Id.* at 104.

Generally, only one or two drops of blood, ten hair roots, or a trace of semen will suffice for the DNA testing. The tested samples can be much older than those needed for other test such as traditional blood typing and analysis. Additionally, since the DNA molecule is very stable, it will still be available to the researcher in a sample which is weeks, months and even years old. However, the use of older samples increases the likelihood of receiving ambiguous results. *Id.* at 2. Scientists have been able to obtain DNA profiling results from forensic samples that are over eight years old and DNA testing has even been successfully completed on a 2,400 year-old Egyptian mummy. U.S. Dep't of Justice, *National Institute of Justice DNA Profiling: For Positive Identification* 2 (Sept. 1990).

14. Except for rape cases, DNA testing may only signify that a person may have been at the scene of a crime or is somehow connected to the scene where the crime took place. The prosecutor carries the burden of establishing that an individual defendant was in fact the perpetrator of the crime. *See supra* note 6 and accompanying text.

15. *See* People v. Castro, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989). "Because the scientific method for determining whether two samples of DNA do not match and, therefore, are genetically different, is less complex in its analysis, it is equally clear that DNA forensic evidence establishing an exclusion is reliable." *Id.* at 995.

16. For example, a fourteen-year old teenager charged with the rape of a twenty four-year old blind woman, had the charges against him dropped after a DNA test had determined that he could not possibly be the rapist. CHI. TRIB., Oct. 30, 1990, at 1, col. 3. DNA testing was also used in the highly publicized Illinois rape case involving Gary Dotson. Nearly a decade after the actual crime was committed, a judge vacated a 1979 rape conviction after a DNA test conducted using the PCR technique, exculpated the defendant. After spending six years in jail, the alleged victim

The landmark case of *Andrews v. State*[17] signified the first time a state court, using the relevancy standard for admissibility, allowed the introduction of DNA profiling evidence. Since this Florida decision, several authors have addressed the significance of *Andrews*, focusing their attention on DNA profiling.[18] Early analysis by these authors predicted that the likely trend in the future would be to render DNA evidence admissible, with little or no qualification or preliminary inquiry into the credibility or reliability of the tests.[19]

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recanted her story in 1985. Governor James Thompson granted clemency, but the rape conviction remained on his record. Dotson had asked that his case be reopened for a new trial after the results had excluded him. Congress, *supra* note 9, at 119, 163.

DNA profiling evidence also has the potential for other beneficial consequences. Results of DNA testing can save law enforcement officials and courts time and money by exonerating innocent suspects before trial. Additionally, the potential for plea bargaining or a guilty plea by parties increases as more defendants are confronted with DNA profiling results. *See, e.g.*, United States v. Two Bulls, 918 F.2d 56 (8th Cir. 1990) (defendant entered a conditional plea of guilty after a judge rendered DNA evidence admissible during a suppression hearing); *see also* Congress, *supra* note 9, at 17.

17. 533 So. 2d 841 (Fla. Dist. Ct. App. 1988).

18. *See* C. Thomas Blair, Spencer v. Commonwealth *and Recent Developments in the Admissibility of DNA Fingerprint Evidence*, 76 VA. L. REV. 853 (1990); Caroline D. Rymer, *Evidence-Admissibility of Genetic Fingerprinting in Criminal Cases*-Andrews v. State, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988), 23 SUFFOLK U. L. REV. 167 (1989); Dan L. Burk, *DNA Fingerprinting: Possibilities and Pitfall of a New Technique*, 28 JURIMETRICS J. 455 (1988); Jean L. Marx, *DNA Fingerprinting Takes the Witness Stand*, 240 SCI. 1616 (1988); Charles L. Williams, *DNA Fingerprinting: A Revolutionary Technique in Forensic Science and Its Probable Effects on Criminal Evidentiary Law*, 37 DRAKE L. REV. 1 (1987); C. Thomas Caskey, *Disease Diagnosis by Recombinant DNA Methods*, 236 SCI. 1223 (1987); William C. Thompson & Simon Ford, *Is DNA Fingerprinting Ready for the Courts?*, 1710 NEW SCI. 38 (1990); and American Society of Human Genetics, Ad Hoc Committee on Individual Identification by DNA Analysis, *Individual Identification by DNA Analysis: Points to Consider*, 46 AM. J. HUM. GENETICS 631 (1990).

19. However, it may well be the case that the courts have been too hasty to admit such evidence because the scientific community has not yet agreed on the standards that ensure the reliability of the evidence. Lander, *supra* note 8, at 501.

Furthermore, the results of DNA testing being introduced in criminal courts are often based on questionable testing procedures. Several different issues can be raised with regards to the final test results. These include:

1. Sampling problems-DNA samples may be degraded, or contaminated either by the DNA of another organism, including bacteria;

2. Sample preparation problems-the test samples that a laboratory prepares may have be instituted improperly;

3. Measurement problems-bands may be too close together to distinguish by visual assessment alone. Additionally, degradation of the sample may obliterate an important band, thus contributing to the measurement problems; and

4. Interpretation of the Analysis-important to an interpretation of the analysis is the consideration of population studies. Correct calculation of probability can be solved by properly conducting genetic studies and statistical analysis. Unless an attorney knows what to look for, an accused may face inflated probability claims.

For a discussion of the above-mentioned challenges to DNA profiling results, see Edna Selan

Five years have passed since *Andrews*, and this passage of time has allowed for a more thorough examination of DNA profiling evidence and its potential significance in the United States criminal justice system. Recent cases from both state and federal jurisdictions demonstrate a change in judicial attitudes towards a standard of admissibility for this new line of evidence.[20] Additionally, states have begun to recognize the need for a uniform standard of admissibility within their own jurisdictional boundaries. Furthermore, some legislatures have adopted statutes to define the admissibility standards for this type of genetic evidence.[21]

Although state legislation addressing the admissibility of DNA evidence in criminal proceedings does not reveal legislators' apprehensions in admitting DNA profiling evidence, some judges today have a tendency to be more cautious in determining the admissibility of this genetic evidence.[22] In exercising their discretion, state and federal judges have pointed to the lack of uniformity in applying standards for determining the admissibility of such evidence.[23] Consequently, analyzing identical facts in two different jurisdictions may lead to different results concerning the admissibility of genetic evidence.[24]

Epstein, *The Problem with DNA Tests: Cross-Examining the DNA Fingerprint*, 78 ILL. B.J. 392 (1990). Mixing experiments and internal controls are often omitted, and some laboratories use no objective standards for declaring a match. *Id.*

20. *See infra* note 22 and accompanying text.

21. *See infra* notes 174-86 and accompanying text.

22. No court has held DNA profiling evidence to be inadmissible per se. Prater v. Arkansas, 820 S.W.2d 429 (1991). However, some courts have questioned the results in a particular case or in some way have limited the testimony. *See, e.g.*, United States v. Two Bulls, 918 F.2d 56 (8th Cir. 1990) (appellate court remanded case to trial court to conduct an expanded pre-trial hearing to determine the admissibility of DNA profiling evidence); Minnesota v. Schwartz, 447 N.W.2d 422 (Minn. 1989) (DNA test results not admissible where Cellmark laboratory failed to make its testing data and results available to the defense); *see also* State v. Stroud, 459 N.W.2d 332 (Minn. App. 1990) (denial of state's request for continuance pending receipt of test results was appealable because DNA test results would have critical impact in sexual misconduct trial). Courts have refused to admit DNA profiling evidence in particular cases because of inadequate application of testing procedures. *See* People v. Castro, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989); Minnesota v. Schwartz, 447 N.W.2d 422 (Minn. 1989); and State v. Pennell, 584 A.2d 513 (Del. 1989) (court ruled only RFLP evidence of match was admissible while reasoning that genotype frequency methods "had not been demonstrated to rest on sound scientific basis"); *See also* Andrew Alderson and Rachel Cooke, "Scientists challenge "foolproof" gene tests: "DNA testing . . . has until now enjoyed a reputation for pin-point accuracy." TIMES NEWSPAPERS LIMITED, Dec. 29, 1991. *But see* State v. Woodall, 385 S.E.2d 253 (W. Va. 1989) (court takes judicial notice of DNA typing reliability but test results not admitted because they were inconclusive).

23. *See, e.g., Cadwell v. State*, 393 S.E. 2d 436, 441 (Ga. 1990).

24. *See infra* notes 103-30 and accompanying text.

In a jurisdiction adhering to a liberal standard of admissibility,[25] the introduction of the DNA test results is more probable than in a jurisdiction using a more conservative approach.[26] To eliminate the nonuniformity in the current state of DNA admissibility law, this Note recommends that the federal judiciary adopt a supplement to Rule 702[27] of the Federal Rules of Evidence. The supplement would explicitly address the standard for admissibility for the introduction of DNA profiling evidence in a criminal trial or proceeding.[28]

The limited number of federal courts that have addressed the admissibility of DNA profiling evidence are split as to the applicable standard for making such a determination.[29] Federal courts are bound by the Federal Rules of Evidence when applying procedural rules to trials and proceedings before them.[30] As a result, the proposed supplementation of Rule 702 would provide for uniformity, certainty, and predictability in determining how a judge will analyze the admissibility of DNA profiling evidence.[31]

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25. *See infra* notes 95-102 and accompanying text.

26. *See infra* notes 87-94 and accompanying text.

27. 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. FED. R. EVID. 702. Although this Note proposes a supplementation to a Federal Rule of Evidence, it is recommended that the codification of the standards for determining the admissibility of DNA profiling evidence be used by all state courts, whether or not the jurisdiction has adopted Rule 702 of the Federal Rules of Evidence.

28. *See infra* notes 242-58 and accompanying text. This proposed supplementation to Rule 702 of the Federal Rules of Evidence will be applicable to any request for introduction of DNA profiling evidence, offered by either the prosecution or the defense. Additionally, this proposed supplementation to Rule 702 will expressly suggest remedies for any violation of the mandated requirements. It is not this author's position that DNA profiling evidence be excluded in all cases. Instead, because of the potential consequences of the genetic evidence, the defendant's rights must be safeguarded and certain procedural standards should be adhered to before a judge rules this type of evidence admissible.

29. *See, e.g.*, State v. Ford, 392 S.E.2d 781 (S.C. 1990) (applying Relevancy approach); United States v. Yee, No. 89CR0720, U.S. Dist. LEXIS 15908 (N.D. Ohio 1990) (applying *Frye* standard); *Jakobetz*, 747 F. Supp. 250 (D. Vt. 1990) (applying a combined Relevancy/*Frye* approach); United States v. Two Bulls, 918 F.2d 56 (8th Cir. 1990).

30. FED. R. EVID. 101. The Federal Rules of Evidence are generally applicable in the Federal Courts whether a case is before a Judge, a Bankruptcy Judge, or a Magistrate. Also, the Rules are applicable in all civil and criminal cases. *See also* 1 SALTZBURG, FEDERAL RULES OF EVIDENCE MANUAL (5th ed. 1990).

The Federal Rules of Evidence are embodied in the revised Uniform Rules of Evidence (1974), largely without change of substance. EDWARD W. CLEARLY, MCCORMICK ON EVIDENCE, p. xv (3d ed. 1984).

31. A uniform standard does not transform a judge's discretion into a mechanical formality for purposes of admitting or denying admissibility of DNA evidence. However, this Note proposes general guidelines for judges to follow when faced with the decision of determining the admissibility of DNA profiling evidence. *See infra* notes 242-58 and accompanying text.

Although state jurisdictions are not bound by the Federal Rules of Evidence, some states have adopted the Rules with or without qualification.[32] Twenty-eight states[33] have adopted Federal Rule 702 verbatim, and six states[34] have made minor changes in the text of Rule 702. Consequently, a supplementation of Rule 702 would also encourage uniformity of standards among state courts in determining whether the genetic evidence should be deemed admissible.

Part I of this Note introduces the concept of DNA profiling and explains the testing procedures and steps that are used by laboratories during one method[35] of genetic analysis. Part II examines the various standards that state and federal courts have developed concerning the admissibility of DNA test results and related evidence.[36] Turning to state courts, Part III of this Note analyzes the admission of DNA profiling evidence in the state court system and a recent state supreme court's attempt to resolve the controversy surrounding admissibility of DNA profiling evidence.[37] Part III also examines various state legislative attempts to resolve inconsistencies by adopting statutory provisions that define the standards for admissibility of DNA profiling evidence.[38]

Part IV of this Note identifies the conflict among federal jurisdictions concerning the appropriate standard for determining the admissibility of genetic evidence.[39] Close examination of recent federal case law will illustrate the need for a uniform and workable evidentiary standard.[40] Finally, Part V

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32. States which have adopted the Uniform Rules of Evidence (1974) with 1986 Amendments, in whole or in part, include: Alaska, Arizona, Arkansas, Colorado, Delaware, Florida, Guam, Hawaii, Idaho, Iowa, Louisiana, Maine, Michigan, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Puerto Rico, Rhode Island, South Dakota, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming. 13A UNIFORM LAWS ANNOTATED CIVIL PROCEDURAL AND REMEDIAL LAWS, UNIFORM RULES OF EVIDENCE 1 (1986 & Supp. 1990).

33. States adopting Rule 702 without qualification include: Alaska, Arizona, Arkansas, Colorado, Delaware, Hawaii, Idaho, Iowa, Louisiana, Maine, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, south Dakota, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin and Wyoming. G. JOSEPH & S. SALTZBURG, EVIDENCE IN AMERICA, THE FEDERAL RULES IN THE STATES, ch. 51, p. 1 (1988 & Supp. 1989).

34. Florida, Michigan, Nevada, North Carolina, Rhode Island, and Tennessee. *Id.*

35. Currently, two technologies exist to test the identity of a substance. These include restriction fragment length polymorphism (RFLP) and polymerase chain reaction (PCR). Congress, *supra* note 9, at 4.

