A DEFENSE COUNSEL'S GUIDE TO THE USE OF DNA EVIDENCE IN VIRGINIA

And the Lord said unto Cain, Where is Able thy brother? And he said, I know not: Am I my brother's keeper? And he said, What hast thou done? the voice of thy brother's blood crieth unto me from the ground.[1]

Deoxyribonucleic acid (DNA) testing has been referred to as the "single greatest advance in the 'search for truth' ... since the advent of cross-examination."[2] At trial, proponents of DNA testing bombard juries with statistics in an attempt to show the incredible accuracy attainable with a DNA 'fingerprint' analysis.[3] The admission of DNA tests into evidence in Virginia has provided the Commonwealth's Attorney with this powerful tool which, in the words of one court, "will revolutionize the disposition of criminal cases."[4] This article is written to provide a defense counsel with an understanding of DNA testing and possible methods of attacking both the admissibility and credibility of a DNA test result. Part I will provide a list of states with legislative enactments concerning DNA testing, and will focus on Virginia's legislative response to this new science. Part II will provide a list of states that have judicial decisions concerning DNA testing, and will focus on the particular method of analysis used by the Virginia Supreme Court in its rulings upholding the

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1. *Genesis* 4:9-10 (King James Version).

2. People v. Wesley, 533 N.Y.S.2d 643, 644 (N.Y. Sup. Ct. 1988).

3. For example, in a case involving a white defendant the claim was made that the probability of another caucasian having the same DNA pattern as the defendant was "one in 300 million." U.S. v. Jakobetz, 747 F. Supp. 250, 253 (D. Vt. 1990). In a case involving a black defendant, the probability that another north american black male would have the same DNA pattern as the defendant was expressed as "one in 705 million." Spencer v. Commonwealth, 385 S.E.2d 850, 853 (Va. 1989). In a case involving an hispanic defendant, the probability that another individual could have the same DNA pattern as the defendant was expressed as "one in 234 billion." Martinez v. State, 549 So.2d 694, 695 (Fla. Dist. Ct. App. 1989). These probability figures depend in large part both on the uniqueness of the tested DNA and upon the size and composition of the DNA data bank that is used for comparison. Information concerning the nature of a DNA data bank is contained in Appendix I and footnote 115, *infra*.

4. *Wesley*, 533 N.Y.S.2d at 644 (1988).

admission of DNA tests.[5] Part III will list specific factors affecting the credibility and admissibility of DNA test evidence, and will show how Virginia has dealt with these factors as they have arisen in prior cases. Part IV will conclude with a summary emphasizing steps that a defense counsel should take upon learning that a DNA test is to be performed.

The discussion in Part III may involve the use of scientific terms and procedures that are unfamiliar to the reader. However, several appendixes have been offered to provide the reader with information concerning the DNA molecule and DNA testing. Appendix I describes the DNA molecule and the two types of DNA tests currently in use. Appendix II provides diagrams of the DNA molecule for reference. Appendix III provides a "checklist" outlining the methods of opposing and impeaching DNA evidence discussed throughout the article. The reader unfamiliar with DNA analysis is encouraged to browse through Appendix I before reading Part III.

I. LEGISLATIVE ACCEPTANCE OF DNA TESTING

A. Nationwide

The following states have enacted legislation concerning DNA testing: Arkansas, California, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maryland, Michigan, Minnesota, Missouri, New Hampshire, New Mexico, Oklahoma, Oregon, Tennessee, Virginia, and Washington.[6]

B. The Virginia Legislature's Response to DNA Testing

In 1990, subsequent to the Virginia Supreme Court's opinions holding that DNA test evidence is admissible,[7] Virginia's legis-

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5. DNA testing is also referred to as "DNA Fingerprinting," "DNA Printing," and "DNA Profiling."

6. ARKANSAS CODE ANN. § 9-10-108 (Michie 1987); CAL. PENAL CODE § 290.2 (West 1991); CONN. GEN. STAT. § 46b-168 (1991); FLA. STAT. ch. 943.325 (1991); GA. CODE ANN. § 53-4-4 (Michie 1991); HAW. REV. STAT. §706-603 (1991); ILL. REV. STAT. ch. 38, para. 103-5 (1991); IND. CODE § 35-37-4-13 (1991); IOWA CODE § 13.10 (1989); LA. REV. STAT. ANN. § 15:441.1 (West 1992); MD. CTS. & JUD. PROC. ANN. § 10-915 (1989); MICH. COMP. LAWS § 722.716 (1992); MINN. STAT. § 634.25 (1992); MO. REV. STAT. § 650.053 (1992); N.H. REV. STAT. ANN. § 22:1 (1991); N.M. STAT. ANN. § 40-11-12 (1991); OKLA. STAT. tit. 22, § 751.1 (1992); OR. REV. STAT. § 181.085 (1991) TENN. CODE ANN. § 24-7-117 (1991); VA. CODE ANN. § 19.2-270.5 (Michie 1991); WASH. REV. CODE § 43.43.752 (1992).

7. These four cases are: Spencer v. Commonwealth, 384 S.E.2d 775 (Va. 1989) [hereinafter *Spencer I*]; Spencer v. Commonwealth, 384 S.E.2d 785 (Va. 1989) [hereinafter *Spencer II*]; Spencer v. Commonwealth, 385 S.E.2d 850 (Va. 1989) [hereinafter *Spencer III*]; Spencer v. Commonwealth, 393 S.E.2d 609 (Va. 1990) [hereinafter *Spencer IV*].

lature enacted several statutory provisions concerning DNA testing. Of these new sections, the most important is section 19.2-270.5,[8] which states that "DNA ... testing shall be deemed a reliable scientific technique and the evidence of a DNA profile comparison may be admitted to prove or disprove the identity of any person."[9] This section also establishes a requirement that a party wishing to introduce DNA test evidence must give notice of this intent to the other party at least twenty-one days prior to the commencement of the proceeding in which the test will be offered in evidence. Additionally, when notice is given, the party wishing to admit the test results "shall" give the other party copies of the profiles and the statement that will be introduced. If the other party intends to object to the test's admission, written notice containing the basis for the objections "shall" be given at least ten days before the commencement of the proceedings. If a party introduces a DNA test result without first having complied with the notice requirement, "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."[10] Note that while the language "shall" indicates that both notice requirements are mandatory, there are no such mandatory terms in the section that provides a remedy for failure of an opposing party to comply with the 10-day notice requirement for objections.[11]

Three other statutory provisions that were adopted by the Virginia Legislature in 1990 are sections 2.1-434.1, 19.2-310.4, and 19.2-310.3 of the Virginia code.

Section 2.1-434.1 established a Division of Forensic Science to provide forensic laboratory services, including DNA testing, to assist in the resolution of criminal cases when requested by any state agency.

Section 19.2-310.4 dictates that the Division "shall" conduct DNA tests in accordance with the procedures it adopts. It is therefore imperative that a defense counsel obtain a copy of the laboratory's procedural requirements. Additionally, section 19.2-310.4 states that the "Director or his designated representative shall complete and maintain on file a form" which contains the

8. VA. CODE ANN. § 19.2-207.5 (Michie 1991).

9. *Id.*

10. *Id.* Note that a continuance granted under this section "shall not be counted" for speedy trial purposes under VA. CODE ANN. § 19.2-243.

11. *Id.* § 19.2-270.5.

date and name of the person from whom the sample was taken, and a statement that "the seal on the tube had not been broken or otherwise tampered with." These seemingly minor administrative mandates should be inquired into, for they may provide fertile ground for impeaching the credibility of a DNA test result.

Section 19.2-310.3 lists procedures to be followed when removing a sample. This section specifically states that "chemically clean" needles shall be used, that the sample will bear the subject's name, and that the sample shall be "secured to prevent tampering with its contents." However, unlike section 19.2-310.4, section 19.2-310.3 states that these requirements "are procedural and not substantive," and that "substantial compliance therewith shall be deemed sufficient."

The analysis of section 19.2-310.3 does not end at this point, though. The statute also states, in language coming after the sentence relating to substantial compliance, that the sample "shall" be given to the Department of Forensic Science "not more than fifteen days following withdrawal."[12] A credible argument can be made that the language establishing substantial compliance as the rule for complying with section 19.2-310.3's requirements does not apply to this fifteen day time limit, based on the positioning of the time limit after the substantial compliance language. This interpretation is consistent with the biodegradable nature of the sample. Thus, it could be argued that the time limit expresses the Legislature's intent that the sample be tested as soon as possible to ensure an accurate result.

The remaining sections enacted in 1990 are technical in nature. Section 19.2-310.2 of the Virginia Code requires that every person who receives a felony conviction on or after July 1, 1990 shall have a blood sample removed for DNA testing, the results of which are to be stored in the Department of Forensic Science's DNA data bank.[13] Section 19.2-310.5 states that an additional duty of the Division of Forensic Science shall be to maintain this DNA data bank containing files of prior DNA tests. The Division is also charged with providing test information from the data bank upon the request of a law enforcement official. However, only a test result which matches the test result submitted by the official for comparison may be released.[14] Section 19.2-310.6 provides

12. VA. CODE ANN. § 19.2-310.3 (Michie 1991).

13. This section was recently upheld by the Fourth Circuit Court of Appeals in Jones v. Murray, 962 F.2d 302 (4th. Cir. 1992).

14. VA. CODE ANN. § 19.2-310.5 (Michie 1991).

criminal penalties for unauthorized use of the Division's data bank. Finally, the last of the "class of 1990" DNA statutes, section 19.2-310.7, provides for expungement of an individual's DNA profile from the data bank, upon request, if the felony conviction has been reversed and dismissed.

