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## Scientific Evidence: The Nebraska Game and Parks Commission Explores New Blood and Tissue Identification Techniques for Game Law Enforcement

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# Scientific Evidence: The Nebraska Game and Parks Commission Explores New Blood and Tissue Identification Techniques For Game Law Enforcement

## I. INTRODUCTION

In recent years, tremendous advances have been made in the area of scientific technology. It is not surprising that as scientific technology improves, law enforcement agencies attempt to make use of newly available scientific information to aid them in detecting and preventing the violation of laws. "Enforcement agencies, both public and private, have been applying new devices and theories of a scientific nature in an effort to stem the rising crime rate."<sup>1</sup> A large amount of the scientific technology used in this area involves the use of chemical, electrical, and mechanical processes to assist law enforcement officers in their jobs.<sup>2</sup>

Through the years, the courts have come to recognize the value of scientific evidence in the law enforcement area. However, despite this recognition of the potential value of scientific information, courts have, in general, been very cautious in admitting scientific data into evidence and do so only in strict accordance with the long established rules of evidence. It is because of this procedural caution that a spectrum of admissible and inadmissible scientific test results has developed in this country. At one end of the spectrum are scientific methods that have become so widely recognized by the courts that judicial notice is taken of their reliability, for example, fingerprint evidence.<sup>3</sup> On the other end of the spectrum are tests such as "truth-serum" or hypnosis which allegedly determine the truthfulness of a person's statements, and

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1. Boyce, *Judicial Recognition of Scientific Evidence in Criminal Cases*, 8 UTAH L. REV. 313, 313 (1963-1964).
  2. See J. RICHARDSON, *MODERN SCIENTIFIC EVIDENCE* 10-14 (2d ed. 1974).
  3. See generally A. MOENSSENS, R. MOSES & F. INBAU, *SCIENTIFIC EVIDENCE IN CRIMINAL CASES*, 306-47 (1973).

which few courts have considered reliable enough for courtroom use.<sup>4</sup> Between these two extremes are tests like the polygraph (lie detector) technique. Many specialists advocate judicial approval of lie detector tests yet many psychiatrists and psychologists oppose their use. Consequently, at the present time, general admissibility has been denied to polygraph results.<sup>5</sup>

The Nebraska Game and Parks Commission (hereinafter referred to as the Commission), like other law enforcement agencies, has made an extensive effort to keep abreast of the scientific advances which might aid it in carrying out its duty of game law enforcement. In 1968, the Commission began studying and experimenting with the identification of blood and tissue samples for game law enforcement purposes. Its primary objective was to develop a scientific testing procedure for identification of unknown blood or tissue samples from various animal species. These identifications would greatly aid the Commission in determining whether a suspected game law violator had in fact taken game animals illegally. After considerable study and experimentation, the Commission was able to develop two scientific identification techniques by which blood and tissue samples could, in a manner of speaking, be "fingerprinted." These "fingerprints" could then be compared with the "fingerprints" of blood and tissue samples from known animal species in order to identify the particular animal species from which the unknown blood or tissue sample had originated. These identification techniques were developed by adapting two generally known, but not widely used, scientific testing processes to the game law enforcement area. The two testing processes are called immunodiffusion and immunoelectrophoresis.

In the past few years, the Commission has performed approximately twenty-five identifications a year with its new scientific identification techniques. Of these identifications, about four or five have been used in a court of law each year.<sup>6</sup> The surprising fact is that the admissibility of the testing results as valid evidence has yet to be challenged by a defense attorney in a Nebraska court. This fact has caused the Commission some concern. It is confident that its scientific identification results are credible and reliable. However, the Commission is unsure exactly what it must be able to show in order to prove reliability when, as is inevitable, it is eventually put to the task by an aggressive defense attorney.

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4. *Id.* at 565-77.

5. *Id.* at 539-64.

6. D. OATES, C. BROWN & D. WEIGEL, BLOOD AND TISSUE IDENTIFICATION, pt. 1, A-5 (Neb. Game & Parks Comm'n 1974).

The purpose of this article is threefold. First, to explain the historical background, general principles and mechanical processes upon which the Commission's scientific identification methods are based. Second, to examine the standards by which scientific evidence in general must be measured in determining its admissibility in a court of law. And finally, to formulate an opinion based on general legal standards and Nebraska law as to the evidentiary status in Nebraska of the Commission's scientific identification methods.

## II. HISTORICAL BACKGROUND OF SCIENTIFIC PRINCIPLES AND MECHANICAL PROCESSES

"The discovery that human beings could be identified as individuals by means of their fingerprints started research in a broad field that now encompasses the forensic sciences."<sup>7</sup> The major advances that have been made in the field of forensic science since fingerprinting have caused many forensic experts to believe that all items of the universe are in some respect different from all other similar items. This belief has led two eminent forensic scientists to state:

If all similar physical objects are in some respect different from each other, blood should be no exception, be it liquid or dried, in a bottle or as a dry spot on the floor, on the clothing, or on the furniture at the scene of the crime. . . . If blood could be individualized with precision, blood would rank with fingerprints in importance.<sup>8</sup>

The key to individualizing blood was early thought to be in the study of its protein structures. Years of study and research confirmed these beliefs to the extent that, today, the central dogma of molecular biology is that protein differences exist between different animal species and, in a much more intricate and complicated manner, between individuals within the same animal species.<sup>9</sup>

In 1901, the German scientist, P. Uhlenhuth, first demonstrated that due to the protein differences existing between animal species, an unknown blood sample could be identified as coming from a human or an animal.<sup>10</sup> Uhlenhuth's scientific identification technique, the precipitin test, had the capacity to identify blood on test objects consisting of wood, metal, and cloth. The test's results were first used as legal evidence in a 1902 French murder trial in which it was shown that the blood stains on the defendant's cloth-

7. Kirk & Grunbaum, *Individuality of Blood and Its Forensic Significance*, 1969 LEG. MED. ANN. 289, 289.

8. *Id.* at 289-90.

9. See C. MANWELL, *MOLECULAR BIOLOGY AND THE ORIGIN OF THE SPECIES* 394 (1970).

10. J. RICHARDSON, *supra* note 2, at 11. Uhlenhuth achieved this by using immunological principles developed by Bordet in 1898.

ing were human blood, and not rabbit blood as the defendant had claimed.<sup>11</sup> It is important to note that the precipitin test can also be used to identify the specific non-human animal species which is the source of an unknown sample of blood. This is done by preparing antiserum from the blood serum of various animals in a manner similar to the preparation of antiserum from human blood serum.<sup>12</sup>

For the forty years following Uhlenhuth's development of the precipitin test, the technique was rarely used in the United States. It was, however, extensively employed in India and Europe for criminal cases and in tests for meat adulteration.<sup>13</sup> Originally, the precipitin test was thought to be specific in its results but it was soon discovered that related species of animals caused cross reactions and false identification of blood in some cases. For example, anti-human serum was found to react to some extent with the blood of other primates such as chimpanzees and gorillas, yielding false identifications of the blood as that of a human.<sup>14</sup> The precipitin test has also proved inadequate to differentiate between certain related species such as horses and mules or goats and sheep.<sup>15</sup> Very little information has been published on blood and meat identification of game animals for forensic purposes. However, it is

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11. The complexities of the precipitin test are somewhat involved, but the following basic explanation of the test should help the reader to understand at least its mechanics:

The questioned blood sample is dissolved in a saline solution and centrifuged to clearness. The serum is then drawn off and carefully placed into a separate test tube containing antiserum from a rabbit injected with known human blood. The appearance of a white or gray precipitate ring between the suspect serum and known antiserum within five minutes, and the precipitation of this white or gray flock over the succeeding 15 to 20 minutes, are indicative of the blood's human origin. If no precipitate at all appears within 20 minutes, the result is negative, that is, the specimen of blood is not of human origin.

The human antiserum obtained from the rabbit is produced by injecting the rabbit with foreign protein in the form of several centimeters of sterile human serum on each of several intervening occasions. The blood serum of the rabbit reacts to the injected foreign human serum by forming antibodies to combat the foreign human serum. These antibodies formed by the rabbit are drawn off by needle and constitute the antiserum used in the precipitin test. Antiserum from a rabbit inoculated with human serum will react only with the serum from human blood to form a precipitate. Antiserum from rabbits is produced commercially for use in serological tests.

A. MOENSSENS, R. MOSES & F. INBAU, *supra* note 3, at 253-54.

12. See note 11 *supra*.

13. See Wolfe, *Factors Which May Modify Precipitin Tests in Their Applications to Zoology and Medicine*, 6 *PHYSIOL. ZOOL.* 55, 56 (1933).

