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EVIDENTIAL IMPLICATIONS OF THE
DERMAL NITRATE TEST FOR
GUNPOWDER RESIDUES

Edwin C. Conrad*

SHOOTING AS A PATTERN OF MURDER

It is ironical to note that firearms and similar destructive weapons constitute one of the badges of civilization and are directly associated with the cultural progress of Mankind. As so brilliantly phrased by Shaw,

And I (the devil) tell you that in the arts of life man invents nothing, but in the arts of death he outdoes Nature herself... But when he goes to slay, he carries a marvel of mechanism that lets loose at the touch of his finger all the hidden molecular energies, and leaves the javelin, the arrow, the blowpipe of his fathers far behind... Man measures his strength by his destructiveness... 3

As Lucifer says, the world around us abounds in lethal instruments of destruction, both natural and man-made. Guns and firearms still appear to be the favorite instruments used in the killing of human beings. Very sketchy and perhaps outdated studies indicate that on a national basis, in 1950, out of a total of 7567 victims of homicide, 55 percent were killed by firearms and explosives. 2 This is to be contrasted with local studies of a metropolitan area such as Philadelphia, where the use of a pistol or revolver in homicide cases as a means of killing at one time averaged 27 percent. 3 In a special study of homicides in Jefferson County, Alabama for 1920-1925, Hoffman found that 75 percent were caused by firearms. 4 On an analysis of 22 first degree murderers, Banay concluded that the chances of a murder weapon being a gun were three to one. 5 After summarizing his research on 92 Wisconsin murderers, Gillin found that as to the weapon used in murder cases there were three chances out of five that the murderer used a revolver. 6


1 Shaw, Don Juan in Hell, from MAN AND SUPERMAN 19 (Dodd, Mead & Co., N.Y., 4th Printing, 1952).
3 Id. at 84-85.
4 Hoffman, The Increase in Murder, 125 Annals 20, 24 (1926).
DERMAL NITRATE TEST

Even in the absence of more recent studies, it may be safely concluded that the revolver and the hand firearm are common tools in the commission of murder.

Relevancy of Gunpowder Residue Evidence

Let us suppose that in a murder case the defendant contends that he never fired a gun at or near the time of the alleged killing and that the victim did in fact die from a gunshot wound. Obviously, scientific evidence that the accused did fire a hand gun at or near the time of the claimed murder becomes highly significant. Or, suppose that the defendant takes the position that the victim committed suicide by the use of a hand revolver or firearm, which fact would exonerate the accused. Scientific proof that the victim did or did not fire a gun would become quite important. If there is an eyewitness to the shooting, and there is no dispute as to whether a gun was fired either by the accused or the deceased, resort to scientific evidence may be unnecessary. Even in the presence of an eyewitness, especially in a lively fracas, there may be no clear evidence as to whether the victim or the accused fired the revolver and scientific evidence may have to be utilized to settle the disputed facts.

Science has devised certain tests to determine whether there is the presence or absence of gunpowder residues on the hands of the person or persons involved. From these tests it can be inferred circumstantially that a person involved did or did not fire a gun recently. It should be observed that this is only a link in the chain of evidence and in itself may prove nothing. The admissibility of these gunpowder residue tests shall be the subject matter of this article.

The Dermal Nitrate Test for Gunpowder Residues

The eminent criminologist Locard laid down the broad principle that when any two objects come into contact, there is always a transference of material from each object on to the other. Such a transference may be large or small. It may be readily detectable or difficult to discern. Nevertheless, it occurs and the forensic scientist must find and prove the transference, when possible, however small this may be. Locard's Exchange Principle may be applied directly to a situation involving the firing of a gun with the attendant propulsion of gunpowder residues onto the hand of the individual pulling the trigger. The basic assumption underlying any chemical tests for gunpowder residues is that the force of the explosion will cause particles of unburned powder or the products of the explosion to be carried to the skin with such force that

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these particles will not only be found on the surface of the skin but are likely to be imbedded in the pores of the skin, from which they may be removed and tested for chemically.\textsuperscript{8}