II. JUDICIAL ACCEPTANCE OF DNA TESTING

A. Nationwide

DNA testing has received nearly universal acceptance in jurisdictions that have dealt with the issue. As of this writing, DNA testing has been successfully introduced as evidence in trials in thirty-one states.[15] DNA testing has also been ruled admissible by the United States District Court for the districts of Vermont and South Dakota, and by the Second and Eighth Circuit Courts of Appeal.[16]

There have been only seven instances in which a particular DNA test was ruled inadmissible.[17] Of these seven cases, however, not one held that DNA testing was inadmissible *per se*. In two of these cases, the particular test in issue was excluded due to poor handling of test procedures.[18] In another, the test result

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15. Snowden v. State, 574 So.2d 960 (Ala. Crim. App. 1990); White v. State, 781 S.W.2d 478 (Ark. 1989); People v. Axell, 1 Cal. Rptr.2d 411 (1991); People v. Fishback, 828 P.2d 489 (Colo. Ct. App. 1991); Hinton v. Commissioner of Correction, 1990 WL 269448 (Conn. June 22, 1990); State v. Pennell, 584 A.2d 513 (Del. Super. Ct. 1989); Andrews v. State, 533 So.2d 851 (Fla. Dist. Ct. App. 1988); Caldwell v. State, 393 S.E.2d 436 (Ga. 1990); State v. Montalbo, 828 P.2d 1274 (Haw. 1992); People v. Miles, 577 N.E.2d 477 (Ill. App. Ct. 1991); Hopkins v. State, 579 N.E.2d 1297 (Ind. 1991); State v. Brown, 470 N.W.2d 30 (Iowa 1991); State v. Smith, 807 P.2d 144 (Kan. 1991); State v. Sylvester, 581 So.2d 361 (La. 1991); Cobey v. State, 559 A.2d 391 (Md. Ct. Spec. App. 1989); Commonwealth v. Curnin, 565 N.E.2d 440 (Mass. 1991); State v. Schwartz, 447 N.W.2d 422 (Minn. 1989); State v. Davis, 814 S.W.2d 593 (Mo. 1991); State v. Williams, 599 A.2d 960 (N.J. 1991); People v. Wesley, 533 N.Y.S.2d 643 (1988); State v. Pennington, 393 S.E.2d 847 (N.C. 1990); State v. Pierce, 1990 WL 97596 (Ohio Ct. App. July 9, 1990); Commonwealth v. Rodgers, 605 A.2d 1228 (Pa. Super. Ct. 1992); State v. Ford, 392 S.E.2d 781 (S.C. 1990); State v. Wimberly, 467 N.W.2d 499 (S.D. 1991); State v. Harris, 1992 WL 127441 (Tenn. Crim. App. June 12, 1992); Glover v. State, 787 S.W.2d 544 (Tx. Crim. App. 1990); Spencer v. Commonwealth, 384 S.E.2d 775 (Va. 1989), State v. Woodall, 385 S.E.2d 253 (W. Va. 1989); *In Re* The Paternity of J.L.K., 445 N.W.2d 673 (Wis. 1989); Ellison v. Walter, 1992 WL 139309 (Wyo. June 24, 1992).

16. U.S. v. Jakobetz, 747 F. Supp. 250 (D. Vt. 1990); U.S. v. Young, 754 F. Supp. 739 (D. S.D. 1990); U.S. v. Williams, 583 F.2d 1194 (2d. Cir. 1978); U.S. v. Two Bulls, 918 F.2d 56 (8th. Cir. 1990).

17. State v. Schwartz, 447 N.W.2d 422 (Minn. 1989); People v. Castro, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989); Commonwealth v. Curnin, 565 N.E.2d 440 (Mass. 1991).

18. State v. Schwartz, 447 N.W.2d 442, (Minn. 1989); People v. Castro, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989).

was excluded because the issue was one of first impression, and the prosecution had failed to prove the "rationality" of the statistical process that produced a claim that only one person in 59 million could have the same DNA pattern as the defendant.[19] Three other cases have excluded such probability statistics.[20] Finally, the DNA test result in one case was excluded due to a failure by the testifying experts to sufficiently establish the validity and general acceptance of the test.[21]

B. Acceptance of DNA Testing by Virginia Courts

Judicial acceptance of DNA testing in Virginia arose from a series of four cases which preceded the 1990 legislative enactments.[22] In the fall of 1987, several women in different locations throughout the state were found murdered in their homes.[23] In each instance, the women were found to have been bound, raped, and strangled by an individual who entered the homes through a window.[24] The perpetrator was quickly dubbed the "South Side Strangler."[25] Police removed biological samples from the scene of each of these crimes for the purpose of conducting a DNA test. The results of the tests of these samples matched the results of the tests performed on samples taken from the suspect, Mr. Timothy Wilson Spencer.[26]

In each of the four separate trials that followed, the State Supreme Court upheld the trial court's admission of the DNA tests into evidence.[27] The defense in each case urged that the court adopt the "Frye test" in considering the admissibility of the DNA test results. The "Frye test" requires that to admit novel scientific evidence, the court must first be convinced that

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19. Commonwealth v. Curnin, 565 N.E.2d 440, 442 (Mass. 1991). The state proved the reliability of the actual test, but failed to introduce any evidence showing the accuracy of the "1 in 59 million" statistical claim.

20. U.S. v. Porter, 1991 WL 319015 (D.C. Super. Ct. Sept. 20, 1991); Commonwealth v. Lanigan, 1992 WL 171780 (Mass. July 20, 1992); State v. Pennell, 584 A.2d 513 (Del. Super. Ct. 1989).

21. Perry v. State, 586 So.2d 242 (Ala. 1991).

22. *See Spencer I-IV, supra* note 7.

23. Alan Cooper, *DNA Case is First Before a State High Court*, Nat'l L.J., July 3, 1989, at 14, col. 1.

24. *Id.*

25. *Id.*

26. *See Spencer I-IV, supra* note 7.

27. *See Spencer I-IV, supra* note 7. Note that in *Spencer I-III*, the test in issue was the "Restriction Fragment Length Polymorphism Analysis" test, while in *Spencer IV* the test under consideration was the "Polymerase Chain Reaction DNA Amplification" test.

the evidence is reliable and that it is generally accepted in the scientific community.[28] In each case the court specifically rejected application of the "Frye test" to this new scientific technique,[29] stating that "[i]f admissibility were conditioned upon universal acceptance of forensic evidence, no new scientific methods could ever be brought to court."[30] Instead, the court adopted another procedure to be followed by the trial court when ruling on the admissibility of scientific evidence.

> When scientific evidence is offered, the court must make a threshold finding of fact with respect to the reliability of the scientific method offered, unless it is of a kind so familiar and accepted as to require no foundation to establish the fundamental reliability of the system, such as fingerprint analysis, ... ; or unless it is so unreliable that the considerations requiring its exclusion have ripened into rules of law, such as "lie-detector" tests, ... ; or unless its admission is regulated by statute, such as blood-alcohol test results ....[31]

The court stated that in making this "threshold finding of fact," the trial court "must usually rely on expert testimony."[32] "If there is a conflict, and the trial court's finding is supported by credible evidence, it will not be disturbed on appeal."[33] The court went on to state that where reliability is disputed, and a sufficient foundation has been laid, "the court may, in its discretion, admit the evidence with appropriate instructions to the jury to consider the disputed reliability of the evidence in determining its credibility and weight."[34]

In regards to the timing of a trial court's decision on the admissibility of new scientific tests, the court, in *O'Dell v. Commonwealth*, stated that it is "generally advisable" to decide the matter of admissibility in a hearing outside the presence of the

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28. Frye v. U.S., 293 F. 1013, 1014 (D.C. Cir. 1923). In all four *Spencer* cases, the Virginia Supreme Court held that if the Frye test were applied the DNA tests would meet its criteria for admission.

29. *Spencer I*, 384 S.E.2d at 783; *Spencer II*, 384 S.E.2d at 797; *Spencer III*, 385 S.E.2d at 856; *Spencer IV*, 393 S.E.2d at 621. The case cited in all four instances for rejection of the "Frye test" is O'Dell v. Commonwealth, 364 S.E.2d 491, 504, *cert. denied*, 488 U.S. 871 (Va. 1988).

30. *Spencer IV*, 393 S.E.2d at 621.

31. *Id.* (citations omitted).

32. *Id.*

33. *Id.*

34. *Id.*

jury.[35] The court further stated that its rationale for this holding is "to avoid a possible mistrial in the event a trial court concludes the tests are not sufficiently reliable to be introduced in evidence."

At this point, it is reasonable to question the importance of the language used by the court in light of the subsequent enactments by the Virginia State Legislature concerning DNA testing. The answer begins with another look at section 19.2-270.5, which states that "DNA ... testing shall be deemed to be a reliable scientific technique ...."[36] While DNA testing is now considered a reliable scientific technique, the admission of particular DNA test results requires the proponent to also show that the testing procedure has been properly conducted to ensure accuracy. This reflects the two part analysis used by the court in *Spencer I* when it stated that "because ... DNA testing is a reliable scientific technique *and that the tests performed in the present case were properly conducted*, we hold that the trial court did not err in admitting this evidence."[37] The court has further stated, however, that in deciding on the admissibility of new scientific evidence, the trial court shall have "wide discretion."[38] Thus, it is unlikely that the Virginia Supreme Court would reverse a trial court's ruling admitting a DNA test result unless there was a great deal of evidence impeaching the credibility of the result.

