DNA Fingerprinting Evidence: The Road to Admissibility in California

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DNA typing is a forensic technique used to identify genetic material found in such crime scene samples as blood, semen, hair roots, and skin scrapings. The technique, which is heralded as revolutionary, has been admitted into evidence in several states. To secure long-lasting use of DNA typing in California, the technique must satisfy the Kelly-Frye test for the admissibility of novel scientific evidence.

I. INTRODUCTION

Forensic scientists have long hoped for the ability "to identify the origin of blood and body-fluid stains with the same degree of certainty as fingerprints." Now, advances in recombinant deoxyribonucleic acid (DNA) research offer scientists the needed technology. DNA is found in the chromosomes of all living beings and provides a person's genetic blueprint. The same unique blueprint is found in every cell of a human body.

The composition of every person's DNA varies, determining eye color, hair color, and the individuality of a fingerprint. This means an individual's blood, semen, skin, and hair can provide virtual positive identification at the level of their DNA. It is a powerful foren-

2. Budowle, Deadman, Murch & Baechtel. An Introduction to the Methods of DNA Analysis Under Investigation In The FBI Laboratory, 15 Crime Laboratory Dig. 8, 8 (1988) [hereinafter FBI Laboratory].
5. Theoretically, positive identification may be made by DNA fingerprinting with the exception of identical twins. This exception applies throughout this Comment whenever the identification powers of the technique are discussed. The reason for the exception is because DNA is packaged into 46 chromosomes, 23 of which are contributed by the father's sperm and 23 contributed by the mother's egg. As identical twins are created by the same sperm and egg, they share the same DNA, and thus DNA finger-
sic tool. Dubbed “DNA Fingerprinting” by one company,6 DNA typing has tremendous potential applications in the identification of murder or rape suspects by their blood or semen. The testing is also useful in paternity, immigration, and missing person cases.7 DNA typing is a significant advance over conventional methods of testing blood, semen, and hair. The conventional methods can only suggest that a suspect may belong to a certain class of individuals who may have committed a crime.8

The technique has been described by forensic scientists as “the greatest advance in their field since the police at the turn of the century began to identify criminals from fingerprints left at the scene of the crime.”9 It has also been said: “What fingerprinting was to law enforcement at the end of the 19th century, DNA analysis will be at the turn of this century and beyond.”10

DNA typing has already been used in England and several states.11 In January of 1988, California Attorney General John Van de Kamp expressed enthusiasm for DNA typing and its potential uses in California “but implicitly criticized the prosecutors in five states who ha[d] already used it to link a suspect to a crime.”12 Van

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7. Id.
8. See Lewis, supra note 3, at 46.
10. Begley, Leaving Holmes in the Dust, Newsweek, Oct. 26, 1987, at 81 (quoting James Starr of George Washington University, a forensic expert and Cellmark Consultant). DNA Fingerprinting has also been “acclaimed as the biggest advance in the science of crime detection in a century,” N.Y. Times, Nov. 30, 1987, § 1, at 9, col. 1, and, as “the most important technological development in this field, because it permits you to link individuals with crimes when identification is a major issue in most of these cases.” N.Y.L.J. Feb. 24, 1988, § 1, at 1, col. 3 (remark by Assistant District Attorney Paul DerOhannesian, head of Albany County, New York’s sex offense unit). Rape cases are historically the hardest to solve: “Only half the reported rapes end in arrests and only 44 percent of those arrested are convicted, the lowest rate for any violent crime.” Malcolm, F.B.I. Opening Doors to Wide Use of Genetic Tests in Solving Crimes, N.Y. Times, June 12, 1989, at A1, col. 1.
11. Most recently, it was reported that courts in 13 states have ruled that DNA evidence is admissible. L.A. Daily J., Jan. 25, 1989, § 1, at 4, col.1. Specifically, prosecutors who have successfully introduced the evidence at trial in the U.S. include those in Florida, New York, Pennsylvania, Oklahoma, Virginia, and Washington. The technique was first used in England in 1985 to find the culprit in a rape case. Thompson, DNA’s Troubled Debut, Cal. Law., June 1988, at 39, 40, 42 [hereinafter Troubled Debut].
12. Thompson, Authorities Moving Towards Use Of DNA Fingerprints, Crim. Just. NewsL., Feb. 1, 1988, at 3 [hereinafter Authorities]. Among others who have cautioned against the early introduction of the technique are Cecil Hider, manager of the California Criminalistics Institute, which is part of the state Department of Justice in Sacramento, L.A. Times, Jan. 7, 1988, § 1, at 3, col. 1, and, Charles McGowan, commanding officer of the New York City Police Department’s scientific research division, N.Y. Times, Feb. 7, 1988, § I, at 1, col. 1.

One of the strongest criticisms of the Kelly-Frye standard for the admissibility of sci-
de Kamp indicated that by 1989 or 1990 his office might back the use of the technique in a criminal trial, but cautioned: "We have every opportunity to botch this historic moment. How might we do that? By getting mesmerized with DNA's potential and slipping into a counter-productive scramble to rush the technology from laboratory to courtroom in record time."13

One year after the California Attorney General advised prosecutors to wait until the reliability of DNA typing was better established before introducing it in a criminal trial,14 he "announce[d] that DNA is ready to go to court, and ready to win."16 Even so, he cautioned prosecutors to proceed slowly in their use of the technique so that "clear, solid precedents"16 are established for the admissibility of DNA evidence. Otherwise, an unfavorable appellate ruling on DNA typing could delay its inevitable acceptance.17 In order to establish favorable and strong precedents, Van de Kamp stated "the best possible cases"18 must be the first to utilize the DNA typing technique.19

This Comment introduces the reader to the process of DNA typing, cases utilizing the technique, and analyzes its admissibility in California in light of the state’s general rule for the admissibility of scientific evidence. The current rule is derived from the California Supreme Court’s adoption in People v. Kelly20 of the D.C. Circuit’s holding in Frye v. United States.21

This Comment will examine three recent decisions22 in California

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14. Troubled Debut, supra note 11, at 42.
17. Troubled Debut, supra note 11, at 42.
19. See infra text accompanying notes 94-110, for the first cases to introduce the technique in California.
21. 293 F. 1013 (D.C. Cir. 1923).
on the admissibility of electrophoresis which provide a framework for analyzing DNA typing's admissibility under the Kelly-Frye\textsuperscript{23} test. Electrophoresis is another, less sophisticated identification tool utilized by forensic scientists to identify genetic markers found in crime scene samples such as blood and semen.\textsuperscript{24}

This Comment will conclude that California has much to gain from DNA fingerprinting. The technique may well recast the criminal justice system, making it more accurate and efficient. However, proponents of DNA typing evidence must be prepared for critical scrutiny of the technique by California appellate courts.

Whenever novel scientific evidence is offered in court, the legal system faces competing concerns. On one hand, there is a danger that excessive caution will prevent valuable evidence from being admitted in a timely manner. On the other hand, there is a danger that evidence accepted quickly and uncritically will later prove less reliable than promised.\textsuperscript{25}

The risks associated with premature acceptance of DNA typing are particularly high and, based on the electrophoresis experience and California's adherence to the strict Kelly-Frye standard for admitting novel scientific evidence, appellate courts will most likely vigorously review the technique. In order to meet this scrutiny of DNA typing, proponents must thoroughly present the evidence for DNA fingerprinting's admissibility and be prepared to address the apparent problem areas in establishing the general acceptance of DNA typing, such as the lack of independent validation of the technique, experts in the field being from the private sector, and verification of DNA typing with crime scene variables. Otherwise, hasty introduction could lead an appellate court to hold that the technique does not satisfy the Kelly-Frye test.

II. THE DNA FINGERPRINTING TEST GENERALLY\textsuperscript{26}

DNA fingerprinting was discovered in 1985 during the study of...
other genetic phenomena known as "hypervariable regions."27 The technique arose by chance from research "that was not aimed specifically at solving practical problems."28 As of this writing, three private laboratories29 are engaged in DNA fingerprinting, as well as the F.B.I. laboratory.30

The method of obtaining a DNA print varies among labs, but basically the principles behind the methodologies are constant. The process begins by extracting the DNA from a specimen of blood, semen, hair, or skin scraping.31 Once extracted and placed under a high-power microscope, the DNA appears like a ladder which has been twisted into a spiral. This structure is called the double helix.

27. Merz, DNA Fingerprints Come to Court, 259 J. AM. MED. A. 2193, 2193 (1988).
28. Dodd, supra note 1, at 5. Dr. Alec Jeffreys developed DNA fingerprinting. He is a British geneticist and professor of genetics at the University of Leicester, England.
29. The three private labs providing DNA testing are: Lifecodes in Valhalla, N.Y.; Cellmark Diagnostics in Germantown, Md.; and Cetus Corp. in Emeryville, Cal. The three companies specialize in different approaches. Lifecodes concentrates on combinations of single-locus probes, Cellmark on multilocus and single-locus probes, and Cetus on the dot-blot method (see infra notes 40-43 and accompanying text on the use of the probes in the DNA fingerprinting procedure).
30. The F.B.I. laboratory began accepting specimens from law enforcement agencies across the country in January of 1989. These specimens, coupled with those submitted by their own agents, meant that over 220 samples had been received by June 1989. At that time, the Bureau was accepting specimens "only in violent personal crimes with a specific suspect, or serial rapes or child molestations without a suspect." "To promote the technology's use, the agency is training 60 local technicians a year to establish local DNA profiling labs, which cost over $100,000." Malcolm, supra note 10, at § AI, col. 1, § B8, col. 1.
31. The extraction of DNA for typing will undoubtedly raise civil liberties concerns in forced or even voluntary testing procedures. The ACLU is currently studying these issues. Moss, supra note 6, at 70; see also Marx, DNA 'Fingerprints' May One Day Be Our National ID Card, Wall St. J., Apr. 20, 1989, at A14, col. 3.
Within the double helix are four molecules which can be analogized
to chemical building blocks. The sequence of these chemical building
blocks determines an individual's genetic code.\textsuperscript{32}

Much of a person's genetic code, such as the number of arms and legs,
fingers and toes, etc., remains the same from individual to individual,
and therefore cannot be used to differentiate sample cell groups.\textsuperscript{33}
Other areas of the DNA, however, are different from one person to the next,
with each configuration of chemical building blocks displaying a unique pattern.\textsuperscript{34}

These areas are the regions which were being researched when the
process for DNA typing was discovered.\textsuperscript{35} It is in these regions that
samples provide identification unique to one individual.\textsuperscript{36} Enzymes
are used to cut the DNA into sections to facilitate viewing the pat-
ttern of these regions.\textsuperscript{37} The sections are then organized by size, and
the excised fragments neatly aligned.\textsuperscript{38} At this stage, the "DNA fin-
gerprint" can be analogized to a conventional fingerprint before it
has been dusted.\textsuperscript{39}