One chemical procedure to detect the presence of gunpowder residues on the hands of a person suspected of firing a gun recently has been variously described as the "Dermal Nitrate," "Dermo Nitrate," "Diphenylamine,"\textsuperscript{9} "Paraffin,"\textsuperscript{10} "Paraffin Gauntlet or Glove,"\textsuperscript{11} or "Gonzales"\textsuperscript{12} test, which is rather simple to perform. White, hot, liquid paraffin is sprayed or poured over the fingers, hands and wrists of the suspect until a coating of paraffin is built up. Successive layers of cotton or other fabric are added, with additional paraffin poured on between layers, until a paraffin layer of approximately $\frac{3}{8}$ inch or more in thickness is obtained. A paraffin glove is finally molded, which, when cooled, is peeled gently from the hand. (See photo, depicting such a paraffin glove or gauntlet.) An organic reagent, diphenylamine, in a concentrated solution of sulfuric acid, is added to the paraffin glove drop by drop. A positive reaction indicating the presence of gunpowder residues is indicated by the appearance of dark blue pin-point specks on the inner surface of the cast. Sometimes these specks may not appear until twenty minutes after the application of the reagent.\textsuperscript{13} The blue specks are transitory in nature and disappear within a relatively short time.\textsuperscript{14} For this reason, the paraffin glove should be photographed immediately upon the appearance of the blue specks, preferably in color, so that the forensic scientist will have some permanent record of the results of the tests.

The appearance of the dark blue specks upon the application of the reagent may indicate the presence of gunpowder residues as well as other nitrates and therefore such a result is considered positive. As will appear later, other substances containing nitrates may give the same indication. The absence of such specks after the application of the

\textsuperscript{8} So named because of the chemical reagent used.
\textsuperscript{9} Hot paraffin is used to extract the gunpowder residues from the pores.
\textsuperscript{10} So named because the cast assumes the form of a paraffin gauntlet or glove.
\textsuperscript{11} After the name of the person first demonstrating the test publicly.
\textsuperscript{13} Mathews, \textit{supra} note 8, at 21.
The Dermal Nitrate Test for Gunpowder Residues (Courtesy, William E. Kirwan, New York State Crime Laboratory).

reagent would be considered a negative result, but negative results have been obtained even after it has been established positively that an individual fired a gun just prior to the taking of the test. More about this will be explained later.

The paraffin plays an important role. The gunpowder residues found on the hands after the firing of a gun become imbedded in the pores of the skin underneath its surface. The hot melted paraffin causes the pores of the skin to open up, mixes with the oil in the pores, and
causes the pores to exude the gunpowder residues imbedded therein.\textsuperscript{15} Because of the manner in which such residues are imbedded in the skin, no ordinary washing of the hands will remove the imbedded nitrate particles from the pores of the skin.\textsuperscript{16} The test is, therefore, quite valuable because the presence of gunpowder residues can still be ascertained despite frequent and vigorous washing of the hands by the suspected person. Moreover, these nitrates may be imbedded in the skin pores for some time after the firing of the gun, possibly for three weeks; but Mathews declined to indicate how much longer after that they may be recovered.\textsuperscript{17}

**HISTORY OF THE TEST**

In 1933 the original Dermal Nitrate Test was demonstrated before a number of American police departments by Teodoro Gonzales of the Criminal Identification Laboratory, Police Headquarters, Mexico City. Gonzales reported that during a period just short of two years, 121 tests were made by his department by this method, of which 70 were positive and 51 negative. It was his claim that in many cases where positive indications were shown, confessions followed and convictions were obtained.\textsuperscript{18} The test has been widely used in Cuba, where very extensive and favorable studies have been made. The Cuban workers in this field have acclaimed its reliability and usefulness.\textsuperscript{19} We may now say that it is extensively used in the United States as well as other parts of the world, both as an investigative procedure and as an evidential tool.\textsuperscript{20} That there is some controversy about the test must be acknowledged. To understand properly the use of the Dermal Nitrate Test in the courts, one must understand its strength and also its basic weaknesses.

**FALLIBLE NATURE OF THE TEST**

If we are looking for a chemical test for gunpowder residues which is 100 percent infallible, we have none at the present time.\textsuperscript{21} While present day chemical tests for gunpowder residues are based on Locard’s “Exchange Principle” and upon the premise that the hand of a person firing a revolver will have gunpowder residues on it after firing a gun, as Dr. Mathews points out, this assumption may or may not be valid:

\textsuperscript{15} Id. at 20, and O’Hara & Osterburg, supra note 13, at 384.
\textsuperscript{16} Mathews, supra note 8, at 21, 68.
\textsuperscript{17} Ibid.
\textsuperscript{18} Id. at 20; O’Hara & Osterburg, supra note 13, at 384; Castellanos, Dermo Nitrate Test in Cuba, 33 J. Crim. L., C. & P. S. 482 (1943); Snyder contends that Dr. Gonzalo Iturrioz of Cuba first used the test in 1914 and that Teodoro Gonzales of Mexico City improved the technique used. Snyder, supra note 13, at 135-137.
\textsuperscript{19} Castellanos, supra note 18.
\textsuperscript{20} Ibid. See also Nickolls, supra note 7.
\textsuperscript{21} Mathews, supra note 8, at 20.
In the case of rifles and shotguns neither hand is ordinarily in a position to receive anything from the force of the explosion. In the case of revolvers and pistols there are many situations where the hand will not receive any nitrates (or nitrites) from the explosion. If a revolver is well made, and pertinent tolerances are at minimum, the amount of gas escape will be negligible. Often in the less well-made revolvers there is sufficient clearance and looseness of fit of the cartridge to allow the 'passage' of gas necessary to produce powder staining on the hand. With single-shot pistols the escape of gas at the breech is usually negligible, but may occur in those models that are poorly made or loose due to wear. Automatics may or may not leave powder residues on the hand firing the gun, depending on their construction. Those having top ejection of the cartridge are less likely to leave anything on the hand, though some gas may be deflected around the trigger, in which case the residue will be found on the underside of the trigger finger. And, finally the person may have worn gloves, in which case a positive test on the hand could not be expected, but we might get one on the glove.