Still, the fact remains that DNA testing has a great potential to mislead jurors with fantastic statistical claims of accuracy. For this reason the defense counsel should always address the admissibility question in a pretrial hearing. The pretrial hearing is the proper place for the court to first examine this evidence when procedural methods utilized during the test are called into question.[39] A pretrial hearing can serve the valuable function of allowing the judge to evaluate whether the test evidence is "so inherently unreliable that a lay jury must be shielded from it, or whether it is of such character that the jury may safely be left to determine credibility for itself."[40]

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35. O'Dell v. Commonwealth, 364 S.E.2d 491, 504 (Va. 1988).

36. VA. CODE ANN. § 19.2-270.5 (Michie 1991).

37. *Spencer I*, 384 S.E.2d 775, 783 (Va. 1989) (emphasis added).

38. *Spencer IV*, 393 S.E.2d 609, 621 (Va. 1990).

39. People v. Castro, 545 N.Y.S.2d 985, 998-99 (N.Y. Sup. Ct. 1989). A thorough and insightful discussion on the use of pre-trial hearings in evaluating DNA tests begins on page 998.

40. *Spencer IV*, 393 S.E.2d 609, 621 (Va. 1990).

III. Specific Factors Affecting the Credibility of DNA Evidence

There are a number of specific factors that affect the credibility of a DNA test result.[41] The Virginia Supreme Court has addressed only a few of these factors in its analysis of DNA testing in the *Spencer* cases.[42] Some of the factors not addressed in these opinions have been discussed in Virginia cases dealing with other forms of scientific evidence, but a few of these factors have not yet been addressed by the Virginia Supreme Court at all.

A. The Test's Potential Rate of Error

It is highly unlikely that when DNA test results are offered into evidence the jury will be conveniently comprised of persons who hold degrees in molecular biology. Consequently, there is a very real danger that claims of a DNA test result's high degree of accuracy can seduce a lay judge or jury into ascribing an aura of "mystic infallibility" to DNA testing.[43]

In reality, these claims focus on a mathematical calculation of the probability that an individual other than the defendant could be the source of the DNA sample tested. An excellent example of the procedures used to produce such a calculation may be found in *Spencer I*.[44] (Note that the description of these procedures which follows contains terms that the reader may not understand without first reading appendix I.)

The scientist begins by looking at the number of DNA fragments that were shown to be identical in the crime scene and suspect samples.[45] Each one of these matched fragments is then individually compared to a DNA data bank population to determine the frequency with which it could occur at random within the population.[46] Finally, the frequencies with which the matched fragments could occur within the population are multi-

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41. U.S. v. Jakobetz, 747 F. Supp. 250, 254-55 (D. Vt. 1990). The following list of factors was derived primarily from a listing provided in this case.

42. *See Spencer I-IV, supra* note 7.

43. *Jakobetz*, 747 F. Supp. at 255.

44. *Spencer I*, 384 S.E.2d 775 (Va. 1989).

45. The testing procedures used to determine if the crime scene and suspect samples contain identical DNA is described in Appendix I, *infra*.

46. Information concerning the nature of a DNA data bank is contained in Appendix I and footnote 115, *infra*.

plied together, generating a total probability that a person other than the defendant is the source of the DNA.[47]

In *Spencer I*, three different probes matched and bonded with fragments in both the crime scene and suspect samples. Additionally, each separate probe that bonded with a fragment in the crime scene sample also bonded with an identical length fragment in the suspect sample. Thus, it was declared that the two samples tested contained identical DNA. A population genetics expert then attempted to ascertain the relevancy of this match, which in reality is the potential chance that someone else could have the same DNA as that found in the test. The probability of occurrence for each bonded probe was, respectively, 1 in 657, 1 in 1292, and 1 in 159.[48] These three figures were multiplied together, resulting in an overall potential rate of error of 1 in 135,000,000.[49]

At this point the reader should pause to ponder an important rhetorical slight of hand: The last sentence of the preceding paragraph used the term "overall potential rate of error" to describe a formula that is designed merely to calculate the possibility that someone else could have DNA that is the same as the defendant's. Regardless of whether it is intentional or not, a defense counsel cannot allow the prosecution or its witnesses to utilize such deceptive language; he or she should take great pains to insulate the issue of the test's reliability from the potential prejudicial effect of such calculations. In the event that such an astronomical calculation is admitted into evidence, the defense counsel should request that an explicit limiting instruction be given to the jury explaining that the figure is *not* an indication of the reliability of the test, but is merely an indication of the chance that someone else would have the same DNA as that found in the samples tested.

There is no indication that the defense in the *Spencer* cases attempted to challenge either these astronomical figures themselves or the process that produced them.[50] In fact, the defendant was unable to procure even one expert witness to refute these claims.[51]

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47. *Spencer I*, 384 S.E.2d 775, 782 (Va. 1989).
48. *Id.*
49. *Id.*
50. *Id.* at 783.
51. *Id.*

This was not the case in *People v. Castro*.[52] In this case, which arose in a New York trial court, the defense was able to exclude the results of a DNA test by attacking, among other things, the standards used to declare a match.[53] Here, the standard that the laboratory used for declaring a match between the crime scene and defendant samples and the standard that was used to declare the frequency with which the matches could occur within the population were different.[54] The court, applying the "Frye test," found that this particular method of determining the frequency within the population had not gained general scientific acceptance, and held that the statistics produced by this method would be inadmissible.[55]

Even when the statistical methods used are accepted within the scientific community, the admissibility of the figures generated may be challenged based on their potential to prejudice the jury. Such was the argument adopted by the Supreme Court of Minnesota in *State v. Schwartz*.[56] In this case, the state argued that statistical analysis is an integral part of DNA testing, and that the prejudicial effect may be offset by admitting the evidence with proper limiting instructions.[57] The defense countered by claiming that any probative value these statistics have is outweighed by their prejudicial effect, which the court may not be able to limit in light of recent media exposure which had touted the infallible nature of DNA testing.[58]

The court sided with the defense, stating that when "dealing with complex technology, like DNA testing, we remain convinced that juries in criminal cases may give undue weight and deference to presented statistical evidence and [we] are reluctant to take that risk."[59] This is essentially the same view as that expressed by Lawrence Tribe when he stated that there existed a "real danger" that a jury confronted with statistical evidence will use these statistics as a "measure of the probability of the defendant's guilt or innocence, and that the evidence will thereby undermine

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

53. *Id.* at 998.

54. *Id.* at 997-98.

55. *Id.* Three other cases in which such statistics were excluded are: Commonwealth v. Lanigan, 1992 WL 171780 (Mass. July 20, 1992); U.S. v. Porter, 1991 WL 319015 (D.C. Super. Ct. Sept 20 1991); State v. Pennell, 584 A.2d 513 (Del. Super. Ct. 1989).

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

57. *Id.* at 428.

58. *Id.*

59. *Id.*

the presumption of innocence, erode the values served by the reasonable doubt standard, and dehumanize our system of justice."[60] The defense counsel's approach to such statistical evidence should be to isolate it from the actual laboratory test process, and to attack its admissibility separately by using the arguments reiterated above.

B. The Existence of Maintenance Standards and the Care with which the Scientific Test has been Performed

There are several scientific organizations throughout the country that have published guidelines and maintenance standards for conducting DNA tests. One such group is the FBI's Technical Working Group on DNA Analysis Methods (TWGDAM).[61] The TWGDAM consists of 31 scientists from the United States and Canada, and issues quality control guidelines for DNA testing.[62] This group has stated that "it is important that any test procedure used by the laboratory possess a high degree of accuracy and reproducibility. Consequently, the use of appropriate standards and controls are essential in order to ensure reliable results."[63]

A copy of the standards that have been adopted by the laboratory performing the test should be obtained at the earliest possible opportunity. They will provide an excellent blueprint for the cross-examination of the State's expert witnesses on the issue of whether the laboratory which has performed the particular test has followed the appropriate quality control procedures.[64] In

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60. Lawrence Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 Harv. L. Rev. 1329, 1355 (1971).

61. Some other organizations are the California Association of Crime Laboratory Directors (CACLD), the New York State Forensic DNA Analysis Panel, the Congressional Office of Technology Assessment, the American Association of Bloodbanks, and the National Academy of Sciences.

62. State v. Schwartz, 447 N.W.2d 422, 426 (Minn. 1989).

63. *Id.*

64. There are several organizations that conduct DNA testing. The Virginia Division of Forensic Science operates from several locations throughout the state: 9797 Braddock Road #200, Fairfax, Va. 22032, (703) 764-4600; 401-A Colley Avenue, Norfolk, Va. 23507, (804) 683-8327; 1 North 14th. Street, Richmond, Va. 23219, (804) 371-8328; 920 South Jefferson Street, Roanoke, Va. 24016, (703) 857-7192. Another government-operated laboratory is the Federal Bureau of Investigation, Forensic Science Research and Training Center, Quantico, Virginia 22135, (703) 640-6131. The five commercially operated laboratories are Cellmark Diagnostics, 20271 Goldenrod Lane, Germantown, Maryland 20874, (301) 428-4980 & 1-800-USA-LABS; Forensic Science Associates, 3053 Research Drive, Richmond, California 94806, (415) 222-8883; Genescreen Inc, 2600 Stemmons Freeway,

the four *Spencer* cases, the Virginia Supreme Court recognized the importance of compliance with accepted testing standards when it held that the particular tests at issue were admissible because "the undisputed evidence supports the trial court's conclusion that DNA testing is a reliable scientific technique *and that the tests performed in the present case were properly conducted.*"[65]

In *State v. Schwartz* and *People v. Castro*, the laboratory's failure to comply with adopted quality control maintenance standards resulted in the DNA tests involved being ruled inadmissible.[66] In *Castro*, a New York Superior Court noted that the amount of material in a forensic sample taken from a crime scene is often limited.[67] The court stated that "if the experiment goes awry, there is no way to redo it."[68] Therefore, the court reasoned, "the forensic scientist must take special pains to be sure that proper controls were utilized to ensure that the experiment was performed correctly."[69]

In *Schwartz*, the Minnesota Supreme Court, which commented on the *Castro* case at great length, agreed with the *Castro* court's argument, stating that while DNA testing is a reliable scientific technique, admission of a particular test result "hinges on the laboratory's compliance with appropriate standards and controls ...."[70] The court went on to state that since the tests performed in this particular case did not comport with proper guidelines, "the tests lack foundational adequacy and, without more, are thus inadmissible."[71]

There is a great deal of consistency in the analysis used by these three courts in describing the testing process. The Virginia Supreme Court used the words "properly conducted" in describ-

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Suite 133, Dallas, Texas 75207, (212) 631-8152 & 1-800-362-8378; Gennan Corp., 475 North Howard Street, Room 475, Akron, Ohio 44310, (216) 535-3200 & 1-800-262-9191; and Lifecodes Corp., Saw Mill River Road, Valhalla, New York 10595, (914) 784-2600 & 1-800-LIFECOD. Note that the quality control standards that have been adopted by these organizations may vary.