14. A. MOENSSENS, R. MOSES & F. INBAU, *supra* note 3, at 252 n.23.

15. *Id.* at 254.

known that one of the greatest breakthroughs in game law enforcement occurred in California where, for the first time in this country, a person was convicted with evidence based wholly upon the precipitin test and its ability to differentiate venison from beef, mutton, and bear meat.<sup>16</sup>

Due to the false identification problems engendered in the precipitin test, scientists began to search for more accurate and precise testing methods to identify the species origin of unknown blood samples. Immunodiffusion precipitin techniques were developed independently in Sweden and England in 1948.<sup>17</sup> A few years later, in 1953, immunoelectrophoresis precipitin techniques were developed in the United States.<sup>18</sup> In recent years, these new approaches to the problem of identifying blood through detection of hereditary differences in the blood proteins have developed at a remarkable rate. Of all the methods derived for separating and identifying protein fractions, no method has more potential than procedures based on electrophoretic separation.<sup>19</sup> "By any criterion, electrophoresis and immunoelectrophoresis, when combined with conventional blood grouping, offer the most comprehensive, practical, and rapid approach to the individualization of blood that is available at this time."<sup>20</sup> Indeed, scientists have been led to comment that the increased specificity of immunoelectrophoresis in separating the blood proteins is the nearest to a "fingerprint" technique for blood that has yet been developed.<sup>21</sup>

Despite the tremendous scientific advancements that have been made in the area of "fingerprinting" blood, immunodiffusion and immunoelectrophoresis have not been widely used to solve forensic problems. A recent survey of selected criminalistics laboratories within the United States has shown that only limited use is currently being made of available technology in immunological and electrophoretic analysis of blood.<sup>22</sup> There are two major reasons for such limited use. First, the techniques are not yet simple, rapid, or inexpensive enough. Second, many law enforcement agencies lack the trained personnel, laboratory space, funds, or time to use the new techniques.

Despite the limited use of available technology in immunological and electrophoretic analysis of human blood and tissue, the Commission decided to explore the possibility of using the tech-

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16. See Wolfe, *supra* note 13, at 56.

17. See D. OATES, C. BROWN & D. WEIGEL, *supra* note 6, at 8.

18. *Id.*

19. See Kirk & Grunbaum, *supra* note 7, at 300.

20. *Id.* at 309.

21. *Id.* at 312.

22. See Grunbaum, *Electrophoresis in Forensic Applications*, INDUSTRIAL RESEARCH, Nov. 15, 1977, at 13.

niques in the game law enforcement area. During the 1960's, the Commission had come to realize that it was in acute need of an accurate scientific technique for identifying the animal species origin of blood and tissue samples. It was obvious that without such a technique, the Commission would not be able to properly enforce the state's game laws. The Commission had used the precipitin test with some success, but it was extremely slow and awkward to run. Additionally, the test results were often unreliable because they were subject to myriad interpretations. For these reasons, in 1968 the Commission's Research Division initiated a research project to develop an improved scientific technique of identifying blood and tissue samples for game law enforcement purposes.<sup>23</sup> The project produced somewhat unique immunodiffusion and immunoelectrophoretic techniques for identifying the animal species origin of blood and tissue samples. Because the Commission's two scientific identification techniques are somewhat complicated, a basic understanding of how they operate is necessary in order to fully examine the admissibility of their results into evidence in a court of law.

#### A. Immunodiffusion

A glass slide is prepared with three spots containing a mixture of blood from the unknown animal species and three spots filled with a similar solution made from the blood of a known animal species. The spots form a circular pattern and are alternated so that one spot contains the known blood and the next contains the unknown blood. An antiserum produced by injecting blood from the known species into a rabbit is then added to the center of the slide in the middle of the circle of blood spots. As the antibodies contained in the antiserum come into contact with the proteins of the unknown and known blood solutions, a precipitate band is formed. These bands constitute what has been referred to as a "fingerprint" of the proteins contained in the blood samples. If

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23. The research was initiated by Mr. Carl Wolfe, Senior Biologist in the Commission's Research Division and was financially supported by funds from the Federal Aid to Wildlife Restoration Act, 16 U.S.C. §§ 669-669i (1976), under Pittman-Robertson Project W-38-R and by general funds from the Commission itself. In his research, Mr. Wolfe enlisted the assistance of Carl R. Jolliff, Director of the Clinical Laboratory of Lincoln; Dr. Connell L. Marsh, Professor of Biochemistry, University of Nebraska; Dr. Leonard W. Staudinger, Biology Department Chairman, Nebraska Wesleyan University; Dr. Stan Cassel D.V.M.; and Mr. David W. Oates, Senior Chemist in the Commission's Research Division. D. OATES, C. BROWN & D. WEIGEL, *supra* note 6, at 3. Additionally, since it was impossible to purchase the necessary scientific equipment from commercial sources, Mr. Wolfe sought the aid of a group of private Lincoln industries to develop the equipment.

the unknown blood solution contains exactly the same proteins as those in the blood of the known animal species, the bands will form a hexagon. Since no two separate animal species have exactly the same proteins in their blood, the occurrence of a hexagon pattern signals that the unknown animal blood has come from the same animal species as that of the known species.

If the blood from the unknown animal is not the same as that of the known species, then a triangular pattern will appear on the slide. The test must, therefore, be repeated using different blood taken from other known animal species, *e.g.*, cattle, antelope, etc., until a hexagon pattern is finally achieved, resulting in a positive identification.

### **B. Immunoelectrophoresis**

Instead of the six test areas, this method involves the division of the slide in half, with a trough in the middle. The unknown and known blood samples are then mixed into separate saline solutions and placed on opposite sides of the trough. The slide is placed in a chamber in which electric current is then passed through the substances. The current causes the proteins of the samples to migrate toward the poles of the current. An antiserum, produced in the same manner as described above, is then added to the trough in the middle of the slide. After twenty-four hours, the antibodies in the antiserum combine with the electrically-diffused proteins of the blood samples to form a distinct pattern of arcs. Again, if the unknown animal blood contains exactly the same proteins as the blood from the known animal species, the precipitate arcs on the right side of the trough will be exactly the same as the precipitate arcs on the left side. Because no two separate animal species have exactly the same proteins in their blood, the occurrence of mirror image precipitin arcs indicates that a positive identification has been made. If the arcs do not match, the test will be repeated using different known animal blood until a mirror image is achieved, thereby identifying the unknown blood.

When a positive identification has been made by either the immunodiffusion or immunoelectrophoresis method, the evidence may be prepared in a number of ways in order to aid in the prosecution of a game violator. After the slides have been clearly tagged to assure proper identification, they may be photographed. Alternatively, the slide itself may be coated with a protective covering which will make it permanent for filing and future use outside the laboratory. An advantage of preparing the slide in this manner is that it may be used in an overhead projector if presentations must be made to large groups such as juries.



Although these two scientific techniques have been analogized to fingerprinting techniques, this is somewhat inapt. Unlike fingerprinting, the blood testing techniques have not yet been refined to a point at which they can be used to identify a particular individual within a species. Presently, it is only possible to determine the species of the animal. However, this is not regarded as a critical defect in the two scientific techniques. For the purpose of game law enforcement, it is sufficient that the identification techniques allow the Commission to identify the species. Once identified, the proper legal action can be instituted according to the penalties set down for the type of animal found in the hunter's illegal possession.

### III.

#### STANDARDS FOR THE ADMISSIBILITY OF SCIENTIFIC EVIDENCE

In arriving at conclusions concerning the material elements of a case, the trier of fact uses two types of propositions, specific and general.<sup>24</sup> The sources of these propositions depend upon the type of evidence involved. When "ordinary evidence," as distinguished from scientific evidence, is used, the specific propositions are derived from witnesses' statements concerning what they remember or from the trier of fact's own perceptions.<sup>25</sup> The general propositions are obtained from the trier's general everyday knowledge and experience.<sup>26</sup> In the case of scientific evidence, science may provide the trier of fact with specific propositions which neither the witnesses nor trier of fact could have obtained by way of their unaided or uninformed sensory perceptions.<sup>27</sup> Wigmore noted this when he stated that scientific devices now produce precise minute data, perception of which was formerly beyond imagination.<sup>28</sup> Science may also provide the trier of fact with general propositions which are not the product of general everyday knowledge and experience.<sup>29</sup> These general propositions may then be applied to specific scientific propositions to show how data, which otherwise is meaningless to the trier of fact, has a bearing upon the issues of the case.