To make the actual DNA print, manmade DNA probes are intro-

\begin{itemize}
\item[32.] The four chemical building blocks are adenine(A), cytosine(C), guanine(G),
and thymine(T). They make up the sides of the double helix, each chemical building
block only joining with its pair on the other side of the "ladder." A always attaches with
T, and G with C, so that the sequence of building blocks on one strand is always comple-
mented by the sequence on the other strand. \textit{See generally} Lewis, \textit{supra} note 3, at 47-48.
\item[33.] \textit{Id.} at 47.
\item[34.] \textit{Id.} These areas are referred to as "junk DNA," as well as "mini-satellites"
and "hypervariable regions." Merz, \textit{supra} note 27, at 2193.
\item[35.] \textit{See supra} notes 26-27 and accompanying text.
\item[36.] Merz, \textit{supra} note 27, at 2193; \textit{see also} L.A. Times, Dec. 20, 1985, \textit{§} I, at 1,
col. 3.
1987). Restriction enzymes cut the DNA strands whenever they encounter a specific
sequence in the genetic code (the sequence of chemical building blocks in the DNA).
The sites at which a restriction enzyme will chop a length of DNA thus depends on the DNA
sequence; for example, the restriction enzyme Pst 1 always cuts at the sequence CTG-
CAG. Since the restriction enzymes cut the DNA at characteristic locations, restriction
fragments of various lengths are produced, usually in the range of several hundred to
several thousand base pairs of chemical building blocks. The mini-satellite regions, those
unique to every individual, are excised by the restriction enzymes which have cut the
DNA strands at the specified sequences of chemical building blocks or "stable regions"
which flank either end of it. \textit{See} Merz, \textit{supra} note 27, at 2193.
\item[38.] C. McCormick, \textit{supra} note 37, \textit{§} 205, at 74. The sections are organized
through a process called electrophoresis. Electrophoresis is a method to separate particles
for both preparative and analytical studies of macromolecules. The particles are sepa-
rated primarily by their charge and to a lesser extent on the basis of their size and shape.
J. Stenesh, \textit{Dictionary of Biochemistry} 95 (1975). DNA restriction fragments are
separated by electrophoresis to make the unique pattern which serves as the identity
profile, or "DNA fingerprint." L.A. Times, Jan. 7, 1988, \textit{§} I, at 3, col. 1. However,
although electrophoresis is a part of the technique for making a DNA print, in the realm
of scientific evidence, electrophoresis refers more specifically to the technique used by
forensic scientists for separating red cell enzymes and serum proteins. \textit{See} Scientific,
\textit{supra} note 4, \textit{§} 17-8(C), at 594-95.
\item[39.] Lewis, \textit{supra} note 3, at 49.
\end{itemize}
duced to the DNA fragments. The probes are radioactively tagged and have those sequences of the chemical building blocks that determine individual traits. They attach themselves to the DNA which they fit.

A piece of x-ray film is then placed over the probes which attached to the DNA fragments, and developed. After the film is developed, black bars on the film mark the location of the probes. Since the individual traits encoded by the DNA in these regions differ from person to person, the bars from each of the different probes appear at different locations for each individual. The resulting pattern appears something like a supermarket bar code on groceries.

This is the unique DNA fingerprint.

The DNA print is an x-ray which can be displayed on a light box. When the bar codes from two different samples match, the samples came from the same person. In addition to this visual examination to determine a match, statistics are also employed. By consulting a database of how frequently a pattern appears, the DNA evidence is even more convincing.

If DNA from two individuals is compared, the chances are about 20% that any given band will appear in both DNA fingerprints. The chances that two given bands will be present in both samples is 4%. And the chances that all 15 will be present in both are virtually nil: about three in 100 billion—or somewhat greater than the chance that conventional fingerprints from two individuals will be identical.

40. Id. In commenting on the exaggerated claims of companies marketing the DNA typing technique, the type of probe used to locate the DNA segment in a sample is cited as one possible reason for false identification. Thompson & Ford, supra note 25, at 62.

41. Id.

42. Id.

43. Id. Advocates of the technique say that the appearance of the DNA print in this fashion is an advantage because it can be explained easily to a jury. “Everyone is different and we just match them up,” said Peter Gill, one of the researchers who developed the technique. Strauss, DNA Fingerprinting, TECH. REV., Feb.-Mar. 1988, at 8.

44. Lewis, supra note 3, at 50.

45. Moss, supra note 6, at 69.

46. L.A. Times, Dec. 20, 1985, § I, at 1, 34, col. 1. The odds are measured in terms of millions or billions to one that two people will have the same genetic pattern. The figure most often cited is one in 30 billion. Merz, supra note 27, at 2193. Compare id. with L.A. Times, Jan. 7, 1988, § I, at 3, col. 2, 28, col. 2 (the odds that conventional fingerprints from two individuals will be identical are about one in 64 billion).

However, although a conventional fingerprint may provide more statistically sound identification than DNA typing evidence, “[t]he [DNA] technique not only helps place the suspect at the scene of the crime but can also suggest what he or she was doing there.” Toufexis, Convicted by Their Genes, TIME, Oct. 31, 1988, at 74. Timothy Berry, an Orlando prosecutor, said: “One may have some plausible explanation for fingerprints ... [b]ut blood, semen, uprooted hair, skin under the fingernails of the victim are some-
Thus, in theory, DNA typing can identify or exonerate an individual with virtual certainty.

III. UTILIZING DNA FINGERPRINTING IN CASEWORK

A. People v. Andrews

DNA typing can be used to solve violent crimes, to determine paternity, to identify missing persons, and to resolve immigration disputes. Prosecutors in several states have already introduced DNA typing in criminal trials. In other cases, lengthy and costly trials were avoided by confronting suspects with the DNA typing evidence. Additionally, the DNA evidence has helped defense at-
The first case resulting in a conviction based on DNA typing was in Orlando, Florida, in November of 1987. Tommie Lee Andrews was found guilty of rape when DNA of the rapist's semen matched that of Andrews' blood. Andrews was accused of being a serial rapist who methodically attacked women in the Orlando area from the Spring of 1986 until early in 1987. The police suspected the rapist
of being responsible for some twenty-three incidents of prowling, breaking into women's homes, and attempted assaults or rapes.\textsuperscript{56}

Despite their many suspicions, when the police finally apprehended Andrews, prosecuting him for these crimes appeared difficult.\textsuperscript{57} Andrews was initially tried for the rapes of just two women, one victim who had briefly seen her assailant's face, and another at whose house the rapist had left two conventional fingerprints.\textsuperscript{58}

Vaginal swabs had been taken from both women. Standard forensic tests, comparing Andrews' blood with the semen found in the victims, could only include him in a broad class of persons who might have committed the crime. The results fit Andrews, but, at the same time, also fit thirty percent of the population of the United States.\textsuperscript{59} In contrast, a DNA test read that Andrews' pattern could conceivably appear in only one in ten billion persons.\textsuperscript{60} Thus, in a world population of just over five billion, the odds were that he was the only individual whose semen matched that taken from the victims' swabs.\textsuperscript{61}

Andrews' first trial ended in a mistrial when the jury was unable to reach a verdict.\textsuperscript{62} The judge had ruled the DNA evidence admissible and x-ray prints were displayed to the jury which clearly showed that the DNA from Andrews' blood sample matched the sperm found in the victim. Yet, when the defense challenged the statistic that only one in ten billion persons could have the DNA print purported to be Andrews', the prosecutor was not prepared; without a strong legal counter-argument, he decided to withdraw the statistical evidence.\textsuperscript{63} The questioning of the DNA evidence meant that it was Andrews' word against the victim's, and the prosecution lost.\textsuperscript{64}

Andrews was tried a second time. This time, the prosecution established the legal precedence of using statistics to back up forensic test results.\textsuperscript{65} In addition, three expert witnesses testified for the
prosecution about the DNA test. The defense, however, presented no expert witnesses.\textsuperscript{66} The jury returned a guilty verdict and Andrews became the first person in the United States convicted of a crime with the help of DNA evidence.\textsuperscript{67}

Although in this second case conventional fingerprints bolstered the prosecution's case, the DNA fingerprinting was a "key piece of evidence"\textsuperscript{68} because the victim never saw Andrews' face. The identification of suspects is one of the greatest hurdles a prosecutor faces, and the DNA typing evidence was determinative because it positively identified Andrews as the rapist. A defendant can always argue that conventional fingerprints appeared at the scene lawfully; however, a biological semen sample in a rape case is much more difficult to argue away.\textsuperscript{69}

Andrews was upheld on appeal, providing the first appellate ruling on the admissibility of DNA fingerprinting. In holding that the trial court had not abused its discretion in admitting the evidence,\textsuperscript{70} the appellate court found under a relevancy approach that the DNA print results would be both helpful to the jury and demonstrated sufficient indicia of reliability for admissibility.\textsuperscript{71}

\textbf{B. People v. Wesley and People v. Bailey}

The Wesley and Bailey cases\textsuperscript{72} were combined for the purpose of a pre-trial hearing on the admissibility of DNA fingerprinting. In these two respective New York cases, one for rape and murder, and the other for rape, a prosecution motion requiring the defendants to

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\textsuperscript{66} See Andrews v. State, 533 So. 2d 841, 847 (Fla. App. 1988), cert. denied, 542 So. 2d 1332 (Fla. 1989).

\textsuperscript{67} See People v. Andrews, No. 87-1565 (Ninth Judicial Cir. Ct., Orange Co., Fla., Division 15, Nov. 6, 1987).


\textsuperscript{69} "A suspect can always argue that a fingerprint was left when he was on legitimate business," but, "[f]inding an individual's biological sample at the site of a violent crime is much more [convincing to a jury]." L.A. Times, Jan. 7, 1988, § 1, at 3, col. 1 (quoting forensic scientist Ed Blake of Forensic Science Associates, an Emeryville, Cal., consulting firm). Criminology experts say that the main use of the new test will be in rape cases because of the "severe limitations on identifying the origin of sperm through existing techniques and because spermatazoa are largely composed of DNA." Altman, \textit{New DNA Test Offers Biological 'Fingerprints' For Crime Fight} N.Y. Times, Feb. 4, 1986, at C1.

\textsuperscript{70} Andrews, 533 So. 2d at 851.

\textsuperscript{71} See id. at 849-50.