In general it may be said that positive tests are most likely to be obtained when the condition of the gun is such as to allow gas to escape. The more violently the gas escapes, the more powder residue will be carried to the hand. Often the force is considerable and the particles will be carried deeply into the skin. The author has had blood ooze out of the skin due to the impact when firing a revolver in poor condition.22

Some experts say that there is more likelihood that black powder, the use of which was rendered commercially obsolete about 40 years ago, will result in more leakage discharges than smokeless powder, which is now and has been in use for some years.

We, therefore, may obtain a negative test even when we know that a gun has been recently fired by the suspect. As a matter of fact, as explained below, “a positive reaction may be obtained without having discharged a firearm, and a negative reaction may be obtained even after having discharged a firearm.”23 These anomalous results, I believe, may be explained by the expert in the manner indicated but they should not form the basis for exclusion of the test entirely.

Another weakness of the test is that any oxidizing agent, such as any nitrate, will produce a positive reaction. The following non-innoculating nitrates may be found on the hands of the following persons:

<table>
<thead>
<tr>
<th>Substance Handled</th>
<th>Persons in Contact with Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleaching agents</td>
<td>Launderers and housewives</td>
</tr>
<tr>
<td>Chemicals and pharmaceuticals</td>
<td>Chemists, engravers, matchworkers, pharmacists, photographers etc.</td>
</tr>
</tbody>
</table>

22 Ibid.
23 O’HARA & OSTERBURG, supra note 13, at 387.
Because oxidizing agents in common use by the public may produce positive reactions we may say that the Dermal Nitrate Test is specific for nitrates but non-specific for gunpowder or gunpowder residues. This is the most frequent criticism levelled at the test.\textsuperscript{24}

It should be acknowledged that among forensic scientists themselves there is some controversy as to the reliability of the test. I should like to categorize three positions relative to the test in general:

1. The Mathews stand that scientifically the test is sound and has validity, if properly given and interpreted.\textsuperscript{25}
2. The Turkel claim, which in my opinion is based on inadequate data and much hearsay, that the test is unreliable.\textsuperscript{26}
3. A neutral position in which the test is neither defended or castigated vigorously, but which does recognize the use of the test in forensic work, subject to certain precautionary measures.\textsuperscript{27}

The effect of such disagreement has undoubtedly cast some suspicion on the test, but from available data, the test is sufficiently reliable to warrant its use in the process of judicial proof.

**EXPERT TESTIMONY AND ABSOLUTE CERTAINTY**

If the Dermal Nitrate Test is fallible, as Mathews points out,\textsuperscript{28} will the courts say that such procedure and expert testimony relating thereto will not meet the required standards of proof as to scientific evidence? I think not. If our courts were to insist on absolute certainty in the field of evidence in general and scientific evidence in particular then we should have to eliminate much of the proof which we now use. But the courts have never insisted upon complete infallibility as a criterion

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\textsuperscript{24} See authorities cited at note 13.
\textsuperscript{25} Mathews, *supra* note 8 and Castellanos, *supra* note 18.
\textsuperscript{26} Turkel & Lipman, *Unreliability of Dermal Nitrate Test for Gunpowder*, (sic.) 46 J. CRIM. L., C. & P. S. 281 (1955). See also Nickolls, *supra* note 7. Synder states: "It has been the writer's experience that this test is not as reliable as reported by some investigators." Snyder, *supra* note 13, at 156.
\textsuperscript{27} Turner, *supra* note 13.
"It is not possible to state categorically that the reaction is either valid or useless. It is not unlikely that the test is useful when all factors are considered." Kirk, *Crime Investigation* 358 (Interscience Publishers, N. Y. 2nd Printing 1960). See also Hatcher, Jury & Weller, *Firearms Investigation, Identification and Evidence* 435-438 (Stackpole Co., Harrisburg, Pa., 1937).
\textsuperscript{28} Mathews, *supra* note 8, at 20.
for admissibility of evidence. Evidence is to be based not necessarily on absolute certainty but on reasonable probabilities.\textsuperscript{29} Experts and scientists need not testify positively on a particular subject but may base their opinions on reasonable probabilities.\textsuperscript{30} Absolute certainty has never been required of the expert.\textsuperscript{31} The only concern of the courts is that the opinion of experts be consistent with probability and reason.\textsuperscript{32} Exact scientific certainty has never been exacted by the courts in dealing with expert testimony.\textsuperscript{33} Thus, it is said that an expert is not required to speak with such confidence as to exclude all doubts in his mind but may testify to an opinion which is not absolute conviction.\textsuperscript{34} These principles of proof should be borne in mind in considering the competency of the Dermal Nitrate Test.