Most scientific evidence is like circumstantial evidence because it does not directly address itself to legal issues and facts. Conse-

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24. James, *Relevancy, Probability and the Law*, 29 CALIF. L. REV. 689, 696 (1941).

25. See Strong, *Questions Affecting the Admissibility of Scientific Evidence*, 1970 U. ILL. L.F. 1, 2.

26. *Id.*

27. *Id.*

28. 2 J. WIGMORE, *EVIDENCE* § 417b (3d ed. 1940).

29. Strong, *supra* note 25, at 3.

quently, like circumstantial evidence, it must be determined that the offered scientific evidence is reliable and has some logical relationship to the legally determinative facts of the case before it is admissible.<sup>30</sup> With ordinary circumstantial evidence, this determination is left to the trier of fact.<sup>31</sup> With scientific evidence, some unique problems are encountered in attempting to make the above determination.

Where scientific evidence is involved, however, the trier of fact often cannot realistically be viewed as possessing the capacity to evaluate the reliability of specific data gathered by scientific means, to supply a general proposition by which the significance of the data may be seen, or to apply such a proposition correctly. Therefore, various requirements which must be met before scientific evidence is admitted should be, and largely are, designed to compensate for these inadequacies of the trier of fact.<sup>32</sup>

The requirements that must be met before scientific evidence is admissible in court consist of a series of general tests and procedures. The particular admissibility tests and procedures to be used on a specific piece of scientific evidence depend upon whether the evidence is a general proposition of science or a specific proposition obtained by scientific techniques. Consequently, a court must initially categorize the scientific evidence sought to be admitted as a general or a specific proposition before it can begin to apply the proper admissibility tests and procedures. Additionally, it must be remembered that one function of scientific evidence is to supply general propositions of science which, when applied to specific scientific propositions, show how the seemingly meaningless specific data has a bearing upon the issues in the case.<sup>33</sup> "Thus, a line of proof directed at the establishment of a material fact may involve both specific data scientifically obtained and general propositions of science which reveal the significance of that data for the litigation at hand."<sup>34</sup>

This appears to be the situation with immunodiffusion and immunoelectrophoretic evidence. The two scientific identification techniques produce specific propositions that the proteins in the unknown blood sample are exactly the same as the proteins in the known blood sample. These propositions, however, are meaningless to the trier of fact until the general proposition of science, that protein differences arise between different animal species, is applied to the specific propositions. It is only then that the trier of fact can relate the specific propositions obtained from the two sci-

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30. *Id.*

31. *Id.* at 4.

32. *Id.*

33. *Id.* at 2-3.

34. *Id.* at 6.

entific identification techniques to the issues in the case. The trier can then reason that if protein differences arise between different animal species and if the two identification techniques showed no protein differences between the unknown blood sample and the known blood sample, they must be from the same animal species. This reasoning allows the test data to be brought to bear on the issues of the case.

In these instances, where the line of proof directed at establishing a material fact involves both a specific proposition scientifically obtained and a general proposition of science which shows the significance of the specific proposition to the case at hand, the court must first test the admissibility of the general proposition and then, if it finds the general proposition admissible, test the admissibility of the specific proposition. The following discussion will explain the general tests and procedures for determining the admissibility, first, of general propositions of science and, second, of specific propositions obtained by scientific techniques.

#### A. General Propositions of Science

"If a general principle of science will be necessary to show the relevancy of a given line of proof, the most expeditious manner in which that principle may be established is through the use of judicial notice."<sup>35</sup> It is now well known that the general propositions of science upon which fingerprinting, blood tests to determine intoxication and nonpaternity, and radar checks of automobile speed are based have been given judicial notice.<sup>36</sup> What then must be shown concerning a general proposition of science in order to persuade a court to take judicial notice of its validity? When the courts have no precedent to guide them on the issue, they have generally turned to one of two suggested standards for assistance. One standard asserts that judicial notice may be taken of generally known facts but should not be taken of facts which are known, if at all, only by a specially informed class of persons.<sup>37</sup> The alternative standard, as suggested by Professor McCormick, asserts that judicial notice may be taken of all scientific facts for which ready and indisputable verification exists.<sup>38</sup> The new Nebraska Evidence Rules<sup>39</sup> appear to have adopted a combination of the two standards:

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35. *Id.*

36. See C. McCORMICK, EVIDENCE § 330 (2d ed. 1972).

37. See *Lewis v. Firestone*, 130 A.2d 317 (D.C. Mun. Ct. App. 1957); *Lickfelt v. Jorgenson*, 179 Minn. 321, 229 N.W. 138 (1930); *Alexander v. Fireman's Ins. Co.*, 317 S.W.2d 752 (Tex. Civ. App. 1958).

38. C. McCORMICK, *supra* note 36, § 330.

39. NEB. REV. STAT. §§ 27-101 to 1103 (Reissue 1975).

A judicially noticed fact must be one not subject to reasonable dispute in that it is either (a) generally known within the territorial jurisdiction of the trial court or (b) capable of accurate and ready determination by resort to sources whose accuracy cannot reasonably be questioned.<sup>40</sup>

It would appear that under this combined standard, the Commission would be able to persuade a Nebraska court to take judicial notice of the general proposition of science that protein differences exist between different animal species. Although it is questionable whether the Commission could ever show that the general proposition is "generally known within the territorial jurisdiction of the trial court," it seems clear that it is "capable of accurate and ready determination by resort to sources whose accuracy cannot reasonably be questioned." The Commission need only exhibit to the court some of the many nationally recognized publications citing the general proposition as the "central dogma of molecular biology."<sup>41</sup>

Even if a court refuses to take judicial notice of the validity of a general scientific proposition, that validity may still be shown by expert testimony. Although an occasional case may be found suggesting that unless judicial notice is taken of the general scientific proposition the evidence is inadmissible, the overwhelming weight of authority is clearly to the contrary.<sup>42</sup> There are three basic hurdles that must be cleared in establishing the validity of a general scientific proposition by expert testimony.<sup>43</sup> The first is that the expert witness must be qualified by sufficient foundation evidence.<sup>44</sup> This has nothing to do with the validity of the proposition itself; it merely establishes that the witness is in fact an expert. The second hurdle is that the expert witness be shown to be supplying information solely from the field of his or her special knowledge and not from areas beyond those of his or her demonstrated competence.<sup>45</sup> The third and final hurdle is that the general proposition upon which the expert witness proposes to testify must have achieved general acceptance in the scientific community.<sup>46</sup> This final requirement of general acceptance was originally set forth in the case of *Frye v. United States*<sup>47</sup> and has come to be commonly known as the *Frye* standard.<sup>48</sup>

40. *Id.* § 27-201(2).

41. See C. MANWELL, *supra* note 9, at 394.

42. See Strong, *supra* note 25, at 9.

43. *Id.* at 9-11.

44. *Id.* at 9.

45. *Id.* at 10.

46. *Id.* at 10-11.

47. 293 F. 1013 (D.C. Cir. 1923).

48. Exactly what the *Frye* standard requires is unclear: "The resulting standard, something greater than acceptance by the expert himself, but less than ac-

The critical factor in whether a general scientific proposition has achieved "general acceptance" seems to be whether some scientific profession has used it as a working tool in its particular field of science. Under this type of analysis, it would appear that the general scientific proposition upon which the Commission relies has achieved general acceptance within the scientific community. The profession of forensic medicine has relied upon the general proposition since the turn of the century when it began using it in its precipitin identification tests of blood samples. Additionally, the medical and dental professions have relied upon the general proposition in many research oriented projects.<sup>49</sup> It would appear, then, that should a Nebraska court refuse to give judicial notice to the general scientific proposition relied upon by the Commission in its scientific identification techniques, the validity of the proposition could still be shown by expert testimony. The Commission would merely have to call as a witness its senior biologist or chemist, qualify him or her as an expert in the fields of biology or chemistry, and have him or her testify to the fact that the general proposition is the central dogma of molecular biology which has been used in the field of forensic medicine for many years.

## B. Specific Propositions Obtained By Scientific Techniques

For the most part, the methods by which the validity of a scientific test or device is established are the same as those used to establish the validity of a general scientific proposition. The test or device's validity may be established by either judicial notice or expert testimony. "Since scientific methods for the acquisition of specific data are themselves applications of other general scientific principles, no distinction appears warranted between the standard for judicial notice of a general scientific principle and that for notice of a specific testing device or method."<sup>50</sup> However, it is not clear whether the standards for establishing the validity of a scientific testing device or method by expert testimony are the same as those used to establish the validity of a general scientific proposition by expert testimony. The witness must, of course, still be qualified as an expert by the appropriate foundation evidence. The expert must also limit testimony to information solely within the bounds of his or her expertise. However, the courts have not

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ceptance by all experts in the field, is obviously somewhat lacking in definitiveness." Strong, *supra* note 25, at 11.