65. *Spencer I*, 384 S.E.2d 775, 783 (Va. 1989); *Spencer II*, 384 S.E.2d 785, 797 (Va. 1989) (emphasis added).

66. *Schwartz*, 447 N.W.2d at 428; People v. Castro, 545 N.Y.S.2d 985, 997-98 (N.Y. Sup. Ct. 1989).

67. *Castro*, 545 N.Y.S.2d at 993.

68. *Id.*

69. *Id.*

70. *Schwartz*, 447 N.W.2d at 428.

71. *Id.*

ing its decision to admit the tests used in the *Spencer* cases.[72] The trial court in *Castro* used the language "proper controls" in describing the rule for admission of DNA test results.[73] Finally, the Minnesota supreme court in *Schwartz* used the words "comport with proper guidelines."[74] This consistency suggests that an attempt to impeach the test evidence should follow a two-part analysis. First, the laboratory must perform the testing procedure in accordance with the quality control standards it has adopted. Second, the standards that the laboratory adopted must be considered "appropriate" and/or "proper."

In examining whether the test was conducted in compliance with adopted standards, a defense counsel must rely primarily on the testimony of the prosecution's expert witnesses who actually performed the test. The defense should point out that DNA testing is an exacting procedure that requires strict compliance with procedural guidelines. Even minor variations from quality control guidelines can lead to erroneous results. For example, differences in the thickness or voltage of the gel may cause the fragments of the same length to migrate different distances; this could result in an erroneous match. Problems with temperature or saline content may cause bubbles to form on the nylon membrane, which can blur the autorads and cause interpretation problems.[75] In *State v. Schwartz*, the court criticized the laboratory for having declared a match between the forensic sample and the defendant's sample when the banding patterns were not within the laboratory's adopted match criteria.[76]

Any inconsistency discovered should be fully developed on cross-examination. Once again, the importance of obtaining a copy of the laboratory's adopted procedural requirements and quality control standards must be stressed. Without this information an attorney will loose the initiative, and any defense will be based on the mere hope that lightning will strike and a problem with the test process or performance will be stumbled upon by sheer

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72. *See Spencer I*, 384 S.E.2d 775, 783 (Va. 1989); *Spencer II*, 384 S.E.2d 785, 797 (Va. 1989); *Spencer III*, 385 S.E.2d 850, 855 (Va. 1989).

73. People v. Castro, 545 N.Y.S.2d 985, 993 (N.Y. Sup. Ct. 1989).

74. *Schwartz*, 447 N.W.2d at 428.

75. These examples were taken from Janet C. Hoeffel, *The Dark Side of DNA Profiling: Unreliable Scientific Evidence Meets the Criminal Defendant*, 42 Stanford L. Rev. 465, 480-81 (1990). The specific portions of the testing process where these problems could occur are described in steps three, six, and seven of the discussion of Restriction Fragment Length Polymorphism Analysis in Appendix I, *infra*.

76. State v. Schwartz, 447 N.W.2d 422, 426 (Minn. 1989).

accident. The prospects for success through utilization of this method may be likened to that of a blind man, in a dark room, trying to catch a black cat that isn't there.

In examining whether the standards adopted are "proper," the defense inquiry should focus on the general acceptance within the scientific community of the particular set of standards adopted by the laboratory performing the test. Standards which have been adopted as a result of clinical tests with an ample supply of pristine samples may be too liberal to have gained widespread acceptance for use on contaminated or decomposed forensic samples. Different standards adopted by another laboratory may require a higher degree of accuracy in the test before a match is declared. If this situation arises, probing questions should be aimed at challenging the laboratory's rationale for failing to adopt the more stringent standards used by other laboratories. Additionally, in attacking the statistical calculations, the defense counsel should examine whether there are safeguards that provide for the use of a large and random data bank population.[77]

The defense counsel should bear in mind that DNA testing is a new science, and that the procedures for conducting a DNA test will likely change as this field advances. Therefore, the defense counsel should make an inquiry into whether a particular testing procedure sought to be challenged had been adopted at the time of the test. Additionally, if there have been any changes in testing requirements or standards subsequent to the performance of a test, inquiry should be made into the reason for the change. It is possible that the change was brought about by the subsequent finding that a procedure is faulty. Finally, the defense counsel should inquire into whether there are any other cases that have gone to trial using a DNA test that was performed by the laboratory in question. Specifically, a defense counsel needs to know if any of these cases have resulted in the exclusion of the test results because of poor performance and/or the adoption of faulty procedural requirements by the laboratory. The existence of these factors will help the court to determine whether the laboratory has provided adequate safeguards for the reliability of its test results, or whether it has adopted nocturnal aviation policy with regards to accuracy of its tests.

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77. *See* People v. Shi Fu Huang, 546 N.Y.S.2d 920, 922 (N.Y. Sup. Ct. 1989). Information concerning the nature of a DNA data bank is provided in Appendix I and note 115, *infra*.

C. *The Existence of Failsafe Characteristics*

The existence of failsafe characteristics is closely related to the issues of adequate quality control standards and care in the administration of the test process. In examining this factual issue, the primary focus should be upon whether the laboratory has participated in any blind proficiency tests.

The Virginia State Supreme Court opinions in *Spencer I-IV* give no indication as to whether the existence of blind proficiency tests was ever addressed.[78] However, this issue was addressed by the Minnesota Supreme Court in *State v. Schwartz*.[79] Here, the laboratory in question conducted blind proficiency tests where, out of 44 samples, it incorrectly concluded that two of them matched.[80] The court stated that "this rate of error was considered too high by some experts."[81] This performance on the blind proficiency test was especially persuasive in light of the laboratory's failure to follow its own criteria when it declared a match between the forensic sample and the sample taken from the defendant.[82] If a defense counsel discovers that a blind proficiency test standard has not been met, then he should urge the court to reject the evidence by adopting the rationale expressed in *Schwartz* that "independent replication and validation studies ... are *essential prerequisites* to reliability."[83]

D. *The Qualifications and Stature of Expert Witnesses*

The testimony of expert witnesses provides the essential medium for exploration of the issues involved in DNA testing. In light of the overwhelming acceptance of these tests, it would be difficult, if not impossible, for the defense to find an expert witness who is willing to "debunk" the general theory of DNA testing. The defense counsel should instead focus on attempting to find an expert witness who, while agreeing that DNA testing is a reliable scientific technique, is willing to state that the particular test involved is not accurate for any one or more of the possible reasons already discussed.

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78. *See Spencer I-IV*, *supra* note 7.
79. *Schwartz*, 447 N.W.2d at 426 (Minn. 1989).
80. *Id.*
81. *Id.*
82. *Id.*
83. *Id.* at 428.

A defense counsel who cannot obtain any expert witnesses will be prejudiced at trial in two ways. First, the defense counsel will not be able to draw on the expert's knowledge of the testing process in preparing for cross-examination of the prosecution's experts. Second, the defense counsel will be disadvantaged by not having a favorable expert witness who can act as a "backstop" by leading the defense counsel with testimony to the discovery of any problems that counsel may have overlooked.

During cross-examination of the state's expert witnesses, the defense should make an inquiry into both the witnesses' qualifications and motives. For example, opinion testimony from a molecular biologist may be impeached if it is revealed that expert's experience with DNA testing comes from dealing primarily with pure laboratory samples instead of impure and degraded forensic samples.[84] The Virginia State Supreme Court has not laid down any clarifying rule as to what qualifications are needed to be considered an "expert" in DNA testing. In *Spencer III*, the court cited earlier case authority for the proposition that the determination of whether a witness is qualified to testify as an expert "was a matter within the trial court's sound discretion."[85]

In addition to questioning an expert witnesses' qualifications, expert witnesses may be impeached by challenging their motives for testifying. Both the experts themselves and the laboratories in which they do their work may have a financial interest in the future of forensic DNA testing. This is especially true for the commercial laboratories which perform DNA testing. Experts who work in government laboratories are also not immune from this criticism, however, for as with any other career, these experts may frequently change jobs, moving from government operated labs to commercial organizations. It is for this reason that their testimony may be open to challenge on the grounds of personal interest or bias.[86]

If this line of attack is pursued, however, the defense counsel should be aware of the Florida case of *Andrews v. State*.[87] In the *Andrews* case, the defense argued that because the careers and

84. *See* Janet C. Hoeffel, *The Dark Side of DNA Profiling: Unreliable Scientific Evidence Meets the Criminal Defendant*, 42 Stanford L. Rev. 465, 501 (1990).