We should also note another principle of proof with respect to scientific evidence in general and the Dermal Nitrate Test in particular. For several decades now, \textit{Frye}\textsuperscript{35} has taught us that while the courts will go a long way in admitting expert testimony deduced from a well recognized principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs. The foundations of this holding have been fractured recently by a recent decision of the Appellate Department, Superior Court, Alameda County, California, to the effect that scientific acceptance by the profession as a whole is not necessary; that in this day of specialization, it is sufficient foundation for the admissibility of scientific evidence to show that the particular scientific test involved has been accepted generally by a limited few who would be expected to be familiar with its use.\textsuperscript{36} The effect of the California decision will not be felt until sufficient time passes to permit the judicial mind to comprehend its real impact and meaning.

With this backdrop, I should like to explore the judicial thinking with respect to the admissibility in evidence of the results of the Dermal Nitrate Test for gunpowder residues.

\textbf{Considerations of Competency}

The first reported case concerning the admissibility of the test is \textit{Commonwealth v. Westwood},\textsuperscript{37} decided in 1936, in which the accused was charged with the murder of his wife by gunfire. The defendant pleaded an alibi, that he was not at the scene of the crime at the time

\textsuperscript{29}2 \textit{Wigmore, Evidence}, Sec. 235 (3rd ed. 1940).
\textsuperscript{31}Housman v. Geiman, 62 S.D. 310, 252 N.W. 857 (1934).
\textsuperscript{32}Rogers v. Kendall, 122 Me. 248, 119 Atl. 616 (1923).
\textsuperscript{33}Baughman Contracting Co. v. Mellet, 216 Md. 278, 139 A. 2d 852 (1957).
\textsuperscript{34}Dornberg v. St. Paul City Railway Co., 253 Minn. 32, 91 N.W. 2d 178 (1958).
\textsuperscript{36}People v. Williams, 164 Cal. App. 2d 858, 331 P.2d 251, 253, 254 (1958).
\textsuperscript{37}324 Pa. 289, 188 Atl. 304 (1936).
of the killing and therefore could not have fired the gun. There were no eyewitnesses to the firing of the gun, but the undisputed testimony was that there were three bullets imbedded in the head and body of the deceased and that these were fired from a pistol. About three hours after the killing a paraffin glove was made of defendant's right hand and at the same time paraffin gloves were also taken of the detective making the test and of another person (as control tests). A physical examination of defendant's paraffin glove revealed seven black specks, mostly on the index finger and some on the back of the hand. Two experts testified that upon the application of the "Lungee reagent" (Diphenylamine) to defendant's paraffin glove, the black specks turned to a dark blue color and assumed a comet tail formation; that this indicated the presence of gunpowder residues; that this testing procedure was well known to the profession for possibly fifty to seventy-five years.

A chemist testifying for the defendant asserted that 13 substances other than gunpowder, including Pittsburgh soot, sodium perborate tooth powder, cigarette ashes and matches, could cause such a positive reaction. He concluded that the substance found on defendant's hand could be other than gunpowder and that the Dermal Nitrate Test for the reasons mentioned was not infallible.

In sustaining defendant's conviction, the Supreme Court of Pennsylvania upheld the right of the state, as well as that of the defendant, to introduce expert testimony as to the results of the Dermal Nitrate Test, observing that:

> The unexplained presence of specks of partially burned gunpowder on defendant's right hand a few hours after the shooting—as chemists found and testified—was, if the jury found such to be a fact, significant. If the victim had been stabbed instead of shot, the unexplained presence shortly thereafter of human blood on the right hand of one who had an opportunity to commit the crime, would have been significant.\(^3\)

Both the Commonwealth and defendant were entitled to avail themselves of such testimony.\(^3\)

The defendant's assignment of error in the Supreme Court of Pennsylvania, based on the admission of the Dermal Nitrate Test, was overruled.