49. The central dogma of molecular biology is used by these professions when making diagnoses of diseases which cause damage to the proteins in the blood.

50. Strong, *supra* note 25, at 15.

been in full agreement as to whether the expert may only testify on behalf of scientific testing devices or techniques which have achieved "general acceptance in the scientific community." Some courts have applied the *Frye* standard in this context.<sup>51</sup> It is their view that the "general acceptance" requirement applies just as forcefully to the establishment of the validity of scientific testing devices and techniques as it does to the establishment of the validity of a general scientific proposition.

The Nebraska Supreme Court appears to have applied the *Frye* standard in the case of *Boeche v. State*.<sup>52</sup> The issue in the case was whether the results of a polygraph test, to which the defendant had voluntarily submitted, were admissible evidence.<sup>53</sup> The court, after reviewing many reported cases, held that the scientific testing results were inadmissible:

It is apparent from the foregoing authorities that the scientific principle involved in the use of such polygraph has not yet gone beyond the experimental and reached the demonstrable stage, and that it has not yet received general scientific acceptance. The experimenting psychologists themselves admit that a wholly accurate test is yet to be perfected.<sup>54</sup>

Consequently, it would appear that in order to establish the validity of a scientific testing device or technique in a Nebraska court, it must be established that the device or technique has achieved general acceptance within the scientific community.

If the Commission must, by way of expert testimony, show general acceptance within the scientific community of the immunodiffusion and immunoelectrophoretic identification techniques before their results will be admissible evidence in Nebraska, it might attempt to do so by either of two methods. Under the first method, the initial step would be to explain how the two new techniques are in essence merely refined versions of the precipitin test which has been in existence since 1901.<sup>55</sup> The next step would be to show the wide recognition that the precipitin test has now achieved. The California courts have convicted a person for violation of game laws solely on the basis of the precipitin test's results.<sup>56</sup> Nationally-recognized trial preparation books suggest the use of the precipitin test as evidence.<sup>57</sup> Leading treatises on scientific evidence have hailed the precipitin test as "[t]he confirmatory test to identify a substance as being blood, and further classifying

51. See, e.g., *People v. Becker*, 300 Mich. 562, 2 N.W.2d 503 (1942); *State v. Bohner*, 210 Wis. 651, 246 N.W. 314 (1933).

52. 151 Neb. 368, 37 N.W.2d 593 (1949).

53. *Id.* at 376, 37 N.W.2d at 597.

54. *Id.* at 377, 37 N.W.2d at 597.

55. See J. RICHARDSON, *supra* note 2, at 11.

56. See Wolfe, *supra* note 13, at 56.

57. See 2 AM. JUR. PROOF OF FACTS *Blood Tests*, Proof 1 (1959).

it as being from animal or human origin."<sup>58</sup> Furthermore, a national survey made by the Commission in 1973 revealed that fish and game agencies in at least thirteen states were using the precipitin test for the identification of the species' origin of blood and tissue samples.<sup>59</sup> The final step would be to impress upon the court that since immunodiffusion and immunoelectrophoresis are improved refinements of the precipitin test, they should be accorded the same judicial recognition as the precipitin test.

The second method of using expert testimony to establish general acceptance within the scientific community of the immunodiffusion and immunoelectrophoretic identification techniques would be the introduction of national survey findings regarding their usage.<sup>60</sup> The Commission's 1973 national survey revealed that the

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58. See A. MOENSSSENS, R. MOSES & F. INBAU, *supra* note 3, at 252.

59. The 1973 survey found that Arizona, Arkansas, Idaho, Iowa, Maine, Michigan, Mississippi, Missouri, North Carolina, Ohio, Rhode Island, Texas, and Wisconsin were using the precipitin test at that time. D. OATES, C. BROWN & D. WEIGEL, *supra* note 6, at A-1 to -13.

60. The surveys themselves are hearsay evidence. However, it has long been recognized in this country that the special skill of an expert witness enables him or her safely and properly to utilize hearsay material to determine the facts upon which an opinion rests. FED. R. EVID. 703, Adv. Comm. Note. This expert validation of hearsay evidence offered to establish factual premises does not, however, make the hearsay itself admissible. There are many situations in which expert opinion must rest on propositions of fact practically unprovable by conventional means, but as to which there is hearsay material so plainly reliable that the courts can be confident of its accuracy. It is in these situations that experts are allowed to testify to their relevant opinions simply on the basis of their own personal acquaintance with the reliable hearsay evidence. A perfect example of this occurs when an expert is allowed to testify to the value of a particular piece of realty when the only bases for the opinion are past discussions with realtors and published lists of sale or market prices. See Maguire & Haahes, *Requisite Proof of Basis for Expert Opinion*, 5 VAND. L. REV. 432 (1952).

Consequently, it would appear that a qualified expert witness for the Commission could use the surveys as a basis for stating an opinion that the immunodiffusion and immunoelectrophoresis techniques are generally accepted within the scientific community. The expert need not disclose the basis of the opinion on direct examination and it would probably be wise for the proponent of the expert not to ask questions on it. An unperceptive cross examiner will fail to notice that the general acceptance of the two scientific identification techniques is being established on the basis of hearsay evidence. After the results of the two identification techniques are admitted, the unperceptive cross examiner is stuck with the evidence and the only recourse is to attempt to discredit its value in the eyes of the trier of fact. On the other hand, if the cross examiner is perceptive, he or she will notice what the proponent of the witness is doing and will immediately request the basis of the expert's opinion. At this time, the expert must disclose reliance on the results of national surveys. The cross examiner will then undoubtedly object to the admission of results from the two identification techniques.

The court must then determine whether the surveys are so plainly reliable

fish and game agencies of seven states, other than Nebraska, were using the immunodiffusion identification technique.<sup>61</sup> Additionally, the survey showed that the fish and game agencies of three states, other than Nebraska, were using some type of electrophoretic identification technique.<sup>62</sup> Furthermore, a recent Canadian survey revealed that the game law enforcement agencies of two Canadian provinces were using electrophoretic identification techniques.<sup>63</sup>

In January, 1978, the Commission initiated a second survey in an effort to determine what types of blood and tissue identification techniques were becoming most popular. The results from the thirty-seven states which had responded as of April 13, 1978, revealed that fourteen states<sup>64</sup> were still using the precipitin test; nine states<sup>65</sup> were using immunodiffusion techniques; and nine states<sup>66</sup> had implemented some form of electrophoretic identification technique.<sup>67</sup> Additionally, two states indicated that they were presently experimenting with electrophoretic techniques and

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as to carry confident conviction. If the court decides that they are sufficiently reliable, the expert's opinion will not be barred, and may then be used to establish general acceptance within the scientific community of the immunodiffusion and immunoelectrophoresis techniques. Even if the court should decide that the surveys were not sufficiently reliable and thereby bar the expert's opinion, the proponent of the expert might still be able to get the surveys admitted as substantive evidence pursuant to an exception to the hearsay rule. This might be accomplished under either NEB. REV. STAT. § 27-803(2) (Reissue 1975) (state of mind exception) or NEB. REV. STAT. § 27-803(22) (Reissue 1975) (necessity-trustworthiness exception). *Accord*, *Zippo Mfg. Co. v. Rogers Imports, Inc.*, 216 F. Supp. 670 (S.D.N.Y. 1963).

61. The states included Arizona, Colorado, Maine, Montana, Oregon, Wisconsin, and Wyoming. *D. OATES, C. BROWN & D. WEIGEL, supra* note 6, at A-1 to -13.

62. *Id.* This group consisted of California, Idaho, and Oregon.

63. The survey, conducted by Mr. Stan Webb for the Alberta Fish and Wildlife Division, Department of Lands and Forests, revealed that the provinces of Alberta and New Brunswick were using electrophoretic identification techniques.

64. The states included Arizona, Connecticut, Delaware, Florida, Iowa, Louisiana, Maine, Michigan, Missouri, Nevada, New Jersey, New Mexico, Pennsylvania, and Texas.

65. This group was composed of Alaska, Delaware, Idaho, Illinois, New Mexico, Pennsylvania, Tennessee, Utah, and Wyoming.