36. *See infra* notes 81-130 and accompanying text.

37. *See infra* notes 131-73 and accompanying text.

38. *See infra* notes 174-91 and accompanying text.

39. *See infra* notes 192-240 and accompanying text.

40. *Id.*

proposes a supplementation of Federal Rule of Evidence 702[41] explicitly outlining the method and standard a judge should employ when considering the admissibility of DNA profiling evidence. By implementation of this proposal, courts will have definite and express guidelines that will solve the problem of differing evidentiary standards among jurisdictions.

I. METHODS AND PROCEDURES IMPLEMENTED IN THE PROCESS OF DNA PROFILING

The underlying theory of DNA testing for forensic purposes is generally accepted and not frequently disputed.[42] However, the methods and procedures used in the testing analysis are frequently subject to judicial and scientific scrutiny.[43] In the United States, the Federal Bureau of Investigation[44] (FBI) along with three commercial laboratories[45] perform DNA testing for forensic purposes. Essentially, two different methods are used in analyzing biological matter for DNA identification: restriction fragment length polymorphism (RFLP)[46] and polymerase chain reaction (PCR).[47] Since a number of judicial

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41. *See infra* notes 242-57 and accompanying text.

42. State v. Ford, 392 S.E.2d 781, 784 (S.C. 1990); United States v. Jakobetz, 747 F. Supp. 250 (D. Vt. 1990).

43. *See* People v. Castro, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989) (court excluded DNA evidence after an extensive pre-trial hearing because the testing procedures were not performed in this particular case with the scientifically accepted tests and procedures).

44. FBI laboratories are located in Quantico, Virginia, and in Washington, D.C. U.S. DEP'T OF JUSTICE, OFFICE OF JUSTICE PROGRAMS, DNA PROFILING: FOR POSITIVE IDENTIFICATION 2 (Sept. 1990).

45. The three commercial labs include Lifecodes Corporation of Valhalla, New York, Cellmark Diagnostics of Germantown, Maryland and Cetus Corporation of Emeryville, California. *Id.*

46. The FBI, along with Lifecodes Corporation (Lifecodes) and Cellmark Diagnostics (Cellmark) use the RFLP process. Lander, *supra* note 8. Cetus Corporation uses a somewhat different method of DNA analysis (PCR). Thompson & Ford, *supra* note 2, at 856, n.19. For an excellent discussion of the PCR technique see H.A. Erlich, *The Use of the Polymerase Chain Reaction for Genetic Typing in Forensic Samples*, manuscript prepared for an international symposium on the forensic aspects of DNA analysis: Department of Justice, Federal Bureau of Investigation, Quantico, VA (June 1989).

47. Congress, *supra* note 9, at 4. This Note focuses mainly on the RFLP process and its testing procedures. The PCR technique is still subject to dispute. The PCR technique does not used to directly analyze DNA. Instead, it makes possible the application of other techniques when only minute biological specimens are available. *Id.* PCR allows a scientist to take what would ordinarily be an inadequate sample and reproduce it until enough DNA copies can be examined. *Id.*

The PCR technique has recently come under strict scrutiny in Sacramento, California. A Sacramento Superior Court Judge, Ronald Tochterman ruled, after a three week hearing, in a recent rape-murder case, that DNA evidence would not be admitted because he found the technique used to test the sperm sample was not "generally accepted in the relevant scientific community." Judge Tochterman based his ruling, in part, on a disclaimer found in a warranty notice which accompanied the PCR test kit. The warranty read, "The performance characteristics of these procedures have not

opinions discuss the admissibility of DNA profiling evidence that result from the RFLP process,[48] this Note will briefly discuss the basic testing procedures followed in the RFLP analysis.[49]

The DNA molecule stores a person's hereditary information.[50] The premise underlying the DNA "fingerprint" is that each person's DNA is distinct, except for identical twins.[51] With the exception of red blood cells,[52] DNA is found in all body cells of an individual[53] and controls the expression of all genetically determined characteristics that differ within a particular species.[54]

An individual's DNA can be found in the nucleus of each of his or her cells. DNA is made up of four base pairs (nucleotides):[55] adenine (A), guanine (G), thymine (T), and cytosine (C). Because of size and bond restrictions[56] on the nucleotides, A and T can only pair with one another and G and C can only

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been fully established." Wayne Wilson, *Judge Throws Out DNA Evidence*, THE SACRAMENTO BEE, September 20, 1990, at B3.

48. *See* Andrews, *supra* note 17; Caldwell v. State, 393 S.E.2d 436 (Ga. 1990); California v. Axell, 235 Cal. App. 3d 836 (1991) (first state appellate court in California to uphold the use in criminal proceedings of testing results from RFLP analyses); Hopkins v. Indiana, 579 N.E.2d 1297 (Ind. 1991) (Indiana takes deferential approach in reviewing opinions of expert witnesses regarding RFLP analysis); United States v. Yee, No. 89CR0720, U.S. Dist. LEXIS 15908 (N.D. Ohio 1990).

49. Judges, lawyers, and other individuals need to have a basic understanding of the processes used by laboratories which perform DNA testing for forensic purposes, in order to comprehend the importance and significance of the test results and the role they will play in our criminal justice system.

Several sources were consulted regarding the techniques and procedures used in the RFLP analysis. For an excellent discussion of the RFLP analysis see K. F. Kelly, J. J. Rankin & R. C. Wink, *Method and Applications of DNA Fingerprinting: A Guide for the Non-Scientist*, 1987 CRIM. L. REV. 105 (1987); Kanter, Baird, Shaler, *Analysis of Restriction Length Polymorphisms in Deoxyribonucleic Acid (DNA) Recovered From Dried Bloodstains*, 31 J. FORENSIC SCI. 403-408 (1986). For a detailed scientific discussion of DNA analysis see Jeffreys, Wilson and Thein, 314 NATURE 67 (1985).

50. PETER H. RAVEN & GEORGE B. JOHNSON, BIOLOGY 285 (2d ed. 1989) [hereinafter RAVEN]. The DNA molecule is found in the chromosomes in the nucleus of a cell and provides the genetic code which determines a person's characteristics. Cellmark Diagnostics, Information Packet p. 2. The DNA molecule looks like a ladder that has been twisted into a structure called a "double helix". *Id. See also* FRANCISCO JOSE AYALA, MODERN GENETICS 292 (1980).

51. Lander, *supra* note 8, at 501.

52. Non-nucleated cells such as mature red blood cells have no DNA. This phenomenon does not, however, prevent DNA typing of blood because white blood cells contain a nucleus and thus DNA. United States v. Jakobetz, 747 F. Supp. 250, n.2 (D. Vt. 1990).

53. *Id.* The composition of a person's DNA does not vary from cell to cell, except in egg and sperm cells which have half the complement of DNA present in the body cells. Congress, *supra* note 9, at 4.

54. Andrews v. State, 533 So. 2d 841, 847 (Fla. Dist. Ct. App. 1988). *See also* AYALA, *supra* note 50, at 1.

55. Congress, *supra* note 9, at 41.

56. Kelly, *supra* note 49, at 106.

pair with one another.[57] The order in which the nucleotides pair is an important factor in determining the genetic information carried by DNA.[58] The nucleotides form what is commonly referred to as a double spiral staircase or double helix.[59]

Only a fraction of the base pairs in each person differ between any two individuals.[60] It is at these particular sites in a person's genetic make-up where variations occur.[61] These variations are called polymorphisms.[62] Polymorphisms can be compared between any two individuals, thus establishing the basis of DNA profiling.[63]

DNA profiling requires several steps. The first step is for a technician to extract DNA samples from cells contained in blood, semen, hair, or other biological matter.[64] A restriction enzyme[65] is used to cut the DNA into several fragments at various points in the nucleotide sequence.[66] Secondly, the fragments are sorted according to their length so that samples can be compared through a technique called electrophoresis.[67]

During the third step, the DNA fragments are chemically split and the

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57. *Id.*

58. The genetic code lies in the order of the bases in the DNA molecule and the order of bases is passed on from one generation of cells to the next and from one generation of an organism to the next. Caldwell v. State, 393 S.E.2d 436 (Ga. 1990). It causes a rhinoceros to give birth to a rhinoceros and not to an ant. *Id.*

59. A molecule of DNA resembles a twisted ladder. United States v. Jakobetz, 747 F. Supp. 250 (D. Vt. 1990). The rails of the ladder are made up of repeated sequences of phosphate and deoxyribose sugar. *Id.*

60. Base pairs are two complementary nucleotides (adenosine and thymidine or guanosine and cytidine) that are held together by weak bonds. Two strands of DNA are held together in the shape of a double helix by the bonds between base pairs. Congress, *supra* note 9 at, 183.

61. Congress, *supra* note 9, at 4.

62. A polymorphism is the presence of several forms (of a trait or a gene) in a population. AYALA, *supra* note 50, at 809. *See also* United States v. Jakobetz, 747 F. Supp. 250, 251 (1990).

63. *See* Caldwell v. State, 393 S.E.2d 436 (Ga. 1990).

64. *Id.* at 439.

65. The RLFP processes relied upon by Cellmark, Lifecodes and the FBI each rely on different restriction enzymes. Congress, *supra* note 9, at 46. A restriction enzyme can be thought of as biological scissors which cut DNA into fragments. Each enzyme recognizes a particular sequence in DNA and cuts the DNA molecule in places where this sequence is present. CELLMARK DIAGNOSTICS, INFORMATION PACKET 3 (1989).

66. *Caldwell*, 393 S.E.2d at 439.

67. Electrophoresis is a technique for separating molecules by exposing them to an electrical charge. This process separates the numerous fragments that are placed on an electrically charged sheet of gel causing the larger pieces to remain at the top of the sheet and the smaller pieces to move to the bottom due to charges carried on both the DNA and the gel. AYALA, *supra* note 50, at 802. The distance a particle travels on the electrophoretic field depends on its size; the smaller particles will migrate farther than larger particles. *Id.*

resulting single strands are transferred onto a nylon membrane/filter paper in a process called "Southern transfer".[68] This nylon membrane is stained with a chemical, which allows a person to visualize the DNA strands on paper.[69] In the fourth step, radioactively marked DNA strands of a known sequence are introduced on the membrane paper.[70] These radioactive strands function as probes and allow DNA banding patterns and their lengths to be visualized and measured[71] through a process called hybridization.[72]

Exposing the membrane to X-Ray film, called an autorad or autoradiography,[73] allows for patterns of bands to be compared with those from another sample from the same individual or with a pattern of bands produced from another individual's DNA.[74] Comparison of these bands involves an interpretation of the autorads to determine if a visual match exists.[75]

While the genetic test results themselves play an important role, each step that leads to the end result is equally significant.[76] If any of the processes or steps used are not accurately performed, the overall validity of the test could be compromised.[77] In order for the test results to be accurate, all preliminary processes must be performed without significant error.[78]

Attorneys educated and familiar with the processes used in DNA testing

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68. The transferring of the fragments from the gel to a nylon paper-like material is a procedure known more commonly known as "Southern Blotting", after its inventor, Professor Ed Southern. Kelly, *supra* note 49, at 107. The fragments pass from the gel to the nylon sheet in a way similar to the movement of ink into blotting paper. *Id.*

69. The fragment detected by the probe is seen as a dark band on a transparent x-ray film. Congress, *supra* note 9, at 47. Its approximate size can be determined by comparing it to pieces of DNA of known length that were electrophoresed on the gel along with the sample. *Id.*

70. Spencer v. Commonwealth, 384 S.E.2d 775 (Va. 1989), *cert. denied*, 110 S. Ct. 759 (1990).

71. For instance, a probe with the sequence -G-A-T-C-C-T-A-C will seek out and attach itself on the nylon membrane with its complementary sequence -C-T-A-G-G-A-T-G. Kelly, *supra* note 49, at 106. If no complementary match is found, the probe will not attach itself to anything. However, when a probe does eventually attach itself to a complementary sequence, radioactivity occurs at the point of attachment. *Id.*

72. Caldwell v. State, 393 S.E.2d 436, 439 (Ga. 1990).

73. After the film is processed, black bands will appear where the radioactive probes bond. United States v. Jakobetz, 747 F. Supp. 250, 252 (D. Vt. 1990). All of the four probes used by Lifecodes produce an average of two dark bands on a white column. This resembles the bar codes found on food packages in supermarkets. Caldwell v. State, 393 S.E.2d 436, 440 (Ga. 1990). The fragment detected by the probe can be visualized through an X-Ray pictures. *Id.*

74. *Jakobetz*, 747 F. Supp. at 253.

75. Congress, *supra* note 9, at 46.

76. Thompson & Ford, *supra* note 2, at 64.

77. *Id.*

78. *Id.*

analysis are better prepared to advocate for either the introduction or exclusion of the evidence resulting from the testing procedures.[79] Additionally, knowledge of the procedures used in DNA testing aides judges in their determinations as to whether or not the genetic evidence in a particular case will be admissible under the evidentiary standard[80] adopted by that jurisdiction.

II. LEGAL STANDARDS THAT HAVE DEVELOPED CONCERNING THE ADMISSIBILITY OF DNA PROFILING EVIDENCE

The legal standards and approaches that state and federal judges follow in determining the admissibility of DNA profiling evidence are not uniform.[81] The state and the federal judiciary are split as to the appropriate standard to apply.[82] Essentially, two main standards have evolved to determine the admissibility of such evidence: the *Frye*[83] standard, and the relevancy approach.[84] Even though different standards for admissibility exist, all are designed to determine the reliability of the scientific test involved in a case.[85]

Because a workable DNA admissibility standard has not been uniformly adopted by all jurisdictions, a considerable amount of discretion is left to the trial court to apply an approach of its own. While this grant of discretion is not necessarily undesirable, this discretion has created inconsistencies among both state and federal jurisdictions. Furthermore, if a trial court has wide discretion regarding admissibility, its evidentiary decision regarding DNA profile evidence will probably not be disturbed on appeal unless the appellate court finds that the trial court judge abused his or her discretion.[86]

A. Overview of the Frye Standard

One standard of admissibility for DNA profiling evidence, developed sixty-

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79. The more attorneys are aware of each of the processes and how they operate during forensic DNA analysis, the more apt they will be to ensure that procedures were performed correctly in an instant case.