\textsuperscript{72} 140 Misc. 2d 306, 533 N.Y.S.2d 643 (County Ct. 1988) [hereinafter both cases will be referred to as People v. Wesley].
provide samples for DNA testing was granted. Moreover, the court held:

DNA Fingerprinting — its underlying principles, procedures and technology — is a scientific test that is reliable and has gained general acceptance in the scientific community and in the particular fields thereof in which it belongs — to wit, molecular biology, population genetics and diverse other branches of genetics, chemistry, biology and biochemistry.\(^7\)

This decision came after an “extensive and intensive”\(^7\) hearing “involving nearly a dozen sessions over a six-month period,”\(^7\) which entailed the calling of four expert witnesses by the prosecution\(^7\) and two by the defense.\(^7\) The defense attorney said that if either of his clients were convicted on the basis of the evidence, “he would probably challenge the admissibility of the new testing technique and the results in a post-trial appeal.”\(^7\)

C. People v. Castro

Andrews and Wesley both upheld the DNA fingerprinting technique. However, “the first serious legal challenge” to DNA fingerprinting was in the Bronx, New York case of Joseph Castro.\(^7\) Castro was accused of killing his neighbor and her two-year-old daughter.\(^8\) “According to the prosecutors, a portion of DNA extracted from a spot of blood on Castro’s watch matched DNA taken from the murdered mother. The chance of such a match occurring at random, said scientists called by the prosecution, was 1 in 100 million.”\(^8\)

In the Castro pretrial hearing though, these claims were seriously questioned by defense experts.\(^8\) Their challenge did not concern the

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73. Id. at 332, 533 N.Y.S.2d at 659.
74. Id. at 309, 533 N.Y.S.2d at 644-45.
76. The prosecution witnesses were: Dr. Richard J. Roberts, Assistant Director for Research at the Cold Spring Harbor Laboratory on Long Island, N.Y.; Dr. Kenneth K. Kidd, Professor of Human Genetics, Psychiatric, and Biology at the Yale University School of Medicine; Dr. Michael L. Baird, Director of Paternity and Forensic Evaluation for Lifecodes; and Dr. Sandra Nierzwicki-Bauer, Assistant Professor of Biology at the Rensselaer Polytechnic Institute. Wesley, 140 Misc. 2d at 318-25, 533 N.Y.S.2d at 651-55.
77. The defense experts were Dr. Neville Colman, an Associate Professor of Pathology at the Mt. Sinai School of Medicine, and Dr. Richard Borowsky, an Associate Professor of Biology at New York University. Id. at 318, 329, 533 N.Y.S.2d at 651, 657.
79. Wall St. J., May 22, 1989, at B4, col. 5. Professor of Social Ecology William Thompson of the University of California at Irvine said that “[t]his technology has been steamrollered through the courts, and now it’s beginning to get serious scrutiny.” Thompson, A Trial of High-Tech Detectives, TIME, June 5, 1989, at 63 [hereinafter High-Tech].
80. High-Tech, supra note 79, at 63.
81. Id.
82. The main expert for the defense was Dr. Eric Lander, a geneticist and mathe-
basic science of DNA fingerprinting, but the reliability of the testing procedures and the interpretation of the results by Lifecodes, the company that performed the 1987 DNA fingerprinting test on Joseph Castro's blood.83

These tests results were so convincingly controverted by the defense experts that, ultimately, in an unusual pretrial hearing procedure, both defense and prosecution experts met outside of court to discuss the admissibility.84 Afterwards, they issued a statement expressing their doubts concerning the technique. In part, it said that "overall, the DNA data in this case are not scientifically reliable enough to support the assertion" that the blood sample from the defendant's watch came from the murder victim. If the data were submitted to a scientific journal that required pre-publication review by scientific peers, "it would not be accepted."85 The prosecution, because of the position adopted by their experts, "submitted briefs conceding that the tests used in the case are too unreliable to be admitted into evidence."86

Legal experts say this case will probably have a major impact nationally on DNA fingerprinting.87 The fifteen month pretrial hearing supposedly brought forth numerous deficiencies in the DNA finger-

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83. See Schmeck, supra note 82, at B1, col. 6; see also Lander, supra note 82, at 501 (a detailed commentary on why "DNA forensics sorely lacks adequate guidelines for interpretation of results").

84. See Lander, supra note 82, at 504.

85. Schmeck, supra note 82, at B12, col. 4. The four scientists who issued the statement were Dr. Eric Lander, Dr. Richard Roberts of Cold Spring Harbor Laboratory on Long Island, Dr. Carl Dobkin of the Institute for Basic Research in Developmental Disabilities on Staten Island, and Dr. Lorraine Flaherty of the State Health Department in Albany. In addition, "eight expert witnesses on DNA technology who testified in the case have agreed with the conclusions of the statement," said Dr. Lander. Id. at B12, col. 5.


87. Edward Imwinkelreid, Professor of Law at the University of California at Davis said, "[Castro] is extremely important because it highlights the importance of the interpretive standard for evaluating DNA test results." Schmeck, supra note 82, at B12, col. 1. "In telephone interviews [Imwinkelreid] and Prof. Randolph Jonakait, Dean of Academic Affairs at New York Law School, each said the Bronx case was likely to have major impact nationally." Id.
printing test by Lifecodes.\textsuperscript{88} Whether these problems were case-specific to \textit{Castro} or might reflect more general problems in the methodology of the labs engaged in testing,\textsuperscript{89} is an issue which will undoubtedly be debated across the country. Depending on how \textit{Castro} is viewed, \"[c]riminal convictions obtained with the use of genetic testing may be reopened in the wake of [this] unusual New York case.\"\textsuperscript{90}

The pretrial hearing in \textit{Castro} was expected to end on May 26, 1989, and a ruling was anticipated in mid-June.\textsuperscript{91} As of July 13, 1989, the judge had yet to make a finding on the admissibility of the DNA fingerprinting test.\textsuperscript{92} One commentator predicted that \"[Judge Gerald Sheindlin] could make a general ruling on DNA fingerprinting, perhaps saying that it is admissible if proper standards are set, or perhaps taking a tougher line by saying that the technique is only good enough to prove that two samples are not identical. Whether or not the judge chooses to make a general ruling, he is widely expected to decide that Lifecode's data are not admissible in this particular case.\"\textsuperscript{93}

\textbf{D. California Cases Introducing DNA Fingerprinting}

The California case likely to provide the first ruling on DNA fingerprinting in the state is \textit{People v. Axell}.\textsuperscript{94} In \textit{Axell}, the defendant was linked to the murder for which she was charged by DNA analysis of approximately sixty human hairs left at the crime scene.\textsuperscript{95} California Attorney General Van de Kamp said \textit{Axell} \textquoteright{}will provide a very clear test [of DNA typing's admissibility] because there is virtually no other physical evidence, and conventional methods of forensic evidence were attempted to no avail.\textquoteright\textsuperscript{96} In a second California case, \textit{People v. Harris},\textsuperscript{97} a man was

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  \item \textsuperscript{88} L.A. Daily \textit{J.}, July 13, 1989, § 1, at 7, col. 5.
  \item \textsuperscript{89} \textit{See id.}
  \item \textsuperscript{90} \textit{Id.}
  \item \textsuperscript{91} \textit{See Schneck, supra note 82, at B1, col. 6.}
  \item \textsuperscript{92} L.A. Daily \textit{J.}, July 13, 1989, § 1, at 7, col. 5.
  \item \textsuperscript{94} No. CR 23911 (Ventura County, Cal.). The prosecution and the defense have completed their presentation of evidence in the pretrial admissibility hearing and have submitted briefs on the issue. Oral arguments addressing whether the technique meets the \textit{Kelly-Frye} test were held August 7, 1989. Telephone interview with Ms. Carol Nelson, Senior Deputy District Attorney, Ventura County, Cal. (Aug. 1, 1989).
  \item \textsuperscript{95} L.A. Daily \textit{J.}, supra note 11.
  \item \textsuperscript{96} \textit{Id.}
  \item \textsuperscript{97} No. 88F05854 (Orange County, Cal.). The pretrial admissibility hearing in \textit{Harris} will probably not begin until October 1989. The prosecutor does not expect to get
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charged with sixty-three counts of rape, five of which he has been conclusively tied to through DNA typing. The testing in this case was done by Lifecodes, the same company which performed the DNA testing in Castro. The defense lawyer in Harris, John Barnett, views Castro as raising serious questions about the technique: “I have requested discovery of Lifecodes’ statistical base, data and calculations. This is not just a problem with a particular gel, or contamination with probes, but a fundamental problem with their calculus.” If a searching challenge to the lab’s methodology is made in Harris, the case should result in a very important precedent for the admissibility of the technique in California.

Two other cases in California are also underway to establish DNA fingerprinting as admissible scientific evidence. In People v. Wilds, the defendant is charged with ten felony counts, including two rapes, burglary, and robbery. However, as in Andrews, the rape victims did not see their attacker’s face; thus, because the case against Henry Wilds is “largely circumstantial . . . the use of the DNA evidence could change the outcome of his trial.” The prosecution experts in Wilds “have testified that there is between a one-in-66 million and a one-in-180 billion chance that body fluid samples recovered from the rape victims originated with someone other than Henry Wilds.” The defendant’s attorney has opposed the use of the technique on the grounds that DNA fingerprinting has not reached the demonstrable stage required by Kelly-Frye, and that there are too many unanswered questions.

Lastly, People v. Barney will be the first case in the San Francisco area to test the use of DNA fingerprinting. Ralph Barney was accused of attacking a woman at knife point as she left a Bay

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101. No. A816963 (Los Angeles County, Cal.).
103. Id. at 3, col. 2.
104. Id.
105. Id.
106. No. HK10291 (Alameda County, Cal.).
Area Rapid Transit train in January of 1989. Barney "is charged
with five felony counts, including kidnapping for robbery and at-
ttempted rape." The investigators have "strong evidence against
the suspect . . . [but] they decided to proceed with a DNA test on a
demen sample found on the woman's clothes to make the case even
stronger."

E. Potential Applications of DNA Fingerprinting

The Andrews case represents the beginning of acceptance for the
process of DNA typing in the criminal law arena. The appellate
decision in that case provides the only appellate court ruling on the
admissibility of DNA typing to date. However, since Andrews,
several rape and murder convictions have been obtained in trial
courts across the United States with the use of DNA typing. Moreover, ambitious plans are underway for more expansive uses of
the new technique.

Officials hope that in the future, the DNA test will not only pro-
vide evidence for convicting defendants, but will also identify poten-
tial suspects. By establishing a computer database with the DNA
code of thousands of criminals which could be used by police who
have recovered blood or other samples from a crime scene, suspects
could be routinely identified.