66. These states were Arizona, Arkansas, Idaho, Illinois, Iowa, Michigan, New Mexico, Oregon, and Wyoming.

67. It must be pointed out that these states are probably not the only states using one or more of the three identification techniques. Several state fish and game agencies who responded to the survey stated that they did not have their own forensic laboratory facilities. These respondents all stated that any blood or tissue samples which they needed to have identified were sent to either a state or federal crime lab to be tested. The respondents were unable to state on their survey returns exactly what identification techniques were used by the crime labs. Consequently, it is quite possible that many state fish and game agencies are indirectly, through state or federal crime



would be implementing them soon.<sup>68</sup> Nearly all the survey respondents who were using immunodiffusion and electrophoretic identification techniques stated that evidence derived from their techniques had been accepted as admissible evidence in court cases dealing with possible game law violations. However, none of the respondents were aware of any reported opinions specifically addressing the admissibility issue.<sup>69</sup> One can speculate that, as of this time, only lower-level trial courts, whose decisions are not reported, have been confronted with the issue and have decided in favor of admitting the evidence. Nonetheless, this absence of reported decisions is not a critical factor in determining general acceptance within the scientific community of the immunodiffusion and immunoelectrophoretic techniques. As the Commission's 1973 and 1978 surveys demonstrate, more and more states are implementing the two techniques in their game law enforcement programs every year. Furthermore, more state trial courts are allowing the results to be admitted into evidence each year. These facts, in themselves, are a substantial aid in establishing the general acceptance of the two scientific identification techniques.

It is important to note, however, that many courts have not imposed the *Frye* standard of general acceptance in cases in which the issue was the validity of a particular scientific testing device or technique.<sup>70</sup> The following criticism has generally been made of the use of the standard:

The requirement of "general acceptance" before admitting scientific evidence can itself be a thorny problem. If it must be established that the particular test has received wide application to show acceptance, a difficult burden may exist if the scientific principle is logically sound, but, because it is unique, time has not allowed the required application. In addition, if there is little opportunity for the application of scientific tests upon which the evidence may be based, valuable evidence may be unnecessarily rejected. Further, little room may be left to receive evidence where differing schools of thought may disagree as to its reliability.<sup>71</sup>

Other critics of the standard have argued:

[R]ules of evidence must be liberalized to take full advantage of scientific proof, i.e., it is irrational to set up "general scientific acceptance" as the criterion for admissibility when no such standard of certainty exists any-

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labs, using the immunodiffusion and immunoelectrophoretic identification techniques although they are unaware of it.

68. These two states were Alaska and Utah.

69. Information derived from Commission survey (January 1978).

70. See, e.g., *State v. Olivas*, 77 Ariz. 118, 267 P.2d 893 (1954); *People v. Garnier*, 20 Ill. App. 2d 492, 156 N.E.2d 613 (1959); *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); *Toms v. State*, 95 Okla. Crim. 60, 239 P.2d 812 (1952); *Commonwealth v. Mumert*, 183 Pa. Super. 638, 133 A.2d 301 (1957); *McKay v. State*, 155 Tex. Crim. 416, 235 S.W.2d 173 (1951).

71. Boyce, *supra* note 1, at 314.

where else in the law of evidence. Certainly, this standard is not required or expected of witnesses. Such a rigid standard for admissibility ignores that probative value is a relative concept for the triers of fact to weigh and measure.<sup>72</sup>

Seemingly in response to these criticisms, the courts refusing to impose the *Frye* standard have adopted a more liberal standard of acceptance.<sup>73</sup> These courts have generally held that evidence derived from scientific testing devices and techniques is admissible as long as a qualified expert witness testifies that, in his or her opinion, the particular test method employed is reliable and accurate, and that it is generally accepted as such by other experts in the field, rather than the entire scientific community.<sup>74</sup> The fact that there may be some disagreement in the scientific community as to the reliability of a particular test method is considered a matter affecting the weight of the evidence, not its admissibility.

A perfect example of a court applying this more liberal acceptance standard to a scientific test in an effort to determine its admissibility is *People v. Williams*.<sup>75</sup> The issue faced by the court was whether the results of a Nalline test to ascertain whether a person was under the influence of a narcotic were admissible scientific evidence. The court held that the test results were admissible as long as it was shown that the test had gained acceptance in the field of learning in which it was in use.<sup>76</sup> In other words, all that needed to be shown was that a specialty within a general field of science had recognized the reliability of the scientific test. Evidence that the medical profession, as a whole, endorsed the technique was not necessary. Indeed, the average physician would probably have little or no knowledge about the Nalline test, or any other test of a similar nature.

The Nalline test decision recognized the fact that specialization in today's scientific community makes it impossible for many tests

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72. J. RICHARDSON, *supra* note 2, at 15 n.17. It is the belief of many of these critics that

general scientific acceptance is a proper condition for the court to take judicial notice of a scientific fact, without laying the usual foundation, but not a sound criterion for the admissibility of scientific evidence. Any relevant conclusions, which are supported by a qualified expert witness, in a field finding substantial scientific acceptance should be admitted in evidence, for its probative value to be weighed by competent fact-finders in the light of all the circumstances. The courts should not confuse novelty with want of acceptance in refusing to admit the results of scientific techniques which offer much in aiding to ascertain the truth.

*Id.* at 24.

73. See note 70 *supra*.

74. See Boyce, *supra* note 1, at 314.

75. 164 Cal. App. 2d Supp. 858, 331 P.2d 251 (1958).

76. *Id.* at 860, 331 P.2d at 253.

to become widely known and generally accepted within a profession. The decision, however, gave little guidance to courts faced with the admissibility of tests of a more experimental nature which have been devised to meet the demands of a particular scientific problem but are relatively unknown by experts in the field. In 1968, the decision in *Coppolino v. State*<sup>77</sup> appeared to supply that guidance.

The *Coppolino* case was replete with scientific evidence for both the defense and the prosecution. Most significant, however, was evidence of scientific tests which had been specifically devised by a pathologist to reveal the presence of a certain chemical in body tissue. The test was previously unknown among pathologists, and expert witnesses for the opposing side testified to its lack of proven reliability. The court nevertheless upheld the admissibility of the test results on the theory that novel test results, specifically devised to explore a given problem, are not necessarily inadmissible simply because the profession at large is not yet familiar with them, so long as the expert witness lays a proper foundation for his opinion and explains what accepted principles of analysis he used.<sup>78</sup>

The result in *Coppolino* was justified on the basis of the trial judge's wide discretion in determining the admissibility of evidence.<sup>79</sup>

The rejection by some courts of the *Frye* standard in determining the validity of scientific testing devices and techniques encourages speculation about the chances of persuading a Nebraska court to apply a more liberal acceptance standard to the immunodiffusion and immunoelectrophoretic identification techniques. The answer might be found by making a closer analysis of the *Boeche* case. The majority stated the following reasons for requiring general acceptance of the polygraph test in the scientific community before its results are admissible in evidence:

Cogent reasons in support of this attitude readily suggest themselves. In the first place, the vital function of cross-examination would be impaired. The operator, appearing as a witness to report and interpret the results of the test, might be questioned as to his qualifications, experience, his methods, and on similar matters, and that is about all. But the machine itself—conceding the comparatively high percentage record as to accuracy and reliability claimed for it—escapes all cross-examination. There is no persuasive analogy here with such tests as fingerprinting which have a strictly physical basis, clearly demonstrable. It is not contended that the lie detector measures or weighs the important psychological factors.<sup>80</sup>

Unlike the polygraph test, the immunodiffusion and immunoelectrophoretic techniques can be persuasively analogized to

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77. 223 So. 2d 68 (Fla. App. 1968), *appeal dismissed*, 234 So. 2d 120 (Fla. 1969), *cert. denied*, 399 U.S. 927 (1970).