80. *See infra* notes 81-130 and accompanying text.

81. *See infra* notes 132-241 and accompanying text.

82. *Id.*

83. *See infra* notes 87-94 and accompanying text.

84. *See infra* notes 95-102 and accompanying text. Courts have developed several other standards, which are closely related to *Frye* and/or the Relevancy standard. Thompson & Ford, *supra* note 2, at 858.

85. *See generally* Mark McCormick, *Scientific Evidence: Defining a New Approach to Admissibility*, 67 IOWA L. REV. 879 (1982).

86. However, at least one state court of appeals has held that the denial of a continuance pending the state's receipt of DNA test results was an abuse of discretion. *See* State v. Stroud, 459 N.W.2d 332 (Minn. Ct. App. 1990).

nine years ago, is referred to as the *Frye* standard (*Frye*).[87] This standard requires a hearing to determine the scientific acceptance of new tests before the tests' admissibility can be determined. A basic tenet of the *Frye* rule is that general acceptance of a scientific principle or discovery is an indication of reliability.[88] As the court stated in *Frye v. United States*:

> Just when a scientific principle or discovery crosses the line between the experimental and 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.[89]

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87. Several courts have ruled DNA profiling evidence admissible using the *Frye* standard. Colorado v. Fishback, No. 90CAO936, 1991 Colo. App. LEXIS 363 (Dec. 5, 1991); California v. Axell, 235 Cal. App. 3d 836 (1991); Hopkins v. Indiana, 579 N.E.2d 1297 (Ind. 1991) (concurring opinion recoginized that the *Frye* general acceptance test has not been conclusively adopted as a prerequisite to expert testimony in Indiana . . . the majority's analysis should not be construed as an endorsement of *Frye*); Smith v. Deppish, 807 P.2d 144 (Kan. 1991); State v. Schwartz, 447 N.W.2d 422 (Minn. 1989) (DNA typing using RFLP analysis is generally accepted in the scientific community under the *Frye* standard, but results not admitted because they lacked foundational adequacy); State v. Davis, 814 S.W.2d 593 (Mo. 1991), *cert. denied*, Davis v. Missouri, 112 S. Ct. 911 (1992); State v. Ford, 392 S.E.2d 781 (S.C. 1990); Glover v. State, 787 S.W.2d 544 (Tex. Ct. App. 1990); State v. Woodall, 385 S.E.2d 253 (W. Va. 1989) (court takes judicial notice of DNA typing reliability but test results not admitted because they were inconclusive).

88. Thompson & Ford, *supra* note 2, at 53.

89. Frye v. United States, 293 F. 1013, 1014 (D.C. Cir. 1923). The *Frye* standard has been subject to critical analysis, limitation and modification in the last decade. Some courts have held that general acceptance goes to the weight of the evidence, rather than an initial determination of admissibility. *See* Jenkins v. State, 274 S.E.2d 618, 619 (Ga. Ct. App. 1980) (court addressed general acceptance of the process of electrophoresis with blood samples). Still other courts have interpreted the *Frye* doctrine as a test only applicable to the truthfulness of an application. People v. Allweiss, 396 N.E.2d 735 (N.Y. 1979) (court discussed the admissibility of microscopic comparison of hair under *Frye*).

Additionally, several critics find fault with the *Frye* standard. For an excellent discussion of the advantages and disadvantages of the *Frye* doctrine see Paul C. Giannelli, *The Admissibility of Novel Scientific Evidence:* Frye v. United States *A Half Century Later*, 80 COLUM. L. REV. 1197 (1980); *See also* Mark McCormick, *Scientific Evidence: Defining a New Approach to Admissibility*, 67 IOWA L. REV. 879 (1982). One disadvantage of application of the *Frye* rule is that it may cause a delay in the admissibility of reliable evidence because a "cultural lag" may exist between the development and acceptance of new techniques. Thompson & Ford, *supra* note 2, at 54.

A second criticism of the *Frye* approach is that it is ambiguous. For example, some courts focus on the underlying theory being generally accepted while other courts focus on the technique itself. *Id.* at 55.

A third criticism of the *Frye* approach is that this approach is predicated on a "nose counting" and may result in the exclusion of reliable evidence. *See* United States v. Downing, 753 F.2d at 1238 (3d Cir. 1985).

The *Frye* rule has not maintained its original meaning and interpretation over the years.[90] The Supreme Court of Delaware modified the original *Frye* doctrine when applying the standard to determine the admissibility of DNA profile evidence. In *State v. Pennell*,[91] the Delaware court stated that the *Frye* standard would no longer be the sole test for determining the admissibility of scientific evidence.[92] Instead, the court proposed an alternate form of *Frye* that provided that a qualified expert may offer his opinion based on tests or processes if they are reasonably relied upon by experts in the particular field forming opinions or inferences upon the subject.[93] The basic difference with the traditional *Frye* test is that Delaware requires only that the tests or processes are "reasonably relied upon by experts in the field" rather than "generally accepted by experts in the field".[94] This modification is more liberal than the original *Frye* doctrine because it provides for a lower threshold for determining the admissibility of scientific evidence.

B. Overview of the Relevancy Approach

The second major standardized approach used to determine the admissibility

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90. *See generally* Thompson & Ford, *supra* note 2.

91. State v. Pennell, 584 A.2d 513 (Del. Super. Ct. 1989). Prior to the Pennell decision, no court in Delaware had determined the admissibility of forensic DNA analysis in a criminal case where such evidence has been challenged by the defense.

Testimony was presented on behalf of the prosecution by Dr. David Housman, Professor at Massachusetts Institute of Technology, and staff member at the Center for Cancer Research, MIT, accepted as an expert in molecular biology and molecular genetics; Dr. Robin Cotton, manager of research and development, Cellmark, accepted as an expert in molecular biology and biochemistry; Dr. Lisa Forman, Cellmark, accepted as an expert in population statistics; Karen Rubenstein, staff molecular biologist, Cellmark, (person who performed the analysis in this case); Dr. David Goldman, Chief, Section on Genetic Studies at NIAAA, accepted as an expert in human genetics; and Dr. Edward Ratledge, Director, Center for Demography, University of Delaware, accepted as an expert in demographics.

The defense presented testimony by Dr. Lawrence Mueller, Associate Professor, University of California, accepted as an expert in ecology and population genetics; Dr. William Thompson, Associate Professor, University of California, accepted as an expert in psychology, social science surveys, and social ecology.

92. *Id.* at 515. However, it should be noted that the court expressed that the basic principles underlying *Frye* are protected by the current standard that opinions may be based on information, tests or processes which are reasonable relied upon by experts in the field.

93. *Id.* The court went on further and listed the requisite analysis which the trier of fact must undergo. The court must determine first that the expert being offered is qualified; second that the evidence offered is otherwise admissible, relevant and reliable; and third that the bases for the opinion are those reasonably relied upon by experts in the field; and fourth that the specialized knowledge being offered will assist the trier of fact in understanding the evidence or to determine a fact in issue; and finally whether such evidence would create unfair prejudice, confusion of the issues, or misleading of the jury. *Id.*

94. *Id.*

of scientific evidence does not depend on an assumption of reliability.[95] Several jurisdictions adhere to the relevancy approach in determining the admissibility of DNA evidence.[96] Under this approach, codified in Rule 403[97] of the Federal Rules of Evidence (FRE), DNA evidence will be excluded only if its probative value is substantially outweighed by its prejudicial effect.[98] As a result, under the relevancy approach, it is possible that scientific evidence could be admissible without a showing of reliability.[99] The relevancy approach may seem to provide a clear and succinct method of analysis for the introduction of novel scientific evidence.[100] However, application and interpretation of this approach is very fact-intensive and, as a result, analysis under this method requires a case-by-case examination.

Analysis under the relevancy approach becomes further complicated when a jurisdiction qualifies this approach. Some jurisdictions qualify this approach, yet still identify their analyses as being conducted under the original, unmodified relevancy approach.[101] The language of Rule 403 does not expressly refer to

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95. *But see* FED. R. EVID. 703 "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".

96. Prater v. Arkansas, 307 Ark. 180 (1991); Andrews v. State, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988); Caldwell v. State, 393 S.E.2d 436 (1990); State v. Brown, 470 N.W.2d 30 (Iowa 1991); Spencer v. Commonwealth, 384 S.E.2d 775 (Va. 1989).

The test for relevancy under the Federal Rules of Evidence includes an analysis of:

1. the soundness and reliability of the process or technique used in generating the evidence,
2. the possibility that admitting the evidence would overwhelm, confuse, or mislead the jury, and
3. the proffered connection between the scientific research or test result to be presented, and particular disputed factual issues in the case.

United States v. Downing, 753 F.2d 1224, 1237 (3d Cir. 1985).

97. FED. R. EVID. 403.

98. FED. R. EVID. 403 states:

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

99. For instance, evidence may be admitted under the Relevancy approach without a showing of reliability. This approach signifies that any attack on the evidence's reliability will go to the weight of the evidence. *Frye*, on the other hand, demonstrates that attack on the evidence's reliability will go to the initial question of admissibility. If, however, the evidence is unreliable, it may be excluded on grounds of prejudice. FED. R. EVID. 403.

100. *See supra* notes 95-99 and accompanying text.

101. *See* Andrews v. State, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988). *See supra* notes 95-99 and accompanying text. *See also* United States v. Downing, 752 F.2d 1224 (3d Cir. 1985). In *Downing*, the court listed numerous factors which determine the reliability of scientific evidence. These factors include:

1. the technique's relationship to more established modes of scientific analysis,
2. the existence of literature addressing this technique,

reliability as a factor to be weighed in the balancing test. However, one qualification of this standard recognizes relevancy as being the threshold for admissibility while at the same time allowing only reliable scientific evidence to be admitted.[102] This complicates the application of the relevancy approach because courts have not clearly distinguished between the original and qualified approaches.

C. COMPARISON OF THE *FRYE* AND RELEVANCY APPROACHES AS APPLIED TO DNA PROFILING EVIDENCE IN A CRIMINAL PROCEEDING

Some confusion exists as to whether *Frye* has been implicitly superseded by the Federal Rules of Evidence.[103] Rule 702,[104] governing the testimony of expert witnesses, allows for the admissibility of such testimony if it "will assist the trier of fact to understand the evidence or to determine a fact in issue."[105] Neither the Federal Rules of Evidence nor its accompanying Advisory Notes mentions or explicitly recognizes the *Frye* decision.[106] Although commentators[107] have stated that the *Frye* or the "general scientific standard" differs only slightly from that of the relevancy and expert testimony rules as stated in Federal Rules of Evidence 401,[108] 403[109] and 702[110] respectively,[111] specific application of these standards to DNA profiling

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3. the qualifications and professional stature of the expert witnesses, and
4. the nonjudicial uses to which the scientific technique are put.

Id. at 1238-1239.

102. *See infra* notes 225-41 and accompanying text.

103. *See* Paul C. Gianelli, *The Admissibility of Novel Scientific Evidence:* Frye v. United States, *Half-Century Later*, 80 COLUM. L. REV. 1197 (1980); Reager v. Anderson, 371 S.E.2d 619, 628 n.4 (W. Va. 1988).

104. "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." FED. R. EVID. 702.

105. *Id.*

106. JACK B. WEINSTEIN & MARGARET A. BERGER, 3 WEINSTEIN'S EVIDENCE (1990 & Supp.). However, some commentators suggest that the legitimate concerns of the *Frye* rule could be met through careful application of the relevancy and expert testimony rules of the Federal Rules of Evidence. *See generally* Ronald N. Boyce, *Judicial Recognition of Scientific Evidence in Criminal Cases*, 8 UTAH L. REV. 313, 327 (1964); Herman L. Trautman, *Logical or Legal Relevancy-A Conflict in Theory*, 5 VAND. L. REV. 385, 393-396 (1952).

107. *See supra* note 106.

108. "Relevant evidence" means 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. FED. R. EVID. 401.

109. *See infra* note 98 and accompanying text.

110. *See infra* note 27 and accompanying text.

111. Mark McCormick, *Scientific Evidence: Defining a New Approach to Admissibility*, 67 IOWA L. REV. 879, 880 (1982). *See also* State v. Woodall, 385 S.E.2d 253 (W. Va. 1989) (the court stated that rules 702 and 403 taken together, preserve the policies underlying the *Frye* rule).

evidence suggests a somewhat different result.

In applying the *Frye* analysis to DNA profiling evidence, the first step would be to determine the particular scientific field in which DNA profiling belongs.[112] This prong of analysis is problematic because the *Frye* standard does not outline the procedure for determining the relevant scientific community.[113] The applicable relevant scientific field will depend on which issues the court recognizes as a prerequisite to admissibility.[114] Consequently, several relevant scientific fields and communities may be recognized under *Frye*.[115]

Assuming that a court mandates that the techniques and theory used in DNA profiling must be scientifically accepted, the appropriate scientific fields would be molecular biology and genetics.[116] Thus, a court would first make a determination that the DNA profiling technique[117] and underlying theory[118] were generally accepted within the molecular biology and genetics fields before allowing the introduction of the genetic evidence. Under the *Frye* method of analysis, the burden would be placed on the prosecutor, or a defendant wishing to exculpate himself with DNA evidence, to show the scientific reliability of the

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112. *But see* Randolph N. Jonakit, *Will Blood Tell? Genetic Markers in Criminal Cases*, 31 EMORY L.J. 833, 852-54 (1982) (too narrow a definition of the pertinent scientific community can render the *Frye* standard meaningless and ineffective).