Prior to Van de Kamp's announcement in January of 1989 that
DNA typing was ready to be introduced in California, such a
database was already being anticipated in the state. Blood and se-
men samples from 100 people a month who had been convicted of
violent sex crimes were being collected and frozen for future DNA

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108. Id.
109. Id.
110. Id. (quoting William Kleeman, a Deputy Alameda County District Attorney
who is prosecuting the case).
111. Lewis, supra note 3, at 52.
112. However, a Florida appellate decision may not reflect what the California
courts would hold with regard to the evidence's admissibility because, if a relevancy stan-
dard is used, a more liberal view toward admitting evidence is usually taken. See supra
note 52.
113. DNA typing has been utilized in criminal trials in Florida, Oklahoma, New
York, Pennsylvania, and Washington. These cases include: (1) The conviction of
Delmarlo Untrale Hill of sexual battery with great bodily harm, burglary with an ass-
sault, aggravated assault, theft and false imprisonment on January 21, 1988. The DNA
test of the semen found in the victim's body matched Hill's, and conventional blood and
hair analysis were also performed which corroborated the identification. Assistant State
Attorney Doug Beam reported that the jury deliberated only two hours before returning
the verdict. (2) The conviction of Julio Zambrana in October 30, 1987 of second-degree
murder and third-degree assault in New York, New York. Although this case precede
the Andrews case, it is not considered the first conviction based on DNA evidence be-
cause there were also eyewitnesses to the stabbing. Moss, supra note 6, at 68-70 (survey-
ing cases which have gone to trial using the technique).
114. Authorities, supra note 12, at 3.
genetic code testing. Additionally, concurrent with the Attorney General's January announcement, legislation was passed which would further establish the database. Effective January 1, 1989, the legislature amended the California Penal Code to expand the requirements under which felony sex offenders must provide blood and saliva samples for genetic typing.

In April of 1989, the Attorney General called for legislative approval of an even more expansive plan to “make California the first state to establish a computerized genetic data base of everyone convicted of a violent crime.” The proposed legislation expands sample requirements beyond sex offenders, mandating that all people convicted of murder, assault, rape, and other sex crimes give two samples of blood and a saliva sample upon entering or being released from prison. If passed, this legislation would create a system where the DNA analysis would be performed at one of four proposed laboratories around California and fed to a central computer. The information would then be made available to police departments, similarly to conventional fingerprints. The creation of this database system, as well as the opportunity to use DNA typing in general, is eagerly awaited by its supporters. However, use of such

115. Id. Crime scene investigators and field evidence technicians have been advised that the use of DNA typing technology is imminent, so it is important to collect samples of blood, semen, and hair roots from crime scenes. If the samples are properly collected and preserved now, they can be used for comparison of DNA, as several years can intervene between the time the evidence is collected and actual DNA identification occurs. Sloan, What About DNA Identification?, IDENT-O-GRAM NEWSL., Official Publication of the Cal. State Division of the Int'l Ass'n for Identification (Jan. 26, 1988) (unpublished report) [hereinafter Sloan].


117. CAL. PENAL CODE § 290.2 (West Supp. 1989). The section provides that “[a]ny person required to register under Section 290 [of the Penal Code] because of the commission of or the attempt to commit a felony offense specified in Section 290 who is discharged or paroled from a state prison, county jail, or any institution under the jurisdiction of the Youth Authority where he or she was confined, or is granted probation, or is released from a state hospital to which he or she was committed as a mentally disordered sex offender . . . shall, prior to discharge, parole, the granting of probation or release, be required to provide two specimens of blood and a saliva sample to that institution or, in the case of a person granted probation, to a person and at a location within the county designated for testing. The county shall make every effort to utilize one location for testing a person under this section.” Id. Previously, only an offender released or paroled from a state correctional institution was subject to the blood sample and saliva sample requirements. CAL. PENAL CODE § 290.2 (West 1988 & Supp. 1989).


119. Id. at 50, col. 1.

120. Id.

121. Troubled Debut, supra note 11, at 40.
a database goes hand-in-hand with admissibility of the technique in the courtroom, and thus, the establishment of the computer system also has its opponents. In order not to delay such a system for several months or years in California, claims that admitting DNA fingerprinting is premature must be countered by strongly establishing that the Kelly-Frye test for the admissibility of scientific evidence is met.

IV. ANALYZING THE ADMISSIBILITY OF DNA FINGERPRINTING IN CALIFORNIA

A. The Kelly-Frye Test

The test for the admissibility of most evidence in California is California Evidence Code section 350, which allows evidence to be admitted if relevant. Evidence Code section 352, in turn, gives the court the power to exclude relevant evidence.

The admissibility of novel scientific evidence, however, is governed by a more stringent standard. It will not be admitted unless its scientific basis and reliability are generally recognized by competent authorities. The reliability of the evidence derived from scientific principles depends on three factors: (1) the validity of the underlying principle; (2) the validity of the technique applying the principle; and (3) the proper application of the technique on a particular occasion. In balancing these factors, courts have relied principally on one of two tests to determine the admissibility of scientific evidence.

The first test is associated with Professor McCormick, and treats the validity of the underlying principle and the validity of the technique as aspects of relevancy. Under this approach, the admissibility

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122. San Francisco Public Defender Jeff Brown voiced concern that DNA fingerprinting had not yet reached a point of maturity and planned to speak before the State Assembly's Public Safety Committee on July 18, 1989 against SB1408. The legislation would amend the penal code to require genetic testing and appropriate approximately $3 million to set up a DNA identification program. L.A. Daily J., July 17, 1989, § 1, at 4, col. 1.
123. Id. at 42.
124. CAL. EVID. CODE § 350 (West 1988 & Supp. 1989). The code defines relevant evidence as that having "any tendency in reason to prove or disprove any disputed fact that is of consequence to the determination of the action."
125. Id. § 352. "The court in its discretion may exclude evidence if its probative value is substantially outweighed by the probability that its admission will (a) necessitate undue consumption of time or (b) create substantial danger of undue prejudice, of confusing the issues, or of misleading the jury."
126. B. WITKIN, supra note 23, § 864, at 829.
127. SCIENTIFIC, supra note 4, § 1-1.
of scientific evidence is governed by standard relevancy principles. In \textit{Andrews}, the first appellate court to uphold DNA fingerprinting, a relevancy-type test was used.

The second test, the one utilized by California courts and New York courts in deciding \textit{Wesley} and \textit{Castro}, derives from \textit{Frye v. United States}. In \textit{Frye}, the D.C. Circuit Court of Appeals held that "the systolic blood pressure deception test has not gained such standing and scientific recognition among physiological and psychological authorities as would justify the courts in admitting expert testimony deduced from the discovery, development, and experiments thus far made." The \textit{Frye} court wrote only the following in their two page opinion to justify their holding and a rule which has dominated the admission of scientific evidence for more than fifty years:

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.

Thus, \textit{Frye} imposes a more stringent standard than the McCormick relevancy approach. "[I]t is not enough that a qualified expert, or even several experts, believes that a particular technique has entered the demonstrable stage, the technique must be generally accepted by the relevant scientific community."

\begin{itemize}
    \item[129.] Id.; see also C. McCormick, McCormick On Evidence, § 203 (3d ed. 1984).
    \item[130.] The test used in \textit{Andrews} was a relevancy test "substantially adopted by the federal Third Circuit in United States v. Downing, 753 F.2d 1224 (3d Cir. 1985)." \textit{People v. Andrews}, 533 So. 2d 811, 846 (1988). This approach recognizes "relevancy as the linchpin of admissibility, while at the same time ensuring that only reliable scientific evidence will be admitted." \textit{Id}. Where a scientific technique does not have a "track record" in litigation, the \textit{Downing} court stated that various factors may be looked at by the court to determine a technique's reliability: "the novelty of the new technique, i.e., its relationship to more established modes of scientific analysis, the existence of a specialized literature dealing with the technique, the qualifications and professional stature of expert witnesses, and the nonjudicial uses to which the scientific technique are put." \textit{Id}. at 847 (citing \textit{Downing}, 753 F.2d at 1238-39).
    \item[131.] 293 F. 1013 (D.C. Cir. 1923).
    \item[132.] Id. at 1014.
    \item[133.] Id.
    \item[134.] Giannelli, supra note 128, at 1205. Professor Giannelli said: "In effect, \textit{Frye} envisions an evolutionary process leading to the admissibility of scientific evidence. A novel scientific technique must pass through an 'experimental' stage in which it is scrutinized by the scientific community. Only after the technique has been tested and has passed into the 'demonstrable stage' will it receive judicial recognition." \textit{Id}. The technique is in the demonstrable stage when it is generally accepted by the relevant scientific
While the *Frye* test has undergone scathing attacks by commentators in recent years, the test remains the rule in California through the California Supreme Court's reaffirmation of the standard in *People v. Kelly*. In *Kelly*, the court held that voiceprint evidence was inadmissible. The only testimony as to the technique's reliability was that of the head of a state police voice identification unit. The court stated that establishing general acceptance under the *Frye* standard involves a two-step process: 

**(1) The reliability of the method must be established, usually by expert testimony,** and 
**(2) the witness furnishing such testimony must be properly qualified as an expert to give an opinion on the subject. Additionally, the proponent of the evidence must demonstrate that correct scientific procedures were used in the particular case.**

*Kelly* acknowledged that the *Frye* rule has been criticized as “too conservative, often resulting in the prevention of the admission of relevant evidence.” Nevertheless, the court reaffirmed its allegiance to the rule, holding that there is “ample justification for the existence of considerable judicial caution in the acceptance of evidence developed by new scientific techniques.”

The *Frye* opinion had been criticized for failing to set forth a rationale for the general acceptance test. The *Kelly* court, in defending its adoption of the *Frye* rule, also responded to these concerns. First, the court stated that the *Frye* rule, by requiring general acceptance of a technique in the relevant scientific community, assures that “those most qualified to assess the general validity of a scientific method will have the determining voice.” Additionally, general acceptance in the scientific community assures that prosecutors and defense attorneys alike will have a minimal reserve of experts available to critically assess the new procedure.

Another justification for *Frye* is that it will promote uniformity of decisions. Whereas individual judges' opinions may differ as to the reliability of particular scientific evidence, substantial agreement and consensus in the scientific community can be relied on by the courts.

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135. *Id.* at 1206-31, 1206 n.59.
137. *Id.* at 30, 549 P.2d at 1244, 130 Cal. Rptr. at 148. *But see infra* notes 236-39 and accompanying text.
138. *Id.*
139. *Id.* at 31, 549 P.2d at 1244, 130 Cal. Rptr. at 148.
141. *Kelly*, 17 Cal. 3d at 31, 549 P.2d at 1244, 130 Cal. Rptr. at 148 (quoting United States v. Addison, 498 F.2d 741, 743-44 (D.C. Cir. 1974)).
142. *Id.*
143. *Id.* This is in contrast to the relevancy test which would leave the admission
Finally, the primary rationale expounded in *Kelly* for reaffirmation of the *Frye* rule was one of the strongest criticisms against *Frye*: the "essentially conservative nature of the test." The *Kelly* court found this conservatism important because it results in a lag time between advances and discoveries in scientific fields and their acceptance as evidence in court proceedings. This lag time reduces the presence of a "misleading aura of certainty which often envelops a new scientific process, obscuring its currently experimental nature," which can "assume a posture of mystic infallibility in the eyes of a jury." Thus, by determining general acceptance in the relevant scientific community before such evidence goes before the jury, the *Frye* rule seeks to prevent the admission of new and possibly unaccepted principles that a lay juror might trust blindly.