Several observations concerning the decision may be noted. The Pennsylvania Court firmly and unequivocally upheld the competency of such test, over the rigorous objection that it was not infallible and that many substances in common use other than gunpowder would produce positive reactions. Implicit in the holding is the belief that such tests are scientifically reliable and therefore the courts will recognize them. The conviction of defendant could have been and was

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\(^3\) *Id.* at 309.
\(^3\) *Id.* at 311.
based on other important evidence in the case connecting him to the crime and was not limited solely to the results of the Dermal Nitrate Test. This fact is highly significant, as I shall point out later.

For eighteen years the Westwood case, was the leading and only case on the admissibility of the Dermal Nitrate Test, during a period when the procedure was in general use in courts on a trial level. In Henson v. State, handed down in 1954, we find a similar situation where the defendant was charged with firing a pistol at the victim after she resisted his advances to commit rape upon her. The victim could not positively identify the defendant, whose identity, as well as his guilt, was shown primarily by his written confession. Shortly after the alleged offense, the accused was subjected to the Paraffin Test while under arrest. An expert was permitted to testify at the trial that in his opinion the accused had recently and prior to the test fired a gun or pistol. The Texas Court of Criminal Appeals conceded that the fact that the accused had fired a gun recently was of material importance to the state's case. Apparently, the record showed that the accused did not agree to take the test and did not waive any right which he had to object thereto. In its original opinion the Texas court held that defendant's privilege against self-incrimination was not violated, since no testimonial compulsion was involved, and concluded that:

The finding of nitrates upon the hand of appellant as a result of applying the paraffin was but revealing that which could not be altered, changed or colored by oral testimony.

The court held further: "We are constrained to agree that the testimony was admissible."

On a motion for rehearing, the court de-emphasized its previous language relying on the written confession and pointed out that there was other persuasive circumstantial evidence connecting defendant with the crime, such as bloodhound tracking and identification of defendant's shoe marks. The court adopted what it called the "well reasoned opinion" in the Westwood case in upholding the admissibility of the Dermal Nitrate Test and found that there was nothing inherently unreliable about such chemical procedure and expert testimony. A police sergeant with 15 years of experience on the State Highway Patrol was

40 Supra note 37.
41159 Tex. Cr. 647, 266 S.W.2d 864 (1954). See also Washburn v. State, 318 S.W.2d 627 (Tex. Cr. 1958), in which the experts for the state testified that the skin of the deceased, a victim of a dynamite explosion, disclosed the presence of nitrates. It was held that the evidence was admissible to show that death was caused by an explosion of dynamite, but there is no indication as to what test was used, which I assume to be the Dermal Nitrate test.
42 Id. at 868.
43 Ibid.
44 Supra note 37.
held competent to cast the paraffin gauntlet and a Master of Arts in chemistry with post-graduate work and three years of police experience was held to be qualified to describe the test and to give his opinion that nitrates were present.\(^4\)

In *State v. Atwood*,\(^4\) on the issue of whether the deceased shot himself or was shot by defendant some distance away, the North Carolina court permitted in evidence chemical tests for nitrates and gunpowder, which revealed a negligible amount of powder residues on the clothing of the deceased and no nitrates on the skin of the deceased at the entrance wound, facts inconsistent with the defense that the deceased had committed suicide. There is no indication in the case as to whether the Dermal Nitrate Test was used, but in view of the development of the art, it may be safely assumed that the Dermal Nitrate Test was involved and used. Again we may observe that there was other important and substantial evidence in the case linking defendant to the shooting of the victim.

The three cases just reviewed illustrate the favorable attitude of the courts in admitting the results of the Dermal Nitrate Test for gunpowder residues and expert testimony interpreting such tests. This, then, was the setting for the atomic explosion set off by the Colorado Supreme Court in *Brooke v. People*\(^4\) on June 1, 1959. Defendant was convicted of the crime of murder in the first degree. The accused's defense was that the deceased had shot himself. Without bothering to detail the evidence against the accused or even mention such evidence, the Supreme Court of Colorado stated that the evidence against the defendant was entirely circumstantial. It acknowledged that a strong link in this chain of circumstantial evidence was the following testimony: A firearm identification expert testified that a paraffin test of the hands and forearms of the deceased showed a negative reaction for either nitrates or nitrites and on the basis of these results rendered an opinion that the decedent had not fired or discharged a revolver and therefore could not have shot himself. The expert also testified that he had asked defendant while under arrest to take the paraffin test and that defendant had refused to take the test, giving as his reason that this was done upon the advice of his counsel. Apparently, defendant raised no assignment of error with respect to the test being performed on the victim and the negative results obtained thereby, but did claim error in the admission of defendant's refusal to take the Dermal Nitrate Test while in custody. The Colorado Supreme Court bypassed the self-incrimination question raised by defendant (which was not in the case because no testimonial compulsion was involved) by

holding that the Dermal Nitrate Test itself was unreliable and hence defendant's refusal to take the test was inadmissible.