113. *See infra* note 115 and accompanying text.

114. United States v. Yee, No. 89CR0720, 1990 U.S. Dist., LEXIS 15908, at *93 (N.D. Ohio Oct. 26, 1990).

115. The relevant scientific community or fields will change, depending on a determination of the aspects of the DNA profiling must be generally accepted. If the underlying theory and also the techniques used when laboratories perform DNA testing for forensic purposes need to be generally accepted, then the relevant fields are molecular biology and genetics. *See* Thompson & Ford, *supra* note 2, at 56. Several problems exists with structuring the general acceptance within these two fields. First, scientists usually perform these techniques to analyze clean and fresh biological specimens. Molecular biologists may not have experience with typing contaminated DNA samples because molecular biologists rarely deal with such samples. However, some DNA typing will generally be performed on samples that are aged or contaminated when testing for forensic genetic characteristics. The final step would be to limit the scope of the field to professionals who perform DNA profiling techniques on samples which are aged or contaminated. *Id.*

116. A problem exists if a court were only to focus on the general acceptance of molecular biology and genetics. Scientists generally used these techniques to analyze fresh, clean biological specimens. However, DNA analysis often involves analysis of contaminated samples, and some belief exists that the techniques used on the contaminated samples will be less reliable. *Id.* at 56.

117. The profiling technique includes the laboratory's protocol and procedure. *See supra* notes 64-78 and accompanying text.

118. The underlying theory used in the present analysis is the RFLP procedures. *See* Thompson & Ford, *supra* note 2, at 56.

DNA profiling test.[119]

In contrast to an application of the *Frye* approach, an application of the relevancy approach is less restrictive.[120] Using the relevancy approach, a judge will not have to make the initial determination as to the "general acceptance" of the scientific theory or technique used in a particular case.[121] Instead, a judge merely determines admissibility by the logical relevancy[122] of the evidence.

Under Rule 702, all expert testimony is presumptively admissible if it will assist the trier of fact.[123] Unlike the relevancy approach, the burden of excluding such testimony would be placed on the opponent of the evidence because the opponent is the party seeking exclusion of the evidence.[124] As a result, if the DNA evidence is logically relevant,[125] it will only be excluded if its probative value is substantially outweighed by its prejudicial value.[126]

Clearly, the test results stemming from genetic testing performed on semen found on a rape victim and blood taken from a suspected rapist are logically relevant within the meaning of the Federal Rules of Evidence.[127] In a jurisdiction adhering to the original relevancy approach, the admission of the DNA test results is more probable than in a jurisdiction using the *Frye*

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119. The prosecutor has the burden because before the evidence will be admitted under this standard, the proponent must present evidence that the foundational requirements under *Frye* are satisfied. If the defendant sought to introduce the evidence, the burden would be on this party.

120. Evident of the less restrictive nature of the relevancy approach as compared to the *Frye* standard is the decision in Andrews v. State, 533 So.2d 841 (Fla. Dist. Ct. App. 1988). The *Andrews* court stated: "the general acceptance approach of *Frye* which is predicated on a 'nose counting' . . . may result in the exclusion of reliable evidence." *Id.* at 846.

121. Although the relevancy approach avoids the somewhat complex determination of which scientific field is relevant in making the determination of "general acceptance," the relevancy approach may take into account this factor in determining the evidence's admissibility. Using the *Frye* approach, "general acceptance" is explicitly required before the admission of evidence, the relevancy approach merely looks to the reliability as one of several factors to determine the evidence's admissibility. *See* United States v. Downing, 753 F.2d 1224, 1237 (3d Cir. 1985).

122. *See supra* note 108. *See also* LA. REV. STAT. ANN. § 441.1 (West 1991) (evidence of DNA profiles are relevant as proof in conformity with Louisiana's Code of Evidence).

123. *See supra* note 104.

124. State v. Woodall, 385 S.E.2d 253, 259 (W. Va. 1989).

125. *See supra* note 108 and accompanying text.

126. *See supra* note 98 and accompanying text.

127. *See supra* note 108 and accompanying text. Additionally, the test results will be logically relevant under the Federal Rules of Evidence if there is a finding that there is a scientific basis for the test.

approach[128] because of the liberal scope of admissibility under the relevancy approach.

A possibility exists that analyzing identical facts in two jurisdictions each adhering to different standards for admissibility may lead to different conclusions regarding the introduction of genetic evidence. Provided that DNA test results are the only evidence pointing to a particular defendant's guilt, it is conceivable that a jurisdiction complying with the *Frye* standard would set the defendant free if the judge made an initial determination that the technique and/or underlying theory was not generally accepted in the relevant scientific community. On the other hand, in a jurisdiction utilizing the relevancy approach, the defendant would most likely stand trial for rape because the genetic evidence would be rendered admissible since the standard under this approach is more liberal.[129] Furthermore, it is possible that the trier of fact would find the defendant guilty of the crime accused based on the DNA evidence, even though the defendant introduced evidence tending to rebut the assertion that he is in fact the assailant because of the tendency of DNA evidence to "mystify the jury."[130]

Most discussions of the standard for the admissibility of DNA profiling evidence has occurred at the state trial and appellate levels. The standard of admissibility that a state court system uses in determining the admissibility of genetic evidence plays a significant role in determining the evidentiary proof the prosecution or defense counsel must meet during trial.

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128. For purposes of this Note, I am assuming that the analysis under the *Frye* approach will create an obstacle when a judge determines the relevant scientific community that procedures must be generally accepted in.

129. Prater v. Arkansas, 820 S.W. 2d 429 (Ark. 1991). The introduction of DNA profiling evidence in a criminal trial or proceeding becomes more complicated, regardless of the evidentiary standard used, when an identical twin is the alleged assailant. As a consequence of being an identical twin, the defendant shares the same genetic characteristics as his or her twin not on trial. Neufeld & Colman, *When Science Takes the Witness Stand*, 262 SCI. AM. 246 (1990). If a prosecutor were to seek the introduction of genetic evidence tending to link the accused to the scene of the crime, the admissibility would almost certainly create unfair prejudice to the defendant within the realm of the Federal Rules of Evidence. Introduction of the genetic evidence in this case would create unfair prejudice because the evidence might be offered against the twin who did not commit the offense.

130. United States v. Williams, 583 F.2d 1194, 1199-1200 (2d Cir. 1978).

III. USE OF FORENSIC DNA TEST RESULTS IN THE UNITED STATES[131] COURT SYSTEM

A. Introduction of DNA Profiling Evidence in the State Court System and the Standards Used

After the forensic DNA profiling procedures are properly performed,[132] the results of the genetic analysis may be introduced as evidence in a criminal trial or proceeding. The general trend for state courts that have considered the admissibility of DNA profiling evidence has been to favor its admissibility, regardless of the standard the court used in making such a determination.[133] November 6, 1987 marked the first time in the United States that a jury convicted a man of rape based on DNA evidence.[134] The Fifth District Court of Appeals of Florida affirmed a lower court's decision to allow for the introduction and use of the DNA profiling.[135]

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131. DNA profiling evidences' criminal debut took place outside of the boundaries of the United States. After several murders had occurred in an England town, police launched a revolutionary technique to investigate the murders. On January 2, 1987, the police announced a campaign of voluntary blood testing for every male resident in three villages. After taking biological samples from 3,653 men and boys, which amounted to a ninety-eight percent response rate, the offender still had not been found.

The offender had bragged to co-workers on how he had another individual fake his identity when he gave blood. After a co-worker had contacted police, the offender was arrested and later confessed. During the sentencing stage, the judge noted that without the DNA testing, the assailant may still be at large. JOSEPH WAMBAUGH, THE BLOODING (1989).

For a discussion of the International use of DNA tests in other countries, see generally Congress, *supra* note 9, at 24.

132. *See supra* notes 64-78 and accompanying text.

133. *See, e.g.*, State v. Pennington, 393 S.E.2d 847 (N.C. 1990) (applying relevancy test); Kelly v. State, 792 S.W.2d 579 (Tex. Ct. App. 1990) (applying *Frye*); Glover v. State, 787 S.W.2d 544 (Tex. Ct. App. 1990) (applying *Frye*); Caldwell v. State, 393 S.E.2d 436 (Ga. 1990) (applying relevancy test); State v. Ford, 392 S.E.2d 781 (S.C. 1990) (applying less restrictive formulation than *Frye*); Spencer v. Commonwealth, 384 S.E.2d 775 (Va. 1989) (applying relevancy); State v. Schwartz, 447 N.W.2d 422 (Minn. 1989) (applying modified *Frye*); People v. Castro, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989) (applying *Frye*); People v. Wesley, 533 N.Y.S.2d 643 (Albany County Ct. 1988) (applying *Frye*); People v. Shi fu Huang, 546 N.Y.S.2d 920 (Nassau County Ct. 1989) (applying *Frye*). Some courts expressly state in their opinion that DNA evidence would satisfy both the *Frye* and relevancy standards. *See, e.g.*, Spencer v. Commonwealth, 393 S.E.2d 609 (Va. 1990) (DNA evidence satisfies Frye or relevancy test); Andrews v. State, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988) (applying relevancy test but stating that DNA evidence would still be admissible if *Frye* applied). *But see Castro*, 545 N.Y.S.2d at 998 (after a pre-trial hearing, the DNA evidence rendered inadmissible in present case because Lifecode's testing laboratory failed to use the generally accepted scientific techniques and experiments for obtaining reliable results within a reasonable degree of scientific certainty); State v. Schwartz, 447 N.W.2d 422, 427 (Minn. 1989) (results of DNA testing inadmissible in present case because Cellmark failed to establish a foundational adequacy of its testing procedures).

134. Andrews v. State, 533 So. 2d 841 (Fla. Ct. App. 1988) (5th Dist).

135. *Id.* at 851.

In *State v. Andrews*,[136] the prosecution introduced, over defense counsel's objection, DNA print identification evidence that linked the defendant to an alleged rape.[137] The DNA evidence, combined with the victim's identification of the defendant at a photo line up and at trial[138] was sufficient for a jury to find the defendant guilty.

On appeal, the *Andrews* court adopted a qualified "relevancy approach" suggested by other Florida state courts.[139] The *Andrews* court recognized that the threshold for admissibility of the DNA evidence was relevancy, but also noted that only reliable scientific evidence would be admitted.[140] This interpretation avoided a strict application of the relevancy approach and recognized that reliability is a factor to be considered in determining the admissibility of scientific evidence. The *Andrews* court determined that the proffered genetic evidence met the qualified relevancy approach because the evidence was found to be reliable, in addition to being logically relevant, under the Federal Rules of Evidence.[141]

The *Andrews* decision led the way for numerous cases to incorporate evidentiary findings of DNA identification evidence. After *Andrews*, the admissibility of DNA profiling evidence began its path through the United States court system. Several trial and state appellate courts, and eventually state supreme courts, were confronted with the complex issue of determining the

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136. Andrews v. State, 533 So. 2d 851 (Fla. Dist. Ct. App. 1988) (affirming prior decision). In *Andrews*, a twenty-seven year old woman was asleep in her home when a man, whom she could only identify at trial as being a strong black male, broke into her house and raped her. *Id.* at 842.

137. The print identification evidence compared the DNA structure of the victim's blood against the DNA structure of the defendant's blood and the DNA found on a vaginal swab taken from the victim. *Id.* at 843.

138. *Id.* at 851. Even though at one place in the *Andrews* opinion the court states that the victim could only identify the perpetrator at trial as a strong, black male, the court, in a separate opinion states: "in addition to the DNA identification evidence, the victim here identified appellant both at a photo line-up and at trial as the perpetrator." *Id.*

139. The court in *Andrews* adopted a qualified "relevancy approach" suggested by the First District of Florida. *See* Brown v. State, 426 So. 2d 76 (Fla. Dist. Ct. App. 1983) (1st Dist.). This approach was later adhered to by the Fourth District of Florida. *See* Kruse v. State, 483 So. 2d 1383 (Fla. Dist. Ct. App. 1986) (4th Dist.). The *Andrews'* opinion was decided in the Fifth District of Florida.

140. *Andrews*, 533 So. 2d at 846-847.

141. *See supra* note 108. The court in *Andrews* does not recognize that it is adopting a modified relevancy approach. In fact the court agrees with the State's assertion that the evidence would have met the *Frye* standard as well as the relevancy test. *Id.* at 847.

The *Andrews* decision illustrates the potentially devastating effects that introduction of DNA evidence may have on a defendant. As the technician who analyzed the defendant's DNA in Andrews stated, "It's like leaving your name, address, and social security number at the scene of the crime. It's that precise." RAVEN, *supra* note 50, at 360.

standard of admissibility of DNA profile evidence.[142]

B. A State Supreme Court's Attempt to Resolve the Standard for Admissibility

In a case of first impression, the South Carolina[143] Supreme Court in *State v. Ford*,[144] decided the admissibility of test results from the use of an RFLP[145] analysis in a criminal proceeding. South Carolina has neither expressly nor implicitly adopted the *Frye* standard for admissibility, but instead has adopted the less restrictive original relevancy approach.[146] The *Ford* court held that while DNA test results can meet the general standard of acceptance in a scientific community and are admissible pursuant to the *Frye* standard, such tests may be inadmissible on grounds of relevancy.[147]

The victim in *Ford* could not visually identify the defendant as the assailant who had raped her.[148] However, a commercial laboratory[149] performed a DNA profiling analysis on semen found on a patch of the victim's clothing as

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142. Caldwell v. State, 393 S.E.2d 436 (Ga. 1990); Cobey v. State, 559 A.2d 391 (Md. 1989); People v. Wesley, 533 N.Y.S.2d 643 (1988); State v. Ford, 392 S.E.2d 781 (S.C. 1990); Glover v. State, 787 S.W.2d 544 (Tex. Ct. App. 1990).

