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## Ake v. Oklahoma: The Right to Expert Assistance in a Post-Daubert, Post-DNA World

Paul C. Giannelli

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# The Admissibility of Novel Scientific Evidence: *Frye v. United States*, a Half-Century Later

Paul C. Giannelli\*

INTRODUCTION .....	1198
I. THE ADMISSIBILITY OF SCIENTIFIC EVIDENCE .....	1200
II. <i>Frye v. United States</i> .....	1204
A. Difficulties in Application .....	1208
1. Who Must Accept the Procedure .....	1208
a. Identifying the Appropriate Field .....	1208
b. General Acceptance in the Field .....	1210
2. What Must Be Accepted .....	1211
3. Establishing General Acceptance .....	1215
a. Expert Testimony .....	1215
b. Scientific and Legal Literature .....	1217
c. Judicial Opinions .....	1218
4. When to Apply <i>Frye</i> .....	1219
5. Scope of Appellate Review .....	1222
B. Problematic Results .....	1223
1. Exclusions .....	1223
2. Inclusions .....	1224
C. Obscuring Issues .....	1226
D. Current Status of the <i>Frye</i> Test .....	1228
III. THE RADICAL APPROACH: INDEPENDENT COMMISSIONS AND TRI- BUNALS .....	1231
IV. THE TRADITIONAL ANALYSIS: THE RELEVANCY APPROACH ....	1232
A. McCormick's View: <i>Coppolino v. State</i> .....	1233
B. The Federal Rules of Evidence .....	1235
1. Threshold Requirements .....	1235
a. Probative Value .....	1235
b. Dangers .....	1237
c. Balancing .....	1239
2. The Adversary Process .....	1239
a. Notice .....	1240
b. Discovery .....	1242
c. Defense Experts .....	1243
V. A PROPOSAL: THE BURDEN OF PROVING RELIABILITY .....	1245
CONCLUSION .....	1250

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In the past decade courts have faced the difficult task of ruling on the admissibility of evidence derived from a wide range of newly ascertained or applied scientific principles. Neutron activation analysis,<sup>1</sup> sound spectrometry (voiceprints),<sup>2</sup> psycholinguistics,<sup>3</sup> atomic absorption,<sup>4</sup> remote electromagnetic sensing,<sup>5</sup> and bitemark comparisons<sup>6</sup> are but a sample of the kinds of scientific evidence inundating the courts.<sup>7</sup> In addition, prior rulings on the admissibility of scientific evidence have been challenged. In some cases, previously rejected techniques, such as polygraph and hypnotic evidence, have gained admissibil-

1. E.g., *United States v. Stifel*, 433 F.2d 431 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971); *State v. Coolidge*, 109 N.H. 403, 260 A.2d 547 (1969), rev'd on other grounds, 403 U.S. 443 (1971). See generally Annot., 50 A.L.R.3d 117 (1973); Comment, *The Evidentiary Uses of Neutron Activation Analysis*, 59 Cal. L. Rev. 997 (1971).

2. E.g., *United States v. Williams*, 583 F.2d 1194 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979); *United States v. Addison*, 498 F.2d 741 (D.C. Cir. 1974). See generally Annot., 97 A.L.R.3d 294 (1980); O. Tosi, *Voice Identification: Theory and Legal Applications* 135-50 (1979). The National Academy of Sciences sponsored a comprehensive study of voiceprint identification, see National Research Council, *On the Theory and Practice of Voice Identification* 38-57 (1979) [hereinafter cited as *National Academy of Sciences*].

3. See *United States v. Hearst*, 412 F. Supp. 893 (N.D. Cal. 1976), aff'd, 563 F.2d 1331 (9th Cir. 1977), cert. denied 435 U.S. 1000 (1978). See generally Niblett & Borcham, *Cluster Analysis in Court*, 1976 *Crim. L. Rev.* 175; Comment, *Stylistics Evidence in the Trial of Patricia Hearst*, 1977 *Ariz. St. L.J.* 387.

4. See *Chatom v. State*, 348 So. 2d 828 (Ala. Crim. App. 1976), rev'd, 348 So. 2d 838 (Ala.), acq. 348 So. 2d 843 (Ala. Crim. App. 1977); *State v. Chatman*, 156 N.J. Super. 35, 383 A.2d 440 (App. Div. 1978); *State v. Sparks*, 297 N.C. 314, 255 S.E.2d 373 (1979); *State v. Crowder*, 285 N.C. 42, 203 S.E.2d 38 (1974), modified on other grounds, 428 U.S. 903 (1976). See generally Watkins & Watkins, *Identification of Substances by Instrumental Analysis*, 22 *Am. Jur. Proof of Facts* 385, 476-87 (1969).

5. E.g., *United States v. Kilgus*, 571 F.2d 508 (9th Cir. 1978) (forward looking infrared system). See generally Latin, Tannehill & White, *Remote Sensing Evidence and Environmental Law*, 64 *Cal. L. Rev.* 1300 (1976).

6. E.g., *People v. Marx*, 54 Cal. App. 3d 100, 126 Cal. Rptr. 350 (1975); *State v. Peoples*, 227 Kan. 127, 605 P.2d 135 (1980). See generally Note, *The Admissibility of Bite Mark Evidence*, 51 *S. Cal. L. Rev.* 309 (1978); Annot., 77 A.L.R.3d 1122 (1977).

7. See *United States v. Brown*, 557 F.2d 541 (6th Cir. 1977) (ion microprobe analysis); *United States v. Lopez*, 328 F. Supp. 1077 (E.D.N.Y. 1971) (flux-gate magnetometer); *United States v. Bruno*, 333 F. Supp. 570 (E.D. Pa. 1971) (chromatographic analysis of ink); *People v. Palmer*, 80 Cal. App. 3d 239, 145 Cal. Rptr. 466 (1978) (scanning electron microscopic analysis); *Reid v. State*, 267 Ind. 555, 372 N.E.2d 1149 (1978) (trace metal detection technique); *Smith v. State*, 31 Md. App. 106, 355 A.2d 527 (1976) (psychological stress evaluation); *Commonwealth v. Devlin*, 365 Mass. 149, 310 N.E.2d 353 (1974) (identification of human remains through x-ray comparison); *State v. Sharbono*, 174 Mont. 552, 563 P.2d 61 (1977) (gaschrome-biographic analysis); *State v. Boyington*, 153 N.J. Super. 252, 379 A.2d 486 (App. Div. 1977) (Decatur Ragun); *State v. Smith*, 50 Ohio App. 2d 183, 362 N.E.2d 1239 (1976) (modified Harrison-Gilroy test for gunshot residue); *State v. Daniels*, 37 Ohio App. 2d 4, 305 N.E.2d 497 (1973) (trace metal detection technique); *Hernandez v. State*, 530 S.W.2d 563 (Tex. Crim. App. 1975) (ultra-violet and infrared spectrographic analysis).

See generally A. Moenssens & F. Inbau, *Scientific Evidence in Criminal Cases* (2d ed. 1978); Kenety, *The Psychological Stress Evaluator: The Theory, Validity and Legal Status of an Innovative "Lie Detector"*, 55 *Ind. L.J.* 349 (1980).

With some types of novel scientific evidence, only the forensic application of the technique is new. Neutron activation analysis, for example, was well established as a method of elemental analysis before evidence based on this technique was presented in court. In contrast, sound spectrometry (voiceprints) was in an embryonic stage when first presented in court.

ity.<sup>8</sup> In other cases, some well-accepted scientific techniques, such as radar<sup>9</sup> and certain drug-testing procedures,<sup>10</sup> have been challenged successfully.

Several factors may have contributed to the ever-increasing use of scientific evidence. The creation of the Law Enforcement Assistance Administration (LEAA) in 1968 undoubtedly played a significant role.<sup>11</sup> The LEAA has underwritten a number of research projects designed to encourage the forensic application of scientific knowledge, and the admissibility of some novel techniques can be traced directly to this research.<sup>12</sup> Moreover, many commentators<sup>13</sup> attribute the developing importance of scientific evidence to the Supreme Court's decisions of the 1960's, in which the Court, severely restricting the acquisition of evidence for criminal cases via traditional crime-solving techniques such as interrogation<sup>14</sup> and lineups,<sup>15</sup> suggested as an alternative the use of

8. Many courts have reversed their previous position and now admit the results of polygraph examinations upon stipulation of the parties. See *J. Reid & F. Inbau, Truth and Deception* 325-35 (2d ed. 1977); Annot., 43 A.L.R. Fed. 68 (1979); Annot., 53 A.L.R.3d 1005 (1973). In addition, several courts have held polygraph evidence admissible without a stipulation. See *United States v. Ridling*, 350 F. Supp. 90 (E.D. Mich. 1972); *State v. Dorsey*, 88 N.M. 184, 539 P.2d 204 (1975); *State v. Sims*, 52 Ohio Misc. 31, 369 N.E.2d 24 (C.P. 1977).

For cases admitting hypnotic evidence, see *United States v. Awkard*, 597 F.2d 667 (9th Cir.), cert. denied, 444 U.S. 885 (1979); *United States v. Adams*, 581 F.2d 193 (9th Cir.), cert. denied, 439 U.S. 1006 (1978); *State v. McQueen*, 295 N.C. 96, 244 S.E.2d 414 (1978). See generally *Spector & Foster, Admissibility of Hypnotic Statements: Is the Law of Evidence Susceptible?*, 38 Ohio St. L.J. 567 (1977); Annot., 92 A.L.R.3d 442 (1979).

9. See *State v. Aquilera*, 25 Crim. L. Rep. (BNA) 2189 (Dade County Ct. Fla. 1979). See generally *Trichter & Patterson, Police Radar 1980: Has the Black Box Lost Its Magic?*, 11 St. Mary's L.J. 829 (1980); *Schuon, Police Radar Examined Amid Debate*, N.Y. Times, Nov. 27, 1979, § C, at 1, col. 1.

10. See *State v. Vail*,—Minn.—, 274 N.W.2d 127 (1979) (upholding a trial court's ruling that common laboratory tests for marihuana failed to establish identity of seized substance); cf. *State v. Wind*, 60 Wis. 2d 267, 272, 208 N.W.2d 357, 361 (1973) (tests admissible, but insufficient standing alone to support conviction). See generally *Stein, Laessig & Indriksons, An Evaluation of Drug Testing Procedures Used by Forensic Laboratories and the Qualifications of their Analysts*, 1973 Wis. L. Rev. 727.

11. The LEAA was created by Title I of the Omnibus Crime Control and Safe Streets Act of 1968. 42 U.S.C. §§ 3701-3796c (1976).

12. As examples of research projects underwritten by the LEAA, see *B. Culliford, The Examination and Typing of Bloodstains in the Crime Laboratory* (1971); *H. McDonell, Flight Characteristics and Stain Patterns of Human Blood* (1971); *Trace Metal Detection Technique in Law Enforcement* (1970); *Michigan State Police, Voice Identification Research* (1972); *D. Raskin, G. Barland & J. Podlesny, Validity and Reliability of Detection of Deception* (1978).

The LEAA research on voiceprints has played a crucial role in the cases involving the admissibility of this technique. See note<sup>2</sup> *supra*.

13. See *Kelley, Foreword to R. Fox and C. Cunningham, Crime Scene Search and Physical Evidence Handbook* at iii (1973); *Fong, Criminalistics and the Prosecutor*, in *The Prosecutor's Deskbook* 547 (P. Healy & J. Manak eds. 1971); *Fox, McDaniel & Howell, The Criminalistics Mission: A Comment*, in *Legal Medicine Annual* 103, 113 (C. Wecht, ed. 1975); *Osterburg, Forensic Science and the United States Supreme Court: The Impact and Significance of Past Decisions*, in *Legal Medicine Annual* 1 at 1 (C. Wecht ed. 1972) ("The *Miranda*, *Gideon*, *Escobedo*, and several other cases of similar import, indirectly created an entirely new approach to criminal investigation. This has been particularly true with regard to the use and application of the various forensic sciences . . .").

See also *Worley v. State*, 263 So.2d 613, 616 (Fla. Dist. Ct. App. 1972) (concurring opinion) ("In this day and age . . . where recent decisions of the United States Supreme Court establish stringent guidelines in the investigative, custodial and prosecutorial areas a premium is placed upon the development and use of scientific methods of crime detection.").

14. See *Miranda v. Arizona*, 384 U.S. 436 (1966).

15. See *United States v. Wade*, 388 U.S. 218 (1967) (right to counsel applies to lineups); *Stovall v. Denno*, 388 U.S. 293 (1967) (due process applies to identification procedures).

"extrinsic evidence independently secured through skillful investigation."<sup>16</sup> Finally, the use of scientific knowledge to solve legal problems has long been recognized,<sup>17</sup> and it is not surprising that a society so dependent on science and technology should turn to such knowledge as a method of proof.

The important point, however, is not the cause of this development, but rather that the use of scientific evidence will continue and will likely increase. This Article explores one aspect of this development—the evidentiary standards employed by courts to determine the admissibility of evidence based upon novel scientific techniques. The general requirements for the admissibility of evidence derived from a scientific procedure or technique are discussed in Part I. The standard used most often by the courts—the general acceptance test of *Frye v. United States*<sup>18</sup>—is examined in detail in Part II. Next, the relevancy standard and other alternatives are considered. Finally, the Article proposes a solution designed to promote the use of scientific advances while avoiding the problems identified with *Frye* and its suggested replacements.

## I. THE ADMISSIBILITY OF SCIENTIFIC EVIDENCE

For evidence to contribute to the truth-determining function of a trial, it must be reliable. The reliability of evidence derived from a scientific principle<sup>19</sup>

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Interestingly, while the Court was erecting procedural barriers to the use of confessions and lineups, it was removing fourth, fifth, and sixth amendment obstacles to the use of scientific evidence. In *United States v. Dionisio*, 410 U.S. 1 (1973), and *United States v. Mara*, 410 U.S. 19 (1973), the Court held that physical characteristics such as handwriting and the sound of a person's voice fell outside the fourth amendment's protection against unreasonable searches and seizures. The Court also held that compelled production of voice and handwriting exemplars pursuant to a grand jury subpoena did not constitute a seizure of the person within the meaning of the fourth amendment. In *Warden v. Hayden*, 387 U.S. 294 (1967), the Court ruled that the seizure of "mere evidence" was not prohibited by the fourth amendment. See also *Davis v. Mississippi*, 394 U.S. 721, 727 (1969) (suggesting that the seizure of a person, on less than probable cause, for the purpose of obtaining fingerprints may not violate fourth amendment guarantees under certain circumstances).

In *Schmerber v. California*, 384 U.S. 757 (1966), the Court held that the privilege against compulsory self-incrimination applied only to testimonial or communicative evidence and not to physical evidence. Thus, the police could extract blood from Schmerber for blood-alcohol analysis without violating the fifth amendment privilege. See also *United States v. Dionisio*, 410 U.S. 1, 5-7 (1973) (compelled production of voice exemplars does not violate fifth amendment); *Gilbert v. California*, 388 U.S. 263, 266-67 (1967) (compelled production of handwriting exemplars does not violate fifth amendment).

While the Court extended the sixth amendment right to counsel to lineups in *Wade*, it refused to recognize such a right when handwriting exemplars were involved. See *Gilbert v. California*, 388 U.S. 263, 267 (1967). In addition, the obtaining of forensic evidence in most cases occurs before the right to counsel has attached. See *Kirby v. Illinois*, 406 U.S. 682, 688 (1972) (right to counsel attaches at the commencement of adversary judicial proceedings).

16. *Escobedo v. Illinois*, 378 U.S. 478, 488-89 (1964). See also *Breithaupt v. Abram*, 352 U.S. 432, 439 (1957) ("Modern community living requires modern scientific methods of crime detection lest the public go unprotected.").

17. See generally *Scientists in the Legal System* (W. Thomas ed. 1974); Korn, *Law, Fact, and Science in the Courts*, 66 *Colum. L. Rev.* 1080 (1966); Martin, *The Proposed "Science Court,"* 75 *Mich. L. Rev.* 1058 (1977); Whitney, *Technical and Scientific Evidence in Administrative Adjudication*, 45 *U. Cin. L. Rev.* 37 (1976).

18. 293 F. 1013 (D.C. Cir. 1923).

19. Scientific knowledge can be used in two distinct ways at trial. First, data ordinarily unavailable to lay persons can be obtained by scientific means. For example, a stain found at a murder

depends upon three factors: (1) the validity<sup>20</sup> of the underlying principle, (2) the validity of the technique applying that principle,<sup>21</sup> and (3) the proper application of the technique on a particular occasion. This last factor requires an examination<sup>22</sup> of the condition of any instrumentation employed in the technique,<sup>23</sup>

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scene can be analyzed by a serologist to determine whether the stain is blood and, if human blood, the type. Secondly, scientific knowledge may supply the general proposition or hypothesis needed to evaluate specific data. Evidence that the defendant's blood type matches the type found at the crime scene is relevant only because scientific research has demonstrated that the general population can be classified according to blood type. Therefore, evidence that the blood found at the crime scene and the defendant's blood are the same type tends to make the existence of a material or consequential fact, i.e., the murderer's identity, more probable than it would be without the evidence. See Strong, *Questions Affecting the Admissibility of Scientific Evidence*, 1970 U. Ill. L.F. 1, 2-4.

Because scientific knowledge is beyond the expertise of most judges and juries, expert witnesses are used to supply general scientific propositions. An evolutionary process, however, is involved; at some point much of what is initially classified as "scientific" knowledge is assimilated into general knowledge and an expert is no longer needed to supply these propositions. See J. Maguire, *Evidence* 30 (1947).

In many cases the specific data as well as the general proposition will be supplied by an expert. For example, a firearms identification examiner may offer an opinion that two bullets match. This involves testimony concerning specific data—striations found on the suspect and test bullets are identical—and the general proposition that no two bullets could possess identical striations unless fired from the same weapon. In other cases, the expert may supply only the specific data or the general proposition. See 2 J. Wigmore, *Evidence in Trials at Common Law* § 417a (3d ed. 1940) [hereinafter cited as J. Wigmore, *Evidence*]; Strong, *supra*, at 6.

20. Although courts use the terms "validity" and "reliability" interchangeably, the terms have distinct meanings in scientific jargon. "Validity" refers to the ability of a test procedure to measure what it is supposed to measure—its accuracy. "Reliability" refers to whether the same results are obtained in each instance in which the test is performed—its consistency. Validity includes reliability, but the converse is not necessarily true. See Barland, *The Reliability of Polygraph Chart Evaluations*, in *Legal Admissibility of the Polygraph* 120; 121 (N. Ansley ed. 1975).

21. See Latin, Tannehill & White, *supra* note 5, at 1403-10; Strong, *supra* note 19, at 15-18.

22. See 3 J. Wigmore, *Evidence* § 795, at 245-46 (Chadbourne rev. 1970) (listing foundational prerequisites for X-ray evidence); J. Wigmore, *Science of Judicial Proof* § 220, at 449-50 (3d ed. 1937).

23. If a scientific procedure involves instrumentation, the accuracy of results derived from that procedure depends on the functioning of the instrument at the time of the test. Similarly, if a procedure involves the use of reagents or chemicals, the condition of those substances at the time of the test may affect the outcome. See *United States v. Ridling*, 350 F. Supp. 90, 93 (E.D. Mich. 1972) (polygraph); *People v. Adams*, 59 Cal. App. 3d 559, 561, 131 Cal. Rptr. 190, 191 (1976) (breathalyzer); *State v. Stevens*, 467 S.W.2d 10, 23 (Mo.) (neutron activation analysis), cert. denied, 404 U.S. 994 (1971); *State v. Fields*, 434 S.W.2d 507, 516 (Mo. 1968) ("paraffin" test). See also J. Wigmore, *Science of Judicial Proof* 450 (3d ed. 1937). This requirement is imposed by statute in some jurisdictions. E.g., Fla. Stat. Ann. § 316.1905(1) (Harrison) (radar); 75 Pa. Cons. Stat. Ann. § 3368(d) (Purdon) (radar); 75 Pa. Cons. Stat. Ann. § 3368(b) (Purdon) (speedometer).

Various methods of proof have been used to establish the condition of instrumentation employed in scientific procedures. See *State v. McDonough*, 302 Minn. 468, 225 N.W.2d 259 (1975) (use of tuning fork to establish condition of radar). Cf. *United States v. Lopez*, 328 F. Supp. 1077, 1086 (E.D.N.Y. 1971) (custom and practice sufficient to establish condition of flux-gate magnetometer); *People v. Jones*, 10 Misc. 2d 1067, 171 N.Y.S.2d 325 (N.Y. City Magis. Ct., Traffic Ct. 1958) (evidence of periodic testing to establish condition of speedometer); *Whitehead v. City of Lynchburg*, 213 Va. 742, 195 S.E.2d 858 (1973) (test run by a vehicle with calibrated speedometer to establish condition of radar).

Some courts, however, take the position that the condition of the instrument affects the weight, not the admissibility, of the evidence. E.g., *People v. Abdallah*, 82 Ill. App. 2d 312, 226 N.E.2d 408 (1967) (dictum); *People v. Dusing*, 5 N.Y.2d 126, 155 N.E.2d 393, 181 N.Y.S.2d 493 (1959). See C. McCormick, *Evidence* § 210, at 514-16 (2d ed. 1972).

adherence to proper procedures,<sup>24</sup> the qualifications of the person conducting the procedure,<sup>25</sup> and the qualifications of the person interpreting the results.<sup>26</sup> For example, voiceprint identification is premised on the uniqueness of the human voice.<sup>27</sup> If the theory of voice uniqueness is not valid, voiceprint evidence is not reliable. If, however, the uniqueness of the human voice were established, it would not necessarily follow that the voiceprint technique is capable of detecting that uniqueness. Finally, assuming a valid theory and technique, a defective instrument (sound spectrograph), an unqualified operator, or a failure to follow prescribed procedures, may also produce unreliable results.

The first two factors—the validity of the underlying principle and the validity of the technique—are critical only with regard to the admissibility of evidence derived from a novel scientific technique. Once a technique is sufficiently established, a court may take judicial notice of the principle and the technique,<sup>28</sup> thereby relieving the offering party of the burden of producing evidence on these

24. *People v. Kelly*, 17 Cal. 3d 24, 30, 549 P.2d 1240, 1244, 130 Cal. Rptr. 144, 148 (1976) ("[t]he proponent of the [voiceprint] evidence must demonstrate that correct scientific procedures were used in the particular case."); accord, *United States v. Ridling*, 350 F. Supp. 90, 93 (E.D. Mich. 1972); *United States v. Bruno*, 333 F. Supp. 570, 574 (E.D. Pa. 1971).

In some jurisdictions a showing of the analyst's qualifications raises a presumption that the analyst used the proper procedures. *People v. Meikrantz*, 77 Misc. 2d 892, 896, 351 N.Y.S.2d 549, 556 (Broome County Ct. 1974). In other jurisdictions a checklist of the procedures employed may be introduced to corroborate the analyst's testimony. *State v. Hamaker*, 524 S.W.2d 176, 178 (Mo. Ct. App. 1975); *State v. Sutton*, 253 Or. 24, 450 P.2d 748 (1969).

Some courts, however, have taken the position that the methods employed in performing a test affect the weight, not the admissibility, of the evidence. See *United States v. Stifel*, 433 F.2d 431, 438 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971); *State v. Coolidge*, 109 N.H. 403, 418-19, 260 A.2d 547, 558-59 (1969), rev'd on other grounds, 403 U.S. 443 (1971). In contrast, other courts have excluded evidence because the procedures were not acceptable. See *Latin, Tannehill & White*, supra note 5, at 1405-06.

25. See *United States v. Dreos*, 156 F. Supp. 200, 208 (D. Md. 1957) (radar equipment "manned by a competent operator"); *State v. Crowder*, 285 N.C. 42, 50, 203 S.E.2d 38, 44 (1974) (police officer who collected evidence for atomic absorption analysis "qualified by training and experience to perform that simple task"); 3 J. Wigmore, *Evidence* § 795, at 245 (Chadbourn rev. 1970).

26. In many instances the person who conducts the test also interprets the results. Firearms identification, fingerprint identification, and drug analysis are illustrative techniques. Other methods involve two experts. In these cases courts must "differentiate between ability to operate an instrument or perform a test and the ability to make an interpretation drawn from use of the instrument." *People v. King*, 266 Cal. App. 2d 437, 457, 72 Cal. Rptr. 478, 491 (1968). For example, a technician operates the x-ray machine, but a physician interprets the x-rays. Both must be qualified. Similarly, a police officer could qualify as an expert in the operation of a breathalyzer, but would not have the requisite expertise to interpret the results. A physician would have to testify about the relationship between the alcohol content of the breath and the effect on the brain, unless a statute creates a presumption of intoxication when the alcohol concentration reaches a specified level. See *Ohio Rev. Code Ann.* § 4511.19 (Baldwin) (1975). See generally 3 J. Wigmore, *Evidence* § 795, at 245-46 (Chadbourn rev. 1970); *Latin, Tannehill & White*, supra note 5, at 1366-67, 1370; *Strong*, supra note 19, at 9 n.27.

27. More specifically, the validity of voiceprints depends on the extent to which interspeaker variability (how one person's voice differs from another's) exceeds intraspeaker variability (how one person differs in the way he pronounces the same word each time he says it). See National Academy of Sciences, supra note 2, at 10; Tosi, Oyer, Lashbrook, Pedrey, Nicol & Nash, *Experiment on Voice Identification* 51 J. Acoust. Soc'y Am. 2030, 2031 (1972).