85. Lane v. Commonwealth, 292 S.E.2d 358, 361 (Va. 1982), *cited in Spencer III*, 385 S.E.2d 850, 854 (Va. 1989).

86. *See* Laurel Beeler & William R. Wiebe, Comment, *DNA Identification Tests and the Courts*, 63 Washington L. Rev. 903, 940-41 (1988).

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

personal reputations of the state's expert witnesses were based on their work in DNA profiling, their testimony would be biased and hence should not be admitted.[88] The court held that a finding of impartiality was not required before ruling in favor of the admission of expert testimony.[89]

E. The Clarity with which the Technique may be Explained and the Existence of Specialized Literature

The clarity with which the technique may be explained to the trier of fact is, in reality, more of a problem that requires "troubleshooting" by the defense counsel than it is an issue affecting the credibility of DNA testing. Obviously, scientific evidence has little probative value if it is presented in a manner that renders it unintelligible. The trier of fact will then not be able to call upon the wisdom and insight that Solomon once exhibited in determining which harlot was entitled to gain custody of a child;[90] and if a jury becomes confused by the prosecution's presentation, the threat arises that the jury would merely accept the conclusion offered by the experts.

Thus, the defense counsel should urge that great care be taken to present DNA test evidence in a manner that is understandable to the trier of fact. Puzzled looks from the jury box should be considered a danger sign. Additionally, a defense counsel should request, as did the defense in *Schwartz*, that a limiting instruction be given to the jury explaining that the "expert's opinion is offered solely for their assistance [in understanding the test evidence], and [is] subject to their complete rejection if they consider it unreliable."[91]

Unlike the issue of the clarity with which the technique may be explained, the existence of specialized literature does concern the credibility of a test performed by a particular laboratory. Both the FBI's TWGDAM and the CACLD have established minimum guidelines requiring formal methodology validation and published results in peer review journals.[92] In fact, if a laboratory did not fulfill such publication requirements "the FBI likely would

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88. *Id.* at 849.

89. *Id.* Note that this case is similar to the *Spencer* cases in that the defense did not have a single expert on hand to testify against admission of the test evidence.

90. 1 *Kings* 3:16-28.

91. U.S. v. Williams, 583 F.2d 1194, 1200 (2d. Cir. 1978).

92. State v. Schwartz, 447 N.W.2d 422, 427 (Minn. 1989).

not consider their tests results ready for use in court."[93] The publication of a laboratory's procedures and prior test results serves a useful function by providing vital information concerning a laboratory's track record. Procedures and results that are published in peer review journals may be paired with opinions drawn from unbiased scientists who have reviewed the laboratory's testing procedures. The commentary and opinions offered by these scientists may provide a defense counsel with valuable impeachment evidence. Thus, publication of test procedures and results is another safeguard that is designed to ensure the accuracy of the test results.

F. Analogous Relationships with Other Types of Scientific Techniques

In *Spencer IV*, the Supreme Court of Virginia cited specific examples of other forms of scientific tests in explaining the rule for the admission of novel scientific evidence.[94] At trial, a witness may find it useful to draw analogies to other, more familiar types of scientific tests when explaining DNA testing to a lay jury. In fact, the prosecution will often seek to bolster the credibility of a DNA test result by analogizing the test with other forms of scientific testing that are routinely admitted as reliable evidence.

A defense counsel should not allow such an analogy to be drawn between DNA testing and fingerprinting tests. In particular, a defense counsel should seek to preempt any reference to fingerprinting tests by filing a motion *in limine* to prevent the prosecution or its witnesses from referring to DNA testing as "DNA Fingerprinting." The dangers involved in allowing this particular analogy to be drawn were made clear by the Massachusetts Supreme Court when it stated:

> We elect not to use the descriptive phrase "DNA fingerprinting" because (1) it tends to trivialize the intricacies of the process by which information for DNA comparisons is obtained (when compared to the process of fingerprinting) and (2) the word fingerprinting tends to suggest erroneously that DNA testing of the type involved in this case [RFLP analysis] will identify conclusively, like real fingerprinting, the one person in the world who could have left the identifying evidence at the crime scene.[95]

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93. *Id.*
94. *Spencer IV*, 393 S.E.2d 609, 621 (Va. 1990).
95. Commonwealth v. Curnin, 565 N.E.2d 440, 441 (Mass. 1990) .

The power of DNA testing to create an impression of infallibility has been consistently recognized by virtually every court that has considered admitting evidence of a DNA test result. It is, therefore, only appropriate that a defendant be shielded as much as possible from any prejudicial effects associated with this type of evidence.

G. Chain of Custody

Section 19.2-187.01 of the Virginia Code states that a report of a scientific test "duly attested by the person performing" the test or examination in any laboratory operated by the Virginia Department of Consolidated Laboratory Services, the Department of Forensic Science, "or by any laboratory authorized by either such Division to conduct such analysis or examination ... shall be prima facie evidence in a criminal or civil proceeding as to the custody of the material described therein" from the time received by the laboratory until the time the report is released.[96] The language "or by any laboratory authorized ... " indicates that this statute applies to test results performed by any commercial facilities that conduct DNA tests under the authority of these divisions.

This statute should not be read as eliminating the need for the prosecution to introduce *any* evidence concerning the chain of custody of the substance tested. In *Robinson v. Commonwealth*, the Supreme Court of Virginia stated that this language "merely constitutes a statutory exception to the hearsay rule and does not eliminate the necessity of identifying the substance tested with the person from whom obtained."[97] In fact, the primary purpose of this section is not to resolve chain of custody disputes, but to avoid delays caused by a requirement that these experts must testify each time a report is offered in evidence.[98]

In *Bass v. Commonwealth*, the prosecution argued that any lack of proof that the tested sample was taken from the rape victim should not prevent the admission of the medical examiner's

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96. VA. CODE ANN. § 19.2-187.01 (Michie 1991). The statute also extends coverage to reports offered by federally operated laboratories.

97. Bass v. Commonwealth, 187 S.E.2d 188, 189 (Va. 1972).
Note that this case was not discussing § 19.2-187.01, but an earlier statute, § 19.1-45, which contained language similar to § 19.2-187.01 and dealt with the admissibility of reports made by a chief medical examiner.

98. Robertson v. Commonwealth, 175 S.E.2d 260, 262 (Va. 1970).

report, but should go to the weight given to this evidence.[99] The court disagreed, and held that where no evidence is offered to show that the substance tested was taken from the rape victim the tests are deemed inadmissible.[100] These cases clearly indicate that if the prosecution wishes to introduce evidence of a DNA test, it must make a preliminary showing that the two substances that were tested and reported on were indeed taken from the sample provided by the defendant and the sample removed from the crime scene. If the prosecution fails to comply with this requirement the defense counsel should use these cases as authority for requesting that the test results should be excluded altogether.

H. Hearsay Evidence and The Right of Confrontation

Even if the prosecution shows that the substances tested were taken from the defendant and the crime scene, portions of the report of these tests results may be ruled inadmissible on the grounds that it is hearsay evidence and that it denies the defendant the right to confront the witnesses brought against him. In *Robertson v. Commonwealth*, the Supreme Court of Virginia stated that a statute allowing the admission of a medical examiner's report did not violate the defendant's right of confrontation.[101] In particular, the court stated that "[t]he right to be confronted with one's accusers and witnesses does not operate to exclude proper documentary evidence."[102] The holding in this case clearly states that there is no hearsay violation when the prosecution admits factual material contained in a report without calling the report's author to testify.

This holding, however, should not be interpreted as preventing a challenge to opinion evidence contained in a report as inadmissible hearsay. In fact, the court stated that "the language of the statute means that only *facts* contained in the certificate are accorded the dignity of prima facie evidence."[103] The *Robertson* court went on to cite *Life Ins. Co. of Virginia v. Brockman*, which had stated that the statute in question does not provide for the

99. *Bass*, 187 S.E.2d at 189.

100. *Id.*

101. *Robertson*, 175 S.E.2d at 262. The statute in question was § 19.1-45. Additionally, the court cited § 32-353.27(b), which uses the same language as § 19.2-187.01 in stating that these reports shall be "prima facie" evidence of the facts stated therein. *Id.* at 263.

102. *Id.* at 262.

103. *Id.* at 263 (emphasis added).

admission of opinion or conclusion evidence as prima facie proof when the person testifying has no personal knowledge of the facts.[104] Additionally, the Supreme Court of Virginia has further expanded this analysis in *Ward v. Commonwealth.* In *Ward*, the court held that opinion in a medical examiner's report, standing alone, was not competent evidence.[105]

DNA evidence, by its very nature, will contain opinion testimony. For example, the determination of the existence of a match may be largely a matter of interpretive opinion. Additionally, population genetics statistical evidence concerning the probability of another person being the source of the forensic sample may be largely based on opinion evidence. A prosecutor may make a mistake in relying on the "shall be admitted as prima facie evidence . . ." language of section 19.2-187.01, and thereby fail to call the experts who performed the test. If this happens, the defense should seek to exclude the opinion portions of the report as inadmissible hearsay under the rule laid out in the *Ward* case.