How does the court reach its conclusion that the Dermal Nitrate Test is incompetent because of its unreliability? First of all, it refers to the lieutenant's testimony that the test is not specific for powder residues. In the second place, it quotes at length from the Turkel and Lipman study\(^4\) as to the unreliability of the test, without according the authors the courtesy of being mentioned by name, and, in fact intimating that this is the view of the *Journal of Criminal Law, Criminology, and Police Science*. While I respect the findings of Turkel and Lipman as researchers, I would challenge their findings on the basis of inadequate research and data and on the basis that their conclusions seem to be highly fortified by the opinions of many inspectors in their department, which are rank hearsay. Moreover, we can assume that these inspectors were not trained chemists and firearms identification experts, so that from a scientific standpoint their collective hearsay opinions were not of much value. That inspectors of police departments in general are qualified to give and properly interpret Dermal Nitrate Tests for gunpowder residues is highly questionable.

The Turkel study made the following findings:\(^4\)

I  
A series of 20 consecutive cases of known self-inflicted gunshot wounds were studied with the following result:

4—positive, degree suggesting gun fired by deceased  
15—inconclusive-*positive*, but not to a degree excluding possibility of nitrates other than gunpowder  
1—negative, no reaction

II  
Another series of 20 consecutive cases of persons dying of causes unrelated to gunshot with the following results:

0—positive  
16—inconclusive-*positive*, in a degree resembling the 14 inconclusive cases of gunshot deaths  
4—negative, no reaction

III  
A series of 15 cases, 6 of known self-inflicted gunshot deaths and 9 of persons dying of causes other than gunshot:

6 Cases—Gun Fired by Deceased

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<thead>
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<th>J.L.</th>
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<td>3</td>
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Suggestive of gun being fired by deceased


\(^4\) *Id.* at 281-282.
Inconclusive 3 0
Suggestive of gun not fired by deceased 0 1

9 Cases—Gun Not Fired by Deceased

Suggestive of gun being fired by deceased 2 1
Inconclusive 5 1
Suggestive of gun not fired by deceased 2 7

H.T. J.L.

While the authors of the article noted the technician’s findings that in the majority of the cases there was a positive reaction, they conclude that these findings were inconclusive because the technician was of this belief. No attempt was made to furnish any data or details as to the method of making the experiments and the scientific methodology used. No answers to the following questions can be determined from the examination of the study:

1. What training and experience do the authors claim to have with respect to firearms identification in general and the Dermal Nitrate Test in particular?
2. Did the authors run any control test, which is the very foundation of scientific methodology?
3. Did the authors feel that from a scientific standpoint the study of 45 cases would result in a conclusive determination that the Dermal Nitrate Test was unreliable?
4. What types of occupations were the victims engaged in at the time of their deaths?
5. What types of substances were usually handled by the victims at about the times of their deaths and at the times of their deaths?
6. What types of guns were used by the various individuals involved and what were the tolerances of these guns with respect to the discharge of gunpowder residues?
7. Precisely what was the intensity of the blue specks found in each of the tests?
8. What precisely was the spatial distribution of the specks found in the various tests conducted?
9. What type of spatial distribution of gunpowder residues is significant?
10. What type of spatial distribution of non-incriminating nitrates is significant?
11. Why did the authors fail to investigate the subject of what non-incriminating nitrates would interfere with the tests, when this is the most frequent argument used against the validity of the tests?
12. Who actually made the tests mentioned above, Turkel or Lipman, or both, and if the latter, what proportion of the tests were conducted by Turkel and what proportion by Lipman?
13. If the authors' experiments were so conclusive, why did they feel it was so necessary to fortify themselves by reliance on the collective opinion of the inspectors of the police department?

14. In the face of evidence of positive findings in most of the cases examined, what was the precise reasoning used by the authors in reaching their conclusion that these findings were not conclusive but rather were inconclusive?

15. Why did the authors fail to indicate the various patterns found and their interpretations of these patterns, so that other forensic scientists could scientifically test their conclusions?

The questions above suggest the scientific inadequacy of the Turkel and Lipman study, which should be compared with the precision and the scientific methodology of the Harrison and Gilroy studies.\textsuperscript{50} In my own opinion, the Turkel and Lipman research does not conform to the minimum requirements of scientific methodology, and I have gained the impression that the authors want us to accept their findings that the test is unreliable solely upon the strength of their own opinions, to which, of course, they are entitled. But unfortunately the Supreme Court of Colorado, in searching frantically for a way to condemn the Dermal Nitrate Test in general, fell for the authors' conclusion, without determining for itself the validity of their reasoning.