28. See C. McCormick, supra note 23, at 763; 1 J. Weinstein & M. Berger, *Weinstein's Evidence* ¶ 200[05] (1979); Keeffe, Landis & Shaad, *Sense and Nonsense About Judicial Notice*, 2 Stan. L. Rev. 664, 670-71 (1950); *Strong*, supra note 19, at 15.

issues. The principles underlying radar,<sup>29</sup> intoxication tests,<sup>30</sup> fingerprints,<sup>31</sup> firearms identifications,<sup>32</sup> and handwriting comparisons<sup>33</sup> have all been judicially recognized in this fashion. In some cases, the validity of a technique—radar and intoxication tests are the principal examples—has been recognized legislatively.<sup>34</sup> As with judicial notice, legislative recognition relieves the proponent of scientific evidence of the burden of introducing evidence on the validity issue. A new technique, however, is rarely so well established that a court would take judicial notice of its validity the first time evidence derived from the technique is offered at trial.<sup>35</sup> Consequently, the validity of a new technique is typically established through the introduction of evidence including expert testimony.<sup>36</sup>

Courts have relied principally on two alternative tests to determine the admissibility of innovative scientific evidence. One approach, often associated with Professor McCormick, treats the validity of the underlying principle and the validity of the technique as aspects of relevancy.<sup>37</sup> If, for example, everyone's voice is not unique, the results of voiceprint analysis will not tend to establish the identity of a speaker. Or, if fear of detection does not produce certain physiological reactions, the results of polygraph examinations will not tend to establish whether the subject of the examination was being deceptive.<sup>38</sup> Similarly, if the principles underlying polygraph examinations and voiceprint identifications are valid but the techniques applying those principles are not valid, evi-

29. E.g., *United States v. Dreos*, 156 F. Supp. 200 (D. Md. 1957); *State v. Tomanelli*, 153 Conn. 365, 216 A.2d 625 (1966); *State v. Dantonio*, 18 N.J. 570, 115 A.2d 35 (1955); *People v. Magri*, 3 N.Y.2d 562, 147 N.E.2d 728, 170 N.Y.S.2d 335 (1958). See also *State v. Finkle*, 128 N.J. Super. 199, 319 A.2d 733 (App. Div.) (VASCAR), *aff'd*, 66 N.J. 139, 329 A.2d 65 (1974), *cert. denied*, 423 U.S. 836 (1975).

30. E.g., *People v. Stringfield*, 37 Ill. App. 2d 344, 185 N.E.2d 381 (1962) (breathalyzer); *State v. Miller*, 64 N.J. Super. 262, 165 A.2d 829 (App. Div. 1960) (drunkometer); *People v. Donaldson*, 36 A.D.2d 37, 319 N.Y.S.2d 172 (1971) (breathalyzer).

31. E.g., *Piquett v. United States*, 81 F.2d 75 (7th Cir.), *cert. denied*, 298 U.S. 664 (1936); *State v. Rogers*, 233 N.C. 390, 64 S.E.2d 572 (1951); *Grice v. State*, 142 Tex. Crim. 4, 151 S.W.2d 211 (1941).

32. E.g., *State v. Hackett*, 215 S.C. 434, 55 S.E.2d 696 (1949).

33. E.g., *Adams v. Ristine*, 138 Va. 273, 122 S.E. 126 (1924); *Fenelon v. State*, 195 Wis. 416, 217 N.W. 711 (1928).

34. E.g., Ark. Stat. Ann. § 75-1031.1 (1979); Md. Cts. & Jud. Proc. Code Ann. § 10-301, 307 (1980); N.Y. Veh. & Traf. Law § 1195 (Consol.) (Supp. 1976); N.D. Cent. Code § 39-20-07(5) (1980); Ohio Rev. Code Ann. § 4511.091 (Baldwin) (1975); Utah Code Ann. § 41-6-44 (Supp. 1979); Va. Code § 46.1-198 (1974); Uniform Chemical Test for Intoxication Act, 9 U.L.A. 61 (Supp. 1967). See also *People v. Williams*, 164 Cal. App. 2d Supp. 858, 862, 331 P.2d 251, 254 (App. Dep't Super. Ct. 1958) (legislative recognition of Nalline test).

35. Although rare, it is possible for a court to take judicial notice of the validity of a new technique in a case of first impression. See *United States v. Lopez*, 328 F. Supp. 1077 (E.D.N.Y. 1971) (judicial notice of validity of magnetometer; expert testimony also received). See also *People v. Palmer*, 80 Cal. App. 3d 239, 145 Cal. Rptr. 466 (1978) (scanning electron microscopic analysis). See text accompanying notes 142-51 *infra*.

36. See, e.g., *Tiffin v. Whitmer*, 32 Ohio Misc. 169, 170, 290 N.E.2d 198, 199 (Tiffin Mun. Ct. 1970) ("Because the instrument [VASCAR] is new, expert testimony as to the scientific principle, construction, operation, accuracy and reliability of the device must be established beyond a reasonable doubt.").

37. See text accompanying notes 276-87 *infra*.

38. For a discussion of the theory of the polygraph, see J. Reid & F. Inbau, *supra* note 8; Barland & Raskin, *Detection of Deception in Electrodermal Activity in Psychological Research* 417, 445-47 (W. Prokasy & D. Raskin eds. 1973).



dence derived from those techniques will be irrelevant. Under the relevancy approach, novel scientific evidence is treated the same as other kinds of evidence. Thus, if an expert testifies that an innovative technique is valid, a court could find that evidence derived from that technique is probative. Admissibility, however, would not be automatic. As with all relevant evidence, a court would have discretion to exclude the evidence if the probative value were outweighed by considerations of undue prejudice, misleading the jury, and undue consumption of time.<sup>39</sup>

The admissibility of evidence derived from novel scientific techniques has not always been analyzed according to the relevancy approach. Indeed, at a rather early stage in the use of scientific evidence most courts adopted the standard proposed by *Frye v. United States*,<sup>40</sup> a 1923 decision of the United States Court of Appeals for the D.C. Circuit. Because this case has so deeply affected the admissibility of scientific information, the *Frye* test and its consequences will be examined in detail.

## II. *Frye v. United States*

In *Frye* the D.C. Circuit considered the admissibility of polygraph evidence<sup>41</sup> as a case of first impression.<sup>42</sup> In an oft-quoted passage,<sup>43</sup> the court commented:

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 the courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or

39. See C. McCormick, *supra* note 23 at 491. See also Fed. R. Evid. 403. Several commentators have argued that the Federal Rules of Evidence codify this approach. See text accompanying notes 240-57 *infra*.

40. 293 F. 1013 (D.C. Cir. 1923).

41. The machine used in *Frye* was a forerunner of the modern polygraph and is more accurately described as a monograph, since, unlike the modern polygraph, it measured only one physiological response—blood pressure.

42. In a 1927 article Professor McCormick referred to *Frye* as "the only decision on the point that has come to my attention." McCormick, *Deception-Tests and the Law of Evidence*, 15 Cal. L. Rev. 484, 499 (1927). He also provides details of the trial that do not appear in the reported opinion. *Id.* at 499 n.49. *Frye* was noted at 24 Colum. L. Rev. 429 (1924); 37 Harv. L. Rev. 1138 (1924); 28 Law Notes 64 (1924); 2 N.Y.L. Rev. 206 (1924); 33 Yale L.J. 771, 773 (1924); Annot., 34 A.L.R. 147 (1925).

The defendant in *Frye* was subsequently pardoned when someone else confessed to the crime. See Wicker, *The Polygraphic Truth Test and the Law of Evidence*, 22 Tenn. L. Rev. 711, 715 (1953), citing Fourteenth Annual Report of Judicial Council of the State of New York 265 (1948).

Although *Frye* has been employed most frequently as the standard for determining the admissibility of novel scientific techniques through expert testimony, this has not been its exclusive use. In *State v. Cary*, 99 N.J. Super. 323, 239 A.2d 680 (Law Div. 1968), *aff'd*, 56 N.J. 16, 264 A.2d 209 (1970), the court seemed to use the *Frye* test as the standard for judicially noticing the validity of voiceprint evidence "[B]efore a court can take judicial notice of a scientific process there must be general scientific acceptance. . . ." *Id.* at 333, 239 A.2d at 685. *Cary* has been criticized because it seems to suggest that scientific evidence is admissible only if it satisfies the standards for judicial notice. See Strong, *supra* note 19, at 9 n.28.

43. See, e.g., Moenssens, *Polygraph Test Results Meet Standards for Admissibility as Evidence*, in *Legal Admissibility of the Polygraph* 14, 15 (N. Ansley ed. 1975) (the general acceptance test is "probably the most widely quoted portion of any decision involving novel scientific tests results").

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.<sup>44</sup>

The court went on to hold that the polygraph had "not yet gained such standing and scientific recognition among physiological and psychological authorities."<sup>45</sup>

In effect, *Frye* envisions an evolutionary process leading to the admissibility of scientific evidence. A novel technique must pass through an "experimental" stage in which it is scrutinized by the scientific community. Only after the technique has been tested successfully in this stage and has passed into the "demonstrable" stage will it receive judicial recognition. What is unique about the *Frye* opinion is the standard it establishes for distinguishing between the experimental and demonstrable stages.<sup>46</sup> In contrast to the relevancy approach, it is not enough that a qualified expert, or even several experts, believes that a particular technique has entered the demonstrable stage; *Frye* imposes a special burden—the technique must be *generally accepted by the relevant scientific community*.

In its brief two-page opinion, the *Frye* court neither cited authority nor offered an explanation for adopting the general acceptance standard. Nonetheless, the *Frye* test has dominated the admissibility of scientific evidence for more than half a century.<sup>47</sup> In addition to polygraph evidence, it has been used to determine the admissibility of evidence derived from voiceprints,<sup>48</sup> neutron activation analysis,<sup>49</sup> gunshot residue tests,<sup>50</sup> bitemark comparisons,<sup>51</sup> sodium pen-

44. 293 F. at 1014.

45. *Id.*

46. The evolutionary process described in the text would still be possible without the *Frye* test. For example, the court in *United States v. Ridling*, 350 F. Supp. 90 (E.D. Mich. 1972), described a similar process while ignoring the *Frye* test. See also 22 C. Wright & K. Graham, *Federal Practice and Procedure* § 5168, at 88-89 (1978). Typically, scientific evidence progresses through several stages of development: (1) an experimental stage, (2) a demonstrable stage in which expert testimony is used to establish the validity of the technique, and (3) a demonstrable stage in which the technique is so well established that a court could take judicial notice of its validity. There may also be a fourth stage. Some techniques may become so commonplace that neither expert testimony nor judicial notice is required. See J. Maguire, *supra* note 19, at 30 ("Only a few years ago it would have been necessary to take expert evidence on issues with respect to the operation of motor cars, airplanes, or radio which are now so completely inside the domain of popular understanding that such evidence would be rejected as superfluous.").

47. *Reed v. State*, 283 Md. 374, 382, 391 A.2d 364, 368 (1978) ("This criterion of 'general acceptance' in the scientific community has come to be the standard in almost all of the courts in the country which have considered the question of the admissibility of scientific evidence."). Accord, *United States v. Alexander*, 526 F.2d 161, 163 n.3 (8th Cir. 1975); A. Moenssens & F. Inbau, *supra* note 7, at 6. But see R. Lempert & S. Saltzburg, *A Modern Approach to Evidence* 934-35 & 935 n.11 (1977) (questioning influence of *Frye* test).

48. E.g., *United States v. Addison*, 498 F.2d 741, 743 (D.C. Cir. 1974) (citing *Frye*); *People v. Kelly*, 17 Cal. 3d 24, 30, 31, 32, 549 P.2d 1240, 1244, 1245, 130 Cal. Rptr. 144, 148, 149 (1976) (citing *Frye*); *Reed v. State*, 283 Md. 374, 386 *passim*, 391 A.2d 364, 381 *passim* (1978) (citing *Frye*).

49. E.g., *United States v. Stifel*, 433 F.2d 431, 436, 438, 441 (6th Cir. 1970) (citing *Frye*), cert. denied, 401 U.S. 994 (1971); *State v. Stout*, 478 S.W.2d 368, 369 (Mo. 1972) (citing *Frye*).

50. See *State v. Smith*, 50 Ohio App. 2d 183, 193, 362 N.E.2d 1239, 1246 (1976) (modified Harrison-Gilroy technique not generally accepted; citing *Frye*).

51. E.g., *People v. Slone*, 76 Cal. App. 3d 611, 623, 143 Cal. Rptr. 61, 68 (1978) (citing *Frye*); *People v. Milone*, 43 Ill. App. 3d 385, 394-98, 356 N.E.2d 1350, 1356-60 (1976) (citing and distinguishing *Frye*).

tothal,<sup>52</sup> scanning electron microscopic analysis,<sup>53</sup> and numerous other forensic techniques.<sup>54</sup> Unfortunately, in most instances judicial adoption of the general acceptance standard has not been accompanied by a supporting rationale. This is especially true of the early cases, which often cite *Frye* without comment or analysis.<sup>55</sup> As late as 1972 a federal district court could correctly observe that "[t]here is notably an absence of any discussion of the 'general acceptance' standard in federal decisions."<sup>56</sup>

Because of the avalanche of innovative procedures,<sup>57</sup> the advent of the Federal Rules of Evidence,<sup>58</sup> and the scathing attacks on the *Frye* test,<sup>59</sup> courts

52. E.g., *Lindsey v. United States*, 237 F.2d 893, 896 (9th Cir. 1956) (citing *Frye*); *State v. Sinnott*, 24 N.J. 408, 423, 132 A.2d 298, 306 (1957) (citing *Frye*); *Henderson v. State*, 94 Okla. Crim. 45, 52, 55, 230 P.2d 495, 502, 505 (citing *Frye*, and applying *Frye* standard to use of sodium pentothal), cert. denied, 342 U.S. 898 (1951).

53. See *People v. Palmer*, 80 Cal. App. 3d 239, 252, 145 Cal. Rptr. 466, 472 (1978) (citing *Frye*).

54. E.g., *United States v. Brady*, 595 F.2d 359, 362-63 (6th Cir.) ("no evidence as to the general acceptance of microscopic hair analysis in the scientific community"; applying *Frye* standard), cert. denied, 444 U.S. 862 (1979); *Hughes v. Mathews*, 576 F.2d 1250, 1258 (7th Cir.) (psychiatric testimony, citing *Frye*), cert. denied, 439 U.S. 801 (1978); *United States v. Kilgus*, 571 F.2d 508, 510 (9th Cir. 1978) (forward looking infrared system; citing *Frye*); *United States v. Brown*, 557 F.2d 541, 556-57, 558 (6th Cir. 1977) (ion microprobe analysis; citing *Frye*); *Medley v. United States*, 155 F.2d 857, 860 (D.C. Cir.) (spectroscopic analysis; citing *Frye*), cert. denied, 328 U.S. 873 (1946); *United States v. Hearst*, 412 F. Supp. 893, 895 (N.D. Cal. 1976) (psycholinguistics), aff'd on other grounds, 563 F.2d 1331 (9th Cir. 1977); *United States v. Bruno*, 333 F. Supp. 570, 574 (E.D. Pa. 1971) (chromatographic analysis of ink); *Rivers v. Black*, 259 Ala. 528, 531, 68 So. 2d 2, 4 (1953) (drunkometer; citing *Frye*); *Huntingdon v. Crowley*, 64 Cal. 2d 647, 653, 656, 414 P.2d 382, 388, 390, 51 Cal. Rptr. 254, 260, 262 (1966) (Kell-Cellano blood grouping tests; citing *Frye*); *People v. Williams*, 164 Cal. App. 2d Supp. 858, 860, 331 P.2d 251, 253 (App. Dep't Super. Ct. 1958) (Nalline test; citing *Frye*); *People v. Zimmerman*, 385 Mich. 417, 459-60, 189 N.W.2d 259, 278-79 (1971) (separate opinion, Williams, J.) (accident reconstruction evidence; citing *Frye*); *People v. Morse*, 325 Mich. 270, 273-74, 38 N.W.2d 322, 324 (1949) (drunkometer; citing *Frye*); *People v. Watkins*, 78 Mich. App. 89, 96, 259 N.W.2d 381, 385 (1977) (microscopic comparison of hair samples; citing *Frye*); *People v. Lauro*, 91 Misc. 2d 706, 712, 398 N.Y.S.2d 503, 507 (Sup. Ct. 1977) (trace metal detection technique; applying general acceptance standard); *People v. Alston*, 79 Misc. 2d 1077, 1085, 362 N.Y.S.2d 356, 362 (Sup. Ct. 1974) (blood test; citing *Frye*); *Watson v. State*, 64 Wis. 2d 264, 273, 219 N.W.2d 398, 403 (1974) (hair analysis; citing *Frye*).

55. E.g., *People v. Wochnick*, 98 Cal. App. 2d 124, 127, 219 P.2d 70, 72 (1950), cert. denied, 342 U.S. 888 (1951); *Boeche v. State*, 151 Neb. 368, 377, 37 N.W.2d 593, 597 (1949); *Henderson v. State*, 94 Okla. Crim. 45, 52, 230 P.2d 495, 502, cert. denied, 342 U.S. 898 (1951); *State v. Bohner*, 210 Wis. 651, 657, 246 N.W. 314, 317 (1933).

56. *United States v. Zeiger*, 350 F. Supp. 685, 687 n.6 (D.D.C.), rev'd, 475 F.2d 1280 (D. C. Cir. 1972).

57. See text accompanying notes 1-7 supra.

58. Act of Jan. 2, 1975, Pub. L. No. 93-595, 88 Stat. 1926 (codified at 28 U.S.C. app. (1976)). The enactment of the Federal Rules in 1975 and their adoption by a number of states have sparked a lively debate. Some courts and commentators assume the *Frye* test has survived the enactment of the Federal Rules, while others maintain the Federal Rules repeal the *Frye* standard. See text accompanying notes 240-57 infra.

59. Commentators have not been restrained in their criticism of the *Frye* test. See Moenssens, supra note 43, at 19 ("archaic"); 22 C. Wright & K. Graham, supra note 46, at 87 ("a 'sport'"); Conrad, Landmarks and Hallmarks in Scientific Evidence, in *Sourcebook in Criminalistics* 37, 38 (C. Hormachea ed. 1974) ("antiquated on the day of its pronouncement"); Tarlow, Admissibility of

adhering to the general acceptance standard have begun to set forth a supporting rationale.<sup>60</sup> Their main arguments are, first, that the general acceptance standard guarantees that "a minimal reserve of experts exists who can critically examine the validity of a scientific determination in a particular case;"<sup>61</sup> second, that the *Frye* test "may well promote a degree of uniformity of decision;"<sup>62</sup> and third, that the test eliminates the need for time-consuming hearings on the validity of innovative techniques.<sup>63</sup> The principal justification for the *Frye* test, however, is that it establishes a *method* for ensuring the reliability of scientific evidence. As the D.C. Circuit stated in a later case, "The requirement of general acceptance in the scientific community assures that those most qualified to assess the general validity of a scientific method will have the determinative voice."<sup>64</sup>

It is predominantly on the basis of this reliability argument that the *Frye* test must be judged. The other rationales, although important, can be satisfied under other standards.<sup>65</sup> As the next section demonstrates, the problems *Frye* has

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Polygraph Evidence in 1975: An Aid in Determining Credibility in a Perjury-Plagued System, 26 Hastings L.J. 917, 923 & n.38 (1975) ("infamous"). For other critical reviews of *Frye*, see 1 D. Louisell & C. Mueller, Federal Evidence 820-26 (1977); C. McCormick, *supra* note 23, at 489-90; Boyce, Judicial Recognition of Scientific Evidence in Criminal Cases, 8 Utah L. Rev. 313 (1964); Strong, *supra* note 19, at 10-15; Note, Changing the Standard for the Admissibility of Novel Scientific Evidence: State v. Williams, 40 Ohio St. L.J. 757 (1979). But see Latin, Tannehill & White, *supra* note 5, at 1374-81; Note, The Admissibility of Bite Mark Evidence, *supra* note 6; 64 Cornell L. Rev. 875 (1979).

60. By shattering the myth of infallibility that has often shrouded scientific evidence, and by documenting the deficiencies in this country's crime laboratories, the Crime Laboratory Proficiency Testing Program may also have contributed to the reexamination of the *Frye* test. See J. Peterson, E. Fabricant & K. Field, Crime Laboratory Proficiency Testing Research Program (1978). The program was a joint enterprise of the Forensic Sciences Foundation and the Law Enforcement Assistance Administration. The report concluded: "During the course of the proficiency testing program, it was quickly recognized that many of the laboratories were experiencing difficulty in the examination and analysis of various physical evidence types." *Id.* at 261. The report also concluded "that crime laboratories have been and are still in need of help." *Id.* at 263. These conclusions confirmed views expressed in earlier reports. See National Advisory Commission on Criminal Justice Standards and Goals, Police 304-05 (1973).

61. United States v. Addison, 498 F.2d 741, 744 (D.C. Cir. 1974).

62. People v. Kelly, 17 Cal. 3d 24, 31, 549 P.2d 1240, 1244-45, 130 Cal. Rptr. 144, 148-49 (1976) ("Individual judges whose particular conclusions may differ regarding the reliability of particular scientific evidence, may discover substantial agreement and consensus in the scientific community.").

63. Reed v. State, 283 Md. 374, 388, 391 A.2d 364, 371-72 (1978) ("Without the *Frye* test or something similar, the reliability of an experimental scientific technique is likely to become a central issue in each trial in which it is introduced, as long as there remains serious disagreement in the scientific community over its reliability."). See also State v. Cary, 99 N.J. Super. 323, 332, 239 A.2d 680, 684 (Law Div. 1968), *aff'd*, 56 N.J. 16, 264 A.2d 209 (1970).

64. United States v. Addison, 498 F.2d 741, 743-44 (D.C. Cir. 1974). See also People v. Barbara, 400 Mich. 352, 405, 255 N.W.2d 171, 194 (1977) ("It therefore is best to adhere to a standard [*Frye*] which in effect permits the experts who know most about a procedure to experiment and to study it. In effect, they form a kind of technical jury, which must first pass on the scientific status of a procedure before the lay jury utilizes it in making its findings of fact."); 1 D. Louisell & C. Mueller, *supra* note 59, at 827; Strong, *supra* note 19, at 14; 64 Cornell L. Rev. 875, 881 (1979).

65. The "reserve of experts" argument has merit. Nevertheless, the adoption of a less stringent test of admissibility could be accompanied by a requirement that the opposing party be provided with the opportunity to secure the testimony of qualified expert witnesses, thus guaranteeing a reserve of

engendered—the difficulties in applying the test and the anomalous results it creates—so far outweigh these advantages that the argument for adopting a different test has become overwhelming.

### A. *Difficulties in Application*

To determine how well the *Frye* standard performs the function of ensuring the reliability of novel scientific evidence, it is necessary to consider the manner in which courts have applied the general acceptance standard.

Courts applying the general acceptance test have discovered the need to define the parameters of the test more closely than the D.C. Circuit did in *Frye*. In particular, courts must decide *who* must find the procedure acceptable, they must define exactly *what* must be accepted, and they must determine what methods will be used to establish general acceptance. Moreover, the types of evidence to which the *Frye* test is applicable must be identified. An additional problem of application involves the scope of appellate review.

1. *Who Must Accept the Procedure.* The general acceptance standard as set forth in *Frye* appears to require a two-step analysis: first, identifying the field in which the underlying principle falls,<sup>66</sup> and second, determining whether that principle has been generally accepted by members of the identified field.<sup>67</sup> Neither step is free of difficulties.

a. *Identifying the Appropriate Field.* Many scientific techniques do not fall within the domain of a single academic discipline or professional field.<sup>68</sup> Consequently, selecting the proper field may prove troublesome. More importantly, selection of the appropriate field may be dispositive.<sup>69</sup> The voiceprint cases illustrate these points. In *People v. King*<sup>70</sup> the court stated: "Communication by speech does not fall within any one established category of science. Its understanding requires a knowledge of anatomy, physiology, physics, psychology and linguistics."<sup>71</sup> Because the expert produced by the prosecution—the developer

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experts who can critically examine the validity of a scientific determination in a particular case. Moreover, the test proposed as a substitute for *Frye* recognizes consumption of time as a factor in determining the admissibility of scientific evidence. See text accompanying note 278 *infra*. Finally, the uniformity argument is difficult to support, because *Frye* has produced anything but consistent results. See text accompanying notes 159-86 *infra*.

66. See *People v. Collins*, 94 Misc. 2d 704, 708, 405 N.Y.S.2d 365, 368 (Sup. Ct. 1978) ("At the threshold of determining whether the technique meets the test of acceptance in the scientific community, is the question of defining that community.").

67. See *United States v. Zeiger*, 350 F. Supp. 685, 687 (D.D.C.), *rev'd*, 475 F.2d 1280 (D.C. Cir. 1972) ("A preliminary task is to define the phrase 'general acceptance.' The cases following the *Frye* rationale have been carefully considered and they offer little guidance.").

68. Professor Moenssens has written: "Deciding what is the proper field to which a novel test belongs is in itself a chore. Most novel tests represent new approaches to the solution of old problems by a process which is unknown, or belongs to a different field. Because of this, the person developing a novel test frequently finds himself on the fringes of his scientific discipline, and perhaps overlapping into other disciplines." Moenssens, *supra* note 43, at 17. See also Jones, *Danger—Voiceprints Ahead*, 11 Am. Crim. L. Rev. 549, 564-65 (1973); Strong, *supra* note 19, at 12.

69. *United States v. Williams*, 583 F.2d 1194, 1198 (2d Cir. 1978) ("Selection of the 'relevant scientific community,' appears to influence the result."), *cert. denied*, 439 U.S. 1117 (1979).

70. 266 Cal. App. 2d 437, 72 Cal. Rptr. 478 (1968).

71. *Id.* at 456, 72 Cal. Rptr. at 490.

of the technique—was not knowledgeable in all these areas,<sup>72</sup> the court rejected voiceprint evidence. Similar problems arise in connection with polygraph,<sup>73</sup> biomark,<sup>74</sup> psycholinguistics,<sup>75</sup> and remote-sensing<sup>76</sup> evidence.

Even when general agreement as to the relevant field exists, admissibility can be affected by choosing a subspecialty within that field. The leading case is *People v. Williams*,<sup>77</sup> in which the validity of the Nalline test for detecting narcotic use was considered.<sup>78</sup> Because the prosecution's own experts conceded that the "medical profession generally [was] unfamiliar with the use of Nalline. . .,"<sup>79</sup> the technique could not have satisfied the *Frye* test if the medical profession had been selected as the appropriate field.<sup>80</sup> Nevertheless, the court upheld the admissibility of the evidence because the test had "been generally accepted by those who would be expected to be familiar with its use."<sup>81</sup> According to the court, in "this age of specialization more should not be required."<sup>82</sup> In effect, admissibility was achieved through a redefinition of the "field." This approach is not necessarily inconsistent with *Frye*, provided the "specialized field" is sufficiently large so that the *Frye* objective of receiving a consensus judgment of the scientific community can be met.<sup>83</sup> Such an approach, however, does highlight the malleable nature of the general acceptance standard. Moreover, if the "specialized field" is too narrow, the consensus

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72. After identifying the relevant fields in which general acceptance must be achieved, the court questioned the qualifications of the prosecution's expert, Lawrence Kersta, the developer of the voiceprint technique: "While Kersta has degrees in electrical engineering and physics, his field of knowledge is acoustical and audio engineering; there is no indication either from his educational background or his employment experience that he engaged in any scientific investigation or medical research to substantiate his analysis of the functions of the body which produce speech." *Id.* at 450, 72 Cal. Rptr. at 486-87.