The *Kelly* court found further justification for the conservative results of the test in that once a published appellate court ruling upholds admissibility under *Kelly-Frye*, the precedent so established may control subsequent trials. This would be true until new evidence was presented reflecting a change in attitude by the scientific community. The possibility of such an adverse precedential effect has prompted officials to recommend that attorneys proceed cautiously in the introduction of DNA typing in California trial courts. "[P]remature use of the new technique could result in a precedent that would set back genetic fingerprinting's ultimate acceptance in the state by months or years."

Thus, in order to survive challenges to its admissibility in California, it is "vital" that the first uses of the DNA technique be in the best cases. Commenting on the importance of strong precedents, Van de Kamp said: "Every prosecutor who follows behind will be eternally grateful for careful work by those who lead the way."

Moreover, proponents of DNA typing should be aware that the of scientific evidence to the discretion of the trial judge rather than the scientific community from which the new technique emerges. See Giannelli, *supra* note 128, at 1204-05.

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145. *Id.*
146. *Id.* at 32, 549 P.2d at 1245, 130 Cal. Rptr. at 149 (quoting Huntingdon v. Crowley, 64 Cal. 2d 647, 656, 414 P.2d 382, 390, 51 Cal. Rptr. 254, 262 (1966)).
147. *Id.* (quoting *Addison*, 498 F.2d at 744).
149. *Kelly*, 17 Cal. 3d at 32, 549 P.2d at 1245, 130 Cal. Rptr. at 149.
150. See *supra* notes 12-17 and accompanying text.
Kelly-Frye rule may be at its most conservative in an analysis of DNA typing evidence. In addition to the justifications outlined above for the general acceptance standard, Kelly said that exercise of restraint in admitting new scientific evidence is especially warranted when the identification technique is offered to identify the perpetrator of a crime. As a technique characterized to provide virtual certainty in the identification of a suspect, DNA fingerprinting certainly calls for this special scrutiny, especially when a felony conviction is at stake.

B. The Admissibility of Electrophoresis Evidence, Predecessor To DNA Fingerprinting

Like DNA typing, the principal forensic uses of electrophoretic testing are in the areas of identifying perpetrators of violent crimes or sex offenses from traces of blood or semen and determining paternity. Electrophoretic testing of dried body fluids such as blood and semen is also similar to DNA typing because it is based on genetic markers.

Electrophoresis identifies individuals by testing red cell enzymes and serum proteins. Like DNA, these genetic markers may be found in blood, hair, and semen. The enzymes and proteins are of evidentiary value because the pattern of their molecular forms produced by the electrophoresis test varies from individual to individual. However, unlike DNA typing, this technique cannot individualize a sample. DNA typing can provide positive identification because rather than using serum enzymes or proteins as markers for the genes that express these molecules, it is possible to examine the DNA that encodes these genes directly.

Electrophoresis is a standard technique in biochemistry, but its use in analyzing aged or dried blood stains has proved intensely contro-

154. "When identification is chiefly founded upon an opinion which is derived from the utilization of an unproven process or technique, the court must be particularly careful to scrutinize the general acceptance of the technique." Kelly, 17 Cal. 3d at 32, 549 P.2d at 1245, 130 Cal. Rptr. at 149 (1976) (quoting People v. Law, 40 Cal. App. 3d 69, 85, 114 Cal. Rptr 708, 719 (1974).
155. C. McCormick, supra note 129, § 205(B), at 618-19.
156. See Scientific, supra note 4, § 17-8(C).
158. Scientific, supra note 4, § 17-8(C), at 594.
159. Described as a procedure by which blood protein molecules may be separated by their electrical charge, electrophoresis basically involves placing a blood sample on a gel medium in an ionized solution and subjecting the solution to an electrical current. This causes the sample to separate and migrate onto the medium into patterns of bands that can be fixed, dyed, and interpreted by an analyst. The location and number of bands are clues to the identity of the enzyme or protein. The pattern is compared to known frequencies of enzymes and proteins to confirm the identification of the genetic markers. See id. at 595-96.
160. C. McCormick, supra note 37, § 205(B), at 74.
versial. It has been predicted that the application of DNA technology to determine identity will also be controversial. Because the two forensic tests are similar in both principle and the existence of controversy surrounding their admissibility, the electrophoresis experience provides a sound framework for analyzing the “DNA fingerprinting” test’s admissibility.

In People v. Brown, the California Supreme Court determined that substantial controversy existed as to the electrophoretic testing of blood and semen stain evidence. “Where that issue remains open,” the court wrote, “the party offering the evidence has the burden of proving in the trial court that a consensus of scientific opinion has been achieved.” The prosecution in Brown failed to show such a consensus when it presented testimony in the trial court of two criminologists from the California Department of Justice. The witnesses were not considered by the Brown court as qualified to state the view of the relevant community of impartial scientists. The court also noted that neither witness backed their opinion with relevant scientific literature, and concluded that the trial record was “patently inadequate to establish scientific acceptance of the tests under Kelly/Frye.”

Where the trial record is considered inadequate, the reviewing court may do an unaided review of the scientific literature in an effort to determine whether a fair consensus on reliability of a technique exists. However, where the scientific technology under review is considered highly technical, this course of action is not recommended. Because of the technical nature of electrophoresis, the Brown court did not try to determine the consensus of reliability surrounding the evidence. The court did not hold that electrophoresis of dried biological fluids and stain samples was not generally accepted within the scientific community as a matter of law, but they did send a clear message that a more persuasive foundation would have to be established to admit the evidence in the future.

161. Id. at 73. See generally Note, supra note 12.
162. C. McCormick, supra note 37, at 74.
164. Id. at 532, 709 P.2d at 448, 230 Cal. Rptr. at 843.
165. Id. at 533, 709 P.2d at 450, 230 Cal. Rptr. at 844.
166. Id.
167. Id.
168. Id. at 534, 709 P.2d at 450, 230 Cal. Rptr. at 845.
169. See id. at 534-35, 709 P.2d at 451, 230 Cal. Rptr. at 845; see also People v. Morris, 199 Cal. App. 3d 377, 387, 245 Cal. Rptr. 52, 58 (1988) (Brown “did not decide whether electrophoresis of dried biological fluids and stain samples was generally ac-
Three years after the Brown decision, two California appellate courts found that a more persuasive foundation for electrophoresis evidence had been established under Kelly-Frye, holding the technique admissible. In People v. Reilly and People v. Morris, the main challenge to electrophoresis was not to the method in general, but that a consensus of reliability did not exist for the method as applied to dried, aged evidence samples collected from the crime scene.

Through the testimony of the prosecutions' expert witnesses, the Reilly and Morris courts found that a consensus of agreement existed as to the technique's reliability. In both cases, the prosecution presented the testimony of five experts as to the technique's reliability. In Reilly, only one expert testified for the defense, and in Morris there were no defense experts. The thrust of the defense expert's testimony in Reilly was that analysts could not properly account for "the deteriorating effects of aging, improper preservation, and the presence of crime scene contaminants." However, the court explained, "his criticism was repeatedly qualified by noting that well-trained, competent analysts who use proper procedures and are aware of the published literature warning of typing problems can account for those possibilities." Thus, although the witness indicated some dissatisfaction with the number of independently verified studies available, basically he thought the information obtainable was sufficient to render electrophoresis test results acceptable, provided that analysts knew and properly utilized the information.

The defense in Reilly also challenged the qualifications of the

173. Morris, 199 Cal. App. 3d at 390, 245 Cal. Rptr. at 60; Reilly, 196 Cal. App. 3d at 1153, 242 Cal. Rptr. at 512.
175. Reilly, 196 Cal. App. 3d at 1140, 242 Cal. Rptr. at 56.
176. Morris, 199 Cal. App. 3d at 385, 245 Cal. Rptr. at 56.
177. Reilly, 196 Cal. App. 3d at 1140, 242 Cal. Rptr. at 505. "The heart of Dr. Grunbaum's testimony was his doubt whether analysts can accurately account for those possibilities [of the deteriorating effects of aging, improper preservation, and the presence of crime scene contaminants] and thus distinguish between reliable and unreliable results, or even testable and untestable samples." Id. at 1141, 242 Cal. Rptr. at 505.
178. Id.
179. Id. at 1143, 242 Cal. Rptr. at 506.
prosecution’s experts to testify as to the technique’s general acceptance. Specifically, the defense attacked the testimony of several of the prosecution witnesses because they had a professional interest in doing forensic electrophoresis work and were not research scientists.\textsuperscript{180} The court responded that a certain degree of professional interest in a new technique must be tolerated if scientists familiar with the theory and practice of the technique are to testify as to its general acceptability.\textsuperscript{181}

Another aspect of \textit{Kelly-Frye} challenged by the defense, in addition to the technique’s ability to account for aging, environmental and bacterial contamination, was that the prosecution failed to prove the application of correct scientific procedures in conducting electrophoresis in \textit{Reilly} and \textit{Morris}.\textsuperscript{182} In holding that the tests were performed correctly, the court considered such factors as the criminalists’ use of controls and published standards to interpret results, the experience of the analyst, and retesting of the evidence.\textsuperscript{183} The identification of enzymes and serum proteins through electrophoresis “ha[s] moved from an initial position of mistrust of such evidence to the present stage of taking judicial notice of the scientific acceptance or acceptability of serologic and related tests.”\textsuperscript{184}

\section{C. Analyzing the Admissibility of DNA Fingerprinting}

\subsection{1. A Consensus of Opinion}

The proponent of novel scientific evidence must first establish the generally accepted reliability of the method, usually by expert testimony.\textsuperscript{186} Precisely what amounts to “general acceptance” has never clearly been delineated.\textsuperscript{188} \textit{People v. Reilly}, the first appellate court opinion to uphold the admissibility of electrophoresis, agreed with

\begin{itemize}
  \item 180. \textit{Id.} at 1139, 242 Cal. Rptr. at 503.
  \item 181. \textit{Id.} at 1140, 242 Cal. Rptr. at 504.
  \item 184. C. McCORMICK, supra note 129, § 205, at 619. Professor McCormick notes, however, that there is a difference of judicial opinion depending on whether the sample inculpates or exculpates a suspect.
  \item 185. \textit{People v. Kelly}, 17 Cal. 3d 24, 30, 549 P.2d 1240, 1244, 130 Cal. Rptr. 144, 148 (1976). The court may also determine whether a technique is generally accepted by looking beyond the trial record, examining California precedent, cases from other jurisdictions, and scientific literature. This is because appellate endorsement of a technique ends the need for case-by-case adjudication. \textit{See} \textit{id.} at 32-36, 549 P.2d at 1245-48, 130 Cal. Rptr. at 149-52.
  \item 186. Giannelli, supra note 128, at 1210-11.
\end{itemize}
opinions stating the Kelly-Frye issue as whether “a consensus of scientific opinion has been achieved as to the scientific technique.” 187

General acceptability redefined in this manner, the issue becomes whether a consensus or substantial agreement among the scientific community exists as to DNA typing’s reliability. In the Andrews case, the defense attorney said: “We could not find a single scientist who thought it didn’t work.” 188 However, since Andrews, serious challenges to the technique have been made, and from a review of the articles on the new technique and comparison of DNA typing with the electrophoresis cases, acceptance of DNA typing will not be without controversy in California.

