

12-1935

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### Recommended Citation

Coffey, E. P. (1935) "The Importance of Scientific Analysis of Evidence in the Prosecution of Crime," *Indiana Law Journal*: Vol. 11 : Iss. 2 , Article 1.

Available at: <https://www.repository.law.indiana.edu/ilj/vol11/iss2/1>

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# INDIANA LAW JOURNAL

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Volume XI

DECEMBER, 1935

Number 2

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## THE IMPORTANCE OF SCIENTIFIC ANALYSIS OF EVIDENCE IN THE PROSECUTION OF CRIME

By E. P. COFFEY \*

In an effort to show you the premium which is placed upon the scientific analysis of evidence in criminal cases I would like to take a few minutes to tell you about the phenomenal growth of the Technical Laboratory of the Federal Bureau of Investigation of the United States Department of Justice. In the fall of 1932 Mr. John Edgar Hoover, Director of the Bureau, established as an operating part of the Bureau located at Washington, D. C., a Technical Laboratory for the consideration and examination of physical evidence obtained during the investigation of crime. Prior to this time when the occasion arose in connection with the Bureau's work, it was customary to seek the assistance outside of the Bureau of various specialists for the purpose of studying such evidence. With the increase in the amount of work of this nature, Mr. Hoover saw that it would be decidedly advantageous to specially train selected personnel and thus have these analyses made within the Bureau by persons devoting their entire time to specializing in the type of problems being considered. The director felt that with such a staff of sal-

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\* Address by E. P. Coffey, Director of Federal Technical Laboratory of the Department of Justice, Washington, D. C., before the Indiana State Bar Association, September 6, 1935.

aried laboratory technicians working independent of individual case fees it would be possible to organize more closely the so-called police sciences, and tend to encourage research with a view to developing better technique and new applications.

In the intervening time much of this end has been obtained and the venture has justified itself a hundredfold. Located on the top floor of the new Department of Justice Building in Washington, D. C., is the finest criminological laboratory in the world. Its staff of seventeen experts assist field investigators in every part of the United States, both special agents of the Bureau investigating federal law violations and the police and state law enforcement agencies of the country who request this assistance. Adjacent to the technical laboratory in this building are the extensive photographic laboratories of the Federal Bureau of Investigation and the facilities of these photographic laboratories including the staff of fifteen photographers and assistants are of course always available to prepare the photomicrographs and the enlarged exhibit charts which the technical expert often uses in arriving at his conclusions. In addition to the special knowledge of each expert in the laboratory he has for his ready reference the Bureau's own highly selective library of criminology, the Department of Justice great law library, the Congressional Library and in addition a dozen or more world renowned scientific libraries located in Washington, such as that maintained by the National Academy of Sciences. In addition he has, should the occasion necessitate, consulting privileges with the laboratory staff of a number of government departments, such as the National Bureau of Standards.

A picture of the accomplishments of the Bureau's technical laboratory is most interesting. I will not stop at this time to describe these accomplishments but I have here a mimeographed paper entitled "The Technical Laboratory of the Federal Bureau of Investigation" and this article which contains a summary of the examinations made in the laboratory for the fiscal year 1935 is available to those of you who care to have it. I do want to describe to you some of the

general types of examinations made and will endeavor to point out the practicability of such examinations from the prosecutor's standpoint.

Handwriting and document examination in general. Document examinations constitute the largest volume of work performed in the Bureau's technical laboratory. These involve principally the examination of extortion letters, ransom letters, and other similar anonymous communications with a view to making an exact record of the physical characteristics of the documents, an analysis of the written message, and a careful study for all clues which might assist the investigator in tracing the source of the letter and later, in order to establish conclusively to the satisfaction of the court, the authorship.