78. A. MOENSSENS, R. MOSES & F. INBAU, *supra* note 3, at 5.

79. See Strong, *supra* note 25, at 16.

80. 151 Neb. at 377, 37 N.W.2d at 597.

fingerprinting tests. That is to say, the tests can be replicated. This is because they, too, have a strictly physical basis which is clearly demonstrable. The two scientific identification techniques are based solely on the separation and comparison of blood proteins. Their results yield what has commonly been referred to as a "fingerprint" of the blood. For this reason, it can be hypothesized that the court might be willing to apply a more liberal acceptance standard to the immunodiffusion and immunoelectrophoretic techniques when determining the admissibility of their results, even though it applies the *Frye* standard to polygraph tests. This hypothesis is fortified by Justice Chappell's concurring opinion in *Boeche*.<sup>81</sup> Justice Chappell noted that a New York court had admitted the results of a pathometer test<sup>82</sup> after a competent foundation for the expert testimony regarding the results had been laid.<sup>83</sup> Justice Chappell quoted language from that opinion noting that testimony as to fingerprints, X-rays, handwriting, bullet markings, and psychiatric examinations was admissible evidence despite the fact that testifying experts frequently differed in their conclusions.<sup>84</sup> In those cases in which experts differed it was merely left to the jury to determine which expert, if any, it was going to believe. The New York court had reasoned that if such conflicting testimony was admissible, then it logically followed that testimony as to the pathometer test and its results should be admissible when a proper foundation had been laid. It was up to the jury to decide how much weight to give the scientific evidence. With this, Justice Chappell agreed and he subsequently stated: "Modern court procedure must embrace recognized modern conditions of mechanics, psychology, sociology, medicine, or other sciences, philosophy and history. The failure to do so will only serve to question the ability of the courts to efficiently administer justice."<sup>85</sup>

Furthermore, it must be pointed out that Nebraska trial courts, like the *Coppolino* court, have wide latitude in the admission of experimental tests.<sup>86</sup> Unless there is a clear abuse of discretion, a

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81. *Id.* at 378, 37 N.W.2d at 597 (Chappell, J., concurring).

82. A pathometer is a lie detector that measures electrical impulses of the body; a polygraph is a lie detector which measures pulse, blood pressure, and respiration.

83. 151 Neb. at 381, 37 N.W.2d at 599 (citing *People v. Kenny*, 167 Misc. 51, 3 N.Y.S.2d 348 (1938)).

84. 151 Neb. at 382, 37 N.W.2d at 599 (quoting 167 Misc. at 54, 3 N.Y.S.2d at 350).

85. 151 Neb. at 383, 37 N.W.2d at 600. Justice Chappell, however, believed that the more liberal acceptance standard could not be used in the *Boeche* case because the proper foundation had not been laid for the testimony on the polygraph and its results. Consequently, he concurred with the majority in excluding the test results.

86. See *Hawkins Constr. Co. v. Matthews Co.*, 190 Neb. 546, 557, 209 N.W.2d 643, 650 (1973).

judgment will not be reversed on account of the admission of such testimony.<sup>87</sup> In these cases, the foundational prerequisite to the admission of the test results is that the proponent demonstrate the competence of the person making the test, that the device or technique used was of a kind and in a condition suitable for the test, and that the test was fairly and honestly made.<sup>88</sup> All the above considerations lead to the belief that the Nebraska courts today would be willing to apply a more liberal standard than the *Frye* standard to the immunodiffusion and immunoelectrophoretic identification techniques when determining the admissibility of their results. The determination of the weight to be given the scientific evidence would, of course, be left to the jury.

It is also of some interest to note that recently an argument has surfaced for the rejection of the *Frye* standard, based on the new Federal Rules of Evidence.<sup>89</sup> It is urged that the new rules embody a new theory of admissibility for scientific evidence.<sup>90</sup> Proponents of this view argue that since the new rules of evidence do not specifically mention "general acceptance in the scientific community," they are not a codification of the *Frye* standard. Rather, the new theory for admissibility is based upon the language of Rules 401 and 402.<sup>91</sup> Rule 402, as adopted by the Nebraska Legislature,<sup>92</sup> establishes the general rule of admissibility for all evidence:

All relevant evidence is admissible except as otherwise provided by the Constitution of the United States or the State of Nebraska, by Act of Congress or of the Legislature of the State of Nebraska, by these rules, or by other rules adopted by the Supreme Court of Nebraska which are not in conflict with laws governing such matters. Evidence which is not relevant is not admissible.<sup>93</sup>

Consequently, if scientific evidence is to be admissible, it must first be relevant. Relevant evidence is defined in Rule 401: "Relevant evidence means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable than it would be without the evidence."<sup>94</sup> In other words, if the evidence has any probative value it meets the test for relevancy.<sup>95</sup> The critical question, then, becomes whether the scientific evidence in question has any probative value. Rule

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87. *Id.*

88. *Id.* at 557, 209 N.W.2d at 651.

89. Nebraska has, with some changes, adopted the Federal Rules of Evidence. NEB. REV. STAT. §§ 27-101 to 1103 (Reissue 1975).

90. See Romero, *The Admissibility of Scientific Evidence Under the New Mexico and Federal Rules of Evidence*, 6 N.M. L. REV. 187 (1976).

91. *Id.* at 200.

92. NEB. REV. STAT. § 27-402 (Reissue 1975).

93. *Id.*

94. *Id.* § 27-401.

95. Romero, *supra* note 90, at 201.

401 does not expressly state how to determine probative value. However, the Advisory Committee to the Federal Rules of Evidence indicated that the answer to this question "depends upon principles evolved by experience or science, applied logically to the situation at hand."<sup>96</sup> Logically, then, the scientific principles upon which a scientific technique is based should be examined. If these underlying principles are scientifically valid in the sense that the test results reliably indicate whatever the test was designed to prove, the technique has a tendency to prove credibility and is, therefore, relevant.<sup>97</sup>

Although general acceptance of the scientific device or technique among the scientific community is not required by Rules 401 or 402, it is still an important consideration under the new rules of evidence.<sup>98</sup> The lack of general scientific acceptance in the scientific community may still operate to exclude the scientific evidence. Rule 403 provides: "Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence."<sup>99</sup> Consequently, if the judge determines that possible harm which may be caused if the scientific evidence is admitted substantially outweighs the probative value of such evidence, it may be excluded.

Under this new theory of admissibility of scientific evidence, the immunodiffusion and immunoelectrophoretic identification techniques' results would be admissible evidence if it were shown that they were relevant and that their probative value substantially outweighed any possible harm that might be caused by their admission. The relevancy of the two techniques could be established by having an expert witness testify to the validity of the general scientific proposition upon which the two techniques are based, *i.e.*, that protein differences exist between different animal species. The expert could also testify to the validity of the two techniques' blood protein separation and identification processes. It would then be left to the discretion of the judge whether the probative value of the evidence outweighs any possible harm that might be caused by its admission.

In summary, there are three standards of acceptance which are more liberal than the *Frye* standard: (1) general acceptance by some experts within a particular field of science rather than the

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96. FED. R. EVID. 401, Adv. Comm. Note.

97. Romero, *supra* note 90, at 201.

98. *Id.* at 207.

99. NEB. REV. STAT. § 27-403 (Reissue 1975).

entire scientific community;<sup>100</sup> (2) admission of unique, relatively unknown, experimental evidence pursuant to the trial court's wide power of discretion;<sup>101</sup> and (3) relevancy under the newly adopted rules of evidence.<sup>102</sup> There is reason to believe that the Nebraska courts might be persuaded to apply one of the three more liberal standards to the Commission's two scientific identification techniques when attempting to determine the admissibility of their results into evidence. Should the Nebraska courts decide to apply any one of the three standards in place of the *Frye* standard, it is clear the Commission could make an extremely convincing argument that the identification techniques' results are admissible scientific evidence.

### C. Laying A Proper Foundation

After establishing the admissibility of a particular scientific device or technique's results in general, it remains necessary to establish that the device or technique was correctly and properly used or applied in the particular case in question. "Though this point may appear self-evident, the failure to distinguish between a valid method and a valid use of that method on a particular occasion would appear to have produced more errors in the admission of scientific evidence than any other single cause."<sup>103</sup> In order to show the correct and proper use of a scientific device or technique, foundation testimony is required to explain the steps followed on the particular occasion in question. There are no explicit rules delineating exactly what must be shown in order to lay a sufficient foundation concerning the manner of use of a scientific device or technique on a particular occasion. However, the Nebraska Supreme Court has established three broad general foundational requirements for such instances.<sup>104</sup> First, the competence of the person who made the test must be shown.<sup>105</sup> Second, the scientific device or technique used must be shown to be of a kind and in a condition suitable for the test.<sup>106</sup> Finally, the test must be shown to have been honestly and fairly made.<sup>107</sup> In each case, it is left to the discretion of the trial court to determine whether each of the above three elements has been satisfied.

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100. See note 70 & accompanying text *supra*.