143. Not only has the South Carolina Supreme Court decided this case of first impression, but the Arkansas Supreme Court recently was confronted with DNA profiling admissibility. Prater v. Arkansas, 307 Ark. 180 (1991) (admissibility of DNA print analysis depends on relevancy of evidence).

144. 392 S.E.2d 781 (S.C. 1990). The prosecution in *Ford*, like the prosecution in *Andrews*, introduced DNA evidence at trial along with other evidence, to prove that the defendant committed criminal sexual assault. *Id.* at 785. In addition to the charge of criminal sexual assault, the defendant was also charged with conspiracy and kidnapping. *Id.* at 781.

145. *See supra* notes 50-78 and accompanying text.

146. South Carolina has employed a less restrictive standard in regard to the admissibility of scientific evidence. In State v. Jones, 259 S.E.2d 120 (S.C. 1979), this court found that the admissibility of "bite mark" testimony was dependant upon "the degree to which the trier of fact must accept, on faith, scientific hypotheses not capable of proof or disproof in court and not even generally accepted outside the courtroom." *Id.* at 124.

147. *Ford*, 392 S.E.2d at 784.

148. *Id.* at 782. On November 1, 1987, the victim travelled as a passenger in a car driven by Ford's codefendant. The victim was unaware that a man, wearing a rubber Halloween mask, was in the back seat of the car. After the car had traveled a short distance, the masked man arose from the back seat and pointed a gun at the victim. After the codefendant pulled off on a dirt road, the masked man forced the codefendant to have sexual intercourse with the victim. The masked man then forced the victim to perform fellatio upon him and then raped her.

After returning to the car, the masked man instructed the codefendant to drive back to the nightclub from which the victim and the codefendant had originally departed from. The masked man took off the mask as he was getting out of the car and the victim got a brief glimpse of his face. *Id.*

149. Lifecodes performed the DNA testing analysis on the biological samples by using the RFLP analysis. State v. Ford, 392 S.E.2d 781, 782 (S.C. 1990).

well as on a vaginal sample taken from the victim.[150] The DNA profile results of the semen samples matched the genetic make-up of the DNA found in Ford's blood sample.[151]

The defendant appealed his conviction of first degree criminal sexual conduct[152] and argued that the RFLP analysis had not been generally accepted by the scientific community as reliable and therefore was not in accordance with *Frye*.[153] Alternatively, the defendant conceded that although specific techniques such as DNA extraction[154] or electrophoresis[155] may have gained general scientific acceptance, the DNA testing process as a whole was unreliable and not generally accepted in the scientific community.[156]

The prosecution presented evidence that the laboratory that performed the test adhered to a quality control program ensuring that the tests were performed in a manner consistent with accepted principles and procedures of genetics.[157] The defendant presented no evidence to contradict the quality control procedures used by the laboratory.[158] Furthermore, the defense did not challenge the admissibility of the evidence through the use of various procedural methods.[159] The defendant's lack of refutation is significant because a trial judge may be more apt to render evidence admissible if it is not challenged by the opposing party.

In reviewing the lower court's decision, the South Carolina Supreme Court found that the DNA profiling analysis had been documented in numerous journals and that the applicability of this analysis to blood and semen samples had been demonstrated.[160] Furthermore, the court recognized that even though

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150. *Id.* at 783.

151. *Id.* Additionally, testimony revealed that the combination of DNA fragments found in Ford's DNA would only occur in one out of 23 million North American blacks. *Id.*

152. *Id.* at 781.

153. *Id.* at 783.

154. For a detailed schematic of Single-locus Probe RFLP analysis illustrating the concept of extraction see Congress, *supra* note 9, at 45. DNA must be chemically extracted from a sample.

155. *Id.* Electrophoresis is the technique used to separate molecules such as DNA fragments or proteins. In forensic uses of DNA tests, electric current is passed through a gel, and the fragments are separated by size. *Id.* at 184.

156. State v. Ford, 392 S.E.2d 781, 783 (S.C. 1990).

157. *Id.*

158. *Id.*

159. *Id.* at 784. For example, possible procedural methods available to the defendant to challenge the admissibility of the DNA profiling evidence include a motion to suppress or a motion in limine. *Id.*

160. Undisputed evidence existed at the trial stage that indicated that the DNA test print has been documented in several journals. Furthermore, the journals revealed that the DNA print test has been applied to blood and sperm samples. *Id.* at 783.

only two other companies used DNA analysis for identification purposes, thousands of universities utilized the same procedure for disease detection.[161]

The court's finding that DNA analysis had been documented in numerous journals did not necessarily signal that the testing procedures were generally accepted by the scientific community. In fact, even the court noted that the use of DNA analysis in forensic settings was a recent development.[162] Furthermore, the assertion that thousands of universities utilized the same procedure for disease detection did not necessarily support a discussion of the introduction of DNA profiling evidence in a criminal proceeding.[163]

The Supreme Court of South Carolina admitted the DNA evidence and reasoned that the initial test for introduction had been met under both the *Frye* standard[164] and the less restrictive relevancy approach.[165] Significantly, the court declared that in future cases, a *Frye*-type hearing was not necessary in determining the admissibility of DNA profiling evidence.[166]

By not requiring a *Frye*-type hearing, the *Ford* court implied that the admissibility questions surrounding forensic DNA evidence have been settled. Furthermore, the *Ford* court acknowledged that questions challenging the testing procedures and the acceptance of the underlying theory of the DNA analysis spoke to the weight of the evidence and not to an initial determination of

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161. State v. Ford, 392 S.E.2d 781, 783 (S.C. 1990).

162. *Id.* The *Ford* court recognized that the focus of DNA tests for identification is different than in diagnostic settings and that problems may exist unique to forensic DNA tests. However, the court stressed that these problems concern the reliability of the tests performed in a specific case. Even though specific problems of DNA testing may affect a specific test's reliability, the court found that challenges to test reliability does not mean that all forensic DNA tests are unreliable. Nevertheless, the court was "convinced that forensic DNA testing may be accomplished with the same techniques used in diagnostic settings." *Id.*

163. *Id.* at 783. Indeed, the South Carolina Supreme Court recognized that forensic DNA testing has a higher probability of sample contamination, than DNA testing for forensic purposes. *Id.*

164. Even though the court did not accept the *Frye* standard it nevertheless, in dicta, stated that the DNA evidence would meet this standard.

165. *See supra* notes 95-102 and accompanying text.

166. State v. Ford, 392 S.E.2d 781, 783 (S.C. 1990). The court commented that a *Frye*-type hearing will no longer be necessary because it found that the RFLP analysis involves scientific methods which have been generally accepted by the professional community. Note, however, that the court did not expressly recognize what profession or professions were included in the community.

The court further reasoned that the initial burden for the admissibility of DNA profiling evidence has been met and that such evidence may be admitted into judicial proceedings in South Carolina in the same manner as other scientific evidence, such as fingerprint analysis and ABO blood tests, routinely used in trial court proceedings. *Id.*

admissibility.[167] More specifically, the court noted that questions surrounding the contamination or chain of custody of the DNA sample related to the weight of the evidence rather than its admissibility.[168] This ruling placed value on the effectiveness of limiting instructions and assumed that a jury would not give unwarranted weight to the introduction of such evidence.

In *Ford*, the court did not allow for a complete admission of all DNA evidence in future cases. Instead, it recognized that the admissibility of evidence may be challenged by issues of relevancy or prejudice.[169] Allowing exclusion based on relevancy or prejudice is important because it provides at least a minimal safeguard for the party against whom the evidence is offered. The court further recognized that if the evidence were tainted so as to be totally unreliable it could nevertheless be excluded.[170] The *Ford* decision illustrates the complexity of first determining the standard for admissibility and then applying the selected standard to the DNA identification in a particular case. Illustrative of the problem surrounding the admissibility of genetic evidence is the ability of the party, against whom the evidence is offered, to contradict and challenge the procedures and quality controls of the laboratory. A defense counsel's silence as to the procedures or processes used should not automatically signal the court to allow for the evidence's introduction. Instead, before DNA profiling evidence can be admitted, both sides should bring to the judge's attention the strengths and weaknesses of the evidence.[171] Ideally, a presentation of these strengths and weaknesses should be brought to a judge's attention outside the presence of the jury in a pre-trial evidentiary hearing.[172] Excluding the jury from the pre-trial hearing is important because possible grounds for a mistrial may arise if the jury is present at the pre-trial hearing and yet the judge determines that the DNA evidence is not admissible.[173]

In addition to judicial recognition of the complexity of admissibility standards, state jurisdictions have begun to recognize the need for uniformity surrounding the admissibility of DNA profiling evidence. As a result, legislators in these jurisdictions have adopted and passed statutes concerned with the admissibility of genetic evidence.

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167. *Id.* 784.

168. *Id.*

169. *Id.*

170. State v. Ford, 392 S.E.2d 781, 784 (S.C. 1990).

171. In fact, in at least a dozen cases in Maine, Florida, Massachusetts, Pennsylvania, California and North Carolina where defense lawyers have been able to retain experts to question the evidence, it has subsequently been withdrawn by the prosecutors. N.Y. TIMES, June 10, 1990, at 6, col. 1.

172. *See infra* note 241 and accompanying text.

173. *See infra* note 240 and accompanying text.

C. *Statutory Solutions to the Admissibility of DNA Evidence*

The admissibility of various scientific techniques, such as speed detection,[174] chemical tests of bodily substances for intoxication[175] and blood tests for paternity[176] has, in some states, been provided for by statute. Similarly, other state statutes address the admissibility of DNA evidence within a family or environmental context.[177]

However, with the current trend of using DNA profiling evidence in criminal contexts, a few states have recently adopted statutes concerned with the admissibility of DNA evidence in a criminal proceeding.[178] These statutes, that declare the DNA profile evidence admissible, remove the need for a prior hearing determining the technique's reliability or scientific acceptance.[179] Presently, seven states have statutes concerning with the admissibility of DNA profile evidence in criminal cases.[180] At least one state has statutorily changed the legal standard for admissibility of DNA profiling evidence from *Frye* to the relevancy approach.[181]

These legislative enactments, however, may be of little help in resolving the evidentiary standard for the admissibility of DNA profiling evidence because of their substantial vagueness or complete silence as to the procedures followed before genetic identification evidence is introduced in a criminal proceeding.[182] Furthermore, in statutes that do provide for procedures to be followed before DNA evidence can be admitted, state legislatures have failed to explicitly define

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174. *See, e.g.*, FLA. STAT. ch. 316.1906 (1990).

175. *See, e.g.*, ALA. CODE § 32-5A-194 (1991).

176. *See, e.g.*, ALA. CODE § 26-17-12 (1991).

177. *See, e.g.*, OKLA. STAT. tit. 2, § 2013 (1990); CONN. GEN. STAT. § 46b-168 (1990).

178. IND. CODE § 35-37-4-13 (1991); MD. COURTS AND JUDICIAL PROCEEDINGS CODE ANN. § 10-915 (1991); MINN. STAT. § 634.25 (1991); TENN. CODE ANN. § 24-7-117 (1991); VA. CODE ANN. § 19.2-270.5 (Michie 1991).

179. *See, e.g.*, IND. CODE ANN. § 35-37-4-13 (Burns 1991); and MINN. STAT. § 634.25 (1991).

180. *Id.*

181. *See* State v. Schwartz, 447 N.W.2d 422 (Minn. 1989). Even though the legal standard was a modified *Frye* (experts in the field generally agree that the evidence is reliable and trustworthy), the court acknowledged the new statute's effective date (August 1, 1989) and stated that after the statute takes affect, the standard for determining admissibility of DNA profiling evidence will be the relevancy standard. *Id.* at 424-25.

182. *E.g.*, MINN. STAT. § 634.25 (1991):

> In a civil or criminal trial or hearing, the results of DNA analysis, as defined in section 299C.155, are admissible in evidence without antecedent expert testimony that DNA analysis provides a trustworthy and reliable method of identifying characteristics in an individual's genetic material upon a showing that the offered testimony meets the standards for admissibility set forth in the Rules of Evidence.

what constitutes a violation of these procedures.[183] In fact, the wording of several of the statutes does not suggest what will happen if a violation occurs. Because several statutes do not provide statutory criteria for determining when a violation of a DNA admissibility requirement occurs, defendants' rights are at risk where DNA evidence is the sole incriminating evidence.

In addition to defining what constitutes an admissibility requirement violation, protection of defendants' rights requires specific remedies for violations of these requirements. Once a violation is identified, the court, the prosecution, and the defense should know the available remedies for a violation. Consequently, clearly defined violations and their corresponding remedies will serve to deter abuse of DNA testing procedures and evidence.

One state that has enacted a vague statute concerning the admissibility of DNA evidence in a criminal proceeding is Maryland.[184] The section of Maryland's statute discussing the purposes of DNA profiling evidence requires no foundational qualifications before the genetic information can be found admissible.[185] Additionally, this statute fails to address whether any attacks on the reliability of testing procedures, testing results, or issues concerning the chain of custody, go to the initial admissibility or to the weight of the DNA evidence.[186]

This ambiguity is significant because different courts within a state may interpret the statutory provisions differently. The omissions in the statute that may lead to different interpretations further reflect the need for uniform resolution. Because of the significant nature of DNA profiling evidence, attacks

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183. *Id.*

184. MD. CTS. & JUD. PROC. CODE ANN. § 10-915 (1990). Admissibility of DNA profiles. This statute became effective on January 1, 1990.

(a) Definitions.

(1) In this section the following words have the meanings indicated.