Firearms identification. It is most important that during the investigation of any crime in which a firearm was used that the resulting firearms evidence be given study by qualified firearms identification experts. Much can be learned concerning the evidence which would otherwise be lost. In an examination of the projectile alone it is often possible to determine the brand of ammunition and the make and model of gun through which it was fired. The firearms identification expert can study the weapon after one is found by the investigator and in most instances he can definitely state with indisputable conclusiveness that the fatal evidence bullet was or was not fired from the weapon submitted. In a similar manner he can examine the discharged cartridge case and because of microscopic markings which may appear on the base of it he can likewise often determine whether or not it was fired from the questioned gun.

Chemical analyses may be made of a great variety of suspected material found during the investigation. Of course the examination and analyses of the vital organs of the cadaver is usually best made by the local coroner's office performing the autopsy but there are many cases where the coroner and the investigator are confronted with a chemical or microchemical analysis which they do not feel they are equipped to handle.

A microscopic examination of evidence such as dust, a single shaft of hair, debris of any kind, or perhaps the crystalline structure of metal, may result in findings unseen by the naked eye which would constitute clinching evidence in a case.

Blood tests today, properly made are most important in crimes of violence. The Bureau's technical laboratory is equipped to make various chemical tests and biological tests for the determination of blood and its kind and group in a stain.

The Bureau's laboratory is fully equipped for casting reproductions of evidence either in plaster or the various types of moulage available. A record in the third dimension of perishable evidence, which record can be readily made in most instances by a casting process may be most valuable to the prosecutor.

The ultra-violet, infra-red, and X-ray portions of the light spectrum become vital tools in the hands of trained laboratory technicians to uncover hidden evidence. Other important tools are the precise instruments and high fidelity optical apparatus with which the laboratory is equipped and mention must also be made of the comprehensive reference collection of ammunition samples, rifling specifications, the gun collection, typewriting standards, standards of foreign and domestic handwriting, a file of twenty-seven thousand index cards describing watermarks, hundreds of samples of criminal extortion notes classified for ready reference, a file of tire tread designs, and a reference collection of hairs and fibers.

Such specialization, apparatus, and reference data, together with the demand of Director Hoover that the evidence be scrutinized in its minutest detail and sound conclusions reached without bias or exaggeration; could not help but produce results which were lauded by prosecuting attorneys through the country and even by the courts before whom the evidence was placed. With regard to the acceptance of such evidence by the court it may be out of place for us who are engaged in the detection of crime to suggest to you who are more directly concerned with the laws of evidence, the status of

this subject, yet I feel that you might be interested in hearing our view resulting from a study of a number of cases involving scientific evidence which have been reviewed in the various courts of this country.

It is difficult to formulate rules which might serve to indicate the admissibility in evidence of testimony obtained through the use of modern scientific methods in crime detection. Scientific detection of crime is sometimes regarded by those not familiar with criminology as a new method devised for police, which displaces established procedure and in some miraculous or at least mysterious manner, solves crime in the laboratory. Science has been defined as "Knowledge gained and verified by exact observation and correct thinking." So the modern scientific method is one that keeps abreast of the times and applies to criminal investigations, those developments of modern civilization which may be of assistance in determining the facts. In this procedure, exact observation and correct thinking, still predominate. Evidence regarding facts thus developed, is daily admitted in our courts and it is only when the bounds of established practice are flagrantly violated without sound basis that the problem becomes one requiring careful scrutiny.

There has been developed in recent years, a definite laboratory technique which has proven of considerable value in the investigation and subsequent prosecution of crimes and we might consider briefly how the courts look upon this phase of testimony.

Wigmore in his comprehensive treatise on evidence states: "The second axiom on which our law of evidence rests is this: All facts having rational probative value are admissible, unless some specific rule forbids."