101. See notes 77-78 & accompanying text *supra*.

102. See notes 90-91 & accompanying text *supra*.

103. Strong, *supra* note 25, at 18.

104. See *Hawkins Constr. Co. v. Matthews Co.*, 190 Neb. 546, 557, 209 N.W.2d 643, 650-51 (1973).

105. *Id.*

106. *Id.*

107. *Id.*

A corollary question is who must be called as an expert witness to lay the foundation. When only a specific application of the test is in question, it has generally been held that the necessary foundation testimony may be given by a witness who is qualified to mechanically operate the test even though that person may or may not have sufficient expertise to explain its underlying theory or interpret its results.<sup>108</sup> Conversely, the courts have generally refused to allow a witness who has expertise in the principles and theory of the testing process to testify in regard to the three foundational requirements if he or she did not personally conduct the test in question. "The credentials of such a witness, no matter how impressive, do not substitute for the credentials of the operator."<sup>109</sup> The Nebraska Supreme Court, however, has shown a willingness to admit the results of a scientific test without requiring the testimony of the test operator, provided the witness supervised the test procedure and it is established that the operator of the test was qualified to conduct it. In the case of *Houghton v. Houghton*,<sup>110</sup> the court held that a qualified pathologist who made blood grouping tests with the assistance of experienced technicians could testify to the test results from the particular occasion in question,<sup>111</sup> without calling the technicians to give foundation testimony.<sup>112</sup>

Consequently, after the admissibility of the immunodiffusion and immunoelectrophoretic techniques is established, it will become incumbent upon the Commission to demonstrate that the identification techniques were correctly and properly performed in each particular case in question. An expert witness will have to be called to explain the steps followed in performing the particular test involved. In Nebraska, this witness may be either the operator of the testing device or the person who supervised a properly qualified operator.

Finally, in order for the Commission to show that a particular test has been fairly and honestly made, it will have to produce testimony as to the identity and condition of the blood and tissue samples actually tested. Obviously, this must be done in order to assure the court that the samples seized from the suspected game law violator were the ones tested and that they were in such a condition that they could be accurately tested. Furthermore, due to the process used in each of the two scientific identification tech-

108. See, e.g., *City of Abilene v. Hall*, 202 Kan. 636, 451 P.2d 188 (1969).

109. Strong, *supra* note 25, at 20-21.

110. 179 Neb. 275, 137 N.W.2d 861 (1965).

111. NEB. REV. STAT. § 25-12,115 (Reissue 1975) was cited as statutory support for the court's holding.

112. 179 Neb. at 280-81, 137 N.W.2d at 866.



niques, the Commission will also have to establish the identity and condition of its known blood, tissue, and antiserum laboratory samples.

At trial, the first question will be whether the blood or tissue sample analyzed or examined by the Commission's expert in its laboratory, or produced in court as a basis for demonstrations before the jury, can be properly identified as the same sample seized from the defendant.<sup>113</sup> The burden of proof is on the Commission, as the party relying on the scientific evidence, to show the sample was seized from the defendant, and properly stored, and, if necessary, transported and delivered to the expert who made the analysis or examination.<sup>114</sup> Identity of a sample seized from the defendant may be established by direct testimony of a witness that to his or her personal knowledge the sample tested was the sample seized from the defendant.<sup>115</sup> However, if the sample in question has passed through several hands before being analyzed, the testimony of a single witness will not suffice. In such circumstances, it is necessary to establish a complete chain of custody by having everyone who ever had custody of the sample testify from whom the evidence was received and to whom it was delivered.<sup>116</sup> If one link of this chain of custody is not accounted for, then the sample cannot be made the basis of any expert testimony in the case.<sup>117</sup> Additionally, in Nebraska, "the probability of any tampering with the objects of such test must be negatived before evidence of this nature is admitted."<sup>118</sup>

The Commission would not appear to have any problem establishing the identity of the samples tested as those seized from the defendant. In each case that it deems sufficiently important to use one of its two scientific identification techniques, the Commission requires that the officer who seized the sample personally deliver it to the Commission's laboratory in Lincoln.<sup>119</sup> Once received at the laboratory, the sample is labeled and placed in a locked refrigerated evidence chamber to which only the senior chemist has a key.<sup>120</sup> When the sample is to be tested, the senior chemist removes it from the evidence chamber, personally super-

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113. See Annot., 21 A.L.R.2d 1216, 1219 (1952).

114. *Id.*

115. *Id.*

116. *Id.* at 1220.

117. See, e.g., *Roskey v. Hulewicz*, 185 Neb. 608, 177 N.W.2d 744 (1970). The court refused to admit evidence of the results of a urine test when the prosecution could not clearly establish who had taken the urine sample from the defendant.

118. *Hershiser v. Chicago B. & Q. R.R.*, 102 Neb. 820, 825, 170 N.W. 177, 179 (1918).

119. Interview with David W. Oates, Comm'n Senior Chemist (March 10, 1978).

120. *Id.*

vises the testing procedures, and when the test is over, returns any of the remaining sample to the evidence chamber for storage.<sup>121</sup> This procedure negates the possibility of any tampering with the sample. Also, by using this procedure, the Commission limits to two the number of custody witnesses it must produce at trial: the field officer who seized the sample and delivered it to the laboratory, and the senior chemist who received the sample and supervised its storage and testing.

The Commission may be somewhat overcautious in requiring its field officers to personally deliver all samples to the testing laboratory. Nebraska case law suggests that the Commission could have its field officers mail all samples into the laboratory and still only have to call two witnesses to establish the chain of custody of the sample at trial.<sup>122</sup> The most significant Nebraska Supreme Court decision in regard to this issue is *Schacht v. State*.<sup>123</sup> In that case, a doctor had taken samples of the defendant's blood for the purpose of having a chemical analysis made to determine if the defendant was under the influence of intoxicating liquor. He placed the samples in two vials and marked them with the defendant's name and the time of taking. Since it was a Sunday, the doctor then took the samples home with him and placed them in a refrigerator. The next morning, he wrapped them in an invoice requesting a blood examination and mailed them to the state department of health. The samples were received at the laboratory in due course and delivered to the proper persons in the department. The defendant contended at trial that since there was no testimony by the person who picked up the samples at the post office, the foundation was insufficient to admit the results of the test into evidence.<sup>124</sup> The court disagreed:

We think there is a presumption that articles transported by regular United States mail and delivered in the ordinary course of the mails are delivered in substantially the same condition in which they are sent. This presumption is a rebuttable one, but where there is no evidence tending to overcome the presumption it is sufficient to establish the identity of the article mailed and that it is in substantially the same condition as at the time of mailing. The rule for which the defendant contends would place a great burden upon addressee, such as the one here involved, to keep meticulous records of mail deliveries to protect against the mere possibility that articles so delivered might possibly become pertinent in a court proceeding. We think the objection as to foundation on this ground was

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121. *Id.*

122. *See, e.g.,* *State v. Bullard*, 186 Neb. 709, 185 N.W.2d 864 (1971); *State v. Tatreau*, 176 Neb. 381, 126 N.W.2d 157 (1964); *Schacht v. State*, 154 Neb. 858, 50 N.W.2d 78 (1951).

123. 154 Neb. 858, 50 N.W.2d 78 (1951).

124. *Id.* at 860, 50 N.W.2d at 79.

properly overruled.<sup>125</sup>

After establishing the identity of the samples tested, it will be incumbent upon the Commission to show they were in such a condition that they could be accurately tested by the immunodiffusion and immunoelectrophoretic techniques. The blood samples tested by the Commission are recovered in the form of (1) fresh blood, (2) clotted blood, (3) smears or (4) flakes.<sup>126</sup> Additionally, the blood samples are recovered on a variety of items, the most common ones being knives and pieces of clothing. Before the samples have been seized from the suspect, they undoubtedly have been subjected to a variety of unknown factors. "Heat, humidity, and sunlight do have a deleterious effect on blood. Also, blood decomposes in a short time without proper preservatives."<sup>127</sup> Furthermore, there is always the possibility that the blood sample has come into contact with dirt or chemicals before it was seized. These general factors, along with many other factors that can be hypothesized in each case, create questions as to the condition of the blood sample tested. It becomes obvious the Commission may never be able to establish that the sample tested was one hundred percent pure. The problem then is to determine the effect this has upon the admissibility of the results of the Commission's two scientific identification techniques.

"Admittedly, the changes which take place in blood drying are largely unknown."<sup>128</sup> Undoubtedly, some features of fresh blood are lost when the blood undergoes drying, denaturation, and environmental contamination, but the exact effects of the foregoing on the blood's constituency are yet to be discovered. "It is known at least that some labile constituents, such as various enzymes, several antibodies, the serum proteins in general, and numerous others, do not alter rapidly enough to invalidate their successful study in the forensic laboratory."<sup>129</sup> Consequently, P. L. Kirk and B. W. Grunbaum, two of this country's leading experts on the forensic uses of blood, believe the lack of complete and precise information on the changes which occur in blood should not deter the use of immunological identification techniques.<sup>130</sup> They base this conclusion on the fact that many blood proteins are known to resist denaturation for relatively long periods when the blood is dried.<sup>131</sup> This would seem to suggest that an argument by a defendant to the effect that the two scientific identification tech-

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125. *Id.* at 861, 50 N.W.2d at 80.