73. See Moenssens, *supra* note 43, at 17-18 ("Frye rather arbitrarily, relegates the polygraph to the discipline of psychology, a field in which it has unquestionably great application, but which is not necessarily the only field concerned or the best to develop the process."); Note, The Emergence of the Polygraph at Trial, 73 Colum. L. Rev. 1120, 1123 (1973).

74. Compare *People v. Milone*, 43 Ill. App. 3d 385, 395, 356 N.E.2d 1350, 1357 (1976) (citing the "medical profession" as the relevant field), with *People v. Slone*, 76 Cal. App. 3d 611, 625, 143 Cal. Rptr. 61, 69 (1978) (citing "dentistry" as the relevant field).

75. See Comment, Stylistics Evidence in the Trial of Patricia Hearst, *supra* note 3, at 399 ("[A] discipline such as stylistics contains elements from many established sciences—such as mathematics, computer science, psychology, and linguistics. . .").

76. See Latin, Tannehill & White, *supra* note 5, at 1368 ("Remote sensing . . . is not a self-contained or easily recognizable discipline if evaluated in terms of the formal academic training of its proponents.").

77. 164 Cal. App. 2d Supp. 858, 331 P.2d 251 (App. Dep't Super. Ct. 1958).

78. Dilation of the pupils after the injection of Nalline indicates the recent use of narcotics. *Id.* at 860, 331 P.2d at 252-53.

79. *Id.* at 862, 331 P.2d at 253.

80. See Maletskos & Spielman, Introduction of New Scientific Methods in Court, in *Law Enforcement Science & Technology* 957, 960 (S.A. Yefsky ed. 1967) ("Under the traditional readings of *Frye v. United States*, it would have been appropriate to exclude the Nalline test results.").

81. 164 Cal. App. 2d Supp. at 862, 331 P.2d at 254 (emphasis added).

82. *Id.* In contrast, the D.C. Circuit held voiceprint evidence inadmissible because it had not been accepted by the "scientific community as a whole." *United States v. Addison*, 498 F.2d 741, 745 (D.C. Cir. 1974) (emphasis added).

83. See I D. Louisell & C. Mueller, *supra* note 59, at 824-25.

judgment mandated by *Frye* becomes illusory; the judgment of the scientific community becomes, in reality, the opinion of a few experts.<sup>84</sup>

The *Williams* modification of *Frye* has also spawned other problems. In *Commonwealth v. Lykus*,<sup>85</sup> the court, after citing *Williams*,<sup>86</sup> stated: "[The] *Frye* standard does not require unanimity of view, only general acceptance; a degree of scientific divergence of view is inevitable. In this case we are disposed to give greater weight to those experts who have had direct and empirical experience in the field of spectrography [voiceprints]."<sup>87</sup> Although this approach may appear to be an application of *Williams*—defining as a subspecialty those with "direct and empirical experience"—it differs significantly from *Williams*. In *Williams* the medical profession as a whole was not considered the appropriate field because most members of that profession were "unfamiliar" with the Nal-line test. In contrast, the *Lykus* court did not exclude those who were "unfamiliar" with voiceprints; instead, it excluded those whose knowledge was "theoretical."<sup>88</sup> Consequently, the opinions of experts with extensive backgrounds in speech science were discarded.<sup>89</sup> As one court has observed: "The purpose of the *Frye* test is defeated by an approach which allows a court to ignore the informed opinions of a substantial segment of the scientific community which stands in opposition to the process in question."<sup>90</sup>

b. *General Acceptance in the Field.* Once the relevant field or scientific community has been identified, a court applying *Frye* must determine whether the underlying principle and technique have been "generally accepted" by members of that field. The percentage of those in the field who must accept the

84. The *Williams* approach has been adopted by a number of courts and cited approvingly by some commentators. See *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 790-91, 106 Cal. Rptr. 547, 554 (1973); *Commonwealth v. Lykus*, 367 Mass. 191, 203, 327 N.E.2d 671, 677-78 (1975); *People v. Rogers*, 86 Misc. 2d 868, 881, 385 N.Y.S.2d 228, 237 (Sup. Ct. 1976); 1 D. Louisell & C. Mueller, *supra* note 59, at 824; A. Moenssens & F. Inbau, *supra* note 7, at 5-6.

85. 367 Mass. 191, 327 N.E.2d 671 (1975).

86. *Id.* at 203, 327 N.E.2d at 678 (quoting *People v. Williams*, 164 Cal. App. 2d Supp. at 861-62, 331 P.2d at 253-54).

87. *Id.* at 204 n.6, 327 N.E.2d at 678 n.6.

88. *Id.*

89. The experts whose views were rejected constituted a committee of the Acoustical Society of America. See Bolt, Cooper, David, Denes, Pickett & Stevens, *Speaker Identification by Speech Spectrograms: Some Further Observations*, 54 J. Acoust. Soc'y Am. 531 (1973). The Committee had earlier reviewed the subject of voiceprint analysis. See Bolt, Cooper, David, Denes, Pickett & Stevens, *Speaker Identification by Speech Spectrograms: A Scientist's View of its Reliability for Legal Purposes*, 47 J. Acoust. Soc'y Am. 597 (1970). Several of these authors served on the National Academy of Sciences committee that studied voiceprint identification. See National Academy of Sciences, *supra* note 2. It can hardly be said that these scientists had nothing to contribute to the subject.

90. *Reed v. State*, 283 Md. 374, 399, 391 A.2d 364, 377 (1978). The trial court in *Reed* had followed the *Lykus* approach. See *State v. Reed*, 18 Crim. L. Rptr. (BNA) 2011, 2012 (Montgomery County Cir. Ct. 1975) ("[W]e are restricting the relevant field of experts to those who are knowledgeable, directly knowledgeable through work, utilization of the techniques, experimentation and so forth, [and] we are not taking the broad general scientific community of speech and hearing science."). See also *People v. Collins*, 94 Misc. 2d 704, 708, 405 N.Y.S.2d 365, 368 (Sup. Ct. 1978) (refusing to limit the field "to those scientists who actually employ the spectrograph for voice identification").

technique has never been clearly delineated.<sup>91</sup> Most courts applying *Frye* have not addressed the issue adequately; they have either ignored it altogether or offered rather general statements. For example, one court has defined general acceptance as "widespread; prevalent; extensive though not universal."<sup>92</sup> Another court has conceded that "a degree of scientific divergence of view is inevitable,"<sup>93</sup> without elaborating on how much divergence would be dispositive.<sup>94</sup> Again, the latitude allowable to a court under the malleable *Frye* standard could yield the admission of evidence that a large segment of the scientific community would find unacceptable.<sup>95</sup>

2. *What must be accepted.* It is unresolved whether the *Frye* standard requires general acceptance of the scientific technique or of both the underlying principle and the technique applying it.<sup>96</sup> According to one commentator, "[t]he language of *Frye* seems to require acceptance of the underlying theory and not just of the technique itself."<sup>97</sup> The Court of Appeals for the D.C. Circuit apparently has accepted this view.<sup>98</sup> Although some decisions refer to general acceptance of the "procedure,"<sup>99</sup> "technology,"<sup>100</sup> or "scientific

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91. Professor Strong has observed: "The resulting standard, something greater than acceptance by the expert himself but less than acceptance by all experts in the field, is obviously somewhat lacking in definiteness." Strong, *supra* note 19, at 11.

92. *United States v. Zeiger*, 350 F. Supp. 685, 688 (D.D.C.), *rev'd*, 475 F.2d 1280 (D.C. Cir. 1972).

93. *Commonwealth v. Lykus*, 367 Mass. 191, 204 n.6, 327 N.E.2d 671, 678 n.6 (1975).

94. See also *People v. Collins*, 94 Misc. 2d 704, 711-12, 405 N.Y.S.2d 365, 370 (Sup. Ct. 1978) ("The Court notes that it has not been necessary to determine the point at which opposition to a given scientific theory recedes into a minority view, and acceptance of such a theory becomes general.").

95. One commentator has written that the *Frye* standard requires acceptance by a "substantial majority." J. Richardson, *Modern Scientific Evidence* 164 (2d ed. 1974). This standard should be distinguished from a "substantial" acceptance test, which has apparently been applied by some courts, because acceptance could be substantial without representing a majority of scientists in a particular field. See *United States v. Williams*, 443 F. Supp. 269, 273 (S.D.N.Y. 1977) (acceptance by a "substantial section of the scientific community"), *aff'd*, 583 F.2d 1194 (2d Cir. 1978), *cert. denied*, 439 U.S. 1117 (1979); *Commonwealth v. Devlin*, 365 Mass. 149, 153 n.3, 310 N.E.2d 353, 356 n.3 (1974) ("substantial authority" required).

96. The *Frye* court did not state explicitly whether the general acceptance test applied only to the underlying theory or to the technique as well. In discussing this issue, one commentator has remarked: "The [*Frye*] court's prior discussion had indicated that the 'thing from which the deduction is made' might be either the general proposition that there is a connection between conscious insincerity and changes in blood pressure, or some proposition relating to the ability of an expert to interpret such data." C. McCormick, *supra* note 23, at 489.

97. National Academy of Sciences, *supra* note 2, at 41. See also 22 C. Wright & K. Graham, *supra* note 46, at 95 ("As in *Frye*, the decisions turn on the scientific acceptance of the theory. . .").

98. See *United States v. Addison*, 498 F.2d 741, 743 (D.C. Cir. 1974) ("The *Frye* standard . . . requires that the [theory] from which the deduction is made be sufficiently established to have gained general acceptance in the particular field in which it belongs." ) (brackets in original). See also *United States v. Alexander*, 526 F.2d 161, 163 n.3 (8th Cir. 1975) (*Frye* requires "general acceptance in the relevant scientific community of the theory underlying such technique"); *People v. Collins*, 94 Misc. 2d 704, 712, 405 N.Y.S.2d 365, 370 (Sup. Ct. 1978).

99. *People v. Law*, 40 Cal. App. 3d 69, 84, 114 Cal. Rptr. 708, 718 (1974).

100. *United States v. Stifel*, 433 F.2d 431, 438 (6th Cir. 1970), *cert. denied*, 401 U.S. 994 (1971).



technique,"<sup>101</sup> it is doubtful that these references reflect a conscious choice with regard to this issue. If both the underlying principle and the technique must be generally accepted, some types of scientific evidence, such as voiceprints, would be readily excluded.<sup>102</sup>

Resolving this issue involves focusing on the distinction between the validity of a technique and the validity of its underlying theory.<sup>103</sup> One could accept, for instance, the validity of the premise underlying voiceprint identification—voice uniqueness—but still reject the validity of the voiceprint technique. Similarly, the underlying psychological and physiological principles of polygraph evidence could be acknowledged without endorsing the proposition that a polygraph examiner can detect deception by means of the polygraph technique.

A novel forensic technique, however, may involve either the new application of a well-established theory or the application of a new theory. In the latter case, the theory can be validated only empirically or inferentially, not deductively.<sup>104</sup> In other words, the successful application of the technique proves the validity of the underlying theory or principle. In terms of the *Frye* test, if the *technique* is generally accepted, then the *theory* must be valid although not fully understood or explainable. Thus, proponents of voiceprints have argued that even though the "why" and "how" of the technique are not fully understood, the technique works and that alone is sufficient validation.<sup>105</sup> Similarly, one commentator has argued: "[T]here does not appear to be general acceptance of a theory to explain all the phenomenon of aspirin. But even though aspirin's theoretical underpinnings may never be elucidated to the satisfaction of the scientific community, the fact is that it works. So does the polygraph."<sup>106</sup>

101. *Reed v. State*, 283 Md. 374, 385, 391 A.2d 365, 370 (1978). See also *Commonwealth v. Fatalo*, 346 Mass. 266, 269, 191 N.E.2d 479, 481 (1963) (court stated that "[j]udicial acceptance of a scientific theory or instrument can occur only when it follows a general acceptance by the community of scientists involved") (emphasis added).

102. See National Academy of Sciences, *supra* note 2, at 42.

103. See text accompanying notes 27-28 *supra*.

104. The principal proponents of voiceprint identifications have conceded this point: "Since the parameters responsible for variabilities are not well determined and quantified, at the present time the only way to prove scientifically that interspeaker variability is greater than intraspeaker variability is by inference." Tosi, Oyer, Lashbrook, Pedrey, Nicol & Nash, *Experiment on Voice Identification*, 51 J. Acoust. Soc'y Am. 2030, 2031 (1972).

One commentator has described empirical validation as it relates to various drug testing procedures:

The most common tests which are used to identify narcotics are color tests, precipitate tests and crystal tests. . . . Each of these tests was empirically developed. There is no theory whatsoever as to why these particular colors emerge, or why particularly shaped crystals are formed. The foundation of the expert opinion is simply that in each instance in which a known narcotic was tested, these results occurred and that to the best of the chemist's knowledge no other substances will yield the same results. The logic of these tests is inferential. The specificity of the test is assumed on the basis of accumulated consistent data, not upon a general theory. Peculiar to this kind of logic is that it can be completely destroyed by one experiment which contradicts the accumulated data.

Shellow, *The Expert Witness in Narcotic Cases*, in *ABA, Effective Criminal Trial Techniques* 173, 177 (B. George ed. 1978).

105. See Boren, *Voiceprint—Staging A Comeback*, 3 U. San. Fern. V. L. Rev. 1, 9 (1974). See also note 104 *supra*.

106. Tarlow, *supra* note 59, at 922.

Empirical validation should be recognized as an acceptable method of establishing the reliability of a new technique.<sup>107</sup> Many techniques such as fingerprints and firearms identification have gained admissibility in this way. This method of validation, however, gives rise to new questions. First, how much empirical research is sufficient?<sup>108</sup> Many courts believed that the two-year study on voiceprints conducted at Michigan State University provided sufficient validation of that technique;<sup>109</sup> however, the National Academy of Sciences report on voiceprint identification casts doubt on this conclusion.<sup>110</sup> Similarly, some courts have argued that the experience of polygraph examiners is sufficient validation for the polygraph technique,<sup>111</sup> while others have demonstrated serious deficiencies in this approach.<sup>112</sup> Second, how much extrapolation to untested situations should be permitted?<sup>113</sup> For example, assuming sufficient empirical validation of voiceprint evidence has been achieved using undisguised male voices, is the technique valid when applied to female voices or to disguised voices?<sup>114</sup> Third, should validation studies be conducted by those who developed the theory? There may be a conflict of interest when the supporting research is conducted by someone with a professional or commercial interest in the technique.<sup>115</sup>

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107. See 22 C. Wright & K. Graham, *supra* note 46, at 95 ("It would be rational to rely upon a scientific device to determine deception if experiments proved that it worked, even though there was dispute about why it worked.").

108. Dr. Sopher has commented on this problem as it relates to bitemark comparisons:

The problem of specificity in the bite mark analysis results from the lack of a scientific core of basic data for comparison. The results of the bite mark comparison may indicate a perfect or reasonably perfect fit between the bite mark and a suspect's dentition; however, how can one be absolutely or even perhaps reasonably certain that no other individual could have produced a particular bite? Classified bite mark characteristics on large segments of the population are unavailable; therefore, an absolute scientific estimation of specificity regarding the particular bite mark/suspect comparison is not possible. The situation is comparable to the point in the distant past when the 100th set of fingerprints was classified. At that time, it was known that the set of prints did not match the ninety-nine others previously recorded, but it was not known if the set of prints were specific for only the one individual fingerprinted. Today, after categorizing 84 million sets of fingerprints in the United States, it can be stated with certainty that no two sets match. The present position of bite mark specificity is comparable to the 100th fingerprint case example.

I. Sopher, *Forensic Dentistry* 140 (1976).

109. E.g., *United States v. Williams*, 583 F.2d 1194 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979); *United States v. Baller*, 519 F.2d 463 (4th Cir.), cert. denied, 423 U.S. 1019 (1975); *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973); *Commonwealth v. Lykus*, 367 Mass. 191, 327 N.E.2d 671 (1975).

110. National Academy of Sciences, *supra* note 2, at 2.

111. See *State v. Hancock*, 71 Ohio Op. 2d 458 (C.P. 1974).

112. Orne, See Implications of Laboratory Research for the Detection of Deception, in *Legal Admissibility of the Polygraph* 94, 98-106 (N. Ansley ed. 1975); Validity Panel, *id.* at 153-57 (statement of Gordon Barland). See also *Commonwealth v. Foley*, 79 Mass. App. Ct. Adv. Sh. 999, 389 N.E.2d 762, 765 (1979) (expert should not be permitted to testify about statistical reliability of polygraph).

113. National Academy of Sciences, *supra* note 2, at 43.

114. See *State ex rel. Trimble v. Hedman*, 291 Minn. 442, 192 N.W.2d 432 (1971) (court upheld the use of voiceprint identification of a female as corroborative evidence). In *People v. Law*, 40 Cal. App. 3d 69, 114 Cal. Rptr. 708 (1974), the court excluded voiceprint evidence concerning a disguised voice.

115. Several cases have questioned the impartiality of experts who have become associated with the validity of voiceprints. See *People v. Kelly*, 17 Cal. 3d 24, 549 P.2d 1240, 130 Cal. Rptr. 144

Instead of directly addressing the issue of whether *Frye* requires general acceptance of the theory or of both the theory and the technique, and then focusing on the problems associated with empirical validation, the courts have confused the issue by concentrating on the qualifications of experts.

The polygraph cases provide an illustration. Although *Frye* cited the disciplines of "psychology" and "physiology" as the relevant fields in which the polygraph must gain acceptance,<sup>116</sup> several recent decisions have looked to the views of polygraph examiners to determine whether the polygraph has been generally accepted.<sup>117</sup> This approach implicitly turns on the validation of the technique, rather than the theory. Its significance should not be underestimated because general acceptance of the polygraph is almost assured if the opinions of examiners are considered.<sup>118</sup> This approach, however, is not universally endorsed. For example, in *United States v. Alexander*,<sup>119</sup> the Court of Appeals for the Eighth Circuit required the experts to be qualified on the theory of the polygraph: "Experts in neurology, psychiatry and physiology may offer needed enlightenment upon the basic premises of polygraphy. Polygraphists often lack extensive training in these specialized sciences."<sup>120</sup> Similarly, the courts have disagreed about the relevance of the widespread use of the polygraph in law enforcement as well as in security and industrial activities. Some cite this use as evidence of general acceptance,<sup>121</sup> while others ignore it.<sup>122</sup>

Even if empirical validation is recognized, a technician's testimony should never suffice to establish the validity of a novel technique: "[T]he technician merely follows prescribed routines, and is not expected to understand their un-

(1976): *People v. Tobey*, 401 Mich. 141, 257 N.W.2d 537 (1977); *United States v. Wright*, 17 U.S.C.M.A. 183, 192 n.1, 37 C.M.R. 447, 456 n.1 (1967) (dissenting opinion). See text accompanying notes 129-35 *infra*.

116. 293 F. at 1014.

117. See *United States v. Zeiger*, 350 F. Supp. 685, 689 (D.D.C.), rev'd per curiam, 475 F.2d 1280 (D.C. Cir. 1972); *United States v. DeBetham*, 348 F. Supp. 1377, 1388 (S.D. Cal.), aff'd per curiam, 470 F.2d 1367 (9th Cir. 1972), cert. denied, 412 U.S. 907 (1973).

118. A related issue concerns whether the so-called "forensic sciences" or "criminalistics" could be considered a discrete field for purposes of the *Frye* test. One commentator has argued that forensic science is "as much a discipline in its own right as is medicine, which also is not chemistry, not biology, not physics, but a fusion of all three, modified and adapted to a specific purpose, the treatment of disease in human beings." Kirk, *The Interrelationship of Law and Science*, 13 *Buffalo L. Rev.* 393, 394 (1964). This issue has practical significance because once the "forensic sciences" are accepted, it is a short step to recognizing a subspecialty such as polygraphy as an appropriate field.

119. 526 F.2d 161 (8th Cir. 1975).

120. *Id.* at 164 n.6. See also *People v. Leone*, 25 N.Y.2d 511, 516, 255 N.E.2d 696, 699, 307 N.Y.S.2d 430, 433 (1969).

121. E.g., *United States v. Zeiger*, 350 F. Supp. 685 (D.D.C.), rev'd, 475 F.2d 1280 (D.C. Cir. 1972); *United States v. DeBetham*, 348 F. Supp. 1377, 1389 (S.D. Cal.), aff'd, 470 F.2d 1367 (9th Cir. 1972), cert. denied, 412 U.S. 907 (1973); *People v. Cutter*, 12 *Crim. L. Rep.* (BNA) 2133, 2134 (Cal. Super. Ct. 1972). See also Tarlow, *supra* note 59, at 943-45 (equating general acceptance with "general use").

The widespread use of a scientific technique as evidence of its general acceptance has not been limited to the polygraph. See *United States v. Stifel*, 433 F.2d 431, 441 (6th Cir. 1970) ("There was testimony concerning neutron activation analysis' value in many varied applications in civil and commercial affairs."), cert. denied, 401 U.S. 994 (1971); *Medley v. United States*, 155 F.2d 857, 860 (D.C. Cir.) (citing "general use in scientific research and industrial analysis" of spectrographic analysis), cert. denied, 328 U.S. 873 (1946).

122. E.g., *United States v. Alexander*, 526 F.2d 161 (8th Cir. 1975).

derlying fundamentals. He knows how, but not why."<sup>123</sup> Because it is critical to know the "why," or, as in the case of empirical validation, the implications of not knowing the "why," the views of scientists are essential.<sup>124</sup> Moreover, a technician would not be qualified to testify about the general acceptability of a technique because presumably only a scientist would be sufficiently conversant with the views held by those in the relevant field.<sup>125</sup>

3. *Establishing General Acceptance*. Even if a court has pinpointed the community in which to look for acceptance and has decided what it is that this community must accept, the court still must decide what types of proof can be used to establish acceptance by the identified community. Three methods of proof have been recognized by the courts: (1) expert testimony, (2) scientific and legal writings, and (3) judicial opinions.<sup>126</sup> All three methods present problems.

a. *Expert Testimony*. The issue of the qualifications of experts who testify about the general acceptance of a scientific technique has divided the courts.<sup>127</sup> In most cases the offering party calls an expert who testifies about the validity of the technique as well as its general acceptance in the scientific community.<sup>128</sup> Some courts, however, do not consider the testimony of one expert—even if qualified and presumably conversant with the views of other scientists—sufficient. For example, in rejecting voiceprint evidence in *People v. Kelly*,<sup>129</sup> the California Supreme Court questioned "whether the testimony of a single witness alone is ever sufficient to represent, or attest to, the views of an entire scientific community regarding the reliability of a new technique,"<sup>130</sup> and whether the expert, as a leading proponent of the technique,<sup>131</sup> could "fairly and impartially . . . assess the position of the scientific community."<sup>132</sup> Subsequently, the Supreme Court of Pennsylvania rejected voiceprints because the "testimony of one expert . . . cannot satisfy [the *Frye*] standard."<sup>133</sup> In effect, the court imposed a corroboration rule; apparently, at least two experts must

123. Kirk, *The Interrelationship of Law and Science*, 13 Buffalo L. Rev. 393, 394 (1964). See also Fong, *Criminalistics and the Prosecutor*, in *The Prosecutor's Deskbook* 547 (P. Healy & J. Manak eds. 1971).

124. See Strong, *supra* note 19, at 16.

125. See *People v. Kelly*, 17 Cal. 3d 24, 39, 549 P.2d 1240, 1249, 130 Cal. Rptr. 144, 154 (1976).

126. See *Commonwealth v. Lykus*, 367 Mass. 191, 204, 327 N.E.2d 671, 678 (1975); *People v. Rogers*, 86 Misc. 2d 868, 873, 385 N.Y.S.2d 228, 232 (Sup. Ct. 1976).

127. See text accompanying notes 116-20 *supra*. The requisite qualifications to testify on the general acceptance issue should be distinguished from the qualifications required for other purposes. See notes 25-26 *supra*.

128. E.g., *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973); *Commonwealth v. Lykus*, 367 Mass. 191, 327 N.E.2d 671 (1975).

129. 17 Cal. 3d 24, 549 P.2d 1240, 130 Cal. Rptr. 144 (1976).

130. *Id.* at 37, 549 P.2d at 1248, 130 Cal. Rptr. at 152.

131. *Id.* at 38, 549 P.2d at 1249, 130 Cal. Rptr. at 153 (The expert "has virtually built his career on the reliability of the technique.").

132. *Id.* The court also characterized the qualifications of the expert as those of a technician rather than a scientist. *Id.* at 39, 549 P.2d at 1250, 130 Cal. Rptr. at 154.

133. *Commonwealth v. Topa*, 471 Pa. 223, 232, 369 A.2d 1277, 1282 (1977). See also *Commonwealth v. Lykus*, 367 Mass. 191, 207, 327 N.E.2d 671, 679-80 (1975) (dissenting opinion). But see *United States v. Brown*, 13 Crim. L. Rep. (BNA) 2203, 2204 (D.C. Super. Ct. 1973), *aff'd* on other grounds, 384 A.2d 647 (D.C. 1978).

testify on the general acceptance issue. Voiceprint evidence was also rejected by the Michigan Supreme Court because the "reputations and careers"<sup>134</sup> of the experts favoring admissibility were "built on their voiceprint work," and therefore they were not "disinterested and impartial."<sup>135</sup>

The *Frye* decision mandates neither the corroboration nor the impartiality requirement. Nevertheless, these requirements may mitigate, at least to some extent, a recurring problem in the application of the *Frye* test—the inadequacy of the expert testimony on the general acceptance issue. For example, in *People v. Chapter*<sup>136</sup> the court questioned the accuracy of the expert testimony given in *Hodo v. Superior Court*<sup>137</sup> that voiceprints had been generally accepted, and noted that in "approximately eighty percent of the twenty-five cases in which such expert testimony/opinion was admitted there was no opposing expert testimony on the issue of reliability and general acceptability by the scientific community."<sup>138</sup> Moreover, although the *Hodo* court found the general acceptance requirement satisfied at a preliminary examination, it later excluded the voiceprint evidence after hearing the testimony of opposing experts at trial.<sup>139</sup>

Although corroboration by a second, impartial witness bolsters the testimony presented, these requirements are themselves difficult to apply. Courts have not attempted to reconcile these requirements with the other methods of establishing general acceptance. For instance, no court has discussed whether judicial notice of articles by impartial authorities can be used to corroborate the testimony of a "biased" expert. Moreover, the corroboration requirement may not advance the rationale underlying *Frye*. In a case in which one well qualified expert testifies, this requirement would operate to exclude the evidence; in another case, the testimony of two less qualified experts would warrant admission. It should also be pointed out that although two experts have testified in favor of voiceprint analysis in a number of cases,<sup>140</sup> the reliability and general acceptance of that technique remain controversial issues.<sup>141</sup>

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134. *People v. Tobey*, 401 Mich. 141, 146, 257 N.W.2d 537, 539 (1977).