Within this general axiom we might well gather the various influences under which the courts gradually open new fields permitting testimony and the introduction of evidence of a scientific nature, by experts who have made a disinterested, methodical study of the evidence. This study is often made at a place remote from the scene of crime and without knowledge on the part of the experts of extraneous facts in the

case which at times might tend to affect their best judgment. The criticism is sometimes made that our courts are backward in accepting modern laboratory methods in crime detection and in some individual cases the criticism may be a proper one. If, however, we understand the reluctance of the courts to accept every fanciful theory and each new mechanical device until well tried and proved by sound scientific principles, as originating in their ever present duty to keep inviolate the safeguards taken to protect the innocent, we can more readily appreciate their hesitancy at times. Once so proved, the courts generally admit the evidence with the full weight to which it is entitled. Similar views have been expressed by the courts; in a New Jersey case: "There is a scientific basis for the system of fingerprint identification. The courts are justified in admitting this class of evidence. This method of identification is in such general and common use that the courts cannot refuse to take judicial cognizance." Again, "The appliances used and the methods resorted to, so far as we are able to determine, were those appliances and methods recognized by science."

There have been times when the courts were more narrow in their view and this broadening attitude in a careful yet steadily progressive manner is evident from the days when expert testimony was generally confined to pathological conditions. Then, the expert took the stand and cited his bold opinion without being required to explain to the jury step by step the facts which led to his conclusion in a manner which might readily be understood by the lay person. In a similar way was the testimony of the handwriting expert later admitted. Rather than insist that he demonstrate the facts which led to his conclusions he was for many years actually prohibited from bringing into court for the purpose of comparison, known writings of the defendant, his testimony being limited to whatever writings happened to be in evidence at the time and introduced for other purposes. In England this situation was corrected by a statute in 1854, which allowed the introduction of proven writings. But reform in legal procedure is a slow process and the restrictions on the admis-

sion of known standards of handwriting continued in most of the jurisdictions in this country. It was not until 1913 that such writings were admitted in the United States District Courts subsequent to the passage of an act of Congress as follows: "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that in any proceeding before a court or judicial officer of the United States where the genuineness of the handwriting of any person may be involved, any admitted or proved handwriting of such person shall be competent evidence as a basis for comparison by witnesses, or by the jury, court, or officer conducting such proceeding, to prove or disprove such genuineness." Approved February 26, 1913.

The science of fingerprint identification was more readily admitted, probably due to its indisputably demonstrative quality. In this field the expert was not forced to rely entirely upon a statement of his opinion to convince a jury; he was able with the assistance of illustrative charts to direct the attention of the jurors to specific points of identity. In several cases the courts have permitted the expert to demonstrate to the jury his ability to identify fingerprints by making comparisons in the court room itself.

The willingness of our courts to accept the results of scientific methods in crime detection, while carefully guarding the sacred rights of the accused, is ably illustrated by the efforts to introduce testimony as to deception tests conducted with the polygraph, or lie detector. In 1922 in the District of Columbia, this evidence was refused, the Appellate Court stating "We think the systolic blood pressure deception test has not yet gained such standing and scientific recognition among physiological and psychological authorities as would justify the courts in admitting expert testimony deduced from the discovery, development, and experiments thus far made." These remarks are the more significant when considered in the light of an opinion handed down in 1933 by the Supreme Court of Wisconsin where it was said that "While it may have some utility at present and may ultimately be of great value in the administration of justice, it must not be over-

looked that a too hasty acceptance of it at this stage of its development may bring complications and abuses that will overbalance whatever utility it may be assumed to have." Thus we may if we choose, interpret the words in the more recent decision, when weighed against the former, as indicative of a belief that the deception test described has been improved and we may conjecture if we care to, that further improvement may result finally in the stamp of approval of the courts.

The overthrowing of precedent by courts anxious to accept scientific evidence after they are satisfied that the methods used are correct ones is well illustrated by two recent cases reviewed by the Supreme Court of the State of Washington. In the first (in the year 1928) the prosecution was refused permission to introduce as evidence a knife belonging to the accused and photomicrographs by which it was sought to prove the defendant cut certain saplings. Two years later the same court in a case involving similar facts permitted such evidence to be admitted, saying in part: "Courts are no longer skeptical that by the aid of scientific appliances the identity of a person may be established by fingerprints. There is no difference in principle in the utilization of the photomicrograph to determine that the same tool that made the one impression is the same instrument that made another impression. The edge on one blade differs as greatly from the edge on another blade as the lines in one human hand differ from the lines on another. This is a progressive age. The scientific means afforded should be used to apprehend the criminal."