In addition to the hearsay argument, there is another theory that a defense counsel can use to attack opinion testimony contained in a report when the experts who performed the test do not testify. This alternative theory states that if opinion testimony contained in a report is admitted without requiring the report's maker to testify, the defendant will be denied his Sixth Amendment right "to be confronted with the witnesses against him."[106]

The language of the *Robertson* case indicates that its holding that admission of the medical examiner's report did not violate the defendant's right of confrontation does not extend to opinion evidence. In fact, the *Robertson* court specifically noted that "the certificates of the Deputy Medical Examiner in the instant case contain no opinion."[107]

Only one other Virginia case has been found that mentions the right of confrontation problems implicated by admitting opinion evidence in a report without calling the witness to testify.[108]

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104. Life Ins. Co. of Virginia v. Brockman, 3 S.E.2d 48, 482 (Va. 1939).

105. Ward v. Commonwealth, 217 S.E.2d 810, 811 (Va. 1975). Additionally, three other cases have followed this rule: Quintana v. Commonwealth, 295 S.E.2d 643 (Va. 1983), *cert. denied*, 460 U.S. 1029 (1983); Bond v. Commonwealth, 311 S.E.2d 769 (Va. 1984); Hopkins v. Commonwealth, 337 S.E.2d 264 (Va. 1985), *cert. denied*, 475 U.S. 1098 (1986).

106. U.S. CONST. amend. VI.

107. Robertson v. Commonwealth, 175 S.E.2d 260, 264 (Va. 1970).

108. Klimko v. Virginia Employment Commission, 222 S.E.2d 559, (1976), *cert. denied*, 429 U.S. 849 (1976).

In that case, the defendant appealed the admission of opinion testimony contained in a medical report on the grounds that admission of the opinion evidence violated his Sixth Amendment right of confrontation, as the proponent of the evidence had not called the declarant doctor to testify.[109] Here, the court was able to sidestep the issue by pointing out that the defendant had failed to exercise his right to subpoena the doctor. The court held that if the defendant had not enjoyed the right to confrontation at trial, it was "not because [it was] denied him, ... [but] because he did not pursue [it]."[110] This language seems to indicate that the right to confrontation could be a bar to the admission of opinion evidence in a report when the defendant has no opportunity to compel the witness to testify and be subject to cross-examination. The case does not clearly hold that there is no Sixth Amendment issue implicated by this type of evidence.

In crafting an argument for the exclusion of this evidence, the defense counsel should make full use of the multitude of United States Supreme Court cases that give special treatment to Sixth Amendment claims. An example of one such case is *Pointer v. Texas*, where the Supreme Court said that "the right of confrontation and cross-examination is an essential and fundamental requirement for the kind of fair trial which is this country's constitutional goal."[111]

IV. CONCLUSION

There is one final question that could arise when a DNA test is performed. How should a defense counsel react if the prosecution chooses not use the DNA test evidence at all? The obvious response would be to ask why the prosecutor has made this choice. The reason may be very simple: the test may not have resulted in a match between the defendant and crime scene samples.

A defense counsel will automatically know that a DNA test is going to be performed when the defendant is ordered to submit a sample for testing. The defendant should always demand that he be given a copy of the results if the prosecution decides not

109. *Id.* at 569-70.
110. *Id.*
111. Pointer v. Texas, 380 U.S. 400, 405 (1965).

to use the test evidence.[112] The possibility exists that the test has not resulted in a match; if a defense counsel discovers that this is the case, then he should seek to admit the test result as conclusive proof that the defendant is innocent. Ironically, the roles here would be reversed, with the defense arguing that the test was properly conducted and the prosecution arguing that the test did not match because of "slipshod procedures" used in conducting the test, etc. It should also be noted that in *Brady v. Maryland*, the United States Supreme Court stated that a failure to disclose evidence requested by the defendant which "is material either to guilt or to punishment" is a violation of due process.[113]

However, a defense counsel should not count on a DNA test exonerating the defendant. Instead, a defense counsel should take immediate action upon learning that the prosecution intends to perform a DNA test. The following discussion suggests a course of action to be followed by a defense counsel faced with a DNA test. For the sake of convenience, the steps below are also summarized in a checklist form in Appendix III.

The defense counsel, realizing that the primary battleground will be over the reliability of the methods used in conducting the test, should first take action to obtain the services of an expert. This expert will aid the defense by helping the attorney examine the test procedures used to discover any flaws. Additionally, the inability of the defense to effectively challenge the prosecution's experts in the four *Spencer* cases shows that it is imperative for the defendant have an expert witness to use as a sounding board for impeaching the credibility of the test result at trial.

Second, the defendant should obtain a copy of the procedures for testing DNA that have been adopted by the laboratory. The defendant should also obtain copies of the guidelines issued by other testing organizations for comparison. The defendant should use any differences found between the laboratory's protocols and these guidelines in attempting to impeach the evidence.

Third, the defense counsel should obtain copies of published results from the laboratory in question. This will provide the defense's expert with a track record of the laboratory's perform-

112. Note that the mandatory nature of the language requiring disclosure of DNA evidence contained in §19.2-270.5 only extends to situations where the evidence is sought to be admitted at trial.

113. Brady v. Maryland, 373 U.S. 83, 87 (1963).

ance. Such publications may also contain independent scientific assessments of the laboratory's reliability.

Fourth, in the event that testing procedures have changed, the defense counsel should determine which procedures were adopted for use by the laboratory during the time the test was conducted. Subsequent changes in procedure should be inquired into, for they may reveal a tacit admission of a faulty procedural method.

Fifth, the defense counsel should inquire into whether any other cases have come to trial using evidence of a DNA test performed by the laboratory in question. This will provide the defense counsel with a legal track record of the laboratory's performance. If any cases are found in which the DNA test results are excluded or successfully impeached, the defense counsel should inquire into whether the problem that led to the exclusion or impeachment was also in existence when the defendant's test was conducted.

Sixth, the defense counsel should not hound the prosecution in an attempt to obtain a copy of the DNA test results at the earliest possible moment. In fact, there is no need to make a demand for the evidence before the notice requirement deadline contained in section 19.2-270.5.[114] To do otherwise would put the prosecution on notice of a disclosure requirement that may have been overlooked. If the notice is not given and the prosecution seeks to introduce the evidence, the defendant will be in a position to request that the test results be held inadmissible. In this situation, the court may or may not decide to exclude the evidence, but at the very least it would grant a continuance.

Seventh, in the event that the prosecution does not give notice, the possibility does exist that the test did not match the defendant to the forensic sample. The danger here lies in the possibility that the defendant could waive his claim of violation of due process under *Brady*[115] if no request is made for the test results. Therefore, while the defense counsel should not make an inquiry before the notice deadline, a request for the results should be made before trial begins in the event that it becomes apparent that the prosecution will not seek to introduce the evidence.

Eighth, in a pretrial hearing, the defendant should file a motion *in limine* requesting that the population genetics statistics be excluded on the grounds that any probative value is far

114. VA. CODE ANN. § 19.2-270.5 (Michie 1991).

115. Brady v. Maryland, 373 U.S. 83 (1963).

outweighed by their tendency to prejudice the jury. Alternative relief in the event the motion is denied should also be sought in the form of a limiting instruction informing the jury that the statistical evidence is not representative of the accuracy of the test, but is merely an indication of the percentage chance that the tested DNA could occur randomly in the data bank population.

Ninth, the defense should question the experience of the prosecution's experts, being careful to ask, for example, whether the tests were performed with large clinical samples or with small and contaminated forensic samples. An attempt may also be made to impeach the witnesses by questioning their financial interests.

Tenth, the defendant should directly attack the credibility of the test as performed by the laboratory in question. Questions such as the following should be asked: Were the adopted procedures followed? Have these particular procedures been accepted by the scientific community as the best available? What safeguards are used to ensure that the test result has not incorrectly matched the defendant and the forensic sample? Has the laboratory published results of its tests in peer journals? Has the laboratory taken the necessary precautions to ensure that the sample has not been tampered with, or misidentified with a sample from another person?

Finally, the defense counsel should seek to exclude opinion testimony contained in any report unless the persons performing the test are available for cross-examination. It is not enough to have another expert comment on the opinions represented in the report. The preceding questions dealing with the test procedures are best asked of and answered by the expert who has first-hand knowledge of the test in issue.

Evidence of a DNA test is difficult to combat, but it is not impossible to overcome. Familiarization with both the DNA test process and the methods of attacking a test result will provide a defense counsel with the basic knowledge necessary to formulate an adequate shield, capable of warding off the powerful blow that this evidence is capable of delivering.

ROBERT BRYAN HASKINS

APPENDIX I

THE DNA 'FINGERPRINT' ANALYSIS

A. The DNA Molecule

DNA is the fundamental natural material which determines the genetic characteristics of all life forms.[116] All cells that contain a nucleus contain DNA. With the exception of identical twins, no two individuals will have identical DNA.[117] The structure of DNA is that of a long double helix, which resembles a spiral staircase or a spiral ladder (see appendix II, diagram 1). On this "ladder," the "rails" are made up of "repeated sequences of phosphate and deoxyribose sugar," while the "rungs" are made up of a bonded pair of the following four organic bases: Adenine (A), Guanine (G), Cytosine (C), and Thymine (T) (see appendix II, diagram 2). Each separate rung is referred to as a "base pair."

As a result of the chemical nature of these four organic bases, Adenine (A) will only bond to Thymine (T), and Guanine (G) will only bond to Cytosine (C). Therefore, the only four normal rung or base pair combinations are A-T, T-A, G-C, and C-G. This is a critical factor in DNA testing, for it means that the ordering of the bases on one side of the rung of the DNA ladder will determine the order on the other side. (see appendix II, diagram 2.)