135. *Id.* at 145 (citing *People v. Barbara*, 400 Mich. 352, 358, 406, 255 N.W.2d 171, 172, 194-95 (1977)). See also *United States v. Wright*, 17 C.M.A. 183, 192 n.1, 37 C.M.R. 447, 456 n.1 (1967) (dissenting opinion).

136. 13 Crim. L. Rep. (BNA) 2479 (Cal. Super. Ct. 1973).

137. 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973).

138. 13 Crim. L. Rep. (BNA) at 2479.

139. See *People v. Kelly*, 17 Cal. 3d 24, 35, 549 P.2d 1240, 1247, 130 Cal. Rptr. 144, 151 (1976). Other cases also have raised concerns about the tenor of testimony concerning general acceptance. See *People v. Law*, 40 Cal. App. 3d 69, 80-81, 114 Cal. Rptr. 708, 715-16 (1974) (court found expert's testimony on general acceptance "equivocal"); *D'Arc v. D'Arc*, 157 N.J. Super. 553, 564-65, 385 A.2d 278, 284 (Ch. Div. 1978) (expert's testimony concerning the number of states that accept voiceprints "not entirely accurate and may be nothing more than the normal puffery by the proponent of any new device or instrument").

140. E.g., *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973) (voiceprints admitted); *Commonwealth v. Lykus*, 367 Mass. 191, 327 N.E.2d 671 (1975) (voiceprints admitted).

141. This is not to say that the concern underlying the corroboration requirement is not legitimate. The *Frye* objective, however, may be better achieved by requiring the trial court to exercise its power to call independent experts than by mechanically applying a corroboration rule. See generally *United States v. Ridling*, 350 F. Supp. 90 (E.D. Mich. 1972) (court called independent polygraph expert); *State v. Andretta*, 61 N.J. 544, 549-50, 296 A.2d 644, 647 (1972) (trial court called inde-

b. *Scientific and Legal Literature*. In determining whether a novel technique has satisfied the general acceptance standard, courts have frequently cited legal and scientific publications.<sup>142</sup> This represents a type of judicial notice.<sup>143</sup> Courts using published studies are not judicially noticing the validity of the technique;<sup>144</sup> rather, they are taking judicial notice of sundry articles, texts, and other publications, both legal and scientific, in attempting to determine whether general acceptance has been achieved.<sup>145</sup> In some cases general acceptance has been established solely by this means. For example, in *People v. Palmer*,<sup>146</sup> the court considered the admissibility of gunshot residue evidence based upon scanning electron microscopic analysis. Rejecting the defendant's argument that no expert testimony on the general acceptance issue had been proffered at trial, the court stated that "[n]o useful purpose would have been served by requiring expert testimony on that point" because the literature on the subject demonstrated general acceptance.<sup>147</sup>

The use of judicial notice under these circumstances is problematical. The appellate court may not have discovered all the relevant articles, many of which may be published in technical and scientific, rather than legal, journals. Recent research, not yet generally available, may have raised new doubts about the validity of a technique. Moreover, since the defendant in *Palmer* presumably did not have the burden of production or persuasion on the general acceptance issue,<sup>148</sup> he had no obligation to produce his own experts, and since the govern-

pendent voiceprint experts); *Commonwealth v. Lykus*, 367 Mass. 191, 213, 327 N.E.2d 671, 683 (1975) (dissenting opinion) (trial court should have called independent voiceprint experts); *Fed. R. Evid.* 706.

142. See *United States v. Stifel*, 433 F.2d 431, 441 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971); *People v. Palmer*, 80 Cal. App. 3d 239, 252, 145 Cal. Rptr. 466, 472 (1978); *People v. Kelly*, 17 Cal. 3d 24, 35-36, 549 P.2d 1240, 1247-48, 130 Cal. Rptr. 144, 151-52 (1976); *Commonwealth v. Lykus*, 367 Mass. 191, 199 n.3, 204, 327 N.E.2d 671, 676 n.3, 678 (1975); *People v. Collins*, 94 Misc. 2d 704, 705, 405 N.Y.S.2d 365, 366 (Sup. Ct. 1978) ("documents, treatises, studies and articles" introduced as exhibits); *People v. Rogers*, 86 Misc. 2d 868, 873, 385 N.Y.S.2d 228, 232 (Sup. Ct. 1976); *Commonwealth v. Topa*, 471 Pa. 223, 229-33, 369 A.2d 1277, 1280-82 (1977).

Two cases have cited informal polls of scientists as being relevant to the general acceptance issue. *D'Arc v. D'Arc*, 157 N.J. Super. 553, 560-61, 385 A.2d 278, 282 (Ch. Div. 1978); *People v. Collins*, 94 Misc. 2d 704, 711, 405 N.Y.S.2d 365, 370 (Sup. Ct. 1978). See also *State v. Cary*, 99 N.J. Super. 323, 331, 239 A.2d 680, 684 (Law Div. 1968), aff'd, 56 N.J. 16, 264 A.2d 209 (1970) (citing 39 letters from scientists).

143. See generally I J. Weinstein & M. Berger, *supra* note 28, ¶ 200[05].

144. See text accompanying notes 28-33 *supra*.

145. In *State v. Cary*, 99 N.J. Super. 323, 239 A.2d 680 (Law Div. 1968), aff'd, 56 N.J. 16, 264 A.2d 209 (1970), the court cited 39 letters from scientists when considering the general acceptance issue. The court stated: "They have relevancy in indicating that there is an existing controversy in the related scientific fields concerned as to the lack of scientific acceptance of the reliability of the technique." *Id.* at 331, 239 A.2d at 684.

146. 80 Cal. App. 3d 239, 145 Cal. Rptr. 466 (1978).

147. *Id.* at 254, 145 Cal. Rptr. at 473.

148. Such fundamental issues as the burden and standard of proof with respect to general acceptance are rarely discussed in the reported cases. A few cases indicate that the burden of proof rests with the offering party. See *People v. Kelly*, 17 Cal. 3d 24, 40, 549 P.2d 1240, 1251, 130 Cal. Rptr. 144, 255 (1976) (Prosecution "failed to carry [its] burden of establishing . . . reliability . . ."); *People v. Tobey*, 401 Mich. 141, 148, 257 N.W.2d 537, 540 (1977) (Prosecution

ment's expert did not address the general acceptance issue, the defendant had no reason to cross-examine the expert on this point.<sup>149</sup> If the appellate court cited the articles without notice to the defense, the defendant may never have had an opportunity to contest the issue—to call his own experts or to cite articles expressing opposing views in his appellate brief.<sup>150</sup>

On the other hand, use of judicial notice to determine *lack* of general acceptance seems more acceptable. If one or two experts testify that a particular technique has been generally accepted, but the literature demonstrates a significant dispute on the matter, it would be appropriate for a court, either trial or appellate, to consider the available literature in holding that general acceptance has not been achieved. Because the proponent has the burden of proof on the general acceptance issue, the proponent should be responsible for informing the trial court of opposing views in the literature and for explaining why the literature is not persuasive evidence of lack of general acceptance. Failure to inform the trial court of opposing scientific views should not preclude a court from judicially noticing those views.

c. *Judicial Opinions*. Some courts have considered prior judicial decisions in deciding whether general acceptance has been achieved.<sup>151</sup> Judicially noticing the testimony of experts that appears in other cases seems appropriate;<sup>152</sup> it should not matter whether the experts present their opinions in scientific journals or in courtroom testimony. Some cases, however, go beyond this practice; they "seem to adopt an approach to the *Frye* test that emphasizes previous court decisions, considering general acceptance not only by scientists but also by courts."<sup>153</sup> *State v. Olderman*<sup>154</sup> illustrates this development. Based solely on cases upholding admissibility, the court in *Olderman* concluded that voiceprint evidence had met the *Frye* test. This use of prior judicial decisions undercuts the rationale supporting *Frye*—that those *most qualified* to judge the validity of a

"failed to demonstrate that voiceprint evidence has achieved general scientific acceptance . . ."). See also *People v. Barbara*, 400 Mich. 352, 365, 255 N.W.2d 171, 175 (1977) ("Frye emphasize[s] that it is the burden of the party seeking admissibility to demonstrate acceptability of the proposed technique [polygraph]"). Judicial commentary on the standard of proof, however, is virtually nonexistent.

149. An expert did testify, but not on this issue. 80 Cal. App. 3d at 254 n.8, 145 Cal. Rptr. at 473 n.8.

150. See generally 1 J. Weinstein & M. Berger, *supra* note 28, ¶ 201[05]; Davis, *Judicial Notice*, 1969 Law & Soc. Ord. 513.

151. *People v. Palmer*, 80 Cal. App. 3d 239, 252, 145 Cal. Rptr. 466, 472 (1978). Accord, *Commonwealth v. Lykus*, 367 Mass. 191, 204, 327 N.E.2d 671, 678 (1975); *People v. Rogers*, 86 Misc. 2d 868, 873, 385 N.Y.S.2d 228, 232 (Sup. Ct. 1976).

152. See *People v. Kelly*, 17 Cal. 3d 24, 34, 549 P.2d 1240, 1247, 130 Cal. Rptr. 144, 151 (1976) (citing expert's testimony in *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973)); *Commonwealth v. Lykus*, 367 Mass. 191, 199-200 n.3, 327 N.E.2d 671, 676 n.3 (1975) (citing expert's testimony in *United States v. Addison*, 498 F.2d 741 (D.C. Cir. 1974)); *Commonwealth v. Topa*, 471 Pa. 223, 230 n.2, 369 A.2d 1277, 1281 n.2 (1977) (citing expert's testimony in *Worley v. State*, 263 So.2d 613 (Fla. App. 1972)).

153. National Academy of Sciences, *supra* note 2, at 45.

154. 44 Ohio App. 2d 130, 336 N.E.2d 442 (1975). See also *Reed v. State*, 35 Md. App. 472, 483, 372 A.2d 243, 251 (1977), *rev'd*, 283 Md. 374, 391 A.2d 364 (1978); *People v. Rogers*, 86 Misc. 2d 868, 385 N.Y.S.2d 228 (Sup. Ct. 1976).

technique should have the determinative voice.<sup>155</sup> Even if reliance on prior judicial decisions is a proper application of the *Frye* test, *Olderman* remains troublesome. Although the court recognized that other decisions had rejected voiceprint evidence,<sup>156</sup> it failed to explain why these cases did not show, at least, a judicial dispute on the subject. Moreover, several of the cases cited by the court as upholding voiceprint evidence did not apply the *Frye* standard<sup>157</sup> and one case that did apply the *Frye* test was subsequently overruled.<sup>158</sup>

4. *When to Apply Frye.* Courts that accept the *Frye* test often have difficulty deciding when to apply it. As McCormick has commented, the application of the *Frye* test is "highly selective."<sup>159</sup> Indeed, the selective application of the general acceptance standard is one of its most notable features—inconsistencies in application abound. Part of the problem may lie in defining what types of evidence should be classified as "scientific evidence" and thus subject to the *Frye* test.<sup>160</sup> This definitional problem, however, does not wholly explain the selective application phenomenon.<sup>161</sup> For example, the Missouri Supreme Court in *State v. Stout*<sup>162</sup> held that the results of a blood examination by neutron activation analysis should have been excluded because the technique had not gained general acceptance in the scientific community.<sup>163</sup> Several years earlier, however, the same court had upheld the admissibility of the results of a "paraffin test" without referring to *Frye*; all that was required, according to the court in *State v. Fields*,<sup>164</sup> was that the examiner be qualified, the test be conducted

155. See text accompanying note 64 supra. The use of judicial precedents in applying the general acceptance test was criticized in an early article as illustrating the doctrine of legal relevancy. Trautman, Logical or Legal Relevancy—A Conflict in Theory, 5 Vand. L. Rev. 385, 395, 413 (1952). See also Note, Evolving Methods of Scientific Proof, 13 N.Y.L.F. 677, 682 (1967).

156. 44 Ohio App. 2d at 138 n.7, 336 N.E.2d at 448 n.7.

157. Although cited by the court, the following decisions did not apply the general acceptance standard: *Alea v. State*, 265 So. 2d 96 (Fla. App. 1972); *Worley v. State*, 263 So. 2d 613 (Fla. App. 1972); *State ex rel. Trimble v. Hedman*, 291 Minn. 442, 192 N.W.2d 432 (1971).

158. *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973), was subsequently overruled by the California Supreme Court in *People v. Kelly*, 17 Cal. 3d 24, 35, 549 P.2d 1240, 1247, 130 Cal. Rptr. 144, 151 (1976).

159. C. McCormick, supra note 23, at 490. See also 1 D. Louisell & C. Mueller, supra note 59, at 818; Boyce, supra note 59, at 314.

160. Professors Wright and Graham have commented on this problem: "What is 'scientific evidence' to which the test applies? When a witness testifies that he saw the defendant throw a rock at the victim, the inferences to be drawn from this testimony involve a number of principles of physics, but few courts would apply the *Frye* test." 22 C. Wright & K. Graham, supra note 46, at 87 n.10. Various definitions have been offered. See G. Lilly, An Introduction to the Law of Evidence 400 (1978) ("The adjective 'scientific,' as we broadly use it here, refers to evidence that draws its convincing force from some principle of science, mathematics, or the like."); Boyce, supra note 59, at 314 n.19 ("Scientific evidence as used in this article refers to those areas of evidentiary inquiry which purport to be based upon the scientific method . . ."). See also C. McCormick, supra note 23, at 488-89.

161. For one explanation of why courts may apply *Frye* selectively, see Strong, supra note 19, at 11.

162. 478 S.W.2d 368 (Mo. 1972).

163. Id. at 371.

164. 434 S.W.2d 507 (Mo. 1968).



according to usual standards, the test and results be adequately described, and the opponent be given an opportunity to cross-examine the expert.<sup>165</sup>

A series of cases decided by the Court of Appeals for the Sixth Circuit offers another illustration. In *United States v. Stifel*,<sup>166</sup> the Sixth Circuit applied the *Frye* test and upheld the admissibility of evidence based upon neutron activation analysis.<sup>167</sup> Five years later, in *United States v. Franks*,<sup>168</sup> the same court upheld the admissibility of voiceprint evidence, stating in a footnote that general acceptance was "nearly synonymous with reliability."<sup>169</sup> Equating general acceptance with reliability, however, represents an abandonment of *Frye* because the reliability of a scientific technique could be established notwithstanding its lack of general acceptance in the scientific community.<sup>170</sup> A subsequent voiceprint case, *United States v. Jenkins*,<sup>171</sup> in which *Frye* was not mentioned, provided further evidence that the Sixth Circuit was moving away from *Frye*.<sup>172</sup> Despite the unmistakable thrust of these cases,<sup>173</sup> the Sixth Circuit inexplicably resurrected *Frye* in *United States v. Brown*<sup>174</sup> and held that evidence based upon ion microprobe analysis was inadmissible.<sup>175</sup>

The Supreme Judicial Court of Massachusetts also has applied the *Frye* standard selectively. In 1963 that court adopted the *Frye* test in *Commonwealth v. Fatalo*,<sup>176</sup> rejecting the admissibility of polygraph evidence. Nevertheless, in *Commonwealth v. Devlin*<sup>177</sup> the court chose not to apply the *Frye* test and upheld the admissibility of identification of skeletal remains by x-ray comparison.<sup>178</sup> Subsequently, in *Commonwealth v. A Juvenile*,<sup>179</sup> the court held that

165. *Id.* at 516.

166. 433 F.2d 431 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971).

167. *Id.* at 438.

168. 511 F.2d 25 (6th Cir.), cert. denied, 422 U.S. 1042 (1975).

169. *Id.* at 33 n.12. See also *United States v. Brown*, 13 Crim. L. Rep. (BNA) 2203, 2204 (D.C. Super. Ct. 1973), aff'd on other grounds, 384 A.2d 647 (D.C. 1978). Other courts have recognized that general acceptance and reliability are distinct tests. In *D'Arc v. D'Arc*, 157 N.J. Super. 553, 385 A.2d 278 (Ch. Div. 1978), the court concluded that admissibility was permissible if *either* test is satisfied. *Id.* at 559, 385 A.2d at 281. In contrast, the court in *People v. Collins*, 94 Misc. 2d 704, 405 N.Y.S.2d 365 (Sup. Ct. 1978), indicated that *both* tests must be satisfied. *Id.* at 706, 405 N.Y.S.2d at 367.

170. Citing *Franks*, one court has observed that "[i]n essence, the Sixth Circuit has modified *Frye*." *People v. Rogers*, 86 Misc. 2d 868, 879, 385 N.Y.S.2d 228, 236 (Sup. Ct. 1976).

171. 525 F.2d 819 (6th Cir. 1975).

172. Citing *Franks*, the court stated: "This Court has recently held that voiceprint analysis falls into the category of scientific evidence and that its admissibility is a matter within a trial judge's discretion." *Id.* at 827. The court also noted that *Franks* had been satisfied because the trial court had made "an extensive inquiry into [the expert's] qualifications and the reliability of the scientific process." *Id.*

173. See *Reed v. State*, 283 Md. 374, 396, 391 A.2d 364, 375 (1978) ("It is important to note, however, that neither *United States v. Baller* . . . nor *United States v. Franks* . . . seemed to apply the *Frye* test."); 44 U. Cin. L. Rev. 616 (1975).

174. 557 F.2d 541 (6th Cir. 1977).

175. *Id.* at 556-57. In a subsequent case, *United States v. Brady*, 595 F.2d 359 (6th Cir.), cert. denied, 444 U.S. 862 (1979), the Sixth Circuit applied the general acceptance test to expert testimony concerning the microscopic comparison of hair samples.

176. 346 Mass. 266, 269, 191 N.E.2d 479, 480-81 (1963).

177. 365 Mass. 149, 310 N.E.2d 353 (1974).

178. The Court did, however, attempt to distinguish *Frye*. *Id.* at 154-55, 310 N.E.2d at 357.

179. 365 Mass. 421, 313 N.E.2d 120 (1974).

polygraph evidence could be admitted under certain circumstances even though the court acknowledged that general acceptance had not yet been achieved.<sup>180</sup> Then, in *Commonwealth v. Lykus*,<sup>181</sup> the court again cited *Frye* as the controlling standard in admitting voiceprint evidence.<sup>182</sup> In a footnote the court mentioned that the state had argued (correctly it would appear) that *Devlin* had modified *Frye*.<sup>183</sup> The court responded: "We make no comment at this time as to whether the *Devlin* . . . case has application in any circumstances other than the precise scientific principles involved in [that case]." <sup>184</sup> Thus, while adhering to the *Frye* standard in *Lykus*, the court acknowledged its selective application; nevertheless it failed to explain the bases for such selectivity.<sup>185</sup>

If the *Frye* test is justified because it assures that "those most qualified to assess the general validity of a scientific method will have the determinative voice,"<sup>186</sup> it makes no sense to rely upon the "voice" of the scientific community in considering the admissibility of some techniques but not others. Instead of using *Frye* as an analytical tool to decide whether novel scientific evidence should be admitted, it appears that many courts apply it as a label to justify their own views about the reliability of particular forensic techniques.

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180. *Id.* at 425, 313 N.E.2d at 123. The Michigan Supreme Court described *A Juvenile* as follows: "This case is peculiar in that it purports to follow the *Frye* rule but nonetheless makes a special exception to permit the defendant to submit to polygraph testing and offer the tests in evidence. . . ." *People v. Barbara*, 400 Mich. 352, 388-89, 255 N.W.2d 171, 186 (1977).

181. 367 Mass. 191, 327 N.E.2d 671 (1975).

182. *Id.* at 196, 327 N.E.2d at 674.

183. *Id.* at 203 n.5, 327 N.E.2d at 678 n.5.

184. *Id.*

185. Another example of selective application is found in the decisions of the U.S. Court of Military Appeals. That court, in a 1954 decision, cited *Frye* as the controlling authority in determining the admissibility of evidence involving the detection of narcotics through urinalysis. *United States v. Ford*, 4 C.M.A. 611, 613, 16 C.M.R. 185, 187 (1954). Subsequently, in *United States v. Wright*, 17 C.M.A. 183, 37 C.M.R. 447 (1967), the court became the first appellate tribunal to uphold the admissibility of voiceprint evidence. The majority opinion did not mention *Frye* and was vigorously criticized in the dissenting opinion for abandoning the general acceptance test. *Id.* at 193, 37 C.M.R. at 457. Since the major research on voiceprint identification had not commenced in 1967, the technique clearly was not generally accepted by the scientific community at the time *Wright* was decided. Recently, however, in *United States v. Hulen*, 3 M.J. 275 (C.M.A. 1977), the court cited *Frye* as the controlling standard in considering the admissibility of expert testimony on the psychology of eyewitness identifications. The court stated: "In *United States v. Ford* . . . we adopted the test set forth in *Frye v. United States* . . . for the admissibility of expert testimony." *Id.* at 276. Inexplicably, the court cited *Wright* along with *Frye*, apparently believing that the two cases embrace the same standard.

An interesting example of selective application of *Frye* is found in the polygraph stipulation cases. In recent years a growing number of courts have admitted the results of polygraph examinations, but only if the parties stipulate in advance to the admissibility of the results. See *J. Reid & F. Inbau*, *supra* note 8, at 325-35; Annot., 53 A.L.R.3d 1005 (1973). Instead of requiring the polygraph technique to meet the stringent standards imposed by *Frye*, these courts consider it sufficient that the technique "has been developed to a state in which its results are probative enough to warrant admissibility upon stipulation." *State v. Valdez*, 91 Ariz. 274, 283, 371 P.2d 894, 900 (1962); accord, *United States v. Oliver*, 525 F.2d 731, 736 (8th Cir. 1975), cert. denied, 424 U.S. 973 (1976). In effect, lack of general acceptance is somehow offset by a stipulation between the parties. However, because the stipulation "does nothing to enhance the reliability of such evidence . . .," *Romero v. State*, 493 S.W.2d 206, 213 (Tex. Crim. App. 1973), the *Frye* test is effectively bypassed in this context.

186. See text accompanying note 64 *supra*.

5. *Scope of Appellate Review.* The scope of appellate review of a trial court's application of the *Frye* test is another issue that has received minimal analysis<sup>187</sup> but has generated much confusion. Some courts apparently treat the general acceptance issue as a matter of law, subject to de novo review on appeal.<sup>188</sup> Other courts, however, take the view that the "determination of 'general acceptance' is primarily a question of fact for the trial court subject to an appellate court's determination that the trial court has not abused its discretion."<sup>189</sup>

The abuse of discretion standard has been properly criticized as contributing to the "essential vagueness" of the *Frye* test.<sup>190</sup> The full implication of this criticism can be understood in the light of *Coppolino v. State*.<sup>191</sup> After citing *Frye*, the court in *Coppolino* upheld the admissibility of a scientific technique that could not have satisfied the *Frye* standard, stating, "the trial judge enjoys wide discretion in areas concerning the admission of evidence."<sup>192</sup> Since *Coppolino* is most often viewed as rejecting the *Frye* general acceptance standard in favor of the relevancy approach,<sup>193</sup> the abuse of discretion standard would seem to blur the distinction between *Frye* and the principal alternative approach to the admissibility of novel scientific evidence.<sup>194</sup>

187. See *People v. Law*, 40 Cal. App. 3d 69, 74-75, 114 Cal. Rptr. 708, 711 (1974).

188. *Id.* at 75, 114 Cal. Rptr. at 711 ("[T]here is a view that the [general acceptance] issue is one of law . . ."). The D.C. Circuit follows this view. In *United States v. Zeiger*, 350 F. Supp. 685 (D.D.C. 1972), the district court, ruling on the admissibility of polygraph evidence, concluded that the *Frye* test had "been satisfied." *Id.* at 692. The D.C. Circuit reversed per curiam without issuing an opinion. *United States v. Zeiger*, 475 F.2d 1280 (D.C. Cir. 1972). See also *United States v. Addison*, 498 F.2d 741, 744 (D.C. Cir. 1974) ("neither the court's opinion nor the record satisfy the *Frye* standard of admissibility" as applied to voiceprint evidence).

189. *People v. Marx*, 54 Cal. App. 3d 100, 109, 126 Cal. Rptr. 350, 355 (1975); accord, *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 784-85, 106 Cal. Rptr. 547, 550 (1973); *People v. King*, 266 Cal. App. 2d 437, 443, 72 Cal. Rptr. 478, 482 (1968). See also Tarlow, *supra* note 59, at 942.

Other courts seem to equivocate. For example, in *United States v. Stifel*, 433 F.2d 431 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971), a case upholding the admissibility of neutron activation under the *Frye* test, the Court of Appeals for the Sixth Circuit emphasized the "considerable area of discretion" enjoyed by the trial court "in admitting or refusing to admit proffered expert testimony." *Id.* at 437-38. The same court, however, minimized the extent of trial court discretion in *United States v. Brown*, 557 F.2d 541 (6th Cir. 1977), when it overruled a lower court's determination that ion microprobe analysis had satisfied the general acceptance test. The court simply concluded: "After extensive review of the record, we are inclined to agree with Appellant that the Government failed to fulfill the threshold requirement of demonstrating that ion microprobe analysis is a generally accepted procedure. . . ." *Id.* at 557.