Another example of the use made of microscopy in the court room is in the identification of bloodstains. In one case involving such evidence where an expert distinguished between the blood of animals and of humans, the court remarked, "The history of the development of scientific principles by actual experiments, within a few of the last years, show us that many things which were once regarded generally as incredible, are now admitted universally to be established facts." In another case the court goes so far as to permit

two experts to testify as to the direction taken by a knife in inflicting a fatal wound, relying upon a microscopic examination of the weapon and the wound.

In the case of *State v. Johnson*, 21 Pac. (2d) 813, the defendant was convicted of murder with the assistance of expert testimony concerning a microscopic examination of material scraped from beneath the defendant's fingernails. It was found that the scrapings revealed particles of lipstick similar to that worn by deceased at the time of her death; and beneath the nails of the latter were found threads from clothing such as that worn by the accused on the night in question.

The range of material traces admitted is broad including, in addition to fingerprints and palm prints, automobile tire tracks, foot prints, and horses' hoof prints, among others.

Naturally, many cases involve a combination of various types of evidence developed in the laboratory. This is illustrated in an Illinois case involving a homicide by automobile. Paint appearing on the shirt of the deceased was found to have come from a fender, where it left marks which in turn identified the cloth by its weave. Also certain other scratches appearing on the fender were identified as having been made by a buckle attached to the same clothing.

In another Wisconsin case there appears an even greater variety of applied scientific principles. One John Magnuson was tried on a charge of murder by a bomb which exploded when the package containing it was opened, causing the death of the addressee's wife. Three experts positively identified the handwriting on the package as that of the accused. "Under the microscope the writing upon the package showed that it was written with a fountain pen with a round point, similar to the pen of Ethel Magnuson, the daughter of the defendant. The ink used in writing the wrapper, Exhibit A, gave the same reaction to chemicals as the ink in the pen of Ethel Magnuson. The ink in the Magnuson house did not give the same chemical reaction, but it was discovered that Ethel's pen had been used by a schoolmate who used black ink, and this black ink combined with the ink which was

found in the house gave the special reaction." An analysis of the glue used disclosed that it was of the same brand as that used by Magnuson. The microscopic examination disclosed that sawdust in the defendant's workshop was of white elm—the same material as the wooden covering of the bomb. The trigger of the bomb was found to be identical with one in the possession of the accused when compared as to the crystalline formation of the metal. Photomicrographs also disclosed the identity of two pieces of wrought iron, one of which was used in the construction of the bomb and the other found in the possession of Magnuson. Two pieces of iron pipe were similarly identified. Commenting upon the evidence the Appellate Court stated "We have, however, set out the evidence with greater particularity than would ordinarily be warranted under such circumstances because it discloses what may be done by a diligent prosecuting officer who has an intelligent comprehension of the things that are necessary to establish guilt in a case of this importance. The guilt of the defendant is as conclusively established as it is possible for it to be. It is scarcely conceivable that any jury could find otherwise than did the jury in this case."

Again, in a later case the same court says "We have expressed our approval in the case of *Magnuson v. State*, of the highly scientific and enlightened experiments resorted to in order to prove the defendant's guilt in that case. The case last referred to sets a standard which it would be well for all prosecuting attorneys in important criminal cases to emulate."

Such a determined effort to utilize the sciences to help unearth the facts, as have been disclosed in some of the aforementioned cases cannot help but win the favor of the courts. It is believed the future will witness an ever increasing efficiency in crime detection and establishment of proof through similar methods.

Permit me to extend to the district attorneys present and to any law enforcement official who may be here an invitation from Mr. Hoover, the director of the Bureau, to submit to the Bureau for examination in its technical laboratory any

physical evidence obtained in criminal investigation under your jurisdiction which evidence you may believe warrants the careful scrutiny of specialists. Mr. Hoover is more than anxious to cooperate wherever he possibly can in the enforcement of law in this country and your case will receive without charge the same careful examination in the Bureau's technical laboratory as our own cases.