There are roughly three billion rungs or base pairs in a DNA molecule. It is the sequence or order in which the four possible rung combinations occur along the DNA molecule that determines an individual's genetic makeup. Approximately ninety-nine percent of the sequence of these rungs in a DNA molecule occurs in the same order in all humans. It is this similarity in

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116. The following summary of the DNA molecule, Restriction Fragment Length Polymorphism Analysis, and Polymerase Chain Reaction DNA Amplification was compiled from the following sources: William C. Thompson & Simon Ford, *DNA Typing: Acceptance and Weight of the New Genetic Identification Tests*, 75 Va. L. Rev. 45, 60-101 (1989); Anthony Pearsall, Comment, *DNA Printing: The Unexamined "Witness" in Criminal Trials*, 77 Cal. L. Rev. 655, 667-76 (1989); People v. Castro, 545 N.Y.S.2d 985, 988-95 (N.Y. Sup. Ct. 1989); U.S. v. Jakobetz, 747 F. Supp. 250, 251-53 (D. Vt. 1990); *Spencer I*, 384 S.E.2d 775, 781-82 (Va. 1989); *Spencer IV*, 393 S.E.2d 609, 613 (Va. 1990).

More detailed descriptions of DNA testing may be found in CHRISTOPHER LAMPTON, DNA FINGERPRINTING (1991), and LORNE T. KIRBY, DNA FINGERPRINTING: AN INTRODUCTION (1990).

117. *Spencer I*, 384 S.E.2d 775, 781 (Va. 1989).

DNA structure which makes human beings human, instead of dogs, cats, or elephants. The approximately one percent of the molecule which makes each human being unique are sections along the length of the molecule within which the order of the rung or base pair combinations vary from individual to individual. It is this individualized one percent of the molecule that is the subject of a DNA test.

B. Restriction Fragment Length Polymorphism Analysis

Each individualized section of a DNA molecule is referred to as a "polymorphism." In any given person these individualized sections of a DNA molecule will vary not only in the ordering of the rungs contained within them, but in their overall number and size as well. Thus, there are three variables present in every individual's DNA structure: The random ordering of the rung or base pair sequences within a polymorphism, the total number of polymorphisms in the molecule, and the length of each polymorphism. The total length of one of these individualized sections of a DNA molecule is referred to as a "Restriction Fragment Length Polymorphism" (RFLP).

RFLP analysis is the most widely used method of testing DNA. With this test, the individualized sections or fragments are removed from the molecule and arranged in order according to their length. The individualized section fragments are then "tagged" with a series of radioactive "probes" in an attempt to determine the ordering of the rungs or base pairs within the fragment. Thus, the goal of the test is to determine both the length of an individualized section fragment and the sequencing of the rungs within it. The test itself involves an eight step process:

First, the DNA in the samples submitted for testing must be extracted. The known sample taken from the suspect is tested along with the sample removed from the crime scene.

Second, the individualized DNA fragments that are to be tested must be separated from the molecule. To accomplish this, chemical enzymes are used as "scissors" to "cut" the individualized sections into fragments separated from the rest of the molecule. This process is termed "restriction" or "digestion." It is important to note here that due to time and financial restraints it is impractical for a laboratory to test each and every individualized section of a DNA molecule. Thus, only a select few highly individualized sections will be removed as fragments for testing.

Third, the individualized fragments that have been removed from the molecule are separated from each other according to length. The fragments that were removed from the crime scene sample and the fragments removed from the sample taken from the suspect are placed side-by-side in an agarose gel in two separate "lanes" or "tracks." The gel is then polarized, and the DNA fragments, being negatively charged in nature, begin to migrate or drift towards the positive end of the gel. The fragments do not drift the same distance, however. The shorter a fragment is, the less it weighs, and, consequently, the farther it will travel. Thus, the fragments of differing lengths are separated by the distances that they travel within the gel. This process is referred to as "gel electrophoresis." During this stage of the test, the scientist will place synthetic DNA fragments in the gel to be tested alongside the fragments taken from the crime scene and suspect samples. These synthetic fragments are called "molecular weight markers," and their lengths are already known by the scientist performing the test (i.e., they contain a known number of rungs or base pairs). Thus, the length of each fragment taken from the crime scene and suspect samples can be accurately measured by comparing how far each one drifted in relation to the synthetic molecular weight markers.

Fourth, because the gel is cumbersome to work with, the individualized section fragments are removed from it and are placed onto a nylon membrane. The membrane is placed over the gel, and capillary action removes the DNA fragments which become permanently fixed in their respective positions on the membrane. This process is referred to as "southern transfer." During this transfer, each individual fragment "splits" from top to bottom, with each rung being broken in half. In essence, the bonds that hold each base pair together are broken. This phenomenon may be likened to the "unzipping" of a closed zipper, which creates two separate halves for each fragment.

Fifth, having unzipped each fragment into two separate halves, the scientist will now attempt to discover the order or pattern of occurrence of the four organic bases that make up the rungs or base pairs of each fragment of DNA. The scientist floods the membrane with a synthetic probe. The probe, like the test samples that are locked on the nylon membrane, is composed of several one-halves of a DNA fragment. The probe is man-made, and the exact arrangement of the organic bases along its length is known. When the probe fragments are flooded across the membrane, they will bond with any fragment that complements the sequencing of their organic bases. Remember that only Ad-

enine will bond to Thymine, and only Guanine will bond to Cytosine. Thus, when the probe fragments find a test fragment that is a complementary match they will bond to it, revealing the sequencing of the organic bases in the test fragment. This process is referred to as "hybridization." Prior to being released on the membrane, the probe fragments are exposed to radiation; they therefore cause a buildup of radiation to occur wherever they bond. Any remaining unbonded probe fragments are "washed" off the membrane.

Sixth, a record is made of the current progress. The nylon membrane is placed over x-ray film, and the radioactive probes expose the film clearly showing the location of each individualized fragment with which they bonded. This process is referred to as "autoradiography." The x-ray film is termed an "autoradiograph," or "autorad" for short.

Steps five and six are then repeated, using probes with different sequences of organic bases. Typically, four or five different probes will be used. The use of multiple probes is considered necessary to discover a high degree of individualization.

Seventh, the autorads are visually examined to determine whether a match exists between the suspect and crime scene samples. If a visual match is declared, a mathematical measurement is taken to confirm the existence of the match. This procedure is performed through a computer imaging process, which uses the known molecular weight markers shown on the autorad as a reference. If the sample taken from the crime scene and the sample taken from the suspect are from the same person, then identical probes will have bonded with fragments of an identical length from each sample, and the autorad will have exposures at identical locations. The FBI considers a match to have occurred when two or more of the bonded fragments from the suspect sample are within plus or minus 2.5 percent of two or more bonded fragments from the crime scene sample in their total number of rungs or base pairs. The FBI would consider a test inconclusive if a deviation greater than 2.5 percent occurs.

Eighth, the statistical significance of the match is examined. This process relies primarily on the science of population genetics to determine the probability of another individual having exactly the same DNA pattern as the suspect. A DNA data bank is used to obtain a population base for the survey.[118] Each individual fragment that matched is examined to determine the frequency

118. A DNA data bank is the compilation of the results of multiple DNA tests. The

with which it could occur at random within the data bank population. It is this calculation which produces statistics indicating the infinitesimally small probability that another person would have the same DNA pattern.[119]

C. *Polymerase Chain Reaction DNA Amplification*

Polymerase Chain Reaction (PCR) Amplification, also called allele-specific probe analysis, is another method of testing DNA. This procedure allows for the testing of samples too small to be tested by the RFLP analysis method. With PAR Amplification, samples as small as a single hair may be tested. However, the ability of this test to eliminate persons other than the suspect as the source of the sample is much more limited.

In this procedure, DNA is first extracted from the sample and purified. The DNA is then placed in a buffer solution containing enzymes. The solution is heated, which causes the DNA to "unzip," or "split." The enzymes bond to the individualized sections of the molecule. These newly bonded sections replicate billions of times. The replicated DNA is then flooded over a nylon membrane containing a number of probes. Each probe is designed to recognize one variant form of a DNA fragment. A visible dot is made on the membrane when a probe contacts and recognizes a specific fragment type. In the alternative radioactive probes may be used. The membrane is then placed over x-ray film, and the film is exposed at each point where the probes recognize a specific fragment. These replicated individualized fragments are termed "alleles."

Typically, probes will be used to identify the six different alleles that are present in the HLA DQ-Alpha genetic marker system. Every person carries these six alleles in pairs, having received one from each parent. There are a total of 21 possible pairs, and each pair is referred to as a "genotype." The purpose of PAR Amplification is to identify the genotype present in the amplified DNA. More than one different genotype may be discovered in this process. If the sample from the suspect matches the sample from the crime scene, population genetics must once

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scientist uses these test results to forecast the possibility that a particular matched fragment could occur in more that one person's DNA. In Virginia, with the enactment of § 19.2-310.2, the Division of Forensic Science's data bank has its files augmented by storing the results of the now mandatory testing of every individual convicted of a felony.

119. U.S. v. Jakobetz, 747 F. Supp. 250, 253 (D. Vt. 1990); *Spencer III*, 385 S.E.2d 850, 853 (Va. 1989).

again be consulted to determine the statistical significance of the match. The probability that another person would have the same genetic profile produced by PAR Amplification depends on the number of genotypes that matched, the rarity of the matched genotypes, and the degree to which the genotypes are independent of one another. A discussion of PAR Amplification's accuracy may be found in *Spencer IV*.[120] In that case, the defendant's identified genotype occurred in about five percent of the population.[121] This result was combined with the result from a blood test, which indicated that the defendant's blood-type and enzyme group occurred in about thirteen percent of the population.[122] The final result indicated that the specimens removed from the crime scene, which were matched with the samples taken from the defendant, occurred in combination in slightly less than on percent of the population.[123]

Thus, while this process allows for testing of very small samples, it is unable to produce the extreme accuracy claimed by the proponents of RFLP analysis.[124] It is for this reason that RFLP analysis is used whenever the circumstances permit.