190. I D. Louisell & C. Mueller, *supra* note 59, at 821. Such a standard would also undercut several of the purported rationales for the *Frye* test, such as the promotion of uniformity and the conservation of judicial time. See text accompanying notes 62-63 *supra*.

191. 223 So. 2d 68 (Fla. Dist. Ct. App. 1968), appeal dismissed, 234 So. 2d 120 (Fla. 1969), cert. denied, 399 U.S. 927 (1970). For a more detailed discussion of *Coppolino*, see text accompanying notes 285-87 *infra*.

192. *Id.* at 70.

193. See I D. Louisell & C. Mueller, *supra* note 59, at 825; C. McCormick, *supra* note 23, at 490 n.33; A. Moenssens & F. Inbau, *supra* note 7, at 4-5; Strong, *supra* note 19, at 16. See also text accompanying notes 276-87 *infra*.

194. This blurring has already occurred. Professors Louisell and Mueller cite *United States v. Baller*, 519 F.2d 463 (4th Cir.), cert. denied, 423 U.S. 1019 (1975), as a case applying *Frye* but emphasizing judicial discretion. I D. Louisell & C. Mueller, *supra* note 59, at 821. *Baller*, however, does not apply *Frye*. *Baller*, in turn, cites *Coppolino* and *United States v. Stifel*, 433 F.2d 431 (6th

Moreover, the courts have not explained why recognition of trial judge discretion is appropriate in this context. While it has long been recognized that a trial judge has discretion with respect to an expert's qualifications,<sup>195</sup> the "question of qualifying the expert" should not subsume the "question of qualifying the process."<sup>196</sup> Deferring to a trial court in one instance does not justify deferring in the other. As one court has observed correctly: "The answer to the question about the reliability of a scientific technique or process does not vary according to the circumstances of each case. It is therefore inappropriate to view this threshold question of reliability as a matter within each trial judge's individual discretion."<sup>197</sup>

### B. Problematic Results

The problems associated with the application of *Frye* discussed in the previous section have led commentators to label the general acceptance standard "remarkably vague,"<sup>198</sup> "undefinable,"<sup>199</sup> and "not enlightening."<sup>200</sup> There are, however, other criticisms and problems. For example, the general acceptance standard has been criticized for excluding reliable evidence. Paradoxically, the standard also may permit the admission of unreliable evidence.

1. *Exclusions*. As one commentary has pointed out, "[a] literal reading of *Frye v. United States* would require that the courts always await the passing of a 'cultural lag' during which period the new method will have had sufficient time to diffuse through scientific discipline and create a requisite body of scientific opinion needed for acceptability."<sup>201</sup> This delay, according to critics, deprives the courts of reliable evidence.<sup>202</sup>

Of course, courts applying *Frye* take a different view. The D. C. Circuit has recognized that the *Frye* standard retards the admissibility of novel forensic techniques but has stated that such a consequence is not an "unwarranted

Cir. 1970), cert. denied, 401 U.S. 994 (1971). *Stifel* applies *Frye* (and also emphasizes trial court discretion); *Coppolino*, as noted in the text, is often cited as rejecting *Frye*.

195. See C. McCormick, *supra* note 23, at 29-30.

196. Case Comment, Evidence: Admissibility of Spectrographic Voice Identification, 56 Minn. L. Rev. 1235, 1246 (1972).

197. *Reed v. State*, 283 Md. 374, 381, 391 A.2d 364, 367 (1978). Moreover, the recognition of trial court discretion in this matter would seem to be inconsistent with the use of judicial notice on appeal. See text accompanying notes 142-50 *supra*. If the trial court has not abused its discretion, can an appellate court judicially notice articles challenging the reliability of a technique and thereby find a lack of general acceptance?

198. 22 C. Wright & K. Graham, *supra* note 46, at 87; see also 1 D. Louisell & C. Mueller, *supra* note 59, at 821.

199. Strong, *supra* note 19, at 14.

200. C. McCormick, *supra* note 23, at 490.

201. Maletskos & Spielman, *supra* note 80, at 958.

202. One judge phrases this criticism rather compellingly: "Society need not tolerate homicide until there develops a body of medical literature about some particular lethal agent." *Coppolino v. State*, 223 So. 2d 68, 75 (Fla. Dist. Ct. App. 1968) (concurring opinion), appeal dismissed, 234 So. 2d 120 (Fla. 1969), cert. denied, 399 U.S. 927 (1970). See also *United States v. Sample*, 378 F. Supp. 44, 53 (E.D. Pa. 1974) (*Frye* "precludes too much relevant evidence for purposes of the fact determining process . . ."); 1 D. Louisell & C. Mueller, *supra* note 59, at 822; Boyce, *supra* note 59, at 314.

cost."<sup>203</sup> Indeed, some courts consider the conservative nature of the *Frye* test its primary advantage.<sup>204</sup> These courts raise a valid point. The question is not whether *Frye* embodies a conservative approach to the admissibility of scientific evidence (which it does) but rather whether such conservatism is justified. Thus, the critical issue is whether other approaches can better achieve the *Frye* objective of "prevent[ing] . . . the introduction into evidence of specious and unfounded scientific principles or conclusions based upon such principles."<sup>205</sup> If such alternative approaches exist, then the conservatism implicit in the *Frye* test is not an "advantage," but rather an unjustified obstacle to the truth-determining process. Alternatives to *Frye* are discussed in later sections of this Article.<sup>206</sup>

2. *Inclusions*. The critics who argue that the *Frye* standard is too conservative are saying, in effect, that the general acceptance standard works too well—it excludes much that is reliable along with that which is unreliable. Interestingly, many commentators have overlooked instances in which *Frye* does not work. This defect can be illustrated by the so-called "paraffin test," which was designed to detect gunshot residue on the hand of a person who has recently fired a weapon.<sup>207</sup> Introduced in this country in the early 1930's,<sup>208</sup> the paraffin test was adopted quickly by law enforcement agencies.<sup>209</sup> The first reported case upholding the admissibility of this test was decided in 1936.<sup>210</sup> Although a series of articles questioned the validity of the paraffin test,<sup>211</sup> it was not until 1959 that a case rejecting the test was reported,<sup>212</sup> and it was not until 1967 that

203. *United States v. Addison*, 498 F.2d 741, 743 (D.C. Cir. 1974).

204. *People v. Kelly*, 17 Cal. 3d 24, 31, 549 P.2d 1240, 1245, 130 Cal. Rptr. 144, 149 (1976). See also *Reed v. State*, 283 Md. 374, 385-86, 391 A.2d 364, 370 (1978).

205. Strong, *supra* note 19, at 14.

206. See text accompanying notes 265-388 *infra*.

207. For a more complete description of the paraffin test, see text accompanying notes 228-31 *infra*.

208. See Mathews, *The Paraffin Test*, 102 *American Rifleman* 20 (1954).

209. An article published in the FBI Law Enforcement Bulletin in October of 1935 commenced with the following phrase: "In view of the current widespread use of the diphenylamine [paraffin] test . . ." *Diphenylamine Test for Gun Powder*, 4 FBI Law Enforcement Bull. 5 (1935). See also Castellanos & Plasencia, *The Paraffin Gauntlet: A New Technique for the Dermo-Nitrate Test*, 32 J. Crim. L. & Criminology 465 (1941). See also authorities cited in note 214 *infra*.

210. *Commonwealth v. Westwood*, 324 Pa. 289, 188 A. 304 (1936).

211. In 1935 the FBI Laboratory, on the basis of a number of experiments, concluded that "[i]n spite of the obvious impossibility of drawing positive conclusions from the diphenylamine [paraffin] test, when properly conducted and with a full understanding of its merits and limitations, it is of some value in criminal investigations." *Diphenylamine Test for Gun Powder*, *supra* note 209, at 6. In 1940 the FBI reported the results of further experiments "which corroborate[d] the unreliability of the diphenylamine [paraffin] test as a test for gunpowder residue." Further Observations on the Diphenylamine Test for Gun Powder Residue, 9 FBI Law Enforcement Bull. 10 (1940). In a subsequent article, the FBI reported that based on additional tests the "results obtained demonstrated the unreliability of the test." *Gunpowder Tests*, 18 FBI Law Enforcement Bull. 2, 3 (1949). But see Conrad, *Evidential Implications of the Dermal Nitrate Test for Gunpowder Residues*, 44 Marq. L. Rev. 500 (1961); Mathews, *supra* note 208. See also Turkel & Lipman, *Unreliability of Dermal Nitrate Test for Gunpowder*, 46 J. Crim. L. C. & P.S. 281 (1955).

212. See *Brooke v. People*, 139 Colo. 388, 339 P.2d 993 (1959). *Brooke* was subsequently followed in *Born v. State*, 397 P.2d 924 (Okla. Crim. App. 1964), cert. denied, 379 U.S. 1000 (1965);

the first comprehensive evaluation of the test was published in the scientific literature. That study found the test to be unreliable.<sup>213</sup> Prior to this study the paraffin test was used widely;<sup>214</sup> evidence based on the test was admitted in trials through the 1960's.<sup>215</sup> In short, the paraffin test was generally accepted. By looking to the scientific community to assure the reliability of novel techniques, the *Frye* model assumes that extensive testing of the technique will be conducted by that community. The paraffin test experience casts doubt upon this assumption. As one commentator has noted, "[n]othing in the scientific method guarantees that hypotheses will be tested or when they will be tested . . . ."<sup>216</sup> Of course, opponents of *Frye* cannot take much comfort in this problem because if the stringent requirements imposed by *Frye* would not have prevented the admissibility of the paraffin test, it seems doubtful that a less demanding standard would have. Indeed, cases not applying the *Frye* standard did admit paraffin test results.<sup>217</sup>

Clarke v. State, 218 Tenn. 259, 402 S.W.2d 863, cert. denied, 385 U.S. 942 (1966). Other courts, however, admitted evidence based on this test after *Brooke* was decided. See cases cited in note 215 *infra*.

213. See Cowan & Purdon, A Study of the "Paraffin Test", 12 J. Forensic Sci. 19 (1967). Prior studies that reached the same conclusion were not based on extensive testing. See note 211 *supra*.

214. See A. Moenssens & F. Inbau, *supra* note 7, at 7 n.12 ("The test was enthusiastically embraced by crime laboratories generally which used it very widely in criminal investigations."); Cowan & Purdon, *supra* note 213, at 20; Conrad, *supra* note 211, at 504; Midkiff, Detection of Gunshot Residues: Modern Solutions for an Old Problem, 3 J. Police Sci. & Ad. 77, 78 (1975).  
215. See *Harris v. State*, 239 Ark. 771, 394 S.W.2d 135 (1965), cert. denied, 386 U.S. 964 (1967); *State v. Foster*, 44 Haw. 403, 354 P.2d 960 (1960); *State v. Hoy*, 199 Kan. 340, 430 P.2d 275 (1967); *People v. Simpson*, 5 Mich. App. 479, 146 N.W.2d 828 (1966); *State v. Fields*, 434 S.W.2d 507 (Mo. 1968); *Henson v. State*, 159 Tex. Crim. 647, 266 S.W.2d 864 (1953).

216. Martin, *supra* note 17, at 1064.

217. See *Harris v. State*, 239 Ark. 771, 394 S.W.2d 135 (1965) cert. denied, 386 U.S. 964 (1967); *State v. Fields*, 434 S.W.2d 507 (Mo. 1968); *Commonwealth v. Westwood*, 324 Pa. 289, 188 A. 304 (1936). This is not evidence, however, that the *Frye* test worked. The first case applying *Frye* was decided in 1959, over twenty-five years after the paraffin test was first introduced and widely accepted. See A. Moenssens & F. Inbau, *supra* note 7, at 7 n.12.

The voiceprint cases offer another illustration. In the initial cases applying the *Frye* test, voiceprint evidence was excluded. See *People v. King*, 266 Cal. App. 2d 437, 72 Cal. Rptr. 478 (1968); *State v. Cary*, 49 N.J. 343, 230 A.2d 384 (1967), on remand, 99 N.J. Super. 323, 239 A.2d 680 (Law Div. 1968), remanded again, 53 N.J. 256, 250 A.2d 15 (1969), *aff'd*, 56 N.J. 16, 264 A.2d 209 (1970). But see *United States v. Wright*, 17 C.M.A. 183, 37 C.M.R. 447 (1967) (voiceprints admitted; *Frye* test not applied). Then, Dr. Oscar Tosi completed his two-year study of voiceprints at Michigan State University. See Law Enforcement Assistance Administration, Voice Identification Research (1972); Tosi, Oyer, Lashbrook, Pedrey, Nicol & Nash, Experiment on Voice Identification, 51 J. Acoust. Soc'y Am. 2030 (1972). Even though the results of this study were favorable, many questions were left unanswered. Nevertheless, courts began to admit voiceprint evidence, finding general acceptance had been achieved as a result of the Tosi study. See *Hodo v. Superior Court*, 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973); *United States v. Brown*, 13 Crim. L. Rep. (BNA) 2203 (D.C. Super. Ct. 1973), *aff'd* on other grounds, 384 A.2d 647 (D.C. 1978); *Commonwealth v. Lykus*, 367 Mass. 191, 327 N.E.2d 671 (1975). These courts were unwilling to pay the price demanded by *Frye*—waiting for the reaction of the scientific community to the Tosi study. See, e.g., *Commonwealth v. Lykus*, 367 Mass. 191, 208, 327 N.E.2d 671, 680 (1975) (Kaplan, J., dissenting) (The "scientific community had not had sufficient time to study Dr. Tosi's work . . . ."). The National Academy of Sciences report demonstrates that general acceptance of voiceprints in the scientific community remains a debatable issue. National Academy of Sciences, *supra* note 2, at 2.

### C. Obscuring Issues

Perhaps the most important flaw in the *Frye* test is that by focusing attention on the general acceptance issue, the test obscures critical problems in the use of a particular technique. Cases considering the admissibility of neutron activation analysis (NAA) illustrate this point.<sup>218</sup> Under the *Frye* test courts have concentrated primarily on the general acceptance of NAA.<sup>219</sup> This approach tends to conceal the most critical aspect of NAA—whether, as interpreted, the results of the test are relevant to the issues in dispute.<sup>220</sup>

For example, in the detection of gunshot residues, activation analysis is used to discover the presence and quantity of the elements antimony and barium on the hand of a person suspected of discharging a firearm. These elements are the primer constituents of most American-manufactured ammunition, and their presence in certain concentrations is indicative of the recent firing of a weapon.<sup>221</sup> In *State v. Spencer*<sup>222</sup> a government expert testified that NAA revealed the presence of 1.67 micrograms of barium and 1.33 micrograms of antimony on the defendant's hand, thus conclusively establishing, in the expert's opinion, that the defendant recently had fired a gun.<sup>223</sup>

The presence and quantity of antimony and barium, however, have no probative value unless the detected amounts differ from normal concentrations of these elements in the general population.<sup>224</sup> The relevancy of this type of information, therefore, depends on the validity of background studies of the general population and the proper correlation of these studies with the data derived from the analysis in a particular case. Similarly, if NAA is used for comparative purposes, such as hair analysis, the matching of certain elements, both qualitatively and quantitatively, in two samples becomes relevant only if the detected distribution differs from hair samples in the general population.<sup>225</sup> In short, NAA involves problems of statistical probability.<sup>226</sup> Instead of concentrating on whether NAA has been generally accepted, the courts should have been concerned with the statistical foundation on which NAA evidence rests. If this had

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218. For a discussion of the NAA, see A. Moenssens & F. Inbau, *supra* note 7, at 441-46; Comment, *The Evidentiary Uses of Neutron Activation Analysis*, *supra* note 1, at 997-1080.

219. See *United States v. Stifel*, 433 F.2d 431 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971); *State v. Coolidge*, 109 N.H. 403, 260 A.2d 547 (1969), rev'd on other grounds, 403 U.S. 443 (1971).

220. See Comment, *The Evidentiary Uses of Neutron Activation Analysis*, *supra* note 1, at 998 ("[M]ost of the legal problems surrounding NAA do not involve its validity as a technique of chemical analysis. Rather, *interpretation* of the results of the chemical analysis—the relevance of the results to a particular legal issue—causes most of the difficulties."). See also 1 D. Louisell & C. Mueller, *supra* note 59, at 848-49.

221. See Ruch, Buchanan, Guinn, Bellanca & Pinker, *Neutron Activation Analysis in Scientific Crime Detection—Some Recent Developments*, 9 J. Forensic Sci. 119, 129-31 (1964).

222. 298 Minn. 456, 216 N.W.2d 131 (1974).

223. *Id.* at 459, 216 N.W.2d at 134.

224. Comment, *The Evidentiary Uses of Neutron Activation Analysis*, *supra* note 1, at 1074-78.

225. *Id.* at 1013-14.

226. See Broun & Kelly, *Playing the Percentages and the Law of Evidence*, 1970 U. Ill. L.F. 23, 46-47; Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 Harv. L. Rev. 1329, 1342 n.40 (1971); Comment, *The Evidentiary Uses of Neutron Activation Analysis*, *supra* note 1, at 1013-14.

been the courts' focus, they would have better understood the misleading nature of testimony that two hair samples subject to NAA "were all from the same source, that is, the same person."<sup>227</sup>

The paraffin test cases offer another illustration. This test is used to detect the presence of nitrite and nitrate residues, which, due to the backblast of gases that escape through crevices in the weapon, may be deposited on the hand of a person firing a gun. The residues are removed by means of a paraffin cast and, when tested with a reagent, produce a color reaction. The problem with the test is its nonspecificity; a significant number of substances other than gunpowder residues contain nitrates and nitrites and therefore also produce a positive reaction. For example, one study concluded that a positive reaction is produced by "'rust,' colored fingernail polishes, residue from evaporated urine, soap and tap water";<sup>228</sup> another study found that "[t]obacco or tobacco ash, fertilizer, pharmaceuticals, leguminous plants, urine"<sup>229</sup> all produce a reaction. In considering the admissibility of the paraffin test, a court applying the *Frye* test would, of course, focus on the general acceptance of the test. This approach tends to mask several problems. First, neither the cases nor the literature disclose why the reaction occurs. This suggests that the test may have been validated empirically. If this is so, studies testing a large number of substances must be conducted in order to validate the test. Even if the reaction were understood, it should have been clear that the test was specific for nitrates and nitrites, but not necessarily for gunshot residues. Again, extensive testing of other substances should have been conducted. These problems should have been a prime concern of the courts that initially considered the admissibility of the test. Second, once it was established that many common substances produce a positive reaction, the probative value of the evidence would have become marginal at best and could have been excluded on this basis. If, however, a positive reaction to the test is accompanied by microscopic identification of gunpowder particles, the problem of nonspecificity is overcome<sup>230</sup> and consequently, the argument for admission becomes more persuasive. Finally, by the 1960's the application of neutron activation, a method far superior to the paraffin test for detecting gunshot residues,

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227. *State v. Stevens*, 467 S.W.2d 10, 22 (Mo.), cert. denied, 404 U.S. 994 (1971). See also *United States v. Stifel*, 433 F.2d 431, 436 (6th Cir. 1970) (samples "were 'of the same type and same manufacture'"), cert. denied, 401 U.S. 994 (1971); *People v. Collins*, 43 Mich. App. 259, 264, 204 N.W.2d 290, 293 (1972) (hair samples "came from the same source"), app. dismissed, 391 Mich. 798, cert. denied, 419 U.S. 866 (1974); *State v. Stout*, 478 S.W.2d 368, 368 (Mo. 1972) (blood analysis revealed "match of the materials"); *State v. Coolidge*, 109 N.H. 403, 421, 260 A.2d 547, 560 (1969) (samples had "common origin or source"), rev'd on other grounds, 403 U.S. 443 (1971); *State v. Krummacher*, 269 Ore. 125, 132, 523 P.2d 1009, 1012 (1974) ("same batch"); *Ward v. State*, 427 S.W.2d 876, 884 (Tex. Crim. App. 1968) (hair samples "were identical and probably came from the same person"); Comment, *The Evidentiary Uses of Neutron Activation Analysis*, *supra* note 1, at 1024.

228. Cowan & Purdon, *supra* note 213, at 23.

229. Turkel & Lipman, *supra* note 211, at 282.

230. Two of the cases admitting paraffin test results include this type of evidence. See *State v. Fields*, 434 S.W.2d 507 (Mo. 1968); *Commonwealth v. Westwood*, 324 Pa. 289, 188 A. 304 (1936).



was recognized.<sup>231</sup> The availability of such an alternative method should play a role in the admissibility decision, but concentrating on the general acceptance issue does not adequately take this factor into account.

#### D. Current Status of the Frye Test.

The current status of the *Frye* test is difficult to assess. While some courts have rejected the general acceptance standard,<sup>232</sup> there remains considerable support for the *Frye* test.<sup>233</sup> However, there are, in fact, several *Frye* tests, not one. Some courts, such as the D.C. Circuit, have applied a strict interpretation of *Frye*.<sup>234</sup> Other courts have followed *People v. Williams*,<sup>235</sup> limiting the field to those experts who are familiar with the use of a particular scientific process.<sup>236</sup> *Williams*, in turn, has been applied in different ways.<sup>237</sup> Still other courts, while citing *Frye*, "seem tacitly to have ignored it."<sup>238</sup> Moreover, the selective application of the test has added another element of confusion.<sup>239</sup> In sum, *Frye* may be tottering, but has not yet fallen.

The adoption of the Federal Rules of Evidence<sup>240</sup> has not resolved the uncertain status of the *Frye* test. Indeed, the Federal Rules, which became effective in 1975 and have been adopted in various forms in twenty-two jurisdictions,<sup>241</sup>

231. See Watkins & Watkins; Identification of Substances by Neutron Activation Analysis, 15 Am. Jur. Proof of Facts 115 (1964); Midkiff, *supra* note 214, at 79; Ruch, Guinn, Buchanan, Bellanca & Pinker, *supra* note 221, at 129-31. The first reported case admitting NAA of gunshot residues was *People v. Pieropan*, 72 Misc. 2d 770, 340 N.Y.S.2d 31 (Oneida County Ct. 1973).

In addition, in 1959 Harrison and Gilroy proposed a method of detection that was more reliable than the paraffin test. See Harrison & Gilroy, Firearms Discharge Residues, 4 J. Forensic Sci. 184 (1959). This test apparently was not widely adopted because of its lack of sensitivity. See Pillay, New Method for the Collection and Analysis of Gunshot Residues as Forensic Evidence, 19 J. Forensic Sci. 769 (1974). See also *State v. Smith*, 50 Ohio App. 2d 183, 362 N.E.2d 1239 (1976) (modified Harrison-Gilroy test excluded); *Commonwealth v. Farrior*, 446 Pa. 31, 284 A.2d 684 (1971) (admissibility of Harrison-Gilroy test upheld; however, court apparently believed it was dealing with the paraffin test).

232. E.g., *United States v. Baller*, 519 F.2d 463 (4th Cir.), cert. denied, 423 U.S. 1019 (1975); *State v. Williams*, 388 A.2d 500 (Me. 1978); *State v. Dorsey*, 88 N.M. 184, 539 P.2d 204 (1975).

233. Several state supreme courts and several federal courts of appeals have applied *Frye* in recent cases. See *United States v. Brady*, 595 F.2d 359 (6th Cir. 1979); *United States v. Alexander*, 526 F.2d 161, 163 & n.3 (8th Cir. 1975); *United States v. Addison*, 498 F.2d 741 (D.C. Cir. 1974); *People v. Kelly*, 17 Cal. 3d 24, 549 P.2d 1240, 130 Cal. Rptr. 144 (1976); *Reed v. State*, 283 Md. 374, 391 A.2d 364 (1978); *People v. Tobey*, 401 Mich. 141, 257 N.W.2d 537 (1977); *Commonwealth v. Topa*, 471 Pa. 223, 369 A.2d 1277 (1977).

234. E.g., *United States v. Addison*, 498 F.2d 741 (D.C. Cir. 1974). See also *People v. Kelly*, 17 Cal. 3d 24, 549 P.2d 1240, 130 Cal. Rptr. 144 (1976).

235. 164 Cal. App. 2d Supp. 858, 331 P.2d 251 (App. Dep't Super. Ct. 1958).

236. See text accompanying notes 77-84 *supra*.

237. See text accompanying notes 85-90 *supra*.

238. C. McCormick, *supra* note 23, at 490.

239. See text accompanying notes 159-86 *supra*.

240. Act of Jan. 2, 1975, Pub. L. No. 93-595, 88 Stat. 1926 (codified at 28 U.S.C. app. (1976)).

241. The following jurisdictions have adopted variations of the Federal Rules of Evidence: Alaska, Arizona, Arkansas, Colorado, Delaware, Florida, Maine, Michigan, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oklahoma, Puerto Rico, South Dakota, Washington, Wisconsin, and Wyoming. The Military Rules of Evidence also are patterned after the Federal Rules. Other states, including Hawaii, Massachusetts, New York, Pennsylvania, Texas and Vermont are considering adoption.

have contributed to the confusion. Although the federal courts generally followed the *Frye* standard prior to the adoption of the Federal Rules,<sup>242</sup> the Rules are silent on whether the general acceptance standard has been superseded.<sup>243</sup> The issue is simply ignored in the Advisory Committee's Notes,<sup>244</sup> congressional committee reports,<sup>245</sup> floor debates, and hearings.<sup>246</sup> Some courts<sup>247</sup> and commentators<sup>248</sup> assume that *Frye* remains the applicable standard, while others reject this view.<sup>249</sup>

Those who argue that the *Frye* test survived the enactment of the Federal Rules have some support in the legislative history. Because the Federal Rules were not intended to be a comprehensive codification of the rules of evidence,<sup>250</sup> a number of evidentiary rules are not covered,<sup>251</sup> and many others, though mentioned, are treated only in a general fashion. Therefore, it can be argued that because *Frye* was the established rule and no statement repudiating *Frye* appears in the legislative history, the general acceptance standard remains intact.<sup>252</sup>

242. See *United States v. Alexander*, 526 F.2d 161, 163 n.3 (8th Cir. 1975). See also *United States v. Addison*, 498 F.2d 741 (D.C. Cir. 1974); *United States v. Stifel*, 433 F.2d 431 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971).

243. Rule 401, which defines relevant evidence, and Rules 702-703, which govern expert testimony, are the pertinent provisions.

244. The Advisory Committee's Notes are found at 56 F.R.D. 183 (1973). For earlier drafts, see 51 F.R.D. 315 (1971); 46 F.R.D. 161 (1969).