The time which has elapsed in a pretrial hearing on a less sophisticated form of blood analysis in California, over one year, exemplifies the scrutiny which new scientific procedures undergo in this state. 189 In contrast, the pretrial hearing in the Andrews case lasted only one day. 190 Proponents of the evidence in California must expect to lay a more persuasive foundation for DNA typing’s admissibility than needed in jurisdictions which take a more liberal approach to the introduction of novel scientific evidence. One of the leading DNA fingerprinting experts among California defense attorneys predicted the following in 1988: “I’m not sure who the voice crying in the wilderness will be [against the admissibility of DNA fingerprinting],

187. Reilly, 196 Cal. App. 3d at 1134, 242 Cal. Rptr. at 500 (quoting People v. Brown, 40 Cal. 3d 512, 532, 709 P.2d 440, 450, 230 Cal. Rptr. 834, 843 (1985)). In Kelly, the court at one point says that a substantial agreement and consensus suffice, and in Brown, the court says that its responsibility is to conduct a “‘fair overview’ of the subject, sufficient to disclose whether 'scientists significant either in number or expertise publicly oppose [a technique] as unreliable.'” Kelly, 17 Cal. 3d at 31, 549 P.2d at 1244, 130 Cal. Rptr. at 148; Brown, 40 Cal. 3d at 533, 709 P.2d at 450, 230 Cal. Rptr. at 844 (quoting People v. Shirley, 31 Cal. 3d 18, 56, 641 P.2d 775, 798, 181 Cal. Rptr. 243, 266 (1982)).


189. Troubled Debut, supra note 11, at 44. The anticipated time lengths for DNA fingerprinting admissibility hearings in California also reflect a more searching inquiry into novel scientific evidence. For example, in People v. Barney (No. HK 10291), the Alameda County case, Richard Iglehart, Chief Assistant District Attorney for Alameda County, said that prosecutors plan to “put on an extensive Kelly-Frye hearing, since there are no appellate court decisions in California on this issue . . . [and] include a fairly long and complicated procedure for admission of evidence from a new scientific area.” L.A. Daily J., Feb. 16, 1989, § 1, at 1, col. 2. In addition, the New York experience in People v. Wesley, 533 N.Y.S.2d 643 (1988), where the admissibility hearing lasted over six months from its commencement on December 11, 1987 until the opinion was rendered on July 15, 1988, resulting in “a transcript of over a thousand pages,” id. at 645, and in People v. Castro, where the admissibility hearing lasted 15 months, L.A. Daily J., July 13, 1989, § 1, at 7, col. 5, indicate that in a Frye jurisdiction prosecutors must expect to establish a more extensive foundation.

190. See Lewis, supra note 3, at 50. Attorney General John Van de Kamp’s genetic fingerprinting watchdog, Frederick Millar, supervising deputy attorney general in San Diego, also “notes that the entire trial transcript from some of the cases in other states in which genetic fingerprinting has been introduced in court ha[ve] [sic] run less than 100 pages. . . .” Troubled Debut, supra note 11, at 44.
but I’m sure it will be somebody.” Since then, a clearer picture has been drawn of the technique’s opponents and their reasons for asserting that DNA fingerprinting does not yet meet *Kelly-Frye*.

Electrophoresis was developed in the late 1960s, and although in early electrophoresis cases the evidence was successfully introduced, the California Supreme Court in *Brown* positioned itself with those courts adopting a more skeptical attitude toward this technique. Electrophoresis experienced a considerable lag time, then, between its discovery and eventual admissibility in California in *Reilly*. The *Kelly* court set forth the delay between the discovery of a new technique and its admissibility into evidence as one of the primary justifications for the *Frye* rule. Since DNA fingerprinting was developed in 1985, it has not yet experienced the same degree of lag time as electrophoresis did before its acceptance in California appellate courts. An expert in the *Andrews* case testified in the pretrial hearing to the technique’s general acceptability as follows: “We do it routinely, roughly five to ten times a day in my laboratory . . . and it’s done on a similar basis in laboratories around the world.” However, using a methodology under laboratory conditions can produce different results than those in the field.

The effect of the variable conditions of the crime scene on electrophoresis test results was one of the main challenges to the technique in *Reilly* and *Morris*. The defendants opposed the field-readiness of the technique. Indeed, forensic scientists express similar con-

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191. *Troubled Debut*, supra note 11, at 44.
194. *Scientific*, supra note 4, § 17-8(C), at 600.
195. *See id.* at 601.
196. Electrophoresis was developed in the late 1960s. *Brown*, 40 Cal. 3d at 531, 709 P.2d at 449, 220 Cal. Rptr. at 646. However, it was at least 18 years before it was held admissible in California (People v. Reilly, 196 Cal. App. 3d 1127, 242 Cal. Rptr. 496 (1987), was the first appellate court decision in the state to hold admissible electrophoretic evidence).
198. Lewis, supra note 3, at 50. David Housman, a molecular biologist at the Massachusetts Institute of Technology, was prosecution expert witness in the *Andrews* case. *Id.* at 47, 50; *see People v. Andrews*, 533 So. 2d 841, 848 (1988).
199. *See Dodd*, supra note 1, at 5-6 (“The technique, however, has yet to be tested and assessed for application in actual casework. How easily DNA fingerprinting can be assimilated in a routine crime laboratory remains to be established.”).
200. *See supra* note 177 and accompanying text.
cerns about the DNA test's effectiveness in the uncertain conditions of a crime scene. While the technique may well be infallible "under ideal laboratory conditions using ample and pristine samples, . . . [t]he probability of two people having the same DNA print under these circumstances is not, ultimately, a meaningful statistic." John Hicks, head of the Federal Bureau of Investigation's serology unit, in January of 1988 said: "We're very excited about it . . . but the fact is, we can't do it in crime laboratories now. We've only done a limited number of tests yet. So we can't say with absolute certainty that [the technique] works on different sizes of stains, aged stains, and putrefied stains.

At that time, research was being done by the F.B.I. and other forensic scientists on these environmental variables. Apparently the F.B.I.'s testing resolved favorably the issue of how crime scene variables affect the DNA fingerprinting process. After a year of research on the process which concluded in December of 1988, the Bureau is "now doing DNA profiling routinely every day," and accepting samples from law enforcement agencies across the country for use "in violent personal crimes with a specific suspect, or serial rapes or child molestations without a suspect." Additionally, testing was underway by the Bureau so that it could formulate its own statistics on the technique's reliability. A major concern of law enforcement officials is that most of the research on the DNA test has been done by private labs which have a proprietary interest in their findings. These private firms, for the most part, have not put the technology through independent validation studies. Without more independent validation of the technique's reliability, or disclosure by private firms of their own studies, the relevant scientific community cannot evaluate the technique, and consequently, general acceptance is difficult to establish. Bringing the technology into the public sector for evaluation of the impressive claims made by those

202. See Troubled Debut, supra note 11, at 44.
203. Thompson & Ford, supra note 25, at 64.
204. Troubled Debut, supra note 11, at 44.
205. Moss, supra note 6, at 70.
207. See Troubled Debut, supra note 11, at 44.
208. Frederick Millar says that he is aware of only one blind validation study, of 700 hundred New Yorkers. However, with claims that the technique has the ability to identify one print from billions of others, such a sample is too small to prove the test's reliability. Michelle Terry, director of marketing for Lifecodes Corp., says that the genetic fingerprinting firms have their own way of knowing that the technique works. The results of the tests by Lifecodes which support their claims of the technique's identification powers cannot be disclosed because that information is proprietary. Troubled Debut, supra note 11, at 44.
209. See generally id. at 44; Moss, supra note 6, at 69; Sensabaugh, Forensic Biology — Is Recombinant DNA Technology in its Future?, 31 J. FORENSIC SCI. 393, 394-95 (1986); FBI Laboratory, supra note 2, at 18-20.
private companies marketing DNA typing will aid in reaching a consensus of reliability.

In People v. Reilly, the appellate court found unanimous agreement among prosecution experts as to electrophoresis' reliability. The defense expert was the "lone detractor" from this position. However, as People v. Castro illustrated, unanimity is not the position with regard to DNA typing. An informal poll taken in September 1987 at a meeting of the American Society of Crime Laboratory Directors also showed a lack of consensus. Out of the eighty-seven directors who were asked whether DNA testing was ready for use in casework, only one-third of the criminologists pronounced it field-ready. And, although it was reported in April of 1989 that the California Association of Crime Lab Directors "evaluated the private companies and endorsed their procedures," in actuality "the lab directors' investigation disclosed that two of the three aren't nearly as accurate as they claim to be."

Research scientist George Sensabaugh, an expert witness for the prosecution in Reilly, testified in that case: "There really is no question among people in the field that this kind of evidence material, that is the dried stains, can be typed reliably using electrophoretic methods." Sensabaugh has also been studying DNA typing, but his evaluation of the scientific field's attitude towards that technique is not as glowing. Although he thinks additional research on the technique will prove, not disprove, its reliability, he calls for additional independent research to establish reliability. Like other officials and scientists, he expresses the forensic community's concern that the research validating DNA fingerprinting has, for the most part, come from companies in the private sector. He recommends

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211. Troubled Debut, supra note 11, at 44.
213. Two out of three private laboratories "came up with one incorrect match out of 50 samples sent to each in a blind test of their abilities," said Margaret Quo, Chief Criminalist in the Orange County Sheriff's Department Crime Lab. The two labs which incorrectly matched samples were Forensic Science Associates in Richmond and Cellmark Diagnostics in Germantown, Md. Lifecodes correctly matched all of the samples. In light of the impressive identification claims made by these labs, Cellmark claims the odds of an incorrect match are 30 billion to one, and Forensic Science Associates "that the chance of a false identification . . . is several tens of thousands to one," but, opponents argue that the labs' performance is unacceptable, "particularly since unreliable evidence could lead to an innocent defendant's conviction." Id. at 34-35.
215. Moss, supra note 6, at 69.
that such research be published quickly for critical evaluation by other scientists.\textsuperscript{216} Sensabaugh predicted that it will be 1992 before enough research and education have taken place for DNA typing to be admissible in California under the \textit{Kelly-Frye} test\textsuperscript{217} Other officials say that less time will be needed before there is adequate documentation of the process to provide the general acceptance in the scientific community.\textsuperscript{218}

It is difficult to predict whether, at this time, DNA typing has found general acceptance in the relevant scientific community under \textit{Kelly-Frye}. Since the \textit{Castro} pretrial admissibility hearing, the stance of some experts seems to be that DNA fingerprinting will provide a "powerful tool for forensic identification," but, "there is an urgent need for the scientific community to agree on clear guidelines for the procedures and standards needed to ensure reliable DNA fingerprinting."\textsuperscript{219} However, there are certain guidelines as to what steps should be taken when DNA typing is introduced in California courtrooms.