The Supreme Court of Colorado lays down a standard that, to be admissible, scientific evidence must be irrefutably accurate; and according to this criterion, it will admit in evidence proof of fingerprints, palm prints, foot prints, and the like as positive means of identification. In the second breath, the court talks about analyses of blood, breath and urine for alcohol being admissible because such methods are "acceptably accurate";\textsuperscript{51} but classifies the Dermal Nitrate Test in the lie-detector category. Just what standard is the Colorado Supreme Court now proposing with respect to the admissibility of scientific evidence: Irrefutable or acceptable accuracy?

The court concludes with these remarks:

We hold, therefore, that the results of a paraffin test, rather than being placed in the category of the accepted tests has the same reputation for unreliability as the lie detector test. The authorities, therefore, which deal with the inadmissibility of the results of the lie detector tests, or which reject evidence of a refusal of an accused person to take such a test, are more nearly in point. . . .

To paraphrase the authorities which have considered the efficacy of the lie detector test, we hold that the paraffin test has not gained that standing and scientific recognition or demonstrated that degree of reliability to justify courts in approving its use in

\textsuperscript{50} See note 58 infra.

\textsuperscript{51} Brooke v. People, supra note 47.
criminal cases. Therefore, because of its unreliability, it was error to admit the results of the paraffin test as conducted on the body of the decedent, and if Brooke had submitted to the test the result thereof would not have been admissible in evidence. This being true, the fact that the defendant refused to take the test was likewise inadmissible. The inference to be drawn from both the testimony of the results of the paraffin test on the decedent, as well as those which probably were drawn by the jury from the recital of Brooke's refusal to take the test were prejudicial.\(^{52}\)

It is astonishing to note that the Colorado court makes no reference to the Pennsylvania, Texas, and North Carolina cases discussed in this article or to any of the technical literature on the subject other than the Turkel paper. This indicates a serious lack of basic legal research in the field or an attempt to decide the point involved as a matter of policy rather than because of considerations of reason and logic. Courts, of course, exercise a great deal of power over the lives and destinies of man. It seems to me that the Colorado Supreme Court, without any adequate basic research, acted arbitrarily in condemning the use of the Dermal Nitrate Test in the Colorado courts by reference to one single isolated authority in the technical literature and by ignoring the viewpoint of eminent criminologists such as Dr. Mathews and others. When the court on its own initiative uses authority in the technical literature to prove the unreliability of a scientific test, then it is under a further duty to examine all or a substantial body of the technical literature on the subject or call for expert testimony to establish the necessary facts. Judges may decide questions of law, but they cannot assume the role of expert scientists upon subjects with which they are not at all familiar.

Actually, the holding of the Colorado court was not necessary. If the results of the Dermal Nitrate Test on the victim and the defendant's refusal to take the test, constituted the only evidence in the case (which point is not clear because the court refuses to detail the evidence), the court could have concluded that there was insufficient evidence to convict the defendant under the State's burden to prove him guilty beyond a reasonable doubt. This was the logical conclusion for the court to reach. The court's open condemnation of the test as unreliable indicates a deeply ingrained suspicion of scientific evidence in general, although the court itself lives from day to day using the products of science, and represents an unnecessary and unjustified major set-back for the cause of scientific evidence.

Our fiftieth state, however, has softened some of the effects of the Colorado decision. Late in 1960 the Supreme Court of Hawaii had occasion to consider the validity of the Dermal Nitrate Test in *State

\(^{52}\) Id. at 996.
v. Foster,\(^5\) in which we find a typical situation where there were no eyewitnesses to the killing and the accused wife was charged with firing a revolver at her husband and killing him. Insanity of the accused at the time of the crime and at the time of the taking of a confession and Dermal Nitrate Tests of the defendant were in the picture.

An expert chemist of the Honolulu Police Department testified that he made a paraffin test on defendant's hands shortly after the crime and found a small amount of nitrates present. Similar tests conducted on the hands of the decedent indicated a positive reaction on both hands. Further tests showed that the deceased was not killed by a contact wound but that the lethal weapon was actually fired from a distance greater than 15 inches from the wound. Consequently, there was evidence that the deceased's wound was not self-inflicted.

The written assignment of error in the Supreme Court of Hawaii was directed apparently to the Dermal Nitrate Tests performed on defendant herself, the objection being to the manner in which they were performed and not to their inconclusiveness. The Supreme Court of Hawaii held that there was sufficient evidence to warrant admission of the results of the Dermal Nitrate Tests over the objection that they were given involuntarily, the court assuming for the purposes of the ruling that consent to the taking of the tests was necessary since defendant at the time was under arrest. There is no doubt in my mind that the court considered the Dermal Nitrate Test reliable and therefore competent. Because of the failure to submit defendant's instruction on the question of her insanity at the time of the crime, the judgment of conviction was reversed and a new trial ordered.