245. See H.R. Rep. No. 650, 93d Cong., 1st Sess. (1973), reprinted in [1974] U.S. Code Cong. & Ad. News 7075; S. Rep. No. 1277, 93d Cong., 2d Sess., reprinted in [1974] U.S. Code Cong. & Ad. News 7051; H.R. Rep. No. 1597, 93d Cong., 2d Sess., reprinted in [1974] U.S. Code Cong. & Ad. News 7098 (conference report).

246. See Proposed Rules of Evidence: Hearings Before the Special Subcomm. on Reform of Federal Criminal Laws of the House Comm. on the Judiciary, 93d Cong., 1st Sess. (1973); Rules of Evidence: Hearings Before the Senate Comm. on the Judiciary, 93d Cong., 2d Sess. (1974).

247. See *United States v. Kilgus*, 571 F.2d 508, 510 (9th Cir. 1978); *United States v. Brown*, 557 F.2d 541, 556 (6th Cir. 1977); *United States v. McDaniel*, 538 F.2d 408, 412 (D.C. Cir. 1976); *United States v. Bowers*, 534 F.2d 186, 193 (9th Cir. 1976) (tool mark identification is a "generally accepted procedure"), cert. denied, 429 U.S. 942 (1976); *United States v. Alexander*, 526 F.2d 161 (8th Cir. 1975); *United States v. Addison*, 498 F.2d 741, 743 n.5 (D.C. Cir. 1974).

248. See 1 D. Louisell & C. Mueller, *supra* note 59, at 818 (*Frye* probably survives enactment of Federal Rules); P. Rothstein, *Rules of Evidence for the United States Courts and Magistrates* 268 (1978).

249. Two cases have held that state rules of evidence, patterned after the Federal Rules, displace *Frye*. *State v. Williams*, 388 A.2d 500 (Me. 1978); *State v. Dorsey*, 88 N.M. 184, 539 P.2d 204 (1975). See also *United States v. Williams*, 583 F.2d 1194 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979); *United States v. Bennett*, 539 F.2d 45, 53 (10th Cir. 1976); *United States v. Wilson*, 361 F. Supp. 510 (D. Md. 1973); *United States v. Ridling*, 350 F. Supp. 90 (E.D. Mich. 1972).

Commentators have also endorsed this view. See 22 C. Wright & K. Graham, *supra* note 46, at 92; Abbell, *Polygraph Evidence: The Case Against Admissibility in Federal Criminal Trials*, 15 Am. Crim. L. Rev. 29, 32 (1977); Berger, *Courts Wrestle with Standards for Admission of Scientific Advances*, Nat'l L.J., Sept. 24, 1979, at 22, col. 1; Romero, *The Admissibility of Scientific Evidence Under the New Mexico and Federal Rules of Evidence*, 6 N.M.L. Rev. 187 (1976); Comment, *Expert Testimony and Voice Spectrogram Analysis*, 1975 Wash. U.L.Q. 775, 782 n.27.

250. See E. Morgan, *Basic Problems of State and Federal Evidence* (5th ed. J. Weinstein 1976); S. Saltzburg & K. Redden, *Federal Rules of Evidence Manual* 735-44 (2d ed. 1977).

251. For example, impeachment by evidence of bias is not mentioned in the Rules.

252. See S. Saltzburg & K. Redden, *supra* note 250, at 426 ("It would be odd if the Advisory Committee and the Congress intended to overrule the vast majority of cases excluding such evidence as lie detectors without explicitly stating so."). These authors, however, also remark: "It is not clear whether Rule 703 is intended to codify the *Frye* test or whether it establishes a less demanding standard for scientific evidence." *Id.*

Those who argue that the Federal Rules repeal the *Frye* standard<sup>253</sup> focus on the language of the Rules. Rule 401 defines relevant evidence as "evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence."<sup>254</sup> Rule 402 mandates that "[a]ll relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by Act of Congress, by these rules, or by other rules prescribed by the Supreme Court pursuant to statutory authority."<sup>255</sup> Because scientific evidence could be shown to be reliable and thus relevant under Rule 401 without regard to its general acceptance in the scientific community, and because none of the exclusions enumerated in Rule 402 is applicable, the Federal Rules have provided a standard of admissibility inconsistent with *Frye*.<sup>256</sup> Although this argument has considerable merit, jurisdictions adopting the Uniform Rules of Evidence (1953), which contain a similar relevancy provision, have not accepted the argument.<sup>257</sup>

In addition, several constitutional principles raise questions about the continued validity of the general acceptance standard. The most important of these principles concerns a criminal defendant's right to present defense evidence.<sup>258</sup> The cases applying this principle have involved polygraph evidence, one of the few scientific techniques that tends to be offered by the defense. In *State v. Sims*<sup>259</sup> an Ohio trial court found an implied right to present defense evidence in the compulsory process guarantee, which, it concluded, compelled admission of

253. 22 C. Wright & K. Graham, *supra* note 46, at 92.

254. Fed. R. Evid. 401.

255. Fed. R. Evid. 402.

256. See *State v. Williams*, 388 A.2d 500, 503 (Me. 1978) ("The Maine Rules of Evidence [patterned after the Federal Rules] . . . do not purport to establish a special standard to govern the admissibility of testimony involving newly ascertained, or applied, scientific principles.").

257. Uniform Rule 1(2) provides: "'Relevant evidence' means evidence having any tendency in reason to prove any material fact." California and New Jersey have adopted rules of evidence based on the Uniform Rules, but nevertheless apply the *Frye* standard. See *People v. Kelly*, 17 Cal. 3d 24, 549 P.2d 1240, 130 Cal. Rptr. 144 (1976); *State v. Cary*, 99 N.J. Super. 323, 239 A.2d 680 (Law Div. 1968), *aff'd*, 56 N.J. 16, 264 A.2d 209 (1970). See also *Jones*, *supra* note 68, at 571-72.

Even if a court found that Congress did not intend to overrule *Frye* by enacting the Federal Rules, the tension between *Frye* and the Federal Rules should, at the very least, cause judicial reevaluation of the general acceptance standard. Since *Frye* is a judicial creation and there is no evidence Congress intended to retain it, it could be overruled by the courts.

258. In addition to the cases involving a defendant's right to present defense evidence, several cases have ruled polygraph evidence admissible on other grounds. In *United States v. Hart*, 344 F. Supp. 522 (E.D.N.Y. 1971), the court ruled that the results of a polygraph examination of a government witness, which indicated deception, was admissible under *Brady v. Maryland*, 373 U.S. 83 (1963). The court interpreted *Brady* as requiring the disclosure of "any evidence which may tend to exculpate a defendant." 344 F. Supp. at 523. Since the government initially thought the polygraph sufficiently reliable to conduct an examination, it had the burden, according to the court, of explaining why the test results should be excluded at trial. *Hart* was followed in *State v. Christopher*, 134 N.J. Super. 263, 339 A.2d 239 (Law Div. 1975), *rev'd*, 149 N.J. Super. 269, 373 A.2d 705 (App. Div. 1977). New Jersey also follows the general acceptance standard. See *State v. Cary*, 99 N.J. Super. 323, 239 A.2d 680 (Law Div. 1968), *aff'd*, 56 N.J. 16, 264 A.2d 209 (1970). But see *State v. Young*, 89 Wash. 2d 613, 574 P.2d 1171, *cert. denied*, 439 U.S. 870 (1978) (rejecting the *Brady* argument).

259. 52 Ohio Misc. 31, 369 N.E.2d 24 (C.P. 1977). Ohio apparently adheres to the general acceptance standard. See *State v. Olderman*, 44 Ohio App. 2d 130, 336 N.E.2d 442 (1975).

defense polygraph evidence.<sup>260</sup> In *State v. Dorsey*<sup>261</sup> a New Mexico appellate court upheld the admissibility of a defense-offered polygraph examination on due process grounds. The court based its decision on *Chambers v. Mississippi*,<sup>262</sup> in which the Supreme Court held that a state's evidentiary rules precluding the admission of critical and reliable defense evidence denied the defendant due process under the circumstances of that case. Although the Court subsequently applied *Chambers* in *Green v. Georgia*,<sup>263</sup> it did not there clarify further the reliability requirement. Nevertheless, it may be that the *Chambers* reliability standard differs from the general acceptance standard, in which case the *Frye* test may be unconstitutional as applied to evidence offered by a criminal defendant.<sup>264</sup>

Because of the problems outlined above, it is likely that more courts will consider jettisoning the *Frye* standard. Rejecting this test, however, would require the adoption of a different approach to the admissibility of novel scientific techniques. Some commentators have suggested a radical approach; others have advocated a return to a more traditional mode of analysis. The following sections investigate these alternatives.

### III. THE RADICAL APPROACH: INDEPENDENT COMMISSIONS AND TRIBUNALS

Several judges and commentators have advocated the creation of independent bodies of experts who would be called upon to review novel scientific techniques before they could be used in court. This, of course, represents a radical departure from present practice. The specifics of the various proposals differ in many significant respects. For example, Judge Kaplan sought the establishment of ad hoc commissions to advise the Supreme Judicial Court of Massachusetts on the validity of polygraph<sup>265</sup> and voiceprint evidence.<sup>266</sup> Maletskos

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260. The *Sims* rationale finds some support in *Washington v. Texas*, 388 U.S. 14 (1967), in which the Supreme Court, after holding that the compulsory process clause was binding upon the states, stated: "The right to offer the testimony of witnesses, and to compel their attendance, if necessary, is in plain terms the right to present a defense . . ." *Id.* at 19.

261. 87 N.M. 323, 532 P.2d 912 (Ct. App.), *aff'd*, 88 N.M. 184, 539 P.2d 204 (1975). But see *United States v. Cavell*, 156 F. Supp. 79, 81 (W.D. Pa. 1957); *State v. Treadaway*, 116 Ariz. 163, 568 P.2d 1061 (1977); *State v. Conner*, 241 N.W.2d 447 (Iowa 1976); *State v. Maynard*, 232 N.W.2d 265 (Iowa 1975).

262. 410 U.S. 284 (1973).

263. 442 U.S. 95 (1979). In *Masri v. United States*, 434 U.S. 907 (1977), the Supreme Court denied certiorari, over the dissents of Justices White and Marshall, in a case in which the admissibility of polygraph evidence was in issue.

264. See generally Westen, *The Compulsory Process Clause*, 73 Mich. L. Rev. 73, 149-59 (1974); Clinton, *The Right to Present a Defense: An Emergent Constitutional Guarantee in Criminal Trials*, 9 Ind. L. Rev. 711, 810-15 (1976); Note, *Compulsory Process and Polygraph Evidence: Does Exclusion Violate a Criminal Defendant's Due Process Rights?*, 12 Conn. L. Rev. 324 (1980); Note, *Admission of Polygraph Results: A Due Process Perspective*, 55 Ind. L.J. 157 (1979).

265. *Commonwealth v. A Juvenile*, 365 Mass. 421, 452, 313 N.E.2d 120, 139 (1974) (dissenting opinion). See also dissenting opinion of Justice Quirico. *Id.* at 444, 313 N.E.2d at 134.

266. *Commonwealth v. Lykus*, 367 Mass. 191, 212-13, 327 N.E.2d 671, 683 (1975) (dissenting opinion).

and Spielman proposed a "body or board . . . to determine whether or not the scientific innovation . . . meets minimum, specified performance criteria and/or has scientific acceptability."<sup>267</sup> Under this approach certification by an independent expert tribunal would be a prerequisite to admissibility.<sup>268</sup> The proposed "Science Court" also could be used for this purpose.<sup>269</sup>

These proposals have several advantages over both the *Frye* and relevancy approaches. First, as under *Frye*, the initial screening function would be performed by a group of scientists. In contrast to *Frye*, however, evaluation would be organized, rather than haphazard. The *Frye* standard assumes that experts will adequately review each novel technique. Judicial experience with the paraffin test casts doubt on this assumption.<sup>270</sup> Second, evaluation would be conducted by scientists without a financial or professional interest in the technique, thus obviating the problem of partiality that has surfaced on a number of occasions.<sup>271</sup> Third, such a tribunal could suggest areas of further research. A technique that has demonstrated potential but has not yet been sufficiently validated would not receive an unqualified veto, which might stifle future development and research.

Unfortunately, none of these proposals ever has been adopted. Nevertheless, the National Academy of Sciences' involvement in the voiceprint controversy represents an instructive development.<sup>272</sup> The FBI requested the Academy to review voiceprints<sup>273</sup> and presumably funded the evaluation. In effect, an independent commission of experts has evaluated that technique. The LEAA can be criticized for failing to establish such an evaluative process as part of its procedures. Voiceprint<sup>274</sup> and trace metal detection<sup>275</sup> research projects were sponsored by the LEAA, but no independent evaluations of the studies were required.

#### IV. THE TRADITIONAL ANALYSIS: THE RELEVANCY APPROACH

Perhaps because the relevancy approach is viewed as a return to traditional analysis, it has received relatively little scrutiny. The emerging dissatisfaction

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267. Maletskos & Spielman, *supra* note 80, at 962. See also Note, The Admissibility of Bite Mark Evidence, *supra* note 6, at 331 (proposing a "review committee of forensic odontologists" in bitemark cases).

268. Maletskos & Spielman, *supra* note 80, at 962.

269. See Martin, The Proposed "Science Court," 75 Mich. L. Rev. 1058 (1977); Task Force of the Presidential Advisory Group on Anticipated Advances in Science and Technology, The Science Court Experiment: An Interim Report, 193 Sci. 653 (1976); Kantrowitz, The Science Court Experiment, 13 Trial 48 (March 1977); Boffey, Experiment Planned to Test Feasibility of A "Science Court," 193 Sci. 129 (1976); Kantrowitz, Controlling Technology Democratically, 1975 Am. Scientist 505; Boffey, Science Court: High Officials Back Test of Controversial Concept, 194 Sci. 167 (1976).

270. See text accompanying notes 207-17 *supra*.

271. See text accompanying notes 129-35 *supra*.

272. See National Academy of Sciences, *supra* note 2.

273. *Id.*, Preface at vii.

274. See note 12 *supra*.

275. See note 12 *supra*.

with *Frye* and its possible rejection by the Federal Rules mandate a reexamination of this approach.<sup>276</sup>

A. *McCormick's View*: *Coppolino v. State*

The relevancy approach is often associated with Professor McCormick and *Coppolino v. State*.<sup>277</sup> The precise formulation of McCormick's view, however, is difficult to discern, and *Coppolino* is even more confusing.

In his 1954 text on evidence, McCormick wrote:

"General scientific acceptance" is a proper condition upon the court's taking judicial notice of scientific facts, but not a criterion for the admissibility of scientific evidence. Any relevant conclusions which are supported by a qualified expert witness should be received unless there are other reasons for exclusion. Particularly, its probative value may be overborne by the familiar dangers of prejudicing or misleading the jury, unfair surprise and undue consumption of time.<sup>278</sup>

This formulation has generated some confusion. Several courts have concluded that under the McCormick view, lack of general acceptance plays no part in the trial judge's determination of admissibility. Thus, in *Reed v. State*<sup>279</sup> the court stated: "McCormick . . . believes that disagreement in the scientific community regarding the reliability of a scientific process should go to the weight rather than the admissibility of scientific evidence."<sup>280</sup> The case cited by McCormick in support of his position, *McKay v. State*,<sup>281</sup> would seem to confirm this interpretation. Nevertheless, immediately following the above quoted passage McCormick wrote: "On this footing the novelty and want of acceptance [at the time *Frye* was decided] of the lie-detector lessened the probative value of

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276. Cases following this approach include *United States v. Baller*, 519 F.2d 463 (4th Cir.), cert. denied, 423 U.S. 1019 (1975); *United States v. Sample*, 378 F. Supp. 44 (E. D. Pa. 1974); *United States v. Wilson*, 361 F. Supp. 510 (D. Md. 1973); *United States v. Ridling*, 350 F. Supp. 90 (E.D. Mich. 1972). See also *State v. Olivas*, 77 Ariz. 118, 267 P.2d 893 (1954); *People v. Bobczyk*, 343 Ill. App. 504, 99 N.E.2d 567 (1951); *City of Abilene v. Hall*, 202 Kan. 636, 451 P.2d 188 (1969); *McKay v. State*, 155 Tex. Crim. 416, 235 S.W.2d 173 (1950); 1 D. Louisell & C. Mueller, *supra* note 59, at 825-26.

277. 223 So. 2d 68 (Fla. Dist. Ct. App. 1968), appeal dismissed, 234 So. 2d 120 (Fla. 1969), cert. denied, 399 U.S. 927 (1970).

278. C. McCormick, *Evidence* 363-64 (1954) (footnote omitted).

279. 283 Md. 374, 391 A.2d 364 (1978).

280. *Id.* at 386-87, 391 A.2d at 370-71; accord, *Commonwealth v. Lykus*, 367 Mass. 191, 204, 327 N.E.2d 671, 678 (1975) (stating McCormick's view as urging "that the opinions of a qualified expert should be received and that the considerations similar to those expressed in the *Frye* [case] . . . should be for the fact finder as to weight and value of the opinions."). See also *United States v. Baller*, 519 F.2d 463, 466 (4th Cir.), cert. denied, 423 U.S. 1019 (1975); *United States v. DeBetham*, 348 F. Supp. 1377, 1383-84 (S.D. Cal.), *aff'd*, 470 F.2d 1367 (9th Cir. 1972), cert. denied, 412 U.S. 907 (1973).

281. 155 Tex. Crim. 416, 421, 235 S.W.2d 173, 175 (1950) ("Dr. Beerstecher testified that the [Harger Drunkometer] is accurate and he gave his reasons for it. He admitted that there are others who disagree with its accuracy. The objection to his testimony, therefore, goes to its weight and not to its admissibility.").

the test and probably heightened the danger of misleading the jury."<sup>282</sup> This passage suggests that novelty and want of general acceptance are integral parts of the relevancy analysis. In short, the admissibility of the evidence, not just its weight, is affected by lack of general acceptance.

An even more puzzling statement appears in a later section of McCormick's chapter on scientific evidence. In discussing the polygraph, McCormick refers to his original comments on the general acceptance test and then observes: "If we thus deflate the requirement [of general acceptance] to the normal standard which simply demands that the theory or device be *accepted by a substantial body of scientific opinion*, there can be little doubt that the lie-detector technique meets this requirement."<sup>283</sup> This passage seems to propose a "substantial acceptance" standard, an approach markedly different from the relevancy analysis. Indeed, a substantial acceptance standard would seem to come close to the *Frye* general acceptance standard, requiring the court to identify the field or profession in which the technique belongs and then to determine whether substantial acceptance has been achieved in that field.<sup>284</sup>

The leading case said to espouse the McCormick view, *Coppolino v. State*,<sup>285</sup> does not resolve these ambiguities. In that case the prosecution was allowed to introduce the results of a test that had not been accepted by the scientific community because it was developed specifically for the *Coppolino* trial.<sup>286</sup> Although the appellate court cited *Frye*, it nevertheless upheld the ad-

282. C. McCormick, *supra* note 278, at 364 (emphasis added). This passage was deleted from the second edition of McCormick. See C. McCormick, *Evidence* 491 (2d ed. 1972).

283. C. McCormick, *supra* note 278, at 371-72 (emphasis added). This passage was also deleted from the second edition of McCormick. See C. McCormick, *Evidence* 506-07 (2d ed. 1972).

284. McCormick's other works on expert testimony and scientific evidence do not resolve these difficulties. See McCormick, *Deception-Tests and the Law of Evidence*, 15 Calif. L. Rev. 484, 499 (1927) (mentioning *Frye* but not in a critical manner); McCormick, *Law and the Future: Evidence*, 51 Nw. L. Rev. 218, 224 (1956) (citing *McKay*); McCormick, *Science, Experts and the Courts*, 29 Tex. L. Rev. 611 (1951); McCormick, *Some Observations Upon the Opinion Rule and Expert Testimony*, 23 Tex. L. Rev. 109 (1945).

Dean Wigmore seems to have advocated a similar standard. See 3A J. Wigmore, *Evidence* § 990, at 922 (Chadbourn rev. 1970) ("All that should be required as a condition is the preliminary testimony of a scientist that the proposed test is an accepted one in his profession and that it has a reasonable measure of precision in its indications.") (psychological evidence); 3 J. Wigmore, *Evidence* § 795, at 245 (x-ray instrument accepted by profession); 2 J. Wigmore, *Evidence* § 659, at 771 (3d. ed. 1940) (accepted in branch of learning); J. Wigmore, *The Science of Judicial Proof* 450 (3d ed. 1937) ("The type of apparatus purporting to be constructed on scientific principles must be accepted as dependable for the proposed purpose by the profession concerned in that branch of science or its related art.").

285. 223 So. 2d 68 (Fla. Dist. Ct. App. 1968), appeal dismissed, 234 So. 2d 120 (Fla. 1969), cert. denied, 399 U.S. 927 (1970). See generally F. Bailey, *The Defense Never Rests* 224-28 (1971). The validity of the evidence introduced in *Coppolino* is still the source of controversy. Newsweek reported that evidence favorable to the defense concerning the tests in *Coppolino* was allegedly suppressed. Newsweek, May 7, 1979, at 16.

The second edition of McCormick's work cites *Coppolino* as the approach "which should be followed in respect to expert testimony and scientific evidence generally." C. McCormick, *supra* note 23, at 491. See also *United States v. Baller*, 519 F.2d 463 (4th Cir.) (citing McCormick and *Coppolino*), cert. denied, 423 U.S. 1019 (1975); A. Moenssens & F. Inbau, *supra* note 7 at 6-7; I. Louisell & C. Mueller, *supra* note 59, at 103; Strong, *supra* note 19, at 16.

286. The prosecution attempted to prove that the defendant had murdered his wife by administering a fatal dose of succinylcholine chloride. At the time of trial the medical profession had not

missibility of the evidence on the ground that the trial judge did not abuse his discretion.<sup>287</sup> *Coppolino* thus ignores rather than rejects *Frye*. More importantly, it neither endorses the McCormick approach nor offers any alternative standard; it merely recognizes trial judge discretion.

### B. The Federal Rules of Evidence

In contrast to *Coppolino*, the Federal Rules of Evidence map out the steps involved in applying the relevancy analysis. Assuming that the Federal Rules were intended to reject *Frye*,<sup>288</sup> the admissibility of a novel scientific technique would depend on a three-step process: first, the probative value of the evidence would be determined; second, dangers such as the potential of the evidence to mislead the jury would be identified; and third, the probative value would be balanced against the identified dangers. The next section demonstrates the problems posed by these threshold requirements and explains why the safeguards of the adversarial system are insufficient to overcome them.

#### 1. Threshold Requirements

a. *Probative Value*. The first step requires an assessment of the probative value of the proffered evidence. Federal Rule 401 defines relevant evidence as "evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence."<sup>289</sup> Since the "law furnishes no test of relevancy,"<sup>290</sup> the judge must rely on "logic"<sup>291</sup> and "experience to evaluate the probabilities on which relevancy turns."<sup>292</sup> The probative value of scientific evidence, however, is connected inextricably to its reliability;<sup>293</sup> if the technique is not reliable, evidence derived from the technique is not relevant.<sup>294</sup> Because the judge in most cases cannot resort to logic and experience to evaluate the probative value of a novel technique, he must turn to science. The Advisory

recognized a method for detecting succinylcholine chloride or its derivatives in human tissues. 223 So. 2d at 70, 75.

287. *Id.* at 70.

288. See text accompanying notes 240-57 *supra*.

289. Fed. R. Evid. 401.

290. J. Thayer, *A Preliminary Treatise on Evidence at the Common Law* 265 (1898).

291. See Comment, *Uniform Rule of Evidence* 1(2) (1953) ("The only test of relevancy is logic.") See also J. Thayer, *supra* note 290, at 265.

292. 1 J. Weinstein & M. Berger, *supra* note 28, at 401-07. See also *United States v. Williams*, 545 F.2d 47, 50 (8th Cir. 1976); James, *Relevancy, Probability and the Law*, 29 Calif. L. Rev. 689, 696 n.15, 704 (1941); Korn, *supra* note 17, at 1110-11.

293. See *United States v. Ridling*, 350 F. Supp. 90, 94-95 (E.D. Mich. 1972) ("The acceptance of the basic theory [of the polygraph] is a part of the process of making the evidence relevant."); *United States v. DeBetham*, 348 F. Supp. 1377, 1384 (S. D. Cal.), *aff'd*, 470 F.2d 1367 (9th Cir. 1972), cert. denied, 412 U.S. 907 (1973); *State v. Williams*, 388 A.2d 500 (Me. 1978); Boyce, *Judicial Recognition of Scientific Evidence in Criminal Cases*, 8 Utah L. Rev. 313, 314 (1964); Jones, *supra* note 68, at 571, Strong, *supra* note 19, at 14.

Of course, the relevancy of all evidence is affected by its reliability. See note 379 *infra*.

294. See text accompanying notes 37-39 *supra*.



Committee's Note accompanying Federal Rule 401 specifically alludes to this possibility.<sup>295</sup>

If the technique has a "track record," then its acceptance by a profession would be circumstantial proof of its reliability.<sup>296</sup> This reasoning may explain McCormick's belief that lack of general acceptance affected probative value.<sup>297</sup> If the technique, as in *Coppolino*, has been applied for the first time in the very case in which the judge is asked to rule on its admissibility, the judge obviously cannot rely on the track record. However, if the judge does not have a scientific background to assist him, as is usually the case, on what does he rely? Professor Strong predicts that "in the case of scientific evidence the court will generally be forced to accept the probative value of the evidence as what a qualified expert testifies it to be."<sup>298</sup> Thus, probative value could be established by the assertions of one expert.<sup>299</sup> Furthermore, it is not enough for the judge to determine

295. In drafting the Federal Rules of Evidence, the Advisory Committee rejected the formulation of relevancy found in the Uniform Rules of Evidence (1953), because it overemphasized the "logical process" to the detriment of "experience or science." Advisory Committee's Note, Fed. R. Evid. 401. See also Uniform R. Evid. 1(2) (1953) (" 'Relevant evidence' means evidence having any tendency in reason to prove any material fact"); 1 J. Weinstein & M. Berger, *supra* note 28, at 401-28 to -29 ("In an earlier internal working draft of Rule 401, relevant evidence was defined in terms of 'evidence having any tendency on the basis of logic and experience or technical or other specialized knowledge . . . .'").