The Forensic Science Research Unit of the F.B.I. Laboratory has published a protocol for certification of DNA typing techniques. "This approach should enable research scientists to establish the scientific validity of DNA typing methods as they are applied to the examination of evidentiary materials and directly address the \textit{Frye} standard . . . for admissibility of evidence."\textsuperscript{220}

\begin{itemize}
  \item \textsuperscript{216} \textit{Id.}; see also Sensabaugh, \textit{supra} note 209, at 396. ("The stability of DNA in evidence materials needs to be critically assessed.").
  \item \textsuperscript{217} Lomhoff, \textit{supra} note 48, at 9. Notwithstanding these observations, George Sensabaugh was a prosecution witness in People v. Wilds (No. A816963), a Los Angeles County case which has been continued until September 18, 1989. At that time the defense will begin its case against the admissibility of DNA fingerprinting. Telephone interview with Dino Fulgoni, Head Deputy District Attorney, Special Crimes Division, Los Angeles County, Cal. (Aug. 2, 1989).
  \item \textsuperscript{218} California Attorney General John Van de Kamp said in February of 1988 that "within a year or two his office may back use of DNA fingerprinting in a criminal trial." \textit{Authorities}, \textit{supra} note 12, at 3; see also \textit{supra} text accompanying notes 14-19.
  \item \textsuperscript{219} Lander, \textit{supra} note 82, at 505; see also Schmeck, \textit{Standards Urged for Genetic Fingerprinting}, \textit{N.Y. Times}, June 15, 1989, at A18, col. 2.
  \item \textsuperscript{220} FBI Laboratory, \textit{supra} note 2, at 19-20. The validation protocol steps, published by the F.B.I. are:
    \begin{enumerate}
      \item Perfect the typing methods with fresh body tissues and liquids obtained and stored in a controlled manner.
      \item Using specimens taken from donors of known phenotypes/genotypes, evaluate the reproducibility of the techniques both within the laboratory and between unrelated laboratories.
      \item Establish population distribution data in different racial groups for the alleles detected by a given RE-DNA probe pair.
      \item Prepare dried stains using body fluids from donors of known phenotypes and analyze using the tentatively perfected typing methods.
      \item If required, modify the typing methods to ensure that stain specimens exhibit accurate, interpretable and reproducible DNA typing profiles that agree qualitatively with the profiles obtained on liquid specimens.
      \item Determine if the polymorphic patterns in dried stains change as a function
    \end{enumerate}
\end{itemize}
The F.B.I. report says that the major focus in the validation of DNA typing methods must be on the legitimacy of their applications to human tissue and fluid specimens that were removed from the body in an uncontrolled manner and might have deteriorated prior to collection.221 This focus responds to the concerns of some scientists that the results of DNA typing under controlled laboratory conditions cannot be the basis for determining reliability in the crime scene situation.222 These are the same types of concerns which were eventually overcome in the electrophoresis cases.223

The F.B.I. report says that the validation of DNA typing methods will likely follow the same path electrophoresis took in establishing its acceptance.224 In _Reilly_, expert testimony established that: scientific literature on electrophoresis was sufficient to inform a competent technician of problems with the technique; most crime labs already adhered to guidelines like those which the defense expert suggested for electrophoresis; published protocols were available for each marker system; and most labs had in-house training on the pro-

of storage time.
7. Determine if DNA isolated from various tissues and organs within an individual yields identical typing profiles.
8. Expose laboratory-prepared body fluid stains to a variety of commonly-encountered adventitious substances to assess the impact of these substances on DNA profiles.
9. Examine DNA profiles in nonprobative evidentiary stain materials as examples of stains that are likely to have been exposed to a wide variety of adventitious substances and climatic extremes. Because all possible contaminants and environmental conditions that might affect DNA typing profiles cannot be addressed experimentally, special attention will be directed to a comparison of DNA profiles derived from victim's liquid blood versus victim's blood deposited on typical crime scene substrata.
10. Determine if DNA typing methods designed for use with human specimens detect DNA profiles in fluids and tissues from nonhuman sources.
11. Set up typing methods in the case-working laboratory for onsite validation of methodology.
12. Publish results of experimental studies in peer reviewed journals and present data at scientific meetings. (These mechanisms provide a forum for public criticism of the methodologies.)
13. Train case-working unit personnel in all aspects of the performance of DNA typing methods and interpretation of typing results.
14. Establish formal training sessions for, and engage in collaborative testing procedures with, scientists in state and local forensic science laboratories. This program will not only serve to broaden the base of laboratories capable of performing the analyses, but also will demonstrate that the methods are technologically stable.

221. _Id._ at 19.
222. See Thompson & Ford, _supra_ note 25, at 64.
223. See _supra_ notes 170-79 and accompanying text.
224. _FBI Laboratory, supra_ note 2, at 19.
procedure. DNA typing will most probably be scrutinized to determine if similar conditions are met. Following steps similar to those in the FBI report will allow the relevant scientific community to examine DNA typing and arrive at a consensus about its reliability. This should lead California trial courts to hold DNA typing admissible as each case is presented with the same certainty as electrophoresis and will guard against challenges to the technique's admissibility on appeal.

2. Proper Qualifications of Witnesses

The prosecution in Brown failed to establish a consensus of opinion as to reliability in the scientific community on the admissibility of electrophoresis. The prosecution's primary shortcoming in presenting their case was their failure to meet the second part of the Frye test. It requires that the proponent of the evidence establish that the expert witnesses are properly qualified to give an opinion on the subject:

The witness must have academic and professional credentials which equip him to understand both the scientific principles involved and any differences of view on their reliability. He must also be 'impartial,' that is, not so personally invested in establishing the technique's acceptance that he might not be objective about disagreements within the relevant scientific community.

The lesson to be applied to DNA typing from Brown is that in the trial court, qualified expert witnesses must be used to show a consensus of reliability. DNA typing, like electrophoresis, is a highly technical process and, if the expert's testimony in the trial record is deficient, an appellate court is unlikely to review the scientific literature to determine the evidence's general acceptability. An appellate court's reversal on these grounds will delay further the acceptance of the technique in California.

The Brown expert witnesses were considered "unqualified to state the view of relevant community of impartial scientists [because of] their identification with law enforcement, their career interest in the acceptance of the tests, and their lack of formal training and background in the applicable scientific disciplines." While the weaknesses of the Brown witnesses stemmed from both their lack of competency to testify on the general acceptance of electrophoresis and their lack of impartiality as to the technique, a problem for proponents of typing may be finding impartial expert witnesses.

The fact that most of the research involving DNA typing has oc-

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226. Brown, 40 Cal. 3d at 530, 709 P.2d at 448, 230 Cal. Rptr. at 841.
227. See supra notes 166-68 and accompanying text.
228. Brown, 40 Cal. 3d at 533, 709 P.2d at 450, 230 Cal. Rptr. at 843-44.
ocurred in private laboratories presents difficulties in finding qualified witnesses under *Kelly-Frye*. Some prosecutors fear that there are insufficient credible witnesses regarding DNA typing, and that a challenge to the evidence's admissibility would stand a good chance of succeeding for this reason.

In *Reilly*, the defense challenged the prosecution experts as not being “disinterested” parties for *Kelly-Frye* purposes. The court responded: “The important point with regard to disinterest is that [we have] before [us] a broad range of backgrounds . . . to assess general acceptance through [the witnesses’] combined testimony regardless of any shortcomings that any of them would have suffered as a sole spokesperson for the general scientific community.”

At this point, it might be difficult to bring disinterested witnesses for DNA typing before the court because private laboratories dominate the field. In *Reilly* and *Morris*, the combined testimony of research and forensic scientists in the private and public sector comprised the relevant field of impartial witnesses under *Kelly-Frye*. Their combined testimony qualified them to testify as to the general acceptance of electrophoresis. The court found there that self-interest in the technique did not make the witnesses’ testimony unacceptable because: “[a] certain degree of ‘interest’ must be tolerated if scientists familiar with the theory and practice of a new technique are to testify at all.” Even so, until DNA typing is researched and validated by public sector scientists, courts may consider competent experts available for DNA typing to have more than a “certain degree of interest.”

An additional requirement under the second part of *Kelly-Frye* is that the proponent of the evidence must demonstrate that correct scientific procedures were used in the particular case. Moreover, the analyst performing the procedures, as well as testifying about

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229. *Troubled Debut*, supra note 11, at 44.
230. Attorney General John Van de Kamp said in January of 1988: “Of the handful [of DNA researchers working in forensics], almost none are law enforcement personnel. They are all attached to private laboratories, which by the way, have a proprietary interest in their own procedures.” *Id.* However, in January 1989, Van de Kamp reported that legislation was underway to create five regional DNA labs. L.A. Daily J., Jan. 25, 1989, § I, at 4, col. 1. This should produce law enforcement personnel able to give testimony about DNA typing.
232. *Id.* at 1144-47, 242 Cal. Rptr. at 507-09.
233. *Id.* at 1140, 242 Cal. Rptr. at 504 (quoting People v. Young, 391 N.W.2d 270, 275 (Mich. 1986)).
234. *Id.*
235. *See supra* note 137 and accompanying text.
them, must be properly qualified. "Essentially, this part of the Kelly/Frye standard insures that the technique was performed reliably in each particular case before the evidence can be put to the trier of fact."236

Recently, however, it seems that this requirement has been clarified by the California Supreme Court. In People v. Farmer,237 the court held in the context of footprint identification evidence that "the Kelly-Frye rule tests the fundamental validity of a new scientific methodology, not the degree of professionalism with which it is applied."238 And additionally, "[c]areless testing affects the weight of the evidence and not its admissibility, and must be attacked on cross-examination or by other expert testimony."239

It is likely that Farmer will be challenged as dicta by opponents of DNA fingerprinting. But, notwithstanding the interpretation given to Farmer by California courts, the quality control of DNA typing will still be open to attack in each particular case where the test is held admissible. An associate scientist at one of the companies producing a DNA test reminds experts to be humble in their statistical evaluation of the certainty with which a DNA test can identify an individual because the DNA test is done by people, and people make mistakes.240

It would seem that in the context of DNA fingerprinting, where the complexity of the procedure might overwhelm a lay person, the underlying rationale of Kelly-Frye would be best met by the demonstration of correct scientific procedures in the pretrial hearing. If jurors lacked the knowledge to properly understand attacks on the DNA fingerprinting testing in the case before them, the identification claims asserted by the evidence's proponent may "assume a posture of mystic infallibility in the eyes of [the jurors]."241

Crime laboratories have been criticized for their rate of error in performing other tests, and it is feared "that such personnel would not be able to adequately perform the sophisticated techniques required for DNA analysis."242 The DNA typing process requires intensive work and "both meticulous expertise and much experience in the reading and interpretation of the bands that appear in the final autoradiographs."243 Additionally, "since the outcome in human

238. Id. at 913, 765 P.2d at 956, 254 Cal. Rptr. at 524.
239. Id.
243. Dodd, supra note 1, at 7; see also Thompson & Ford, supra note 25, at 64 (discusses the complexity of the procedure).
terms is likely to be far reaching and since no confirmatory tests using other independent systems are possible, it is surely essential to duplicate each test.\textsuperscript{244}

In\textsuperscript{245}\textit{Reilly} and\textit{Morris}, the proponents of the evidence met similar challenges with regard to the testing of the particular samples used in each case. There, the courts were satisfied that proper procedures were used by qualified personnel.\textsuperscript{246} In order to meet the demands of\textit{Kelly-Frye} it is important that personnel be carefully trained to perform the DNA typing test and be aware of published standards as to DNA typing. The FBI report includes in its guidelines for validating DNA typing steps toward meeting this part of the\textit{Kelly-Frye} test.\textsuperscript{246} Technicians should be familiar with such guidelines and quality controls in force before introduction of the technique.