126. Interview with David W. Oates, Comm'n Senior Chemist (March 10, 1978).

127. A. MOENSSENS, R. MOSES & F. INBAU, *supra* note 3, at 259.

128. Kirk & Grunbaum, *supra* note 7, at 290.

129. *Id.* at 290-91.

130. *Id.* at 296-97.

131. *Id.*

niques results should not be admitted because the blood sample tested was not one hundred percent pure fresh blood would be unfounded. Rather, any questions which the particular condition of the blood sample tested might create as to the accuracy of the identification results would go only to the weight and credibility to be given them and not their admissibility.

Authority for the position that the condition of a tested blood sample affects only credibility and not the admissibility of the test results may be found in *State v. Fox*.<sup>132</sup> The defendant had been taken into custody upon suspicion of driving while under the influence of alcohol. A blood sample was taken by the doctor of his choice. The test for alcohol was conducted by a licensed technician of the state department of health according to methods approved by the department. The test results showed the defendant to be under the influence of alcohol. At trial, the defendant was convicted upon the basis of this evidence. On appeal, he argued that his blood sample had been contaminated by an anticoagulant in the vial in which it was placed and by the use of an antiseptic to cleanse his arm before the sample was withdrawn. He further argued that the state had failed to carry its burden of proving that the sample was not contaminated and demanded that the evidence be stricken.<sup>133</sup> The Nebraska Supreme Court held that the evidence was admissible:

It is obvious from the record that all the statutory foundational requirements for the admission of the result of the blood analysis have been met, and such evidence was competent and properly admitted. There is nothing in the statutes which, either expressly or inferentially, prohibits the use of an anticoagulant for the purpose of preserving the blood during the interim from withdrawal until the test. Any evidence to the effect that the alcoholic content of the defendant's blood might have been affected by the presence of an improper amount of anticoagulant in the test tube, or by the use of an antiseptic to cleanse the arm before injection with the syringe and needle, would have no effect upon the admissibility of the test, but, rather, such evidence would go only to the weight and credibility of the test.

It was not the legislative intent that all possibility of inaccuracy or imperfection in the test should be excluded before being received in evidence. It is apparent that the intention of the Legislature was that such tests are admissible, and prima facie proof, whenever it be established that the statutory requirements are satisfied, which is true in the instant case, and the presence or absence of other facts which might reflect upon the verity of the test results affect only the matter of rebuttal of the statutory presumption, not the admissibility of the test results, as such.<sup>134</sup>

The same type of rationale would appear to apply to the admissibility of the results of the Commission's two new scientific iden-

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132. 177 Neb. 238, 128 N.W.2d 576 (1964).

133. *Id.* at 249, 128 N.W.2d at 582.

134. *Id.*

tification techniques when the condition of the sample tested is in question. It would be highly unreasonable to require the Commission to rebut every conceivable factor that may have affected the condition of the sample tested before the identification results could be received in evidence. The more logical position to take would be to allow the results to be admitted into evidence and let the finder of fact determine what credence to give them in light of questions raised by the defendant as to the condition of the sample tested. This position appears even more justified in light of the fact that the Commission, as a practical matter, would not continue to prosecute a case in which its results indicate damaging contamination of the sample tested. If it did, the defense attorney would merely have to ask to have the test slides shown to the jury and the visibly poor quality of the precipitin formations produced by the badly contaminated sample would undoubtedly destroy any belief the jury might have in the accuracy of the test results.

Due to the particular process used in the Commission's two new scientific identification techniques, it will also have to establish the identity and condition of its known blood, tissue, and anti-serum laboratory samples before its identification results will be admissible.<sup>135</sup> This means that a chain of custody must be established for each laboratory sample used and the possibility of any tampering must be negated in order to positively identify the sample as being from the animal species the Commission claims it is from. This could prove to be difficult because, at the present time, the Commission does not maintain nearly as tight a system of security over its laboratory samples as it does over samples seized from suspected game law violators.<sup>136</sup> The laboratory samples are kept in unlocked storage chambers in the Commission's laboratory. All members of the laboratory staff have access to them without asking the senior chemist's permission.<sup>137</sup> Consequently, it could be very difficult to prove the proper chain of custody. Furthermore, as far as negating the possibility of tampering is concerned, it is not clear in Nebraska whether a showing that only laboratory personnel had access to the samples is sufficient to carry the burden of proof.

The Nebraska case most directly on point is *Hershiser v. Chicago B. & Q. Railroad*.<sup>138</sup> In that case, the Wasserman test for the presence of syphilis was applied to a sample of the plaintiff's blood. It appeared from the evidence at trial that from the time the sample was drawn until the time the test was conducted the

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135. See note 115 & accompanying text *supra*.

136. Interview with David W. Oates, Comm'n Senior Chemist (March 10, 1978).

137. *Id.*

138. 102 Neb. 820, 170 N.W. 177 (1918).

sample had been stored in the laboratory's ice box. Other people associated with the doctor who performed the test had access to the laboratory. The doctor testified that he himself had made no change in the sample and that to the best of his knowledge, none of his associates had either.<sup>139</sup> Nonetheless, the defendant moved to have all testimony in regard to the test stricken for the reason that the possibility of a substitution of blood had not been precluded by the facts shown.<sup>140</sup> The Nebraska Supreme Court acknowledged that "[a]s a general rule, the probability of any tampering with the objects of such tests should be negatived before evidence [of the test results] is admitted."<sup>141</sup> It further stated that rather than showing that the only persons who had access to the laboratory were the doctor's associates, it would have been better to prove the sample had been absolutely undisturbed by anyone except the doctor.<sup>142</sup> However, since another test had been made under proper conditions, with the same result, the court held the admission of testimony in regard to the first test was nonprejudicial error.<sup>143</sup> Consequently, it is unclear whether the possibility of tampering with a sample can be sufficiently negatived by a showing that only laboratory personnel had access to it. There is strong indication that it cannot be. Because of the evidentiary problems created by the Commission's present laboratory system of storing laboratory samples used in the immunodiffusion and immunoelectrophoretic techniques, it would be advisable to establish a new storage system. A system similar to the one used in storing evidentiary samples seized from suspected game law violators should be sufficient.

The Commission will have a much easier task in establishing the fact that its laboratory blood, tissue, and antiserum samples were in such a condition as to produce accurate test results. The samples are produced by the Commission itself at its laboratory rather than purchased commercially, as they are by some other laboratories.<sup>144</sup> This eliminates the question of whether the purchased samples are what they purport to be. Furthermore, all the laboratory samples are stored in chambers specially designed for their continued preservation.<sup>145</sup> Here again, as was true with samples seized from suspected game law violators, any question that might possibly be raised in regard to the condition of the laboratory samples should only affect the weight and credibility to be

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139. *Id.* at 825, 170 N.W. at 179.

140. *Id.*

141. *Id.*

142. *Id.*

143. *Id.*

144. Interview with David W. Oates, Comm'n Senior Chemist (March 10, 1978).

145. *Id.*

given the test results. It should have no bearing on the admissibility of the immunodiffusion and immunoelectrophoretic identification results.

#### IV. CONCLUSION

Once the Commission clears up the problems it presently faces in establishing the identity and condition of its known laboratory samples, it would appear that it will have no major problem in persuading a Nebraska court to admit into evidence the results of its two new scientific identification techniques, if challenged by a defense attorney. Although the use of immunodiffusion and immunoelectrophoresis for game law enforcement purposes is somewhat novel, that in itself is not sufficient grounds for denying admissibility to the Commission's scientific identifications. If questions arise at trial in regard to the accuracy of the Commission's identification results, they should only be considered by the trier of fact in determining the weight to be given the results. They should not, however, have any effect on the admissibility of the two scientific techniques' identification results.

The use of scientific methods and techniques is necessary to achieve accurate fact-finding. The use of scientific evidence in the courtroom produces more expeditious handling of cases, just disposition of cases, and increased public confidence in the judicial system. These are all desirable results which can be lost if courts refuse to admit reliable scientific evidence because it is new and somewhat unique. The immunodiffusion and immunoelectrophoretic blood and tissue identification techniques clearly have probative value for the courts. If they fail to recognize the identification results as admissible evidence, their ability to efficiently administer justice will be inhibited.

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