(2) "Deoxyribonucleic Acid (DNA)" means the molecules in all cellular forms that contain genetic information in a patterned chemical structure of each individual.

(3) "DNA profile" means an analysis of DNA resulting in the identification of an individual's patterned chemical structure of genetic information.

(b) Purposes. In any criminal proceeding, the evidence of a DNA profile is admissible to prove or disprove the identity of any person.

. . . .

185. In order to eliminate the vagueness in the statutes, express foundational guidelines must be set forth so that the party proffering the evidence will know the burden of admitting the evidence. For example, the chain of custody must be established, properly performed procedures by the laboratory analyzing the sample, and proper interpretation of the test results must be established.

186. *See supra* note 184. A party proffering DNA forensic evidence should be aware of what will constitute a violation of the foundational requirements for admissibility. If violations are not definitively expressed, parties seeking the introduction of the evidence may not be as careful to ensure the validity of the results.

on the reliability of DNA evidence should be addressed in the initial determination of its admissibility.[187] If DNA evidence is incorrectly admitted, there exists a potential prejudicial error that may not be fully corrected by a curative instruction[188] to the jury.

Even though some states have adopted statutes prescribing the admissibility of DNA profiling tests and results, these statutes cannot circumvent each state's rules of evidence; the proffered evidence must still meet the requirements for admissibility under the rules of evidence of each respective state. Admissibility of scientific evidence, even though codified in statute, must still pass the balancing test outlined in Rule 403 of the Federal Rules of Evidence. After the statutory requirements for admissibility are met, the evidence may nevertheless be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury.[189]

Even more recent than state legislatures' enactment of statutes addressing the admissibility of DNA profiling evidence is the federal judiciary's involvement in determining the admissibility of genetic identification evidence. As more criminal defendants exercise the option of a post-conviction federal remedy,[190] focusing on an aspect of DNA evidence, an increasing number of federal courts will be forced to address the evidentiary standard for the admissibility of DNA profiling evidence. Both federal district and appellate courts have recently given their own analysis on what the applicable evidentiary

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187. One judge has commented that any attempt to have such attacks relate to the admissibility of the evidence undermines the ability of an attorney to cross-examine. United States v. Two Bulls, 918 F.2d 56 (8th Cir. 1990). However, with the newness surrounding DNA profile evidence an attorney's ability to cross-examine may indeed be hampered. If the attorney cannot retain any experts to support the proposition that the test, procedures, or results were wrongfully applied, than clearly the attorney is at a disadvantage because the judge may allow the evidence in based on the proponents unchallenged testimony. By mandating a pre-trial hearing on the credibility of the testing procedures and the theory underlying the test, an attorney would be sufficiently informed to cross-examine.

188. A curative instruction is an admonition by the court to disregard evidence that was brought improperly to the jury's attention, and then stricken from the record in response to a motion to strike. MICHAEL H. GRAHAM, EVIDENCE TEXT, RULES, ILLUSTRATIONS AND PROBLEMS 558 (2d ed. 1989). These instructions, however, have been characterized as trying to unring a bell. *See* Lakeside v. Oregon, 435 U.S. 333, 345 (1978) ("[T]elling them to ignore the defendant's silence is like telling them not to think of a white bear").

189. FED. R. EVID. 403.

190. Almost every state has one or more post-conviction procedures that permit prisoners to challenge at least some constitutional violations. A prisoner may exercise his right of habeas corpus ad subjiciendum whereby a writ directs a person and commands him to produce the body of the prisoner. The purpose of this writ is to test the legality of the detention or imprisonment, not whether the prisoner is guilty or innocent. BLACK'S LAW DICTIONARY 638 (6th ed. 1990).

standard should be concerning the admissibility of DNA profiling evidence.[191]

IV. SPLIT AMONG FEDERAL JURISDICTIONS CONCERNING THE STANDARD FOR ADMISSIBILITY OF DNA PROFILING EVIDENCE

A. District Courts' Attempt to Define the Standard of Admissibility for DNA Profiling Evidence

Although all federal district and appellate courts are bound by the same rules of evidence, these courts have recently begun to encounter questions addressing the admissibility of DNA evidence. District courts have not been consistent in determining the admissibility of DNA profile evidence in a criminal trial or proceeding.[192] For example, some federal district courts have used the *Frye* standard[193] and some have used a combined approach.[194]

In a recent decision, the United States District Court for the District of Vermont resolved a debate surrounding the ability of DNA profiling evidence to "pierce the protective evidentiary boundaries of the criminal trial."[195] In *United States v. Jakobetz*, the district court answered the debate by denying a defense motion for the suppression of DNA profile evidence in a rape trial.[196] The court ruled that DNA profiling is a reliable scientific technique and that in this particular case the technique was properly applied and therefore the evidence met a modified relevancy test for admissibility.[197]

In *Jakobetz*, the United States alleged that the defendant raped a woman. The FBI performed the genetic testing using the RFLP technique.[198] Both the prosecution and the defense agreed that the appropriate standard to use in

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191. *See, e.g.*, Lobdell v. O'Leary, 918 F.2d 959 (7th Cir. 1990); United States v. Two Bulls, 918 F.2d 56 (8th Cir. 1990); Smith v. Black, 904 F.2d 950 (5th Cir. 1990); Roach v. Martin, 757 F.2d 1453 (4th Cir. 1985); United States v. Jakobetz, 747 F. Supp. 250 (D. Vt. 1990); Yarris v. Fulcomer, No. 89-7210, 1989 U.S. Dist. LEXIS 15295 (E.D. Pa. 1989); Simkunas v. Tardi, 720 F. Supp. 687 (N.D. Ill. 1989).

192. *See infra* notes 193-241 and accompanying text.

193. United States v. Yee, No. 89CR0720, 1990 U.S. Dist. LEXIS 15908 (N.D. Ohio, Oct. 26, 1990).

194. United States v. Jakobetz, 747 F. Supp. 250 (D. Vt. 1990).

195. *Id.* at 254. This ruling was decided on September 20, 1990.

196. *Id.* at 263.

197. *Id.* at 256. Before the *Jakobetz* court ruled that the DNA genetic evidence would be admissible, it closely scrutinized the FBI's procedures and protocols. *Id.* at 257.

198. In interpreting the test results, the FBI used a two stage procedure. First, the FBI employee would determine if a visual match existed. If no match existed, then there would be a determination as to whether the non-match signaled an inclusive result, or an exoneration result. However, if a visual match was declared, then a mechanical measurement is taken to verify that a match does in fact exist. This stage is done through a computer imaging process. *Id.* at 253.

determining the admissibility of the genetic evidence would be the relevancy approach.[199]

The prosecution asserted that any flaws in the testing procedures and results should go to the weight of the evidence. Additionally, the prosecution contended that errors in the application of DNA profiling should be exposed through cross-examination as issues for the jury to resolve.[200] The court, however, rejected the government's position on this issue and reasoned that as long as a scientific technique is considered novel, evidence establishing that the technique was not meticulously performed tends to show that the technique is not conducive to reliable application.[201] As a result, the court held that procedural mistakes that occur during a DNA profiling analysis should be addressed at an initial stage of trial for determining the admissibility of the evidence.

In making its decision to admit the genetic evidence under the relevancy approach, the court relied heavily on the government's experts who testified at a pre-trial hearing that the "potential rate of error in the determination of a match is at worst remote and at best inconceivable."[202] Additionally, the

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199. United States v. Williams, 583 F.2d 1194 (2d Cir. 1978). In *Williams*, the court stated that novel scientific evidence would be analyzed for its admissibility the same as other evidence. *Id.* at 1198. The court went on to further state that the test to use was inherently a balancing one that weighs the probativeness, materiality, and reliability of the evidence against the tendency to mislead or confuse the jury, or unfairly prejudice the defendant. The *Williams* opinion rejected *Frye* in favor of the more flexible approach of the relevancy test. FED. R. EVID. 401-403 and 701-703.

Even though in *Jakobetz* both sides conceded to the standard set forth in *Williams*, the Second Circuit has produced disturbing results concerning the standard to be applied when determining the admissibility of scientific evidence. *See* United States v. Torniero, 735 F.2d 725 (2d Cir. 1984) (in discussing the standard for admissibility, the court failed to recognize the *Williams* decision). *See also* United States v. McBride, 786 F.2d 45 (2d Cir. 1986) (in rendering evidence concerned with psychiatry admissible, the court failed to mention the *Williams* opinion and instead stated that Federal Rule of Evidence 702 specifically applies *Frye* by "requiring that specialized knowledge assist the trier of fact to understand the evidence or to determine a fact in issue." *Id.* at 49.

200. United States v. Jakobetz, 747 F. Supp. 250, 257 n.16 (D. Vt. 1990).

201. *Id.*

202. *Id.* at 256. The *Jakobetz* court also found that the government had established that if the FBI application procedures were erroneously followed, the end result would either be identified as a false negative or as an inconclusive result. *Id.* In *Williams*, the court listed several factors to analyze in determining the admissibility of scientific evidence. As the United States Court of Appeal for the Second Circuit stated:

> 1. One indicator of evidential reliability is the potential rate of error.
> 2. Another reliability indicia is the existence and maintenance of standards.
> 3. A third reliability factor can be the care and concern with which a scientific technique has been employed, an whether it appears to lend itself to abuse.
> 4. A further indication of reliability . . . is its analogous relationship with other types of scientific techniques, and their results, routinely admitted into evidence.

The court in *Jakobetz* expressed, with regards to the fourth criteria, that because the power of identity (of DNA profiling) is considerably greater than most other forensic techniques, strong

Jakobetz court heard testimony presented by the government's experts concerning the reliability of DNA profiling that the FBI performed, and testimony given by defense experts who challenged the reliability and testing procedures used.[203] The defense expert did not dispute that in a non-forensic setting each phase of the technique used in the RFLP process is generally accepted by the scientific community.[204] However, the defense expert tried unconvincingly to persuade the court that, in forensic settings, testing typically involves the use of contaminated samples,[205] for which the FBI had failed to compensate.

Addressing the concerns of a Rule 403 balancing examination,[206] the *Jakobetz* court listened to defense arguments that the introduction of the DNA profiling evidence would be unfairly prejudicial to the defendant and that the jury would regard it with an "aura of mystic infallibility."[207] However, the

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analogies are difficult to establish. *Jakobetz*, 747 F. Supp. at 258.

5. Lastly, a convincing element in determining reliability is the presence of "failsafe characteristics." United States v. Williams, 583 F.2d 1194, 1198-99 (2d Cir. 1978).

Even though the court in *Williams* outlines the above mentioned factors to consider, it is not clear how much each factor should weight in relation to the other. The *Jakobetz* court expressed that the lack of persuasive analogies, by itself, was not enough to preclude admission of the genetic evidence. Likewise, it is not evident how the analysis would turn out if only two of the five factors were present.

See also People v. Wesley, 533 N.Y.S.2d 643 (Albany County Ct. 1988) (DNA fingerprinting test incapable of giving false match or false positive result).

203. Early cases which paved the way for the introduction of DNA profiling evidence generally involved a judged rendering the evidence admissible after only hearing testimony by the side which had proffered the evidence. *See, e.g.*, State v. Ford, 392 S.E.2d 781 (S.C. 1990). However, the judge in *Ford* listened to experts from both sides concerning the merits of the genetic evidence.

Experts testifying for the prosecution included: Dr. Kenneth Kidd, a molecular geneticist and human population geneticist, Dr. C. Thomas Caskey, a molecular biologist and population geneticist, Dr. Bruce Budowle, FBI research chemist and geneticist, and Mr. Lawrence Presley, FBI research chemist and geneticist. These witnesses testified that each step of the RFLP analysis is both reliable and generally accepted in the scientific community for forensic purposes. United States v. Jakobetz, 747 F. Supp 250, 256 (D. Vt. 1990). Additionally, these prosecution experts testified that the FBI procedures for conducting the RFLP analysis were entirely acceptable. *Id.*

On behalf of the defense, Dr. Joseph Nadeau, a molecular biologist and population geneticist testified. *Id.*

204. *Id.* at 256.

205. United States v. Jakobetz, 747 F. Supp. 250, 256 (D. Vt. 1990). Dr. Nadeau argued that in a forensic setting, DNA analysis generally involves the use of tainted samples, instead of "pristine samples used in research and diagnostics." *Id.* On cross-examination, however, Dr. Nadeau conceded that three of the potential problems areas involved in the RFLP analysis (band shifting, sample degradation, and partial digestion by the restriction enzyme) did not occur in this case. *Id.* at 258.

206. The court reasoned that inherent in the balancing test set out by Rule 403 was the court's obligation to require a proportionally higher showing of reliability when there is an increased likelihood of misleading the jury or unfairly prejudicing the defendant. *Id.* at 262.

207. *Id.* *See also* United States v. Williams, 583 F.2d 1194, 1199 (2d Cir. 1978).

court rejected this argument, stating that defense counsel's argument undermined "the combined ability of cross-examination, opposing expert witnesses, and limiting instructions to counteract the hazards of DNA profile evidence."[208] Moreover, the court found that the prosecution sufficiently established the current reliability and accuracy of DNA profiling to justify an "aura of amazement."[209]

The *Jakobetz* court decided the admissibility of the DNA genetic evidence only after hearing testimony presented by both the proponent and the opposing party. Even though the *Jakobetz* court made its decision based on the relevancy approach, the pre-trial hearing conducted in the case was characteristic of a *Frye*-type hearing. The judge eventually ruled that the evidence would be admissible; however, the pre-trial hearing sought to protect the defendant's rights by making an initial determination of admissibility outside of the jury's presence.