I do not believe that the Hawaii court intended to change the rule that the taking of physical tests while under arrest does not violate defendant's privilege against self-incrimination under the orthodox view that the privilege applies only in cases involving testimonial compulsion. The court holds that there was sufficient evidence of a valid consent.

The holding of the Supreme Court of Hawaii is the last opinion of an appellate court on the admissibility of the Dermal Nitrate Test to prove the presence or absence of gunpowder residues.\(^5\)

A Personal Evaluation

Men like Dr. Mathews and others who have worked in the field have conceded that the Dermal Nitrate Test is not infallible and 100 percent certain. Dr. Mathews has made this point:

\[\text{It is the author's opinion that the "dermal nitrate test" has considerable value when properly used and properly interpreted.}\]

It must be done by one who is skilled and experienced and preferably by one who has some training in chemistry. A negative test, for reasons stated earlier, has no value, as it proves nothing. A positive test may have considerable value. The test is not an infallible one but it often is useful.

Actually, it is not the Dermal Nitrate Test which is the important aspect of the procedure. It is the expert's interpretation of the results of the test, including the patterns and configurations produced by the blue specks, which is of paramount importance. Powder patterns formed as the result of residues escaping from a revolver differ greatly from those nitrate patterns on the hands of persons handling non-incriminating nitrate compounds. A careful analysis of these patterns will enable the expert to form an opinion as to whether he has located gunpowder residues or non-incriminating nitrates. If he has made such an examination and is able to testify that he has found gunpowder residues, his testimony should be admissible as is the testimony of any other expert in a field beyond the knowledge of the jurors. This is really the basis for the rule permitting expert testimony.

The importance of the qualifications of an expert must be emphasized. Since the technique of making the glove and the application of the reagent is of great importance and since the test is of such a transitory nature that the results must be observed within a relatively short time, as time goes, I would require the expert to be adequately trained in firearms identification and have broad experience in chemistry. I would require him to conduct and interpret the test, with the help of whatever technicians are necessary, but working under his direct supervision. It is extremely unwise and inimical to the cause of the forensic scientist to permit any other person to run and interpret the results of such tests.

In the area of which we are speaking, we are witnessing a rather paradoxical situation. On the one hand we find eminent courts such as the Supreme Courts of Pennsylvania, North Carolina and Hawaii and the Court of Criminal Appeals of Texas, upholding the validity of the Dermal Nitrate Test, with Colorado courts dissenting. On the other hand, we must acknowledge that there is some disagreement among the scientists as to the scientific reliability of the test. We must, therefore, conclude that with respect to the admissibility of the Dermal Nitrate Test the law is far ahead of science, when normally legal developments would lag far behind scientific achievements.

From a legal standpoint, I think expert testimony as to the results of the Dermal Nitrate Test to prove the presence or absence of gunpowder residues is competent and extremely useful. It certainly should

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55 Mathews, supra note 8, at 68.
56 Id. at 21.
be permitted in corroboration of other evidence in the case on any theory of relevancy, materiality, or competency. The weight of evidence necessary to convict is another matter. If the only evidence in the case is that someone other than the deceased killed him, and that the Dermal Nitrate Tests revealed the presence of gunpowder residues on the hand or hands of the defendant, then I think that this evidence standing alone would not be sufficient to convict the defendant because the state has not proven him guilty beyond a reasonable doubt. This is not inconsistent with my position that the evidence is relevant, material, and competent. As Kirk points out, "It is dangerous in the extreme to place the life or liberty of a suspect in jeopardy on the results of the test alone."\(^\text{57}\) My own viewpoint is that expert testimony as to the results of the Dermal Nitrate Test to prove the presence or absence of gunpowder residues should be limited solely to corroboration of other evidence in the case.

In passing, one should note the chemical and spectrographic tests for gunpowder residues developed by Harrison and Gilroy and claimed to be superior to the Dermal Nitrate Test. These scientists found that the presence of the metals antimony, barium, and lead could be used to characterize primer and leakage discharge residues; that these tests may be made by colorimetric methods; that they are specific and sensitive; and that the spatial distribution of the residues is of such a consistent pattern as to insure the reliability of this method. Positive tests are obtained in all cases in which a revolver-type weapon is used and in a few instances where a semi-automatic weapon is used. No instances of false positive tests obtained from the hands not used to fire a revolver were obtained. No false tests were discovered and there was no failure of the tests to detect the metals antimony, barium and lead because of occupational or other contamination of the hands. Unfortunately, washing of the hands prior to the test will render it useless.\(^\text{58}\)

The recent nature of the research and the lack of any reaction to the proposal in the technical literature makes it difficult to evaluate the test, but the scientific methodology used by Harrison and Gilroy is impressive.

\(^{57}\) Kirk, *supra* note 27, at 358.