120. *Spencer IV*, 393 S.E.2d 609 (Va. 1990).
121. *Id.* at 613.
122. *Id.*
123. *Id.*
124. *See* Martinez v. State, 549 So.2d 694, 695 (Fla. Dist. Ct. App. 1989); *Spencer III*, 385 S.E.2d 850, 853 (Va. 1989).

APPENDIX II

DIAGRAM 1 shows a graphic representation of the DNA molecule. The "ladder" description (figure shown left) is used in the text of the article for ease of reference. The actual structure of the molecule is that of a "double-helix," and is represented by the figure shown on the right.

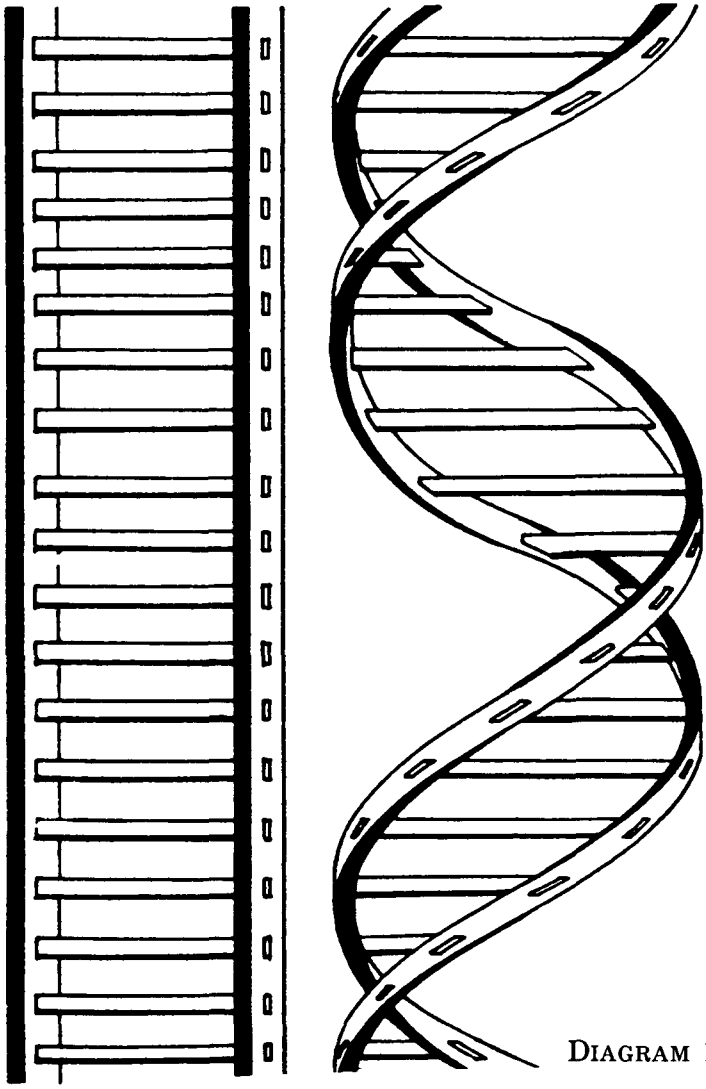

DIAGRAM 1[125]

125. Diagram 1 is reprinted from JOHN GRIBBIN, IN SEARCH OF THE DOUBLE HELIX 240 (1985). Reprinted with permission of Mcgraw-Hill Book Co.

DIAGRAM 2 shows the chemical makeup of the DNA molecule as described in the article.

The "Rails" are comprised of repeating sequences of Phosphate and Deoxyribose sugar.

The "Rungs" (or Base Pairs) are comprised of one pair of the following organic bases:
Thymine (T), Adenine (A), Guanine (G), and Cytosine (C).
Note that because of their chemical nature, only A will bond to T, and only G will bond with C. Thus, the only "Rung" four possible bonded pair combinations are (from left to right) A-T, T-A, G-C, and C-G.

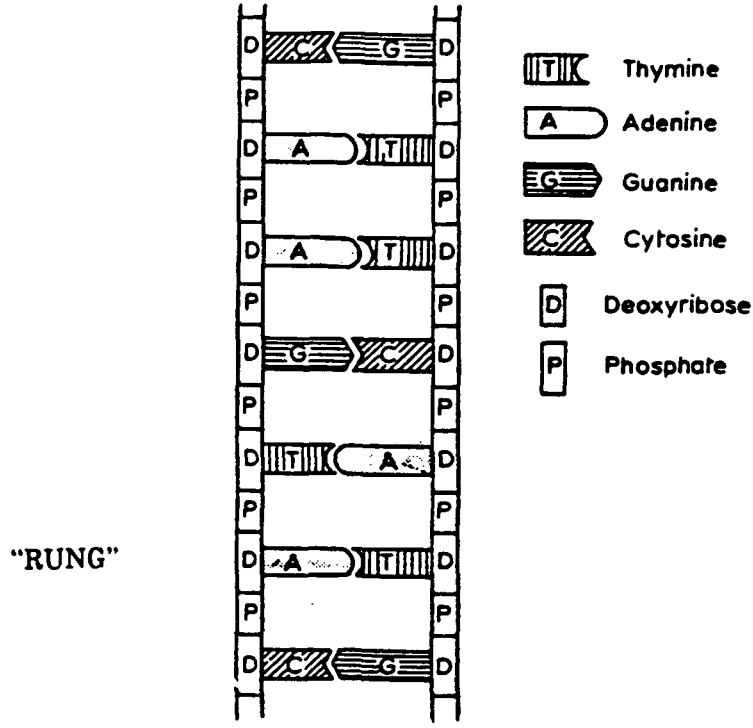

DIAGRAM 2[126]

126. Diagram 2 is reprinted from JOHN GRIBBIN, IN SEARCH OF THE DOUBLE HELIX 238 (1985). Reprinted with permission of Mcgraw-Hill Book Co.

APPENDIX III

A CHECKLIST FOR CONFRONTING DNA EVIDENCE

Upon learning that a DNA test is going to be or has been performed, a defense counsel should:

1. Obtain a copy of:
   a. the test results;
   b. the procedures adopted for conducting the test;
   c. any subsequent changes in testing procedure;
   d. quality control guidelines;
   e. the results of any blind proficiency tests;
   f. any published material concerning both the results of prior tests and independent scientific assessment of the reliability of the laboratory;
   g. any other cases that have gone to trial using tests performed by the laboratory in question (particularly any cases where the test results were excluded or successfully impeached);
   h. the list of witnesses expected to be called to present the evidence; and
   i. the procedures and standards adopted by other DNA test laboratories.
2. Consult with an expert in DNA testing to:
   a. review the test results for possible errors;
   b. review the actual performance of the test to discover whether the laboratory conducted the test in compliance with the adopted procedures;
   c. review the adopted procedures to determine whether they adequately ensure the reliability of the tests; and
   d. inquire into the possibility of the expert testifying.
3. Subpoena the persons involved in conducting the test and in preparing the results.
4. Request a pretrial hearing to review the evidence.

At the pretrial hearing the defense counsel should:

1. Seek to exclude the evidence altogether if the following occurs:
   a. discovery of problems affecting the accuracy of the test (for example, failure to comply with the requirement contained in § 19.2-310.3 that no more than 15 days elapse before the sample is submitted for testing);
   b. failure to comply with the notice requirement in § 19.2-270.5; or
   c. failure to prove chain of custody.
2. If the test results are ruled admissible, file a motion *in limine* seeking the following:

a. exclusion of the statistical evidence on the grounds that any probative value this evidence has is far outweighed by its potential prejudicial effects, or
b. in the alternative, a limiting instruction informing the jury that the statistical evidence is NOT indicative of the reliability of the test, but only an indication of the percentage chance that the DNA sample tested could occur at random in the population;
c. an order preventing the prosecution or its witnesses from analogizing the intricacies of DNA testing with fingerprint evidence by referring to DNA testing as "DNA Fingerprinting;" and
d. exclusion of any opinion testimony contained in the report of the test results unless the person(s) who actually made the report testifies, on the grounds that it would be a violation of both the hearsay rule and the defendant's Sixth Amendment right of confrontation.

At trial, the defense counsel should:

1. Challenge the credibility of the prosecution's expert witnesses by attacking:
   a. the expert's qualifications and experience in forensic DNA testing, and
   b. the expert's motives for testifying (i.e., the possibility of the expert having a financial motive).
2. Attack the evidence itself. This may truly be where the battle is won or lost. Questions similar to the following should be asked:
   a. What was the condition of the sample taken from the crime scene when it was tested? Had any decomposition or contamination occurred before testing? Were any contaminants found in the sample? If so, what steps were taken to compensate for them?
   b. Was the submitted sample properly sealed and identified?
   c. Are the laboratory's adopted procedures considered reliable?
   d. Did the laboratory follow these procedures in conducting the test?
   e. What safeguards have been adopted to prevent the possibility of an incorrect match?
   f. What safeguards have been adopted to prevent the possibility of tampering with the samples? What about mislabeling of samples or test results by the laboratory?
   g. Has the laboratory performed any blind proficiency tests?
   h. What is the laboratory's track record concerning past reliability of DNA testing?