In contrast to the Relevancy/*Frye* standard employed in the *Jakobetz* decision is the standard used in *United States v. Yee*.[210] After a six-week hearing, the *Yee* court concluded under a *Frye* analysis, that the processes and procedures used by the laboratory performing the DNA profiling analysis were generally accepted in the pertinent scientific communities.[211] As a result, the DNA profiling test results were admissible because the prosecution had met its burden of proof concerning the standard for admissibility for the genetic evidence.[212]

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208. *Jakobetz*, 747 F. Supp. at 262. *See also Williams*, 583 F.2d at 1199-2000.

209. *Jakobetz*, 747 F. Supp. at 263.

210. No. 89CR0720, U.S. Dist. LEXIS 15908 (N.D. Ohio Oct. 26, 1990). In *Yee*, three members of the Cleveland chapter of the Hell's Angels motorcycle club are charged in state and federal proceedings with murder, conspiracy and illegal possession of firearms. Prosecutors allege that the three men killed a victim as part of a turf war with another organization, the Outlaws Motorcycle Club. Stephen Labaton, *DNA Fingerprinting Showdown Expected in Ohio*, N.Y. TIMES, June 10, 1990, at 6.

211. The *Yee* court agreed with the defendants that the F.B.I.'s DNA principles and procedures must be shown to be generally accepted to scientists beyond the forensic users of the techniques that the F.B.I. used. *Yee*, 1990 U.S. Dist. LEXIS 15908 at *95, relying on Reed v. Stated, 391 A.2d 364, 377 (Md. 1978) (trial court committed error when it limited its consideration of the technique to the testimony of members "of the group actually engaged in the use of and in the experimentation with this technique").

The court went on to further define the pertinent scientific community to include scientists from the fields of molecular biology and population genetics who have expertise in either or both of these fields and a "reasonably comprehensive understanding about the F.B.I.'s DNA testing protocol and procedures." *Id.* at *96.

212. The *Yee* opinion recognized that in accordance with Federal Rule of Evidence 104(a), and precedent established in the Sixth Circuit, the applicable standard of proof to be met by the proponent is a preponderance of evidence. *Id.* at *98.

During the six week *Frye*-type hearing, the *Yee* court listened to several expert witnesses testify on behalf of the prosecution and the defense.[213] The issues surrounding the challenge related to the FBI's procedures and protocol for determining that DNA fragments from known and unknown sources matched. An expert testifying on behalf of the prosecution expressed that although future improvements in DNA forensic technology are probable, these advances did not invalidate the processes being used presently.[214]

The *Yee* opinion examined the evolution of the standard for admissibility for novel scientific evidence in the Sixth Circuit Court of Appeals and concluded that the *Frye* standard was applicable.[215] The opinion recognized that the *Frye* approach encompassed several unanswered questions, including what is the pertinent scientific community whose general acceptance must be manifest, what is the appropriate standard of proof, and what is the meaning of the term "general acceptance."[216]

In trying to uncover what the pertinent scientific community was, the *Yee* court pointed to an important observation concerning the admissibility of DNA profiling in a jurisdiction adhering to the *Frye* standard: the problem of recognizing the applicable pertinent scientific community.[217] Neither party in *Yee* sought to expressly define the relevant scientific community.[218] Instead, the court noted that the government seemed to place emphasis on approval of

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213. The prosecution called six expert witnesses to testify to the validity of the RFLP analysis and the F.B.I.'s protocol and procedures. These witnesses, including testimony from the chemist principally responsible for developing the F.B.I.'s protocol, testified that standards of acceptable scientific practice were met. The prosecution also asserted that the flaws to which the defendant's experts were challenging did not affect the ability of the F.B.I. to reliably declare matches. *Id.* at *23.

The defense called several expert witnesses to testify that the main challenge involved the design of the standards for declaring a match, the quality of basic scientific work required to ensure that a laboratory can perform its work in a reliable and reproducible manner, adequacy of the F.B.I.'s research into the effects of environmental and other outside forces on the DNA fragments, failure to implement a program of proficiency testing of its examiners, and the ability to perform basic scientific procedures in an acceptable manner. *Id.* at *22.

The court also called a witness of its own to testify. This expert witness was Dr. Eric S. Lander, (Associate Professor, The Whitehead Institute for Biomedical Research, Massachusetts Institute of Technology; Member, OTA Advisory Panel, OTA Report, *Genetic Witness: Forensic Uses of DNA*; Member, National Academy of Sciences Committee on DNA Technology and Forensic Science). *Yee,* 1990 U.S. Dist. LEXIS 15908, at *21.

214. United States v. Yee, U.S. Dist. LEXIS 15908, at *34.

215. The court reasoned that the phrase "widely accepted" and "generally accepted" are synonymous. United States v. Yee, No. 89CR0720, U.S. Dist. LEXIS 15908, at *90-91 (N.D. Ohio Oct. 26, 1990).

216. *Id.*

217. *Id.* at *94.

218. *Id.*

other forensic scientists.[219] In contrast, the *Yee* court noted that the defense implicitly acknowledged that acceptance must come from a broader scientific community of members familiar with molecular biology and population genetics.[220]

In making its ruling, the *Yee* court seemed to focus more on the aspect of general acceptance than reliability.[221] Indeed, the judge reasoned:

> If in making its determination about the level of acceptance . . . [if] a court ventures into adjudicating the merits of any underlying scientific disputes, it necessarily will be required to reach conclusions about the validity of the scientific principles and reliability of the procedures and results. At that point, [the standard that evolved for determining the admissibility of novel scientific evidence] would improperly become converted into a hearing whose outcome is dependent on the court's determination of the validity and reliability of the scientific method employed by the proponent. The effect of adjudication of the merits of the scientific dispute, is, therefore, unavoidably to abrogate the . . . standard and substitute in its place [a] reliability standard.[222]

The *Yee* and *Jakobetz* decisions clearly illustrate that federal district courts are divided not only as to the appropriate evidentiary standard used for DNA evidence, but also as to the appropriate factors considered when using that standard. The *Jakobetz* court recognized the need for the proponent to make a showing of reliability,[223] while the *Yee* court found that such a showing would undermine the *Frye* approach to determine admissibility.[224] This difference

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219. *Id.* Cross-examination by the prosecution emphasized that DNA test results, performed by the F.B.I. had been rendered admissible in other courts and had the support and approval of other forensic scientists.

220. United States v. Yee, No. 89CR0720, U.S. Dist. LEXIS 15908, at *96 (N.D. Ohio Oct. 26, 1990).

221. "But the court must take care not to expand the scope of its adjudication, or permit it to exceed those which are delineated by the applicable criteria for admissibility." The court further explained that the criterion in this case is the "general acceptance" of the protocol and not reliability. *Id.* at *99.

222. The court noted that its interpretation of the standard for admissibility may be in error. As a result, the court noted listed factual findings on the scientific disputes if in fact an interpretation of the standard calls for an analysis of factors of reliability. The court found by a preponderance of evidence that the FBI's procedures can reliably detect matches. *Id.* at *136.

But see Caldwell v. State, 393 S.E.2d 439 (Ga. 1990) (admission of DNA test results requires determination of not just whether general scientific principles and techniques are valid, but also whether the laboratory substantially performed scientific procedures in acceptable manner).

223. United States v. Jakobetz, 747 F. Supp. 250, 256-57 (D. Vt. 1990).

224. *Yee,* U.S. Dist. LEXIS 15908 at *99.

in approaches is significant because analyzing similar facts in the two different jurisdictions may lead to different results concerning the admissibility of the DNA evidence.

B. A Federal Appellate Court's Attempt to Define the Standard of Admissibility for DNA Profiling Evidence

One federal appellate court has recently been confronted with the task of resolving whether a trial court correctly determined the admissibility of DNA profiling evidence. In *United States v. Two Bulls*,[225] decided five days after *Yee*, the Eighth Circuit Court of Appeals reasoned that DNA evidence could not be admitted at trial until a preliminary hearing was held to determine whether proper laboratory procedures were used to obtain the proffered test results.[226]

In *Two Bulls*, the prosecution charged the defendant with the rape of a minor.[227] Agents of the FBI were able to isolate a semen stain from the victim's underwear and performed DNA profiling analysis on the semen sample.[228] After comparing the results of this test with genetic testing results of the defendant's blood, the government concluded that a high probability existed that the semen on the victim's underwear came from the defendant.[229]

The defendant challenged the introduction of the DNA test results and moved to suppress the DNA test evidence before trial. At the pre-trial suppression hearing, the district court judge, after hearing testimony of only the government's first expert witness, ruled that testimony had sufficiently established that DNA evidence was generally accepted by the scientific community[230] and that the evidence could be admitted and presented to the jury.[231] However, no witnesses testified on behalf of the defense as to the admissibility of the DNA evidence during this pre-trial suppression hearing.

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225. United States v. Two Bulls, 918 F.2d 56 (8th Cir. 1990). The opinion was filed on October 31, 1990.

226. *Id.* at 61.

227. The prosecution charged the defendant with sexual abuse of a minor resulting from the rape of a fourteen-year-old girl on an Indian Reservation in South Dakota. *Id.* at 57.

228. *Id.*

229. *Two Bulls*, 918 F.2d at 57.

230. United States v. Two Bulls, 918 F.2d 56, 57 (8th Cir. 1990). The *Two Bulls* court neglected to define what scientific community the genetic evidence was scientifically accepted by. However, after the district court ruled at the pre-trial hearing that the evidence could be presented to the jury, the defendant entered a conditional guilty plea. *Id.* The defendant was sentenced to 108 months in prison with two years of supervised released after he served this time. However, his sentence was delayed pending the outcome of his appeal. *Id.*

231. *Id.*

The defendant appealed on the grounds that the trial court applied the incorrect standard in determining the admissibility of the DNA profiling evidence.[232] The defendant argued that the trial court erred by not using the *Frye* test and instead used the standard under Rule 702.[233] Specifically, the defendant argued that the trial court committed reversible error because it did not make a determination as to whether the testing procedures were conducted properly.[234]

The Eighth Circuit stated that:

> given the complexity of the DNA multi-system identification tests and the powerful impact that they may have on a jury, passing muster under *Frye* alone is insufficient to place this type of evidence before a jury without a preliminary, critical examination of the actual testing procedures performed in a particular case.[235]

The court in *Two Bulls* reasoned that despite the applicable standard used for determining the admissibility of genetic evidence, both Rule 702 and *Frye* require the same general approach to the admissibility of new scientific evidence.[236] Further, the appellate court stated that under either of the two standards, the trial court should not "permit speculative and conjectural testing which fails normal foundational requirements necessary for the admissibility of scientific testimony or opinion."[237] The court remanded the case back to the trial court with the instructions to hold an expanded pre-trial hearing.[238] The court listed several factors for the trial court to decide throughout the course of the pre-trial hearing in order to determine the admissibility of the DNA profiling evidence.[239]

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232. The defendant also argued that the district court violated his due process because the pre-trial suppression hearing was incomplete. *Id.* at 58.

233. *Id.*

234. *Id.*

235. United States v. Two Bulls, 918 F.2d 56, 61 (8th Cir. 1990).

236. Indeed, the court viewed the two standards for admissibility as generally compatible and not mutually exclusive. *Id.* at 60.

237. The appellate court vacated the defendant's conviction and set aside the conditional plea. *Id.* at 60.

238. *Id.* at 61.

239. These factors included:

(1) whether DNA evidence is generally accepted by the scientific community,

(2) whether the testing procedures used in this case are generally accepted as reliable and performed properly,

(3) whether the test was performed properly in this case,

(4) whether the evidence is more prejudicial than probative in this case, and

(5) whether the statistics used to determine the probability of someone else having the same genetic characteristics is more probative than prejudicial under Rule 403.

The appellate court, recognizing that the pre-trial hearing was incomplete, expressed that DNA evidence was a new phenomenon and that the resulting potential prejudice to the defendant could be great.[240] As a result, the court reasoned that a sufficient foundational basis was essential concerning the overall admissibility of the DNA evidence. This foundational basis must be found prior to a jury's exposure to the laboratory results.[241] The court recognized that certain procedural safeguards must be adhered to before admitting genetic identification evidence. Although the *Two Bulls* court made an attempt to define an express standard, more specificity and guidelines are needed. Additional clarifying guidelines concerning the admissibility of DNA profiling evidence will tend to discourage and deter the admission of tainted evidence. Guidelines will attempt to insure that proponents will not side-step or avoid proper procedures in obtaining samples. Proponents of genetic evidence should not be allowed to admit genetic evidence without provisions that set forth admissibility requirements.

V. PROPOSED SUPPLEMENTATION OF RULE 702

> [A] body of law is more rational and more civilized when every rule it contains is referred articulately and definitely to an end which it subserves, and when the grounds for desiring that end are stated or are ready to be stated in words.[242]

The admission of DNA profiling evidence directly bears on an ultimate issue[243] in a criminal trial: whether the defendant was in fact the perpetrator of the criminal act. Various procedural methods, such as motions *in limine* or motions to suppress can be used to challenge the admissibility of DNA profiling evidence. However, because of the significant weight a jury may place on DNA evidence, the admission of DNA profiling evidence must be subject to specific judicial scrutiny, and DNA evidence sought to be introduced must be evaluated

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Id. at 61. At least one other federal decision has recognized and adhered to the guidelines for admissibility set forth in *Two Bulls*. *See* United States v. Yound, 754 F. Supp 739 (D. S.D. 1990).

240. "DNA typing poses [a] dilemma in a striking manner. The stakes are high. It is an extraordinarily powerful and promising innovation, but the complexity of the techniques may hide some dangerous pitfalls, and in routine forensic use, it may fail to live up to the high expectations of its proponents. Until additional validation studies are done, the legal profession would be well advised to approach the new techniques with caution." United States v. Two Bulls, 918 F.2d at 56, 58 (8th Cir. 1990) quoting William C. Thompson & Simon Ford, *DNA Typing*, TRIAL 4 (1988).