296. See Moenssens, *supra* note 43, at 18.

297. See text accompanying note 282 *supra*.

298. Strong, *supra* note 19, at 22 (emphasis added).

299. Like the *Frye* standard, the relevancy approach depends on the quality of expert testimony. See Strong, *supra* note 19, at 14-15. A court's failure to impose a demanding standard on the qualifications of experts, however, is more important under the relevancy approach, because the stringent requirements of *Frye* no longer provide a backstop to admissibility. As noted earlier, the trial judge is given considerable leeway in determining the qualifications of experts, and his decision will be reversed only for an abuse of discretion. See note 195 *supra*. Unfortunately, this means in many cases that the "standards applied are often quite loose." Korn, *supra* note 17, at 1084. For example, in *Reid v. State*, 267 Ind. 555, 372 N.E.2d 1149 (1978), evidence derived from the trace metal detection technique (TMDT) was admitted to show that a homicide defendant had recently held a metal object, possibly a handgun. The defendant challenged both the reliability of the technique and the qualifications of the government expert. The expert testified that

his knowledge concerning the TMDT came from a seminar presented by the manufacturer of the chemical solution, written instructions that accompanied the chemical and his personal experience in conducting such tests upon approximately fifteen occasions. He admitted that he had no understanding of the reason for the reaction that occurred when such test was administered.

*Id.* at 559, 372 N.E.2d at 1152. Nevertheless, the court found no error in the trial court's determination that the witness was qualified, a decision that, according to the court, is "generally left to the trial court's sound discretion." *Id.* at 560, 372 N.E.2d at 1152.

The cavalier attitude of the court in *Reid* is extremely troublesome. The court by its own admission believed it was confronting an issue of first impression—the first case upholding the admissibility of TMDT. No opposing experts were presented, and the prosecution's expert was, in fact, only a technician; he did not know why the reaction occurred and thus could not testify whether the same reaction could have resulted from objects other than a gun. Moreover, the court cited no articles or other publications to support its conclusions. Instead, the court offered a barren and unadorned conclusion: "[W]e believe[] [TMDT] is generally recognized as reliable." *Id.* at 559, 372 N.E.2d at 1152. See also *State v. Daniels*, 37 Ohio App. 2d 4, 305 N.E.2d 497 (1973). The court was apparently unaware that TMDT had been rejected previously in *People v. Lauro*, 91 Misc. 2d 706, 398 N.Y.S.2d 503 (Sup. Ct. 1977), because there was "absolutely no testimony before the court as to this test having been received in any court or in the literature of forensic science; nor is there any scientific data presented to show the reliability of this test." *Id.* at 712, 398 N.Y.S.2d at 507. A

that the evidence meets the minimum relevancy standard under Rule 401. Because the judge will be required, under Rule 403, to balance the probative value against any accompanying dangers, he must have some idea of the probative worth of the evidence. Thus, the process of evaluating the probative value of novel techniques presents a fundamental difficulty in the relevancy approach.

b. *Dangers*. The major danger of scientific evidence is its potential to mislead the jury;<sup>300</sup> an aura of scientific infallibility may shroud the evidence and thus lead the jury to accept it without critical scrutiny. Other factors, such as undue prejudice, confusion of issues, and waste of time, may be associated with scientific evidence, but often these factors overlap with the danger of misleading the jury or are of only secondary importance. Here, unlike the assessment of the probative value of novel scientific evidence, the trial judge appears to be on familiar turf;<sup>301</sup> evaluating the misleading aspects of evidence is a problem judges face in admitting or excluding nonscientific evidence. Thus, while "an exaggerated popular opinion of the accuracy of a particular technique [may make] its use prejudicial or likely to mislead the jury,"<sup>302</sup> a trial judge would be expected to understand this problem. Moreover, a judge would be expected to appreciate how a technique that involves the use of instrumentation might also overimpress a jury.<sup>303</sup> Similarly, some scientific techniques do not require the jury to rely totally on the expert's opinion. In admitting evidence of bitemark comparisons, one court observed: "[T]he basic data on which the experts based their conclusions were verifiable by the court" and thus the jury could arrive at its own evaluation independently.<sup>304</sup> In contrast, other techniques require almost total reliance on the expert.<sup>305</sup> The trial judge presumably would be capable of making such discriminations in considering a jury's ability to evaluate novel scientific techniques.

Nevertheless, determining the extent to which a jury will be misled involves, in many cases, an understanding of the limitations of a particular

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better approach to the qualification issue is found in *United States v. Ridling*, 350 F. Supp. 90 (E.D. Mich. 1972), in which the court, in admitting polygraph evidence, stated: "In this case it is not sufficient for a person to testify that he has the minimum qualifications of an expert and thus be allowed to testify." *Id.* at 96. The court used its power to appoint independent experts to control the quality of expert testimony.

300. See *United States v. Addison*, 498 F.2d 741, 744 (D.C. Cir. 1974) (scientific evidence may "assume a posture of mystic infallibility in the eyes of a jury of laymen."); *United States v. Wilson*, 361 F. Supp. 510, 513 (D. Md. 1973); *United States v. Ridling*, 350 F. Supp. 90, 95 (E.D. Mich. 1972); *People v. King*, 266 Cal. App. 2d 437, 461, 72 Cal. Rptr. 478, 493 (1968). See also I J. Weinstein & M. Berger, *supra* note 28, at 403-27; 22 C. Wright & K. Graham, *supra* note 46, § 5217, at 295.

301. See Strong, *supra* note 19, at 22.

302. *United States v. Baller*, 519 F.2d 463, 466 (4th Cir.), cert. denied, 423 U.S. 1019 (1975).

303. See Strong, *supra* note 19, at 13.

304. *People v. Marx*, 54 Cal. App. 3d 100, 111, 126 Cal. Rptr. 350, 356 (1975) (relying on independent judgment of trier of fact). See also Comment, *supra* note 3, at 402 ("The procedures used in statistical analysis of style are not so alien to the layman as are the processes involved in other scientific fields.").

305. *People v. Marx*, 54 Cal. App. 3d 100, 110, 126 Cal. Rptr. 350, 356 (1975) ("[T]he trier of fact is required to rely on the testimony of the polygrapher, verified at most by marks on a graph, to which the expert's hypothesis gives some relevant meaning. Similar total reliance on the expert's assumptions is required for voice spectrogram.").

technique. This in turn requires knowledge of the technique, and again makes the court dependent upon the expert's assertions. Overstatements by experts about the conclusions that can be drawn from various scientific techniques are not uncommon. For example, neutron activation analysis has been characterized as being "as infallible as . . . fingerprints."<sup>306</sup> Similarly, unqualified assertions have been made for bitemark<sup>307</sup> and voiceprint evidence.<sup>308</sup> Indeed, the term "voiceprint" has been criticized for drawing an unwarranted analogy between voice spectrographic analysis and fingerprint identification.<sup>309</sup>

Of course, if the trial judge is knowledgeable about the technique, this problem can be solved by exercising a tighter rein on the expert's testimony. If, however, the judge is not knowledgeable—if he does not know, for example, that activation analysis and voiceprint identifications are markedly different from fingerprints—he cannot appreciate the extent to which the jury is being misled. One solution emphasized by some courts is to require a cautionary instruction.<sup>310</sup> Again, however, lack of knowledge limits the efficacy of this device. Without scientific knowledge, only a general cautionary instruction can be given. While such an instruction may be helpful in alerting the jury to the importance of evaluating the reliability of the technique, it "fails to assist the jurors in [that] task."<sup>311</sup>

306. *State v. Coolidge*, 109 N.H. 403, 420, 260 A.2d 547, 560 (1969), rev'd on other grounds, 403 U.S. 443 (1971). But see Comment, *The Evidentiary Uses of Neutron Activation Analysis*, supra note 1, at 1029 (The comparison with fingerprints "can be quite misleading."). In upholding the admission of evidence of a gunshot residue test based upon neutron activation analysis, the Minnesota Supreme Court remarked:

We are concerned, however, about the sweeping and unqualified manner in which [the expert's] testimony was offered. Where expert testimony concerning a new scientific technique is heard by a jury, there is danger that the evidence may be given more weight than is warranted.

An expert witness could be permitted to testify that in his opinion the chemicals present on defendant's hand may have resulted from firing a gun. He should not have been permitted to state, as he did, that this defendant had definitely fired a gun.

*State v. Spencer*, 298 Minn. 456, 461, 216 N.W.2d 131, 134 (1974).

307. Compare *State v. Garrison*, 120 Ariz. 255, 258, 585 P.2d 563, 566 (1978) (Expert testified "that there is an eight in one million probability that the teeth marks found on the deceased's breast were not made by appellant."), with *People v. Slone*, 76 Cal. App. 3d 611, 621, 143 Cal. Rptr. 61, 67 (1978) (Expert testified that "it is very highly probable that the bite mark on the victim was perpetrated by teeth belonging to the defendant.").

308. The developer of the voiceprint technique repeatedly used the fingerprint analogy in his testimony. See *United States v. Wright*, 17 C.M.A. 183, 191, 37 C.M.R. 447, 455 (1967) (dissenting opinion) ("[V]oiceprints are practically the equivalent of fingerprints in reliability."); *People v. King*, 266 Cal. App. 2d 437, 442, 72 Cal. Rptr. 478, 481 (1968) ("voiceprint" method of identification [defended] as having the infallibility of fingerprints"); *State v. Cary*, 99 N.J. Super. 323, 334, 239 A.2d 680, 685 (Law Div. 1968), remanded, 53 N.J. 256, 250 A.2d 15 (1969), aff'd, 56 N.J. 16, 264 A.2d 209 (1970) (expert "claims that [voiceprint identification] is virtually infallible").

309. *United States v. Williams*, 583 F.2d 1194, 1197 n.5 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979); *United States v. Baller*, 519 F.2d 463, 465 n.1 (4th Cir.), cert. denied, 423 U.S. 1019 (1975).

310. See *United States v. Williams*, 583 F.2d 1194, 1200 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979); *United States v. Baller*, 519 F.2d 463, 467 (4th Cir.), cert. denied, 423 U.S. 1019 (1975); *People v. Rogers*, 86 Misc. 2d 868, 881-82, 385 N.Y.S.2d 228, 237 (Sup. Ct. 1976). In *Williams* the court quoted an instruction that it described as "excellent." 583 F.2d at 1200 n.13.

311. National Academy of Sciences, supra note 2, at 47. Moreover, the efficacy of jury instruction seems questionable. See generally L.S.E. Jury Project, *Juries and the Rules of Evidence*, 1973

c. *Balancing*. The final step in the relevancy analysis is balancing the probative value of the proffered evidence against the danger of misleading the jury. As noted above,<sup>312</sup> assessing the probative worth of a novel scientific technique and its potential for misleading the jury will often result in reliance on the opinion of one or two experts. This problem is exacerbated by the requirement of Federal Rule 403 that the danger of misleading the jury *substantially* outweigh probative value before exclusion is appropriate.<sup>313</sup> Moreover, appellate courts will defer to the trial court's discretion when reviewing this issue.<sup>314</sup>

## 2. *The Adversary Process*

As the problems presented above indicate, it is questionable whether the initial screening of novel techniques under the relevancy approach will adequately protect against the admission of unreliable scientific evidence. In contrast to *Frye*, however, the relevancy approach does not attempt to assure the reliability of novel techniques prior to admission. To be sure, under the relevancy approach some techniques will be excluded by the trial judge; but most will pass the threshold requirements of admissibility, at which stage deficiencies should be exposed before the jury through traditional adversary trial procedures. Courts adopting the relevancy approach have emphasized this point. For example, in upholding the admissibility of voiceprint evidence in *United States v. Baller*,<sup>315</sup> the Court of Appeals for the Fourth Circuit commented: "Unless an exaggerated popular opinion of the accuracy of a particular technique makes its use prejudicial or likely to mislead the jury, it is better to admit relevant scientific evidence in the same manner as other expert testimony and allow its *weight to be attacked by cross-examination and refutation*." <sup>316</sup>

Thus, one of the underlying assumptions of the relevancy approach is that the jury is capable of evaluating novel scientific evidence. For example, in applying the relevancy approach to polygraph evidence, the court in *United States v. Ridling*<sup>317</sup> stated:

[I]t is important to understand how different juries are today than they were when the restrictive rules of evidence were first developed. On the whole they read widely. Largely because of television they know generally what is going on in the world. Their educational background

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Crim. L. Rev. 208, 221-22; Note, Did Your Eyes Deceive You? Expert Psychological Testimony on the Unreliability of Eyewitness Identification, 29 Stan. L. Rev. 969, 1002-05 (1977).

312. See text accompanying notes 289-311 *supra*.

313. Fed. R. Evid. 403.

314. See C. McCormick, *supra* note 23, at 440; 22 C. Wright & K. Graham, *supra* note 46, at 309.

315. 519 F.2d 463 (4th Cir.), cert. denied, 423 U.S. 1019 (1975).

316. *Id.* at 466 (emphasis added). See also *United States v. Williams*, 583 F.2d 1194, 1200 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979); *United States v. Sample*, 378 F. Supp. 44, 53 (E.D. Pa. 1974); *United States v. Ridling*, 350 F. Supp. 90, 95-96 (E.D. Mich. 1972) ("The evidence is admitted for its worth, and the expert who attempts to make more from it than he should seldom survives a good *cross-examination*."') (emphasis added).

317. 350 F. Supp. 90 (E.D. Mich. 1972).

is extensive. They think. They reason. They are really very good at sorting out good evidence from bad, of separating the credible witness from the incredible, and of disregarding experts who attempt to inject their opinions into areas of which they have little knowledge.<sup>318</sup>

Unfortunately, empirical support for this view is lacking. The few available studies,<sup>319</sup> mostly involving the impact of polygraph evidence on jury deliberations, are inconclusive.<sup>320</sup> Considering the techniques that may be involved—neutron activation analysis, atomic absorption, and ion microprobing analysis—the assumption of jury capability provides a shaky foundation upon which to construct an approach to admissibility of novel scientific techniques.

A second assumption underlying the relevancy approach is that unreliable novel scientific evidence will be exposed through the adversary process. The specific safeguards afforded by the adversary process will be examined in the context of criminal trials, in which the consequences of an erroneous judgment based upon unreliable scientific evidence are of most importance.<sup>321</sup>

a. *Notice*. Effective cross-examination and refutation presuppose adequate notice and discovery of the evidence the opposing party intends to introduce at trial. This is especially true of challenges to evidence based upon innovative scientific procedures, which inevitably require extensive preparation, including identification of and consultation with experts. *Ward v. State*,<sup>322</sup> a case involving neutron activation analysis, illustrates the problems criminal defendants have encountered in this respect. In *Ward*, a rape-murder trial, the prosecution introduced the results of microscopic comparison of pubic hairs discovered at the

318. *Id.* at 98. See also *Worley v. State*, 263 So. 2d 613, 616 (Fla. Dist. Ct. App. 1972) (concurring opinion) ("My faith in the jury system leads me to believe that [the scientific evidence] will be given the weight that the situation and circumstances may dictate.")

In contrast, courts favoring the *Frye* standard voice concern that scientific evidence may "assume a posture of mystic infallibility in the eyes of a jury of laymen," *United States v. Addison*, 498 F.2d 741, 744 (D.C. Cir. 1974), or may be "shrouded with an aura of near infallibility, akin to the ancient oracle of Delphi." *United States v. Alexander*, 526 F.2d 161, 168 (8th Cir. 1975).

319. See Barnett, *How Does a Jury View Polygraph Examination Results?*, 2 *Polygraph* 275 (1973); Carlson, Passano & Jannuzzo, *The Effect of the Lie Detector Evidence on Jury Deliberations: An Empirical Study*, 5 *J. Police Sci. & Ad.* 148 (1977); Forkosch, *The Lie Detector and the Courts*, 16 *N.Y.U. L. Rev.* 202, 228-30 (1939); Koffler, *The Lie Detector—A Critical Appraisal of the Technique as a Potential Undermining Factor in the Judicial Process*, 3 *N.Y.L.F.* 123, 138-46 (1957); Tarlow, *supra* note 59, 968-69; Markwart & Lynch, *The Effect of Polygraph Evidence on Mock Jury Decision-Making*, 7 *J. Police Sci. & Ad.* 324 (1979). See also Greene, *Voiceprint Identification: The Case in Favor of Admissibility*, 13 *Am. Crim. L. Rev.* 171, 190-91 (1975).

The results of one survey of prosecutors, criminal defense attorneys, and trial judges indicated that lawyers and judges believe scientific evidence to have a significant impact on juries. See O. Schroeder, *A Legal Study Concerning the Forensic Sciences Personnel* (1977). In response to the question "Does scientific evidence have more credibility than lay witness testimony?", 1054 lawyers and judges answered "yes", and 188 answered "no". In response to the question "Is scientific evidence given more credibility than other evidence by decision-maker [jury]?", 958 answered "yes", and 221 answered "no". *Id.* at 14.

320. See Markwart & Lynch, *supra* note 319, at 324 ("Relatively little research has been conducted in this area, and what has been done has yielded conflicting results.")

321. The overwhelming majority of cases involving the admissibility of novel scientific techniques have been criminal prosecutions. See cases cited in notes 1-7 *supra*.

322. 427 S.W.2d 876 (Tex. Crim. App. 1968).

crime scene with hair exemplars obtained from the defendant. The analysis was performed by a member of the Toxicology and Chemistry Division of the Houston Police Department. During the subsequent cross-examination of a different prosecution expert, the defense attorney suggested that neutron activation, rather than microscopic, analysis would have been a superior method of examination. The prosecution then recalled the hair examiner who testified that the hair exemplars also had been subjected to activation analysis and that, in his opinion, the samples "were identical and probably came from the same person."<sup>323</sup> The expert in *Ward* was employed by a city crime laboratory, and thus it is unlikely that he would have had the educational and practical background to conduct this type of sophisticated examination.<sup>324</sup> In addition, his testimony that the samples "were identical and probably came from the same person" was "highly vulnerable."<sup>325</sup> Nonetheless, these issues were not pursued, perhaps because the defense attorneys acknowledged they were caught off guard.<sup>326</sup> While *Ward* may represent great trial tactics, it surely represents a poor use of scientific evidence.<sup>327</sup>

The party offering evidence based upon a novel technique should be required to provide sufficient advance notice to the adversary.<sup>328</sup> Moreover, this

323. *Id.* at 884.

324. In other neutron activation cases the experts have been associated with major federal or university laboratories. E.g., *United States v. Stifel*, 433 F.2d 431 (6th Cir. 1970) (Postal Service Laboratory), cert. denied, 401 U.S. 994 (1971); *State v. Stout*, 478 S.W.2d 368 (Mo. 1972) (University of Missouri); *State v. Coolidge*, 109 N.H. 403, 260 A.2d 547 (1969) (U.S. Treasury Laboratory), rev'd on other grounds, 403 U.S. 443 (1971).

325. Comment, *The Evidentiary Uses of Neutron Activation Analysis*, *supra* note 1, at 1036 n.216.

326. *Id.*, citing letter from the defense attorney in *Ward*.

327. In *United States v. Kelly*, 420 F.2d 26 (2d Cir. 1969), the Court of Appeals for the Second Circuit took a different view of such tactics. In *Kelly*, the court reversed the defendant's conviction because the defense had not been notified that the results of activation analysis of drugs would be introduced at trial. The court observed:

While the newness of the test is not itself reason for depriving the jury of its results, and the opportunity to weigh conflicting claims as to its reliability, fairness requires that adequate notice be given the defense to check the findings and conclusions of the government's experts. . . . The course of the government smacks too much of a trial by ambush . . . .

*Id.* at 29. In *Kelly* the defendant requested discovery of scientific tests, and consequently the holding rested upon the prosecution's continuing duty to disclose under Federal Rule of Criminal Procedure 16(c). Had the defendant not made such a request, "trial by ambush" might have been permitted.

The defendant in *State v. Kassow*, 28 Ohio St. 2d 141, 277 N.E.2d 435 (1971), modified, 408 U.S. 939 (1972), attempted to rely on *Kelly* in challenging the prosecution's use of neutron activation analysis. The Ohio Supreme Court, however, readily distinguished *Kelly*, because Ohio, at that time, did not have a discovery provision comparable to the federal rule relied upon in *Kelly*. See also *State v. Stevens*, 467 S.W.2d 10, 24 (Mo.) (failure to notify defendant of NAA not error where no request made), cert. denied, 404 U.S. 994 (1971).

328. For example, one commentary has noted:

[S]urprise should play no role in litigation featuring the introduction of unfamiliar scientific information.

Within the context of the adversarial system, it might be appropriate to impose an affirmative obligation for disclosure on parties who contemplate the introduction of evidence produced by innovative techniques, and to condition the amount and the timing of required disclosure on the complexity and novelty of the process . . . .

*Latin, Tannehill & White, supra* note 5, at 1445 (footnote omitted).

requirement should not depend on a request for discovery, but should be an affirmative duty. Notice provisions are not uncommon; both the Federal Rules of Evidence<sup>329</sup> and the Federal Rules of Criminal Procedure<sup>330</sup> contain such provisions. Such a requirement is especially important because the modern trend has been to refuse to recognize unfair surprise as a legitimate ground for excluding relevant evidence.<sup>331</sup>

b. *Discovery*. Even when procedural rules provide for the discovery of the results of scientific tests,<sup>332</sup> the defendant may not receive all the necessary information. Many laboratory reports reveal only the results of the examination.<sup>333</sup> Other critical information, such as the nature of the tests performed, the procedures employed, and the qualifications of the examiner, are not furnished. In most jurisdictions, this information cannot be obtained by deposition because depositions in criminal cases are limited to the preservation of testimony and are not permitted for the purpose of discovery.<sup>334</sup> Moreover, in many forensic procedures the evidence is either consumed during analysis or otherwise not preserved. Thus, discovery provisions providing for re-examination of evidence by defense experts<sup>335</sup> may prove ineffectual.

Full disclosure, including written reports and depositions, should be mandated in this context. None of the usual reasons for limiting discovery in criminal cases applies to experts. As the ABA Standards Relating to Discovery and Procedure Before Trial note: "[I]t is virtually impossible for evidence or information of this kind to be distorted or misused because of its advance disclosure."<sup>336</sup> In addition, Federal Rule of Evidence 706(a), which is applicable in criminal as well as in civil cases, authorizes deposition of a court-appointed expert.<sup>337</sup> Judge Weinstein has commented that this provision "can be justified on the grounds that an examination into the expert's findings will enable the parties to better prepare for examination and cross-examination thereby increasing the likelihood that the truth may be ascertained and proceedings justly determined."<sup>338</sup> This rationale is equally applicable to all experts, not only

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329. See Fed. R. Evid. 412(c)(1) (character evidence in rape cases); Fed. R. Evid. 803(24) & 804(b)(5) (residual hearsay exceptions). See also Fla. Stat. § 90.404(2)(b); Minn. R. Crim. P. 7.02 (evidence of prior bad acts).

330. See Fed. R. Crim. P. 12.2 (insanity).

331. See Fed. R. Evid. 403. The Advisory Committee's Note to Rule 403 states: "The rule does not enumerate surprise as a ground for exclusion . . . ."

332. See Fed. R. Crim. P. 16(a)(1)(D).

333. An example of a typical laboratory report is reproduced in *United States v. Parker*, 491 F.2d 517, 525 (8th Cir. 1973), cert. denied, 416 U.S. 989 (1974).

334. See, e.g., Fed. R. Crim. P. 15(a); 18 U.S.C. § 3503(a) (1976). In contrast, the Federal Rules of Civil Procedure explicitly authorize the use of depositions for discovery. Fed. R. Civ. P. 26(a). There are, however, a few jurisdictions that authorize discovery depositions in criminal cases. See Fla. R. Crim. P. 3.220(d); N.H. Rev. Stat. Ann. § 517:13; Vt. R. Crim. P. 15(a). See generally Note, *Discovery Depositions: A Proposed Right for Criminal Defendants*, 51 S. Cal. L. Rev. 467 (1978).

335. See, e.g., Fed. R. Crim. P. 16(a)(1)(C).

336. ABA, *Standards Relating to Discovery and Procedure Before Trial* 67 (1969).

337. Fed. R. Evid. 706(a).

338. 3 J. Weinstein & M. Berger, *supra* note 28, at 706-17 to -18.

court-appointed experts, and is especially critical in cases in which novel techniques are introduced.

Moreover, a duty to preserve evidence so as to provide the defense with the opportunity to retest it should be considered part of the government's discovery obligation. The trend is to recognize this duty.<sup>339</sup> In *United States v. Stifel*,<sup>340</sup> the Court of Appeals for the Sixth Circuit, after upholding the admissibility of neutron activation analysis, stated: "[I]f the government sees fit to use this time consuming, expensive means of fact-finding, it must both allow time for a defendant to make similar tests, and in the instance of an indigent defendant, a means to provide for payment for same."<sup>341</sup> The defendant's right to retest evidence<sup>342</sup> carries with it a corollary duty on the part of the government to preserve the evidence.

c. *Defense Experts*. Securing the services of experts to examine evidence, to advise counsel, and to rebut the prosecution's case is probably the single most critical factor in defending a case in which novel scientific evidence is introduced.<sup>343</sup> Nevertheless, a surprising number of novel techniques have gained admissibility without the presentation of defense expert testimony.<sup>344</sup> Incredibly, several courts have cited the absence of opposing experts to support their decision to admit voiceprints, apparently inferring reliability from a lack of opposition.<sup>345</sup> This inference is unwarranted.

339. See *People v. Hitch*, 11 Cal. 3d 159, 520 P.2d 974, 113 Cal. Rptr. 158, vacated, 12 Cal. 3d 641, 527 P.2d 361, 117 Cal. Rptr. 9 (1974); *People v. Gomez*, — Colo. —, 596 P.2d 1192 (1979); *Johnson v. State*, 249 So. 2d 470 (Fla. App. 1971), writ discharged, 280 So. 2d 673 (Fla. 1973); *People v. Taylor*, 54 Ill. App. 3d 454, 369 N.E.2d 573 (1977). See generally Note, *The Right to Independent Testing: A New Hitch in the Preservation of Evidence Doctrine*, 75 Colum. L. Rev. 1355 (1975); Note, *Criminal Procedure—Preservation of Due Process When Evidence is Destroyed or Tested*, 53 Wash. L. Rev. 573 (1978); Comment, *Judicial Response to Government Loss or Destruction of Evidence*, 39 U. Chi. L. Rev. 542 (1972); Comment, *Criminal Procedure: Government Has Duty to Implement Effective Guidelines to Preserve Discoverable Evidence*, 1971 Duke L. J. 644.