\textbf{V. CONCLUSION}

The identification capabilities of DNA typing may be revolutionary in their applications. The "DNA fingerprinting" test will, at best, provide virtually positive proof that a suspect did or did not commit a crime, or, at worst, a reliable identification system for blood, semen, hair, or skin scrapings. Additionally, with the addition of DNA computer databases, a suspect may well be placed at the crime scene.

The electrophoresis cases show that under\textit{Kelly-Frye}, when the proponent of "DNA fingerprinting" wants to introduce the evidence in California: (1) there should be a body of research from various sources substantiating the technique, which also alerts forensic scientists and technicians to proper procedures and potential problems surrounding it; (2) qualified experts in the relevant field should be available to testify that the technique is generally accepted; and (3) personnel performing the technique should be properly trained and follow procedures generally accepted by the relevant scientific community.

In order for the proponent of DNA typing to meet these objectives, or for the opponent of the technique to effectively object to its admissibility, knowledge of the recommended steps for validation of DNA typing, such as those published by the FBI, is important.\textsuperscript{247}

\textsuperscript{244} Dodd, supra note 1, at 7.


\textsuperscript{246} See supra text accompanying notes 224-25.

\textsuperscript{247} See supra note 220.
Professor McCormick wrote:

To deal effectively with scientific evidence, the attorney must know more than the rules of evidence. He must know something of the scientific principles as well. While he can rely on suitably chosen experts for advice about the more arcane points, he must have a sufficient grasp of the field to see what is essential and what is unnecessary detail and verbiage if he is to develop or counteract the evidence in the way that will have the most impact.248

The validation steps set forth by the F.B.I. give a framework to the proponent and opponent of DNA typing for handling the scientific evidence. The problems DNA typing faces in being held admissible under Kelly-Frye go hand in hand with the fact that control of the technique is in the private sector. In setting forth its approach to the evidence’s admissibility, the F.B.I. framework also responds to these concerns. Additionally, the justifications for the conservatism of the general acceptance rule set forth in Kelly will be met through this approach.

Prosecutors and defense attorneys alike benefit from certainty of identification. Thorough preparation before presenting DNA typing evidence, as well as its use in the clearest cases, will ensure early and enduring use of the technique for both sides. Undoubtedly, the DNA typing test will undergo thorough scrutiny in California. California Attorney General John Van de Kamp warned prosecutors to proceed cautiously with their use of DNA typing evidence, stating that he worried someone would rush into court ill-prepared and, on appeal, the admissibility of the technique would be overturned.249 Considering some of the problems identified for establishing DNA typing’s general acceptance under Kelly-Frye, a cautious approach to the introduction of DNA typing is justified. This will secure favorable precedents on appeal, upholding the admissibility of DNA typing evidence, and improve the quality of justice with the availability of such an innovative technique for identifying and exonerating suspects.

APPENDIX

There have been two recent developments bearing on the admissibility of DNA fingerprinting: In the New York case of People v. Cas-

248. C. McCormick, supra note 129, § 203, at 604.
249. L.A. Daily J., Jan. 25, 1989, § I, at 4, col. 1. Additionally, each time DNA typing evidence is introduced in a different manner, e.g., a new type of specimen, a significant variation in the age or size of the sample or a procedural variation in how the test is performed, general acceptance of the technique will have to be shown by the proponent of the evidence. This is exemplified by Reilly, 196 Cal. App. 3d at 1127, 242 Cal. Rptr. at 496, and Morris, 199 Cal. App. 3d at 377, 245 Cal. Rptr. at 52. In the former case, electrophoresis test results for dried blood stains were upheld while in the latter, a different system to obtain electrophoretic test results, the “multi-system,” was upheld.
the use of DNA tests to demonstrate the inclusion of Castro in a class of suspects was barred, and, in the California case of People v. Axell, the technique was held admissible for the first time in the state. The ruling in Axell resulted in California’s first conviction based in part on DNA testing.

The Castro court utilized the Frye test of admissibility, but focused on the third prong of the test. The third prong asks whether “the testing laboratory perform[ed] the accepted scientific techniques in analyzing the forensic samples in this particular case?” The court noted that some courts, “in guarding the province of the trier of the facts,” have said that this prong affects the weight of the evidence and not admissibility, and therefore, have based their Frye analysis on only the first two prongs of the test: whether the underlying principle of the technique is valid and whether the technique applying the principle is valid.

In contrast, the Castro court advised that caution in reviewing the procedures utilized by a testing laboratory should be the focus of the inquiry because of the complexity of DNA fingerprinting and the opportunity for error. Judge Sheindlin disagreed with the proposition of other courts “that improper procedures and experiments will automatically and clearly be revealed” to the trier of fact.

Based on the three prong analysis, the court found that there was “unanimity amongst all the scientists and lawyers as well, that DNA identification is capable of producing reliable results” and “that DNA forensic identification tests to determine inclusions are reliable and meet the Frye standard of admissibility,” but, that the DNA identification evidence of inclusion in the case, matching the blood on Castro’s watch to the victim’s, was inadmissible as a matter of law because the laboratory (Lifecodes) “failed in several major respects to use the generally accepted scientific techniques and experiments for obtaining reliable results, within a reasonable degree of

252. Id.
254. Id.
255. Id.
256. See id.
257. See id.
258. Id. at 20, col. 4.
259. Id. at 19, col. 4.
260. Id. at 20, col. 4.
Only the evidence of exclusion in the *Castro* case, or that the blood on Castro's watch was not his own, was held admissible as a question of fact for the jury. No appellate courts in New York have ruled on the admissibility of the technique, and *Castro* is often cited as the first serious challenge to the admissibility of the technique in that state. While the prosecution claimed that *Castro* was a victory for the state in that it simply means that now when DNA evidence is offered the proponents have to make sure that the scientists have "dotted all the i's and crossed all the t's in making sure that the procedures they use are viable and defensible," Castro's defense attorneys are calling for retrials of DNA cases. They think that if DNA testing is used at all, it must meet the strictest laboratory standards.

Many legal and scientific experts agree that such laboratory standardization is necessary. While recognizing the revolutionary nature of DNA fingerprinting, it is felt that "unless standards are soon established there is a great risk that the credibility of this type of evidence could be compromised through mishandling, mismanagement and improper analysis." In *People v. Axell*, Judge Storch determined after a lengthy pretrial admissibility hearing that DNA testing was admissible in that case. This ruling resulted in the first conviction in California on the basis of DNA typing.

According to James Farley, one of Axell's defense attorney's, the decision to waive the jury in that case was made because the scientific evidence would have been more devastating in a jury trial because "[w]hen a government scientist testifies, his words somehow or other attain a level that's almost God-like" to the jurors. Farley urges defense attorneys to continue challenging DNA typing and to develop their own pool of experts to testify about the technique. He cites *Castro* as an example of the mistakes that the laboratories can make, predicting that more and more companies are going to begin marketing the DNA test. This proprietary interest could result in biased experts which should be guarded against in the pretrial ad-

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261. Id. at 20, col. 6.
262. See id.
263. See supra notes 79-90 and accompanying text.
265. See id.
266. See id.
267. Id. (quoting Tom C. Smith, associate director of the ABA's Criminal Justice Section).
269. Id.
270. Id.
271. See id.
missibility procedure.\textsuperscript{272}

Until an appellate court upholds the admissibility of DNA fingerprinting, proponents must continue to establish the general acceptance of the technique in each particular case.\textsuperscript{273} For this reason, Professor Imrinkelreid said that \textit{Axell} was more important for its psychological impact in upholding DNA fingerprinting following the \textit{Castro} decision, than for its legal impact.\textsuperscript{274}

In \textit{Axell}, the prosecutor said that a key component in the judge's ruling was "his determination that the basic science of DNA testing should be subject to the \textit{Kelly-Frye} standard" but "that a jury — not a judge — should decide how much weight to give the specific results of a DNA test in a particular case."\textsuperscript{275} Apparently, the court followed \textit{People v. Farmer}\textsuperscript{276} in deciding that the third prong was to be left to the trier of fact, in contrast with the \textit{Castro} ruling.\textsuperscript{277}

As this Comment stated previously, it seems that the basic rationale of \textit{Kelly-Frye} would be undermined by upholding \textit{Farmer}'s ruling that \textit{Kelly-Frye} "tests the fundamental validity of a new scientific methodology, not the degree of professionalism with which it is applied"\textsuperscript{278} in the context of DNA testing.

Because of the complexity of the procedure and the concerns expressed by scientists about the lack of standard laboratory procedures for testing, the application of \textit{Farmer} will likely be an important issue in the pending California DNA identification cases in California. The stakes involved with using DNA testing are high so it is vital that this evidence does not "assume a posture of mystic infallibility in the eyes of [the jurors]."\textsuperscript{279} Standardized procedures should be adopted and the proponents of DNA evidence should be required to demonstrate that correct scientific procedures were used in that particular case, and that the analyst performing them and testifying about them is properly qualified, before the evidence can be put to the trier of fact.\textsuperscript{280}

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\textsuperscript{272} See supra notes 232-34 and accompanying text.

\textsuperscript{273} L.A. Daily J., Aug. 9, 1989, § 1, at 1, col. 3.

\textsuperscript{274} Id.

\textsuperscript{275} Id.

\textsuperscript{276} 417 Cal. 3d 888, 765 P.2d 940, 254 Cal. Rptr. 508 (1989).

\textsuperscript{277} See supra text accompanying notes 237-240.

\textsuperscript{278} \textit{Farmer}, 47 Cal. 3d at 913, 765 P.2d at 956, 254 Cal. Rptr. at 524.

\textsuperscript{279} \textit{People v. Kelly}, 17 Cal. 3d 24, 32, 549 P.2d 1240, 1245, 130 Cal. Rptr. 144, 149 (1976) (quoting United States v. Addison, 498 F.2d 741, 744 (D.C. Cir. 1974)).

\textsuperscript{280} See id. at 30, 549 P.2d at 1244, 130 Cal. Rptr. at 148.