241. As the *Two Bulls* court stated, "[n]otwithstanding the fact that an objection is sustained and the evidence excluded, aside from valuable trial time wasted, the jury would be exposed to prejudicial proofs and left to speculate as to why the defendant opposed the ultimate result." Two Bulls, 918 F.2d at 60.

242. Oliver W. Holmes, *The Path of the Law*, 10 HARV. L. REV. 457, 468 (1897).

243. An ultimate issue is a question which must finally be answered. BLACK'S LAW DICTIONARY 1365 (6th ed. 1990).

on a case-by-case basis. However, even though a case-by-case analysis[244] is preferable, certain general guidelines should be adhered to in determining the admissibility of DNA identification evidence.

First of all, a term[245] must be selected and used to describe the procedure laboratories use to determine the genetic characteristics of biological matter. This term must encompass two forms of technology: the present available techniques to perform DNA analysis[246] and the future development of technology for DNA analysis. As scientific knowledge progresses, new methods of analysis will develop to compare genetic characteristics in a forensic setting.

Secondly, the proposed guidelines must recognize the novelty of this evidentiary advance in the courtroom setting. The newness of a technological advance does not necessarily mean that the procedure or any aspect of it may be flawed. However, the seriousness and gravity of the introduction of DNA profile evidence in a particular case requires a preliminary hearing on the acceptance of the method used to conduct the test. Furthermore, the reliability of the procedures and processes used to carry out this method must be examined before the evidence may be admitted.

At a preliminary hearing to determine the admissibility of DNA profile evidence, a party proffering the evidence would have the affirmative burden of showing the general acceptance of the method used and the reliability of the specific procedures employed. Several factors may be taken into account to satisfy this burden. These include, establishing the proper acquisition and labeling of the samples, establishing the proper chain of custody, and establishing an accurate interpretation of the test results by at least two qualified scientists familiar with the procedures for genetic testing for forensic purposes.[247]

As indicated throughout this Note, the procedures used in DNA analysis for forensic purposes must be understood before an attorney or other member of the criminal justice system can determine the validity and accurateness of the results. Often this understanding cannot be mastered in a matter of days.

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244. Various issues may remain the same concerning challenges to the admissibility of forensic DNA profiling evidence. For example, the underlying technique (i.e., RFLP) may remain constant in several different cases. However, every case must address challenges to the specific protocol and procedures used by a laboratory in a specific case.

245. *See supra* note 4.

246. For example, the RFLP and PCR techniques are two current methods of forensic DNA analysis.

247. The use of two qualified scientists interpreting the results will tend to eliminate any hasty declaration that a match exists. Each person will act as a check for the other in their process of interpretation.

Consequently, the party against whom the evidence is offered must have appropriate time with which to prepare for the challenge or concession of the evidence. This Note proposes that at least a twenty-one day notice be given by the proponent of the evidence to the party against whom the genetic evidence is offered. Additionally, if the requisite notice is not given, the judge will have discretion to allow for a continuance or may decide to exclude the evidence.

Finally, if one side does not have the ability or cannot find experts to contradict or question the procedures used in a particular case, the court should appoint an independent expert to analyze the procedures and results stemming from the DNA profiling analysis. This court appointed expert may testify at both the pre-trial and trial stages. The cost[248] of retaining such an expert will be placed on the party unable to find an expert to testify on its behalf. In the case of an indigent party, the cost will be paid by the state.

RULE 702.1 FORENSIC DNA ANALYSIS; ADMISSIBILITY

1. Definition

As used in this section, "forensic DNA analysis" means an identification process in which the unique genetic code of an individual that is carried by the individual's deoxyribonucleic acid (DNA) is compared to genetic codes carried in DNA found in human bodily substance samples obtained by a law enforcement agency in the exercise of the law enforcement agency's investigative function.[249]

2. DNA Profiling Evidence; Use in Criminal Proceedings

DNA profiling evidence may be admitted into evidence in any criminal trial or proceeding. However, if a dispute arises as to the credibility of the test procedures or the reliability of the results or testing procedures or processes used by the laboratory the evidence may not be admitted until after the presiding judge, or any appointed judge, hears antecedent prior testimony at a pre-trial hearing on the issues.

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248. It has been reported that while Lifecodes charges $485.00 to analyze a single sample, the experts who present the results in court charge between $800.00 to $1,200.00 per day. The Christian Science Publishing Society, March 27, 1991.

249. *See* IND. CODE ANN. § 35-37-4-13 (Burns 1991). This definition encompasses all methods of DNA analysis, including RFLP and polymerase chain reaction (PCR). Additionally, this broad definition also allows for the future development of new technologies associated with, and whose goal is the association or exclusion of an identity by DNA-based tests.

3. Pre-Trial Hearing

(A) Burden of Proof

During a pre-trial hearing[250] the judge must find that the proponent of the evidence meets the burden of establishing that the DNA analysis performed in the present case provides a trustworthy and reliable method of identifying characteristics in an individual's genetic material. Questions concerning the reliability of testing procedures must be addressed at the initial stage of admissibility. Additionally, if the evidence is admissible, the weight of the evidence may be attacked by issues questioning the reliability of test procedures. The results and any other matter related to the testing will be admissible upon a showing that the offered testimony meets the standards for admissibility set forth in the Federal Rules of Evidence.[251]

(B) Elements of Proof

The party proffering the forensic DNA evidence will have the affirmative burden of showing the following factors (the list is not intended to be an exhaustive of the factors to determine the initial admissibility of the evidence):

(a) the acquisition of the sample,
(b) the chain of custody of the sample and test results,
(c) the proper labeling of samples,
(d) the testing procedures followed, and
(e) the interpretation of the test results by a minimum of at least two scientists properly qualified to read and interpret the test results.

Both the party offering the evidence and the opposing party will have a reciprocal burden of establishing the relevant scientific community for specific challenges to either the procedures used by a laboratory or the results and/or interpretation of those results. The pertinent scientific community will differ depending on the issue[s] challenged.

(C) Court Appointed Expert

When DNA profiling evidence is offered for admissibility, if the party

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250. A pre-trial hearing determining the admissibility of DNA profile evidence is essential. *See, e.g.*, People v. Castro, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989). In *Castro*, a twelve-week hearing was conducted to determine the admissibility of DNA analysis performed by Lifecodes. The court held that DNA testing for forensic purposes can produce reliable results and that current techniques exist which are capable of producing results that are generally accepted in the scientific community. However, the court found as a result of the pre-trial hearing, that Lifecodes did not perform the accepted scientific techniques in analyzing the forensic samples in the present case. Therefore, the DNA test results were ruled inadmissible.

251. *See* MINN. STAT. ANN. § 634.25 (West 1990).

against whom the evidence is offered, has not, in good faith, been able to obtain an expert to testify at the preliminary hearing, the court will appoint an independent expert to testify at the cost of that party. Additionally, the same court appointed expert may testify if the case proceeds to trial and any additional cost will be placed on the party of whose side the expert is testifying.

4. Notice

At least twenty-one days prior to commencement of the proceeding in which the results or any aspect of the DNA analysis will be offered as evidence, the party intending to offer the evidence shall notify the opposing party, in writing, of the intent to offer the analysis and shall provide or make available copies of the profile and the report or statement to be introduced. In the event that such notice is not given, and the person proffers such evidence, then the court may in its discretion either allow the opposing party a continuance or, under appropriate circumstances, bar the person from presenting such evidence. If the party against whom the evidence is offered intends to object to the admissibility of such evidence, he shall give written notice of that fact and the basis for his objections at least ten days prior to commencement of the proceedings.[252]

5. Cost

The cost of the forensic DNA analysis will be placed on the party proffering the evidence. If, in some instances, a person seeking to have a forensic DNA analysis performed cannot afford the cost of the tests, the cost of such testing may shift to the party against whom the testing is offered. This decision will be made on a case-by-case basis to be determined by the presiding judge. In cases where the party is indigent and cannot afford the testing or the cost of the expert witness, the trial judge may order the costs to flow to the state.[253]

6. Statistical Probability Evidence

In a criminal trial or proceeding, statistical population frequency evidence, bases on genetic test results, is admissible to demonstrate the fraction of the

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252. *See* VA. CODE ANN. 19.2, § 19.2-270.5 (Michie 1990).

253. *See, e.g.*, Prater v. Arkansas, 820 S.W. 2d 429 (Ark. 1991). As the *Prater* court stated: "appellant asked for funds to employ an expert on DNA testing . . . [the] elected judge held a hearing and ruled that DNA testing was admissible but, because of a shortage of county funds, declined to appoint an expert in DNA analysis for the appellant. That ruling was in error." *Id.* at 439.

population that would have the same combination of genetic markers as was found in a specific human biological specimen. "Genetic marker" means the various blood types or DNA types that an individual may possess.[254]

7. DNA Evidence: Inadmissible

(A) Unattainable Sample

If DNA testing was performed on biological samples taken from a person and was attempted to be matched with another sample that turned out to be unattainable, than this evidence is not admissible.[255] The inability to obtain a sample from an unknown sample does not go merely to the weight of the evidence, but instead to its relevancy.[256]

(B) Identical Twins

DNA profiling evidence will be inadmissible:

a) where the co-defendants are identical twins; or

b) where one defendant is an identical twin. If the twin who is not on trial is "unavailable",[257] within the meaning of the Federal Rules of Evidence, then the DNA profiling results can be rendered admissible against an identical twin.

8. Applicability of the provisions of Rule 702.1

The specified guidelines and provisions outlined in provisions one through nine of Rule 702.1 apply to any person's request for introduction of forensic DNA profiling analysis in any criminal trial, hearing or other proceeding. This chapter on forensic DNA admissibility shall be only prospectively applied and effective upon passage.

9. Waiver

A party may waive the opportunity to have an expert witness challenge the

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254. *See* MINN. STAT. ANN. § 26 (West 1990).

255. A result such as this is not exculpatory. When a print cannot be obtained, an assertion that the test exculpates the defendant would only confuse the jury. State v. Woodall, 385 S.E.2d 253, 260 (W. Va. 1989).

256. *Id.* The inability to obtain a sample does not tend to make more or less likely any factual issue in the case. Additionally, the scientific testimony would not be helpful to the jury in determining the facts. *Id.* at 261; FED. R. EVID. 403, 702.

257. For example, one of the identical twins may be dead, or may be in another country. If there are facts demonstrating that one twin could not have possibility committed the offense, then the DNA profiling evidence can be rendered admissible provided that the foundational requirements listed in the other sections are met.

validity of the theory of the DNA analysis and the reliability of the procedures of the testing.[258]

Supplementation of Rule 702 will provide for comprehensive and workable standards with express guidelines for judges to follow when faced with the task of determining the admissibility of DNA identification evidence at trial or at any other criminal judicial proceeding. Furthermore, general guidelines for foundational requirements eliminate the potential for a blanket rule that DNA profiling evidence is admissible or inadmissible in all circumstances. Additionally, the supplementation of Rule 702 discourages any potential for misconduct by the proponent of the evidence by setting forth the requirements that the proponent must follow before DNA identification evidence can be introduced.

VI. CONCLUSION

An important goal concerning the admissibility of DNA profiling evidence is the promotion of a workable and uniform standard among criminal court proceedings. In both state and federal courts, the evolving common law standard for the admissibility of DNA profiling evidence is neither clearly definable nor uniform. Furthermore, even though state legislatures have tried to resolve these inconsistencies through statutory solutions, the resulting legislative enactments may create more problems than they solve. Several factors contribute to the lack of uniformity among jurisdictions concerning DNA evidence.

The lack of uniformity is illustrated by the judiciary's use of preliminary hearings to determine the admissibility of genetic evidence. Some jurisdictions allow for a pre-trial hearing regardless of the application of either the *Frye* or Relevancy Approach. However, at least one state supreme court has declared that a *Frye*-type hearing is not necessary. Still other courts recognize that a *Frye*-type hearing alone is not enough.

Perhaps the most important factor contributing to the lack of a uniform and workable national standard for the admissibility of forensic DNA evidence is the apparent overlap of the various evidentiary standards. Courts across the country, and even within the same jurisdiction, have not clearly delineated the relationship and interaction between the competing evidentiary standards. Some courts view the standards as mutually exclusive, while others reason that the standards are complementary.

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258. Waiver may occur, for instance, in a rape case where the defendant is not contesting the fact that he had sexual intercourse with the victim. Instead, the offender may plead the defense of consent.

The admission of DNA evidence in court, however, presents a special dilemma because the scientific analysis surrounding DNA testing involves technical information "beyond the ken" of the average citizen.[259] Furthermore, even if scientists and lawyers agree that the theory underlying the abilities of DNA testing may be sound, various safeguards must be adhered to and followed before this type of evidence can find a place as evidence in a criminal trial or proceeding.

An express and workable admissibility standard that balances the power of the state against the rights of an individual is desirable. Although properly obtained forensic DNA profiling evidence should be admissible in a criminal trial or proceeding, the rights of the party against whom the evidence is offered should be protected in the search for truth. Because DNA profiling evidence is potentially devastating, a step-by-step method of analysis is essential.

The use of DNA profiling evidence in criminal trial and proceedings has gained popular yet sometimes speculative support. Nevertheless, as more people become knowledgeable of the abilities of this evidentiary advance, we can expect that the use of genetic evidence will dramatically increase. Eventually a day will come when forensic DNA profiling analysis will become a routine part of criminal investigations, trials, and other proceedings. Because the common law standard for the admissibility of DNA profiling evidence is not clearly definable and because of the potential powerful consequences of the introduction of DNA profiling evidence in a criminal proceeding, the need has arisen to develop a uniform and workable standard.

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259. People v. Allweiss, 396 N.E.2d 735 (N.Y. 1979) (court approved admission into evidence of expert testimony that a hair found in the murdered victim's teeth matched the hairs removed from the accused's head).