340. 433 F.2d 431 (6th Cir. 1970), cert. denied, 401 U.S. 994 (1971).

341. *Id.* at 441.

342. Several courts have recognized that a defendant's right to reexamine scientific evidence is constitutionally based. See *White v. Maggio*, 556 F.2d 1352 (5th Cir. 1977); *Barnard v. Henderson*, 514 F.2d 744 (5th Cir. 1975); *Warren v. State*, 292 Ala. 71, 288 So. 2d 826 (1973); *Patterson v. State*, 238 Ga. 204, 232 S.E.2d 233, cert. denied, 431 U.S. 970 (1977); *Jackson v. State*, 243 So. 2d 396 (Miss. 1970). Moreover, the recent study by the Forensic Sciences Foundation demonstrating the errors that frequently occur in crime laboratory analysis also supports this right. See note 60 *supra*.

343. See *United States v. Baller*, 519 F.2d 463, 466 (4th Cir.) ("[I]t is difficult to rebut such an opinion except by other experts or by cross-examination based on a thorough acquaintance with the underlying principles."), cert. denied, 423 U.S. 1019 (1975).

344. See National Academy of Sciences, *supra* note 2, at 49; *People v. Chapter*, 13 Crim. L. Rep. (BNA) 2479 (Cal. Super. Ct. 1973) ("In approximately eighty percent of the twenty-five [voiceprint] cases in which such expert testimony/opinion was admitted there was no opposing expert testimony on the issue of reliability and general acceptability by the scientific community . . .").

Kalven and Zeisel, in their study of the American jury system, also noted the disparity between defense and prosecution use of expert witnesses: "Again, the imbalance between prosecution and defense appears. In 22 per cent of the cases the prosecution has the only expert witness, whereas in only 3 per cent of the cases does the defense have such an advantage." H. Kalven & H. Zeisel, *The American Jury* 139 (1966).

345. See *United States v. Franks*, 511 F.2d 25, 33 (6th Cir.), cert. denied, 422 U.S. 1042 (1975); *United States v. Sample*, 378 F. Supp. 44, 53-54 (E.D. Pa. 1974).



The underlying problem is that the "burden of rebuttal is generally borne in these criminal cases by defendants without the economic means to marshal scientific witnesses for a battle of the experts."<sup>346</sup> In contrast, the prosecution has ready access to expert witnesses and laboratory facilities. All states and most large metropolitan areas have government-operated forensic laboratories.<sup>347</sup> In addition, federal laboratories provide services to local and state law enforcement agencies. The FBI laboratory, for example, is "available without charge to all duly constituted state, county, and municipal law enforcement agencies of the United States and its territorial possessions."<sup>348</sup> This includes both the examination of evidence and the court appearance of the expert.

This advantage takes on added significance with new techniques, many of which involve sophisticated and expensive equipment. Securing defense experts is essential both for the court's assessment of relevancy and for the jury's evaluation of reliability.<sup>349</sup> The need of indigent defendants for expert assistance is met in some instances by statutory provisions.<sup>350</sup> In addition, the right to compulsory process,<sup>351</sup> to the effective assistance of counsel,<sup>352</sup> to due process,<sup>353</sup>

346. *State v. Williams*, 388 A.2d 500, 506 (Me. 1978) (concurring opinion).

347. See A. Moenssens & F. Inbau, *supra* note 7, at 8-9 & 17. For a listing of crime laboratories, see R. Fox & C. Cunningham, *Crime Scene Search and Physical Evidence Handbook* 174-85 (1974).

348. *Williams*, *The FBI Laboratory—Its Availability and Use by Prosecutors from Investigation to Trial*, 28 U. Kan. City L. Rev. 95, 99 (1960). See also Federal Bureau of Investigation, *Handbook of Forensic Science* 5 (Rev. ed. 1978).

349. See Coleman & Walls, *The Evaluation of Scientific Evidence*, 1974 *Crim. L. Rev.* (England) 276, 280.

350. See A. Moenssens & F. Inbau, *supra* note 7, at 10 n.19 ("About half of the states and the federal government have specific provisions under which courts are authorized to provide for public compensation of defense experts. A number of other states have statutes which allow appointed counsel to recover his expenses, including, in some of these states, fees of experts."). The Criminal Justice Act of 1964, 18 U.S.C. § 3006(A)(e) (1976) provides for such costs. See generally, 3 C. Wright, *Federal Practice and Procedure* § 740 (1969); Annot., 6 A.L.R. Fed. 1007 (1971).

351. In *People v. Watson*, 36 Ill. 2d 228, 221 N.E.2d 645 (1966), the court commented:

The court recognizes that there is a distinction between the right to call witnesses and the right to have these witnesses paid for by the government, but in certain instances involving indigents, the lack of funds with which to pay for the witness will often preclude him from calling that witness and occasionally prevent him from offering a defense. Thus, although the defendant is afforded the shadow of the right to call witnesses, he is deprived of the substance.

*Id.* at 233, 221 N.E.2d at 648.

352. See *Hintz v. Beto*, 379 F.2d 937, 941 (5th Cir. 1967); *Bush v. McCollum*, 231 F. Supp. 560, 565 (N.D. Tex. 1964) ("But the right to counsel is meaningless if the lawyer is unable to make an effective defense because he has no funds to provide the specialized testimony which the case requires."), *aff'd*, 344 F.2d 672 (5th Cir. 1965). See also ABA, *Standards Relating to Providing Defense Services* 23 (1967) ("The quality of representation at trial may be excellent and yet valueless to the defendant if his defense requires . . . the services of a handwriting expert and no such services are available.").

353. See *United States ex rel. Robinson v. Pate*, 345 F.2d 691, 695 (7th Cir. 1965) ("[T]he denial of a reasonable request to obtain the services of a necessary psychiatric witness is effectually a suppression of evidence violating the fundamental right of due process."), *aff'd in part, remanded in part on other grounds*, 383 U.S. 375 (1966); *cf. Chambers v. Mississippi*, 410 U.S. 284, 302 (1973) ("Few rights are more fundamental than that of an accused to present witnesses in his own defense.").

and to equal protection<sup>354</sup> seem to support such a right.<sup>355</sup> Nevertheless, a number of courts have refused to recognize the right to the assistance of experts.<sup>356</sup> As a last resort, the trial court should exercise its power to appoint an expert for the court.<sup>357</sup>

Provisions for notice, full discovery, the opportunity to re-examine evidence, and the appointment of defense experts are critical components of the relevancy approach. While it is true that "manipulation of the rules of evidence"<sup>358</sup> will not solve these problems, courts lowering the barriers of admissibility—even the uneven barrier erected by *Frye*—cannot ignore the procedural setting in which scientific evidence is introduced.

#### V. A PROPOSAL: THE BURDEN OF PROVING RELIABILITY

Even with the procedural safeguards discussed above, it seems questionable whether the relevancy approach will adequately protect against the misuse of unreliable novel scientific evidence. The voiceprint cases provide a useful illustration of the problem. In *United States v. Wright*,<sup>359</sup> the admissibility of voiceprint evidence was upheld for the first time by an appellate court. The developer of the voiceprint technique testified that the method was valid ("virtually infallible").<sup>360</sup> Apparently, all the procedural safeguards enumerated above were present. Notice and discovery were provided; opposing experts testified.<sup>361</sup> In addition, although the qualifications of the government expert have been questioned,<sup>362</sup> he was obviously more than a technician, and permitting him to testify as an expert was probably not erroneous. Moreover, the impact of the voiceprint evidence must have been significant because it identified the defendant as the person who committed the charged offense.<sup>363</sup>

354. See *Jacobs v. United States*, 350 F.2d 571, 573 (4th Cir. 1965) ("It is obvious that only his inability to pay for the services of a psychiatrist prevented a proper presentation of his case."); cf. *Douglas v. California*, 372 U.S. 353 (1963) (right to counsel); *Griffin v. Illinois*, 351 U.S. 12 (1956) (right to transcript).

355. See generally Note, The Indigent's Right to an Adequate Defense: Expert and Investigational Assistance in Criminal Proceedings, 55 Cornell L. Rev. 632 (1970); Note, Right to Aid in Addition to Counsel for Indigent Criminal Defendants, 47 Minn. L. Rev. 1054 (1963); Note, Criminal Law: Indigent Defendant's Right to Independent Psychiatrist, 7 Tulsa L.J. 137 (1971); Annot., 34 A.L.R.3d 1256 (1970).

356. E.g., *United States ex rel. Smith v. Baldi*, 344 U.S. 561 (1953); *Watson v. Patterson*, 358 F.2d 297 (10th Cir.), cert. denied, 385 U.S. 876 (1966); *Stidham v. State*, 507 P.2d 1312 (Okla. Crim. 1973); *Huitt v. State*, 562 P.2d 873 (Okla. Crim. 1977). See also Annot., 34 A.L.R.3d 1256 (1970).

357. See Fed. R. Evid. 706(a). "The inherent power of a trial judge to appoint an expert of his own choosing is virtually unquestioned." Advisory Committee's Note, Fed. R. Evid. 706. See also C. McCormick, *supra* note 23, at 37-38; 2 J. Wigmore, Evidence § 563, at 648 (3d ed. 1940).

358. 22 C. Wright & K. Graham, *supra* note 46, at 91.

359. 17 C.M.A. 183, 37 C.M.R. 447 (1967).

360. *Id.* at 193, 37 C.M.R. at 457 (dissenting opinion).

361. Two defense experts testified in *Wright*.

362. See text accompanying notes 70-72 *supra*.

363. See 17 C.M.A. at 194, 37 C.M.R. at 458. ("[T]he evidence other than the voiceprints is far from compelling. . . . In short, the Government has made it clear from the beginning that its main prop here was the 'scientific' evidence . . .") (dissenting opinion).

Voiceprint evidence should not have been admitted in *Wright*. The technique had not been sufficiently validated at that time. Indeed, it is debatable whether the technique has been sufficiently validated today.<sup>364</sup> Nevertheless, under the circumstances presented in *Wright*, admitting voiceprint evidence was not improper under the relevancy approach.<sup>365</sup> Under that approach, the court, as illustrated by *Wright*, too often will "be forced to accept the probative value of the evidence as what a qualified expert testifies it to be."<sup>366</sup> Even if opposing experts testify, frequently they will be able to testify only that the technique has not been sufficiently validated, not that the technique is invalid.<sup>367</sup> Such testimony rarely will result in exclusion since, under the Federal Rules, the probative value of proffered evidence must be substantially outweighed by countervailing dangers before exclusion is proper.

If *Wright* had been a civil case, the adoption of the relevancy approach might have been acceptable. A criminal case, however, is a different matter. The introduction of unreliable evidence that has a significant potential to influence a jury greatly increases the likelihood of an erroneous verdict.<sup>368</sup> In effect, the relevancy approach places the burden on the party opposing admissibility<sup>369</sup>—typically the defendant in a criminal case. Instead of the prosecution carrying a substantial burden of establishing the reliability of a novel scientific technique, the defendant must shoulder the burden of establishing unreliability. This Article takes the position that a special burden should be placed on the admissibility of novel scientific evidence.<sup>370</sup> As one court has observed:

A courtroom is not a research laboratory. The fate of a defendant in a criminal prosecution should not hang on his ability to successfully rebut scientific evidence which bears an "aura of special reliability and trustworthiness," although, in reality the witness is testifying on the basis of an unproved hypothesis in an isolated experiment which has yet to gain general acceptance in its field.<sup>371</sup>

Once it is determined that a special burden should be imposed on the admissibility of novel scientific evidence, the formulation of that burden becomes

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364. See National Academy of Sciences, *supra* note 2.

365. While it is clear that the *Wright* court did not apply the *Frye* test, see note 185 *supra*, it is not as clear that the relevancy approach was used.

366. Strong, *supra* note 19, at 22.

367. In *Wright* the court dismissed the testimony of the opposing experts in one sentence: "True, two defense expert witnesses expressed reservations as to the complete reliability of Mr. Kersta's system and procedures." 17 C.M.A. at 189, 37 C.M.R. at 453.

368. See Saltzburg, Standards of Proof and Preliminary Questions of Fact, 27 Stan. L. Rev. 271, 278-80 (1975).

369. See Latin, Tannhill & White, *supra* note 5, at 1377-78.

370. Because of the unreliability problems associated with novel scientific evidence, several advocates of scientific evidence have conceded that the *Frye* standard may be necessary. See A. Moenssens & F. Inbau, *supra* note 7, at 7-8 and 584. Professor Moenssens's earlier views on *Frye* were extremely critical. See Moenssens, *supra* note 43. See also Coleman & Walls, *supra* note 349, at 281 (urging caution in the use of scientific evidence).

371. *United States v. Brown*, 557 F.2d 541, 556 (6th Cir. 1977).

critical. Several initial issues are fairly easy to resolve. First, the proponent of the evidence should have the burden of production and persuasion. Second, the issue of whether the burden of proof has been satisfied should be decided by the judge as a preliminary question of fact.<sup>372</sup> The last, and undoubtedly the most difficult, issue is the standard of proof. As an initial proposition, the *Frye* test must be rejected. It is a substantive standard, which functions as an inappropriate basis for excluding scientific evidence. Thus, the substitution of a different test, whether it be "reasonable scientific acceptance"<sup>373</sup> or "substantial acceptance,"<sup>374</sup> would be equally inapposite. As was stated in a different context, such a change may have "all the vices of novelty and none of the virtues of lasting improvement."<sup>375</sup> Instead, the admission of scientific evidence should be controlled by adjusting the burden of proof.

Professor Saltzburg has offered a useful analysis of how the standard of proof with respect to preliminary questions of fact should be determined:<sup>376</sup> "[A]n enhanced burden of proof [should be required] whenever there is something extraordinary about a particular kind of fact question or type of evidence."<sup>377</sup> Such an enhanced burden is appropriate when the reliability of a particular type of evidence is critical, because "[w]hen the purpose of a rule of competency is to enhance the reliability of a jury verdict, the greater the risk of error in preliminary factfinding, the greater the risk of error in the final judgment by the jury."<sup>378</sup> Since novel scientific evidence presents significant reliability problems that may result in erroneous verdicts, an enhanced burden of proof should be required.<sup>379</sup>

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372. See Fed. R. Evid. 104(a). Since the purpose of imposing a special burden on the admissibility of novel scientific evidence is to insulate the jury from unreliable evidence, treating the issue of admissibility as one of conditional relevancy under Fed. R. Evid. 104(b) would undermine that purpose.

373. See S. Saltzburg & K. Redden, *supra* note 250, at 423; Latin, Tannehill & White, *supra* note 5, at 1380. See also Commentary to Alaska Rules of Evidence 202-03 (May 1979).

374. See text accompanying notes 283-84 *supra*.

375. Clark, *Two Decades of the Federal Civil Rules*, 58 Colum. L. Rev. 435, 451 (1958).

376. See Saltzburg, *supra* note 368.

377. *Id.* at 292.

378. *Id.* at 291.

379. The imposition of a special rule for the admissibility of novel scientific evidence would not necessarily represent a departure from traditional evidentiary principles. Under the relevancy approach, the validity of a novel technique is analyzed in terms of its probative value. If a technique is not valid or reliable, results derived from that technique are not considered probative. See text accompanying notes 37-39 and 293 *supra*. For example, if voiceprint identification is used in a kidnapping case to identify the defendant's voice as the one which made the ransom call, the probative value of the identification would depend upon the reliability of the technique. Framing the issue in these terms, however, does not resolve the issue, because the probative value of *all* evidence depends on its reliability. If a witness in the kidnapping case testifies that it was the defendant who made the ransom call, the probative value of the evidence also would depend on its reliability—the reliability of the witness's identification of the defendant's voice. However, the reliability determination in such a case is functionally assigned to the jury as a matter of credibility because the jury is thought to be especially equipped to make such reliability determinations.

Hearsay evidence offers another example in which relevancy and reliability are functionally distinguished. Although relevant, hearsay evidence is excluded because it is thought to be unreliable. In contrast to the credibility of witnesses, however, hearsay is treated as a rule of competence, and determinations concerning the applicability of the rule and its exceptions are assigned to the judge because it is of "such character as to be incapable of reasonably accurate evaluation and therefore

Professor Saltzburg also recognizes that the standard of proof for preliminary questions of fact may differ in criminal and civil cases.

Evidentiary rules or principles need not be uniform in civil and criminal cases. Since our society has chosen to give criminal defendants the benefit of all reasonable factual doubts—a benefit not usually conferred upon civil litigants—rules of evidence may be tailored in a principled way to reflect and support this choice.<sup>380</sup>

The prosecution in a criminal case should be required to establish the validity of a novel scientific technique beyond a reasonable doubt. Civil litigants and criminal defendants, on the other hand, should establish the validity of a novel technique by a preponderance of the evidence.<sup>381</sup>

Although it imposes an enhanced burden on the admissibility of novel scientific evidence in criminal cases, this approach uses a traditional burden of proof rather than the ambiguous general acceptance standard espoused in *Frye*. Consequently, many of the problems associated with the application of the *Frye* test would be avoided. Although general acceptance by a recognized discipline or profession would be relevant, such acceptance would be neither required nor necessarily sufficient.

The principal criticism of this approach will be that it imposes too high a burden on the prosecution. It is clear that such a burden is not impossible to satisfy. Fingerprint, firearms, and questioned document comparisons all satisfy this burden. Moreover, such a burden would apply only in the initial cases in which the technique is offered in evidence and then only to the validity of the technique, not to its application on a particular occasion. Once the technique

likely to mislead the jury." Morgan, Functions of Judge and Jury in the Determination of Preliminary Questions of Fact, 43 Harv. L. Rev. 165, 165-66 (1929). Novel scientific evidence can be viewed in much the same way as hearsay.

380. Saltzburg, *supra* note 368, at 304. A number of cases, in applying the *Frye* standard, have emphasized the fact that the case involved a criminal prosecution. See *United States v. Brown*, 557 F.2d 541, 556 (6th Cir. 1977) ("[A] strong countervailing restraint on the admission of expert testimony is the defendant's right to a fair trial . . ."); *People v. Law*, 40 Cal. App. 3d 69, 85, 114 Cal. Rptr. 708, 718-19 (1974) ("It is our duty . . . where the life or liberty of a defendant is at stake, to be particularly careful that . . . the finding is based upon admissible and nonprejudicial evidence."); *Commonwealth v. Topa*, 471 Pa. 223, 232, 369 A.2d 1277, 1282 (1977) ("Strict application of the *Frye* standard when scientific proof is offered is essential if the defendant is to receive a just and fair trial.").

381. Applying the preponderance standard to scientific evidence offered by a defendant in a criminal case would avoid any possible constitutional problems. See text accompanying notes 258-64 *supra*.

The preponderance standard would also apply in proceedings other than trial. Novel scientific evidence has been introduced in hearings involving the suppression of evidence, sentencing, parole and probation revocation, and motions for new trials. See *United States v. Sample*, 378 F. Supp. 44 (E.D. Pa. 1974) (voiceprints admitted in probation revocation proceedings); *State v. Jones*, 110 Ariz. 546, 521 P.2d 978 (polygraph results admitted at sentencing), cert. denied, 419 U.S. 1004 (1974); *People v. Cutter*, 12 Crim. L. Rep. (BNA) 2133 (Cal. Super. Ct. 1972) (polygraph results admitted at suppression hearing); *State v. Catanese*, 368 So. 2d 975 (La. 1979) (polygraph results admissible in hearing for a new trial); *People v. Barbara*, 400 Mich. 352, 255 N.W.2d 171 (1977) (polygraph results admitted in hearing for new trial); *State v. Watson*, 115 N.J. Super. 213, 278 A.2d 543 (Hudson County Ct. 1971) (polygraph results admitted at sentencing). See also *State ex rel. Trimble v. Hedman*, 291 Minn. 442, 192 N.W.2d 432 (1971) (voiceprints admitted to establish probable cause).

becomes accepted, the courts could take judicial notice of its validity. Finally, such a burden could be satisfied more readily if the limitations of the technique are candidly acknowledged. For example, an expert could testify that the paraffin test is capable of detecting nitrates, or he could overstate the conclusions that can be drawn from the test by testifying that the test is capable of establishing the recent firing of a weapon. The former statement would satisfy the beyond a reasonable doubt standard, the latter would not.

Still, it may be argued that the beyond a reasonable doubt standard will delay for too long a time the admission of evidence based upon novel techniques. This, however, will depend on whether the necessary resources are expended to validate new techniques. The federal government possesses the capability of marshalling those resources, of establishing independent tribunals, and of conducting the validating research. As one court, in rejecting voiceprint evidence, stated:

It is certainly reasonable to expect science to withhold judgment on a new theory until it has been well tested in the crucible of controlled experimentation and study. Such a procedure would require replication of original experiments, and scrutiny of the results in various scientific journals. . . . The Tosi [voiceprint] experiment is not so monumental that it could be performed but once in a lifetime.<sup>382</sup>

Again, the National Academy of Sciences report is instructive. The evaluation of the voiceprint technique conducted by the Academy (at the request of the FBI) should have preceded, and not followed, the proffer of voiceprint evidence.

The adoption of the beyond a reasonable doubt standard, of course, would not solve all the problems associated with the admissibility of innovative scientific evidence. Difficult questions of application will remain. Courts would still have to rely on expert testimony and scientific publications in determining whether the reasonable doubt standard has been satisfied.<sup>383</sup> Similarly, careful scrutiny of innovative techniques to discern whether they are based on subjective rather than objective criteria,<sup>384</sup> or on an unexplained theory supported only by empirical validation, would still be required. The availability of alternative methods would also have to be considered.<sup>385</sup> Consequently, the procedural safeguards considered earlier,<sup>386</sup> a demanding standard for the qualifications of

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382. *People v. Collins*, 94 Misc. 2d 704, 709-10, 405 N.Y.S.2d 365, 369 (Sup. Ct. 1978). See also *D'Arc v. D'Arc*, 157 N.J. Super. 553, 562-63, 385 A.2d 278, 283 (Ch. Div. 1978) ("What this court finds disconcerting is the paucity of major tests and studies. . . . But to be assured that we have a scientific technique which is valid and reliable we also need something more than the bare results of one major study.").

383. See text accompanying notes 126-50 *supra*.

384. In *Reed v. State*, 283 Md. 374, 391 A.2d 364 (1978), the court stressed the superiority of the *Frye* test when considering expert testimony based on subjective criteria. *Id.* at 388, 391 A.2d at 371. For a discussion of the difference between objectively and subjectively based results, see Coleman & Walls, *supra* note 349; Latin, Tannehill & White, *supra* note 5, at 1384-85; Comment, The Evidentiary Uses of Neutron Activation Analysis, *supra* note 1, 1020-25; Note, The Admissibility of Bite Mark Evidence, *supra* note 6, at 329 ("Without statistical background data forming a solid objective basis for the odontologist's conclusion, the opinion as to the existence of a [bitemark] match is necessarily partly subjective.").

385. See Latin, Tannehill & White, *supra* note 5, at 1401.

386. See text accompanying notes 322-58 *supra*.

experts,<sup>387</sup> and a strict standard of appellate review,<sup>388</sup> would have to be integral parts of such an approach.

### CONCLUSION

The *Frye* test, which has cast its shadow over the admissibility of scientific evidence for more than a half-century, has proved unworkable. Nevertheless, the underlying rationale of the *Frye* test—requiring evidence derived from newly ascertained or applied scientific principles to meet a special burden as a prerequisite to admissibility—has merit. The major flaw in the relevancy analysis, the principal alternative to *Frye*, is its failure to recognize the distinctive problems of scientific evidence. In assessing probative value under this approach, the judge frequently is forced to defer to an expert, thereby permitting admissibility based on the views of a single individual in some cases. Consequently, voiceprints,<sup>389</sup> the paraffin test,<sup>390</sup> trace metal detection technique,<sup>391</sup> psychological stress evaluation,<sup>392</sup> as well as other insufficiently validated techniques<sup>393</sup> may readily gain admissibility.

The proposal set forth in this Article accepts the premise of *Frye*, at least in criminal cases, but rejects the standard of *Frye*. In contrast to the relevancy approach, this proposal highlights the unique reliability problems associated with the admissibility of innovative scientific procedures and provides a principled approach for distinguishing “good” science from “bad” science.

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387. See text accompanying notes 123-25 and note 299 *supra*.

388. See text accompanying notes 187-97 *supra*.

389. See *United States v. Wright*, 17 C.M.A. 183, 37 C.M.R. 447 (1967) (court did not apply *Frye* and admitted voiceprint evidence before any studies on the subject were published); *Worley v. State*, 263 So. 2d 613 (Fla. Dist. Ct. App. 1972).

390. See cases cited in note 215 *supra*.

391. See *Reid v. State*, 267 Ind. 555, 372 N.E.2d 1149 (1978); *State v. Journey*, 201 Neb. 607, 614, 271 N.W.2d 320, 324 (1978); *State v. Daniels*, 37 Ohio App. 2d 4, 305 N.E.2d 497 (1973). But see *People v. Lauro*, 91 Misc. 2d 706, 398 N.Y.S.2d 503 (Sup. Ct. 1977) (technique rejected for failure to satisfy general acceptance standard). See also Stevens & Messler, *The Trace Metal Detection Technique (TMDT): A Report Outlining a Procedure for Photographing Results in Color, and Some Factors Influencing the Results in Controlled Laboratory Tests*, 19 J. Forensic Sci. 496 (1974).

392. In *Smith v. State*, 31 Md. App. 106, 355 A.2d 527 (1976), the court rejected PSE, viewing the technique as a type of polygraph. See also Kenety, *supra* note 7.

393. Application of the *Frye* test prevented the introduction into evidence of remote sensing evidence, *United States v. Kilgus*, 571 F.2d 508 (9th Cir. 1978), and a modified Harrison-Gilroy test for gunshot residue, *State v. Smith*, 50 Ohio App. 2d 183, 362 N.E.2d 1239 (1976). Undoubtedly the admissibility of these techniques would have been more readily achieved under the relevancy approach.